Incorporation of the Simplified Hydrogen Generation Scheme into the One-Dimensional Hydrodynamic Model, TEXAS III

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M.S. thesis.

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INCORPORATION OF A SIMPLIFIED HYDROGEN GENERATION SCHEME INTO THE 1-D HYDRODYNAMIC MODEL, TEXAS-III

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Abstract

During a loss of coolant accident (LOCA) in the core of a water-cooled reactor, fission product decay heat could eventually cause the reactor fuel and cladding to melt. This molten core material is sometimes called corium, and is composed of certain fractions of fissionable fuel, cladding and structural steel. The corium, which contains unoxidized metal, may come in contact with water, either in the lower plenum, or if the vessel wall fails in the reactor cavity itself. If corium falls into water, a fuel/coolant interaction (FCI) will take place, with the additional probability that hydrogen will be generated by the oxidation of the metal with water vapor. In a related sense, future fusion reactor designs will probably incorporate water as a secondary side heat transfer agent. With a liquid metal (lithium or lithium alloys), as the most likely candidate for coolant and breeding, the potential exists, through a heat exchanger leak or a metal spill, for FCI type accident scenario with fusion systems. In both cases, the FCI can lead to the production of large quantities of steam and hydrogen that can cause containment overpressurization. The hydrogen generated poses an additional threat from subsequent hydrogen combustion. Using a simplified hydrogen generation model for FCIs, and incorporating it into an existing 1-D hydrodynamic model, TEXAS, hydrogen production levels can be calculated for metal/water interactions (e.g. molten aluminum). The objective is to develop an improved model that better characterizes the fuel/coolant mixing process with hydrogen generation for metal/water interactions.

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1 Acknowledgements

I wish to thank the Department of Energy, Office of Fusion Research, for their generous financial support of this project, without which completion of this task would have been impossible. Support from Mr. Jian Tang in understanding and utilizing the TEXAS code as an analysis tool was essential in completion of the project. Many thanks to the University of Wisconsin Nuclear Engineering and Engineering Physics (NEEP) Department office staff for help with numerous projects. Most importantly, I wish to thank my advisor, Michael Corradini, for his tireless coaching and enthusiasm through this project. His door was always open.

Finally, I wish to thank my parents for their unwavering support and love through my educational adventures. Both are great sources of inspiration in my life. Most importantly, the nurturing and loving environment supplied by my wife and daughter made a seemingly endless task fun. They are both the lights in my life. To Lisa and Michelle I dedicate this thesis.

2 Introduction

In the event of a loss of coolant accident (LOCA), fission product decay heat could cause reactor fuel and cladding to melt. The molten material may contact water with a fuel/coolant interaction (FCI) taking place. Fusion reactor designs will probably incorporate liquid metals and water as coolants for the primary and secondary sides, respectively. These systems exhibit the obvious potential for an FCI if a heat exchanger between the two sides fails. Both fission and fusion reactor safety designs need to address the FCI issue. Along with the eventual generation of steam, from the contact between the hot metal and water, hydrogen will be generated in a chemical reaction between the unoxidized metal and water vapor. This thesis takes a specific look at the interaction of molten aluminum with subcooled water. An existing transient hydrodynamics model is updated to include the dynamics of hydrogen generation along with steam production. The production of hydrogen and steam together can increase the gas void produced in FCI scenarios. Larger voids can lead to greater system pressurization and are of concern in safety design aspects of nuclear reactors. The added problem of potential combustion of hydrogen gas also adds to the overpressurization concerns. Characterizing the pressure effects and relative void changes with hydrogen production is of great importance to the behavior during the FCI mixing process.

An important aspect of the project was to convert the existing TEXAS-II computer model (which is a transient, one-dimensional,

three-field fluid dynamic eqution solver) to include hydrogen generation from the water/aluminum chemical reaction. Modifications were made in the vapor mass balance and particle energy balance to incorporate hydrogen gain and water vapor loss, and the energy liberated from the exothermic chemical reaction. The model developed includes the non-condensable (e.g. hydrogen) gas in the system energy and momentum balances (via the mass balance), but does not include the effect of the presence of non-condensable gas in any of the transport rate equations. In order to create a truly comprehensive model this would have to be done. This simplified model gives trends and sheds some light onto the effects of producing non-condensable gas (hydrogen) in FCI type scenarios.

Two proposed FCI/reactor meltdown scenarios were reviewed and analyzed, with aluminum as the melt. The material combination was chosen because of the avialability of qualitative data over a wide range of conditions for this molten metal/water combination. The two cases were viewed with the modified TEXAS code using hydrogen generation capabilities and without. Comparisons are made between the various cases and explained in the report.

3 TEXAS-II Code Description

3.1 Introduction

The TEXAS-II [1] computer code, which is evolving into TEXAS -III, is based on the TEXAS [2] methodology for solving transient, one-dimensional, three-field fluid dynamic equations. The three fields consist of two Eulerian (vapor and liquid) and one Lagrangian field (fuel particle). The liquid and vapor fields are calculated numerically by semi-implicit Eulerian techniques while the Lagrangian particles are treated discretely as they move through the liquid-vapor fields. Separate partial differential equations are used in the model to express conservation of mass, momentum and energy for the fields [1]. In using this three-field fluid dynamics model, thermal and mechanical nonequilibrium between the phases can exist. In doing this the mathematical expressions for mass, momentum and energy exchange between the phases must be calculated. Such a formulation allows reasonable modeling of the designated physical system (i.e. the relative motion of the phases and the thermal nonequilibrium).

The particle field, within the TEXAS-II code, is modeled using representative material volumes, rather than control volumes. The master particles are separate initial masses that are allowed to deform and fragment. The code also offers the choice of either pressure or velocity boundary conditions at the top and/or bottom of the physical system considered. This feature is important for general

transient analysis and permits realistic modeling of the system's boundaries.

The numerical solution technique, used in TEXAS, is based on the SIMMER-II [3] pressure iteration method, with improvements in the convection energy and pressure work terms used in the pressure iteration loop [7]. Constituent relationships were developed for the construction of a local flow regime map, interfacial area and mass concentrations, and momentum and energy transport equations. A pressure iteration is done that minimizes the error in the liquid and vapor continuity equations for each discrete cell. When a balance is achieved the program automatically time steps to the next iteration. The time step can be automatically adjusted by the pressure changing rate, the internal energy changing rate or the pressure iteration number to ensure convergence at a sufficiently small time step. Because of the rapid relative acceleration between the components, a transient virtual mass force model was also developed and included in the model. The key element in the TEXAS-II code is a transient liquid particle fragmentation model [4] based on Rayleigh-Taylor instabilities [5]. This fragmentation model includes a dynamic pressure deformation mechanism which predicts the liquid particle transient fragment size.

TEXAS-II is a dynamic code which provides the framework for multiphase analyses of fuel/coolant interactions. The code includes a variable mesh cell size, variable flow area, an implicit numerical formulation and a modular structure to facilitate application to a

wide range of problems. The following section will give a brief overview of the basic equations and numerical differencing scheme used in TEXAS-II.

3.2 TEXAS Conservation Equations

As described previously the mass, momentum and energy equations are used in TEXAS to determine system conditions. In TEXAS [2], the liquid-vapor field equations are described by a two-fluid model [6] with particle field constituent terms added in the momentum and energy equations. The equations are averaged over time and space to give a set of conservation equations. To simplify the situation, the liquid and vapor pressures are assumed to be equal within any control volume.

The governing equations of mass, momentum and energy for the various fields (liquid and vapor) and particle are written in one-dimensional form and are shown in tables 3.2.1, 3.2.2 and 3.2.2. Nonconservative momentum equations were used to numerically simplify the equations. The terms describing the momentum exchange and energy exchange array, the vapor field, liquid field and fuel particles are included in these equations. Mass transfer between the phases is included and shows up in the mass and energy equations. Provided on the following pages are the conservation equations.

Table 3.2.1 Conservation of Mass [1]

Vapor Mass Equation -

$$\frac{\partial \alpha_g \rho_g}{\partial t} + \frac{\partial}{A \partial x}(A \alpha_g \rho_g v_g) = \Gamma_e - \Gamma_c$$

Liquid Mass Equation -

$$\frac{\partial \alpha_L \rho_L}{\partial t} + \frac{\partial}{A \partial x}(A \alpha_L \rho_L v_L) = \Gamma_c - \Gamma_e$$

Lagragian Liquid Particle Mass Equation -

$$\frac{dM_{pk}}{dt} = \Gamma_{pk}$$

where:

α_g = void fraction of vapor field

α_L = void fraction of liquid field

ρ_g = microscopic density of vapor field

ρ_L = microscopic density of liquid field

A = cross-sectional area

v_g = velocity of vapor field

v_L = velocity of liquid field

Γ_e = evaporation rate

Γ_c = condensation rate

M_{pk} = mass of Lagragian particle of kth group

Γ_{pk} = mass transfer rate of Lagragian Particle

Table 3.2.2 Conservation of Momentum [1]

Vapor Momentum Equation -

$$\alpha_g \rho_g \frac{\partial v_g}{\partial t} + \alpha_g \rho_g v_g \frac{\partial v_g}{\partial x} = -\alpha_g \rho_g g - \alpha_g \frac{\partial P}{\partial x} + k_{gL}(v_L - v_g) - k_{wg} v_g - v_g + A_m \frac{d}{dt}(v_L - v_g) - \Gamma_e (v_g - v_L) + M_{gp}$$

Liquid Momentum Equation -

$$\alpha_L \rho_L \frac{\partial v_L}{\partial t} + \alpha_L \rho_L v_L \frac{\partial v_L}{\partial x} = -\alpha_L \rho_L g - \alpha_L \frac{\partial P}{\partial x} + k_{gL}(v_L - v_g) - k_{wL} v_L - v_L + A_m \frac{d}{dt}(v_g - v_L) - \Gamma_c (v_L - v_g) + M_{Lp}$$

Lagragian Liquid Particle Momentum Equation -

$$M_{pk} \frac{dv_{pk}}{dt} = -M_{pkg} + D_k(v_g - v_{pk}) + E_k(v_L - v_{pk})$$

where:

g = gravity

p = pressure

k_{gL} = vapor-liquid macroscopic drag coefficient

k_{wL} = wall-liquid friction coefficient

k_{wg} = wall-vapor friction coefficient

V_g = viscous loss term of vapor field

V_L = viscous loss term of liquid field

Am = transient virtual mass force coefficients

M_{gp} = summation of vapor-Lagragian particle drags

M_{Lp} = summation of liquid-Lagragian particle drags

D_k = Liquid-Lagrangian particle drag term

E_k = vapor-Lagrangian particle drag term

3.2.3 Conservation of Energy [1]

Vapor Energy Equation -

$$\frac{\partial}{\partial t}(\alpha_g \rho_g I_g) + \frac{\partial}{A\partial x}(A\alpha_g \rho_g I_g v_g) = -P\left(\frac{\partial \alpha_g}{\partial t} + \frac{\partial}{\partial x}\alpha_g v_g\right) + W_g + Q_{gw} + Q_{gp} + Q_{gi} - C_g + S_g - (\Gamma_c - \Gamma_e) H_{gsat}$$

Liquid Energy Equation -

$$\frac{\partial}{\partial t}(\alpha_L \rho_L I_L) + \frac{\partial}{A\partial x}(A\alpha_L \rho_L I_L v_L) = -P\frac{\partial \alpha_L}{\partial t} - P\frac{\partial}{\partial x}\alpha_L v_L + W_L + Q_{Lw} + Q_{Lp} + Q_{Li} - C_L + S_L + (\Gamma_c - \Gamma_e) H_{Lsat}$$

Lagrangian Liquid particle Energy equation -

$$M_{pk}\frac{dI_{pk}}{dt} = R_{Lk}(T_L - T_{pk}) + R_{gk}(T_g - T_{pk}) + R_{ik}(T_{sat} - T_{pk}) + R_{wk}(T_w - T_{pk}) + S_{pk}$$

where:

I_g = internal energy of vapor field

I_L = internal energy of liquid field

I_{pk} = internal energy of Lagrangian particle

W_g = viscous work for vapor field

Q_{gw} = wall-vapor heat transfer term

Q_{Lw} = wall-liquid heat transfer term

Q_{gp} = vapor-Lagrangian particle heat transfer term

Q_{Lp} = liquid-Lagrangian particle heat transfer term

Q_{gi} = vapor-interface heat transfer term

Q_{Li} = liquid-interface heat transfer term

C_g = conduction heat transfer term for vapor

C_L = conduction heat transfer term for liquid

H_{gsat} = vapor enthalpy at saturation temperature

H_{Lsat} = liquid enthalpy at saturation temperature

S_g = heat source term for vapor

S_L = heat source term for liquid

S_{pk} = heat source term for Lagrangian particle

T_g = vapor temperature

T_L = liquid temperature

T_{pk} = temperature for Lagrangian particle

T_{sat} = saturation temperature

R_{gk} = macroscopic heat transfer coefficient between vapor and Lagrangian particle (kth group)

R_{Lk} = macroscopic heat transfer coefficient between liquid and Lagrangian particle (kth group)

R_{ik} = macroscopic heat transfer coefficient between vapor interface and Lagrangian particle

R_{wk} = macroscopic heat transfer coefficient between wall and Lagrangian particle (kth group)

3.3 Finite Difference Methodology

A semi-implicit differencing method is used, where temporal derivatives are replaced by a forward differencing operator [1]. Related terms are treated either implicitly or explicitly, with new time variables subscripted (n+1) and old ones as (n). Source terms which are evaluated by semi-implicit formulation are subscripted (n+1/2) [1].

A one-dimensional grid is overlayed on the geometrical configuration, which allows spatial discretization of the equations [1]. For the finite difference equations the thermodynamic properties are evaluated at the mesh cell center and the velocities at the edges of their mesh.

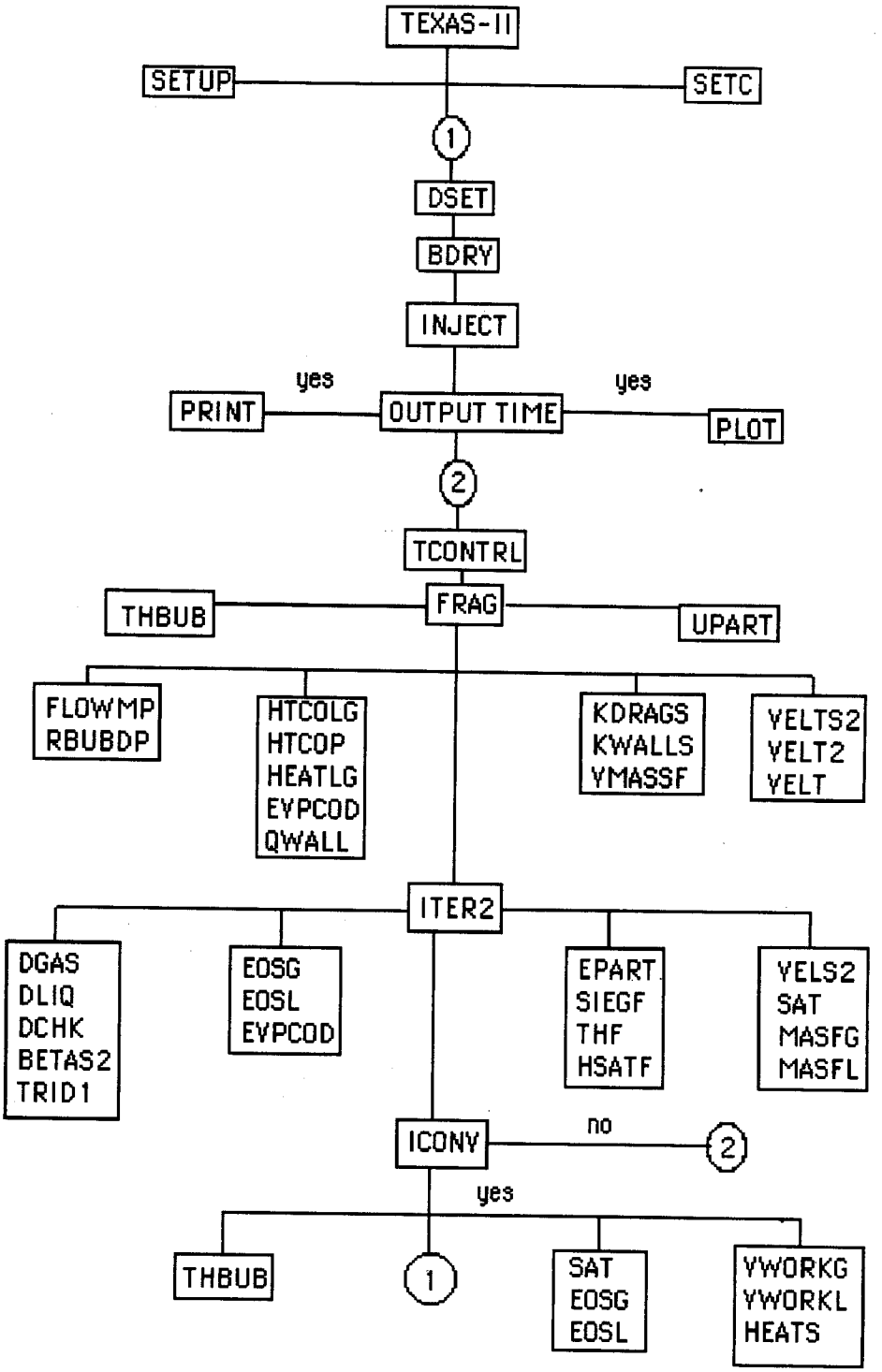
3.4 Code Description [7]

3.4.1 Overview

The first required information for a program user is the internal structure of the TEXAS-II code. Figure 3.4.1 gives a macroscopic overview of the structure and calling sequences of the code. The main program is separated into five parts:

(1) the input of data and the initializing of certain variables and arrays in subroutines DTSET and SETUP,

3.4.1 TEXAS-II Code Structure Chart [1]



(2) control of the time-step, boundary conditions and output information is contained in subroutines DTSET, TCONTRL, BDRY and PRINT; while control of particle fragmentation and injection is contained in INJECT and FRAG,

(3) calculation of the flow regime map, bubble or droplet size, heat transfer coefficient, momentum transfer drag coefficient and particle velocities are perfomed in subroutines FLOWMP, RBUBDP, HTCOLG and VELST2,

(4) subroutine ITER2 controls the pressure iteration calculations, and

(5) convergence criteria are checked along with the liquid-vapor mass and energy conservation equations.

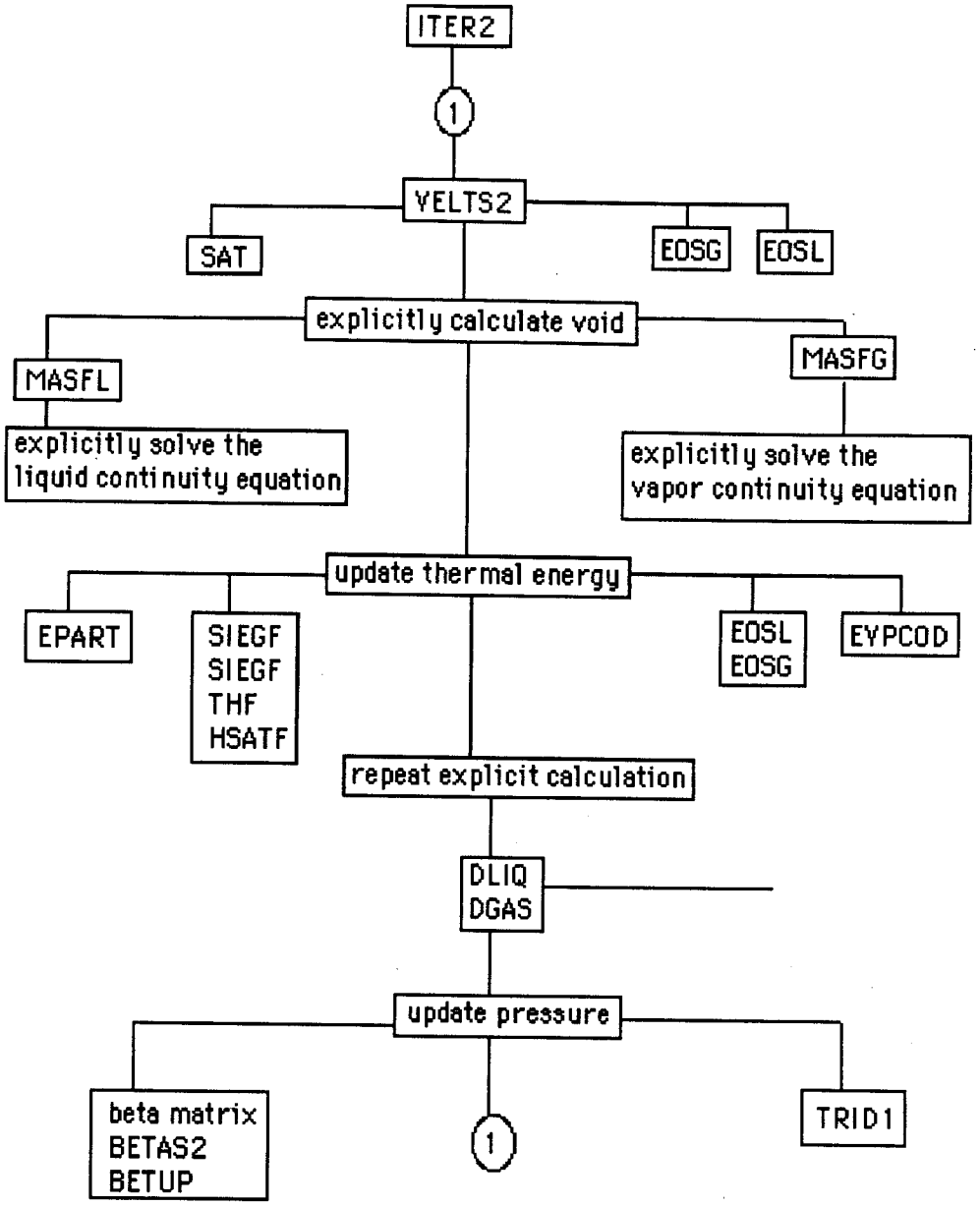
3.4.2 Program Outline [7]

Initially the main program reads input data, while subroutine SETUP initializes system geometrical arrays, physical properties, liquid, vapor and particle variables. Subroutine DTSET is then used to set up a sufficient time-step to satisfy the numerical requirements. Subroutine BDRY initializes system boundary conditions with subroutine INJECT calculating the particle injection rate at the required injection time interval (TPT). Subsequently PRINT outputs data at the required time and checks run-time against a user supplied maximum value. Subroutines FRAG and UPART update the particle size and position.

The program then updates all of the interfacial energy, momentum and exchange variables. Subroutines FLOWMP and RBUBDP determine the flow regime for the local mesh cell and bubble or liquid droplet size. HTCOLG, HTCOP, HEATLG and QWALL are used to determine various heat transfer coefficients among the vapor, liquid, particle and wall surface. EVPCOD is used to calculate the mass transfer rate between the liquid and vapor fields caused by the net heat transfer rate at the liquid-vapor standard steady-state drag coefficients and transport virtual mass drag coefficients. Liquid or vapor-wall drag coefficients are calculated in KWALLS. Finally, particle, liquid and vapor velocities are updated in subroutines VELT, VELT2 and VELS2. The calculation of heat transfer and drag coefficients are based on 'old time' variables.

As shown in figure 3.4.2, subroutine ITER2 controls the major portion of program execution, which is the pressure iteration. The pressure iteration calculation begins with a call to VELS2, which determines the liquid and vapor velocities. Calling MSFG or MSFL calculates the convective vapor or liquid mass flux where the vapor void fraction is explicitly calculated. The particle internal energy, temperature and liquid-particle, vapor-particle macroscopic heat transfer coefficients are calculated in EPART. Using SIELF, SIEGF, THF and HSATF, while controlling the energy terms, allows for a comprehensive solution to the thermal energy equations. Following an update of the liquid-vapor internal energy, the liquid-vapor temperatures, densities,

3.4.2 Pressure Iteration Loop [1]



evaporation rates and condensation rates are calculated by calling EOSG, EOSL and EVPCOD. At this point the vapor void fraction and macroscopic liquid-vapor densities are again explicitly calculated. DLIQ and DGAS are used to calculate error functions from the liquid or vapor continuity equations. DCHK and SIECHK are then used to check whether the error function and rate of change of internal energy are smaller than the convergence criteria. If not subroutine BETAS or BETUP is called to determine the matrix of error function derivatives with respect to pressure. At this point the needed pressure change in TRID1 is calculated until the error function satisfies the convergence criteria.

Once the pressure distribution has been found the other variables are updated in ITER2. The liquid and vapor internal energies are updated by adding the viscous work and heat conduction terms calculated in subroutines VWORKG, VWORKL and HEATS. Figures 3.4.1 and 3.4.2 are provided to give a flow path depiction for program operation.

4 Physical Description of Hydrogen Generation

4.1 Overview

As previously stated, the TEXAS model employs a transient, one-dimensional, three-field fluid dynamic solving technique [1]. TEXAS models the breakup and dispersion of metal/melt spheres as they are dropped through water. The current code calculates water vapor void fractions, gas and liquid temperatures, and pressure distributions throughout the system for various times. As the hot unoxidized melt drops through the water, a layer of steam (water vapor) will form around the particle. This water vapor will want to chemically combine with the unoxidzed metal, and will form hydrogen gas as one of its products. A diffusion model, used to predict the hydrogen generation rate, is proposed and incorporated into the existing TEXAS code. The combined code should better represent the physical phenomena of aluminum/water interactions.

Provided in the following sections is an explanation as to how the hydrogen generation fits into the existing TEXAS model, and a description of the diffusion model employed.

4.2 Hydrogen Generation Incorporated Into TEXAS

Modifications were made to the existing TEXAS code to incorporate hydrogen generation. Of the three main constituent balances only the mass balance was changed to directly show the effect of hydrogen

generation. The variables that previously represented the water vapor mass per cell now have source and sink terms that correspond to hydrogen gas addition and water vapor removal. The mass balance now reflects the fact that water vapor is being converted into hydrogen gas as shown below in the example chemical reaction for aluminum and water. The momentum and energy balances are influenced by the hydrogen accounting in the mass balance. Only the system transport rate equations are not updated to account for a noncondensible gases effect on mass and energy transport (as previously mentioned).

$$Al + (3/2)\ H_2O\ (vapor) \longrightarrow (3/2)H_2 + (1/2)\ Al_2O_3 + Qreac$$

The energy balance for the above equation, assuming products and reactants are at some constant temperature is:

$$N_{Al}h_{Al} + N_{H2O}h_{H2O} + H_{fH2O} = N_{H2}h_{H2} + N_{Al2O3}h_{Al2O3} + H_{fAl2O3} + Qreac$$

where : N = moles h = enthalpy Hf = heat of formation

The assumption was made that the heat of formation for the compounds would dominate the energy balance. Subsequently the following assumption was made:

$$N_{Al}h_{Al} + N_{H2O}h_{H2O} = N_{H2}h_{H2} + N_{Al2O3}h_{Al2O3}$$

Therefore the energy balance simplifies to:

$$\begin{aligned} Qreac &= (0.5)\ (Hf\ Al_2O_3) - (1.5)\ (Hf\ H_2O) \\ &= (0.5)\ (400.5 \frac{kcal}{gmol}) - (1.5)\ (57.8 \frac{kcal}{gmol}) \\ &= 97.78 \frac{kcal}{gmol} \\ &= 4.09 \times 10^8 \frac{J}{Kgmol\text{-}Al} \end{aligned}$$

where: Hf is the heat of formation (from CRC handbook)

With one mole of aluminum for 1.5 moles of hydrogen, the above value of Qreac is converted to:

$$Qreac = 2.727.X\ 10^8 \frac{J}{Kgmol\text{-}H_2}$$

The energy liberated (2.727×10^8 J/Kgmol H2) is all assumed to have moved into the individual fuel particle (where it was produced). The assumption greatly simplified the complexity of the heat flow and reduces the need to update any system macro energy balances. The physical limitations of this assumption will be discussed in section 9..

Finally because of the presence of hydrogen in the water vapor, partial pressures must be used when pressure dependent properties are calculated for the water vapor in the mixture. At various points in the program this change was made. Also, in order to keep the hydrogen generating model realistic, the hydrogen generation

equation was stopped at any time when the hydrogen molar concentration reached 80% of the mixtures level. This seemingly arbitrary limit would actually occur as the molar concentration of hydrogen approaches 100%. This simplification was done to maintain a physically relevant system and simplify coding changes.

4.3 Diffusion Based Hydrogen Generation Equation

A hydrogen generation model, during FCIs, was developed by Corradini, Mitchell and Evans (CME) [8]. In a pouring contact mode (fuel falling into water), three FCI phases can be distinguished for various tests and reactor accident scenarios: (a) a coarse mixing phase composed of fuel droplets in film boiling surrounding the liquid coolant; (b) a steam explosion phase; and (c) a reagglomerated stratified molten pool, if a steam explosion does not occur [9]. In this report only the coarse mixing phase and eventual stratification is examined for hydrogen generation. Proposed testing scenarios as of yet do not include explosive phenomena and any associated hydrogen generation.

It is assumed the rate of metal oxidation is controlled by the melt temperature, the rate of steam diffusion to the melt surface through the hydrogen that is geing generated, and by the rate of diffusion of the oxygen atoms through the molten or solid oxide layer, when such a layer exists [8,9]. In the CME model the rate of steam production is not considered a limiting factor for hydrogen production. In some of our proposed test scenarios an empirical correction has been added

to the partial pressure calculation to account for this possibility and is explained below. The CME model assumes the molten fuel is sufficiently agitated that fresh metal is always available at the surface. Hence, steam diffusion represents the primary rate-limiting process for molten metal oxidation [9].

The governing equation for equimolar counter diffusion of two perfect gases is [8];

$$\frac{dN_H}{dt} = A \frac{D_H}{RT_V} \frac{dP_H}{dn}$$

With the discrete time stepping in TEXAS, the equation is rewritten in a more convenient form.

$$dN_H = \frac{6\ m_f\ \Delta P_H}{\rho_f\ D_o\ \delta} \frac{D_H}{RT_V} dt$$

where: dN_H = kgmols of hydrogen produced

m_f = mass (kg) of fuel particle

ρ_f = density (kg/m^3) of fuel particle

D_o = diameter (m) of fuel particle

δ = vapor film layer (m) on hot particle

ΔP_H = difference in partial pressure between the melt/vapor and liquid/vapor interfaces (Pa)

D_H = diffusion coefficient for hydrogen and steam

$= (6.52 \times 10^{-9})\ Tg(k)^{1.68}$ (m^2/s) [10]

R = universal gas constant

$$= 8313 \frac{Kg\ m^2}{s^2\ Kgmol\ K}$$

Tv = Tg = vapor temperature (k)

dt = time step (s)

All of the previously designated parameters (used in the diffusion equation) are local TEXAS variables that are available at each time step for the calculation.

Because at various times the fuel particle may not be completely surrounded by water vapor, a correction must be applied to the partial pressure term in the previous equation. It was estimated that the partial pressure would be linearly proportional to the molar percentage of water vapor in the gas mixture. As the water vapor is used up in the chemical reaction, the partial pressure will tend to zero and accordingly stop the hydrogen production in the CME model. The following section will discuss the programming changes made to TEXAS.

5 TEXAS Computer Model Changes

5.1 Overview

The ability to determine the hydrogen generated for each Lagrangian (fuel) particle, immersed in water vapor, was added to the TEXAS code. The diffusion model used assumes that water vapor generation, from the hot fuel particle, is not a limiting factor, which in this case it can be. The diffusion based equation was modified with a change to the partial pressure difference between the melt/vapor and water/vapor interfaces. The partial presure was assumed to be directly proportional to the percentage of water vapor in the gas mixture. Provided in the next section is a brief description of the changes made in each affected subroutine. In appendix E, a complete listing of the TEXAS code, with hydrogen generation is supplied. Details of specific changes are supplied therein.

5.2 Description of Code Changes

Subroutine CONVERT -
The mesh cell vapor density was changed to include hydrogen as a component. A water vapor-hydrogen mixture gas constant is calculated and used to determine the combined gas density. Variables CG(I) (vapor heat capacity) and SIEGS(I) (vapor internal energy at saturation temperature), which are both functionally dependent upon pressure, have been modified to use the water vapor partial pressure in the gas mixture.

Subroutine DGAS -

This subroutine calculates the error continuity function for the vapor field. It now includes a loss term for water vapor and an addition term for hydrogen generation from the chemical reaction.

Subroutine EOSG -

Water vapor internal energy at saturation temperature (SIEGS(I)) and vapor heat capacity (CG(I)) are calculated with the water vapor partial pressure. The mesh cell vapor density is calculated, as in subroutine CONVERT, to be a mixture of water vapor and hydrogen gas.

Subroutine EPART -

Each fuel particle's internal energy is updated to include the energy liberated from the chemical reaction of aluminum and water. Each individual fuel particle's hydrogen generation (kgmols) is calculated by calling subroutine H2GEN.

Subroutine FILEOPEN -

Various files for output and plotting purposes are opened and written to later in subroutine PRINT.

Subroutine ITER2 -

This subroutine updates the pressure distribution in the system (i.e. performs a presure iteration until the system is balanced). The total hydrogen generated for each Eulerian mesh cell is now calculated in

this module per time step. The vapor mass balances (i.e. solving by liquid or gas continuity equation) are updated to include the chemical change of water vapor to hydrogen. The gas mixture balance shows an increase in hydrogen and a decrease in water vapor as the chemical reaction proceeds.

MAIN Program -

As part of adjusting the value for each time step, the macroscopic water vapor density at the old time is given the current time's value.

Subroutine PRINT -

Changes have been made to output appropriate variables. Files out89, out101, out102, out103 and out104 have been created and are used to investigate hydrogen generation levels and plot data. Calculations performed in the subroutine include the aggregate hydrogen quantity for each mesh cell, the total molar gas quantity for the mixture in each cell and the total hydrogen generated at that time.

Subroutine SAT -

The saturation temperature is calculated and is functionally dependent on water vapor pressure. The pressure has been updated to reflect the partial pressure in the gas mixture.

Subroutine H2GEN -

This subroutine calculates the hydrogen produced (kgmols) for a given time step using a simplified diffusion model. As previously

explained in section 4.3, the equation used to calculate the hydrogen generated is:

$$dN_H = \frac{6\ mf\ \Delta P_H}{\rho f\ D_O\ \delta}\ \frac{D_H}{RT_V}$$

with variable explanations given in the previous section. In order to maintain the hydrogen quantity in each cell to a workable level, the hydrogen was limited to 80% of the total gas mixture molar quantity.

5.3 Listing of New TEXAS Variables

Provided below is a listing of the significant variable additions to the TEXAS code. These variables constitute the group that was added to the program's universal common block. Variables used internally in subroutines for calculational purposes are not included, only those used throughout the program.

- RGPZ(I) macroscopic water vapor density (kg/m3) per cell.
- RGPZN(I) macroscopic water vapor density, old time.
- X1H(I) cumulative hydrogen quantity (kgmols) per cell.
- XTH(I) hydrogen quantity generated for that time step and cell.
- XN1H(I,K) hydrogen produced per particle.
- QH2 energy liberated per XN1H(I,K).
- XGAS(I) total moles of gas in mixture per cell.
- XGAS1(I) total moles of gas, where H_2 has been generated.

6 Baseline Problem

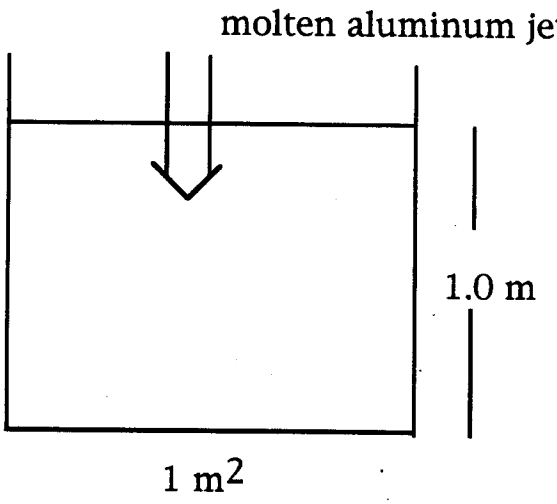
6.1 Introduction

In order to confirm the validity of the TEXAS computer code an exhaustive search was performed to find suitable melt/water, in particular aluminum/water FCI type data. Data [12] from breakup tests of molten aluminum jets in water, from Brookhaven National Laboratory, were found to be inadequate. The data showed that all particles re-agglomerated to form larger structures, which TEXAS may predict but cannot model accurately. The other pertinent data, jet breakup length, was defined differently than in literature and as used in the TEXAS model and could not be used. Data [13] from metal/water tests at Argonne National Laboratory were not adequate in the respect that explosive phenomena were not modeled in this report. Data [14] were finally retrieved, from Sandia National Laboratory, for a test where a violent explosion did not occur. The test (NPR-4) had a "small" energetic reaction that produced explosion size fragments (< 6mm), but most of the material stayed in a larger particle size range. This limited data may be used to give some credence to the TEXAS computer model predictions.

In the future experiments will be run at the University of Wisconsin-Madison that will provide vapor void fraction and particle size data for model verification using various metal/water combinations. At this time the Sandia tests [14] were the best available and the limited data are utilized in this report.

6.2 NPR-4 Test and Results

Test NPR-4 was one of the final tests in a series designed to locate the possible ignition temperature threshold for aluminum/water explosive interactions. A 10.3 kg jet of molten aluminum was injected into subcooled water (285 K). No violent explosion took place, although a local interaction was observed and small diameter particles (< 6mm) were measured and weighed. This small fraction of debris that is finely fragmented was produced by a weak thermal interaction that occurred during the test and ejected water from the chamber. Provided below is a schematic with all pertinent input parameters for the test described above.



d_j = 0.10 m $\quad$ m_{jet} = 10.3 kg

v_j = 5 m/s $\quad$ T_{jet} = 1000 K

T_{water} = 285 K

Because of the lack of an explosion in NPR-4 most of the material from the test re-agglomerated into large chunks, which were highly porous in nature [14]. The data that was provided shows the size of the particle versus the relative mass percent of material that is less than this size. This data, for NPR-4, is shown below in table 6.2.1.

Table 6.2.1 (Mass Distribution of Particles)

Mass Percentage for Particles Smaller than Sieve Size	Sieve Size (mm)
0.1	0.15
0.6	0.40
1.0	0.80
3.0	1.00
6.0	2.00
10.0	4.00
18.0	6.00

This data reveals that non-explosive type tests with the previously described test input parameters did not produce particles smaller than 6 mm in diameter.

6.3 TEXAS Computer Code Simulation

A simulation of the NPR-4 test was performed using the TEXAS code. Test parameters presented in section 6.2 were used in this

simulation. Data extracted from the run; pressure profiles, vapor void fractions, vapor temperatures, fuel particle fractions and liquid temperatures are provided along with the particle breakup information in appendix A (figures A.1-A.6 and table A.7). Presented below is the only pertinent parameter, for comparison to the published NPR-4 test data, particle size at the end of test (table 6.3.1). The jet was totally injected by 0.1 seconds and all the jet was predicted to breakup before reaching the base, with the particle debris (in the simulation) settling to the bottom by 1.2 seconds.

Table 6.3.1 (particle size at end of simulation)

Time (s)	Particle Temp (k)	Part Mass (kg)	Particle Diam (mm)
1.2	933	2.76×10^{-3}	12.5
1.2	933	5.52×10^{-3}	15.7

These particle diameters will be discussed in the next section.

6.4 Comparison of Data

The NPR data showed that in a non-explosive situation, for the specified test conditions, no particle should be smaller than 6 mm in diameter. NPR-1X was an identical test to NPR-4 without any explosion, hence no small particles (< 6mm). The TEXAS simulation showed that the smallest particle seen in the same situation would be 12.5 mm. This seems to verify the TEXAS simulation as providing reasonable estimates as to breakup size during coarse mixing

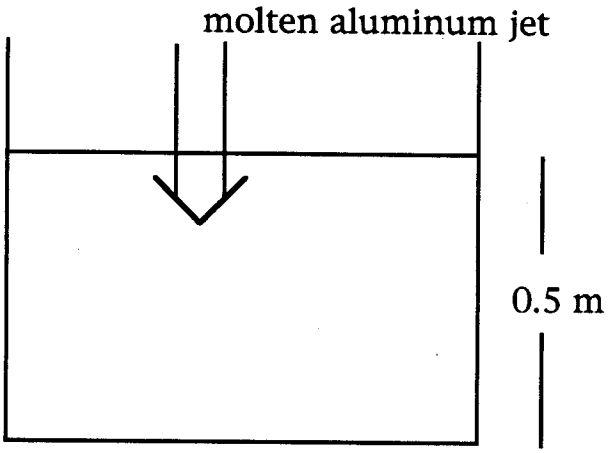
phenomena. This is by no means a verification of the entire model. However, it shows with the limited available data that TEXAS appears to be in the "ball park" as to modeling the non-explosive phenomena, which are analyzed in the following sections.

7 Problem Description

Because of the limited availability of molten aluminum/water FCI type data and the interest in the accident scenarios described below, two FCI accident sequences are reviewed (In-Vessel and Ex-Vessel failures) and analyzed in this report. Both scenarios were proposed by personnel at Westinghouse Savannah River Company and are of interest in their specific reactor design accident analysis [11].

7.1 In-Vessel assembly Failure [11]

The first fuel/coolant interaction (FCI) accident scenario involves a loss of pumping accident (LOPA) without activation of the emergency core cooling system (ECCS) [11]. A single assembly dries out and a mass of molten fuel falls into the water filled bottom end fitting (BEF) beneath the fuel assembly. Local melting or a small FCI then occurs creating a 0.05 m hole in the BEF. The remaining fuel and target inventory melts and pours through the hole mixing with the heavy water moderator in the cell area surrounding the assembly. The melt is considered as purely aluminum for simplicity sake.



0.3 m^2 = pool area

Vjet = 2 m/s fuel deposited = 32 kg (for 4 sec run)

djet = 0.05 m fuel temperature = 950 k

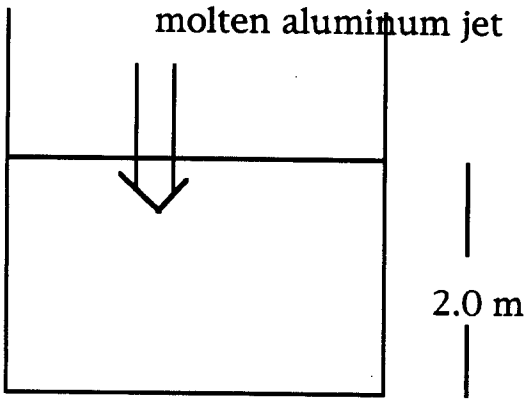
water temperature = 323 k

7.2 In-Vessel Parametric Studies

Additional simulations were performed with and without hydrogen generation to determine the effect melt temperature and bulk liquid temperature would have on various output parameters. The particle melt temperature was increased from 950 K to 1150 K and the liquid bulk temperature was increased from 323 K to 373 K in separate runs. The individual effects, both independent changes produced, are shown and discussed in section 8.2.

7.3 Ex-Vessel Failure

In this scenario the entire fuel and target inventory is assumed to melt and fall to the bottom of the reactor vessel. The fuel mass then melts through the muff and flows into outlet piping, failing in a horizontal leg. The aluminum melt is assumed to be at the melting temperature of stainless steel (1470 K, where the horizontal leg fails). A stream of debris (aluminum) flows out of 1 m^2 break and falls into a 2 m depth pool of water on the pump room floor.



30 m^2 = pool area

Vjet = 2 m/s * water temperature = 308 k

djet = 0.6 m

fuel deposited = 14080 kg fuel temperature = 1470 k
(melting point of stainless)

* original velocity too high (14 m/s), re-estimation made, with high speed run performed on Cray-XMP.

8 TEXAS Results

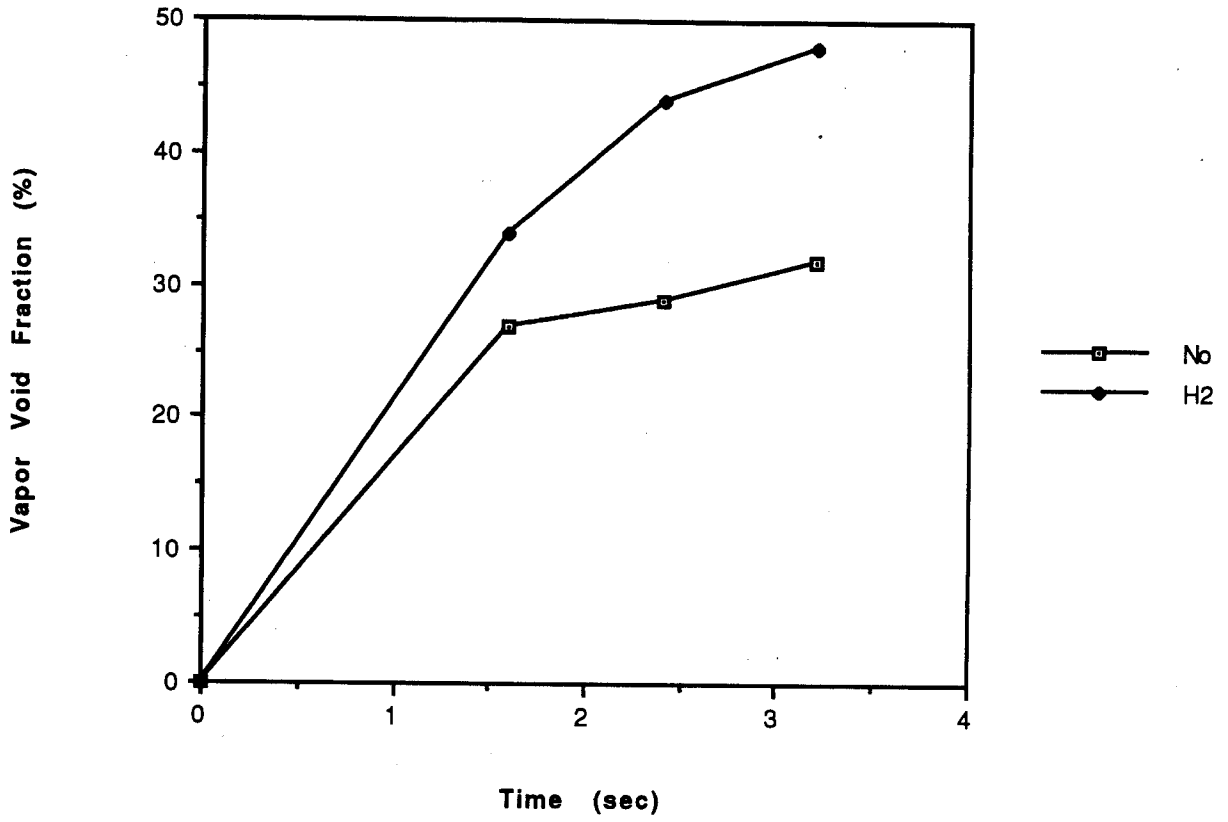
8.1 In-Vessel Assembly Failure

Because of inherent inaccuracies in TEXAS when large amounts of debris begin to accumulate on the bottom of the pool, three second runs (3.20 s) were performed with and without hydrogen generation. All jet characteristics were maintained as in the problem description in section 7.1. It would take approximately four seconds to deliver the 32 kg mass for the entire jet. For a 3.20 s run it can be assumed that roughly 80% or about 26 kg was delivered by run termination.

A number of system parameters were observed and plotted for times of 0.80, 1.60, 2.40 and 3.20 seconds. The mesh cell liquid temperature, fuel particle fraction (percent of volume occupied by fuel particles), vapor void fraction and vapor temperature were important parameters that can not only characterize the problem but give insight into the effect of hydrogen generation on the system. The only two parameters within the above group that showed any appreciable differences (H_2 generation vs. none) were the vapor void fraction at the bottom of the pool and the vapor temperature. At program termination (3.20 s) the mesh cell at the bottom of the pool showed void fractions of 48% and 32% for cases with hydrogen generation and without, respectively (figure 8.1.1). This makes sense in that as hydrogen is being produced on a one to one basis with the consumption of water vapor, and being less dense, that a larger void fraction should result. Also since hydrogen gas is non-condensable,

once its produced it does not go away whereas steam can recondense back into liquid water, the void should be increased by the presence of hydrogen. These two effects lead to the larger vapor void fraction found in the hydrogen generation cases.

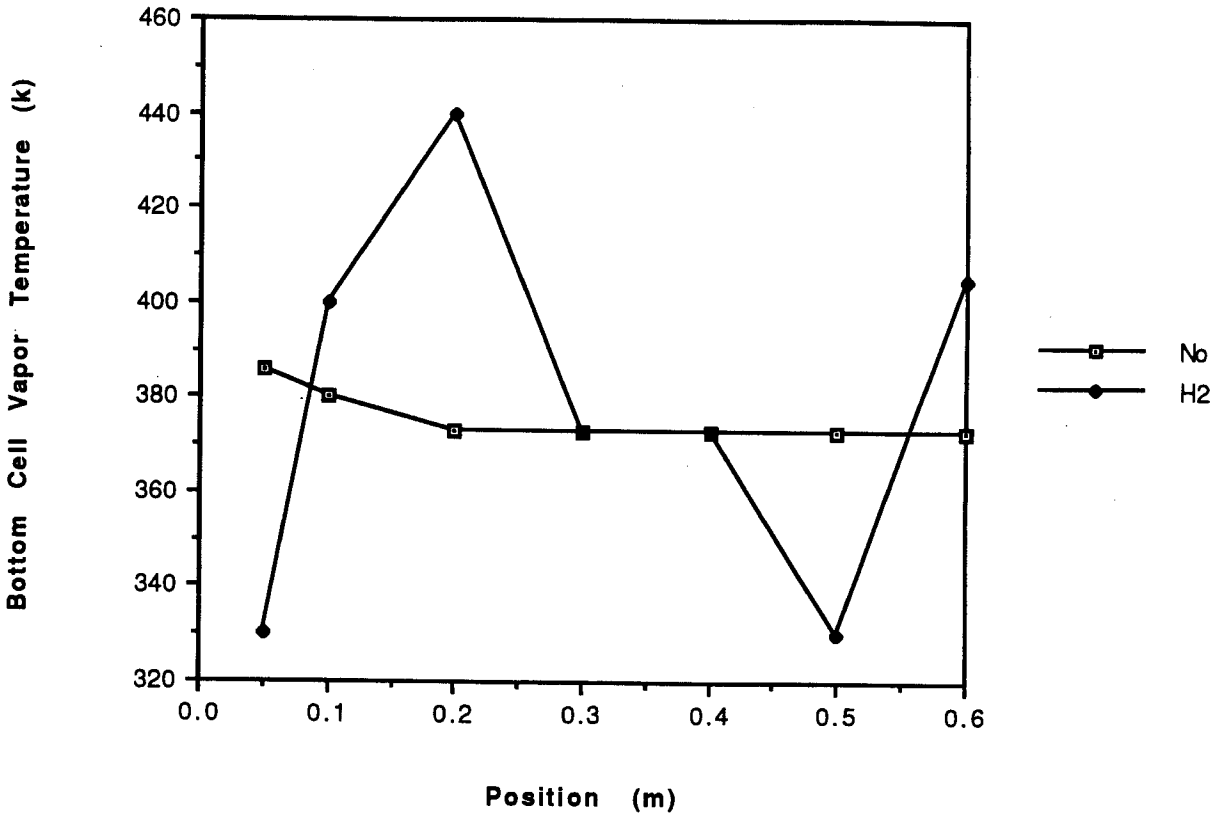
Figure 8.1.1: In-Vessel Vapor Void Fraction (with and without H2, Bott Cell) vs. time(s)



All other parameters, except vapor temperature, were virtually identical (with and without hydrogen generation). The entire set of "In-Vessel" plots is given in appendix B, figures B.1-B.12 and tables B.13-B.16.

Significant differences (~ 100 K) were seen in the vapor temperatures for the simulations with and without hydrogen generation. The explanation for lower vapor temperatures when hydrogen is generated is that the partial pressure of the water vapor is used to calculate the saturation temperature, which affects the temperature of the steam produced due to evaporation at the vapor-liquid interface. This in turn reduces the vapor temperature in TEXAS. As the water vapor molar percentage decreases, as water turns into hydrogen, the partial pressure also decreases and this drives down the vapor temperature. There are instances where the vapor temperature is higher for the hydrogen generating case. Generalized vapor temperature peaking (sometime as high as 900 k) occurred in a region where the molten particles were being injected, which happens to be slightly (~ 0.05 m) above the water/vapor interface in the cell. Since TEXAS models all gaseous voids as water vapor, the molten particle was exposed to a purely water vapor environment and significant hydrogen generation ensued. Figure B.5 (appendix B) shows the cyclical behavior of vapor temperature at this interface (a position of roughly 0.5 m). Large vapor temperatures (> 600 k) occur when the environment is composed mostly of water vapor and a significant quantity of hydrogen (with the subsequent energy release) is being produced. Because liquid water with its high thermal capacitance is not present, the energy release in the interfacial region primarily increases vapor temperature, hence the large values seen in figure B.5. Provided on the next page is a plot of vapor temperature with and without hydrogen generation for the In-Vessel case (figure 8.1.2).

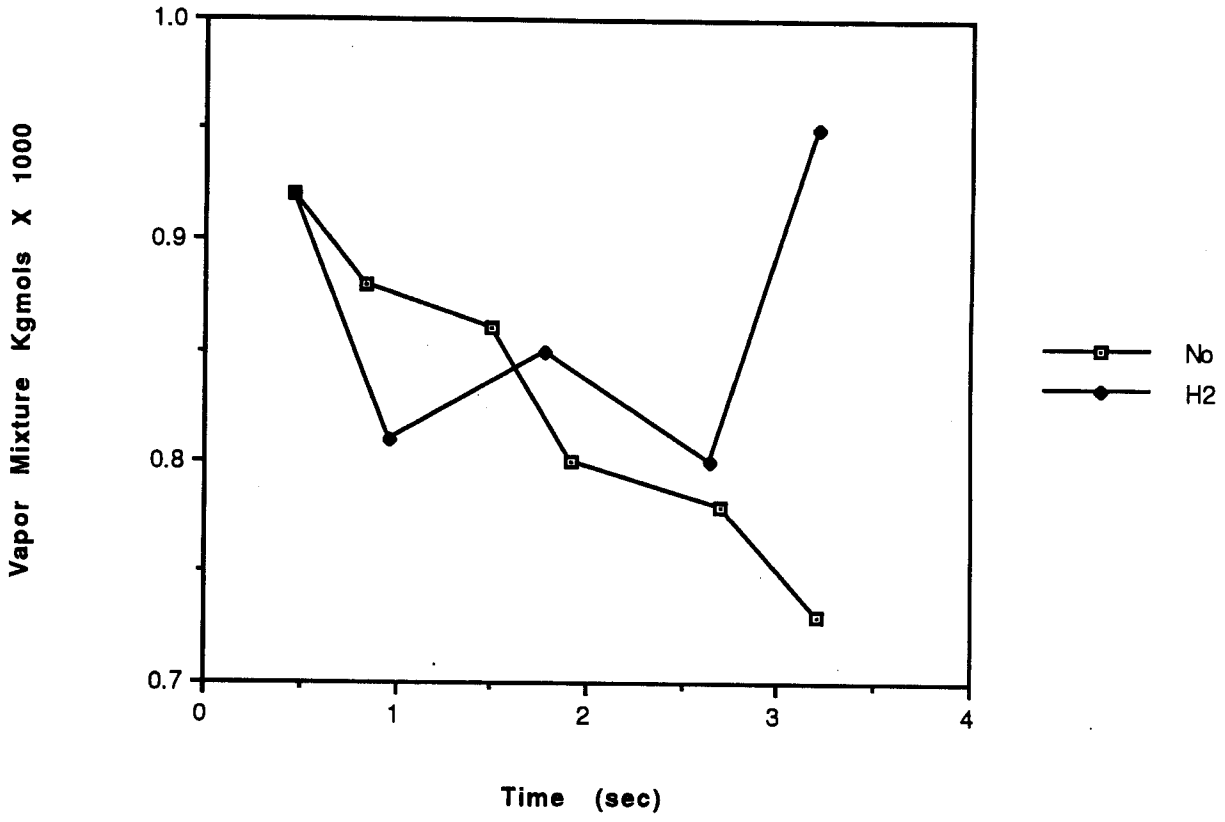
Figure 8.1.2: Vapor Temp.(k) vs. Position (m) (with and without H2) at 3.2 seconds



Pressure traces (also provided in appendix B, figures B.1-B.4) show virtually identical behavior for the cases with and without hydrogen generation. The pressure calculations were performed at the bottom of the pool and above the initial point of jet entry into the water, a region where TEXAS models the air as water vapor. Because of the relatively small change in void fraction, and only in the cell at the bottom of the pool, pressure excursions between the two cases would seem erroneous. The pressure traces should be and are very similar.

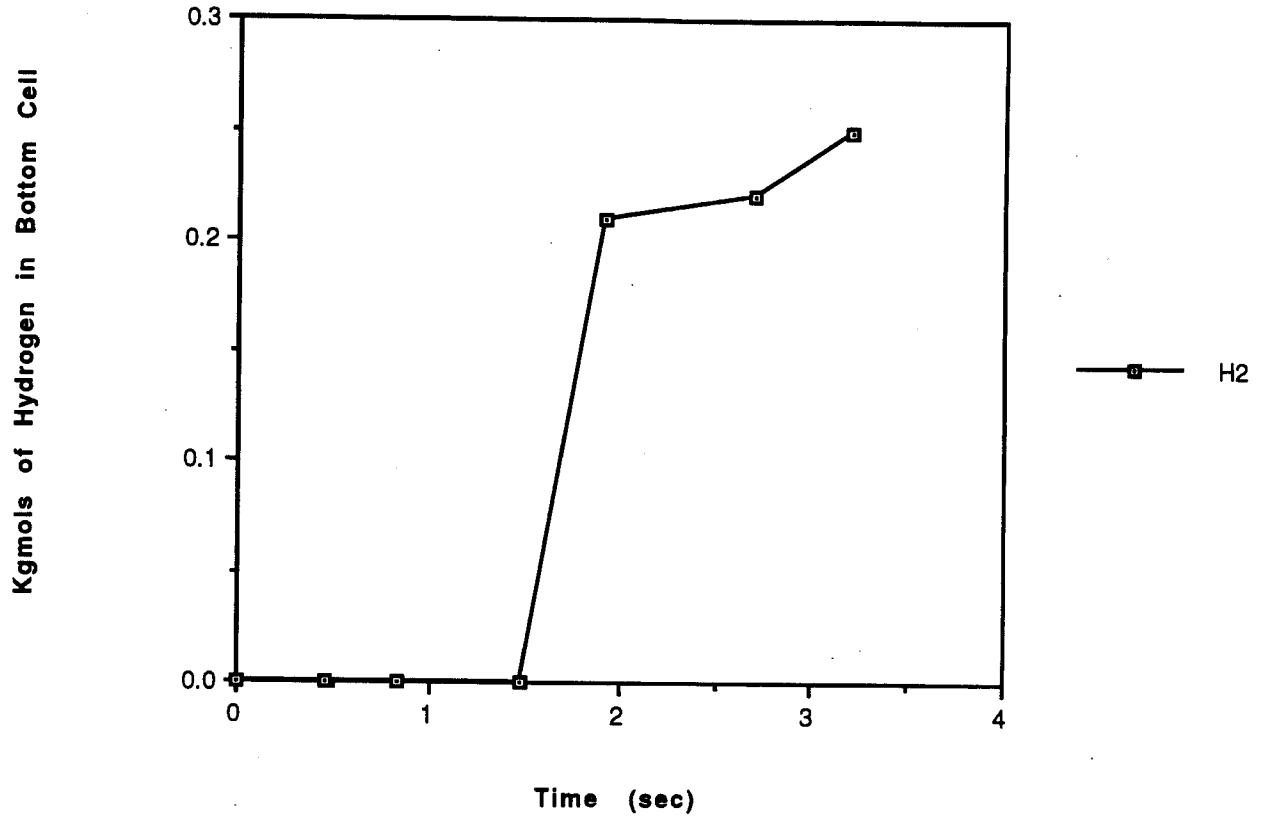
To simplify the calculational process, only steam voids greater than 1% were deemed sufficient for hydrogen generation to begin. This was not a significant factor and was chosen to simplify the coding changes that had to be done to TEXAS. For the run of 3.20 s, the total moles of gas for the non-hydrogen generating case (only water vapor) and the hydrogen generation case (hydrogen and water vapor) were found and are shown below in figure 8.1.3. Only cell elements that had fuel particles in them were included in the survey.

Figure 8.1.3: Vapor Mixture Kgmols (with and without H2) vs. time (s)



The molar concentration for the hydrogen generation case as a function of time is also given in figure 8.1.4.

Figure 8.1.4 : Kgmols of Hydrogen in Bottom Cell vs. Time (sec)



The difference in void at the bottom of the pool, where significant quantities of hot material are settling, show that hydrogen generation can be a major contributor to void production. Running the TEXAS code for longer periods of time would reveal potentially larger voids and greater system pressures, especially for sealed environments. The runs performed herein were constant presure boundary conditions (1 atm), meaning that great overpressurizations

would not be seen. Additional longer runs with hydrogen generation will be attempted in the future.

8.2 Parametric Results

The standard In-Vessel case (section 8.1), with identical input except a melt temperature of 1150 K first and then a bulk liquid temperature of 373 K (fuel at 950 K), were run with and without hydrogen generation for 1.2 seconds. The parameters of interest are shown below in table 8.2.1. The 1.2 second run time was chosen because of TEXAS convergence problems in running the off-nominal cases to 3.2 seconds. Large melt accumulations (excessive particle fractions) combined with excessive hydrogen generation makes convergence in the hydrodynamic code difficult.

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Table 8.2.1 (In-Vessel Parametric Results)

	Void at Bottom (%)	Vap Temp(k) at Bottom	Hydrogen Bott Cell Kgmols	Tot Hyd. Kgmols	Tot Gas Kgmols
Std					
With H_2	26	390	.11 (10^{-3})	.25 (10^{-3})	.81 (10^{-3})
No H_2	24	408	-	-	.87 (10^{-3})
1150 Tmelt					
With H_2	35	375	.14 (10^{-3})	.28 (10^{-3})	.83 (10^{-3})
No H_2	20	414	-	-	.85 (10^{-3})
373 Tbulk					
With H_2	57	330	.26 (10^{-3})	.20 (10^{-2})	.35 (10^{-2})
No H_2	22	399	-	-	.10 (10^{-2})

From the standard "In-Vessel" case we see signifcant changes in the output from the two parametric runs (with and without hydrogen generation). The cases run without hydrogen generation generally produced similar results; with the bottom cell void fraction ranging from 20% to 24%, the bottom cell vapor temperature ranging from 400 K to 414 K and the total molar concentration of vapor (in cells where fuel particles are present) ranging from 0.85 to 1.0 $X10^{-2}$ kgmols. We see that changing the fuel particle temperature and/or the bulk liquid temperature had a minimal effect on vapor void fraction and vapor temperature from the standard case. We see by raising the bulk liquid temperature to the saturation level (373 K), more (~ 16%) vapor was produced throughout the mesh cells where liquid was present. This makes sense in that the water is closer to

the point of evaporation, and that more of it should when the 950 K particle is dropped through water.

We see larger excursions from the standard "In-Vessel" output when hydrogen generation is included. Bottom cell vapor void fractions range from 26% to 57%, which is explained by the presence of less dense, non-condensable hydrogen that is accumulating in the bottom cell. With the larger void fractions (in the bottom cell) smaller vapor temperatures are found (ranging from 390 K to 330 K). The presence of hydrogen in the gas mixture causes the partial pressure of the water vapor to decrease, which forces the vapor pressure downward (as previously explained). The hydrogen generated in the bottom cell is consistent with previous results and shows a marked increase of 86% when the bulk liquid temperature is raised to 373 K. All TEXAS parametric outputs are given in appendix C, figures C.1-C.36 and tables C.37-C.48.

8.3 Ex-Vessel Failure

Because of the nature of the problem (large water pool), minimal water vapor voids were generated and hence negligible hydrogen quantities. The real problem in simulating the "Ex-Vessel" accident scenario was the particle inlet velocity (14 m/s) to the water pool. The developmental TEXAS version, that has the hydrogen production capability, could not handle such a high velocity. Subsequently a low velocity run was performed and baselined against a TEXAS version run on a Cray-XMP computer, which incorporates more advanced

numerical techniques. This version allowed an inlet velocity of 14 m/s and a parametric analysis was performed to find particle velocity effect on various output parameters. Shown in table 8.3.1 are the results.

Table 8.3.1 : Ex-Vessel Parametric Results

(all data taken at 0.6 seconds, 1.3 m up from bottom of cell)

	Vapor Temp(K)	Void Fraction	Fuel Particle Fraction	Avg. Part. Radius(m)
Titan				
(2 m/s)	377	0	8.06 X 10-2	-
Cray-XMP				
(2 m/s)	374	0	8.08 X 10-2	0.189
(14 m/s)	377	0	3.83 X 10-2	3.32 X 10-2

In order to better understand the particle breakup between the "Ex-Vessel" simulations, using velocities of 2 m/s and 14 m/s, plots were made of mixed melt mass and Sauter mean diameter (SMD) versus time. Separate plots are not shown for the two simulations with inlet velocities of 2 m/s (Titan and CRAY) because the particle breakup data are identical. The mixed melt mass is defined as the total mass in the system, at any given time, that exists in a particle that has already been broken (i.e not in a master particle of injection dimension). These fractured particles are considered mixed, hence the name mixed melt mass. The Sauter mean diameter (SMD) is defined below:

$$SMD = \frac{\Sigma N_i D_i^3}{\Sigma N_i D_i^2}$$

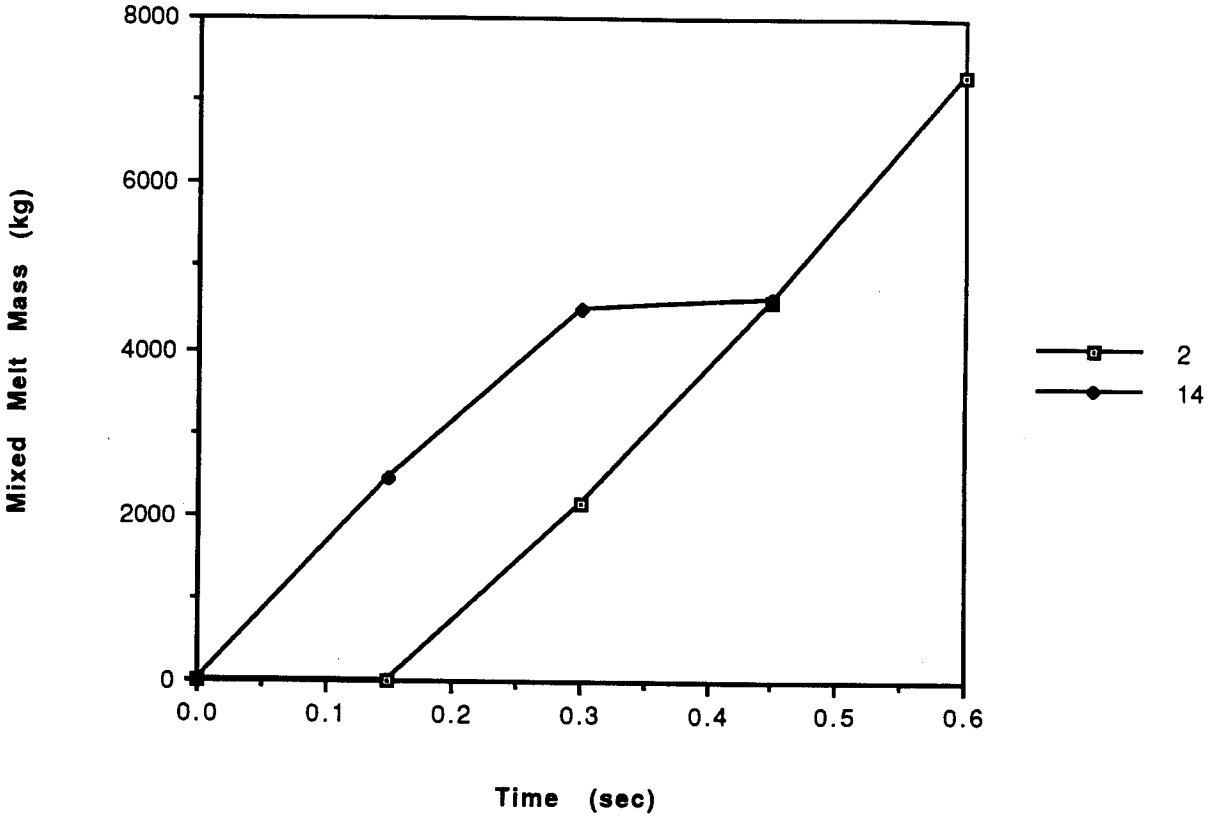
where: N_i = number of particles of a specific size

D_i = diameter of particles

It provides a measure of the average system particle diameter at any given time.

Figure 8.3.1 gives the mixed melt mass versus time for the two "Ex-Vessel" cases (2 and 14 m/s inlet velocities).

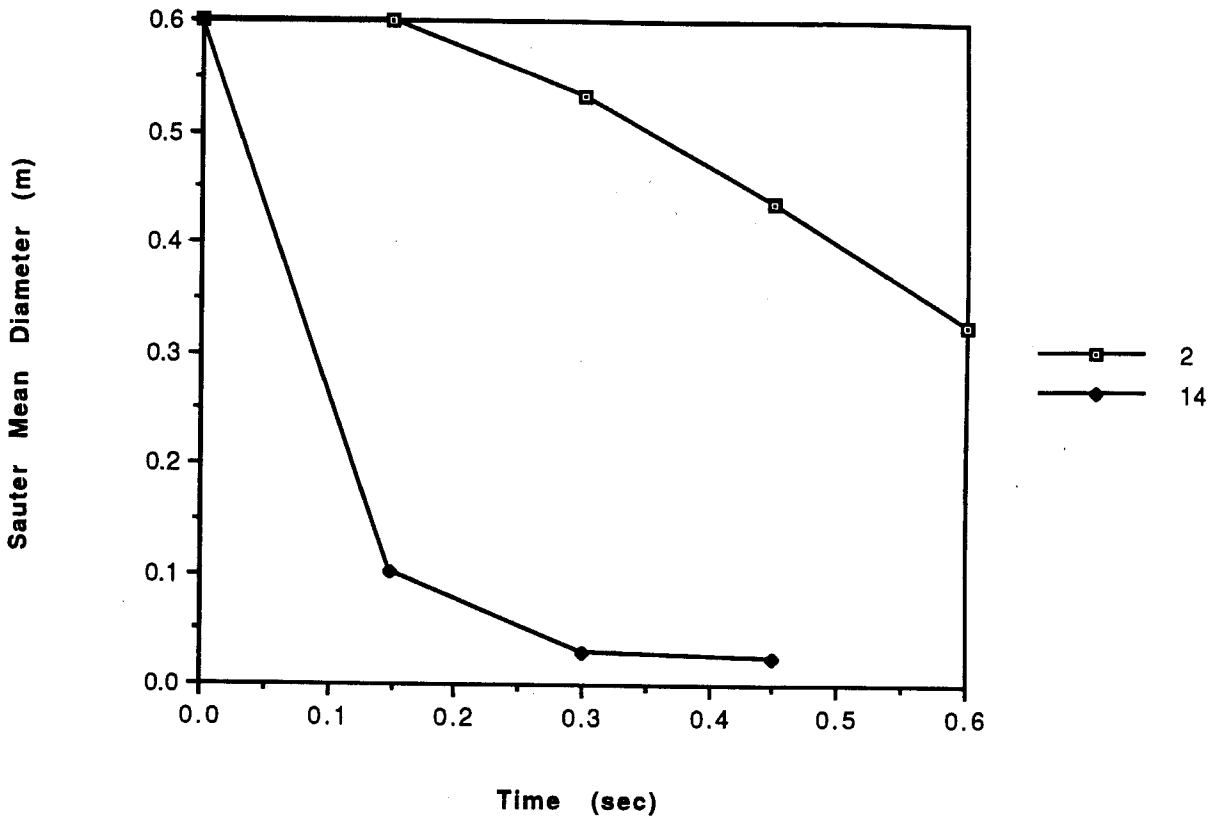
Figure 8.3.1: Mixed Melt Mass (kg) (for 2 and 14 m/s vel.) vs. time (s)



The characteristic shape of increasing mixed melt mass versus time is seen in both plots. It makes sense that more of the jet will break up as time goes on (hydrodynamically). It is also obvious that the simulation with the larger particle inlet velocity (14 m/s) should produce more mixed melt mass (better mixing), and it does. We consistently see larger mixed melt masses for a given time in the case of particle inlet velocity of 14 m/s.

Figure 8.3.2 presents the SMD versus time for the two "Ex-Vessel" cases (2 and 14 m/s particle inlet velocities).

Figure 8.3.2: Sauter Mean Diameter (m) (for 2 and 14 m/s vel.) vs. Time (s)



Here again we expect to see better mixing with the high velocity case, hence a smaller SMD. This behavior is apparent from the figure and shows that as time progresses continued breakup is seen as the SMD decreases with time.

By utilizing the CRAY-XMP computer and simulating the "Ex-Vessel" case with high particle inlet velocity (14 m/s), we see significantly greater particle breakup as expected. Again, because of the pool size (30 m2 in area) hydrogen generation was not a significant factor.

9 Discussion and Observations

9.1 Discussion

The TEXAS (hydrodynamic) code was updated to include hydrogen generation from the interaction of the unoxidized aluminum melt with the water vapor. Using a simplified diffusion based rate equation, TEXAS calculates the amount of hydrogen generated with each time step in the transient model. The model successfully demonstrated the increasing void effect with the presence of hydrogen in the gas mixture. This is explained by the lower density of the hydrogen gas as compared to the water vapor and its non-condensibility. The model was reasonably used to predict system characteristics for two reactor accident scenarios. The discussion that follows will relate the limitations and successes of the incorporated model for the scenarios described.

The model in its present form has a number of limitations. The model curently assumes that all energy liberated in the vapor/melt interface (from the chemical reaction) flows into the particle. This assumption was made to simplify accounting in the energy balance, no interfacial energy balances needed to be updated. In reality not all of the energy would move into the particle, especially considering it is usually the hottest element of the system. A more detailed heat transfer model should be derived for the system. The system energy and momentum balances were updated to include the presence of the non-condensable gas (hydrogen), but not the transport rate

equations. To accurately describe any system with a significant hydrogen void quantity, its presence would have to be included in these rate equations. Both of the hypothetical scenarios (In-Vessel and Ex-Vessel) analyzed in the report were small hydrogen void generators over small time spans (~ 0.5 seconds). Subsequently the simplified changes made to TEXAS (updating only system mass balance) should allow an accurate analysis of the two scenarios. Their are many accident scenarios that involve greater hydrogen generation, and in order to accurately predict these cases, TEXAS momentum and energy transport equations would have to be modified to include non-condensable gas (hydrogen). A final limitation involves the use of a simplified diffusion based rate equation for hydrogen generation. The model used assumes a hot fuel particle is immersed in water vapor. The model does not take into account that oxide is forming from the reaction of water vapor and aluminum, causing potentially a significant barrier to steam/hydrogen diffusion. The model also assumes that water vapor is always present to react with the melt, when in reality melted particles and hydrogen can begin to occupy significant volumetric space, especially at the bottom of the structure, during accidents and test scenarios. This was modified by correcting the partial pressure term in the diffusion equation. The term was biased by the percentage of water vapor in the gas mixture. As the water vapor is used up the partial pressure should go to zero and stop the diffusion based rate equation. A more realistic diffusion based equation should be proposed and incorporated into the TEXAS (hydrodynamic) code.

The results from the TEXAS runs showed very similar behavior for the two cases (with and without hydrogen generation) for the two reactor accident scenarios. The only real difference revealed was the greater void fraction generated at the bottom of the pool for the hydrogen production case. It makes sense that at a position where large steam voids and particle fractions occur, larger hydrogen quantities will be generated. The less dense hydrogen produces larger gas mixture voids. In scenario 7.1 (In-Vessel Failure) the void at the bottom of the pool increased from 32% to 48% (a 50% increase). This data verifies the importance of building a comprehensive hydrogen generation model, incorporating it into the TEXAS code, and running accident scenarios for longer time periods to better characterize the presence of hydrogen. I also believe it important to run hydrogen generating cases with sealed boundaries to determine the effective system prssure increases form the presence of the less dense hydrogen.

9.2 Summary

(1) TEXAS was successfully run with and without hydrogen generation using a simplified diffusion based rate equation.

	End of Run Bottom Cell Void Fraction (No H_2)	End of Run Bottom Cell Void Fraction (with H_2)
In-Vessel Failure	32%	48%

(2) Vapor temperature behavior was quite different with hydrogen generation. Explained by the position of the particle at injection and the hydrogen generation cycling.

(3) More total gas is created when hydrogen generation is included because of its noncondensibility.

(4) Parametric analyses show significant changes in void when particle temperature is increased or bulk liquid temperature is increased, with hydrogen generation.

(5) High velocity "Ex-Vessel" case shows greater particle breakup as expected.

9.3 Recommendations

(1) Run TEXAS with sealed boundaries.

(2) Incorporate in a more comprehensive hydrogen model.
   (a) Oxide layer resistence should be included.
   (b) Physically significant correction for steam limitation.

(3) Include hydrogen gas (noncondensible) in transport equations.

(4) Distribute exothermic energy from chemical reaction.

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Appendix A (NPR-4 Test Data)

Figure/Table	Explanation
A.1	Liquid Bulk Temp vs. Position
A.2	Vapor Void Fraction vs. Position
A.3	Fuel Particle Fraction vs. Position
A.4	Vapor Temp vs. Position
A.5	Pressure at Bottom of Cell vs. Time
A.6	Pressure at Top of Cell vs. Time
A.7	Particle Breakup Data

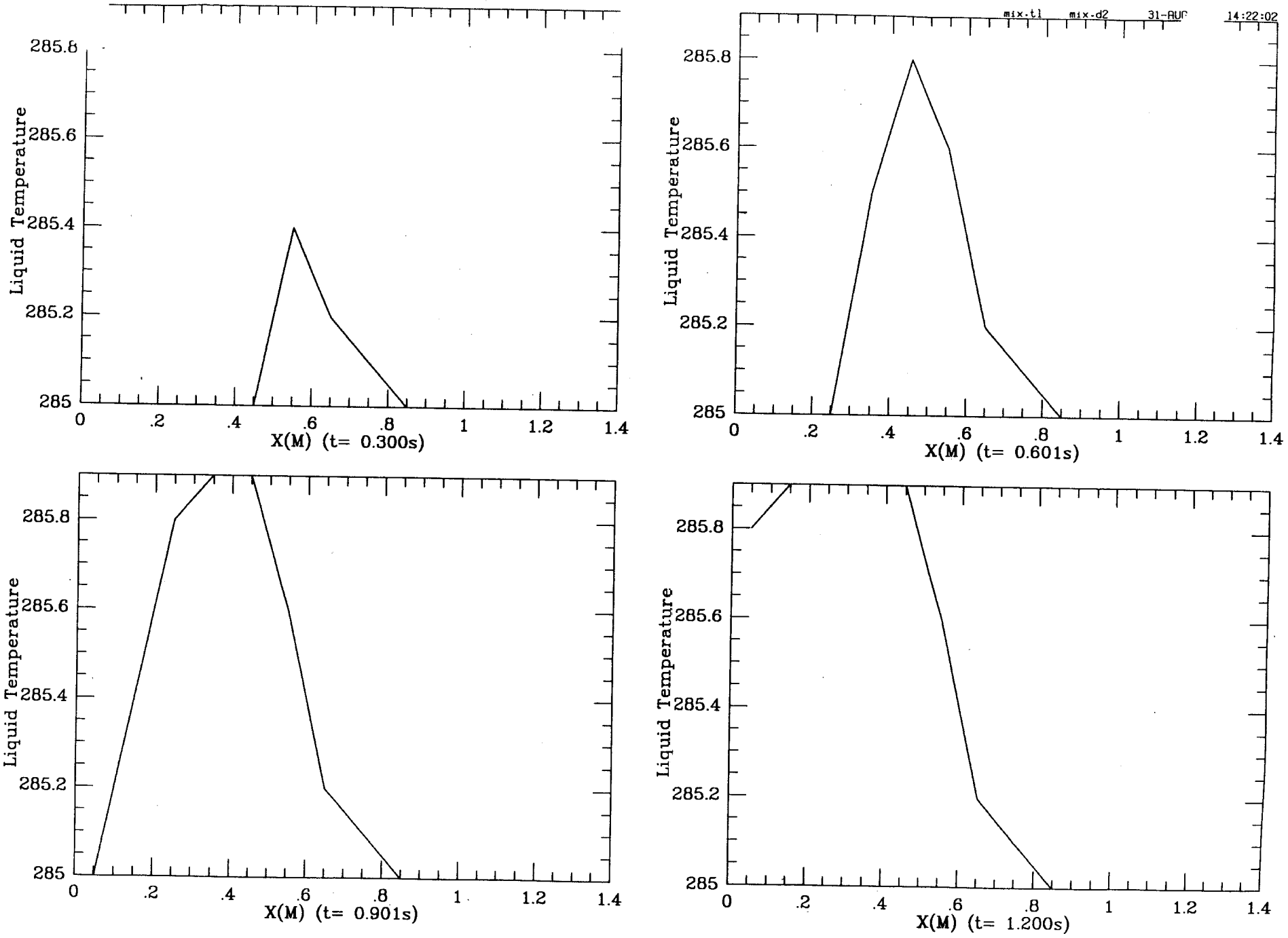

Figure A.1: Liquid Bulk Temp(K) vs. Position(m)

(for various times)

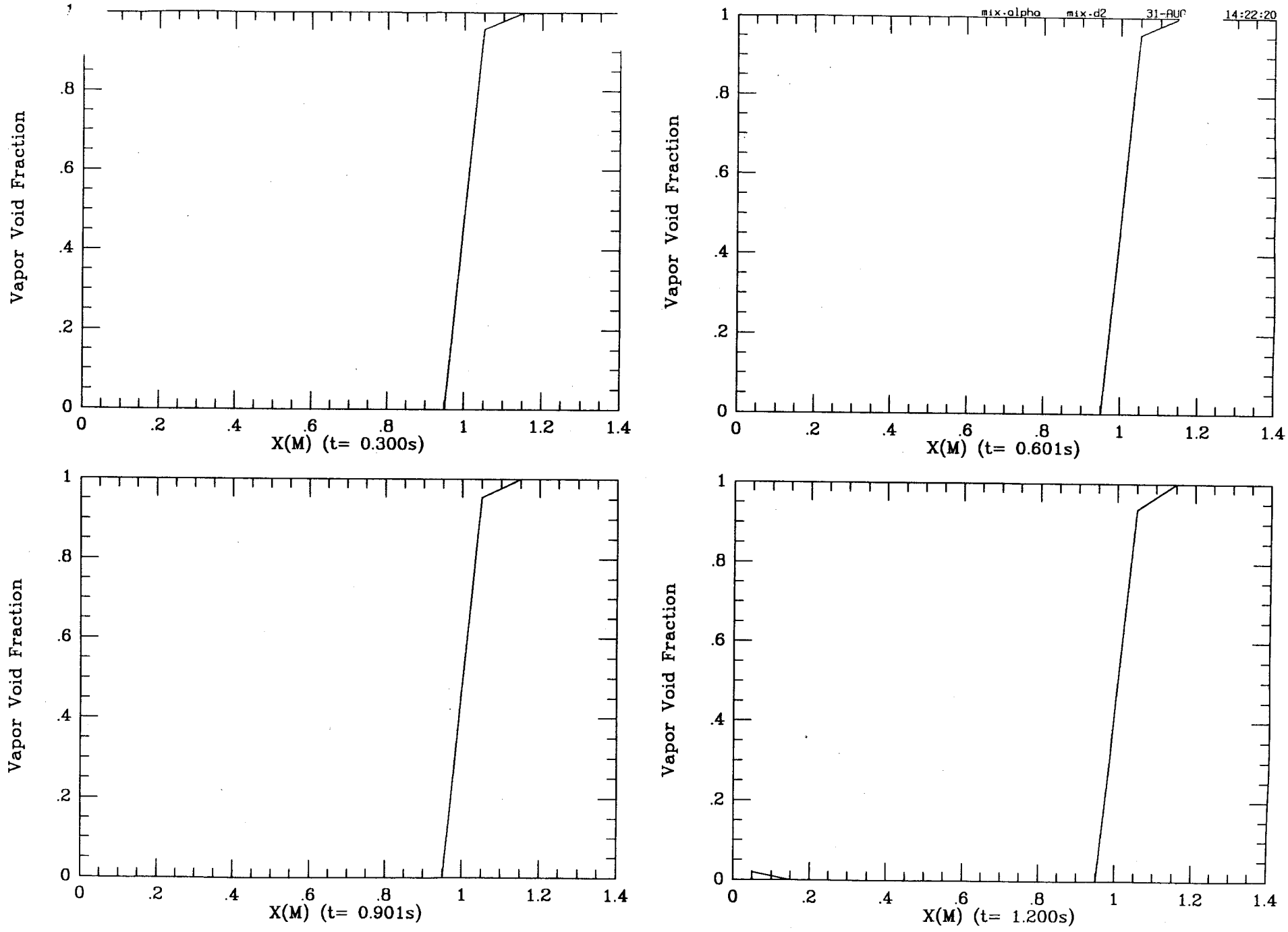

Figure A.2: Vapor Void Fraction vs. Position(m)
(for various times)

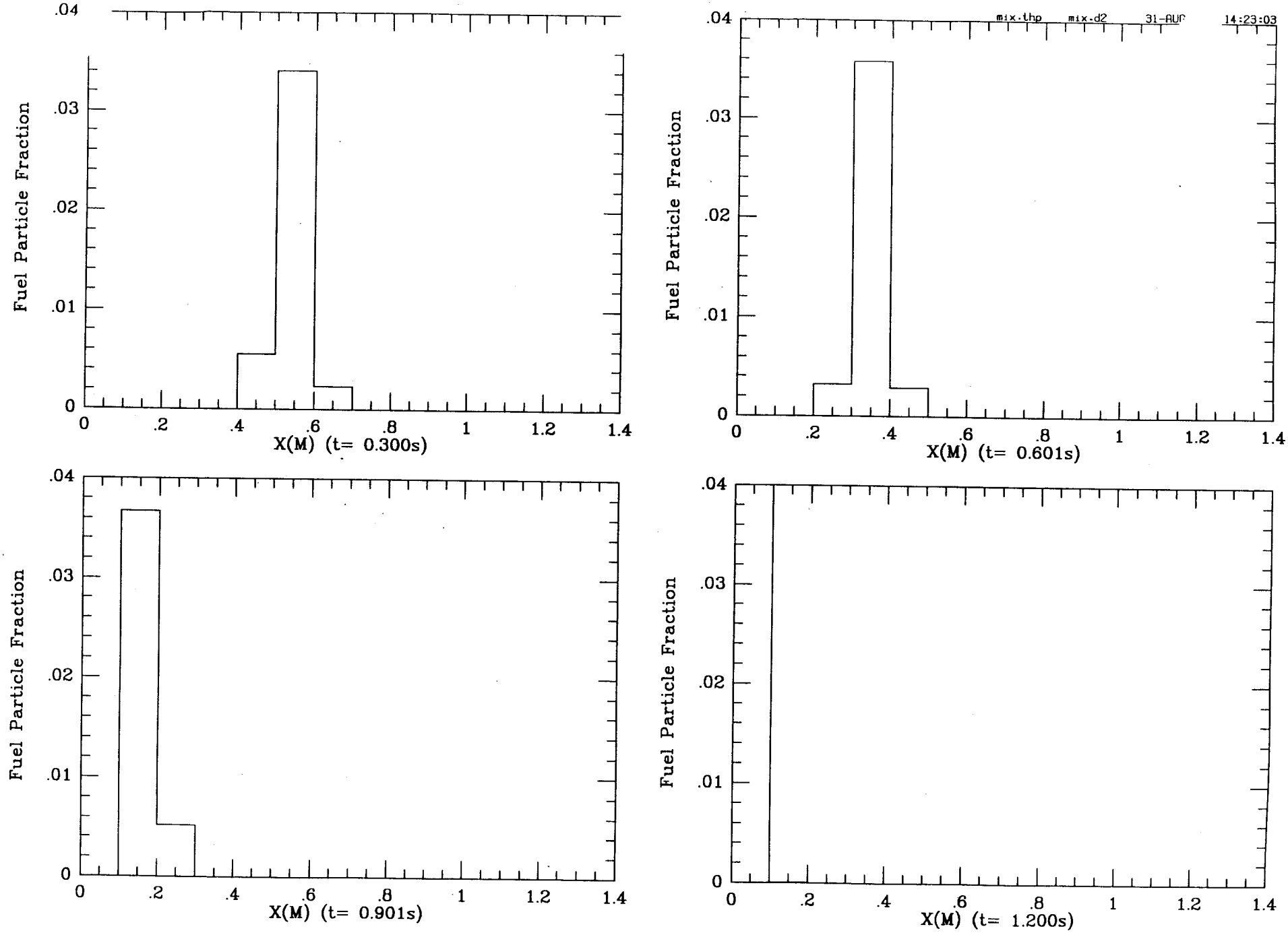

Figure A.3: Fuel Particle Fraction vs. Position(m)
(for various times)

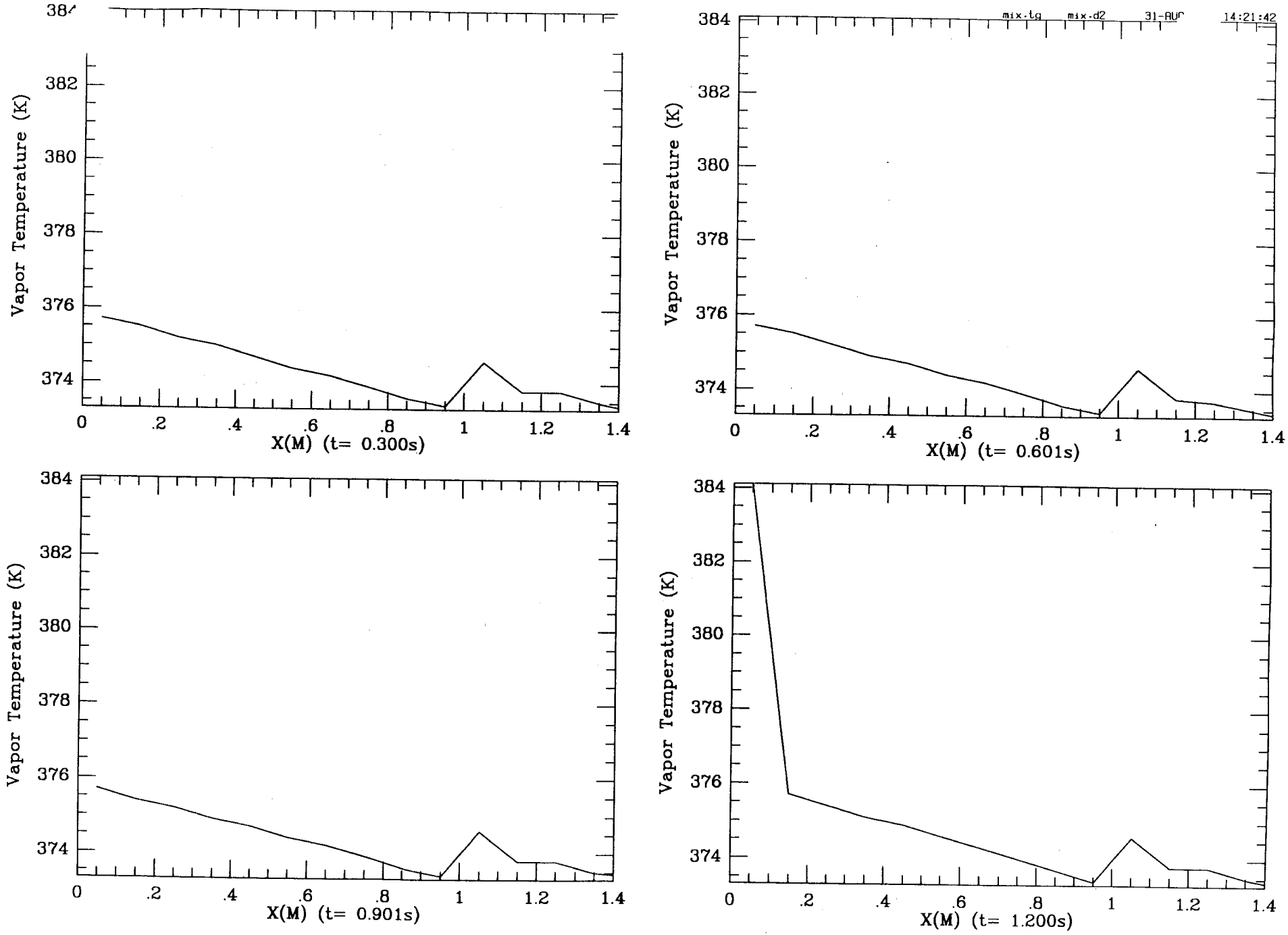

Figure A.4: Vapor Temp(K) vs. Position(m)
(for various times)

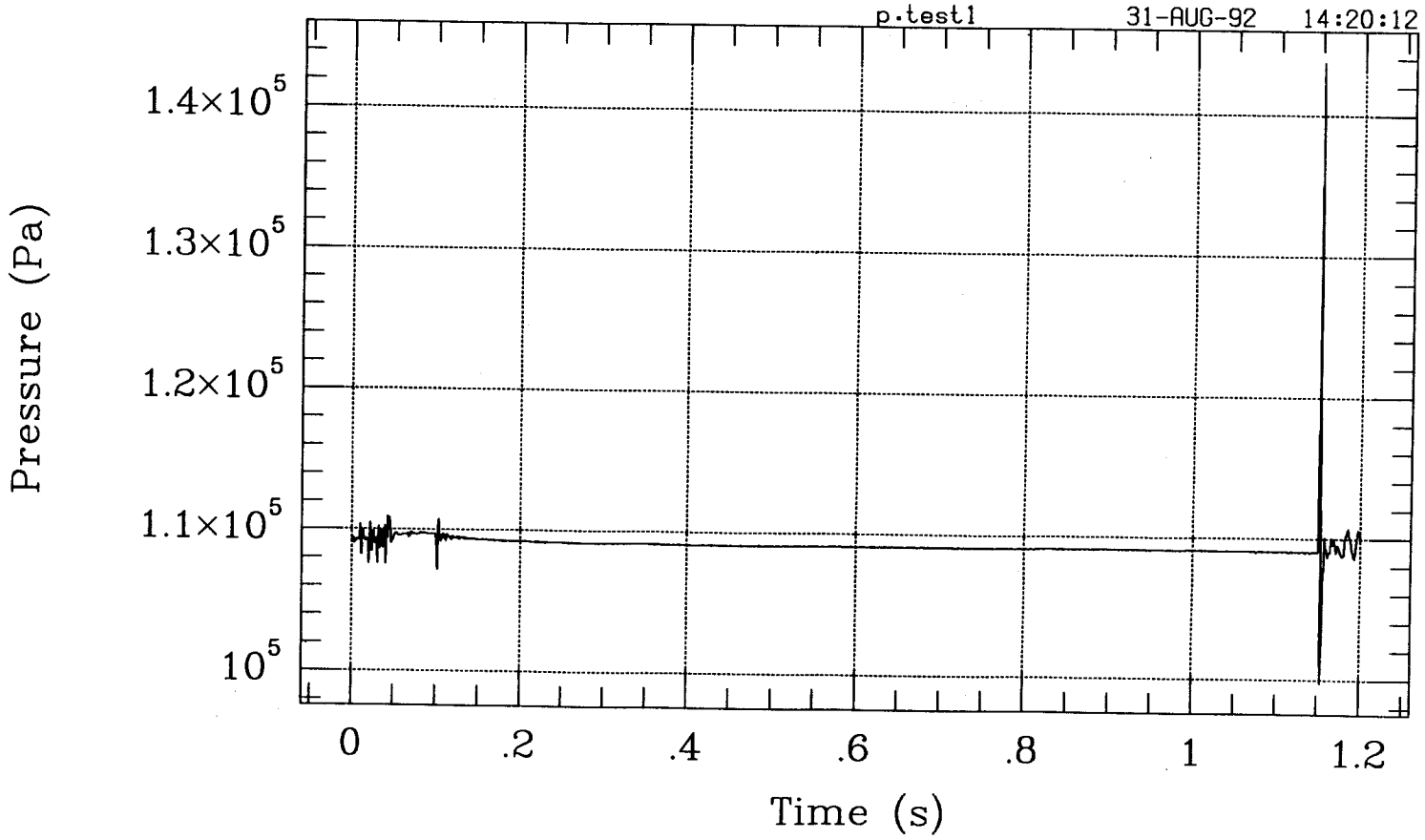

Figure A.5: Pressure(Pa) at Bottom of Cell vs. Time(s)

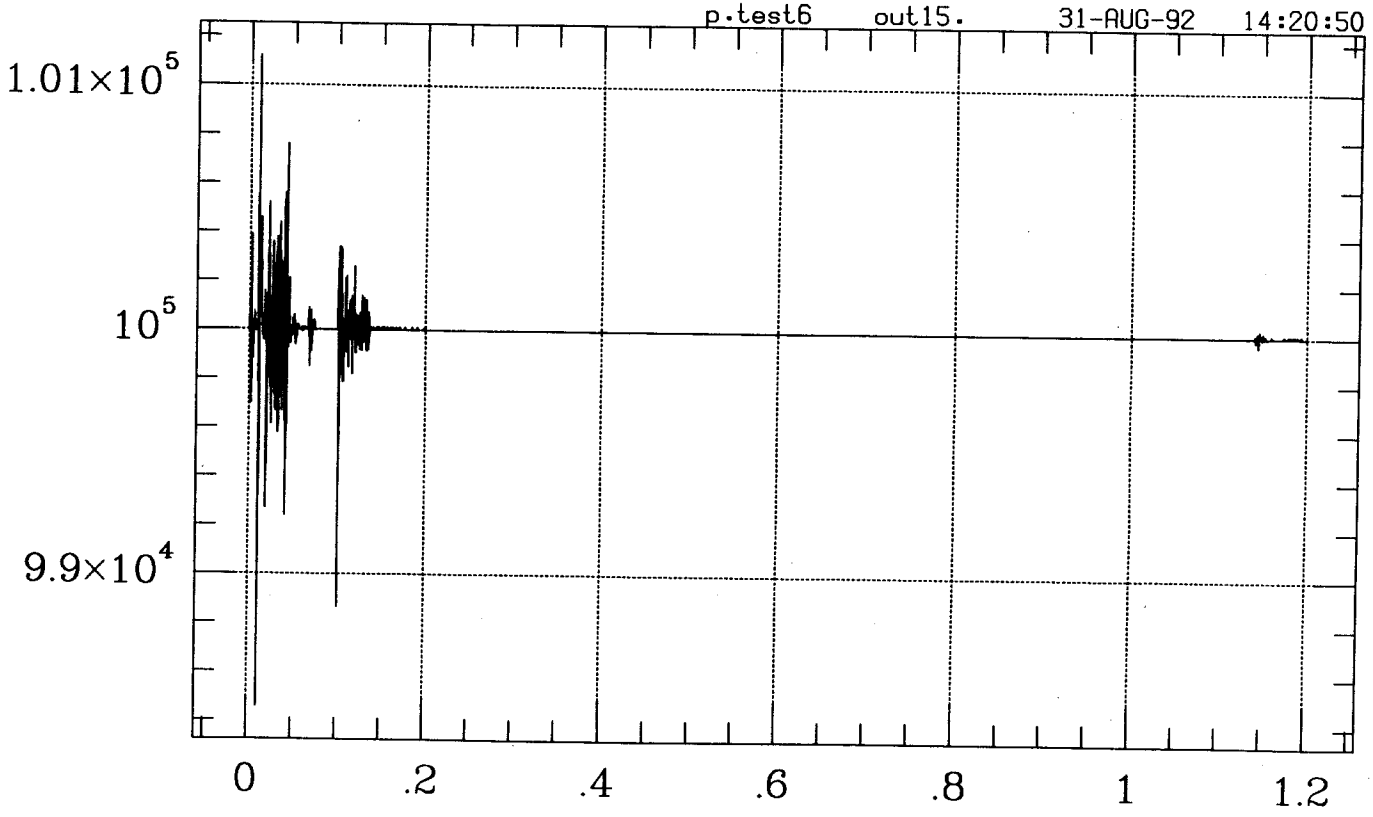

Figure A.6: Pressure(Pa) at Top of Cell vs. Time(s)

Table A.7: Particle Breakup Data

```
1Baselining case for thesis (npr-4) (08/17/92)
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00       1
    1          1     1.000E+03  5.000E-02 -5.000E+00  1.100E+00
  2.999017E-01      51
    1        512     9.797E+02  6.250E-03 -6.615E-01  5.056E-01
    2        256     9.837E+02  7.875E-03 -7.126E-01  4.882E-01
    3        256     9.826E+02  7.875E-03 -6.921E-01  5.211E-01
    4        256     9.842E+02  7.875E-03 -7.211E-01  5.262E-01
    5        256     9.853E+02  7.875E-03 -7.451E-01  5.340E-01
    6         64     9.891E+02  9.921E-03 -8.651E-01  5.061E-01
    7         16     9.883E+02  7.875E-03 -8.283E-01  5.404E-01
    8          8     9.886E+02  7.875E-03 -8.369E-01  5.578E-01
    9          8     9.882E+02  7.875E-03 -8.245E-01  5.859E-01
   10          8     9.879E+02  7.875E-03 -8.287E-01  6.160E-01
   11         16     9.883E+02  7.875E-03 -8.290E-01  5.599E-01
   12         16     9.885E+02  7.875E-03 -8.331E-01  5.773E-01
   13          8     9.879E+02  7.875E-03 -8.263E-01  6.051E-01
   14          8     9.878E+02  7.875E-03 -8.295E-01  6.357E-01
   15          8     9.878E+02  7.875E-03 -8.354E-01  6.479E-01
   16          8     9.883E+02  7.875E-03 -8.259E-01  5.982E-01
   17          8     9.879E+02  7.875E-03 -8.322E-01  6.284E-01
   18          8     9.879E+02  7.875E-03 -8.288E-01  6.174E-01
   19         16     9.883E+02  7.875E-03 -8.287E-01  5.529E-01
   20         16     9.884E+02  7.875E-03 -8.296E-01  5.722E-01
   21         16     9.886E+02  7.875E-03 -8.335E-01  5.896E-01
   22          8     9.885E+02  7.875E-03 -8.350E-01  5.702E-01
   23         16     9.885E+02  7.875E-03 -8.331E-01  5.872E-01
   24         16     9.884E+02  7.875E-03 -8.346E-01  5.993E-01
   25         16     9.885E+02  7.875E-03 -8.285E-01  5.504E-01
   26         16     9.884E+02  7.875E-03 -8.290E-01  5.698E-01
   27         16     9.883E+02  7.875E-03 -8.287E-01  5.628E-01
   28         16     9.884E+02  7.875E-03 -8.296E-01  5.821E-01
   29          8     9.886E+02  7.875E-03 -8.350E-01  5.801E-01
   30          8     9.886E+02  7.875E-03 -8.369E-01  5.677E-01
   31         64     9.891E+02  9.921E-03 -8.648E-01  5.160E-01
   32          8     9.878E+02  7.875E-03 -8.328E-01  6.435E-01
   33          8     9.878E+02  7.875E-03 -8.368E-01  6.558E-01
   34          8     9.879E+02  7.875E-03 -8.287E-01  6.239E-01
   35          8     9.879E+02  7.875E-03 -8.263E-01  6.130E-01
   36          8     9.879E+02  7.875E-03 -8.342E-01  6.362E-01
   37          8     9.879E+02  7.875E-03 -8.288E-01  6.253E-01
   38          8     9.883E+02  7.875E-03 -8.245E-01  5.938E-01
   39          8     9.880E+02  7.875E-03 -8.259E-01  6.061E-01
   40          8     9.885E+02  7.875E-03 -8.350E-01  5.780E-01
   41          8     9.887E+02  7.875E-03 -8.350E-01  5.880E-01
   42         16     9.883E+02  7.875E-03 -8.284E-01  5.483E-01
   43          8     9.886E+02  7.875E-03 -8.369E-01  5.656E-01
   44         16     9.883E+02  7.875E-03 -8.290E-01  5.677E-01
   45         16     9.883E+02  7.875E-03 -8.287E-01  5.607E-01
   46         16     9.884E+02  7.875E-03 -8.296E-01  5.801E-01
   47         16     9.885E+02  7.875E-03 -8.285E-01  5.582E-01
   48         16     9.884E+02  7.875E-03 -8.290E-01  5.777E-01
```

49	16	9.883E+02	7.875E-03	-8.287E-01	5.707E-01
50	16	9.885E+02	7.875E-03	-8.296E-01	5.900E-01
51	8	9.886E+02	7.875E-03	-8.369E-01	5.756E-01
6.008978E-01		78			
1	512	9.439E+02	6.250E-03	-6.105E-01	3.195E-01
2	256	9.512E+02	7.875E-03	-6.141E-01	2.989E-01
3	256	9.503E+02	7.875E-03	-6.112E-01	3.334E-01
4	256	9.518E+02	7.875E-03	-6.118E-01	3.371E-01
5	256	9.529E+02	7.875E-03	-6.116E-01	3.436E-01
6	64	9.571E+02	7.875E-03	-6.188E-01	3.061E-01
7	16	9.559E+02	7.875E-03	-6.125E-01	3.449E-01
8	8	9.562E+02	7.875E-03	-6.114E-01	3.620E-01
9	8	9.523E+02	6.250E-03	-6.076E-01	3.918E-01
10	8	9.517E+02	6.250E-03	-6.095E-01	4.210E-01
11	16	9.560E+02	7.875E-03	-6.122E-01	3.643E-01
12	16	9.530E+02	6.250E-03	-6.097E-01	3.821E-01
13	8	9.517E+02	6.250E-03	-6.079E-01	4.106E-01
14	8	9.512E+02	6.250E-03	-6.124E-01	4.407E-01
15	8	9.511E+02	6.250E-03	-6.157E-01	4.527E-01
16	8	9.520E+02	6.250E-03	-6.085E-01	4.036E-01
17	8	9.516E+02	6.250E-03	-6.112E-01	4.330E-01
18	8	9.518E+02	6.250E-03	-6.097E-01	4.223E-01
19	16	9.560E+02	7.875E-03	-6.123E-01	3.573E-01
20	16	9.560E+02	7.875E-03	-6.121E-01	3.764E-01
21	16	9.529E+02	6.250E-03	-6.090E-01	3.943E-01
22	8	9.531E+02	6.250E-03	-6.108E-01	3.747E-01
23	16	9.529E+02	6.250E-03	-6.089E-01	3.920E-01
24	16	9.524E+02	6.250E-03	-6.098E-01	4.037E-01
25	16	9.562E+02	7.875E-03	-6.123E-01	3.548E-01
26	16	9.560E+02	7.875E-03	-6.122E-01	3.741E-01
27	16	9.560E+02	7.875E-03	-6.122E-01	3.672E-01
28	16	9.560E+02	7.875E-03	-6.111E-01	3.864E-01
29	8	9.530E+02	6.250E-03	-6.098E-01	3.847E-01
30	8	9.562E+02	7.875E-03	-6.114E-01	3.719E-01
31	64	9.571E+02	7.875E-03	-6.184E-01	3.162E-01
32	8	9.512E+02	6.250E-03	-6.160E-01	4.482E-01
33	8	9.509E+02	6.250E-03	-6.145E-01	4.605E-01
34	8	9.517E+02	6.250E-03	-6.112E-01	4.286E-01
35	8	9.518E+02	6.250E-03	-6.090E-01	4.182E-01
36	8	9.516E+02	6.250E-03	-6.137E-01	4.405E-01
37	8	9.518E+02	6.250E-03	-6.116E-01	4.299E-01
38	8	9.522E+02	6.250E-03	-6.081E-01	3.994E-01
39	8	9.520E+02	6.250E-03	-6.093E-01	4.112E-01
40	8	9.530E+02	6.250E-03	-6.097E-01	3.827E-01
41	8	9.531E+02	6.250E-03	-6.089E-01	3.926E-01
42	16	9.560E+02	7.875E-03	-6.123E-01	3.528E-01
43	8	9.562E+02	7.875E-03	-6.114E-01	3.698E-01
44	16	9.560E+02	7.875E-03	-6.122E-01	3.721E-01
45	16	9.560E+02	7.875E-03	-6.122E-01	3.652E-01
46	16	9.560E+02	7.875E-03	-6.111E-01	3.844E-01
47	16	9.562E+02	7.875E-03	-6.122E-01	3.627E-01
48	16	9.561E+02	7.875E-03	-6.123E-01	3.818E-01
49	16	9.560E+02	7.875E-03	-6.122E-01	3.750E-01
50	16	9.561E+02	7.875E-03	-6.115E-01	3.940E-01

51	8	9.532E+02	6.250E-03	-6.109E-01	3.797E-01
52	64	9.573E+02	7.875E-03	-6.185E-01	3.141E-01
53	64	9.572E+02	7.875E-03	-6.181E-01	3.242E-01
54	8	9.511E+02	6.250E-03	-6.158E-01	4.588E-01
55	8	9.509E+02	6.250E-03	-6.147E-01	4.666E-01
56	8	9.512E+02	6.250E-03	-6.151E-01	4.468E-01
57	8	9.512E+02	6.250E-03	-6.170E-01	4.543E-01
58	8	9.518E+02	6.250E-03	-6.108E-01	4.270E-01
59	8	9.517E+02	6.250E-03	-6.088E-01	4.166E-01
60	8	9.519E+02	6.250E-03	-6.111E-01	4.284E-01
61	8	9.520E+02	6.250E-03	-6.128E-01	4.346E-01
62	8	9.517E+02	6.250E-03	-6.101E-01	4.242E-01
63	8	9.516E+02	6.250E-03	-6.132E-01	4.391E-01
64	8	9.515E+02	6.250E-03	-6.164E-01	4.466E-01
65	8	9.519E+02	6.250E-03	-6.134E-01	4.360E-01
66	8	9.522E+02	6.250E-03	-6.080E-01	3.979E-01
67	8	9.520E+02	6.250E-03	-6.091E-01	4.096E-01
68	8	9.519E+02	6.250E-03	-6.087E-01	4.054E-01
69	8	9.520E+02	6.250E-03	-6.101E-01	4.172E-01
70	16	9.526E+02	6.250E-03	-6.094E-01	4.003E-01
71	16	9.524E+02	6.250E-03	-6.104E-01	4.097E-01
72	16	9.530E+02	6.250E-03	-6.099E-01	3.882E-01
73	16	9.528E+02	6.250E-03	-6.092E-01	3.980E-01
74	8	9.530E+02	6.250E-03	-6.100E-01	3.908E-01
75	8	9.530E+02	6.250E-03	-6.100E-01	3.888E-01
76	8	9.530E+02	6.250E-03	-6.093E-01	3.986E-01
77	8	9.531E+02	6.250E-03	-6.109E-01	3.809E-01
78	8	9.532E+02	6.250E-03	-6.111E-01	3.859E-01
9.008939E-01		78			
1	512	9.330E+02	6.250E-03	-6.102E-01	1.365E-01
2	256	9.330E+02	7.875E-03	-6.142E-01	1.148E-01
3	256	9.330E+02	7.875E-03	-6.103E-01	1.502E-01
4	256	9.330E+02	7.875E-03	-6.110E-01	1.536E-01
5	256	9.330E+02	7.875E-03	-6.111E-01	1.602E-01
6	64	9.330E+02	7.875E-03	-6.185E-01	1.208E-01
7	16	9.330E+02	7.875E-03	-6.118E-01	1.612E-01
8	8	9.330E+02	7.875E-03	-6.109E-01	1.786E-01
9	8	9.330E+02	6.250E-03	-6.076E-01	2.092E-01
10	8	9.330E+02	6.250E-03	-6.119E-01	2.376E-01
11	16	9.330E+02	7.875E-03	-6.117E-01	1.806E-01
12	16	9.330E+02	6.250E-03	-6.094E-01	1.990E-01
13	8	9.330E+02	6.250E-03	-6.093E-01	2.276E-01
14	8	9.330E+02	6.250E-03	-6.149E-01	2.573E-01
15	8	9.330E+02	6.250E-03	-6.139E-01	2.691E-01
16	8	9.330E+02	6.250E-03	-6.091E-01	2.205E-01
17	8	9.330E+02	6.250E-03	-6.158E-01	2.495E-01
18	8	9.330E+02	6.250E-03	-6.123E-01	2.389E-01
19	16	9.330E+02	7.875E-03	-6.118E-01	1.737E-01
20	16	9.330E+02	7.875E-03	-6.117E-01	1.927E-01
21	16	9.330E+02	6.250E-03	-6.091E-01	2.112E-01
22	8	9.330E+02	6.250E-03	-6.104E-01	1.914E-01
23	16	9.330E+02	6.250E-03	-6.089E-01	2.089E-01
24	16	9.330E+02	6.250E-03	-6.104E-01	2.202E-01
25	16	9.330E+02	7.875E-03	-6.118E-01	1.712E-01

26	16	9.330E+02	7.875E-03	-6.118E-01	1.903E-01
27	16	9.330E+02	7.875E-03	-6.117E-01	1.835E-01
28	16	9.330E+02	7.875E-03	-6.109E-01	2.028E-01
29	8	9.330E+02	6.250E-03	-6.095E-01	2.015E-01
30	8	9.330E+02	7.875E-03	-6.109E-01	1.884E-01
31	64	9.330E+02	7.875E-03	-6.178E-01	1.310E-01
32	8	9.330E+02	6.250E-03	-6.151E-01	2.644E-01
33	8	9.330E+02	6.250E-03	-6.129E-01	2.770E-01
34	8	9.330E+02	6.250E-03	-6.147E-01	2.449E-01
35	8	9.330E+02	6.250E-03	-6.112E-01	2.349E-01
36	8	9.330E+02	6.250E-03	-6.162E-01	2.567E-01
37	8	9.330E+02	6.250E-03	-6.152E-01	2.462E-01
38	8	9.330E+02	6.250E-03	-6.086E-01	2.165E-01
39	8	9.330E+02	6.250E-03	-6.105E-01	2.278E-01
40	8	9.330E+02	6.250E-03	-6.095E-01	1.996E-01
41	8	9.330E+02	6.250E-03	-6.089E-01	2.095E-01
42	16	9.330E+02	7.875E-03	-6.118E-01	1.691E-01
43	8	9.330E+02	7.875E-03	-6.109E-01	1.864E-01
44	16	9.330E+02	7.875E-03	-6.117E-01	1.883E-01
45	16	9.330E+02	7.875E-03	-6.117E-01	1.815E-01
46	16	9.330E+02	7.875E-03	-6.108E-01	2.009E-01
47	16	9.330E+02	7.875E-03	-6.118E-01	1.790E-01
48	16	9.330E+02	7.875E-03	-6.119E-01	1.979E-01
49	16	9.330E+02	7.875E-03	-6.118E-01	1.912E-01
50	16	9.330E+02	7.875E-03	-6.115E-01	2.102E-01
51	8	9.330E+02	6.250E-03	-6.105E-01	1.963E-01
52	64	9.330E+02	7.875E-03	-6.180E-01	1.288E-01
53	64	9.330E+02	7.875E-03	-6.172E-01	1.390E-01
54	8	9.330E+02	6.250E-03	-6.142E-01	2.750E-01
55	8	9.330E+02	6.250E-03	-6.132E-01	2.828E-01
56	8	9.330E+02	6.250E-03	-6.151E-01	2.631E-01
57	8	9.330E+02	6.250E-03	-6.153E-01	2.703E-01
58	8	9.330E+02	6.250E-03	-6.142E-01	2.434E-01
59	8	9.330E+02	6.250E-03	-6.106E-01	2.334E-01
60	8	9.330E+02	6.250E-03	-6.147E-01	2.447E-01
61	8	9.330E+02	6.250E-03	-6.174E-01	2.507E-01
62	8	9.330E+02	6.250E-03	-6.130E-01	2.406E-01
63	8	9.330E+02	6.250E-03	-6.162E-01	2.553E-01
64	8	9.330E+02	6.250E-03	-6.164E-01	2.625E-01
65	8	9.330E+02	6.250E-03	-6.174E-01	2.520E-01
66	8	9.330E+02	6.250E-03	-6.083E-01	2.150E-01
67	8	9.330E+02	6.250E-03	-6.103E-01	2.263E-01
68	8	9.330E+02	6.250E-03	-6.094E-01	2.223E-01
69	8	9.330E+02	6.250E-03	-6.121E-01	2.336E-01
70	16	9.330E+02	6.250E-03	-6.099E-01	2.170E-01
71	16	9.330E+02	6.250E-03	-6.114E-01	2.260E-01
72	16	9.330E+02	6.250E-03	-6.098E-01	2.049E-01
73	16	9.330E+02	6.250E-03	-6.096E-01	2.147E-01
74	8	9.330E+02	6.250E-03	-6.100E-01	2.074E-01
75	8	9.330E+02	6.250E-03	-6.098E-01	2.055E-01
76	8	9.330E+02	6.250E-03	-6.096E-01	2.153E-01
77	8	9.330E+02	6.250E-03	-6.106E-01	1.974E-01
78	8	9.330E+02	6.250E-03	-6.108E-01	2.023E-01

1.199901E+00 78

1	512	9.330E+02	6.250E-03	-6.386E-03	6.250E-03
2	256	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
3	256	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
4	256	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
5	256	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
6	64	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
7	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
8	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
9	8	9.330E+02	6.250E-03	-6.046E-01	2.762E-02
10	8	9.330E+02	6.250E-03	-5.823E-01	5.594E-02
11	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
12	16	9.330E+02	6.250E-03	-6.102E-01	1.661E-02
13	8	9.330E+02	6.250E-03	-5.884E-01	4.627E-02
14	8	9.330E+02	6.250E-03	-5.802E-01	7.551E-02
15	8	9.330E+02	6.250E-03	-5.794E-01	8.715E-02
16	8	9.330E+02	6.250E-03	-5.974E-01	3.894E-02
17	8	9.330E+02	6.250E-03	-5.813E-01	6.773E-02
18	8	9.330E+02	6.250E-03	-5.823E-01	5.720E-02
19	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
20	16	9.330E+02	7.875E-03	-6.128E-01	9.649E-03
21	16	9.330E+02	6.250E-03	-6.050E-01	2.928E-02
22	8	9.330E+02	6.250E-03	-6.115E-01	8.734E-03
23	16	9.330E+02	6.250E-03	-6.061E-01	2.699E-02
24	16	9.330E+02	6.250E-03	-5.991E-01	3.826E-02
25	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
26	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
27	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
28	16	9.330E+02	7.875E-03	-6.115E-01	2.004E-02
29	8	9.330E+02	6.250E-03	-6.102E-01	1.912E-02
30	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
31	64	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
32	8	9.330E+02	6.250E-03	-5.805E-01	8.229E-02
33	8	9.330E+02	6.250E-03	-5.787E-01	9.503E-02
34	8	9.330E+02	6.250E-03	-5.824E-01	6.293E-02
35	8	9.330E+02	6.250E-03	-5.822E-01	5.332E-02
36	8	9.330E+02	6.250E-03	-5.815E-01	7.458E-02
37	8	9.330E+02	6.250E-03	-5.825E-01	6.417E-02
38	8	9.330E+02	6.250E-03	-6.005E-01	3.490E-02
39	8	9.330E+02	6.250E-03	-5.896E-01	4.610E-02
40	8	9.330E+02	6.250E-03	-6.102E-01	1.720E-02
41	8	9.330E+02	6.250E-03	-6.058E-01	2.757E-02
42	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
43	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
44	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
45	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
46	16	9.330E+02	7.875E-03	-6.115E-01	1.811E-02
47	16	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
48	16	9.330E+02	7.875E-03	-6.128E-01	1.485E-02
49	16	9.330E+02	7.875E-03	-6.129E-01	8.152E-03
50	16	9.330E+02	7.875E-03	-6.083E-01	2.750E-02
51	8	9.330E+02	6.250E-03	-6.114E-01	1.363E-02
52	64	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
53	64	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
54	8	9.330E+02	6.250E-03	-5.798E-01	9.272E-02

55	8	9.330E+02	6.250E-03	-5.791E-01	1.006E-01
56	8	9.330E+02	6.250E-03	-5.804E-01	8.101E-02
57	8	9.330E+02	6.250E-03	-5.808E-01	8.786E-02
58	8	9.330E+02	6.250E-03	-5.824E-01	6.149E-02
59	8	9.330E+02	6.250E-03	-5.822E-01	5.187E-02
60	8	9.330E+02	6.250E-03	-5.824E-01	6.273E-02
61	8	9.330E+02	6.250E-03	-5.826E-01	6.844E-02
62	8	9.330E+02	6.250E-03	-5.823E-01	5.888E-02
63	8	9.330E+02	6.250E-03	-5.814E-01	7.324E-02
64	8	9.330E+02	6.250E-03	-5.817E-01	8.006E-02
65	8	9.330E+02	6.250E-03	-5.826E-01	6.967E-02
66	8	9.330E+02	6.250E-03	-6.013E-01	3.344E-02
67	8	9.330E+02	6.250E-03	-5.919E-01	4.463E-02
68	8	9.330E+02	6.250E-03	-5.959E-01	4.065E-02
69	8	9.330E+02	6.250E-03	-5.835E-01	5.171E-02
70	16	9.330E+02	6.250E-03	-6.013E-01	3.506E-02
71	16	9.330E+02	6.250E-03	-5.938E-01	4.395E-02
72	16	9.330E+02	6.250E-03	-6.089E-01	2.260E-02
73	16	9.330E+02	6.250E-03	-6.029E-01	3.280E-02
74	8	9.330E+02	6.250E-03	-6.081E-01	2.509E-02
75	8	9.330E+02	6.250E-03	-6.088E-01	2.319E-02
76	8	9.330E+02	6.250E-03	-6.025E-01	3.338E-02
77	8	9.330E+02	6.250E-03	-6.114E-01	1.475E-02
78	8	9.330E+02	6.250E-03	-6.114E-01	1.960E-02

Appendix B (Standard In-Vessel Results)

Figure/Table	Explanation
B.1	Pressure at Top of Cell vs. Time (with H_2)
B.2	Pressure at Top of Cell vs. Time (no H_2)
B.3	Pressure at Bottom of Cell vs. Time (with H_2)
B.4	Pressure at Bottom of Cell vs. Time (no H_2)
B.5	Vapor Temp vs. Position (with H_2)
B.6	Vapor Temp vs. Position (no H_2)
B.7	Fuel Particle Fraction vs. Position (with H_2)
B.8	Fuel Particle Fraction vs. Position (no H_2)
B.9	Vapor Void Fraction vs. Position (with H2)
B.10	Vapor Void Fraction vs. Position (no H2)
B.11	Liquid Temp vs. Position (with H_2)
B.12	Liquid Temp vs. Position (no H_2)
B.13	Gas Mixture Information (with H_2)
B.14	Gas Mixture Information (no H_2)
B.15	Particle Breakup Data (with H_2)
B.16	Particle Breakup Data (no H_2)

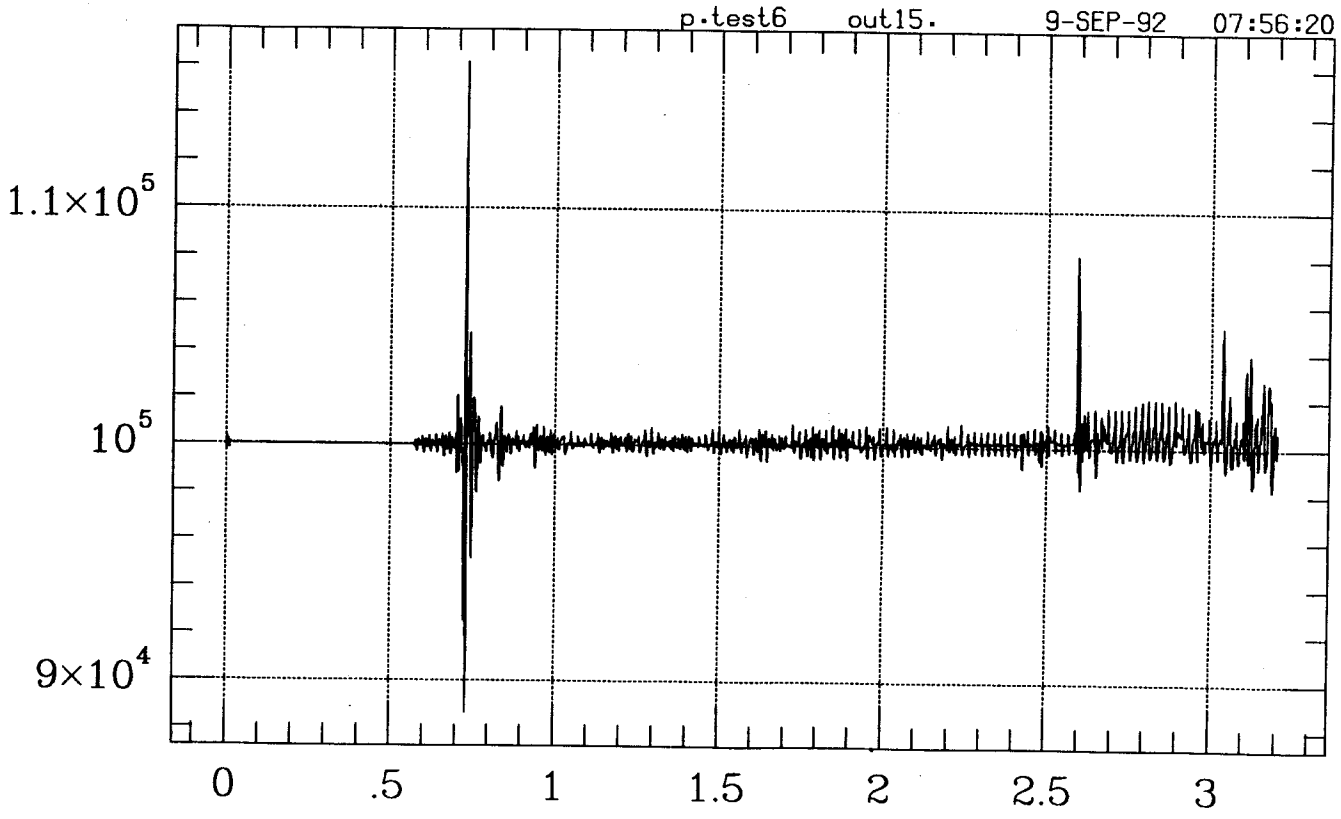

Figure B.1: Pressure(Pa) at Top of Cell vs. Time(s) (with H_2)

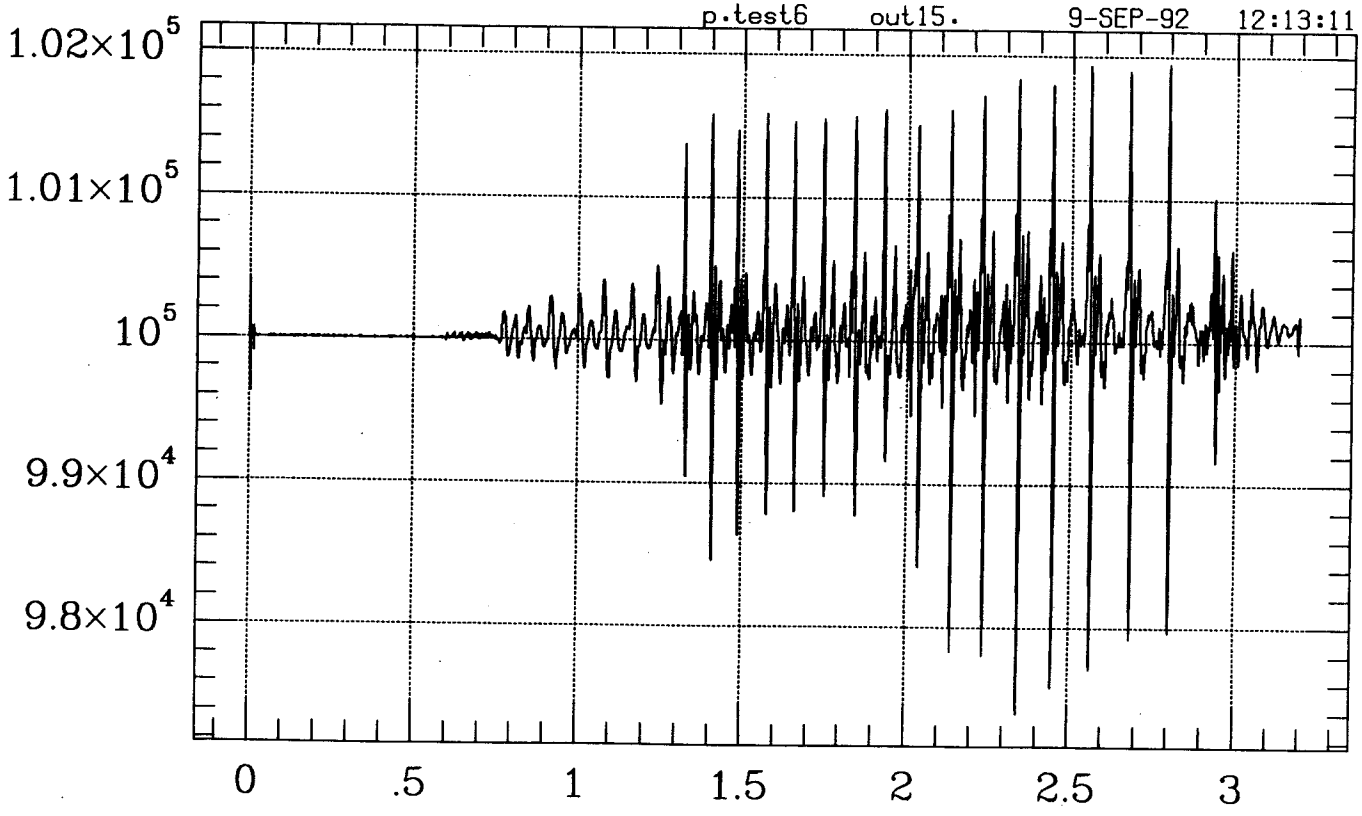

Figure B.2: Pressure(Pa) at Top of Cell vs. Time(s) (no H_2)

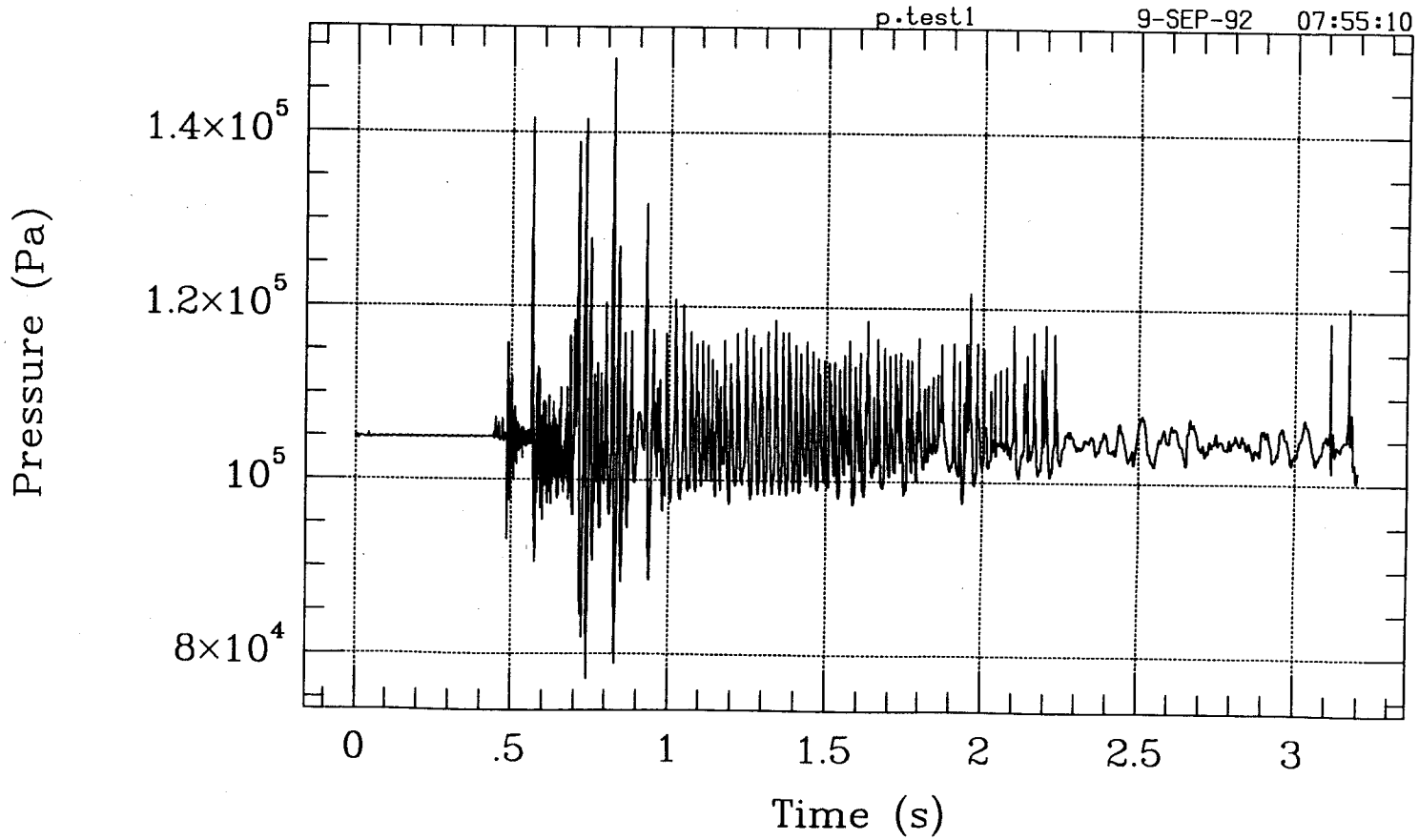

Figure B.3: Pressure(Pa) at Bottom of Cell vs. Time(s) (with H_2)

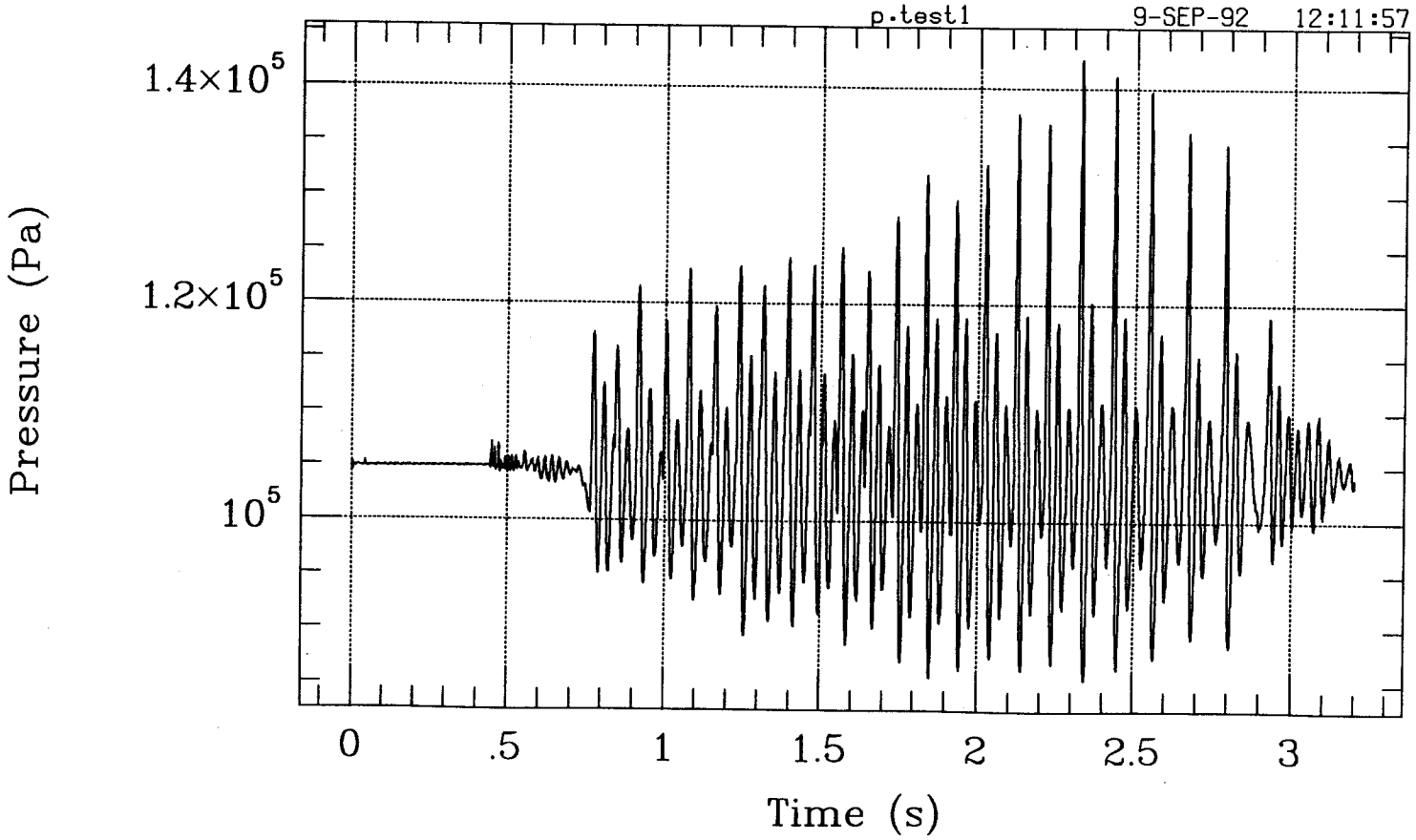

Figure B.4: Pressure(Pa) at Bottom of Cell vs. Time(s) (no H_2)

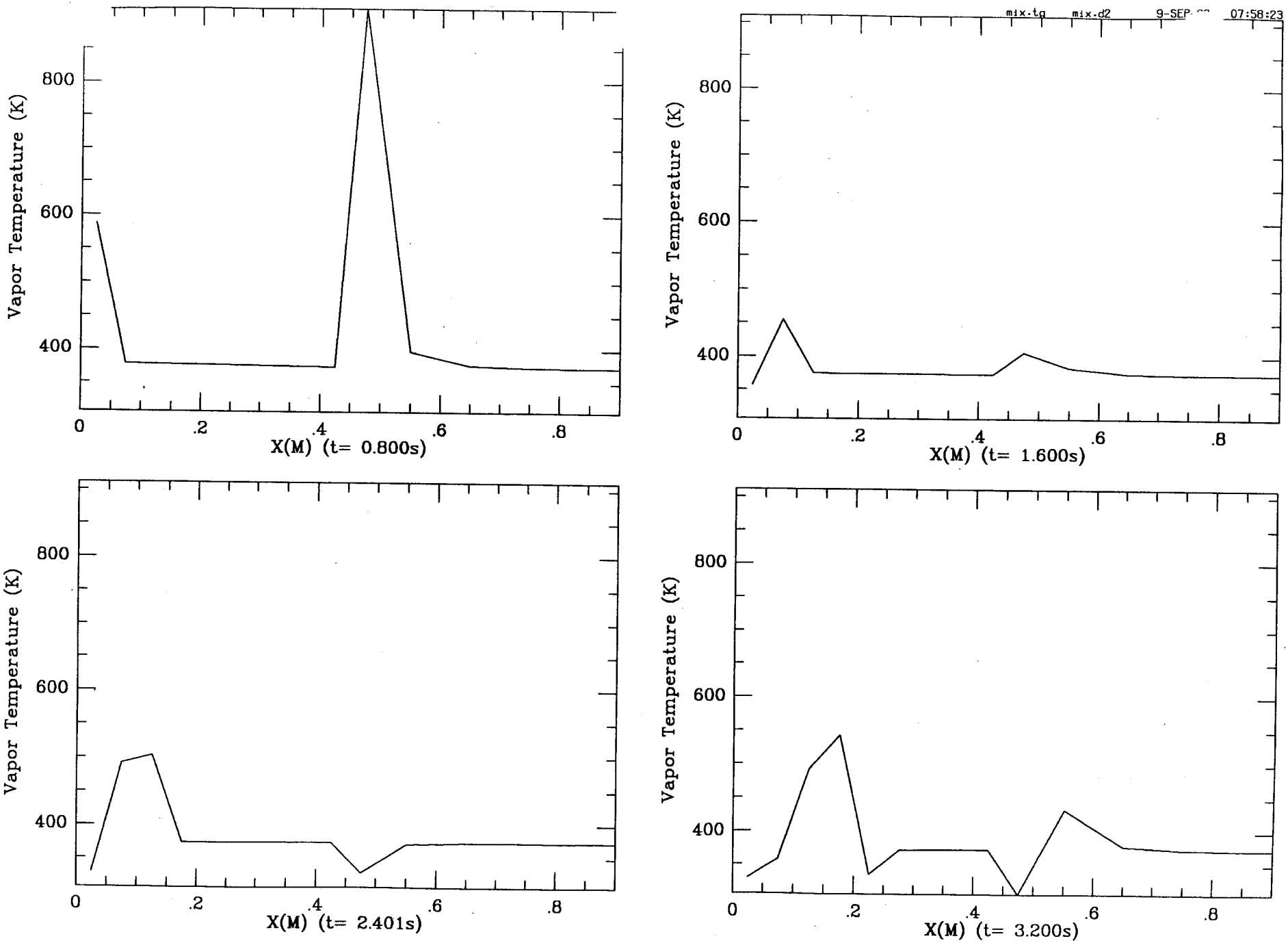

Figure B.5: Vapor Temp(K) vs. Position(m) (with H_2)

(for various times)

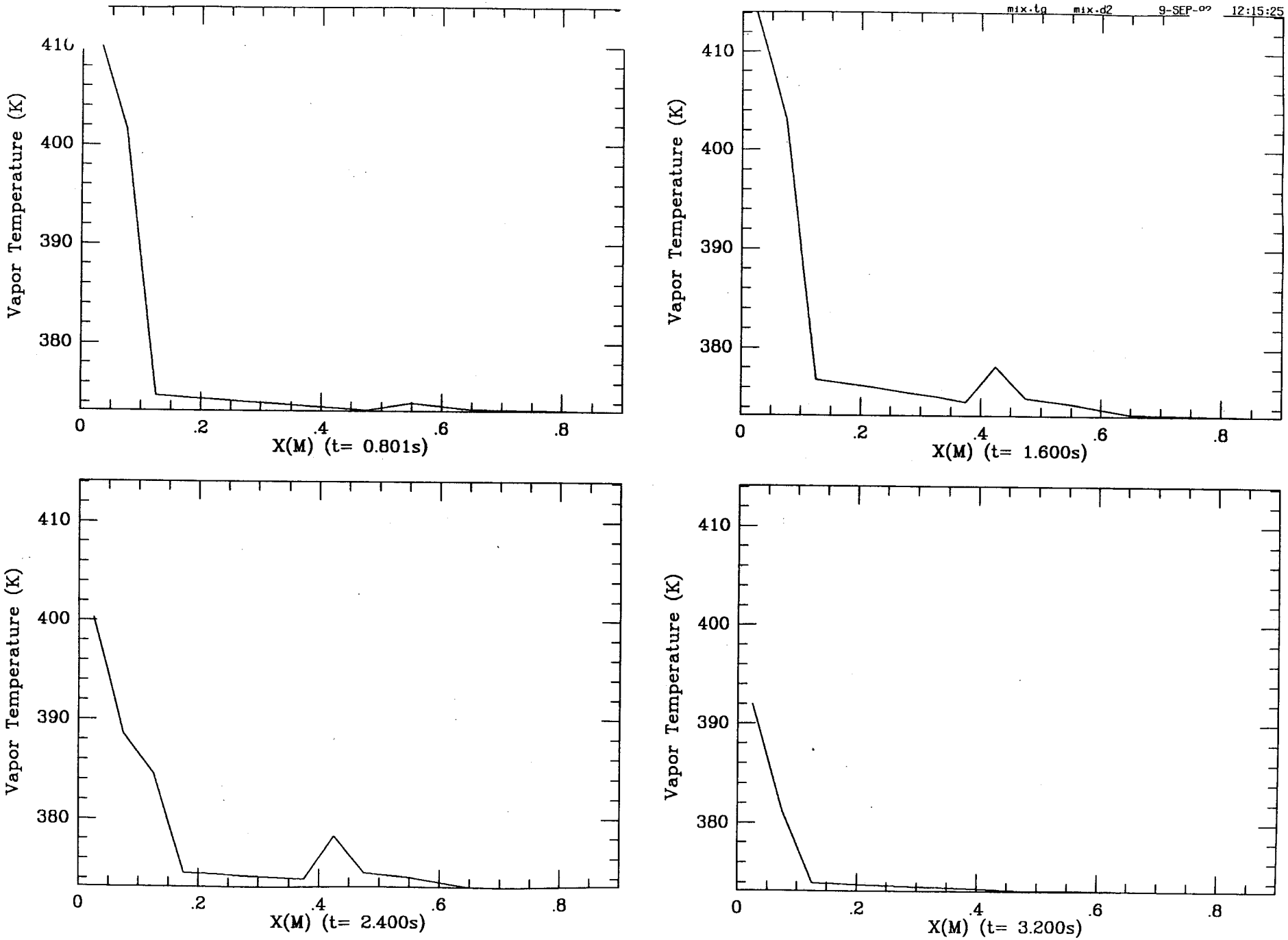

Figure B.6: Vapor Temp(K) vs. Position(m) (no H_2)

(for various times)

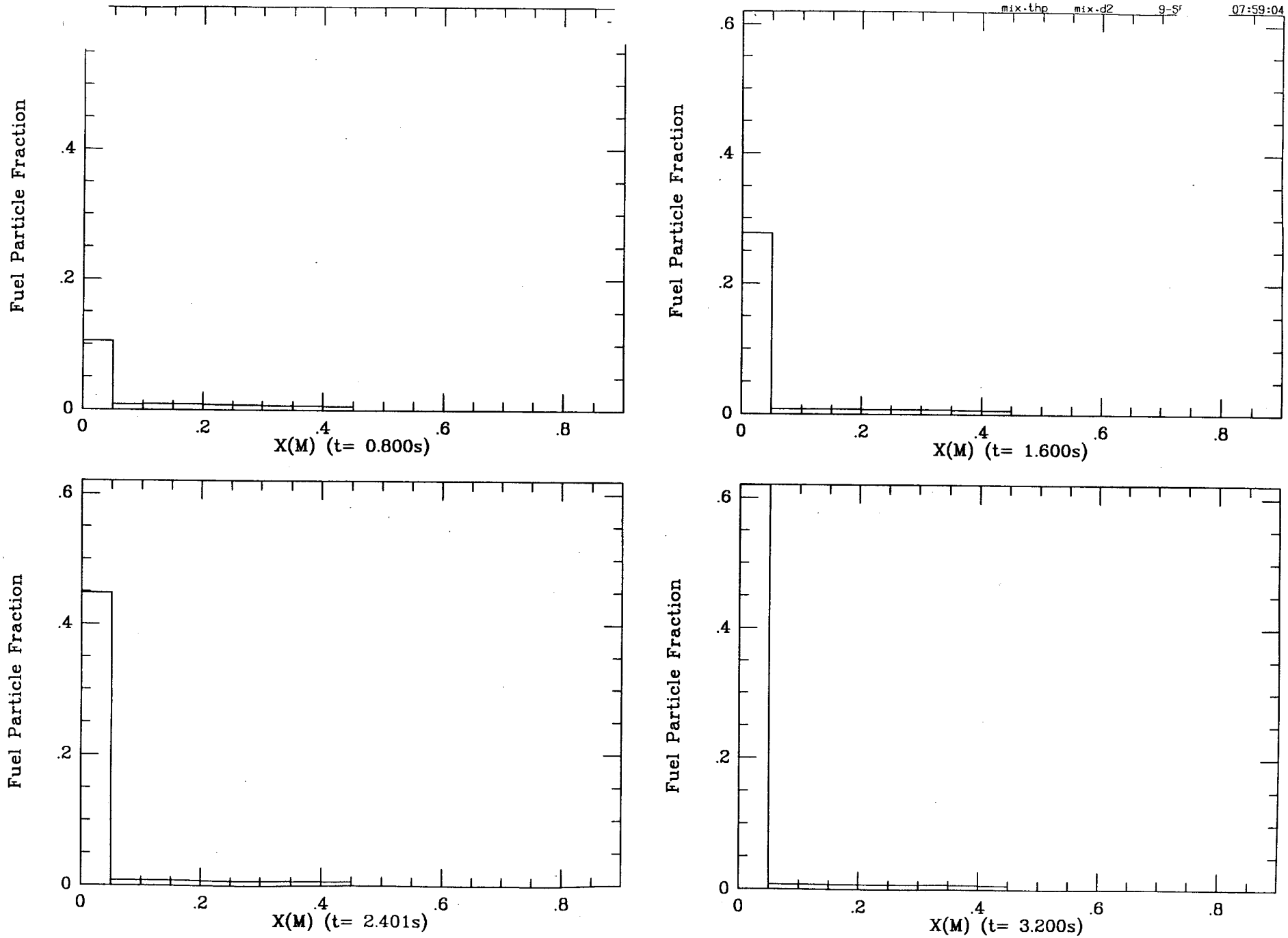

Figure B.7: Fuel Particle Fraction vs. Position(m) (with H_2)

(for various times)

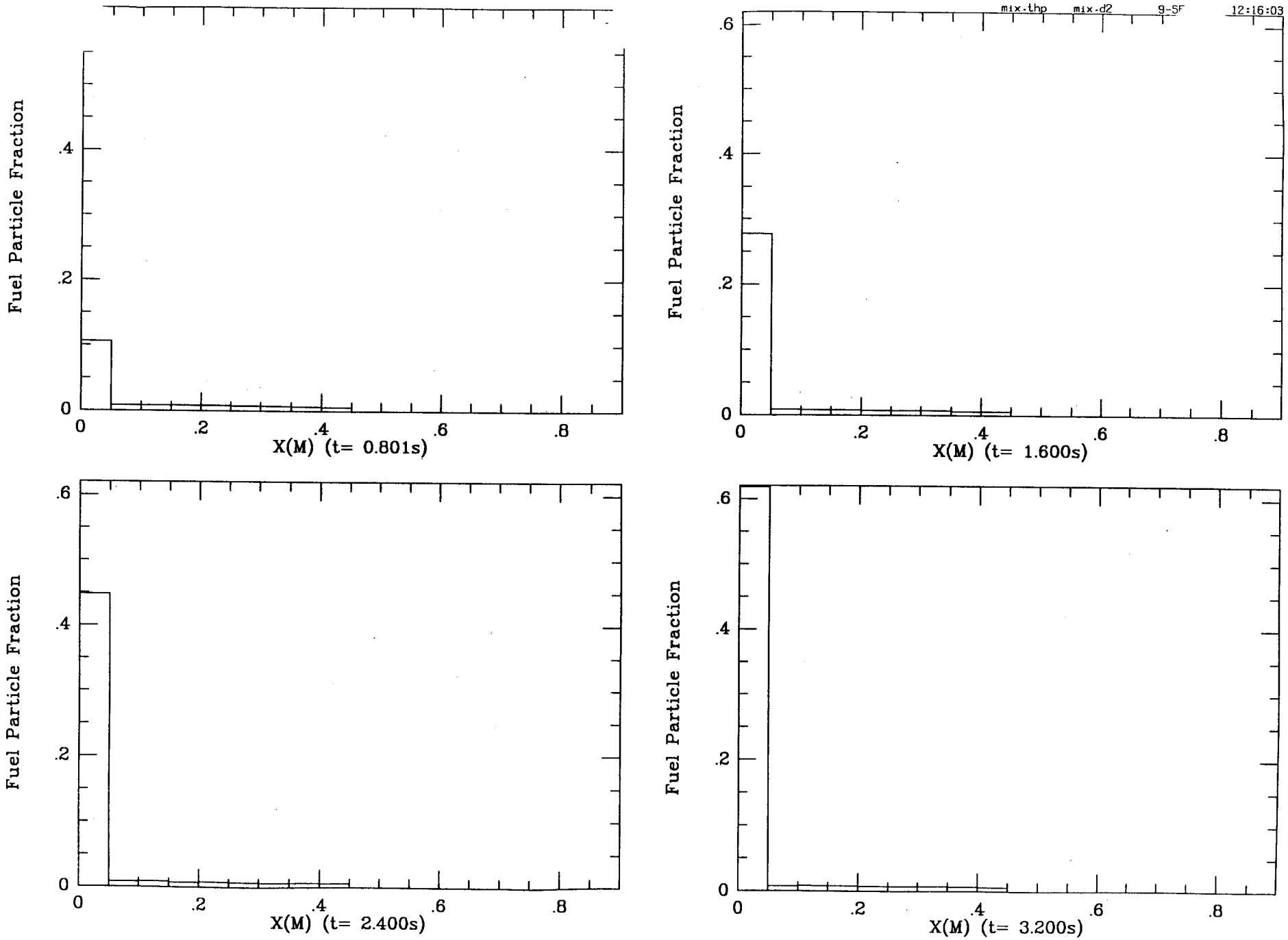

Figure B.8: Fuel Particle Fraction vs. Position(m) (no H_2)

(for various times)

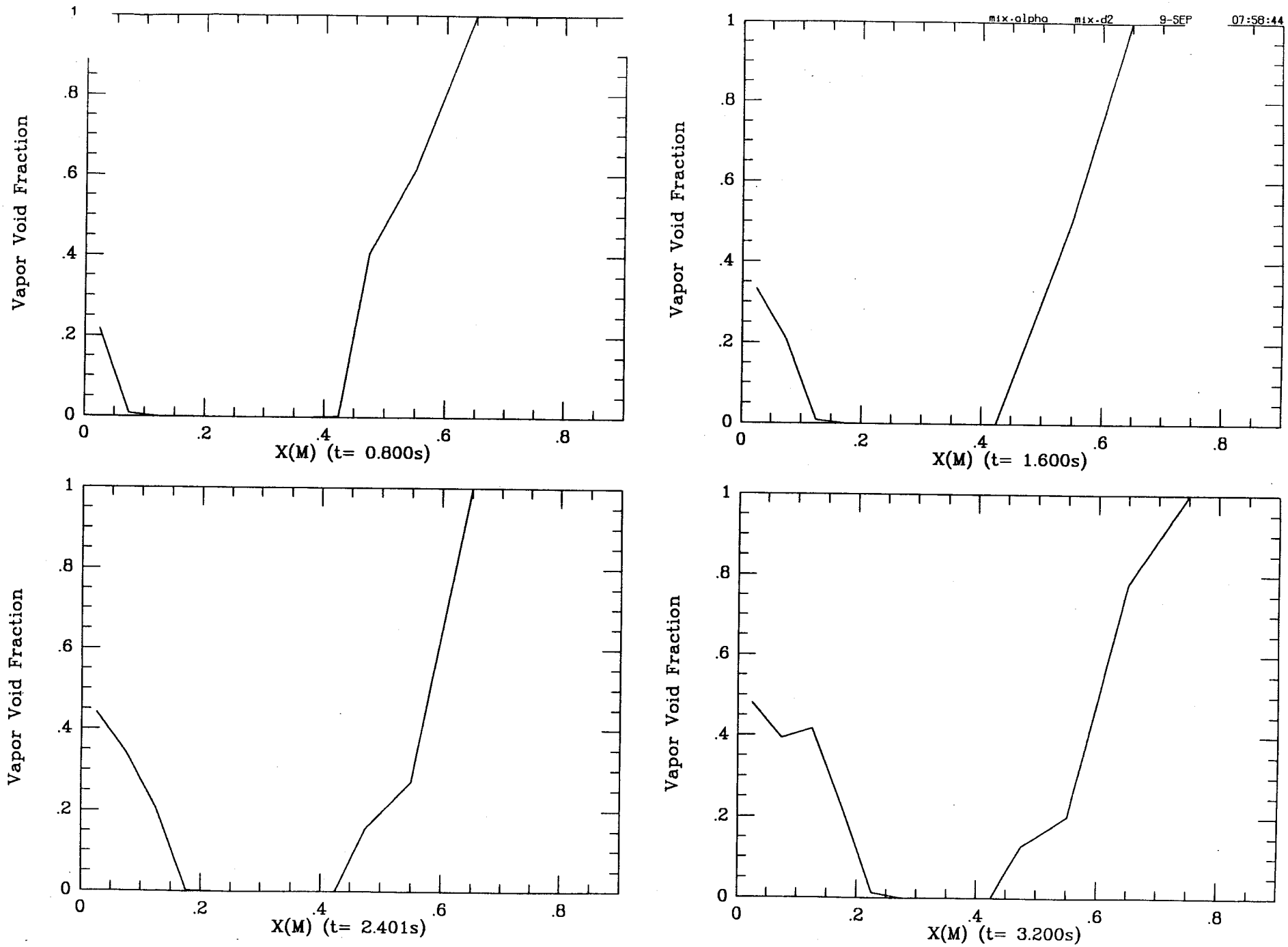

Figure B.9: Vapor Void Fraction vs. Position(m) (with H2)

(for various times)

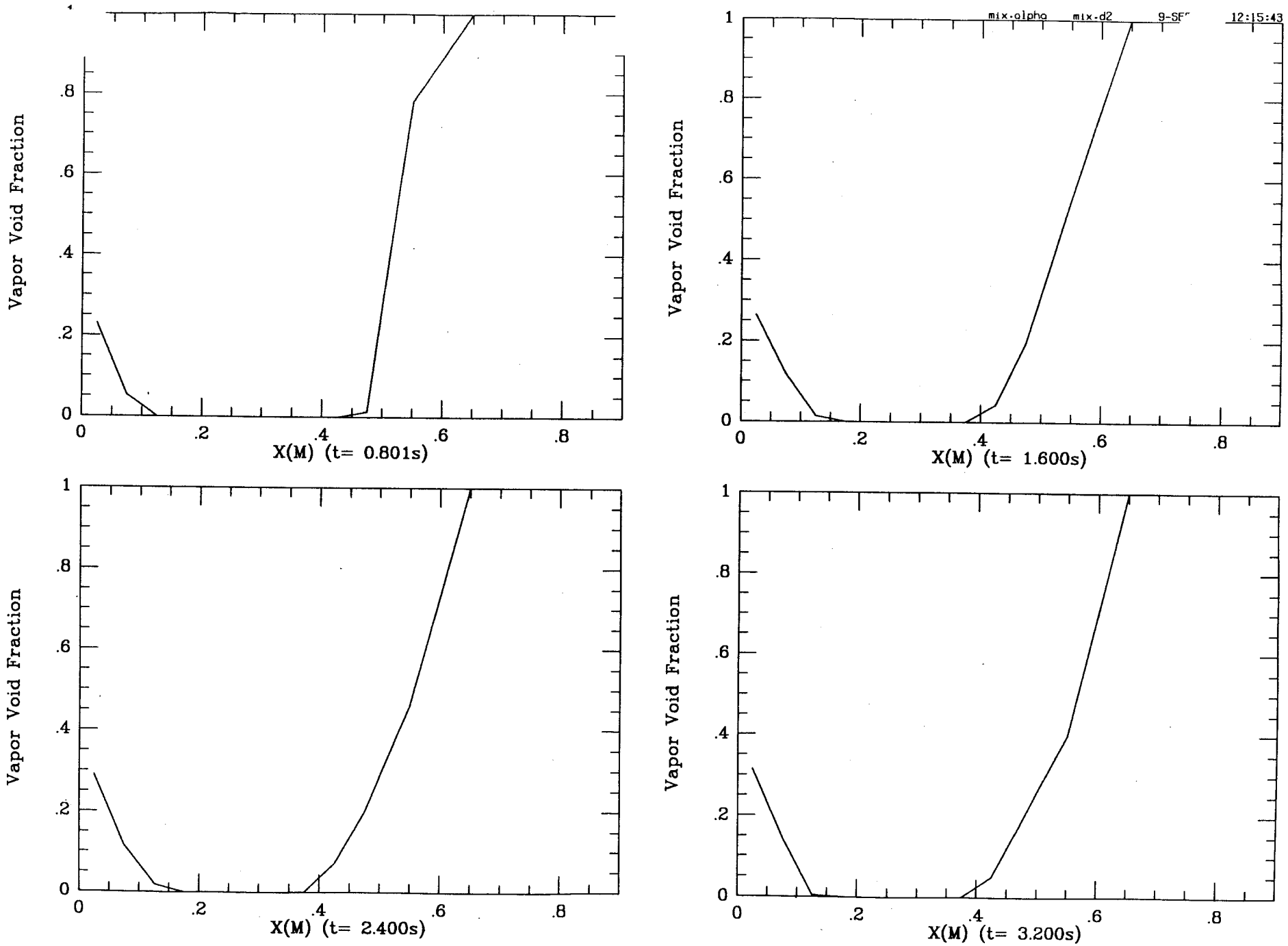

Figure B.10: Vapor Void Fraction vs. Position(m) (no H2)

(for various times)

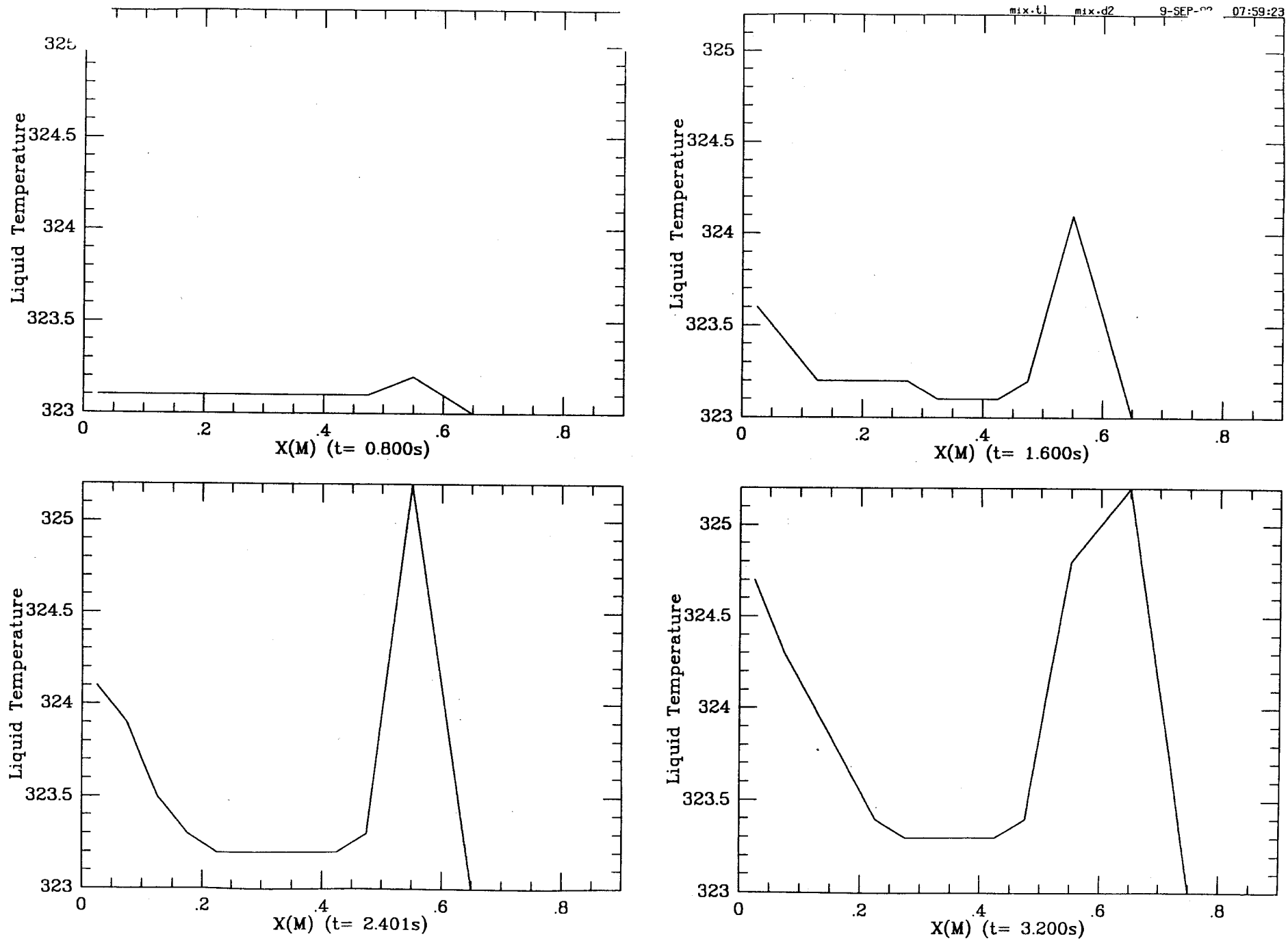

Figure B.11: Liquid Temp(K) vs. Position(m) (with H_2)

(for various times)

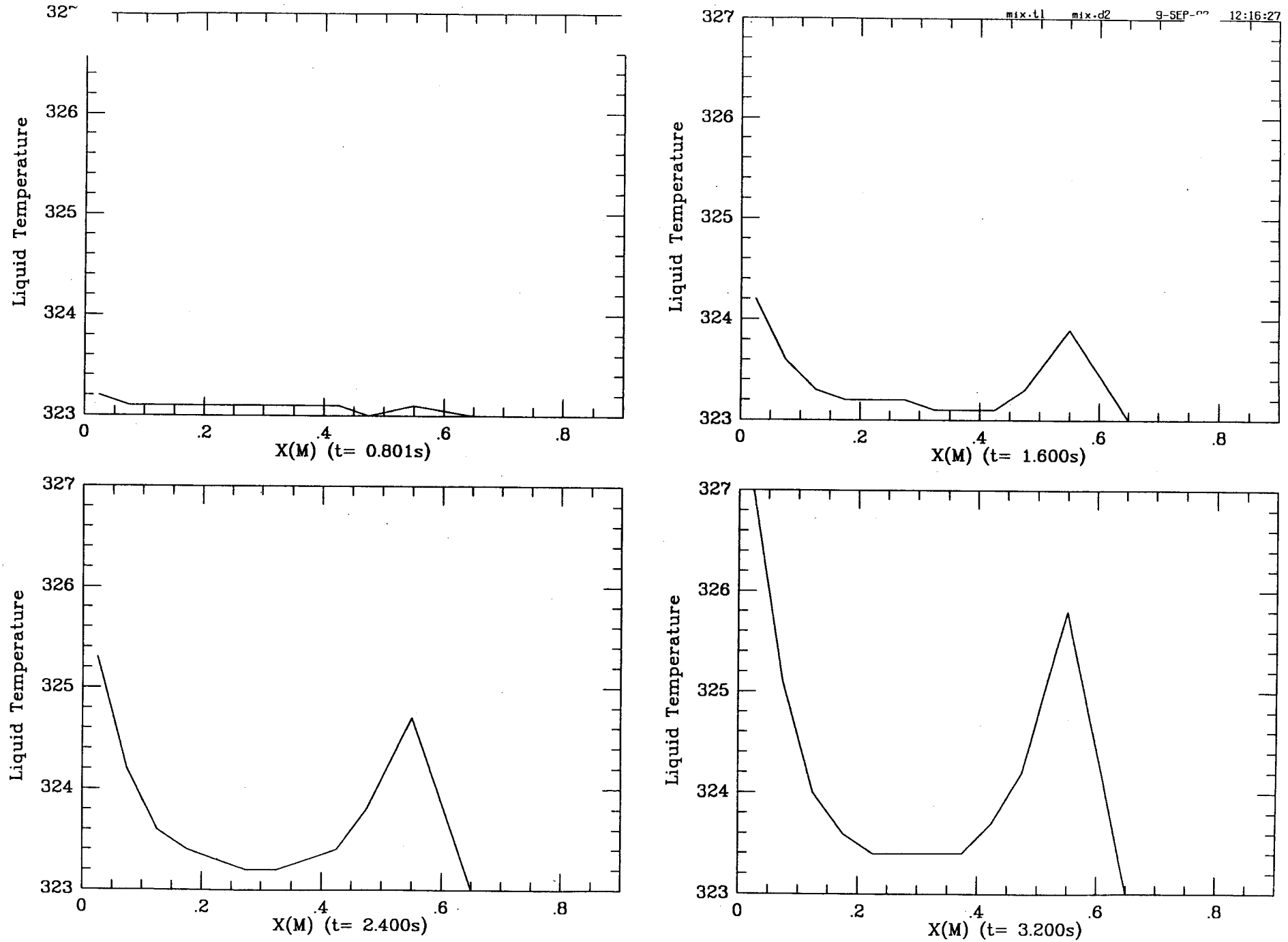

Figure B.12: Liquid Temp(K) vs. Position(m) (no H_2)

(for various times)

Table B.13: Gas Mixture Information (with H_2)

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.05511 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.5	323.0	0.0
0.05511 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.0	0.0
0.05511 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.0	0.0
0.05511 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.0	0.0
0.05511 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	0.0
0.05511 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	0.0
0.05511 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.0	0.0
0.05511 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	0.0
0.05511 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	949.7
0.05511 s	11	0.15E-07	0.00E+00	(0.25E-04)	373.3	323.0	950.0
0.05511 s	12	0.96E-03	0.35E-07	(0.10E+01)	374.0	323.0	0.0
0.05511 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.05511 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.05511 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.05511 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.3484E-07
Gas-Mix	0.9627E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.15511 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.5	323.0	0.0
0.15511 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.0	0.0
0.15511 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.0	0.0
0.15511 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.0	0.0
0.15511 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	0.0
0.15511 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	947.5
0.15511 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.0	948.6
0.15511 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	949.3
0.15511 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	949.8
0.15511 s	11	0.15E-07	0.00E+00	(0.24E-04)	373.4	323.0	950.0
0.15511 s	12	0.95E-03	0.90E-07	(0.98E+00)	374.1	323.0	0.0
0.15511 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.15511 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.15511 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.15511 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.9021E-07
Gas-Mix	0.9511E-03

-- Gas Mixture Quantity Within Part Injection --

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.45511 s	2	0.66E-06	0.00E+00	(0.13E-02)	374.5	323.0	943.0
0.45511 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.1	939.6
0.45511 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.1	947.0
0.45511 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.1	947.4
0.45511 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	947.9
0.45511 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	948.4
0.45511 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.0	948.9
0.45511 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	949.3
0.45511 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	949.7
0.45511 s	11	0.14E-07	0.00E+00	(0.23E-04)	373.4	323.0	950.0
0.45511 s	12	0.92E-03	0.26E-06	(0.95E+00)	374.3	323.0	0.0
0.45511 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.45511 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.45511 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.45511 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.2563E-06
Gas-Mix	0.9193E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.50861 s	2	0.12E-04	0.95E-05	(0.21E-01)	332.9	323.0	943.1
0.50861 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.7	323.1	943.6
0.50861 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.5	323.1	946.9
0.50861 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.1	947.4
0.50861 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.1	948.0
0.50861 s	7	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	948.4
0.50861 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	948.8
0.50861 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.0	949.4
0.50861 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	949.9
0.50861 s	11	0.24E-07	0.00E+00	(0.45E-04)	373.4	323.0	950.0
0.50861 s	12	0.90E-03	0.28E-06	(0.94E+00)	374.4	323.0	0.0
0.50861 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.50861 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.50861 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.50861 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.9761E-05

Gas-Mix 0.9200E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.55861 s	2	0.28E-04	0.23E-04	(0.49E-01)	332.3	323.1	944.7
0.55861 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.1	946.5
0.55861 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.1	947.0
0.55861 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.1	947.4
0.55861 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.1	947.9
0.55861 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	948.4
0.55861 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.0	948.8
0.55861 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	949.3
0.55861 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	949.7
0.55861 s	11	0.22E-07	0.00E+00	(0.43E-04)	373.3	323.0	950.0
0.55861 s	12	0.89E-03	0.32E-06	(0.92E+00)	374.4	323.0	0.0
0.55861 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.55861 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.55861 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.55861 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.2286E-04
Gas-Mix	0.9146E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.60862 s	2	0.42E-04	0.34E-04	(0.21E+00)	920.3	323.1	945.9
0.60862 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.1	946.3
0.60862 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.1	946.9
0.60862 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.1	947.4
0.60862 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	948.0
0.60862 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	948.4
0.60862 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	948.9
0.60862 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	949.3
0.60862 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	950.7
0.60862 s	11	0.15E-07	0.00E+00	(0.37E-04)	373.3	323.0	951.9
0.60862 s	12	0.80E-03	0.23E-05	(0.84E+00)	377.2	323.0	0.0
0.60862 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.5	323.0	0.0
0.60862 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.60862 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.60862 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

Kg-mols

H2	0.3636E-04
Gas-Mix	0.8634E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.65837 s	2	0.54E-04	0.43E-04	(0.28E+00)	953.8	323.1	946.5
0.65837 s	3	0.71E-06	0.00E+00	(0.17E-02)	373.5	323.1	946.2
0.65837 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	946.8
0.65837 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	947.3
0.65837 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	947.9
0.65837 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	948.5
0.65837 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	948.9
0.65837 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	951.2
0.65837 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	951.7
0.65837 s	11	0.11E-07	0.00E+00	(0.34E-04)	373.3	323.0	951.9
0.65837 s	12	0.76E-03	0.51E-05	(0.80E+00)	381.5	323.1	951.7
0.65837 s	13	0.96E-03	0.00E+00	(0.10E+01)	373.7	323.0	0.0
0.65837 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.65837 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.65837 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.4828E-04
Gas-Mix	0.8147E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.69081 s	2	0.59E-04	0.48E-04	(0.24E+00)	711.2	323.1	946.7
0.69081 s	3	0.14E-05	0.00E+00	(0.33E-02)	372.9	323.1	946.3
0.69081 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.0	323.1	946.9
0.69081 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.1	947.5
0.69081 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	947.9
0.69081 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	948.3
0.69081 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	950.8
0.69081 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	951.2
0.69081 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.1	954.8
0.69081 s	11	0.14E-04	0.68E-05	(0.28E-01)	362.1	323.0	958.6
0.69081 s	12	0.76E-03	0.62E-05	(0.80E+00)	382.2	323.1	0.0
0.69081 s	13	0.96E-03	0.00E+00	(0.10E+01)	373.7	323.0	0.0
0.69081 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.69081 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.69081 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.6095E-04
Gas-Mix	0.8343E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.70446 s	2	0.61E-04	0.49E-04	(0.20E+00)	631.9	323.1	946.6
0.70446 s	3	0.14E-05	0.00E+00	(0.33E-02)	374.1	323.1	946.3
0.70446 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	946.7
0.70446 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.1	947.3
0.70446 s	6	0.00E+00	0.00E+00	(0.00E+00)	372.6	323.1	947.8
0.70446 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.0	323.1	949.4
0.70446 s	8	0.00E+00	0.00E+00	(0.00E+00)	371.5	323.1	950.9
0.70446 s	9	0.00E+00	0.00E+00	(0.00E+00)	370.9	323.1	951.3
0.70446 s	10	0.00E+00	0.00E+00	(0.00E+00)	370.4	323.1	961.9
0.70446 s	11	0.23E-04	0.12E-04	(0.88E-01)	622.7	323.0	954.9
0.70446 s	12	0.75E-03	0.72E-05	(0.79E+00)	385.4	323.1	0.0
0.70446 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.8	323.0	0.0
0.70446 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.70446 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.70446 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.6831E-04
Gas-Mix	0.8418E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.72133 s	2	0.65E-04	0.52E-04	(0.25E+00)	625.6	323.1	946.8
0.72133 s	3	0.20E-05	0.00E+00	(0.51E-02)	371.6	323.1	946.2
0.72133 s	4	0.00E+00	0.00E+00	(0.00E+00)	372.1	323.1	946.8
0.72133 s	5	0.00E+00	0.00E+00	(0.00E+00)	372.4	323.1	947.3
0.72133 s	6	0.00E+00	0.00E+00	(0.00E+00)	372.8	323.1	947.9
0.72133 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.9	323.1	950.3
0.72133 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	950.7
0.72133 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	954.4
0.72133 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	965.6
0.72133 s	11	0.22E-04	0.17E-04	(0.14E+00)	303.6	323.0	958.4
0.72133 s	12	0.68E-03	0.82E-05	(0.74E+00)	385.4	323.1	0.0
0.72133 s	13	0.96E-03	0.00E+00	(0.10E+01)	374.3	323.0	0.0
0.72133 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0

0.72133 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.72133 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.7775E-04
Gas-Mix	0.7772E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.72435 s	2	0.66E-04	0.53E-04	(0.26E+00)	585.0	323.1	946.8
0.72435 s	3	0.23E-05	0.00E+00	(0.59E-02)	370.5	323.1	946.2
0.72435 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	946.7
0.72435 s	5	0.00E+00	0.00E+00	(0.00E+00)	376.4	323.1	947.3
0.72435 s	6	0.00E+00	0.00E+00	(0.00E+00)	379.0	323.1	947.9
0.72435 s	7	0.00E+00	0.00E+00	(0.00E+00)	381.5	323.1	950.3
0.72435 s	8	0.00E+00	0.00E+00	(0.00E+00)	383.7	323.1	950.9
0.72435 s	9	0.00E+00	0.00E+00	(0.00E+00)	385.8	323.1	957.7
0.72435 s	10	0.00E+00	0.00E+00	(0.00E+00)	387.8	323.1	965.6
0.72435 s	11	0.57E-04	0.18E-04	(0.11E+00)	570.6	323.0	959.5
0.72435 s	12	0.67E-03	0.82E-05	(0.75E+00)	377.6	323.1	0.0
0.72435 s	13	0.96E-03	0.00E+00	(0.10E+01)	373.9	323.0	0.0
0.72435 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.1	323.0	0.0
0.72435 s	15	0.96E-03	0.00E+00	(0.10E+01)	373.1	323.0	0.0
0.72435 s	16	0.96E-03	0.00E+00	(0.10E+01)	373.1	323.0	0.0

	Kg-mols

H2	0.7929E-04
Gas-Mix	0.8137E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.73346 s	2	0.69E-04	0.56E-04	(0.24E+00)	863.5	323.1	946.9
0.73346 s	3	0.19E-05	0.00E+00	(0.36E-02)	381.2	323.1	946.3
0.73346 s	4	0.00E+00	0.00E+00	(0.00E+00)	379.9	323.1	946.9
0.73346 s	5	0.00E+00	0.00E+00	(0.00E+00)	378.4	323.1	947.4
0.73346 s	6	0.00E+00	0.00E+00	(0.00E+00)	377.0	323.1	948.9
0.73346 s	7	0.00E+00	0.00E+00	(0.00E+00)	375.4	323.1	950.3
0.73346 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	950.7
0.73346 s	9	0.00E+00	0.00E+00	(0.00E+00)	372.1	323.1	961.5
0.73346 s	10	0.48E-06	0.00E+00	(0.11E-02)	370.3	323.1	966.6
0.73346 s	11	0.84E-04	0.24E-04	(0.24E+00)	442.5	323.0	962.0
0.73346 s	12	0.62E-03	0.82E-05	(0.69E+00)	380.1	323.1	0.0

0.73346 s	13	0.96E-03	0.00E+00	(0.10E+01)	374.9	323.0	0.0
0.73346 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.73346 s	15	0.96E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.73346 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.8735E-04
Gas-Mix	0.8442E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.77703 s	2	0.77E-04	0.62E-04	(0.26E+00)	597.3	323.1	947.0
0.77703 s	3	0.35E-05	0.00E+00	(0.85E-02)	372.7	323.1	946.3
0.77703 s	4	0.00E+00	0.00E+00	(0.00E+00)	372.7	323.1	946.9
0.77703 s	5	0.00E+00	0.00E+00	(0.00E+00)	372.8	323.1	948.4
0.77703 s	6	0.00E+00	0.00E+00	(0.00E+00)	372.8	323.1	949.8
0.77703 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.9	323.1	953.6
0.77703 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.0	323.1	964.8
0.77703 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.0	323.1	968.8
0.77703 s	10	0.30E-06	0.00E+00	(0.61E-03)	373.1	323.1	971.5
0.77703 s	11	0.88E-04	0.45E-04	(0.36E+00)	745.5	323.1	962.7
0.77703 s	12	0.57E-03	0.10E-04	(0.62E+00)	393.5	323.1	0.0
0.77703 s	13	0.96E-03	0.00E+00	(0.10E+01)	376.3	323.0	0.0
0.77703 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.7	323.0	0.0
0.77703 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.77703 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0

	Kg-mols
H2	0.1170E-03
Gas-Mix	0.7512E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.83434 s	2	0.86E-04	0.69E-04	(0.25E+00)	521.3	323.1	947.1
0.83434 s	3	0.61E-05	0.41E-05	(0.12E-01)	342.8	323.1	949.3
0.83434 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.0	323.1	948.8
0.83434 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	949.3
0.83434 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	960.1
0.83434 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	965.2
0.83434 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	970.7
0.83434 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	965.0
0.83434 s	10	0.55E-06	0.00E+00	(0.11E-02)	373.8	323.1	959.5

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

			Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.82670	s	2	0.21E-03	0.17E-03	(0.38E+00)	355.5	323.7	949.7
1.82670	s	3	0.94E-04	0.76E-04	(0.21E+00)	416.1	323.5	952.7
1.82670	s	4	0.33E-04	0.26E-04	(0.11E+00)	632.4	323.2	951.7
1.82670	s	5	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.2	949.8
1.82670	s	6	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.2	949.7
1.82670	s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.2	950.3
1.82670	s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.2	950.5
1.82670	s	9	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.2	950.9
1.82670	s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.2	951.7
1.82670	s	11	0.88E-04	0.72E-04	(0.17E+00)	345.9	323.2	952.0
1.82670	s	12	0.42E-03	0.56E-04	(0.44E+00)	381.5	324.4	951.6
1.82670	s	13	0.96E-03	0.00E+00	(0.10E+01)	374.1	323.0	0.0
1.82670	s	14	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.82670	s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.82670	s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.3985E-03
Gas-Mix	0.8411E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

			Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.88170	s	2	0.21E-03	0.17E-03	(0.38E+00)	331.8	323.8	949.6
1.88170	s	3	0.97E-04	0.77E-04	(0.23E+00)	444.1	323.6	953.6
1.88170	s	4	0.38E-04	0.31E-04	(0.15E+00)	749.6	323.3	951.0
1.88170	s	5	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.2	949.0
1.88170	s	6	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.2	949.8
1.88170	s	7	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.2	950.0
1.88170	s	8	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.2	950.6
1.88170	s	9	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.2	951.4
1.88170	s	10	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.2	951.8
1.88170	s	11	0.86E-04	0.72E-04	(0.16E+00)	328.0	323.2	951.6
1.88170	s	12	0.39E-03	0.58E-04	(0.41E+00)	378.0	324.5	0.0
1.88170	s	13	0.96E-03	0.00E+00	(0.10E+01)	374.0	323.0	0.0
1.88170	s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.88170	s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.88170	s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.4101E-03

	Kg-mols
H2	0.4897E-03
Gas-Mix	0.8412E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.30068 s	2	0.26E-03	0.21E-03	(0.45E+00)	330.5	324.1	948.9
2.30068 s	3	0.11E-03	0.91E-04	(0.28E+00)	458.4	323.8	951.0
2.30068 s	4	0.74E-04	0.59E-04	(0.20E+00)	513.6	323.5	949.2
2.30068 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.3	948.8
2.30068 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.2	949.5
2.30068 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.2	949.9
2.30068 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.2	950.6
2.30068 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.2	950.7
2.30068 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.2	951.1
2.30068 s	11	0.88E-04	0.72E-04	(0.16E+00)	329.9	323.3	951.4
2.30068 s	12	0.30E-03	0.75E-04	(0.31E+00)	371.1	325.0	0.0
2.30068 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
2.30068 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.30068 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.30068 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.5060E-03
Gas-Mix	0.8318E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.40067 s	2	0.25E-03	0.21E-03	(0.44E+00)	329.1	324.1	948.7
2.40067 s	3	0.13E-03	0.10E-03	(0.34E+00)	491.9	323.9	951.3
2.40067 s	4	0.76E-04	0.61E-04	(0.21E+00)	502.9	323.5	949.0
2.40067 s	5	0.16E-05	0.00E+00	(0.34E-02)	374.1	323.3	948.9
2.40067 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.2	949.3
2.40067 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.2	949.8
2.40067 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.2	950.2
2.40067 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.2	950.7
2.40067 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.2	951.1
2.40067 s	11	0.86E-04	0.72E-04	(0.15E+00)	327.6	323.3	951.3
2.40067 s	12	0.27E-03	0.78E-04	(0.27E+00)	370.8	325.2	951.3
2.40067 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
2.40067 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

2.40067 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.40067 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.5228E-03
Gas-Mix	0.8123E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.47734 s	2	0.25E-03	0.21E-03	(0.44E+00)	328.7	324.2	948.5
2.47734 s	3	0.14E-03	0.11E-03	(0.38E+00)	499.3	323.9	952.2
2.47734 s	4	0.78E-04	0.62E-04	(0.21E+00)	505.3	323.6	948.8
2.47734 s	5	0.49E-05	0.41E-06	(0.10E-01)	371.5	323.3	949.2
2.47734 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.3	949.3
2.47734 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.2	949.7
2.47734 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.2	950.1
2.47734 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.2	950.6
2.47734 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.2	951.1
2.47734 s	11	0.85E-04	0.72E-04	(0.15E+00)	325.5	323.2	951.2
2.47734 s	12	0.24E-03	0.80E-04	(0.24E+00)	364.3	325.2	0.0
2.47734 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
2.47734 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.47734 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.47734 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.5358E-03
Gas-Mix	0.8035E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.48118 s	2	0.25E-03	0.21E-03	(0.44E+00)	328.4	324.2	948.5
2.48118 s	3	0.14E-03	0.11E-03	(0.38E+00)	497.0	323.9	951.7
2.48118 s	4	0.77E-04	0.62E-04	(0.21E+00)	505.5	323.6	948.8
2.48118 s	5	0.52E-05	0.21E-05	(0.10E-01)	359.0	323.3	950.8
2.48118 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.3	949.3
2.48118 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.2	949.8
2.48118 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.2	950.2
2.48118 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.2	950.6
2.48118 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.2	951.0
2.48118 s	11	0.84E-04	0.72E-04	(0.15E+00)	325.4	323.2	951.2
2.48118 s	12	0.24E-03	0.80E-04	(0.24E+00)	366.9	325.2	950.4

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
3.19968 s	2	0.27E-03	0.22E-03	(0.48E+00)	330.1	324.7	947.7
3.19968 s	3	0.20E-03	0.16E-03	(0.39E+00)	357.8	324.3	951.7
3.19968 s	4	0.15E-03	0.12E-03	(0.42E+00)	493.3	324.0	950.8
3.19968 s	5	0.74E-04	0.59E-04	(0.22E+00)	544.2	323.7	950.6
3.19968 s	6	0.69E-05	0.52E-05	(0.13E-01)	336.6	323.4	952.6
3.19968 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.3	949.3
3.19968 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.3	949.7
3.19968 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.3	950.2
3.19968 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.3	950.6
3.19968 s	11	0.76E-04	0.72E-04	(0.13E+00)	306.6	323.4	951.0
3.19968 s	12	0.17E-03	0.98E-04	(0.20E+00)	432.9	324.8	950.6
3.19968 s	13	0.74E-03	0.00E+00	(0.78E+00)	378.3	325.2	0.0
3.19968 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.7	323.0	0.0
3.19968 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
3.19968 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.7385E-03
Gas-Mix	0.9479E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
3.20018 s	2	0.27E-03	0.22E-03	(0.48E+00)	330.1	324.7	947.7
3.20018 s	3	0.20E-03	0.16E-03	(0.39E+00)	357.9	324.3	951.7
3.20018 s	4	0.15E-03	0.12E-03	(0.42E+00)	492.9	324.0	950.8
3.20018 s	5	0.74E-04	0.59E-04	(0.22E+00)	543.6	323.7	950.6
3.20018 s	6	0.70E-05	0.53E-05	(0.13E-01)	336.1	323.4	952.6
3.20018 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.3	949.3
3.20018 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.3	949.7
3.20018 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.3	950.2
3.20018 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.3	950.6
3.20018 s	11	0.76E-04	0.72E-04	(0.13E+00)	306.7	323.4	951.0
3.20018 s	12	0.17E-03	0.98E-04	(0.20E+00)	434.3	324.8	950.8
3.20018 s	13	0.74E-03	0.00E+00	(0.78E+00)	378.3	325.2	0.0
3.20018 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.7	323.0	0.0
3.20018 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
3.20018 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.7387E-03
Gas-Mix	0.9482E-03

-- Gas Mixture Quantity Within Part Injection --

Table B.14: Gas Mixture Information (no H_2)

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.35511 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.0	0.0
0.35511 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.0	944.9
0.35511 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.0	942.3
0.35511 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.0	947.4
0.35511 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	947.8
0.35511 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	948.4
0.35511 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.0	949.0
0.35511 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	949.4
0.35511 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	949.7
0.35511 s	11	0.14E-07	0.00E+00	(0.23E-04)	373.4	323.0	950.0
0.35511 s	12	0.93E-03	0.00E+00	(0.96E+00)	374.0	323.0	0.0
0.35511 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.35511 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.9291E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.74011 s	2	0.10E-03	0.00E+00	(0.22E+00)	409.8	323.2	939.6
0.74011 s	3	0.12E-04	0.00E+00	(0.25E-01)	384.7	323.1	946.2
0.74011 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.1	946.8
0.74011 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	947.3
0.74011 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	947.9
0.74011 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	948.4
0.74011 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	948.9
0.74011 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	949.3
0.74011 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	949.8
0.74011 s	11	0.00E+00	0.00E+00	(0.17E-04)	373.2	323.0	950.0
0.74011 s	12	0.78E-03	0.00E+00	(0.81E+00)	374.0	323.1	950.0
0.74011 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.74011 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.74011 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.74011 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8933E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.01311 s	2	0.10E-03	0.00E+00	(0.22E+00)	402.7	323.4	938.4
1.01311 s	3	0.53E-04	0.00E+00	(0.11E+00)	394.5	323.2	946.4
1.01311 s	4	0.10E-05	0.00E+00	(0.24E-02)	374.2	323.1	947.0
1.01311 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.1	947.4
1.01311 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.1	947.8
1.01311 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	948.4
1.01311 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	948.9
1.01311 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	949.4
1.01311 s	10	0.78E-06	0.00E+00	(0.16E-02)	373.4	323.1	949.8
1.01311 s	11	0.51E-04	0.00E+00	(0.11E+00)	373.3	323.0	950.0
1.01311 s	12	0.67E-03	0.00E+00	(0.69E+00)	373.7	323.3	0.0
1.01311 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.01311 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.01311 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.01311 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8875E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.29711 s	2	0.10E-03	0.00E+00	(0.23E+00)	396.1	323.8	936.8
1.29711 s	3	0.59E-04	0.00E+00	(0.13E+00)	383.8	323.4	946.5
1.29711 s	4	0.44E-05	0.00E+00	(0.94E-02)	372.7	323.2	947.0
1.29711 s	5	0.00E+00	0.00E+00	(0.00E+00)	372.7	323.1	947.4
1.29711 s	6	0.00E+00	0.00E+00	(0.00E+00)	372.8	323.1	947.8
1.29711 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.9	323.1	948.4
1.29711 s	8	0.00E+00	0.00E+00	(0.00E+00)	372.9	323.1	949.0
1.29711 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.0	323.1	949.4
1.29711 s	10	0.74E-05	0.00E+00	(0.15E-01)	373.1	323.1	949.7
1.29711 s	11	0.95E-04	0.00E+00	(0.20E+00)	373.2	323.1	950.0
1.29711 s	12	0.58E-03	0.00E+00	(0.60E+00)	373.5	323.5	0.0
1.29711 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.29711 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.29711 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.29711 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8431E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.47885 s	2	0.11E-03	0.00E+00	(0.22E+00)	410.8	324.0	935.7
1.47885 s	3	0.54E-04	0.00E+00	(0.11E+00)	400.4	323.5	946.5
1.47885 s	4	0.59E-05	0.00E+00	(0.11E-01)	376.9	323.2	947.1
1.47885 s	5	0.00E+00	0.00E+00	(0.00E+00)	376.7	323.2	947.5
1.47885 s	6	0.00E+00	0.00E+00	(0.00E+00)	376.5	323.2	947.9
1.47885 s	7	0.00E+00	0.00E+00	(0.00E+00)	376.3	323.1	948.4
1.47885 s	8	0.00E+00	0.00E+00	(0.00E+00)	376.0	323.1	948.9
1.47885 s	9	0.00E+00	0.00E+00	(0.00E+00)	375.8	323.1	949.3
1.47885 s	10	0.19E-04	0.00E+00	(0.37E-01)	380.6	323.1	949.8
1.47885 s	11	0.98E-04	0.00E+00	(0.19E+00)	378.8	323.2	950.0
1.47885 s	12	0.57E-03	0.00E+00	(0.59E+00)	374.5	323.7	950.0
1.47885 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.47885 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.47885 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.47885 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.0000E+00
Gas-Mix	0.8573E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.65509 s	2	0.11E-03	0.00E+00	(0.22E+00)	410.2	324.3	934.5
1.65509 s	3	0.50E-04	0.00E+00	(0.96E-01)	400.1	323.6	946.3
1.65509 s	4	0.65E-05	0.00E+00	(0.12E-01)	377.1	323.3	946.9
1.65509 s	5	0.00E+00	0.00E+00	(0.00E+00)	376.7	323.2	947.4
1.65509 s	6	0.00E+00	0.00E+00	(0.00E+00)	376.3	323.2	948.0
1.65509 s	7	0.00E+00	0.00E+00	(0.00E+00)	375.9	323.2	948.4
1.65509 s	8	0.00E+00	0.00E+00	(0.00E+00)	375.5	323.1	948.9
1.65509 s	9	0.17E-06	0.00E+00	(0.33E-03)	375.1	323.1	949.4
1.65509 s	10	0.26E-04	0.00E+00	(0.51E-01)	378.2	323.2	949.9
1.65509 s	11	0.97E-04	0.00E+00	(0.20E+00)	376.3	323.3	950.0
1.65509 s	12	0.55E-03	0.00E+00	(0.57E+00)	375.4	323.9	0.0
1.65509 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.65509 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.65509 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.65509 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.0000E+00

Gas-Mix 0.8402E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.83583 s	2	0.12E-03	0.00E+00	(0.21E+00)	423.0	324.5	933.5
1.83583 s	3	0.45E-04	0.00E+00	(0.79E-01)	412.1	323.7	946.4
1.83583 s	4	0.58E-05	0.00E+00	(0.97E-02)	380.2	323.3	946.9
1.83583 s	5	0.00E+00	0.00E+00	(0.00E+00)	379.5	323.2	947.5
1.83583 s	6	0.00E+00	0.00E+00	(0.00E+00)	378.8	323.2	948.1
1.83583 s	7	0.00E+00	0.00E+00	(0.00E+00)	378.1	323.2	948.5
1.83583 s	8	0.00E+00	0.00E+00	(0.00E+00)	377.4	323.2	948.9
1.83583 s	9	0.11E-05	0.00E+00	(0.20E-02)	376.6	323.2	949.3
1.83583 s	10	0.31E-04	0.00E+00	(0.61E-01)	383.3	323.2	949.8
1.83583 s	11	0.99E-04	0.00E+00	(0.20E+00)	379.5	323.4	950.0
1.83583 s	12	0.54E-03	0.00E+00	(0.56E+00)	374.1	324.1	0.0
1.83583 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.83583 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.83583 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.83583 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.0000E+00
Gas-Mix	0.8326E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.01532 s	2	0.95E-04	0.00E+00	(0.20E+00)	396.7	324.8	933.0
2.01532 s	3	0.43E-04	0.00E+00	(0.88E-01)	384.4	323.9	946.5
2.01532 s	4	0.60E-05	0.00E+00	(0.12E-01)	374.0	323.4	947.0
2.01532 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.3	947.4
2.01532 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.2	947.9
2.01532 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.2	948.4
2.01532 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.2	949.0
2.01532 s	9	0.16E-05	0.00E+00	(0.32E-02)	373.3	323.2	949.4
2.01532 s	10	0.34E-04	0.00E+00	(0.71E-01)	373.8	323.3	949.7
2.01532 s	11	0.10E-03	0.00E+00	(0.21E+00)	373.3	323.6	950.0
2.01532 s	12	0.51E-03	0.00E+00	(0.53E+00)	373.5	324.3	0.0
2.01532 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
2.01532 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.01532 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.01532 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

Kg-mols

H2	0.0000E+00
Gas-Mix	0.7866E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.21356 s	2	0.95E-04	0.00E+00	(0.20E+00)	398.7	325.0	933.0
2.21356 s	3	0.43E-04	0.00E+00	(0.87E-01)	385.7	324.0	946.6
2.21356 s	4	0.64E-05	0.00E+00	(0.13E-01)	374.6	323.5	947.0
2.21356 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.3	947.4
2.21356 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.2	948.0
2.21356 s	7	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.2	948.5
2.21356 s	8	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.2	948.9
2.21356 s	9	0.19E-05	0.00E+00	(0.39E-02)	373.8	323.2	949.4
2.21356 s	10	0.37E-04	0.00E+00	(0.75E-01)	375.5	323.4	949.8
2.21356 s	11	0.10E-03	0.00E+00	(0.21E+00)	374.2	323.7	950.0
2.21356 s	12	0.49E-03	0.00E+00	(0.51E+00)	373.8	324.5	0.0
2.21356 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
2.21356 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.21356 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.21356 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.7630E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.41956 s	2	0.11E-03	0.00E+00	(0.23E+00)	393.8	325.3	933.0
2.41956 s	3	0.48E-04	0.00E+00	(0.10E+00)	381.6	324.2	946.4
2.41956 s	4	0.82E-05	0.00E+00	(0.17E-01)	373.4	323.6	946.8
2.41956 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.4	947.4
2.41956 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.3	947.9
2.41956 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.2	948.5
2.41956 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.2	948.9
2.41956 s	9	0.16E-05	0.00E+00	(0.33E-02)	373.1	323.3	949.4
2.41956 s	10	0.37E-04	0.00E+00	(0.77E-01)	373.7	323.4	949.8
2.41956 s	11	0.10E-03	0.00E+00	(0.21E+00)	373.1	323.8	950.0
2.41956 s	12	0.46E-03	0.00E+00	(0.47E+00)	373.7	324.7	950.0
2.41956 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.41956 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.41956 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.41956 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.7598E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.64230 s	2	0.13E-03	0.00E+00	(0.30E+00)	388.9	325.6	933.0
2.64230 s	3	0.60E-04	0.00E+00	(0.13E+00)	376.9	324.5	946.3
2.64230 s	4	0.11E-04	0.00E+00	(0.23E-01)	373.0	323.8	946.8
2.64230 s	5	0.00E+00	0.00E+00	(0.00E+00)	372.3	323.5	947.4
2.64230 s	6	0.00E+00	0.00E+00	(0.00E+00)	372.4	323.3	948.0
2.64230 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.6	323.3	948.5
2.64230 s	8	0.00E+00	0.00E+00	(0.00E+00)	372.7	323.3	949.0
2.64230 s	9	0.25E-06	0.00E+00	(0.53E-03)	372.8	323.3	949.4
2.64230 s	10	0.35E-04	0.00E+00	(0.73E-01)	372.9	323.5	949.9
2.64230 s	11	0.99E-04	0.00E+00	(0.21E+00)	373.1	323.9	950.0
2.64230 s	12	0.41E-03	0.00E+00	(0.43E+00)	373.6	324.9	0.0
2.64230 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.64230 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.64230 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.64230 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.7462E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
2.88903 s	2	0.16E-03	0.00E+00	(0.33E+00)	391.8	326.0	933.0
2.88903 s	3	0.70E-04	0.00E+00	(0.15E+00)	380.3	324.7	946.4
2.88903 s	4	0.12E-04	0.00E+00	(0.24E-01)	374.7	323.9	946.8
2.88903 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.6	947.4
2.88903 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.4	948.0
2.88903 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.3	948.5
2.88903 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.3	949.0
2.88903 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.4	949.4
2.88903 s	10	0.33E-04	0.00E+00	(0.67E-01)	373.3	323.6	949.8
2.88903 s	11	0.95E-04	0.00E+00	(0.20E+00)	373.2	324.0	950.0
2.88903 s	12	0.39E-03	0.00E+00	(0.40E+00)	373.3	325.2	0.0
2.88903 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.88903 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

2.88903 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
2.88903 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.7551E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
3.09452 s	2	0.14E-03	0.00E+00	(0.29E+00)	389.3	326.6	933.0
3.09452 s	3	0.60E-04	0.00E+00	(0.12E+00)	379.8	324.9	946.4
3.09452 s	4	0.40E-05	0.00E+00	(0.87E-02)	373.7	324.0	947.0
3.09452 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.6	947.4
3.09452 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.4	947.9
3.09452 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.4	948.5
3.09452 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.4	948.9
3.09452 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.4	949.4
3.09452 s	10	0.31E-04	0.00E+00	(0.63E-01)	373.3	323.7	949.8
3.09452 s	11	0.96E-04	0.00E+00	(0.20E+00)	373.2	324.2	950.0
3.09452 s	12	0.40E-03	0.00E+00	(0.41E+00)	373.3	325.6	0.0
3.09452 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
3.09452 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
3.09452 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
3.09452 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.7327E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
3.20001 s	2	0.15E-03	0.00E+00	(0.31E+00)	392.0	327.0	933.0
3.20001 s	3	0.72E-04	0.00E+00	(0.15E+00)	381.2	325.1	946.5
3.20001 s	4	0.27E-06	0.00E+00	(0.39E-02)	374.0	324.0	946.9
3.20001 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.6	947.3
3.20001 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.4	947.9
3.20001 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.4	948.5
3.20001 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.4	948.9
3.20001 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.4	949.3
3.20001 s	10	0.25E-04	0.00E+00	(0.51E-01)	373.4	323.7	949.8
3.20001 s	11	0.93E-04	0.00E+00	(0.19E+00)	373.3	324.2	950.0
3.20001 s	12	0.39E-03	0.00E+00	(0.40E+00)	373.3	325.8	950.0

3.20001	s	13	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
3.20001	s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
3.20001	s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
3.20001	s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.0000E+00
Gas-Mix	0.7281E-03

-- Gas Mixture Quantity Within Part Injection --

Table B.15: Particle Breakup Data (with H_2)

```
1Test case for Aluminum Jet MS problem, in-vessel ( 08/31/92 )
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00        1
    1           1     9.500E+02  2.500E-02 -2.000E+00  5.050E-01
  8.000292E-01       61
    1           8     9.390E+02  7.875E-03 -6.386E-03  7.875E-03
    2           4     9.456E+02  7.875E-03 -6.386E-03  7.875E-03
    3           1     9.470E+02  1.250E-02 -6.386E-03  1.250E-02
    4           1     9.487E+02  1.575E-02 -6.387E-03  1.575E-02
    5           1     9.482E+02  1.984E-02 -6.387E-03  1.984E-02
    6           1     9.479E+02  2.500E-02 -7.136E-03  2.500E-02
    7           1     9.482E+02  2.500E-02 -7.136E-03  2.500E-02
    8           1     9.485E+02  2.500E-02 -7.136E-03  2.500E-02
    9           1     9.491E+02  2.500E-02 -7.136E-03  2.500E-02
   10           1     9.488E+02  2.500E-02 -7.136E-03  2.500E-02
   11           1     9.485E+02  2.500E-02 -7.136E-03  2.500E-02
   12           1     9.482E+02  2.500E-02 -7.136E-03  2.500E-02
   13           1     9.479E+02  2.500E-02 -7.136E-03  2.500E-02
   14           1     9.475E+02  2.500E-02 -7.136E-03  2.500E-02
   15           1     9.473E+02  2.500E-02 -7.136E-03  2.500E-02
   16           1     9.471E+02  2.500E-02 -7.136E-03  2.500E-02
   17           1     9.469E+02  2.500E-02 -7.136E-03  2.500E-02
   18           1     9.467E+02  2.500E-02 -7.136E-03  2.500E-02
   19           1     9.465E+02  2.500E-02 -7.136E-03  2.500E-02
   20           1     9.466E+02  2.500E-02 -7.136E-03  2.500E-02
   21           1     9.465E+02  2.500E-02 -7.136E-03  2.500E-02
   22           1     9.463E+02  2.500E-02 -7.136E-03  2.500E-02
   23           1     9.461E+02  2.500E-02 -7.136E-03  2.500E-02
   24           1     9.461E+02  2.500E-02 -1.290E+00  3.432E-02
   25           1     9.461E+02  2.500E-02 -1.280E+00  6.010E-02
   26           1     9.464E+02  2.500E-02 -1.280E+00  8.608E-02
   27           1     9.467E+02  2.500E-02 -1.288E+00  1.118E-01
   28           1     9.470E+02  2.500E-02 -1.300E+00  1.376E-01
   29           1     9.491E+02  2.500E-02 -1.316E+00  1.615E-01
   30           1     9.494E+02  2.500E-02 -1.337E+00  1.856E-01
   31           1     9.497E+02  2.500E-02 -1.362E+00  2.107E-01
   32           1     9.500E+02  2.500E-02 -1.391E+00  2.372E-01
   33           1     9.566E+02  2.500E-02 -1.425E+00  2.654E-01
   34           1     9.645E+02  2.500E-02 -1.468E+00  2.949E-01
   35           1     9.656E+02  2.500E-02 -1.523E+00  3.270E-01
   36           1     9.713E+02  2.500E-02 -1.598E+00  3.575E-01
   37           1     9.712E+02  2.500E-02 -1.719E+00  3.892E-01
   38           1     9.676E+02  2.500E-02 -1.867E+00  4.250E-01
   39           1     9.610E+02  2.500E-02 -1.975E+00  4.631E-01
   40           1     9.500E+02  2.500E-02 -2.000E+00  5.050E-01
   41           8     9.378E+02  7.875E-03 -6.386E-03  7.875E-03
   42           8     9.405E+02  7.875E-03 -6.386E-03  7.875E-03
   43           8     9.342E+02  7.875E-03 -6.386E-03  7.875E-03
   44           4     9.451E+02  7.875E-03 -6.386E-03  7.875E-03
   45           4     9.451E+02  7.875E-03 -6.386E-03  7.875E-03
   46           4     9.448E+02  7.875E-03 -6.386E-03  7.875E-03
   47           2     9.497E+02  9.921E-03 -6.386E-03  9.921E-03
   48           4     9.452E+02  7.875E-03 -6.386E-03  7.875E-03
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Table B.16: Particle Breakup Data (no H_2)

```
1Test case for Aluminum Jet MS problem, in-vessel ( 08/31/92 )
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00       1
    1           1     9.500E+02  2.500E-02 -2.000E+00  5.050E-01
  8.008589E-01      61
    1           8     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
    2           4     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
    3           1     9.330E+02  1.250E-02 -6.386E-03  1.250E-02
    4           1     9.365E+02  1.575E-02 -6.387E-03  1.575E-02
    5           1     9.389E+02  1.984E-02 -6.387E-03  1.984E-02
    6           1     9.410E+02  2.500E-02 -7.174E-03  2.500E-02
    7           1     9.413E+02  2.500E-02 -7.174E-03  2.500E-02
    8           1     9.416E+02  2.500E-02 -7.174E-03  2.500E-02
    9           1     9.418E+02  2.500E-02 -7.174E-03  2.500E-02
   10           1     9.421E+02  2.500E-02 -7.174E-03  2.500E-02
   11           1     9.424E+02  2.500E-02 -7.174E-03  2.500E-02
   12           1     9.426E+02  2.500E-02 -7.174E-03  2.500E-02
   13           1     9.429E+02  2.500E-02 -7.174E-03  2.500E-02
   14           1     9.432E+02  2.500E-02 -7.174E-03  2.500E-02
   15           1     9.434E+02  2.500E-02 -7.174E-03  2.500E-02
   16           1     9.437E+02  2.500E-02 -7.174E-03  2.500E-02
   17           1     9.440E+02  2.500E-02 -7.174E-03  2.500E-02
   18           1     9.442E+02  2.500E-02 -7.174E-03  2.500E-02
   19           1     9.445E+02  2.500E-02 -7.174E-03  2.500E-02
   20           1     9.448E+02  2.500E-02 -7.174E-03  2.500E-02
   21           1     9.450E+02  2.500E-02 -7.174E-03  2.500E-02
   22           1     9.453E+02  2.500E-02 -7.174E-03  2.500E-02
   23           1     9.456E+02  2.500E-02 -7.174E-03  2.500E-02
   24           1     9.458E+02  2.500E-02 -1.251E+00  3.087E-02
   25           1     9.461E+02  2.500E-02 -1.250E+00  5.632E-02
   26           1     9.464E+02  2.500E-02 -1.246E+00  8.310E-02
   27           1     9.466E+02  2.500E-02 -1.251E+00  1.078E-01
   28           1     9.469E+02  2.500E-02 -1.258E+00  1.345E-01
   29           1     9.472E+02  2.500E-02 -1.272E+00  1.600E-01
   30           1     9.475E+02  2.500E-02 -1.290E+00  1.870E-01
   31           1     9.477E+02  2.500E-02 -1.311E+00  2.131E-01
   32           1     9.481E+02  2.500E-02 -1.339E+00  2.410E-01
   33           1     9.483E+02  2.500E-02 -1.373E+00  2.681E-01
   34           1     9.486E+02  2.500E-02 -1.417E+00  2.974E-01
   35           1     9.489E+02  2.500E-02 -1.472E+00  3.262E-01
   36           1     9.492E+02  2.500E-02 -1.545E+00  3.577E-01
   37           1     9.495E+02  2.500E-02 -1.636E+00  3.894E-01
   38           1     9.498E+02  2.500E-02 -1.750E+00  4.255E-01
   39           1     9.500E+02  2.500E-02 -1.911E+00  4.622E-01
   40           1     9.500E+02  2.500E-02 -1.999E+00  5.030E-01
   41           8     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
   42           8     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
   43           8     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
   44           4     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
   45           4     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
   46           4     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
   47           2     9.330E+02  9.921E-03 -6.386E-03  9.921E-03
   48           4     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
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49	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
50	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
51	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
52	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
53	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
54	1	9.359E+02	1.575E-02	-6.387E-03	1.575E-02
55	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
56	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
57	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
58	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
59	1	9.385E+02	1.984E-02	-6.387E-03	1.984E-02
60	1	9.359E+02	1.575E-02	-6.387E-03	1.575E-02
61	1	9.354E+02	1.575E-02	-6.387E-03	1.575E-02
1.600097E+00	100				
1	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
2	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
3	1	9.330E+02	1.250E-02	-3.193E-03	1.250E-02
4	1	9.330E+02	1.575E-02	-3.193E-03	1.575E-02
5	1	9.330E+02	1.984E-02	-3.193E-03	1.984E-02
6	1	9.330E+02	2.500E-02	-3.643E-03	2.500E-02
7	1	9.330E+02	2.500E-02	-3.643E-03	2.500E-02
8	1	9.330E+02	2.500E-02	-3.643E-03	2.500E-02
9	1	9.330E+02	2.500E-02	-3.643E-03	2.500E-02
10	1	9.330E+02	2.500E-02	-3.643E-03	2.500E-02
11	1	9.330E+02	2.500E-02	-3.643E-03	2.500E-02
12	1	9.330E+02	2.500E-02	-3.643E-03	2.500E-02
13	1	9.330E+02	2.500E-02	-3.643E-03	2.500E-02
14	1	9.331E+02	2.500E-02	-3.643E-03	2.500E-02
15	1	9.333E+02	2.500E-02	-3.643E-03	2.500E-02
16	1	9.336E+02	2.500E-02	-3.643E-03	2.500E-02
17	1	9.338E+02	2.500E-02	-3.643E-03	2.500E-02
18	1	9.341E+02	2.500E-02	-3.643E-03	2.500E-02
19	1	9.343E+02	2.500E-02	-3.643E-03	2.500E-02
20	1	9.346E+02	2.500E-02	-3.643E-03	2.500E-02
21	1	9.349E+02	2.500E-02	-3.643E-03	2.500E-02
22	1	9.352E+02	2.500E-02	-3.643E-03	2.500E-02
23	1	9.354E+02	2.500E-02	-3.643E-03	2.500E-02
24	1	9.357E+02	2.500E-02	-3.643E-03	2.500E-02
25	1	9.360E+02	2.500E-02	-3.643E-03	2.500E-02
26	1	9.363E+02	2.500E-02	-3.643E-03	2.500E-02
27	1	9.359E+02	2.500E-02	-3.643E-03	2.500E-02
28	1	9.368E+02	2.500E-02	-3.643E-03	2.500E-02
29	1	9.371E+02	2.500E-02	-3.643E-03	2.500E-02
30	1	9.372E+02	2.500E-02	-3.643E-03	2.500E-02
31	1	9.376E+02	2.500E-02	-3.643E-03	2.500E-02
32	1	9.378E+02	2.500E-02	-3.643E-03	2.500E-02
33	1	9.382E+02	2.500E-02	-3.643E-03	2.500E-02
34	1	9.384E+02	2.500E-02	-3.643E-03	2.500E-02
35	1	9.384E+02	2.500E-02	-3.643E-03	2.500E-02
36	1	9.389E+02	2.500E-02	-3.643E-03	2.500E-02
37	1	9.392E+02	2.500E-02	-3.643E-03	2.500E-02
38	1	9.394E+02	2.500E-02	-3.643E-03	2.500E-02
39	1	9.392E+02	2.500E-02	-3.643E-03	2.500E-02
40	1	9.399E+02	2.500E-02	-3.643E-03	2.500E-02

41	1	9.402E+02	2.500E-02	-3.643E-03	2.500E-02
42	1	9.404E+02	2.500E-02	-3.643E-03	2.500E-02
43	1	9.407E+02	2.500E-02	-3.643E-03	2.500E-02
44	1	9.410E+02	2.500E-02	-3.643E-03	2.500E-02
45	1	9.413E+02	2.500E-02	-3.643E-03	2.500E-02
46	1	9.412E+02	2.500E-02	-3.643E-03	2.500E-02
47	1	9.411E+02	2.500E-02	-3.643E-03	2.500E-02
48	1	9.420E+02	2.500E-02	-3.643E-03	2.500E-02
49	1	9.423E+02	2.500E-02	-3.643E-03	2.500E-02
50	1	9.425E+02	2.500E-02	-3.643E-03	2.500E-02
51	1	9.425E+02	2.500E-02	-3.643E-03	2.500E-02
52	1	9.431E+02	2.500E-02	-3.643E-03	2.500E-02
53	1	9.433E+02	2.500E-02	-3.643E-03	2.500E-02
54	1	9.436E+02	2.500E-02	-3.643E-03	2.500E-02
55	1	9.436E+02	2.500E-02	-3.643E-03	2.500E-02
56	1	9.441E+02	2.500E-02	-3.643E-03	2.500E-02
57	1	9.443E+02	2.500E-02	-3.643E-03	2.500E-02
58	1	9.446E+02	2.500E-02	-3.643E-03	2.500E-02
59	1	9.447E+02	2.500E-02	-3.643E-03	2.500E-02
60	1	9.451E+02	2.500E-02	-3.643E-03	2.500E-02
61	1	9.454E+02	2.500E-02	-3.643E-03	2.500E-02
62	1	9.456E+02	2.500E-02	-3.643E-03	2.500E-02
63	1	9.459E+02	2.500E-02	-3.643E-03	2.500E-02
64	1	9.461E+02	2.500E-02	-1.268E+00	4.630E-02
65	1	9.464E+02	2.500E-02	-1.294E+00	7.446E-02
66	1	9.467E+02	2.500E-02	-1.293E+00	9.801E-02
67	1	9.469E+02	2.500E-02	-1.291E+00	1.256E-01
68	1	9.472E+02	2.500E-02	-1.303E+00	1.528E-01
69	1	9.475E+02	2.500E-02	-1.319E+00	1.805E-01
70	1	9.477E+02	2.500E-02	-1.344E+00	2.058E-01
71	1	9.481E+02	2.500E-02	-1.371E+00	2.348E-01
72	1	9.483E+02	2.500E-02	-1.404E+00	2.639E-01
73	1	9.486E+02	2.500E-02	-1.449E+00	2.944E-01
74	1	9.489E+02	2.500E-02	-1.514E+00	3.225E-01
75	1	9.492E+02	2.500E-02	-1.587E+00	3.544E-01
76	1	9.495E+02	2.500E-02	-1.677E+00	3.886E-01
77	1	9.498E+02	2.500E-02	-1.785E+00	4.250E-01
78	1	9.500E+02	2.500E-02	-1.932E+00	4.631E-01
79	1	9.500E+02	2.500E-02	-1.997E+00	5.030E-01
80	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
81	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
82	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
83	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
84	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
85	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
86	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
87	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
88	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
89	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
90	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
91	1	9.330E+02	1.250E-02	-3.193E-03	1.250E-02
92	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
93	1	9.330E+02	1.575E-02	-3.193E-03	1.575E-02
94	1	9.330E+02	1.250E-02	-3.193E-03	1.250E-02

95	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
96	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
97	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
98	1	9.330E+02	1.984E-02	-3.193E-03	1.984E-02
99	1	9.330E+02	1.575E-02	-3.193E-03	1.575E-02
100	1	9.330E+02	1.575E-02	-3.193E-03	1.575E-02
2.400059E+00	139				
1	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
2	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
3	1	9.330E+02	1.250E-02	-3.193E-03	1.250E-02
4	1	9.330E+02	1.575E-02	-3.193E-03	1.575E-02
5	1	9.330E+02	1.984E-02	-3.193E-03	1.984E-02
6	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
7	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
8	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
9	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
10	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
11	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
12	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
13	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
14	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
15	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
16	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
17	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
18	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
19	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
20	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
21	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
22	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
23	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
24	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
25	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
26	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
27	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
28	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
29	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
30	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
31	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
32	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
33	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
34	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
35	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
36	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
37	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
38	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
39	1	9.330E+02	2.500E-02	-3.699E-03	2.500E-02
40	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
41	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
42	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
43	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
44	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
45	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
46	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
47	1	9.330E+02	2.500E-02	-3.699E-03	2.500E-02

48	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
49	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
50	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
51	1	9.330E+02	2.500E-02	-3.698E-03	2.500E-02
52	1	9.335E+02	2.500E-02	-3.698E-03	2.500E-02
53	1	9.339E+02	2.500E-02	-3.698E-03	2.500E-02
54	1	9.339E+02	2.500E-02	-3.698E-03	2.500E-02
55	1	9.333E+02	2.500E-02	-3.699E-03	2.500E-02
56	1	9.346E+02	2.500E-02	-3.698E-03	2.500E-02
57	1	9.348E+02	2.500E-02	-3.698E-03	2.500E-02
58	1	9.350E+02	2.500E-02	-3.698E-03	2.500E-02
59	1	9.345E+02	2.500E-02	-3.698E-03	2.500E-02
60	1	9.356E+02	2.500E-02	-3.698E-03	2.500E-02
61	1	9.359E+02	2.500E-02	-3.698E-03	2.500E-02
62	1	9.354E+02	2.500E-02	-3.698E-03	2.500E-02
63	1	9.363E+02	2.500E-02	-3.698E-03	2.500E-02
64	1	9.366E+02	2.500E-02	-3.698E-03	2.500E-02
65	1	9.369E+02	2.500E-02	-3.698E-03	2.500E-02
66	1	9.365E+02	2.500E-02	-3.698E-03	2.500E-02
67	1	9.373E+02	2.500E-02	-3.698E-03	2.500E-02
68	1	9.376E+02	2.500E-02	-3.698E-03	2.500E-02
69	1	9.379E+02	2.500E-02	-3.698E-03	2.500E-02
70	1	9.376E+02	2.500E-02	-3.698E-03	2.500E-02
71	1	9.382E+02	2.500E-02	-3.698E-03	2.500E-02
72	1	9.386E+02	2.500E-02	-3.698E-03	2.500E-02
73	1	9.389E+02	2.500E-02	-3.698E-03	2.500E-02
74	1	9.387E+02	2.500E-02	-3.698E-03	2.500E-02
75	1	9.393E+02	2.500E-02	-3.698E-03	2.500E-02
76	1	9.395E+02	2.500E-02	-3.698E-03	2.500E-02
77	1	9.398E+02	2.500E-02	-3.698E-03	2.500E-02
78	1	9.397E+02	2.500E-02	-3.698E-03	2.500E-02
79	1	9.404E+02	2.500E-02	-3.698E-03	2.500E-02
80	1	9.405E+02	2.500E-02	-3.698E-03	2.500E-02
81	1	9.408E+02	2.500E-02	-3.698E-03	2.500E-02
82	1	9.408E+02	2.500E-02	-3.698E-03	2.500E-02
83	1	9.410E+02	2.500E-02	-3.698E-03	2.500E-02
84	1	9.415E+02	2.500E-02	-3.698E-03	2.500E-02
85	1	9.418E+02	2.500E-02	-3.698E-03	2.500E-02
86	1	9.421E+02	2.500E-02	-3.698E-03	2.500E-02
87	1	9.421E+02	2.500E-02	-3.698E-03	2.500E-02
88	1	9.426E+02	2.500E-02	-3.698E-03	2.500E-02
89	1	9.428E+02	2.500E-02	-3.698E-03	2.500E-02
90	1	9.430E+02	2.500E-02	-3.698E-03	2.500E-02
91	1	9.431E+02	2.500E-02	-3.698E-03	2.500E-02
92	1	9.435E+02	2.500E-02	-3.698E-03	2.500E-02
93	1	9.438E+02	2.500E-02	-3.698E-03	2.500E-02
94	1	9.440E+02	2.500E-02	-3.698E-03	2.500E-02
95	1	9.443E+02	2.500E-02	-3.698E-03	2.500E-02
96	1	9.444E+02	2.500E-02	-3.698E-03	2.500E-02
97	1	9.447E+02	2.500E-02	-3.698E-03	2.500E-02
98	1	9.449E+02	2.500E-02	-3.698E-03	2.500E-02
99	1	9.452E+02	2.500E-02	-3.698E-03	2.500E-02
100	1	9.455E+02	2.500E-02	-3.698E-03	2.500E-02
101	1	9.457E+02	2.500E-02	-3.698E-03	2.500E-02

102	1	9.459E+02	2.500E-02	-3.698E-03	2.500E-02
103	1	9.461E+02	2.500E-02	-1.241E+00	4.664E-02
104	1	9.464E+02	2.500E-02	-1.300E+00	7.380E-02
105	1	9.467E+02	2.500E-02	-1.299E+00	9.948E-02
106	1	9.469E+02	2.500E-02	-1.299E+00	1.255E-01
107	1	9.472E+02	2.500E-02	-1.312E+00	1.509E-01
108	1	9.475E+02	2.500E-02	-1.326E+00	1.803E-01
109	1	9.478E+02	2.500E-02	-1.349E+00	2.088E-01
110	1	9.481E+02	2.500E-02	-1.382E+00	2.342E-01
111	1	9.483E+02	2.500E-02	-1.417E+00	2.628E-01
112	1	9.486E+02	2.500E-02	-1.465E+00	2.912E-01
113	1	9.489E+02	2.500E-02	-1.517E+00	3.234E-01
114	1	9.492E+02	2.500E-02	-1.592E+00	3.559E-01
115	1	9.495E+02	2.500E-02	-1.696E+00	3.887E-01
116	1	9.498E+02	2.500E-02	-1.811E+00	4.242E-01
117	1	9.500E+02	2.500E-02	-1.939E+00	4.614E-01
118	1	9.500E+02	2.500E-02	-1.997E+00	5.020E-01
119	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
120	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
121	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
122	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
123	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
124	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
125	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
126	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
127	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
128	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
129	4	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
130	1	9.330E+02	1.250E-02	-3.193E-03	1.250E-02
131	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
132	1	9.330E+02	1.575E-02	-3.193E-03	1.575E-02
133	1	9.330E+02	1.250E-02	-3.193E-03	1.250E-02
134	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
135	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
136	2	9.330E+02	9.921E-03	-3.193E-03	9.921E-03
137	1	9.330E+02	1.984E-02	-3.193E-03	1.984E-02
138	1	9.330E+02	1.575E-02	-3.193E-03	1.575E-02
139	1	9.330E+02	1.575E-02	-3.193E-03	1.575E-02
3.200013E+00	178				
1	8	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
2	4	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
3	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
4	1	9.330E+02	1.575E-02	-6.386E-03	1.575E-02
5	1	9.330E+02	1.984E-02	-6.386E-03	1.984E-02
6	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
7	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
8	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
9	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
10	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
11	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
12	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
13	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
14	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
15	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02

16	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
17	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
18	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
19	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
20	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
21	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
22	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
23	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
24	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
25	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
26	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
27	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
28	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
29	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
30	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
31	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
32	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
33	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
34	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
35	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
36	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
37	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
38	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
39	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
40	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
41	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
42	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
43	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
44	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
45	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
46	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
47	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
48	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
49	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
50	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
51	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
52	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
53	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
54	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
55	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
56	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
57	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
58	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
59	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
60	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
61	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
62	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
63	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
64	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
65	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
66	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
67	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
68	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
69	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02

70	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
71	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
72	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
73	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
74	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
75	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
76	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
77	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
78	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
79	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
80	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
81	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
82	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
83	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
84	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
85	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
86	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
87	1	9.330E+02	2.500E-02	-7.458E-03	2.500E-02
88	1	9.336E+02	2.500E-02	-7.458E-03	2.500E-02
89	1	9.337E+02	2.500E-02	-7.458E-03	2.500E-02
90	1	9.339E+02	2.500E-02	-7.458E-03	2.500E-02
91	1	9.334E+02	2.500E-02	-7.458E-03	2.500E-02
92	1	9.343E+02	2.500E-02	-7.458E-03	2.500E-02
93	1	9.348E+02	2.500E-02	-7.458E-03	2.500E-02
94	1	9.349E+02	2.500E-02	-7.458E-03	2.500E-02
95	1	9.352E+02	2.500E-02	-7.458E-03	2.500E-02
96	1	9.348E+02	2.500E-02	-7.458E-03	2.500E-02
97	1	9.356E+02	2.500E-02	-7.458E-03	2.500E-02
98	1	9.359E+02	2.500E-02	-7.458E-03	2.500E-02
99	1	9.361E+02	2.500E-02	-7.458E-03	2.500E-02
100	1	9.363E+02	2.500E-02	-7.458E-03	2.500E-02
101	1	9.359E+02	2.500E-02	-7.458E-03	2.500E-02
102	1	9.363E+02	2.500E-02	-7.458E-03	2.500E-02
103	1	9.372E+02	2.500E-02	-7.458E-03	2.500E-02
104	1	9.373E+02	2.500E-02	-7.458E-03	2.500E-02
105	1	9.370E+02	2.500E-02	-7.458E-03	2.500E-02
106	1	9.372E+02	2.500E-02	-7.458E-03	2.500E-02
107	1	9.373E+02	2.500E-02	-7.458E-03	2.500E-02
108	1	9.383E+02	2.500E-02	-7.458E-03	2.500E-02
109	1	9.386E+02	2.500E-02	-7.458E-03	2.500E-02
110	1	9.382E+02	2.500E-02	-7.458E-03	2.500E-02
111	1	9.388E+02	2.500E-02	-7.458E-03	2.500E-02
112	1	9.384E+02	2.500E-02	-7.458E-03	2.500E-02
113	1	9.394E+02	2.500E-02	-7.458E-03	2.500E-02
114	1	9.397E+02	2.500E-02	-7.458E-03	2.500E-02
115	1	9.395E+02	2.500E-02	-7.458E-03	2.500E-02
116	1	9.400E+02	2.500E-02	-7.458E-03	2.500E-02
117	1	9.398E+02	2.500E-02	-7.458E-03	2.500E-02
118	1	9.406E+02	2.500E-02	-7.458E-03	2.500E-02
119	1	9.408E+02	2.500E-02	-7.458E-03	2.500E-02
120	1	9.410E+02	2.500E-02	-7.458E-03	2.500E-02
121	1	9.409E+02	2.500E-02	-7.458E-03	2.500E-02
122	1	9.407E+02	2.500E-02	-7.458E-03	2.500E-02
123	1	9.416E+02	2.500E-02	-7.458E-03	2.500E-02

124	1	9.419E+02	2.500E-02	-7.458E-03	2.500E-02
125	1	9.422E+02	2.500E-02	-7.458E-03	2.500E-02
126	1	9.422E+02	2.500E-02	-7.458E-03	2.500E-02
127	1	9.425E+02	2.500E-02	-7.458E-03	2.500E-02
128	1	9.425E+02	2.500E-02	-7.458E-03	2.500E-02
129	1	9.430E+02	2.500E-02	-7.458E-03	2.500E-02
130	1	9.433E+02	2.500E-02	-7.458E-03	2.500E-02
131	1	9.436E+02	2.500E-02	-7.458E-03	2.500E-02
132	1	9.437E+02	2.500E-02	-7.458E-03	2.500E-02
133	1	9.440E+02	2.500E-02	-7.458E-03	2.500E-02
134	1	9.441E+02	2.500E-02	-7.458E-03	2.500E-02
135	1	9.445E+02	2.500E-02	-7.458E-03	2.500E-02
136	1	9.448E+02	2.500E-02	-7.458E-03	2.500E-02
137	1	9.450E+02	2.500E-02	-7.458E-03	2.500E-02
138	1	9.452E+02	2.500E-02	-7.458E-03	2.500E-02
139	1	9.454E+02	2.500E-02	-7.458E-03	2.500E-02
140	1	9.457E+02	2.500E-02	-7.458E-03	2.500E-02
141	1	9.459E+02	2.500E-02	-7.458E-03	2.500E-02
142	1	9.462E+02	2.500E-02	-1.153E+00	4.240E-02
143	1	9.464E+02	2.500E-02	-1.272E+00	6.934E-02
144	1	9.467E+02	2.500E-02	-1.298E+00	9.904E-02
145	1	9.469E+02	2.500E-02	-1.291E+00	1.253E-01
146	1	9.472E+02	2.500E-02	-1.305E+00	1.517E-01
147	1	9.475E+02	2.500E-02	-1.322E+00	1.796E-01
148	1	9.477E+02	2.500E-02	-1.343E+00	2.075E-01
149	1	9.481E+02	2.500E-02	-1.371E+00	2.348E-01
150	1	9.483E+02	2.500E-02	-1.406E+00	2.643E-01
151	1	9.486E+02	2.500E-02	-1.450E+00	2.935E-01
152	1	9.489E+02	2.500E-02	-1.505E+00	3.229E-01
153	1	9.492E+02	2.500E-02	-1.578E+00	3.555E-01
154	1	9.495E+02	2.500E-02	-1.667E+00	3.878E-01
155	1	9.498E+02	2.500E-02	-1.784E+00	4.241E-01
156	1	9.500E+02	2.500E-02	-1.896E+00	4.610E-01
157	1	9.500E+02	2.500E-02	-1.993E+00	5.010E-01
158	8	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
159	8	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
160	8	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
161	4	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
162	4	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
163	4	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
164	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
165	4	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
166	4	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
167	4	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
168	4	9.330E+02	7.875E-03	-6.385E-03	7.875E-03
169	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
170	2	9.330E+02	9.921E-03	-6.385E-03	9.921E-03
171	1	9.330E+02	1.575E-02	-6.386E-03	1.575E-02
172	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
173	2	9.330E+02	9.921E-03	-6.385E-03	9.921E-03
174	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
175	2	9.330E+02	9.921E-03	-6.385E-03	9.921E-03
176	1	9.330E+02	1.984E-02	-6.386E-03	1.984E-02
177	1	9.330E+02	1.575E-02	-6.386E-03	1.575E-02

178	1	9.330E+02	1.575E-02	-6.386E-03	1.575E-02

Appendix C (Parametric Output)

Figure/Table	Explanation
C.1	Press at Top of Cell vs. Time (In-Vessel, with H_2)
C.2	Press at Top of Cell vs. Time (1150 Tm, with H_2)
C.3	Press at Top of Cell vs. Time (373 Tl, with H_2)
C.4	Press at Bott. of Cell vs. Time (In-Vess, with H_2)
C.5	Press at Bott. of Cell vs. Time (1150 Tm, with H_2)
C.6	Press at Bott. of Cell vs. Time (373 Tl, with H2)
C.7	Press at Top of Cell vs. Time (In-Vessel, no H_2)
C.8	Press at Top of Cell vs. Time (1150 Tm, no H_2)
C.9	Press at Top of Cell vs. Time (373 Tl, no H_2)
C.10	Press at Bott. of Cell vs. Time (In-Vesel, no H_2)
C.11	Press at Bott. of Cell vs. Time (1150 Tm, no H_2)
C.12	Press at Bott. of Cell vs. Time (373 Tl, no H_2)
C.13	Liquid Temp vs. Position (In-Vessel, with H_2)
C.14	Vapor Void Fraction vs. Position (")
C.15	Fuel Particle Fraction vs. Time (")
C.16	Vapor Temp vs. Position (")
C.17	Liquid Temp vs. Position (1150 Tm, with H_2)
C.18	Vapor Void Fraction vs. Position (")
C.19	Fuel Particle Fraction vs. Position (")
C.20	Vapor Temp(K) vs. Position (")
C.21	Liquid Temp vs. Position (373 Tl, with H_2)
C.22	Vapor Void Fraction vs. Position (")

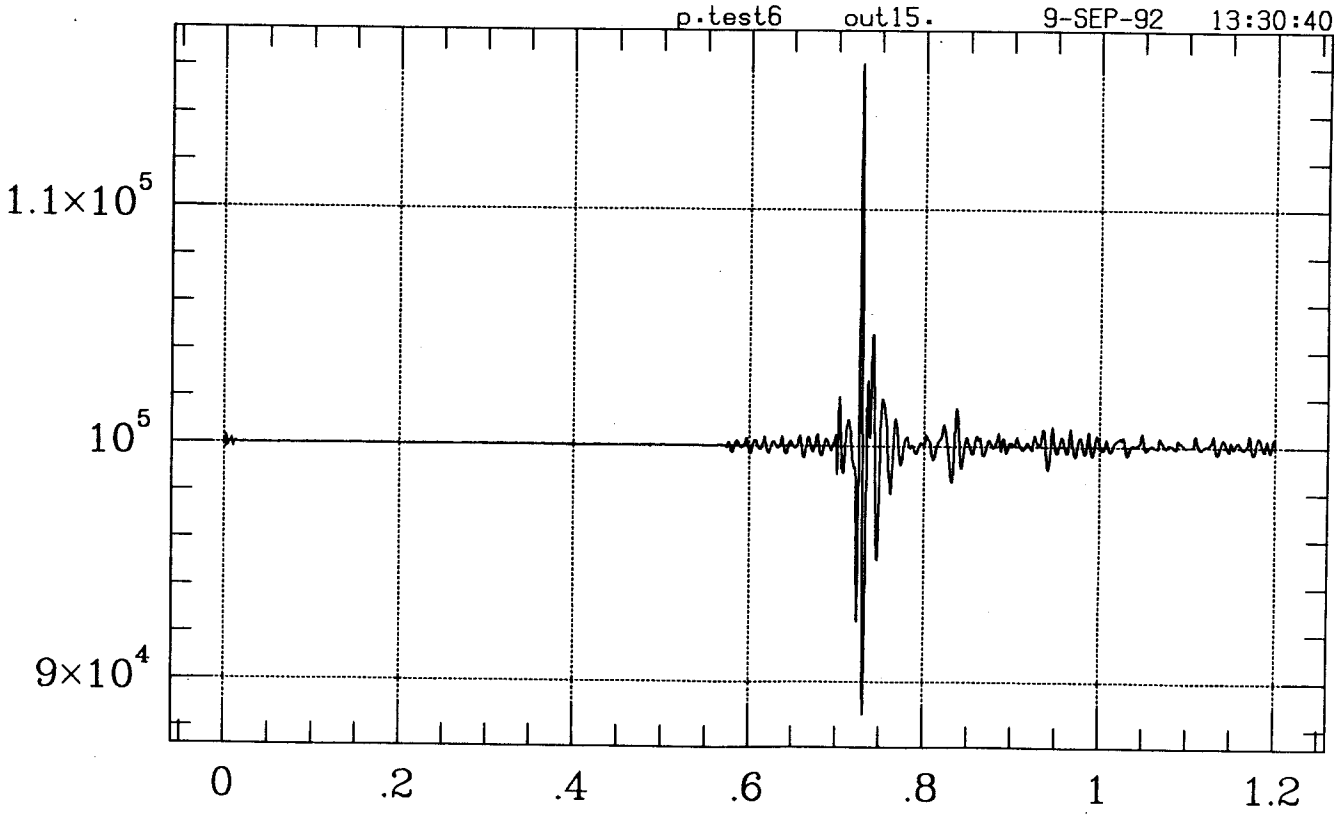

Figure C.1: Press(Pa) at Top of Cell vs. Time(s) (In-Vessel, with H_2)

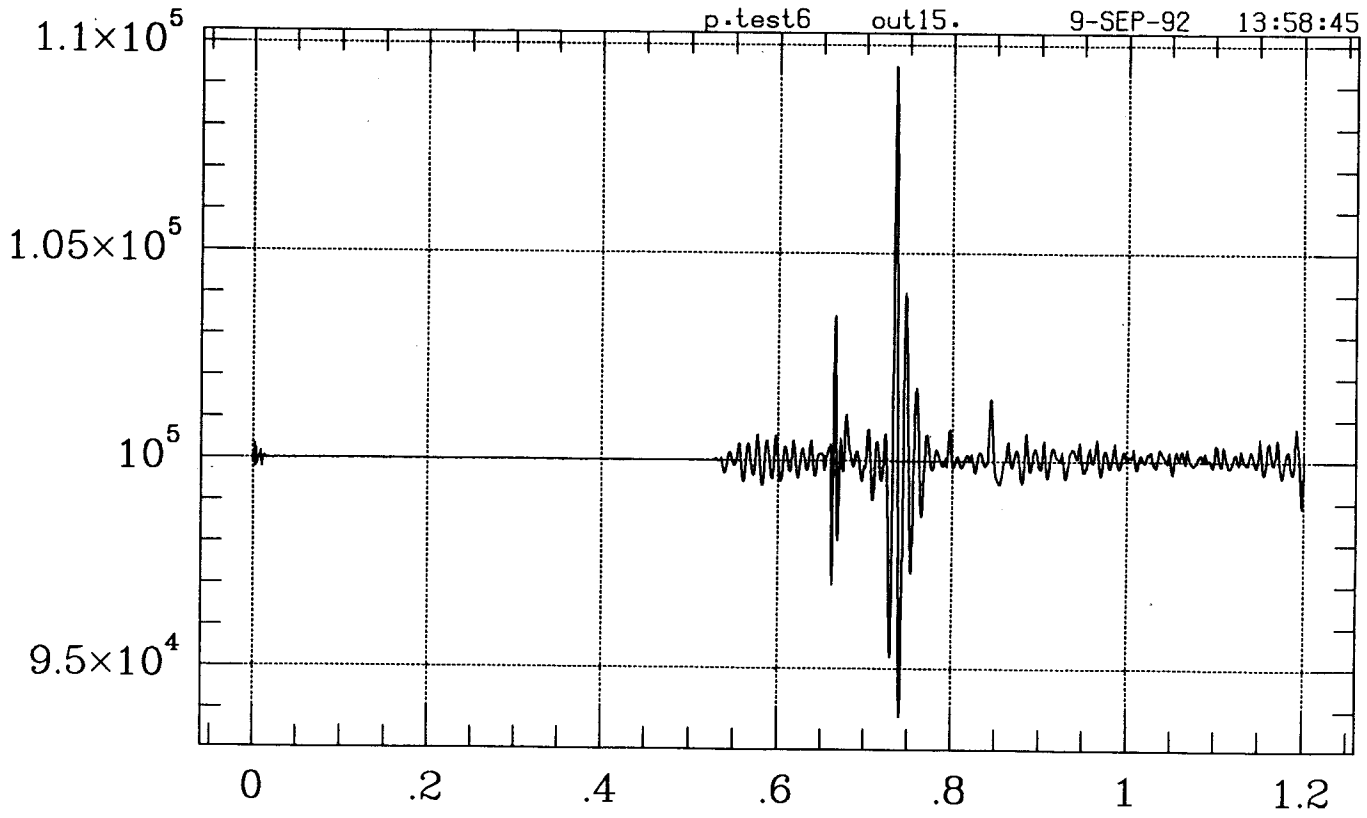

Figure C.2: Press(Pa) at Top of Cell vs. Time(s) (1150 Tm, with H_2)

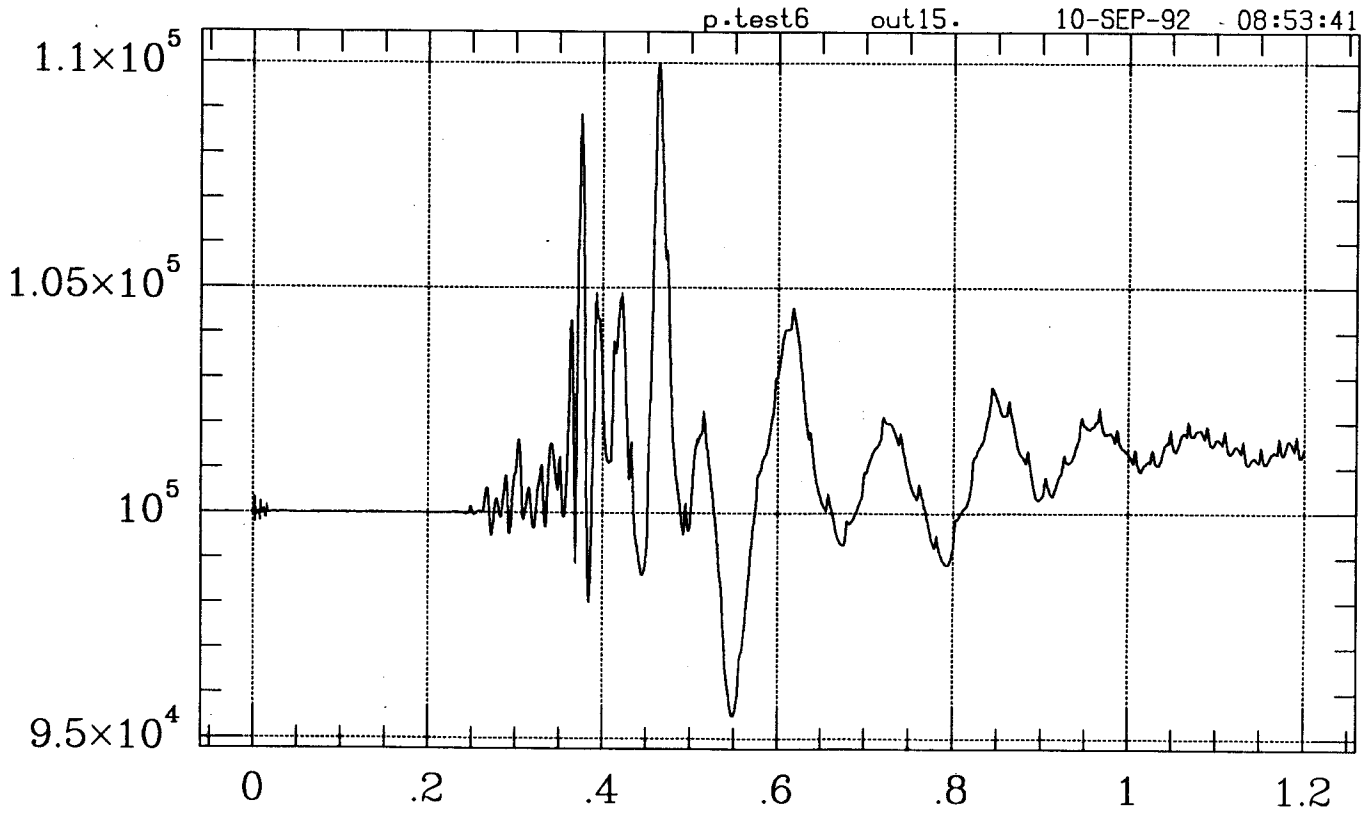

Figure C.3: Press(Pa) at Top of Cell vs. Time(s) (373 Tl, with H_2)

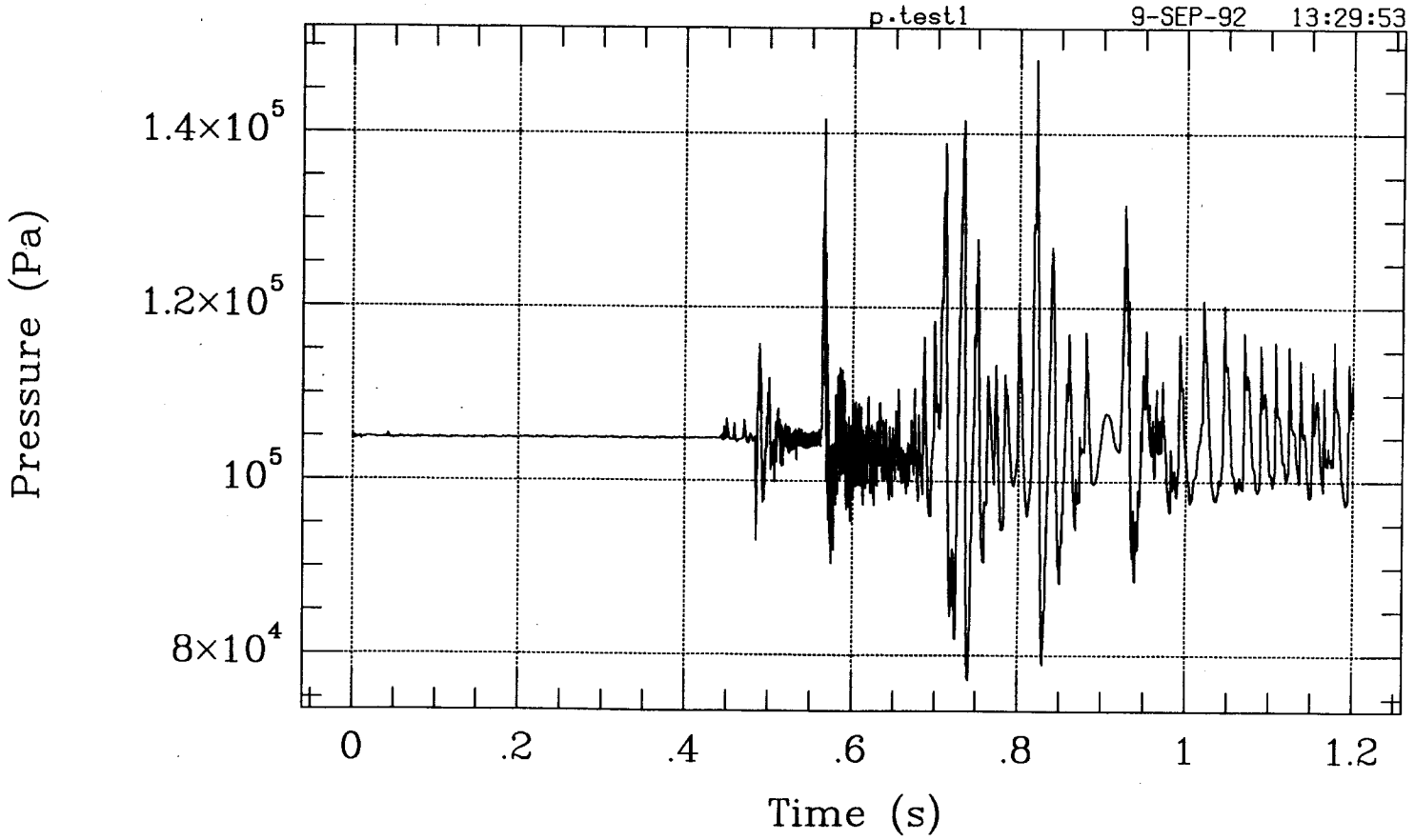

Figure C.4: Press(Pa) at Bott. of Cell vs. Time(s) (In-Vess, with H_2)

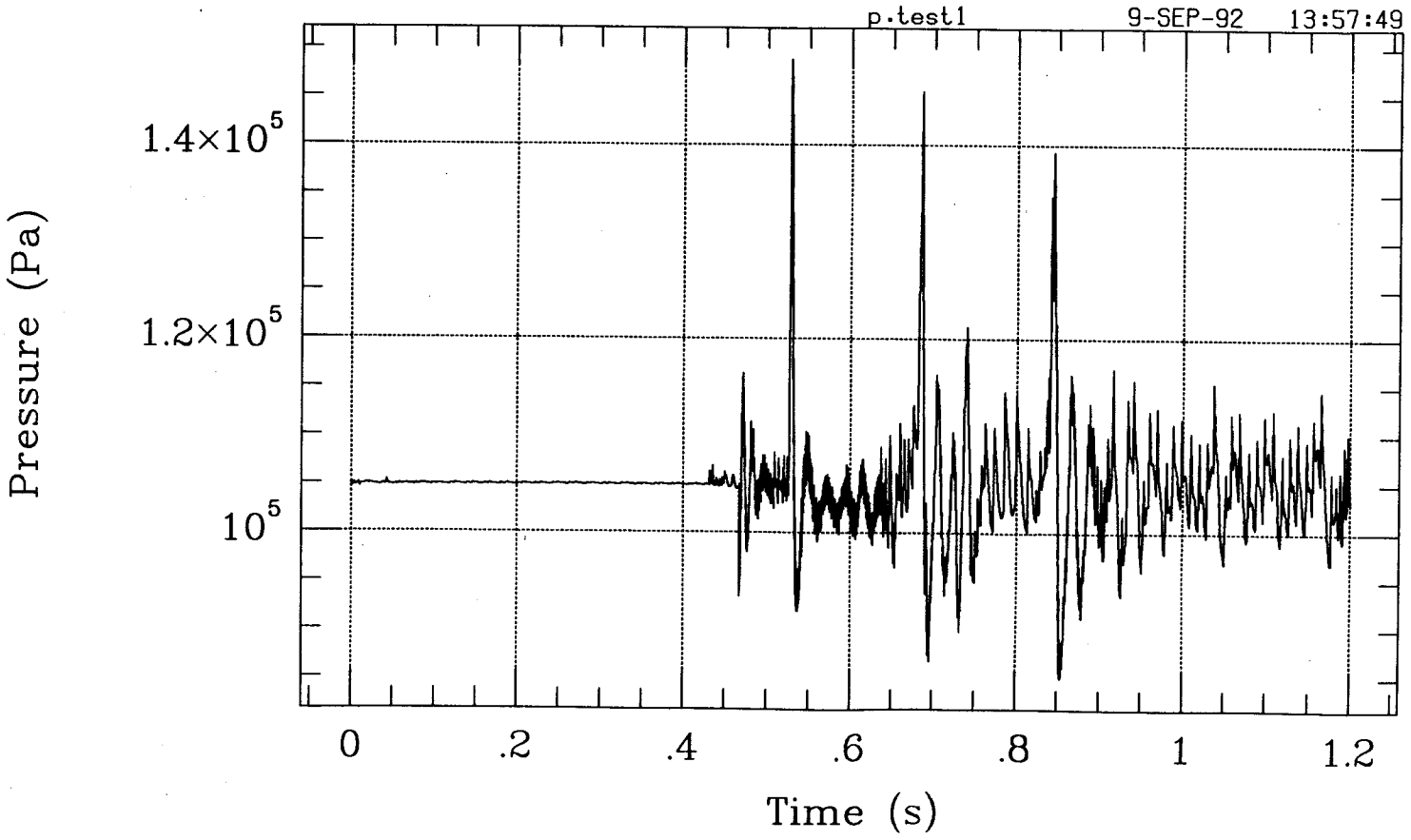

Figure C.5: Press(Pa) at Bott. of Cell vs. Time(s) (1150 Tm, with H_2)

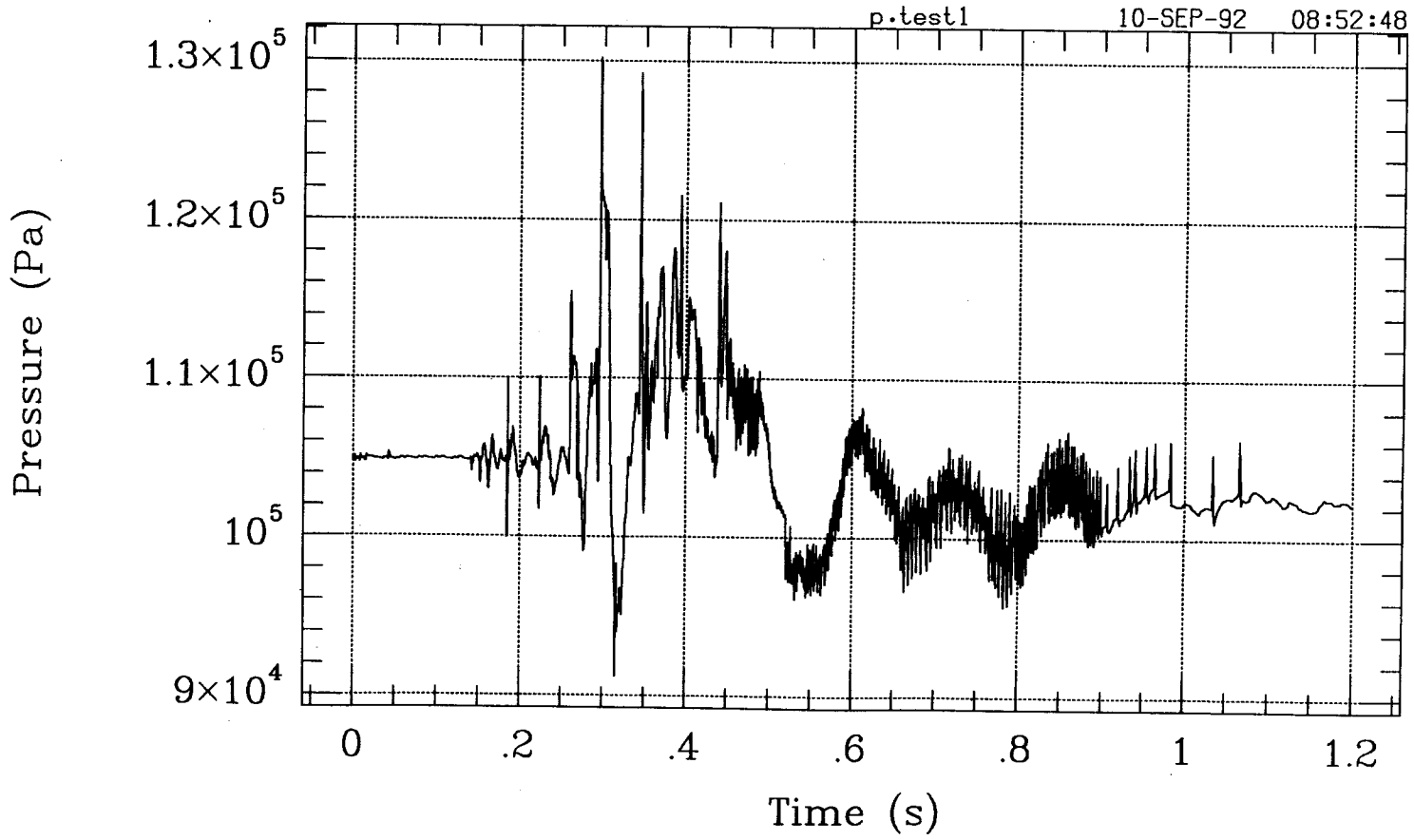

Figure C.6: Press(Pa) at Bott. of Cell vs. Time(s) (373 Tl, with H2)

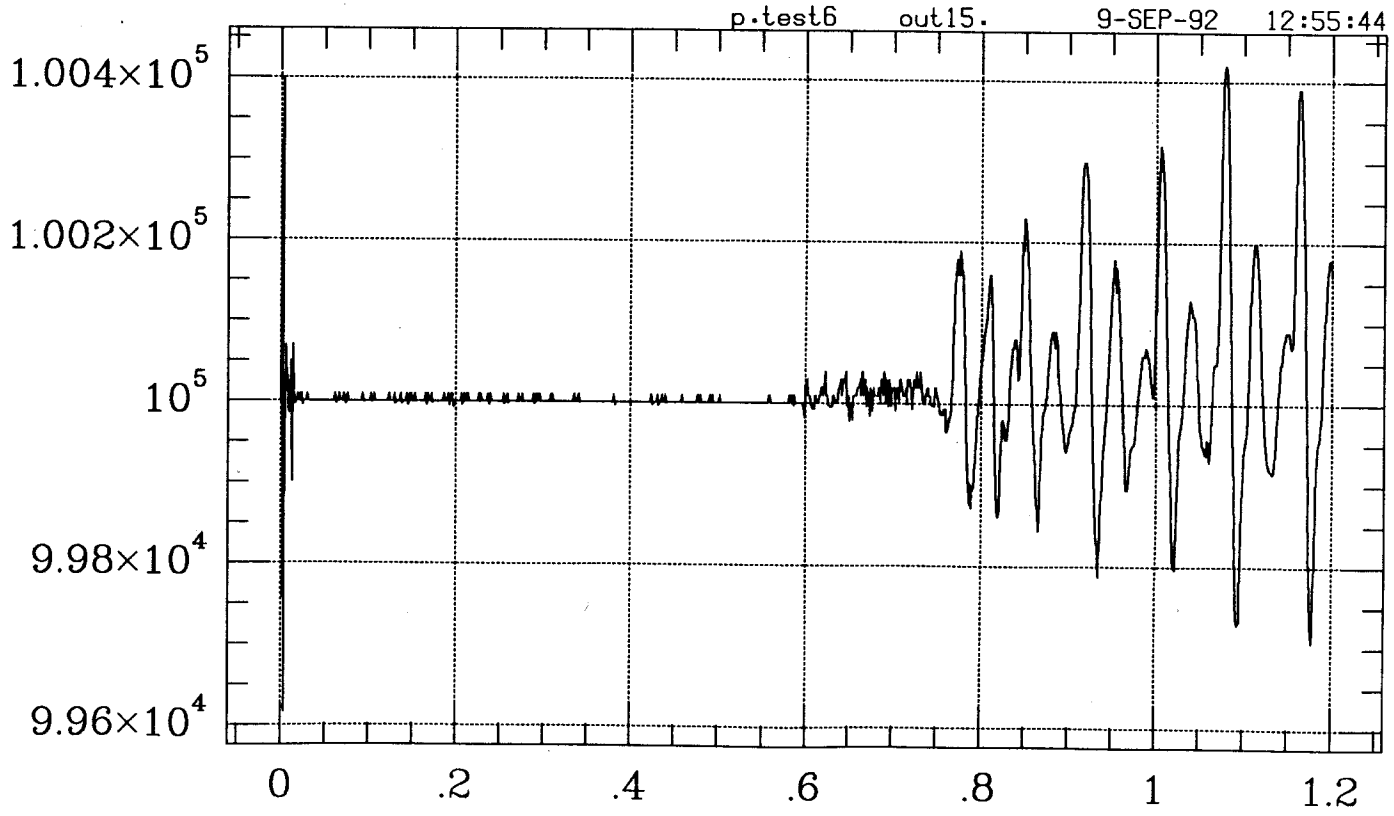

Figure C.7: Press(Pa) at Top of Cell vs. Time(s) (In-Vessel, no H_2)

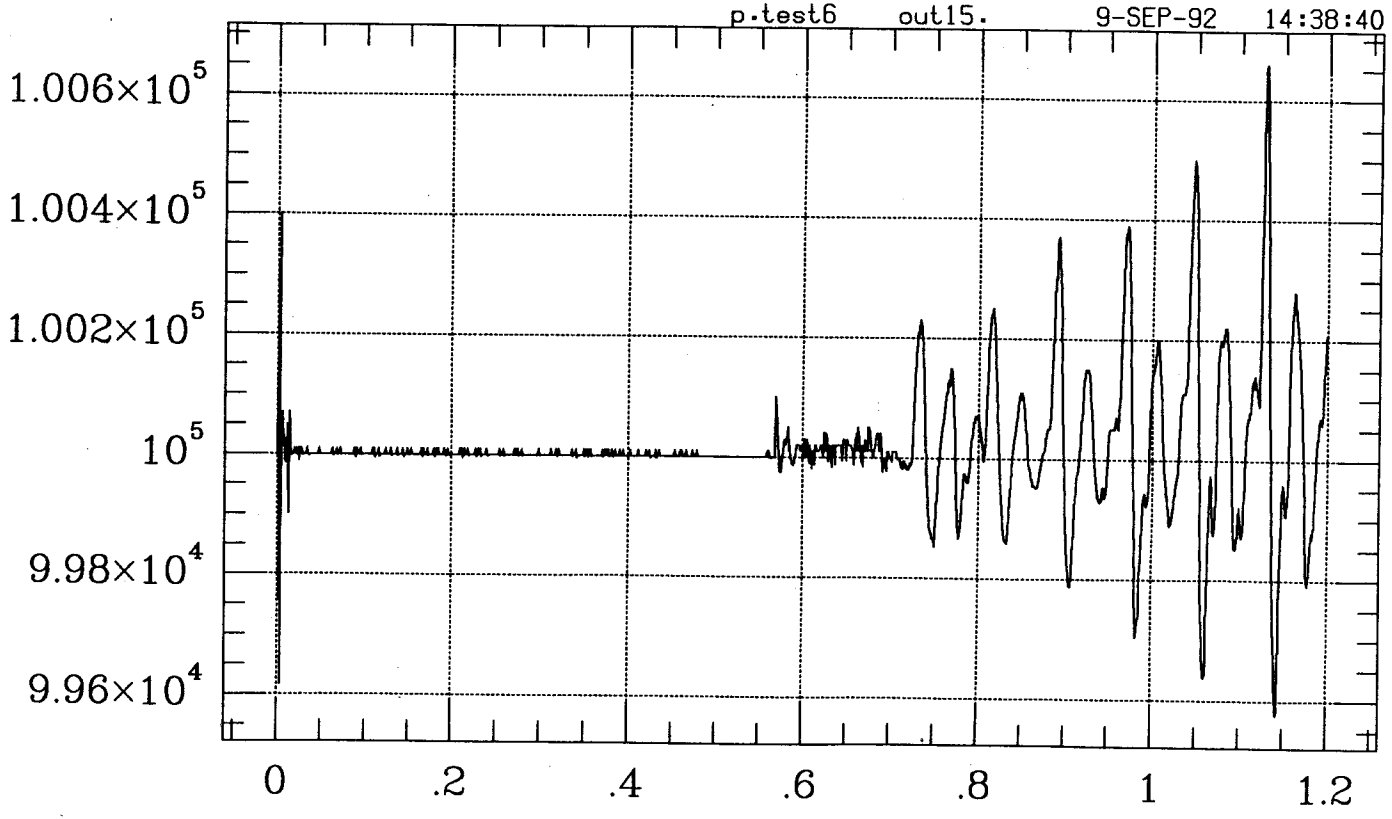

Figure C.8: Press(Pa) at Top of Cell vs. Time(s) (1150 Tm, no H_2)

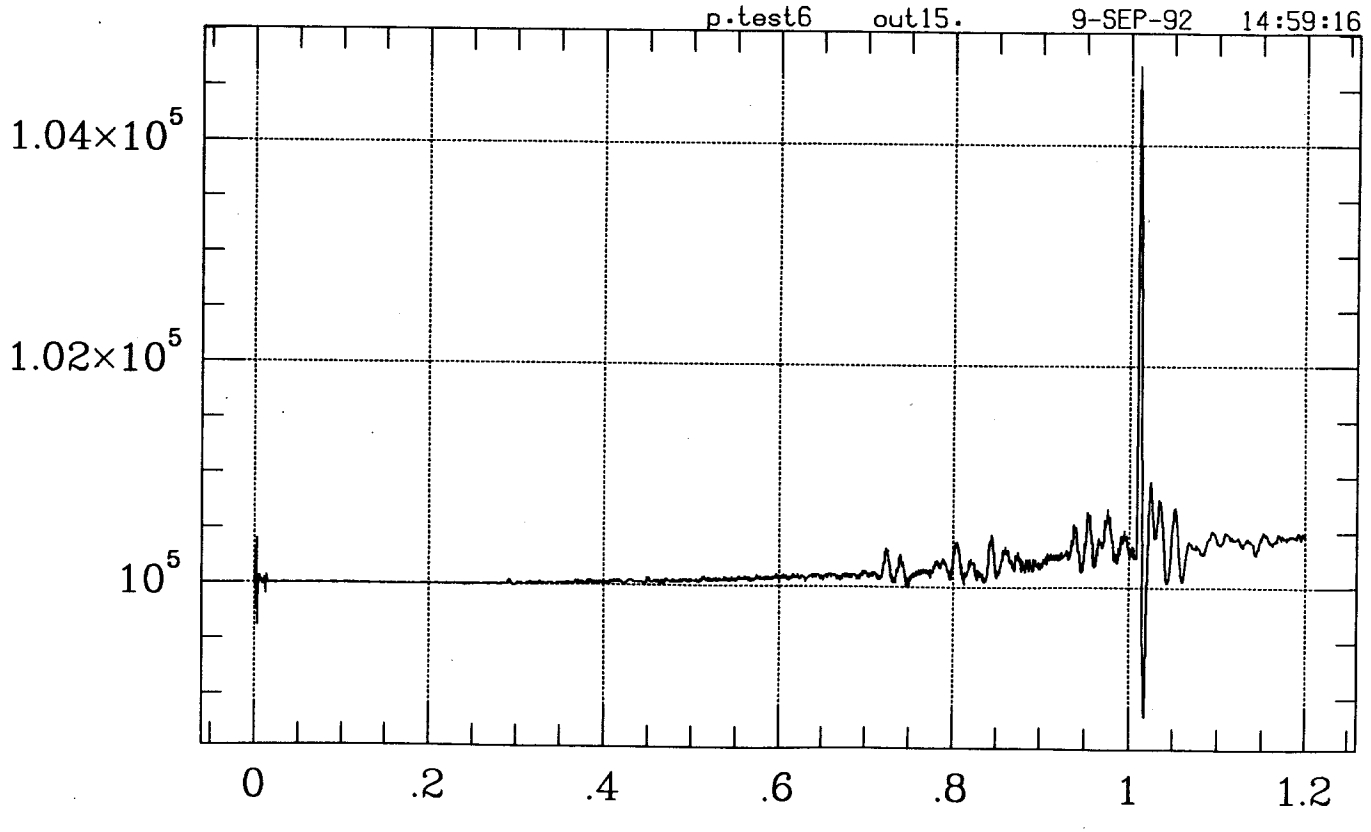

Figure C.9: Press(Pa) at Top of Cell vs. Time(s) (373 Tl, no H_2)

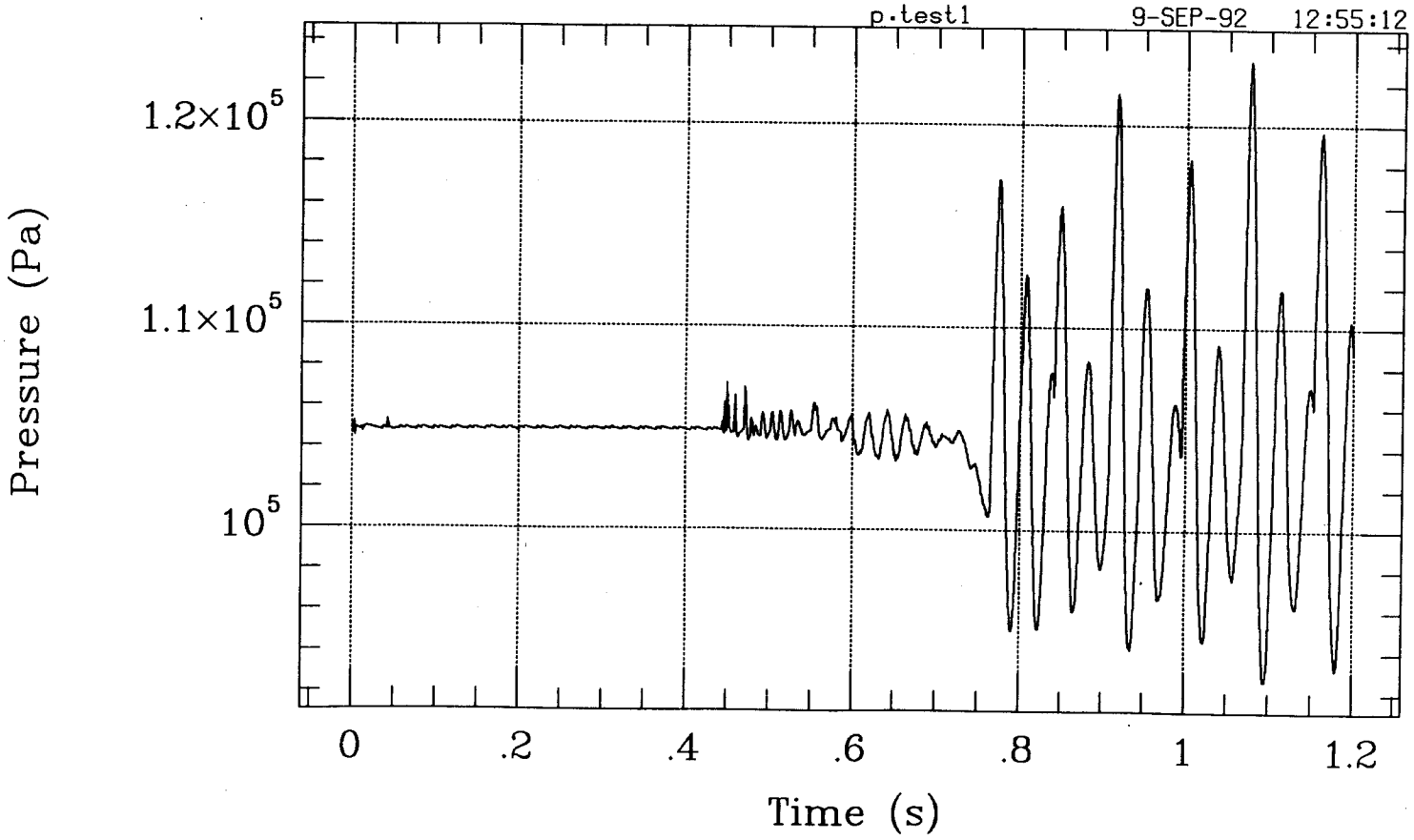

Figure C.10: Press(Pa) at Bott. of Cell vs. Time(s) (In-Vesel, no H_2)

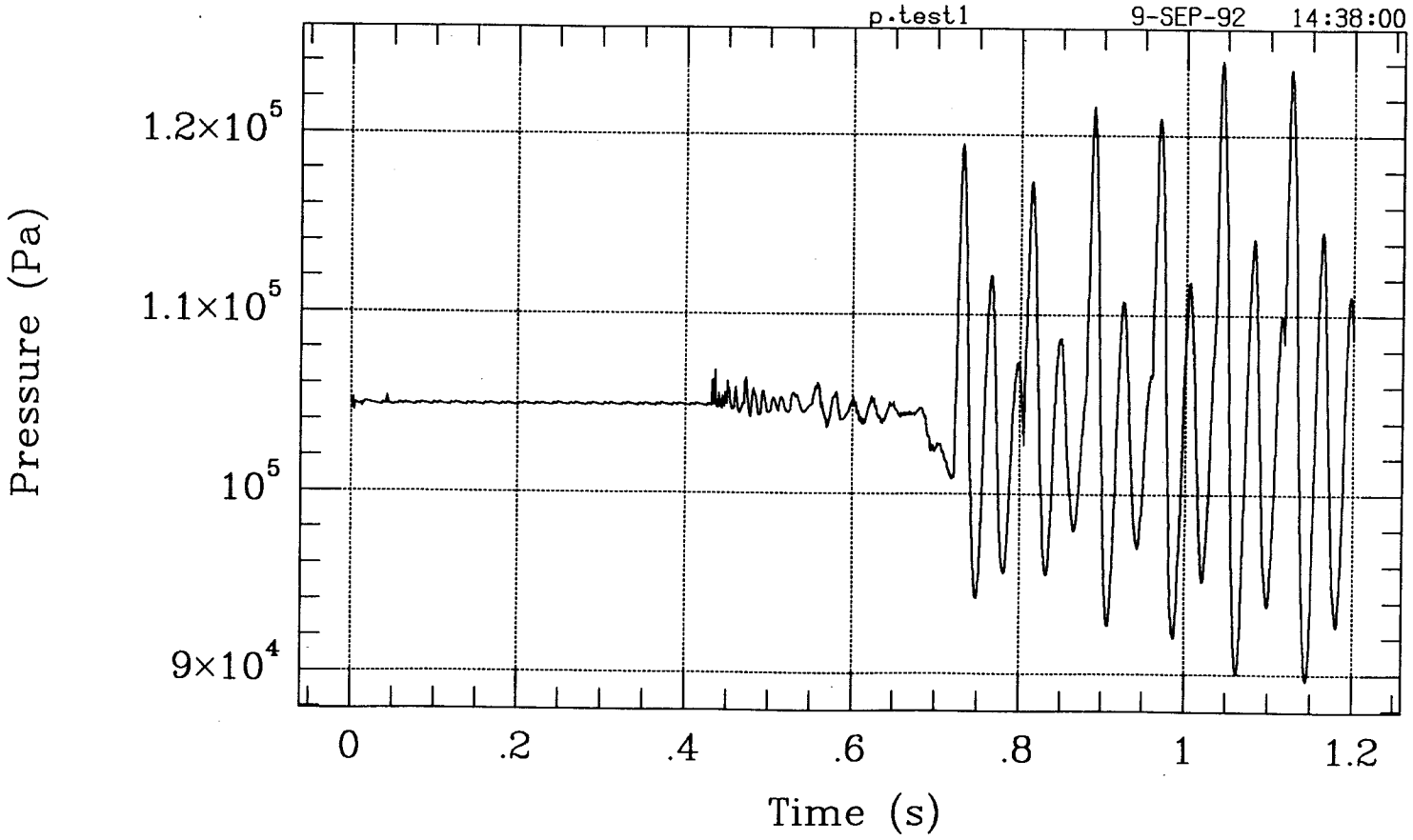

Figure C.11: Press(Pa) at Bott. of Cell vs. Time(s) (1150 Tm, no H_2)

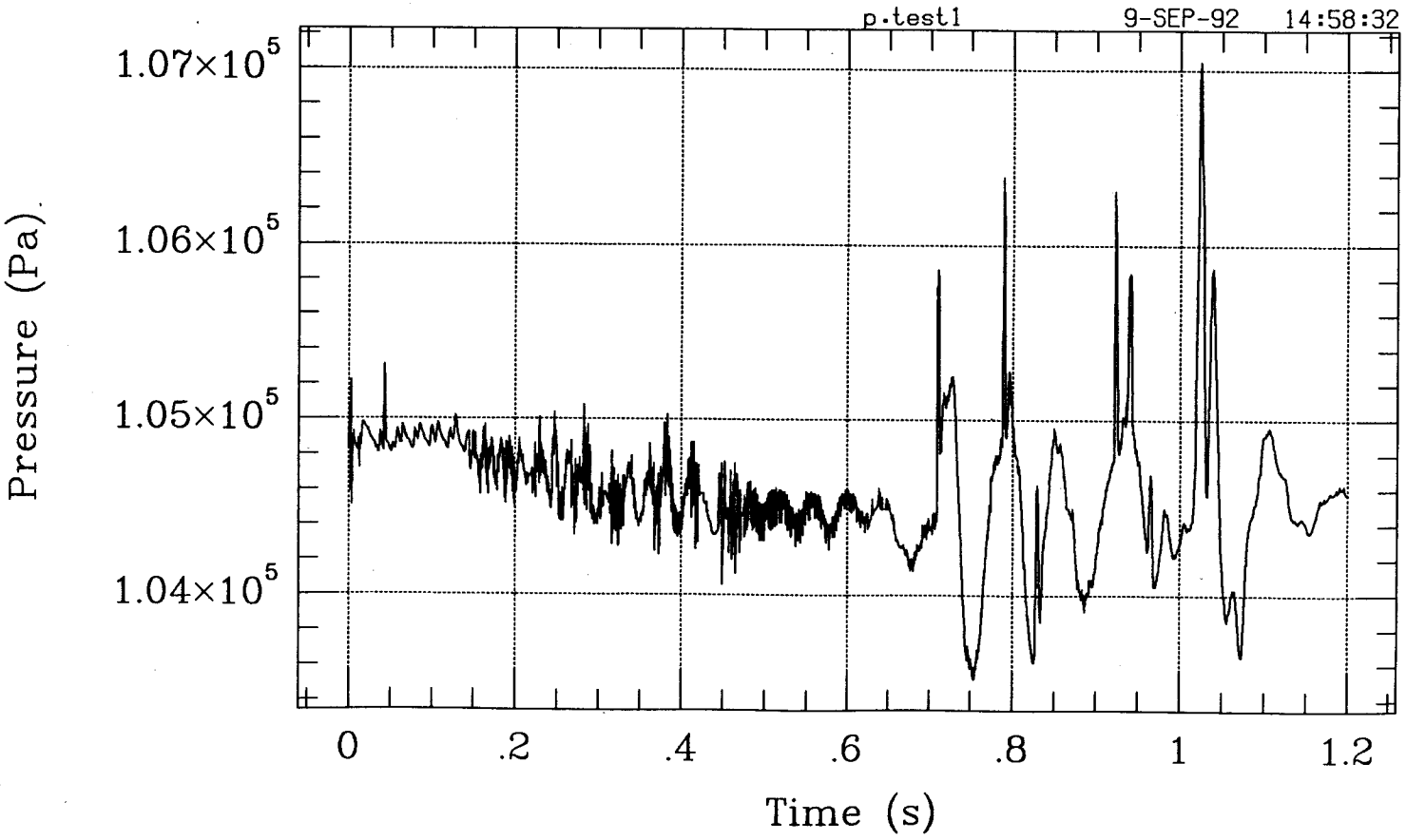

Figure C.12: Press(Pa) at Bott. of Cell vs. Time(s) (373 Tl, no H_2)

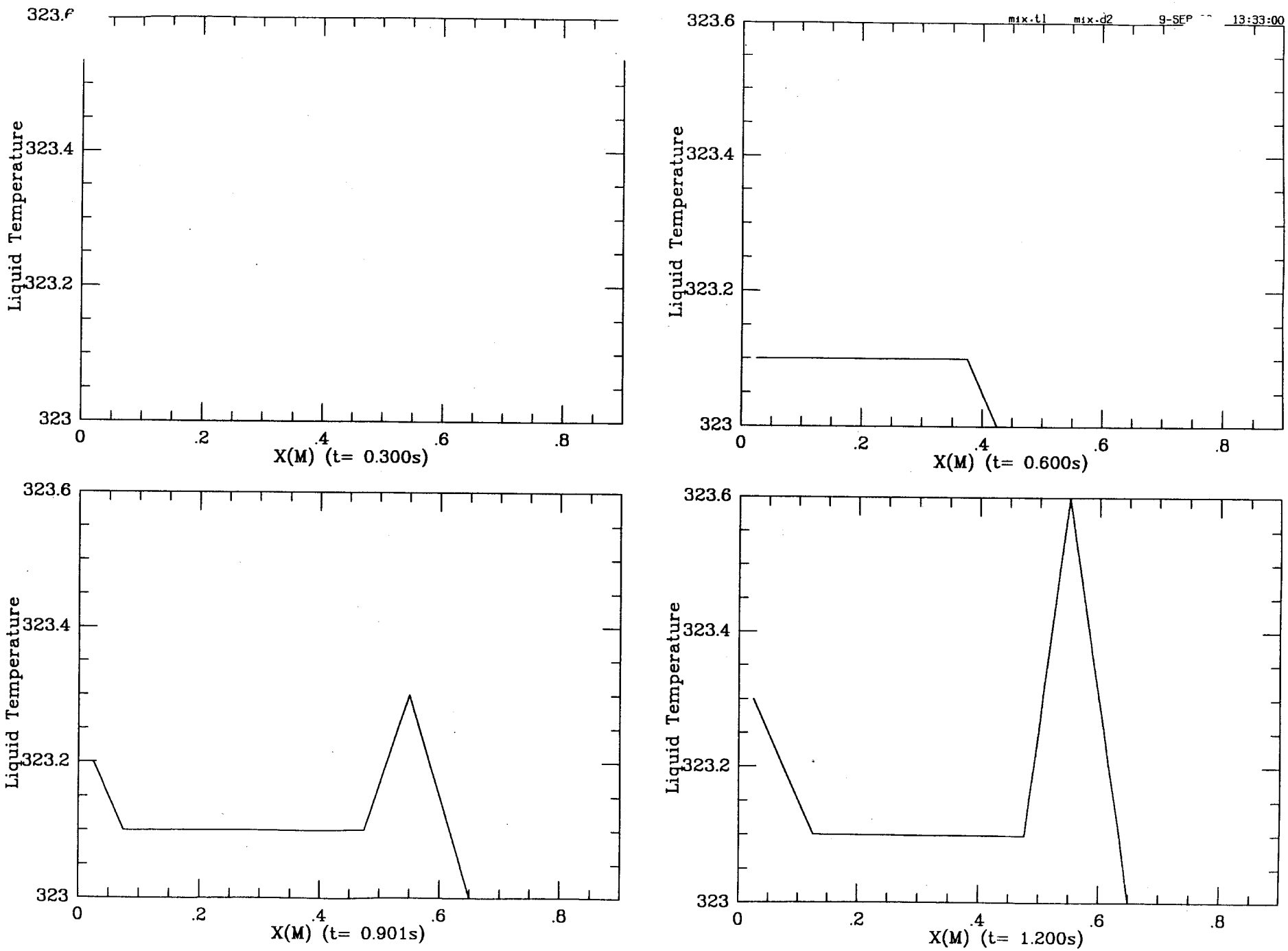

Figure C.13: Liquid Temp(K) vs. Position(m) (In-Vessel, with H_2)

(for various times)

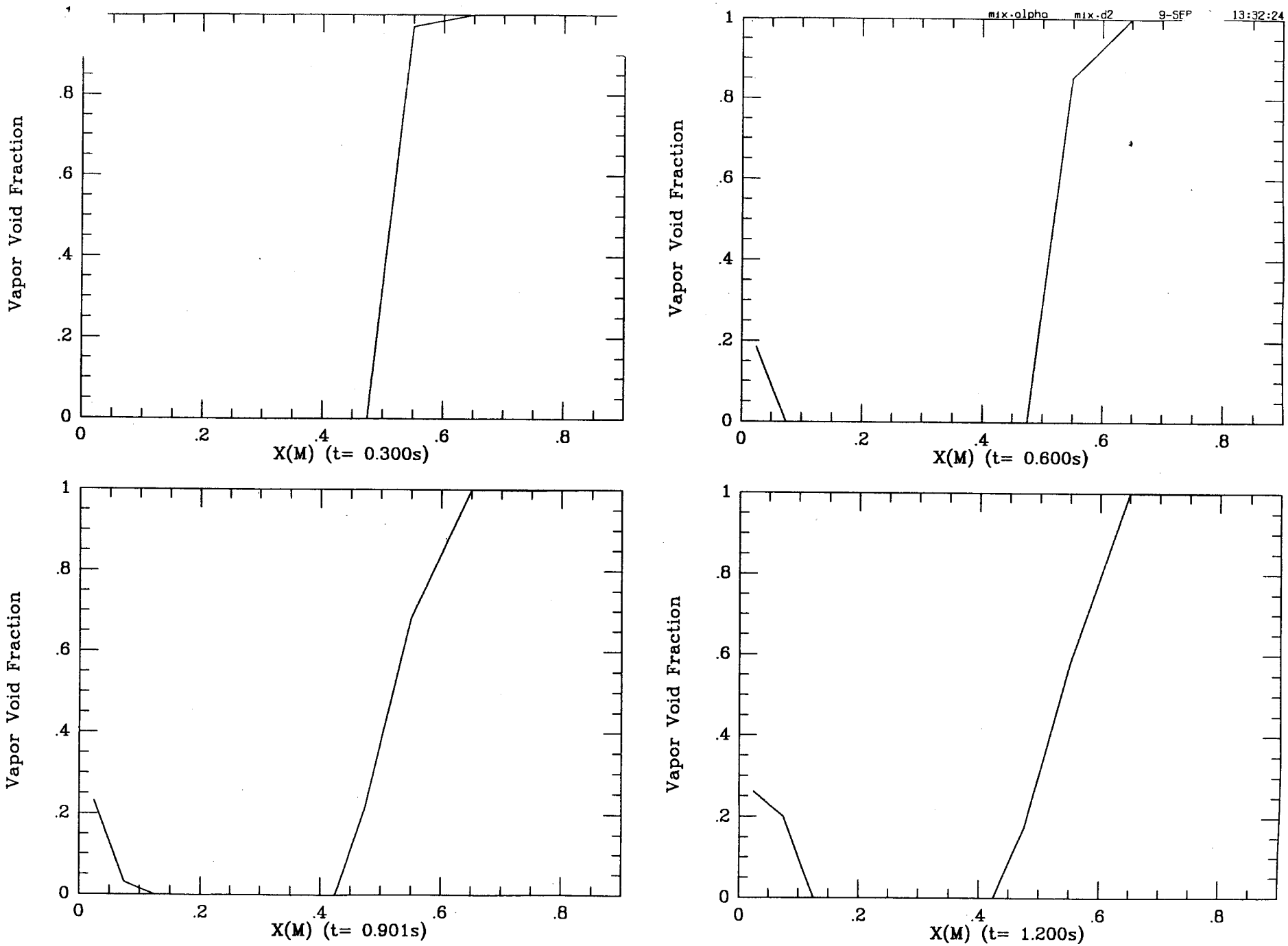

Figure C.14: Vapor Void Fraction vs. Position(m) (In-Vessel, with H_2)

(for various times)

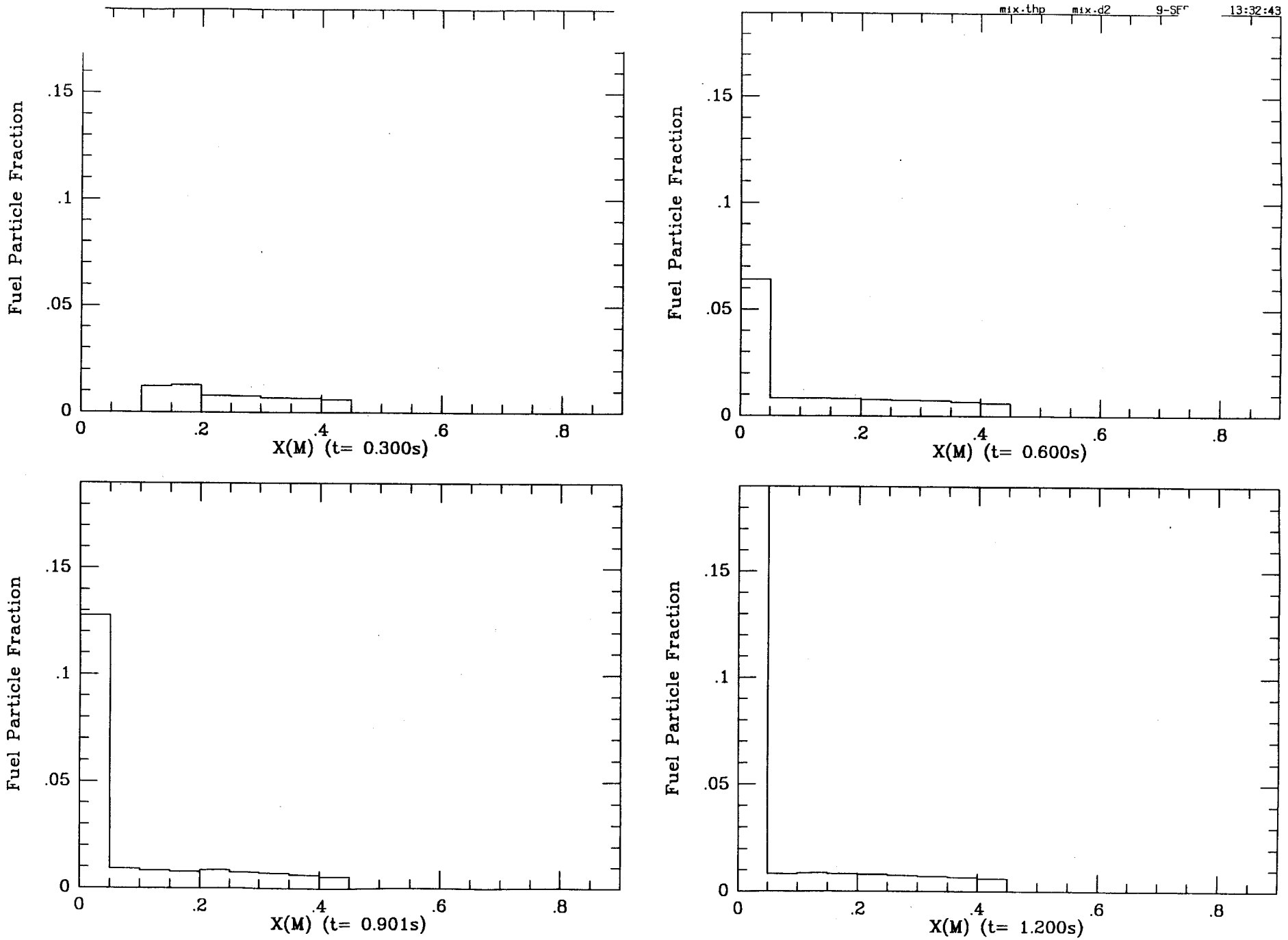

Figure C.15: Fuel Particle Fract vs. Position(m) (In-Vessel, with H_2)

(for various times)

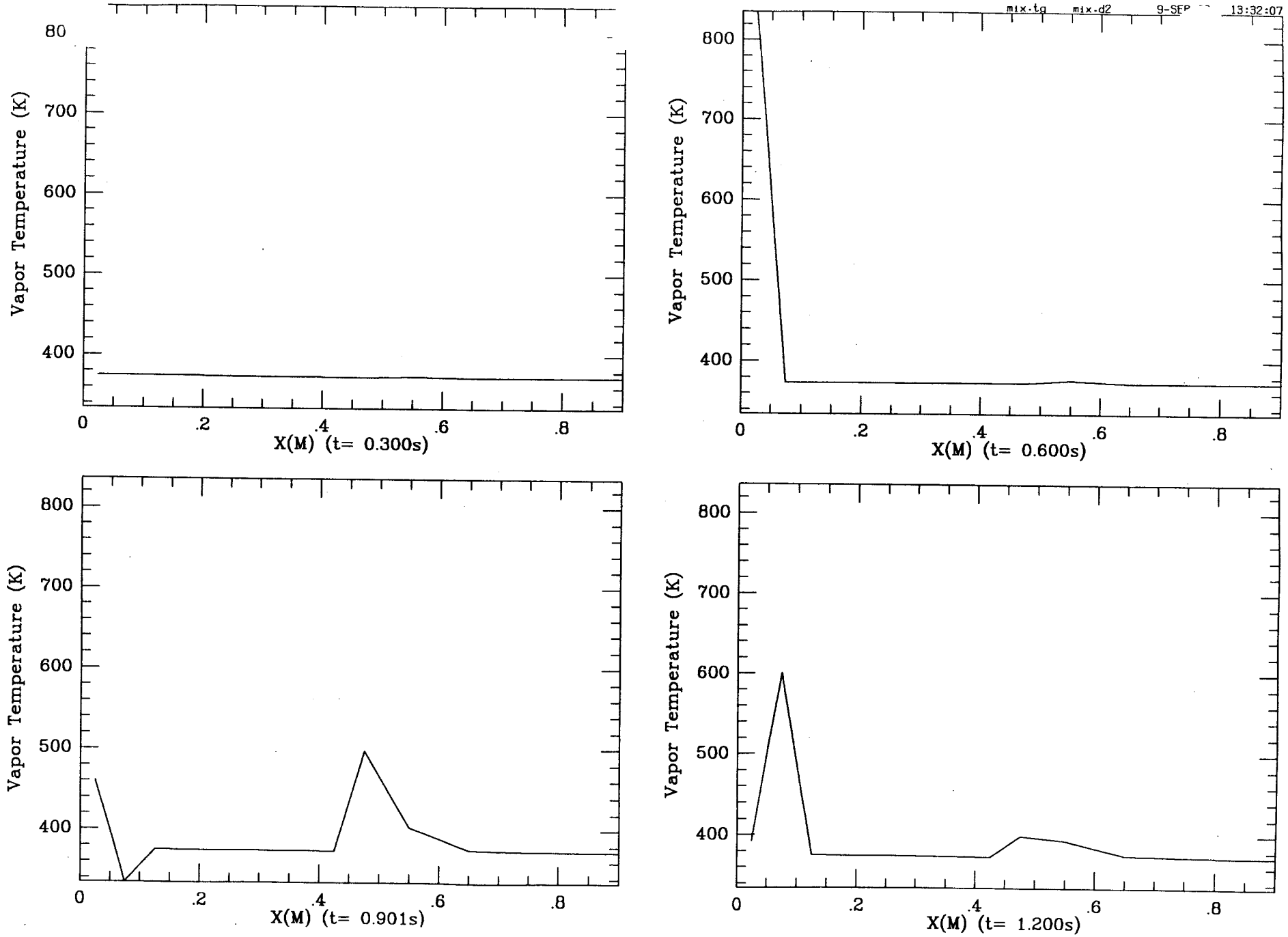

Figure C.16: Vapor Temp(K) vs. Position(m) (In-Vessel, with H_2)

(for various times)

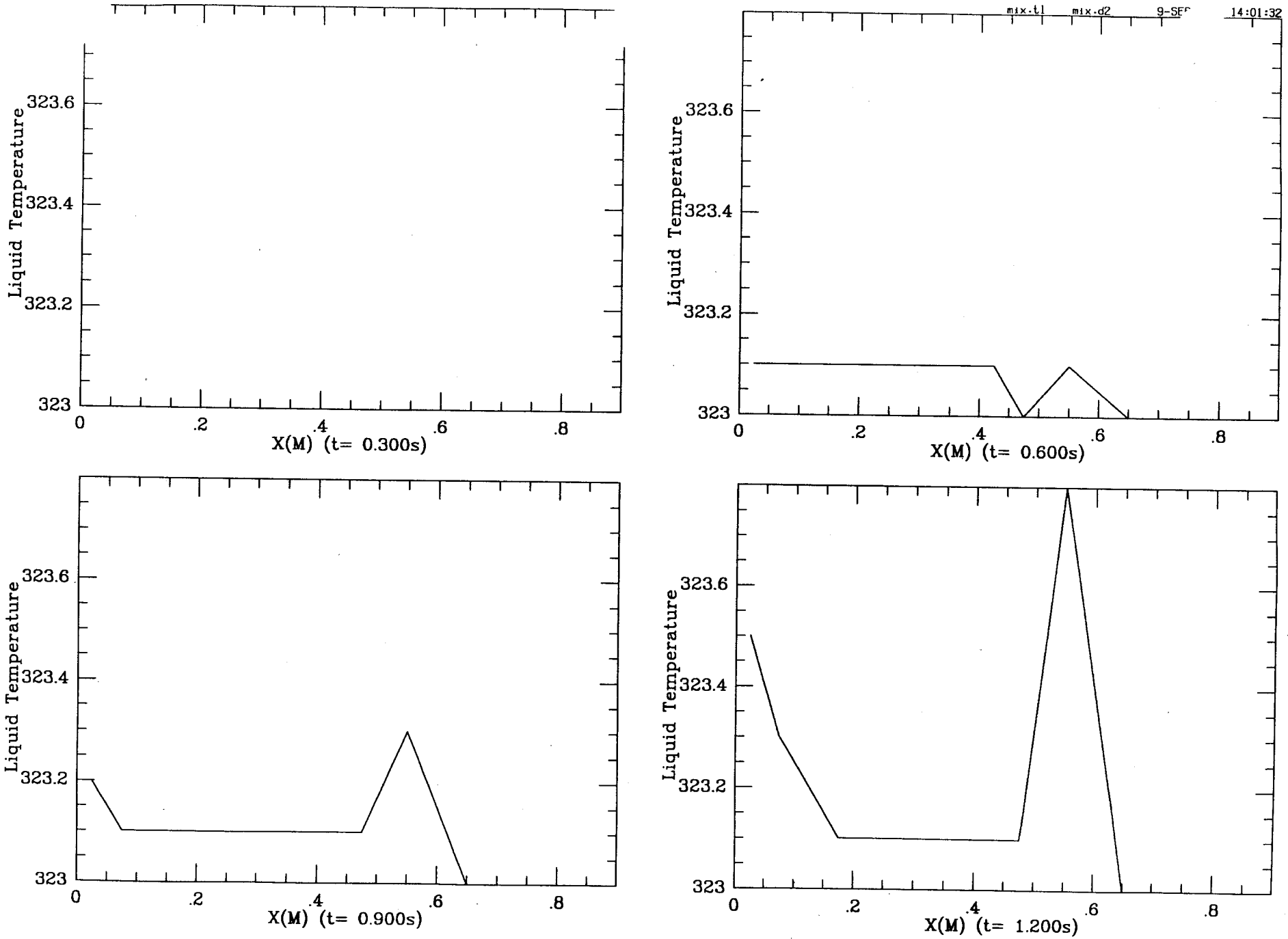

Figure C.17: Liquid Temp(K) vs. Position(m) (1150 Tm, with H_2)

(for various times)

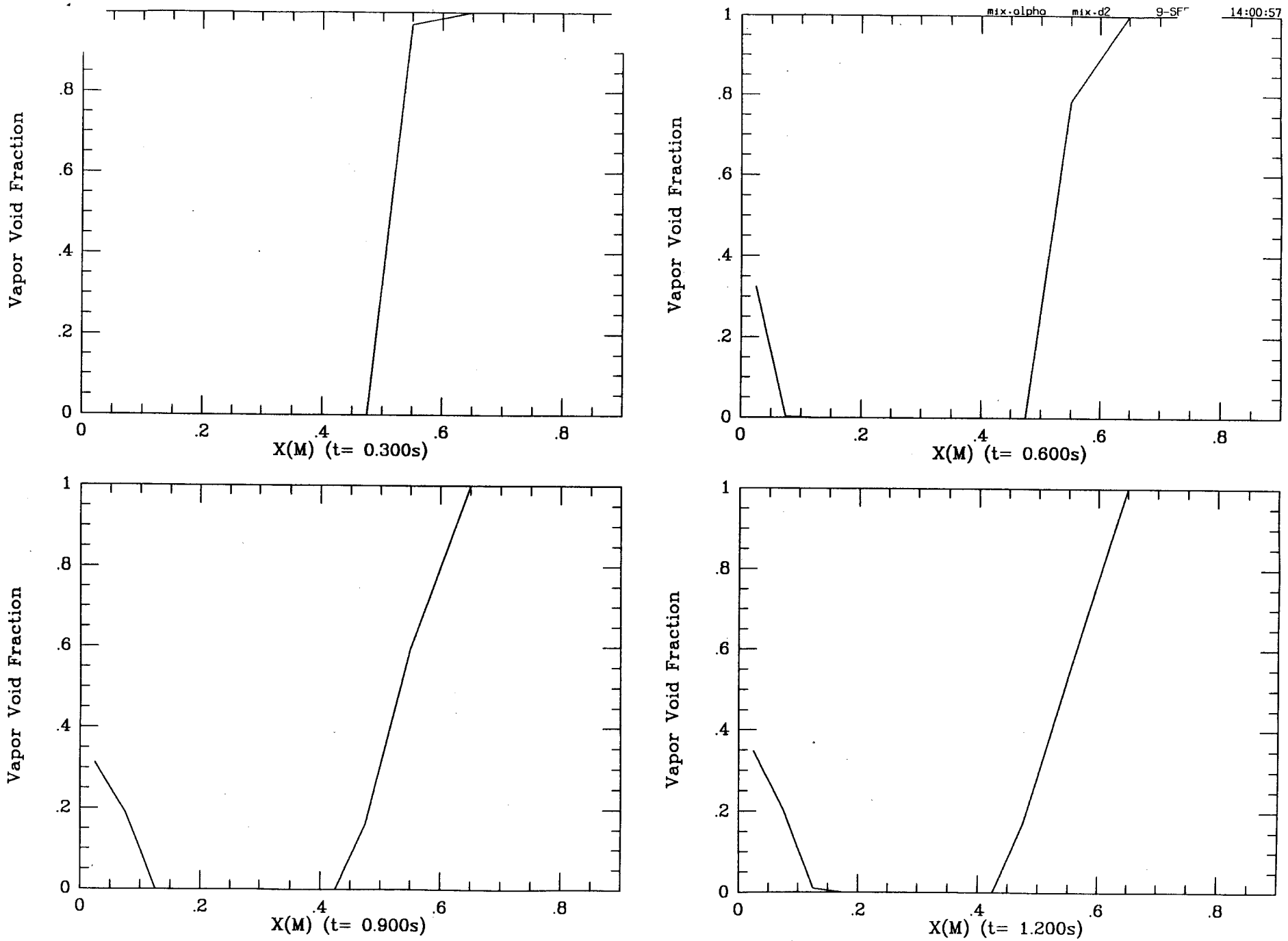

Figure C.18: Vapor Void Fraction vs. Position(m) (1150 Tm, with H_2)

(for various times)

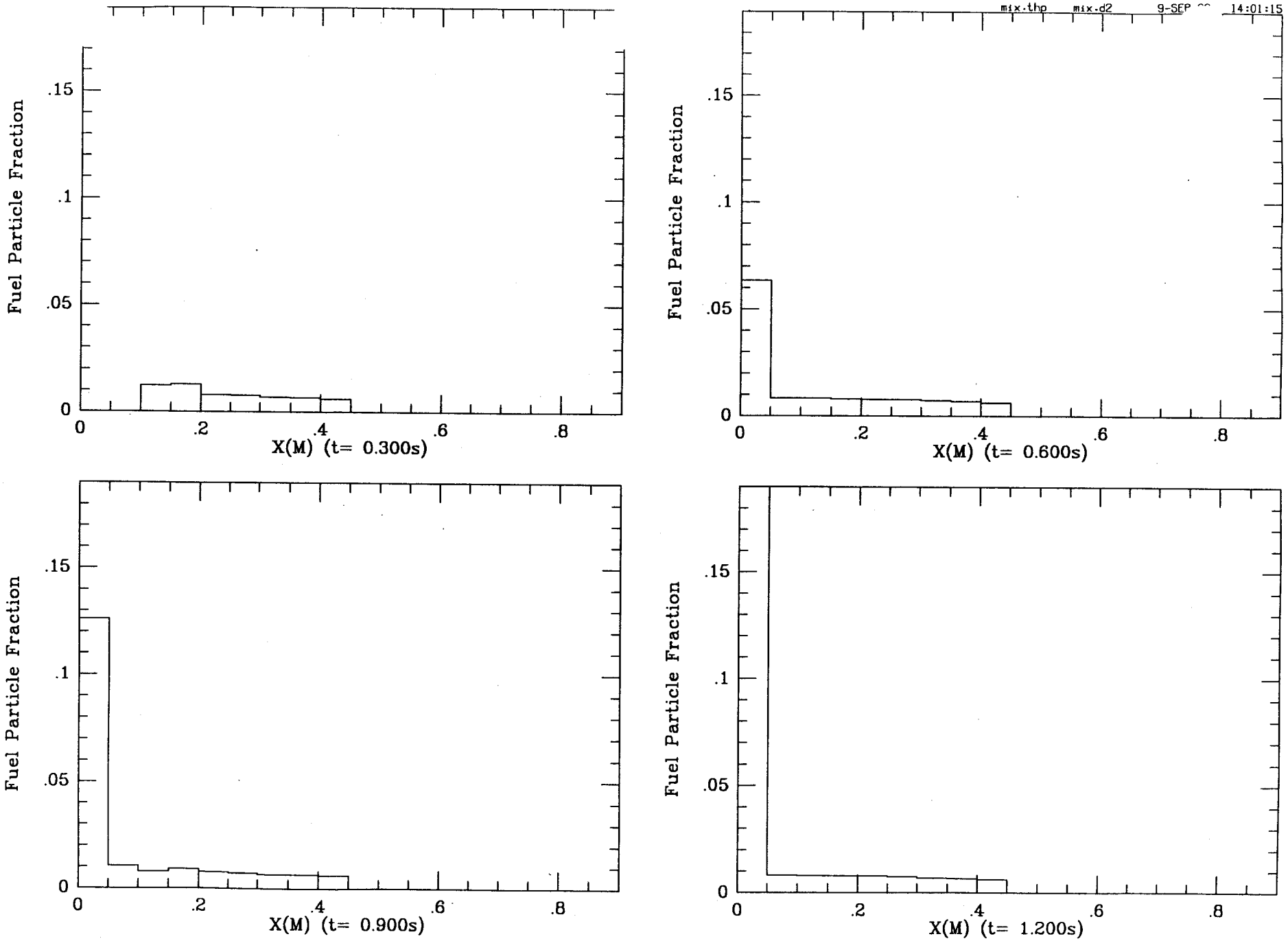

Figure C.19: Fuel Particle Fraction vs. Position(m) (1150 Tm, with H_2)

(for various times)

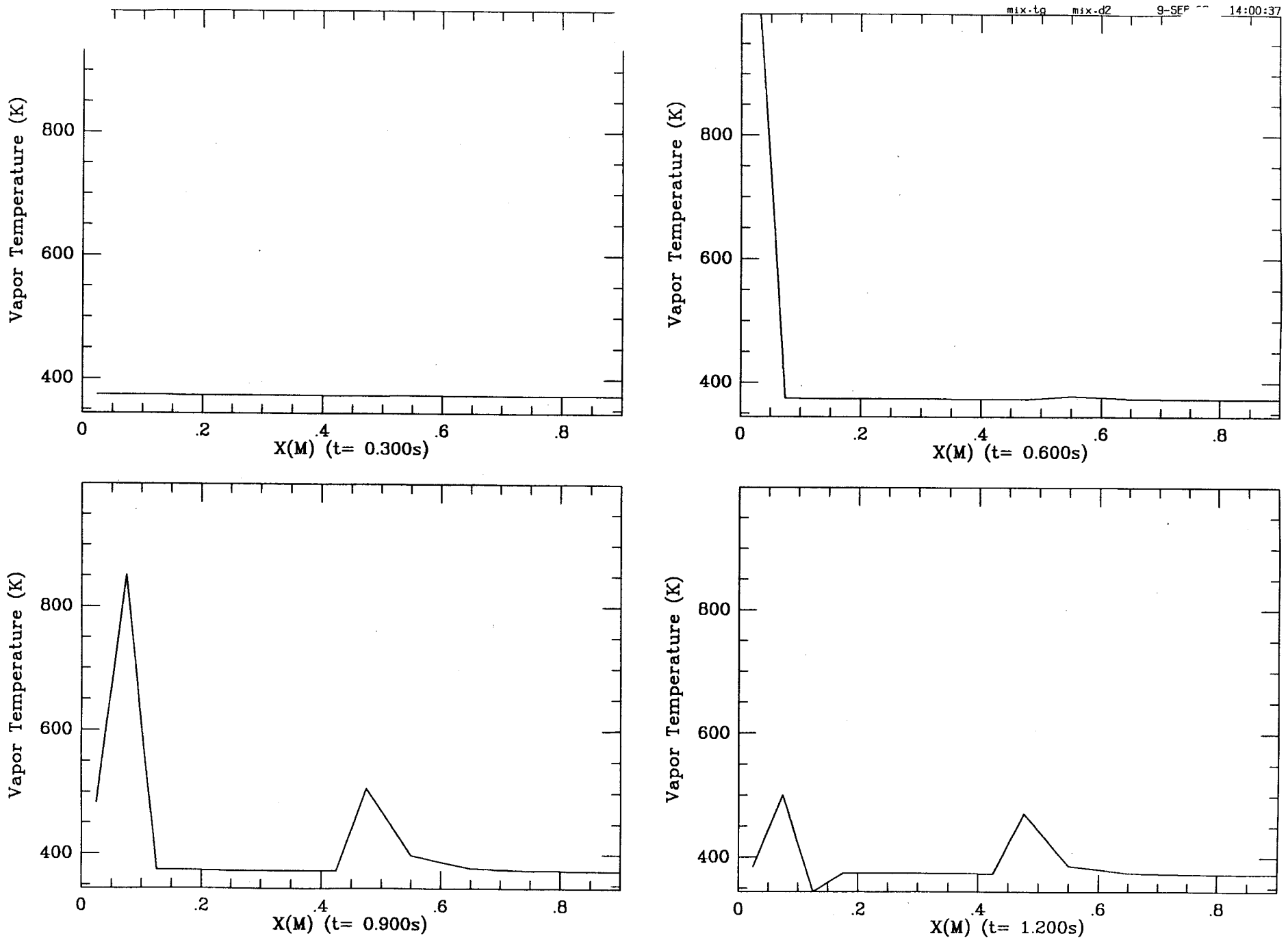

Figure C.20: Vapor Temp(K) vs. Position(m) (1150 Tm, with H_2)

(for various times)

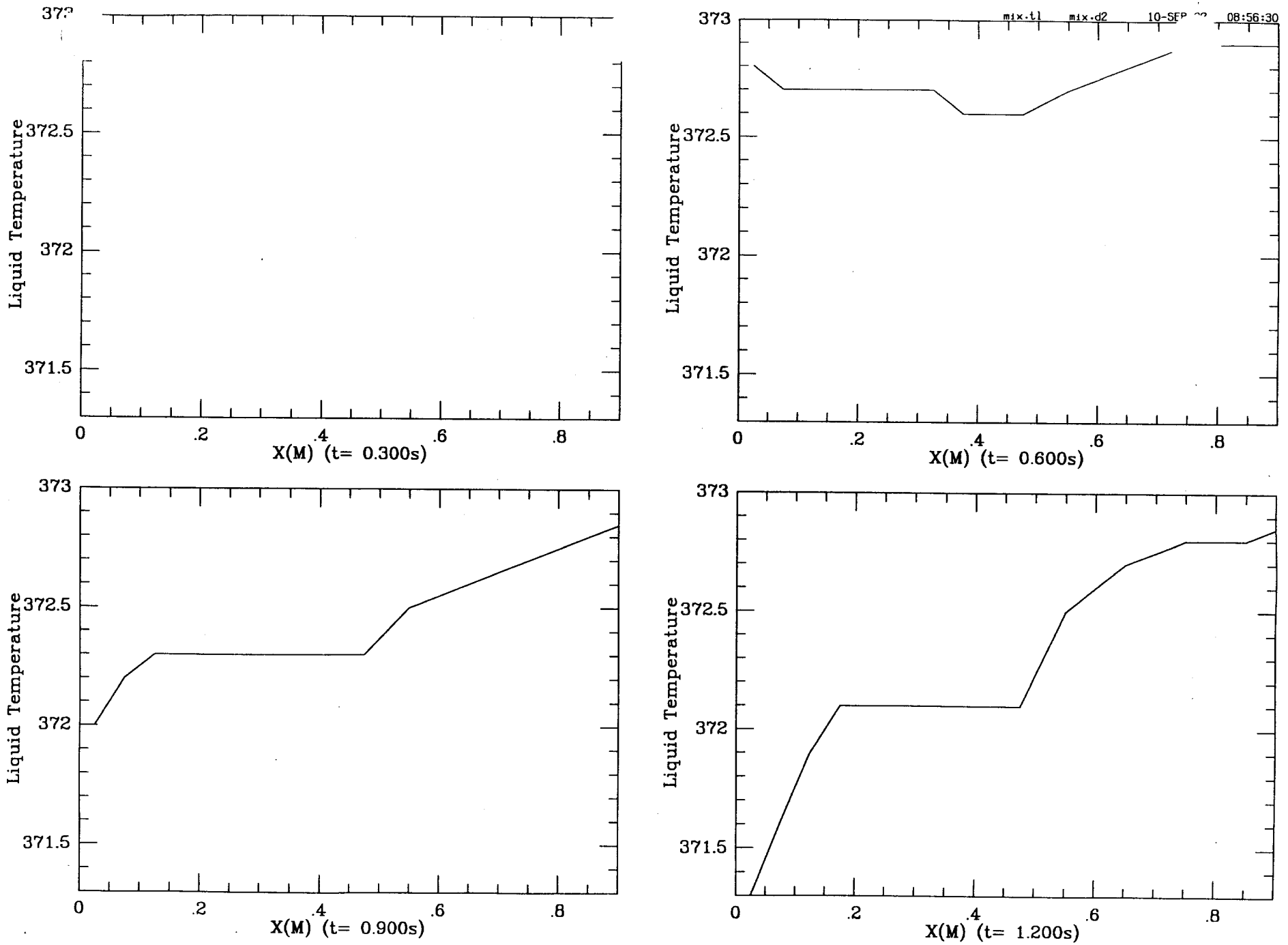

Figure C.21: Liquid Temp(K) vs. Position(m) (373 Tl, with H_2)

(for various times)

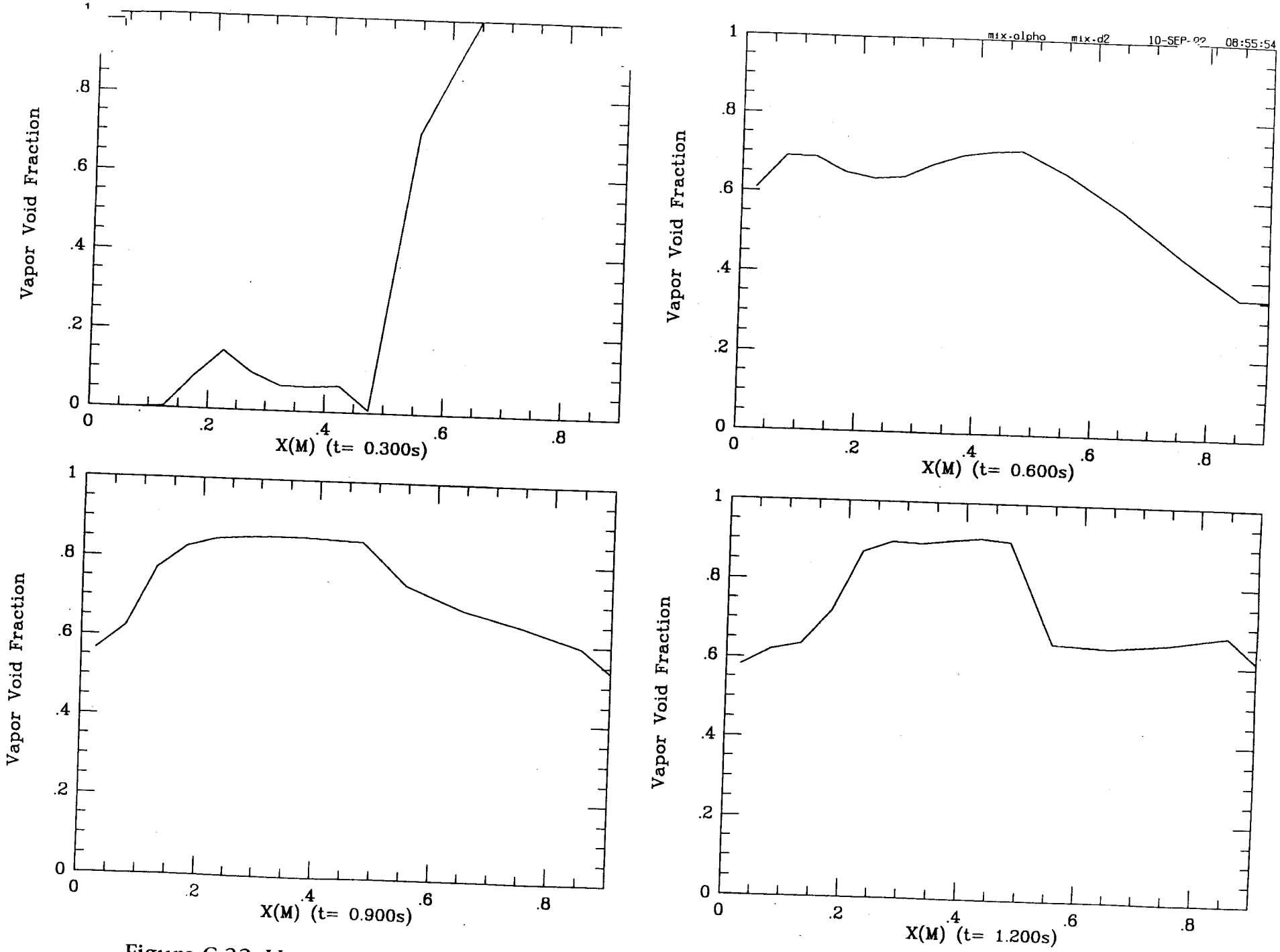

Figure C.22: Vapor Void Fraction vs. Position(m) (373 Tl, with H_2)

(for various times)

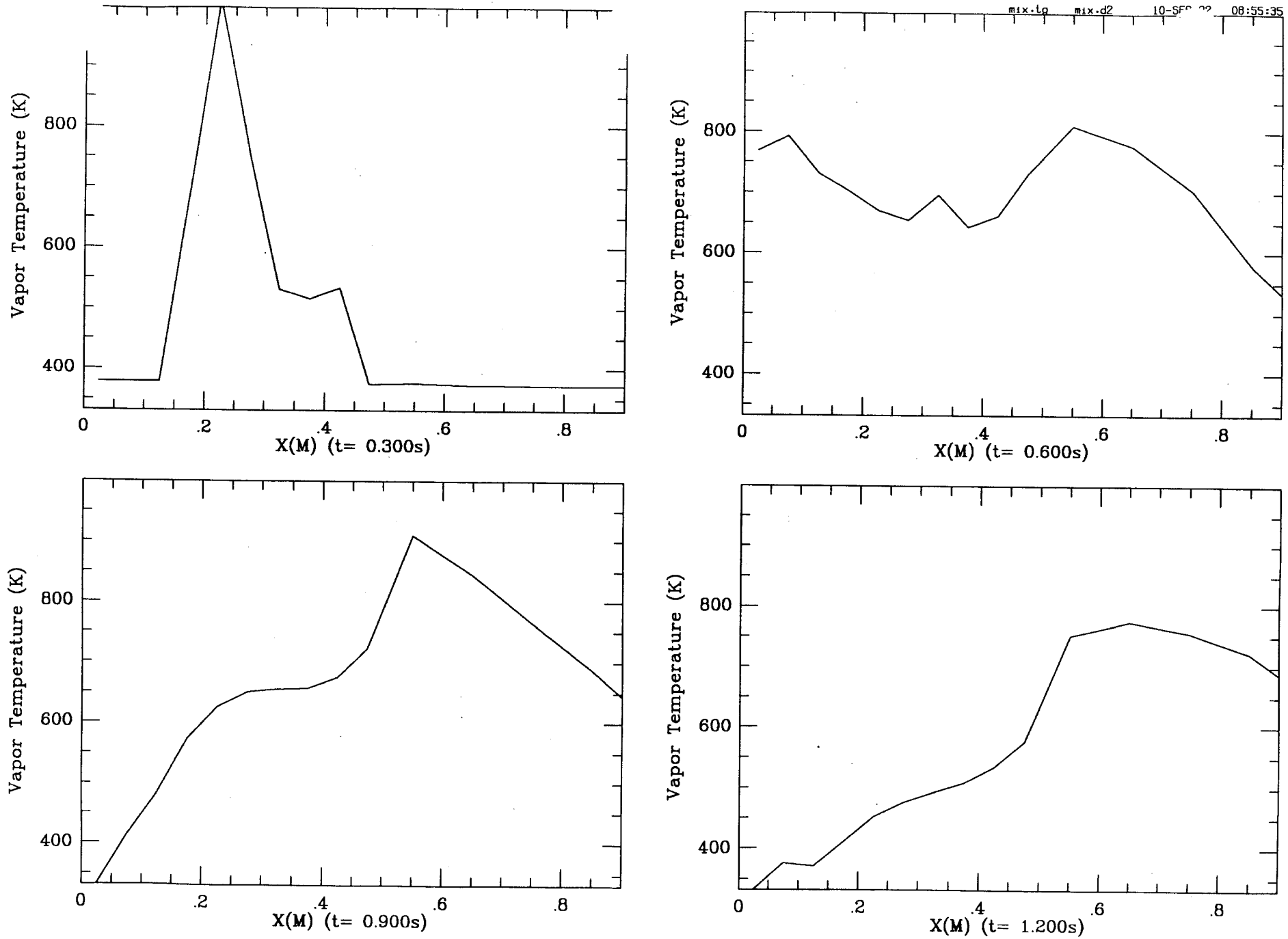

Figure C.24: Vapor Temp(K) vs. Position(m) (373 Tl, with H_2)

(for various times)

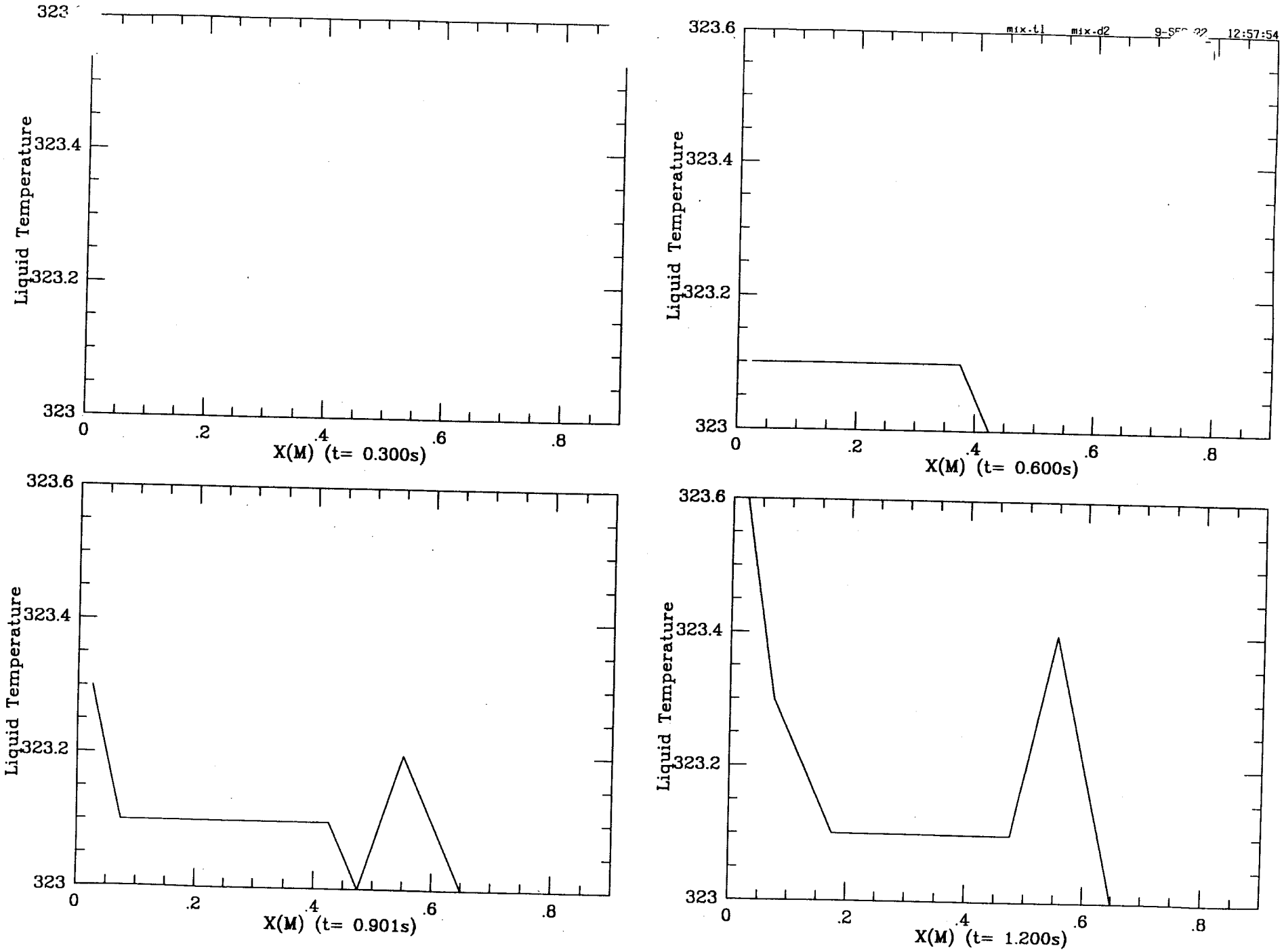

Figure C.25: Liquid Temp(K) vs. Position(m) (In-Vessel, no H_2)

(for various times)

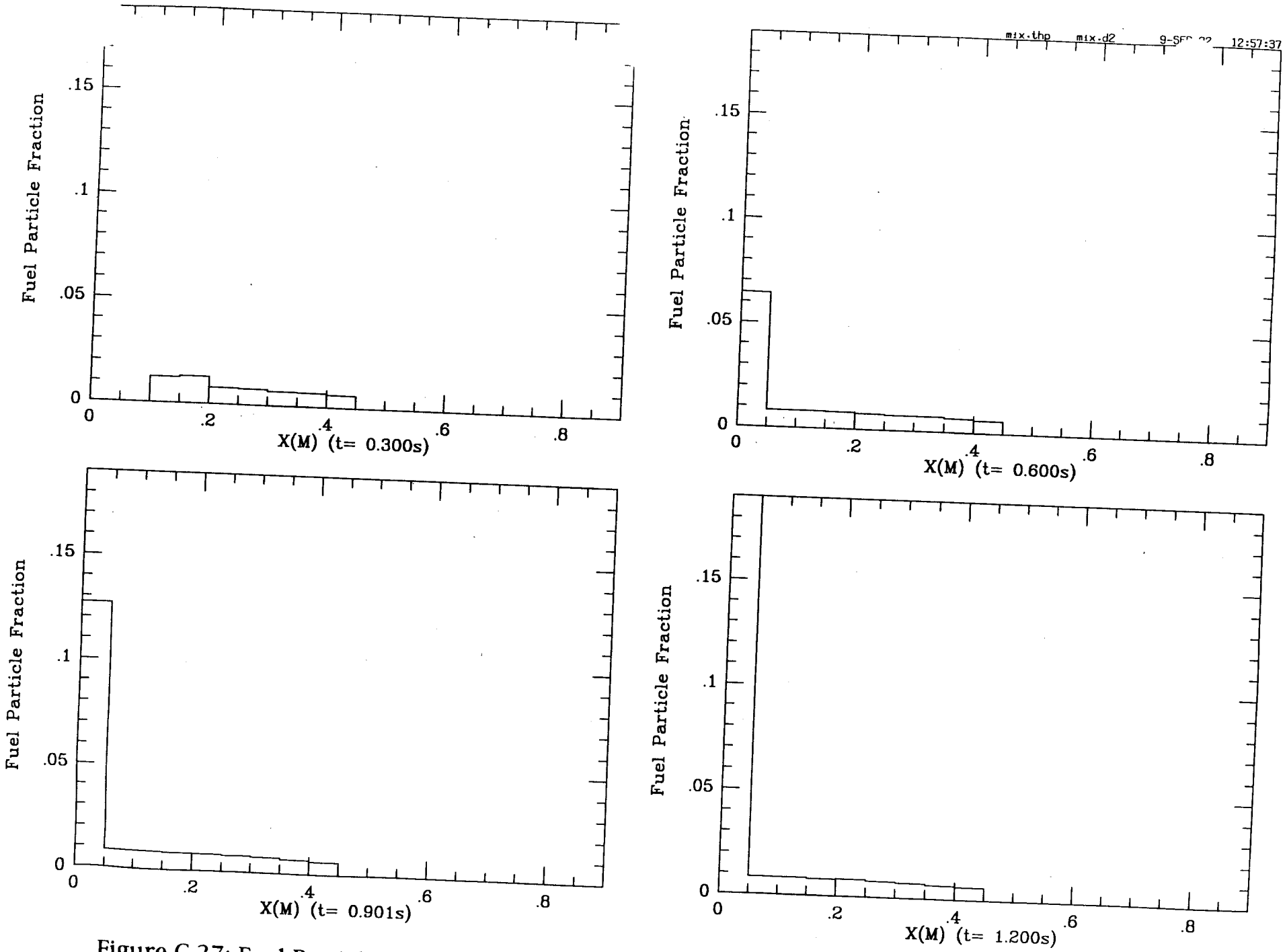

Figure C.27: Fuel Particle Fraction vs. Position(m) (In-Vessel, no H_2)

(for various times)

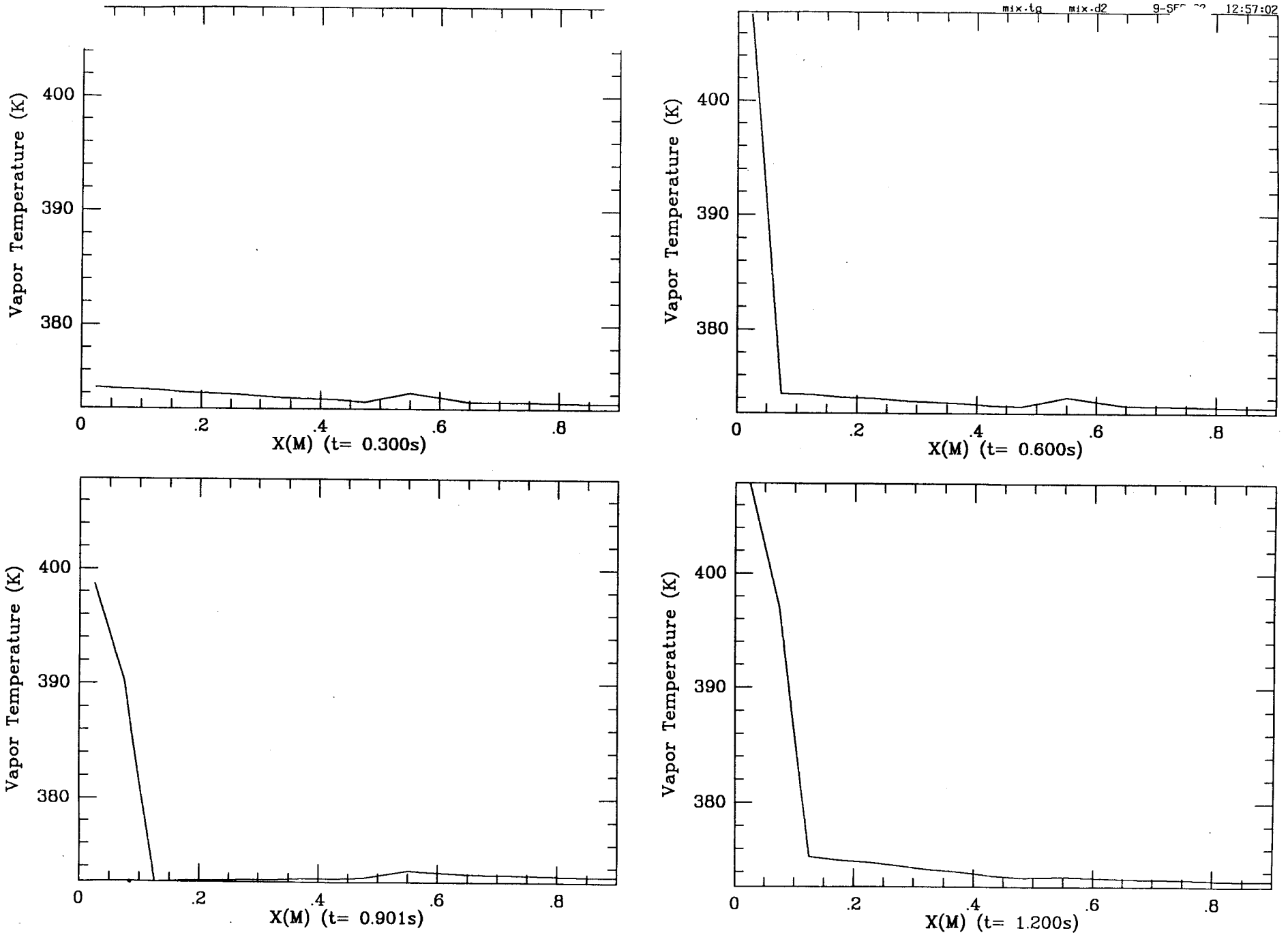

Figure C.28: Vapor Temp(K) vs. Position(m) (In-Vessel, no H_2)

(for various times)

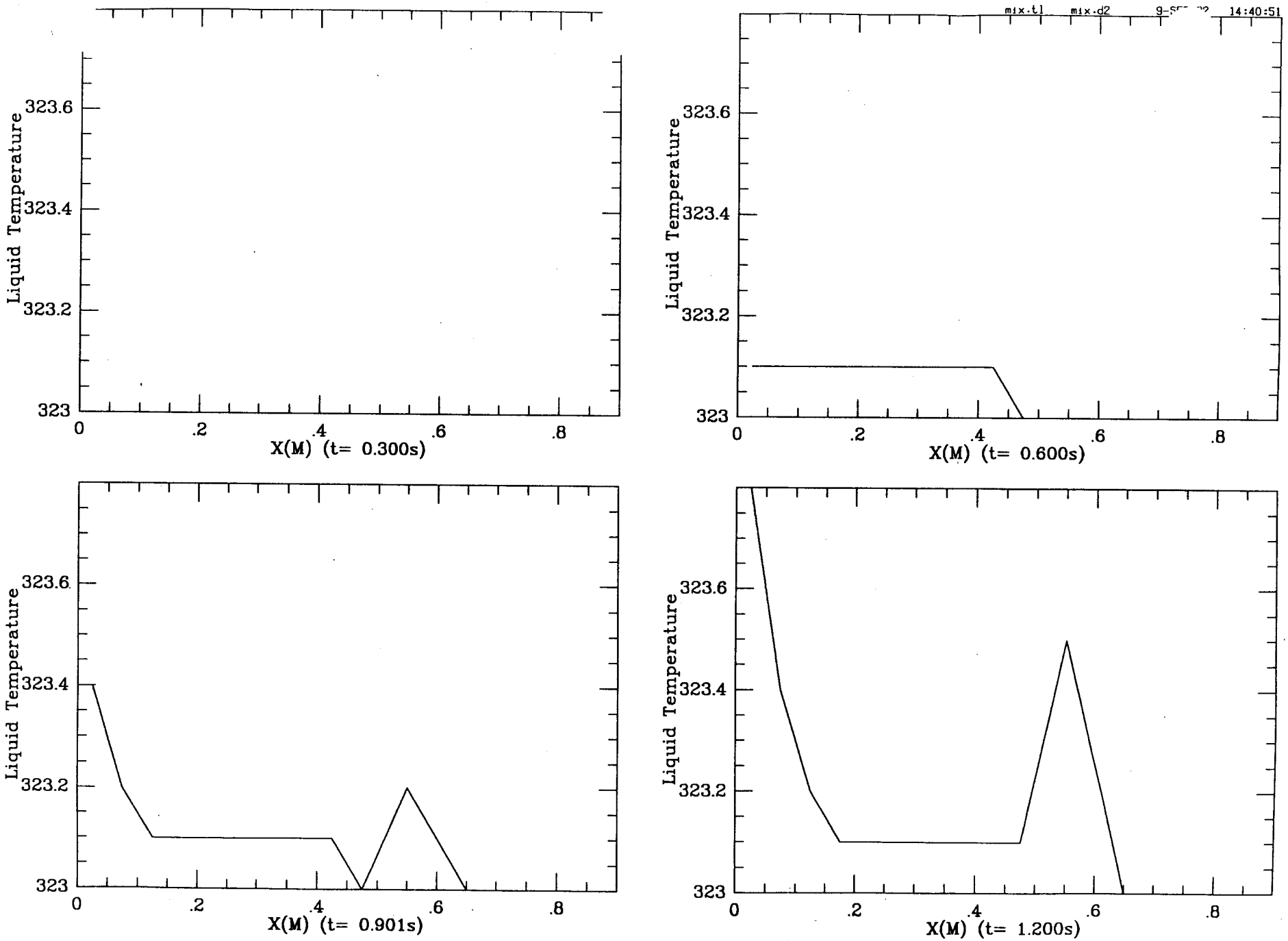

Figure C.29: Liquid Temp(K) vs. Position(m) (1150 Tm, no H_2)

(for various times)

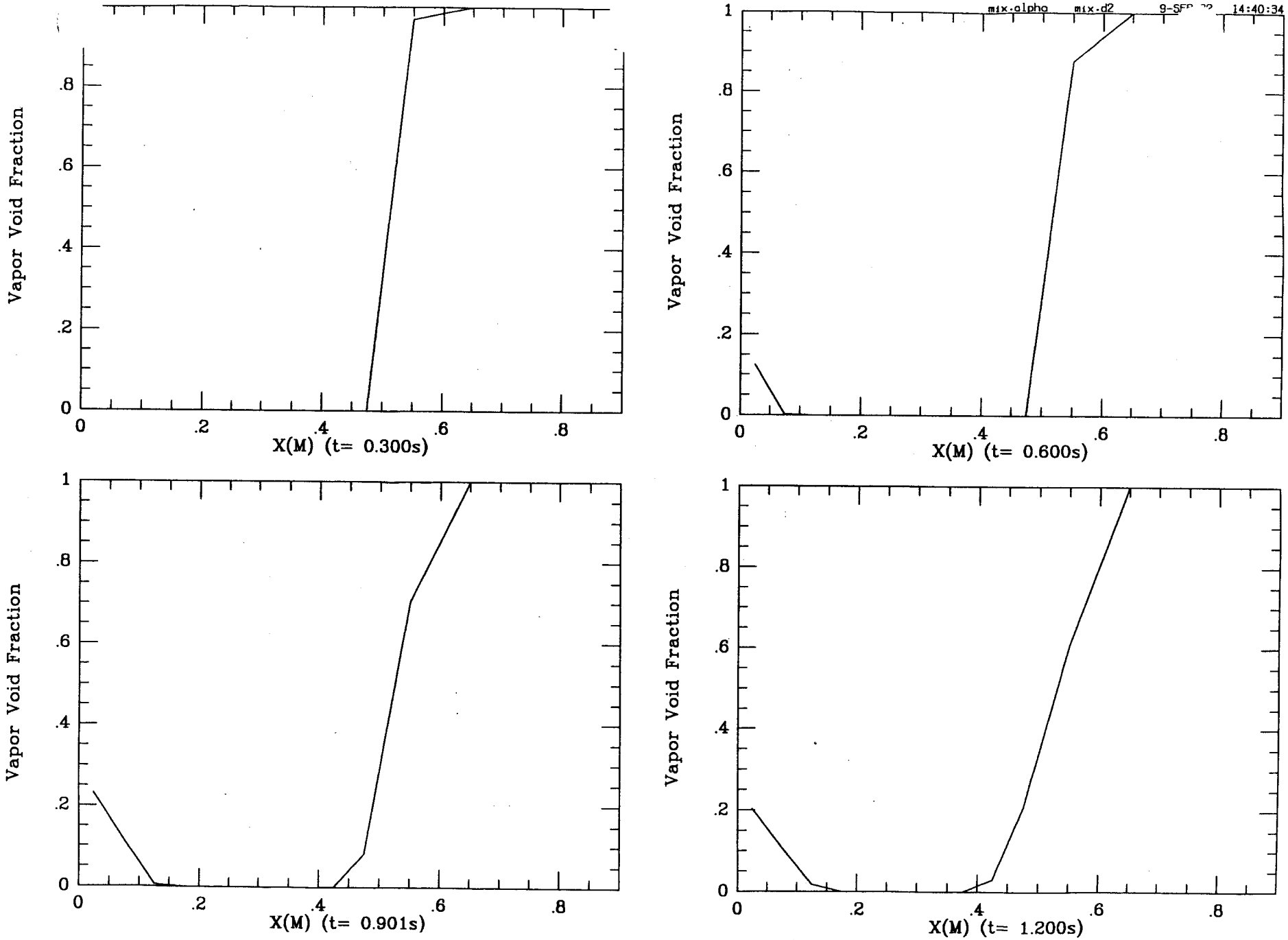

Figure C.30: Vapor Void Fraction vs. Position(m) (1150 Tm, no H_2)

(for various times)

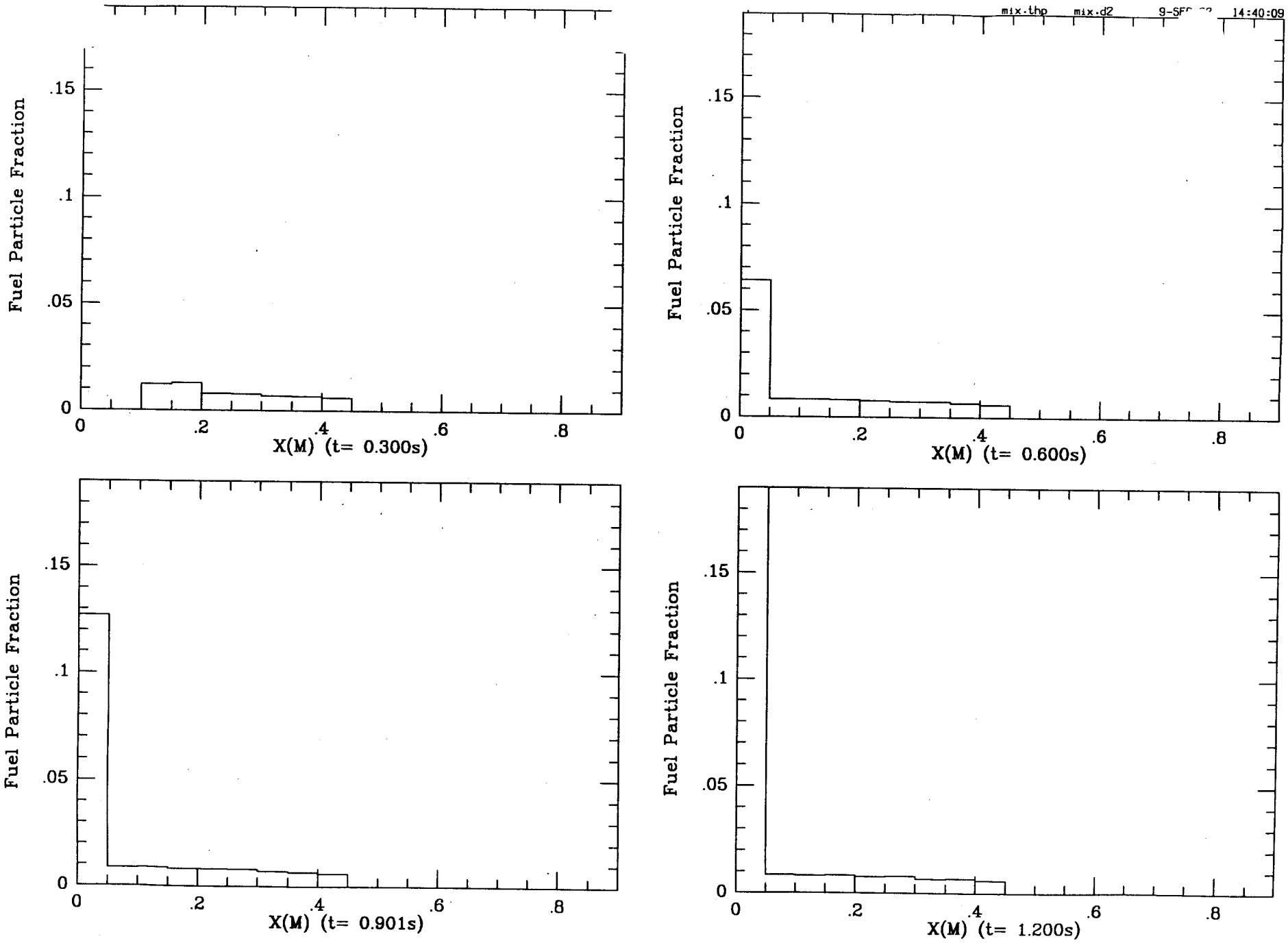

Figure C.31: Fuel Particle Fraction vs. Position(m) (1150 Tm, no H_2)

(for various times)

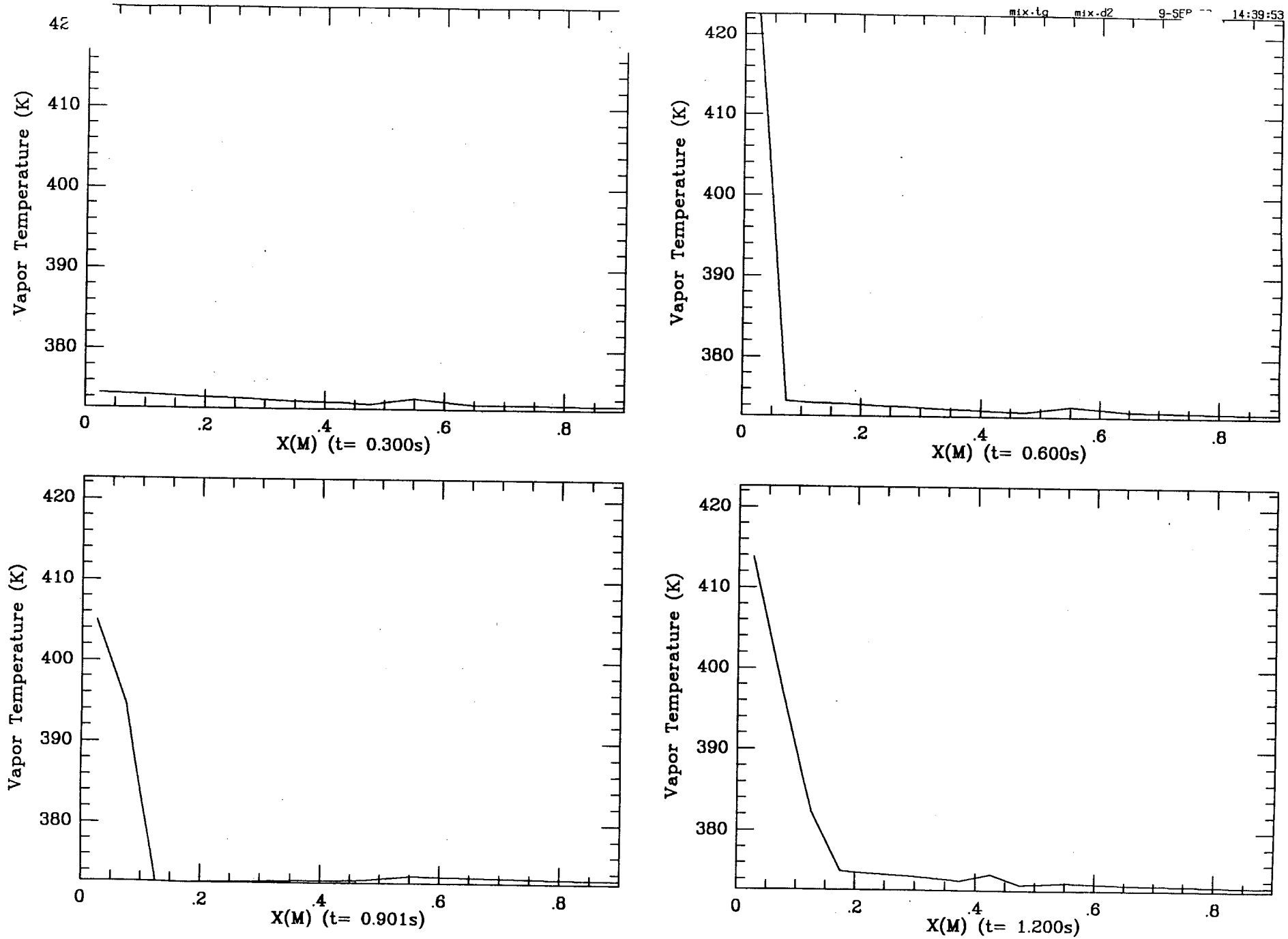

Figure C.32: Vapor Temp(K) vs. Position(m) (1150 Tm, no H_2)

(for various times)

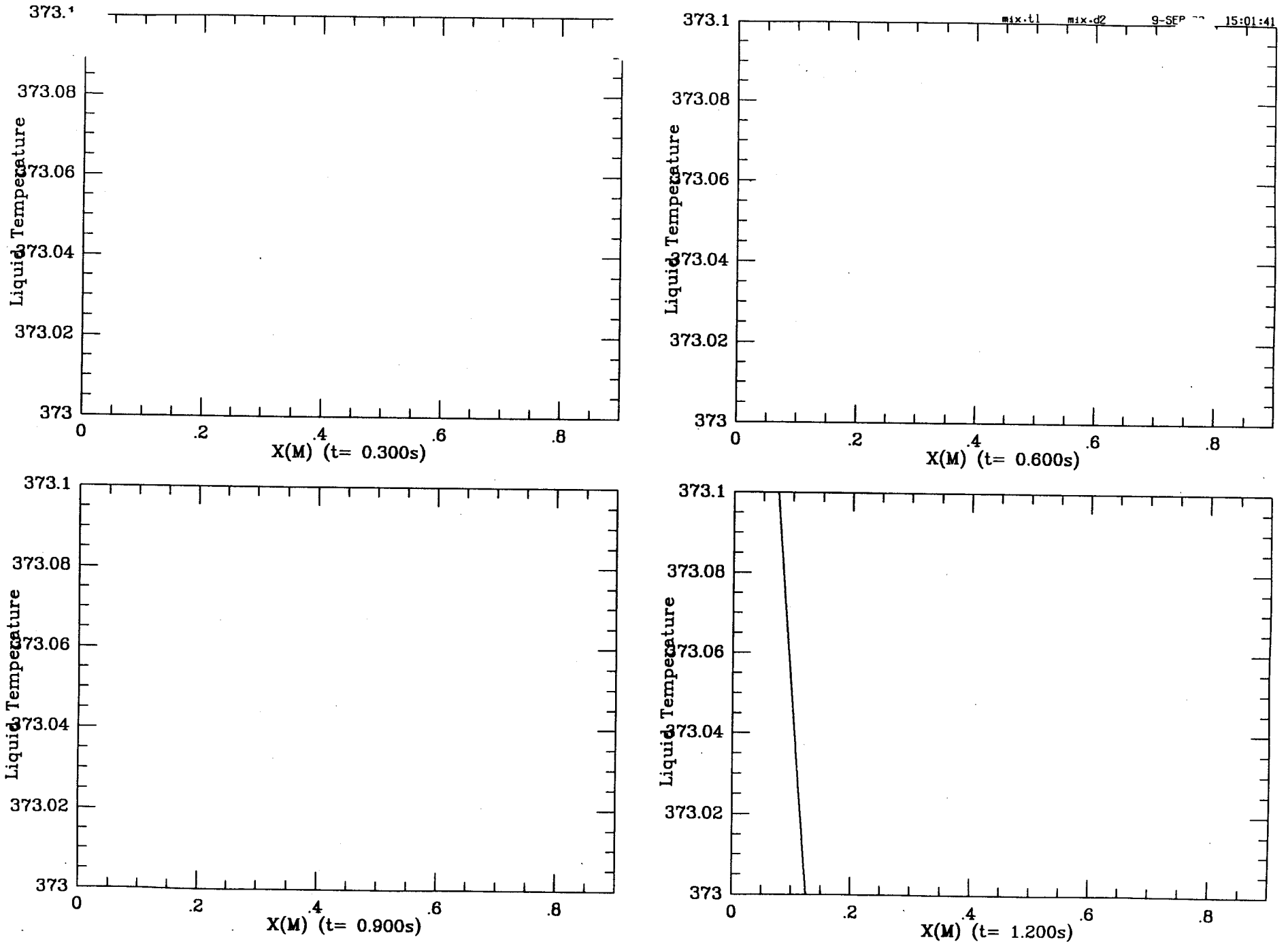

Figure C.33: Liquid Temp(K) vs. Position(m) (373 Tl, no H_2)

(for various times)

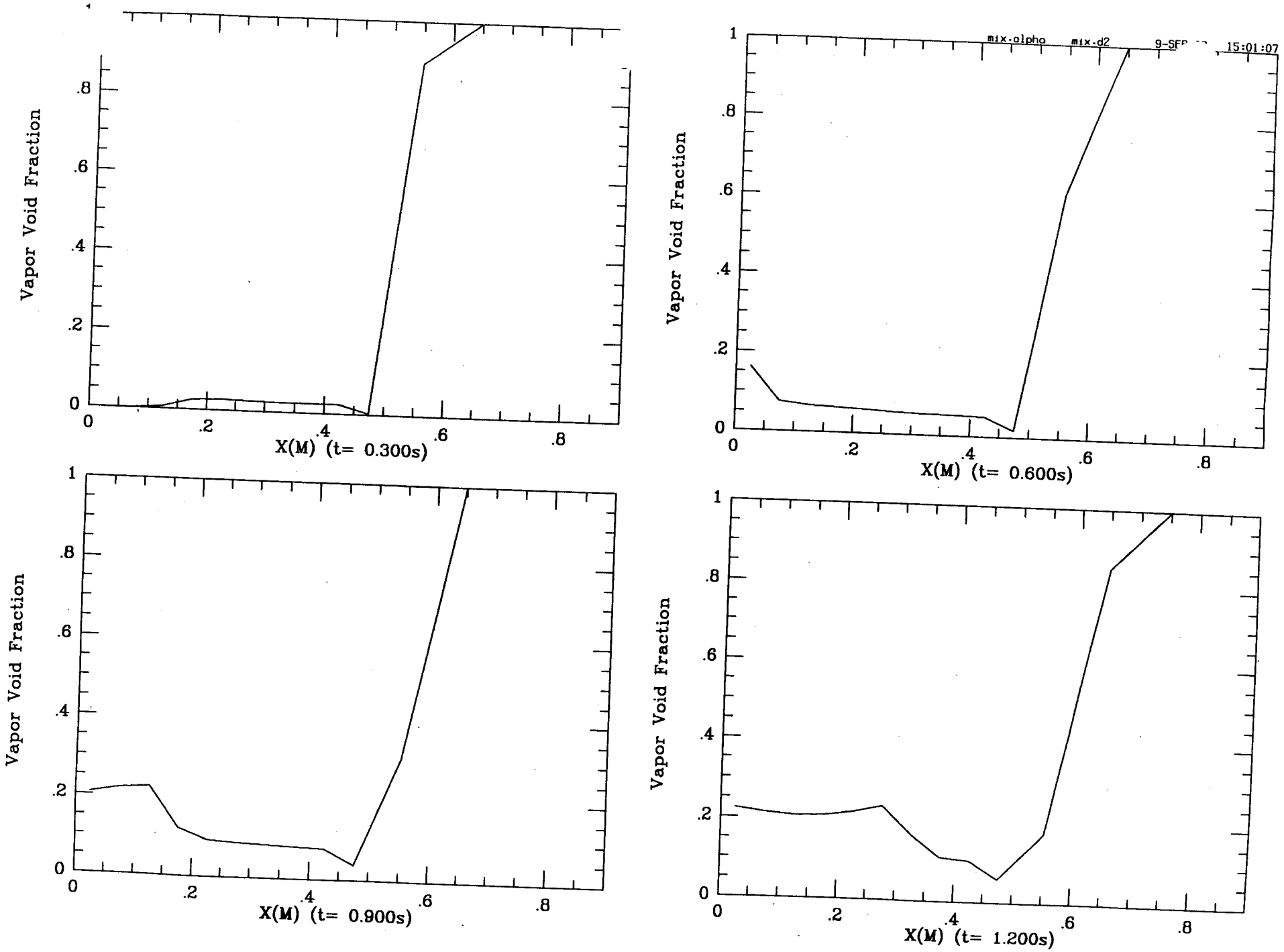

Figure C.34: Vapor Void Fraction vs. Position(m) (373 Tl, no H_2)

(for various times)

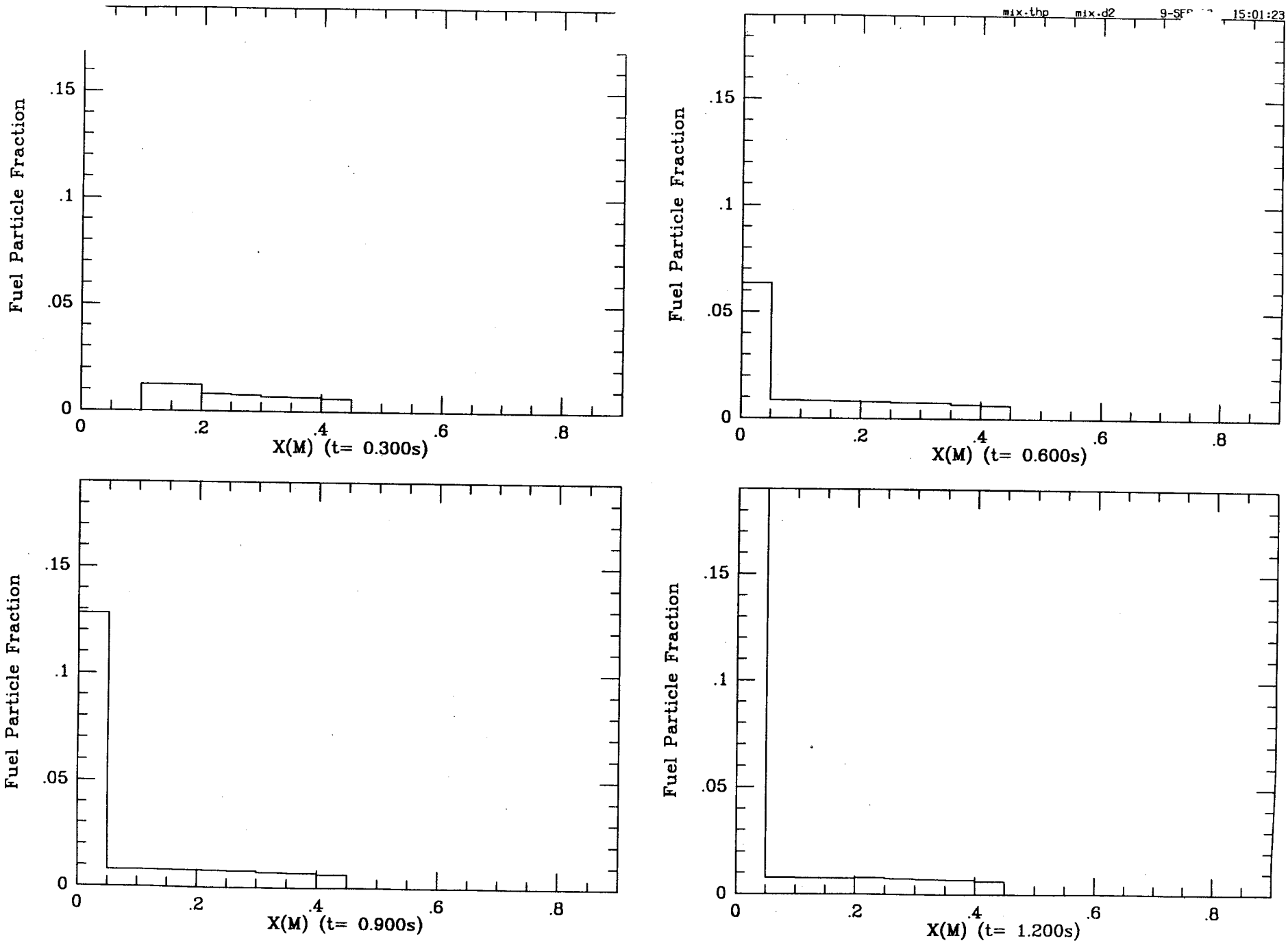

Figure C.35: Fuel Particle Fraction vs. Position(m) (373 Tl, no H_2)

(for various times)

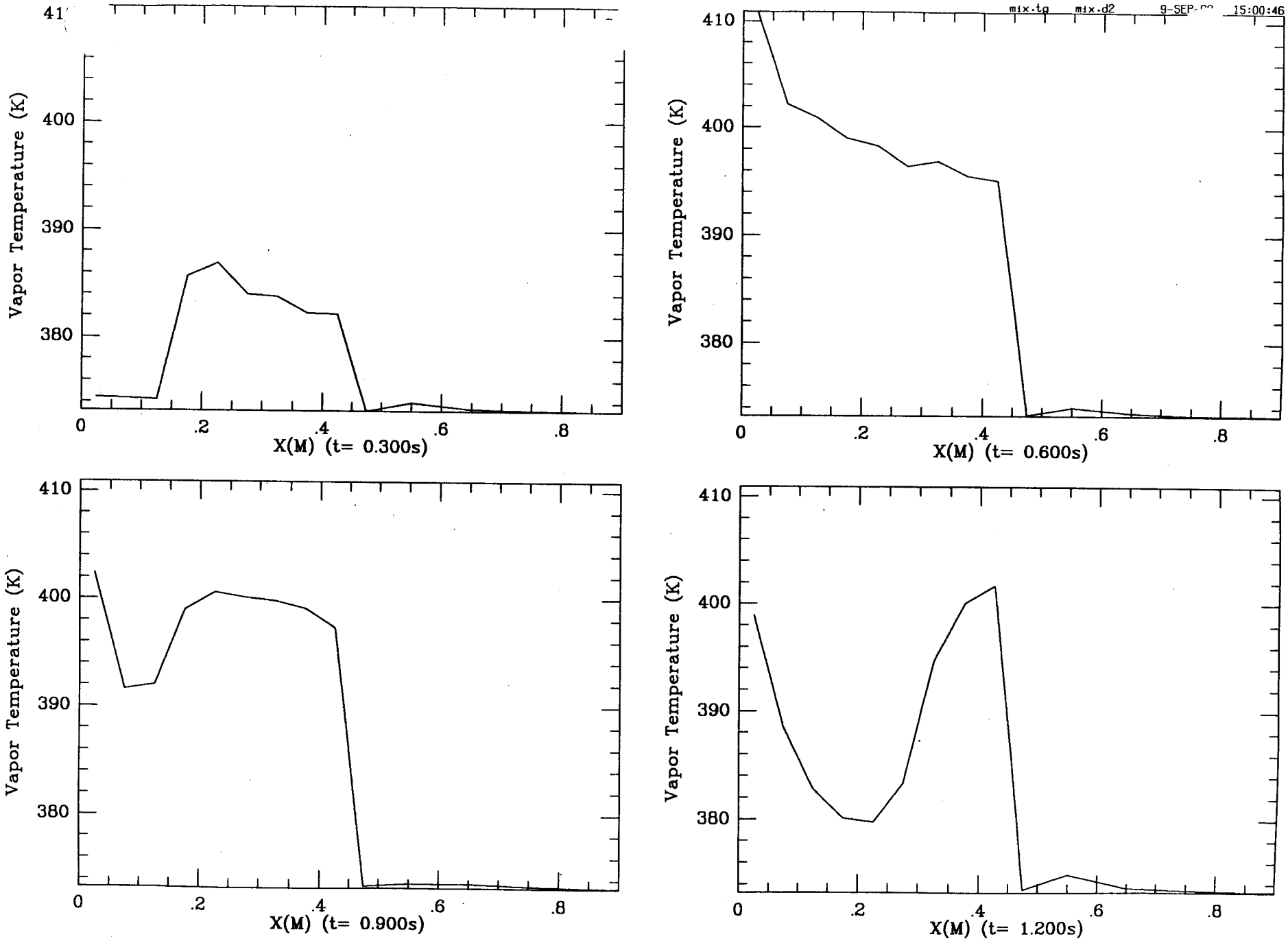

Figure C.36: Vapor Temp(K) vs. Position(m) (373 Tl, no H_2)

(for various times)

Table C.37: Breakup Data (std In-Vessel, with H_2)

```
1Test case for Aluminum Jet MS problem, in-vessel ( 08/31/92 )
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00        1
    1           1      9.500E+02  2.500E-02 -2.000E+00  5.050E-01
  3.001137E-01       26
    1           8      9.374E+02  7.875E-03 -6.876E-01  1.504E-01
    2           1      9.440E+02  1.250E-02 -9.505E-01  1.132E-01
    3           1      9.462E+02  1.984E-02 -1.156E+00  1.168E-01
    4           1      9.471E+02  2.500E-02 -1.290E+00  1.385E-01
    5           1      9.473E+02  2.500E-02 -1.315E+00  1.644E-01
    6           1      9.476E+02  2.500E-02 -1.336E+00  1.922E-01
    7           1      9.479E+02  2.500E-02 -1.360E+00  2.191E-01
    8           1      9.482E+02  2.500E-02 -1.391E+00  2.480E-01
    9           1      9.485E+02  2.500E-02 -1.426E+00  2.762E-01
   10           1      9.487E+02  2.500E-02 -1.474E+00  3.067E-01
   11           1      9.490E+02  2.500E-02 -1.532E+00  3.368E-01
   12           1      9.493E+02  2.500E-02 -1.611E+00  3.698E-01
   13           1      9.496E+02  2.500E-02 -1.708E+00  4.030E-01
   14           1      9.499E+02  2.500E-02 -1.844E+00  4.403E-01
   15           1      9.500E+02  2.500E-02 -2.007E+00  4.790E-01
   16           8      9.374E+02  7.875E-03 -6.878E-01  1.705E-01
   17           8      9.373E+02  7.875E-03 -6.879E-01  1.663E-01
   18           8      9.376E+02  7.875E-03 -6.890E-01  1.863E-01
   19           1      9.442E+02  1.250E-02 -9.470E-01  1.333E-01
   20           1      9.440E+02  1.250E-02 -9.476E-01  1.291E-01
   21           1      9.442E+02  1.250E-02 -9.460E-01  1.492E-01
   22           1      9.463E+02  1.984E-02 -1.154E+00  1.367E-01
   23           1      9.441E+02  1.250E-02 -9.485E-01  1.257E-01
   24           1      9.441E+02  1.250E-02 -9.465E-01  1.459E-01
   25           1      9.440E+02  1.250E-02 -9.473E-01  1.416E-01
   26           1      9.441E+02  1.250E-02 -9.455E-01  1.617E-01
  6.001164E-01       51
    1           8      9.348E+02  7.875E-03 -3.193E-03  7.875E-03
    2           4      9.413E+02  7.875E-03 -3.193E-03  7.875E-03
    3           1      9.447E+02  1.250E-02 -3.193E-03  1.250E-02
    4           1      9.468E+02  1.575E-02 -3.193E-03  1.575E-02
    5           1      9.469E+02  1.984E-02 -3.193E-03  1.984E-02
    6           1      9.470E+02  2.500E-02 -3.442E-03  2.500E-02
    7           1      9.473E+02  2.500E-02 -3.443E-03  2.500E-02
    8           1      9.476E+02  2.500E-02 -3.443E-03  2.500E-02
    9           1      9.481E+02  2.500E-02 -3.443E-03  2.500E-02
   10           1      9.478E+02  2.500E-02 -3.443E-03  2.500E-02
   11           1      9.476E+02  2.500E-02 -3.443E-03  2.500E-02
   12           1      9.473E+02  2.500E-02 -3.443E-03  2.500E-02
   13           1      9.470E+02  2.500E-02 -3.442E-03  2.500E-02
   14           1      9.466E+02  2.500E-02 -3.442E-03  2.500E-02
   15           1      9.462E+02  2.500E-02 -1.207E+00  4.435E-02
   16           1      9.463E+02  2.500E-02 -1.212E+00  7.119E-02
   17           1      9.466E+02  2.500E-02 -1.218E+00  9.688E-02
   18           1      9.469E+02  2.500E-02 -1.228E+00  1.241E-01
   19           1      9.471E+02  2.500E-02 -1.240E+00  1.502E-01
   20           1      9.474E+02  2.500E-02 -1.256E+00  1.779E-01
   21           1      9.477E+02  2.500E-02 -1.274E+00  2.047E-01
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22	1	9.480E+02	2.500E-02	-1.299E+00	2.334E-01
23	1	9.482E+02	2.500E-02	-1.328E+00	2.612E-01
24	1	9.486E+02	2.500E-02	-1.369E+00	2.905E-01
25	1	9.488E+02	2.500E-02	-1.418E+00	3.198E-01
26	1	9.491E+02	2.500E-02	-1.482E+00	3.508E-01
27	1	9.494E+02	2.500E-02	-1.568E+00	3.831E-01
28	1	9.497E+02	2.500E-02	-1.684E+00	4.175E-01
29	1	9.519E+02	2.500E-02	-1.857E+00	4.540E-01
30	1	9.519E+02	2.500E-02	-1.991E+00	4.940E-01
31	8	9.336E+02	7.875E-03	-3.193E-03	7.875E-03
32	8	9.363E+02	7.875E-03	-3.193E-03	7.875E-03
33	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
34	4	9.409E+02	7.875E-03	-3.193E-03	7.875E-03
35	4	9.409E+02	7.875E-03	-3.193E-03	7.875E-03
36	4	9.406E+02	7.875E-03	-3.193E-03	7.875E-03
37	2	9.461E+02	9.921E-03	-3.193E-03	9.921E-03
38	4	9.410E+02	7.875E-03	-3.193E-03	7.875E-03
39	4	9.406E+02	7.875E-03	-3.193E-03	7.875E-03
40	4	9.406E+02	7.875E-03	-3.193E-03	7.875E-03
41	4	9.424E+02	7.875E-03	-3.193E-03	7.875E-03
42	1	9.442E+02	1.250E-02	-3.193E-03	1.250E-02
43	2	9.456E+02	9.921E-03	-3.193E-03	9.921E-03
44	1	9.465E+02	1.575E-02	-3.193E-03	1.575E-02
45	1	9.444E+02	1.250E-02	-3.193E-03	1.250E-02
46	2	9.456E+02	9.921E-03	-3.193E-03	9.921E-03
47	2	9.456E+02	9.921E-03	-3.193E-03	9.921E-03
48	2	9.452E+02	9.921E-03	-3.193E-03	9.921E-03
49	1	9.468E+02	1.984E-02	-3.193E-03	1.984E-02
50	1	9.465E+02	1.575E-02	-3.193E-03	1.575E-02
51	1	9.464E+02	1.575E-02	-3.193E-03	1.575E-02
9.007936E-01		65			
1	8	9.391E+02	7.875E-03	-6.386E-03	7.875E-03
2	4	9.457E+02	7.875E-03	-6.386E-03	7.875E-03
3	1	9.471E+02	1.250E-02	-6.386E-03	1.250E-02
4	1	9.489E+02	1.575E-02	-6.387E-03	1.575E-02
5	1	9.483E+02	1.984E-02	-6.387E-03	1.984E-02
6	1	9.480E+02	2.500E-02	-7.230E-03	2.500E-02
7	1	9.483E+02	2.500E-02	-7.229E-03	2.500E-02
8	1	9.486E+02	2.500E-02	-7.229E-03	2.500E-02
9	1	9.491E+02	2.500E-02	-7.229E-03	2.500E-02
10	1	9.488E+02	2.500E-02	-7.229E-03	2.500E-02
11	1	9.486E+02	2.500E-02	-7.229E-03	2.500E-02
12	1	9.483E+02	2.500E-02	-7.229E-03	2.500E-02
13	1	9.480E+02	2.500E-02	-7.229E-03	2.500E-02
14	1	9.476E+02	2.500E-02	-7.229E-03	2.500E-02
15	1	9.474E+02	2.500E-02	-7.229E-03	2.500E-02
16	1	9.471E+02	2.500E-02	-7.229E-03	2.500E-02
17	1	9.469E+02	2.500E-02	-7.229E-03	2.500E-02
18	1	9.467E+02	2.500E-02	-7.228E-03	2.500E-02
19	1	9.466E+02	2.500E-02	-7.228E-03	2.500E-02
20	1	9.466E+02	2.500E-02	-7.229E-03	2.500E-02
21	1	9.465E+02	2.500E-02	-7.229E-03	2.500E-02
22	1	9.463E+02	2.500E-02	-7.229E-03	2.500E-02
23	1	9.462E+02	2.500E-02	-7.228E-03	2.500E-02

24	1	9.461E+02	2.500E-02	-7.228E-03	2.500E-02
25	1	9.463E+02	2.500E-02	-7.229E-03	2.500E-02
26	1	9.485E+02	2.500E-02	-7.229E-03	2.500E-02
27	1	9.525E+02	2.500E-02	-7.229E-03	2.500E-02
28	1	9.527E+02	2.500E-02	-7.228E-03	2.500E-02
29	1	9.532E+02	2.500E-02	-1.287E+00	3.282E-02
30	1	9.524E+02	2.500E-02	-1.278E+00	5.611E-02
31	1	9.502E+02	2.500E-02	-1.275E+00	7.983E-02
32	1	9.486E+02	2.500E-02	-1.287E+00	1.046E-01
33	1	9.552E+02	2.500E-02	-1.301E+00	1.306E-01
34	1	9.630E+02	2.500E-02	-1.315E+00	1.575E-01
35	1	9.642E+02	2.500E-02	-1.332E+00	1.865E-01
36	1	9.699E+02	2.500E-02	-1.355E+00	2.126E-01
37	1	9.697E+02	2.500E-02	-1.390E+00	2.374E-01
38	1	9.661E+02	2.500E-02	-1.432E+00	2.650E-01
39	1	9.620E+02	2.500E-02	-1.480E+00	2.939E-01
40	1	9.585E+02	2.500E-02	-1.541E+00	3.264E-01
41	1	9.549E+02	2.500E-02	-1.627E+00	3.570E-01
42	1	9.515E+02	2.500E-02	-1.738E+00	3.902E-01
43	1	9.514E+02	2.500E-02	-1.877E+00	4.270E-01
44	1	9.531E+02	2.500E-02	-1.975E+00	4.670E-01
45	8	9.380E+02	7.875E-03	-6.386E-03	7.875E-03
46	8	9.407E+02	7.875E-03	-6.386E-03	7.875E-03
47	8	9.344E+02	7.875E-03	-6.386E-03	7.875E-03
48	4	9.452E+02	7.875E-03	-6.386E-03	7.875E-03
49	4	9.452E+02	7.875E-03	-6.386E-03	7.875E-03
50	4	9.450E+02	7.875E-03	-6.386E-03	7.875E-03
51	2	9.501E+02	9.921E-03	-6.386E-03	9.921E-03
52	4	9.454E+02	7.875E-03	-6.386E-03	7.875E-03
53	4	9.449E+02	7.875E-03	-6.386E-03	7.875E-03
54	4	9.449E+02	7.875E-03	-6.386E-03	7.875E-03
55	4	9.467E+02	7.875E-03	-6.386E-03	7.875E-03
56	1	9.462E+02	1.250E-02	-6.386E-03	1.250E-02
57	2	9.492E+02	9.921E-03	-6.386E-03	9.921E-03
58	1	9.484E+02	1.575E-02	-6.387E-03	1.575E-02
59	1	9.465E+02	1.250E-02	-6.386E-03	1.250E-02
60	2	9.493E+02	9.921E-03	-6.386E-03	9.921E-03
61	2	9.494E+02	9.921E-03	-6.386E-03	9.921E-03
62	2	9.485E+02	9.921E-03	-6.386E-03	9.921E-03
63	1	9.480E+02	1.984E-02	-6.387E-03	1.984E-02
64	1	9.484E+02	1.575E-02	-6.387E-03	1.575E-02
65	1	9.481E+02	1.575E-02	-6.387E-03	1.575E-02
1.200363E+00	82				
1	8	9.357E+02	7.875E-03	-6.386E-03	7.875E-03
2	4	9.424E+02	7.875E-03	-6.386E-03	7.875E-03
3	1	9.452E+02	1.250E-02	-6.386E-03	1.250E-02
4	1	9.478E+02	1.575E-02	-6.387E-03	1.575E-02
5	1	9.474E+02	1.984E-02	-6.387E-03	1.984E-02
6	1	9.472E+02	2.500E-02	-7.275E-03	2.500E-02
7	1	9.476E+02	2.500E-02	-7.275E-03	2.500E-02
8	1	9.478E+02	2.500E-02	-7.275E-03	2.500E-02
9	1	9.484E+02	2.500E-02	-7.275E-03	2.500E-02
10	1	9.481E+02	2.500E-02	-7.275E-03	2.500E-02
11	1	9.479E+02	2.500E-02	-7.275E-03	2.500E-02

12	1	9.476E+02	2.500E-02	-7.275E-03	2.500E-02
13	1	9.472E+02	2.500E-02	-7.275E-03	2.500E-02
14	1	9.469E+02	2.500E-02	-7.275E-03	2.500E-02
15	1	9.467E+02	2.500E-02	-7.275E-03	2.500E-02
16	1	9.464E+02	2.500E-02	-7.275E-03	2.500E-02
17	1	9.462E+02	2.500E-02	-7.275E-03	2.500E-02
18	1	9.460E+02	2.500E-02	-7.275E-03	2.500E-02
19	1	9.459E+02	2.500E-02	-7.275E-03	2.500E-02
20	1	9.459E+02	2.500E-02	-7.275E-03	2.500E-02
21	1	9.458E+02	2.500E-02	-7.275E-03	2.500E-02
22	1	9.456E+02	2.500E-02	-7.275E-03	2.500E-02
23	1	9.455E+02	2.500E-02	-7.275E-03	2.500E-02
24	1	9.454E+02	2.500E-02	-7.275E-03	2.500E-02
25	1	9.455E+02	2.500E-02	-7.275E-03	2.500E-02
26	1	9.477E+02	2.500E-02	-7.275E-03	2.500E-02
27	1	9.518E+02	2.500E-02	-7.275E-03	2.500E-02
28	1	9.520E+02	2.500E-02	-7.275E-03	2.500E-02
29	1	9.524E+02	2.500E-02	-7.275E-03	2.500E-02
30	1	9.519E+02	2.500E-02	-7.275E-03	2.500E-02
31	1	9.521E+02	1.984E-02	-6.387E-03	1.984E-02
32	1	9.522E+02	1.984E-02	-6.387E-03	1.984E-02
33	1	9.588E+02	2.500E-02	-7.275E-03	2.500E-02
34	1	9.666E+02	2.500E-02	-7.275E-03	2.500E-02
35	1	9.676E+02	2.500E-02	-7.275E-03	2.500E-02
36	1	9.730E+02	2.500E-02	-7.275E-03	2.500E-02
37	1	9.727E+02	2.500E-02	-7.275E-03	2.500E-02
38	1	9.689E+02	2.500E-02	-7.275E-03	2.500E-02
39	1	9.647E+02	2.500E-02	-7.275E-03	2.500E-02
40	1	9.609E+02	2.500E-02	-7.275E-03	2.500E-02
41	1	9.569E+02	2.500E-02	-7.275E-03	2.500E-02
42	1	9.532E+02	2.500E-02	-7.275E-03	2.500E-02
43	1	9.524E+02	2.500E-02	-7.275E-03	2.500E-02
44	1	9.553E+02	2.500E-02	-1.306E+00	3.672E-02
45	1	9.526E+02	2.500E-02	-1.302E+00	6.656E-02
46	1	9.488E+02	2.500E-02	-1.296E+00	9.214E-02
47	1	9.488E+02	2.500E-02	-1.284E+00	1.177E-01
48	1	9.491E+02	2.500E-02	-1.290E+00	1.428E-01
49	1	9.494E+02	2.500E-02	-1.307E+00	1.685E-01
50	1	9.502E+02	2.500E-02	-1.327E+00	1.964E-01
51	1	9.505E+02	2.500E-02	-1.351E+00	2.237E-01
52	1	9.505E+02	2.500E-02	-1.383E+00	2.525E-01
53	1	9.506E+02	2.500E-02	-1.421E+00	2.807E-01
54	1	9.505E+02	2.500E-02	-1.472E+00	3.110E-01
55	1	9.507E+02	2.500E-02	-1.535E+00	3.409E-01
56	1	9.510E+02	2.500E-02	-1.621E+00	3.737E-01
57	1	9.513E+02	2.500E-02	-1.728E+00	4.069E-01
58	1	9.520E+02	2.500E-02	-1.860E+00	4.446E-01
59	1	9.520E+02	2.500E-02	-1.980E+00	4.831E-01
60	8	9.346E+02	7.875E-03	-6.386E-03	7.875E-03
61	8	9.373E+02	7.875E-03	-6.386E-03	7.875E-03
62	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
63	4	9.418E+02	7.875E-03	-6.386E-03	7.875E-03
64	4	9.418E+02	7.875E-03	-6.386E-03	7.875E-03
65	4	9.416E+02	7.875E-03	-6.386E-03	7.875E-03

66	2	9.484E+02	9.921E-03	-6.386E-03	9.921E-03
67	4	9.420E+02	7.875E-03	-6.386E-03	7.875E-03
68	4	9.416E+02	7.875E-03	-6.386E-03	7.875E-03
69	4	9.416E+02	7.875E-03	-6.386E-03	7.875E-03
70	4	9.433E+02	7.875E-03	-6.386E-03	7.875E-03
71	1	9.441E+02	1.250E-02	-6.386E-03	1.250E-02
72	2	9.472E+02	9.921E-03	-6.386E-03	9.921E-03
73	1	9.472E+02	1.575E-02	-6.387E-03	1.575E-02
74	1	9.444E+02	1.250E-02	-6.386E-03	1.250E-02
75	2	9.474E+02	9.921E-03	-6.386E-03	9.921E-03
76	2	9.476E+02	9.921E-03	-6.386E-03	9.921E-03
77	2	9.462E+02	9.921E-03	-6.386E-03	9.921E-03
78	1	9.469E+02	1.984E-02	-6.387E-03	1.984E-02
79	1	9.472E+02	1.575E-02	-6.387E-03	1.575E-02
80	1	9.467E+02	1.575E-02	-6.386E-03	1.575E-02
81	1	9.525E+02	1.984E-02	-6.387E-03	1.984E-02
82	1	9.544E+02	1.984E-02	-6.387E-03	1.984E-02

Table C.38: Gas Mixture Data (std. In-Vessel, with H_2)

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.35511 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.0	0.0
0.35511 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.0	944.9
0.35511 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.0	942.4
0.35511 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.0	947.4
0.35511 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	947.8
0.35511 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	948.4
0.35511 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.0	949.0
0.35511 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	949.4
0.35511 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	949.7
0.35511 s	11	0.14E-07	0.00E+00	(0.23E-04)	373.4	323.0	950.0
0.35511 s	12	0.93E-03	0.20E-06	(0.96E+00)	374.3	323.0	0.0
0.35511 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.35511 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.35511 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.2010E-06
Gas-Mix	0.9298E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.60862 s	2	0.42E-04	0.34E-04	(0.21E+00)	920.3	323.1	945.9
0.60862 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.1	946.3
0.60862 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.1	946.9
0.60862 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.1	947.4
0.60862 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	948.0
0.60862 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	948.4
0.60862 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	948.9
0.60862 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	949.3
0.60862 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	950.7
0.60862 s	11	0.15E-07	0.00E+00	(0.37E-04)	373.3	323.0	951.9
0.60862 s	12	0.80E-03	0.23E-05	(0.84E+00)	377.2	323.0	0.0
0.60862 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.5	323.0	0.0
0.60862 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.60862 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.60862 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.3636E-04
Gas-Mix	0.8634E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.72133 s	2	0.65E-04	0.52E-04	(0.25E+00)	625.6	323.1	946.8
0.72133 s	3	0.20E-05	0.00E+00	(0.51E-02)	371.6	323.1	946.2
0.72133 s	4	0.00E+00	0.00E+00	(0.00E+00)	372.1	323.1	946.8
0.72133 s	5	0.00E+00	0.00E+00	(0.00E+00)	372.4	323.1	947.3
0.72133 s	6	0.00E+00	0.00E+00	(0.00E+00)	372.8	323.1	947.9
0.72133 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.9	323.1	950.3
0.72133 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	950.7
0.72133 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	954.4
0.72133 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	965.6
0.72133 s	11	0.22E-04	0.17E-04	(0.14E+00)	303.6	323.0	958.4
0.72133 s	12	0.68E-03	0.82E-05	(0.74E+00)	385.4	323.1	0.0
0.72133 s	13	0.96E-03	0.00E+00	(0.10E+01)	374.3	323.0	0.0
0.72133 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.72133 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.72133 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.7775E-04
Gas-Mix	0.7772E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.83434 s	2	0.86E-04	0.69E-04	(0.25E+00)	521.3	323.1	947.1
0.83434 s	3	0.61E-05	0.41E-05	(0.12E-01)	342.8	323.1	949.3
0.83434 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.0	323.1	948.8
0.83434 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	949.3
0.83434 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	960.1
0.83434 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	965.2
0.83434 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	970.7
0.83434 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	965.0
0.83434 s	10	0.55E-06	0.00E+00	(0.11E-02)	373.8	323.1	959.5
0.83434 s	11	0.77E-04	0.59E-04	(0.36E+00)	868.2	323.1	953.8
0.83434 s	12	0.55E-03	0.13E-04	(0.62E+00)	408.1	323.2	0.0
0.83434 s	13	0.96E-03	0.00E+00	(0.10E+01)	376.5	323.0	0.0
0.83434 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.7	323.0	0.0
0.83434 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.83434 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0

	Kg-mols
H2	0.1449E-03
Gas-Mix	0.7248E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.96273 s	2	0.11E-03	0.85E-04	(0.27E+00)	482.7	323.2	948.2
0.96273 s	3	0.28E-04	0.22E-04	(0.62E-01)	402.8	323.1	962.0
0.96273 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	966.2
0.96273 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	967.0
0.96273 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	959.4
0.96273 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	952.3
0.96273 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	950.5
0.96273 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	953.4
0.96273 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	951.4
0.96273 s	11	0.74E-04	0.62E-04	(0.19E+00)	458.3	323.1	952.0
0.96273 s	12	0.59E-03	0.18E-04	(0.66E+00)	403.8	323.4	0.0
0.96273 s	13	0.96E-03	0.00E+00	(0.10E+01)	376.2	323.0	0.0
0.96273 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.7	323.0	0.0
0.96273 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.96273 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.1881E-03
Gas-Mix	0.8096E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.20036 s	2	0.13E-03	0.11E-03	(0.26E+00)	392.6	323.3	951.4
1.20036 s	3	0.65E-04	0.52E-04	(0.20E+00)	600.1	323.2	950.7
1.20036 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.9	323.1	949.0
1.20036 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.1	949.8
1.20036 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.1	950.5
1.20036 s	7	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.1	950.6
1.20036 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.1	950.6
1.20036 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	951.0
1.20036 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	951.6
1.20036 s	11	0.80E-04	0.64E-04	(0.18E+00)	399.4	323.1	952.0
1.20036 s	12	0.53E-03	0.29E-04	(0.58E+00)	393.6	323.6	0.0
1.20036 s	13	0.96E-03	0.00E+00	(0.10E+01)	375.7	323.0	0.0
1.20036 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.6	323.0	0.0
1.20036 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.20036 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.2507E-03

Gas-Mix 0.8082E-03

-- Gas Mixture Quantity Within Part Injection --

Table C.39: Particle Breakup Data (1150 Tm, with H_2)

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1Test case for Aluminum Jet MS problem, 1150 Tm, in-vessel ( 08/14/92 )
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00        1
    1           1     1.150E+03  2.500E-02 -2.000E+00  5.050E-01
  3.001137E-01       26
    1           8     1.134E+03  7.875E-03 -6.876E-01  1.504E-01
    2           1     1.143E+03  1.250E-02 -9.505E-01  1.132E-01
    3           1     1.145E+03  1.984E-02 -1.156E+00  1.168E-01
    4           1     1.146E+03  2.500E-02 -1.290E+00  1.385E-01
    5           1     1.147E+03  2.500E-02 -1.315E+00  1.644E-01
    6           1     1.147E+03  2.500E-02 -1.336E+00  1.922E-01
    7           1     1.147E+03  2.500E-02 -1.360E+00  2.191E-01
    8           1     1.148E+03  2.500E-02 -1.391E+00  2.480E-01
    9           1     1.148E+03  2.500E-02 -1.426E+00  2.762E-01
   10           1     1.148E+03  2.500E-02 -1.474E+00  3.067E-01
   11           1     1.149E+03  2.500E-02 -1.532E+00  3.368E-01
   12           1     1.149E+03  2.500E-02 -1.611E+00  3.698E-01
   13           1     1.150E+03  2.500E-02 -1.708E+00  4.030E-01
   14           1     1.150E+03  2.500E-02 -1.844E+00  4.403E-01
   15           1     1.150E+03  2.500E-02 -2.007E+00  4.790E-01
   16           8     1.134E+03  7.875E-03 -6.878E-01  1.705E-01
   17           8     1.134E+03  7.875E-03 -6.879E-01  1.663E-01
   18           8     1.135E+03  7.875E-03 -6.890E-01  1.863E-01
   19           1     1.143E+03  1.250E-02 -9.470E-01  1.333E-01
   20           1     1.143E+03  1.250E-02 -9.476E-01  1.291E-01
   21           1     1.143E+03  1.250E-02 -9.460E-01  1.492E-01
   22           1     1.145E+03  1.984E-02 -1.154E+00  1.367E-01
   23           1     1.143E+03  1.250E-02 -9.485E-01  1.257E-01
   24           1     1.143E+03  1.250E-02 -9.465E-01  1.459E-01
   25           1     1.143E+03  1.250E-02 -9.473E-01  1.416E-01
   26           1     1.143E+03  1.250E-02 -9.455E-01  1.617E-01
  6.000469E-01       51
    1           8     1.136E+03  7.875E-03 -1.597E-03  7.875E-03
    2           4     1.141E+03  7.875E-03 -1.597E-03  7.875E-03
    3           1     1.144E+03  1.250E-02 -1.597E-03  1.250E-02
    4           1     1.147E+03  1.575E-02 -1.597E-03  1.575E-02
    5           1     1.146E+03  1.984E-02 -1.597E-03  1.984E-02
    6           1     1.146E+03  2.500E-02 -1.861E-03  2.500E-02
    7           1     1.147E+03  2.500E-02 -1.861E-03  2.500E-02
    8           1     1.148E+03  2.500E-02 -1.861E-03  2.500E-02
    9           1     1.147E+03  2.500E-02 -1.861E-03  2.500E-02
   10           1     1.147E+03  2.500E-02 -1.861E-03  2.500E-02
   11           1     1.147E+03  2.500E-02 -1.861E-03  2.500E-02
   12           1     1.146E+03  2.500E-02 -1.861E-03  2.500E-02
   13           1     1.146E+03  2.500E-02 -1.861E-03  2.500E-02
   14           1     1.146E+03  2.500E-02 -1.861E-03  2.500E-02
   15           1     1.145E+03  2.500E-02 -1.199E+00  4.812E-02
   16           1     1.145E+03  2.500E-02 -1.177E+00  7.526E-02
   17           1     1.146E+03  2.500E-02 -1.184E+00  1.010E-01
   18           1     1.146E+03  2.500E-02 -1.194E+00  1.282E-01
   19           1     1.146E+03  2.500E-02 -1.206E+00  1.544E-01
   20           1     1.147E+03  2.500E-02 -1.221E+00  1.822E-01
   21           1     1.147E+03  2.500E-02 -1.239E+00  2.092E-01
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22	1	1.147E+03	2.500E-02	-1.263E+00	2.379E-01
23	1	1.148E+03	2.500E-02	-1.292E+00	2.656E-01
24	1	1.148E+03	2.500E-02	-1.332E+00	2.940E-01
25	1	1.149E+03	2.500E-02	-1.382E+00	3.243E-01
26	1	1.149E+03	2.500E-02	-1.448E+00	3.553E-01
27	1	1.150E+03	2.500E-02	-1.549E+00	3.857E-01
28	1	1.151E+03	2.500E-02	-1.688E+00	4.181E-01
29	1	1.152E+03	2.500E-02	-1.860E+00	4.542E-01
30	1	1.152E+03	2.500E-02	-1.989E+00	4.940E-01
31	8	1.129E+03	7.875E-03	-1.597E-03	7.875E-03
32	8	1.130E+03	7.875E-03	-1.597E-03	7.875E-03
33	16	1.127E+03	6.250E-03	-1.597E-03	6.250E-03
34	4	1.141E+03	7.875E-03	-1.597E-03	7.875E-03
35	4	1.141E+03	7.875E-03	-1.597E-03	7.875E-03
36	4	1.143E+03	7.875E-03	-1.597E-03	7.875E-03
37	2	1.146E+03	9.921E-03	-1.597E-03	9.921E-03
38	4	1.141E+03	7.875E-03	-1.597E-03	7.875E-03
39	4	1.142E+03	7.875E-03	-1.597E-03	7.875E-03
40	4	1.142E+03	7.875E-03	-1.597E-03	7.875E-03
41	4	1.145E+03	7.875E-03	-1.597E-03	7.875E-03
42	1	1.144E+03	1.250E-02	-1.597E-03	1.250E-02
43	2	1.146E+03	9.921E-03	-1.597E-03	9.921E-03
44	1	1.146E+03	1.575E-02	-1.597E-03	1.575E-02
45	1	1.144E+03	1.250E-02	-1.597E-03	1.250E-02
46	2	1.146E+03	9.921E-03	-1.597E-03	9.921E-03
47	2	1.146E+03	9.921E-03	-1.597E-03	9.921E-03
48	2	1.145E+03	9.921E-03	-1.597E-03	9.921E-03
49	1	1.146E+03	1.984E-02	-1.597E-03	1.984E-02
50	1	1.146E+03	1.575E-02	-1.597E-03	1.575E-02
51	1	1.146E+03	1.575E-02	-1.597E-03	1.575E-02
8.999612E-01	67				
1	8	1.137E+03	7.875E-03	-3.193E-03	7.875E-03
2	4	1.143E+03	7.875E-03	-3.193E-03	7.875E-03
3	1	1.145E+03	1.250E-02	-3.193E-03	1.250E-02
4	1	1.147E+03	1.575E-02	-3.193E-03	1.575E-02
5	1	1.147E+03	1.984E-02	-3.193E-03	1.984E-02
6	1	1.147E+03	2.500E-02	-3.728E-03	2.500E-02
7	1	1.147E+03	2.500E-02	-3.728E-03	2.500E-02
8	1	1.148E+03	2.500E-02	-3.728E-03	2.500E-02
9	1	1.148E+03	2.500E-02	-3.728E-03	2.500E-02
10	1	1.147E+03	2.500E-02	-3.728E-03	2.500E-02
11	1	1.147E+03	2.500E-02	-3.728E-03	2.500E-02
12	1	1.146E+03	2.500E-02	-3.728E-03	2.500E-02
13	1	1.146E+03	2.500E-02	-3.728E-03	2.500E-02
14	1	1.146E+03	2.500E-02	-3.728E-03	2.500E-02
15	1	1.146E+03	2.500E-02	-3.728E-03	2.500E-02
16	1	1.145E+03	2.500E-02	-3.728E-03	2.500E-02
17	1	1.145E+03	2.500E-02	-3.728E-03	2.500E-02
18	1	1.145E+03	2.500E-02	-3.728E-03	2.500E-02
19	1	1.145E+03	2.500E-02	-3.728E-03	2.500E-02
20	1	1.149E+03	2.500E-02	-3.728E-03	2.500E-02
21	1	1.153E+03	2.500E-02	-3.728E-03	2.500E-02
22	1	1.151E+03	2.500E-02	-3.728E-03	2.500E-02
23	1	1.150E+03	2.500E-02	-3.728E-03	2.500E-02

24	1	1.150E+03	2.500E-02	-3.728E-03	2.500E-02
25	1	1.150E+03	2.500E-02	-3.728E-03	2.500E-02
26	1	1.150E+03	2.500E-02	-3.728E-03	2.500E-02
27	1	1.151E+03	2.500E-02	-3.728E-03	2.500E-02
28	1	1.152E+03	2.500E-02	-3.728E-03	2.500E-02
29	1	1.153E+03	1.984E-02	-1.212E+00	3.041E-02
30	1	1.153E+03	1.984E-02	-1.182E+00	5.554E-02
31	1	1.153E+03	2.500E-02	-1.219E+00	7.957E-02
32	1	1.161E+03	2.500E-02	-1.221E+00	1.064E-01
33	1	1.165E+03	2.500E-02	-1.215E+00	1.353E-01
34	1	1.163E+03	2.500E-02	-1.228E+00	1.635E-01
35	1	1.155E+03	2.500E-02	-1.249E+00	1.871E-01
36	1	1.160E+03	2.500E-02	-1.278E+00	2.093E-01
37	1	1.161E+03	2.500E-02	-1.302E+00	2.395E-01
38	1	1.158E+03	2.500E-02	-1.336E+00	2.689E-01
39	1	1.155E+03	2.500E-02	-1.379E+00	2.993E-01
40	1	1.153E+03	2.500E-02	-1.426E+00	3.334E-01
41	1	1.150E+03	2.500E-02	-1.505E+00	3.640E-01
42	1	1.151E+03	2.500E-02	-1.611E+00	3.973E-01
43	1	1.152E+03	2.500E-02	-1.771E+00	4.312E-01
44	1	1.152E+03	2.500E-02	-1.934E+00	4.689E-01
45	8	1.131E+03	7.875E-03	-3.193E-03	7.875E-03
46	8	1.132E+03	7.875E-03	-3.193E-03	7.875E-03
47	16	1.132E+03	6.250E-03	-3.193E-03	6.250E-03
48	4	1.142E+03	7.875E-03	-3.193E-03	7.875E-03
49	4	1.142E+03	7.875E-03	-3.193E-03	7.875E-03
50	4	1.144E+03	7.875E-03	-3.193E-03	7.875E-03
51	2	1.149E+03	9.921E-03	-3.193E-03	9.921E-03
52	4	1.142E+03	7.875E-03	-3.193E-03	7.875E-03
53	4	1.144E+03	7.875E-03	-3.193E-03	7.875E-03
54	4	1.143E+03	7.875E-03	-3.193E-03	7.875E-03
55	4	1.146E+03	7.875E-03	-3.193E-03	7.875E-03
56	1	1.144E+03	1.250E-02	-3.193E-03	1.250E-02
57	2	1.147E+03	9.921E-03	-3.193E-03	9.921E-03
58	1	1.147E+03	1.575E-02	-3.193E-03	1.575E-02
59	1	1.144E+03	1.250E-02	-3.193E-03	1.250E-02
60	2	1.148E+03	9.921E-03	-3.193E-03	9.921E-03
61	2	1.148E+03	9.921E-03	-3.193E-03	9.921E-03
62	2	1.147E+03	9.921E-03	-3.193E-03	9.921E-03
63	1	1.147E+03	1.984E-02	-3.193E-03	1.984E-02
64	1	1.147E+03	1.575E-02	-3.193E-03	1.575E-02
65	1	1.146E+03	1.575E-02	-3.193E-03	1.575E-02
66	1	1.153E+03	1.984E-02	-1.158E+00	7.557E-02
67	1	1.155E+03	1.984E-02	-1.212E+00	5.025E-02
1.200087E+00	82				
1	8	1.133E+03	7.875E-03	-3.193E-03	7.875E-03
2	4	1.139E+03	7.875E-03	-3.193E-03	7.875E-03
3	1	1.143E+03	1.250E-02	-3.193E-03	1.250E-02
4	1	1.146E+03	1.575E-02	-3.193E-03	1.575E-02
5	1	1.146E+03	1.984E-02	-3.193E-03	1.984E-02
6	1	1.146E+03	2.500E-02	-3.788E-03	2.500E-02
7	1	1.146E+03	2.500E-02	-3.788E-03	2.500E-02
8	1	1.147E+03	2.500E-02	-3.788E-03	2.500E-02
9	1	1.147E+03	2.500E-02	-3.788E-03	2.500E-02

10	1	1.146E+03	2.500E-02	-3.788E-03	2.500E-02
11	1	1.146E+03	2.500E-02	-3.788E-03	2.500E-02
12	1	1.145E+03	2.500E-02	-3.788E-03	2.500E-02
13	1	1.145E+03	2.500E-02	-3.788E-03	2.500E-02
14	1	1.145E+03	2.500E-02	-3.788E-03	2.500E-02
15	1	1.145E+03	2.500E-02	-3.788E-03	2.500E-02
16	1	1.144E+03	2.500E-02	-3.788E-03	2.500E-02
17	1	1.144E+03	2.500E-02	-3.788E-03	2.500E-02
18	1	1.144E+03	2.500E-02	-3.788E-03	2.500E-02
19	1	1.144E+03	2.500E-02	-3.788E-03	2.500E-02
20	1	1.148E+03	2.500E-02	-3.788E-03	2.500E-02
21	1	1.152E+03	2.500E-02	-3.788E-03	2.500E-02
22	1	1.150E+03	2.500E-02	-3.788E-03	2.500E-02
23	1	1.149E+03	2.500E-02	-3.788E-03	2.500E-02
24	1	1.149E+03	2.500E-02	-3.788E-03	2.500E-02
25	1	1.149E+03	2.500E-02	-3.788E-03	2.500E-02
26	1	1.149E+03	2.500E-02	-3.788E-03	2.500E-02
27	1	1.150E+03	2.500E-02	-3.788E-03	2.500E-02
28	1	1.151E+03	2.500E-02	-3.788E-03	2.500E-02
29	1	1.152E+03	1.984E-02	-3.193E-03	1.984E-02
30	1	1.153E+03	1.984E-02	-3.193E-03	1.984E-02
31	1	1.155E+03	2.500E-02	-3.788E-03	2.500E-02
32	1	1.166E+03	2.500E-02	-3.788E-03	2.500E-02
33	1	1.169E+03	2.500E-02	-3.788E-03	2.500E-02
34	1	1.166E+03	2.500E-02	-3.788E-03	2.500E-02
35	1	1.157E+03	2.500E-02	-3.788E-03	2.500E-02
36	1	1.162E+03	2.500E-02	-3.788E-03	2.500E-02
37	1	1.162E+03	2.500E-02	-3.788E-03	2.500E-02
38	1	1.158E+03	2.500E-02	-3.788E-03	2.500E-02
39	1	1.155E+03	2.500E-02	-3.788E-03	2.500E-02
40	1	1.152E+03	2.500E-02	-3.788E-03	2.500E-02
41	1	1.149E+03	2.500E-02	-3.788E-03	2.500E-02
42	1	1.149E+03	2.500E-02	-3.788E-03	2.500E-02
43	1	1.149E+03	2.500E-02	-3.788E-03	2.500E-02
44	1	1.150E+03	2.500E-02	-1.313E+00	3.451E-02
45	1	1.149E+03	2.500E-02	-1.321E+00	6.000E-02
46	1	1.149E+03	2.500E-02	-1.315E+00	8.718E-02
47	1	1.153E+03	2.500E-02	-1.298E+00	1.142E-01
48	1	1.150E+03	2.500E-02	-1.300E+00	1.417E-01
49	1	1.149E+03	2.500E-02	-1.313E+00	1.682E-01
50	1	1.149E+03	2.500E-02	-1.332E+00	1.961E-01
51	1	1.149E+03	2.500E-02	-1.355E+00	2.233E-01
52	1	1.150E+03	2.500E-02	-1.386E+00	2.522E-01
53	1	1.150E+03	2.500E-02	-1.425E+00	2.811E-01
54	1	1.151E+03	2.500E-02	-1.471E+00	3.102E-01
55	1	1.150E+03	2.500E-02	-1.536E+00	3.417E-01
56	1	1.151E+03	2.500E-02	-1.616E+00	3.730E-01
57	1	1.151E+03	2.500E-02	-1.722E+00	4.082E-01
58	1	1.152E+03	2.500E-02	-1.852E+00	4.437E-01
59	1	1.153E+03	2.500E-02	-1.977E+00	4.830E-01
60	8	1.127E+03	7.875E-03	-3.193E-03	7.875E-03
61	8	1.128E+03	7.875E-03	-3.193E-03	7.875E-03
62	16	1.129E+03	6.250E-03	-3.193E-03	6.250E-03
63	4	1.138E+03	7.875E-03	-3.193E-03	7.875E-03

64	4	1.138E+03	7.875E-03	-3.193E-03	7.875E-03
65	4	1.141E+03	7.875E-03	-3.193E-03	7.875E-03
66	2	1.147E+03	9.921E-03	-3.193E-03	9.921E-03
67	4	1.139E+03	7.875E-03	-3.193E-03	7.875E-03
68	4	1.140E+03	7.875E-03	-3.193E-03	7.875E-03
69	4	1.139E+03	7.875E-03	-3.193E-03	7.875E-03
70	4	1.142E+03	7.875E-03	-3.193E-03	7.875E-03
71	1	1.141E+03	1.250E-02	-3.193E-03	1.250E-02
72	2	1.145E+03	9.921E-03	-3.193E-03	9.921E-03
73	1	1.145E+03	1.575E-02	-3.193E-03	1.575E-02
74	1	1.142E+03	1.250E-02	-3.193E-03	1.250E-02
75	2	1.145E+03	9.921E-03	-3.193E-03	9.921E-03
76	2	1.146E+03	9.921E-03	-3.193E-03	9.921E-03
77	2	1.144E+03	9.921E-03	-3.193E-03	9.921E-03
78	1	1.145E+03	1.984E-02	-3.193E-03	1.984E-02
79	1	1.145E+03	1.575E-02	-3.193E-03	1.575E-02
80	1	1.145E+03	1.575E-02	-3.193E-03	1.575E-02
81	1	1.155E+03	1.984E-02	-3.193E-03	1.984E-02
82	1	1.154E+03	1.984E-02	-3.193E-03	1.984E-02

Table C.40: Gas Mixture Data (1150 Tm, with H_2)

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.35511 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.0	0.0
0.35511 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.0	1143.6
0.35511 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.0	1140.5
0.35511 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.0	1146.7
0.35511 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	1147.3
0.35511 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	1148.0
0.35511 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.0	1148.7
0.35511 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	1149.3
0.35511 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	1149.6
0.35511 s	11	0.14E-07	0.00E+00	(0.23E-04)	373.4	323.0	1150.0
0.35511 s	12	0.93E-03	0.20E-06	(0.96E+00)	374.3	323.0	0.0
0.35511 s	13	0.96E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.35511 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.2010E-06
Gas-Mix	0.9298E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.54018 s	2	0.34E-04	0.27E-04	(0.12E+00)	657.3	323.1	1143.4
0.54018 s	3	0.64E-07	0.00E+00	(0.16E-03)	372.4	323.1	1145.5
0.54018 s	4	0.00E+00	0.00E+00	(0.00E+00)	372.4	323.1	1146.2
0.54018 s	5	0.00E+00	0.00E+00	(0.00E+00)	372.5	323.1	1146.7
0.54018 s	6	0.00E+00	0.00E+00	(0.00E+00)	372.6	323.1	1147.2
0.54018 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.7	323.1	1148.0
0.54018 s	8	0.00E+00	0.00E+00	(0.00E+00)	372.8	323.0	1148.7
0.54018 s	9	0.00E+00	0.00E+00	(0.00E+00)	372.8	323.0	1149.3
0.54018 s	10	0.00E+00	0.00E+00	(0.00E+00)	372.9	323.0	1149.6
0.54018 s	11	0.11E-07	0.00E+00	(0.20E-04)	373.0	323.0	1150.3
0.54018 s	12	0.85E-03	0.54E-06	(0.88E+00)	374.4	323.0	0.0
0.54018 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.54018 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.54018 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.54018 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.2766E-04
Gas-Mix	0.8985E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.59017 s	2	0.52E-04	0.41E-04	(0.31E+00)	1108.4	323.1	1144.8
0.59017 s	3	0.11E-05	0.00E+00	(0.25E-02)	374.1	323.1	1145.3
0.59017 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.1	1146.0
0.59017 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.1	1146.7
0.59017 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	1147.2
0.59017 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	1147.8
0.59017 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	1148.5
0.59017 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	1149.1
0.59017 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	1150.7
0.59017 s	11	0.83E-08	0.00E+00	(0.17E-04)	373.2	323.0	1151.6
0.59017 s	12	0.76E-03	0.22E-05	(0.79E+00)	376.9	323.1	0.0
0.59017 s	13	0.96E-03	0.00E+00	(0.10E+01)	373.6	323.0	0.0
0.59017 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.59017 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.59017 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.4359E-04
Gas-Mix	0.8328E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.66027 s	2	0.69E-04	0.56E-04	(0.26E+00)	751.8	323.1	1145.6
0.66027 s	3	0.30E-05	0.00E+00	(0.62E-02)	376.3	323.1	1145.2
0.66027 s	4	0.00E+00	0.00E+00	(0.00E+00)	376.2	323.1	1145.9
0.66027 s	5	0.00E+00	0.00E+00	(0.00E+00)	376.0	323.1	1146.6
0.66027 s	6	0.00E+00	0.00E+00	(0.00E+00)	375.7	323.1	1147.3
0.66027 s	7	0.00E+00	0.00E+00	(0.00E+00)	375.5	323.1	1148.3
0.66027 s	8	0.00E+00	0.00E+00	(0.00E+00)	375.3	323.1	1150.1
0.66027 s	9	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.1	1150.7
0.66027 s	10	0.00E+00	0.00E+00	(0.00E+00)	368.5	323.1	1155.1
0.66027 s	11	0.15E-04	0.89E-05	(0.60E-01)	330.1	323.0	1158.2
0.66027 s	12	0.74E-03	0.54E-05	(0.78E+00)	381.6	323.1	0.0
0.66027 s	13	0.96E-03	0.00E+00	(0.10E+01)	373.6	323.0	0.0
0.66027 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.66027 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.66027 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.6997E-04
Gas-Mix	0.8274E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.80406 s	2	0.95E-04	0.77E-04	(0.21E+00)	439.6	323.2	1146.7
0.80406 s	3	0.23E-04	0.17E-04	(0.40E-01)	336.7	323.1	1148.3
0.80406 s	4	0.00E+00	0.00E+00	(0.00E+00)	375.0	323.1	1146.9
0.80406 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.8	323.1	1148.2
0.80406 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.1	1157.8
0.80406 s	7	0.00E+00	0.00E+00	(0.00E+00)	374.5	323.1	1165.5
0.80406 s	8	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.1	1159.2
0.80406 s	9	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.1	1162.7
0.80406 s	10	0.54E-06	0.00E+00	(0.11E-02)	373.9	323.1	1159.5
0.80406 s	11	0.64E-04	0.48E-04	(0.21E+00)	616.6	323.1	1154.2
0.80406 s	12	0.64E-03	0.11E-04	(0.69E+00)	393.0	323.3	0.0
0.80406 s	13	0.96E-03	0.00E+00	(0.10E+01)	375.7	323.0	0.0
0.80406 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.5	323.0	0.0
0.80406 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.80406 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.1539E-03
Gas-Mix	0.8203E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.87946 s	2	0.11E-03	0.89E-04	(0.31E+00)	455.4	323.2	1147.1
0.87946 s	3	0.37E-04	0.29E-04	(0.17E+00)	762.5	323.1	1151.3
0.87946 s	4	0.94E-07	0.00E+00	(0.36E-03)	371.5	323.1	1156.4
0.87946 s	5	0.00E+00	0.00E+00	(0.00E+00)	371.7	323.1	1164.1
0.87946 s	6	0.00E+00	0.00E+00	(0.00E+00)	371.9	323.1	1157.8
0.87946 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.1	323.1	1159.7
0.87946 s	8	0.00E+00	0.00E+00	(0.00E+00)	372.3	323.1	1155.6
0.87946 s	9	0.00E+00	0.00E+00	(0.00E+00)	372.5	323.1	1151.9
0.87946 s	10	0.00E+00	0.00E+00	(0.00E+00)	372.6	323.1	1151.5
0.87946 s	11	0.58E-04	0.50E-04	(0.17E+00)	520.3	323.1	1151.8
0.87946 s	12	0.55E-03	0.14E-04	(0.61E+00)	397.6	323.3	0.0
0.87946 s	13	0.96E-03	0.00E+00	(0.10E+01)	376.5	323.0	0.0
0.87946 s	14	0.96E-03	0.00E+00	(0.10E+01)	373.6	323.0	0.0
0.87946 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.87946 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.1811E-03

Gas-Mix 0.7822E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.18713 s	2	0.17E-03	0.13E-03	(0.35E+00)	383.7	323.5	1149.9
1.18713 s	3	0.78E-04	0.63E-04	(0.22E+00)	508.2	323.3	1149.2
1.18713 s	4	0.51E-05	0.77E-06	(0.10E-01)	369.7	323.2	1148.9
1.18713 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	1148.7
1.18713 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	1149.4
1.18713 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	1150.1
1.18713 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	1150.8
1.18713 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	1150.9
1.18713 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.1	323.1	1151.5
1.18713 s	11	0.66E-04	0.53E-04	(0.16E+00)	451.6	323.1	1151.5
1.18713 s	12	0.50E-03	0.25E-04	(0.54E+00)	385.5	323.7	0.0
1.18713 s	13	0.96E-03	0.00E+00	(0.10E+01)	375.3	323.0	0.0
1.18713 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.18713 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.18713 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols

H2	0.2753E-03
Gas-Mix	0.8235E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.20009 s	2	0.17E-03	0.14E-03	(0.35E+00)	384.5	323.5	1149.8
1.20009 s	3	0.78E-04	0.63E-04	(0.20E+00)	500.6	323.3	1148.8
1.20009 s	4	0.58E-05	0.40E-05	(0.10E-01)	344.6	323.2	1151.5
1.20009 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.8	323.1	1148.8
1.20009 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.7	323.1	1149.5
1.20009 s	7	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.1	1149.9
1.20009 s	8	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.1	1150.4
1.20009 s	9	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.1	1151.1
1.20009 s	10	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.1	1151.6
1.20009 s	11	0.68E-04	0.54E-04	(0.17E+00)	472.5	323.1	1152.6
1.20009 s	12	0.51E-03	0.26E-04	(0.54E+00)	386.7	323.8	0.0
1.20009 s	13	0.96E-03	0.00E+00	(0.10E+01)	375.2	323.0	0.0
1.20009 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.20009 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.20009 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

Kg-mols

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H2         0.2820E-03
Gas-Mix    0.8265E-03

 -- Gas Mixture Quantity Within Part Injection --

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Table C.41: Particle Breakup Data (373 Tl, with H_2)

```
1Test case for Aluminum Jet MS problem, 373 Twater, in-vessel ( 08/15/92 )
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00        1
    1           1      9.500E+02  2.500E-02 -2.000E+00  5.050E-01
  3.000871E-01       24
    1           8      9.719E+02  7.875E-03 -6.872E-01  1.507E-01
    2           1      9.466E+02  1.250E-02 -9.485E-01  1.138E-01
    3           1      9.543E+02  1.984E-02 -1.157E+00  1.176E-01
    4           1      9.685E+02  2.500E-02 -1.291E+00  1.398E-01
    5           1      9.741E+02  2.500E-02 -1.304E+00  1.664E-01
    6           1      9.766E+02  2.500E-02 -1.278E+00  1.956E-01
    7           1      9.711E+02  2.500E-02 -1.282E+00  2.234E-01
    8           1      9.672E+02  2.500E-02 -1.294E+00  2.519E-01
    9           1      9.644E+02  2.500E-02 -1.293E+00  2.818E-01
   10           1      9.616E+02  2.500E-02 -1.332E+00  3.108E-01
   11           1      9.591E+02  2.500E-02 -1.372E+00  3.417E-01
   12           1      9.565E+02  2.500E-02 -1.431E+00  3.731E-01
   13           1      9.545E+02  2.500E-02 -1.524E+00  4.075E-01
   14           1      9.519E+02  2.500E-02 -1.660E+00  4.416E-01
   15           1      9.511E+02  2.500E-02 -1.908E+00  4.796E-01
   16          16      9.975E+02  6.250E-03 -6.661E-01  1.718E-01
   17           8      9.909E+02  7.875E-03 -6.720E-01  1.677E-01
   18          16      1.013E+03  6.250E-03 -6.089E-01  1.891E-01
   19           2      9.609E+02  1.250E-02 -9.430E-01  1.343E-01
   20           2      9.705E+02  1.250E-02 -9.390E-01  1.503E-01
   21           1      9.556E+02  1.250E-02 -9.463E-01  1.297E-01
   22           1      9.583E+02  1.984E-02 -1.156E+00  1.375E-01
   23           1      9.507E+02  1.250E-02 -9.476E-01  1.263E-01
   24           1      9.597E+02  1.250E-02 -9.456E-01  1.423E-01
  6.001149E-01       50
    1          16      1.176E+03  6.250E-03 -6.386E-03  6.250E-03
    2           4      1.014E+03  7.875E-03 -6.386E-03  7.875E-03
    3           1      9.857E+02  1.250E-02 -6.387E-03  1.250E-02
    4           1      9.901E+02  1.984E-02 -6.387E-03  1.984E-02
    5           1      1.002E+03  1.984E-02 -6.387E-03  1.984E-02
    6           1      1.007E+03  2.500E-02 -8.470E-03  2.500E-02
    7           1      1.005E+03  2.500E-02 -8.470E-03  2.500E-02
    8           1      1.013E+03  2.500E-02 -8.469E-03  2.500E-02
    9           1      1.020E+03  2.500E-02 -8.469E-03  2.500E-02
   10           1      1.026E+03  2.500E-02 -8.469E-03  2.500E-02
   11           1      1.034E+03  2.500E-02 -8.469E-03  2.500E-02
   12           1      1.040E+03  2.500E-02 -1.343E+00  7.045E-02
   13           1      1.045E+03  2.500E-02 -1.219E+00  1.239E-01
   14           1      1.045E+03  2.500E-02 -1.104E+00  1.734E-01
   15           1      1.044E+03  2.500E-02 -1.016E+00  2.174E-01
   16           1      1.043E+03  2.500E-02 -9.642E-01  2.457E-01
   17           1      1.036E+03  2.500E-02 -9.169E-01  2.726E-01
   18           1      1.031E+03  2.500E-02 -8.735E-01  3.041E-01
   19           1      1.030E+03  2.500E-02 -8.056E-01  3.368E-01
   20           1      1.023E+03  2.500E-02 -8.329E-01  3.456E-01
   21           1      1.014E+03  2.500E-02 -9.235E-01  3.392E-01
   22           1      1.005E+03  2.500E-02 -1.049E+00  3.298E-01
   23           1      9.964E+02  2.500E-02 -1.169E+00  3.301E-01
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24	1	9.882E+02	2.500E-02	-1.310E+00	3.344E-01
25	1	9.810E+02	2.500E-02	-1.475E+00	3.428E-01
26	1	9.744E+02	2.500E-02	-1.658E+00	3.586E-01
27	1	9.694E+02	2.500E-02	-1.814E+00	3.824E-01
28	1	9.644E+02	2.500E-02	-1.915E+00	4.165E-01
29	1	9.594E+02	2.500E-02	-1.969E+00	4.536E-01
30	1	9.525E+02	2.500E-02	-1.992E+00	4.950E-01
31	32	1.349E+03	4.961E-03	-5.777E-01	6.535E-02
32	32	1.327E+03	4.961E-03	-5.961E-01	5.719E-02
33	32	1.415E+03	4.961E-03	-3.147E-01	1.429E-01
34	8	1.059E+03	7.875E-03	-6.386E-03	7.875E-03
35	16	1.112E+03	6.250E-03	-6.386E-03	6.250E-03
36	4	1.046E+03	7.875E-03	-6.386E-03	7.875E-03
37	2	1.015E+03	9.921E-03	-6.386E-03	9.921E-03
38	4	1.036E+03	7.875E-03	-6.386E-03	7.875E-03
39	8	1.091E+03	6.250E-03	-6.386E-03	6.250E-03
40	1	9.967E+02	1.250E-02	-6.386E-03	1.250E-02
41	1	1.027E+03	9.921E-03	-6.386E-03	9.921E-03
42	1	1.002E+03	1.575E-02	-6.387E-03	1.575E-02
43	1	1.035E+03	9.921E-03	-6.386E-03	9.921E-03
44	1	9.906E+02	1.250E-02	-6.386E-03	1.250E-02
45	2	1.021E+03	9.921E-03	-6.386E-03	9.921E-03
46	2	1.015E+03	9.921E-03	-6.386E-03	9.921E-03
47	1	1.003E+03	1.575E-02	-6.387E-03	1.575E-02
48	1	1.036E+03	9.921E-03	-6.386E-03	9.921E-03
49	1	1.029E+03	9.921E-03	-6.386E-03	9.921E-03
50	1	1.003E+03	1.984E-02	-6.387E-03	1.984E-02
9.001111E-01		64			
1	16	1.213E+03	6.250E-03	-6.386E-03	6.250E-03
2	4	1.045E+03	7.875E-03	-6.386E-03	7.875E-03
3	1	1.003E+03	1.250E-02	-6.386E-03	1.250E-02
4	1	9.995E+02	1.984E-02	-6.387E-03	1.984E-02
5	1	1.012E+03	1.984E-02	-6.387E-03	1.984E-02
6	1	1.014E+03	2.500E-02	-8.316E-03	2.500E-02
7	1	1.012E+03	2.500E-02	-8.316E-03	2.500E-02
8	1	1.020E+03	2.500E-02	-8.316E-03	2.500E-02
9	1	1.027E+03	2.500E-02	-8.316E-03	2.500E-02
10	1	1.033E+03	2.500E-02	-8.316E-03	2.500E-02
11	1	1.041E+03	2.500E-02	-8.316E-03	2.500E-02
12	1	1.048E+03	2.500E-02	-8.316E-03	2.500E-02
13	1	1.058E+03	2.500E-02	-8.316E-03	2.500E-02
14	1	1.065E+03	2.500E-02	-8.316E-03	2.500E-02
15	1	1.071E+03	2.500E-02	-8.316E-03	2.500E-02
16	1	1.074E+03	2.500E-02	-8.316E-03	2.500E-02
17	1	1.070E+03	2.500E-02	-8.316E-03	2.500E-02
18	1	1.065E+03	2.500E-02	-8.316E-03	2.500E-02
19	1	1.061E+03	2.500E-02	-8.316E-03	2.500E-02
20	1	1.053E+03	2.500E-02	-8.316E-03	2.500E-02
21	1	1.044E+03	2.500E-02	-8.316E-03	2.500E-02
22	1	1.036E+03	2.500E-02	-8.316E-03	2.500E-02
23	1	1.028E+03	2.500E-02	-8.316E-03	2.500E-02
24	1	1.020E+03	2.500E-02	-8.316E-03	2.500E-02
25	1	1.013E+03	2.500E-02	-8.316E-03	2.500E-02
26	1	1.006E+03	2.500E-02	-8.316E-03	2.500E-02

27	1	9.992E+02	2.500E-02	-8.316E-03	2.500E-02
28	1	9.940E+02	2.500E-02	-8.316E-03	2.500E-02
29	1	9.910E+02	2.500E-02	-8.316E-03	2.500E-02
30	1	9.891E+02	2.500E-02	-8.316E-03	2.500E-02
31	1	9.878E+02	2.500E-02	-8.316E-03	2.500E-02
32	1	9.863E+02	2.500E-02	-8.316E-03	2.500E-02
33	1	9.851E+02	2.500E-02	-8.316E-03	2.500E-02
34	1	9.842E+02	2.500E-02	-8.316E-03	2.500E-02
35	1	9.832E+02	2.500E-02	-8.316E-03	2.500E-02
36	1	9.824E+02	2.500E-02	-2.928E+00	4.073E-02
37	1	9.794E+02	2.500E-02	-3.045E+00	9.430E-02
38	1	9.754E+02	2.500E-02	-3.032E+00	1.525E-01
39	1	9.712E+02	2.500E-02	-2.937E+00	2.081E-01
40	1	9.673E+02	2.500E-02	-2.797E+00	2.662E-01
41	1	9.640E+02	2.500E-02	-2.647E+00	3.198E-01
42	1	9.608E+02	2.500E-02	-2.479E+00	3.733E-01
43	1	9.578E+02	2.500E-02	-2.316E+00	4.211E-01
44	1	9.542E+02	2.500E-02	-2.145E+00	4.678E-01
45	32	1.416E+03	4.961E-03	-6.385E-03	4.961E-03
46	32	1.388E+03	4.961E-03	-6.385E-03	4.961E-03
47	32	1.568E+03	4.961E-03	-6.385E-03	4.961E-03
48	8	1.089E+03	7.875E-03	-6.386E-03	7.875E-03
49	16	1.151E+03	6.250E-03	-6.386E-03	6.250E-03
50	4	1.076E+03	7.875E-03	-6.386E-03	7.875E-03
51	2	1.039E+03	9.921E-03	-6.386E-03	9.921E-03
52	4	1.067E+03	7.875E-03	-6.386E-03	7.875E-03
53	8	1.132E+03	6.250E-03	-6.386E-03	6.250E-03
54	1	1.014E+03	1.250E-02	-6.386E-03	1.250E-02
55	1	1.050E+03	9.921E-03	-6.386E-03	9.921E-03
56	1	1.015E+03	1.575E-02	-6.387E-03	1.575E-02
57	1	1.057E+03	9.921E-03	-6.386E-03	9.921E-03
58	1	1.008E+03	1.250E-02	-6.386E-03	1.250E-02
59	2	1.045E+03	9.921E-03	-6.386E-03	9.921E-03
60	2	1.038E+03	9.921E-03	-6.386E-03	9.921E-03
61	1	1.016E+03	1.575E-02	-6.387E-03	1.575E-02
62	1	1.059E+03	9.921E-03	-6.386E-03	9.921E-03
63	1	1.052E+03	9.921E-03	-6.386E-03	9.921E-03
64	1	1.013E+03	1.984E-02	-6.387E-03	1.984E-02
1.200119E+00		79			
1	16	1.205E+03	6.250E-03	-6.386E-03	6.250E-03
2	4	1.041E+03	7.875E-03	-6.386E-03	7.875E-03
3	1	1.001E+03	1.250E-02	-6.386E-03	1.250E-02
4	1	9.984E+02	1.984E-02	-6.387E-03	1.984E-02
5	1	1.011E+03	1.984E-02	-6.387E-03	1.984E-02
6	1	1.013E+03	2.500E-02	-8.370E-03	2.500E-02
7	1	1.012E+03	2.500E-02	-8.370E-03	2.500E-02
8	1	1.019E+03	2.500E-02	-8.370E-03	2.500E-02
9	1	1.027E+03	2.500E-02	-8.370E-03	2.500E-02
10	1	1.033E+03	2.500E-02	-8.370E-03	2.500E-02
11	1	1.040E+03	2.500E-02	-8.370E-03	2.500E-02
12	1	1.047E+03	2.500E-02	-8.370E-03	2.500E-02
13	1	1.058E+03	2.500E-02	-8.370E-03	2.500E-02
14	1	1.064E+03	2.500E-02	-8.370E-03	2.500E-02
15	1	1.070E+03	2.500E-02	-8.370E-03	2.500E-02

16	1	1.073E+03	2.500E-02	-8.370E-03	2.500E-02
17	1	1.069E+03	2.500E-02	-8.370E-03	2.500E-02
18	1	1.064E+03	2.500E-02	-8.370E-03	2.500E-02
19	1	1.060E+03	2.500E-02	-8.370E-03	2.500E-02
20	1	1.053E+03	2.500E-02	-8.370E-03	2.500E-02
21	1	1.043E+03	2.500E-02	-8.370E-03	2.500E-02
22	1	1.036E+03	2.500E-02	-8.370E-03	2.500E-02
23	1	1.027E+03	2.500E-02	-8.370E-03	2.500E-02
24	1	1.020E+03	2.500E-02	-8.370E-03	2.500E-02
25	1	1.012E+03	2.500E-02	-8.370E-03	2.500E-02
26	1	1.005E+03	2.500E-02	-8.370E-03	2.500E-02
27	1	9.985E+02	2.500E-02	-8.370E-03	2.500E-02
28	1	9.934E+02	2.500E-02	-8.370E-03	2.500E-02
29	1	9.904E+02	2.500E-02	-8.370E-03	2.500E-02
30	1	9.884E+02	2.500E-02	-8.370E-03	2.500E-02
31	1	9.871E+02	2.500E-02	-8.370E-03	2.500E-02
32	1	9.856E+02	2.500E-02	-8.370E-03	2.500E-02
33	1	9.845E+02	2.500E-02	-8.370E-03	2.500E-02
34	1	9.835E+02	2.500E-02	-8.370E-03	2.500E-02
35	1	9.825E+02	2.500E-02	-8.370E-03	2.500E-02
36	1	9.818E+02	2.500E-02	-8.370E-03	2.500E-02
37	1	9.812E+02	2.500E-02	-8.370E-03	2.500E-02
38	1	9.807E+02	2.500E-02	-8.370E-03	2.500E-02
39	1	9.803E+02	2.500E-02	-8.370E-03	2.500E-02
40	1	9.803E+02	2.500E-02	-8.370E-03	2.500E-02
41	1	9.804E+02	2.500E-02	-8.370E-03	2.500E-02
42	1	9.804E+02	2.500E-02	-8.370E-03	2.500E-02
43	1	9.805E+02	2.500E-02	-8.370E-03	2.500E-02
44	1	9.805E+02	2.500E-02	-8.370E-03	2.500E-02
45	1	9.804E+02	2.500E-02	-8.370E-03	2.500E-02
46	1	9.806E+02	2.500E-02	-8.370E-03	2.500E-02
47	1	9.807E+02	2.500E-02	-8.370E-03	2.500E-02
48	1	9.808E+02	2.500E-02	-8.370E-03	2.500E-02
49	1	9.809E+02	2.500E-02	-8.370E-03	2.500E-02
50	1	9.810E+02	2.500E-02	-8.370E-03	2.500E-02
51	1	9.809E+02	2.500E-02	-2.901E+00	3.235E-02
52	1	9.777E+02	2.500E-02	-3.047E+00	9.486E-02
53	1	9.734E+02	2.500E-02	-3.085E+00	1.562E-01
54	1	9.680E+02	2.500E-02	-3.035E+00	2.204E-01
55	1	9.638E+02	2.500E-02	-2.870E+00	2.793E-01
56	1	9.586E+02	2.500E-02	-2.675E+00	3.372E-01
57	1	9.553E+02	2.500E-02	-2.489E+00	3.886E-01
58	1	9.531E+02	2.500E-02	-2.293E+00	4.386E-01
59	1	9.513E+02	2.500E-02	-2.104E+00	4.825E-01
60	32	1.400E+03	4.961E-03	-6.385E-03	4.961E-03
61	32	1.374E+03	4.961E-03	-6.385E-03	4.961E-03
62	32	1.544E+03	4.961E-03	-6.385E-03	4.961E-03
63	8	1.084E+03	7.875E-03	-6.386E-03	7.875E-03
64	16	1.145E+03	6.250E-03	-6.386E-03	6.250E-03
65	4	1.072E+03	7.875E-03	-6.386E-03	7.875E-03
66	2	1.037E+03	9.921E-03	-6.386E-03	9.921E-03
67	4	1.063E+03	7.875E-03	-6.386E-03	7.875E-03
68	8	1.127E+03	6.250E-03	-6.386E-03	6.250E-03
69	1	1.012E+03	1.250E-02	-6.386E-03	1.250E-02

70	1	1.048E+03	9.921E-03	-6.386E-03	9.921E-03
71	1	1.014E+03	1.575E-02	-6.387E-03	1.575E-02
72	1	1.055E+03	9.921E-03	-6.386E-03	9.921E-03
73	1	1.006E+03	1.250E-02	-6.386E-03	1.250E-02
74	2	1.042E+03	9.921E-03	-6.386E-03	9.921E-03
75	2	1.036E+03	9.921E-03	-6.386E-03	9.921E-03
76	1	1.015E+03	1.575E-02	-6.387E-03	1.575E-02
77	1	1.056E+03	9.921E-03	-6.386E-03	9.921E-03
78	1	1.049E+03	9.921E-03	-6.386E-03	9.921E-03
79	1	1.012E+03	1.984E-02	-6.387E-03	1.984E-02

Table C.42: Gas Mixture Data (373 Tl, with H_2)

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.18460 s	2	0.00E+00	0.00E+00	(0.00E+00)	373.8	373.0	0.0
0.18460 s	3	0.00E+00	0.00E+00	(0.00E+00)	373.6	373.0	0.0
0.18460 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.4	373.0	0.0
0.18460 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.3	373.0	0.0
0.18460 s	6	0.33E-06	0.00E+00	(0.69E-03)	373.2	373.0	948.3
0.18460 s	7	0.49E-05	0.10E-05	(0.10E-01)	367.0	373.0	951.4
0.18460 s	8	0.77E-05	0.53E-05	(0.14E-01)	342.7	373.0	958.9
0.18460 s	9	0.87E-05	0.62E-05	(0.16E-01)	340.8	373.0	958.3
0.18460 s	10	0.98E-05	0.70E-05	(0.18E-01)	340.5	373.0	951.9
0.18460 s	11	0.19E-06	0.00E+00	(0.59E-03)	373.4	373.0	950.0
0.18460 s	12	0.92E-03	0.10E-06	(0.95E+00)	373.7	373.0	950.0
0.18460 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.18460 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.18460 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0
0.18460 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols
H2	0.1962E-04
Gas-Mix	0.9512E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.28484 s	2	0.00E+00	0.00E+00	(0.00E+00)	375.9	373.0	0.0
0.28484 s	3	0.00E+00	0.00E+00	(0.00E+00)	375.8	373.0	0.0
0.28484 s	4	0.66E-06	0.00E+00	(0.13E-02)	375.7	373.0	955.0
0.28484 s	5	0.16E-04	0.11E-04	(0.28E-01)	341.6	373.0	971.3
0.28484 s	6	0.29E-04	0.23E-04	(0.13E+00)	845.8	373.0	971.4
0.28484 s	7	0.25E-04	0.18E-04	(0.58E-01)	456.2	373.0	964.8
0.28484 s	8	0.23E-04	0.17E-04	(0.40E-01)	340.7	373.0	960.7
0.28484 s	9	0.23E-04	0.17E-04	(0.47E-01)	397.9	373.0	955.5
0.28484 s	10	0.24E-04	0.17E-04	(0.43E-01)	352.5	373.0	952.2
0.28484 s	11	0.18E-05	0.00E+00	(0.41E-02)	374.1	373.0	951.0
0.28484 s	12	0.77E-03	0.11E-05	(0.80E+00)	375.2	373.0	0.0
0.28484 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
0.28484 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.28484 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0
0.28484 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols
H2	0.1040E-03
Gas-Mix	0.9643E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.28485 s	2	0.00E+00	0.00E+00	(0.00E+00)	375.9	373.0	0.0
0.28485 s	3	0.00E+00	0.00E+00	(0.00E+00)	375.8	373.0	0.0
0.28485 s	4	0.66E-06	0.00E+00	(0.13E-02)	375.7	373.0	955.0
0.28485 s	5	0.16E-04	0.11E-04	(0.28E-01)	341.6	373.0	971.3
0.28485 s	6	0.29E-04	0.23E-04	(0.13E+00)	845.9	373.0	971.4
0.28485 s	7	0.25E-04	0.18E-04	(0.58E-01)	456.3	373.0	964.8
0.28485 s	8	0.23E-04	0.17E-04	(0.40E-01)	340.7	373.0	960.7
0.28485 s	9	0.23E-04	0.17E-04	(0.47E-01)	397.9	373.0	955.5
0.28485 s	10	0.24E-04	0.17E-04	(0.43E-01)	352.6	373.0	952.2
0.28485 s	11	0.18E-05	0.00E+00	(0.41E-02)	374.1	373.0	951.0
0.28485 s	12	0.77E-03	0.11E-05	(0.80E+00)	375.2	373.0	0.0
0.28485 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
0.28485 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.28485 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0
0.28485 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols

H2	0.1040E-03
Gas-Mix	0.9643E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.28485 s	2	0.00E+00	0.00E+00	(0.00E+00)	375.9	373.0	0.0
0.28485 s	3	0.00E+00	0.00E+00	(0.00E+00)	375.8	373.0	0.0
0.28485 s	4	0.66E-06	0.00E+00	(0.13E-02)	375.8	373.0	955.0
0.28485 s	5	0.16E-04	0.11E-04	(0.28E-01)	341.6	373.0	971.3
0.28485 s	6	0.29E-04	0.23E-04	(0.13E+00)	846.0	373.0	971.4
0.28485 s	7	0.25E-04	0.18E-04	(0.58E-01)	456.4	373.0	964.8
0.28485 s	8	0.23E-04	0.17E-04	(0.40E-01)	340.7	373.0	960.7
0.28485 s	9	0.23E-04	0.17E-04	(0.47E-01)	398.0	373.0	955.5
0.28485 s	10	0.24E-04	0.17E-04	(0.43E-01)	352.6	373.0	952.2
0.28485 s	11	0.18E-05	0.00E+00	(0.41E-02)	374.2	373.0	951.0
0.28485 s	12	0.77E-03	0.11E-05	(0.80E+00)	375.1	373.0	0.0
0.28485 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
0.28485 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.28485 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0
0.28485 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols

H2	0.1040E-03
Gas-Mix	0.9643E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.31412 s	2	0.00E+00	0.00E+00	(0.00E+00)	372.3	373.0	0.0
0.31412 s	3	0.51E-07	0.00E+00	(0.11E-03)	372.1	373.0	0.0
0.31412 s	4	0.45E-05	0.00E+00	(0.96E-02)	372.0	373.0	965.3
0.31412 s	5	0.34E-04	0.27E-04	(0.20E+00)	1014.2	373.0	993.2
0.31412 s	6	0.34E-04	0.27E-04	(0.19E+00)	952.4	373.0	971.0
0.31412 s	7	0.29E-04	0.23E-04	(0.14E+00)	845.1	373.0	965.5
0.31412 s	8	0.28E-04	0.21E-04	(0.11E+00)	673.8	373.0	961.5
0.31412 s	9	0.28E-04	0.21E-04	(0.10E+00)	652.6	373.0	958.0
0.31412 s	10	0.28E-04	0.21E-04	(0.98E-01)	626.8	373.0	954.4
0.31412 s	11	0.51E-05	0.12E-05	(0.10E-01)	365.3	373.0	952.4
0.31412 s	12	0.52E-03	0.24E-05	(0.55E+00)	377.7	373.0	0.0
0.31412 s	13	0.96E-03	0.00E+00	(0.10E+01)	374.2	373.0	0.0
0.31412 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
0.31412 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.31412 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols
H2	0.1426E-03
Gas-Mix	0.7564E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.38927 s	2	0.11E-05	0.00E+00	(0.21E-02)	376.6	373.0	968.8
0.38927 s	3	0.22E-04	0.16E-04	(0.37E-01)	340.5	373.0	987.2
0.38927 s	4	0.47E-04	0.37E-04	(0.29E+00)	1273.4	373.0	999.8
0.38927 s	5	0.89E-04	0.55E-04	(0.34E+00)	765.2	372.9	1010.6
0.38927 s	6	0.99E-04	0.45E-04	(0.34E+00)	692.2	372.9	983.8
0.38927 s	7	0.99E-04	0.41E-04	(0.33E+00)	658.7	372.9	979.5
0.38927 s	8	0.93E-04	0.38E-04	(0.32E+00)	660.5	372.9	975.5
0.38927 s	9	0.89E-04	0.39E-04	(0.31E+00)	665.6	372.9	972.2
0.38927 s	10	0.85E-04	0.38E-04	(0.30E+00)	652.9	372.9	964.3
0.38927 s	11	0.46E-04	0.16E-04	(0.19E+00)	750.3	373.0	960.3
0.38927 s	12	0.14E-03	0.48E-05	(0.17E+00)	421.4	373.0	0.0
0.38927 s	13	0.60E-03	0.00E+00	(0.63E+00)	378.7	373.0	0.0
0.38927 s	14	0.92E-03	0.00E+00	(0.95E+00)	374.8	373.0	0.0
0.38927 s	15	0.96E-03	0.00E+00	(0.10E+01)	373.7	373.0	0.0
0.38927 s	16	0.96E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0

	Kg-mols
H2	0.3302E-03

Gas-Mix 0.8539E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.51112 s	2	0.96E-04	0.75E-04	(0.55E+00)	1068.0	372.9	1010.9
0.51112 s	3	0.13E-03	0.89E-04	(0.53E+00)	753.5	372.9	1092.6
0.51112 s	4	0.16E-03	0.10E-03	(0.54E+00)	633.5	372.8	1078.9
0.51112 s	5	0.16E-03	0.82E-04	(0.53E+00)	605.7	372.8	1022.5
0.51112 s	6	0.16E-03	0.76E-04	(0.52E+00)	595.1	372.8	1022.1
0.51112 s	7	0.17E-03	0.77E-04	(0.54E+00)	600.7	372.8	1019.0
0.51112 s	8	0.17E-03	0.85E-04	(0.57E+00)	606.5	372.8	1015.3
0.51112 s	9	0.18E-03	0.88E-04	(0.59E+00)	616.1	372.8	1009.5
0.51112 s	10	0.18E-03	0.11E-03	(0.63E+00)	640.5	372.7	985.2
0.51112 s	11	0.16E-03	0.75E-04	(0.64E+00)	711.8	372.8	959.5
0.51112 s	12	0.25E-03	0.12E-04	(0.55E+00)	787.8	372.8	0.0
0.51112 s	13	0.22E-03	0.00E+00	(0.42E+00)	701.0	372.9	0.0
0.51112 s	14	0.20E-03	0.00E+00	(0.32E+00)	581.2	372.9	0.0
0.51112 s	15	0.28E-03	0.00E+00	(0.35E+00)	468.5	373.0	0.0
0.51112 s	16	0.57E-03	0.00E+00	(0.65E+00)	410.0	373.0	0.0

	Kg-mols

H2	0.8641E-03
Gas-Mix	0.1805E-02

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.91111 s	2	0.31E-03	0.25E-03	(0.57E+00)	331.5	372.0	1035.9
0.91111 s	3	0.28E-03	0.18E-03	(0.62E+00)	404.8	372.2	981.3
0.91111 s	4	0.30E-03	0.18E-03	(0.77E+00)	473.7	372.3	977.4
0.91111 s	5	0.27E-03	0.16E-03	(0.83E+00)	559.4	372.3	973.4
0.91111 s	6	0.25E-03	0.16E-03	(0.85E+00)	612.2	372.3	969.3
0.91111 s	7	0.24E-03	0.16E-03	(0.86E+00)	641.0	372.3	965.7
0.91111 s	8	0.24E-03	0.17E-03	(0.86E+00)	649.0	372.3	962.4
0.91111 s	9	0.24E-03	0.17E-03	(0.86E+00)	653.0	372.3	959.4
0.91111 s	10	0.23E-03	0.16E-03	(0.86E+00)	670.7	372.3	956.1
0.91111 s	11	0.21E-03	0.14E-03	(0.85E+00)	720.0	372.3	952.6
0.91111 s	12	0.29E-03	0.27E-04	(0.74E+00)	910.8	372.5	0.0
0.91111 s	13	0.29E-03	0.00E+00	(0.68E+00)	846.8	372.6	0.0
0.91111 s	14	0.30E-03	0.00E+00	(0.65E+00)	767.4	372.7	0.0
0.91111 s	15	0.31E-03	0.00E+00	(0.60E+00)	689.8	372.8	0.0
0.91111 s	16	0.28E-03	0.00E+00	(0.48E+00)	602.6	372.9	0.0

Kg-mols

	Kg-mols
H2	0.1752E-02
Gas-Mix	0.2870E-02

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.20012 s	2	0.32E-03	0.26E-03	(0.58E+00)	332.1	371.3	1018.7
1.20012 s	3	0.31E-03	0.20E-03	(0.62E+00)	375.0	371.6	977.7
1.20012 s	4	0.32E-03	0.20E-03	(0.64E+00)	370.8	371.9	0.0
1.20012 s	5	0.32E-03	0.18E-03	(0.72E+00)	410.3	372.1	973.4
1.20012 s	6	0.35E-03	0.18E-03	(0.87E+00)	452.6	372.1	968.0
1.20012 s	7	0.35E-03	0.19E-03	(0.90E+00)	476.4	372.1	963.8
1.20012 s	8	0.33E-03	0.19E-03	(0.90E+00)	493.4	372.1	958.6
1.20012 s	9	0.33E-03	0.19E-03	(0.90E+00)	509.2	372.1	955.3
1.20012 s	10	0.31E-03	0.18E-03	(0.91E+00)	535.2	372.1	953.1
1.20012 s	11	0.29E-03	0.17E-03	(0.90E+00)	576.6	372.1	951.3
1.20012 s	12	0.32E-03	0.37E-04	(0.65E+00)	752.4	372.5	0.0
1.20012 s	13	0.30E-03	0.00E+00	(0.64E+00)	775.0	372.7	0.0
1.20012 s	14	0.31E-03	0.00E+00	(0.66E+00)	756.6	372.8	0.0
1.20012 s	15	0.34E-03	0.00E+00	(0.68E+00)	722.8	372.8	0.0
1.20012 s	16	0.30E-03	0.00E+00	(0.55E+00)	652.9	372.9	0.0

	Kg-mols
H2	0.1981E-02
Gas-Mix	0.3538E-02

-- Gas Mixture Quantity Within Part Injection --

Table C.43: Particle Breakup Data (std In-Vessel, no H_2)

```
1Test case for Aluminum Jet MS problem, in-vessel ( 08/31/92 )
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00        1
    1           1     9.500E+02  2.500E-02 -2.000E+00  5.050E-01
  3.001137E-01       26
    1           8     9.374E+02  7.875E-03 -6.876E-01  1.504E-01
    2           1     9.440E+02  1.250E-02 -9.505E-01  1.132E-01
    3           1     9.462E+02  1.984E-02 -1.156E+00  1.168E-01
    4           1     9.470E+02  2.500E-02 -1.290E+00  1.385E-01
    5           1     9.473E+02  2.500E-02 -1.315E+00  1.644E-01
    6           1     9.476E+02  2.500E-02 -1.336E+00  1.922E-01
    7           1     9.478E+02  2.500E-02 -1.360E+00  2.191E-01
    8           1     9.482E+02  2.500E-02 -1.391E+00  2.480E-01
    9           1     9.484E+02  2.500E-02 -1.426E+00  2.762E-01
   10           1     9.487E+02  2.500E-02 -1.474E+00  3.067E-01
   11           1     9.490E+02  2.500E-02 -1.532E+00  3.368E-01
   12           1     9.493E+02  2.500E-02 -1.611E+00  3.698E-01
   13           1     9.496E+02  2.500E-02 -1.708E+00  4.030E-01
   14           1     9.499E+02  2.500E-02 -1.844E+00  4.403E-01
   15           1     9.500E+02  2.500E-02 -2.007E+00  4.790E-01
   16           8     9.374E+02  7.875E-03 -6.878E-01  1.705E-01
   17           8     9.373E+02  7.875E-03 -6.879E-01  1.663E-01
   18           8     9.376E+02  7.875E-03 -6.890E-01  1.863E-01
   19           1     9.441E+02  1.250E-02 -9.470E-01  1.333E-01
   20           1     9.440E+02  1.250E-02 -9.476E-01  1.291E-01
   21           1     9.442E+02  1.250E-02 -9.460E-01  1.492E-01
   22           1     9.463E+02  1.984E-02 -1.154E+00  1.367E-01
   23           1     9.441E+02  1.250E-02 -9.485E-01  1.257E-01
   24           1     9.441E+02  1.250E-02 -9.465E-01  1.459E-01
   25           1     9.440E+02  1.250E-02 -9.473E-01  1.416E-01
   26           1     9.441E+02  1.250E-02 -9.455E-01  1.617E-01
  6.001098E-01       51
    1           8     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
    2           4     9.330E+02  7.875E-03 -6.386E-03  7.875E-03
    3           1     9.364E+02  1.250E-02 -6.386E-03  1.250E-02
    4           1     9.407E+02  1.575E-02 -6.387E-03  1.575E-02
    5           1     9.423E+02  1.984E-02 -6.387E-03  1.984E-02
    6           1     9.436E+02  2.500E-02 -6.660E-03  2.500E-02
    7           1     9.439E+02  2.500E-02 -6.660E-03  2.500E-02
    8           1     9.441E+02  2.500E-02 -6.660E-03  2.500E-02
    9           1     9.444E+02  2.500E-02 -6.660E-03  2.500E-02
   10           1     9.447E+02  2.500E-02 -6.660E-03  2.500E-02
   11           1     9.449E+02  2.500E-02 -6.660E-03  2.500E-02
   12           1     9.452E+02  2.500E-02 -6.660E-03  2.500E-02
   13           1     9.455E+02  2.500E-02 -6.660E-03  2.500E-02
   14           1     9.457E+02  2.500E-02 -6.660E-03  2.500E-02
   15           1     9.460E+02  2.500E-02 -1.244E+00  4.346E-02
   16           1     9.463E+02  2.500E-02 -1.252E+00  7.023E-02
   17           1     9.466E+02  2.500E-02 -1.260E+00  9.590E-02
   18           1     9.468E+02  2.500E-02 -1.271E+00  1.231E-01
   19           1     9.471E+02  2.500E-02 -1.283E+00  1.492E-01
   20           1     9.474E+02  2.500E-02 -1.299E+00  1.769E-01
   21           1     9.477E+02  2.500E-02 -1.318E+00  2.037E-01
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22	1	9.480E+02	2.500E-02	-1.344E+00	2.323E-01
23	1	9.482E+02	2.500E-02	-1.374E+00	2.600E-01
24	1	9.486E+02	2.500E-02	-1.415E+00	2.896E-01
25	1	9.488E+02	2.500E-02	-1.465E+00	3.188E-01
26	1	9.491E+02	2.500E-02	-1.532E+00	3.505E-01
27	1	9.494E+02	2.500E-02	-1.620E+00	3.819E-01
28	1	9.497E+02	2.500E-02	-1.738E+00	4.173E-01
29	1	9.500E+02	2.500E-02	-1.889E+00	4.536E-01
30	1	9.500E+02	2.500E-02	-1.998E+00	4.950E-01
31	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
32	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
33	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
34	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
35	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
36	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
37	2	9.353E+02	9.921E-03	-6.386E-03	9.921E-03
38	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
39	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
40	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
41	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
42	1	9.357E+02	1.250E-02	-6.386E-03	1.250E-02
43	2	9.346E+02	9.921E-03	-6.386E-03	9.921E-03
44	1	9.404E+02	1.575E-02	-6.387E-03	1.575E-02
45	1	9.359E+02	1.250E-02	-6.386E-03	1.250E-02
46	2	9.347E+02	9.921E-03	-6.386E-03	9.921E-03
47	2	9.347E+02	9.921E-03	-6.386E-03	9.921E-03
48	2	9.341E+02	9.921E-03	-6.386E-03	9.921E-03
49	1	9.421E+02	1.984E-02	-6.387E-03	1.984E-02
50	1	9.404E+02	1.575E-02	-6.387E-03	1.575E-02
51	1	9.402E+02	1.575E-02	-6.387E-03	1.575E-02
9.006089E-01	65				
1	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
2	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
3	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
4	1	9.343E+02	1.575E-02	-6.387E-03	1.575E-02
5	1	9.372E+02	1.984E-02	-6.387E-03	1.984E-02
6	1	9.397E+02	2.500E-02	-7.147E-03	2.500E-02
7	1	9.400E+02	2.500E-02	-7.146E-03	2.500E-02
8	1	9.403E+02	2.500E-02	-7.146E-03	2.500E-02
9	1	9.406E+02	2.500E-02	-7.146E-03	2.500E-02
10	1	9.408E+02	2.500E-02	-7.146E-03	2.500E-02
11	1	9.411E+02	2.500E-02	-7.146E-03	2.500E-02
12	1	9.414E+02	2.500E-02	-7.146E-03	2.500E-02
13	1	9.416E+02	2.500E-02	-7.146E-03	2.500E-02
14	1	9.419E+02	2.500E-02	-7.146E-03	2.500E-02
15	1	9.422E+02	2.500E-02	-7.146E-03	2.500E-02
16	1	9.424E+02	2.500E-02	-7.146E-03	2.500E-02
17	1	9.427E+02	2.500E-02	-7.146E-03	2.500E-02
18	1	9.429E+02	2.500E-02	-7.146E-03	2.500E-02
19	1	9.432E+02	2.500E-02	-7.146E-03	2.500E-02
20	1	9.435E+02	2.500E-02	-7.146E-03	2.500E-02
21	1	9.437E+02	2.500E-02	-7.146E-03	2.500E-02
22	1	9.440E+02	2.500E-02	-7.146E-03	2.500E-02
23	1	9.443E+02	2.500E-02	-7.146E-03	2.500E-02

24	1	9.446E+02	2.500E-02	-7.146E-03	2.500E-02
25	1	9.448E+02	2.500E-02	-7.146E-03	2.500E-02
26	1	9.451E+02	2.500E-02	-7.146E-03	2.500E-02
27	1	9.453E+02	2.500E-02	-7.148E-03	2.500E-02
28	1	9.456E+02	2.500E-02	-7.146E-03	2.500E-02
29	1	9.459E+02	2.500E-02	-1.280E+00	3.380E-02
30	1	9.461E+02	2.500E-02	-1.276E+00	6.024E-02
31	1	9.464E+02	2.500E-02	-1.273E+00	8.536E-02
32	1	9.467E+02	2.500E-02	-1.274E+00	1.117E-01
33	1	9.470E+02	2.500E-02	-1.279E+00	1.368E-01
34	1	9.472E+02	2.500E-02	-1.294E+00	1.634E-01
35	1	9.475E+02	2.500E-02	-1.312E+00	1.890E-01
36	1	9.478E+02	2.500E-02	-1.335E+00	2.162E-01
37	1	9.481E+02	2.500E-02	-1.363E+00	2.426E-01
38	1	9.484E+02	2.500E-02	-1.397E+00	2.723E-01
39	1	9.487E+02	2.500E-02	-1.442E+00	2.999E-01
40	1	9.489E+02	2.500E-02	-1.502E+00	3.295E-01
41	1	9.492E+02	2.500E-02	-1.573E+00	3.609E-01
42	1	9.495E+02	2.500E-02	-1.662E+00	3.943E-01
43	1	9.498E+02	2.500E-02	-1.790E+00	4.292E-01
44	1	9.500E+02	2.500E-02	-1.947E+00	4.673E-01
45	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
46	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
47	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
48	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
49	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
50	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
51	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
52	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
53	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
54	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
55	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
56	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
57	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
58	1	9.336E+02	1.575E-02	-6.387E-03	1.575E-02
59	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
60	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
61	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
62	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
63	1	9.367E+02	1.984E-02	-6.387E-03	1.984E-02
64	1	9.336E+02	1.575E-02	-6.387E-03	1.575E-02
65	1	9.330E+02	1.575E-02	-6.387E-03	1.575E-02
1.200117E+00	80				
1	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
2	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
3	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
4	1	9.330E+02	1.575E-02	-6.387E-03	1.575E-02
5	1	9.330E+02	1.984E-02	-6.387E-03	1.984E-02
6	1	9.358E+02	2.500E-02	-7.190E-03	2.500E-02
7	1	9.362E+02	2.500E-02	-7.190E-03	2.500E-02
8	1	9.365E+02	2.500E-02	-7.190E-03	2.500E-02
9	1	9.367E+02	2.500E-02	-7.190E-03	2.500E-02
10	1	9.370E+02	2.500E-02	-7.190E-03	2.500E-02
11	1	9.373E+02	2.500E-02	-7.190E-03	2.500E-02

12	1	9.375E+02	2.500E-02	-7.190E-03	2.500E-02
13	1	9.378E+02	2.500E-02	-7.190E-03	2.500E-02
14	1	9.381E+02	2.500E-02	-7.190E-03	2.500E-02
15	1	9.383E+02	2.500E-02	-7.190E-03	2.500E-02
16	1	9.386E+02	2.500E-02	-7.190E-03	2.500E-02
17	1	9.389E+02	2.500E-02	-7.190E-03	2.500E-02
18	1	9.391E+02	2.500E-02	-7.190E-03	2.500E-02
19	1	9.394E+02	2.500E-02	-7.190E-03	2.500E-02
20	1	9.397E+02	2.500E-02	-7.190E-03	2.500E-02
21	1	9.399E+02	2.500E-02	-7.190E-03	2.500E-02
22	1	9.402E+02	2.500E-02	-7.190E-03	2.500E-02
23	1	9.404E+02	2.500E-02	-7.190E-03	2.500E-02
24	1	9.407E+02	2.500E-02	-7.190E-03	2.500E-02
25	1	9.410E+02	2.500E-02	-7.190E-03	2.500E-02
26	1	9.413E+02	2.500E-02	-7.190E-03	2.500E-02
27	1	9.413E+02	2.500E-02	-7.190E-03	2.500E-02
28	1	9.418E+02	2.500E-02	-7.190E-03	2.500E-02
29	1	9.421E+02	2.500E-02	-7.190E-03	2.500E-02
30	1	9.423E+02	2.500E-02	-7.190E-03	2.500E-02
31	1	9.426E+02	2.500E-02	-7.190E-03	2.500E-02
32	1	9.428E+02	2.500E-02	-7.190E-03	2.500E-02
33	1	9.431E+02	2.500E-02	-7.190E-03	2.500E-02
34	1	9.434E+02	2.500E-02	-7.190E-03	2.500E-02
35	1	9.436E+02	2.500E-02	-7.190E-03	2.500E-02
36	1	9.439E+02	2.500E-02	-7.190E-03	2.500E-02
37	1	9.442E+02	2.500E-02	-7.190E-03	2.500E-02
38	1	9.444E+02	2.500E-02	-7.190E-03	2.500E-02
39	1	9.446E+02	2.500E-02	-7.190E-03	2.500E-02
40	1	9.450E+02	2.500E-02	-7.190E-03	2.500E-02
41	1	9.452E+02	2.500E-02	-7.190E-03	2.500E-02
42	1	9.455E+02	2.500E-02	-7.190E-03	2.500E-02
43	1	9.457E+02	2.500E-02	-7.190E-03	2.500E-02
44	1	9.460E+02	2.500E-02	-1.287E+00	3.678E-02
45	1	9.462E+02	2.500E-02	-1.291E+00	6.530E-02
46	1	9.466E+02	2.500E-02	-1.294E+00	9.026E-02
47	1	9.468E+02	2.500E-02	-1.290E+00	1.149E-01
48	1	9.471E+02	2.500E-02	-1.297E+00	1.414E-01
49	1	9.473E+02	2.500E-02	-1.310E+00	1.691E-01
50	1	9.477E+02	2.500E-02	-1.330E+00	1.969E-01
51	1	9.479E+02	2.500E-02	-1.355E+00	2.225E-01
52	1	9.482E+02	2.500E-02	-1.386E+00	2.516E-01
53	1	9.485E+02	2.500E-02	-1.421E+00	2.808E-01
54	1	9.487E+02	2.500E-02	-1.478E+00	3.099E-01
55	1	9.491E+02	2.500E-02	-1.541E+00	3.395E-01
56	1	9.493E+02	2.500E-02	-1.625E+00	3.725E-01
57	1	9.496E+02	2.500E-02	-1.717E+00	4.072E-01
58	1	9.500E+02	2.500E-02	-1.859E+00	4.447E-01
59	1	9.500E+02	2.500E-02	-1.987E+00	4.831E-01
60	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
61	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
62	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
63	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
64	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
65	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03

66	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
67	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
68	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
69	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
70	4	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
71	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
72	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
73	1	9.330E+02	1.575E-02	-6.386E-03	1.575E-02
74	1	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
75	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
76	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
77	2	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
78	1	9.330E+02	1.984E-02	-6.387E-03	1.984E-02
79	1	9.330E+02	1.575E-02	-6.386E-03	1.575E-02
80	1	9.330E+02	1.575E-02	-6.386E-03	1.575E-02

Table C.44: Gas Mixture Data (std. In-Vessel, no H_2)

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.35511 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.0	0.0
0.35511 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.0	944.9
0.35511 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.0	942.3
0.35511 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.0	947.4
0.35511 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	947.8
0.35511 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	948.4
0.35511 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.0	949.0
0.35511 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	949.4
0.35511 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	949.7
0.35511 s	11	0.14E-07	0.00E+00	(0.23E-04)	373.4	323.0	950.0
0.35511 s	12	0.93E-03	0.00E+00	(0.96E+00)	374.0	323.0	0.0
0.35511 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.35511 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.9291E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.74011 s	2	0.10E-03	0.00E+00	(0.22E+00)	409.8	323.2	939.6
0.74011 s	3	0.12E-04	0.00E+00	(0.25E-01)	384.7	323.1	946.2
0.74011 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.1	946.8
0.74011 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	947.3
0.74011 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	947.9
0.74011 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.1	948.4
0.74011 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	948.9
0.74011 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.4	323.1	949.3
0.74011 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	949.8
0.74011 s	11	0.00E+00	0.00E+00	(0.17E-04)	373.2	323.0	950.0
0.74011 s	12	0.78E-03	0.00E+00	(0.81E+00)	374.0	323.1	950.0
0.74011 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.74011 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.74011 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.74011 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8933E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.01311 s	2	0.10E-03	0.00E+00	(0.22E+00)	402.7	323.4	938.4
1.01311 s	3	0.53E-04	0.00E+00	(0.11E+00)	394.5	323.2	946.4
1.01311 s	4	0.10E-05	0.00E+00	(0.24E-02)	374.2	323.1	947.0
1.01311 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.1	323.1	947.4
1.01311 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.1	947.8
1.01311 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.1	948.4
1.01311 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.7	323.1	948.9
1.01311 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.1	949.4
1.01311 s	10	0.78E-06	0.00E+00	(0.16E-02)	373.4	323.1	949.8
1.01311 s	11	0.51E-04	0.00E+00	(0.11E+00)	373.3	323.0	950.0
1.01311 s	12	0.67E-03	0.00E+00	(0.69E+00)	373.7	323.3	0.0
1.01311 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.01311 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.01311 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.01311 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8875E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.20012 s	2	0.11E-03	0.00E+00	(0.24E+00)	407.9	323.6	937.3
1.20012 s	3	0.65E-04	0.00E+00	(0.13E+00)	397.1	323.3	946.4
1.20012 s	4	0.18E-05	0.00E+00	(0.65E-02)	375.3	323.2	946.9
1.20012 s	5	0.00E+00	0.00E+00	(0.00E+00)	375.0	323.1	947.5
1.20012 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.8	323.1	947.9
1.20012 s	7	0.00E+00	0.00E+00	(0.00E+00)	374.5	323.1	948.3
1.20012 s	8	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.1	948.9
1.20012 s	9	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.1	949.3
1.20012 s	10	0.32E-05	0.00E+00	(0.64E-02)	373.7	323.1	949.8
1.20012 s	11	0.80E-04	0.00E+00	(0.16E+00)	373.5	323.1	950.0
1.20012 s	12	0.60E-03	0.00E+00	(0.62E+00)	373.6	323.4	0.0
1.20012 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.20012 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.20012 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.20012 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8656E-03

-- Gas Mixture Quantity Within Part Injection --

Table C.45: Particle Breakup Data (1150 Tm, no H_2)

```
1Test case for Aluminum Jet MS problem, 1150 Tm, in-vessel ( 08/14/92 )
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00        1
    1           1      1.150E+03  2.500E-02 -2.000E+00  5.050E-01
  3.001137E-01       26
    1           8      1.134E+03  7.875E-03 -6.876E-01  1.504E-01
    2           1      1.142E+03  1.250E-02 -9.505E-01  1.132E-01
    3           1      1.145E+03  1.984E-02 -1.156E+00  1.168E-01
    4           1      1.146E+03  2.500E-02 -1.290E+00  1.385E-01
    5           1      1.147E+03  2.500E-02 -1.315E+00  1.644E-01
    6           1      1.147E+03  2.500E-02 -1.336E+00  1.922E-01
    7           1      1.147E+03  2.500E-02 -1.360E+00  2.191E-01
    8           1      1.148E+03  2.500E-02 -1.391E+00  2.480E-01
    9           1      1.148E+03  2.500E-02 -1.426E+00  2.762E-01
   10           1      1.148E+03  2.500E-02 -1.474E+00  3.067E-01
   11           1      1.149E+03  2.500E-02 -1.532E+00  3.368E-01
   12           1      1.149E+03  2.500E-02 -1.611E+00  3.698E-01
   13           1      1.149E+03  2.500E-02 -1.708E+00  4.030E-01
   14           1      1.150E+03  2.500E-02 -1.844E+00  4.403E-01
   15           1      1.150E+03  2.500E-02 -2.007E+00  4.790E-01
   16           8      1.134E+03  7.875E-03 -6.878E-01  1.705E-01
   17           8      1.134E+03  7.875E-03 -6.879E-01  1.663E-01
   18           8      1.135E+03  7.875E-03 -6.890E-01  1.863E-01
   19           1      1.143E+03  1.250E-02 -9.470E-01  1.333E-01
   20           1      1.143E+03  1.250E-02 -9.476E-01  1.291E-01
   21           1      1.143E+03  1.250E-02 -9.460E-01  1.492E-01
   22           1      1.145E+03  1.984E-02 -1.154E+00  1.367E-01
   23           1      1.143E+03  1.250E-02 -9.485E-01  1.257E-01
   24           1      1.143E+03  1.250E-02 -9.465E-01  1.459E-01
   25           1      1.143E+03  1.250E-02 -9.473E-01  1.416E-01
   26           1      1.143E+03  1.250E-02 -9.455E-01  1.617E-01
  6.001098E-01       51
    1           8      1.108E+03  7.875E-03 -6.386E-03  7.875E-03
    2           4      1.121E+03  7.875E-03 -6.386E-03  7.875E-03
    3           1      1.133E+03  1.250E-02 -6.386E-03  1.250E-02
    4           1      1.138E+03  1.575E-02 -6.387E-03  1.575E-02
    5           1      1.140E+03  1.984E-02 -6.387E-03  1.984E-02
    6           1      1.142E+03  2.500E-02 -6.788E-03  2.500E-02
    7           1      1.142E+03  2.500E-02 -6.788E-03  2.500E-02
    8           1      1.143E+03  2.500E-02 -6.788E-03  2.500E-02
    9           1      1.143E+03  2.500E-02 -6.788E-03  2.500E-02
   10           1      1.143E+03  2.500E-02 -6.788E-03  2.500E-02
   11           1      1.144E+03  2.500E-02 -6.788E-03  2.500E-02
   12           1      1.144E+03  2.500E-02 -6.788E-03  2.500E-02
   13           1      1.144E+03  2.500E-02 -6.788E-03  2.500E-02
   14           1      1.145E+03  2.500E-02 -6.788E-03  2.500E-02
   15           1      1.145E+03  2.500E-02 -1.239E+00  4.437E-02
   16           1      1.145E+03  2.500E-02 -1.243E+00  7.122E-02
   17           1      1.146E+03  2.500E-02 -1.250E+00  9.691E-02
   18           1      1.146E+03  2.500E-02 -1.260E+00  1.241E-01
   19           1      1.146E+03  2.500E-02 -1.273E+00  1.502E-01
   20           1      1.147E+03  2.500E-02 -1.289E+00  1.780E-01
   21           1      1.147E+03  2.500E-02 -1.308E+00  2.048E-01
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22	1	1.147E+03	2.500E-02	-1.333E+00	2.333E-01
23	1	1.148E+03	2.500E-02	-1.363E+00	2.609E-01
24	1	1.148E+03	2.500E-02	-1.405E+00	2.905E-01
25	1	1.149E+03	2.500E-02	-1.455E+00	3.194E-01
26	1	1.149E+03	2.500E-02	-1.526E+00	3.506E-01
27	1	1.149E+03	2.500E-02	-1.612E+00	3.822E-01
28	1	1.150E+03	2.500E-02	-1.731E+00	4.175E-01
29	1	1.150E+03	2.500E-02	-1.884E+00	4.537E-01
30	1	1.150E+03	2.500E-02	-1.996E+00	4.950E-01
31	8	1.108E+03	7.875E-03	-6.386E-03	7.875E-03
32	8	1.108E+03	7.875E-03	-6.386E-03	7.875E-03
33	8	1.107E+03	7.875E-03	-6.386E-03	7.875E-03
34	4	1.120E+03	7.875E-03	-6.386E-03	7.875E-03
35	4	1.120E+03	7.875E-03	-6.386E-03	7.875E-03
36	4	1.120E+03	7.875E-03	-6.386E-03	7.875E-03
37	2	1.132E+03	9.921E-03	-6.386E-03	9.921E-03
38	4	1.120E+03	7.875E-03	-6.386E-03	7.875E-03
39	4	1.120E+03	7.875E-03	-6.386E-03	7.875E-03
40	4	1.120E+03	7.875E-03	-6.386E-03	7.875E-03
41	4	1.119E+03	7.875E-03	-6.386E-03	7.875E-03
42	1	1.132E+03	1.250E-02	-6.386E-03	1.250E-02
43	2	1.131E+03	9.921E-03	-6.386E-03	9.921E-03
44	1	1.138E+03	1.575E-02	-6.387E-03	1.575E-02
45	1	1.132E+03	1.250E-02	-6.386E-03	1.250E-02
46	2	1.131E+03	9.921E-03	-6.386E-03	9.921E-03
47	2	1.131E+03	9.921E-03	-6.386E-03	9.921E-03
48	2	1.130E+03	9.921E-03	-6.386E-03	9.921E-03
49	1	1.140E+03	1.984E-02	-6.387E-03	1.984E-02
50	1	1.138E+03	1.575E-02	-6.387E-03	1.575E-02
51	1	1.138E+03	1.575E-02	-6.387E-03	1.575E-02
9.006105E-01		65			
1	8	1.087E+03	7.875E-03	-6.386E-03	7.875E-03
2	4	1.100E+03	7.875E-03	-6.386E-03	7.875E-03
3	1	1.121E+03	1.250E-02	-6.386E-03	1.250E-02
4	1	1.130E+03	1.575E-02	-6.387E-03	1.575E-02
5	1	1.134E+03	1.984E-02	-6.387E-03	1.984E-02
6	1	1.137E+03	2.500E-02	-7.084E-03	2.500E-02
7	1	1.137E+03	2.500E-02	-7.085E-03	2.500E-02
8	1	1.138E+03	2.500E-02	-7.085E-03	2.500E-02
9	1	1.138E+03	2.500E-02	-7.085E-03	2.500E-02
10	1	1.138E+03	2.500E-02	-7.085E-03	2.500E-02
11	1	1.139E+03	2.500E-02	-7.085E-03	2.500E-02
12	1	1.139E+03	2.500E-02	-7.085E-03	2.500E-02
13	1	1.139E+03	2.500E-02	-7.085E-03	2.500E-02
14	1	1.140E+03	2.500E-02	-7.085E-03	2.500E-02
15	1	1.140E+03	2.500E-02	-7.085E-03	2.500E-02
16	1	1.140E+03	2.500E-02	-7.085E-03	2.500E-02
17	1	1.141E+03	2.500E-02	-7.085E-03	2.500E-02
18	1	1.141E+03	2.500E-02	-7.085E-03	2.500E-02
19	1	1.141E+03	2.500E-02	-7.085E-03	2.500E-02
20	1	1.142E+03	2.500E-02	-7.086E-03	2.500E-02
21	1	1.142E+03	2.500E-02	-7.085E-03	2.500E-02
22	1	1.142E+03	2.500E-02	-7.086E-03	2.500E-02
23	1	1.143E+03	2.500E-02	-7.086E-03	2.500E-02

24	1	1.143E+03	2.500E-02	-7.086E-03	2.500E-02
25	1	1.143E+03	2.500E-02	-7.085E-03	2.500E-02
26	1	1.144E+03	2.500E-02	-7.086E-03	2.500E-02
27	1	1.144E+03	2.500E-02	-7.086E-03	2.500E-02
28	1	1.144E+03	2.500E-02	-7.086E-03	2.500E-02
29	1	1.145E+03	2.500E-02	-1.273E+00	3.404E-02
30	1	1.145E+03	2.500E-02	-1.280E+00	6.014E-02
31	1	1.146E+03	2.500E-02	-1.267E+00	8.512E-02
32	1	1.146E+03	2.500E-02	-1.267E+00	1.112E-01
33	1	1.146E+03	2.500E-02	-1.271E+00	1.359E-01
34	1	1.146E+03	2.500E-02	-1.286E+00	1.613E-01
35	1	1.147E+03	2.500E-02	-1.304E+00	1.882E-01
36	1	1.147E+03	2.500E-02	-1.324E+00	2.155E-01
37	1	1.148E+03	2.500E-02	-1.354E+00	2.419E-01
38	1	1.148E+03	2.500E-02	-1.392E+00	2.699E-01
39	1	1.148E+03	2.500E-02	-1.434E+00	2.983E-01
40	1	1.149E+03	2.500E-02	-1.483E+00	3.298E-01
41	1	1.149E+03	2.500E-02	-1.562E+00	3.604E-01
42	1	1.149E+03	2.500E-02	-1.662E+00	3.938E-01
43	1	1.150E+03	2.500E-02	-1.779E+00	4.286E-01
44	1	1.150E+03	2.500E-02	-1.920E+00	4.673E-01
45	8	1.087E+03	7.875E-03	-6.386E-03	7.875E-03
46	8	1.087E+03	7.875E-03	-6.386E-03	7.875E-03
47	8	1.086E+03	7.875E-03	-6.386E-03	7.875E-03
48	4	1.099E+03	7.875E-03	-6.386E-03	7.875E-03
49	4	1.099E+03	7.875E-03	-6.386E-03	7.875E-03
50	4	1.099E+03	7.875E-03	-6.386E-03	7.875E-03
51	2	1.118E+03	9.921E-03	-6.386E-03	9.921E-03
52	4	1.099E+03	7.875E-03	-6.386E-03	7.875E-03
53	4	1.099E+03	7.875E-03	-6.386E-03	7.875E-03
54	4	1.099E+03	7.875E-03	-6.386E-03	7.875E-03
55	4	1.098E+03	7.875E-03	-6.386E-03	7.875E-03
56	1	1.120E+03	1.250E-02	-6.386E-03	1.250E-02
57	2	1.116E+03	9.921E-03	-6.386E-03	9.921E-03
58	1	1.130E+03	1.575E-02	-6.387E-03	1.575E-02
59	1	1.120E+03	1.250E-02	-6.386E-03	1.250E-02
60	2	1.117E+03	9.921E-03	-6.386E-03	9.921E-03
61	2	1.117E+03	9.921E-03	-6.386E-03	9.921E-03
62	2	1.115E+03	9.921E-03	-6.386E-03	9.921E-03
63	1	1.133E+03	1.984E-02	-6.387E-03	1.984E-02
64	1	1.130E+03	1.575E-02	-6.387E-03	1.575E-02
65	1	1.129E+03	1.575E-02	-6.387E-03	1.575E-02
1.200099E+00	80				
1	8	1.066E+03	7.875E-03	-3.193E-03	7.875E-03
2	4	1.080E+03	7.875E-03	-3.193E-03	7.875E-03
3	1	1.110E+03	1.250E-02	-3.193E-03	1.250E-02
4	1	1.123E+03	1.575E-02	-3.193E-03	1.575E-02
5	1	1.128E+03	1.984E-02	-3.193E-03	1.984E-02
6	1	1.132E+03	2.500E-02	-3.562E-03	2.500E-02
7	1	1.133E+03	2.500E-02	-3.562E-03	2.500E-02
8	1	1.133E+03	2.500E-02	-3.562E-03	2.500E-02
9	1	1.133E+03	2.500E-02	-3.562E-03	2.500E-02
10	1	1.134E+03	2.500E-02	-3.562E-03	2.500E-02
11	1	1.134E+03	2.500E-02	-3.562E-03	2.500E-02

12	1	1.134E+03	2.500E-02	-3.562E-03	2.500E-02
13	1	1.135E+03	2.500E-02	-3.562E-03	2.500E-02
14	1	1.135E+03	2.500E-02	-3.562E-03	2.500E-02
15	1	1.135E+03	2.500E-02	-3.562E-03	2.500E-02
16	1	1.136E+03	2.500E-02	-3.562E-03	2.500E-02
17	1	1.136E+03	2.500E-02	-3.562E-03	2.500E-02
18	1	1.136E+03	2.500E-02	-3.562E-03	2.500E-02
19	1	1.137E+03	2.500E-02	-3.562E-03	2.500E-02
20	1	1.137E+03	2.500E-02	-3.562E-03	2.500E-02
21	1	1.137E+03	2.500E-02	-3.562E-03	2.500E-02
22	1	1.138E+03	2.500E-02	-3.562E-03	2.500E-02
23	1	1.138E+03	2.500E-02	-3.562E-03	2.500E-02
24	1	1.138E+03	2.500E-02	-3.562E-03	2.500E-02
25	1	1.139E+03	2.500E-02	-3.562E-03	2.500E-02
26	1	1.139E+03	2.500E-02	-3.562E-03	2.500E-02
27	1	1.139E+03	2.500E-02	-3.562E-03	2.500E-02
28	1	1.140E+03	2.500E-02	-3.562E-03	2.500E-02
29	1	1.140E+03	2.500E-02	-3.562E-03	2.500E-02
30	1	1.140E+03	2.500E-02	-3.562E-03	2.500E-02
31	1	1.141E+03	2.500E-02	-3.562E-03	2.500E-02
32	1	1.141E+03	2.500E-02	-3.562E-03	2.500E-02
33	1	1.141E+03	2.500E-02	-3.564E-03	2.500E-02
34	1	1.142E+03	2.500E-02	-3.563E-03	2.500E-02
35	1	1.142E+03	2.500E-02	-3.562E-03	2.500E-02
36	1	1.142E+03	2.500E-02	-3.562E-03	2.500E-02
37	1	1.143E+03	2.500E-02	-3.562E-03	2.500E-02
38	1	1.143E+03	2.500E-02	-3.562E-03	2.500E-02
39	1	1.143E+03	2.500E-02	-3.562E-03	2.500E-02
40	1	1.144E+03	2.500E-02	-3.562E-03	2.500E-02
41	1	1.144E+03	2.500E-02	-3.563E-03	2.500E-02
42	1	1.144E+03	2.500E-02	-3.562E-03	2.500E-02
43	1	1.145E+03	2.500E-02	-3.562E-03	2.500E-02
44	1	1.145E+03	2.500E-02	-1.310E+00	3.769E-02
45	1	1.145E+03	2.500E-02	-1.316E+00	6.283E-02
46	1	1.146E+03	2.500E-02	-1.323E+00	8.863E-02
47	1	1.146E+03	2.500E-02	-1.319E+00	1.164E-01
48	1	1.146E+03	2.500E-02	-1.325E+00	1.439E-01
49	1	1.147E+03	2.500E-02	-1.341E+00	1.684E-01
50	1	1.147E+03	2.500E-02	-1.360E+00	1.954E-01
51	1	1.147E+03	2.500E-02	-1.383E+00	2.239E-01
52	1	1.148E+03	2.500E-02	-1.418E+00	2.528E-01
53	1	1.148E+03	2.500E-02	-1.461E+00	2.790E-01
54	1	1.148E+03	2.500E-02	-1.511E+00	3.087E-01
55	1	1.149E+03	2.500E-02	-1.572E+00	3.407E-01
56	1	1.149E+03	2.500E-02	-1.660E+00	3.733E-01
57	1	1.150E+03	2.500E-02	-1.783E+00	4.061E-01
58	1	1.150E+03	2.500E-02	-1.904E+00	4.432E-01
59	1	1.150E+03	2.500E-02	-2.006E+00	4.830E-01
60	8	1.066E+03	7.875E-03	-3.193E-03	7.875E-03
61	8	1.066E+03	7.875E-03	-3.193E-03	7.875E-03
62	8	1.066E+03	7.875E-03	-3.193E-03	7.875E-03
63	4	1.079E+03	7.875E-03	-3.193E-03	7.875E-03
64	4	1.079E+03	7.875E-03	-3.193E-03	7.875E-03
65	4	1.078E+03	7.875E-03	-3.193E-03	7.875E-03

66	2	1.105E+03	9.921E-03	-3.193E-03	9.921E-03
67	4	1.079E+03	7.875E-03	-3.193E-03	7.875E-03
68	4	1.078E+03	7.875E-03	-3.193E-03	7.875E-03
69	4	1.078E+03	7.875E-03	-3.193E-03	7.875E-03
70	4	1.078E+03	7.875E-03	-3.193E-03	7.875E-03
71	1	1.107E+03	1.250E-02	-3.193E-03	1.250E-02
72	2	1.102E+03	9.921E-03	-3.193E-03	9.921E-03
73	1	1.121E+03	1.575E-02	-3.193E-03	1.575E-02
74	1	1.108E+03	1.250E-02	-3.193E-03	1.250E-02
75	2	1.103E+03	9.921E-03	-3.193E-03	9.921E-03
76	2	1.103E+03	9.921E-03	-3.193E-03	9.921E-03
77	2	1.100E+03	9.921E-03	-3.193E-03	9.921E-03
78	1	1.127E+03	1.984E-02	-3.193E-03	1.984E-02
79	1	1.121E+03	1.575E-02	-3.193E-03	1.575E-02
80	1	1.120E+03	1.575E-02	-3.193E-03	1.575E-02

Table C.46: Gas Mixture Data (1150 Tm, no H_2)

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.35511 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.6	323.0	0.0
0.35511 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.4	323.0	1143.6
0.35511 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.3	323.0	1140.5
0.35511 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.0	1146.7
0.35511 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.0	323.0	1147.3
0.35511 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.9	323.0	1148.0
0.35511 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.8	323.0	1148.7
0.35511 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.6	323.0	1149.3
0.35511 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.5	323.0	1149.6
0.35511 s	11	0.14E-07	0.00E+00	(0.23E-04)	373.4	323.0	1150.0
0.35511 s	12	0.93E-03	0.00E+00	(0.96E+00)	374.0	323.0	0.0
0.35511 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.35511 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.35511 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.9293E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.72086 s	2	0.89E-04	0.00E+00	(0.20E+00)	415.0	323.2	1137.2
0.72086 s	3	0.24E-04	0.00E+00	(0.52E-01)	400.4	323.1	1145.2
0.72086 s	4	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	1145.9
0.72086 s	5	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	1146.6
0.72086 s	6	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	1147.3
0.72086 s	7	0.00E+00	0.00E+00	(0.00E+00)	373.3	323.1	1148.0
0.72086 s	8	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	1148.6
0.72086 s	9	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	1149.1
0.72086 s	10	0.00E+00	0.00E+00	(0.00E+00)	373.2	323.1	1149.7
0.72086 s	11	0.37E-05	0.00E+00	(0.76E-02)	373.2	323.0	1150.0
0.72086 s	12	0.77E-03	0.00E+00	(0.80E+00)	373.9	323.1	0.0
0.72086 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
0.72086 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
0.72086 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
0.72086 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8899E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.01936 s	2	0.10E-03	0.00E+00	(0.24E+00)	401.4	323.5	1135.4
1.01936 s	3	0.59E-04	0.00E+00	(0.13E+00)	387.3	323.2	1145.4
1.01936 s	4	0.51E-05	0.00E+00	(0.11E-01)	372.1	323.1	1146.1
1.01936 s	5	0.00E+00	0.00E+00	(0.00E+00)	372.2	323.1	1146.8
1.01936 s	6	0.00E+00	0.00E+00	(0.00E+00)	372.4	323.1	1147.5
1.01936 s	7	0.00E+00	0.00E+00	(0.00E+00)	372.5	323.1	1148.0
1.01936 s	8	0.00E+00	0.00E+00	(0.00E+00)	372.6	323.1	1148.6
1.01936 s	9	0.00E+00	0.00E+00	(0.00E+00)	372.8	323.1	1149.1
1.01936 s	10	0.14E-05	0.00E+00	(0.28E-02)	372.9	323.1	1149.7
1.01936 s	11	0.60E-04	0.00E+00	(0.12E+00)	373.0	323.0	1150.0
1.01936 s	12	0.64E-03	0.00E+00	(0.66E+00)	373.5	323.3	0.0
1.01936 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.01936 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.01936 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.01936 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8676E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.20010 s	2	0.96E-04	0.00E+00	(0.20E+00)	413.8	323.8	1134.2
1.20010 s	3	0.53E-04	0.00E+00	(0.11E+00)	397.7	323.4	1145.5
1.20010 s	4	0.90E-05	0.00E+00	(0.18E-01)	382.3	323.2	1146.2
1.20010 s	5	0.00E+00	0.00E+00	(0.00E+00)	375.0	323.1	1146.9
1.20010 s	6	0.00E+00	0.00E+00	(0.00E+00)	374.7	323.1	1147.4
1.20010 s	7	0.00E+00	0.00E+00	(0.00E+00)	374.5	323.1	1147.9
1.20010 s	8	0.00E+00	0.00E+00	(0.00E+00)	374.2	323.1	1148.6
1.20010 s	9	0.27E-06	0.00E+00	(0.53E-03)	373.9	323.1	1149.2
1.20010 s	10	0.15E-04	0.00E+00	(0.31E-01)	374.7	323.1	1149.7
1.20010 s	11	0.10E-03	0.00E+00	(0.21E+00)	373.4	323.1	1150.0
1.20010 s	12	0.59E-03	0.00E+00	(0.61E+00)	373.7	323.5	0.0
1.20010 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	323.0	0.0
1.20010 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	323.0	0.0
1.20010 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0
1.20010 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	323.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8545E-03

-- Gas Mixture Quantity Within Part Injection --

Table C.47: Particle Breakup Data (373 Tl, no H_2)

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1Test case for Aluminum Jet MS problem, 373 Twater, in-vessel ( 08/15/92 )
 4
 TIMEK-FUELNPTPRPUPXP
  0.000000E+00        1
    1           1     9.500E+02  2.500E-02 -2.000E+00  5.050E-01
  3.001135E-01       22
    1           8     9.430E+02  7.875E-03 -6.826E-01  1.509E-01
    2           2     9.466E+02  1.250E-02 -9.458E-01  1.140E-01
    3           1     9.479E+02  1.984E-02 -1.154E+00  1.177E-01
    4           1     9.483E+02  2.500E-02 -1.287E+00  1.396E-01
    5           1     9.485E+02  2.500E-02 -1.307E+00  1.659E-01
    6           1     9.487E+02  2.500E-02 -1.326E+00  1.938E-01
    7           1     9.488E+02  2.500E-02 -1.348E+00  2.210E-01
    8           1     9.490E+02  2.500E-02 -1.377E+00  2.488E-01
    9           1     9.491E+02  2.500E-02 -1.411E+00  2.777E-01
   10           1     9.493E+02  2.500E-02 -1.456E+00  3.073E-01
   11           1     9.495E+02  2.500E-02 -1.513E+00  3.381E-01
   12           1     9.496E+02  2.500E-02 -1.591E+00  3.699E-01
   13           1     9.498E+02  2.500E-02 -1.691E+00  4.036E-01
   14           1     9.500E+02  2.500E-02 -1.829E+00  4.402E-01
   15           1     9.500E+02  2.500E-02 -1.993E+00  4.795E-01
   16           8     9.430E+02  7.875E-03 -6.725E-01  1.718E-01
   17           8     9.429E+02  7.875E-03 -6.731E-01  1.677E-01
   18           8     9.431E+02  7.875E-03 -6.676E-01  1.885E-01
   19           2     9.467E+02  1.250E-02 -9.396E-01  1.344E-01
   20           1     9.479E+02  1.984E-02 -1.150E+00  1.377E-01
   21           2     9.467E+02  1.250E-02 -9.373E-01  1.470E-01
   22           2     9.466E+02  1.250E-02 -9.430E-01  1.265E-01
  6.001124E-01       42
    1           8     9.330E+02  7.875E-03 -1.597E-03  7.875E-03
    2           8     9.370E+02  7.875E-03 -1.597E-03  7.875E-03
    3           2     9.425E+02  1.250E-02 -1.597E-03  1.250E-02
    4           1     9.451E+02  1.984E-02 -1.597E-03  1.984E-02
    5           1     9.459E+02  1.984E-02 -1.597E-03  1.984E-02
    6           1     9.465E+02  2.500E-02 -1.732E-03  2.500E-02
    7           1     9.466E+02  2.500E-02 -1.732E-03  2.500E-02
    8           1     9.468E+02  2.500E-02 -1.732E-03  2.500E-02
    9           1     9.469E+02  2.500E-02 -1.732E-03  2.500E-02
   10           1     9.471E+02  2.500E-02 -1.732E-03  2.500E-02
   11           1     9.472E+02  2.500E-02 -1.732E-03  2.500E-02
   12           1     9.473E+02  2.500E-02 -1.732E-03  2.500E-02
   13           1     9.475E+02  2.500E-02 -1.732E-03  2.500E-02
   14           1     9.476E+02  2.500E-02 -1.732E-03  2.500E-02
   15           1     9.478E+02  2.500E-02 -1.270E+00  4.880E-02
   16           1     9.479E+02  2.500E-02 -1.271E+00  7.468E-02
   17           1     9.481E+02  2.500E-02 -1.276E+00  1.011E-01
   18           1     9.483E+02  2.500E-02 -1.282E+00  1.276E-01
   19           1     9.484E+02  2.500E-02 -1.291E+00  1.547E-01
   20           1     9.486E+02  2.500E-02 -1.304E+00  1.810E-01
   21           1     9.487E+02  2.500E-02 -1.321E+00  2.080E-01
   22           1     9.489E+02  2.500E-02 -1.343E+00  2.354E-01
   23           1     9.490E+02  2.500E-02 -1.371E+00  2.633E-01
   24           1     9.492E+02  2.500E-02 -1.408E+00  2.920E-01
   25           1     9.494E+02  2.500E-02 -1.456E+00  3.218E-01
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26	1	9.495E+02	2.500E-02	-1.518E+00	3.521E-01
27	1	9.497E+02	2.500E-02	-1.599E+00	3.846E-01
28	1	9.498E+02	2.500E-02	-1.704E+00	4.181E-01
29	1	9.500E+02	2.500E-02	-1.847E+00	4.545E-01
30	1	9.500E+02	2.500E-02	-1.980E+00	4.945E-01
31	8	9.330E+02	7.875E-03	-1.597E-03	7.875E-03
32	8	9.330E+02	7.875E-03	-1.597E-03	7.875E-03
33	8	9.330E+02	7.875E-03	-1.597E-03	7.875E-03
34	8	9.366E+02	7.875E-03	-1.597E-03	7.875E-03
35	4	9.419E+02	9.921E-03	-1.597E-03	9.921E-03
36	8	9.363E+02	7.875E-03	-1.597E-03	7.875E-03
37	8	9.368E+02	7.875E-03	-1.597E-03	7.875E-03
38	4	9.415E+02	9.921E-03	-1.597E-03	9.921E-03
39	2	9.422E+02	1.250E-02	-1.597E-03	1.250E-02
40	1	9.448E+02	1.575E-02	-1.597E-03	1.575E-02
41	1	9.446E+02	1.575E-02	-1.597E-03	1.575E-02
42	1	9.458E+02	1.984E-02	-1.597E-03	1.984E-02
9.003734E-01		56			
1	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
2	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
3	2	9.376E+02	1.250E-02	-3.193E-03	1.250E-02
4	1	9.420E+02	1.984E-02	-3.193E-03	1.984E-02
5	1	9.433E+02	1.984E-02	-3.193E-03	1.984E-02
6	1	9.445E+02	2.500E-02	-3.545E-03	2.500E-02
7	1	9.446E+02	2.500E-02	-3.545E-03	2.500E-02
8	1	9.448E+02	2.500E-02	-3.545E-03	2.500E-02
9	1	9.449E+02	2.500E-02	-3.545E-03	2.500E-02
10	1	9.451E+02	2.500E-02	-3.545E-03	2.500E-02
11	1	9.452E+02	2.500E-02	-3.545E-03	2.500E-02
12	1	9.453E+02	2.500E-02	-3.545E-03	2.500E-02
13	1	9.455E+02	2.500E-02	-3.545E-03	2.500E-02
14	1	9.456E+02	2.500E-02	-3.545E-03	2.500E-02
15	1	9.458E+02	2.500E-02	-3.545E-03	2.500E-02
16	1	9.459E+02	2.500E-02	-3.545E-03	2.500E-02
17	1	9.460E+02	2.500E-02	-3.545E-03	2.500E-02
18	1	9.462E+02	2.500E-02	-3.545E-03	2.500E-02
19	1	9.463E+02	2.500E-02	-3.545E-03	2.500E-02
20	1	9.465E+02	2.500E-02	-3.545E-03	2.500E-02
21	1	9.466E+02	2.500E-02	-3.545E-03	2.500E-02
22	1	9.467E+02	2.500E-02	-3.545E-03	2.500E-02
23	1	9.469E+02	2.500E-02	-3.545E-03	2.500E-02
24	1	9.470E+02	2.500E-02	-3.545E-03	2.500E-02
25	1	9.472E+02	2.500E-02	-3.545E-03	2.500E-02
26	1	9.473E+02	2.500E-02	-3.545E-03	2.500E-02
27	1	9.474E+02	2.500E-02	-3.545E-03	2.500E-02
28	1	9.476E+02	2.500E-02	-3.545E-03	2.500E-02
29	1	9.477E+02	2.500E-02	-1.355E+00	2.819E-02
30	1	9.479E+02	2.500E-02	-1.365E+00	5.539E-02
31	1	9.480E+02	2.500E-02	-1.366E+00	8.253E-02
32	1	9.482E+02	2.500E-02	-1.349E+00	1.101E-01
33	1	9.483E+02	2.500E-02	-1.341E+00	1.371E-01
34	1	9.485E+02	2.500E-02	-1.332E+00	1.643E-01
35	1	9.486E+02	2.500E-02	-1.334E+00	1.916E-01
36	1	9.488E+02	2.500E-02	-1.349E+00	2.192E-01

37	1	9.490E+02	2.500E-02	-1.371E+00	2.467E-01
38	1	9.491E+02	2.500E-02	-1.399E+00	2.750E-01
39	1	9.493E+02	2.500E-02	-1.435E+00	3.044E-01
40	1	9.494E+02	2.500E-02	-1.483E+00	3.344E-01
41	1	9.496E+02	2.500E-02	-1.545E+00	3.653E-01
42	1	9.498E+02	2.500E-02	-1.624E+00	3.978E-01
43	1	9.499E+02	2.500E-02	-1.729E+00	4.322E-01
44	1	9.500E+02	2.500E-02	-1.873E+00	4.691E-01
45	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
46	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
47	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
48	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
49	4	9.361E+02	9.921E-03	-3.193E-03	9.921E-03
50	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
51	8	9.330E+02	7.875E-03	-3.193E-03	7.875E-03
52	4	9.354E+02	9.921E-03	-3.193E-03	9.921E-03
53	2	9.369E+02	1.250E-02	-3.193E-03	1.250E-02
54	1	9.413E+02	1.575E-02	-3.193E-03	1.575E-02
55	1	9.409E+02	1.575E-02	-3.193E-03	1.575E-02
56	1	9.430E+02	1.984E-02	-3.193E-03	1.984E-02
1.200378E+00	71				
1	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
2	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
3	2	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
4	1	9.390E+02	1.984E-02	-6.387E-03	1.984E-02
5	1	9.408E+02	1.984E-02	-6.387E-03	1.984E-02
6	1	9.426E+02	2.500E-02	-7.145E-03	2.500E-02
7	1	9.427E+02	2.500E-02	-7.145E-03	2.500E-02
8	1	9.428E+02	2.500E-02	-7.145E-03	2.500E-02
9	1	9.430E+02	2.500E-02	-7.145E-03	2.500E-02
10	1	9.431E+02	2.500E-02	-7.145E-03	2.500E-02
11	1	9.432E+02	2.500E-02	-7.145E-03	2.500E-02
12	1	9.434E+02	2.500E-02	-7.145E-03	2.500E-02
13	1	9.435E+02	2.500E-02	-7.145E-03	2.500E-02
14	1	9.436E+02	2.500E-02	-7.145E-03	2.500E-02
15	1	9.438E+02	2.500E-02	-7.145E-03	2.500E-02
16	1	9.439E+02	2.500E-02	-7.145E-03	2.500E-02
17	1	9.441E+02	2.500E-02	-7.145E-03	2.500E-02
18	1	9.442E+02	2.500E-02	-7.145E-03	2.500E-02
19	1	9.443E+02	2.500E-02	-7.145E-03	2.500E-02
20	1	9.445E+02	2.500E-02	-7.145E-03	2.500E-02
21	1	9.446E+02	2.500E-02	-7.145E-03	2.500E-02
22	1	9.448E+02	2.500E-02	-7.145E-03	2.500E-02
23	1	9.449E+02	2.500E-02	-7.145E-03	2.500E-02
24	1	9.450E+02	2.500E-02	-7.145E-03	2.500E-02
25	1	9.452E+02	2.500E-02	-7.145E-03	2.500E-02
26	1	9.453E+02	2.500E-02	-7.145E-03	2.500E-02
27	1	9.455E+02	2.500E-02	-7.145E-03	2.500E-02
28	1	9.456E+02	2.500E-02	-7.145E-03	2.500E-02
29	1	9.457E+02	2.500E-02	-7.145E-03	2.500E-02
30	1	9.459E+02	2.500E-02	-7.145E-03	2.500E-02
31	1	9.460E+02	2.500E-02	-7.145E-03	2.500E-02
32	1	9.461E+02	2.500E-02	-7.145E-03	2.500E-02
33	1	9.463E+02	2.500E-02	-7.145E-03	2.500E-02

34	1	9.464E+02	2.500E-02	-7.145E-03	2.500E-02
35	1	9.465E+02	2.500E-02	-7.145E-03	2.500E-02
36	1	9.467E+02	2.500E-02	-7.145E-03	2.500E-02
37	1	9.468E+02	2.500E-02	-7.145E-03	2.500E-02
38	1	9.470E+02	2.500E-02	-7.145E-03	2.500E-02
39	1	9.471E+02	2.500E-02	-7.145E-03	2.500E-02
40	1	9.472E+02	2.500E-02	-7.145E-03	2.500E-02
41	1	9.474E+02	2.500E-02	-7.145E-03	2.500E-02
42	1	9.475E+02	2.500E-02	-7.145E-03	2.500E-02
43	1	9.476E+02	2.500E-02	-7.145E-03	2.500E-02
44	1	9.478E+02	2.500E-02	-7.145E-03	2.500E-02
45	1	9.479E+02	2.500E-02	-1.425E+00	5.237E-02
46	1	9.481E+02	2.500E-02	-1.455E+00	8.094E-02
47	1	9.482E+02	2.500E-02	-1.456E+00	1.095E-01
48	1	9.484E+02	2.500E-02	-1.459E+00	1.385E-01
49	1	9.486E+02	2.500E-02	-1.461E+00	1.675E-01
50	1	9.487E+02	2.500E-02	-1.462E+00	1.962E-01
51	1	9.489E+02	2.500E-02	-1.465E+00	2.260E-01
52	1	9.490E+02	2.500E-02	-1.472E+00	2.550E-01
53	1	9.492E+02	2.500E-02	-1.484E+00	2.842E-01
54	1	9.493E+02	2.500E-02	-1.494E+00	3.154E-01
55	1	9.495E+02	2.500E-02	-1.527E+00	3.456E-01
56	1	9.497E+02	2.500E-02	-1.582E+00	3.774E-01
57	1	9.498E+02	2.500E-02	-1.663E+00	4.105E-01
58	1	9.500E+02	2.500E-02	-1.773E+00	4.466E-01
59	1	9.500E+02	2.500E-02	-1.912E+00	4.835E-01
60	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
61	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
62	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
63	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
64	4	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
65	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
66	8	9.330E+02	7.875E-03	-6.386E-03	7.875E-03
67	4	9.330E+02	9.921E-03	-6.386E-03	9.921E-03
68	2	9.330E+02	1.250E-02	-6.386E-03	1.250E-02
69	1	9.378E+02	1.575E-02	-6.386E-03	1.575E-02
70	1	9.373E+02	1.575E-02	-6.386E-03	1.575E-02
71	1	9.404E+02	1.984E-02	-6.387E-03	1.984E-02

Table C.48: Gas MIxture Data (373 Tl, no H_2)

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.20061 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.5	373.0	0.0
0.20061 s	3	0.00E+00	0.00E+00	(0.00E+00)	374.3	373.0	0.0
0.20061 s	4	0.00E+00	0.00E+00	(0.00E+00)	374.2	373.0	0.0
0.20061 s	5	0.00E+00	0.00E+00	(0.00E+00)	374.1	373.0	0.0
0.20061 s	6	0.16E-05	0.00E+00	(0.32E-02)	373.9	373.0	948.2
0.20061 s	7	0.68E-05	0.00E+00	(0.14E-01)	373.8	373.0	948.6
0.20061 s	8	0.68E-05	0.00E+00	(0.14E-01)	373.6	373.0	949.4
0.20061 s	9	0.71E-05	0.00E+00	(0.14E-01)	373.6	373.0	949.7
0.20061 s	10	0.73E-05	0.00E+00	(0.15E-01)	373.4	373.0	949.9
0.20061 s	11	0.29E-06	0.00E+00	(0.88E-03)	373.3	373.0	950.0
0.20061 s	12	0.92E-03	0.00E+00	(0.95E+00)	374.0	373.0	0.0
0.20061 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
0.20061 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.20061 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0
0.20061 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.9511E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.32911 s	2	0.00E+00	0.00E+00	(0.00E+00)	374.5	373.0	0.0
0.32911 s	3	0.65E-06	0.00E+00	(0.13E-02)	374.3	373.0	946.7
0.32911 s	4	0.79E-05	0.00E+00	(0.16E-01)	374.2	373.0	946.8
0.32911 s	5	0.16E-04	0.00E+00	(0.34E-01)	392.3	373.0	947.1
0.32911 s	6	0.14E-04	0.00E+00	(0.30E-01)	389.5	373.0	948.8
0.32911 s	7	0.13E-04	0.00E+00	(0.28E-01)	385.4	373.0	949.2
0.32911 s	8	0.13E-04	0.00E+00	(0.27E-01)	387.4	373.0	949.4
0.32911 s	9	0.13E-04	0.00E+00	(0.26E-01)	384.0	373.0	949.6
0.32911 s	10	0.12E-04	0.00E+00	(0.26E-01)	385.0	373.0	949.9
0.32911 s	11	0.14E-05	0.00E+00	(0.38E-02)	373.2	373.0	950.0
0.32911 s	12	0.84E-03	0.00E+00	(0.87E+00)	374.0	373.0	950.0
0.32911 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
0.32911 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.32911 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0
0.32911 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.9311E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.49761 s	2	0.31E-04	0.00E+00	(0.68E-01)	405.7	373.0	945.1
0.49761 s	3	0.27E-04	0.00E+00	(0.57E-01)	399.4	373.0	946.5
0.49761 s	4	0.26E-04	0.00E+00	(0.55E-01)	399.9	373.0	948.2
0.49761 s	5	0.25E-04	0.00E+00	(0.53E-01)	397.1	373.0	948.5
0.49761 s	6	0.23E-04	0.00E+00	(0.49E-01)	396.4	373.0	948.8
0.49761 s	7	0.21E-04	0.00E+00	(0.45E-01)	393.7	373.0	949.1
0.49761 s	8	0.20E-04	0.00E+00	(0.44E-01)	394.9	373.0	949.4
0.49761 s	9	0.20E-04	0.00E+00	(0.42E-01)	392.5	373.0	949.6
0.49761 s	10	0.19E-04	0.00E+00	(0.41E-01)	392.9	373.0	949.8
0.49761 s	11	0.56E-05	0.00E+00	(0.12E-01)	373.3	373.0	950.0
0.49761 s	12	0.69E-03	0.00E+00	(0.72E+00)	374.0	373.0	0.0
0.49761 s	13	0.97E-03	0.00E+00	(0.10E+01)	373.5	373.0	0.0
0.49761 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.49761 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.49761 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.9129E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.63886 s	2	0.91E-04	0.00E+00	(0.20E+00)	411.4	373.0	944.5
0.63886 s	3	0.39E-04	0.00E+00	(0.84E-01)	403.2	373.0	947.9
0.63886 s	4	0.33E-04	0.00E+00	(0.71E-01)	401.3	373.0	948.2
0.63886 s	5	0.32E-04	0.00E+00	(0.68E-01)	399.5	373.0	948.5
0.63886 s	6	0.30E-04	0.00E+00	(0.64E-01)	398.8	373.0	948.8
0.63886 s	7	0.28E-04	0.00E+00	(0.60E-01)	397.1	373.0	949.1
0.63886 s	8	0.27E-04	0.00E+00	(0.58E-01)	397.4	373.0	949.4
0.63886 s	9	0.26E-04	0.00E+00	(0.56E-01)	396.2	373.0	949.6
0.63886 s	10	0.25E-04	0.00E+00	(0.54E-01)	395.6	373.0	949.9
0.63886 s	11	0.98E-05	0.00E+00	(0.20E-01)	373.4	373.0	950.0
0.63886 s	12	0.56E-03	0.00E+00	(0.58E+00)	374.0	373.0	0.0
0.63886 s	13	0.96E-03	0.00E+00	(0.10E+01)	373.5	373.0	0.0
0.63886 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.63886 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.63886 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.8961E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
0.84787 s	2	0.10E-03	0.00E+00	(0.22E+00)	406.6	373.0	944.2
0.84787 s	3	0.10E-03	0.00E+00	(0.21E+00)	394.6	373.0	948.0
0.84787 s	4	0.83E-04	0.00E+00	(0.18E+00)	397.8	373.0	948.3
0.84787 s	5	0.45E-04	0.00E+00	(0.96E-01)	400.9	373.0	948.5
0.84787 s	6	0.40E-04	0.00E+00	(0.86E-01)	400.9	373.0	948.8
0.84787 s	7	0.38E-04	0.00E+00	(0.82E-01)	399.8	373.0	949.1
0.84787 s	8	0.36E-04	0.00E+00	(0.79E-01)	399.7	373.0	949.4
0.84787 s	9	0.35E-04	0.00E+00	(0.76E-01)	399.2	373.0	949.6
0.84787 s	10	0.33E-04	0.00E+00	(0.73E-01)	397.1	373.0	949.8
0.84787 s	11	0.17E-04	0.00E+00	(0.35E-01)	373.4	373.0	950.0
0.84787 s	12	0.35E-03	0.00E+00	(0.36E+00)	373.7	373.0	0.0
0.84787 s	13	0.96E-03	0.00E+00	(0.10E+01)	373.6	373.0	0.0
0.84787 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
0.84787 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
0.84787 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols

H2	0.0000E+00
Gas-Mix	0.8839E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

		Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.08938 s	2	0.10E-03	0.00E+00	(0.22E+00)	399.8	373.1	943.6
1.08938 s	3	0.11E-03	0.00E+00	(0.22E+00)	389.1	373.0	948.1
1.08938 s	4	0.10E-03	0.00E+00	(0.22E+00)	383.6	373.0	948.3
1.08938 s	5	0.11E-03	0.00E+00	(0.22E+00)	382.5	373.0	948.5
1.08938 s	6	0.11E-03	0.00E+00	(0.22E+00)	387.6	373.0	948.8
1.08938 s	7	0.59E-04	0.00E+00	(0.13E+00)	398.3	373.0	949.2
1.08938 s	8	0.47E-04	0.00E+00	(0.10E+00)	401.5	373.0	949.4
1.08938 s	9	0.45E-04	0.00E+00	(0.98E-01)	400.1	373.0	949.6
1.08938 s	10	0.43E-04	0.00E+00	(0.95E-01)	400.2	373.0	949.9
1.08938 s	11	0.25E-04	0.00E+00	(0.52E-01)	373.4	373.0	950.0
1.08938 s	12	0.18E-03	0.00E+00	(0.19E+00)	374.7	373.0	950.0
1.08938 s	13	0.90E-03	0.00E+00	(0.94E+00)	373.6	373.0	0.0
1.08938 s	14	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
1.08938 s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
1.08938 s	16	0.97E-03	0.00E+00	(0.10E+01)	373.2	373.0	0.0

	Kg-mols

H2	0.0000E+00

Gas-Mix 0.9284E-03

-- Gas Mixture Quantity Within Part Injection --

TEXAS H2 Generation - Aluminum Melt/Jet

			Moles Gas	Moles H2	Gas Void	Tgas	Tliq	Tpart
1.20038	s	2	0.11E-03	0.00E+00	(0.22E+00)	398.9	373.1	943.3
1.20038	s	3	0.10E-03	0.00E+00	(0.21E+00)	388.5	373.1	948.0
1.20038	s	4	0.10E-03	0.00E+00	(0.21E+00)	382.8	373.0	948.3
1.20038	s	5	0.10E-03	0.00E+00	(0.21E+00)	380.1	373.0	948.6
1.20038	s	6	0.11E-03	0.00E+00	(0.22E+00)	379.8	373.0	948.9
1.20038	s	7	0.11E-03	0.00E+00	(0.24E+00)	383.3	373.0	949.1
1.20038	s	8	0.77E-04	0.00E+00	(0.17E+00)	394.7	373.0	949.4
1.20038	s	9	0.51E-04	0.00E+00	(0.11E+00)	400.1	373.0	949.7
1.20038	s	10	0.48E-04	0.00E+00	(0.10E+00)	401.7	373.0	949.9
1.20038	s	11	0.29E-04	0.00E+00	(0.60E-01)	373.5	373.0	950.0
1.20038	s	12	0.17E-03	0.00E+00	(0.18E+00)	374.9	373.0	0.0
1.20038	s	13	0.82E-03	0.00E+00	(0.85E+00)	373.6	373.0	0.0
1.20038	s	14	0.97E-03	0.00E+00	(0.10E+01)	373.4	373.0	0.0
1.20038	s	15	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0
1.20038	s	16	0.97E-03	0.00E+00	(0.10E+01)	373.3	373.0	0.0

	Kg-mols
H2	0.0000E+00
Gas-Mix	0.1009E-02

-- Gas Mixture Quantity Within Part Injection --

Appendix D (no hydrogen cases, Ex-Vessel)

Table	Explanation
D.1	Particle Breakup Data (Titan, inlet velocity 2 m/s)
D.2	Particle Breakup Data (CRAY-XMP, inlet vel 2 m/s)
D.3	Particle Breakup Data (CRAY-XMP, inlet vel 14 m/s)
D.4	Mixed Mass Melt and SMD Calculations

Table D.1: Particle Breakup Data (Titan, inlet velocity 2 m/s)

```
1Test case for Aluminum Jet MS problem, ex-vessel , HP ( 08/20/92 )
 4
 timek-fuelnptprpupxp
  0.000000E+00       1
    1          1     1.470E+03  3.000E-01 -2.000E+00  2.200E+00
  1.501140E-01       9
    1          1     1.470E+03  3.000E-01 -2.923E+00  1.816E+00
    2          1     1.470E+03  3.000E-01 -2.864E+00  1.869E+00
    3          1     1.470E+03  3.000E-01 -2.793E+00  1.920E+00
    4          1     1.470E+03  3.000E-01 -2.703E+00  1.969E+00
    5          1     1.470E+03  3.000E-01 -2.612E+00  2.017E+00
    6          1     1.470E+03  3.000E-01 -2.518E+00  2.063E+00
    7          1     1.470E+03  3.000E-01 -2.410E+00  2.108E+00
    8          1     1.470E+03  3.000E-01 -2.234E+00  2.149E+00
    9          1     1.470E+03  3.000E-01 -2.058E+00  2.188E+00
  3.001140E-01      17
    1          4     1.470E+03  1.890E-01 -3.149E+00  1.356E+00
    2          2     1.470E+03  2.381E-01 -3.127E+00  1.414E+00
    3          2     1.470E+03  2.381E-01 -3.101E+00  1.471E+00
    4          2     1.470E+03  2.381E-01 -3.076E+00  1.528E+00
    5          2     1.470E+03  2.381E-01 -3.052E+00  1.584E+00
    6          2     1.470E+03  2.381E-01 -3.024E+00  1.639E+00
    7          2     1.470E+03  2.381E-01 -2.994E+00  1.694E+00
    8          1     1.470E+03  3.000E-01 -2.951E+00  1.748E+00
    9          1     1.470E+03  3.000E-01 -2.903E+00  1.801E+00
   10          1     1.470E+03  3.000E-01 -2.850E+00  1.853E+00
   11          1     1.470E+03  3.000E-01 -2.791E+00  1.905E+00
   12          1     1.470E+03  3.000E-01 -2.705E+00  1.954E+00
   13          1     1.470E+03  3.000E-01 -2.617E+00  2.002E+00
   14          1     1.470E+03  3.000E-01 -2.527E+00  2.049E+00
   15          1     1.470E+03  3.000E-01 -2.435E+00  2.093E+00
   16          1     1.470E+03  3.000E-01 -2.279E+00  2.136E+00
   17          1     1.470E+03  3.000E-01 -2.111E+00  2.175E+00
  4.501140E-01      26
    1         16     1.469E+03  1.191E-01 -2.978E+00  8.908E-01
    2          8     1.469E+03  1.500E-01 -2.994E+00  9.502E-01
    3          8     1.469E+03  1.500E-01 -3.008E+00  1.009E+00
    4          8     1.469E+03  1.500E-01 -3.019E+00  1.066E+00
    5          8     1.469E+03  1.500E-01 -3.028E+00  1.124E+00
    6          4     1.469E+03  1.890E-01 -3.041E+00  1.180E+00
    7          4     1.469E+03  1.890E-01 -3.051E+00  1.237E+00
    8          4     1.470E+03  1.890E-01 -3.056E+00  1.293E+00
    9          4     1.470E+03  1.890E-01 -3.060E+00  1.349E+00
   10          4     1.470E+03  1.890E-01 -3.057E+00  1.405E+00
   11          2     1.470E+03  2.381E-01 -3.049E+00  1.461E+00
   12          2     1.470E+03  2.381E-01 -3.036E+00  1.517E+00
   13          2     1.470E+03  2.381E-01 -3.020E+00  1.572E+00
   14          2     1.470E+03  2.381E-01 -2.998E+00  1.627E+00
   15          2     1.470E+03  2.381E-01 -2.971E+00  1.681E+00
   16          1     1.470E+03  3.000E-01 -2.932E+00  1.735E+00
   17          1     1.470E+03  3.000E-01 -2.885E+00  1.788E+00
   18          1     1.470E+03  3.000E-01 -2.832E+00  1.840E+00
   19          1     1.470E+03  3.000E-01 -2.774E+00  1.891E+00
   20          1     1.470E+03  3.000E-01 -2.698E+00  1.940E+00
```

21	1	1.470E+03	3.000E-01	-2.614E+00	1.988E+00
22	1	1.470E+03	3.000E-01	-2.528E+00	2.035E+00
23	1	1.470E+03	3.000E-01	-2.439E+00	2.080E+00
24	1	1.470E+03	3.000E-01	-2.315E+00	2.122E+00
25	1	1.470E+03	3.000E-01	-2.157E+00	2.163E+00
26	1	1.470E+03	3.000E-01	-2.000E+00	2.200E+00
6.001140E-01		34			
1	64	1.468E+03	7.500E-02	-2.437E+00	4.801E-01
2	64	1.468E+03	7.500E-02	-2.496E+00	5.340E-01
3	64	1.468E+03	7.500E-02	-2.555E+00	5.873E-01
4	32	1.468E+03	9.449E-02	-2.607E+00	6.401E-01
5	32	1.469E+03	9.449E-02	-2.658E+00	6.925E-01
6	32	1.469E+03	9.449E-02	-2.709E+00	7.446E-01
7	16	1.469E+03	1.191E-01	-2.767E+00	7.959E-01
8	16	1.469E+03	1.191E-01	-2.813E+00	8.482E-01
9	16	1.469E+03	1.191E-01	-2.858E+00	9.007E-01
10	8	1.469E+03	1.500E-01	-2.896E+00	9.541E-01
11	8	1.469E+03	1.500E-01	-2.932E+00	1.008E+00
12	8	1.469E+03	1.500E-01	-2.963E+00	1.062E+00
13	8	1.469E+03	1.500E-01	-2.988E+00	1.117E+00
14	4	1.469E+03	1.890E-01	-3.007E+00	1.172E+00
15	4	1.469E+03	1.890E-01	-3.022E+00	1.228E+00
16	4	1.469E+03	1.890E-01	-3.030E+00	1.283E+00
17	4	1.470E+03	1.890E-01	-3.035E+00	1.339E+00
18	4	1.470E+03	1.890E-01	-3.033E+00	1.395E+00
19	2	1.470E+03	2.381E-01	-3.025E+00	1.450E+00
20	2	1.470E+03	2.381E-01	-3.012E+00	1.505E+00
21	2	1.470E+03	2.381E-01	-2.996E+00	1.560E+00
22	2	1.470E+03	2.381E-01	-2.976E+00	1.615E+00
23	2	1.470E+03	2.381E-01	-2.949E+00	1.669E+00
24	2	1.470E+03	2.381E-01	-2.912E+00	1.722E+00
25	1	1.470E+03	3.000E-01	-2.865E+00	1.775E+00
26	1	1.470E+03	3.000E-01	-2.813E+00	1.827E+00
27	1	1.470E+03	3.000E-01	-2.756E+00	1.877E+00
28	1	1.470E+03	3.000E-01	-2.687E+00	1.927E+00
29	1	1.470E+03	3.000E-01	-2.607E+00	1.975E+00
30	1	1.470E+03	3.000E-01	-2.525E+00	2.021E+00
31	1	1.470E+03	3.000E-01	-2.440E+00	2.066E+00
32	1	1.470E+03	3.000E-01	-2.342E+00	2.109E+00
33	1	1.470E+03	3.000E-01	-2.195E+00	2.150E+00
34	1	1.470E+03	3.000E-01	-2.049E+00	2.188E+00

Table D.2: Particle Breakup Data (CRAY-XMP, inlet vel 2 m/s)

```
1Test case for Aluminum Jet MS problem, ex-vessel , HP ( 08/20/92 )
 4
 timek-fuelnptprpupxp
  0.000000E+00        1
    1           1     1.470E+03  3.000E-01 -2.000E+00  2.200E+00
  1.501140E-01        9
    1           1     1.470E+03  3.000E-01 -2.923E+00  1.816E+00
    2           1     1.470E+03  3.000E-01 -2.864E+00  1.869E+00
    3           1     1.470E+03  3.000E-01 -2.793E+00  1.920E+00
    4           1     1.470E+03  3.000E-01 -2.703E+00  1.969E+00
    5           1     1.470E+03  3.000E-01 -2.612E+00  2.017E+00
    6           1     1.470E+03  3.000E-01 -2.518E+00  2.063E+00
    7           1     1.470E+03  3.000E-01 -2.410E+00  2.108E+00
    8           1     1.470E+03  3.000E-01 -2.234E+00  2.149E+00
    9           1     1.470E+03  3.000E-01 -2.058E+00  2.188E+00
  3.001140E-01       17
    1           4     1.470E+03  1.890E-01 -3.149E+00  1.356E+00
    2           2     1.470E+03  2.381E-01 -3.127E+00  1.414E+00
    3           2     1.470E+03  2.381E-01 -3.101E+00  1.471E+00
    4           2     1.470E+03  2.381E-01 -3.076E+00  1.528E+00
    5           2     1.470E+03  2.381E-01 -3.052E+00  1.584E+00
    6           2     1.470E+03  2.381E-01 -3.024E+00  1.639E+00
    7           2     1.470E+03  2.381E-01 -2.994E+00  1.694E+00
    8           1     1.470E+03  3.000E-01 -2.951E+00  1.748E+00
    9           1     1.470E+03  3.000E-01 -2.903E+00  1.801E+00
   10           1     1.470E+03  3.000E-01 -2.850E+00  1.853E+00
   11           1     1.470E+03  3.000E-01 -2.791E+00  1.905E+00
   12           1     1.470E+03  3.000E-01 -2.705E+00  1.954E+00
   13           1     1.470E+03  3.000E-01 -2.617E+00  2.002E+00
   14           1     1.470E+03  3.000E-01 -2.527E+00  2.049E+00
   15           1     1.470E+03  3.000E-01 -2.435E+00  2.093E+00
   16           1     1.470E+03  3.000E-01 -2.279E+00  2.136E+00
   17           1     1.470E+03  3.000E-01 -2.111E+00  2.175E+00
  4.501140E-01       26
    1          16     1.469E+03  1.191E-01 -2.978E+00  8.908E-01
    2           8     1.469E+03  1.500E-01 -2.994E+00  9.502E-01
    3           8     1.469E+03  1.500E-01 -3.008E+00  1.009E+00
    4           8     1.469E+03  1.500E-01 -3.019E+00  1.066E+00
    5           8     1.469E+03  1.500E-01 -3.028E+00  1.124E+00
    6           4     1.469E+03  1.890E-01 -3.041E+00  1.180E+00
    7           4     1.469E+03  1.890E-01 -3.051E+00  1.237E+00
    8           4     1.470E+03  1.890E-01 -3.056E+00  1.293E+00
    9           4     1.470E+03  1.890E-01 -3.060E+00  1.349E+00
   10           4     1.470E+03  1.890E-01 -3.057E+00  1.405E+00
   11           2     1.470E+03  2.381E-01 -3.049E+00  1.461E+00
   12           2     1.470E+03  2.381E-01 -3.036E+00  1.517E+00
   13           2     1.470E+03  2.381E-01 -3.020E+00  1.572E+00
   14           2     1.470E+03  2.381E-01 -2.998E+00  1.627E+00
   15           2     1.470E+03  2.381E-01 -2.971E+00  1.681E+00
   16           1     1.470E+03  3.000E-01 -2.932E+00  1.735E+00
   17           1     1.470E+03  3.000E-01 -2.885E+00  1.788E+00
   18           1     1.470E+03  3.000E-01 -2.832E+00  1.840E+00
   19           1     1.470E+03  3.000E-01 -2.774E+00  1.891E+00
   20           1     1.470E+03  3.000E-01 -2.698E+00  1.940E+00
```

21	1	1.470E+03	3.000E-01	-2.614E+00	1.988E+00
22	1	1.470E+03	3.000E-01	-2.528E+00	2.035E+00
23	1	1.470E+03	3.000E-01	-2.439E+00	2.080E+00
24	1	1.470E+03	3.000E-01	-2.315E+00	2.122E+00
25	1	1.470E+03	3.000E-01	-2.157E+00	2.163E+00
26	1	1.470E+03	3.000E-01	-2.000E+00	2.200E+00
6.001140E-01	34				
1	64	1.468E+03	7.500E-02	-2.437E+00	4.801E-01
2	64	1.468E+03	7.500E-02	-2.496E+00	5.340E-01
3	64	1.468E+03	7.500E-02	-2.555E+00	5.873E-01
4	32	1.468E+03	9.449E-02	-2.607E+00	6.401E-01
5	32	1.469E+03	9.449E-02	-2.658E+00	6.925E-01
6	32	1.469E+03	9.449E-02	-2.709E+00	7.446E-01
7	16	1.469E+03	1.191E-01	-2.767E+00	7.959E-01
8	16	1.469E+03	1.191E-01	-2.813E+00	8.482E-01
9	16	1.469E+03	1.191E-01	-2.858E+00	9.007E-01
10	8	1.469E+03	1.500E-01	-2.896E+00	9.541E-01
11	8	1.469E+03	1.500E-01	-2.932E+00	1.008E+00
12	8	1.469E+03	1.500E-01	-2.963E+00	1.062E+00
13	8	1.469E+03	1.500E-01	-2.988E+00	1.117E+00
14	4	1.469E+03	1.890E-01	-3.007E+00	1.172E+00
15	4	1.469E+03	1.890E-01	-3.022E+00	1.228E+00
16	4	1.469E+03	1.890E-01	-3.030E+00	1.283E+00
17	4	1.470E+03	1.890E-01	-3.035E+00	1.339E+00
18	4	1.470E+03	1.890E-01	-3.033E+00	1.395E+00
19	2	1.470E+03	2.381E-01	-3.025E+00	1.450E+00
20	2	1.470E+03	2.381E-01	-3.012E+00	1.505E+00
21	2	1.470E+03	2.381E-01	-2.996E+00	1.560E+00
22	2	1.470E+03	2.381E-01	-2.976E+00	1.615E+00
23	2	1.470E+03	2.381E-01	-2.949E+00	1.669E+00
24	2	1.470E+03	2.381E-01	-2.912E+00	1.722E+00
25	1	1.470E+03	3.000E-01	-2.865E+00	1.775E+00
26	1	1.470E+03	3.000E-01	-2.813E+00	1.827E+00
27	1	1.470E+03	3.000E-01	-2.756E+00	1.877E+00
28	1	1.470E+03	3.000E-01	-2.687E+00	1.927E+00
29	1	1.470E+03	3.000E-01	-2.607E+00	1.975E+00
30	1	1.470E+03	3.000E-01	-2.525E+00	2.021E+00
31	1	1.470E+03	3.000E-01	-2.440E+00	2.066E+00
32	1	1.470E+03	3.000E-01	-2.342E+00	2.109E+00
33	1	1.470E+03	3.000E-01	-2.195E+00	2.150E+00
34	1	1.470E+03	3.000E-01	-2.049E+00	2.188E+00

Table D.3: Particle Breakup Data (CRAY_XMP, inlet vel 14 m/s)

```
1Test case for Aluminum Jet MS problem, ex-vessel , HP ( 08/20/92 )
 4
 timek-fuelnptprpupxp
  0.000000E+00        1
    1          1      1.470E+03  3.000E-01 -1.400E+01  2.200E+00
  1.501140E-01        9
    1       4096      1.467E+03  1.875E-02 -2.831E+00  8.766E-01
    2       2048      1.468E+03  2.362E-02 -3.796E+00  9.383E-01
    3        512      1.469E+03  3.750E-02 -5.087E+00  1.020E+00
    4        256      1.469E+03  4.725E-02 -6.637E+00  1.131E+00
    5         64      1.470E+03  7.500E-02 -8.440E+00  1.268E+00
    6         16      1.470E+03  1.191E-01 -1.026E+01  1.438E+00
    7          4      1.470E+03  1.890E-01 -1.192E+01  1.639E+00
    8          2      1.470E+03  2.381E-01 -1.335E+01  1.868E+00
    9          1      1.470E+03  3.000E-01 -1.405E+01  2.116E+00
  3.001140E-01       28
    1      65536      1.451E+03  7.441E-03 -6.774E-01  6.821E-01
    2      65536      1.454E+03  7.441E-03 -7.298E-01  6.969E-01
    3      65536      1.457E+03  7.441E-03 -8.022E-01  7.158E-01
    4      32768      1.459E+03  9.375E-03 -8.981E-01  7.432E-01
    5      32768      1.461E+03  9.375E-03 -1.043E+00  7.611E-01
    6      16384      1.463E+03  1.181E-02 -1.222E+00  7.832E-01
    7      16384      1.465E+03  1.181E-02 -1.477E+00  8.084E-01
    8       8192      1.466E+03  1.488E-02 -1.797E+00  8.529E-01
    9       2048      1.467E+03  1.875E-02 -2.379E+00  8.896E-01
   10       1024      1.468E+03  2.362E-02 -3.212E+00  9.406E-01
   11        512      1.469E+03  2.976E-02 -4.423E+00  1.007E+00
   12        128      1.469E+03  4.725E-02 -5.874E+00  1.106E+00
   13         64      1.470E+03  5.953E-02 -7.610E+00  1.229E+00
   14         16      1.470E+03  9.449E-02 -9.477E+00  1.385E+00
   15          2      1.470E+03  1.500E-01 -1.125E+01  1.573E+00
   16          1      1.470E+03  2.381E-01 -1.279E+01  1.790E+00
   17          1      1.470E+03  3.000E-01 -1.384E+01  2.032E+00
   18       4096      1.467E+03  1.488E-02 -2.317E+00  1.075E+00
   19       2048      1.468E+03  1.875E-02 -3.334E+00  1.120E+00
   20        512      1.469E+03  2.976E-02 -4.600E+00  1.194E+00
   21        128      1.469E+03  4.725E-02 -6.229E+00  1.295E+00
   22         32      1.470E+03  7.500E-02 -8.187E+00  1.427E+00
   23          4      1.470E+03  1.191E-01 -1.020E+01  1.594E+00
   24          4      1.470E+03  1.191E-01 -1.084E+01  1.770E+00
   25          2      1.470E+03  1.500E-01 -1.201E+01  1.796E+00
   26          2      1.470E+03  1.500E-01 -1.139E+01  1.760E+00
   27          1      1.470E+03  1.890E-01 -1.243E+01  1.983E+00
   28          1      1.470E+03  2.381E-01 -1.325E+01  2.026E+00
  4.501140E-01       63
    1      65536      1.431E+03  7.441E-03 -5.588E-01  5.926E-01
    2      65536      1.434E+03  7.441E-03 -5.661E-01  6.044E-01
    3      65536      1.437E+03  7.441E-03 -5.762E-01  6.196E-01
    4      65536      1.440E+03  7.441E-03 -5.847E-01  6.424E-01
    5      65536      1.443E+03  7.441E-03 -5.946E-01  6.527E-01
    6      65536      1.445E+03  7.441E-03 -6.045E-01  6.656E-01
    7      65536      1.448E+03  7.441E-03 -6.125E-01  6.787E-01
    8      65536      1.449E+03  7.441E-03 -6.008E-01  7.107E-01
    9      32768      1.452E+03  7.441E-03 -6.288E-01  7.219E-01
```

10	32768	1.454E+03	7.441E-03	-6.679E-01	7.353E-01
11	16384	1.457E+03	9.375E-03	-7.254E-01	7.449E-01
12	16384	1.459E+03	9.375E-03	-7.983E-01	7.698E-01
13	8192	1.461E+03	1.181E-02	-9.111E-01	7.864E-01
14	8192	1.462E+03	1.181E-02	-1.052E+00	8.053E-01
15	4096	1.464E+03	1.181E-02	-1.260E+00	8.266E-01
16	2048	1.465E+03	1.488E-02	-1.586E+00	8.533E-01
17	1024	1.467E+03	1.875E-02	-2.108E+00	8.900E-01
18	512	1.468E+03	2.362E-02	-2.822E+00	9.427E-01
19	256	1.468E+03	2.976E-02	-3.790E+00	1.004E+00
20	128	1.469E+03	3.750E-02	-5.145E+00	1.086E+00
21	32	1.469E+03	5.953E-02	-6.819E+00	1.195E+00
22	8	1.470E+03	9.449E-02	-8.707E+00	1.336E+00
23	4	1.470E+03	1.191E-01	-1.055E+01	1.511E+00
24	1	1.470E+03	1.890E-01	-1.217E+01	1.718E+00
25	1	1.470E+03	3.000E-01	-1.349E+01	1.951E+00
26	1	1.470E+03	3.000E-01	-1.400E+01	2.200E+00
27	32768	1.449E+03	7.441E-03	-6.399E-01	9.084E-01
28	32768	1.452E+03	7.441E-03	-6.827E-01	9.090E-01
29	32768	1.454E+03	7.441E-03	-7.414E-01	9.255E-01
30	32768	1.457E+03	7.441E-03	-8.145E-01	9.480E-01
31	16384	1.459E+03	9.375E-03	-9.201E-01	9.648E-01
32	8192	1.461E+03	9.375E-03	-1.069E+00	9.839E-01
33	8192	1.461E+03	9.375E-03	-1.122E+00	1.117E+00
34	4096	1.463E+03	1.181E-02	-1.297E+00	1.007E+00
35	4096	1.463E+03	1.181E-02	-1.266E+00	1.013E+00
36	8192	1.463E+03	9.375E-03	-1.343E+00	1.151E+00
37	4096	1.465E+03	1.181E-02	-1.618E+00	1.037E+00
38	4096	1.465E+03	1.181E-02	-1.571E+00	1.041E+00
39	4096	1.465E+03	1.181E-02	-1.689E+00	1.181E+00
40	2048	1.466E+03	1.488E-02	-2.113E+00	1.073E+00
41	2048	1.467E+03	1.488E-02	-2.165E+00	1.066E+00
42	2048	1.466E+03	1.488E-02	-2.217E+00	1.219E+00
43	1024	1.467E+03	1.875E-02	-2.825E+00	1.125E+00
44	1024	1.467E+03	1.875E-02	-2.727E+00	1.127E+00
45	1024	1.468E+03	1.875E-02	-3.035E+00	1.264E+00
46	512	1.468E+03	2.362E-02	-3.905E+00	1.187E+00
47	512	1.468E+03	2.362E-02	-3.711E+00	1.186E+00
48	512	1.469E+03	2.362E-02	-4.251E+00	1.332E+00
49	128	1.469E+03	3.750E-02	-5.452E+00	1.273E+00
50	128	1.469E+03	3.750E-02	-5.128E+00	1.267E+00
51	128	1.469E+03	3.750E-02	-5.886E+00	1.425E+00
52	32	1.470E+03	5.953E-02	-7.348E+00	1.390E+00
53	64	1.469E+03	4.725E-02	-6.909E+00	1.376E+00
54	32	1.470E+03	5.953E-02	-7.891E+00	1.551E+00
55	8	1.470E+03	9.449E-02	-9.370E+00	1.543E+00
56	16	1.470E+03	7.500E-02	-8.846E+00	1.520E+00
57	8	1.470E+03	9.449E-02	-9.995E+00	1.715E+00
58	2	1.470E+03	1.500E-01	-1.127E+01	1.731E+00
59	4	1.470E+03	1.191E-01	-1.070E+01	1.698E+00
60	2	1.470E+03	1.500E-01	-1.185E+01	1.914E+00
61	1	1.470E+03	1.890E-01	-1.283E+01	1.949E+00
62	1	1.470E+03	1.890E-01	-1.232E+01	1.906E+00
63	1	1.470E+03	1.890E-01	-1.294E+01	2.138E+00

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1	65536	1.413E+03	7.441E-03	-5.356E-01	5.108E-01
2	65536	1.416E+03	7.441E-03	-5.412E-01	5.217E-01
3	65536	1.418E+03	7.441E-03	-5.492E-01	5.356E-01
4	65536	1.421E+03	7.441E-03	-5.556E-01	5.574E-01
5	65536	1.424E+03	7.441E-03	-5.608E-01	5.667E-01
6	65536	1.426E+03	7.441E-03	-5.657E-01	5.787E-01
7	65536	1.429E+03	7.441E-03	-5.691E-01	5.911E-01
8	65536	1.430E+03	7.441E-03	-5.663E-01	6.242E-01
9	32768	1.433E+03	7.441E-03	-5.706E-01	6.342E-01
10	32768	1.435E+03	7.441E-03	-5.737E-01	6.462E-01
11	32768	1.438E+03	7.441E-03	-5.784E-01	6.530E-01
12	32768	1.440E+03	7.441E-03	-5.786E-01	6.747E-01
13	32768	1.443E+03	7.441E-03	-5.847E-01	6.850E-01
14	32768	1.446E+03	7.441E-03	-5.893E-01	6.968E-01
15	8192	1.450E+03	9.375E-03	-5.994E-01	7.080E-01
16	16384	1.450E+03	7.441E-03	-6.139E-01	7.201E-01
17	16384	1.453E+03	7.441E-03	-6.424E-01	7.340E-01
18	8192	1.455E+03	9.375E-03	-6.926E-01	7.514E-01
19	8192	1.458E+03	9.375E-03	-7.551E-01	7.647E-01
20	8192	1.459E+03	9.375E-03	-8.243E-01	7.819E-01
21	4096	1.461E+03	1.181E-02	-9.199E-01	8.007E-01
22	4096	1.463E+03	1.181E-02	-1.054E+00	8.210E-01
23	2048	1.464E+03	1.488E-02	-1.231E+00	8.446E-01
24	2048	1.465E+03	1.488E-02	-1.461E+00	8.795E-01
25	1024	1.466E+03	1.875E-02	-1.821E+00	9.116E-01
26	1024	1.467E+03	1.875E-02	-2.338E+00	9.515E-01
27	512	1.468E+03	2.362E-02	-3.131E+00	1.003E+00
28	128	1.469E+03	3.750E-02	-4.369E+00	1.071E+00
29	32	1.469E+03	4.725E-02	-6.028E+00	1.166E+00
30	8	1.470E+03	7.500E-02	-7.975E+00	1.293E+00
31	2	1.470E+03	1.191E-01	-9.847E+00	1.454E+00
32	1	1.470E+03	1.500E-01	-1.157E+01	1.649E+00
33	1	1.470E+03	2.381E-01	-1.302E+01	1.872E+00
34	1	1.470E+03	3.000E-01	-1.396E+01	2.116E+00
35	32768	1.430E+03	7.441E-03	-5.246E-01	8.252E-01
36	32768	1.433E+03	7.441E-03	-5.270E-01	8.240E-01
37	32768	1.435E+03	7.441E-03	-5.313E-01	8.370E-01
38	32768	1.437E+03	7.441E-03	-5.372E-01	8.551E-01
39	32768	1.440E+03	7.441E-03	-5.453E-01	8.664E-01
40	16384	1.442E+03	7.441E-03	-5.544E-01	8.782E-01
41	16384	1.442E+03	7.441E-03	-5.478E-01	1.010E+00
42	16384	1.445E+03	7.441E-03	-5.690E-01	8.897E-01
43	16384	1.444E+03	7.441E-03	-5.677E-01	8.969E-01
44	16384	1.444E+03	7.441E-03	-5.551E-01	1.033E+00
45	16384	1.447E+03	7.441E-03	-5.816E-01	9.049E-01
46	16384	1.447E+03	7.441E-03	-5.809E-01	9.114E-01
47	16384	1.446E+03	7.441E-03	-5.708E-01	1.047E+00
48	16384	1.449E+03	7.441E-03	-6.025E-01	9.197E-01
49	16384	1.451E+03	7.441E-03	-6.209E-01	9.062E-01
50	16384	1.449E+03	7.441E-03	-5.925E-01	1.061E+00
51	16384	1.452E+03	7.441E-03	-6.290E-01	9.408E-01
52	16384	1.452E+03	7.441E-03	-6.386E-01	9.434E-01
53	16384	1.451E+03	7.441E-03	-6.283E-01	1.070E+00

54	16384	1.455E+03	7.441E-03	-6.762E-01	9.557E-01
55	16384	1.455E+03	7.441E-03	-6.842E-01	9.585E-01
56	16384	1.454E+03	7.441E-03	-6.860E-01	1.085E+00
57	8192	1.457E+03	9.375E-03	-7.354E-01	9.720E-01
58	8192	1.457E+03	9.375E-03	-7.560E-01	9.717E-01
59	16384	1.456E+03	7.441E-03	-7.811E-01	1.101E+00
60	8192	1.459E+03	9.375E-03	-8.454E-01	9.837E-01
61	8192	1.459E+03	9.375E-03	-8.431E-01	9.884E-01
62	8192	1.459E+03	9.375E-03	-8.783E-01	1.117E+00
63	8192	1.462E+03	9.375E-03	-9.736E-01	1.003E+00
64	8192	1.461E+03	9.375E-03	-9.575E-01	1.007E+00
65	8192	1.461E+03	9.375E-03	-1.011E+00	1.137E+00
66	4096	1.463E+03	1.181E-02	-1.148E+00	1.025E+00
67	4096	1.463E+03	1.181E-02	-1.177E+00	1.016E+00
68	8192	1.463E+03	9.375E-03	-1.193E+00	1.166E+00
69	4096	1.464E+03	1.181E-02	-1.362E+00	1.058E+00
70	4096	1.464E+03	1.181E-02	-1.357E+00	1.060E+00
71	4096	1.464E+03	1.181E-02	-1.477E+00	1.188E+00
72	2048	1.466E+03	1.488E-02	-1.793E+00	1.088E+00
73	2048	1.466E+03	1.488E-02	-1.760E+00	1.090E+00
74	2048	1.466E+03	1.488E-02	-1.922E+00	1.221E+00
75	1024	1.467E+03	1.875E-02	-2.462E+00	1.127E+00
76	1024	1.467E+03	1.875E-02	-2.370E+00	1.127E+00
77	1024	1.467E+03	1.875E-02	-2.635E+00	1.261E+00
78	512	1.468E+03	2.362E-02	-3.379E+00	1.180E+00
79	512	1.468E+03	2.362E-02	-3.209E+00	1.179E+00
80	512	1.468E+03	2.362E-02	-3.744E+00	1.321E+00
81	256	1.469E+03	2.976E-02	-4.770E+00	1.254E+00
82	256	1.469E+03	2.976E-02	-4.479E+00	1.248E+00
83	256	1.469E+03	2.976E-02	-5.203E+00	1.403E+00
84	64	1.469E+03	4.725E-02	-6.593E+00	1.358E+00
85	32	1.469E+03	4.725E-02	-6.197E+00	1.345E+00
86	32	1.470E+03	4.725E-02	-7.091E+00	1.515E+00
87	8	1.470E+03	7.500E-02	-8.585E+00	1.496E+00
88	8	1.470E+03	7.500E-02	-8.101E+00	1.475E+00
89	16	1.470E+03	5.953E-02	-7.556E+00	1.646E+00
90	32	1.469E+03	4.725E-02	-6.195E+00	1.282E+00
91	32	1.469E+03	4.725E-02	-6.247E+00	1.463E+00
92	8	1.470E+03	7.500E-02	-9.160E+00	1.664E+00
93	2	1.470E+03	1.191E-01	-1.054E+01	1.670E+00
94	8	1.470E+03	7.500E-02	-8.041E+00	1.441E+00
95	8	1.470E+03	7.500E-02	-8.295E+00	1.619E+00
96	8	1.470E+03	7.500E-02	-8.726E+00	1.641E+00
97	2	1.470E+03	1.191E-01	-9.989E+00	1.640E+00
98	4	1.470E+03	9.449E-02	-9.650E+00	1.804E+00
99	2	1.470E+03	1.191E-01	-1.114E+01	1.849E+00
100	1	1.470E+03	1.890E-01	-1.224E+01	1.877E+00
101	2	1.470E+03	1.191E-01	-9.881E+00	1.604E+00
102	2	1.470E+03	1.191E-01	-1.017E+01	1.787E+00
103	2	1.470E+03	1.191E-01	-1.069E+01	1.818E+00
104	1	1.470E+03	1.500E-01	-1.170E+01	1.837E+00
105	1	1.470E+03	1.500E-01	-1.143E+01	1.997E+00
106	1	1.470E+03	1.890E-01	-1.254E+01	2.065E+00
107	1	1.470E+03	2.381E-01	-1.340E+01	2.109E+00

108	1	1.470E+03	1.500E-01	-1.157E+01	1.799E+00
109	1	1.470E+03	1.500E-01	-1.172E+01	1.987E+00

Table D.4: Mixed Mass Melt and SMD Calculations

$$SMD = \frac{\sum N_i D_i^3}{\sum N_i D_i^2} = 2 \frac{\sum N_i r_i^3}{\sum N_i r_i^2}$$

Particle Mass melt

Time (sec)	N_i	r_i (m)	$N_i r_i^2$	$N_i r_i^3$	$\frac{4}{3}\pi r_i^3 \rho$ / N_i	SMD
0	1	.3				.6
.15	9	.3				.6
.30	4	.189	.1429	.0270	806	
	12	.238	.6797	.1618	1832	
	10	.300	.900	.270		
Σ			1.7226	.4588	2138	.533
.45	16	.1191	.227	.027	304	
	32	.150	.720	.108	1224	
	20	.189	.714	.135	1528	
	10	.238	.566	.135	1528	
	11	.300	.990	.297		
Σ			3.217	.702		.436
					4584	

D.4 : Ex-Vessel (2 m/s inlet velocity, continued)

Particle Mass Melt

Time (sec)	N_i	r_i (m)	$N_i V_1^2$	$N_i r_i^3$	$\frac{4}{3} \pi r_i^3 \rho N_i$	SMD
.60	192	.075	1.08	.081	916	
	96	.095	.857	.081	916	
	48	.119	.681	.081	916	
	32	.150	.720	.108	1221	
	20	.189	.714	.135	1526	
	12	.238	.680	.162	1829	
	10	.300	.900	.270	[illegible]	
Σ			5.032	.918		.326
					7324	

D.4: Ex-Vessel { CRAY, high speed (14 m/s) run }

Time (sec)	N_i	r_i (m)	$r_i^2 N_i$	$r_i^3 N_i$	$\frac{4}{3}\pi r_i^3 \rho N_i$	SMD
0	1	.3				.6
.15	4096	.0188	1.448	.027	305	
	2048	.0236	1.141	.027	305	
	512	.0375	.720	.027	305	
	256	.0473	.573	.027	305	
	64	.0750	.360	.027	305	
	16	.1191	.227	.027	305	
	4	.1890	.143	.027	305	
	2	.2381	.113	.027	305	
	1	.3000	.09	.027	—	
Σ			4.815	.243	2440	.101
.30	196,608	.0074	10.77	.080	904	
	65,536	.0094	5.79	.054	610	
	32,768	.0118	4.56	.054	610	
	8192	.0149	1.82	.027	305	
	2048	.0188	.72	.014	154	

23.46 .229

Time (sec)	N_i	r_i (m)	$N_i r_i^2$	$N_i r_i^3$	$\frac{4}{3}\pi\rho_s N_i r_i^3$	SMP
.30	4096	.0149	.91	.014	154	
	2048	.0188	.72	.014	154	
	1024	.0236	.57	.013	152	
	1024	.0298	.91	.027	305	
	256	.0473	.57	.027	305	
	64	.0595	.23	.013	152	
	16	.0944	.14	.013	152	
	16	.150	.14	.020	226	
	32	.075	.18	.013	152	
	8	.1191	.11	.013	152	
	1	.189	.036	.007	—	
	1	.238	.057	.013	—	
Σ			28.23	.416	4488	.029

Time (sec)	N_i	r_i (m)	$N_i r_i^2$	$N_i r_i^3$	$\frac{4}{3}\pi\rho_w N_i r_i^3$	SMD
.45	589,824	.0074	~~3.59~~ 32.30	~~.027~~ .24	305	
	73,728	.0094	6.51	.061	680	
	131,072	.0074	7.18	.053	599	
	28,672	.0118	3.99	.047	531	
	8192	.0149	1.82	.027	305	
	12288	.0118	1.71	.020	226	
	4096	.01875	1.44	.027	305	
	2048	.0236	1.14	.027	305	
	256	.0298	.23	.007	79	
	512	.0375	.72	.027	305	
	64	.0595	.23	.013	152	
	24	.0945	.21	.020	226	
	8	.119	.11	.013	152	
	4	.189	.14	.027	305	
	4	.158	.09	.013	152	
	2	.300	.18	.054		
			58.0	.656		.023

4637