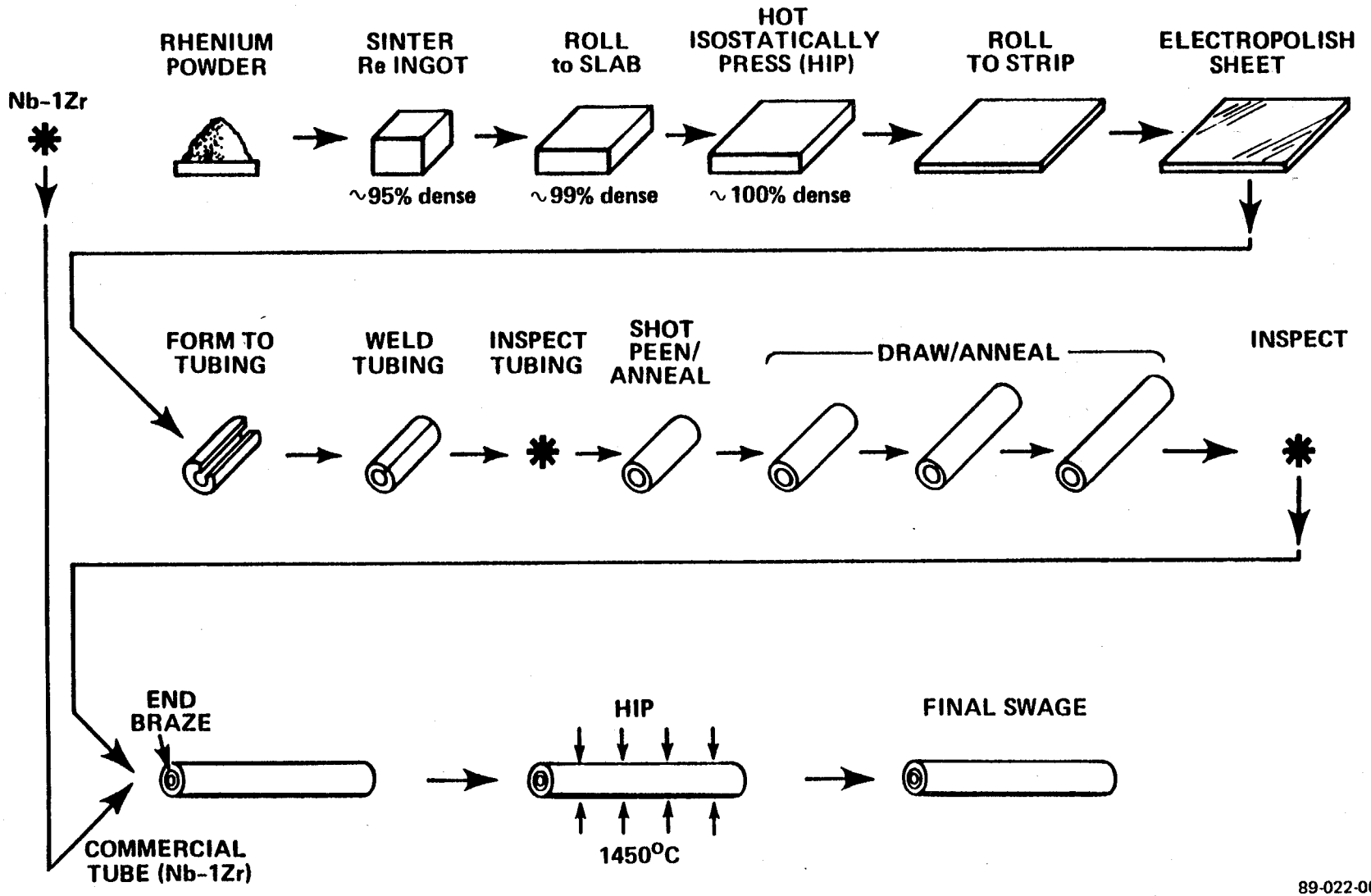
Fabrication of Nb-1Zr/Re Bonded Tubing



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SP-100 Shield Considerations

- ***neutron shield is LiH***
- ***gamma shield is W***

==========

Operating Temperature Constraints for LiH

- **At low temperatures, LiH swells due to the accumulation of He**

- **At high temperatures LiH dissociates**

Compromise is to operate at 600-700°K

Radiation Limits for SP-100

Over a 7 year period at 25 meters from far end of the reactor;

$$\Phi_n < 1 \times 10^{13} \text{ n/cm}^2 \quad (<1 \text{ MeV equiv.})$$

$$\Phi_\gamma < 500{,}000 \text{ Rad (Si)}$$

==========

Figure of shield geometry-

Note that a 17° cone is necessary to limit n and gamma production in the radiator and other structure.

Mass of shield=681 kg
(W=274 kg, ^{7}LiH=35kg, LiH=243 kg, SS=79 kg, Al=50kg)

old

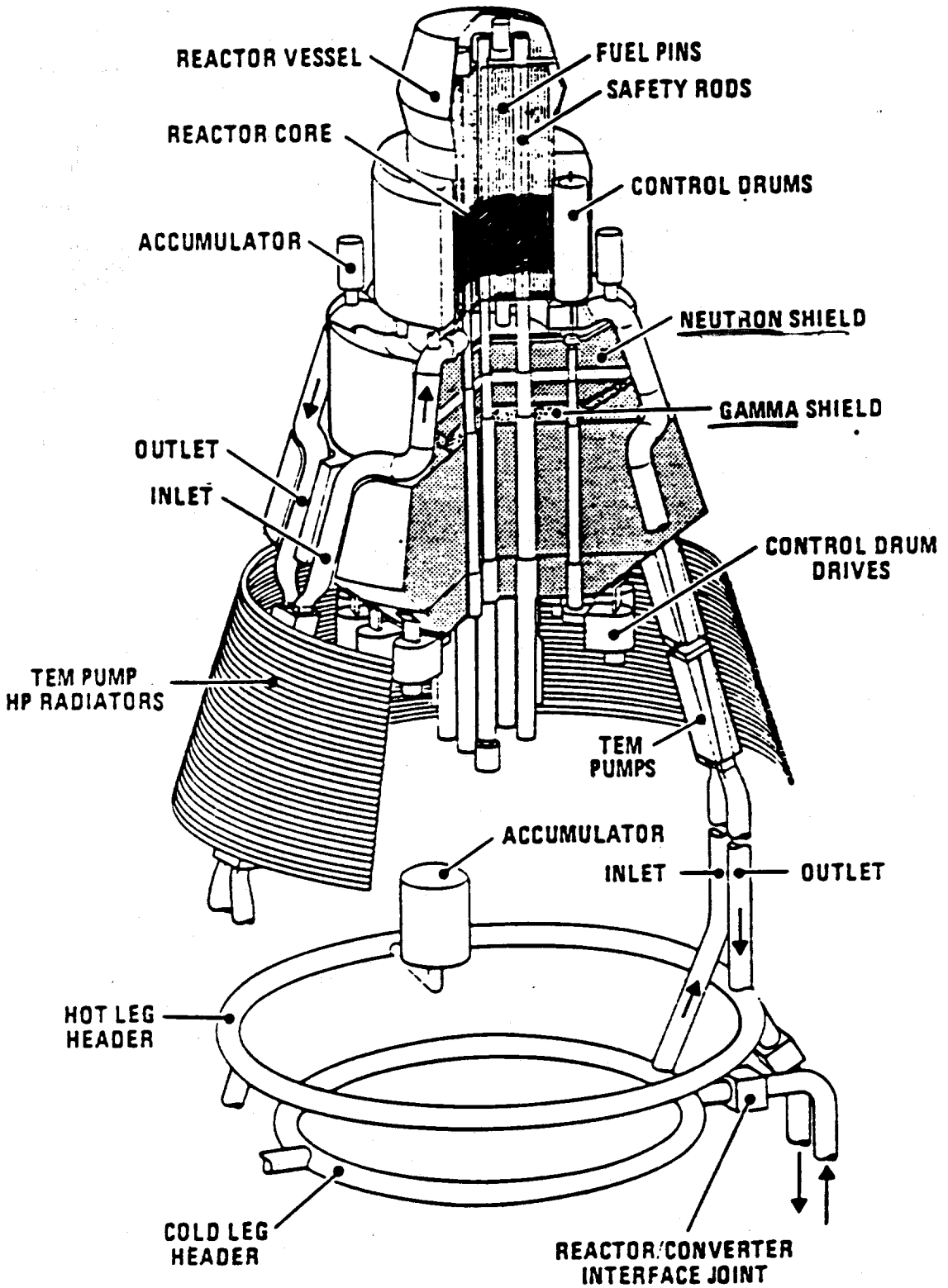
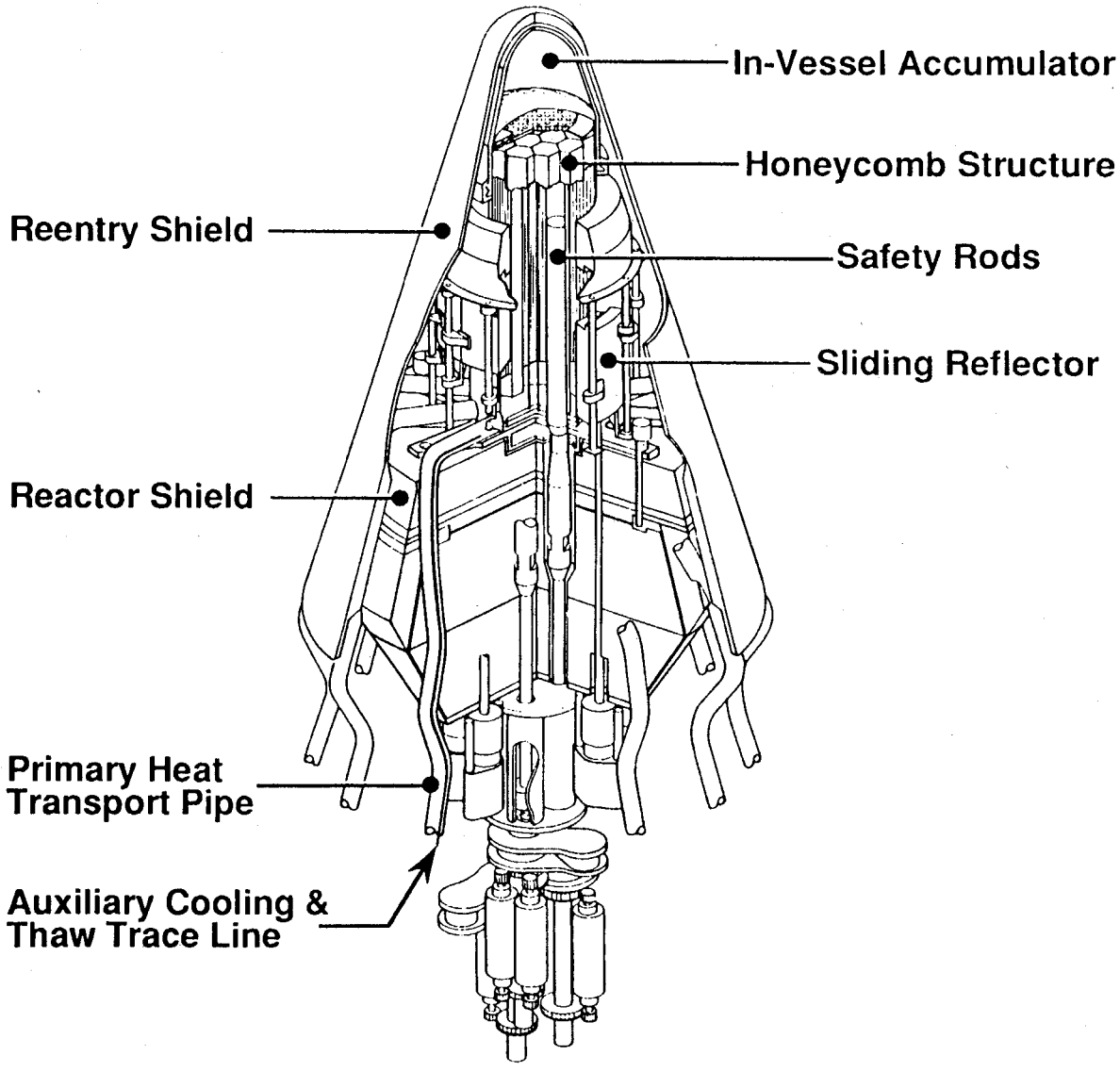


Figure 3-1 Reactor/Shield/Heat Transport Layout

Reactor and Shield



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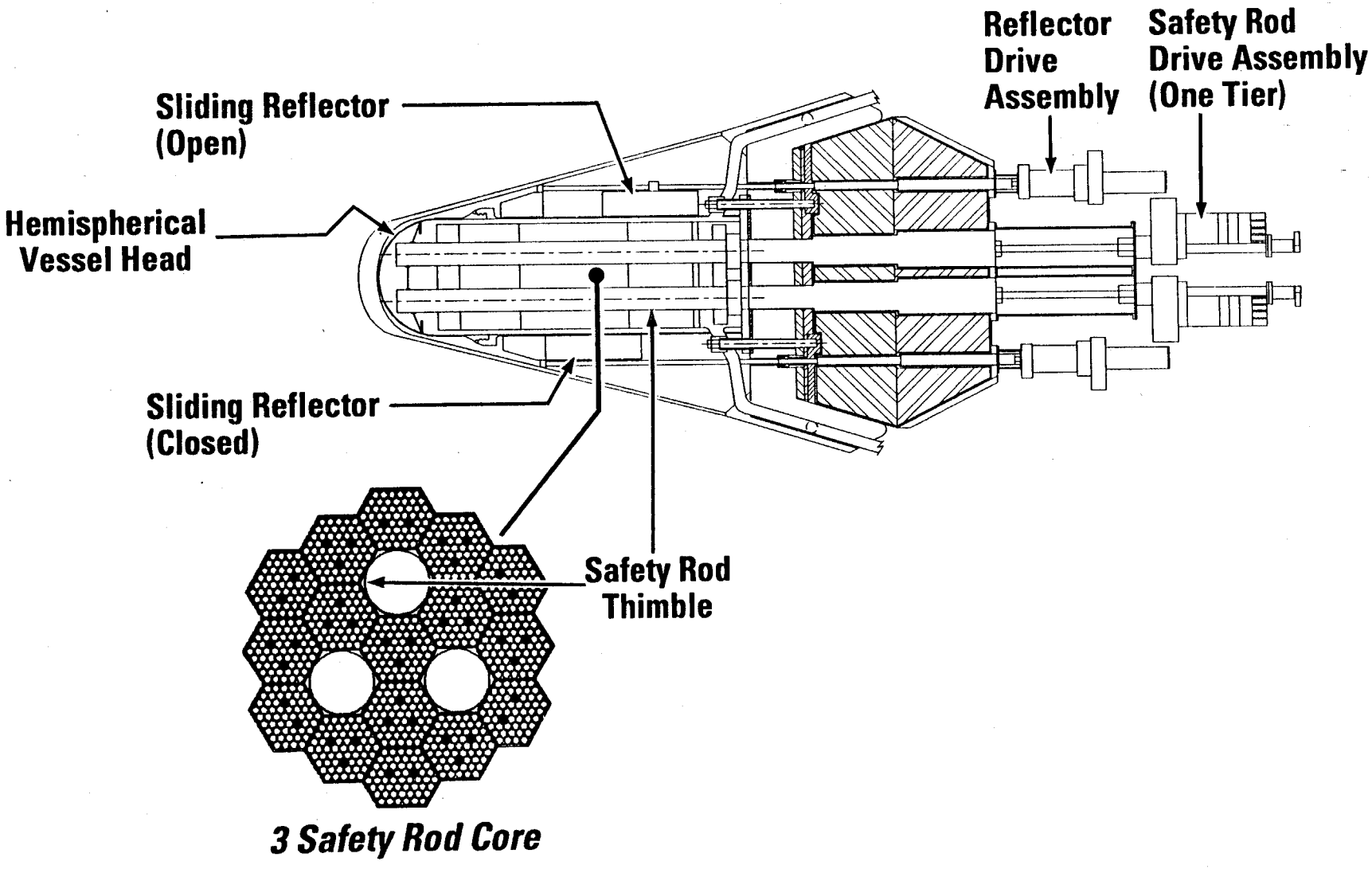
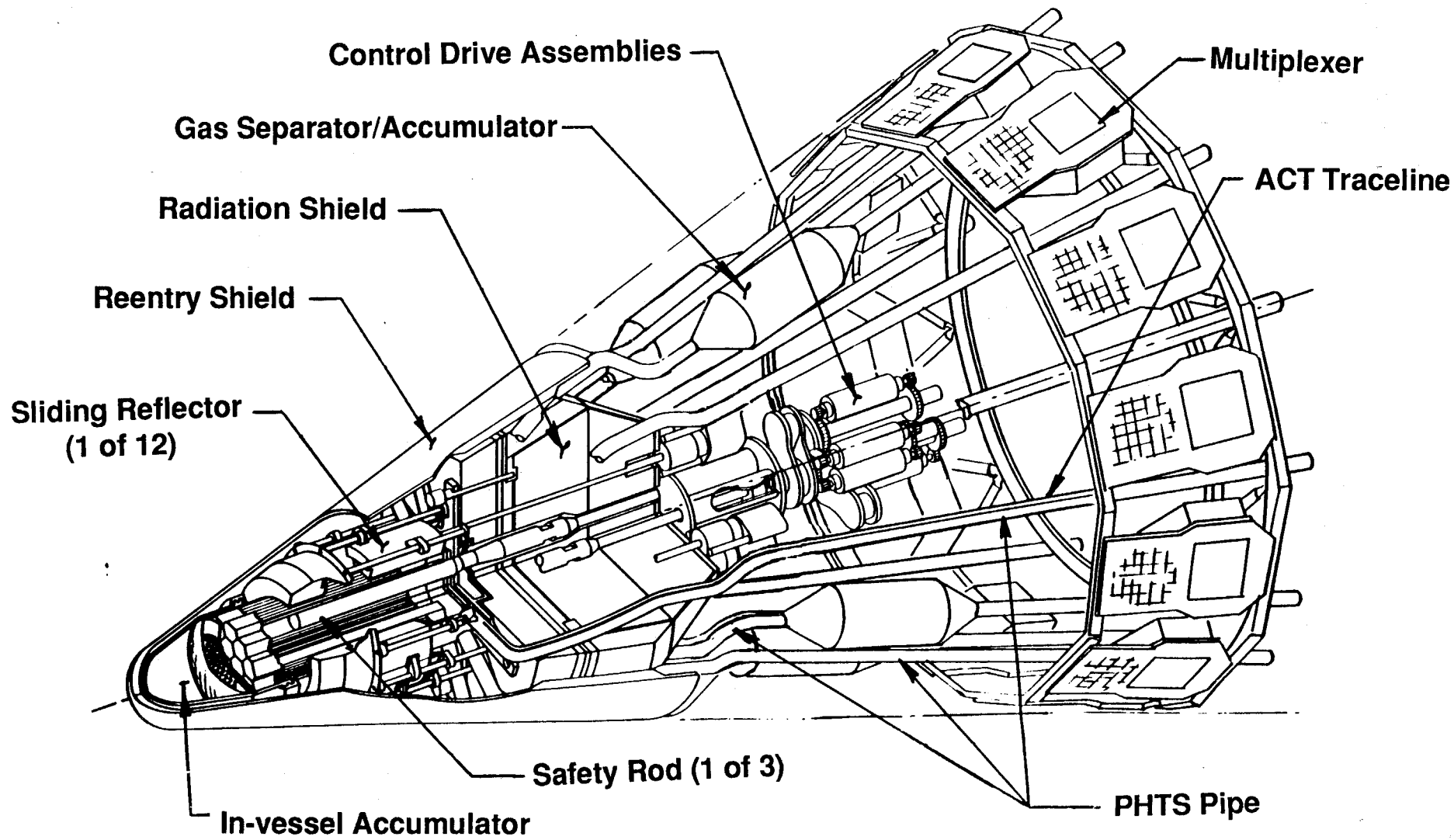
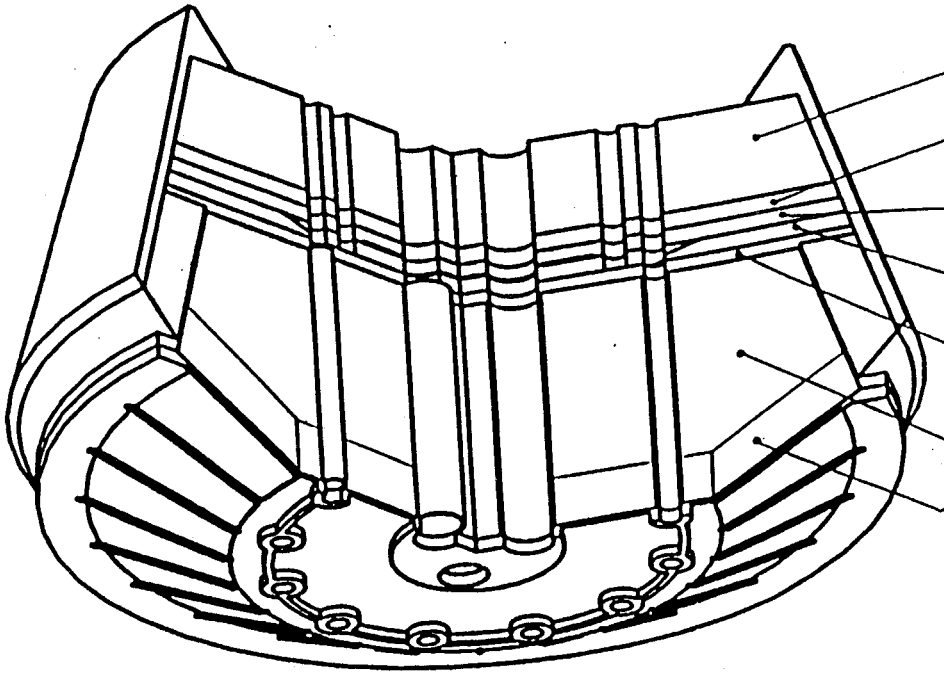
Example Design Margin Analysis – Reactor Design



Reactor Power Assembly

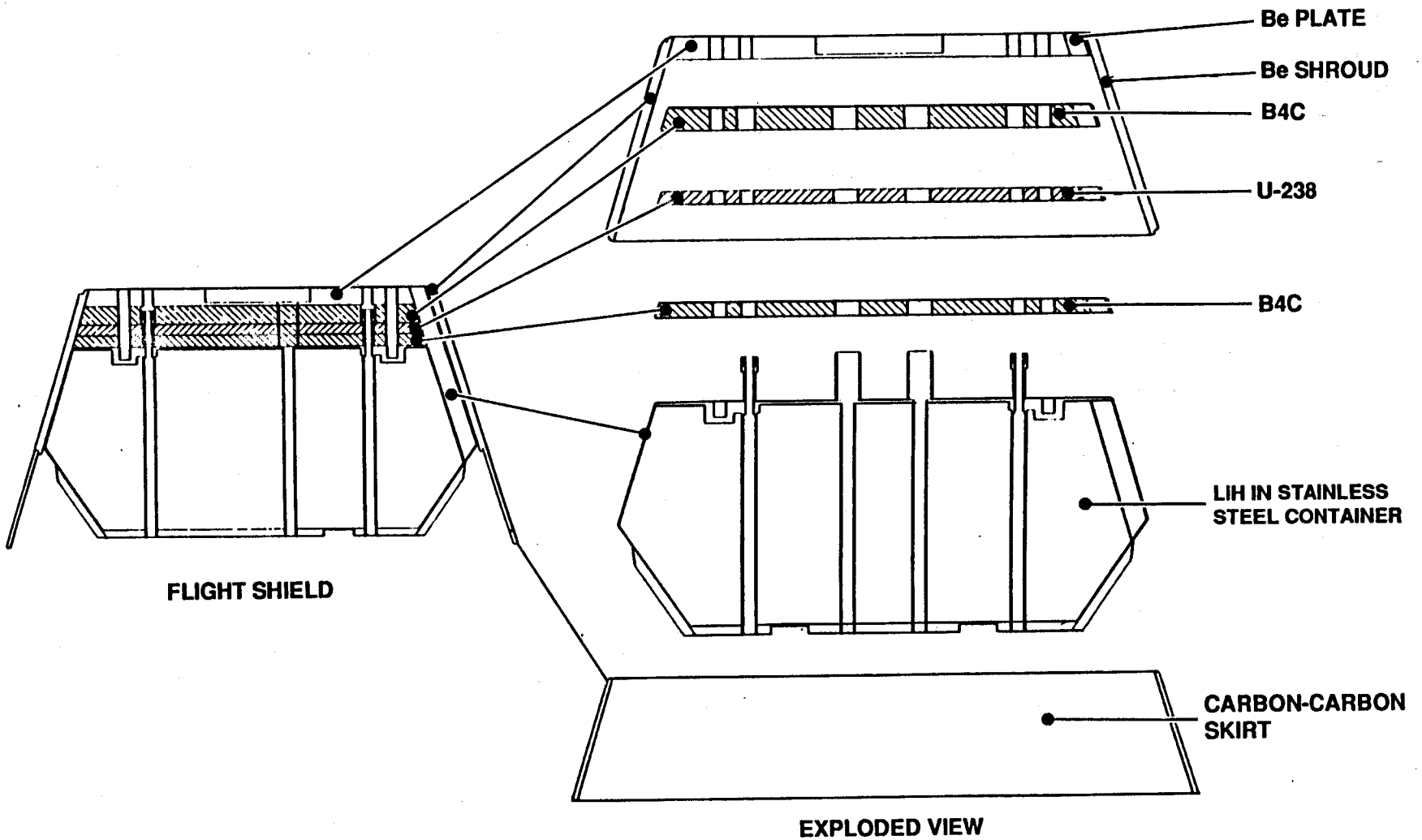


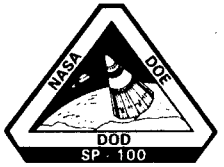
Shield Subsystem



Material	Purpose
Be	Thermal Control And Neutron Moderator
B_4C	Neutron Absorber
W (or U)	Gamma Shield
B_4C	Neutron Absorber
Stainless Steel	LiH Shield Casing and Gamma Shield
LiH (Natural Li)	Neutron Moderator and Absorber
90 Li^6H/10 Li^7H	Neutron Moderator and Enhanced Neutron Absorber

Flight Shield

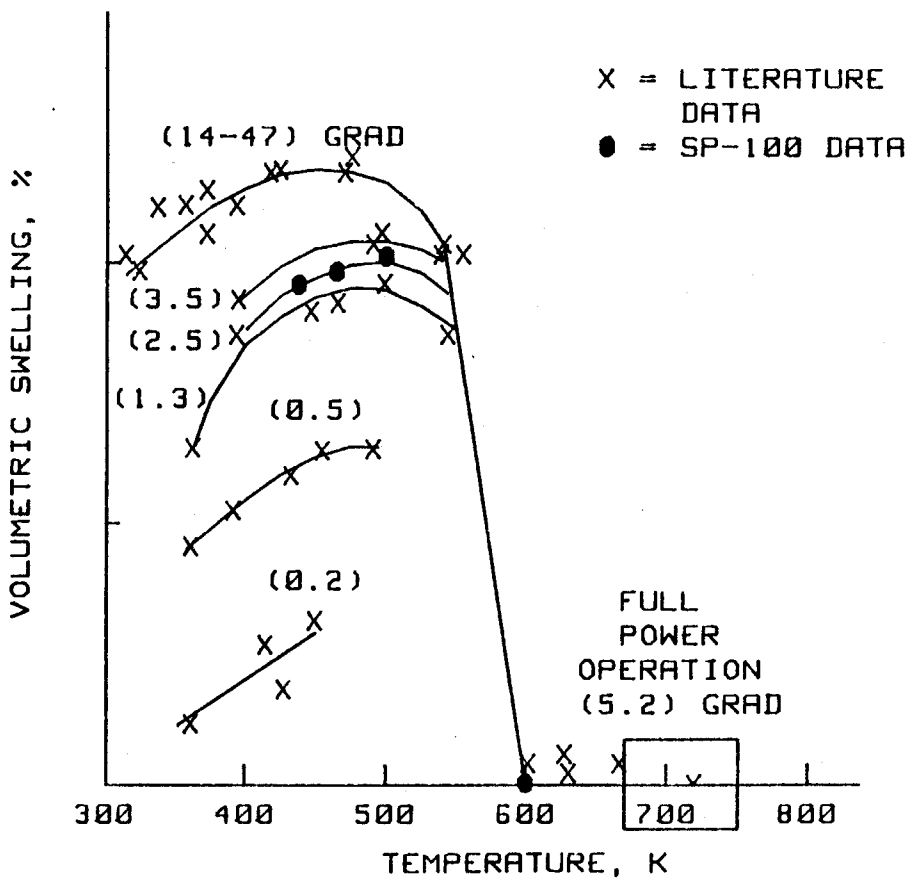


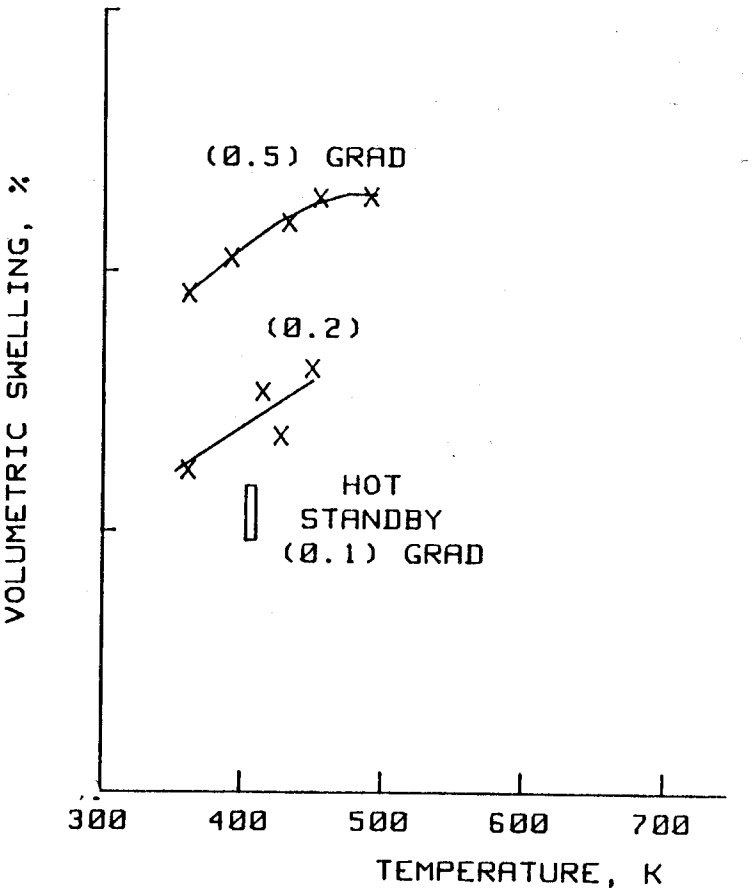


Shield Subsystem Accomplishments

- SUBSYSTEM DESIGN MEETS DEFINED GENERIC MISSION REQUIREMENTS
- FMECAs, FMAs AND DESIGN MARGIN CALCULATIONS
- PRELIMINARY DESIGN AND INDEPENDENT REVIEW AND APPROVAL FOR SHIELD GROUND TEST
- PSAR FOR SHIELD GROUND TEST
- CHEMICAL COMPATIBILITY OF LITHIUM HYDRIDE IN CONTACT WITH STAINLESS STEEL FOR 10 YEARS
- CHEMICAL NONCOMPATIBILITY OF LITHIUM HYDRIDE WITH BERYLLIUM
- MECHANICAL PROPERTIES OF LITHIUM HYDRIDE AS A FUNCTION OF TEMPERATURE
- THERMAL RATCHETING CHARACTERISTICS
- LiH FABRICATION SPECIFICATION COMPLETED, REVIEWED AND APPROVED
- LiH SWELLING ANALYSES DEVELOPED AND VERIFIED WITH NEUTRON AND GAMMA RADIATION TESTS AT DIFFERENT TEMPERATURES
- SHIELD ASSEMBLY FLOW CHARTS INCLUDED NDE OF STAINLESS SHIELD WELDS

LiH Behavior - Gamma Irradiation





Irradiation Data Confirms Photon-Induced LiH Swelling of less than 1% is Expected Under Shield Design Conditions

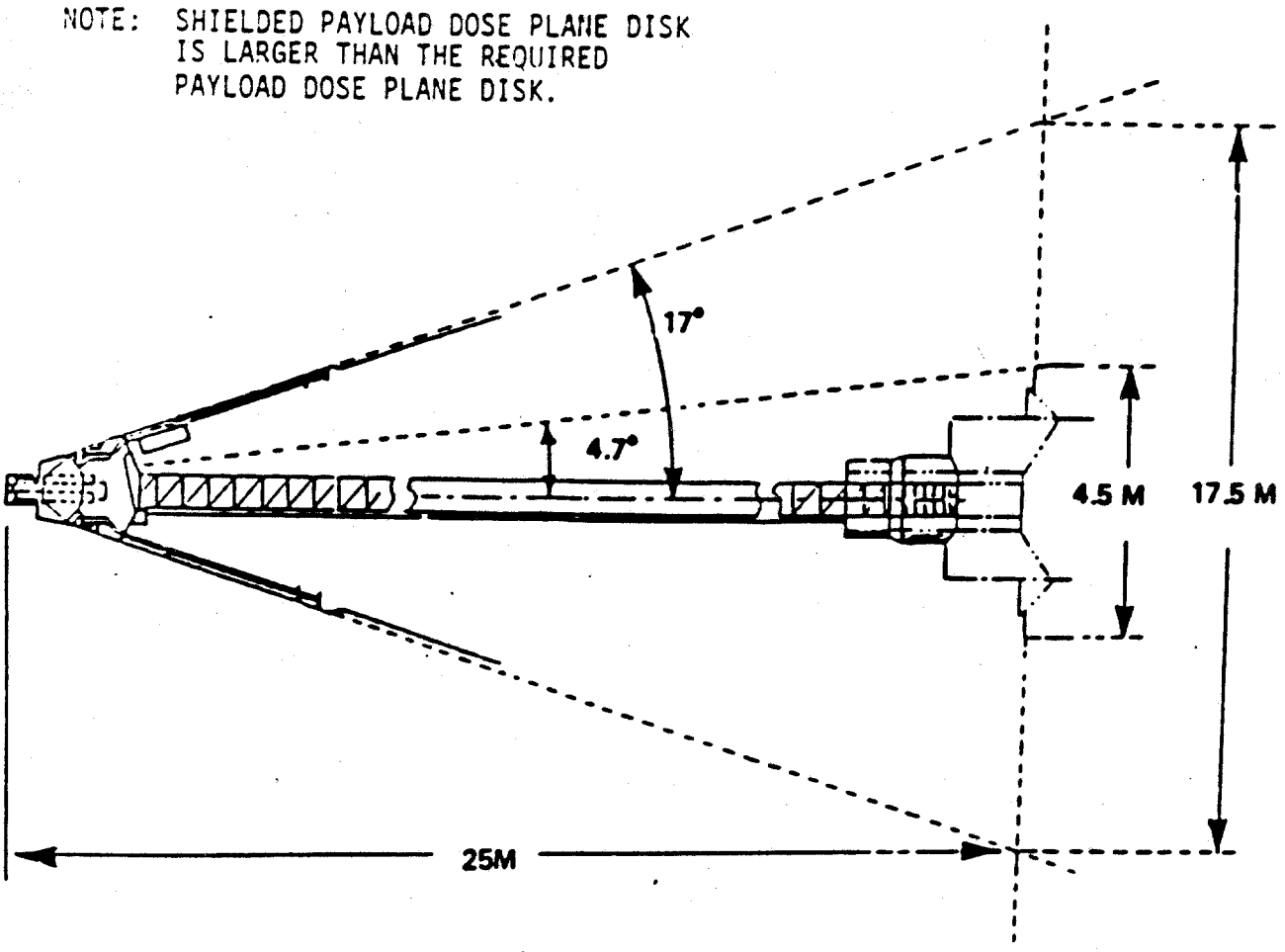
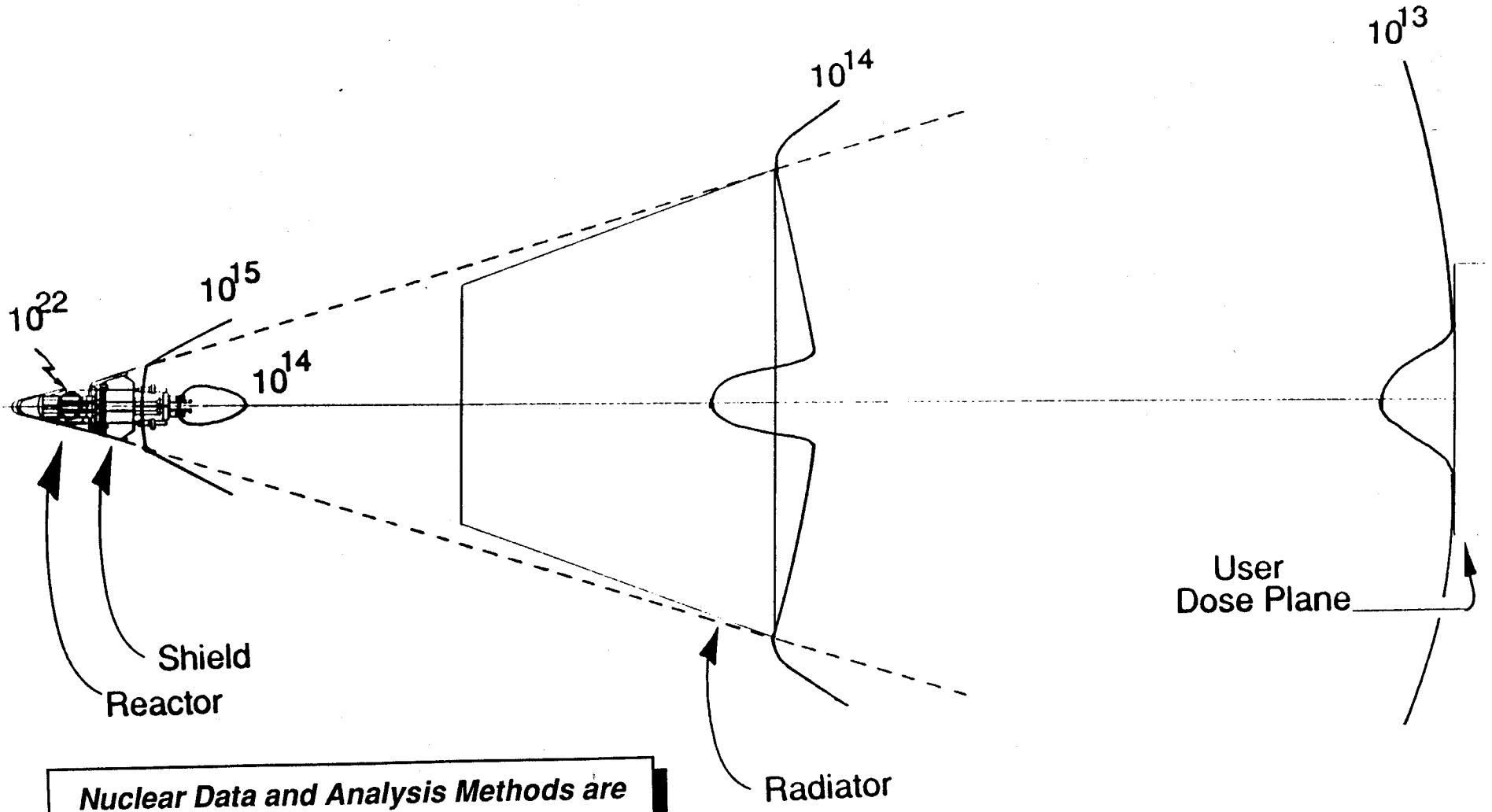
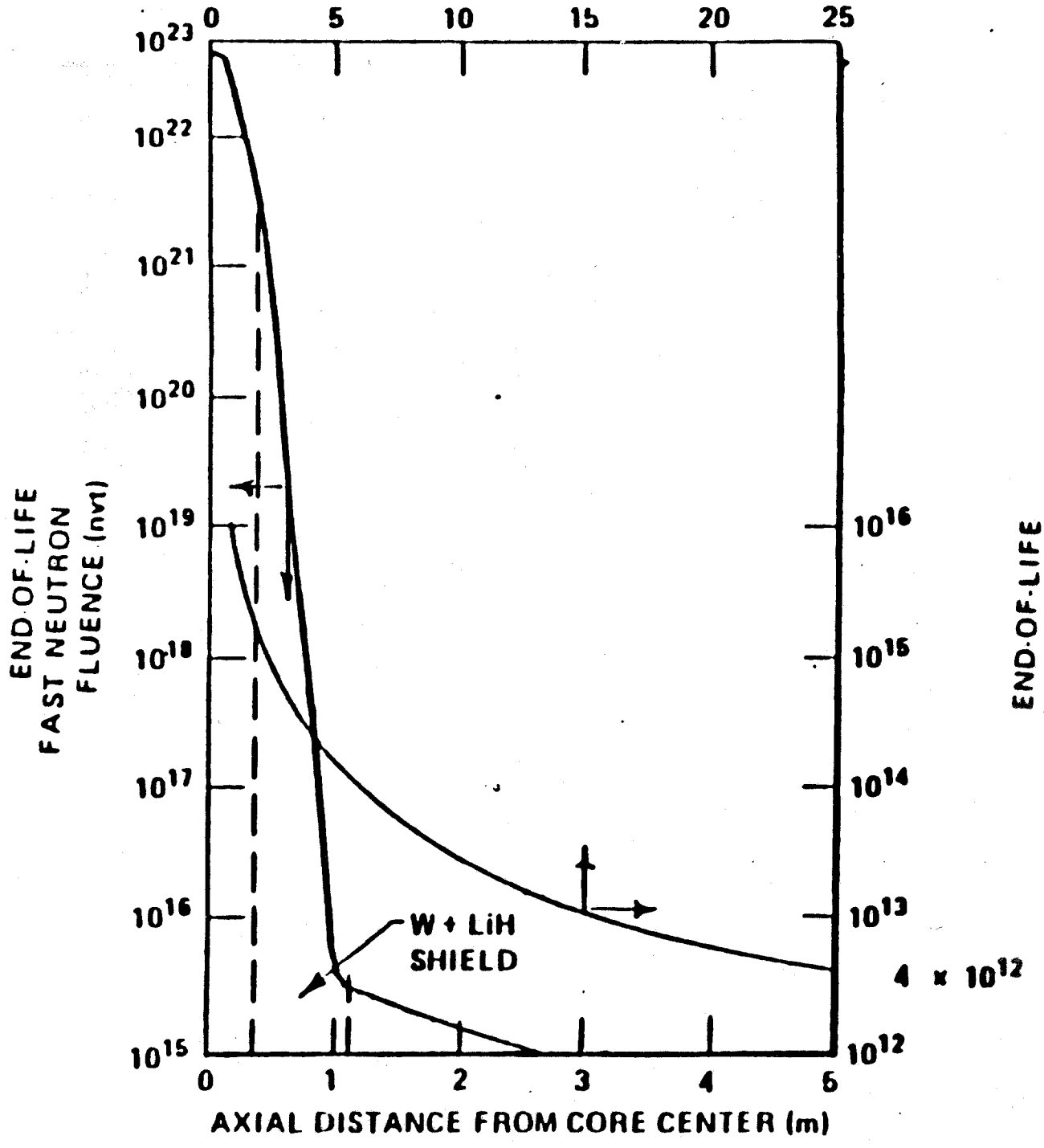


Figure 4-2 Baseline Design Shield Attenuation Geometry

GFS Neutron Fluence (1 MeV Equivalent) Profiles

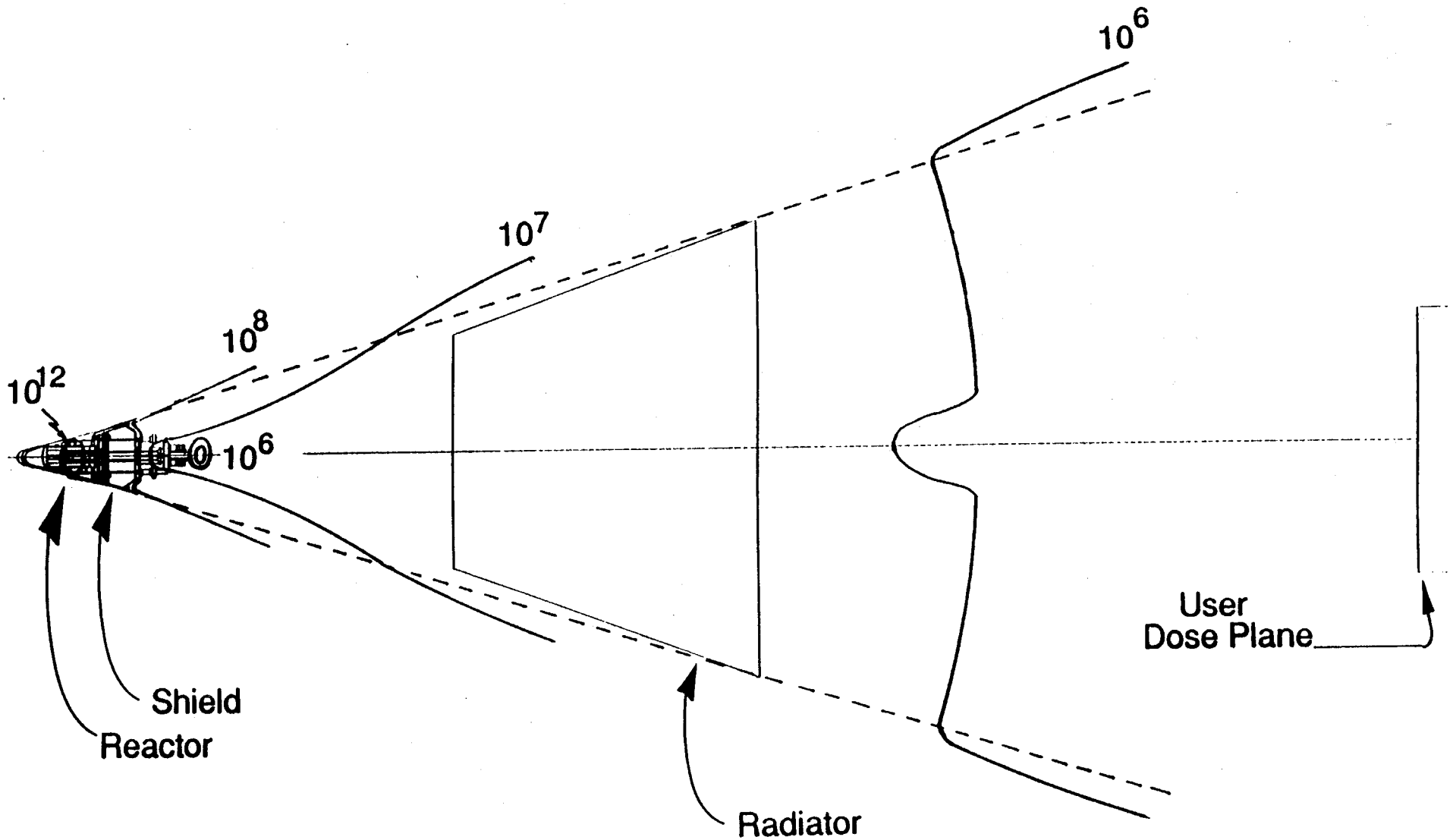


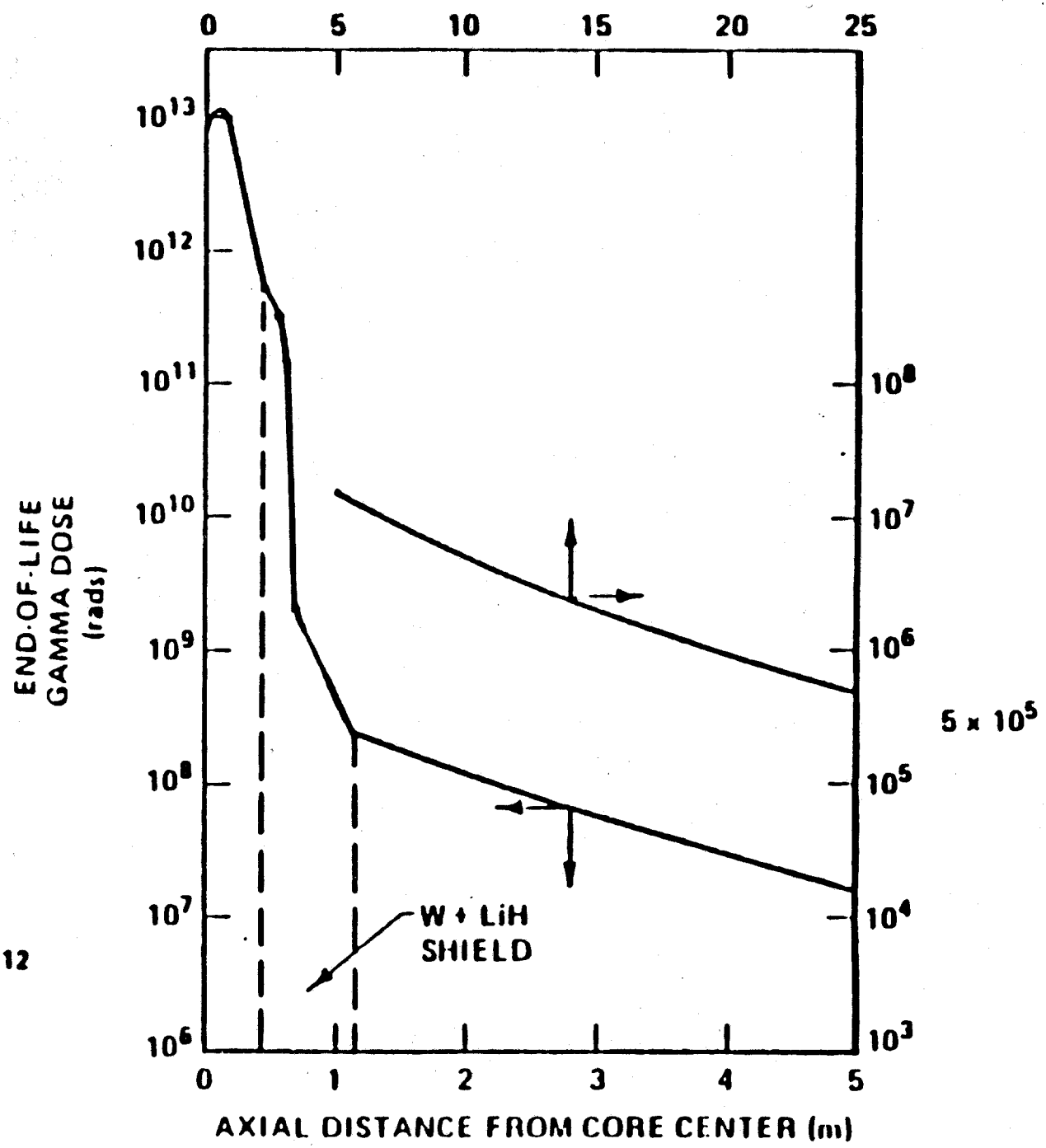
Nuclear Data and Analysis Methods are Sufficient to Assure Payload Shielding



(a) Neuton Fluence Attenuation

GFS Gamma Fluence (Rad Si) Profile





(b) Gamma Dose Attenuation