EUROPEAN TECHNOLOGICAL EFFORT IN PREPARATION OF ITER CONSTRUCTION

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1. EUROPEAN FUSION PROGRAMME

- Coordinated by the European Commission (EURATOM treaty)

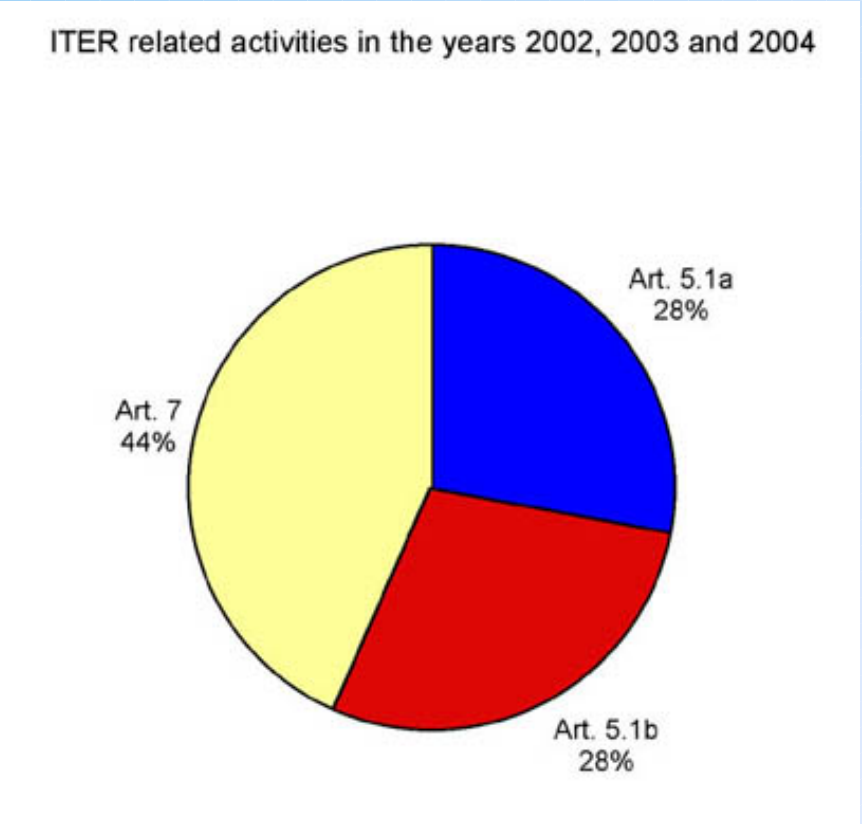
- The European Fusion Development Agreement (EFDA), concluded in 2000 between EURATOM and 15 national organisations of member states of the EU plus Switzerland (Associations with EURATOM). With 10 new member states, further organisations are expected to join.

- EFDA tasks:
  1. Manage the European fusion technology programme and prepare for ITER construction;
  2. Run JET;
  3. Contribute to international cooperation.
- European research programme on fusion financed through 5 years Framework Research Programmes (FP) of the European Commission (4 years plus 1 year overlapping with the following FP)
- Current FP (2003-2006) : 830 M€ commission money assigned to fusion research (about 300 M€ to EFDA)
- 200 M€ spent for JET, 100 M€ for technology.

- Technology budget: 70% ITER preparation, 30% long term programme (materials, power plant conceptual studies, blanket for DEMO, IFMIF)
- Close Support Unit in Garching : 45 full time professionals to manage the technology programme.
- Financial instruments to manage the technology programme
  - Art. 5.1.a tasks to Associations: 20% Commission money, 80% national institutes;
  - Art. 5.1.b contracts to Associations: 40% Commission money, 60% national institutes;
  - Art. 7 contracts to industry: 100% Commission money.

- Considering the multiplying effect of the financial instruments, with respect to the EURATOM money, the amount of money spent on ITER preparation from 2002 to 2004 (3 years) is about 160 M€.

Percentage of expenditure, from 2002 to 2004, of EURATOM money in Art. 5.1.a, 5.1.b, 7.



2. MAIN PROGRAMMATIC GUIDELINES

- To provide Europe full capability to build DEMO.
- This implies to cover all the main (critical) physics, technology and engineering issues, relevant to a reactor, in design and R&D, already with reference to ITER.
- ITER represents a major transition step in fusion research:
  - Conclusive physics experiment;
  - Large nuclear system (comparable to a fission power plant with complex fusion specific technologies). This will imply a strong involvement of nuclear industry and technologically advanced industry.

- Before and during the construction of ITER, the Host is going to play a delicate major role assisting the ITER Organisation (the Owner of the plant) in its interaction with the Host national licensing authorities;

3. EUROPEAN WORKPROGRAMME IN TECHNOLOGY IN VIEW OF ITER CONSTRUCTION

6 main areas of work:

- **Physics:** - Integration in ITER physics of the results obtained on JET and the other EU experiments
  - Heating & Current Drive Systems
  - Diagnostics
- **Magnets:** - TF coils, PF coils: strands, cables, conductors
- **Vessel/In vessel:** - Divertor, First Wall and Shielding blanket
  - Vacuum Vessel
  - Remote Handling

- **Test Blanket modules (two helium cooled concepts)**
- **Fuel Cycle**
- **Safety & Environmental Impact**
- **Site Preparation:**
  - Licensing preparation
  - Codes & standards
  - Site layout
  - Pulsed electric power
  - Auxiliaries (electric power distribution, water cooling system, cryogenic system, vacuum pumping system etc.)

4. OBJECTIVES

- **Design:** conduct activities in EFDA, in the Associations and in industry, to assure continuity in ITER design in support of the ITER International Team also during this transitional period

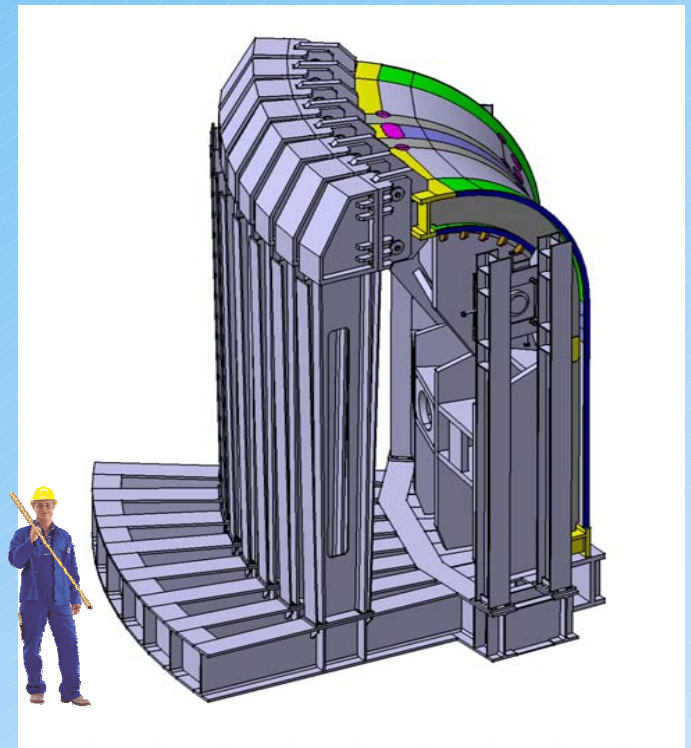
- **R&D:** in Associations and in industry with two main objectives:
  - To test the design of critical components and systems
  - to prepare viable efficient routes to manufacture components
- **Facilities:** build and use facilities to check the performance of components and systems specifically designed for ITER in order to assure the design effectiveness and reliability.

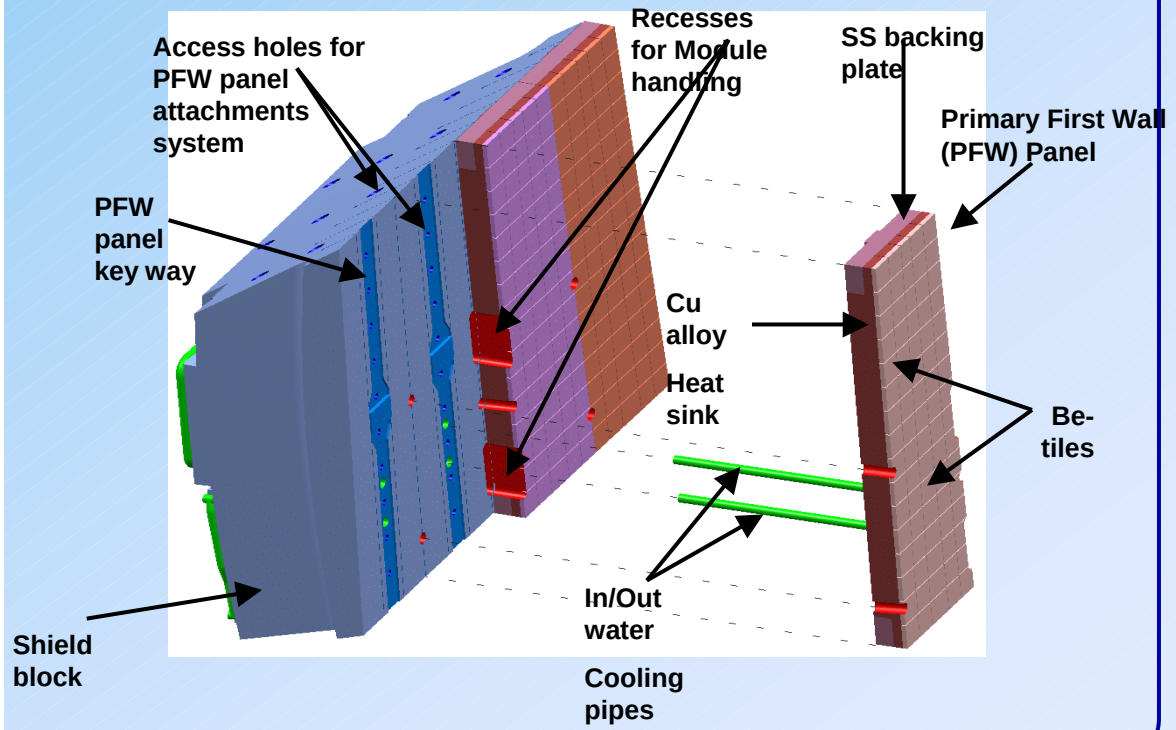
  Prepare facilities for quality assurance during series production of components for ITER.

5. MAIN LINES OF ACTIVITY

- Vacuum vessel: segment manufacturing and test of assembly procedure

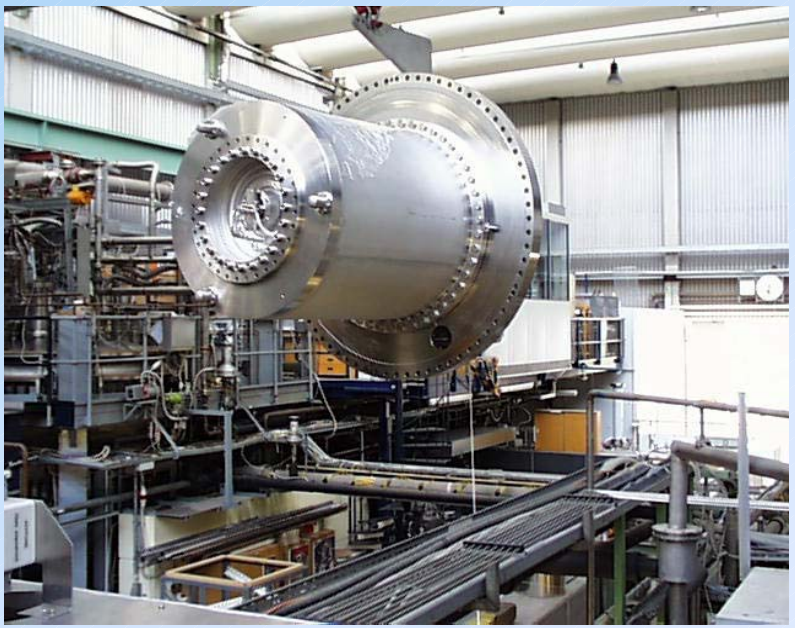
- Shielding Blanket and Plasma Facing Components: manufacturing and test





Divertor: vertical target prototype. W and graphite monoblocks tested at full performance.

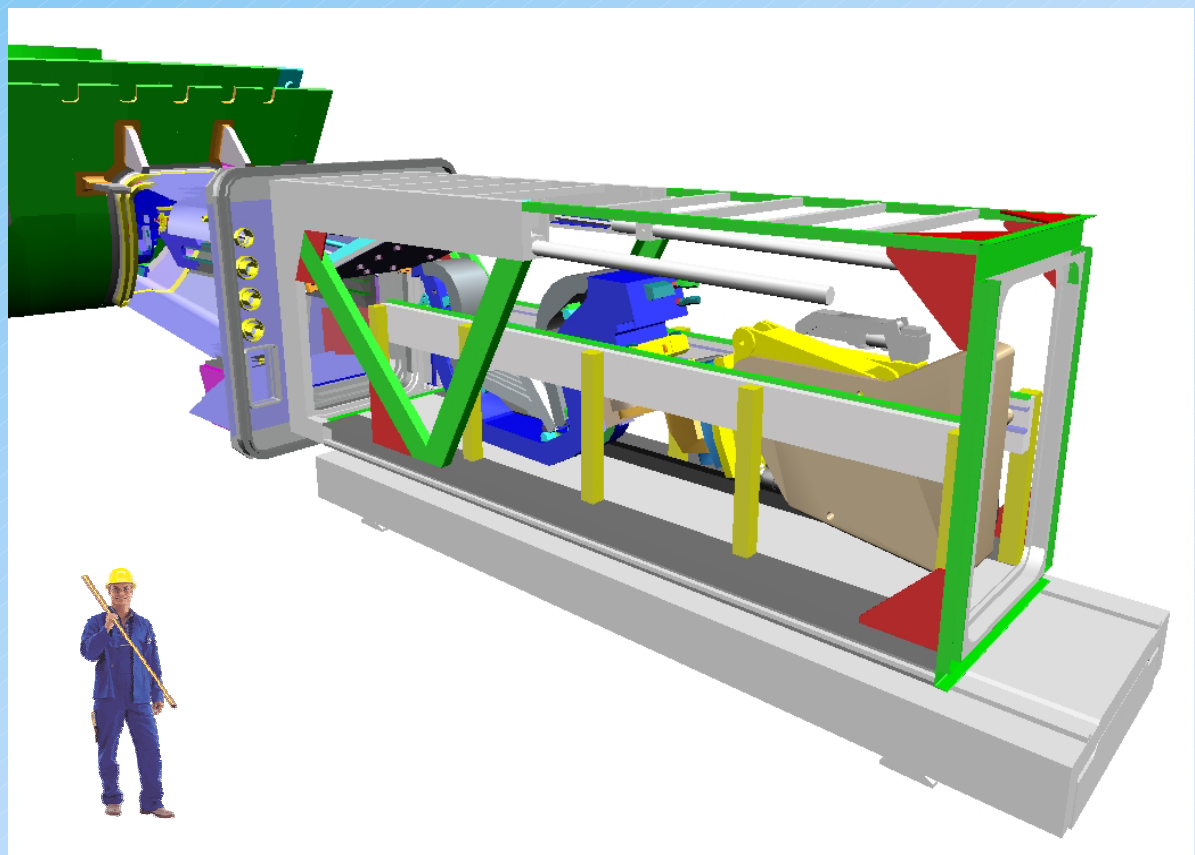
– Cryogenic Pumps: Second Prototype manufacturing and test

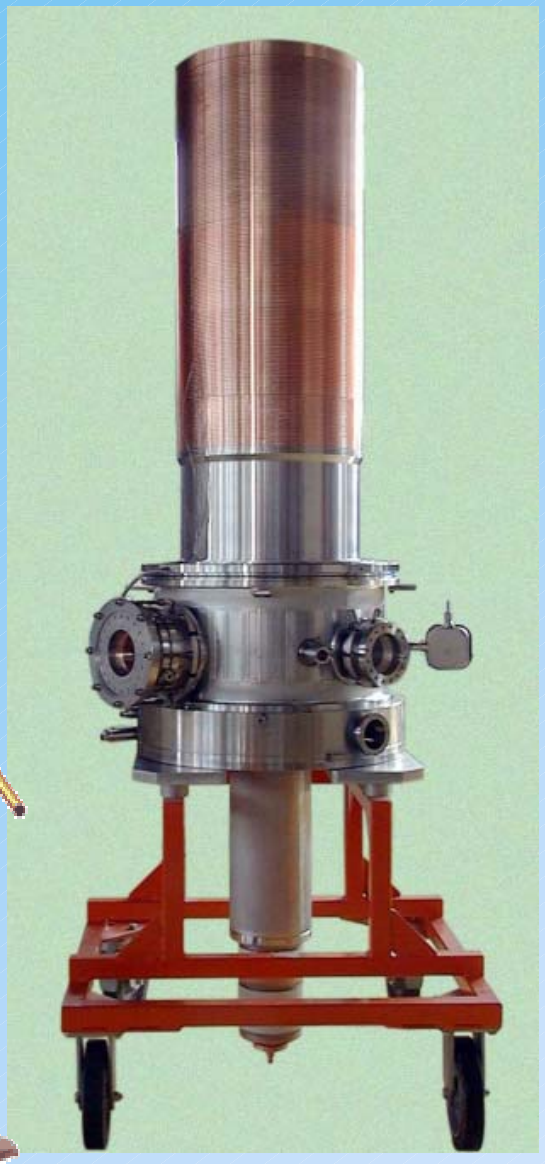


– TFMC: successfully tested. First batches of advanced strands successfully demonstrated

– Poloidal Field Coils: Insert Coil (PFIC) manufacturing and test

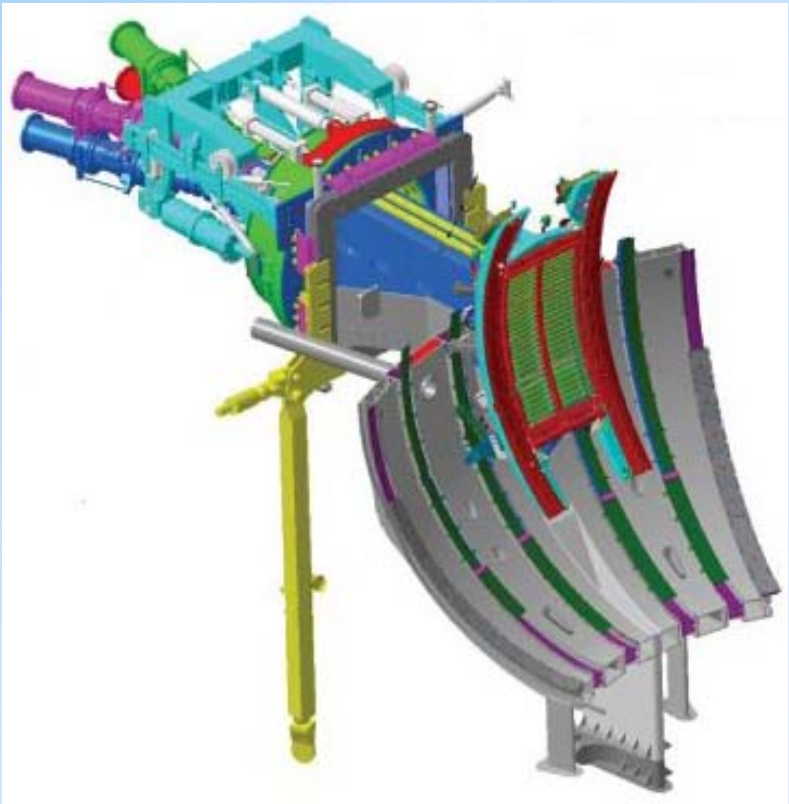
– Remote handling system: Cassette Multifunctional Mover and Second Cassette Carrier manufacturing, test in a dedicated facility, DTP-2





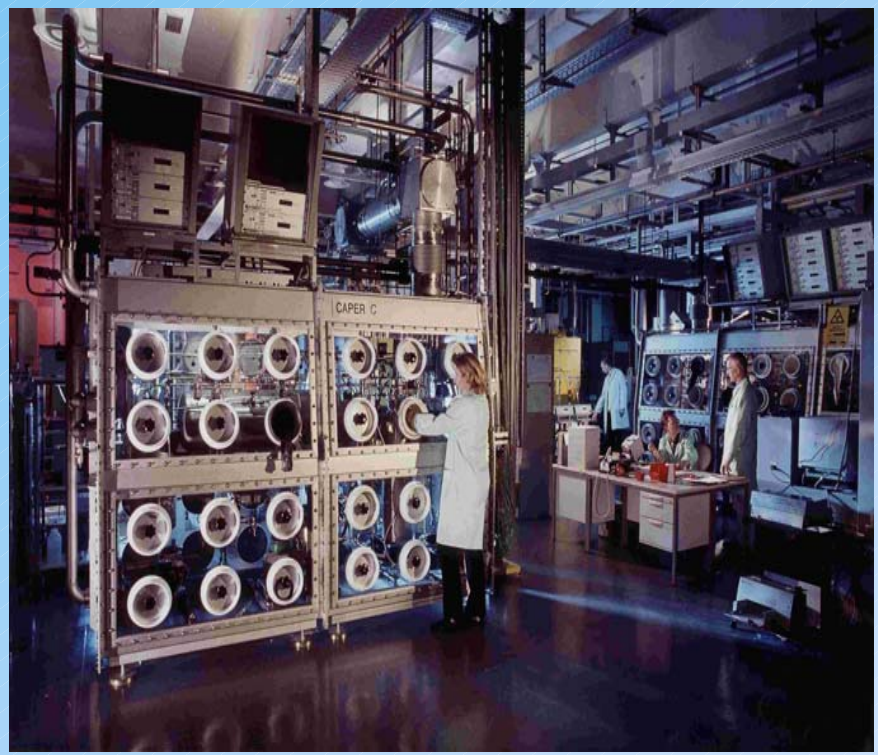
ECRH: development of a 2 MW, cw, 170 GHz coaxial cavity gyrotron.

ITER ICRH antenna design for JET



- **System Testing**
  - SULTAN facility available to test superconducting conductor performance. Construction of a Dipole under consideration as test facility for quality assurance during conductor series manufacturing
  - Facility for thermal fatigue testing (30,000 cycles) of the First Wall Plasma Facing Components
  - High heat flux and low cycle fatigue testing of the Divertor Plasma Facing Components

Fuel Cycle: laboratory demonstration of the fuel cycle operation



HEFUS 3 facility to test helium cooled solid breeder and lithium lead BB Modules.

6. CONCLUSIONS

- As a result of the wide ranging technology programme conducted specifically on the new ITER design, a comprehensive in-depth knowledge of the problems presented by ITER construction, in all domains, has been generated in Europe;
- A strong know-how basis has been built, in the Associations and in industry, ready to be used in support of the ITER Organisation;
- Europe is offering an excellent technical site, well prepared to welcome ITER construction and is ready to provide open and full cooperation to all our Partners to successfully realise ITER as a corner-stone for future fusion development.