EFDA Task Force Integrated Tokamak Modelling EUROPEAN FUSION DEVELOPMENT AGREEMENT The European Integrated Modelling effort : challenges and achievements

The Integrated Tokamak Modelling Task Force (ITM-TF) plays a crucial role in the coordination effort of European modelling activities pursued by EFDA AIM: provide a framework supplying transparent, consistent and efficient integration of most of the state-of-the-art European tokamak physics codes, modelling both the plasma physics and the tokamak subsystems, allowing to explore new physics issues on present experiments, ITER and beyond.

Challenges and objectives

- > Develop a software infrastructure specific to fusion physics for the integration of tokamak models and allowing the access to experimental data
- > Validate on the existing tokamak experiments
- > Use the developed tools for modelling ITER
- Junique and ambitious wide scale Integrated Modelling effort

ITM-TF philosophy and approach

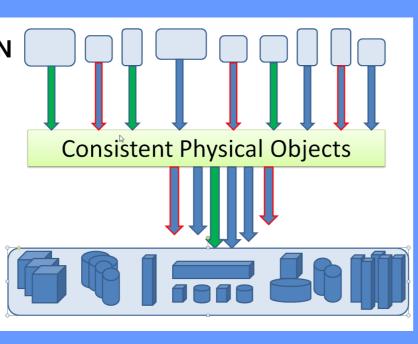
Comprehensive integrated tokamak modelling:

- infrastructure describing both the tokamak physics and the machine within a unique framework
- strategy: divide the global problem into Elementary Physics
 Problems (equilibrium, transport, MHD, sources, diagnostic response, ...)
- ✓ fully modular and flexible simulation platform
- standardized interfaces for physics and technology Consistent Physical Objects (CPO) a solution to the N² problem
- completely generic workflow

N modules coupled into a dynamic application framework

https://www.efda-itm.eu/

EFDA ITM-TF Expo "The European Integrated Modelling effort : challenges and achievements" – 38th EPS 2011 G. Falchetto, CEA, ITM-TF Leader and ITM-TF contributors



ITM-TF history and timeline

Preparatory Phase Expert Working Groups **Development**

Phase EURATOM funding Task Agreements

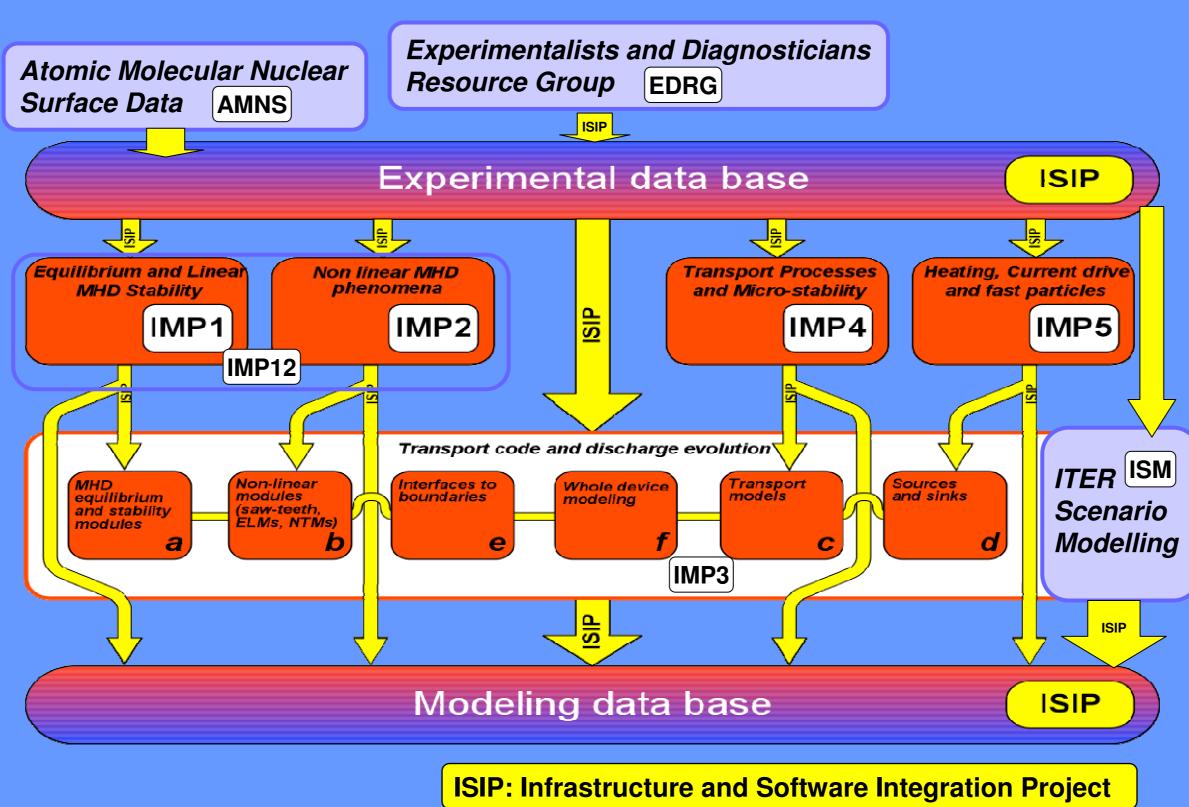
2004

2006

HPC-FF FZJ

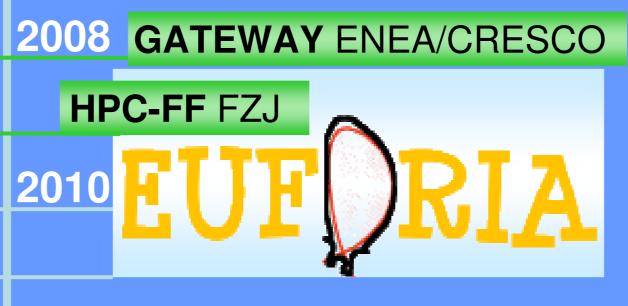
Deployment phase

ITM-TF modular structure

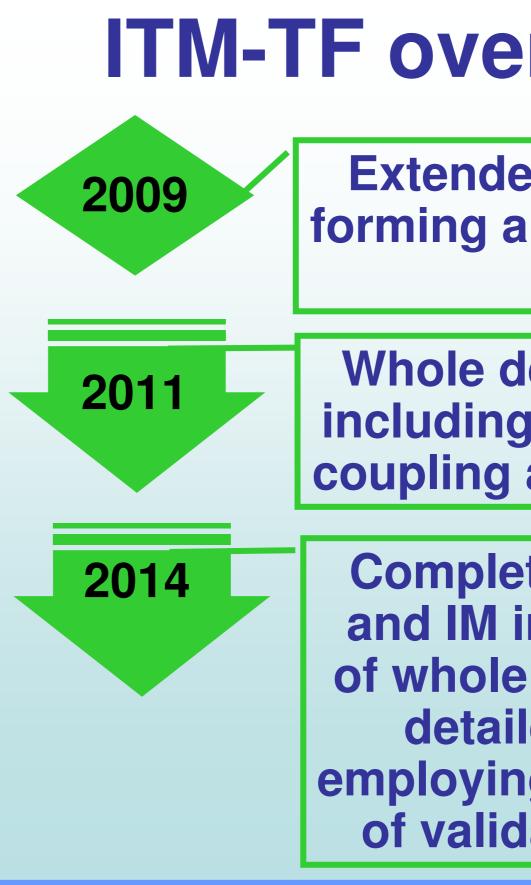


IM + Infrastructure projects

ITM server EFDA-CSU, Garching



- of a robust platform and software infrastructure
- mappings from most existing tokamak devices
- ready for integration to the transport solver.
- existing transport codes
- equilibrium reconstruction and MHD stability chain
- Predictive ITER baseline scenario modelling



Present status and Achievements

Increasing progress since the Gateway advent and the delivery

Delivery and upgrade of machine descriptions and data-

Most ITM codes ported on the Gateway as stand-alone modules (or Kepler actors), tested in protoype workflows and

Significant progress in the development and of the core transport code ETS, as well as its verification against leading

Prototype workflows running on the Gateway or HPC-FF

Production workflow ready for exploitation on existing devices:

ITM-TF overall Milestones

Extended set of platform tools forming a predictive core physics capacity

Whole device modelling capability including comprehensive core-edge coupling and first-principle elements

Complete modelling platform and IM infrastructure capable of whole device modelling and detailed physics studies employing a comprehensive set of validated physics models