

# 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

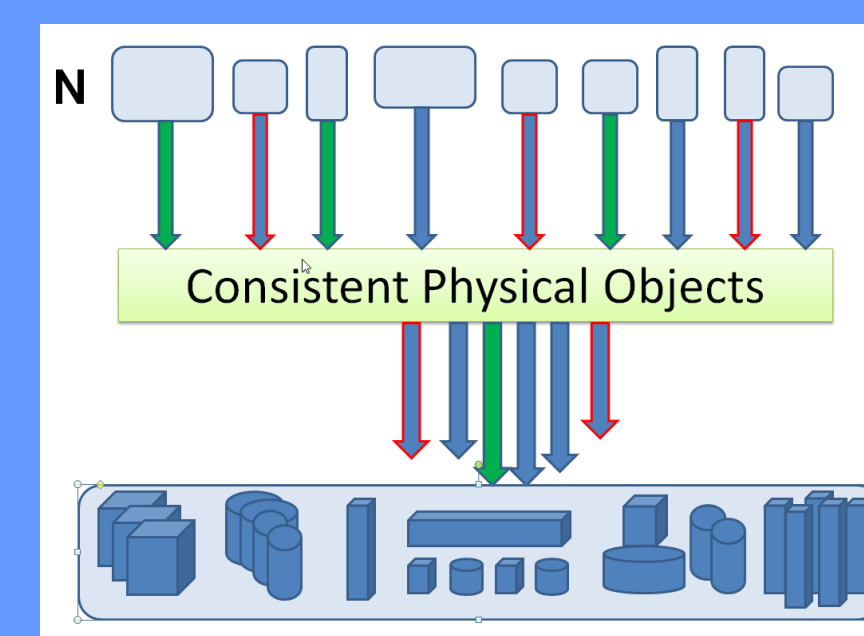
- Develop a software infrastructure specific to fusion physics for the integration of tokamak models and allowing the access to experimental data
- Validate on the existing tokamak experiments
- Use the developed tools for modelling ITER
- ➔ unique and ambitious wide scale Integrated Modelling effort

## ITM-TF philosophy and approach

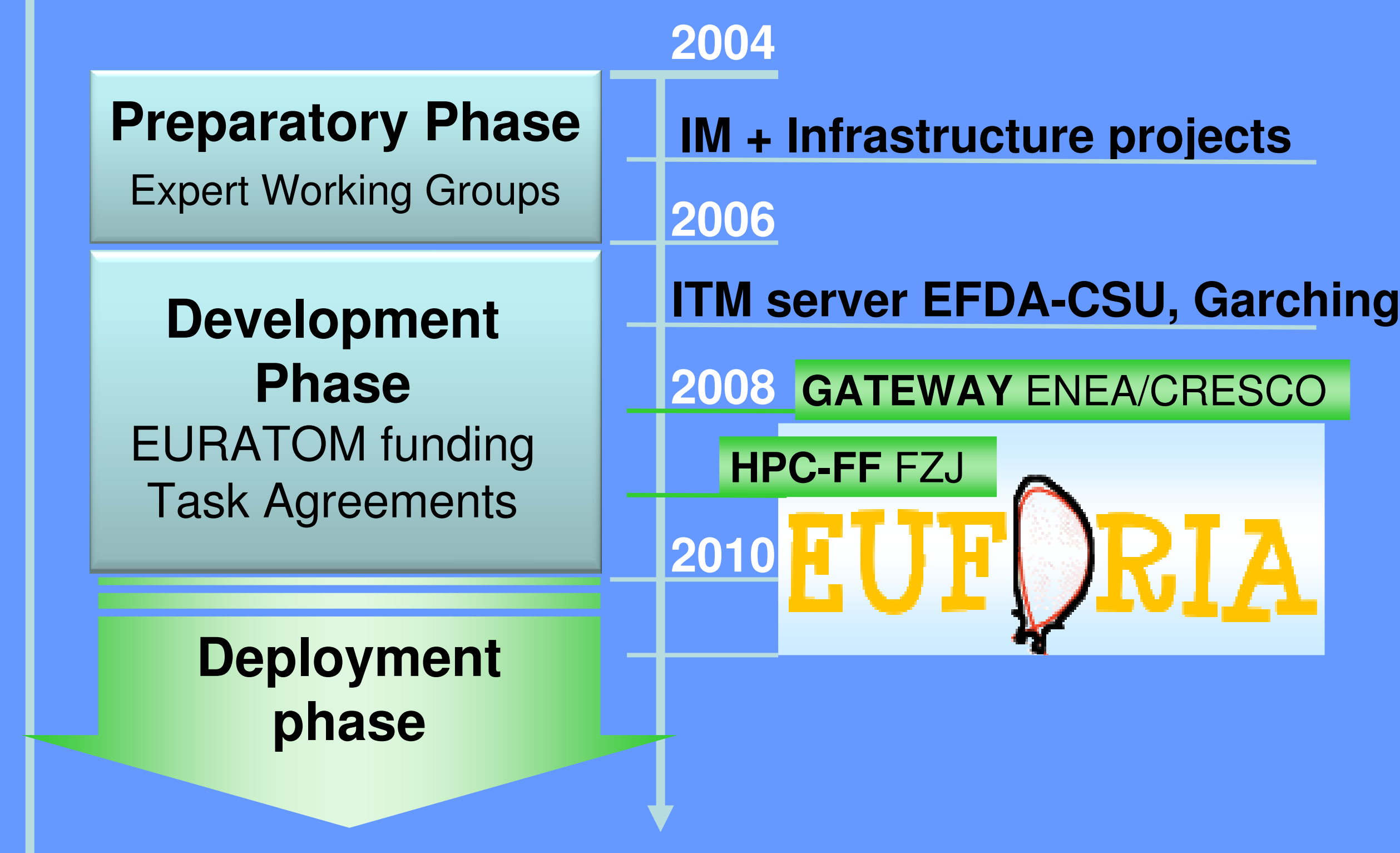
Comprehensive integrated tokamak modelling:

- ✓ 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  $N^2$  problem
- ✓ completely generic workflow

*N modules coupled into a dynamic application framework*



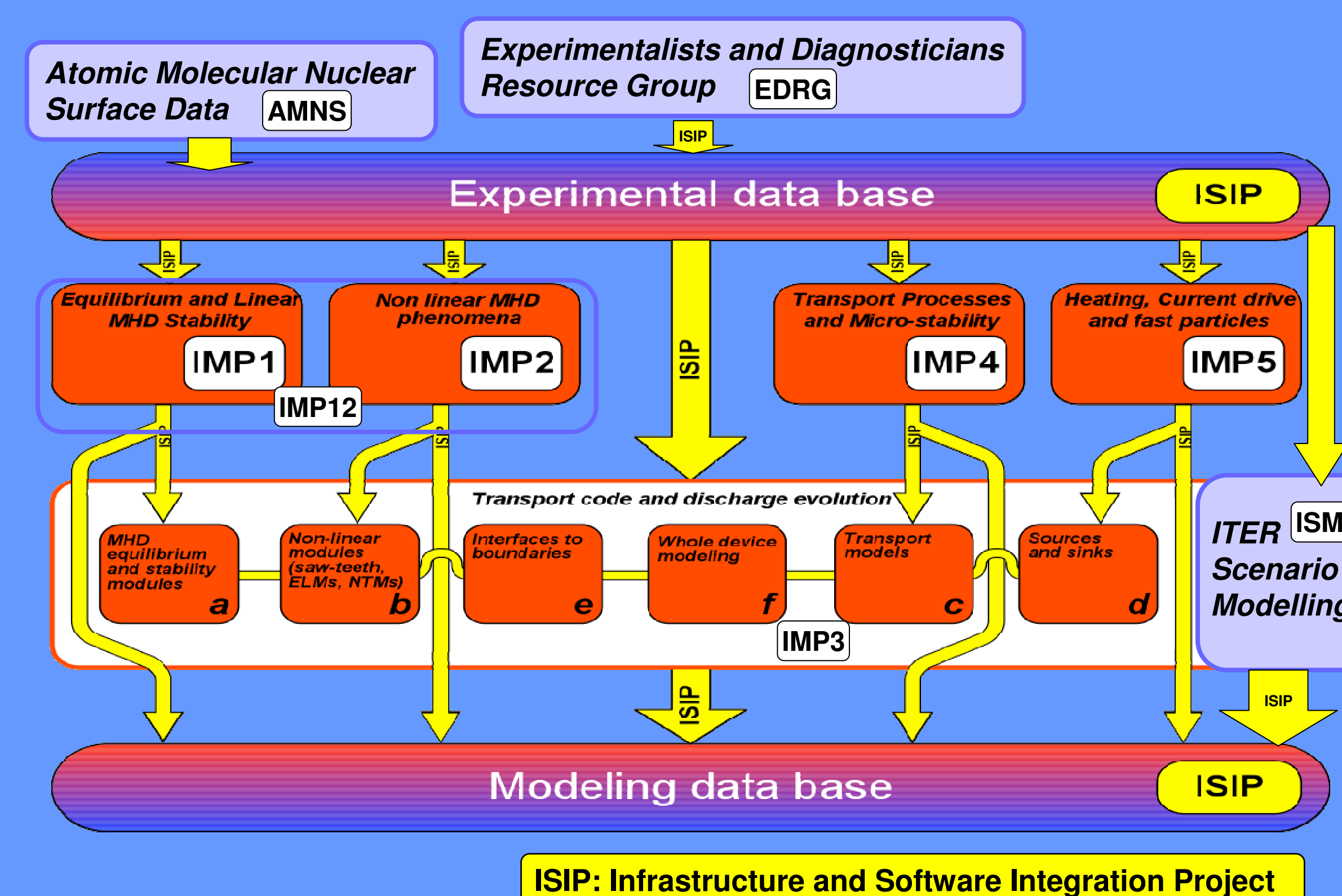
## ITM-TF history and timeline



## Present status and Achievements

- ✓ Increasing progress since the Gateway advent and the delivery of a robust platform and software infrastructure
- ✓ Delivery and upgrade of machine descriptions and data-mappings from most existing tokamak devices
- ✓ Most ITM codes ported on the Gateway as stand-alone modules (or Kepler actors), tested in prototype workflows and ready for integration to the transport solver.
- ✓ Significant progress in the development and of the core transport code ETS, as well as its verification against leading existing transport codes
- ✓ Prototype workflows running on the Gateway or HPC-FF
- ✓ Production workflow ready for exploitation on existing devices: equilibrium reconstruction and MHD stability chain
- ✓ Predictive ITER baseline scenario modelling

## ITM-TF modular structure



## ITM-TF overall Milestones

