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Advanced computing for fusion simulation and modelling

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ITER is the next generation of fusion devices and is intended to demonstrate the scientific and technical feasibility of fusion as a sustainable energy source for the future. To exploit the full potential of the device and to guarantee optimal operation for the device, a high degree of physics modelling and simulation is needed even in the current construction phase of the ITER project. The detailed modelling tools that are needed for an adequate description of the underlying physics cover both a wide range of timescales and spatial orderings and are in general very demanding from a computational point of view. Current modelling activities rely on local or national computational resources and an improved access to computing infrastructures will be instrumental in advancing a pan-European modelling activity for ITER to a very competitive status in relation to the ITER partners.

The EUFORIA project is developing a comprehensive framework and infrastructure for core and edge transport and turbulence simulation, linking grid and High Performance Computing (HPC), to the fusion modelling community.

EUFORIA is enhancing the modelling capabilities for ITER sized plasmas through the adaptation, optimization and integration of a set of critical applications for edge and core transport modelling targeting different computing paradigms as needed (serial and parallel grid computing and HPC). Deployment of both a grid service and a High Performance Computing service have proven essential to the project. A novel aspect is the dynamic coupling and integration of codes and applications running on a set of heterogeneous platforms into a single coupled framework through a workflow engine, a mechanism needed to provide the necessary level of integration between the physics applications. This strongly enhances the integrated modelling capabilities of fusion plasmas and will at the same time provide new computing infrastructures and tools to the fusion community in general.

Current status, lessons learned and future prospects are reviewed in the project.

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