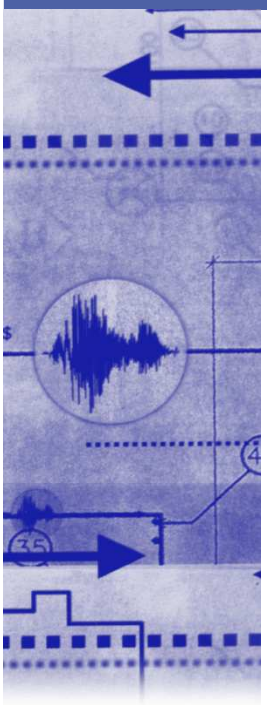
FUSION APPLICATIONS



ITER (the International Thermonuclear Experimental Reactor) is a joint international research and development project that aims to demonstrate the scientific and technical feasibility of fusion power, which will be constructed at Cadarache, France. The project aims to create a hydrogen plasma torus operating at over 100 million ℃, which could potentially produce 500 MW of fusion power by around 2016.

The Steering Committee of the European Fusion Development Agreement (EFDA) has formed a group to study the future computing needs for the European fusion community, and the capability of Grids for meeting these needs has already been demonstrated. Currently, 11 sites spread over 4 federations support the Virtual Organisation for the Fusion community, providing some 1,100 CPUs. To increase the number of fusion applications on the Grid, the associations of EFDA have been invited to run their code and applications on the EGEE Grid.

The following applications are already running on the EGEE Gridinfrastructure:

- **Massive Ray Tracing** is an application that estimates the trajectory of a microwave beam in plasma. The beam, used to heat the plasma, is simulated by a bunch with a large number of rays (typically 105). The program estimates the trajectory and the absorption of every single independent ray in complex plasmas.
- Global **Kinetic Transport** is estimated by following the orbits of a large number of independent particles that suffer collisions with background plasma, characterized by temperature, density, and electric field. The final trajectories are used to estimate important properties of transport in plasmas, namely particle flux, heat flux, confinement times, asymmetries, and the distribution function of particles.
- A genetic algorithm has been developed to perform **Stellarator optimisation**. Stellarators are magnetic confinement fusion devices that are designed to work in steady state confine current-less plasmas. There are several possible stellarator magnetic configurations and it is necessary to establish which of them is the most convenient. Every configuration is studied in a single processor of the Grid and a genetic algorithm is used to find the best configuration of all those obtained.

In addition, nuclear fusion scientists who use the Russian Data Intensive Grid (RDIG) resources in their work have formed their own, local Virtual Organisation. Currently, members of this VO are identifying generic Grid access patterns, formulating middleware requirements, and porting their initial applications.

EGEE is keen to consider other applications. For further information on how to participate, as well as more information about the applications running on EGEE, visit the User and Application Portal at http://egeena4.lal.in2p3.fr/.

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