

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. The project, centred at Cadarache, France, aims to create a hydrogen plasma torus operating at over 100 million °C, whose first plasma will be created around 2018, and which could potentially produce 500 MW of fusion power.

Several pilot applications are now in production within Enabling Grids for E-science's (EGEE) Fusion Virtual Organisation (VO). This VO integrates 28,375 CPUs, belonging to 27 sites of four federations. To increase the use of grid within the fusion community, the EUFORIA project, funded by the European Commission, began in 2007 to encourage collaboration between grid, HPC and fusion communities. The EGEE and EUFORIA projects have close ties.

The following applications are already running on the EGEE grid infrastructure:

- **Massive Ray Tracing** is an application that estimates the trajectory of a microwave beam in plasmas. The beam, used to heat the plasma, is simulated by a bunch with a large number of rays. The program estimates the trajectory and the absorption of every single independent ray in complex plasmas. This application is under modification to allow the heated plasma to evolve.
- **Ion Kinetic Transport** estimates properties of the plasma such as particle flux, heat flux, confinement times, asymmetries, and the distribution of particles. This is being adapted to enable more complex, physical predictions.
- **Stellarator Optimisation** is based on a genetic algorithm, recently updated and improved. Stellarators are magnetic confinement fusion devices that are designed to work in steady state confine current-less plasmas. Of the many magnetic configurations possible, this application calculates which is best.
- **Neutral Beam Injection** is an application to simulate the high energy particles that enter the reactor to heat the plasma. This application will shed further light on the dynamics of plasma physics, including the confinement of high energy particles.
- **Linear Turbulence** is an application that estimates the linear dynamics of the turbulence in plasmas.
- **Tokameq** is a code that estimates the plasma geometry together with the background magnetic field in a tokamak for different plasma currents and pressures.
- **DKES** (Drift Kinetic Equation Solver) calculates the transport created in plasmas by the inhomogeneity of the magnetic field plus the collisions among different particles.
- The grid is also used to estimate the orientation of carbon nanotubes that are created by the carbon dust deposited by the plasma on the wall.

Different strategies have been used to port those applications to the grid and those codes solve problems in different fusion fields, showing that grid computing is a powerful tool in solving plasma physics problems. These applications are used daily by fusion researchers.

The possibilities of grid technologies for data management in fusion devices are presently under investigation.

## Application webpages

EGEE is keen to consider other applications. For further information on how to participate see <http://technical.eu-egee.org/index.php?id=392>. More information about the applications running on EGEE be found on the EGEE website at <http://technical.eu-egee.org/index.php?id=148>.

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