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THE CONTRIBUTION OF JET TO ITER

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The mid-term JET experimental programme will exploit the recently enhanced scientific capabilities of the JET tokamak. The divertor has been modified allowing high triangularity ITER relevant scenarios to be run at high plasma current; sixteen new or upgraded diagnostics are being made operational and a new ITER-like Ion Cyclotron Resonant Heating (ICRH) antenna will be installed for operation in 2007. The experimental campaigns will be devoted to studying critical issues potentially impacting the detailed design of ITER components (e.g. first wall, heating and current drive systems, diagnostic) and, in parallel, aiming at further developing ITER operating scenarios and address specific physics issues of direct relevance to ITER (e.g. transport physics, burning plasma physics).

For the longer term, work on a “JET programme in support of ITER” has begun, which aims at making optimal use of JET’s unique features: large plasma size and capability to handle beryllium (Be) and tritium (T).

ITER is currently designed to have a beryllium-clad first wall, tungsten (W) brushes at the divertor entrance and carbon fibre reinforced carbon (CFC) tiles at the divertor strike points. This combination of materials has never been tested in a tokamak. The ITER-like wall project on JET, planned for installation starting mid 2008, will use a combination of Be on the first wall, bulk-W and W-coated CFC tiles in the divertor. W-coating and bulk W technologies have been selected as result of one year of intensive R&D. The experimental programme will include T-retention studies, material erosion and migration, mixed materials effects, melt layer behaviour and impurity control, and operational scenario compatibility with a Be/W material mix.

Techniques for avoiding the issues caused by the effects of expected large Edge Localised Modes (ELMs) on the walls and divertor in ITER will be tested in JET with the installation of a pellet injector with a high repetition rate (up to 50 Hz), for ELM pace making as demonstrated on ASDEX Upgrade.

In order to increase the ITER-relevance of the plasma scenarios, additional neutral beam heating power, up to 36 MW for 20s (compared to 25 MW for 10s presently) will be provided by upgrading the existing beam boxes and power supplies for operation at higher current. Phasing the two beam boxes will make it possible to deliver 17-18 MW of neutral beam power for up to 40s, for full exploitation of the pulse length capability of the JET machine. This will be essential ingredient to progress, in particular, hybrid and advanced scenarios for ITER, which require full or partial current profile control.

Finally, diagnostics required to support further developments of ITER plasma scenarios, as well as ITER diagnostics that need to be tested on JET, such as fast wave reflectometer and radiation hard hall probe, will be implemented mostly by upgrading existing systems.

Besides tokamak experiments, the JET activities in support of ITER include also technology R&D. A particular focus has been put recently on activities aiming at characterising dust and erosion/deposition areas in JET, improving in-situ T removal techniques and providing support in topics relevant to the

licensing of ITER.