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New jet results tick all the boxes for ITER

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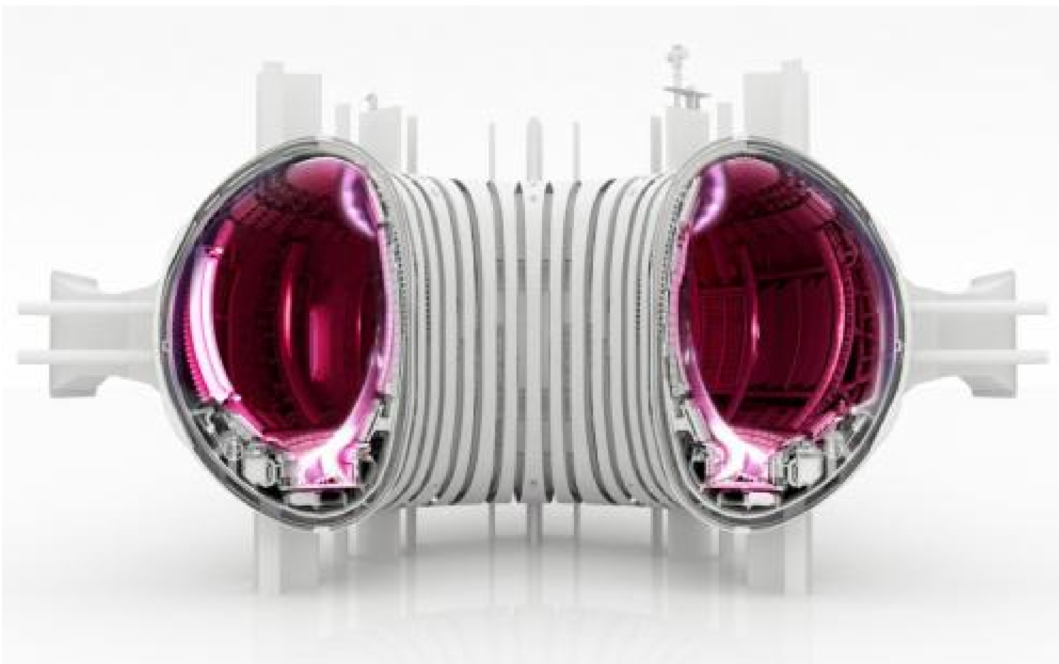

Computer-generated cutaway image of JET during a plasma experiment

Latest results from the Joint European Torus (JET) fusion device are giving researchers increasing confidence in prospects for the next-generation ITER project, the international experiment that is expected to pave the way for commercial fusion power plants. Operation with a new lining inside JET has demonstrated the suitability of materials for the much larger and more powerful ITER device.

JET, Europe's premier magnetic confinement fusion facility, based at Culham, UK, has completed eleven months of tests to simulate the environment inside ITER and to prototype key components. For this purpose JET has been successfully transformed into a 'mini-ITER' with a wall made of the same materials – beryllium and tungsten – that ITER plans to use. Initial results will be summarised by Dr Francesco Romanelli, Leader of the European Fusion Development Agreement (EFDA) and JET Leader, at the IAEA Fusion Energy Conference in San Diego, U.S. on Monday 8 October.

At the heart of tokamak fusion reactors like JET is a ring-shaped vacuum vessel in which very hot plasma is confined using magnetic fields. Selecting the correct materials for the inner wall of this vessel is essential. Firstly to minimise 'pollution' when small amounts of wall materials enter the plasma, and secondly to prevent the fusion fuels from becoming trapped in the wall. ITER will use beryllium for the main wall and tungsten (with its higher melting point) for the floor of the chamber – the 'divertor' – where plasma is exhausted and heat loads are greatest. A 20-month engineering upgrade during 2010 and 2011 installed a new plasma-facing wall inside JET to validate these materials for ITER.

From the first test in August 2011, the beryllium and tungsten lining enabled more reliable plasmas to be produced. Crucially, researchers from the 27 European fusion laboratories which participate in JET have found that the amount of fuel being retained in the wall is at least ten times less than in the previous, carbon-based, configuration. The results achieved may lead ITER to drop plans for an initial phase of operation with carbon and adopt a beryllium-tungsten wall from the outset, bringing a significant saving in time and cost for the project.

Experiments at JET will restart in early 2013, with the goal of demonstrating plasma performance even beyond ITER's expectations. Looking further ahead, EFDA is already planning a full 'dress rehearsal' for ITER – an experimental campaign at JET using the optimum deuterium-tritium fuel mix that is needed for high-power fusion operation. JET is the only device currently able to run fusion plasmas with tritium, and exploiting these capabilities will be a crucial part of ITER preparations. ITER Director General Osamu Motojima praised the work being done at JET during a visit this summer and has been discussing collaborations with EFDA on future experiments.

Dr Francesco Romanelli said: "These results are very encouraging for ITER. JET is getting as close to ITER conditions as any present-day fusion device can. If this performance is scaled up, ITER will be successful and take a huge step towards the goal of commercial fusion power."

JET has largely formed the basis for ITER's design and is an ideal test-bed. We hope to open up new collaborations with ITER partners as we prepare for full deuterium-tritium tests in 2015. Already we are working with Indian colleagues on magnetic coils for suppressing plasma instabilities. I hope to build more partnerships so JET's unique capabilities can be used for the benefit of the worldwide fusion programme."

More information: www.efda.org/

Provided by European Fusion Development Agreement

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