

Research team uses remote control to replace the fusion reactor cassette collecting impurities

October 6 2014

VTT Technical Research Centre of Finland has reached an important objective in the development of ITER fusion reactor remote control, when the divertor cassette was replaced for the first time using remote control in the research facility for remote controlled maintenance. This operation is one of the most demanding measures in the forthcoming ITER fusion reactor, the construction of which is proceeding rapidly in Gadarache, Southern France.

The requirements for the technologies used in ITER, are high, since they are used to control the fusion plasma burning at a temperature of hundred million degrees centigrade. Once the ITER comes into use, its core is activated when bombed by neutrons. Therefore, all maintenance, inspection and repair measures are performed using remote operation.

Located in the lower part of the ITER reactor chamber, the 54 cassettes of the reactor component, or the divertor, measuring 3.4 m x 2.3 m x 0.6 m and weighing approximately 10 tonnes each, need to be handled at tolerances of a few millimetres. The divertor cassette is like a giant ashtray, into which the hot ashes and impurities settle.

In remote operation, the 54 divertor cassettes are installed via three separate maintenance tunnels using a robot and a manipulator. When it is time to remove the divertors, they are unlocked and detached from the ITER reactor chamber, placed in a transport container and removed to

be processed in a 'hot cell' facility. According to the plan, the parts will be replaced three times during the 20-year service life of the reactor.

For the cassette replacement operation, the lights of the Divertor Test Platform, or the DTP2 facility located in a VTT research facility were dimmed to correspond with the prevailing conditions in ITER, and the whole operation was performed from a control room with the assistance of virtual models and camera views. The DTP2 is a full scale mock-up of the bottom part of the [fusion reactor](#), its so-called divertor area. The actual test platform is approximately 20 metres long and weighs some 65 tonnes.

The successful operation was also witnessed by representatives from Fusion for Energy (F4E), responsible for European coordination of the ITER project, and also from the ITER organisation. Work related to remote operation and maintenance operations has not yet reached completion and will continue.

Components for the reactor are being produced in different parts of the world. In Finland, VTT collaborates with Tampere University of Technology to perform R&D related to remote maintenance of the ITER reactor divertor part.

In the ITER [reactor](#) maintenance, remote operation and virtual technologies play a key role, and they have extensive opportunities for application in other industrial sectors as well. Similar technologies are being used, for example, on space flights and in underground operations. The system combines robotics, advanced technological tools, powerful computers, and virtual reality platforms.

Provided by VTT Technical Research Centre of Finland

Citation: Research team uses remote control to replace the fusion reactor cassette collecting impurities (2014, October 6) retrieved 24 April 2024 from <https://phys.org/news/2014-10-team-remote-fusion-reactor-cassette.html>

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