IAEA FEC 201

Contribution ID: **316** Type: **Poster**

Ion Cyclotron Range of Frequency Power for DEMO

Friday, 21 October 2016 08:30 (4 hours)

The paper summarizes the studies carried out on the use of an Ion Cyclotron Range of Frequency System on DEMO in the framework of the PPPT.

An ion cyclotron range of frequency (ICRF) heating system can contribute significantly to various plasma phases during an experimental cycle ('shot'). It can be used in the plasma start-up and current ramp-up phase, where election heating is beneficial. After this phase, various heating schemes that aim at direct or indirect bulk ion heating offer different paths to suitable operation points with a large power gain factor and large efficiencies.
Although mainly meant to heat the plasma, ICRF power can also contribute to current drive and plasma rotation and can help to control MHD instabilities. ICRF power can further be used to ensure a 'soft'termination of the discharge. It was confirmed experimentally that the ICRF can be used for all those functions.

With the present emphasis on a pulsed DEMO machine (the EU DEMO1 2015 baseline) we studied in more detail the heating scenarios and a corresponding antenna.

In DEMO, to reduce as much as possible the number and area of openings in the vessel, heating systems with high power density, using the smallest port area, would be expected to be favored. An alternative is to integrate the heating system into the machine. ICRF antennas have been operating in machines like JET and ASDEX Upgrade close to the plasma without using a large port for several tens of years without any problems. In DEMO, a distributed antenna, integrated in the blanket, covering the full 360° toroidal extend and of the travelling wave type would have a low power density, not use any port (except for the feeds) and be compatible with the tritium breeding. This new antenna type allows for an improved coupling by being able to work with low k// and conceptually avoids, with its 360° symmetry, the occurrence of sheaths and thus additional impurity production.

Such an integrated antenna needs to fulfill a number of conditions on compatibility with blanket function and remote handling, on modularity, level of safety and complexity. Scoping studies indicate that there are indeed no show-stoppers.

A test of this type of antenna in a tokamak plasma is needed. It could be done in several steps, but a final proof of principle on a large machine will be essential.

Paper Number

FIP/P7-13

Country or International Organization

Germany

Primary author: Mr BADER, A (Max-Planck-Institute for Plasma Physics)

Co-authors: Mr RESEARCH UNITS PARTICPATING IN WP HCD, - (EUROfusion); Mr GARCIA, A (UGent, Belgium); Dr MESSIAEN, A (LPP/ERM-KMS, Brussels, Belgium); Dr VAN EESTER, Dirk (LPP-ERM/KMS); Prof. BOSIA, G (University Torino, Italy); Prof. NOTERDAEME, Jean-Marie (Max Planck Institute for Plasma Physics); Mr RAGONA, R (LPP/ERM-KMS, Brussels, Belgium); Dr FISCHER, Ulrich (Karlsruhe Institute of Technology)

Presenter: Mr BADER, A (Max-Planck-Institute for Plasma Physics)

Session Classification: Poster 7

Track Classification: FIP - Fusion Engineering, Integration and Power Plant Design