25th IAEA Fusion Energy Conference - IAEA CN-221

Contribution ID: **183**

Type: **Poster**

TCV Heating and In-Vessel Upgrades for Addressing DEMO Physics Issues

Friday 17 October 2014 08:30 (4 hours)

The TCV tokamak is characterized by the most extreme plasma shaping capability worldwide, the highest microwave EC power concentration in the plasma, and a large degree of flexibility in its heating and control schemes. TCV is presently undergoing major heating upgrades, installing a neutral beam for direct ion heating and increasing the EC power injected in X-mode at the third harmonic (X3). The injection of 1MW 30keV D beam will allow access to regimes with Ti/Te>1 and βN~2.8 in L- and H-mode, with densities compatible with X3 EC heating. A lower energy and power (20keV, 0.5MW) D NBI is suitable for lower densities with X2 EC heating and current drive. Tangential injection is necessary, due to beam access, shine through and orbit losses. The modifications to the TCV vacuum vessel required for installing two ports, through which 1MW of power can be injected, are presently under way. The neutral beam is under construction at Budker INP-Plasma (Russia), with energies of 20-35keV and power up to 1MW for 2s.

The X3 upgrade consists of adding two dual-frequency gyrotrons (X2/X3, 126GHz/84GHz) with a total power at 126GHz of 2MW. The design of the new gyrotron will be carried out at CRPP with contributions from KIT, and will be based on the gyrotron (140GHz/1MW/CW) manufactured by Thales Electron Devices for the W7-X stellarator.

Further substantial improvements in the TCV infrastructure are under examination. Additional power in the dual frequency gyrotron systems is envisioned, to complete and maintain the heating capabilities in regimes of relevance for burning plasma conditions. Substantial diagnostic improvements would also be undertaken, in the areas of THz waves and of advanced imaging systems in the visible, infrared, and mm-wave ranges. An even more substantial modification would be the insertion of new in-vessel modular structures, generating a divertor aperture with variable closure to explore solutions to the crucial problem of the heat and particle exhaust, yet maintaining a good degree of flexibility. To be considered for DEMO, innovative solutions like the snowflake divertor need in fact to be proven viable in the presence of a closed divertor chamber, which allows for high neutral density in the divertor, and of an effective pumping system for particle control.

Country or International Organisation

Switzerland

Paper Number

FIP/P7-7

Author: Prof. FASOLI, Ambrogio (CRPP-EPFL)

Presenter: Prof. FASOLI, Ambrogio (CRPP-EPFL)

Session Classification: Poster 7