Contribution ID: **339** Type: **Poster**

EX/P4-09: Rotation Braking and Error Field Correction of the Test Blanket Module Induced Magnetic Field Error in ITER

Wednesday, 10 October 2012 14:00 (4h 45m)

Experiments on DIII-D confirm that the tritium breeding test blanket modules (TBMs) in ITER will lead to a decrease of the plasma rotation in H-modes [1]. Moreover, they suggest that long-wavelength correction fields applied with non-axisymmetric saddle coils will only be able to ameliorate a fraction of such a rotation reduction. The new finding obtained in rotating H-modes contrasts previous experiments, which showed that saddle coils are very effective in restoring resilience to locked modes in L-mode plasmas. The experiments use a TBM mock-up coil that has been especially designed to simulate the error field induced by the ferromagnetic steel of a pair of TBMs in one of ITER port. The TBM field is applied in rotating H-mode plasmas with shape, beta and safety factor similar to the ITER baseline scenario. The n=1 error field correction (EFC) is applied with a set of non-axisymmetric saddle coils (I-coil), whose currents are optimized in the presence of the TBM mock-up field using a newly developed non-disruptive technique that maximizes the plasma rotation. However, a test of the effectiveness of the TBM EFC yields that the optimized EFC can only recover approximately a quarter of the 30% rotation decrease attributed to the TBM error field. An alternative criterion to evaluate the "goodness"of an EFC has been its effectiveness in canceling the n=1 plasma response to the error field. Plasma response measurements in the TBM experiment show that the I-coil can indeed cancel the magnetic measurements of the n=1 plasma response to the TBM mock-up field. The required currents are consistent with ideal MHD predictions using the IPEC code, but differ significantly from the currents that maximize the plasma rotation. The contrast between the limited effectiveness of n=1 EFC in rotating H-modes and their ability to recover a low locking density in L-mode plasmas shows that the components of the non-axisymmetric field that braking the plasma at high rotation differ from the components that are responsible for the field penetration. However the observation that the n=1 currents that minimize the n=1 plasma response do not correspond to the n=1 currents that maximize the rotation challenge our understanding of error field correction.

[1] M.J. Schaffer, et al., Nucl. Fusion 51 (2011) 103028.

Country or International Organization of Primary Author

Switzerland

Primary author: Mr REIMERDES, Holger (Switzerland)

Co-authors: SALMI, Antti (Association EURATOM-Tekes, VTT, FI-02044 VTT, Finland); STRAIT, Edward J. (General Atomics, San Diego, California 92186, USA); HANSON, Jeremy M. (Columbia University, New York, New York 10027, USA); PARK, Jong-Kyu (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543, USA); SNIPES, Joseph A. (ITER Organization, Route de Vinon sur Verdon, 13115 Saint Paul Lez Durance, France); SCHAFFER, Michael J. (General Atomics, San Diego, California 92186, USA); OKABAYASHI, Michio (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543, USA); OYAMA, Naoyuki (JAEA, 801-1, Mukouyama, Naka City, Ibaraki, 311-0193, Japan); TALA, Tuomas (Association EURATOM-Tekes, VTT, FI-02044 VTT, Finland); SOLOMON,

Wayne (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543, USA); IN, Yongkyoon (FAR-TECH, Inc., San Diego, California 92121, USA)

Presenter: Mr REIMERDES, Holger (Switzerland)

Session Classification: Poster: P4

Track Classification: EXC - Magnetic Confinement Experiments: Confinement