Contribution ID: **3011** Type: **not specified**

O4.109 Experimental and modelling study of locked mode dynamics prior to disruptions in high performance JET plasmas

Thursday, 11 July 2019 17:30 (15 minutes)

See the full abstract here http://ocs.ciemat.es/EPS2019ABS/pdf/O4.109.pdf

The presence of Error Fields (EFs) in magnetic fusion devices can affect energy confinement and plasma stability by braking plasma rotation, by inducing fast particle losses and being amplified when exploring high-regimes. The resulting EF Locked Modes (LMs) can be stabilized by NBI injection through the rotation shielding mechanism. However, the NBI is switched off to exit H-mode and to terminate the plasma discharge. Therefore, the rotation shielding effect is lost during these phases and an EF LM could be triggered. This contribution presents a characterization of the LM dynamics prior to the termination phase of high performance JET plasmas. The JET tokamak is a suitable device for performing this study being subject to an intrinsic EF, associated with asymmetries in the poloidal field coils [1], and with the NBI terminated when the real-time protection system detects the possibility of a plasma disruption. This study is carried out through a statistical analysis of magnetics and ECE data, which reveals that the n=1 mode is more prone to lock at the intrinsic EF toroidal location. The mode locking mechanism has been modelled by the RFXlocking code [2], which solves the torque balance equation considering the electromagnetic, the viscous and the toroidal viscosity torques. EF correction experiments performed in 2006 show that EF correction coils can spin up EF LMs, and can be thus exploited to avoid disruptions induced by LM.
This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2014-2018 and 2019-2020 under grant agreement No 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission.

[1] Fishpool G.M. and Haynes P.S. 1994 Nucl. Fusion 34 109, [2] P. Zanca et al 2015 Nucl. Fusion 55 043020

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Session Classification: MCF

Track Classification: MCF