Contribution ID: **3100** Type: **not specified**

P1.1056 Locked mode and disruption in JET-ILW

Monday, 8 July 2019 14:00 (2 hours)

See the full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P1.1056.pdf

An n = 1 locked, or slowly rotating, mode has been observed in most pulses prior to JET disruptions. However, a small fraction of non-disruptive pulses has a locked mode which eventually vanishes without disruption. Despite these exceptions the locked mode amplitude is routinely used as a trigger for the JET disruption protection system. There are two threshold levels of locked mode: (i) if locked mode amplitude exceeds the "low" threshold level, the emergency pulse shutdown is activated; (ii) if the locked mode amplitude exceeds the "high" threshold level, the massive gas injection (MGI) is triggered to terminate the pulse because the plasma is at high risk of disruption, and so it is necessary to mitigate disruption damage to the vessel and the Plasma Facing Component (PFC). On JET, four vessel octant data consisting of 18 pick-up coils and 14 saddle loops can be used to calculate the locked mode amplitude and phase. The coils measure tangential to the vessel poloidal magnetic field (Bp) and saddles normal to the vessel field (Bn). The n = 1 locked mode amplitude and phase are calculated either from a subset of the four pick-up coils or the four saddle loops located in the identical poloidal location. An n = 2 locked mode was observed in a few exceptional pulses prior to disruption, in that case the amplitude and phase are calculated from 8 octant saddle measurements in the middle plane at the low toroidal field side. For the monotonic plasma current profile, the O-point of the tearing mode island corresponds to a reduction of the measured tangential poloidal field. ECE data, when they are valid, are used to study a locked mode evolution during 2011-16 JET-ILW operation. The O-point of the locked mode has a preferred toroidal phase dwelling mainly in octants 4 and 5, which manifest in the machine toroidal asymmetries. The fact the locked mode exists for a long time prior to disruptions suggests other physics could be involved in finally triggering the disruption.

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 and from the RCUK Energy Programme [EP/P012450/1]. The views and opinions expressed herein do not necessarily reflect those of the European Commission.

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Session Classification: Poster P1

Track Classification: MCF