Contribution ID: **117** Type: **Poster**

TH/P3-10: Pedestal Modelling Based on Ideal MHD and Gyrokinetic Stability Analyses on JET And ITER Plasmas

Wednesday, 10 October 2012 08:30 (4 hours)

The H-mode pedestal is crucial for the good confinement of a tokamak fusion plasma. In this paper we analyze the stability of the pedestal used in ITER transport simulations and show that a pedestal temperature of 6.1 keV (corresponding to 115 kPa) is at the stability limit of a type I ELMy H-mode pedestal limited by peeling-ballooning modes. We also show that the pedestals assumed in the ramp-up and ramp-down simulations are within the stability limits.

To get further understanding at the pedestal development, we investigate ideal MHD and gyrokinetic stability in the pedestal of two well-diagnosed JET discharges. We find that both infinite-n ideal MHD ballooning and kinetic ballooning modes (KBM) are in the second stable region due to a bootstrap current peak driven by the pedestal pressure gradient. This indicates that the pedestal pressure gradient in JET is not limited by the KBMs during the inter-ELM period. The experimental observation of steady increase of the edge pressure gradient during the inter-ELM period in low fuelling plasma further confirms that the edge pressure gradient is not limited until an ELM crash that is triggered by the peeling-ballooning modes. This is in strong contrast with the earlier analysis of MAST pedestals where the entire pedestal was found KBM unstable and no increase of pressure gradient during the ELM cycle was observed [1].

The results from the gyrokinetic analysis indicate that the pedestal evolution in JET is not controlled by KBMs. It is likely that ITER pedestals with a large bootstrap current peak are also stable against KBMs.

[1] Dickinson D. et al., Plasma Phys. Controlled Fusion, 53 (2011) 115010,

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Session Classification: Poster: P3

Track Classification: THS - Magnetic Confinement Theory and Modelling: Stability