Contribution ID: **2973** Type: **not specified**

O2.111 H-mode power threshold studies at ASDEX Upgrade in mixed ion species plasmas

Tuesday, 9 July 2019 18:00 (15 minutes)

See the full abstract here http://ocs.ciemat.es/EPS2019ABS/pdf/O2.111.pdf

Understanding the dependence of the H-mode power threshold, PLH, on the main ion composition is critical for the pre-nuclear operational phase of ITER, which will be perfomed in H and He plasmas. For pure H plasmas it is well known that PLH(H) = 2PLH(D), while in the case of pure He plasmas the results vary between PLH(He) = PLH(D) and PLH(He) = 1.8PLH(D) [1, 2]. Moreover, PLH studies in mixed ion species plasmas at JET show a non-linear increase of PLH with increasing H/(H+D) ratio and a reduction of PLH in H by about 40 % when increasing the He concentration, cHe, to 0.05 [3].
Recently, experiments were conducted at AUG studying the impact of He seeding on PLH in H plasmas and the behaviour of PLH in mixed H-D plasmas. A reduction of PLH(H) by He seeding is not observed, with cHe ranging from about 0.01 to 0.2. The non-linear dependence of PLH on the H/(H+D) ratio has been confirmed, but unlike the JET results the AUG experiments show a step-like change of PLH(D) ~ 1 MW to PLH(H) ~ 2.5 MW at an H/(H+D) ratio between 0.5 and 0.8.
All the discharges in this study are in the high density branch, slightly above or at the density minimum of AUG. This allows us to determine PLH in both electron cyclotron and neutral beam heated plasmas, where it is seen that PLH(H) is by 30 % higher in the neutral beam heated cases. The overall behaviour of PLH as described above does not change with different heating schemes.
The evolution of kinetic ion and electron profiles before the L-H transition will be shown, as well as charge exchange measurements of the radial electric field at the plasma edge. Dedicated TRANSP power balance and torque calculations will be performed and compared to the experimental results.

References
[1] P. Gohil et al., Nucl. Fusion, 51 103020 (2011)
[2] F. Ryter et al., Nucl. Fsuion, 49 062003 (2009)
[3] J. C. Hillesheim et al., 27th IAEA Fusion Energy Conf., 2018

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Presenter: PLANK, U. (EPS 2019)

Session Classification: MCF

Track Classification: MCF