# H-mode operation in Helium plasmas on TCV: access and pedestal characterisations

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In ITER, not only will fusion operation be performed in mixed deuterium-tritium (D-T) plasmas, but also the pre-fusion power operation will be performed in helium (He) plasmas. Therefore, it is important to understand not only the dependence of the H-mode power threshold, $P_{L-H}$, for Helium plasmas but also the pedestal properties for type-I ELMy H-modes.

In this contribution, we will report on recent experiments on TCV, unbaffled, conducted to document the properties of H-mode Helium plasmas and we will compare with Deuterium cases from the TCV pedestal database [1]. The plasma configuration features a lower single-null divertor with $B_T$=1.43T and $I_p$=240 kA ($q_{95}$=3.2, $\kappa$=1.6, $\delta$=0.34). The plasmas were heated with NBI only either operated in Deuterium or Hydrogen, resulting in $n_{He}/n_e$~0.85.

The L-H threshold was assessed with NB ramps and no significant differences was found between H and D beams. The power threshold agrees well with the ITPA scaling [2]. In particular, the density dependence is well reproduced in line with past experiments with ohmic heating only [3]. On JET, a significant upshift of the density at minimum $P_{L-H}$ was observed in Helium [4]. This was not seen in our experiments.

The Type-I ELM regime was identified from a clear change in the ELM frequency dependence with NB power. In stationary-state conditions, a fuelling scan was performed. A preliminary analysis indicates that the pedestal pressure degrades faster with $n_{e,sep}$ as compared to D cases. No striking difference was seen between NBH-D and NBH-H driven ELMy H-mode plasmas. Pedestal stability w.r.t. peeling-ballooning boundaries will also be reported.

[1] B. Labit et al, *H-mode physics studies on TCV supported by the EUROfusion pedestal database,* EX/P4-17 id883, 28th IAEA Fusion Energy Conference (FEC2020)
[2] Y. R. Martin et al 2008 J. Phys.: Conf. Ser. 123 012033
[3] R. Behn et al 2015 Plasma Phys. Control. Fusion 57 025007
[4] E.R. Solano et al 2021 Nucl. Fusion 61 124001

[a] See appendix of "H. Reimerdes, Overview of the TCV experimental programme" to be published in Nuclear Fusion, 2022