Pedestal Structure and Energy Confinement Studies on TCV

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The high confinement plasma mode is characterised by an edge transport barrier leading to strong T_e and n_e gradients at the plasma edge, termed the pedestal. The pedestal can be tailored through fuelling and seeding to improve core confinement, enhance fusion yield and reduce divertor power loads. Recent studies have focussed on the role of the pedestal position, particularly the location of the density gradient relative to the separatrix. In AUG, an outward shift of pedestal position was correlated to a high density front in the high field side scrape-off layer (HFSHD), resulting in reduced pedestal top pressure and global confinement[1]. Similarly, a relative shift between the locations of the peak T_e and n_e gradients was observed in low triangularity discharges at JET-ILW, although it has not been conclusively linked with the HFSHD[2].

TCV is an ideal machine to address these uncertainties as a HFSHD is not expected due to the open geometry and carbon walls. Pedestal behaviour can therefore be investigated in conditions that are not attainable in standard operation in AUG or JET. Furthermore, due to the TCV's present engineering characteristics and flexible shaping capabilities, experiments can shed light on the effect of combinations of impurity seeding, fuelling and plasma shape.

A database consisting of 36 shots scanning plasma triangularity, fuelling and nitrogen seeding rates in NBH heated ELM-y H-mode plasmas was constructed. Increases in pedestal top P_e and stored energy of approximately 30% and 10% respectively were measured with increasing triangularity. These were accompanied by a reduction in the relative shift between the locations of the peak T_e and n_e gradients. Increased seeding at high triangularity led to an outward shift in pedestal position and decreasing pedestal top P_e, but with increased total stored energy by up to 5% and core P_e by up to 15%. These observations suggest that the outward shift of the pedestal and the relative shift between the locations of the peak T_e and n_e gradients are not necessarily correlated with the HFSHD, but may include changes in pedestal transport. The relevance of these results in relation to results from AUG and JET, will be discussed in comparison with interpretive modelling carried out with an EPED-like code.

References

[1] Dunne, M. G., et al., *Plasma Phys. Control Fusion*, **59**, 025010, (2017).

[2] Frassinetti, L., et al., *Plasma Physics and Controlled Fusion*, **59**, 014014, (2017).