Pedestal structure and stability at peeling boundary in TCV

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ITER will operate at low pedestal collisionality ($\nu^*_{ee}{}^{ped}$) and high separatrix density ($n_e{}^{sep}$). The ITER pedestal collisionality is supposed to be sufficiently low ($\nu^*_{ee}{}^{ped}$<1) that the pedestal will be limited by the peeling instabilities, rather than ballooning instabilities. Most of the present days machines, in particular in Europe, tend to operate at higher pedestal collisionality, with the ELMs typically triggered by the balloning modes. While pedestal physics has been well studied at the ballooning boundary, so far information on the pedestal behaviour at the peeling boundary has been described mainly from DIII-D [1].

The aim of this work is to investigate the pedestal behaviour at the peeling boundary in TCV, with particular emphasis to the pedestal structure, pedestal stability and their links with pedestal density and separatrix density.

The use of both neutral beam heating and ECRH heating in TCV at Ip=150kA, Bt=1.4T has allowed to reach a low collisionality regime characterized by $\nu^*_{ee}{}^{ped}\approx$0.1-0.9, both at low and at high triangularity. Figure 1 shows the pedestal electron pressure ($p_e{}^{ped}$) and density ($n_e{}^{ped}$) for the low $\nu^*_{ee}{}^{ped}$ / high-δ plasma #71472 (red square). The blue data show the corresponding pedestal pressure predicted with the Europed code [2] and the corresponding most unstable mode. The experimental pedestal is close to the peeling boundary, as shown by the fact that the most unstable mode has a rather low toroidal number (n=7).

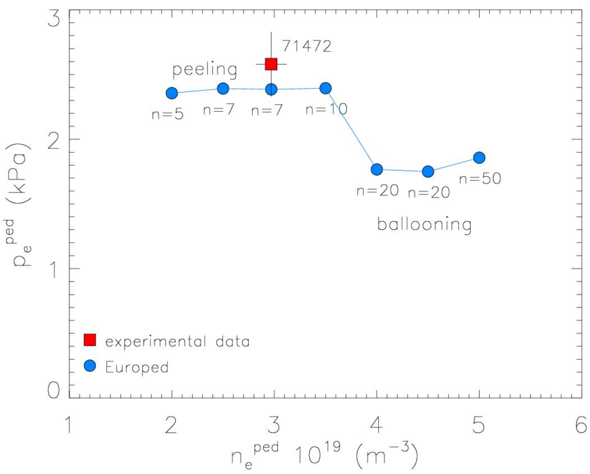

Figure 1. Electron pedestal pressure versus density for a low ν pulse (red square) and corresponding Europed modelling (blue) and most unstable modes.*

The work will investigate the change of the pedestal structure and of the pedestal stability with increasing $n_e{}^{ped}$ and with increasing $n_e{}^{sep}$. The work will also highlight the difference at the peeling boundary between high and low triangularity. The investigation, in particular the role of $n_e{}^{sep}$, is particularly useful to test the pedestal predictions in ITER-relevant regimes.

REFERENCES

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