Pedestal properties of H-modes with negative triangularity using the EPED model

A. Merle[1], **O.Sauter**[1], **S.Yu. Medvedev**[2]

[1] Ecole Polytechnique Fédérale de Lausanne (EPFL), Swiss Plasma Center (SPC), CH-1015 Lausanne, Switzerland

[2] Keldysh Institute, Russian Academy of Sciences, Moscow, Russia

Abstract.

The EPED model [1, 2] has been designed to predict the pedestal height and width from a minimal set of parameters and using the stability of the pedestal region for global MHD peeling-ballooning modes as well as local Kinetic Balooning Modes (KBMs). This approach has been validated for type-I ELMy H-modes but can also be used for other types of H-modes where it usually sets an upper limit on the achievable pedestal height.

Using a recently developed EPED-like model based on the equilibrium codes CHEASE [3] and CAXE [4] and the MHD stability code KINX [5], we investigate in this work the effect of negative triangularity on the pedestal structure. Our simulation results confirm the experimental results from TCV where a reduction of the pedestal height was observed when going from positive to negative triangularity [6]. This was interpreted as a degradation of the peeling-balooning stability due to the closed access to the second stability region for balooning modes in the case of negative triangularity. This effect is further enhanced by the coupling to the KBM stability criterion in EPED simulations.

The novel concept of the Negative Triangularity Tokamak [7] (a DEMO-sized machine) is also investigated. Again a strong reduction of the pedestal height and width is observed going from positive to negative triangularity for up-down symmetric equilibria. The pedestal height is also reduced going to more up-down asymmetric cases. The beneficial effect of the global β value on the pedestal height, which is linked to the second stability access, is strongly reduced for negative triangularity.

[1] P. Snyder, et al., *Phys. Plasmas* **16**(5), 056118 (2009)
[2] P. Snyder, et al., *Nucl. Fusion* **51**(10), 103016 (2011)
[3] H. Lutjens et al., *Comp. Phys. Comm.* **97**(3), 219 (1996)
[4] S.Yu. Medvedev et al., *20th EPS Conf. on Contr. Fusion and Plasma Phys.*, Lisbon, Vol.**17C**, part IV, P. 1279 (1993)
[5] L. Degtyarev, et al., *Comp. Phys. Comm.* **103**(1), 10 (1997)
[6] A. Pochelon et al., *Plasma and Fusion Research* **7**, 2502148 (2012)
[7] S.Yu. Medvedev, et al., *Nuclear Fusion* **55**(6), 063013 (2015)