MHD activity in high beta discharges in ASDEX Upgrade

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Tokamak plasmas are subject to various resistive and ideal MHD instabilities when operating close to the MHD limits. In this paper we investigate these instabilities in high beta plasmas in ASDEX Upgrade tokamak. Experimental limits for maximal achievable \( \beta_N \) in these plasmas are typically set by the neoclassical tearing modes (NTMs). It is possible to remove these modes (or reduce their amplitudes) with application of electron cyclotron current drive (ECCD) either in pre-emptive or in feedback control variants. As far as this done, the normalized pressure can be increased further into the region, where ideal kink modes become main limiting factor [1,2]. In this paper, we investigate structure and dynamics of these resistive and ideal modes with the main focus on recent experiments during the last campaigns. The other problem which appears in these discharges is resonant field amplification which is the result of the proximity to the “no wall” limit. In this situation, even small external fields are amplified and influence the plasma performance. Based on the results of the previous experiments, the optimal error field correction is applied with the use of the B-coils to extend the achievable pressure values. Stability boundaries for experimental discharges are calculated with CAS3D/STARWALL codes [3], taking into account main conducting structures located close to the plasma boundary.

References

* H. Meyer et al., Nuclear Fusion FEC 2016 Special Issue (2017)