Edge Stability of TCV Plasma

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Ideal MHD stability of external kink modes driven by large current density and pressure gradient values in the pedestal region of the tokamak plasma is one of the possible triggers for the edge localized modes (ELM). A number of useful scalings for the edge stability boundaries were derived from the results of the calculations with the KINX code that includes plasma up to the separatrix [1].

Since the ELM triggering mechanism depends on the edge current and pressure profiles, a modification of these parameters can lead to a variation of the ELM cycle controlling their frequency and amplitude as in the magnetic ELM triggering experiments on TCV [2]. The stability analysis is based on a detail quasi equilibrium modeling of the edge current induction performed with the PET code integrated into the DINA-CH Simulink environment. Both edge current generation and plasma boundary shape variations during the vertical oscillation of the plasma were investigated as candidates for the ELM triggering.

A more detailed analysis is required to compare the theoretical scalings with specific experimental observations. TCV can now measure edge profiles more accurately due to an upgrade of the Thomson scattering system [3]. These measurements, with self-consistent equilibria including the edge bootstrap current, will be used for quantitative comparisons with experimental observations of ELMs characteristics. In particular, the relation between the pedestal width, q_{95} value and the toroidal wave number n of the most unstable mode, as well as the effect of shape on the stability limits need to be compared specifically.

References

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