Global stability and MHD dynamics in TCV negative triangularity plasmas

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Negative triangularity tokamak (NTT) plasmas are the subject of increasing interest both in existing experiments and in view of fusion demonstration reactors. Experimental results indicate that negative triangularity plasmas keep L-mode edge characteristics while achieving improved core performance and confinement with respect to positive triangularity. An L-mode edge implies absence of Edge Localized Modes, making the NTT reactor an appealing concept. On the TCV device negative triangularity is studied since the 1990s [1] and recent experiments have further characterized a variety of scenarios with record performance in terms of normalized β [2]. MHD activity not necessarily leading to discharge termination is observed, in many cases from initial phases and related to n=1 [neoclassical] tearing modes. Global MHD stability of these plasmas is investigated with parametric numerical studies, to confirm the experimental evidence suggesting that most of the disruptive shots terminate below the eventual β limit. The numerical analysis is carried out with the linear resistive MHD stability code MARS-F, to investigate the nature of instabilities appearing in both diverted and limited scenarios. Projections of the ideal β limit are made for positive and negative triangularity comparable cases.

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