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P4.1058 Analysis of rotating mhd perturbations to identify disruptive phases in TCV tokamak

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MagnetoHydrodynamic instabilities appear in several cases as the main cause of a disruption, since they can strongly reduce the plasma confinement and lead to a mode locking. Mode locking signals are routinely used as a disruption alarm to trigger mitigating actions. However, in order to reduce the number of disruptions and then to minimize the stress on the plasma facing components, earlier disruption alarms can be used to trigger avoidance actions and lead the discharge to a "soft" landing. The presence of rotating MHD instability is already a clue of unhealthy plasma conditions (e.g., large NTM Islands, or impurity accumulation, et cetera), which can justify the early and safe termination of a discharge. However, such an approach would lead to terminate also discharges that could be recovered, motivating the application of advanced RT processing, like SVD, to MHD signals in order to provide additional information and, then, to disentangle such ambiguity. Magnetic pick-up coils signals from TCV experiments are applied to a Singular Value Decomposition (SVD) code. SVD is a processing already implemented in the TCV real time control system [1] to provide a trigger for NTM control. In the present work, simple post-processing are applied to SVD results to provide up to 24 variables, which give a complete description of the MHD fluctuations state. The code has run over a set of 196 safe discharges and 82 disruptions, performed at TCV in 2015-2017 campaigns. Data are analysed with the aim of assessing the minimum number of variables required for a disruption precursor and of assessing the potentiality of such a processing to evaluate the probability of a disruption. The number of SVD variables required to describe the MHD state is defined by means of a preliminary Principal Component Analysis. Then, different sets with a varying number of SVD variables are input to a Generative Topographic Mapping [2] to compare the results in homogeneous 2D maps.
References: [1] C.Galperti et al., 2017 IEEE Trans. on Nucl. Science 64, no. 6, 1446 [2] A.Pau et al., 2018 45th EPS, July 2nd-6th, Prague
See the author list of H. Meyer et al 2017 Nucl. Fusion 57 102014 * See the author list of S. Coda et al 2017 Nucl. Fusion 57 102011

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