Contribution ID: **112** Type: **Poster**

EX/P8-04: Latest Developments in Data Analysis Tools for Disruption Prediction and for the Exploration of Multimachine Operational Spaces

Friday, 12 October 2012 14:00 (4h 45m)

Disruptions are unavoidable in current Tokamaks and accurate and reliable predictions are a prerequisite to any mitigation strategy. Therefore the most recent efforts in data analysis and machine learning have concentrate on the one hand on improving the success rate of predictors and on the other hand on developing tools which can help in the understanding of disruption physics. The best performing predictor for JET is APODIS, which has been trained and tested, in a 24 dimensional space of features (all available in real time), using hundred of shots selected among more than 8400 discharges analysed using high performance computation tools. In the campaigns (C24, C25, C27a) with good quality signals and without the use of magnetic perturbation for ELM mitigation, not included in the training set, the success rate of the predictor is higher than 90% 35 ms before the disruption (for a rate of false alarms of a few percent). The following developments of this line of research will involve the optimisation of the learning rate.

The prediction of the type of disruption is in its turn a fundamental aspect to optimise mitigation strategies. The predictors of the complexity of APODIS can reach very good performance but their results are quite difficult to relate to physical theories of disruptions. Tools of higher interpretability are required to explore the operational space and investigate the physics (even at the price of reduced performance in terms of prediction accuracy). The adopted data driven approach consists of trying to determine whether the relevant information lies on an embedded, possibly non-linear, manifold within the higher-dimensional space. If this proved feasible, the data could be represented well in a low-dimensional subspace and more effectively analysed to extract information about the physics of the disruptions and their precursors. To this end, recently, dimensionality reduction and manifold learning methods have been successfully investigated, using various tools ranging from Data Tours to Principal Component Analysis and Self Organising Maps (SOM). In particular using SOM it has been possible to map seven non dimensional parameters in a way that the disruptive and non disruptive regions of the operational space are quite separate. This is quite promising for the understanding of disruptions and cross machine comparison.

Country or International Organization of Primary Author

JET

Collaboration (if applicable, e.g., International Tokamak Physics Activities)

EFDA

Primary author: Mr MURARI, Andrea (Italy)

Co-authors: Prof. FANNI, Alessandra (Electrical and Electronic Engineering Dept. - University of Cagliari); Mr PAU, Alessandro (Electrical and Electronic Engineering Dept. - University of Cagliari, Italy); Dr CANNAS, Barbara (Dept. - University of Cagliari); Dr MLYNAR, Jan (Association EURATOM-IPP.CR, Faculty of Nuclear Sciences and Physical Engineering CTU Prague, CZ-115 19, Czech Republic); Prof. RAMIREZ, Jesus Manuel (Dpto. Informática y Automática, UNED. Madrid, Spain.); Dr VEGA, Jesus (CIEMAT); Mr ODSTRCIL, Michal (Association EURATOM-IPP.CR, Faculty of Nuclear Sciences and Physical Engineering CTU Prague, CZ-115 19, Czech Republic); Prof. DORMIDO-CANTO, Sebastian (Dpto. Informática y Automática, UNED.); Dr GIULIANA, Sias (Electrical and Electronic Engineering Dept. - University of Cagliari, Italy)

Presenter: Mr MURARI, Andrea (Italy)

Session Classification: Poster: P8

Track Classification: EXS - Magnetic Confinement Experiments: Stability