Contribution ID: **658** Type: **Poster**

Developing Disruption Warning Algorithms Using Large Databases on Alcator C-Mod and EAST Tokamaks

Wednesday 19 October 2016 08:30 (4 hours)

To address the challenge of disruption prediction, we have created large disruption warning databases for both Alcator C-Mod and EAST by compiling values for a number of proposed disruption-relevant parameters sampled at many different times throughout all plasma discharges, disruptive and non-disruptive, during the 2015 campaigns on the respective machines. The disruption-relevant parameters include such intuitive quantities as Ip error [= Ip –Ip (programmed)], radiated power fraction [= Prad/Pinput], n/nGreenwald, n=1 mode amplitude, as well as a number of equilibrium parameters derived from EFIT reconstructions (q95, elongation, etcetera). Examples of the evolution of these parameters prior to disruptions on C-Mod and EAST, will be shown.

The disruption warning databases for C-Mod and EAST each contain parameter values from well over 100,000 time slices. This allows one to provide quantitative answers to such questions as: (1) Is parameter "X"(e.g. Ip error or n/nG or n=1 mode amplitude) correlated with impending disruptions? If yes, (2) What fraction of disruptions do not show a correlation (i.e. missed disruptions)? (3) What is an appropriate trigger level for each correlated parameter, and how does the number of 'false positives'vary with the trigger level? (4) What is the typical warning time, and how does the warning time vary with trigger level? This fundamental quantitative characterisation of disruption-relevant parameters is absolutely crucial for developing any credible real-time disruption warning algorithms.

These databases are also amenable to the application of advanced 'machine learning'techniques to discern more complicated dependencies on parameters, and the development of more advanced warning algorithms.

In principle, the disruption-relevant parameters in the C-Mod and EAST disruption warning databases could be available in real-time, and their plasma control systems could implement a disruption prediction algorithm based on the analysis of these large databases to provide a warning with sufficient lead time that could be used to move the plasma to a less unstable state to avoid a disruption, or to trigger a disruption mitigation system.

Acknowledgments: This work supported in part by: US DoE Grants DE-FC02-99ER54512, DE-SC0010720 and DE-SC0010492, using Alcator C-Mod, a DoE Office of Science User Facility

Paper Number

EX/P3-8

Country or International Organization

US

Author: Dr GRANETZ, Robert (MIT)

Co-authors: Mr TINGUELY, Alex (MIT); Prof. XIAO, Bingjia (ASIPP); Mr WANG, Bo (ASIPP); Dr LUO, Zhengping (ASIPP)

Presenter: Dr GRANETZ, Robert (MIT)

Session Classification: Poster 3

Track Classification: EXS - Magnetic Confinement Experiments: Stability