Contribution ID: **48** Type: **Oral**

The realization of controlled plasma termination towards off-normal events in EAST PCS

The termination of a discharge may be caused by plants faults or off-normal plasmas events, e.g. plasma current error, neoclassical tearing modes or vertical displacements events. In order to avoid plasma disruption and protect the tokamak device, real-time off-normal event detection and handling is realized in plasma control system (PCS). In EAST PCS, the common strategy for off-normal event handling is switching the normal execution sequence to shutdown sequence with zero commands output to all the actuator systems, e.g. power supply system, gas puffing system and heating systems. The reason to abandon plasma control during the new switched sequence is the difficulty to set suitable plasma parameter targets in the GUI before shot, since the off-normal event trigger time is uncertain. In this paper, a new event handling trajectory is proposed and implemented in PCS. The plasma current and shape are kept being controlled during termination phase instead of outputting zero commands. The plasma current target is calculated in real-time with a preset current ramp down rate and the measured value, which is then feedback controlled using the same PID control parameters as set in normal execution sequence. While for plasma shape control, although the plasma shape at switching time is unknown before shot, a target shape parameters are set with lower elongation at several hundred milliseconds after the switched control phase starts. Thus, the target shapes between the termination phase starts (off-normal event happens and sequence switched) and the first target shape (several hundred milliseconds after the switched control phase starts) are calculated with linear interpolation from the actual plasma shape at the switching time. The plasma shape is transitioned smoothly for stable PEFIT/ISOFLUX control. Such trajectory is realized in 2019 EAST experiment with successful plasma current and shape control at the current ramp rate -0.2MA/s and elongation from 1.65 to 1.5. Further research is undergoing for more event detection and better handling strategy.

Keywords: EAST PCS; Off-normal event handling; Controlled plasma termination; PEFIT/ISOFLUX control; Real-time target calculation

Speaker's Affiliation

Institute of Plasma Physics, Chinese Academy of Sciences, Hefei

Member State or IGO

China, People's Republic of

Primary author: YUAN, Qiping

Co-authors: Dr HUANG, Yao (Institute of Plasma Physics, Chinese Academy of Sciences); Prof. XIAO, Bingjia (Institute of Plasma Physics, Chinese Academy of Sciences); Ms ZHU, Jianqiu (Institute of Plasma Physics, Chinese Academy of Sciences); Dr ZHANG, Ruirui (Institute of Plasma Physics, Chinese Academy of Sciences); Dr LUO, Zhengping (Institute of Plasma Physics, Chinese Academy of Sciences); Dr PENAFLOR, Ben (General Atomics, DIII-D National Fusion Facility); Prof. HUMPHREYS, David (General Atomics, DIII-D National Fusion Facility)

Presenter: YUAN, Qiping

Session Classification: Plasma Control 1

Track Classification: Plasma Control