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The C-2W plasma control system : Overview and experimental results JESUS ROMERO, COLIN FINUCANE, SERGEI GALKIN, KEVIN PHUNG, THOMAS ROCHE, TAE Technologies, Inc., TAE TEAM — In TAE Technologies' current experimental device, C-2W (also called "Norman") [1], record breaking, advanced beam-driven field reversed configuration (FRC) plasmas are produced and sustained in steady state utilizing variable energy neutral beams (15 – 40 keV, total power up to 20 MW), advanced divertors, end bias electrodes, and an active plasma control system. In C-2W, the Keeping the FRC plasma well centered inside the confinement vessel to minimize stochastic fast ion losses is one of the key ingredients of the high-performance operating regime. This is achieved by a combination of end electrode biasing and magnetic control. The C-2W plasma control system (PCS) provides high bandwidth (2.5 MHz) data acquisition and low latency (10 us) magnetic control of plasma shape and position, as well as kinetic control of electrode biasing current and Neutral Beam Injection grid acceleration voltage. PCS is a distributed digital control system based on Speedgoat modules for fast data acquisition and plasma control, which use multi-gigabit transceivers with Xilinx Aurora protocol to communicate among data acquisition systems, control modules and actuators. The core functionality, system setup, observers, and control algorithms are implemented using Matlab scripts and Simulink and HDL coder workflow. This enables a quick and easy transition from model-based designs to FPGA hardware implementations. Recent results with boundary flux and plasma radius control will be presented and discussed. [1] H. Gota et al., Nucl. Fusion 59, 112009 (2019)

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