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P4.043 ST40 Data and Control

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ST40 is a new high field spherical tokamak built by Tokamak Energy Ltd. (TE). When operating at full power, the main parameters of ST40 will be: $R_0=0.4-0.6\text{m}$, $A=1.7-2.0$, $I_{pl}=2\text{MA}$, $B_t=3\text{T}$, $\kappa=2.5$, and it will have up to 2MW of auxiliary heating power, and a pulse length of 1-2s. The first operational phase of ST40, at limited performance, took place in early 2018, and its results are presented by M. Gryaznevich et al. at this conference. This contribution presents the data flow and control systems of ST40 and discusses plans for their future development.

ST40 is controlled by two systems: Machine Control System (MCS) and Plasma Control System (PCS). MCS consists of a central server and a distributed system of National Instruments cRIO crates, each of which communicates with MCS server using TCP/IP. MCS is responsible for 24/7 monitoring and control of the full plant, including non-timed functions such as glow discharge cleaning and boronization. The 1MHz plant clock and the triggering of an array of diagnostics and other subsystems also fall under its remit. During a pulse, PCS will control the plasma current, position and shape using feedforward and feedback controllers. PCS is written in MATLAB/Simulink, converted to C, and built into an executable. Signals used for plasma control are acquired using simultaneous sampling digitizers by D-TACQ Solutions Ltd. and sent to PCS over a fibre optic link.

All the data acquired during a pulse is stored in an MDSplus database. This allows easy platform independent access to the data using any of the various MDSplus APIs, e.g., in LabView, Python, MATLAB, IDL, C, and Fortran. During pulse preparation, the pulse schedule is stored in MDSplus and accessed by both MCS (running on Windows), and PCS (running on Linux).

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