

A Plant System Configuration Tool based on MDSplus and EPICS for the ITER Neutral Beam Test Facility experiment SPIDER

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The SPIDER experiment (Source for the Production of Ions of Deuterium Extracted from a Radio frequency plasma) is a prototype devoted to the heating and diagnostic neutral beam studies in operation at the ITER Neutral Beam Test Facility (NBTF) at Consorzio RFX, Padova. SPIDER is the full-size ITER ion source prototype and the largest negative ion source in operation in the world. In view of ITER heating requirements to realize plasma burning conditions and instabilities control, SPIDER aims at achieving long-time operation (3600 s) with beam energy up to 100 keV, high extracted current density (above 355 A.m⁻² for H- and above 285 A.m⁻² for D-) at maximum beam source pressure of 0.3 Pa. Moreover, the maximum deviation from uniformity must be kept under 10%.^[1]

The SPIDER pulse preparation follows a strict procedure of approval of the operation parameters, in view of safety, machine protection and efficiency. In a simplified description, the session leader (SL) defines the parameters according with the best implementation of the science program. The technical responsible (RT) verifies all parameters for approval and only after agreeing with the setup, sends the configuration to the technical operator (OT) to load the configuration into SPIDER instrumentation.

The current tools used in SPIDER integrated commissioning and initial SPIDER campaign [2] permit the SL to design a new pulse and program the set of parameters directly into a temporary MDSplus pulse file. This information is then passed to the RT for approval. The same pulse file can be visualised by the RT but there is no indication of what parameters were changed since the previous pulse, or from a pre-set pulse file taken from a previous run. In consequence, the RT must go through a tedious and error prone procedure of checking all the parameters, even if the set of parameters have already been approved for a previous pulse. Moreover, the current set of tools does not foresee an automated load of previously set configurations, except for the possibility of using a command line to load previous setups from an executed or reference pulse.

Aiming at the automated implementation of rules and procedures, as well as improving the usability, safety and interoperability between the SL and RT, a new configuration tool for setting the SPIDER pulse parameters is under development, using the integration of two relevant tools in the fusion I&C community: MDSplus and Epics.

This contribution will emphasize on (i) the present solution that has been used during initial SPIDER campaigns ; (ii) the requirements of the configuration tool according to the set of procedures to be implemented in the SPIDER pulse preparation; (iii) the set of development tools available for implementing the necessary application(s); (iv) the design options and application architecture; (v) the implementation details and preliminary tests of the alpha release application.

[1] V. Toigo et al 2019 Nucl. Fusion 59 086058

[2] A. Luchetta et al 2019 Fusion Engineering and Design, Volume 146, Part A, 500-504

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