

JET Plasma Control System Upgrade using MARTe2

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JET real-time plasma control has been delivered with a heterogeneous collection of control systems linked by a dedicated low-jitter, low-latency network. To provide a high degree of flexibility in tuning plasma control algorithms to experimental requirements, the Real-Time Central Controller (RTCC) has been available since 1997. RTCC provides a sandboxed execution environment where experimental algorithms can be deployed with a rapid development workflow. New control laws can be developed by operators during the course of an experimental session. The potential impact of a defect in algorithms evolved without full lifecycle quality assurance can be bounded by clipping feedback control requests at the actuator managers. The likelihood of such defects is reduced in the first place by constraining the algorithms to be composed from reusable blocks and trusted real-time signals. Although this system operated successfully for a long time, limitations in compute capacity of the legacy hardware on which the application was deployed constrained algorithm development.

Motivated by the need to provide physics operators with a more performant system, an upgrade project was carried out to port the RTCC application to a modern high performance PC platform. The architecture selected was to use the MARTe2 framework. Development was able to reuse existing MARTe2 data sources to connect the application to the JET environment using the ITER SDN protocol. RTCC blocks were converted to MARTe2 functions. Python tooling was created to automatically convert previously deployed RTCC algorithms to MARTe2 configuration form.

This paper describes the techniques used to demonstrate system correctness prior to deployment in the JET operating environment. This was particularly important given that it was deployed around the time of the DT campaigns. It explains how the system was used to demonstrate some novel control methods which delivered useful experiments in the final JET campaigns. It also outlines how the JET legacy data combined with this MARTe2 application can offer future value, even in the absence of the JET machine itself.

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