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P4.040 Robust configuration of the JET real-time protection sequencer

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The JET Real-Time Protection Sequencer (RTPS) co-ordinates responses for magnetic and kinetic actuators to protect the ITER-Like Wall from possible melting events and other undesirable scenarios. It allows programmable stop responses per pulse, based on alarms raised by other systems.

The architecture combines a modular run-time application developed using MARTe (Multithreaded Application for Real-Time execution) with the top-level JET supervisory and configuration software, Level-1. Operational experience since 2011 drove a requirement to refactor the system in 2017 [1], moving the maximum degree of functionality from compiled code to configuration data, providing more flexibility, maintainability and verifiability of action(s) to be taken during a pulse.

This paper discusses the features of the architecture that made this clean separation of rule-based logic and real-time signal processing possible and practical, including how functions and interfaces between MARTe and Level-1 are organised. It also explains data management to address development, testing, commissioning and operations, each with individual ownership, responsibility and lifecycles. The core technology enabling this is the Level-1 domain specific language, able to manipulate, validate and load into plant configuration parameter sets. The language also enables implementation of advanced user interfaces, providing operators with the tools to focus on essentials tasks for their area of responsibility. It exemplifies this with recent verification and validation of the refactored protection system: unit/low-level integration tests defined by core developers and integration/behavioural tests defined by JET's Plasma Operations Group, respectively, ensuring robust and consistent behaviour. We show how the wide scope and power of this language has enabled evolution of JET operations efficiently and correctly over decades of operational experience.

[1] P. J. Lomas et al. this conference

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