

## Real-Time Software for the COMPASS Tokamak Plasma Control

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The COMPASS tokamak ( $R = 0.56$  m,  $a = 0.18 \div 0.23$  m), which has an ITER-like geometry, has started its operation recently in Prague, Czech Republic. The scientific programme will concern on edge plasma physics, namely pedestal studies and resonant magnetic perturbations, and on wave-plasma interaction studies. This offers an important research potential as a small, flexible and low-cost facility with an ITER-relevant programme. To meet the necessary operation parameters, its real-time system for data processing and control must be designed for both flexibility and performance, allowing the easy integration of code from several developers and to guarantee the desired time cycle. In particular, a control cycle of  $50 \mu\text{s}$  is needed for the vertical and horizontal positions control and a  $500 \mu\text{s}$  loop is required for the plasma current, equilibrium, and shaping control.

For this purpose an ATCA-based real-time system has been deployed with a solution based on a multi-core x86 processor. It makes use of two software components: the BaseLib2 framework and the MARTe real-time executor. The BaseLib2 framework is a generic real-time library with optimized objects for the implementation of real-time algorithms. MARTe executes the developed real-time software modules in kernel space RTAI allowing to attain the required cycle time and a jitter of less than  $1.5 \mu\text{s}$ . The system collects the signals from the ATCA acquisition boards, processes the data and generates the control signals which are transmitted to the power supplies for the magnetic actuators through a serial communication protocol. MARTe configuration and data storage is accomplished through a Java hardware client that connects to the FireSignal control and data acquisition software.

This article details the implementation of the real-time system for the Compass tokamak, in particular the organization of the control code, the design and implementation of the communications with the actuators and how MARTe integrates with the FireSignal software.

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