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## IMPLEMENTATION OF THE DIGITAL PLASMA MAGNETIC CONTROL SYSTEM IN THE GLOBUS-M2 TOKAMAK $^{\ast)}$

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The report presents an overview of the results from the first stage of implementing the digital plasma control system in the Globus-M2 tokamak [1]. In September 2024, commissioning work was carried out to integrate the real-time target machine (RTTM) "RITM" into the feedback loop of the plasma magnetic control system.

The RTTM includes an Intel Core i7-12700K CPU and an FPGA from the Xilinx UltraScale series. The system supports 80 analog inputs, 16 analog outputs, 64 digital input/output channels, and 6 Real-Time Ethernet ports.

The RTTM operates under a real-time operating system (RTOS) based on RTLinux. Control algorithms can be executed at either the RTOS or FPGA level. At the RTOS level, "slow" control algorithms with a base sample time of 100  $\mu$ s are implemented, such as real-time plasma equilibrium restoration and plasma shape control. At the FPGA level, "fast" control algorithms with a 5  $\mu$ s base sample time are implemented, for example, plasma position control.

By the end of 2024, the first experiments with the new digital plasma control system will be conducted, including:

- matrix control of currents in the poloidal field coils, where mutual inductance of the coils is taken into account in calculating control actions;
- plasma position control, where the vertical and horizontal control field coils will be powered by new PWM-mode voltage inverters;
- plasma current control;
- real-time plasma equilibrium reconstruction.

In the next stage of implementation, it is planned to enable plasma shape control and connect Thomson scattering diagnostics to the RTTM to use electron temperature profile data in plasma equilibrium restoration and control algorithms.

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## References

[1]. Minaev V.B. et al., 2017 Nucl. Fusion 57 066047

<sup>\*)</sup> abstracts of this report in Russian