

Next-generation diagnostics for ASDEX Upgrade

Wednesday 6 December 2023 14:15 (15 minutes)

For 30 years, the ASDEX Upgrade diagnostics provided scientists with the experimental data needed to advance the field of fusion. During this time, the machine's systems and diagnostics have evolved. In-house production of state-of-the-art data acquisition hardware has been the norm. However, the serial input/output standards SIO1, SIO1a, and SIO2 have reached the end of their useful life. While it is still possible to maintain existing hardware, it is no longer feasible to produce new boards. The goal is to make the transition to the MTCA hardware standard as painless as possible. Much of the front-end electronics application-specific boards are housed in PIPE crates, such as the magnetic field integrators. These integrator channels are very expensive and replacing them is not efficient. A step-by-step approach is presented that is applied on three fronts: new diagnostics, old front-ends, and a new software framework. New diagnostics should be made available as soon as possible with MTCA-compatible technologies. These diagnostics use D-TACQ ELF modules, which in the future can be integrated into an MTCA crate using DESY AMCs and a d-tacq RTM. The PIPE crates are controlled by a slot-in interface card that supports the old standard. However, the new interfaces should use standard protocols such as PCIe or 10G Ethernet. These technologies will allow the front-ends to be upgraded or connected to MTCA in the future. To update the diagnostic software framework, ITER and DESY standards are considered. The concept uses EPICS as configuration and monitoring layer. This is connected to ITER NDSv3 drivers that standardize the device access so that any AUG diagnostics can be controlled in the same way. The DESY FPGA Framework (FWK), which supports future DESY AMCs and device access layer, completes the vertical integration plans. It is of utmost importance to find a standard solution. Current estimates count the old front-end channels in more than 7000, divided into more than 60 diagnostics. The work is in the conceptual phase, and ideas and diagrams are shared for discussion within the MTCA community.

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Session Classification: Session V