

Topical Summary of Data Acquisition & Signal Processing 1 & 2

- ▶ **There were 11 (13) papers presented in Data Acquisition and Signal Processing sessions 1 & 2, on Day 3.**
 - ▶ Data acquisition/management systems have been reported, with related to JT-60SA, ASDEX Upgrade, EAST, ITER CODAC, WEST, TCABR, and SPIDER.
- ▶ **ASDEX-U tries to keep the systems modern by combined uses of new frameworks such as ITER NDS, abstraction/standardization layers, or new wrapper drivers. (M. Astrain)**
 - ▶ An iterative learning control method is also reported that the central temperature was successfully optimized with a very small number of iterations. (O. Kudlacek)
- ▶ **EAST DAQ system has been upgraded with a Web-based management console which enables the users to describe the related device configurations. (Y. Chen)**
 - ▶ Diagnostics and control system design was also reported for laser fusion in China. (F. Wang)
- ▶ **Nominal Device Support (NDS) in ITER CODAC Core system is well reported, which provides an abstraction layer for integrated uses with EPICS, ITER RTF, and MARTe2. (M. Ruiz)**

Data Acquisition & Signal Processing (cont.)

- ▶ **WEST CODAC reported that the real-time inter-process messaging communications are being migrated by using MQTT middleware. Confirmed performance looks much improved than before. (G. Caulier)**
 - ▶ WEST also reported that 30 yrs old LynxOS/PowerPC systems to be maintained properly they introduced PPC virtual emulator on QEMU to enable cross-compilation. The custom toolchain has been successfully qualified in the WEST experimental campaign. (G. Caulier)

- ▶ **For signal conditioning and data analysis/recognition,**
 - ▶ Tomographic inversion using Max. Likelihood (ML) applied for JET bolometry. MATLAB codes are ported in C++ for perf. improvements with GPU & FPGA. (M. Ruiz)

- ▶ **Current status of TCABR tokamak system is reported which conducts some implement using EPICS, MARTe, and MDSplus for operational flexibility and robustness. (W. Pires)**
 - ▶ With the use of tools already well known and used in the Plasma Physics Community and Controlled Thermonuclear Fusion, it is possible for small machines to have an importance in this scenario. In the Control and Data Acquisition System, the use of MDSplus, EPICS, MARTe2 implies a shorter implementation time.

Data Acquisition & Signal Processing (cont.)

- ▶ **EAST also reported the data interlink between PCS and real-time DAQ based on RFM technology. Mapping between signal names and the DAQ channels are unified to be accessed by control algorithms. (T. Lu)**
 - ▶ One of the big issue in experiments is the fact that we have different equipment doing the same kind of work. In this work, the author has a proposal to mitigate this issue.
 - ▶ The diagnostics have a distributed characteristic, and the centralized acquisition mode is not suitable.
 - ▶ Unified DAQ cabinet deployment specifications: improve the scalability of the control system;
 - ▶ Unified data transmission specification: decoupling & shielding for system and hardware;
 - ▶ Unified mapping specification between signal name and channel

- ▶ **SPIDER experiment is held at ITER Neutral Beam Test Facility (NBTF) and the CODAS consists of EPICS and MDSplus for long lasting experiments. (G. Manduchi)**
 - ▶ For prioritizing the concurrent read/write performance some optimization methods have been applied, such as limiting other accesses or resampling the accessed data.
 - ▶ The author shows in the SPIDER experiment how the MDSplus solution can (and this already is) be easily updated to integrate in future long-lasting systems.

- ▶ **RedPitaya Zynq-based FPGA board has been widely used in SPIDER experiment. As it enables real-time DAQ and control, event-driven measurement and analysis can be processed in real time with a reasonable cost. (A. Rigioni)**
 - ▶ The SPIDER experiment has been an excellent system to show the implementation of the technologies that will be used in future experiments. In this work, the author presents the RedPitaya board solution.
 - ▶ Due to the flexibility, RedPitaya has been considered for a variety of advanced diagnostic measurements at SPIDER, one of the two experiments being held at the ITER Neutral Beam Test Facility located in Padova (Italy).

Data Acquisition & Signal Processing (cont.)

▶ General Impressions,

- ▶ FPGA technology has been steadily included not only in fast control uses but also real-time monitoring & signal conditioning.
- ▶ High ITER-relevant or -induced/-related activities are found.
- ▶ “Integrated Data Analysis (IDA)” is becoming a trend word.
- ▶ Introducing the “abstraction layer” is considered for long-term system support-ability and/or wider coverage of device APIs and drivers.