

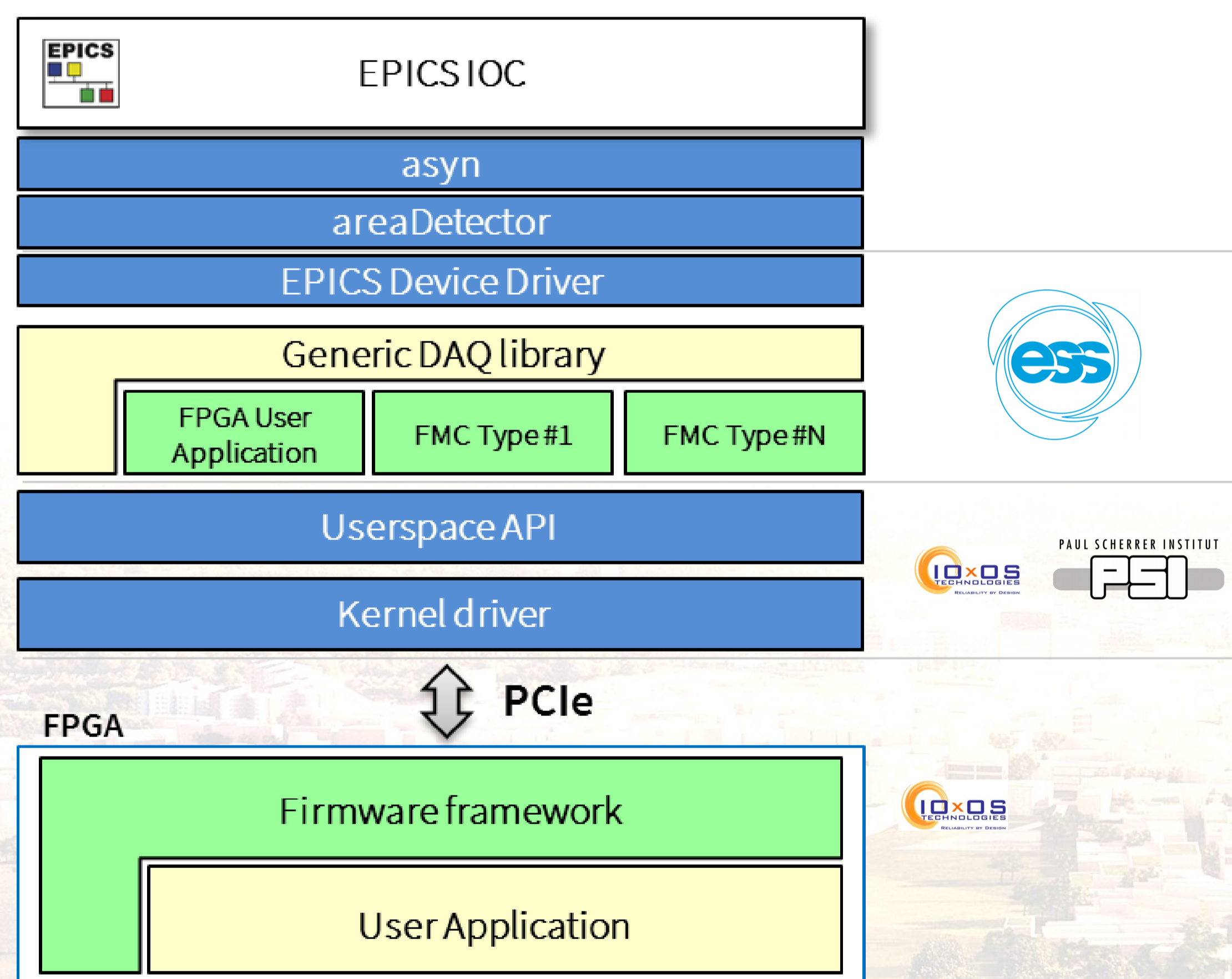
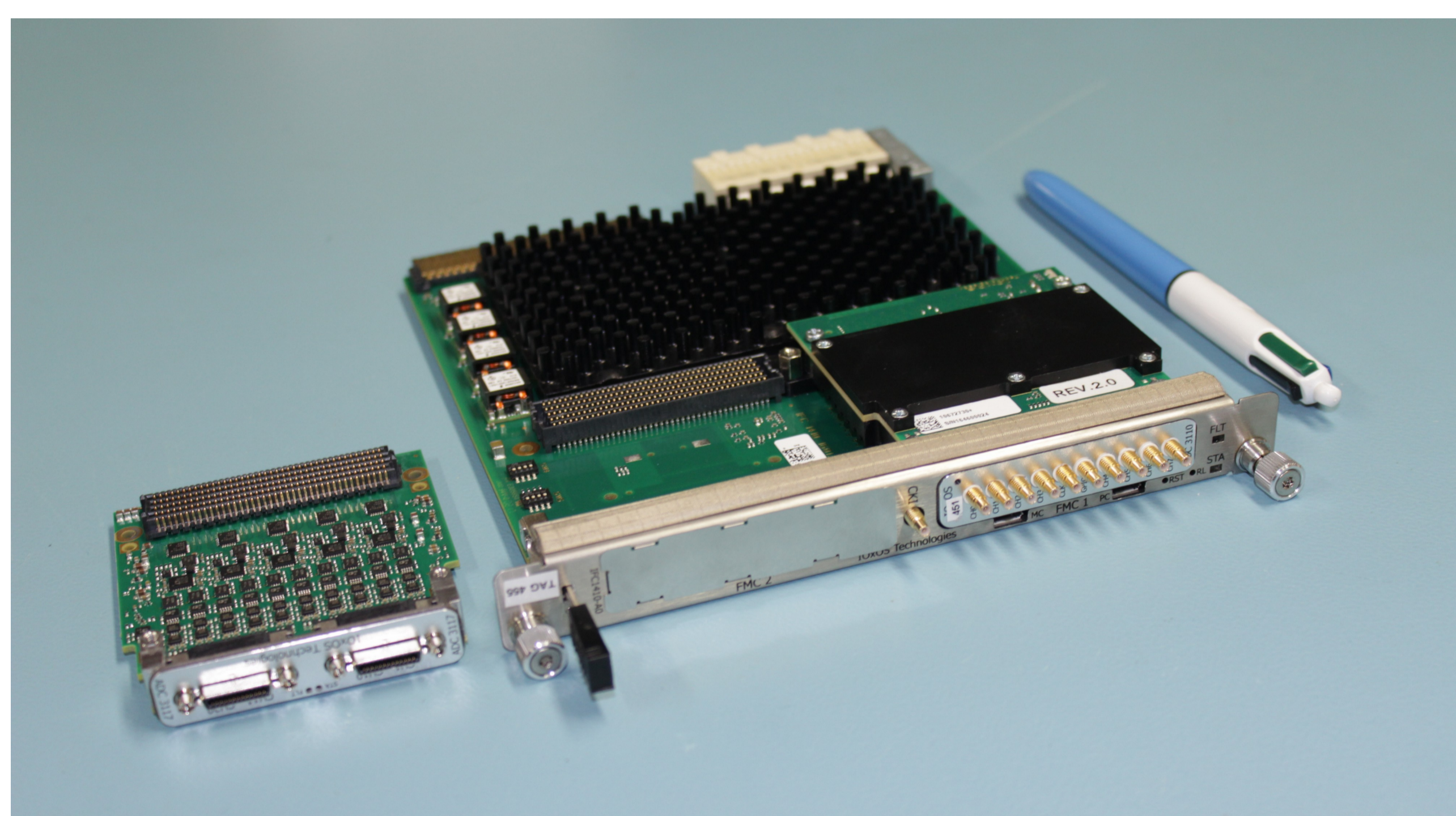


## Abstract

The European Spallation Source (ESS) is a collaboration of 17 European countries that is building a leading neutron research center in Lund, Sweden. The ESS facility will have the most powerful neutron source in the world, providing 5 MW of beam power. The Integrated Control Systems Division (ICS) is responsible for all the control systems for the whole facility. For the accelerator control, ICS will provide different hardware platforms according to the requirements of each specific system. For high performance systems, demanding high data throughput, the hardware platform is the MicroTCA.4 standard. This work presents the software stack that makes the integration of a high-end MicroTCA hardware into the ESS Control System, with the implementation details of the FPGA firmware framework, kernel and userspace drivers, EPICS driver and finally the EPICS IOC that integrates the MicroTCA boards.

## Hardware Platform

The main board of this set of hardware is the AMC FMC carrier IFC1410, equipped with a Xilinx Kintex Ultrascale FPGA and a QorIQ T2081 CPU, manufactured by IOxOS Technologies. The IFC1410 also has two HPC VITA 57.1 slots for FPGA Mezzanine Card (FMC) units. The combination of FMC cards and Rear Transition Modules (RTM) to the AMC board gives the flexibility to configure an acquisition system. The on-board T2081 CPU allows a user to run an EPICS IOC directly on the board, thus increasing the modularity of the hardware platform in the sense of control system integration and distribution.

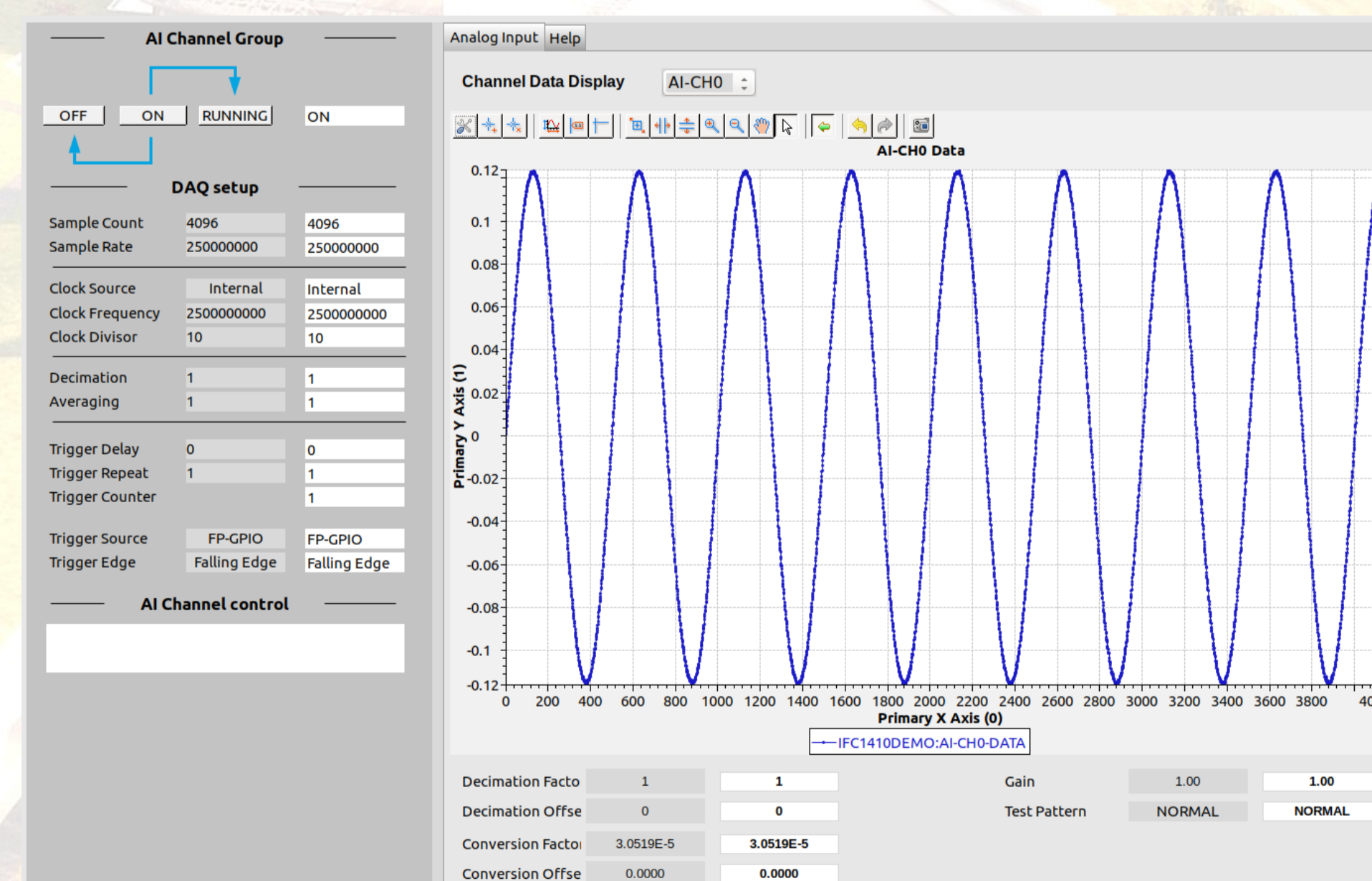


## Software Integration

The basic software layer provided by IOxOS as part of the support package for its MicroTCA boards is a kernel module and a userspace API. On the top of those software layers, ICS is developing a library to provide generic data acquisition interface to the firmware application running on the FPGA. This library abstracts away the differences between the FMC cards providing a unified set of common functions for arming the device for analog conversion, wait for acquisition to complete and reading out the acquired samples. AreaDetector will be the standard module for the device support layer of MicroTCA digitizers, so it can benefit from the community support and out-of-the-box plugins that are available.

## User Interfaces

ESS will use Control System Studio (CSS) as main tool to create and execute user interfaces for the facility control system. ESS uses a site-specific version of CSS but also participates on the development of CSS project for the EPICS community. The latest releases of CSS include the Display Builder plugin, a new framework that replaces OPI Builder (BOY) and adds new features to CSS, while still keeping compatibility with BOY displays.



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