



# Development of the EPICS-based Monitoring and Control System for EAST Fast Control Power System



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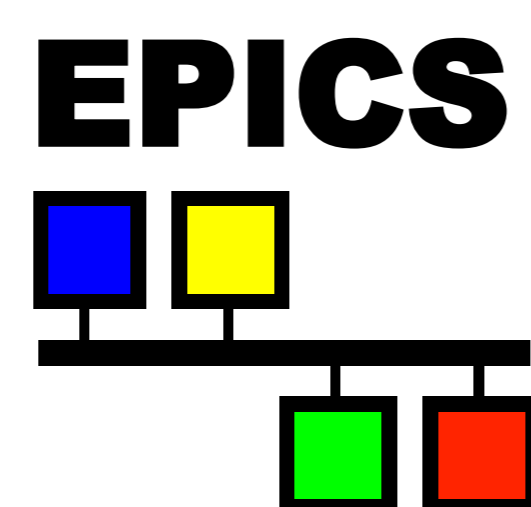
**ABSTRACT :** For the 2014 EAST experimental campaign, the Fast Control Power System (FCPS) has been newly developed. FCPS is composed of the main circuit and the control and protect section. The main circuit of FCPS includes the high-voltage circuit breakers, the multi phase rectifier transformers, the AC/DC rectifier, and the DC/AC inverters. Because of the complexity of FCPS and the poor working environment, the remote monitoring and control system is considered as a very important part of FCPS. The developed monitoring and control system is based on EPICS framework, and includes the data acquisition module, FCPS status monitoring and control module. The above modules are developed as EPICS device support modules. The monitoring and control system communicates with the control and protect section through the serial RS-485 protocol and with the main circuit through the modbus protocol based on TCP/IP . In addition, this system also includes a module that is developed with C. It is considered as the front end executable module of Plasma Control System, and communicates with PCS through the reflective memory cards. All the status and the acquired data from FCPS are demonstrated on the OPI developed by Control System Studio, and are archived by the MDSPlus database. The new monitoring and control system has been test and showed the stable and robust performance.

## Introduction

The newly development FCPS in EAST is a kind of large capacity single phase inverter, which excites feedback coils to produce magnetic field to restrain plasma's fast vertical displacement. The method of multiple inverters paralleled with current sharing reactor is presented to meet the need of large current and fast control.

Because of the complexity of FCPS and the poor working environment, the remote monitoring and control system is also considered as a very important part of FCPS.

Experimental Physics and Industrial Control System (EPICS) is a software tool as a main framework to deploy distributed control systems in large scientific environments especially ITER. It has so many benefits, so the developed monitoring and control system for FCPS is also based on EPICS framework.



## System Structure

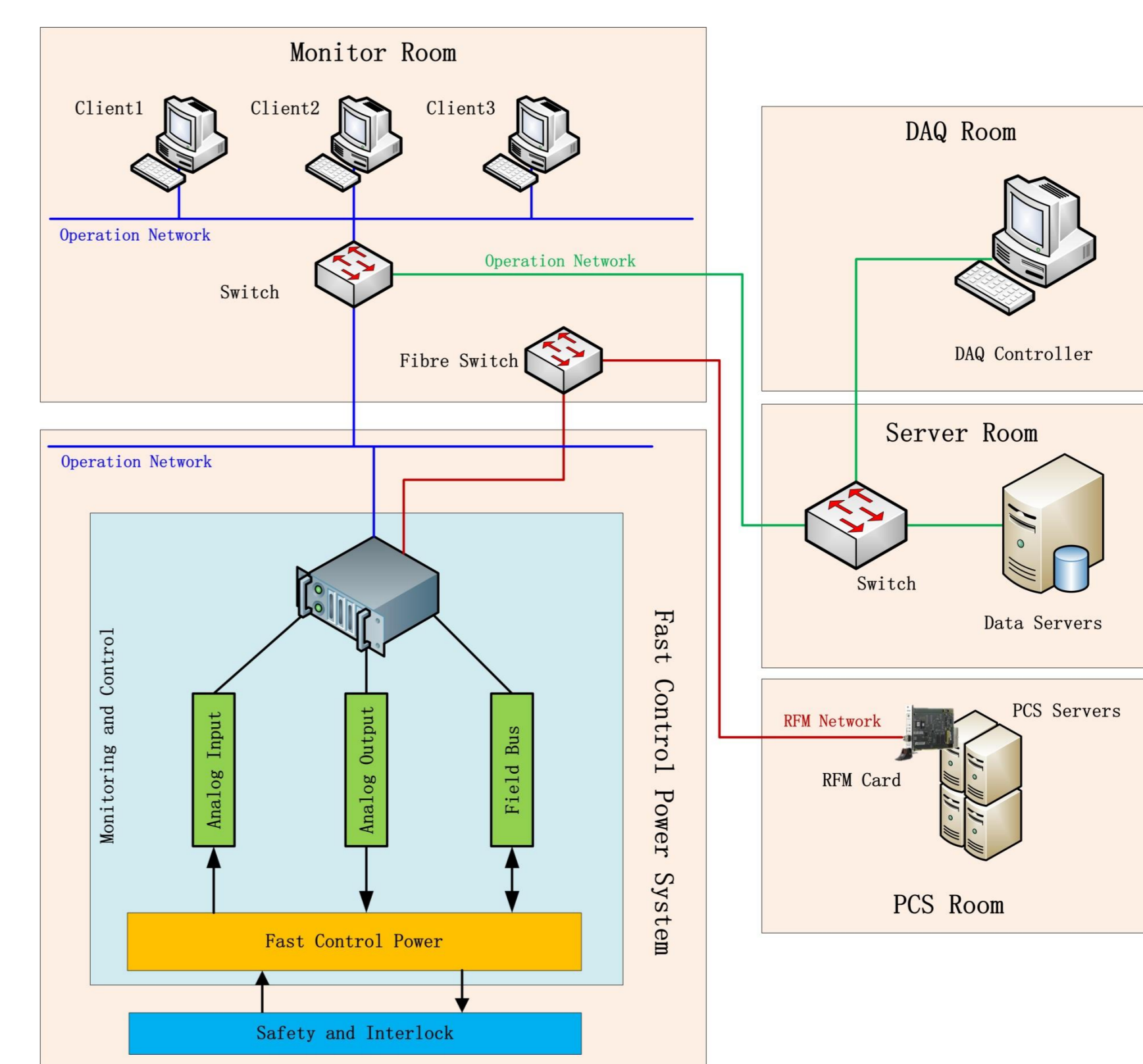
System includes the following modules:

- ✓ data acquisition module
- ✓ status monitoring module
- ✓ Feedback Control with PCS

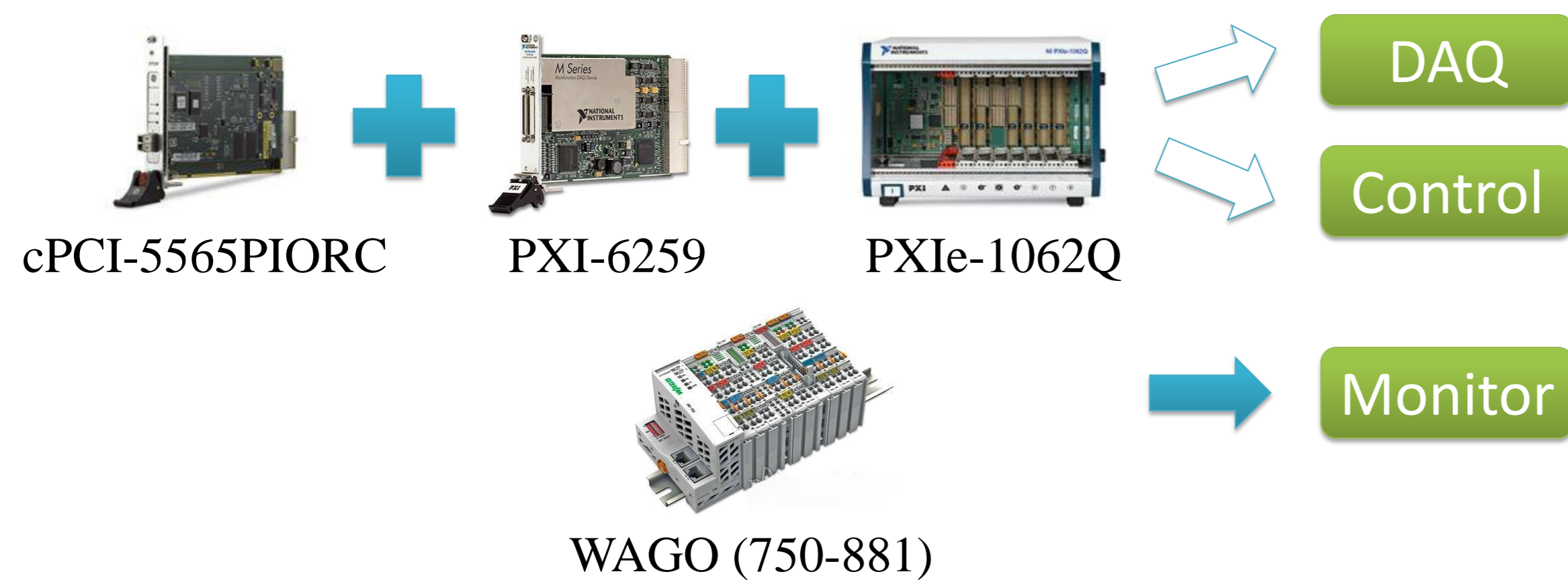
The monitoring and control system communicates with the control and protect section through the serial RS-485 protocol and with the main circuit through the TCP/IP based MODBUS protocol.

Feedback control module is considered as the front end executable module of PCS and communicates with PCS through the reflective memory Network.

All of the acquired data from FCPS are demonstrated on the OPI developed by Control System Studio, and are archived by the MDSPlus database.



## Hardware Structure

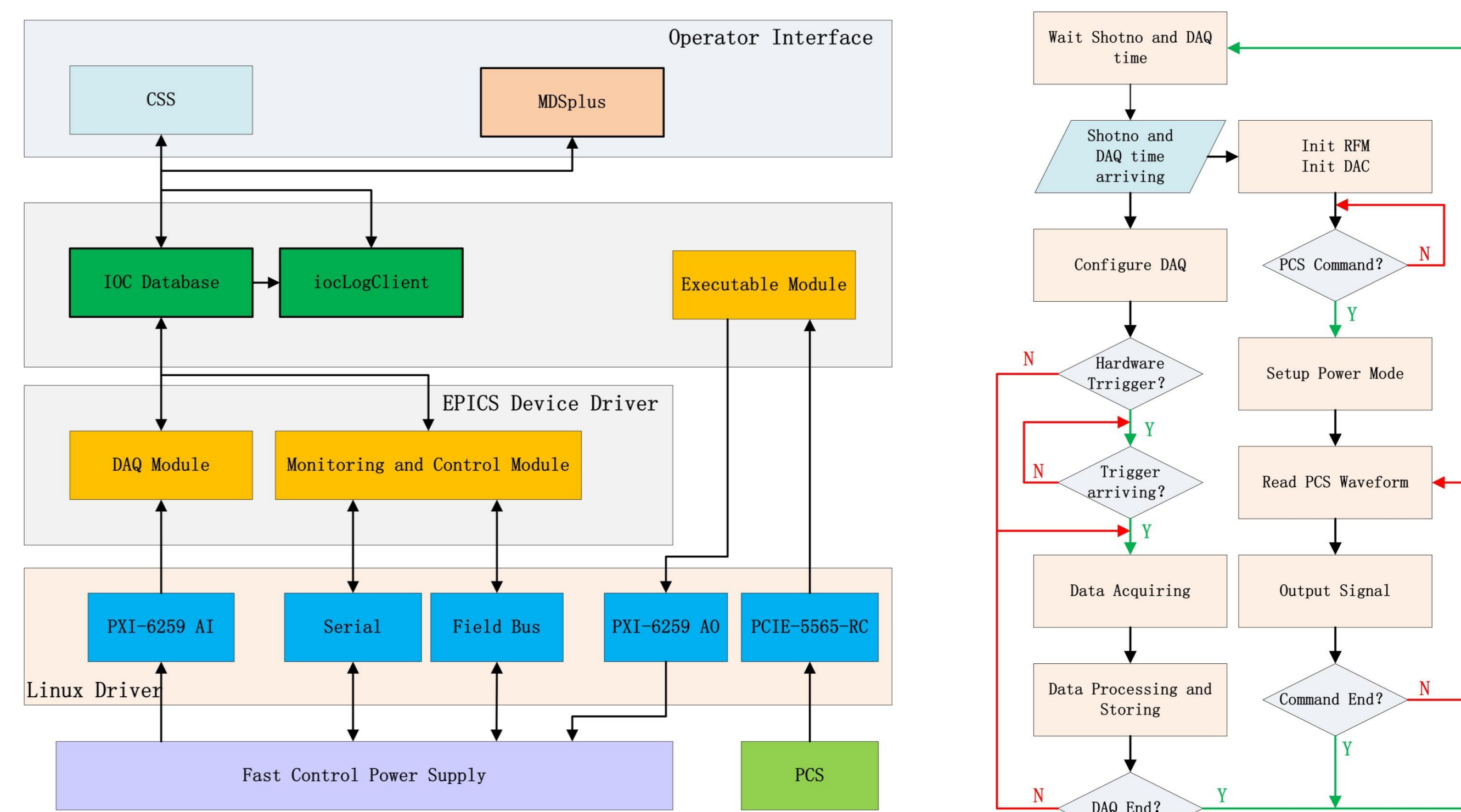


WAGO (750-881)

cPCI-5565 communicates with PCS through the fiber network. PXI-6259 has 32 channel and 1MHz multichannel sampling rate. WAGO is used to monitor the status of power supply, including 6 DI, 1 DO and 1 AI module.

## Software Structure

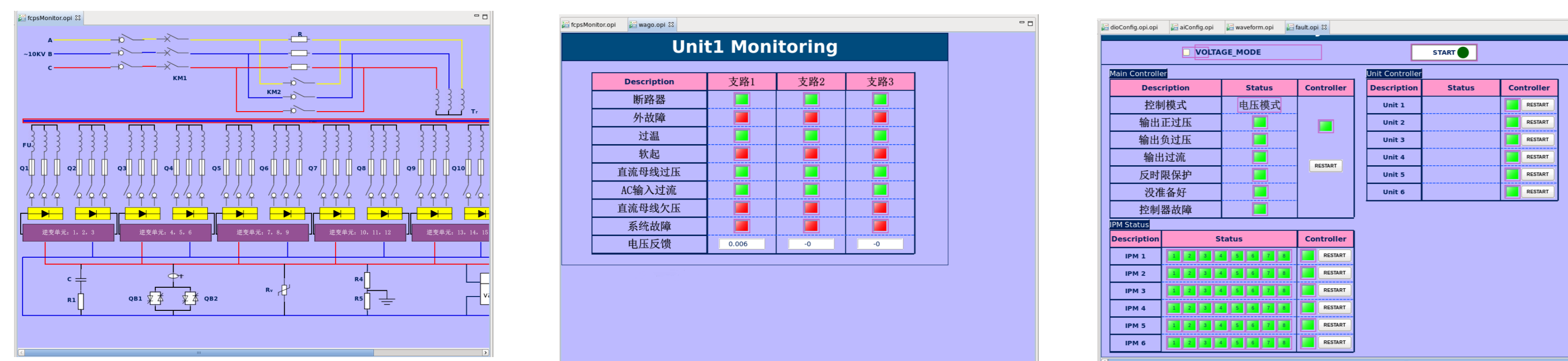
The software is mainly based on the EPICS, including four level (the operator interface, data processing, EPICS device support and Linux driver). The data acquisition module and status monitoring module are developed as EPICS device support modules, and the feedback control module is developed by C. The (b) figure shows that the data acquisition and feedback with PCS conform to the timing of EAST control system.



(a) System Software Structure

(b) Software Work Flow

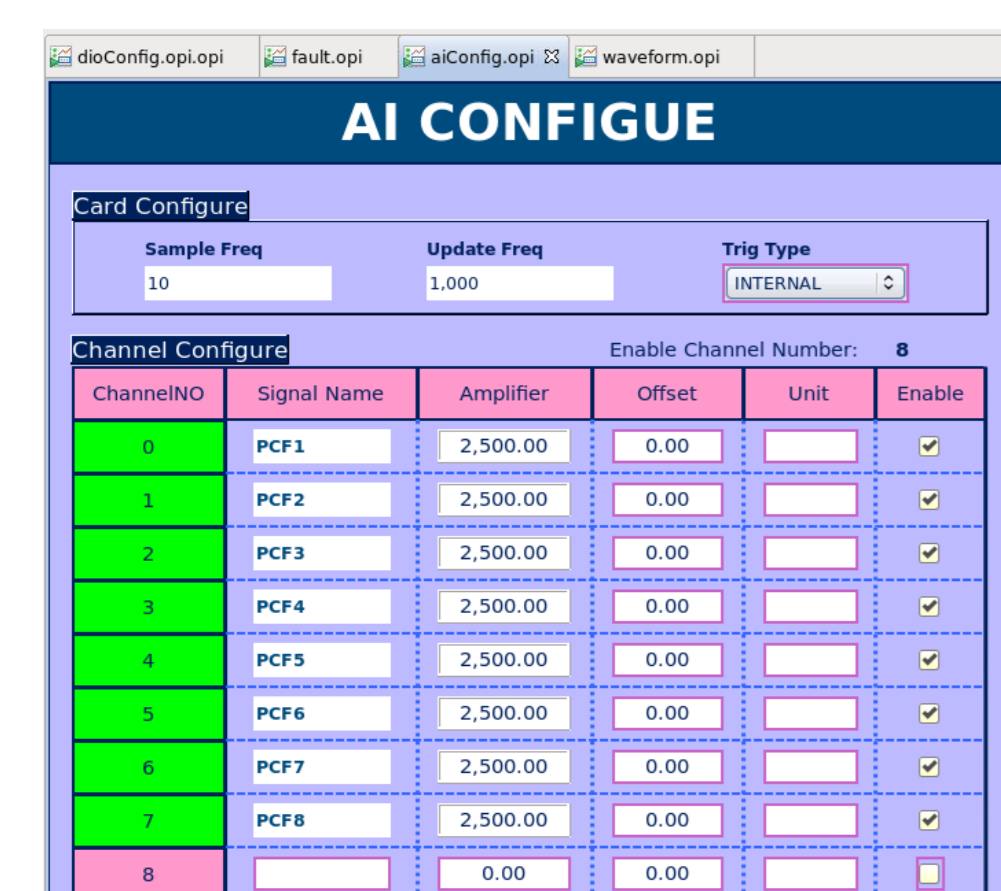
## Operation Status



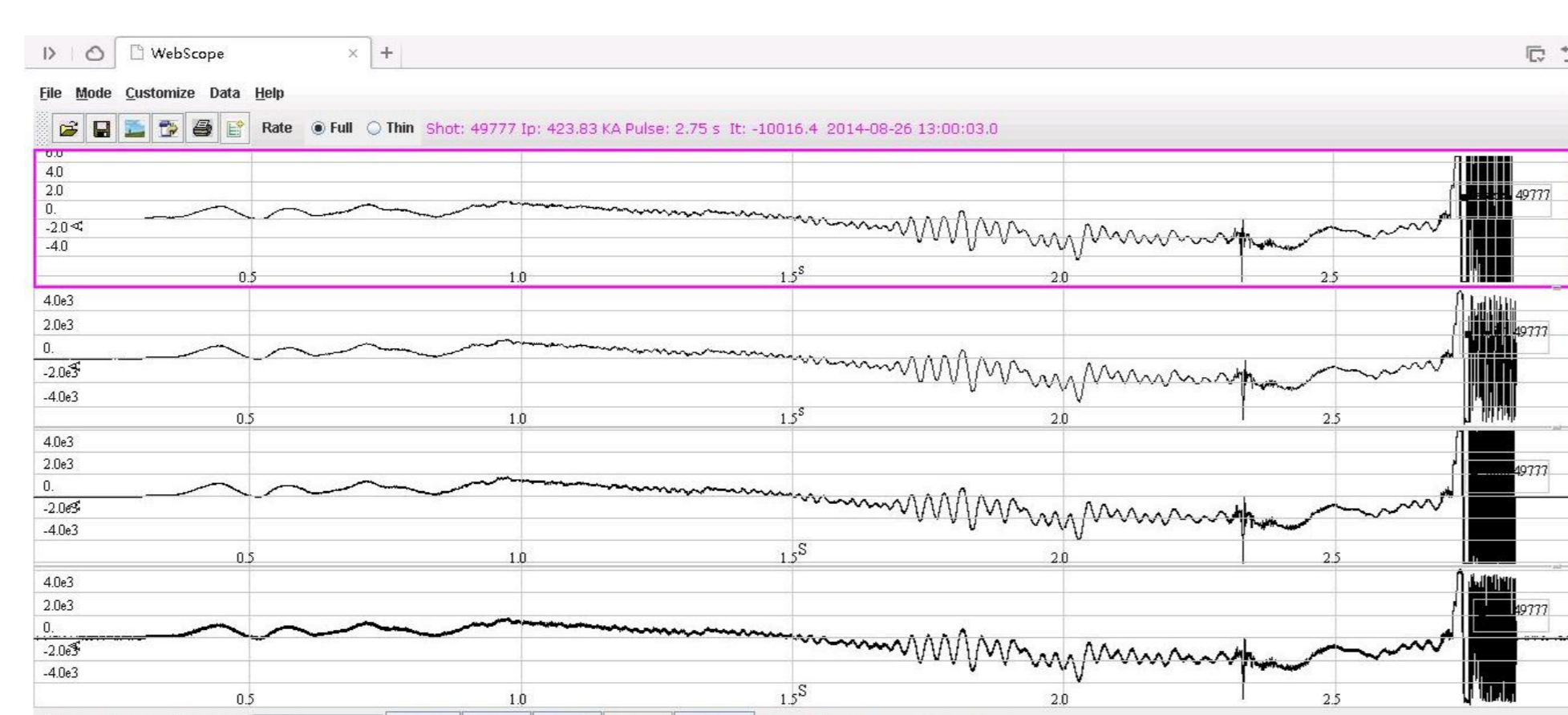
(a) Power Supply Monitor

(b) Power Subsystem Monitor

(c) Power Controller Monitor



(d) DAQ Configure



(e) Power Supply Response with PCS Command

The new monitoring and control system has been tested and used during 2014 EAST experimental campaign. It showed the stable and robust performance.

The (e) figure shows that the output current of FCPS with feedback of PCS.

## Summary and Future Work

This system based on EPICS was modularly designed to meet the monitoring and control requirements of FCPS. This involves publishing its signals in an EPICS network and storing the data in a MDSPlus database, together with a redundant local control for testing purposes.

The further work line moves toward applying the EPICS framework to other subsystems.

## Acknowledgment

This work is supported by China 973 projects (Grant ID: 2014GB103000) and National Natural Science Foundation of China (Grant No: 11405205).