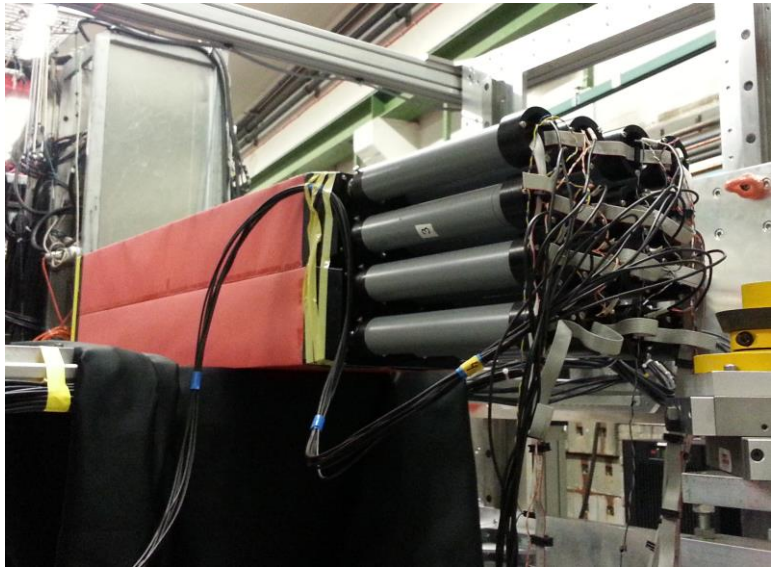
Forward Spectrometer Calorimeter (FSC)

Detector control system



Institute for High Energy Physics, Protvino, Russia

DCS includes:

1. PMT power control (1512 PMTs):
   - 1512 channels of ADC
   - 1512 channels of DAC
   - 1512 channels of EEPROM-codes
   - few HV/LV-channels

     [now 36-channel prototype in use]

2. Monitoring systems control:

~ 400 channels of LED-pulses control & stability.

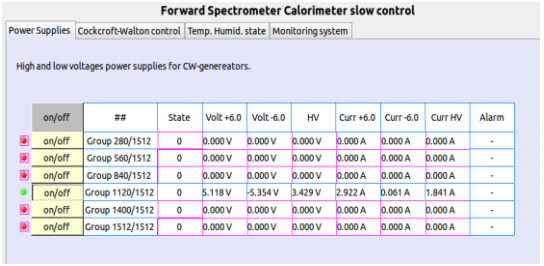
Total: up to 5000 channels (PVs in FSC DCS).

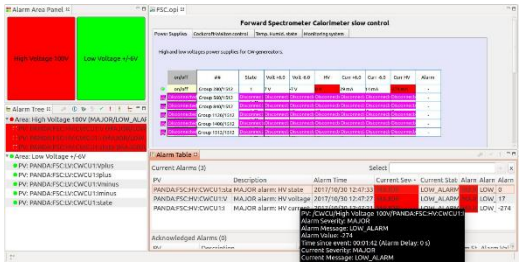
FSC DCS: structure

Field layer: MCU boards (stm32f2xx, stm32f4xx) + Modbus RTU

Control layer: Raspberry Pi B+ with RS485/CAN-adapter

Supervisory layer: Control system studio (+ ArchiveEngine & AlarmHandler)





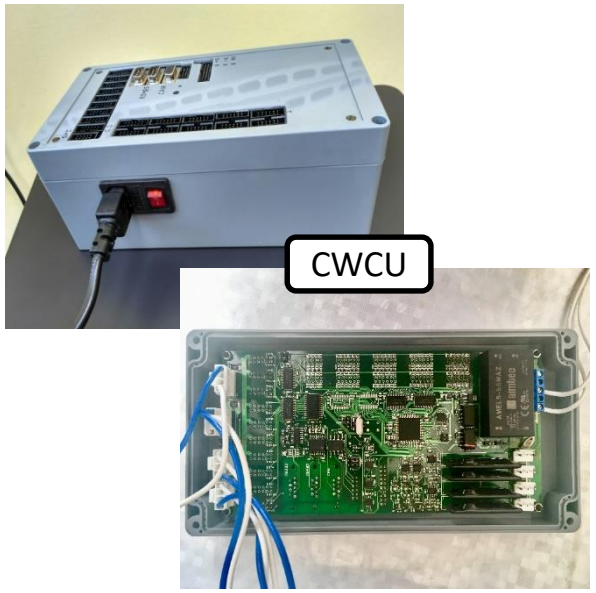
This was tested 2 years ago for the 36-channel prototype. Nothing new.

FSC DCS: field layer

Field layer: MCU boards (stm32f2xx, stm32f4xx) + Modbus RTU

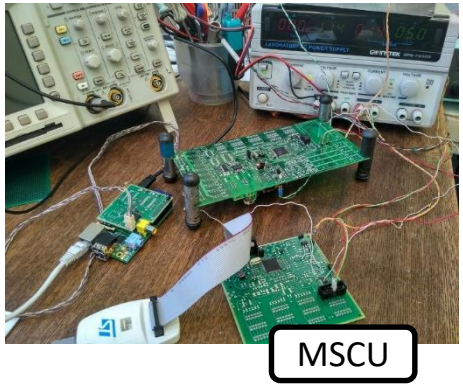
CWCU (Cockcroft-Walton Control Unit):

- HV & LV control
- Voltage reference codes for up to 280 PMTs
- Temperature sensors interface (Dallas, 1-Wire)
- Modbus RTU/CAN-bus



MSCU (Monitoring System Control Unit)

- LED control in both monitoring systems
- Temperature sensors interface (Dallas, 1-Wire)
- Modbus RTU



FSC DCS: control layer

Control layer: Raspberry Pi B+ with RS485/CAN-adapter

Adapter for Raspberry Pi:

- ISO3086T for Modbus/RS485 (main interface in FSC DCS)
- SJA1000T for CAN-bus (used for few custom-made power supplies)

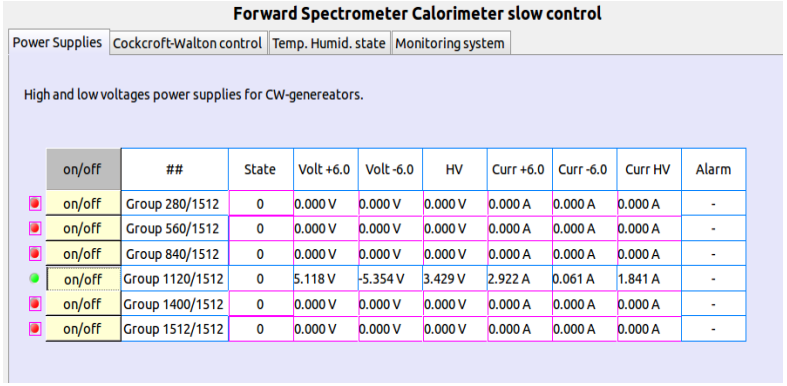
FSC DCS: supervisory layer

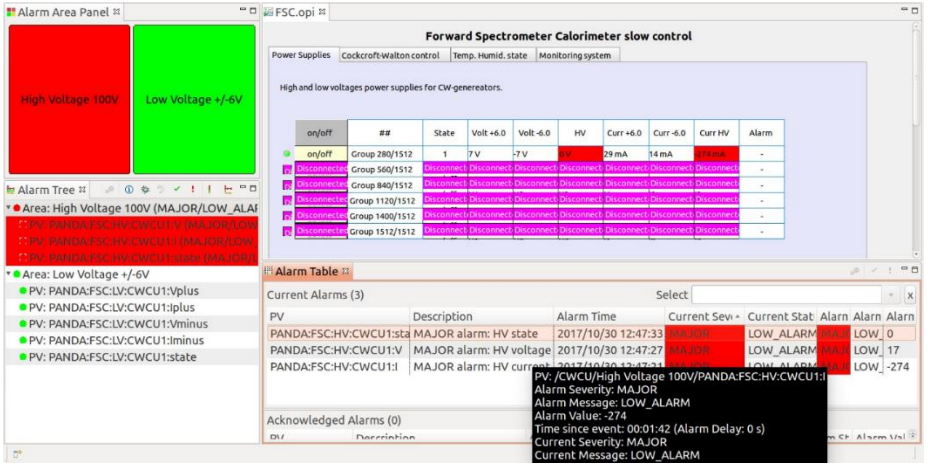
Supervisory layer: Control system studio (+ ArchiveEngine & AlarmHandler)

Control system studio:

- GUI (test version)
- ArchiveEngine (works fine)
- AlarmHandler (some difficulties,

but basically it works)





FSC DCS: monitoring systems

Monitoring systems:

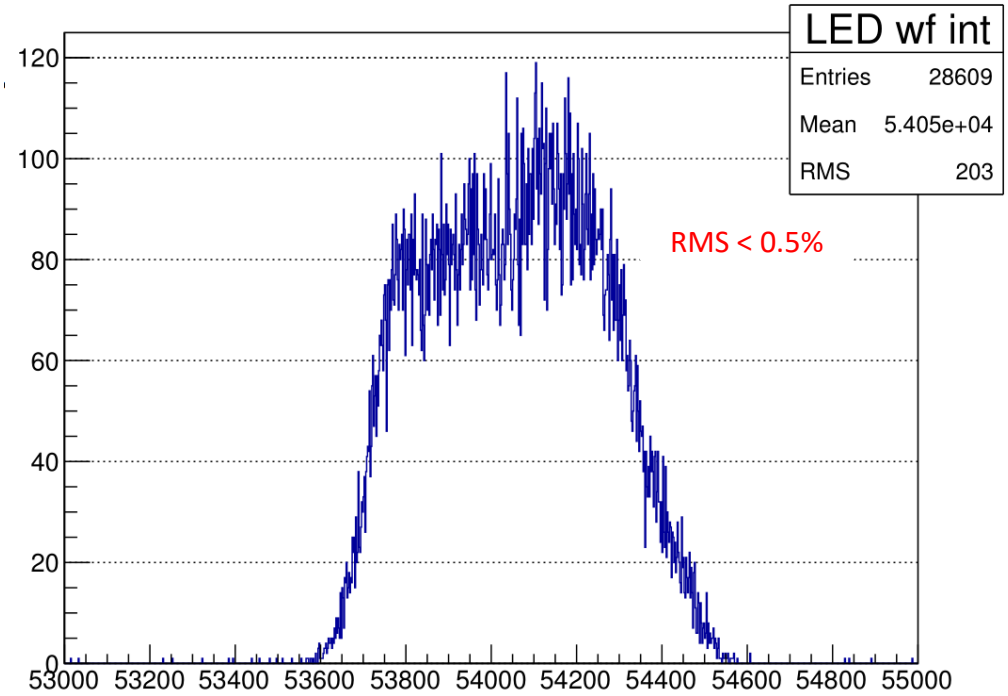
1) Front-side system for quick and simple checking of the detector channels (independently) and the readout electronics circuits. 378 LEDs – each in 4-channel module of FSC. [*Under the development]*
2) Back-side system for precise monitoring of the PMT gain in each channel of the detector. Two light pulsers for the whole detector, LED pulse in each channel by optical fiber. [*Prototyping]*

FSC DCS: back-side monitoring system

Back-side system is based on light pulser (1 for half of the detector):

- Powerfull blue LED, LED-driver
- Light mixer
- Reference photodiode (for LED-pulse stability measurement)
- Temperature heater (for thermal stabilization)

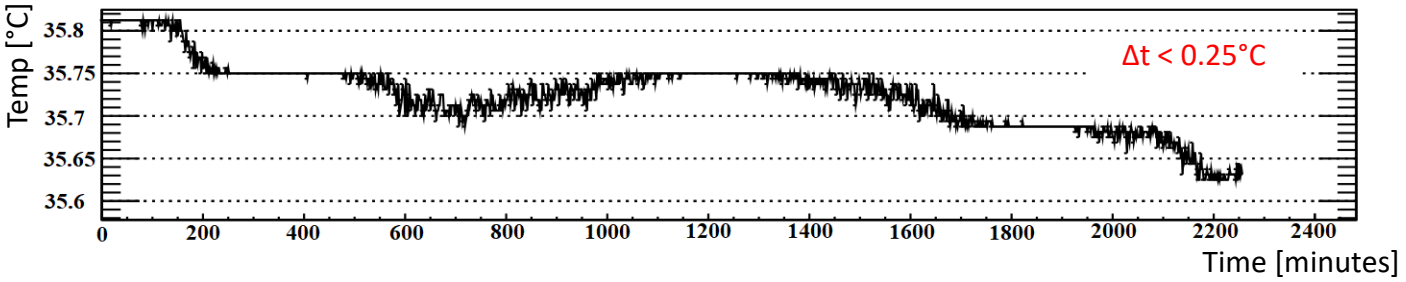
Photodiode signal (received by MSCU in DCS):



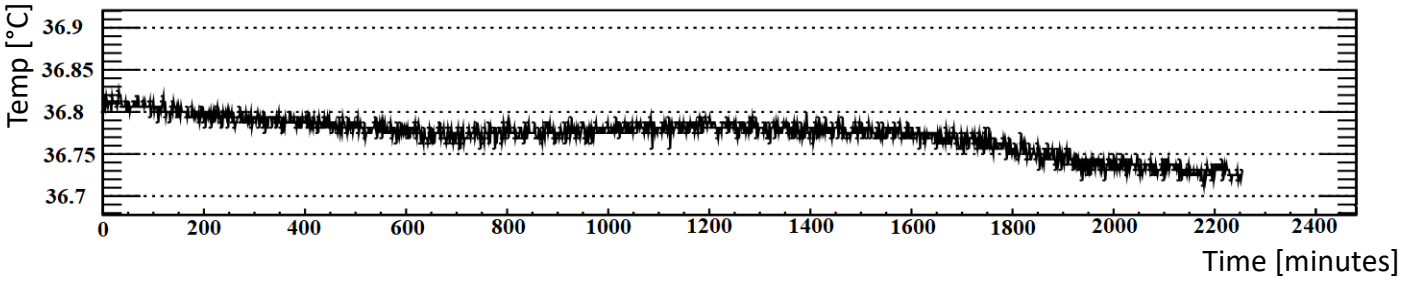
FSC DCS: back-side monitoring system

Temperature stability (received by MSCU in DCS):

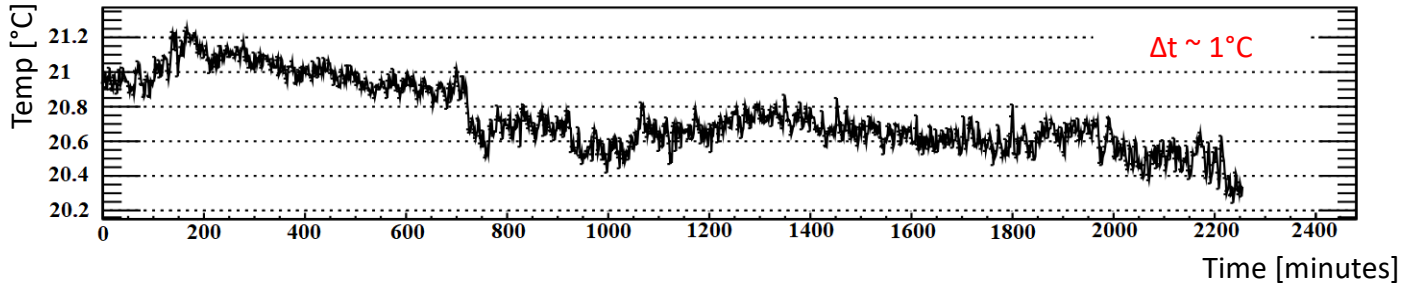
Temperature near LED



Temperature near the heater



Temperature outside



FSC DCS: summary

DCS was tested with 36-channel prototype, but not in beam time.

DCS-chain (MCU + Raspberry/IOC + CSS/Archiver) was successfully applied also in other tasks (for radiation hardness tests of DCS components).

Contact: Sofia Bukreeva
E-mail: bukreeva@ihep.ru