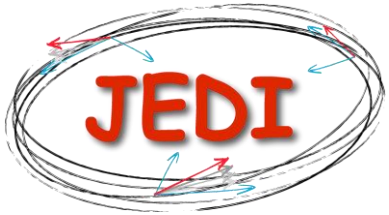


JÜLICH
FORSCHUNGSZENTRUM

Readout System

David Mchedlishvili *for the JEDI collaboration*

(HEPI TSU / IKP Jülich)

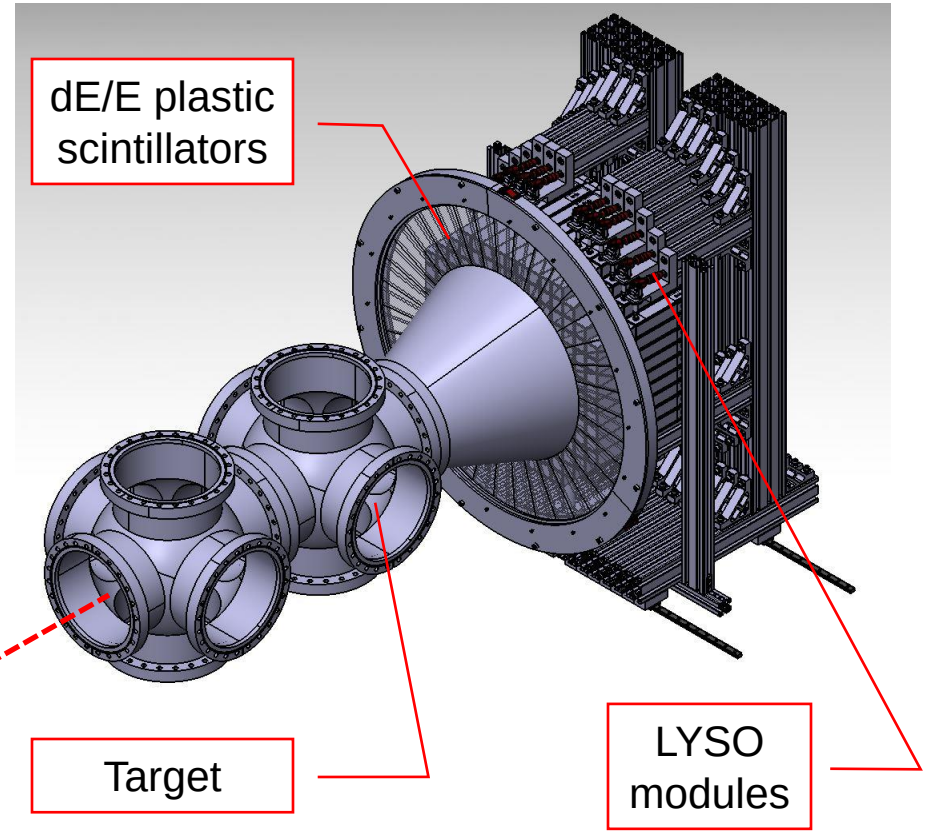
01.09.2016

Introduction

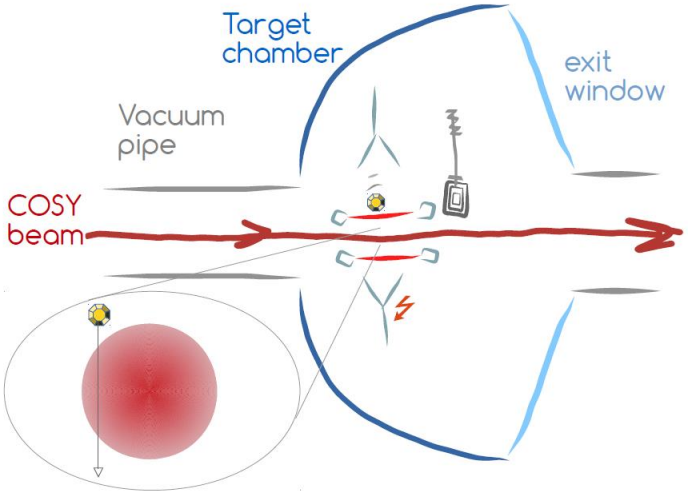
JEDI polarimetry

- High efficiency
- Full φ in maximum FOM region
- No magnetic / electric field
- Stability

Heavy crystal calorimeter

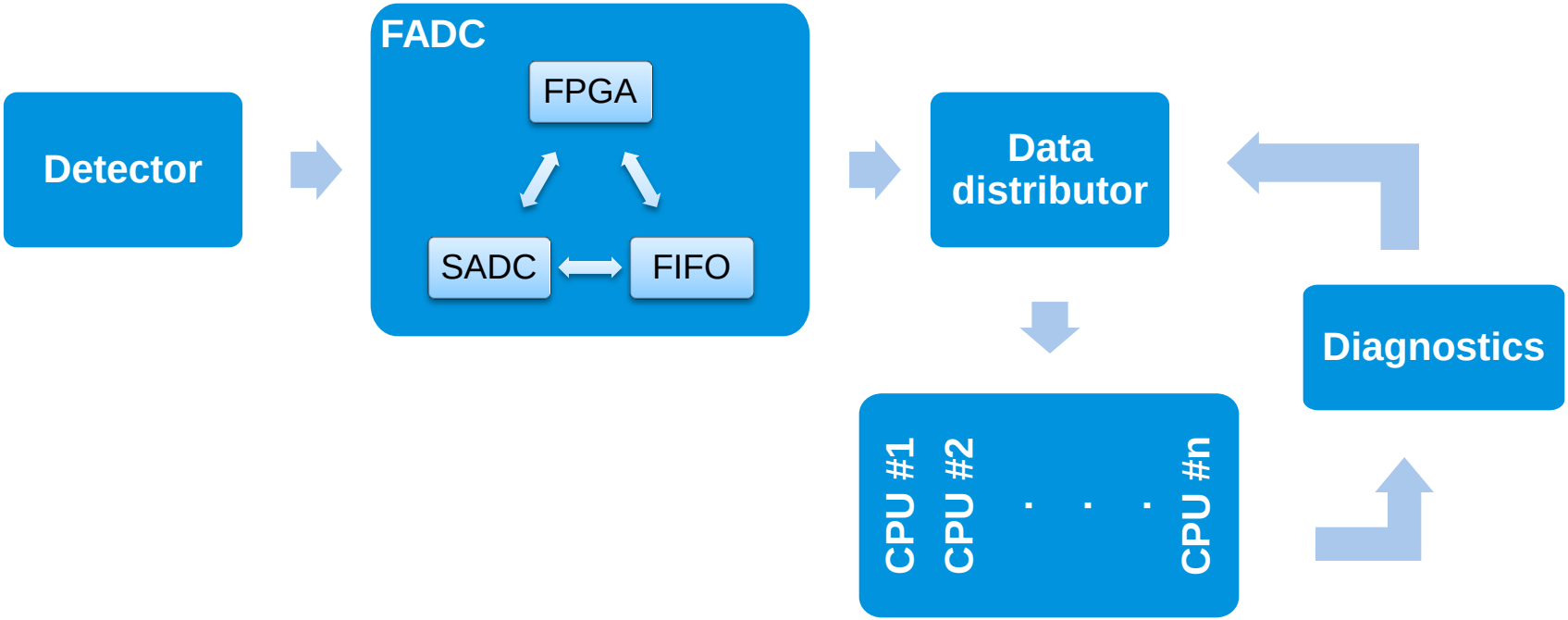


Ballistic Diamond Pellet Target



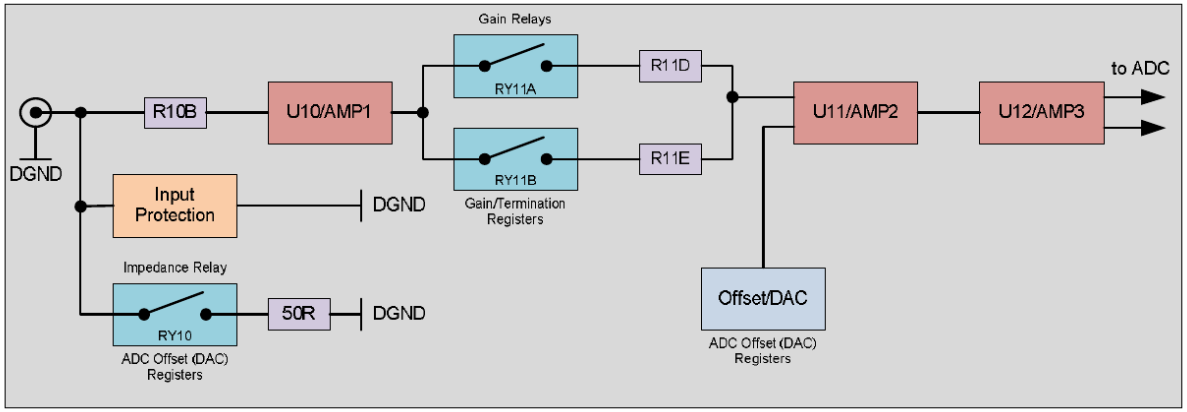
FADC based DAQ

- ~100% efficiency
- Real-time data processing
- Multi-threaded



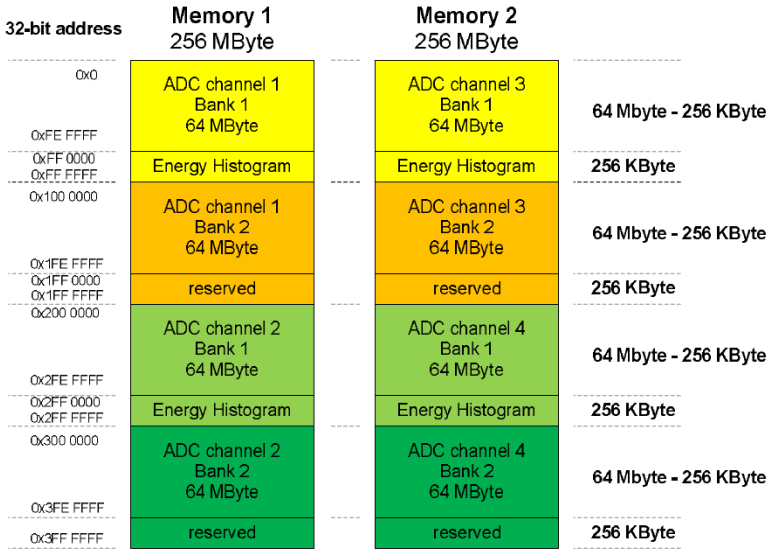
Struck SIS3316

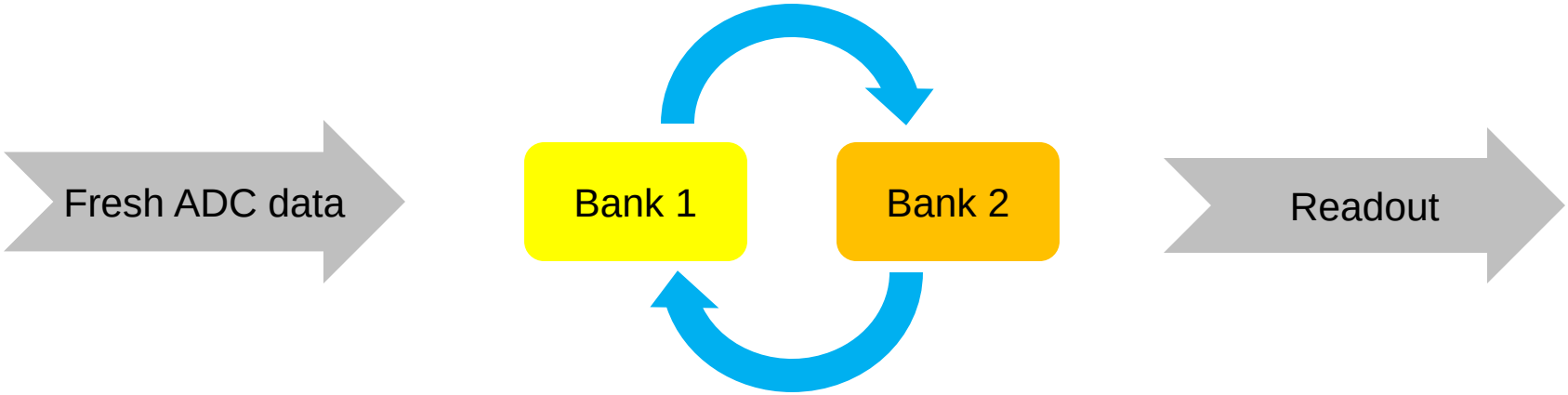
- 16 channels per module
- 250 MS/s per channel
- 125 MHz analog bandwidth
- 14-bit resolution
- Offset DACs
- Internal/External clock
- Readout in parallel to acquisition
- Capable of working in a chain
- QDC mode in parallel with SADC
- Built-in hardware features (Pile-up detection, averaging and more)
- Self triggering



Memory and data structure

- Two memory banks per channel
- While bank 1 is used for acquisition, bank 2 is being read out

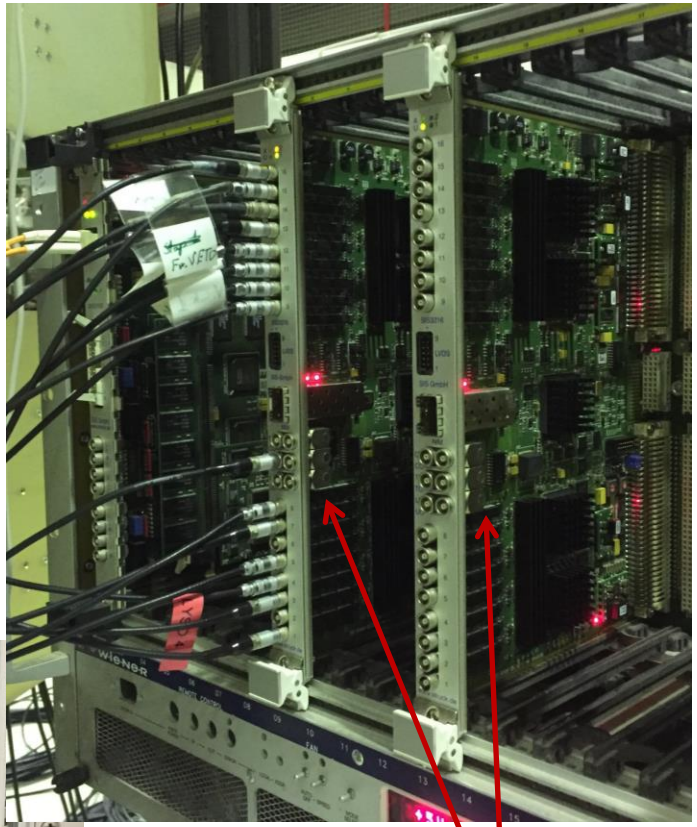


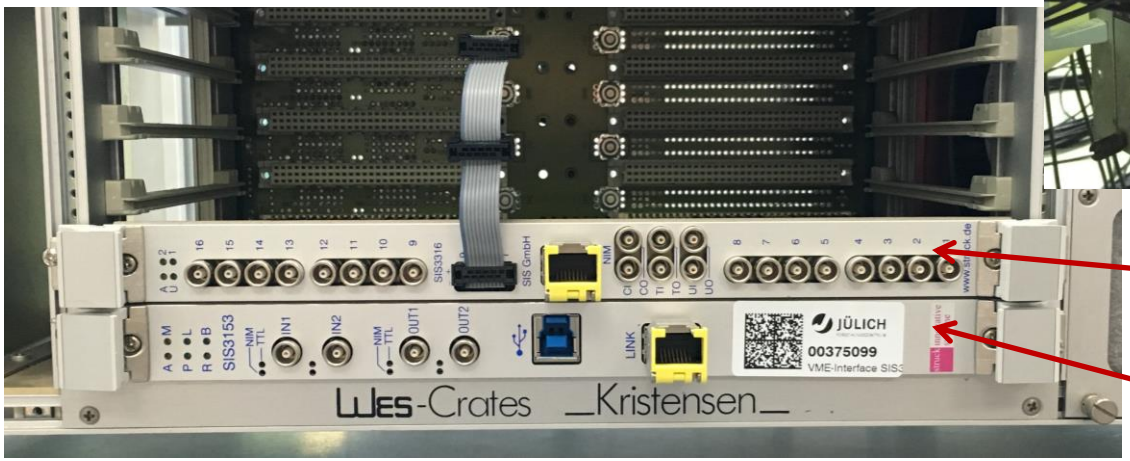


Recent status: Hardware

- ✓ 3x SIS3316 FADCs (48 channels in total)
- ✓ USB3.0 to VME interface SIS3153

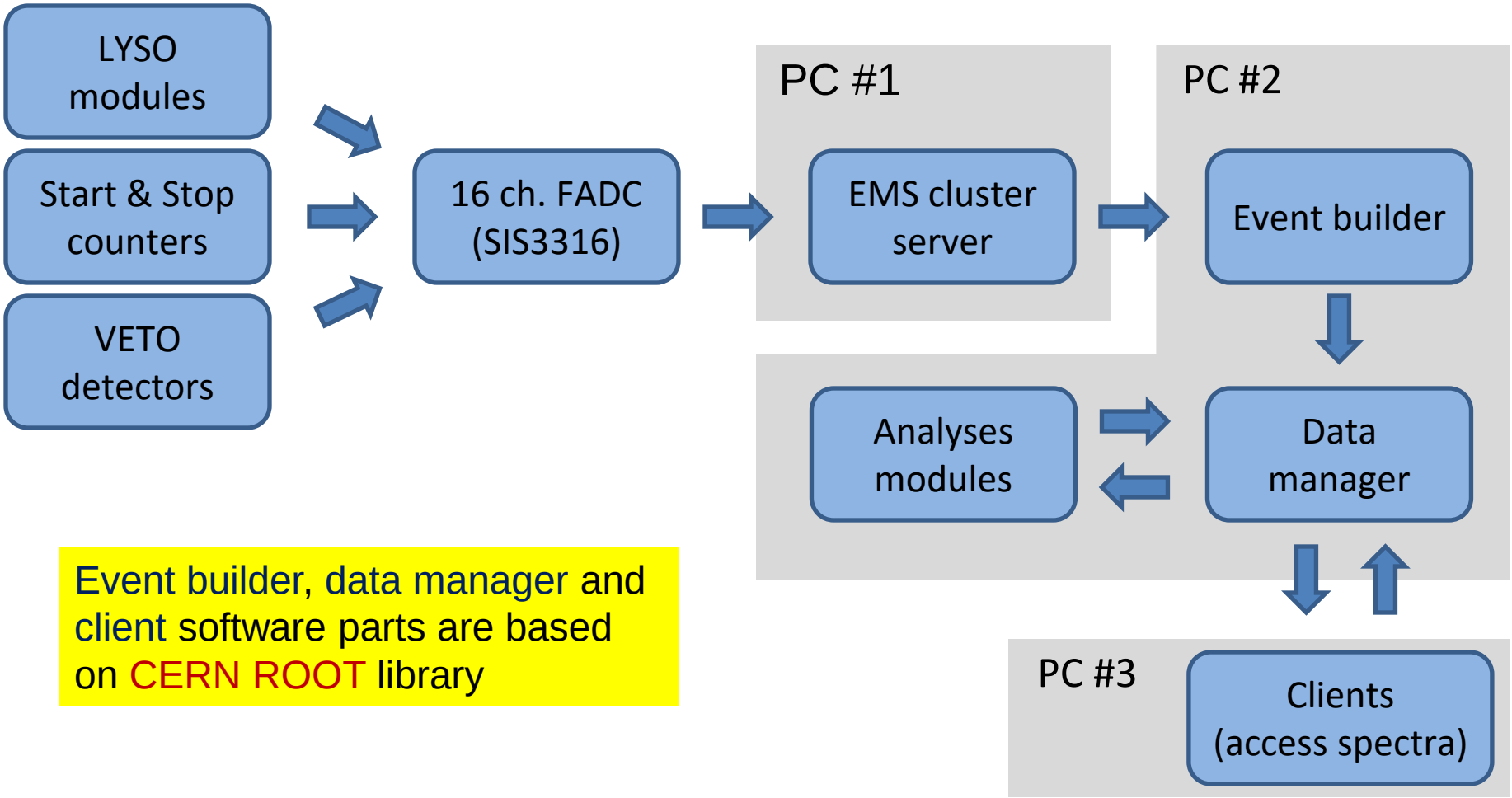
  (also supports GBit Ethernet)





Recent status: Software

Used in recent JEDI experiment (LYSO tests)



Event builder, data manager and client software parts are based on CERN ROOT library

Block description

EMS cluster server

- Reads experimental data
- Wraps data in a EMS cluster structure
- Redirects output cluster stream to file or sends it via socket

Event builder (multi-threaded)

- Reads FADC data from the cluster stream (channel-wise data) and stores in a buffer
- Synchronizes data from different channels using timestamps
- Builds events and fills event container (event-wise data)

Data manager (multi-threaded)

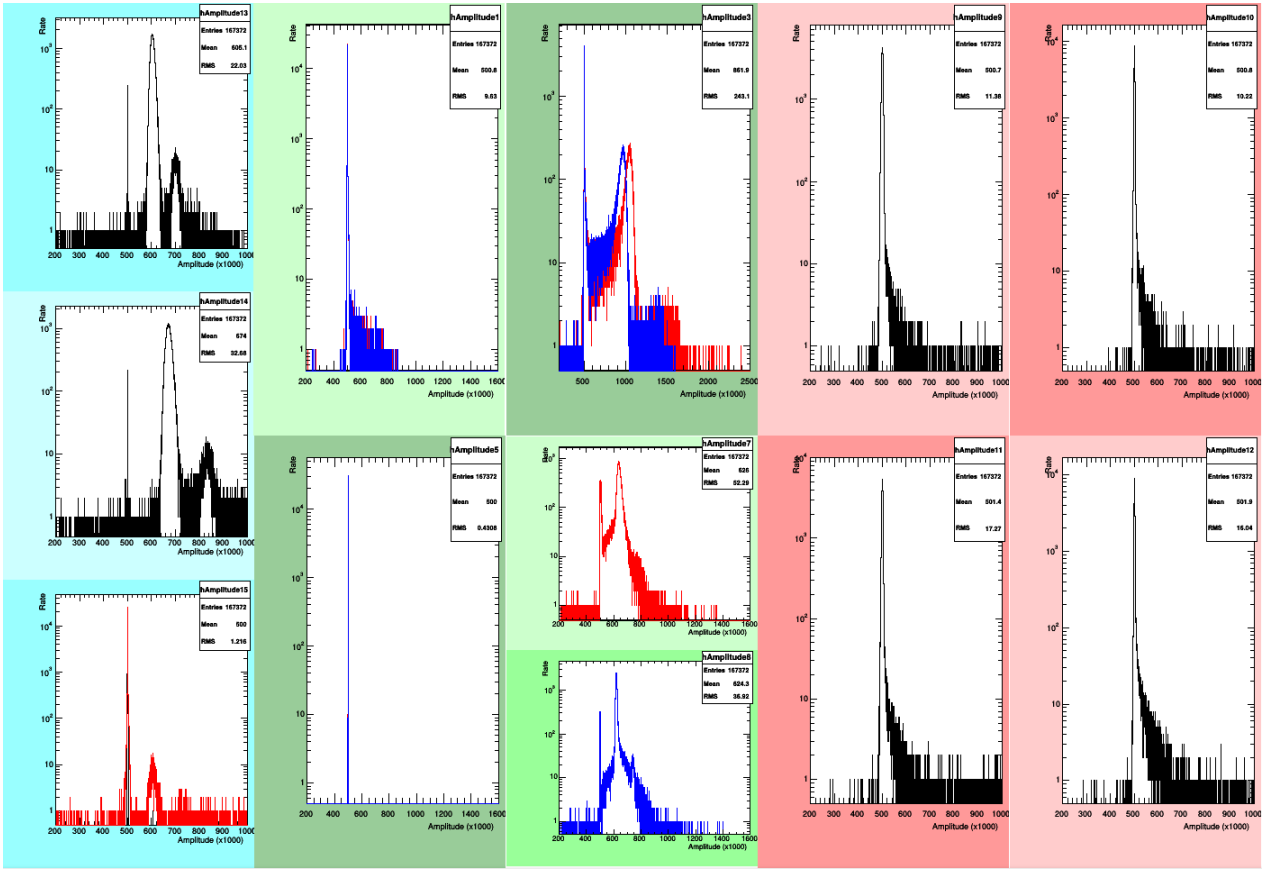
- Reads cluster data from file or socket, or gets events from external event maker
- Registers and runs analyses modules
- Listens to clients and processes requests
- Sends histogram objects to clients on request

Client

- Connects to data manager and controls it
- Gets results from analyses modules (draws spectra)
- Handles configuration files

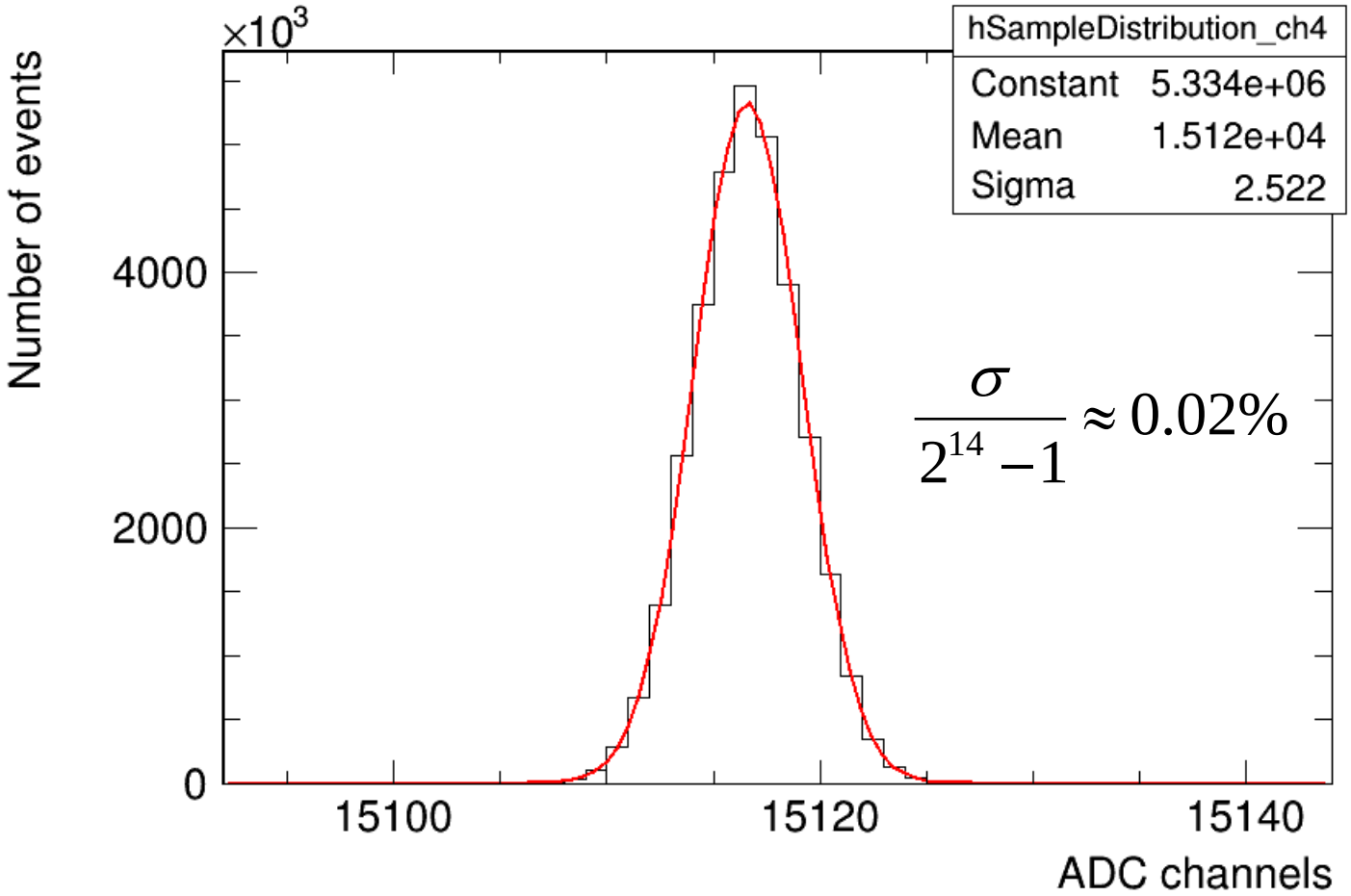
Client side

- Sends ASCII commands to data manager
- Spectra from different analysis can be retrieved separately
- Canvas/Pad structure and style can be described in configuration file



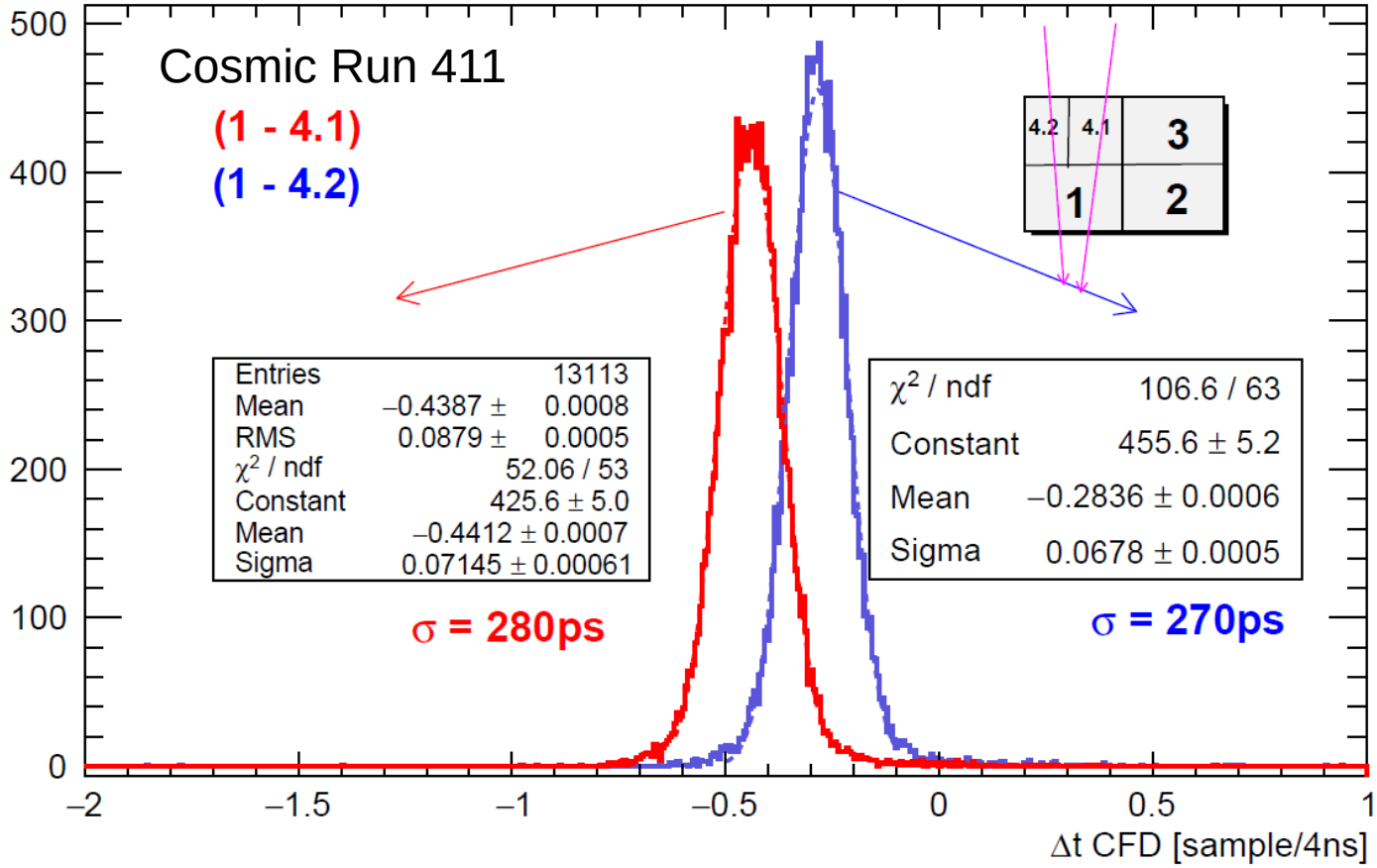
Some tests

Pedestal stability



Some tests

Time resolution between different channels using CFD technique



What's next?

Previous experiment

- ✓ Only one SIS3316 module
- ✓ All events were sampled
- ✓ External triggering
- ✓ No internal features

Next experiment

- ➢ Two SIS3316 modules will be employed (32 channels in total)
- ➢ Synchronous operation (shared clock)
- ➢ Internal features will be used:
  - Self triggering
  - Pile-up detection
  - Signal integration (QDC mode)

In addition:

- Consider alternative way of module readout using USB3.0 to VME interface
- Adopt the readout software to new features
- Develop analysis for online asymmetry measurement

→ and possibly some useful data for feedback system?

Summary

- ✓ Readout hardware: Almost fixed; first measurements already performed
- ✓ Readout software: First working version (single module, SADC mode) ready

Outlook

- ❑ Prepare for the up-coming experiment
- ❑ Take control of the internal features of SIS3316
- ❑ Continue readout software development