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Software interface with ICS

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Outline

- Status at PDR
- Work after PDR
- Status at CDR
- Work after CDR

Crew and tasks

- Hardware Rafael A. Baron
- Firmware Fredrik Kristensen (LTH), porting to SIS8300-KU Maurizio Donna
- Software Hinko Kocevar
- Cabling Rafael A. Baron
- Testing / debugging / data evaluation Rafael A. Baron
- Coordination made through JIRA issues
- Small ICS involvement due to lack of resources

Status at PDR

- LLRF EPICS support and IOC ported to work with BPM firmware/hardware
- Demonstrated that chosen hardware and developed firmware are adequate for BPM application
- Presented path forward
  - Stop using NDS based EPICS support
  - Final BPM EPICS support shall be areaDetector based
  - Decision was in sync with ICS

Work after PDR

- Soon after PDR work on final BPM EPICS support started
- First task was to develop generic Struck SIS8300 digitizer support
  - Previously based on NDS
  - Now based on areaDetector (asynNDArrayDriver C++ class)
  - Allows control and status reporting of the digitizer and RTM
  - Delivers 10 channels of digitized analog input data as waveform PVs to clients
- Integration with MTCA based EVR and mrfioc2

Work after PDR

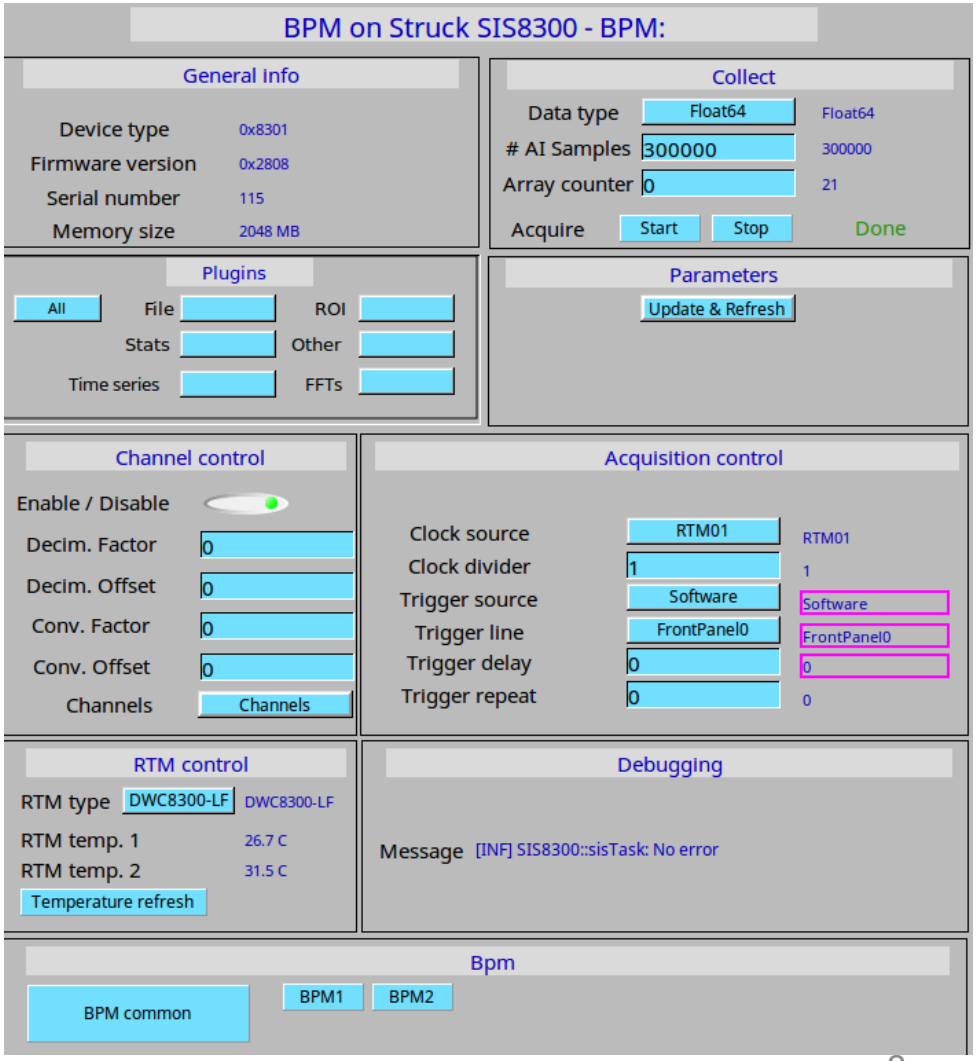
- Once generic SIS8300 support was in place, BPM application development was started
- BPM EPICS support derives C++ class of generic SIS8300
- Along the way generic support was modularized and improved
  - Fairly straight forward since BPM is derived from generic
- All aspects of control and data transfer were completed in 3 months
  - Also with CSS OPI

Work after PDR

- Two instances of BPM are supported
- User controls:
  - Clock source, trigger source, near IQ parameters, BPM FIR filter parameters, select to monitor desired BPM channels, amount of samples to request, monitoring of BPM core status, setup EVR for trigger generation
- Data streams
  - 10 raw digitized data streams or 24 BPM specific data stream (12 per BPM instance)
- AD plugins utilization (ROI, stats, proc, HDF5, ..)

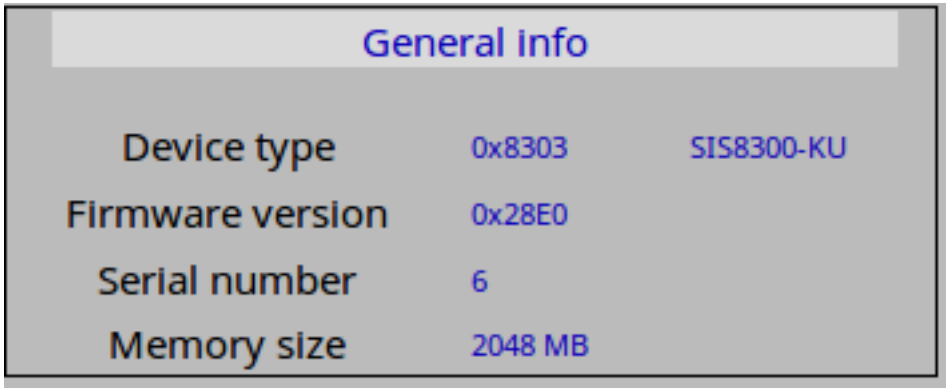
CSS OPI

- Top level CSS OPI
  - General info
  - Acquisition control
  - Access to other OPI
  - RTM selection
  - BPM instance OPI access



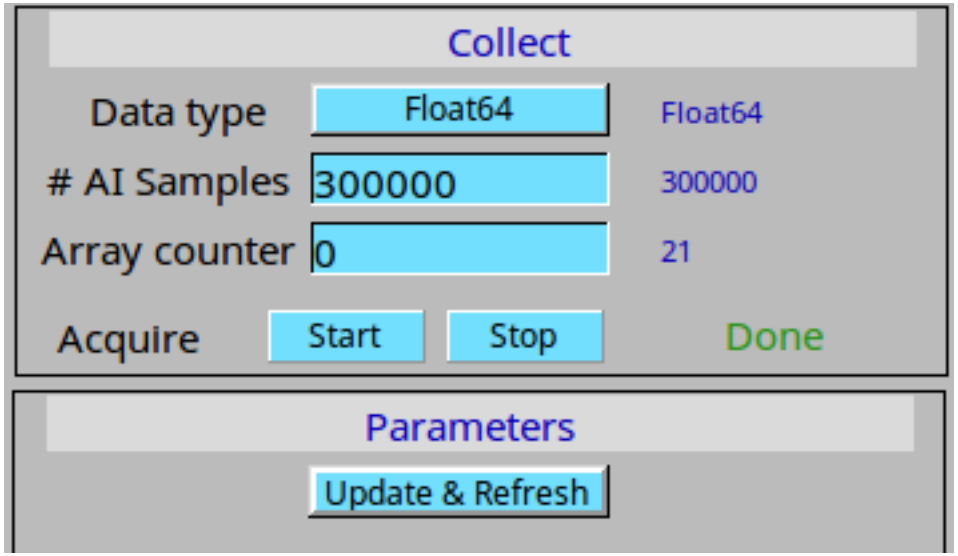
CSS OPI general info

- Some generic SIS8300-x digitizer information



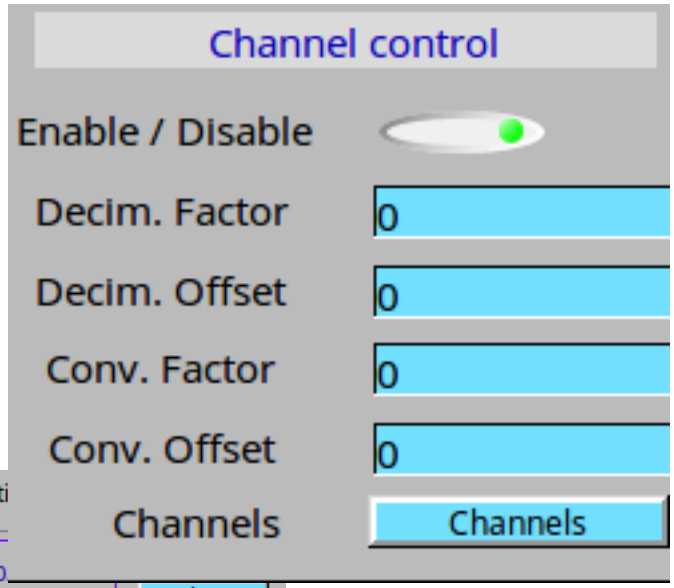
CSS OPI acquisition control

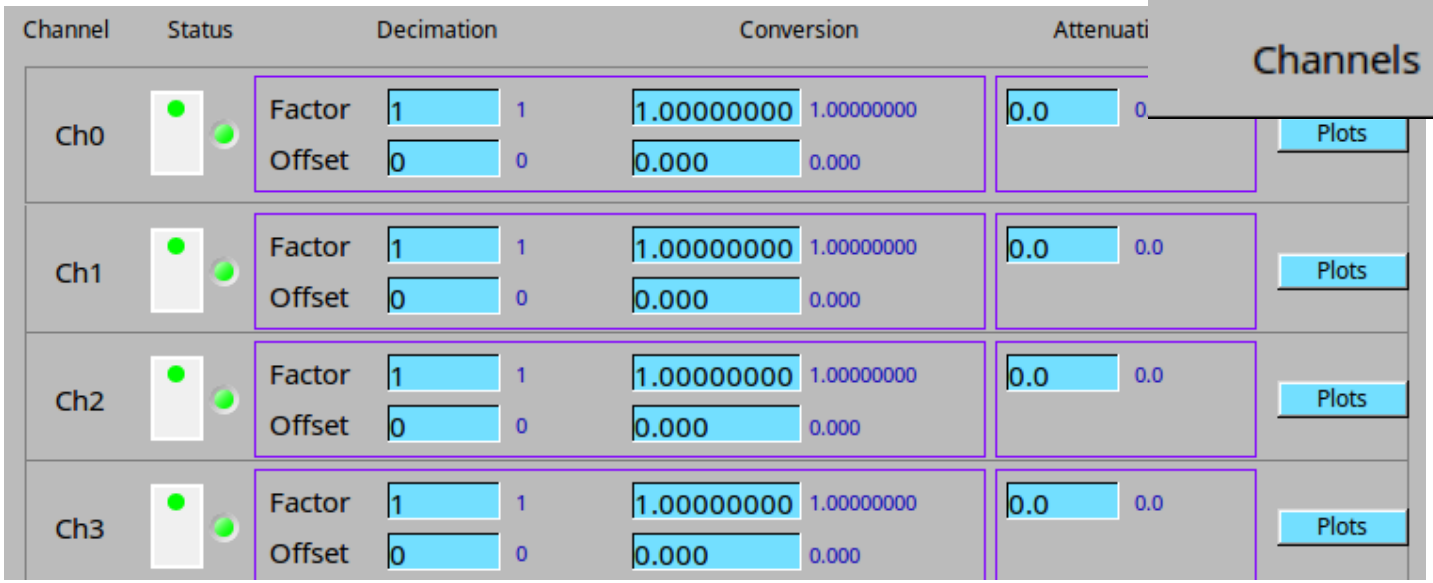
- Selectable data type
- Desired number of raw samples
- Number of arrays (pulses) collected so far
- Force parameter update
  - FPGA parameters are latched and automatically applied between the pulses



CSS OPI analog channels

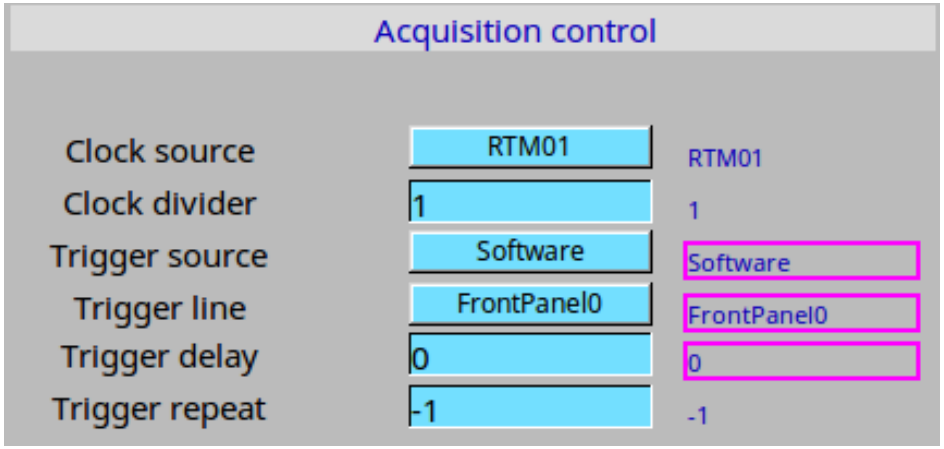
- Channel enable/disable
- Software scaling and offset control
- Attenuation control (RTM)





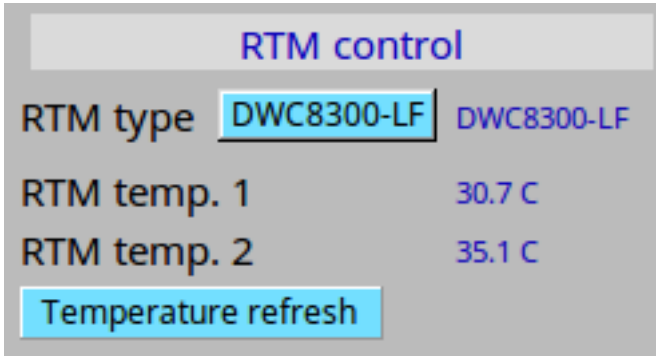
CSS OPI acquisition control

- Selectable clock source
  - backplane, RTM, front panel, internal
- Clock divider
  - integer divisor
- Trigger repeat
  - how many pulses to acquire
- Others
  - not applicable to BPM at this stage



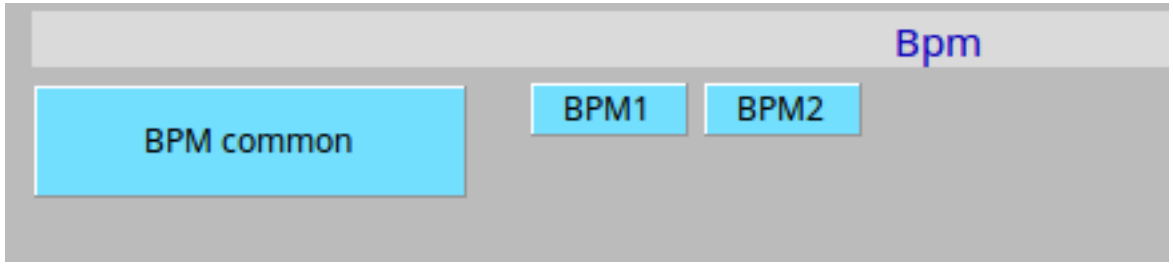
CSS OPI RTM controls

- One type of RTM
  - At least for BPM
- RTM temperature sensors readout
  - Over PCIe
  - Slow conversion (~150 ms)
  - Better to use IPMI which should cover other sensors, too



CSS OPI BPM control

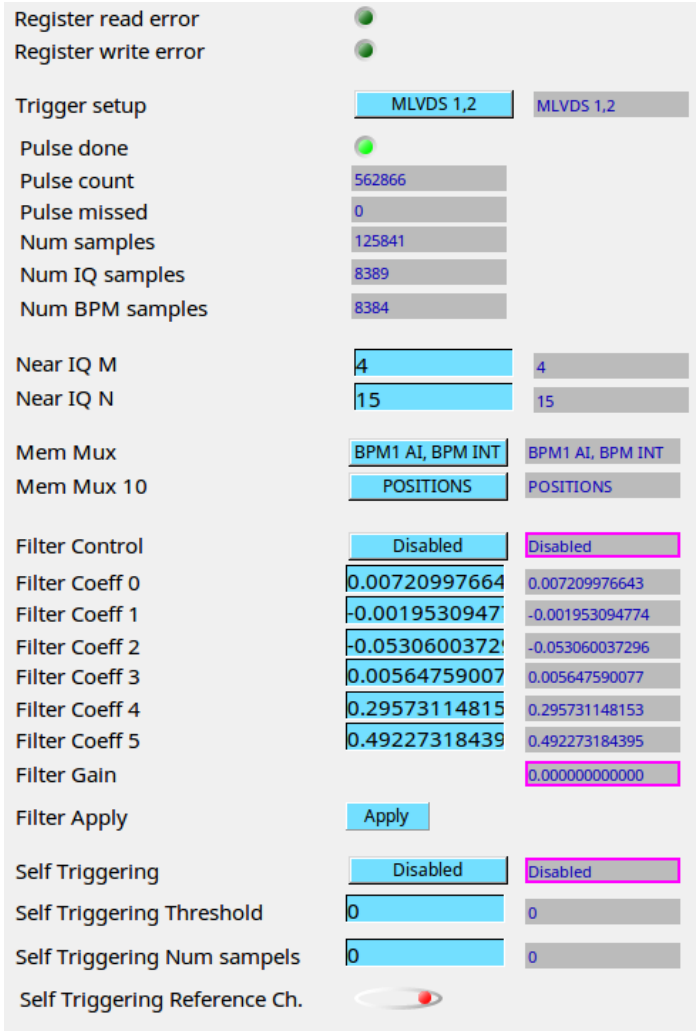
- Two instances of BPM DSP on single AMC
  - Instances are pretty much independent, but..



- Some controls are common for both instances
  - Trigger source, clock source, decimation,..

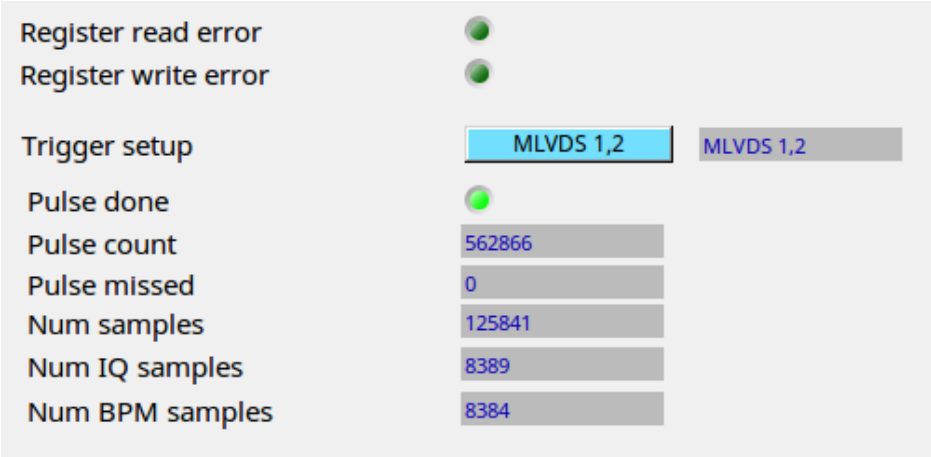
CSS OPI common BPM

- Collection of common BPM controls and statuses
  - These apply to both BPM instances
  - Snag: how to name them in control room?



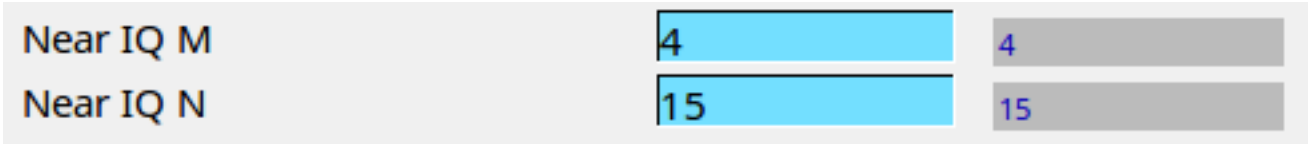
CSS OPI BPM counters

- FPGA access status
- Trigger line select
  - Always backplane
- Sample / pulse counters
  - # pulses
  - Raw
  - IQ
  - BPM



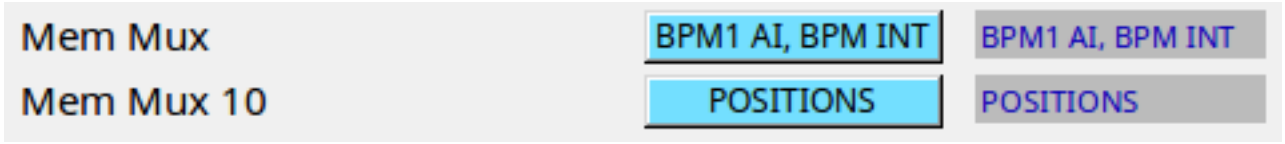
CSS OPI BPM near IQ

- Near IQ sampling control



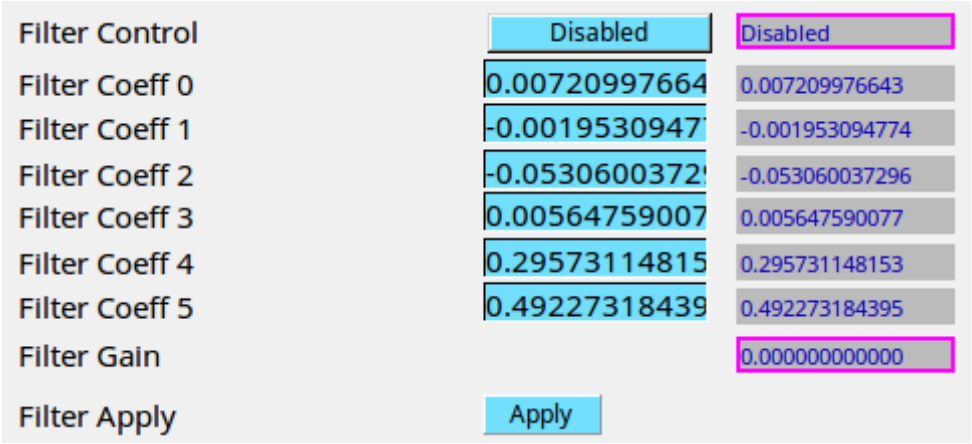
CSS OPI BPM stream muxes

- Using suboptimal BPM data streams at the moment
  - Limited number of data stream channels
  - Need to specify which data stream we want to have from FPGA
  - Muxes allow both BPM data to be interleaved in data streams
  - If becomes software bottleneck then firmware needs to be improved



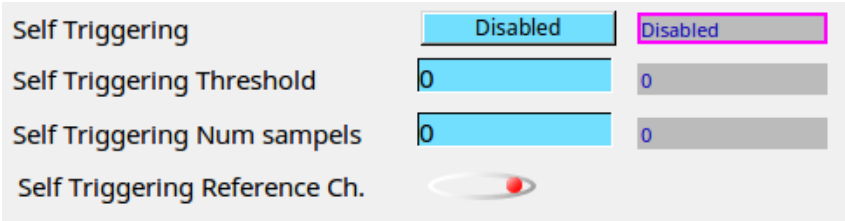
CSS OPI BPM filter

- Filter control enable/disable
- FIR coefficients
- Resulting gain
- Manual coefficient application



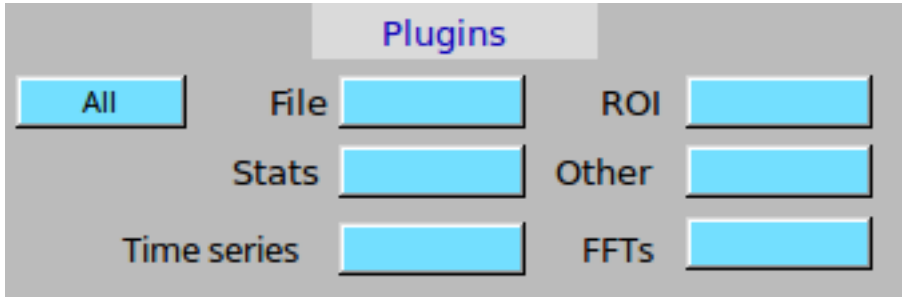
CSS OPI self-triggering

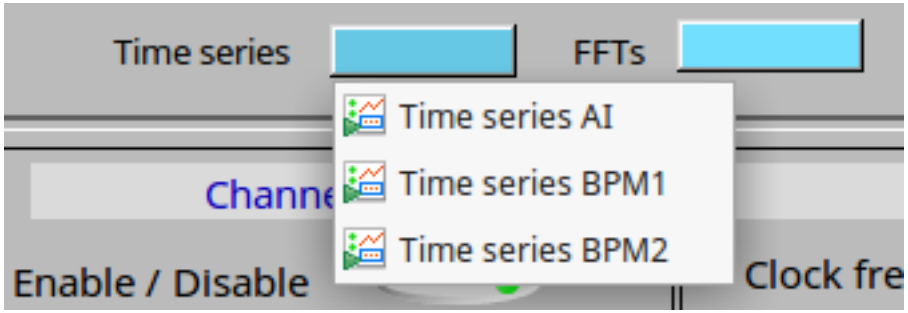
- Self triggering instead of backplane trigger
  - When fishing for pulse
  - Debugging timing (triggers)
  - No timing, no triggers



CSS OPI AD plugins

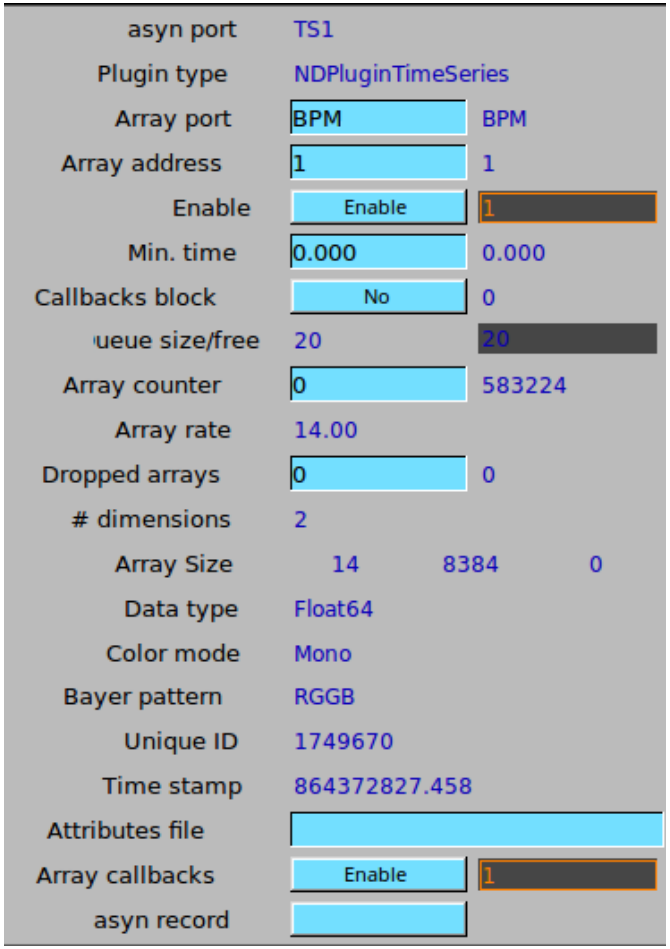
- AreaDetector provides plugins
  - Chain data stream/array
  - Source can vary, so can destination
- Many provided out of the box
  - Statistics, processing, time series, ROI, saving to file,..
- Can develop own plugins
  - Already done for other systems





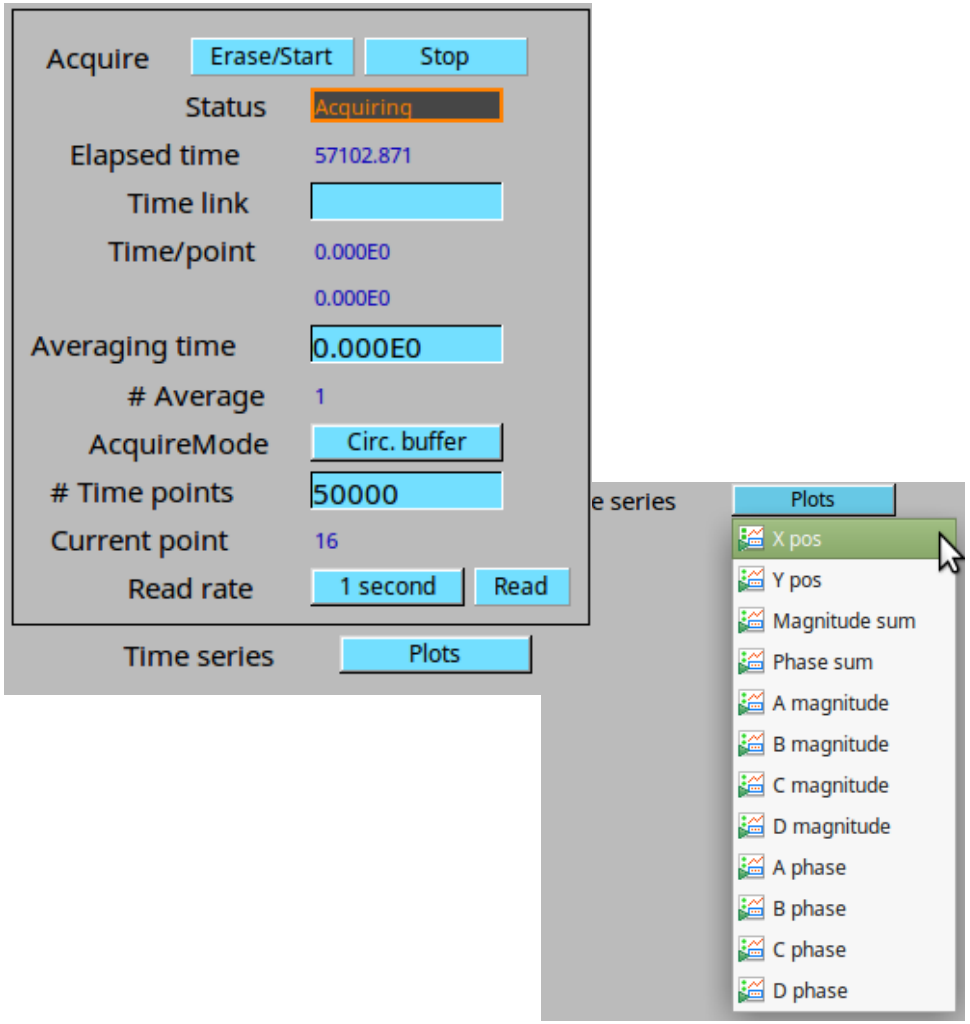
CSS OPI AD plugin setup

- Generic for all AD plugins
- Define data source
- Monitor array arrival to the plugin
- Inspect array properties
- Control publishing resulting array to other plugins



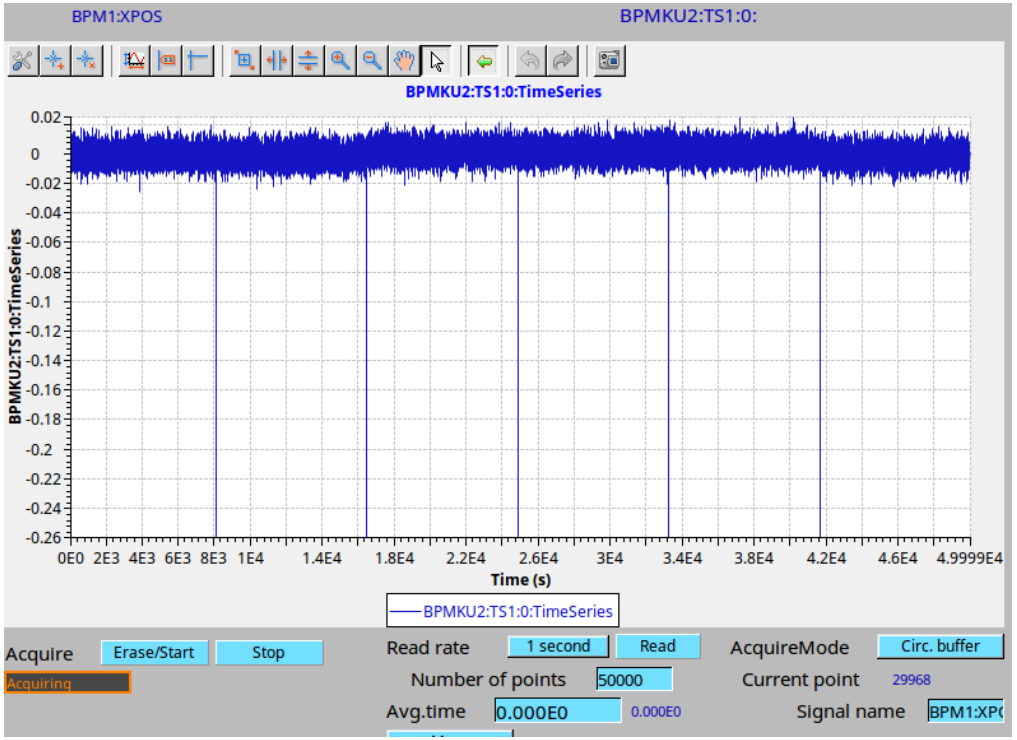
CSS OPI time series plugin control

- Control acquisition
- Averaging
- Mode
  - Circular buffer or one shot
- Number of points in the buffer
- Publishing rate
- Access to individual plots



CSS OPI time series plot

- Plot of BPM1 X position
- Holds ~6 pulses
- Glitches due to firmware



Status at CDR

- Debugged and tested with several different SIS8300 boards and board flavors
- Updated EPICS support with latest firmware features
- Works with final BPM RTM
- Works with final BPM AMC (SIS8300-KU)
- Several over-the-weekend run tests passed
-

Work after CDR

- Handover the EPICS support for SIS8300 and BPM to ICS
- Perform integration with multiple SIS8300 AMCs in the same crate
- Long term and stability tests (IPMI IOC)
- Python scripts for automated tests and reports
- Determine minimum set of PVs and amount of data to be delivered (as per BP requirements)

Work after CDR

- Add recently added FPGA parameters
- Solve some outstanding firmware issues (glitches seen in data)
- Asses performance of the CPU with multiple AMCs / BPMs
- Test, test, test..

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Questions ?