EPICS integration & IOC

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Outline

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

Crew and tasks

- Hardware Hooman Hassanzadegan
- Firmware Klemen Erjavec and Dušan Slavinec (Cosylab)
- Software Hinko Kocevar
- Cabling Hooman Hassanzadegan
- Testing / debugging / data evaluation Hooman Hassanzadegan
- Coordination made through JIRA issues
- Small ICS involvement due to lack of resources

Status at PDR

- Demo EPICS support and IOC developed by Cosylab in 2014
- Demonstrated that chosen hardware is adequate for BCM application
- Limited functionality and reduced set of features
- Based on obsoleted SIS8300 digitizer board

Work after PDR

- Work on final BCM EPICS support started in Q3 2016
- 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

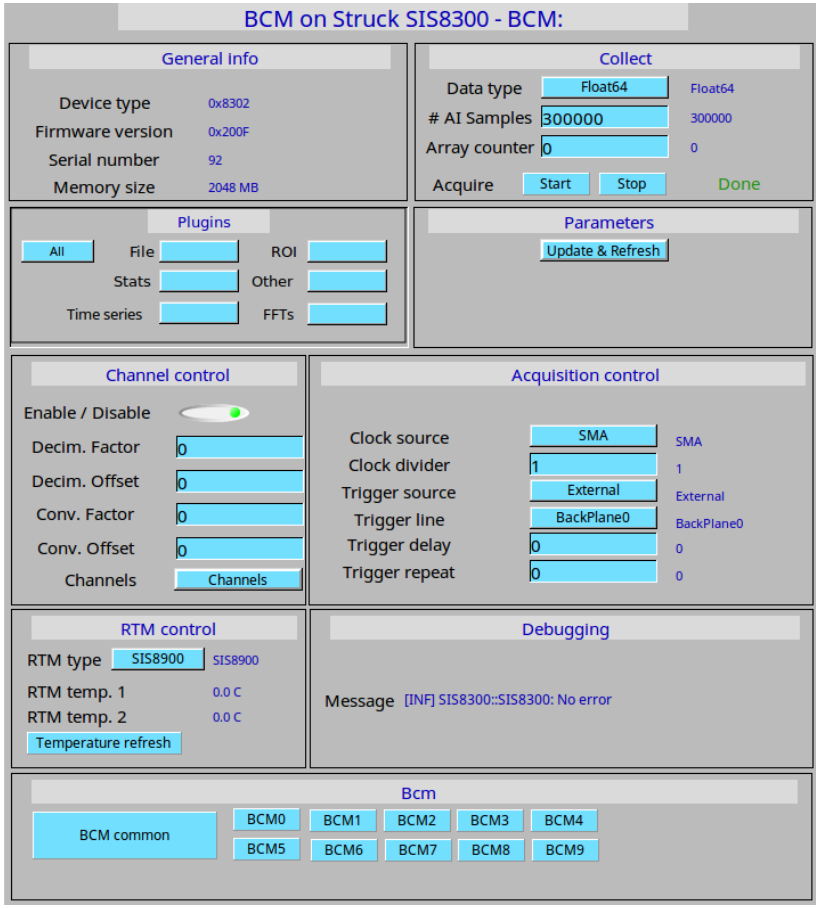
- Once generic SIS8300 support was in place, BCM application development was started
- BCM EPICS support derives C++ class of generic SIS8300
- Along the way generic support was modularized and improved
  - Fairly straight forward since BCM is derived from generic
- All aspects of control and data transfer were completed in 2 months
  - Also with CSS OPI

Work after PDR

- Ten instances of BCM are supported
- User controls:
  - Clock source, trigger source, DSP parameters, alarms, select to monitor desired BCM channels, amount of samples to request, monitoring of BCM core status, setup EVR for trigger generation
- Data streams
  - 10 raw digitized data streams, 10 BCM specific data streams, debugging streams
- AD plugins utilization (ROI, stats, proc, HDF5, ..)

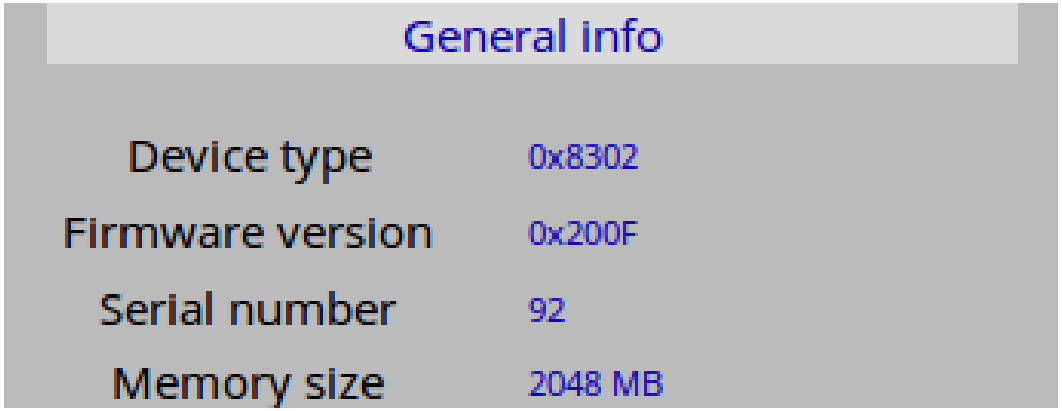
CSS OPI

- Top level CSS OPI
  - General info
  - Acquisition control
  - Access to other OPI
  - RTM selection
  - BCM instance OPI access
  - AFE control and monitoring (not seen here)



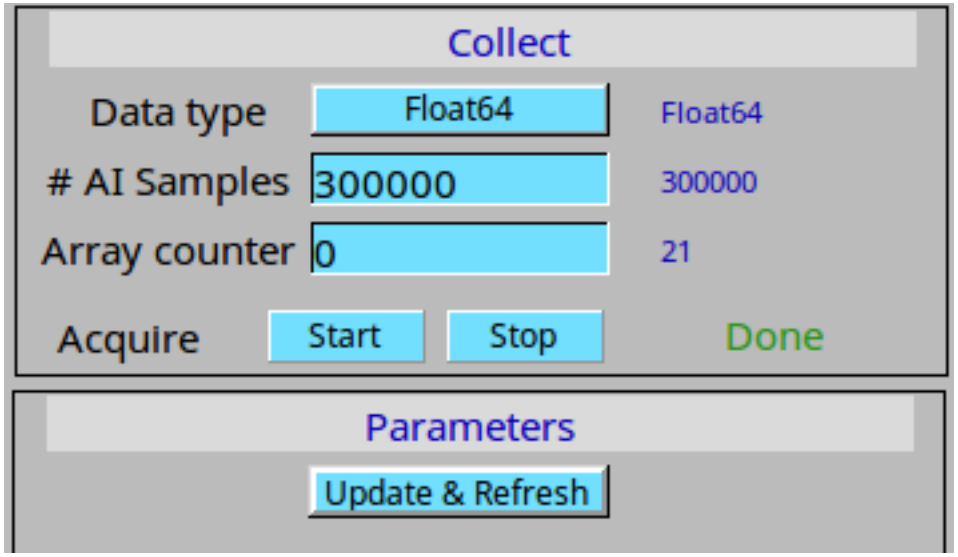
CSS OPI general info

- Some generic SIS8300-x digitizer information



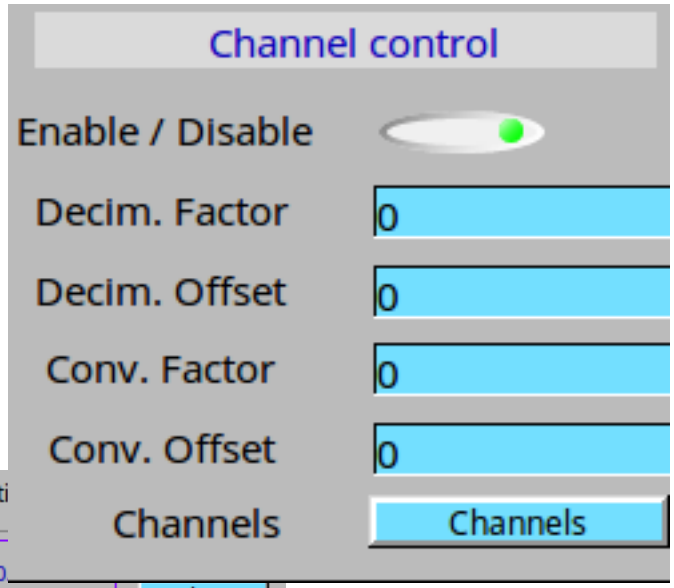
CSS OPI acquisition control

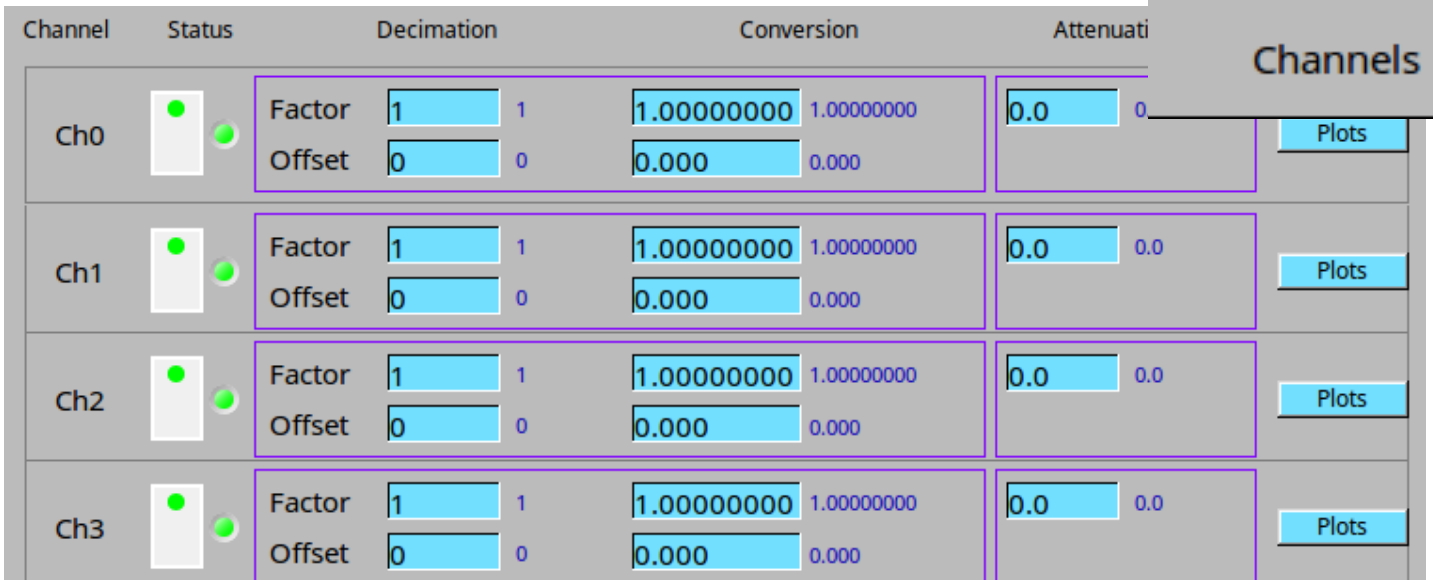
- Selectable data type
- Desired number of raw samples
- Number of arrays (pulses) collected so far
- Force parameter update
  - FPGA parameters are latched and automatically applied between the pulses



CSS OPI analog channels

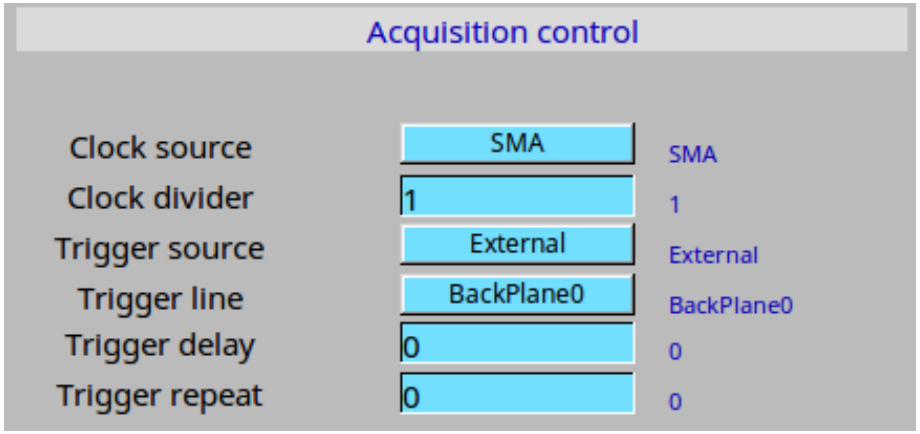
- Channel enable/disable
- Software scaling and offset control
- No attenuation control





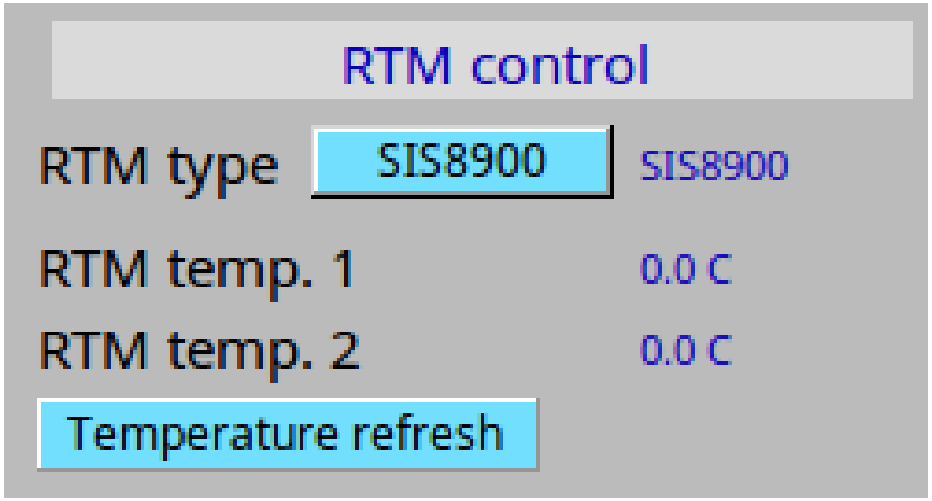
CSS OPI acquisition control

- Selectable clock source
  - backplane, RTM, front panel, internal
- Clock divider
  - integer divisor
- Trigger repeat
  - how many pulses to acquire
- Trigger source & line
  - want to use external (EVR),
  - any available backplane line



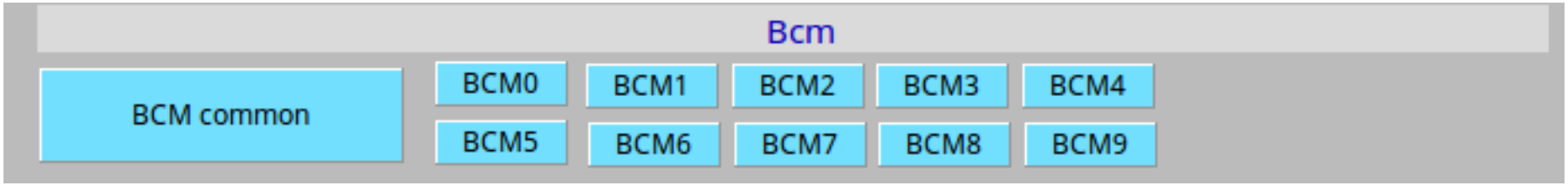
CSS OPI RTM controls

- One type of RTM
  - At least for BCM
- No RTM temperature sensors readout
  - RTM has them but accessible only over IPMIO



CSS OPI BCM control

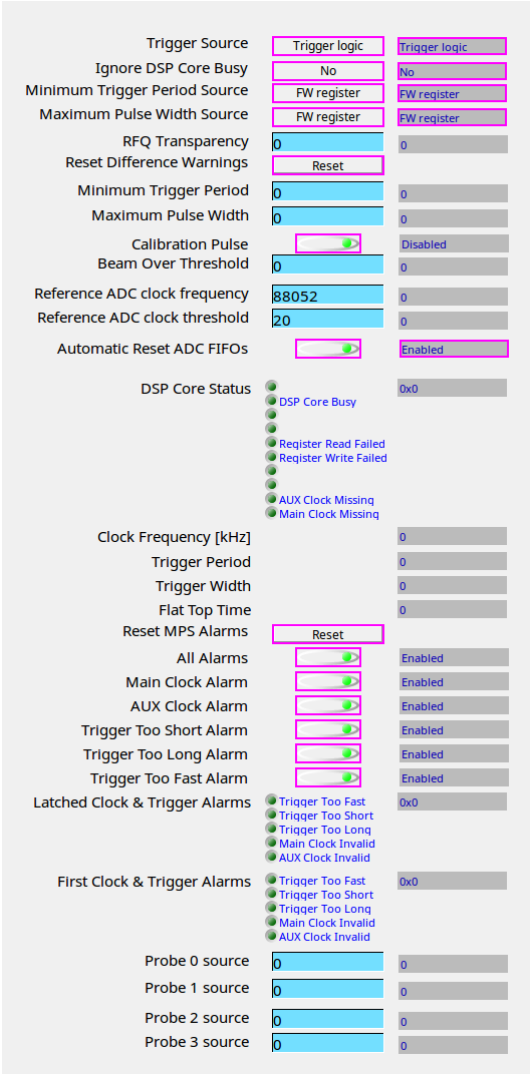
- Ten instances of BCM DSP on single AMC
  - Instances are pretty much independent, but..



- Some controls are common for both instances
  - Trigger source, clock source, decimation, pulse detection conditions, pulse parameters for alarms,..

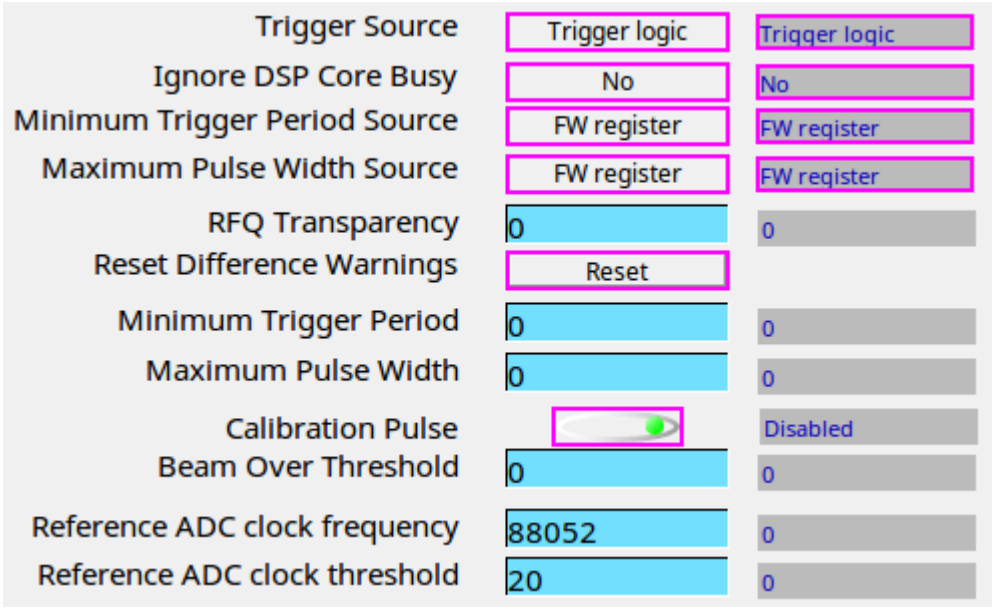
CSS OPI common BCM

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



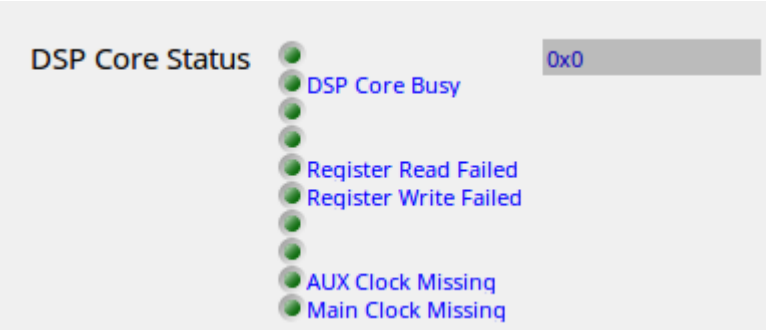
CSS OPI BCM DSP configuration

- BCM DSP core configuration parameters
- Latched after the pulse



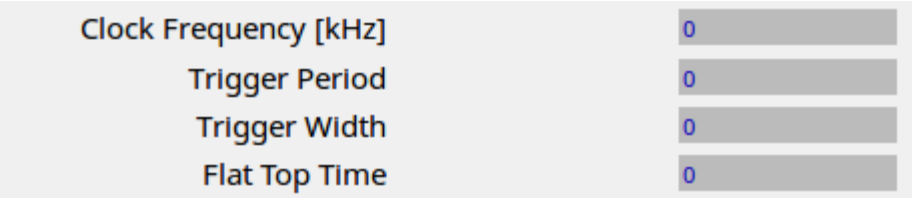
CSS OPI BCM DSP status

- DSP provides core status access status
- Refreshed per pulse



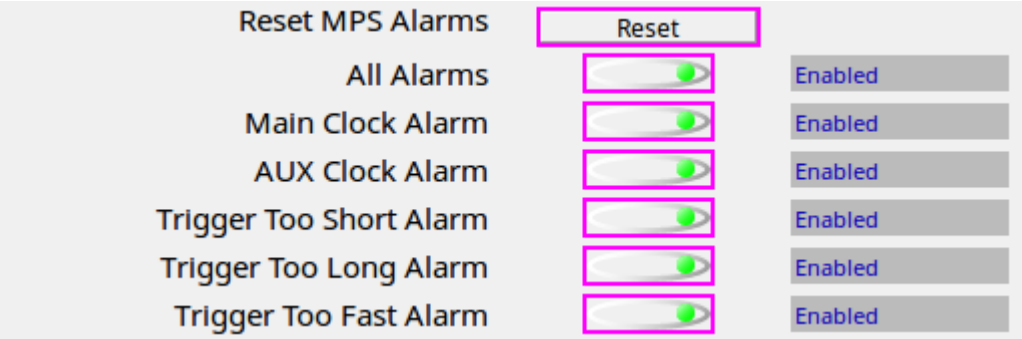
CSS OPI BCM pulse measurements

- BCM DSP measures several pulse parameters including ADC sampling clock frequency
- Can raise alarm if not in bounds as configured



CSS OPI common BCM alarm controls

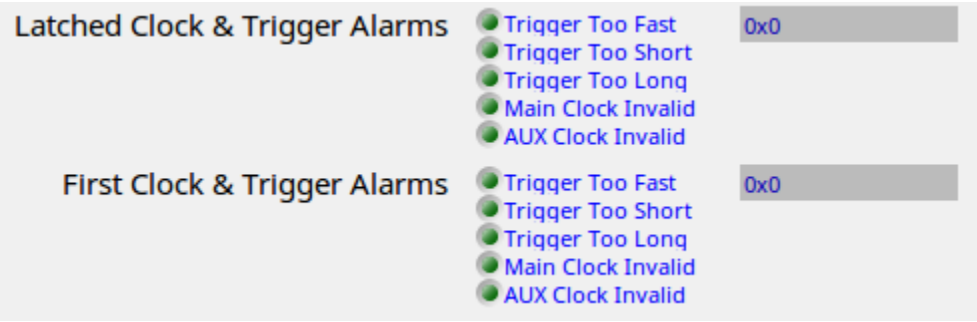
- BCM DSP can be configured to raise alarm on several conditions



- Alarm status is available for monitoring purposes as well as for MPS interfacing

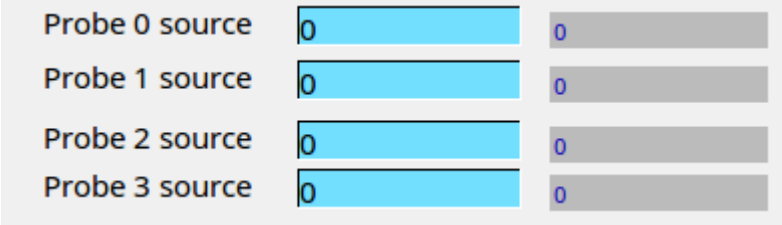
CSS OPI common BCM alarm monitors

- Individual alarm status is delivered per pulse
- Can be cleared on demand by the user



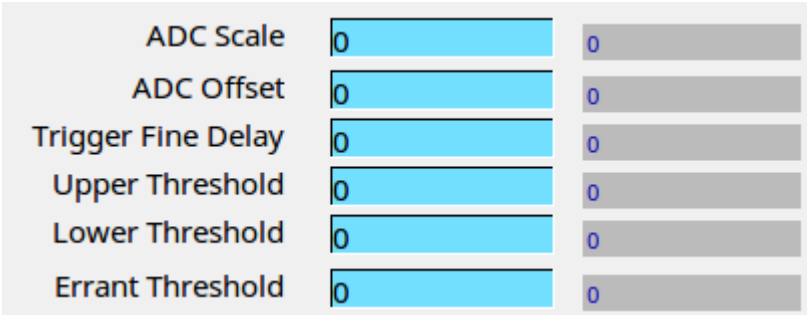
CSS OPI BCM probes

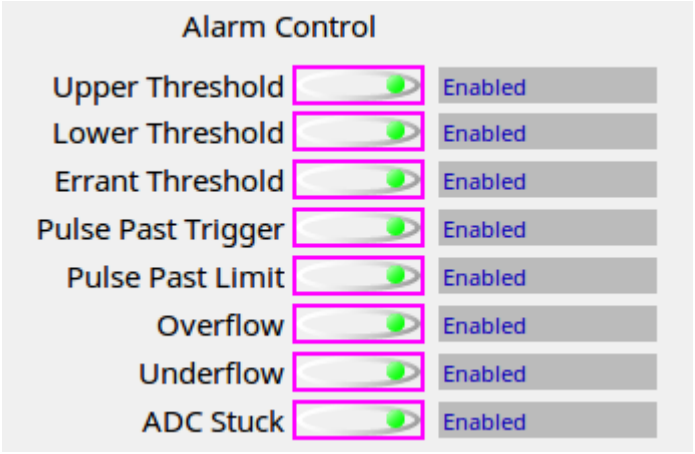
- With probes we can tap into certain point along the DSP processing chain
- Configurable per channel
- Up to 64 tap sources available per channel
- Used for debugging



CSS OPI channel BCM alarm controls

- Individual BCM channel can be configured to raise an alarm on several conditions





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CSS OPI channel BCM alarm monitors

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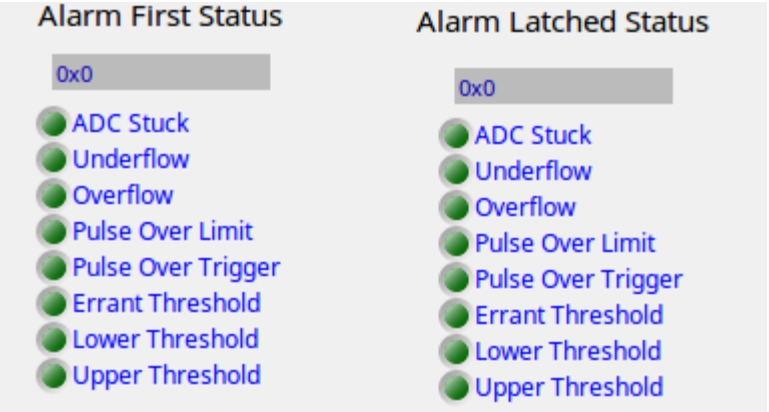
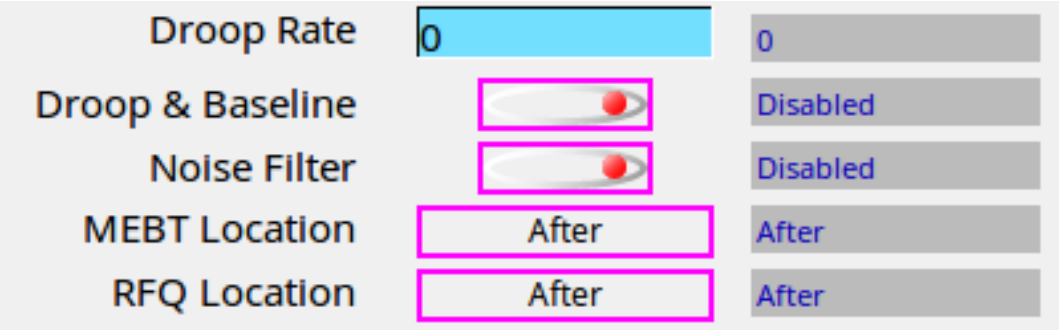


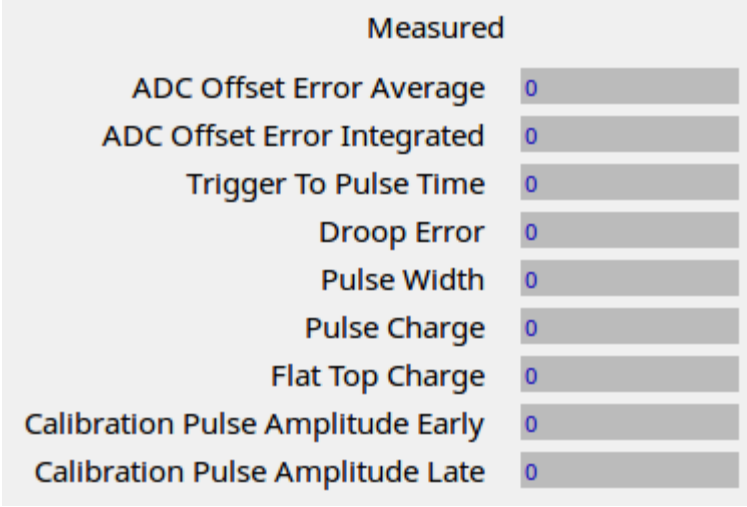
CSS OPI channel BCM configuration

- Droop compensation
- Baseline correction
- Filtering
- Location along the linac



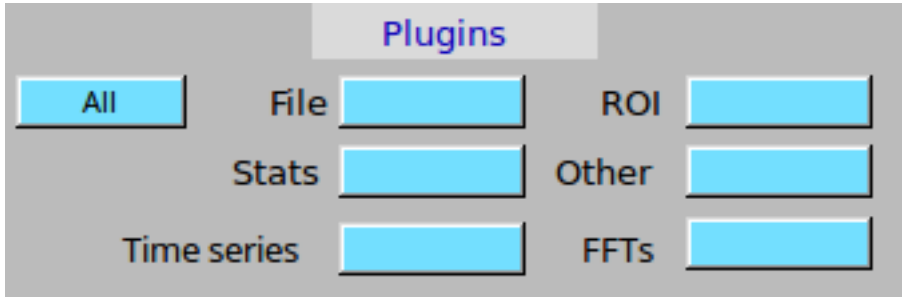
CSS OPI channel BCM monitoring

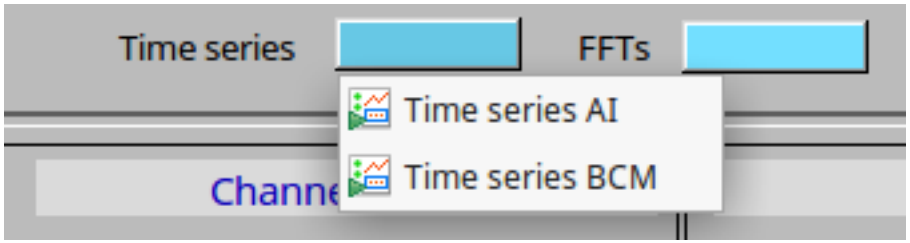
- DSP delivers measurements of several parameters per pulse



CSS OPI AD plugins

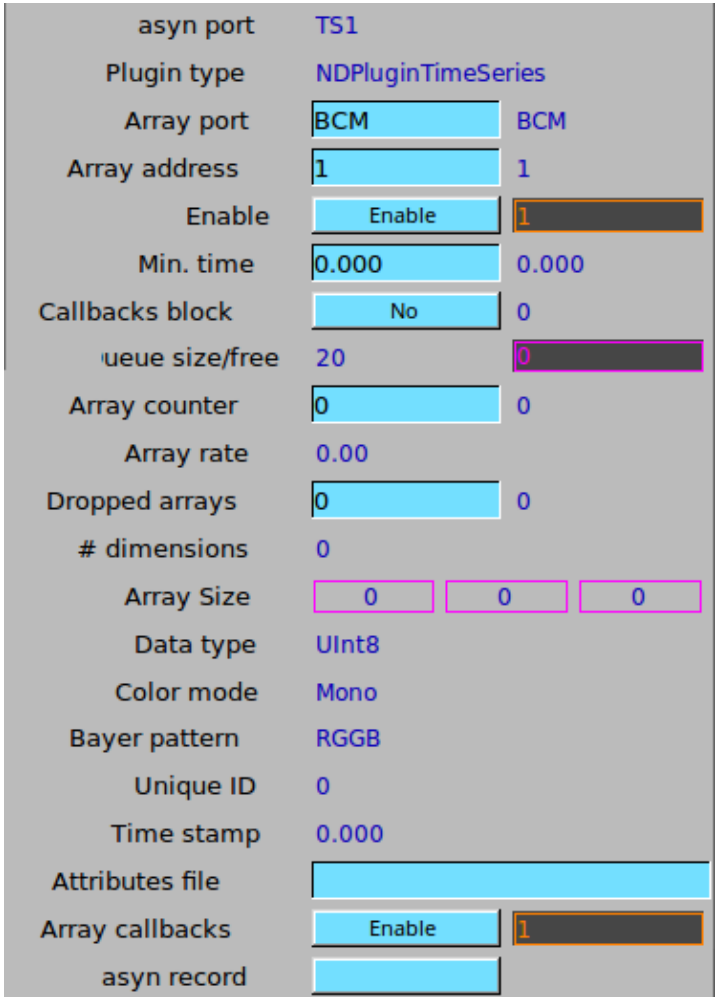
- AreaDetector provides plugins
  - Chain data stream/array
  - Source can vary, so can destination
- Many provided out of the box
  - Statistics, processing, time series, ROI, saving to file,..
- Can develop own plugins
  - Already done for other systems





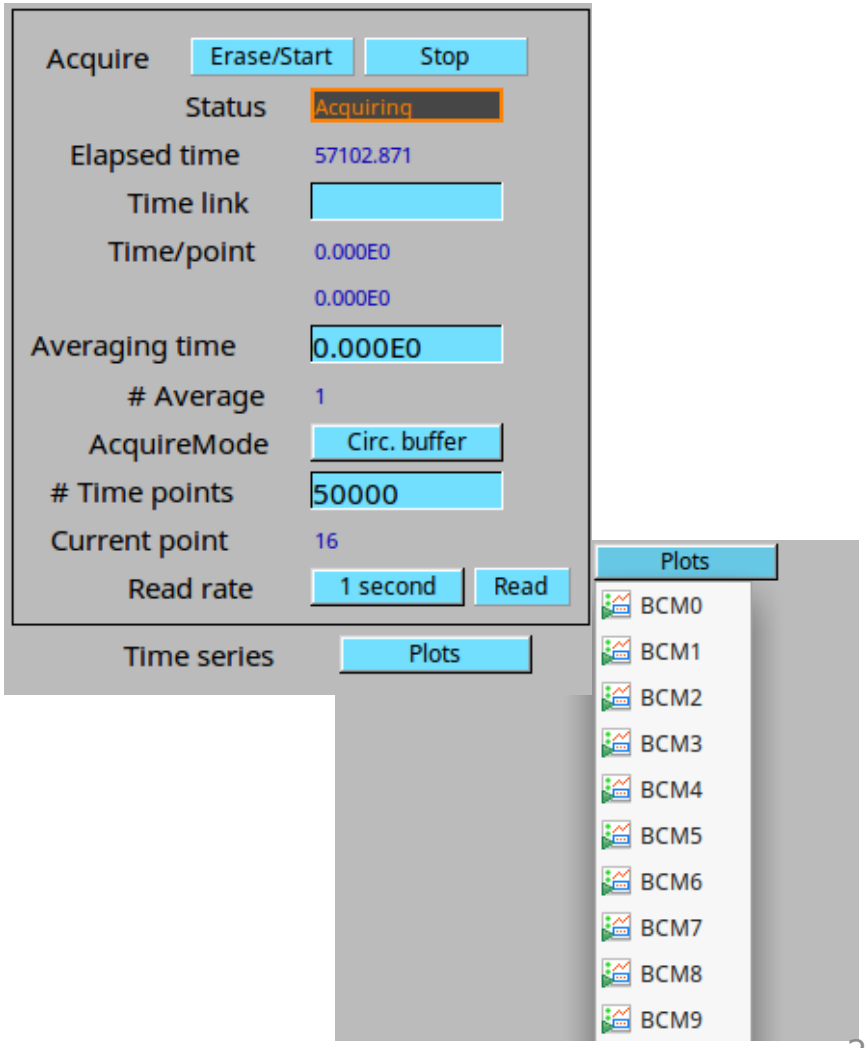
CSS OPI AD plugin setup

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



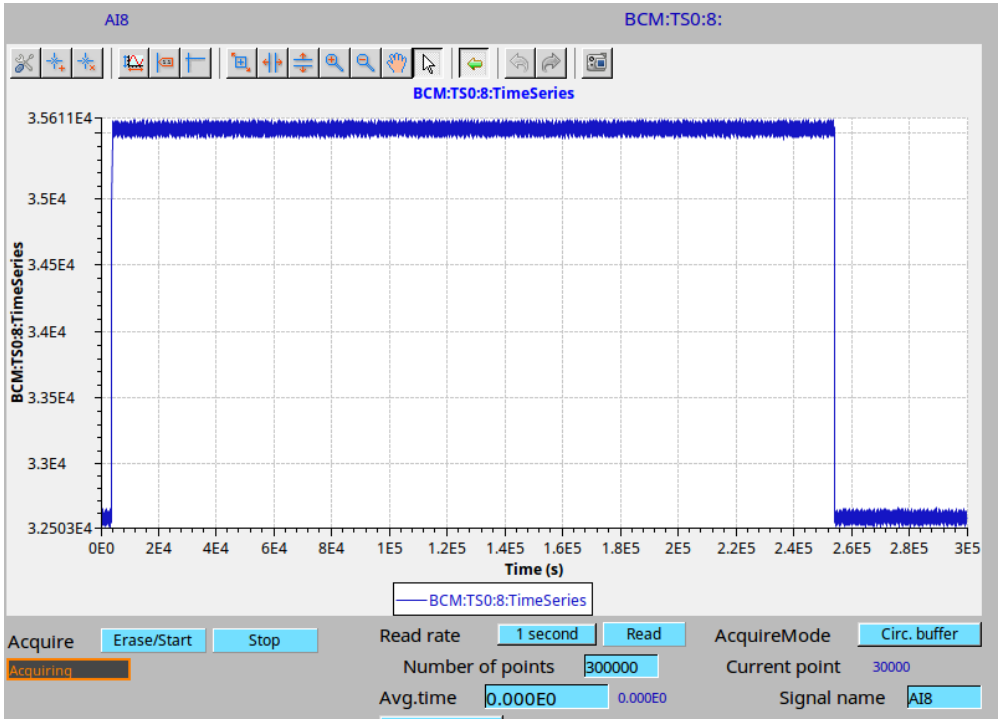
CSS OPI time series plugin control

- 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 BCM8 analog input
- Holds 1 pulse



Status at CDR

- Firmware debugged and tested at Cosylab
- Firmware & software debugged and tested also at ESS with EPICS & IOC
- Updated EPICS support with latest firmware features
- Works with final BCM RTM
- Works with SIS8300-L2 AMC (final?)
- Several over-the-weekend run tests passed
-

Work after CDR

- Handover the EPICS support for SIS8300 and BCM 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 (ADC stuck)
- Asses performance of the CPU with multiple AMCs / BPMs
- Test, test, test..

Questions ?