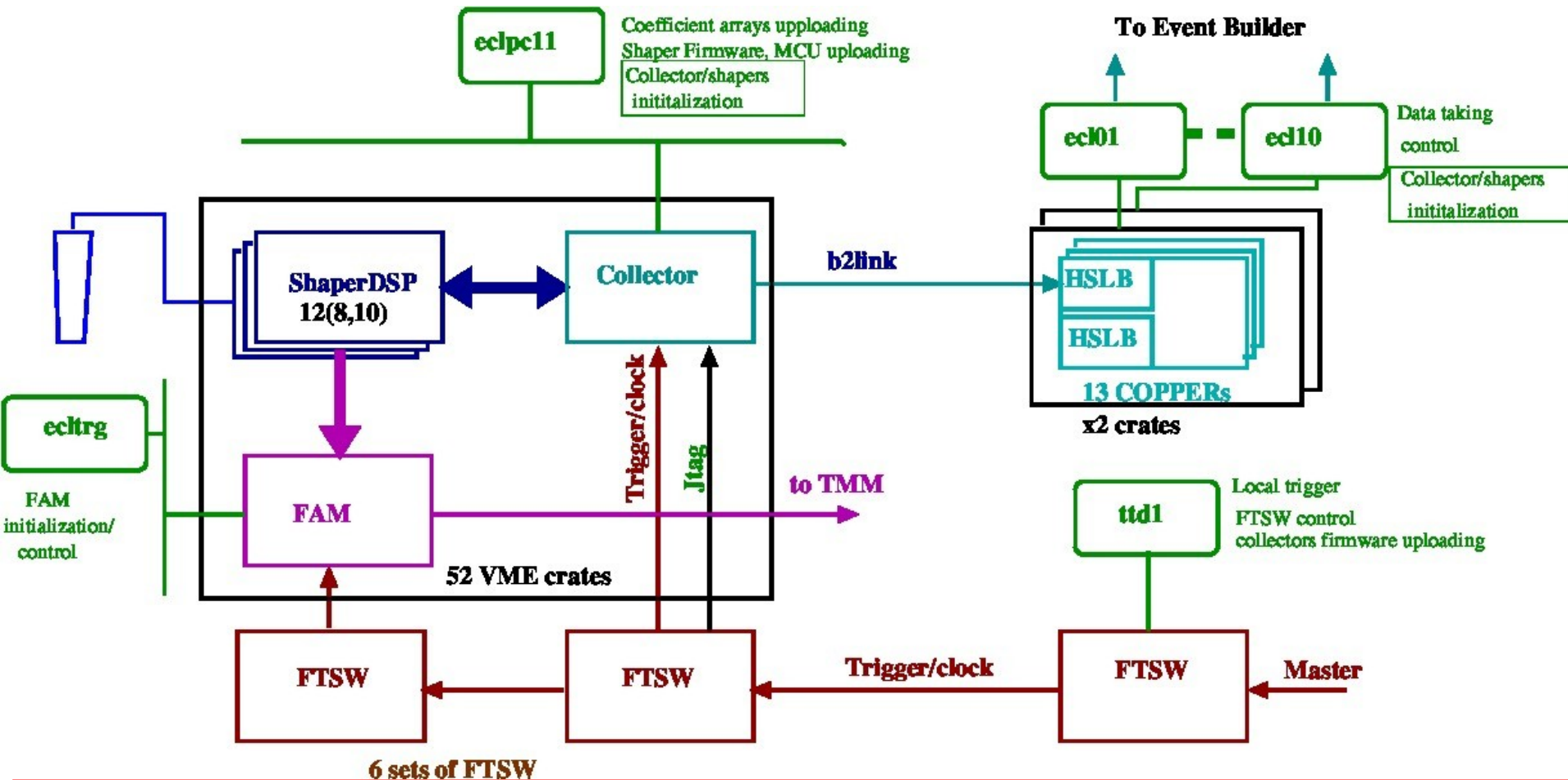# Status of ECL

Trigger-DAQ workshop, 2017.08.24
A.Kuzmin/V.Zhulanov

- **Belle II calorimeter**

- **Status of ECL DAQ and ectronics**

- **Firmware modification**

- **Initialization update**

- **GCR status**

- **Calibrations**

ECL DAQ scheme

- ECL shaper DSP initialization

- Collector & shaper initialization before run

Counters status

For all counters noise, test-pulse response and cosmic signal is measured.   Barrel:

- All 6624 counters operational.

- Electrical noise for most of the channels < 300 keV.

- Coherent noises <30 keV.
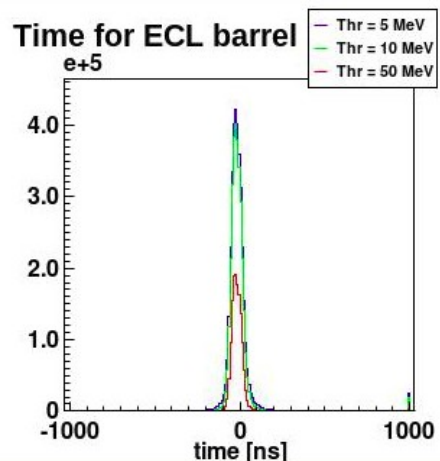
    7 channels have noise 300-600 keV (due to grounding of shield inside the container)

- 6 channels have 1/2 signal due to one preamplifier/PIN dead or unstable work of one channel.

BWD endcap:

- 12 channels have noise 400~800 keV (spice on the DQM figure)

- 1 counter gives ~1/10 signal/ will be tested/fixed in September

- We fixed 3 cables swap in barrel and 3 pairs swap in endcap

ECL DQM
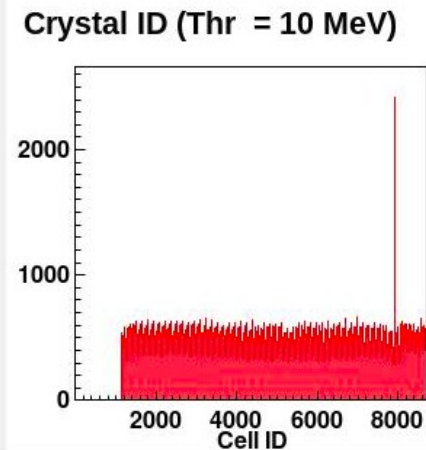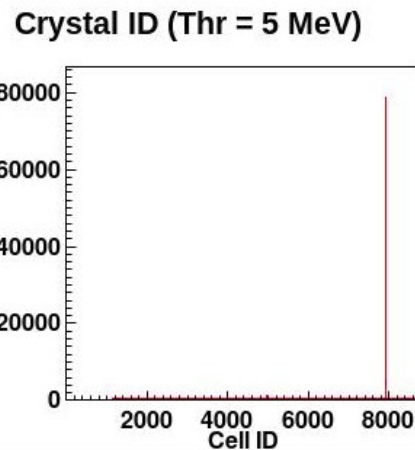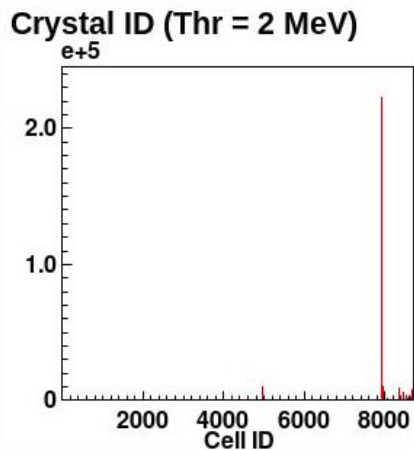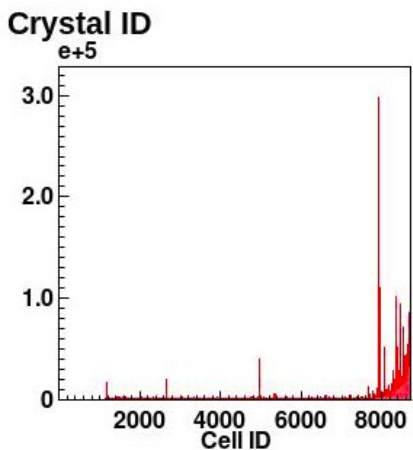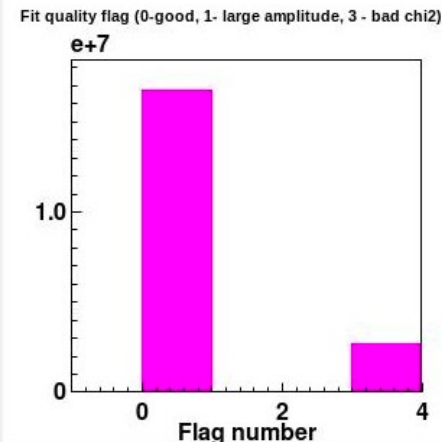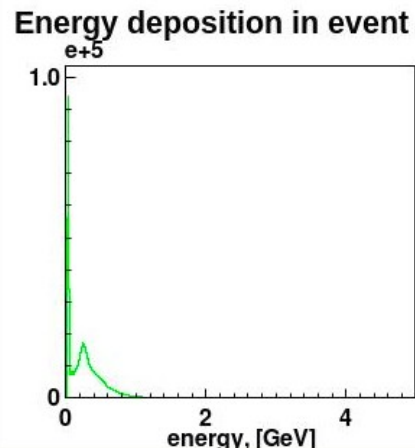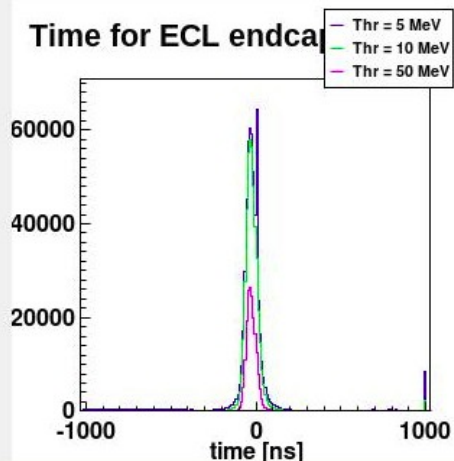
We plan to add trigger time and number of hits per event

Problems in July

Events ``without ECLClusters''?

▸ A large number of events has zero reconstructed ECLClusters.

▸ A large (almost identical) number of events has zero reconstructed ECLShowers, **ruling out timing and energy selections** as reason.

▸ The ``missing'' events are events with a total deposited energy of ~30 MeV in the ECL.
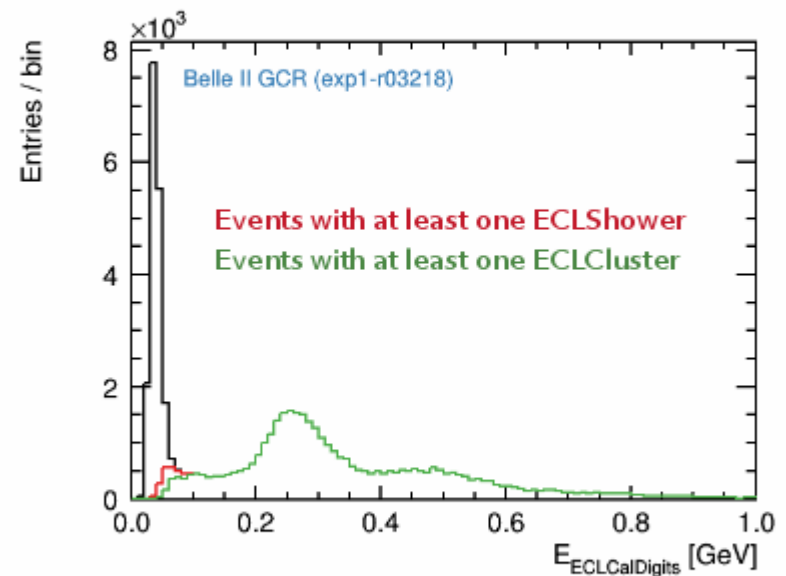
Track-to-ECLCluster matching (actually track-to-ECLCalDigit matching here)
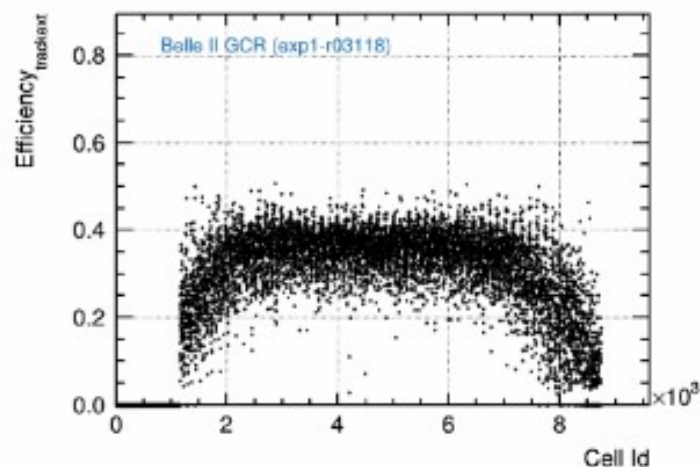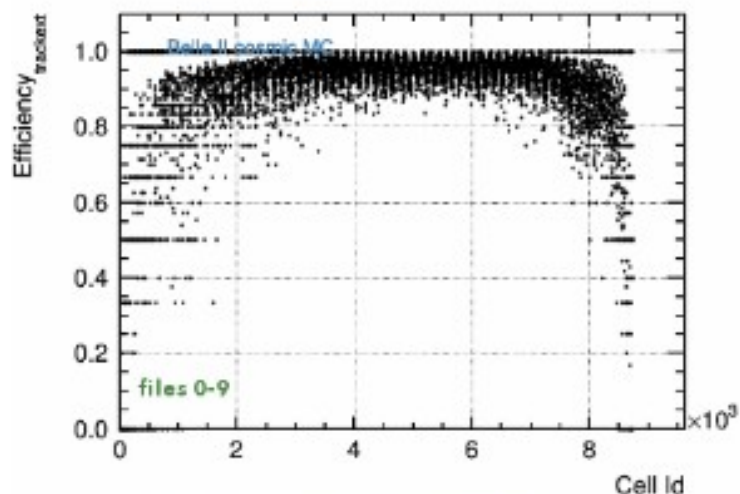
MC (CRY):
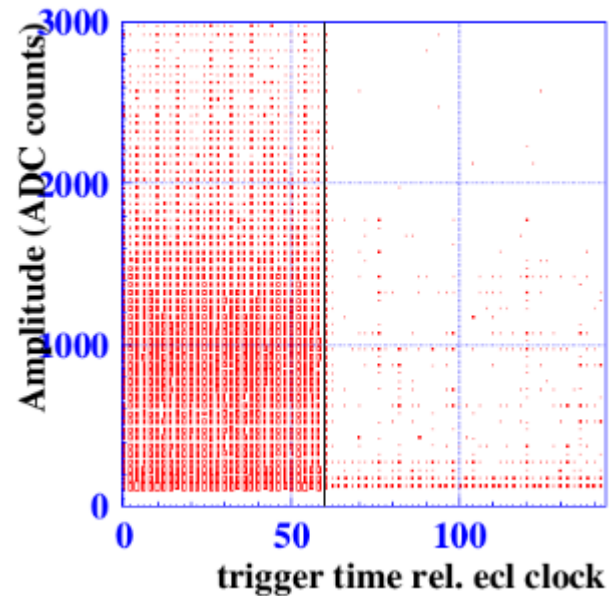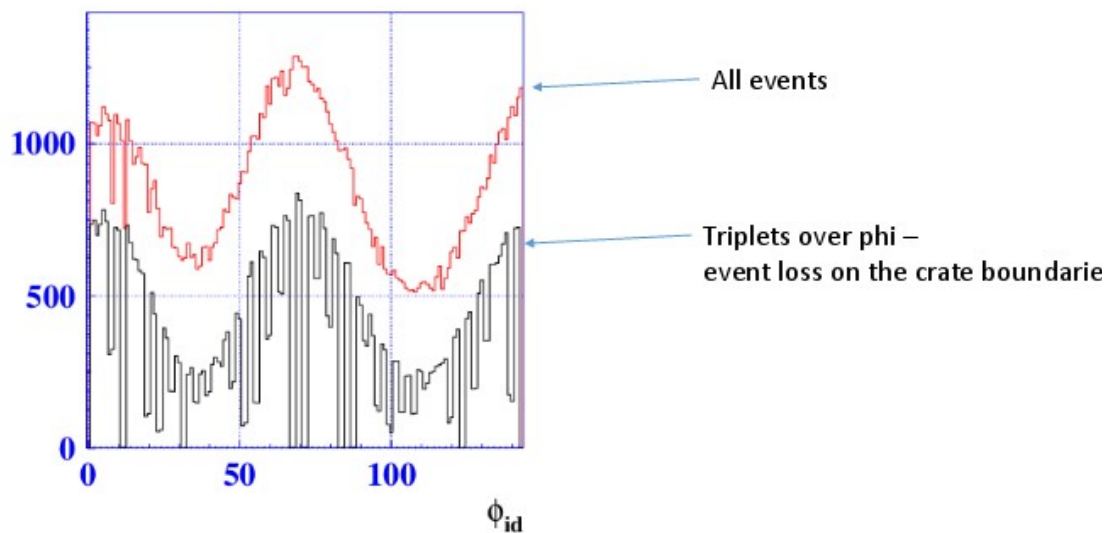release-00-09-00 (through IP only):
/ghi/fs01/belle2/bdata/users/karim/MC/
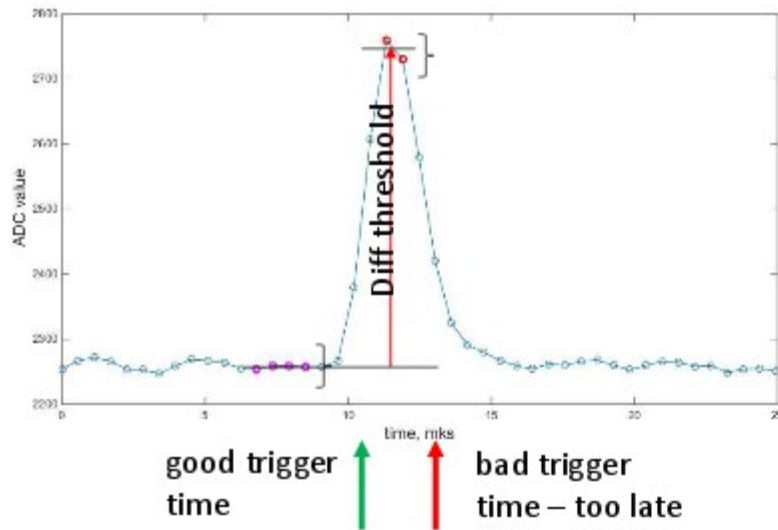GCR1/release-00-09-00/ (25k pro file)

Event distribution over phi

All events

Triplets over phi –
event loss on the crate boundarie

Data processing details

good trigger time

bad trigger time – too late

Hit channels selection algorithm works in real-time: Trigger accepted →wait for signal peak → check the amplitude →mark for processing if high enough

Other processing is performed as soon as processing resources are free.

Trigger comes too late → no way to select hit channels → The simple solution is to insert a FIFO on input ADC data

Problem with corrupted ADC data

- Because of a problem some ShaperDSP firmware compilations are bad: ADC data become corrupted after communication event with ShaperDSP module. The problems happen for positions ##9-12 of Collector
  <->ShaperDSP interfaces. They work perfectly for a long time if no communication (other than the event data processing and collection) with them is performed

- But the ShaperDSP firmware compilation with a very few modification works perfectly and is immune to faults due to communication event. We call these compilations **stable**.

- Now we have a stable version of the ShaperDSP firmware with ADC data FIFO to accommodate the later (global) trigger.

Interface to ShaperDSP modules

Some problem:
activity on Ethernet and CPU (ping Collector, for example)
leads to wrong ADC data from Shaper – ADC data deserializer reset restores the situation
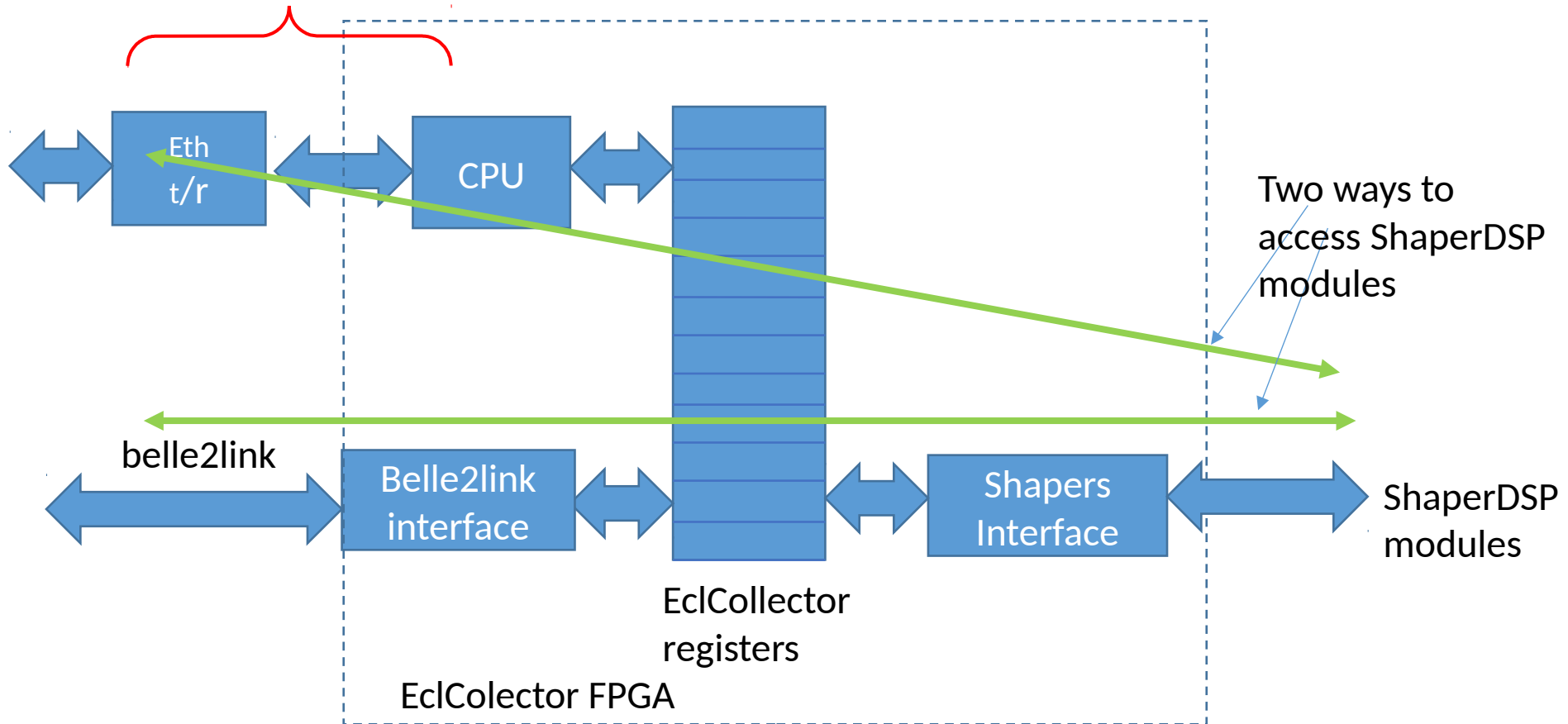
Firmware status

- Almost all ShaperDSP interface functions are duplicated and can be accomplished through belle2link
Load ShaperDSP firmware ~1 sec
Load ShaperDSP DSP coefs ~5 sec to all 12 ShaperDSP modules
Load parameters ~5 sec

- Eth-only function write flash-memory (update ShaperDSP firmware and coefs) should be performed **when no data are being collected**.

- belle2link v0.19 and b2tt v0.52 were incorporated to the ECLCollector firmware

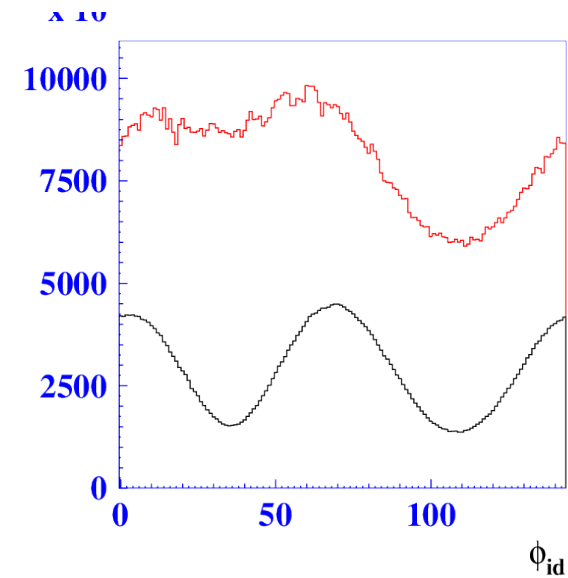- Collection of all ADC data for RANDOM trigger was implemented. To be tested.
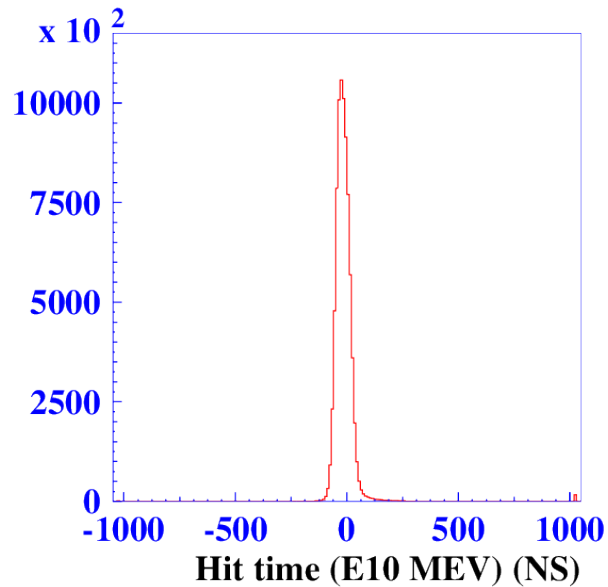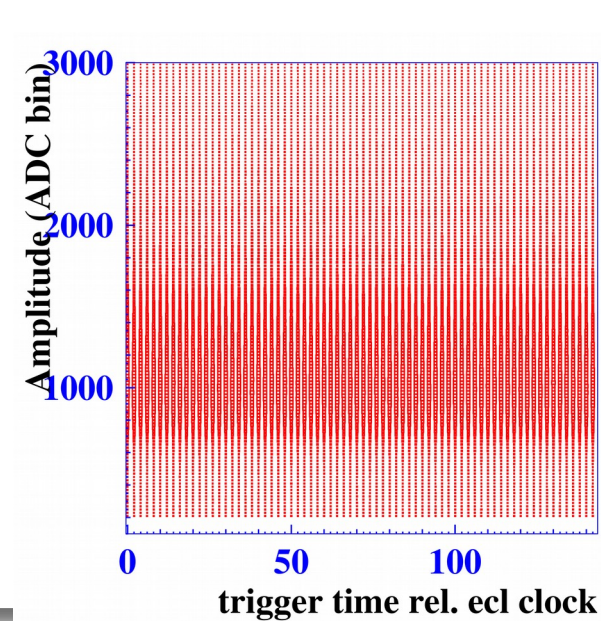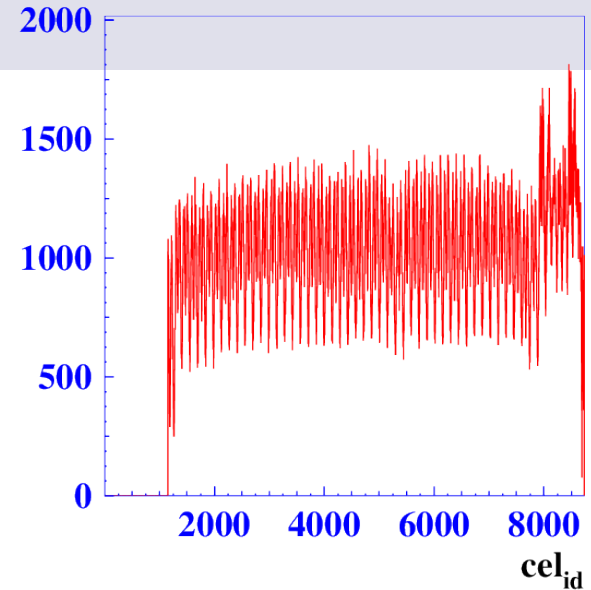
Run 3837

On August 18 we recorded calibration run with ecl trigger.

It shows good ecl data.
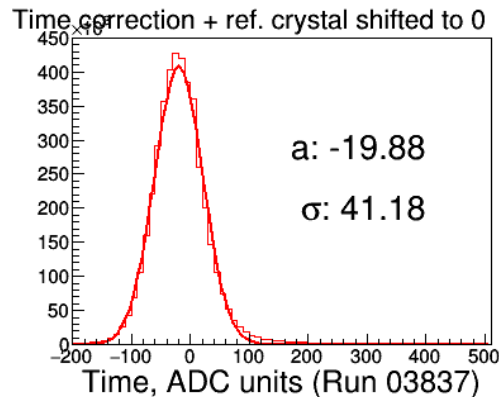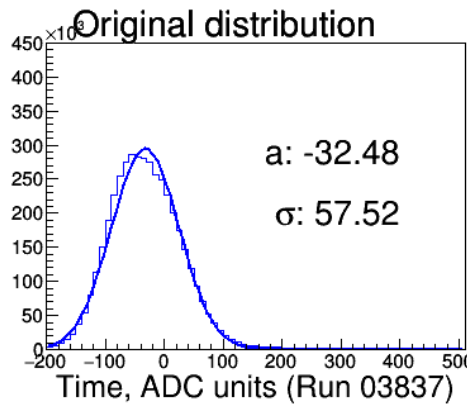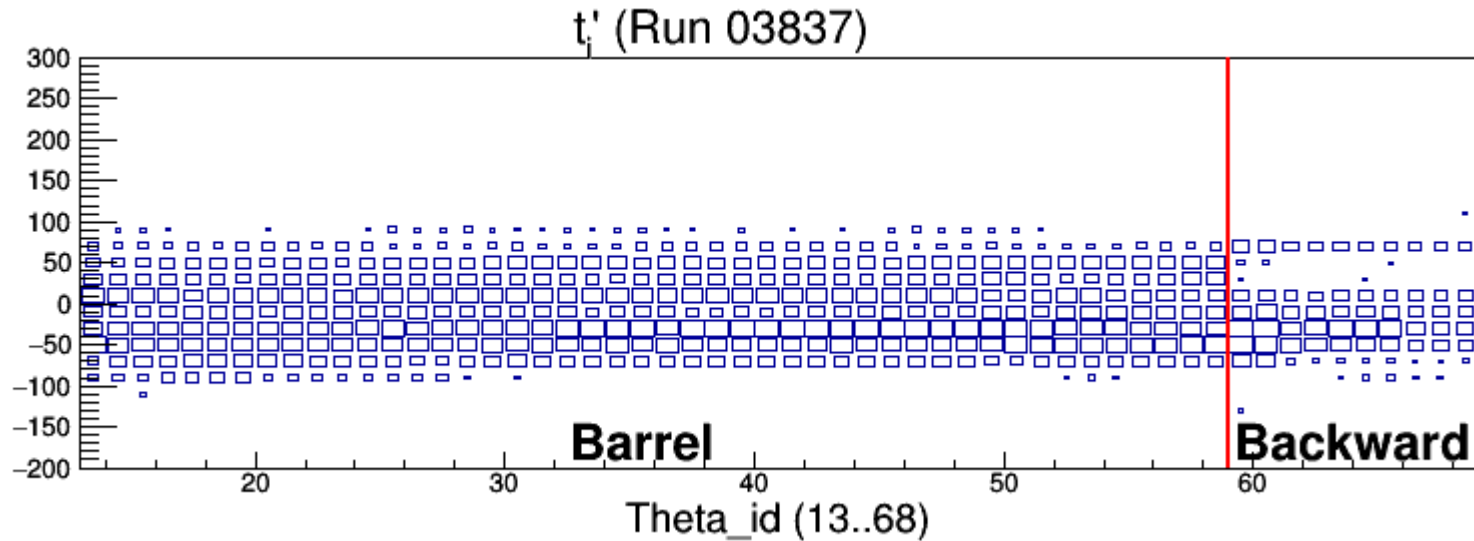
No gaps in trigger time

No gaps in celid

Using this run Mikhail Remnev has caried out calibration of time shifts of each crystall
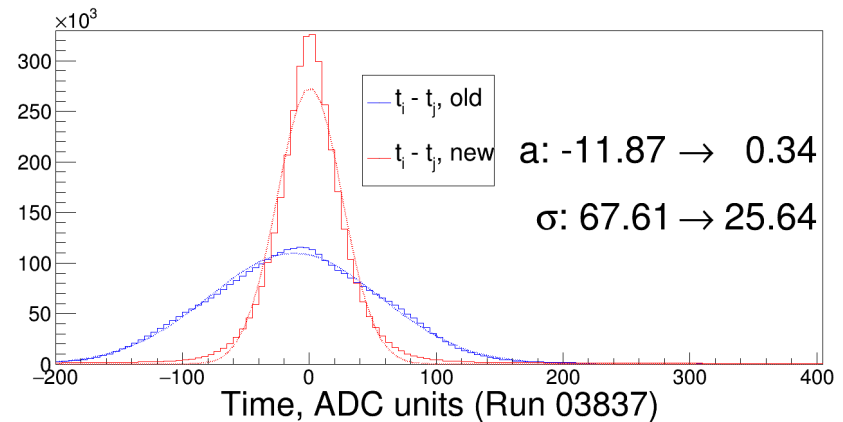
New Run tests

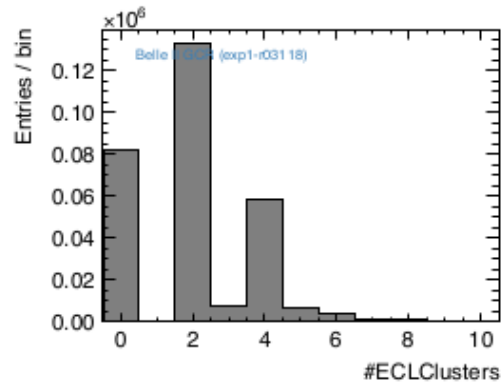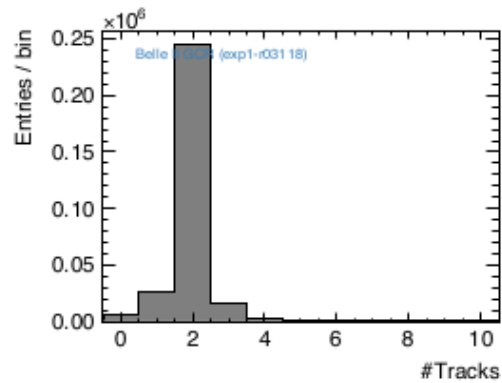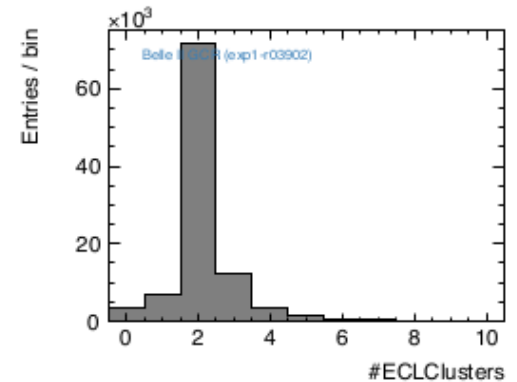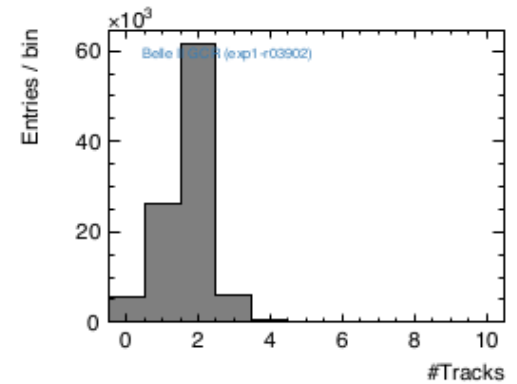## Number of tracks and clusters (N1 hypothesis)

New Run tests

Sum of ECLCalDigit energies for different #tracks per event
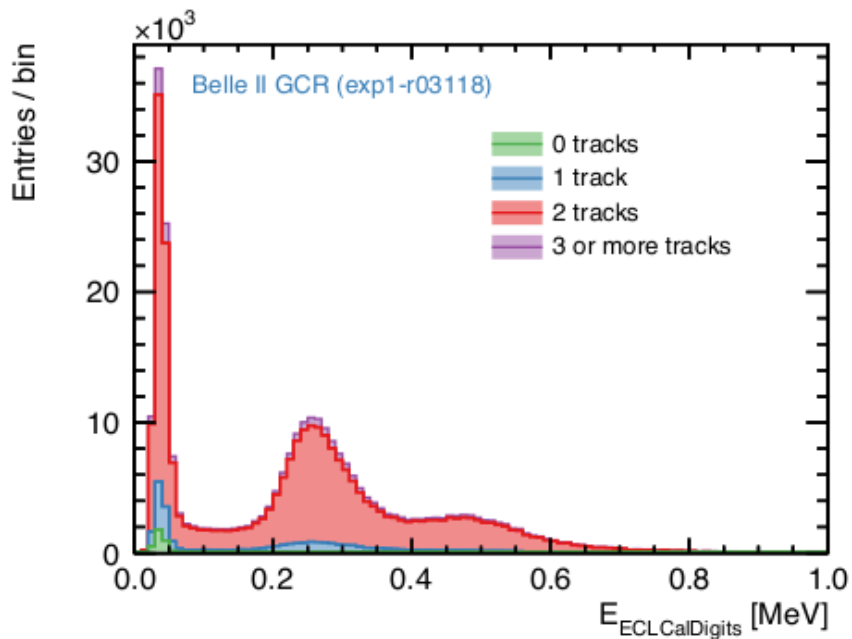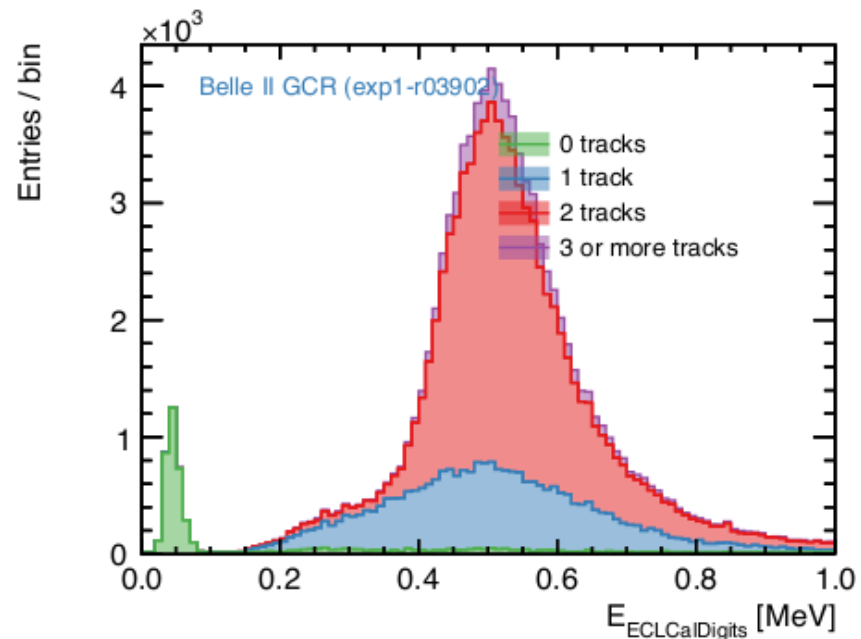
New Run tests

Track matching

r03118

r03902
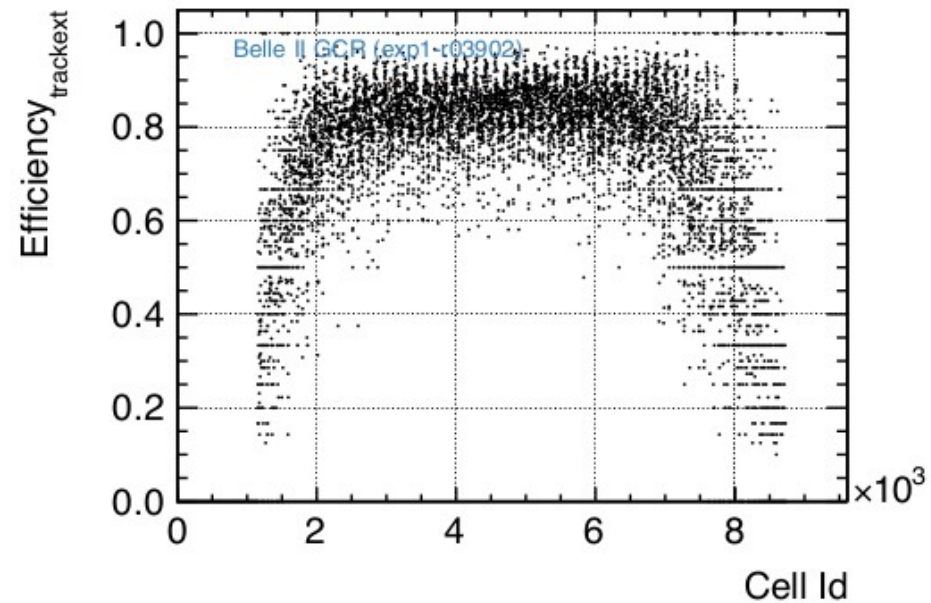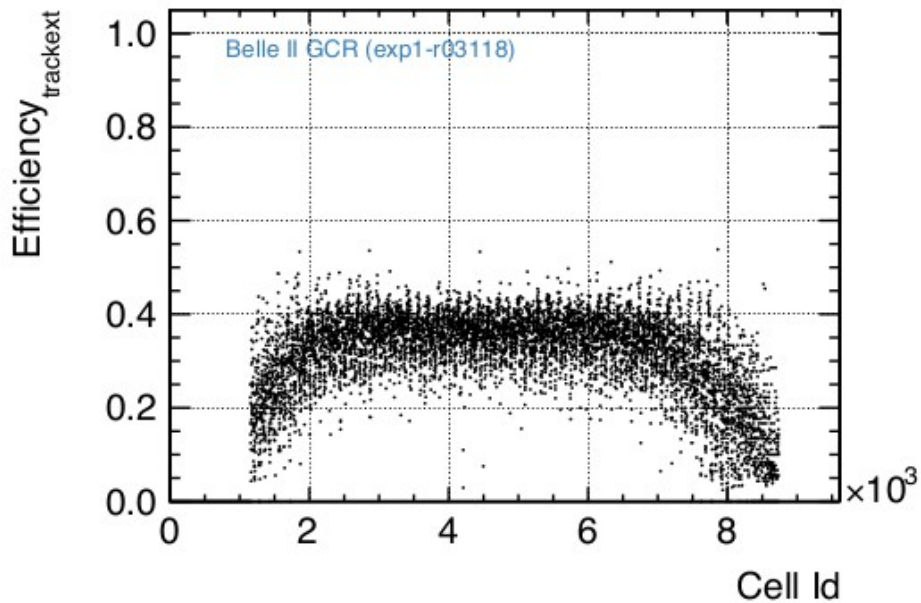
New initialization

New firmware allows to initialize shaperDSP via b2link.

   We prepare initializations on ecl01 (in local mode):

- **Firmware uploading (~1sec)**
- **Coefficients uploading (~10 sec)**
- **Parameters setting(~5sec)**

   The parameter seting includes array of the attenuation coefficients for the trigger signals.

   We'll need help Konno_san after WS for modification the initialization procedure for global run.

Local calibrations

Local run calibration – have been transferred to GUI mode (Thanks to Konno_san)(~1 minute)

Shape calibration – setting will be prapared and will be transferred to

GUI mode. We would like to take run of the Shape calibration after GCR.

Nonlinearity calibration – in the preparation

Endcap installation

FWD endcap is ready for installation.
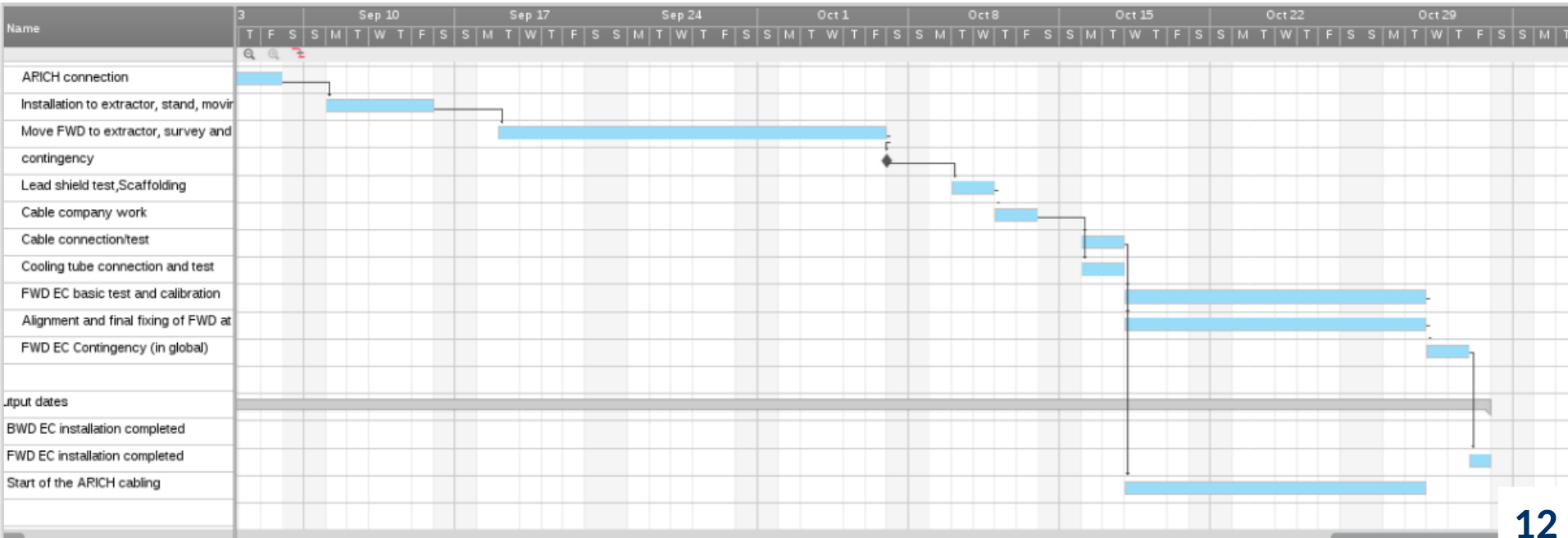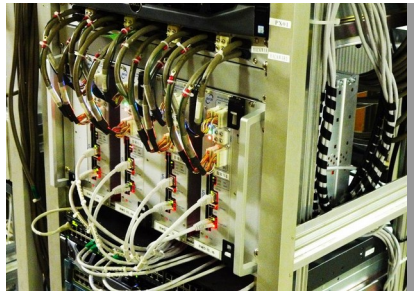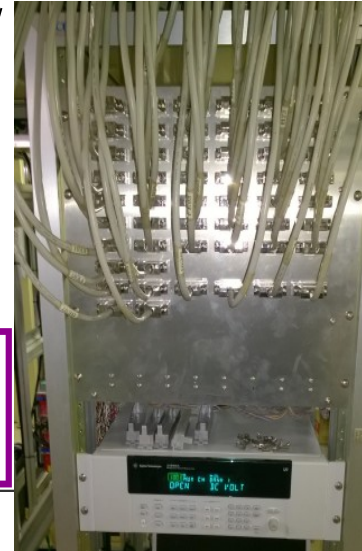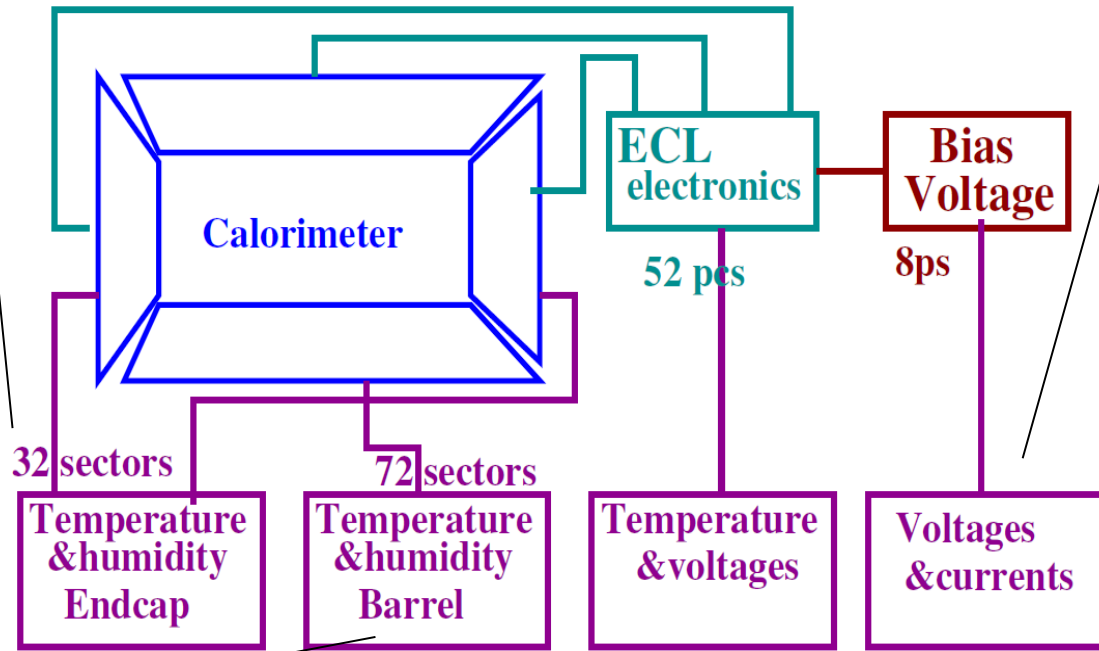
In October after testing it in local mode we need to perform the shape calibration of forward endcap

Environment monitor

Connector box Data Logger

Calorimeter

ECL electronics

52 pcs

Bias Voltage

8ps

32 sectors

72 sectors

Temperature &humidity Endcap	Temperature &humidity Barrel	Temperature &voltages	Voltages &currents

 -**Temperature&humidity monitor for barrel:**All cables, hardware and PC setup are ready. The software will be prepared in comming months. Temporary FWD endcap system readout part of the sensors of the barrel.
 -**Temperature&humidity monitor for endcaps:** is ready and running for backward endcap
 -**Temperature&voltages monitor for VME electronics** is working.
 -**Isolation amplifiers for current measurement:** All 6 modules were produced and tested at KEK.In July-August the installation of the modules is supposed to be done . The software will be prepared in comming months.

Prospect for phase 2

High rate test was carried out in local mode up to 40 kHz and is being performed by Yamada_san.

New versions of b2tt& b2link have been implemented.

Summary

-ECL works stably

-Stable version of ShaperDSP firmware has been prepared and is using for GCR

-Updated version of b2tt&b2link has been implemented to collector firmware.

-Possibility of the initialization via b2link has been prepared

-Problem of ecl efficiency lost has been solved

-Software and calibration programs are being developed

Backup

Signal shape calibration

-Special setting: recording waveform for every hit with E>Eth(15 MeV)
-Calibration of each barrel and BWD endcap counter was performed
-Using reconstruction Trec and Arec the shape can be obtained and parameterized
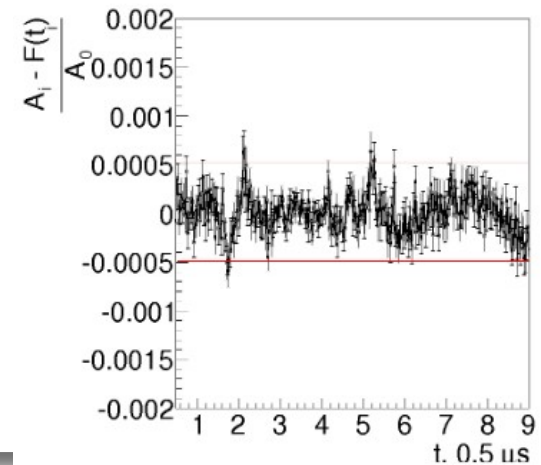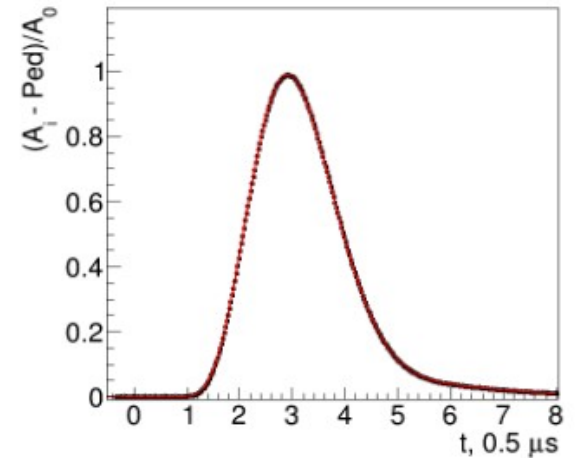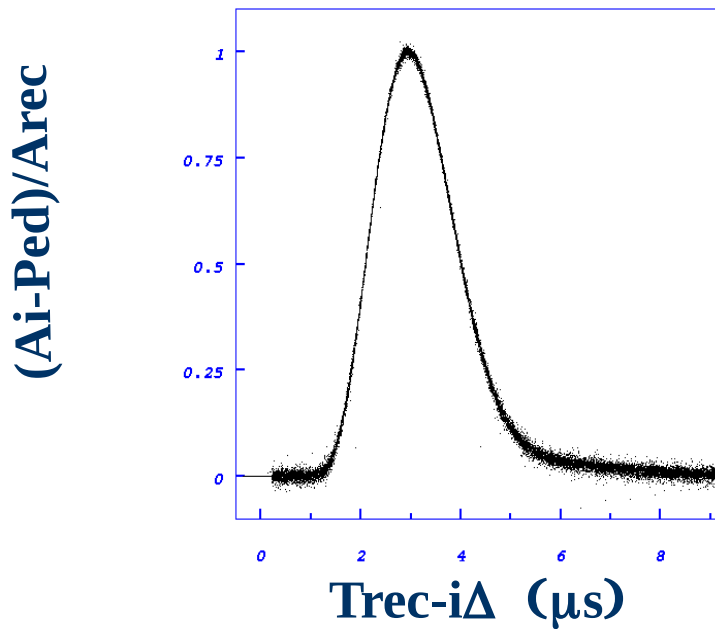
Data taking ~ 1 day accuracy 10⁻⁴

Now in local mode → global record mode

During beam data taking small fraction of wf data will be used

Test pulse calibration

-It works in local mode now
-Will be converted to global mode readout
-It takes about 2 sec on run time + time for initialization
-Accuracy <10^{-4}