ECL status

Claudia Cecchi for the ECL italian people

Detector status

- The detector works in general without serious issues
- Small problems are solved when they appear during the run, as well as improvement of the system

- **Example: dead channels, usually 0**
- Small number of physics runs with 16 dead channels (one ShaperDSP board not available)
- If new dead channel appear priority is to fix as quickly as possible
- If it is not possible to fix → evaluate if the physics run can continue or switch to background studies waiting for DAQ expert
- Procedure:
  - Possible to fix → stop the run and do it
  - # dead channels <=32 and not quickly fix → continue the run
  - # dead channels > 32 and not quickly fix → stop the run because data are not usable

Improve the monitoring during data taking

- Example: monitor of ECL DQM histograms on RocketChat

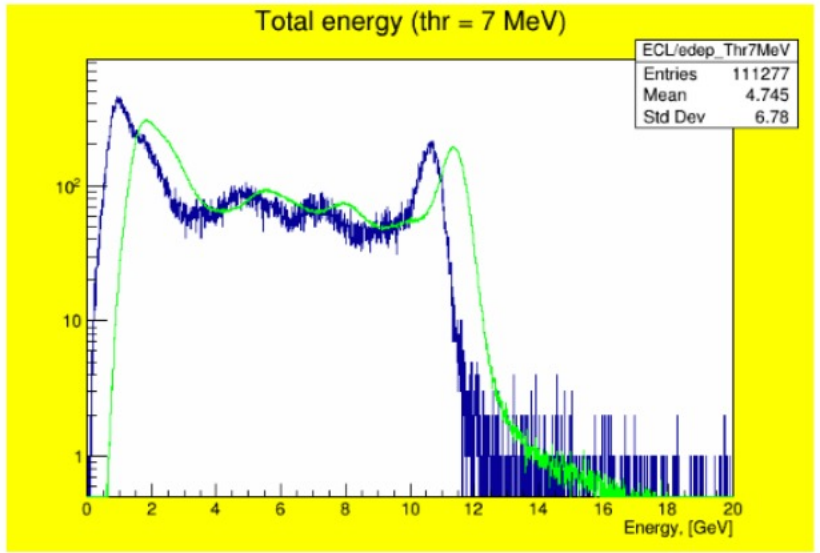
* Alerts are automatically posted in #ecl_bot channel.

ecldqm_bot @ecl_bot Moderator

mention-here per room | Delete own message | 3:15 PM

A significant difference (> 0.5 GeV) between peak positions on live and reference histograms was detected by dqm bot. Please pay attention.

edep_Thr7MeV_w.png

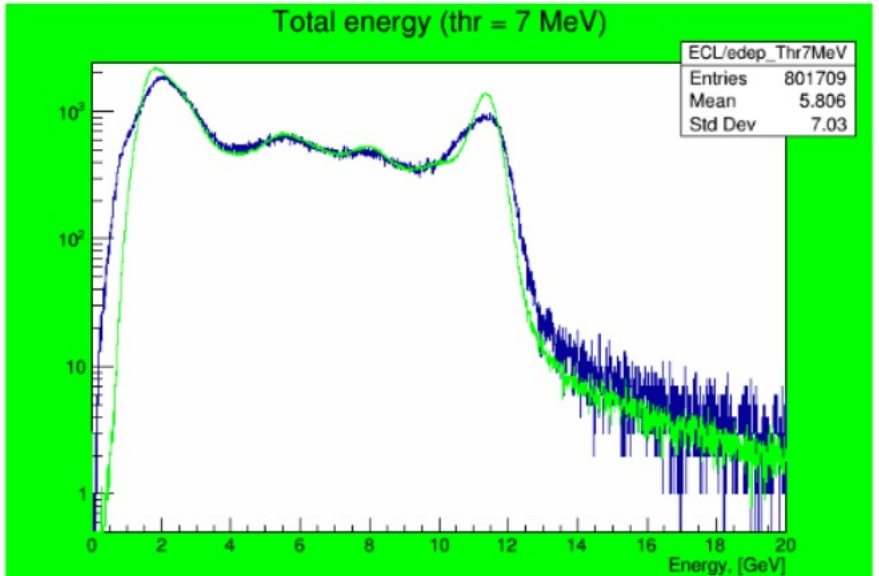


ecldqm_bot @ecl_bot Moderator

mention-here per room | Delete own message | 3:30 PM

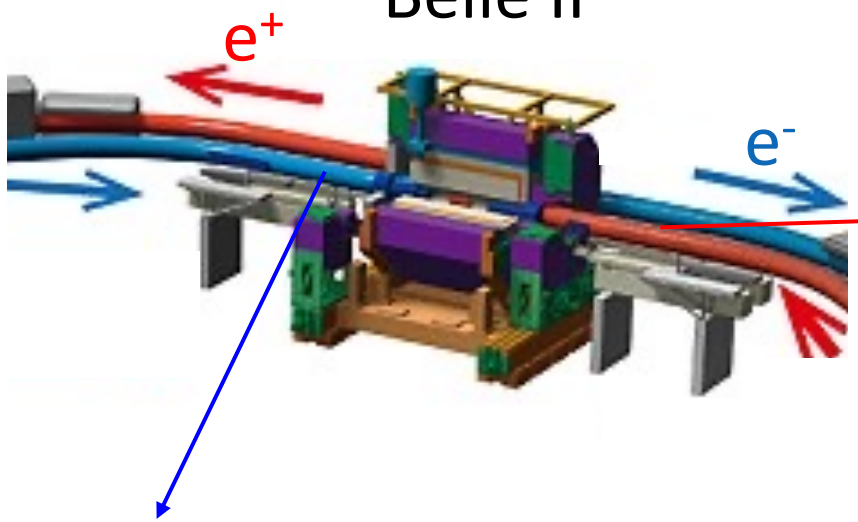
Problem with histogram ECL/edep_Thr7MeV in the run 1864 was solved.

edep_Thr7MeV_w.png

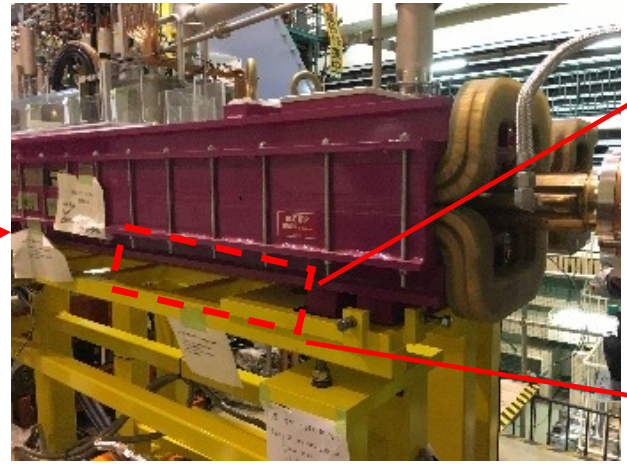


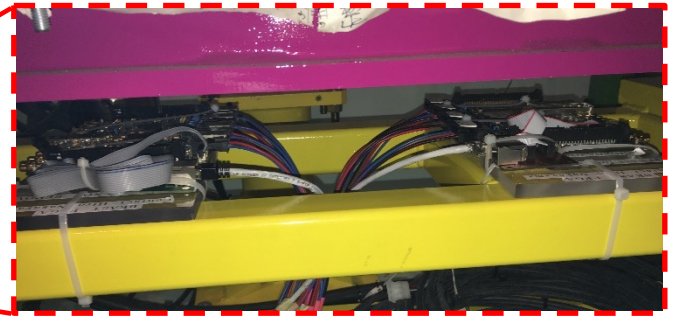
Monitoring SEUs in FPGAs

Belle II



10m forward from collision point



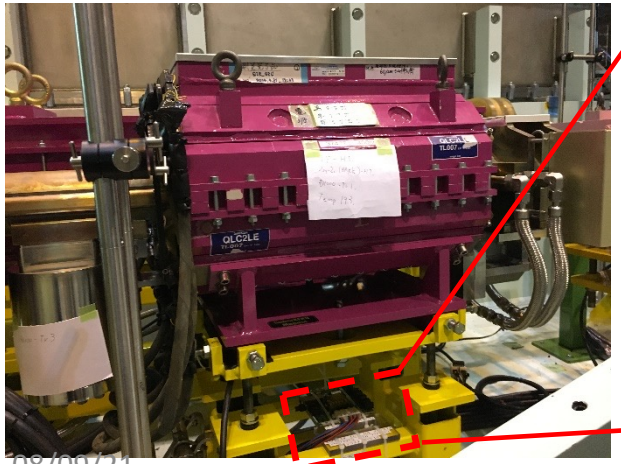


Magnet tag: BLC1RP RT009

Kintex-7 325T

Virtex-5 LX50T

7m backward from collision point



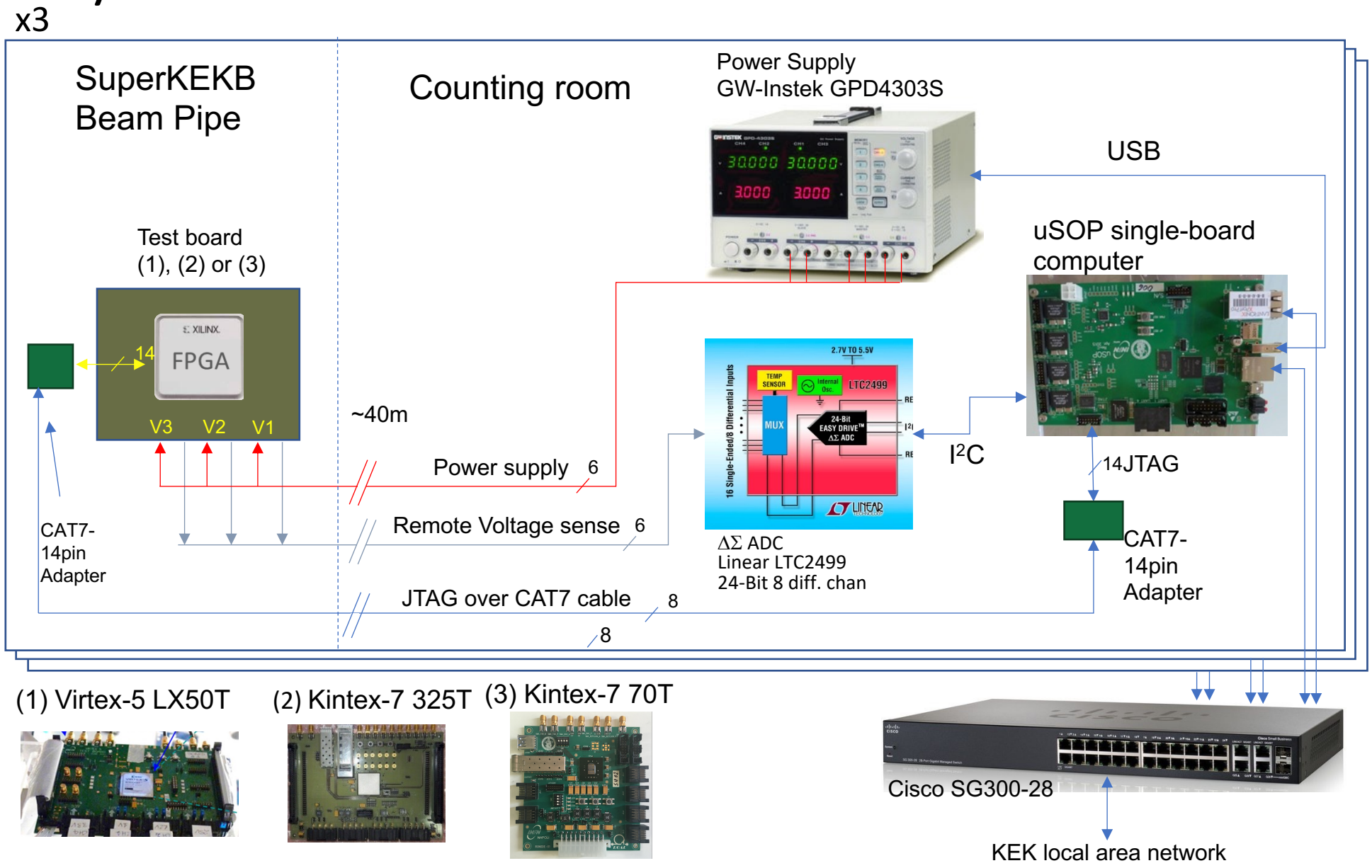
Magnet tag: QLC2LE

Kintex-7 70T

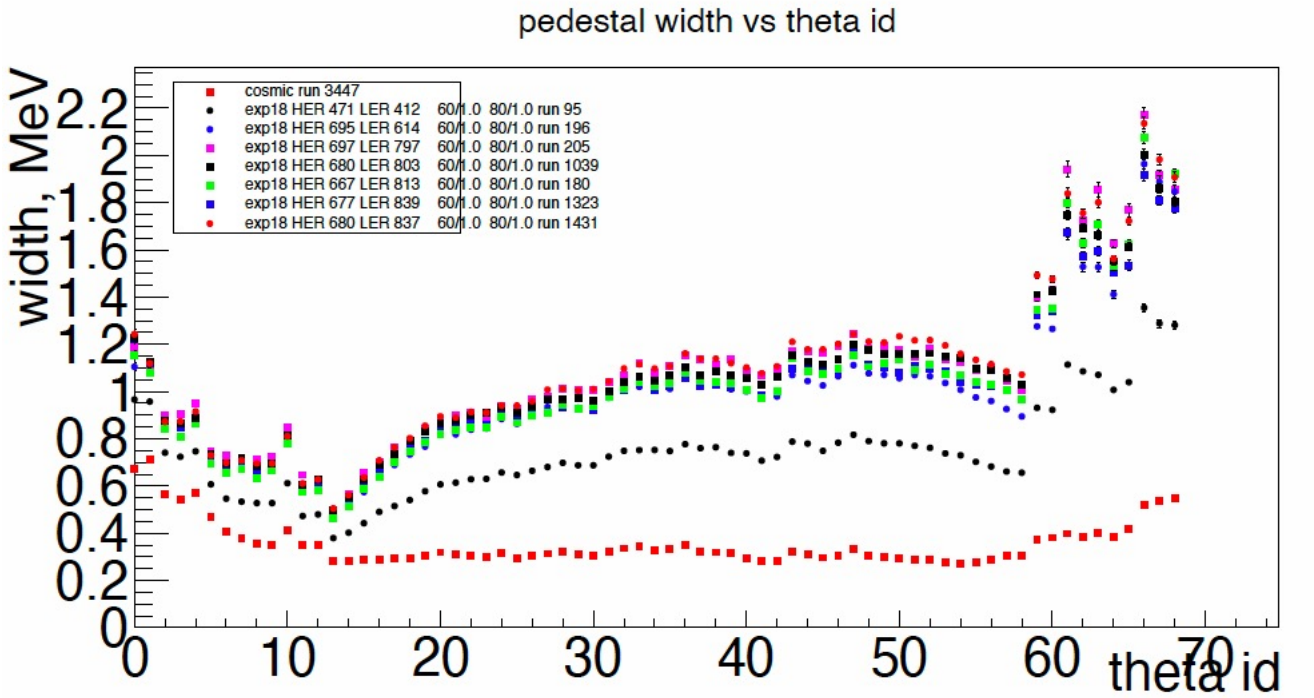
- Boards right outside the Belle II volume on final focusing magnets (QCS) supports
- Kintex-7 325T and Virtex-5 50T at 10 m forward from collision point (under e^+ pipe)
  - Direct K7 vs V5 comparison
- Kintex-7 70T at 7 m backward from collision point (under e^- pipe)
- Latest results presented as oral contribution at IEEE NSS2020 conference (Virtual Meeting, Oct. 2020)
- Need to remove the boards and cabling before QCS movement (required for accessing the vertex) and reinstall afterwards: two travels to KEK for 1 week for 1 person

Readout System

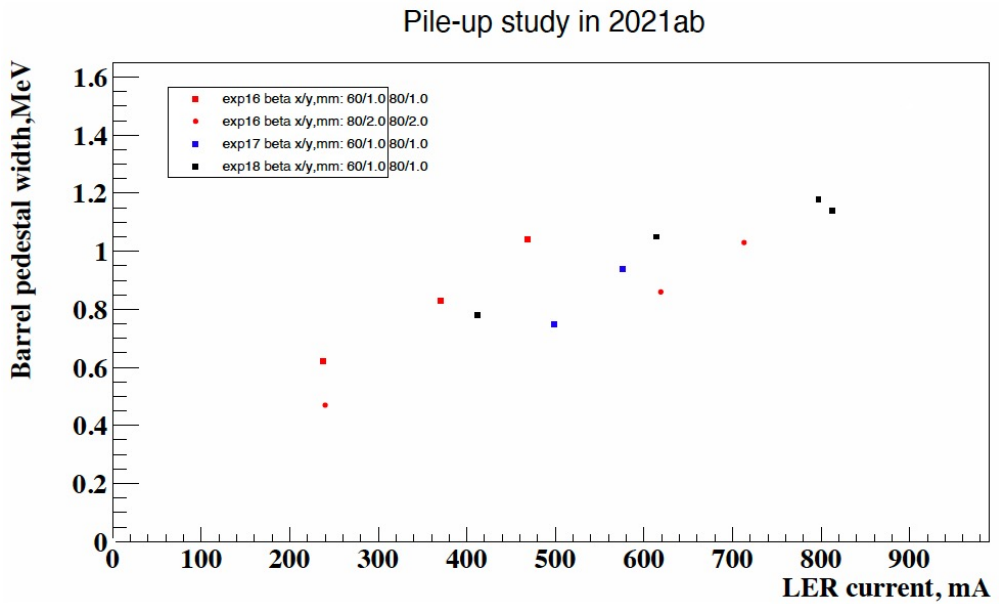
- System in three slices
- Test board
- USB-controlled power supply, 3 channels for FPGA supply domains
- 24-bit sigma-delta ADC for voltage sense at FPGA
- uSOP single-board computer, controls power supply, ADC and FPGA configuration/ readback via JTAG, remote control via LAN
- Power supplies are delicate components, in operation since 2016 and without spares
- Need for purchasing at least one spare unit in case of failures
- One travel for one week for one person in case of failures of the system (SJ)

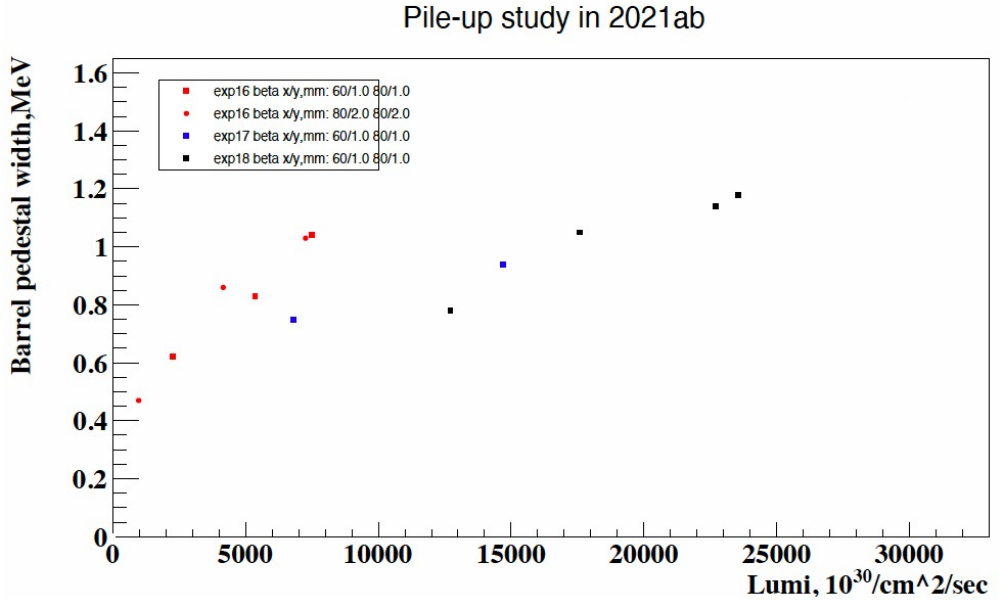


Pile up noise in 2021



- No change w.r.t. previous experiments
- BWD has high pile-up

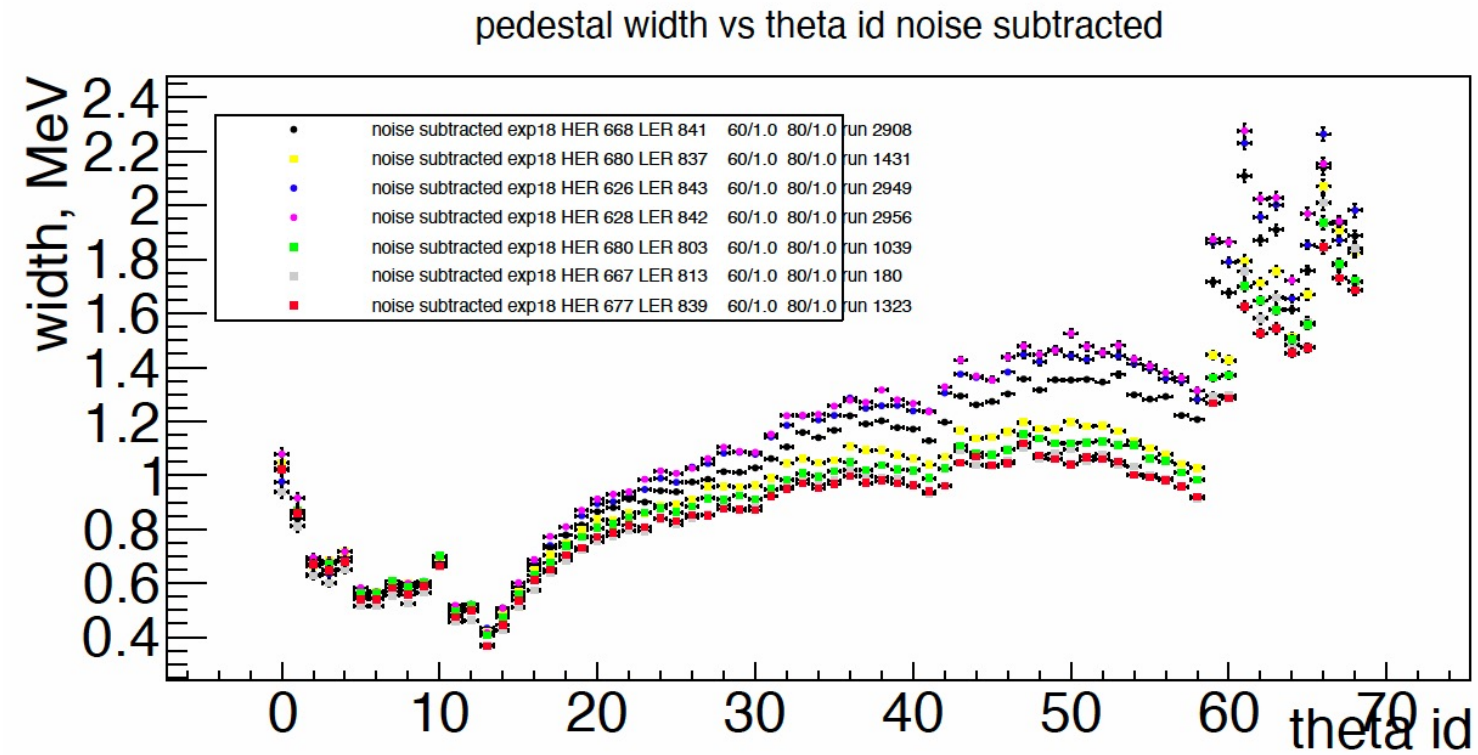




Slightly increasing with luminosity

Pile-up noise behavior

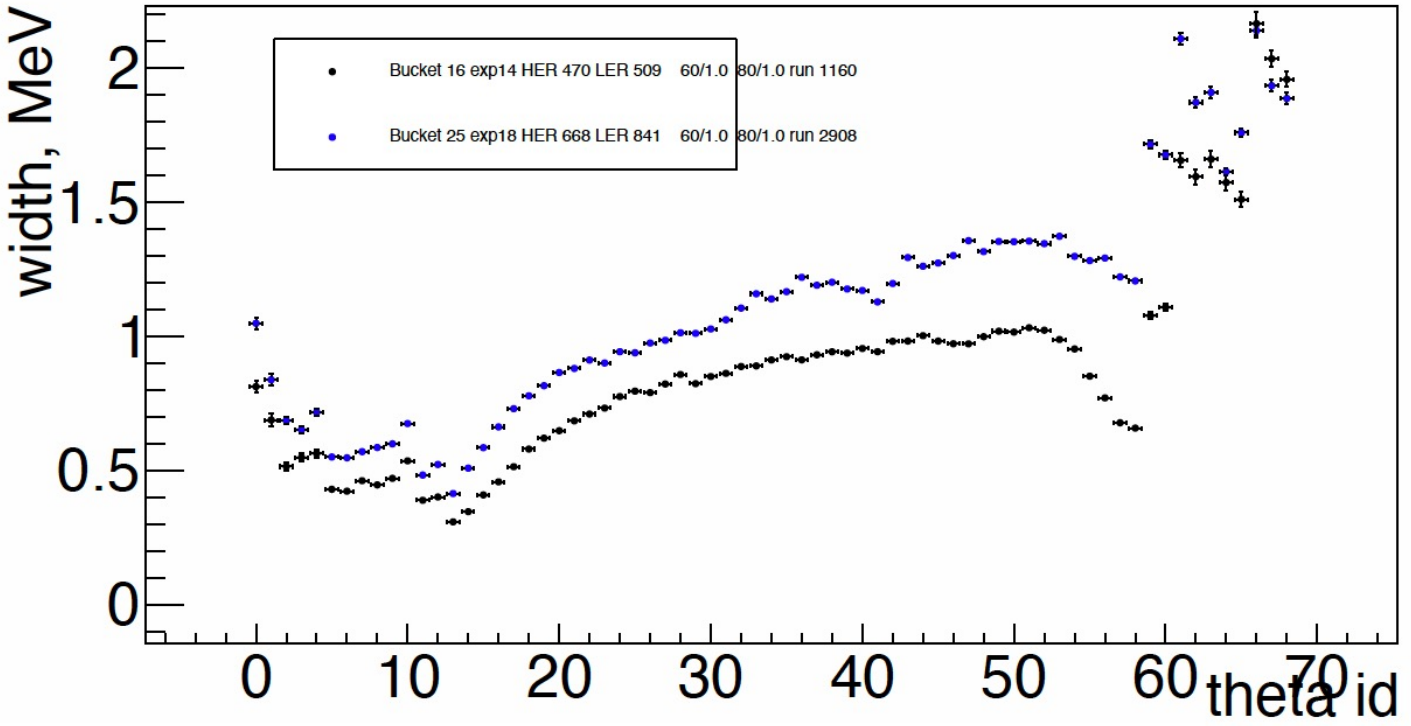
EXP 18 before and after trigger rate increasing



Pile-up noise behavior

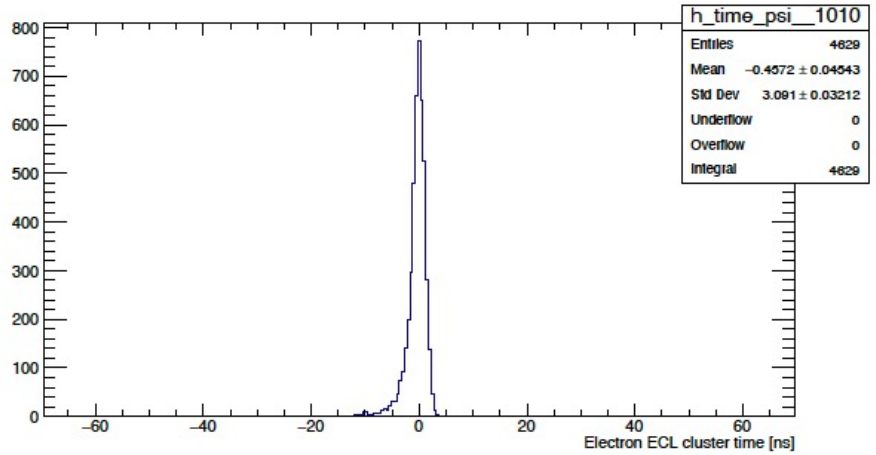
Bucket 16 vs 25

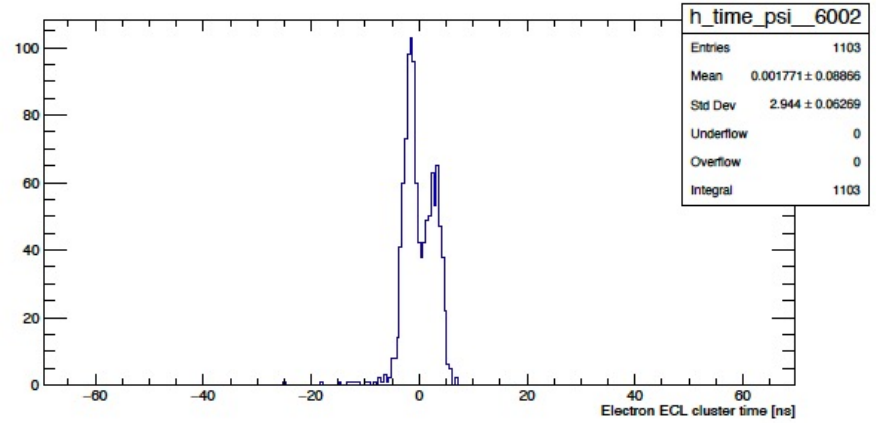
Bucket	exp	run	LER,mA	Barrel pedestal width, MeV
16	14	1160	509	1.02
25	18	2908	841	1.35



Timing calibration

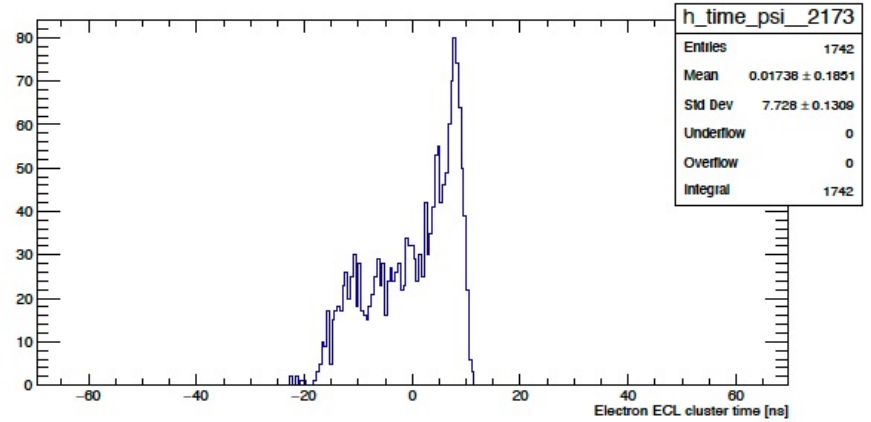
Crystal 1009





Crystal 6001

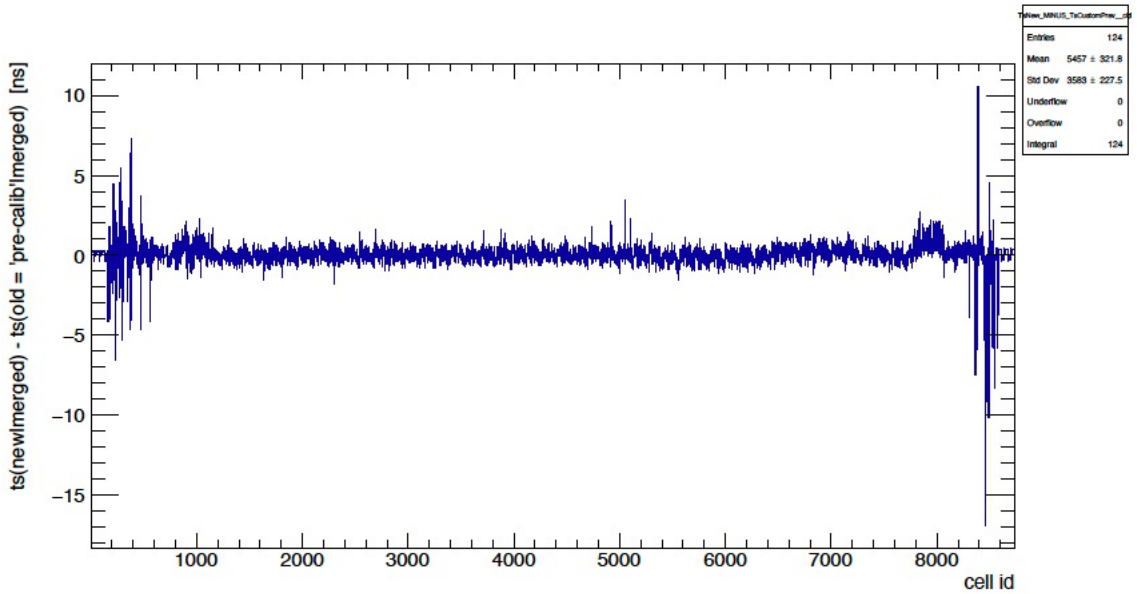
Crystal 2172



- Crystal 1009 has a good ECL cluster time distribution for bhabhas
- Some crystals have weird ECL cluster time distributions that maybe can't be fixed (e.g. crystals 2172 and 6001). The ECL group decided to modify MC by blurring the time distributions for these crystals, likely with a Guassian.

Timing calibration

Final change in the crystal calibrations constants between buckets 25 and 24 mostly show ts convergence changes



New calibration code from bucket 24

The overall change in the crystal calibration constants (including values derived from cosmics where bhabha calibration not available) between buckets 25 and 24:

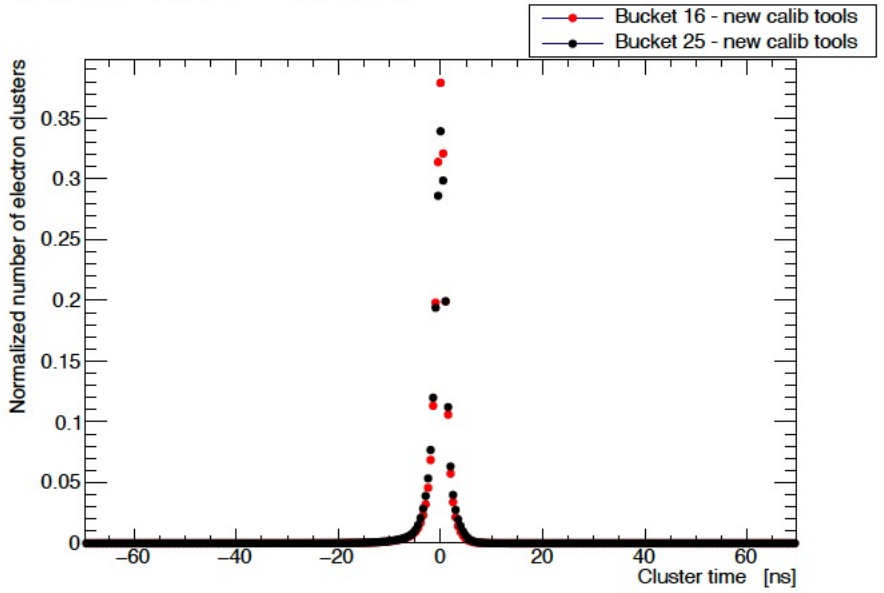
- Most changes likely because bucket 24 wasn't fully converged.
- Some "features" seen around cid $\sim 1000, 7800$, which are the barrel-endcap gaps.
- Largest changes are near the edge of the CDC acceptance and are typically (haven't checked) the crystals where there are very few ECL crystal hits.

Timing calibration

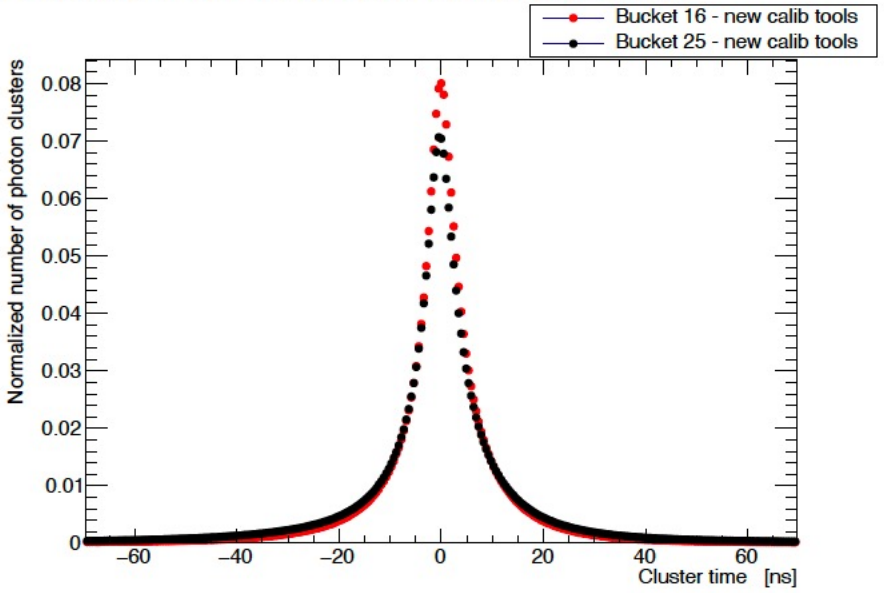
Bucket 16: locally calibrated, not official calibration.

Timing distributions in bucket 25 slightly wider than bucket 16

Bhabha event selection



Photons from hadronic event selection

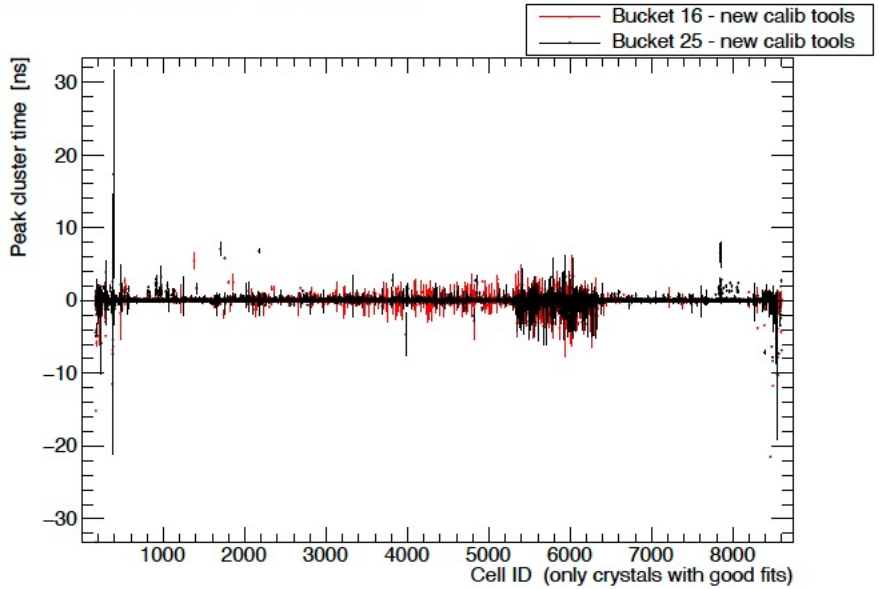


- Both bucket 25 and custom bucket 16 should have "fully" converged timing calibration constants.
- Normalized number of events so that comparisons are easier.
- Distribution shapes similar to the eye but bucket 25 slightly wider for both bhabha and hadronic validation plots

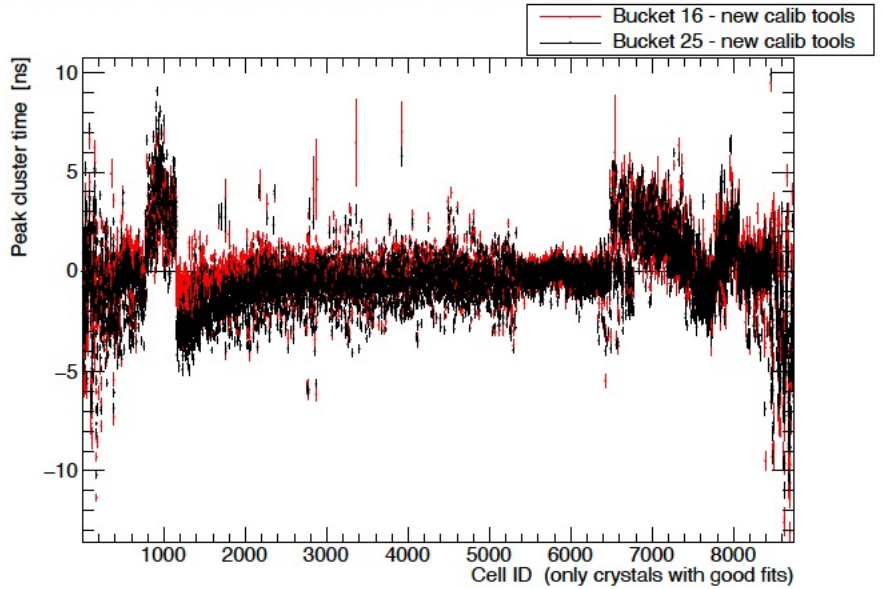
Timing calibration

The peak cluster times are similar between buckets 25 and 16, except around cid ~ 1300 for unknown reasons.

Bhabha event selection



Photons from hadronic event selection



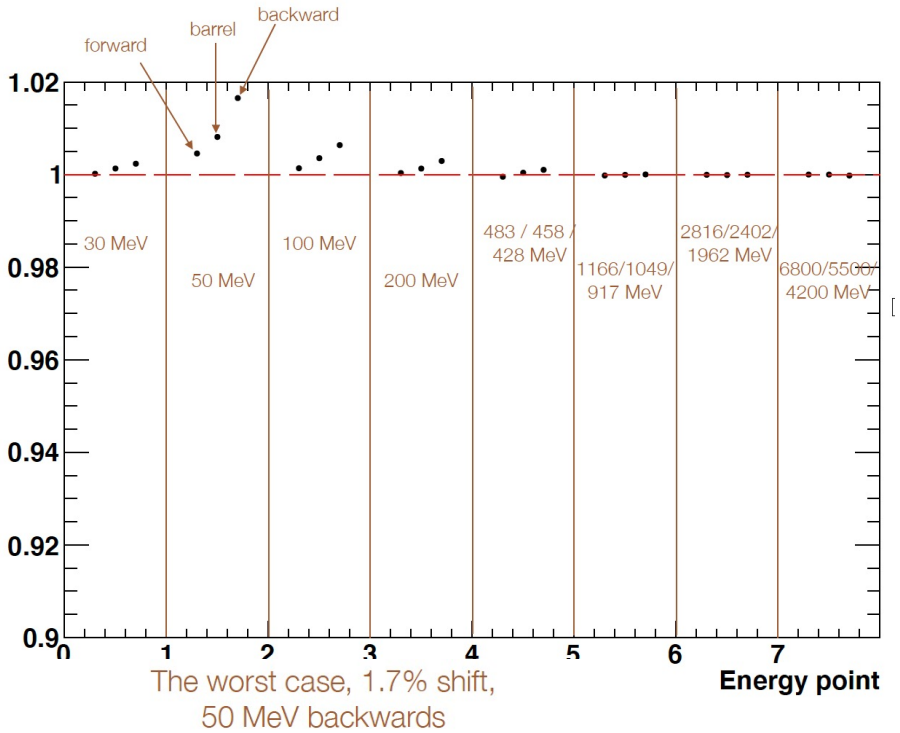
- Times of $e^{\pm}$ from bhabha selection suggest bucket 25 and 16 are similarly well calibrated.
- Groups of positive $e^{\pm}$ times near barrel-endcap gaps in bucket 25.
- Bucket 25 for γ from a hadronic event selection show even more negative times for cid ~ 1300. Not sure why the negative shift has gotten larger.

Issues in the current leakage calibrations

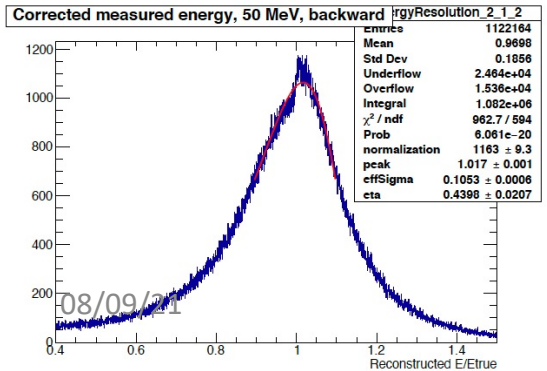
- They take a long time to derive, require a number of special productions, and many manual interventions to get the payloads into the correct global tags.
  - we did not get the release-05 corrections ready early enough to be used in mc14_ri production.
  - manual interventions = errors.

- The current corrections depend on theta, phi, and energy, but not on nCrys.

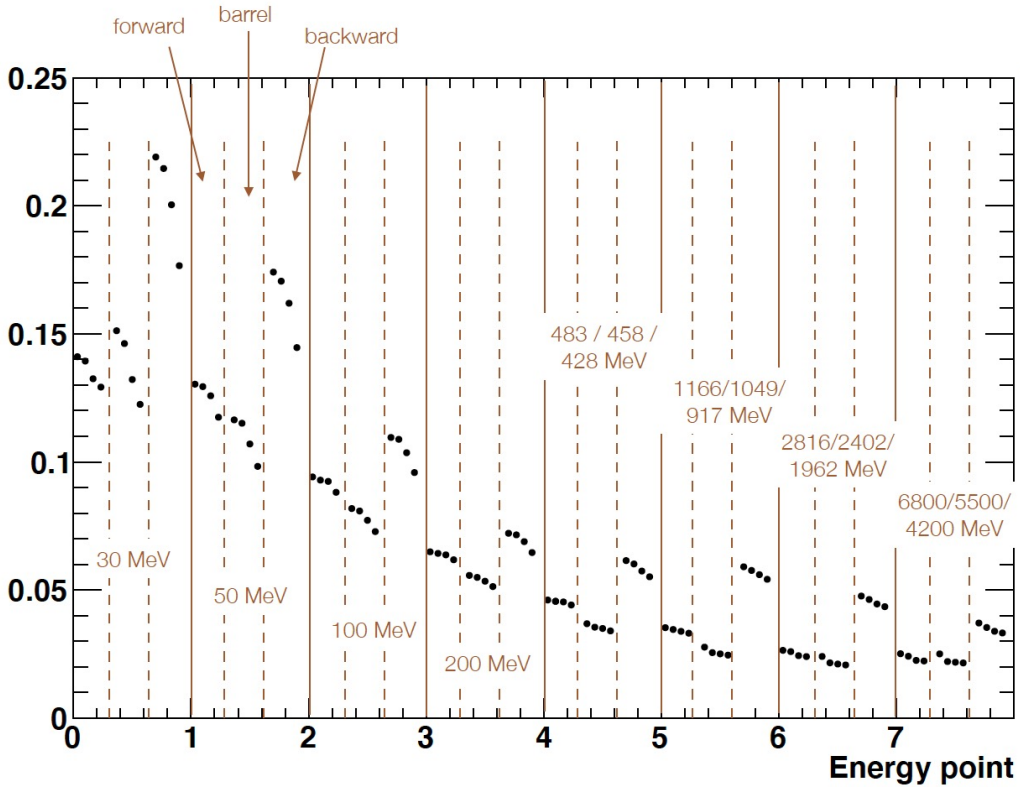
Single photons MC, exp 14, bucket 16, bckg



The worst case, 1.7% shift, 50 MeV backwards



Using measured energy (as would be done in data), the addition of nCrys in the leakage correction provides only modest improvements. Noticeably better using true energy.



Four points per region:
- Uncorrected
- Existing correction
- Corrected using measured E
- Corrected using true E

Reviewers of the ECL EoI upgrade

Shoji Uno and Eunil Won reported at the UWG meeting in April

They send comments on the three options described in the EOI:

- Pure CsI + APD : 49 M Euros
- Pre-shower (BGO/LYSO + Si) : 23.3 M Euros
- Keep CsI(Tl) + APD : 8.5 M Euros

Comments from reviewers

1) Is the upgrade for the Barrel only? Please specify explicitly.
If the upgrade includes the Endcap also, a separate EoI should be prepared.

2) None of the options discuss the human resources.
The EoI should include the human resources for the upgrade.

3) For the pure CsI option, crystal production strategy, duration, installation plan need to be included.
For the pre-shower option, it appears that the pre-shower detector needs to be attached on the head of the crystal, directly. In that case, all crystals should be removed and reinstalled. Including the pre-shower option, and the APD-only option, detailed plan on the installation schedule should be discussed.

In other words, for all three options, plan on roll-out, roll-in, removing all inner detectors has to be described.

4) None of the options include physics benchmark studies.
We ask the proponents to include a benchmark physics studies for all three options.

- Yes physics benchmark studies need to be addressed
- For the Pure CsI option we have to work on the reconstruction code which was implemented to get the signal waveform
- For the CsI+APD a complete new study is needed and the same for the Preshower option
- Costituisce la to do list da iniziare in questo autunno per la parte di upgrade ECL

Comment from T. Browder during the discussion: fourth option?

There is any way of replacing only the Read Out Electronics leaving crystals and PiN diodes?

This option is not present in the EoI
Alex Kuzmin et al. who have developed the ECL electronics upgrade from BELLE to Belle II which is now implemented in the detector

Richieste 2022

B	C	D	E	F	G	H	I
Sede	**Capitolo**	**Categoria**	**Descrizione**	**Richiesta**	**Richiesta SJ**	**Anticipabile 2021?**	**Commenti**
NA	missioni	D	manutenzione uSOP e sistema di rete 2 m.u.	12			2 m.u. (Aloisio/Giordano/DiCapua + Tortone)
PG	missioni	D	turni sottorivelatore ECL fase 3	21.5			(comprendono turni per PG-NA) da assegnare alla sede del responsabile sottosistema. 4.5 mesi di run *2persona/giorno=9 MU*0.4 frazione IT=3.6 MU, cosi suddivisi: PG: 1.8mu turni NA: 1.8mu turni
NA	missioni	D	FPGA-based radiation monitor. Disinstallazione e successiva installazione FPGA	3			0.5 m.u. per due missioni di una settimana (Giordano)
NA	missioni	D	Dosimetria real-time. Test in sito e installazione sistema	9			1.5 m.u corrispondenti a 3 missioni di una settimana per due persone per istallazione sistema e relativo DAQ e PC.
NA	apparati	A	power suppy per FPGA-based radiation monitor	1			
NA	apparati	A	manutenzione uSOP eventuale sostituzioni per faliure switch, power manager e server		10		