SiW-ECAL 2018 CERN Beam Test:

beam test summary

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Notes on the commissioning procedure

- For the FEV11, running in Power Pulsing, the generation of the configuration file starts from this file: /opt/calicoes/config/all_on_1pF_FA_CC6pF.SC.txt
  - 0xFE000031FE2F8A8082800000000000000044444444444444444444444444444444444444444444444444444444444428
    42AA0000000000000000000000000000000000000000000019D

- This slow control is used as starting point for the commissioning.
- https://twiki.cern.ch/twiki/bin/view/CALICE/SiWDESY201706Commissioning
- The commissioning scripts are in **Calicoes**, branch **features/calicoes3_commissioning**
  - This branch was not in the PC when the beam test started. Copied during operation for commissioning done on friday/saturday. Important debugging and improvements were done during operation

- **Is the data from the server recovered??**
  - Here there is the newest commissioning and monitoring (updated version was in the calicoes3_commissioning branch and some changes were done during operation, but never tested since the monitoring didn't work)

Software

- Same repository than the one created in 2017 by the analysis team
  - https://github.com/SiWECAL-TestBeam/SiWECAL-TB-analysis

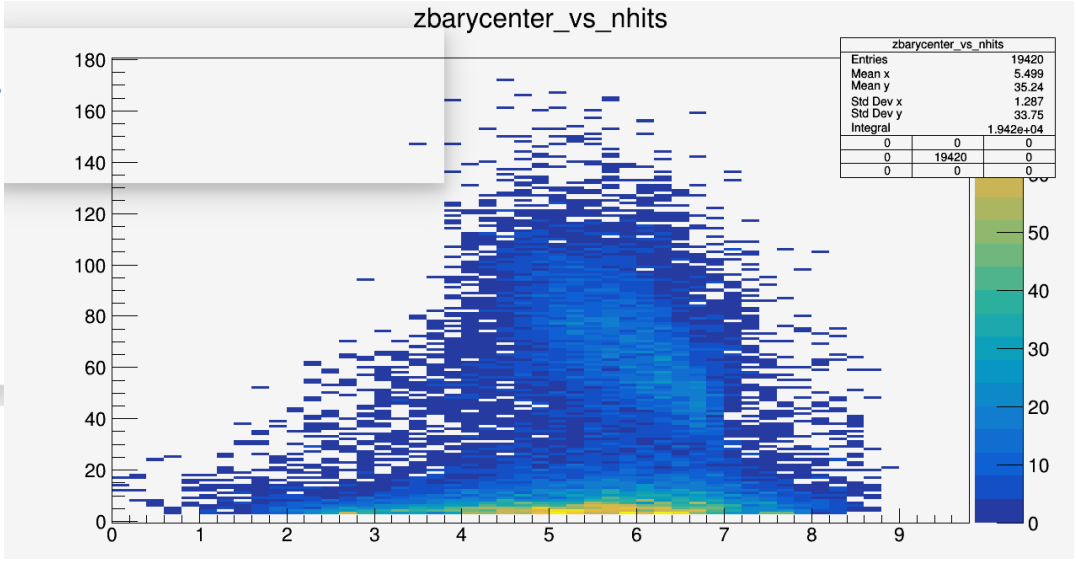
- Two branches:
  - TB201809_7slabs without clock correction for the first slab (which had 5MHz instead of the expected 2.5MHz)
  - TB201809_10slabs with dummy pedestal and mip files for the latest FEV13 to be set on the prototype
- Different definitions than in the new https://twiki.cern.ch/twiki/bin/view/CALICE/SiWEcalBT201809Analysis but easily exportable. Differences are:
  - the x/y offset,
  - and the fact that in the twiki it is requested to not do pedestal correction or single cell calibration…
  - Some more info: https://llrelog.in2p3.fr/calice/2037

Standalone runs: 7 slabs

- Data taking started on the night of the saturday 29th, with between 6-7: all working FEV11 + 1 FEV13
- Statistics calculated on site https://llrelog.in2p3.fr/calice/2036
  - Enough for muon calibration.
  - Small for electron physics (and the missing slabs were just in the middle of the detector…) Selection: at least 3 slabs with hit.
  - The different clock of the first slab was not corrected.

These are the statistics for electron data. Obtained from the zbarycenter vs nhits plots.

energy	total events	electrons shower like events
10 GeV	630	~630 (very low contamination)
20 GeV	4060	~3480
40 GeV	2023	~1800
80 GeV	19420	~8000
150 GeV	8474	~1000



Standalone runs: 7 slabs. Status of the SLABs

- Slab 21 was not recovered (or tried). So far this makes only 6 working slabs… Still don't know which ones are recoverable or not.

slab	position (CERN2018) (first the closest to the beam pipe)	dif_name CERN2018	calibrated cells 2018	dif_name DESY 2017	calibrated cells 2017	comments
17	1	1_1_2	95,00%	1_1_3	93,00%	
22	2	1_2_2	87,00%	1_2_2	84,00%	
20	3	1_2_1	96,00%	1_2_1	94,00%	
K1	4	1_1_5	x	non used		broken HV connector. Before this, it was showing nice mip spectra
P2	5	1_2_5	97,00%	non used		
P3	6	1_2_4	x	non used		no spill received at all
K2	7	1_2_3	?	non used		loses spill trailers. Only one half of the slab is readout
18	8	1_1_3	79,00%	1_1_4	94,00%	Damaged ? The areas covered by chip 5 and 7 have much lower performance.
19	9	1_1_4	92,00%	1_1_5	93,00%	
16	10	1_1_1	79,00%	1_1_2	92,00%	We fit ~ 92 %% of the channels, but the outliers of chips 0, 2, 9, 11 give much smaller signal.
21	not used	not used		1_1_1	54,00%	no data seen from this slab since DESY2018

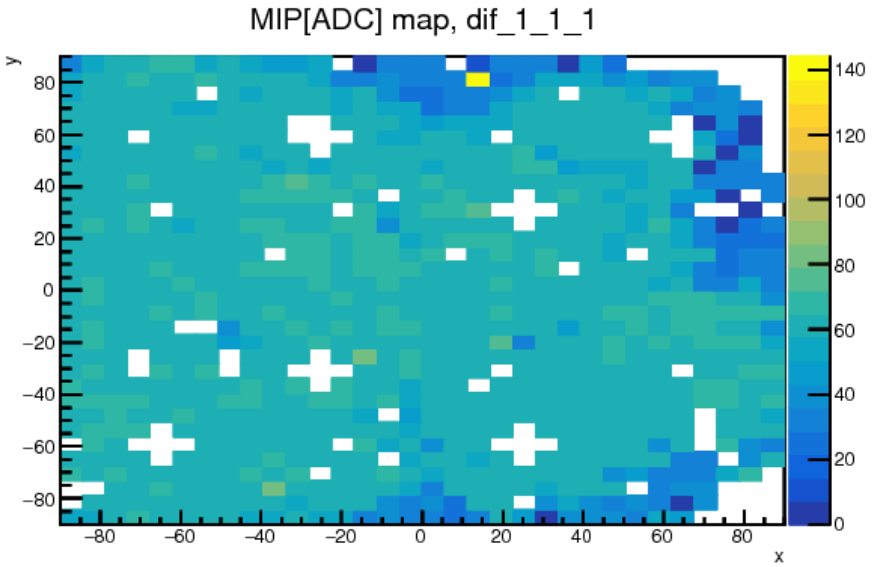
Attachment 1: summary_dif_1_1_1.eps

Attachment 2: Signal_dif_1_1_1.eps

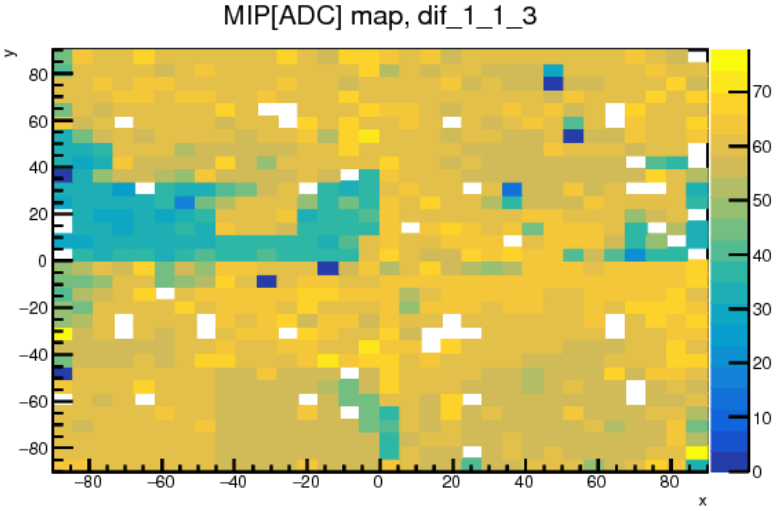
In fact, the slab 21 was completely silent DESY2018

Standalone runs: 7 slabs. Status of the SLABs

- Slab 21 was not recovered (or tried). So far this makes only 6 working slabs… Still don't know which ones of the 4 are recoverable.
- Some degradation is observed in at least 2/6 slabs, see entry: https://llrelog.in2p3.fr/calice/2013



- Slab 16



- Slab 18

Common + last standalone muon runs

- Location of the converted + standalone event built data /eos/project/s/siw-ecal/TB2018-09/Common/ECAL
- Scripts for conversion in /eos/project/s/siw-ecal/TB2018-09/converter
  - Main script: *build_script.sh*
  - Script with the selection of runs from the e-log: */launch_build.sh*
  - Instructions and comments are within the script and in the README in the github (for the use of the root building event script).

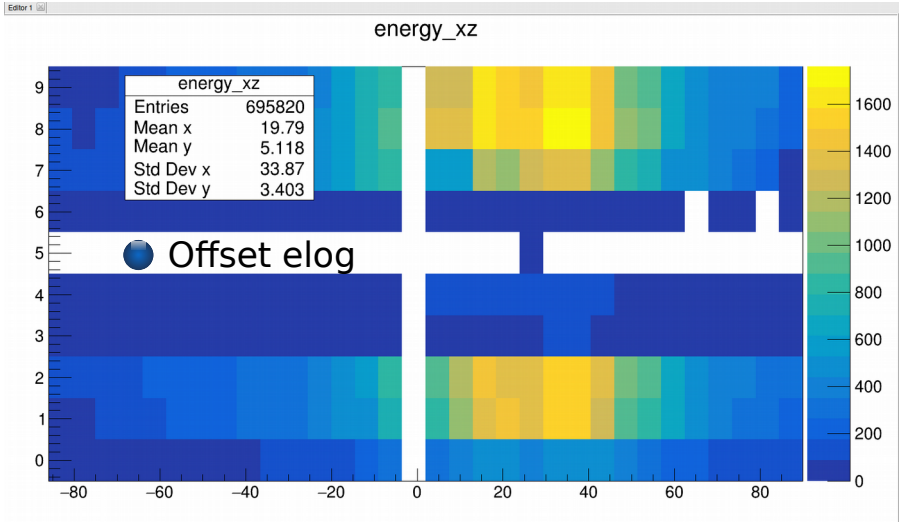
- Still some data to be copied:
  - Common electron runs
  - Last muon runs for calibration of the 3-4 FeV13s not calibrated during the standalone runs

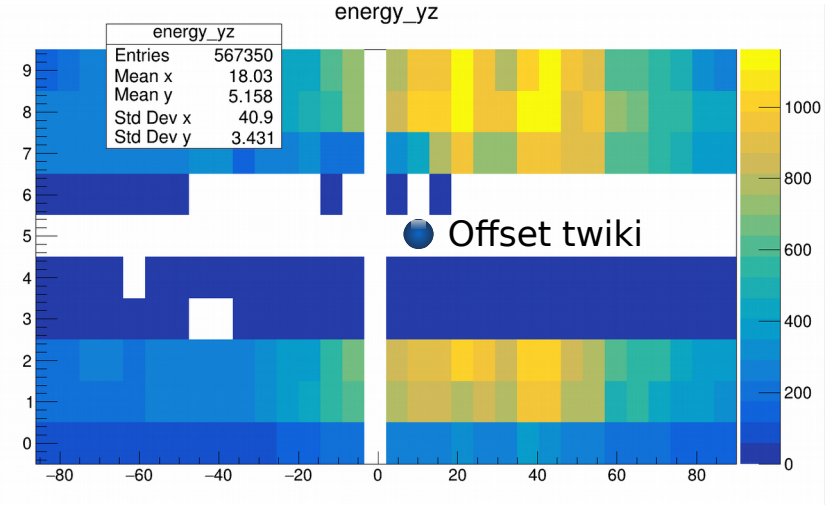
Common + last standalone muon runs

- Two sets of time offsets used:
  - One calculated independently by Sasha and Adrian on site (see elog: https://llrelog.in2p3.fr/calice/2052)
  - One on the twiki https://twiki.cern.ch/twiki/bin/view/CALICE/SiWEcalBT201809Analysis (from DIF firmware code?)
- Having 25ms (~30 over run of the BCID counter for the 5MHz) + noisy slabs + different time_offsets due to different dif firmwares + the val event in different places makes very difficult to make the synchronization.
  - But lets try (at least preliminary)

Common + last standalone muon runs

- Full common muon run hit map (x vs z) , for the two sets of offsets.
- Selection: nslabs_with_hit≥3



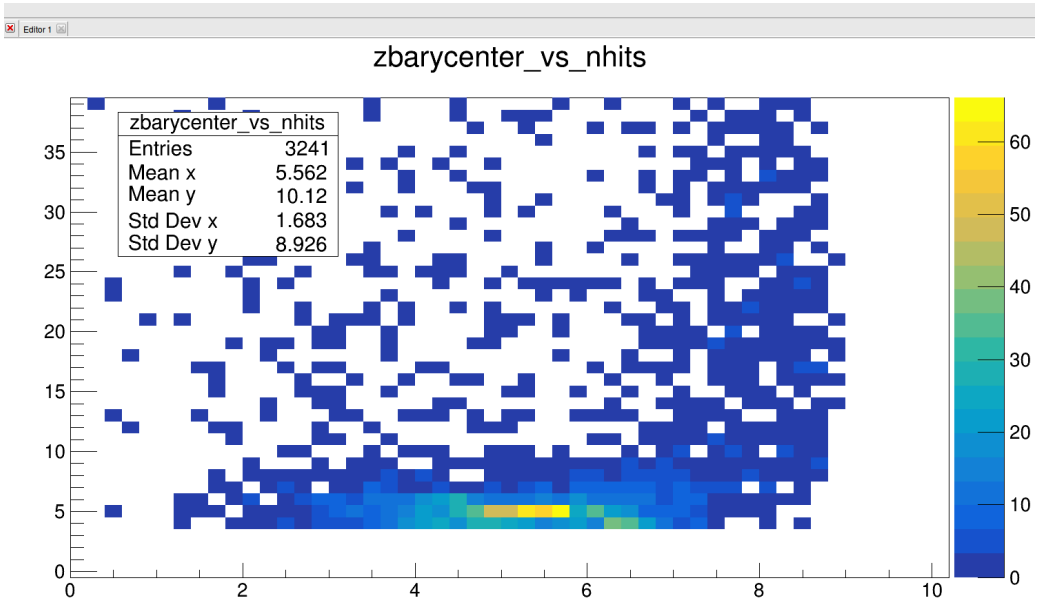


- Some optimization of the event building + offsets management may be needed (i.e. in the first slab) but: it is the only issue? Please remind the tracking efficiency plots shown in our last meeting (after DESY@2018)
  - FEV13 showed 20-40% hit efficiency.
- If the event building is the issue… the selection will still accept two groups of events:
  - the events where the FEV11 are synchronized and the events where the 4 central slabs are synchronized
  - This is not the case.

Common + last standalone muon runs

- Selection: nslabs_with_hit≥3
- Plot for PiPlus_50GeV (offset from e-log)

Common runs (selection = nslabs with hit >3)		
run	**events (offsets elog)**	**events (offsets twiki)**
PiPlus_40GeV	28299	not calculated
PiPlus_50GeV	3241	not calculated
PiPlus_60GeV	2365	not calculated
PiPlus_70GeV	12727	not calculated
PiPlus_80GeV	5484	not calculated
Muon_200GeV	108729	89506
Electron 150 GeV	not copied to the cern eos	
Standalone last muon ruon	not copied to the cern eos	



- The selection is very loose, a proper selection may easily apply a substantial reduction
- In addition, the hole in the detector is still there…
- The muon run seems to have enough statistics, but the slabs in the middle have not enough triggers

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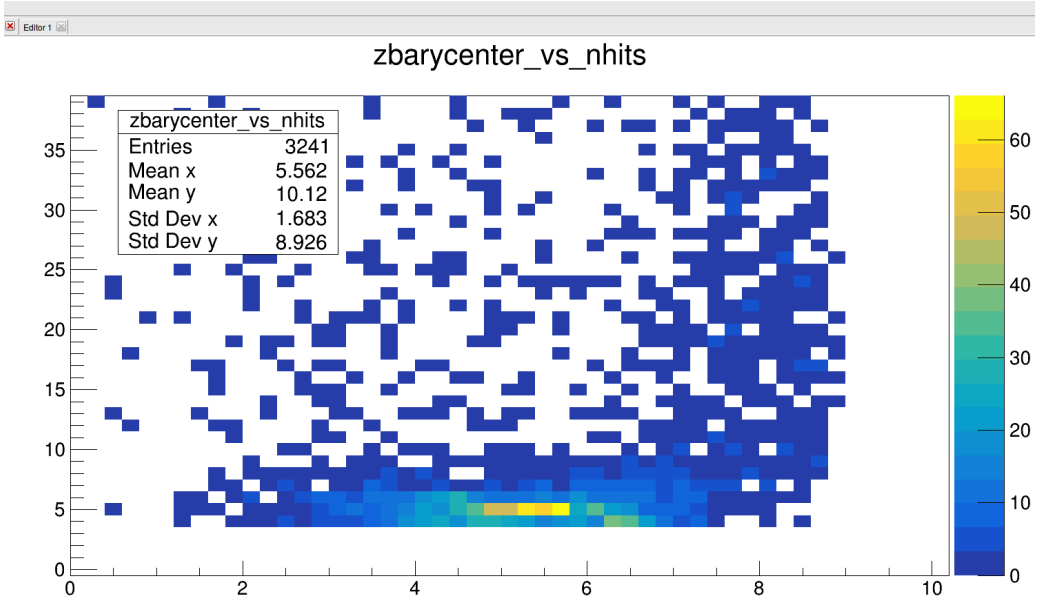

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Suitable for shower studies??

Some issues observed during beam test

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- **Online monitoring stopped working (!!) Why?**
  - One suspicion was that cause is in a change on the data format… meaning different DIF firmware than at DESY@2017 ??
  - The raw2root and R converter seem to work (but they deal differently with the unexpected size packets)… has the pyrame/calicoes online convrter changed?
  - https://llrelog.in2p3.fr/calice/1999

Some issues observed during beam test

How many different firmwares did we used?

- Dif_1_1_2 (FEV11) had an “experimental” 5MHz firmware developed at home.
- The other 2.5MHz FEV11s slabs have also new firmware?? (see point about the monitoring)
- The 5MHz firmware used in the FEV13 was developed on site… it is different from dif_1_1_2 firmware? It has different offset.
- Even in the case that all fw were properly optimized and debugged beforehand… running with such different clock configurations is far from optimal.

Some issues observed during beam test

- CCC → inverted signal for the spill, not expected. This was done for the SDHCAL+ECAL test on 2015.
  - Would be seen during commissioning.
- GDCC data concentration capabilities are on the limit?
  - See elog entry https://llrelog.in2p3.fr/calice/1862
  - The busy signal should not be larger than ~180ms in the worst case with all chips full, but we have 337ms of effective busy signal (total time needed to move one spill data from the detector to the PC) even if the chips are not saturated.
  - For 2Hz and 2.4ms window

Some issues observed during beam test

- What is the current sorting of slabs in the prototype ?
  - From some private discussions, it seems that the slab "sorting" provided in the twiki and here seems not correct…
  - UPDATE!!: Last entry on the analysis twiki (26/10) said: P1 was K2. Same was stated in https://llrelog.in2p3.fr/calice/2013 The rest is ok.
- Example: the slab upstreamer in the beam is
  - the slab 17
  - Named dif_1_1_2
  - Connected to the gdcc1
  - using HDMI cable 12 plugged to port 2
  - and… which LV/HV cables are used??
- This distribution is highly error prone.