Data quality and Beam Test Performance SiW-ECAL TB@DESY 2021

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on behalf the SiW-ECAL team

Test Beam DESY 2021

Test Beam

▶ **DESY offers non-spilled beams of 1-6GeV (e-, e+)**

▶ **15 layers with 1024 readout cells each**

- More than any LHC calorimeter
- But it fits in a suitcase

▶ **First week dedicated for commissioning**

- Threshold optimization, single cell calibration, etc

▶ **Second week dedicated to electromagnetic showers**

▶ Mounting started monday afternoon

▶ Ready for data taking since wednseday morning

- But it took us a bit more for problems with the movable stahe
- **Since then: the smoother data taking :D**

Test Beam setup

Detector
Interface (DIF)

Adapter card
(SMB) for signal
buffering + power
regulation.

DIF and SL-
Board concepts
are completely
compatible.

▶ **First 4 layers have been "ressurrected"**

- Not operative before for different reasons

▶ **7 more layers have been "rebuild" → to adapt them to the new ultracompact DAQ (heavy manipulation)**

▶ **4 Layers new**

- 2 of them with sensors glued in two separated batches (one sensor for test, the other 3 one year later)
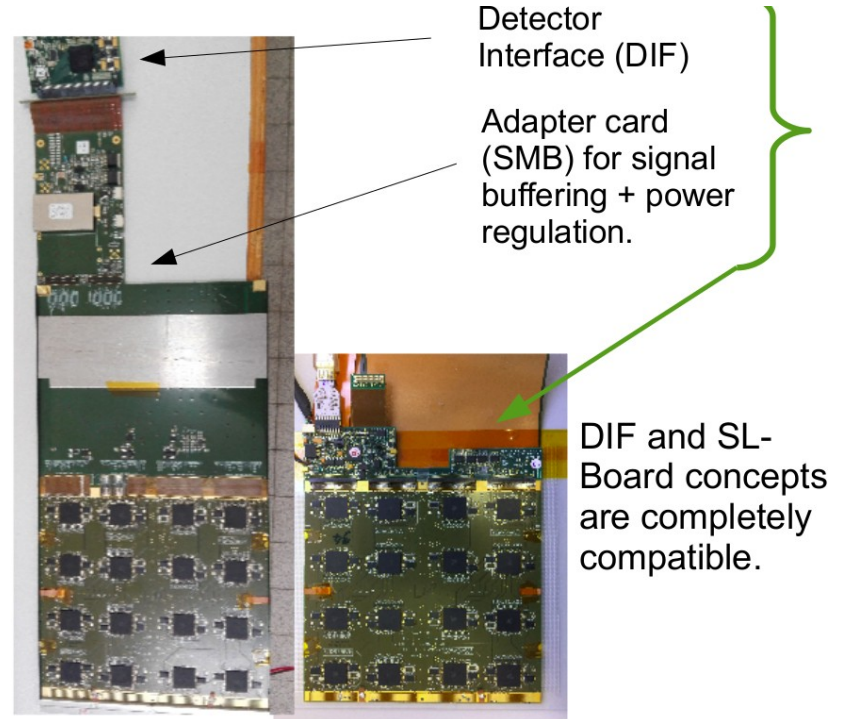
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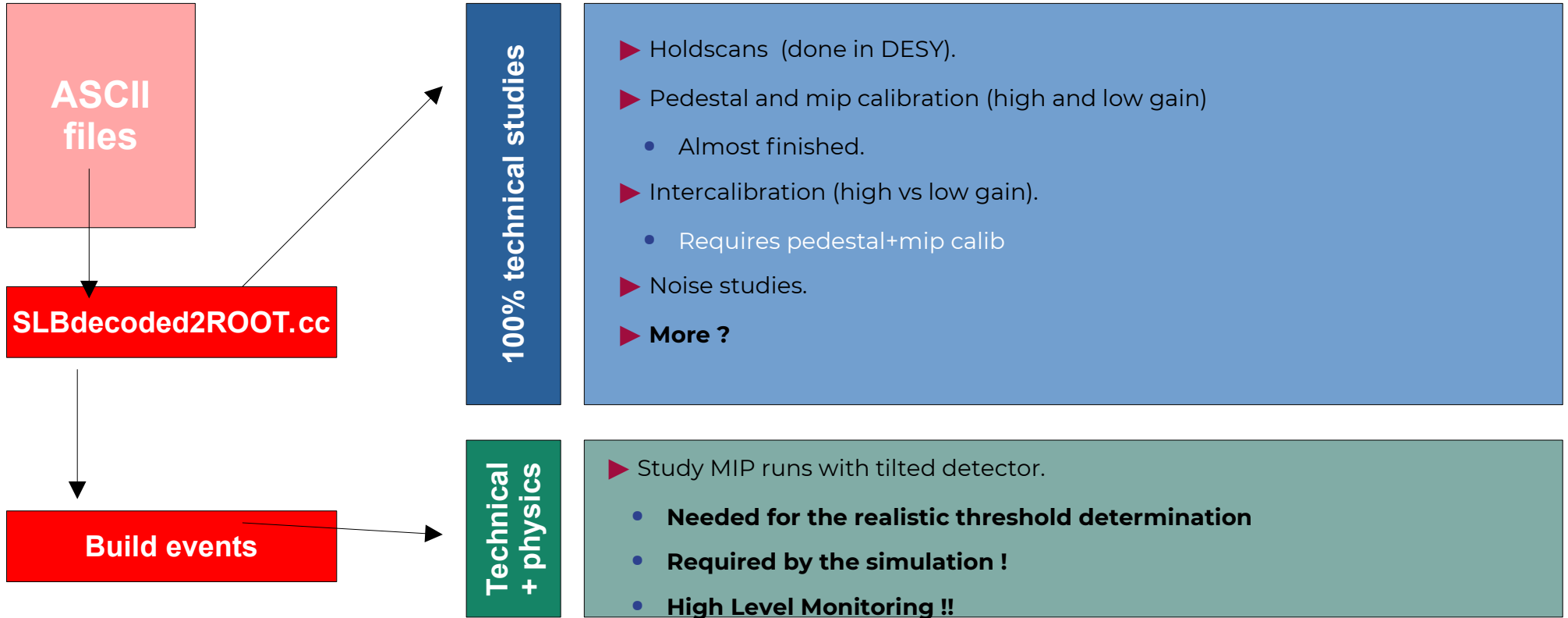
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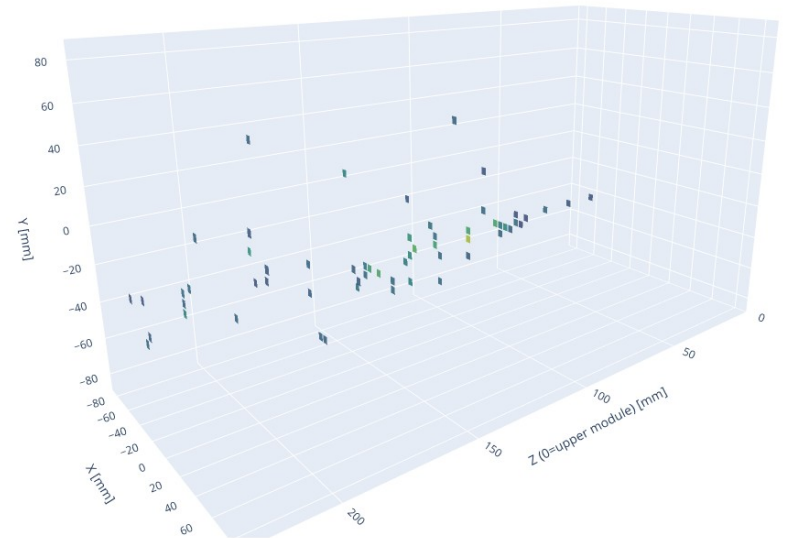
**Technical TestBeam
with new DAQ,
larger concentration (xyz) than ever**

Next... is analyze the data

https://github.com/SiWECAL-TestBeam

▶ **SiWECAL-TB-analysis** → code for commissioning, detector operation and technical analysis

- Branch during the beam test: slboard_TB2020
- New branch tfor analysis TB2021-Analysis (as master)

▶ SiWECAL-TB-Sim

- Tools for simulation (DD4HEP based) and for digitization

▶ SiWECAL-TB-LCIO Analysis

- For LCIO based analysis
- Starting from event building (see H. Garcia's talk)

▶ Users/developpers: Y. Okugawa, J. Kunath, H. cabrera, F. Jimenez, S. Tsumura

**SiWECAL-TB-Analysis is the
master code for "technical" studies.**

Technical analysis (100% root based)

ASCII files

↓

SLBdecoded2ROOT.cc

↓

Build events

100% technical studies

▶ Holdscans (done in DESY).

▶ Pedestal and mip calibration (high and low gain)

- Almost finished.

▶ Intercalibration (high vs low gain).

- Requires pedestal+mip calib

▶ Noise studies.

▶ **More ?**

Technical + physics

▶ Study MIP runs with tilted detector.

- **Needed for the realistic threshold determination**

- **Required by the simulation !**

- **High Level Monitoring !!**

Physics analysis (LCIO based)

Simulation

► Define xml file with geometry

► Create data files (SimHits) + digitise them (CalorimeterHits) + get MIP calibration constants

- Requires the knowledge of the thresholds per chip
- + noise studies
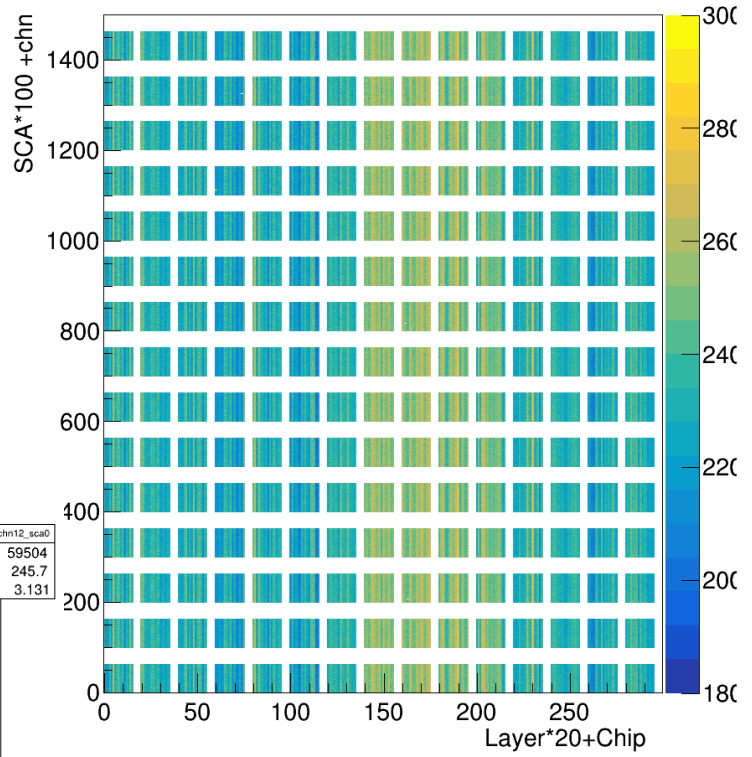
ASCII files

Build events

**Physics w/ MIPs
Validation of the simulationn. Fabricio**

Physics w/ showers

► Linearity (vs beam energy) –

► Shower profiles

► Shower studies with different angle incidences

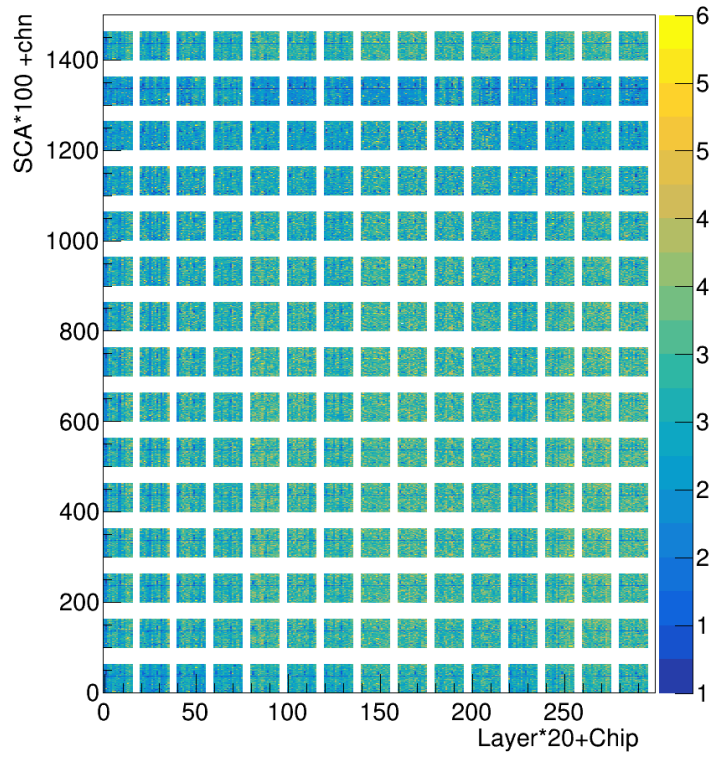► **More ?**

► **Requires the MIP/Pedestal calibration**

Basic performance: pedestals

▶ 15slabs x 16 ASIC x 64 chns x 15 sca =
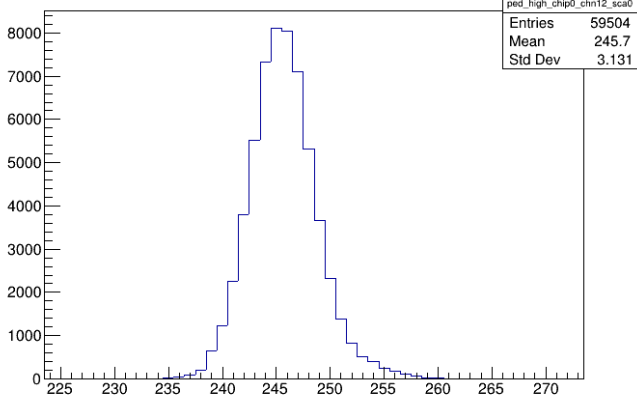
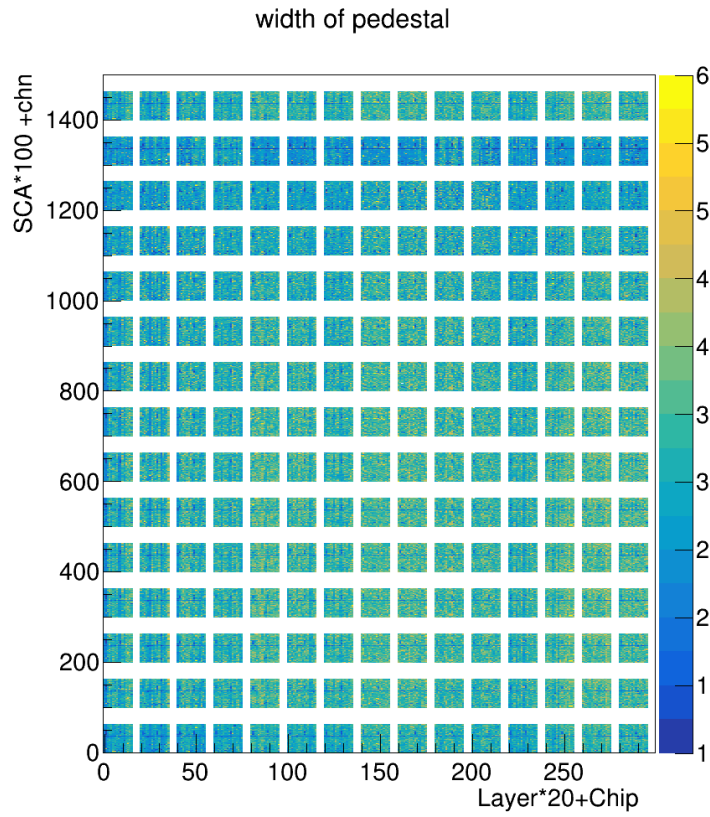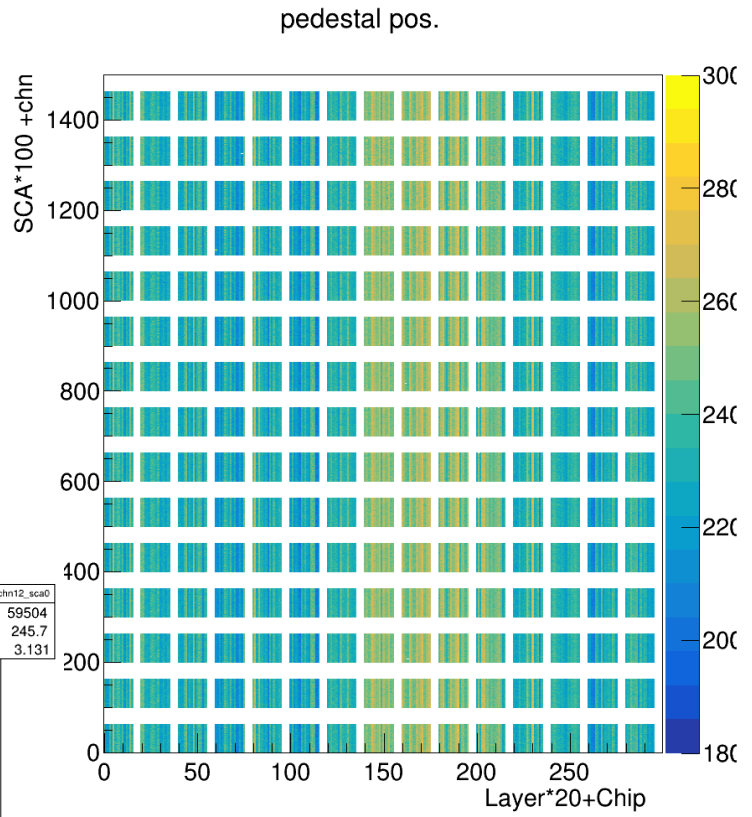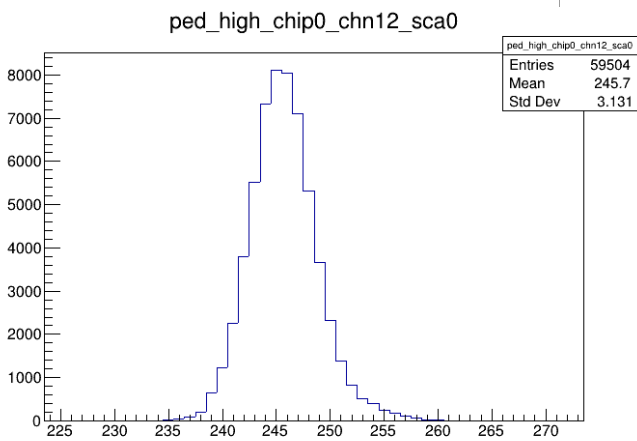- 230400 pedestal calibration constants

pedestal pos.

width of pedestal

ped_high_chip0_chn12_sca0

ped_high_chip0_chn12_sca0	
Entries	59504
Mean	245.7
Std Dev	3.131

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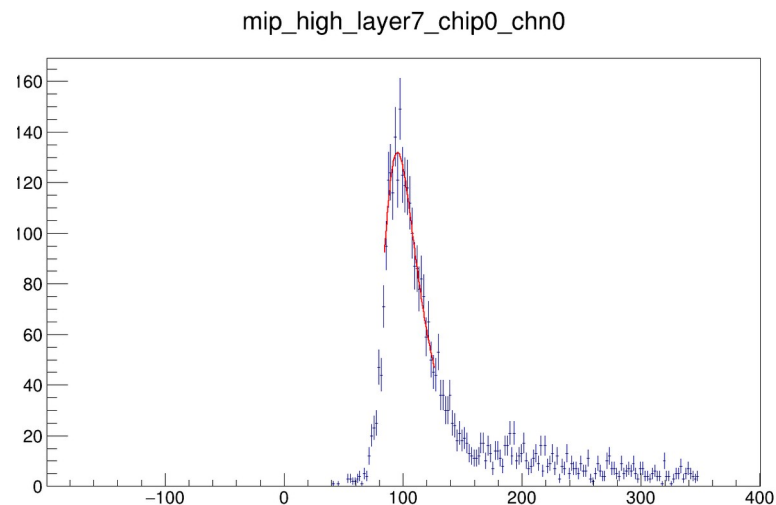
ped_high_chip0_chn12_sca0	
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MIP calibration

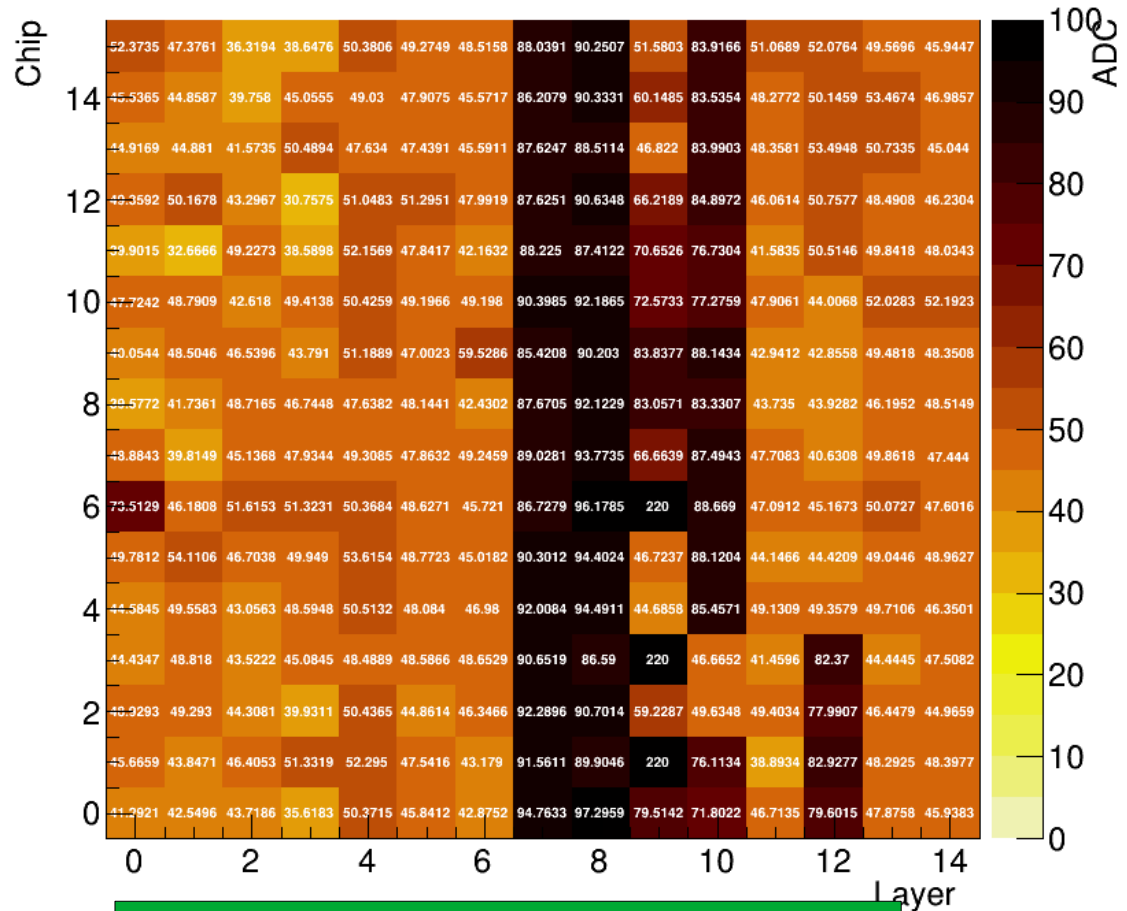average of MPVs

mip_high_layer7_chip0_chn0

▶ 15slabs x 16 ASIC x 64 chns =

- 15360 single cell calibration constants
- (shown here averages for each ASIC)

MIP calibration
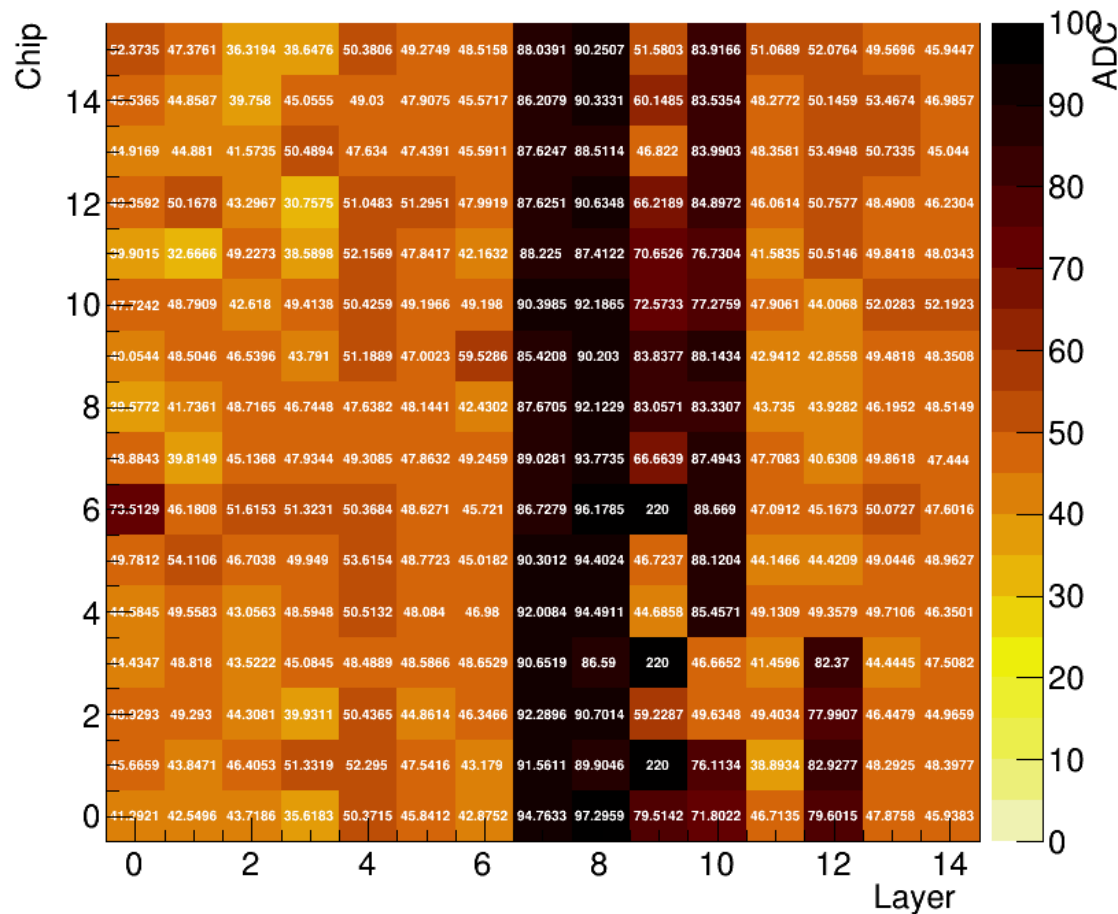
► We observe few unhomogeneities:

- Layers 7-10 have thicker sensors (larger signal)

- Issues during the gluing of the sensors of Layers 9-10 were reported (training of the gluing robot, different mix of glue used, manual interventions during the process)

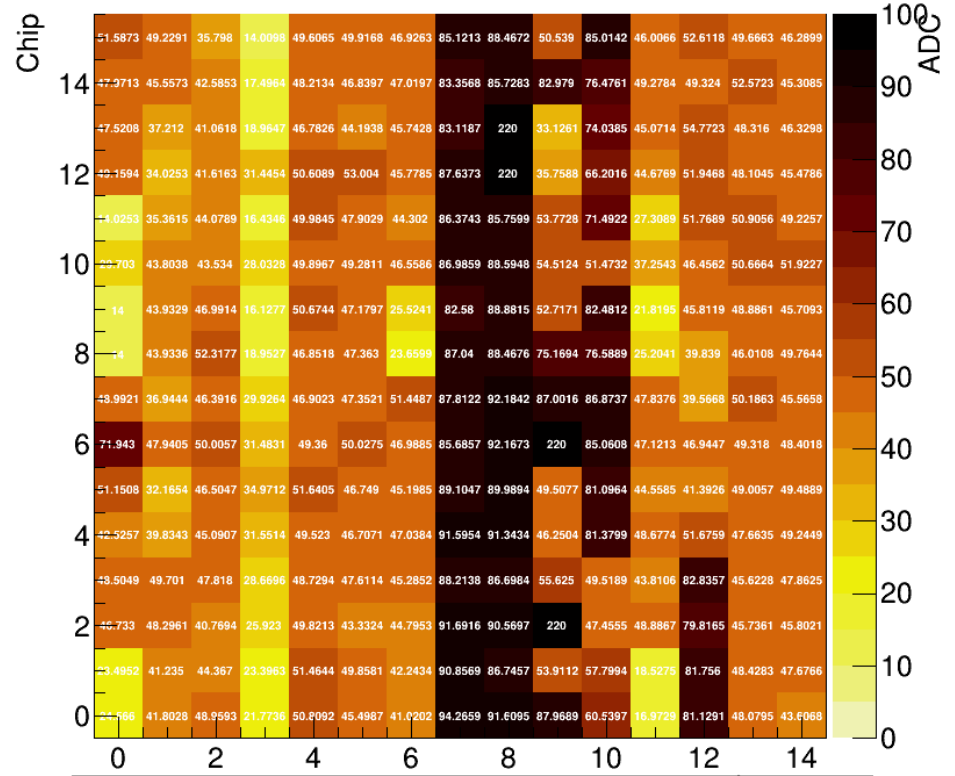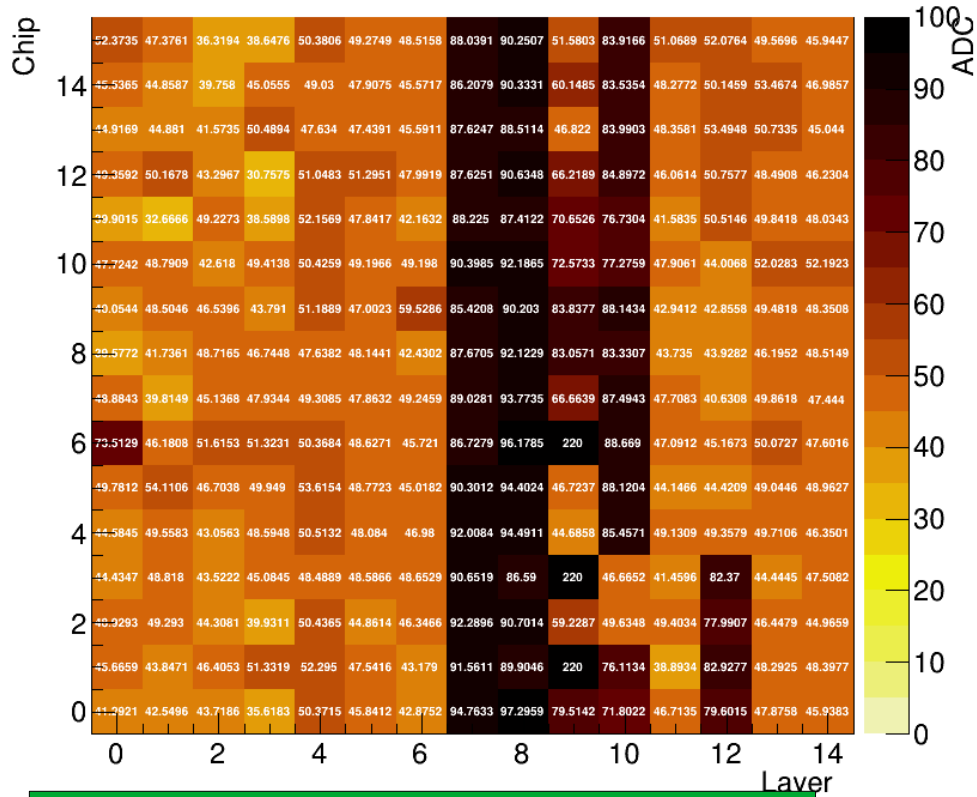- Layer 12 had one wafer replaced

average of MPVs

Holdscan MIPs vs Position scan MIPs

average of MPVs

average of MPVs

First quick mip calibration run

**Long calibration run (position scan)
Were we observed problems with
HV system**

Irles A., 17th February. 2022

Summary + prospects

▶ **Beam tests are crucial to understand the hardware !!**

- New DAQ system and a mix of new and old layers
- Higher density and number of channels than ever in the project
- Unexpected situations that challenge the hardware only appear during testbeam (HV issue)

▶ Work is being done in several fronts

- Technical studies (pedestal calibratio, noise, mip calibration, …)
- Data analysis
- Simulation