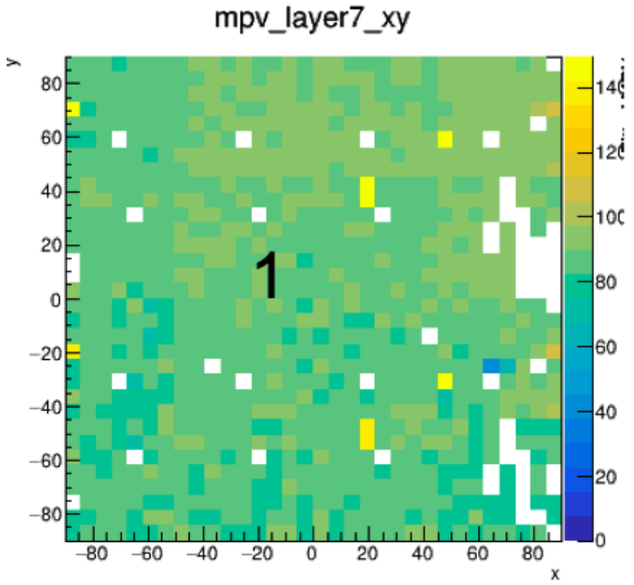
Sensor delamination

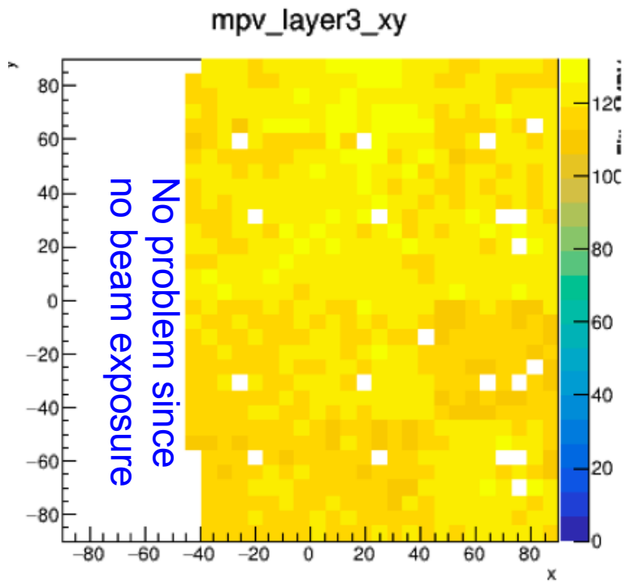
Roman Pöschl

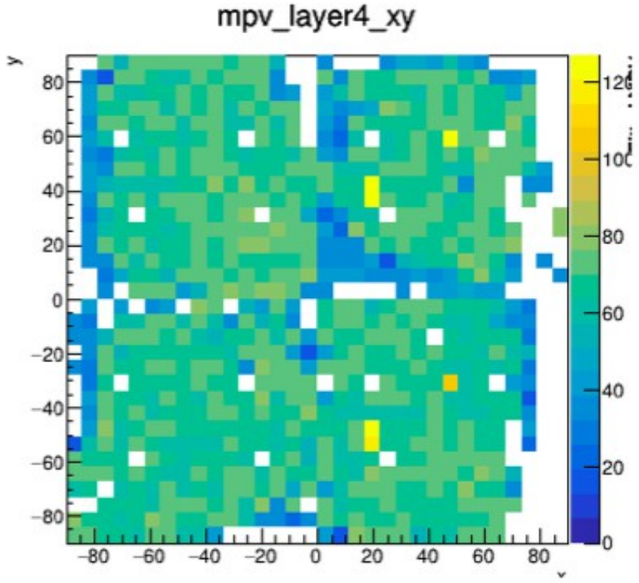
On behalf of the SiW ECAL Groups in CALICE:

CALICE Meeting – October 2022

Silicon Tungsten electromagnetic calorimeter







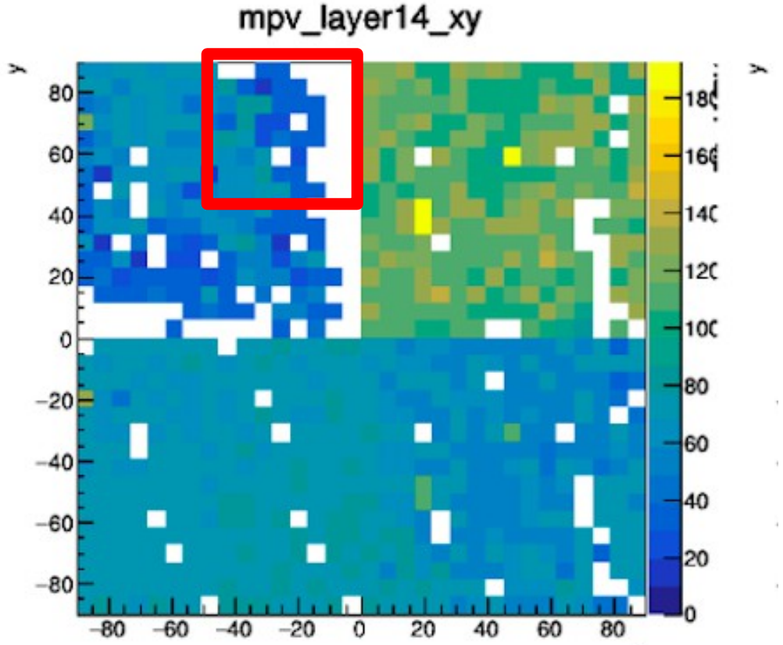
- We have good layers ...
  - Homogeneous response to MIPs over layer surface
  - > 90% efficiency for MIPs
  - Here white cells are masked cells due to PCB routing
    - understood and will be corrected

... and not so good layers

- Inhomogeneous response to MIPs
  - Partially even no response at all, in particular at the wafer boundaries
    - See also talk by Hector on Thursday
  - Not seen in 2017, degradation already observed during 2018/19
  - Upon visual inspection delamination could be seen by eye
- Since Summer 2022 access to the different stages of the ASICs
  - => analogue probes, major debugging tool

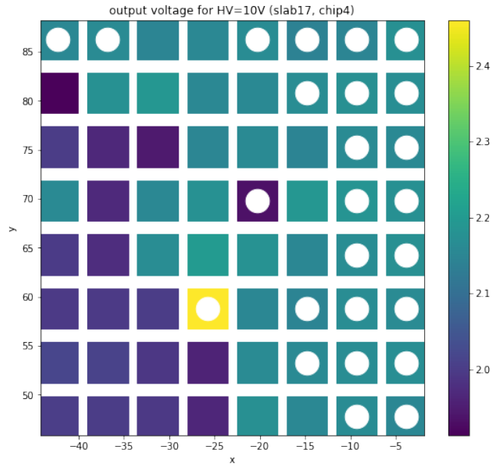
Debugging with analogue probes

Adrian, Fabricio, Jihane, Jonas, Dominique, Yuichi, Stephane



Plots Jonas Kunath

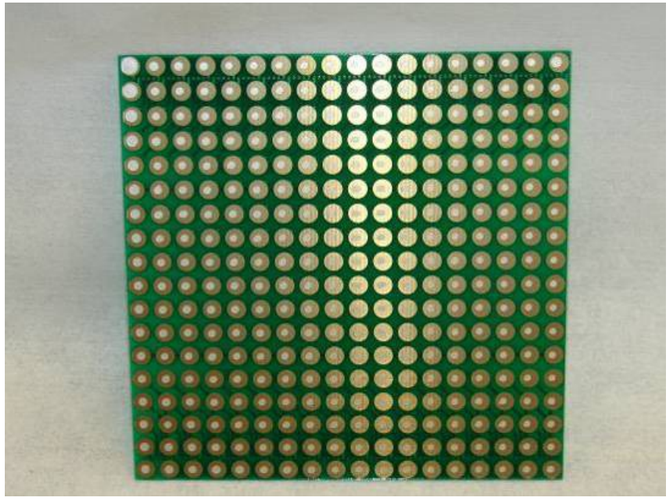
- Analogue probe: Slow control parameter allow for reading DC output voltage a ASIC preaamp
  - New feature implemented in DAQ system between DESY and CERN beam test
- Input voltage should change in case Si sensor gets polarised
- Validation for **one ASIC**



- Clearly spotted non connected Si pads
- One to one correspondance between “White cells” in MPV plots and AP measurements
- “Strange MIPs” in MPV plot could also be identified as not connected
  => Analgue probes allow for identifying Si pad status
- Here: handish measurement with voltmeter
- Future: Automatised reading with DAQ

Sensor Delamination – Shopping List

- PCB bending during cabling ?
  - Heat may cause deformation of PCB that in the long run pull on the glue dots
  - => Carry out some fake cabling with existing material in next weeks
  - ... and measure the PCB dimensions after each step



For illustration only

- Surface issues ?
  - Production PCB were also used (before) intensively on test benches
    - => degradation of (gold) coating on PCB
  - Reaction between glue dots and PCB and sensor surface
    - Will inquire with glue producers
    - Will try to produce fake (unprocessed) sensors with Al coating similar to “real” sensors
    - With these sensors we can produce fake ASUs for mechanical tests

- Quality of glue ?
  - Glue is two component material. Has the correct mixture been observed?
    - Since we produce so few layers at a time we also use small quantities of (expensive) glue
    - This makes it more difficult to precisely observe manufacturer advice
  - Did the glue perish over the years (Unlikely but who knows) => Chemical analysis)

- Review of gluing procedures (in France and Japan)

- Alternatives to gluing?