Tile assembly

Di Venere L.

for Bari group

HERD PSD Italian meeting

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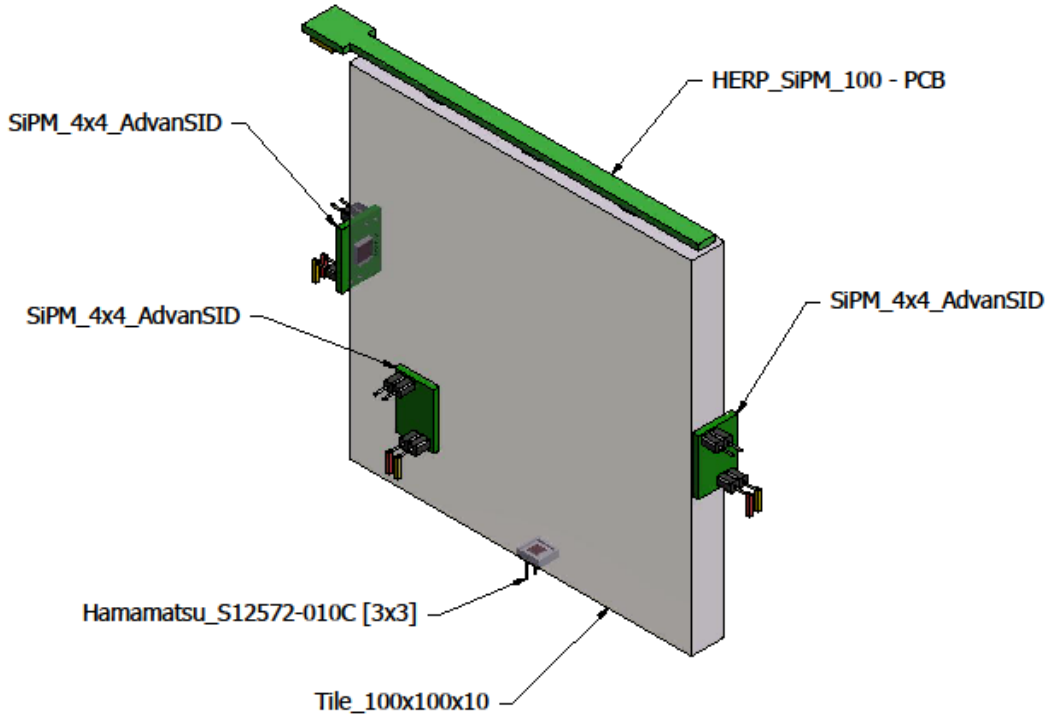
Hardware details

- 3 new tile to be assembled
  1. BC-404 (**GSSI**) , size:10 cm x 10 cm, height: 10 mm
  2. Epic Crystal (eq. BC-400) , size:10 cm x 10 cm, height: 10 mm
  3. Epic Crystal (eq. BC-400) , size:10 cm x 10 cm, height: 5 mm
- SiPMs :
  - AdvanSiD ASD-NUV4S-P: NUV, 4x4mm2 size, 40um cell pitch
  - Hamamatsu S12572-015C, S12572-010C : NUV, 3x3mm2 size, 10/15 um cell pitch
  - SiPM PCB with 3x Hamamatsu S12572-050P (**Pavia**): NUV, 3x3mm2, 50um cell pitch

Assembly

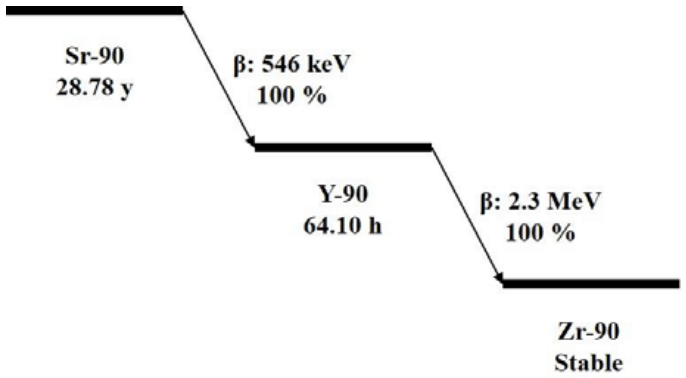
- 4 single SiPMs + 1 SiPM-PCB per tile
  - 2x AdvanSiD NUV SiPMs on opposite sides
  - 1x AdvanSiD NUV SiPM on top facet
  - 1x Hamamatsu on side
  - 1x SiPM PCB on remaining side



- Tile 1: 1 x HAM 10um + 1 x PCB 50um +3 x ADV 40um
- Tile 2: 1 x HAM 15um + 1 x PCB 50um +3 x ADV 40um
- Tile 3: 1 x HAM 15um + 1 x PCB 50um +3 x ADV 40um

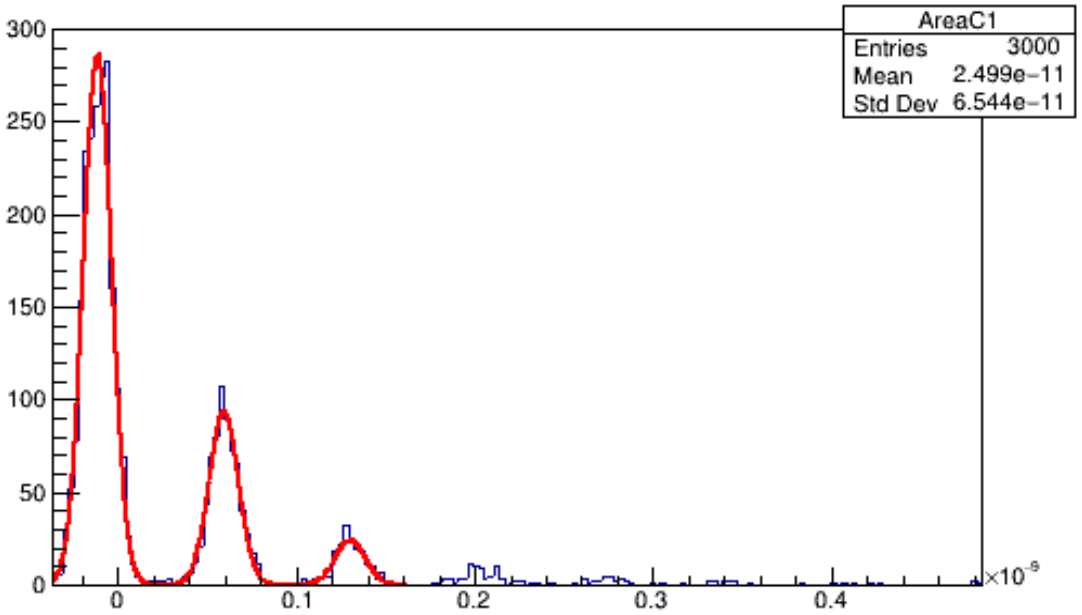
First measurements

- Sr-90 radioactive source placed in the central position of the tile
  - Beta decay
- Calibration based self-triggering on individual SiPMs
  - obtain pedestal and gain
  - Used for p.e. conversion
- Operating voltages:
  - ADV : 29V (Vbr=26V)
  - HAM 15u: 70 V
    - recommended bias is : 69.4 V for 15um , 69.13 V for 10um → to be checked
  - SiPM PCB: 67 V
- Pre-amplifier: AdvanSiD trans-impedance preamp
  - Low gain for ADV top SiPM
  - High gain for other SiPMs
- Trigger: logic AND on two ADV side

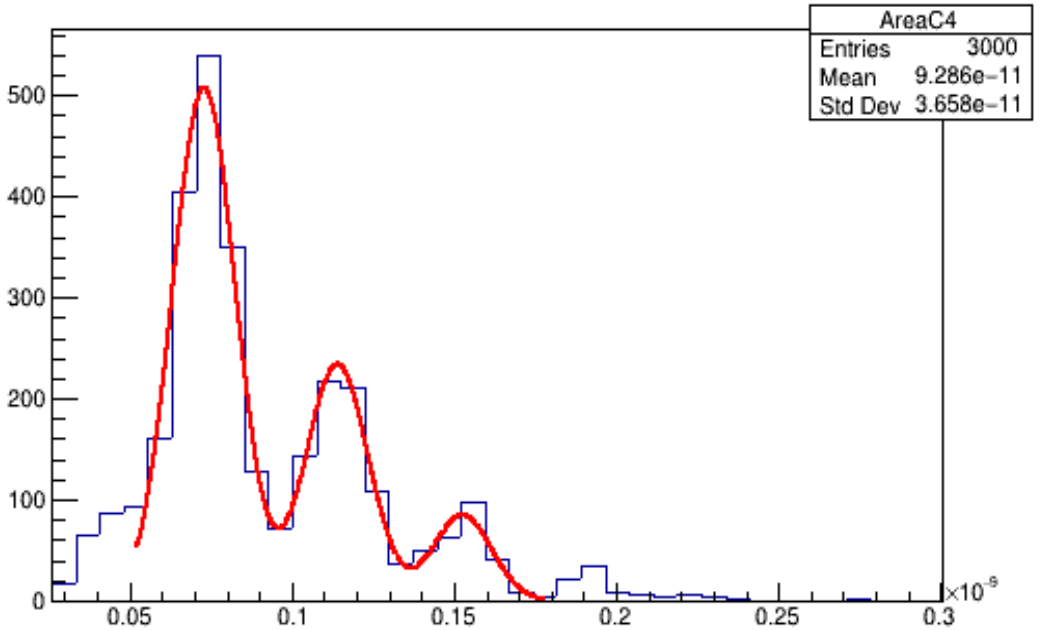


Calibration

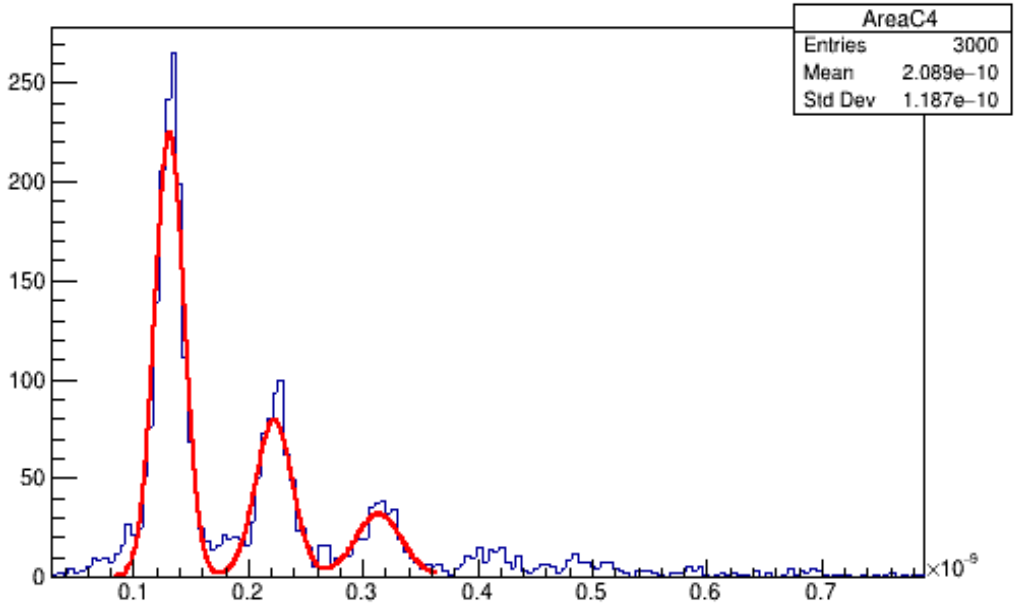
ADV



HAM 15um

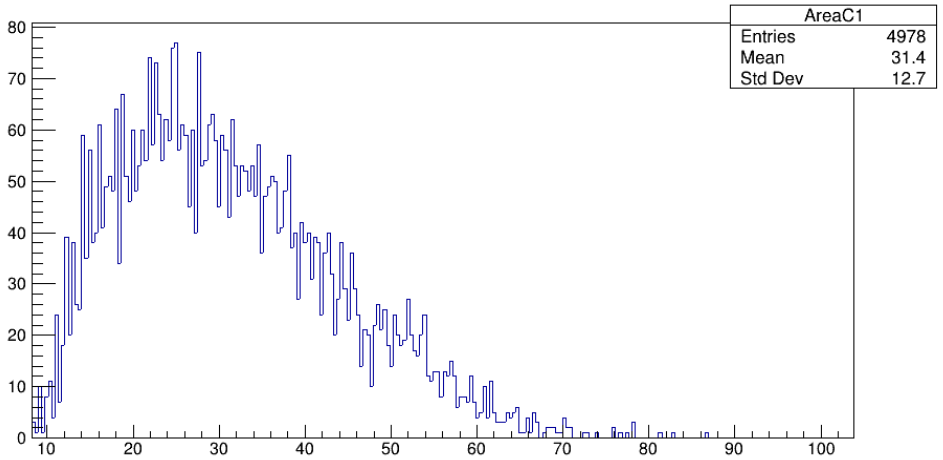


SiPM PCB

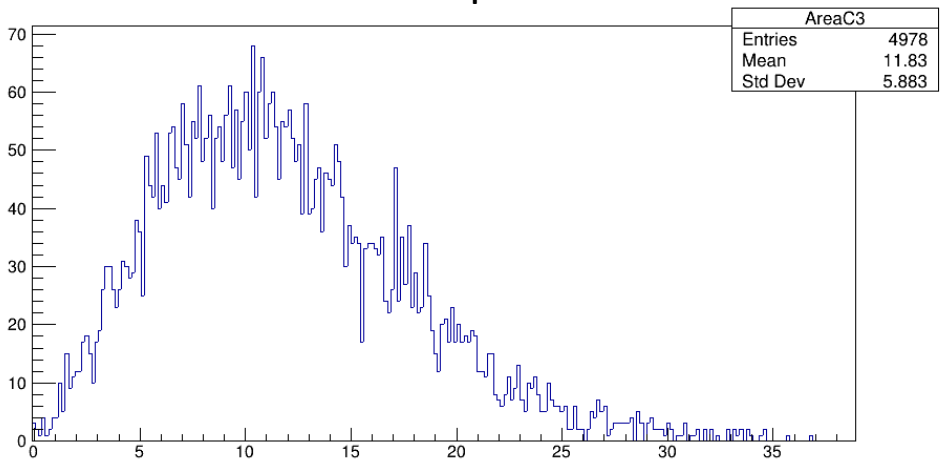


Sr-90 distributions

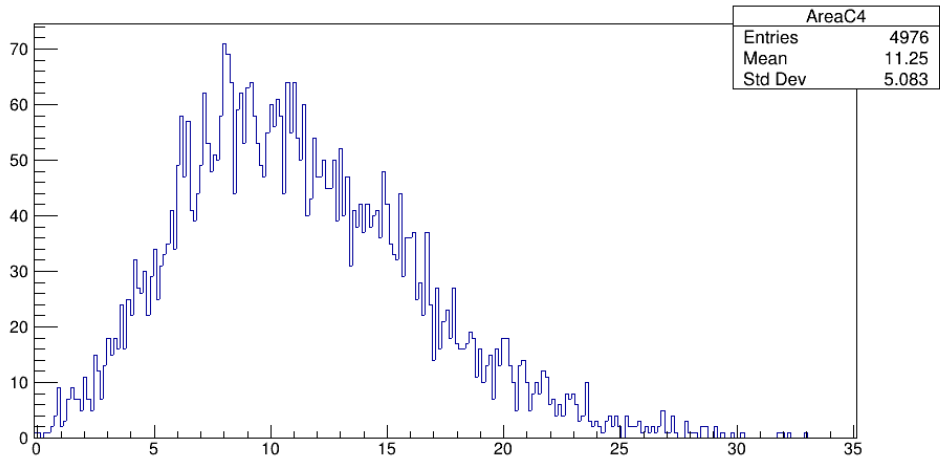
ADV side



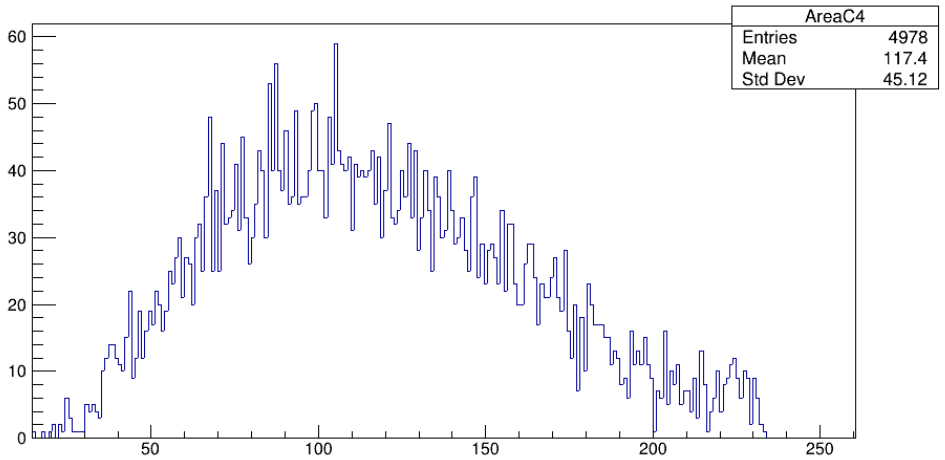
ADV top



HAM – 15 um



HAM-PCB – 50 um



Sr-90 distributions

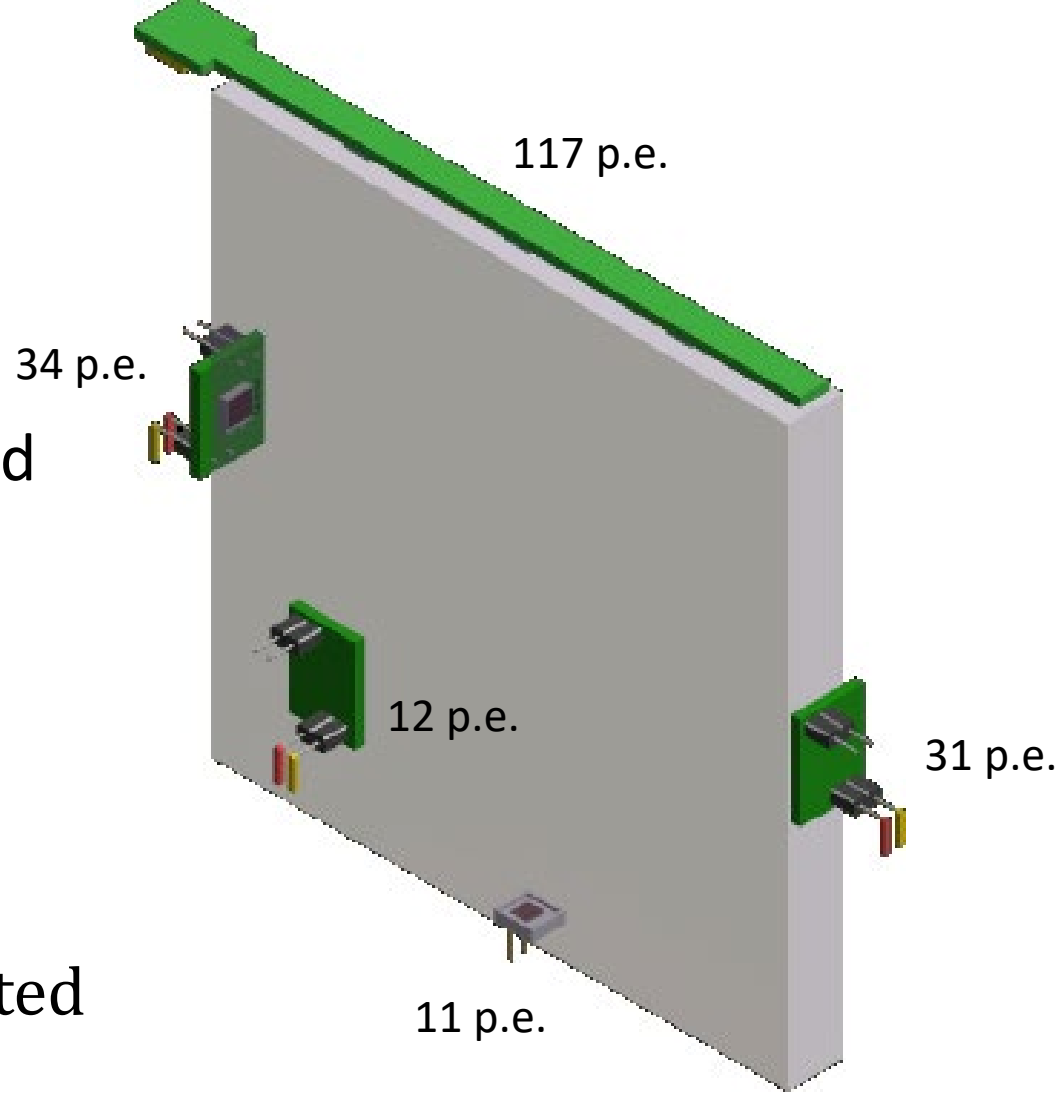
- ADV side are compatible with previous measurements
- ADV top has low photons, probably due to bad optical coupling → will be improved
- HAM_15um results are compatible*:

$$N_{HAM} = N_{ADV} \frac{PDE_{HAM}}{PDE_{ADV}} \frac{Area_{HAM}}{Area_{ADV}}$$

  - $N_{HAM\_15um} \approx N_{ADV} \frac{25\%}{40\%} \frac{9\ mm^2}{16\ mm^2} \approx 0.35\ N_{ADV}$
- HAM_PCB: we detect more light than expected

$$N_{HAM\_PCB} \approx N_{ADV} \frac{35\%}{40\%} \frac{3 * 9\ mm^2}{16\ mm^2} \approx 1.5\ N_{ADV}$$

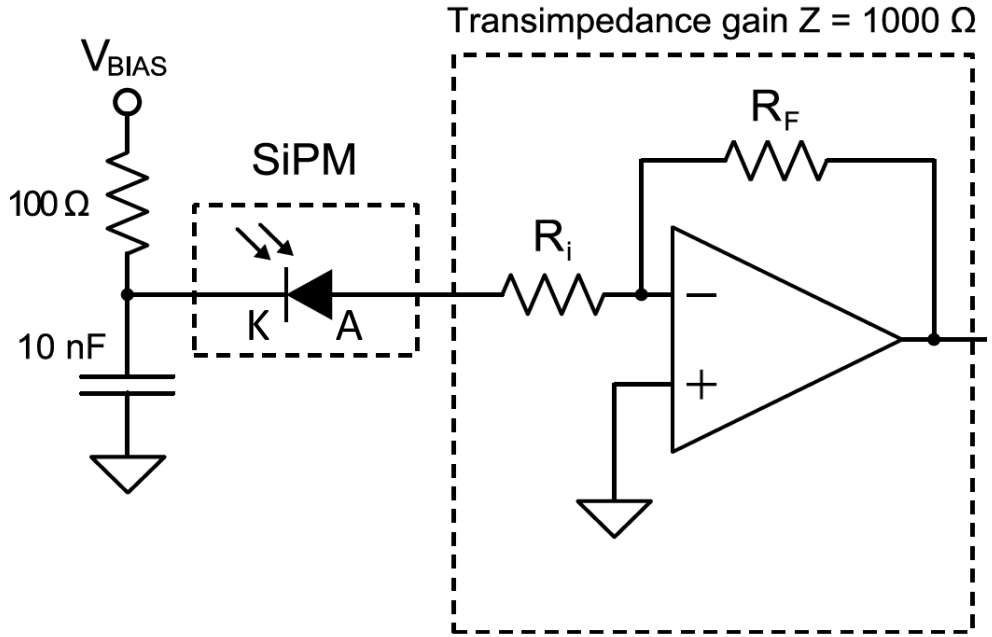
  - Must be corrected for the over-voltage:
    - Do we have operating voltages for these SiPMs?
    - We will measure the breakdown voltage

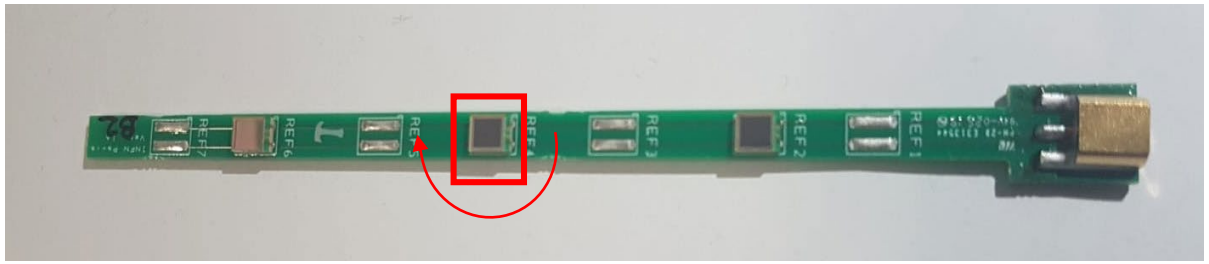


*PDE @ 400nm

Issues

- Issue with HAM SiPMs
  - 2 different operating voltages for HAM-15um and HAM-PCB → still need to study the best operating voltage for each SiPM
- Issue with HAM-PCB
  - The SiPMs are probably mounted in the opposite way:
    - Vbias is negative
    - Output signals are positive
  - Inverting the polarity of the cable doesn't work → current signal would be on the shield of the coaxial cable
  - SiPMs should be rotated by 180°
  - PCB designs would be helpful





Next steps

- Finalize assembly of this tile
  - Glue SiPMs except for HAM-PCB
- Assembly of second tile with optical glue ongoing

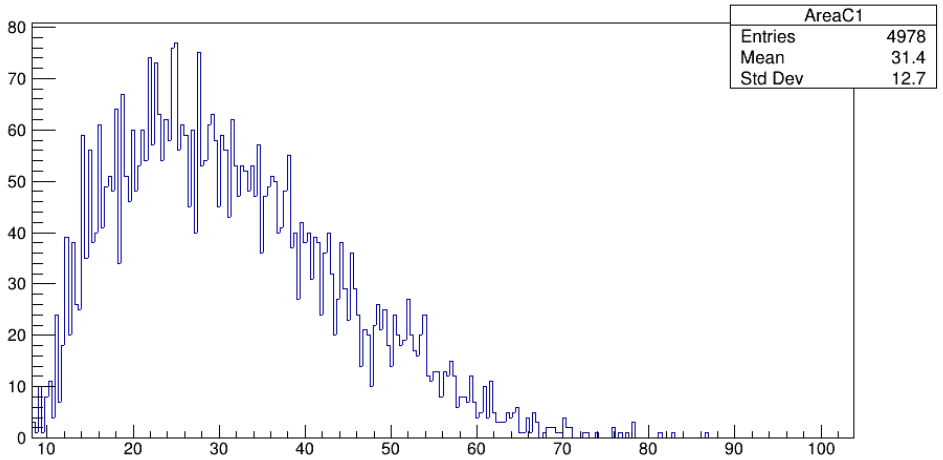
- Possible solution of HAM-PCB polarity:
  - Re-working of the HAM-PCB to invert polarity
    - High risk of damaging SiPM → not recommended
  - Produce new HAM-PCB and replace the present ones
  - Probably not necessary for CNAO test beam

- Need to understand the light detected on HAM-PCB

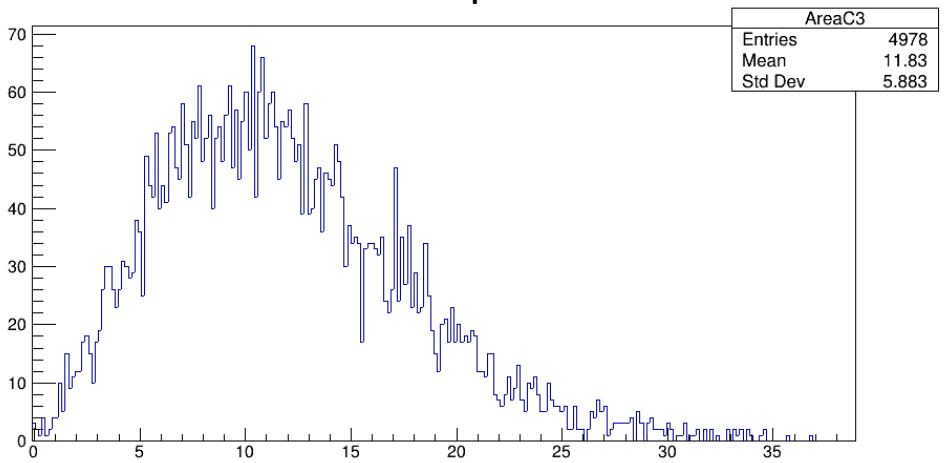
backup

Sr-90 distributions

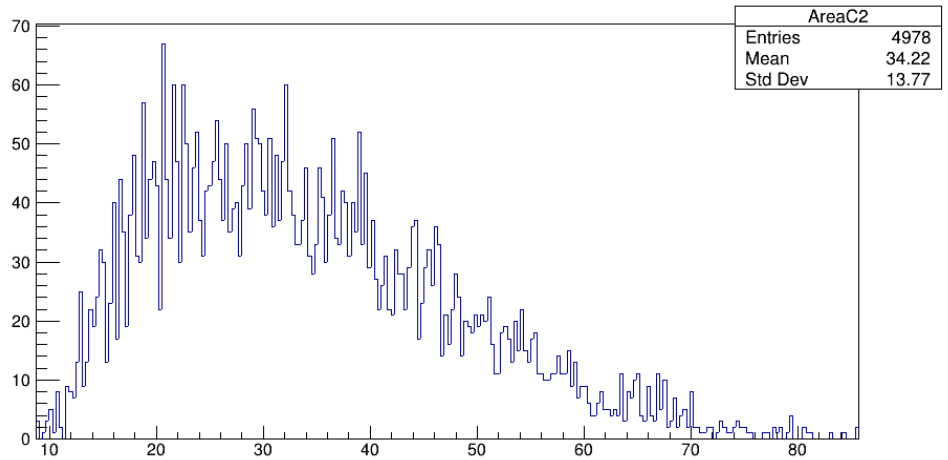
ADV side



ADV top

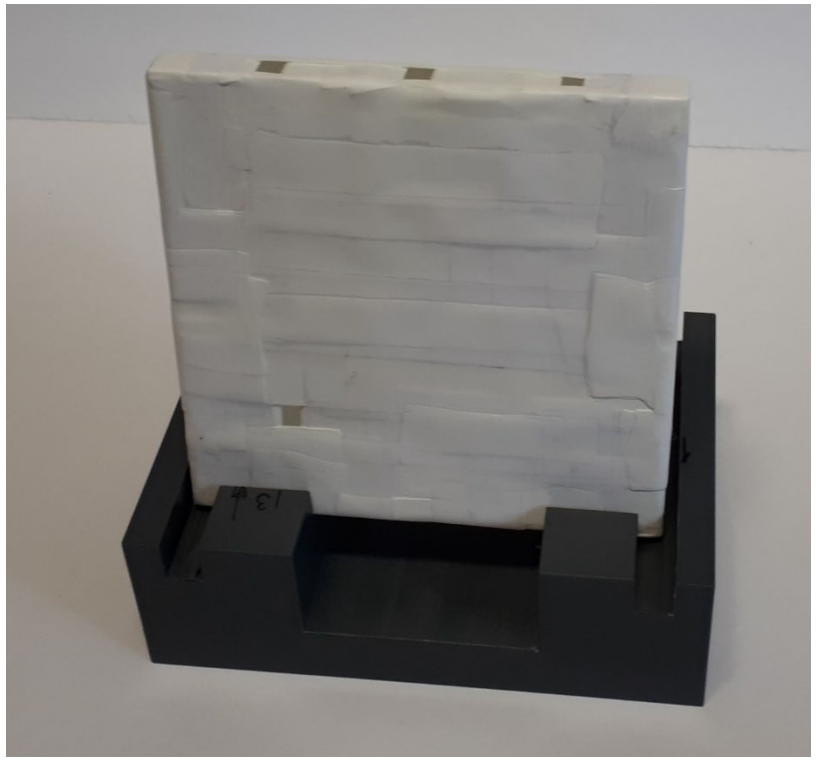


ADV side 2



Assembly procedure

- Wrapping teflon, 200 um thickness
  - 2 layers, but some parts have 3-4 layers due to overlap
- We leave small windows for SiPMs



Assembly procedure

- Wrapping teflon, 200um thickness
  - 2 layers, but some parts have 3-4 layers due to overlap
- We leave small windowsfor SiPMs
- SiPMs are coupled with optical grease
  - Black tape to secure SiPMs
  - Probably moving to optical glue instead of grease
- External layer of black tape for light insulation