ISOLDE Superconducting Recoil Separator

Plan de Recuperación, Transformación y Resiliencia

Financiado por la Unión Europea NextGenerationEU

IEM

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Focal plane detector (T2.5)

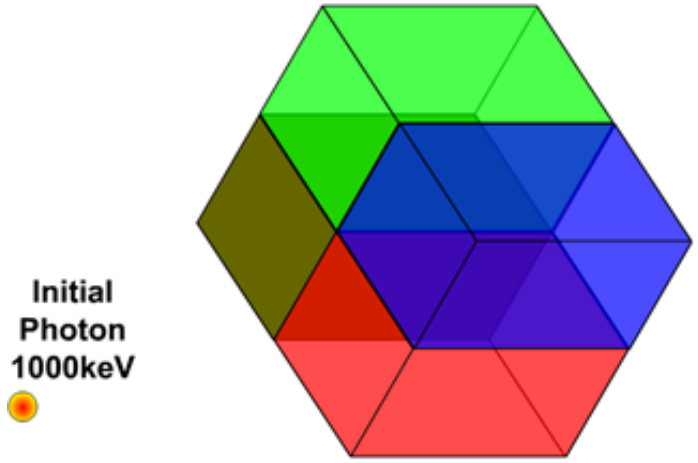
Luis Acosta
IEM-CSIC, Madrid

ISRS Collaboration meeting
November 25th, 2024

For the focal plane, a number of different detector are been proposed. During the last 9 moths (and previous test y 2022 and 2023) we have carried out several tests, particularly centred in the SiC detectors and its comparison with Silicon detectors.

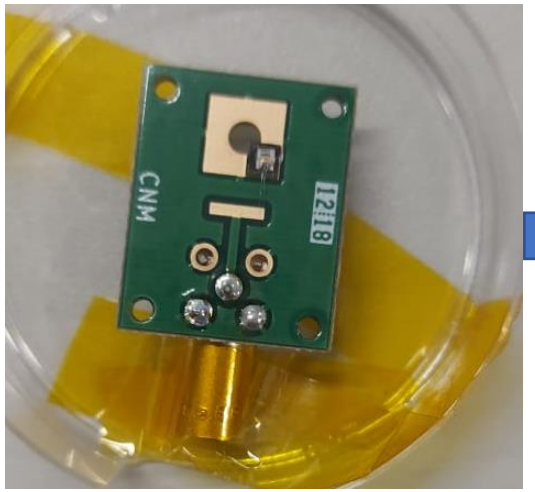
Focal plane detectors:
Si, SiC, LaBr3, BGO

The SiC detectors are a promising tool not just for a focal plane, but also as beam monitor and/or tagging system. (till $1x10^{-7}$ pps).

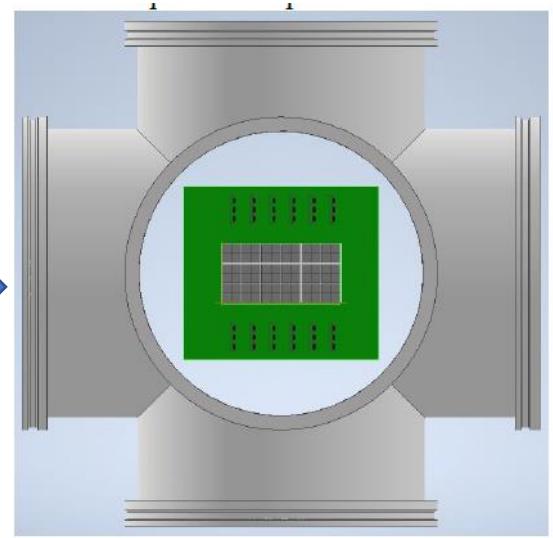


LaBr3 clover

BGO



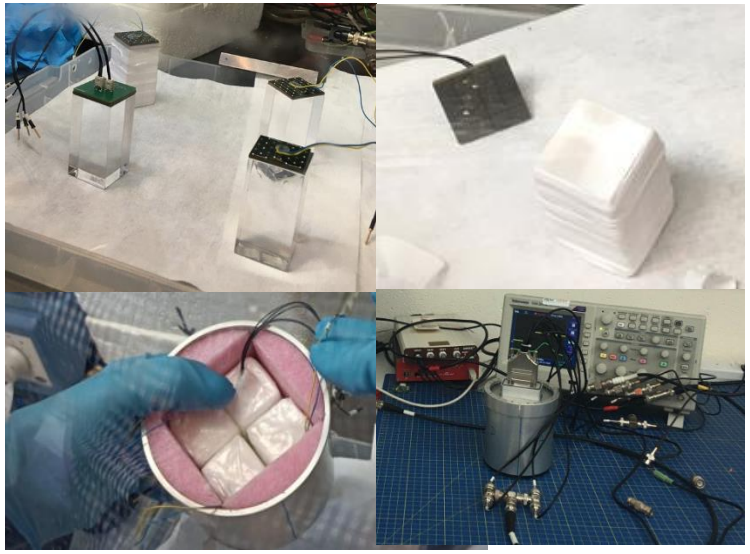
SiC



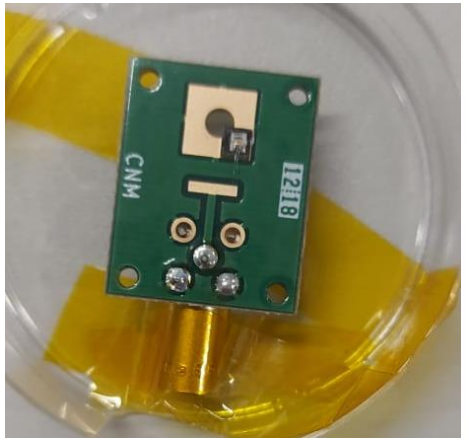
SiC as tagging system

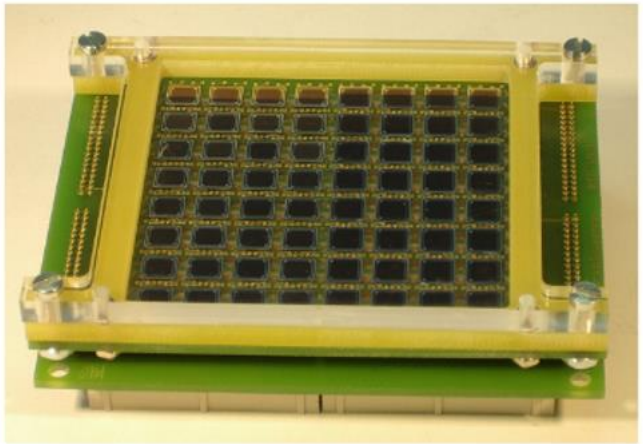
Critical elements of the focal plane

- Particle telescope with different detection layers and a dedicated readout system.
- The frontend electronics must face a twofold challenge, the wide dynamic range and the time resolution for ToF
  - ✓ Silicon Cardbide based detectors and fast scintillators.
    - ✓ Collaboration :
      - ✓ Chiara Guazzoni, Politecnico di Milano
      - ✓ Nara Singh Bondili, University of the West of Scotland



BGO





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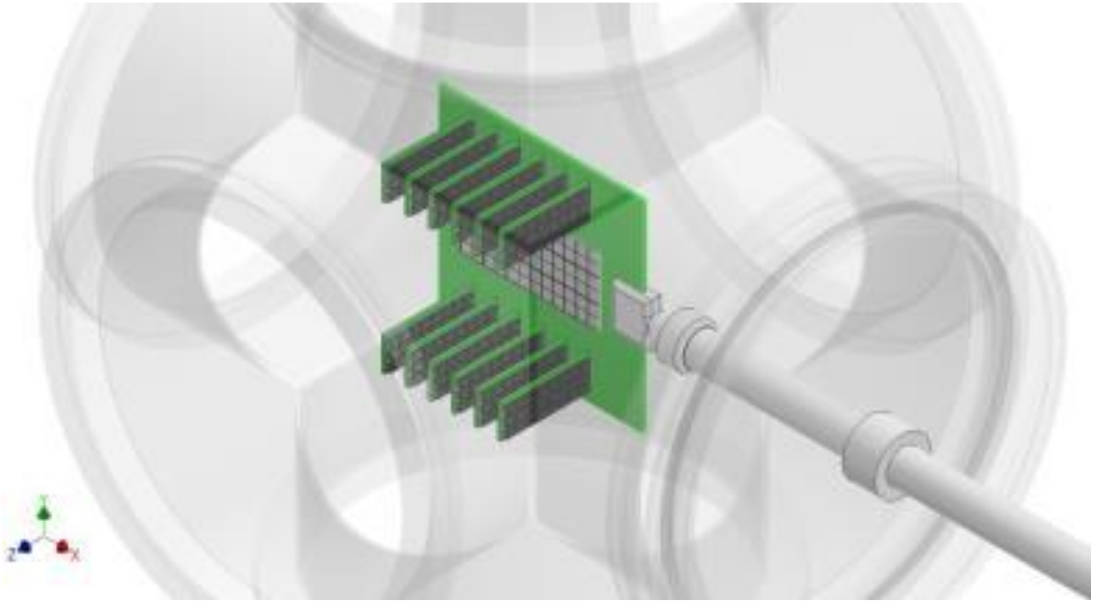
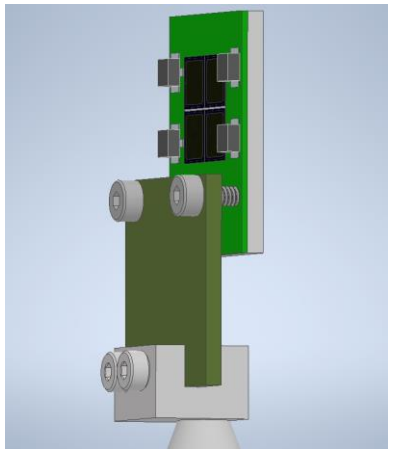
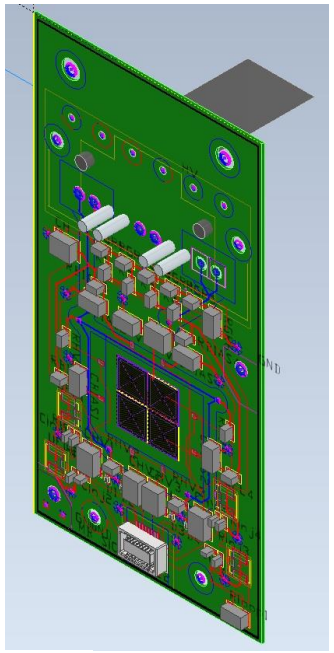
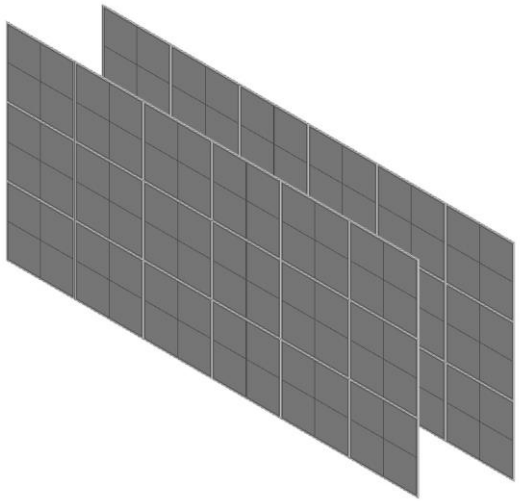
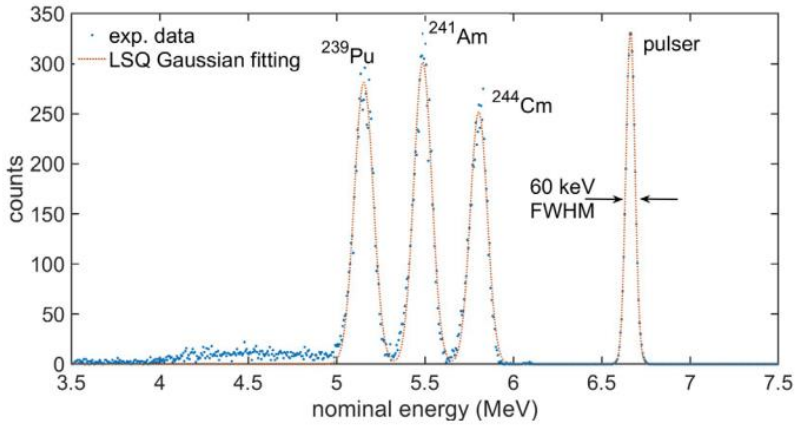
SiC first interactions (2022)







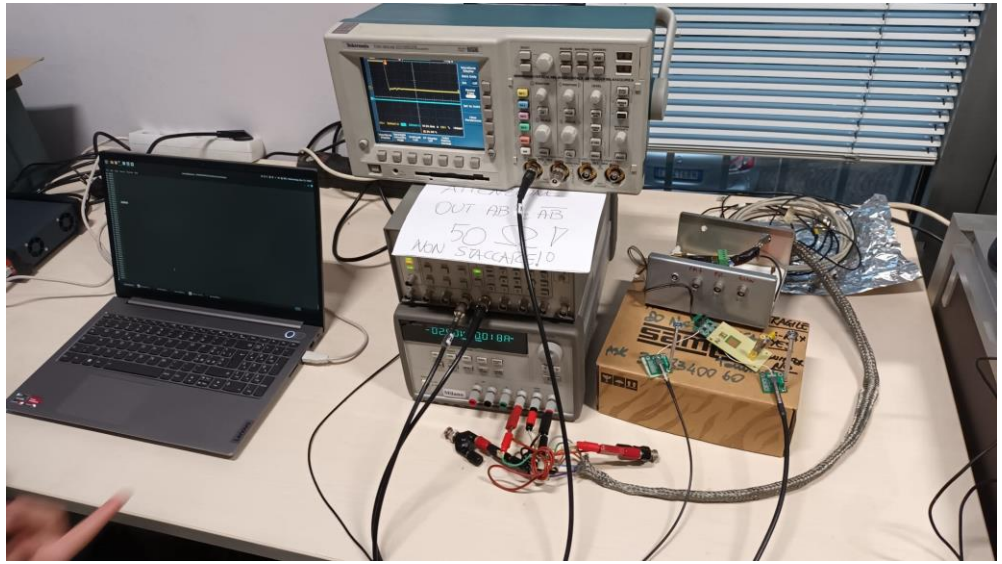


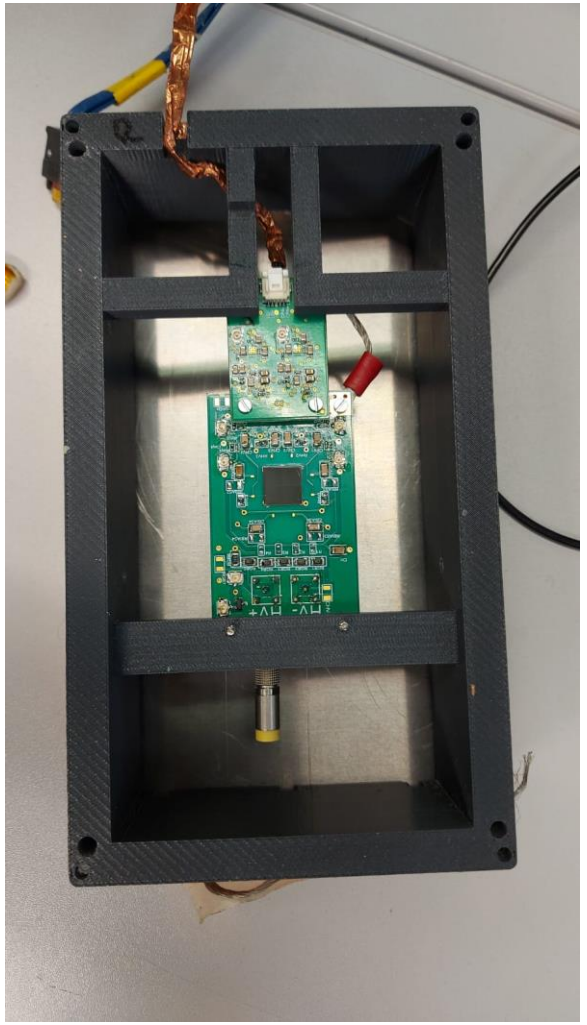


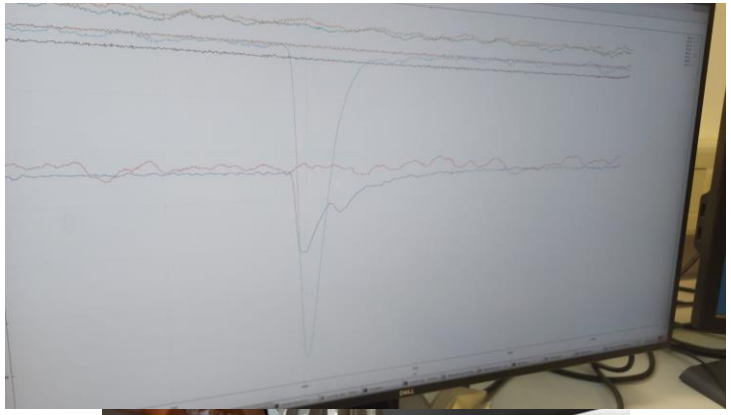
First studies of SiC detector for FRAISE project LNS-INFN and POLIMI, show the ASIC devoted to the system.

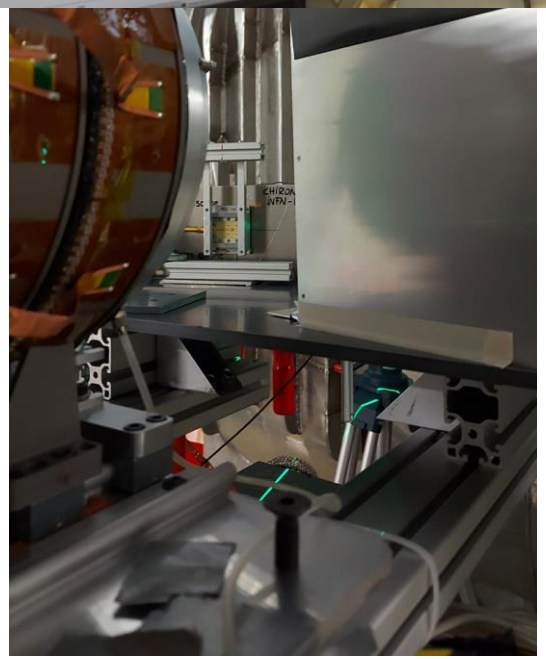
100 micron and 60 keV res.

SiC first interactions: Trying with commercial Digitizers (POLIMI-GSI)







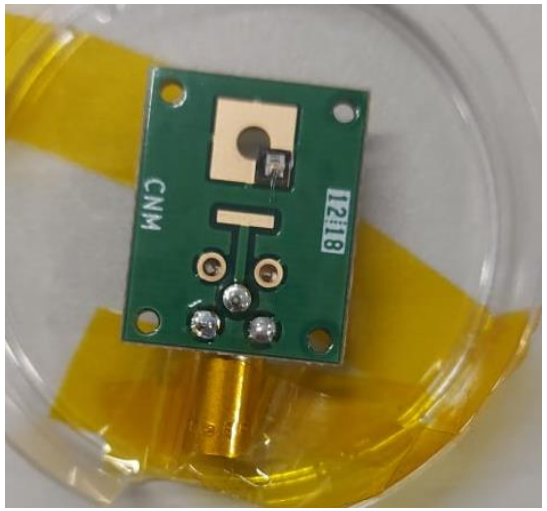


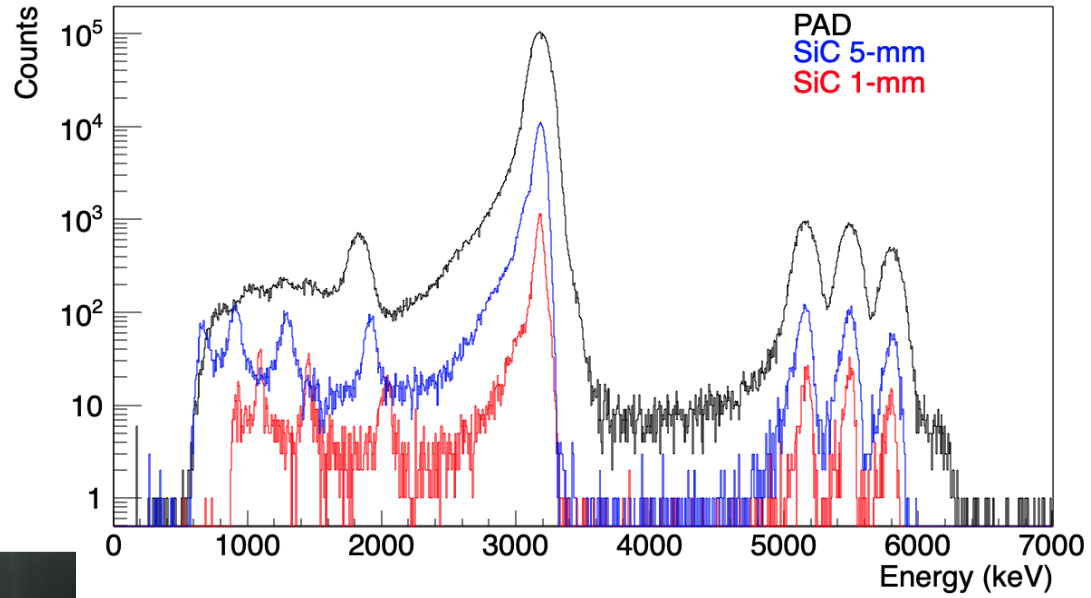
Prototype tested at POLIMI (LNS-MI-CSIC) using the ASIC + 8 channels digitizer CAEN module.

First test with beam carried out at GSI as parasitic setup of the S122 “test for the experiment”.

Very few coincidences between plastic an SiC were observed.

SiC developed at IMB-CSIC for ISRS project (IEM-CSIC)





MVLC vme controller, MSI-8, MDPP16-L QDC digitizer module

We obtain a resolution of about 60 keV for the 1mm SiC, 80 keV for the 5mm SiC and 150 keV for the Si PAD

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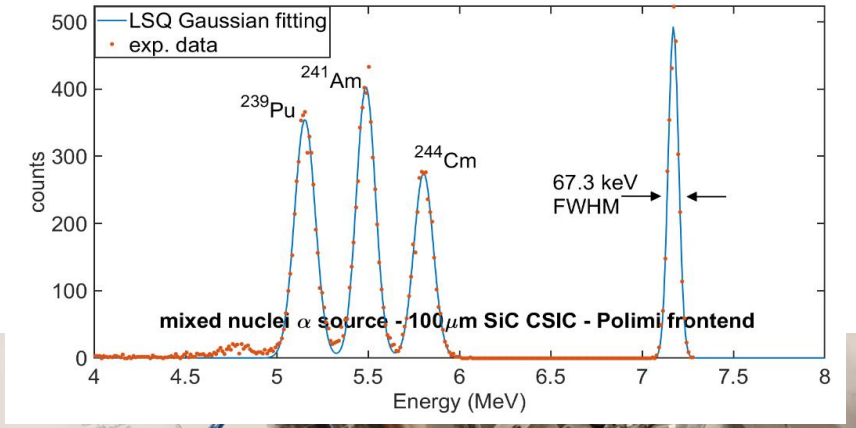
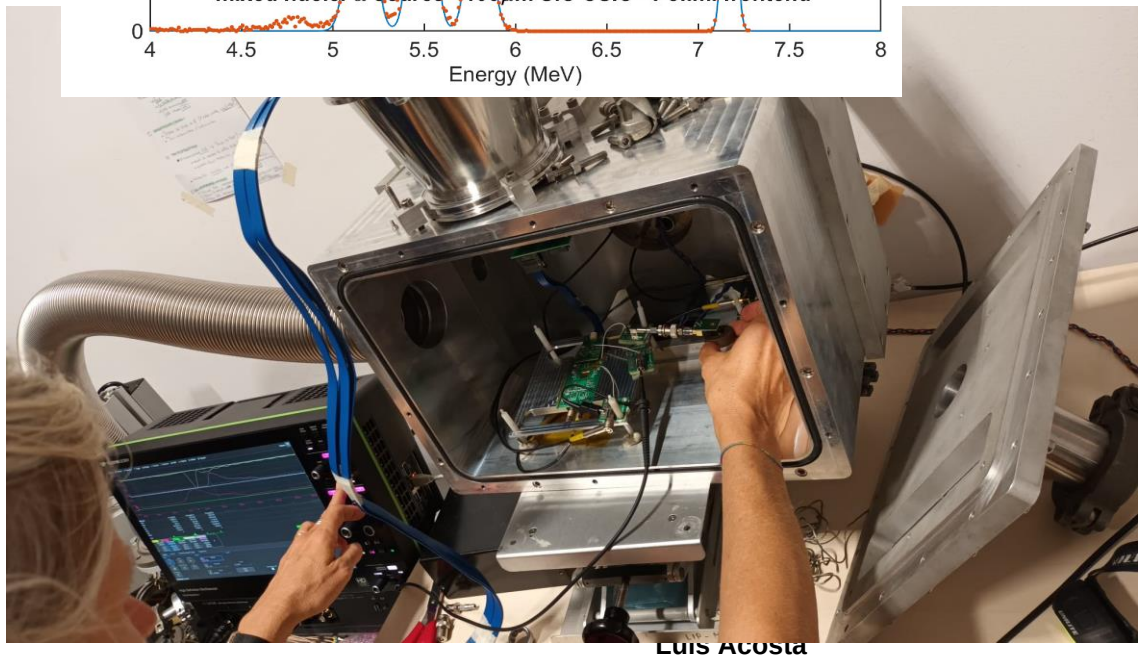
SiC-CSIC test at POLIMI (with MI-ASIC) and recent 2nd round at IEM-CSIC (using Multichannel+ORTEC modules)

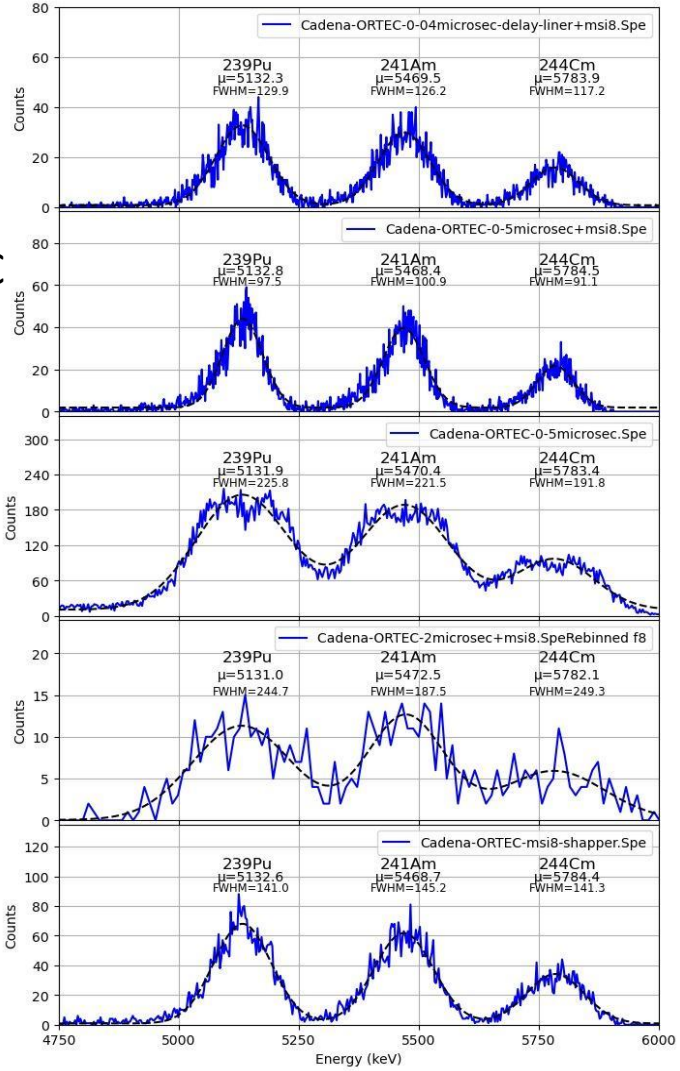
POLIMI lab setup

They kept the 5 mm 50 micron detector for further adaptation





MSI-8 PA signal ORTEC 142 + 671 ORTEC Delay-liner ORTEC + Maestro Multichannel



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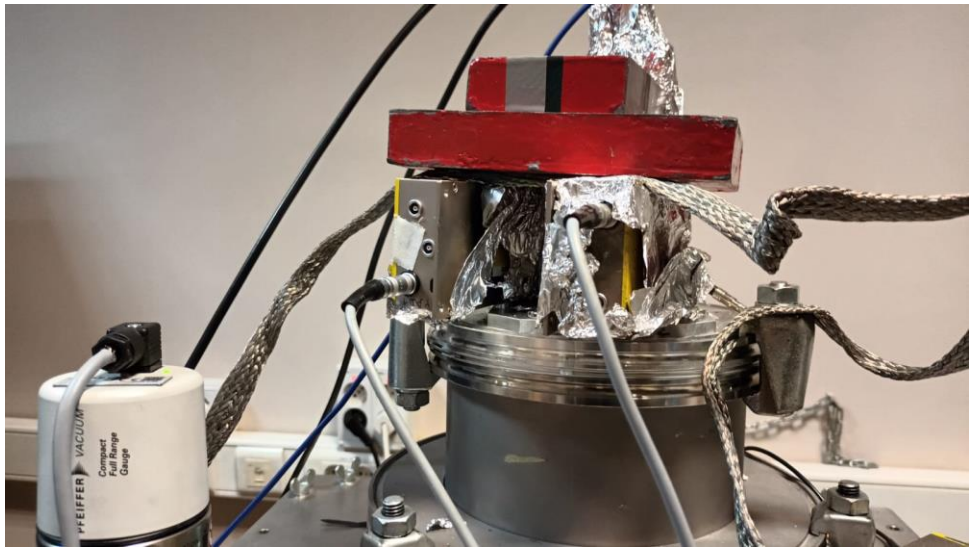
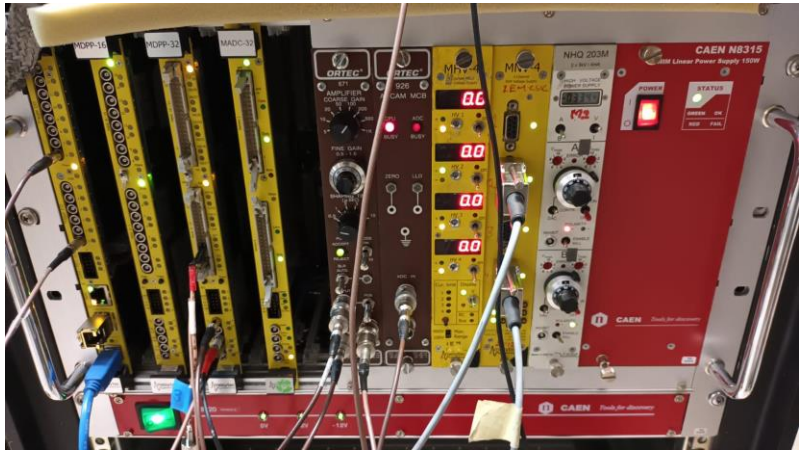
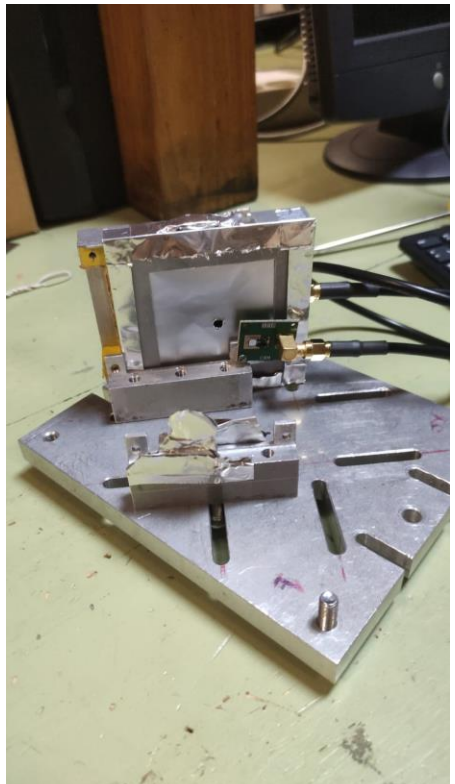
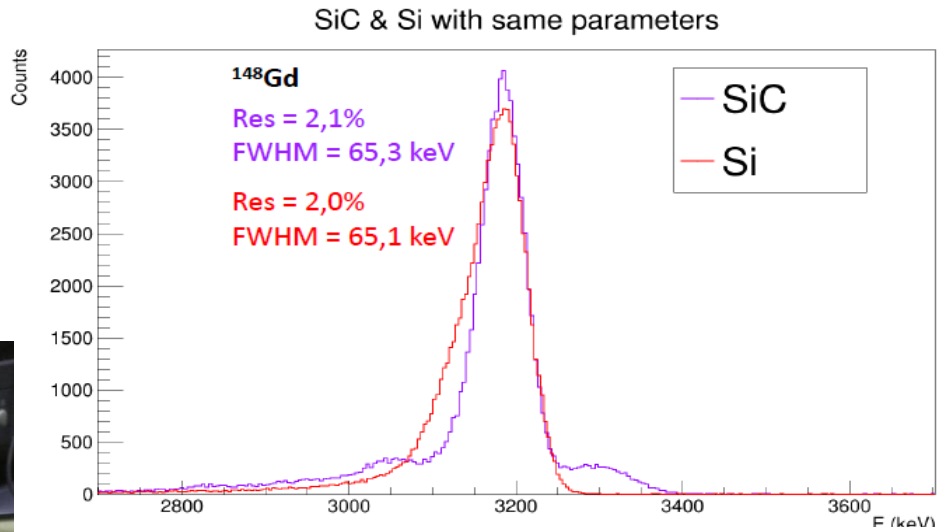
SiC vs Si test at IEM-CSIC: 3nd round, using Mesytec MPR-1, Cividec (for diamond module) along to DAQ-Mesytec and Maestro Multichannel

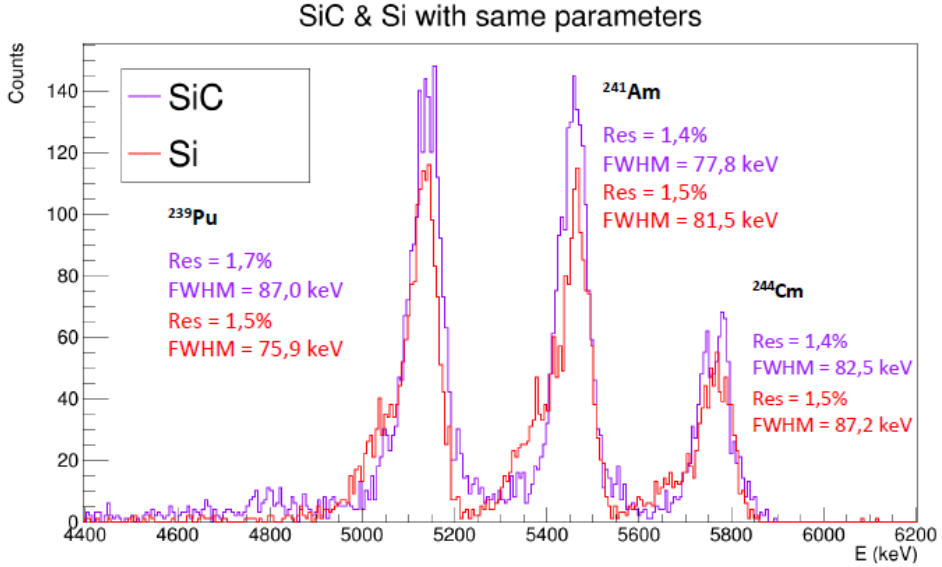




Fine tunning of MDPP-32 Mesytec module







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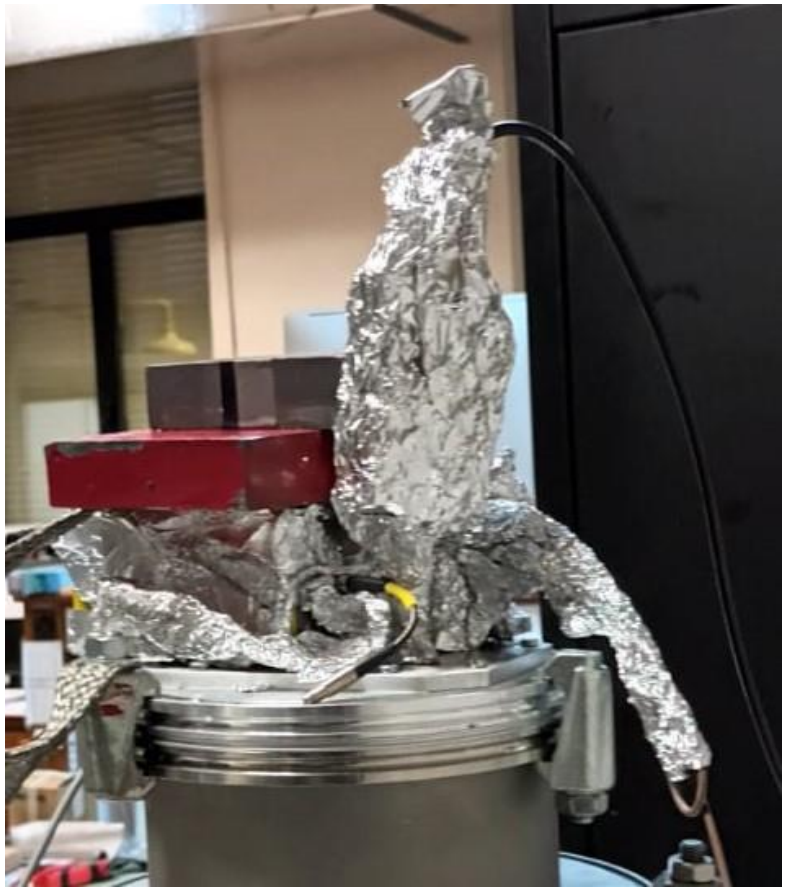
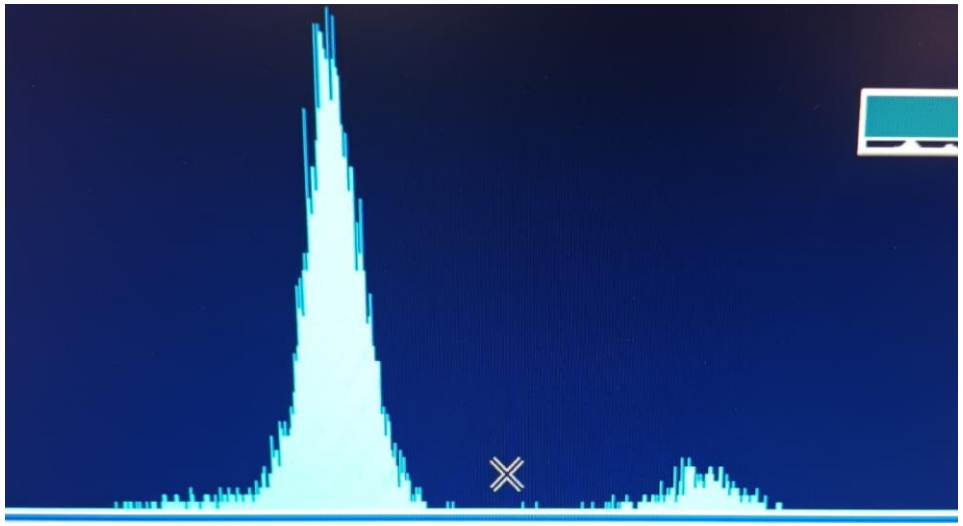
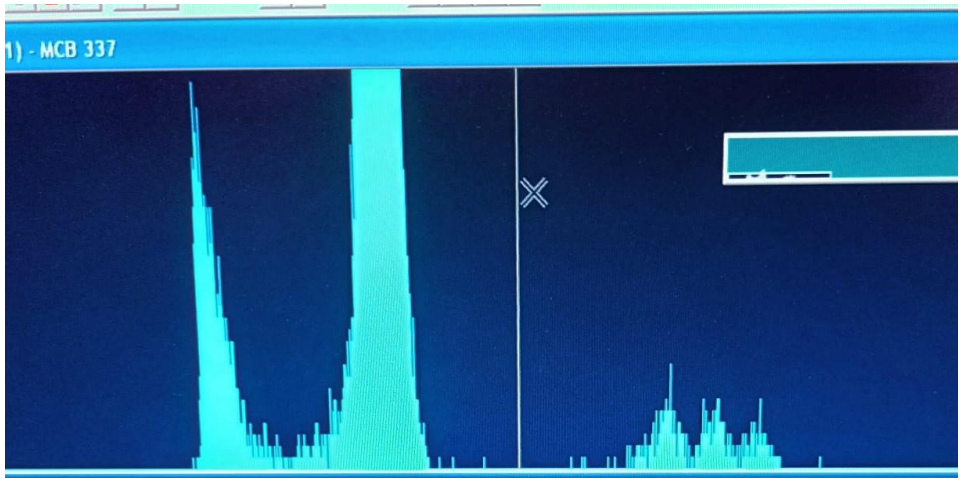


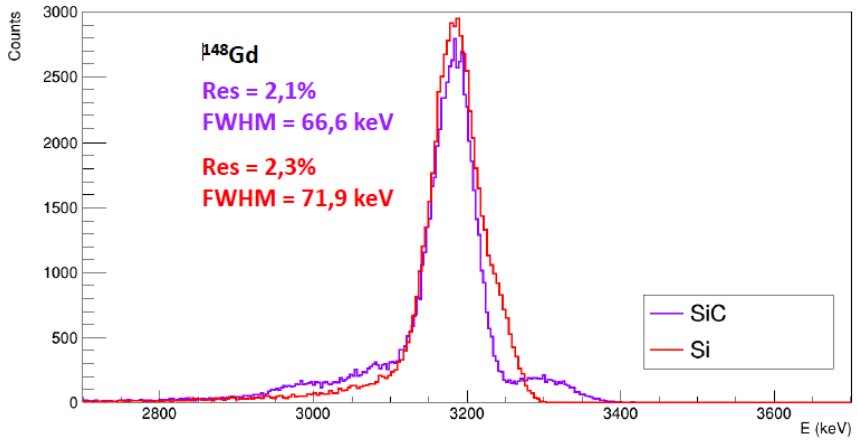
SiC: gadolinium + triple alpha source



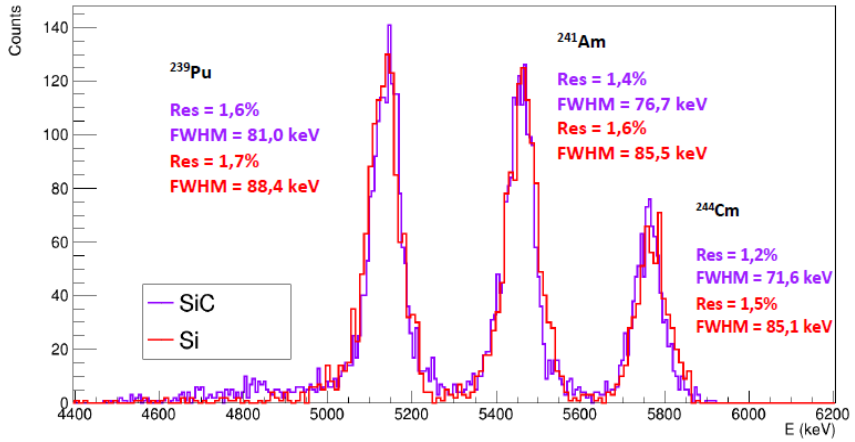
Si: gadolinium + triple alpha source



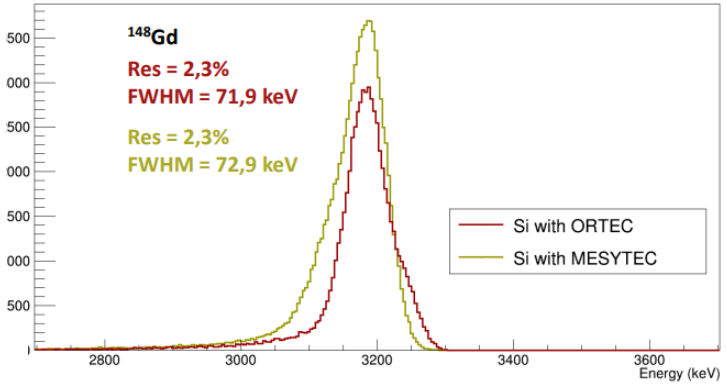
SiC vs Si test at IEM-CSIC: 3nd round, using Mesytec MPR-1, Cividec (for diamond module) along to DAQ-Mesytec and Maestro Multichannel

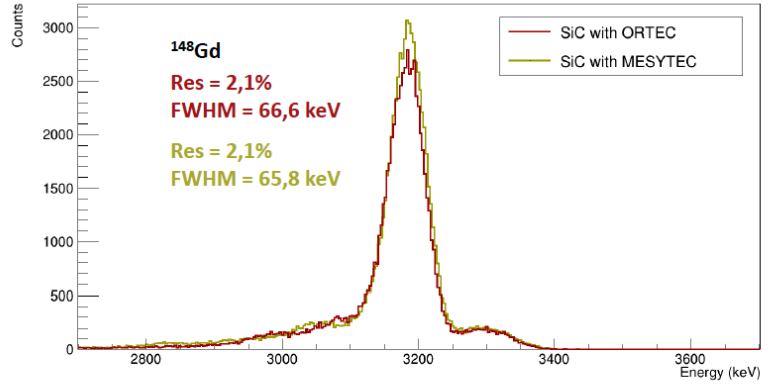


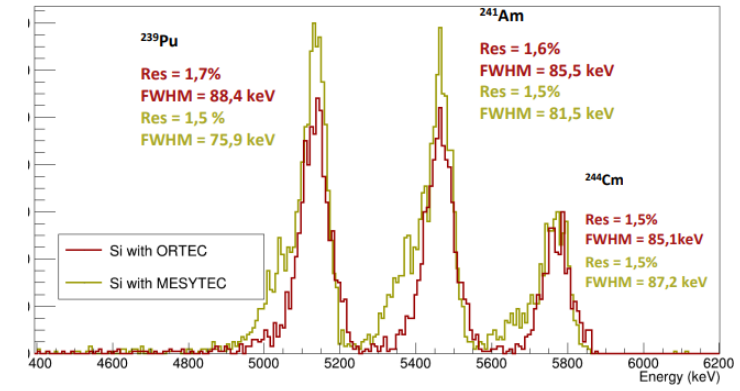
MPR-1 + ORTEC 671 Amp on Maestro

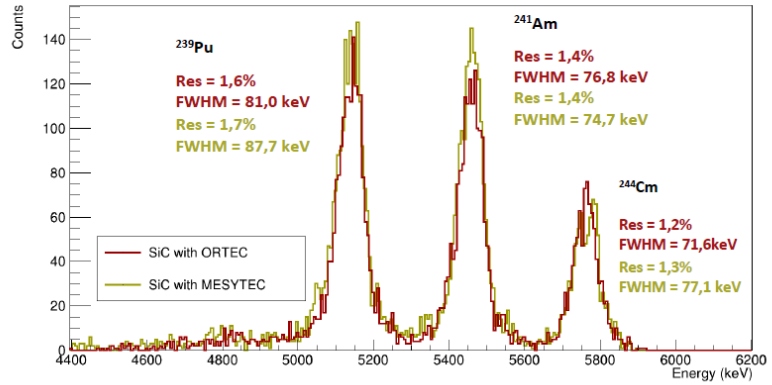


Comparison between ORTEC chain + Maestro data taking Mesytec digitizer for SiC and Si detector. Both cases use the MPR-1 readout









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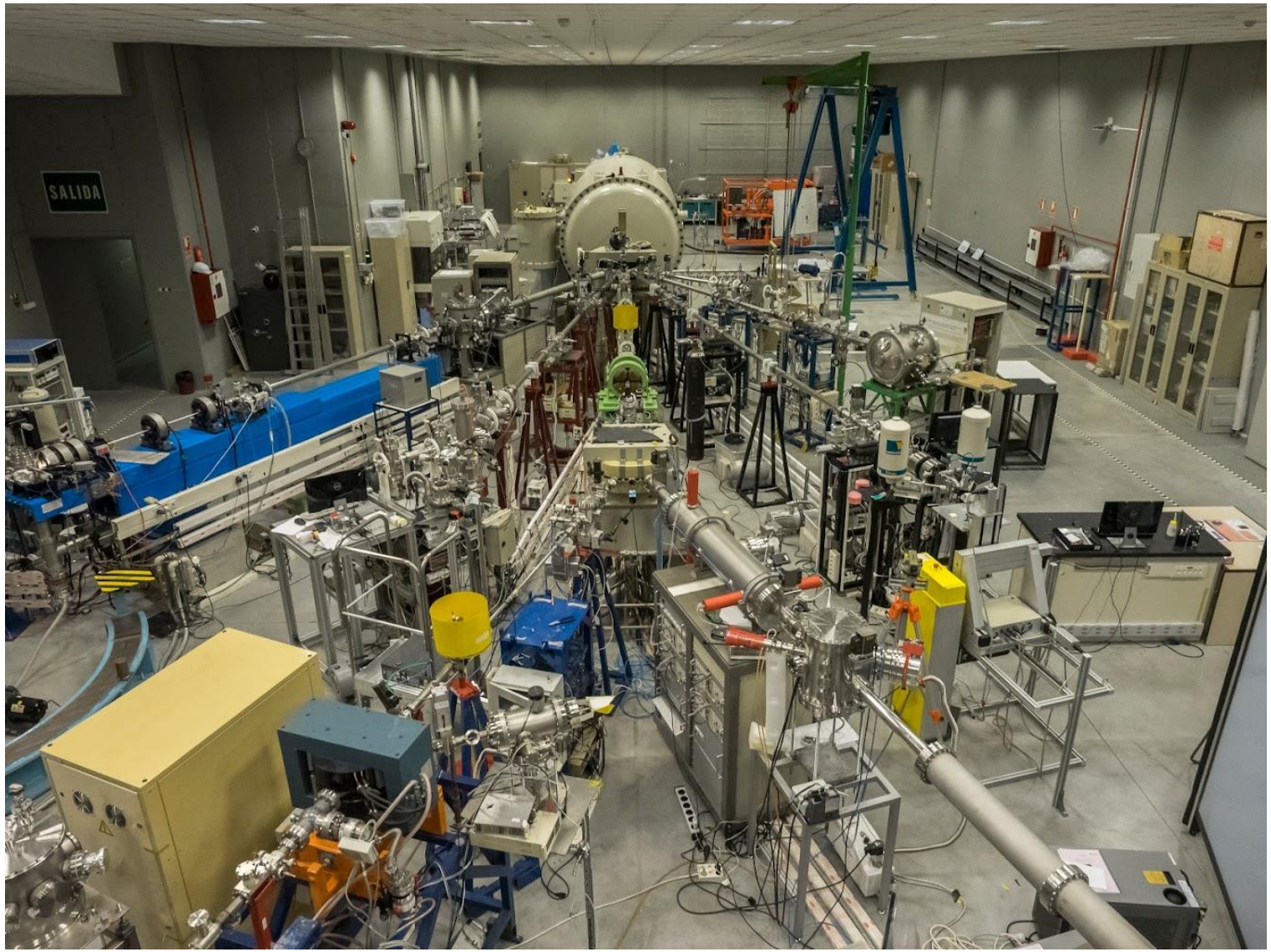
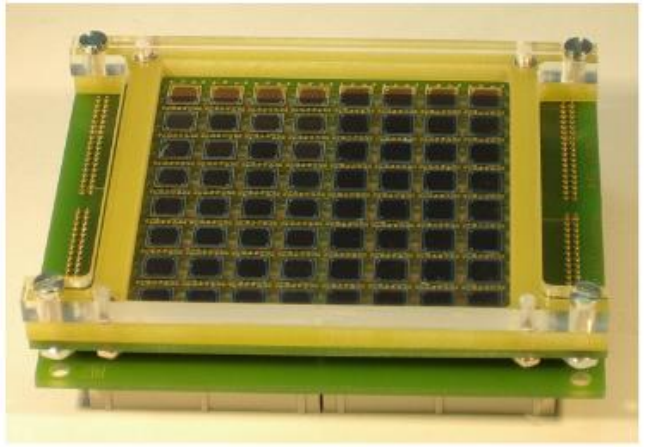
Further studies to be carried out at CMAM Madrid

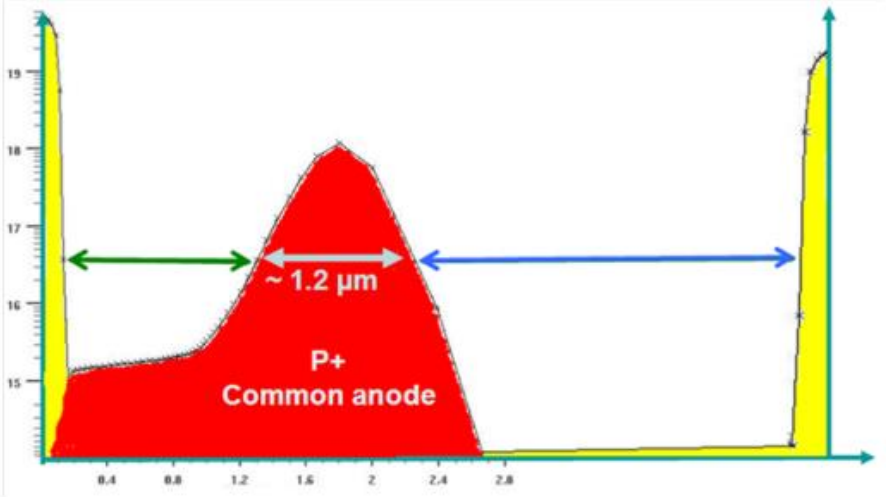
Using the best solution with beams, including the photon arrays (still in the waiting list)



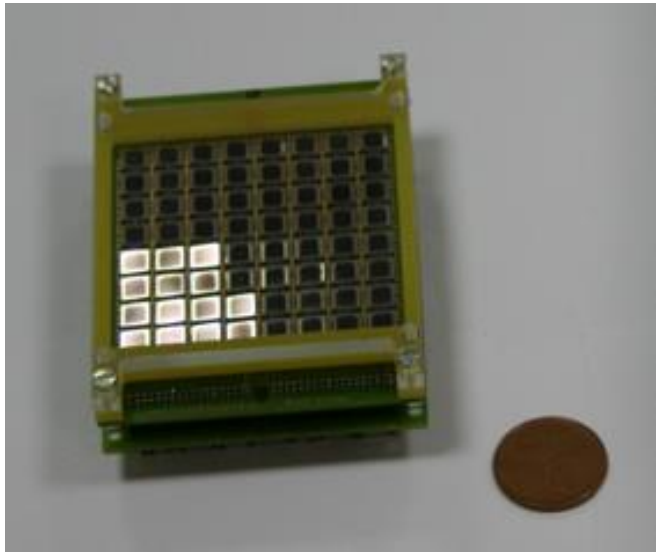
Monolithic Si Detector (will be included in CMAM test)

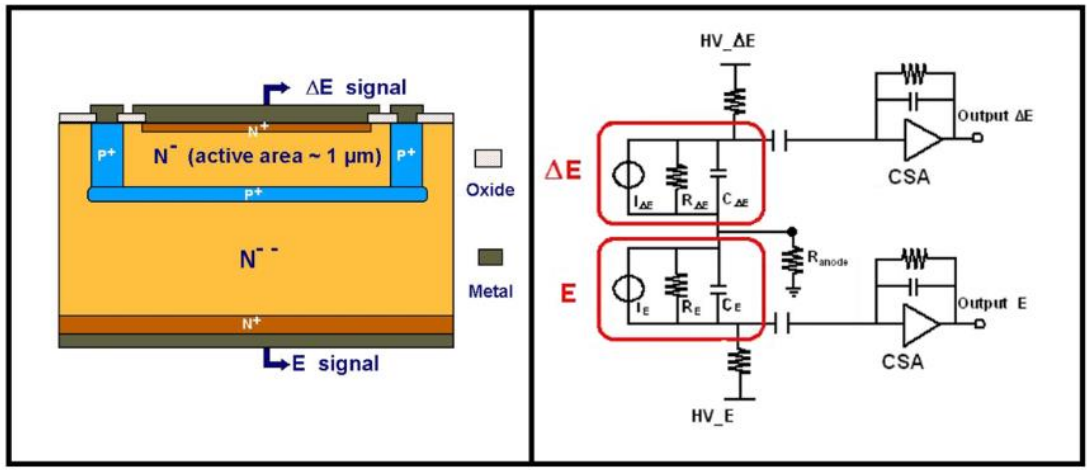


a) Photo of the monolithic detector.

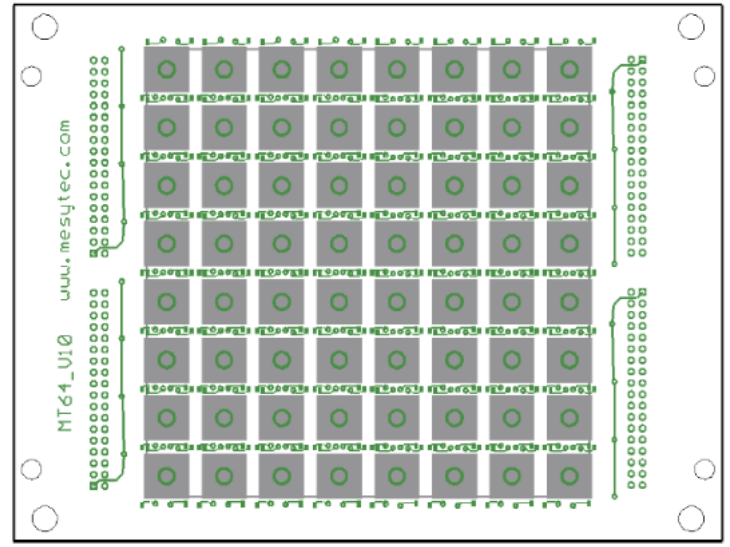


b) Doping structure of the Si wafer.





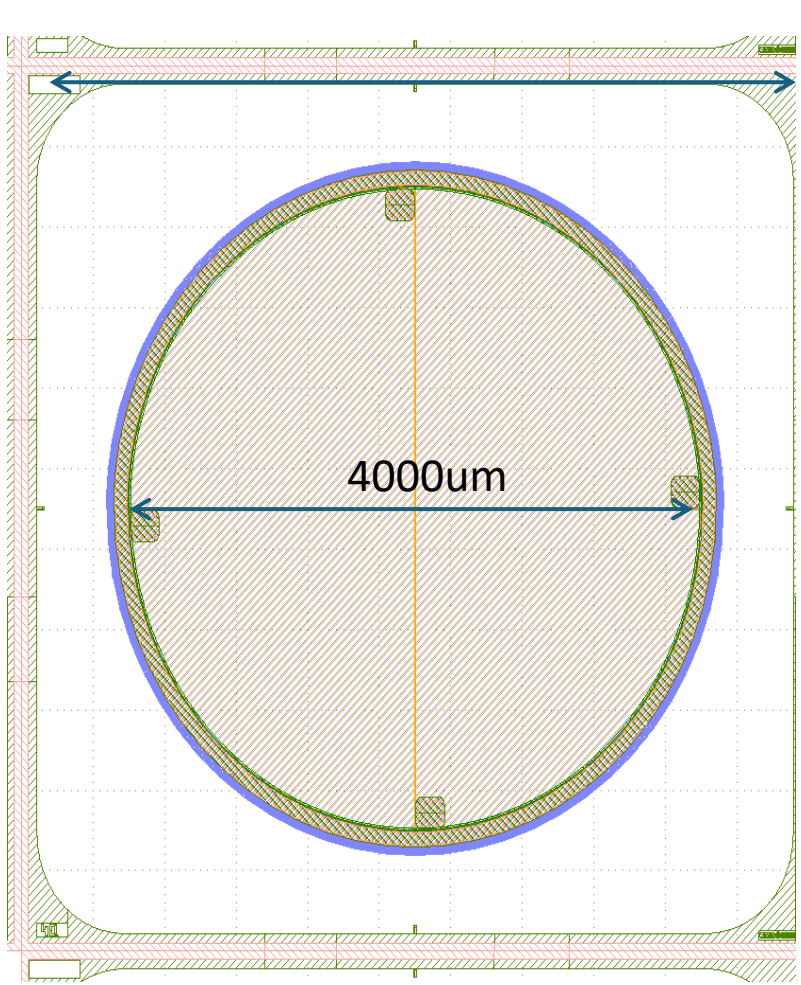
c) Electronic equivalent circuit of the monolithic detector.

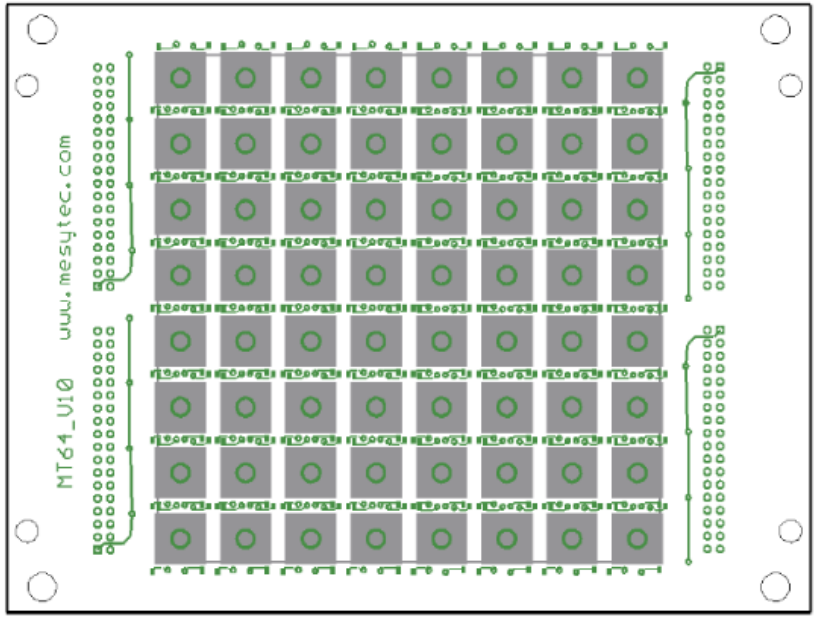


Build new SiC detectors coming in the future months

The dice is 5500 um x 5500um
Active diameter is 4000um
The quadrant has a radius of 2000um

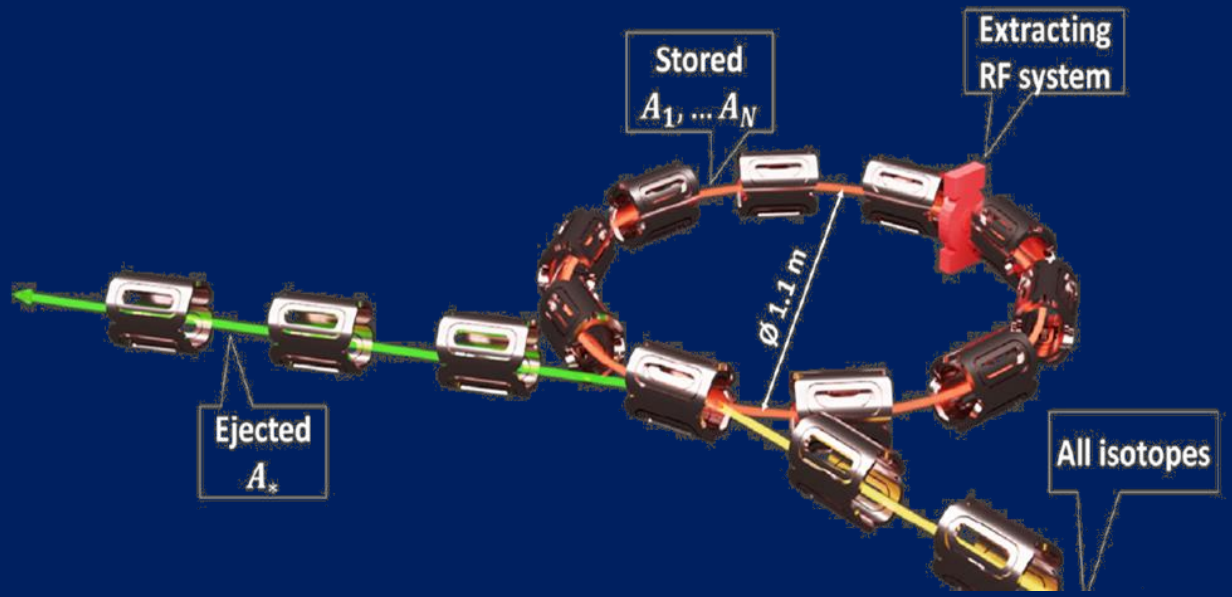
Giulio Pellegrini
performance at IMB





32 diodes of 50µm

32 diodes of 100 µm



That's all folks

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Juan F. González (IEM-CSIC)

Giulio (IMB-CSIC)

Chiara Guazzoni (POLIMI)
Mattia Pozzi (POLIMI)
Carlo Stucchi (POLIMI)
Andrea Castoldi (POLIMI)

Nunzia Martorana (LNS-INFN)
Giuseppe D'Agata (LNS-INFN)

Nara Singh (UWS)