ISOLDE Superconducting Recoil Separator

Plan de Recuperación, Transformación y Resiliencia

Financiado por la Unión Europea NextGenerationEU

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Test bench for the ISOLDE Superconducting Recoil Separator ISRS

Sergio Sánchez Navas
CSIC-IEM, Madrid (Spain)

ISOLDE Workshop and Users Meeting
November 27th, 2024

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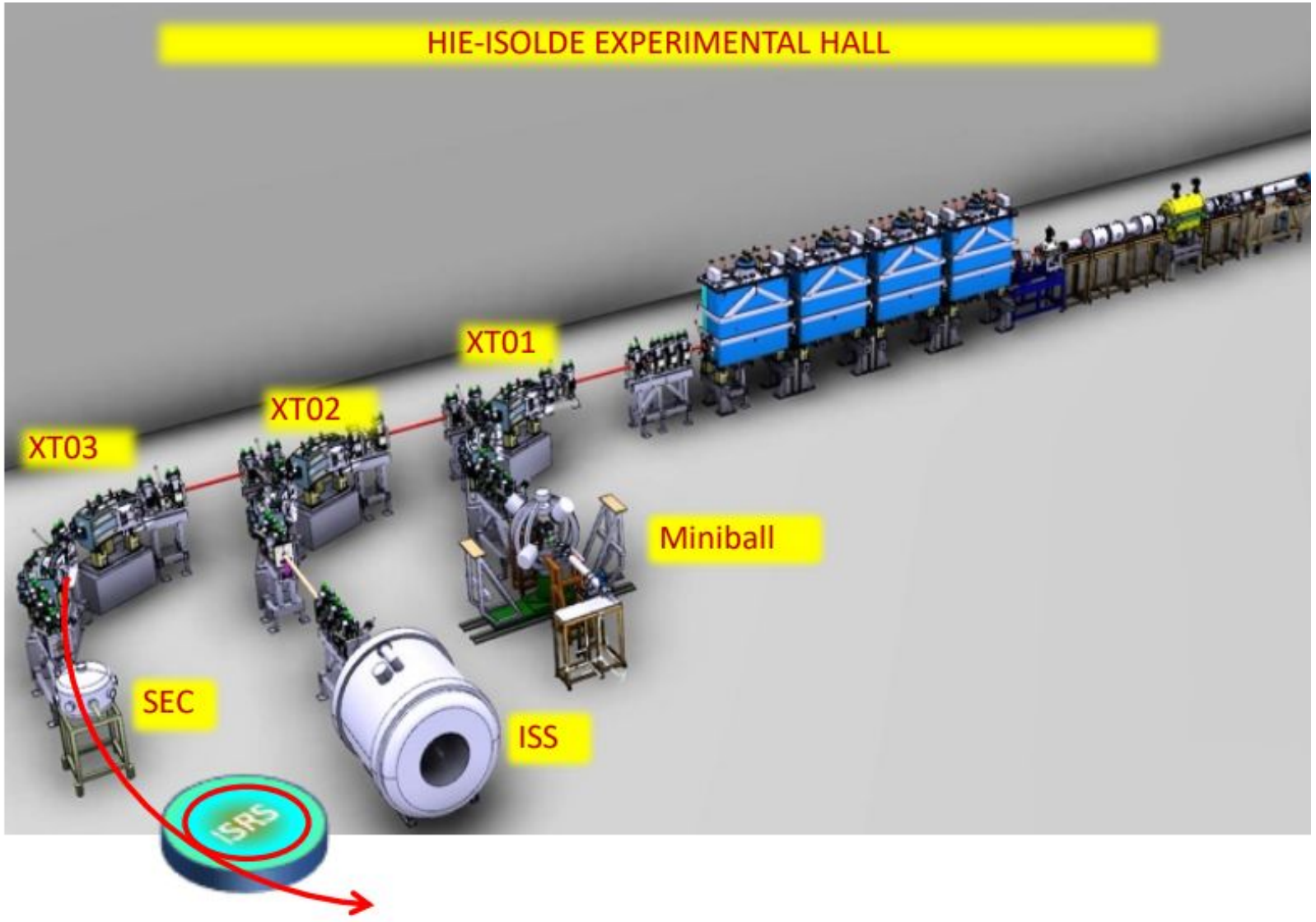
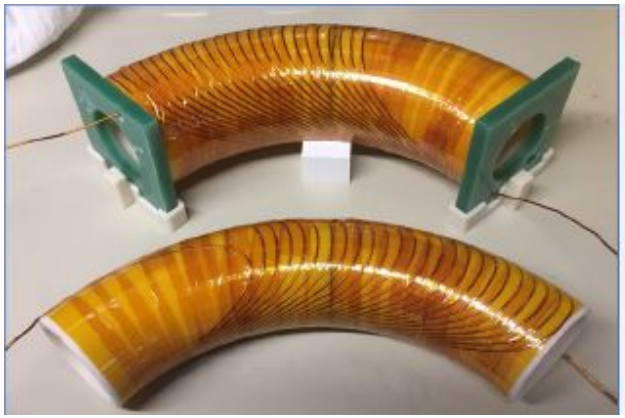
Location

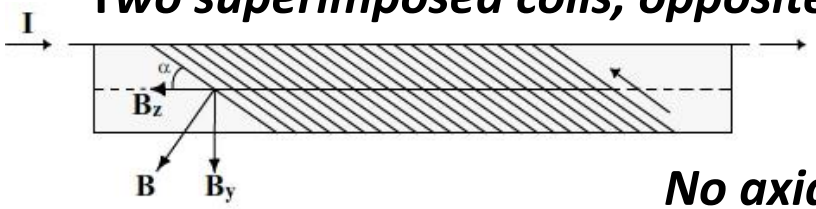


Canted Cosine Theta (CCT)



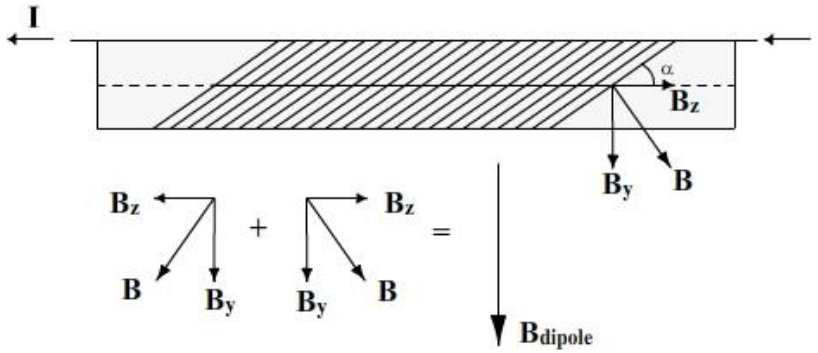
test bench at CERN

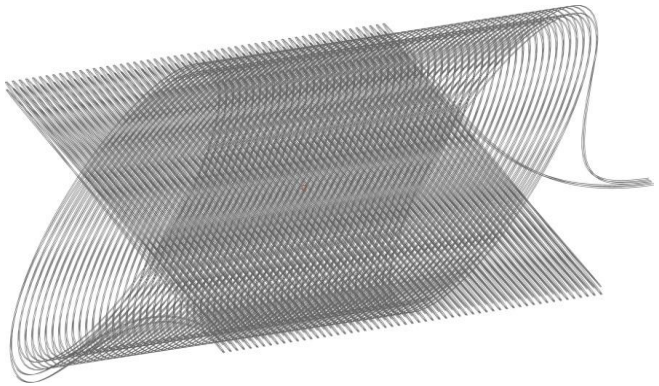
Two superimposed coils, oppositely skewed



pure cosine-theta field

No axial field.

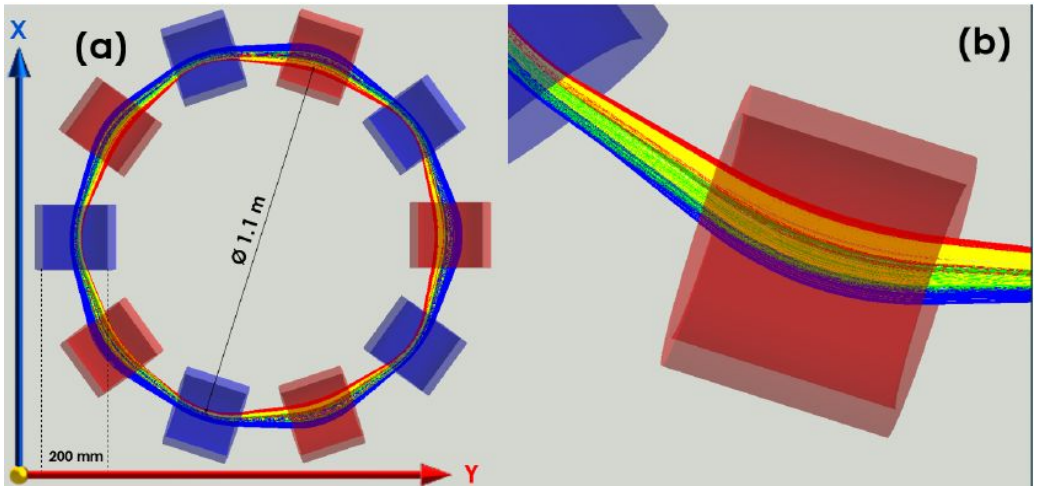




Ion optics

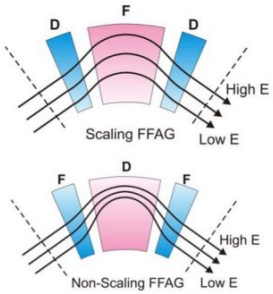
Fixed field alternating gradient (FFAG) focus

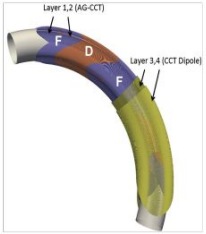
Significantly reducing the size with respect to standard recoil separator configurations



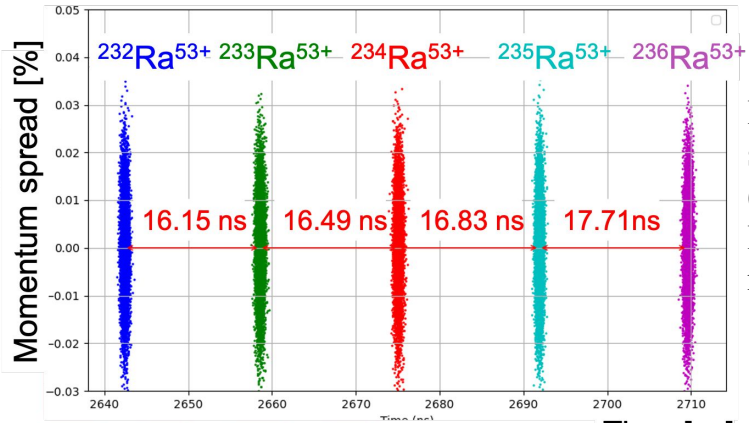
FFAG optics

- DFD or FDF focusing triplet for FFAG lattice
- Combined function magnets as rbends



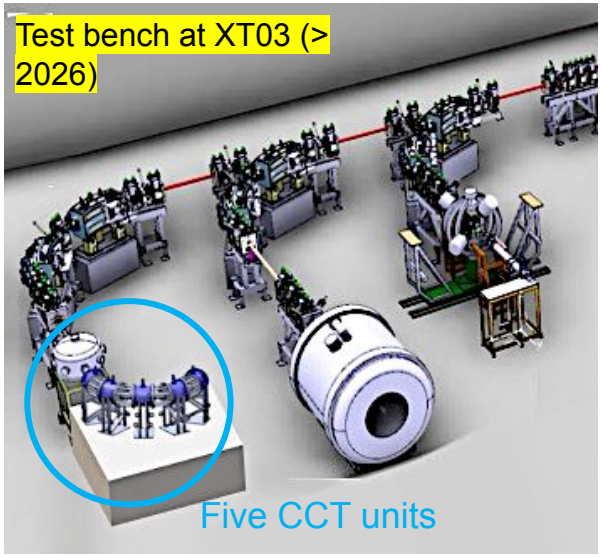


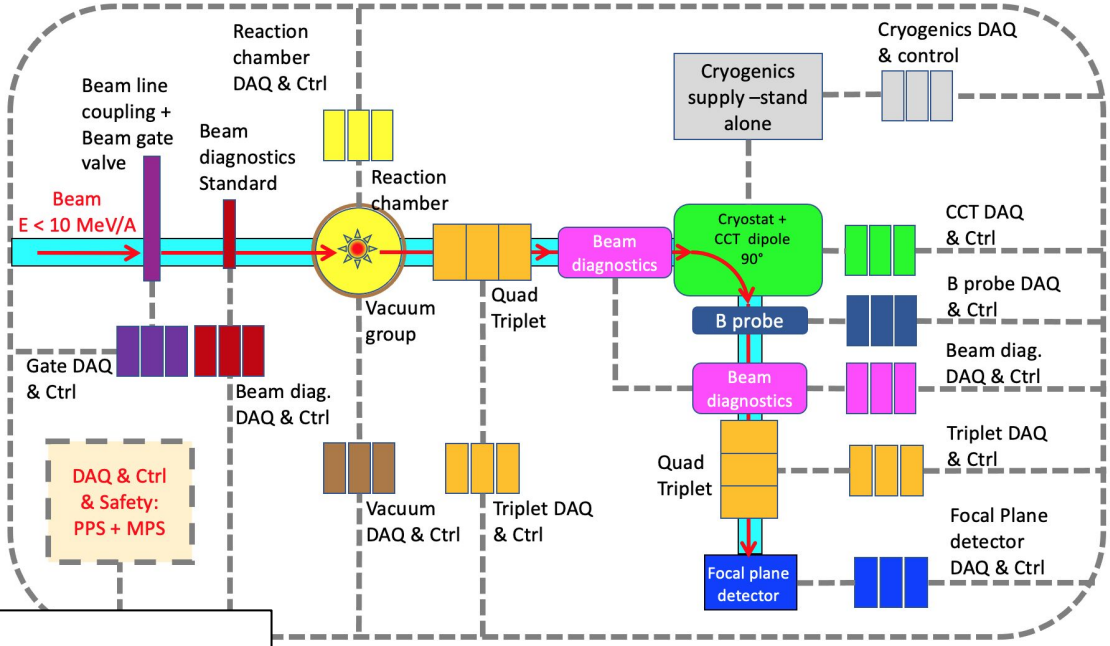
courtesy of Javier Resta

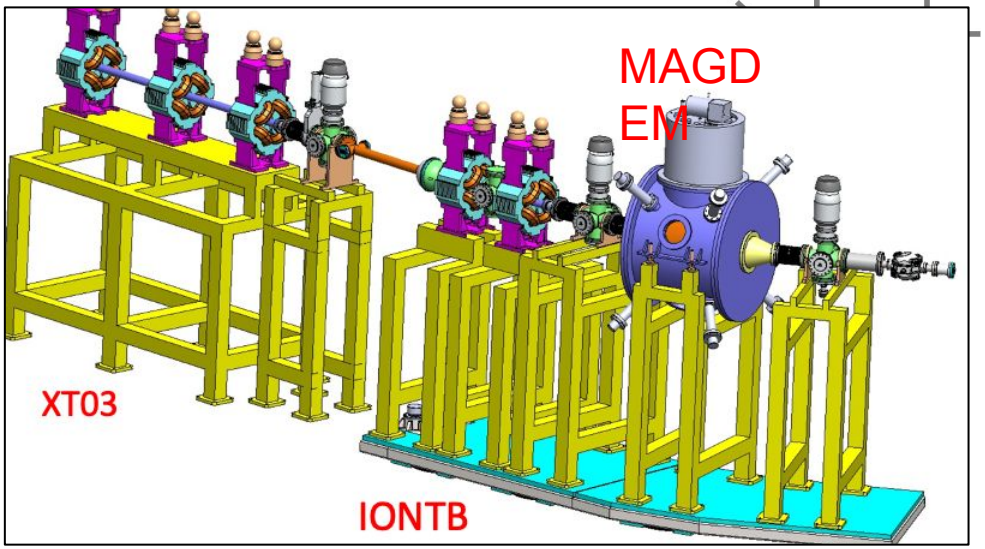


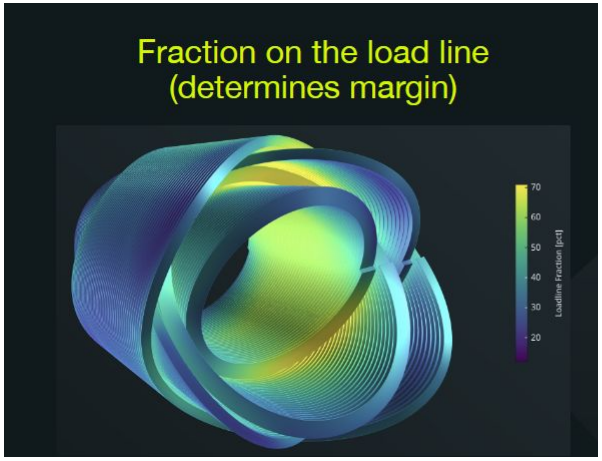
Longitudinal phase space after after 10 turns (2670 ns) for different Ra isotopes in the ISRS ring.

ISRS CCT test bench





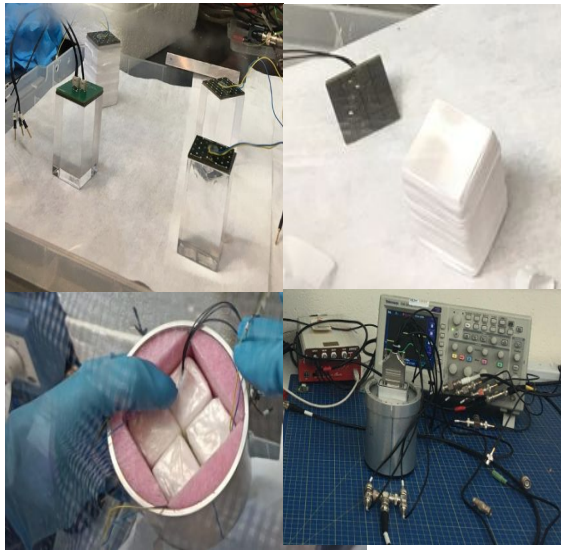


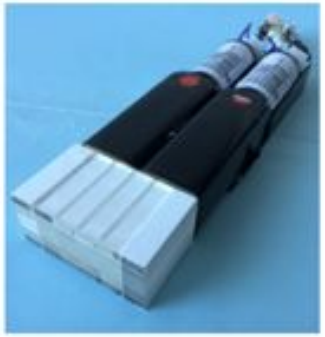


Critical elements of the focal plane

- 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

LaBr3 clover

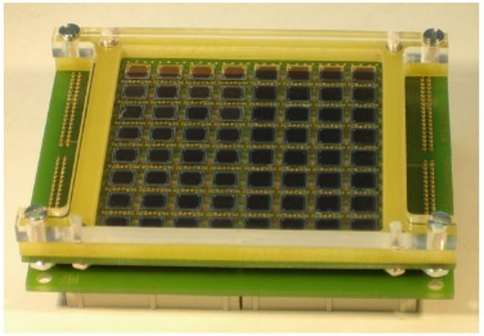




BGO

SiC

Monolith



SiC can be used as tagging system due to radiation hardness

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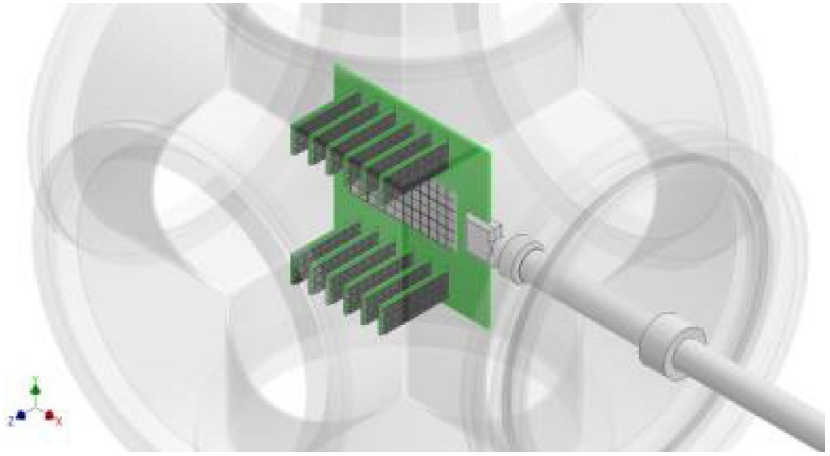
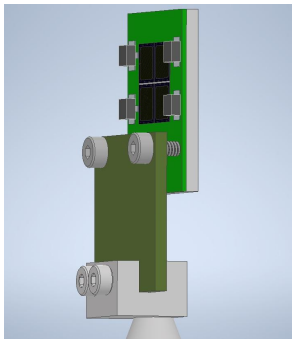
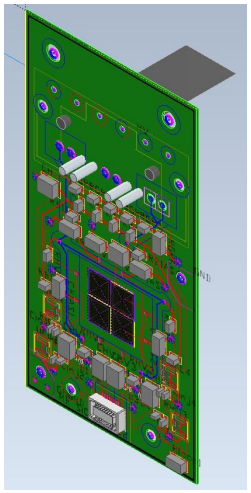
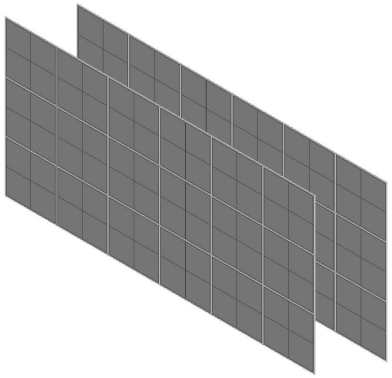
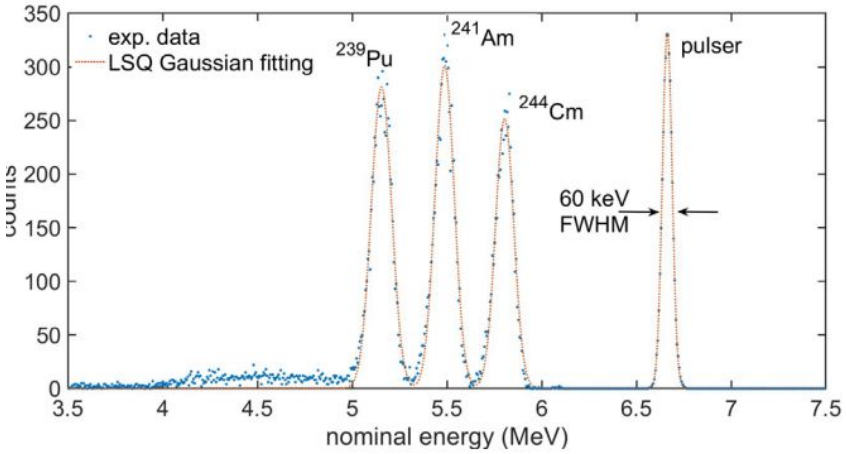
SiC first interactions (2022)









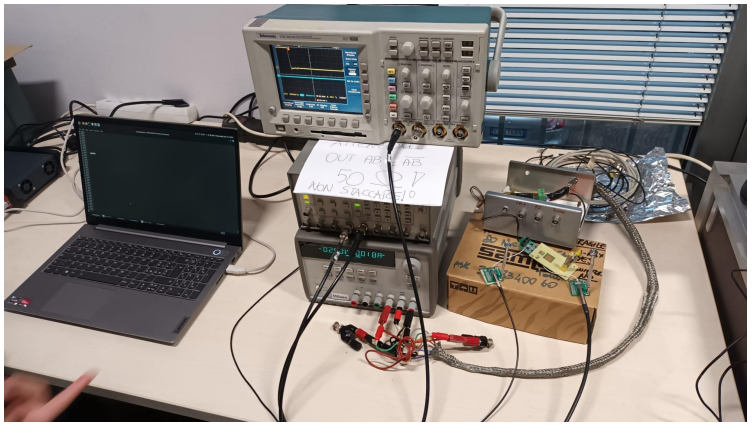


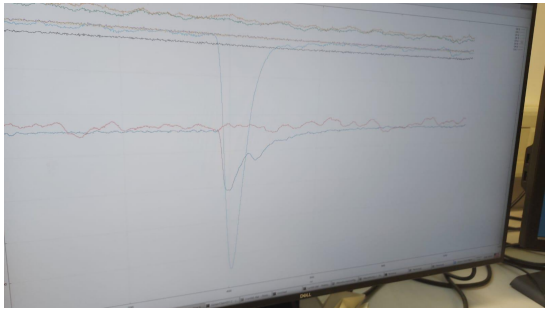
First studies of SiC detector for FRAISE project LNS-INFN and POLIMI, show the ASIC devoted to the system.

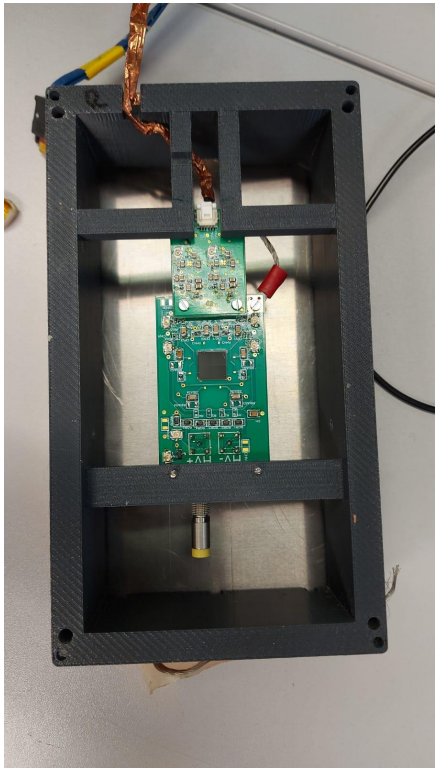
Size and Resolution:
100 micron and 60 keV res.

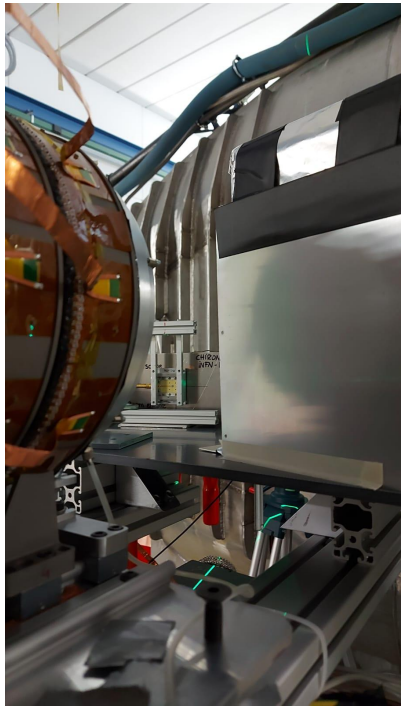
courtesy of Luis Acosta and Chiara Guazzoni

SiC first interactions: Trying with commercial Digitizers (POLIMI-GSI)- Dec. 2023









- 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.

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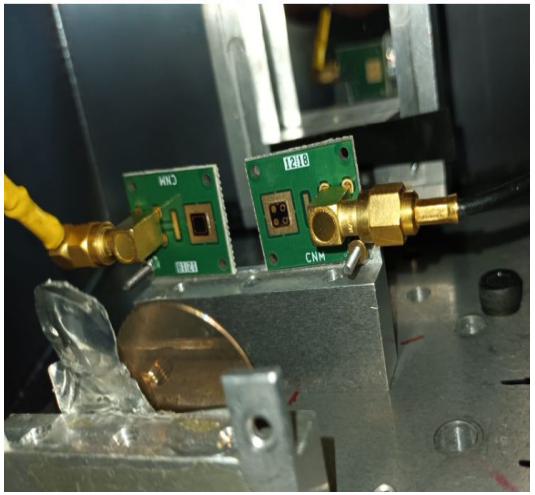
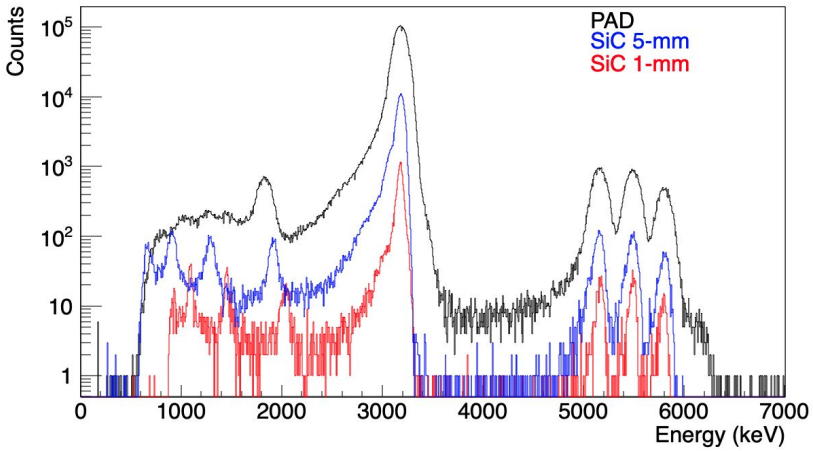
SiC developed at IMB-CSIC for ISRS project (IEM-CSIC) April 2024



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

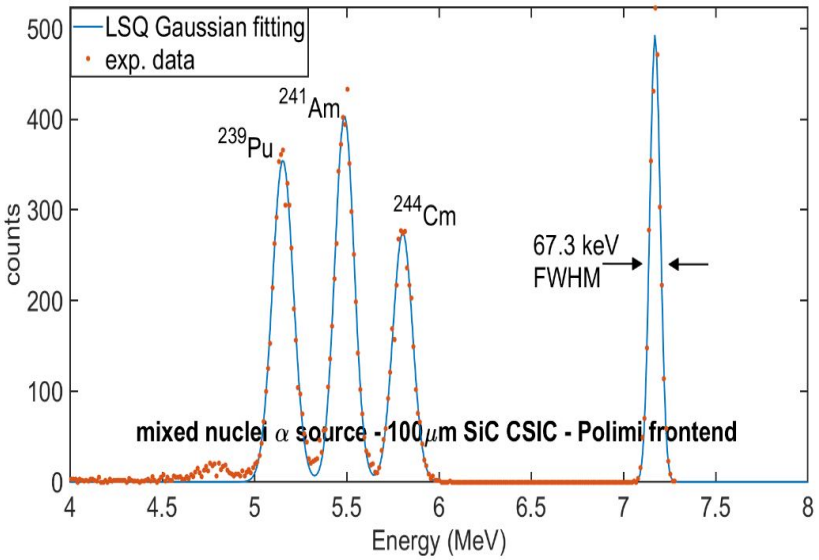


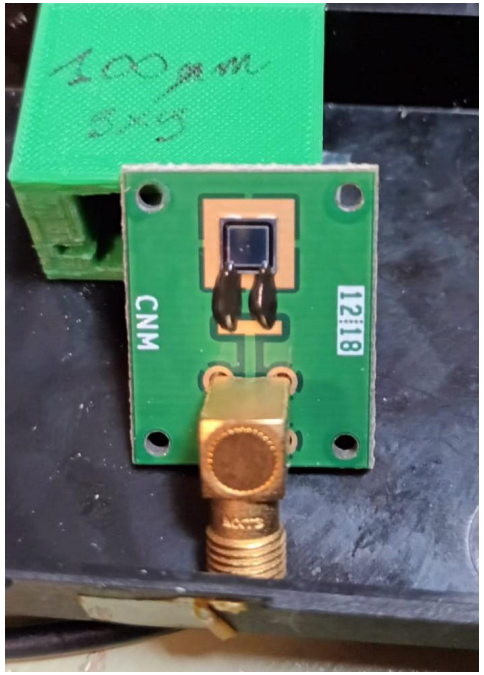
We obtain a resolution of about 60 keV for the 1mm SiC, 80 keV for the 5mm SiC and 150 keV for the Si PAD. Thickness of 50 microns.

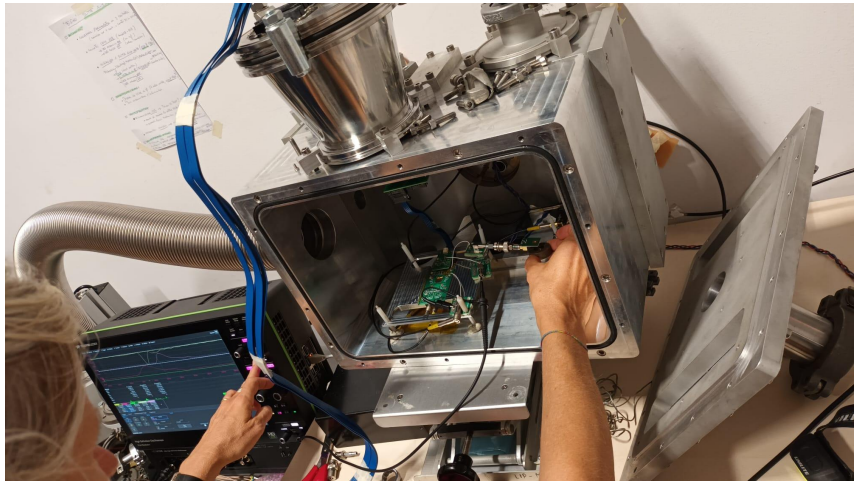
SiC-CSIC test at POLIMI (with MI-ASIC)

POLIMI lab setup with a 100 micron

They kept the 5 mm 50 micron detector for further adaptation







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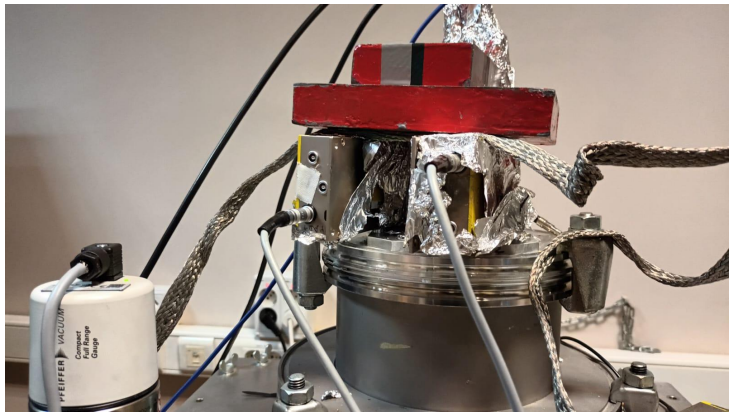
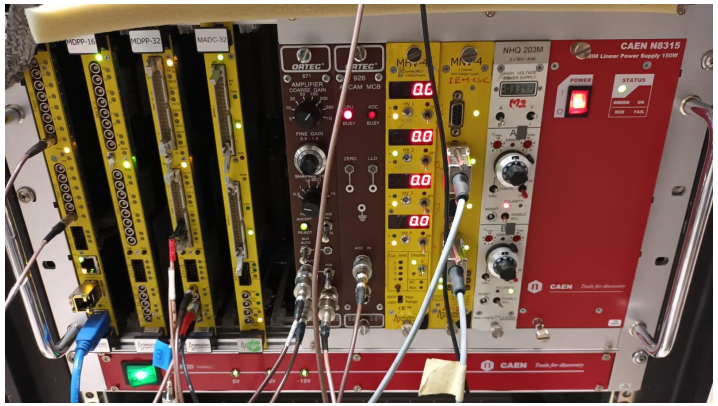
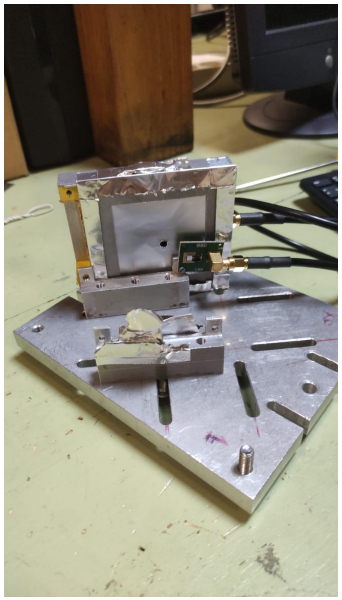
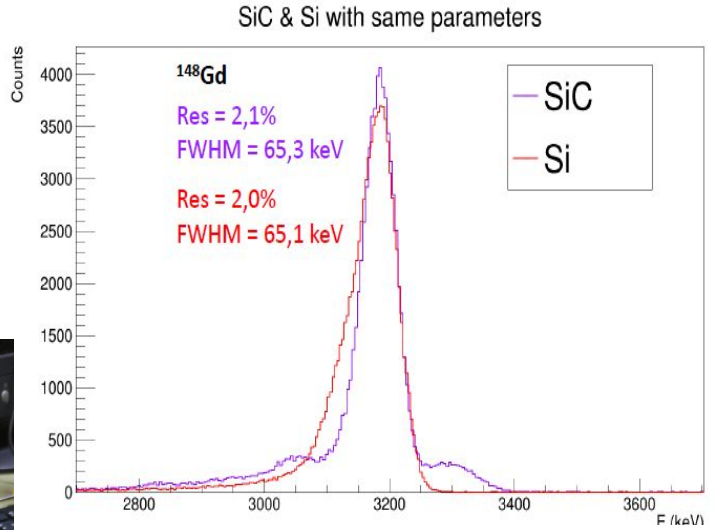
SiC vs Si test at IEM-CSIC: 3nd round, using Mesytec MPR-1, Cividec (for diamond module) along to DAQ-Mesytec and Maestro Multichannel

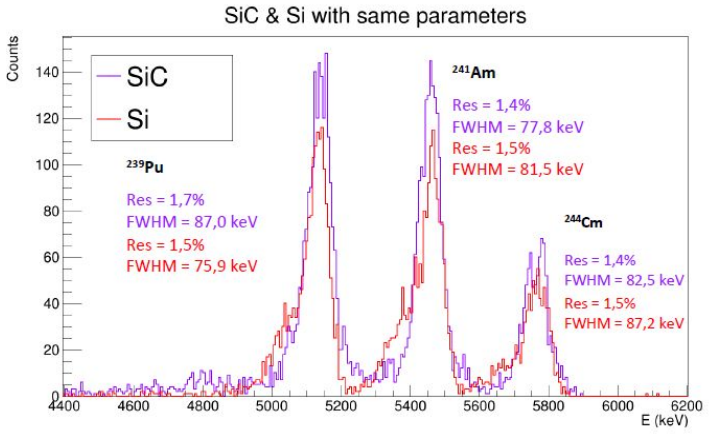
Fine tuning of MDPP-32 Mesytec module and obtain very similar resolution to Si.











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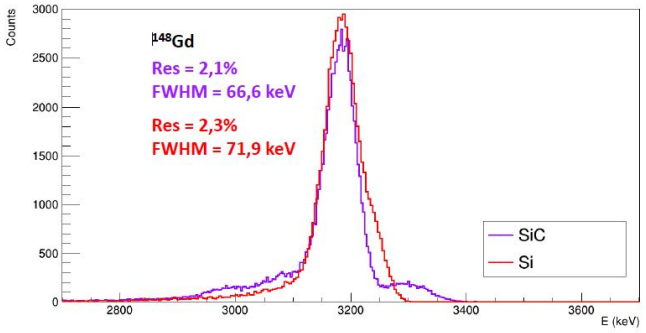
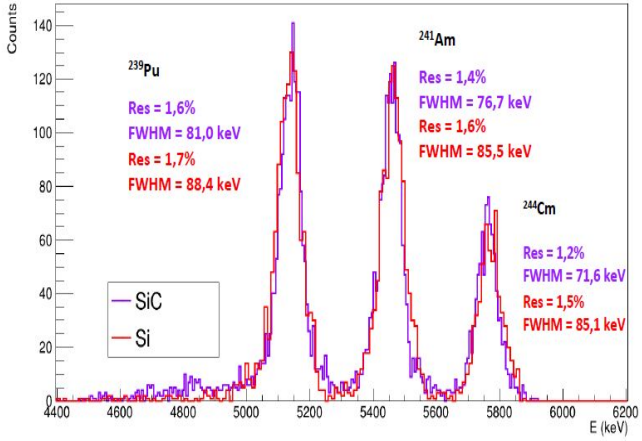
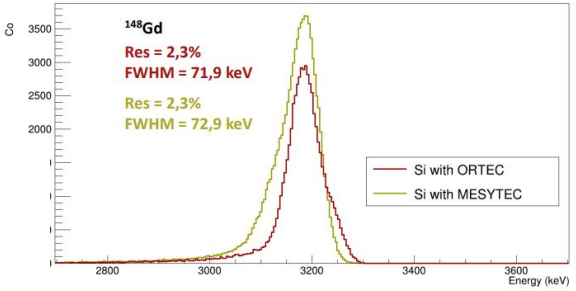
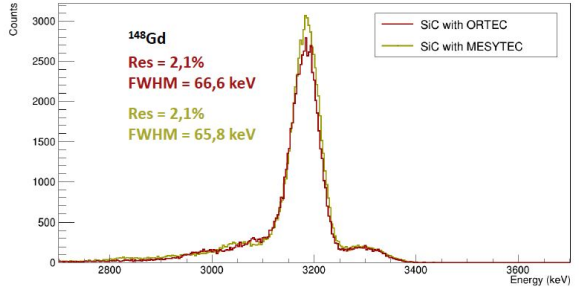


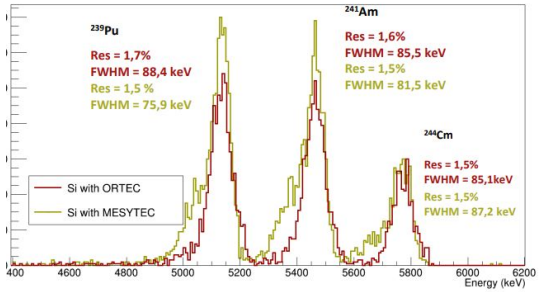
Comparison between ORTEC chain + Maestro data taking Mesytec digitizer for SiC and Si detector. Both cases use the MPR-1 readout

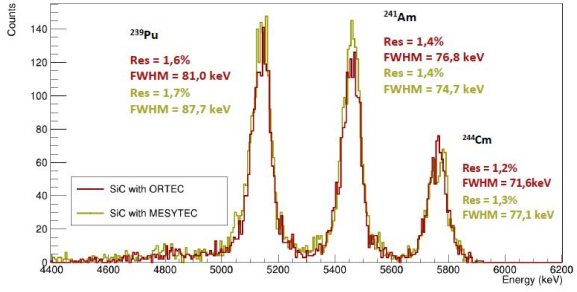
MPR-1 + ORTEC 671 Amp on Maestro











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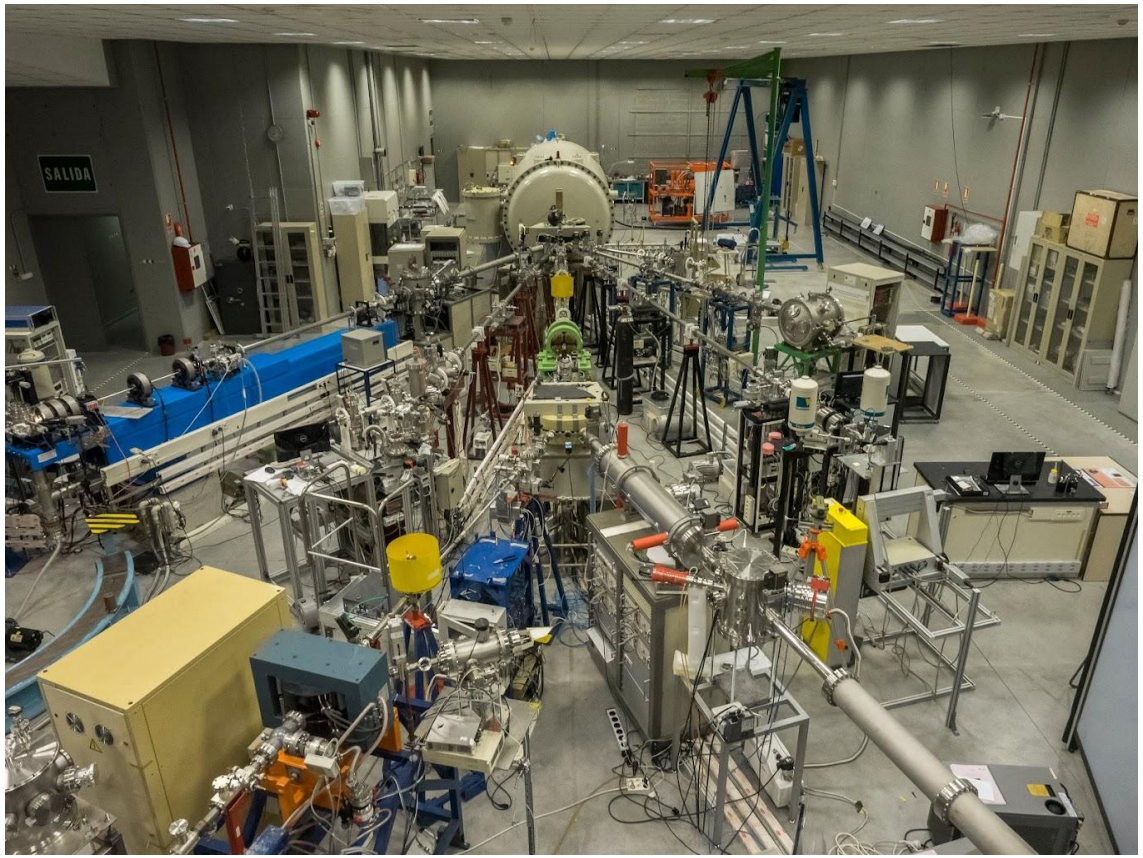
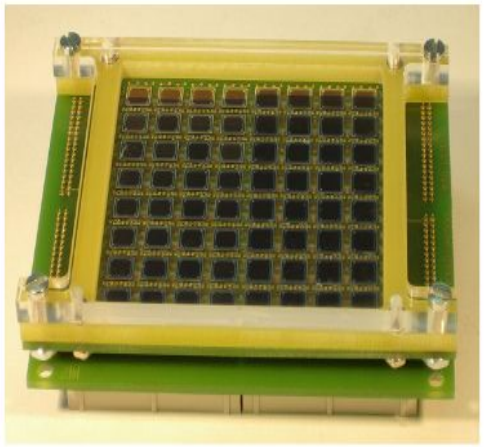
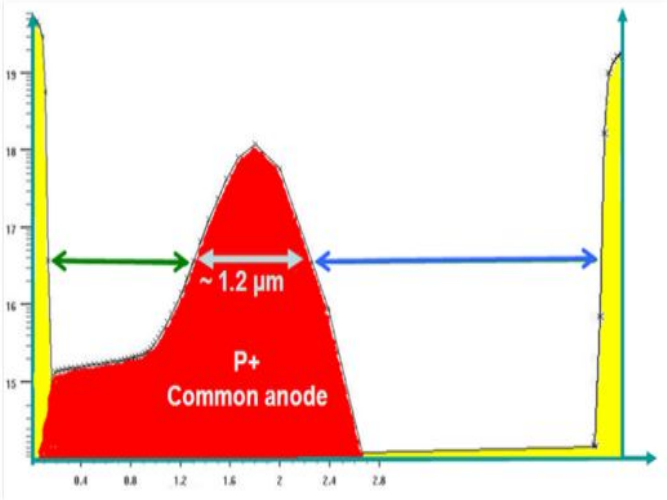
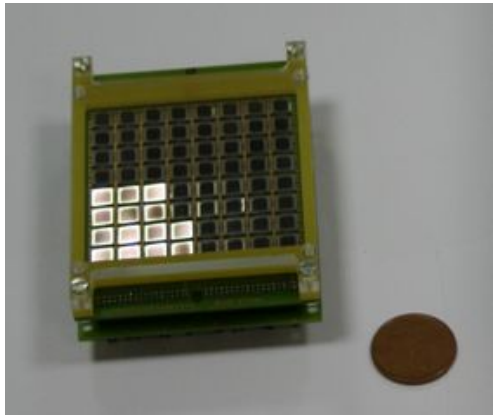
Further studies to be carried out at CMAM Madrid Using the best solution with beams, including the photon arrays (still in the waiting list)



Monolithic Si Detector (will be included in CMAM test)

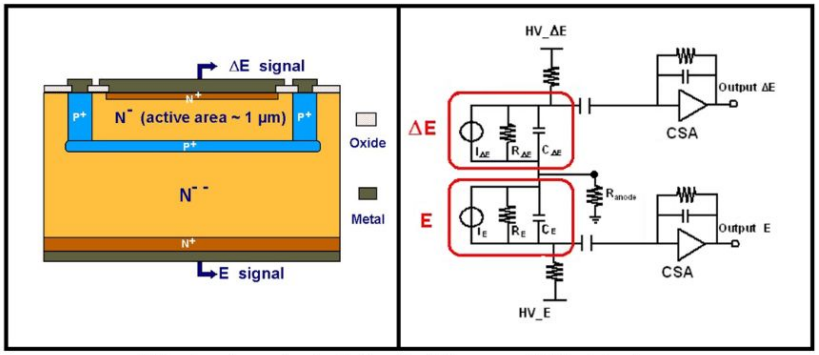




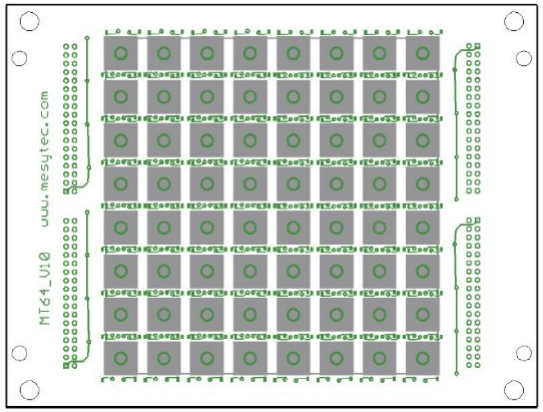


a) Photo of the monolithic detector.

b) Doping structure of the Si wafer.



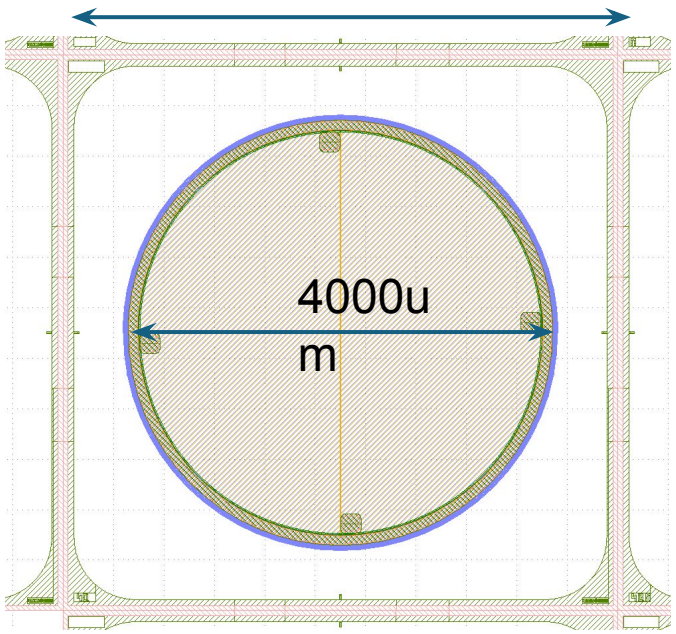
c) Electronic equivalent circuit of the monolithic detector.

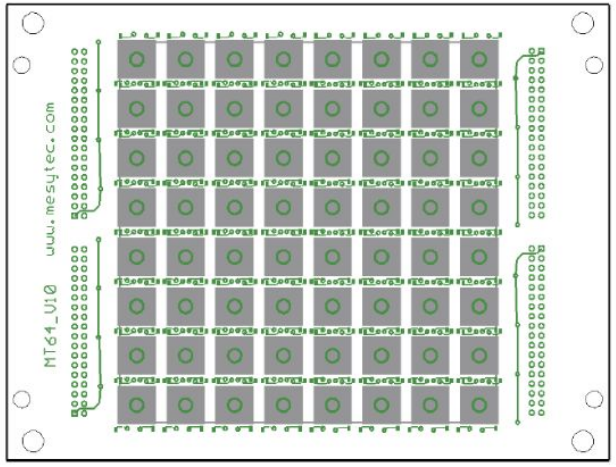


Build new SiC detectors coming in the future months

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

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Thank you for your attention!