EUCLIDES:
4π highly-efficient light-charged–particle detector [1]

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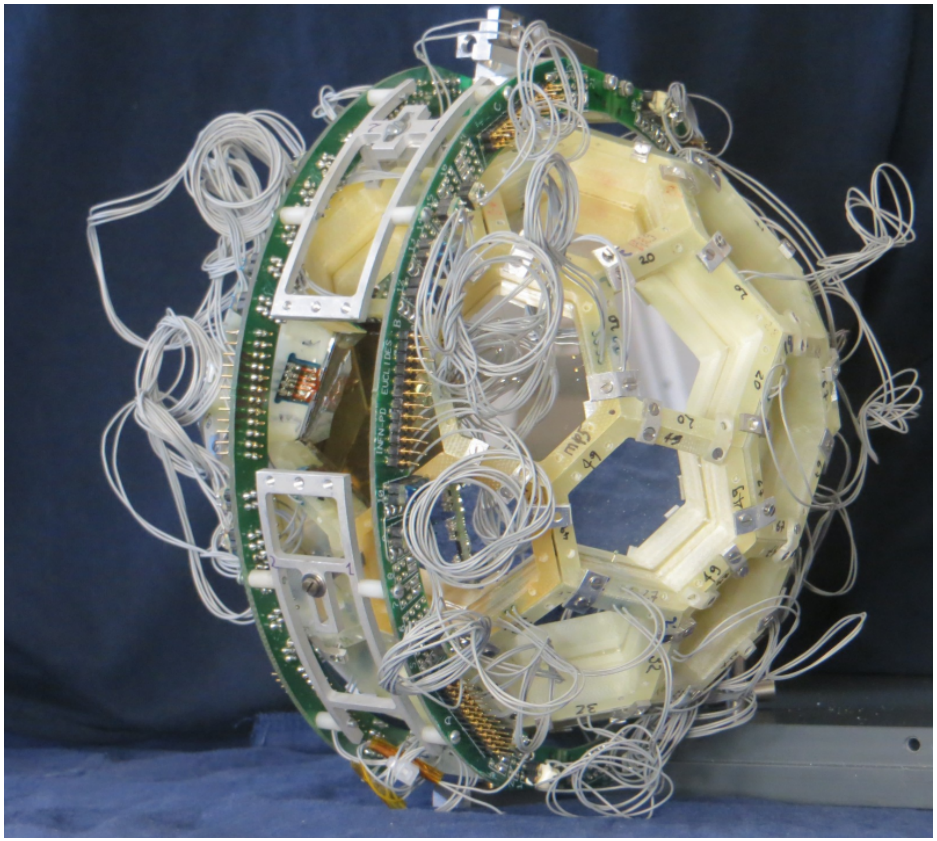
[1] D. Testov et al., *The 4π highly-efficient light-charged–particle detector EUCLIDES, installed at the GALILEO array for in-beam γ-ray Spectroscopy, Eur. Phys. J. A (2019) 55: 47*

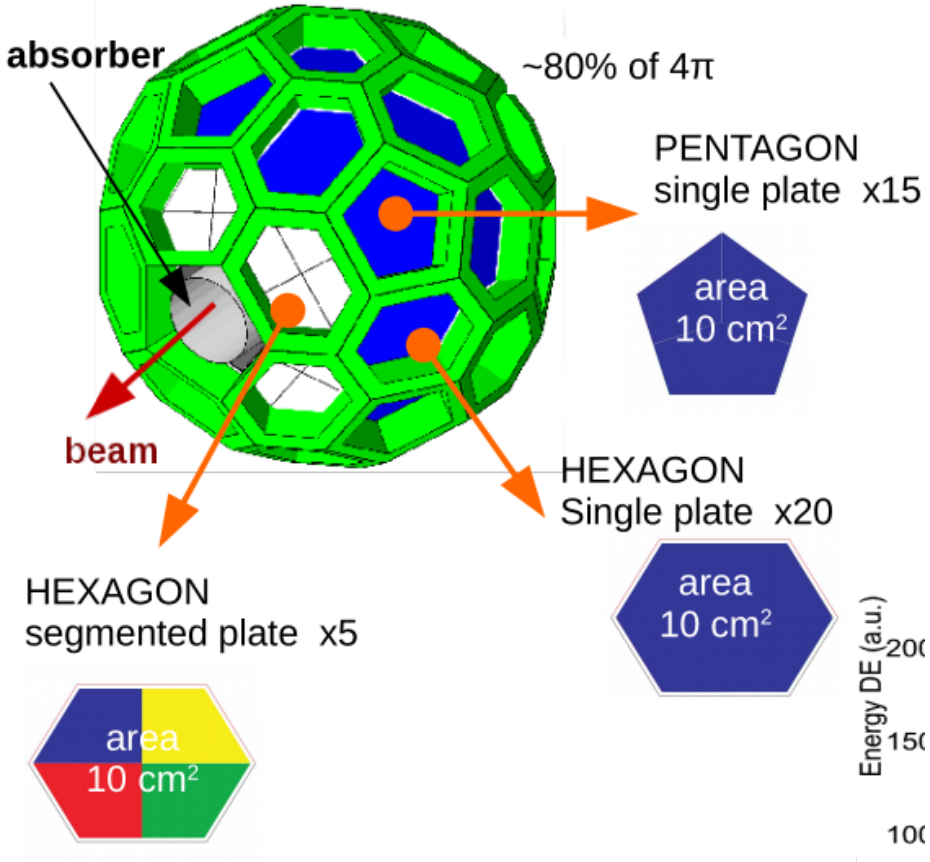
EUCLIDES in a nutshell

- Particle discrimination ΔE-E + PSA
- High gamma-ray transparency
- High efficiency thanks to 4-π design
- Event-by-Event Doppler correction
- Reaction channel filter (fusion evaporation reactions)



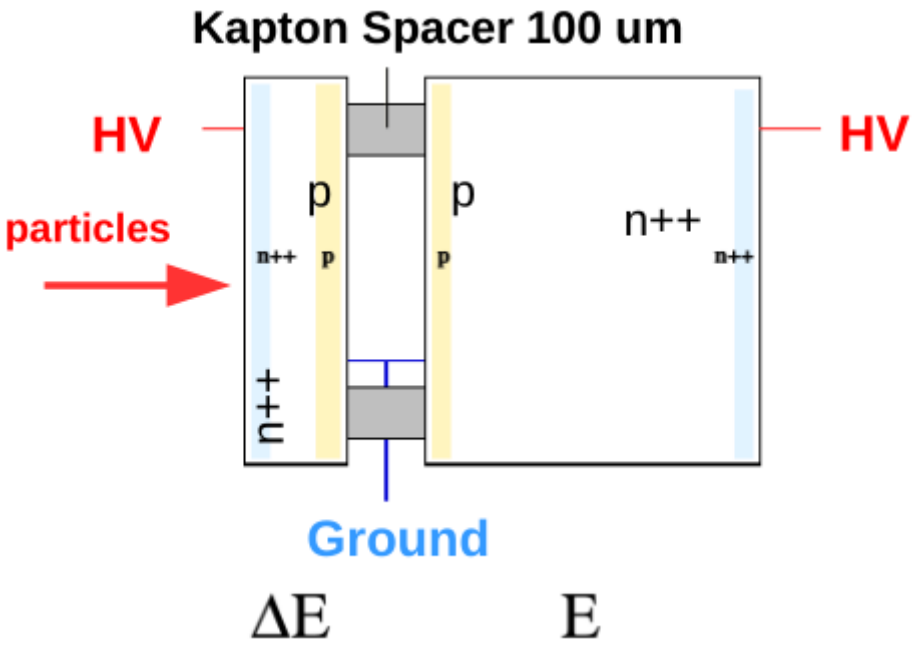
Geometry

- 80% solid-angle coverage
- Football shape 40 Si telescopes:
  1) 15 pentagons
  2) 20 hexagons
  3) 5 4-ways segmented hexagons at forward angles
- Absorber can/must be placed to protect the detectors from scattered beam



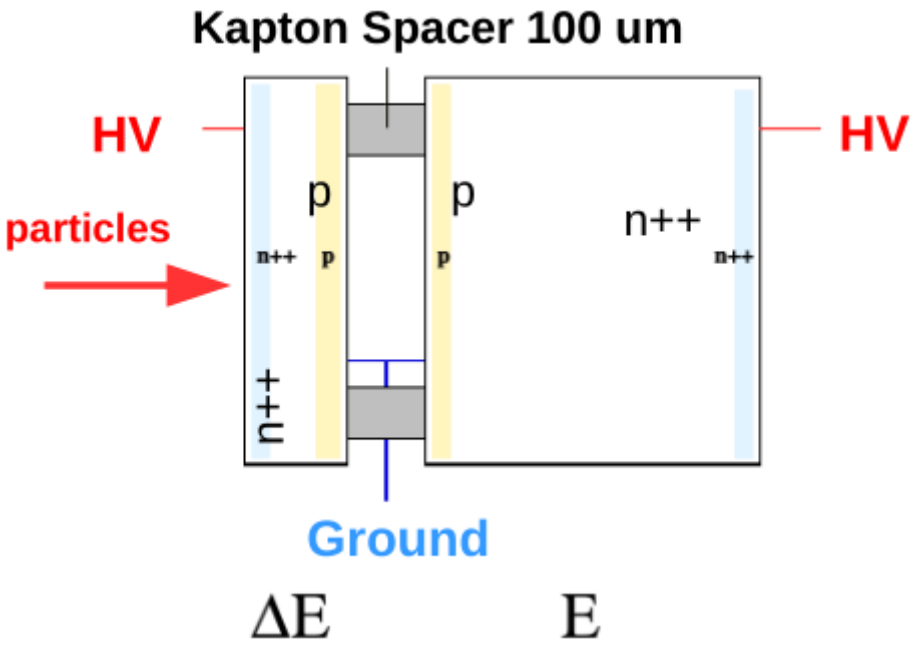
E detector

- Thickness: 1000 µm
- Bias :~140-180 V
- Leakage Current: ~500 nA
- Capacitance: 130 pF
- FWHM 30 keV

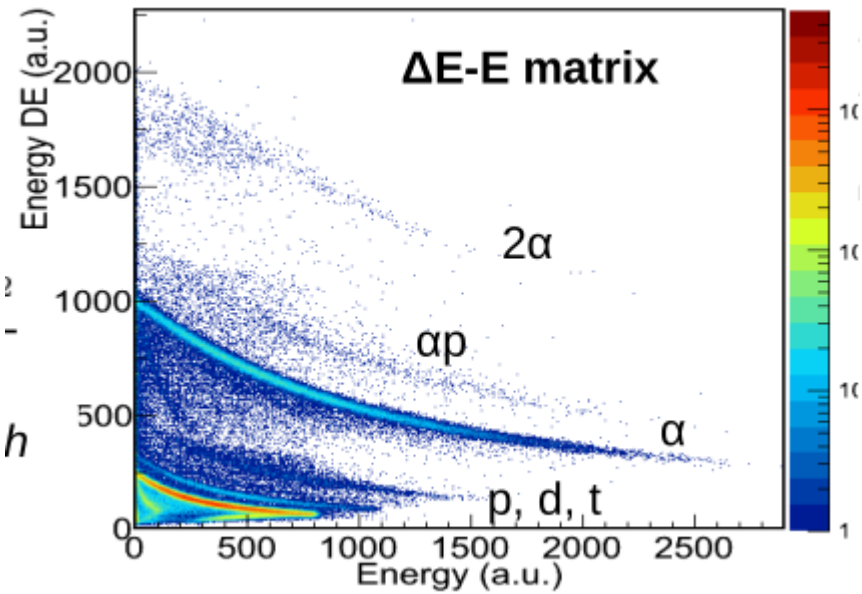


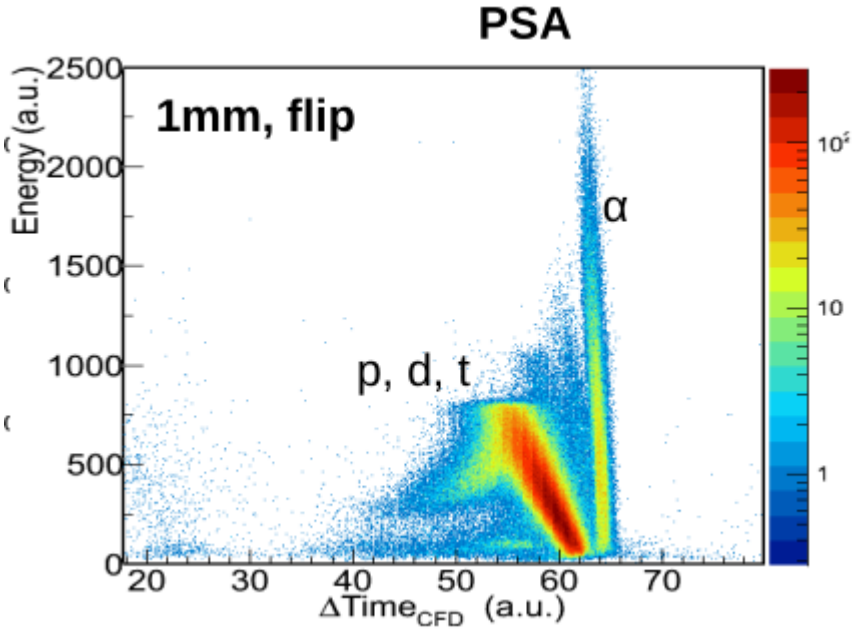
ΔE detector

- Thickness: ~150 µm
- Bias :~40-50 V
- Leakage Current: ~100 nA
- Capacitance: 850pF
- FWHM 50 keV



Particle discrimination

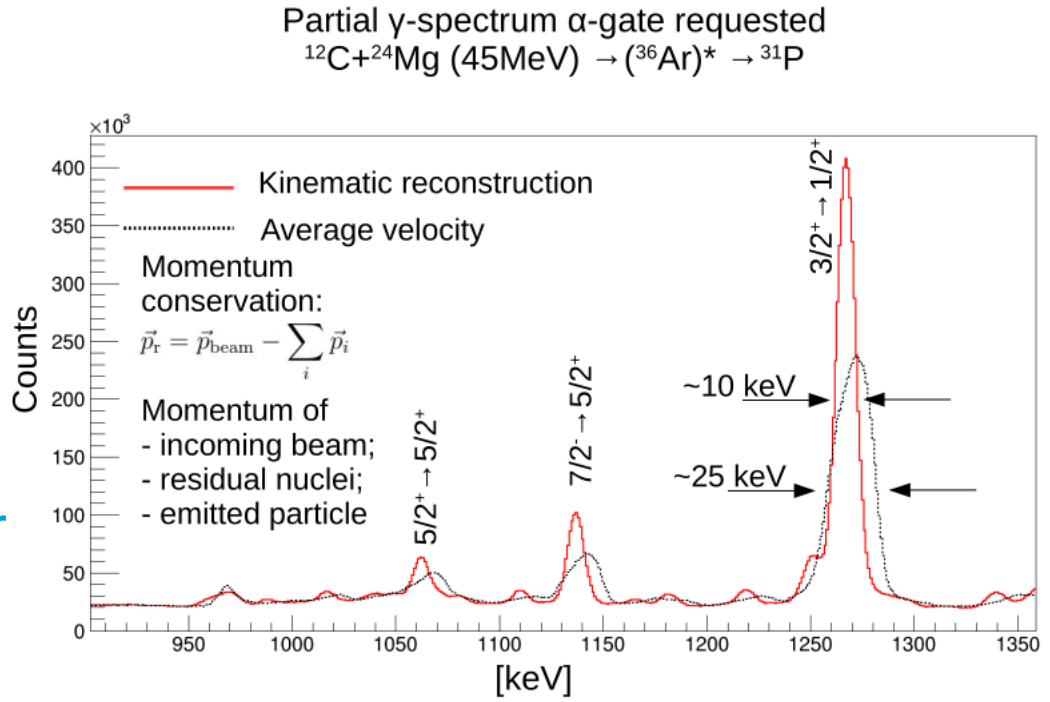




- Excellent discrimination of light ejectiles
- PSA can also be used

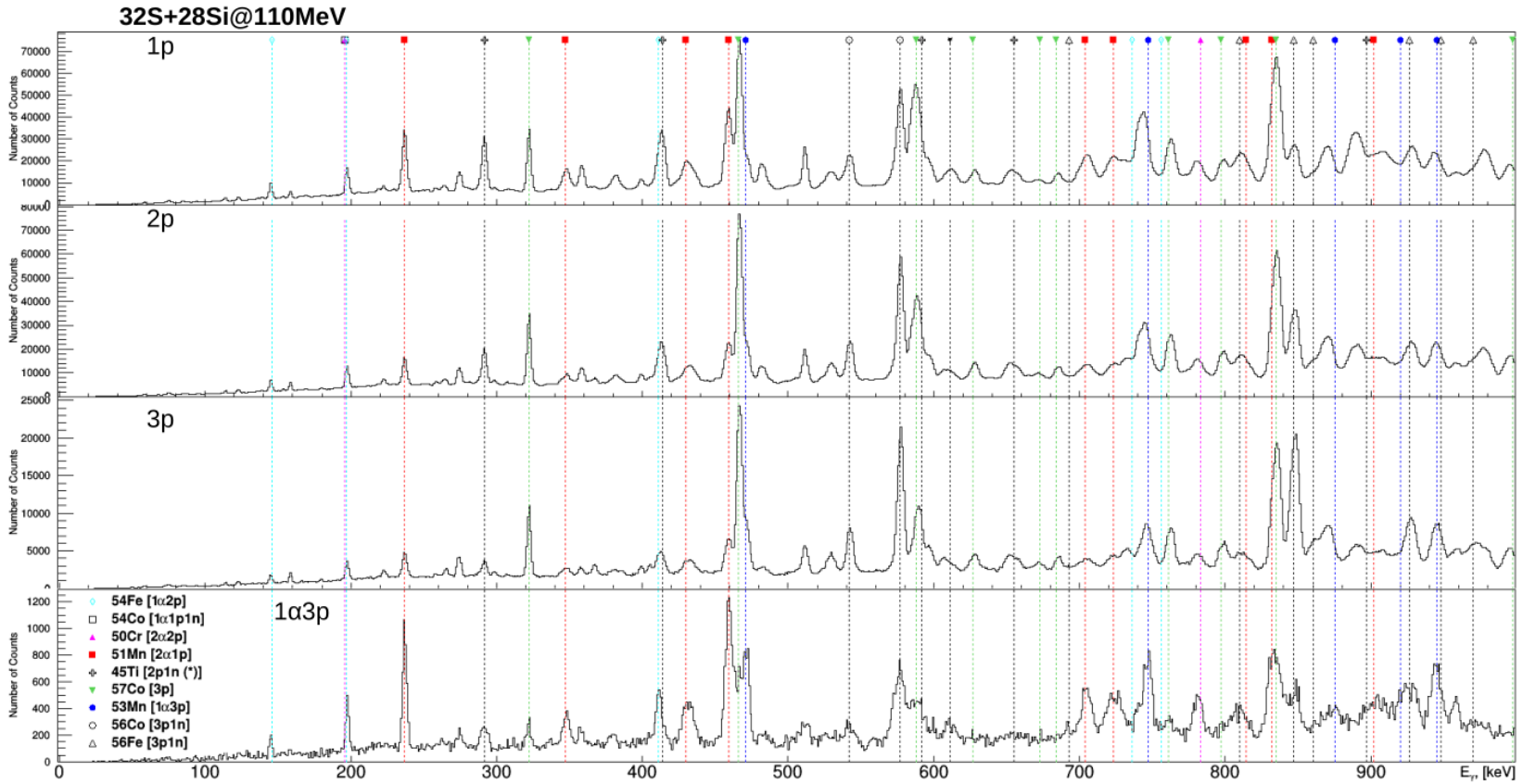
Doppler correction

- Event by event Doppler correction based on the kinematics
- Example with GALILEO, most likely limiting the intrinsic resolution
- AGATA will perform even better thanks to its position sensitivity
- Dramatic difference in FWHM



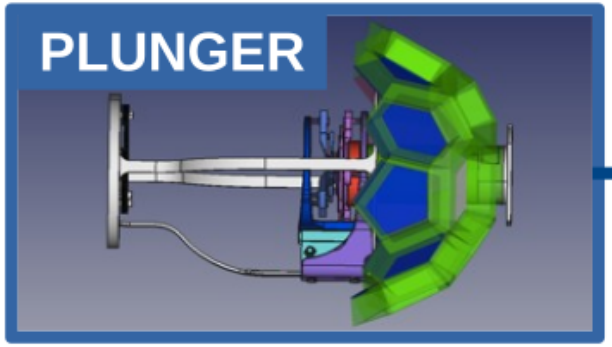
Reaction channel filter

- Significant suppression of background from other reaction channels

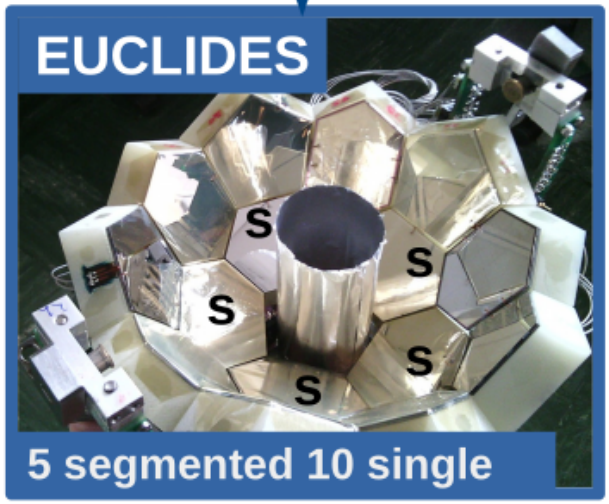


Plunger configuration

- Can be operated in combination with the plunger at the cost of removing the backward portion f the solid angle
- Distances between target and stopper foil from a few um tens of mm with a sub-um precision



θ=152° 129° 119°

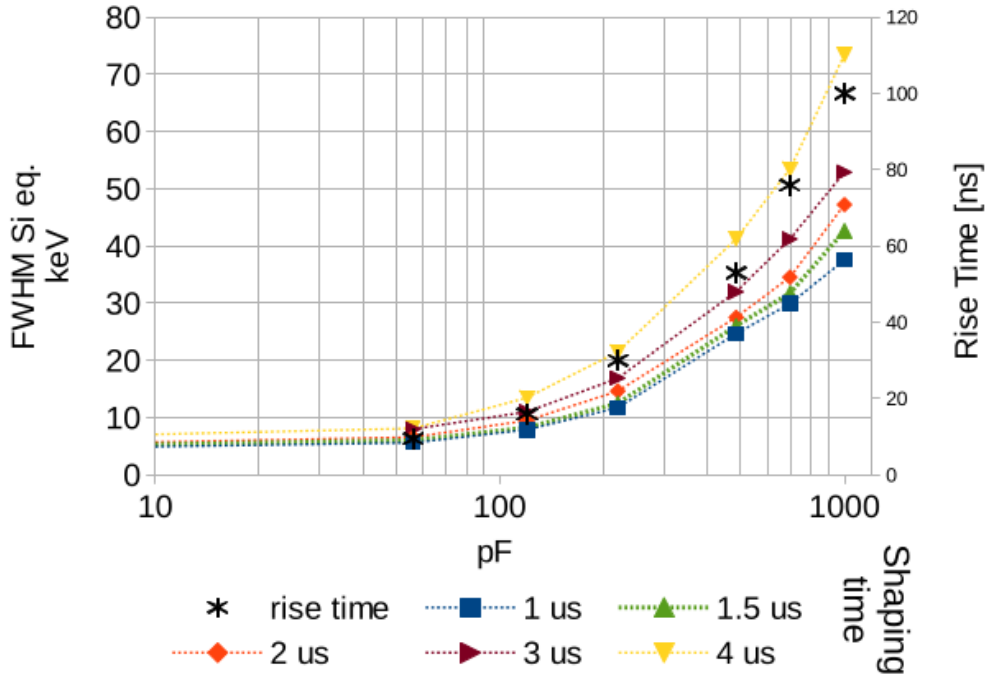


See Irene's presentation

In collaboration with
Institut für Kernphysik,
Universität zu Köln, Germany

DAQ and electronics

- GGP readout
- 4 Galileo digitizers
- 112 channels in total for 4-π configuration
- 16-ch chrge-sensitive pre-amplifiers in the reaction chamber
- Can be added to the trigger processor



Great preamplifier performance as a function of the input capacitance

Some technical details

- A cylindrical Al absorber needs to be added (if necessary) to protect the telescopes from scattered beam
- Detection threshold 1 MeV in ΔE
- Max (tested) rate 45 kHz (100 kHz for forward detectors)
- Fits in a reaction chamber with 220 mm diameter
- Included in AGATA Geant4 simulation code

Summary

- Great reaction filter for fusion evaporation reactions
- High efficiency (4-π design)
- Can improve dramatically the Doppler correction procedure
- Precise particle discrimination capabilities
- Can be used in a plunger setup
- Can be added to the trigger processor