Phase-0 silicon detectors et al.

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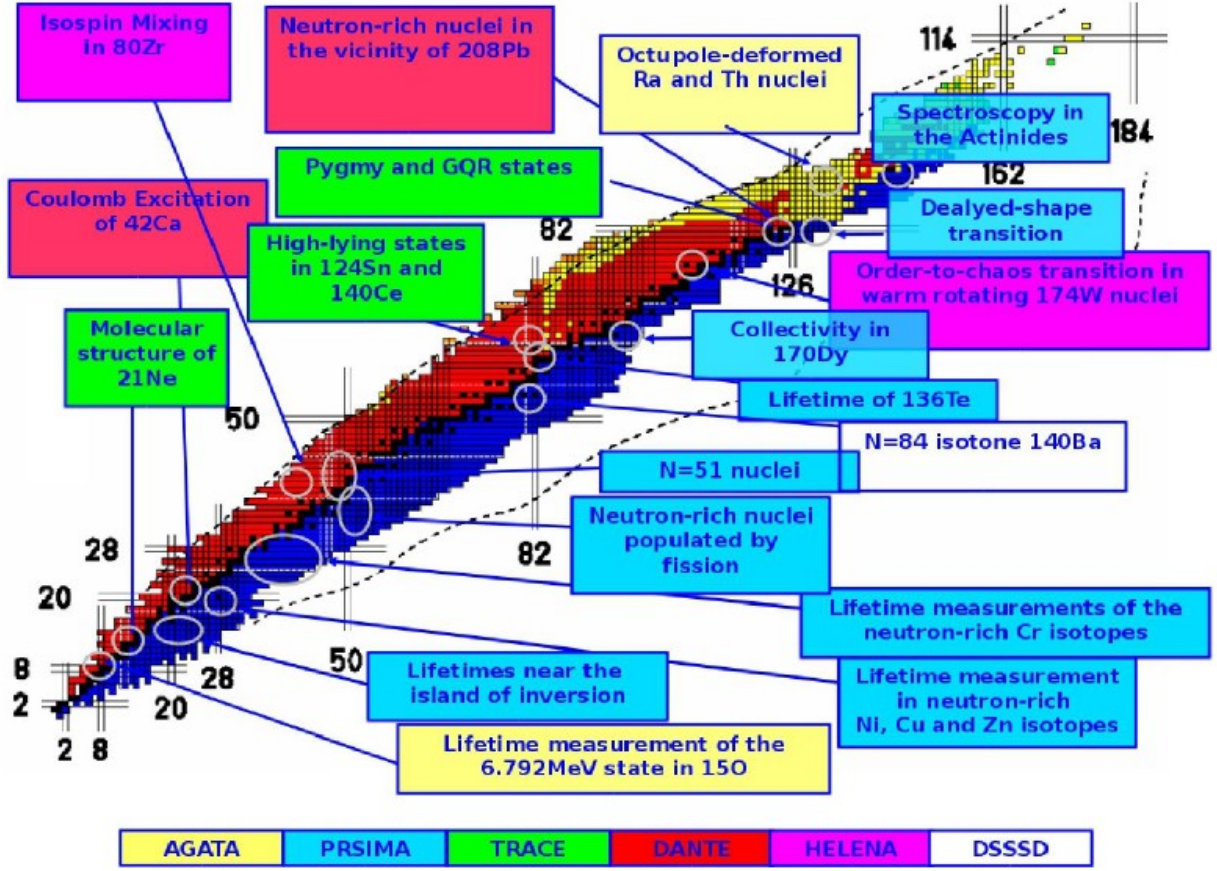
Agata Demonstrator campaign

Complementary Instrumentation



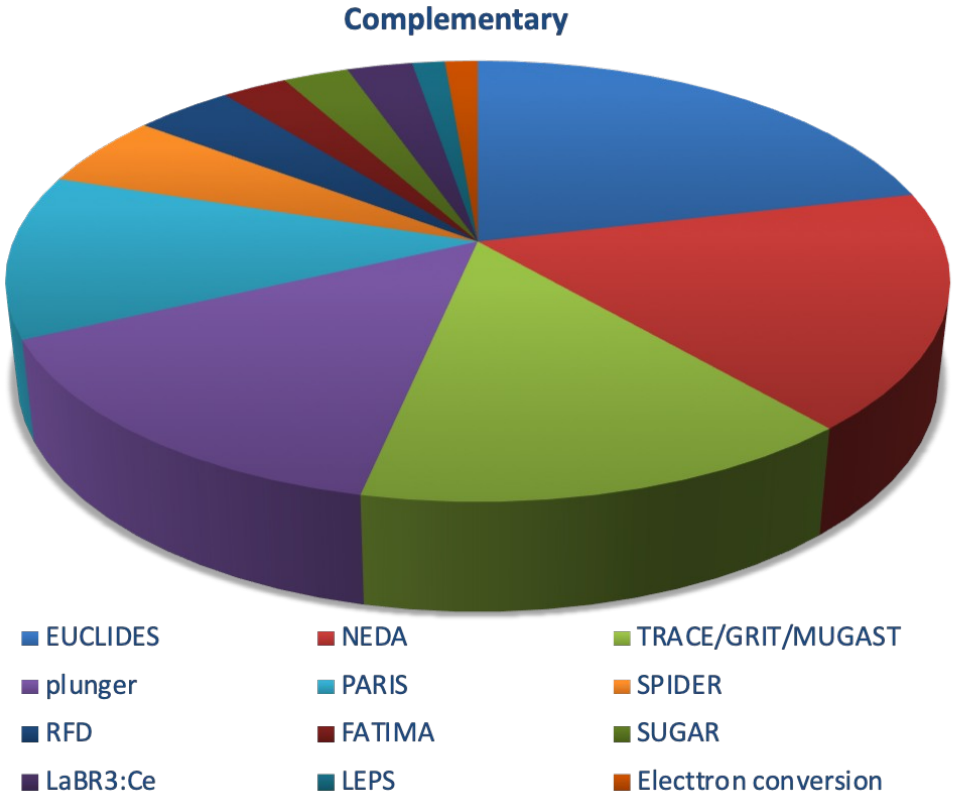
AGATA Demo 2010
LNL EXPERIMENTS:
20 exps, 148 days, 3500 hs

90% with complementary detectors

Increase of resolving power.

Complementary Instrumentation

LoIs 2016/2019



LoIs for <u>stable</u> and RI beams.
PRISMA not accounted in this graph.

Specific *vs* common needs:
Chamber, flanges, feedthrough
Electronics, trigger & DAQ

AGATA phase 1

stable beams and compatible with PRISMA

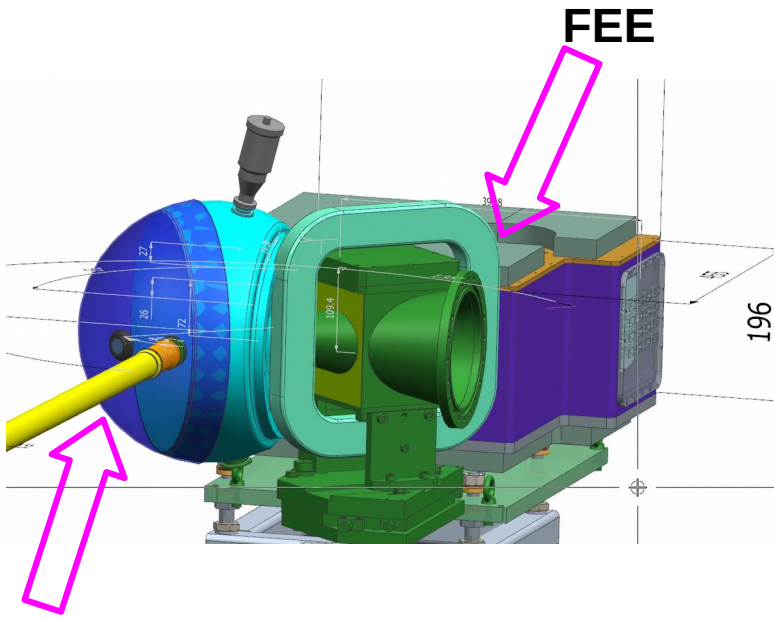
Silicon detectors:

- **Coulex → SPIDER**
- **Transfer → GALTRACE (+SPIDER/CD)**
- **[Euclides]**

Other...

- **MCP → DANTE**

- **Plunger**

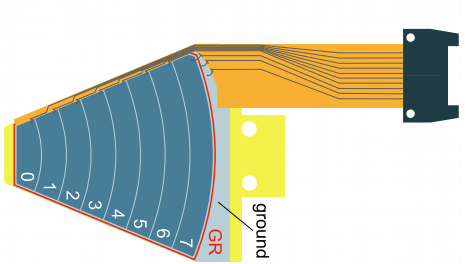


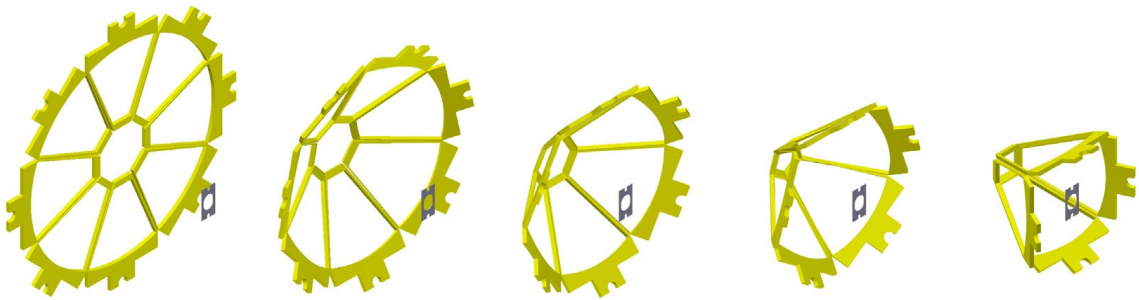
Integration challenge

SPIDER

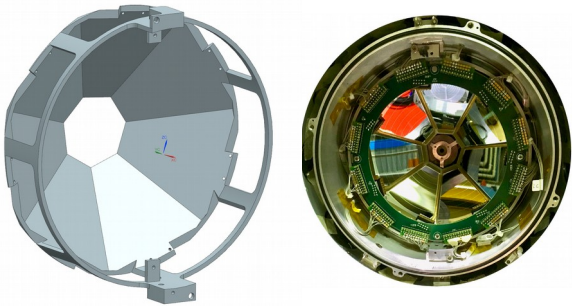
Coulomb Excitation experiments

- Silicon strips single detector electrically segmented in 8 sectors
- Heavy-ion measurement: position and velocity reconstruction
- Different configuration depending on the space available:





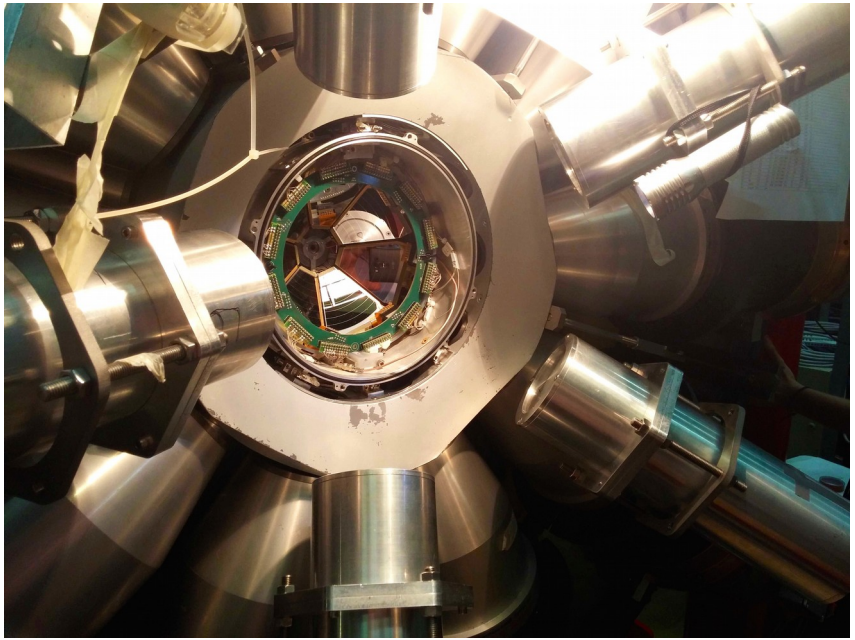
@GALILEO

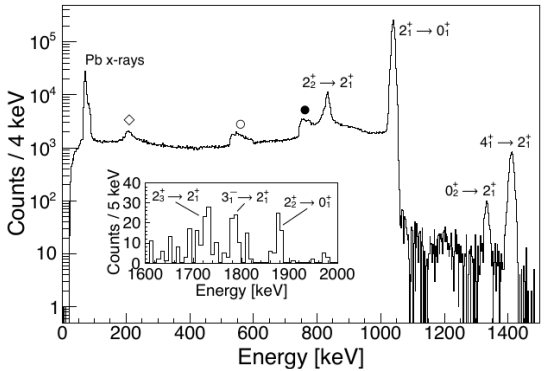


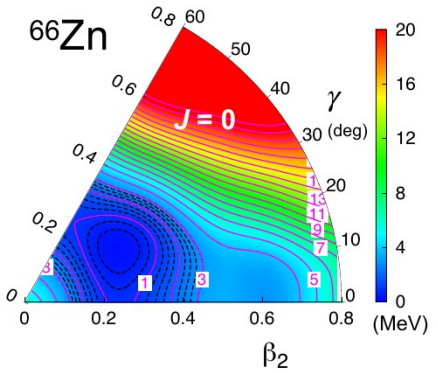
- Under consideration 7/8 dets
- Target distance standard: 85-100 mm

M.Rocchini et al., Nucl.Instrum.Meth.A 971 (2020) 164030

Recently at GALILEO





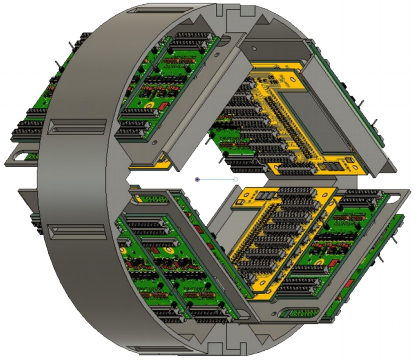


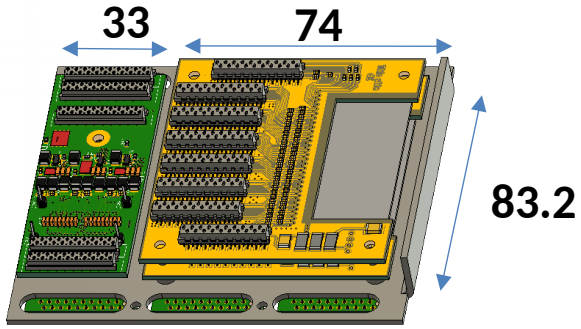
- 7 trapezoidal si detectors in a cone-like configuration◦
- 37.8 deg. of the polar angle and 17.2% of 4π

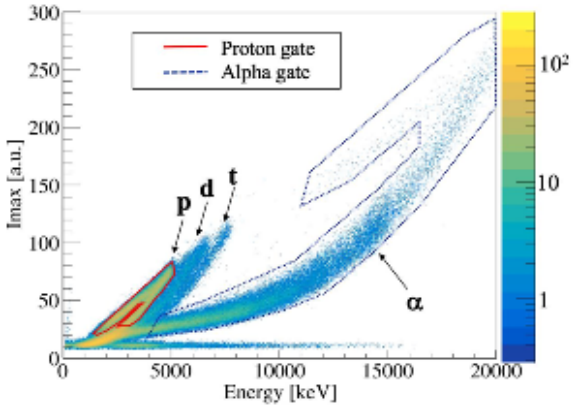
M. Rocchini et al., Phys. Rev. C 103 (2021) 014311

GAL-TRACE

Inelastic scattering, transfer







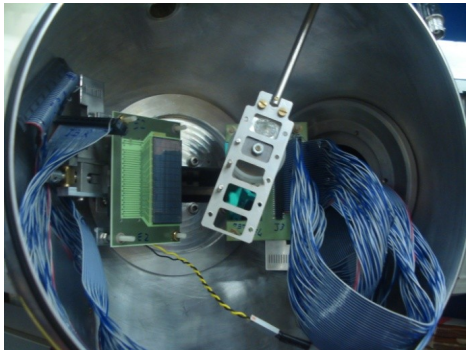
Si-PAD(12*5=60) in a telescope configuration [E-ΔE]

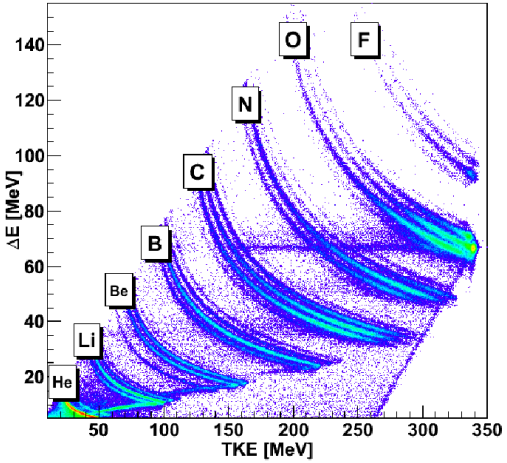
- **Modular telescopes ensemble**
- **Light-charged particle spectroscopy**
- **Angles and position are reaction dependent**
- **Preamp inside the reaction chamber to improve energy resolution**
- **preamp board (GREEN) 82.5x 33 mm, detector board (YELLOW) 83.2x74mm.**
- **Estimated optimal distance ~ 150 mm**

D.Mengoni et al., NIMA 764 (2014) 241-246.

back in 2010

Also recently used in GALILEO





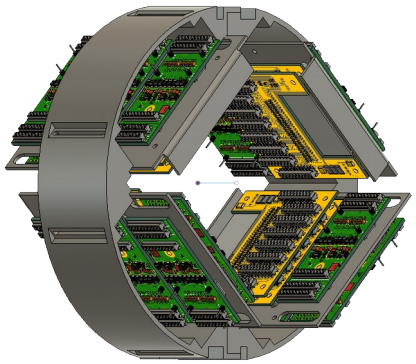
TWO EXPERIMENTS PERFORMED:

Studied Nuclei: 208Pb 90Zr
R. Nicolini (Università di Milano /INFN)
D.Mengoni (Università di Padova/INFN)

Studied nuclei: 208Pb, 124Sn,140Ce
M. Kmiecik (IFJ PAN Kraków) ,
F. Crespi (Univ. di Milano/INFN)

F. C. L. Crespi et al. Phys. Rev. Lett. 113 (2014) 012501

Integration



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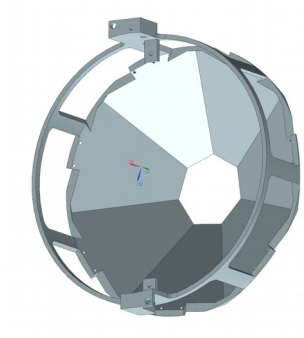

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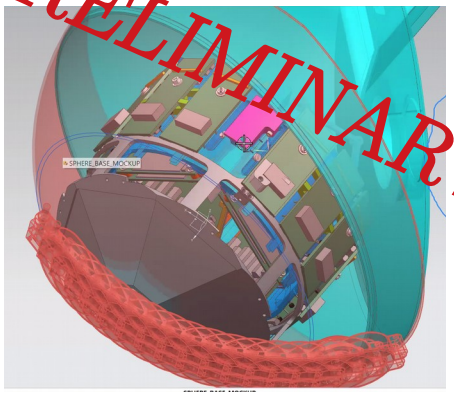
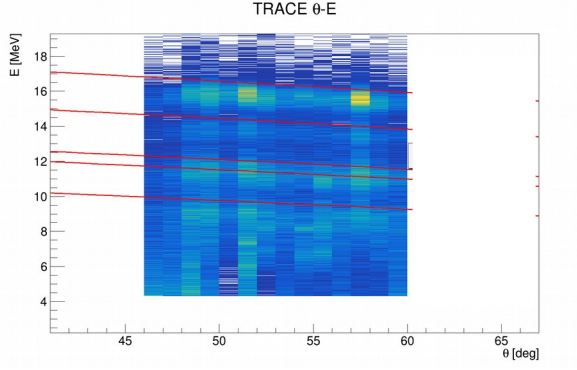
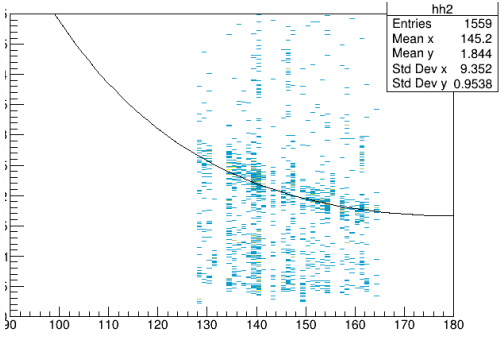




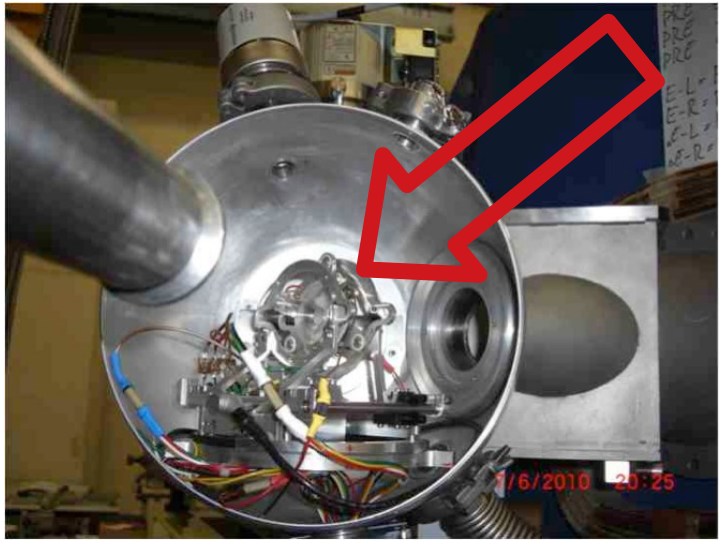


GALTRACE (4/5 telescopes)+ SPIDER:

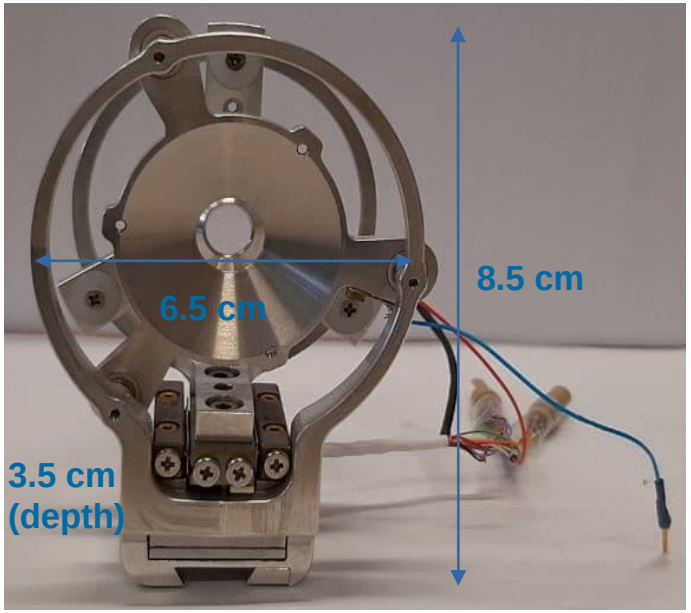
GALTRACE angle ~90 , SPIDER backward angles.

PLUNGER

AGATA campaign 2011



GALILEO plunger

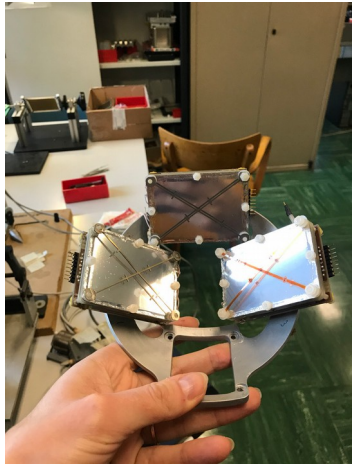


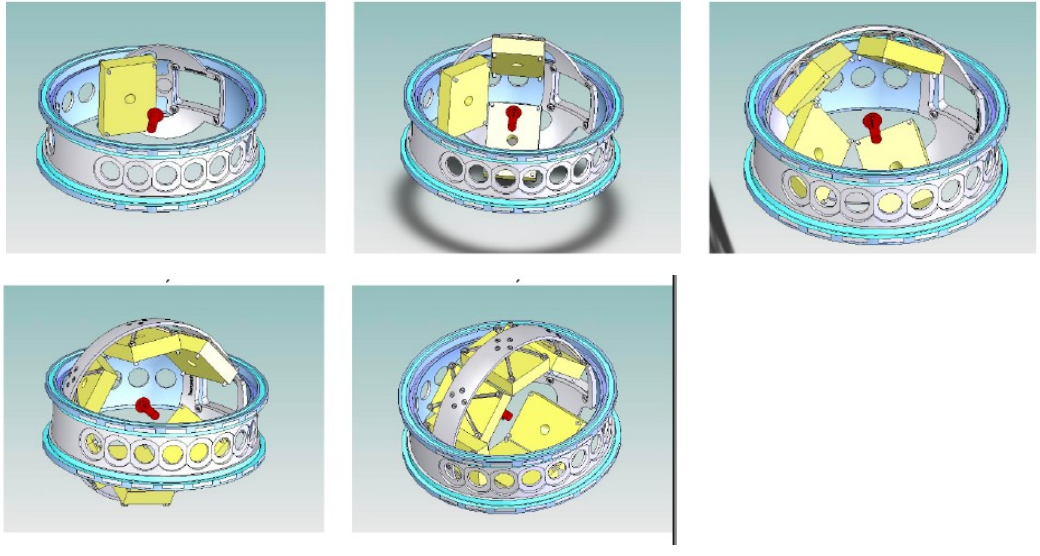
C.Müller-Gatermann et al NIMA, 920 (2019) 95

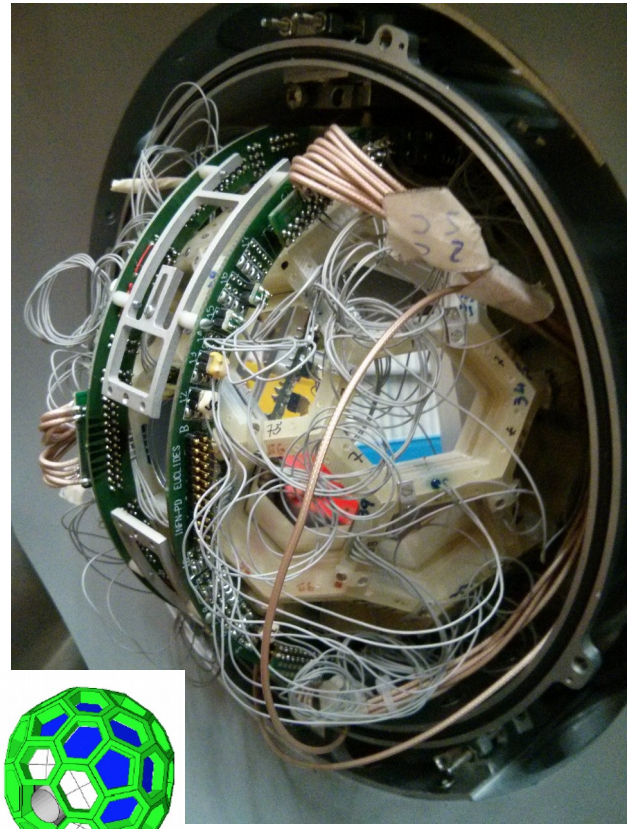
★ **New Q-521 motor**
New mechanical support compatible with the PRISMA chamber

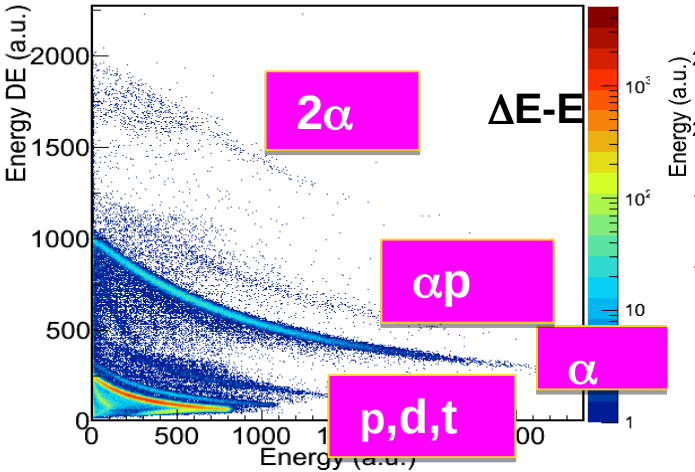
In the old chamber:
up to 6 MCPs in a ring, 40x60 mm² each, position resolution ≲ 1 mm, timing ≈ 130 ps

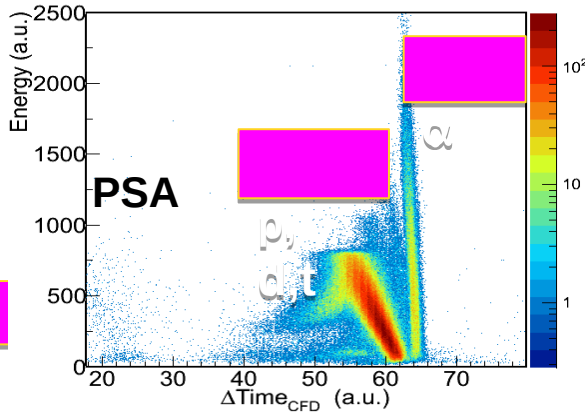
Anything that needs detection of a charged particle at grazing angles
- **Can be put in forward direction**
- **Fusion-fission, MNT, coulex…**











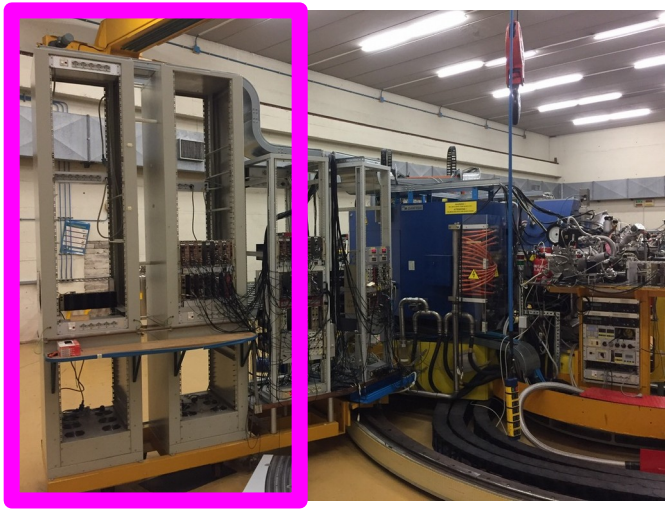
- 110 Silicon detectors (80%4π)
- New compact electronics
- Trigger less operation
- Telescope technique (DE-E and ...PSA)
- Efficiency highly depends on experiment

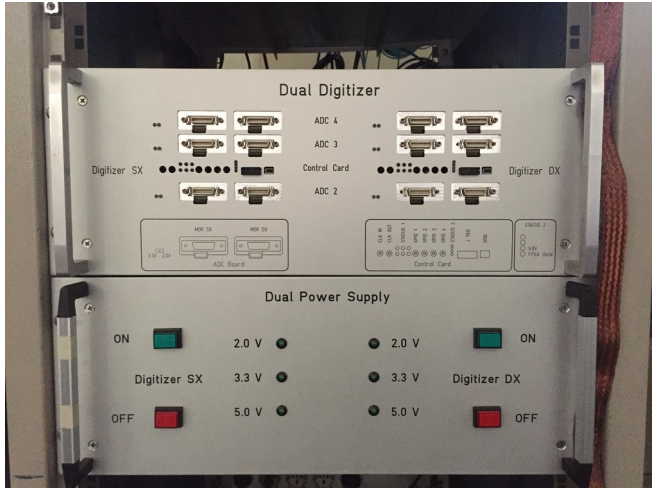
D.Testov eta al., Eur. Phys. J. A55 (2019) 47

FEE & BEE ELECTRONICS

ancillary integration

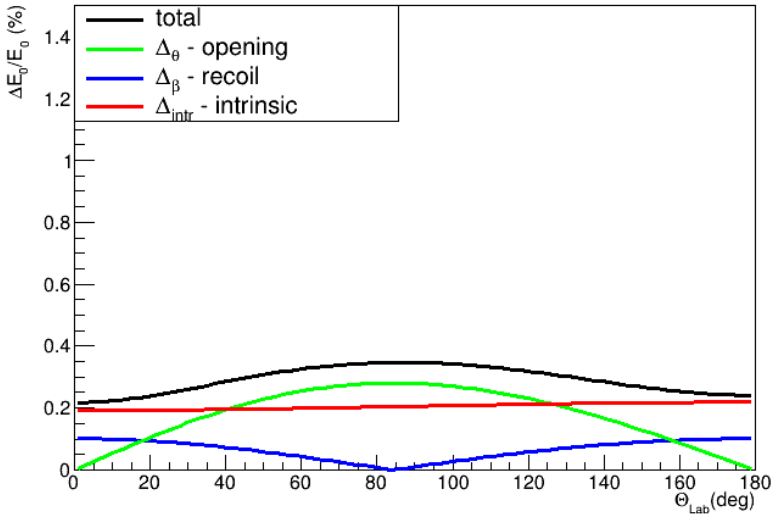
- Custom FEE: available preamplifiers + new production (SPIDER&TRACE)
- About 500 channels accounted for BEE
- GALILEO digitizers
- Racks at PRISMA platform

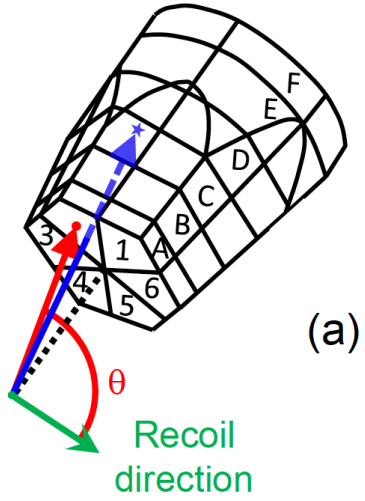




Summary

- Pool of existing detectors available for first phase
- Discussion within specific detector collaboration to understand needs and boost dedicated actions for mechanical and electronics integration
- Design of holding structure, cabling and cooling system inside the reaction chamber are in progress.
- FEE & BEE electronics development/purchase on ongoing



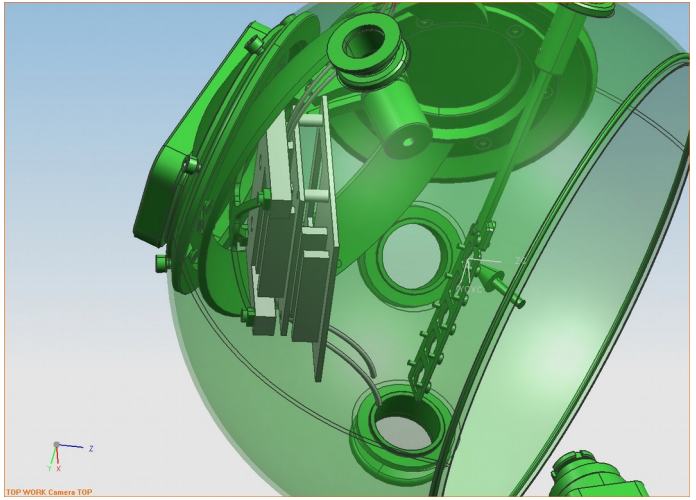


Δθ ~ 1.6°,
Δβ ~1% (β ~ 0.1),
γ - ray energy 1000 keV

Raffreddamento

ancillary integration

- **FEE : 10mW/ch x 60 x 10 rivelatori: ~ 10 W ---> preamp dissipavano per contatto su fondo camera espansione.**
- **Rivelatori (consumo 10 mW /detector); per raffreddarli a circa -20 C (riduzione corrente di leakage): peltier (50 Watt detector escursione 60 gradi) + scambiatore (alcool) + tubi Norvival 0.6 cm diametro) + chiller ---> OK si può rifare scalando**



Configurazione
Dimostratore AGATA 2011

Ancillary ELECTRONICS

integration

- FEE: existing preampfliers: ASISc for uTRACE and SPIDER. PCB adaptation needed
- BEE: max numbers of READOUT channels:10 digitizers x 32 ch
- 1-2 crates VME DIGITIZER Caen (V1730, GTS AGAVA)
- 1-2 crates NIM/mainframe for power modules and the like.
- 1,2+ V1730 extra channels for fast dets FEE FATIMA
- FEE/BEE displacement
- trigger (processor) → join electronics/DAQ meeting

FEE & BEE ELECTRONICS

ancillary integration

- GALTRACE[5 telescopes] 5x60 +10 + 3x10+10 + 10 (spare) + SPIDER 9x8 ~ 400 canali
- BEE (digitizers): 360 + 72 (from beta decay) → recuperiamo da beta decay per omogeneità [adc commerciali V1725 (250 MHz) @ beta station]

- preamp: 14x16=224
  16x16=256
  ~160 canali → 10 schede
- flangia : 400 canali + plunger + HV + controllo preamp
  singolo connettore flat 5x1 cm² [17+17 oppure 30+4]
  25 x 5 = 125 cm² → 25 x 8 cm² ingombro flangia
  15 x 5 = 75 cm² → 15 x 5 cm² ingombro flangia
- flat-to-mdr connectors patch panel
- oppure SEDIFF