Properties of the AGATA-Triple-Cryostats

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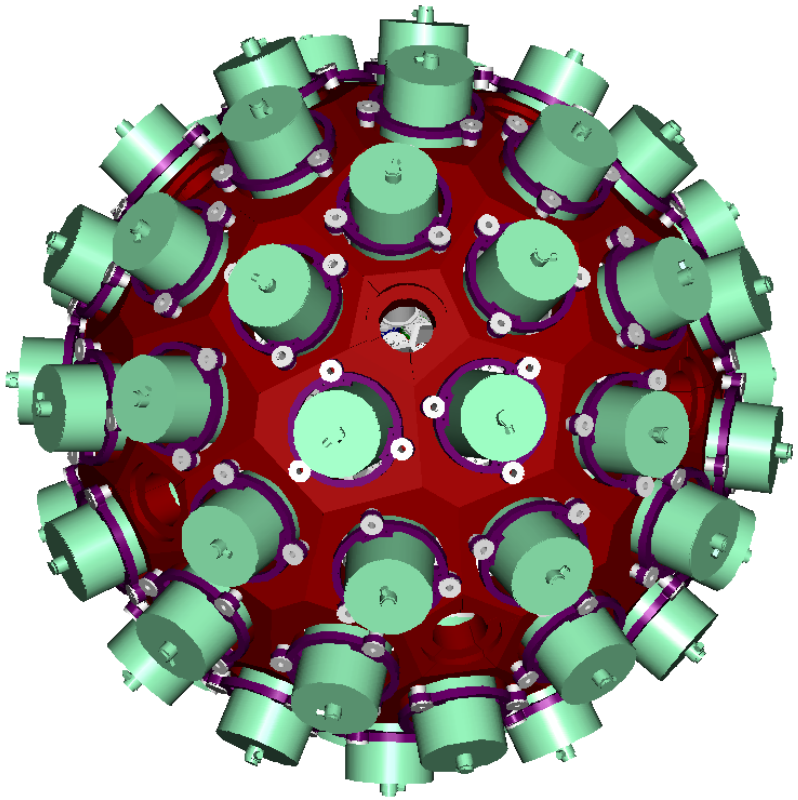
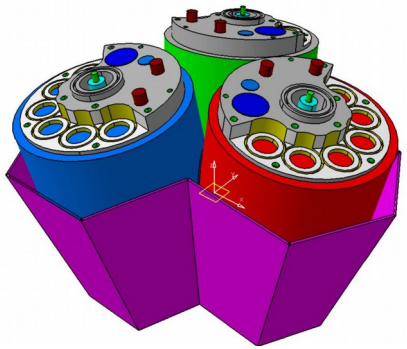
The AGATA Spectrometer





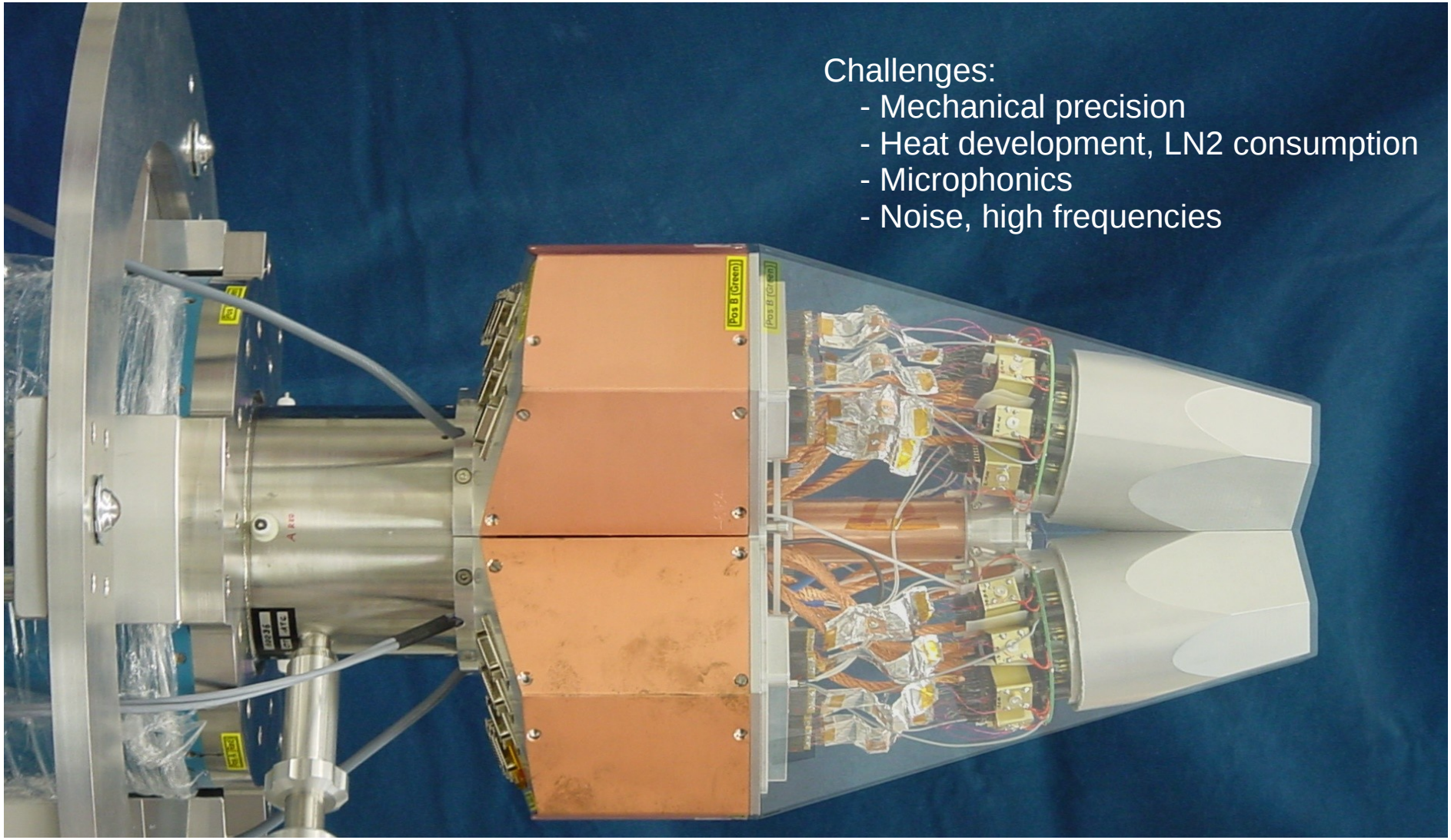
180 hexagonal crystals		
60 triple-clusters		
Amount of germanium	362 kg	
Solid angle coverage	82 %	
36-fold segmentation	6480 segments	
Singles rate	>50 kHz	
Efficiency:	43% (M_γ=1)	28% (M_γ=30)
Peak/Total:	58% (M_γ=1)	49% (M_γ=30)

- 6660 high-resolution digital electronics channels
- High throughput DAQ
- Pulse-Shape Analysis

  → position-sensitive operation mode

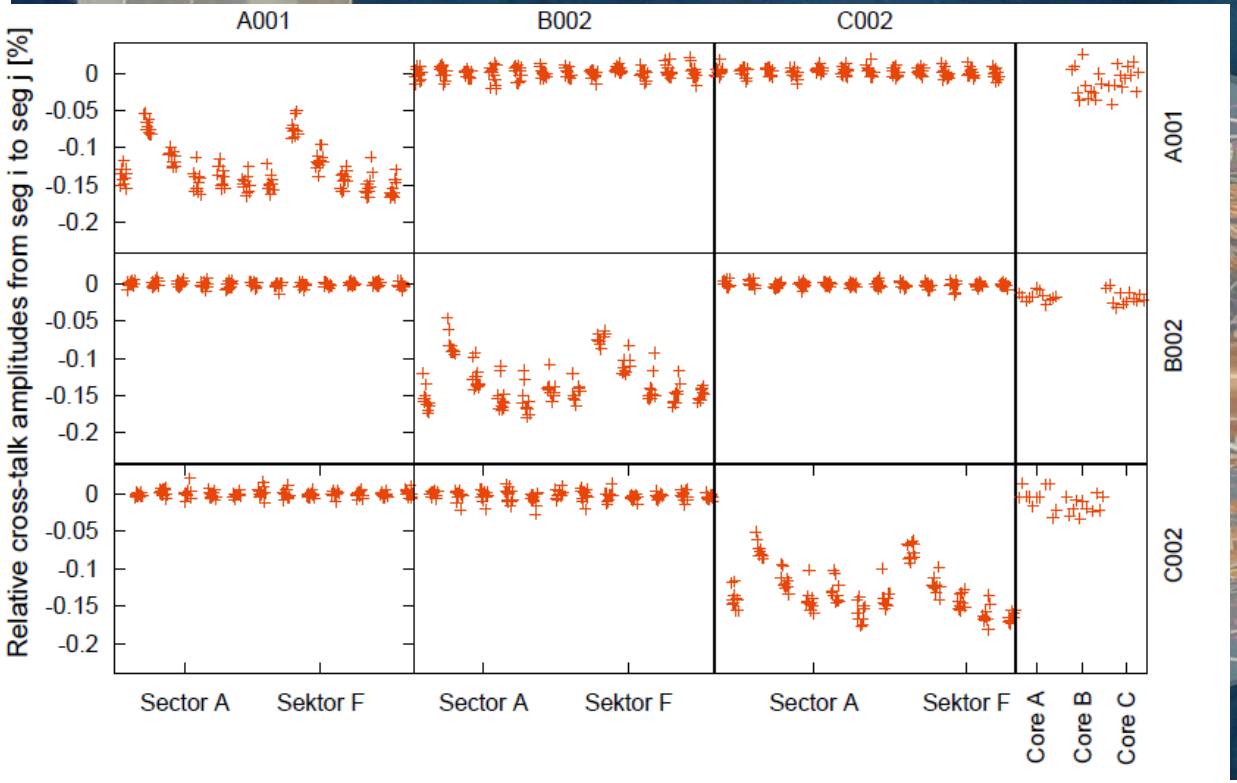
– γ-ray tracking algorithms

Asymetric AGATA Triple Cryostat



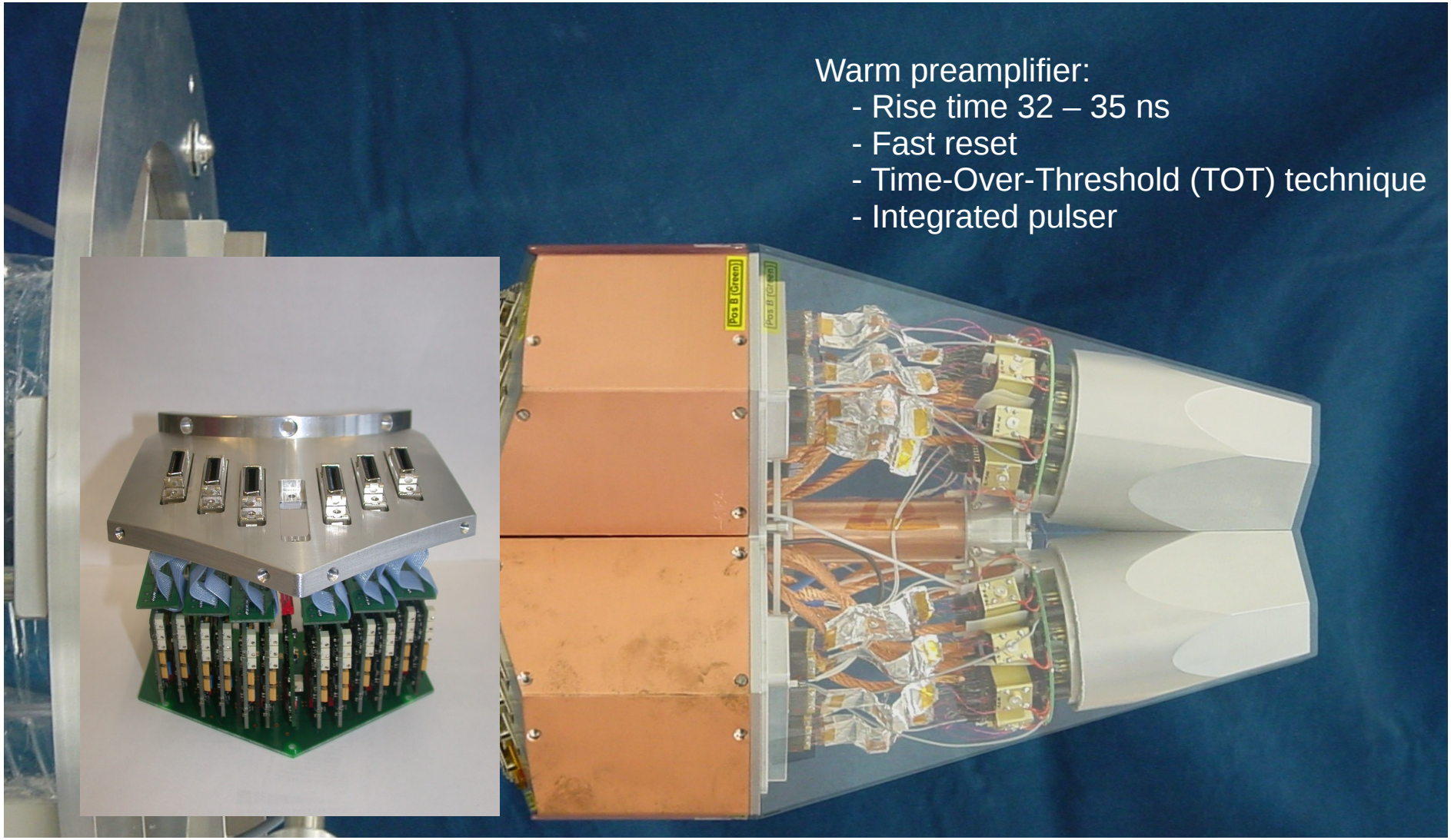
Asymetric AGATA Triple Cryostat

- Integration of 111 high resolution spectroscopy channels
- Cold FET technology for all signals
- Crosstalk < 0.1 %



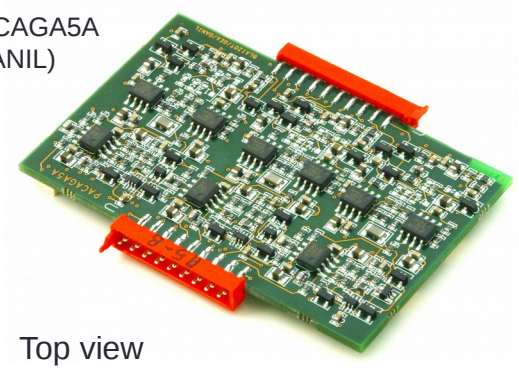
Energy resolution: 2.1 keV for segments and 2.3 keV for core at 1.3 MeV
1.0 keV for segments and 1.3 keV for core at 60 keV

Asymetric AGATA Triple Cryostat



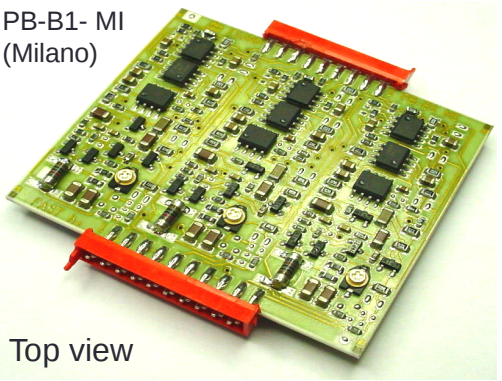
Developed AGATA Preamplifiers

PACAGA5A
(GANIL)



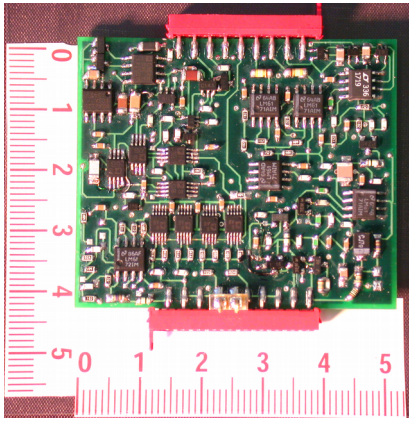
Top view

PB-B1- MI
(Milano)

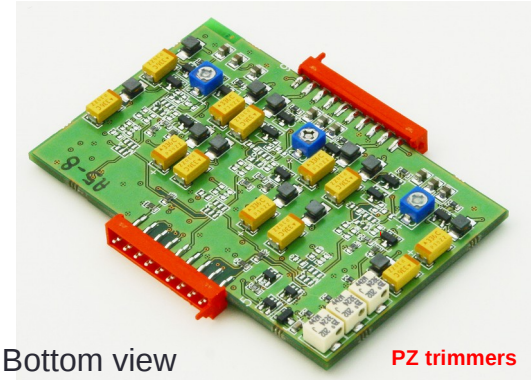


Top view

AGATA_
core-pulser
(Köln)



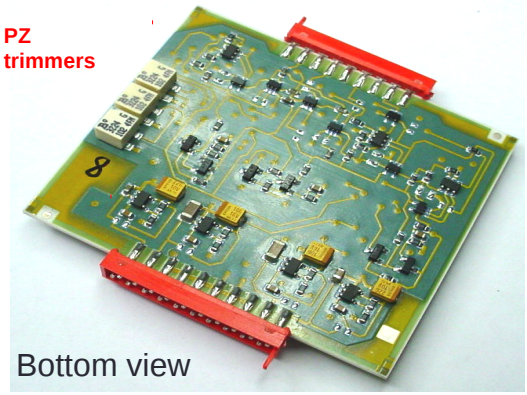
1 Channel
version



Bottom view

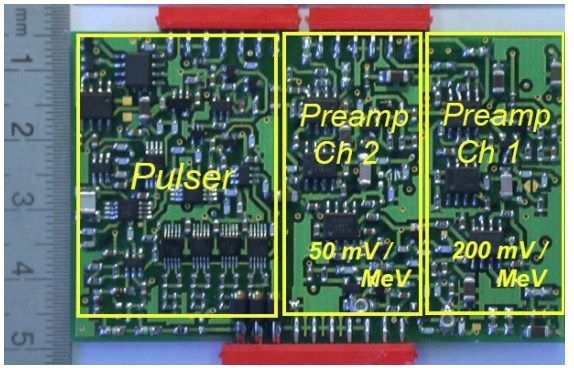
PZ trimmers

PZ
trimmers



Bottom view

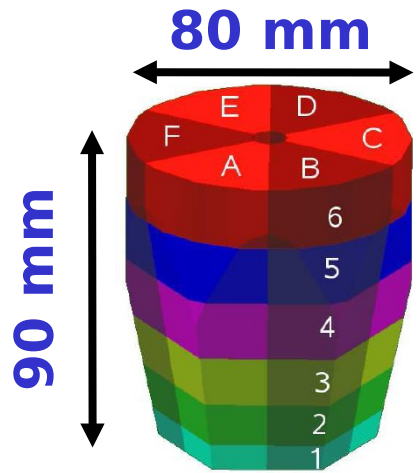
New version: “Dual Core“



Triple segment preamp on FR4 substrate **Mod. “PACAGA5A” – GANIL** B. Cahan et al.	**Triple segment preamp on alumina substrate** **Mod. “PB-B1 MI” – Milano** A. Pullia et al.	**Core preamplifier & built-in pulser on FR4 substrate** **Mod. “AGATA core-pulser” – Koeln** G. Pascovici et al.

A. Pullia, G. Pascovici, B. Cahan, D. Weisshaar, C. Boiano, R. Bassini, M. Petcu, F. Zocca, “**The AGATA charge-sensitive preamplifiers with built-in pulser and active-reset device**”, Proc. Nucl. Sci. Symp., October 16-22, 2004, Rome, Italy

AGATA Components



36-fold segmentation

Benefits and Deficits of the hitherto encapsulation

Benefits:

- Easy to handle detectors for maintenance and mounting in cryostats
- Long integrity lifetime

~ 95% of more than 150 encapsulated detectors produced 25 years ago are still working with original resolution

Deficits:

- Complex technologies for manufacture and repair
- Destructive opening of the capsule for detector repair (max 2-3 times)

→ high costs of repairs

Welding process reduces the dimensional accuracy → has to be compensated during assembly of triple cryostats

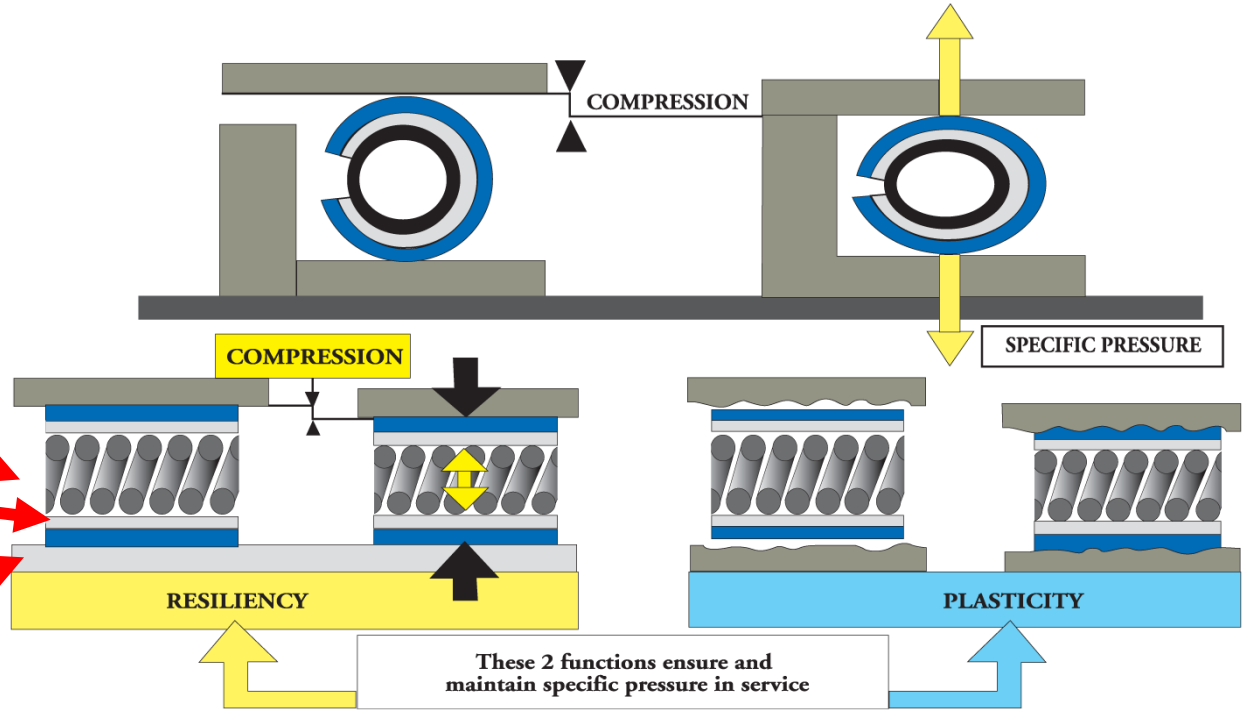
Conclusion: Develop re-usable capsule with metal-elastic seal

Principle of a metal-elastic seal: UHV-tight from liquid He to some 100's centigrades

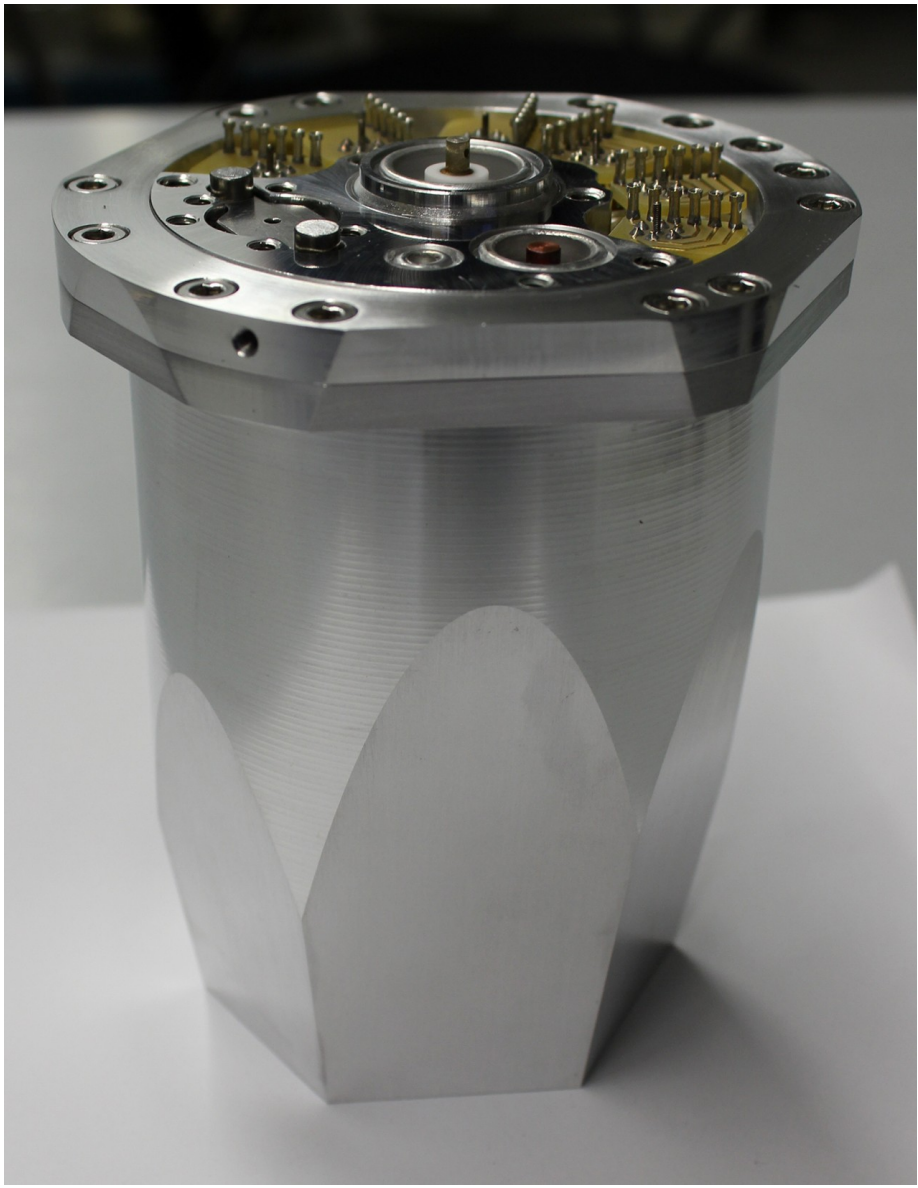
Spiral spring gives the seating stress

Elastic coverage of the spring

Coating softer than flange metal



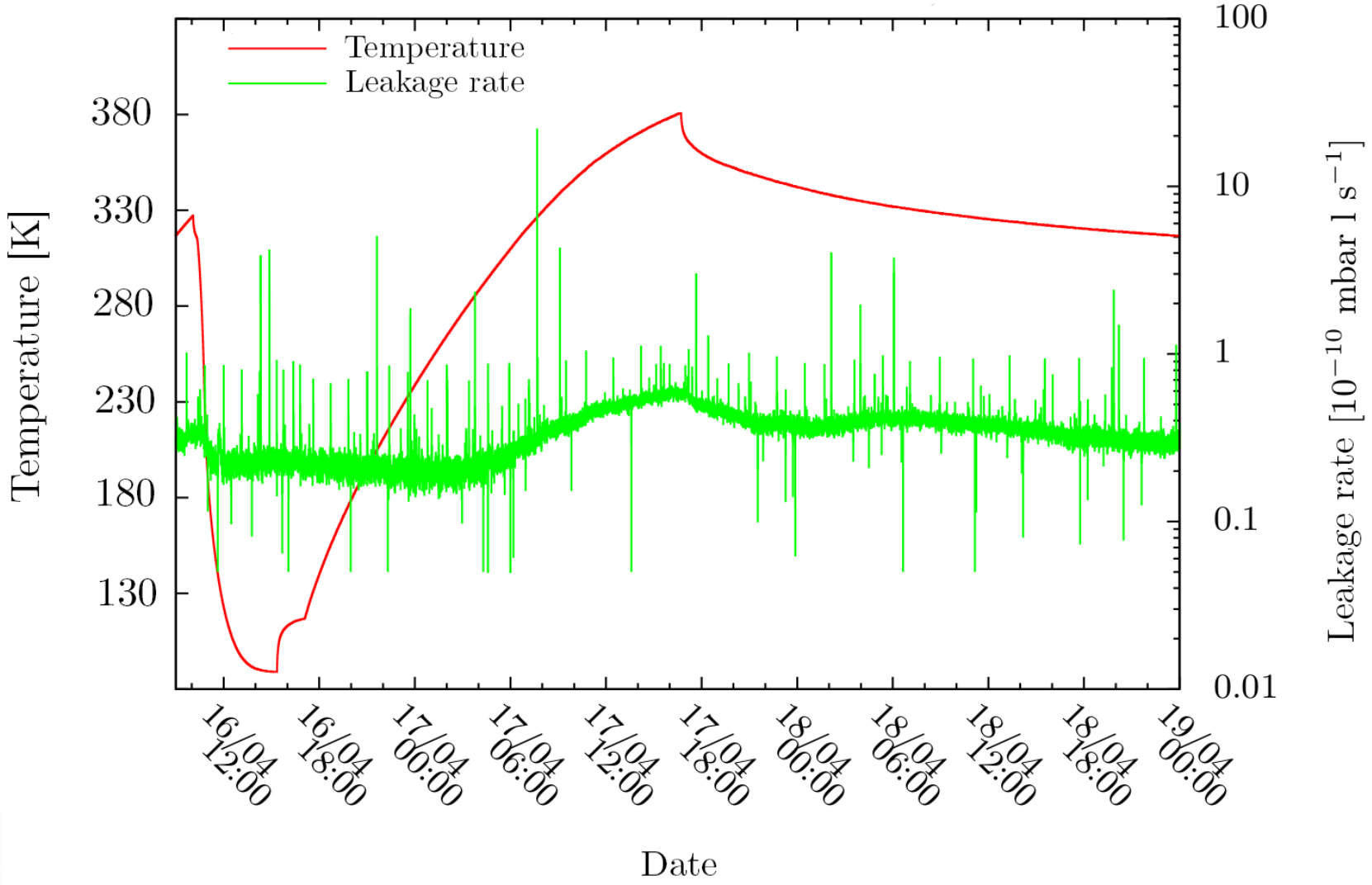
AGATA detector with new sealing technology



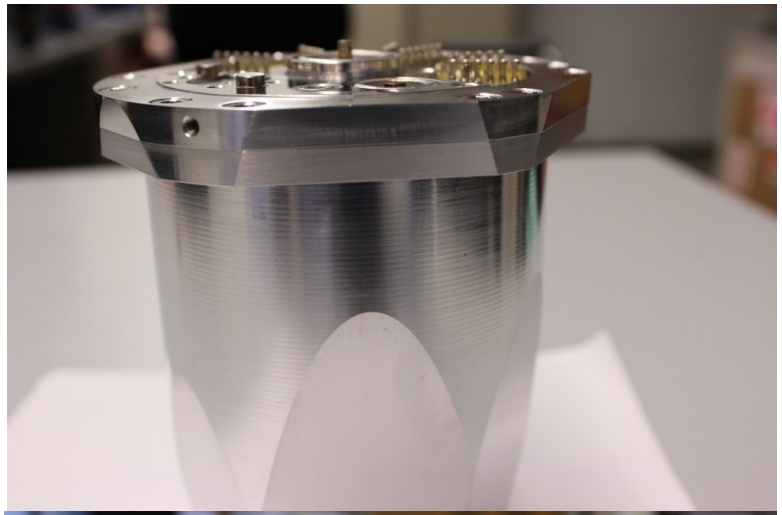
The new AGATA capsule

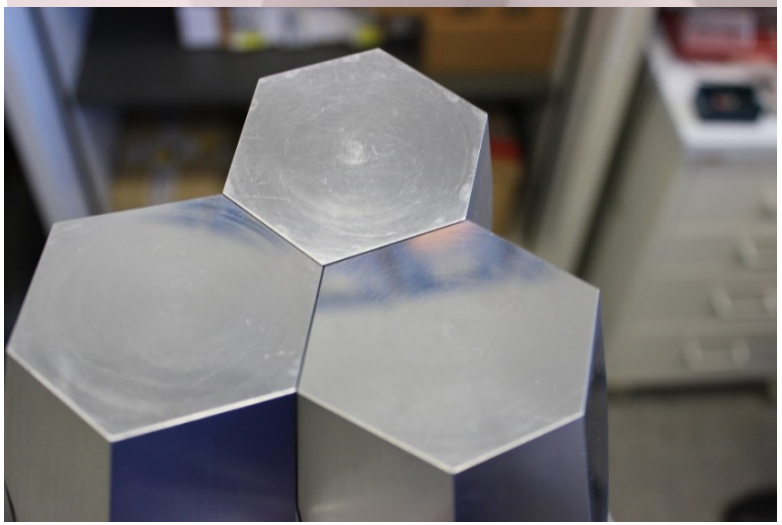
AGATA capsule with a metal elastic seal

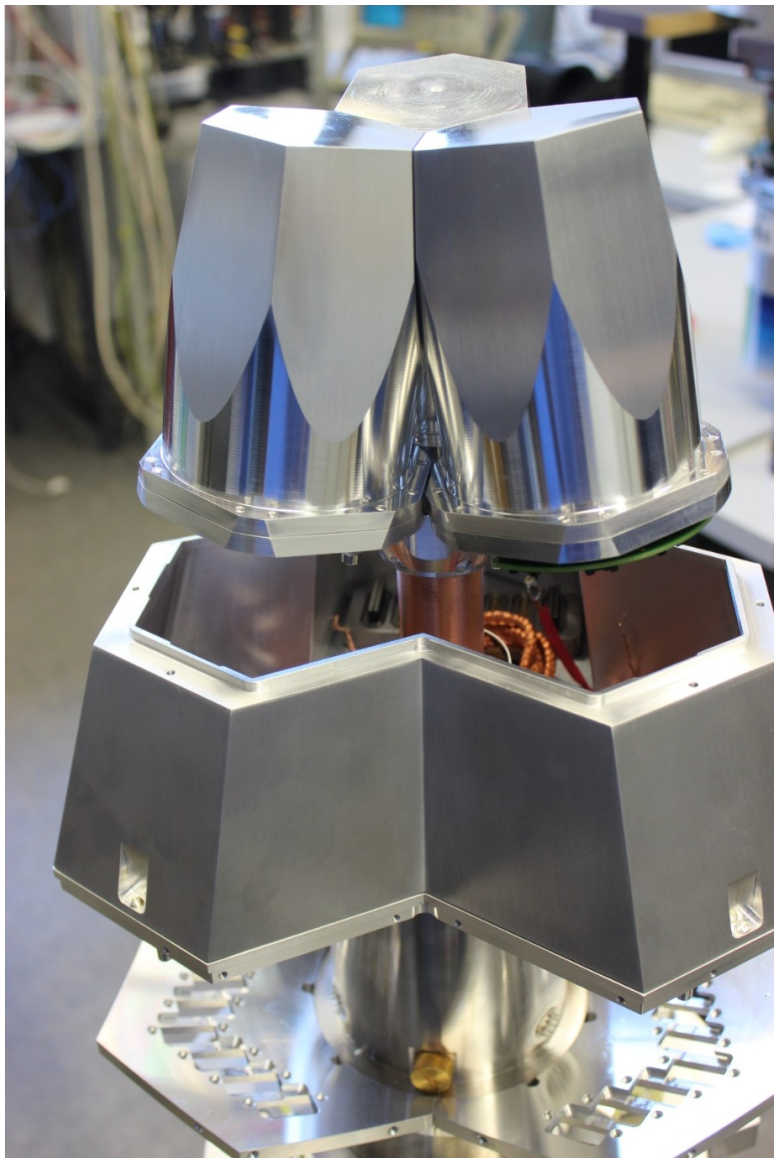
Leakage rate during a temperature cycle from 77 K to 378 K



Assembly of ATC13, new encapsulation technology

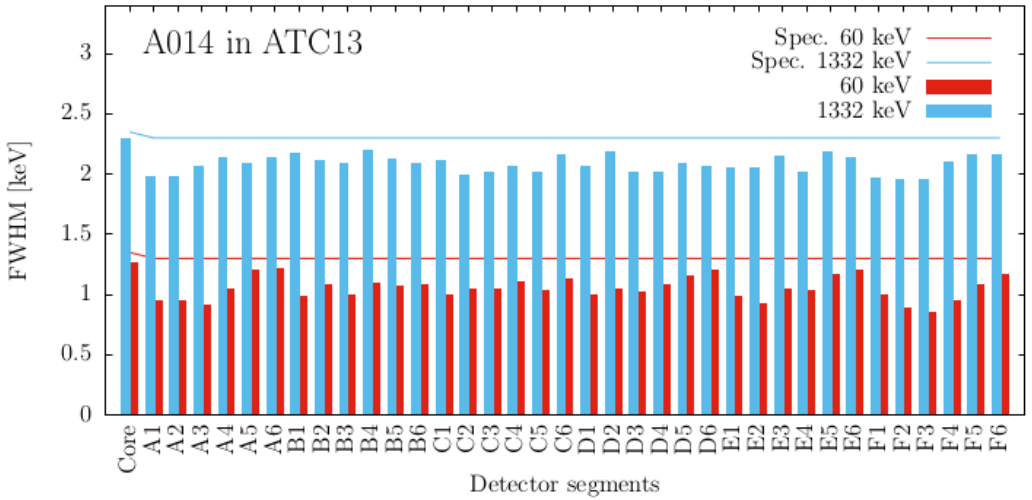


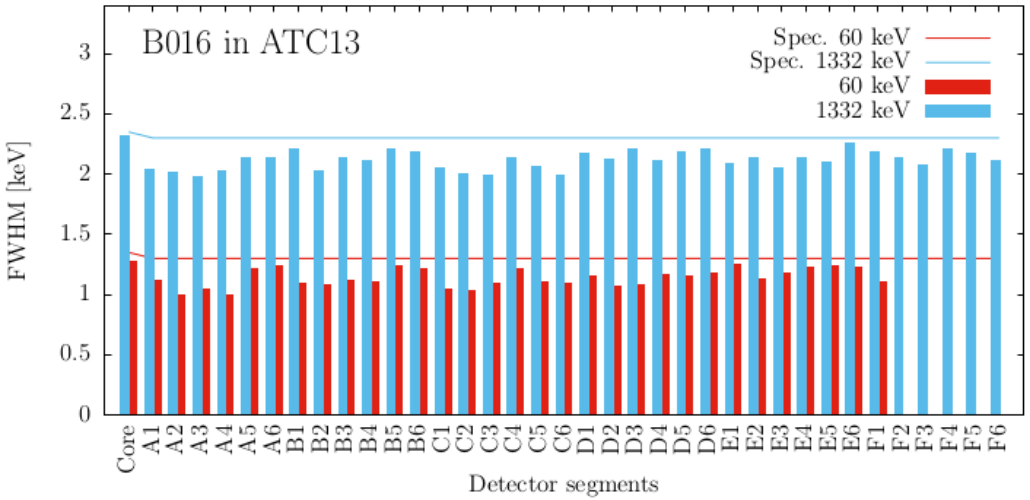




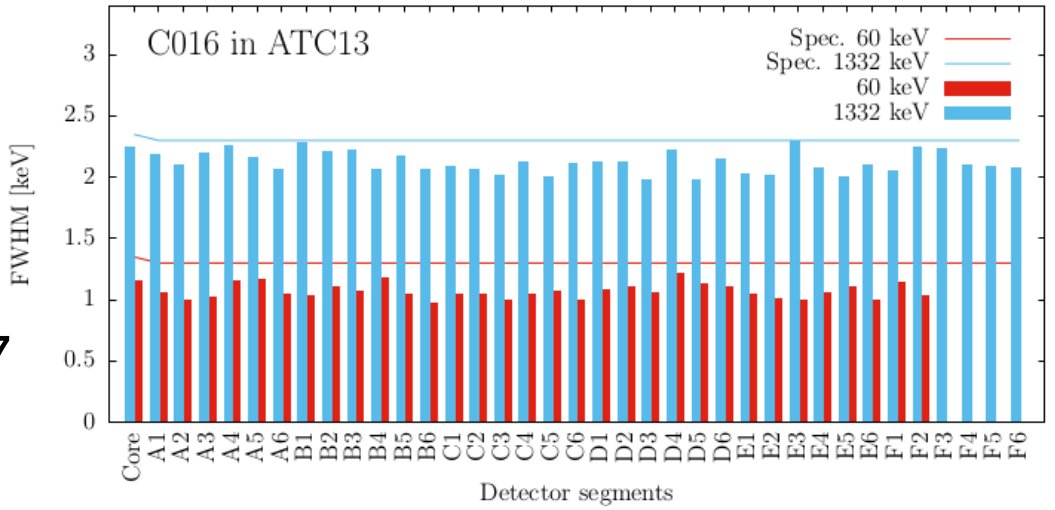
Capsules fit without adjustment

Energy resolution of ATC13 (measured at IKP)

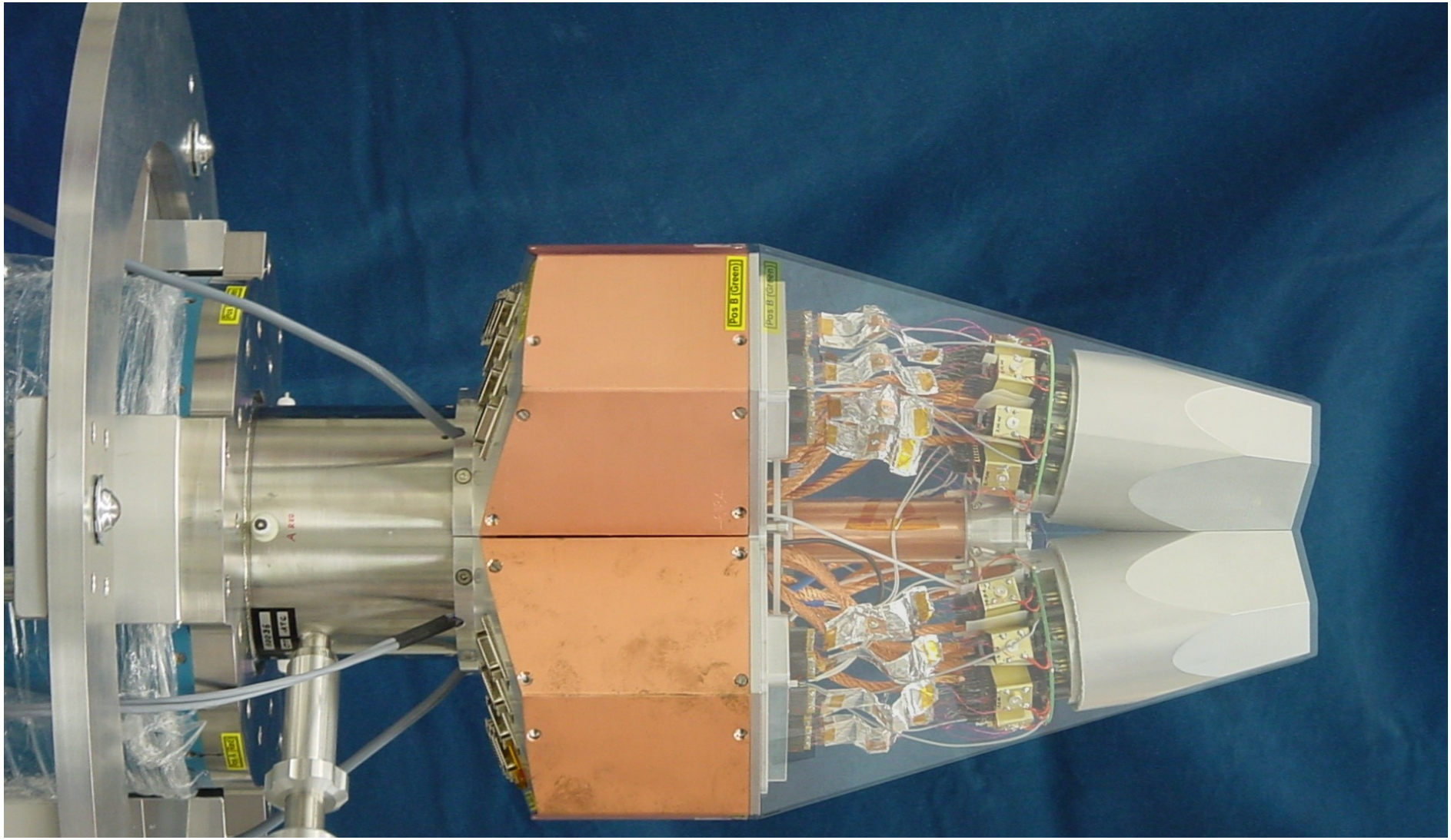




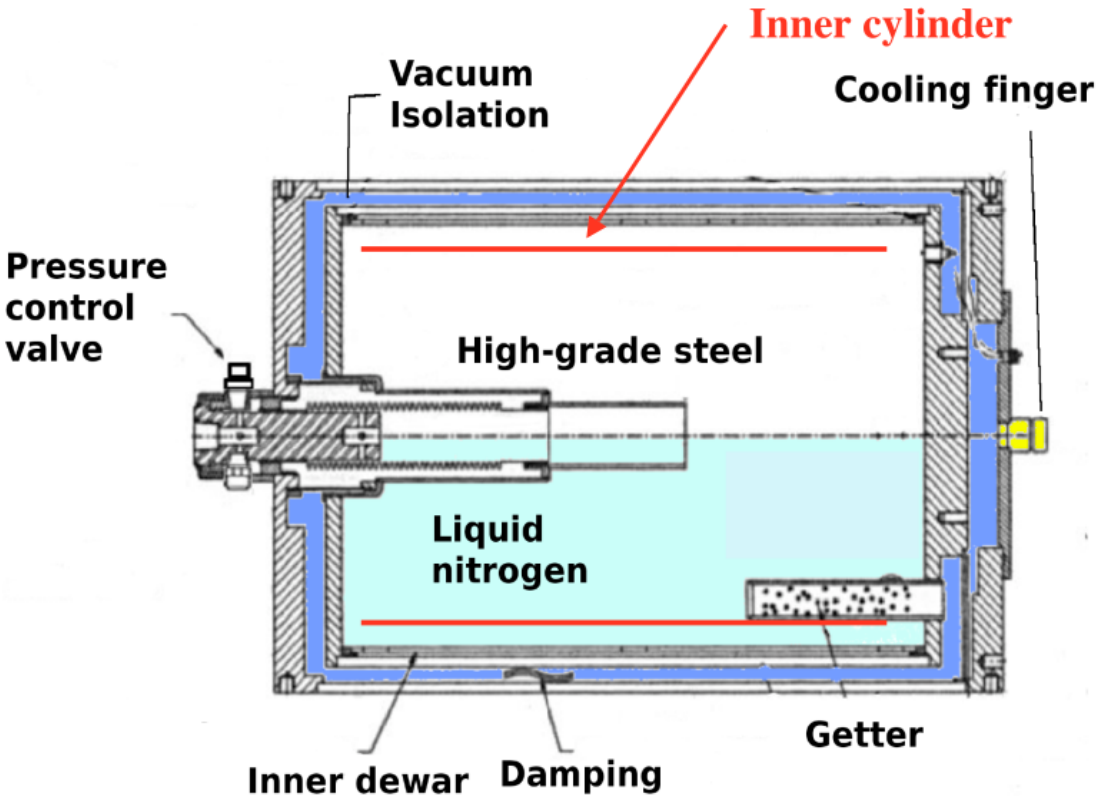
First AGATA triple cryostat with the new encapsulation technology
→ delivered to GANIL March 2017

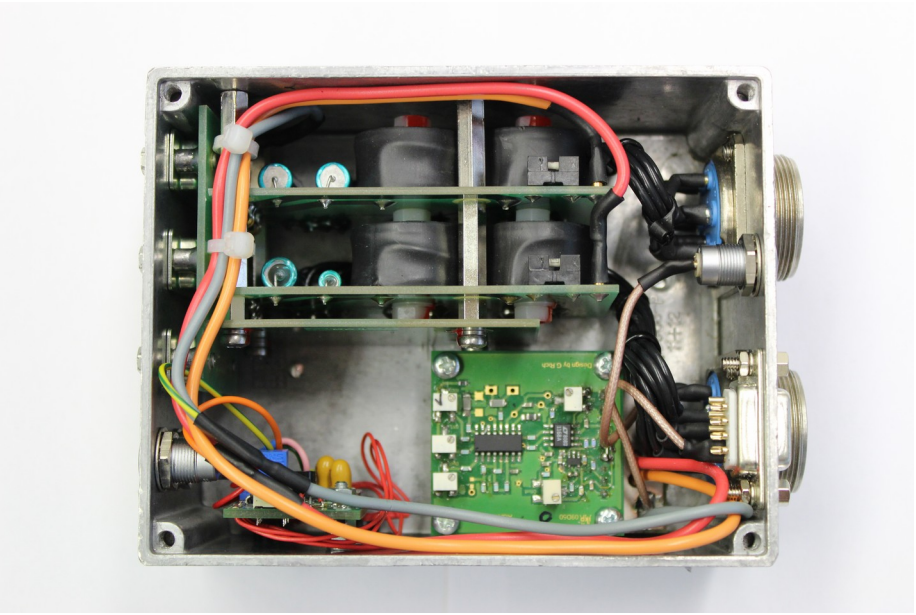


Vacuum properties & PT100



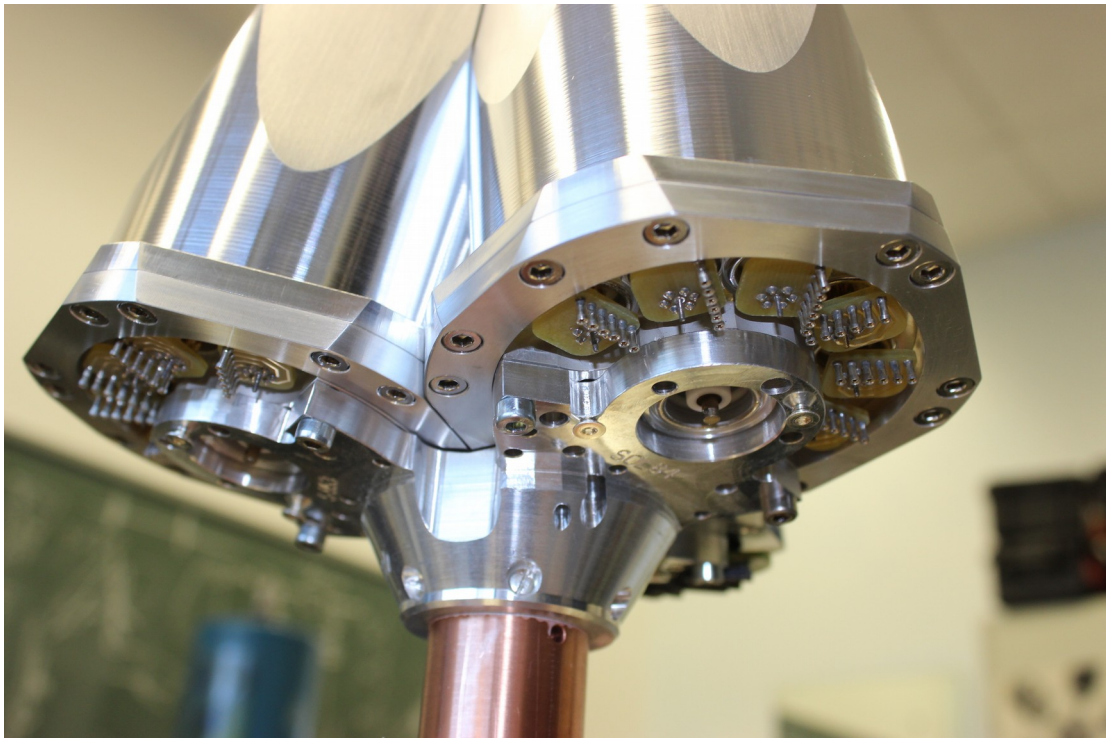
Capacity read out of the AGATA Triple Cryostats





Capacity between inner cylinder and inner dewar
- use of different dielectric constant of liquid- and gaseous nitrogen
- capacity as function of LN2 level
- difference between full and empty dewar ca. 120 pF ~ 12%
- C/V transducer → DC voltage signal
- direct readout of LN2 level
- information about LN2 consumption

Vacuum properties of a AGATA triple cryostat



So far: Getter integrated in dewar

→ has to be annealed with dewar

But: optimal annealing at 200°C

- Getter mounted in a removabel box on the cooling finger, can be annealed outside the cryostat

The AGATA ceramic feedthroughs

To improve the high reliability new feedthroughs were developed

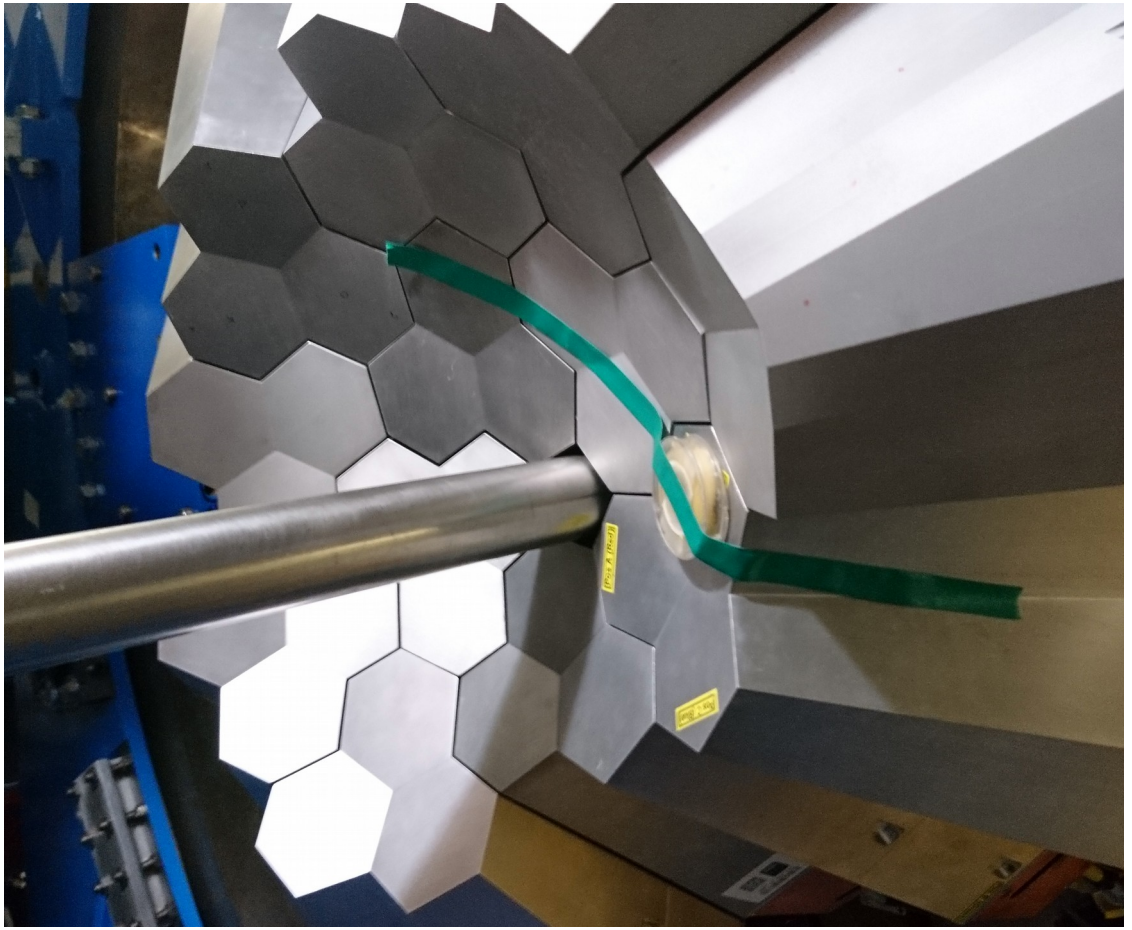
- Ti-housing
- Gold-plated contact pins in insulators of Aluminiumoxide ceramic
- 18 gold-plated pins sintered in one feedthrough with Cu-Ag-alloy
- 7 feedthroughs integrated in one Ti-housing (electron welding)

Detectors in GANIL begin of March

35 out of 47 detectors in GANIL for physics campaign

ATC01: A012, B001, C004
ATC02: A003, B003, C005
ATC04: A007, B007, C007
ATC05: A008, B002, C009
ATC06: A001, B004, C010
ATC07: A006, B013, C006
ATC08: A009, B005, C008
ATC09: A004, B008, C002
ATC11: A011, B006, C012
ATC12: A013, B014, C015
ATC13: A014, B016, C016

ADC03: - B011, C011



Development of a re-usable capsule for AGATA detectors by

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Stefan Thiel

IKP University of Cologne

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Mirion (Canberra) Lingolsheim

The AGATA Collaboration

13 Countries
>40 Institutions

Bulgaria: Univ. Sofia
Denmark: NBI Copenhagen
Finland: Univ. Jyväskylä
France: GANIL Caen, IPN Lyon, CSNSM Orsay, IPN Orsay, CEA-DSM-DAPNIA Saclay, IPHC Strasbourg, LPSC Grenoble
Germany: GSI Darmstadt, TU Darmstadt, Univ. zu Köln, TU München
Hungary: ATOMKI Debrecen
Italy: INFN-LNL, INFN and Univ. Padova, Milano, Firenze, Genova, Napoli,
Poland: NINP and IFJ Krakow, SINS Swierk, HIL & IEP Warsaw
Romania: NIPNE & PU Bucharest
Sweden: Univ. Göteborg, Lund Univ., KTH Stockholm, Uppsala Univ.
Turkey: Univ. Ankara, Univ. Istanbul, Technical Univ. Istanbul
UK: Univ. Brighton, CLRC Daresbury, Univ. Edinburgh, Univ. Liverpool, Univ. Manchester, Univ. West of Scotland, Univ. Surrey, Univ. York
Spain: IFIC Valencia, IEM-CSIC Madrid, LRI Univ. Salamanca