

Advancement of AGATA Technology

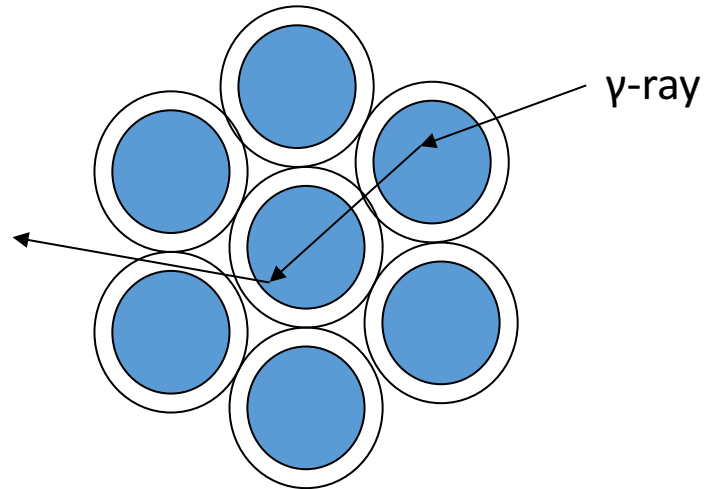
A re-usable canister for detector encapsulation

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Contents:

- **A short history of encapsulated Ge detectors hermetically sealed by electron-beam welding**
- **Benefits and deficits of the existing technology**
- **The re-usable capsule closed with a metal-elastic seal**
- **First results**

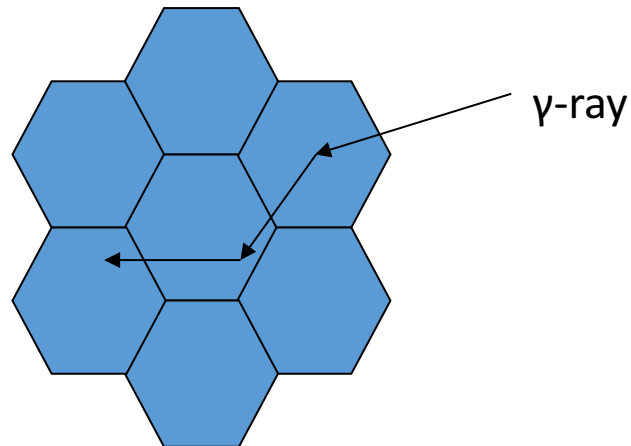
The EUROBALL Cluster Detector



Late 1980's :

Discussion of a cluster
of seven detectors with
large efficiency in
add-back mode

γ -ray

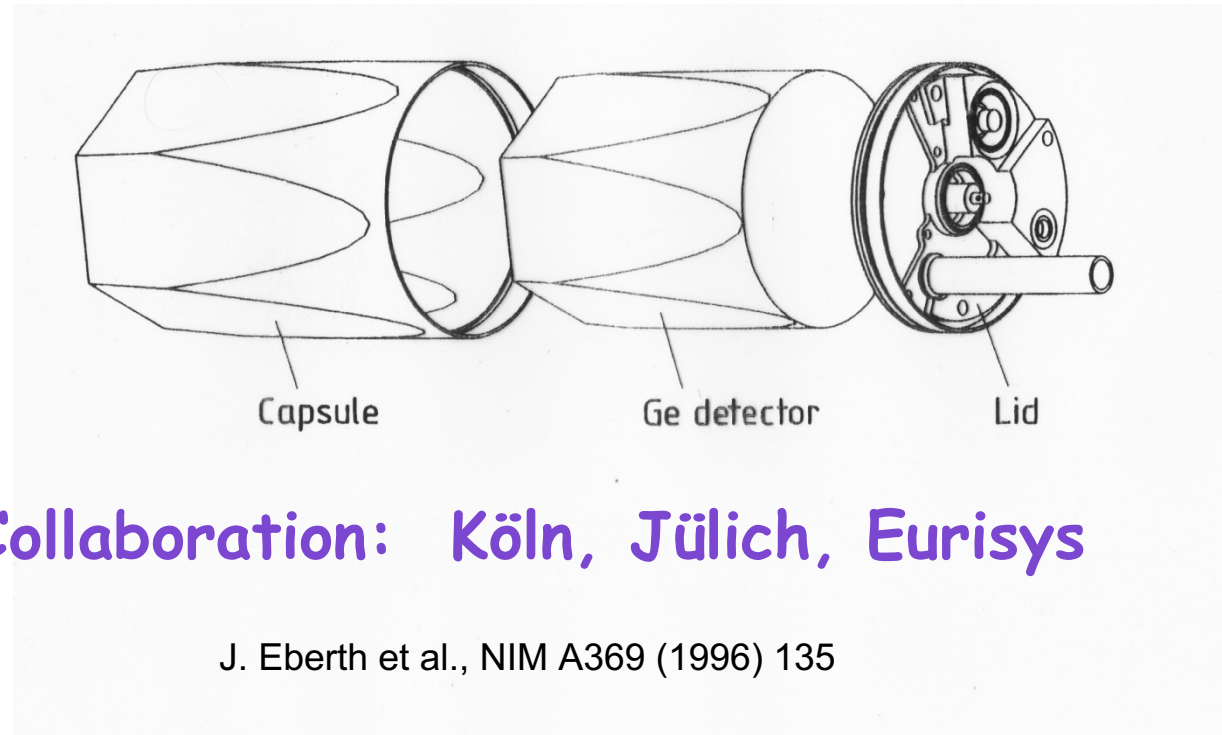


Conclusion:
seven hexagonal detectors in a
common cryostat

**Needs encapsulation of the
individual Ge detectors !**

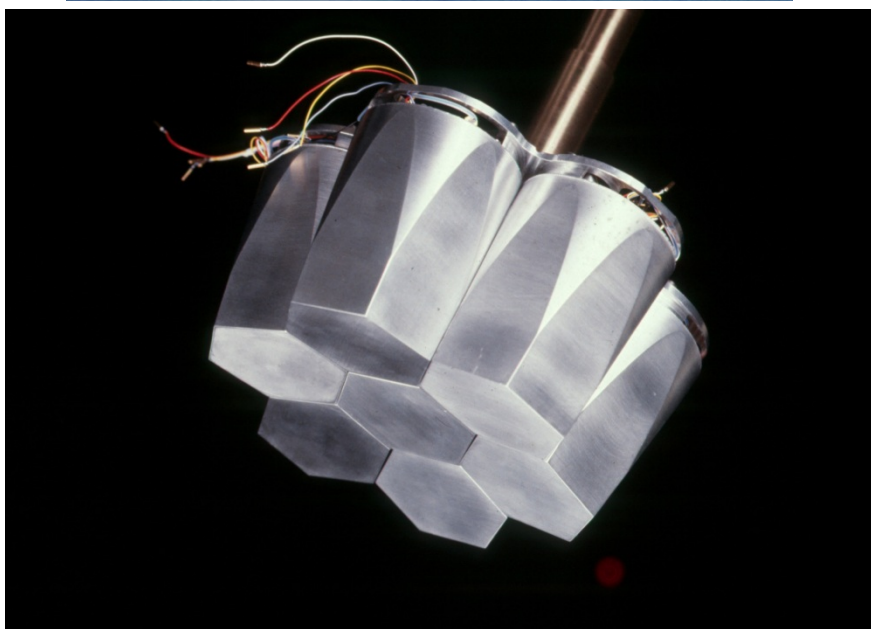
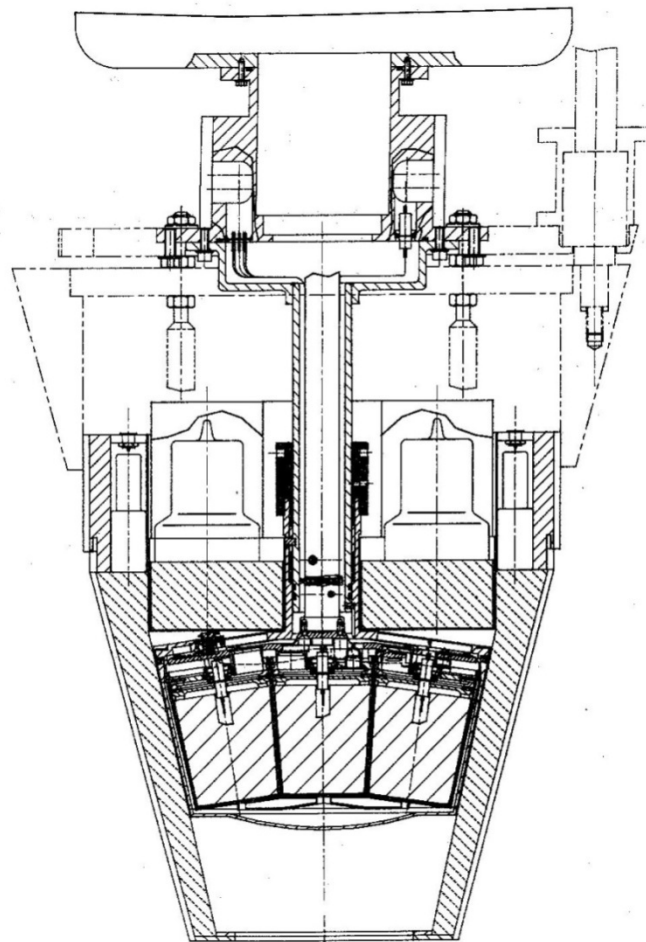
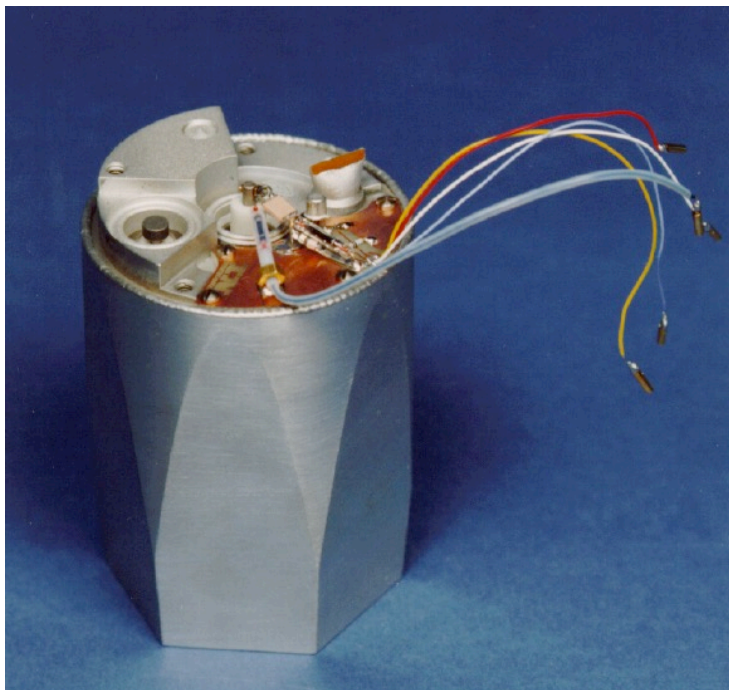
The encapsulated Ge detector

capsule and lid sealed by electron-beam welding
internal Getter, vacuum $< 10^{-6}$ mb,
temperature range -196°C to $+110^{\circ}\text{C}$



Collaboration: Köln, Jülich, Eurisys

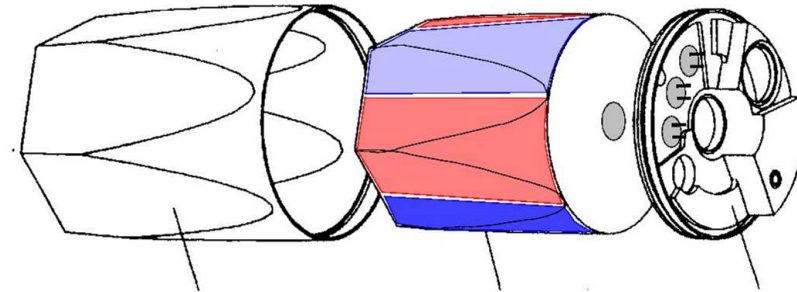
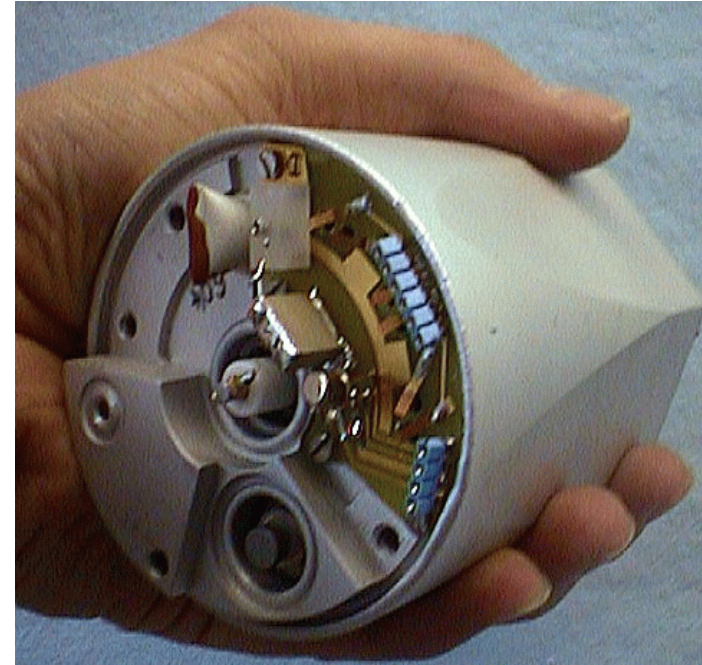
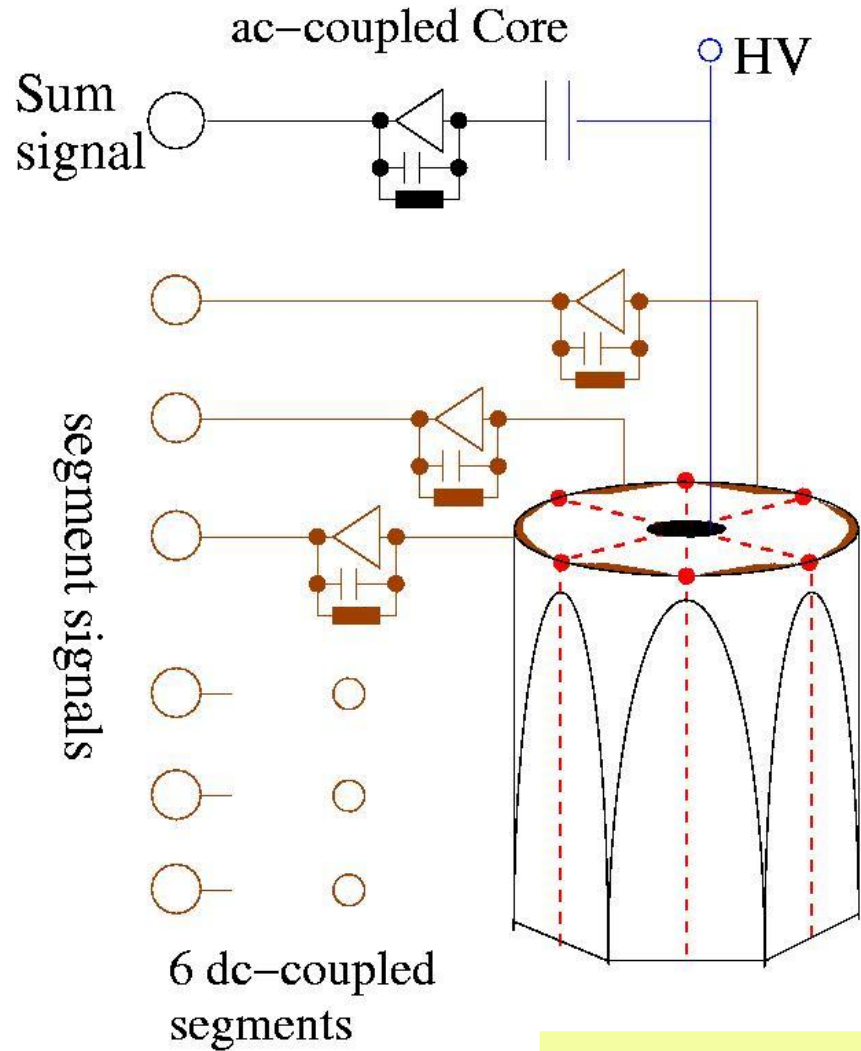
J. Eberth et al., NIM A369 (1996) 135



The EUROBALL Cluster Detector

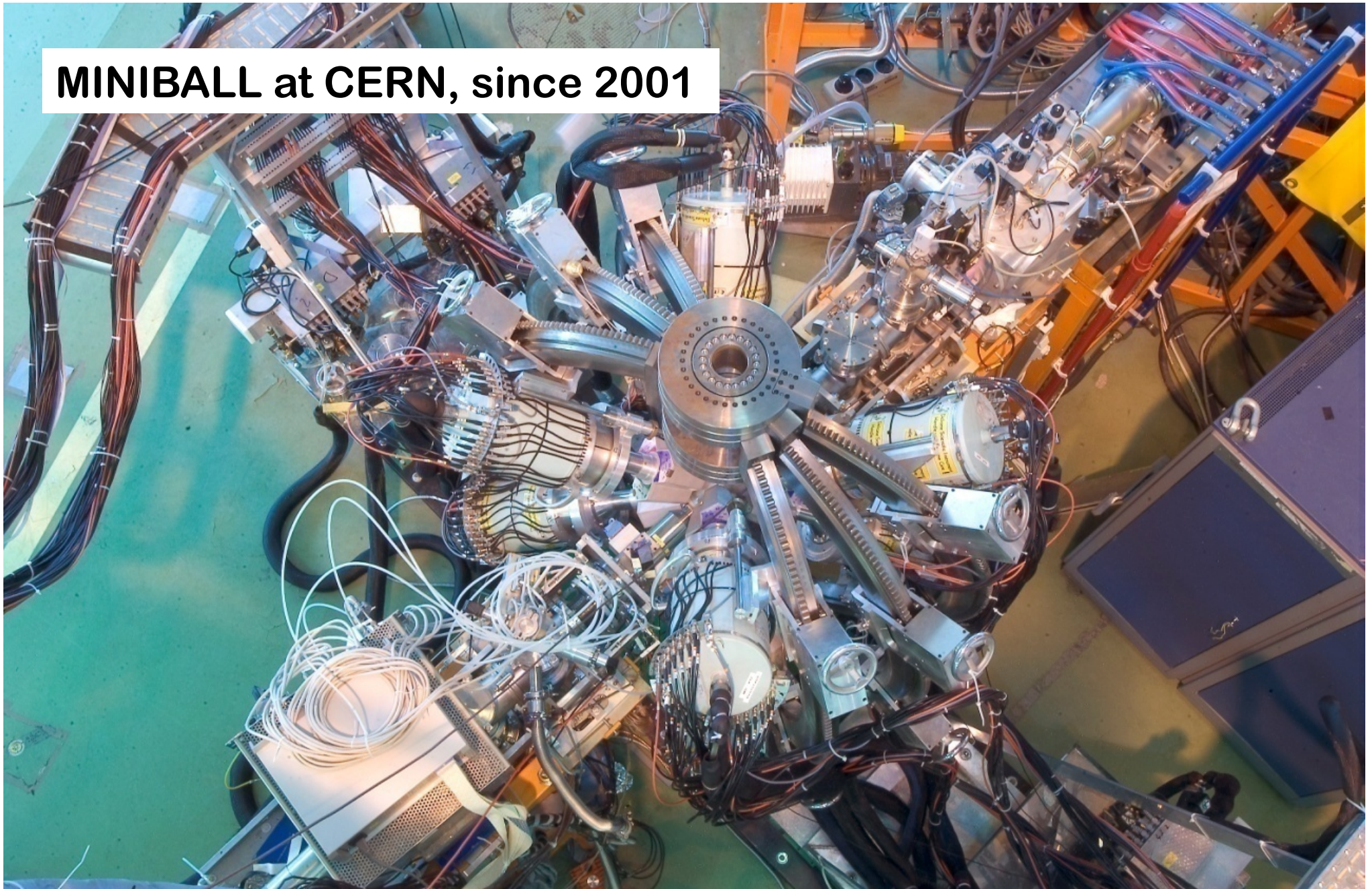


The 6-fold segmented, encapsulated MINIBALL detector

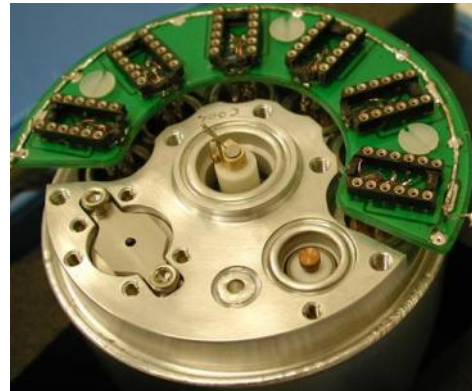
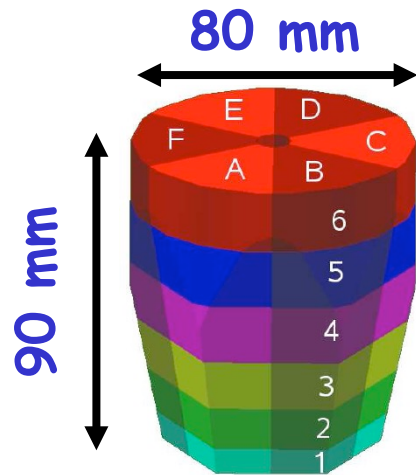


Collaboration: Köln, Heidelberg, München, Leuven

MINIBALL at CERN, since 2001



AGATA Components



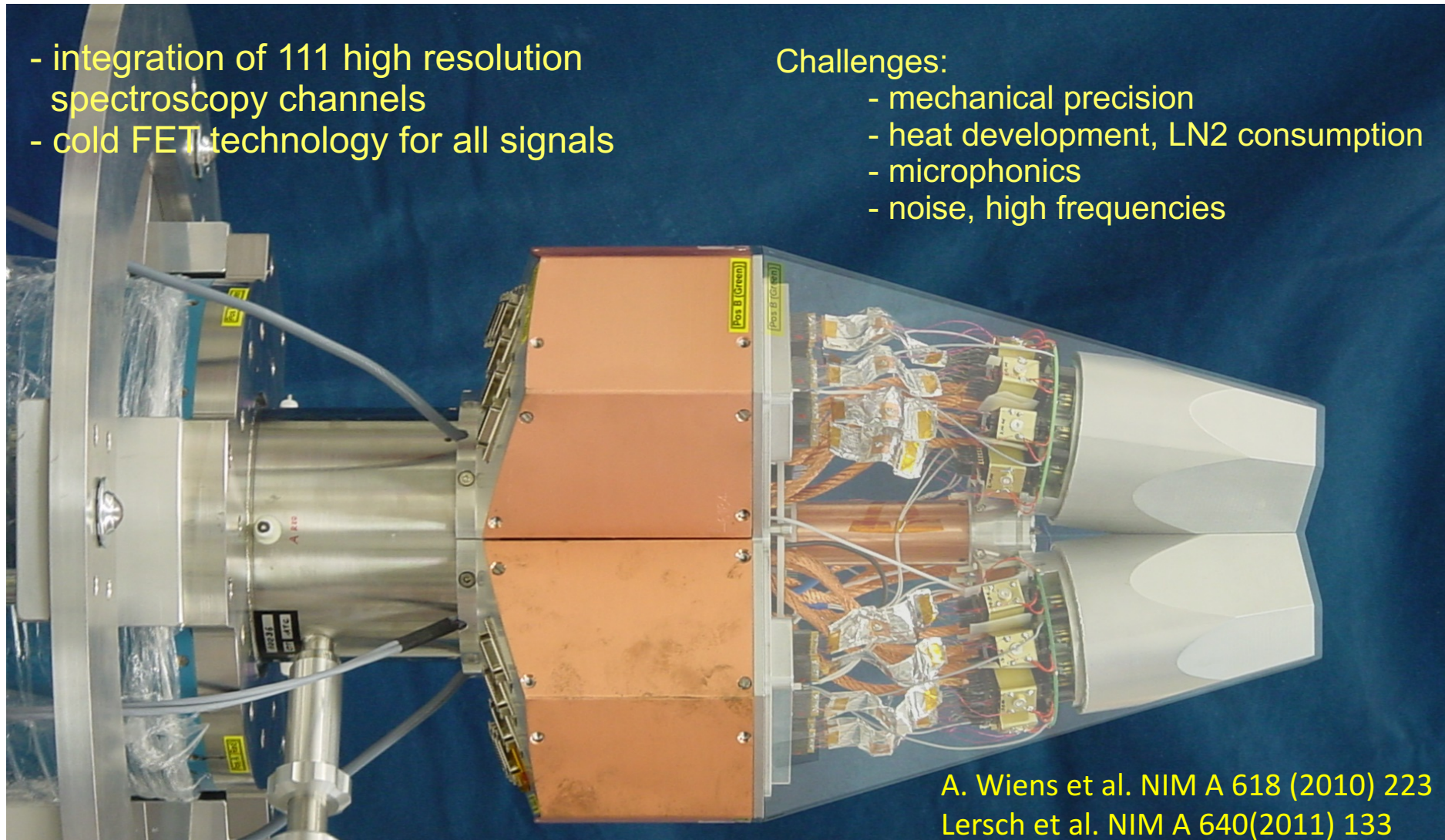
36-fold segmentation

Asymmetric AGATA Triple Cryostat

- integration of 111 high resolution spectroscopy channels
- cold FET technology for all signals

Challenges:

- mechanical precision
- heat development, LN2 consumption
- microphonics
- noise, high frequencies




A. Wiens et al. NIM A 618 (2010) 223
Lersch et al. NIM A 640(2011) 133

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

Benefits of the hitherto encapsulation:

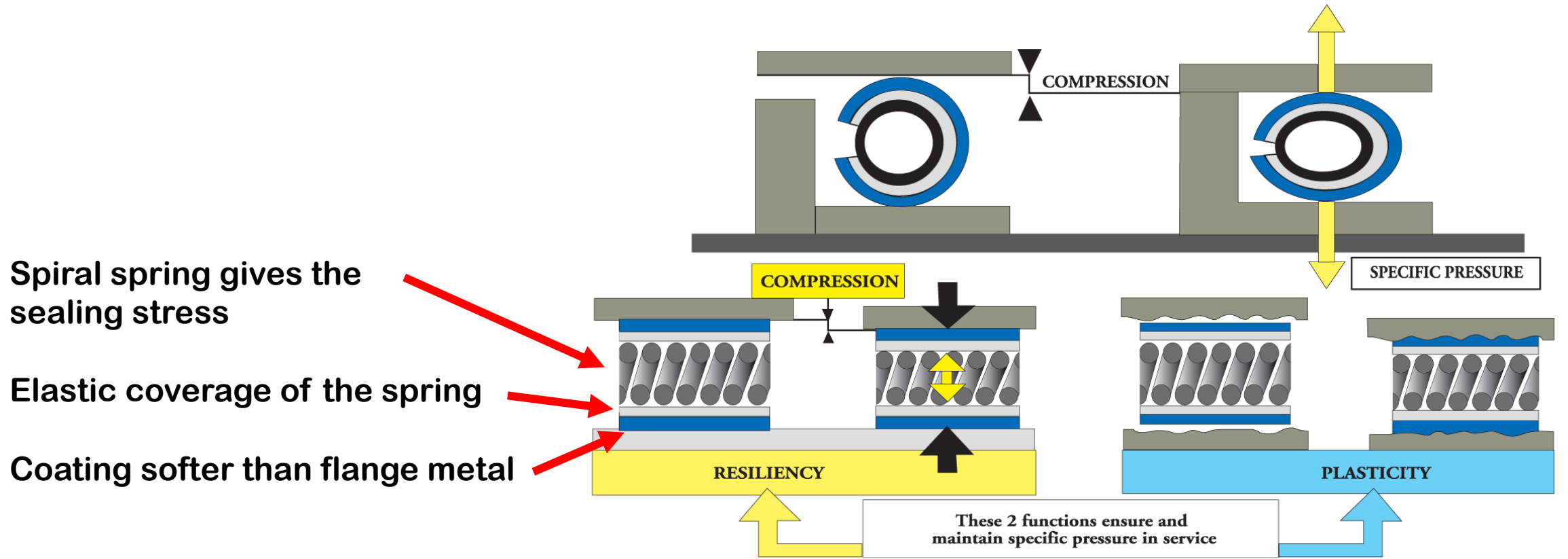
- Easy to handle detectors for maintenance and mounting in cryostats
- Long integrity lifetime:
~ 95% of more than 150 encapsulated detectors produced for EUROBALL 25 years ago are still working with original resolution

Deficits of the hitherto encapsulation:

- Complex technology to manufacture and to repair
- Destructive opening of the capsule for detector repair (max. 2-3 times)  high cost of repairs, long down time
- Welding process reduces the dimensional accuracy (has to be compensated during assembly of triple clusters)

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

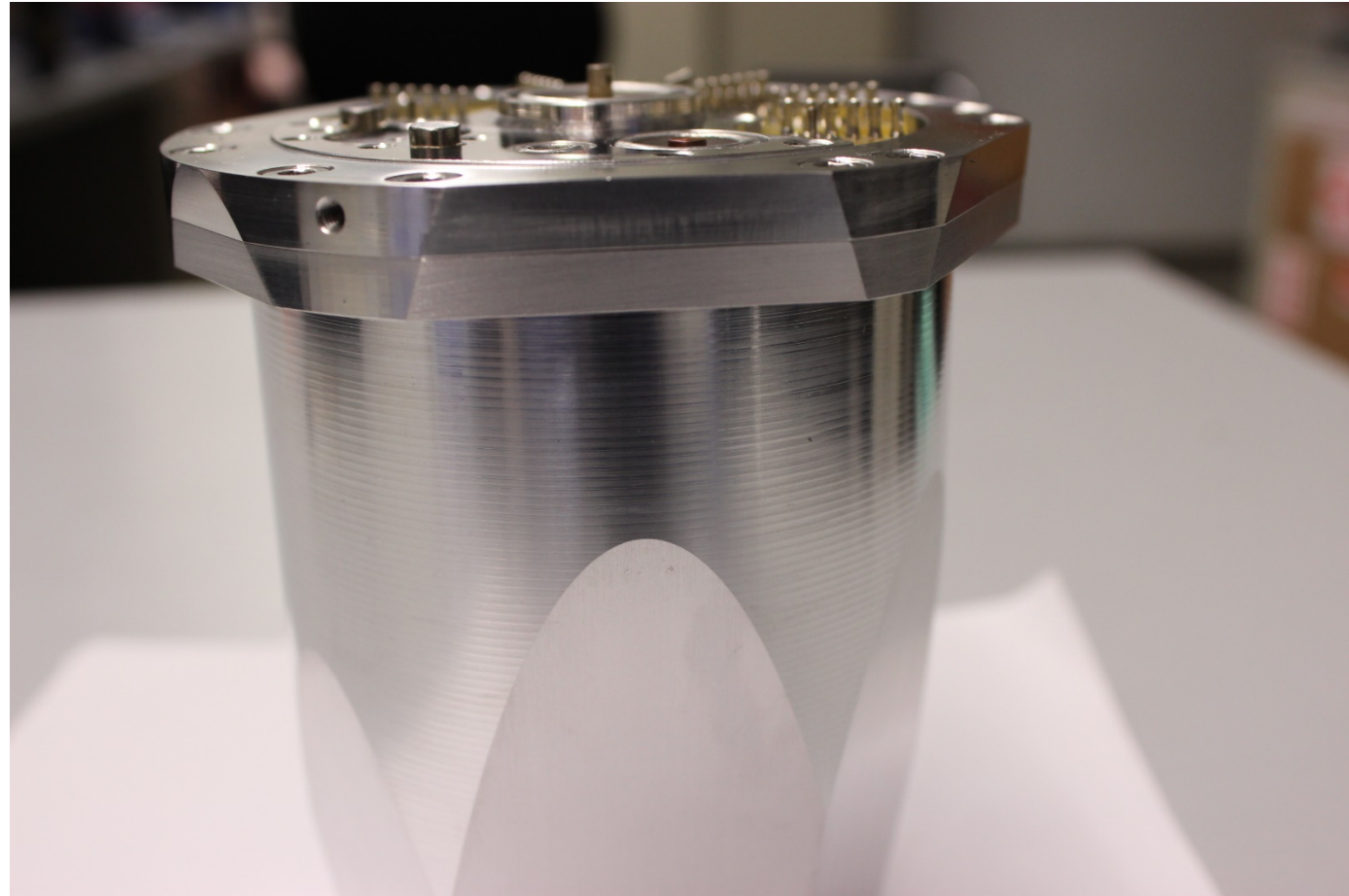
Principle of a metal-elastic seal: UHV-tight from liquid He to some 100's centigrades





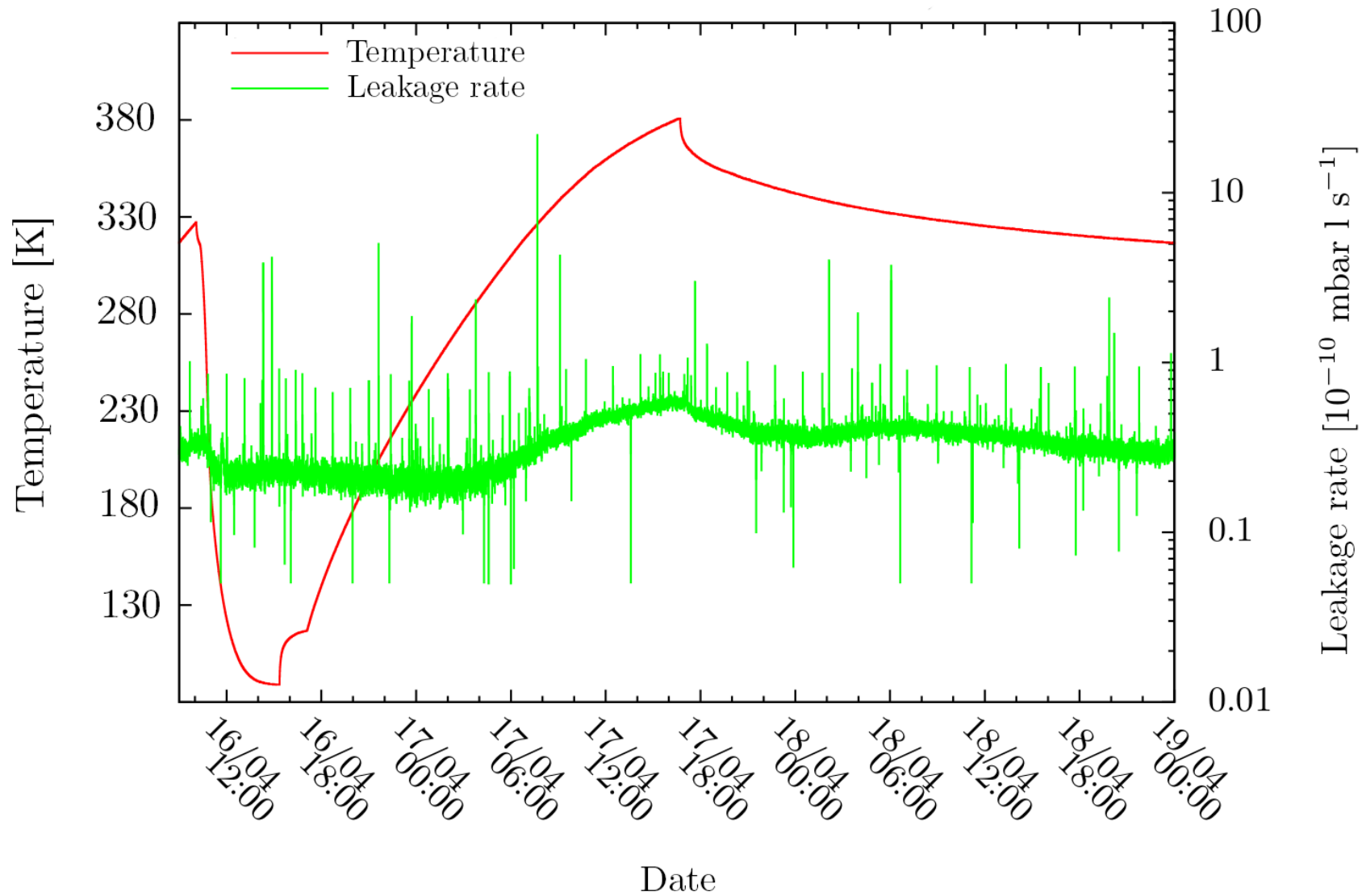
The new AGATA capsule

AGATA detector with the new sealing technology

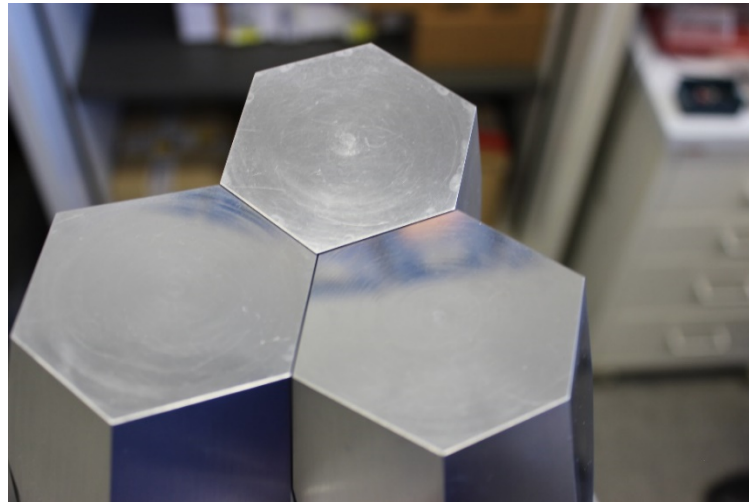
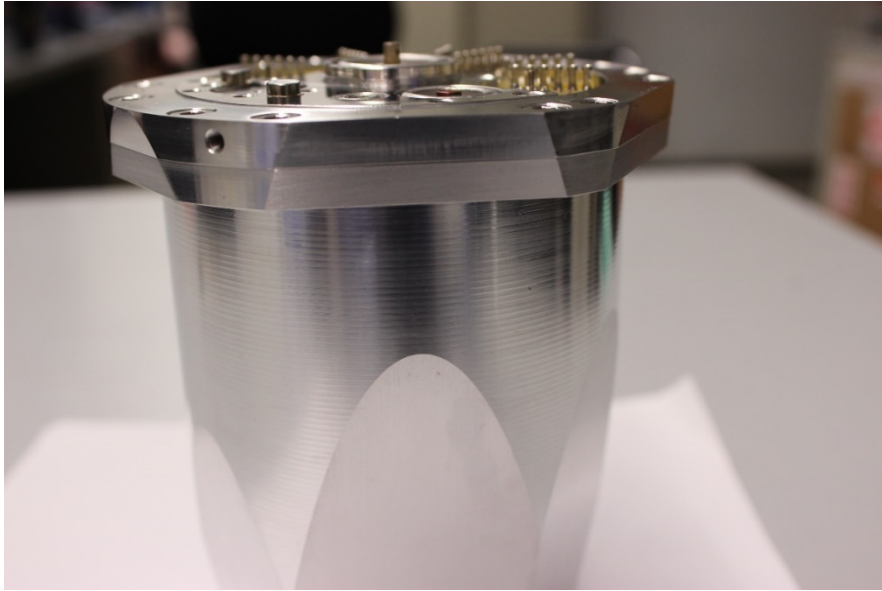


AGATA capsule with a metal-elastic seal

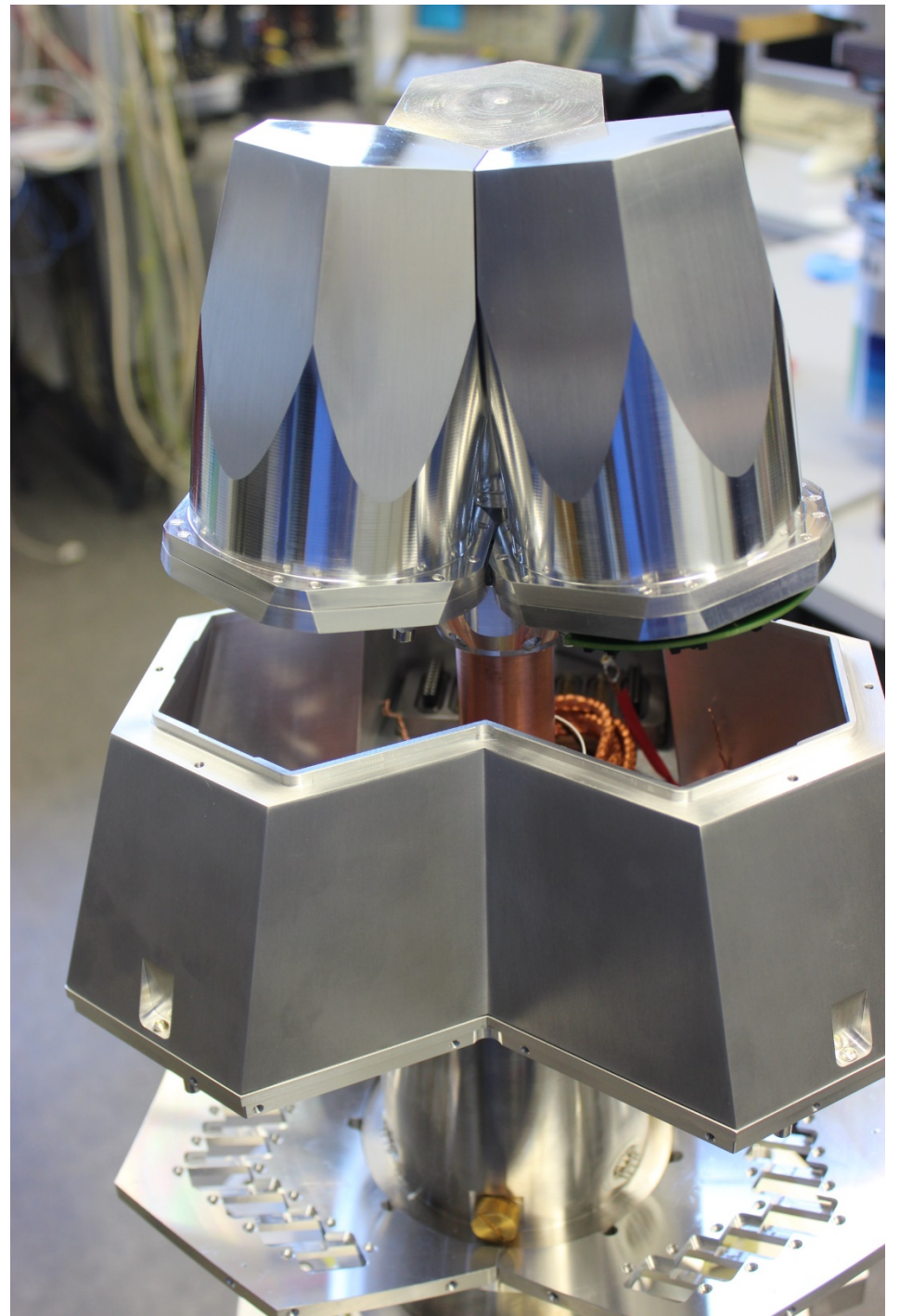
Leakage rate during a temperature cycle of 77 K to 378 K (105 °C)

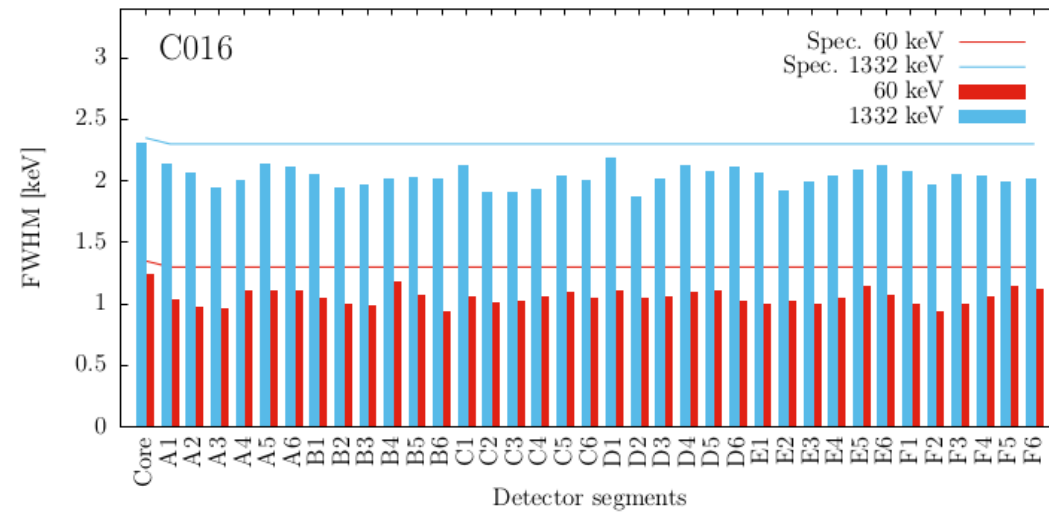
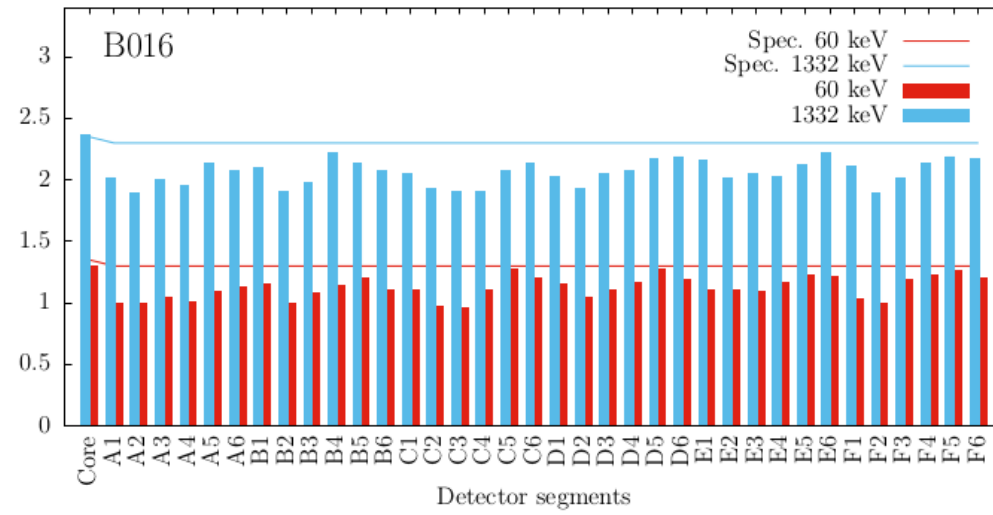
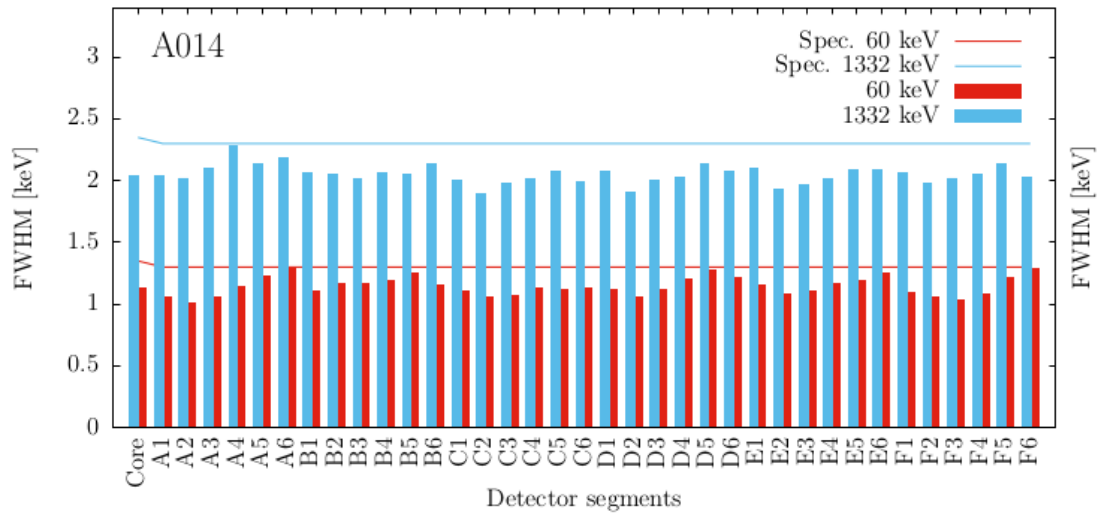


Assembly of ATC 12, new encapsulation technology



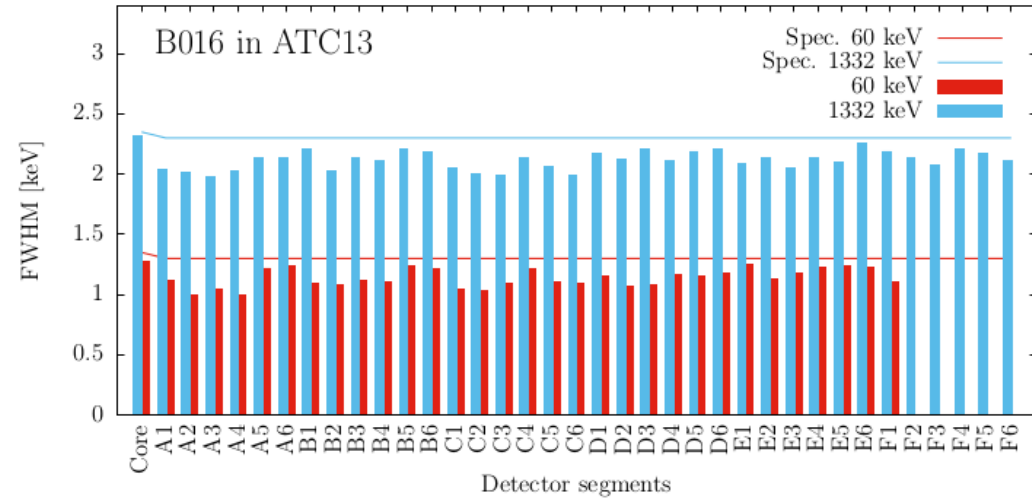
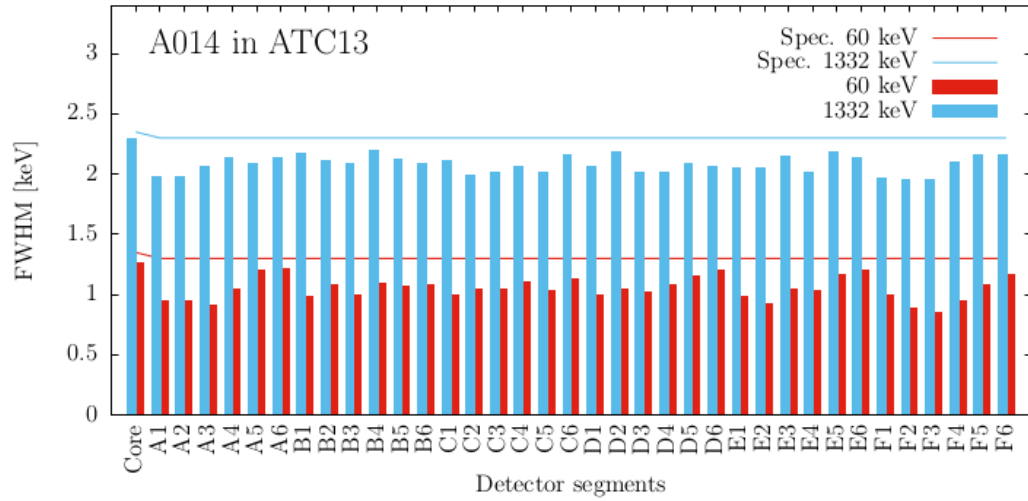
Capsules fit without adjustment





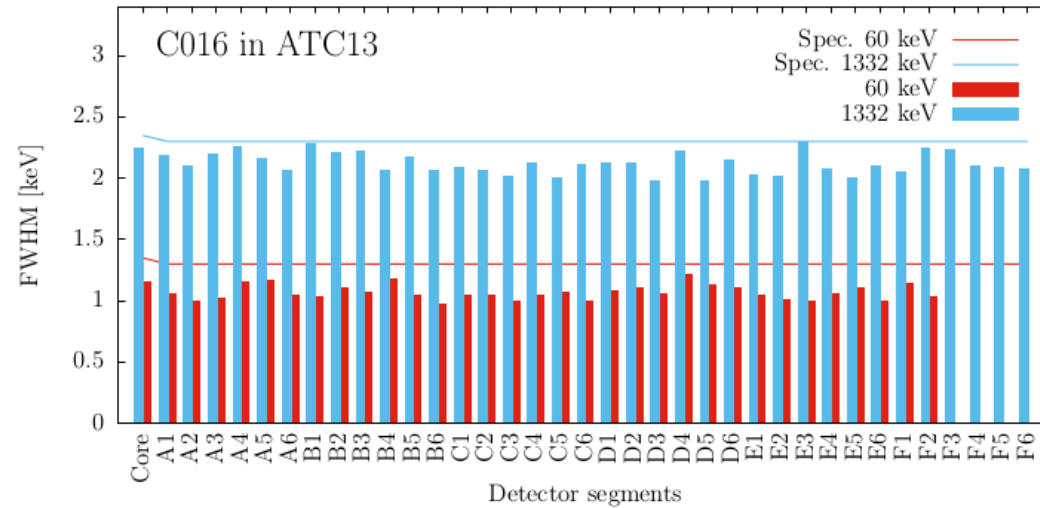
Energy resolution of the first set of three AGATA detectors produced with the new encapsulation technology

All CAT values meet the specification



Energy resolution of ATC13

(first Agata triple-detector with the new encapsulation technology) measured at IKP



Development of a re-usable capsule for AGATA detectors by

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