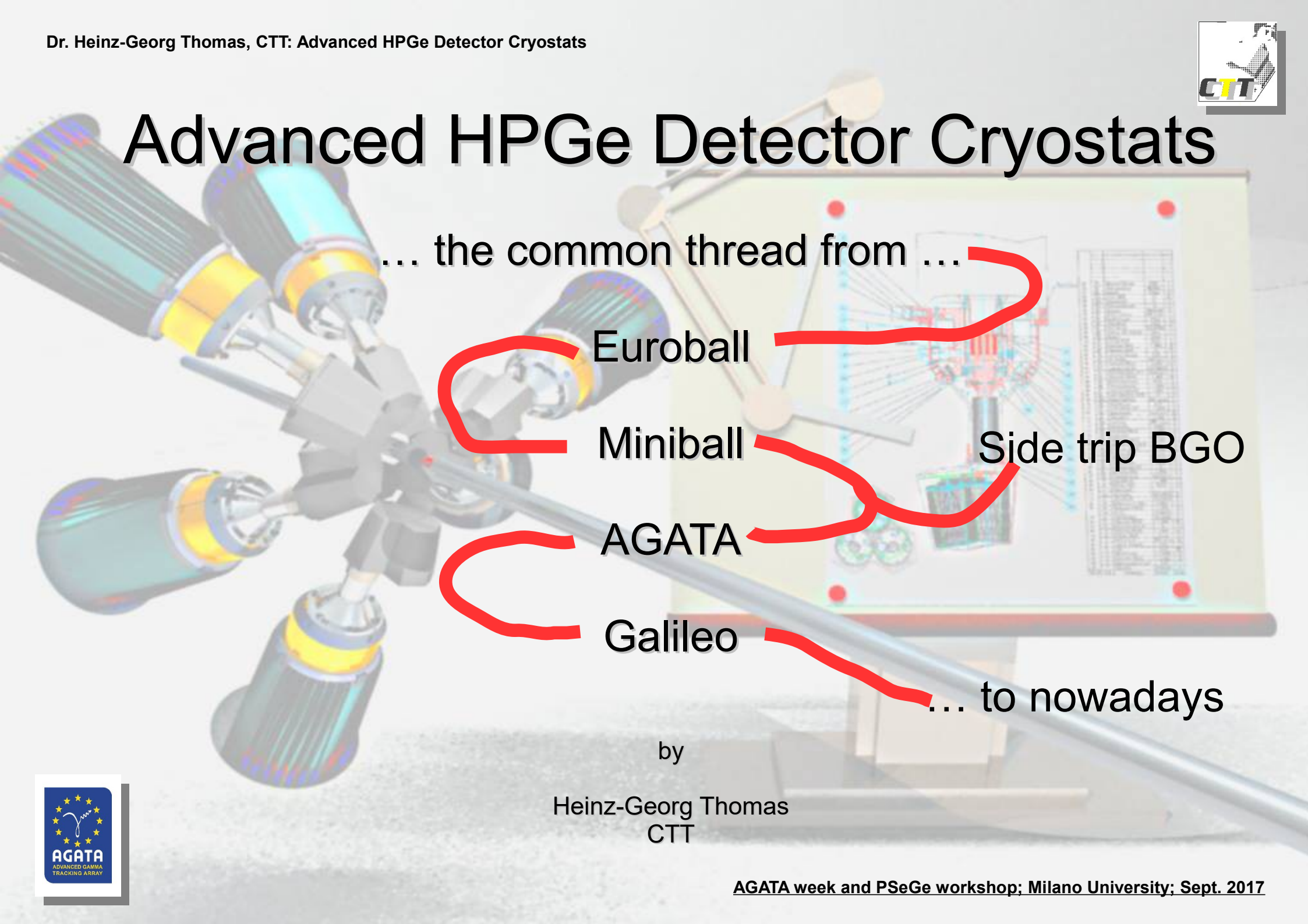
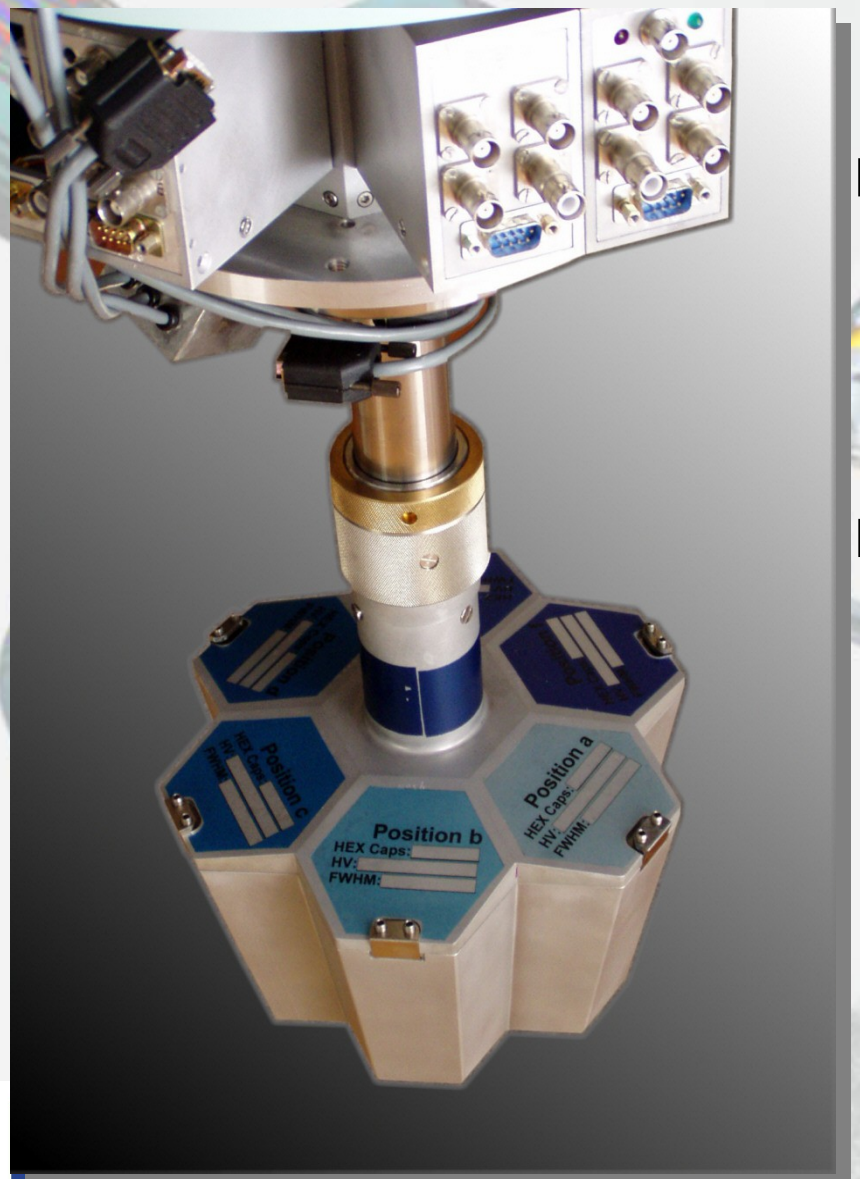
Advanced HPGe Detector Cryostats



by

Heinz-Georg Thomas
CTT

1990 – 1994: Development of the EUROBALL Cluster Detector



Challenges:

Mechanics:

- Dewar size
- Cooling power for 7 individual detectors
- End cap fabrication
- Space reduction for back catcher BGO

Electronics:

- Noise reduction
- Oscillations
- Coupling capacitor
- Signal read out and grounding philosophy

Terra Incognita !

Vintage transparency

Cluster -Cube

The EUROBALL CLUSTER Detector:

a flexible system optimized for high gamma energies

Specifications:
(measured at 1.33 MeV)

Resolution △E = 2.3 keV

Add-Back Factor = 1.45

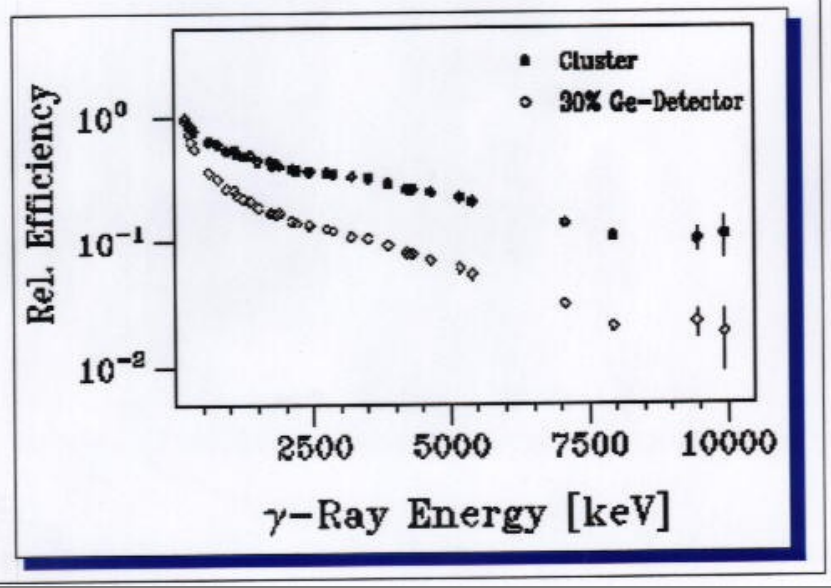
abs. Efficiency = 29 %

rel. Efficiency = 600 %

P/T $_{\text{without BGO}}$ = 39 %

P/T $_{\text{with BGO}}$ = 63 %

The CLUSTER Arrangement



MINIBALL (Development 1995 - 2002):

Challenges:

Mechanics:

- Less space
- Huge number of feedthroughs
- Cooling power
- Flexibility

Electronics:

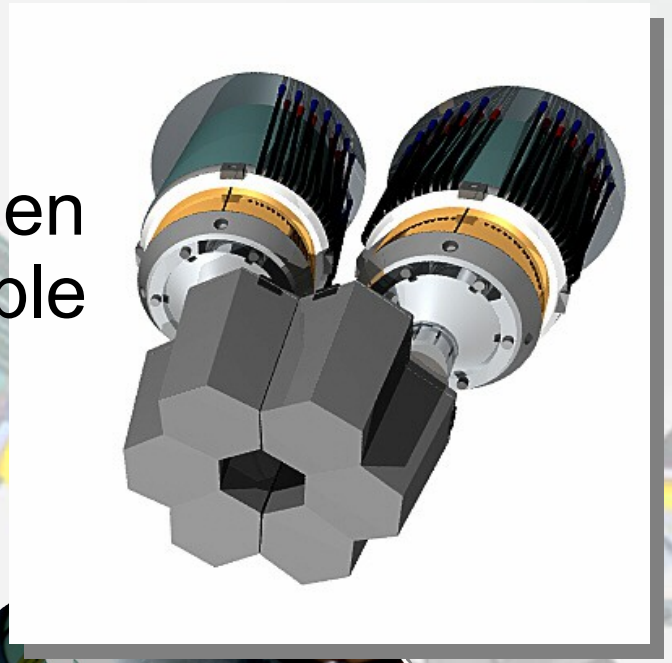
- 21 HRes channels
- SMD cold boards
- New SMD warm preamps
- Improved rise time and pulse shape

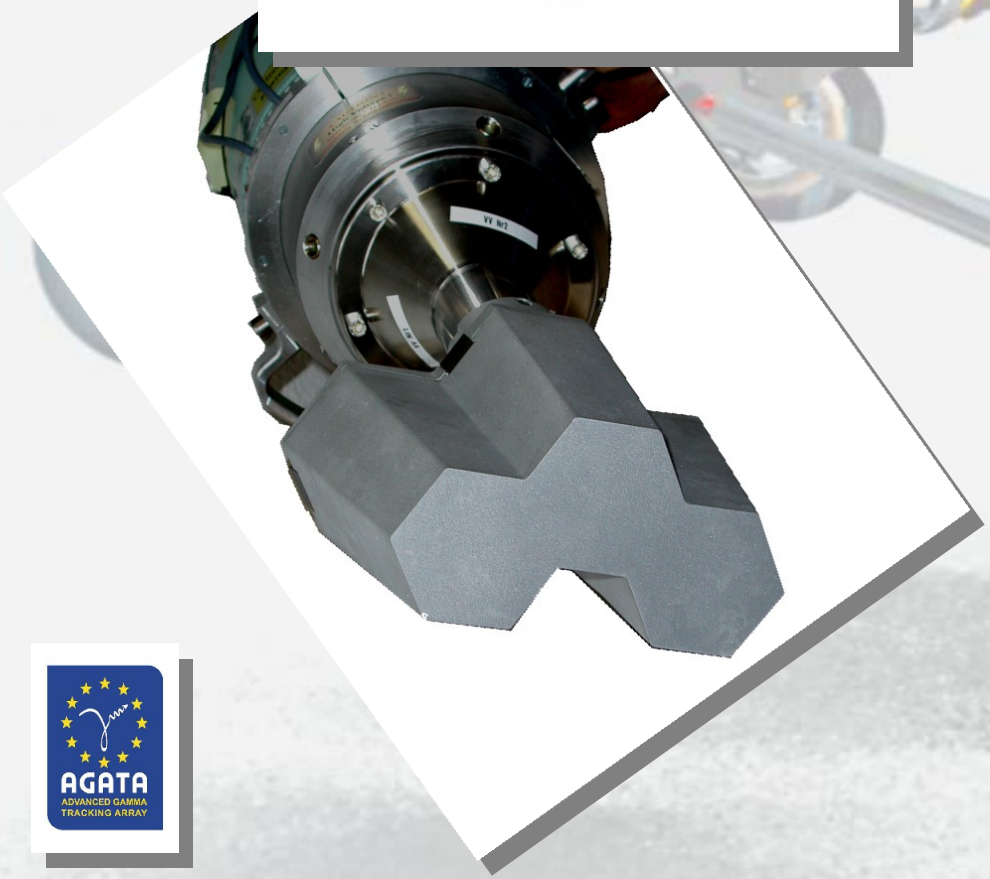
And again fight against:

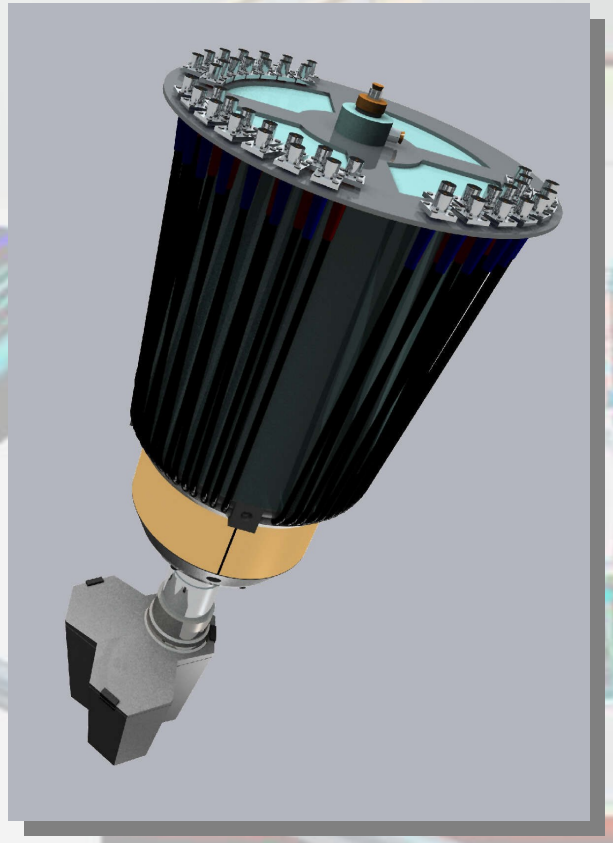
- Resolution deterioration
- Oscillations

Kit for different end caps:

Open Triple







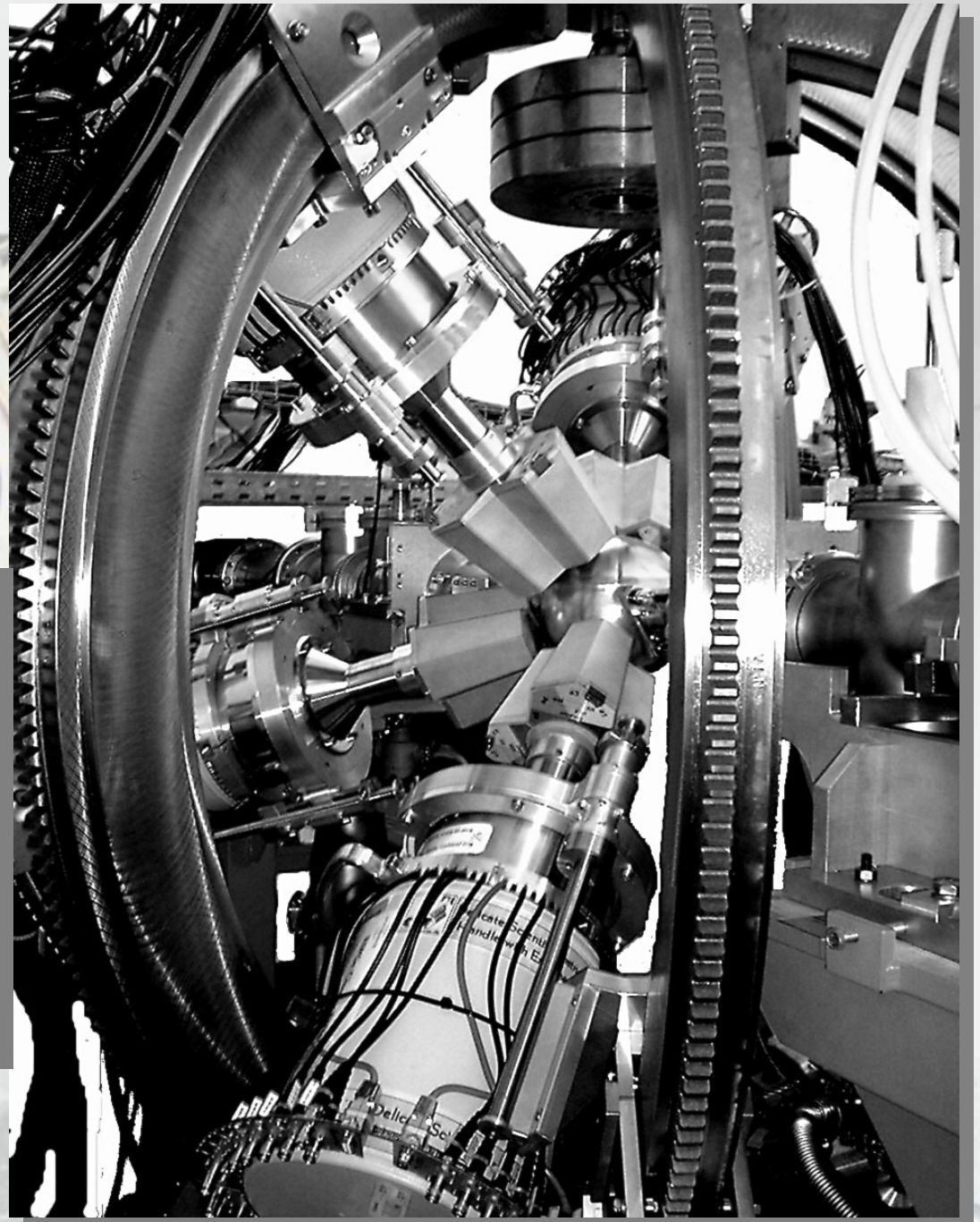
Asym Triple

Quadruple

Finally:

8 symmetric triple cryostats mounted on a flexible frame

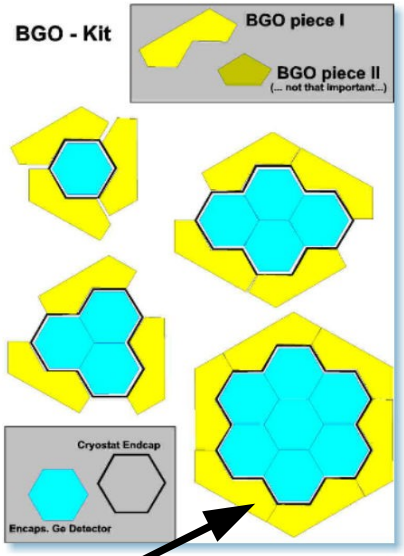
Konfiguration	Targetabstand r	$^{1.3MeV}P_{Ph}$	$\Delta\Theta^r$	β	ΔE_{90^o}	ΔE_{30^o}
Phase I 18 Detektoren	7cm	15%	5.7^o	5%	5.3keV	3.3keV
				15%	14.9keV	8.9keV
	9.5cm	9.4%	4.2^o	5%	4.1keV	2.8keV
				15%	11.1keV	6.7keV
	12cm	6.3%	3.3^o	5%	3.5keV	2.5keV
				15%	8.9keV	5.5keV
Phase II 40 Detektoren	11cm	16.4%	3.6^o	5%	3.7keV	2.6keV
				15%	9.6keV	5.9keV
	13.5cm	11.5%	2.9^o	5%	3.3keV	2.4keV
				15%	7.9keV	4.9keV
	16 cm	8.5%	2.5^o	5%	2.9keV	2.3keV
				15%	6.8keV	4.3keV
	18.5cm	6.5%	3.4^o	5%	2.7keV	2.2keV
				15%	6.0keV	3.9keV

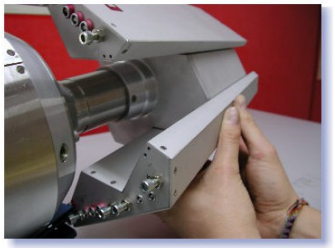


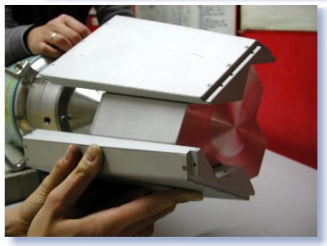
And because it is currently up to date:

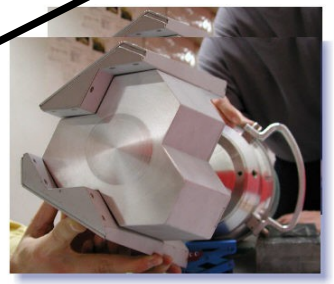
Again an old “vintage” transparency

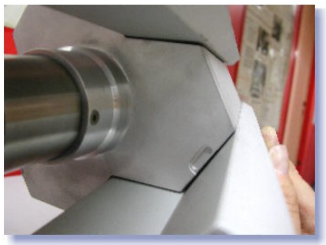
Encapsulated Ge Detectors, a versatile Cryostat and the matching BGO Module(s): A perfect Kit for Gamma Spectroscopy

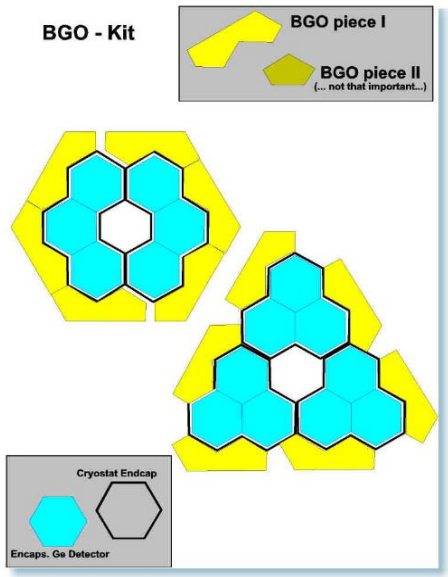












… and AGATA

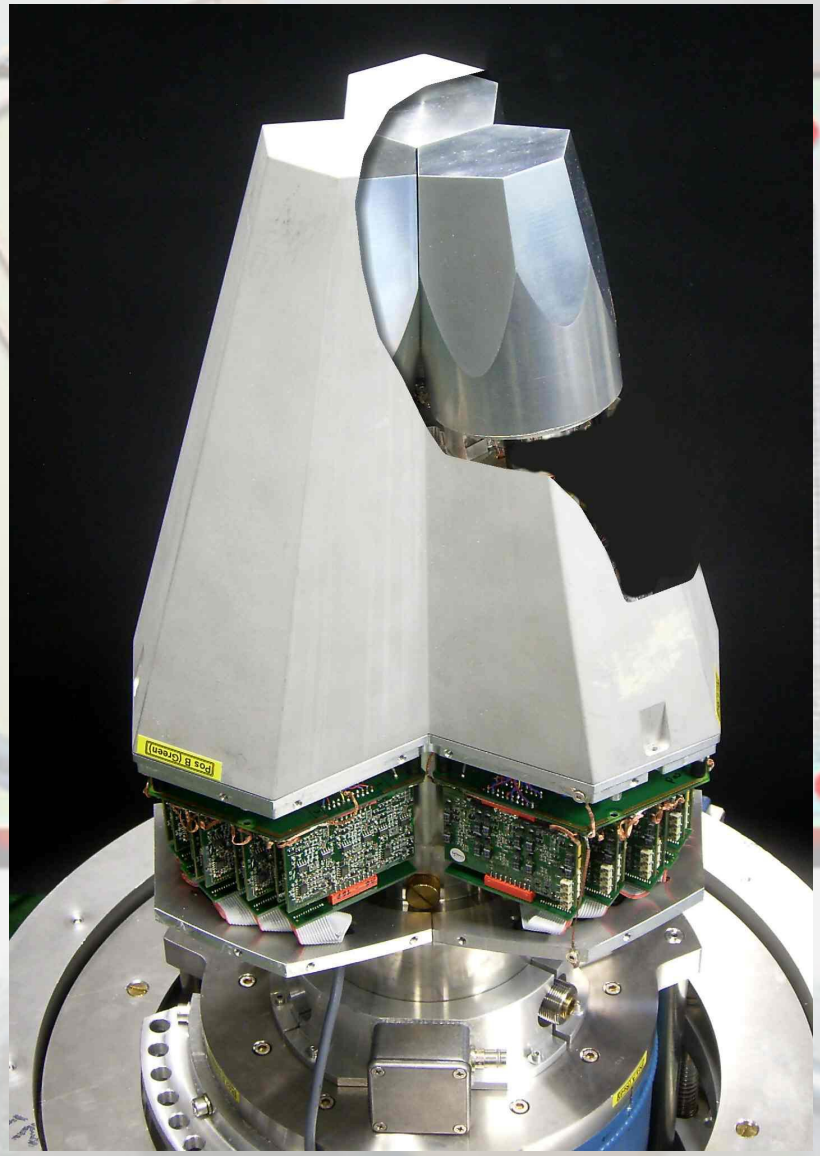
Challenges

Mechanics:

Sophisticated end cap
Self-supporting cryostat
Space in the available solid angle of the end cap and cooling

Electronics:

111 HRes signal channels with Cold FETs
New coupling capacitor
3 different types of warm preamps with fast rise times of 35 ns
High signal density in cabling, feedthroughs and plugs
…

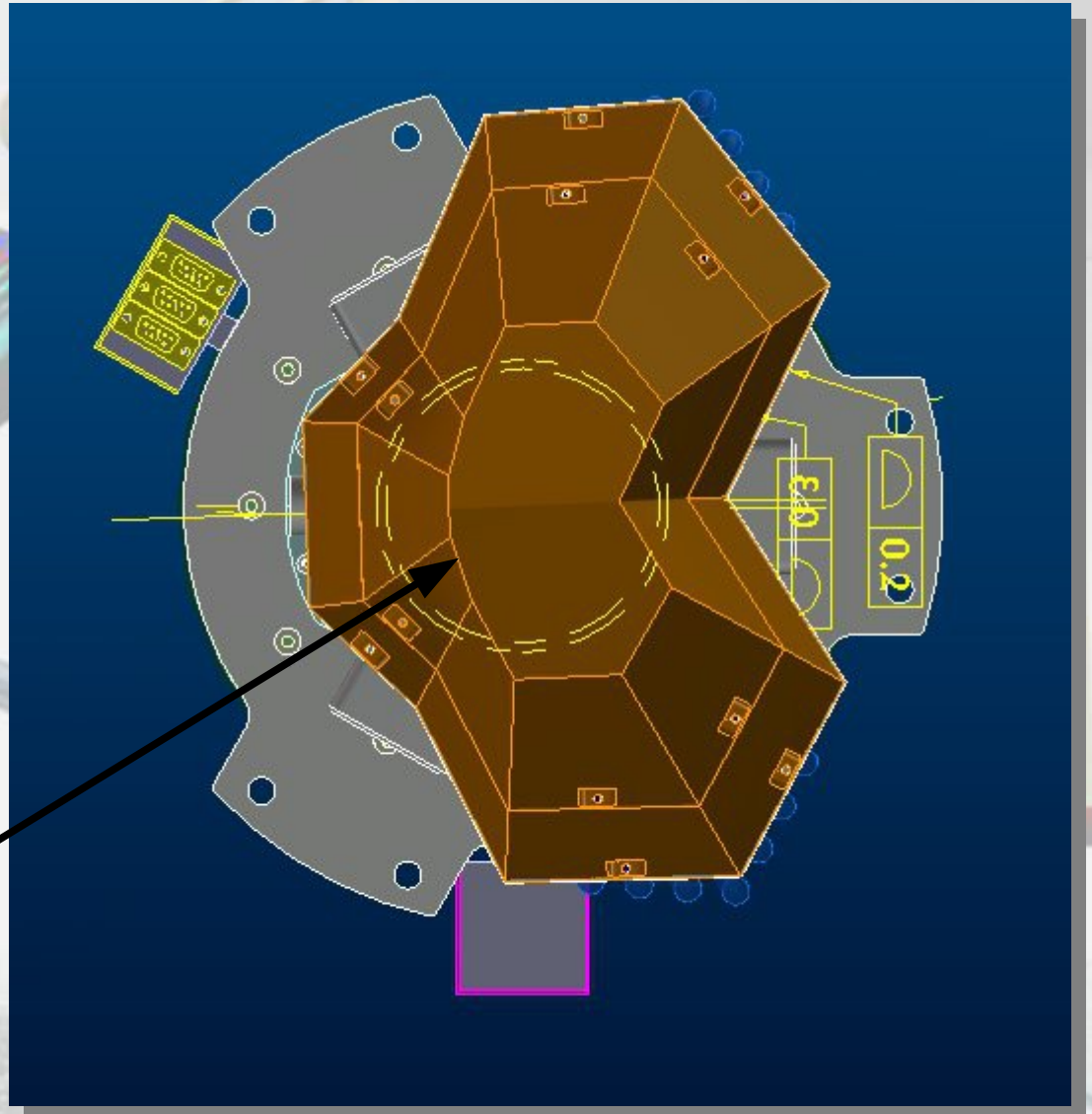


Important focus:

Modularity of the Cryostat components:

Easy exchange of preamps, detectors

and even complete end cap configurations



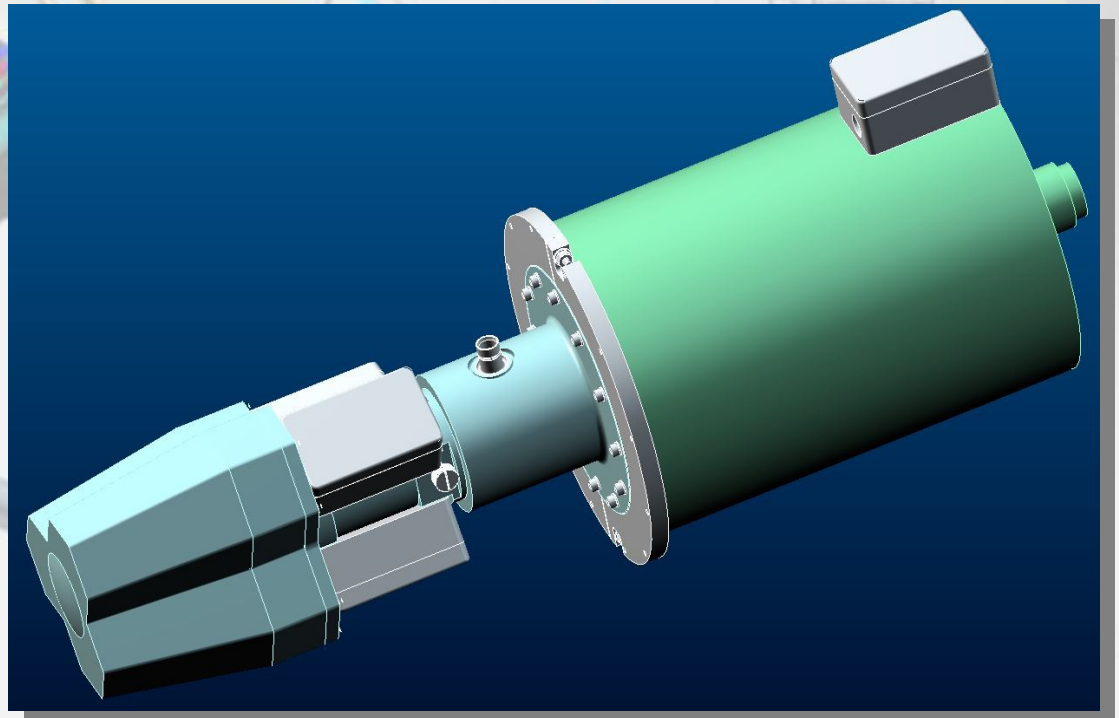
Double end cap

and now?

Development of a prototype system for the spectrometer GALILEO to operate 3 “old fashioned” EUROBALL capsule detectors.

Challenge

Low cost solution
New cold and warm preamps



and to increase the challenge a little:
test of a new coupling capacitor

The results of the prototype measurements:

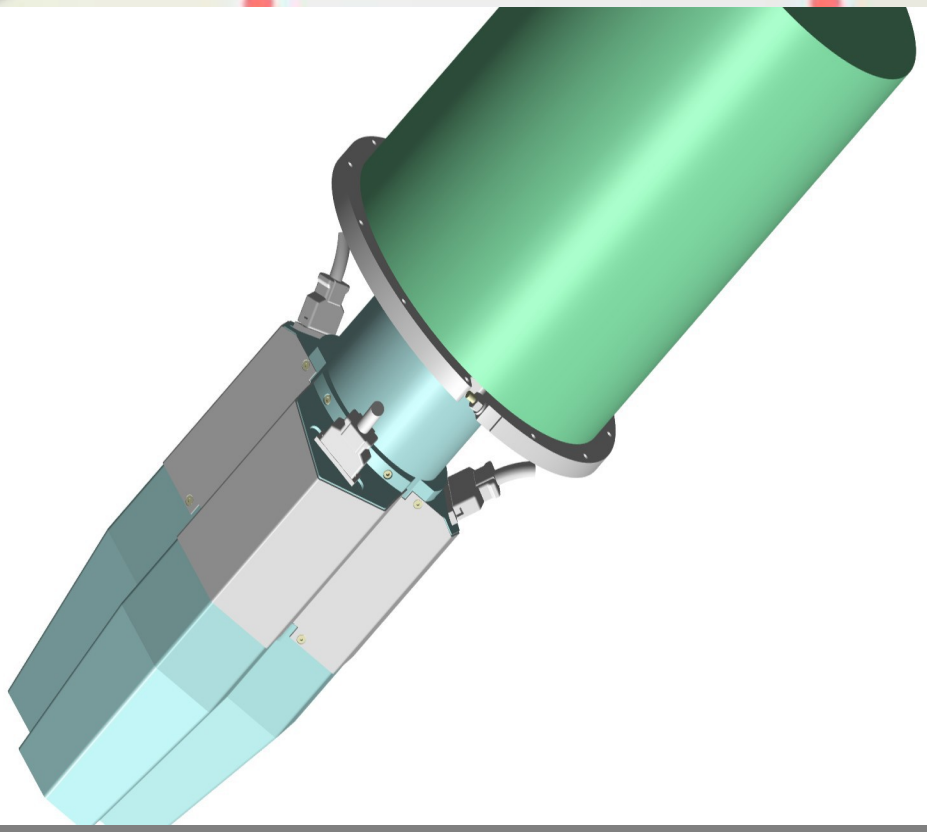
FWHM / Position	Data sheet	Measurements at GSI	Prototype results
Pos A: HEX130 AGATA CC	1.25 keV 2.21 keV	??? 2.02 keV	1.14 keV 2.04 keV
Pos B: HEX161 New CC	1.35 keV 2.30 keV	??? 2.04 keV	1.11 keV 1.94/2.01 keV
Pos C: HEX 31 Orig.CC w Test	1.00 keV 2.00 keV	??? 2.06 keV	1.35 keV 2.17/2.29 keV

- the coupling capacitor reacted a little “nervous”
- not any problems with oscillations
- not any problems with microphonics

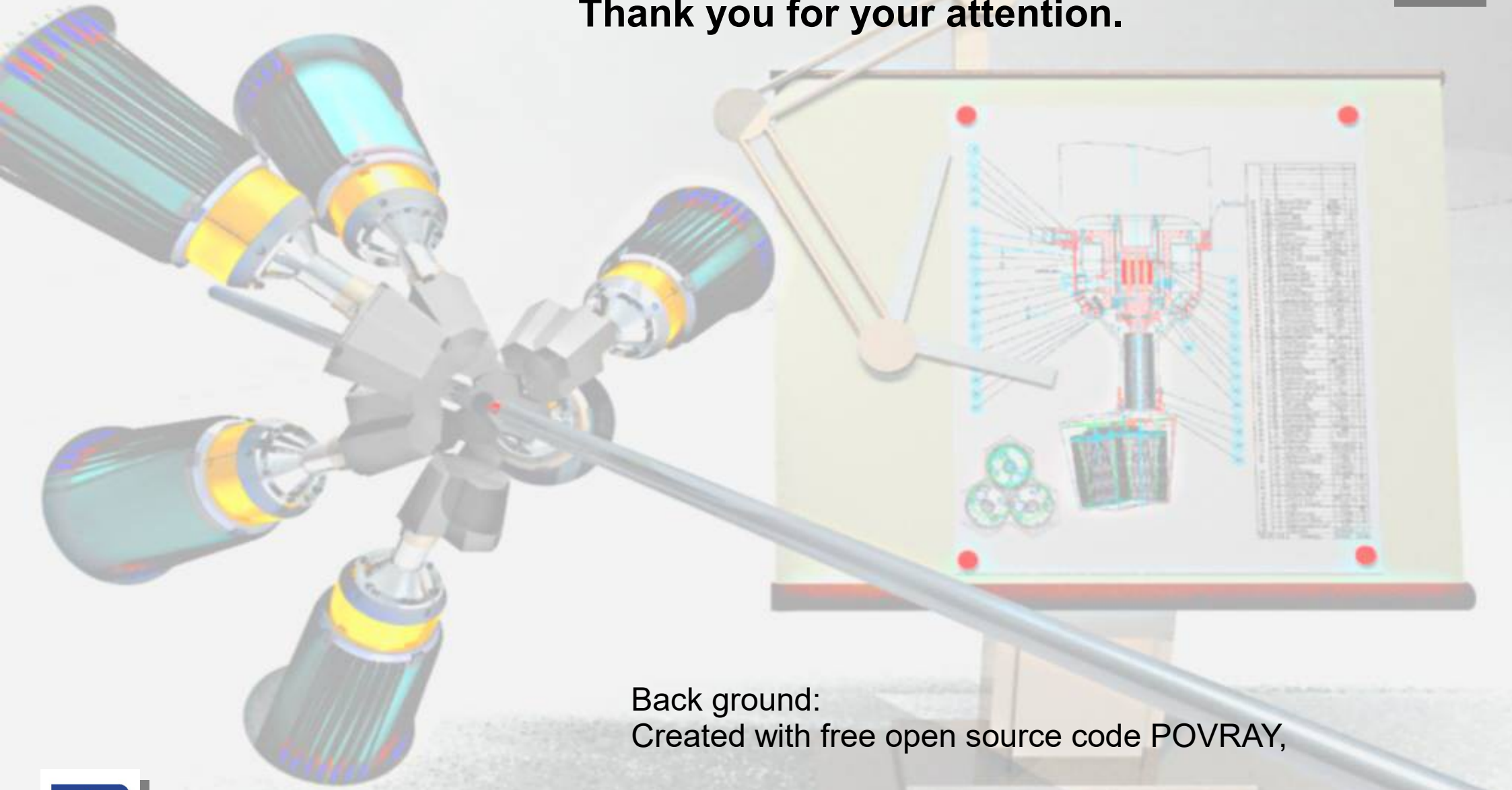
Furthermore: Design Project MINIBALL 2.0

The Goal:

- implementation of the AGATA experience
- new cold and warm preamps
- new coupling capacitor
- new signal read out cabling, vacuum and atmosphere side
- plug 'n play lay out of the electronics
- only one “front end” read out cable for each channel
- welded and exchangeable feedthroughs
- possibility of use of side catcher BGO
- compatible in size and weight to the MB frame



Thank you for your attention.



Back ground:
Created with free open source code POVRAY,