

New AGATA triple detector tests

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CAT - experimental setup and specifications

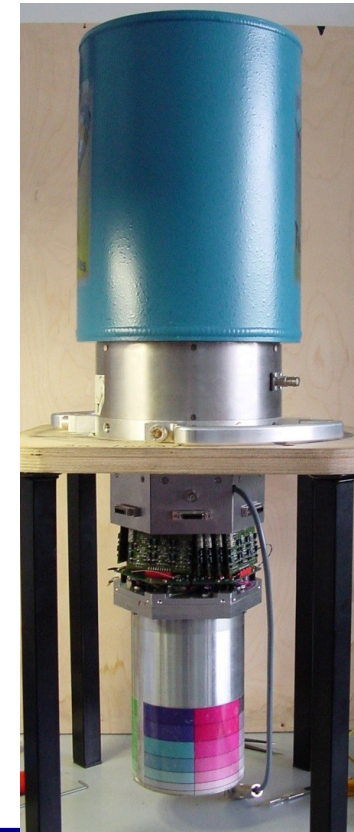
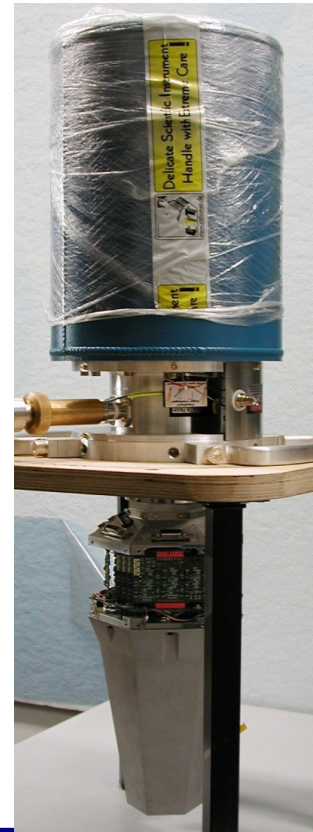
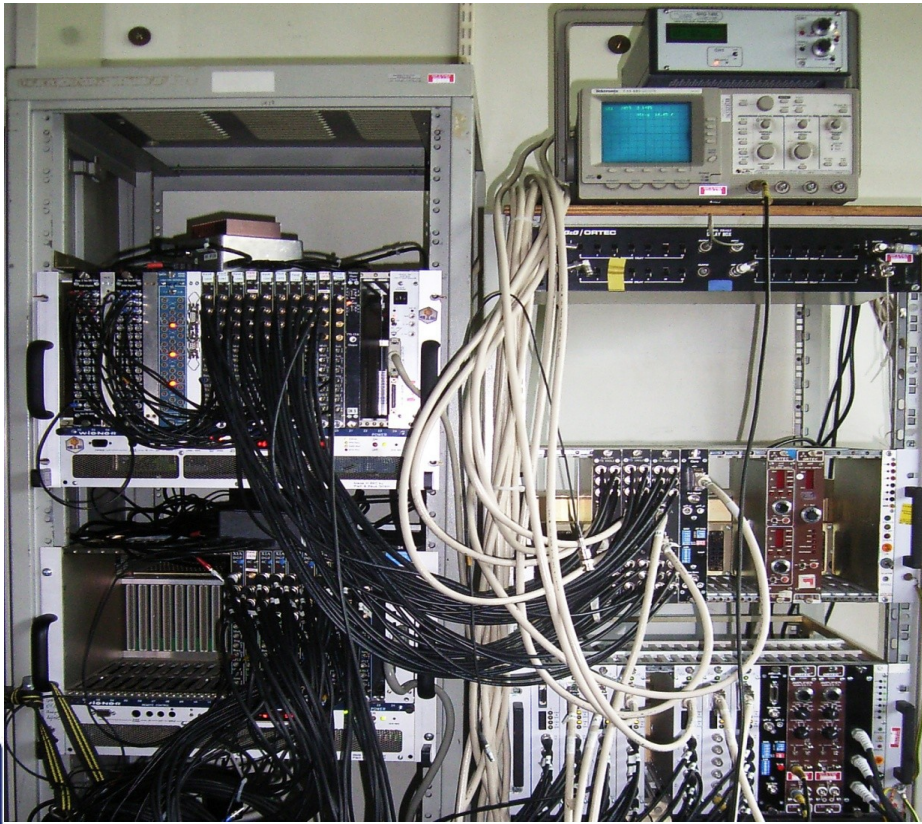
Core FWHM

@ 1.3 MeV: $\Delta E < 2.35$ keV
@ 122 keV: $\Delta E < 1.35$ keV

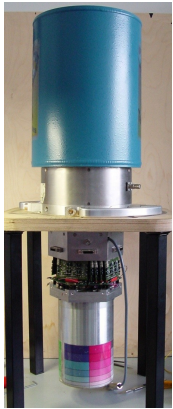
Crosstalk < 0.1 %

Segments FWHM

@ 1.3 MeV: $\Delta E < 2.30$ keV, mean < 2.10 keV
@ 60 keV: $\Delta E < 1.30$ keV, mean < 1.20 keV



Test results capsule A007 - 74108



Performing well

Core FWHM:

@ 122 keV: $\Delta E = 1.19$ keV
@ 1332 keV: $\Delta E = 2.20$ keV

AGATA – rattle

- loose part in capsule

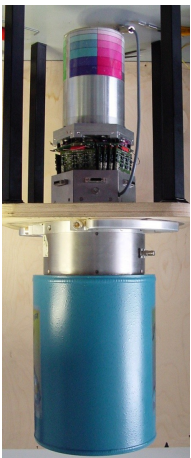
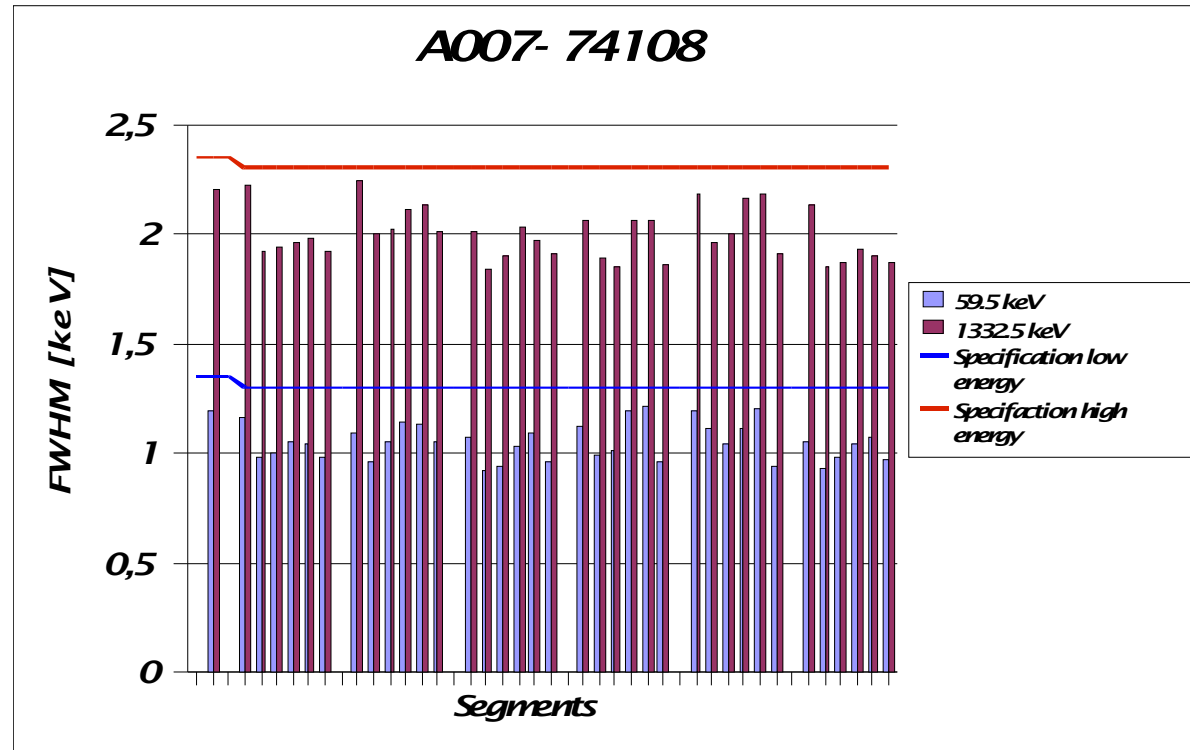
- noise inside detector

- in upside down position the width of the core noiseband increases

spontaneously

- Core FWHM:

@ 1332 keV $\Delta E = 3.08$ keV



Detector rejected



Test results capsule B001 - 74034

Core FWHM:

@ 122 keV: $\Delta E = 1.29$ keV

@ 1332 keV: $\Delta E = 2.17$ keV

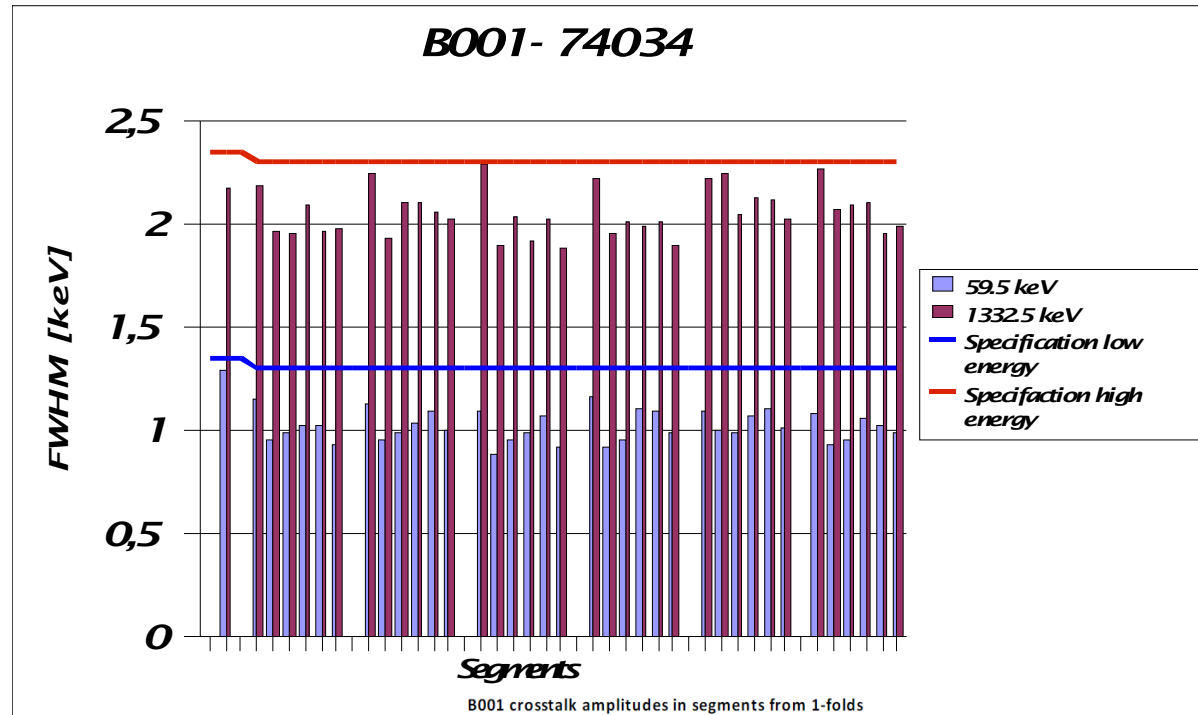
Segments average FWHM

@ 60 keV: $\Delta E = 1.02$ keV

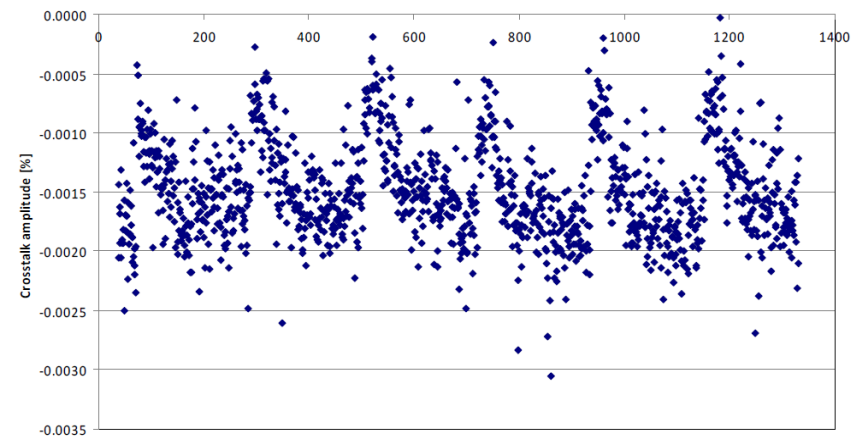
@ 1332 keV: $\Delta E = 2.06$ keV

Crosstalk within specification

Detector accepted



- microphonic behaviour on core
- HV feedthrough stabilized with indium
- HV feedthrough stabilized with epoxy compound by Canberra



All segment combinations: "Hit Segment 1" x 36 + "Segment 2"

Test results capsule B005 - 74065

After the first test B005 was rejected due high leakage current

After repair

core FWHM:

@ 122 keV: $\Delta E = 1.08$ keV

@ 1332 keV: $\Delta E = 2.29$ keV

Segments average FWHM:

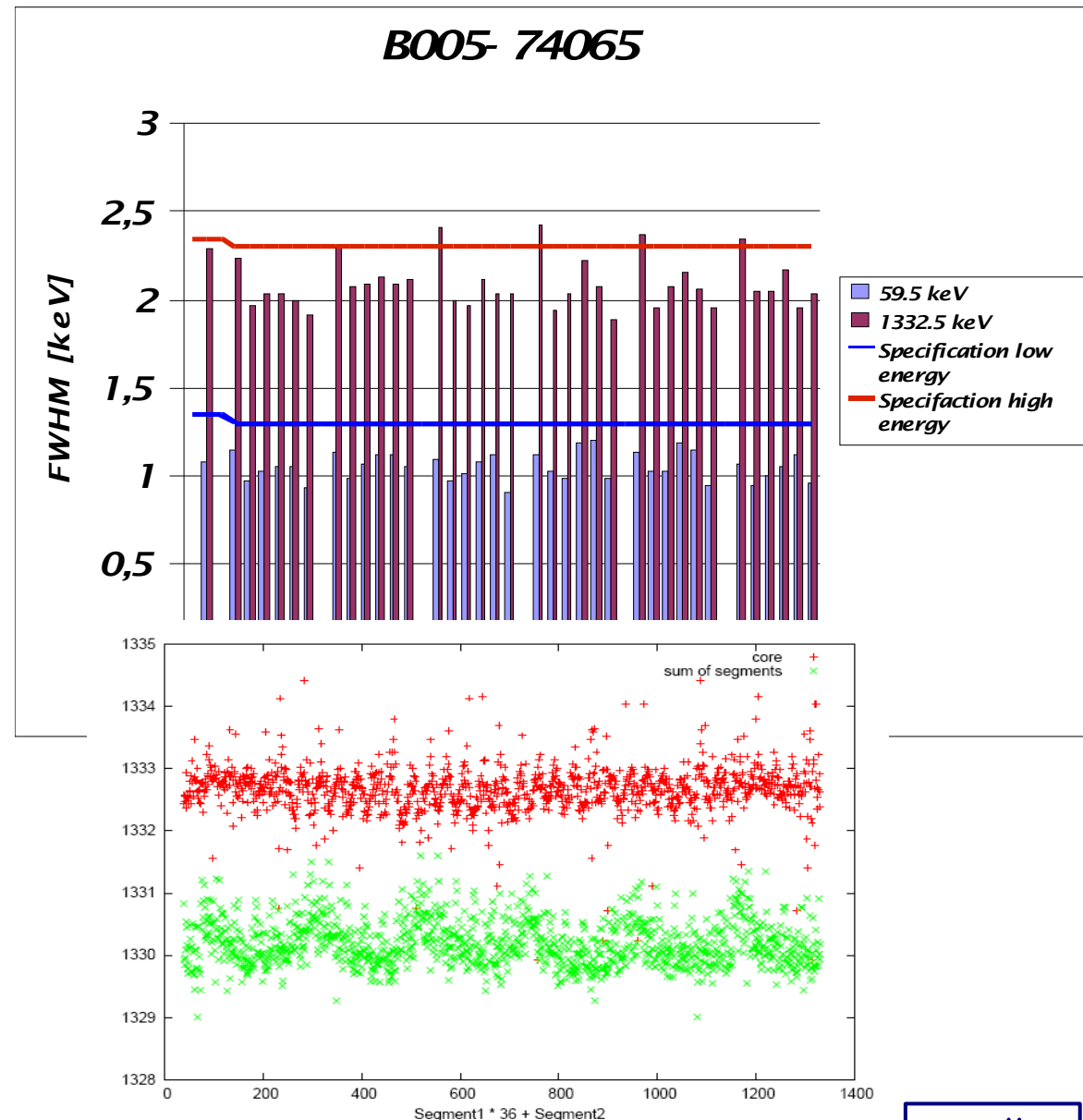
@ 60 keV: $\Delta E = 1.05$ keV

@ 1332 keV: $\Delta E = 2.09$ keV

Crosstalk within specification

Detector accepted

Mounted in ATC3



Test results capsule C006 - 74115

Core FWHM:

@ 122 keV: $\Delta E = 1.09$ keV
@ 1332 keV: $\Delta E = 2.16$ keV

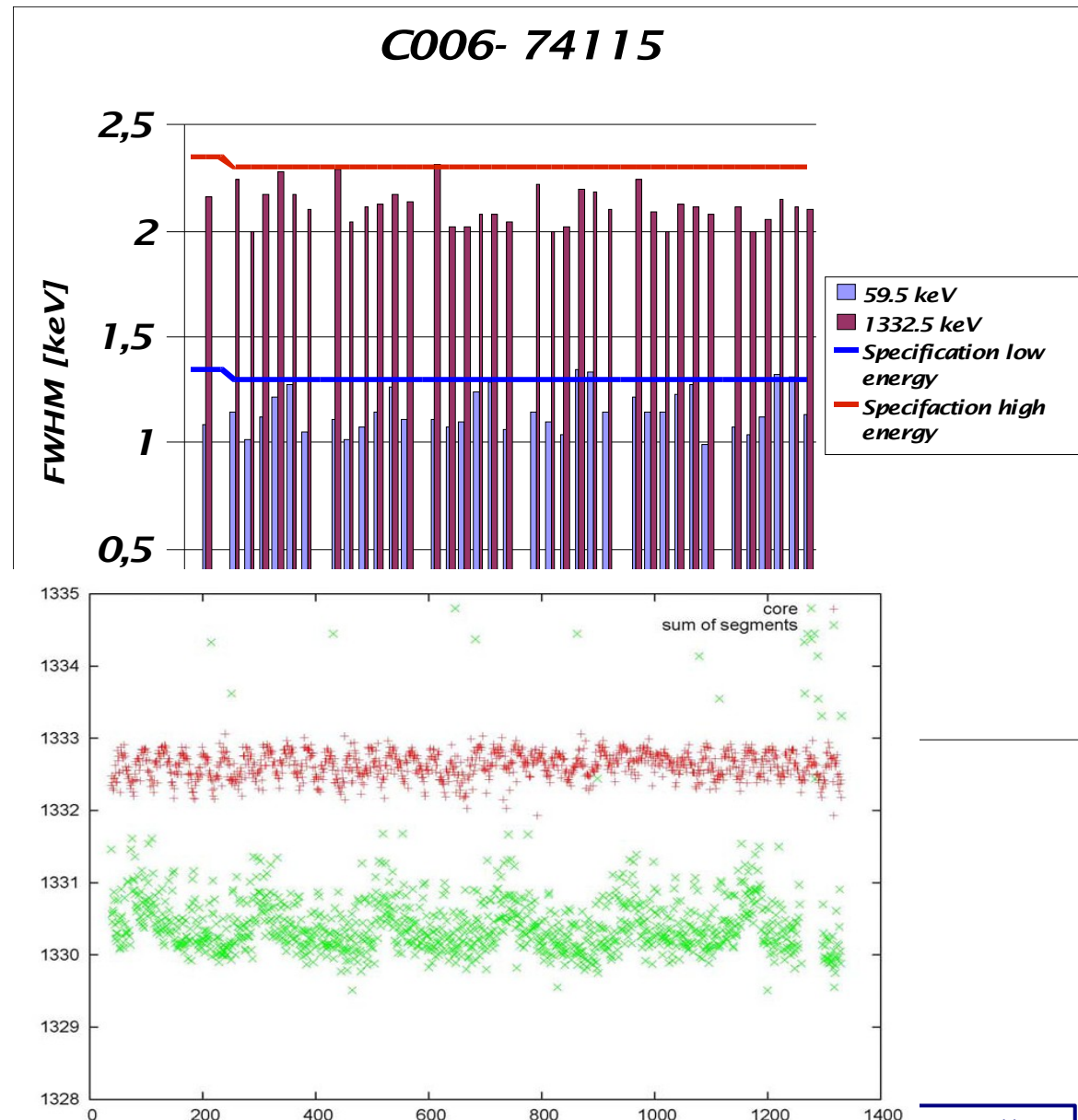
Segments average FWHM

@ 60 keV: $\Delta E = 1.15$ keV
@ 1332 keV: $\Delta E = 2.12$ keV

Crosstalk within specification

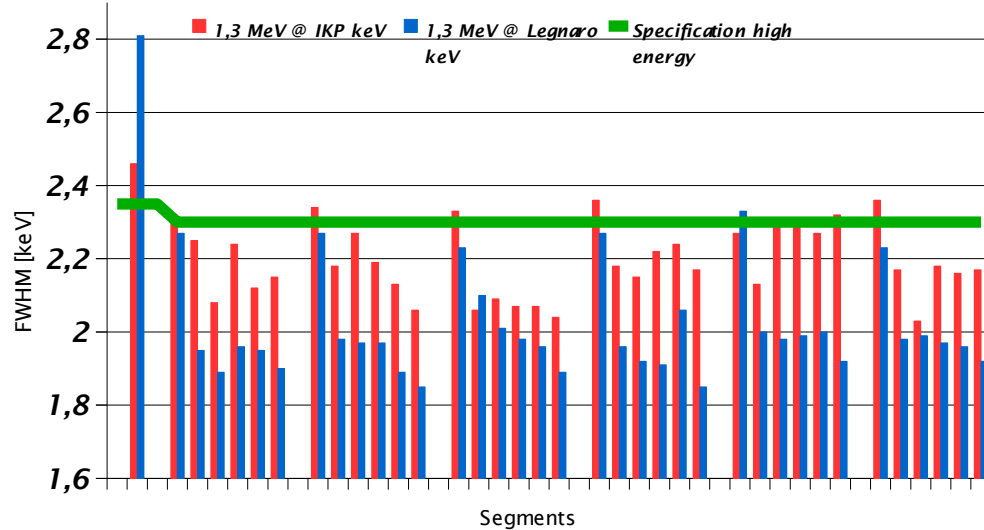
Detector accepted

Mounted in ATC3

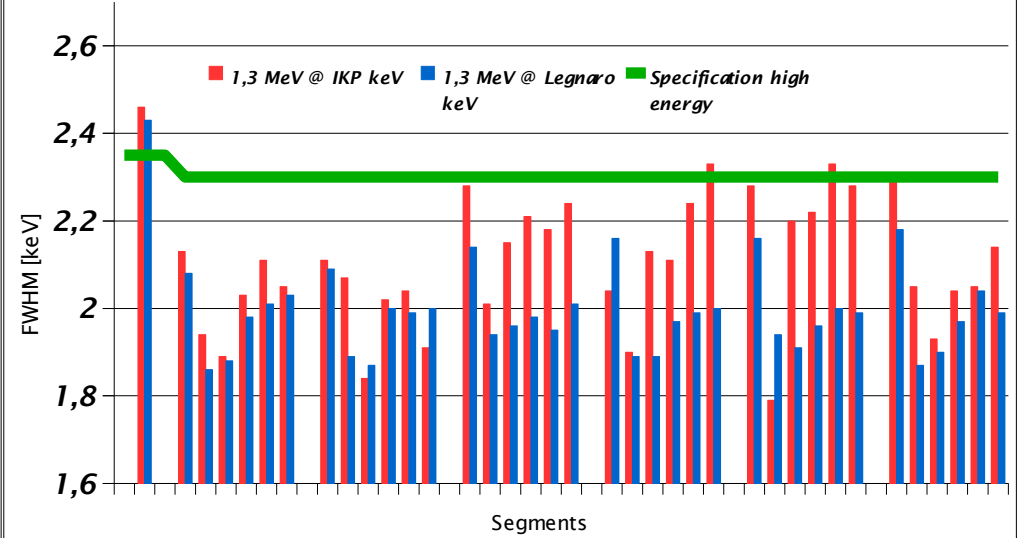


AGATA triple cryostat ATC1

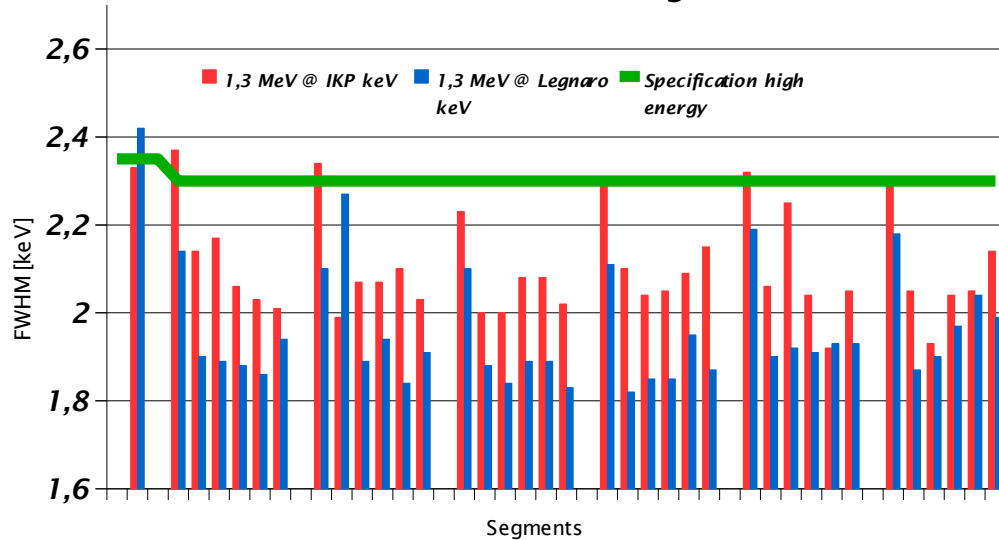
A001 in ATC1 IKP vs. Legnaro



B002 in ATC1 IKP vs. Legnaro



C002 in ATC1 IKP vs. Legnaro



- modified electrical and mechanical configuration including new grounding concept

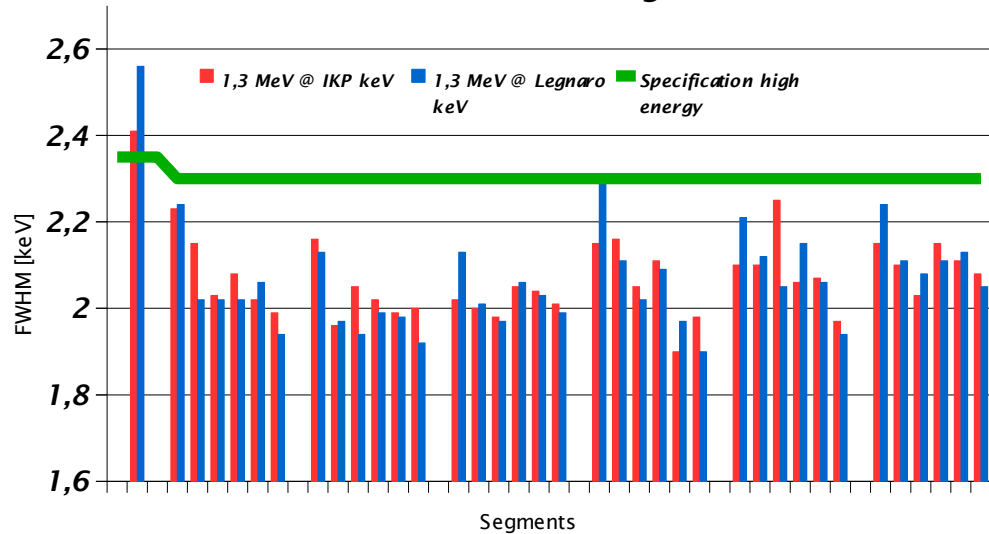
- mean values seg. @ 1.3 MeV IKP / Legnaro
A001: $\Delta E = 2.19$ keV / $\Delta E = 2.01$ keV
B002: $\Delta E = 2.10$ keV / $\Delta E = 1.99$ keV
C002: $\Delta E = 2.10$ keV / $\Delta E = 1.95$ keV

- @ Legnaro measured at high counting rate ~ 10 kHz

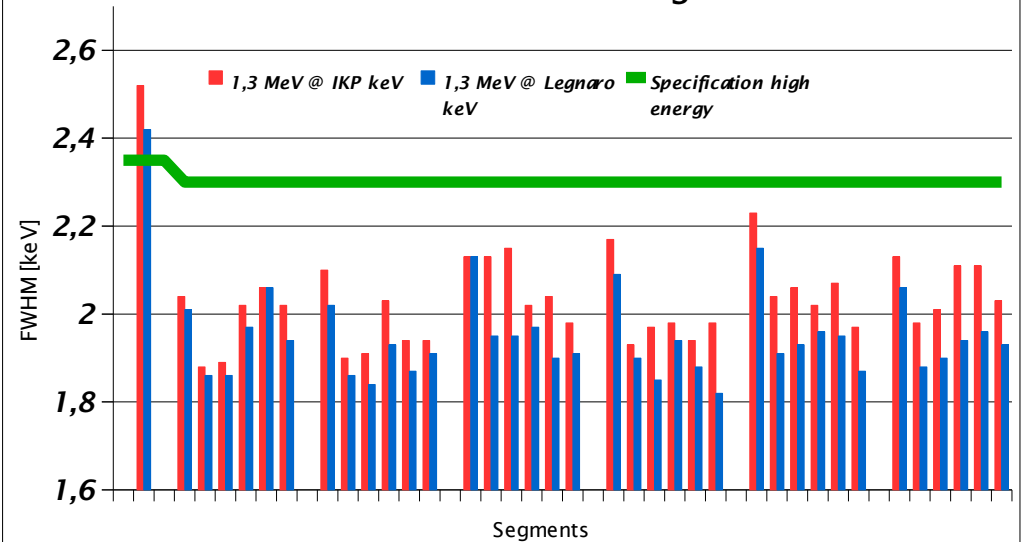
- used for commissioning experiments since summer

AGATA triple cryostat ATC2

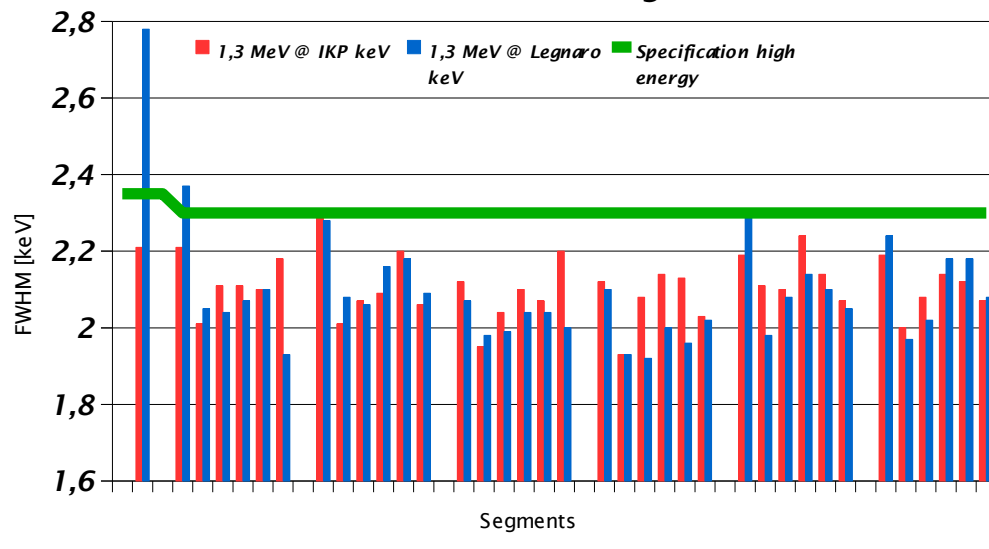
A003 in ATC2 IKP vs. Legnaro



B003 in ATC2 IKP vs. Legnaro



C005 in ATC2 IKP vs. Legnaro



- delivered in July to Legnaro

- mean values segments @ 1.3 MeV
IKP / Legnaro

A001: $\Delta E = 2.06$ keV / $\Delta E = 2.06$ keV

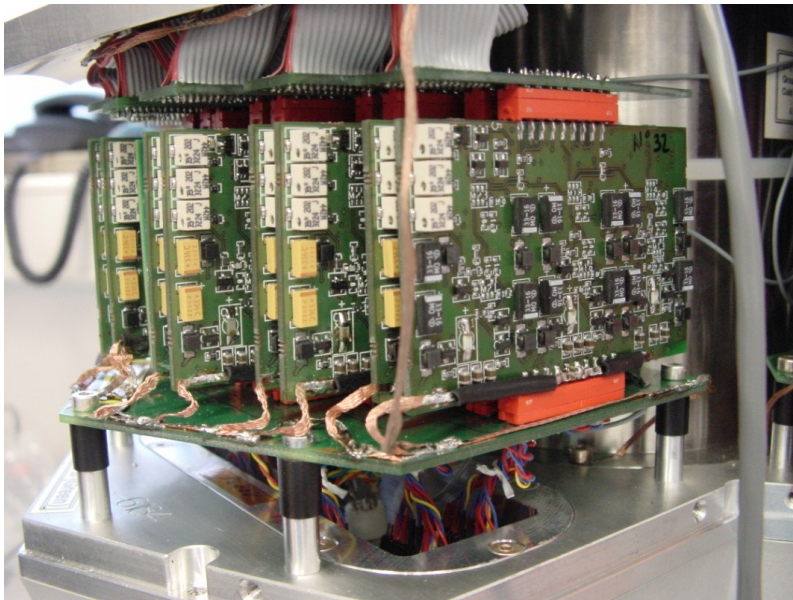
B002: $\Delta E = 2.03$ keV / $\Delta E = 1.94$ keV

C002: $\Delta E = 2.11$ keV / $\Delta E = 2.08$ keV

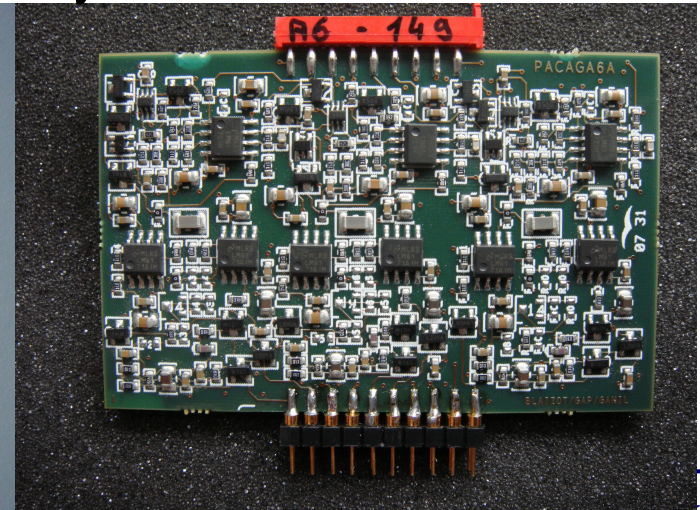
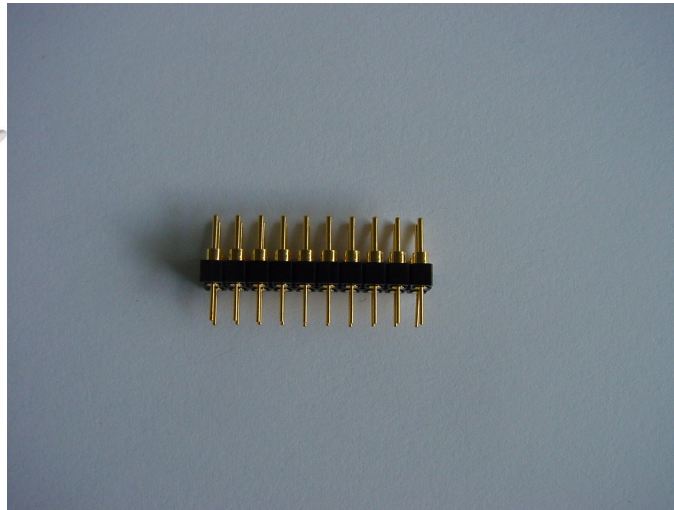
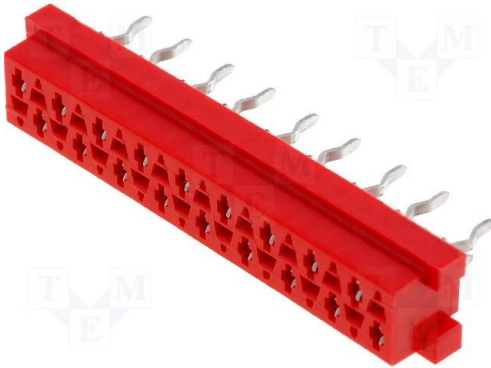
- @ Legnaro measured at high counting rate
 ~ 10 kHz

- used for commissioning experiments since
summer

PreAmp Development ATC3

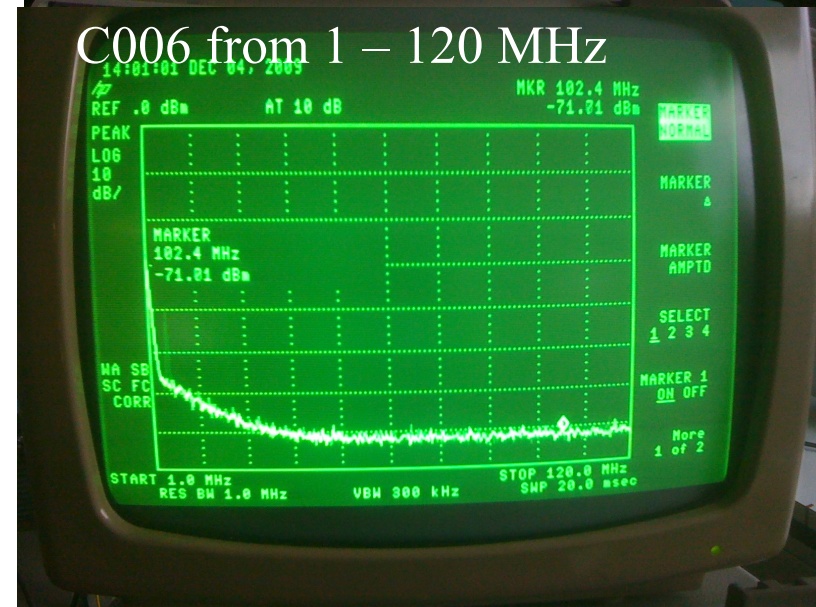
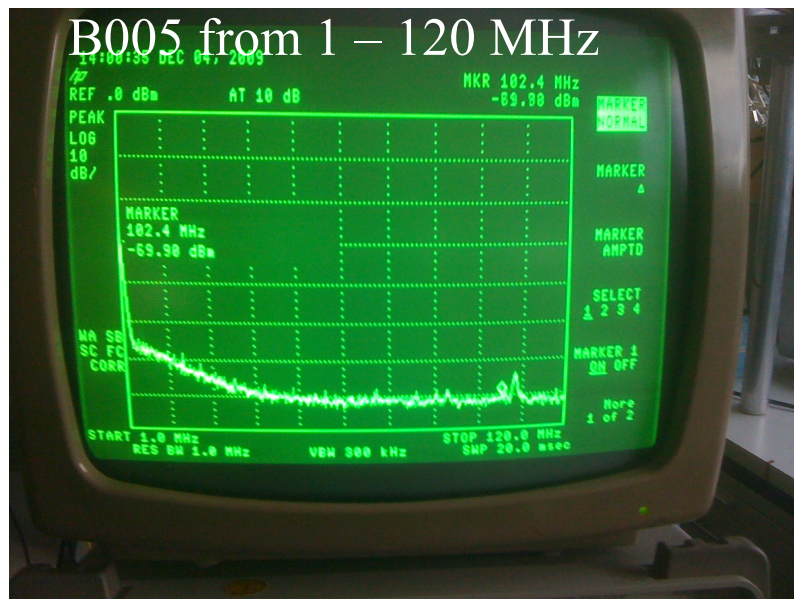
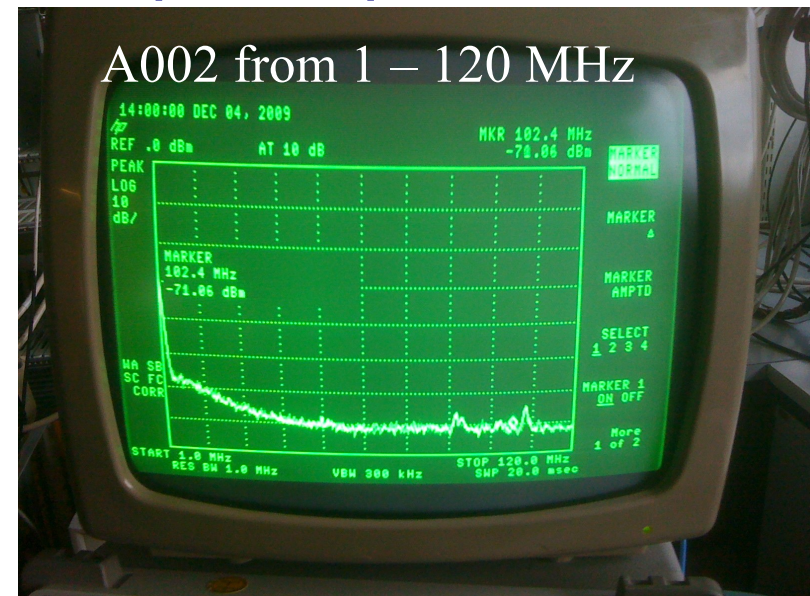
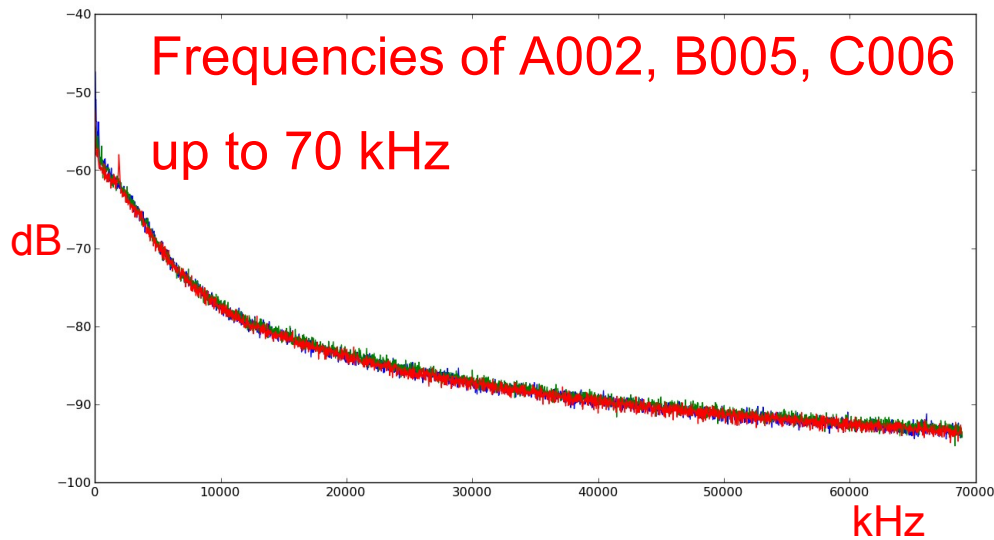


- fretting of micro match pins
- short connection of ground pins on preamp PCB and connection to common ground needed
- exchange with Fisher connector on MILANO preamps by Alberto Pulia and motherboards by CTT



Clean frequency spectra

ATC 3 operated with MILANO preamps



Capton cable test performed in ATC3

For reliability new cabling tested

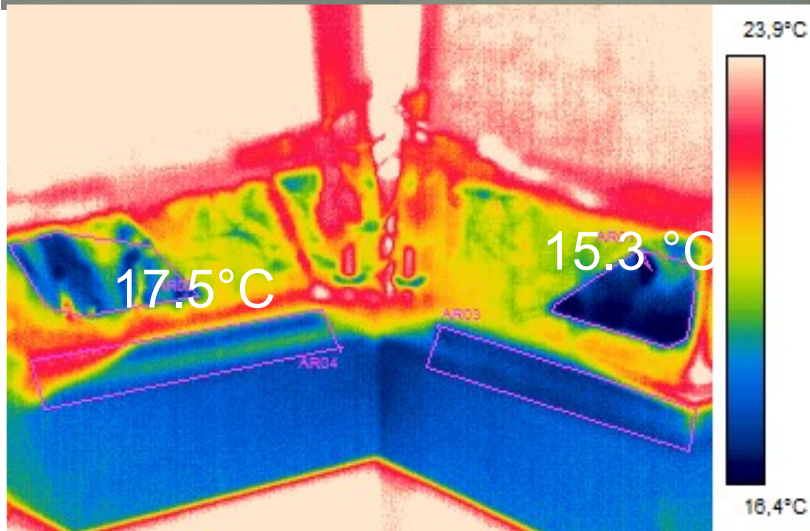
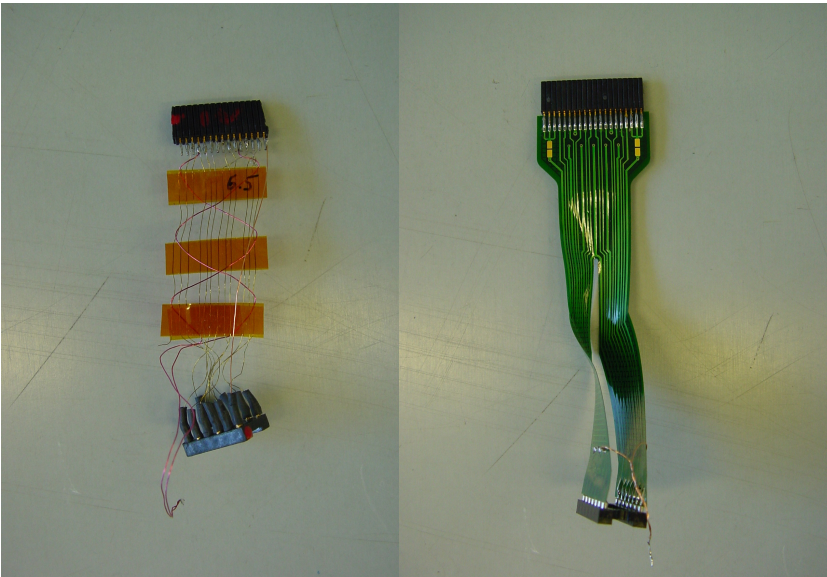
LN₂ consumption with capton cables
20 % increased

Thermal conductivity cools down the endcap
via feedthroughs

Damaged feedthroughs after test

Capton cables are no option in AGATA – cryostats

Problem solved with improved new
cables in ATC3



Test results capsule B006 in ATC3

B006 met the CAT in test cryostat
- after mounting in ATC3 poor FWHM
on one segment observed

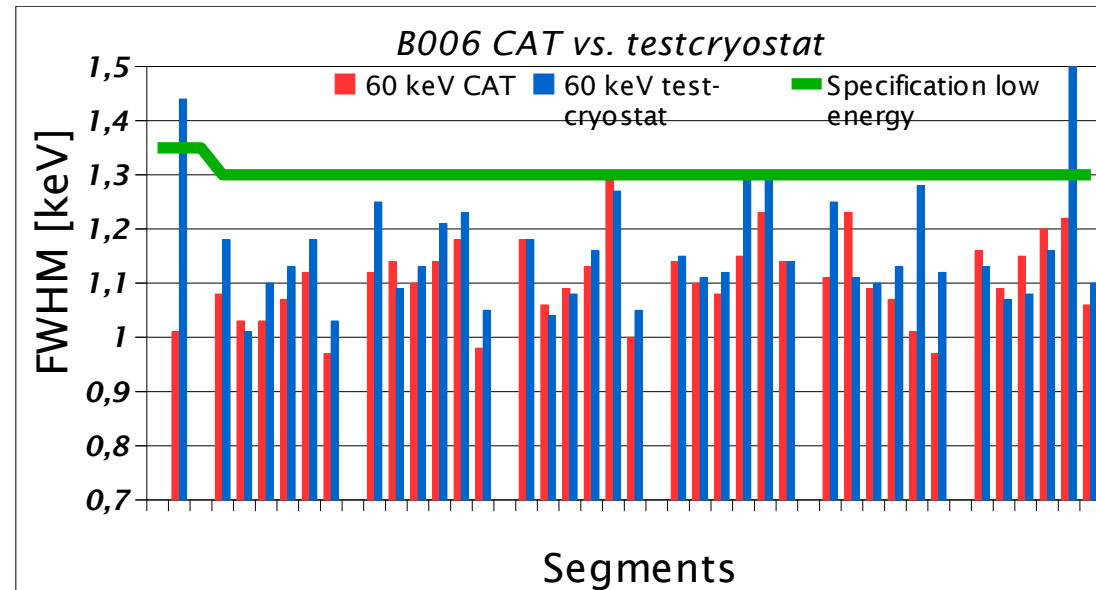
reproduced in test cryostat

Core FWHM:

@ 122 keV: $\Delta E = 1.44$ keV (1.01 keV)
@ 1332 MeV: $\Delta E = 2.37$ keV (2.24 keV)

Segment F5 FWHM:

@ 122 keV: $\Delta E = 1.69$ keV (1.22 keV)
@ 1332 MeV: $\Delta E = 2.46$ keV (2.22 keV)



in upside down orientation the resolution gets worse

Core FWHM:

@ 122 keV: $\Delta E = 2.47$ keV
@ 1332 MeV: $\Delta E = 2.52$ keV

Segment FWHM:

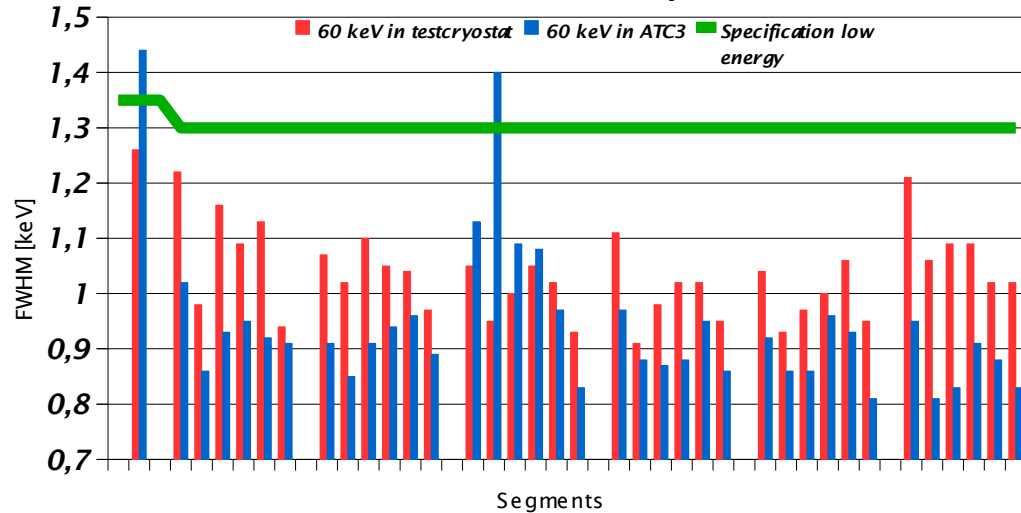
@ 122 keV: $\Delta E = 2.72$ keV
@ 1332 MeV: $\Delta E = 2.76$ keV

Back to Canberra for repair

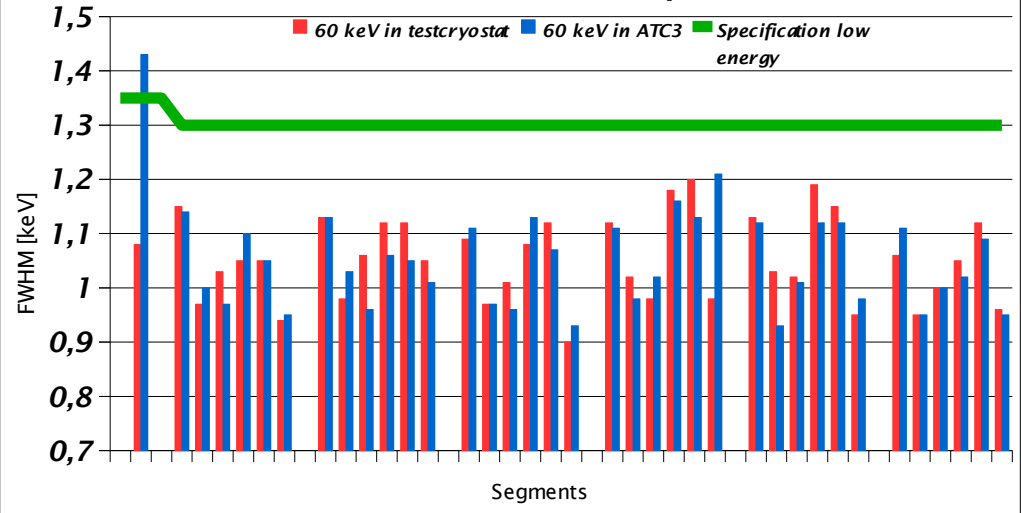


ATC3

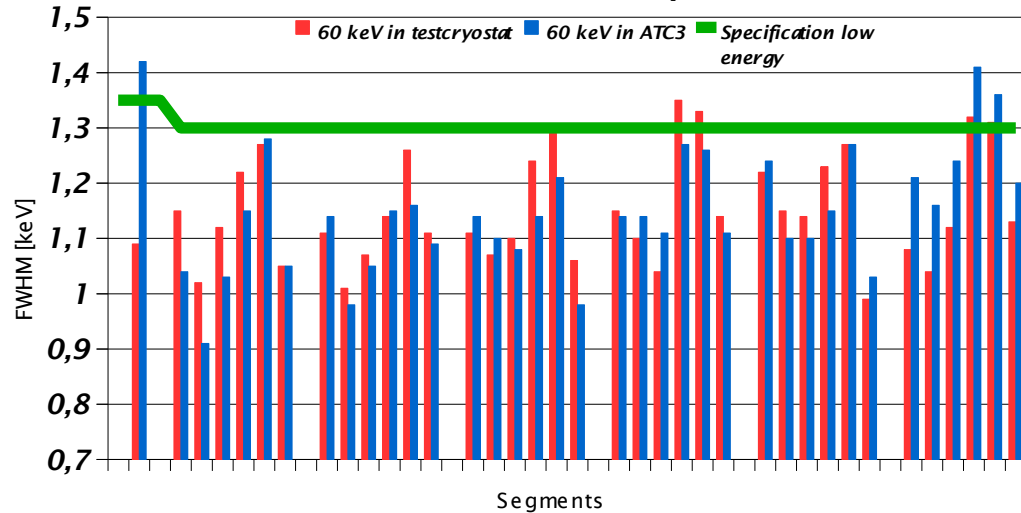
A002 in ATC3 vs. testcryostat



B005 in ATC3 vs. testcryostat



C006 in ATC3 vs. testcryostat



First ATC equipped with MILANO preamplifiers

Mean values segments @ 60 keV

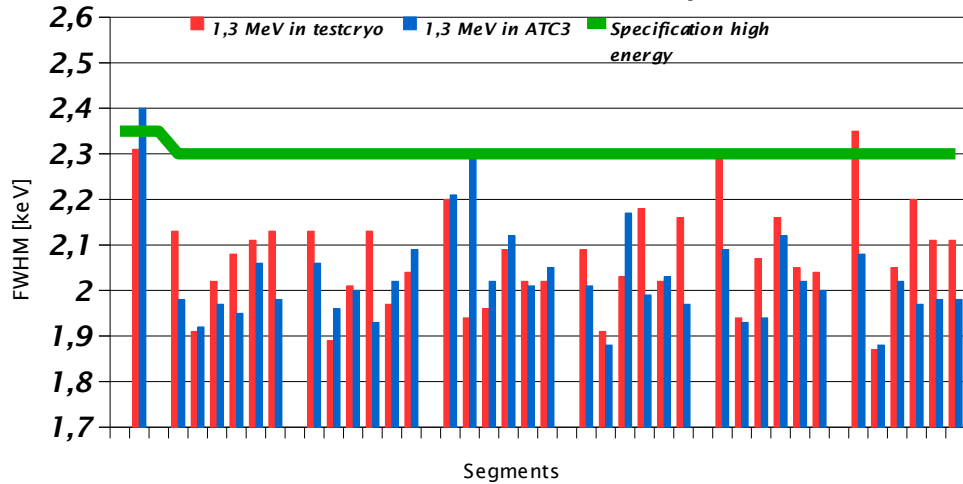
A002: $\Delta E = 0.93$ keV

B005: $\Delta E = 1.05$ keV

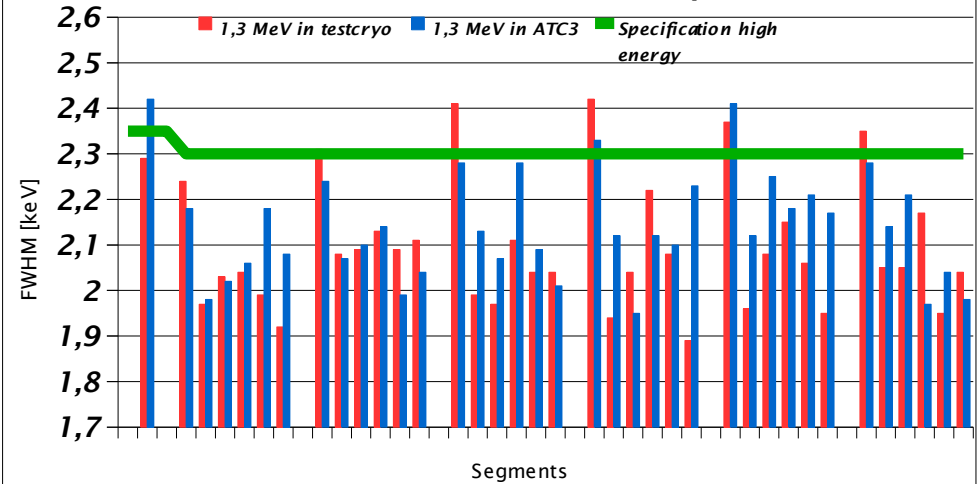
C006: $\Delta E = 1.14$ keV

ATC3

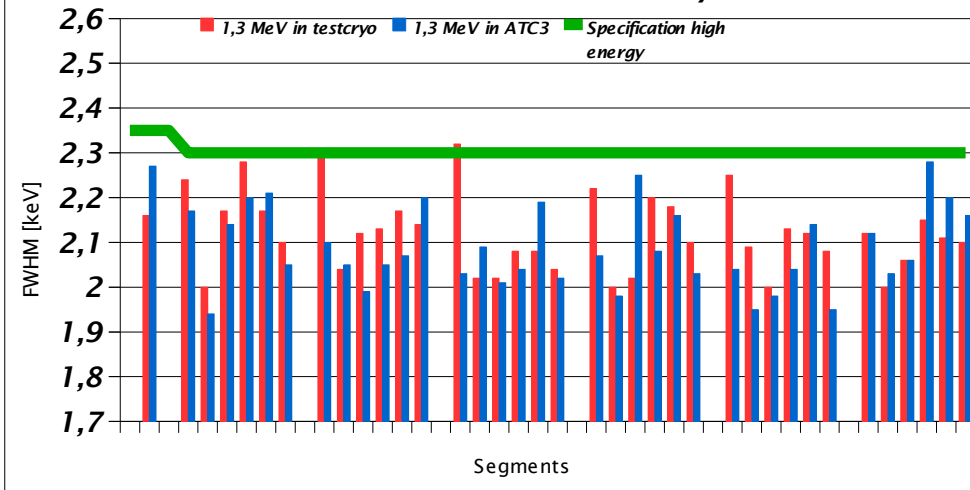
A002 in ATC3 IKP vs. testcryostat



B005 in ATC3 IKP vs. testcryostat



C006 in ATC3 IKP vs. testcryostat



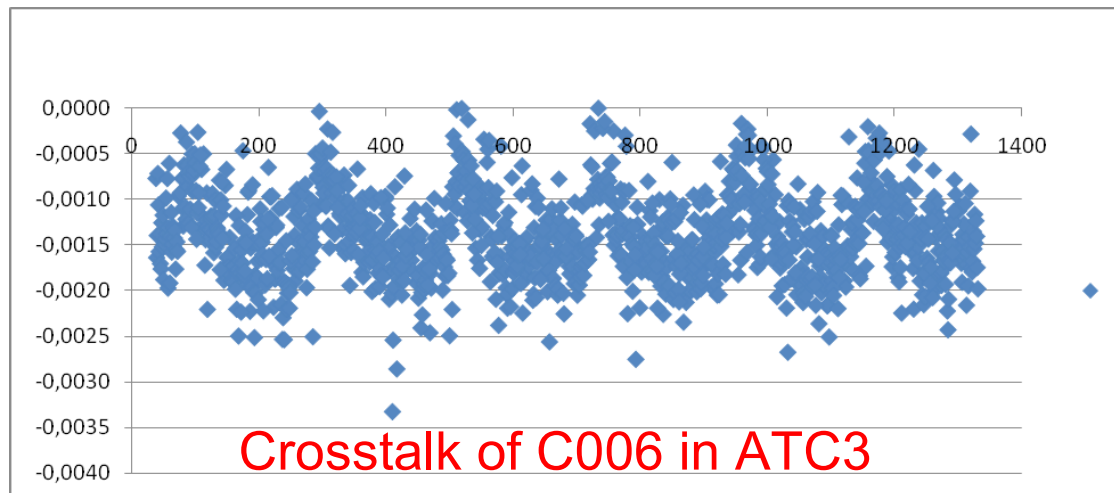
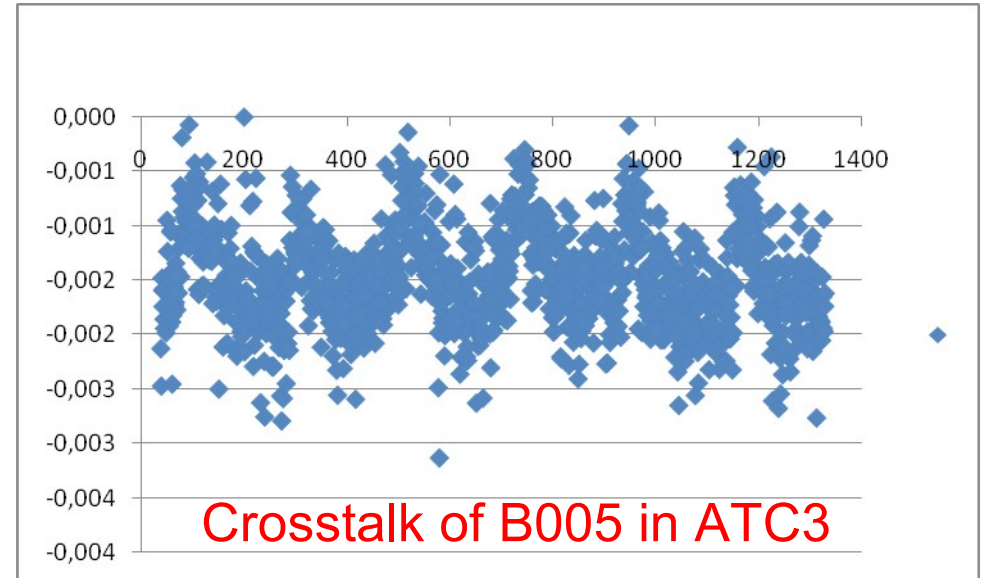
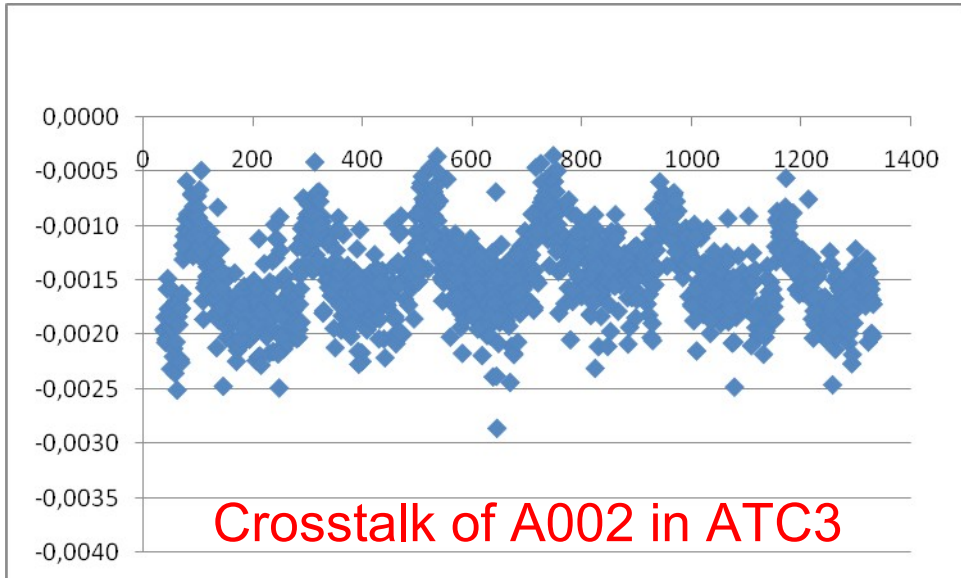
Mean values segments @ 1.3 MeV

A002: $\Delta E = 2.02$ keV

B005: $\Delta E = 2.13$ keV

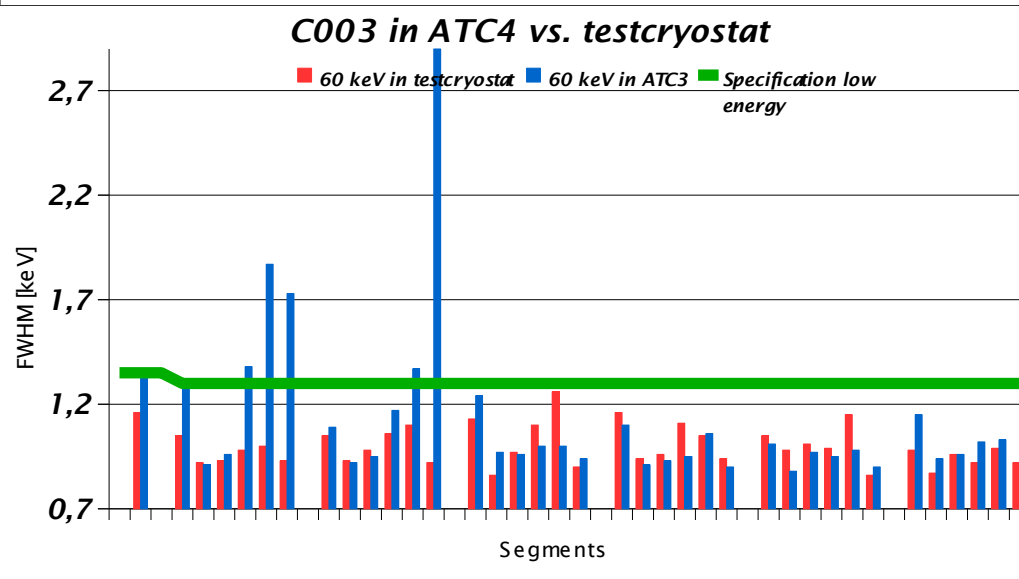
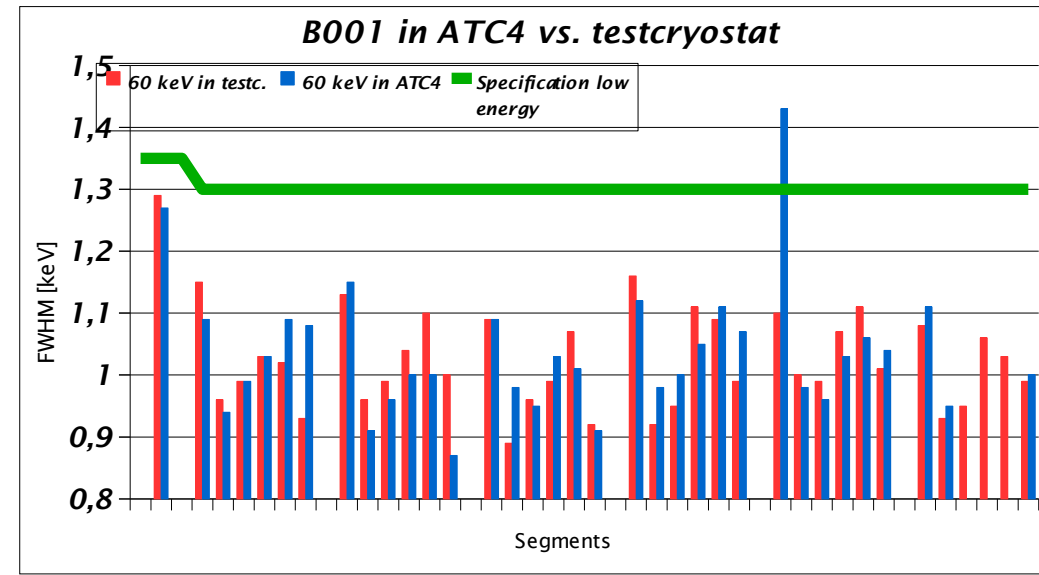
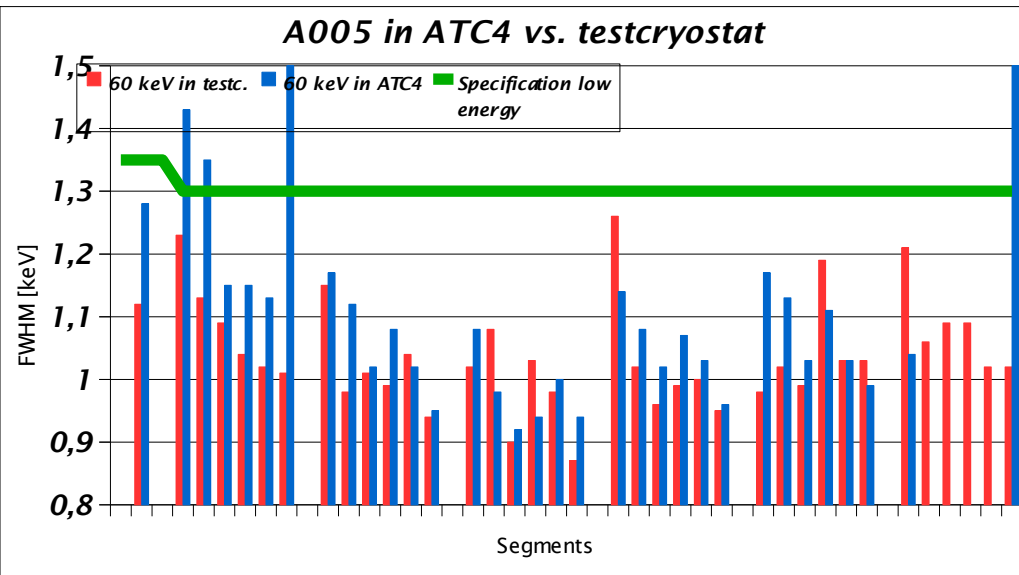
C006: $\Delta E = 2.09$ keV

ATC3



- crosstalk measured by analyzing the traces of 1 – folds
- crosstalk pattern can be entirely attributed to the capacitive coupling between core and segments
- delivered in December to Legnaro

ATC4 – first assembly



FWHM core @ 60 keV:

A005: $\Delta E = 1.28$ keV

B001: $\Delta E = 1.27$ keV

C003: $\Delta E = 1.33$ keV

Mean values segments @ 60 keV:

A005: 1.11 keV

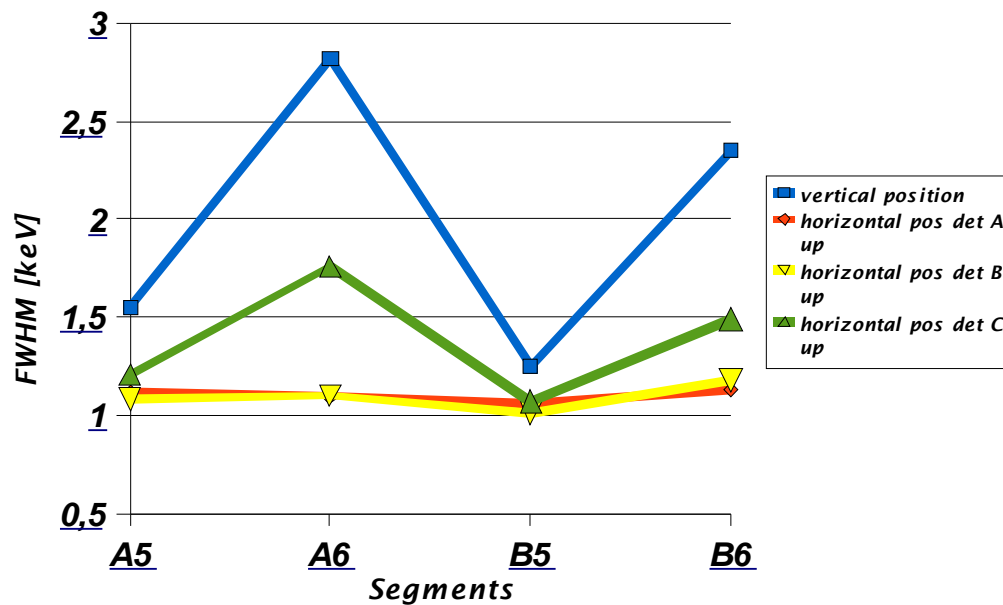
B001: 1.03 keV

C003: 1.12 keV

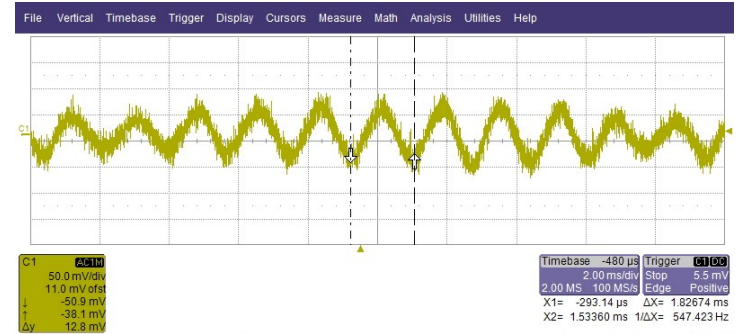
Further test of C003 in ATC4

- dismounting A005, B001
- further tests performed with just C003 mounted in ATC4
- new behaviour: microphonics on segments
- microphonics is position dependent

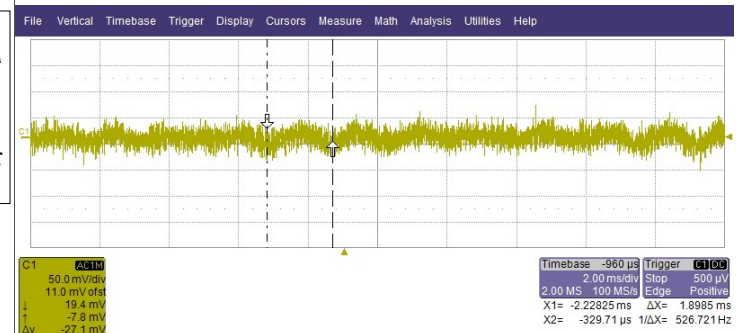
FWHM of A5, A6, B5, B6 position depending



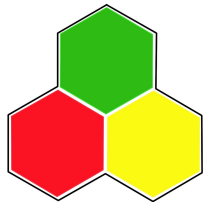
- results confirmed in Cologne test cryostat



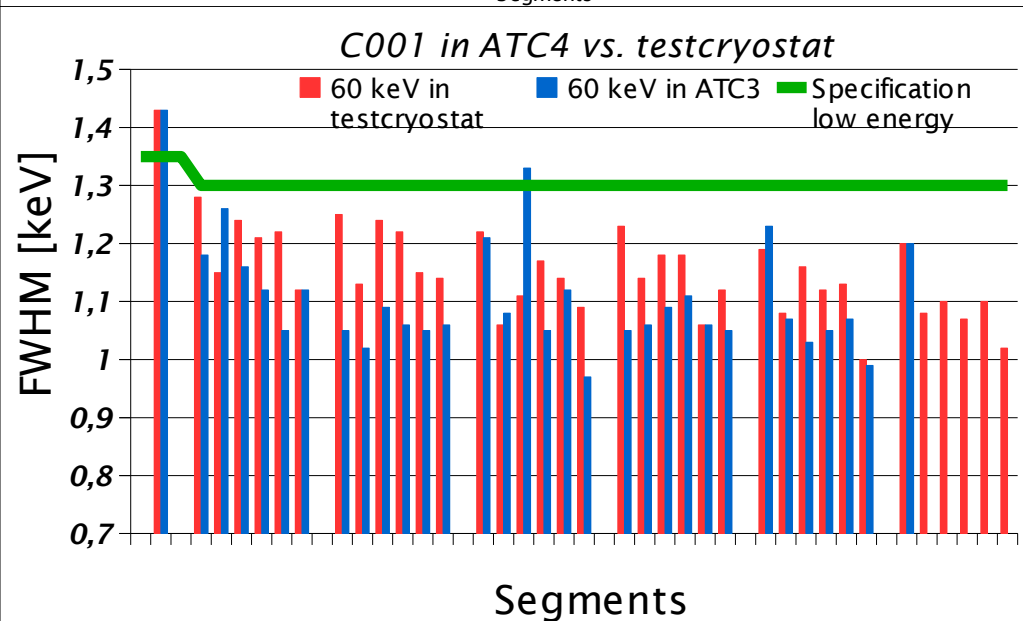
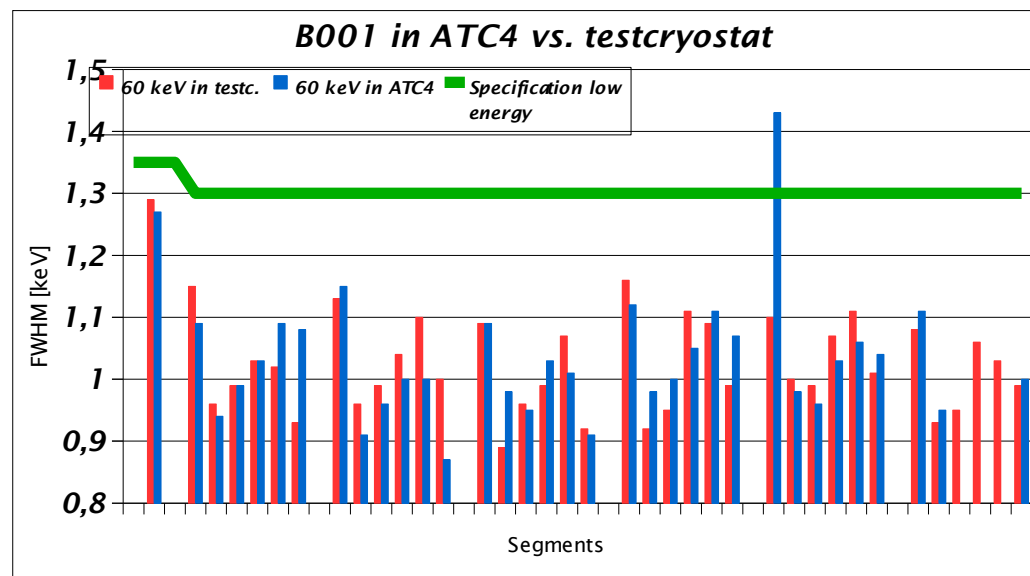
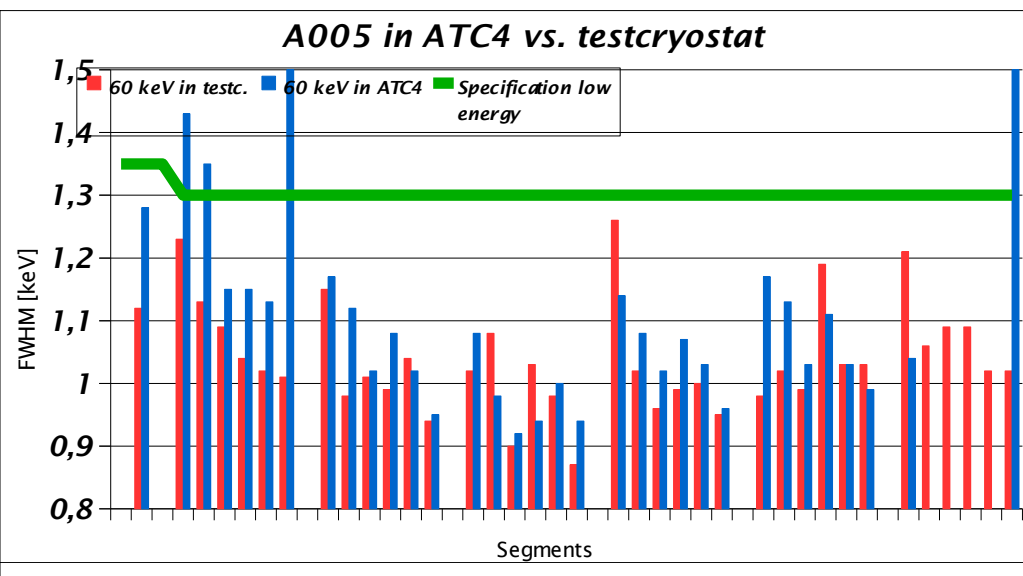
Segment A6 in vertical position (Am gain) fr. \sim 500 Hz



Segment A6 in horizontal position (Am gain, Det. A up)



Status of ATC4 – second assembly



FWHM core @ 60 keV:

A005: $\Delta E = 1.28$ keV

B001: $\Delta E = 1.27$ keV

C001: $\Delta E = 1.43$ keV

Mean values segments @ 60 keV:

A005: 1.11 keV

B001: 1.03 keV

C001: 1.11 keV

ATC5

- cryostat hardware available and tested
- mounting of detectors delayed due to missing B-type detector



Summary and outlook

Single detector tests:

- 4 detectors tested since last AGATA week, 3 accepted, 1 refused

Status of demonstrator detectors:

- ATC1, ATC2, ATC3 performing well within specification
- ATC4 ongoing commissioning
- ATC5 waiting for B-type detector