Status of AGATA Detectors and Cryostats

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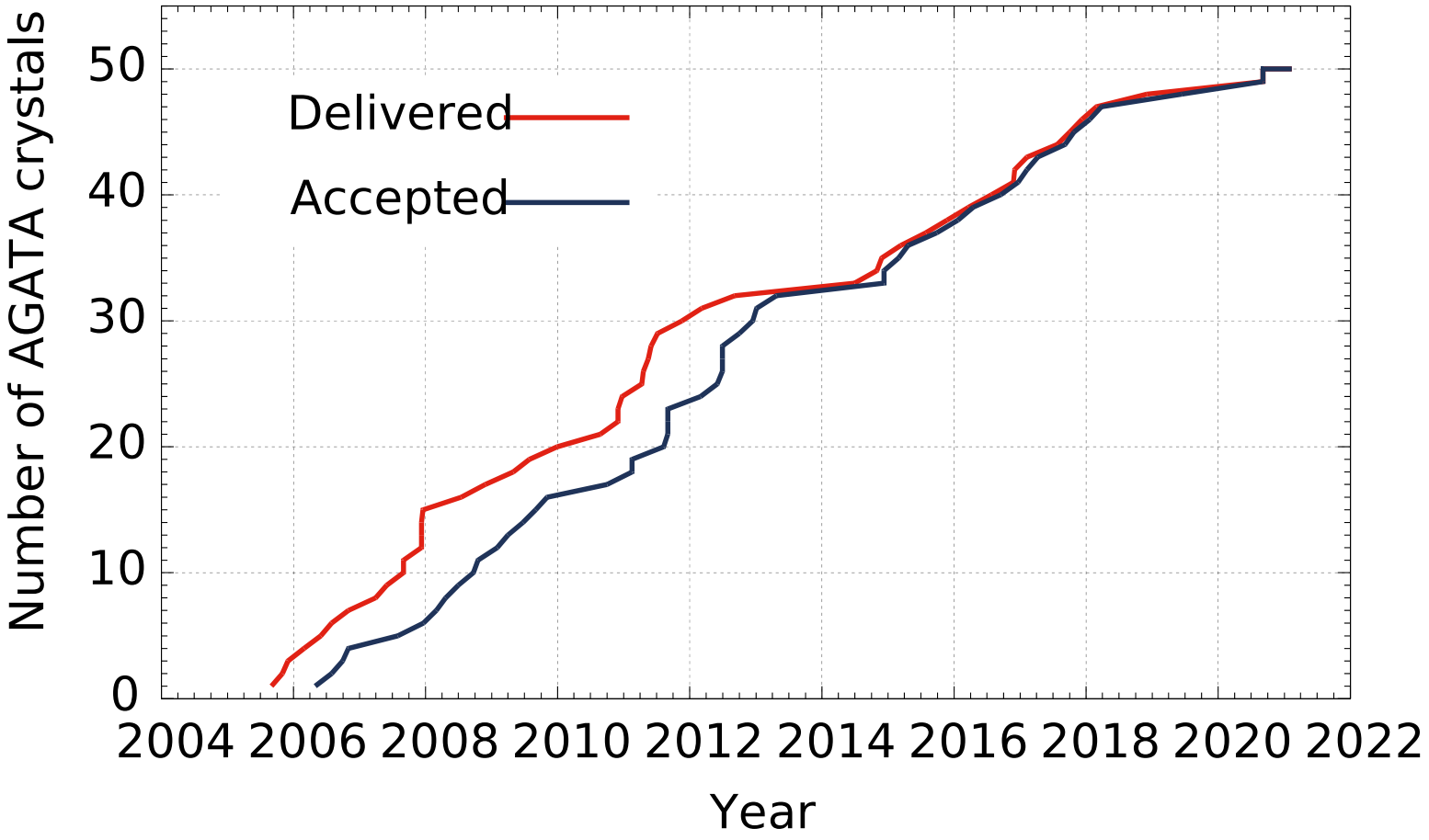
Status of AGATA Detectors and Cryostats

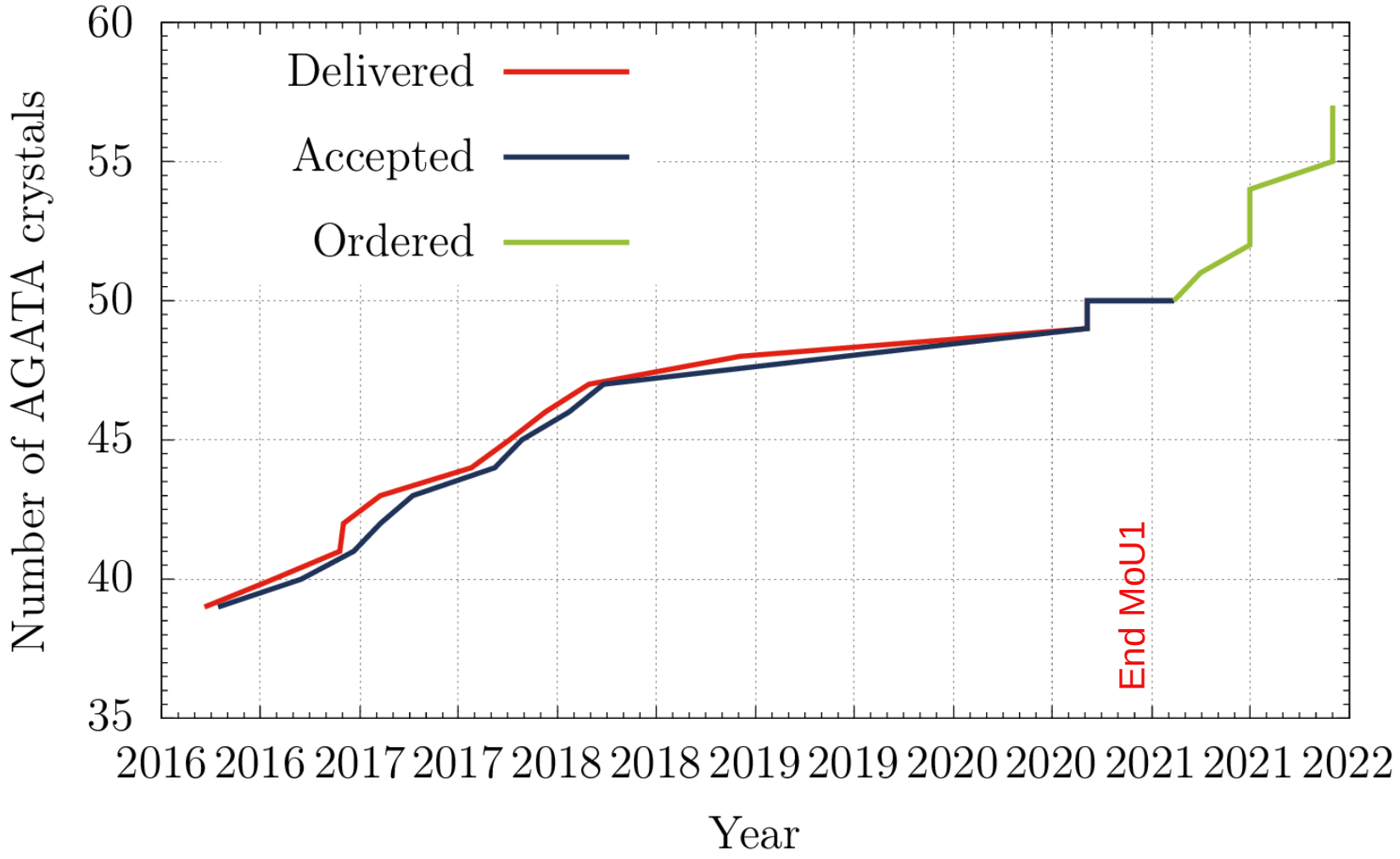
Overview

- AGATA detectors and triple clusters
- Annealing of neutron damaged detectors
- Summary & Outlook

Status Capsules



Future capsule deliveries



Status Capsules 2021

50 detectors available
(13 new encapsulation technology)
(+3 DEGAS)

39 detectors at GANIL

5 detectors within detector group:

3 in Cologne:
A006, B013, C006: annealed at Mirion, will be mounted in ATC08
2 in Liverpool
C017, A005: scanning
+ 2 DEGAS in Cologne B501, C501: mounted in the DEGAS TC

3 detectors under repair at Mirion
B005 (April 21), B010 (April 21), C001 (Feb 21)
(+DEGAS A501 (Feb 21))

3 detectors at Mirion for annealing R&D
A009, B002, C009

Capsule Open Deliveries January 2021

Hungary:
A017, B018, C018, delivery June 21

UK:
A018, B019, C019, delivery December 21
+ A019 Ortec prototype, delivery first quarter 21

→ **57 detectors available end of 2021**
(+ 3 DEGAS)

Status at GANIL

13 ATCs + 1 ADC equipped with 41 detectors available after the physics campaign 2019

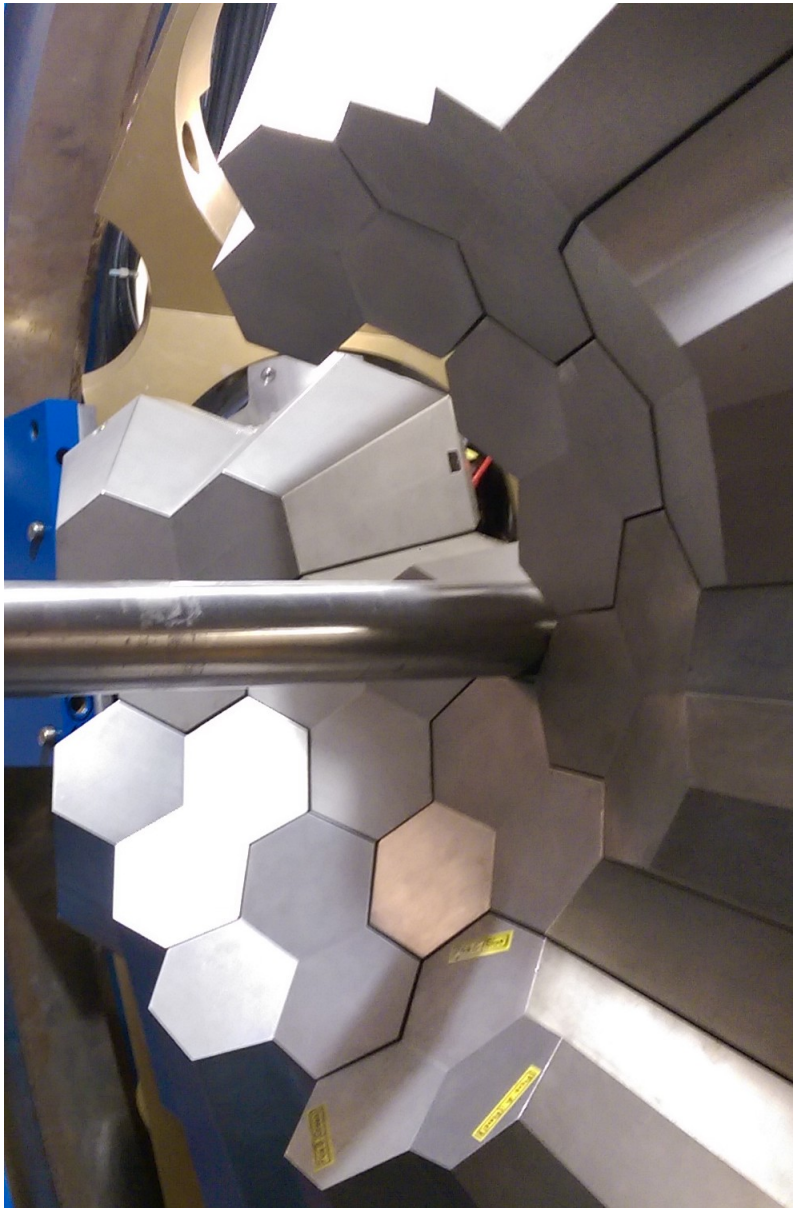
1 ATC vacuum, saturated getter

1 ADC broken mechanics inside the vacuum vessel

6 ATC warmed up due to COVID 19 restrictions, LN2 supply from Belgium not secured

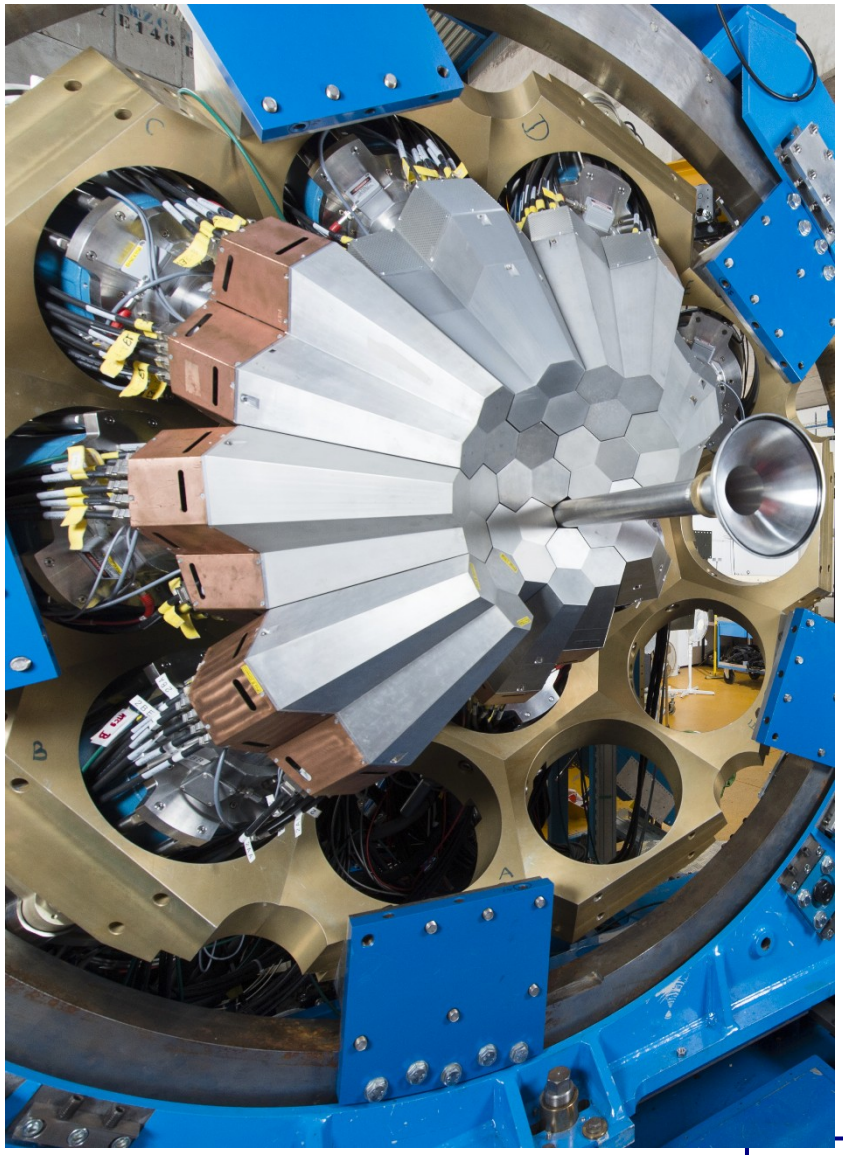
→ NO EXPERIMENT AT GANIL IN 2020 DUE TO COVID 19 RESTRICTIONS

6 ATCs equipped with 18 detectors in operation in April 2020



Preparations for the physics campaign 2021

- 6 ATCs in operation at GANIL
- 1 new ATC from Cologne delivered
- 1 refurbished ATC from IPHC delivered
- 4 ATCs vacuum maintenance (GANIL)
- 1 ATC: replacement of 2 detectors due to neutron damage including maintenance (GANIL, IPHC)
- 13 ATCs are in operation,
  11 ATCs mounted



Status Cryostats January 2021

13 ATCs equipped with 39 detectors available for the physics campaign

GANIL: 1 ATC + 1 ADC without detectors: ATC07 & ADC03

Cologne: 1 ATC installation of 3 annealed detectors: ATC08
1 DEGAS TC in Cologne, waiting for A501

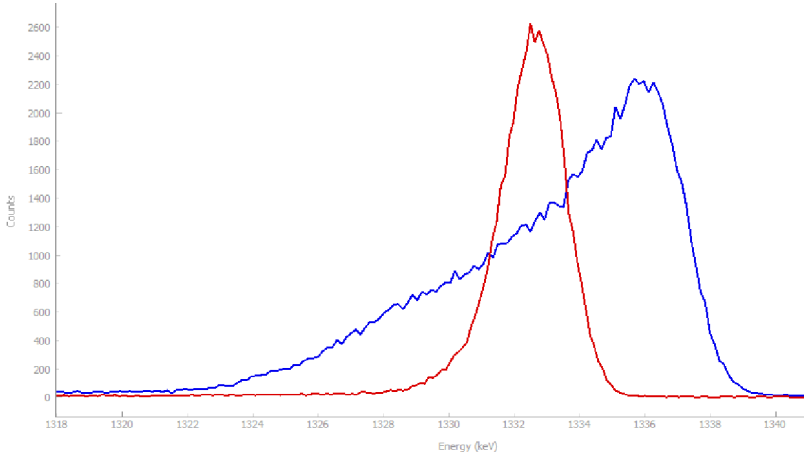
Perspectives: 2 ATC cryostats waiting for detectors at CTT:
ATC16(Italy) & ATC17(Hungary)

Open cryostat deliveries:
UK: ATC18 & ATC19 delivery end of 2021 beginning of 2022

Neutron damage and annealing of AGATA detectors

All AGATA detectors suffer from neutron damage,
16 detectors have to be annealed

ATC08 equipped with A009, B005, C008,
maintenance end of 2019 due to saturated
getter material.

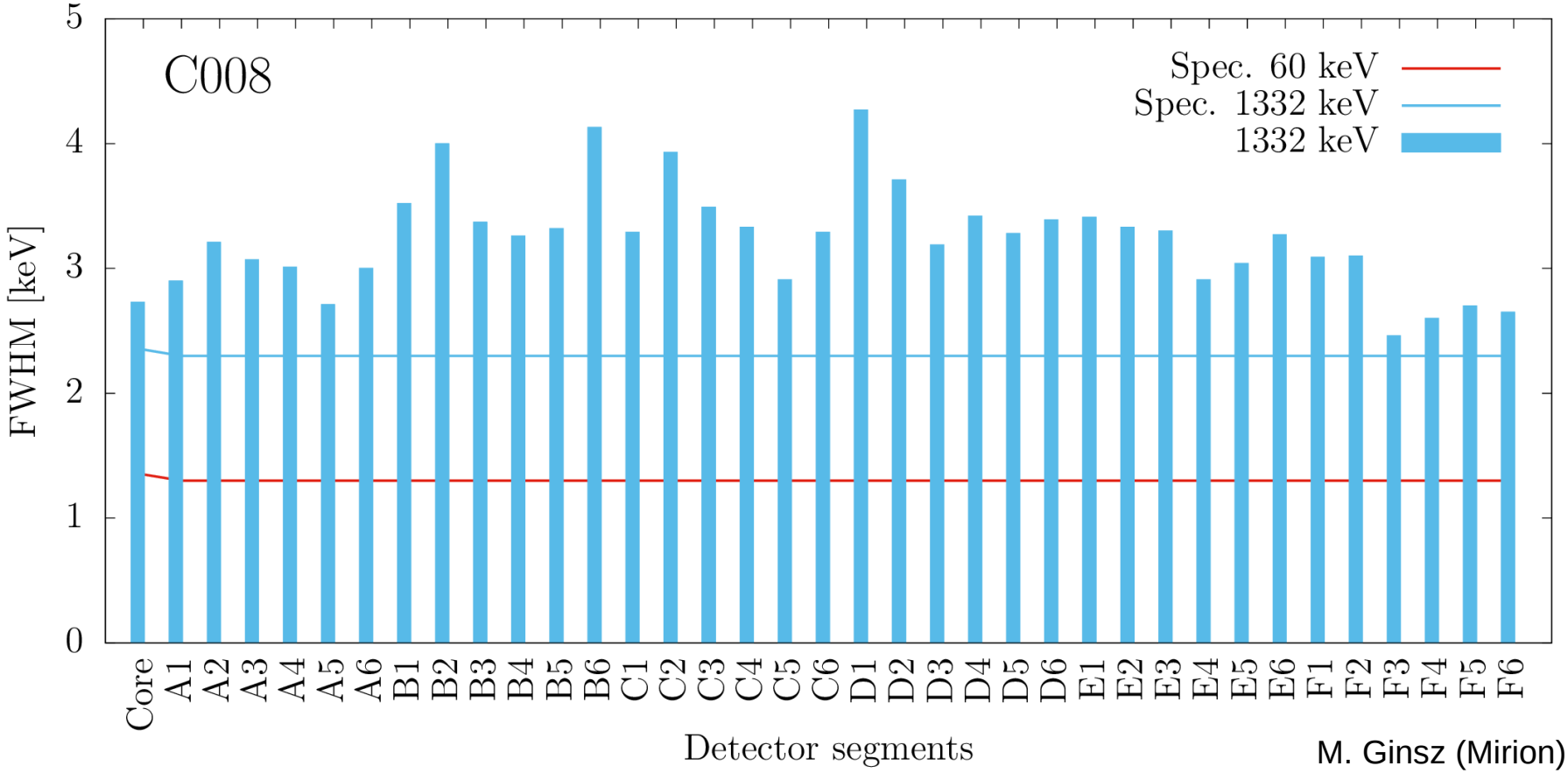


A009: transport to Liverpool for scanning
(first scan of a neutron damaged detector)

Detector annealing by detector group not satisfying,
high yield of broken detectors due to leakage current.

Annealing at Mirion, Lingolsheim
B005 & C008: transported to Mirion for annealing

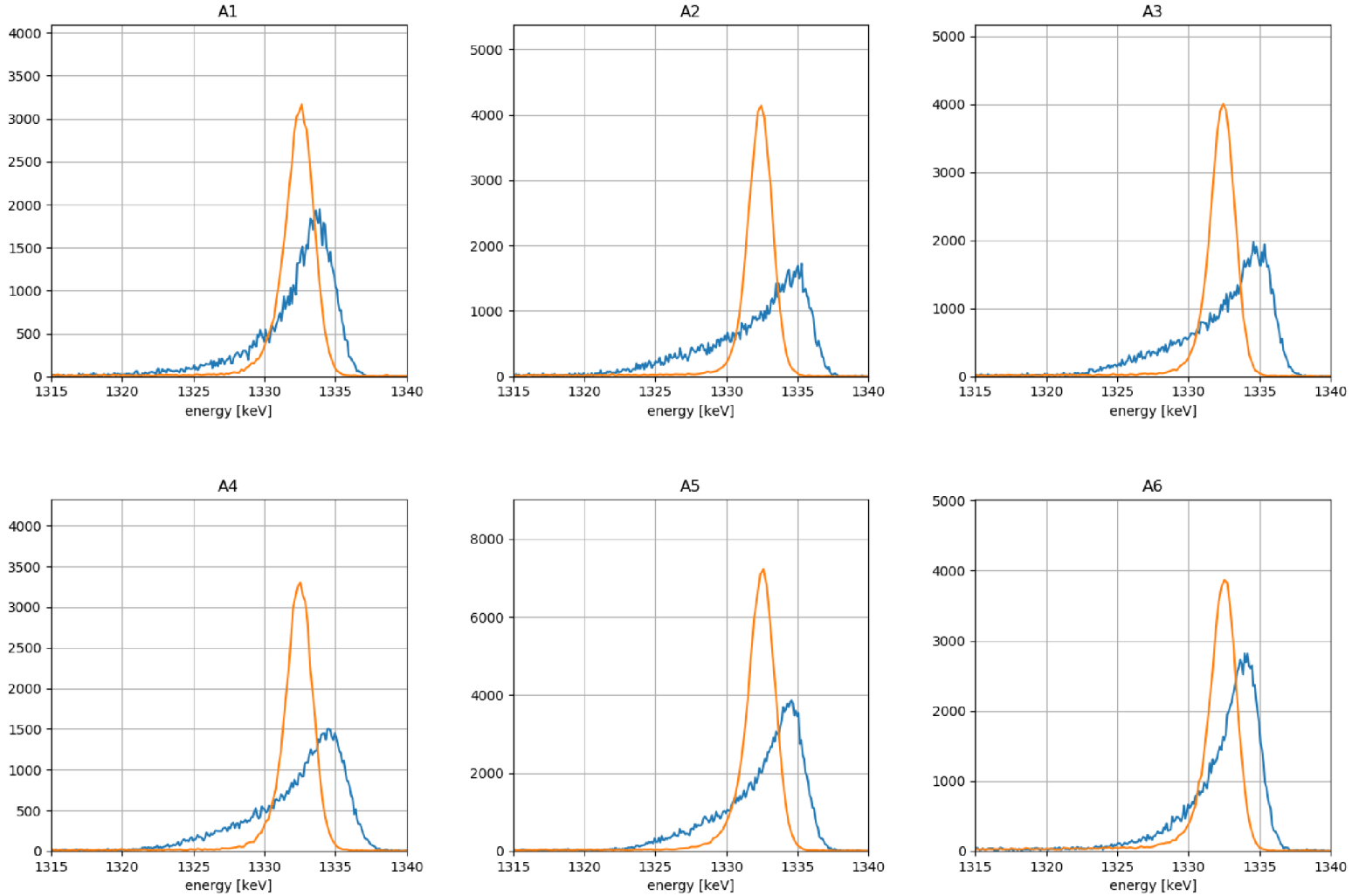
C008 before annealing



M. Ginsz (Mirion)

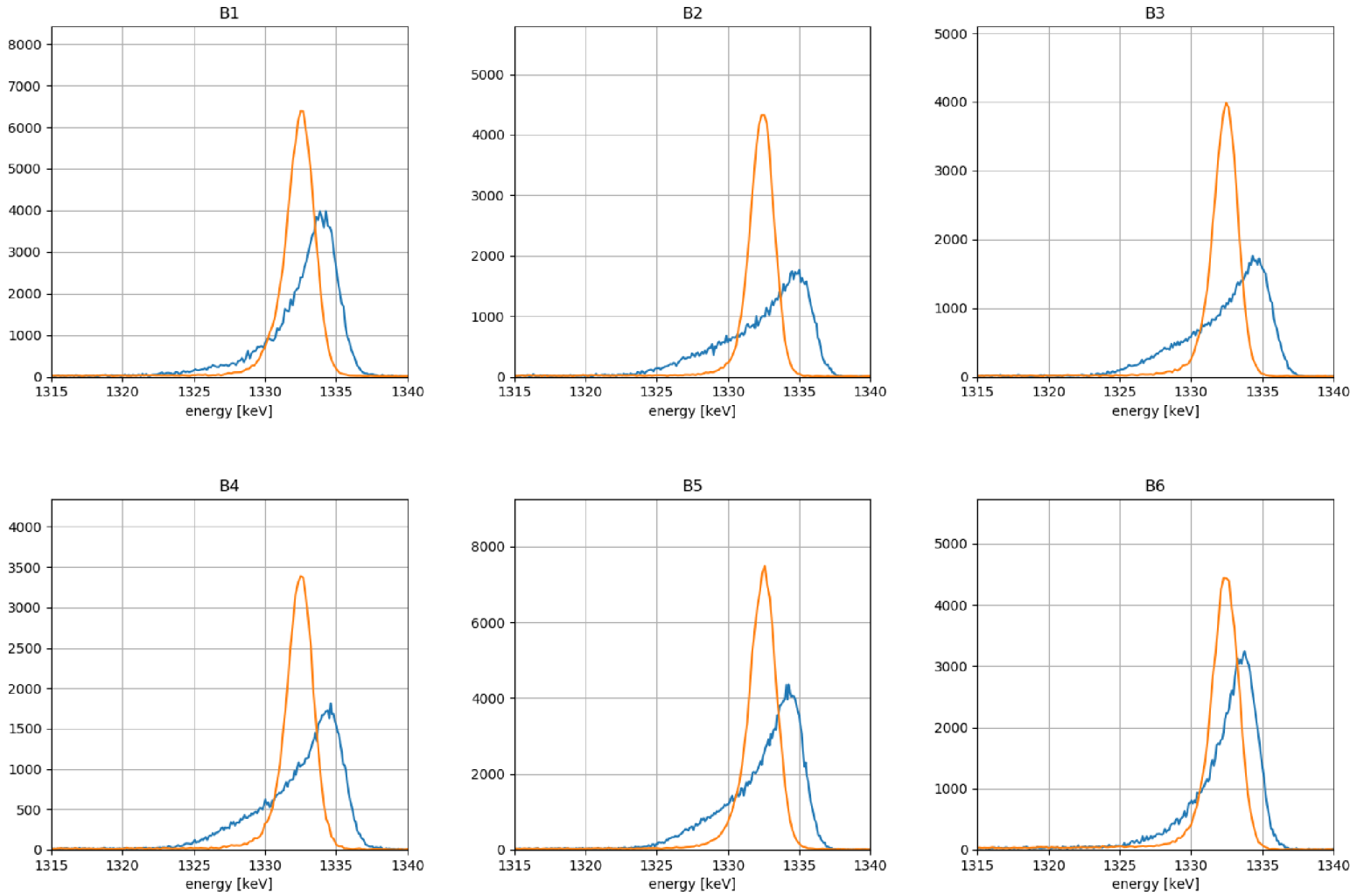
FWHM before annealing C008:
@ ^{60}Co: Core 2.73 keV
Segment average 3.32 keV
(between 2.46 keV and 4.27 keV)

Line shapes of C008



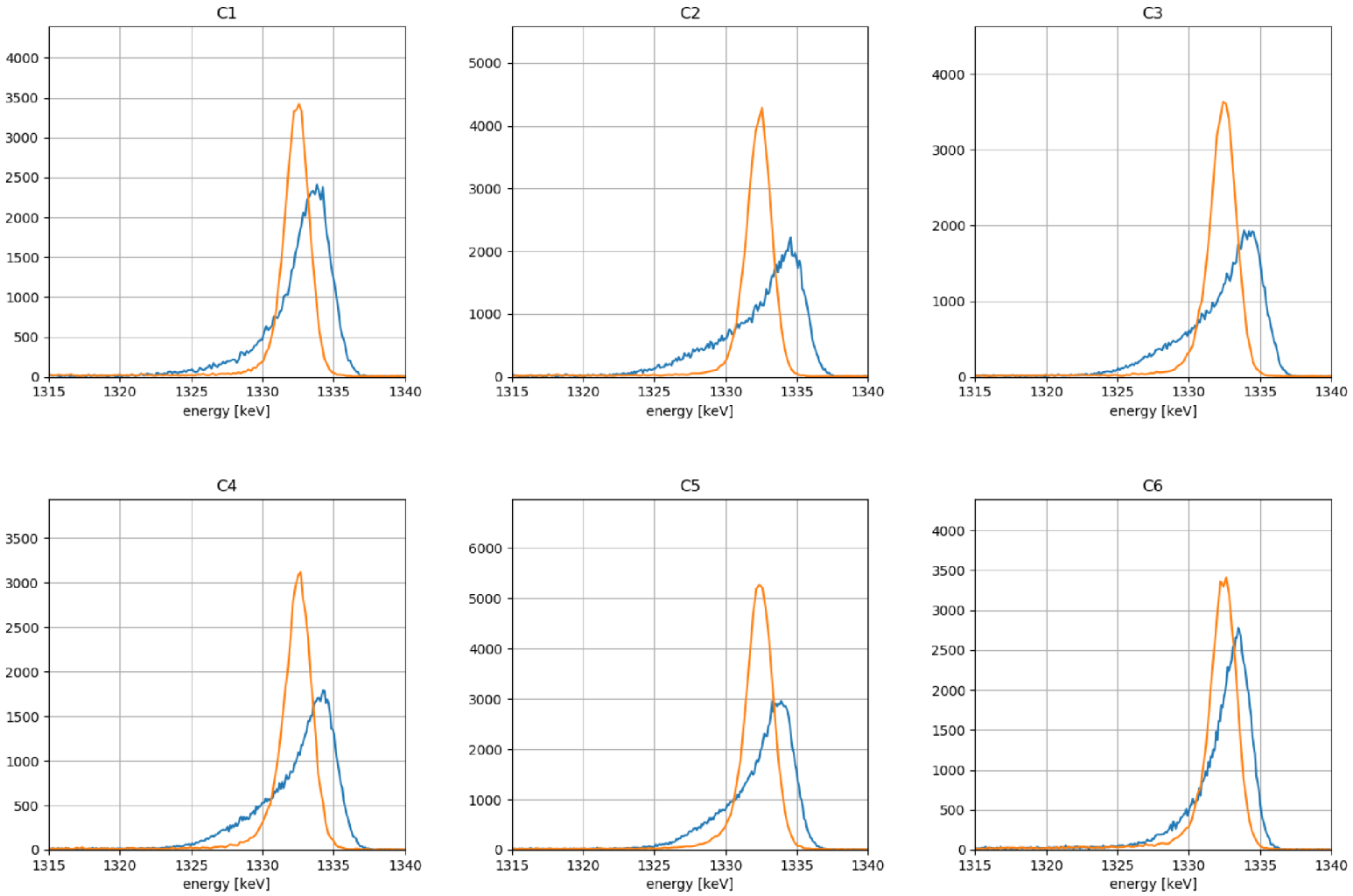
M. Ginsz (Mirion)

Line shapes of C008



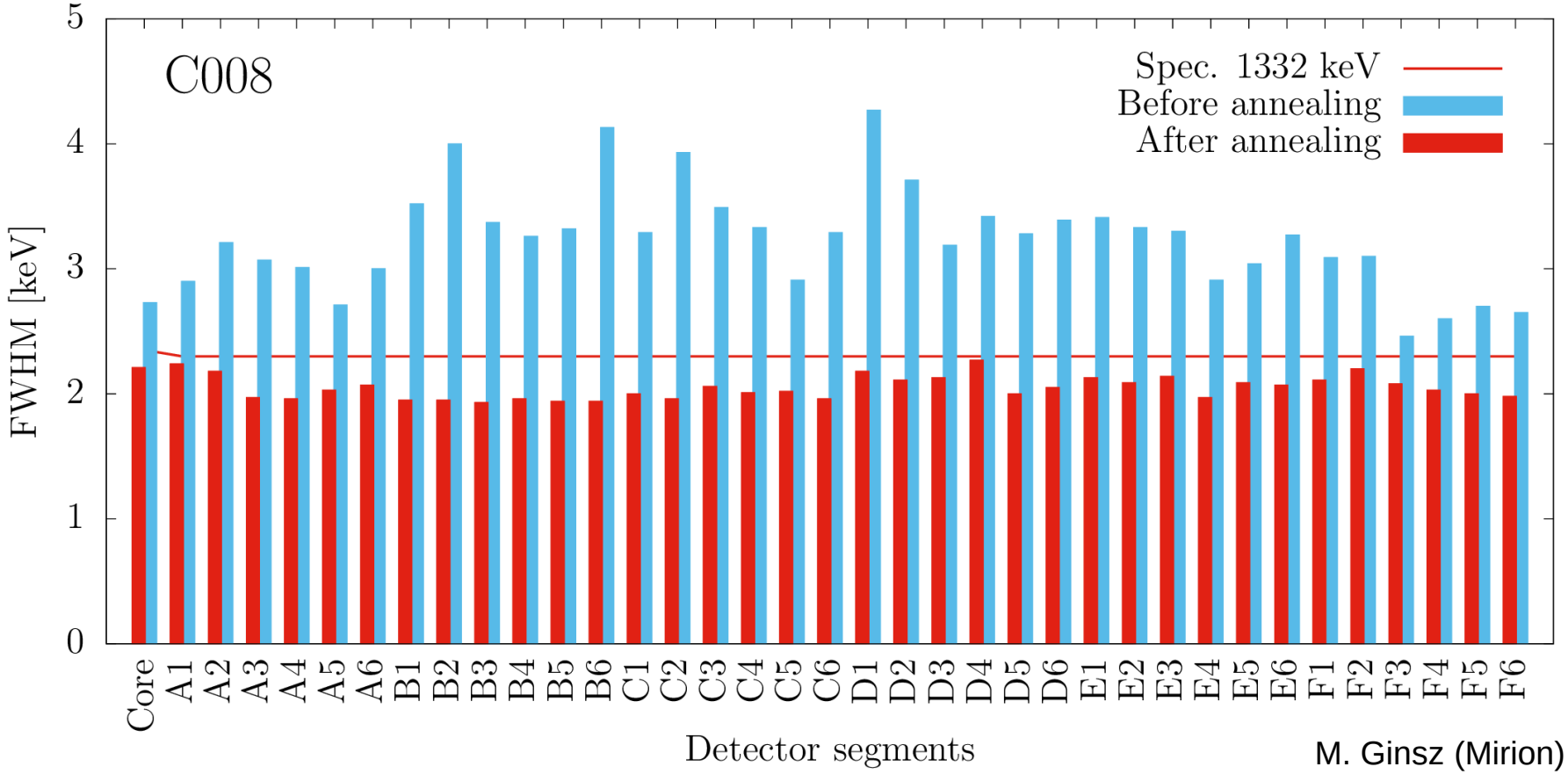
M. Ginsz (Mirion)

Line shapes of C008



M. Ginsz (Mirion)

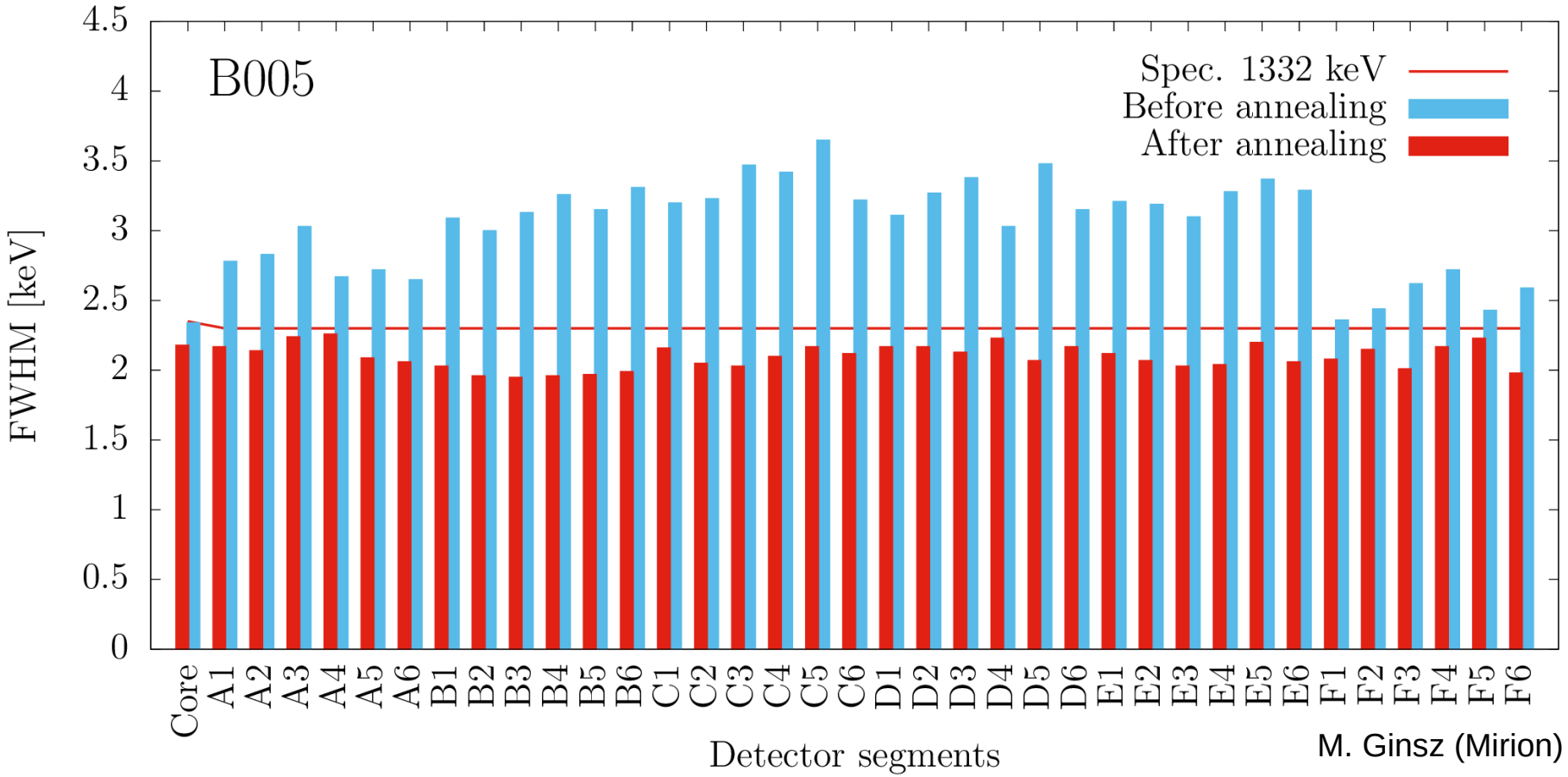
Energy resolution of C008 before/after annealing



M. Ginsz (Mirion)

FWHM after annealing C008:
@ ^{60}Co: Core: 2.21 keV
Segment average: 2.01 keV

Energy resolution of B005 before/after annealing



M. Ginsz (Mirion)

FWHM before annealing B005:
@ ^{60}Co: Core 2.34 keV
Segment average 3.09 keV

FWHM after annealing B005:
@ ^{60}Co: Core 2.18 keV
Segment average 2.08 keV

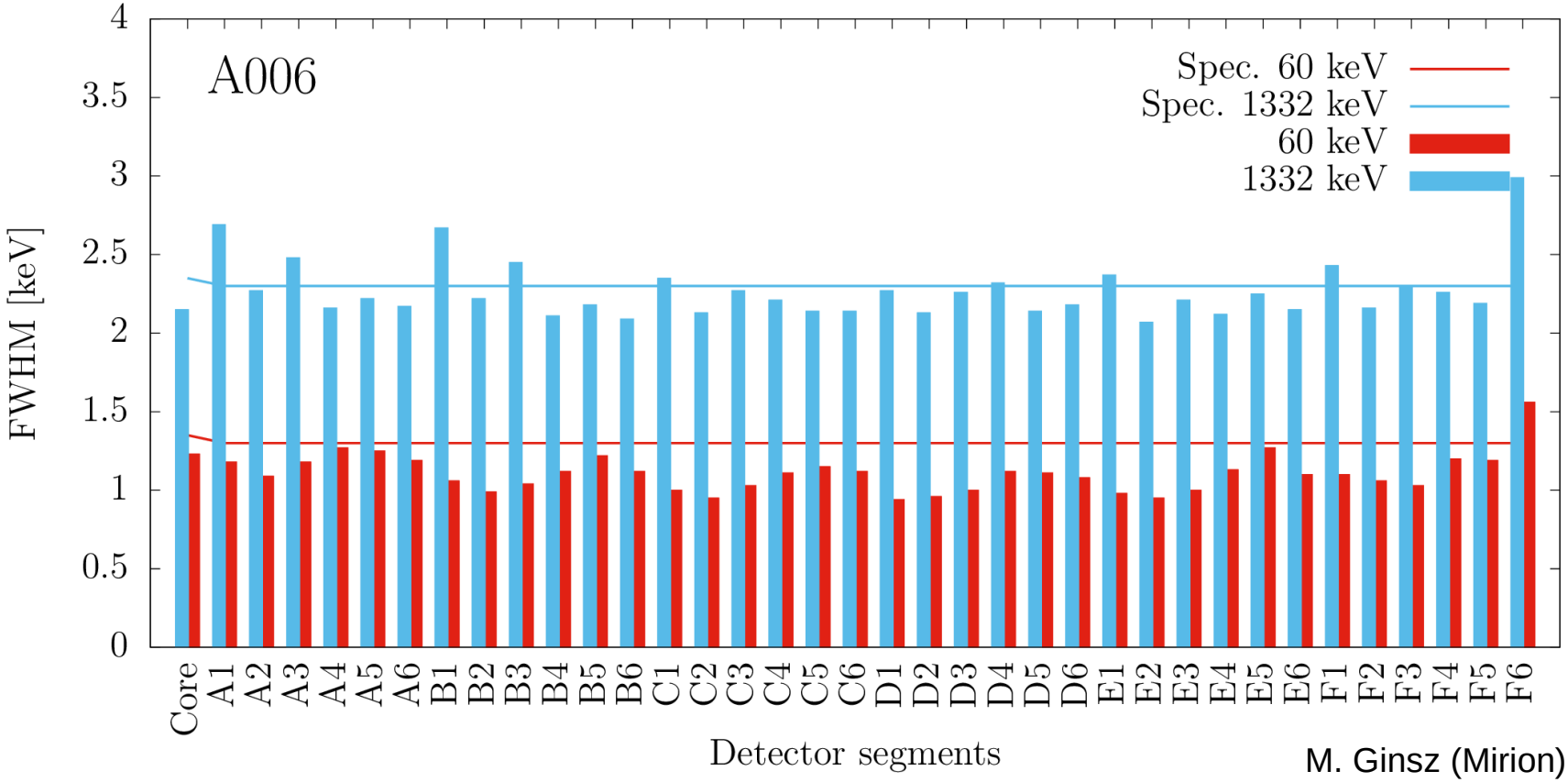
Annealing of A006, B013 and C006

ATC07 equipped with A006, B013, C006 was warmed up March 2020 due to unresolved situation with LN2 supply chain.

A006, B013, C006 highly neutron damaged

A006, B013 & C006: annealed at Mirion in November 2020

A006 before/after annealing



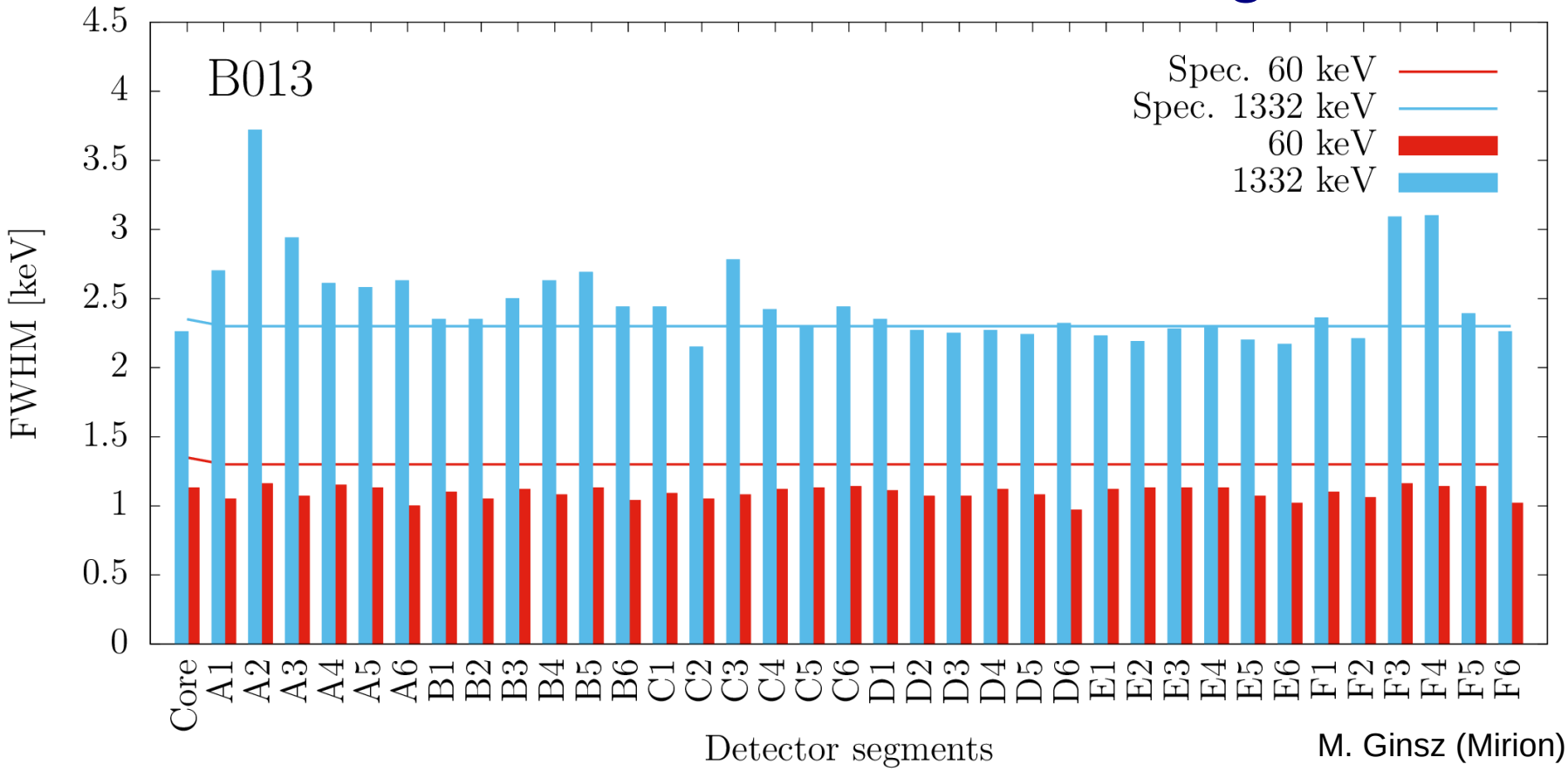
M. Ginsz (Mirion)

FWHM before annealing A006:
@ ^{60}Co: Core - keV
Segment average 3.60 keV
(2.50 keV – 5.00 keV)

FWHM after annealing A006:
@ ^{60}Co: Core 2.15 keV
Segment average 2.27 keV
(2.07 keV – 2.99 keV)

out of specs

B013 before/after annealing



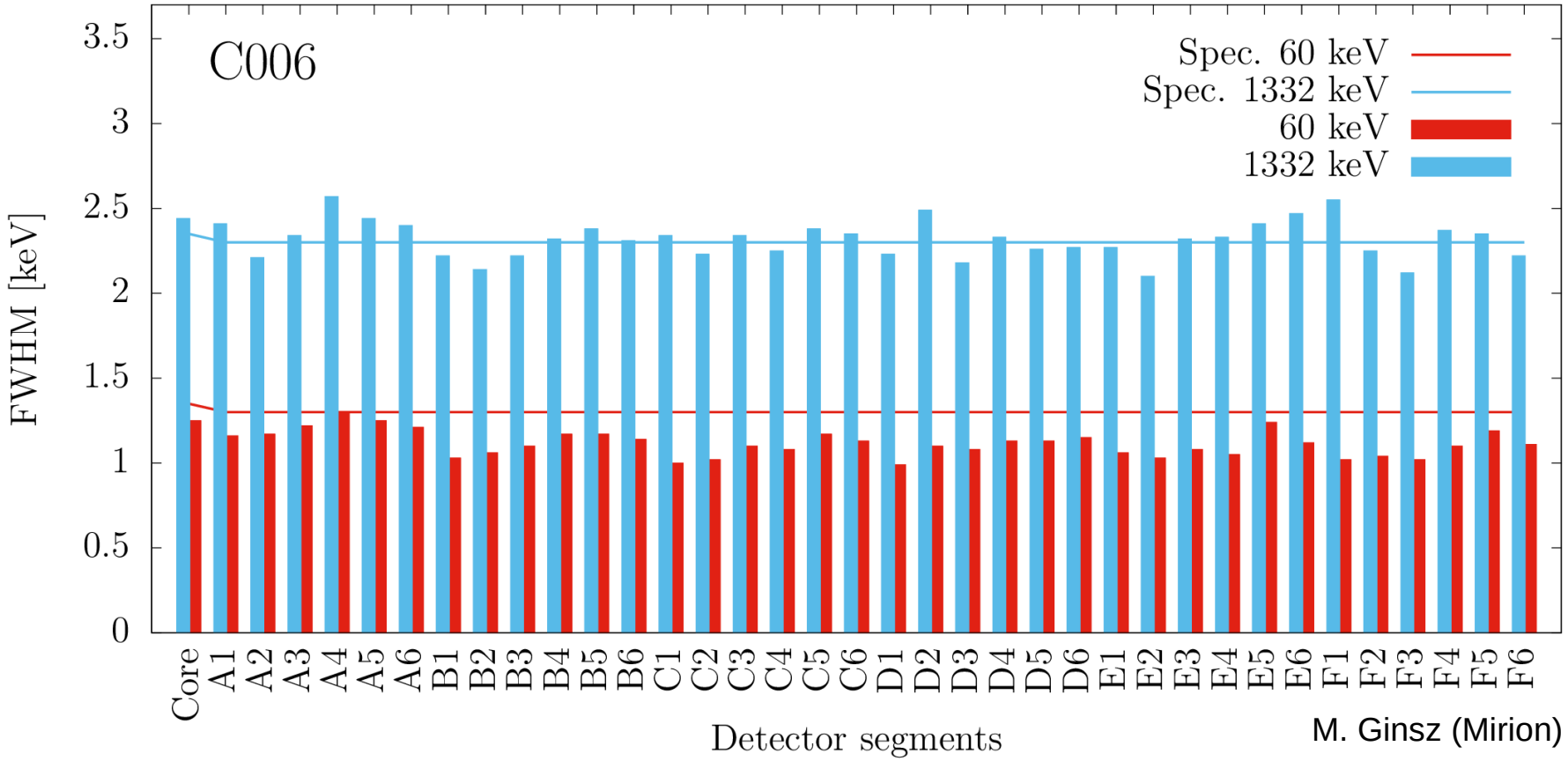
M. Ginsz (Mirion)

FWHM before annealing B013:
@ ^{60}Co: Core 2.30 keV
Segment average 3.20 keV
(2.30 keV – 3.90 keV)

FWHM after annealing B013:
@ ^{60}Co: Core 2.26 keV
Segment average 2.47 keV
(2.15 keV – 3.72 keV)

out of specs

C006 before/after annealing



M. Ginsz (Mirion)

FWHM before annealing C006:
@ ^{60}Co: Core 2.60 keV
Segment average 3.90 keV
(2.90 keV – 5.50 keV)

FWHM after annealing C006:
@ ^{60}Co: Core 2.44 keV
Segment average 2.31 keV
(2.10 keV – 2.57 keV)

out of specs

Annealing of detetors

Conclusions:

5 detectors successfully annealed at Mirion.

No leakage current after annealing.

16 additional detectors have to be annealed after GANIL campaign.

Annealing of detetors

Outlook:

Recovery of the performance of highly neutron damaged detectors should be improved.

B002 or C009 will be annealed at higher temperature.

Annealing procedure proposed by Mirion:

- test of the capsule
- annealing of the capsule
- if leakage current after annealing then reprocessing of the capsule without charge for annealing but for reprocessing

Summary & Outlook

39 detectors in 13 ATCs available for the physics campaign 2021

57 detectors available for AGATA end 2021
(+ 3 DEGAS)

19 ATCs available for AGATA beginning 2022

ATC maintenance due to saturated getter typically after 4 years of operation is needed for several ATCs.

16 detectors have to be annealed after the GANIL campaign.

New annealing procedure at Mirion is promising, ongoing R&D to improve on final segment energy resolution.

THANK YOU !!!

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