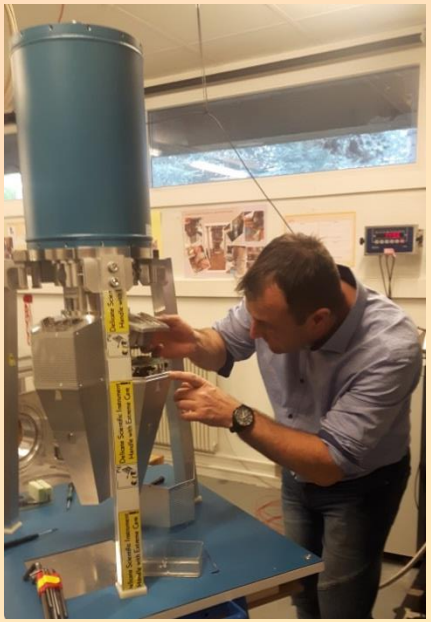
IPHC Detector Lab activity and scanning table upgrade

M-H. SIGWARD – B. DE CANDITIIS – G. DUCHENE – M. FILLIGER – F. DIDIERJEAN

IPHC detector Lab activity

- Training and working on triple cryostats
- CATs
- Scanning table upgrade before a complete scan of an AGATA capsule for Bart's thesis

Triple cryostat ATC14



ATC14 : IN2P3 cryostat

1 February 2019 : delivery @ IPHC

18-19 February : @ IPHC assembly and test
of the electronics thangs to the dummies

18- 20 March : @ IKP assembly of A015, B010 & C013
electrical tests and vacuum leak test

8-10 April : test in cold condition

17 April : repair at room temperature and dismounting of B010

May : B009 detector mounting, test and delivery at GANIL

Triple cryostat ATC14

Encountered problems while working on ATC14

Symptoms :

- Missing segments
- Very weak signals
- Oscillations
- Noisy segments
- Offsets increasing with HV

Due to :
- Soldering defaults on a 6FETs-card or on the ½ moon-card
- Broken HV resistor on a Core card
- Bad preamp card
- Leakage current on B010 (had to be replaced)

Some problems are detected at room temperature, but most of it in cold conditions, so it took several cooling /warming cycles to fix everything

Triple cryostat ATC1

ATC1 failed late last year

16-18 January : problems of Core and oscillations of capsules B and C are fixed

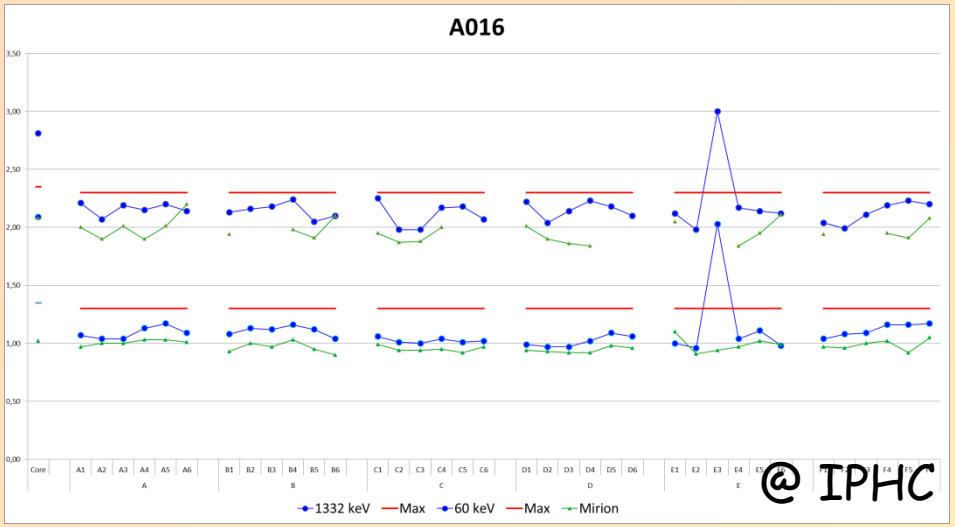
March : failed again

May : disassembly of the 3 capsules : all sent to Saclay to fix the HV problem

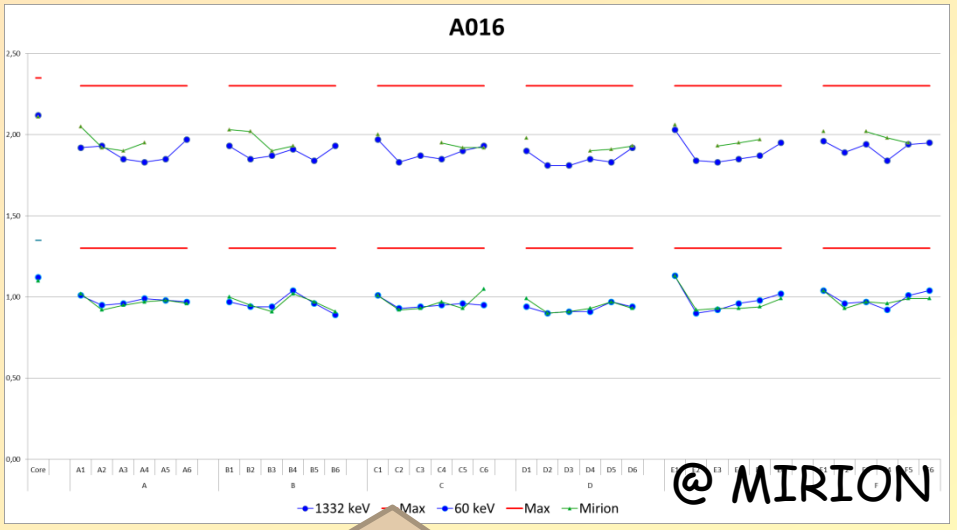
Cryostat refurbished by CTT

→ ATC1 ready to be transported at IPHC for assembly of 3 capsules
A016 already in Strasbourg and 2 being repaired at Mirion

A016 Acceptance Test



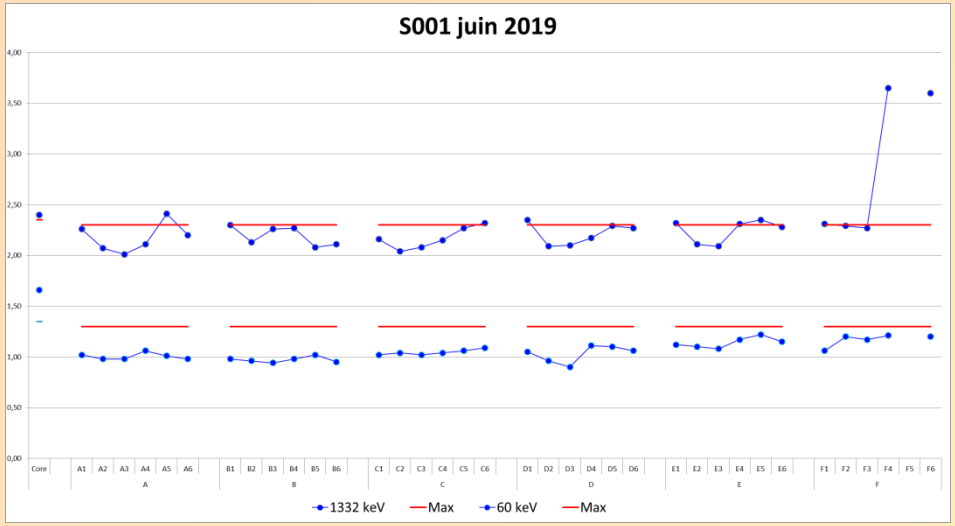
→ Leakage current on E3

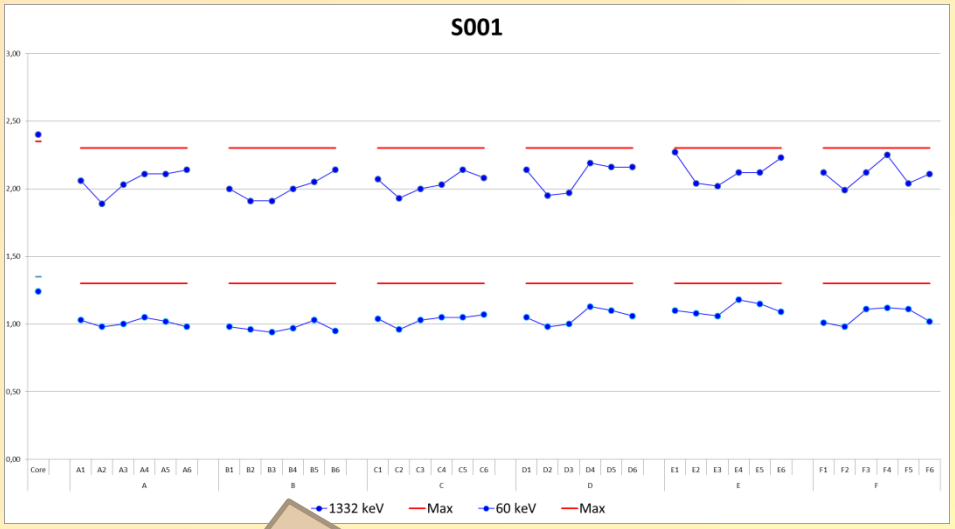


Repaired @ MIRION

→ very good resolutions

S001 Performance test before scanning





→ Very high count rate on F5

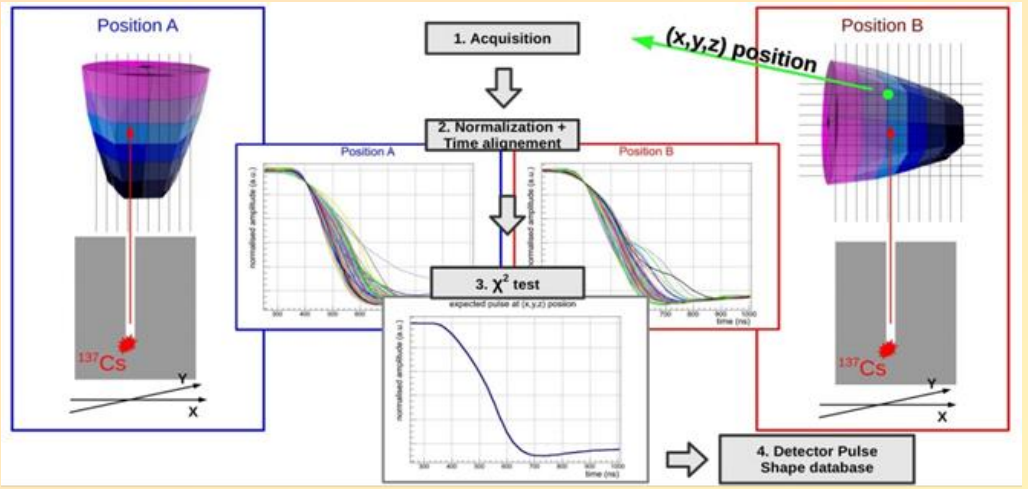
Feedback wire problem inside our test cryostat

→ Good performance but slightly too high Core resolution

Scanning Table upgrade

Principle of our scanning table

→ PSCS method

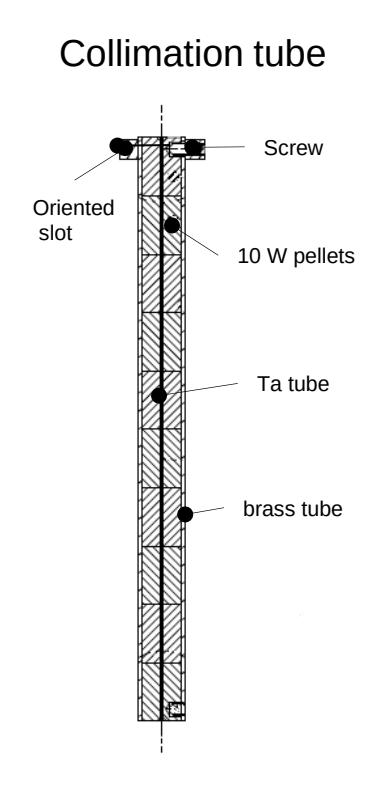


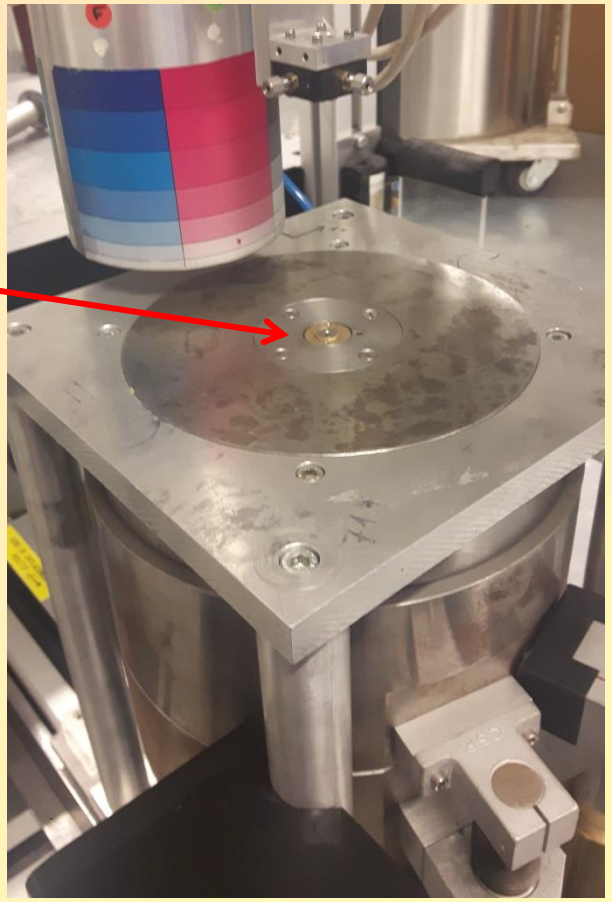
To be more precise at the crossing point it was necessary to:

- Decrease in collimation diameter
- Increase in the number of steps in the rotation of the detector
- Improve the LabView programs correlating acquisition, positioning of the source and cooling.

Scanning Table upgrade – 3 interchangeable collimators

Replacement of the fixed 1.5 mm diameter hole by removable collimation tubes of 1 mm, 0.5 mm and 0.2 mm

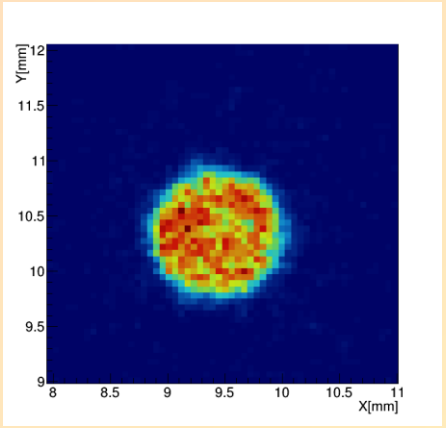




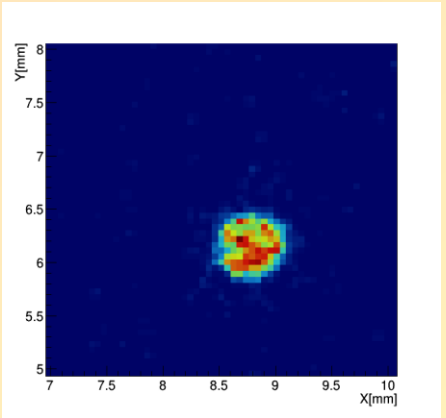
Scanning Table upgrade – 3 interchangeable collimators

Size verification and positioning repeatability in the W castle
for the 1mm and 0.5 mm collimators with a 50x50μm^2 FitPIX position detector*

1 mm



0.5 mm



Size	positioning repeatability
Ø 0.91 mm ± 0.002	15 μm
Ø 0.52 mm ± 0.020	49 μm

→ The values are in the expected specification

Shift of the 2 collimator centers : 155 μm

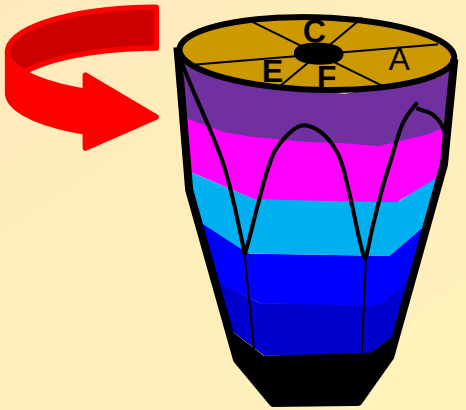
* Mirion detector

Scanning Table upgrade – adjustment frame

Modification of the rotation ring

- ✓ For the pre-adjustment of the EF segmentation axis parallel to Y axis
  → From a 90° to a 30° fix pitch rotation to pre-adjust

- ✓ for the fine adjustment
  → From +/- 10° to 20° continuous rotation



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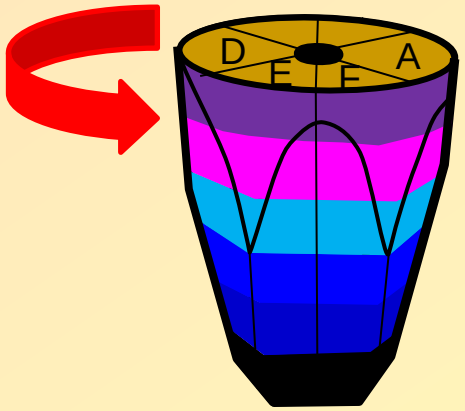
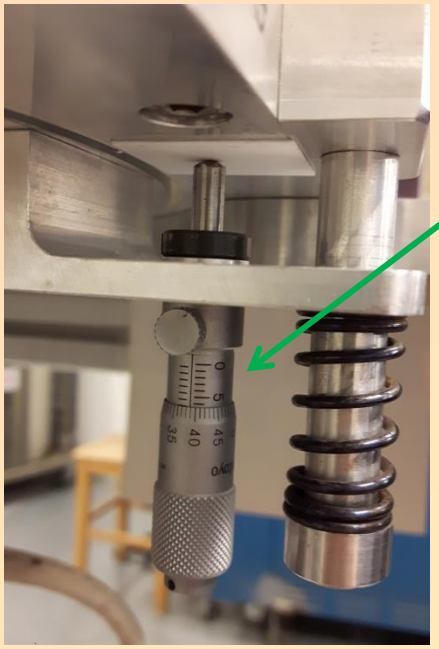


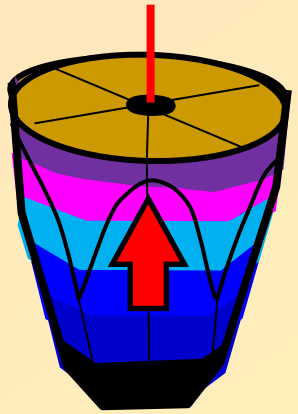
→ theoretical accuracy : 0.12°
S001 adjustment : 0.04°

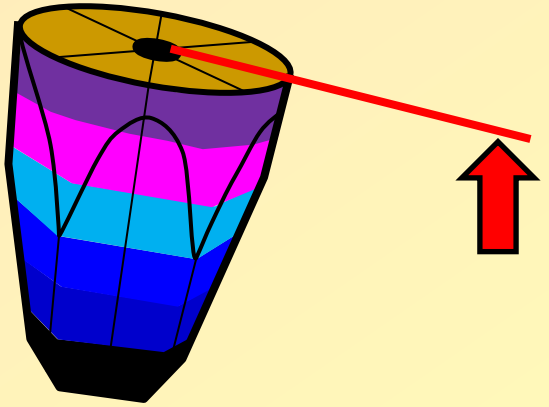
Scanning Table upgrade – adjustment frame



Micrometric screws

→ adjustment of the X & Y tilts parallel to the Z axis





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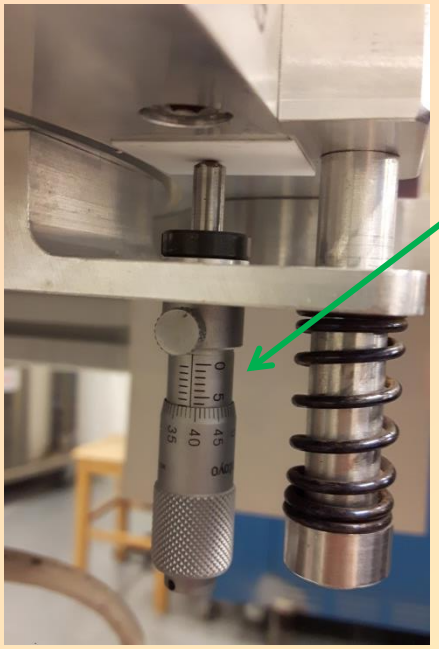

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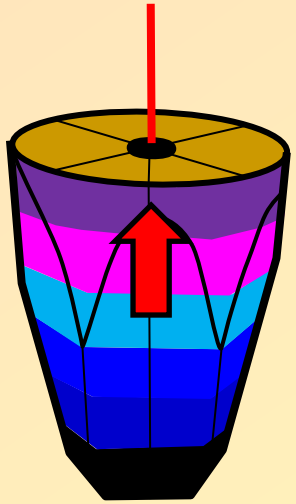
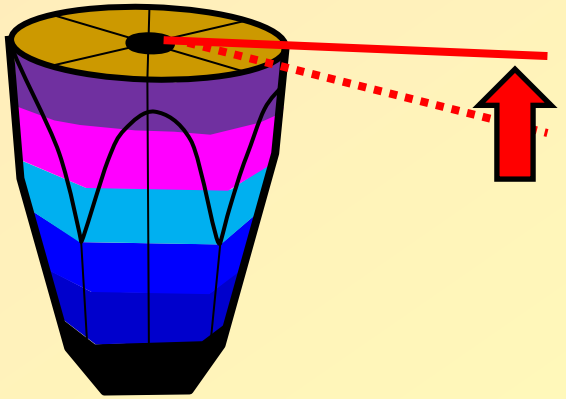
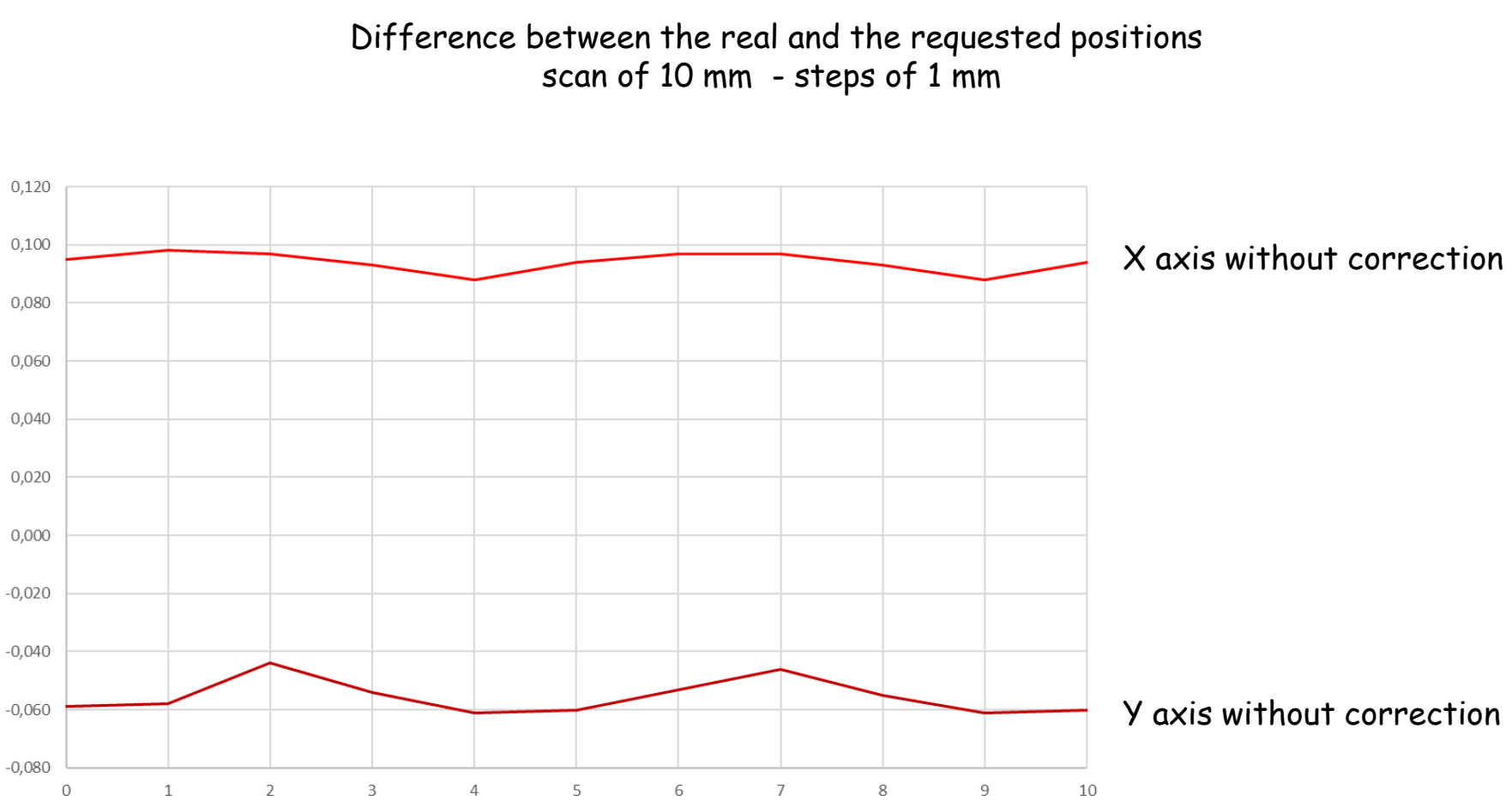




S001 adjustment on Y: 0.048° on X: 0.014°

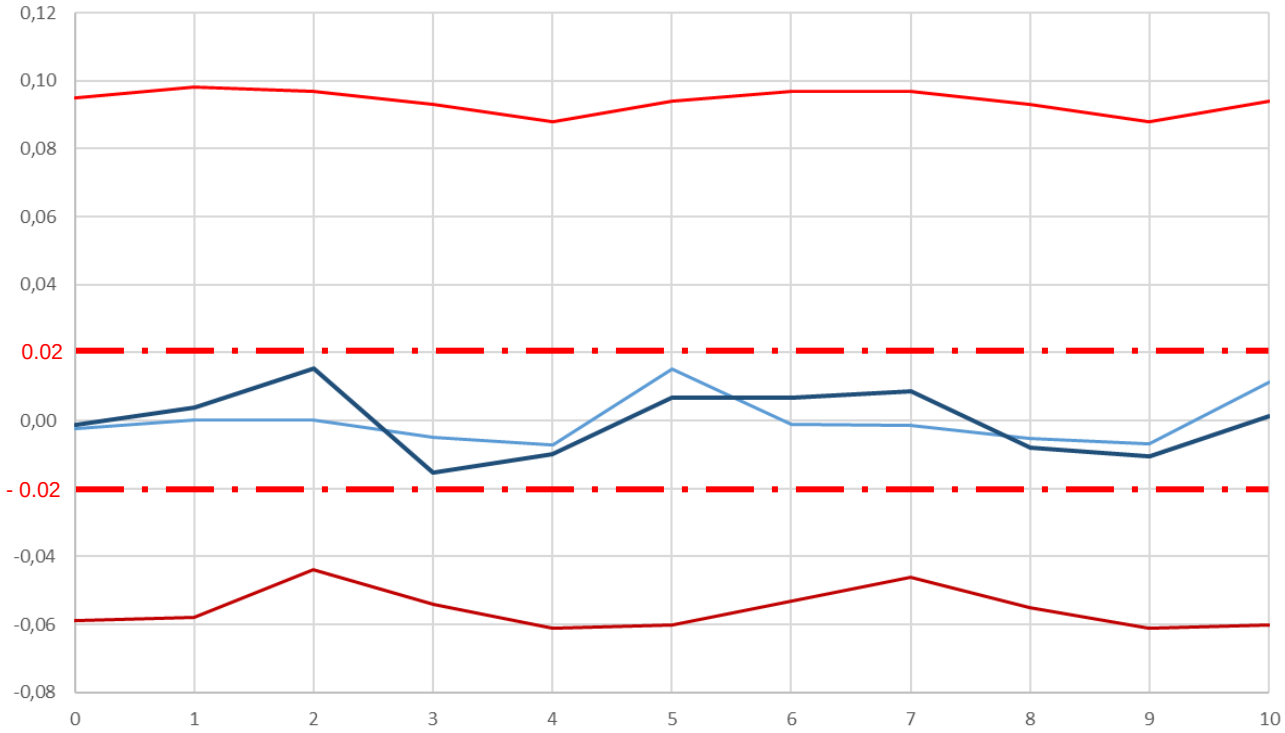
→ Less than 100μm between the front and the back of the detector

Scanning Table upgrade – scanning soft improvement



Scanning Table upgrade – scanning soft improvement

Difference between the real and the requested positions
scan of 10 mm - steps of 1 mm



X axis without correction

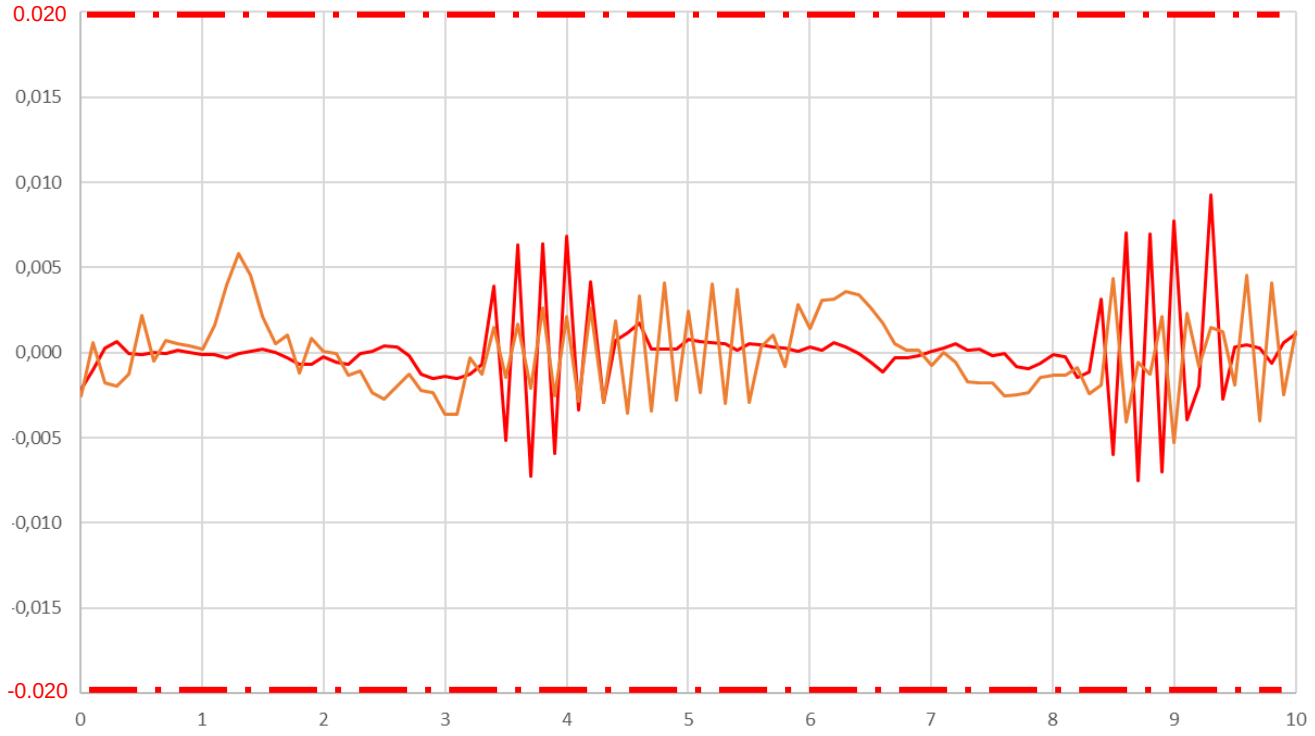
X axis
Y axis

with a correction of 20µm

Y axis without correction

Scanning Table upgrade – scanning soft improvement

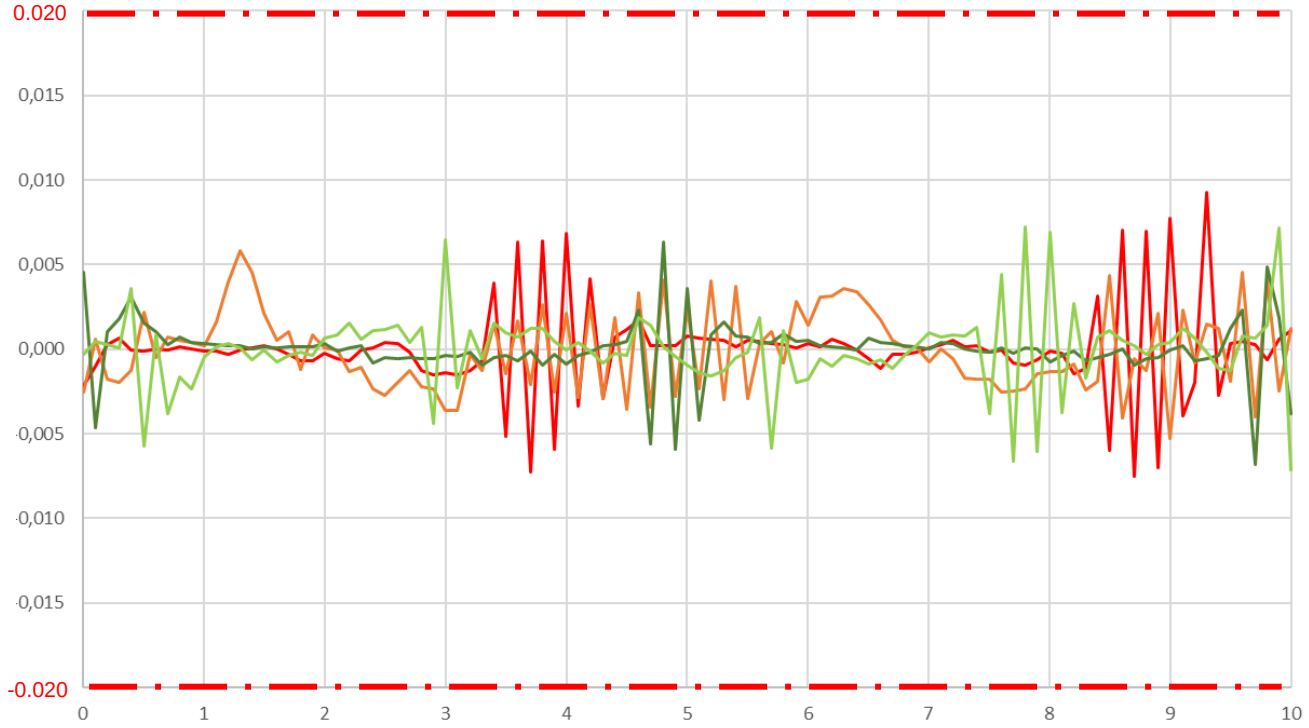
Difference between the real and the requested positions
with a correction of 20µm
steps of 0.1 mm X axis (red) - Y axis (orange)



The accuracy is much
better than 20µm

Scanning Table upgrade – scanning soft improvement

Difference between the real and the requested positions
with a correction of 20µm
steps of 0.1 mm X axis (red and green) Y axis (orange and light green)



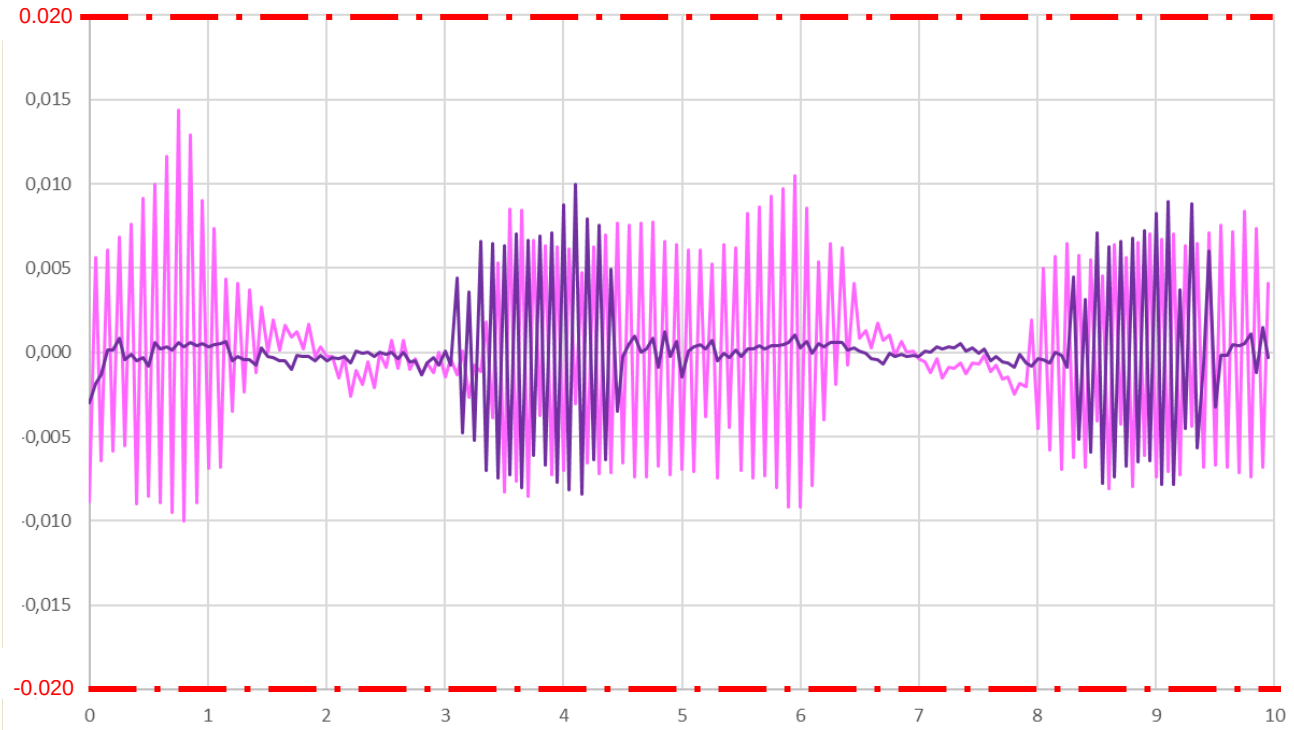
The accuracy is much better than 20µm

The scans were performed in both directions

→ The irregularities are not related to the optical scales

Scanning Table upgrade – scanning soft improvement

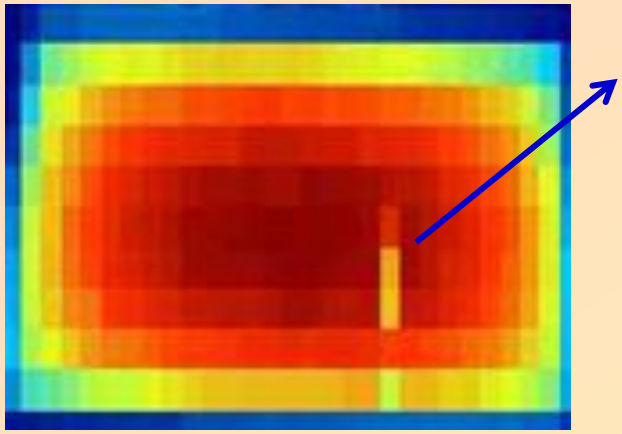
Difference between the real and the requested positions
with a correction of 20µm
steps of 0.05 mm X axis (purple) - Y axis (pink)



More irregularities but

accuracy largely satisfactory

Scanning Table upgrade – autofill soft improvement



Disturbance during the bubbling time of filling

→ No acquisition during a filling and the following 10'

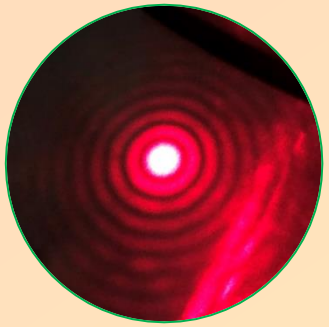
But the data taking for one position cannot be interrupt

Collimator Ø	Source	Acquisition time	
1.5 mm	Cs 0.6 GBq	1 to 3 mn	Filling delayed
1 mm	Cs 1.85 GBq	3 to 6 mn	Acquisition delayed
0.5 mm	Cs 1.85 GBq	30 to 60 mn	Acquisition delayed

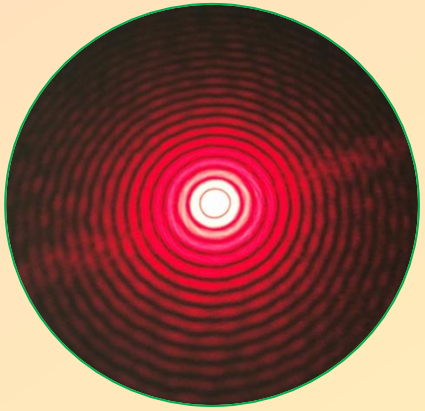
→ Scans of several days with long acquisition times are possible without disturbance

Currently a scan of 270 points of 1 hour is running for 12 days in total autonomy

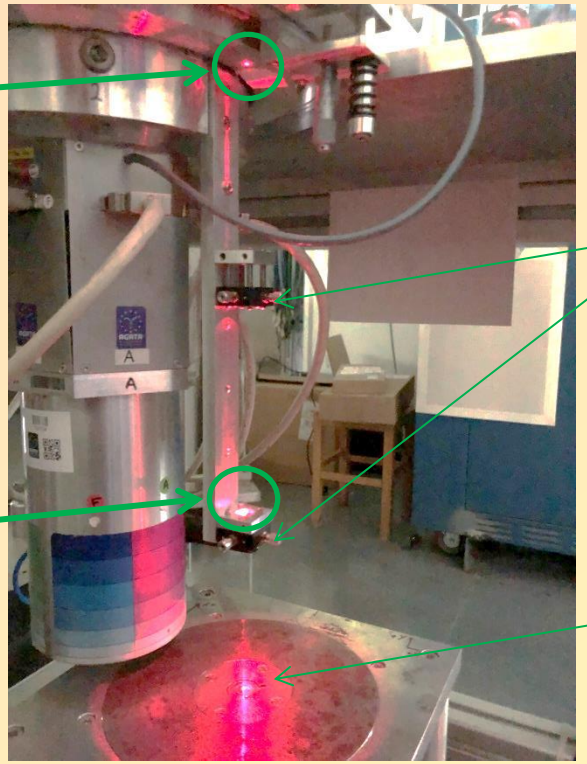
Scanning Table upgrade – Laser realignment



Airy spot behind the hole of 50μm



Airy spot behind the hole of 200μm



Target holes of 200μm and 50μm attached on the detector to represent the position of the capsule

Laser beam passing through the collimator and the holes

→ Transition from vertical to horizontal position while insuring a crossing point precision of 300μm

Conclusion

Next steps

- Assembling ATC1 autonomously

- Completing the scanning of S001 capsule with high precision

- Performing scans of other detectors.

Thank you for your attention!

Scanning Table upgrade – scanning soft upgrade