

Status on C016 scans and alignment precision with the IPHC scanning table

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with the IPHC AGATA group
with help of Gala Gonzalez Briz (Salamanca)

Introduction

□ Gala's talk

- B003 tomography study and prospects (see her talk just before mine)
- B003 pulse-shape database with a 1 mm pitch (see her talk just before mine)

□ Present talk

- Preliminary results of C016 ongoing scans
- Last upgrade and crossing precision

C016 scans

C016 scans

History and plans

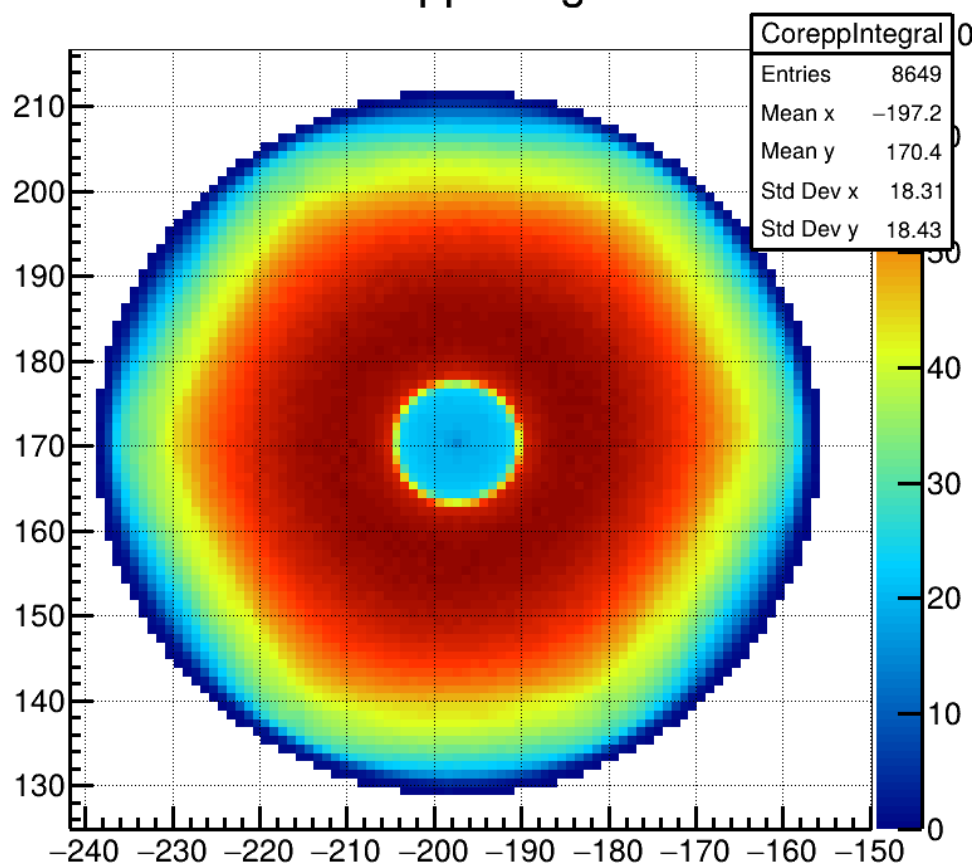
- Upgrades
 - ❖ Stabilisation plate of the collimator
 - ❖ Angular calliper with 2.5' steps
- Stabilisation plate induces problems
 - ❖ Vertical scan already done to be deleted
- New vertical scan with 1 mm pitch performed after removal of the stabilisation plate (in July)
- Full alignment of the laser and the optical module in vertical position
- Laser and C016 alignments in horizontal position
- Horizontal scan with 1 mm pitch (in August – beginning Sept)
- Tomography to be done before end 2026

C016 vertical scan – Preliminary results

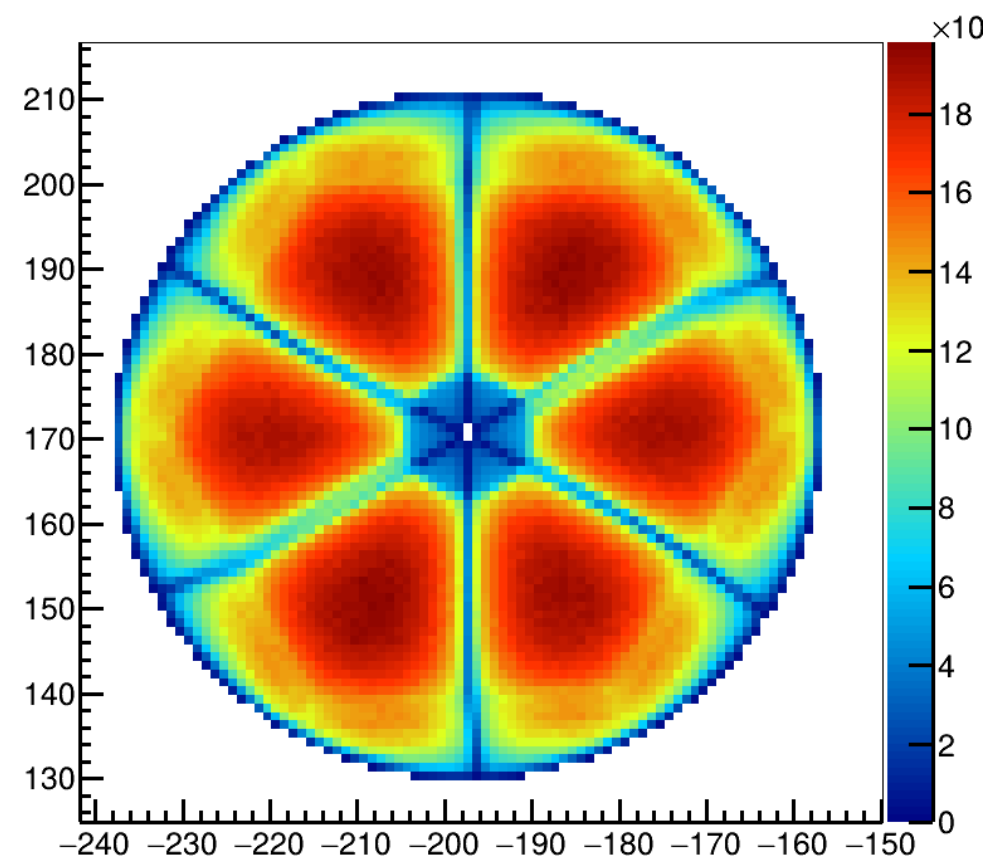
Vertical scan – full surface – Mixte mode

- ^{137}Cs source (1.85 GBq)
- 1 mm step, 5417 points, 240 sec/pts
- Total duration ~ 15 d

Core pp Integral



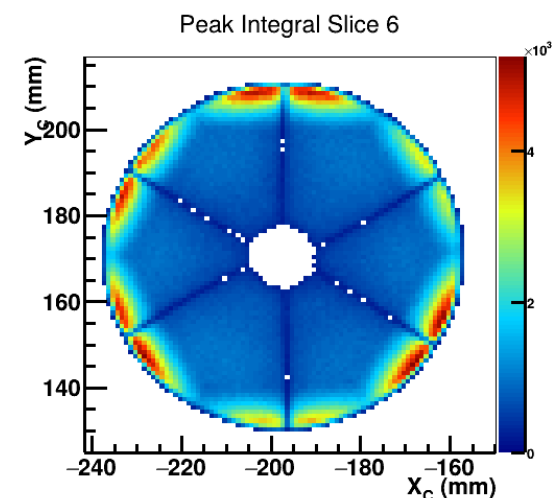
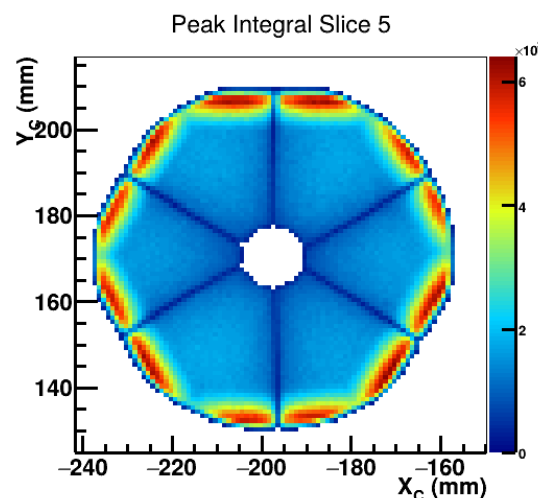
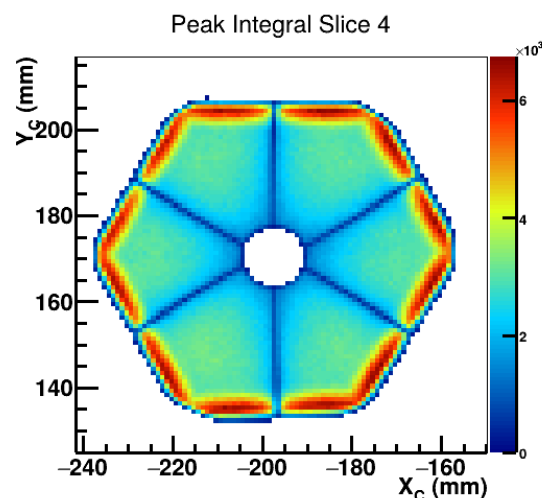
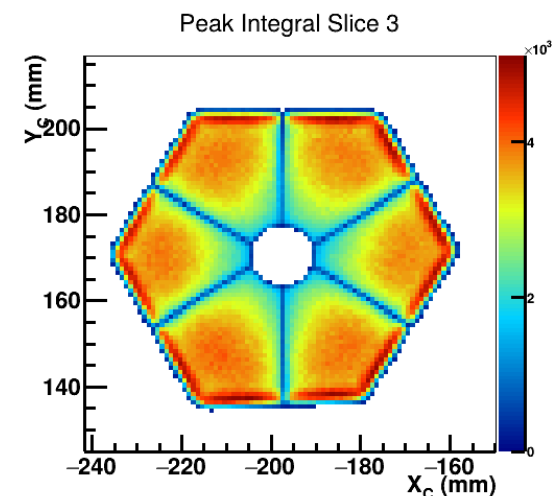
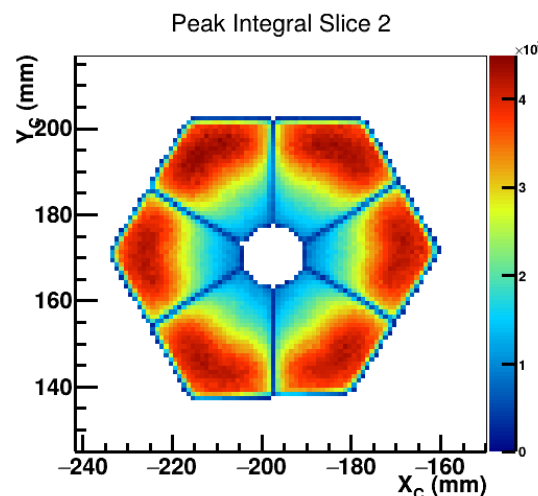
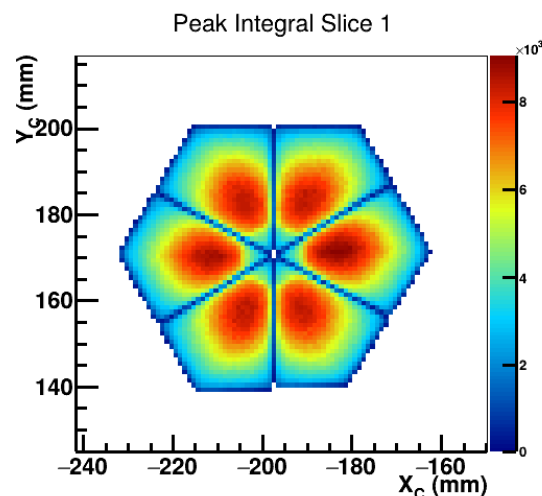
Peak Integral (Sum of all slices without core)



C016 vertical scan – Preliminary results

Vertical scan – full surface – Mixte mode

- ^{137}Cs source (1.85 GBq)
- 1 mm step, 5417 points, 240 sec/pts
- Total duration ~ 15 d

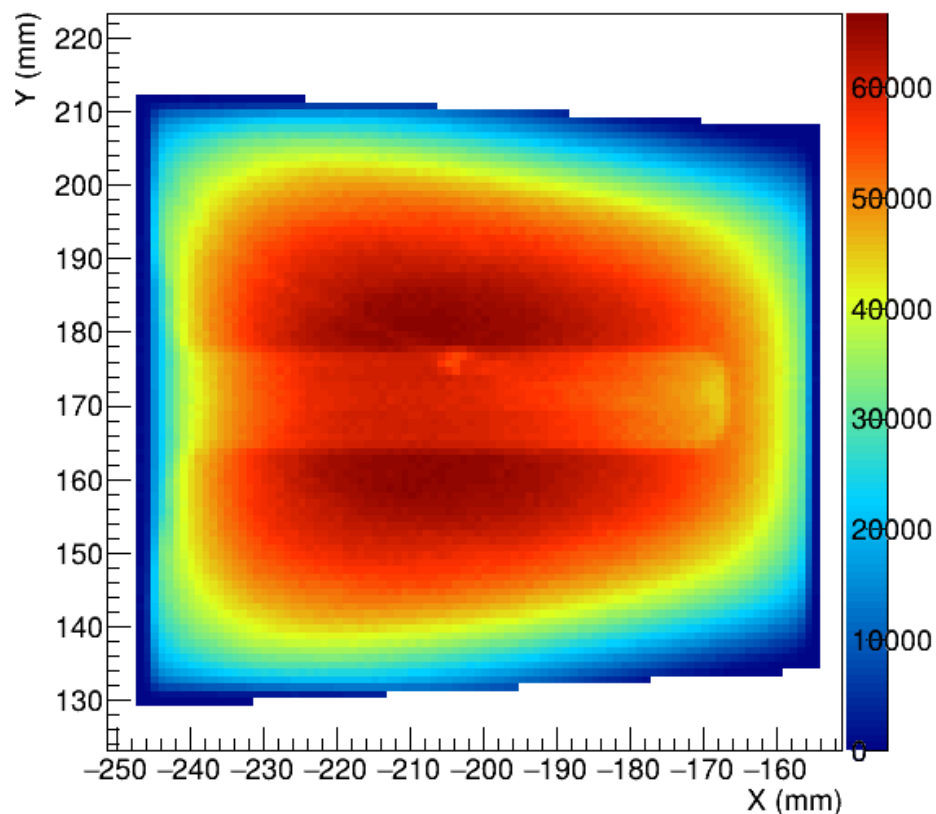


C016 horizontal scan – Preliminary results

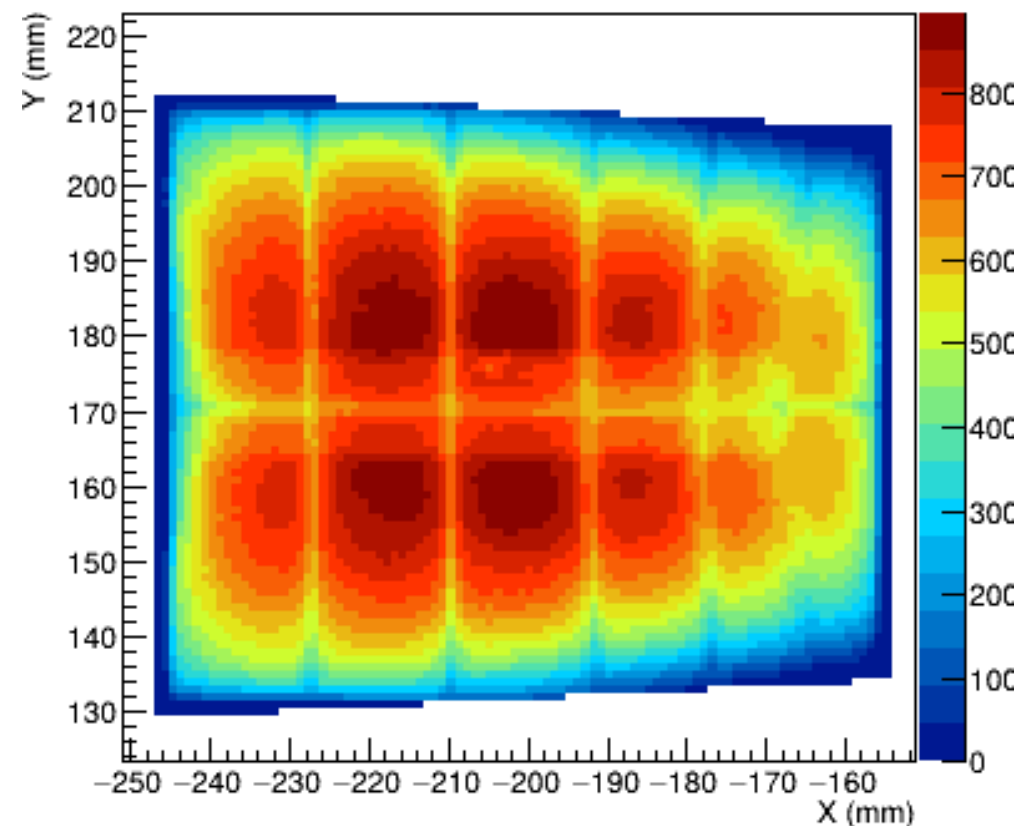
Horizontal scan – full surface – Mixte mode

- ^{137}Cs source (1.85 GBq)
- 1 mm step, 7342 points, 240 sec/pts
- Total duration ~ 22 d

pp_integral



all efficiencies



C016 tomography

❑ Based on Gala's work

- New tomography process
 - ❖ Steps of 15 deg (24 projections)
 - ❖ Pitch of 1.5 mm (~4200 pts)
 - ❖ 40 sec/pt

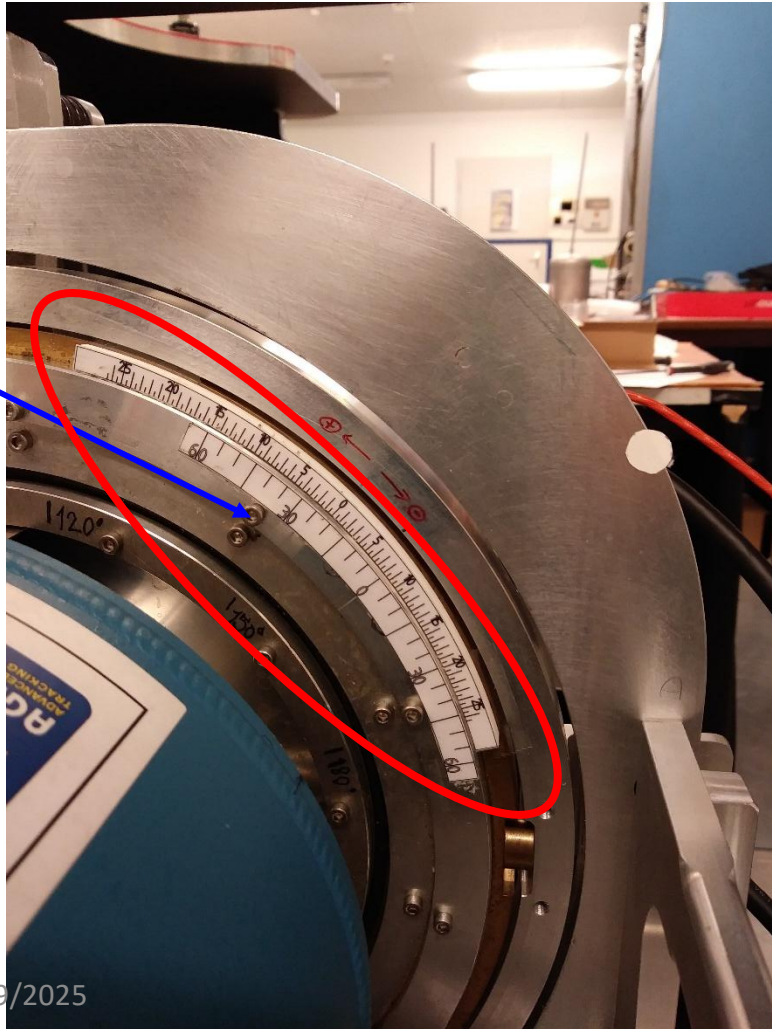
Total duration of 2 months with much better spatial resolution vs previous tomographies (3 months for 30° step/12 projections only, 1mm pitch and 67 sec/pts)

Last upgrade

IPHC scanning-table upgrades

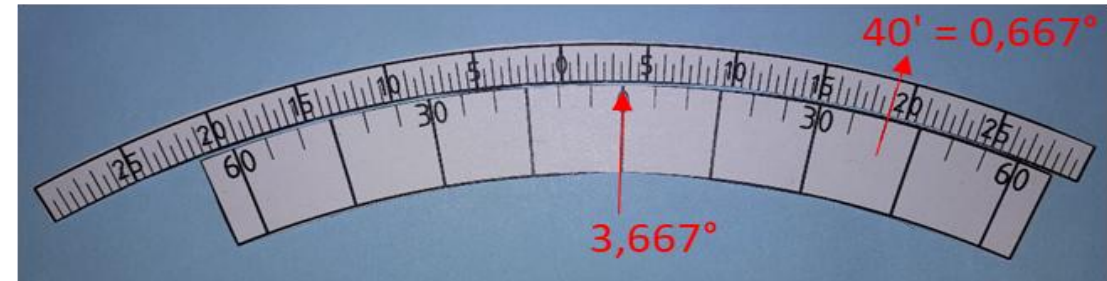
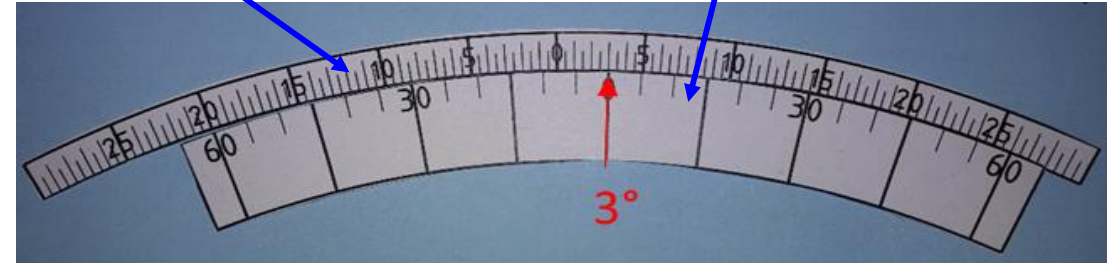
Angular calliper with 5' steps (2025 AGATA week)

Angular calliper
for fine and
precise
continuous
rotation



degrees

minutes

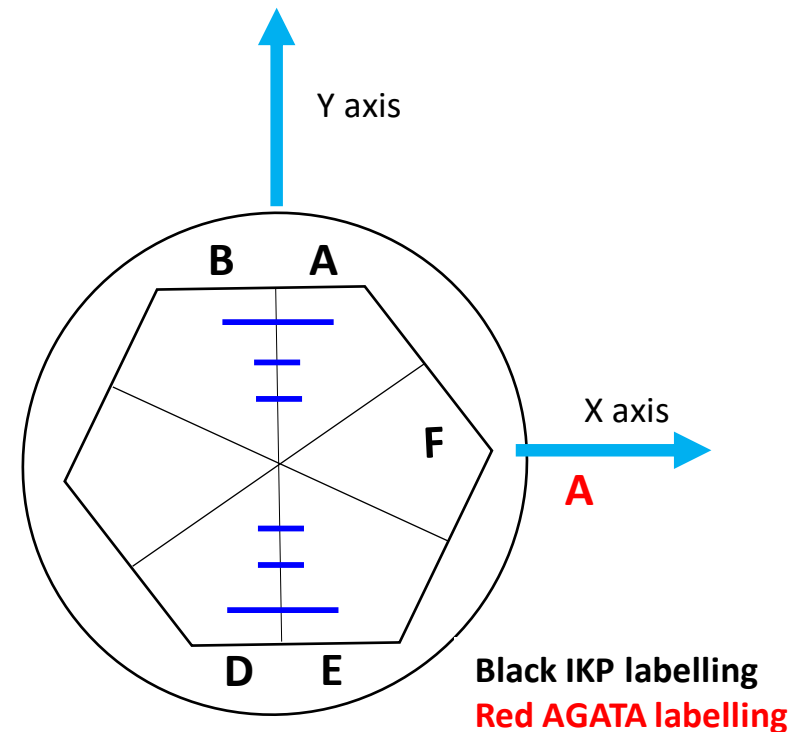
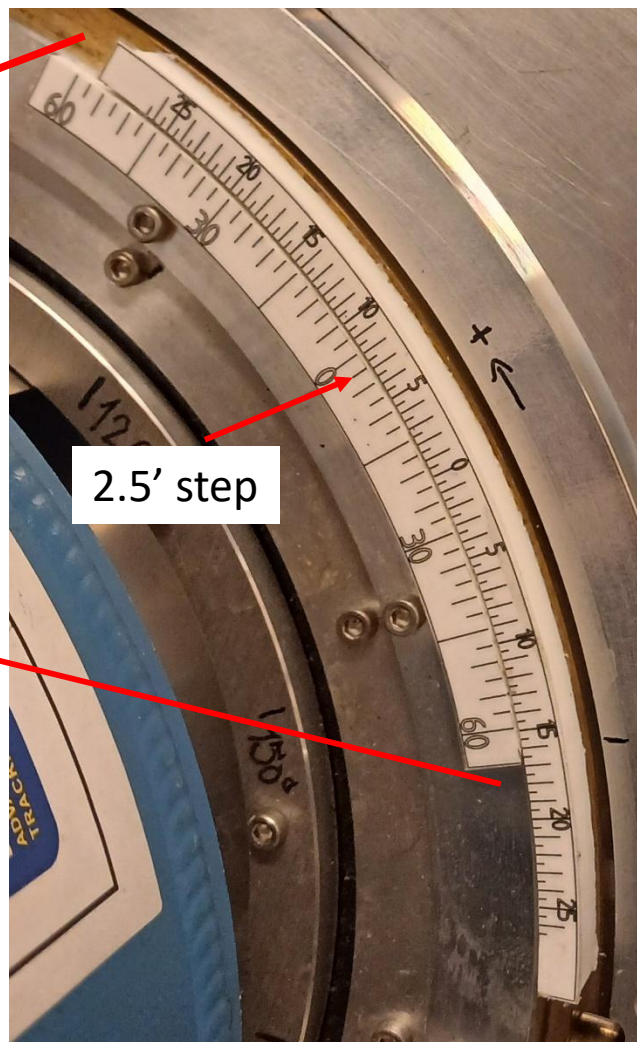
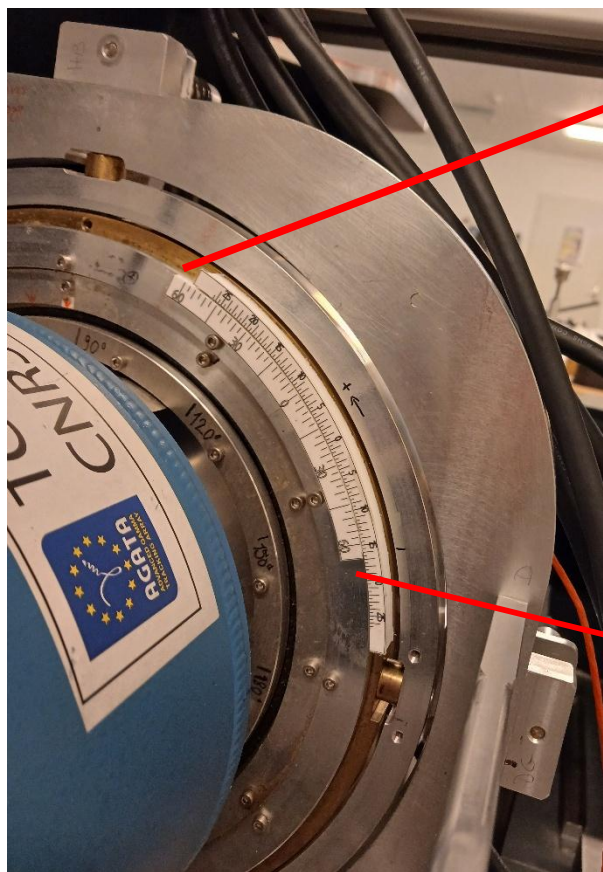


60	1°
55	0,917°
50	0,833°
45	0,750°
40	0,667°
35	0,583°
30	0,500°
25	0,417°
20	0,333°
15	0,250°
10	0,167°
5	0,083°

Will be improved with 2.5' steps -> 40 m°

Alignment on Y axis of BA-DE seg line

❑ Angular calliper with 2.5' steps



Aligned on Y axis at **0.010 deg +/- 0.029 deg**

NB: at best 0.130 deg before

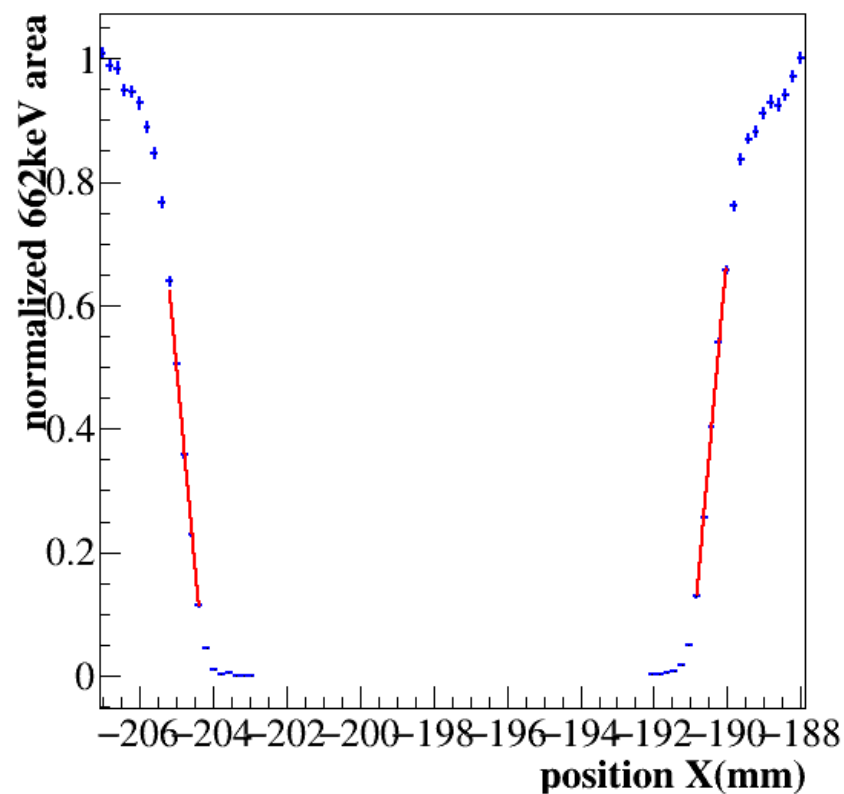
Crossing precision

V/H crossing precision

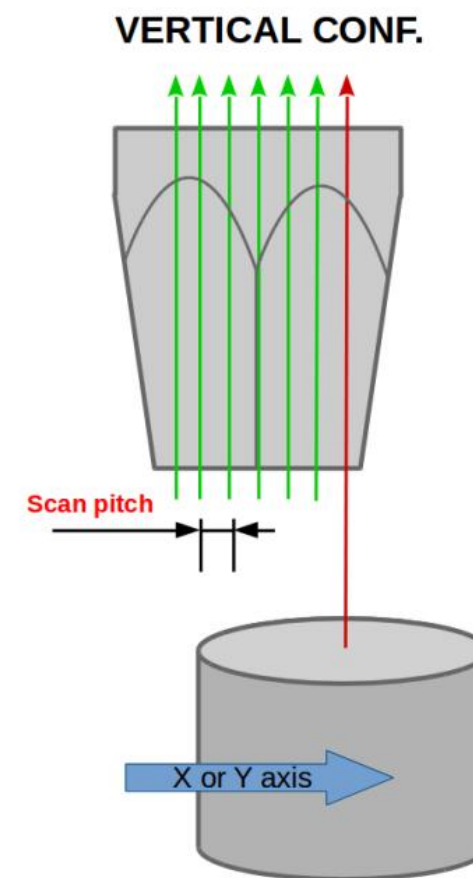
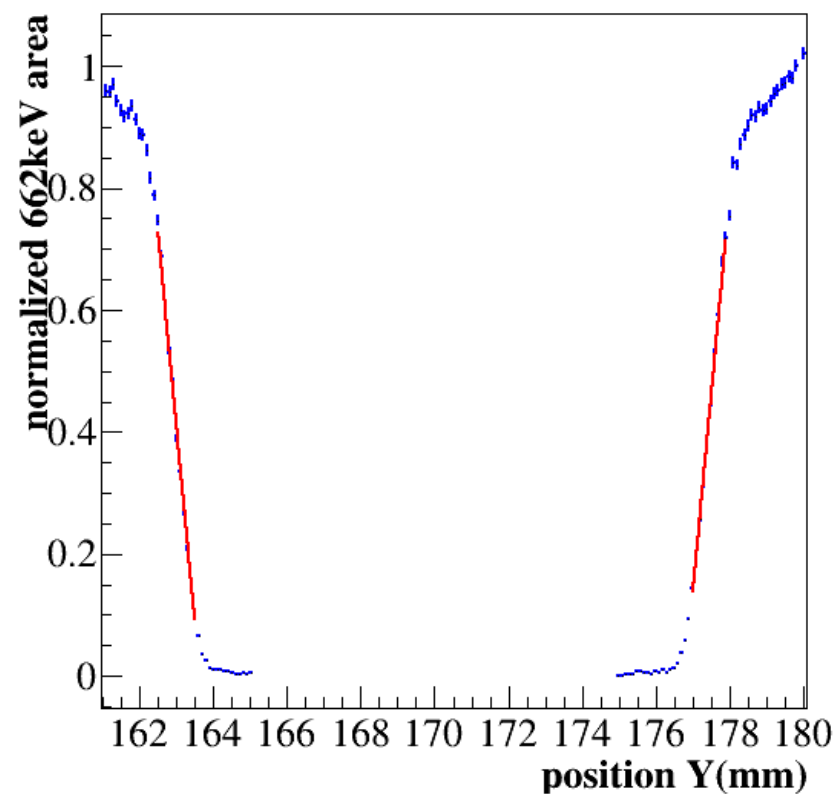
- ^{137}Cs source (1.85 GBq)
- 100 μm pitch, 600 sec/pt

□ **Vertical scan** across the bored hole

slice3_alongX



slice3_alongY

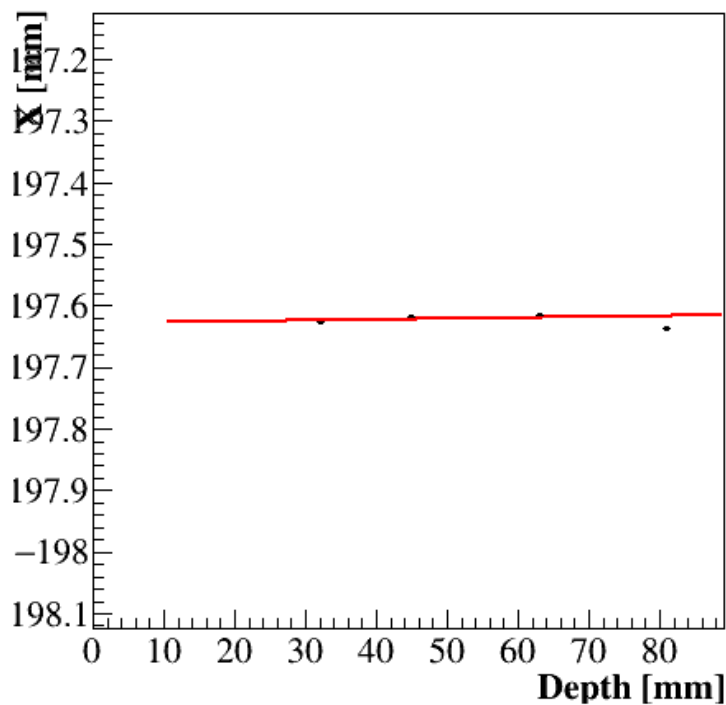


V/H crossing precision

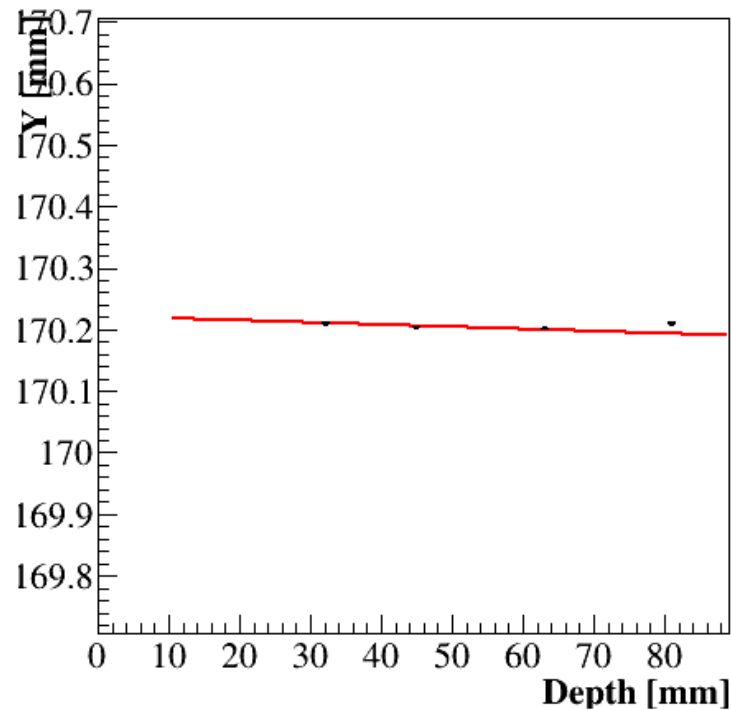
Vertical scan across the bored hole

- ^{137}Cs source (1.85 GBq)
- 100 μm pitch, 600 sec/pt

Center X vs. cristal depth



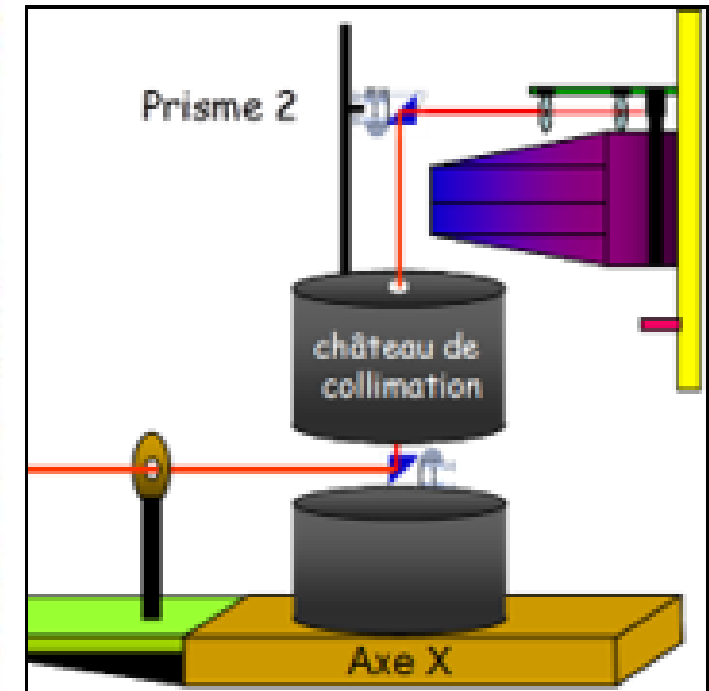
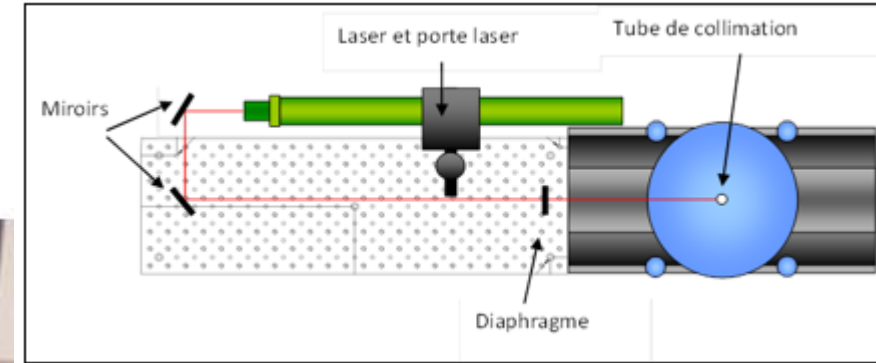
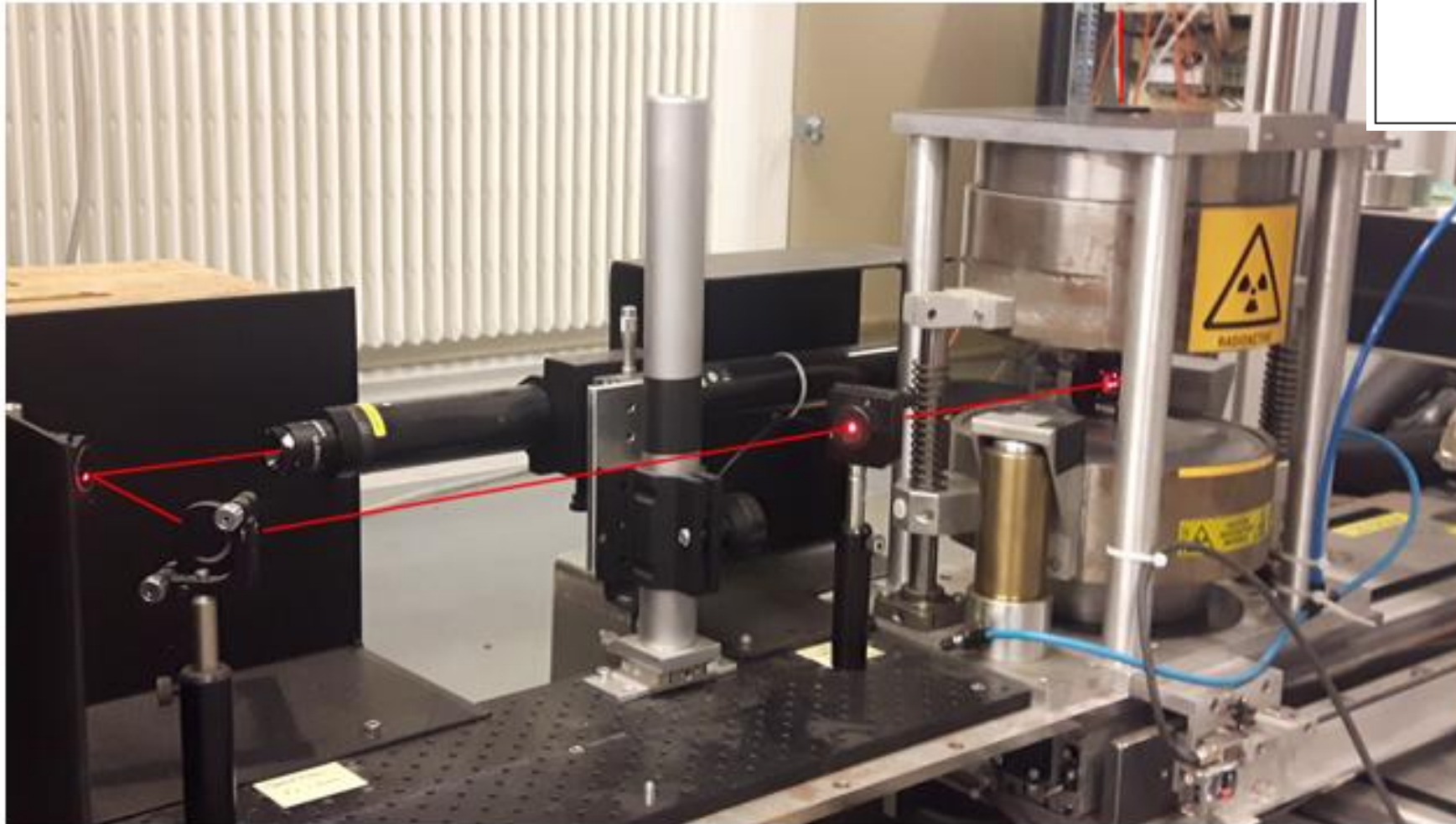
Center Y vs. cristal depth



Scans across slices 3-6 simultaneously

Ultimate alignment: **+/- 0.015 deg**

Laser path



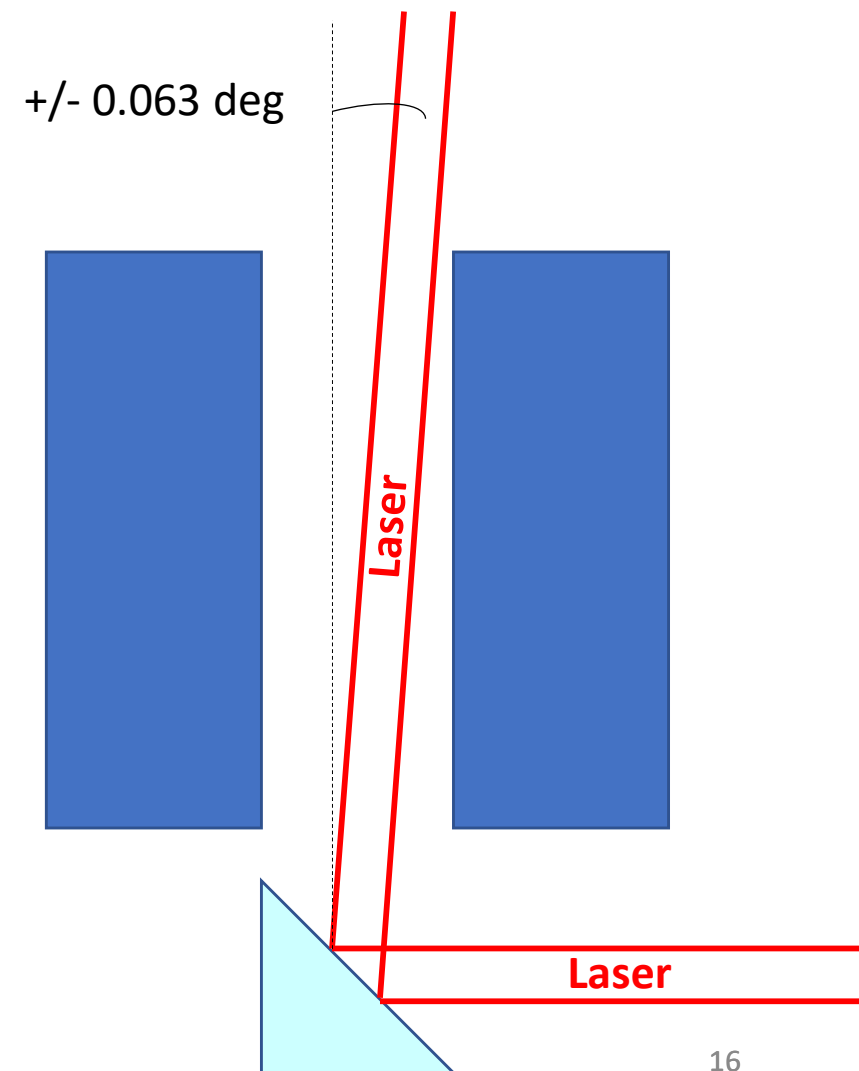
V/H crossing precision

❑ Laser and optical module alignments

❑ Optical module in **vertical position**

➤ Laser passes through the collimator

- ❖ +/- 180 μm along 165 mm which leads to
+/- 0.063 deg

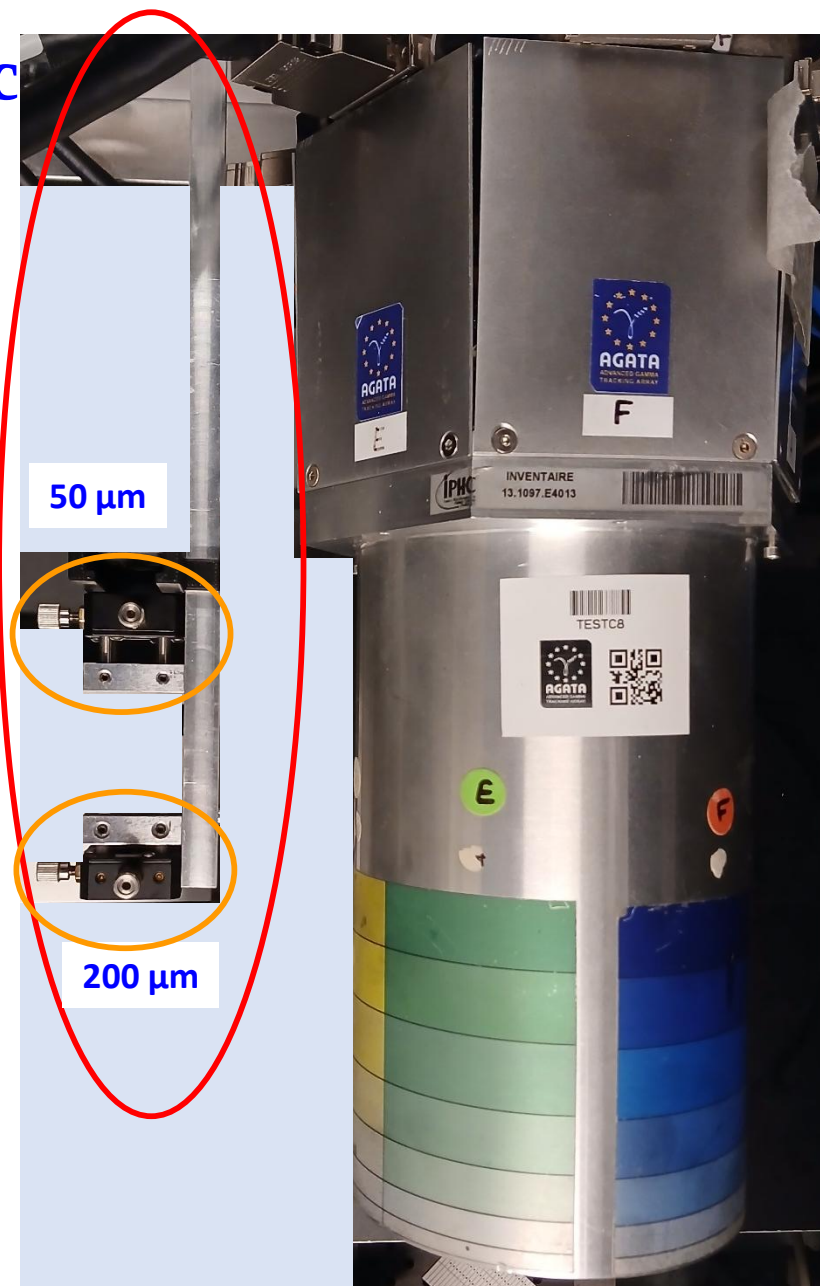


V/H crossing prec

❑ Laser and optical module alignments

❑ Optical module in **vertical position**

- Laser passes through the collimator
 - ❖ $\pm 180 \mu\text{m}$ along 165 mm which leads to $\pm 0.063 \text{ deg}$
- Optical module adjustment
 - ❖ $\pm 15 \mu\text{m}$ along 73 mm which leads to $\pm 0.012 \text{ deg}$

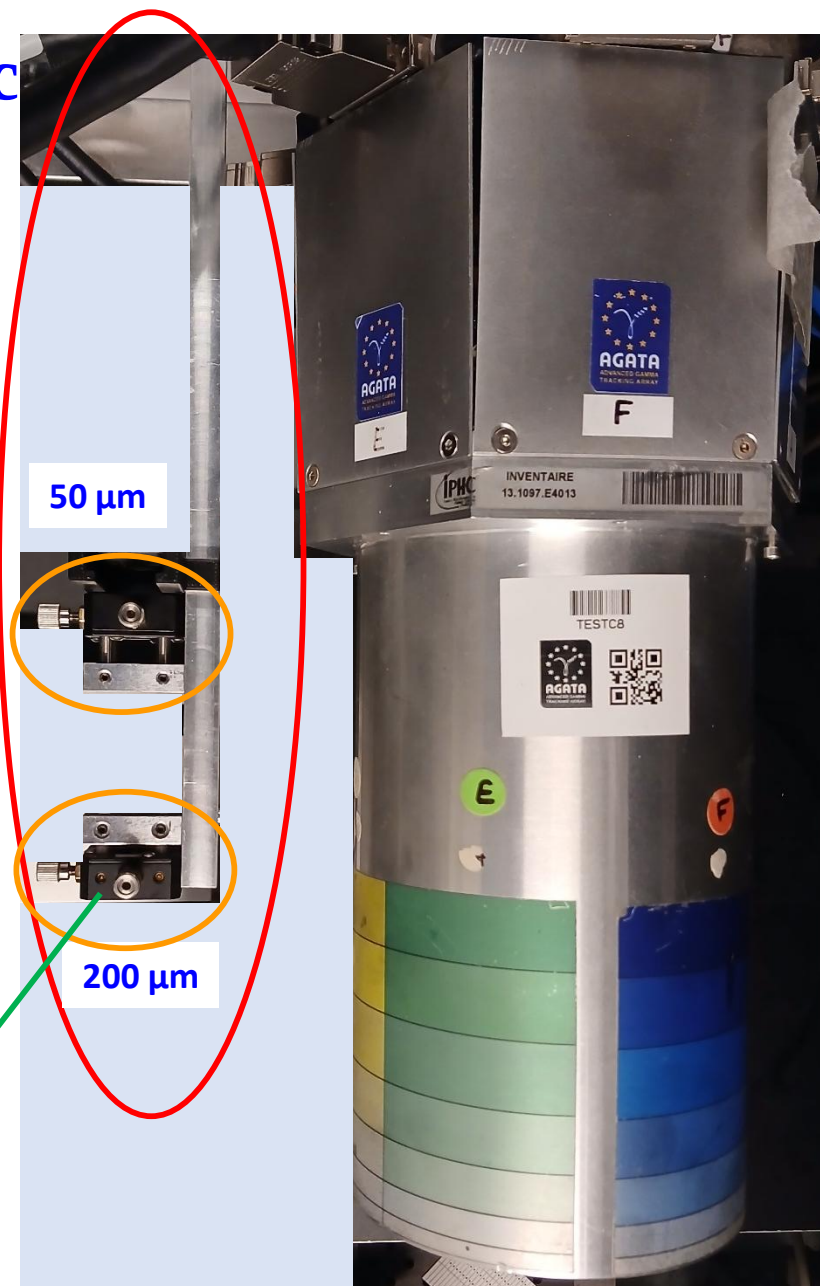
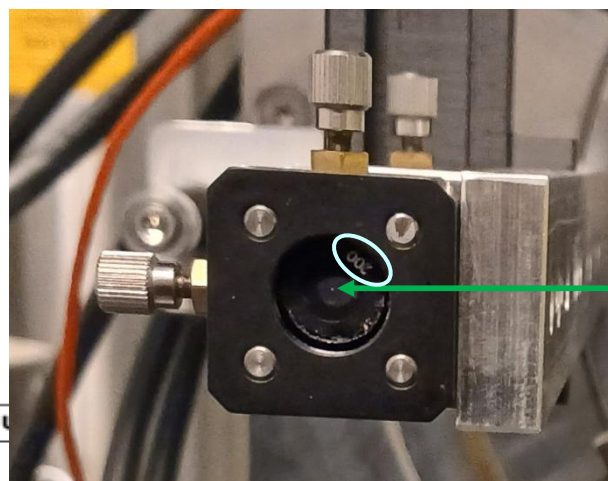


V/H crossing prec

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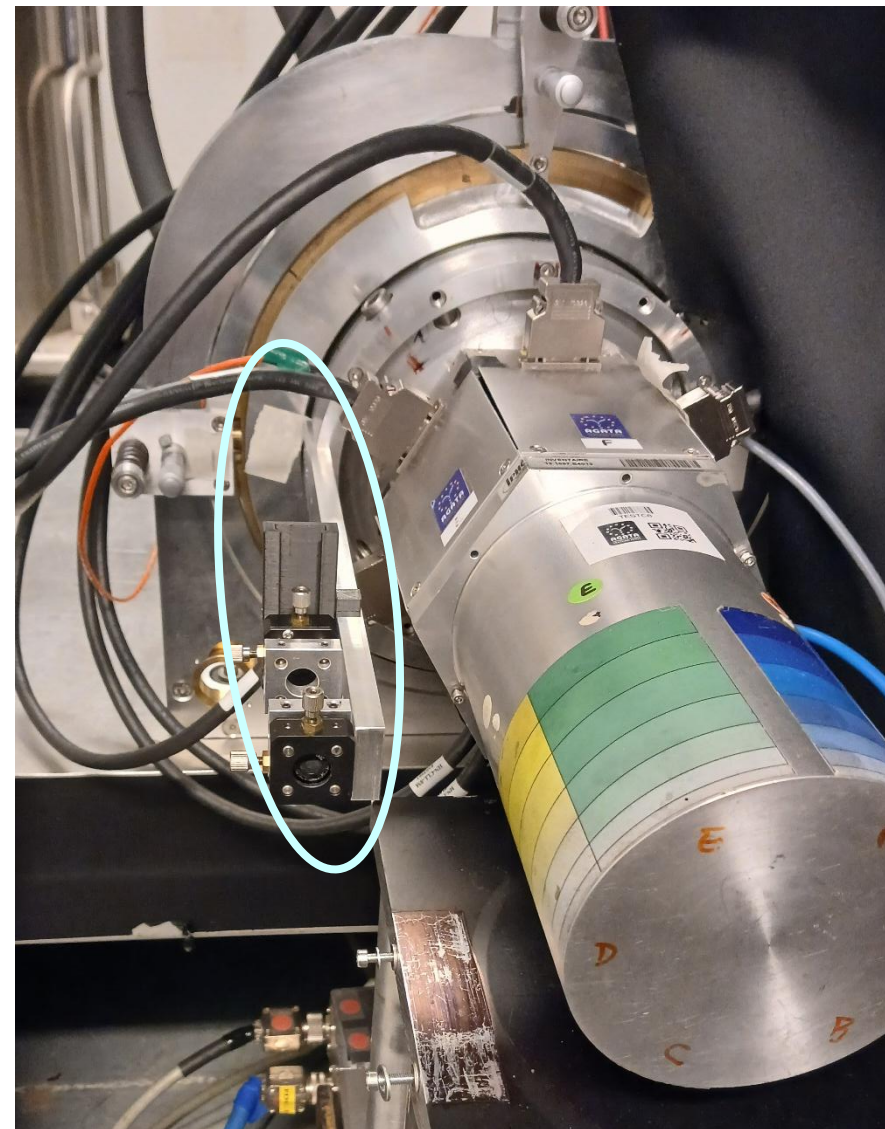


V/H crossing precision

❑ Laser and optical module alignments

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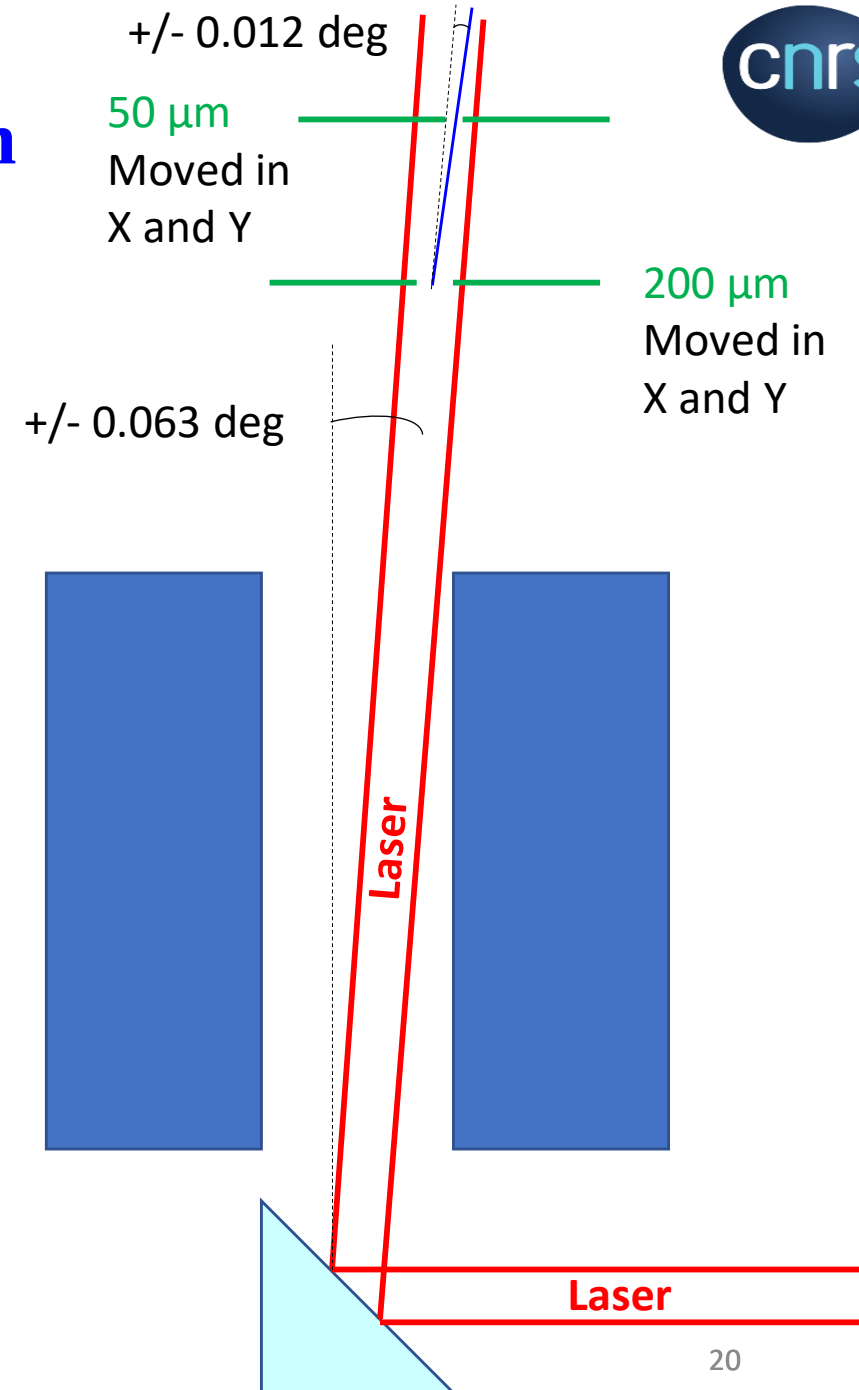


V/H crossing precision

❑ Laser and optical module alignments

❑ Optical module in **vertical position**

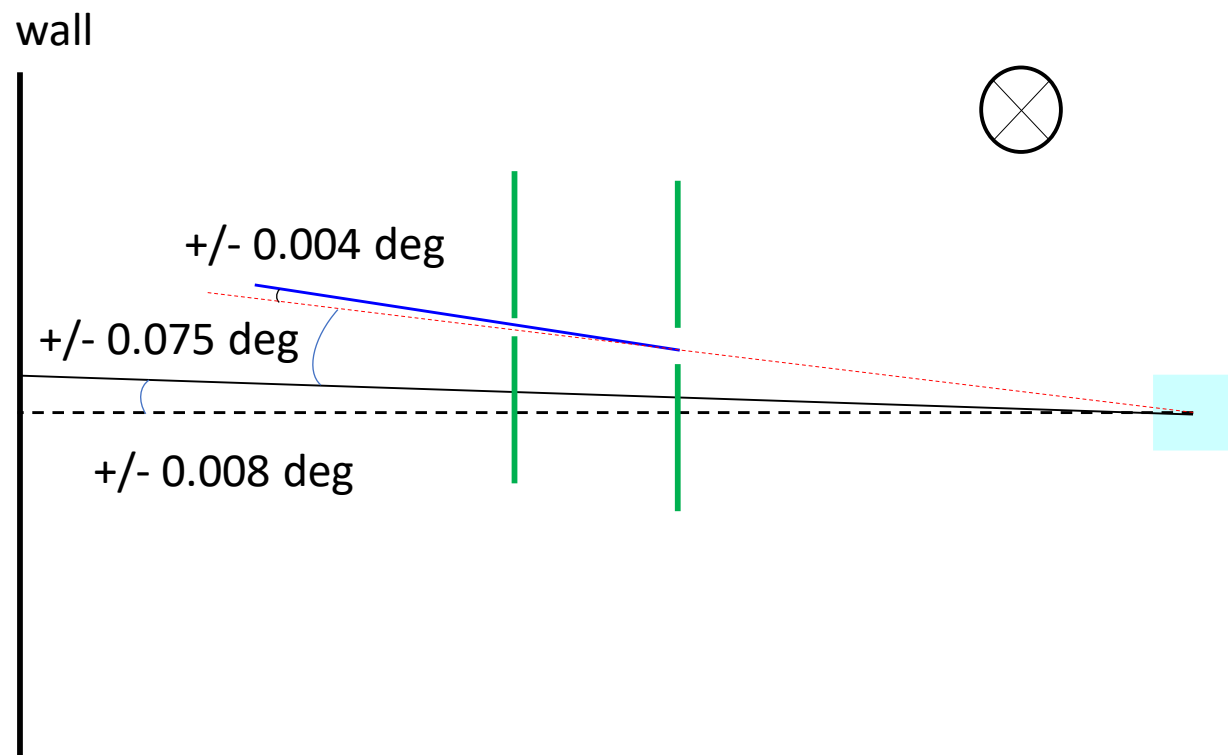
- Laser passes through the collimator
 - ❖ $\pm 180 \mu\text{m}$ along 165 mm which leads to $\pm 0.063 \text{ deg}$
- Optical module adjustment
 - ❖ $\pm 15 \mu\text{m}$ along 73 mm which leads to $\pm 0.012 \text{ deg}$
- Total uncertainty on the optical module adjustment
 - ❖ Small angles so: $\sum \text{tg}(\alpha_i) = \text{tg}(\sum \alpha_i)$
 - ❖ **Optical module tilt = $\pm 0.075 \text{ deg}$**



V/H crossing precision

❑ Laser and optical module alignments

❑ Horizontal position



➤ Laser alignment on the wall

- ❖ ± 0.5 mm along 3560 mm which leads to $\pm 0.008^\circ$

➤ Alignment in the optical module

- ❖ ± 15 μ m along 240 mm which leads to $\pm 0.004^\circ$

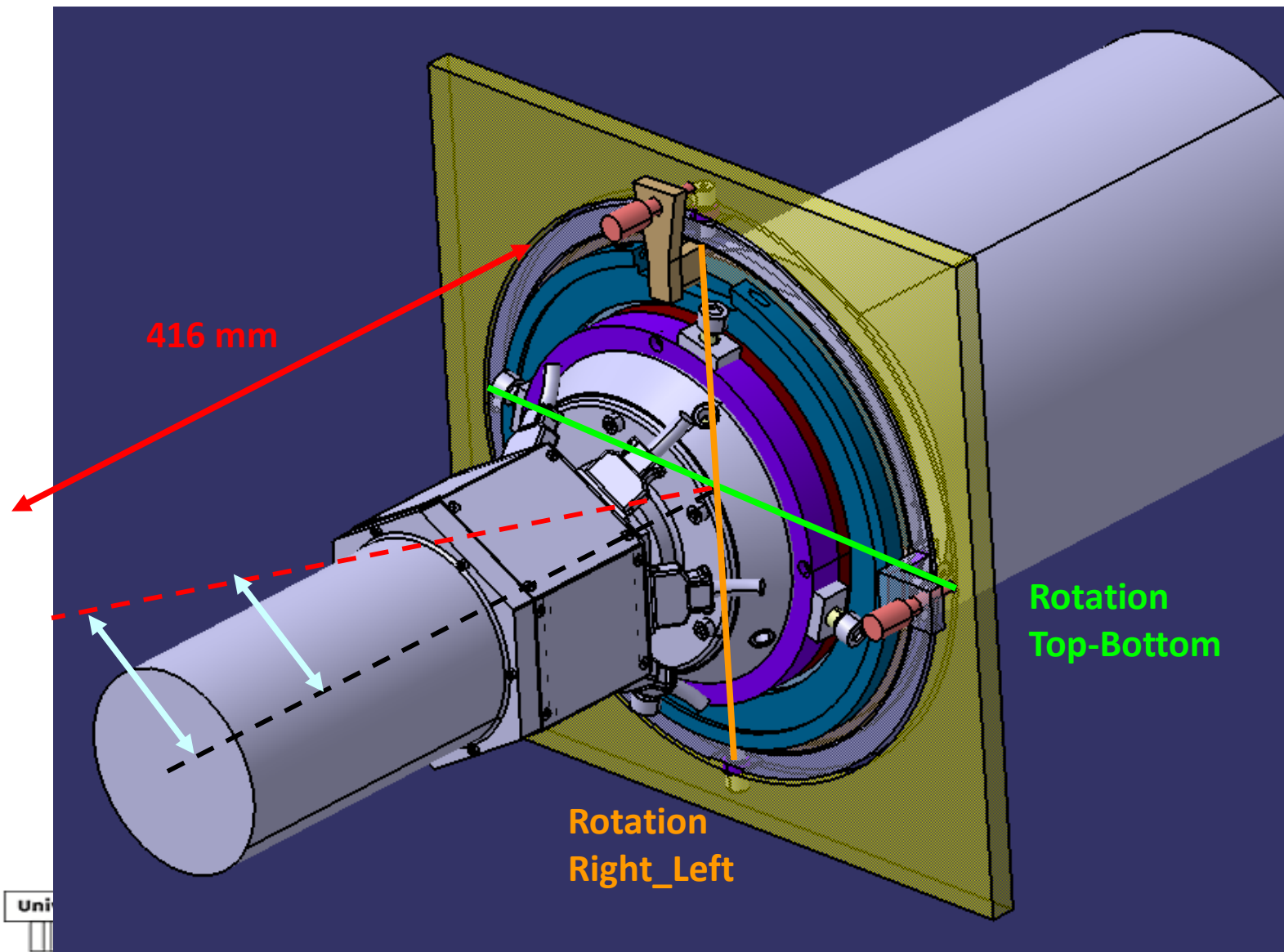
➤ Optical module misalignment

- ❖ $\pm 0.075^\circ$

➤ Total uncertainty in horizontal position

- ❖ **$\pm 0.087^\circ$**

V/H crossing precision



V/H crossing precision

□ Crossing precision

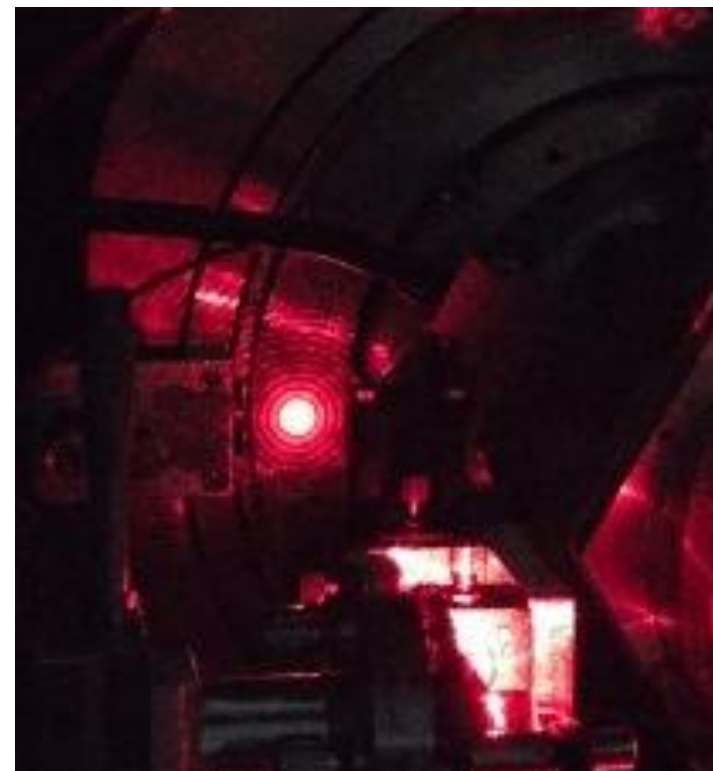
- In the worst case, the shifts cumulate leading to a global shift of **+/- 751(580) μm**

□ Vertical shift

- +/- 0.015 deg along 416(326) mm corresponds to a Ge front(back) shift of +/- **109(85) μm** in the XY plane

□ Horizontal shift

- +/- 0.087 deg which corresponds to a Ge front(back) shift of +/- **632(495) μm** in the YZ plane



Perspectives

❑ Further upgrades

- Angular calliper with 2.5' steps **DONE**
- Stabilisation plate **To be decided**
- Laser alignment in the collimator to be improved **NEW**

❑ Optimal alignments **DONE**

- Proceed to the full alignment procedure
- Extract the optimal alignment values
- Deduce the final alignment at the crossing points

❑ Papers

- IPHC scanning table (MHS) **On going**
- Tomography (Gala) **To be done**

❑ Scan new detectors

- New contacts (Padova-LNL devpt) **Scheduled 2027 Q1**
- Scan of AGATA detectors A011 and B014 **To be done In 2027-2028**

❑ Compare AGATA detector databases

- Compare A, B and C crystal databases **On going**

❑ Analysis programs

- Perform and study $\chi^{0.3}$ comparison to give more weight to the induced signals
- Study gating on the Compton edge to favour single interactions

Special thanks to

❑ The AGATA collaboration

- For B006, S001, A005, B003 and **C016** loans

❑ M. Ginsz, B. De Canditiis, A. Corbel, **G. Gonzalez Briz**

- PhD students for their extremely valuable inputs and developments

❑ The IPHC AGATA team

- M-H. Sigward, F. Didierjean, M. Filliger, M. Moukaddam and J. Ljungvall

Thanks for your attention