Strasbourg scanning table
A005 report

G. Duchêne

Content

- **What happened to A005?**
- **Lateral and front scans – segmentation lines**
- **A005 Tomography**

What happened to A005

What happened to A005?

Request of the Characterisation Team

- A005 scanned already at Liverpool
- Moved to Salamanca but, after 6 months, tripping when raising HV
- Brought from Salamanca to Strasbourg in test cryostat for diagnostic (Jan 23)
- Core FET replaced; not successfull
- A005 dismounted on Feb 8 for capsule leak repair at MIRION
- Back at IPHC on April 26
- Mounted, validated in the Salamanca test cryostat in May-June
- Start of A005 scans in July 23

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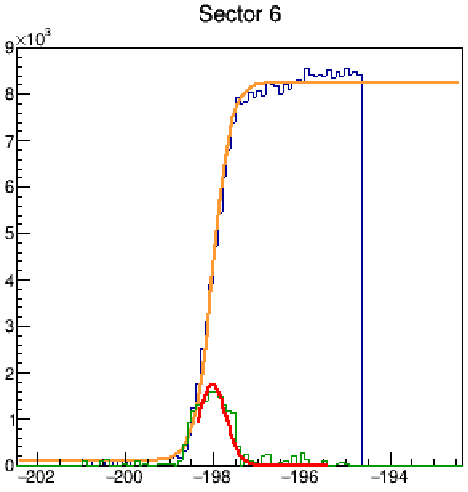
- Core FET replaced; not successfull
- A005 dismounted on Feb 8 for capsule leak repair at MIRION
- Back at IPHC on April 26
- Mounted, validated in the Salamanca test cryostat in May-June
- Start of A005 scans in July 23
- Vertical alignments and scans in autumn 23
- Horizontal alignments and scans January-April 24
- Tomography April – July
- Imager tests July
- The test cryostat with A005 capsule mounted has been pumped from early August to August 21 and packed
- Moved to GSI on August 27

- Meanwhile, J. Dudouet copied the scanned data to Lyon for reformating them in AGATA standard with the goal to further analyse them

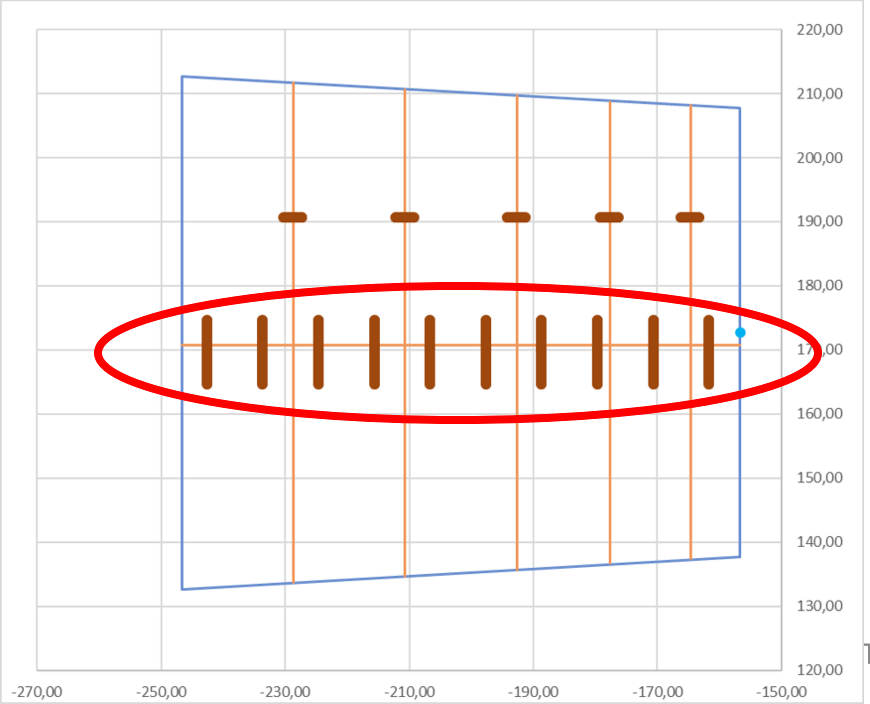
Lateral and front scans – segmentation line widths

Lateral scans – segmentation lines

- **Classical method**
  - Am horizontal (H) scans across segmentation BC
    - 10 scans of 10 mm length each, 5 < z < 86 mm
  - Am H scans across slices
    - 5 scans of 4 mm length each, for z = 8, 21, 36, 54, 72 mm
  - Fit with Wood-Saxon function



M. Moukaddam's analysis



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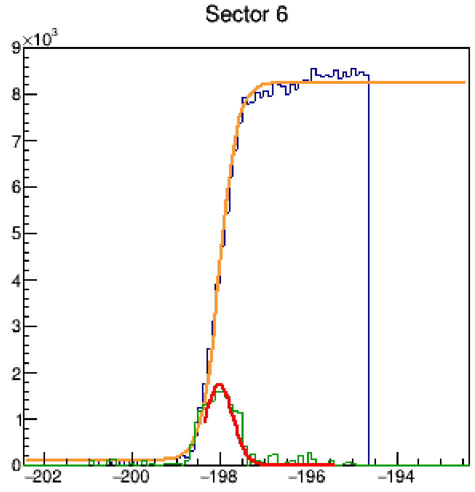

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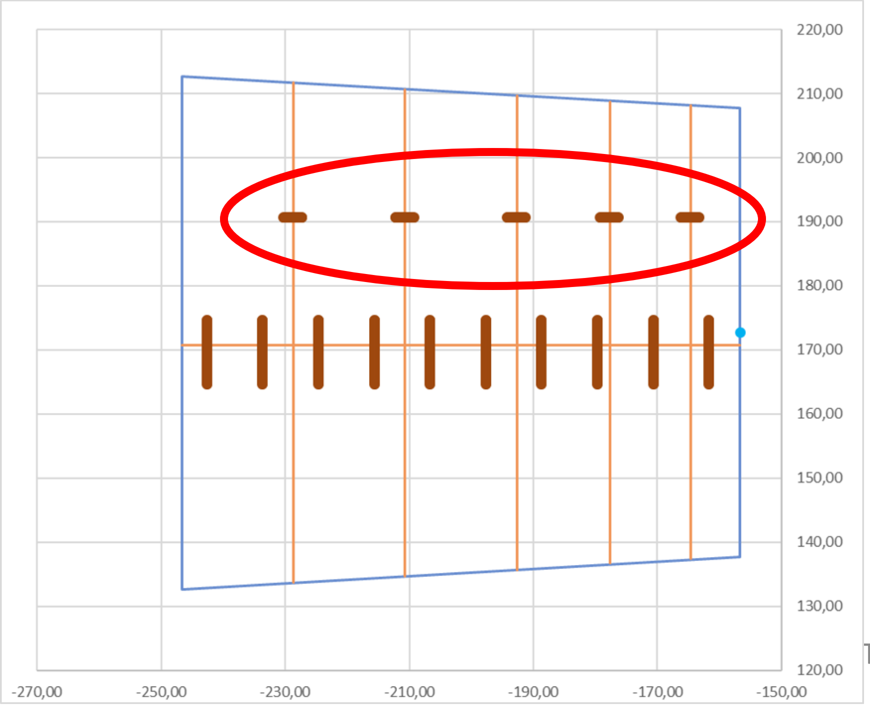

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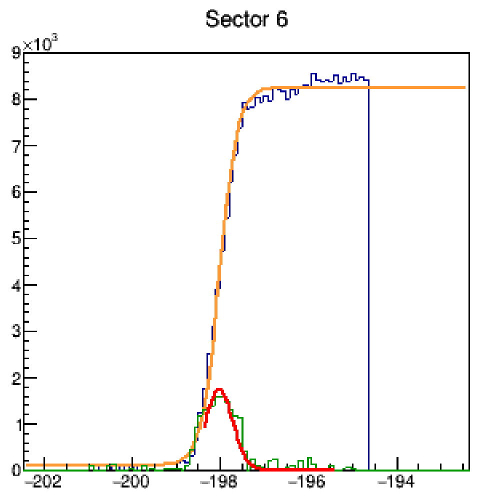
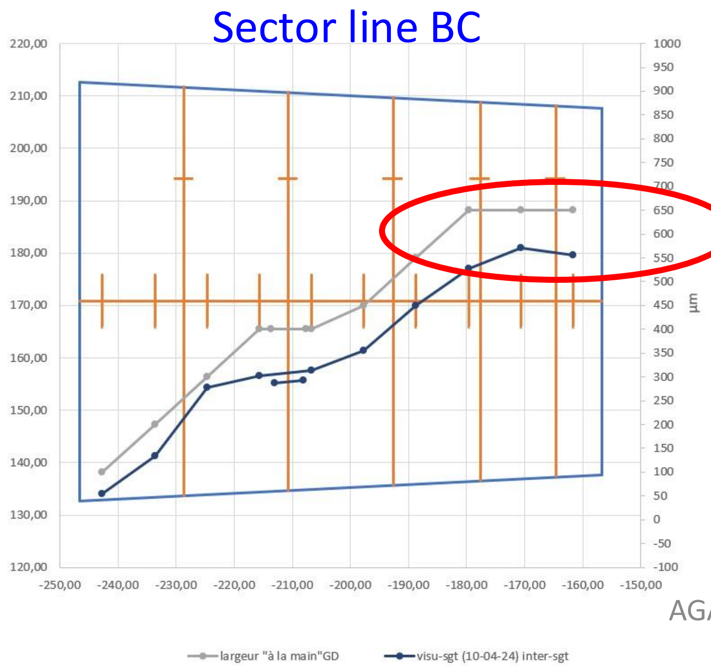
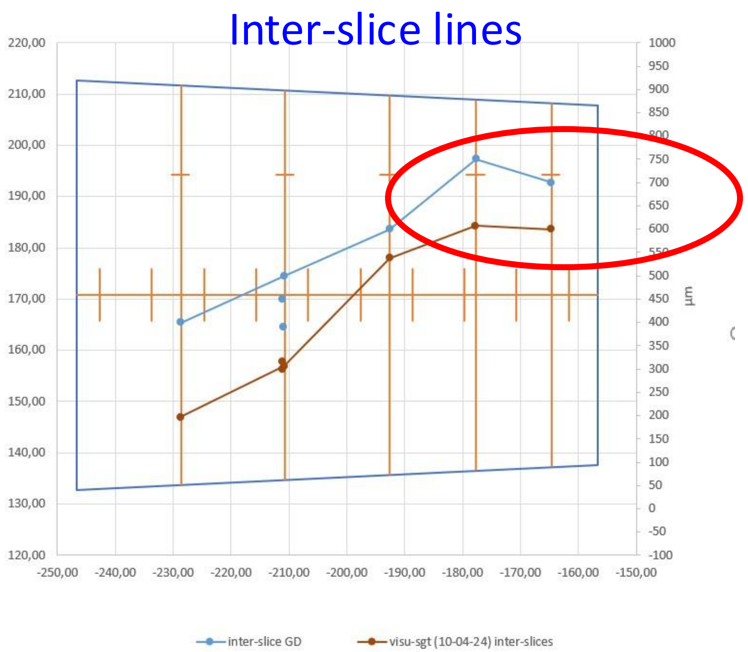




M.H. Sigward's analysis



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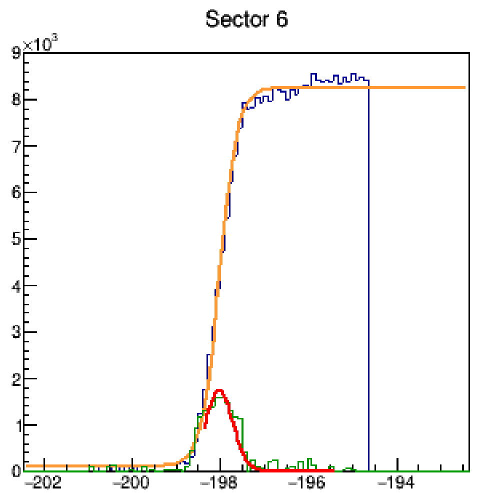

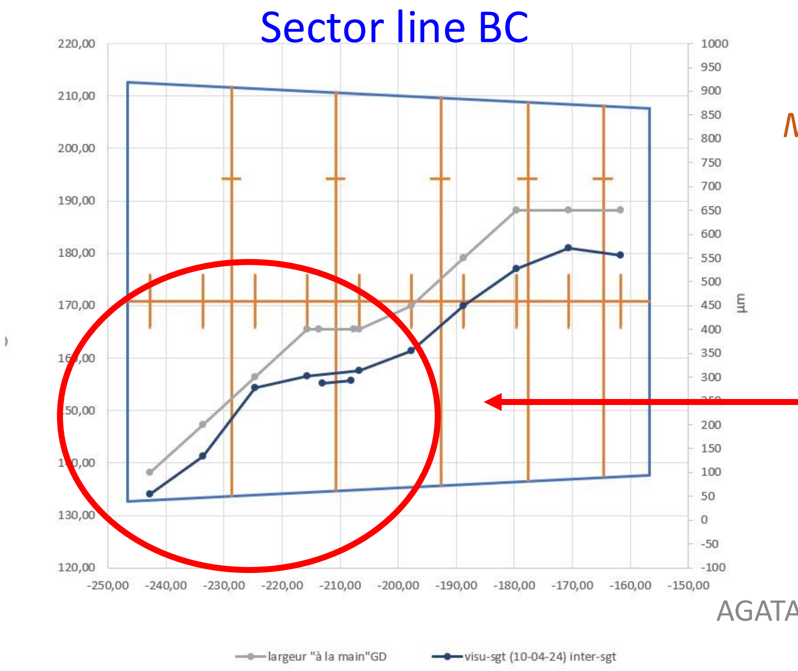

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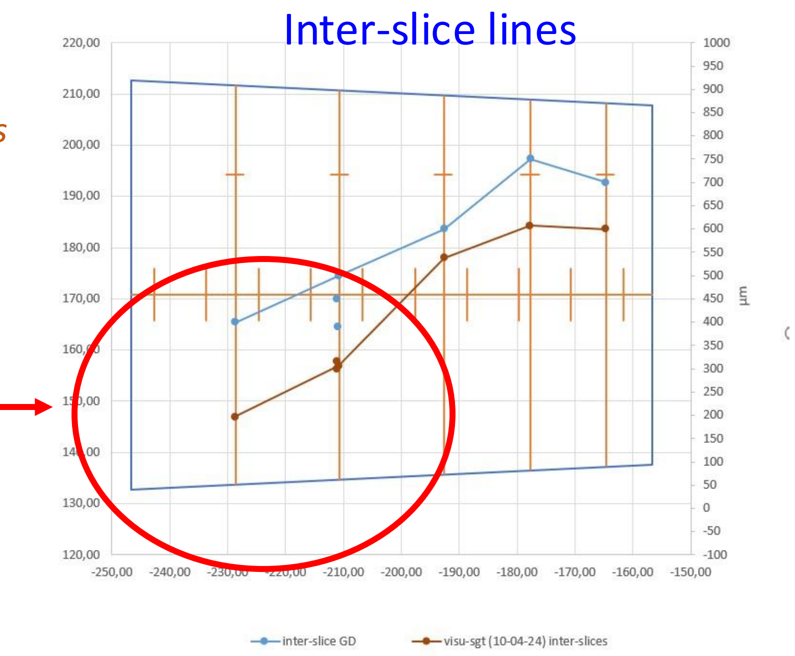
?



G. Duchêne

Lateral scans – segmentation lines

❑ A005 alignments in vertical position

- Vertical (V) scan across the EF segmentation line
  - Use a ^{241}Am to align the EF segmentation line on the Y axis
  - Pitch of 100 µm
  - Front segmentation width

    668 +/- 30 +/- 6 µm with a 1 mm diam. collimator

    626 +/- 30 +/- 4 µm with a 500 µm diam. collimator

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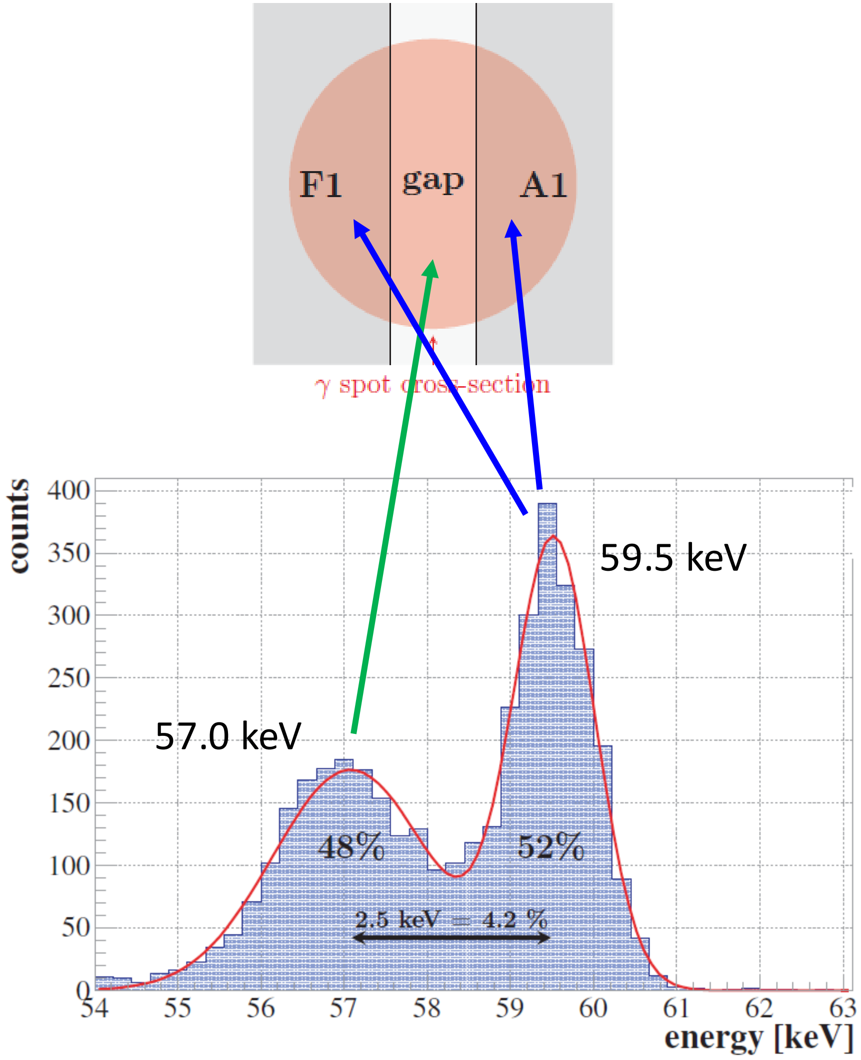
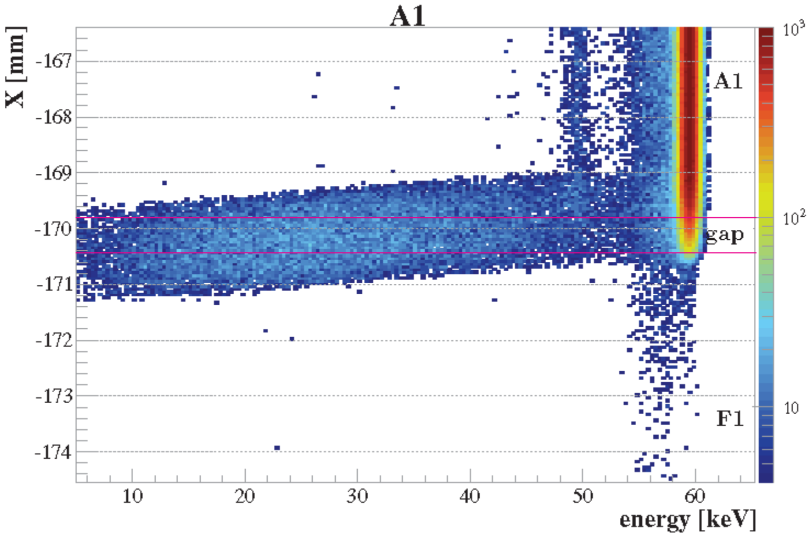
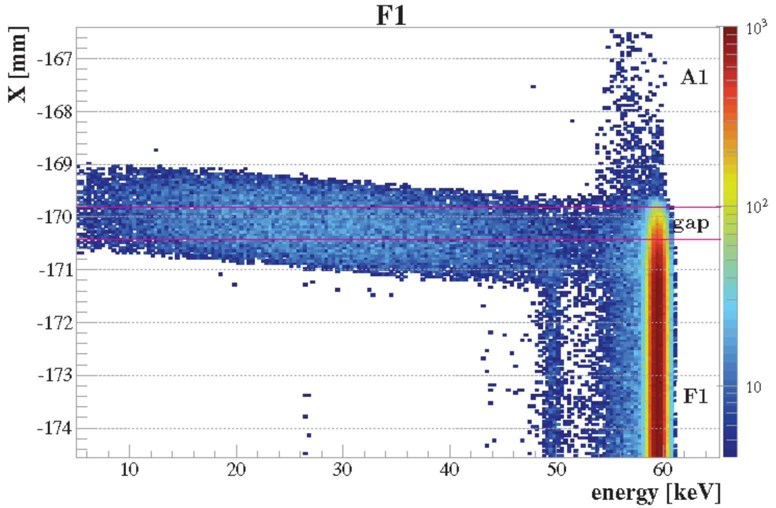
M. Ginsz, PhD, Univ. Strasbourg, 2015



Charge collection in interstrips





M. Ginsz, PhD, Univ. Strasbourg, 2015

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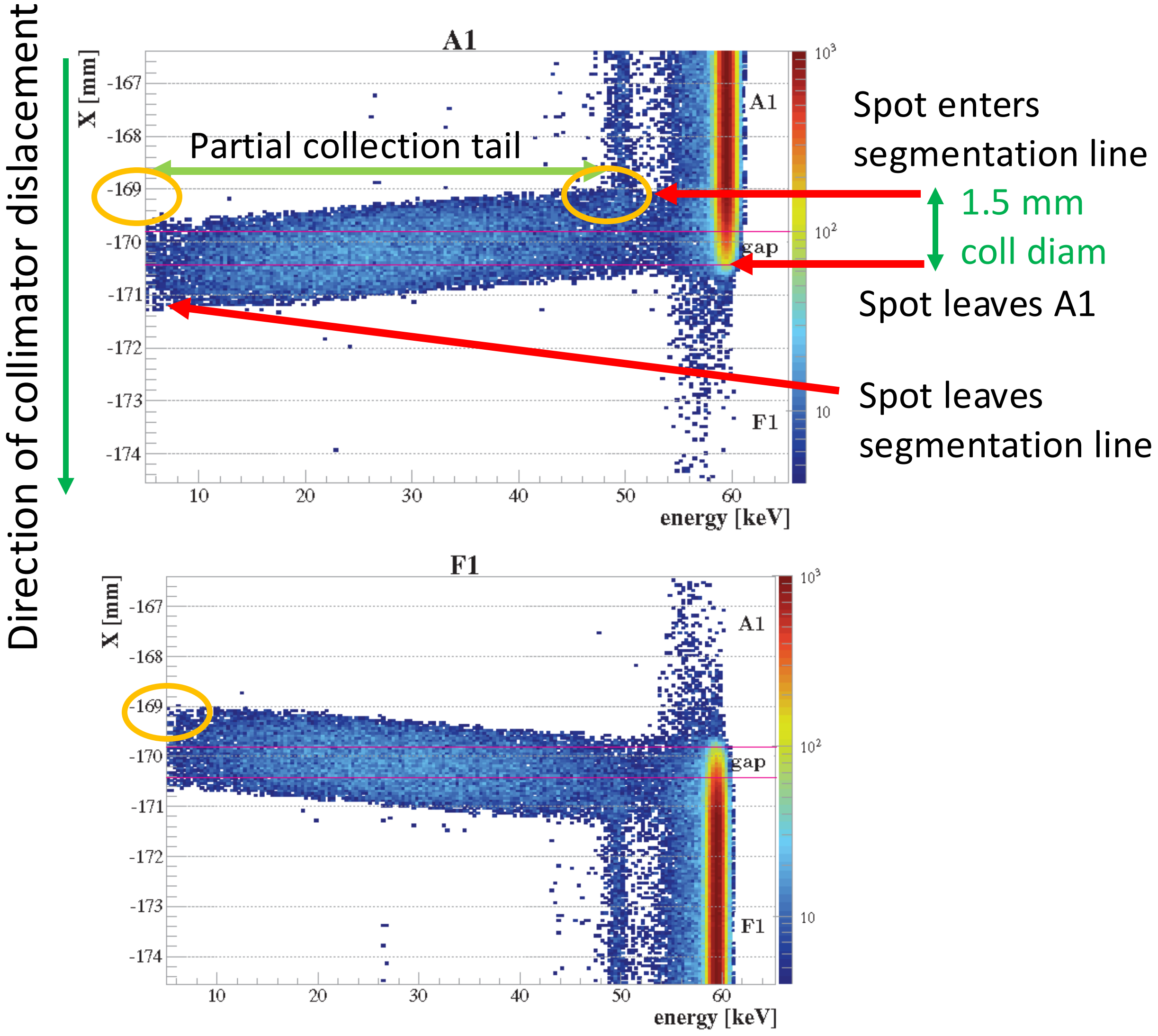

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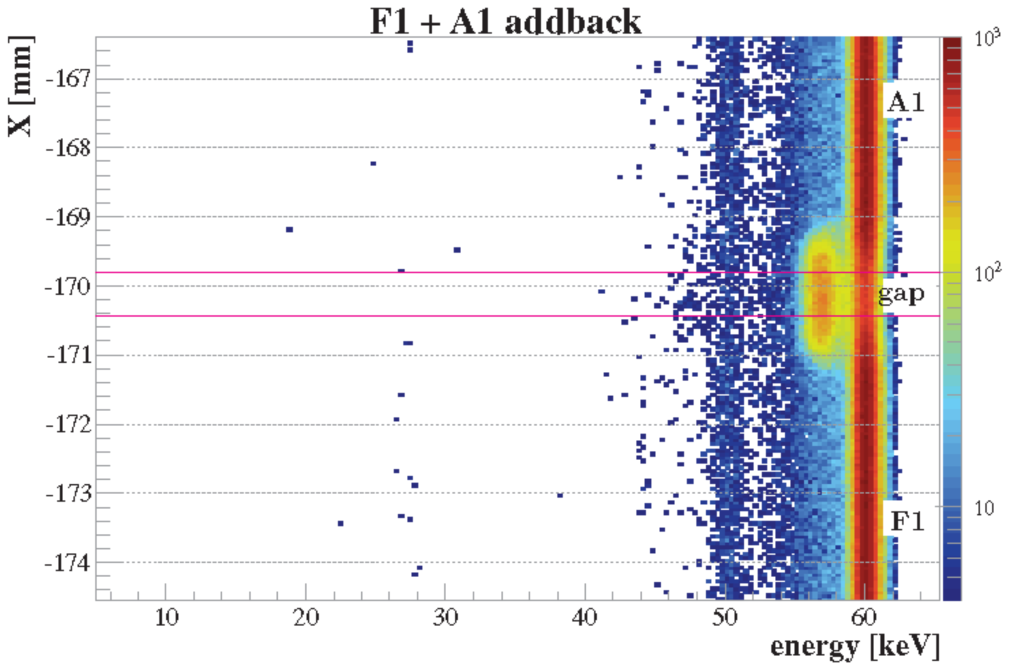
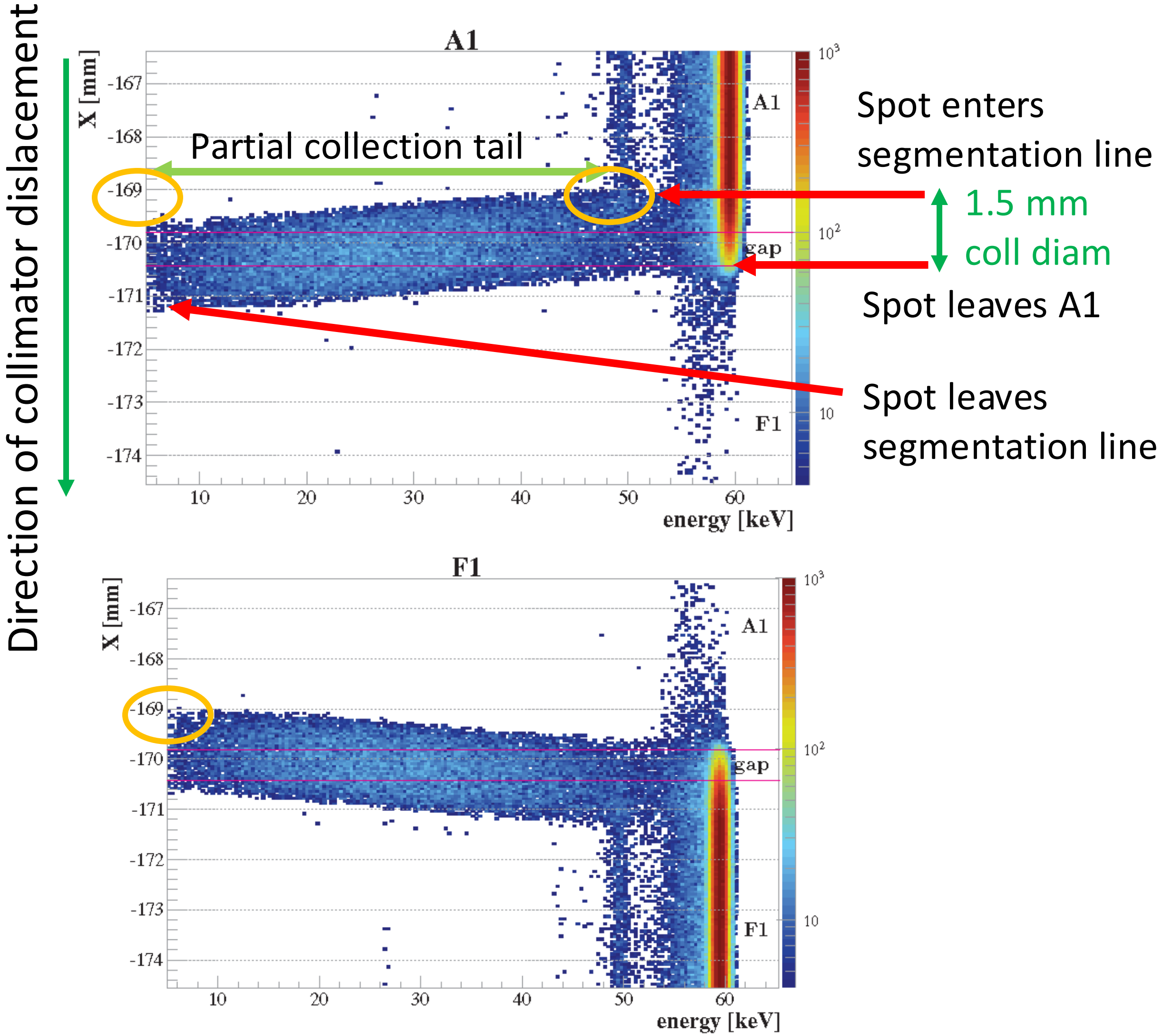
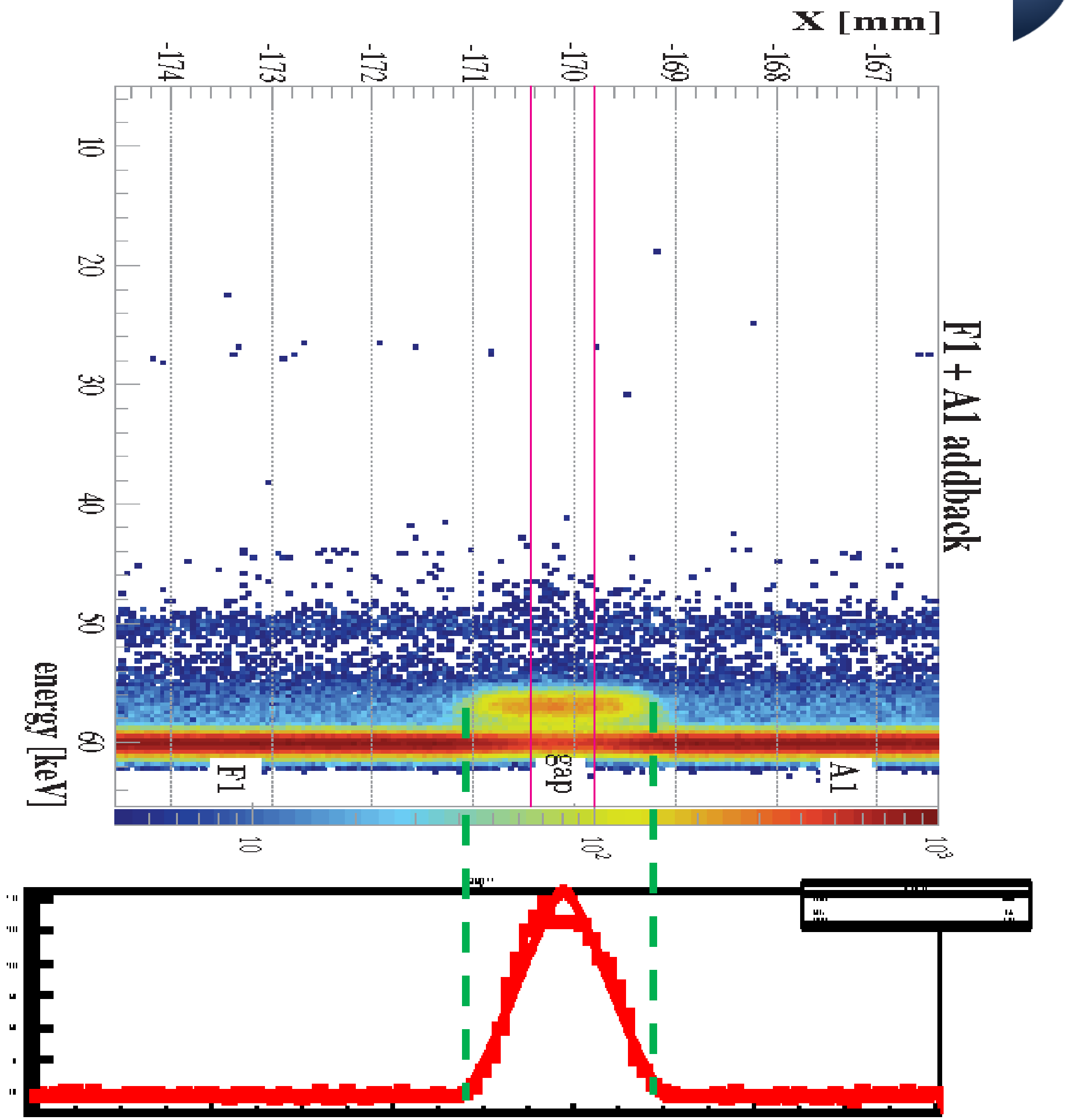


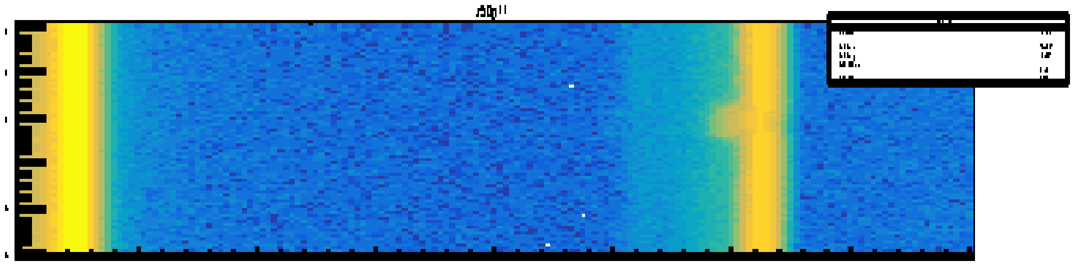


M. Ginsz, PhD, Univ. Strasbourg, 2015

Charge collection in



J. Ljungvall's analysis on A005 data
using Ginsz technique



Lateral scans – segmentation lines

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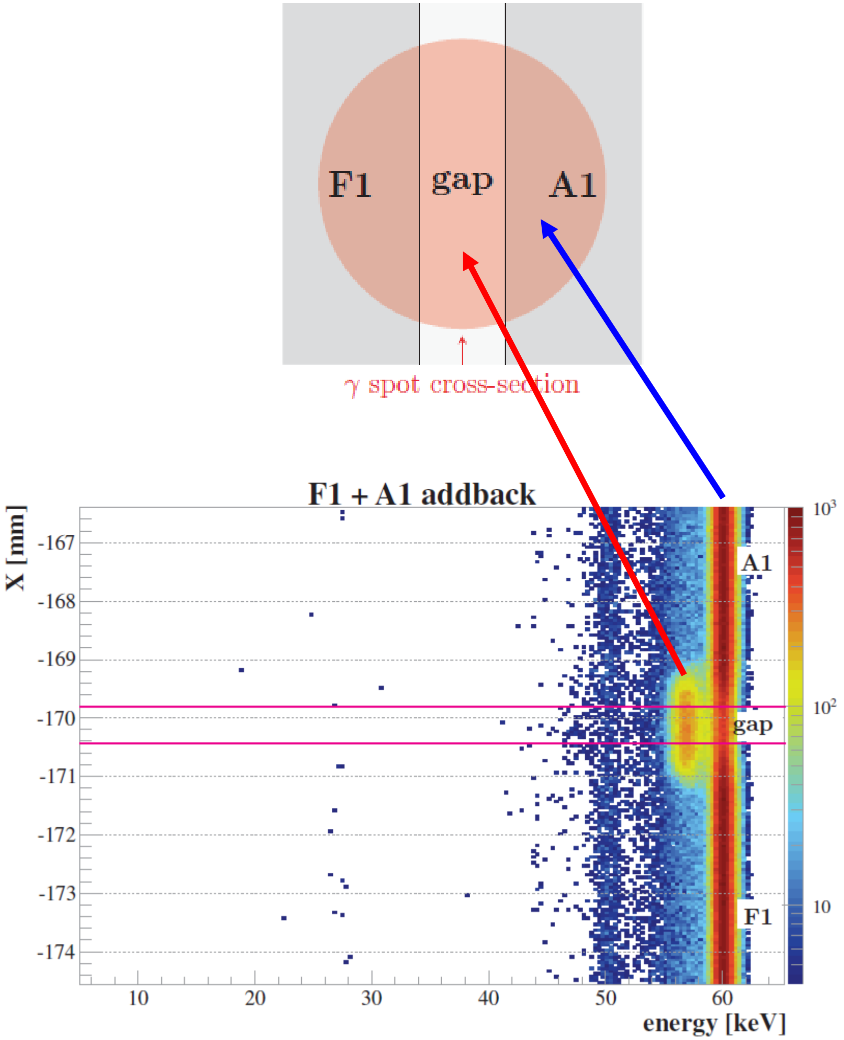

M. Ginsz, PhD, Univ. Strasbourg, 2015

Lateral scans – segmentation lines

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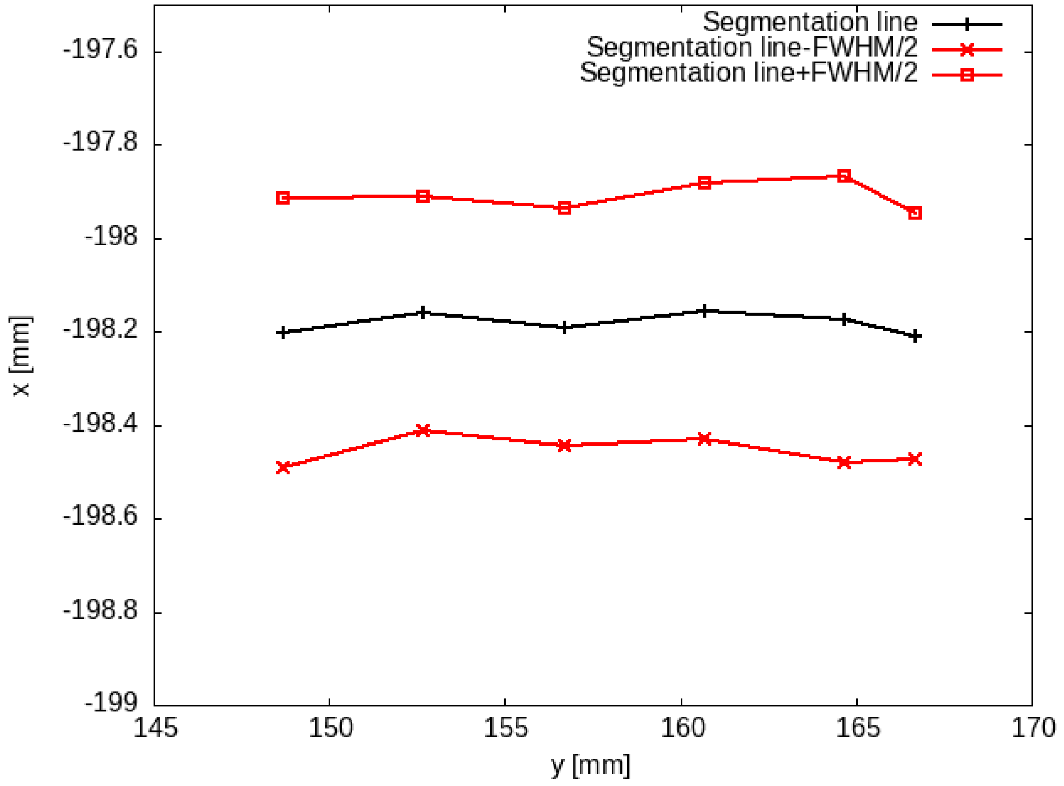
    668 +/- 30 +/- 6 µm with a 1 mm diam. collimator

    626 +/- 30 +/- 4 µm with a 500 µm diam. collimator

    545 +/- 34µm with a 1 mm diam. collimator

Width +/- 50 µm



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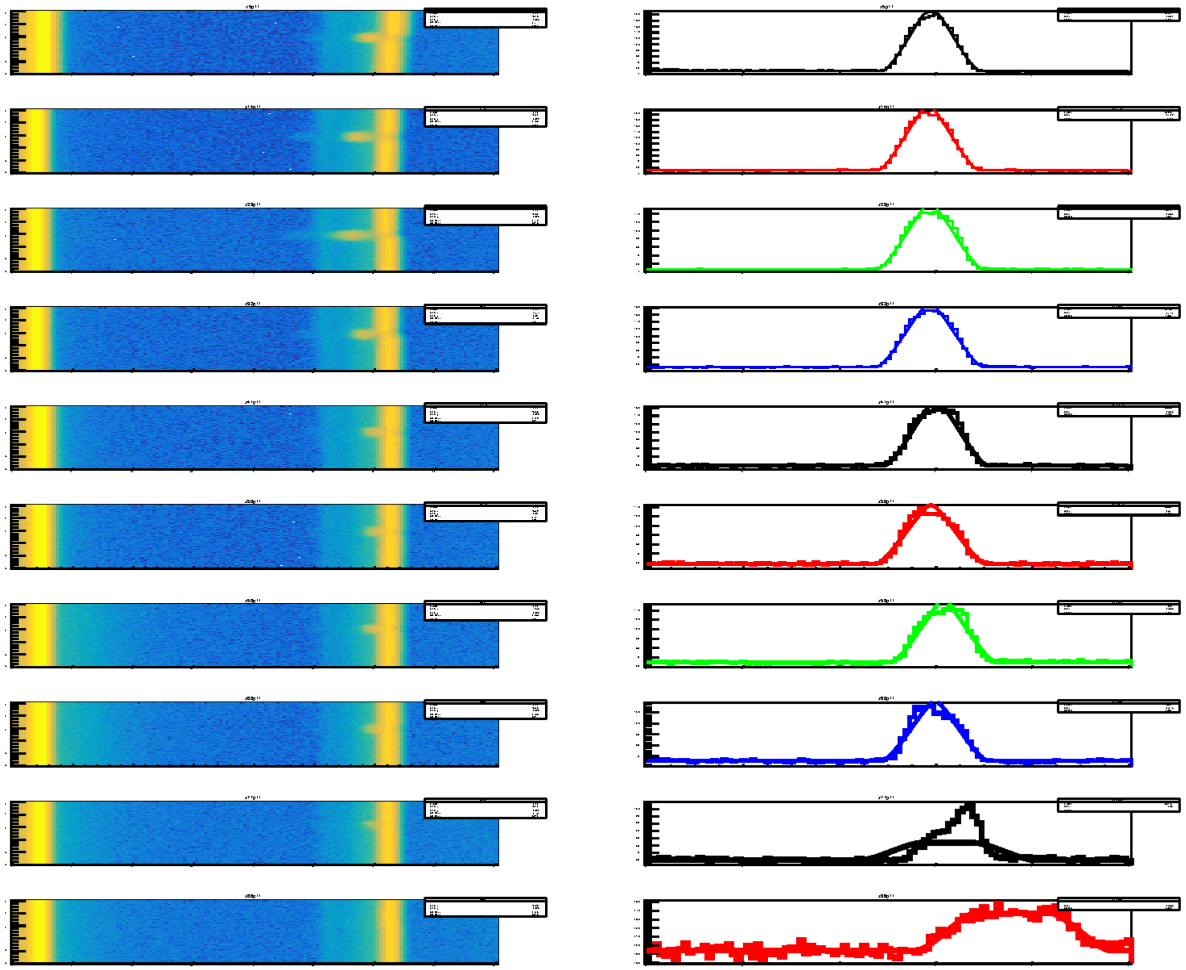
- **Ginsz's method or add-back method**
  - Sum up the energies released in sector B_i and C_i
  - Fit the peak shape along the collimator path



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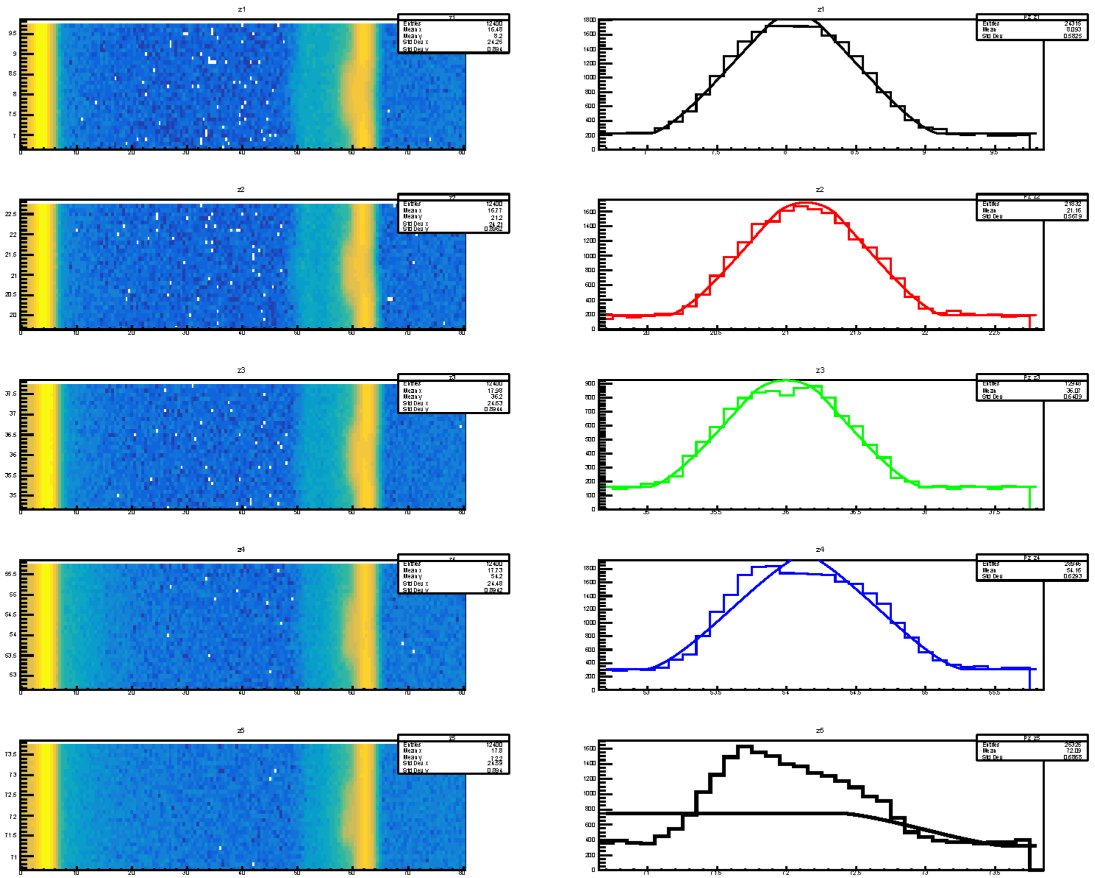

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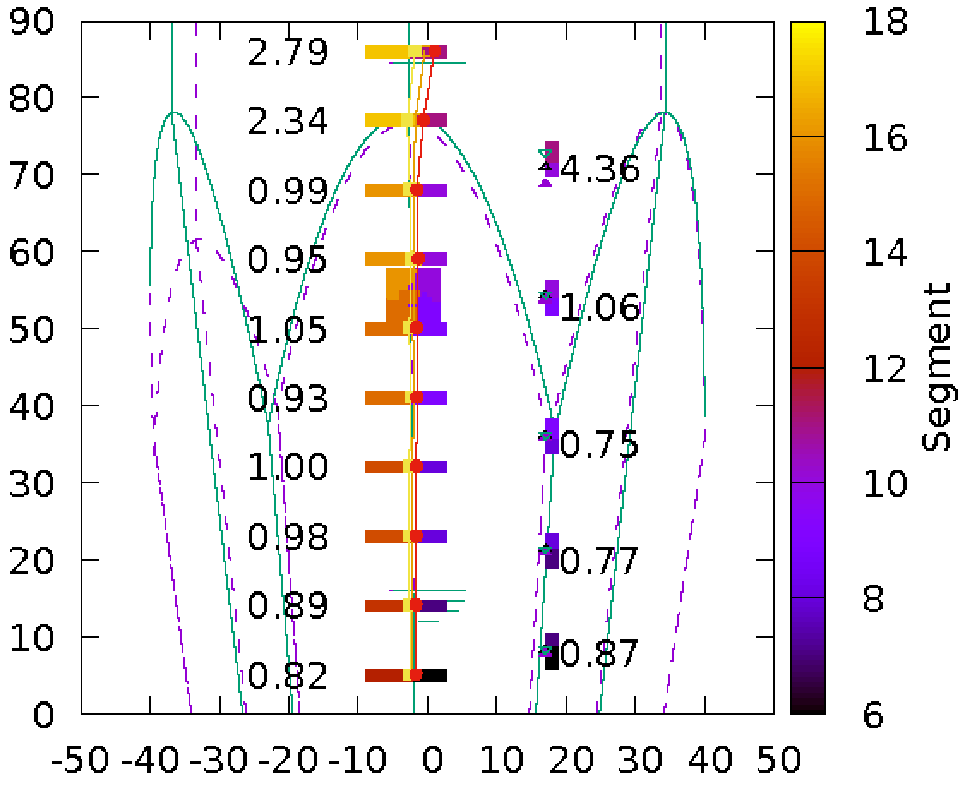


Not yet understood
To be further studied

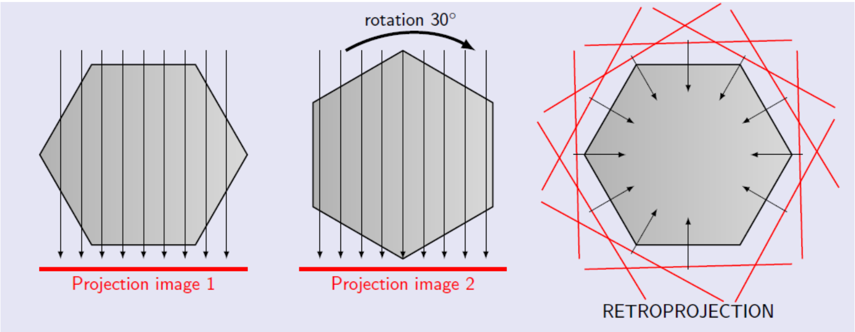
J. Ljungvall's analysis on A005 data using Ginsz technique

A005 tomography

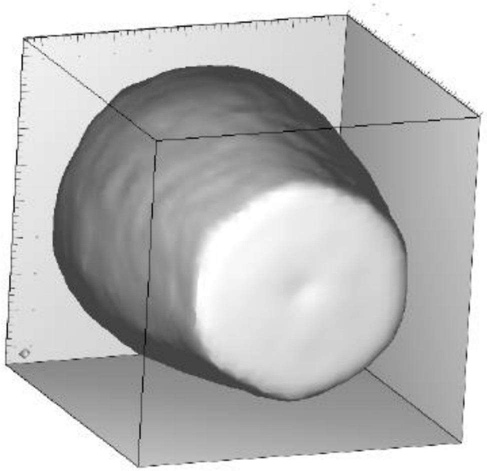
B006 tomography

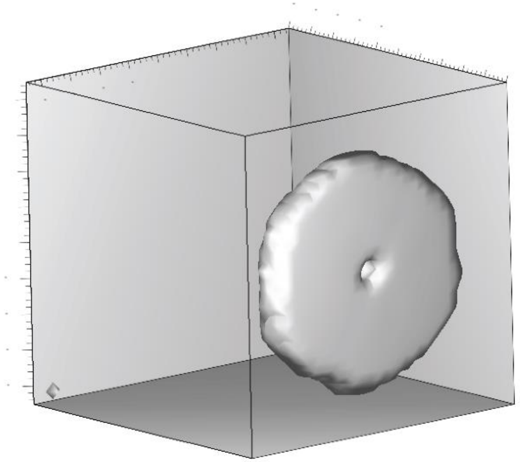
B006 tomography

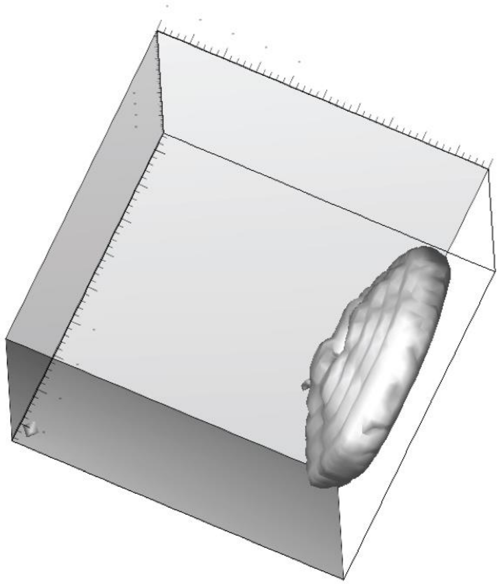
- M. Ginsz's PhD work on B006
  - Full horizontal surface scans
  - 2.5x2.5 mm² pitch (1152 pts), 75 sec/pt
  - 11 scanned 2D projections rotated by 30°
  - Total duration = 14 days



B006







G. Duchêne

A005 tomography

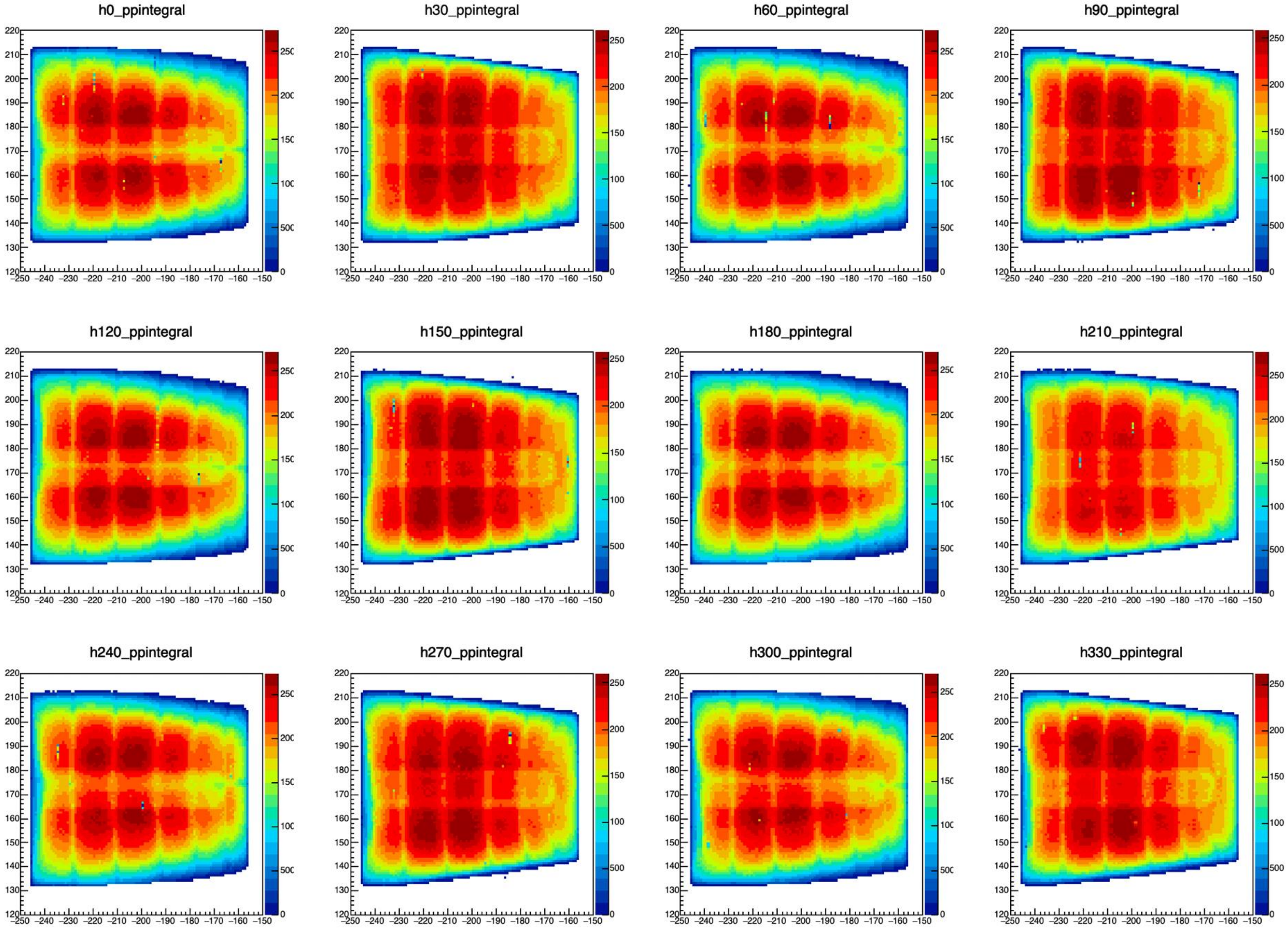
- **A005 tomography – the link between 2D and 3D scans**

  - New work on A005
    - 12 scanned 2D projections rotated by 30°
    - 1x1 mm² pitch (7200 pts), 70 sec/pt
    - Total duration = 3 months

    - Adapted Ginsz's programmes

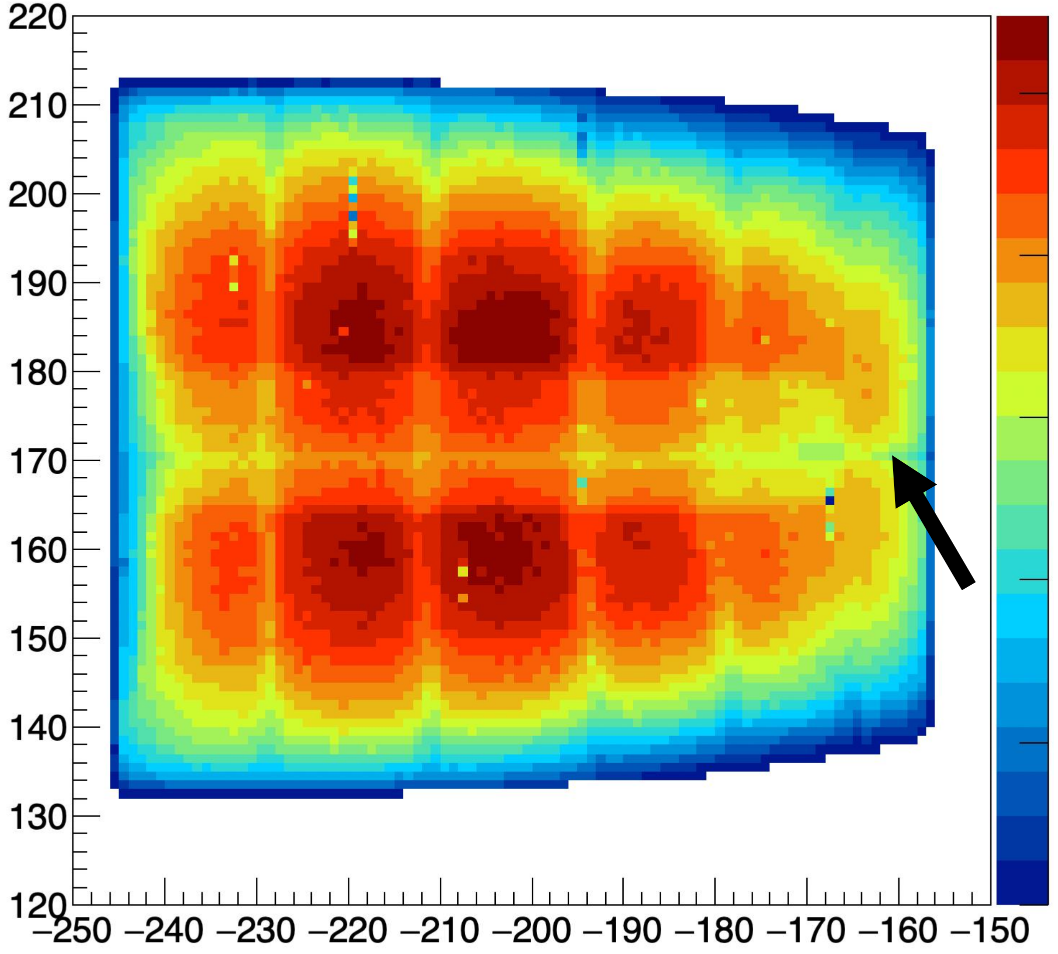
A005 tomography

M.H. Sigward's analysis

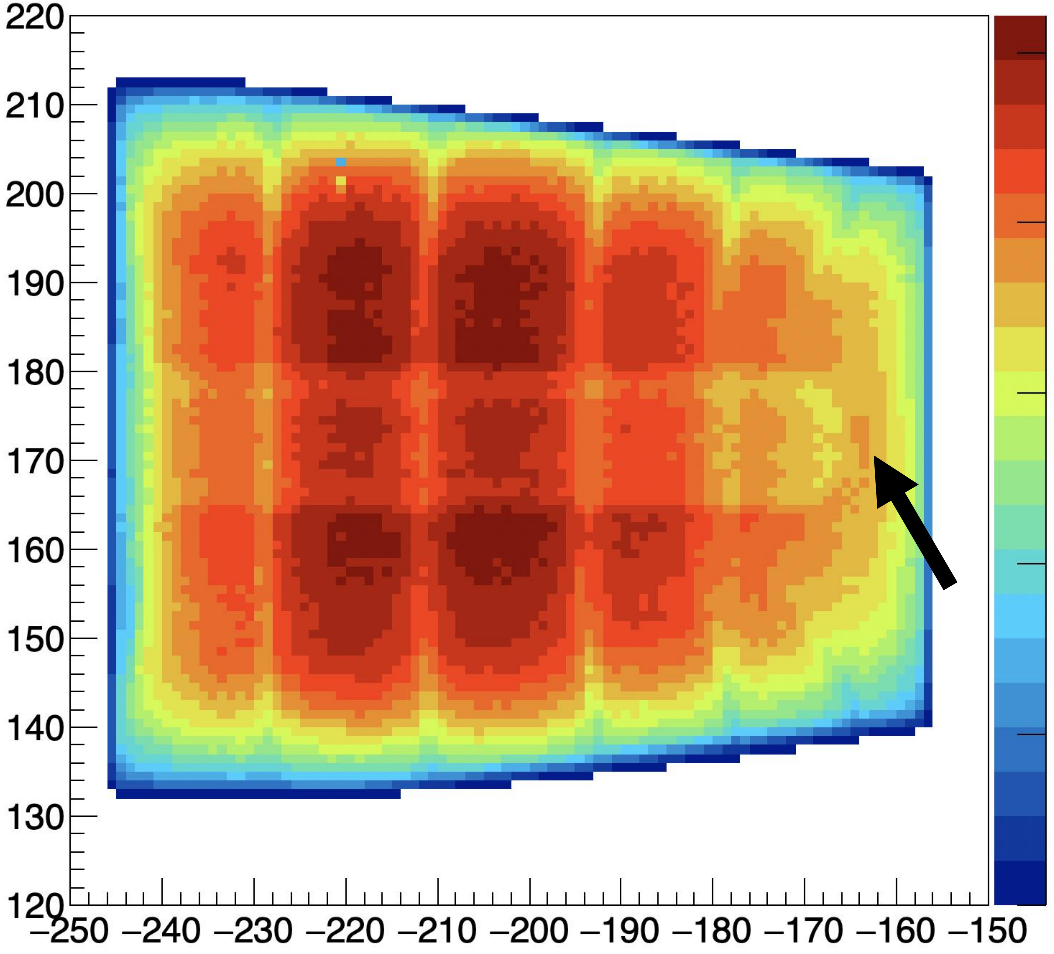


A005 tomography

h0_ppintegral (facing a tapered surface)



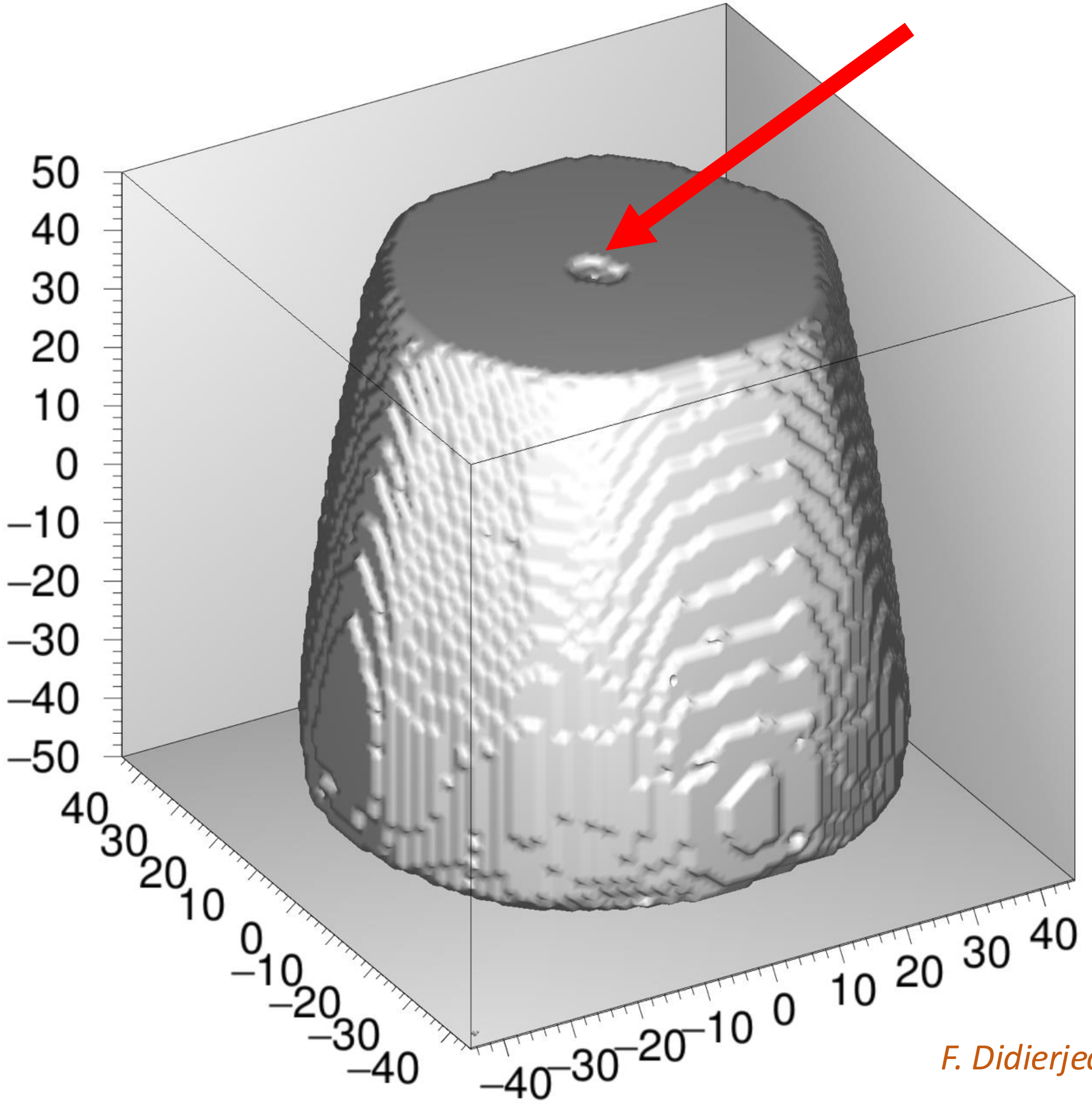
h30_ppintegral (facing a corner)

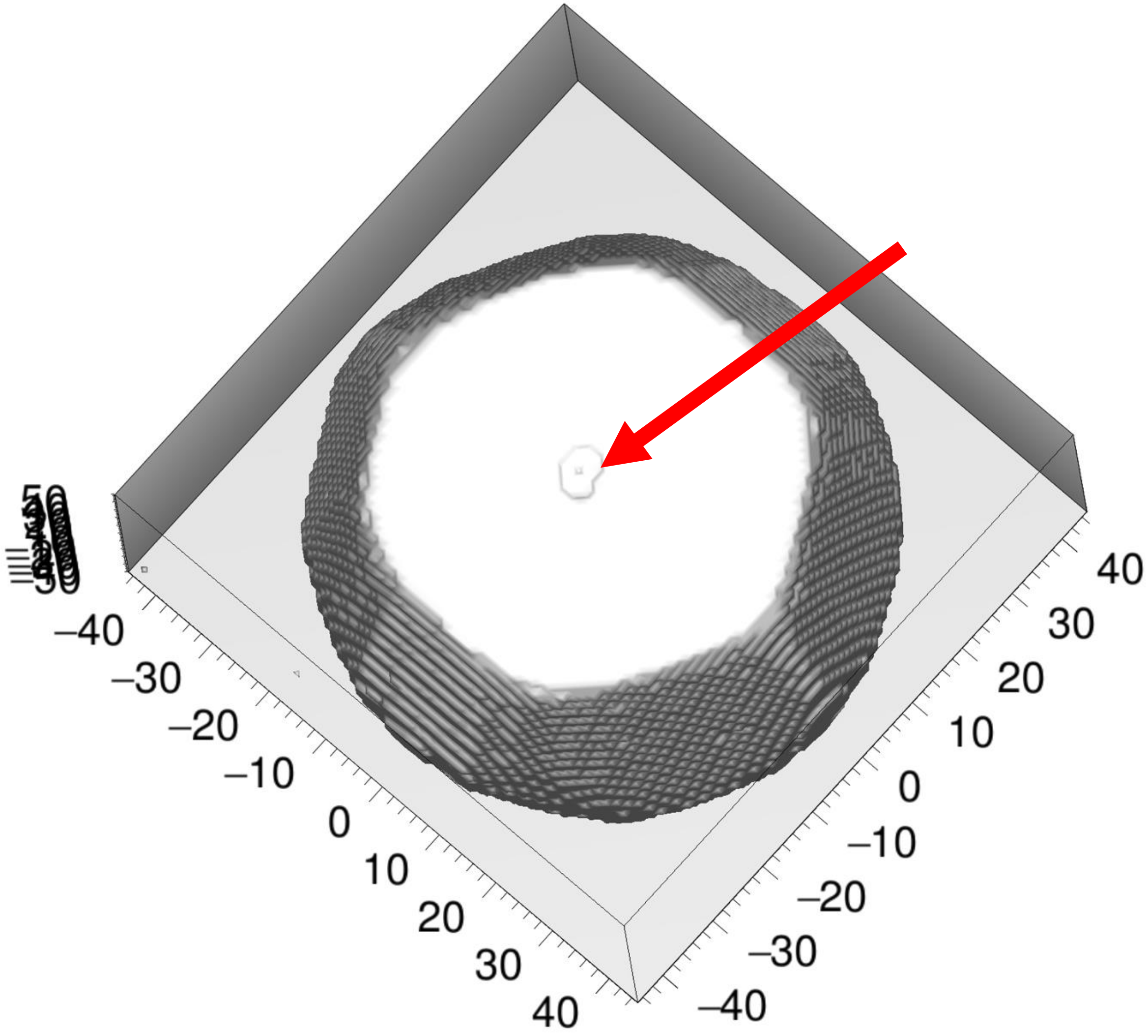


M.H. Sigward's analysis

A005 tomography

F. Didierjean's analysis





F. Didierjean's analysis

G. Duchêne

A005 tomography

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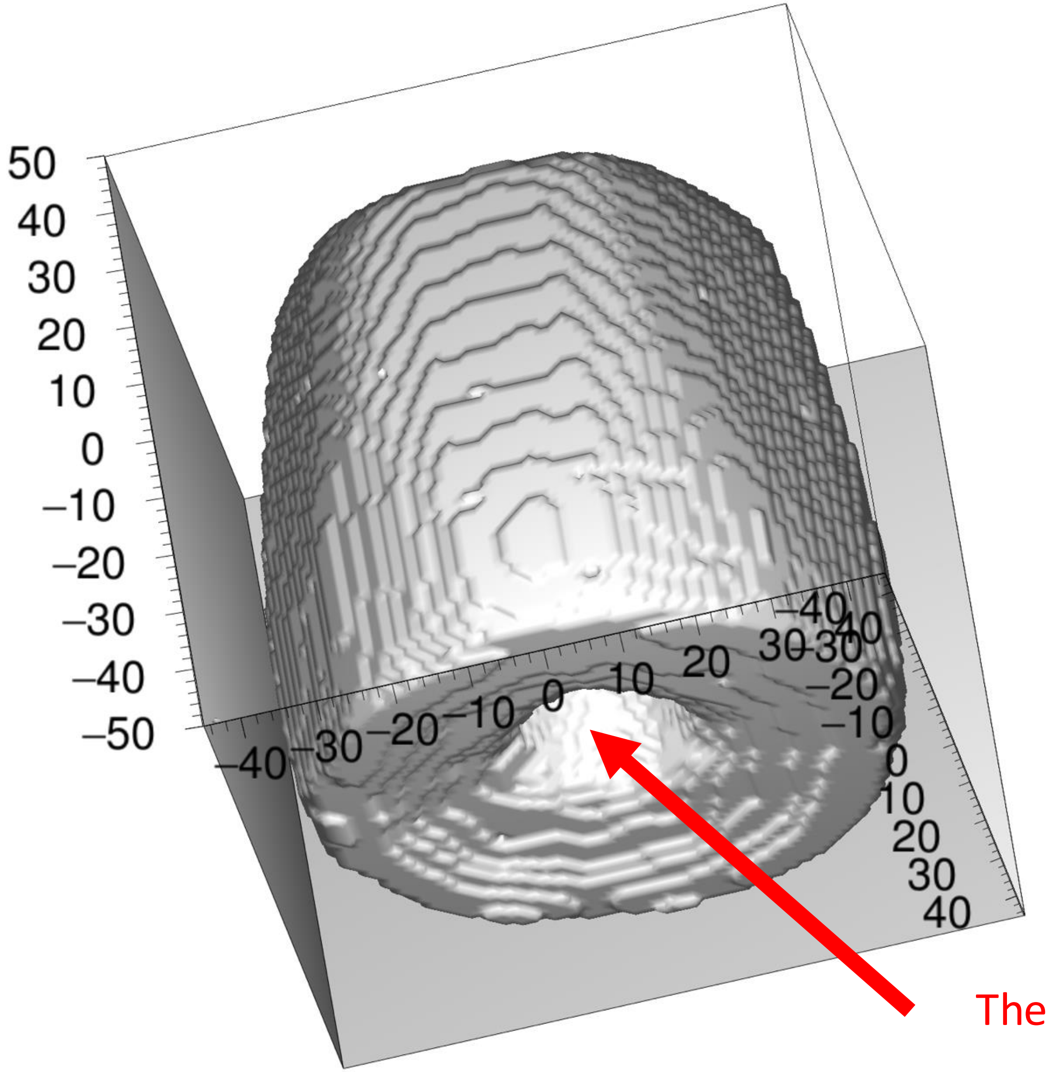
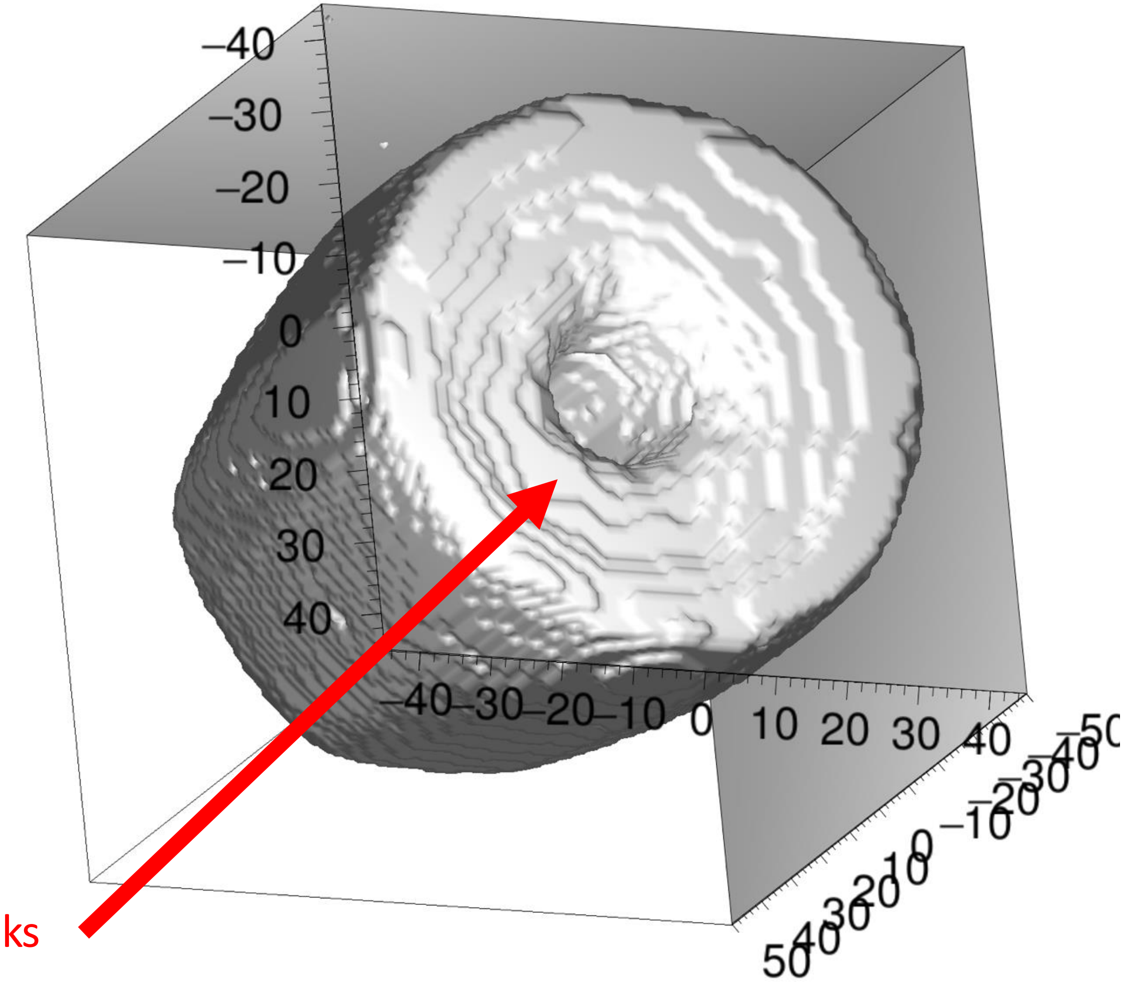
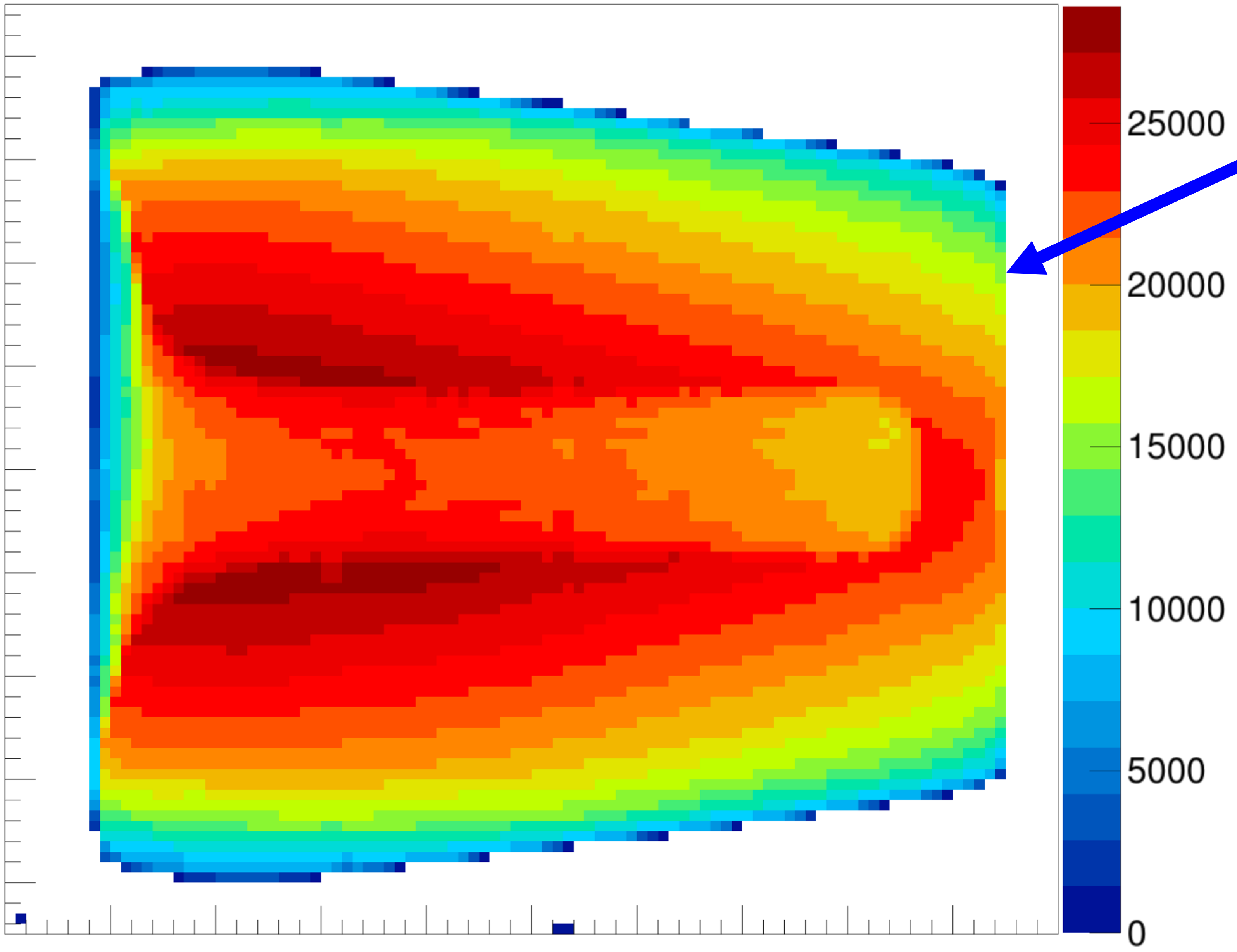




The hole looks large

2D projection of the 3D reconstructed model



Too sharp cut.
Scanning grid wrong by 2 mm

A005

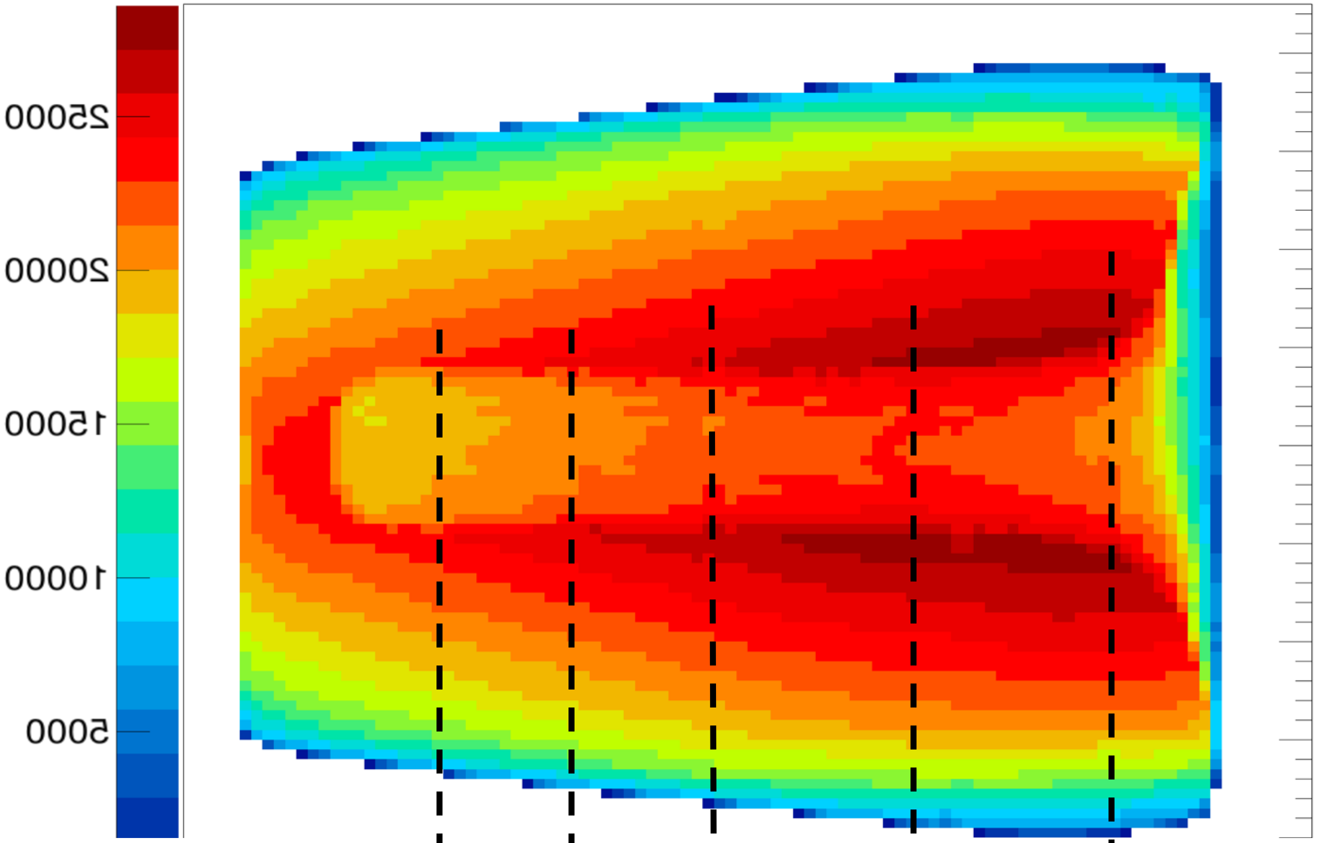
❑ A005 tomography – the link between 2D and 3D scans

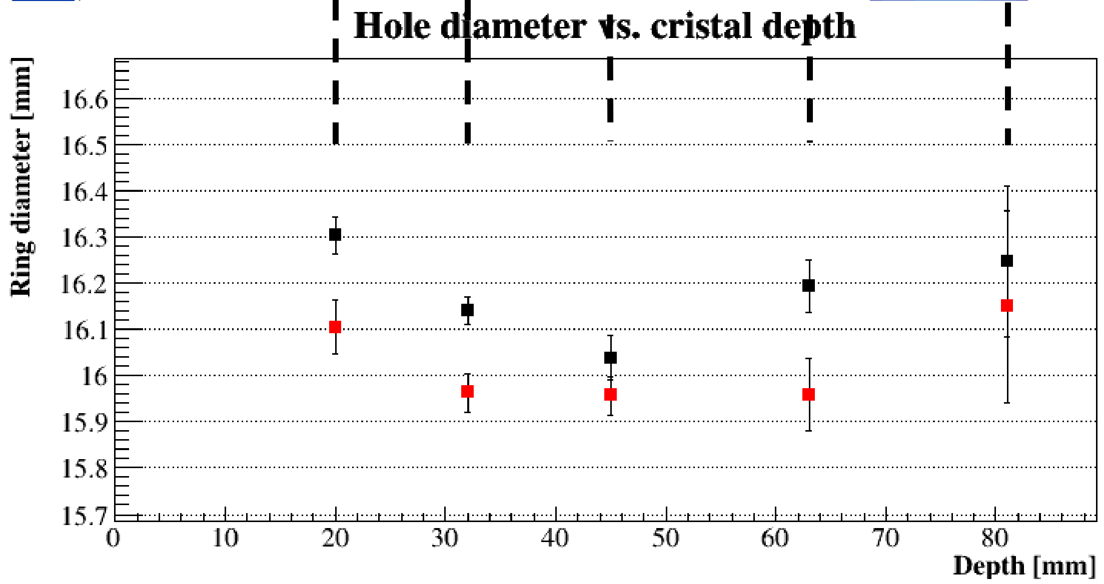
- ➢ New work on A005
  - ❖ 12 scanned 2D projections rotated by 30°
  - ❖ 1x1 mm² pitch (7200 pts), 70 sec/pt
  - ❖ Total duration = 3 months

  - ❖ Adapted Ginsz's programmes

  - ❖ The measured hole diameter fits well with the 2D projection of the reconstructed 3D model
  - ❖ The diameter increase at the back of the crystal has been observed for S001, B006 and A005.

    It is systematic and real

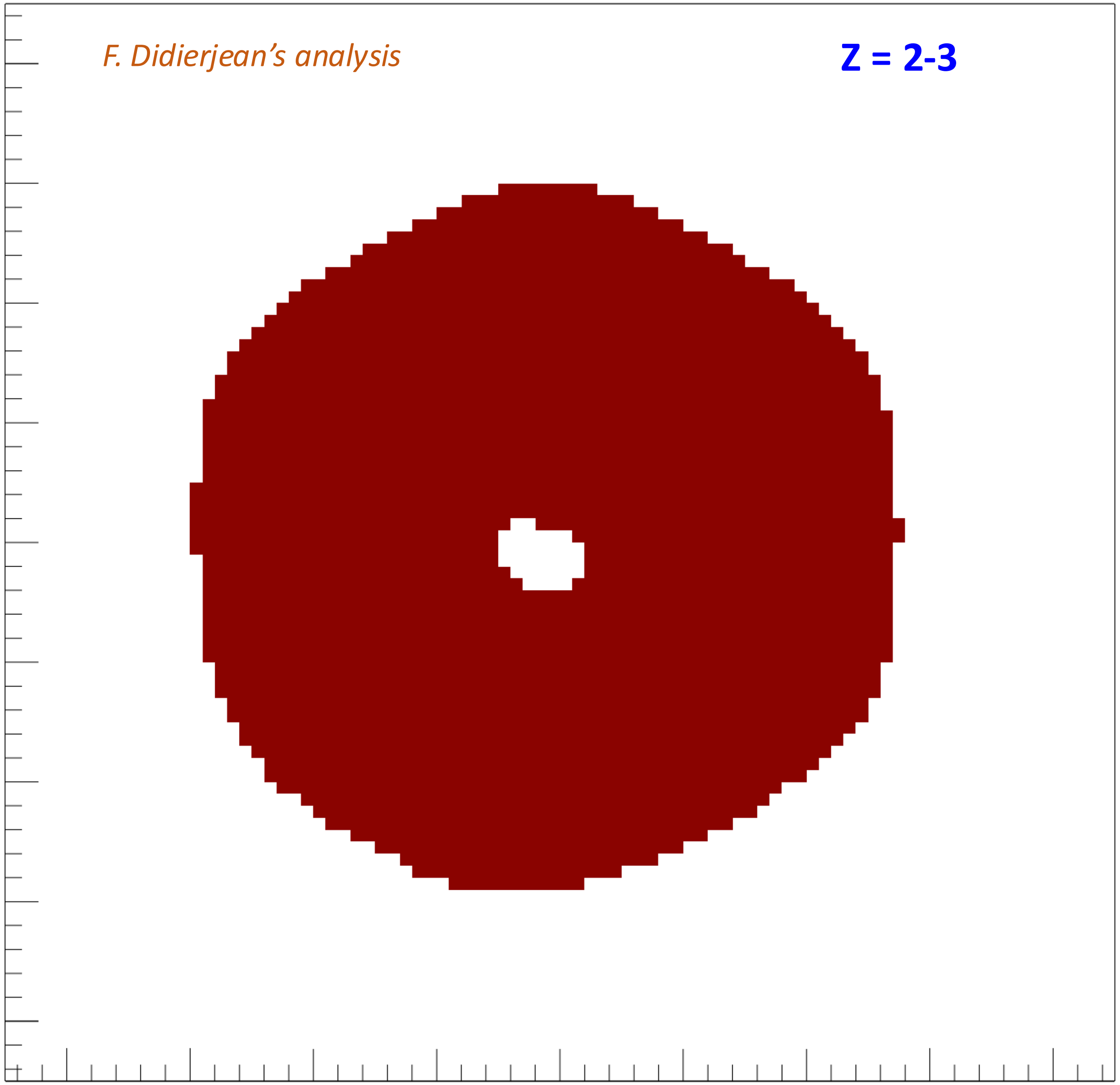




A005

- **A005 tomography – the link between 2D and 3D scans**
  - New work on A005
    - Transversal cuts
    - Front hole due to the crossing of the 3 segmentation lines

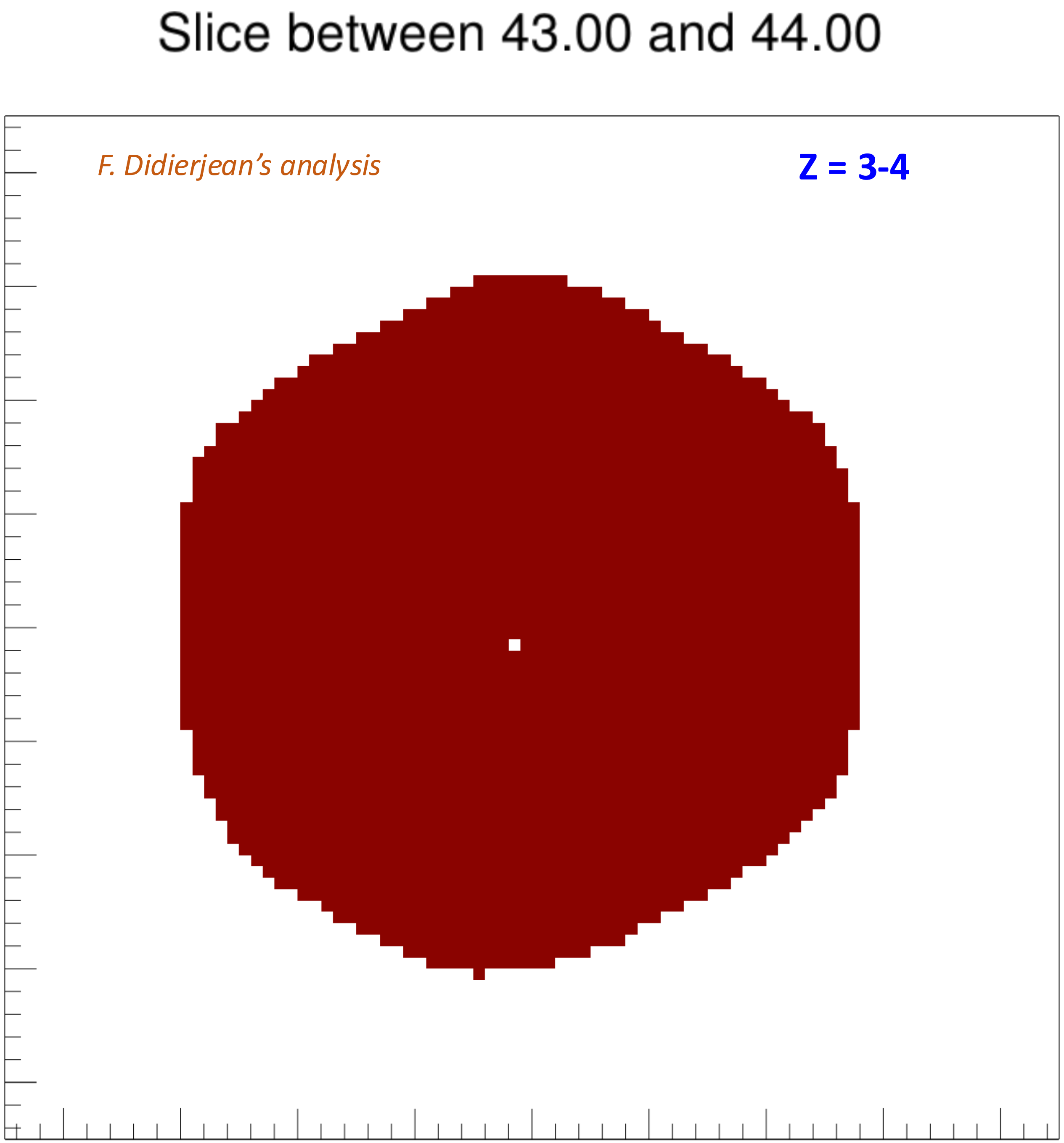
Slice between 44.00 and 45.00



A005

A005 tomography – the link between 2D and 3D scans

- New work on A005
  - Transversal cuts
  - Front hole due to the crossing of the 3 segmentation lines
  - Still present at z = 3-4 mm



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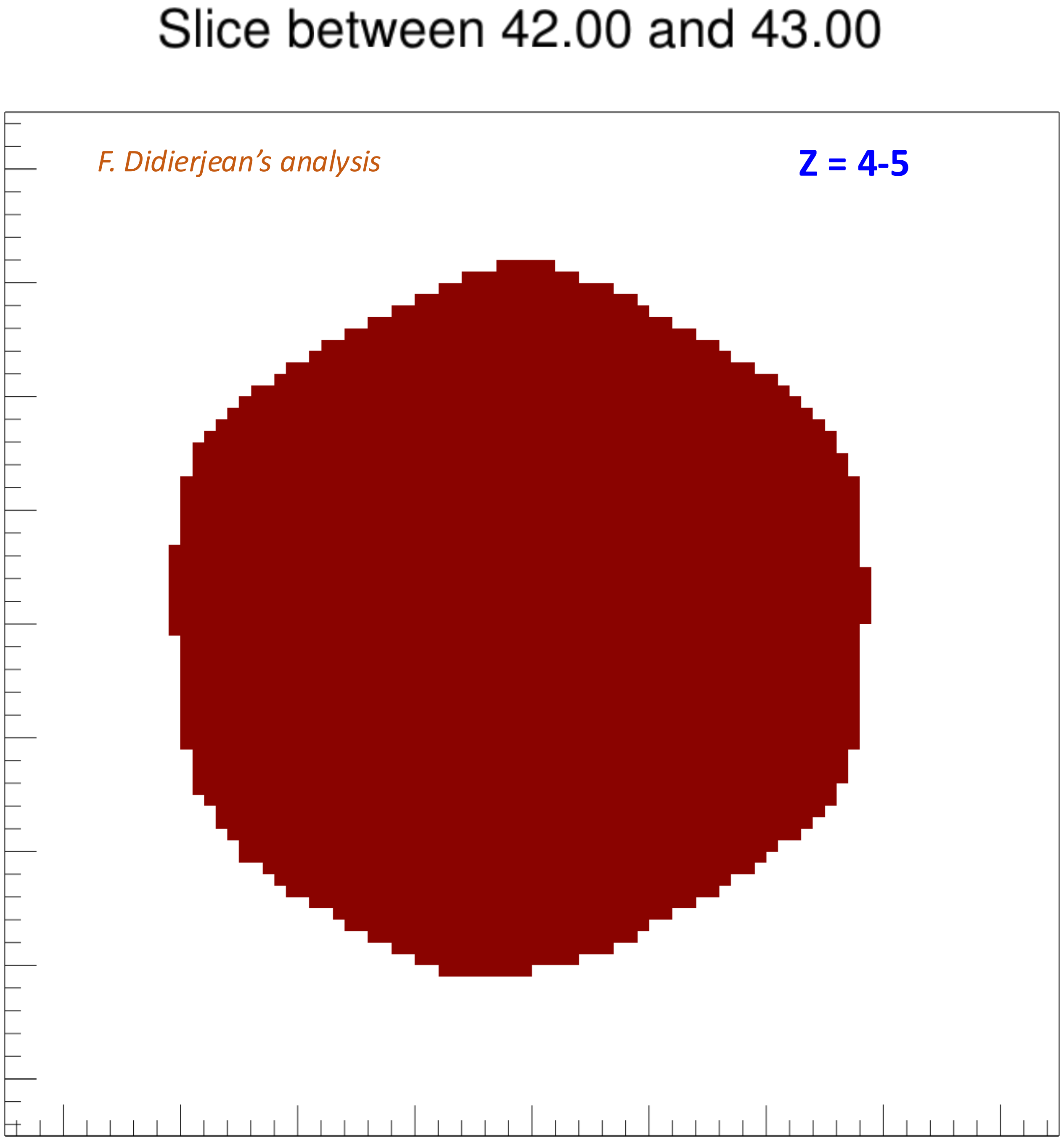
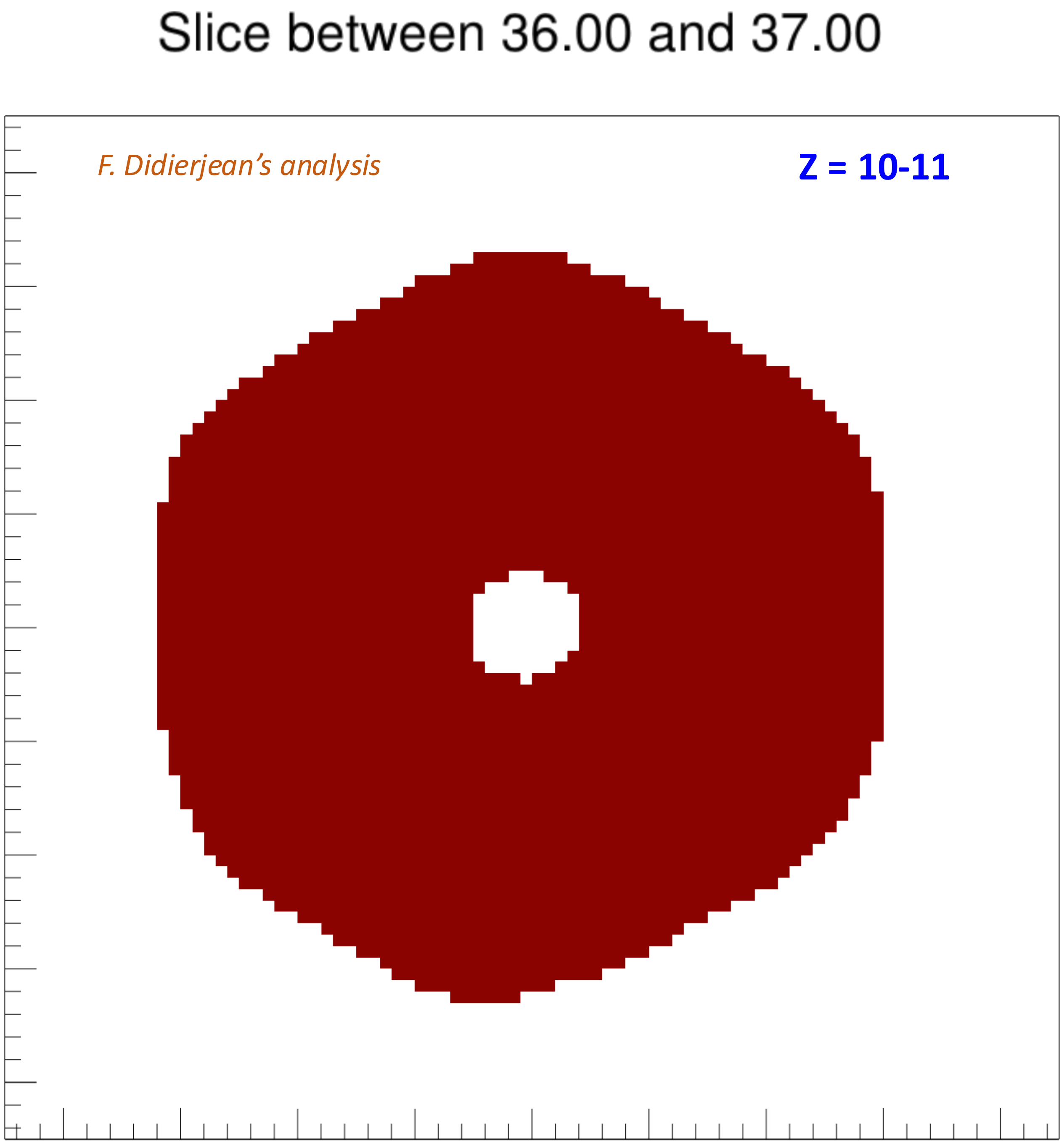


A005

A005 tomography – the link between 2D and 3D scans

- New work on A005
  - Transversal cuts
  - Front hole due to the crossing of the 3 segmentation lines
  - Still present at z = 3-4 mm

  - Bored hole appears at z = 10-11 mm



A005

A005 tomography – the link between 2D and 3D scans

- New work on A005
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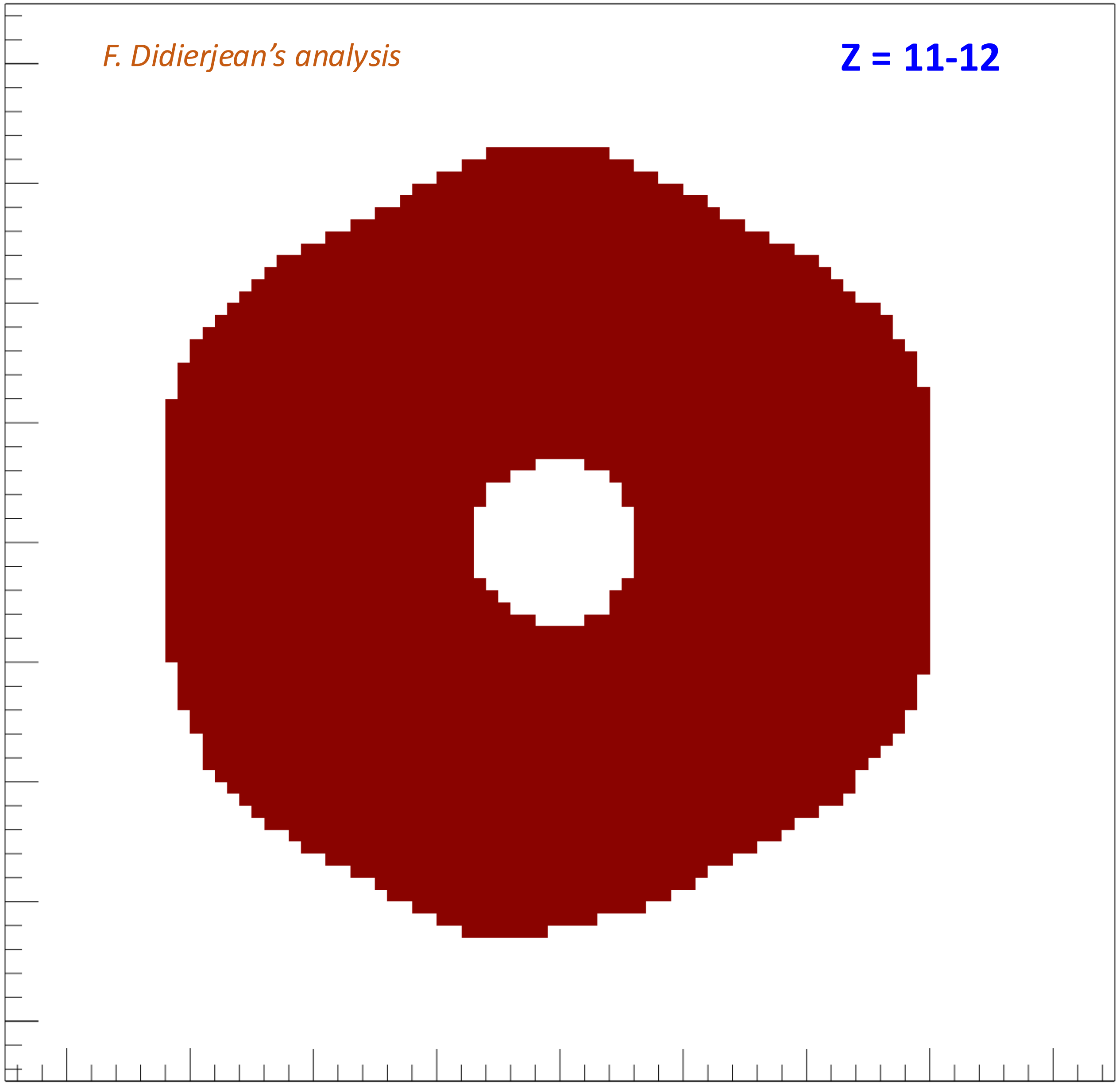
  - Front hole due to the crossing of the 3 segmentation lines
  - Still present at z = 3-4 mm
  - Bored hole appears at z = 10-11 mm

Slice between 35.00 and 36.00

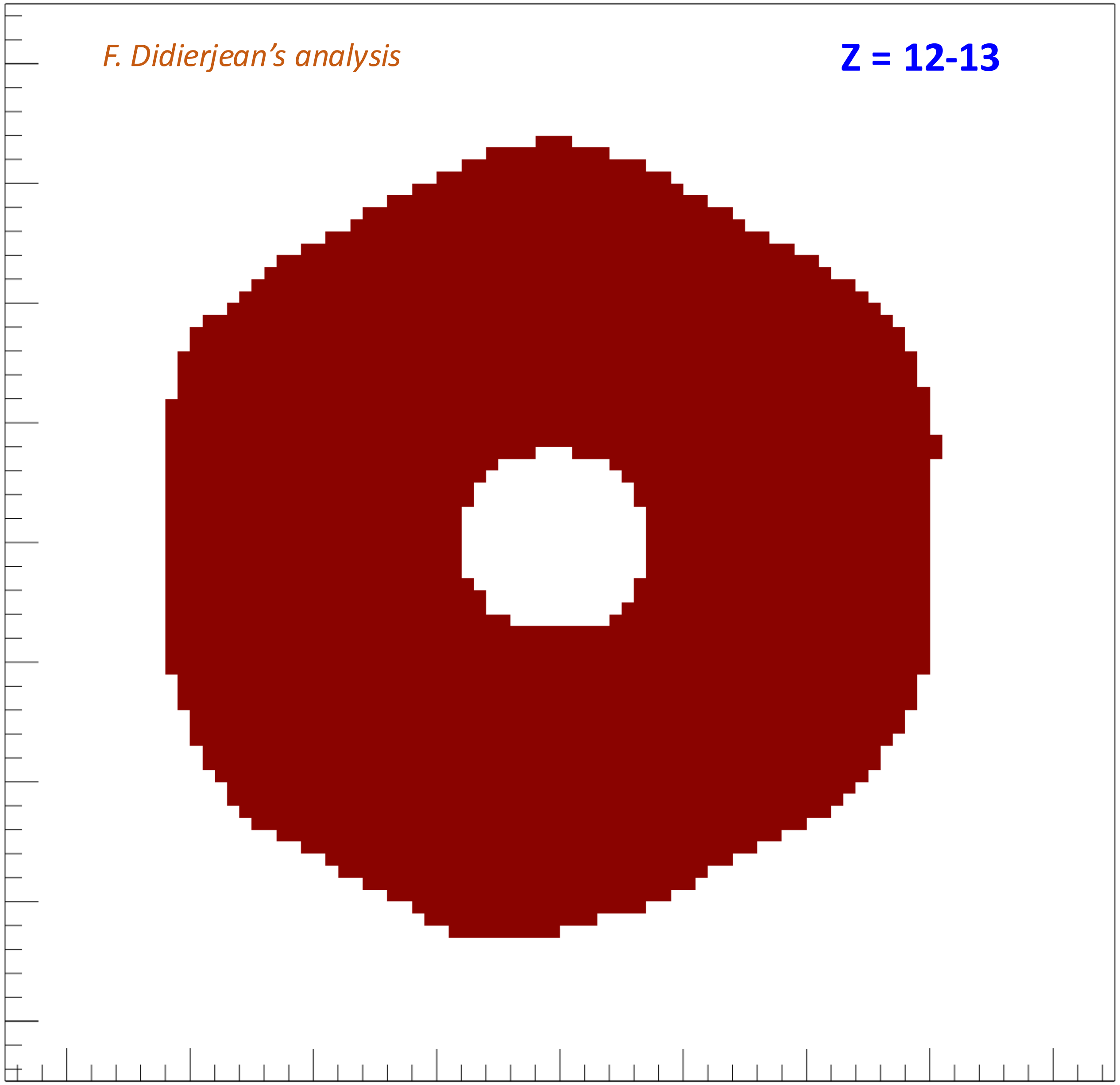


A005

A005 tomography – the link between 2D and 3D scans

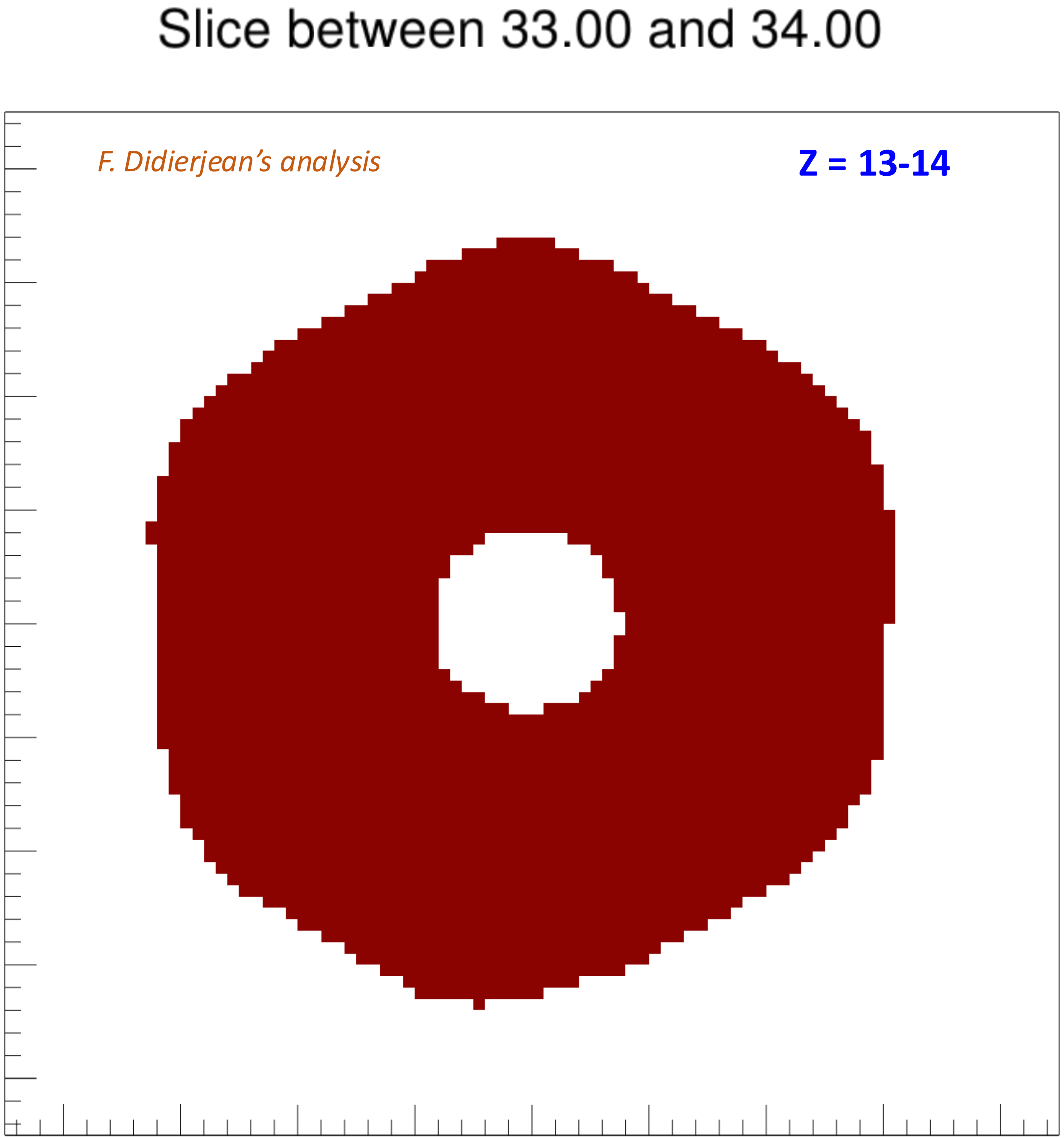
- New work on A005
  - Transversal cuts

Slice between 34.00 and 35.00



A005

- **A005 tomography – the link between 2D and 3D scans**
  - New work on A005
    - Transversal cuts

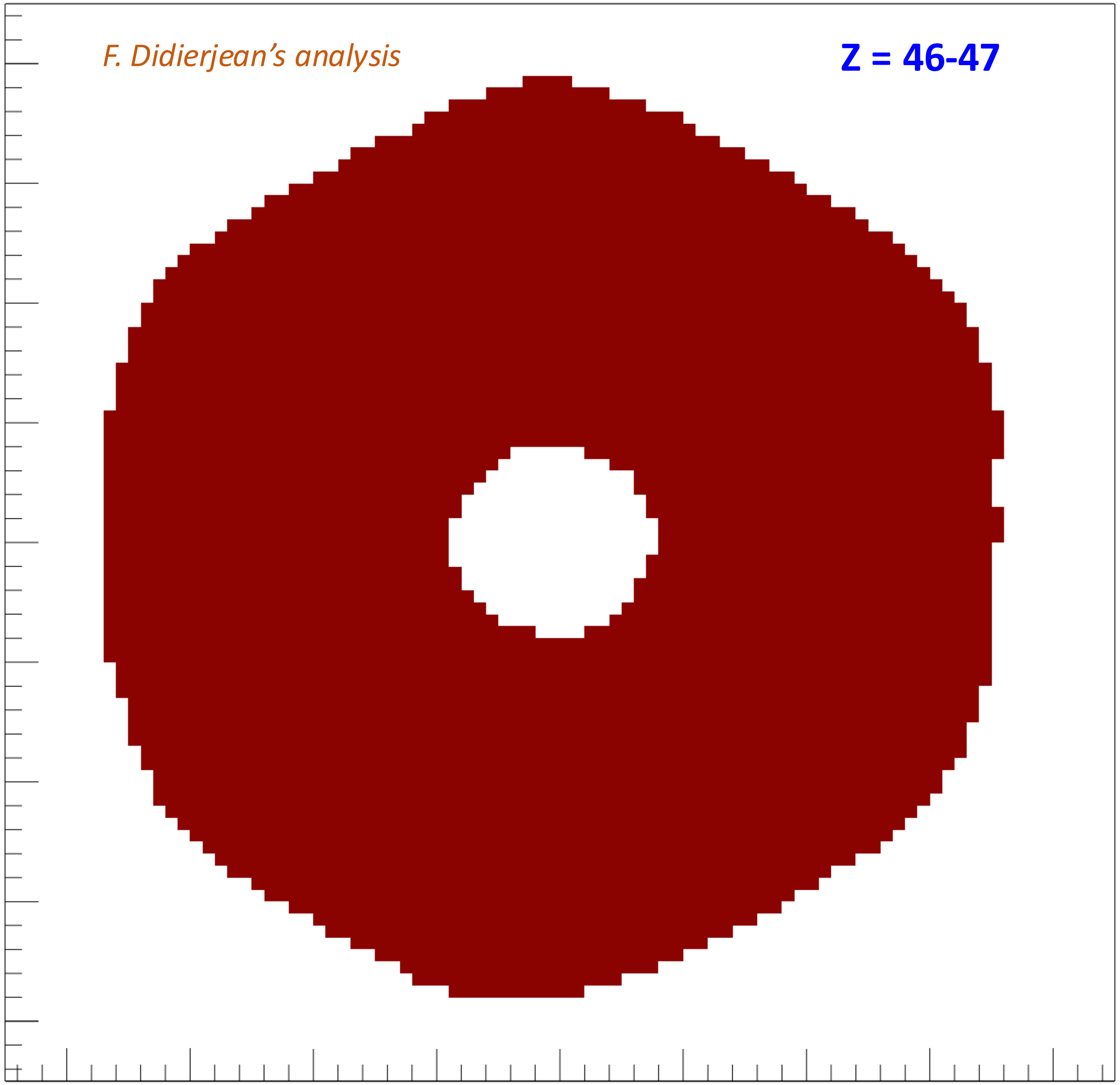


A005

❑ A005 tomography – the link between 2D and 3D scans

- ➢ New work on A005
  - ❖ Transversal cuts

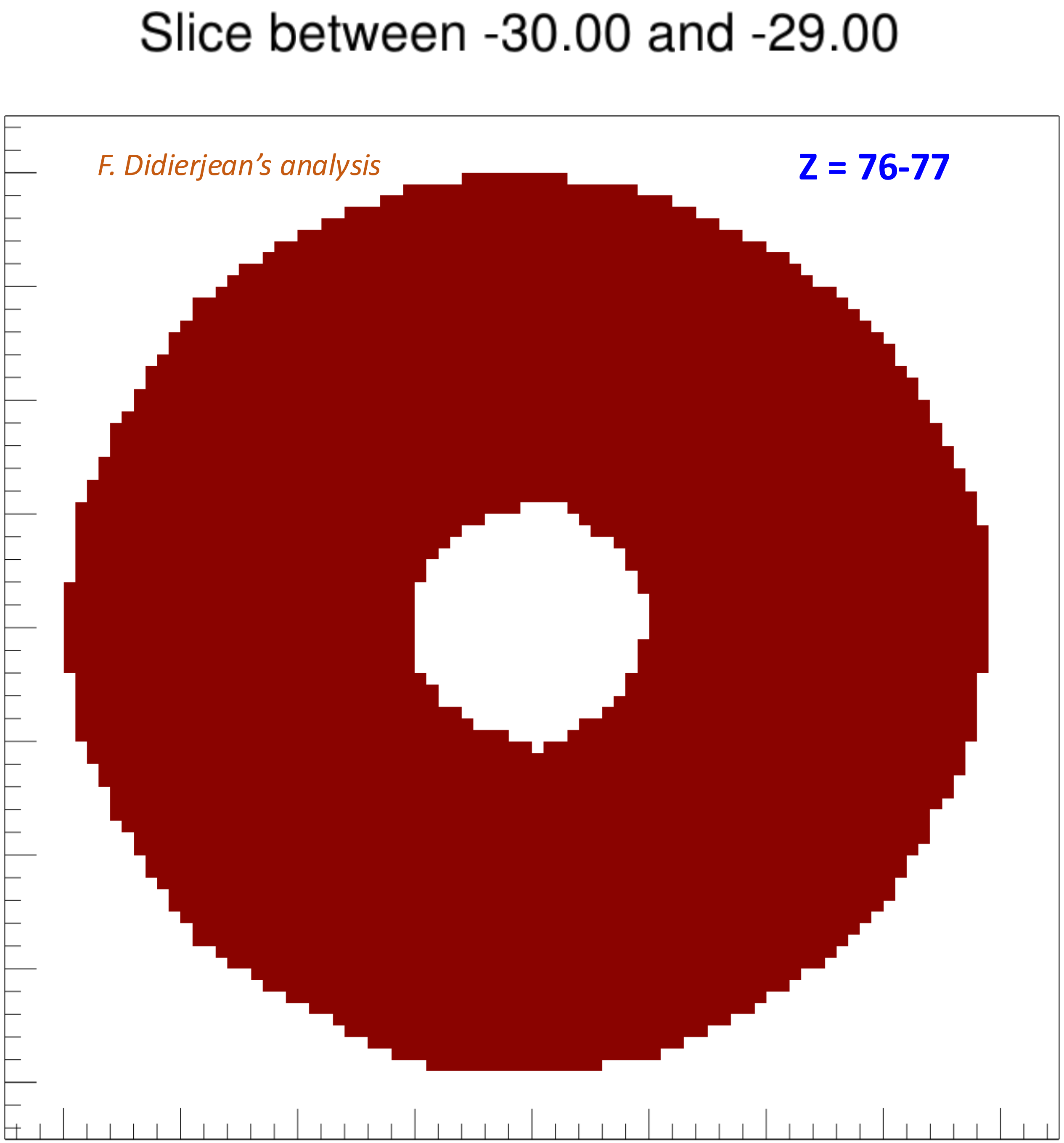
Slice between 0.00 and 1.00



A005

A005 tomography – the link between 2D and 3D scans

- New work on A005
  - Transversal cuts
  - Front hole due to the crossing of the 3 segmentation lines
  - Still present at z = 3-4 mm
  - Bored hole appears at z = 10-11 mm
  - Hole diameter increases from z = 76-77 mm



A005

A005 tomography – the link between 2D and 3D scans

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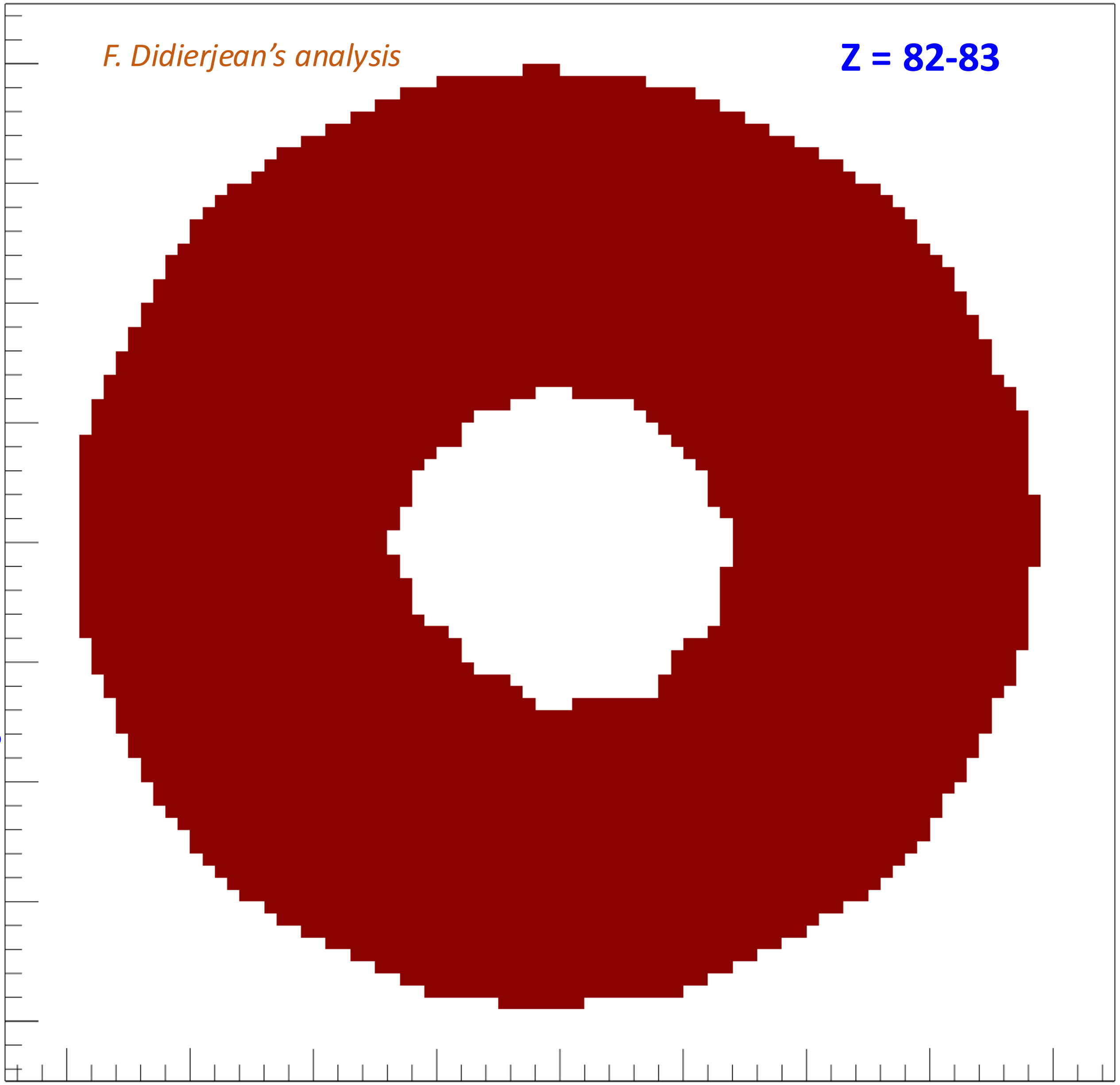
  - Hole diameter increases from z = 76-77 mm

  - Hole diameter gets asymmetric from z = 82-83 mm

Slice between -36.00 and -35.00



A005

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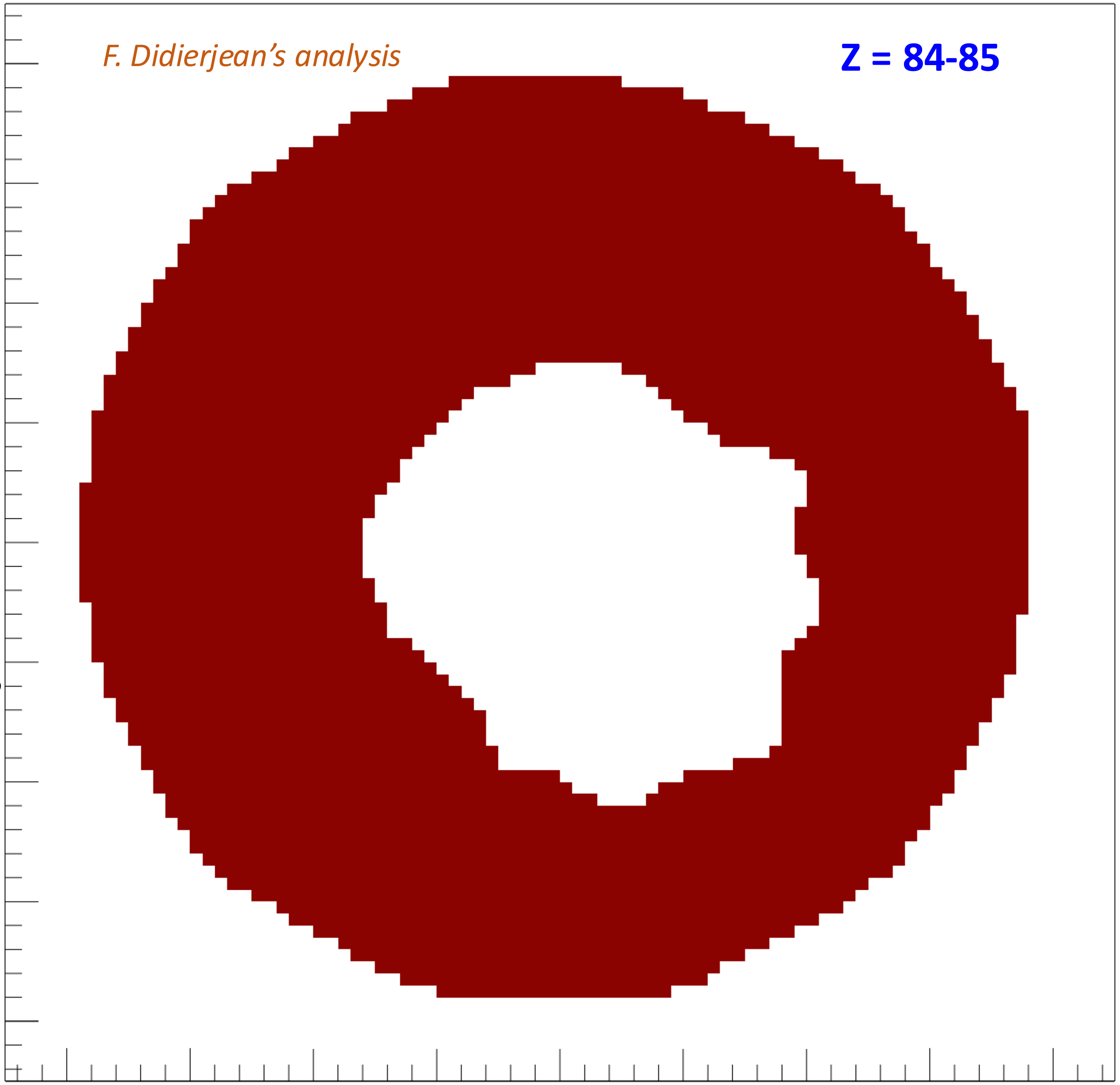
  - Bored hole appears at z = 10-11 mm
  - Hole diameter increases from z = 76-77 mm
  - Hole diameter gets asymmetric from z = 82-83 mm

  - Very asymmetric!!

Slice between -38.00 and -37.00

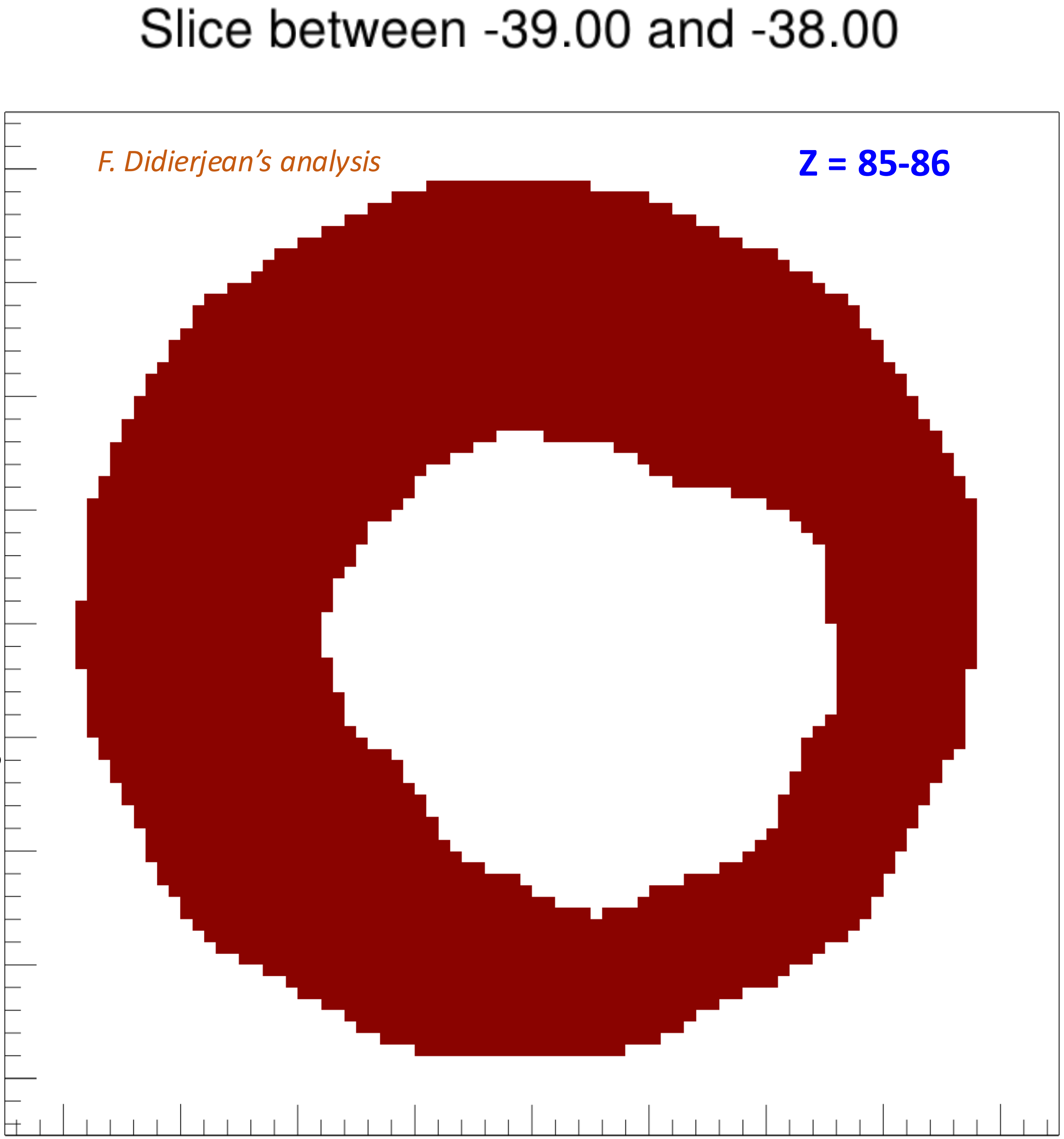


A005

A005 tomography – the link between 2D and 3D scans

- New work on A005
  - Transversal cuts
  - Front hole due to the crossing of the 3 segmentation lines
  - Still present at z = 3-4 mm
  - Bored hole appears at z = 10-11 mm
  - Hole diameter increases from z = 76-77 mm
  - Hole diameter gets asymmetric from z = 82-83 mm

  - Very asymmetric!!



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A005 tomography – the link between 2D and 3D scans

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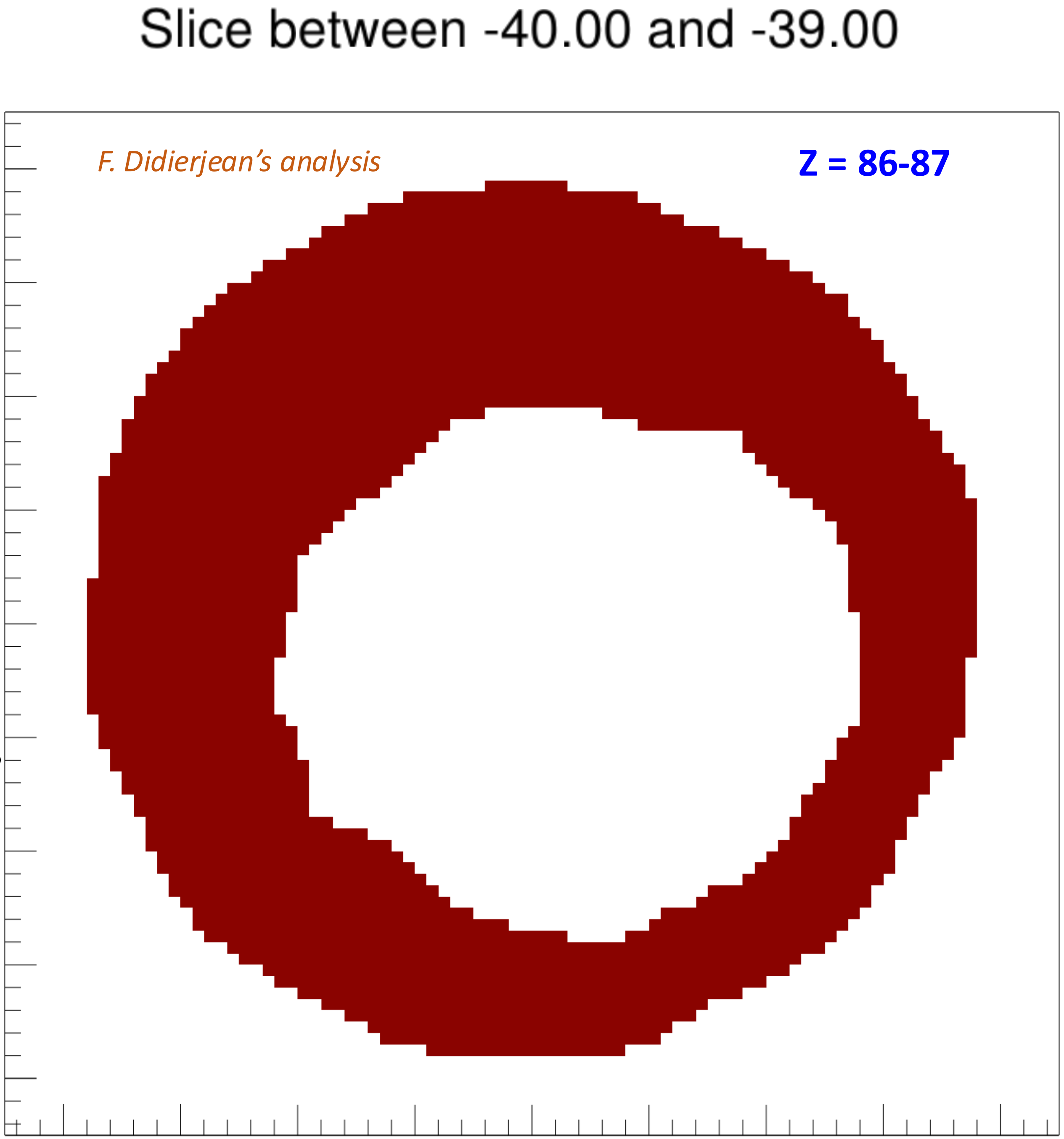
  - The outer diameter seems also to slightly reduce!



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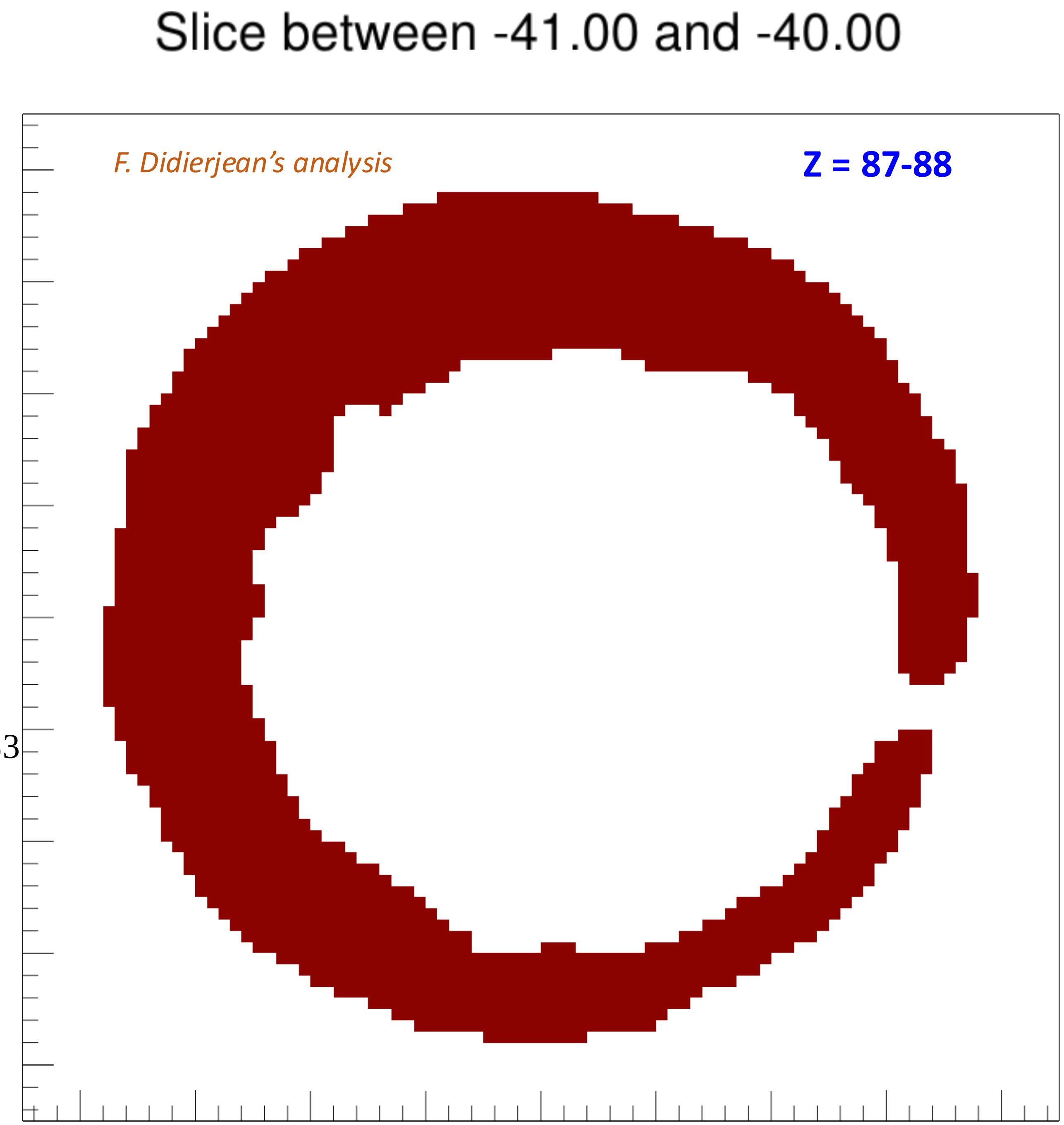

A005

A005 tomography – the link between 2D and 3D scans

- New work on A005
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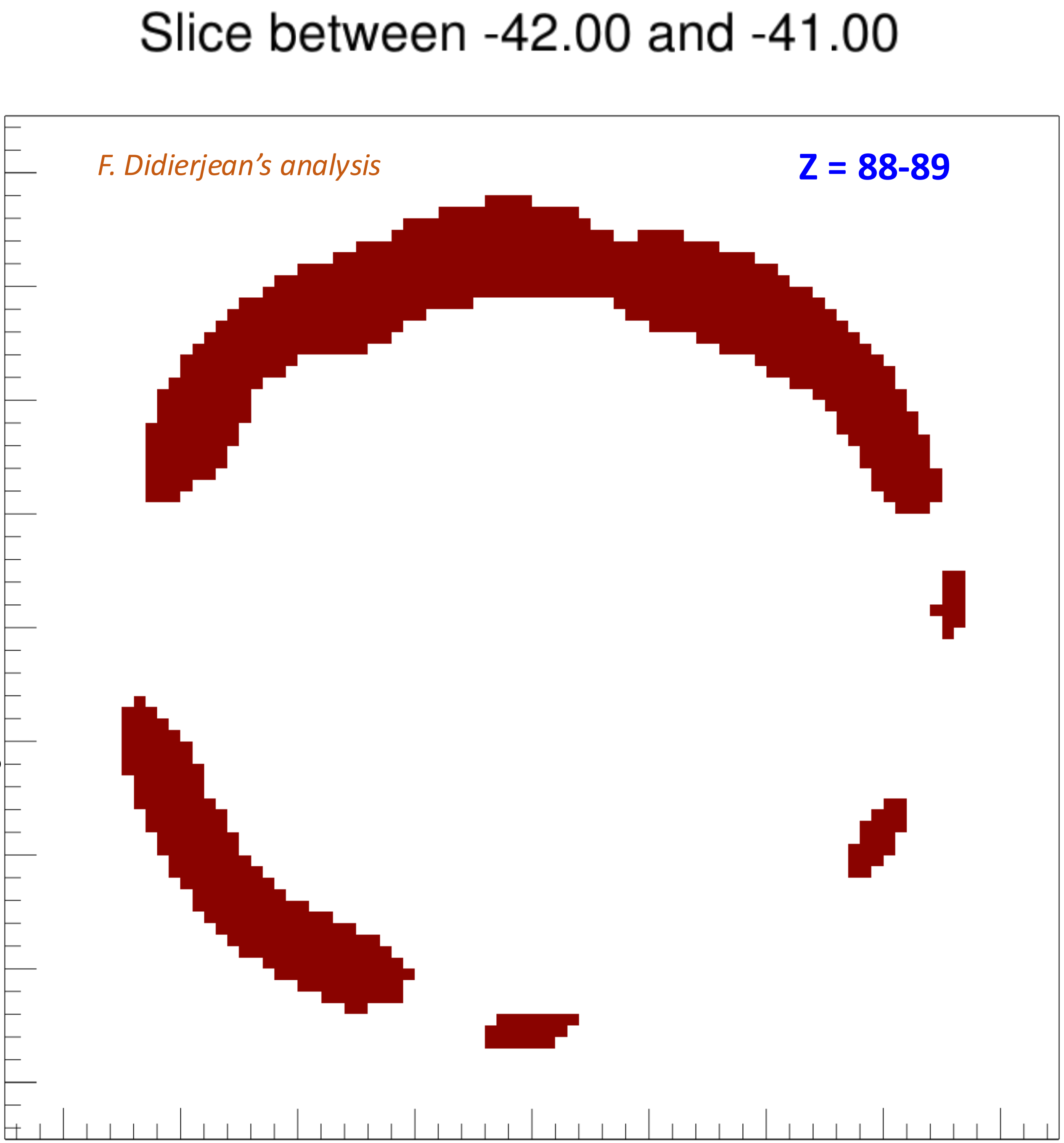

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A005 tomography – the link between 2D and 3D scans

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  - Transversal cuts
  - Front hole due to the crossing of the 3 segmentation lines
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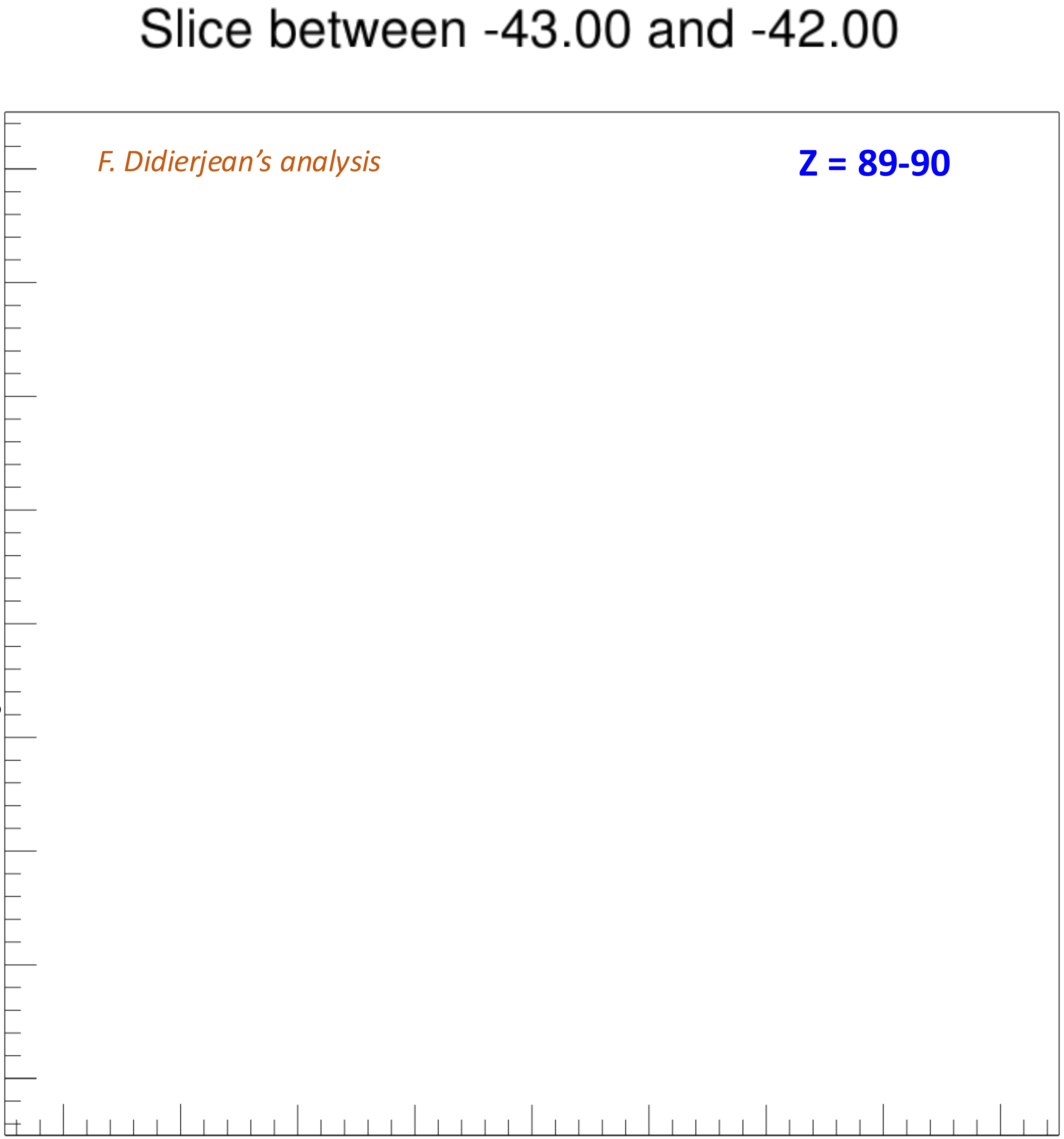
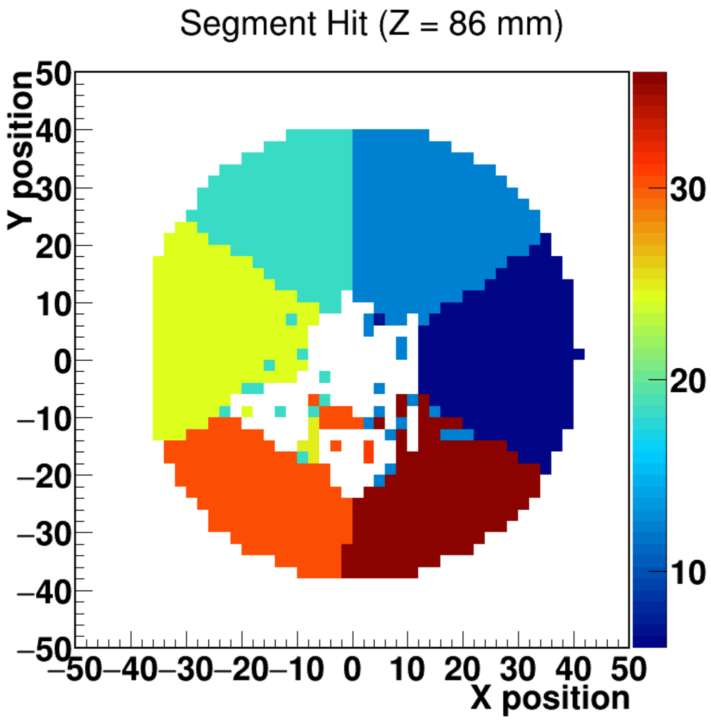
  - Hole diameter increases from z = 76-77 mm
  - Hole diameter gets asymmetric from z = 82-83 mm
  - Very asymmetric!!
  - The outer diameter seems also to slightly reduce!

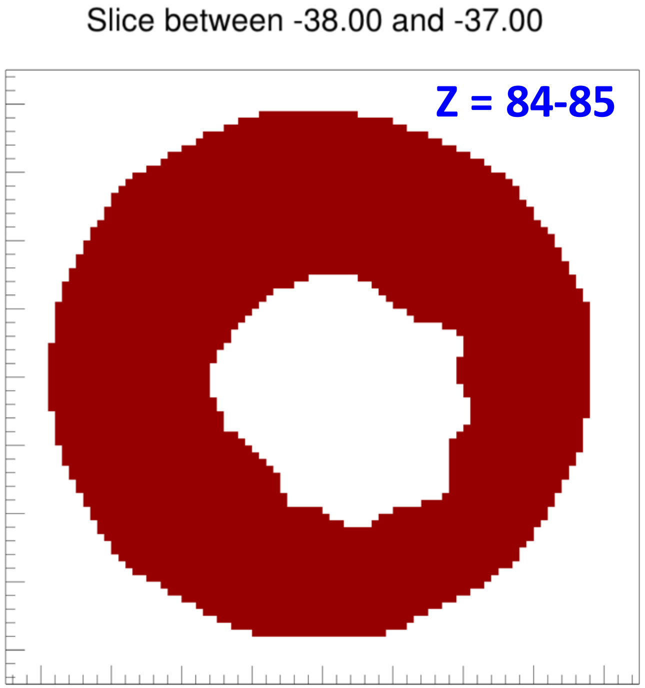
  - 1 mm before the end of the crystal, no Ge volume is active!!!



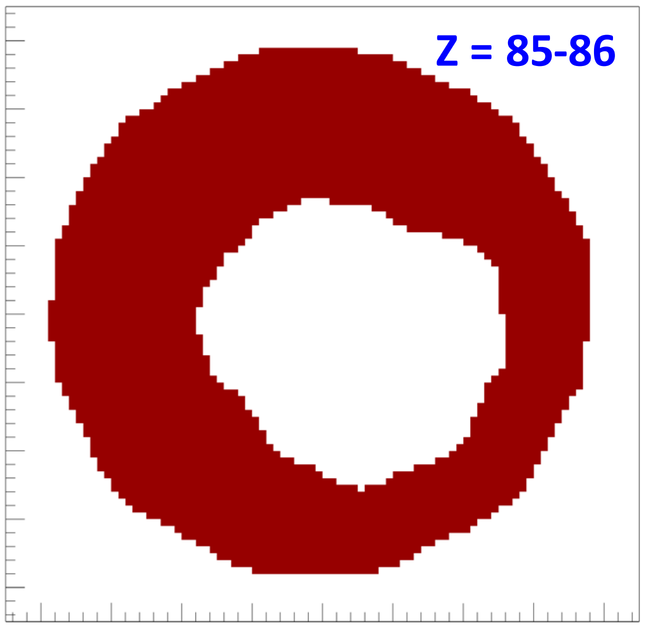
A005 tomography



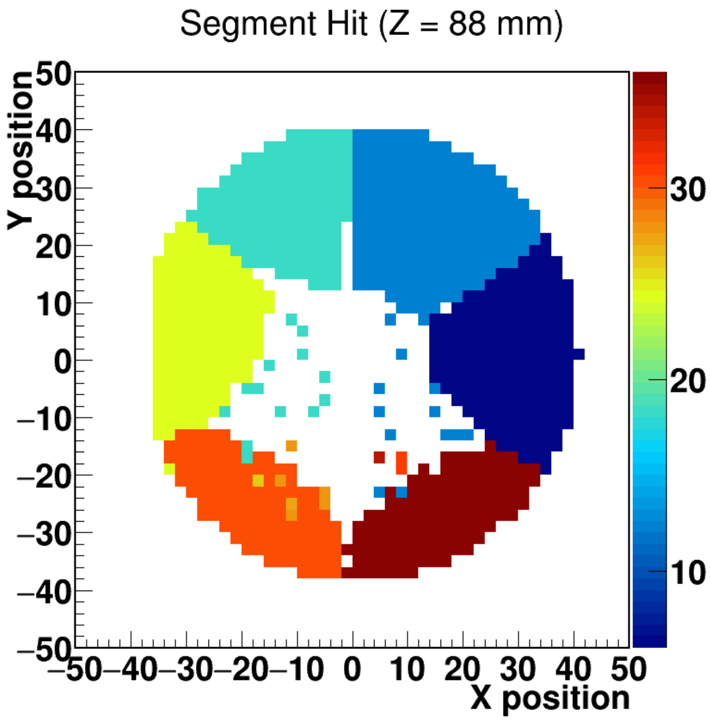
A. Corbel's analysis



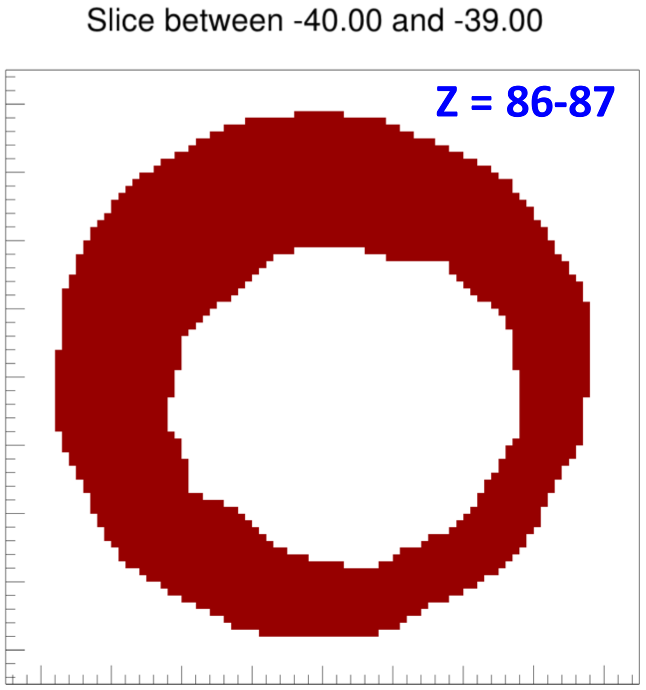
F. Didierjean's analysis



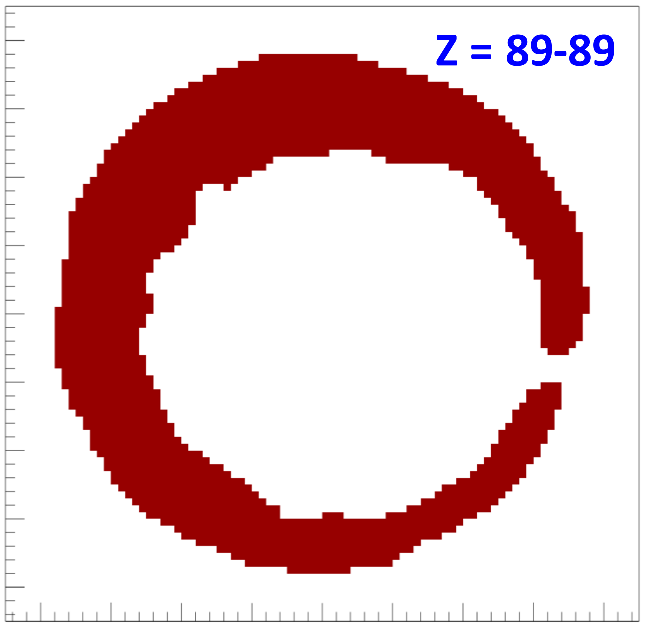
A005 tomography



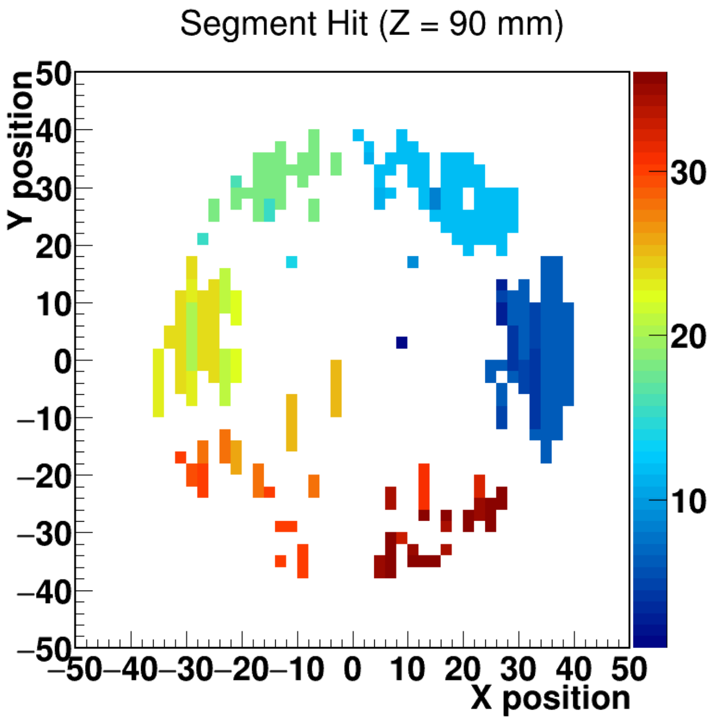
A. Corbel's analysis



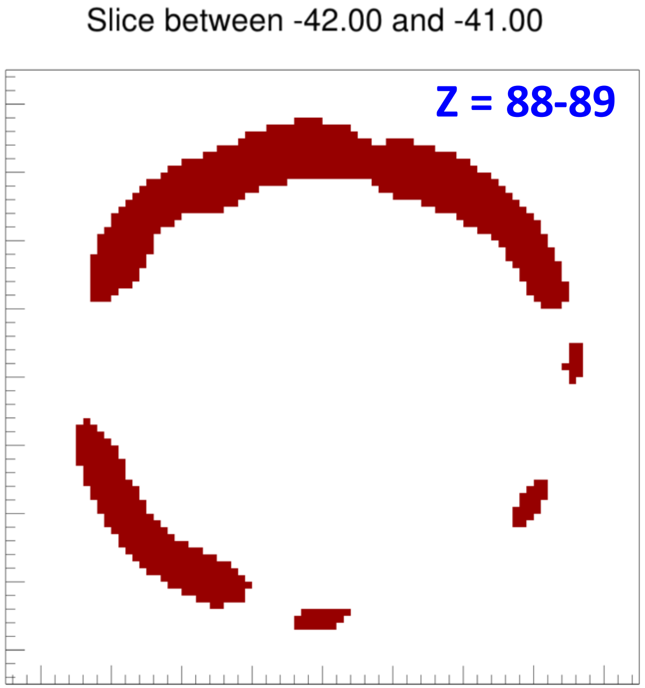
F. Didierjean's analysis



A005 tomography



A. Corbel's analysis



F. Didierjean's analysis

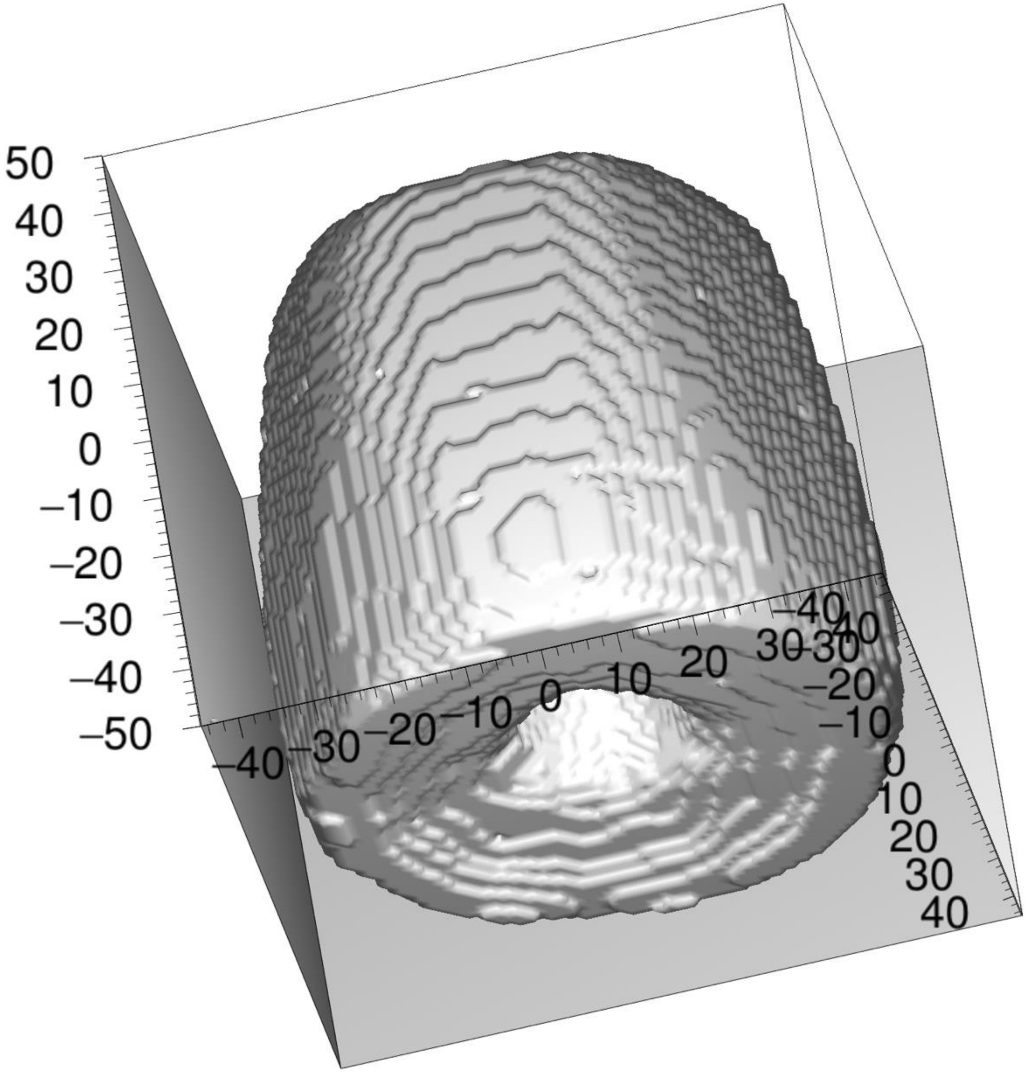
A005 tomography

❑ A005 tomography or 3D scans?

- Perspectives
  - Play with threshold to confirm the inactive volumes
  - Evaluate the volume loss
  - Interact with M. Labiche for implementation in GEANT4 simulations

  - Perform the tomography or a full database with 1 mm pitch on another A crystal, on at least one B and one C

  - Or produce a 1 mm pitch database from which a similar model can be extracted (20 TB, 36d)



Special thanks to

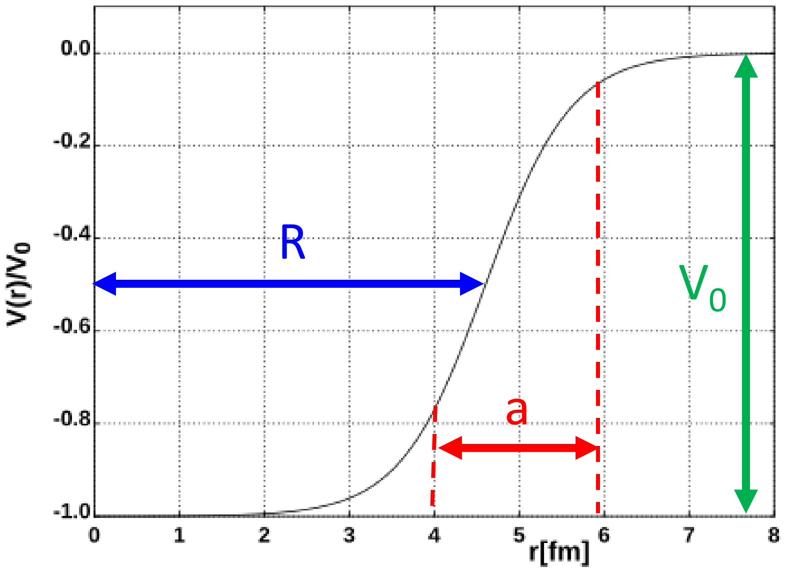
- **The AGATA collaboration**
  - For B006, S001 and A005 loans
- **M. Ginsz, B. De Canditiis, A. Corbel**
  - PhD students for their extremely valuable inputs and developments
- **The IPHC AGATA team**
  - F. Didierjean, M. Filliger, J. Ljungvall, M. Moukaddam and M-H. Sigward

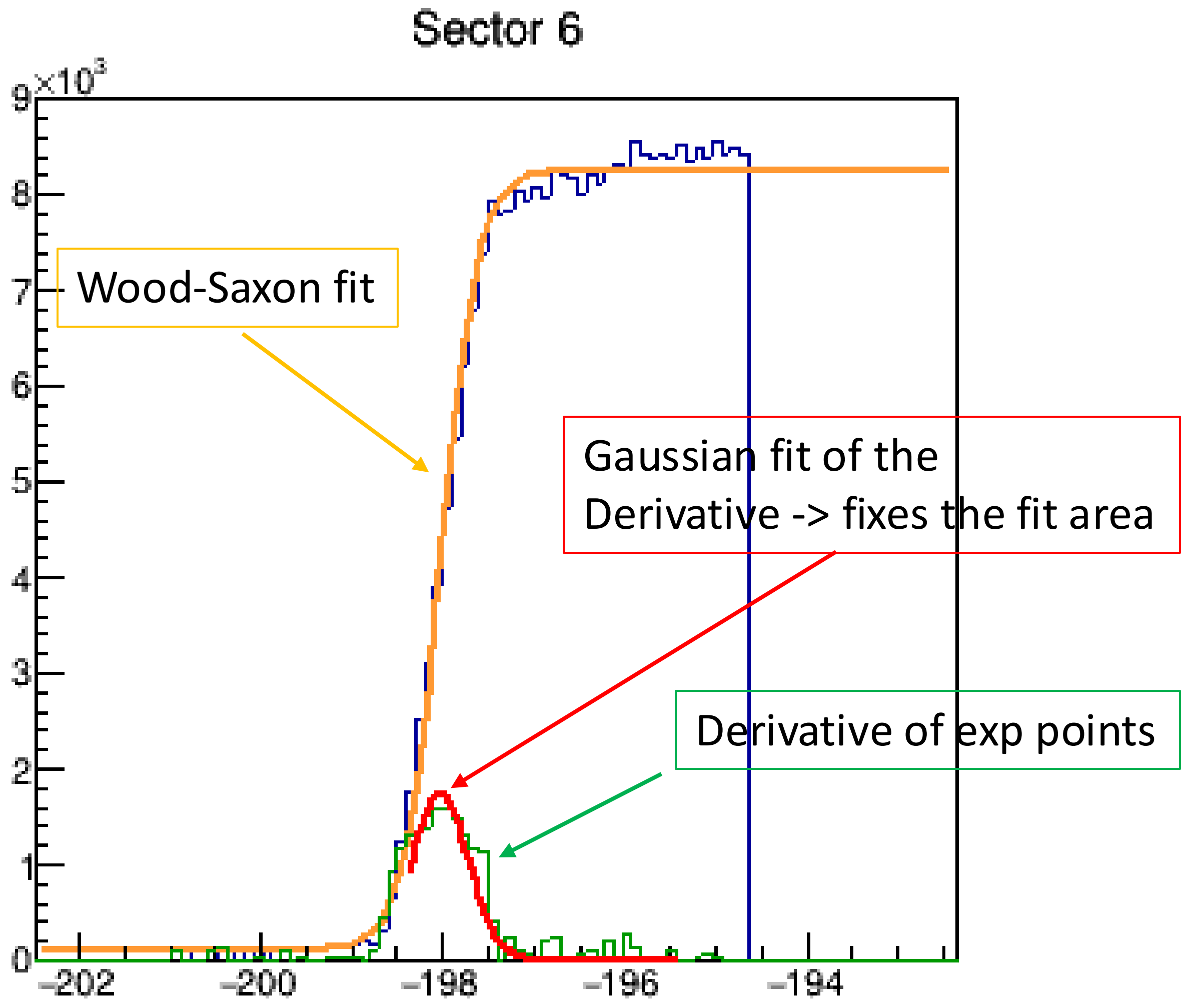
Thanks for your attention

Scan fit using Wood-Saxon function

$$V(r) = -\frac{V_0}{1+\exp(\frac{r-R}{a})}$$

3 parameters: V_0, R and a





The Strasbourg PSCS technique

Perspectives

- Mechanical upgrades
  - On the detector holder – équerre
  - Optical module
  - Support bars for the collimator
- Sources
  - Search for smaller size sources with the same activity (presently diam. 3 mm, height 3 mm)
- 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
- Compare AGATA detector databases
  - Compare A, B and C crystal databases
  - If differences are observed -> compare 2 A crystals, 2 B crystals and 2 C crystals
- Scan new detectors
  - New contacts (Padova-LNL devpt)
  - Scan a crystal and the same crystal after coating
  - Point-contact detectors
  - Neutron damaged detector before and after annealing