OASIS WORKSHOP
15/06/2026
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ML for Basis Generation

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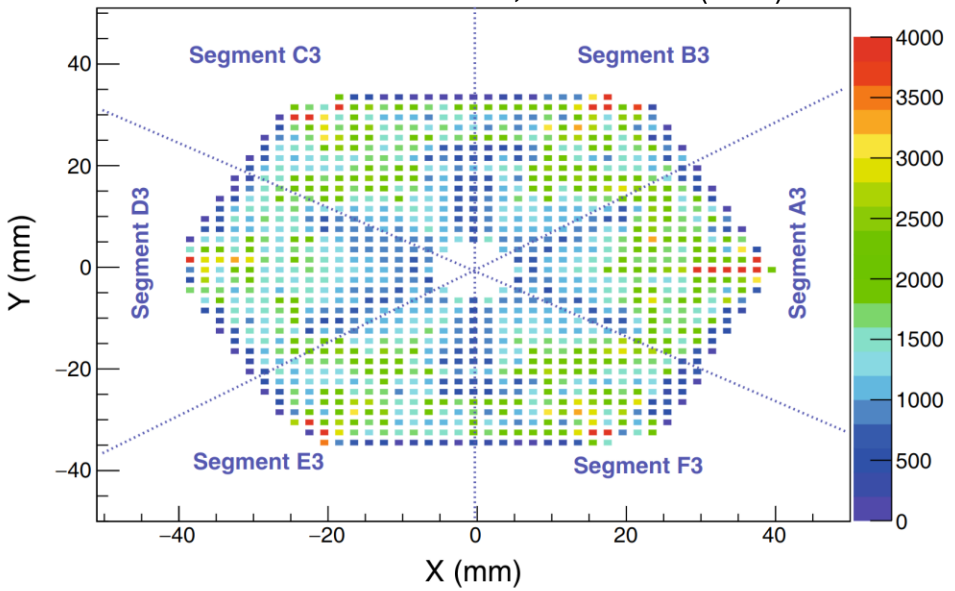
Pulse Shape Analysis

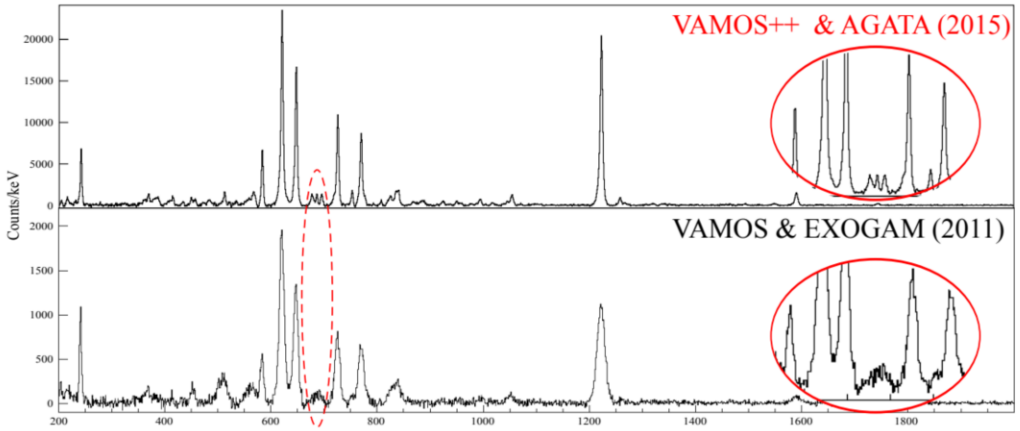
- compare super-pulse (37x60) to standard library of signals
- find the one minimizing a FOM with adaptive grid search

Korichi A. and Lauritsen L., EPJA 55 121 (2019)



AGATA Detector Library

- Calculated detector response function
- Cartesian grid of 2 mm along all axes
- 700-2000 interaction points per segment



We know that PSA works but

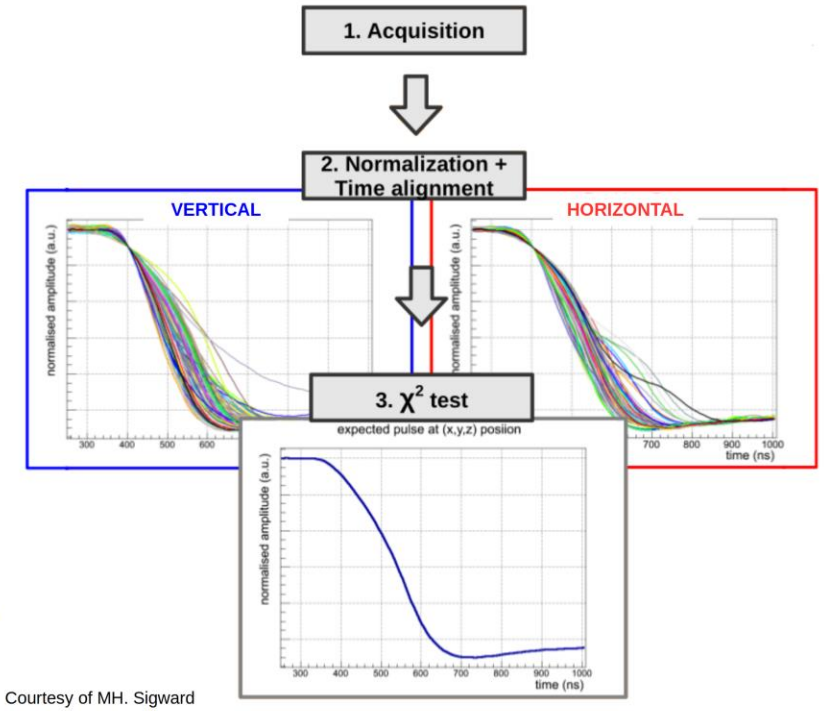
- Errors?
- Margin for improvement?
- Multihit problem?

Switch from calculated basis to experimental basis.

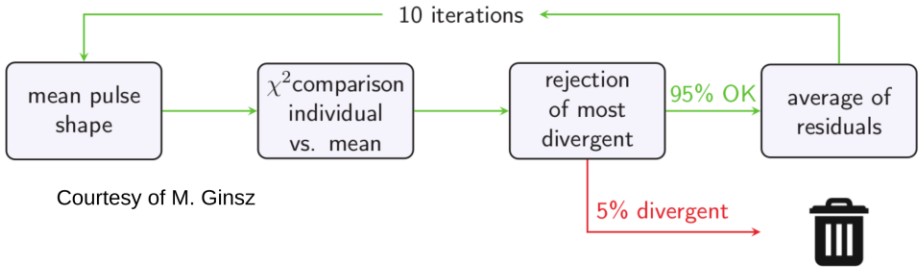
Strasbourg scanning table

Pulse Shape Comparison Scan method

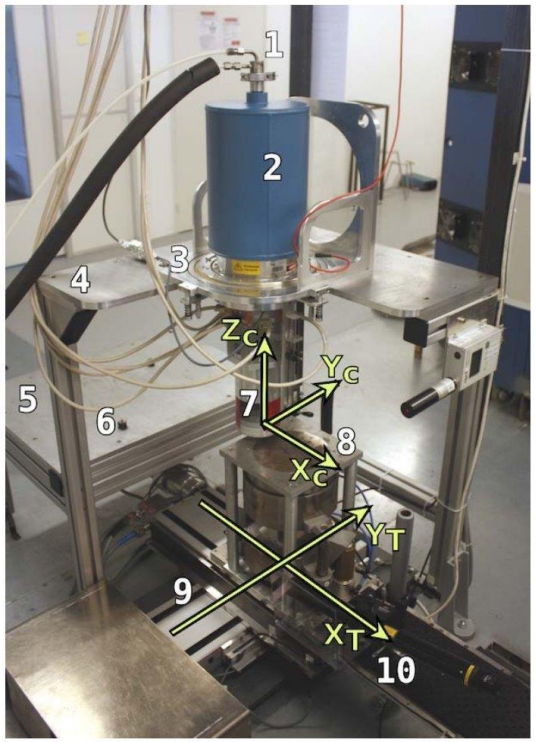
- 2x 2D scans (vertical and horizontal) matched through χ^2 minimization
- ^{137}Cs, ^{152}Eu
- Iterative selection of traces to calculate mean signal of voxel



Courtesy of MH. Sigward



Courtesy of M. Ginsz



✓ motorized collimator (~10 µm)

✓ laser alignment system

→ good position resolution

✗ TNT2 electronics

→ different electronics from currently used one might alter signal shape

Current scans

S001

Symmetric crystal, not used in honeycomb

Thesis of B. de Canditiis, benchmark for PSCS method

NN basis shows less dispersion than PSCS one

A005

Detector 03A @ GANIL

Scanned in July 2024, 2 mm grid in both XY and XZ

NNBasis applied to both scanned and reference dataset
ADL = 4.9 mm, 4.3 keV
AGATAGeFEM = 4.3 mm, 4.05 keV
NN = 2.4 mm, 3.94 keV

Report on this in last AGATA week by Jérémie and Mojahed

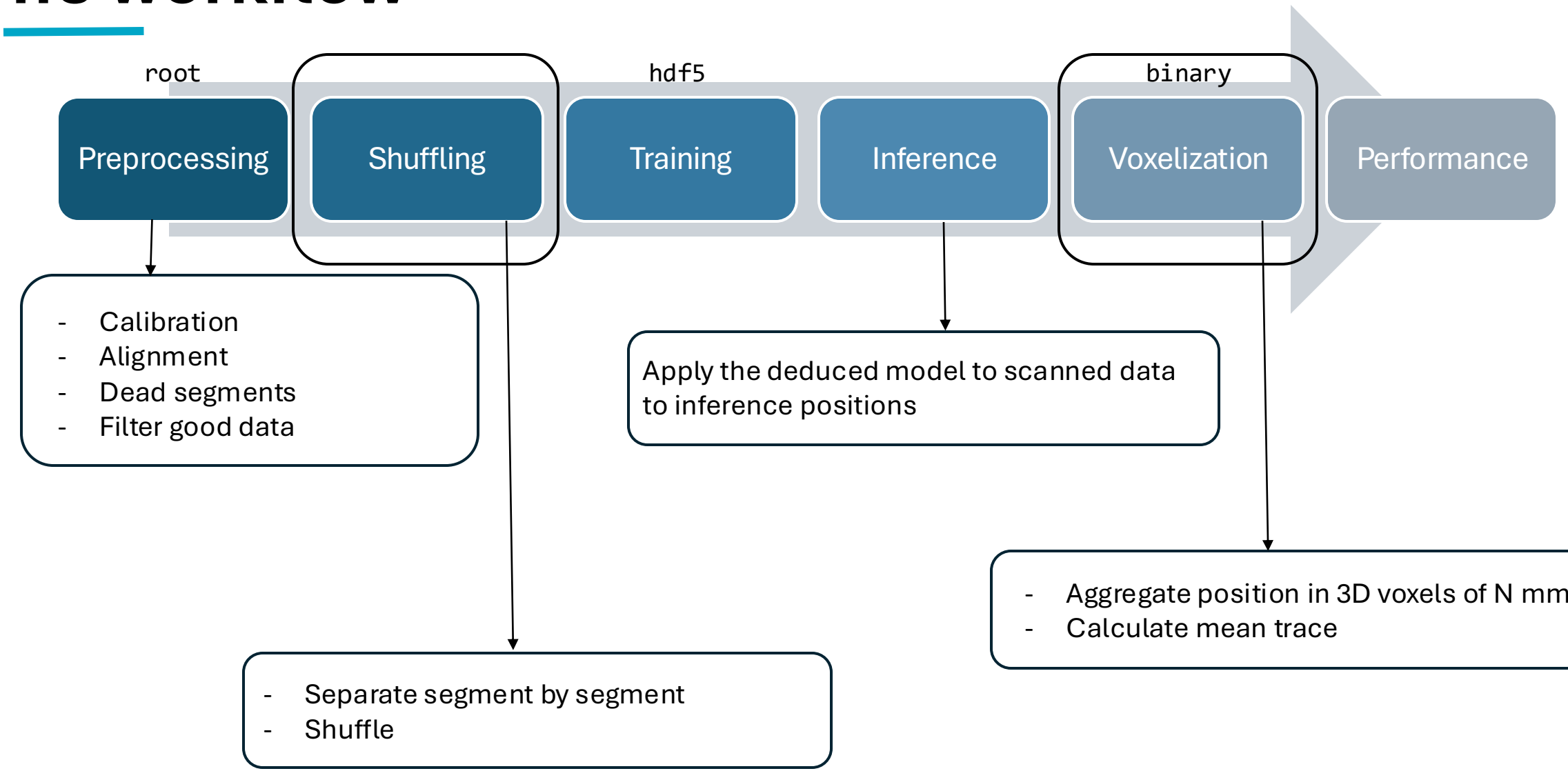
B003

Detector 10B @ GANIL

Scanned in 2025, 1 mm grid in both XY and XZ

Increase by factor 4 of dataset size

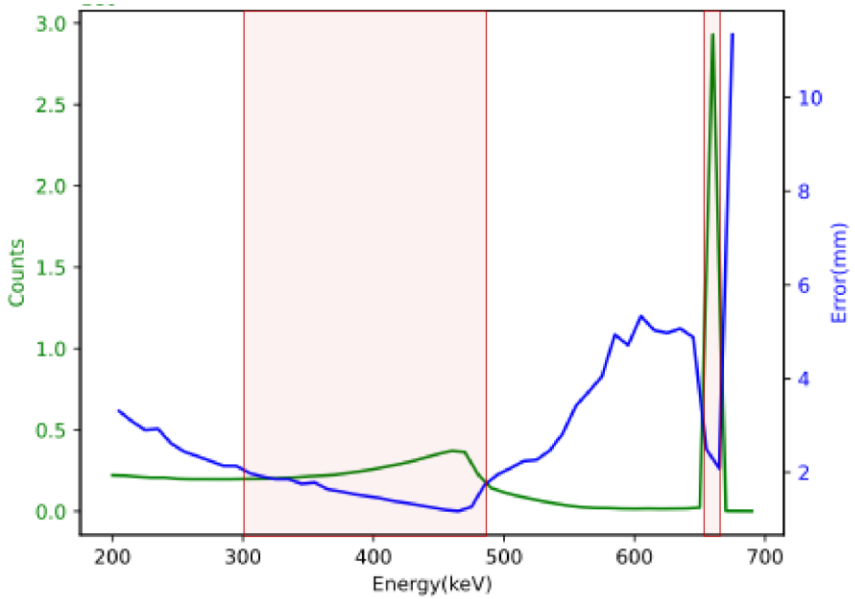
The workflow



The workflow

Preprocessing → Shuffling → Training → Inference → Voxelization → Performance

- Calibration
- Alignment
- Dead segments
- Filter good data



Baseline = 0

Strong baseline fluctuation in traces

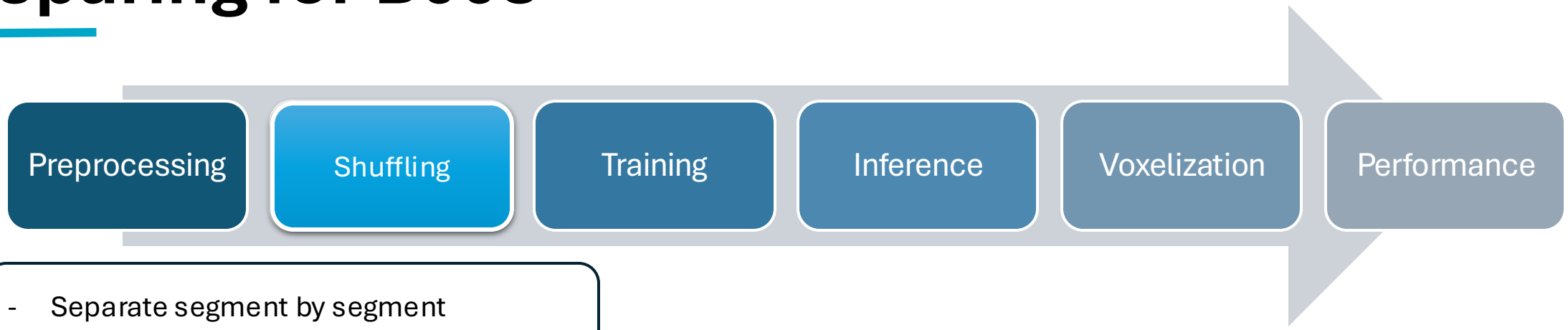
Energy condition: Compton edge

Sensitivity study in different energy regime

Remove non valid segments

Event not corresponding to segments in the scanned position

Preparing for B003



- Separate segment by segment
- Shuffle

`std::shuffle()`

Read whole file and shuffle
~ 140 GB RAM required for largest files

✓ Optimal shuffling
✓ Fast, one-pass
✗ Impossible with B003 dataset

~ 45-60 min per seg

Random access retrieval

Read chunk of file, save it to memory;
std::shuffle() N chunks, write them down

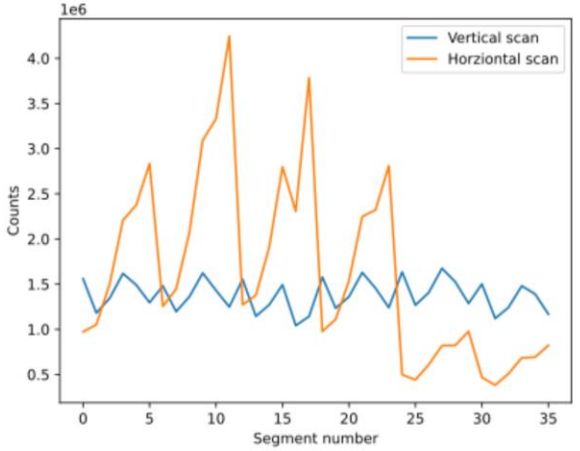
✓ Custom memory requirements
✗ Slow, one-pass with large memory usage
✓ Easy to parallelize

~ 120-150 min per seg

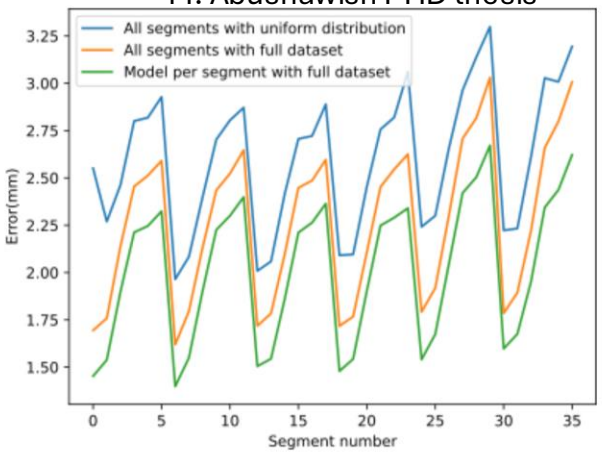
The NN architecture

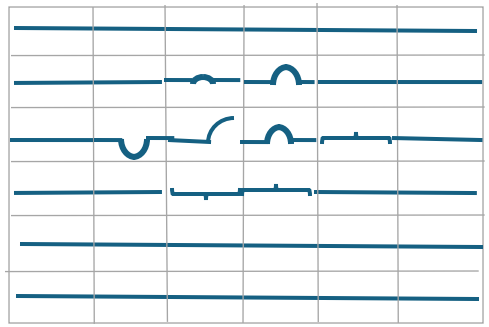
Reconstruct 3D scan with NN from the Strasbourg scanned data

LSTM resilient to time misalignment in traces

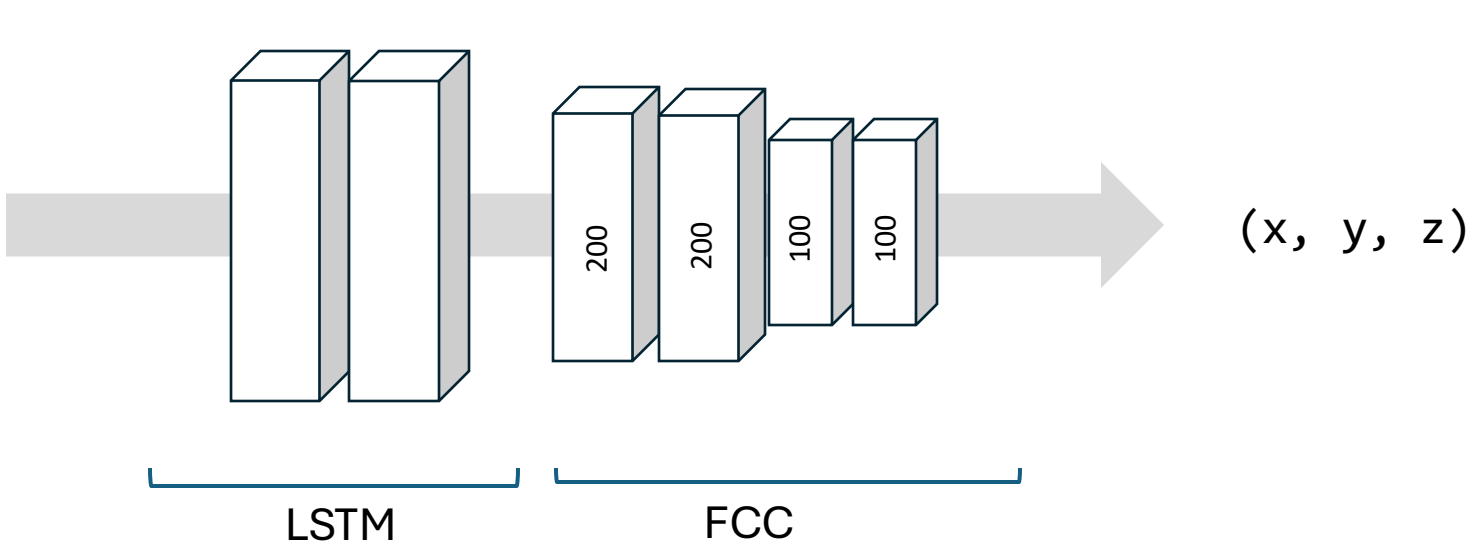


M. Abushawish PHD thesis





(36+1)*60 samples



Loss is euclidean distance, with masked undefined coordinate

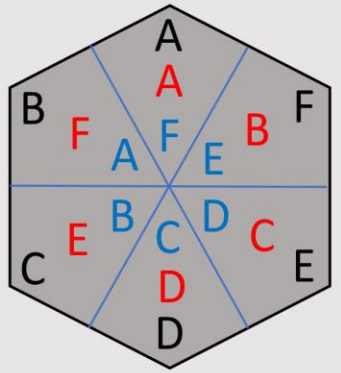
Hyperparams study performed by Mojahed to reduce network size

Preparing for B003

Preprocessing | Shuffling | Training | Inference | **Voxelization** | Performance

Aggregate position in 3D voxels of N mm
Trace expansion

- Rotate coordinates by –63 degrees from IKP to ADL convention
- Dictionary lookup (100-4000 entries in 2 TB set)
- Retrieval, average and std
- Purification of worst traces with iterative process based on curvature
- Reject non physical positions, N<30
- Double trace size (neighbouring average)
- Write ADL format
- Perform PSA



(View from the **BACK** of the detector)

AGATA convention:	**A B C D E F**
Canberra labeling:	**A F E D C B**
IKP labelling:	**F A B C D E**

Conclusions

S001

Symmetric crystal, not used in honeycomb

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A005

Detector 03A @ GANIL

Scanned in July 2024, main benchmark for tests; 2 mm grid in both XY and XZ

Applies to both scanned and reference dataset
ADL = 4.9 mm, 4.3 keV
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HOW DOES IT PERFORM ON OTHER A-TYPES?

B003

Detector 10B @ GANIL

Scanned in 2025, 1 mm grid in both XY and XZ

Increase by factor 4 of dataset size

COMPILE NNB003

APPLY TO REFERENCE DATASET

Thank you for the attention!

https://gitlab.in2p3.fr/m.abushawish/scanning-tables
https://gitlab.in2p3.fr/ip2igamma/scanneddatareader