OAK RIDGE National Laboratory

GROVER – Point-Contact HPGe Quad

J.M. Allmond – ORNL

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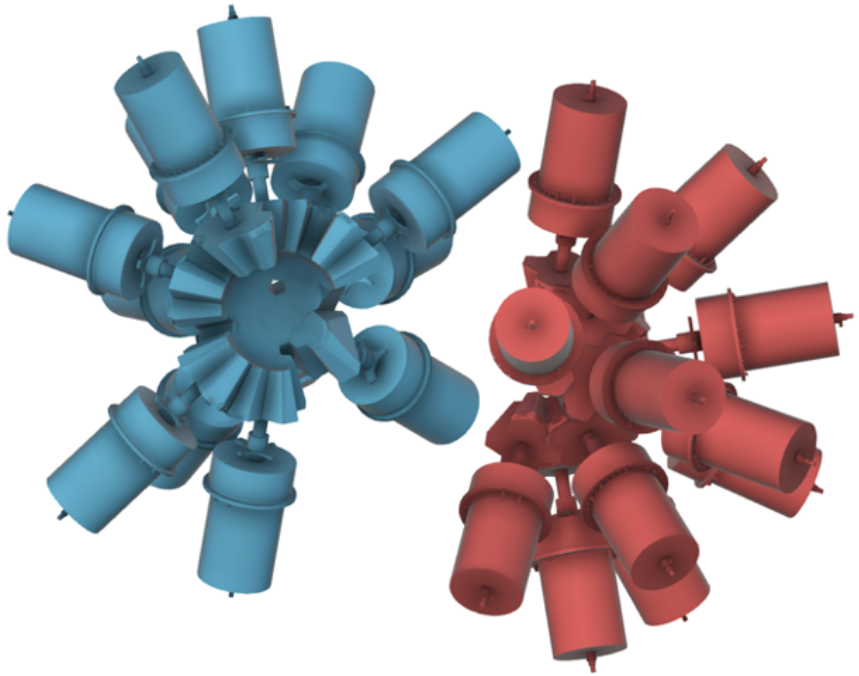
U.S. DEPARTMENT OF ENERGY

GROVER –
A Prototype for DEGA-FDS

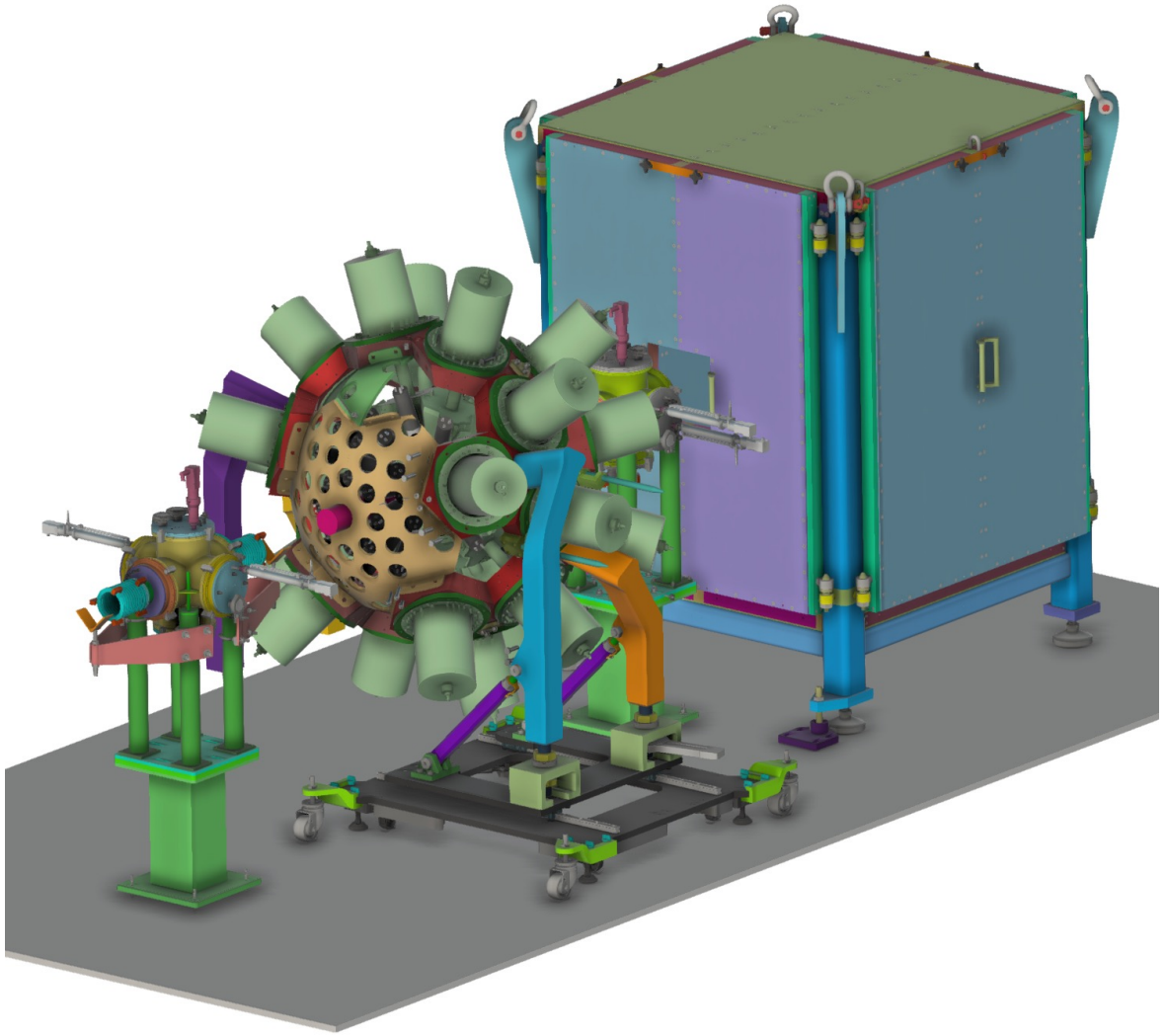
The DEcay Germanium Array – DEGA

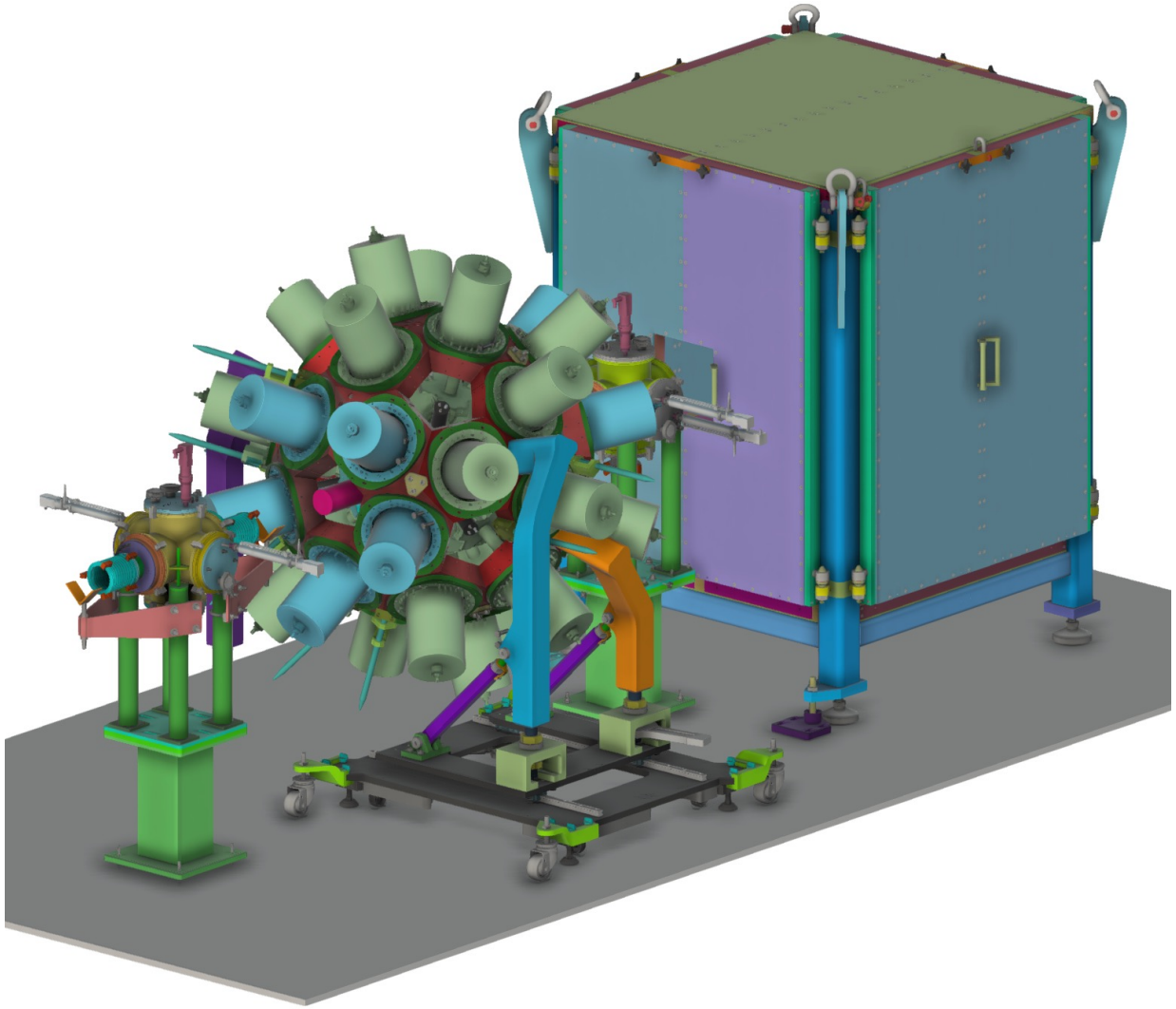


(Preliminary – June 2023)

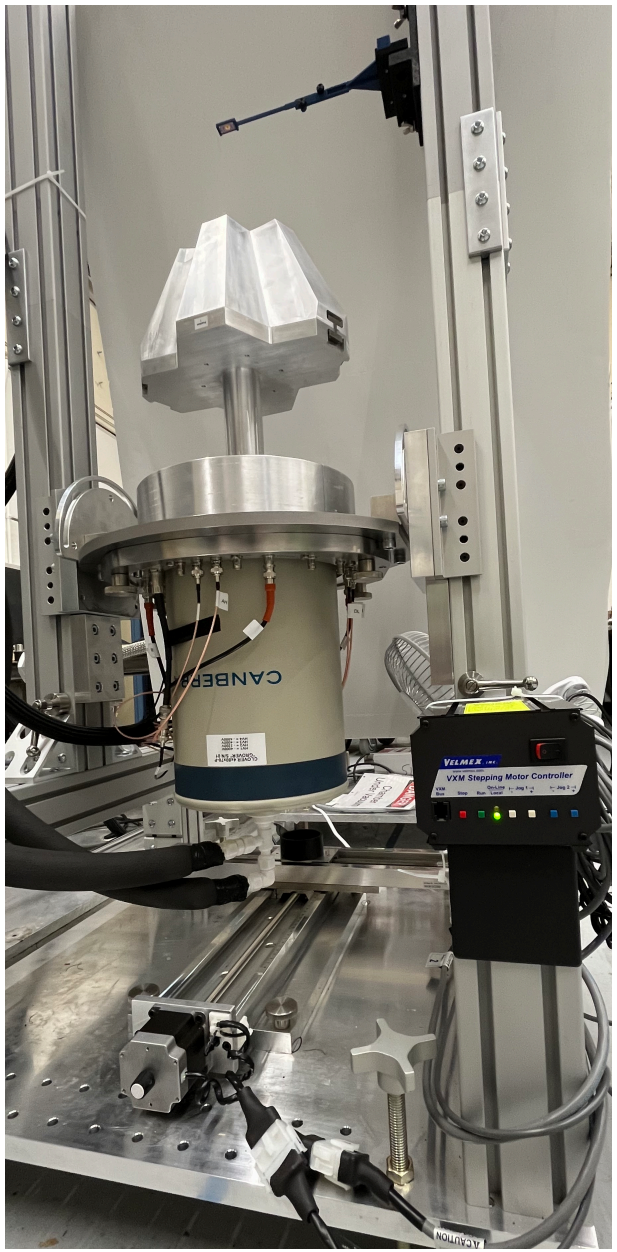
for the FRIB Decay Station (FDS)

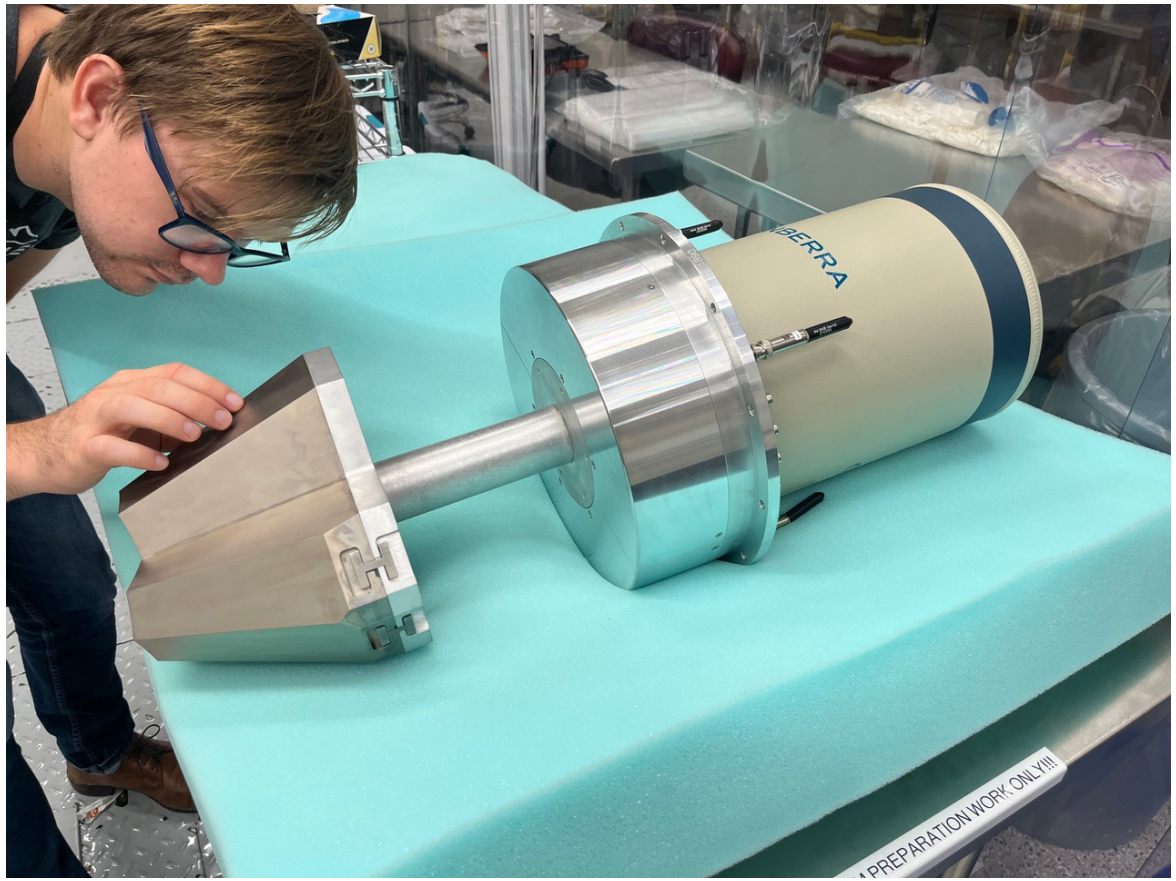
GROVER – A Prototype for DEGA-FDS



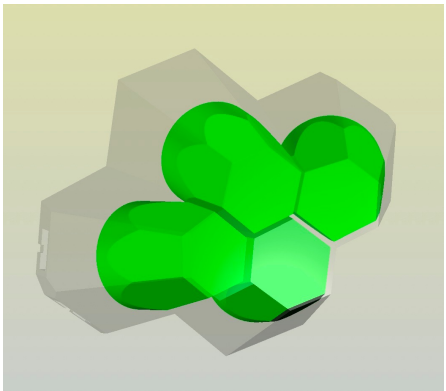


New DEGA Prototype: GROVER





- Four p-type, point-contact, high-purity germanium crystals
- Point contact → low capacitance (noise) + long drift time
- Precut crystal D = 8 cm and L = 7 cm; no center hole
- High energy resolution (0.8 keV at 122 keV)
- Large dynamic range (20 keV to 10 MeV)
- PSD capabilities
- Funded under ICE Award



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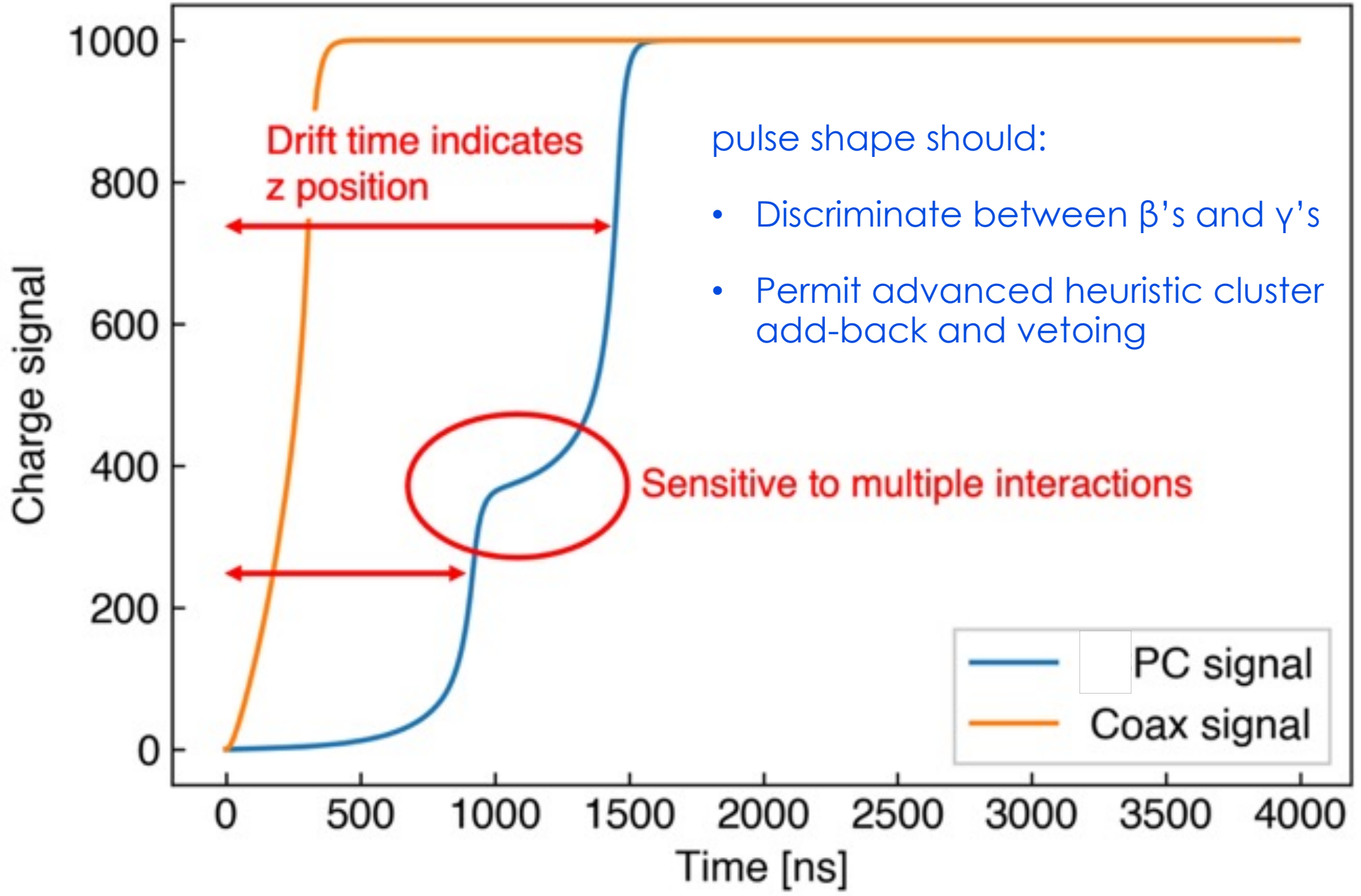
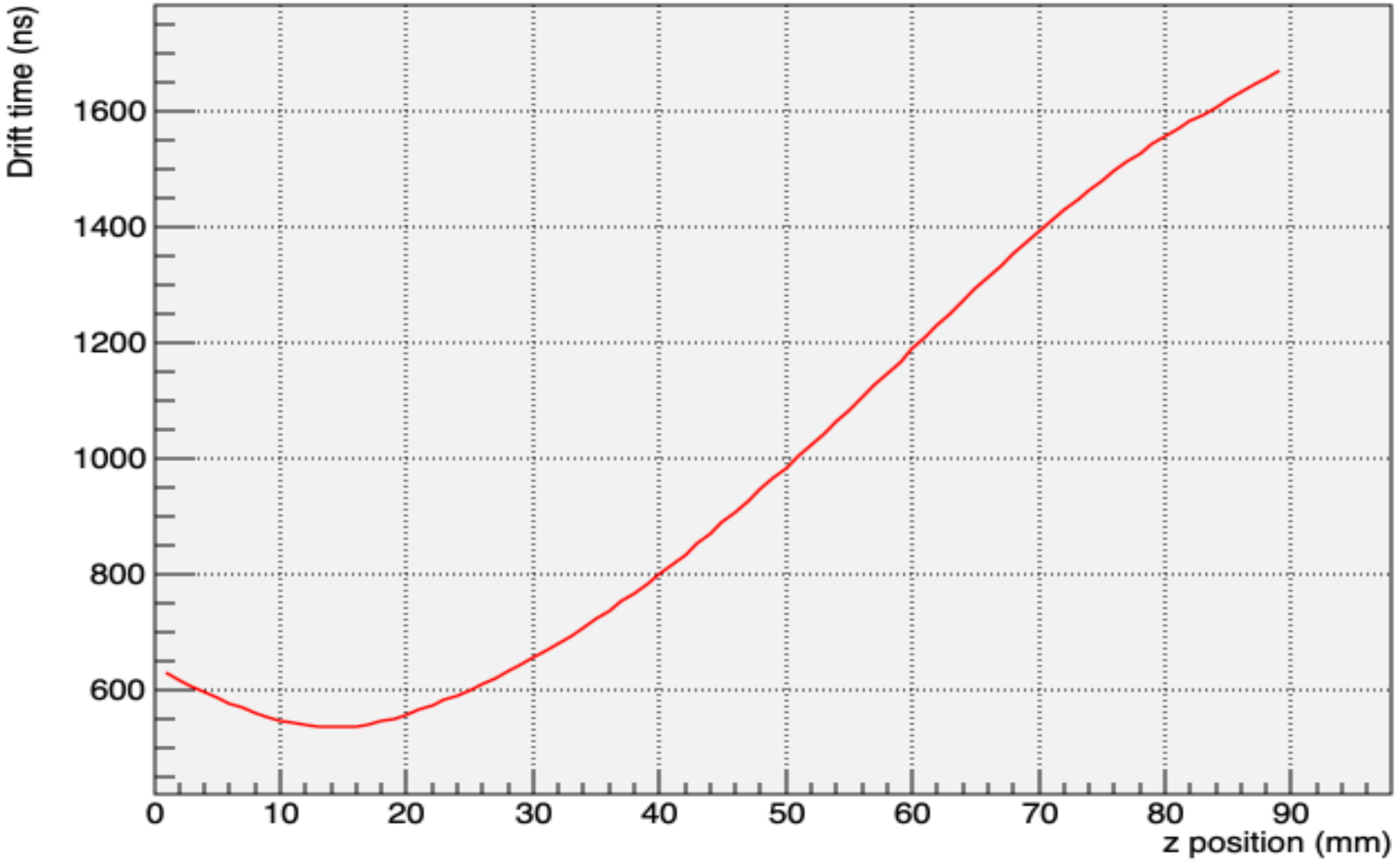


pulse shape should:

- Discriminate between β's and γ's
- Permit advanced heuristic cluster add-back and vetoing

New DEGA Prototype: GROVER

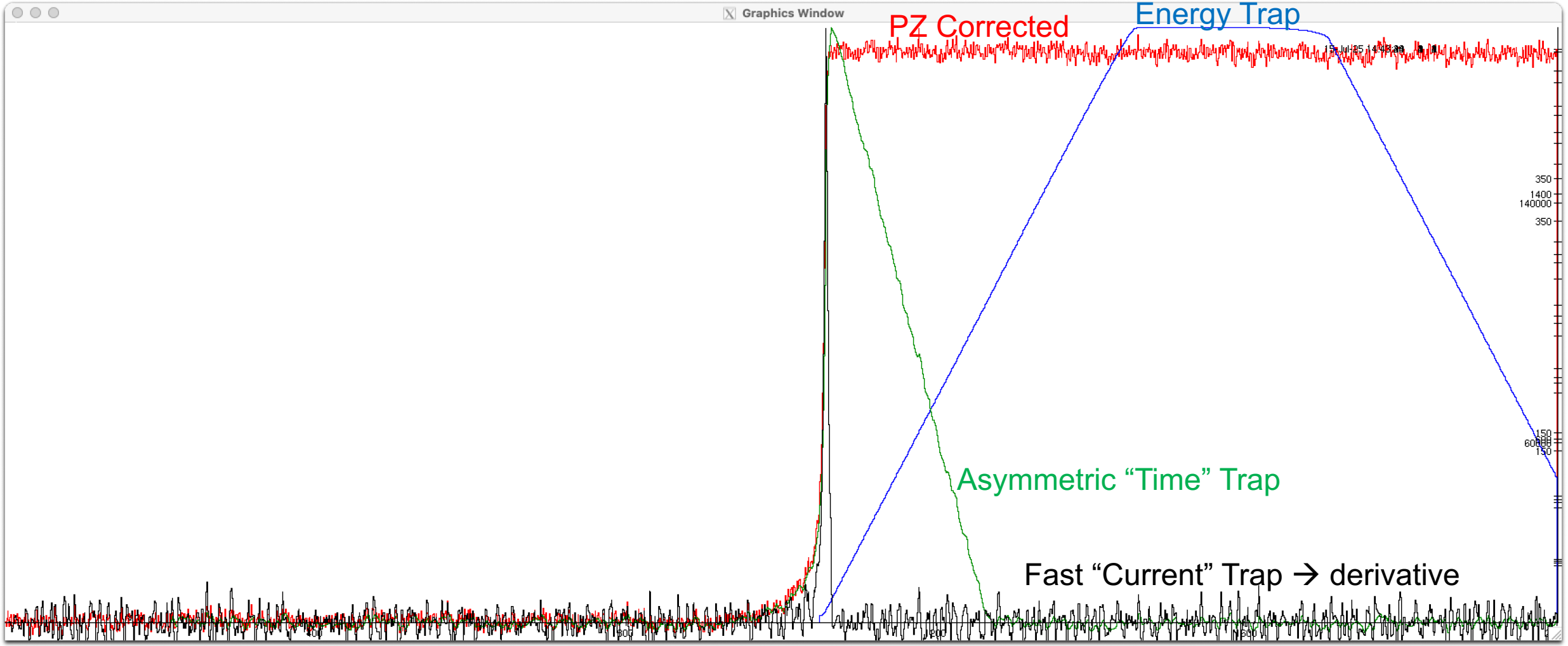


Drift time:

- Z determination
- Empirical correction to lattice damage

  i.e., drift-time dependent energy calibration

New DEGA Prototype: GROVER



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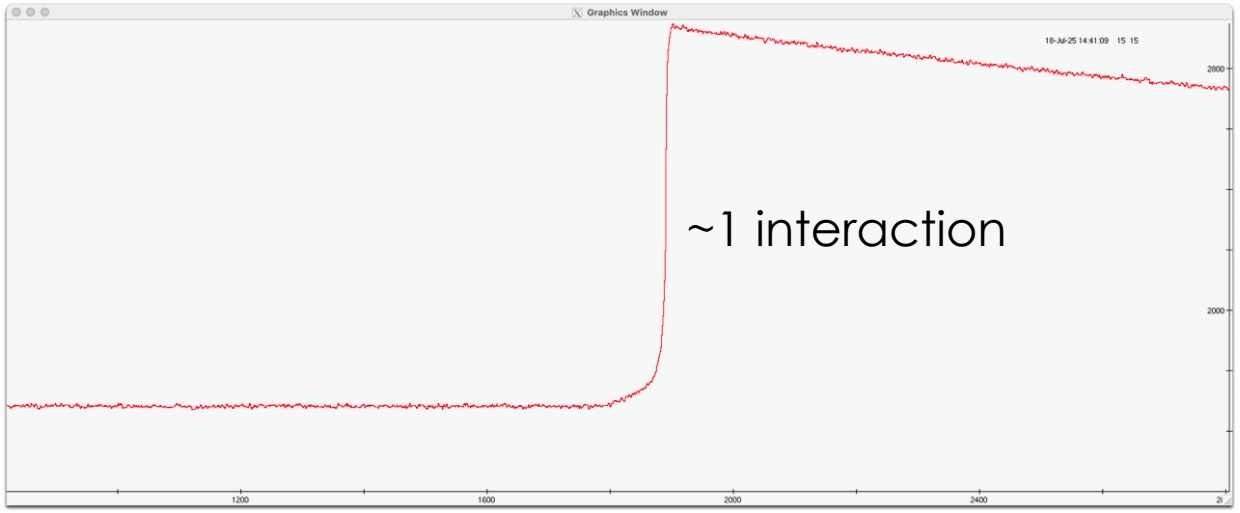
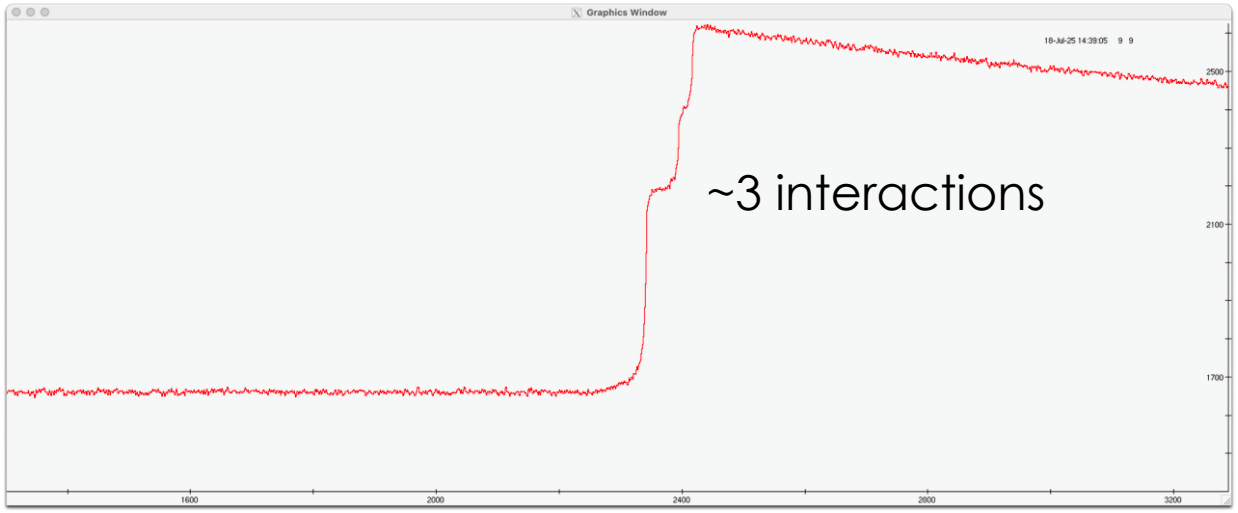
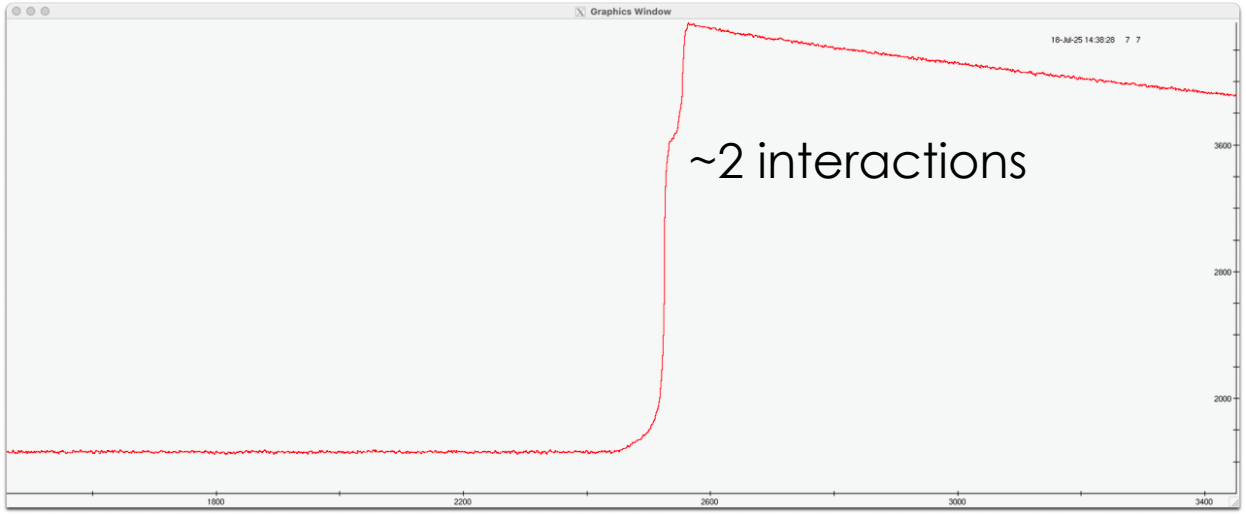
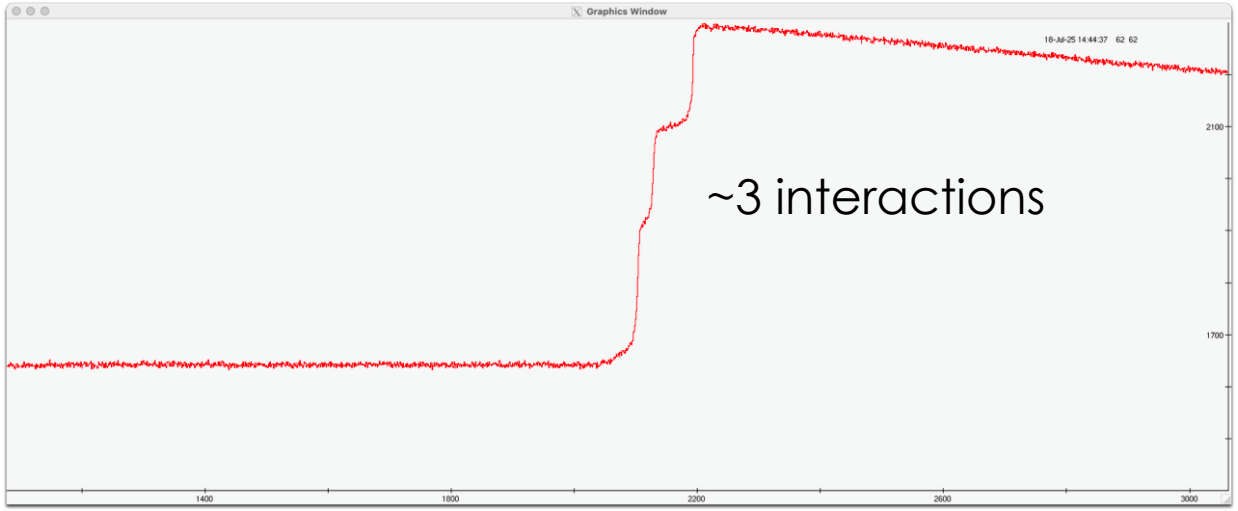






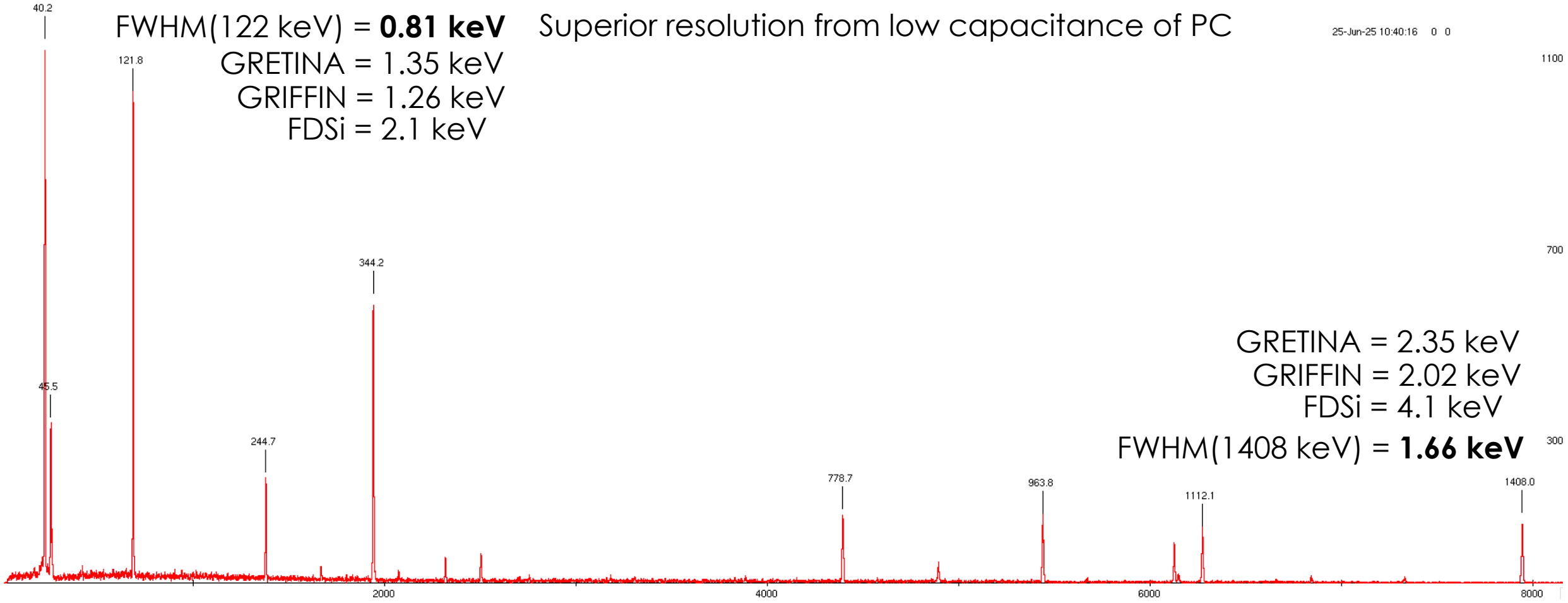


New DEGA Prototype: GROVER

X-rays

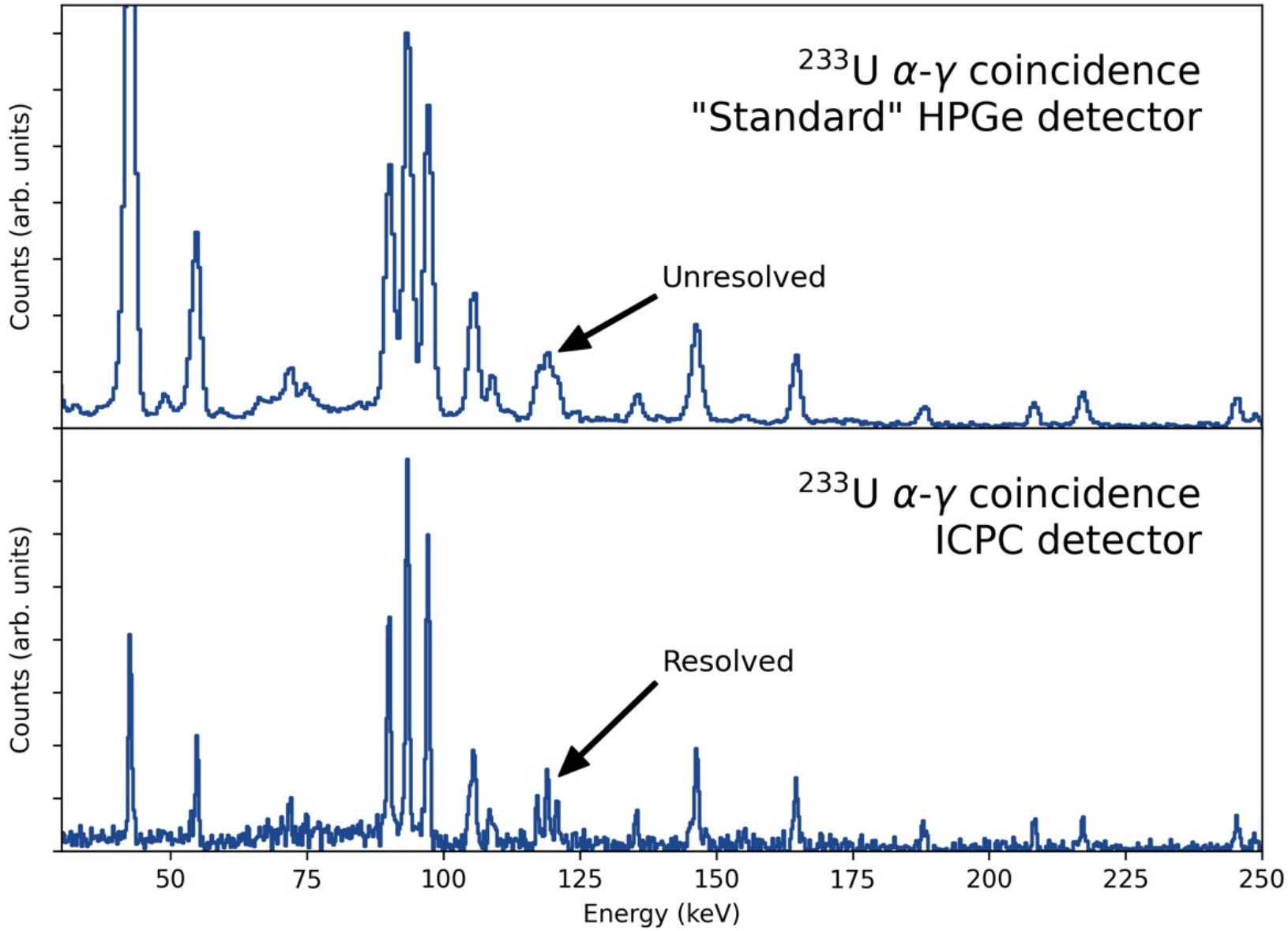
FWHM(122 keV) = **0.81 keV**
GRETINA = 1.35 keV
GRIFFIN = 1.26 keV
FDSi = 2.1 keV

Superior resolution from low capacitance of PC



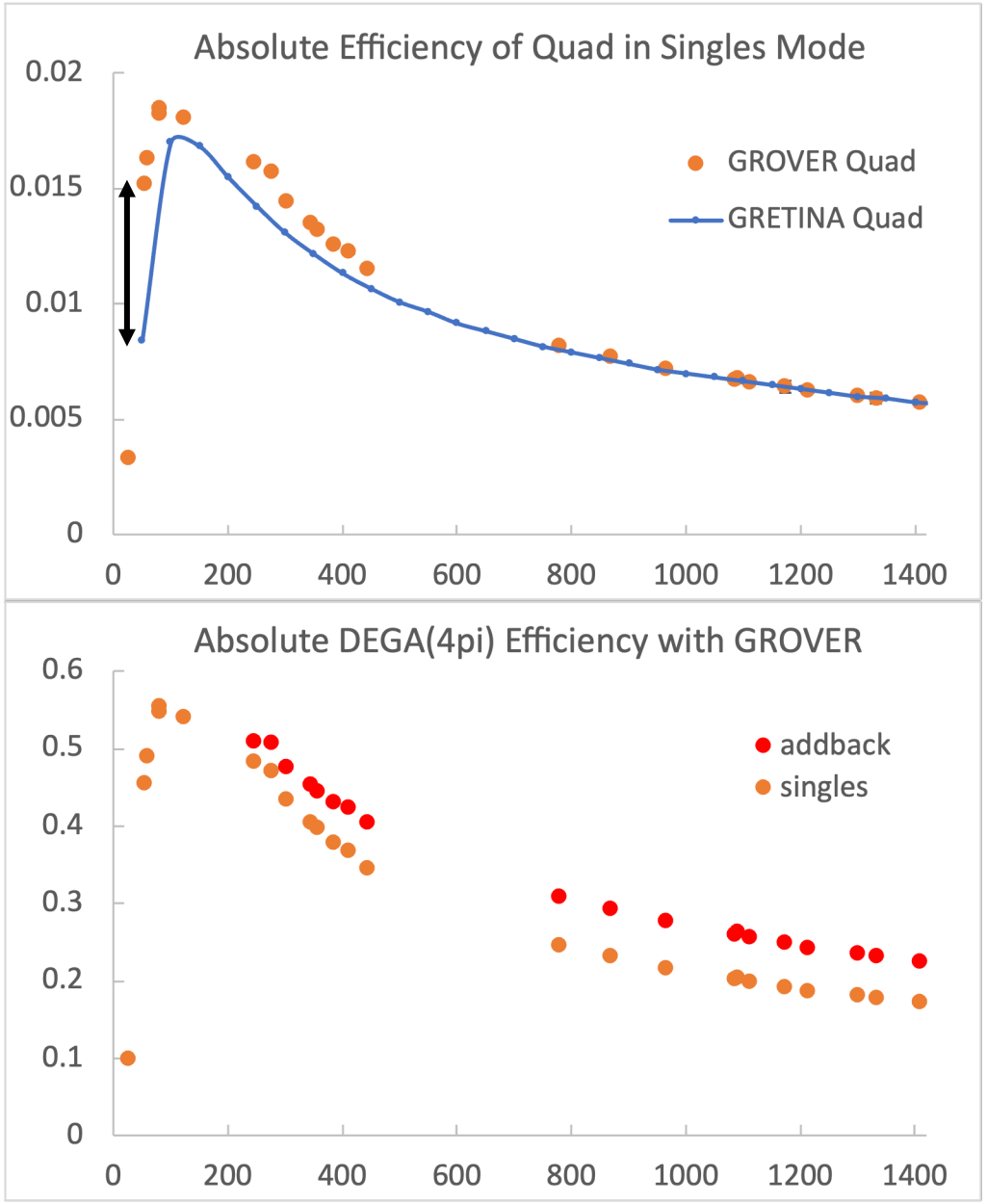
GRETINA = 2.35 keV
GRIFFIN = 2.02 keV
FDSi = 4.1 keV
FWHM(1408 keV) = **1.66 keV**

New DEGA Prototype: GROVER



New DEGA Prototype: GROVER

Superior efficiency at low energy



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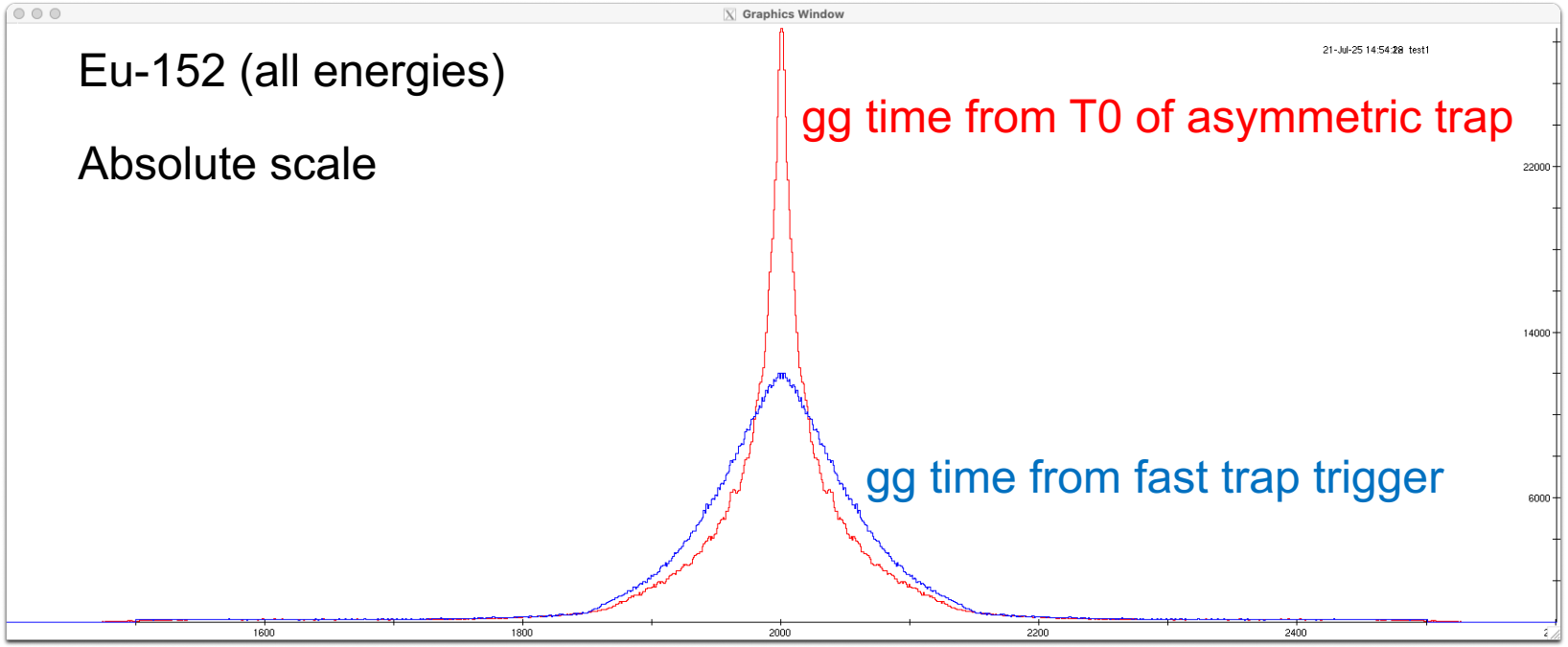
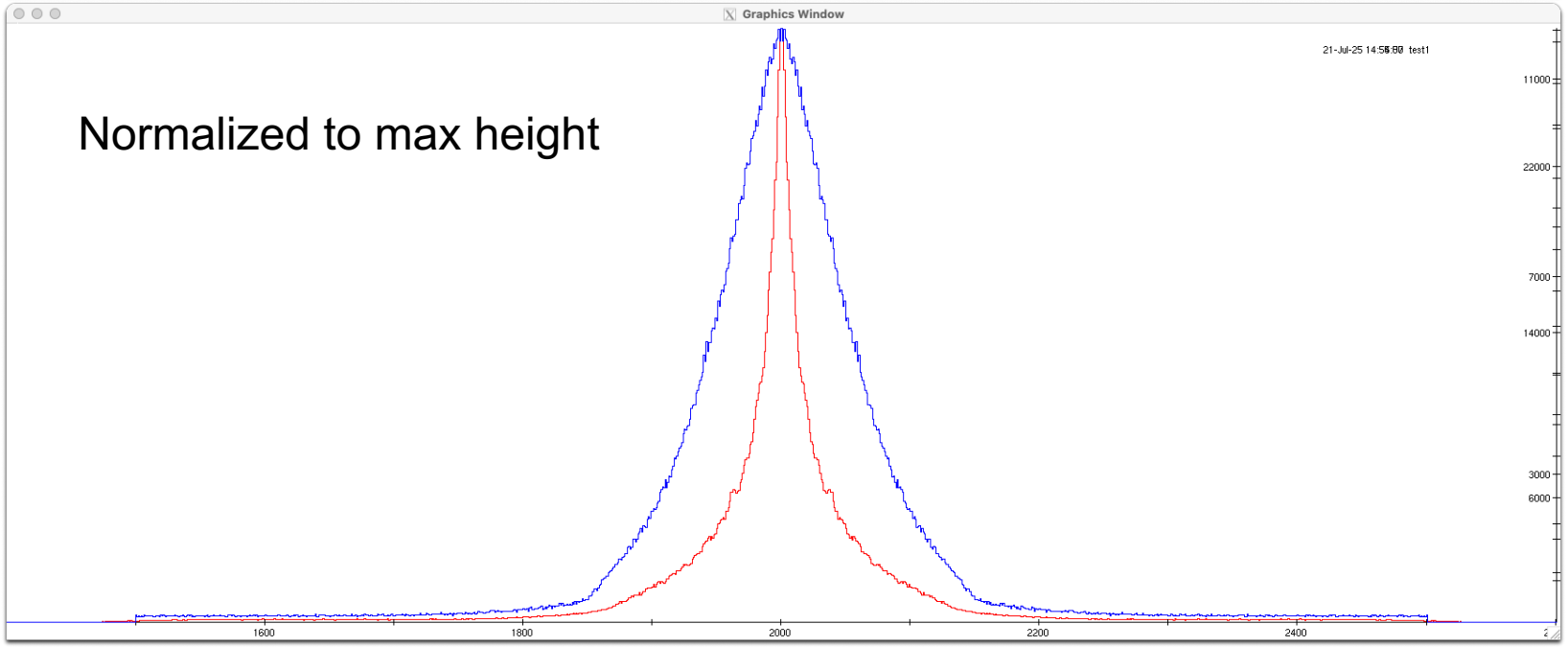
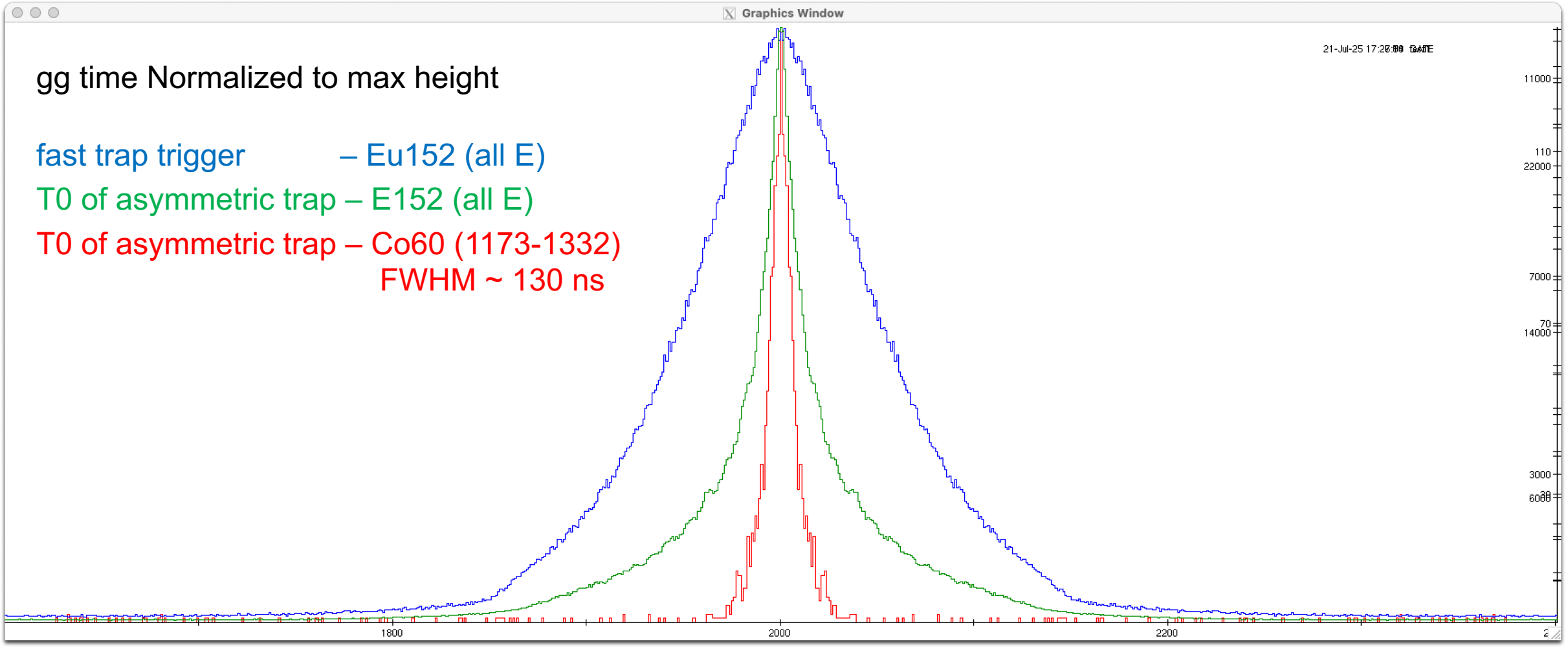

Graphics Window
Eu-152 (all energies)
Absolute scale
gg time from T0 of asymmetric trap
gg time from fast trap trigger
22000
14000
6000
1600
1800
2000
2200
2400


Graphics Window
Normalized to max height
11000
22000
7000
14000
3000
6000
1600
1800
2000
2200
2400

4 μs

New DEGA Prototype: GROVER



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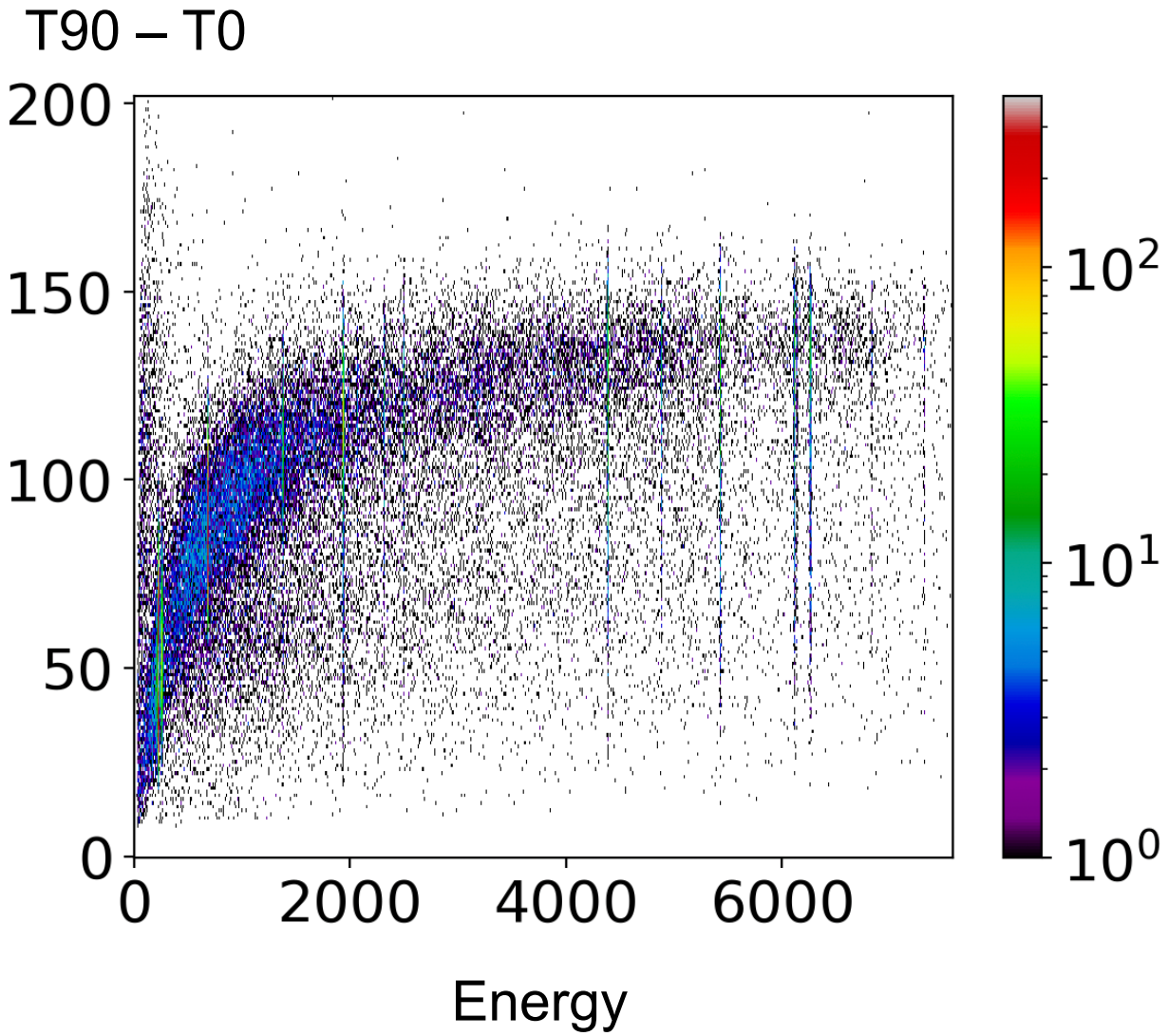
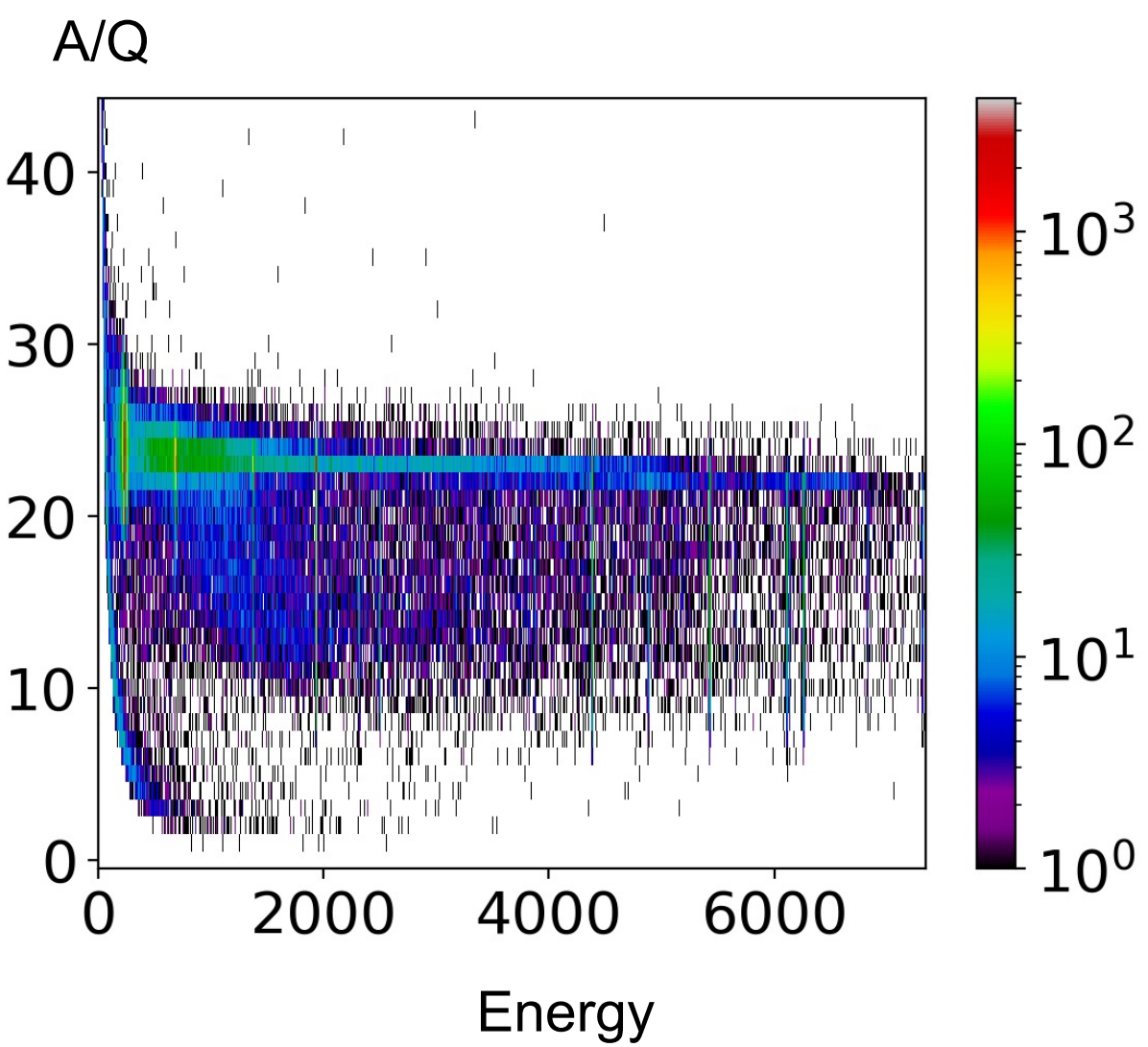
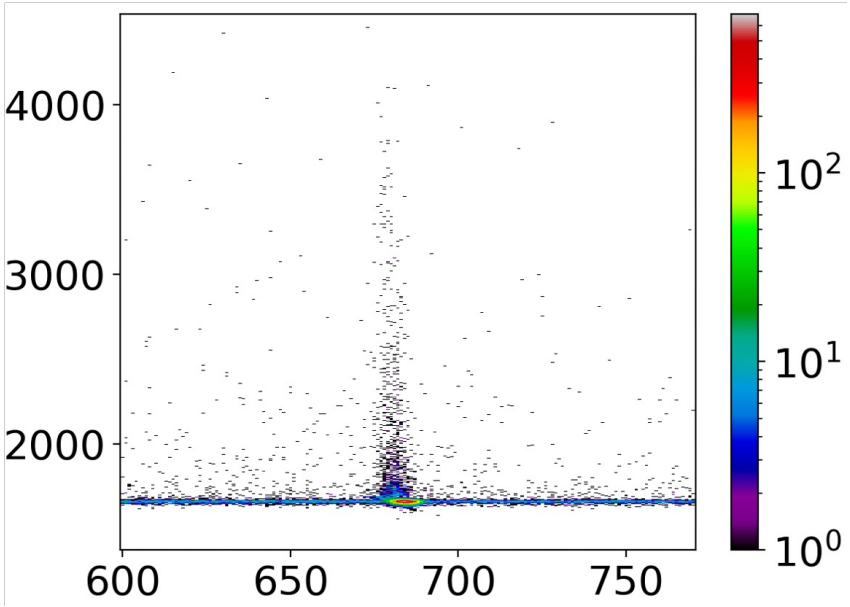




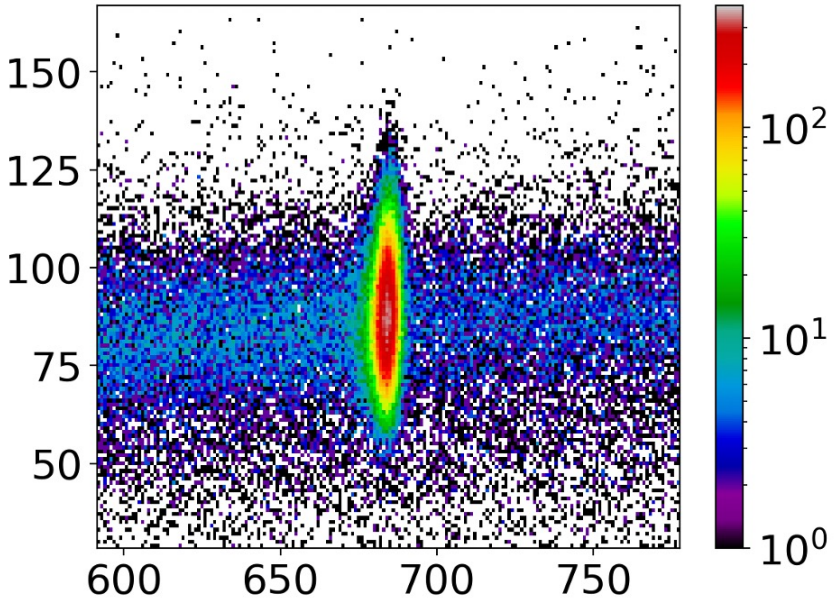
New DEGA Prototype: GROVER

Local Baseline
122 keV



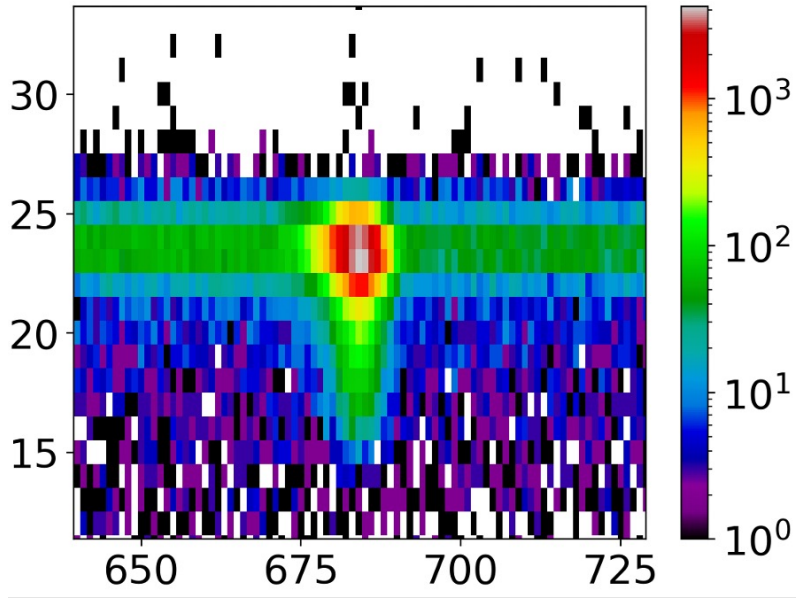
Energy

T90-T0
122 keV



Energy

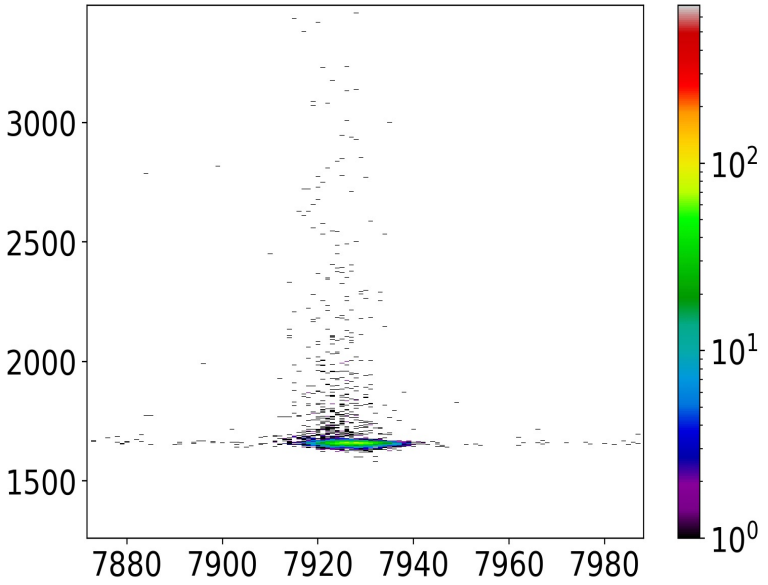
A/Q
122 keV



Energy

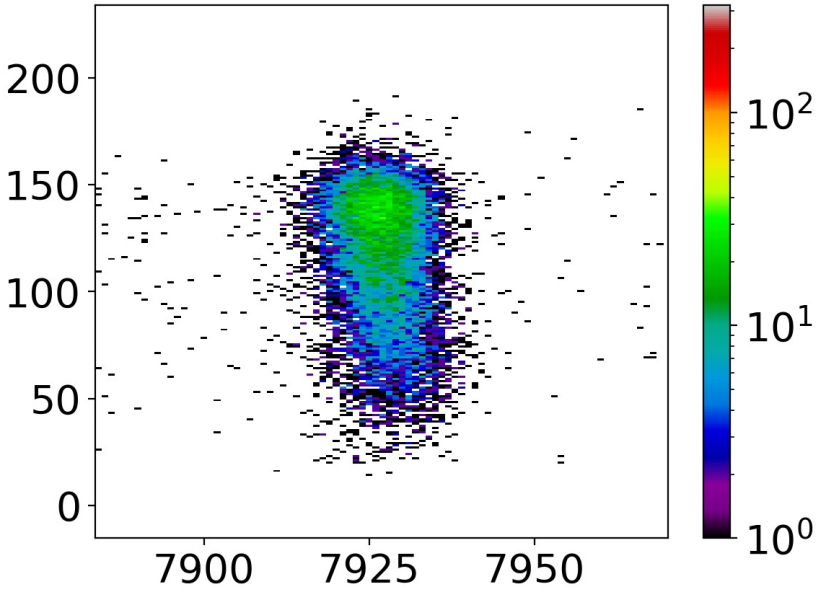
New DEGA Prototype: GROVER

Local Baseline
1408 keV



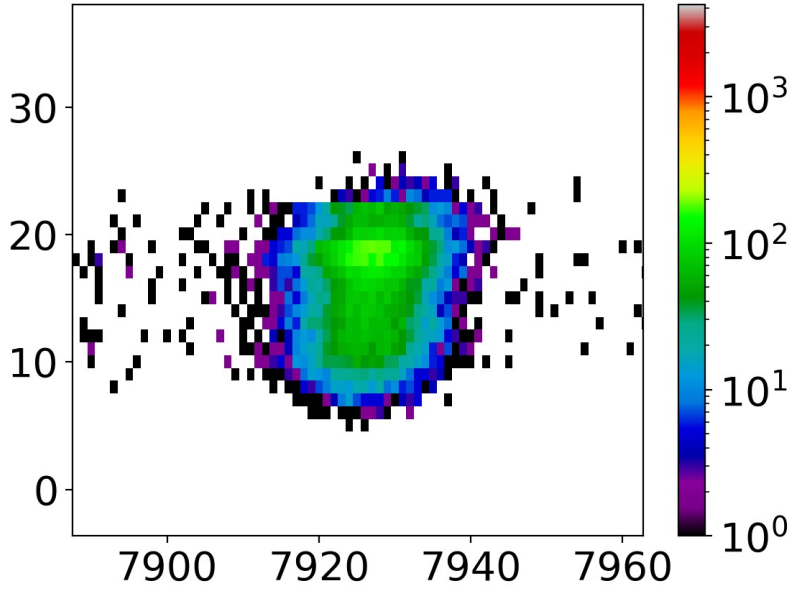
Energy

T90-T0
1408 keV



Energy

A/Q
1408 keV

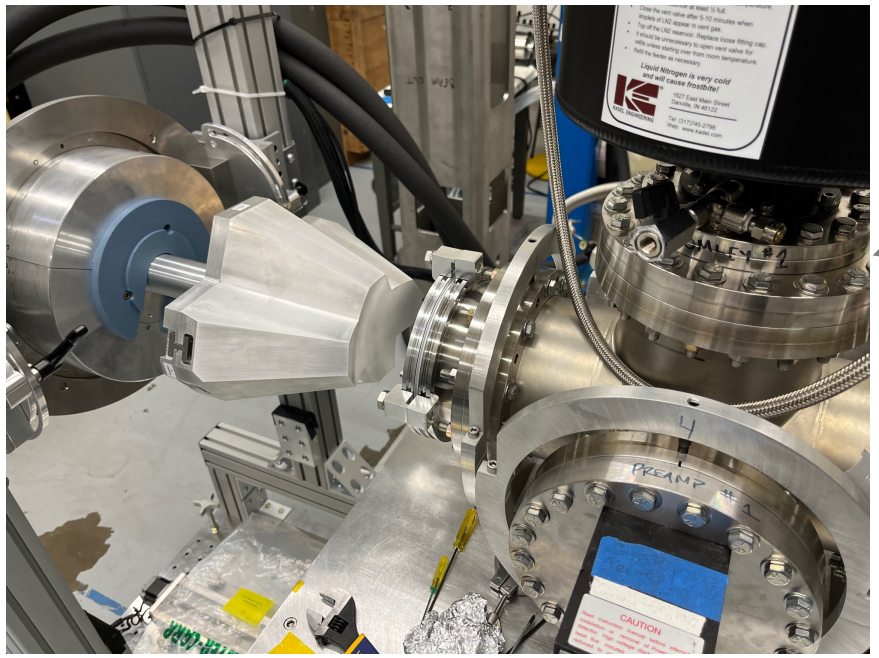


Energy

Upcoming Effort:

- PhD Thesis Work of David He (SCGSR Student): Perform e-e-γ coincidence measurements with GROVER-MUSES and $^{76}As \rightarrow {}^{76}Se$ from HFIR to measure E0 transitions

GROVER: 4 point-contact HPGe crystals



MUSES: 3x3 segmented, 5-mm thick, LN_2 cooled Si(Li)

- Perform 2d "pencil beam" scan of front face with Cs and Am
- Perform 2d "pencil beam" scan of side face with Cs and Am
- Benchmark z vs drift time (T90-T0) sensitivity
- Benchmark PSD addback and veto capabilities
- Model detector with siggen and GEANT