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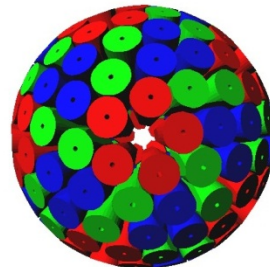
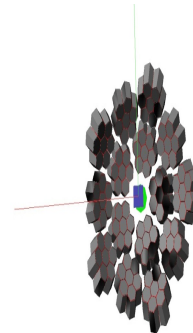
Development of a simulation package for fragmentation and Coulex reactions at GSI

Daniel Bloor & The AGATA Collaboration

AGATA week 11th-13th June 2012



Science & Technology
Facilities Council



- Simulate secondary fragmentation and relativistic Coulex reactions @ GSI to test response of AGATA in high background, relativistic environment
 - Spectral reconstruction
 - Tracking (OFT, MGT)
- Simulate PRESPEC experiment S377 @ GSI (May 2011)

36Ar (480MeV/u)
Primary Beam →

Production Target
9Be (4000mg/cm²)

S1

Magnets + Ion optics

S2

S3

S4

Secondary Target
197Au (386mg/cm²)

RISING + LYCCA-0



- Simulate secondary fragmentation and relativistic Coulomb reactions @ GSI to test response of AGATA in high background, relativistic environment
 - Spectral reconstruction
 - Tracking (OFT, MGT)
- Simulate PRESPEC experiment S377 @ GSI (May 2011)
 - **Replace RISING with AGATA + quantify improvements of using highly segmented Ge detectors**

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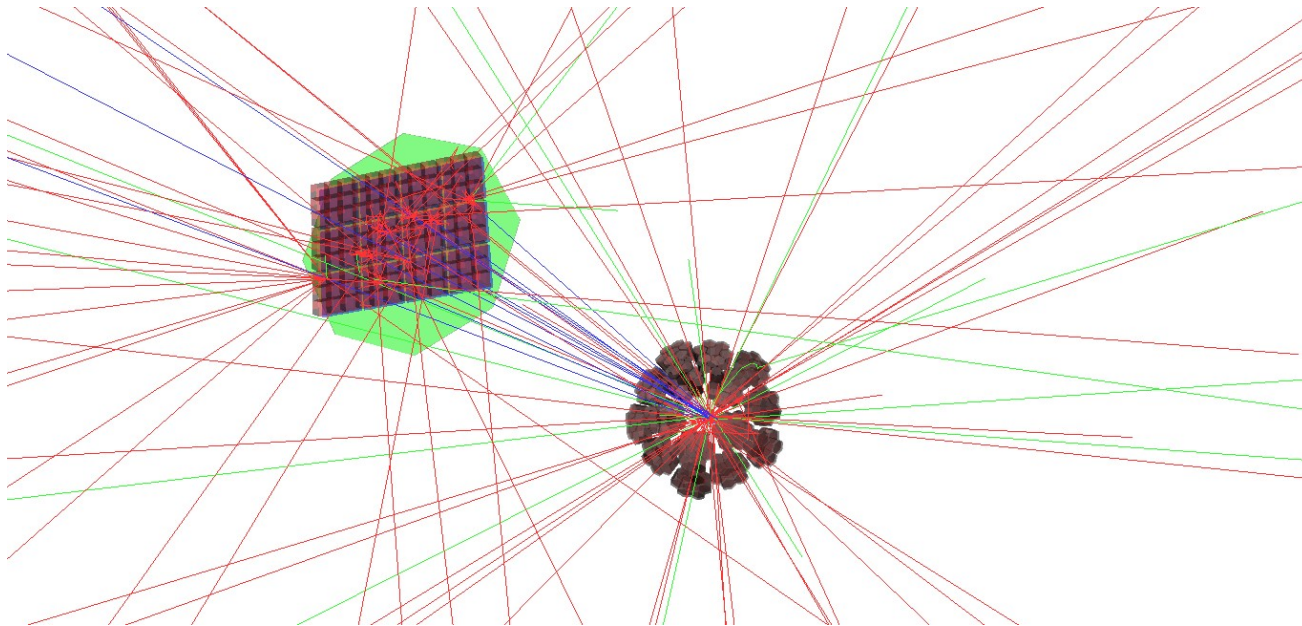
Secondary Target
197Au (386mg/cm²)

AGATA + LYCCA-0

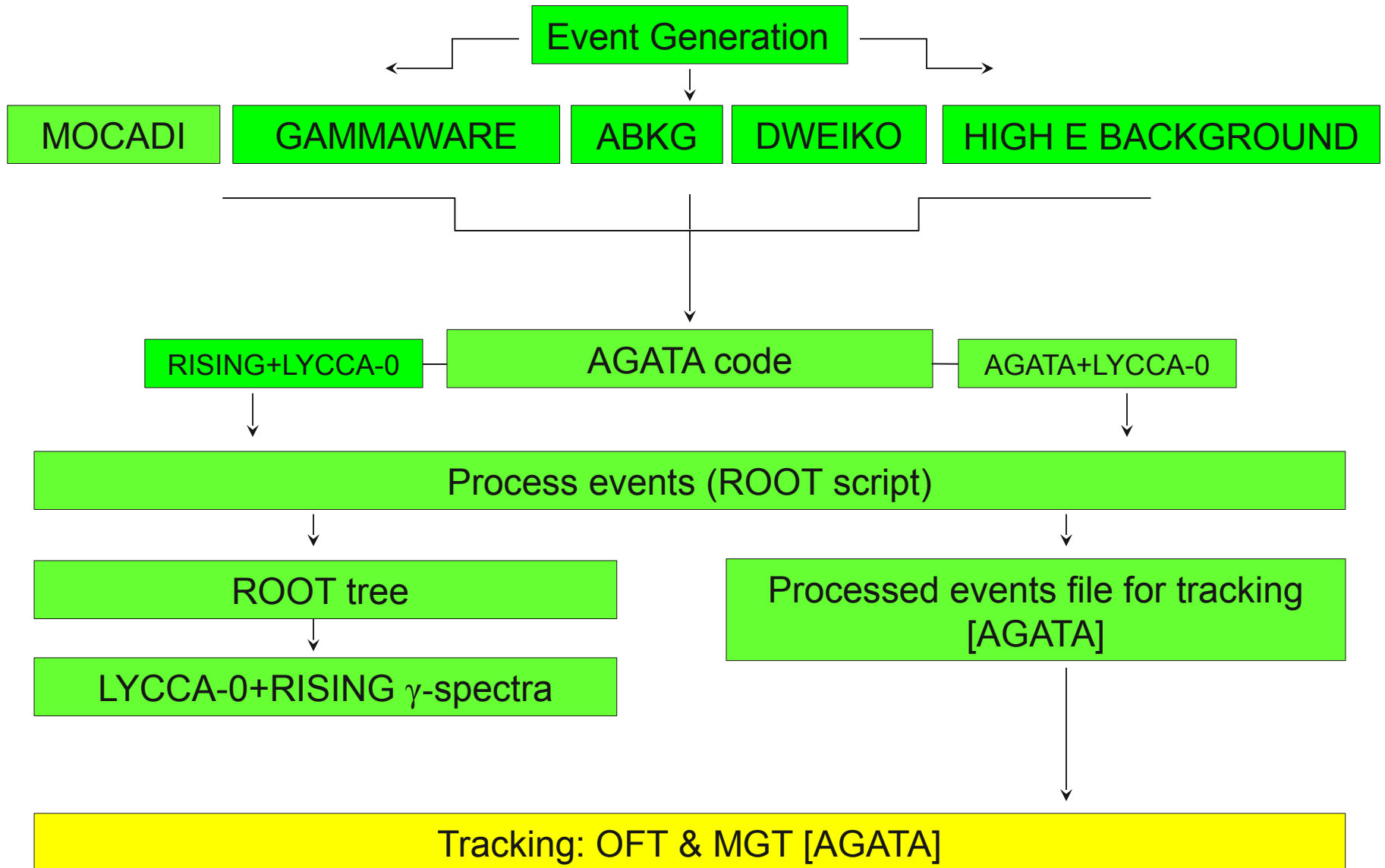


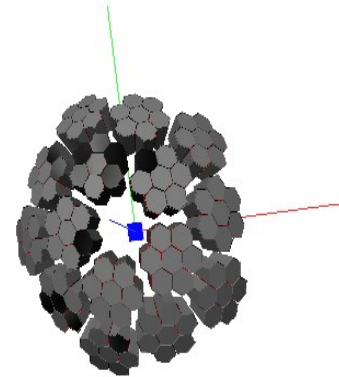
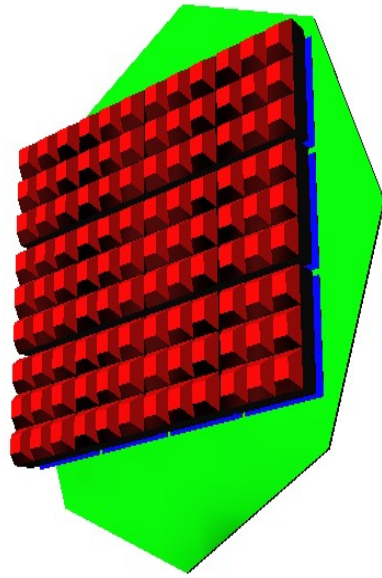
- i. K and L shell X-rays from ionised target atoms
- ii. Radiative electron capture (REC) of the target electrons into the projectile K and/or L shells
- iii. Primary bremsstrahlung (PB) from the target electrons produced by the collisions with the projectile
- iv. Secondary bremsstrahlung (SEB) from energetic knock out electrons re-scattering in the target and/or surrounding material

NIM A 537 (2005) 637-657

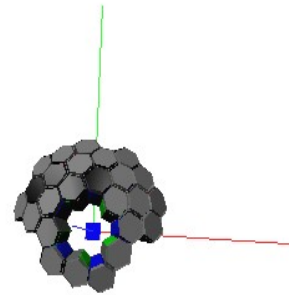
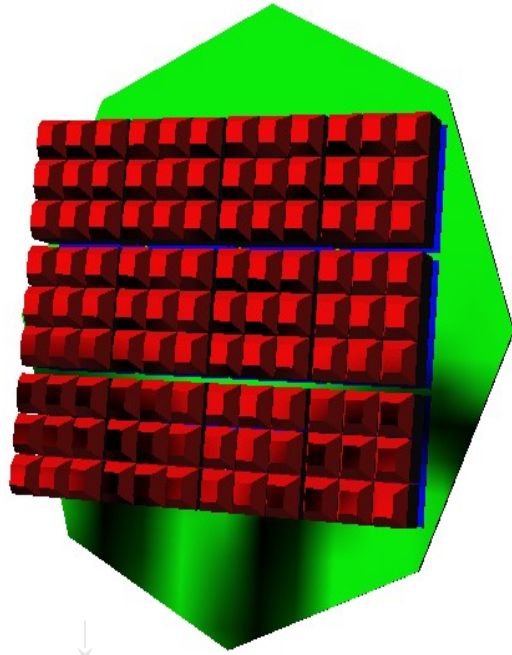


VRML image showing the trajectories of ten excited projectile ^{33}Ar nuclei & secondary products (RISING+LYCCA-0).

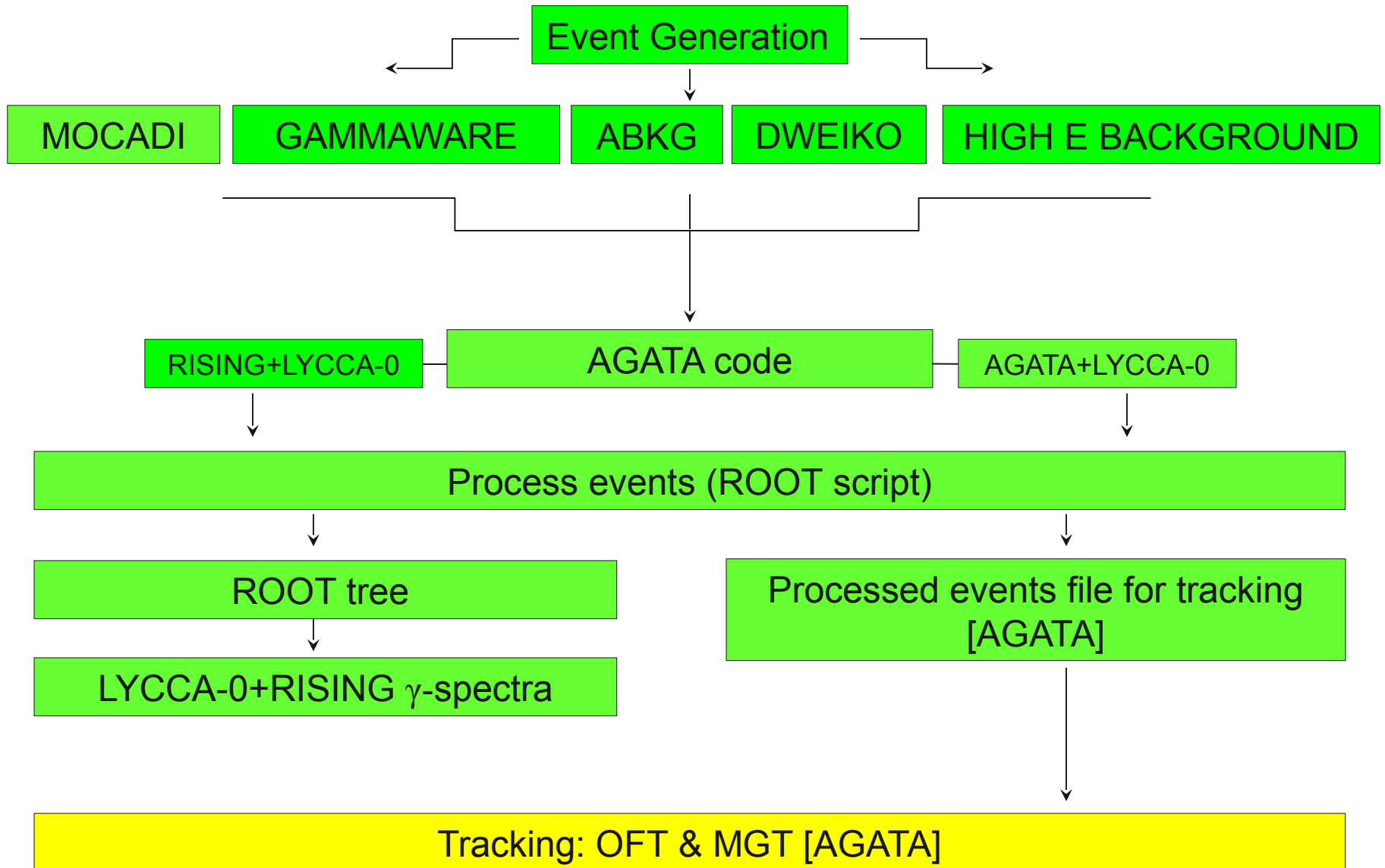


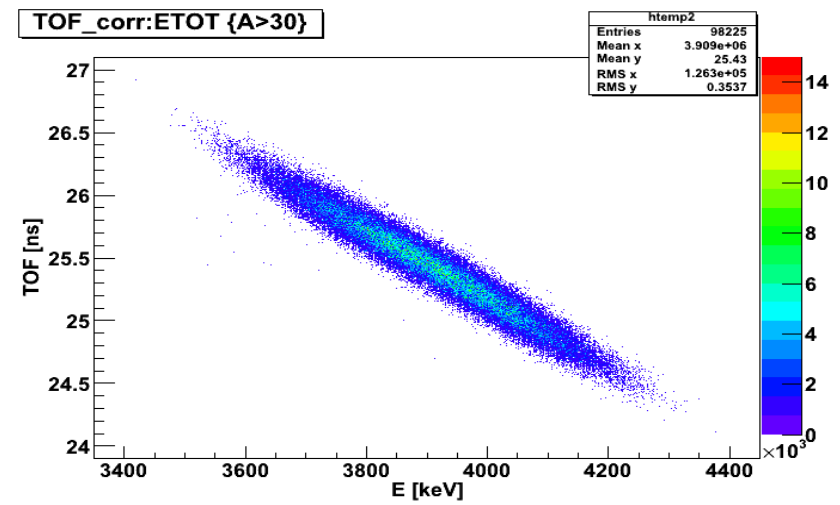
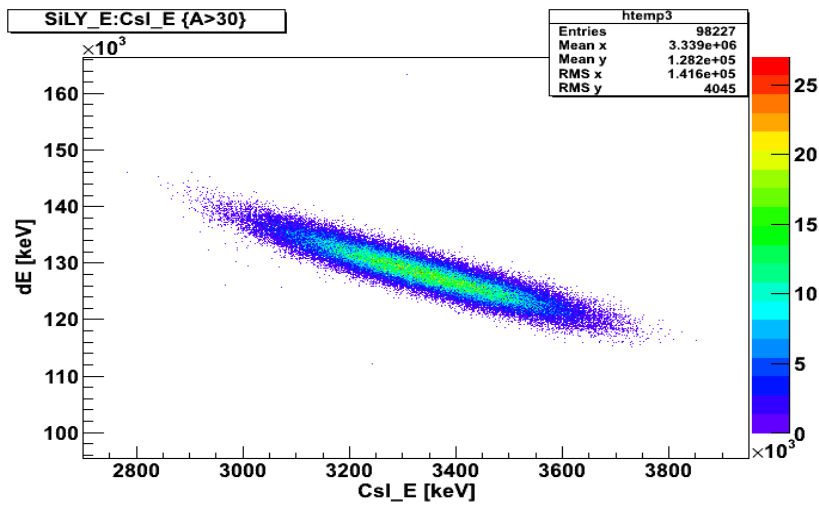
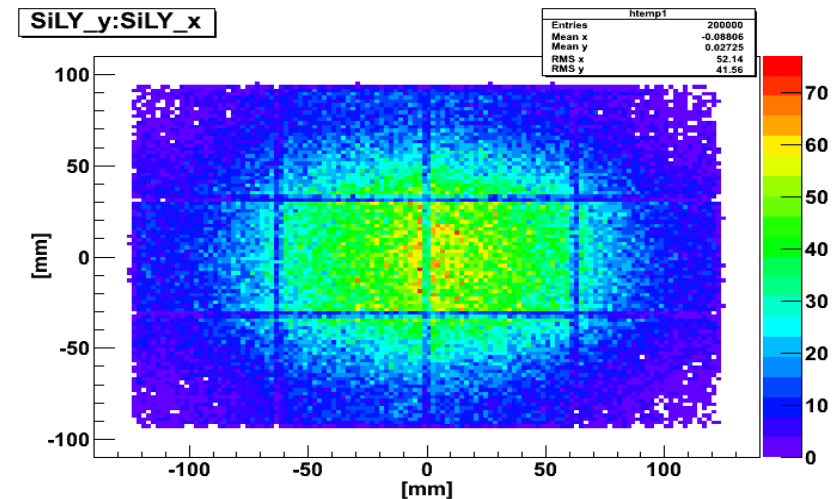
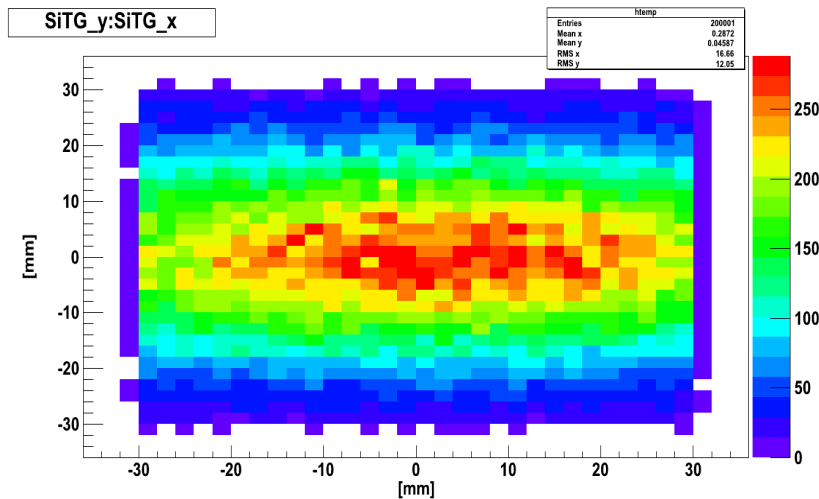


RISING+LYCCA-0

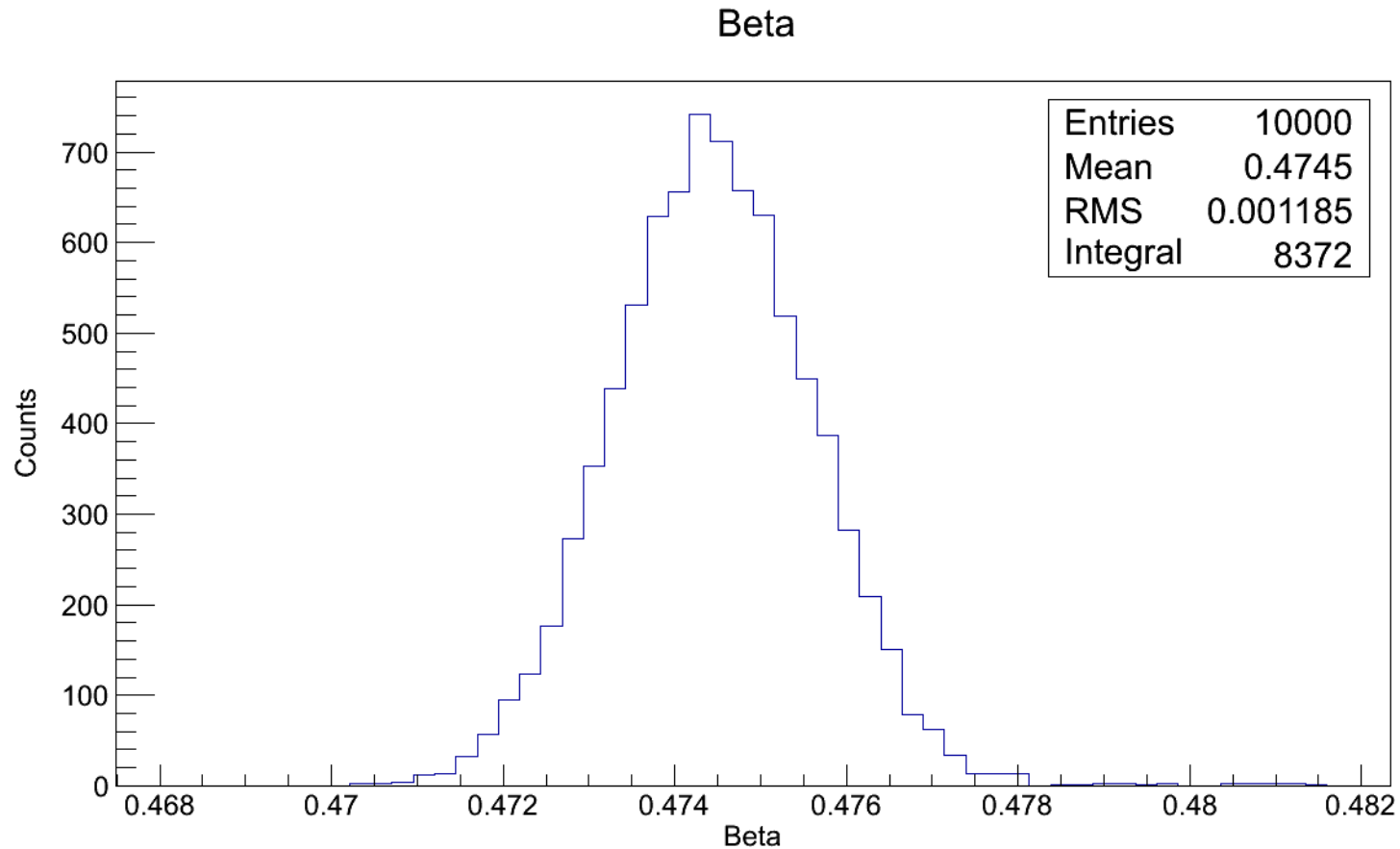


AGATA+LYCCA-0

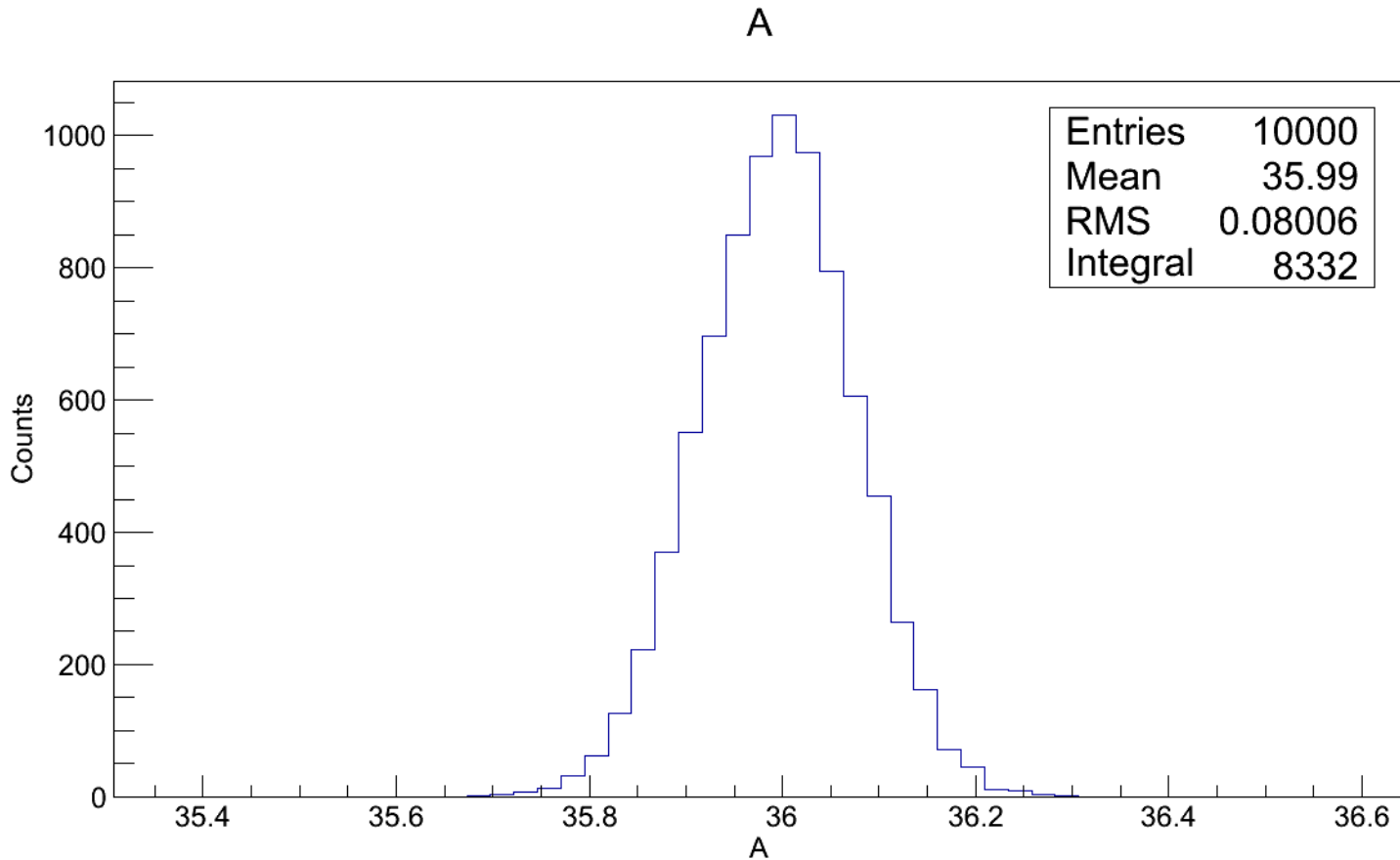




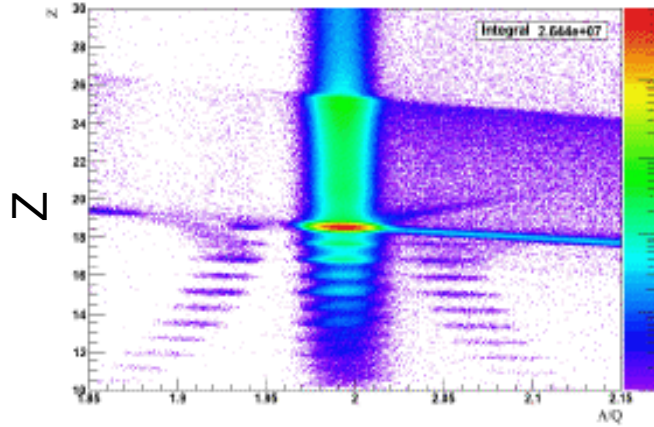
[Top left + right] Hit pattern in target and wall position DSSD detectors.
 [Bottom left] (E,dE) plot. [Bottom right] (E,TOF) plot.



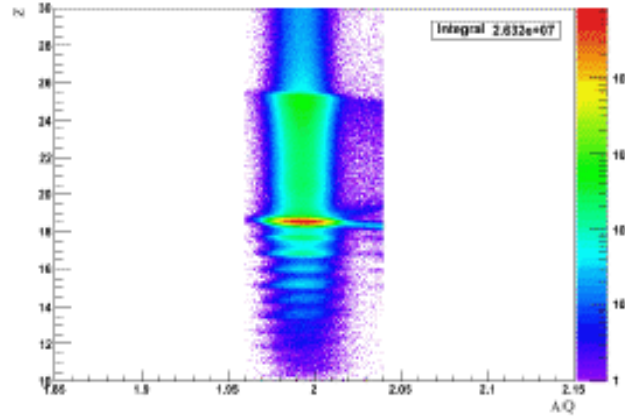
β distribution calculated from TOF measurements.



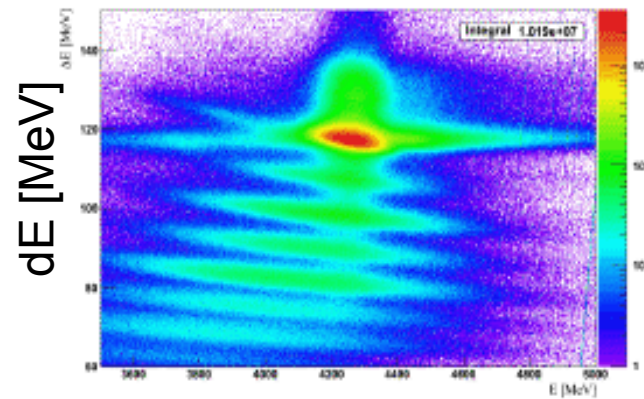
Calculated mass distribution.



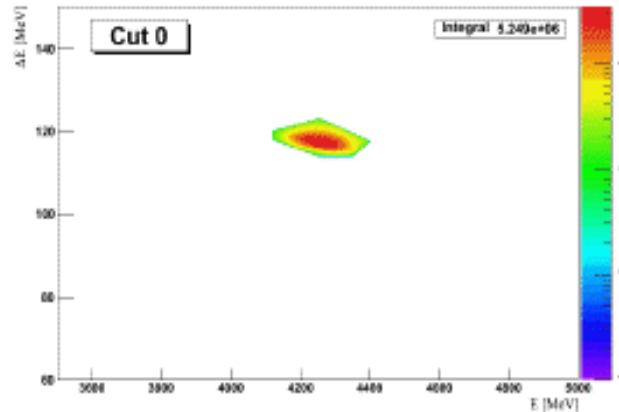
A/Q



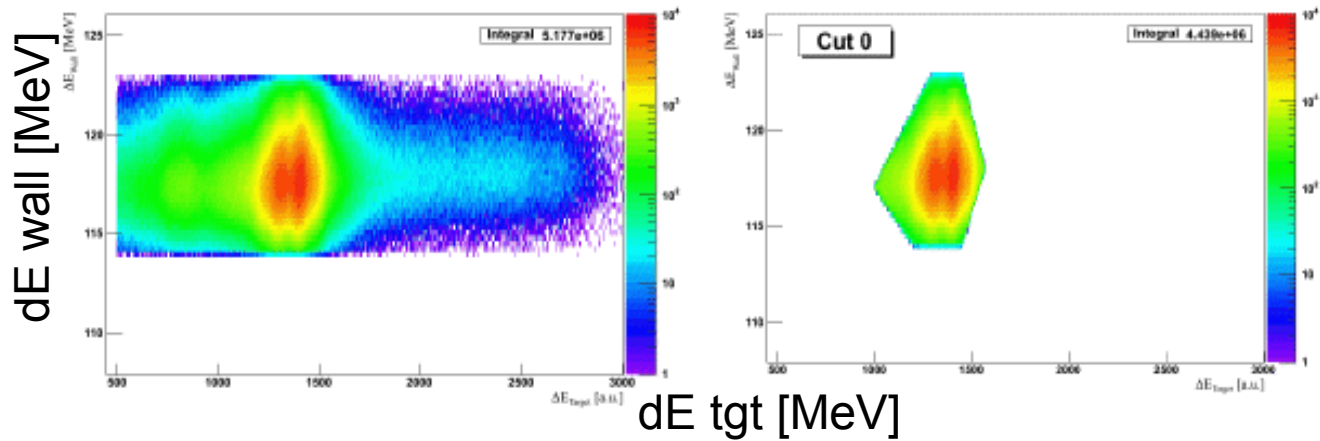
Cut in FRS' AoQ



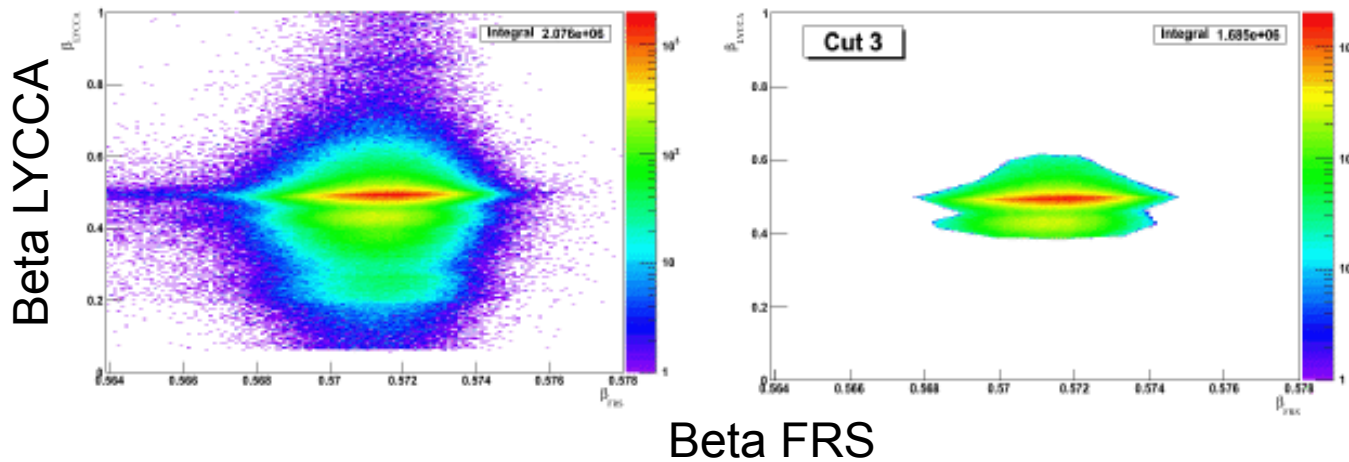
E [MeV]



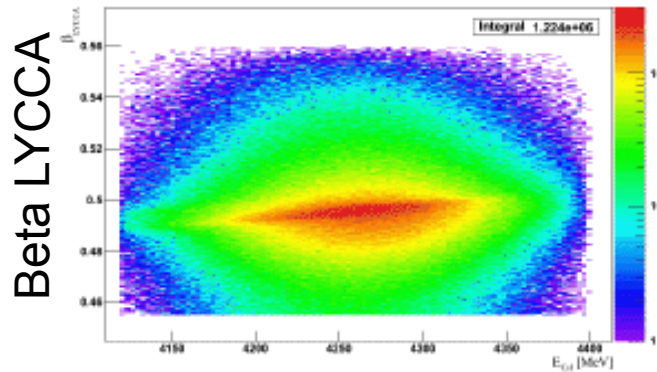
Cut in LYCCA's dE-E



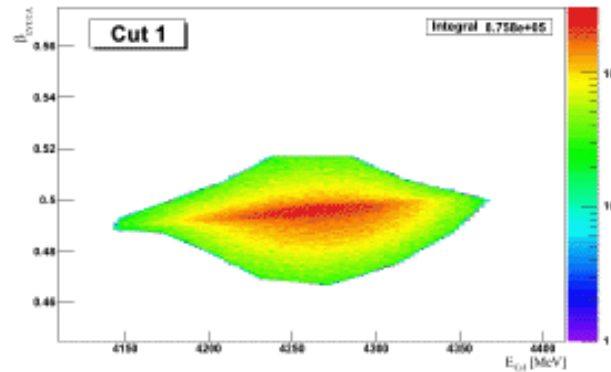
Cut in LYCCA's dE-dE



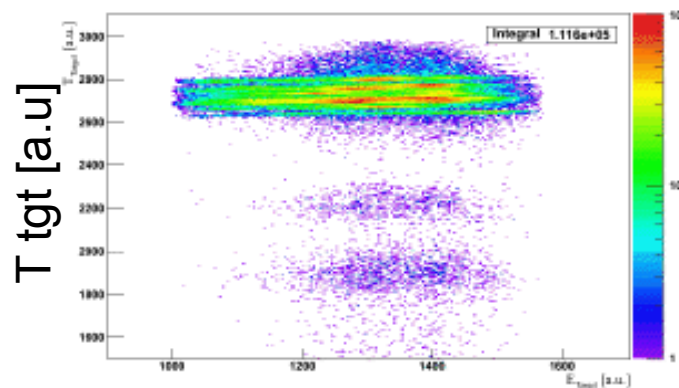
Cut in LYCCA beta Vs FRS beta



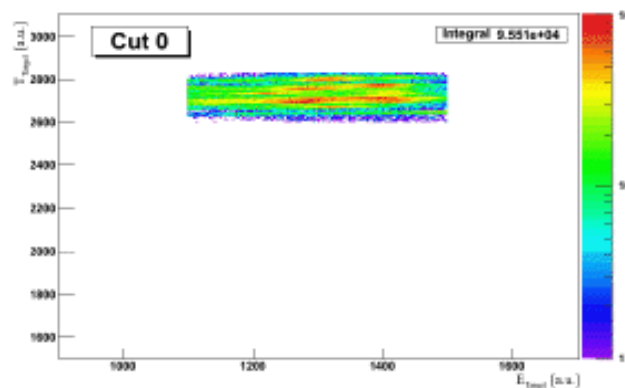
E [MeV]



Cut in LYCCA beta
Vs Csl E

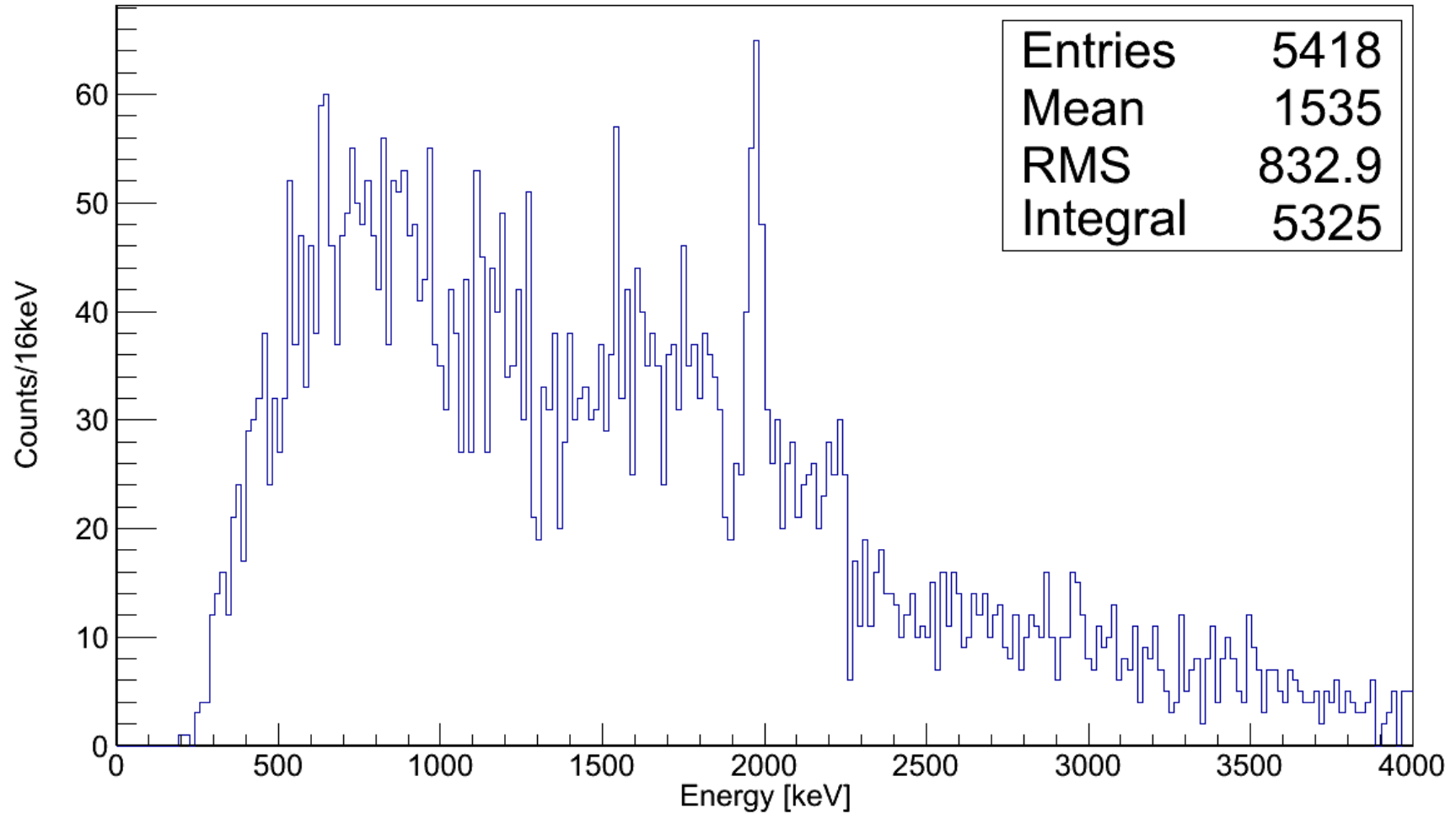


E tgt [a.u]

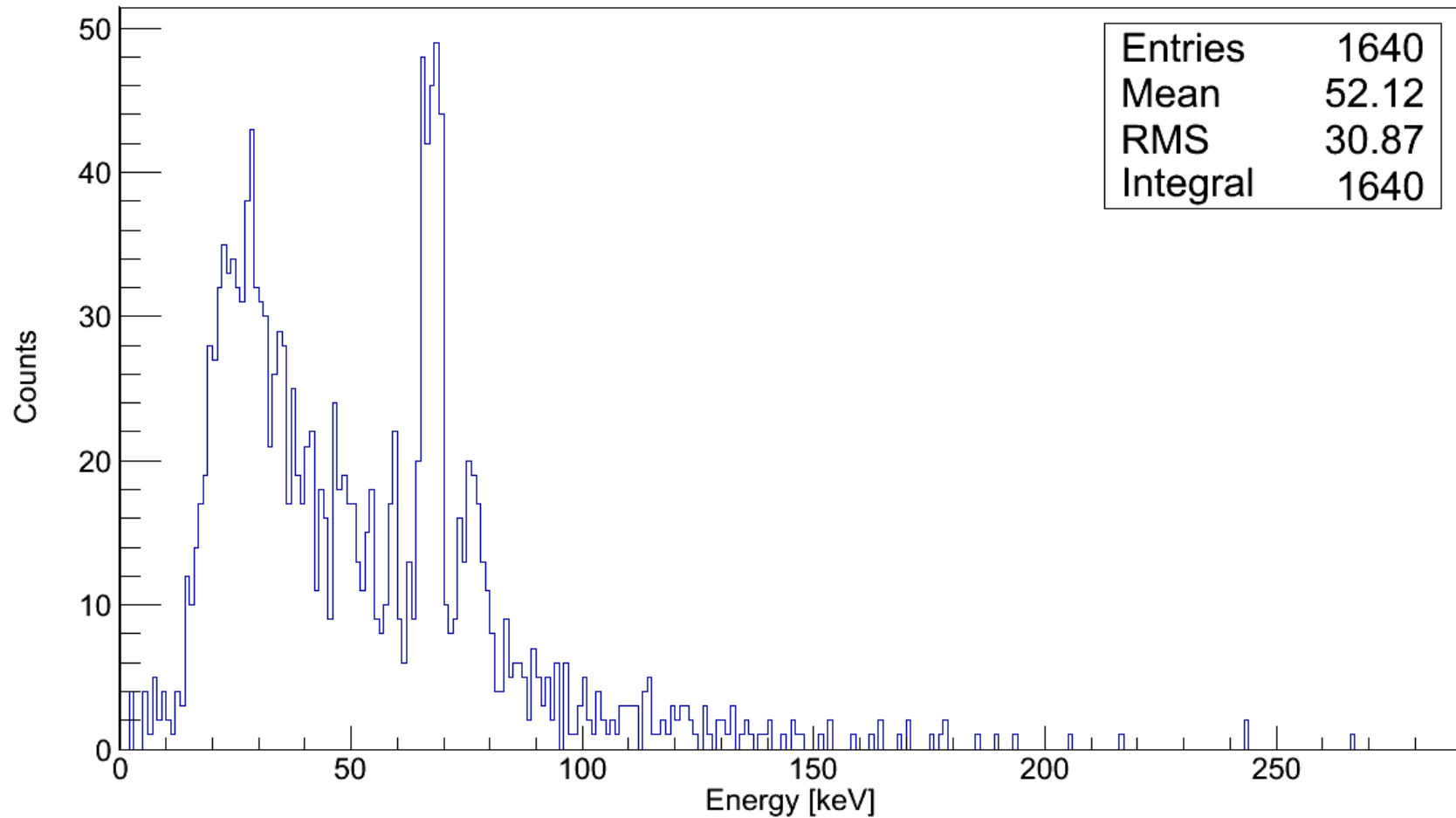


Cut in TA DSSD's
E vs T

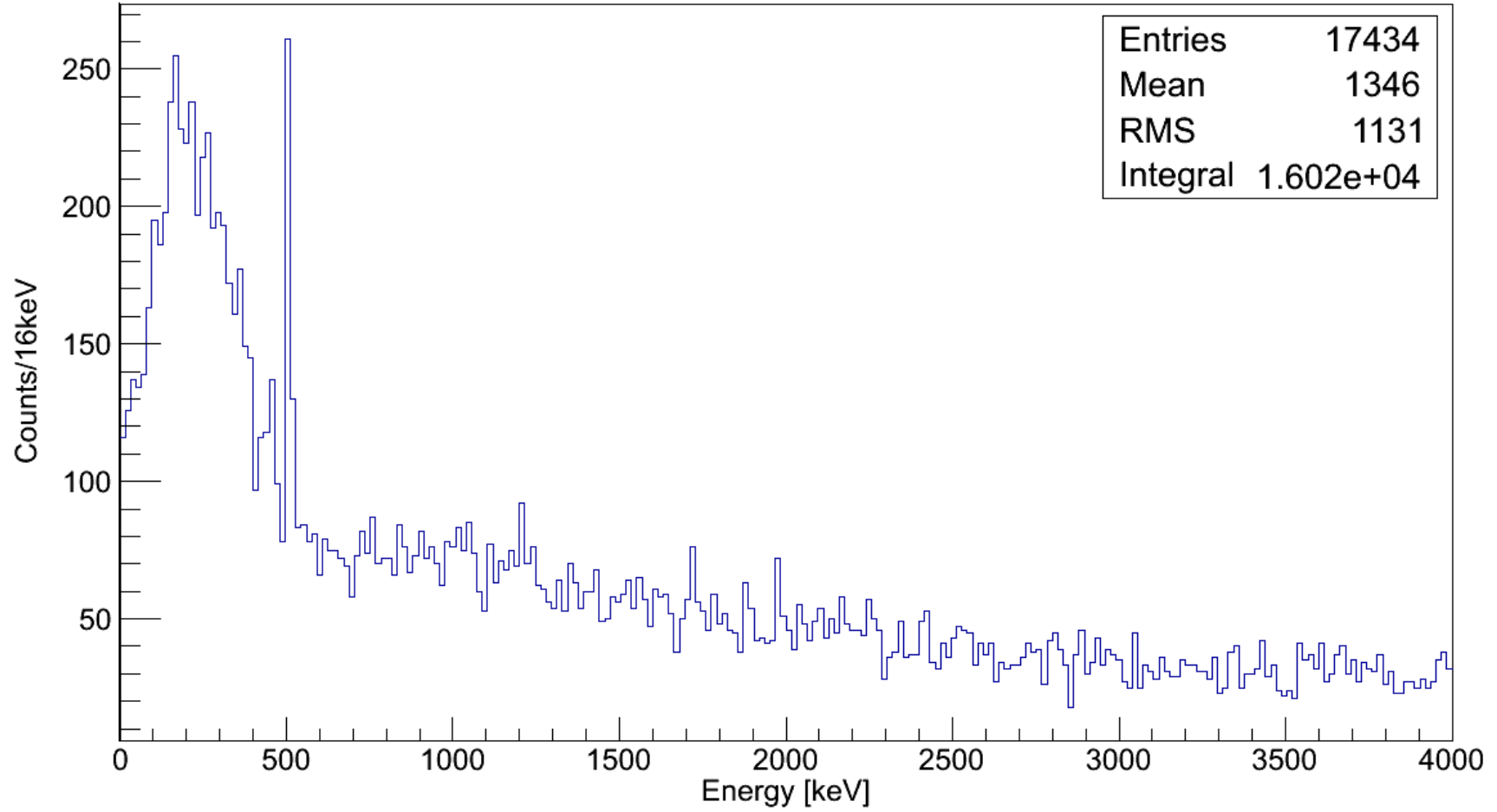
Experimental RISING spectrum

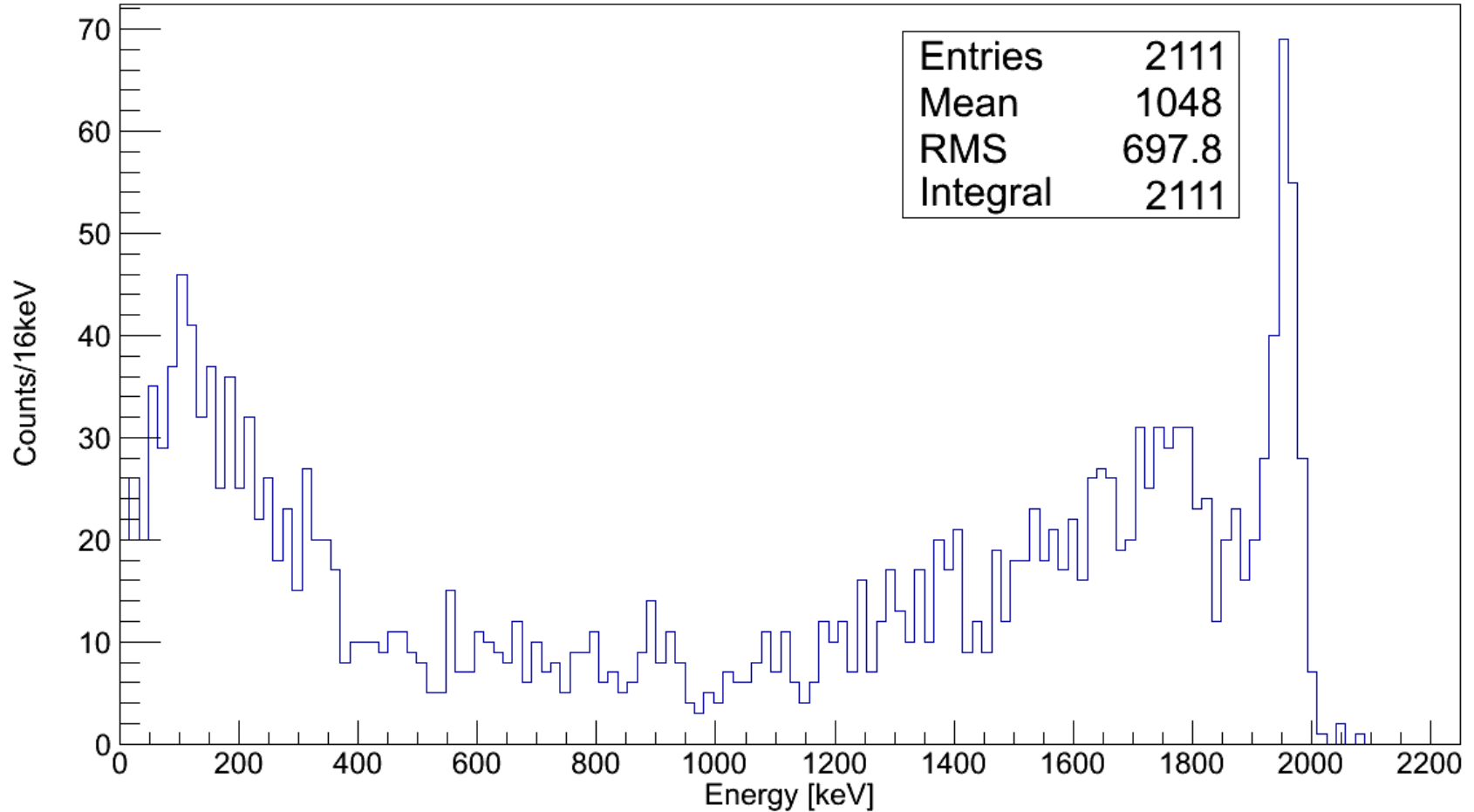


Atomic Background Raw Spectrum (abkg)

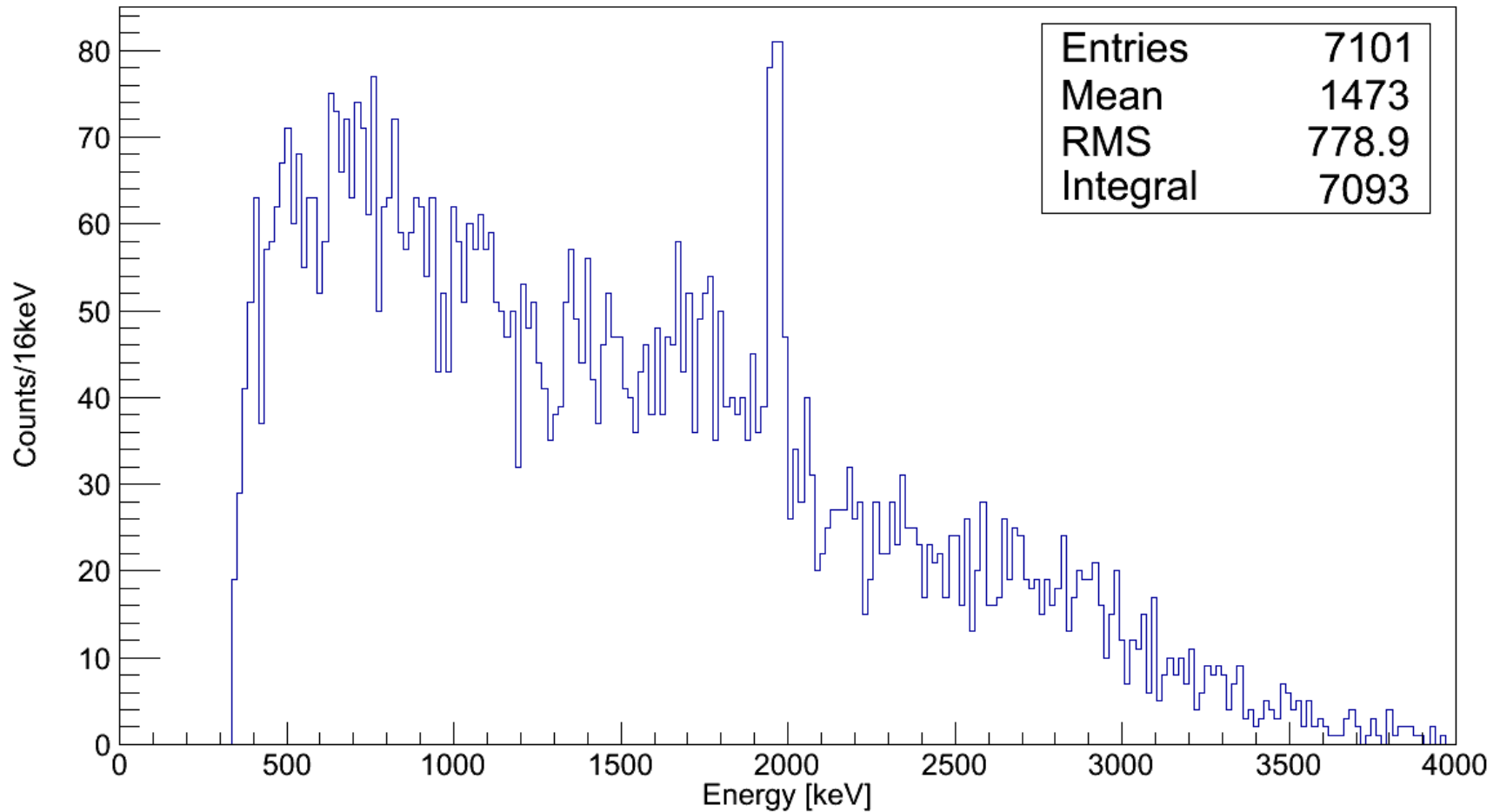


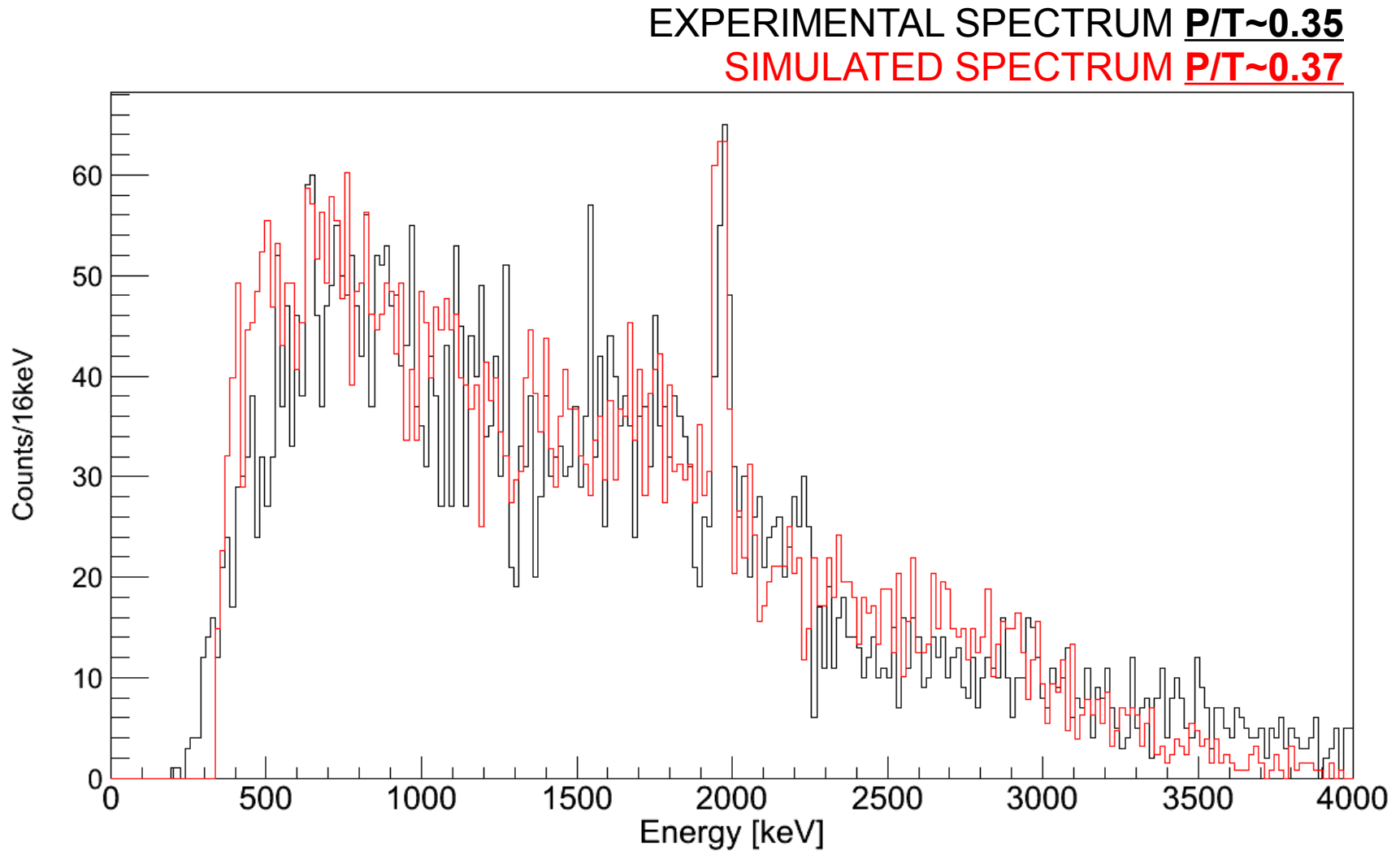
High Energy Background raw energy spectrum



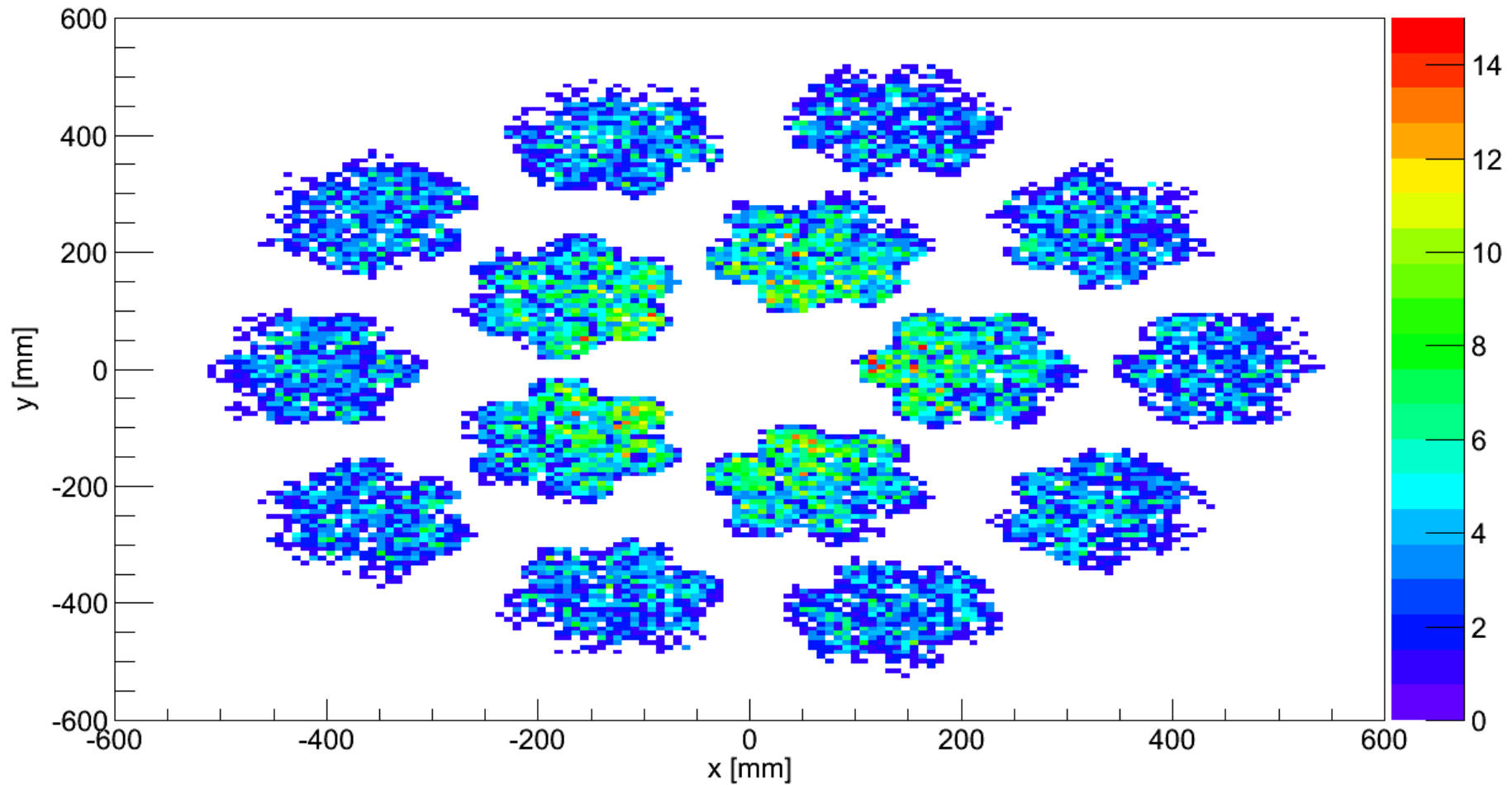
Corrected energy spectrum showing gamma-ray's of interest (^{36}Ar)

Simulated RISING spectrum

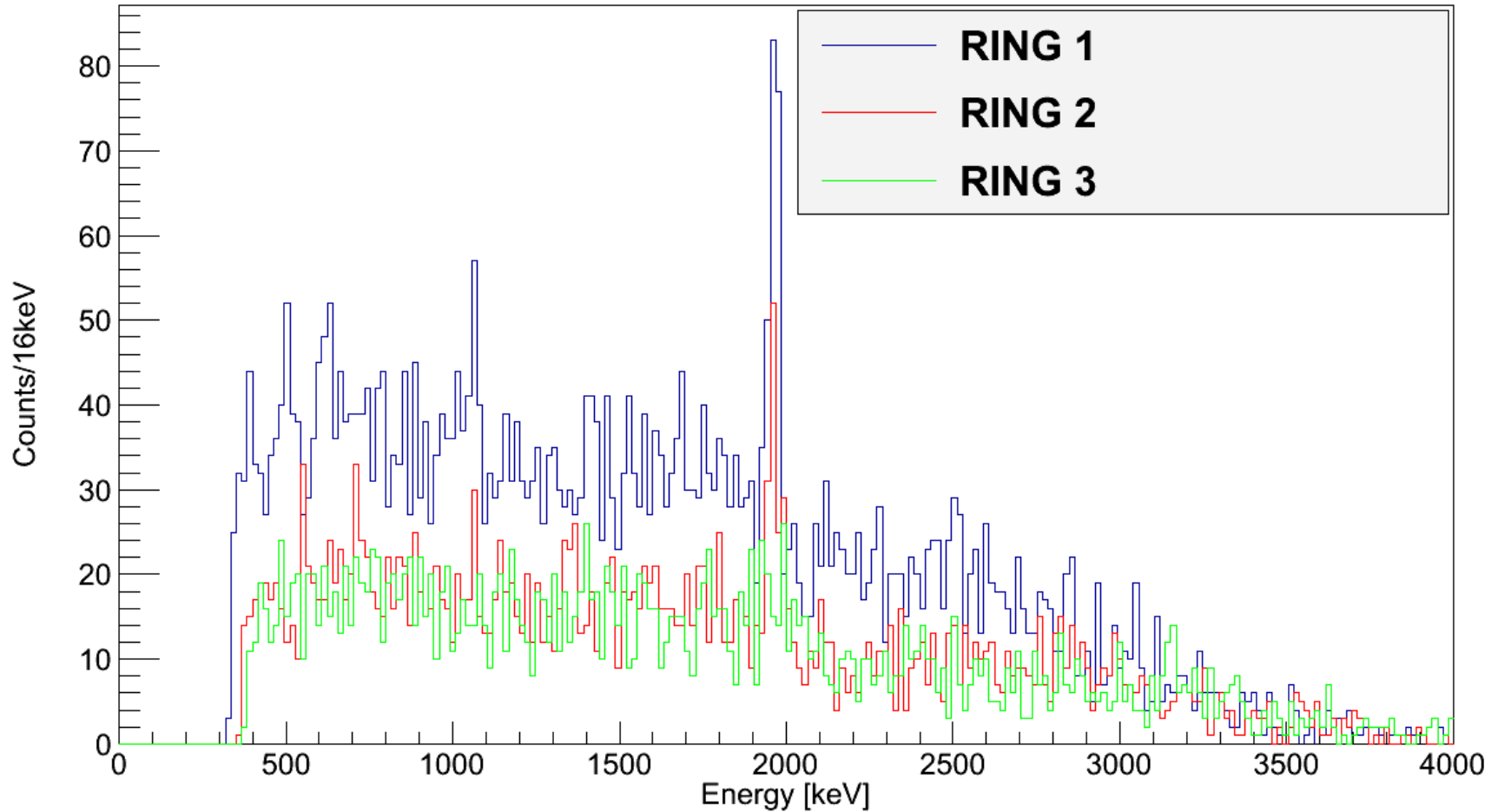


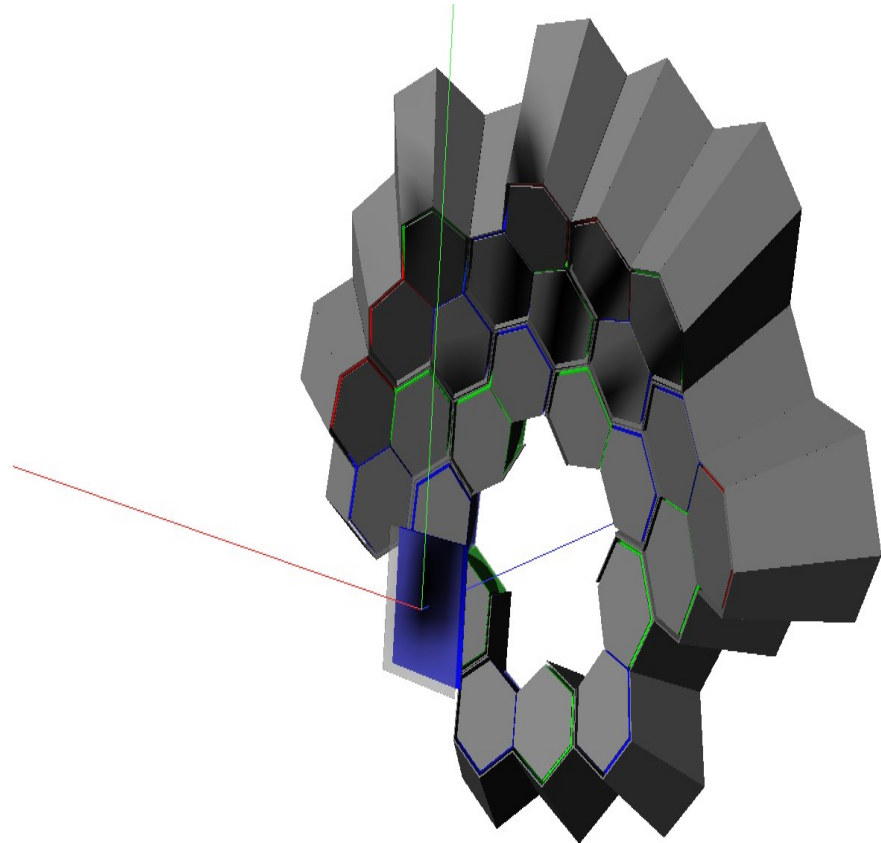
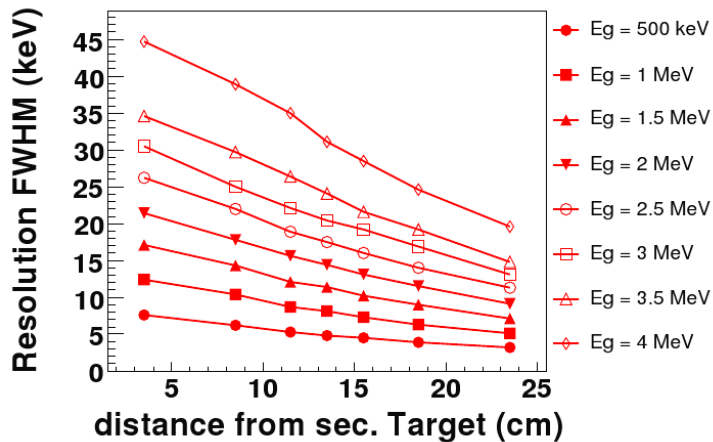
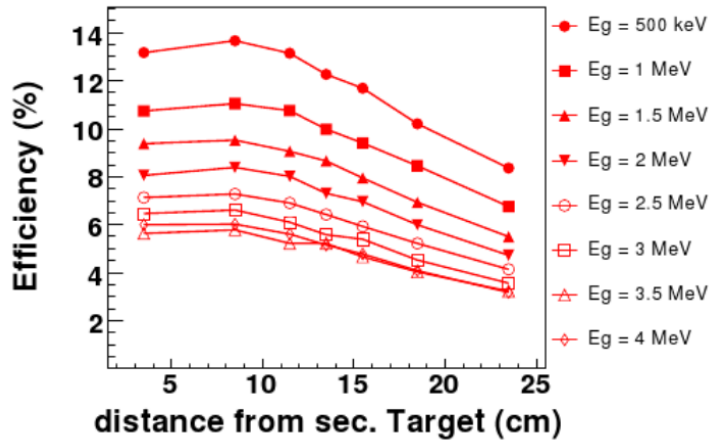


Avg. gamma interaction positions weighted by energy



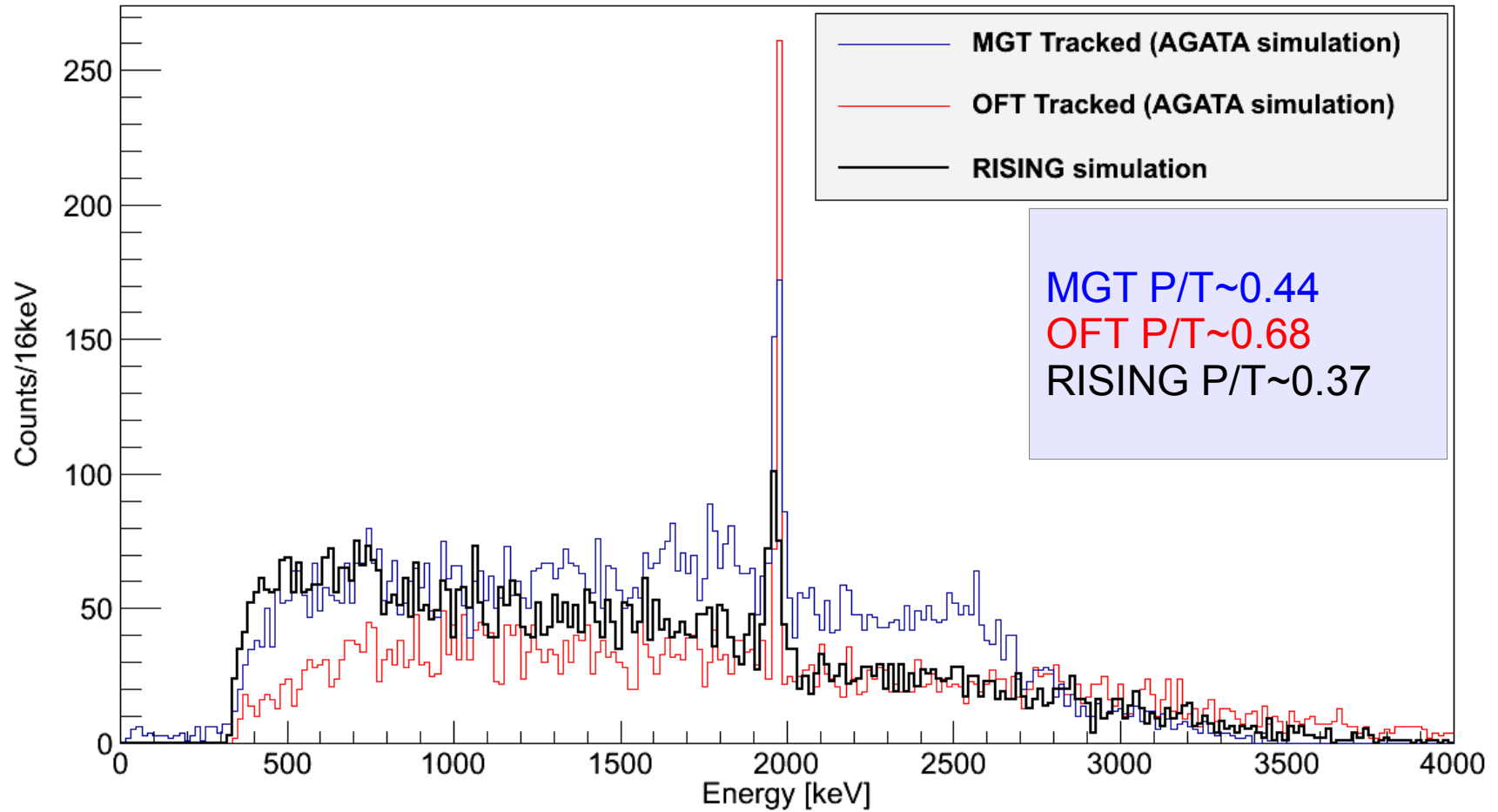
Total add-back spectra



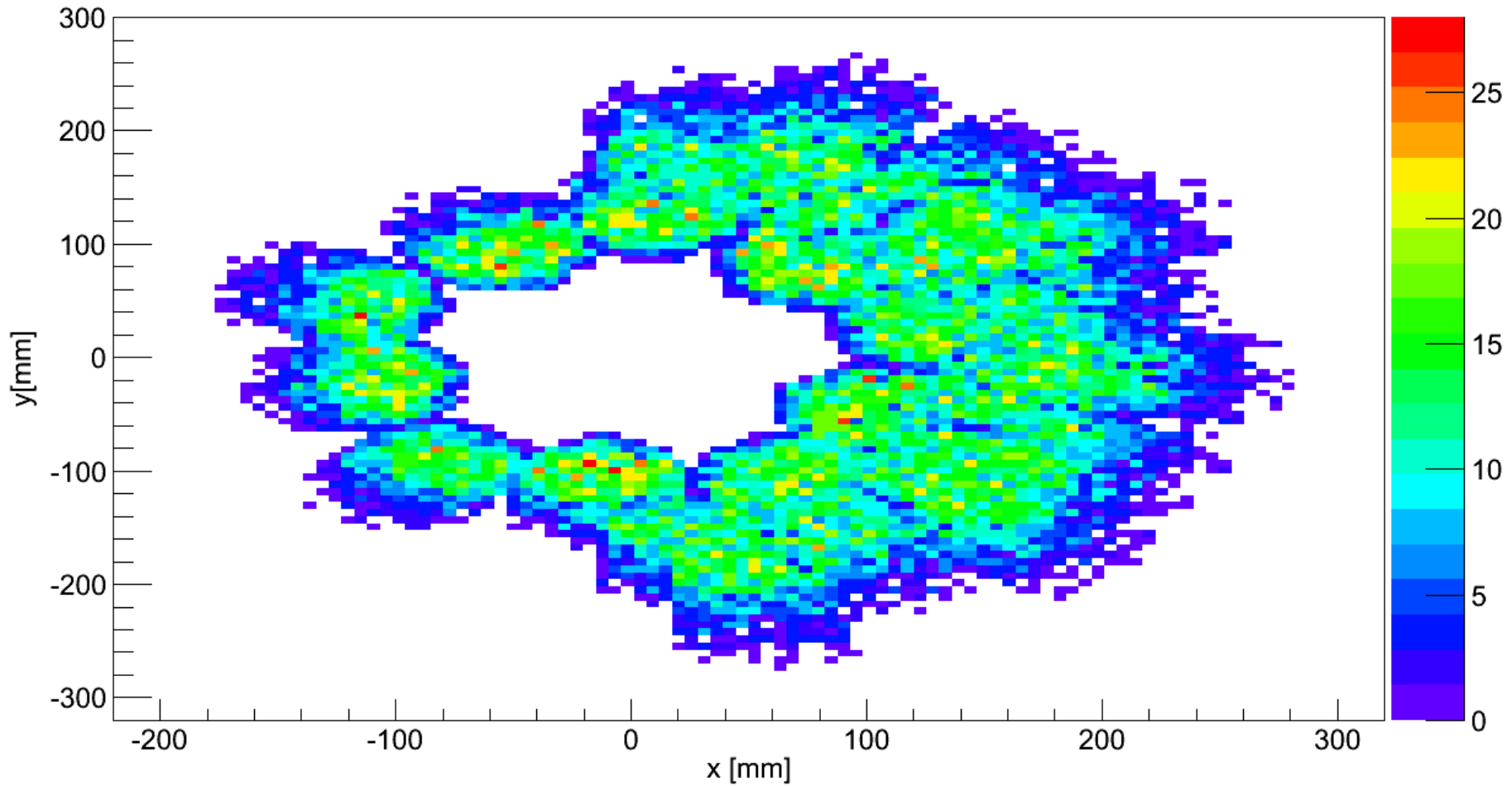


AGATA S2 configuration (5 triples + 5 doubles).

Simulated AGATA & RISING comparison



Avg. gamma interaction positions weighted by the energy



- Simulation package to test performance of AGATA and the γ -tracking codes in the GSI environment

Future Work

- Investigate tracking performance
 - OFT – single interactions
 - Packing and smearing
- Compare ^{33}Ar simulation with experiment

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STFC

Mike Taylor

University of Manchester

Cesar Domingo + AGATA Simulation Group, Helmut Weick

GSI, Darmstadt

Enrico Farnea, Dino Bazzacco et al.

Legnaro National Laboratory

O. Stezowski et al.

IN2P3-IPN Lyon

Araceli Lopez-Martens + Tracking Team

University of Jyväskylä

And the whole AGATA collaboration:

Univ. Ankara, Turkey
Univ. Bonn, Germany
NIPNE Bucharest, Romania
Univ. Brighton, UK
GANIL, Caen, France
Univ. Camerino, Italy
NBI Copenhagen, Denmark
Univ. Cracow, Poland
STFC Daresbury, UK
GSI Darmstadt, Germany
TU Darmstadt, Germany
INFN Firenze, Italy
INFN Genova, Italy
Univ. Göteborg, Sweden
FZ Jülich, Germany
Univ. Jyväskylä, Finland
Univ. Keele, UK
Univ. Köln, Germany
IFJ PAN Krakow, Poland
INFN Legnaro, Italy
Univ. Liverpool, UK
Univ. Istanbul, Turkey

IPN Lyon, France
Univ. Lund, Sweden
Univ. Manchester, UK
INFN/Univ. Milano, Italy
LMU München, Germany
TU München, Germany
INFN Napoli, Italy
CSNSM Orsay, France
IPN Orsay, France
INFN/Univ. Padova, Italy
Univ. Paisley, UK
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CEA Saclay, France, Dapnia
Univ. Sofia, Bulgaria
KTH Stockholm, Sweden
iPHC Strasbourg, France
Univ. Surrey, UK
IPJ Swierk, Poland
Univ. Warsaw, Poland
Univ. Uppsala, Sweden
Univ. York, UK