High-Resolution β-delayed γ-ray Study of the ^{110}Tc→ ^{110}Ru → ^{110}Rh → ^{110}Pd Isobaric Decay Chain

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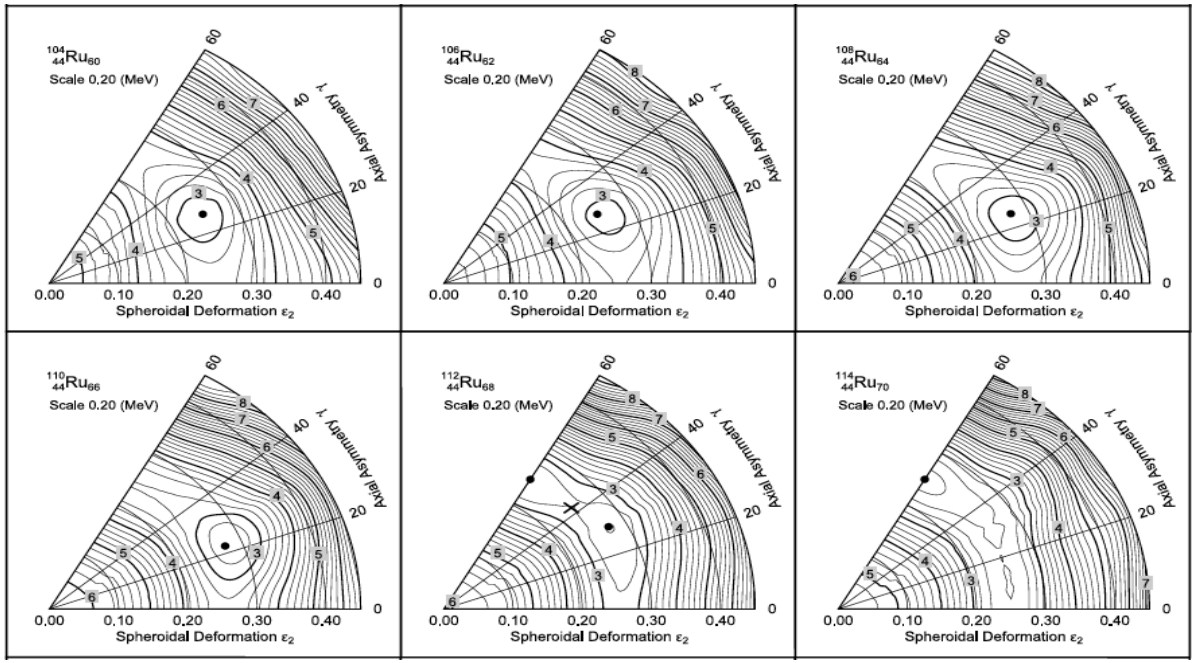
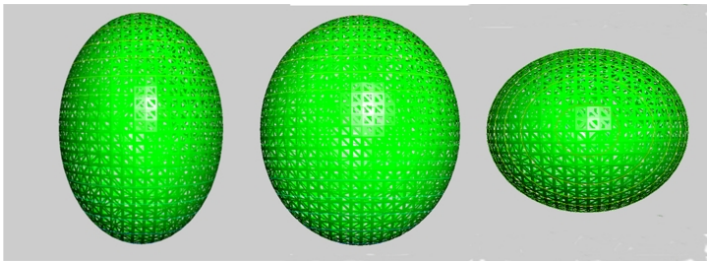
Nuclear Deformation

Nuclei can be spherical, prolate, oblate or triaxial

These can be characterised by the parameters – β and γ





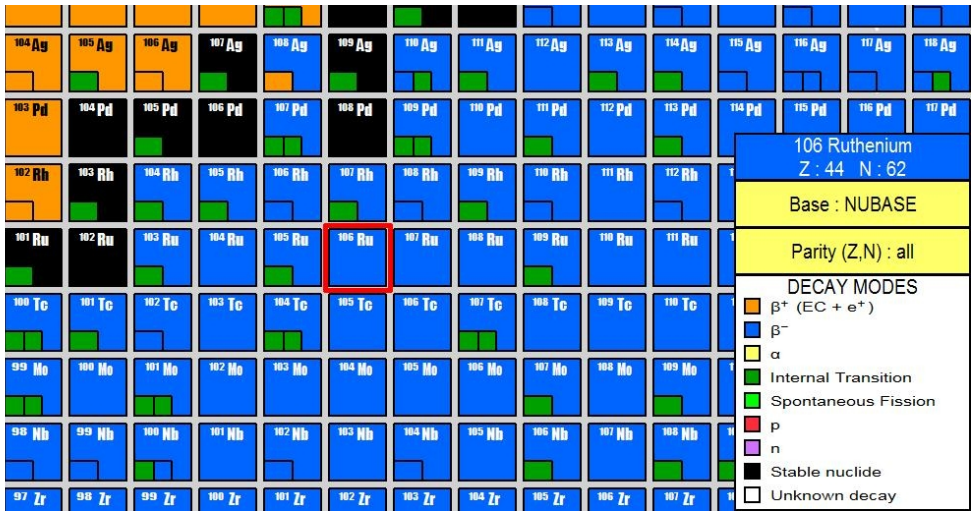
US DOE Science Highlight (2017)

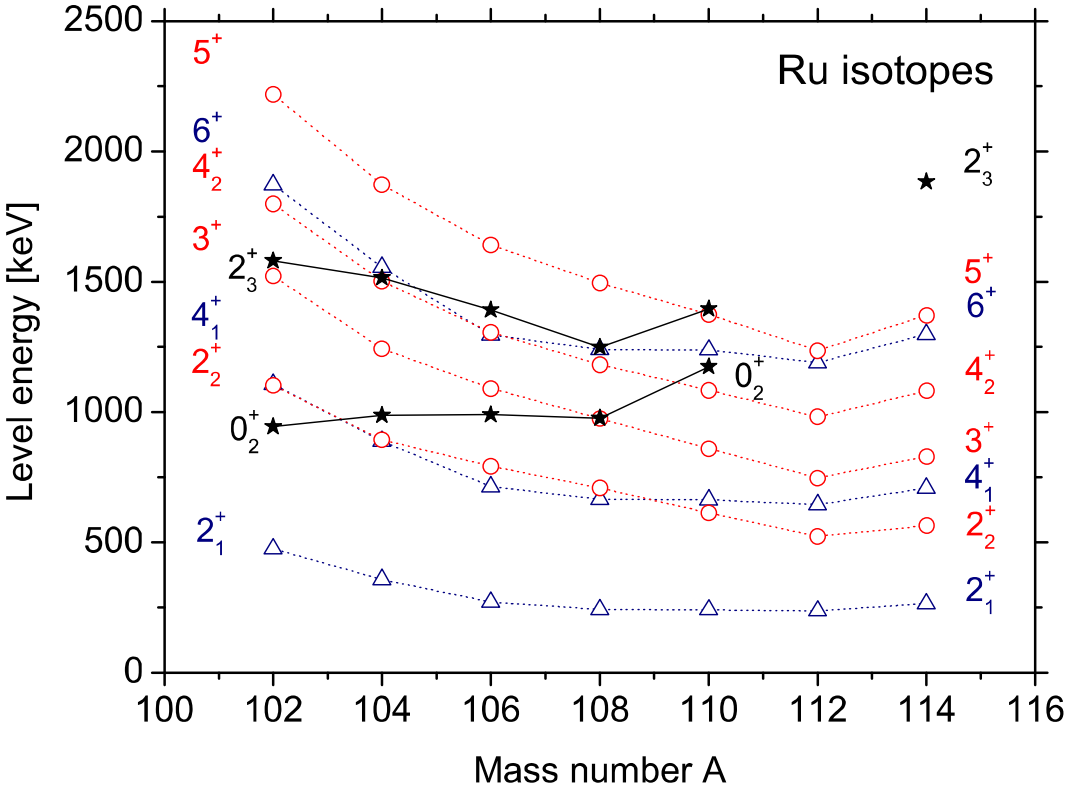
P. Moeller *et al.*, At. Data Nucl. Data Tabl. **94** (2008)

Triaxial Shapes in the A=110 Region

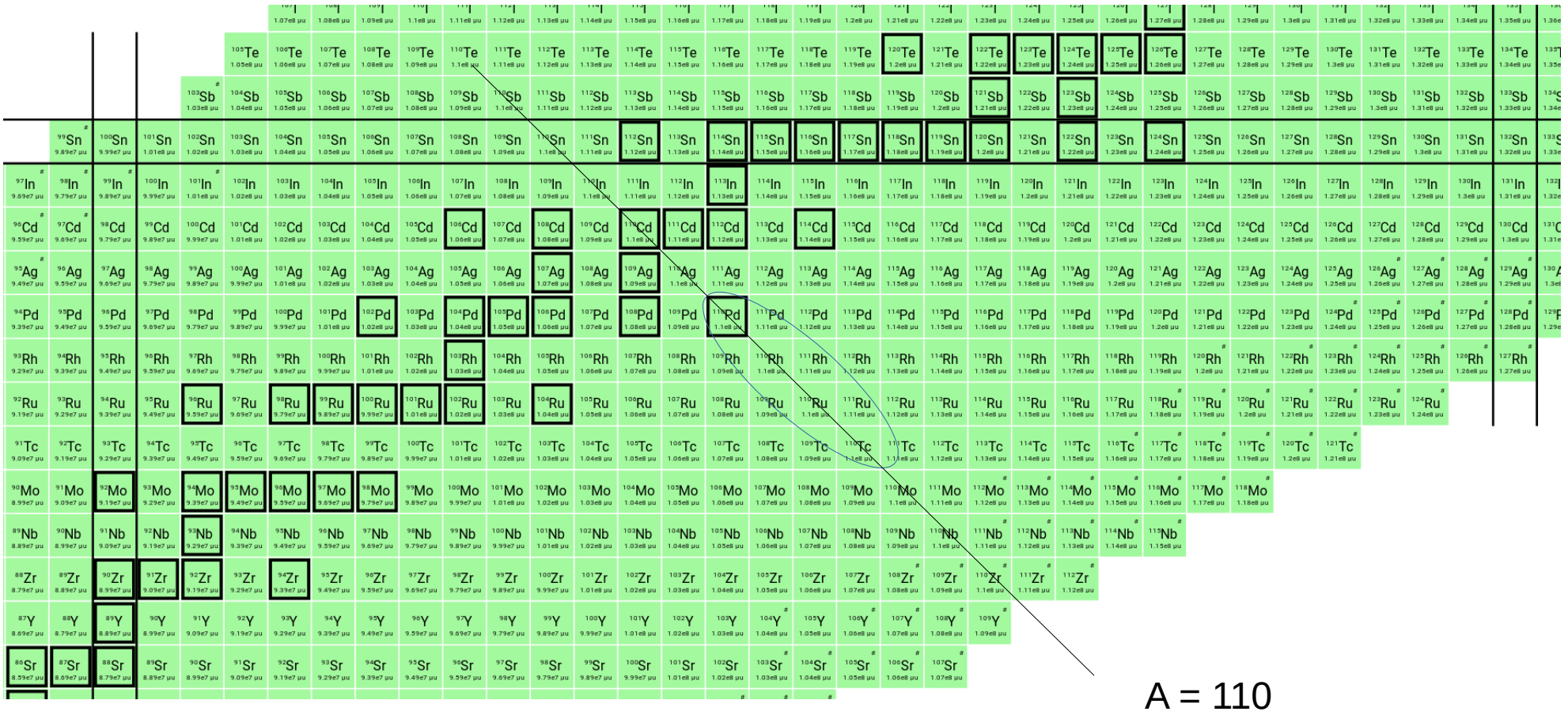
Indications of triaxiality via the Rigid Triaxial Rotor Model:

- $R_{42} < 3.33$ and ~ 2.7
- $E(2_2^+) < E(4_1^+)$





A=110 Nuclei



Motivation and Aims

To find examples of triaxial deformation in the low-lying states of ^{110}Ru

Provide data for comparison to theoretical models of triaxiality

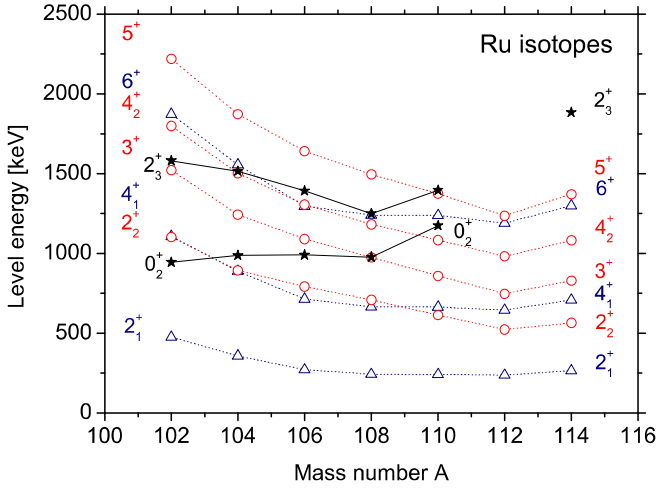
Perform high-resolution gamma-ray coincidence analysis to identify previously unreported nuclear states to improve undersanding of decay population following beta-decay with a large Q_β - values

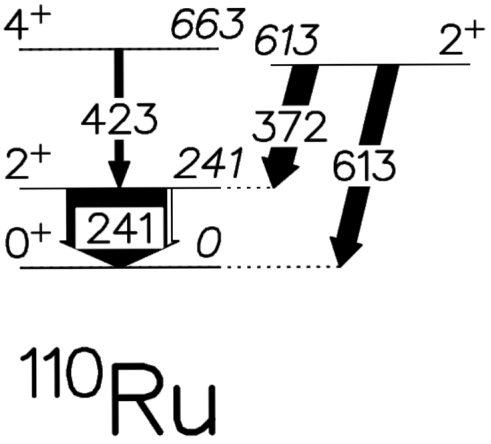
How Can We Measure Deformation?

Observe excited states in the nuclei of interest

Determine branching & mixing ratios, and B(E2) values

Input this information into the CoulEx analysis code GOSIA2 to determine deformation parameters





Experiment (Sept. 2018)

1) CoulEx: – 5 days of ^{110}Ru on a 1.5mg/cm^2 ^{208}Pb target

2) β- decay: – 2 days of ^{110}Tc beam on a thick ^{197}Au target

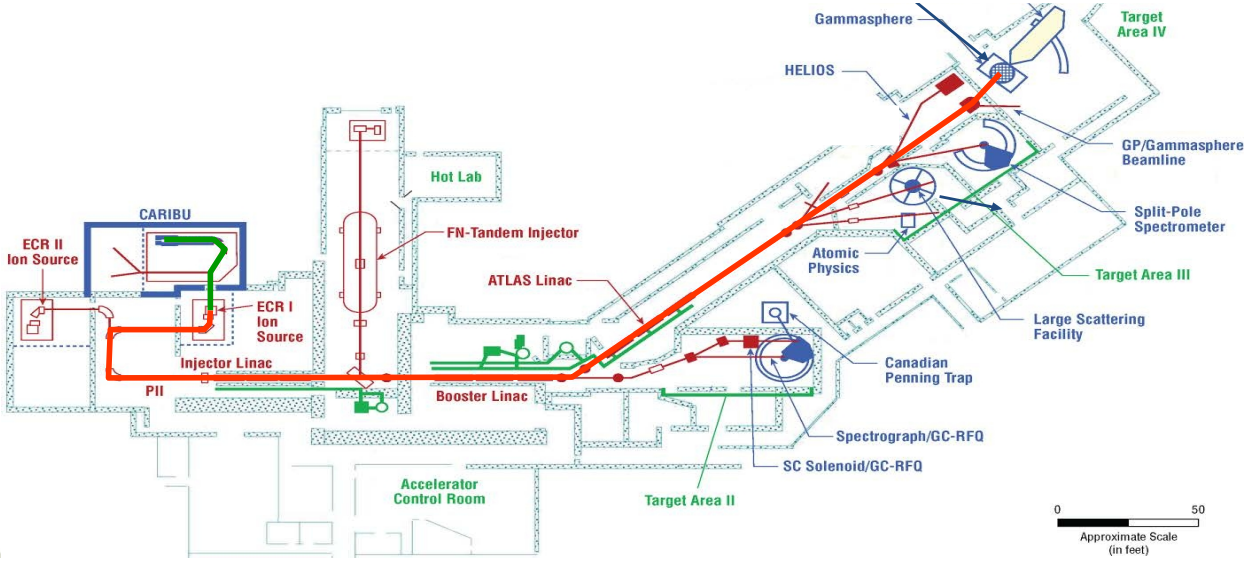
RIB intensity: ~4000 A=110 particles per second in 1+ charge state

Data pre-sorted with a maximum coincidence timing condition of 1.42μs

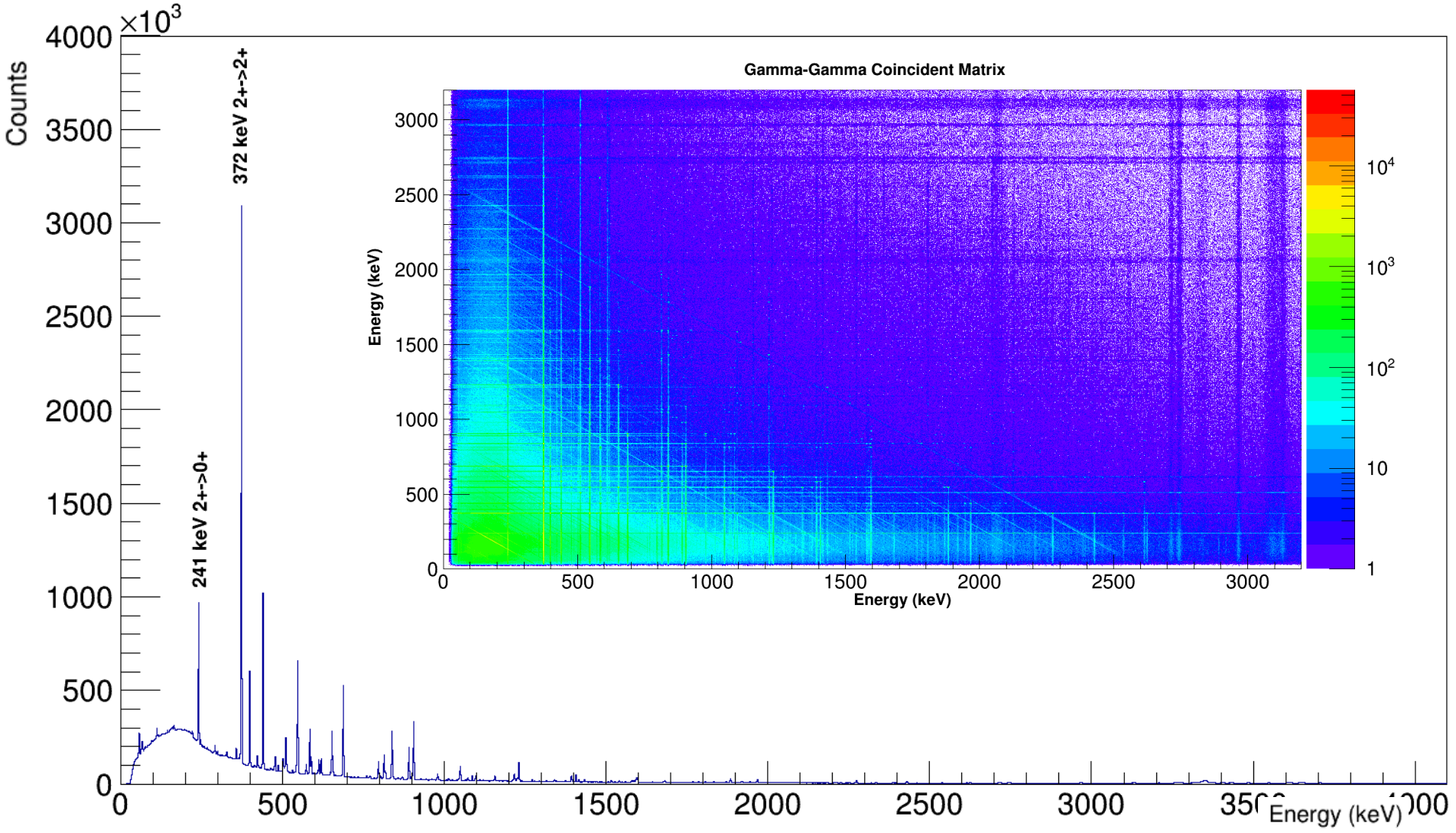
Gamma Ray Energy Tracking In Beam Array (GRETINA)

11 detector modules each consisting of 4, 36 segment HPGe detector

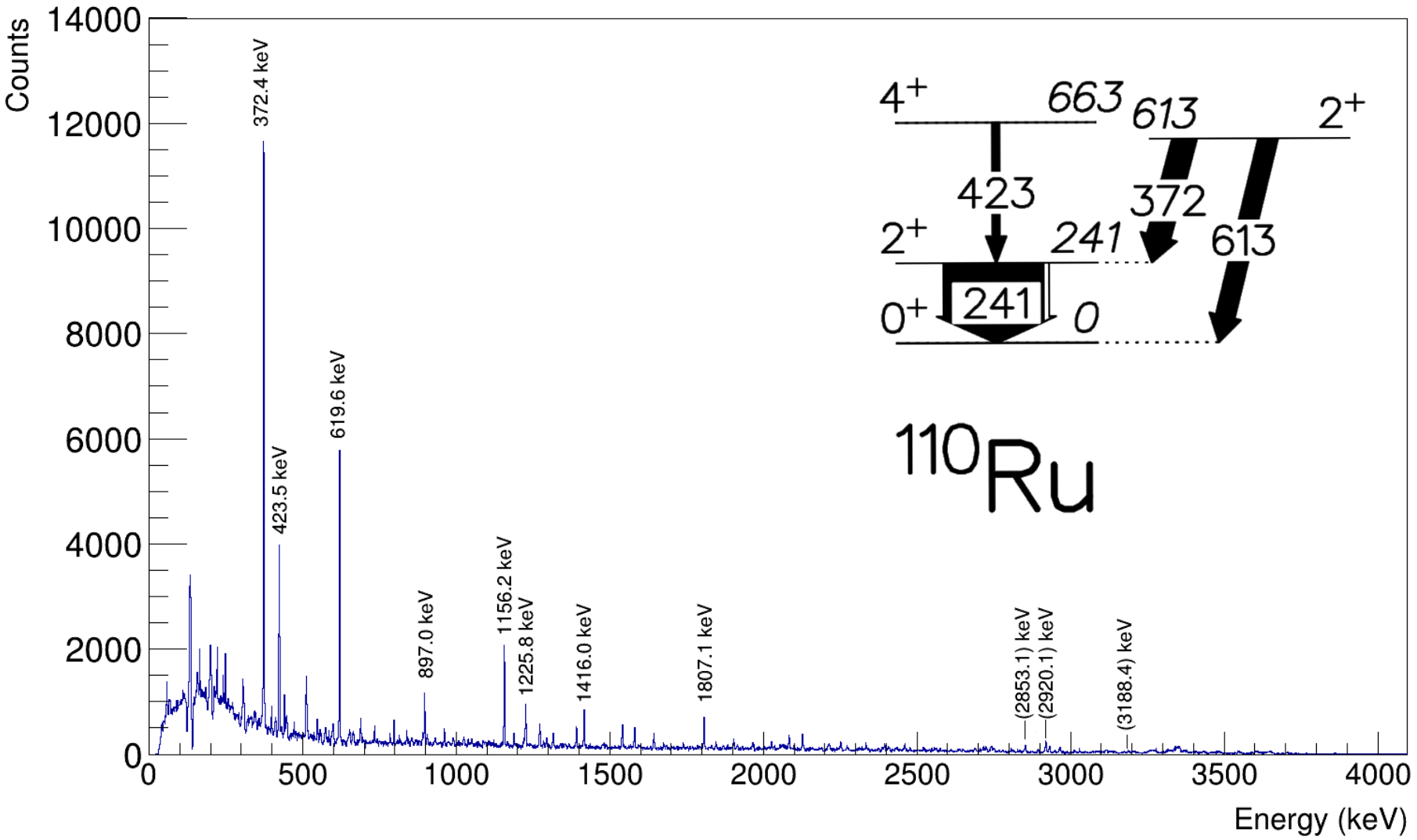
~1π solid angle; tracking and/or addback



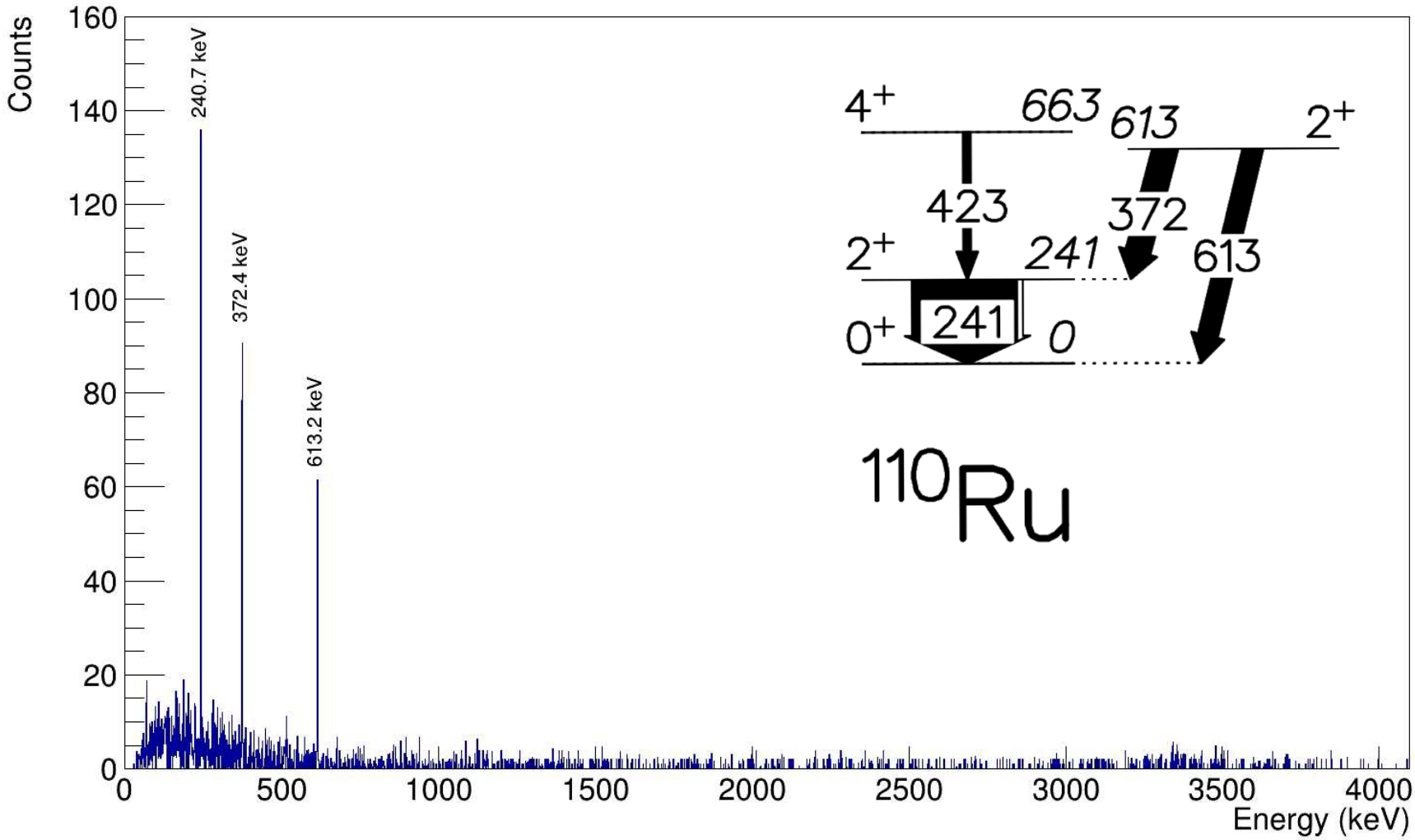
Results: Gamma-Gamma Coincidence for A=110 Nuclei



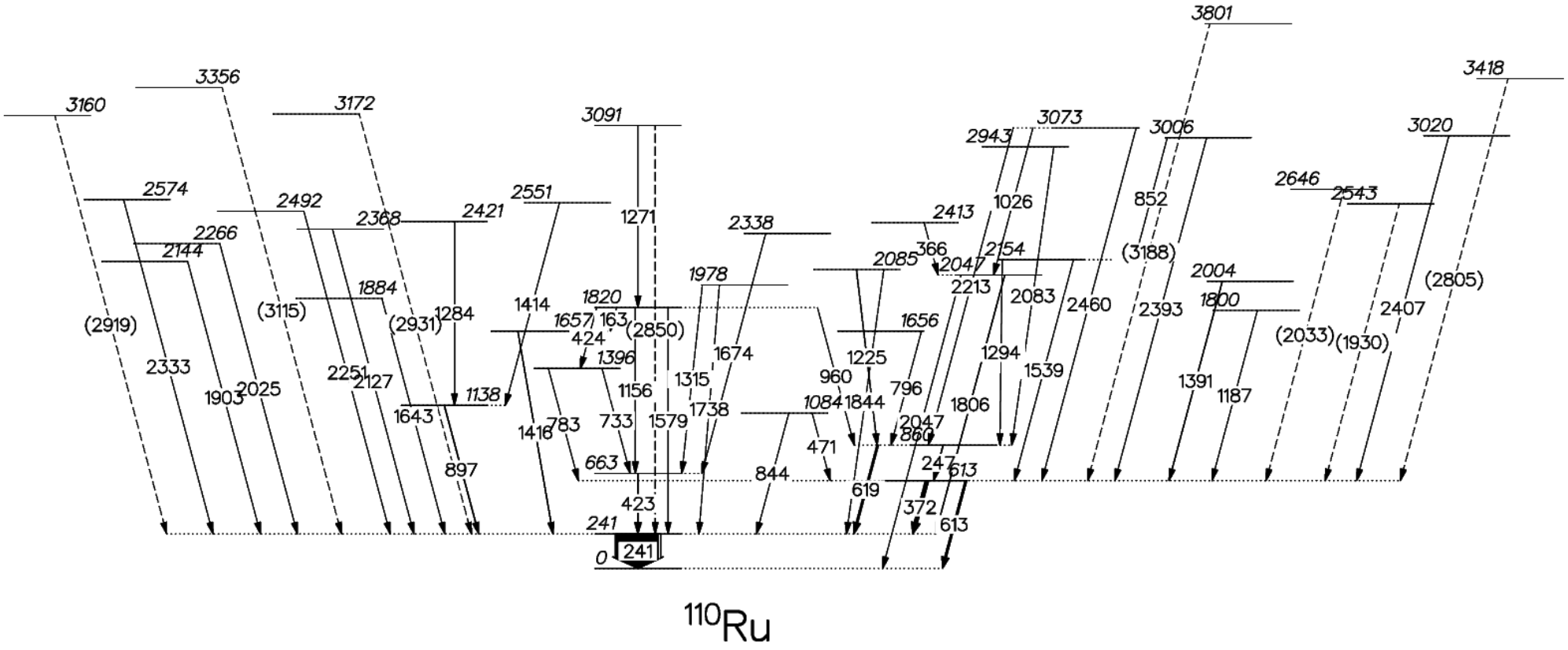
241keV Gate in 2+ → 0+ in 110Ru.



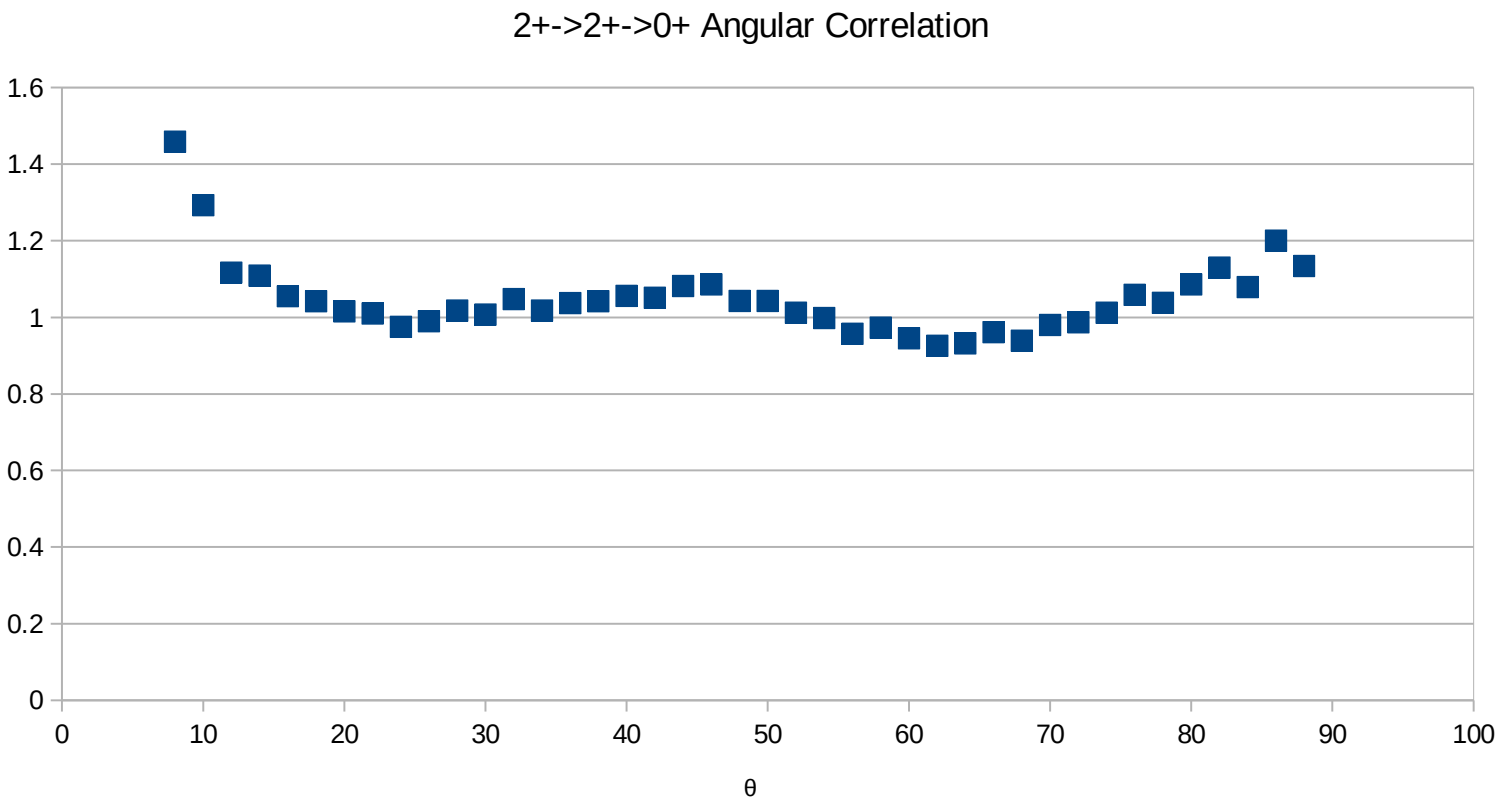
Identification of ‘new’ levels in 110Ru: 3188keV gate 110Ru, feeds directly to I(π)=2+ @613 keV



Updated Level Scheme for 110Tc → 110Ru



^{110}Ru Angular Correlations (preliminary)



To be fitted using the following Legendre Polynomial -

$$W(\theta) = A_o\,(1 + A_2P_2(\cos(\theta) + A_4P_4(\cos(\theta))$$

Summary

Analysis is ongoing

Spectrum to be analysed and fit for branching ratios

Angular correlations to be fitted and mixing ratios determined

Combination of beta decay and CoulEx data will be used to obtain the deformation parameters of ^{110}Ru which describe the nuclear structure

Acknowledgements

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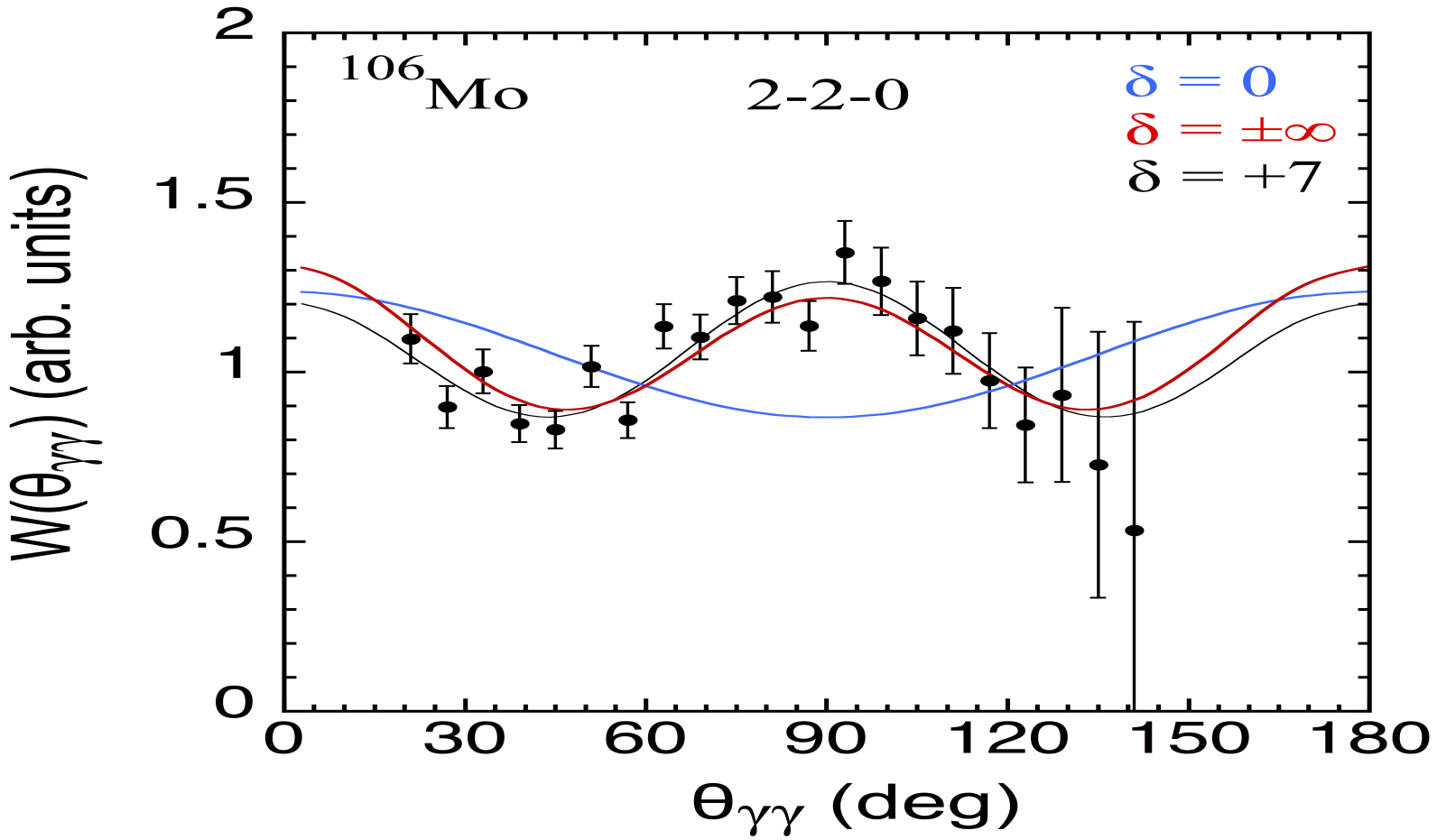
Mitch Allmond for sort codes

Thank You For Listening

Mixing Ratios



Caribu – ^{252}Cf Fission Source

Fission fragments are passed through an isobar separator
Then sent through to ECR ion source for charge breeding
Ions then A/Q separated and injected into ATLAS