Lifetime measurement in the even-even molybdenum isotopes with the PreSPEC-AGATA setup

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- Introduction: the mass region A≈100
- Experimental setup
- Data Analysis
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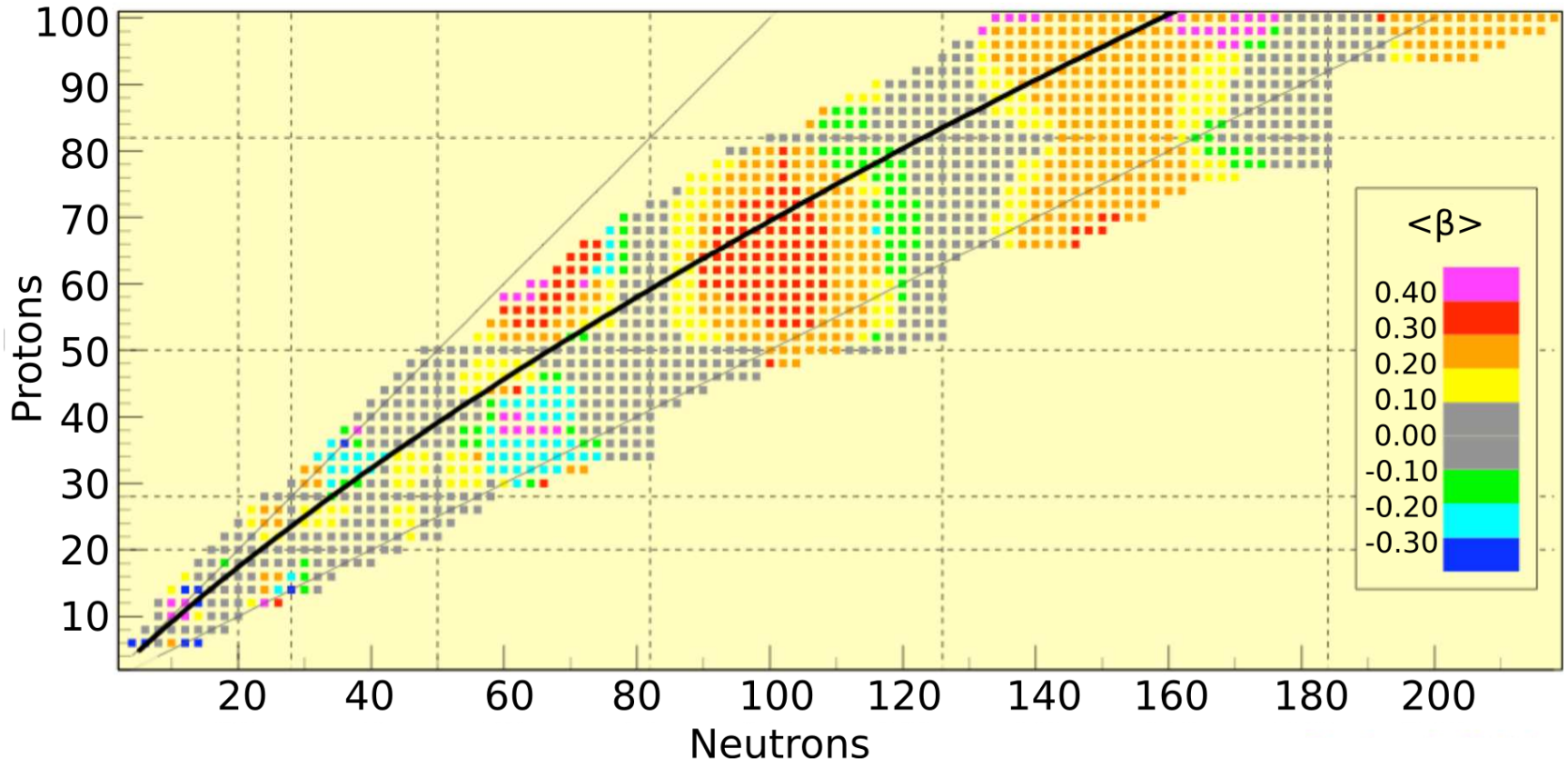
Deformation predictions

Hartree-Fock-Bogoliubov shape predictions

J.P. Delaroche, Phys. Rev. C 81,014303 (2010)



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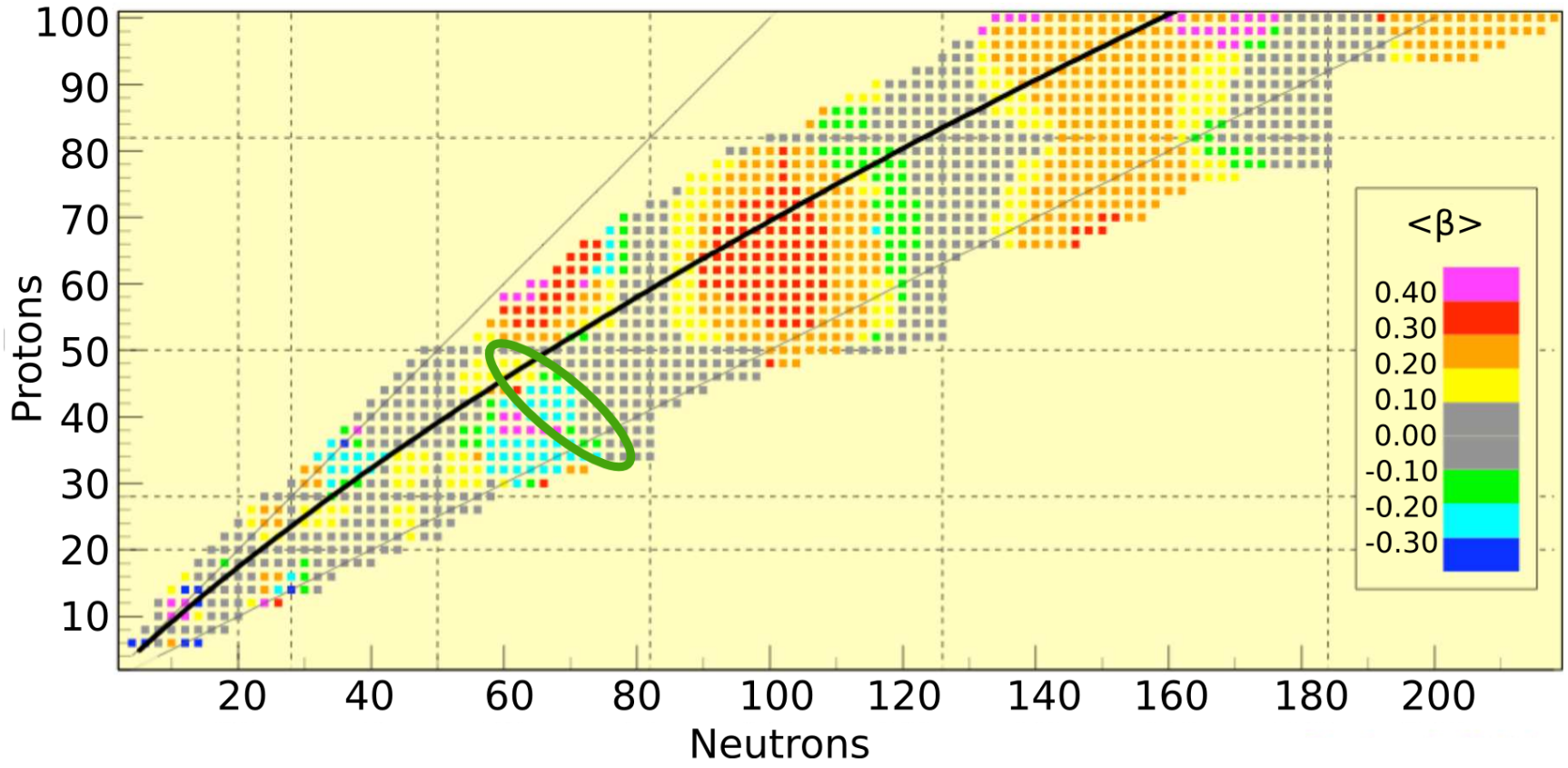
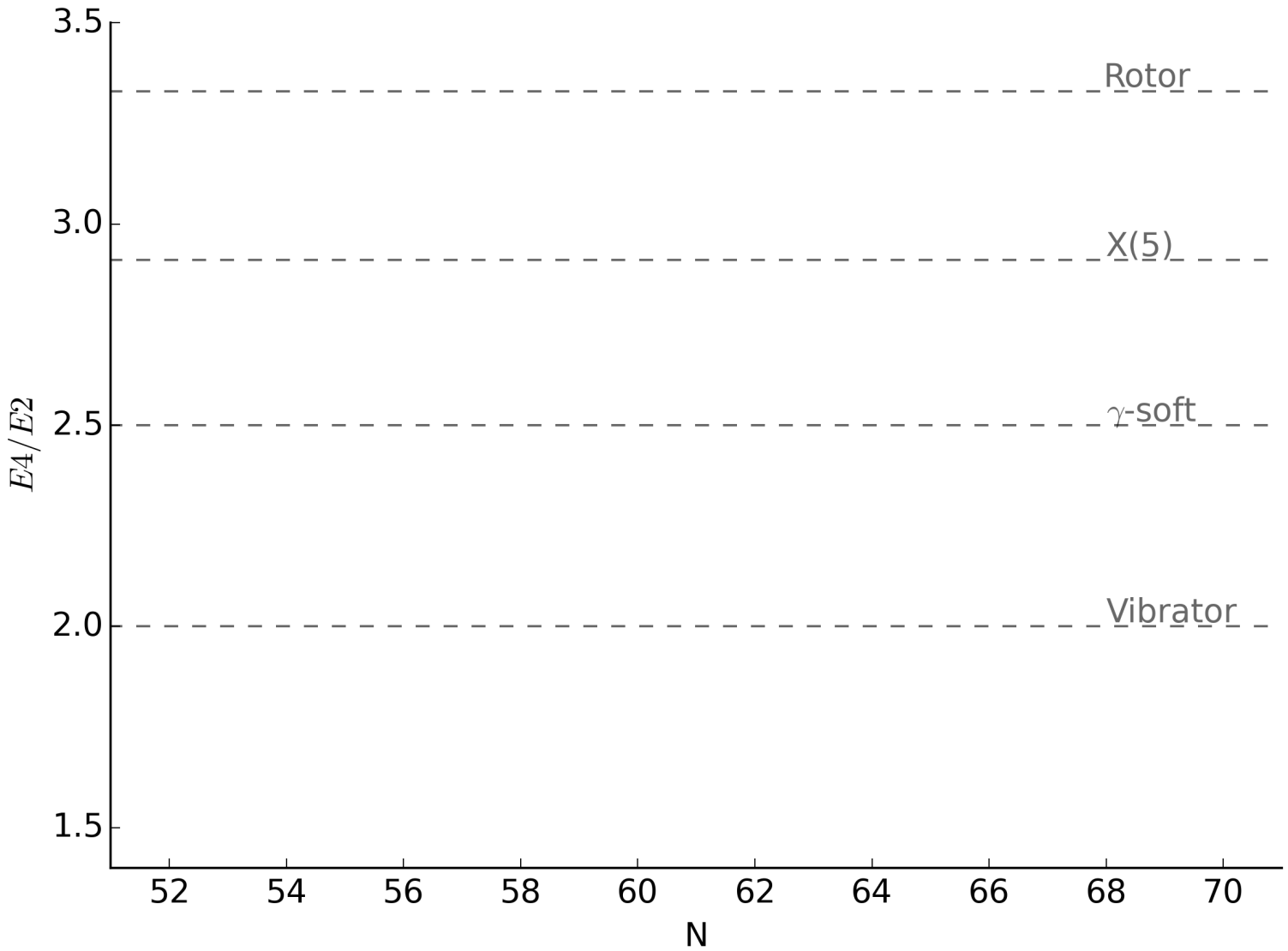


$E4/E2$ energy ratios



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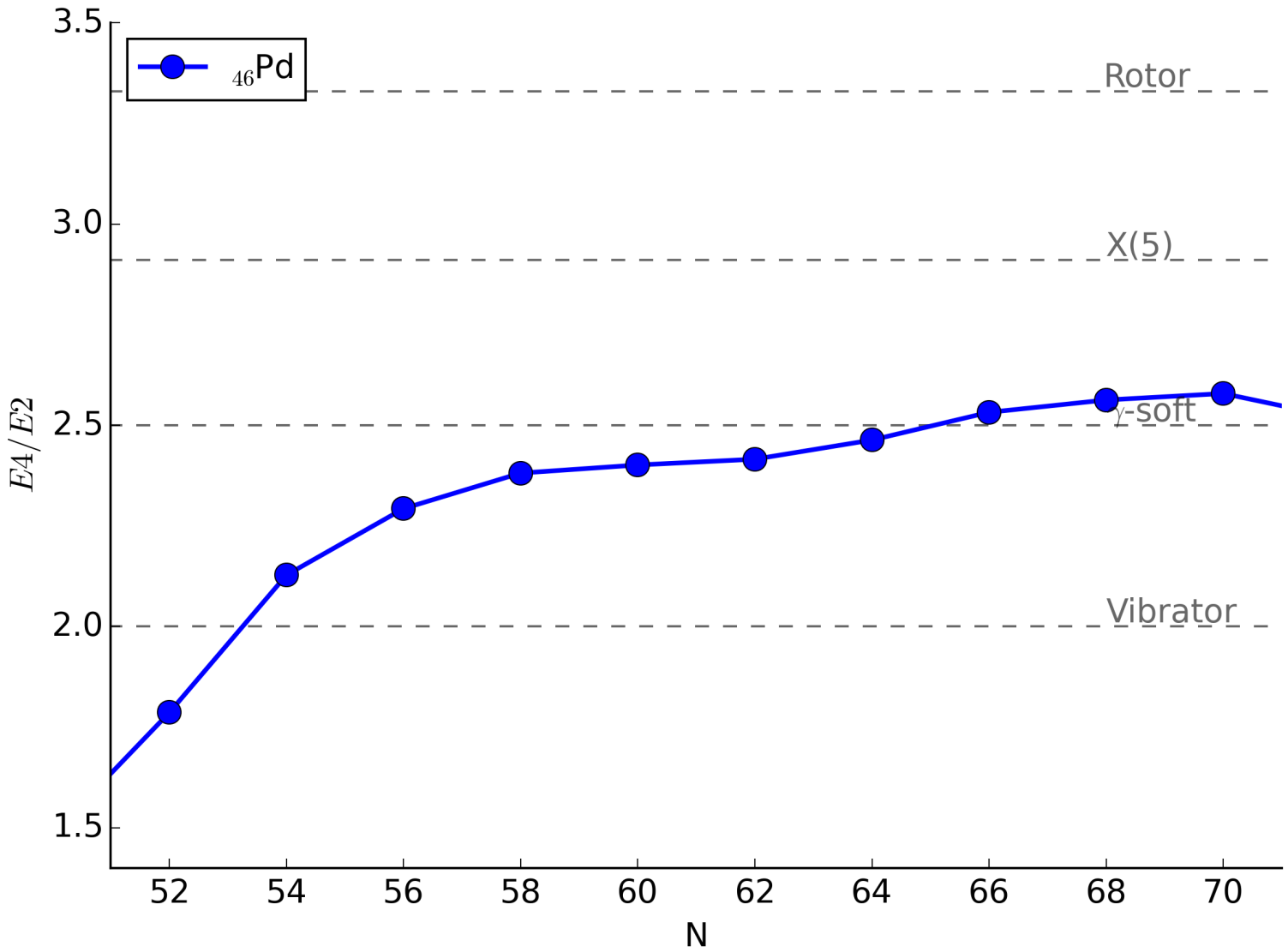

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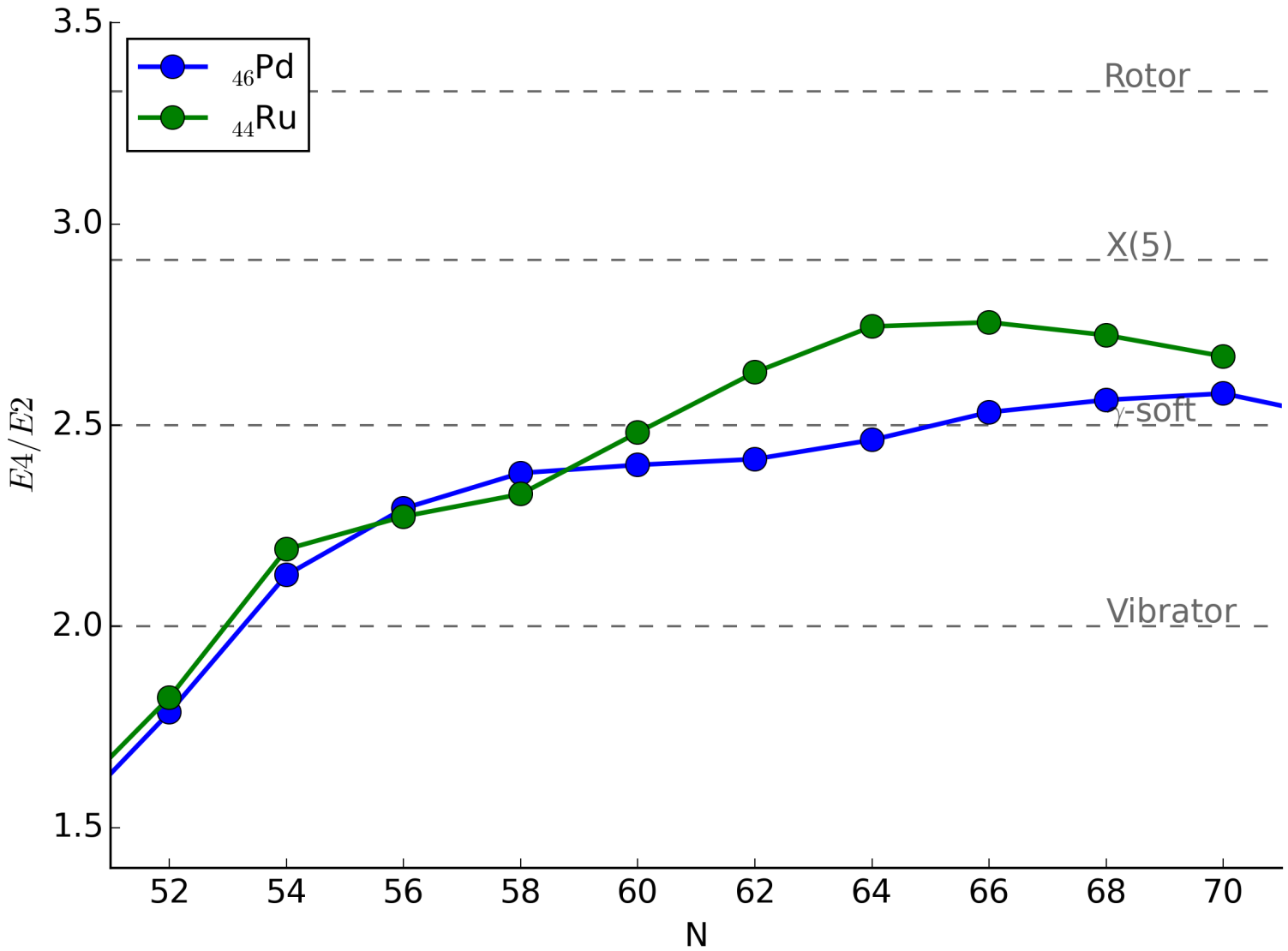

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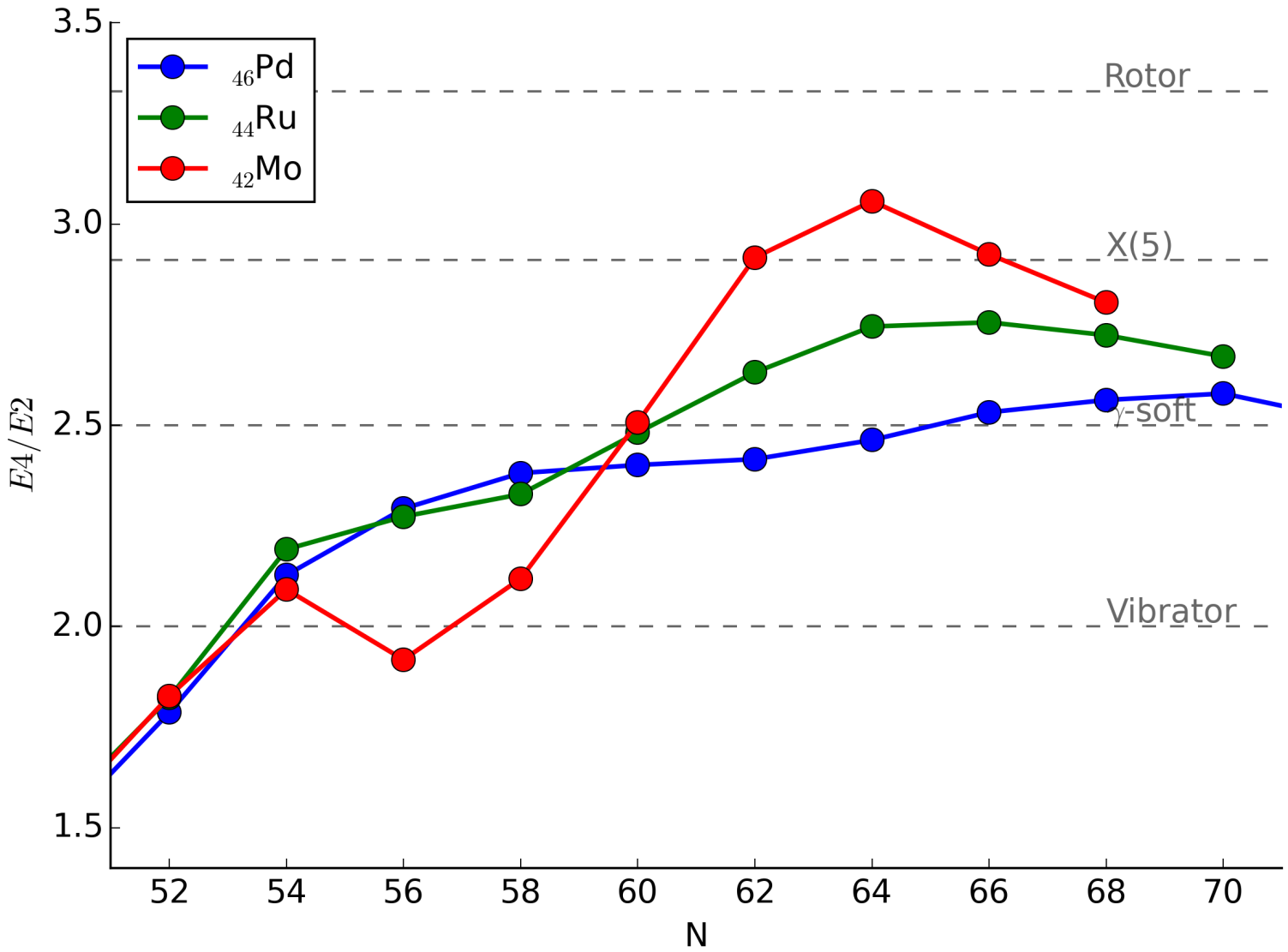

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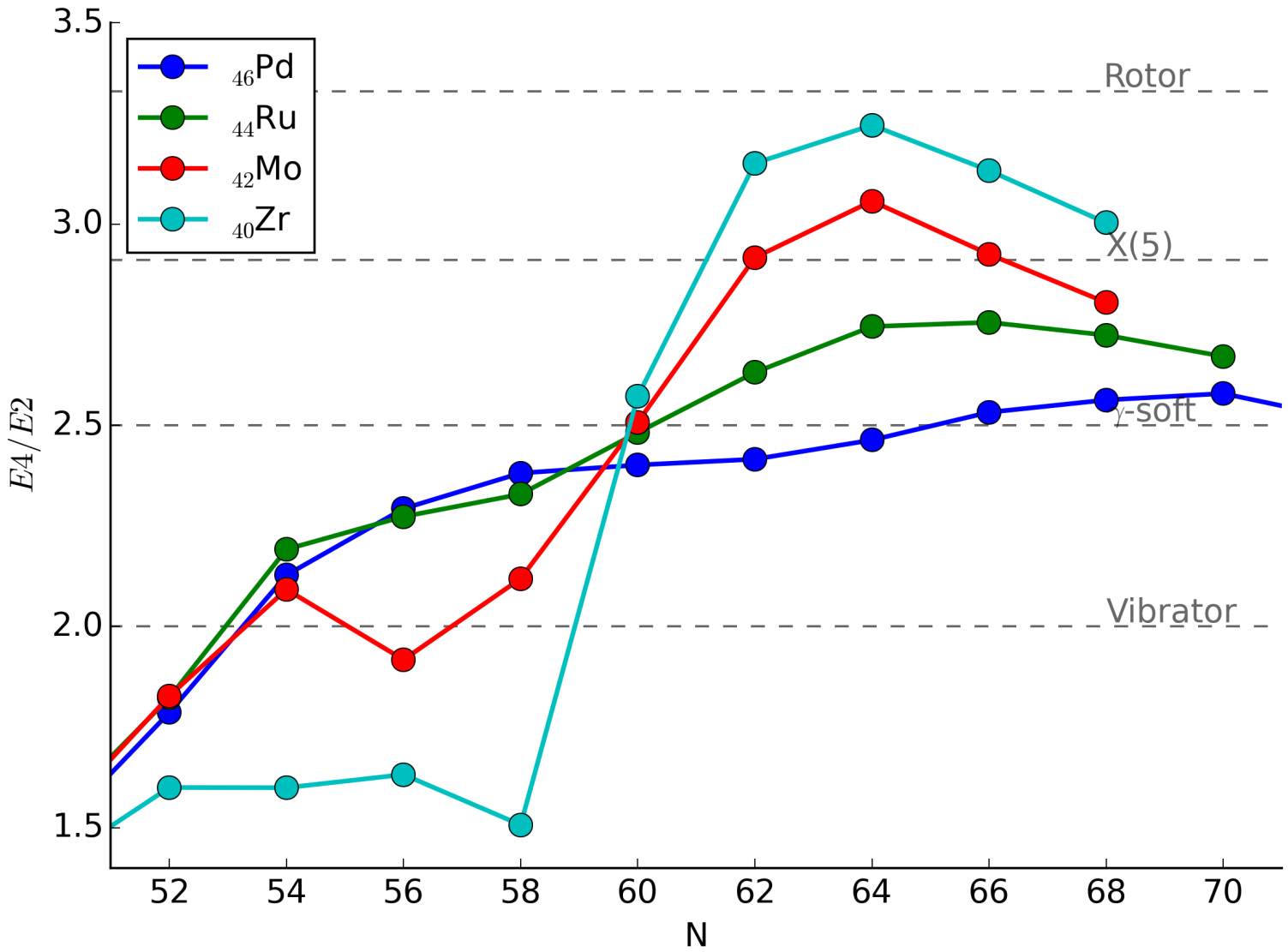

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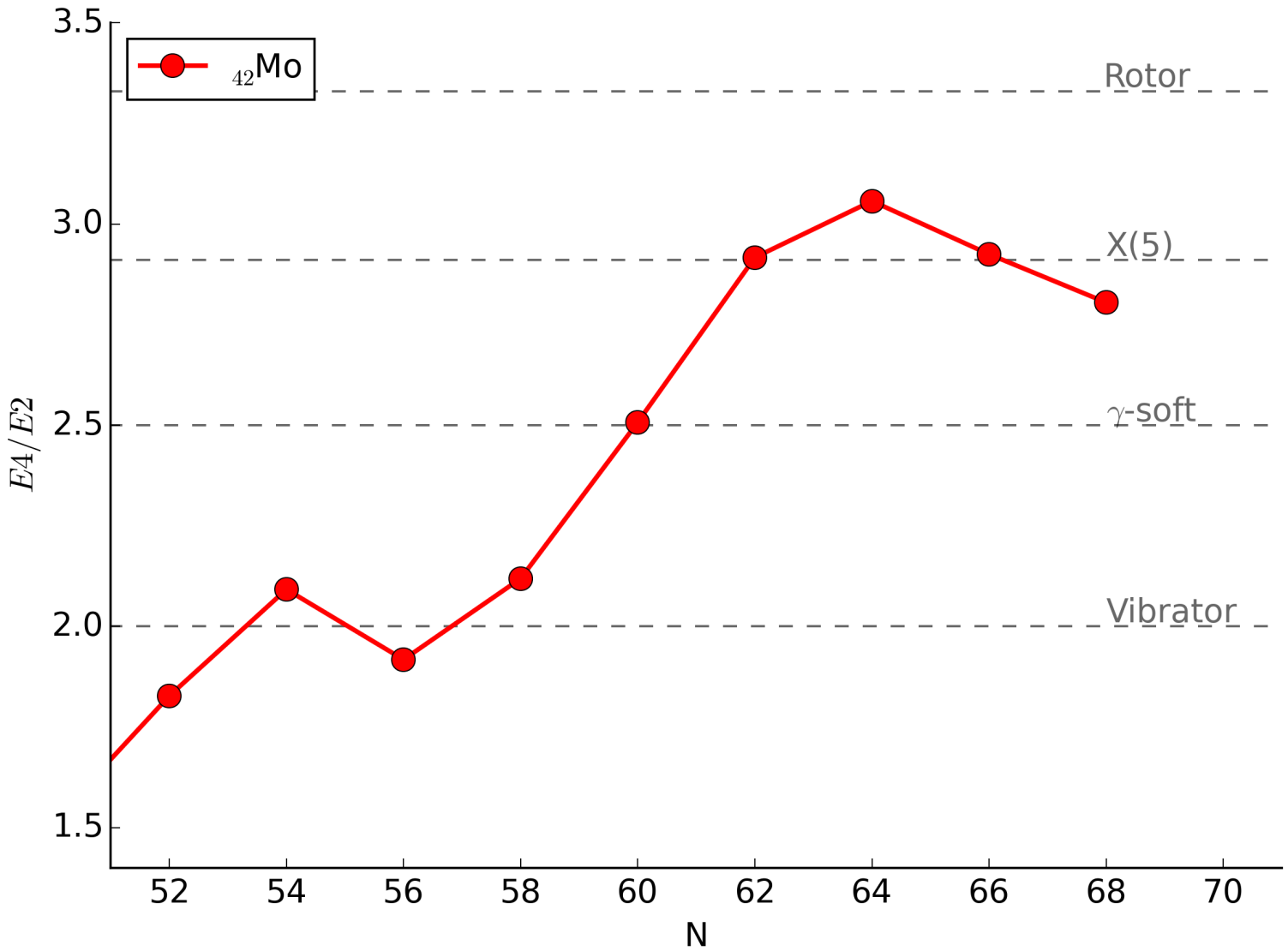
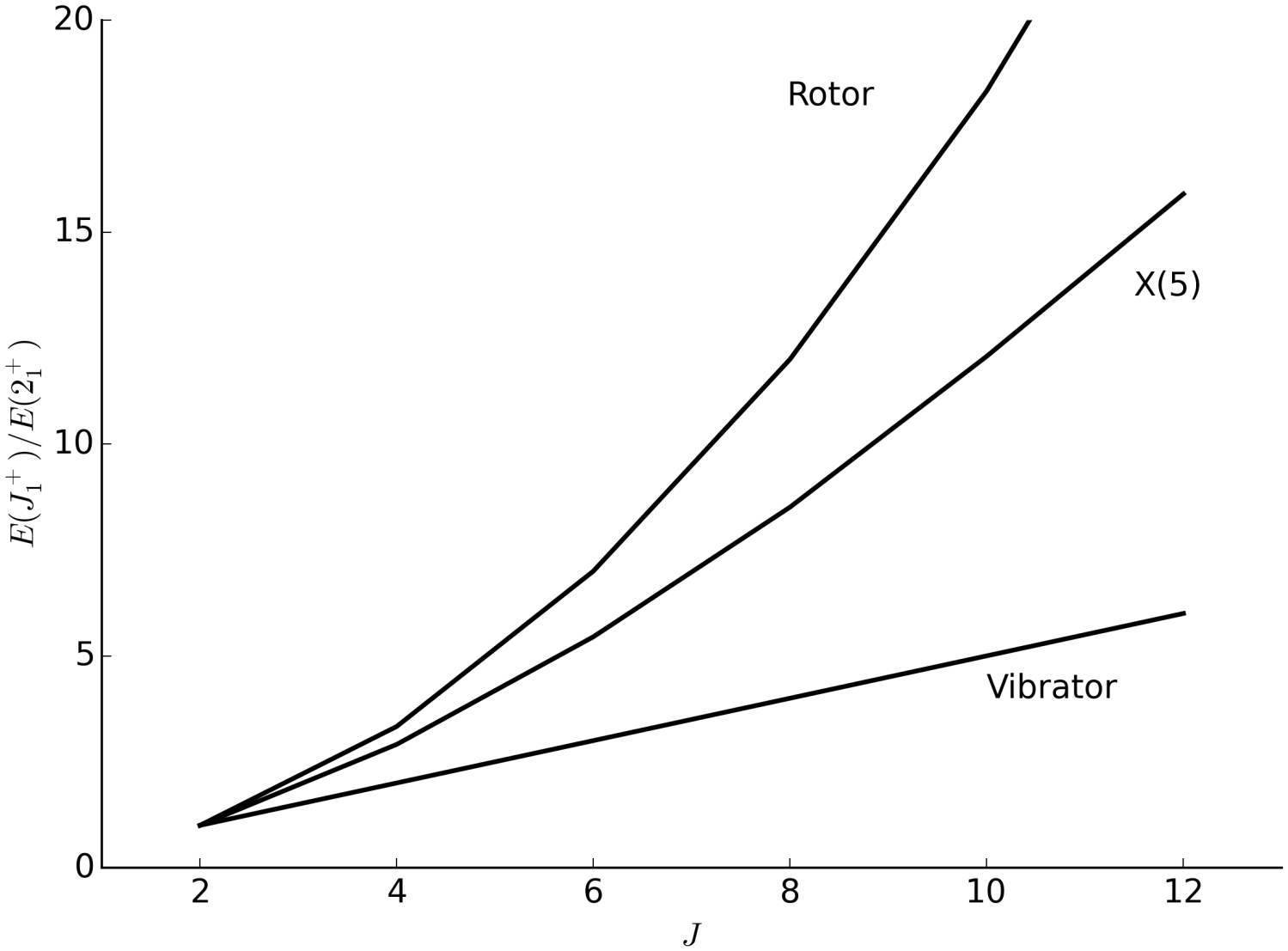


Energy ratios

Adopted energy values



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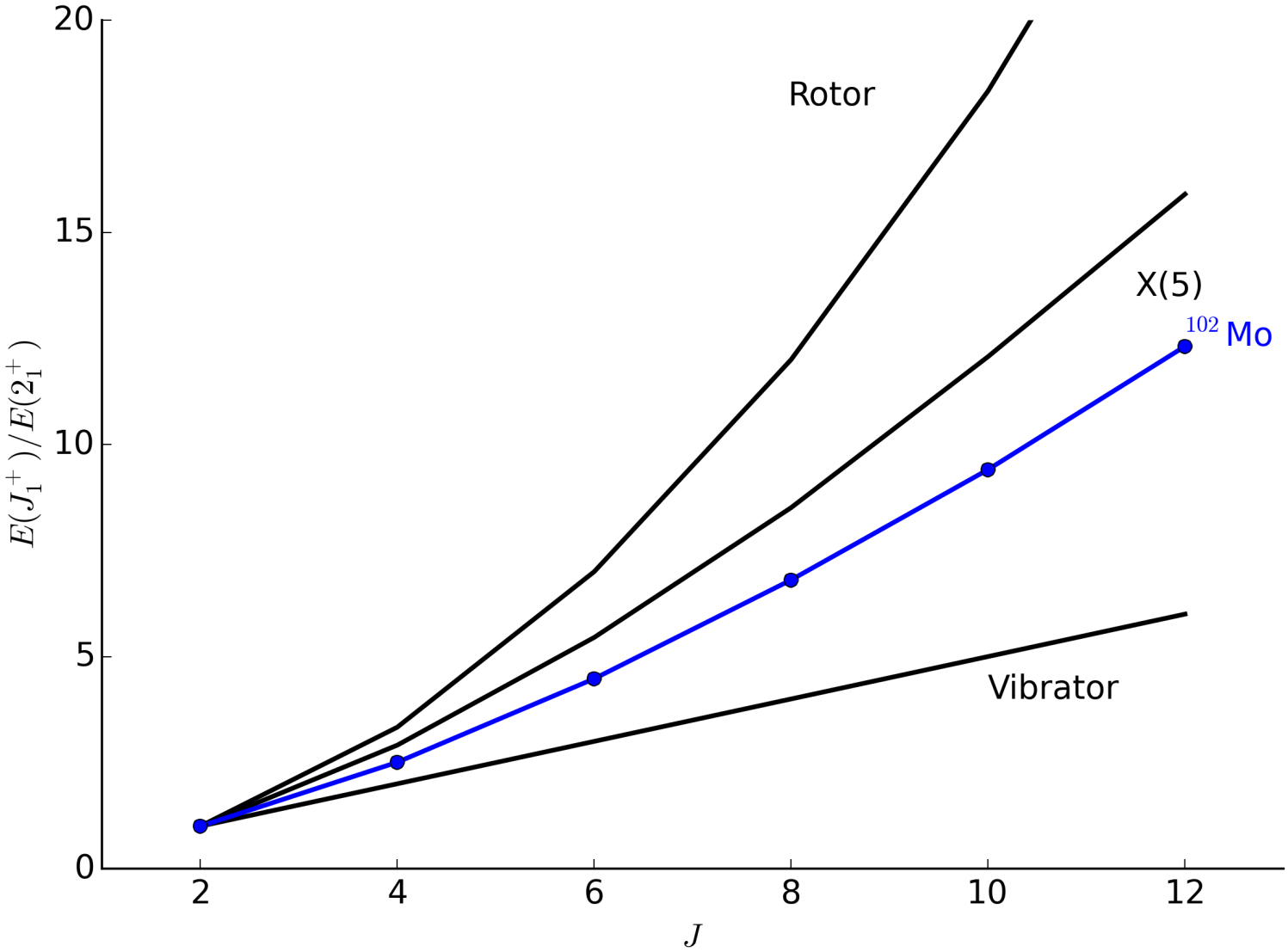

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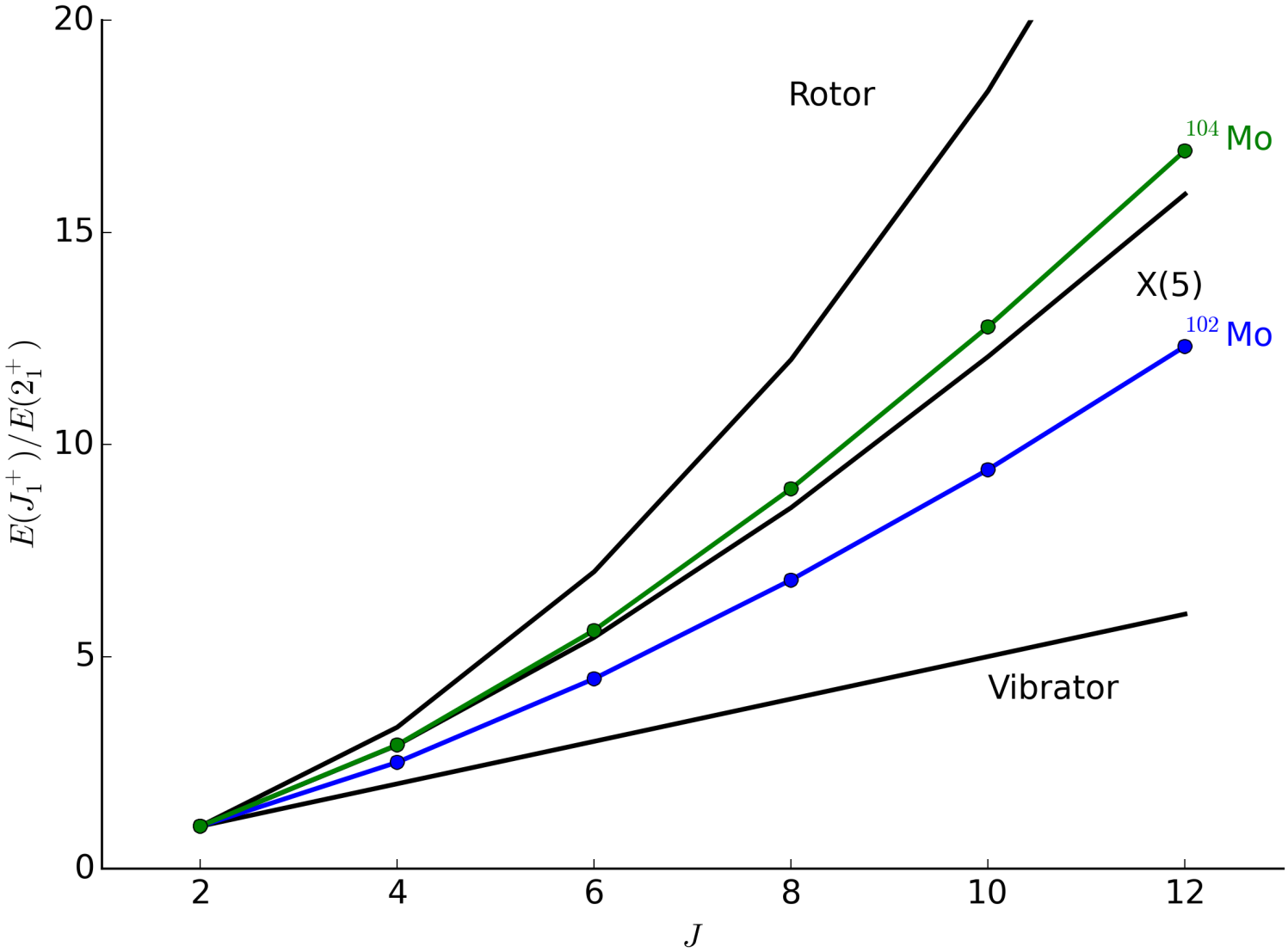

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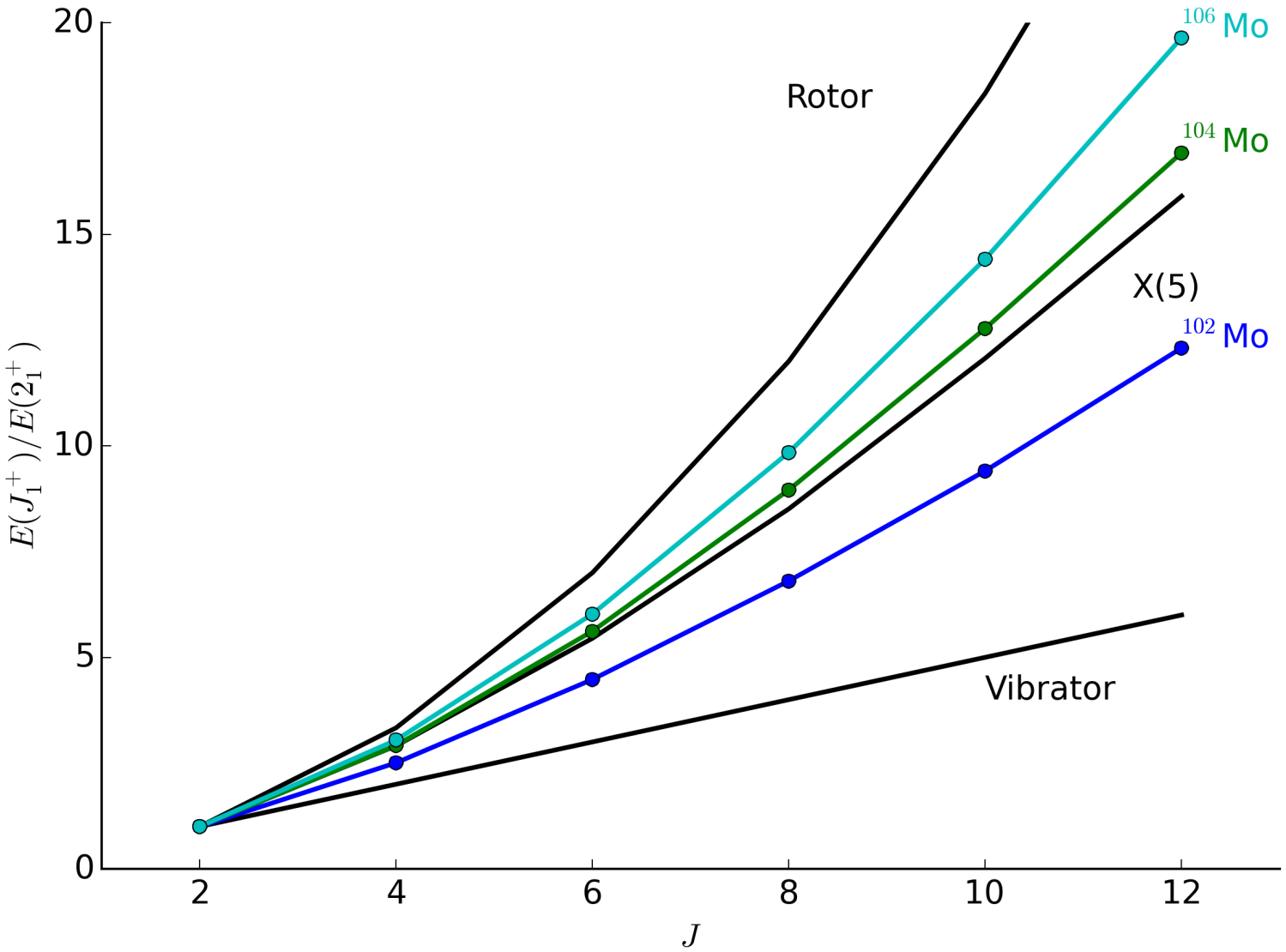

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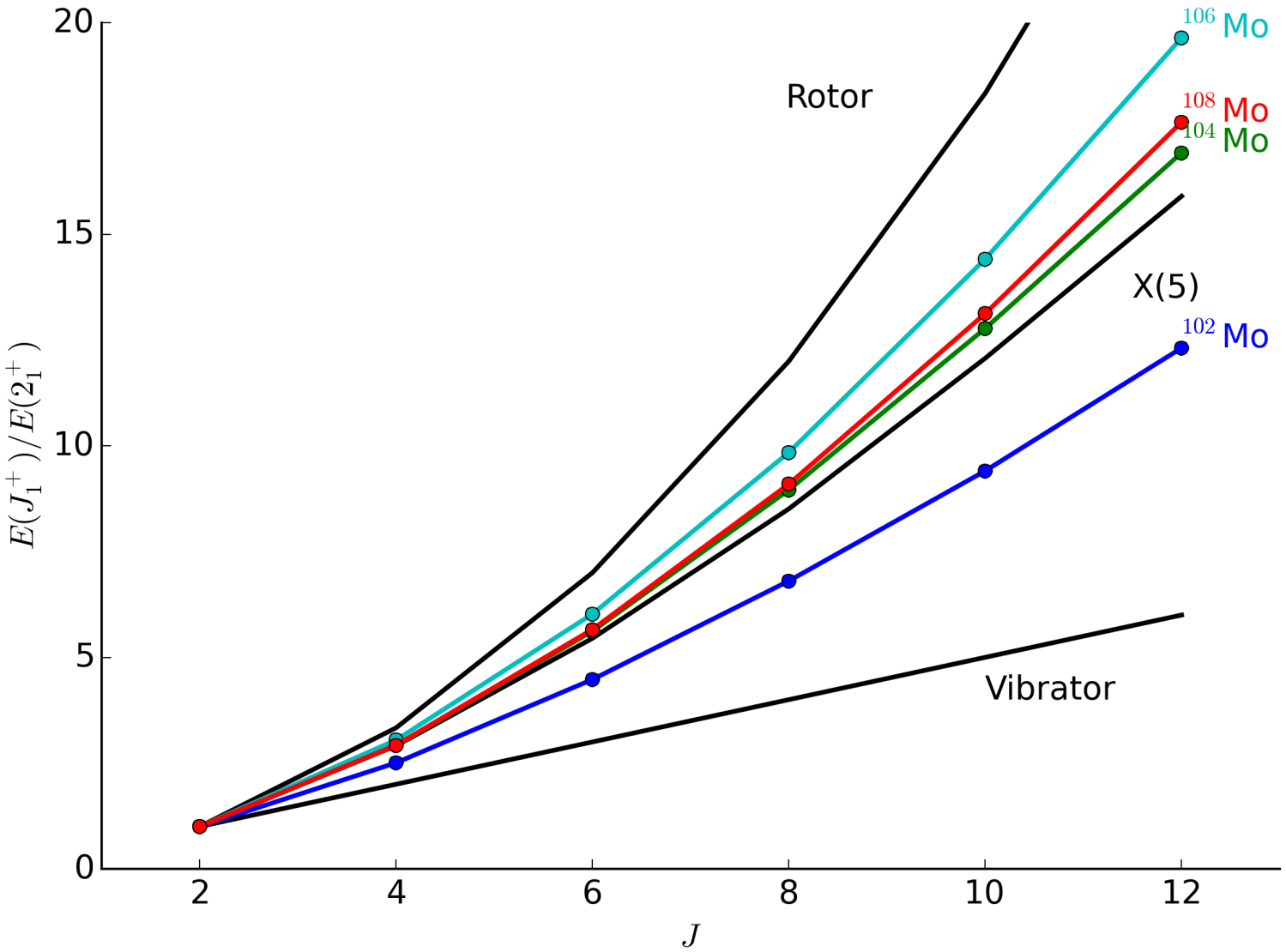
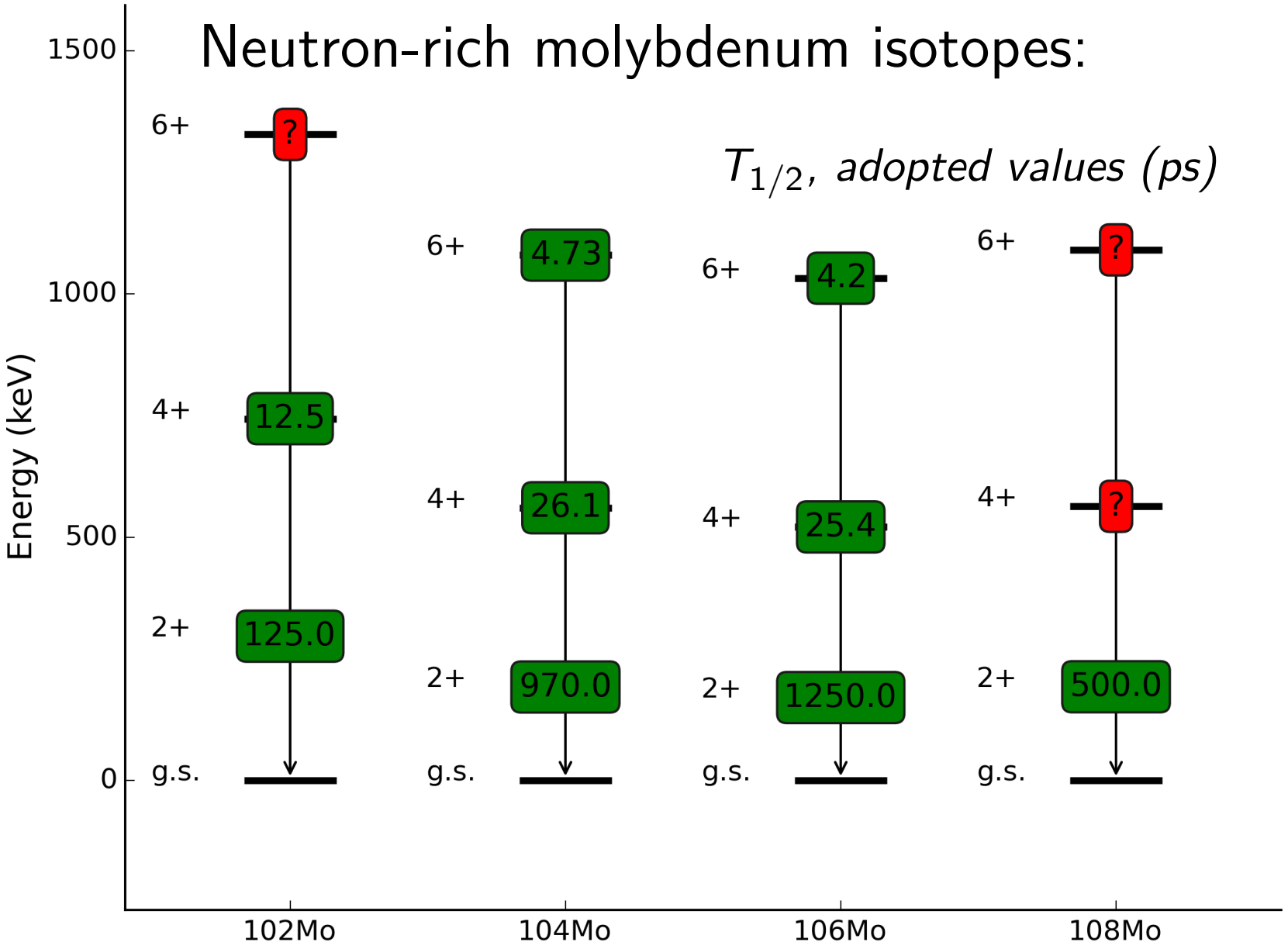


Lifetime range of Mo isotopes



Challenges

Lifetime measurement of ^{108}Mo higher spin states

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In-flight γ-ray spectroscopy with the PreSPEC-AGATA setup

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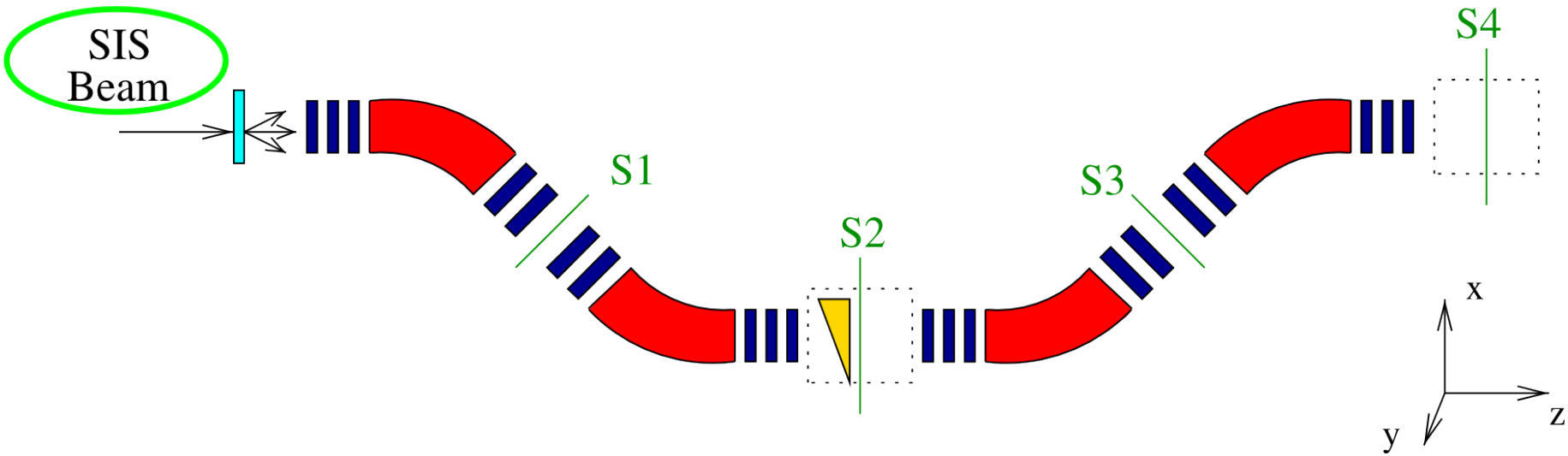
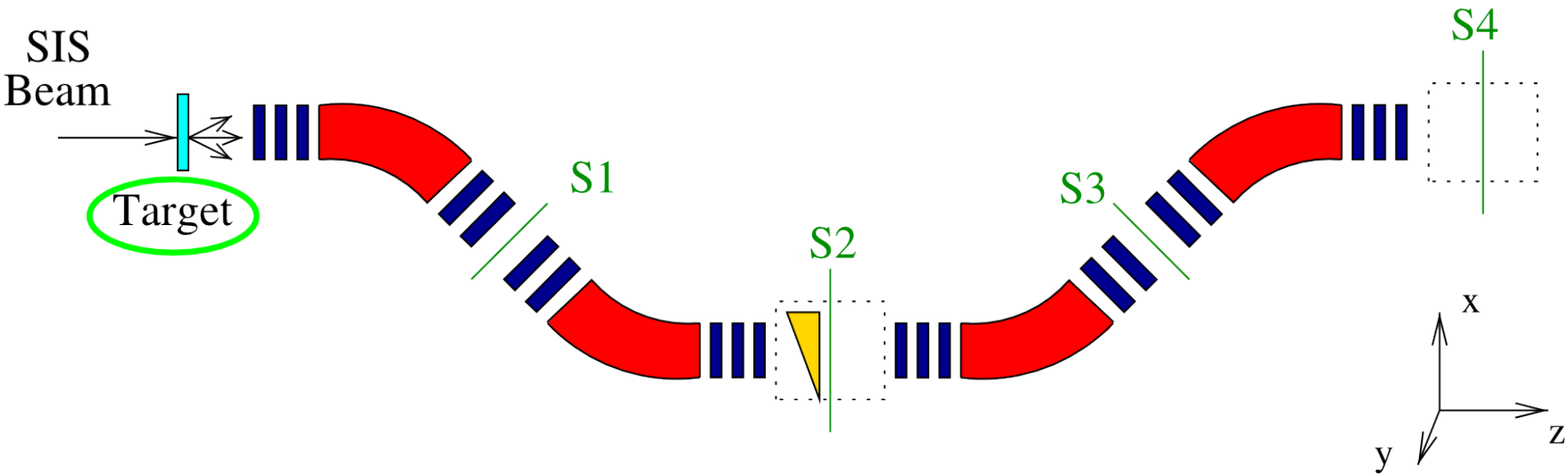
Production of ^{108}Mo @ GSI

Uranium beam from SIS-18, 600 MeV/A



Production of ^{108}Mo @ GSI

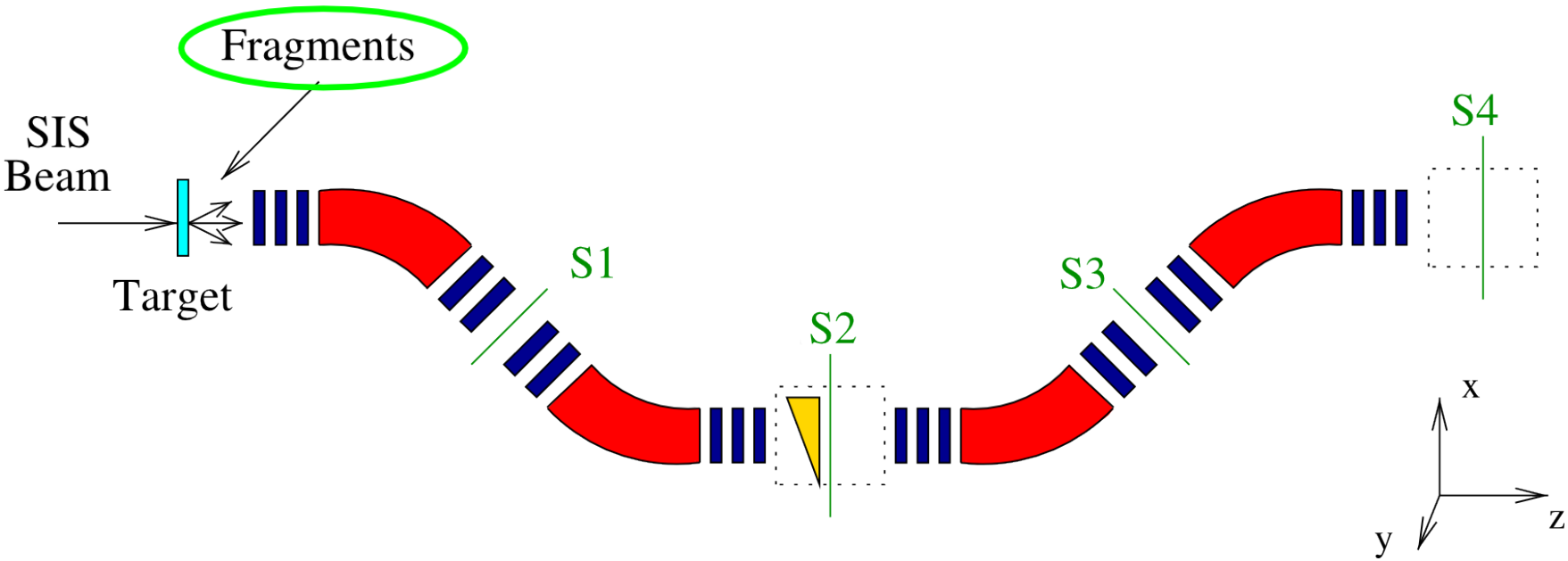
Relativistic fission
on a beryllium target (1033 mg/cm^2)



Production of ^{108}Mo @ GSI

Fission products:

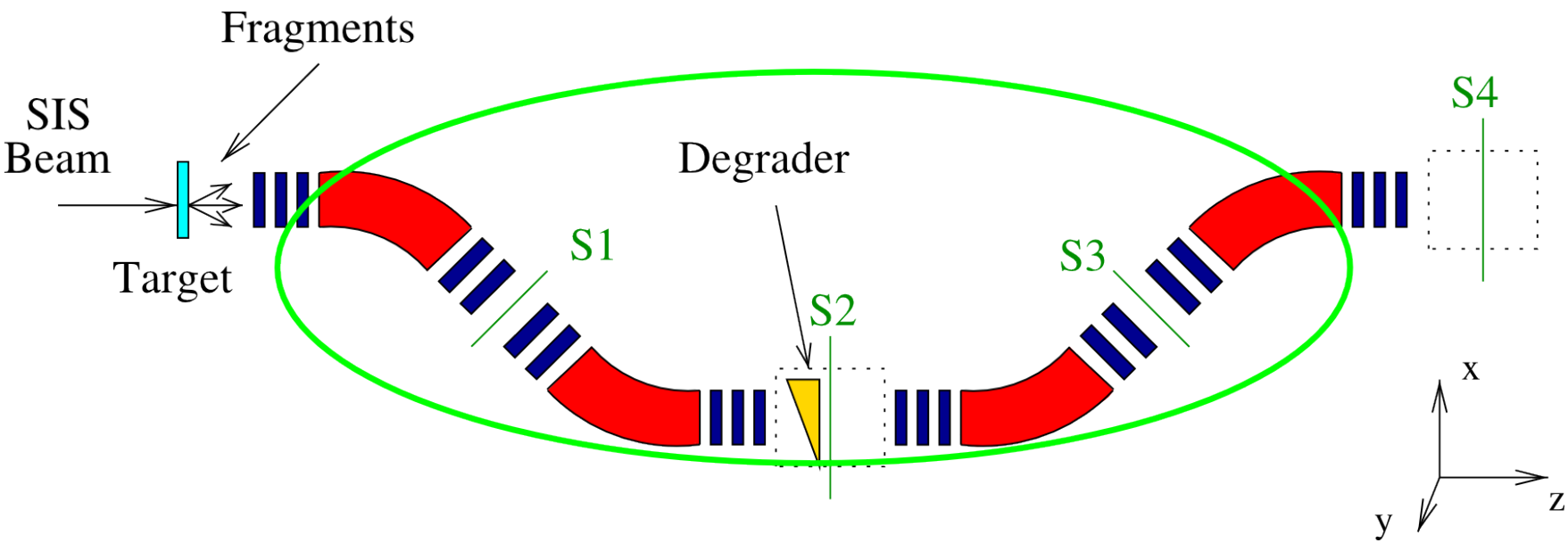
^{109}Tc and ^{108}Mo isotopes produced



Production of ^{108}Mo @ GSI

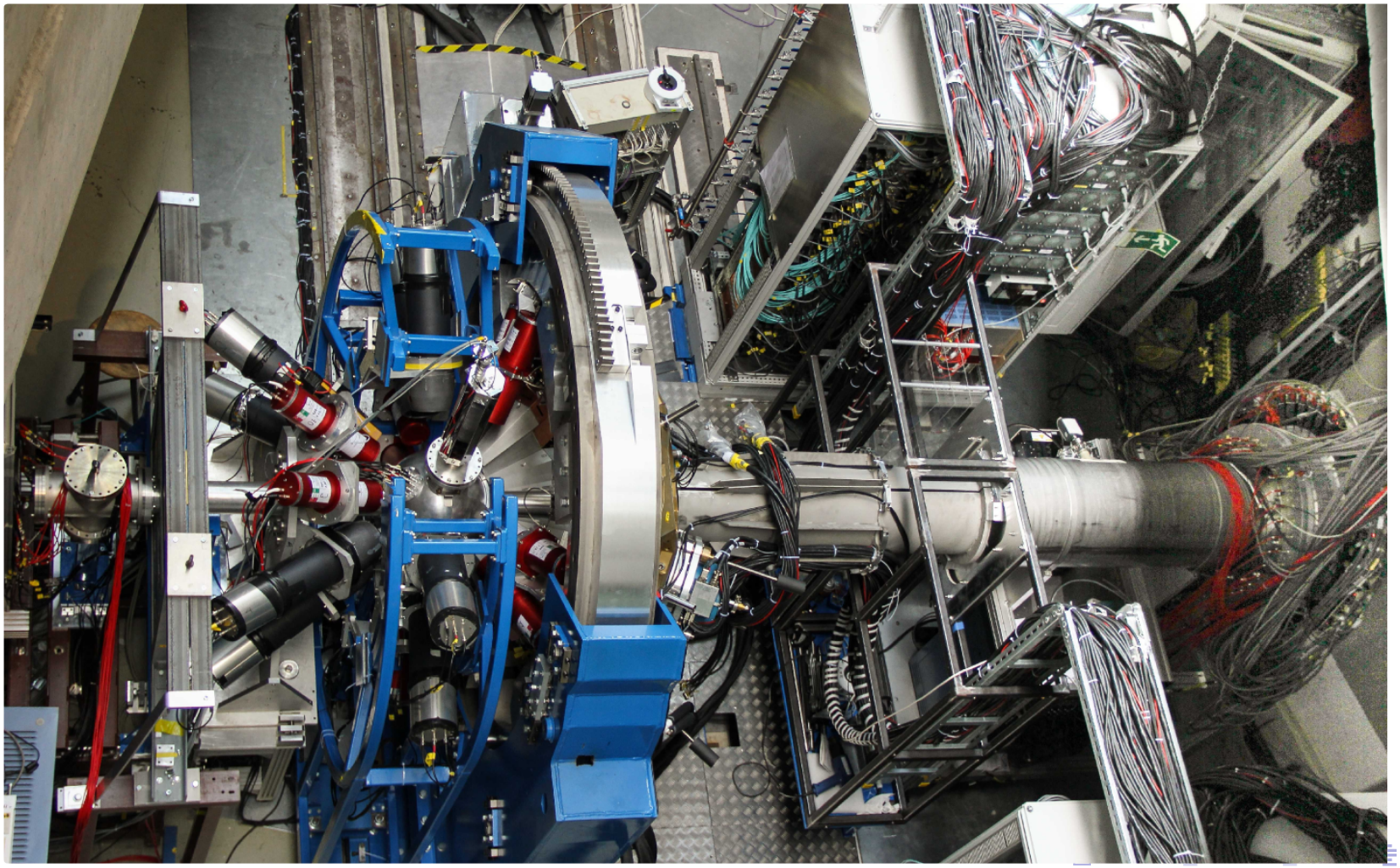
Selection and identification of the fragments:

$B\rho - \Delta E - B\rho$ method



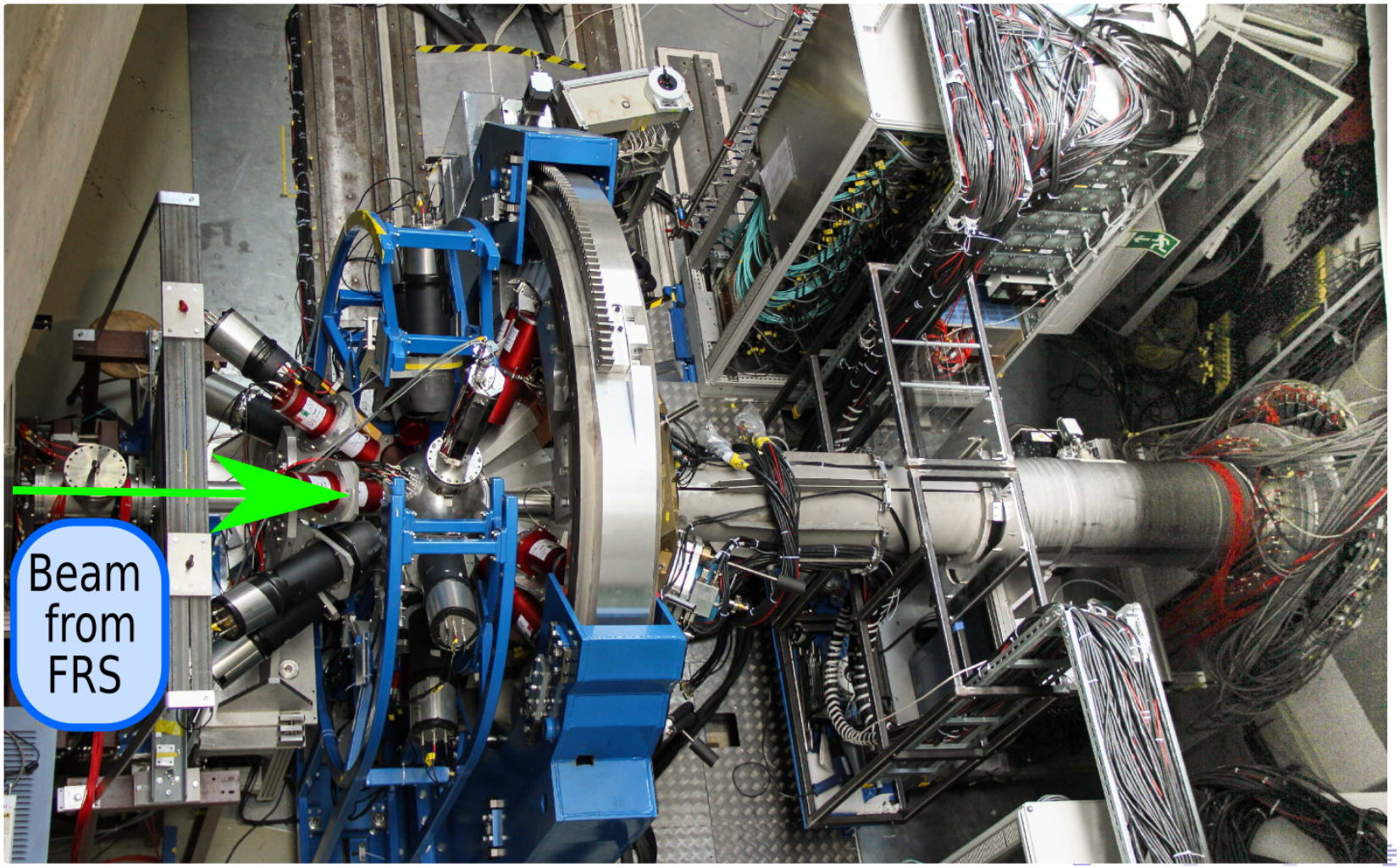
PreSPEC-AGATA setup

Picture of the experimental area



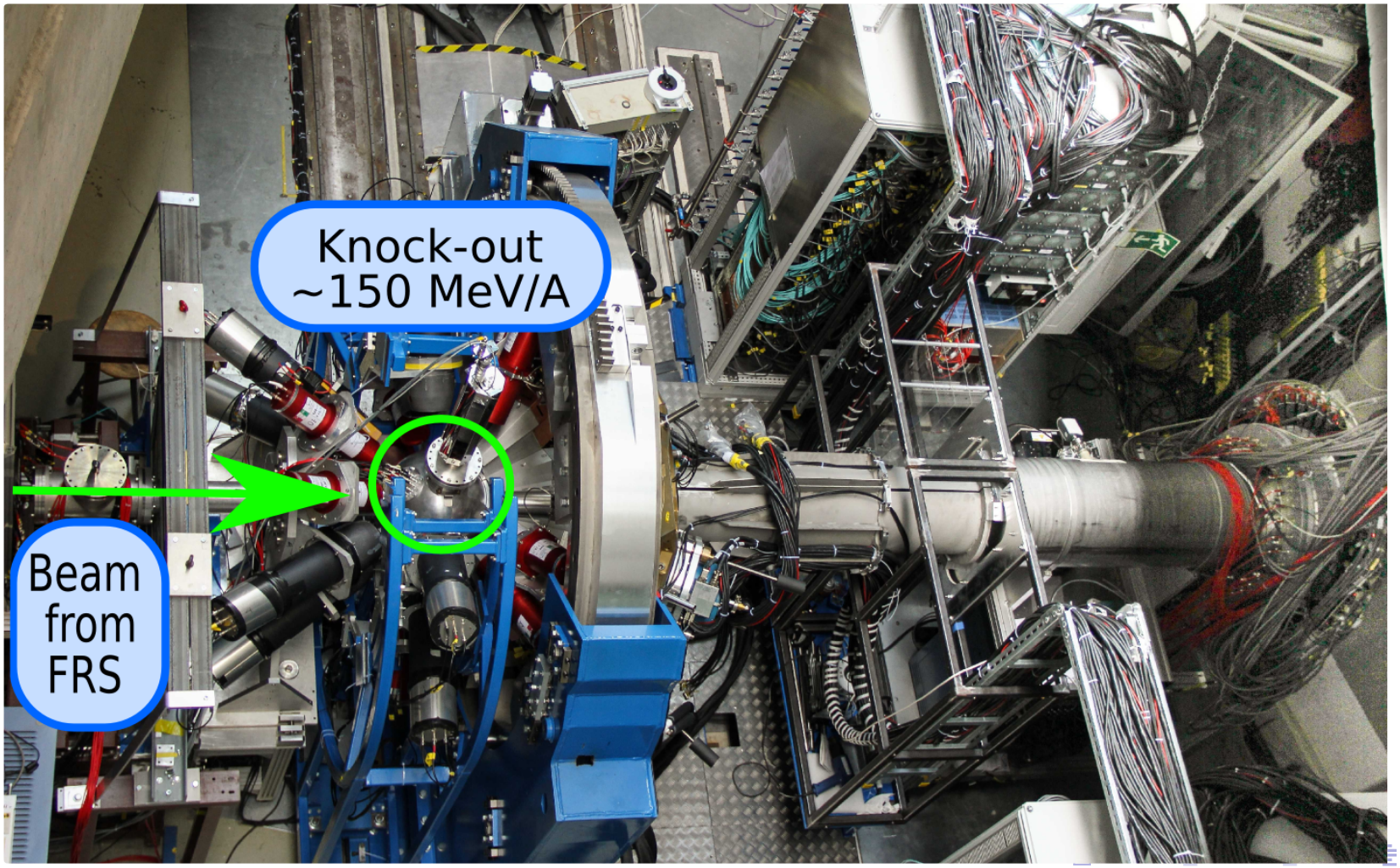
PreSPEC-AGATA setup

Exotic beam from the FRagment Separator (FRS)



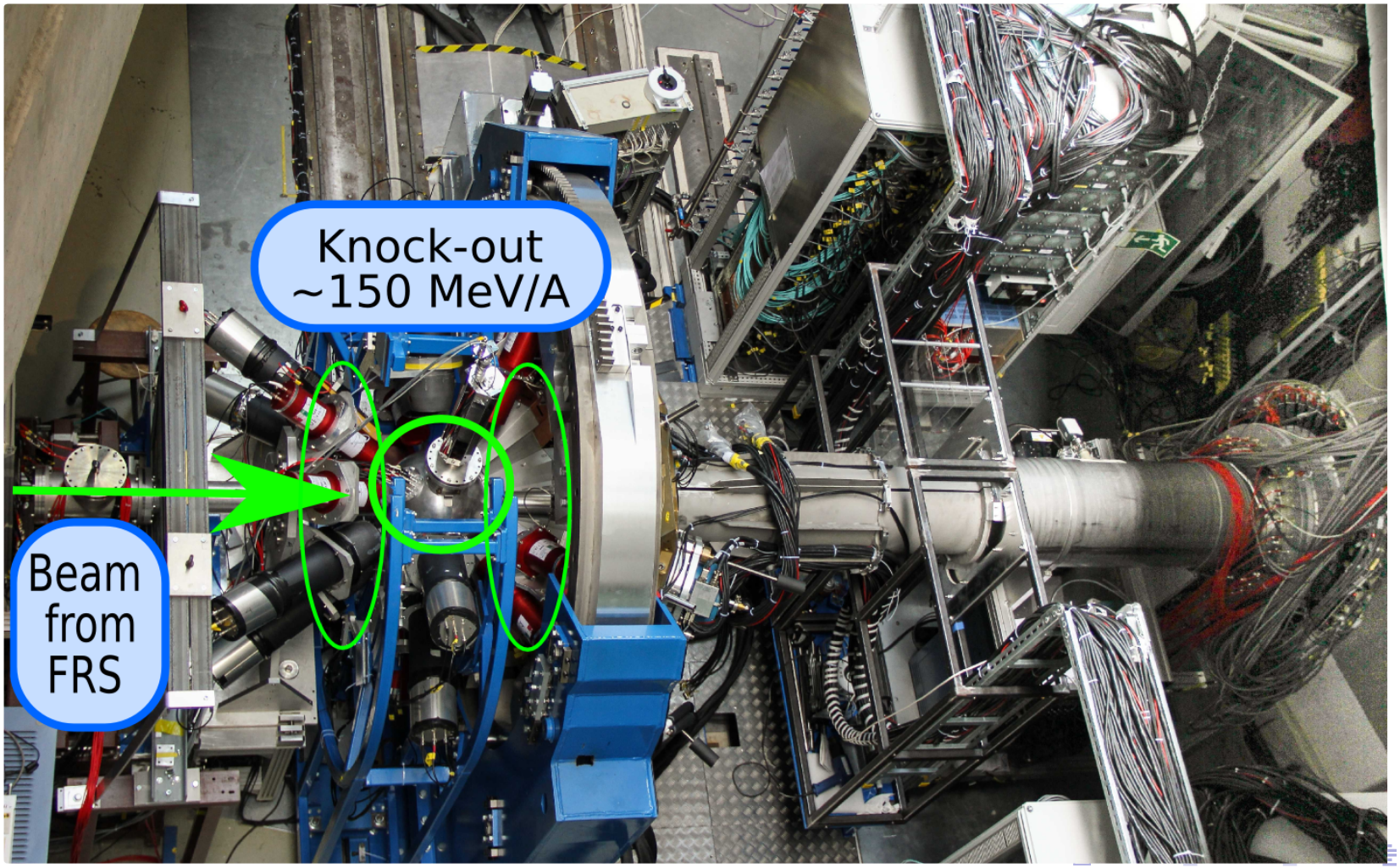
PreSPEC-AGATA setup

Knock-out reaction on a beryllium target (700 mg/cm^2)



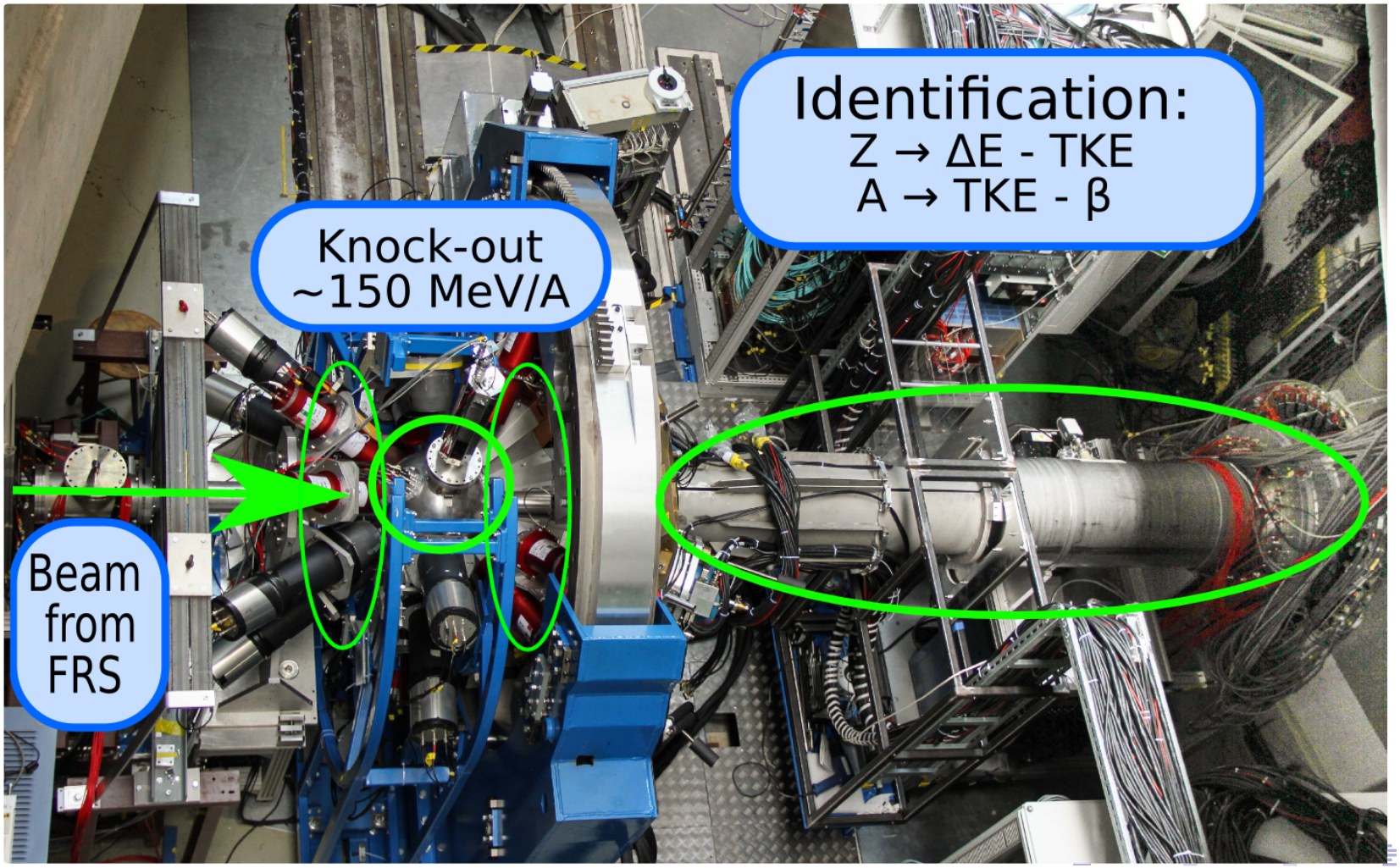
PreSPEC-AGATA setup

γ rays detected with the AGATA and HECTOR detectors



PreSPEC-AGATA setup

Reaction products detected in LYCCA



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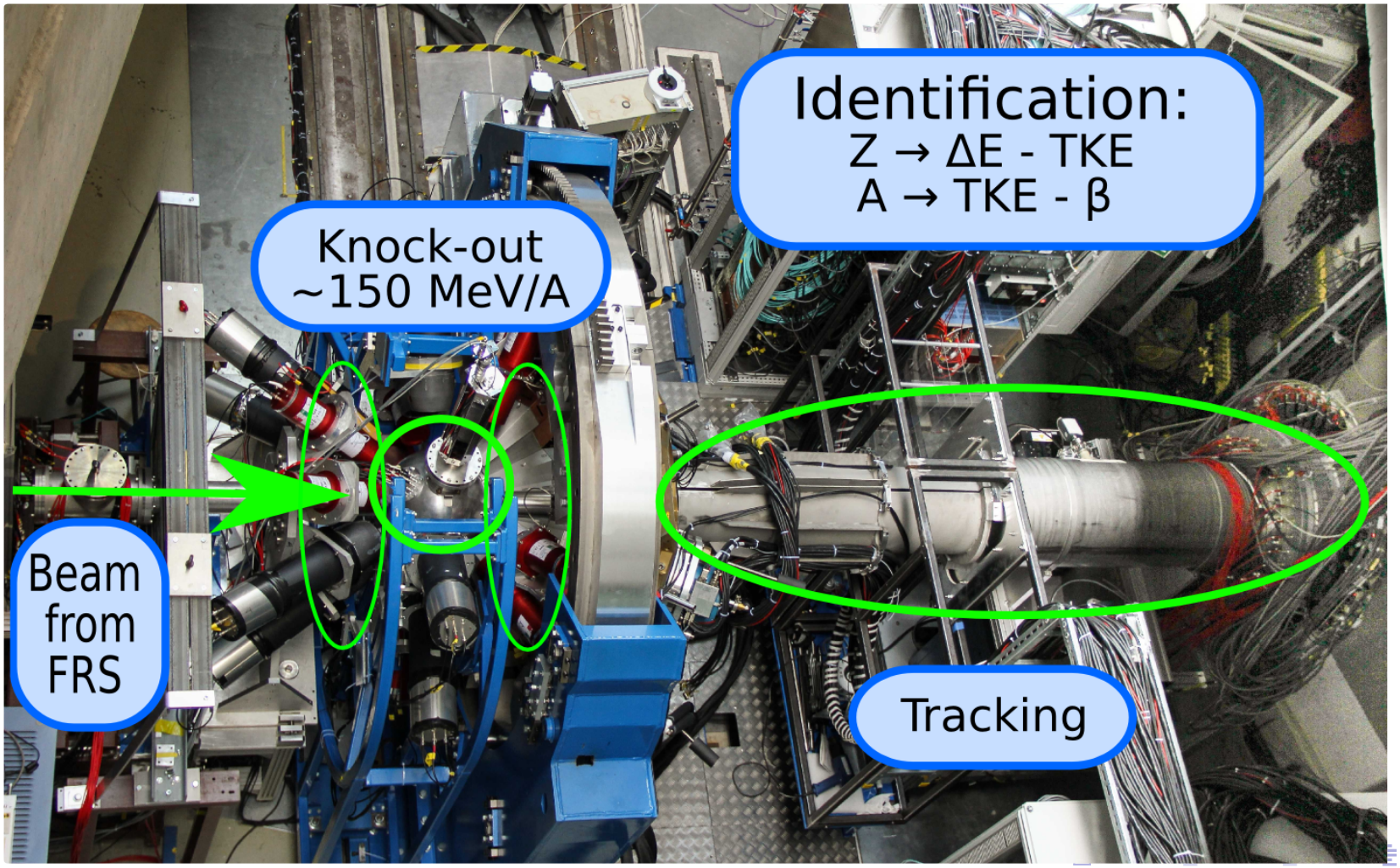

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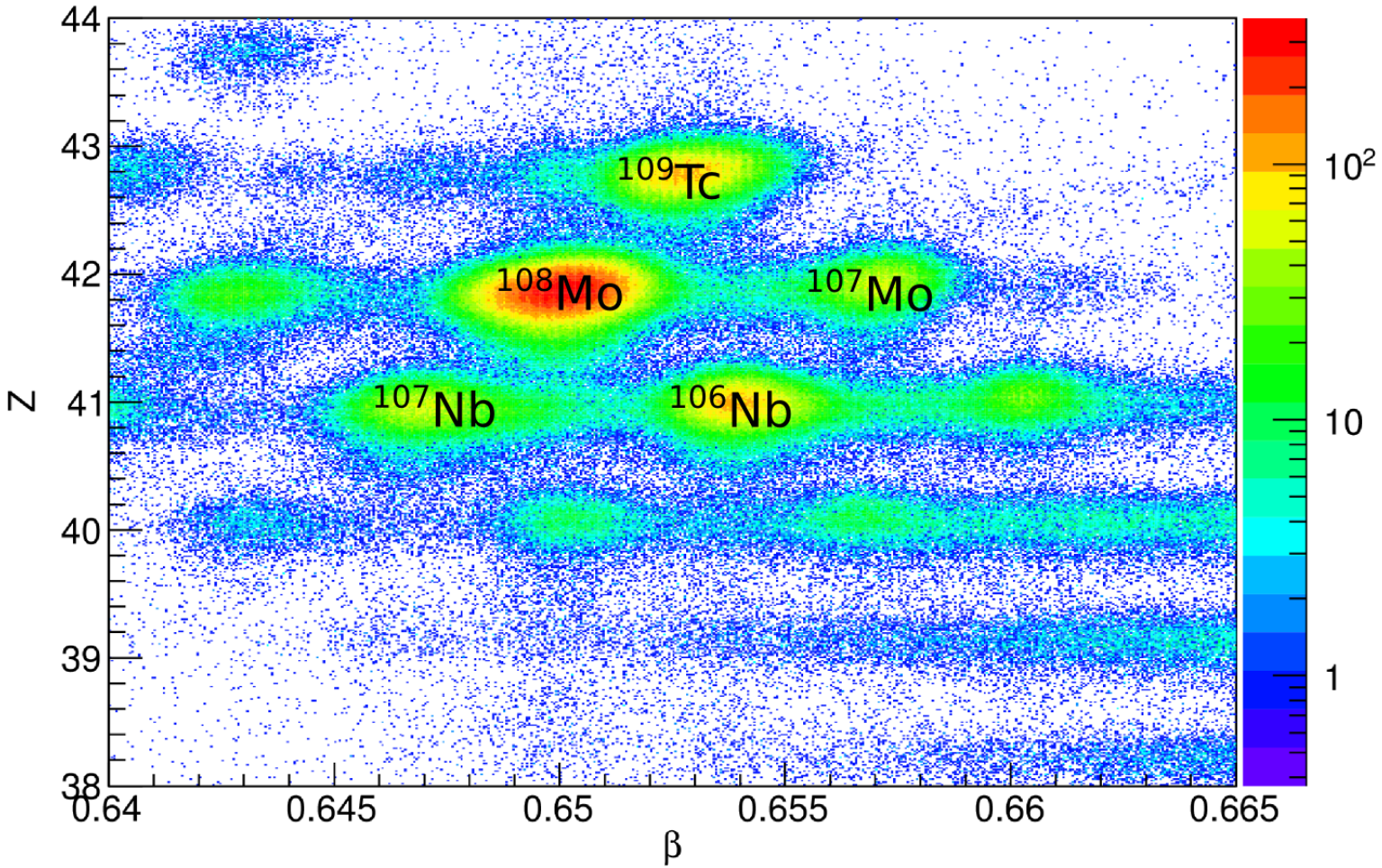
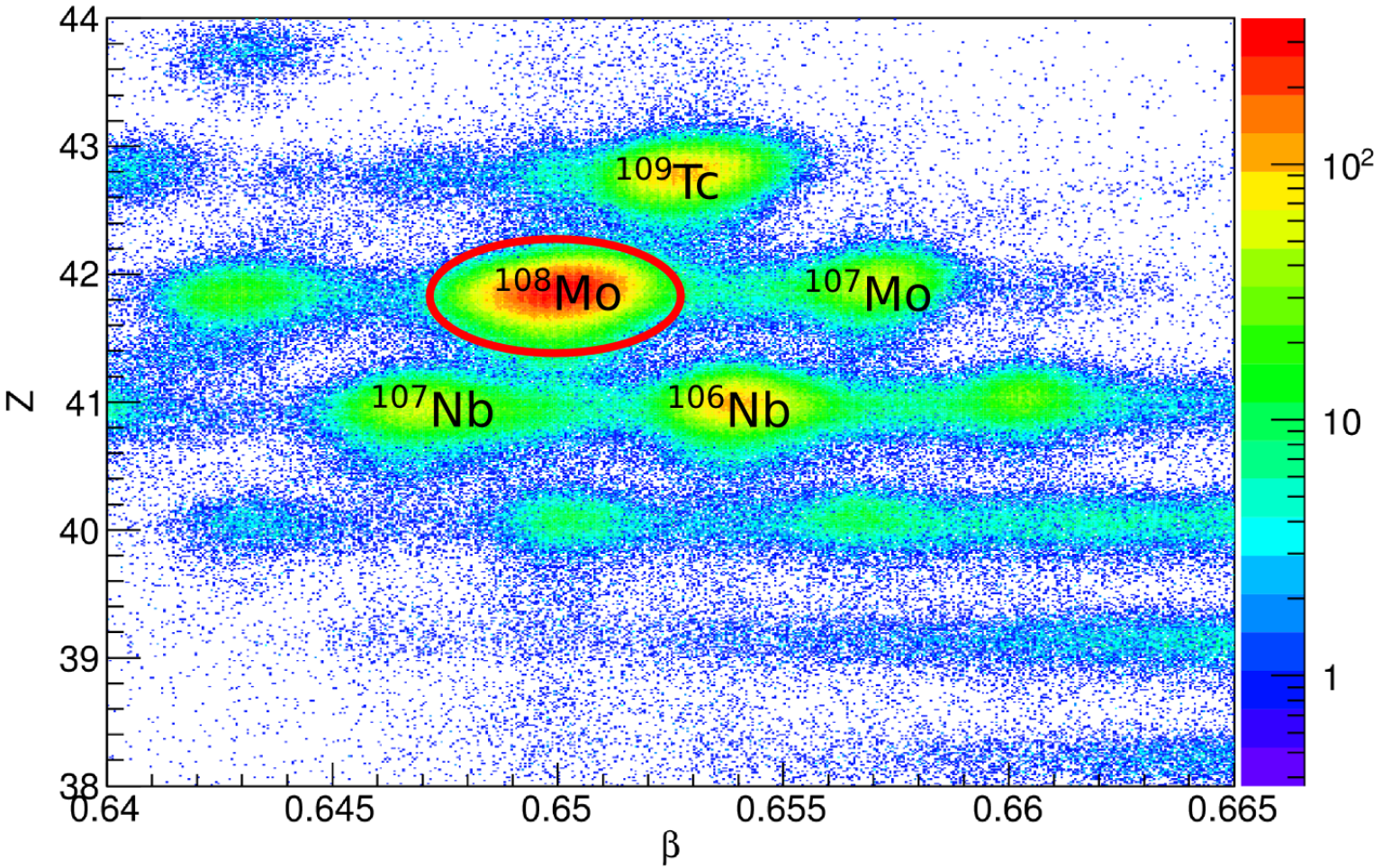
Particle identification: FRS

Identification of the mono-energetic FRS beam



Particle identification: FRS

Gate on ^{108}Mo beam



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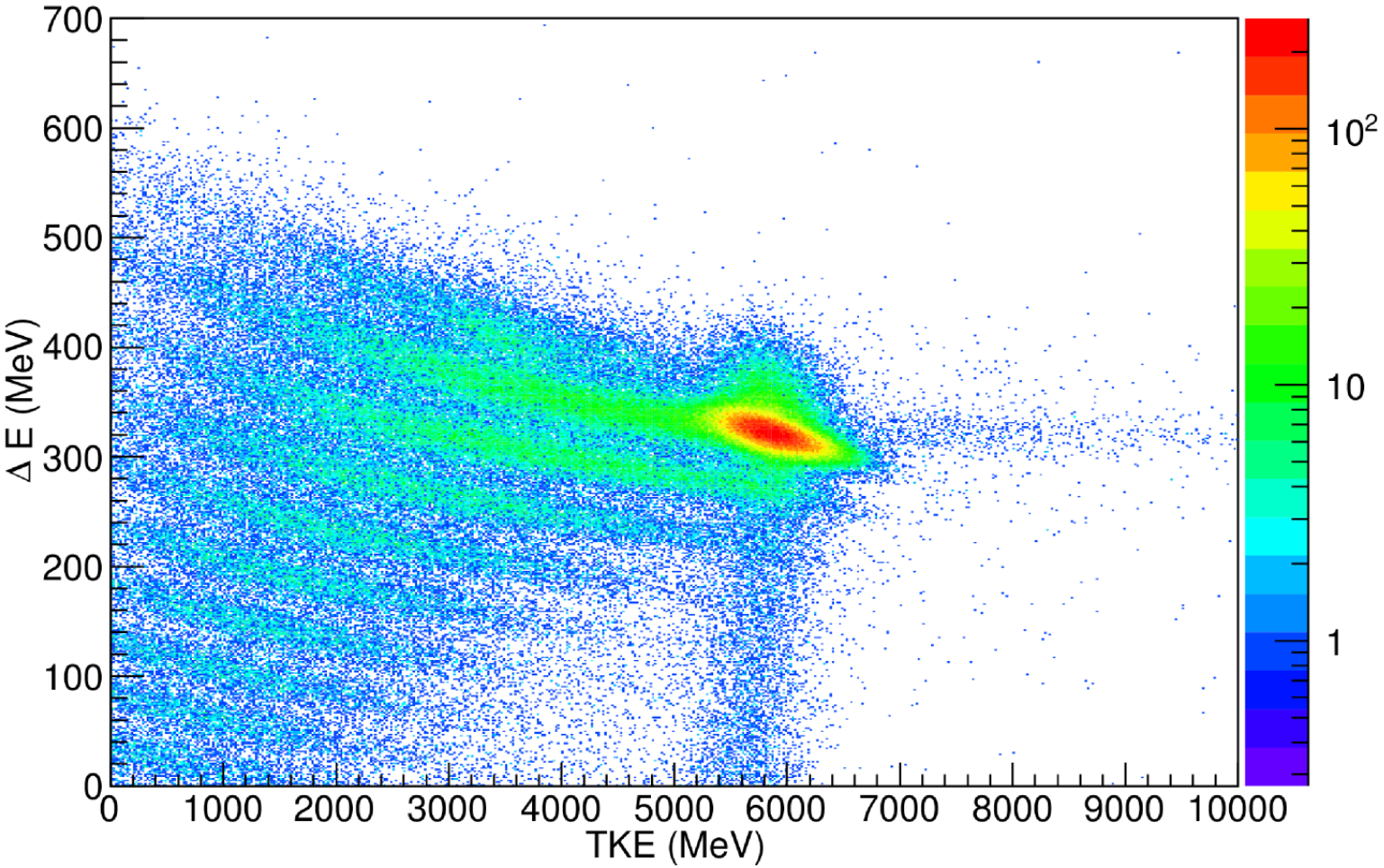
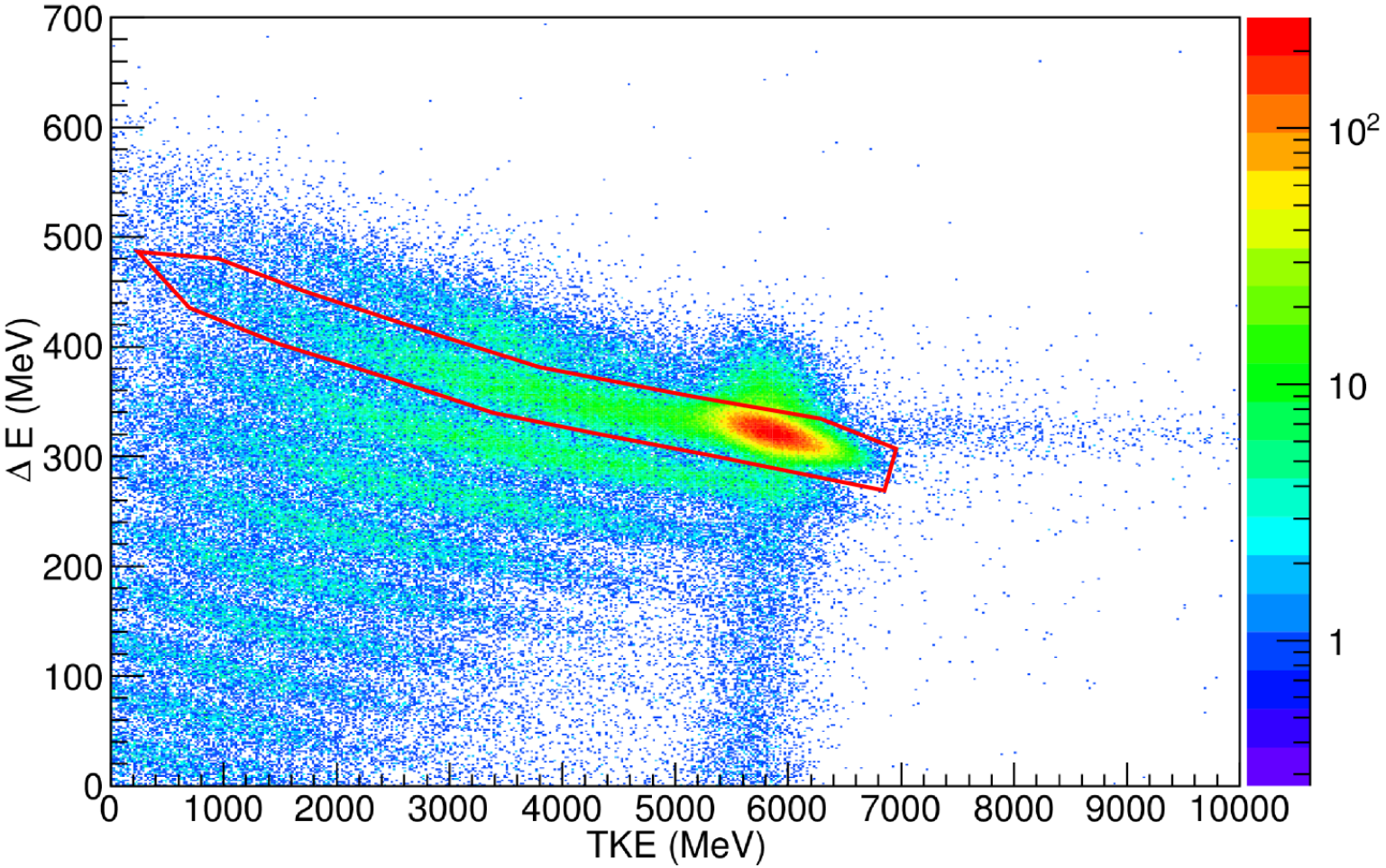
^{108}Mo from FRS:



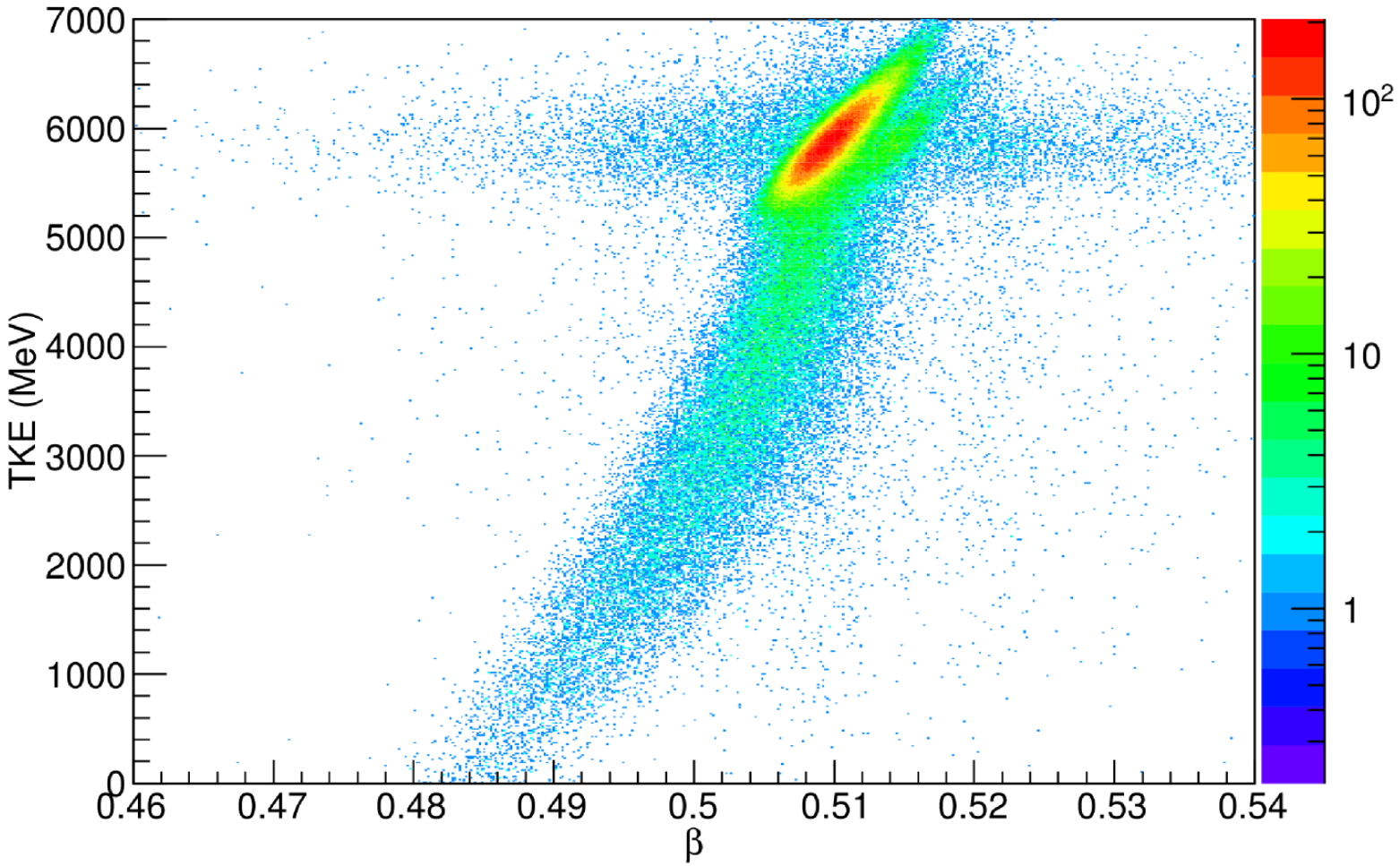
Particle identification: LYCCA

^{108}Mo from FRS: Mo isotopes identified in LYCCA



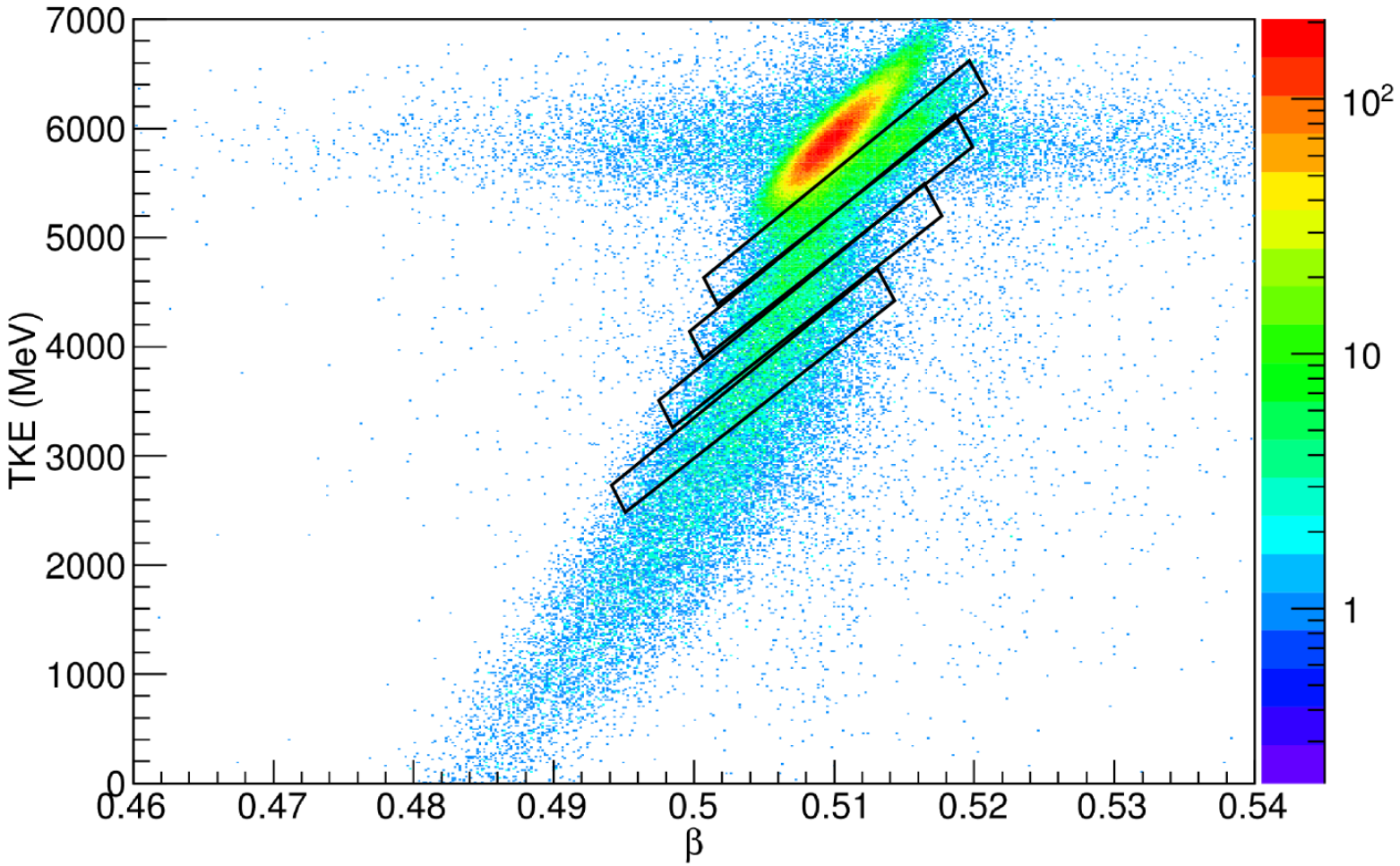
Particle identification: LYCCA

Mass determination of molybdenum isotopes



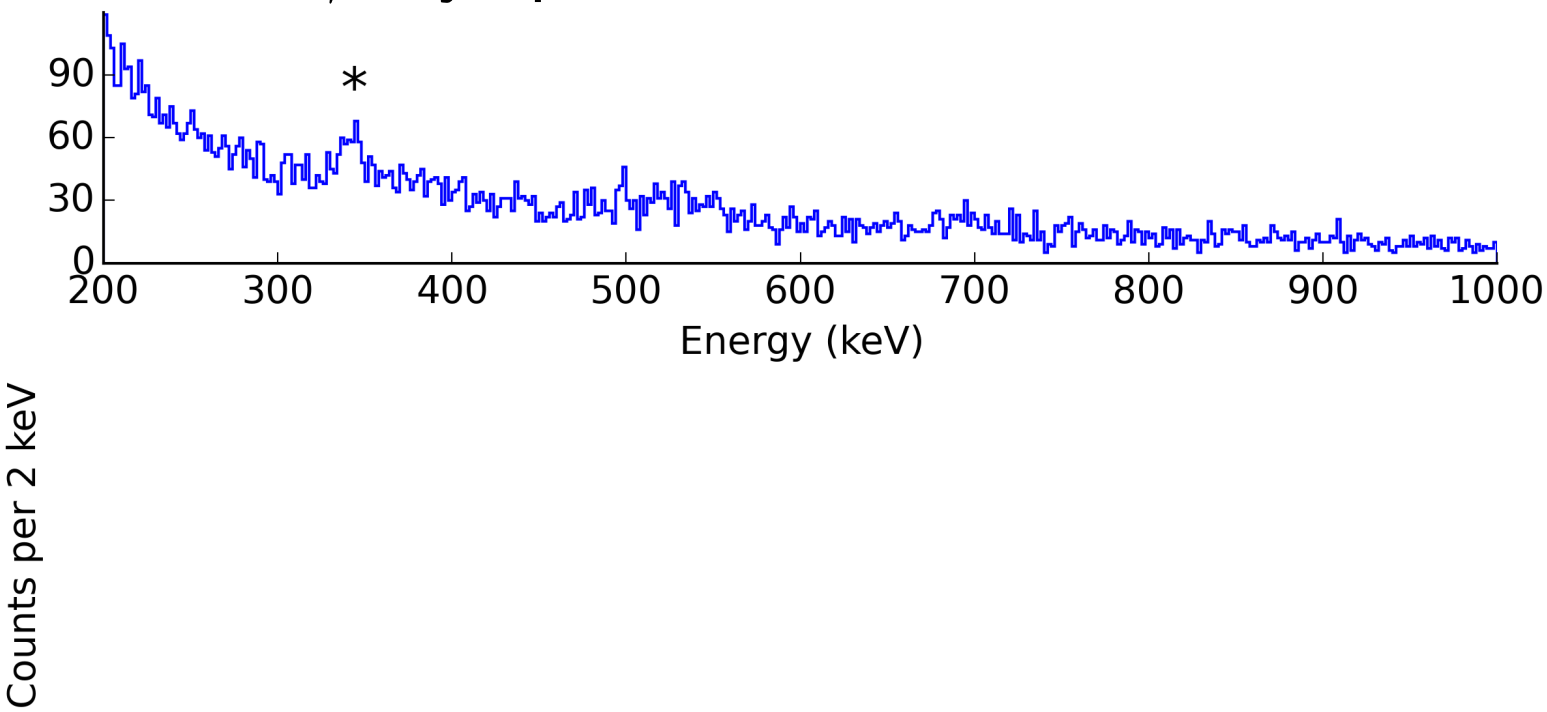
Particle identification: LYCCA

Mass selection



Particle identification: LYCCA

γ-ray spectra: mass selection



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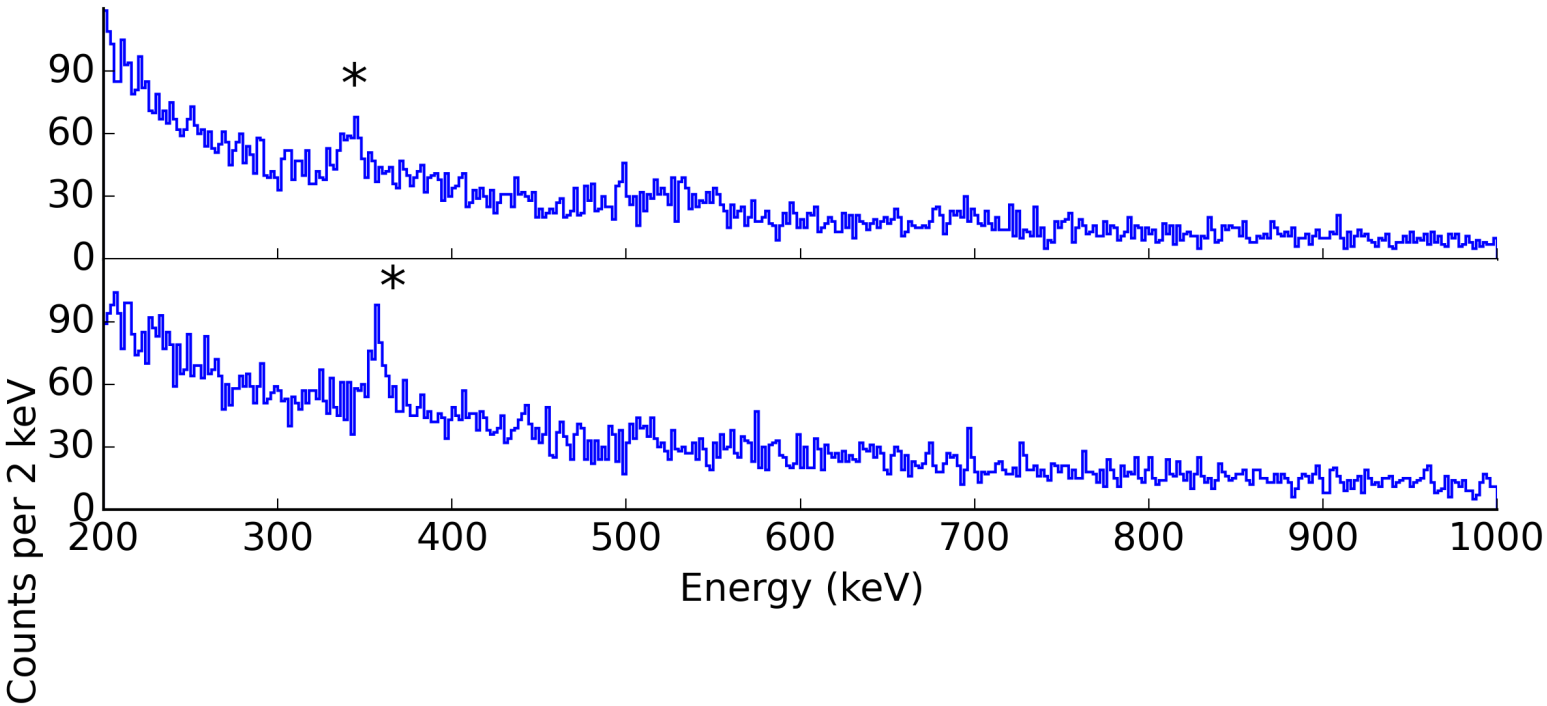

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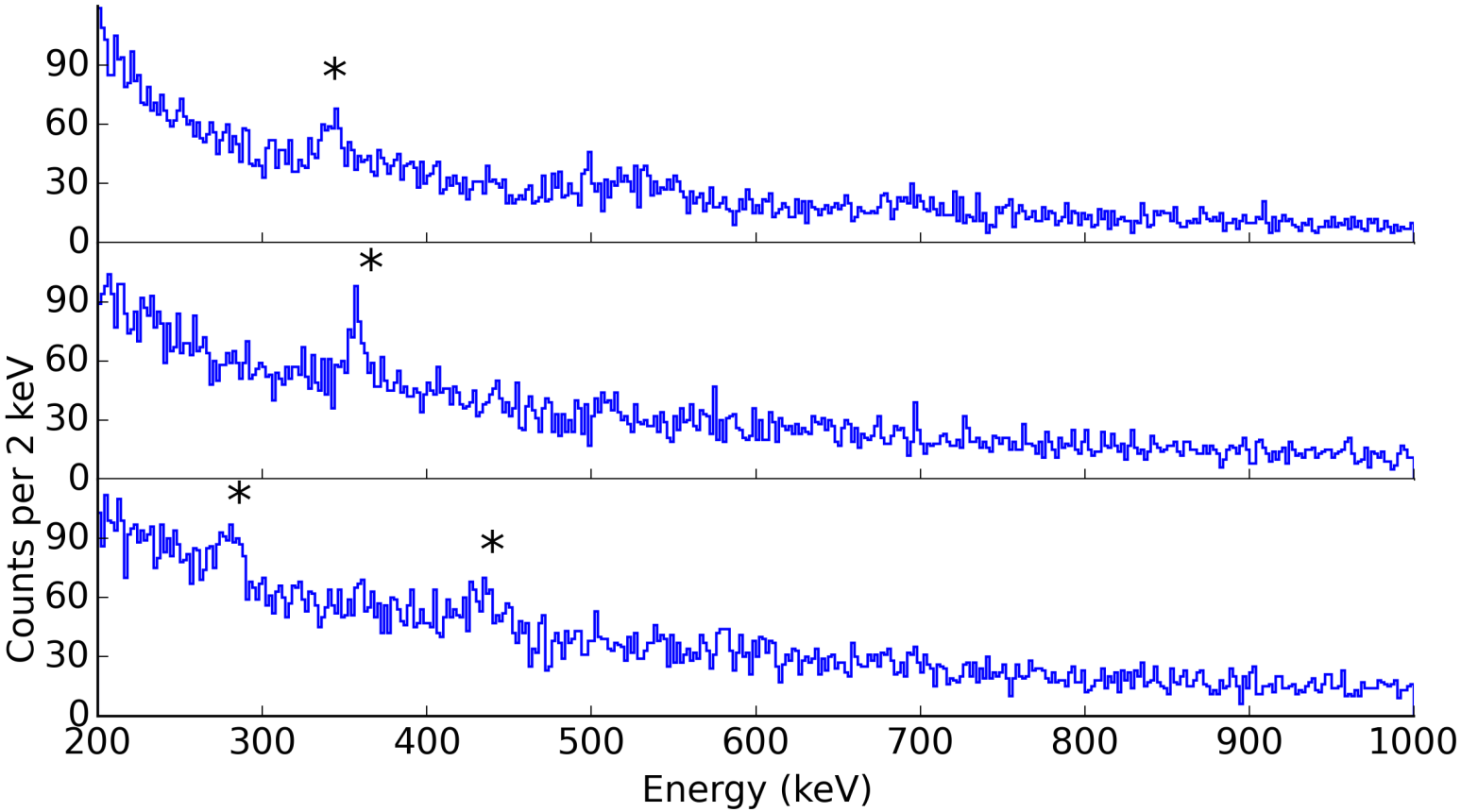

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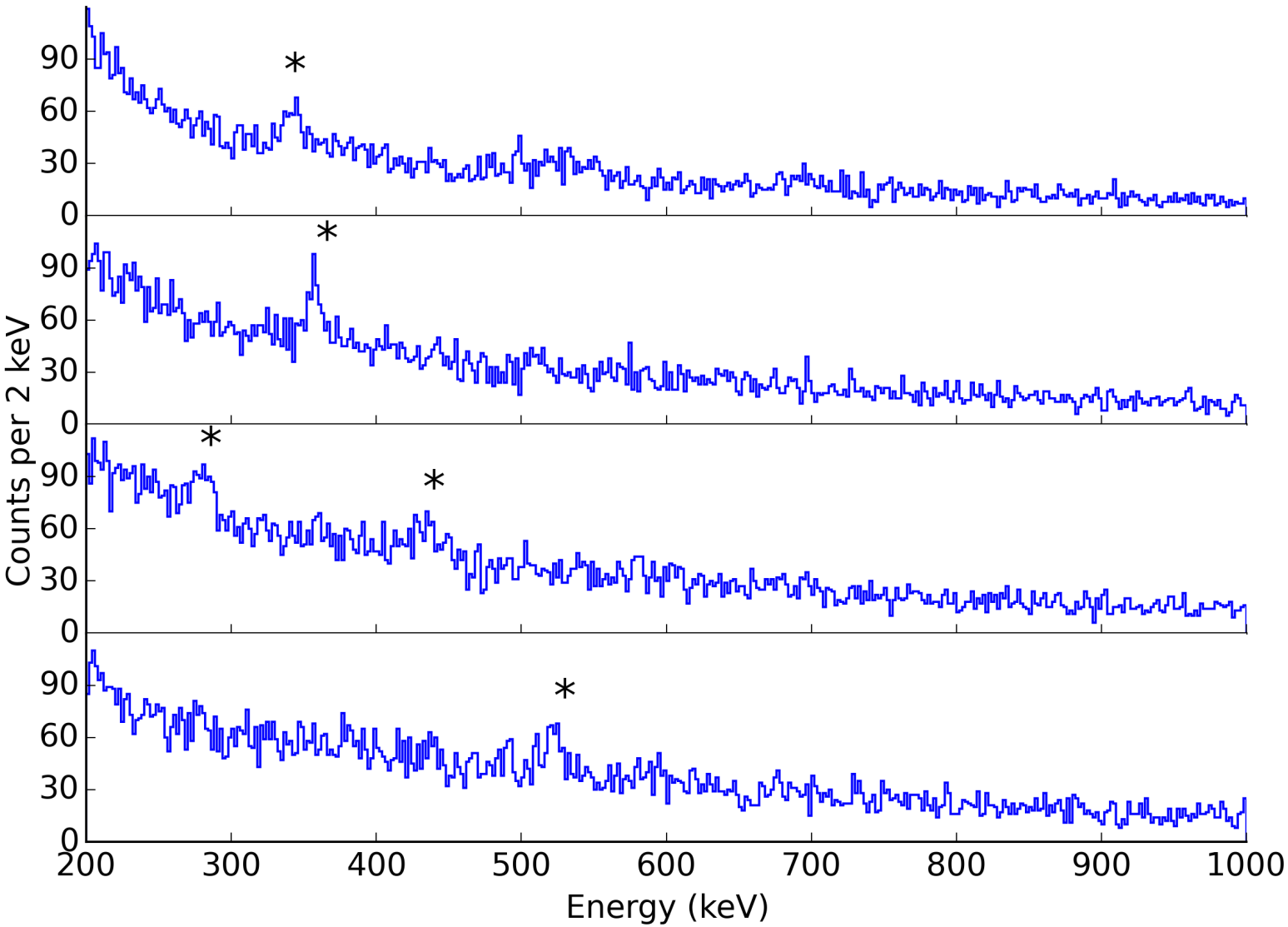
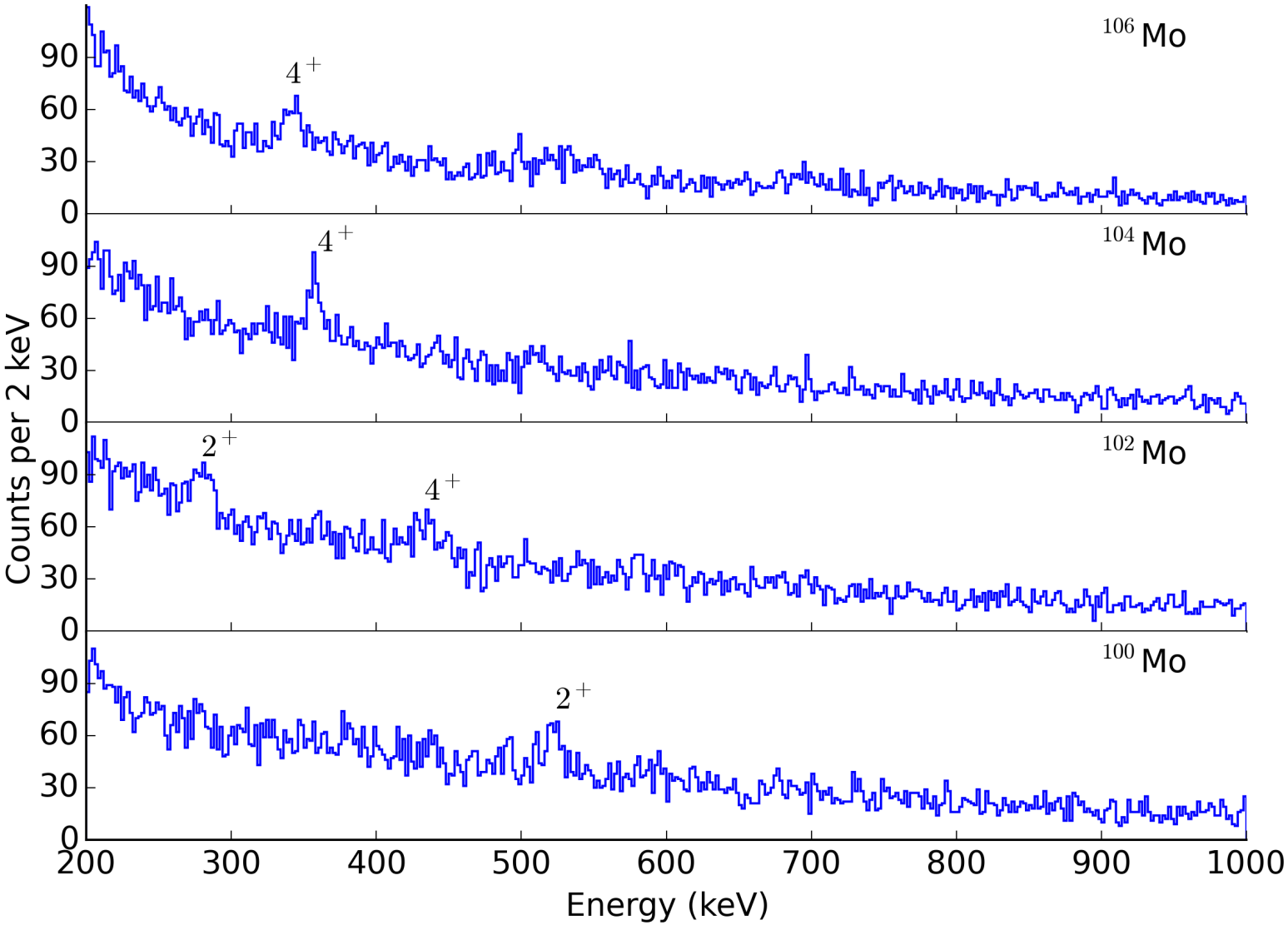


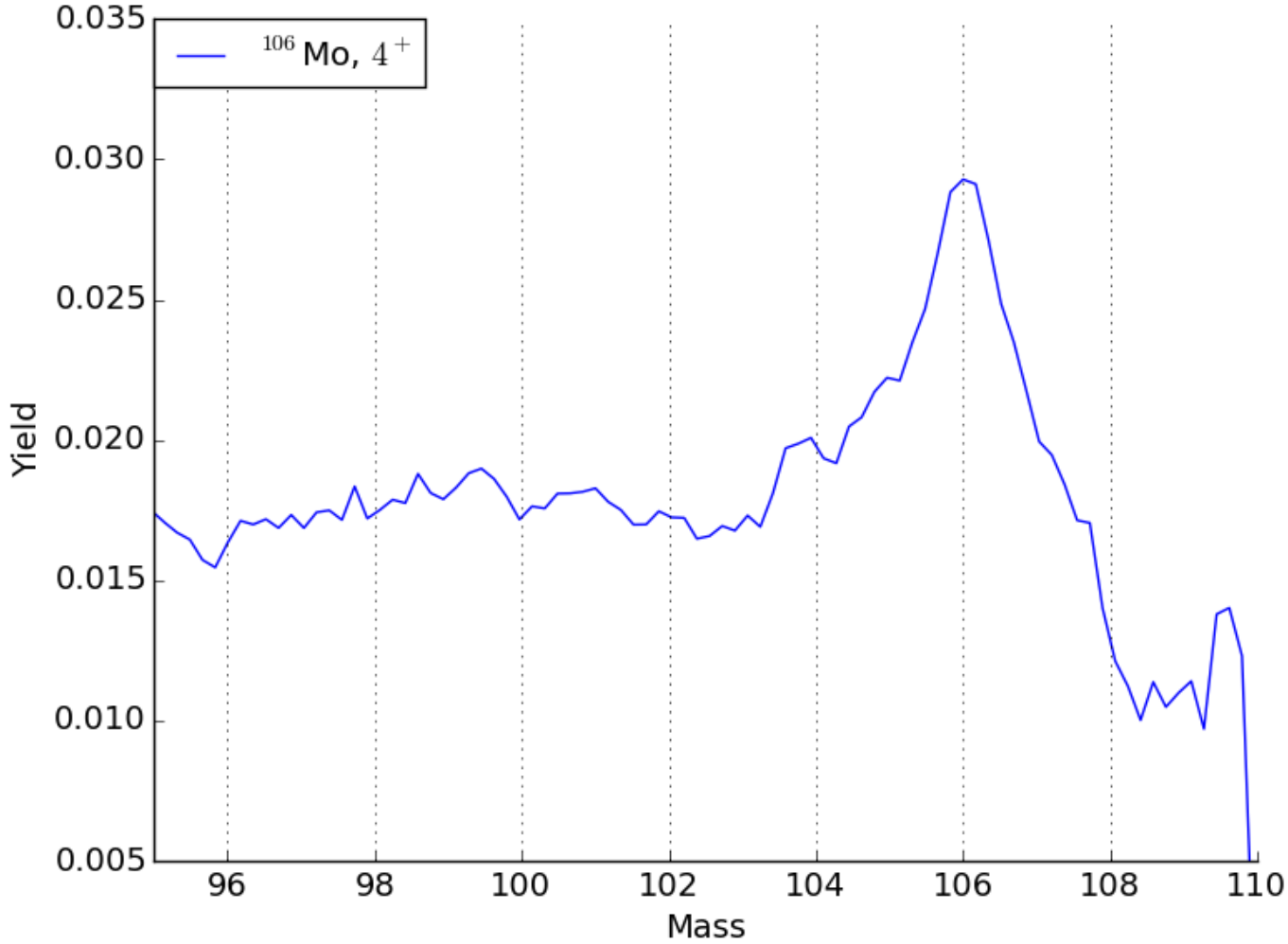
Particle identification: LYCCA

Mo isotope assignment



Mass identification in LYCCA

Mass determination with the observed γ-ray transitions



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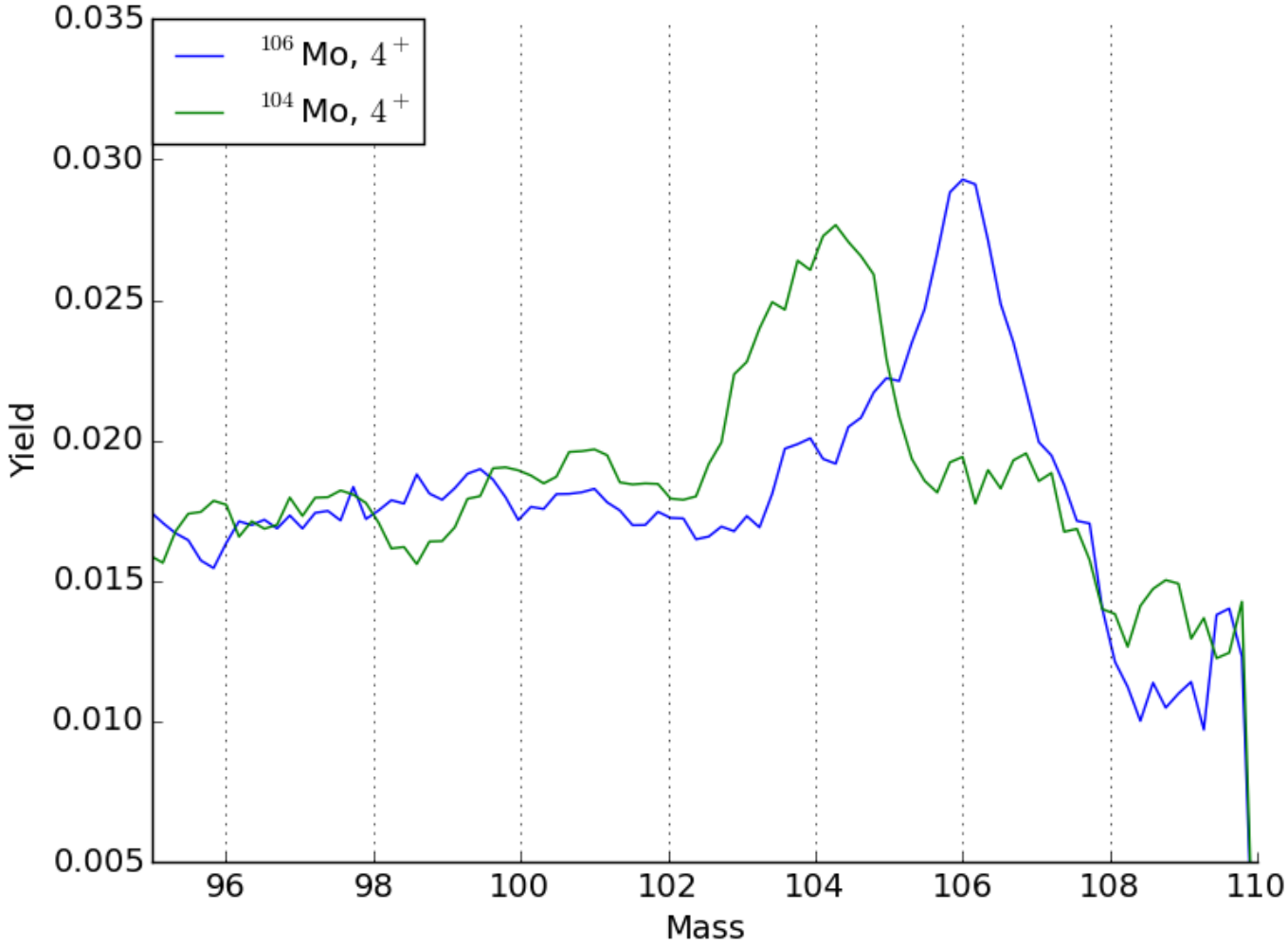

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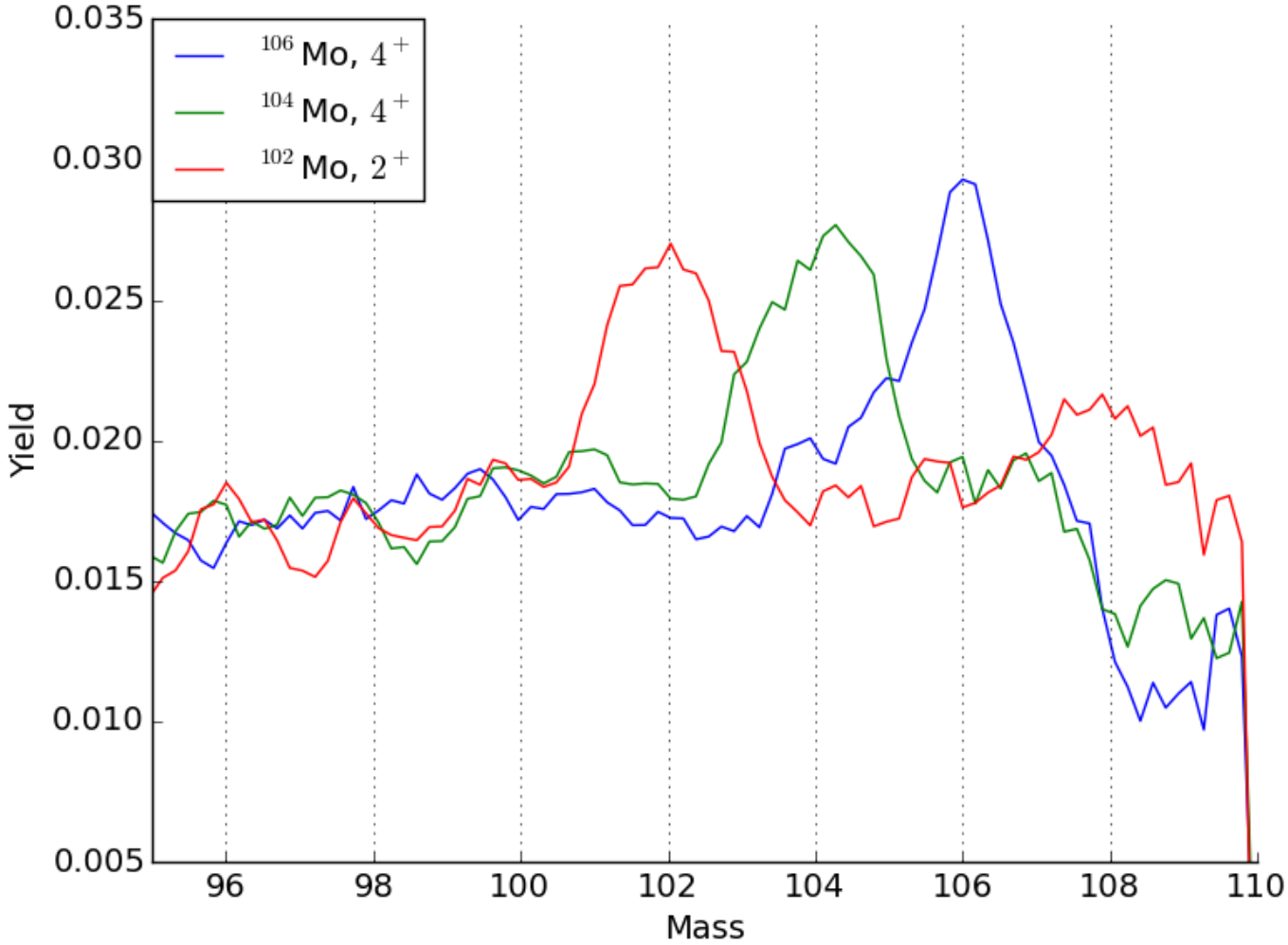

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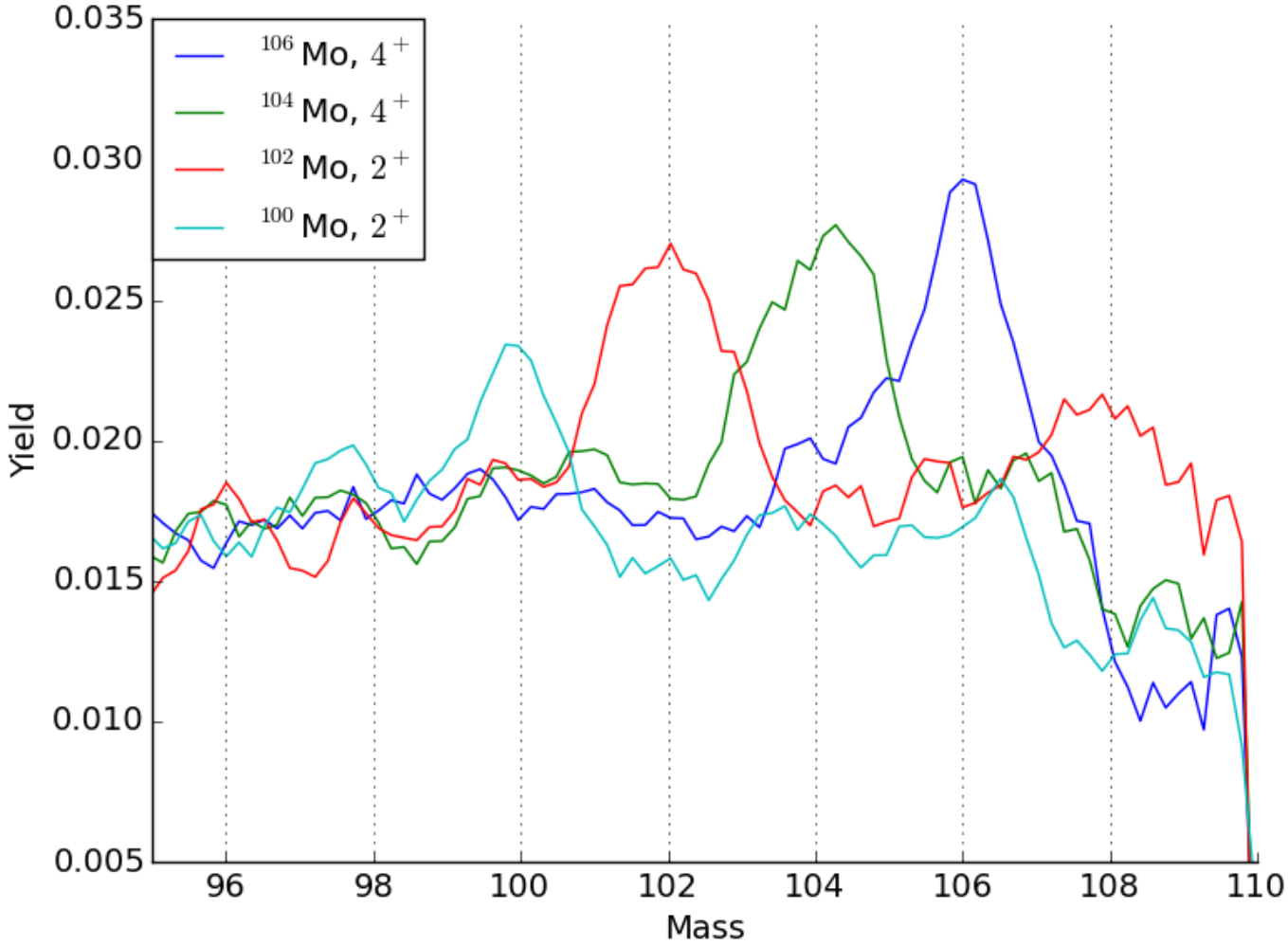
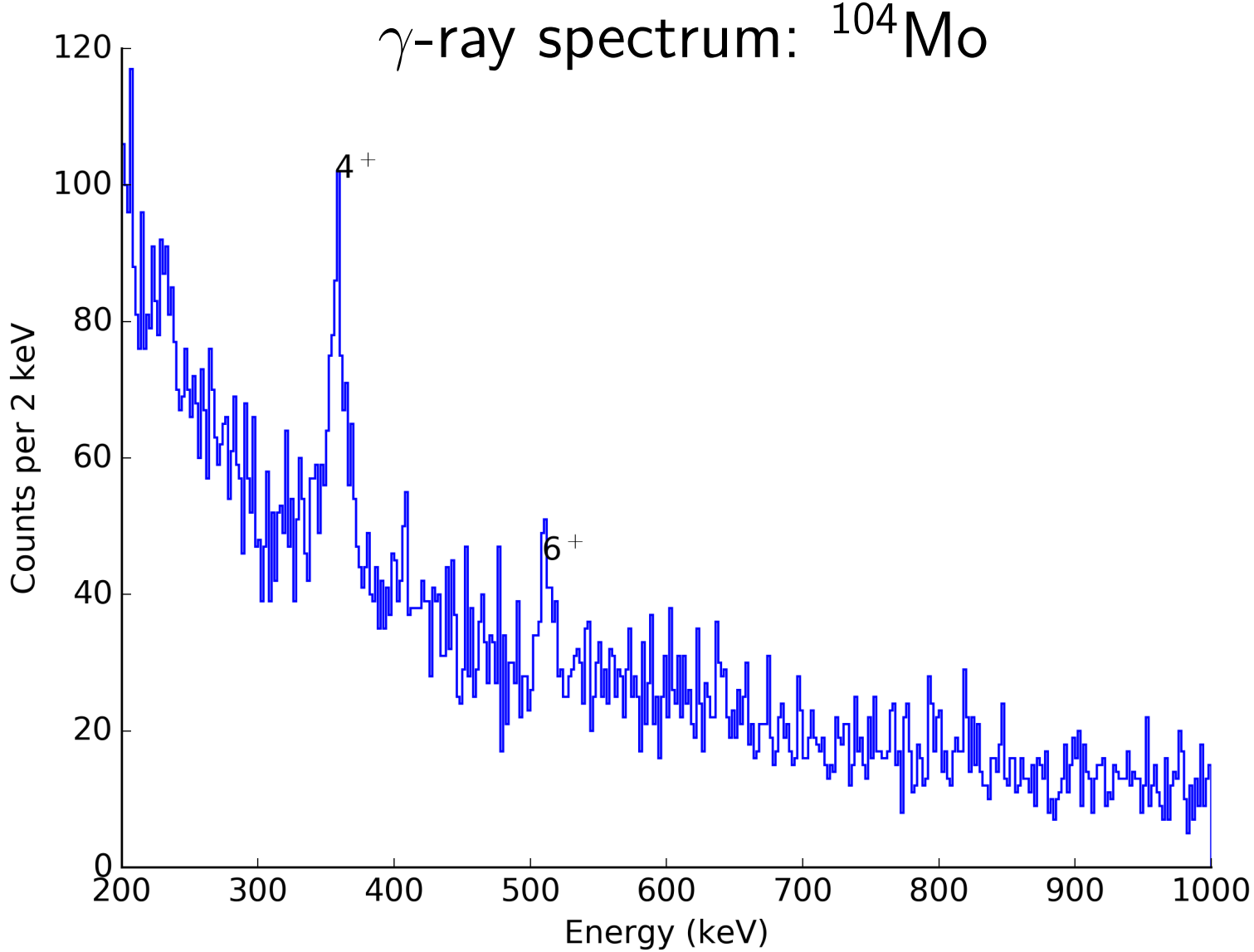


Optimized γ-ray spectrum



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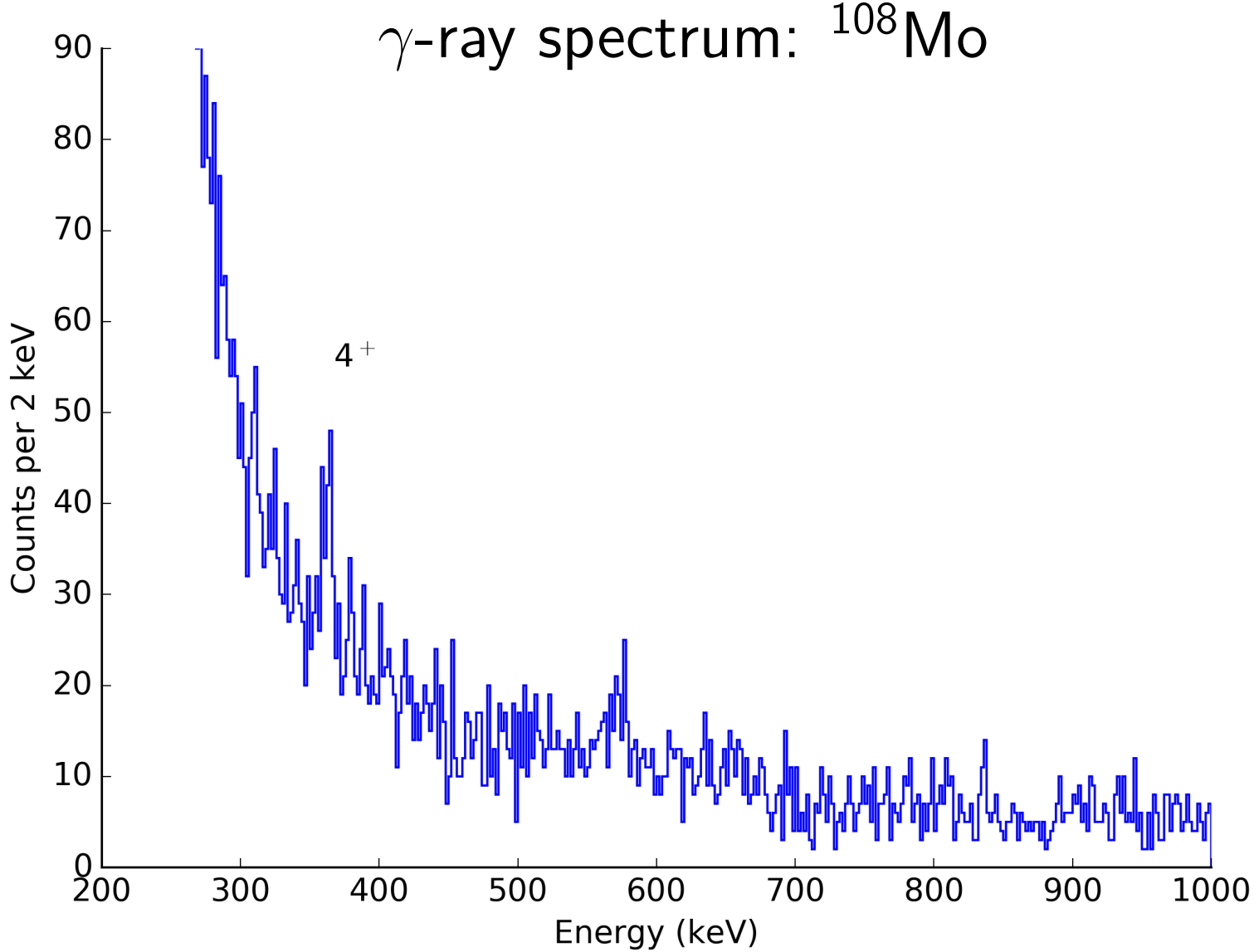

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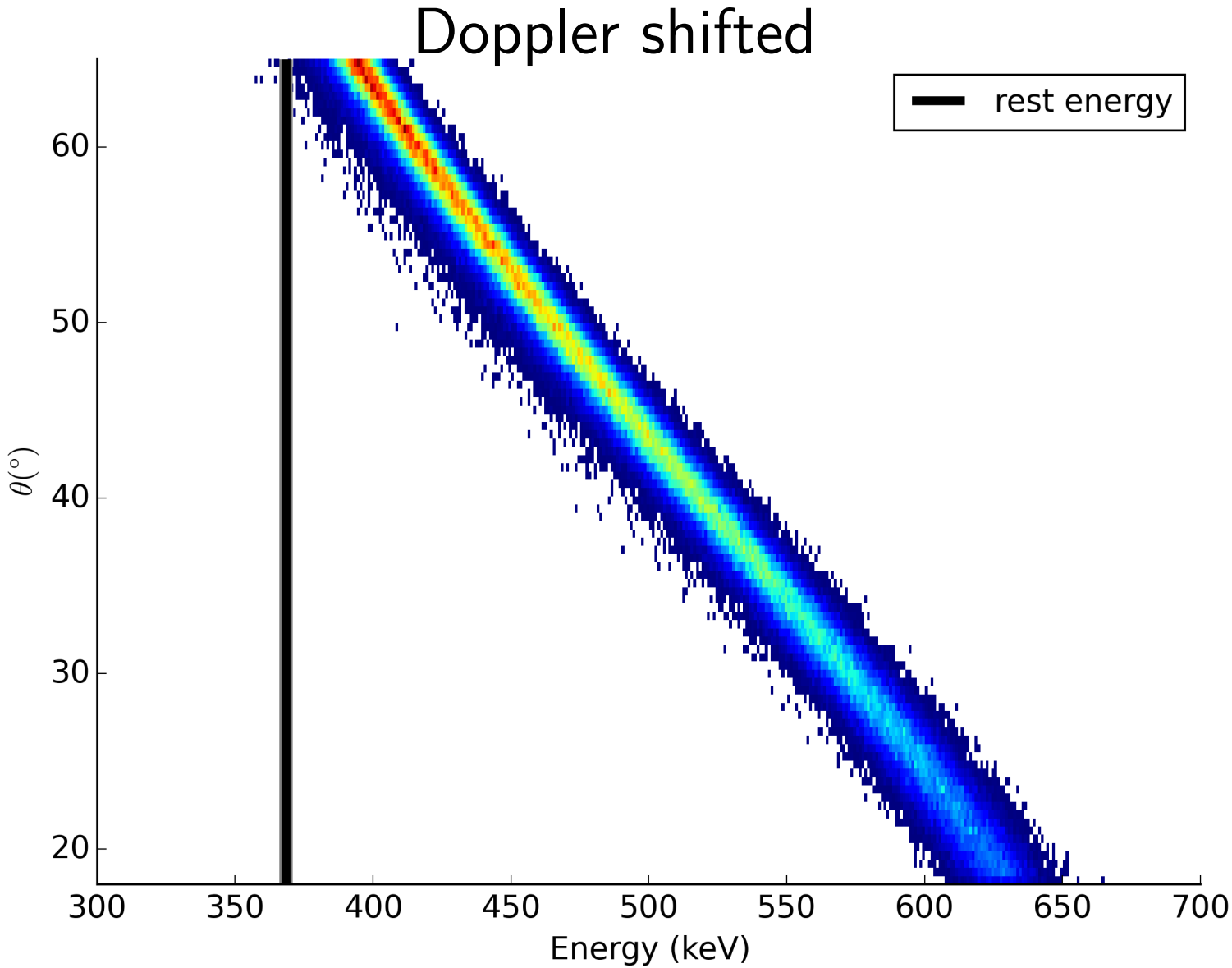
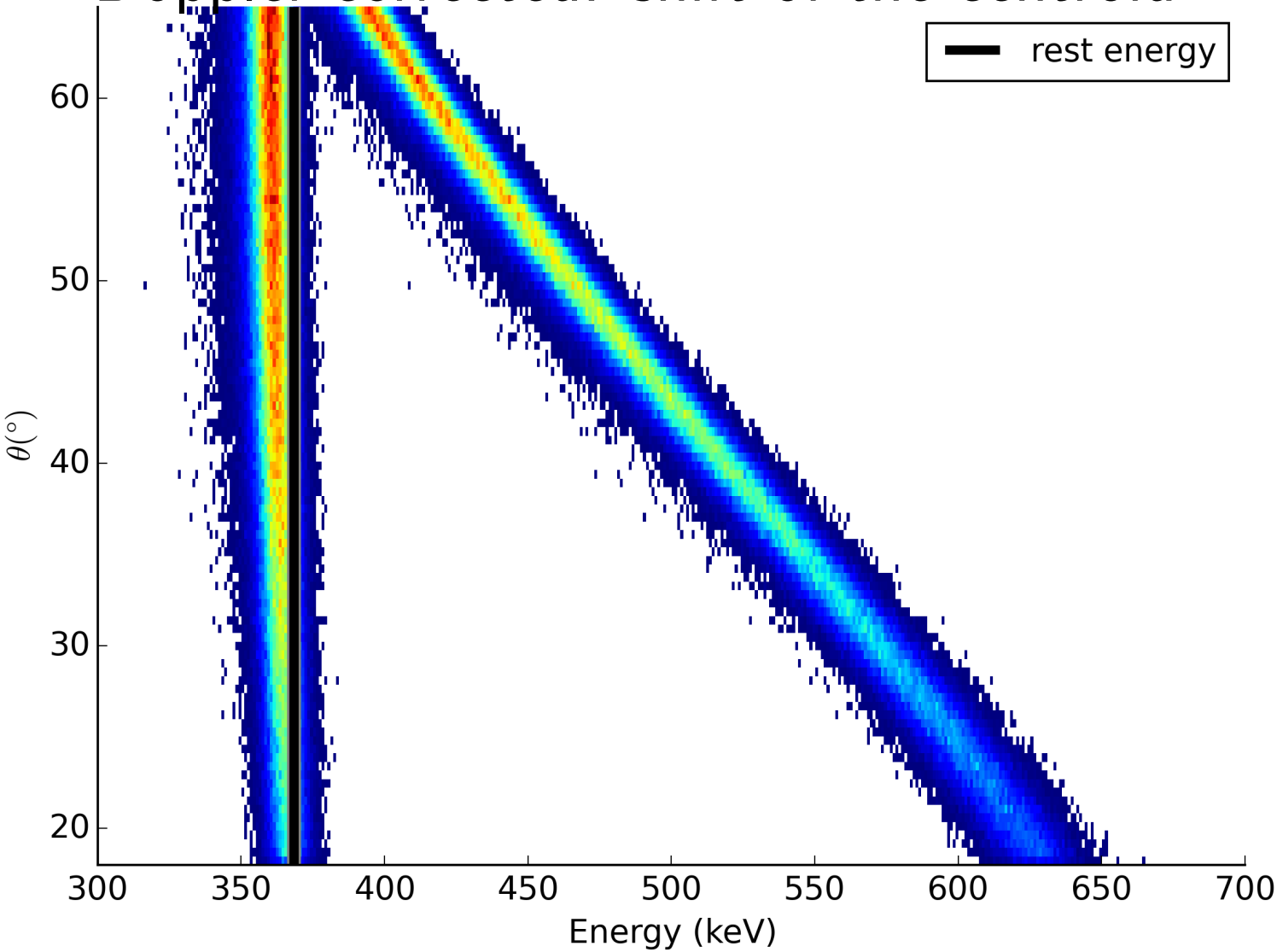
Lifetime measurement



Lifetime measurement

Doppler corrected: shift of the centroid



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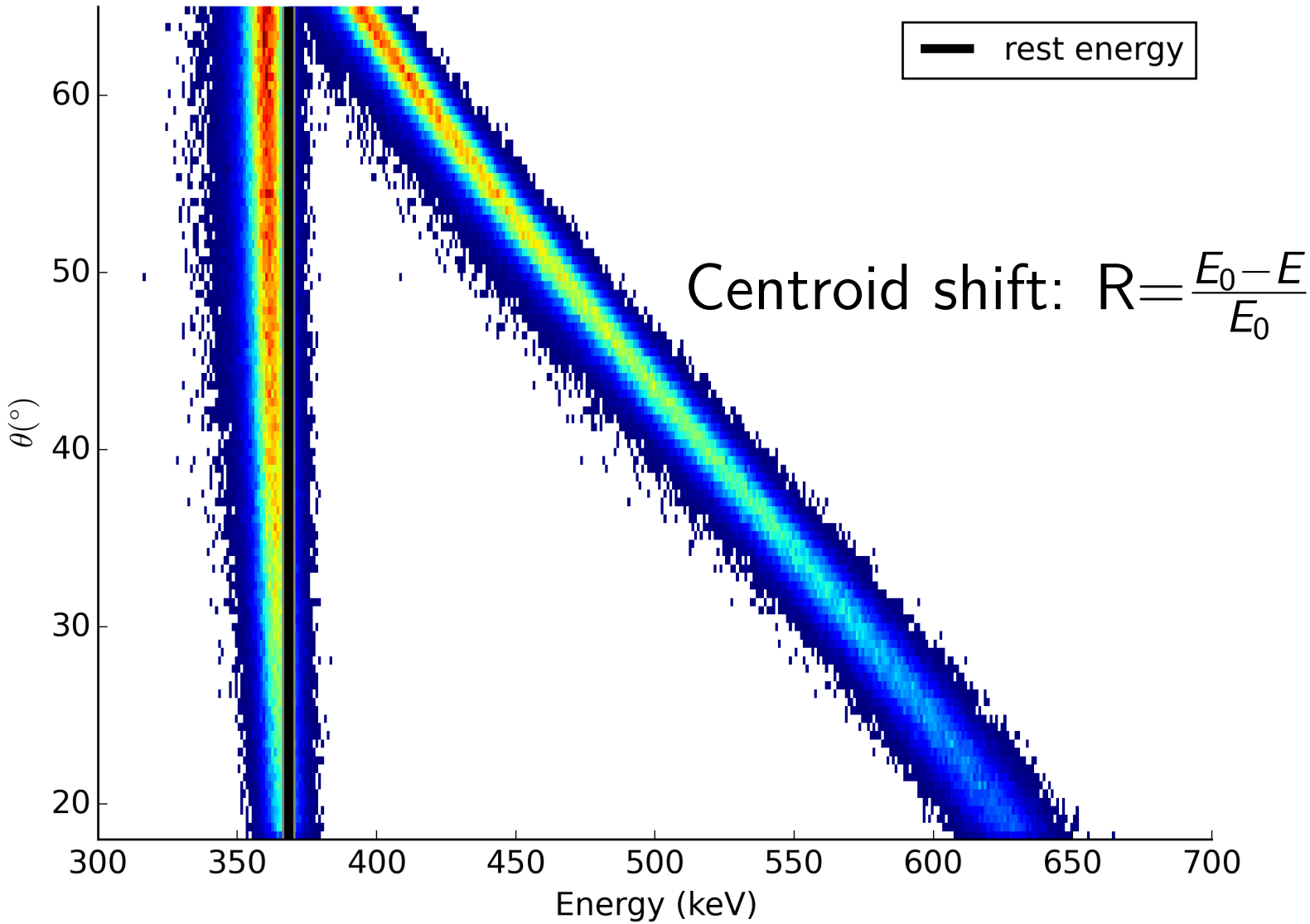
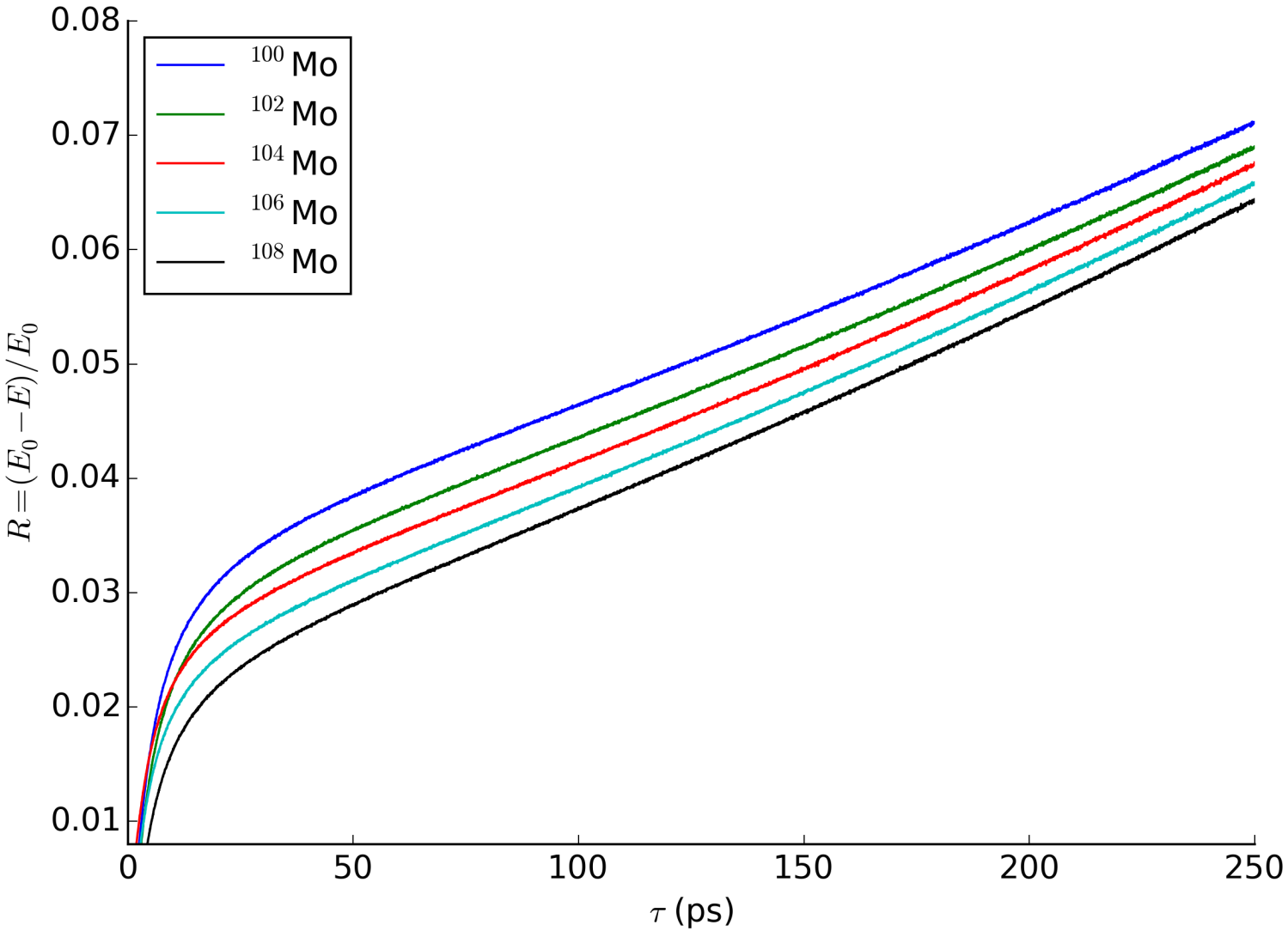


Simulations of the centroid shift

Simulated centroid shift as a function of the half-life



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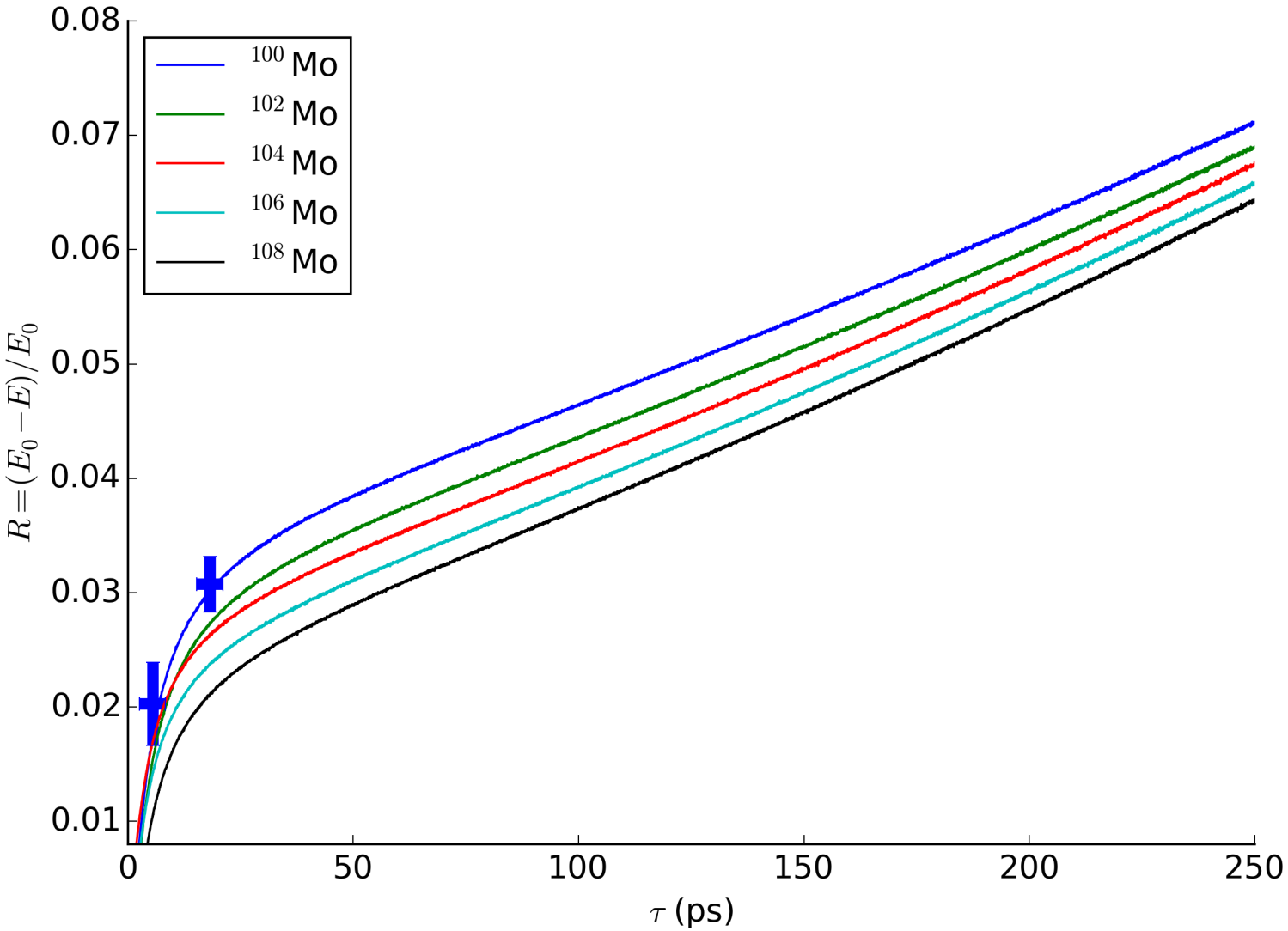

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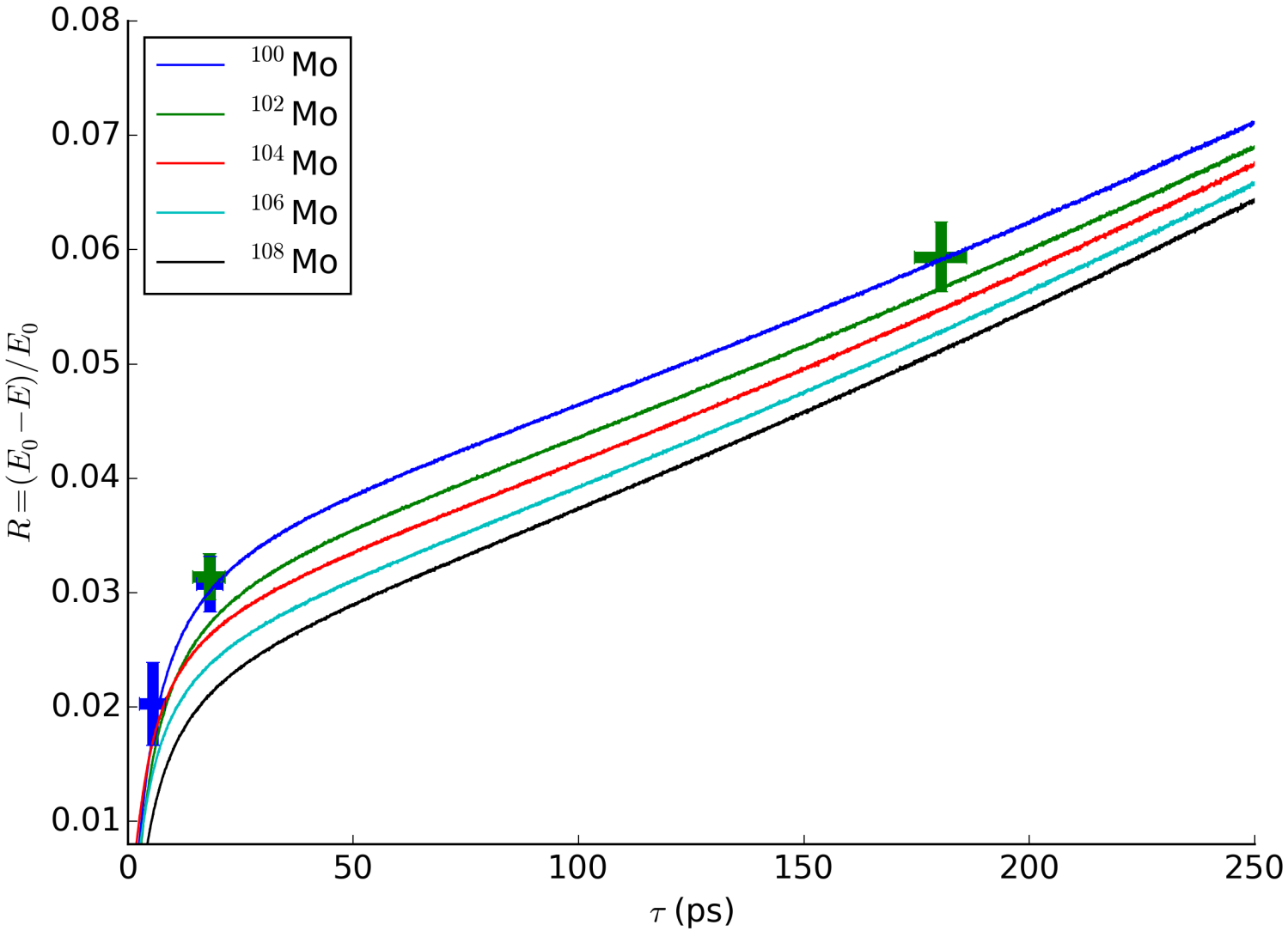

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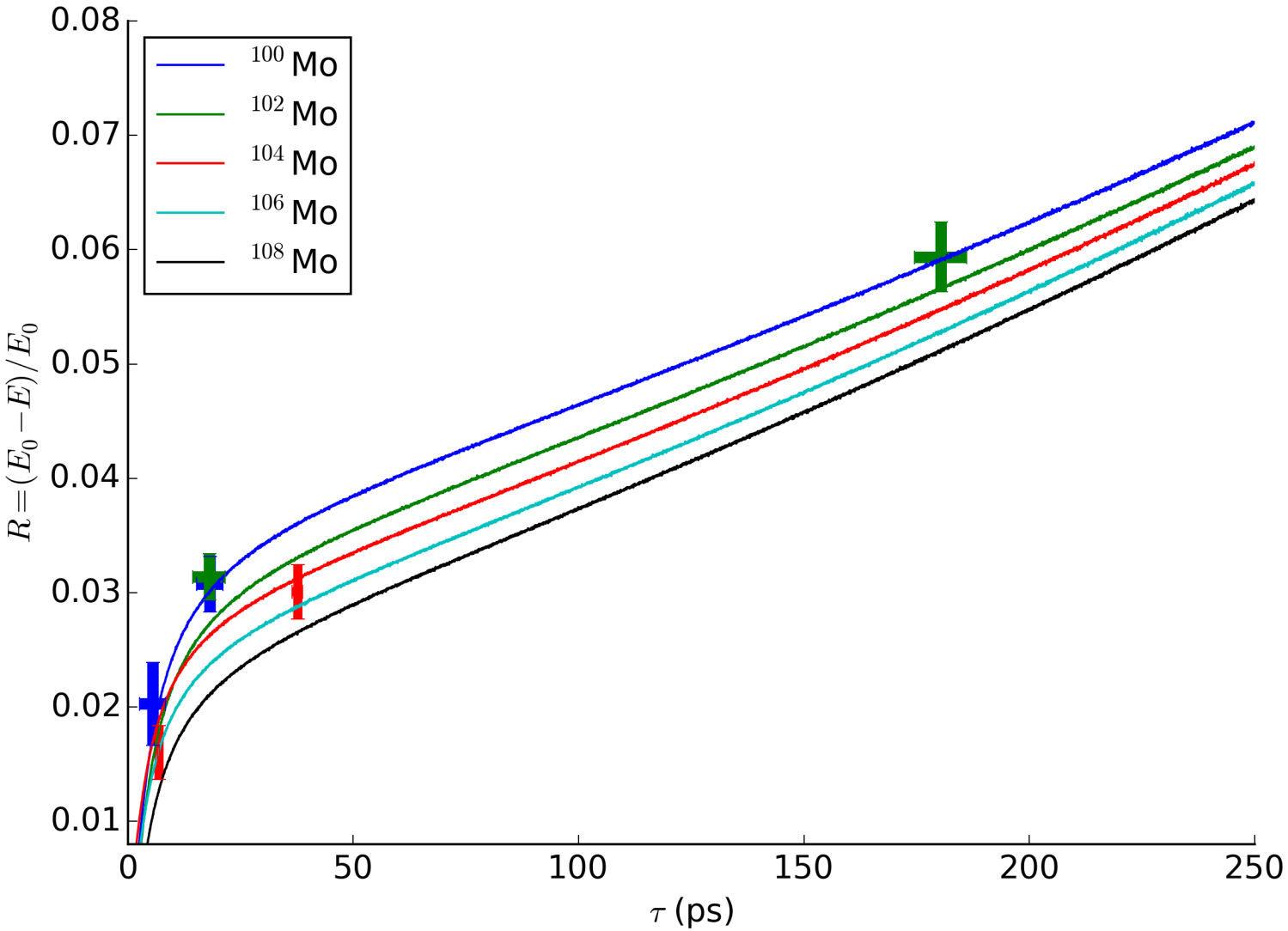

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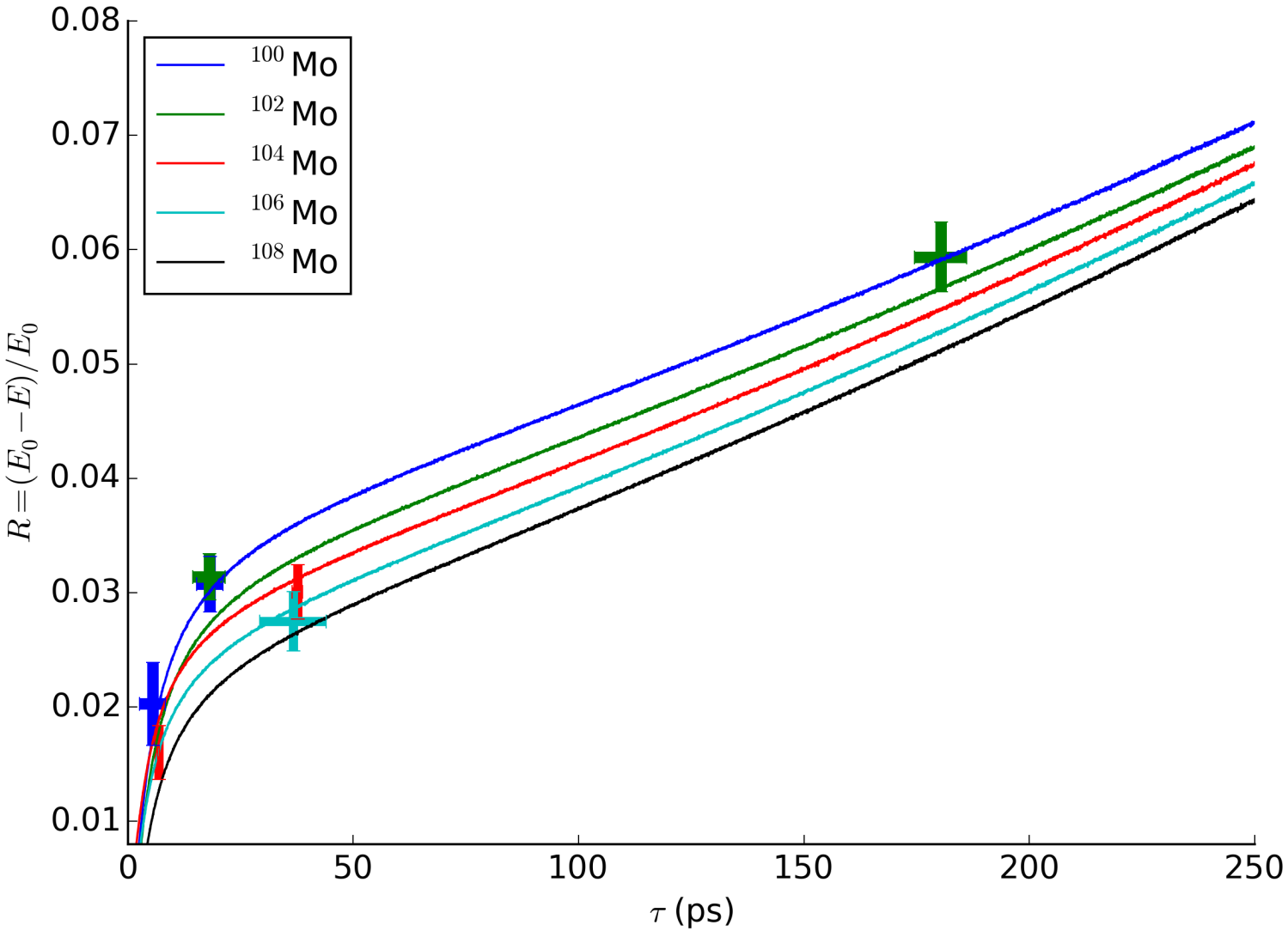
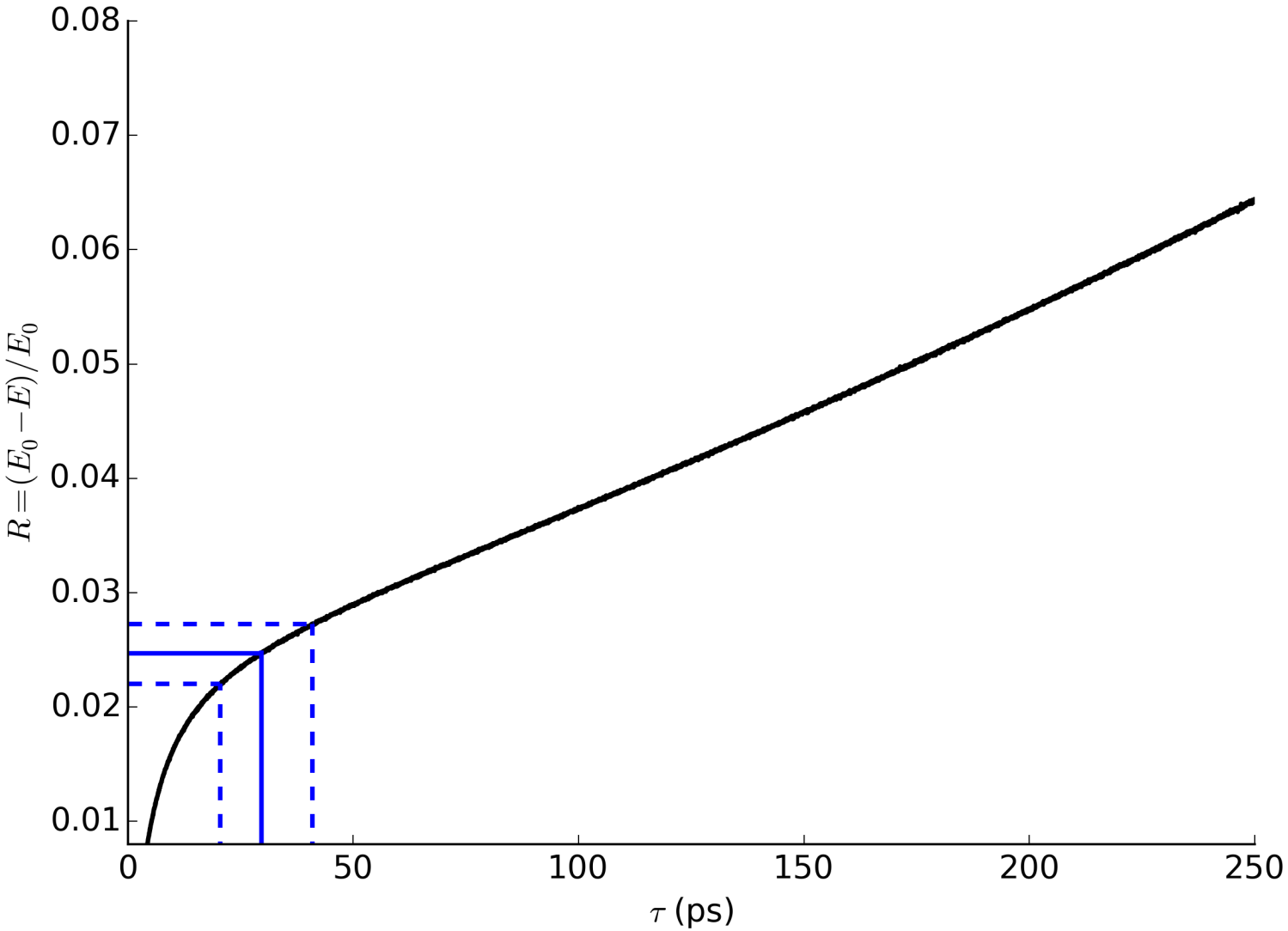


Lifetime of the 4^+ state of ^{108}Mo

D. Ralet, Phys. Rev. C, submitted



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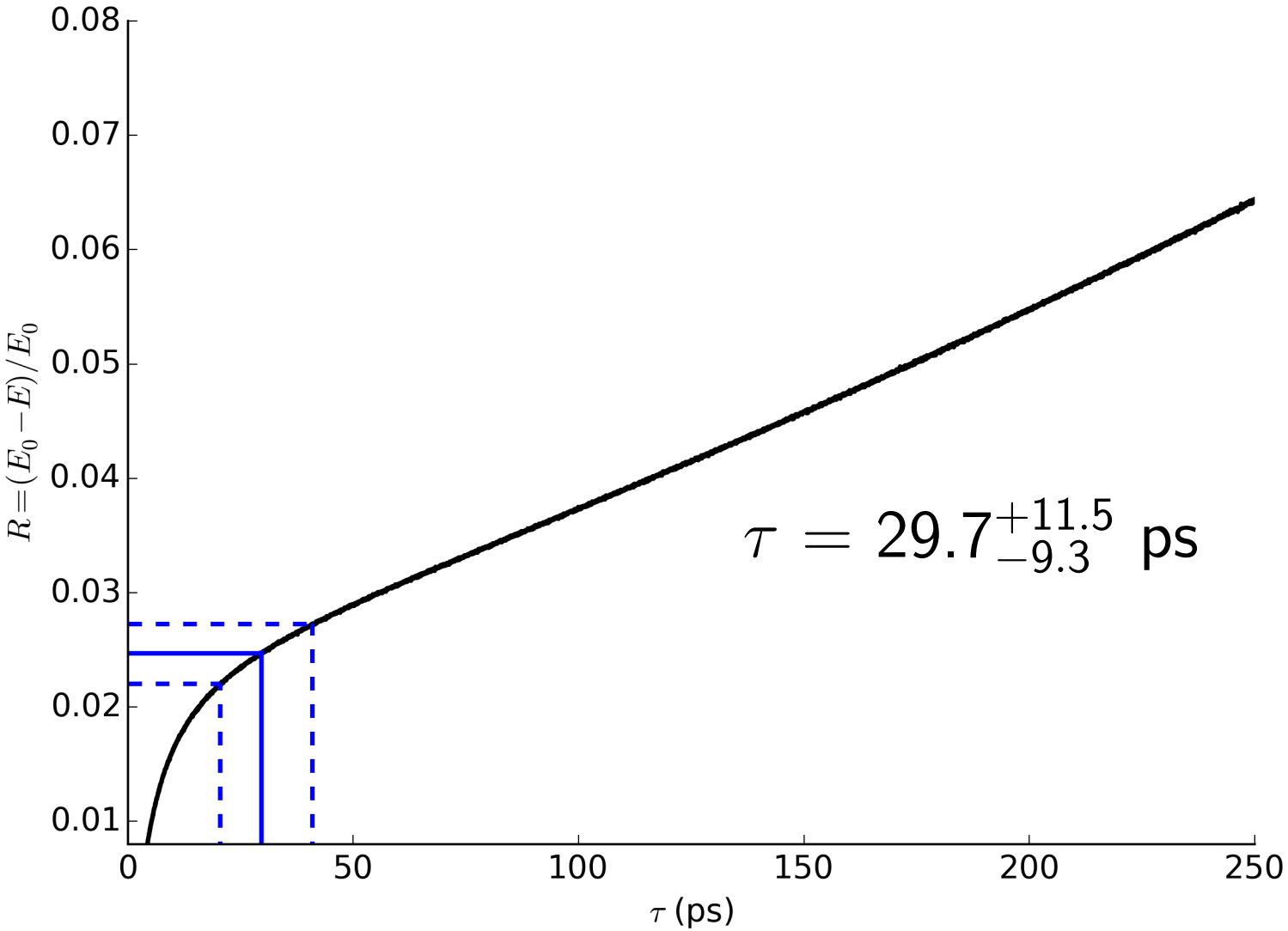

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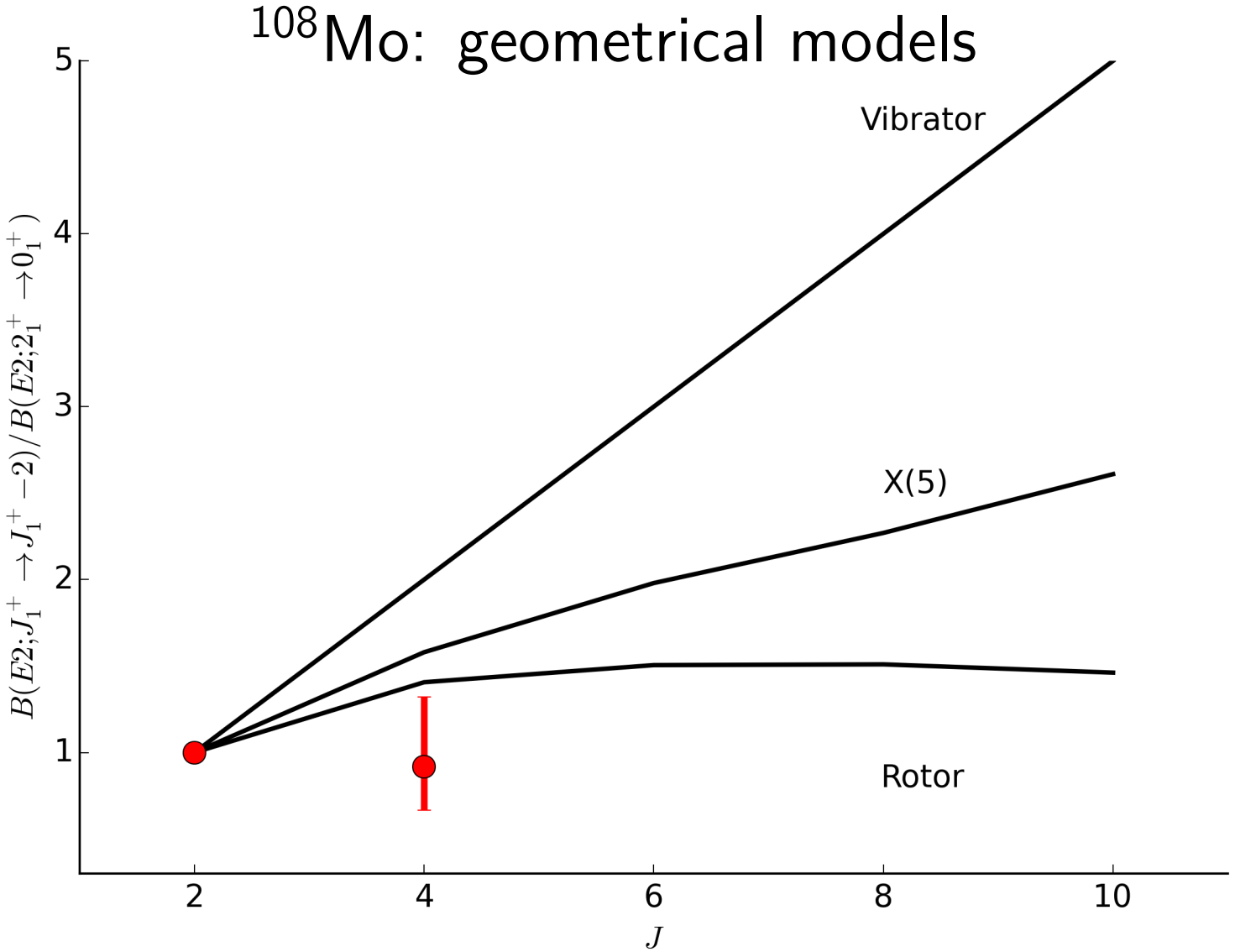
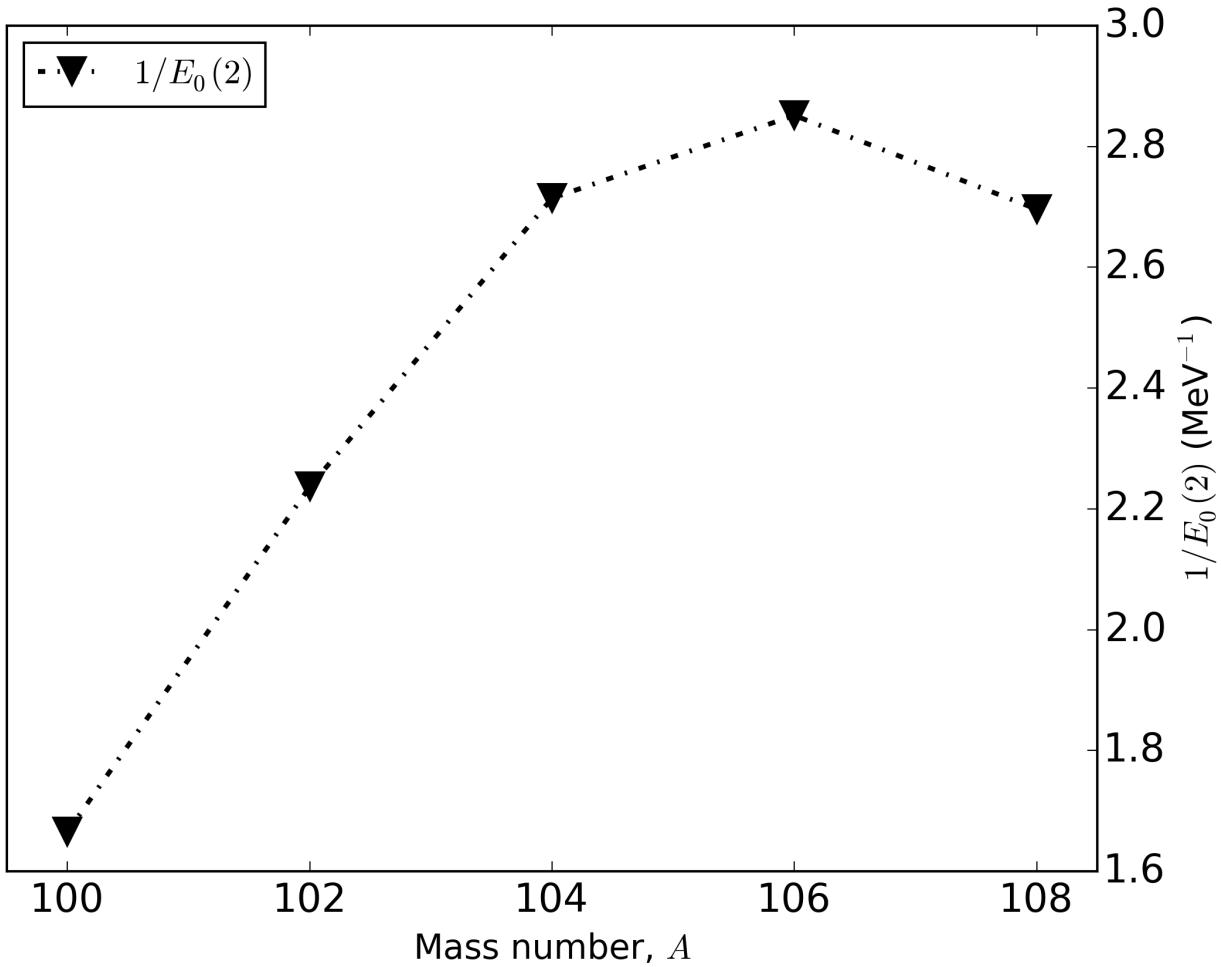
4^+ State of ^{108}Mo



Deformation along $Z = 42$ line

D. Ralet, Phys. Rev. C, submitted

Inverse of the first 2^+ energy: idea of deformation according Grodzins relation



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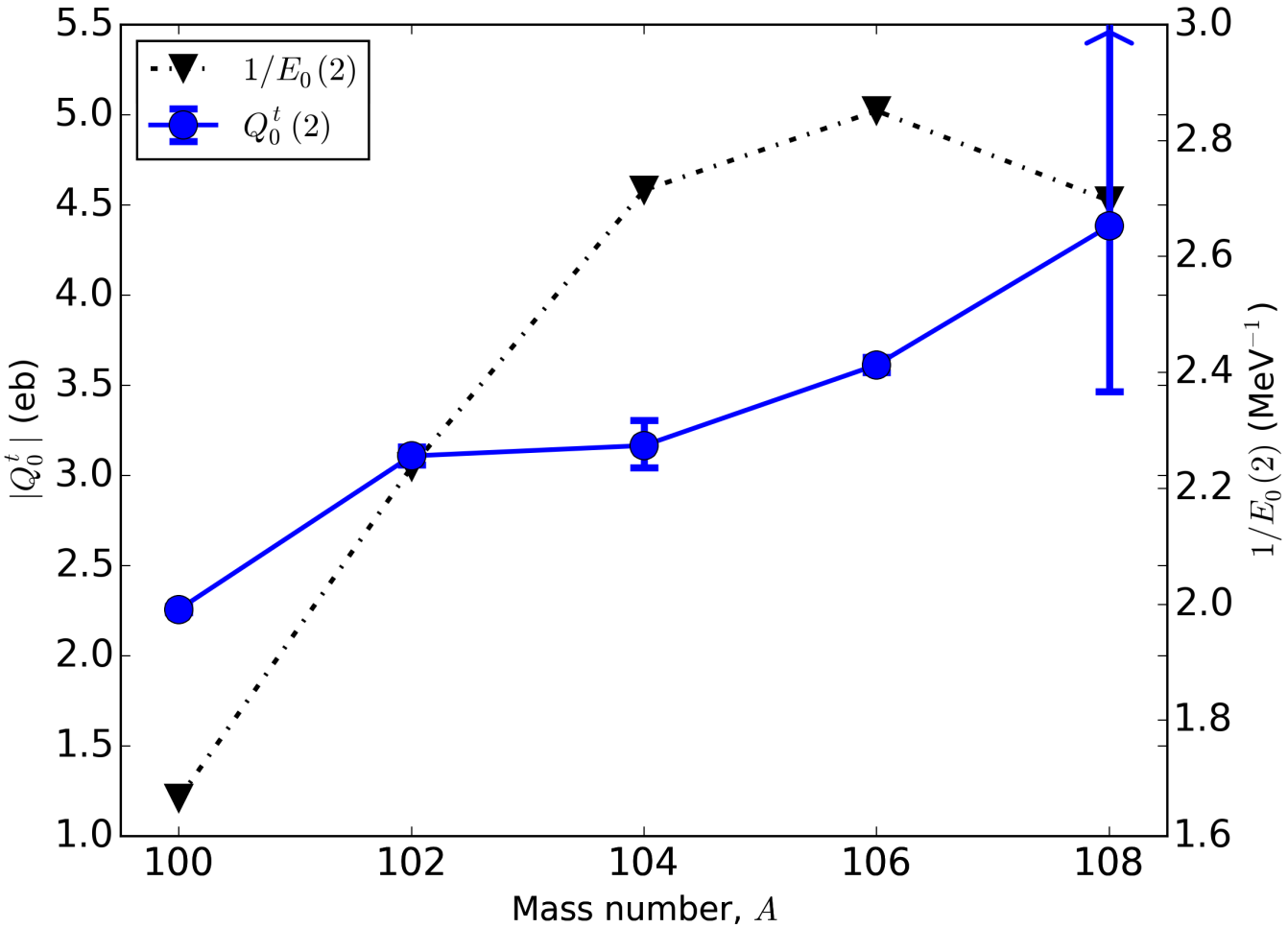
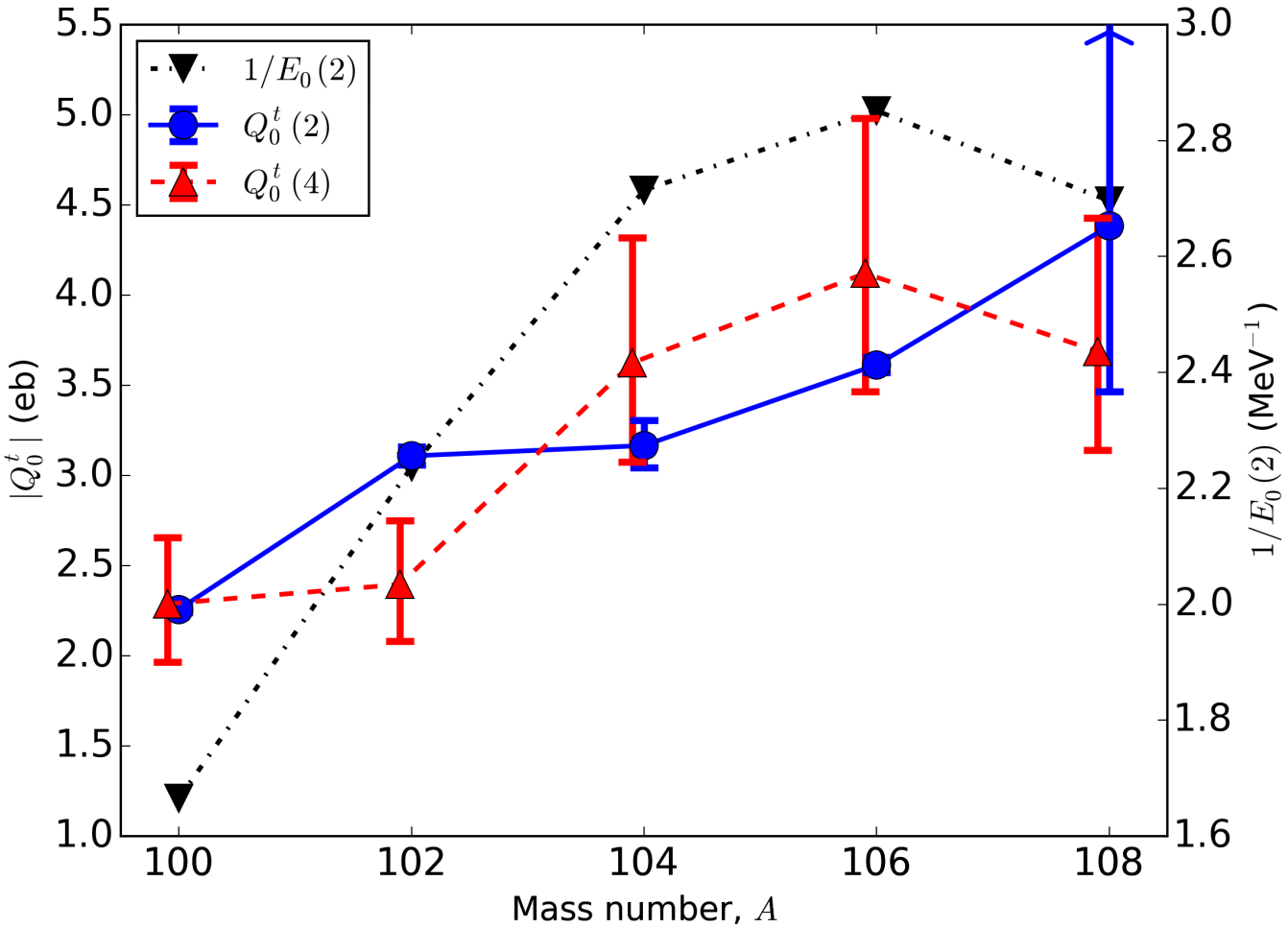
Transitional quadrupole moment $Q_0^t(2^+ \rightarrow 0^+)$ (literature values)



Deformation along $Z = 42$ line

D. Ralet, Phys. Rev. C, submitted

Transitional quadrupole moment $Q_0^t(4^+ \rightarrow 2^+)$ (this work)



Beyond mean field calculations

T. R. Rodríguez et al. PRC 81, 064323 (2010)

Performed by T.R. Rodríguez

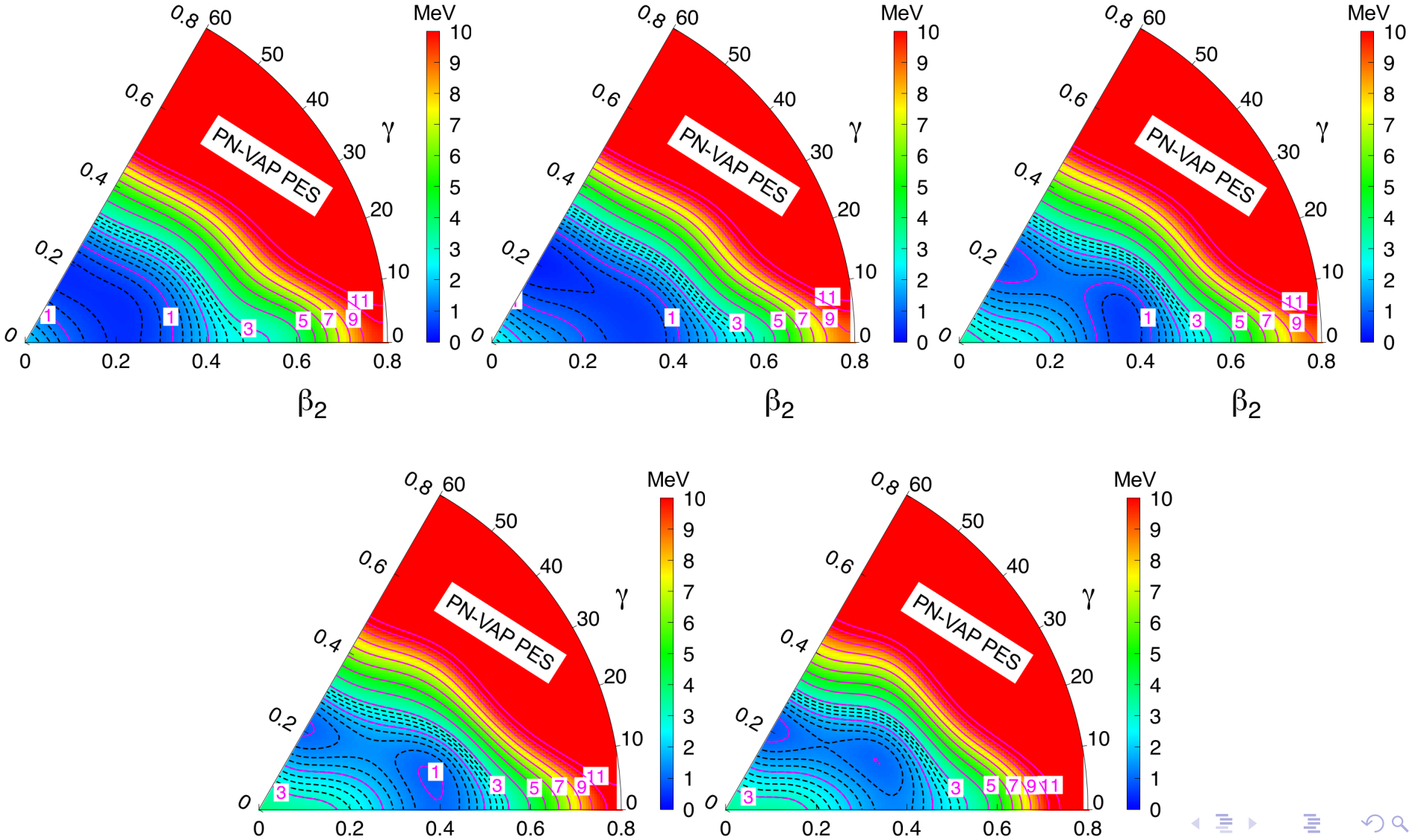
Using the Gogny D1S interactions

within the Symmetry Conserving Mixing Method (SCCM)

particle number and angular momentum projection

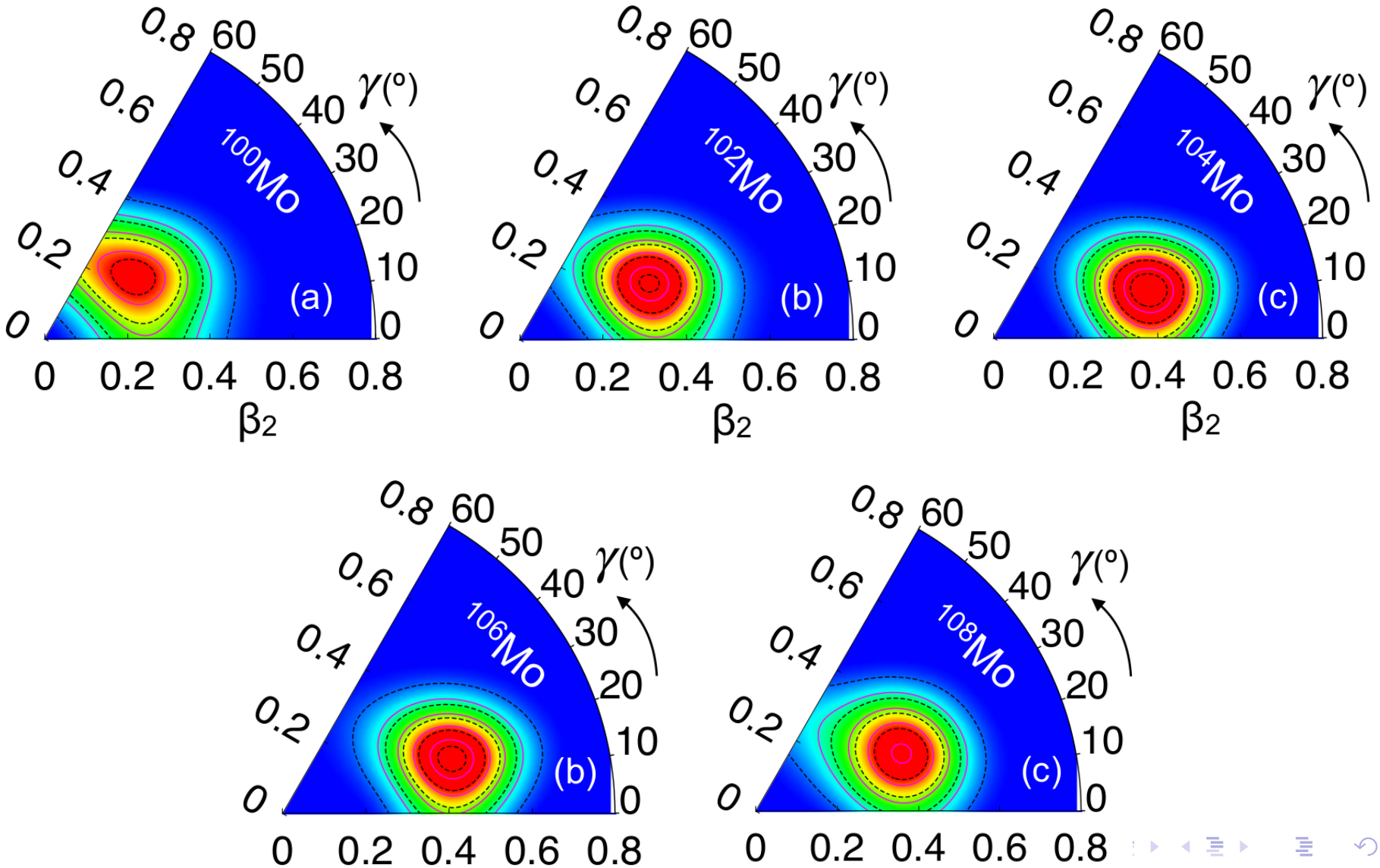
BMF for $^{100-108}$Mo

Potential Energy surface (PES)



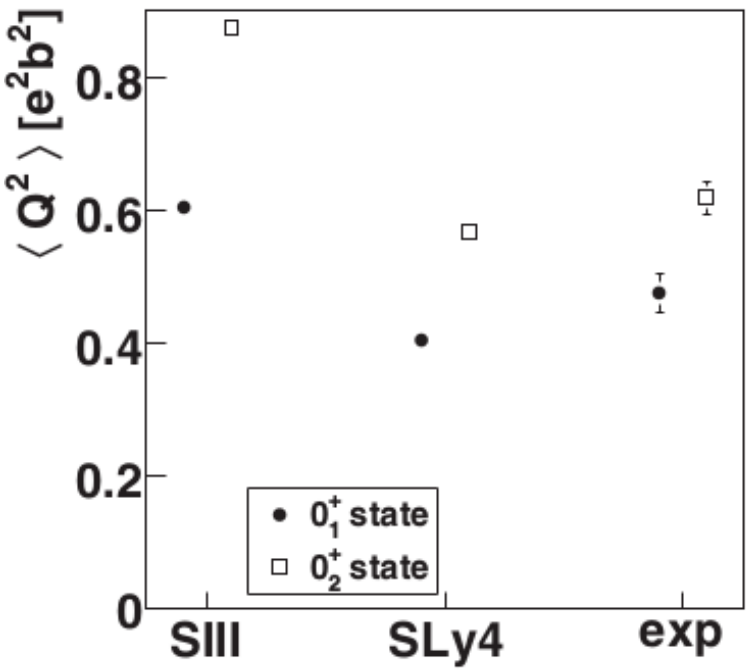
Ground state band of $^{100-108}$Mo

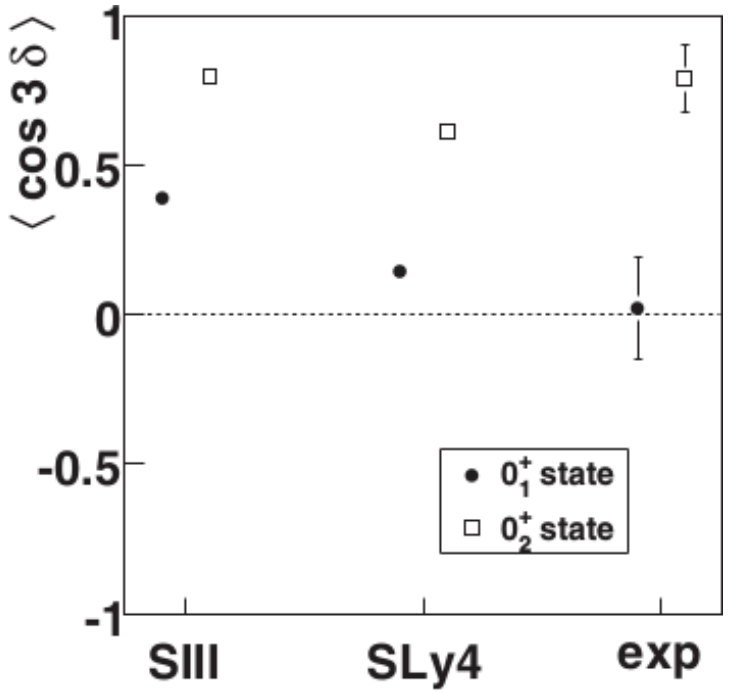
Ground state collective wave function



Coulomb-excitation of ^{100}Mo

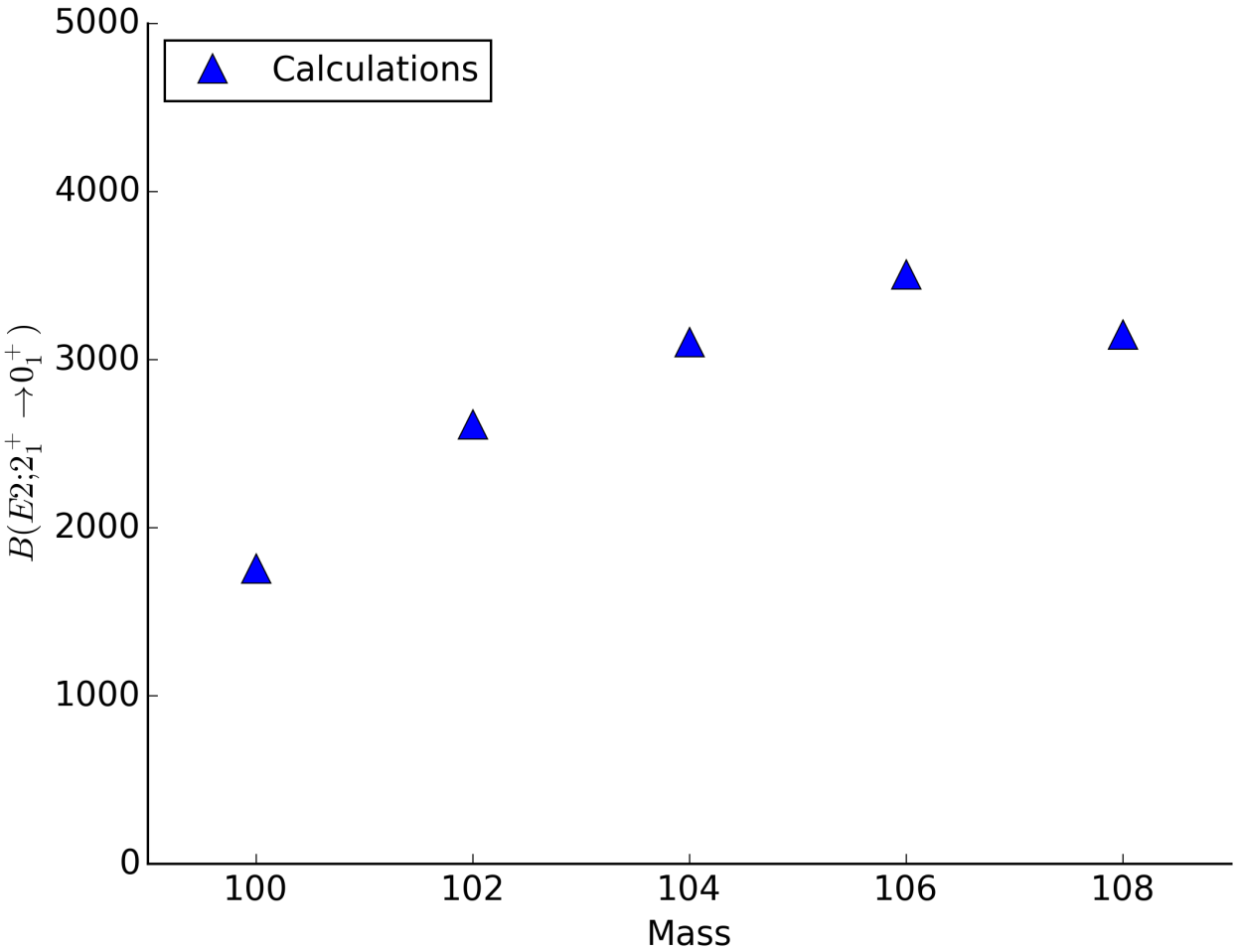
K. Wrzosek-Lipska et al. PRC 86, 064305 (2012)





Ground state band

Systematics $B(E2; 2^+ \rightarrow 0^+)$



Ground state band

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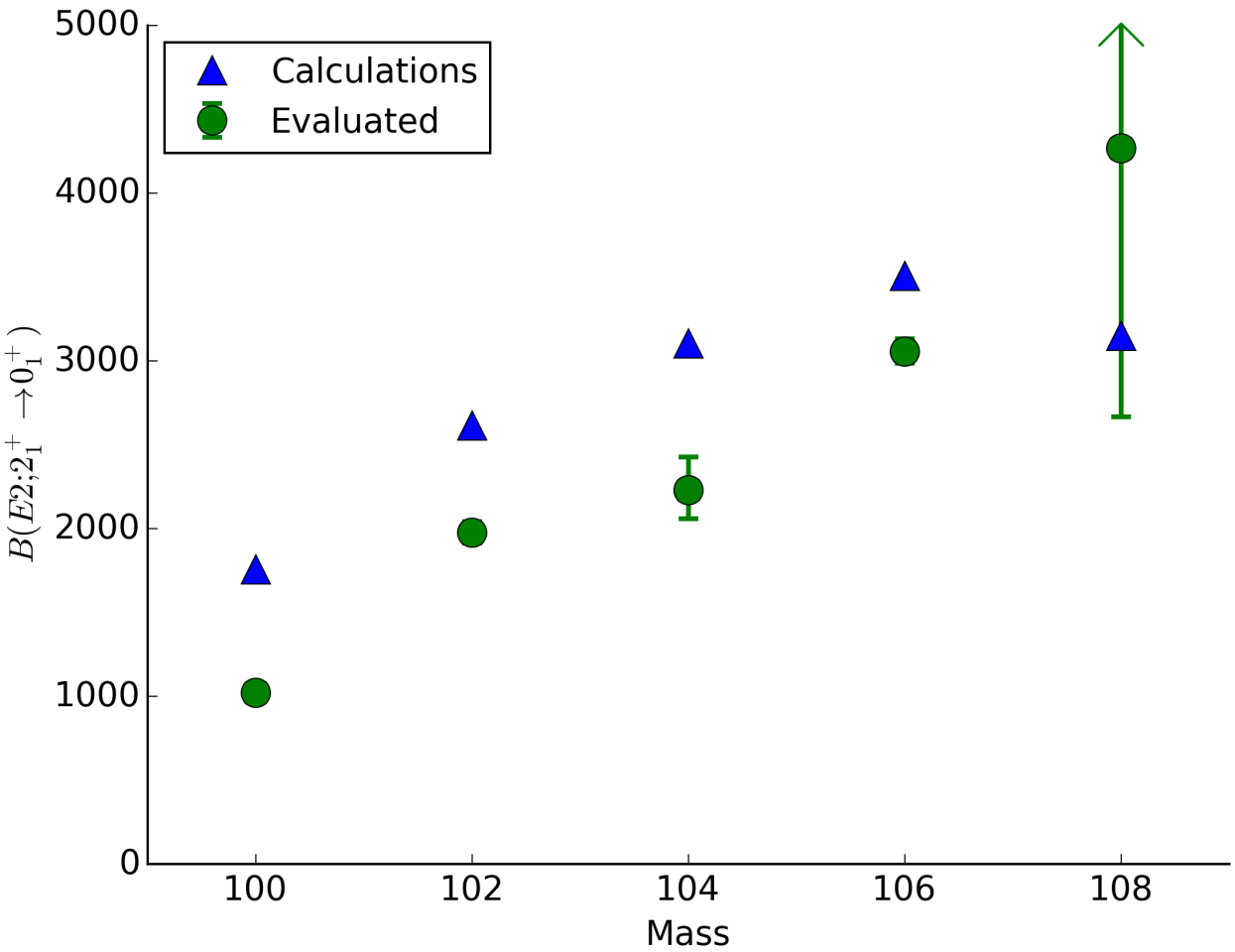

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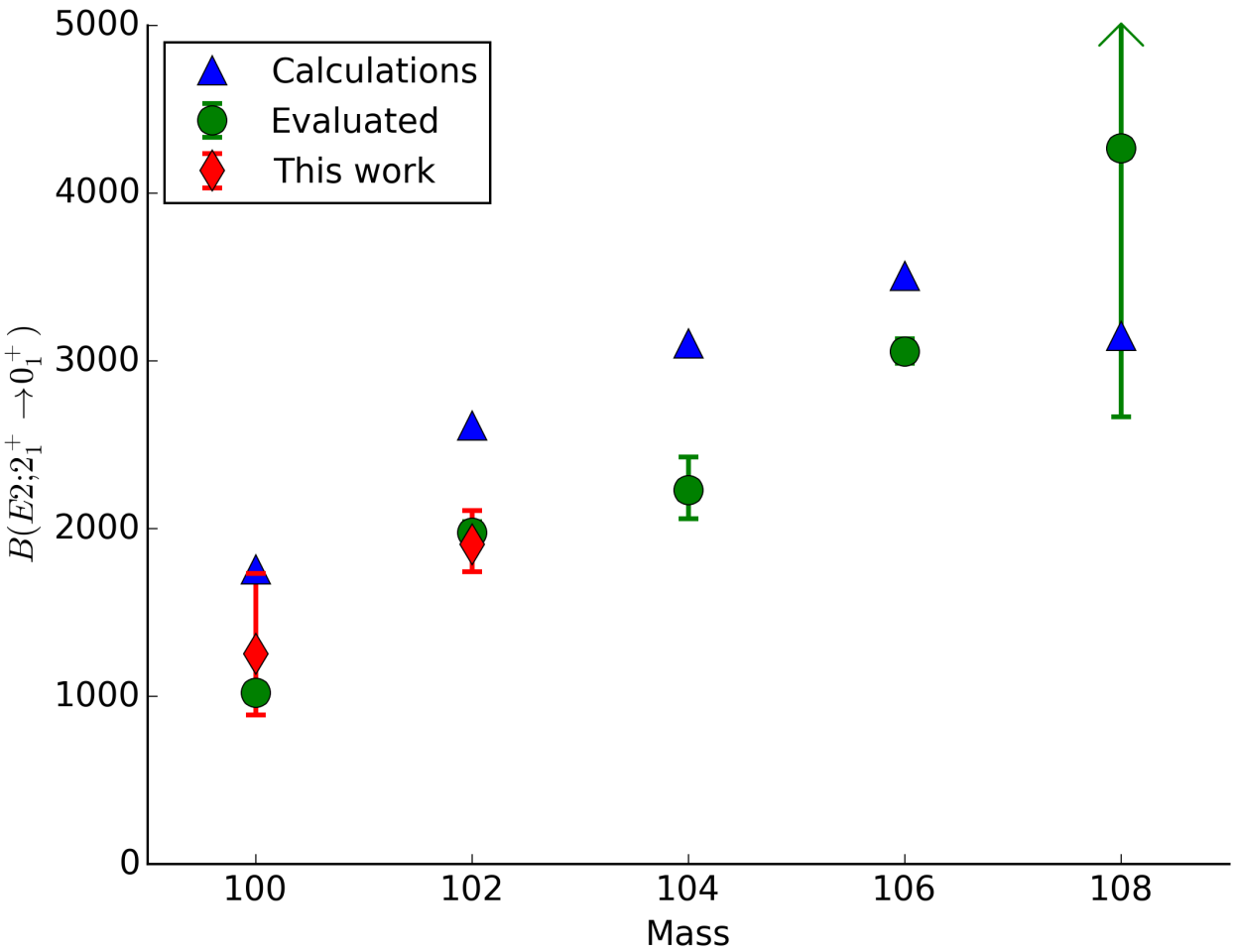
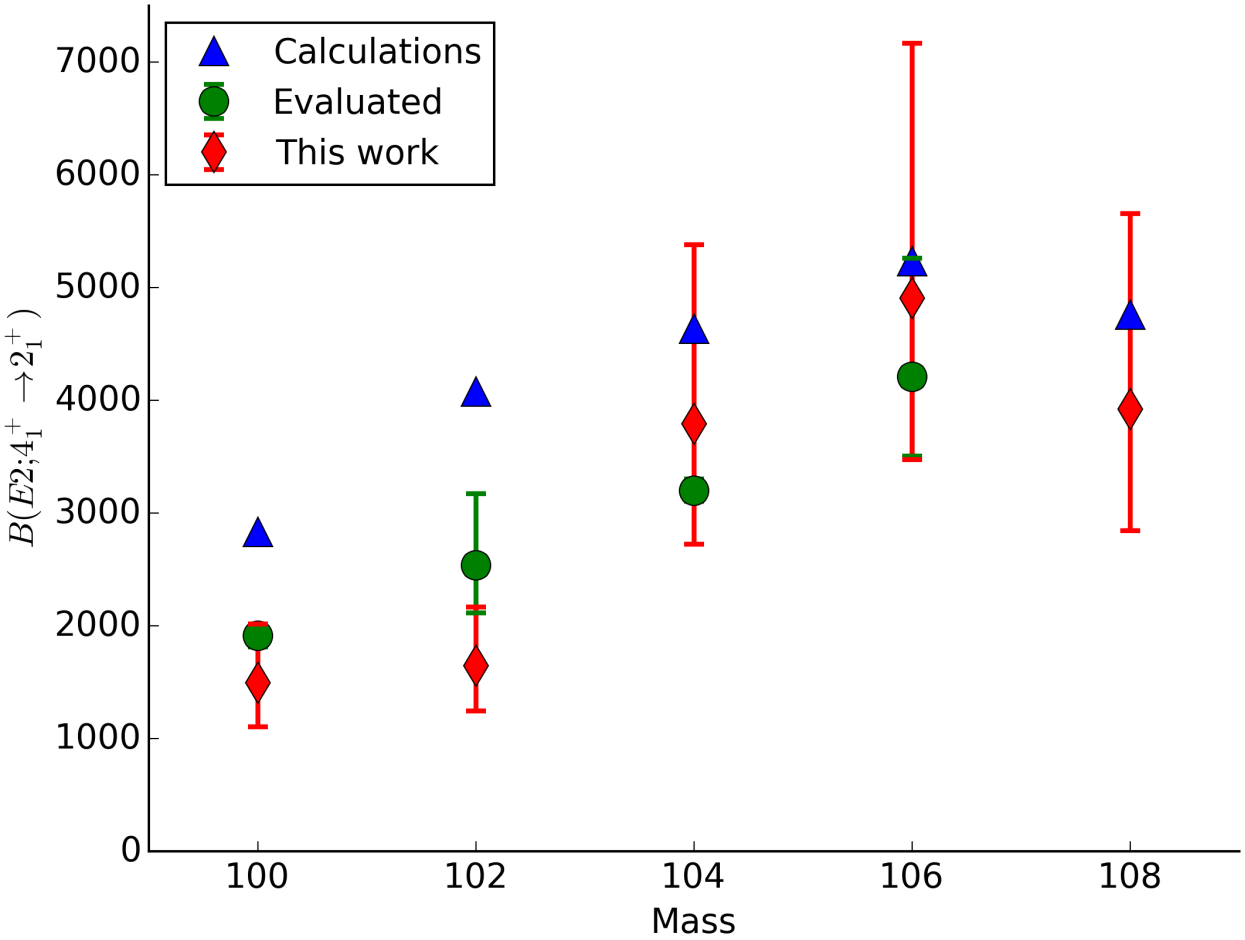


Ground state band

Systematics $B(E2; 4^+ \rightarrow 2^+)$



Maximum of deformation reach for $N = 64$

Summary

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Ground state band of molybdenum are triaxial according to calculations

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Ground state band of molybdenum are triaxial according to calculations

$\Rightarrow$ Proof-of-principle for HiSPEC experiment at the Super-FRS

Collaboration

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