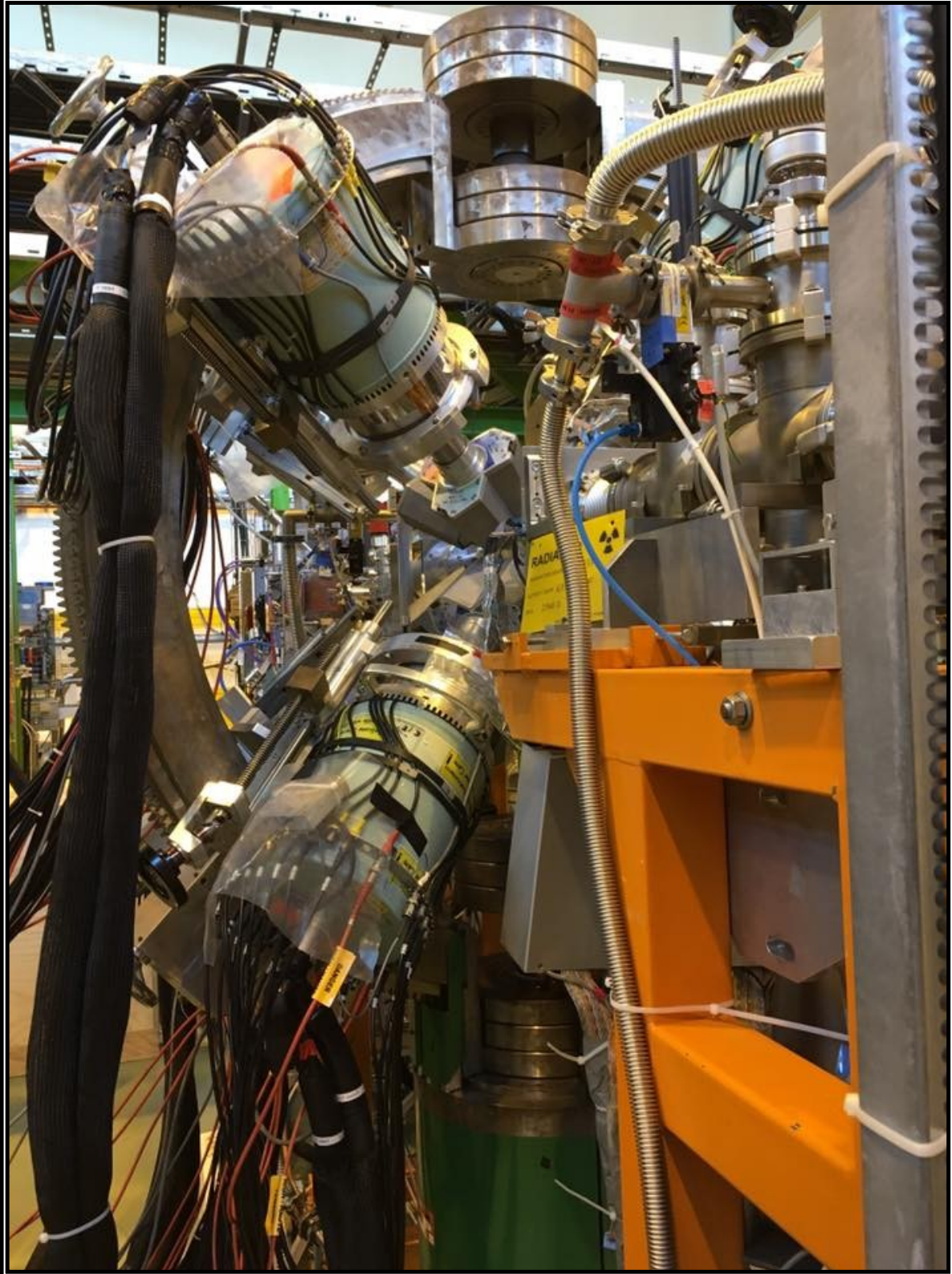
Coulomb Excitation of Semi-Magic ^{206}Hg at MINIBALL ISOLDE

Lisa Morrison

University of Surrey, UK

5/12/18



Overview

(1) Physics motivation

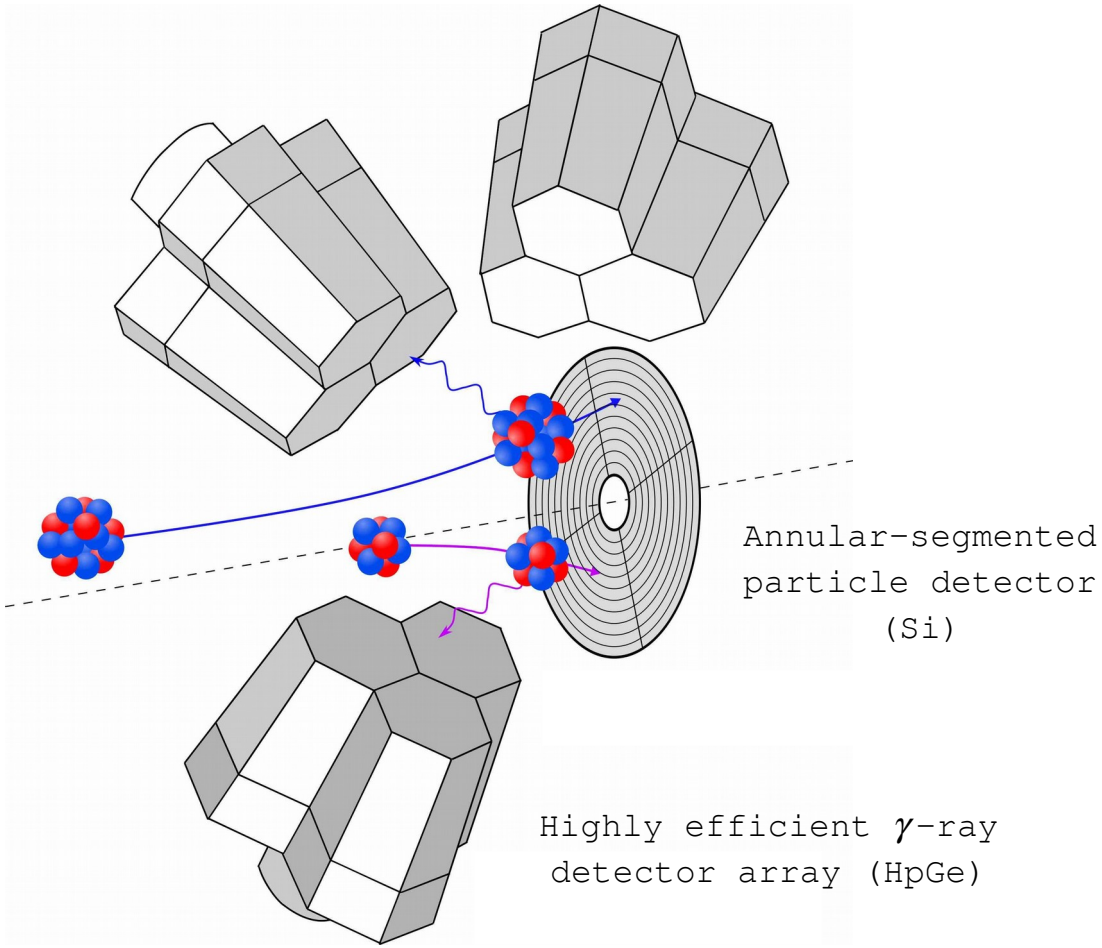
(2) Theory

(3) ^{206}Hg experiment

(4) Analysis

(5) Preliminary results

(6) Summary

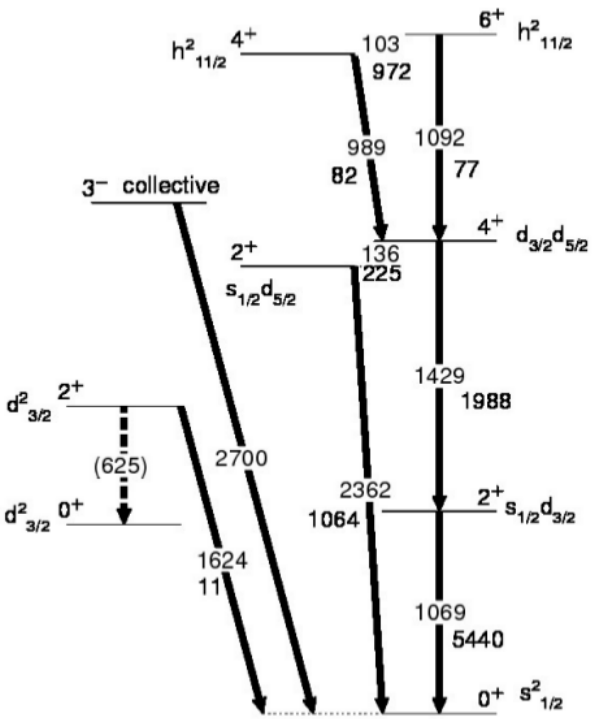


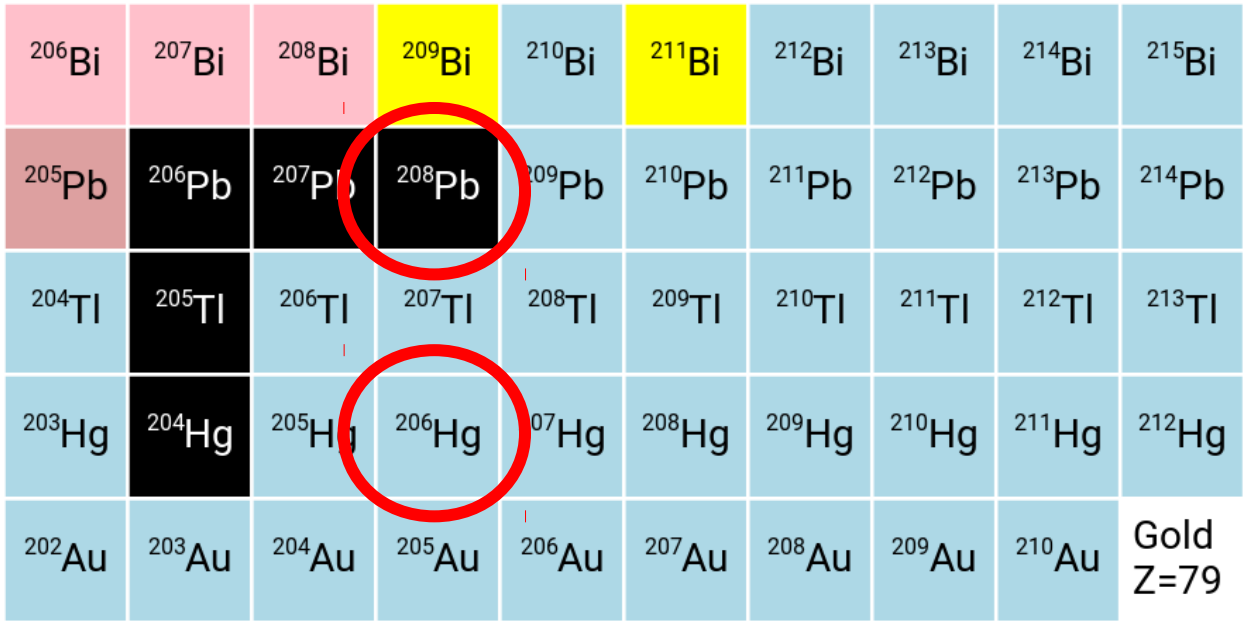
Physics Motivation

- ^{206}Hg (Z = 80, N = 126):

  singly-magic two proton-hole nucleus → proton holes determine nuclear properties

- Shell model calculations (OXBASH, Grawe) describe level scheme → experiment tests predictions





Theory

Transition probability:

$$B(E2; I_i \rightarrow I_f) = \frac{|\langle I_f \| E2 \| I_i \rangle|^2}{2I_i + 1}$$

Matrix Elements:

- Excitation / decay pattern
- γ-ray intensities

Spectroscopic quadrupole moment:

$$Q_s(I) = \sqrt{\frac{16\pi}{5}} \frac{\langle I I 20 | I I \rangle}{\sqrt{2I+1}} \langle I \| E2 \| I \rangle$$

Nuclear Shape:

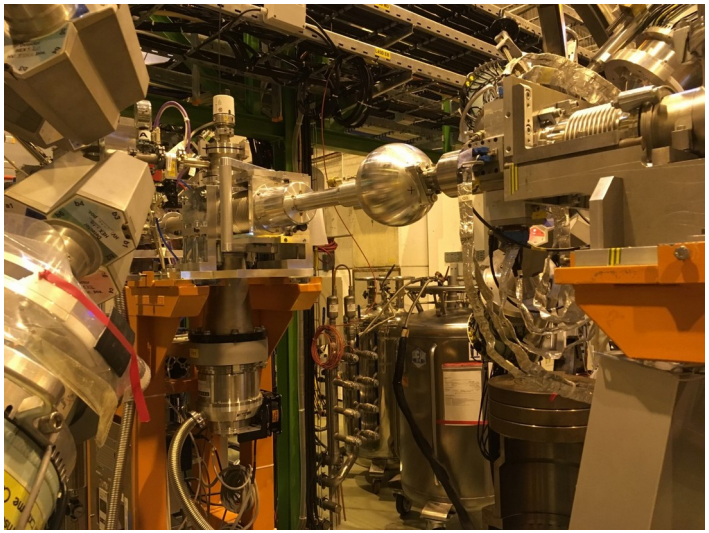
$Q_s < 0$ → prolate

$Q_s = 0$ → spherical

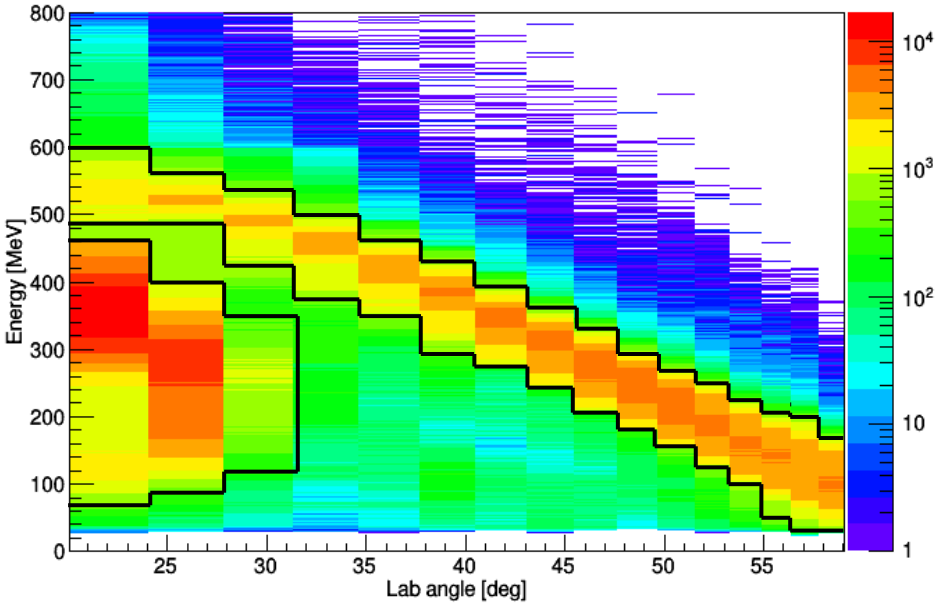
$Q_s > 0$ → oblate

^{206}Hg Experiment

- Took place in November 2017 using MINIBALL at CERN-ISOLDE
- ^{206}Hg beam produced using molten Pb target
- Beam was laser ionised → reduced contaminants
- ^{206}Hg Coulomb excited by ^{94}Mo and ^{104}Pd targets → inverse kinematics
- γ-rays detected using 8 HPGe clusters
- Recoiling particles detected using DSSSD

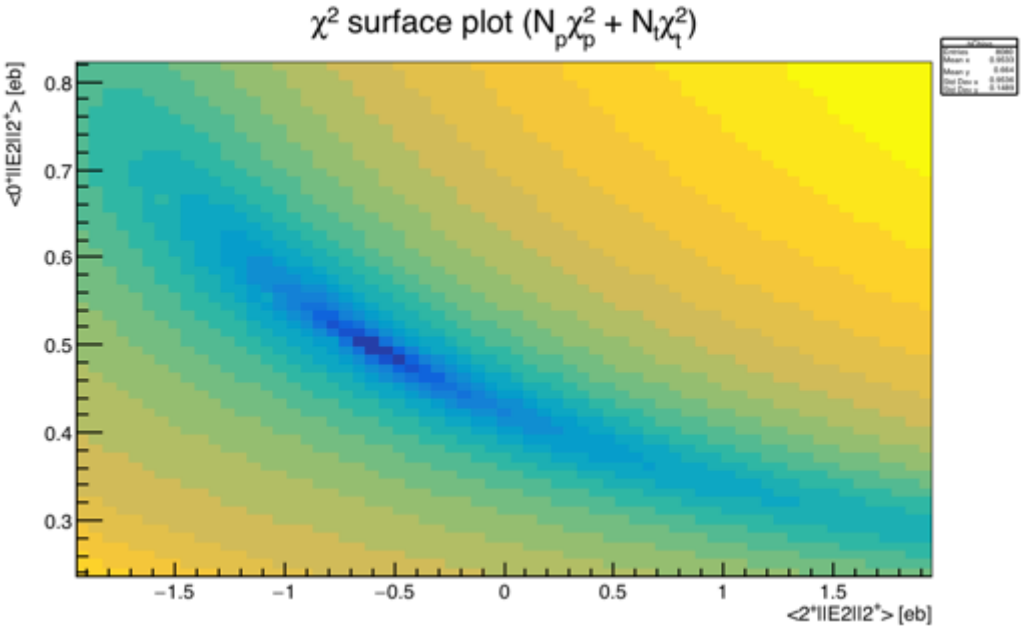


Analysis

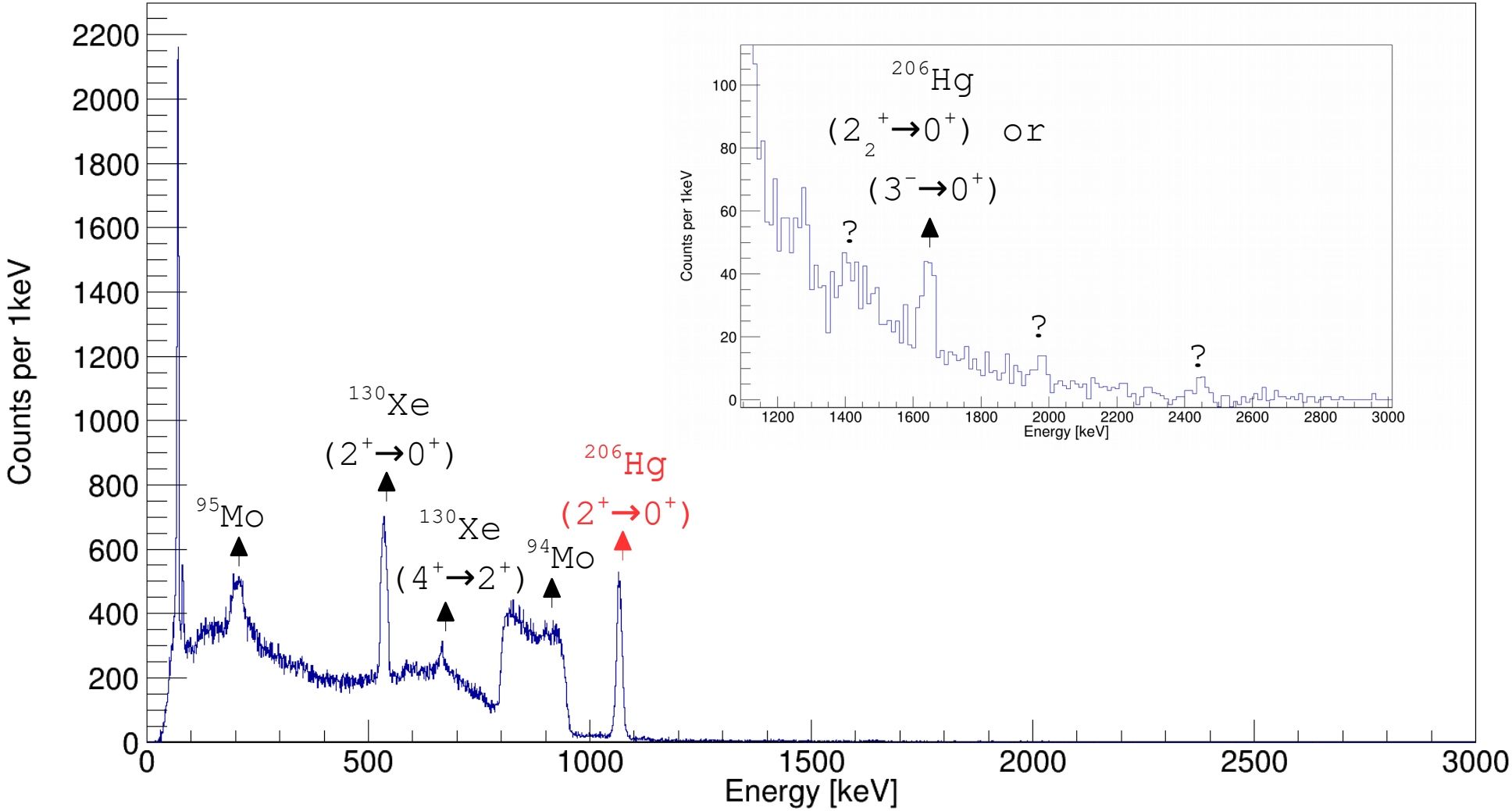


- Kinematics plot for particles striking DSSSD
- Distinguish between beam and target

- χ^2 map calculated using GOSIA 1 and 2
- Calculated for range of transitional and diagonal matrix elements



Preliminary Results



Summary

Analysis is ongoing…

- Preliminary results support SM calcuations → energy of 2^+ state
- Identified previously unmeasured transitions
- Refined values for diagonal and transitional matrix elements
- Current results indicate a prolately deformed ground state

Acknowledgments

Zs. Podolyák[1], K. Hadyńska-Klek[1], L. P. Gaffney[2], M. Brunet[1], R. Canavan[1,3], S. Colosimo[4], J. Cubiss[5], D. Doherty[1], H. Grawe[6], N. Lalović[7], B. Marsh[2], Y. Martinez Palenzuela[2], S. Rothe[2], J. P. Ramos[2], M. Rudigier[1], M. Siciliano[4], M. Zielińska[8] and the MINIBALL collaboration.

[1]University of Surrey, [2]CERN, [3]National Physical Laboratory, [4]INFN-LNL, [5]University of York, [6]GSI Germany, [7]Lund University, [8]CEA Saclay.