

Experimental Activities Report ANL Nuclear Data Program

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Argonne National Laboratory



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ANL Experimental Activities Overview

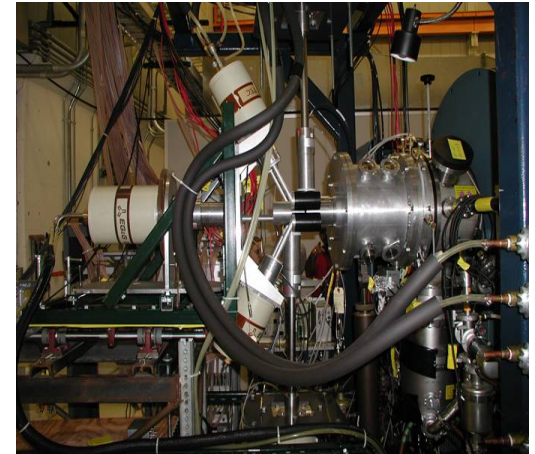
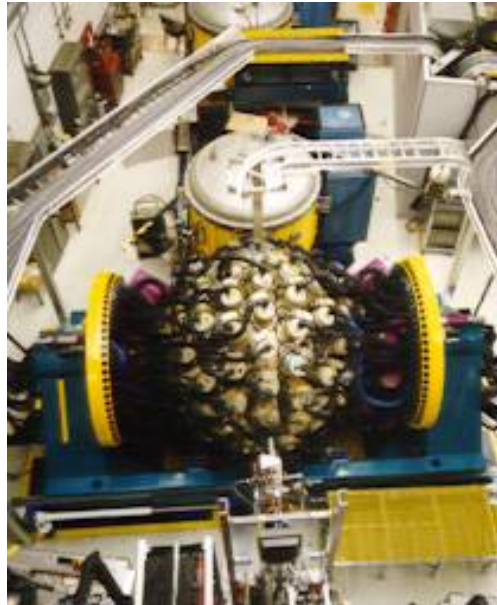
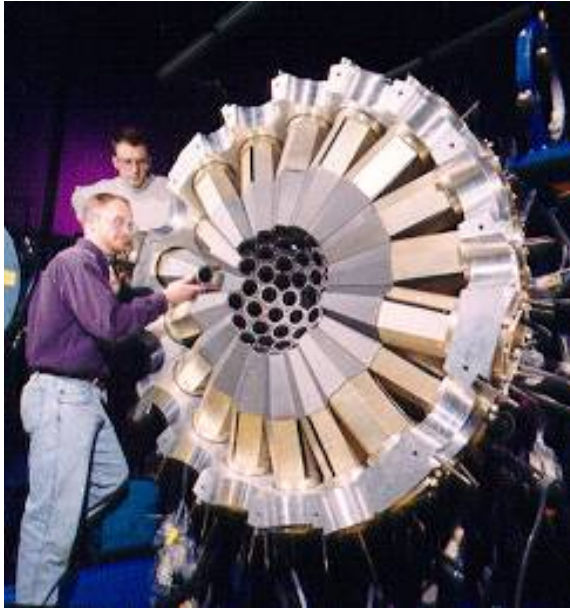
- ❑ *Measurements with Gammasphere & FMA at ATLAS*
 - *Basic low-energy nuclear physics*
 - *Non-energy applications, e.g. astrophysics, detector efficiency standards and others*
 - *Nuclear energy applications, e.g. isomers, FP*
- ❑ *Development of a new generation Ge tracking detectors*
 - *both applied and basic physics communities*
- ❑ *Decay studies of heavy nuclei*
 - *both applied and basic physics communities*
- ❑ *Radioactive HI beams measurements*
 - *Intermediate energy Coulomb excitation at MSU – nuclei near ^{48}Ca ($^{50,52,54,56}\text{Ti}$)*

Measurements with GS & FMA at ATLAS - cont

- ❑ Properties of Nuclear **K-Isomers** in neutron-rich nuclei near $A \sim 180$ and **shell-model isomers** near ^{132}Sn , including spectroscopy of FP – in collaboration with **ANU (Canberra), UML and PHY/ANL**
- ❑ Properties of nuclei **far from the line of stability** - in collaboration with **PHY/ANL, UT**
 - proton-rich nuclei in the rare earth (**Re-Ir**) and **Hg-Pb** regions
- ❑ Spectroscopy of ^{237}U and ^{239}U using Unsafe Coulomb excitations – in collaboration with **PHY/ANL**
- ❑ Triaxial Superdef and Wobbling mode in $^{171-175}\text{Hf}$ and $^{170-171}\text{Ta}$
- ❑ Spectroscopy of **heavy nuclei** – in collaboration with **PHY/ANL**
 - Decay data on ^{253}Es
 - Properties of high-K isomer in ^{254}No

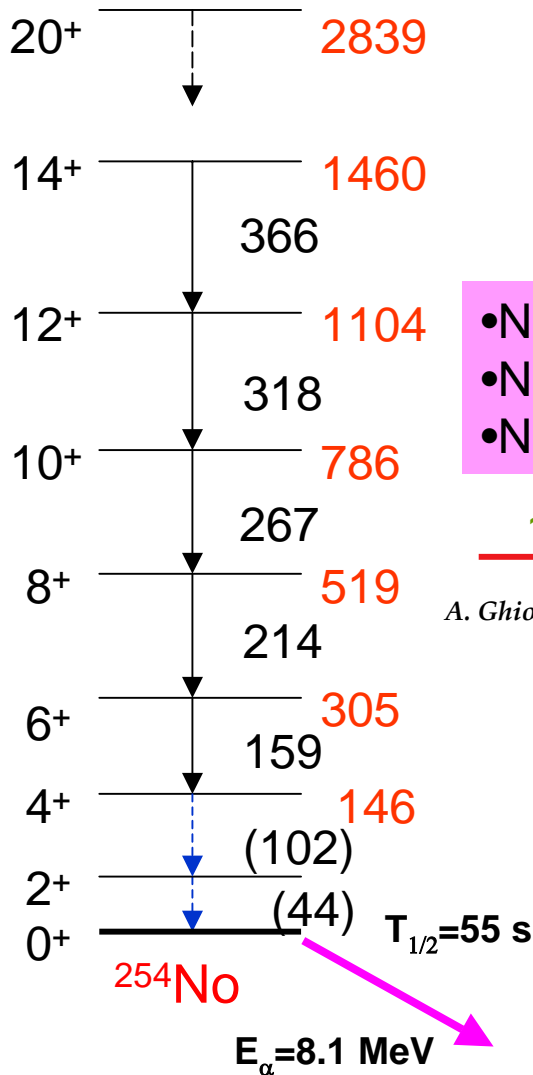
Measurements with GS & FMA at ATLAS

□ Coupling of *GammaSphere* & *FMA* at ATLAS



□ New equipment: 4 Ge CLOVER detectors

Two-quasiparticle Isomer in ^{254}No ?



A. Ghiorso et al., Phys. Rev. C7 (1973) 2032

- A 7 $^-$ isomer (70 ns) in ^{256}Fm
- A 1.8 s isomer in ^{250}Fm .

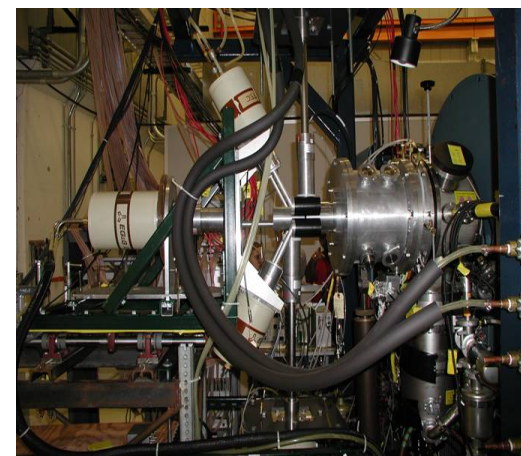
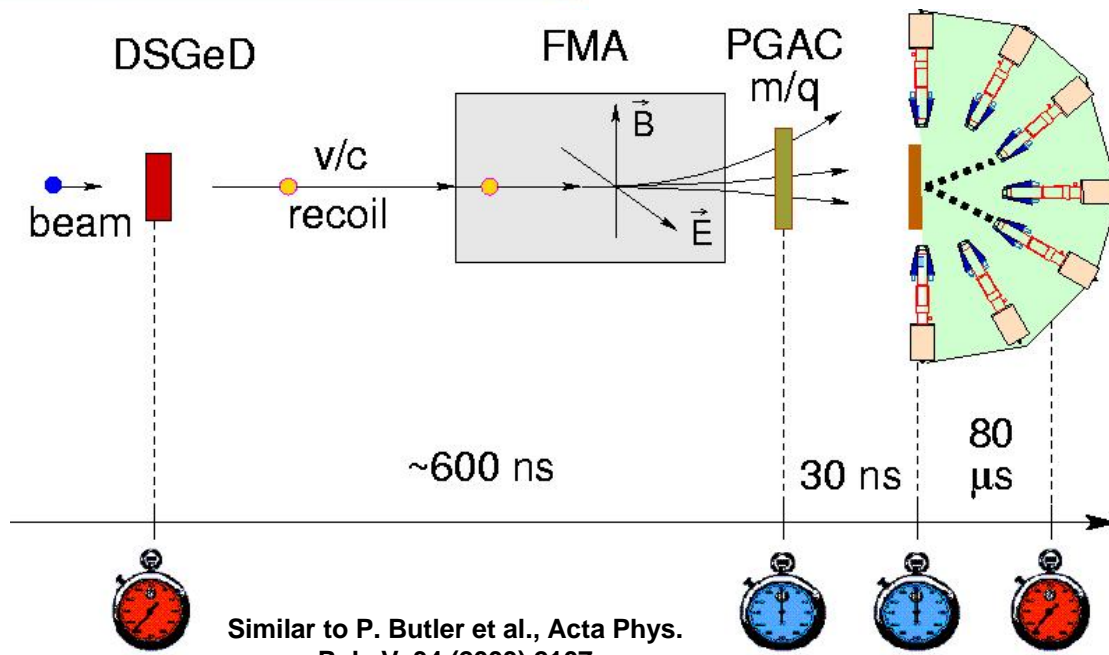
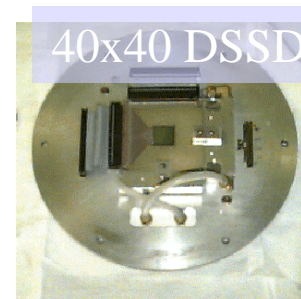
- No E_x
 - No J^π
 - No decay path
- $\sim 280\text{ ms}$

Challenges

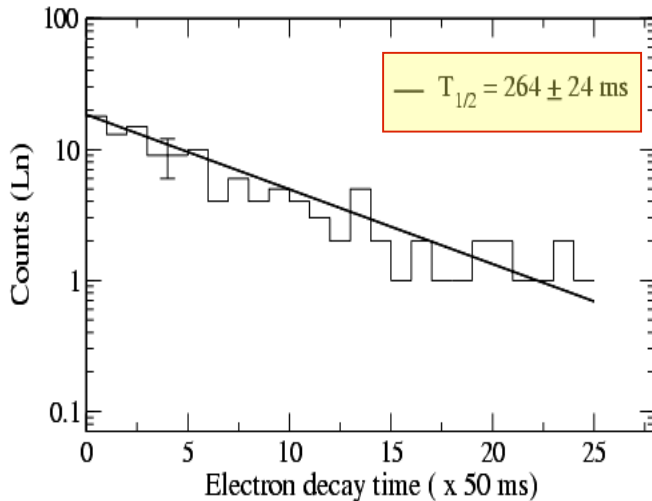
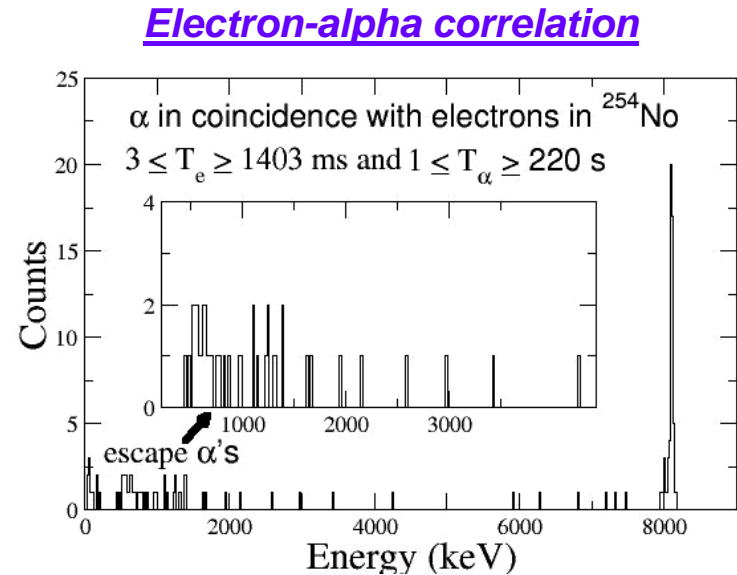
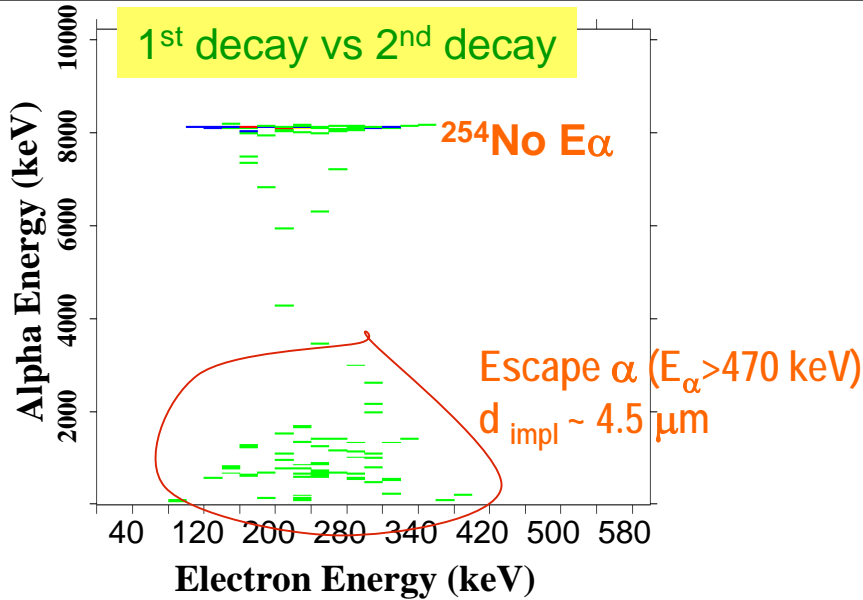
- ❑ small production cross sections – μb or less
- ❑ low sensitivity to γ -ray detection - highly converted transitions
- ❑ long lifetimes (ms or more) – more randoms

Search for electrons following decay in ^{254}No

$^{48}\text{Ca} + ^{208}\text{Pb} \rightarrow ^{254}\text{No} + 2n$
 $E_{\text{beam}} = 219 \text{ \& } 223 \text{ MeV}$
 $I_{\text{beam}} \sim 10 \text{ pA}$
 Target : $\sim 0.5 \text{ mg/cm}^2$



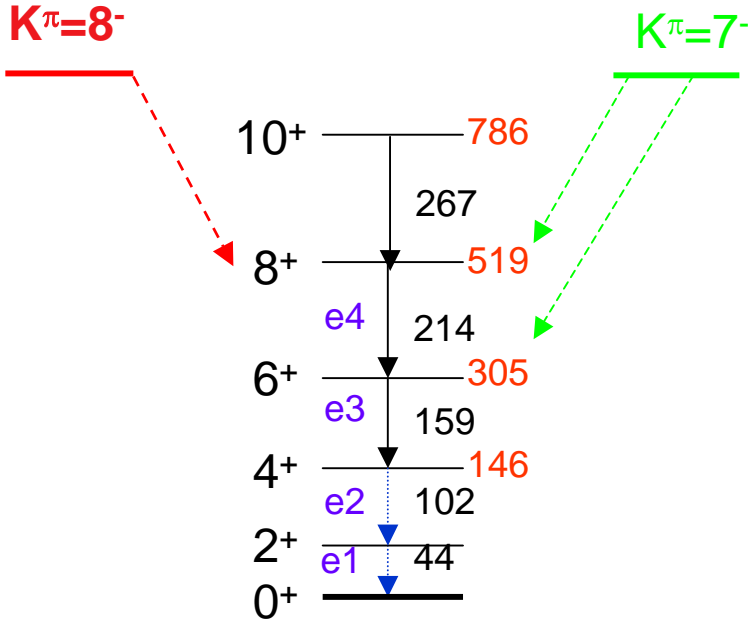
Search for electrons following decay in ^{254}No



- No. of ^{254}No at the DSSD: 1125 (112)
- No. of e - α coincidences: ~ 125

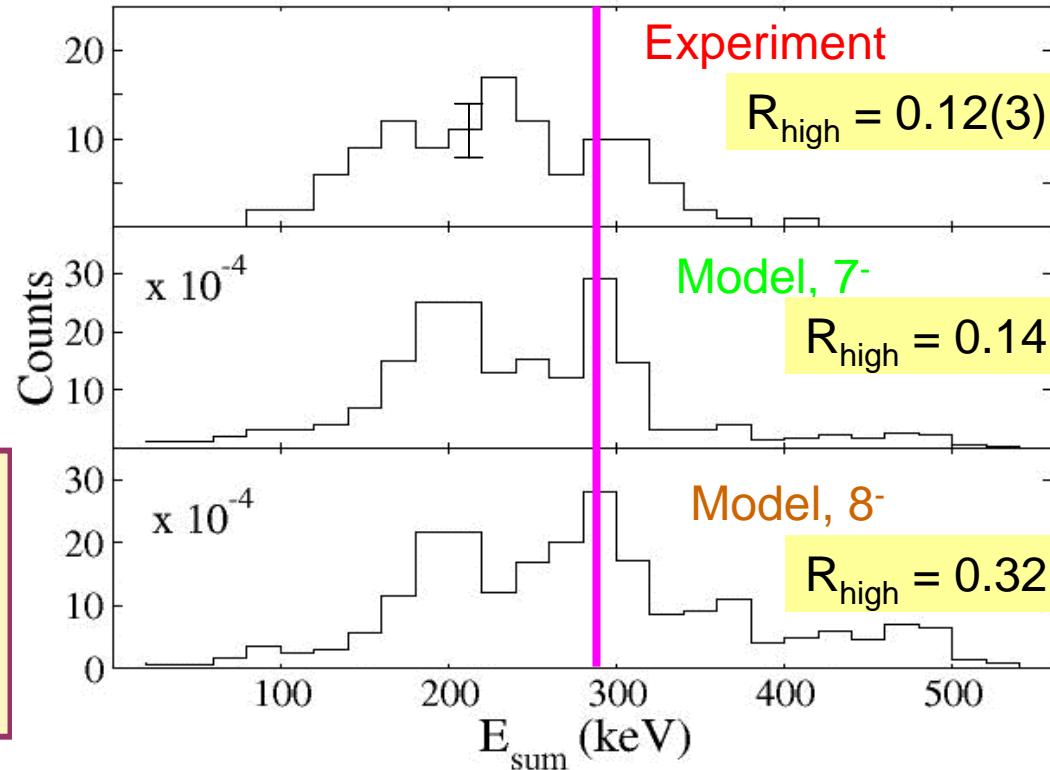
Isomer ratio $\sim 11\%$

Configuration of the 2-qp Isomer



$$E_{\text{sum}} = \sum_{i=1}^4 e_i$$

e_i = energy deposited in the DSSD by the electrons for each transition.



$\pi^2 7/2-[-514] \times 9/2+ [624]$ $\pi^2 7/2-[-514] \times 7/2+ [633]$

1.2 MeV

1.4 MeV

Predictions

