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Canada's national laboratory
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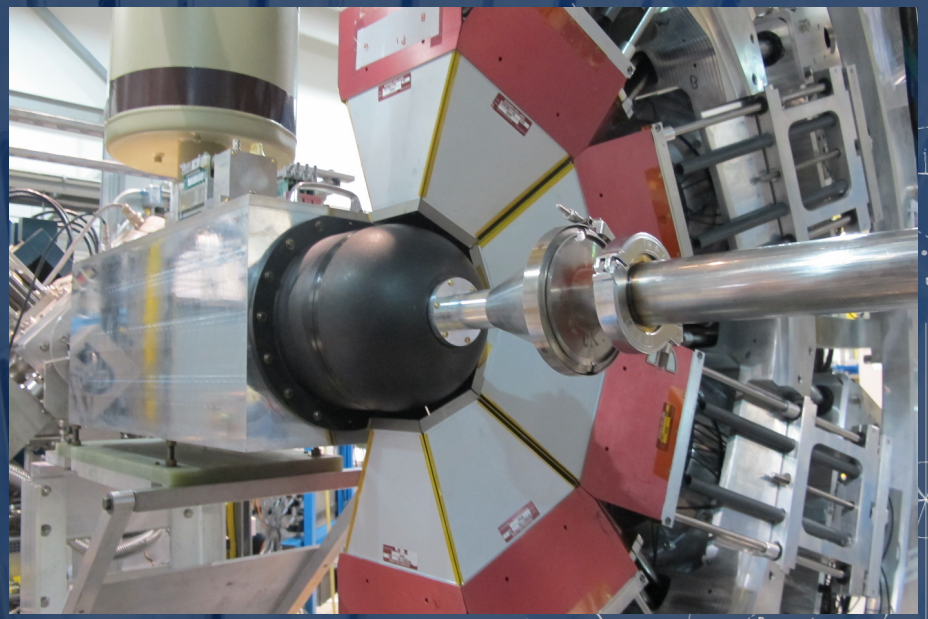
and accelerator-based science

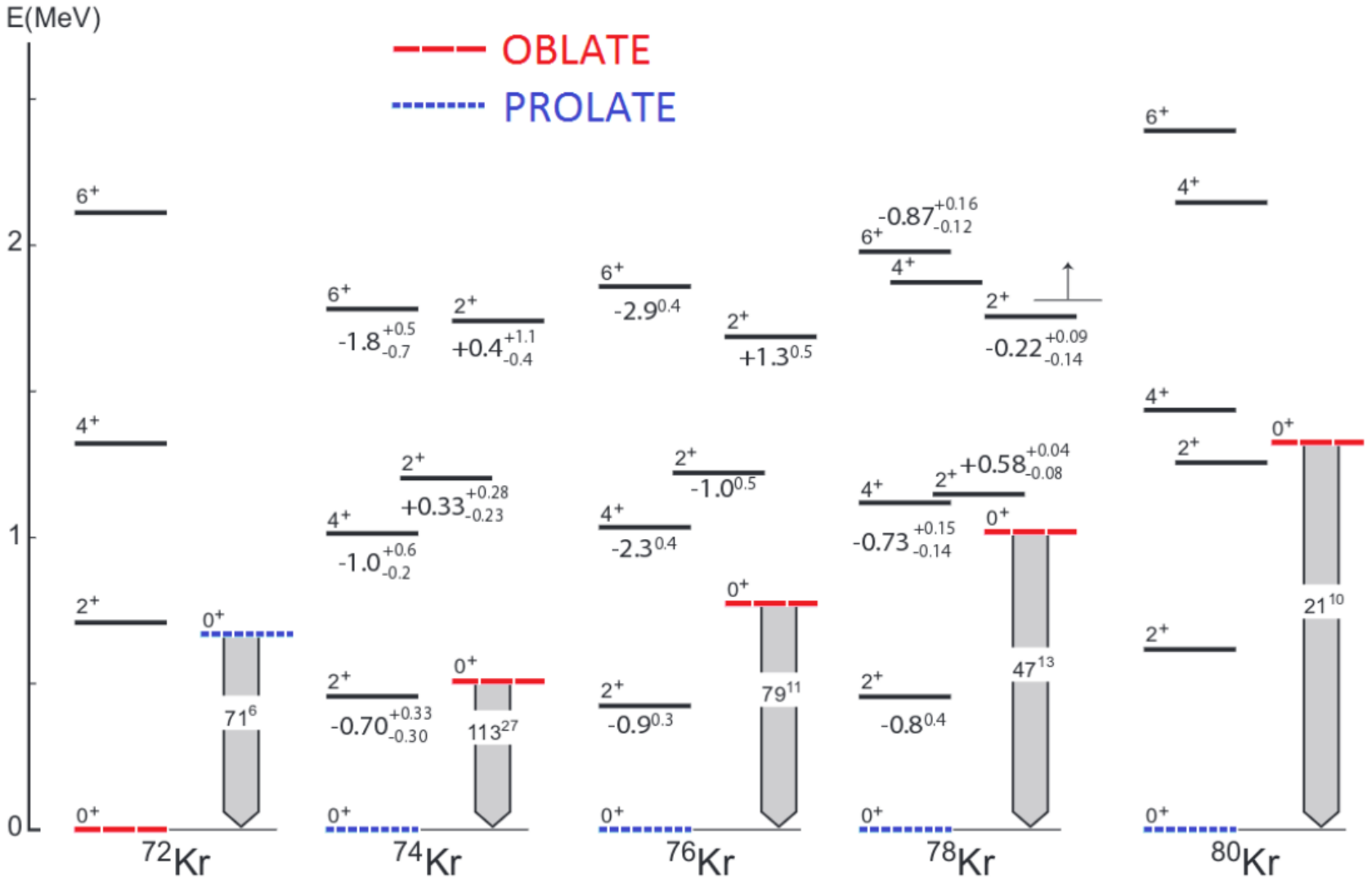
Kr & Se studies with TIGRESS (& SPICE)

James Smallcombe
TRIUMF

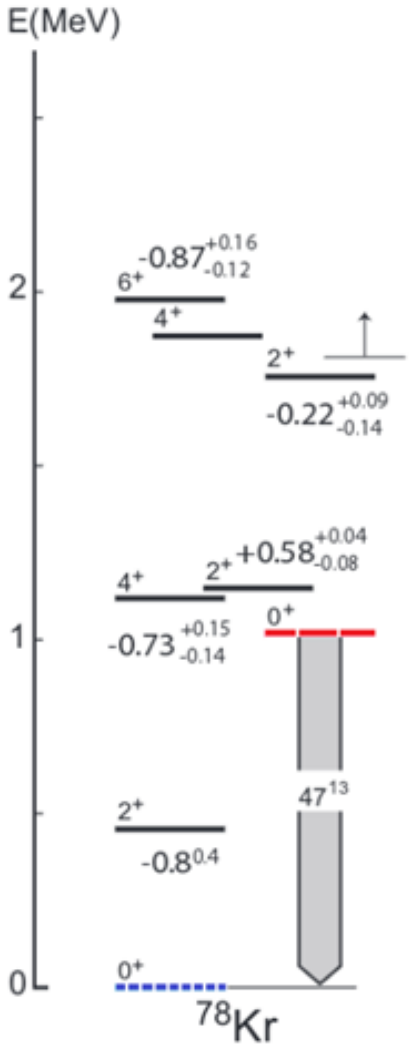
ESNT workshop, CEA
2017 October



78Kr Structure



78Kr Structure



Previous CoulEx - F. Becker et al., Nucl. Phys. A 770, 107 (2006).

"K=2" band actually oblate "K=0" band, unobserved 0^+ band head.

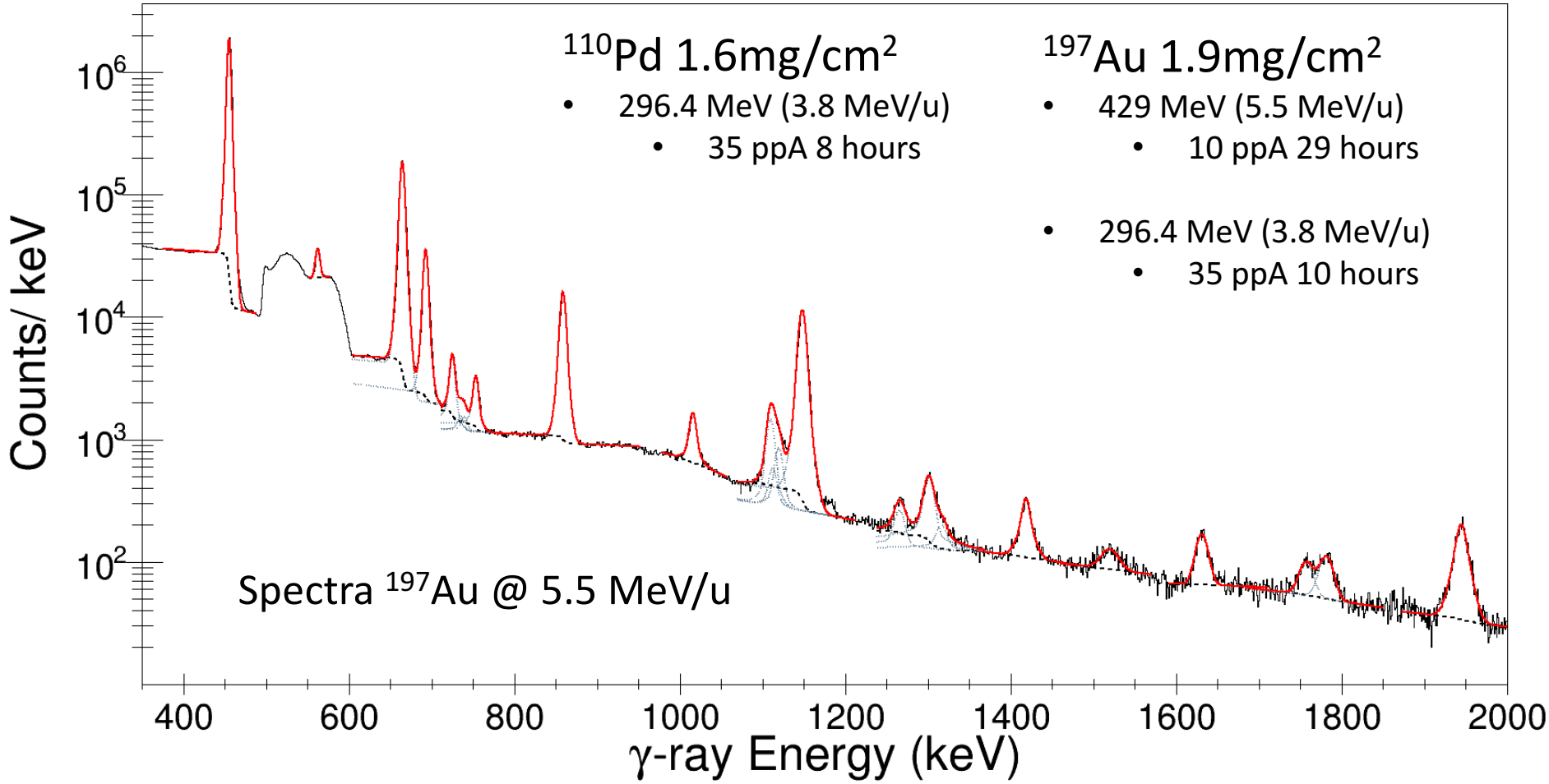
Observed 0_2^+ band prolate, same as gsb.

Reported transition strength differ significantly from measured (& re-measured) branching ratios.

Reported Q_0 biased by omitting odd J states?

78Kr CoulEx Population

D. Levy, UBC BSc



78Kr Population

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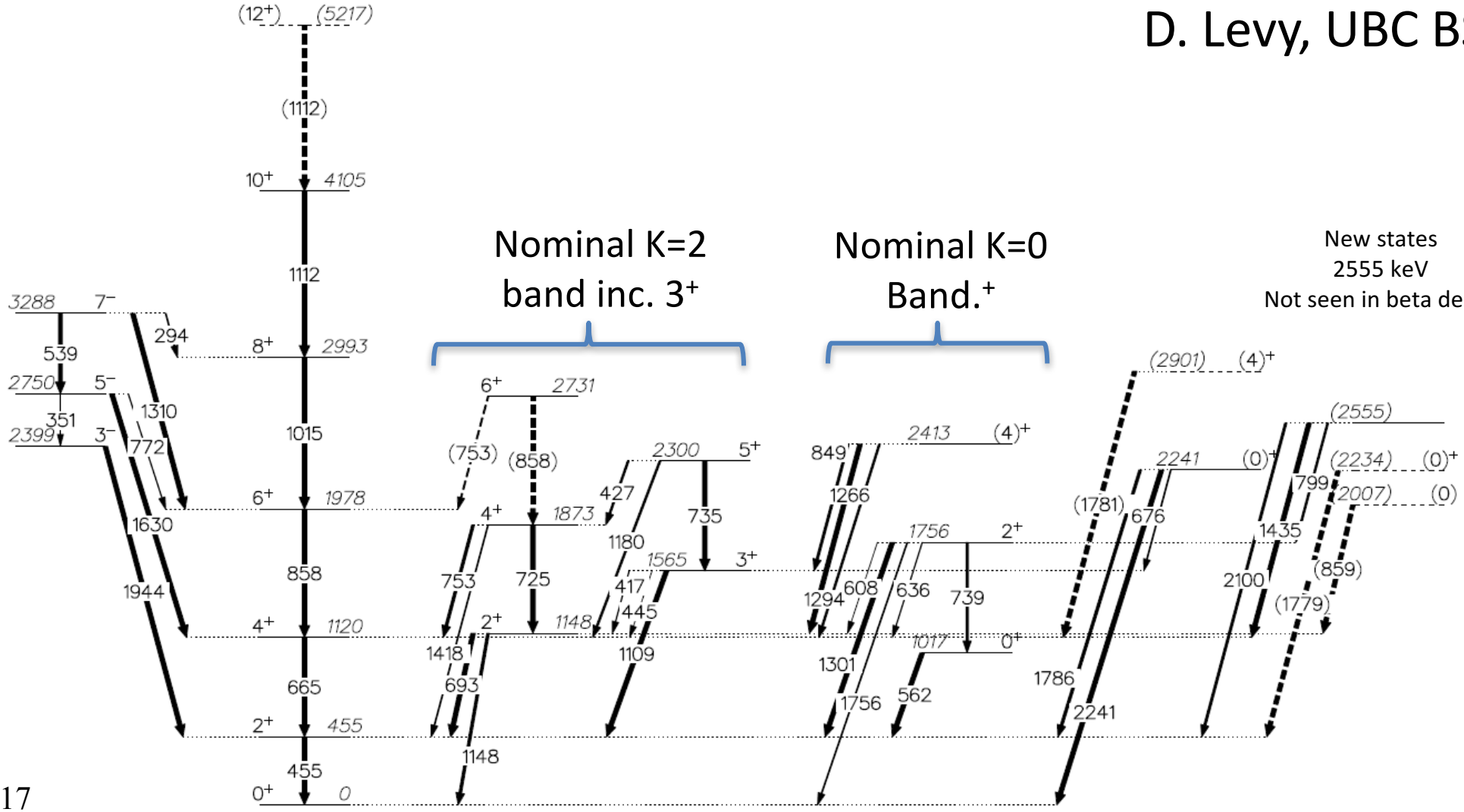

78Kr Population

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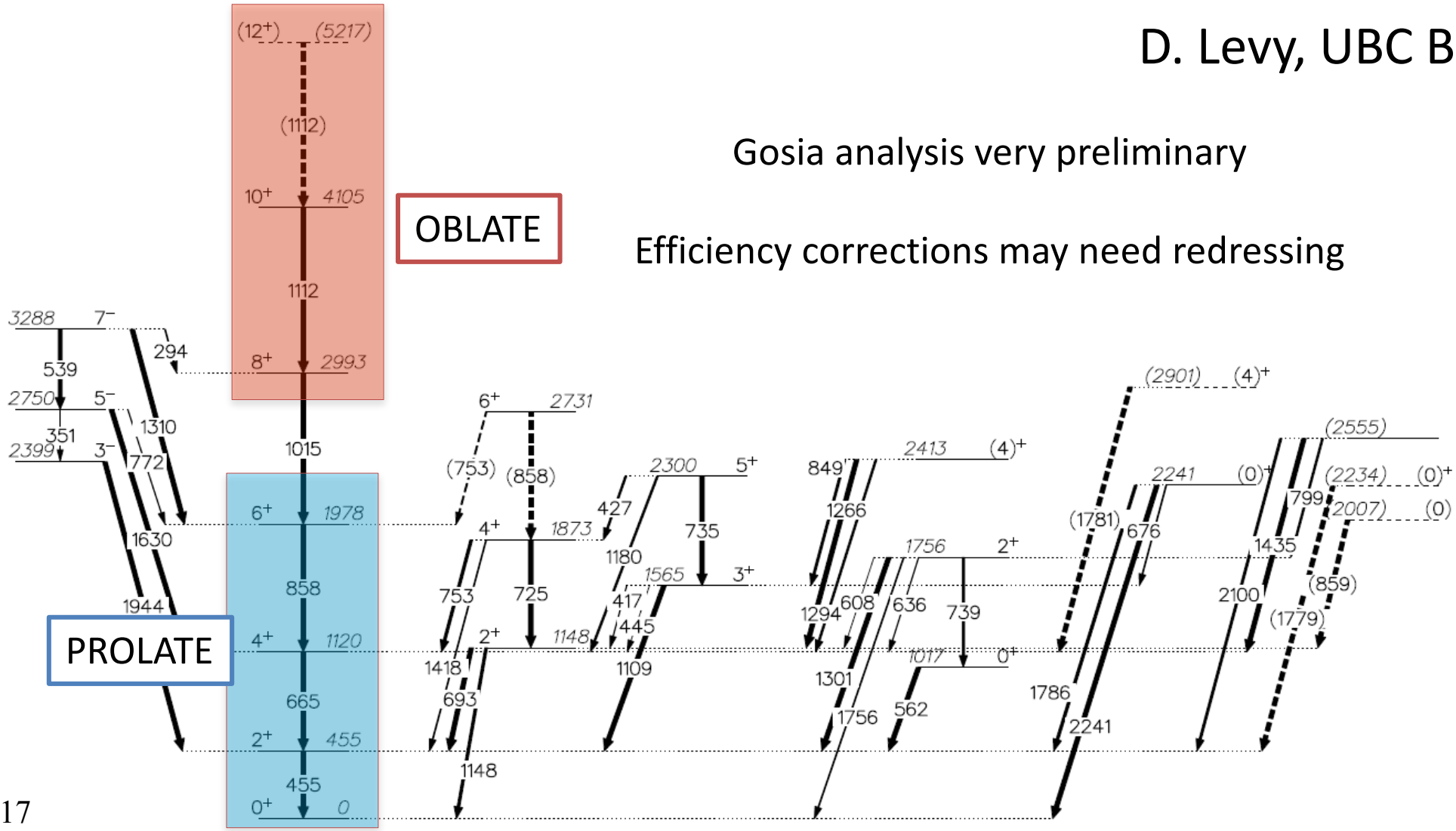
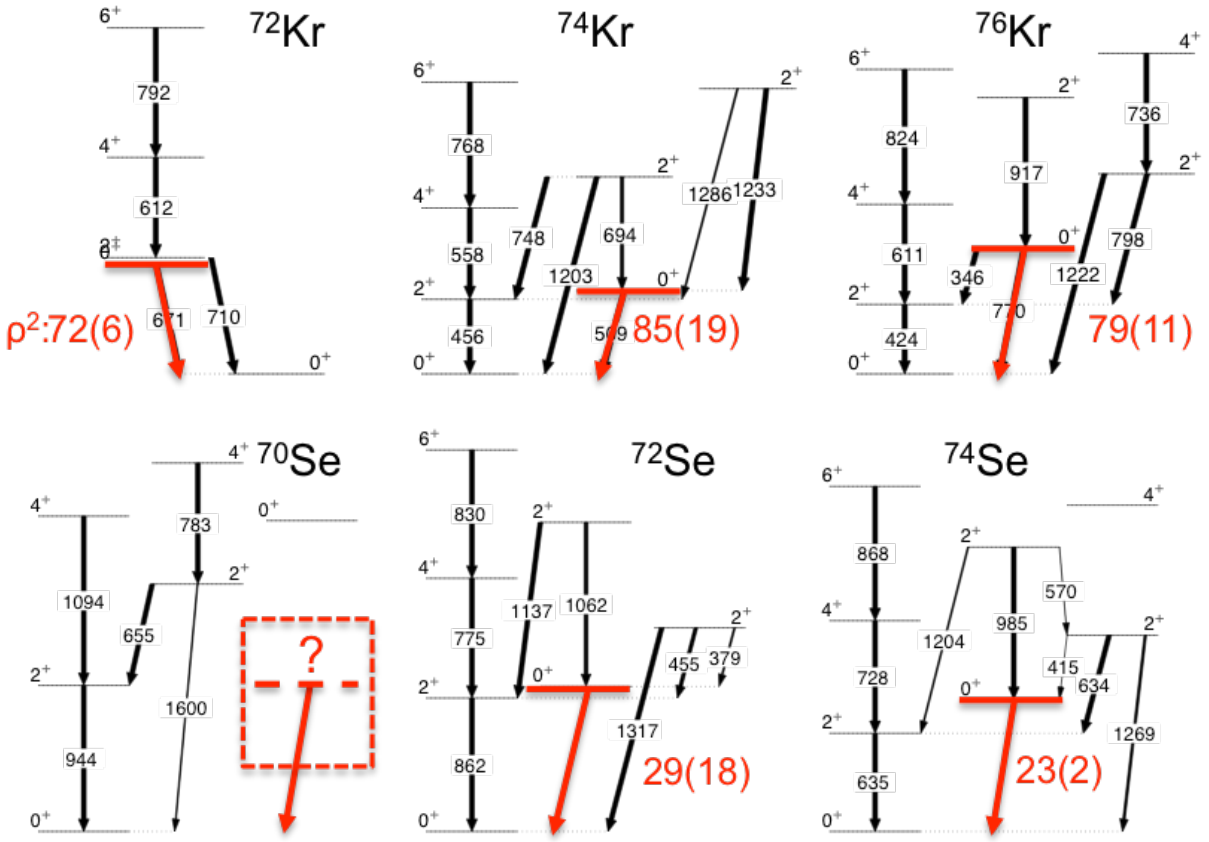
Gosia analysis very preliminary

Efficiency corrections may need redressing



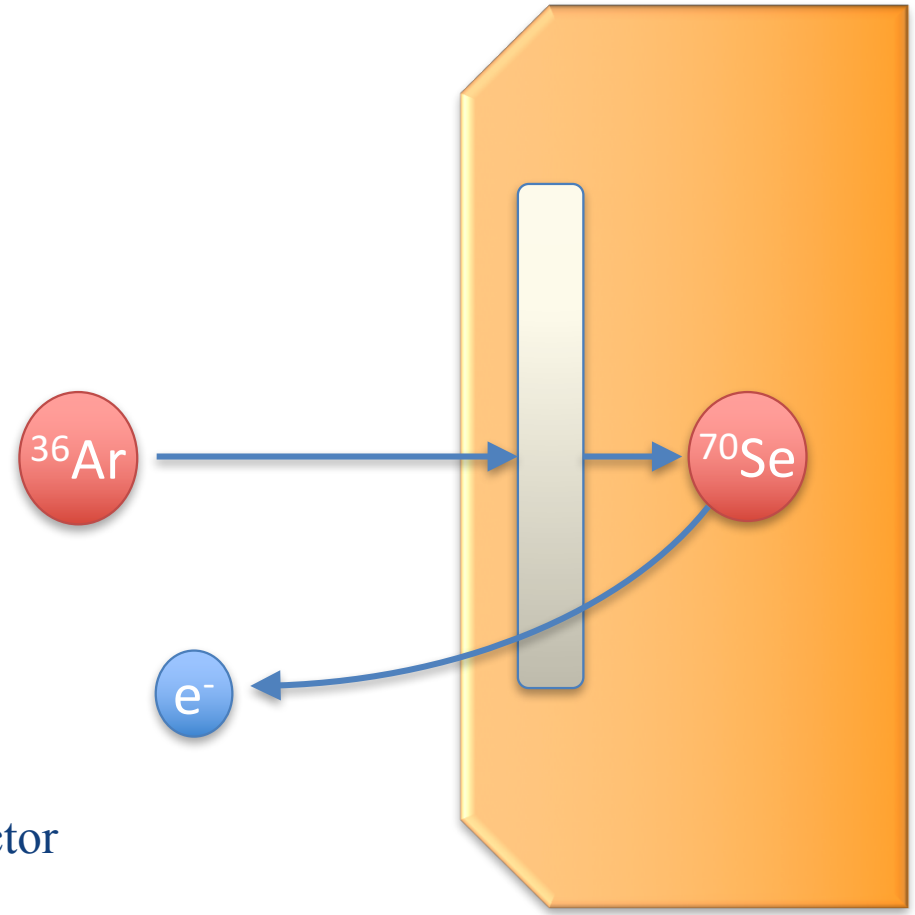
Shape isomers in Se and Kr isotopes near the N=Z line

E. Bouchez et. al., Phys. Rev. Lett. 90, 082502 (2003)



70Se at TRIUMF TIGRESS & SPICE

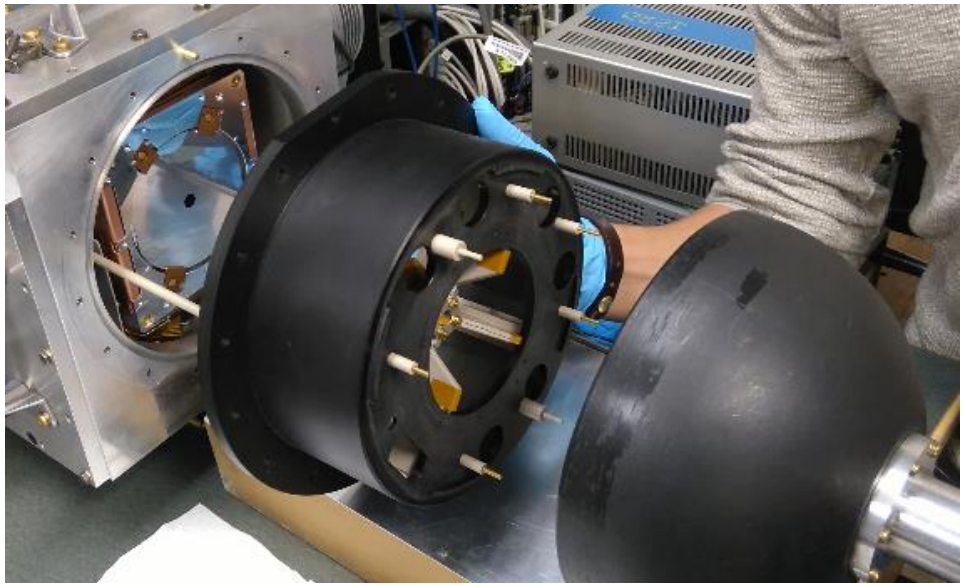
- Nat. Ca target 0.5 mg/cm^2
- Thick (20 mg/cm2) Au (or Ag) backing catch products for ~10 ns isomers
- 0.2 mg/cm^2 “protective” layer Au prevent oxidation
- 120 MeV ^{36}Ar beam ~1 pnA x6 days
  ^{40}Ca(^{36}Ar,α2p)^{70}Se
  ^{40}Ca(^{36}Ar,4p)^{72}Se

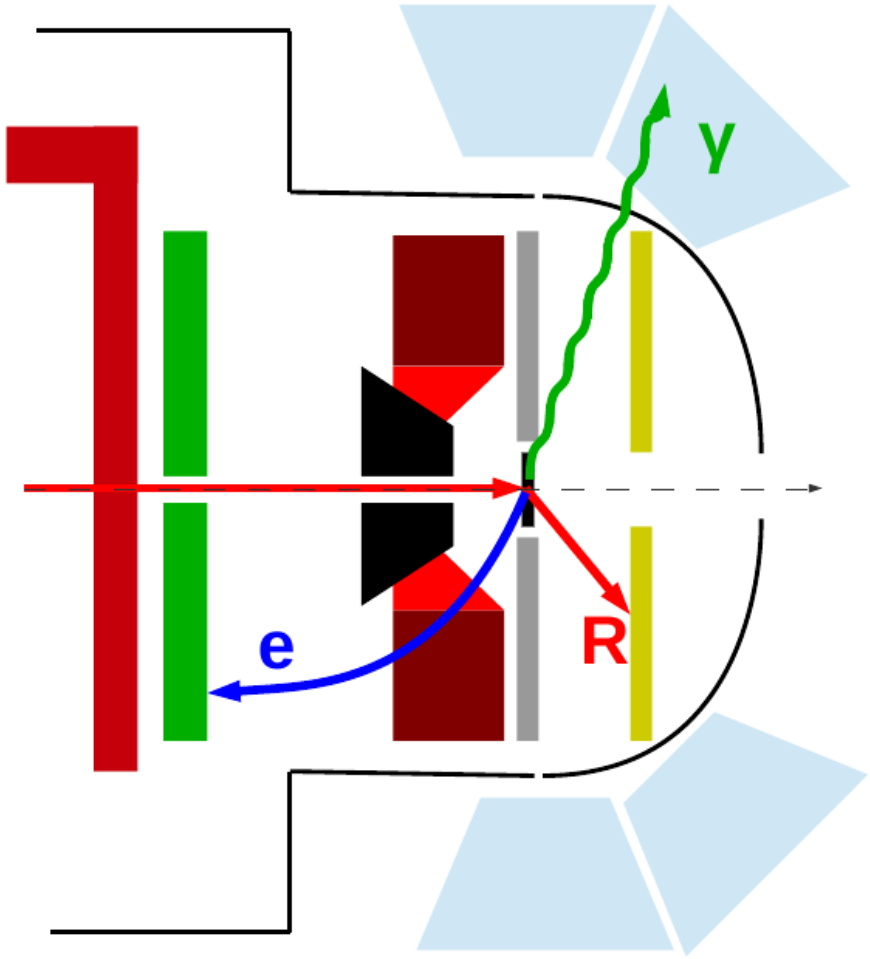


- TIGRESS – Gamma rays
- SPICE – Upstream ICE detector
- S3 – Downstream evaporation residue detector

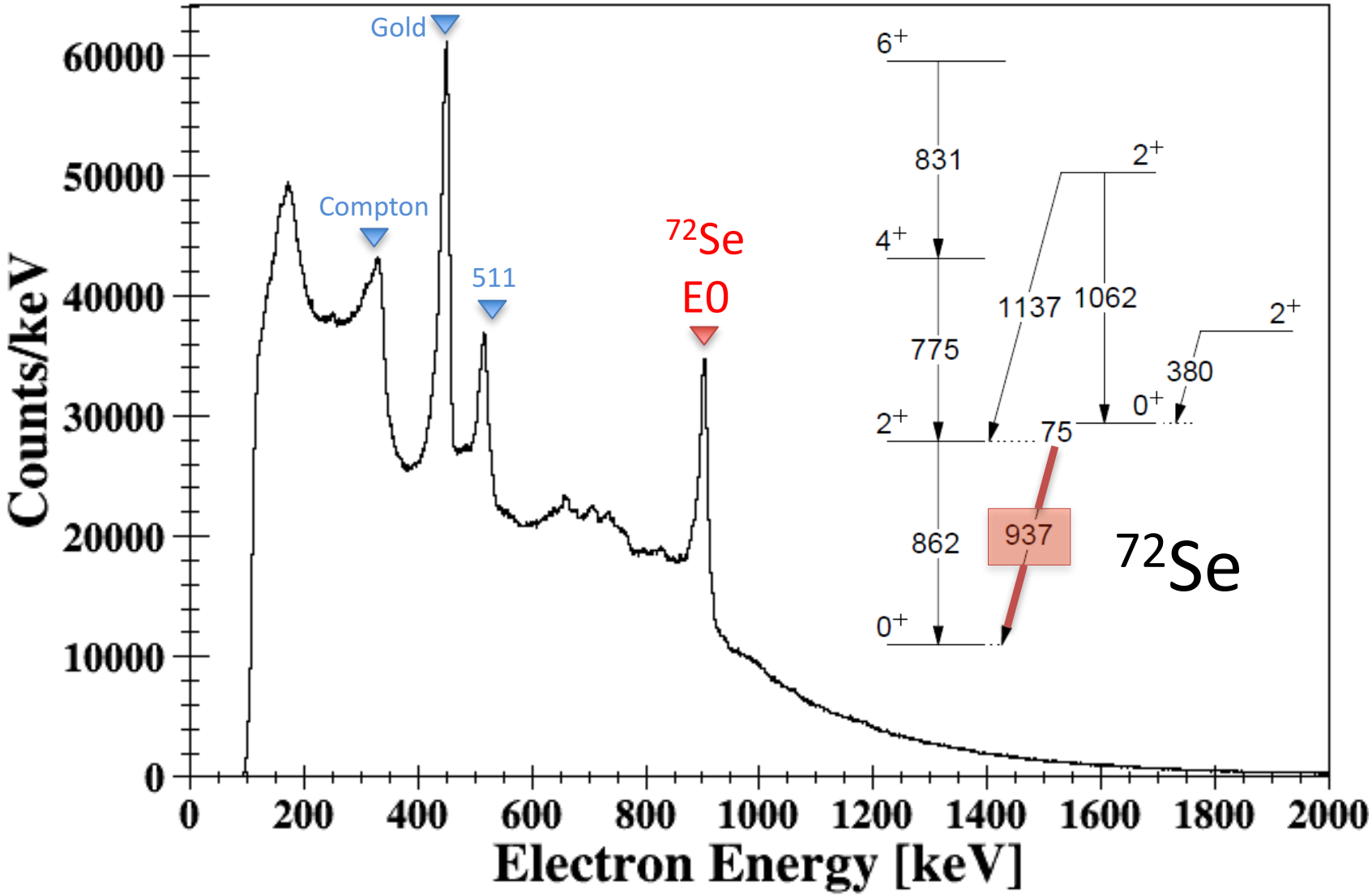
SPICE (SPectrometer for Internal Conversion Electrons)

- Accelerated beam from ISAC II
- Magnet Lens
- Photon Shield
- 6 mm cooled Si(Li)
- Downstream Recoil/Ejectile Detector
- 12x TIGRESS HPGe Clovers

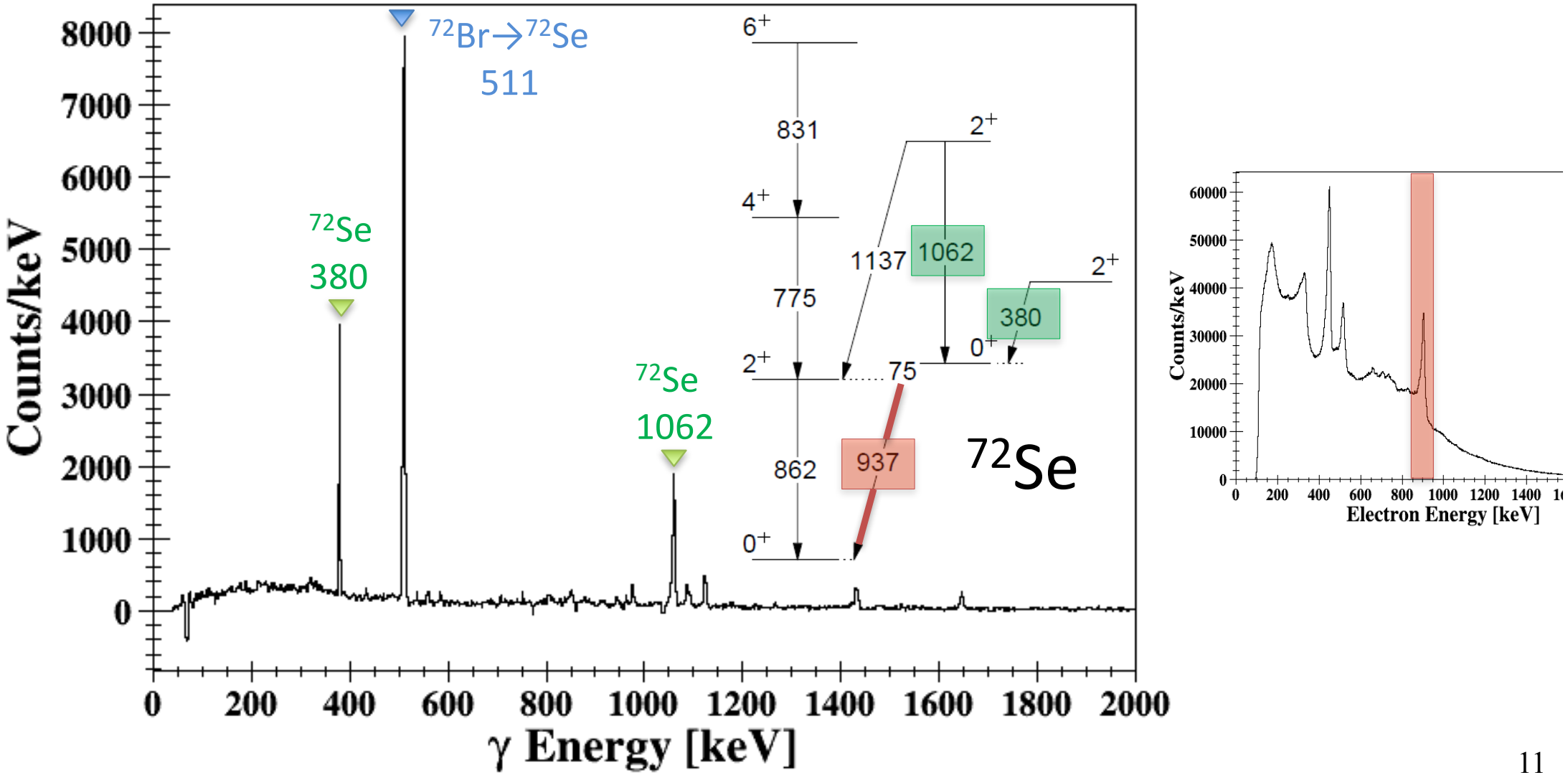




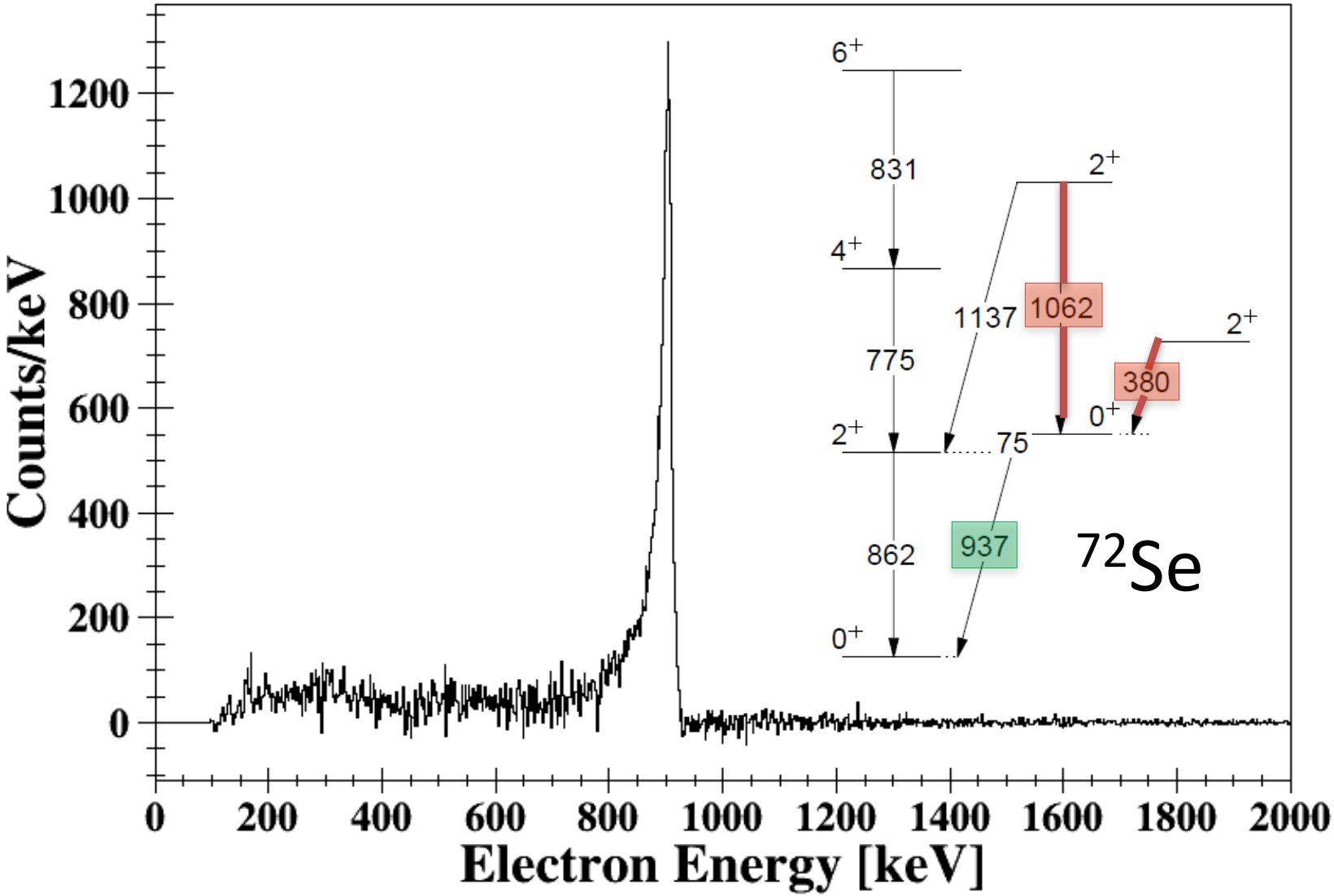
Electron Singles



Electron-Gated Gammas

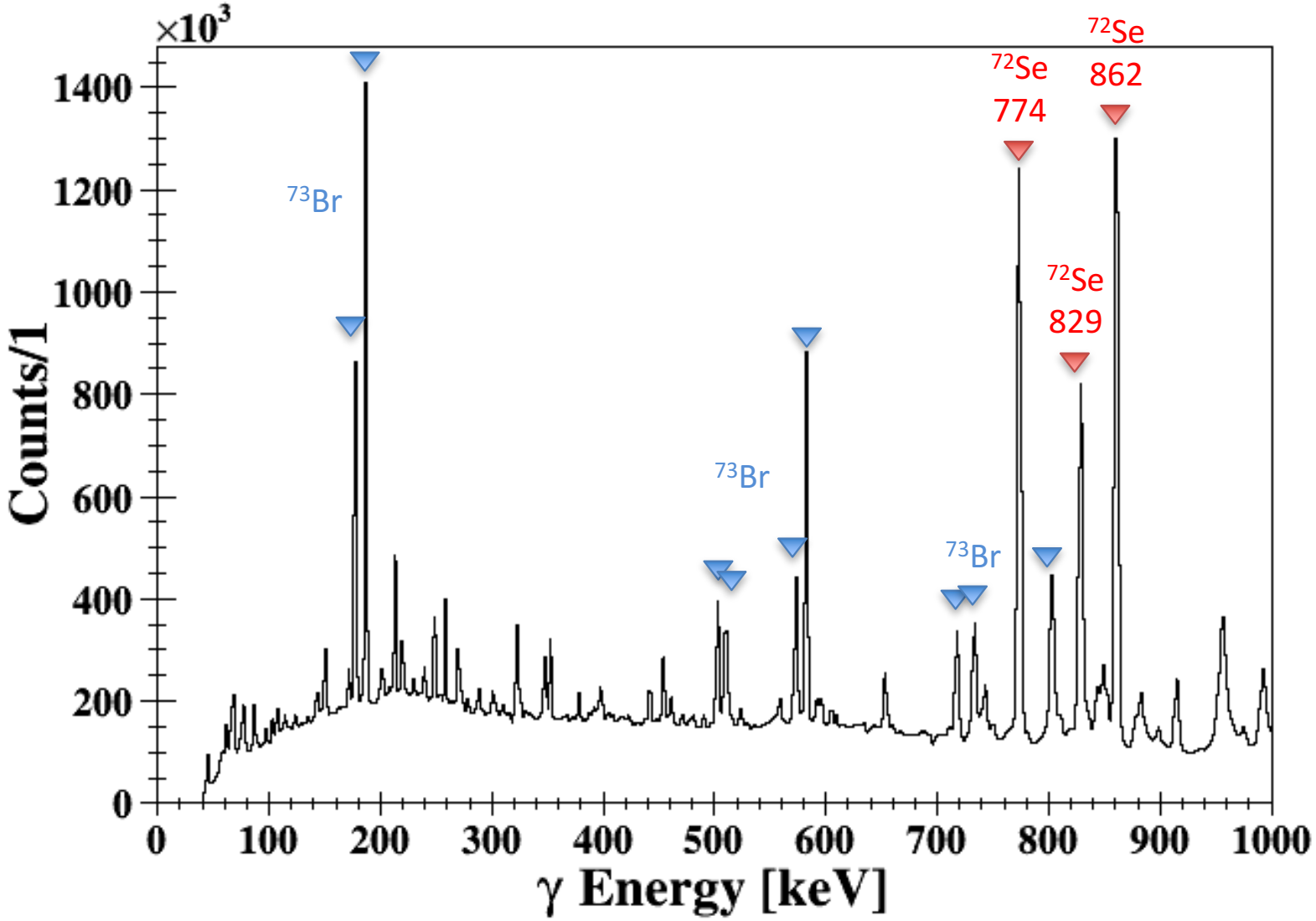


Gamma-Gated Electrons

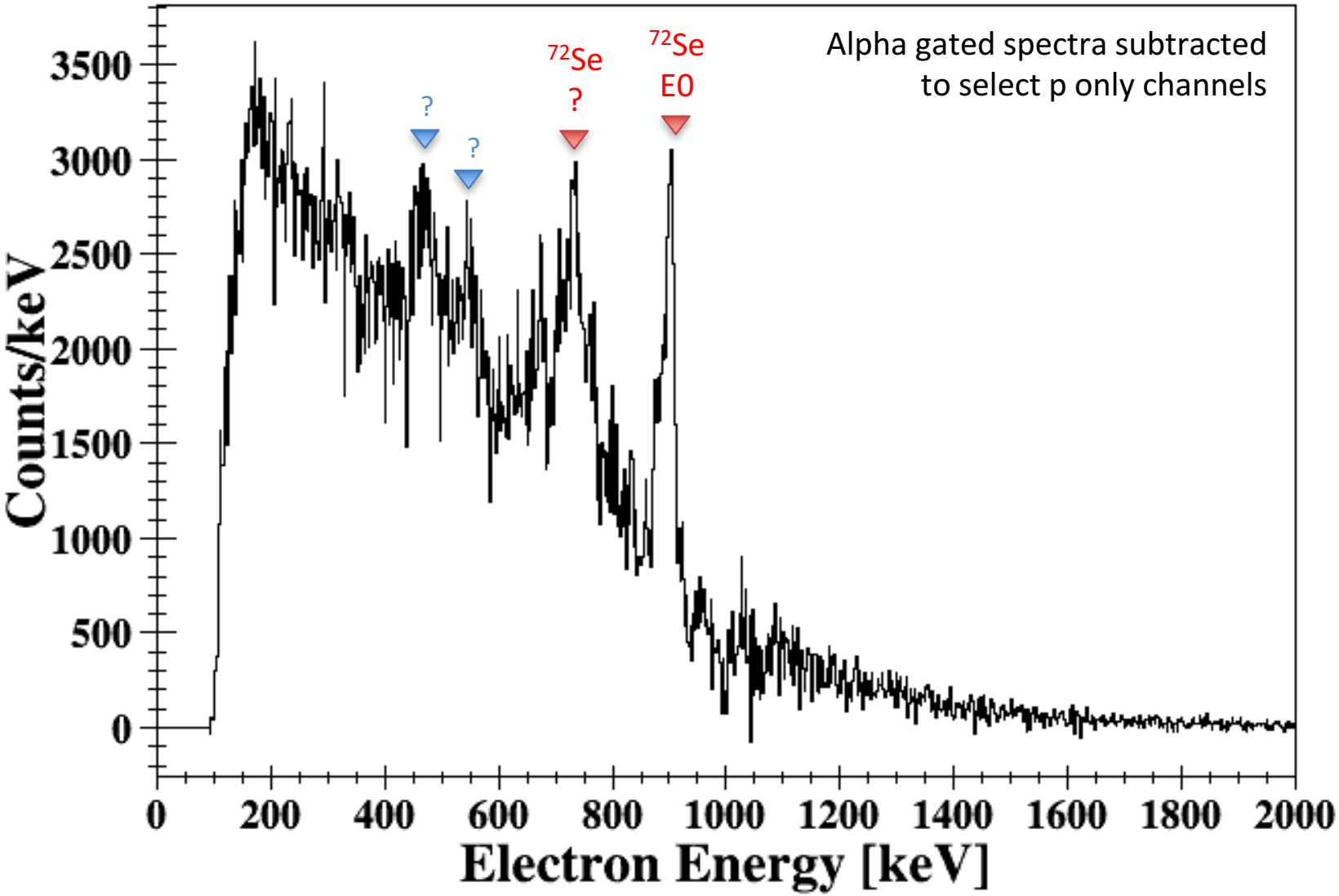


Proton Gated Spectra

$^{40}Ca(^{36}Ar,4p)^{72}Se$
$^{40}Ca(^{36}Ar,3p)^{73}Br$

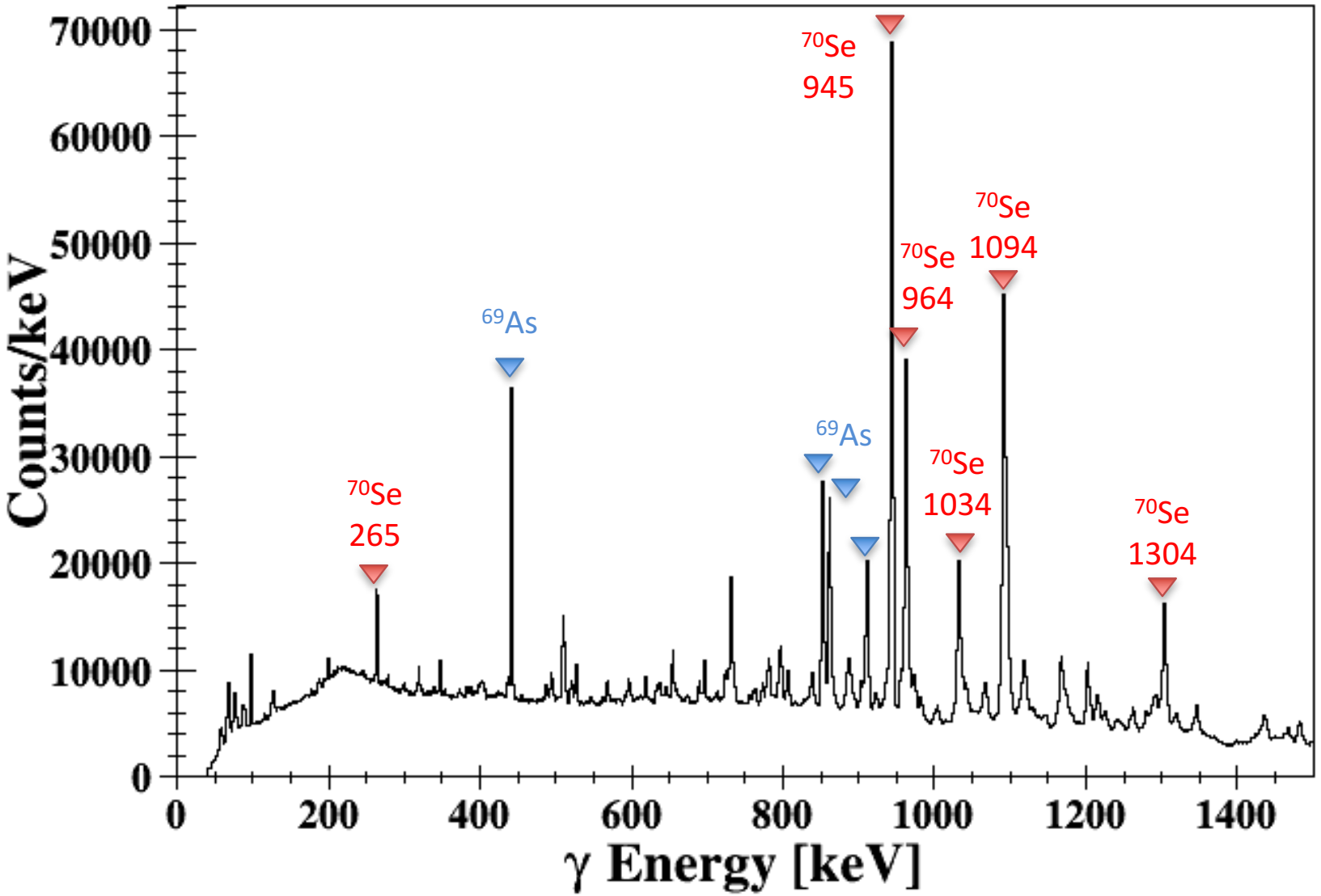


Proton Gated Spectra

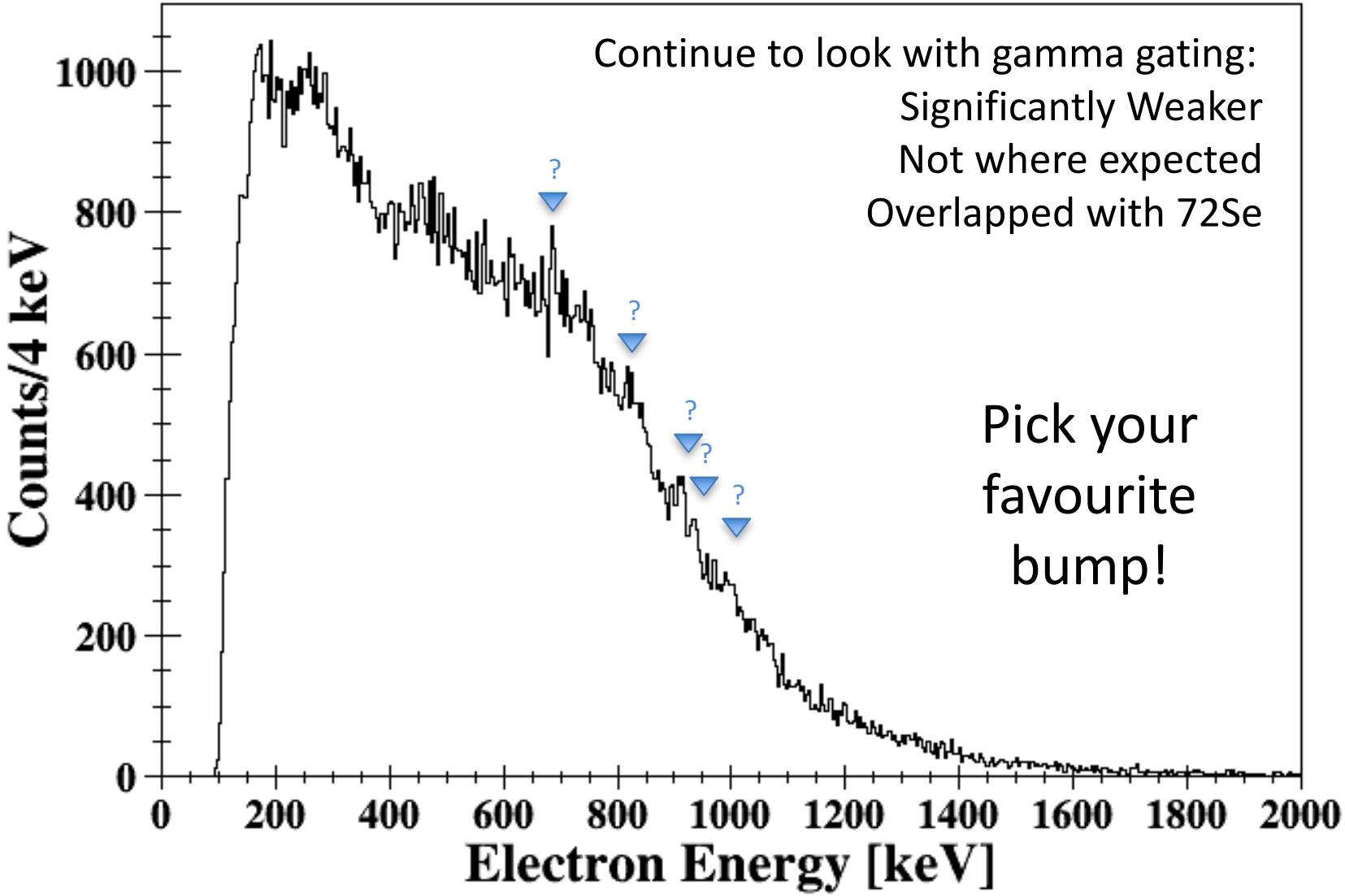


72Se : Proton + Alpha Gated Gamma Spectra

$^{40}Ca(^{36}Ar,\alpha 2p)^{70}Se$
$^{40}Ca(^{36}Ar,\alpha 3p)^{69}As$



72Se : Proton + Alpha Gated Electron Spectra



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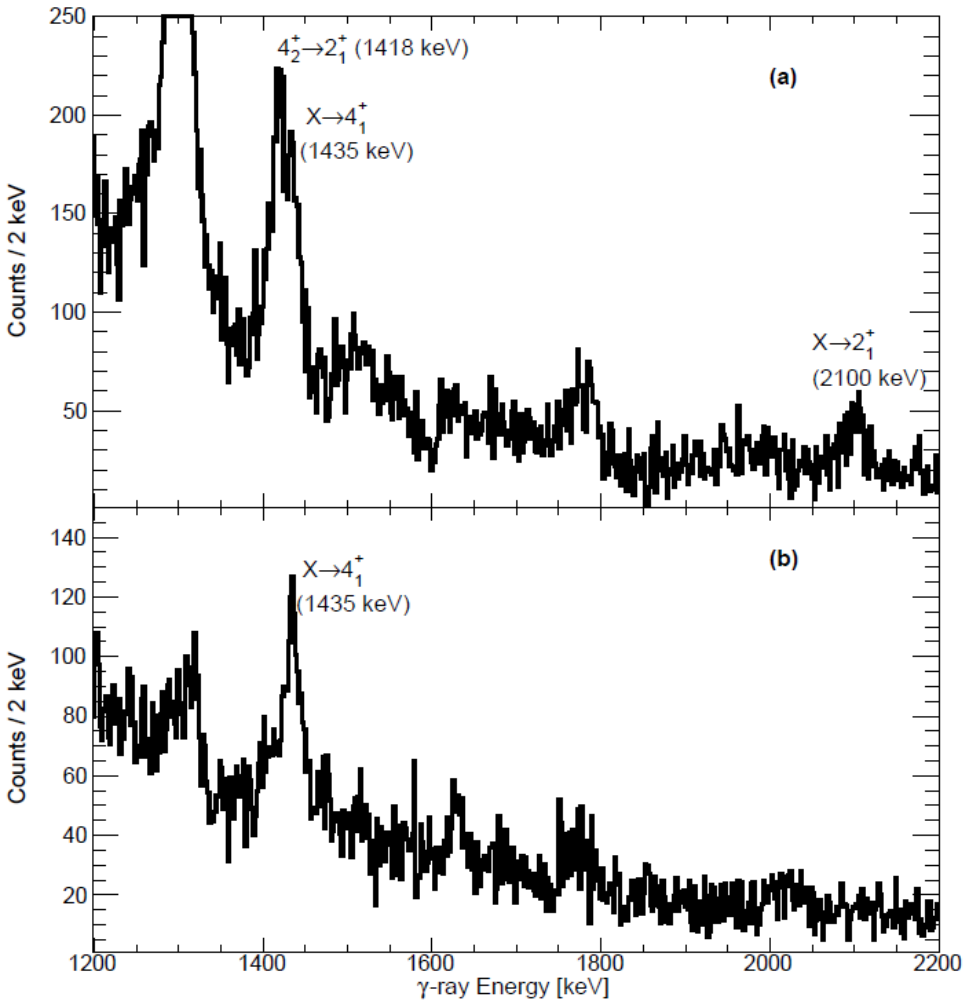
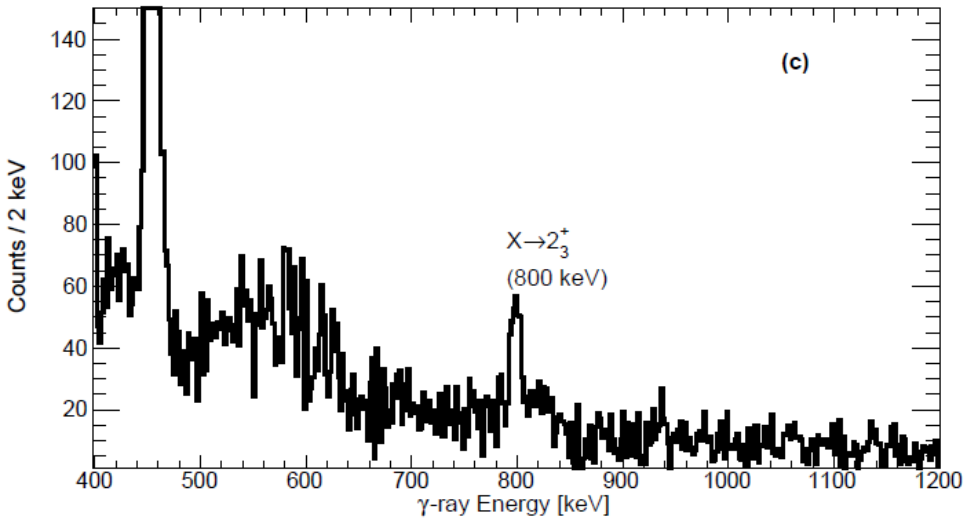
New 78Kr Level

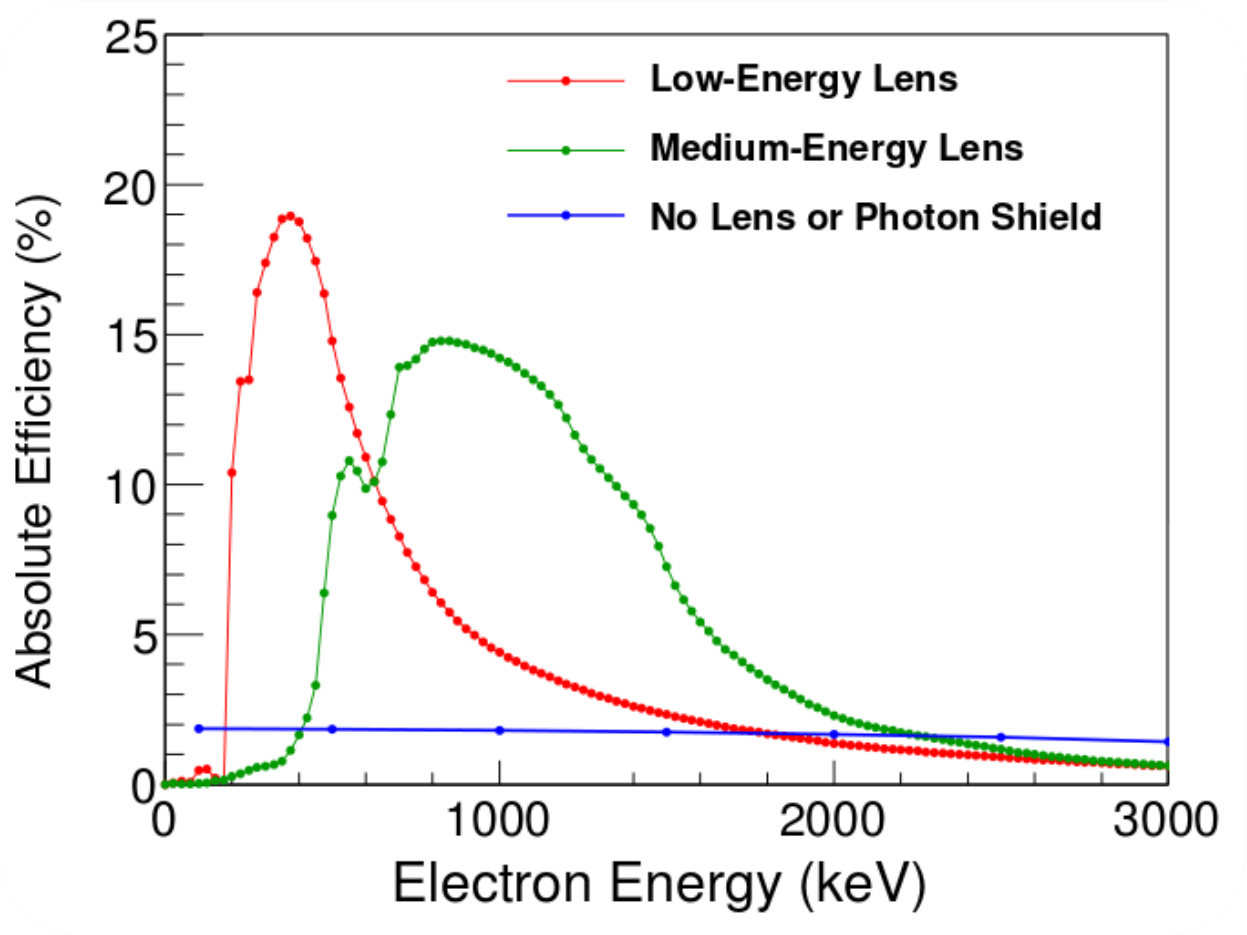
D. Levy, UBC BSc

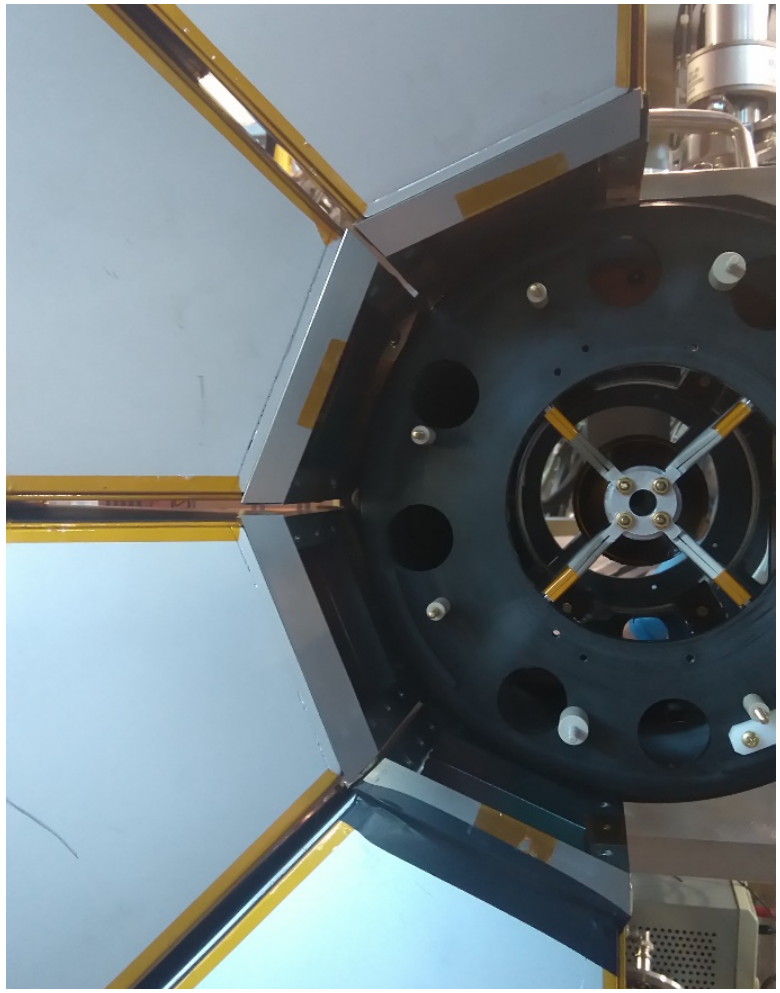


New states
2555 keV
Not seen in beta decay



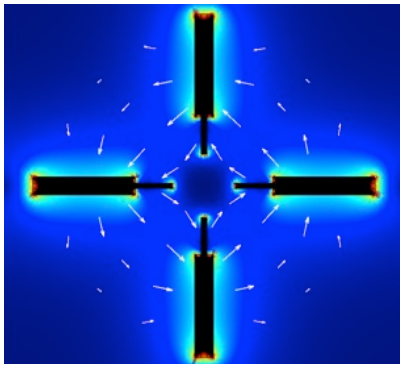
High Efficiency

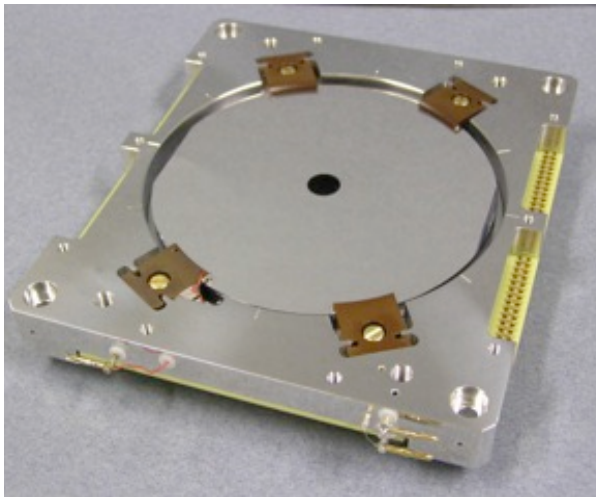


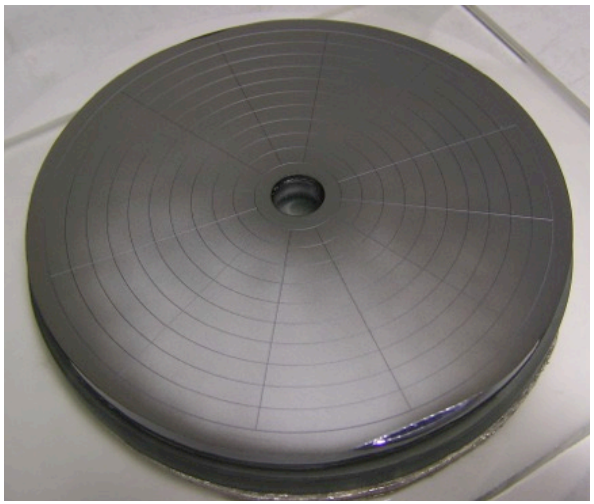


Magnet Lens and Detector

- NdFeB permanent magnets
  - Optimized shape to reduce back-scattering and maximise acceptance
- 6.1 mm thick lithium-drifted silicon
  - LN2 cooled
  - 120 individual segments
  - Cold FETs
  - Manufactured by Semikon







Proton Gated Spectra