(d,pγ): Surrogate for Neutron Capture on Rare Isotopes?

AFC Workshop & Nuclear Data Needs

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Challenge: Understanding nuclear reactor performance & AFC

- Data needs:
  - Neutron capture cross sections
  - Neutron-induced fission cross sections
  - Actinides
  - Fission fragments
- Solution:
  - (d,pγ) as Surrogate for (n,γ) on rare isotopes
    - e.g., fission fragments
  - <u>Beams</u> of rare isotope on “deuterium” target

UNIRIB University Radioactive Ion Beam Consortium
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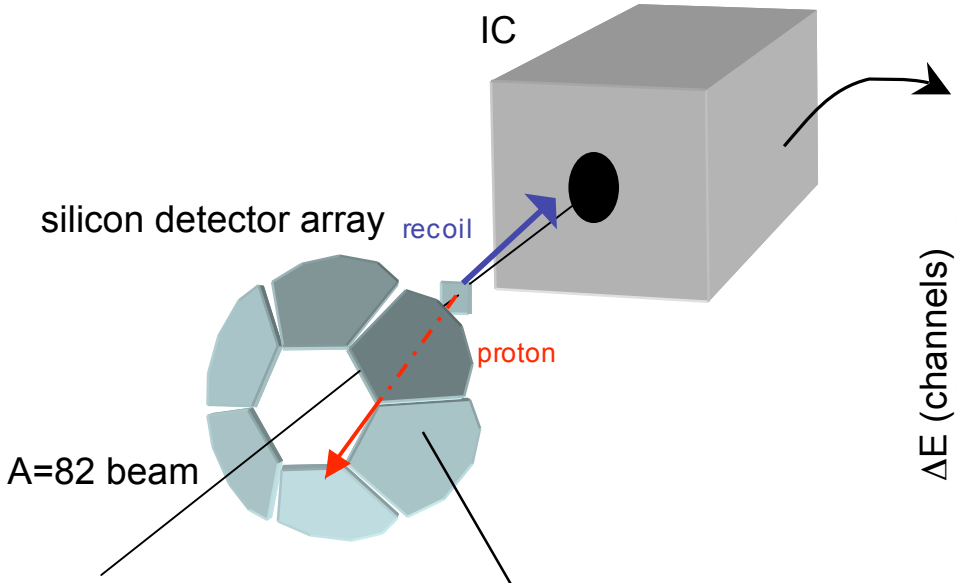
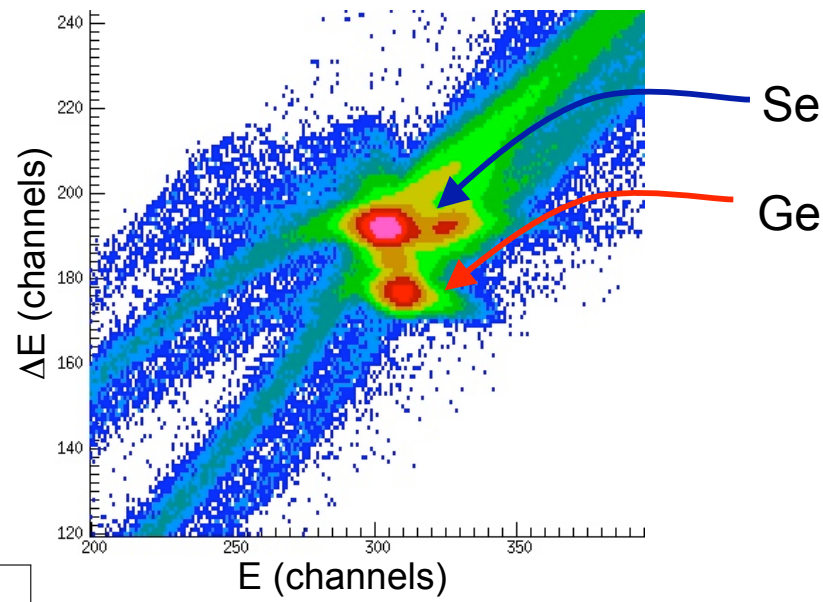
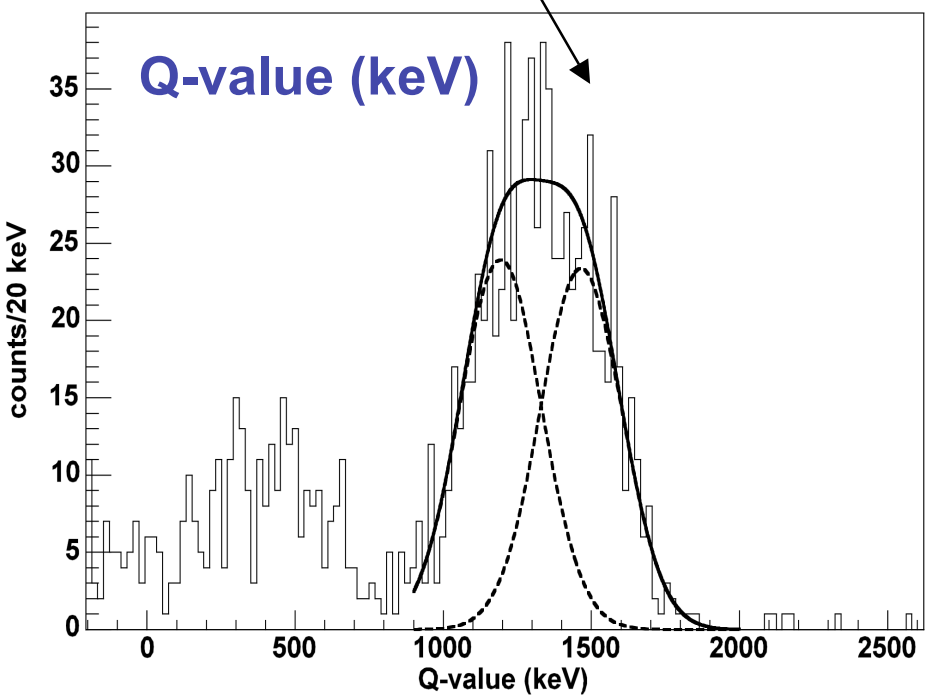
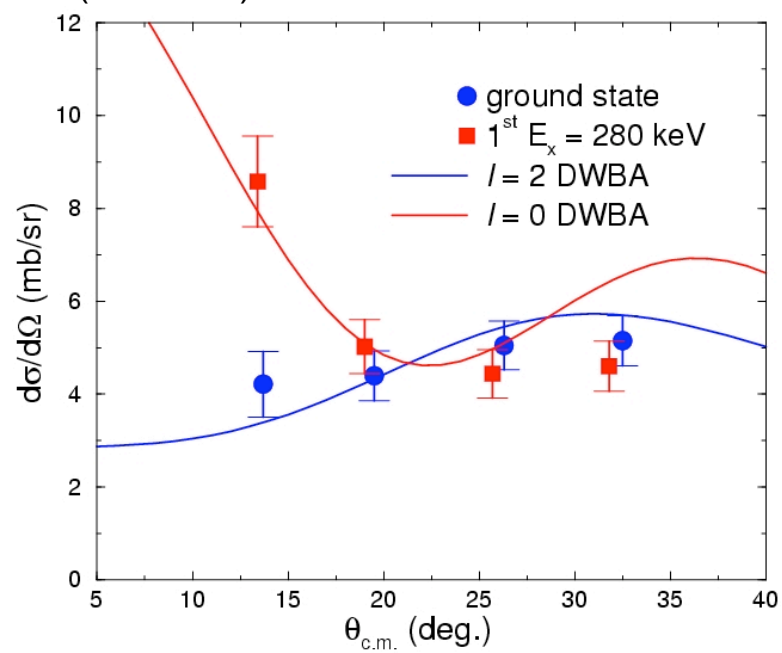
(d,p) & Rare Isotopes

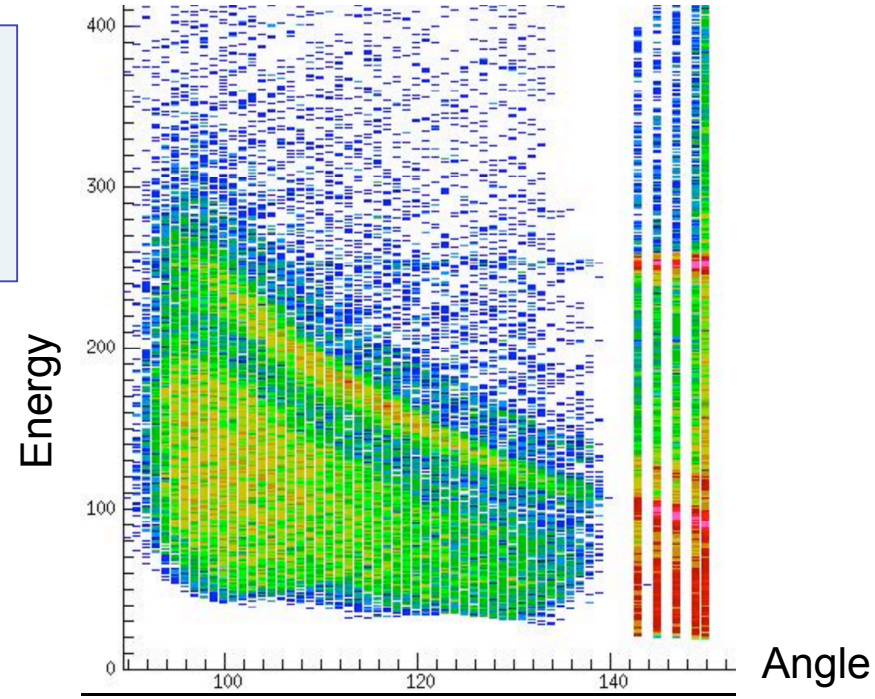


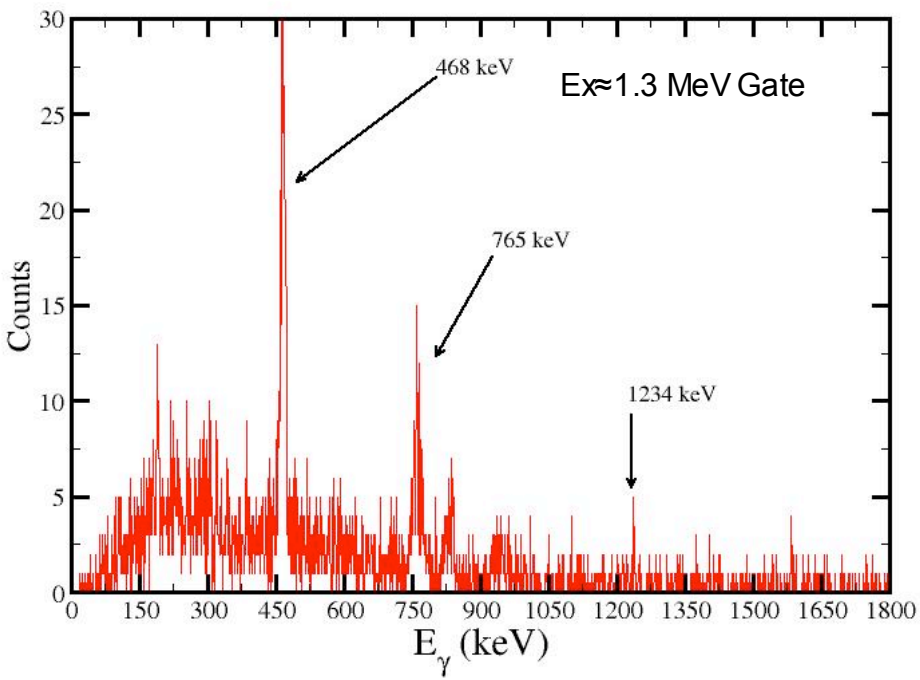


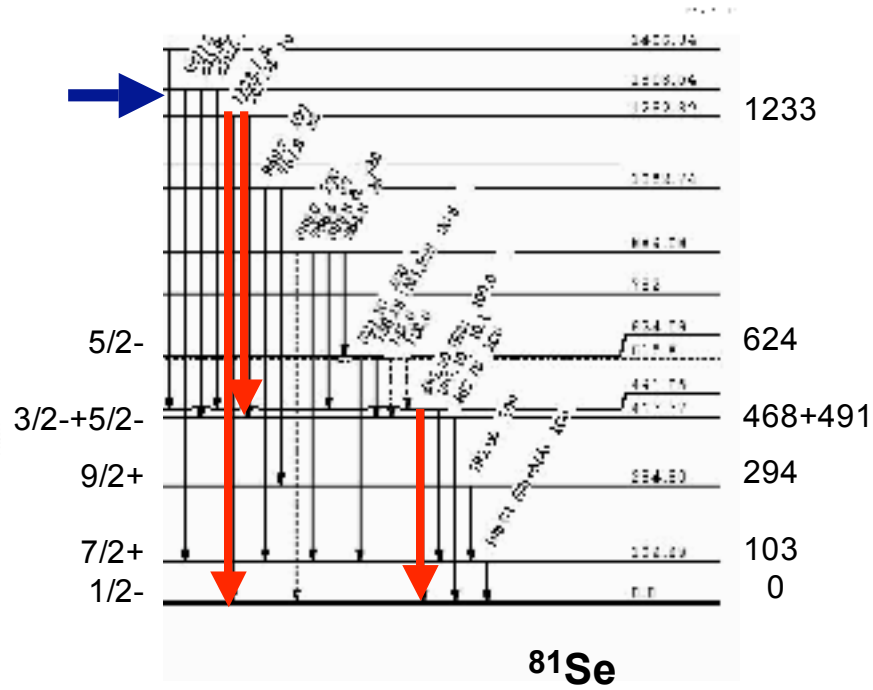




^{80}Se(d,pγ)
stable ^{80}Se beam test







Benchmark of (d,pγ) as surrogate

- ^{143,145}Nd(d,pγ)
  - Neutron cross sections well known
  - Surrogate method
  - Ratio technique to reduce uncertainties
    - Deuteron breakup
  - Use LLNL/LBNL set up
- Advantage of (d,p)
  - Minimize angular momentum mismatch
  - Relatively good energy resolution ⇒ can cut on smaller energy window near neutron separation energy

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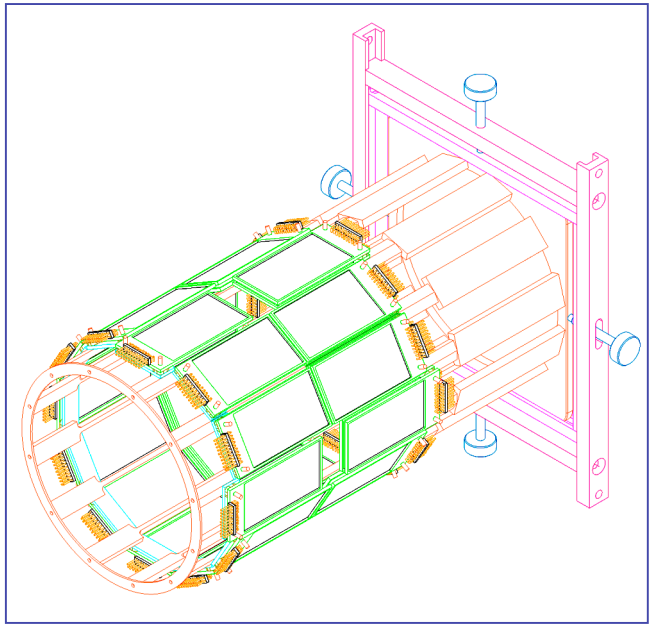
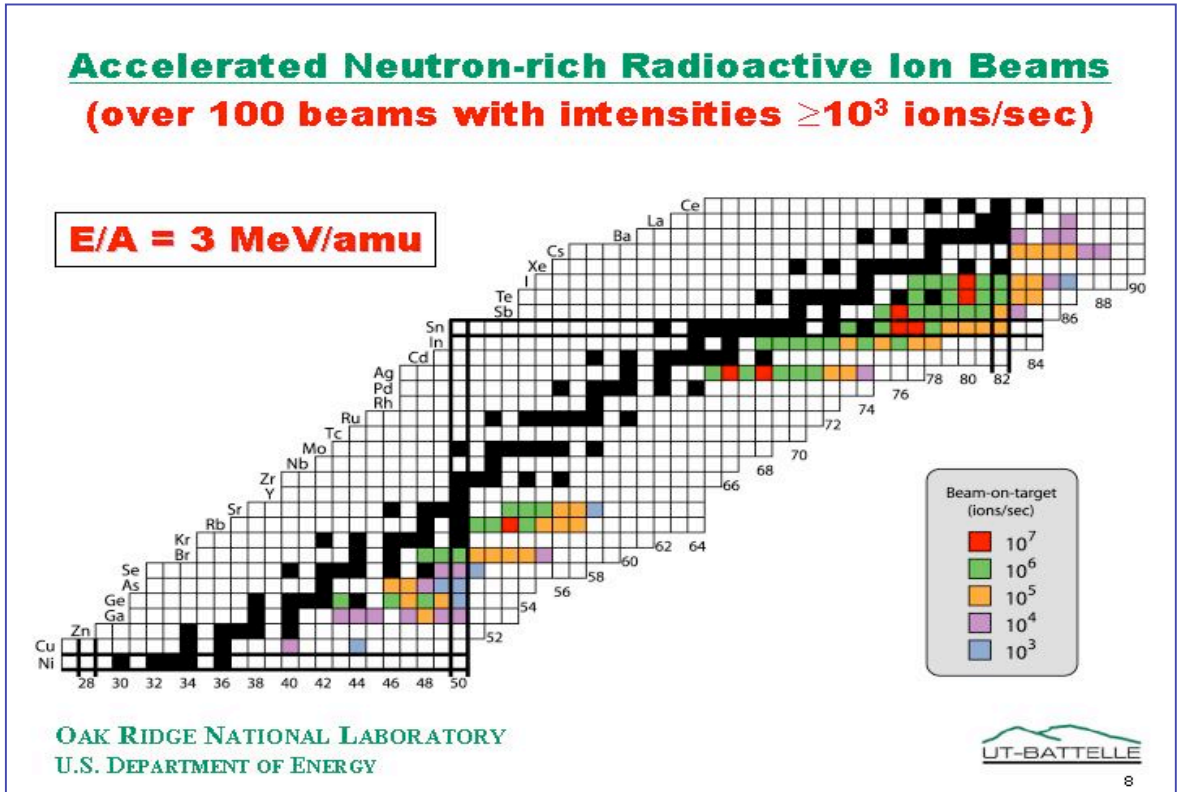
Prospects: $\sigma(n,\gamma)$ of fission fragments

- $(d,p\gamma)$ as surrogate for (n,γ)
- Enhance detection efficiency
  - Improve gamma-ray efficiency
    - E.g., CLARION
  - Improve particle efficiency: ORRUBA





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Recommendations

- Benchmark (d,pγ) as surrogate for (n,γ)
  - Theory support
- Surrogates for neutron-induced reactions on rare isotopes, e.g. fission fragments
  - Enhanced gamma & particle detection
- Engage early career scientists (undergrad & grad students, postdocs) in all aspects