(d,p) Reactions at HRIBF

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Workshop on Transfer Reactions
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Collaborators

- Jeff Thomas, Micah Johnson, *Rutgers*
- Ray Kozub, *Tennessee Tech*
- Jeff Blackmon, Alfredo Galindo-Uribarri, Jorge Gomez del Campo, Carl Gross, Felix Liang, David Radford, Dan Shapira, Cyrus Baktash, *ORNL*
- Wilton Catford, *Surrey*
- Robert Janssens, Ernst Rehm, John Schiffer, *ANL*
- E.Chavez, *UNAM*

Motivation and Challenges

- Motivation
  - Tests of shell model calculations
  - Evidence for onset of deformation
  - Search for change in shell structure
- Challenges
  - Kinematics
  - Each measurement - detectors optimized
  - Affects energy resolution
  - Affects shapes of angular distributions

Example 1: 94Sr(d,p)

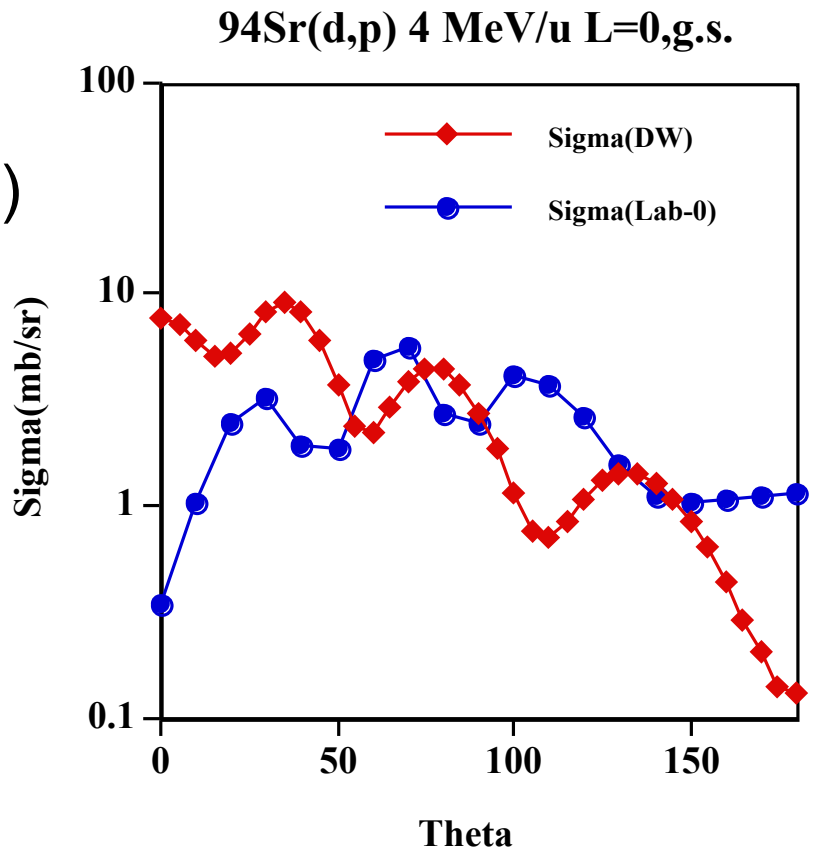
- Motivation
  - Search for onset of deformation - fragmentation of low-j strength
- Challenge - kinematics

94Sr(d,p)

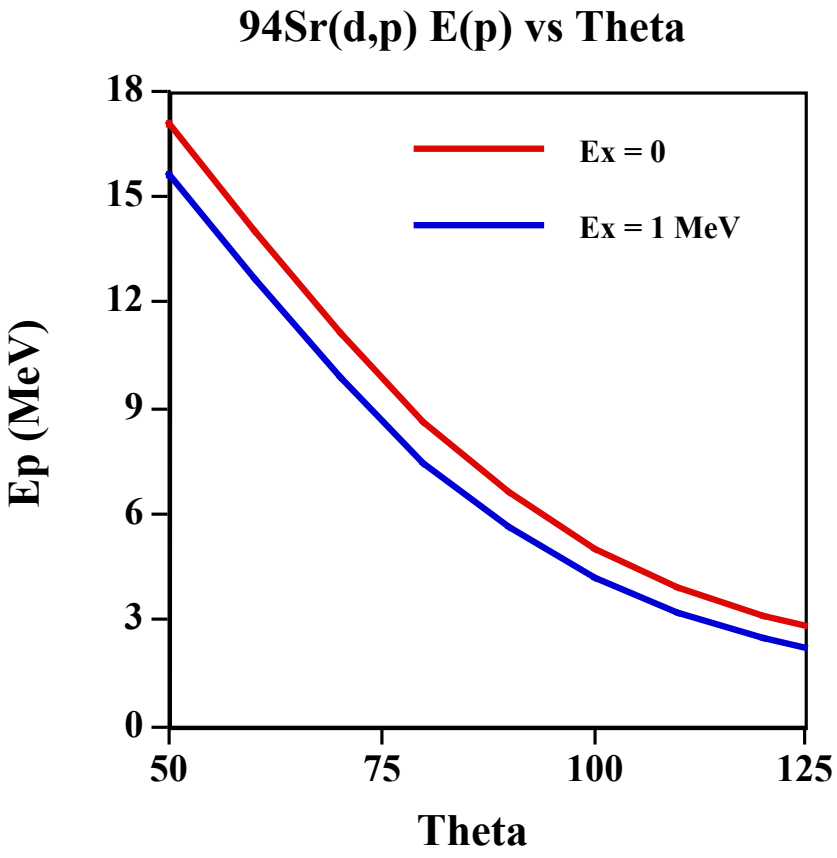
- c.m. ang. dist. Characteristic L=0 shape
- “forward” peaked in c.m.
- <120° peak in lab
- Rapid change in ΔE vs θ(lab)

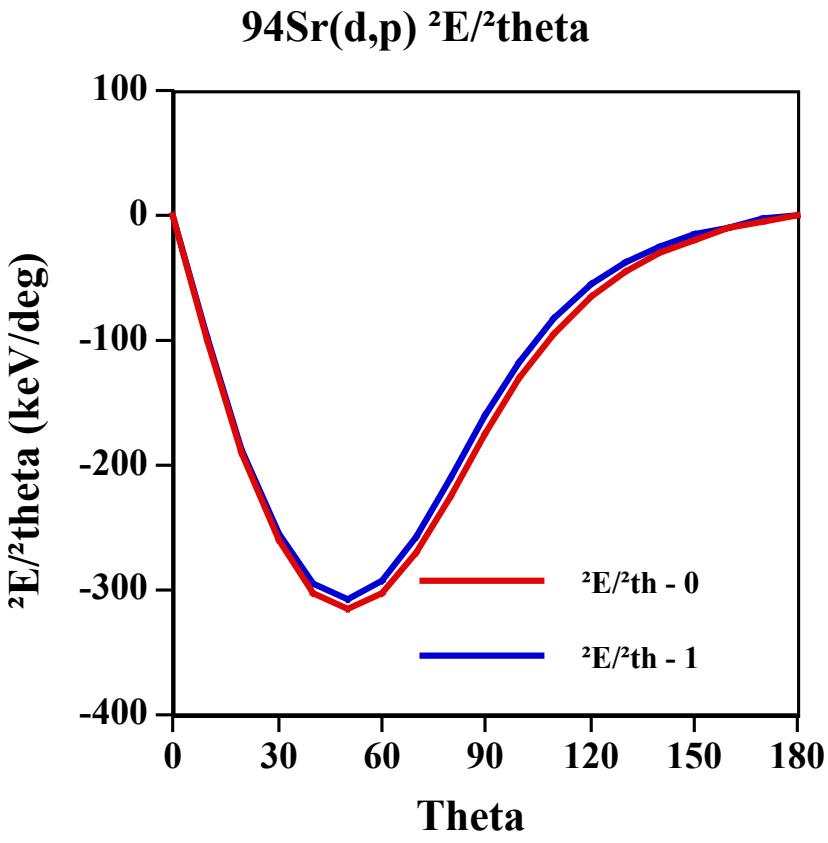
Challenge:

- Granularity of 90° detectors



Proton Energies - Sr(d,p)





Proposed 90° Barrel of PSD Si ΔE-E detectors

Flexible mounting of detectors

- Two forward and backward halves, cylindrical geometry
- Cylinders on parallel bars - slide forward/backward along beam for different angular coverage
- Variable thickness of ΔE detectors

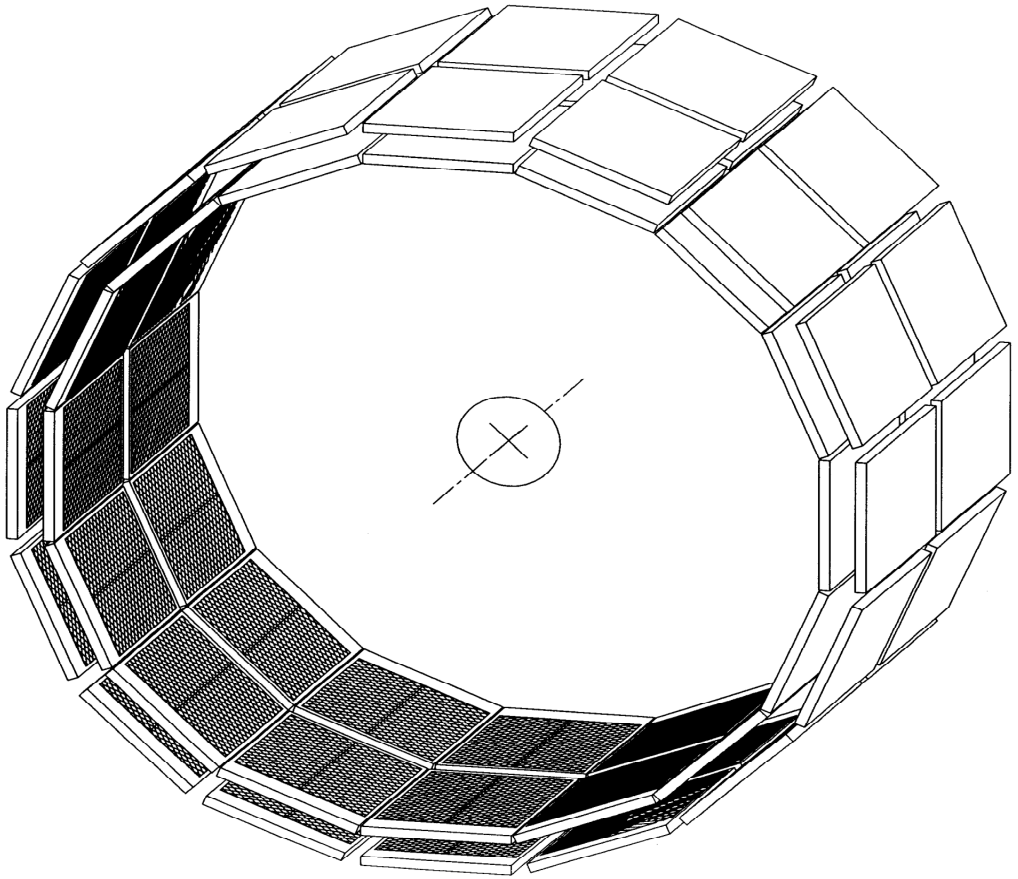
Each cylinder

- 16 Si wafers, ≈3.5 cm x 3.5 cm
- Divided into 2 strips, subtend ϕ=11.25°

Example - next slide

- Two halves joined together, about 8.7 cm from the target
- Angular range 60° - 120°

90° Barrel of PSD Si ΔE-E detectors



Example 2: 132Sn(d,p)

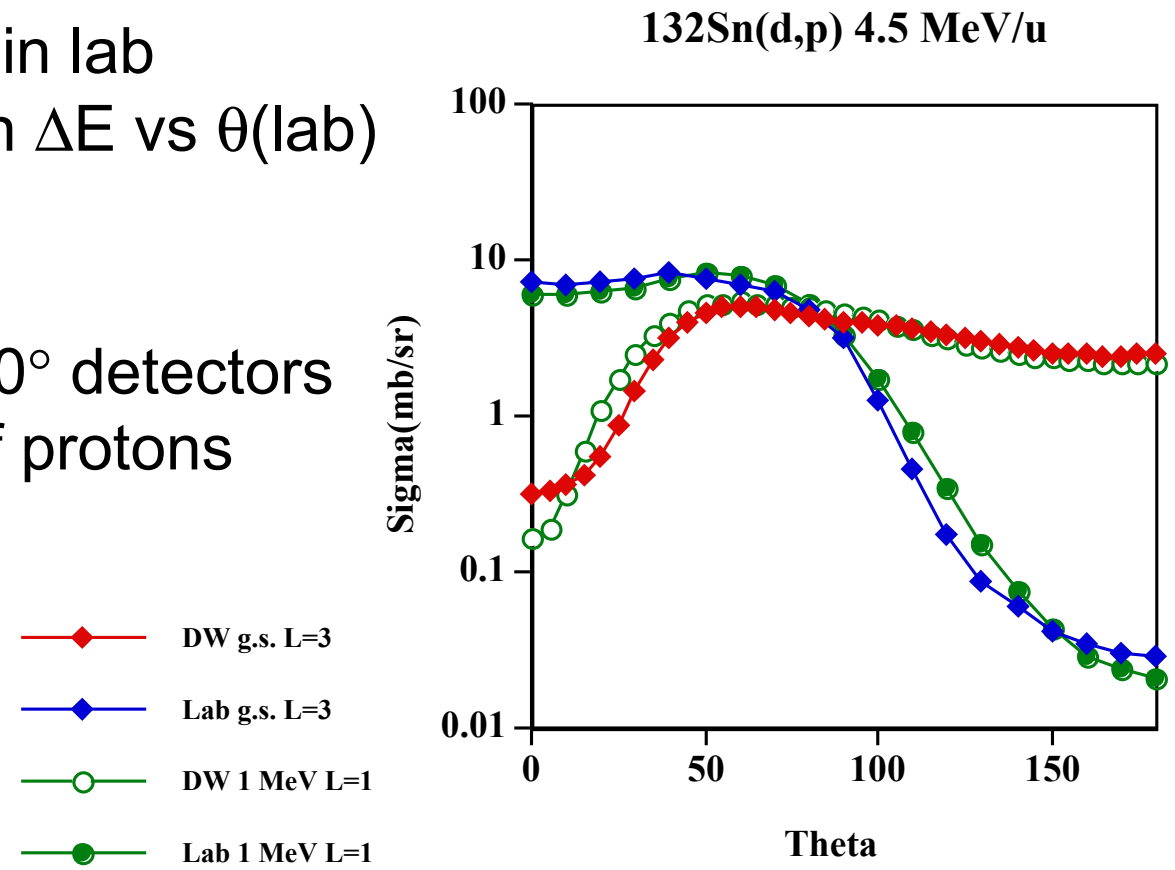
- Motivation
  - Test of shell model predictions
  - Search for change in shell structure
- Challenge
  - Relatively low beam energies
  - Kinematics

132Sn(d,p)

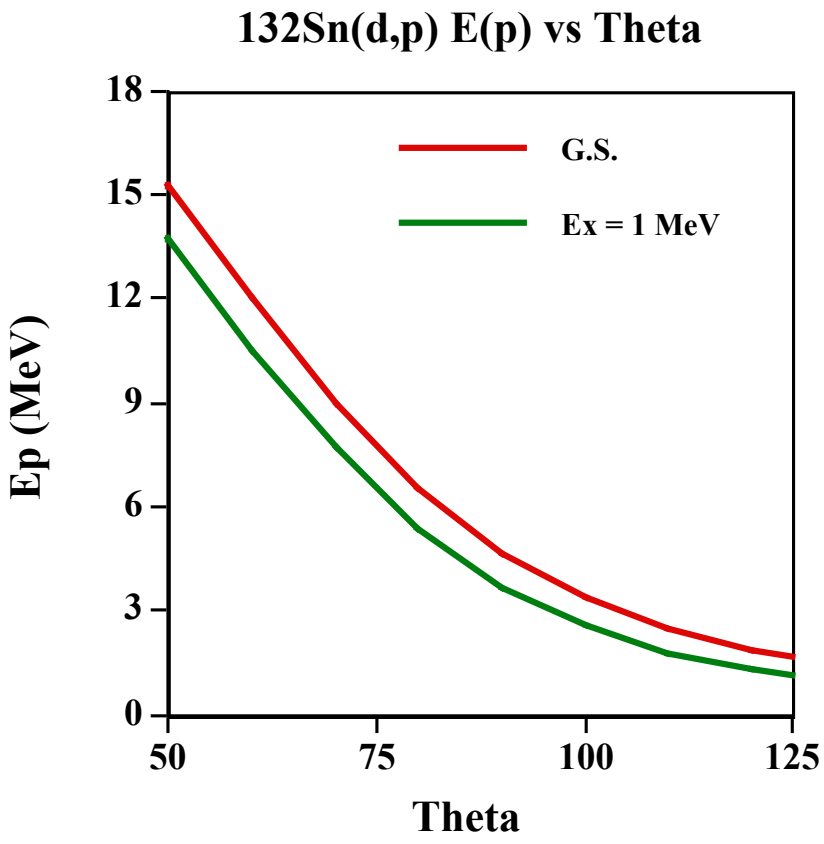
- "Similar" ang. dist. shapes
- "backward" peaked in c.m.
- "forward" peak in lab
- Rapid change in ΔE vs θ(lab)

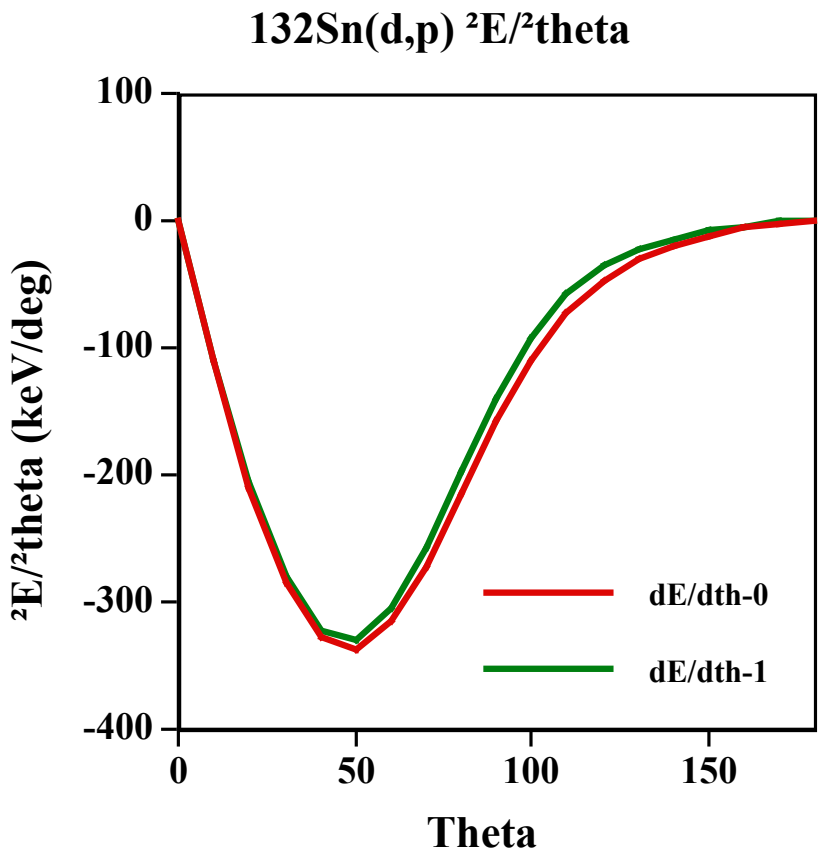
Challenge:

- Granularity of 90° detectors
- "high" energy of protons

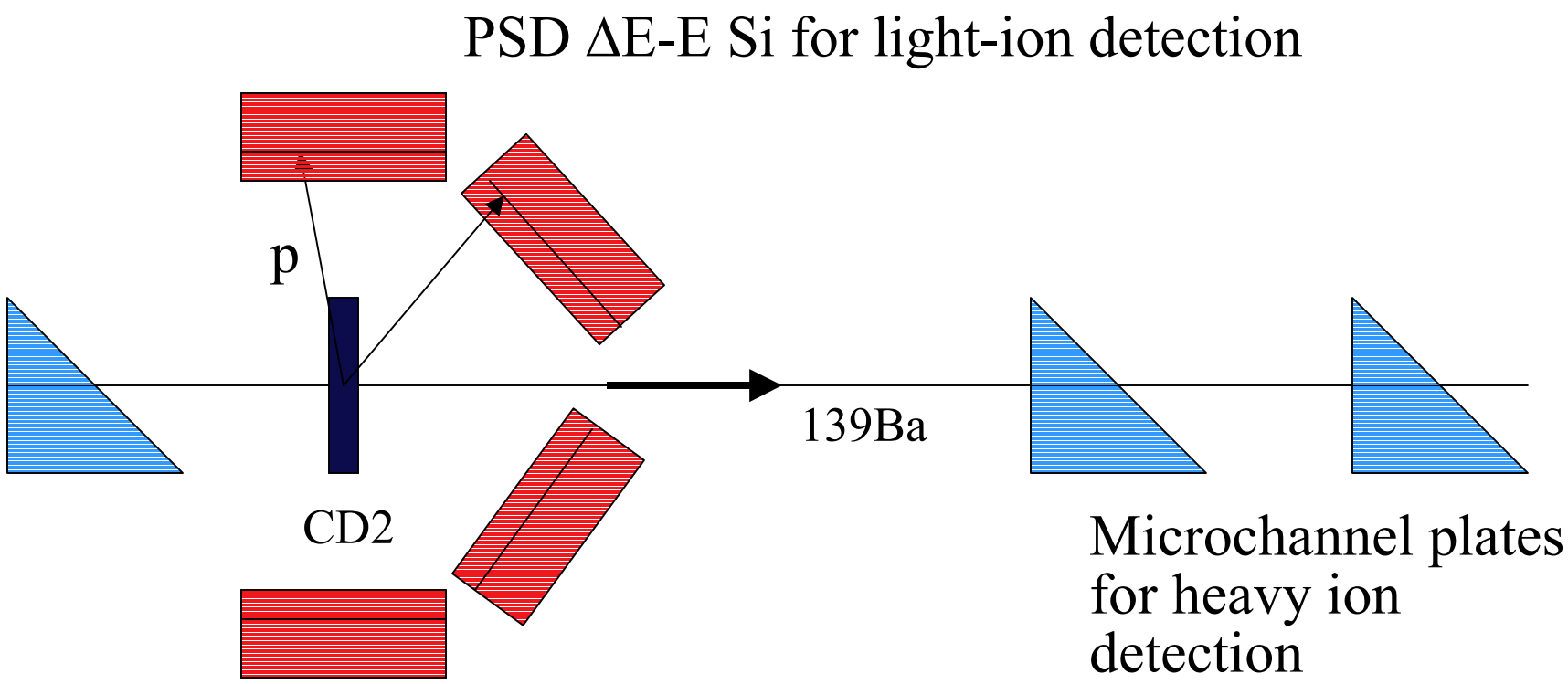


Proton Energies - Sn(d,p)





138Ba(d,p) - Develop Techniques



Summary

- (d,p) reactions provide info on s.p. strengths
  - Onset of deformation (fragmentation)
  - Tests of shell model predictions
  - Search for changes in shell structure
- Challenges - reactions in inverse kinematics
- Solution - flexible arrangements of light-ion detectors