Measurement of spectroscopic factors In the ^{132}Sn region

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- *Motivation*
- *Experimental Setup*
- *Estimated rates*

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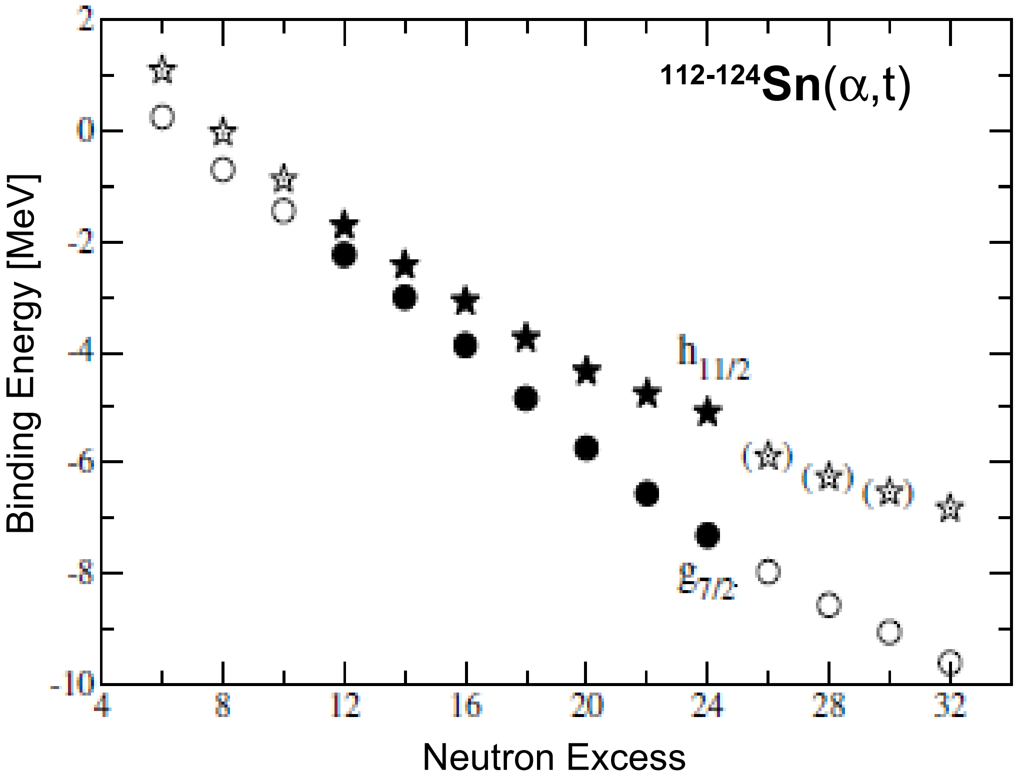
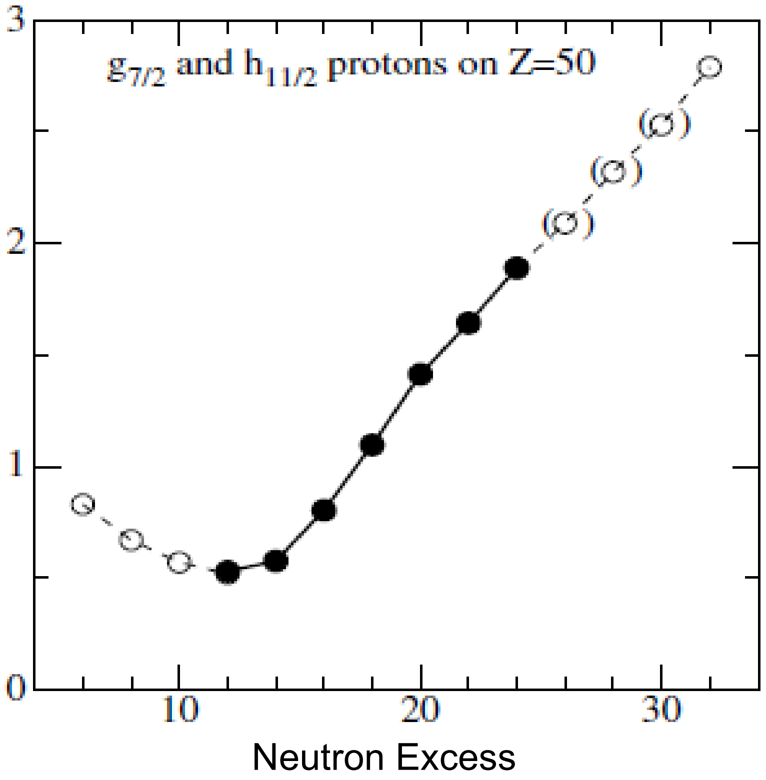
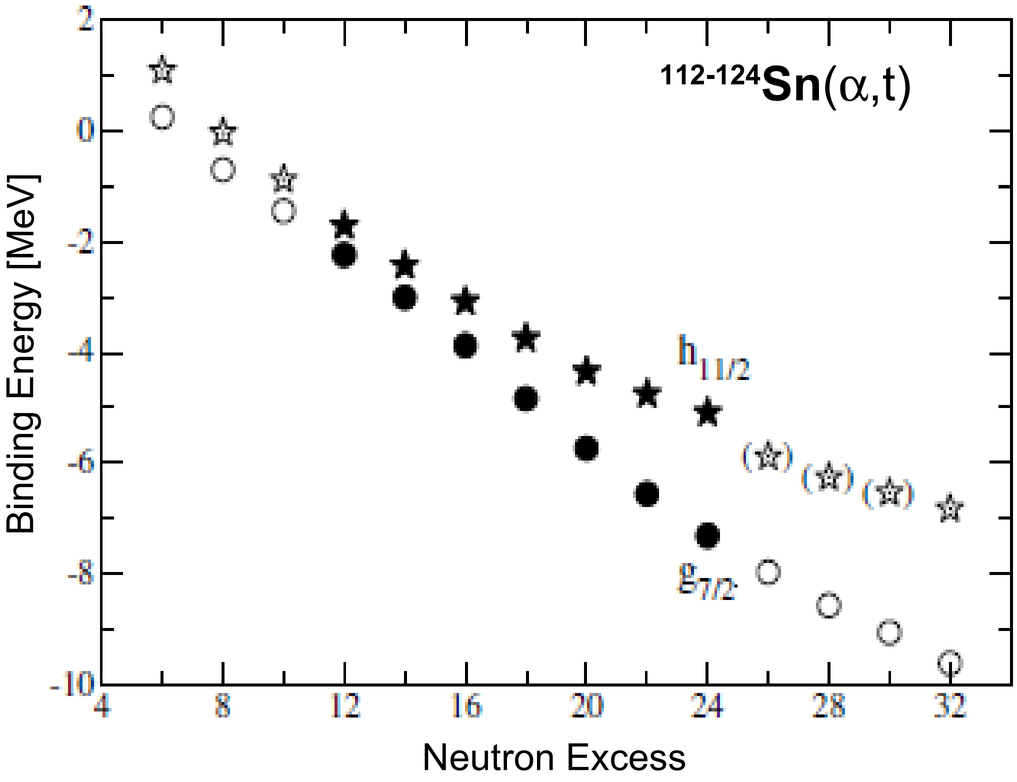
Evolution of the nuclear shells



J.P. Schiffer, *et al.*, Phys. Rev. Lett. 92 (2004) 162501

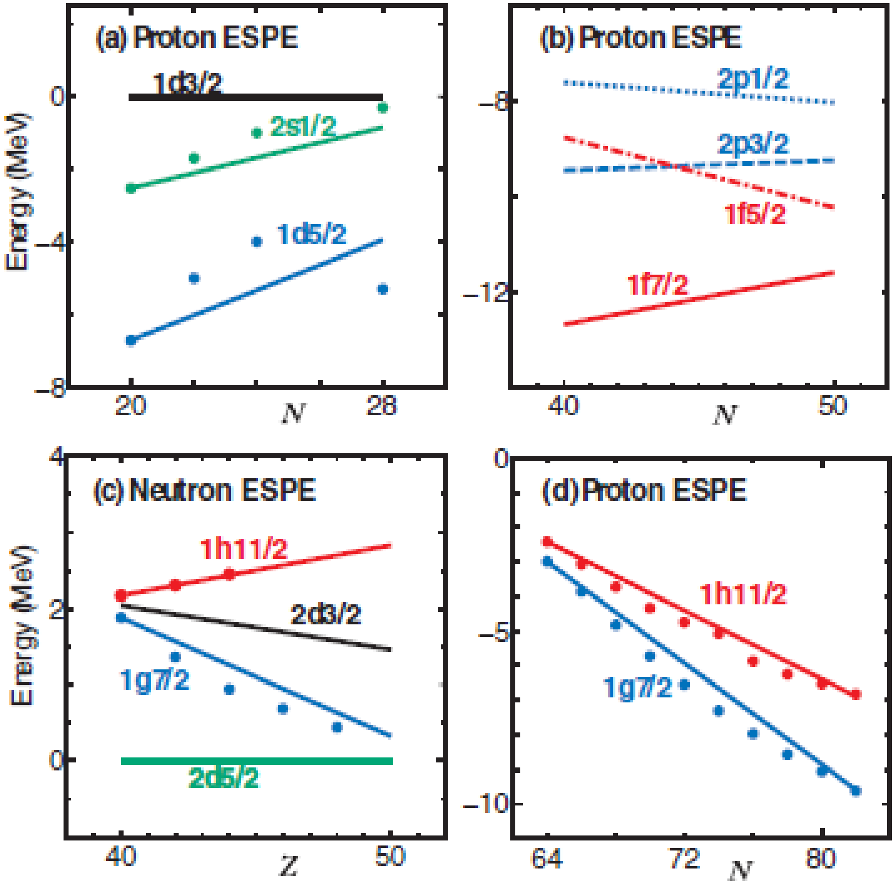


Evolution of the nuclear shells

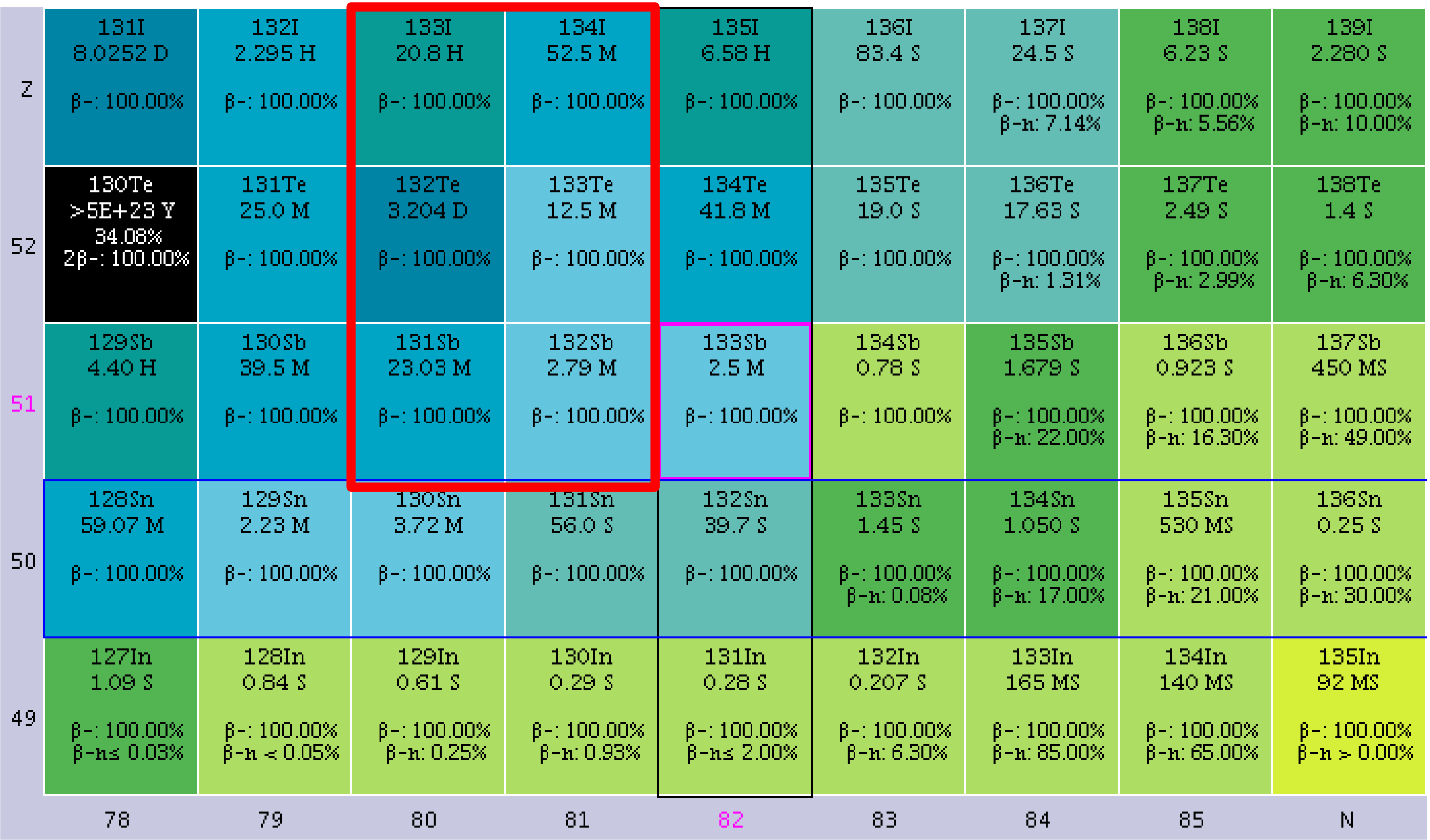


J.P. Schiffer, *et al.*, Phys. Rev. Lett. 92 (2004) 162501

T. Otsuka, *et al.*, Phys. Rev. Lett. 95 (2005) 232502



Evolution of the nuclear shells



Z	131I 8.0252 D β-: 100.00%	132I 2.295 H β-: 100.00%	133I 20.8 H β-: 100.00%	134I 52.5 M β-: 100.00%	135I 6.58 H β-: 100.00%	136I 83.4 S β-: 100.00%	137I 24.5 S β-: 100.00% β-n: 7.14%	138I 6.23 S β-: 100.00% β-n: 5.56%	139I 2.280 S β-: 100.00% β-n: 10.00%
52	130Te >5E+23 Y 34.08% 2β-: 100.00%	131Te 25.0 M β-: 100.00%	132Te 3.204 D β-: 100.00%	133Te 12.5 M β-: 100.00%	134Te 41.8 M β-: 100.00%	135Te 19.0 S β-: 100.00%	136Te 17.63 S β-: 100.00% β-n: 1.31%	137Te 2.49 S β-: 100.00% β-n: 2.99%	138Te 1.4 S β-: 100.00% β-n: 6.30%
51	129Sb 4.40 H β-: 100.00%	130Sb 39.5 M β-: 100.00%	131Sb 23.03 M β-: 100.00%	132Sb 2.79 M β-: 100.00%	133Sb 2.5 M β-: 100.00%	134Sb 0.78 S β-: 100.00%	135Sb 1.679 S β-: 100.00% β-n: 22.00%	136Sb 0.923 S β-: 100.00% β-n: 16.30%	137Sb 450 MS β-: 100.00% β-n: 49.00%
50	128Sn 59.07 M β-: 100.00%	129Sn 2.23 M β-: 100.00%	130Sn 3.72 M β-: 100.00%	131Sn 56.0 S β-: 100.00%	132Sn 39.7 S β-: 100.00%	133Sn 1.45 S β-: 100.00% β-n: 0.08%	134Sn 1.050 S β-: 100.00% β-n: 17.00%	135Sn 530 MS β-: 100.00% β-n: 21.00%	136Sn 0.25 S β-: 100.00% β-n: 30.00%
49	127In 1.09 S β-: 100.00% β-n≤ 0.03%	128In 0.84 S β-: 100.00% β-n < 0.05%	129In 0.61 S β-: 100.00% β-n: 0.25%	130In 0.29 S β-: 100.00% β-n: 0.93%	131In 0.28 S β-: 100.00% β-n≤ 2.00%	132In 0.207 S β-: 100.00% β-n: 6.30%	133In 165 MS β-: 100.00% β-n: 85.00%	134In 140 MS β-: 100.00% β-n: 65.00%	135In 92 MS β-: 100.00% β-n > 0.00%
	78	79	80	81	82	83	84	85	N

^{130,132}Sn(d,p)^{131,133}Sn(K.L. Jones, et al.) and ^{134}Te(d,p)^{135}Te(S. D. Pain, et al.) transfer reaction at HRIBF.

This LoI: Z=51-53 N=80,81

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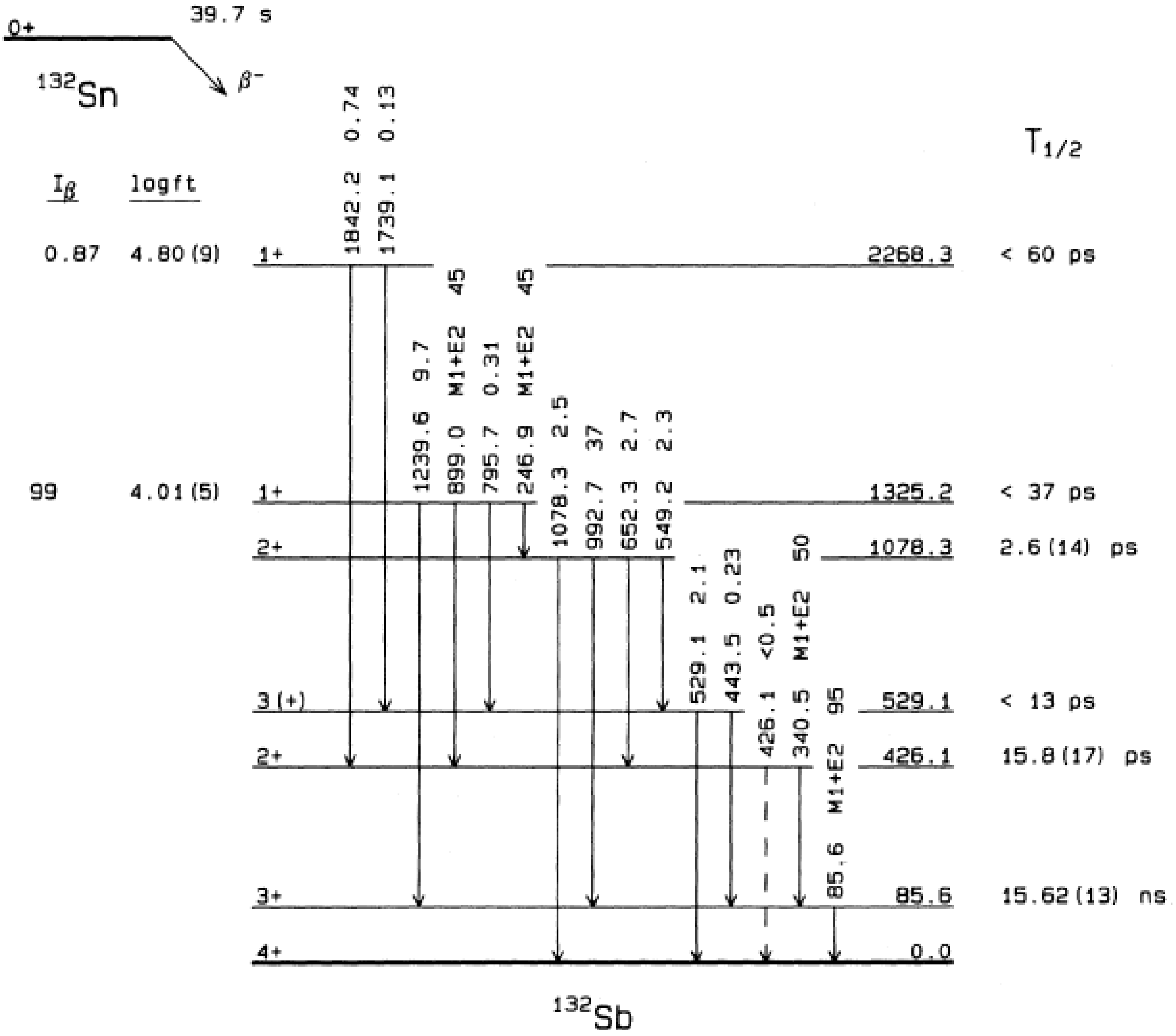
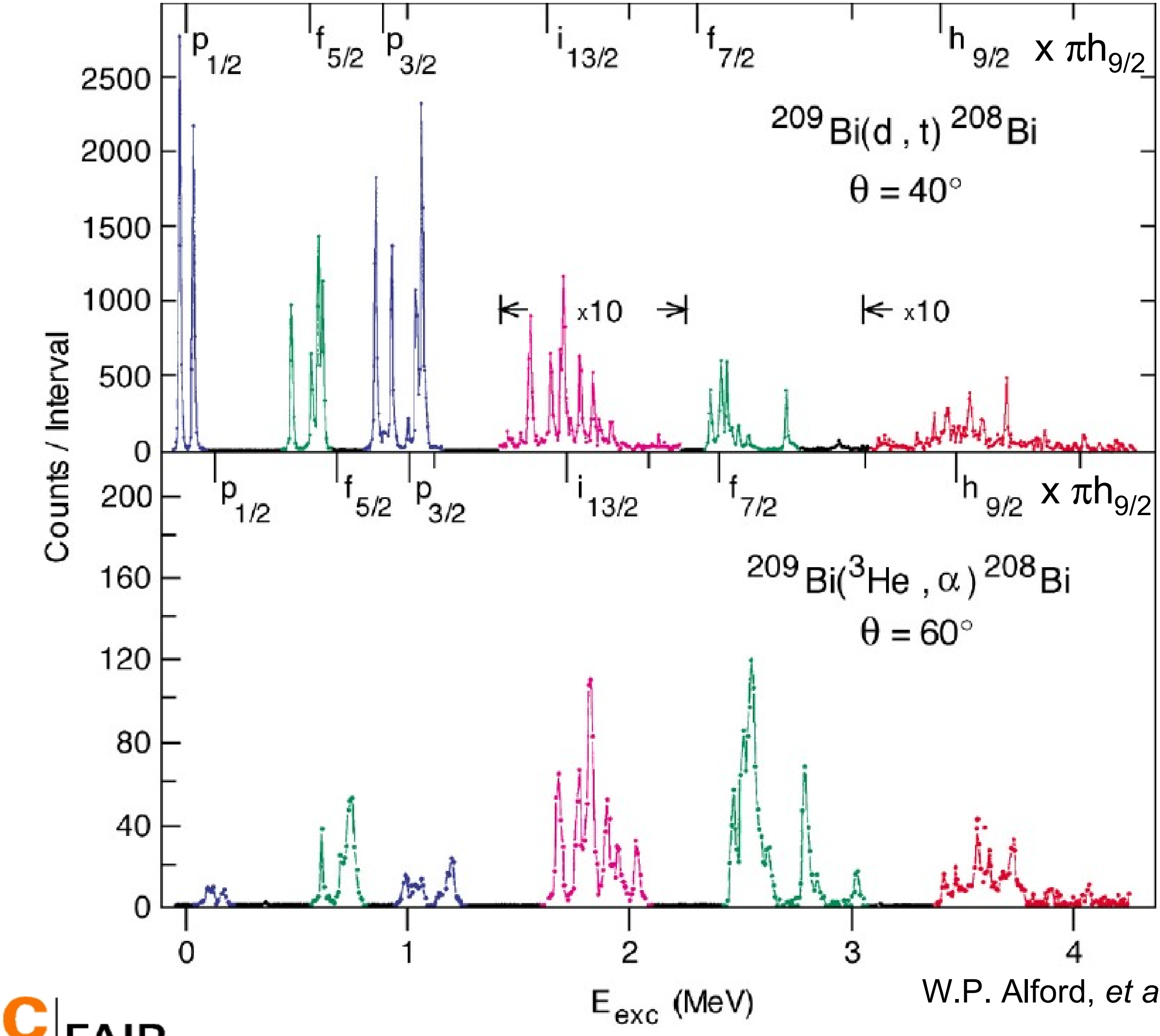
β-decay studies



H. Mach, *et al.*, Phys. Rev. C 51 (1995) 500

Fragmentation of the single-particle excitations



^{208}Pb → ^{132}Sn

^{209}Bi → ^{132}Sb

L → L-1; j → j-1

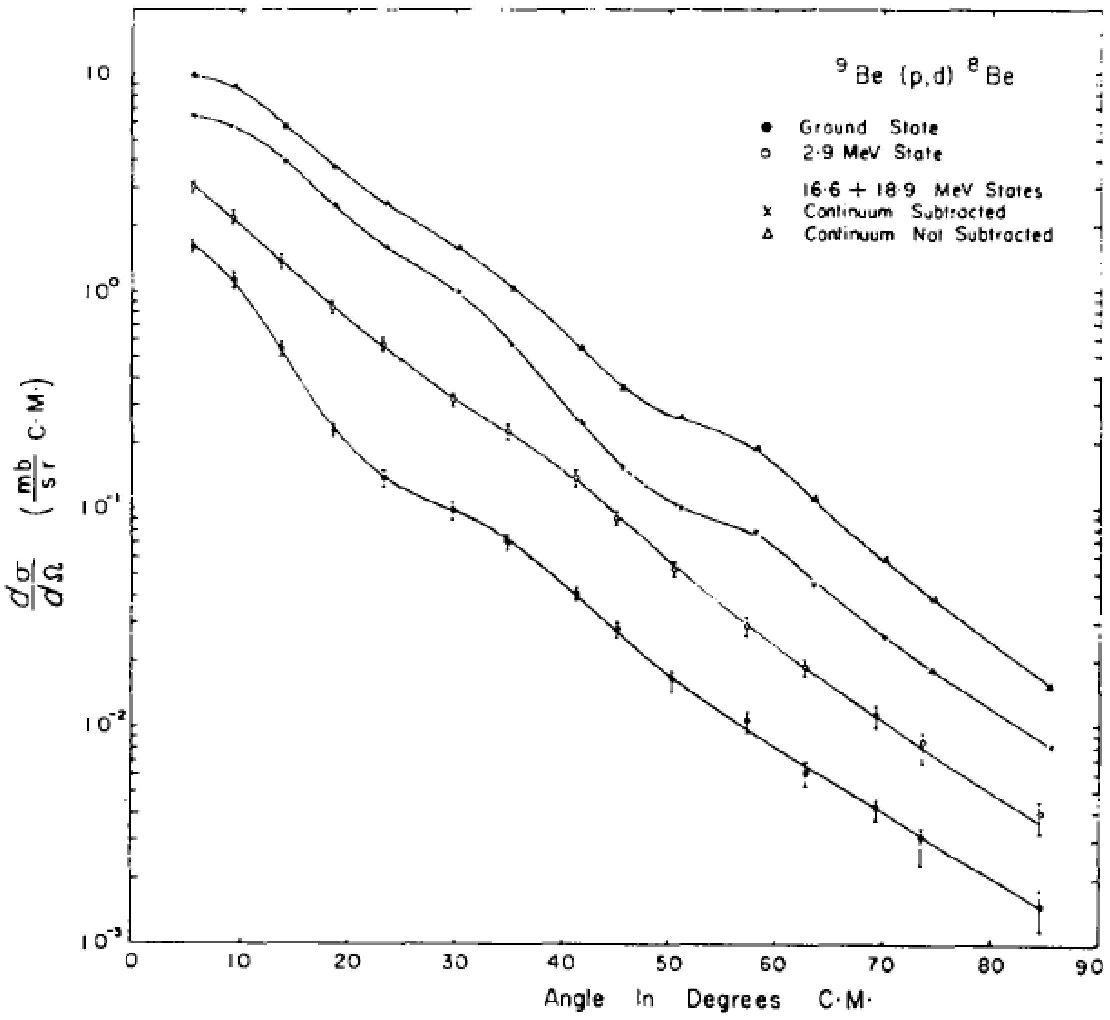
$i_{13/2} \rightarrow h_{11/2}$

$h_{9/2} \rightarrow g_{7/2}$

W.P. Alford, *et al.*, Phys. Rev. C 3 (1971) 860

(p,d) reaction at intermediate Energies ~100MeV/u

- **Populate neutron hole states**
- **A large transfer momentum → investigates high momentum nucleons, near the surface**



J.K.P. Lee, *et al* Nucl. Phys. A 106 (1968) 357

Why at GSI?

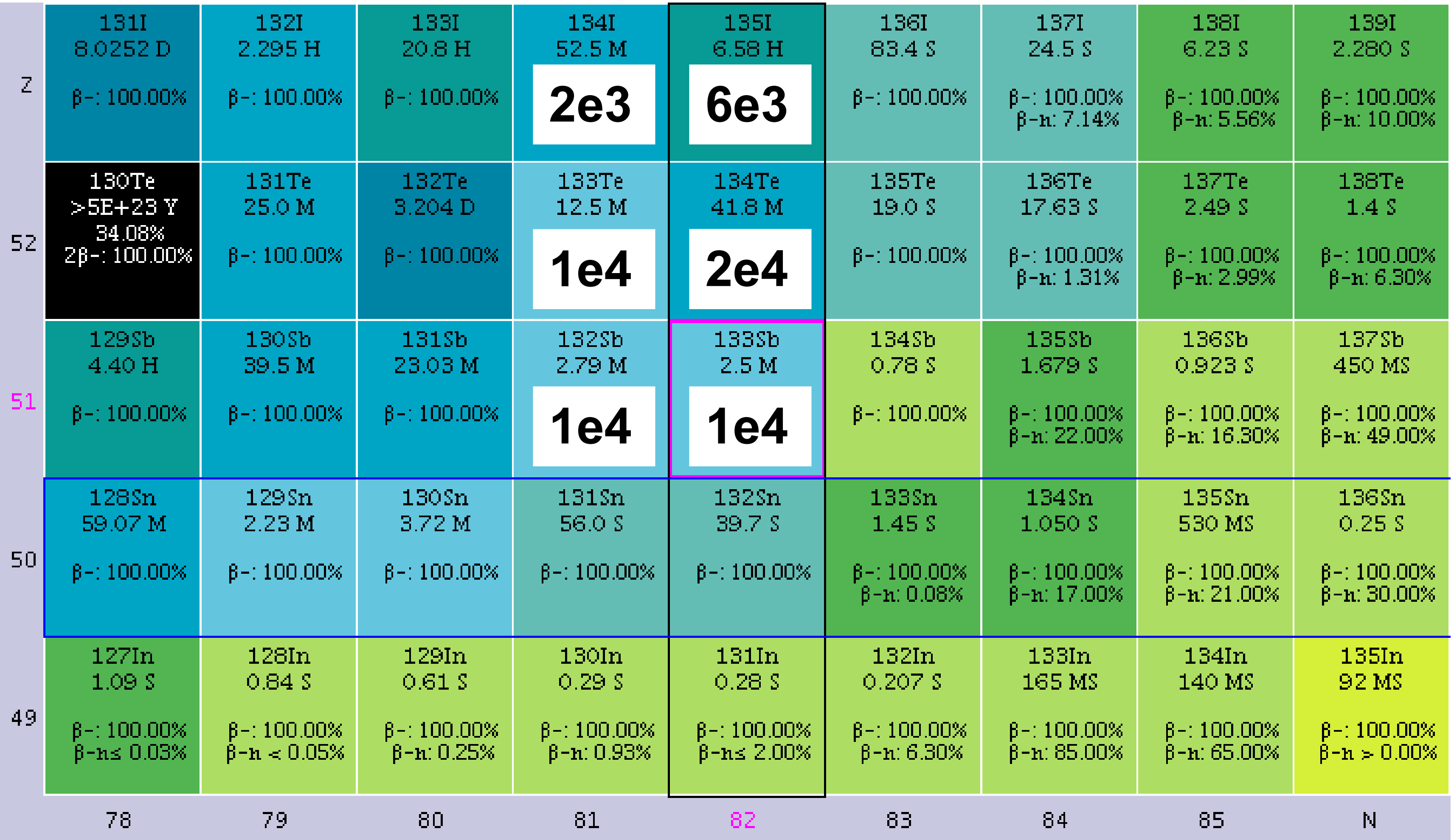
- High RIB intensity
- Systematic study of many nuclei under the same conditions
- LH – target
- High γ - efficiency
- Tag the final state with AGATA

RIB production

Beam:
^{238}U@650MeV/u
I=2x10^9 pps

Target:
^{208}Pb 1.7 g/cm^2

***S2* rate: ~4x10^5 pps**
***S4* rate: ~6x10^4 pps**



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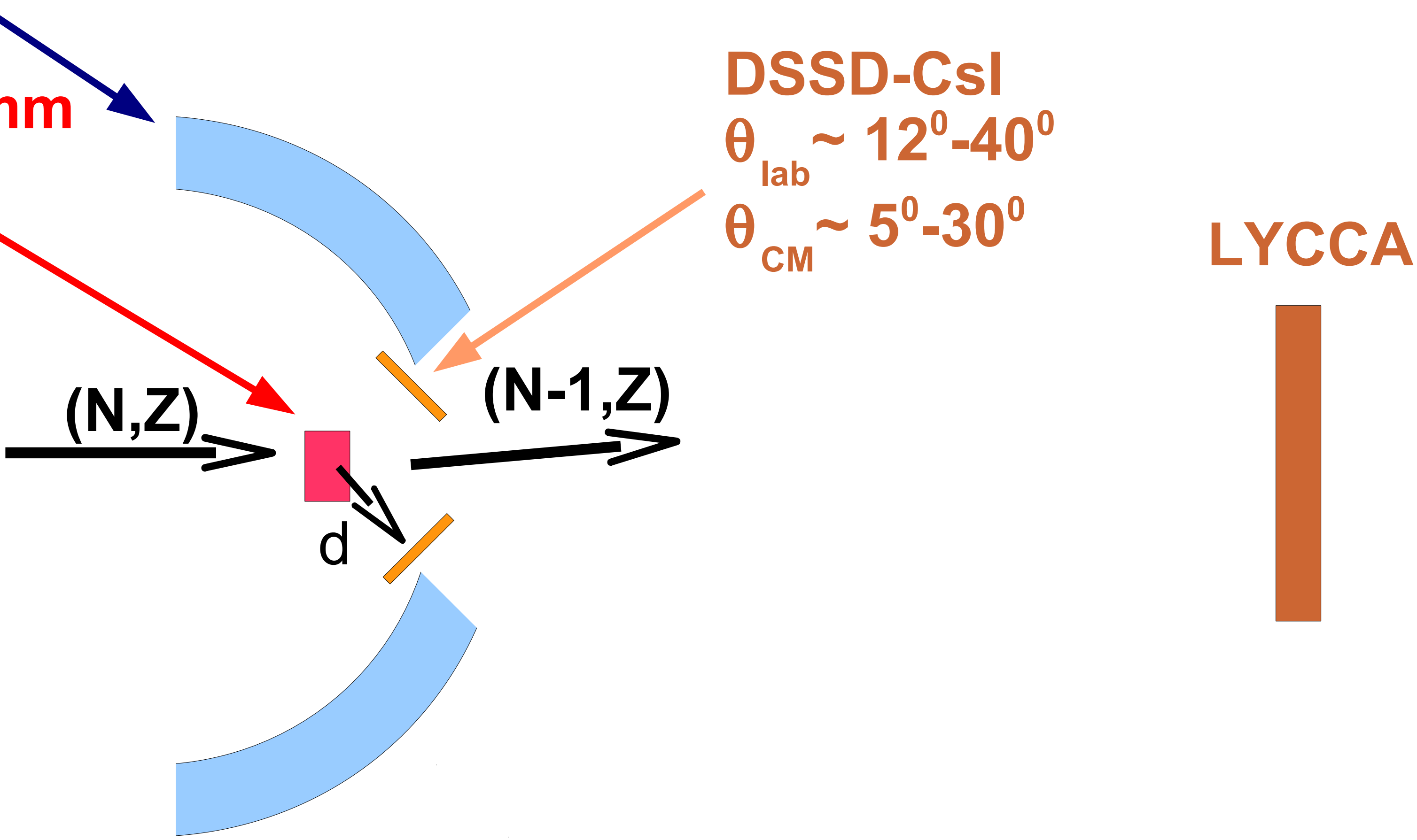
	78	79	80	81	82	83	84	85	N

Setup for (p,d)



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Estimated p-γ coincidences for 10 days

Secondary beam	Intensity at S4 [pps]	reaction	Np-γ [counts for 10d] (dσ/dΩ= 1 mb/sr)	Np-γ [counts for 10d] (dσ/dΩ= 0.01mb/sr)
^{134}I	$2\mathrm{x}10^3$	^{134}I(p,d)^{133}I	597	6
^{135}I	$6\mathrm{x}10^3$	^{135}I(p,d)^{134}I	1792	18
^{133}Te	$1\mathrm{x}10^4$	^{133}Te(p,d)^{132}Te	2989	30
^{134}Te	$1.6\mathrm{x}10^4$	^{134}Te(p,d)^{133}Te	4778	48
^{132}Sb	$1.2\mathrm{x}10^4$	^{132}Sb(p,d)^{131}Sb	3583	36
^{133}Sb	$1\mathrm{x}10^4$	^{133}Sb(p,d)^{132}Sb	2986	30

A bin width of 5^0 for the deuteron angular distribution in center of mass is assumed. 4 ΔE-E telescopes, $\varepsilon_\gamma = 18\%$

Summary

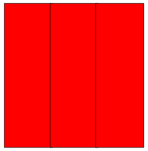
- Pick up reactions at intermediate energies in normal kinematics were used to determine spectroscopic factors with stable beams.

- The unique combination of intense radioactive beams at GSI, a liquid hydrogen target and the high gamma-ray efficiency of the AG allow a study of spectroscopic factors factors in the ^{132}Sn region.

- We propose to determine the spectroscopic factors of states of neutron hole state in ^{133,134}I, ^{132,133}Te and ^{131,132}Sb, populated via (p,d) reaction in inverse kinematics at intermediate energies.

Estimates for ^{132}Sb(p,d)^{131}Sb

LH: d = 10mm



E = 150 MeV/u dE = 16 MeV/u

$E_d(\theta_{cm}=12^0$, beginning of the target)=14.99 MeV/u

$E_d(\theta_{cm}=12^0$, middle of the target)=15.42 MeV/u

$E_d(\theta_{cm}=12^0$, beginning of the target)=15.85 MeV/u

→ Need energy resolution ~ 2%

d(LH) = 20 mm

(dE(of 132Sb in the target) = 26 MeV/u ;1000 keV*$d\beta$=30 keV)

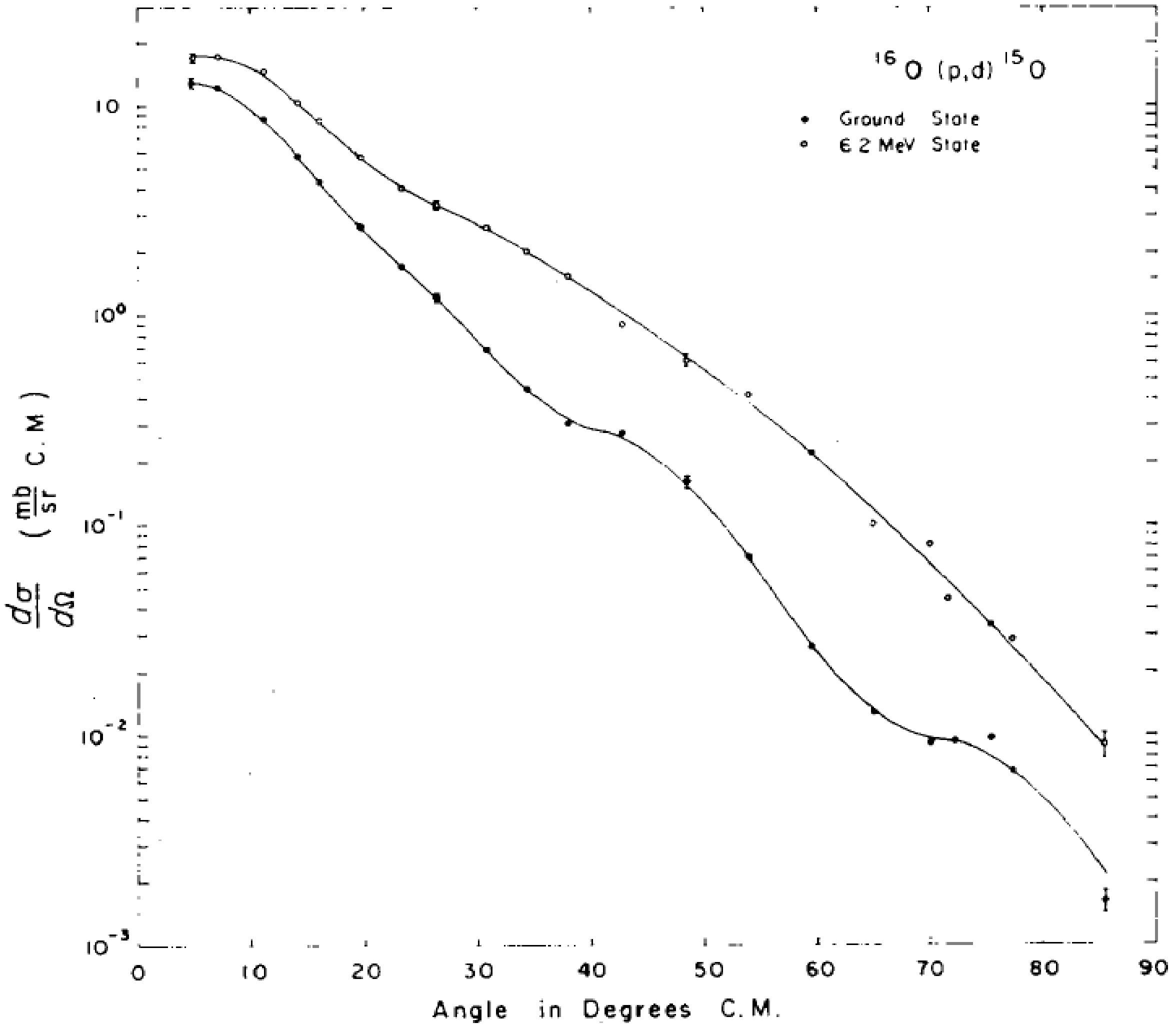
Estimates for (p,d) at 150 MeV/u

For 10 mm resolution of the interaction point → $< 2^0$ resolution in CM

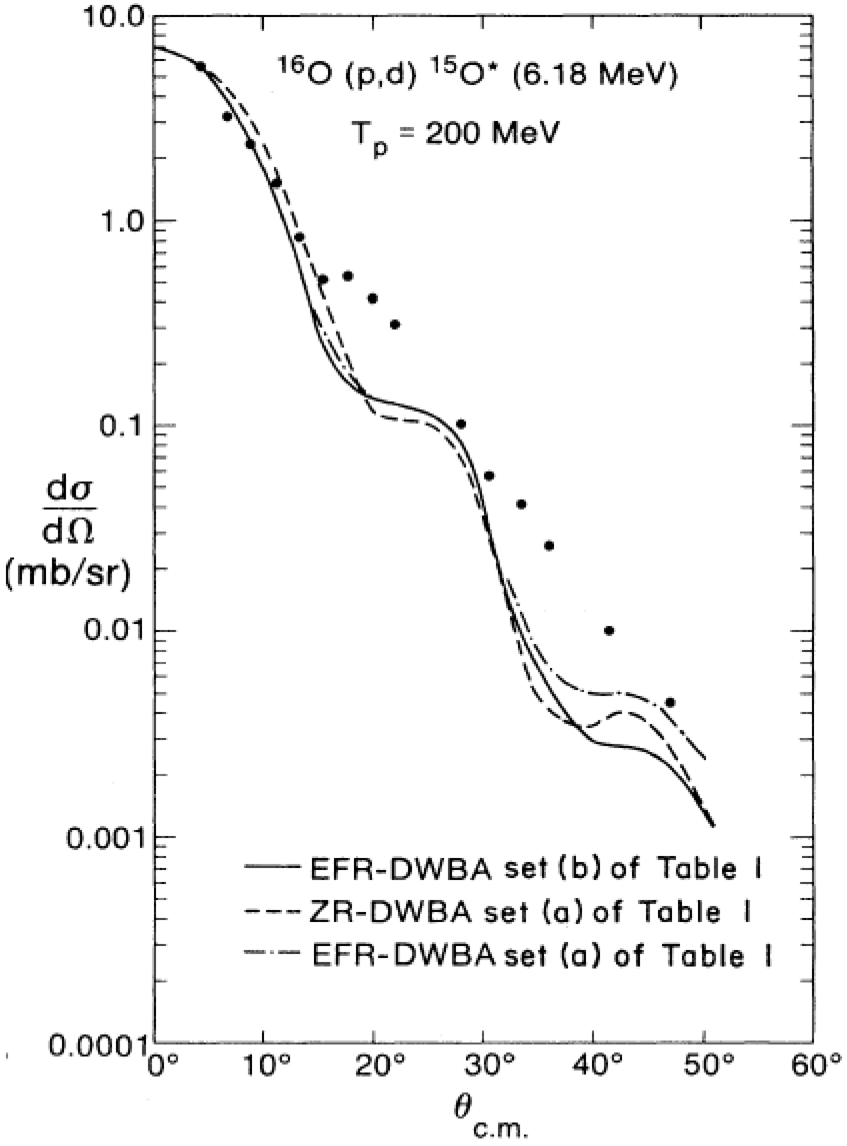
For d(LH) = 20 mm target ΔT(beam-fragment) ~ 53ps

For d(LH) = 40 mm target ΔT(beam-fragment) ~ 362ps

(p,d) at 100 and 200 MeV/u

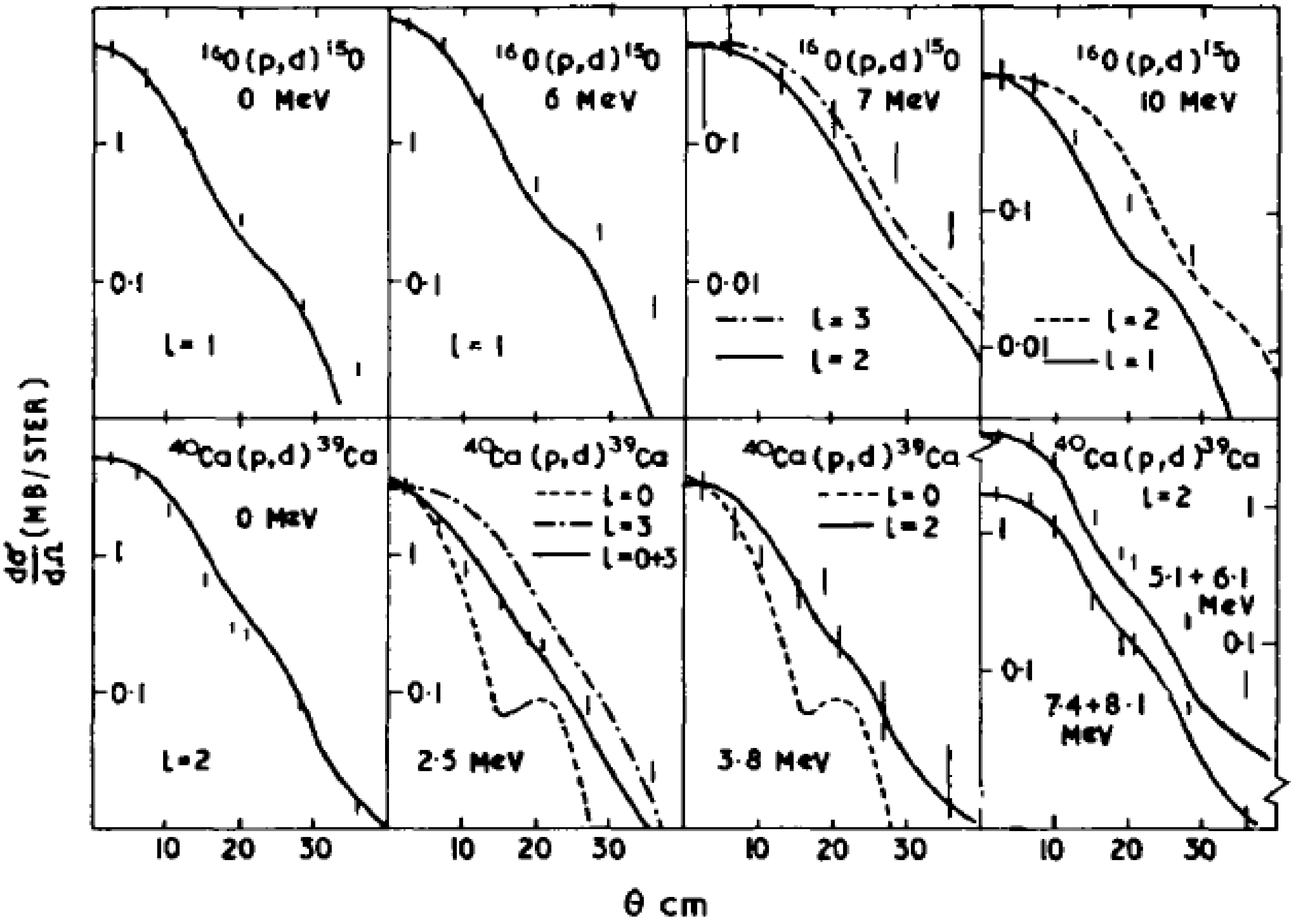


J.K.P. Lee, *et al* Nucl. Phys. A 106 (1968) 357



R. Abegg *et al.* Phys.Rev C 39 (1989) 65

(p,d) at 156 MeV/u



I.S. Towner, Nucl. Phys. A 126 (1969) 97

Setup for (p,p) and (d,d)