

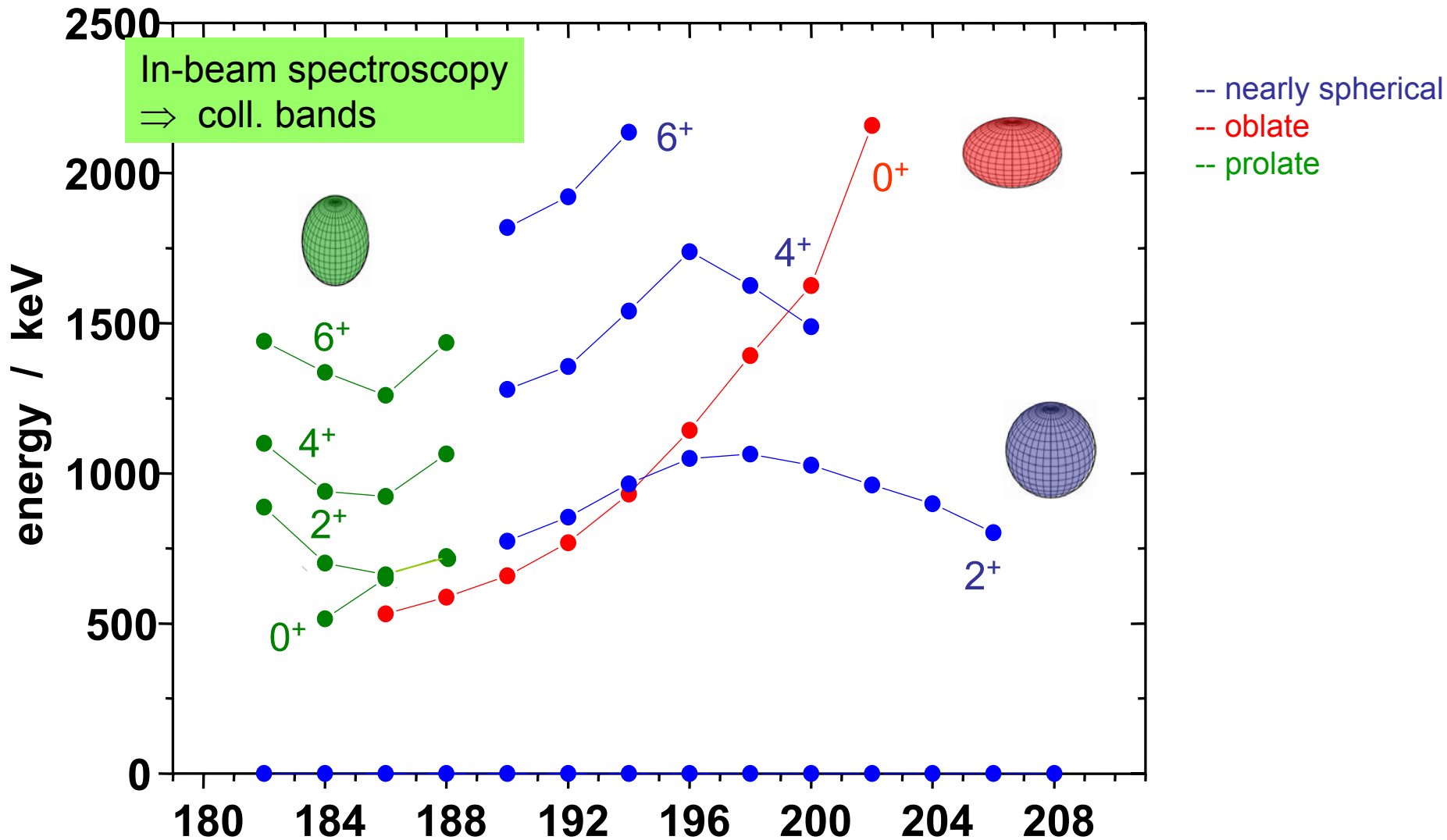
Investigation of triple shape coexistence in neutron deficient Pb and Po nuclei using transition probabilities

A. Dewald, Universität zu Köln

- **Introduction to shape coexistence in neutron deficient Pb nuclei**
- **First lifetime measurements in $^{188,186}\text{Pb}$; ^{194}Po**
- **Test of theoretical models with absolute transition probabilities**
- **Summary**
- **Plunger lifetime measurements with RI beams @ NSCL/MSU**

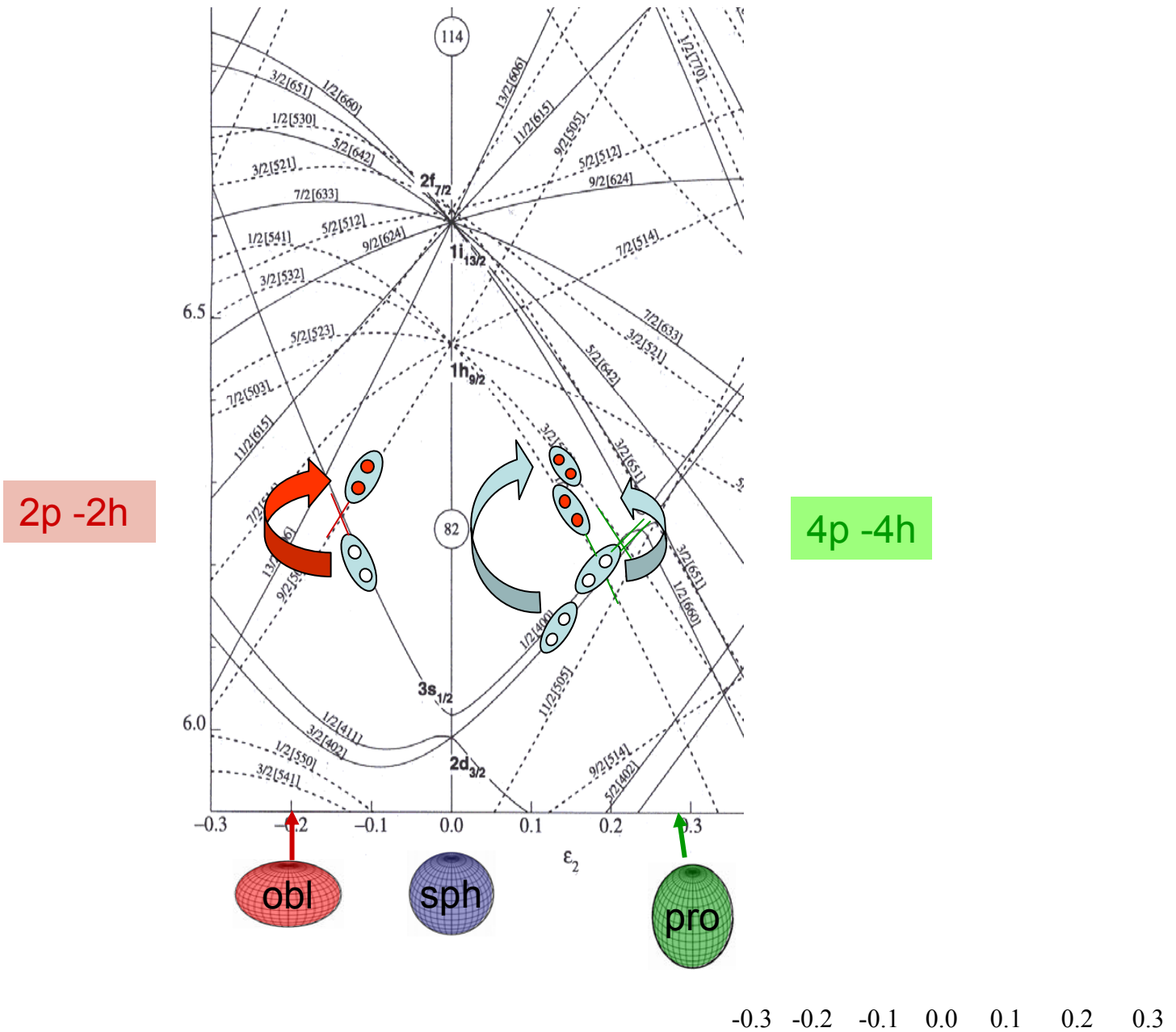
Systematics of neutron-deficient Pb

e.g.: P. Van Duppen et al.
J. Phys.G 16, 441 (1990)



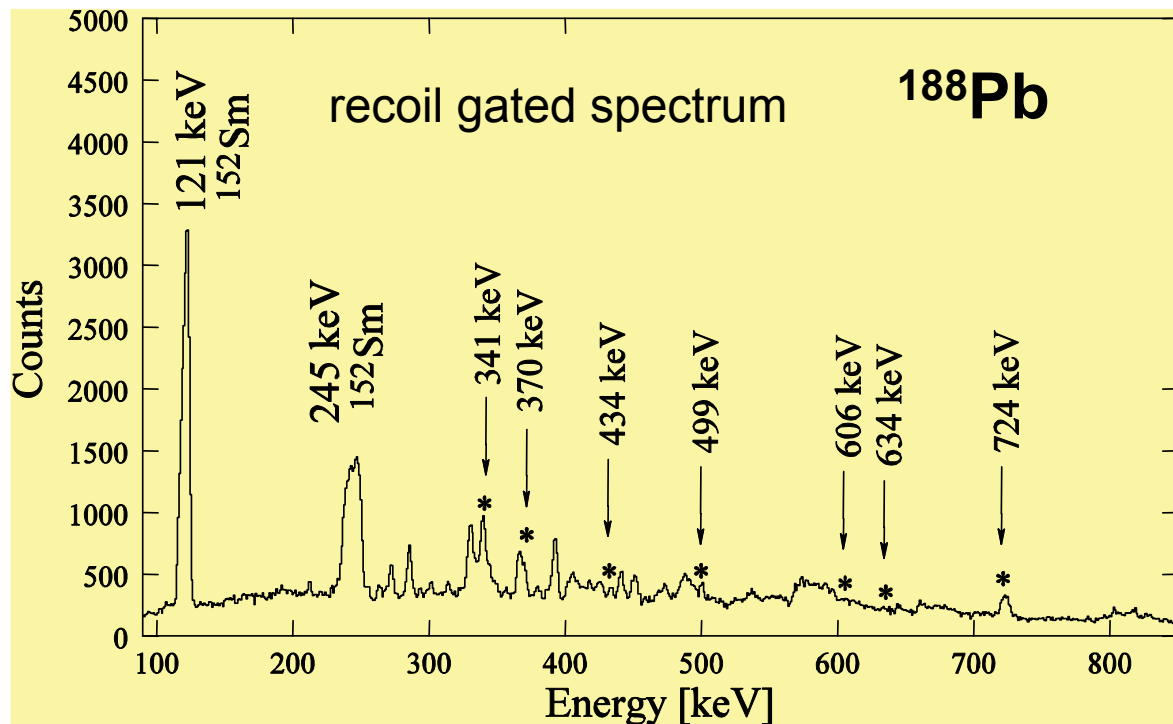
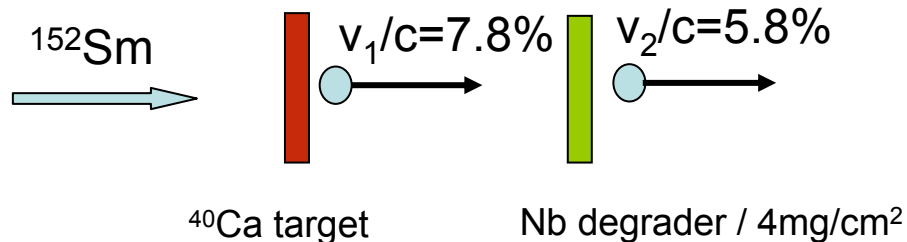
Measure β deformation via absolute transition probabilities/ lifetimes

Proton ; (n particle - n hole) excitations → deformation



GAMMASPHERE + FMA + Plunger

$^{40}\text{Ca}(^{152}\text{Sm},4n)^{188}\text{Pb}$; 805 MeV

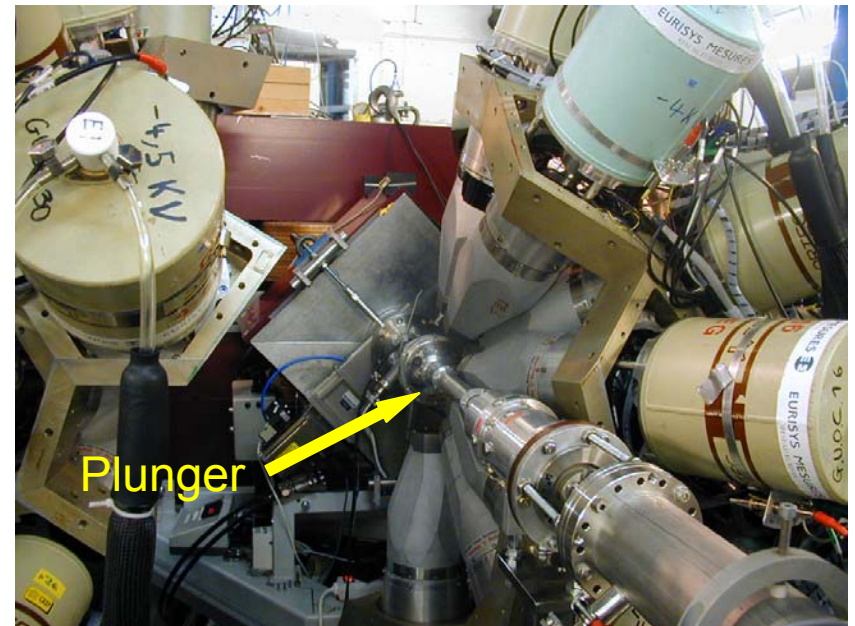
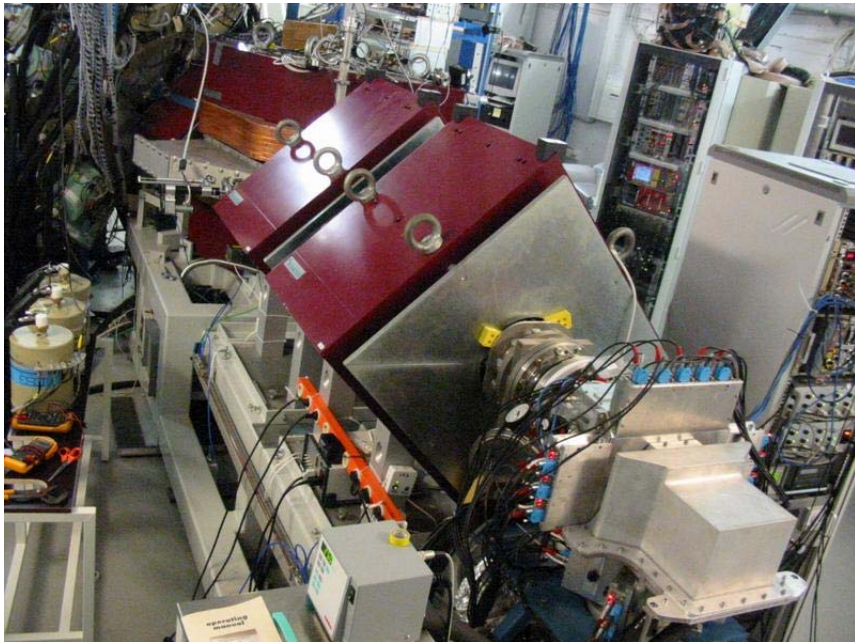
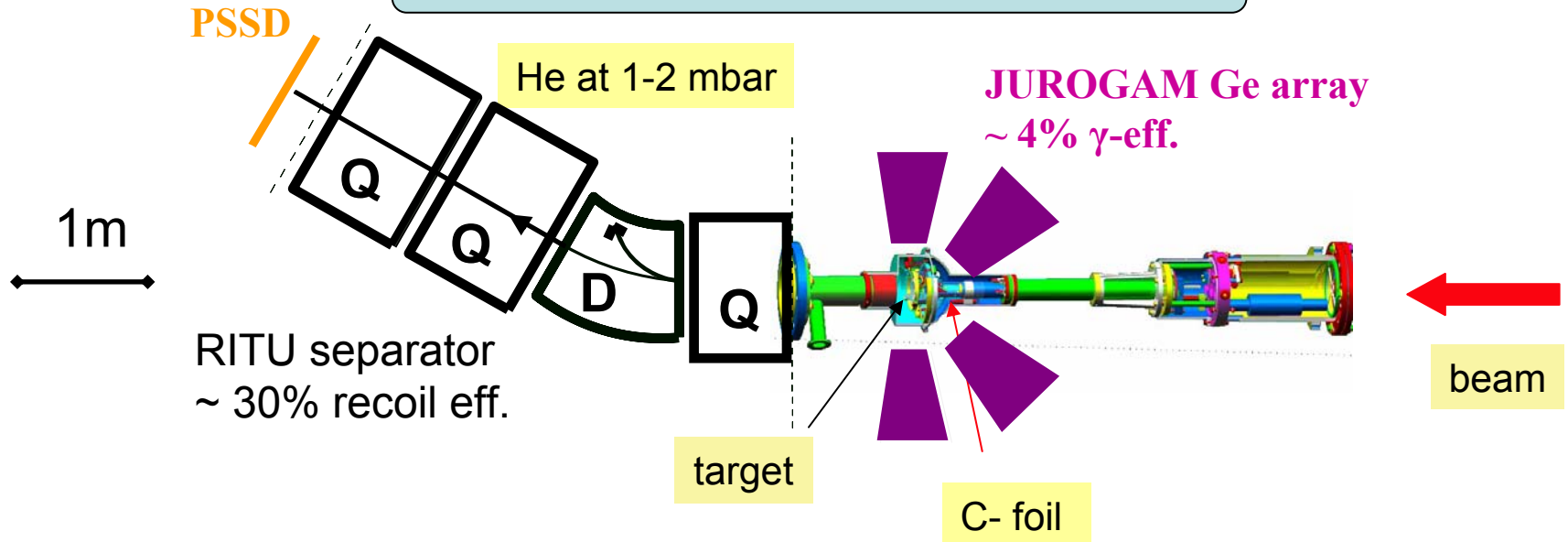


A. Dewald et al. PRC 68,
034314, 2003

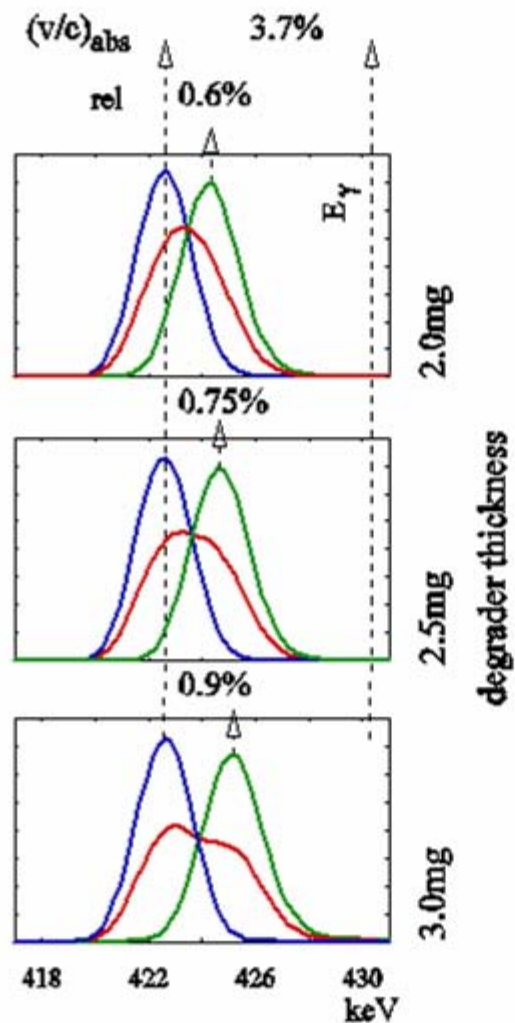
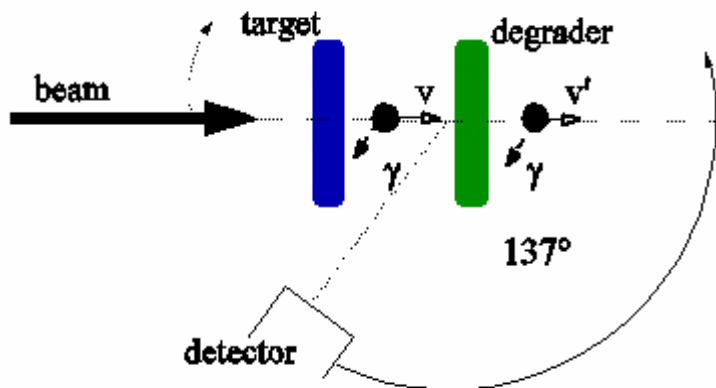
2^+ : 13(7) ps

4^+ : 16(8) ps

Plunger + RITU at Jyväskylä



Doppler shift versus recoil rate



without degrader

120 /min

70 /min

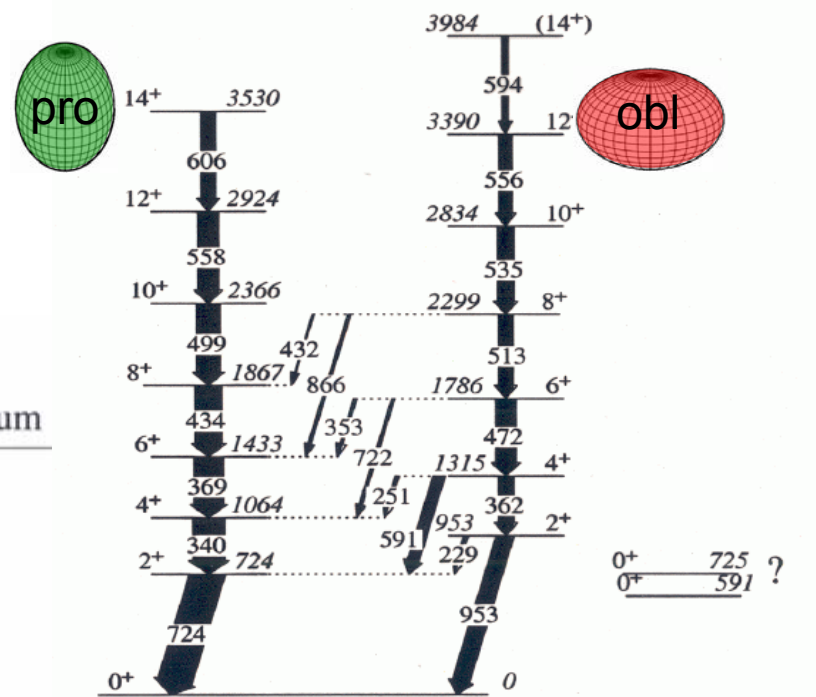
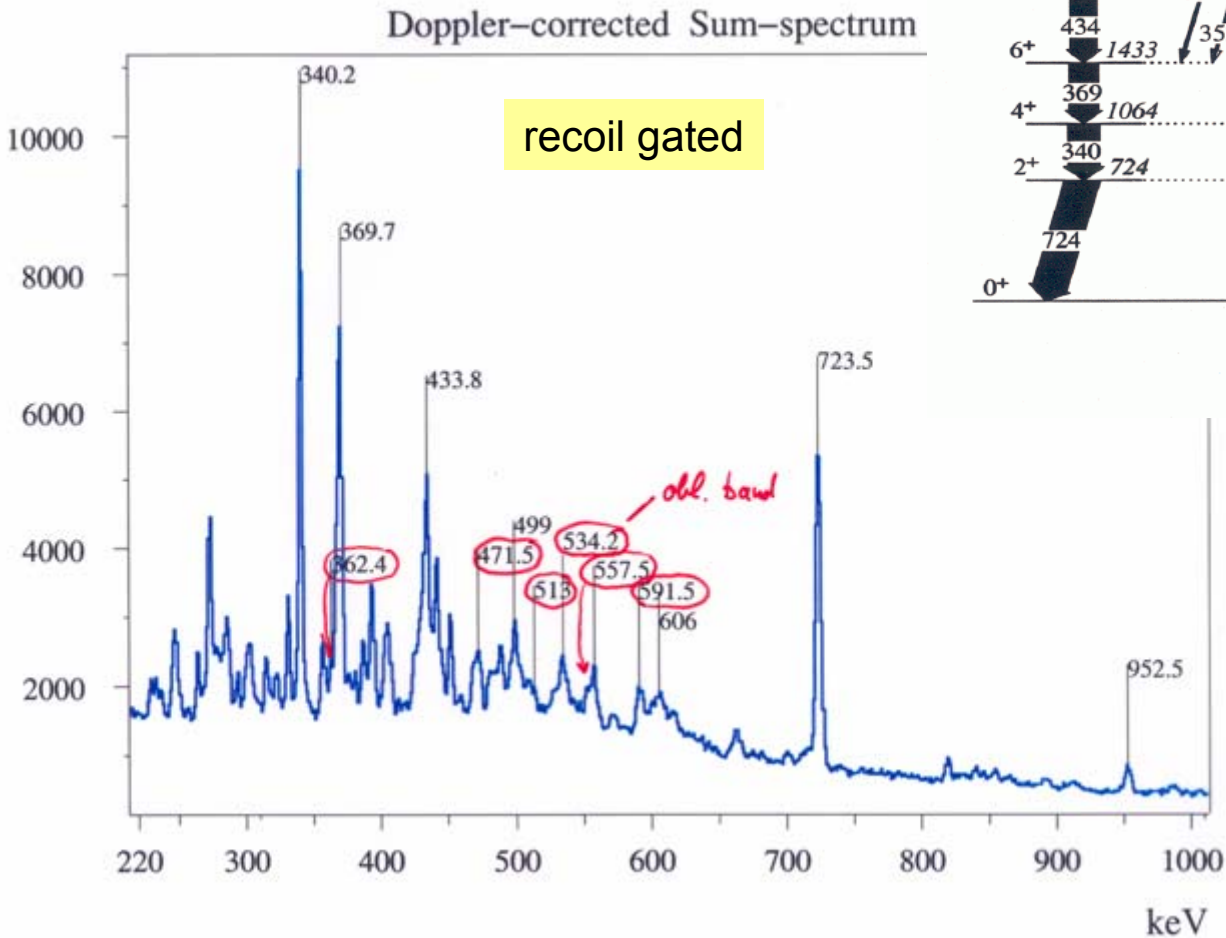
40 /min

30 /min

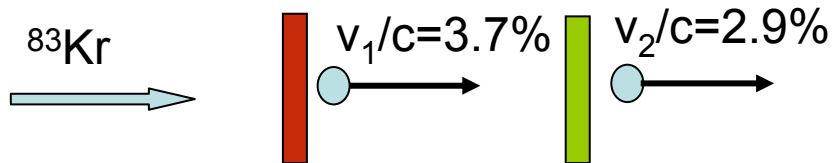
^{188}Pb

$^{108}\text{Pd}(^{83}\text{Kr}, 3n) ; 354 \text{ MeV};$

$\sigma = 500 \mu\text{b}$



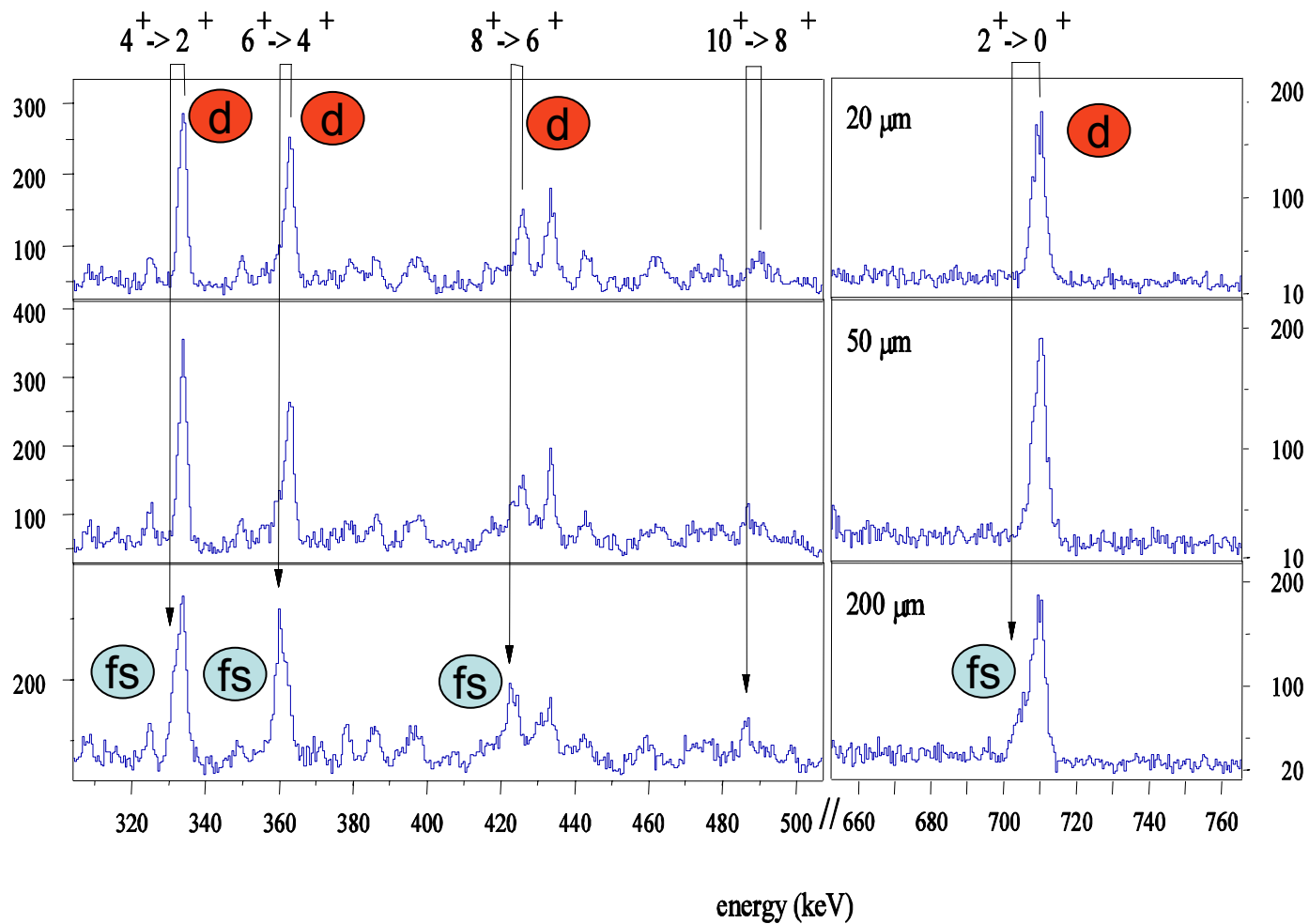
G.D. Dracoulis et al., 2003



^{108}Pd target

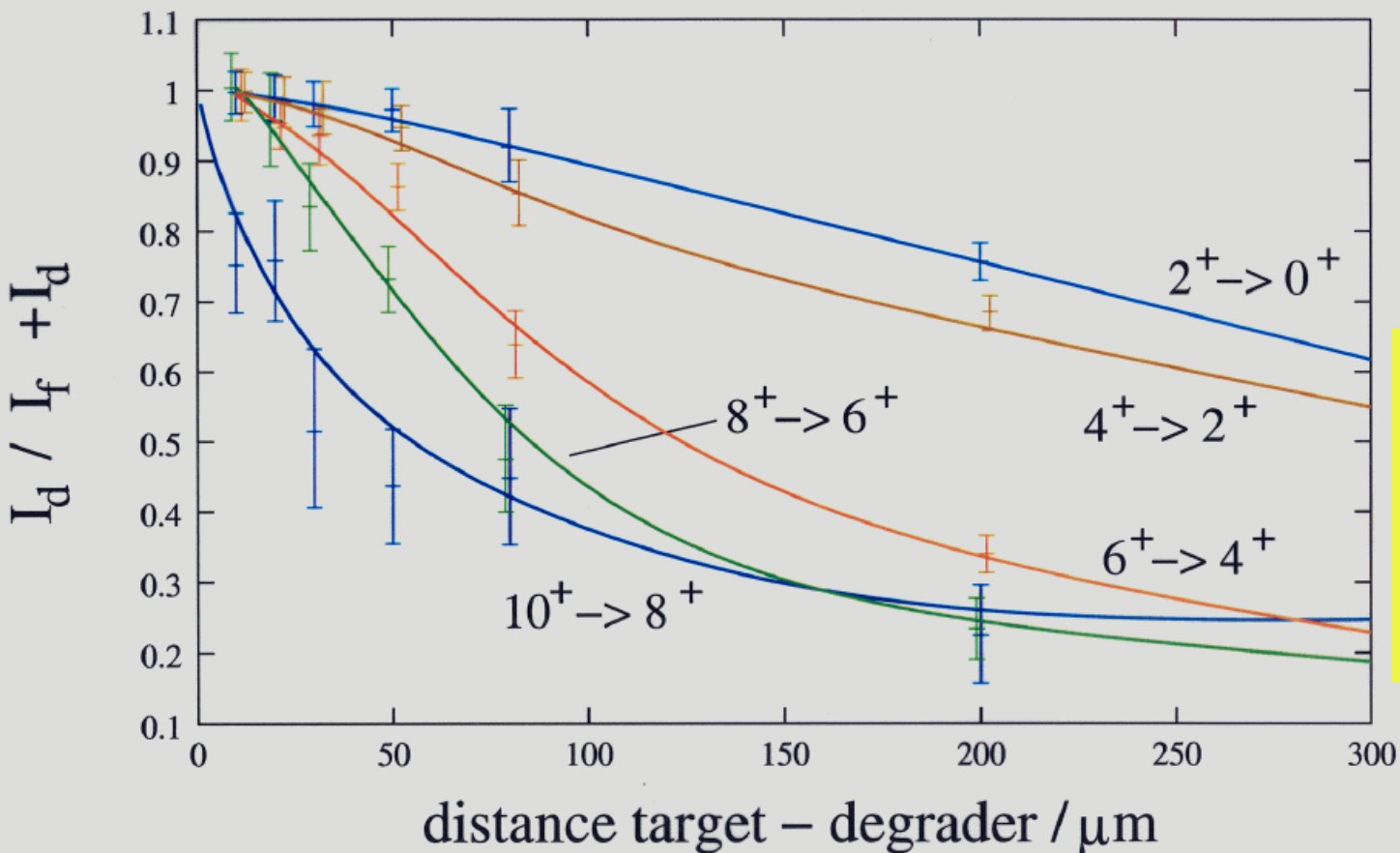
Au degrader / $2.5\text{mg}/\text{cm}^2$

Detector-Ring2; 133°



exp. decay curves

^{188}Pb



Results:

2^+ : 5-12 ps
 4^+ : 15.9 (10) ps
 6^+ : 4.0 (6) ps
 8^+ : 2.3 (4) ps

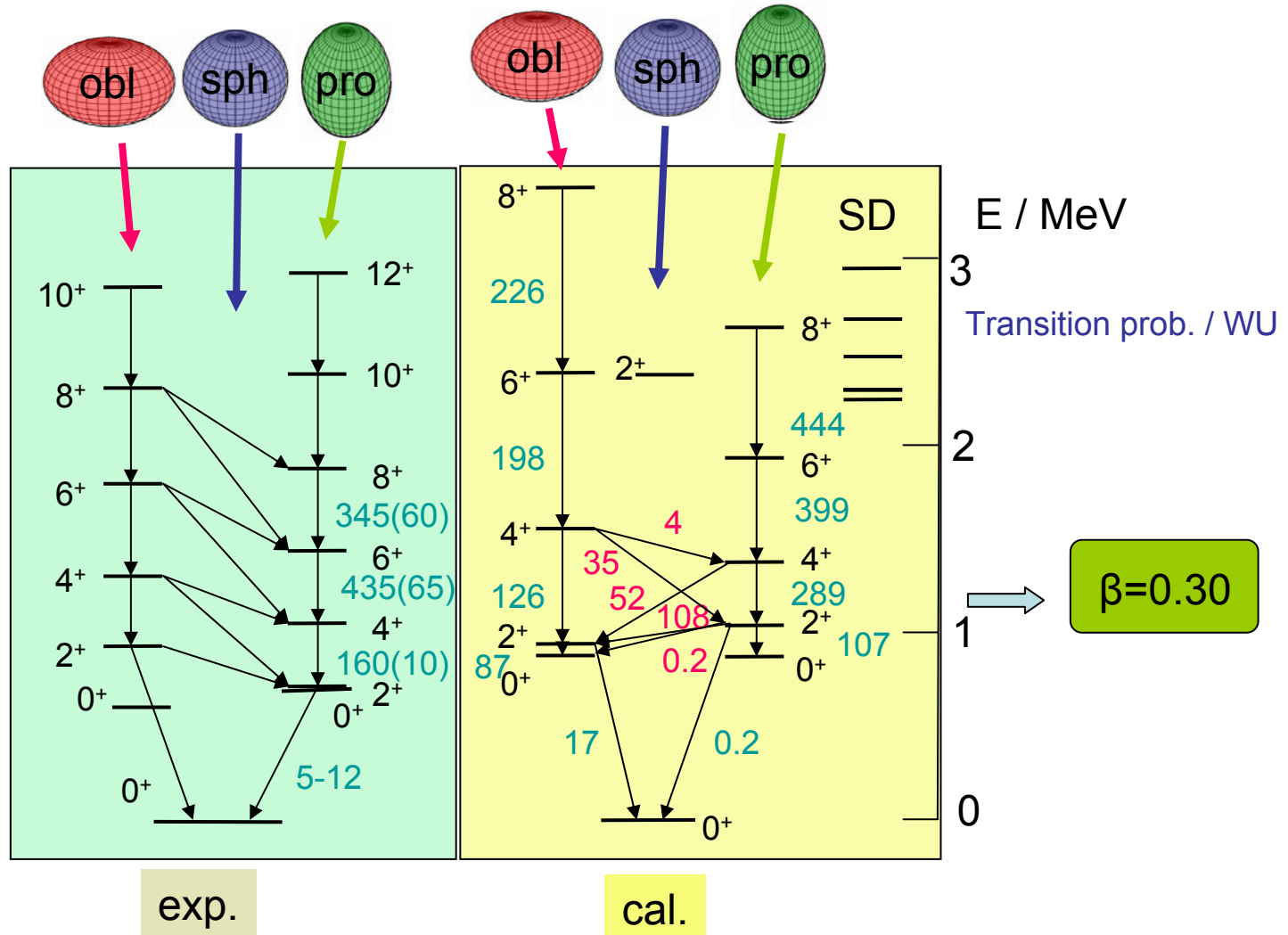
(Tuomas Grahn, JYFL, JYVÄSKYLÄ)

(Oliver Möller, IKP, Köln)

Hartree-Fock + BCS (Skyrme SLy6 interaction + density dependent zero-range pairing force)
 \Rightarrow configuration mixing of angular-momentum and particle-number projected self-consistent mean field states

(M. Bender, P. Bonche, T. Duguet, and P.H. Heenen, PRC 69, 2004, 064303)

^{188}Pb

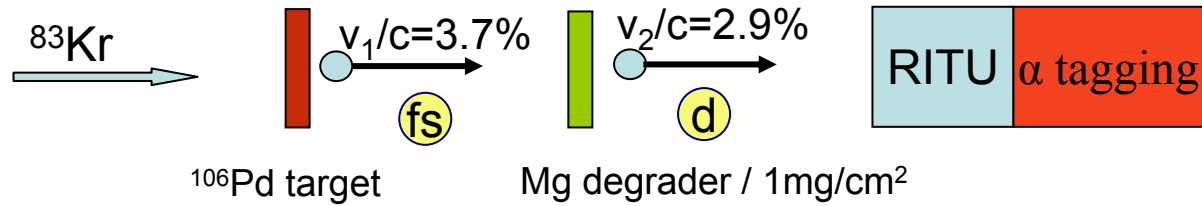


$\beta=0.286(14)$

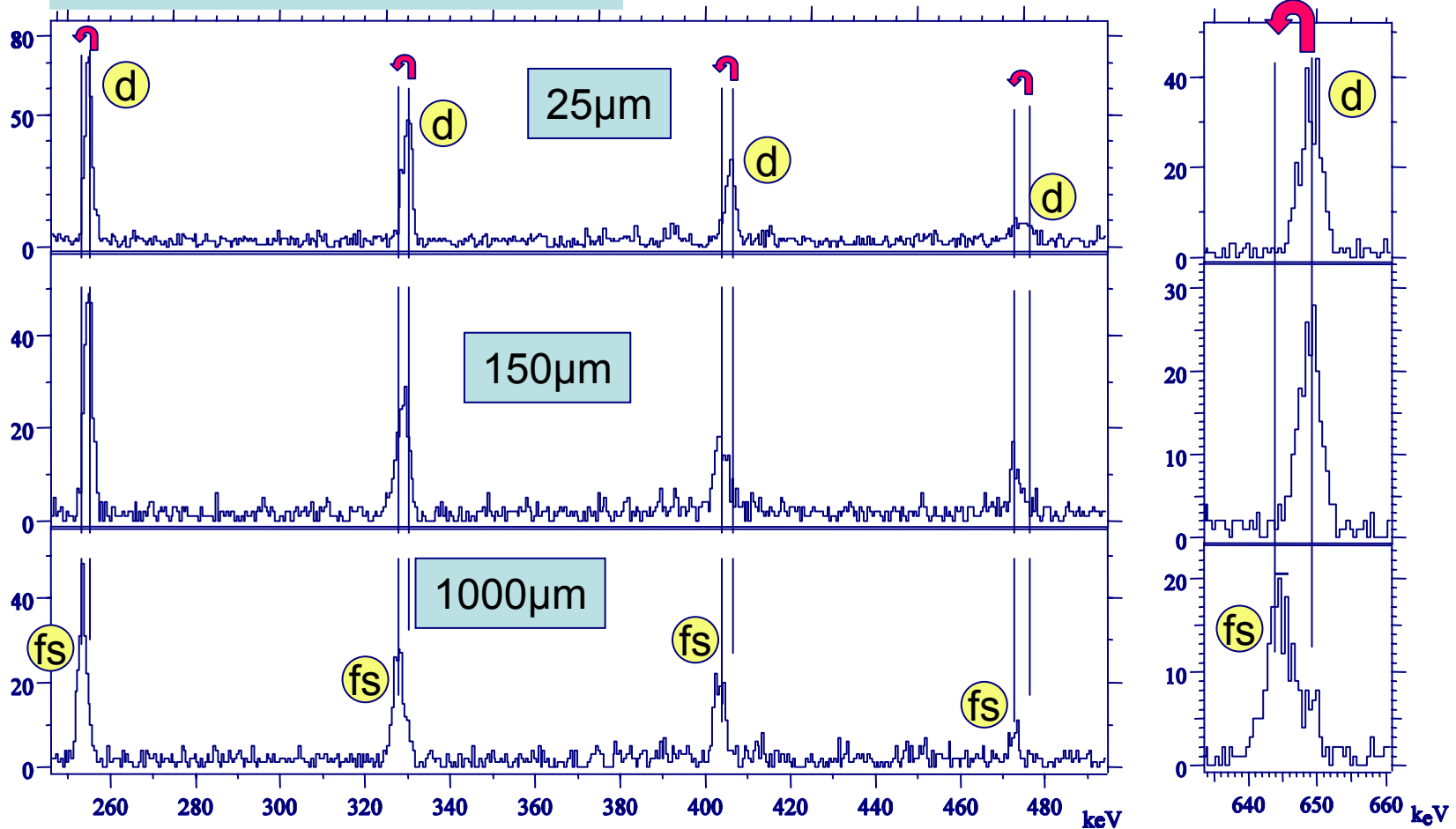
$\beta=0.30$

^{186}Pb

$^{106}\text{Pd}(^{83}\text{Kr},3n); 354 \text{ MeV}; \sigma = 140 \mu\text{b}$



recoil gated & α tagged spectra



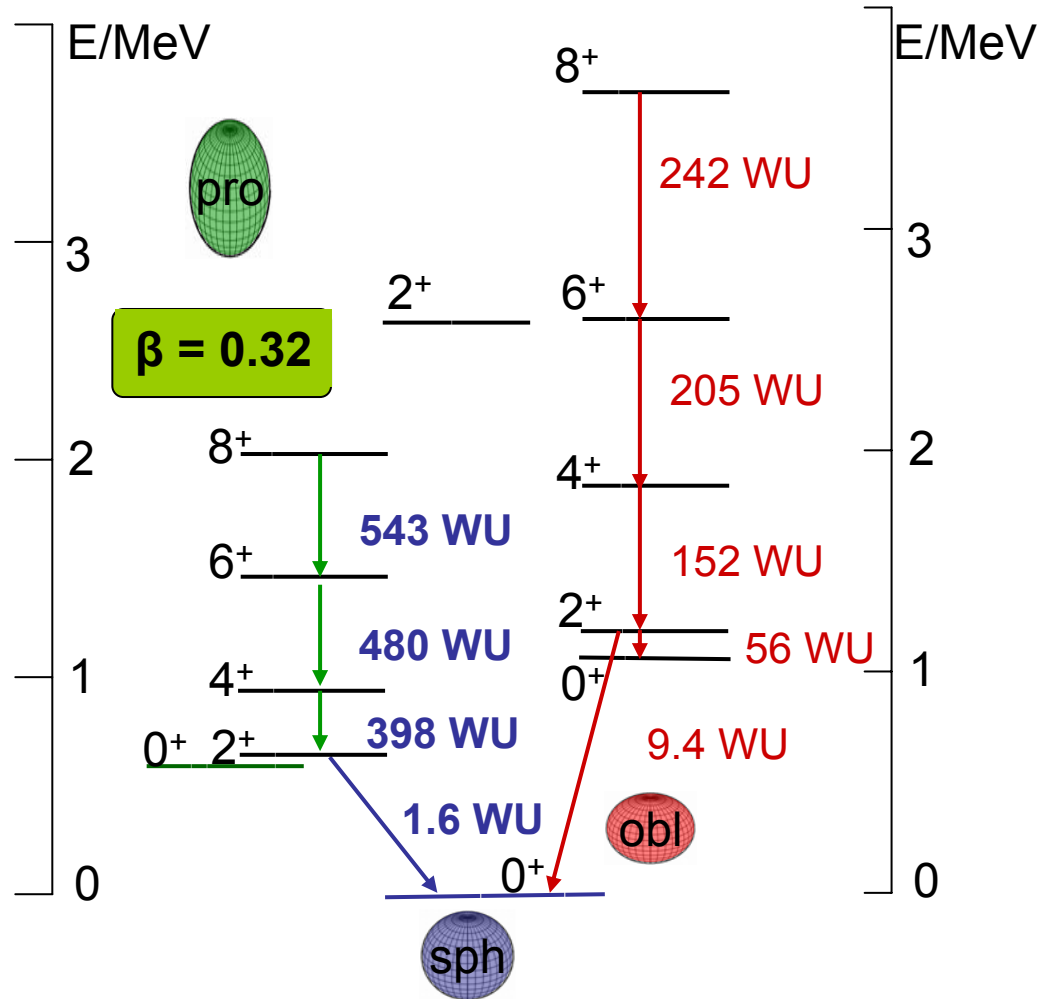
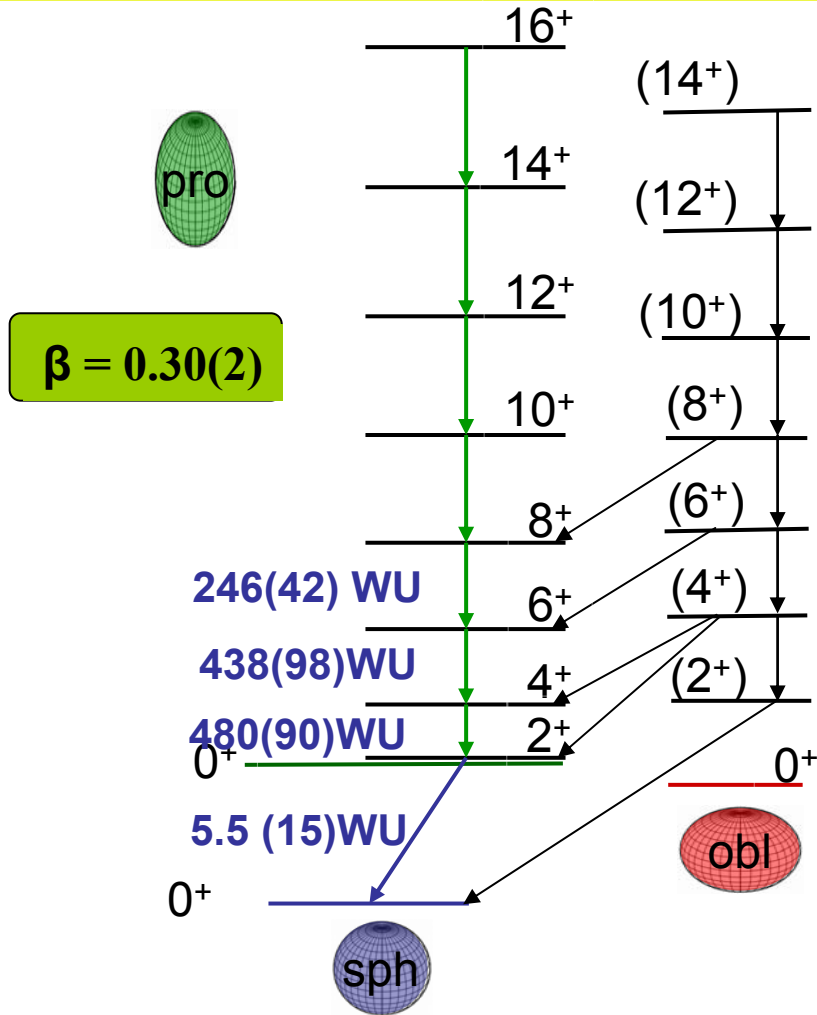
^{186}Pb

exp.

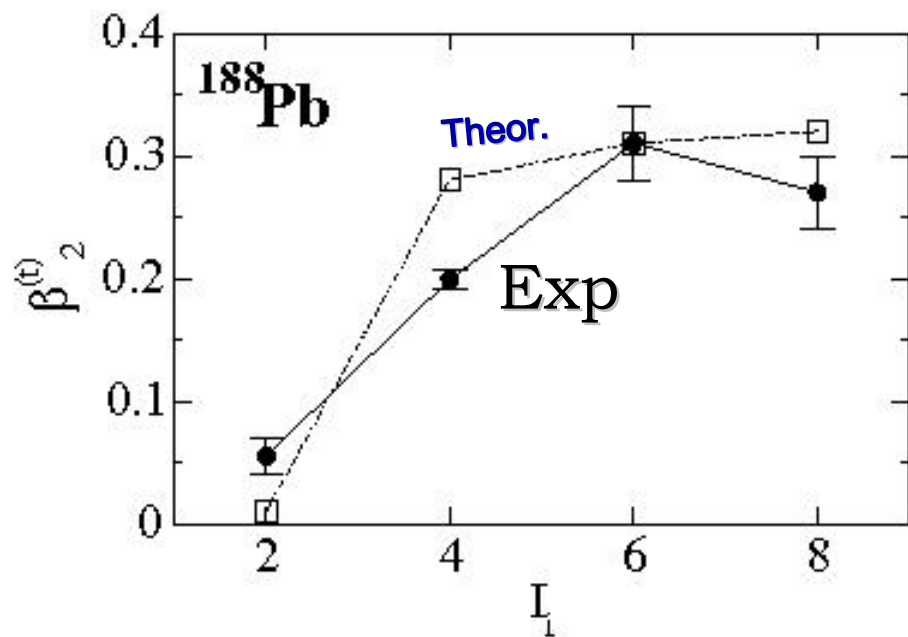
cal.

conf. mix of mean field states (Skyrme intera. SLy6)

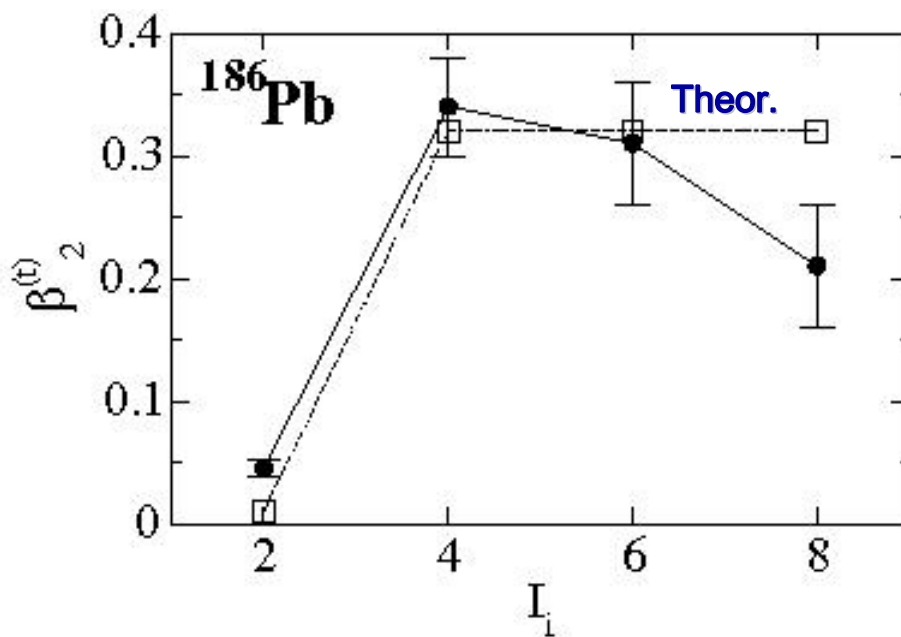
M. Bender et al. PRC 69 (2004), 064303 & privat com.



BEYOND-MEAN-FIELD CALCULATIONS BY BENDER ET AL. VS. THE NEW EXP. DATA

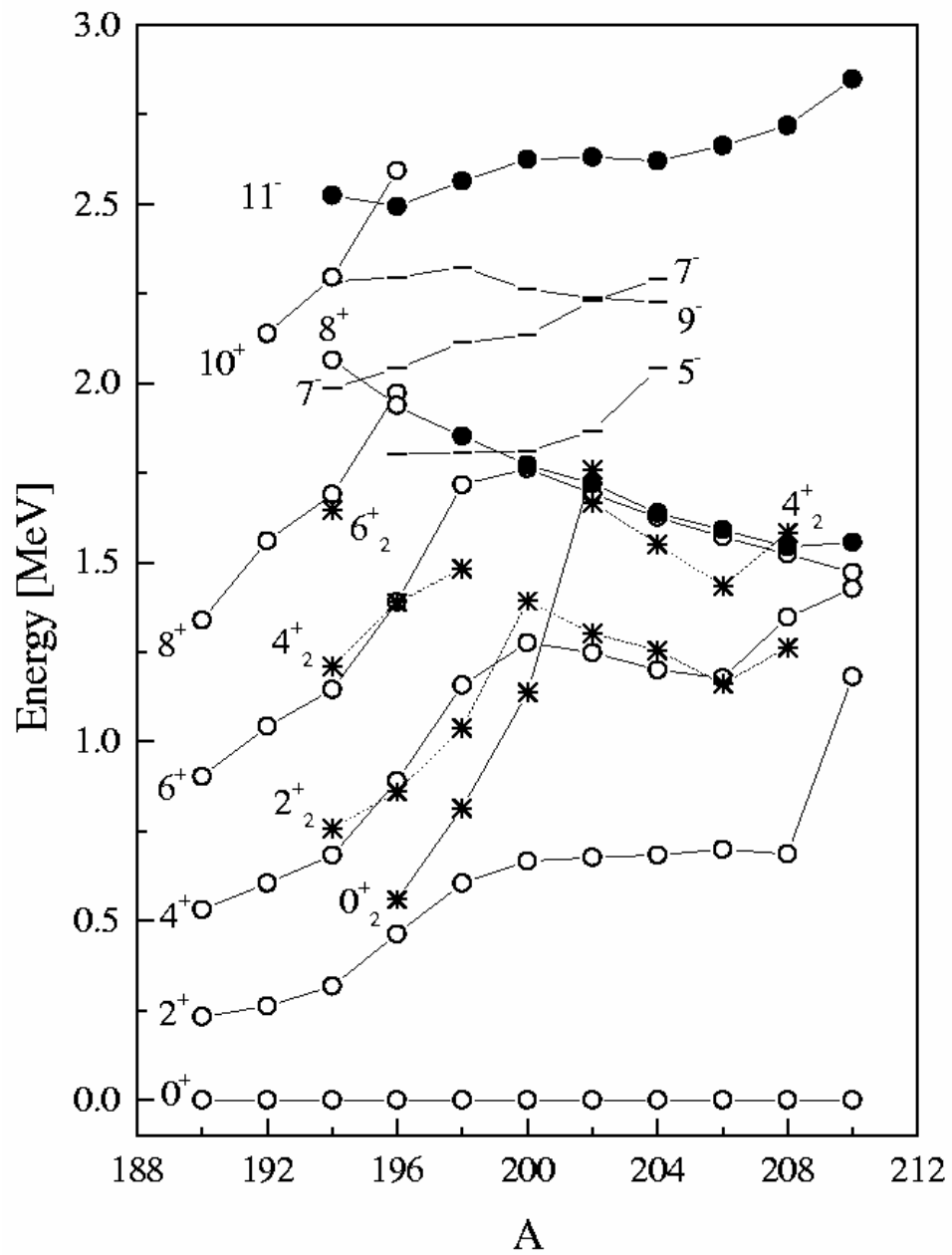


2^+ state: $a_{\text{pro}}^2 = .42$



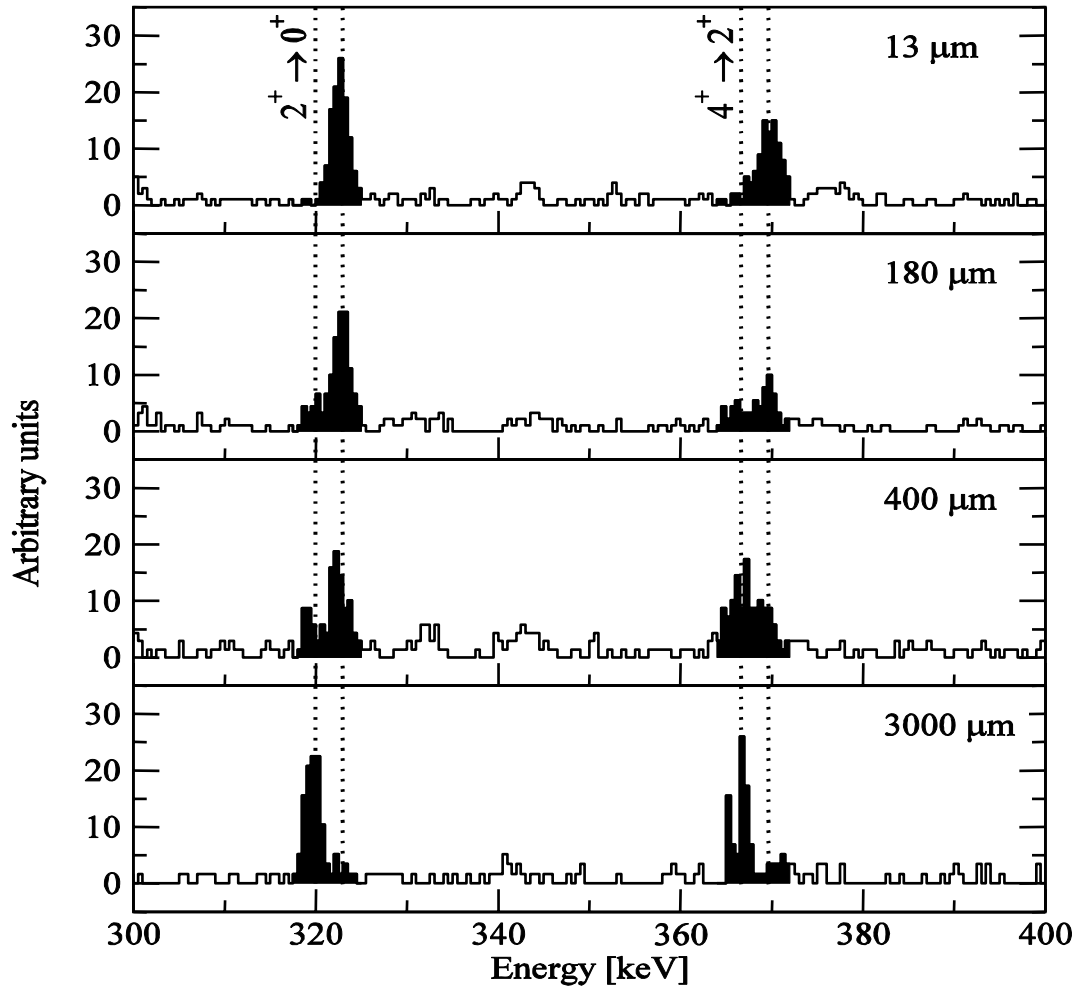
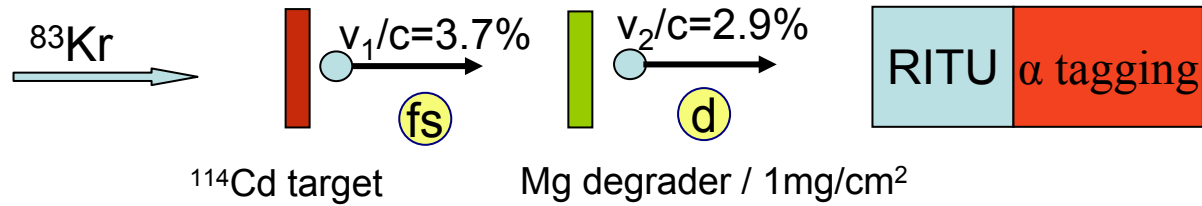
2^+ state: $a_{\text{pro}}^2 \approx 1$

Po



^{194}Po

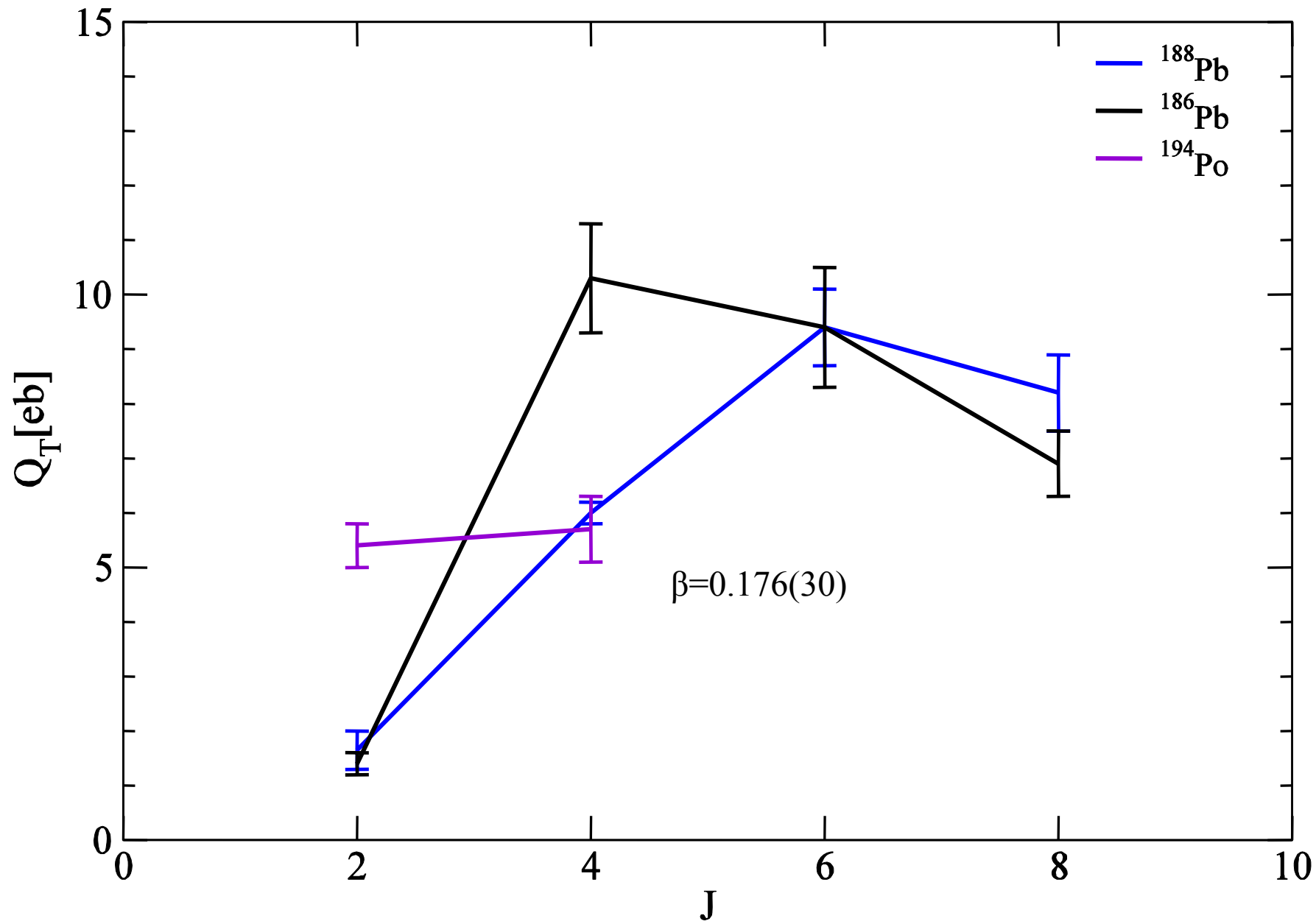
$^{114}\text{Cd}(^{83}\text{Kr},3n); 377\text{ MeV}$

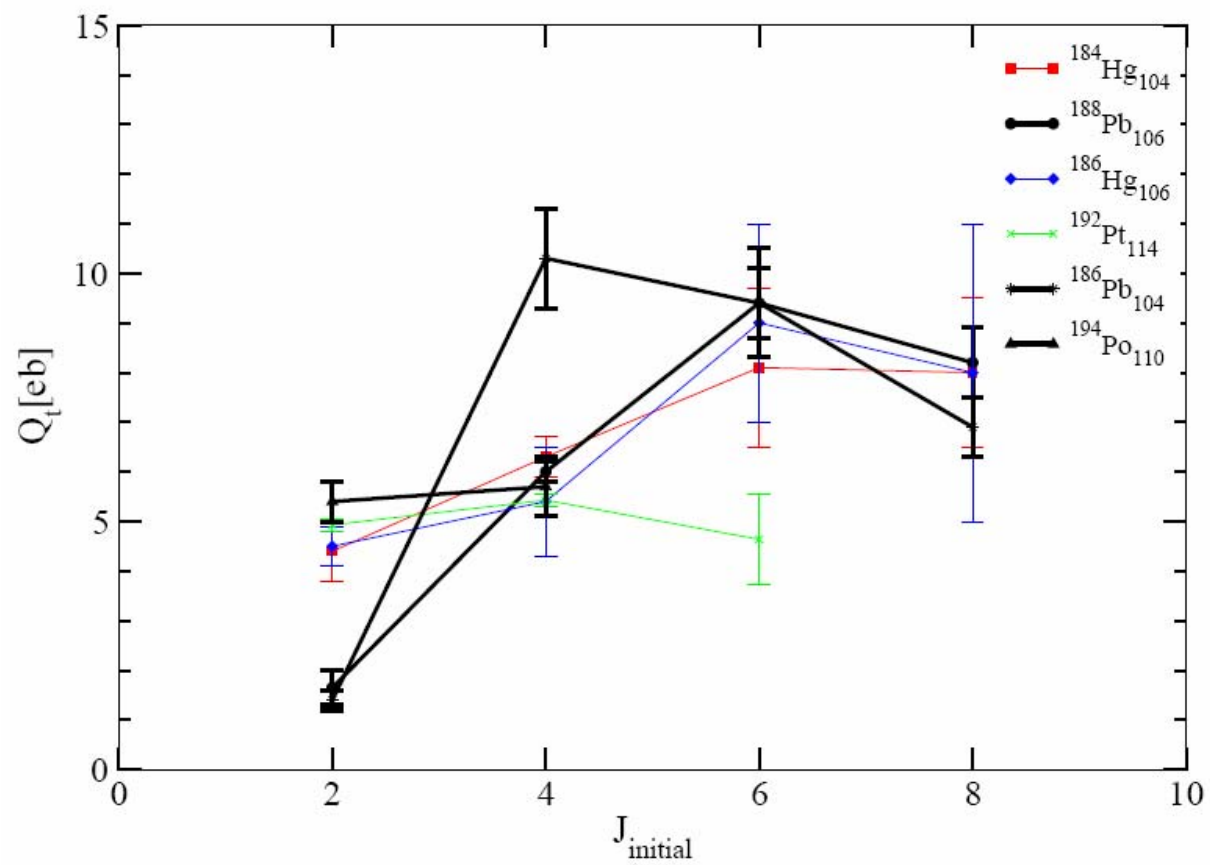


T. Grahn, Jyväskylä

2^+ : 38 ps
 $B(E2) = 88(13)\text{ Wu}$
 $Q_t = 5.4(4)\text{ eb}$

4^+ : 12.5 ps
 $B(E2) = 138(28)\text{ Wu}$
 $Q_t = 5.7(6)\text{ eb}$





Summary

Investigation of shape coexistence in $^{188,186}\text{Pb}$ nuclei
using absolute transition probabilities

First experimental determination of the deformation of the prolate
bands in ^{188}Pb and ^{186}Pb :

^{188}Pb : $\beta = 0.286(14)$

^{186}Pb : $\beta = 0.30(2)$

2_1^+ state : $a_{\text{pro}}^2 = 0.42$

2_1^+ state : pure prolate state

Good agreement with HFB calculations both, with Gogny or Skyrme

^{194}Po : $\beta = 0.176(30)$; 2^+ and 4^+ dominant oblate structure

Collaboration:

Universität zu Köln

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University Jyväskylä

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C.W. Beausang, D.A. Meyer

Daphnia/SPhN, CEA, Saclay

W. Korten, A. Görgen, Y. Le Coz

University of Liverpool

R. D. Page

Relativistic plunger after fragmentation and intermediate energy coulex

K. Starosta et. al NSCL/MSU

A.Dewald et al. IKP/Köln

CCF +

A1900 +

Diamond detector +

Plunger +

SeGA +

S800



Plunger + SEGA @ S800

