Coulomb excitation of neutron-rich ^{44}Ar at SPIRAL

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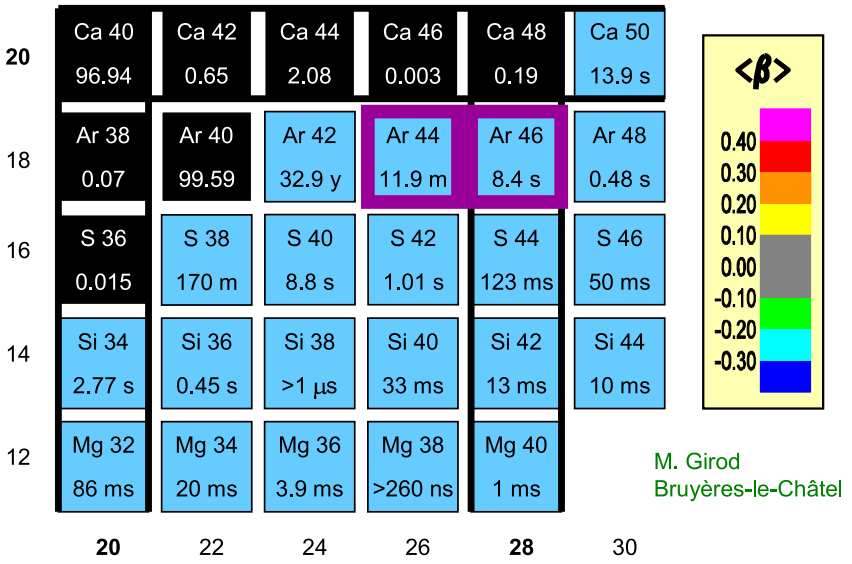
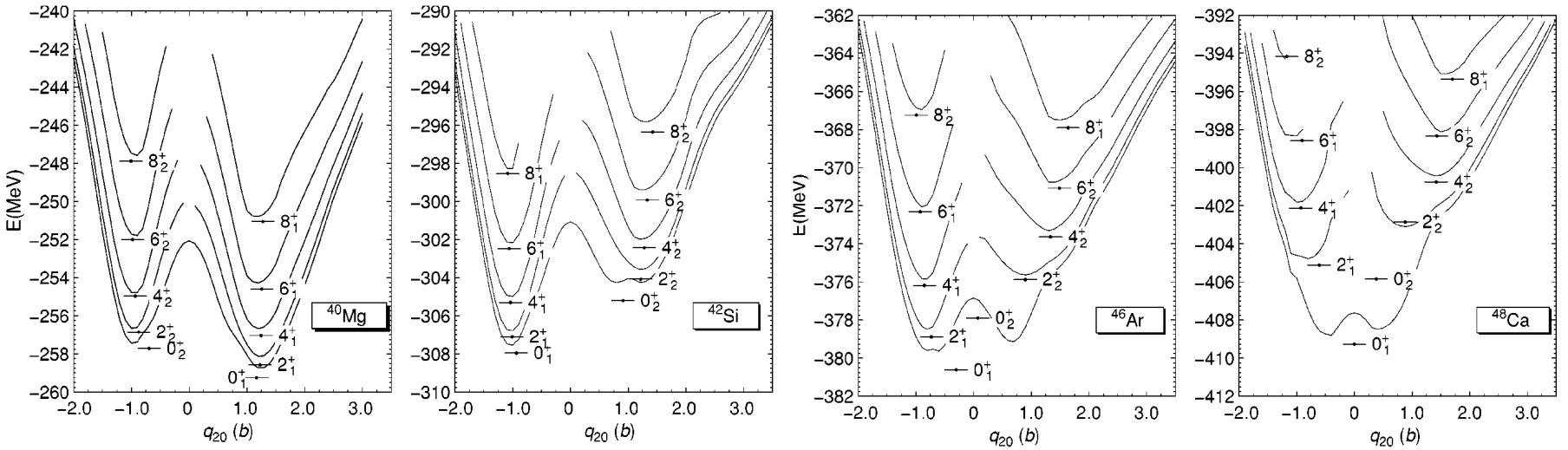
Motivation

- evolution of the N=28 shell closure below ^{48}Ca
- possible shape coexistence





angular momentum projected generator coordinate method

R. Rodríguez-Guzmán et al., Phys. Rev. C 65, 024304 (2002)

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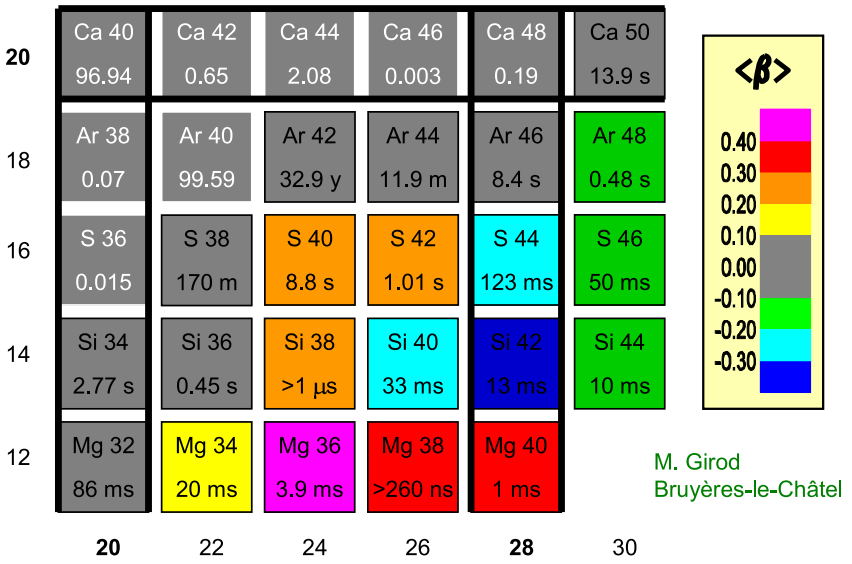

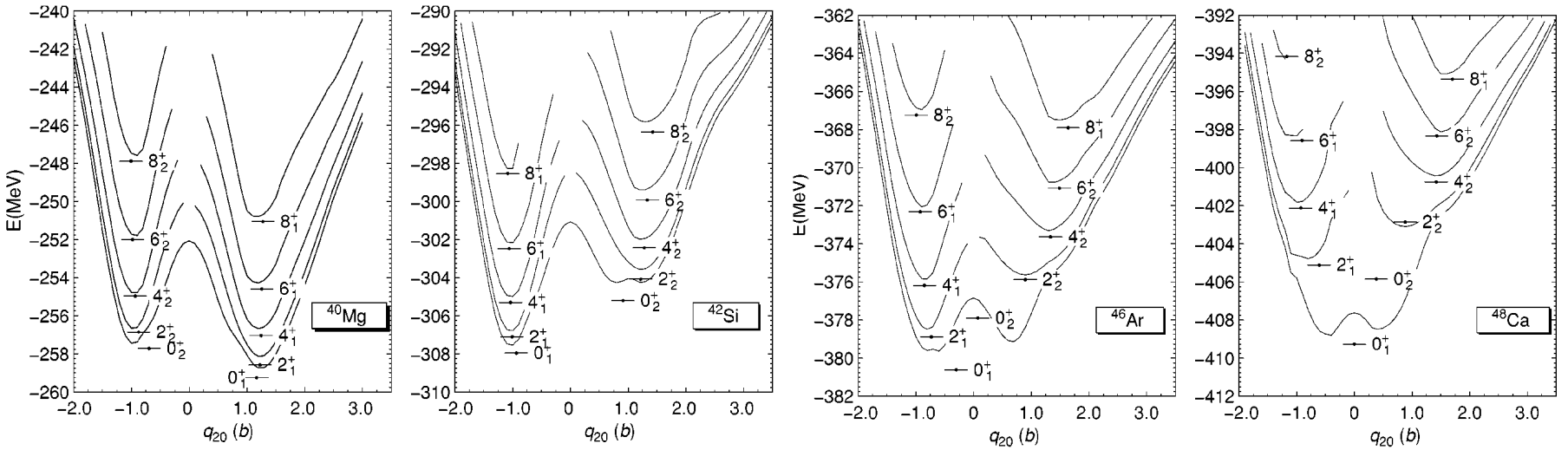

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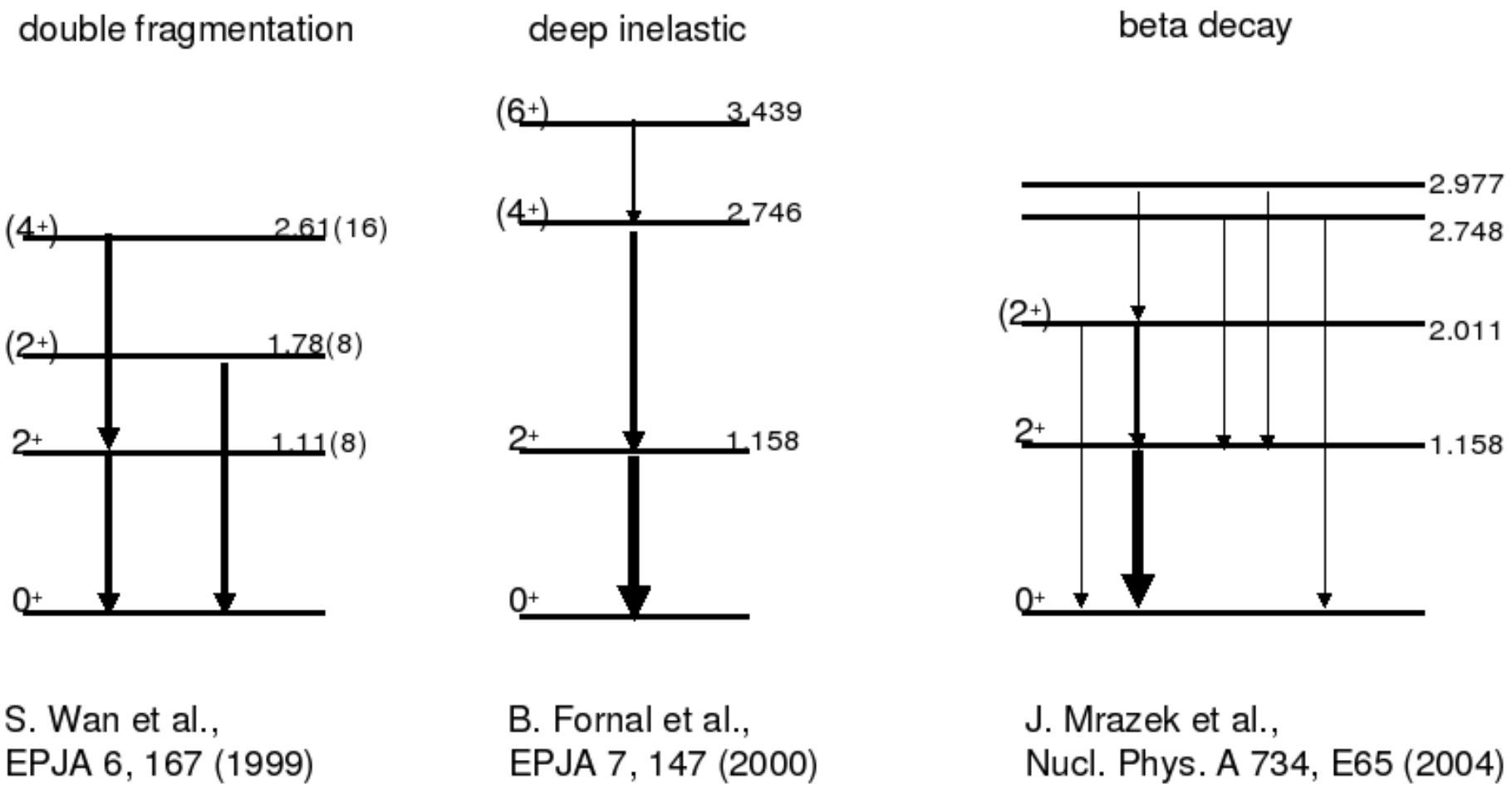
Spectroscopic data on ^{44}Ar



S. Wan et al.,
EPJA 6, 167 (1999)

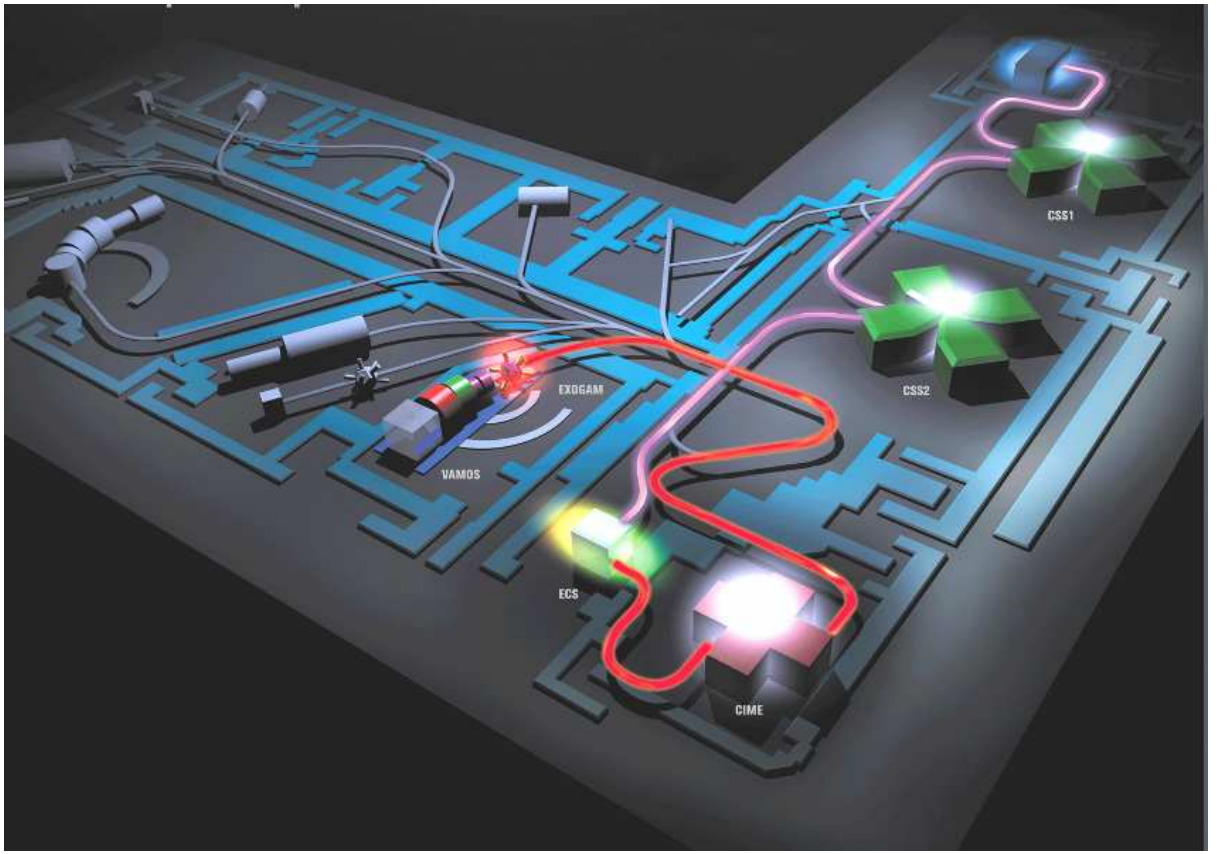
B. Fornal et al.,
EPJA 7, 147 (2000)

J. Mrazek et al.,
Nucl. Phys. A 734, E65 (2004)

- $B(E2;2^+ \rightarrow 0^+) = 345\ (41)\ e^2fm^4$

intermediate energy Coulex, Scheit et al., Phys. Rev. Lett. 77, 3967 (1996)

Beams and targets

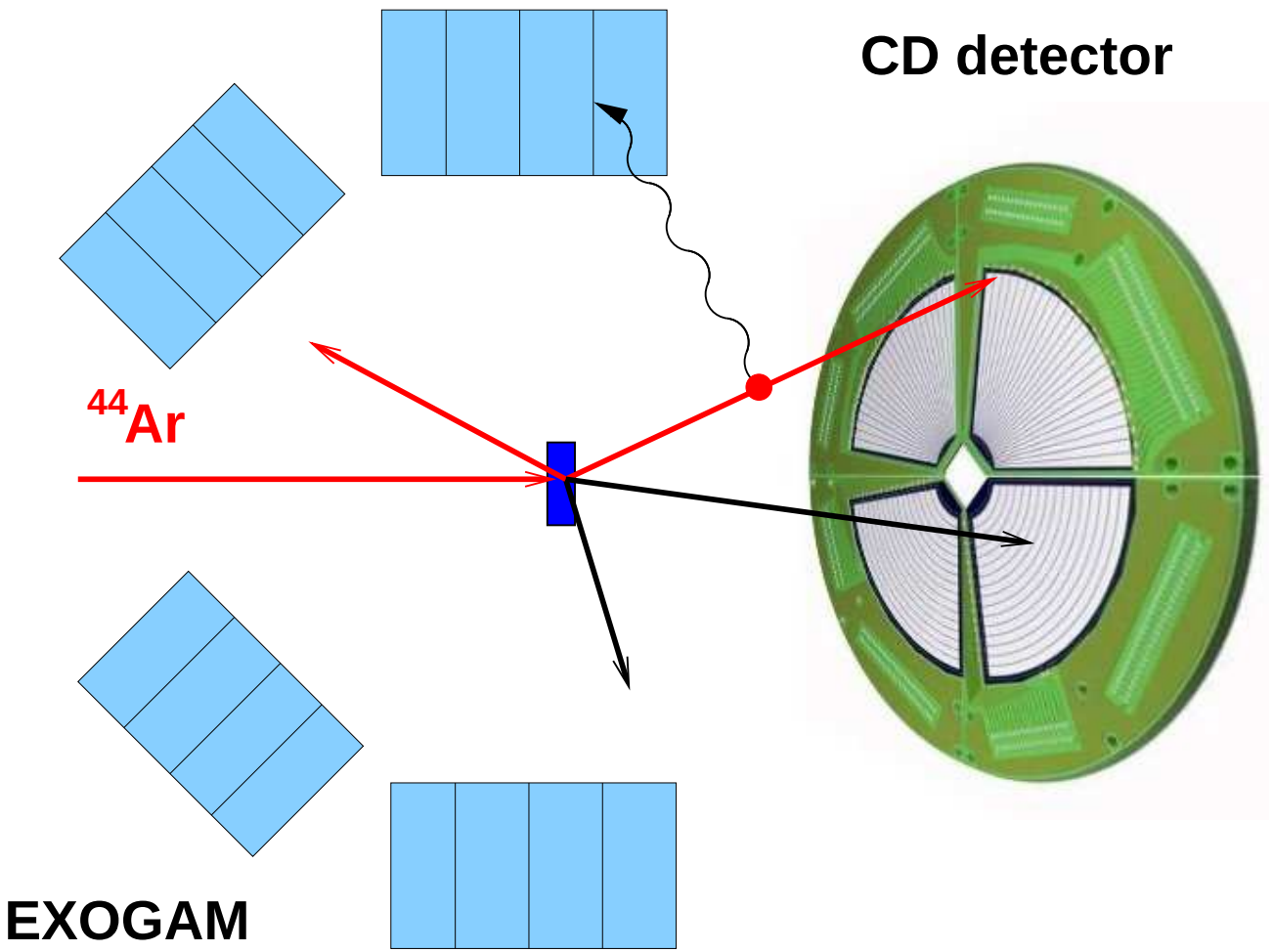


- Primary beam: ^{48}Ca
60 MeV/A,
3.5 μA (nearly 600W)

- Secondary beam: ^{44}Ar

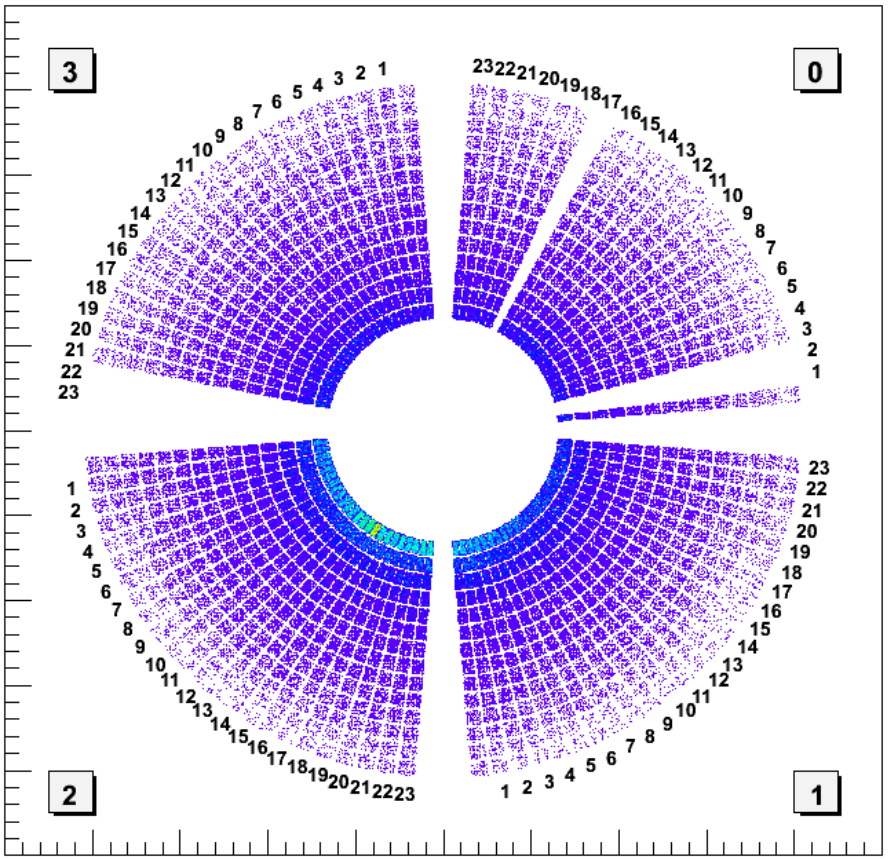
Beam energy	Beam intensity	Target	Target thickness	Duration
3.68 MeV/A	$2.4 \cdot 10^5$ pps	^{208}Pb	1 mg/cm^2	13 UT
2.68 MeV/A	$2.0 \cdot 10^5$ pps	^{109}Ag	0.9 mg/cm^2	8 UT

Experimental setup

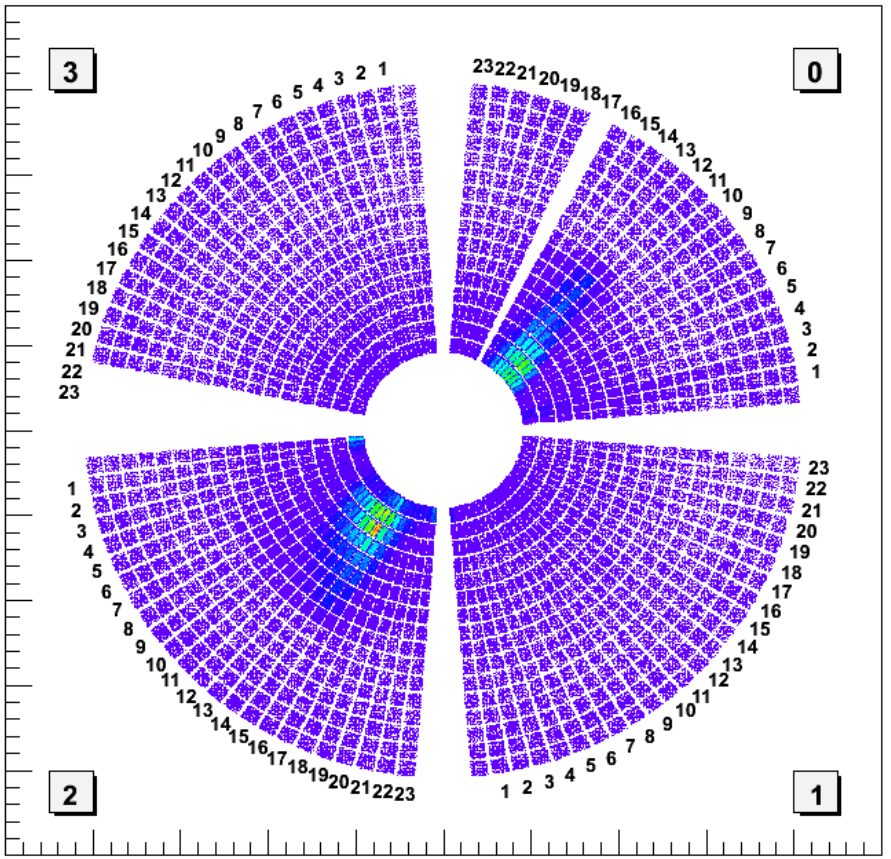


- 10 segmented clovers in EXOGAM (13% efficiency at 1.3 MeV)
- highly segmented particle detector: 96 strips, 16 rings

Events distribution in CD

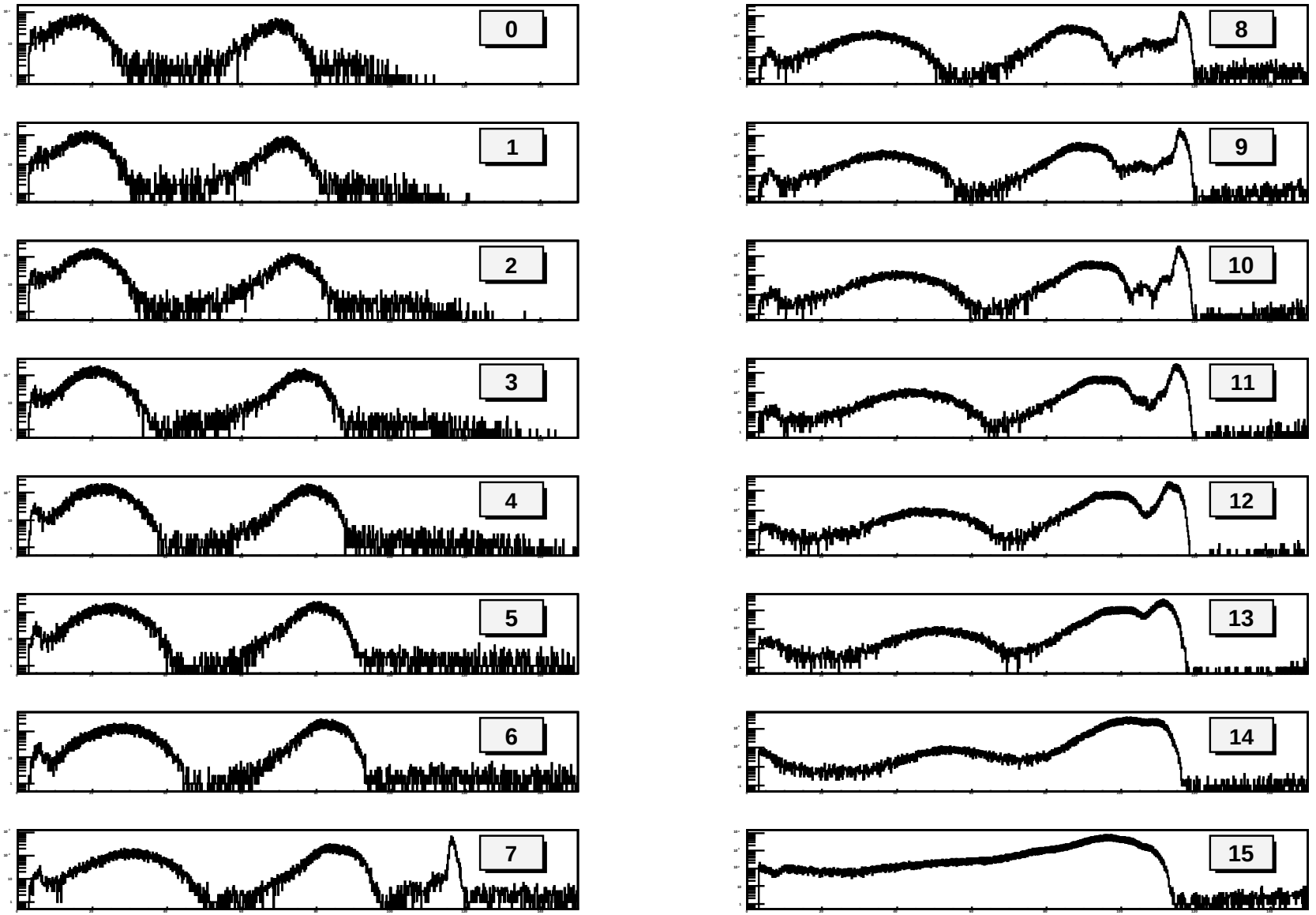


scattered beam



direct beam

Recoil and scattered beam identification



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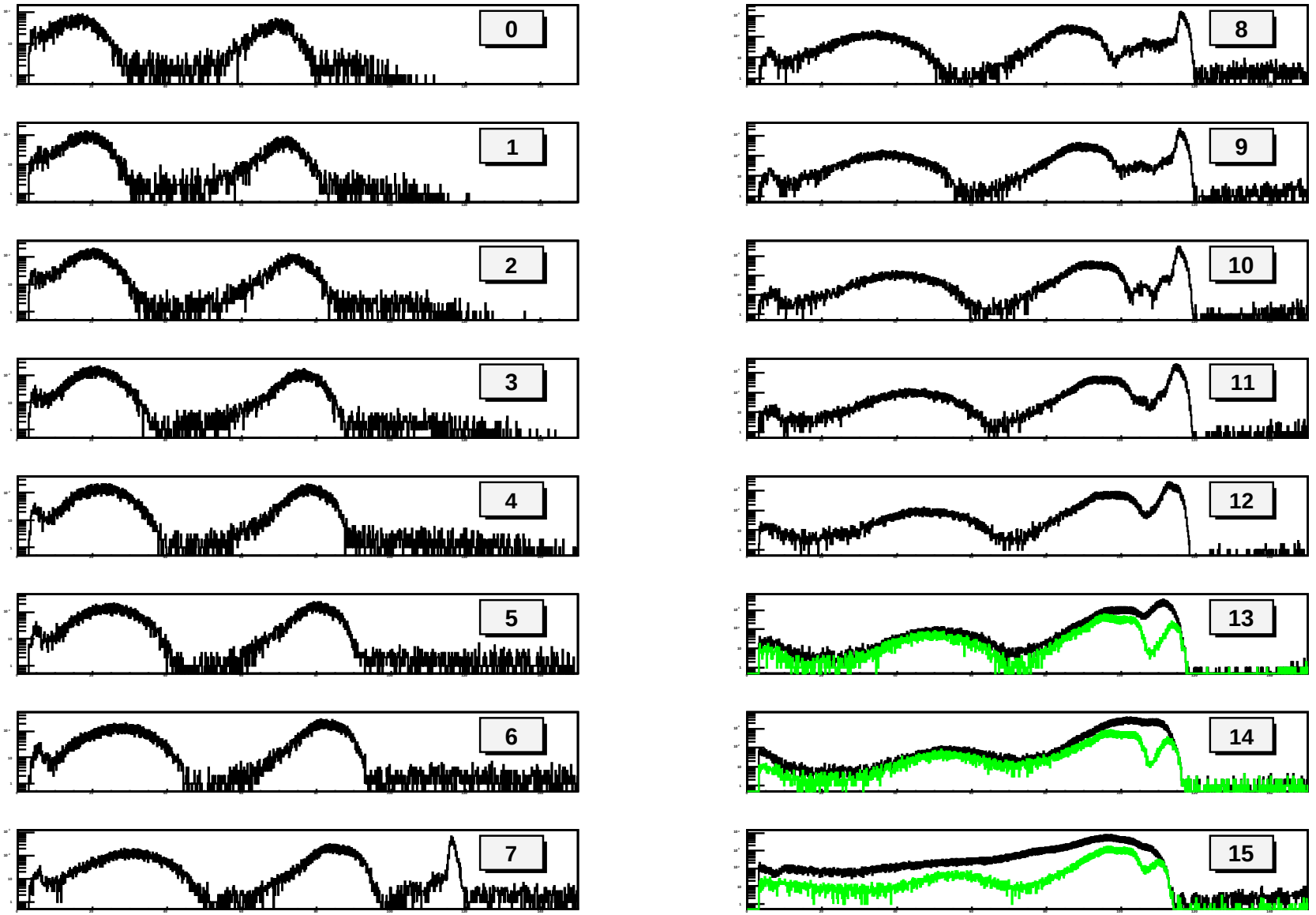
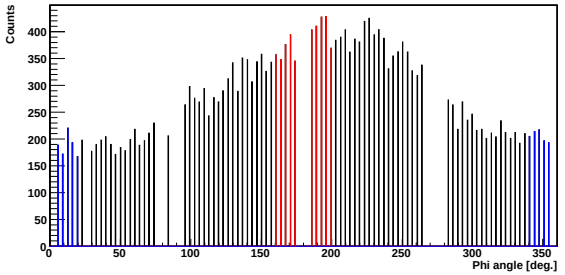
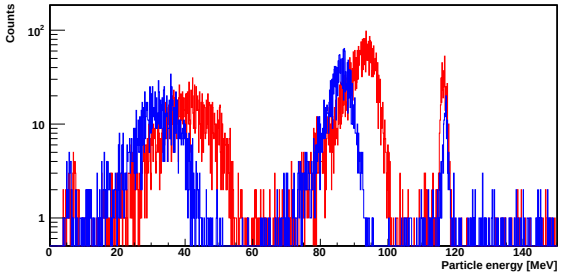
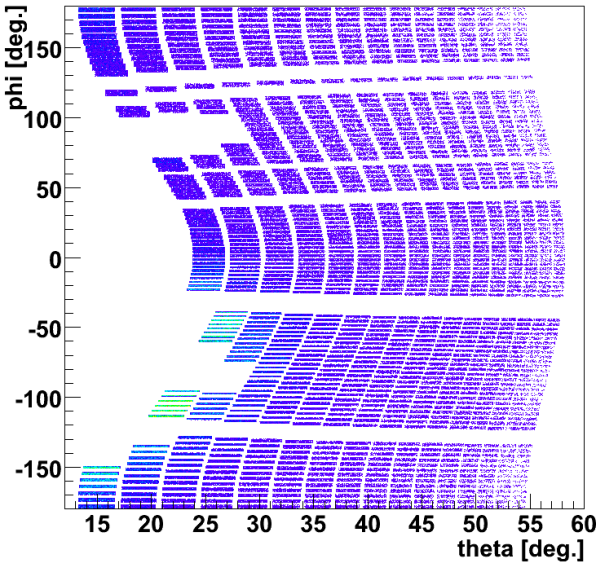
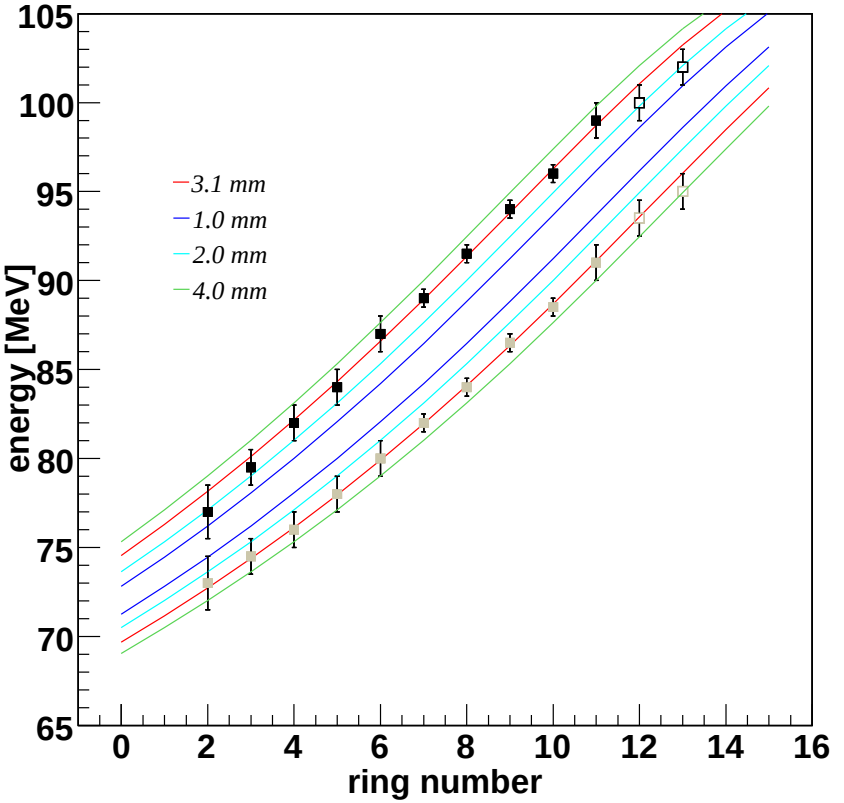


Estimation of displacement based on particle energy



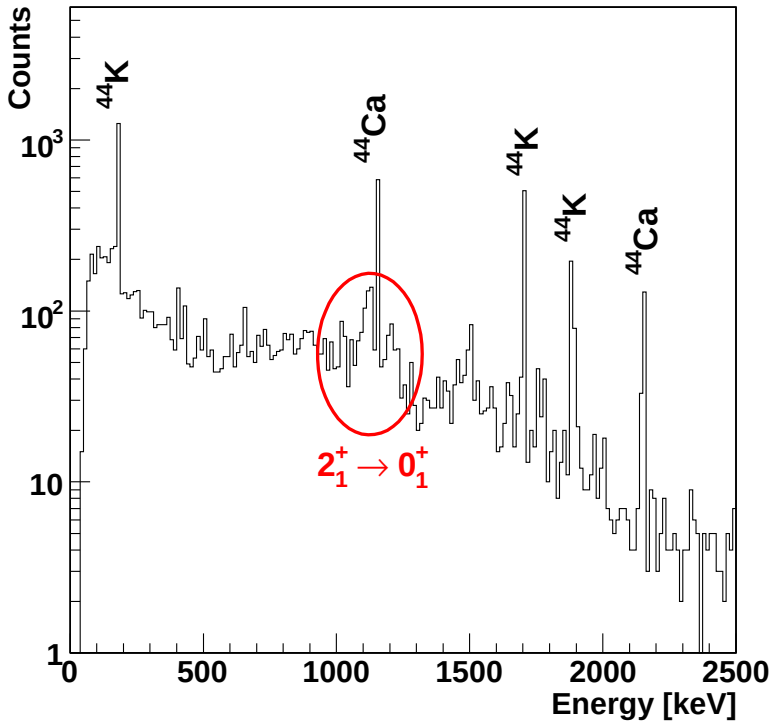


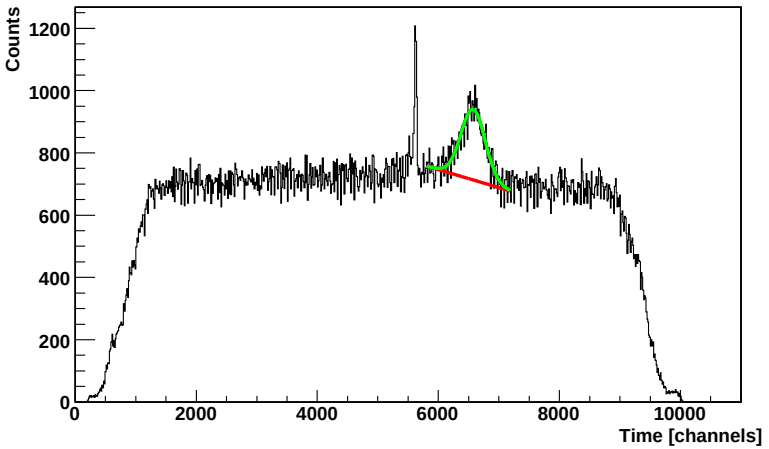


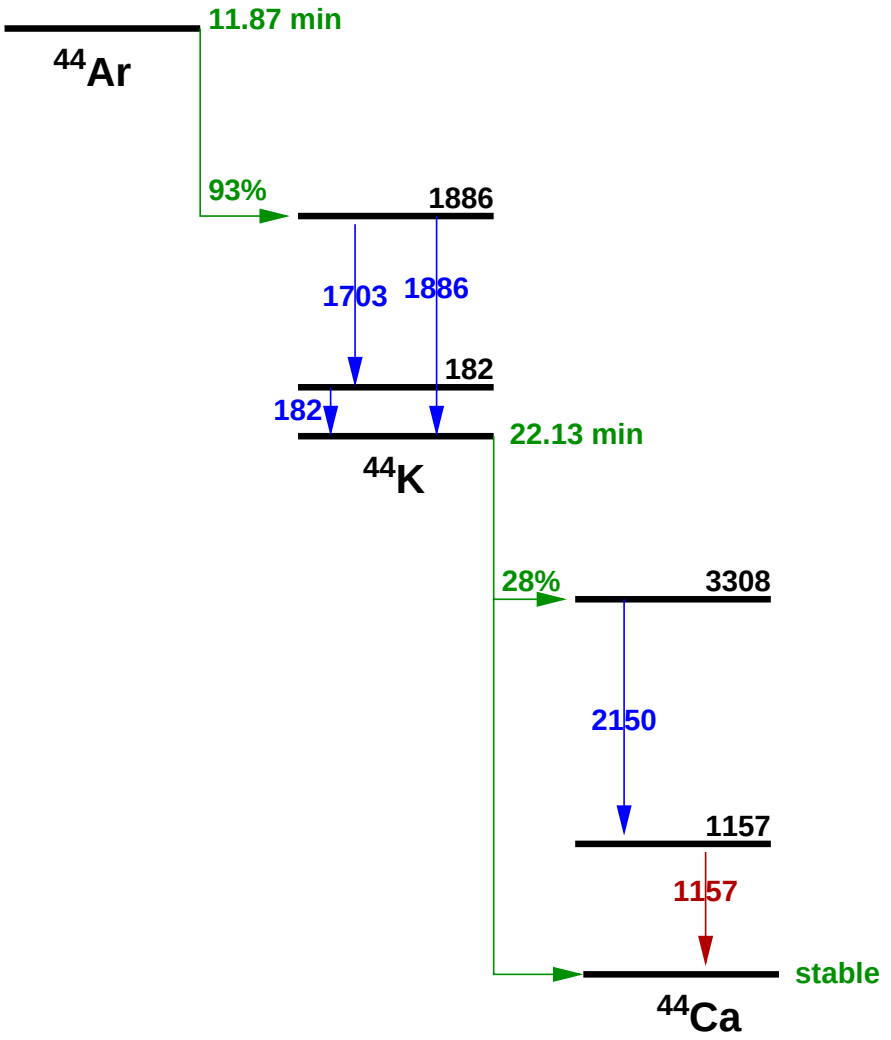


- estimation confirmed by Doppler correction
- complicated shape of the detector due to
  - its displacement
  - necessity of excluding from the analysis parts hit by the direct beam

Background from beta-decay

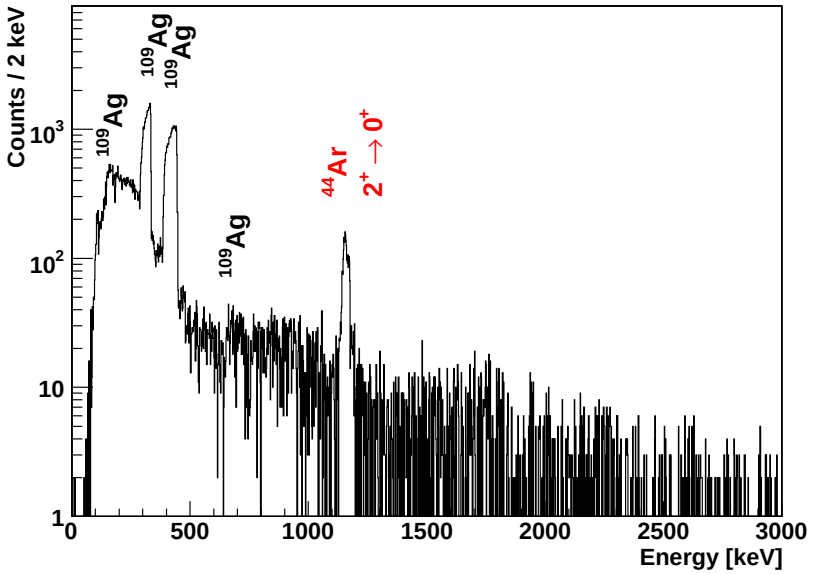




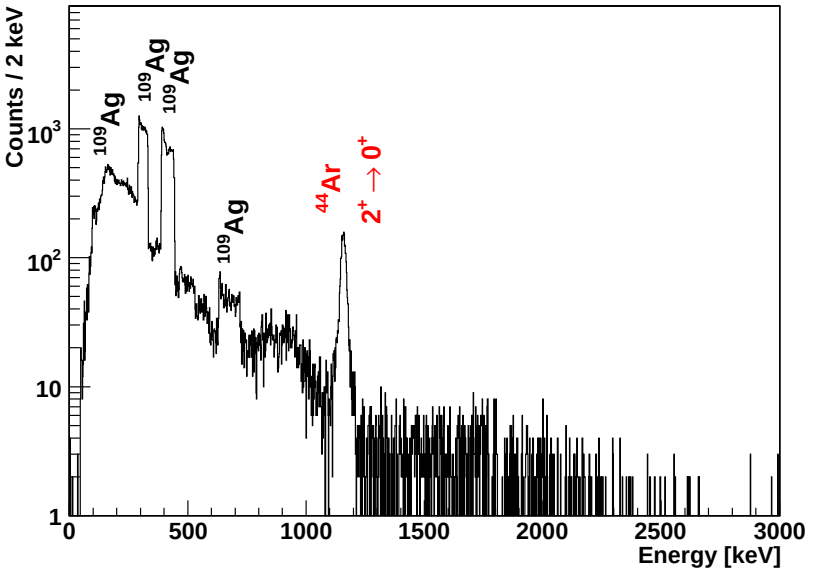


Results from the ^{109}Ag target

^{109}Ag target, projectile detected



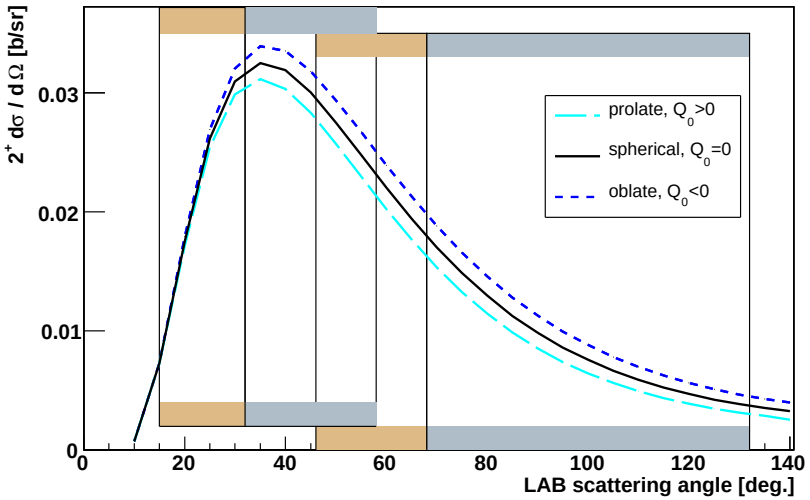
recoil detected

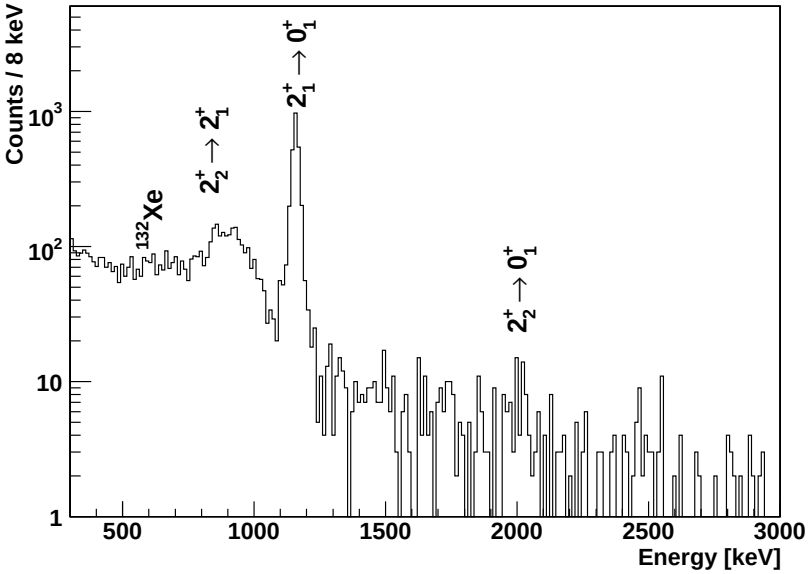


- statistics sufficient to subdivide the data into several angular ranges:
  - $\sim$4300 counts in the $2_1^+ \rightarrow 0^+$ line (1158 keV)
  - $\sim$50 counts in the $2_2^+ \rightarrow 2_1^+$ line (852 keV)
  - for normalization: more than 50 000 counts in 310 keV and 415 keV lines in ^{109}Ag

Extraction of E2 matrix elements

^{208}Pb target, recoil detected

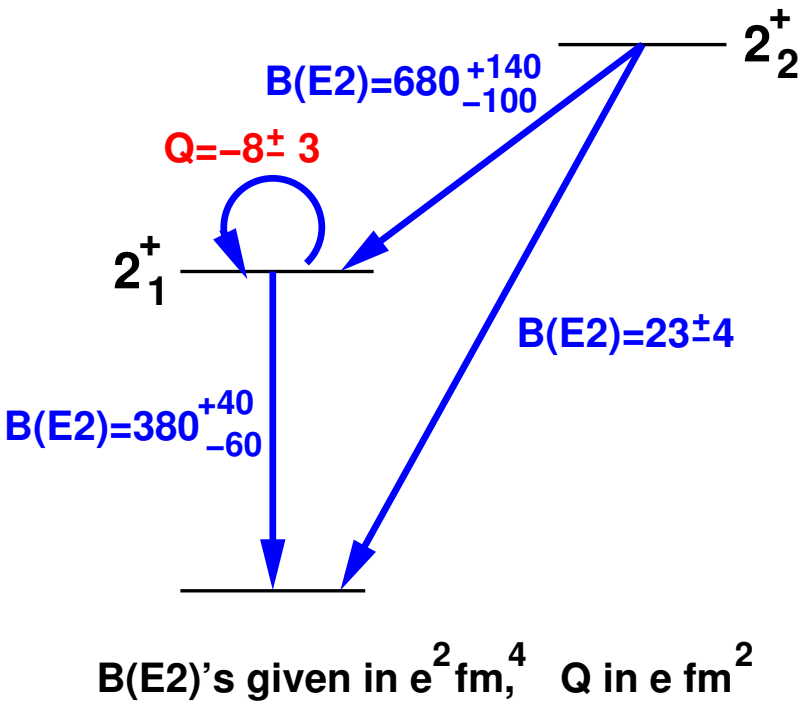




- lowest angular range – influence of quadrupole moment negligible $\rightarrow$ determination of B(E2;$2_1^+ \rightarrow 0^+$)
- information from other bins + data collected on Pb target $\rightarrow$ determination of quadrupole moment of the 2_1^+ state and other B(E2)'s
- relative normalization of the bins based on target excitation
- angular ranges chosen to obtain maximum sensitivity to the quadrupole moment

Results

- B(E2;$2_1^+ \rightarrow 0^+$) in agreement with the result from intermediate energy Coulex (345 (41) e^2fm^4)
- quadrupole moment of the 2_1^+ state measured with precision of 35%
- B(E2;$2_2^+ \rightarrow 2_1^+$) and B(E2;$2_2^+ \rightarrow 0^+$) measured with precision of 20%



- future plans:
  - complementary g-factors (and B(E2)) measurement in ^{42,44,46}Ar (A. Stuchbery *et al.*, accepted at MSU)
  - low-energy Coulomb excitation of ^{46}Ar ?

GOSIA Workshop !!!

WHY?
to discuss problems with GOSIA analysis and possible code developments

WHERE?
at Heavy Ion Laboratory, Warsaw, Poland

WHEN?
in March 2008 (probably 10-12 March - to be announced soon)

Contact persons:

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- Magda Zielińska <magda@slcj.uw.edu.pl>