Isomeric states in ^{98}Cd and ^{98}Ag

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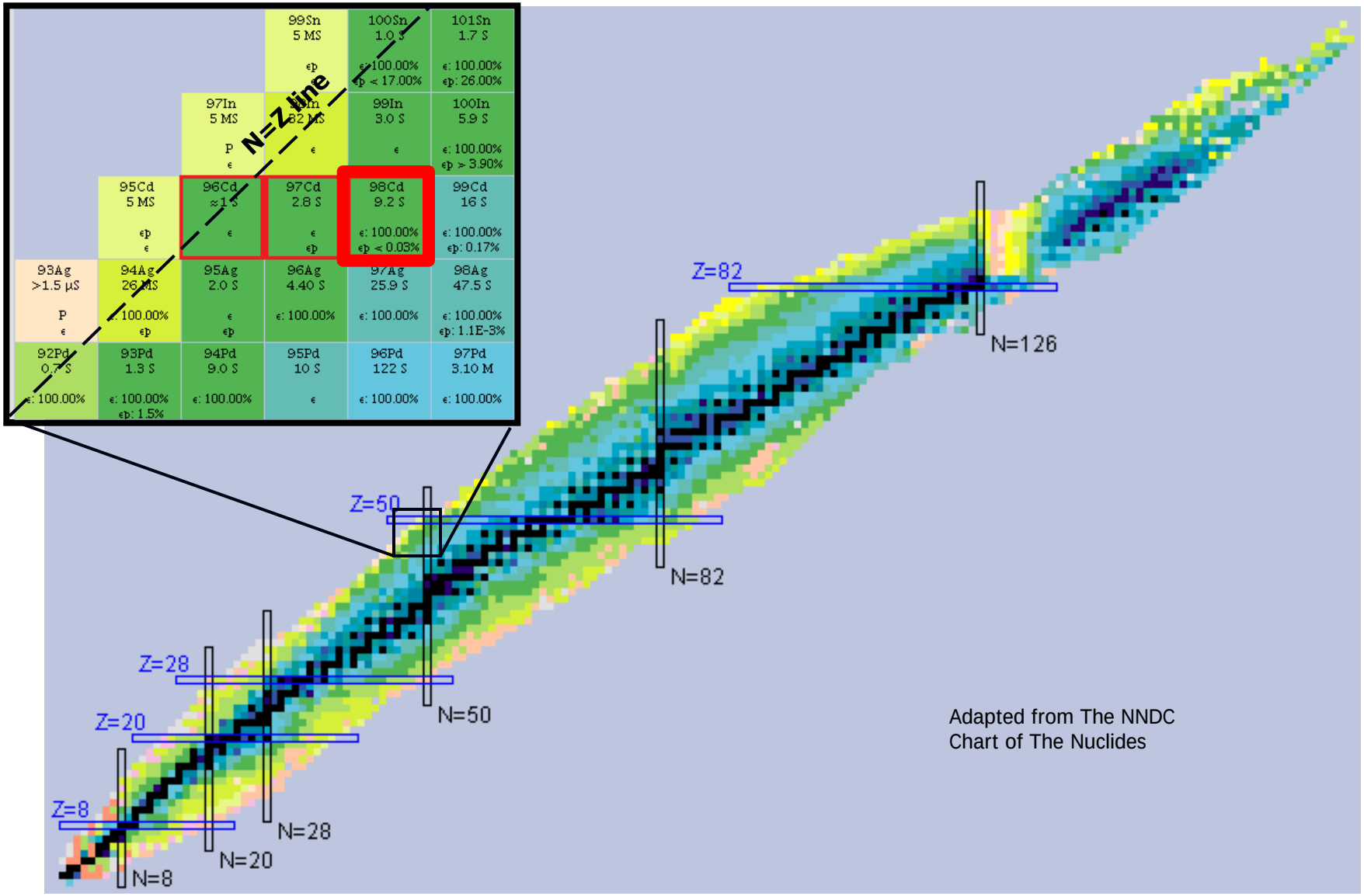
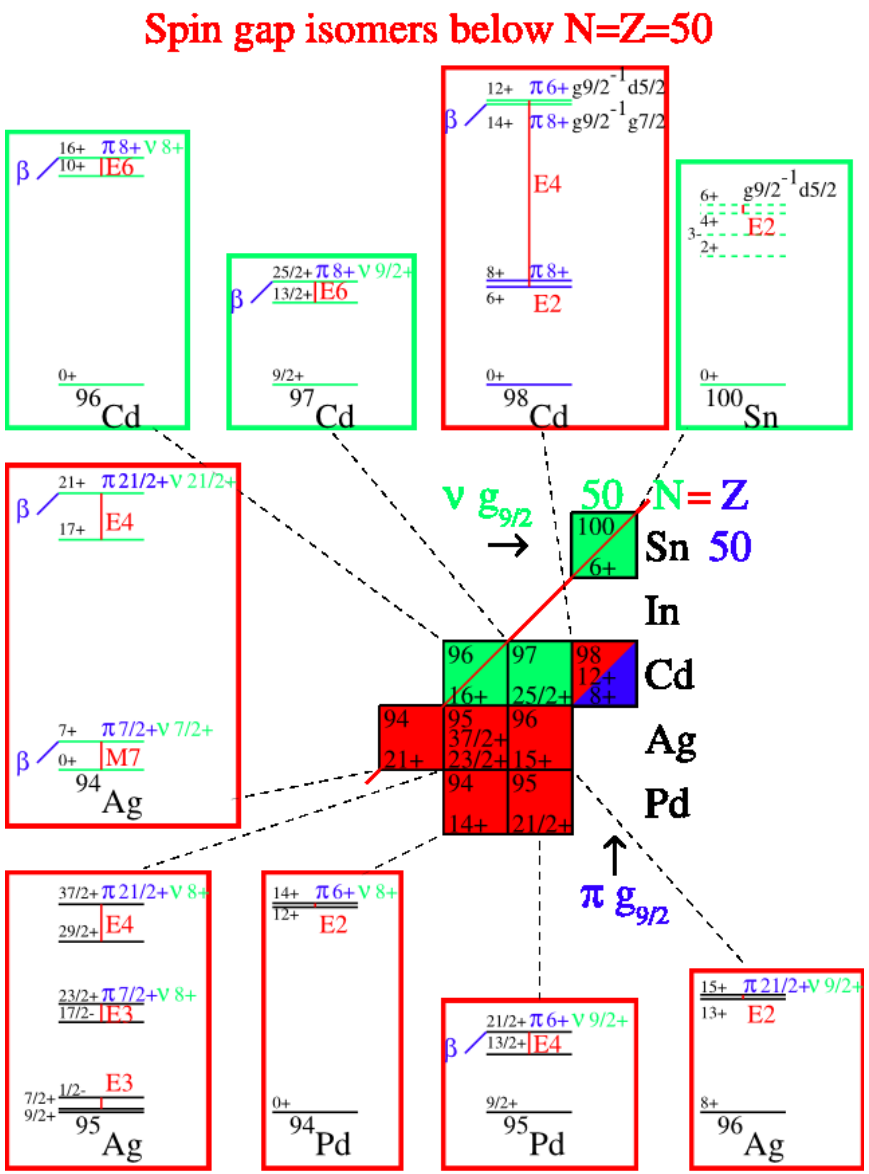
Outline

- Introduction
- RISING S352 Experiment
- ^{98}Cd Isomer Spectroscopy
- ^{98}Cd à ^{98}Ag Decay Data
- Summary and Outlook

Introduction



Isomers in the ^{100}Sn region



H. Grawe *et al.*, Eur. Phys. J A 27, S01, 257 (2006)

Importance of isomers

- Test of the shell model
- Single-particle structure
- Residual interaction
- Astrophysics

Properties of isomers

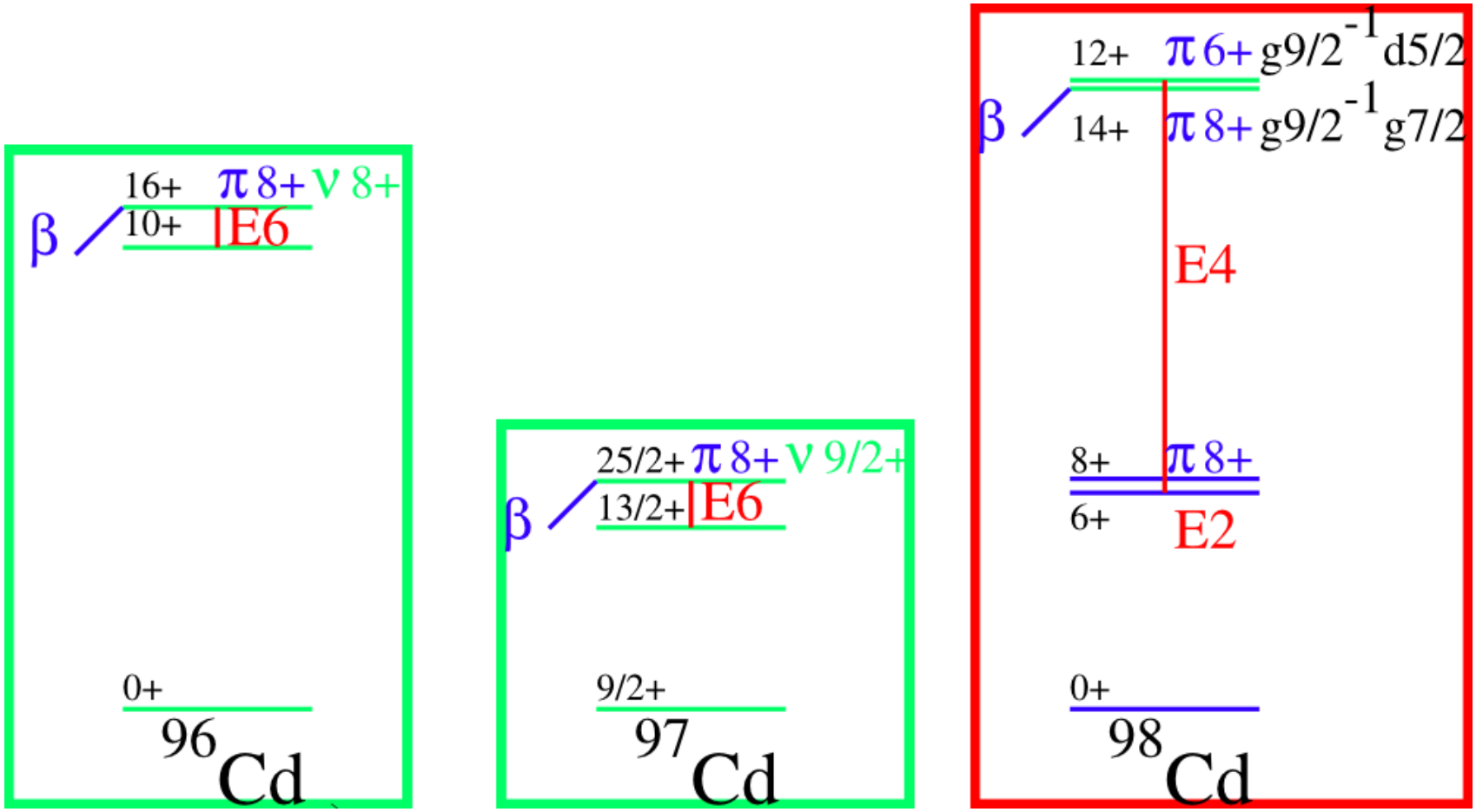
- Existence
- Excitation energy
- Halflife (transition strength)
- Spin and parity
- γ-decay cascades
- Particle decays

Predicted spin-gap isomers

Known spin-gap isomers

Seniority isomers

Main goals of the RISING S352 experiment

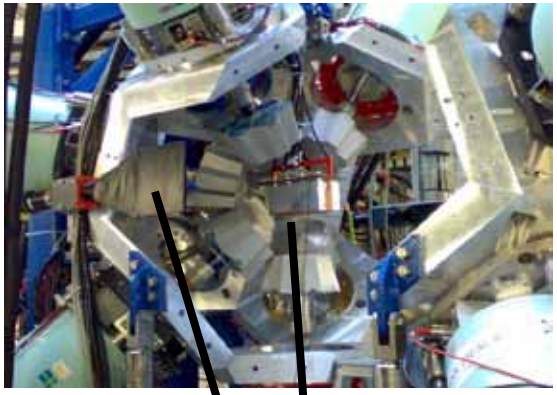


K. Ogawa, Phys. Rev. C 28, 958, (1983)

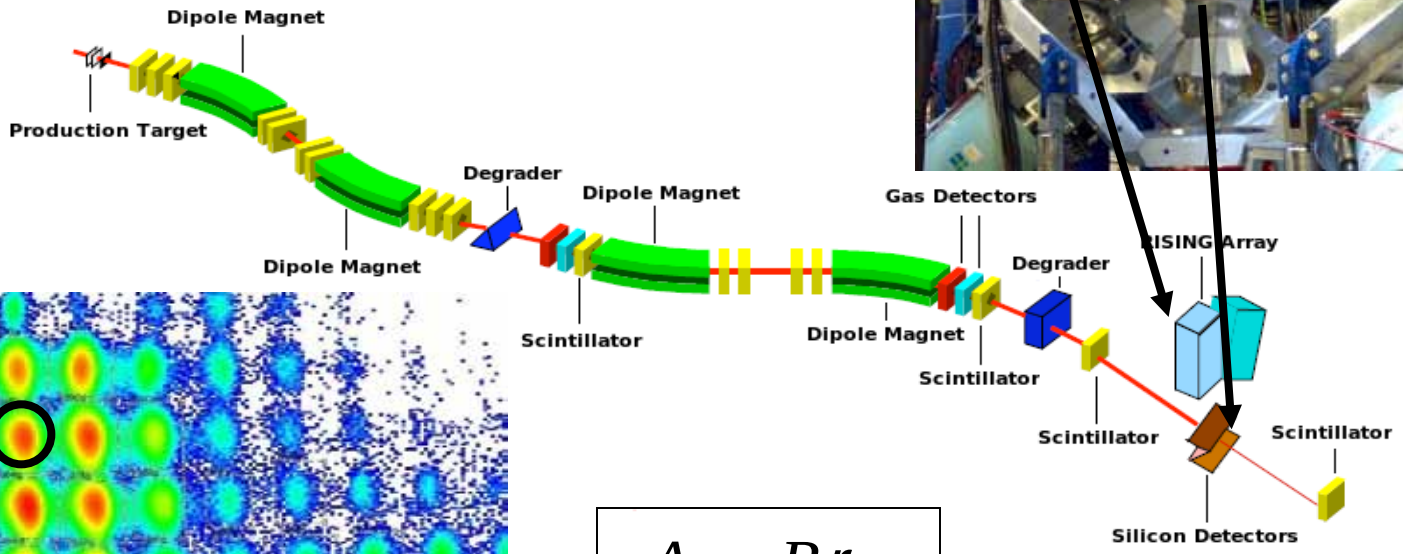
A. B. *et al.*, PRC 69 064304 (2004)

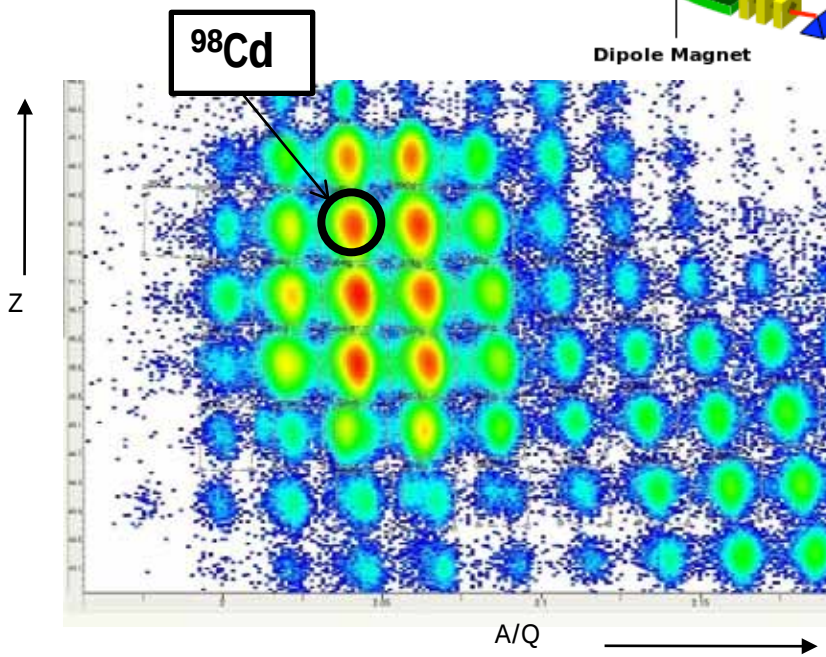
RISING S352 Experimental Setup

Stopped RISING



Primary beam
^{124}Xe @ 0.85 GeV/u



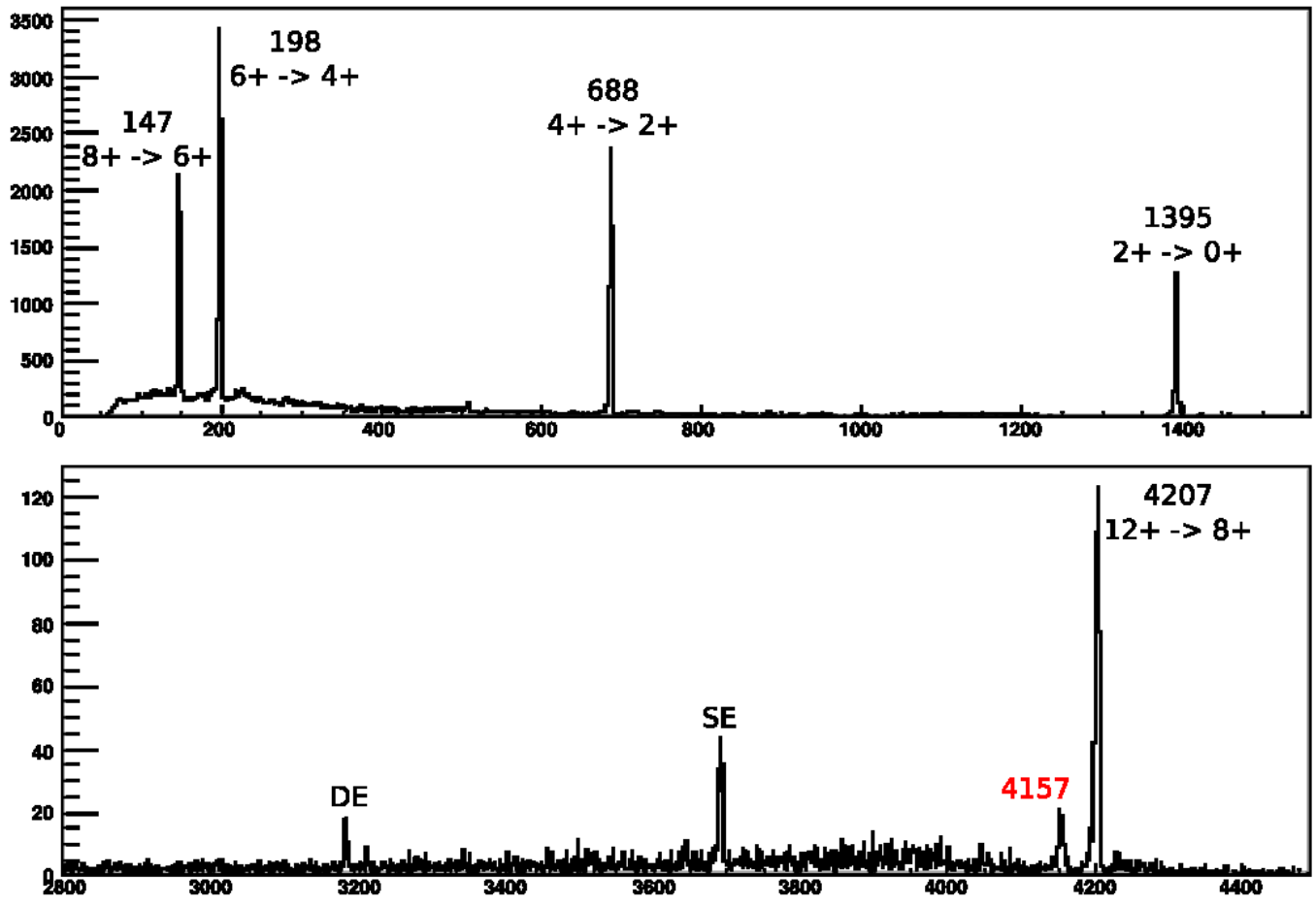


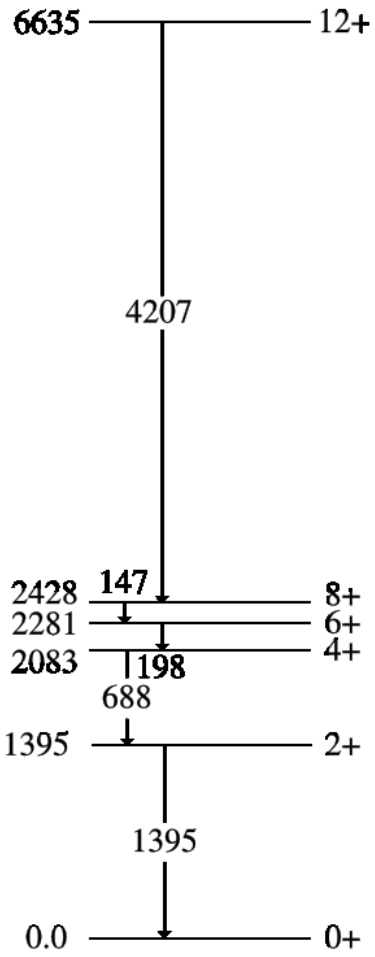
$$\frac{A}{Q} = \frac{Bre}{bgcu}$$

Number of ^{98}Cd implanted ~ $3 \cdot 10^5$

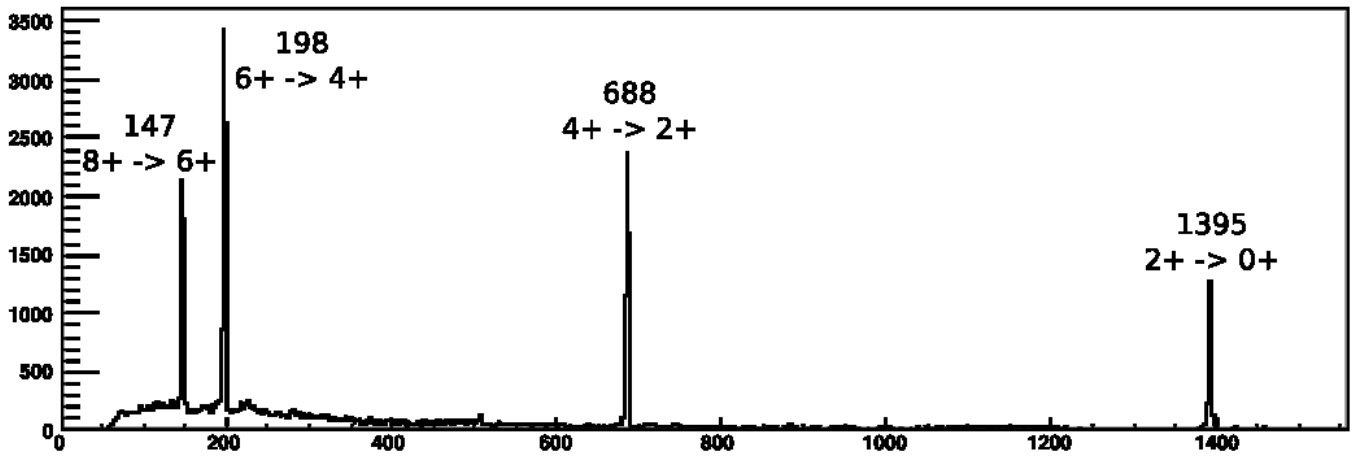
Active stopper

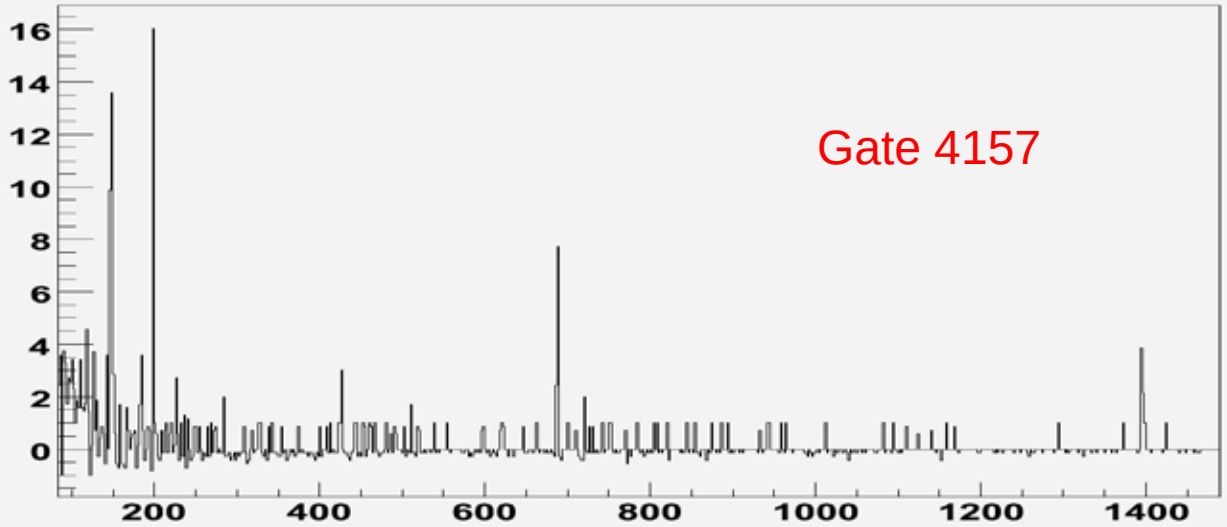
^{98}Cd-gated Ge-spectrum

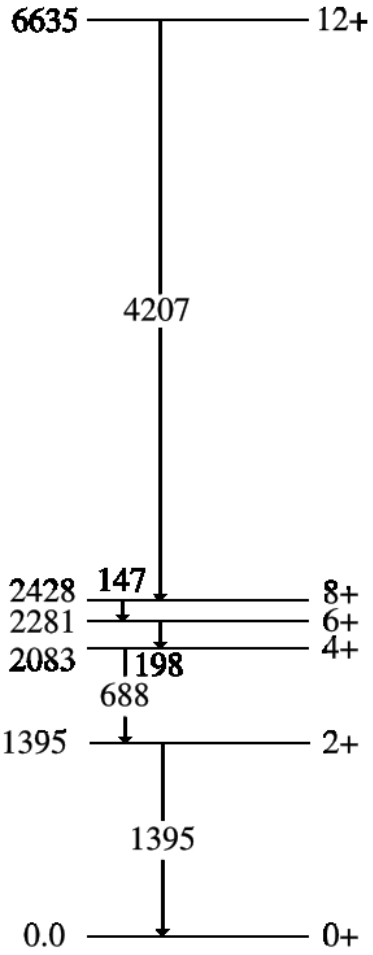




^{98}Cd-gated Ge-spectrum

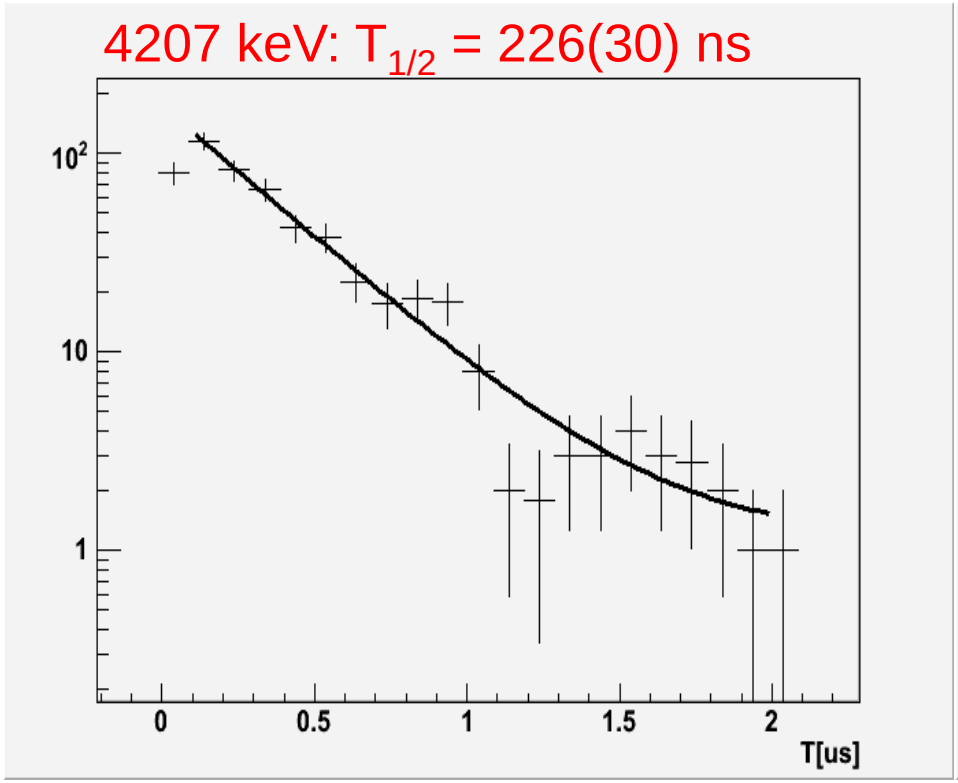




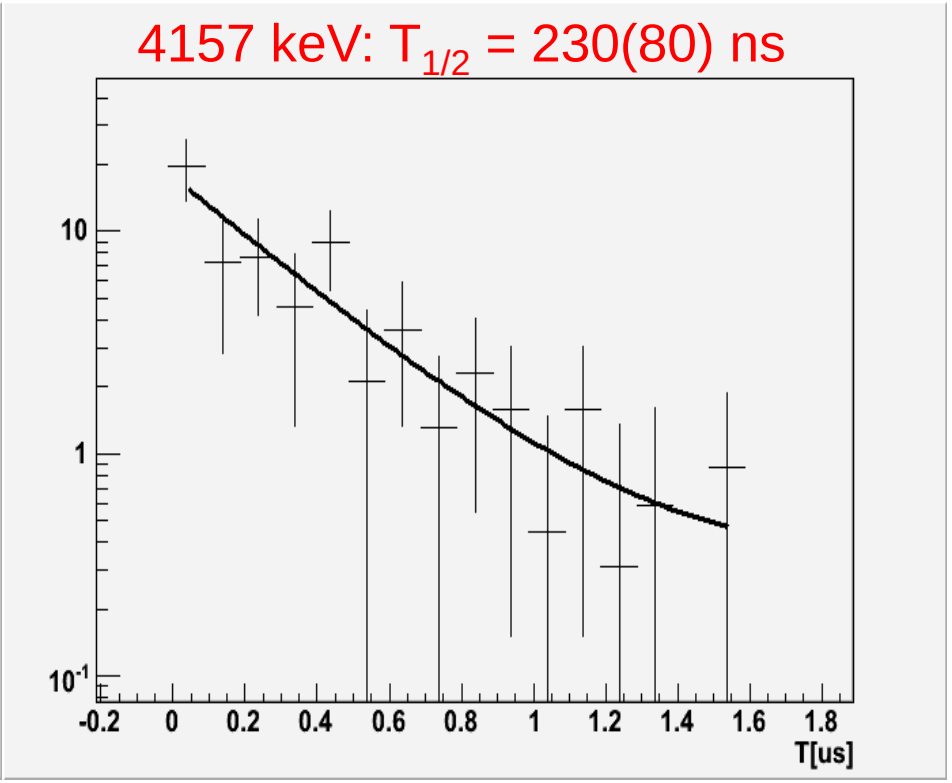


Lifetime measurements (preliminary)

4207 keV: $T_{1/2}$ = 226(30) ns

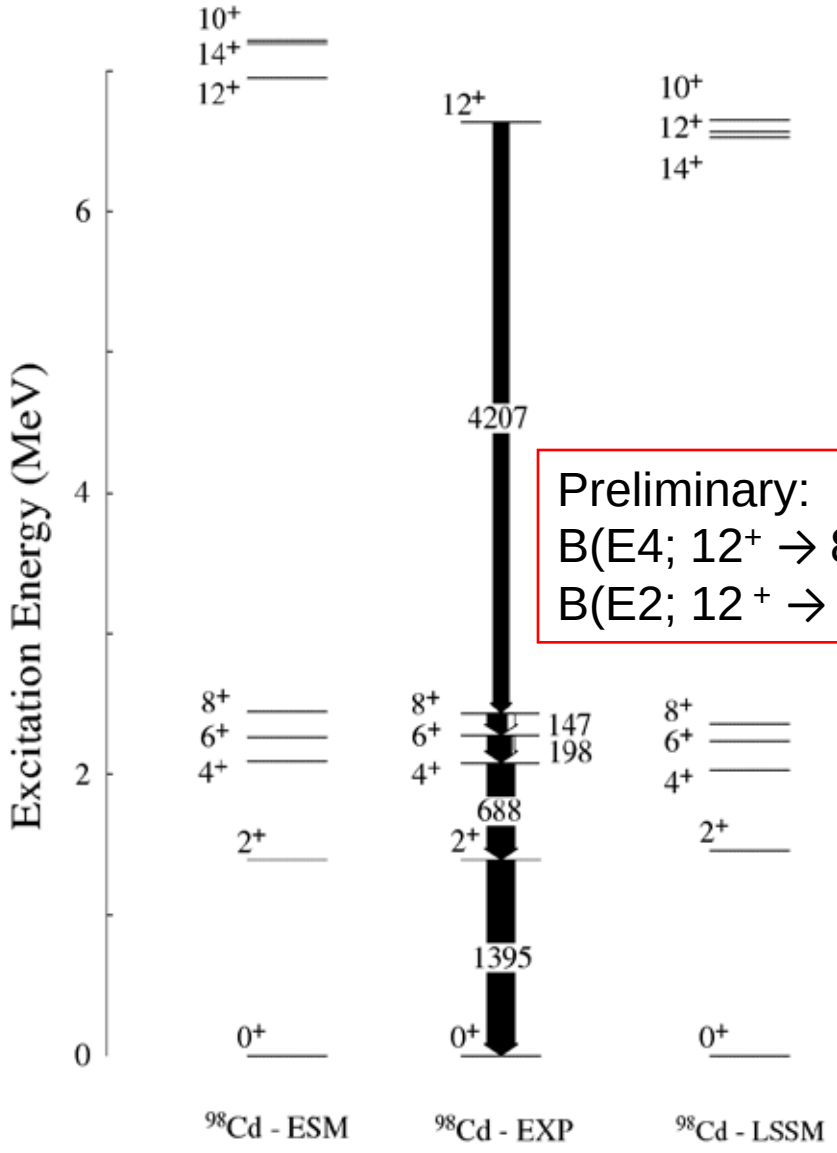


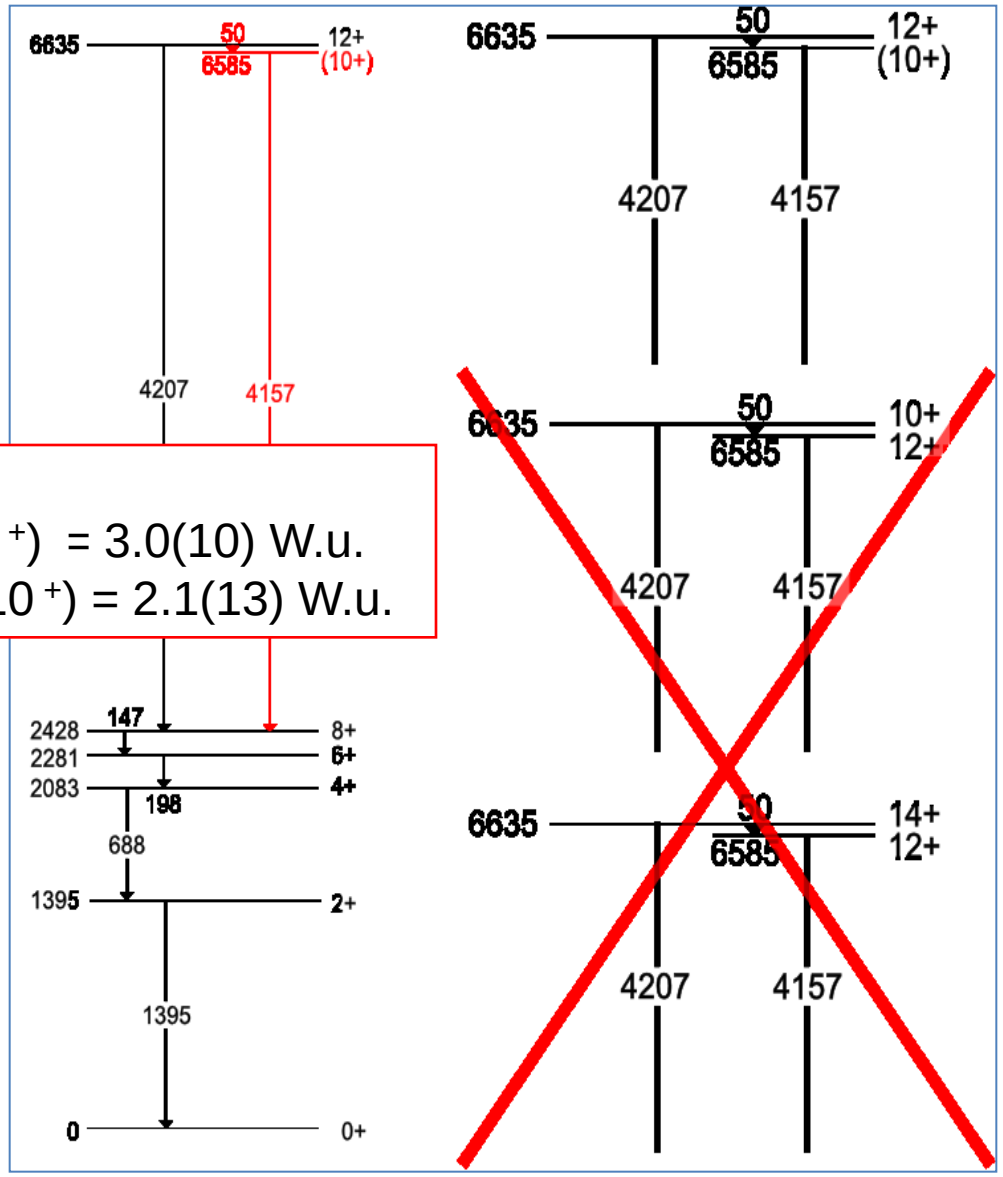
4157 keV: $T_{1/2}$ = 230(80) ns



Literature: $T_{1/2} = 230\ (^{+40}_{-30})$ ns
(A. B. *et al.*, Phys. Rev. C 69, 064304 (2004))

^{98}Cd high-energy level scheme





Preliminary:
B(E4; $12^+ \rightarrow 8^+$) = 3.0(10) W.u.
B(E2; $12^+ \rightarrow 10^+$) = 2.1(13) W.u.

A. B. et al., Phys. Rev. C 69, 064304(2004)

A. B. *et al., J. Phys.: Conf. Ser. 205 (2010) 012035.*

SM Calculations

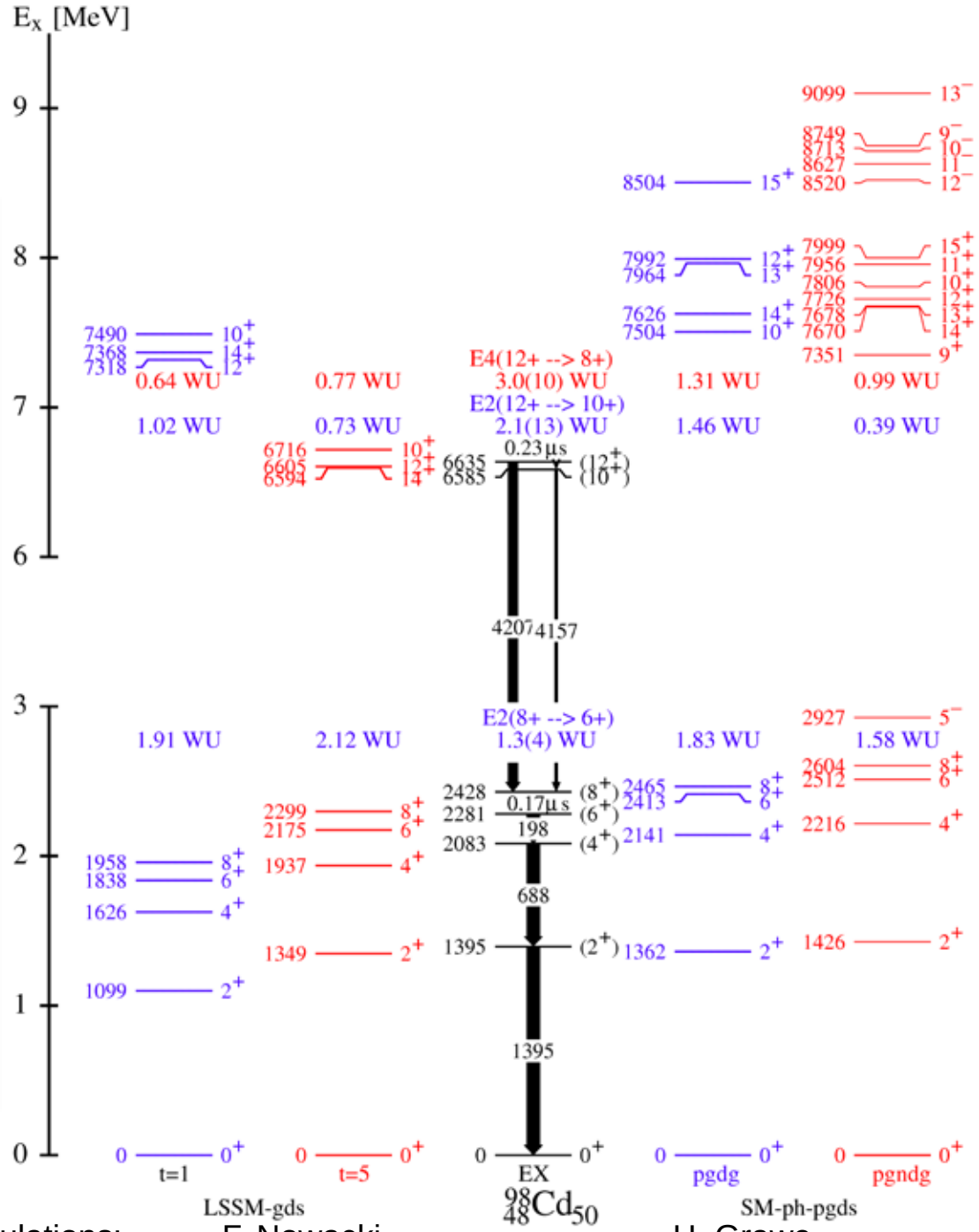
- **LSSM-gds t=1,5**
  - Ø p **ν** $g_{9/2}d_{5/2}g_{7/2}d_{3/2}s_{1/2}$
- **SM-ph-pgds** truncated to 1p1h in any orbit in the model spaces:
  - Ø **pgdg:**

    p **ν** $p_{3/2}f_{5/2}p_{1/2}g_{9/2}d_{5/2}g_{7/2}$
  - Ø**pgndg:**

    p **ν** $p_{3/2}f_{5/2}p_{1/2}g_{9/2}nd_{5/2}g_{7/2}$

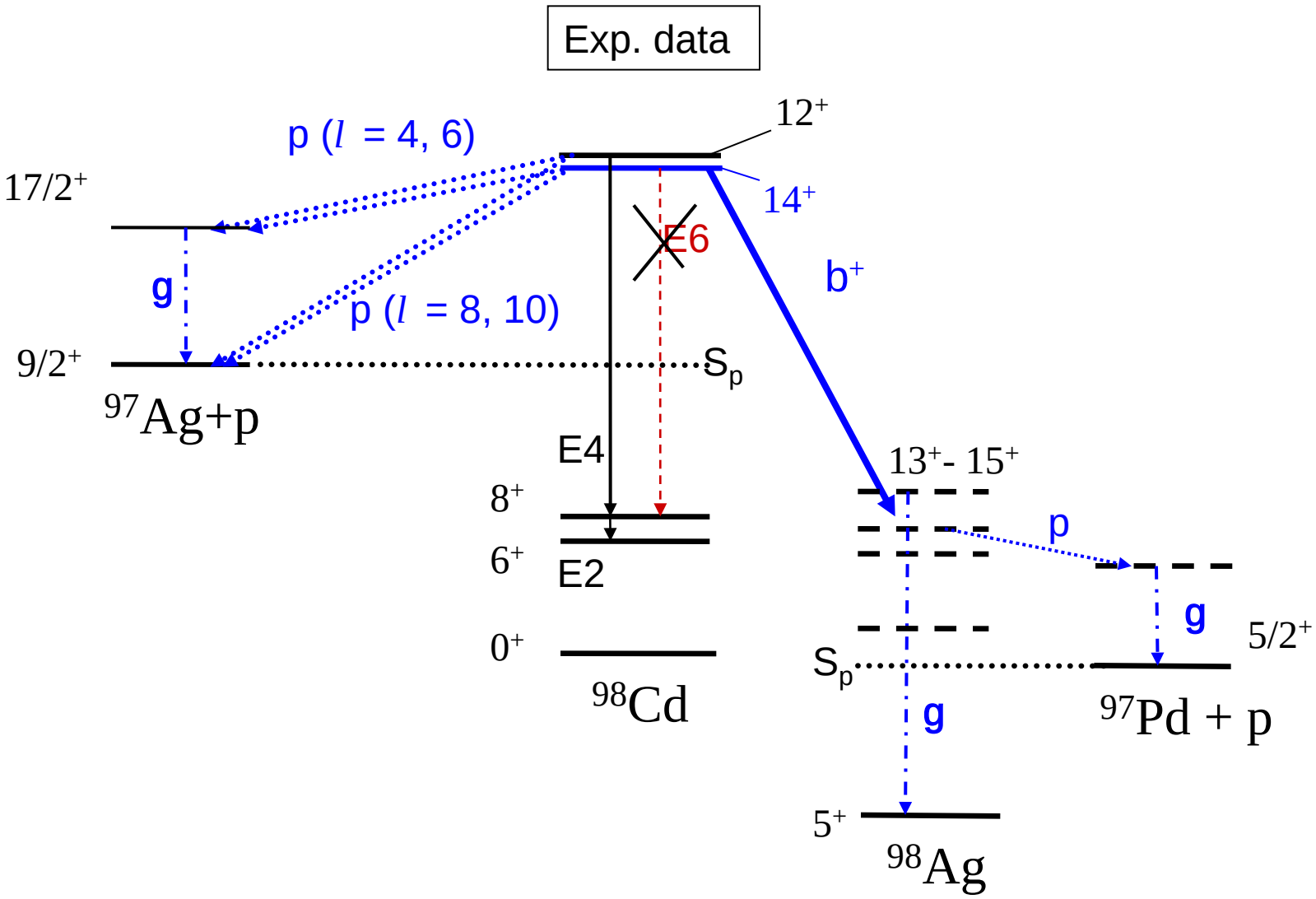
TBME from OXBASH (SNA+GF)*

SPE tuned to ^{100}Sn

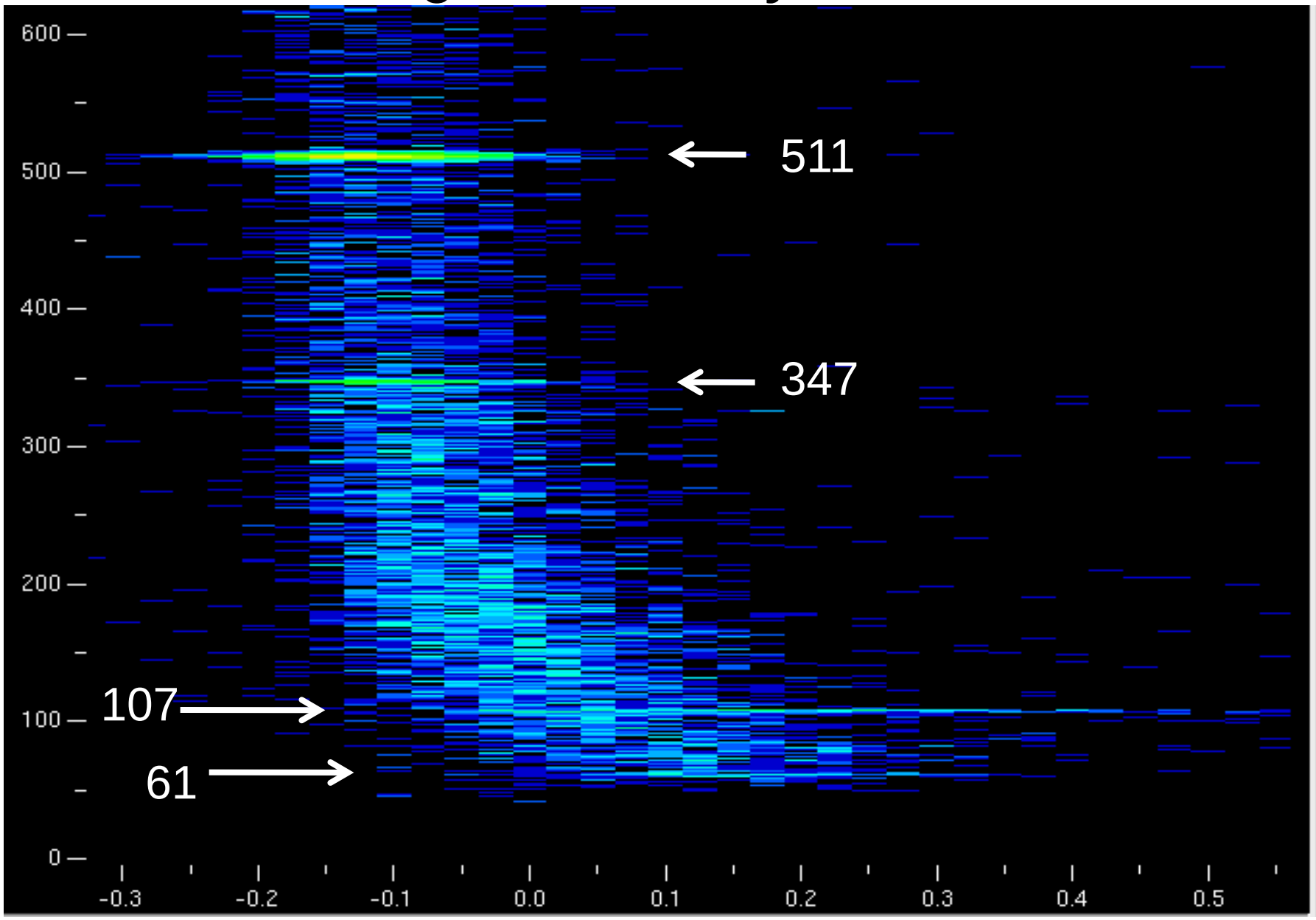


Calculations: F. Nowacki H. Grawe

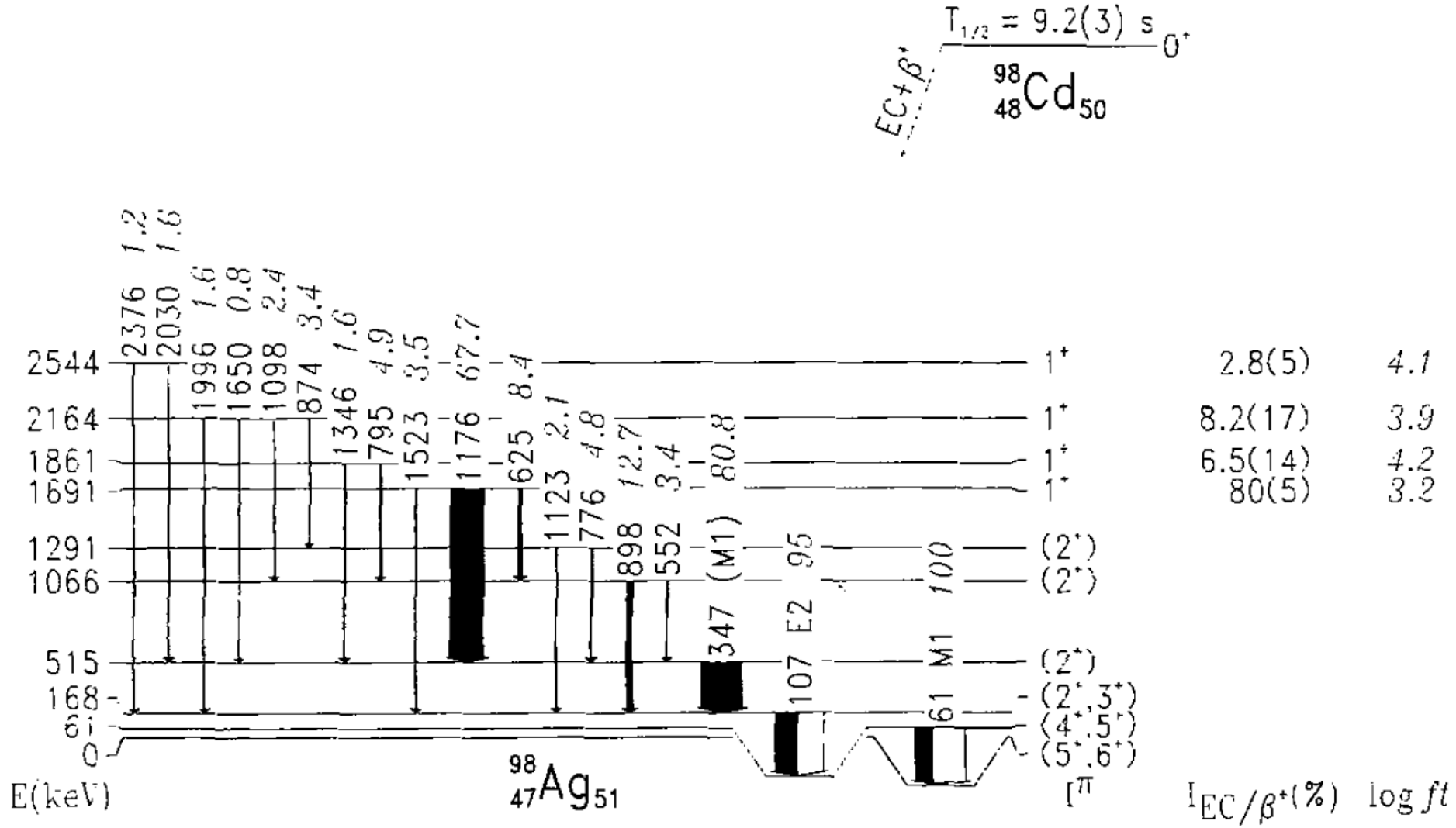
Possible decay modes of ^{98}Cd core-excited isomers



^{98}Cd gated decay data



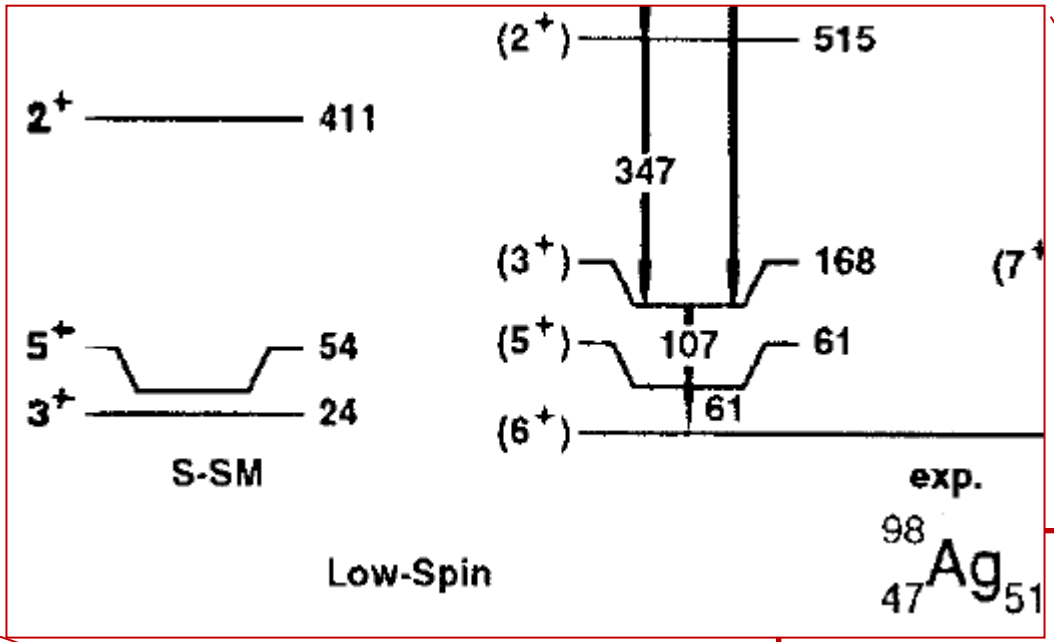
^{98}Cd g.s. à ^{98}Ag GT decay

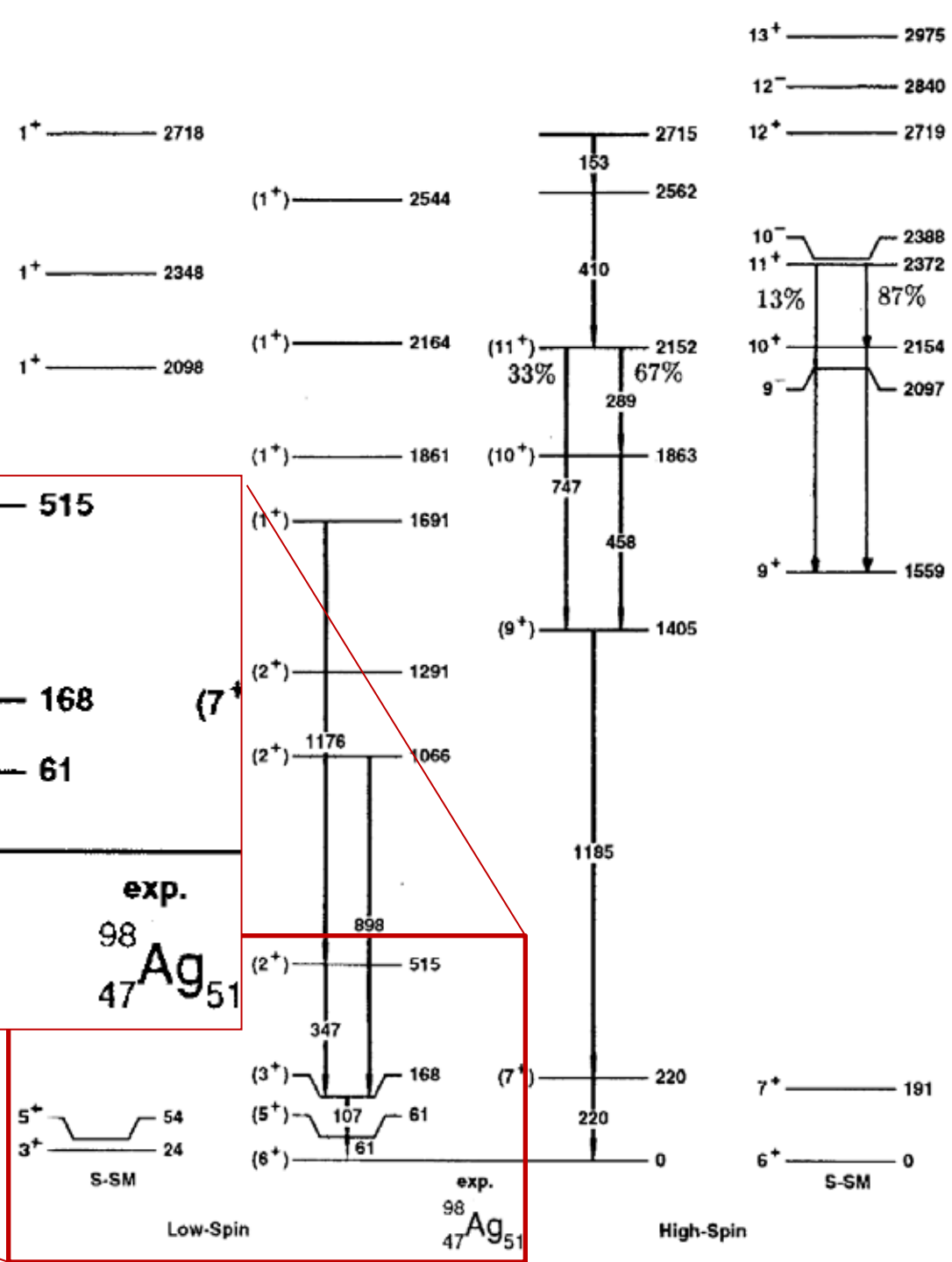


A. Plochocki et al., Z. Phys. A 342 (1992) 43
(including CE spectroscopy)

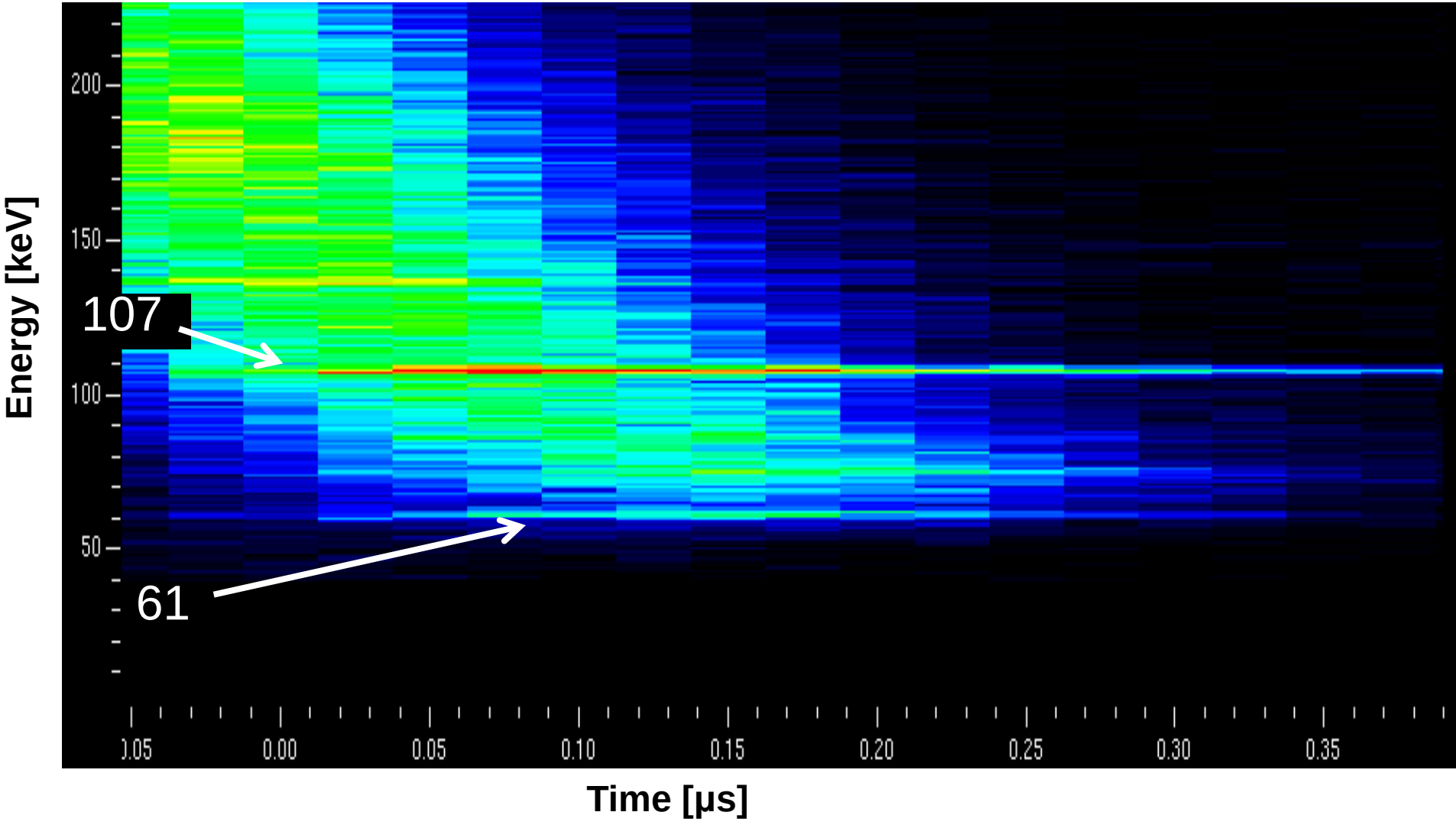
98Ag – EXP and SM

R. Schubart, H. Grawe, et al.,
Z. Phys. A 34252 (1995) 373



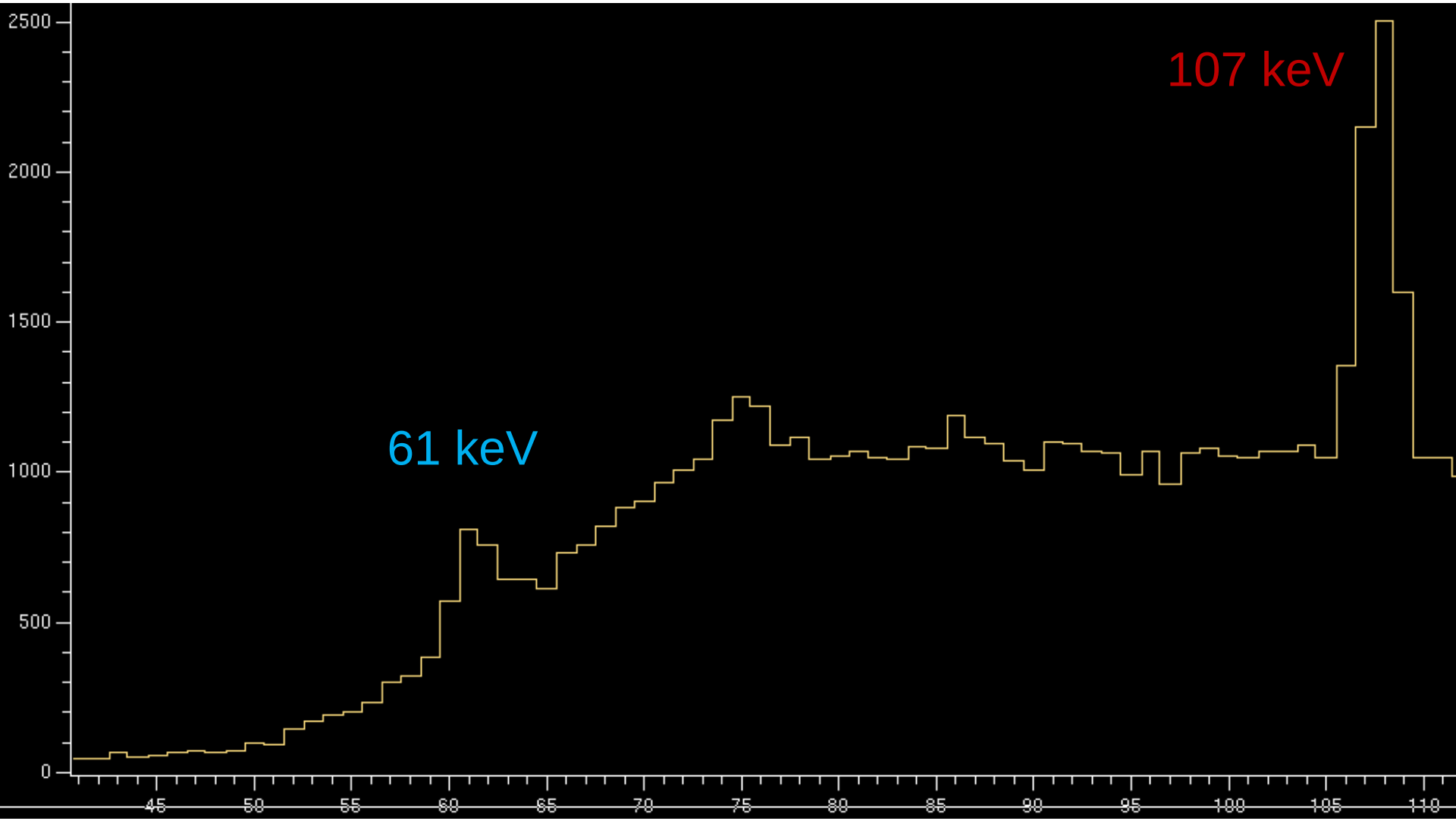


^{98}Cd gated decay data (cont.)



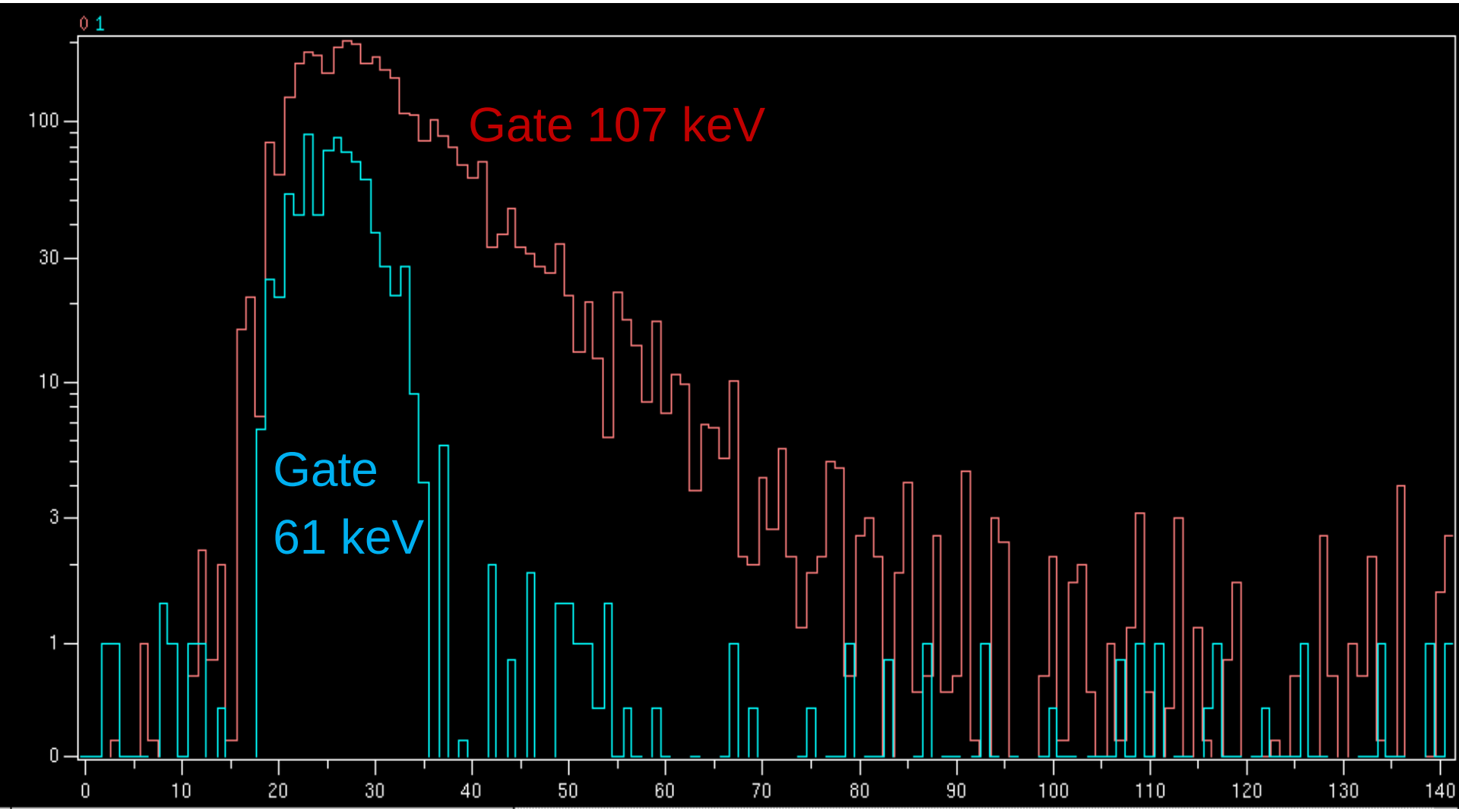
^{98}Cd gated decay data (cont.)

Projection on the energy axis (y)



^{98}Cd gated decay data (cont.)

Time spectra **with** background subtraction



Summary and outlook

- New transition (4157 keV) in ^{98}Cd, suggesting a (10^+) level (6585 keV), 50 keV below the (12^+) level
- Exp. B(E4) and B(E2) estimates of the (12^+) depopulating transitions
- Not reproduced by previous shell-model calculations
- SM analysis of the proton and neutron transition matrix elements
- New isomeric transition in ^{98}Ag, tentative new ordering of 61-107 keV cascade and exp. B(E2) estimate for the 107 keV transition
- Now ^{98}Ag-EXP excellent agreement with SM energies and B(E2) strength

Still to do:

- Final γ-γ and lifetimes analysis
- Continue decay (active stopper) analysis
- Good SM description of the ^{100}Sn region incl. core excited states

Collaboration

Ayse Atac, Linus Bettermann, Andrey Blazhev, Plamen Boutachkov, Norbert Braun, Tim Brock, Lucia Caceres, Cesar Domingo, Tobias Engert, Katrin Eppinger, Thomas Faestermann, Fabio Farinon, Florian Finke, Kerstin Geibel, Jurgen Gerl, Namita Goel, Magda Gorska, Andrea Gottardo, Hubert Grawe, Jerzy Grebosz, Christoph Hinke, Robert Hoischen, Gabriela Ilie, Hironori Iwasaki, Jan Jolie, Ivan Kojouharov, Reiner Krucken, Nikolaus Kurz, Zhong Liu, Edana Merchant, B. S. Nara Singh, Chiara Nociforo, Frederic Nowacki, Johan Nyberg, Marek Pfutzner, Stephane Pietri, Zsolt Podolyak, Andrej Prochazka, Patrick Regan, Peter Reiter, Sami Rinta-Antila, Dirk Rudolph, Clemens Scholl, Par-Anders Soderstrom, Steve Steer, Robert Wadsworth, Nigel Warr, Hans-Jurgen Wollersheim, Philip Woods

Current status S352

- ^{98}Cd new level (10^+) and Exp. B(E4) and B(E2) estimates of the (12^+) depopulating transitions - [A. B. et al., J. Phys.: Conf. Ser. 205 (2010) 012035] + [N. Braun et al., in preparation]

- ^{94}Pd a new high-spin (19^-) E3 isomer
  [T.S. Brock et al., Phys. Rev C82, (2010) 061309(R)]

- ^{96}Ag – new isomeric states including core excited, extended level scheme
  [P. Boutachkov et al., in preparation]

- New isomer in ^{98}Ag, tentative new ordering of 61-107 keV cascade and exp. B(E2) estimate for the 107 keV transition (Cologne)
- Hints of beta-delayed proton decay in ^{96}Cd (Univ. York) and ^{97}Cd (GSI)
- ...
- STILL remain 15 MAIN + 9 Parasitic SHIFTS and we look forward to the next stopped beam campaign to address still unanswered questions esp. $^{96\text{-}98}$Cd βp using better active stopper (AIDA)