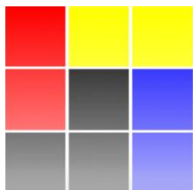


In-beam γ -ray Spectroscopy of low-lying Excited States of ^{129}In and ^{128}Cd

Michał Mikołajczuk

Supervisor: dr hab. Agnieszka Korgul, prof. UW

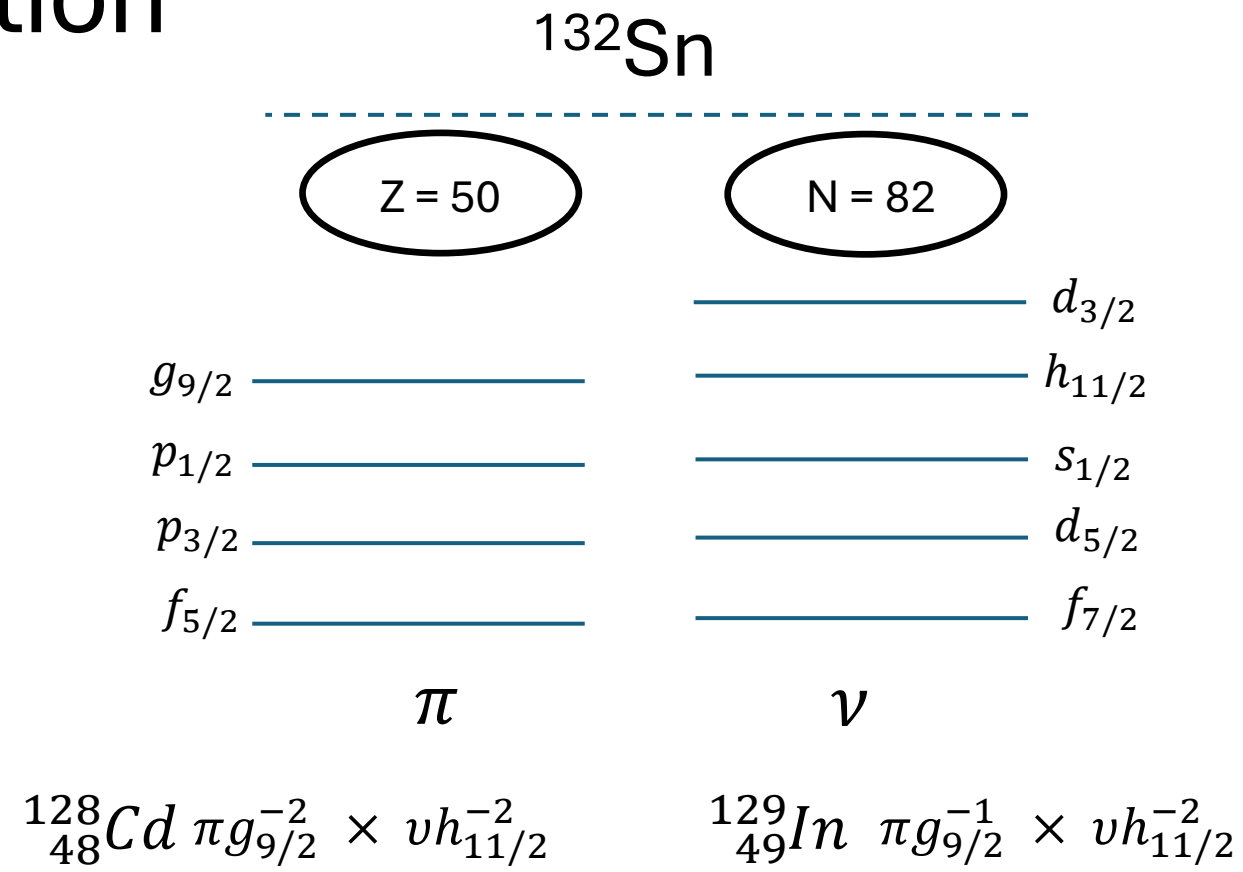
Co-Supervisor: dr Magdalena Górski-Ott (GSI)



NUCLEAR PHYSICS DIVISION
UNIVERSITY OF WARSAW



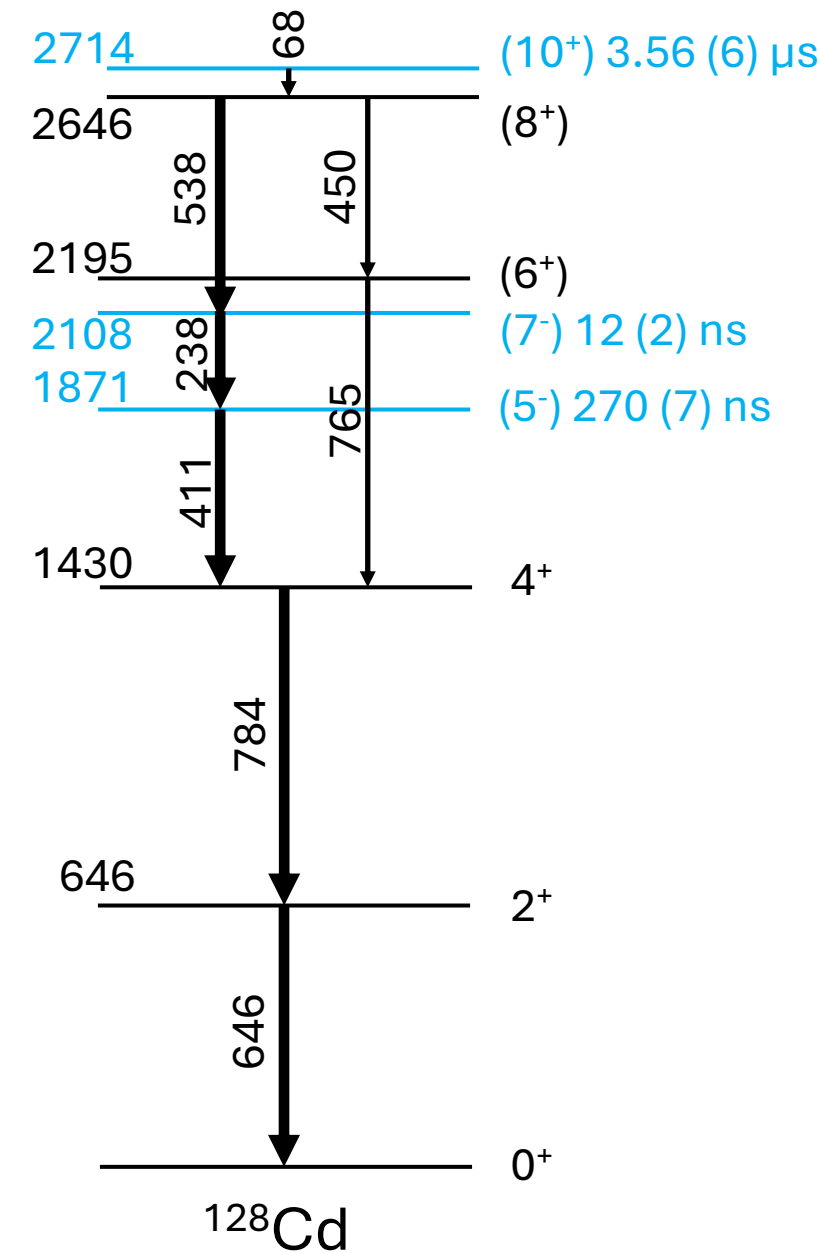
Motivation



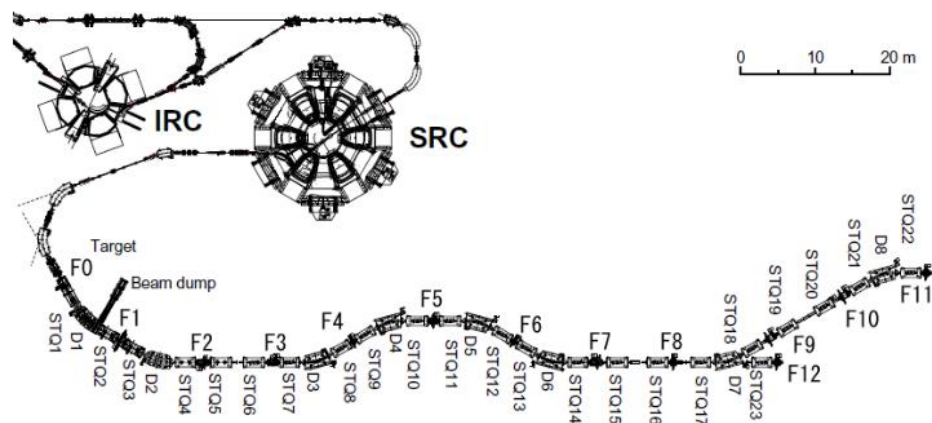
Selected reaction channels

- $^{130}\text{In}(^9\text{Be}, n) ^{129}\text{In}$
- $^{129}\text{Cd}(^9\text{Be}, n) ^{128}\text{Cd}$
- $^{132}\text{Sn}(^9\text{Be}, p) ^{131}\text{In}$ (method validation)

Data from isomer decay spectroscopy

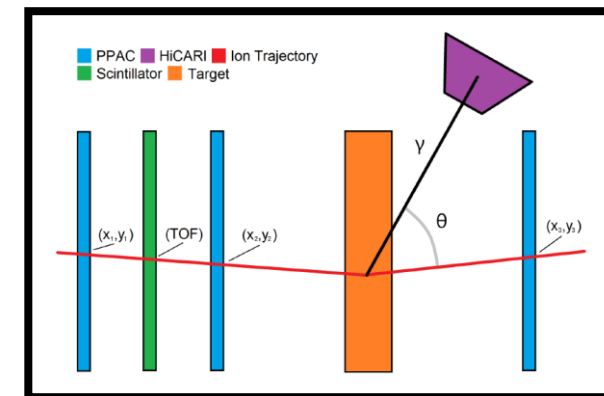
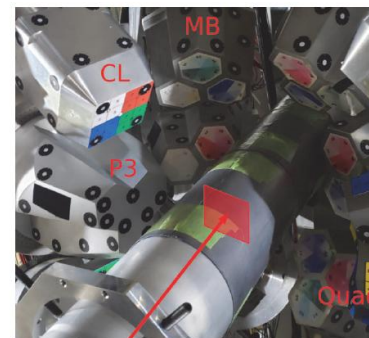
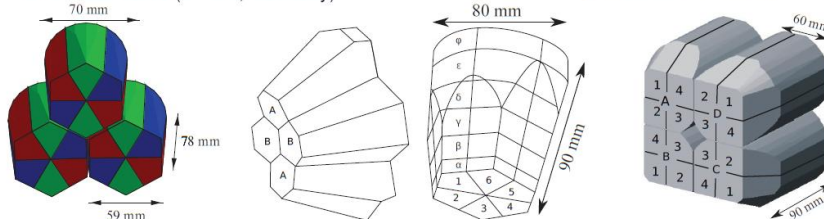


Experiment

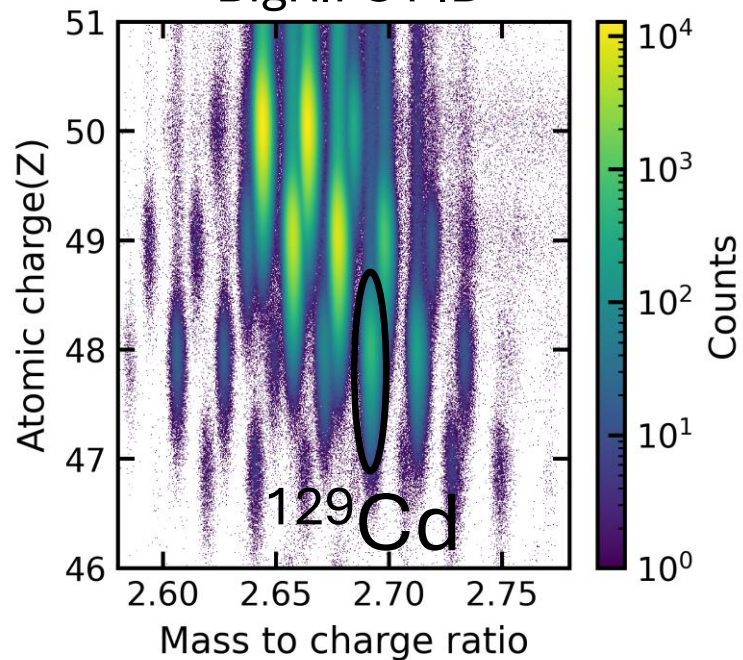


■ hikari 光 means "light"
 ■ Wako-shi (city where RIBF is) 和光市
 international effort:

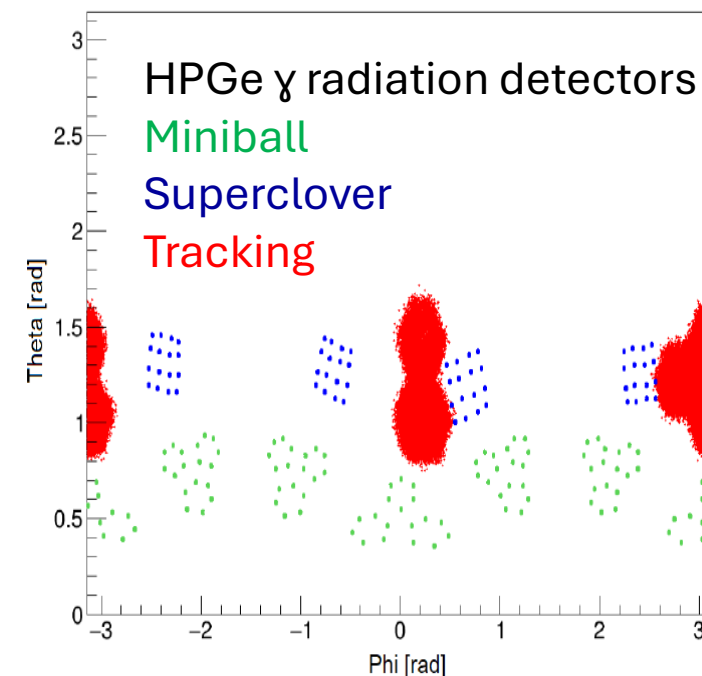
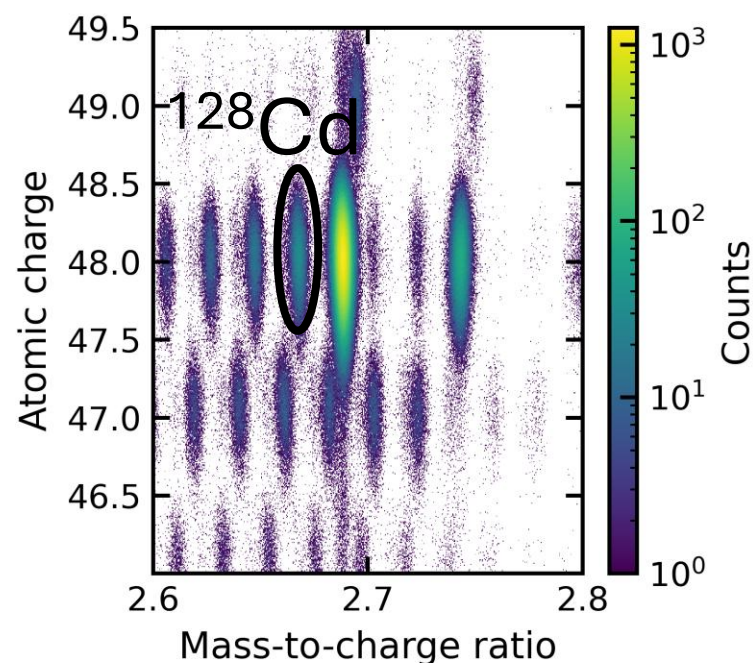
- 6 Miniball triple-cluster from Europe
- RCNP quad (GRETA-type, Japan)
- LBNL triple (GRETA-type, USA)
- 4 Super-Clovers from IBS (Korea)
- 4 Clovers from IMP Lanzhou (China)
- GRETA-type electronics and DAQ (RCNP, ANL, LBNL, U Tokyo)
- Miniball frame (U Köln, Germany)



BigRIPS PID

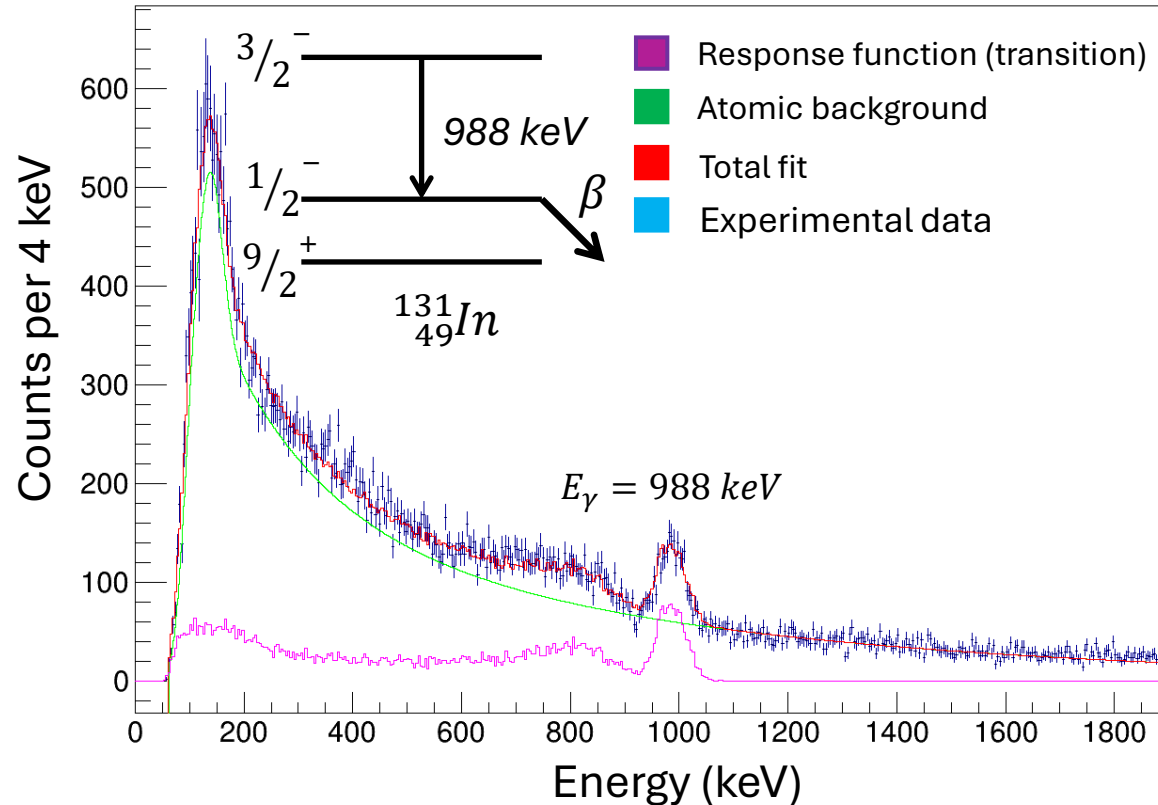


ZeroDegree PID

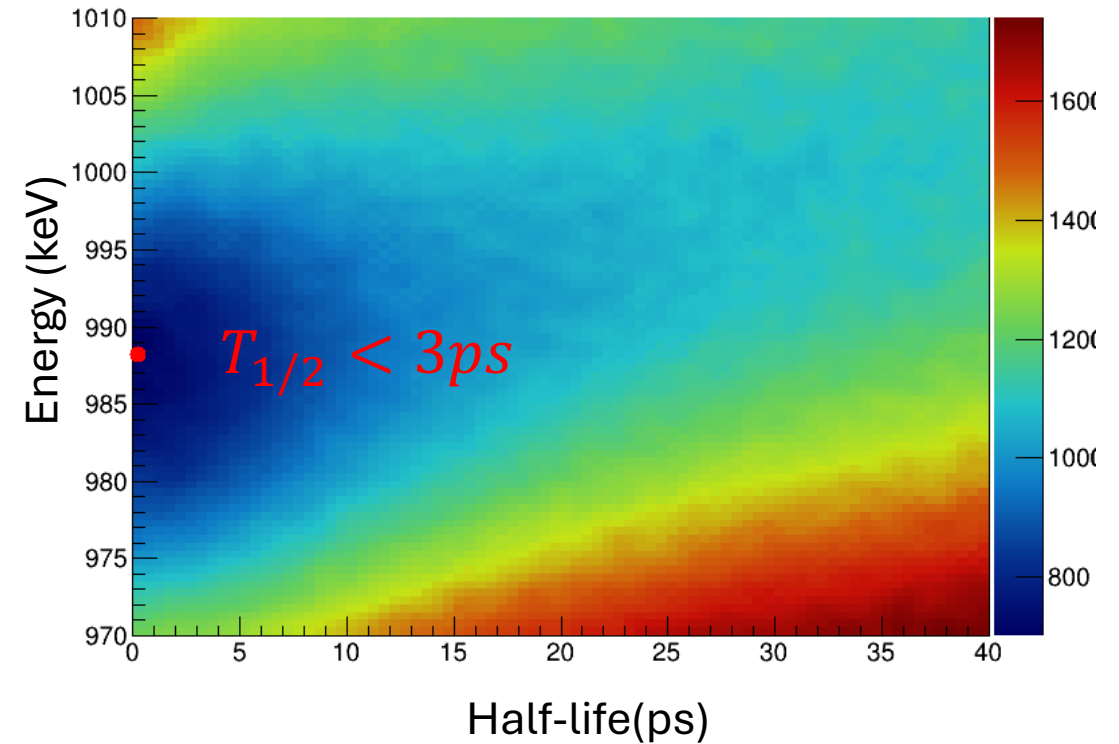


Transition energy and a state half-life extraction method

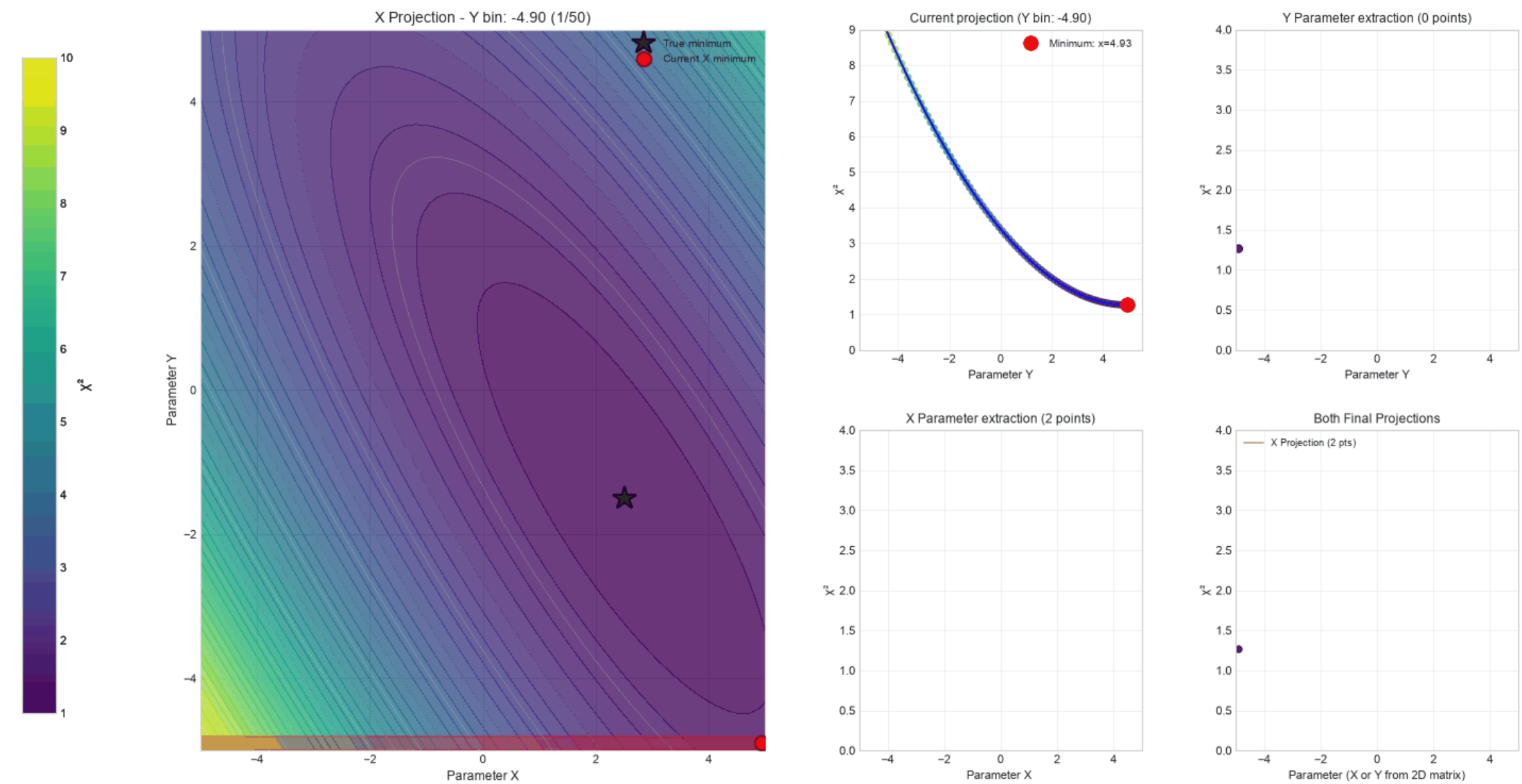
$$\text{Fit quality} \rightarrow \chi^2 = \sum_i \frac{(N_{exp} - N_{sim})^2}{N_{sim}}$$



Sum of all χ^2 matrices

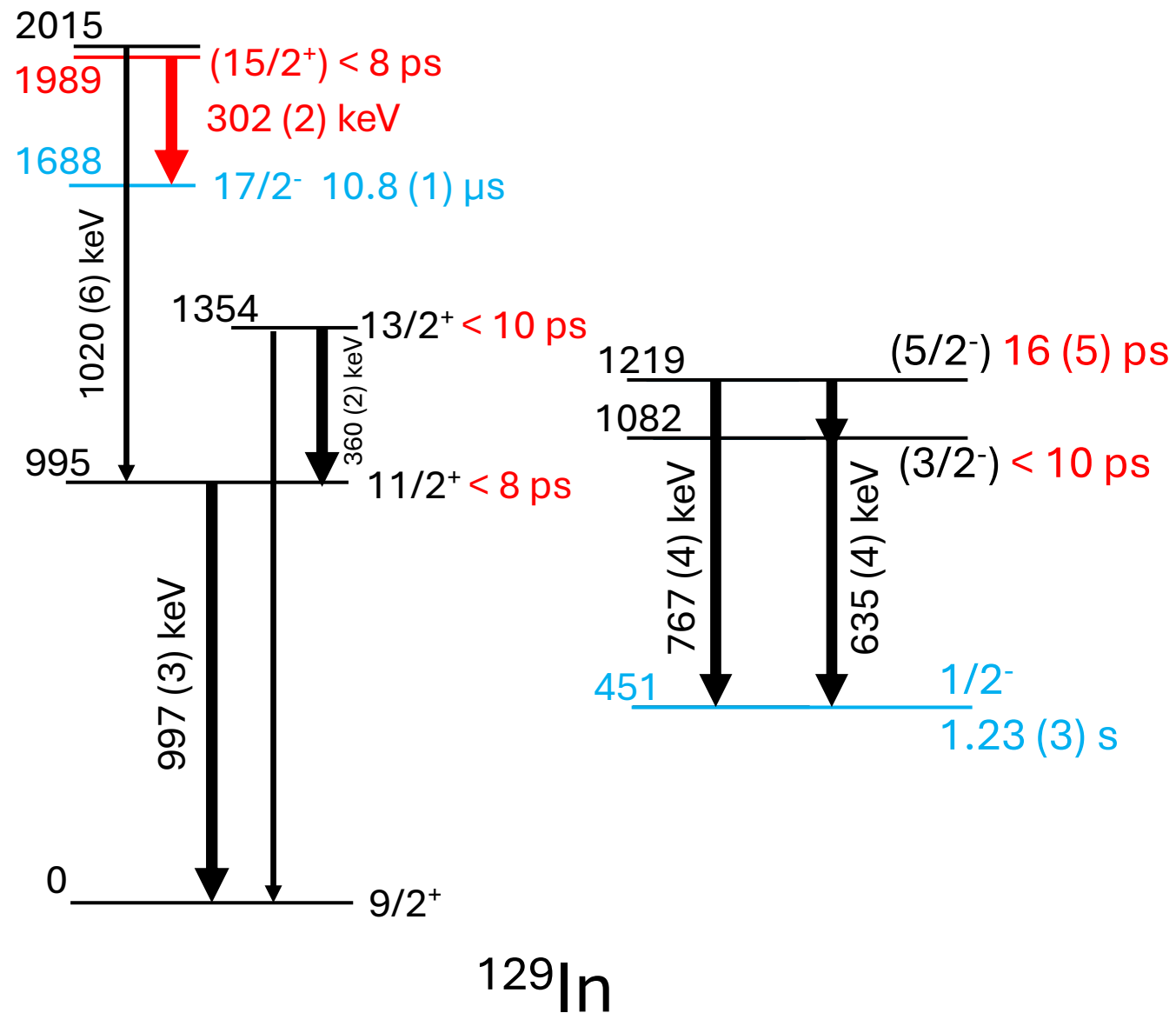
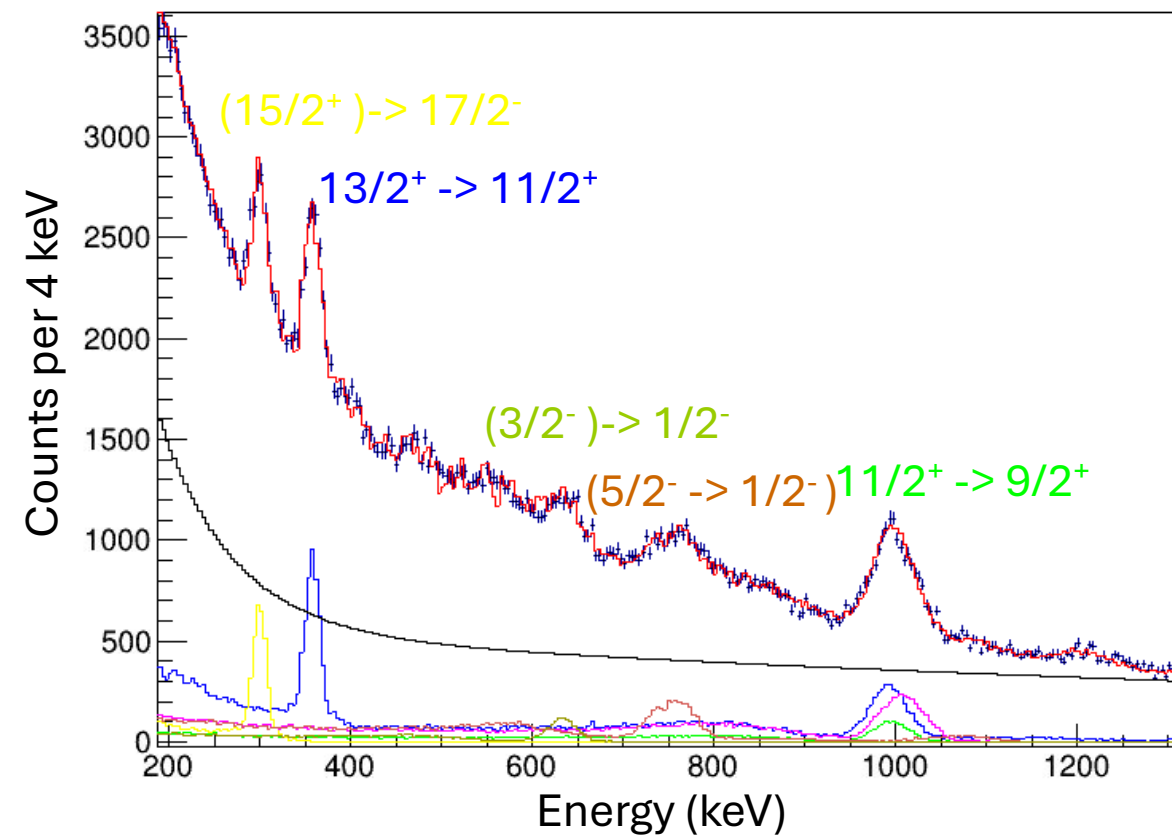


Transition Energy and a state half-life extraction method

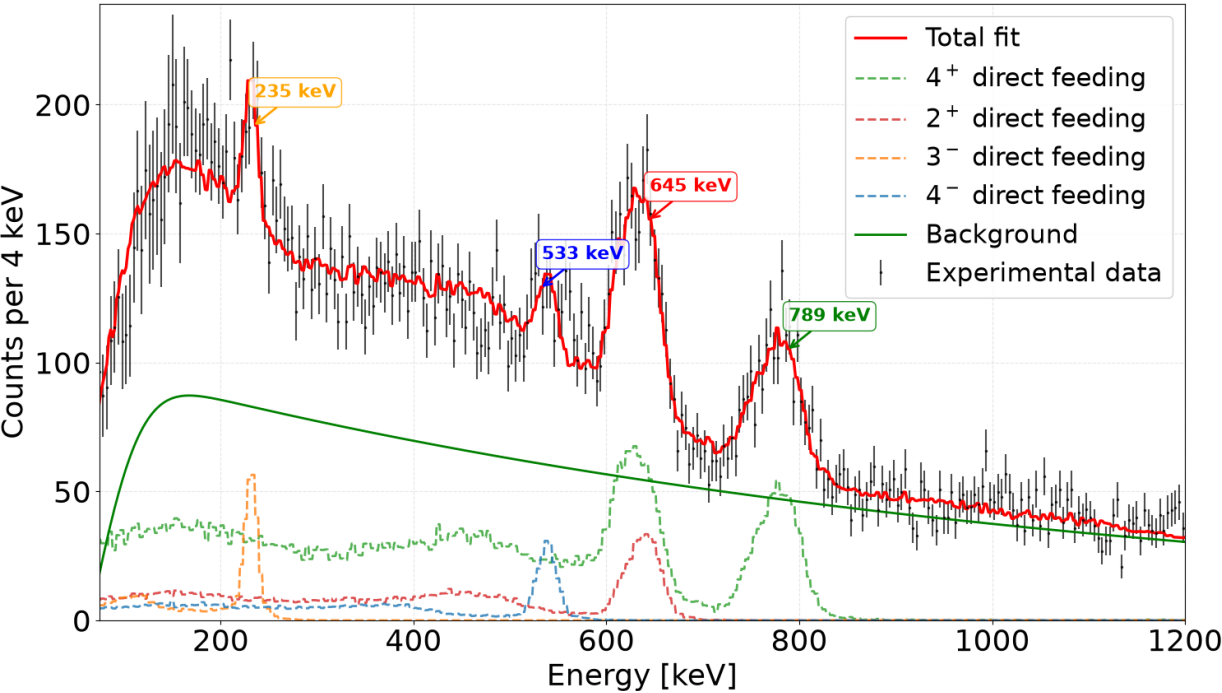


Results: ^{129}In

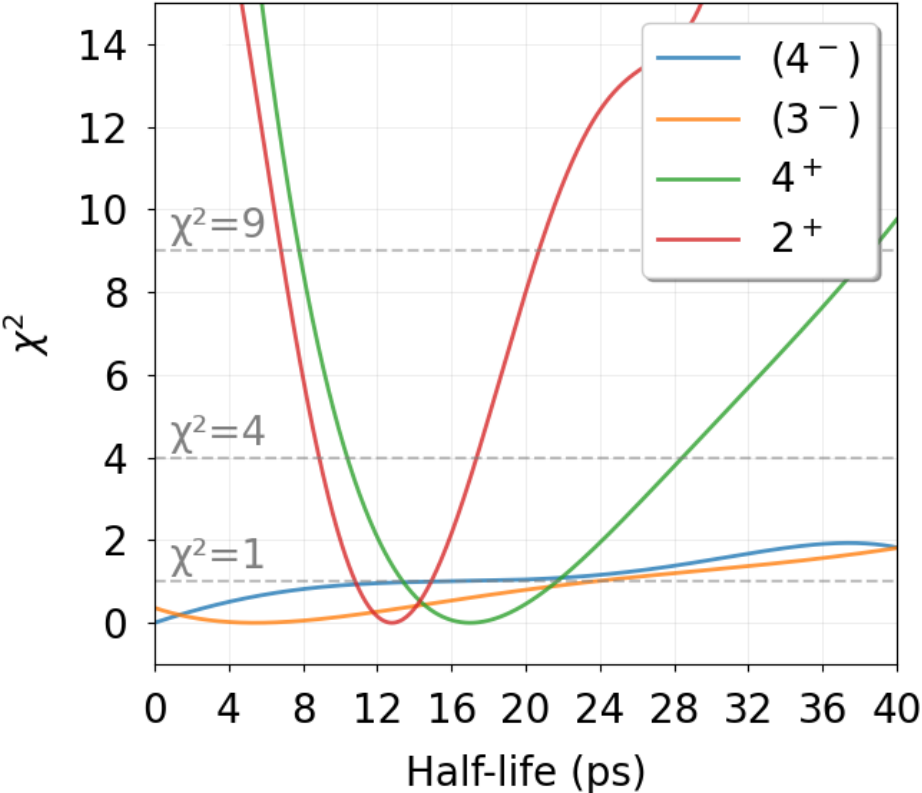
New data
Known isomer



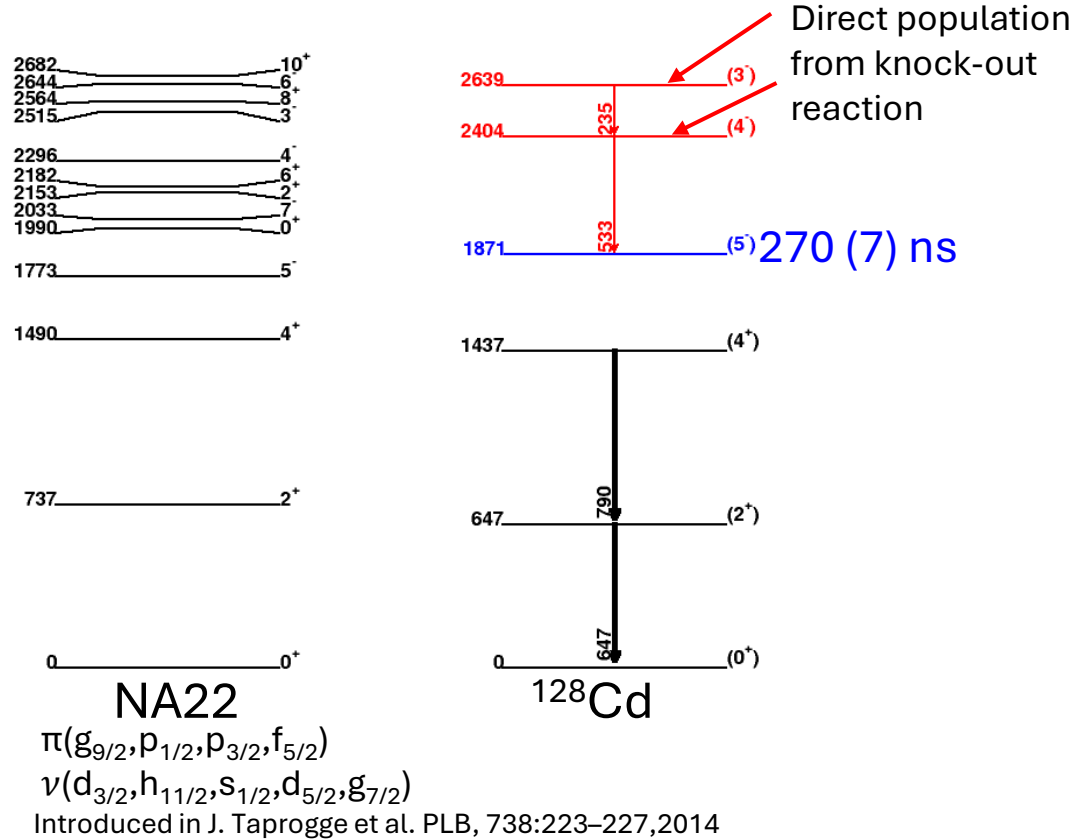
Results: ^{128}Cd



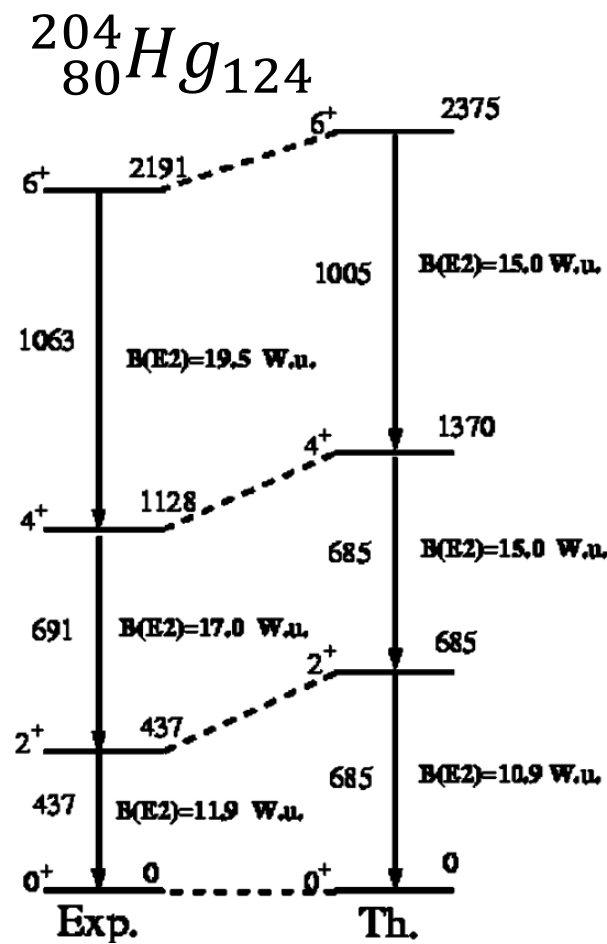
J^π	Multipolarity	E_γ (keV)	$T_{1/2}$ (ps)
2^+	$E2$	$646.8^{+1.4}_{-1.4}$	$12.9^{+1.8}_{-1.7}$
4^+	$E2$	$789.9^{+1.8}_{-0.9}$	$15.0^{+4.0}_{-2.4}$
(4^-)	$M1$	533^{+12}_{-5}	< 19
(3^-)	$M1$	$234.9^{+3.6}_{-2.9}$	< 23



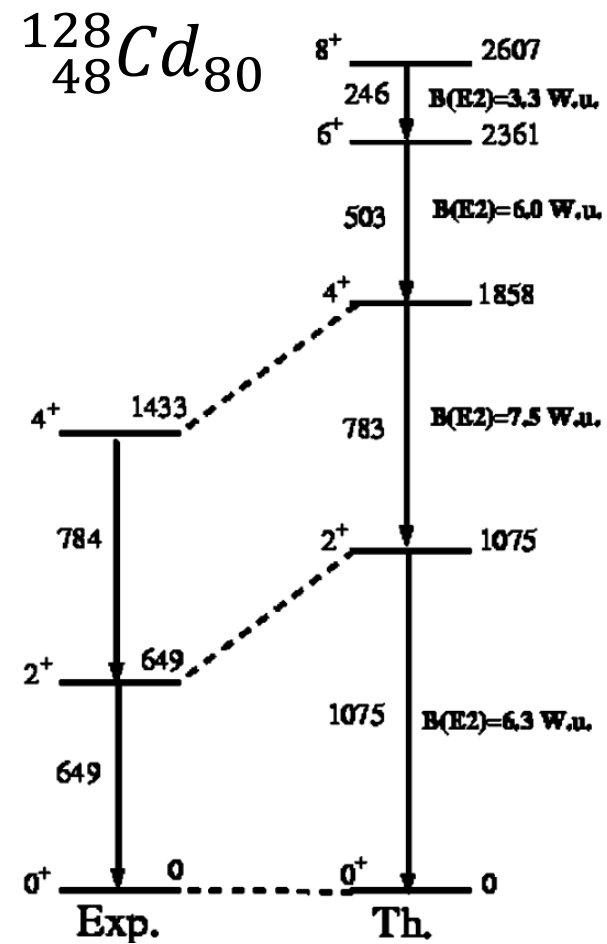
2π2ν holes in doubly magic nuclei



J^π	Multipolarity	$B(\sigma\lambda)_{\text{exp}}$ (W.u.)	$B(\sigma\lambda)_{\text{th}}$ (W.u.)
2^+	$E2$	$10.2^{+1.4}_{-1.2}$	4.65
4^+	$E2$	$3.2^{+0.6}_{-0.7}$	6.42
(4^-)	$M1$	> 0.0076	0.0075
(3^-)	$M1$	> 0.071	0.178



A. Scherillo et al. Phys. Rev. C,70:054318, Nov 2004



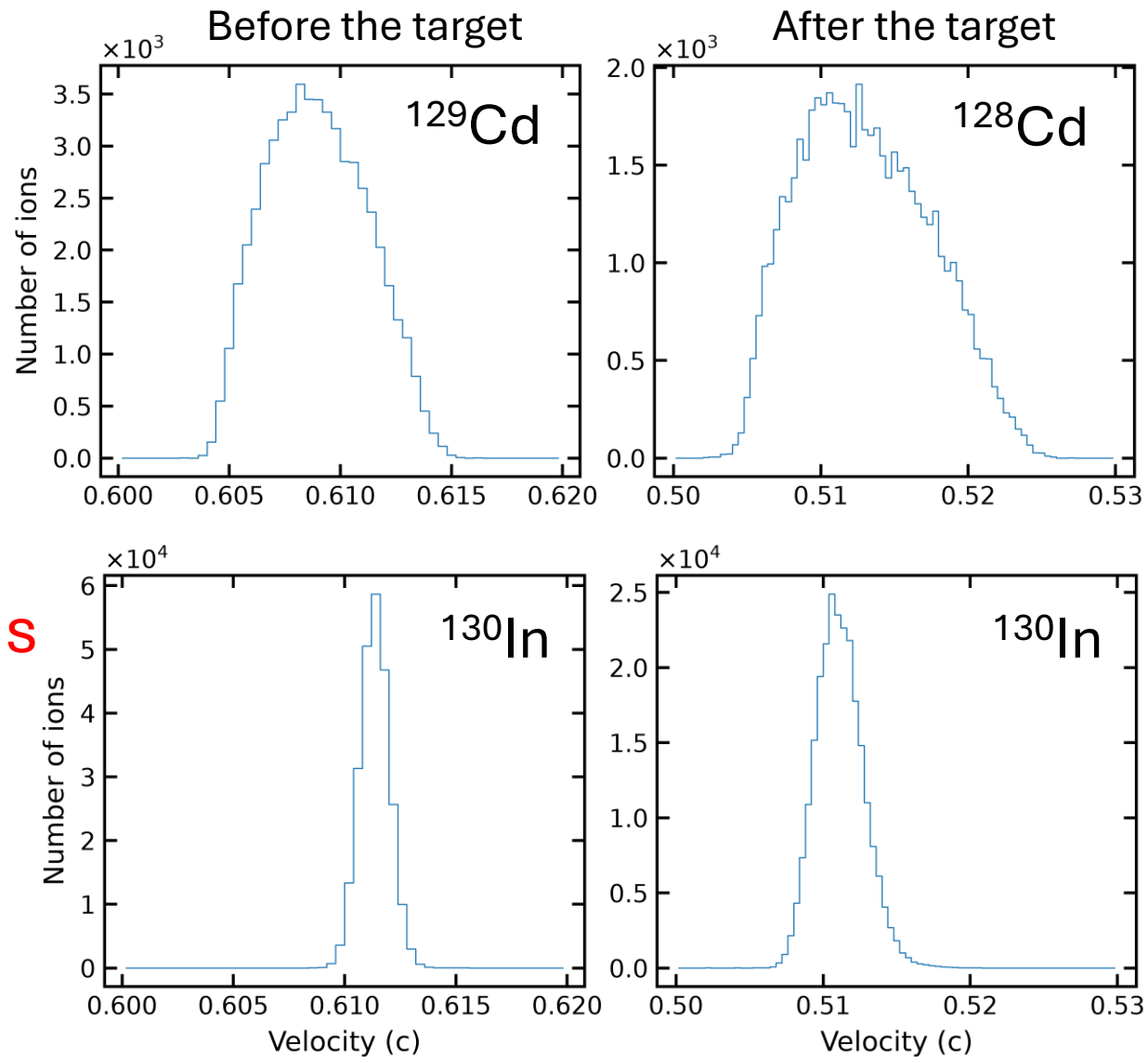
Summary

- In-beam data from HiCARI campaign in RIKEN
- Nucleon removal reactions to populate prompt states
- One new transition and 5 half-lives of excited states measured in ^{129}In
- Two new states tentatively assigned to 3^- and 4^- and their half-life limits measured in ^{128}Cd .
- Half-life of 4^+ and 2^+ states in ^{128}Cd were measured for the first time inferring lack of collectivity as compared to ^{204}Hg .

Backup slides



LISE++ Calculations



Doppler correctinon (DC) for contaminants

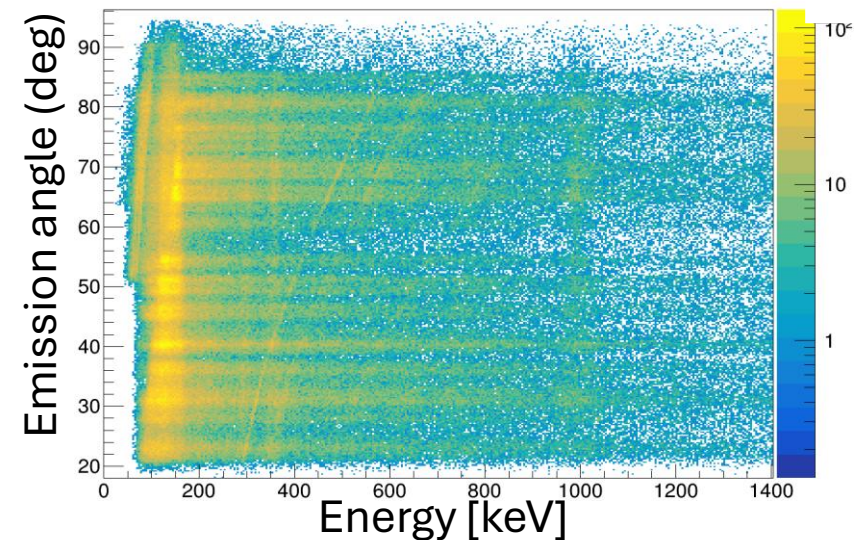
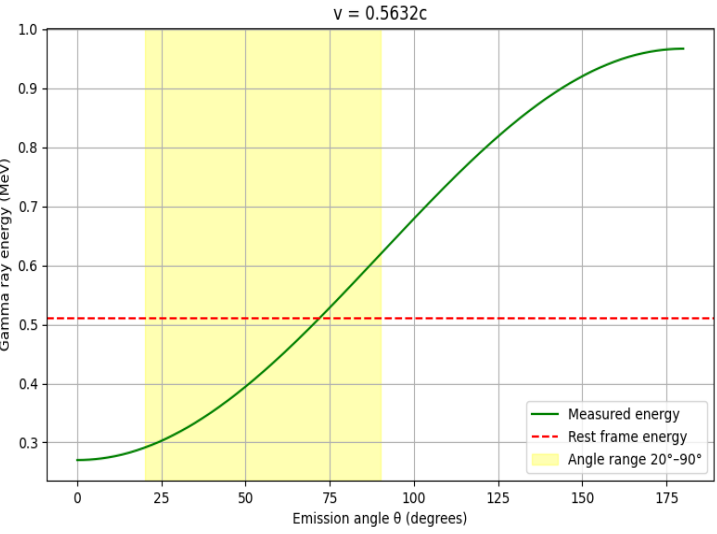
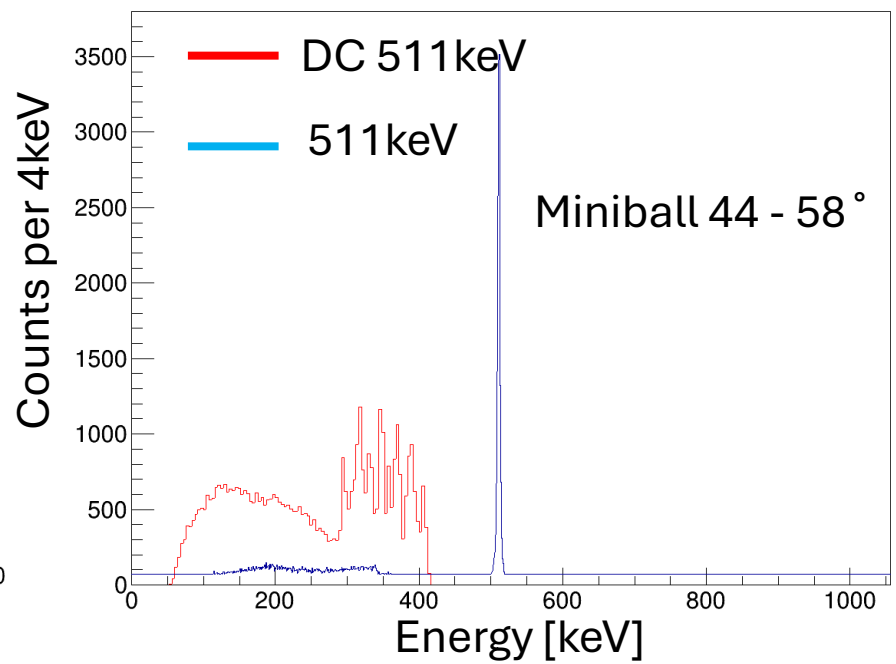
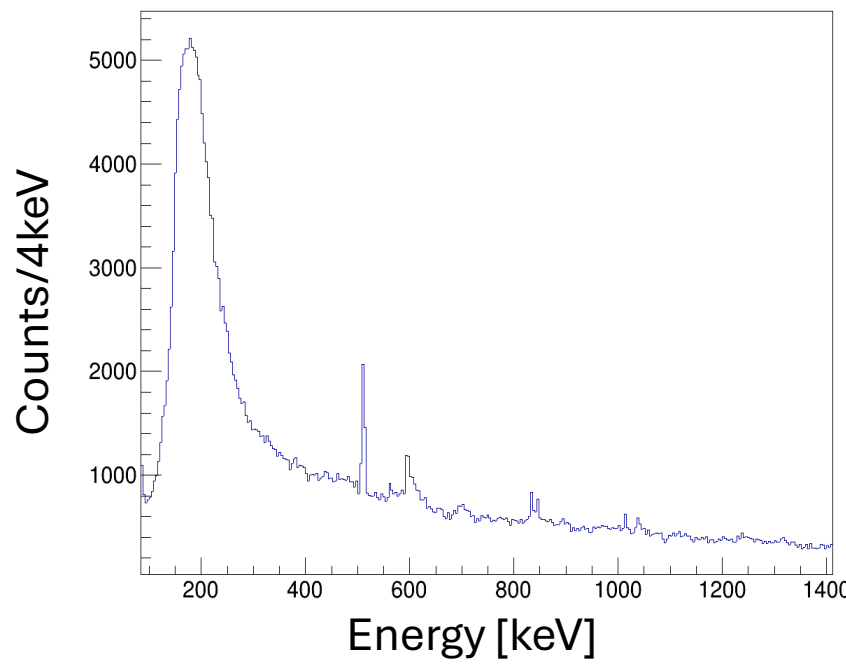
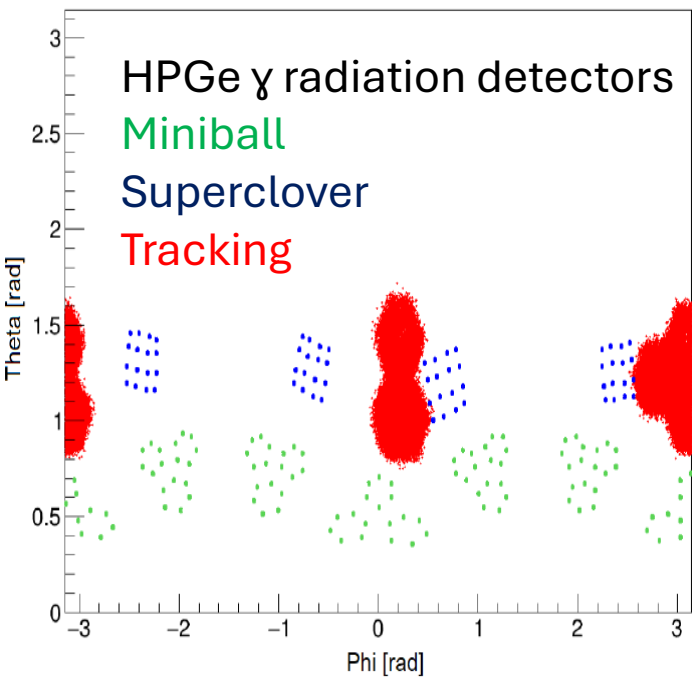


Table 4.2: Observed background γ -rays related to the reaction with neutrons.

Energy [keV]	Origin	Half life
567	$^{76}\text{Ge}(n, n'\gamma)$	420 ns
600	$^{74}\text{Ge}(n, n'\gamma), ^{73}\text{Ge}(n, \gamma)$	
691	$^{72}\text{Ge}(n, n'\gamma)$	
835	$^{72}\text{Ge}(n, n'\gamma)$	
842	$^{27}\text{Al}(n, n'\gamma)$	
1013	$^{27}\text{Al}(n, n'\gamma)$	
1040	$^{70}\text{Ge}(n, n'\gamma)$	