Single-particle states and transition probabilities below ^{132}Sn

S. Lalkovski

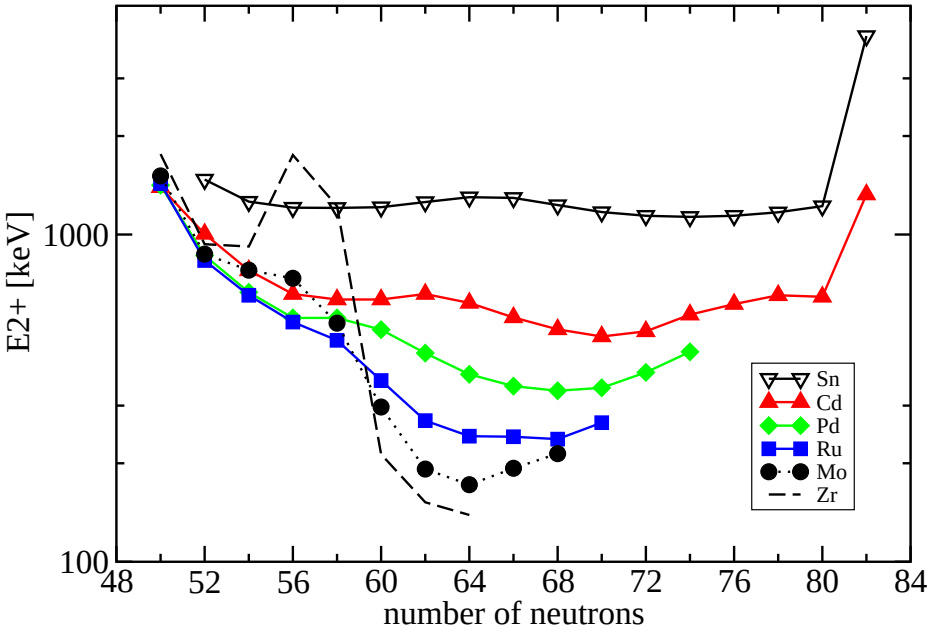
16 April 2011

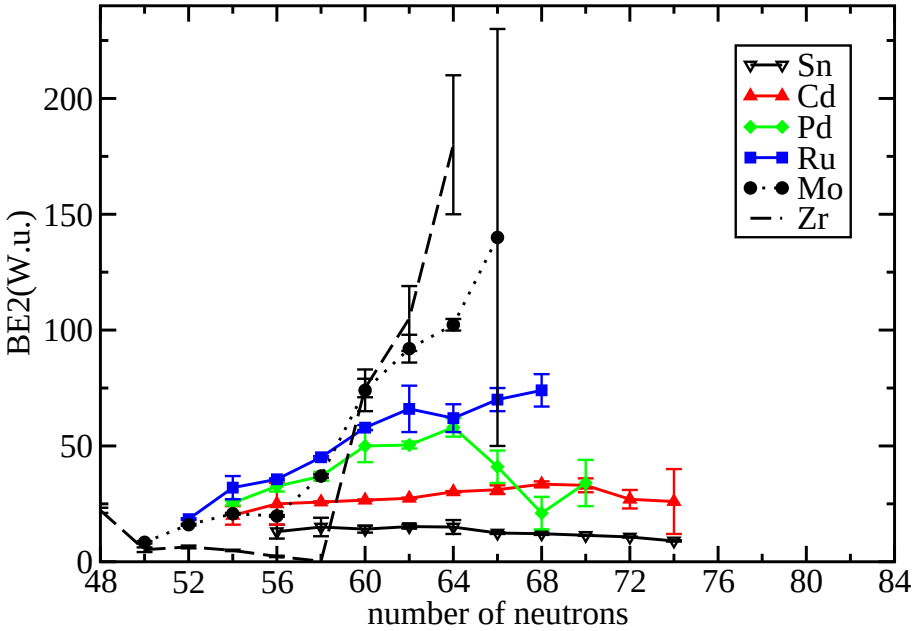
Motivation

Fast-timing

Fast-timing with CARIBU

Motivation

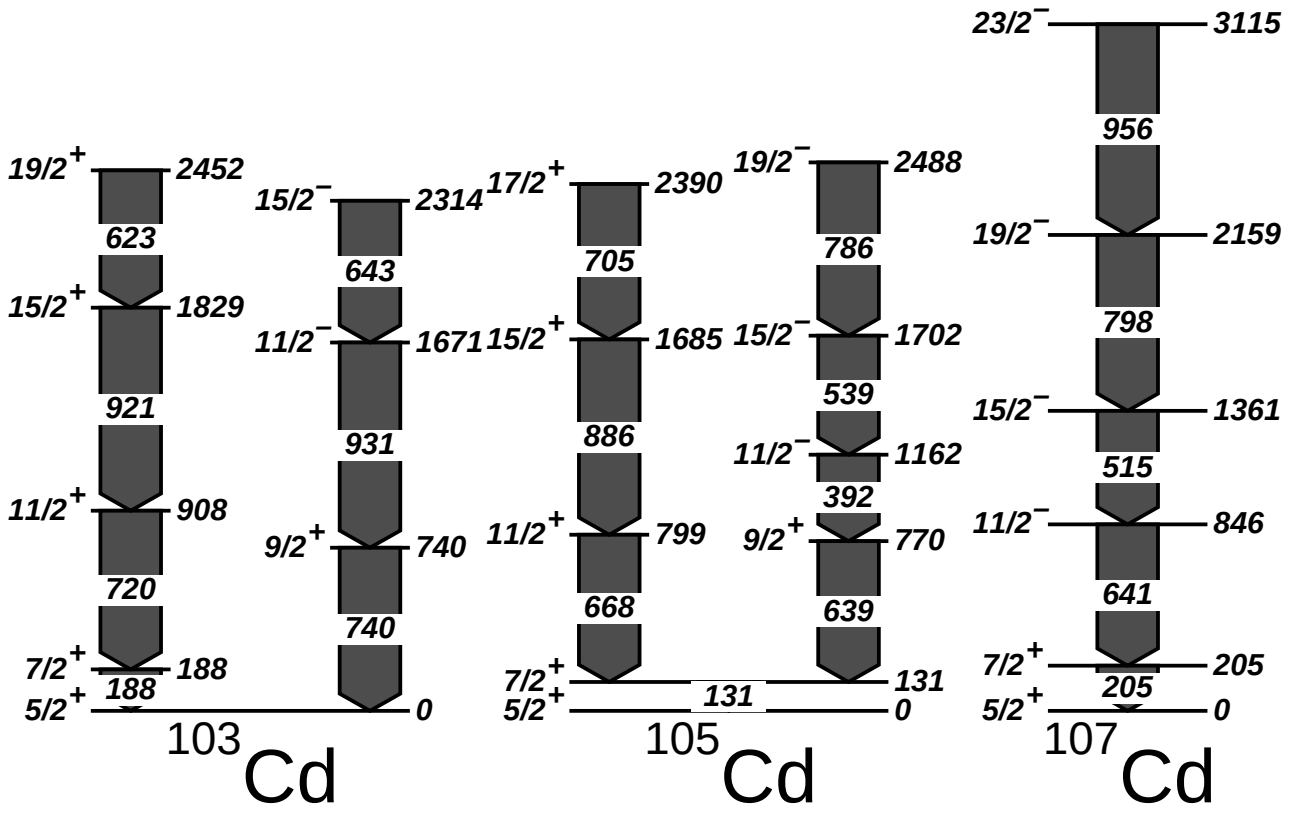




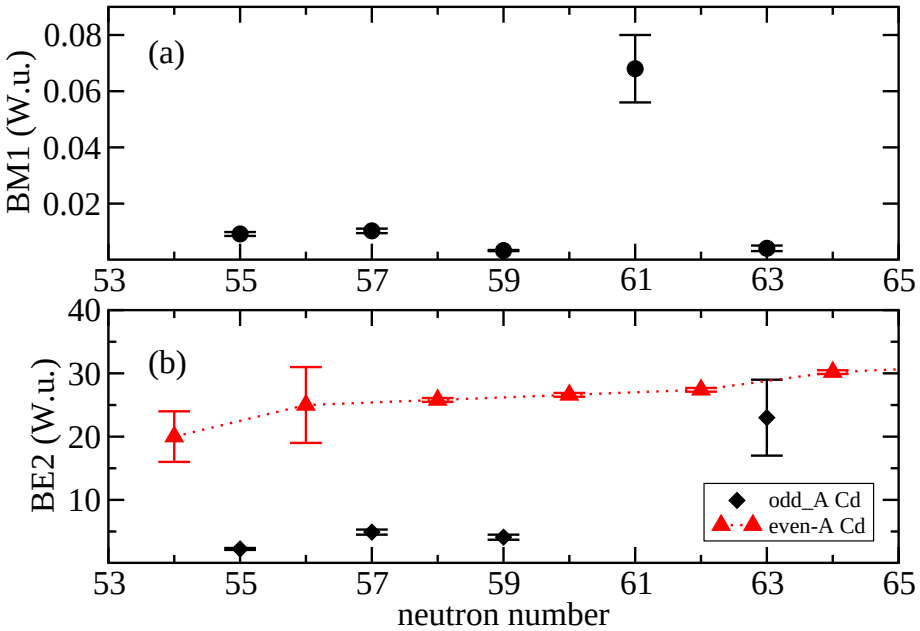
Goals:

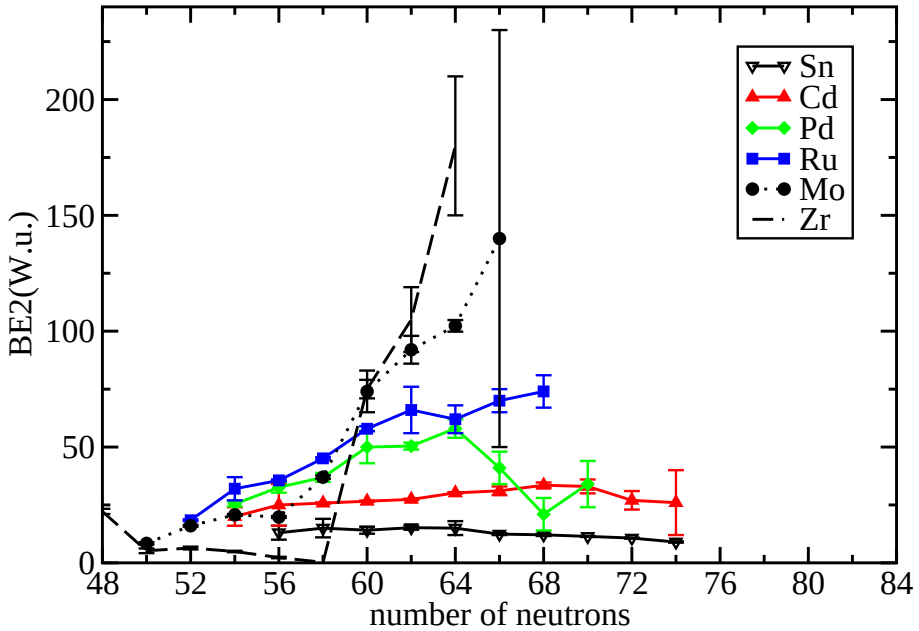
- Evaluation of the "known" half-lives
- More precize measurements
- Filling "the missing" gaps

Motivation


19/2+
2452
623
15/2+
1829
921
11/2+
908
720
7/2+
188
188
5/2+
15/2−
2314
643
11/2−
1671
931
9/2+
740
740
0
103Cd
17/2+
2390
705
15/2+
1685
886
11/2+
799
668
7/2+
131
5/2+
0
19/2−
2488
786
15/2−
1702
539
11/2−
1162
392
9/2+
770
639
131
105Cd
23/2−
3115
956
19/2−
2159
798
15/2−
1361
515
11/2−
846
641
7/2+
205
205
5/2+
0
107Cd

Motivation



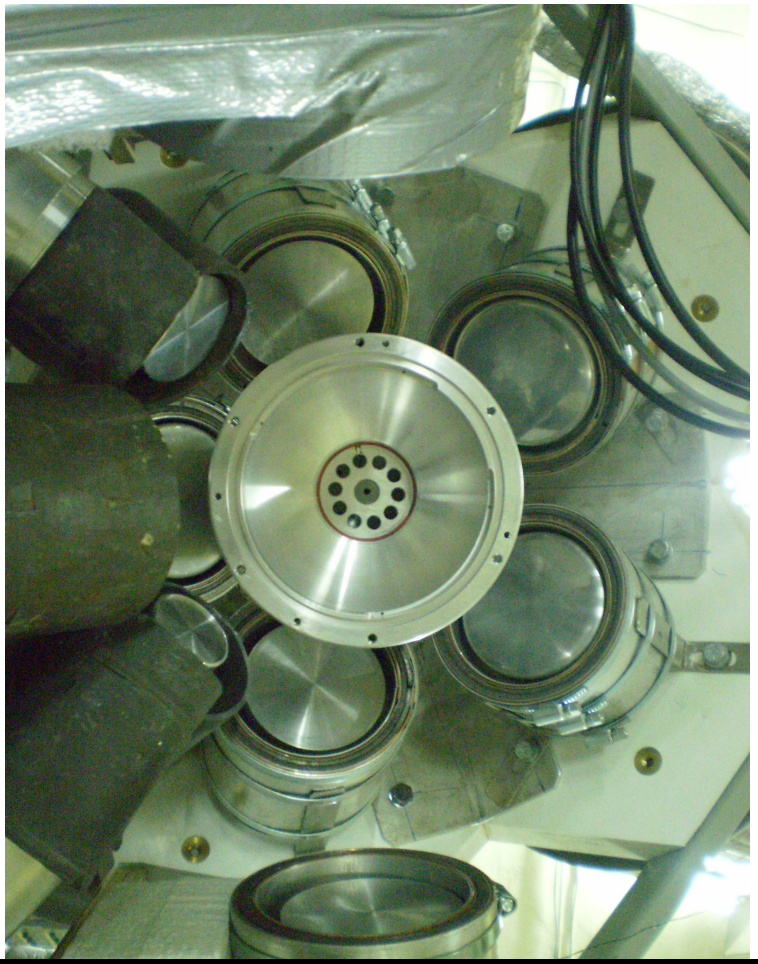


Goals:

- Expansion towards odd-A nuclei
- Identification of the single-particle states

Set-up @ NIPNE (Romania)

N.Marginean *et al.*, Eur.Phys.J.**A46** (2010) 329



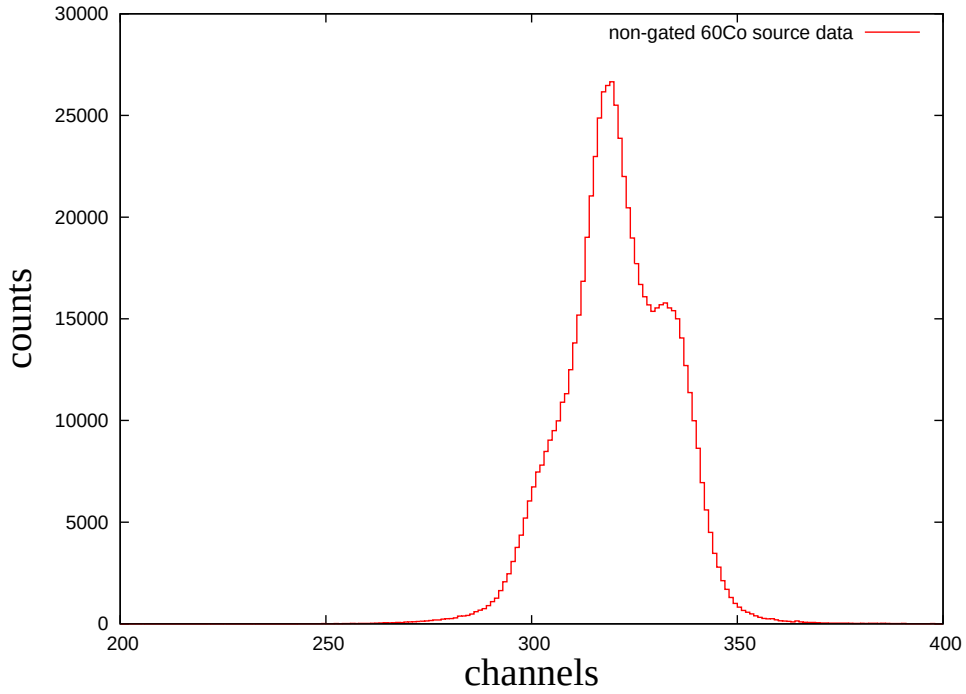
Detectors:

- 7-8 HpGe placed on backward angles and 90° with respect to the beam axis
- 5-8 $LaBr_3$:Ce of cylindrical and conical shapes optically coupled to XP20D0B; placed at backward angles with respect to the beam axis
  Intrinsic Efficiency: $\sim$ 80% for 60 keV
  Energy resolution: $\sim$ 3%;
  Time resolution: FWHM=164 ps

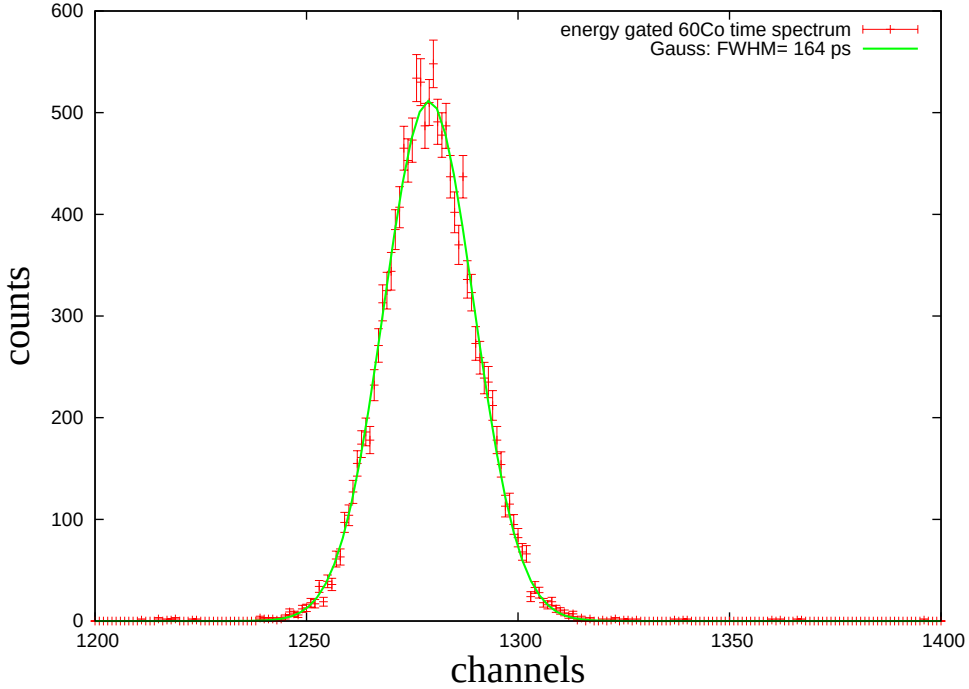
Electronics: 5 TAC opperating in a common start/stop mode; TAC range - 50 ns; 8k ADC

Trigger: 1 HpGe + 2$LaBr_3$:Ce in coincidence

Source test experiments: ^{60}Co



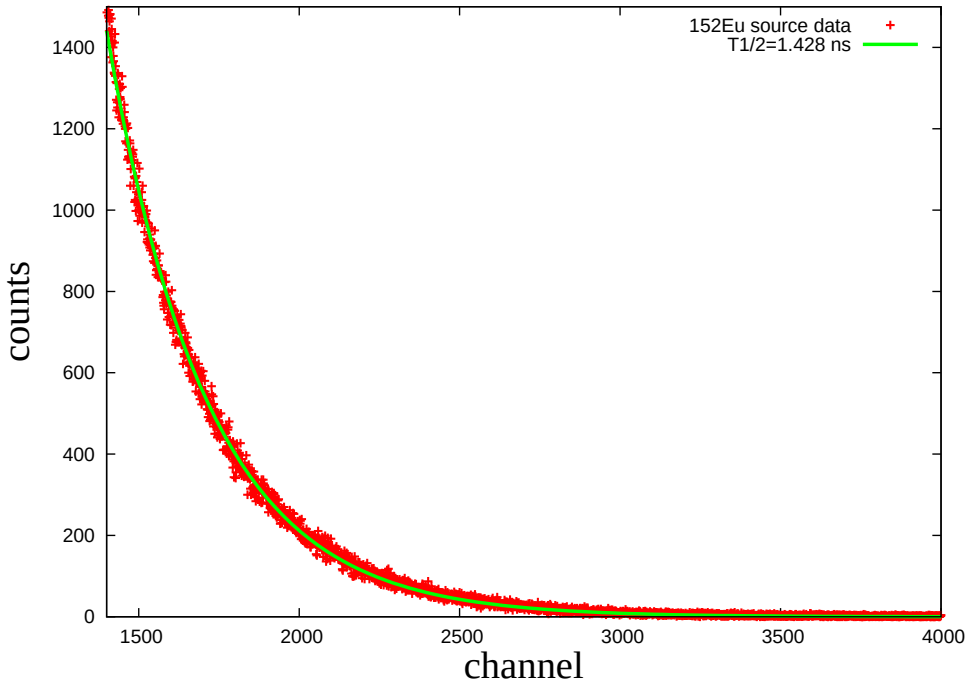
Ungated time spectrum



Time spectrum gated on 1332γ and 1173γ
FWHM=164 ps 5

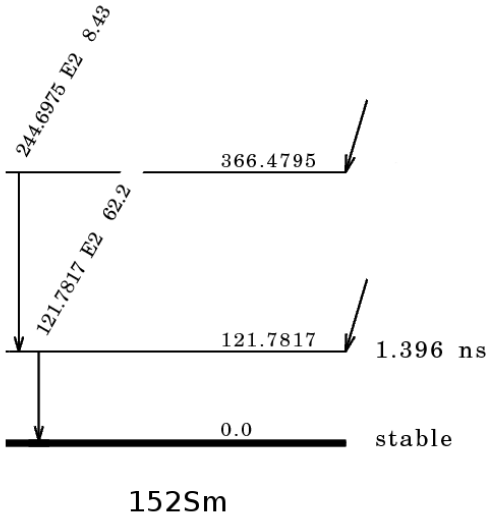
HIL-Warsaw'2011, Students workshop

Source test experiments: ^{152}Eu

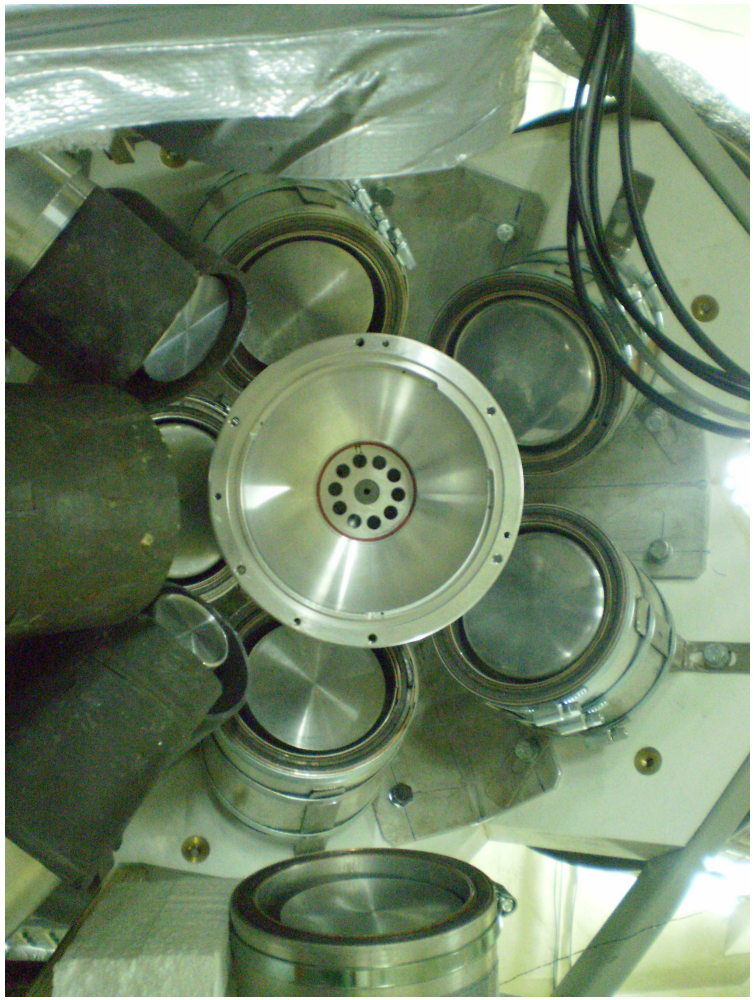


time spectrum gated on 121γ and 244 γ
$T_{1/2}$=1.43 ns 4;

HIL-Warsaw'2011, Students workshop

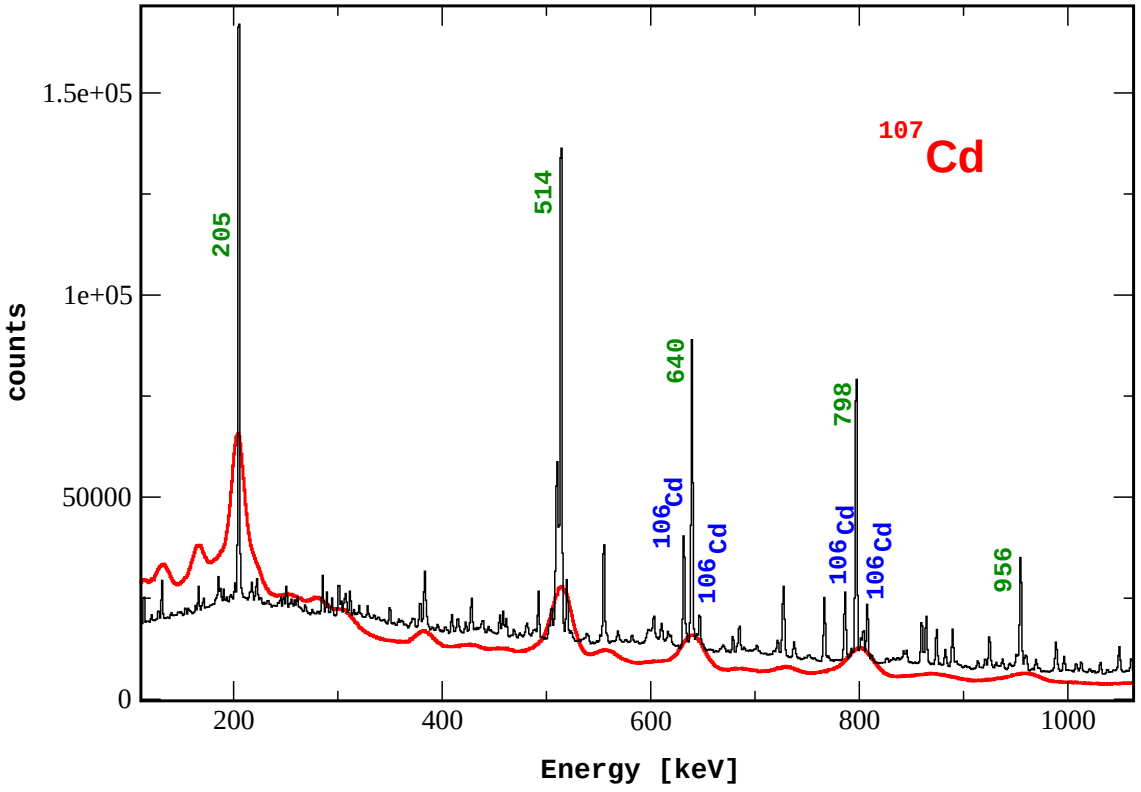


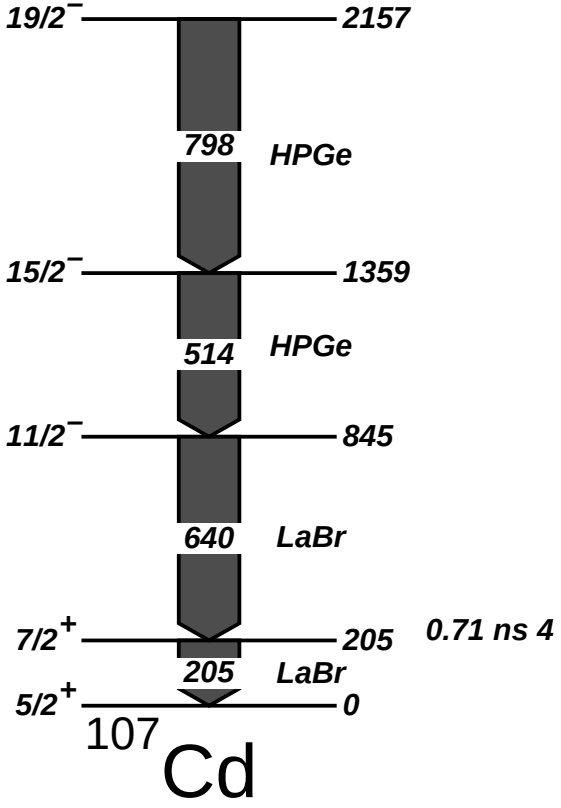
Fast-timing campaign



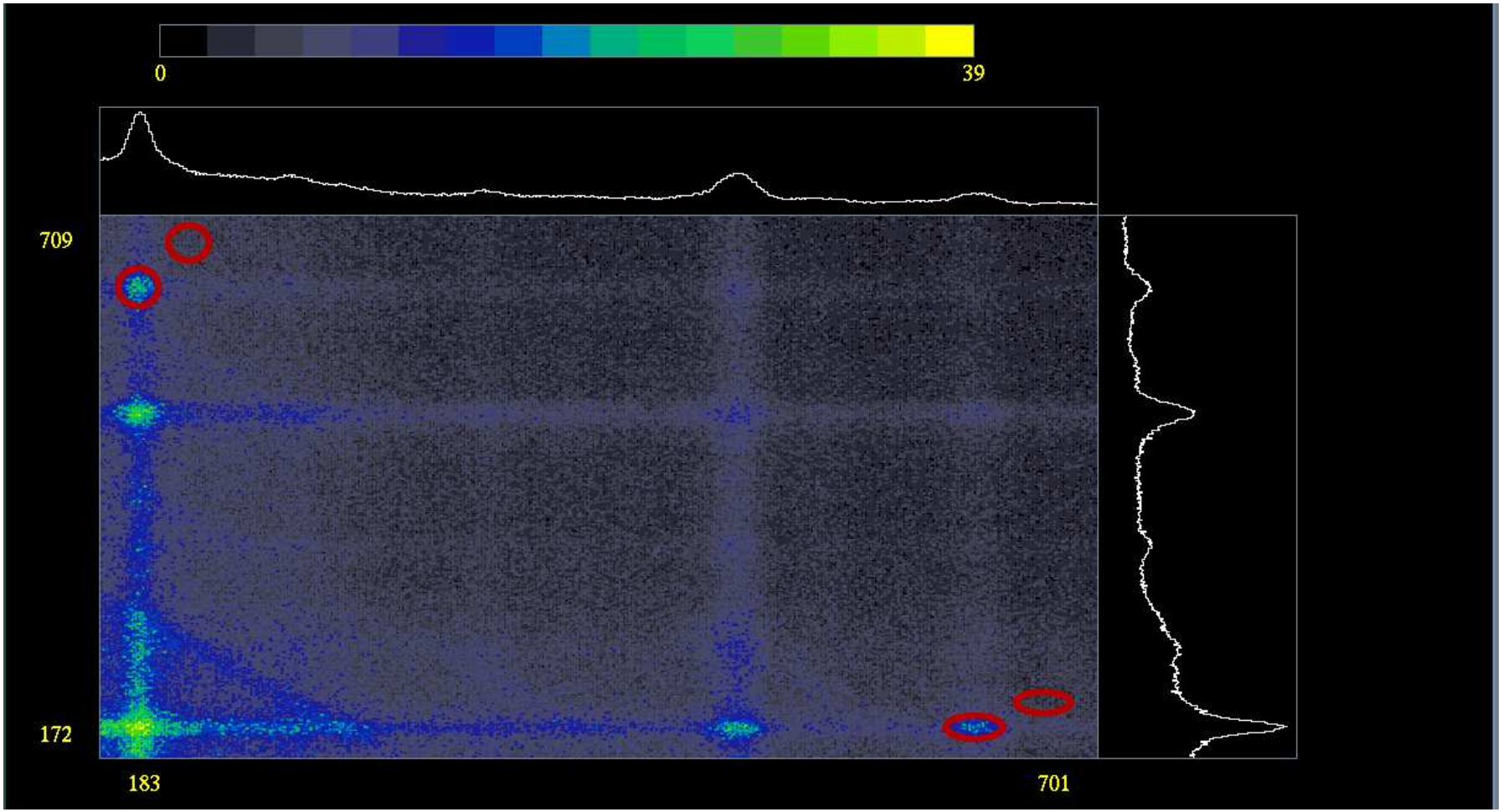
2008-2010: In-beam experiments @ NIPNE (Romania)
Beams: ^{12}C, ^{18}O, ^{7}Li
Targets: ^{107}Ag, ^{94,96,98}Mo
Compound nucleus: ^{103,105,107}Cd, ^{113}Sb, ^{111}Sn, ^{95}Mo

In-beam test experiment: ^{107}Cd

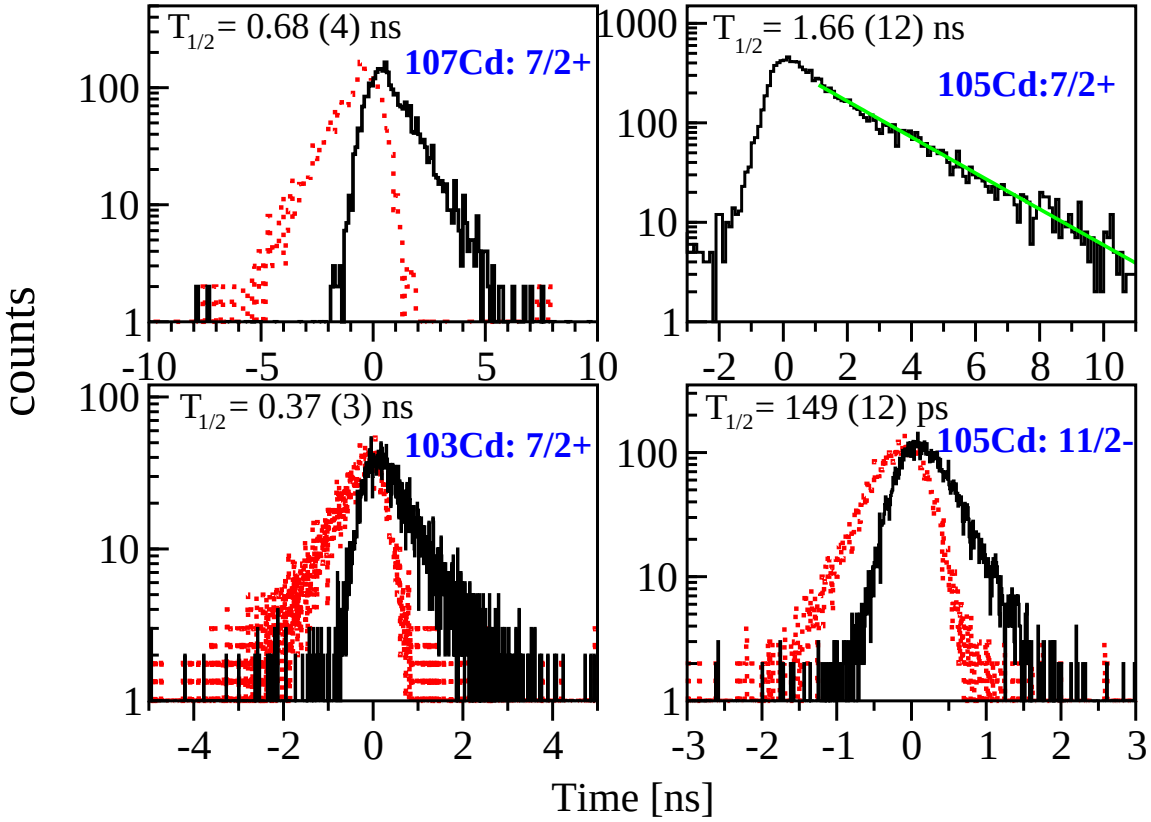




In-beam test experiment: ^{107}Cd



Half-lives in odd-Cd



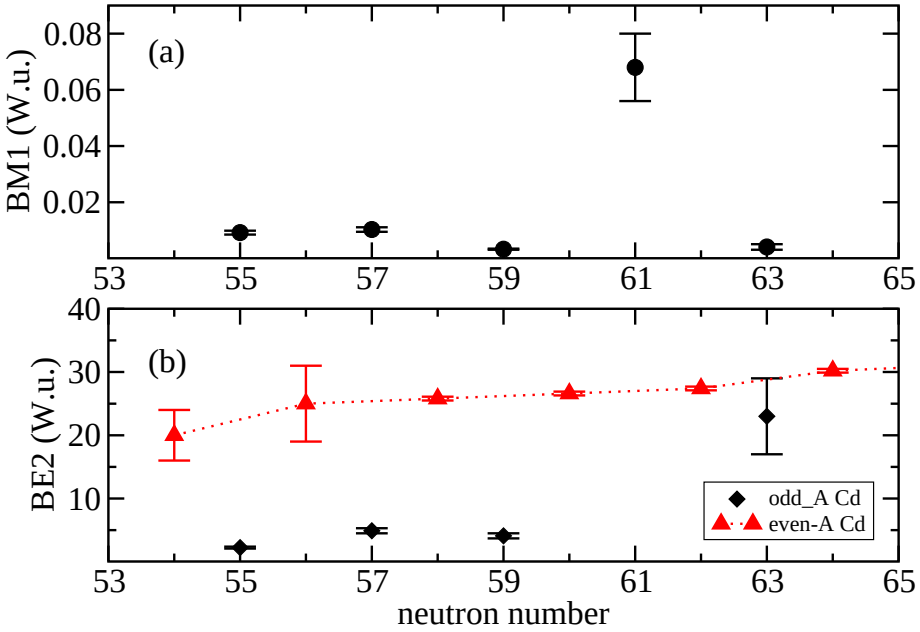
NNDC values:

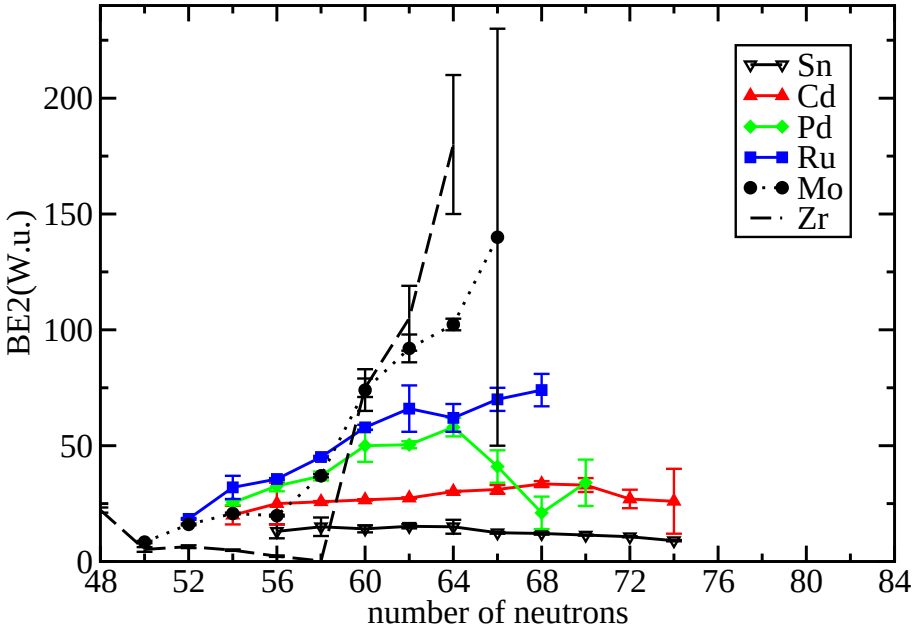
^{107}Cd: $T_{1/2}(7/2^+)$=0.71 ns 4

^{105}Cd: $T_{1/2}(7/2^+)$=1.75 ns 11

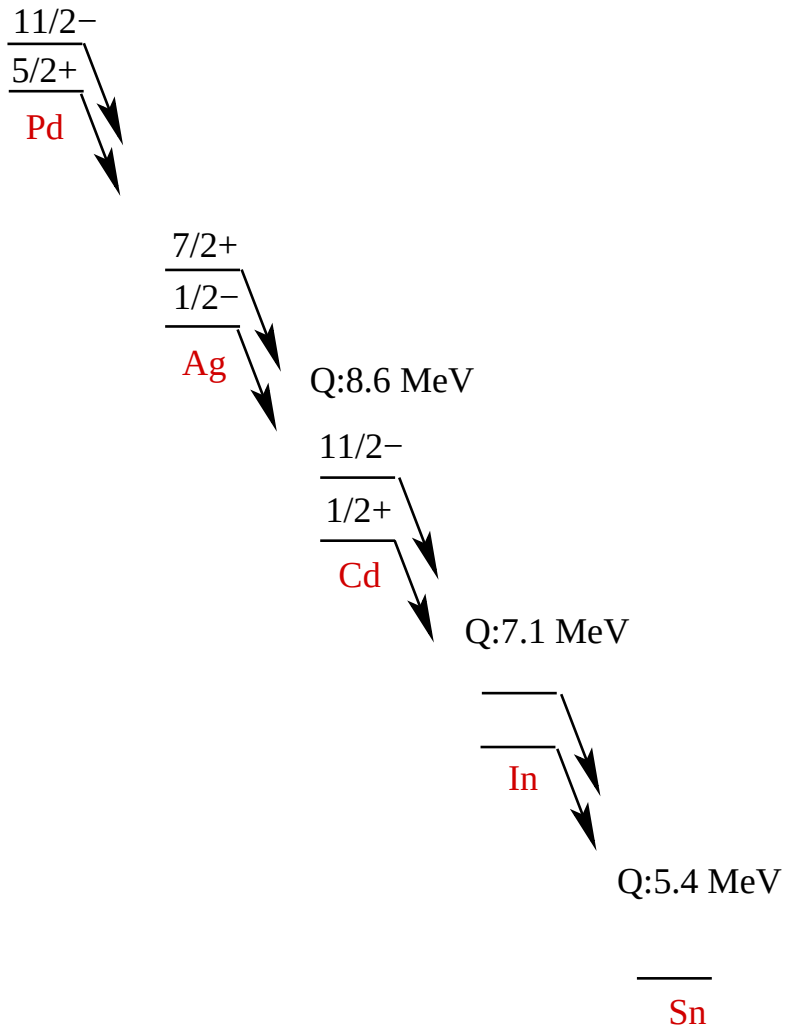
S.Kisyov *et al.*
(to be submitted)

odd-A nuclei: Single Particle Excitations vs. Collectivity





odd-A mass chain



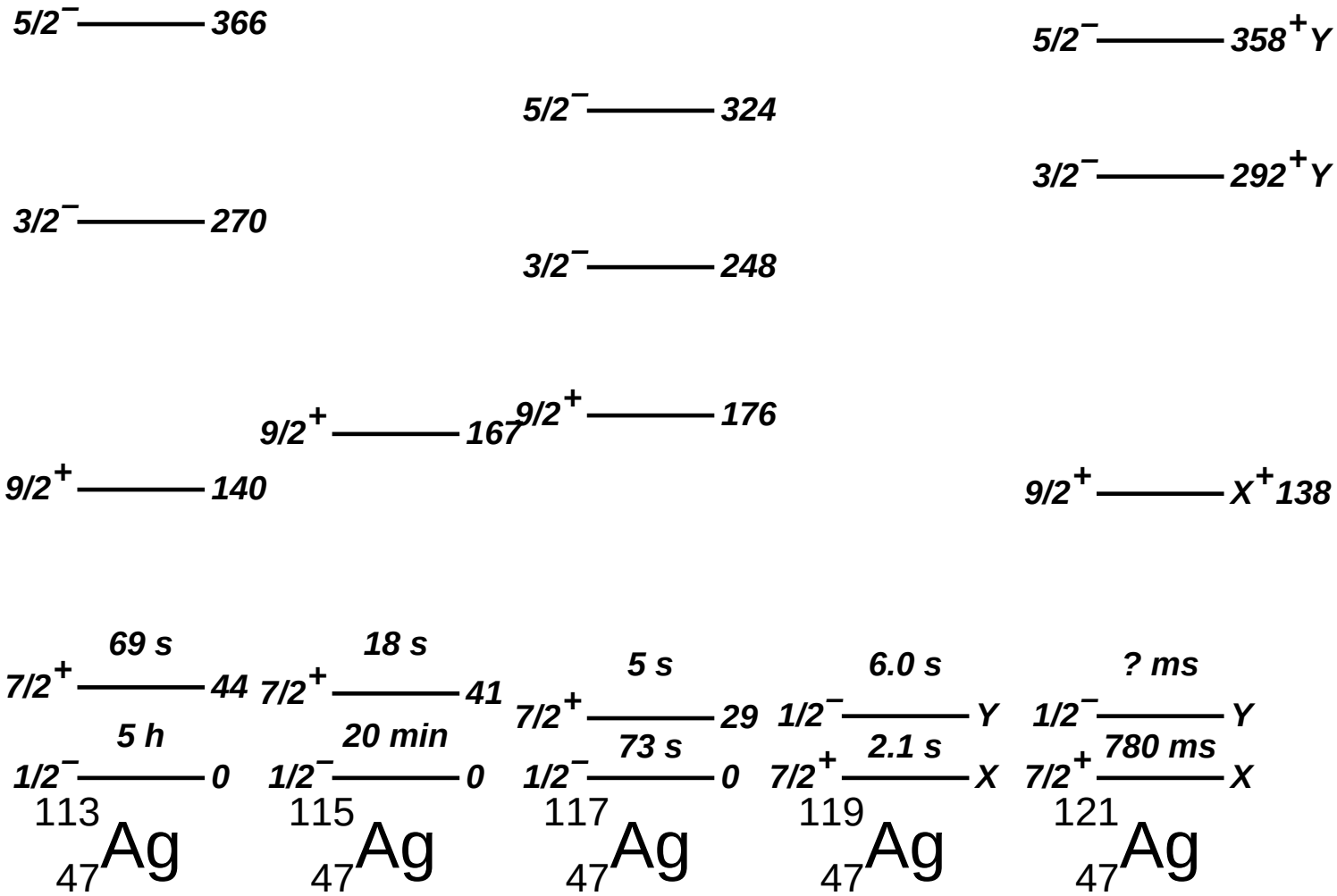
Caribu Yields:

- ^{121}Ag: 5.10^4 ions/sec
- ^{123}Ag: $\sim 10^3$ ions/sec
- ^{125}Ag: $\sim 10^2$ ions/sec

Test experiment @ ANL:

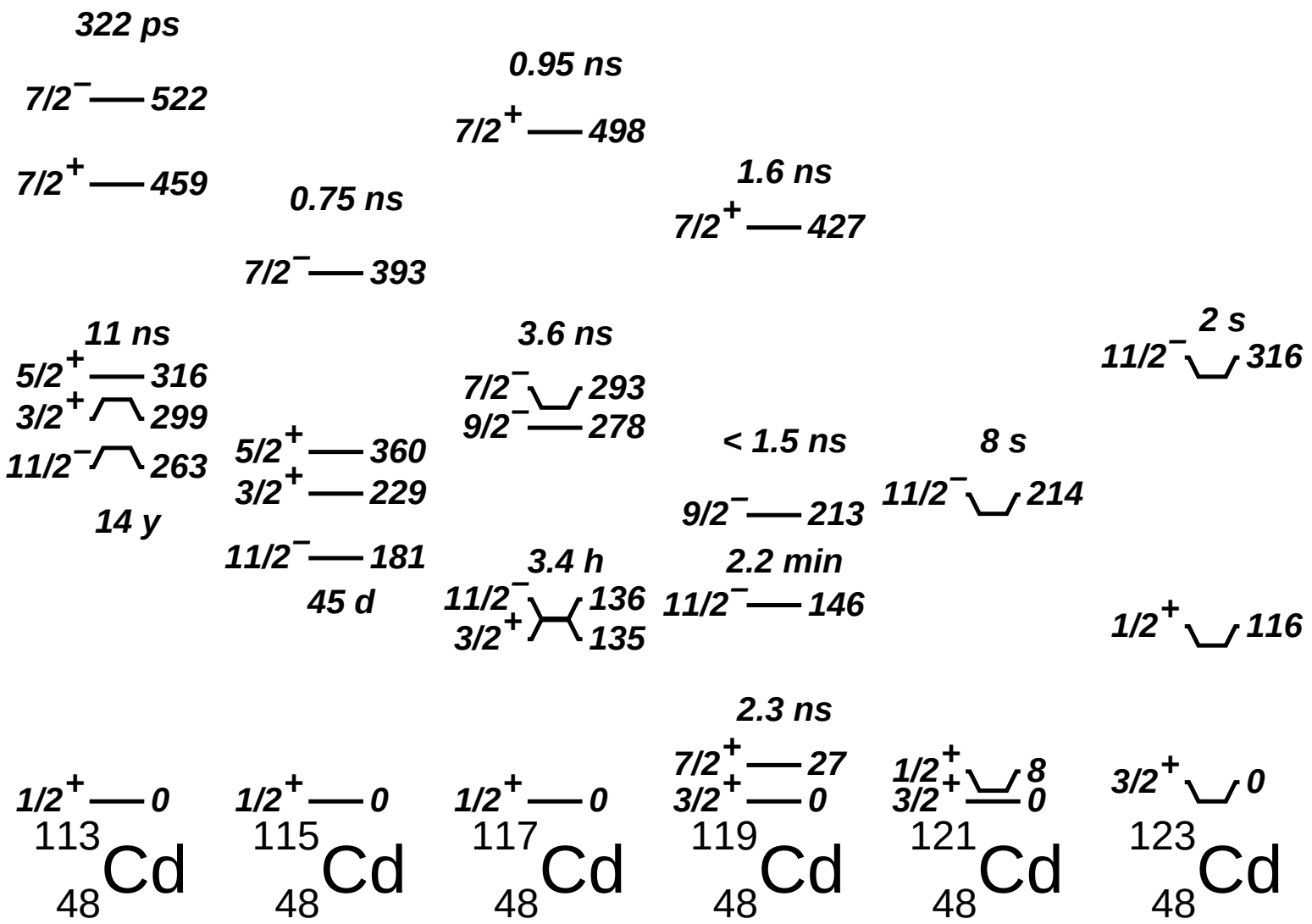
- $LaBr_3$:Ce in coinc. with GAMMASPHERE
  F.Kondev, Friday talk
  S.Zhu *et al.*, NIMA (2010), doi:10.1016/j.nima.2010.10.059
- β-detector.

Example: odd-Ag



RISING
A.Bruce
Friday
Talk

Example: odd-Cd

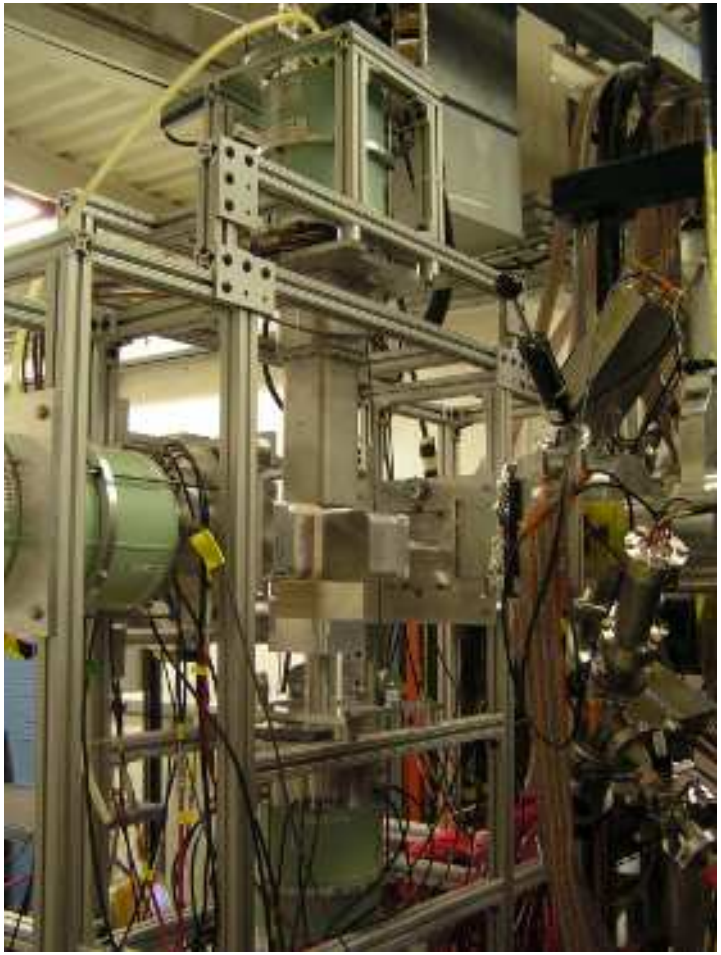


Electromagnetic radiation systematics in N-rich Cd

isotope	E_{level} (keV)	J^{π}	$T_{1/2}$	E_{γ} (keV)	Mult.	F_w
^{113}**Cd**	316	5/2+	10.8 ns	17.78	M1	9.26×10
				316	E2	2.72
	459	7/2+	**(8-500 ps)**[1]	142	M1+E2	
^{115}**Cd**	360	5/2+	**(1-70 ps)**[1]	360	M1+E2	
	393	7/2-	0.75 ns	213	E2	0.4
^{117}**Cd**	498	7/2+	0.95 ns	204.6	E1	5.4×10
				219.7	E1	1.2×10
				362.3	(E2)	2.3
^{119}**Cd**	427	7/2+	1.6 ns			
^{121}**Cd**	330	(9/2-,11/2-)	**($\leq$ 2 ns)**[2]			
	508	(7/2-,9/2-)	**($\leq$ 2 ns)**[2]			
^{123}**Cd**	116	1/2+	**(10^{-12}-10^{-7} s)**[1]	116	M1(+E2)[3]	

Table: [1]Estimated value; [2]Experimentally detemined upper limits; [3]Mixing ratio uknown

Fast-timig with Caribu



X-array

$LaBr_3$:Ce

THANK YOU!