Gamma Ray Counting Rate Measurements in the AGATA-PRISMA Plunger Experiments

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From LNL PAC June 2010: 3 experiments accepted

- PAC N°10.30 (Piave+Alpi)
RDDS lifetime measuremements in the region of n-rich doubly magic ^{132}Sn:
lifetime of the 6^+ state in ^{136}Te (Gadea et al.)
^{136}Xe on ^{238}U reaction (scheduled in July 2011)

- PAC N°10.41 (Tandem+Alpi)
Structure beyond the N=50 shell closure in n-rich nuclei in the vincinity of ^{78}Ni :
The case of N=51 nuclei (Verney, Duchêne, De Angelis et al.)
^{82}Se on ^{238}U reaction (to be performed in fall 2011)

- PAC N°10.44 (Tandem+Alpi)
Lifetimes of intruder states in N~20 sd-pf shell n-rich nuclei (Chapman, Haas et al.)
^{36}S on ^{208}Pb reaction (performed in June 2011)

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- Meetings at the beginning of 2011

- Proposal of a ‘test’ experiment to the LNL PAC March 2011
  Tandem experiment ➔ PAC N° 11.02

- Not accepted by the PAC but put in Plan B

- Finally scheduled on March 13-14, 2011

- Agata demonstrator counting rate measurements for plunger experiments
  (Chapman, Duchêne, De Angelis, Gadea, Haas, Verney)

The counting rate test experiment (13-14/3/2011)

Experimental conditions:

- 32S at 190 MeV, 58 Ni at 250 MeV
- Targets of 4 mg.cm-2: Mg, Ni, Nb, Ta and Pb
- Beam intensity: 1 pnA

Results

Target	Mg	Ni	Nb	Ta	Pb
CR with ^{32}S (kHz)	4.2	2.8	2.0	0.7	0.5
CR with ^{58}Ni (kHz)	11.1	3.9	1.8	0.7	0.5

Background CR: ~80 Hz
Empty target frame CR: ~130 Hz

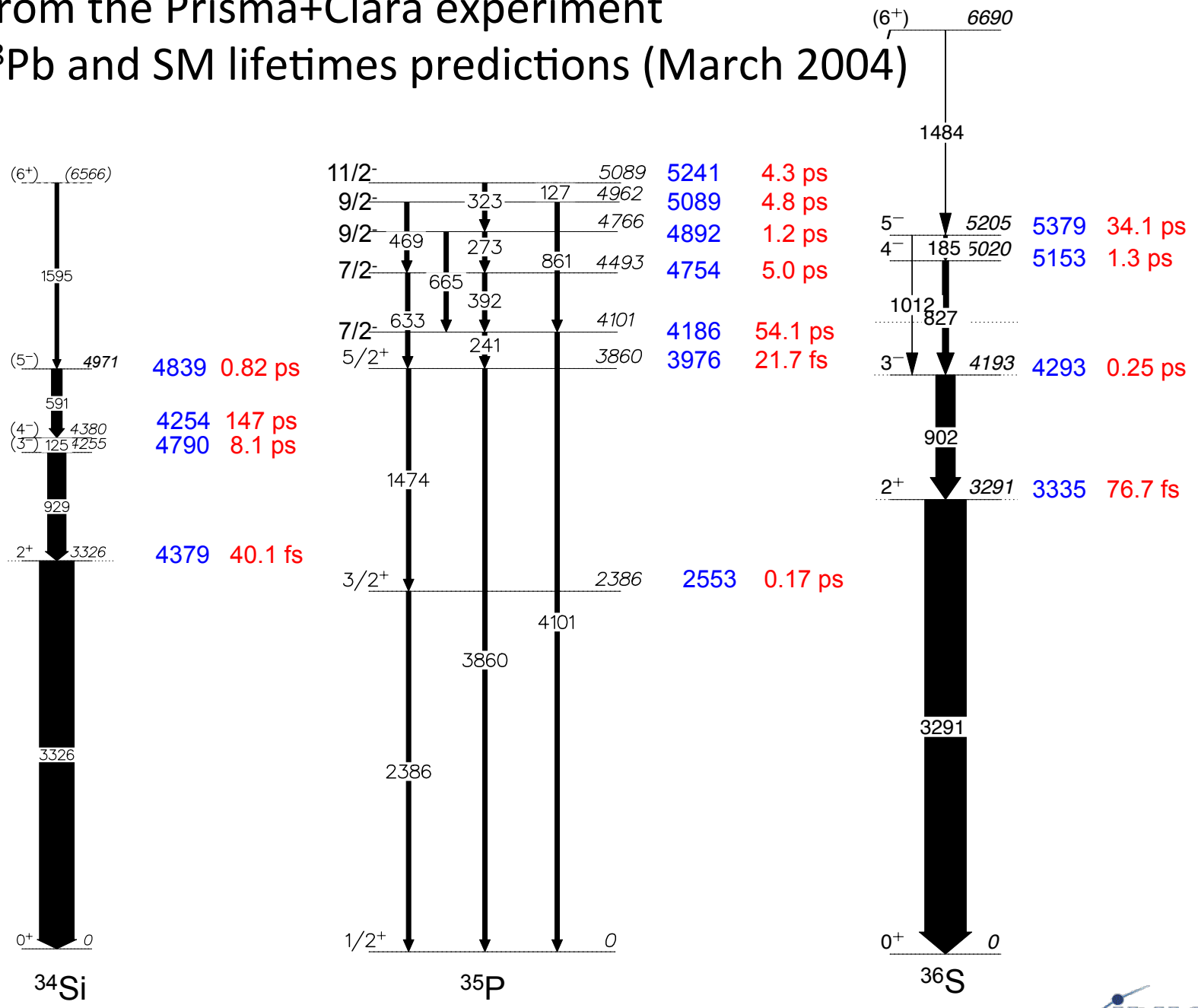
- The 36S+208Pb experiment was scheduled from June 9 to 16 (8 days of beam time)

- The first Alpi experiment (Tandem + Alpi)

- The first experiment with the complete Agata demonstrator

- The Physics en bref …

Results from the Prisma+Clara experiment
^{36}S on ^{208}Pb and SM lifetimes predictions (March 2004)



The adopted experimental conditions:

- Target: 1 mg.cm^{-2} of ^{93}Nb + 1 mg.cm^{-2} of ^{208}Pb
  Degrader: 3 mg.cm-2 of ^{93}Nb

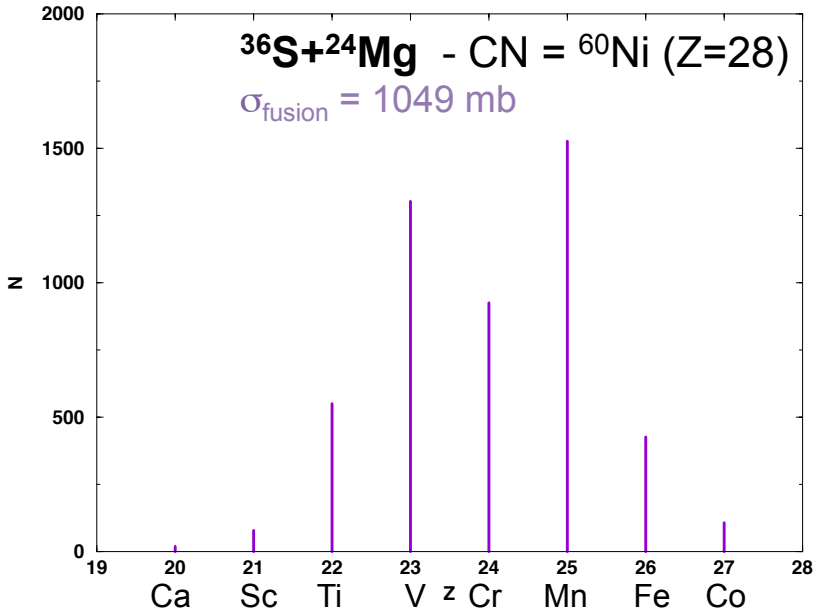
- Tandem + Alpi ^{36}S beam at 225.5 MeV
  i.e. ~25% above the Bass Coulomb barrier

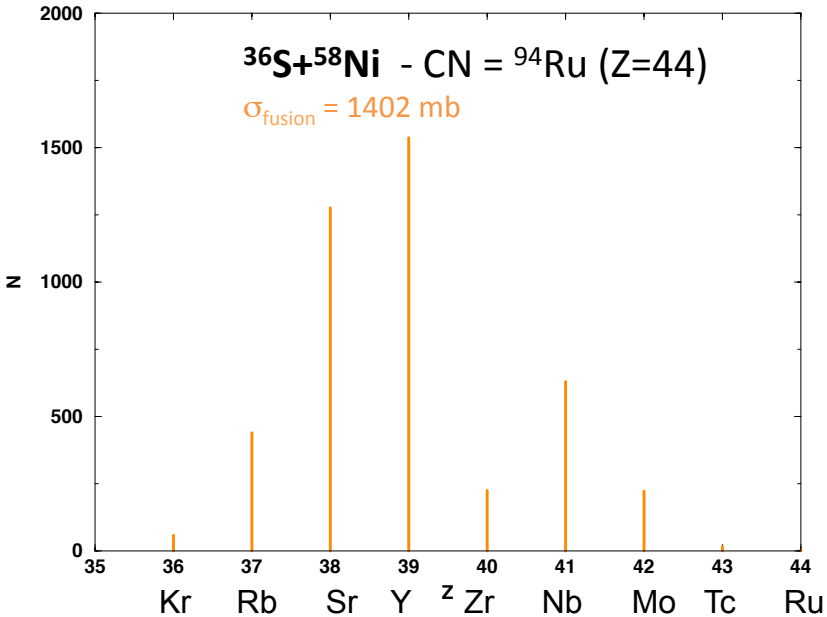
- Prisma placed at 59° (close to the grazing)

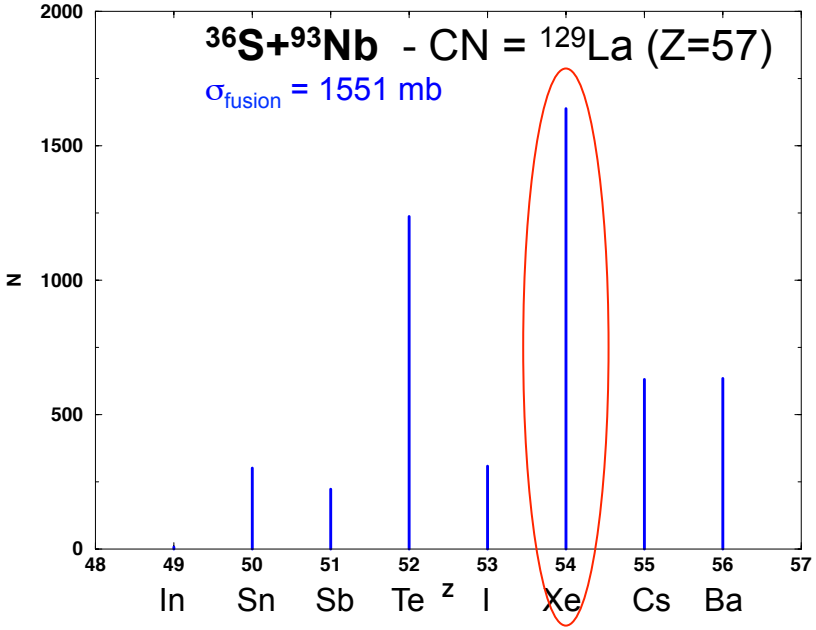
- Typical CR numbers
  Agata 40 kHz/crystal
  Prisma 700 Hz
  Prisma-Agata coinc 350 Hz
  Beam 1 pnA

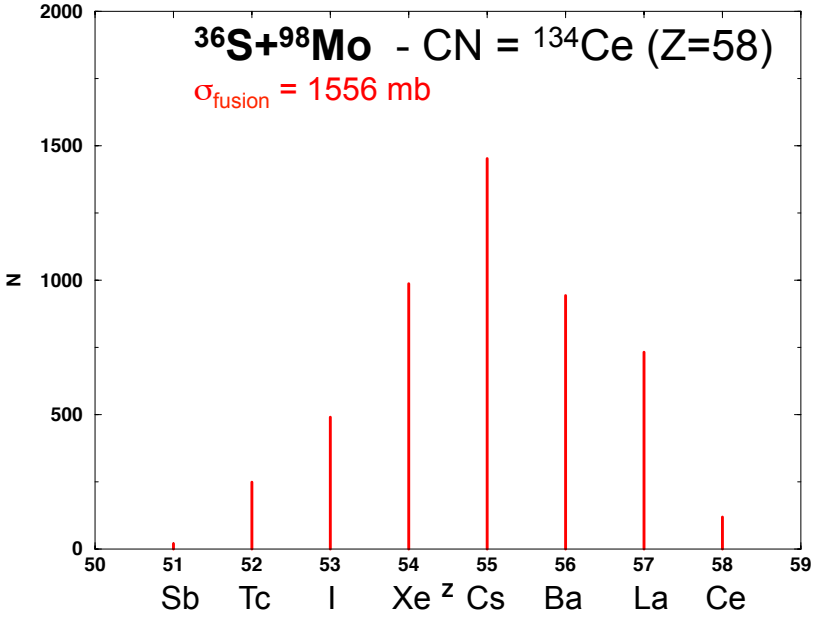
- Run of 8 days, 5 distances measured (7, 20, 35, 65, 120 μm)

Can we explain these counting rates? F-E channels, Cacarizo calc.





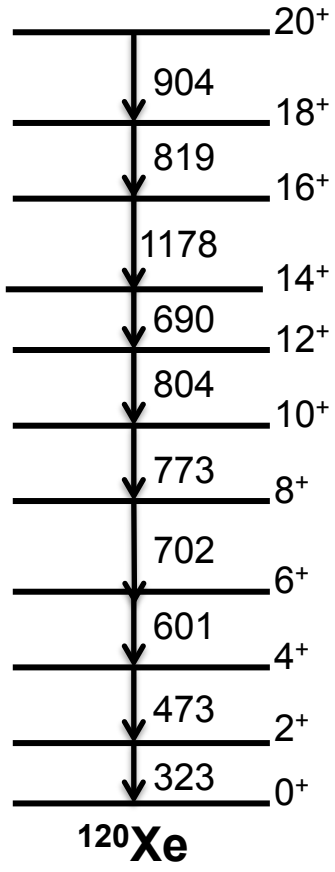




Test case for γ counting rates in Agata

^{36}S+^{93}Nb reaction

- σ_{fusion} = 1551 mb
- The strongest channel: ^{120}Xe
- σ in this channel: 243 mb



^{120}Xe: rotational band up to J>20 (^{32}S+^{92}Mo (4p)).
Large deformation / B(E2) ~ 100 W.u.

Examples of counting rates for 1 pnA ^{36}S

on 1 mg ^{93}Nb / ε $_{Agata(photopeak)}$ = 5%:
2 cases

- Contribution of the $2^+ \rightarrow 0^+$ transition Eγ = 323 KeV
  0.4 kHz

- Contribution of the Yrast band up to $J^\pi=20^+$ with equal feeding of the 10 band members and <Eγ> = 727 KeV.
  2.75 kHz

Total Counting Rate estimated ~10 kHz/crystal

Comments and suggestions

- Choice of the Degrader

- « Thick » target experiments
  . Beam intensity limitations
  . Number of distances to be measured
  . The Prisma response (A and Z)

- The Alpi beam

- The Koeln Plunger

- The LNL target laboratory