



Fission fragments spectroscopy at LNL with AGATA-PRISMA: Insights into the magicity of ^{78}Ni .

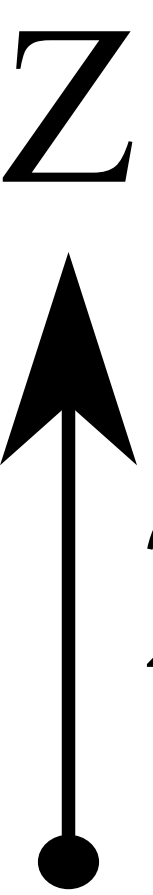
Jérémie Dudouet & collaborators

Institut de Physique des deux infinis de Lyon (IP2I)

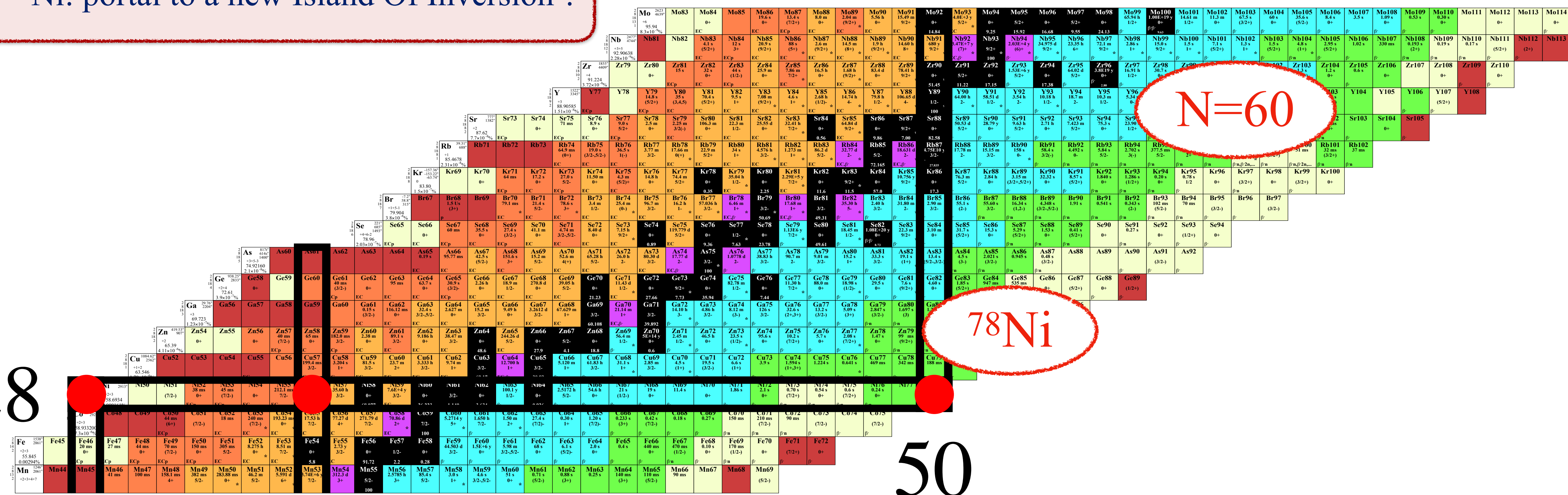
Workshop in-beam spectroscopy, Lyon, 22/06/2023

Physics motivations: Two major nuclear structure topics

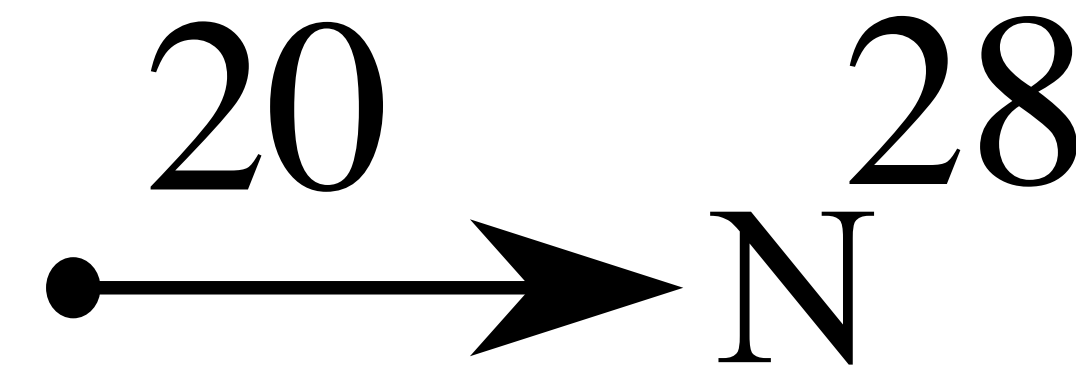
→ ^{78}Ni : portal to a new Island Of Inversion ?



28



50

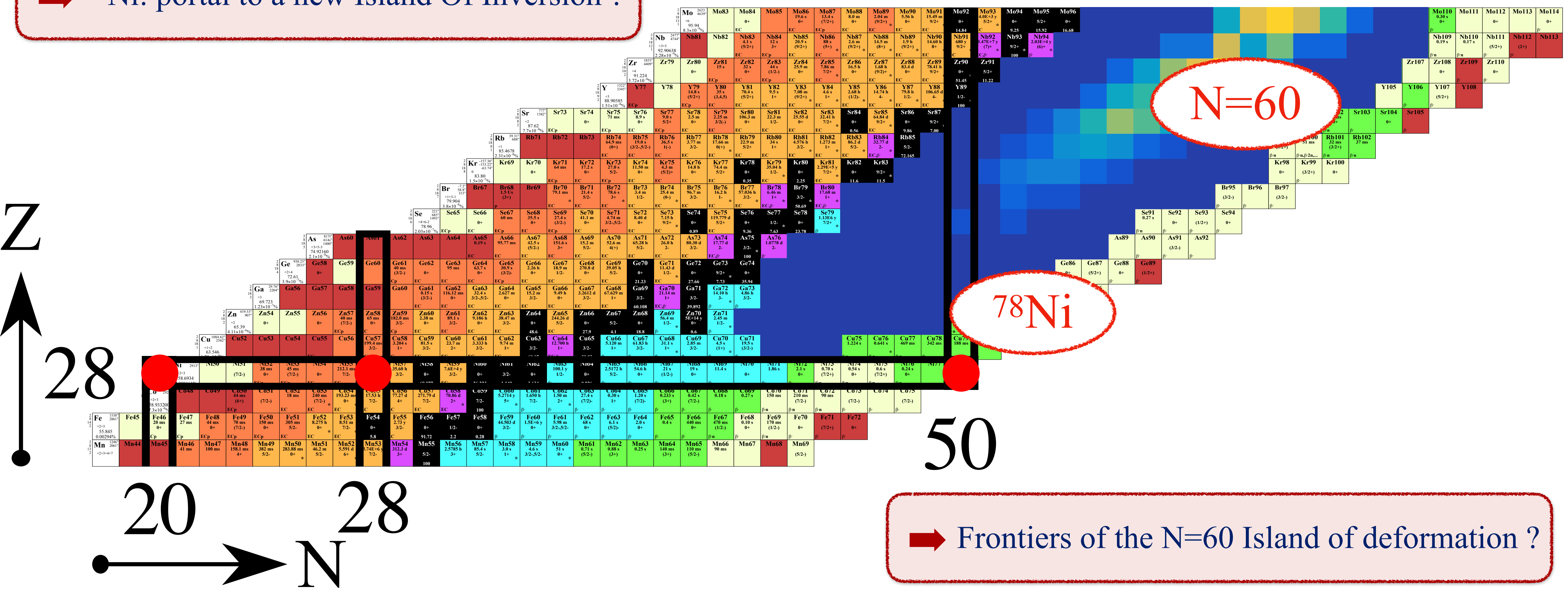


→ Frontiers of the N=60 Island of deformation ?

Physics motivations: Two major nuclear structure topics

→ ^{78}Ni : portal to a new Island Of Inversion ?

Fission is the perfect solution !



→ Frontiers of the N=60 Island of deformation ?

The E680 Experiment: AGATA + VAMOS++ @ GANIL

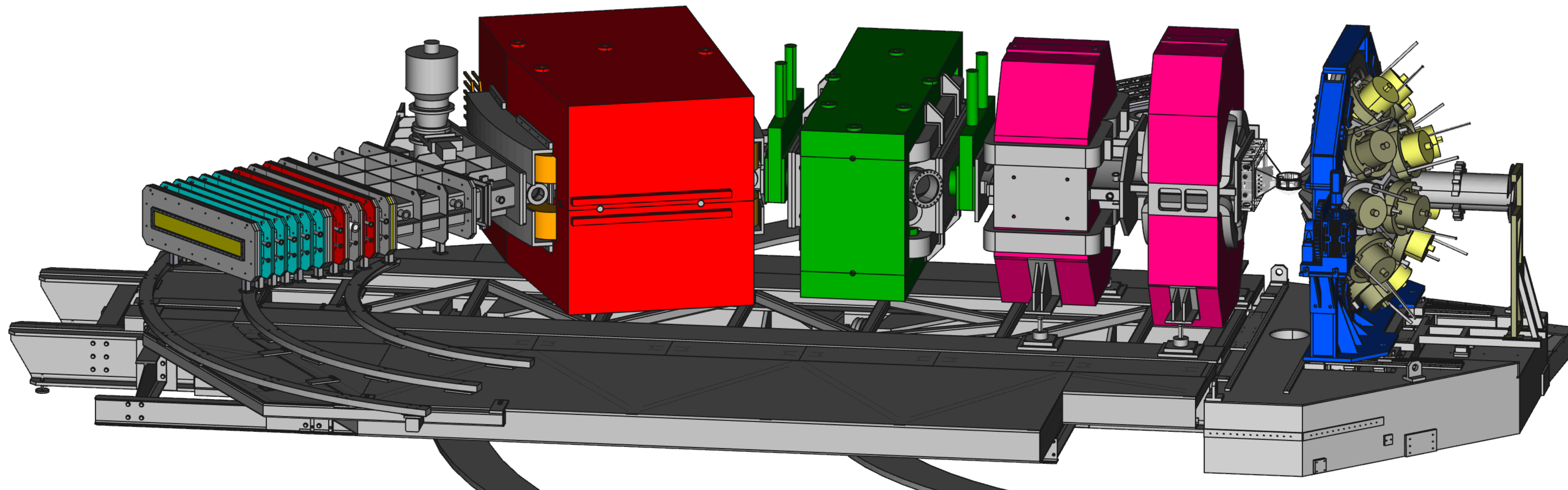


PAC Date:	EXP # (Do not fill in):
April 2014	E

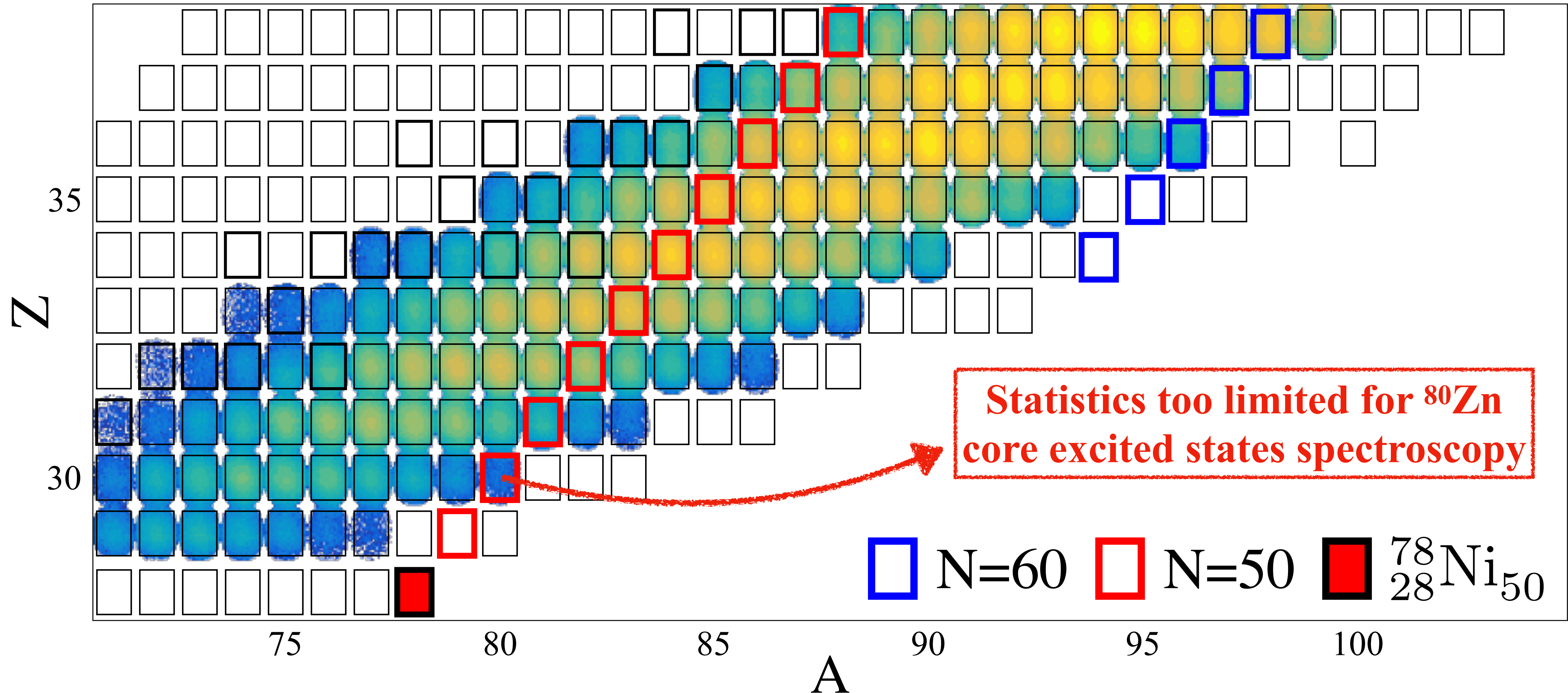
PROPOSAL FOR AN EXPERIMENT

Title: Test of the Z=28 proton- and N=50 neutron- gaps in ^{82}Ge and ^{80}Zn nuclei. Impact on the magicity of ^{78}Ni

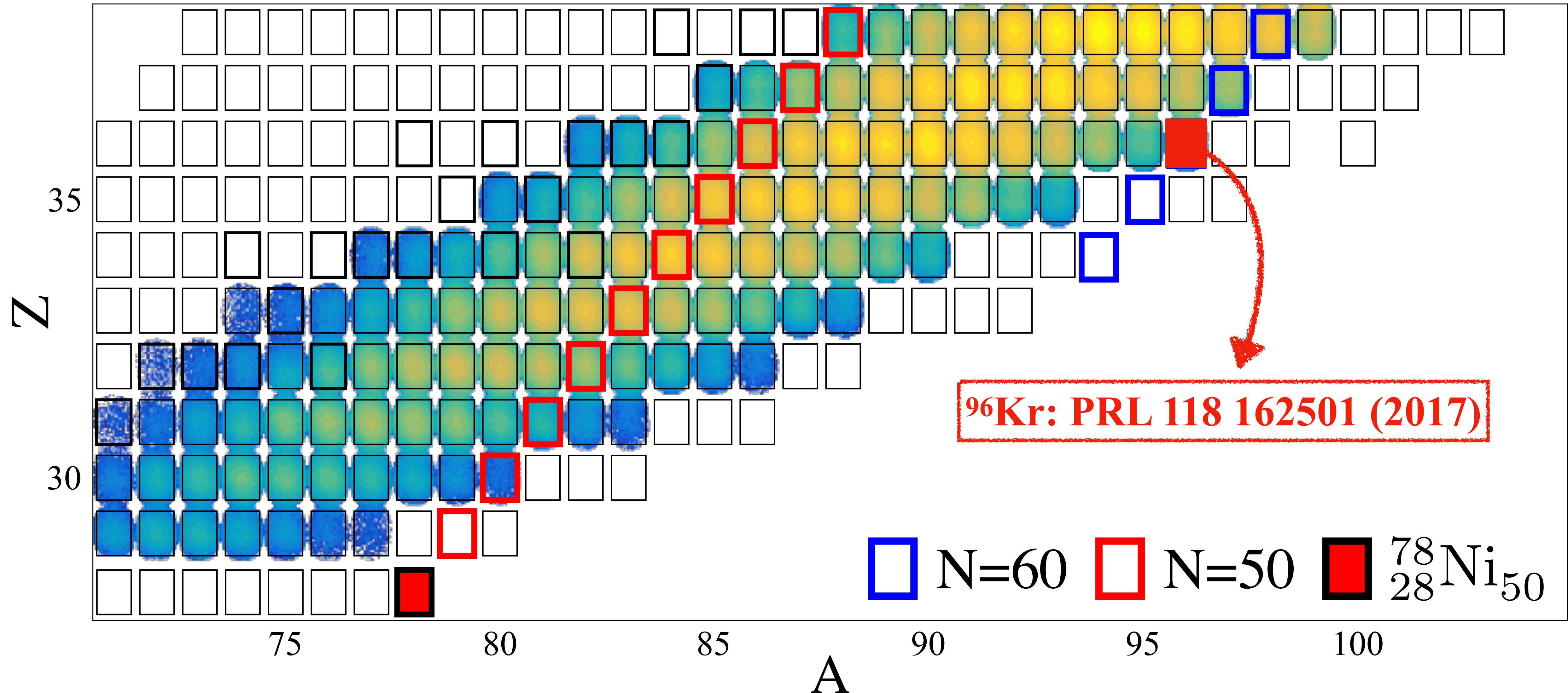
Spokesperson: G. Duchêne



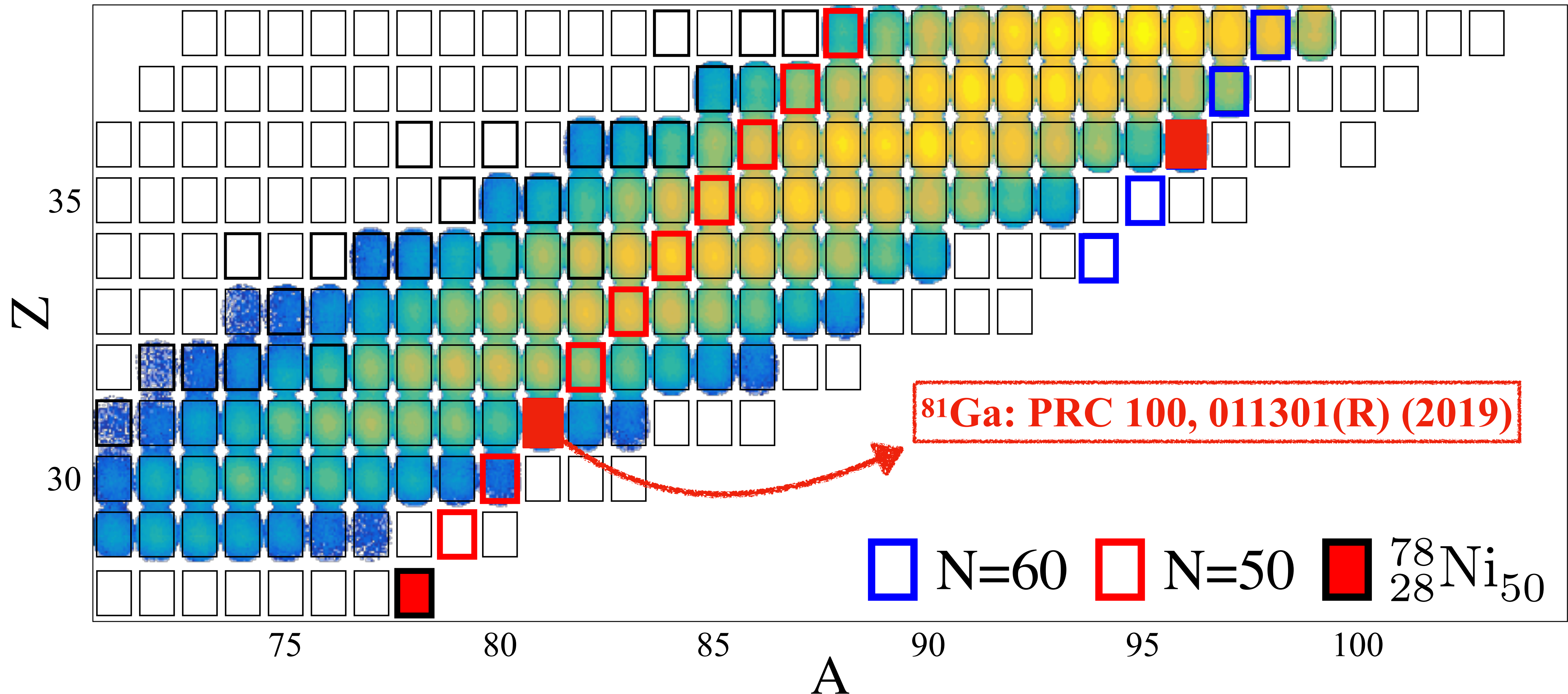
The E680 Experiment: AGATA + VAMOS++ @ GANIL



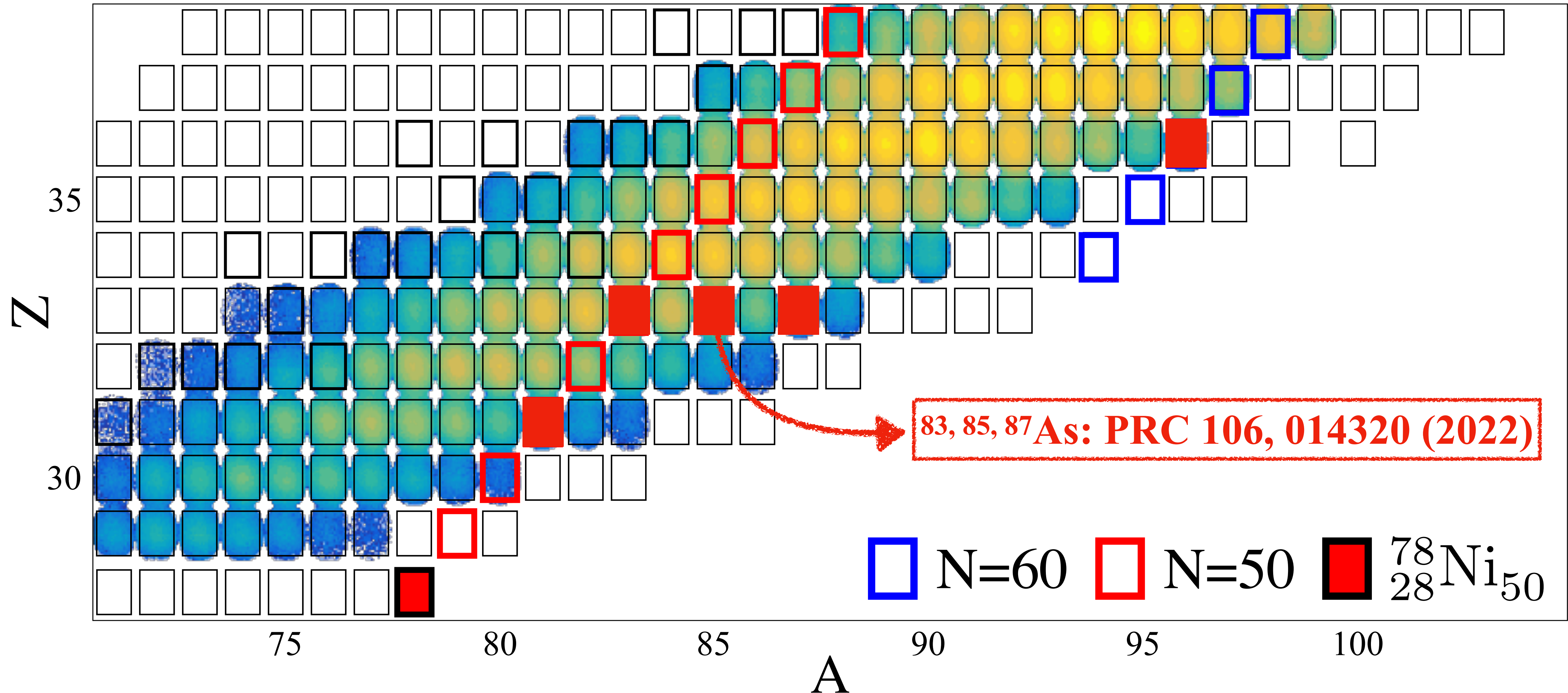
The E680 Experiment: AGATA + VAMOS++ @ GANIL



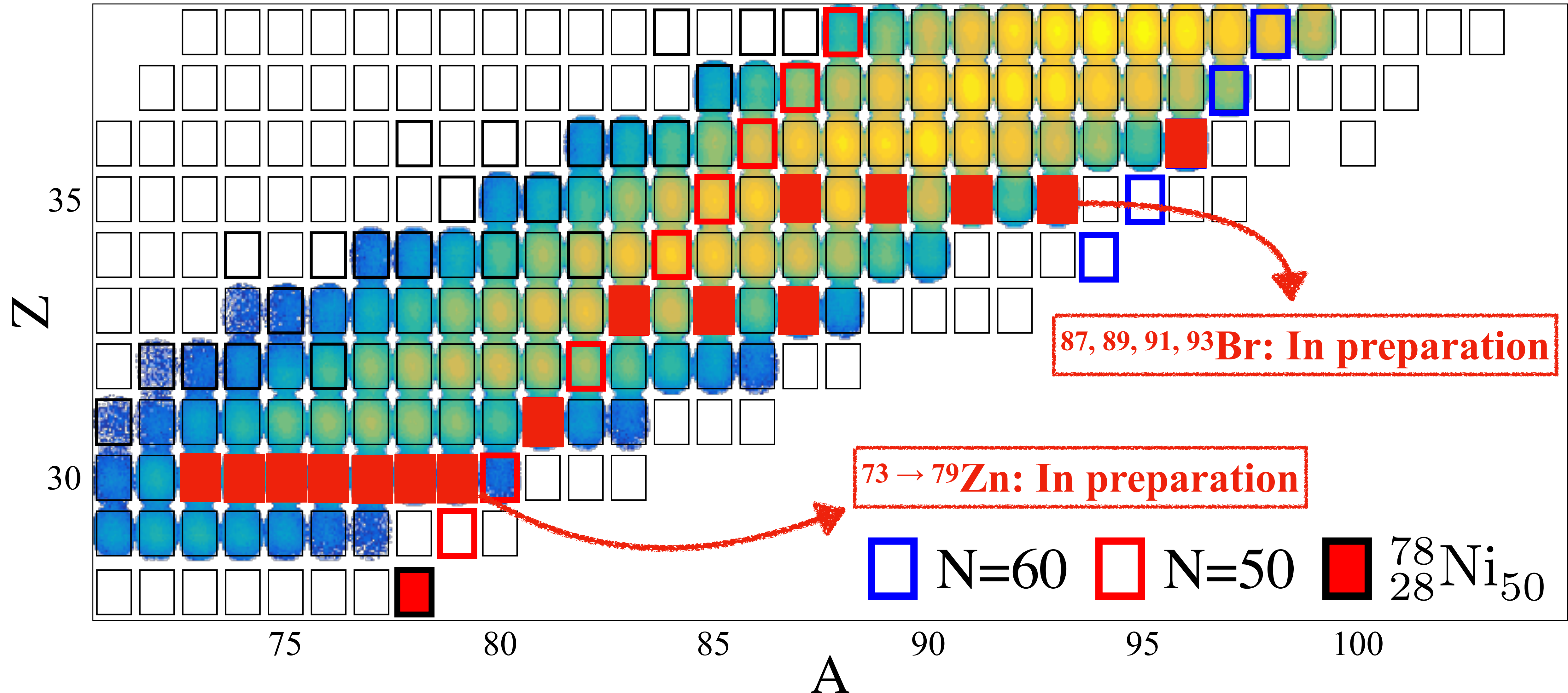
The E680 Experiment: AGATA + VAMOS++ @ GANIL



The E680 Experiment: AGATA + VAMOS++ @ GANIL

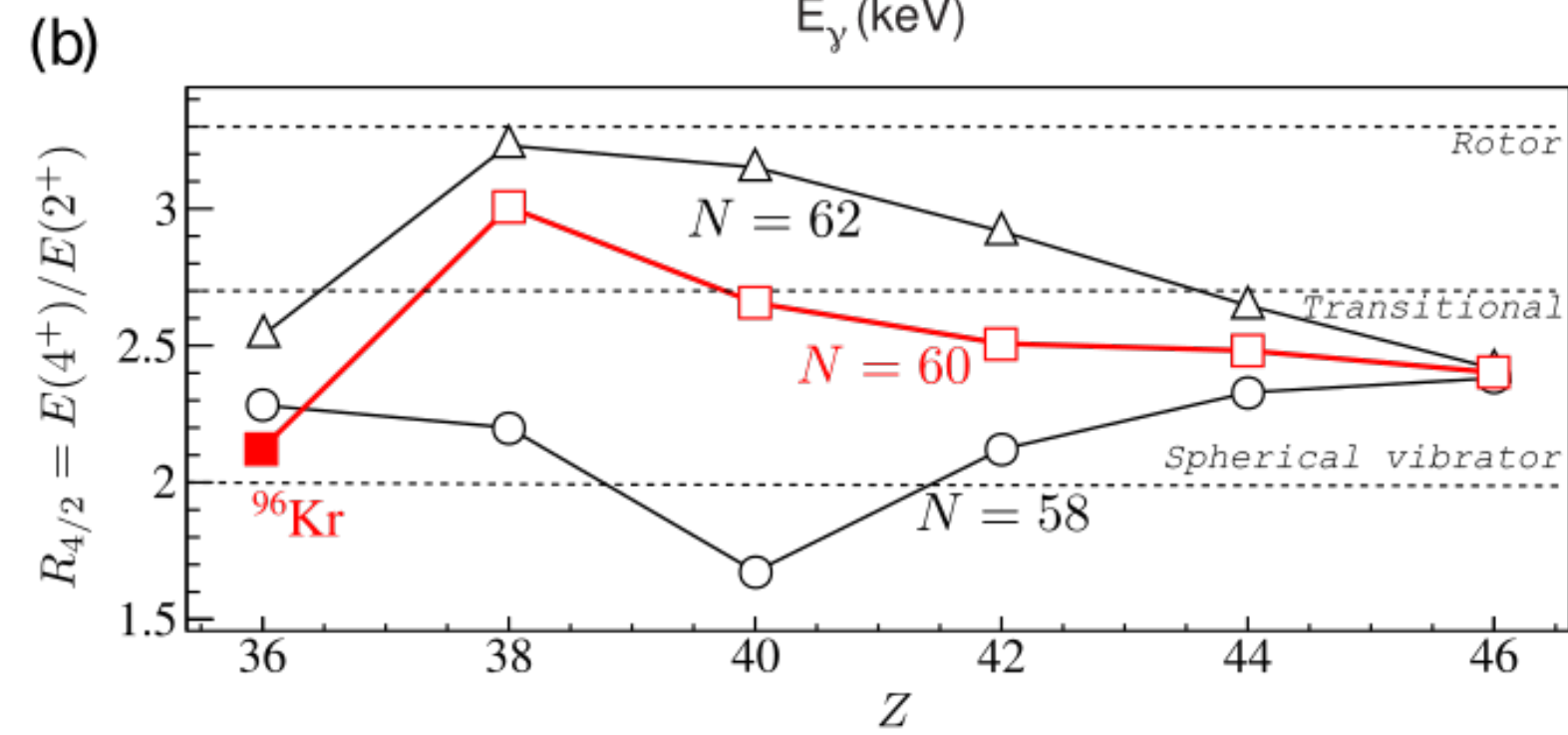
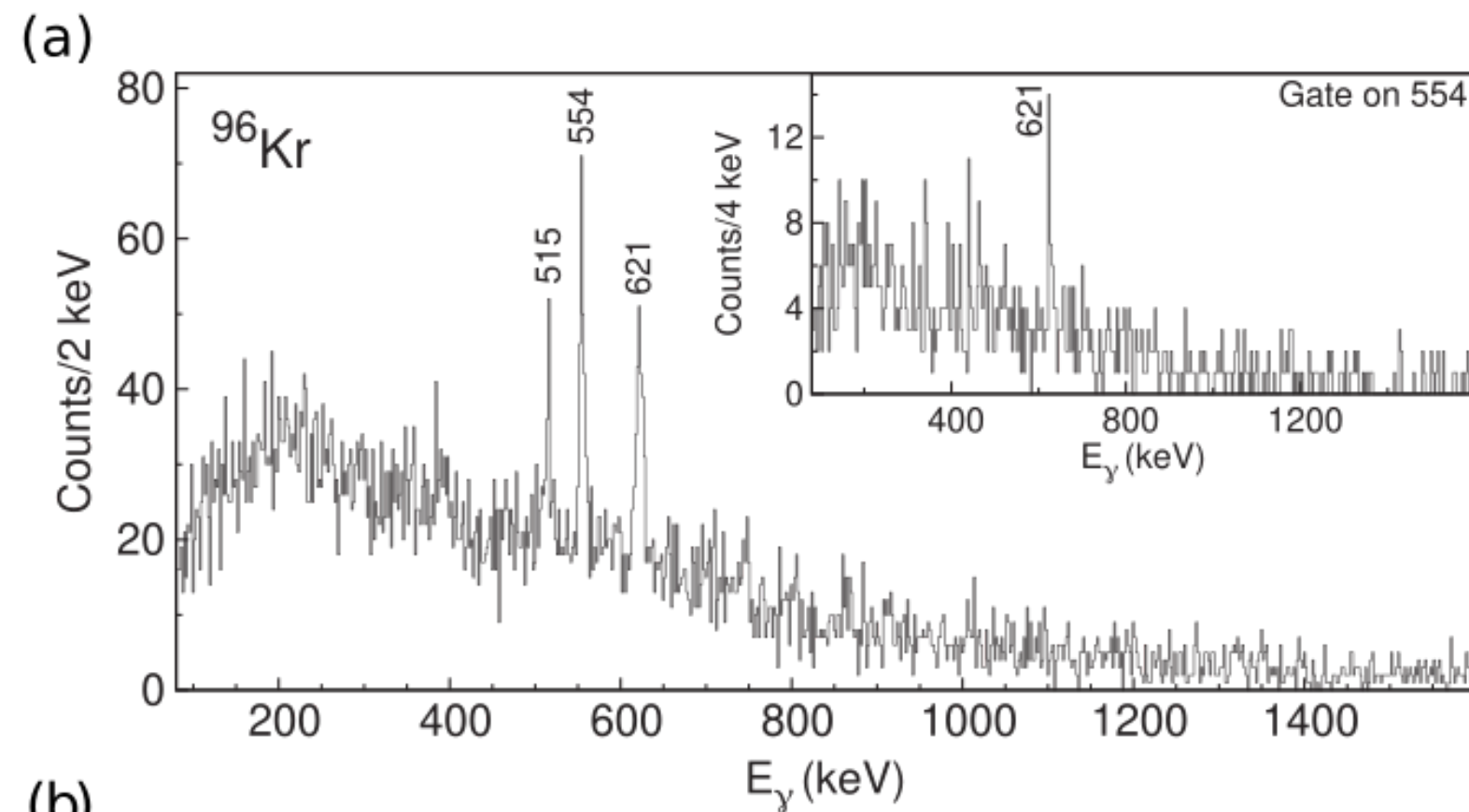


The E680 Experiment: AGATA + VAMOS++ @ GANIL

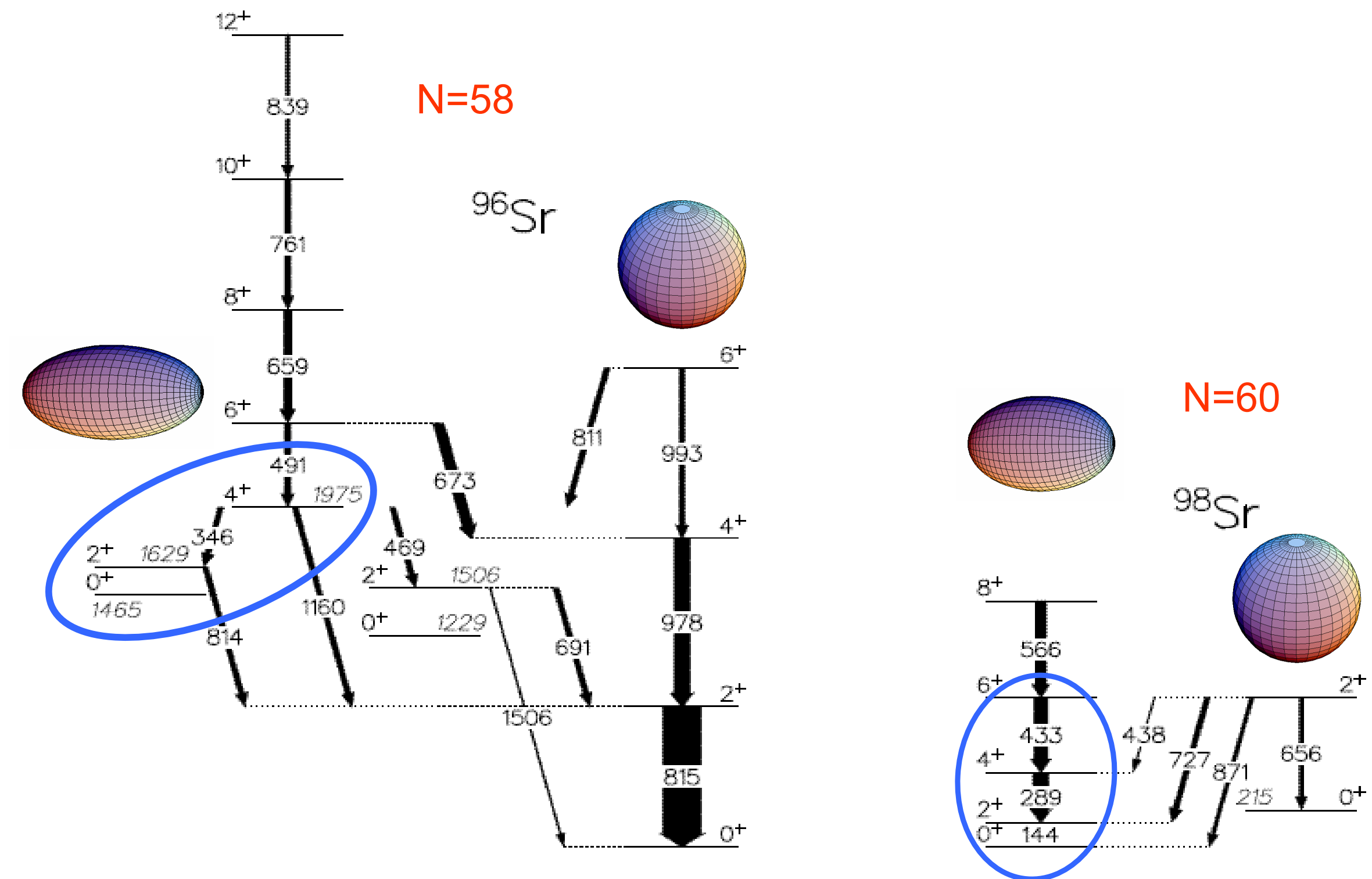


But still open questions...

➔ ^{96}Kr : where is the excited deformed band ?



Dudouet *et al.* PRL 118 162501 (2017)

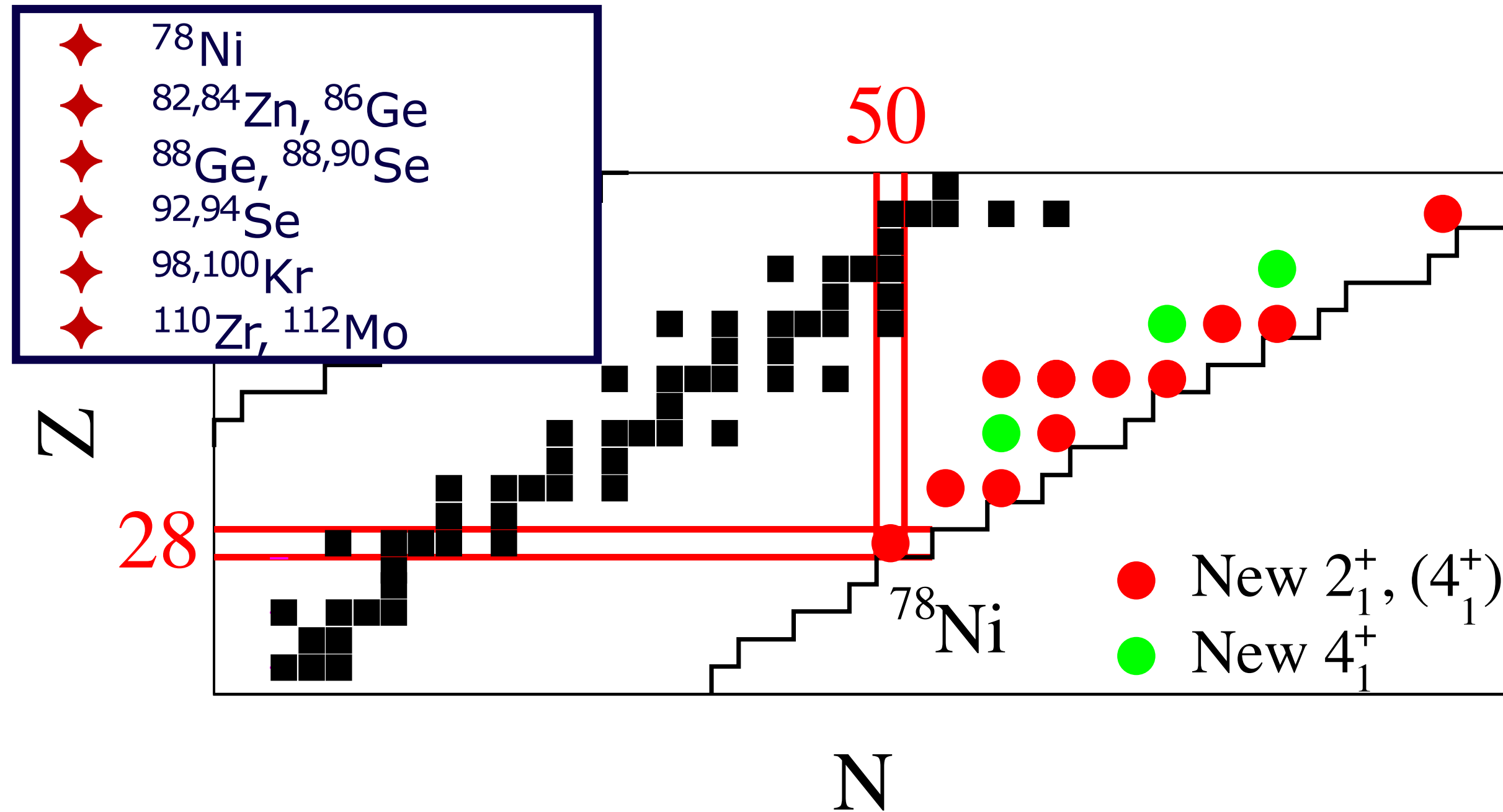


Clement *et al.* PRL 116, 022701 (2016)

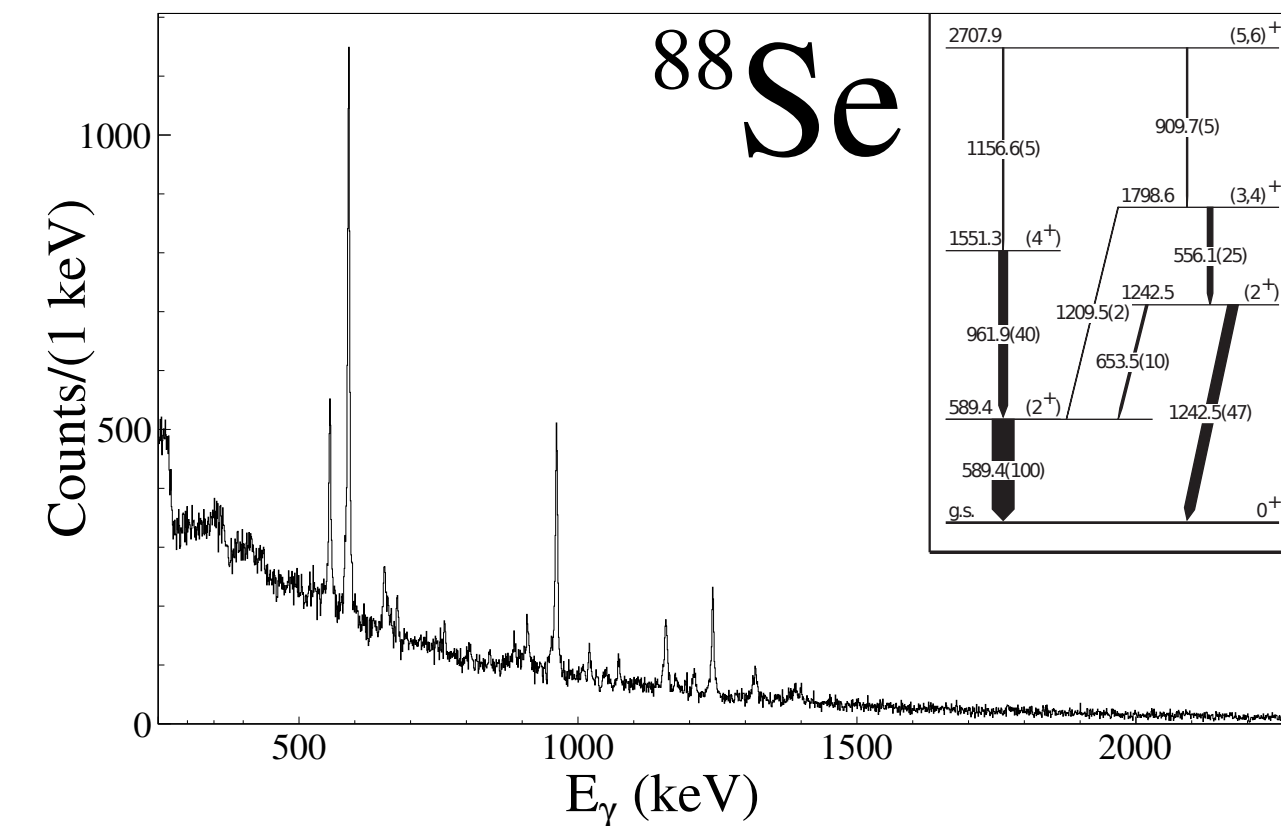
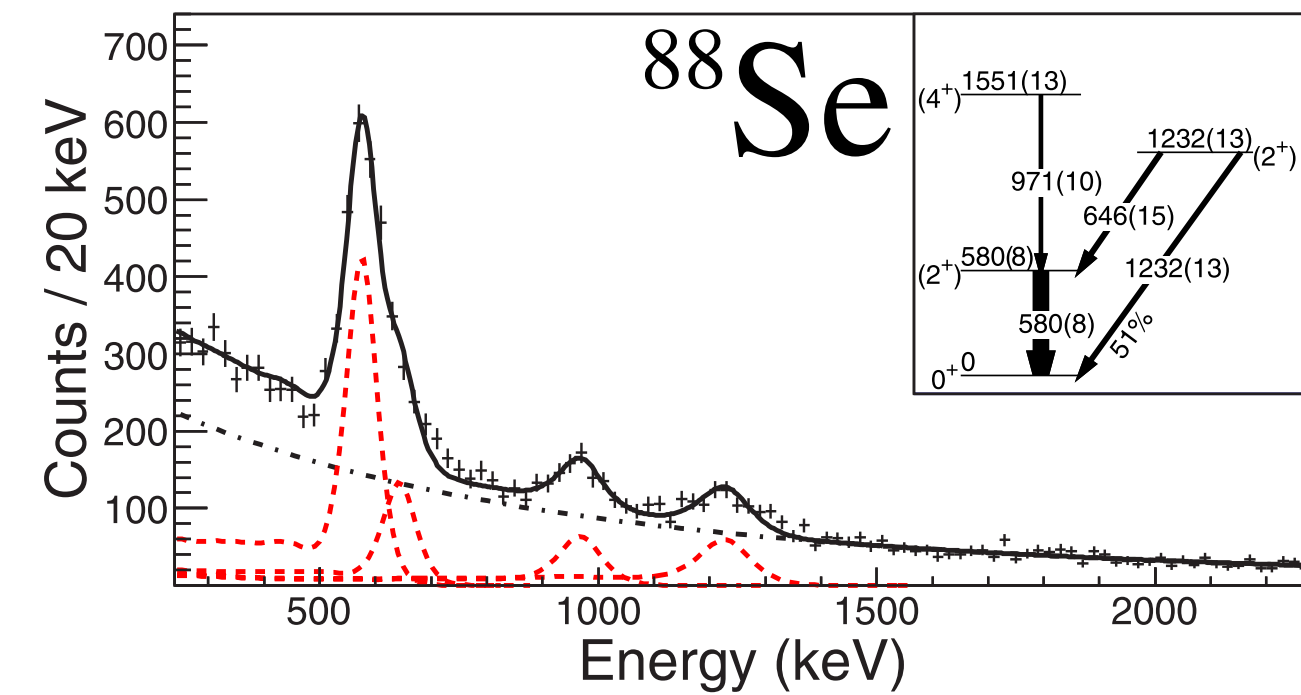
But still open questions...

➔ Spectroscopy of the very neutron rich nuclei / complementarity with RIKEN measurements

The SEASTAR Campaign



No competition on exoticty !

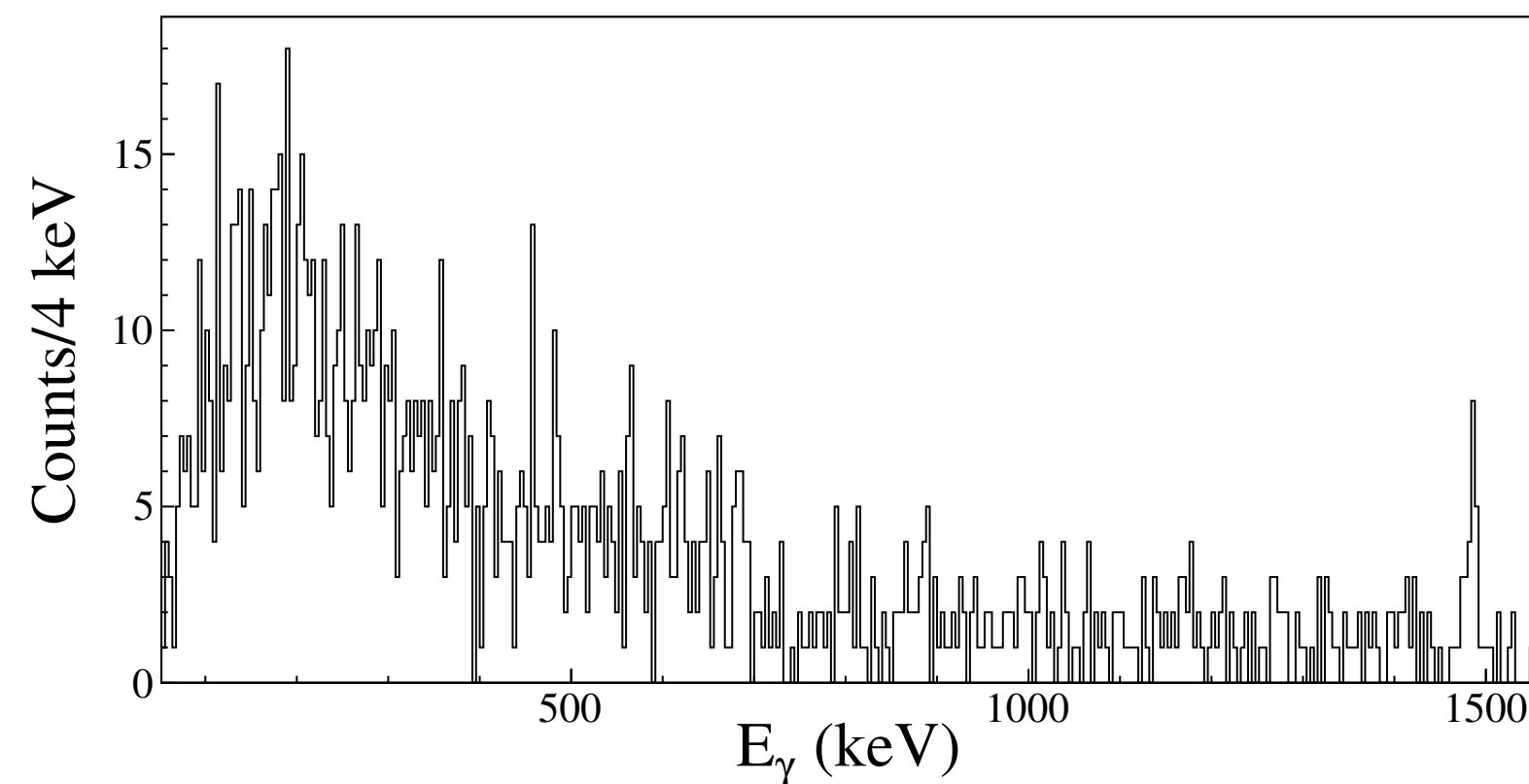


But much better selectivity !

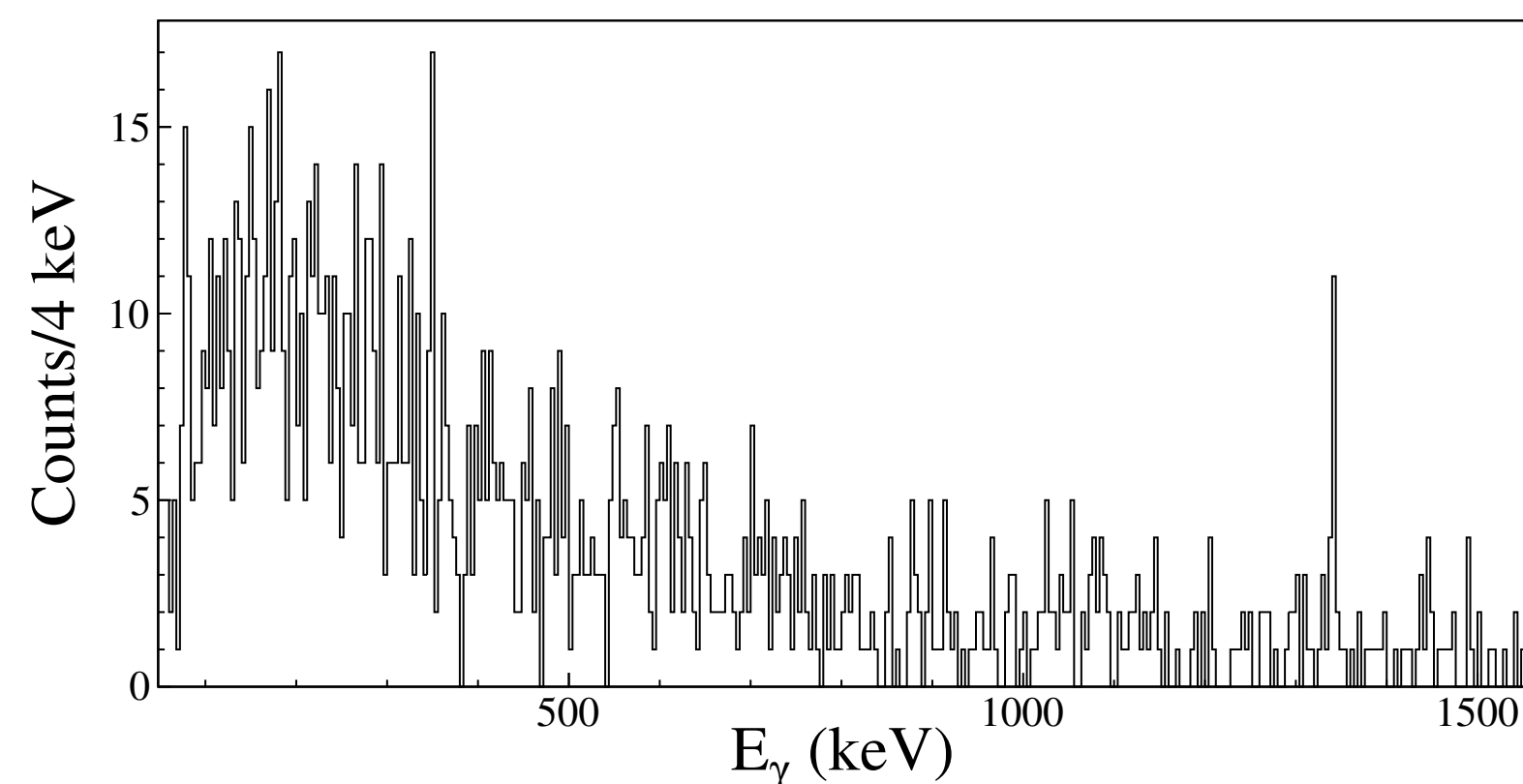
But still open questions...

➔ Quest for core excited states in $Z < 31$ still ongoing

E680: ^{80}Zn



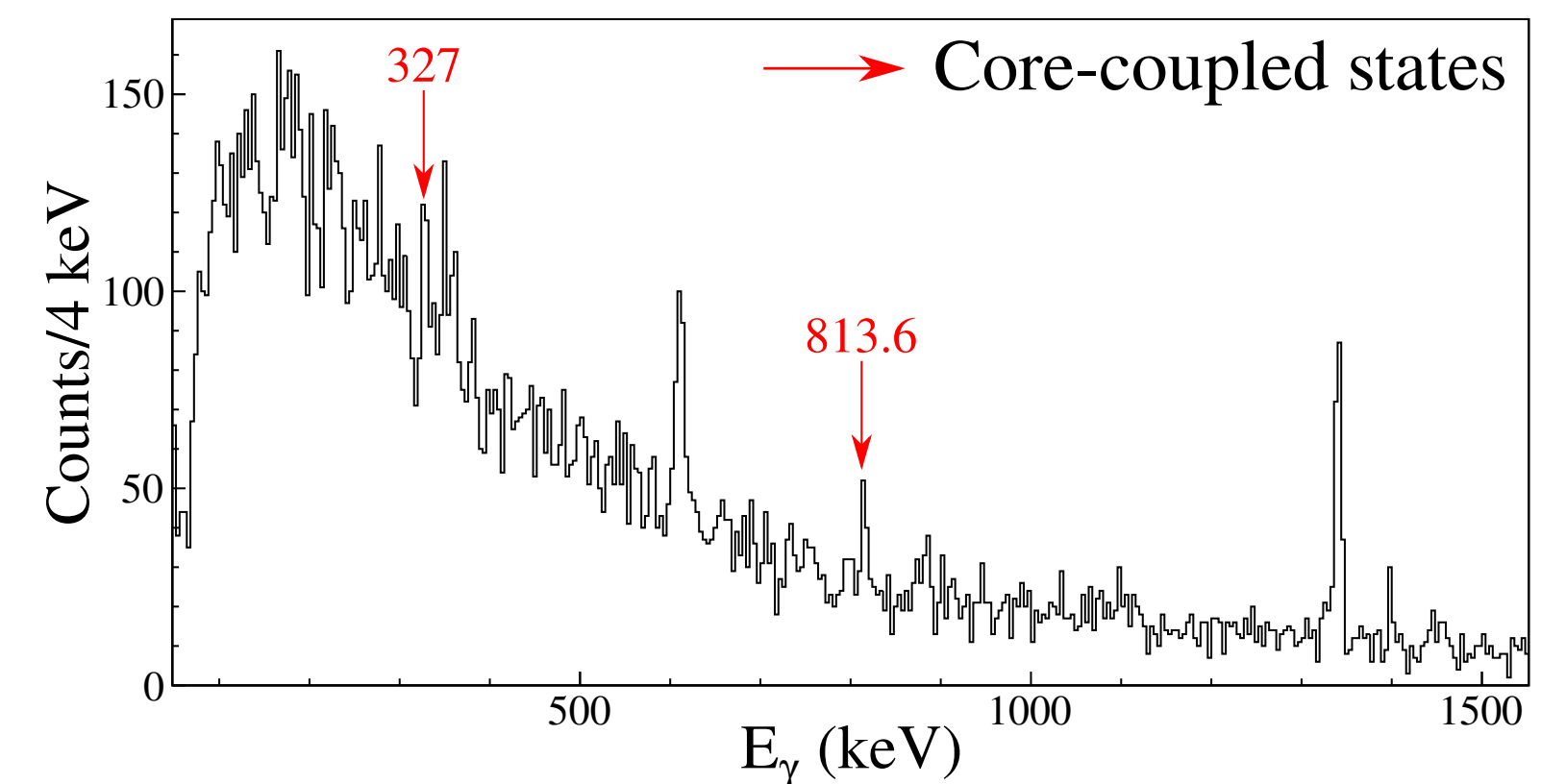
E680: ^{81}Ga with ^{80}Zn stat



➔ A factor ~ 10 in fission yields is required

x10

E680: ^{81}Ga with ^{80}Zn stat x 10



AGATA + PRISMA @ LNL: new opportunities

- ➔ A new ^{238}U beam is under developments at LNL !
 ➔ Can we obtain the required statistics in fission ?

	AGATA-VAMOS	AGATA-PRISMA	factor
Beam	^{238}U @ 6.3 MeV/u, 25enA: 0.8 pnA	^{238}U @ 7.2 MeV/u: ~1 pnA	~1.25
Dead time	2kHz of trigger, 1kHz validated → 50%	2kHz (10% dead time)	~1.8
Crystals	24	45	
agata position	Compact (14cm to target)	Compact (18cm to target)	
single efficiency	~ 4%	~ 9%	~2.2
Target	^9Be , 10um (1.85mg/cm ²)	^9Be , 10um (1.85mg/cm ²)	
Beam time	14 days	14 days	1
Acceptance	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	~1
Total			~5

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Dead time	2kHz of trigger, 1kHz validated → 50%	4kHz (20% dead time)	~3.2
Crystals	24	45	
agata position	Compact (14cm to target)	Nominal (23cm to target)	
single efficiency	~ 4%	~ 7%	~1.75
Target	^9Be , 10um (1.85mg/cm ²)	^9Be , 20um (3.7 mg/cm ²)	
Beam time	14 days	21 days	1.5
Acceptance	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	~1
Total			~10.5

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- ➔ Possibility of using a deuterated target (Calculations from Manuel Caamaño) ?

	Total X sections (ubarn)				
	^{238}U @ 6.3 MeV/u+Be	^{238}U @ 7.2 MeV/u+Be	factor	^{238}U @ 6.3 MeV/u+ CD2	factor
^{79}Cu	0.4	0.5	~1	1.1	~2.7
^{80}Zn	5.9	5.5		15.4	~2.6
^{81}Ga	22.7	24.5		62.6	~2.5
^{96}Kr	22.9	25.7		47.0	~1.8

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Target	^9Be , 10um (1.85mg/cm ²)	C2D4 (1.85mg/cm ²)	
Beam time	14 days	21 days	1.5
Acceptance	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	~1
Total			~13

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Dead time	2kHz of trigger, 1kHz validated → 50%	8kHz (40% dead time)	~5
Crystals	24	45	
agata position	Compact (14cm to target)	Nominal (23cm to target)	
single efficiency	~ 4%	~ 7%	~1.75
Target	^9Be , 10um (1.85mg/cm ²)	C2D4 (3.7 mg/cm ²)	
Beam time	14 days	21 days	1.5
Acceptance	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	~1
Total			~16

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Target	^9Be , 10um (1.85mg/cm ²)	C2D4 (3.7 mg/cm ²)	
Beam time	14 days	14 days	1
Acceptance	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	$\Delta\theta \pm 6^\circ$; $\Delta\phi \pm 10^\circ$	~1
Total			~11



Thank you for your attention