AGATA at GSI

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Centre de Sciences Nucléaires et de Sciences de la Matière

- Introduction
- Standard setup
- Specifities of the setup
- Selected experiments (techniques)
- Conclusion

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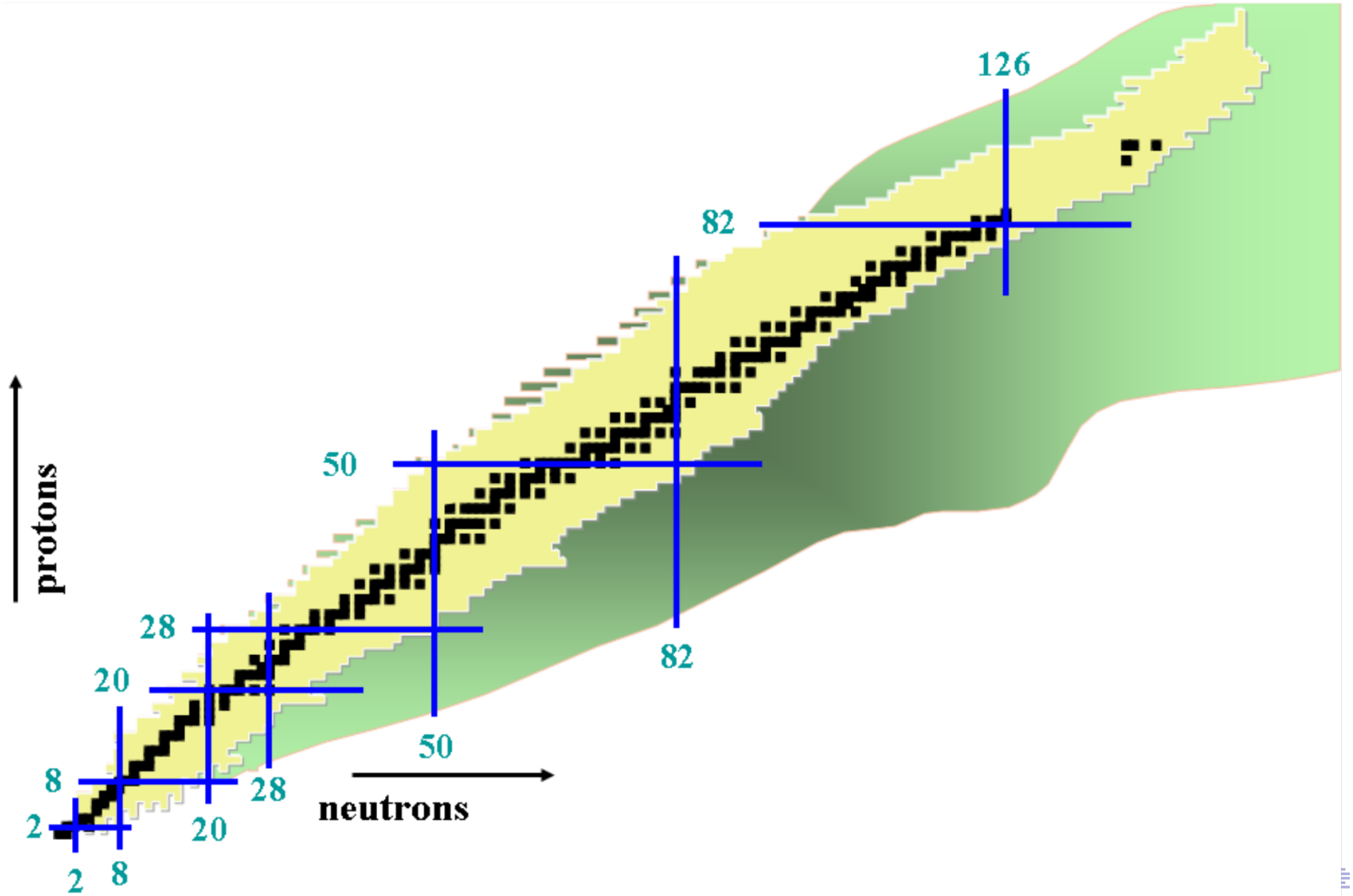
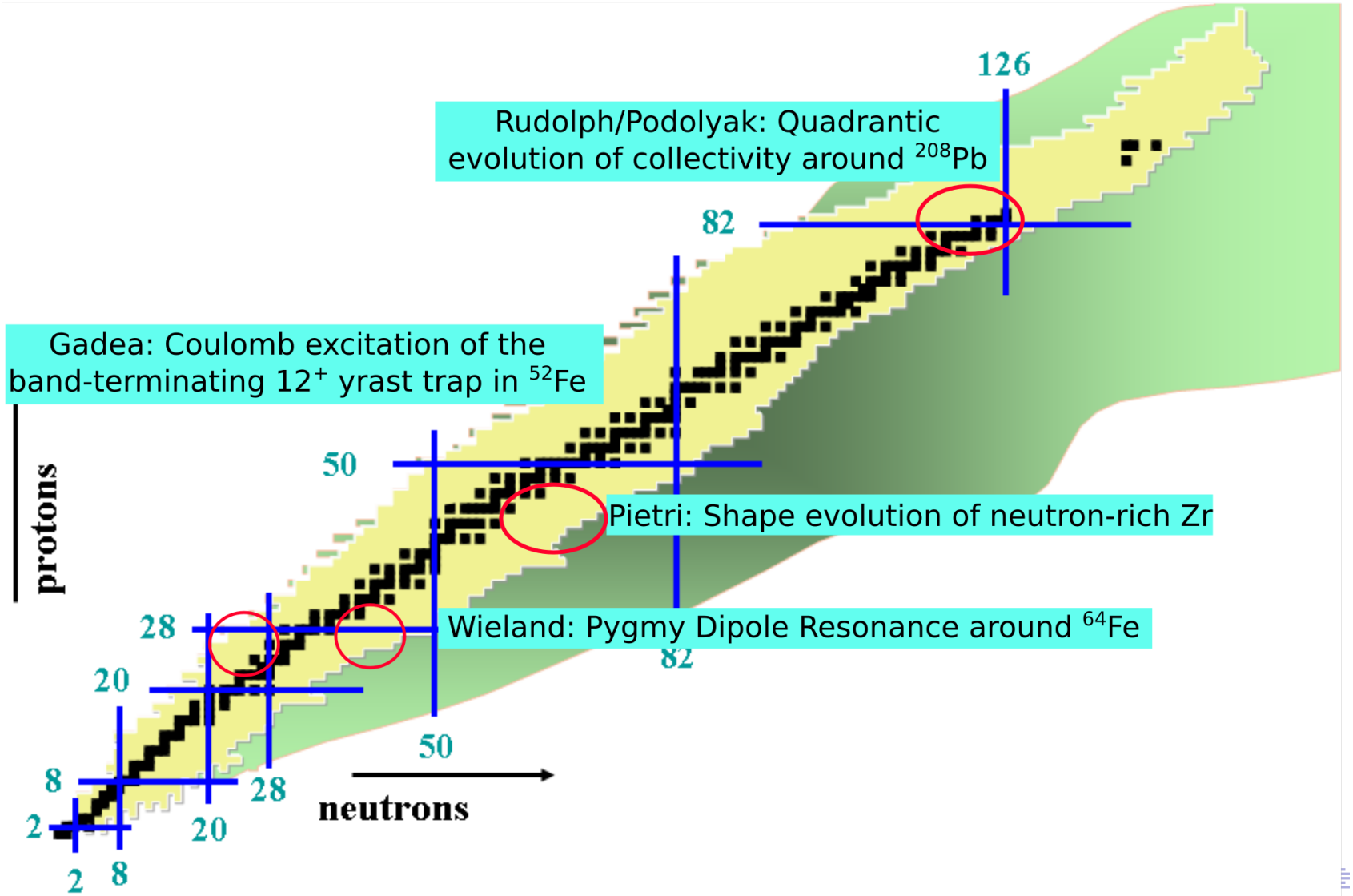
Overview of the experiments



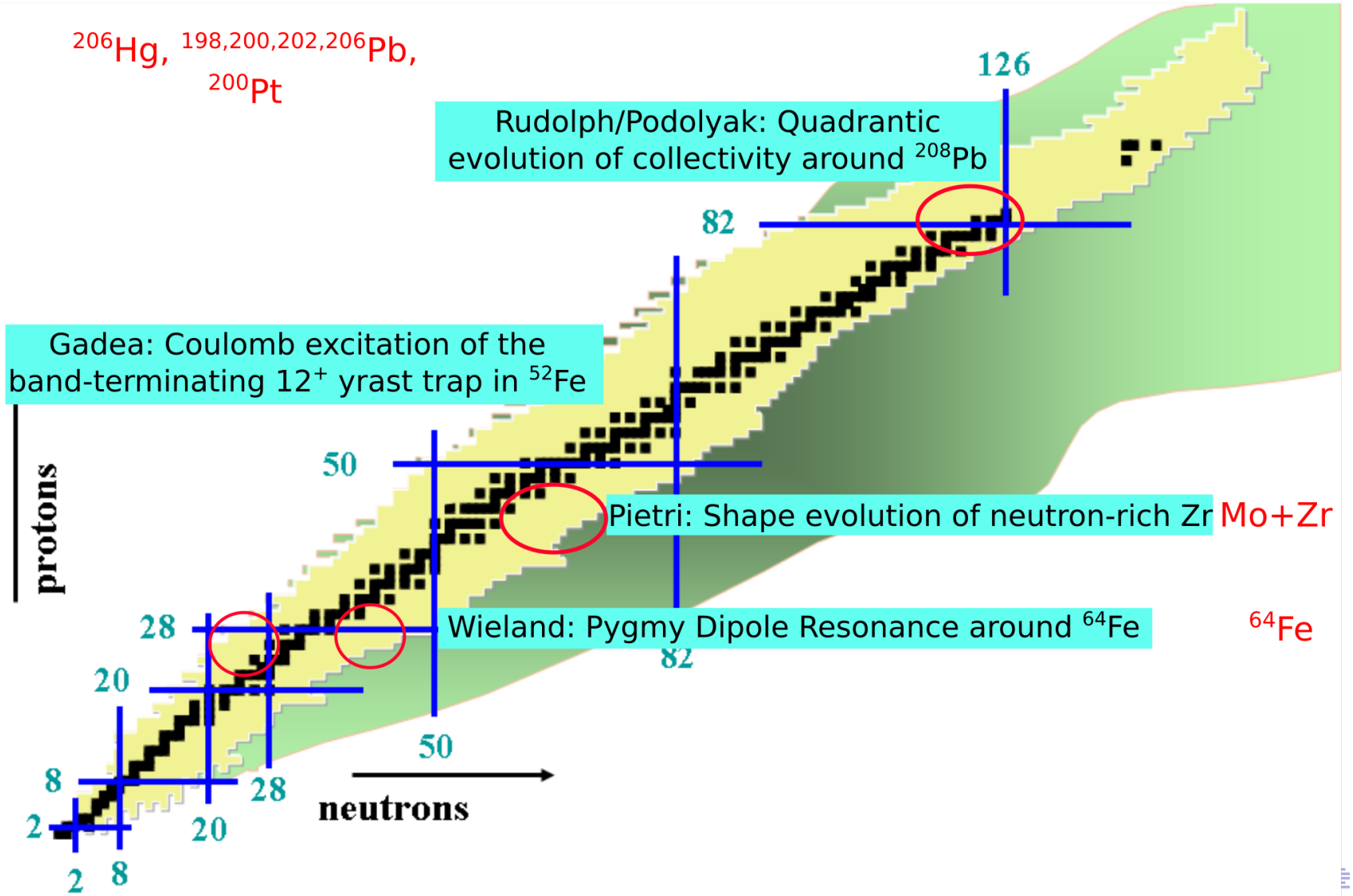
Overview of the experiments

2012: 4 experiments



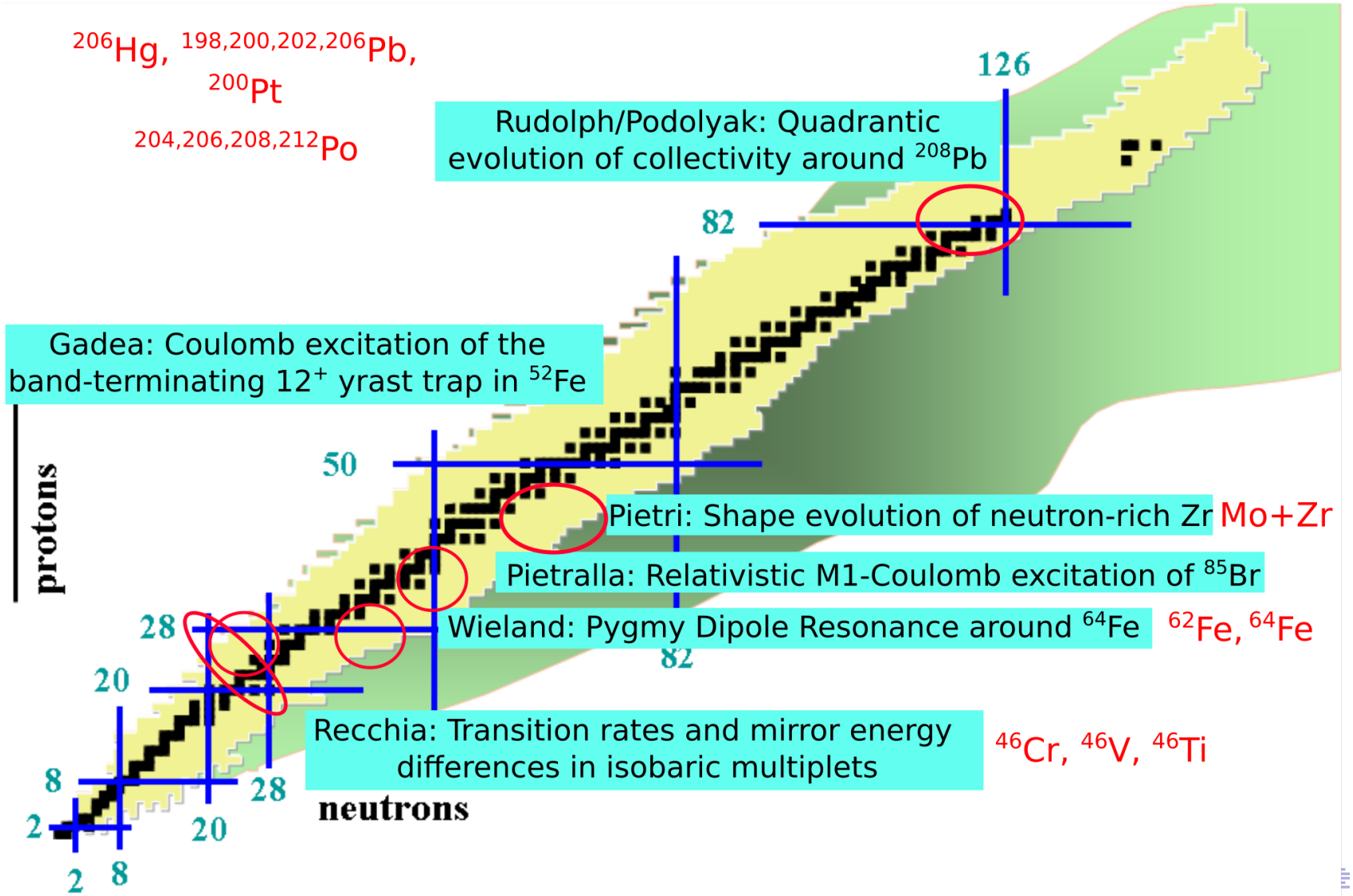
Overview of the experiments

2012: few nuclei investigated



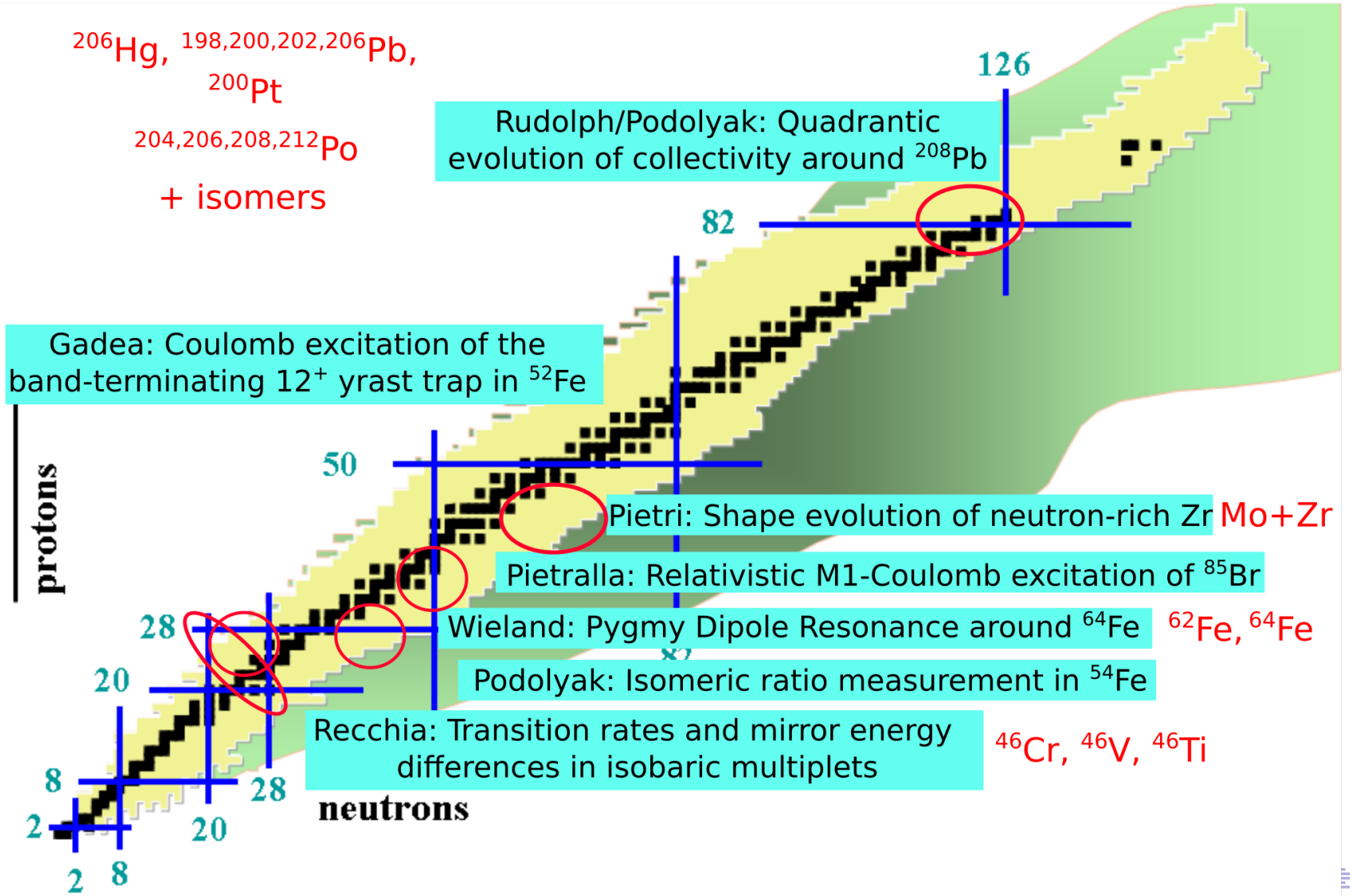
Overview of the experiments

2014: completed 2 experiments, 2 experiments performed



Overview of the experiments

Isomer data: Pb region, and one dedicated beam time



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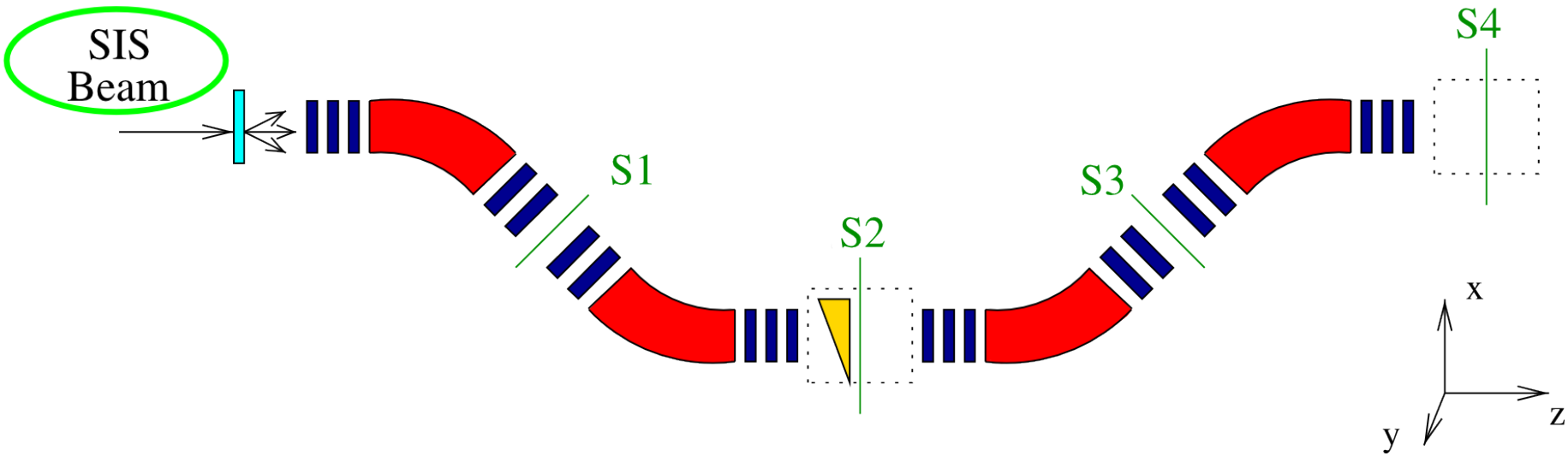
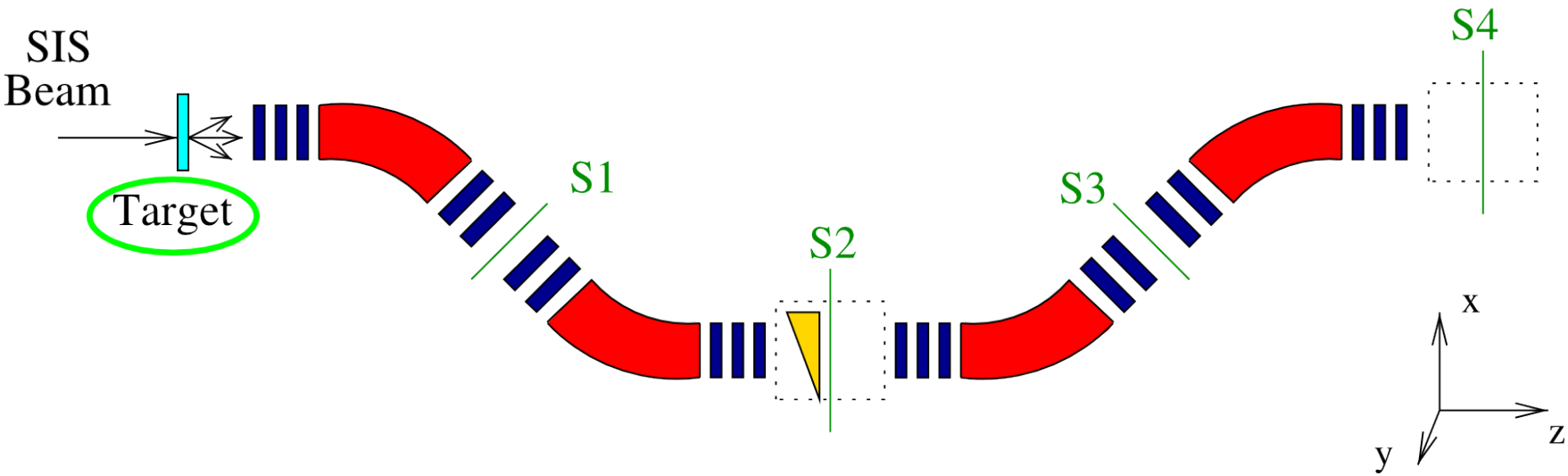
Production of relativistic beam

Primary beam from SIS-18, 600 MeV/A to 1 GeV/A



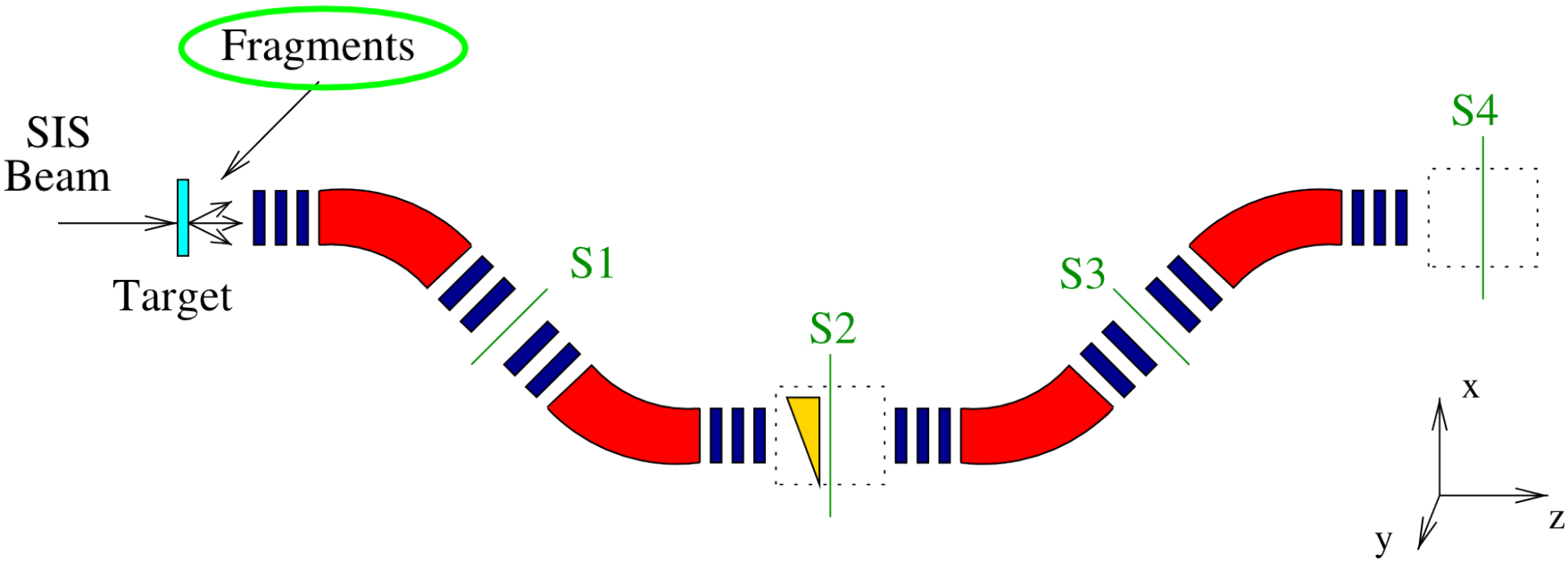
Production of relativistic beam

Relativistic fission or fragmentation



Production of relativistic beam

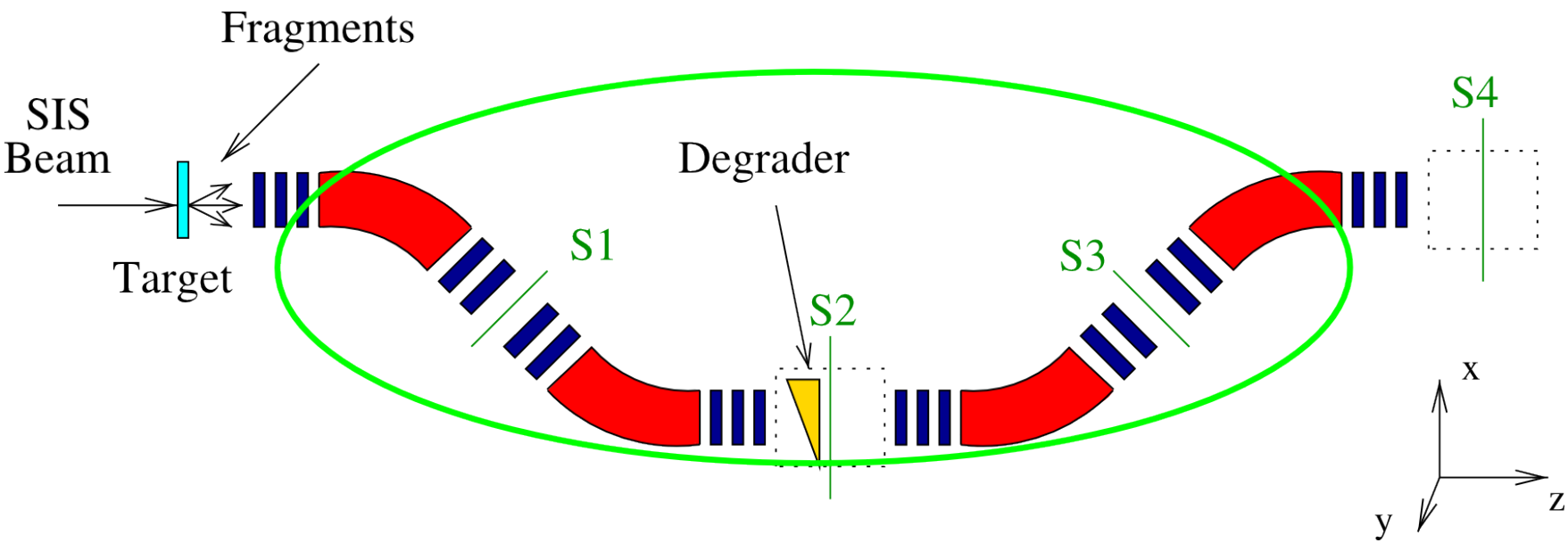
Reaction products



Production of relativistic beam

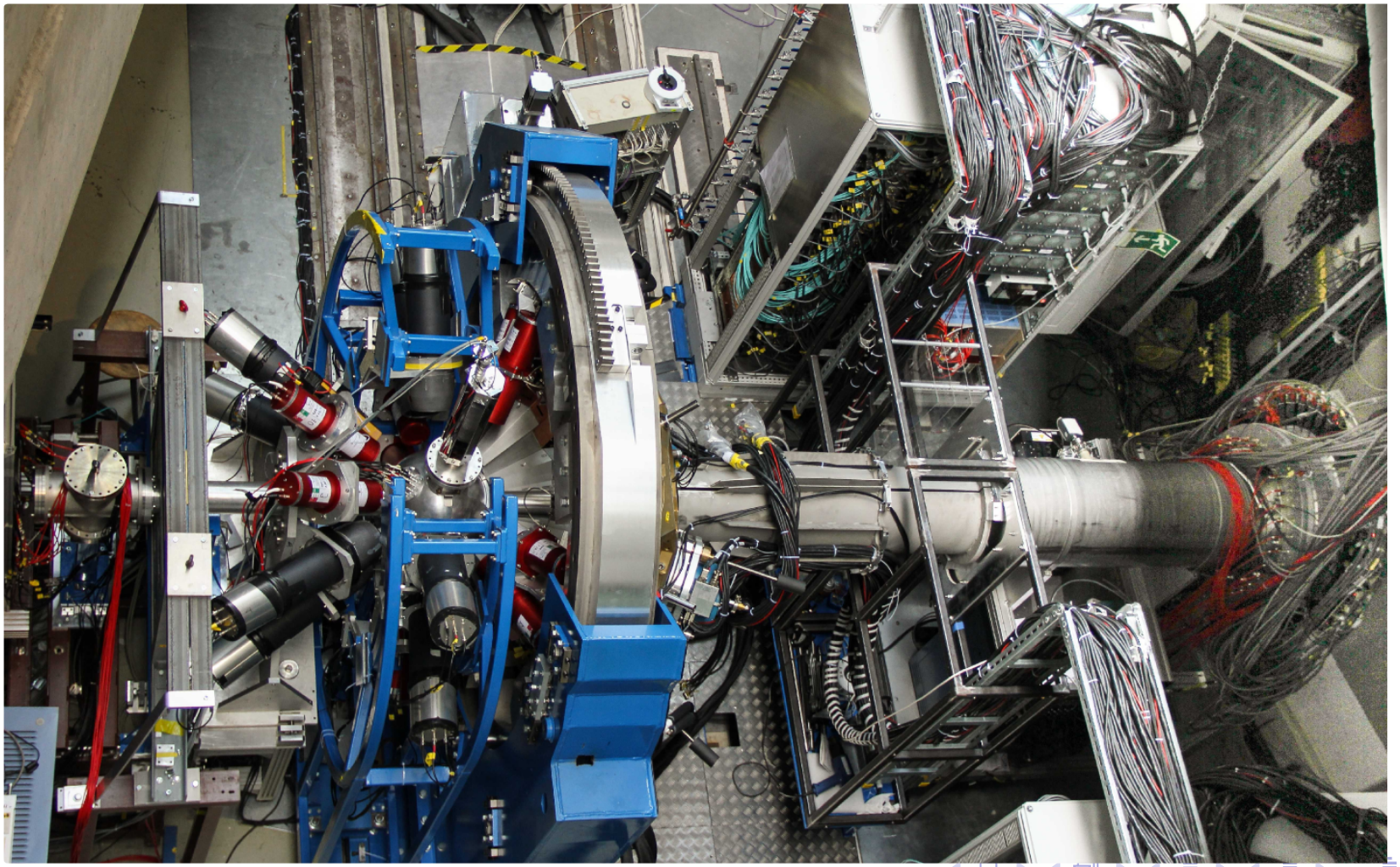
Selection and identification of the fragments:

$B\rho - \Delta E - B\rho$ method



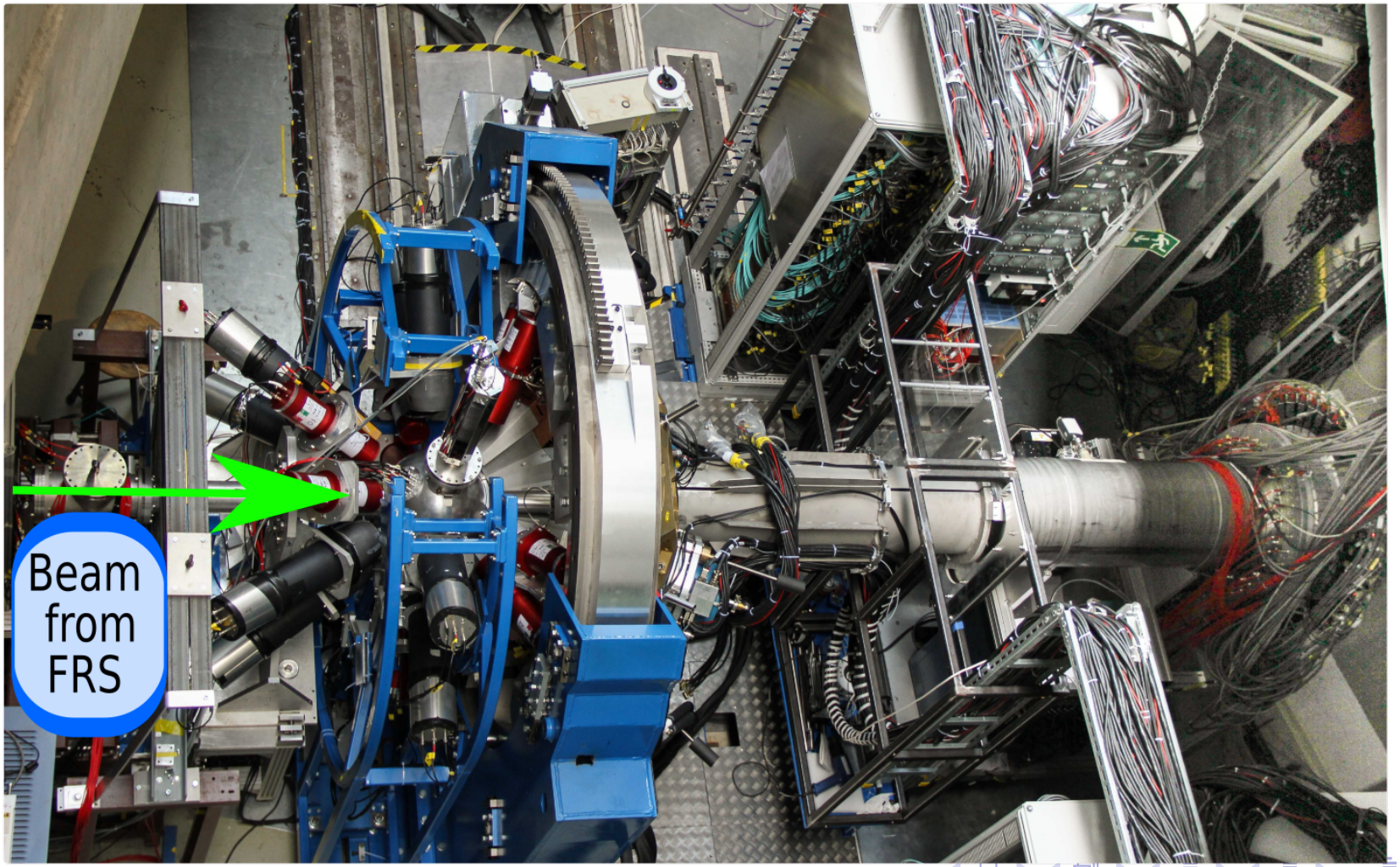
PreSPEC-AGATA setup

Picture of the experimental area



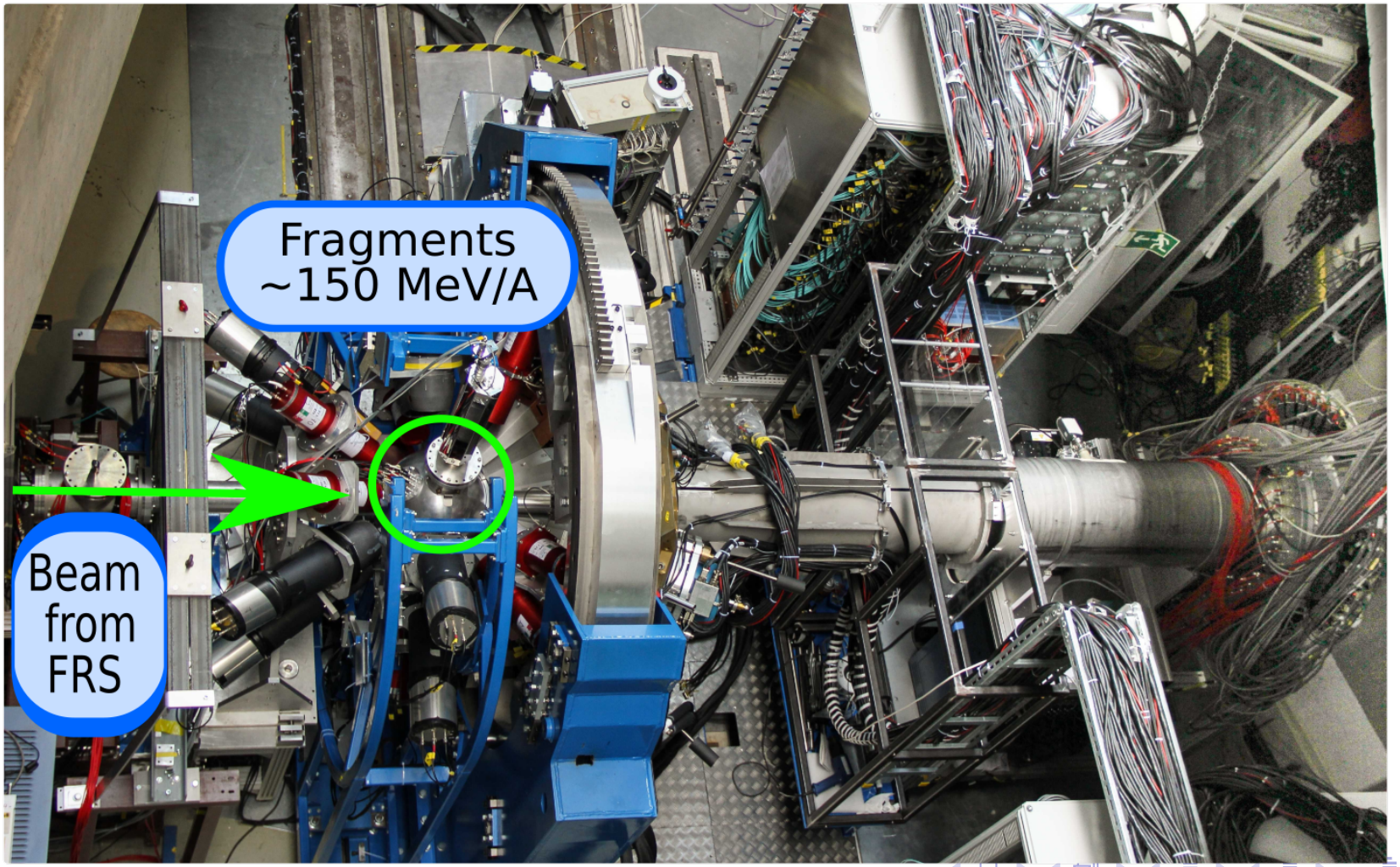
PreSPEC-AGATA setup

Exotic beam from the FRagment Separator (FRS)



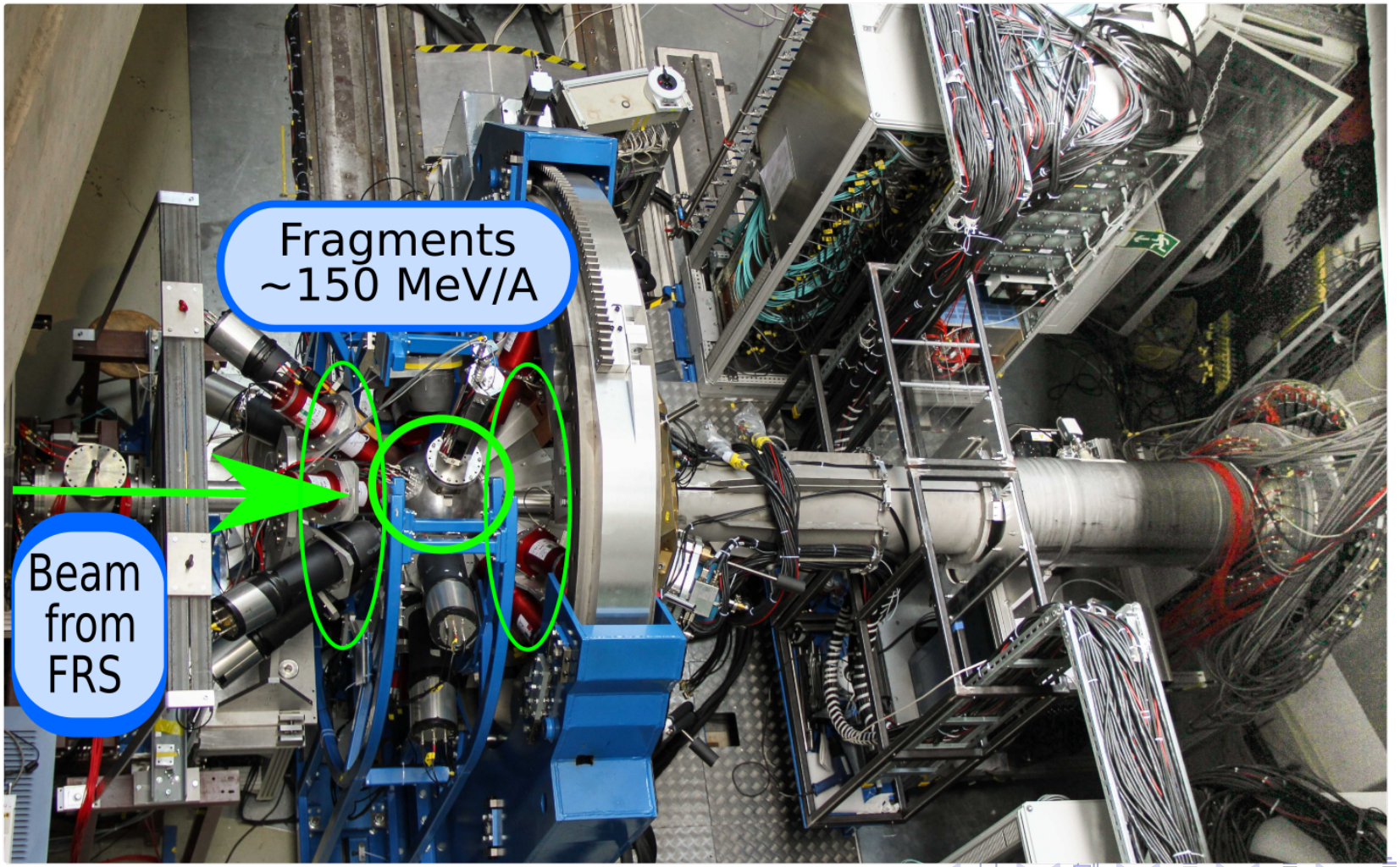
PreSPEC-AGATA setup

Fragmentation or relativistic coulomb-excitation



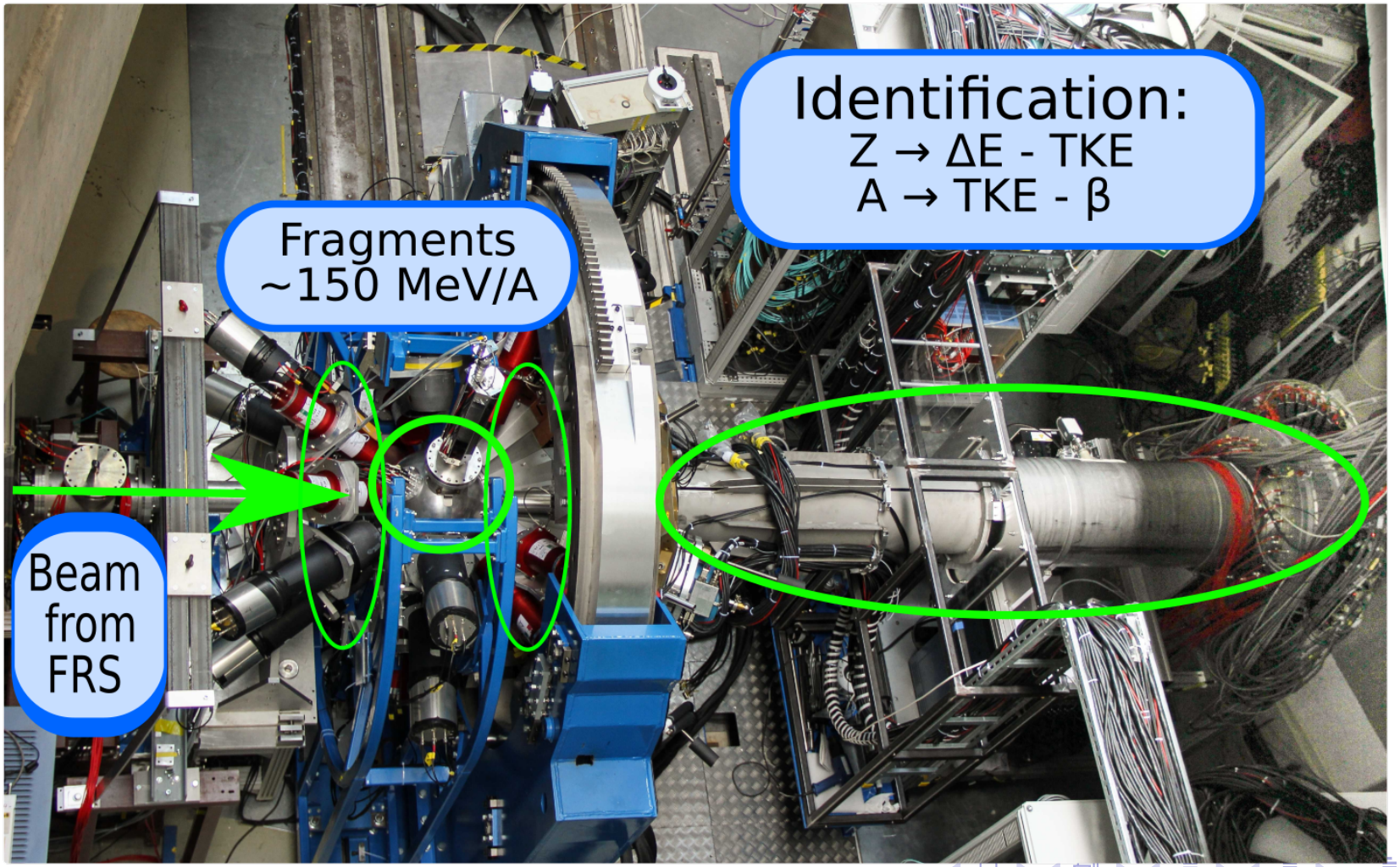
PreSPEC-AGATA setup

γ rays detected with the AGATA and HECTOR+ detectors



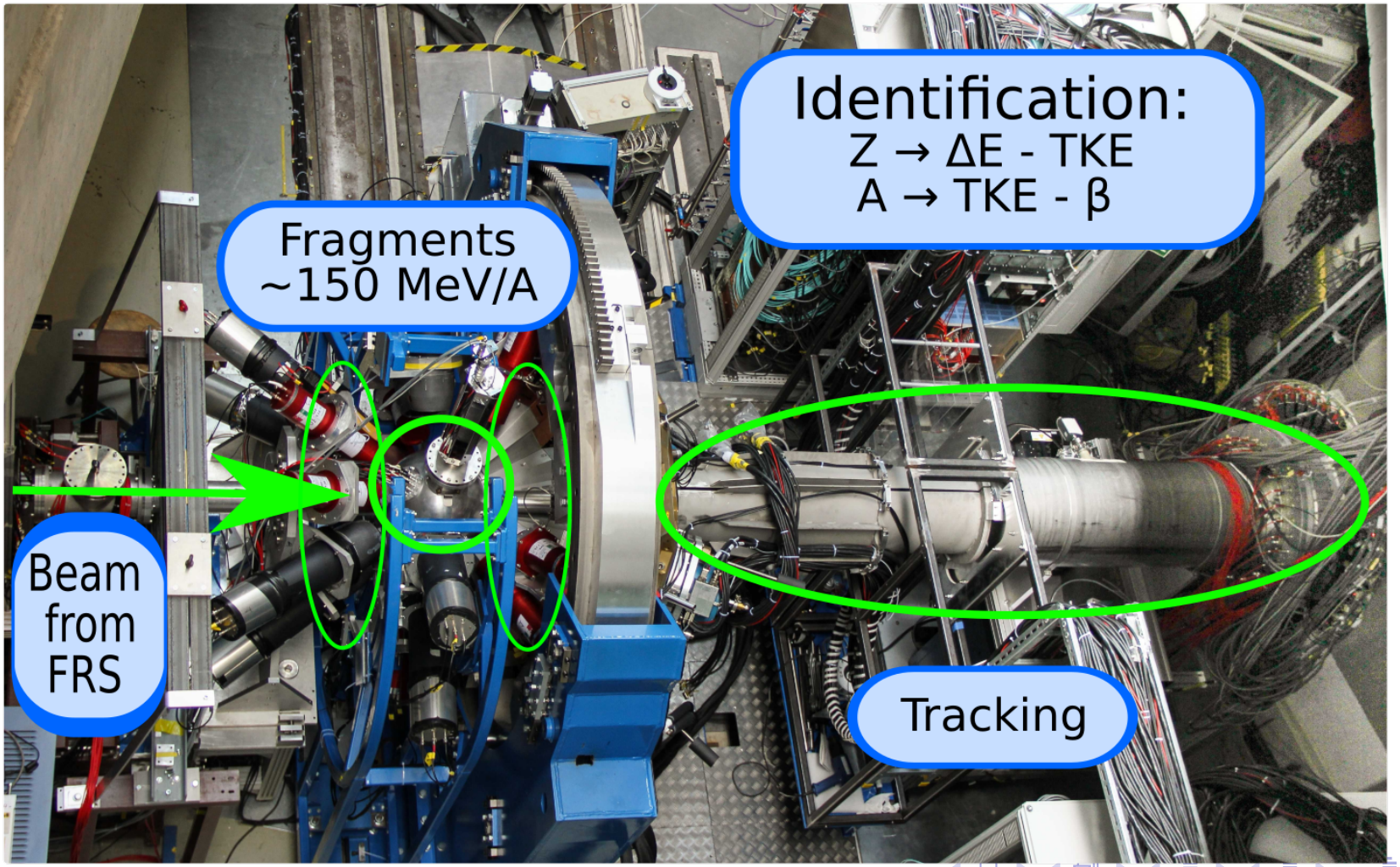
PreSPEC-AGATA setup

Reaction products detected in LYCCA



PreSPEC-AGATA setup

Reaction products detected in LYCCA



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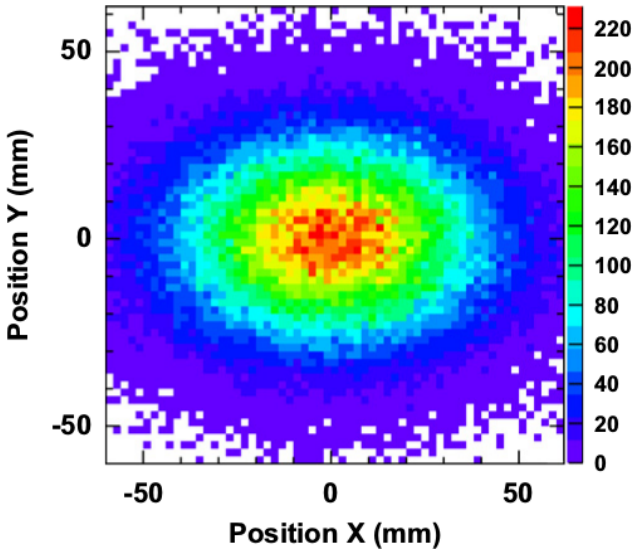
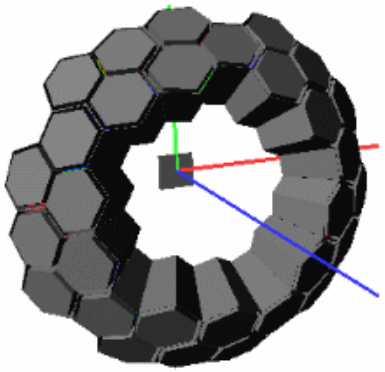
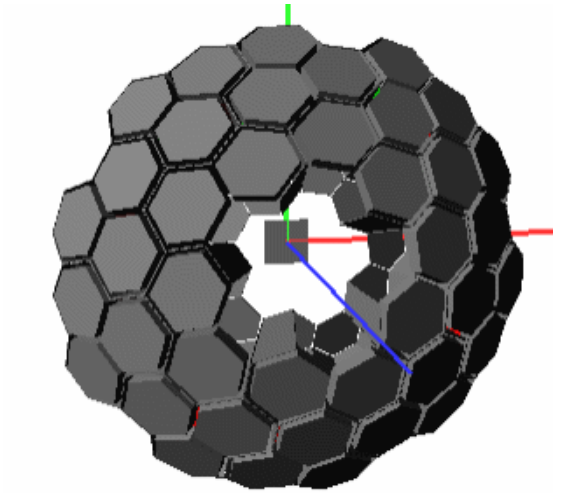
Beam size challenge

C. Domingo-Pardo, NIMA 694 (2012)

Issue with the beam spot size: hitting the detectors



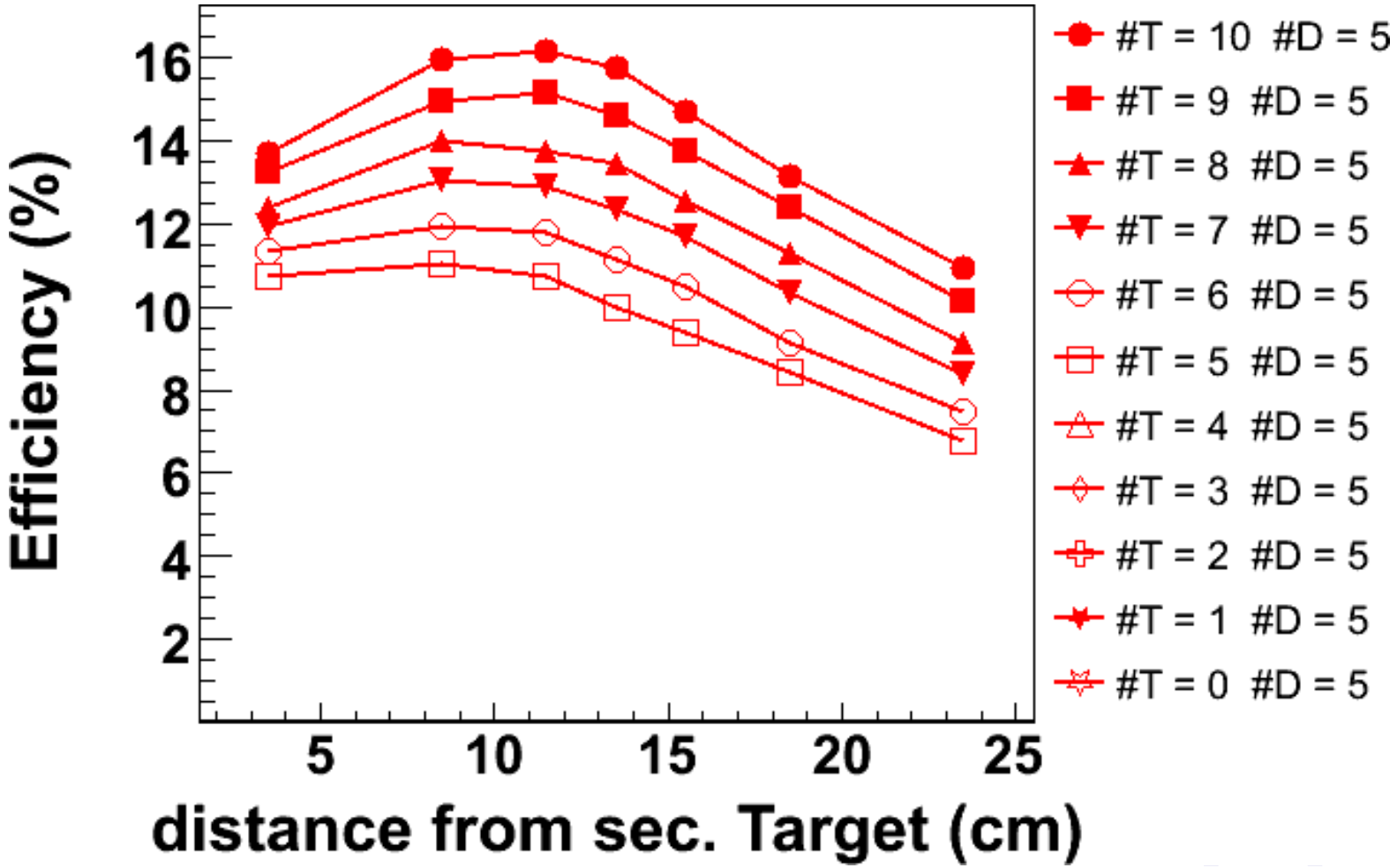




expected efficiency versus reality

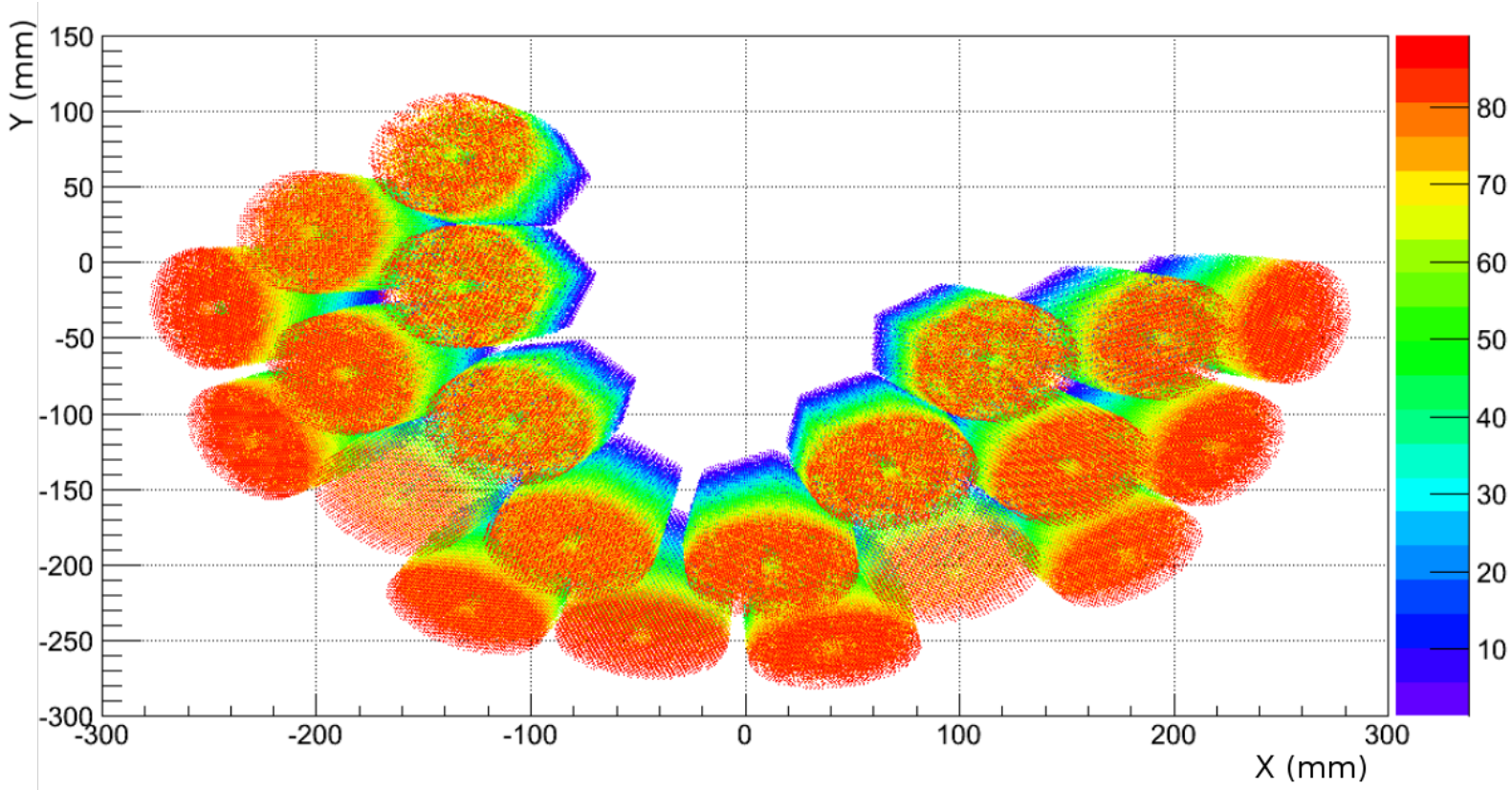
C. Domingo-Pardo, NIMA 694 (2012)

Expecting at least 25 crystals



Measured efficiencies

Up to 21 AGATA crystals (2014)

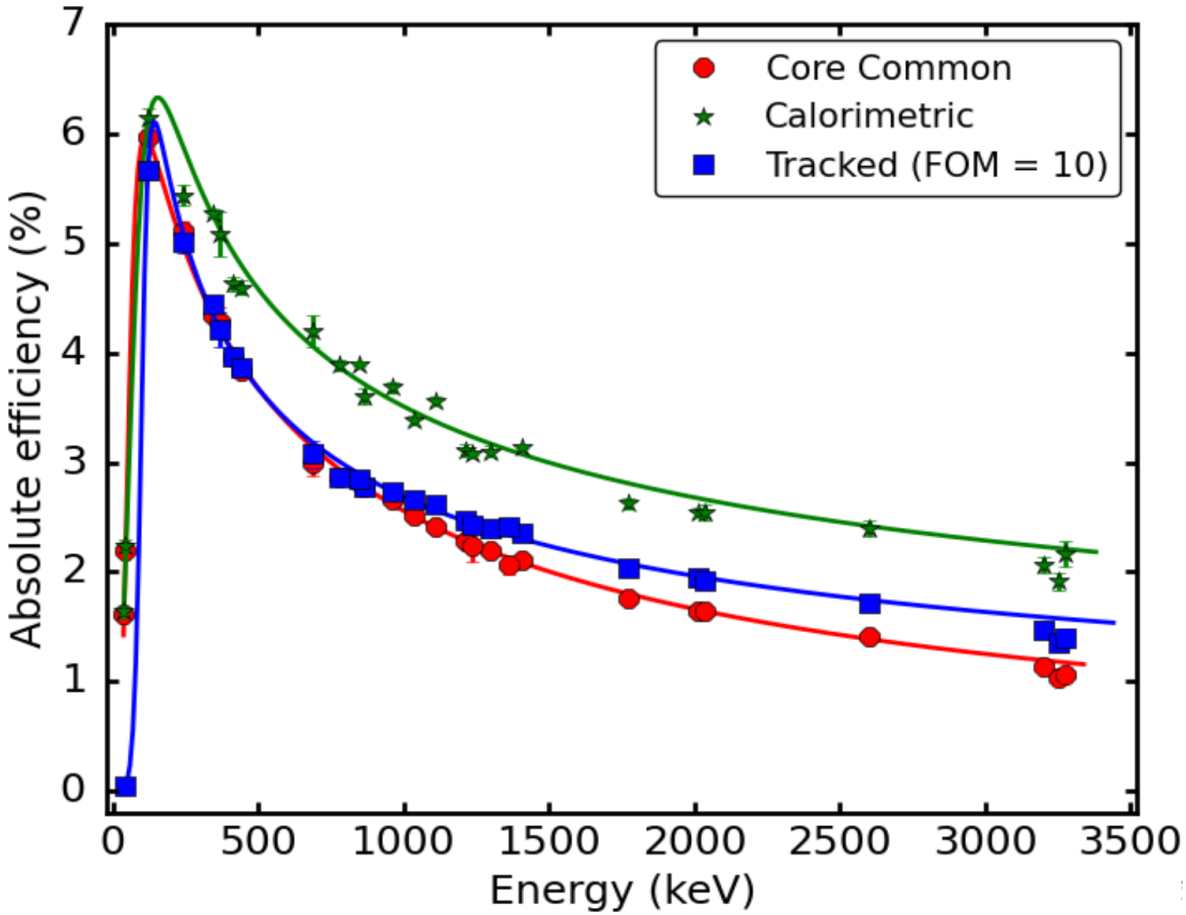


Measured efficiencies

N. Lalović, NIMA 806, 258-266 (2016)

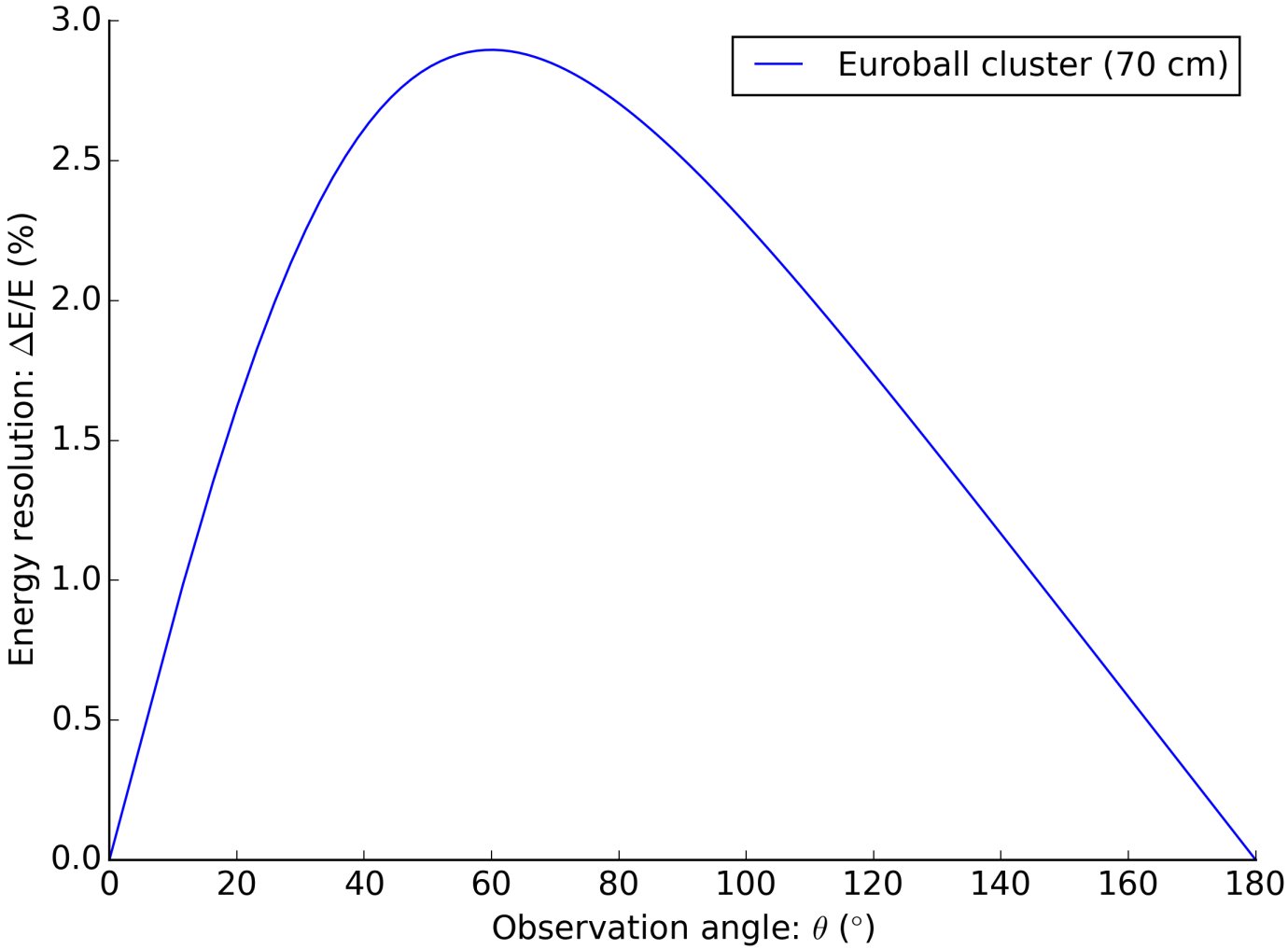
For 21 AGATA detectors at 1172 keV:

2.38% core common, 2.55% tracked, 3.3% calorimetric



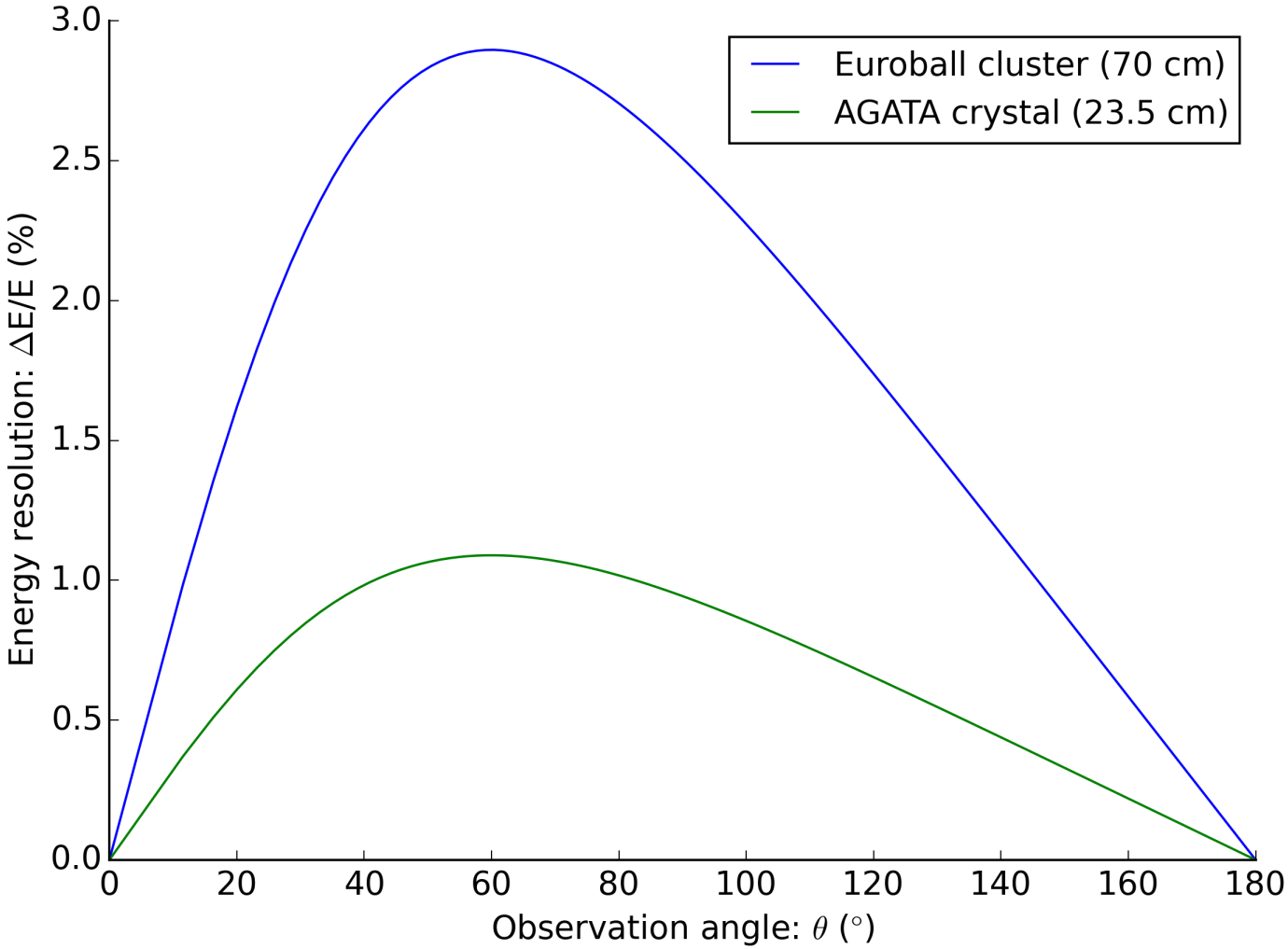
PSA advantage

Opening angle: Euroball cluster detector



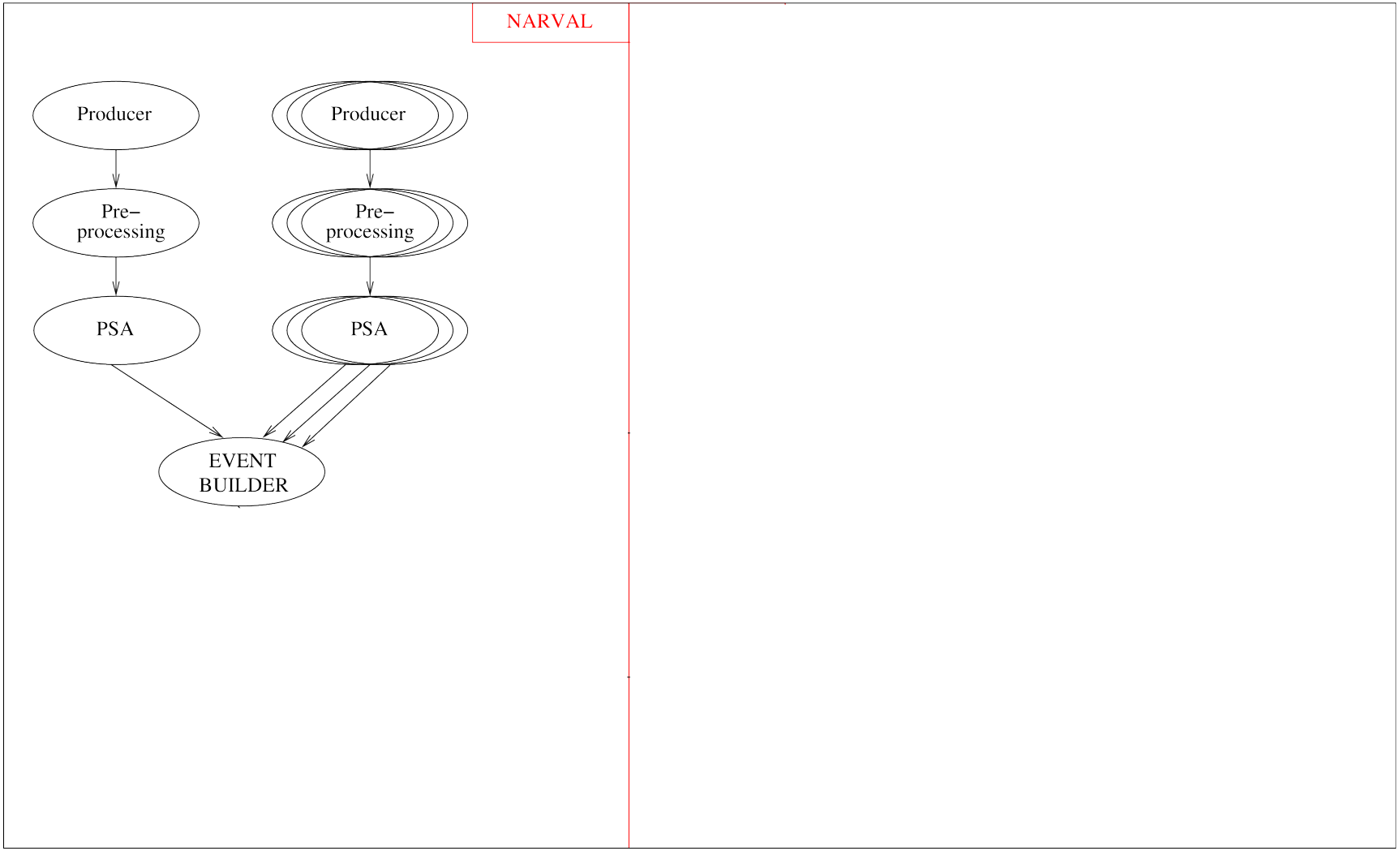
PSA advantage

Opening angle: AGATA segmented detector



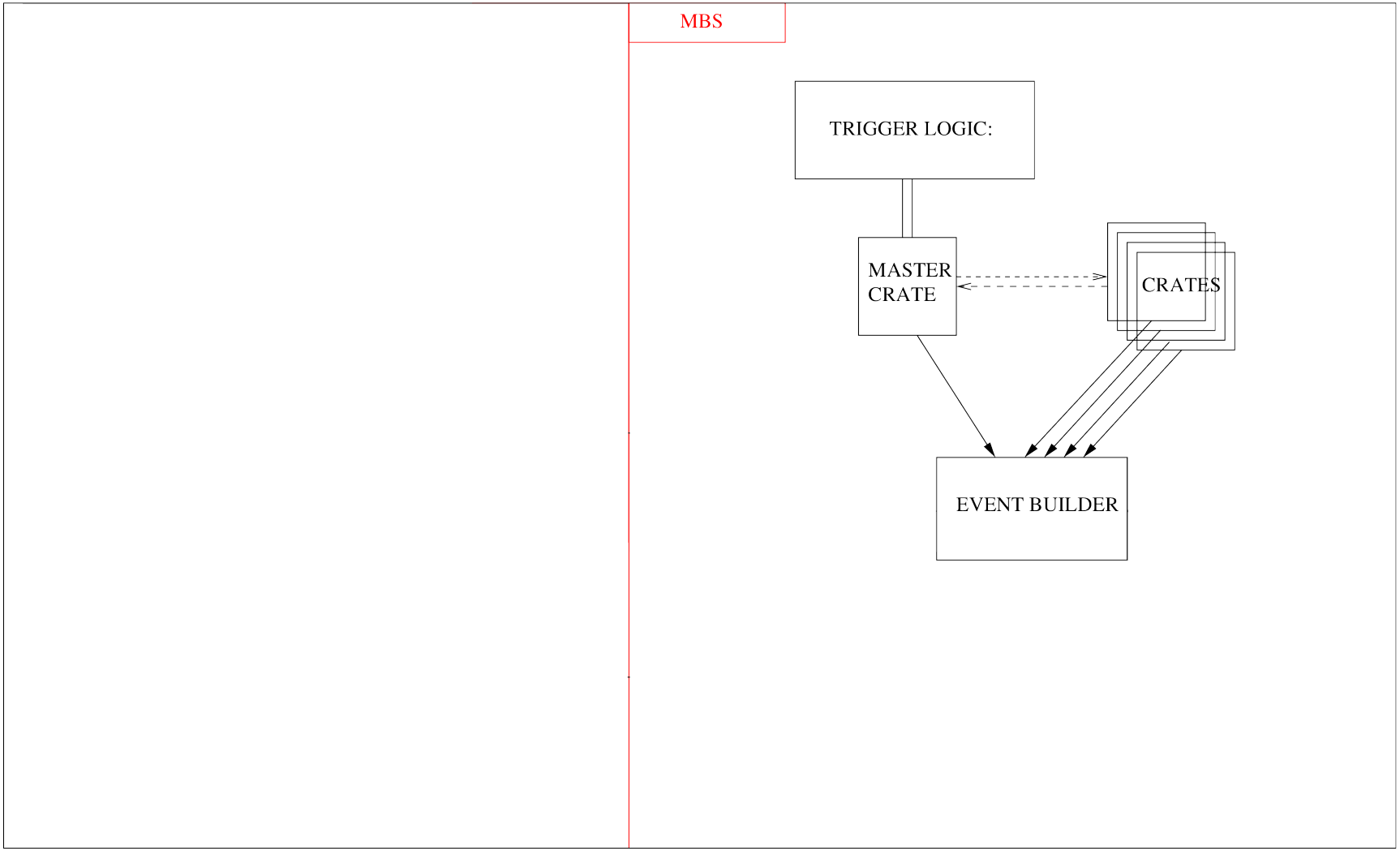
Data-flow handling

NARVAL actors



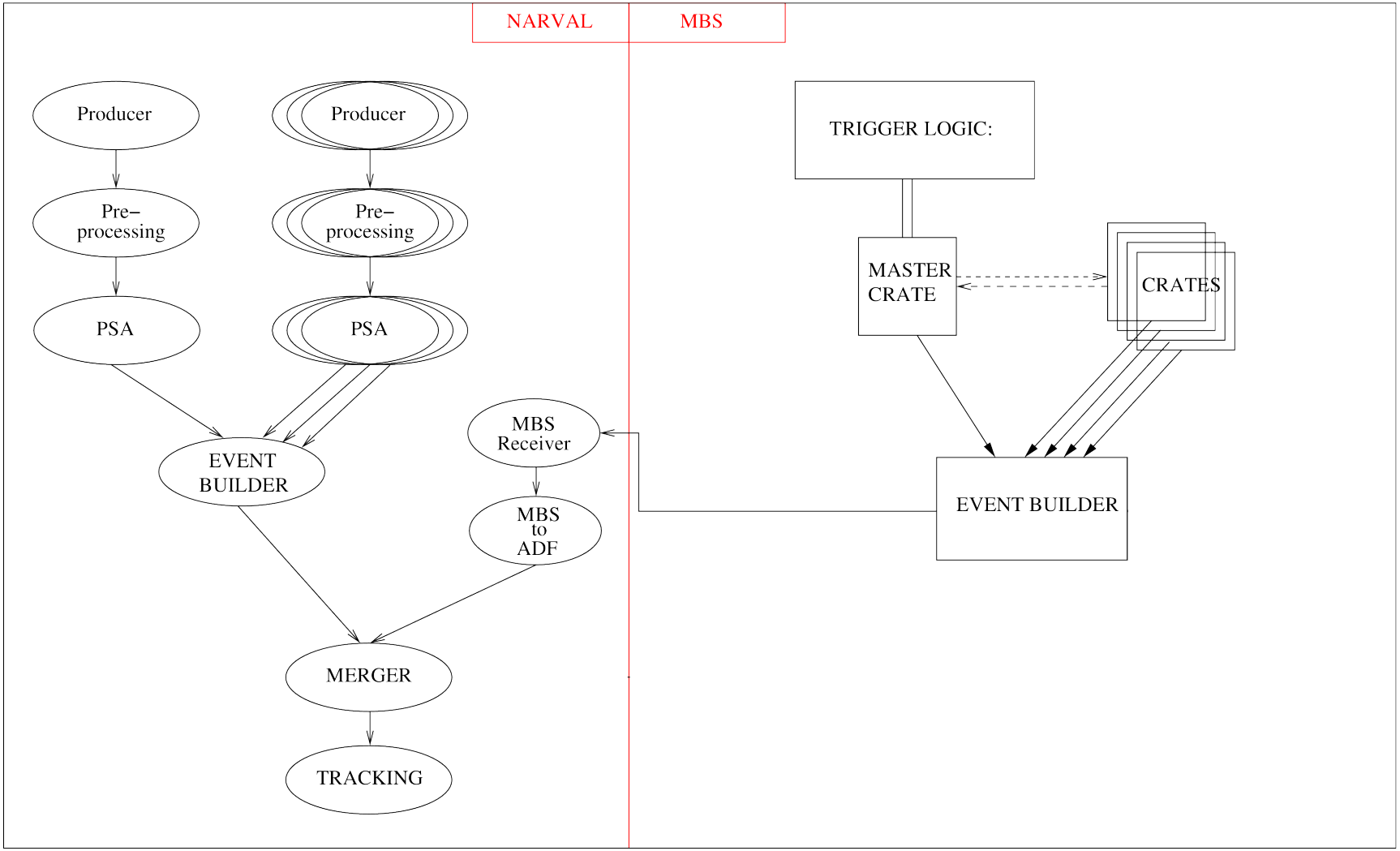
Data-flow handling

MBS DAQ system (FRS+LYCCA)



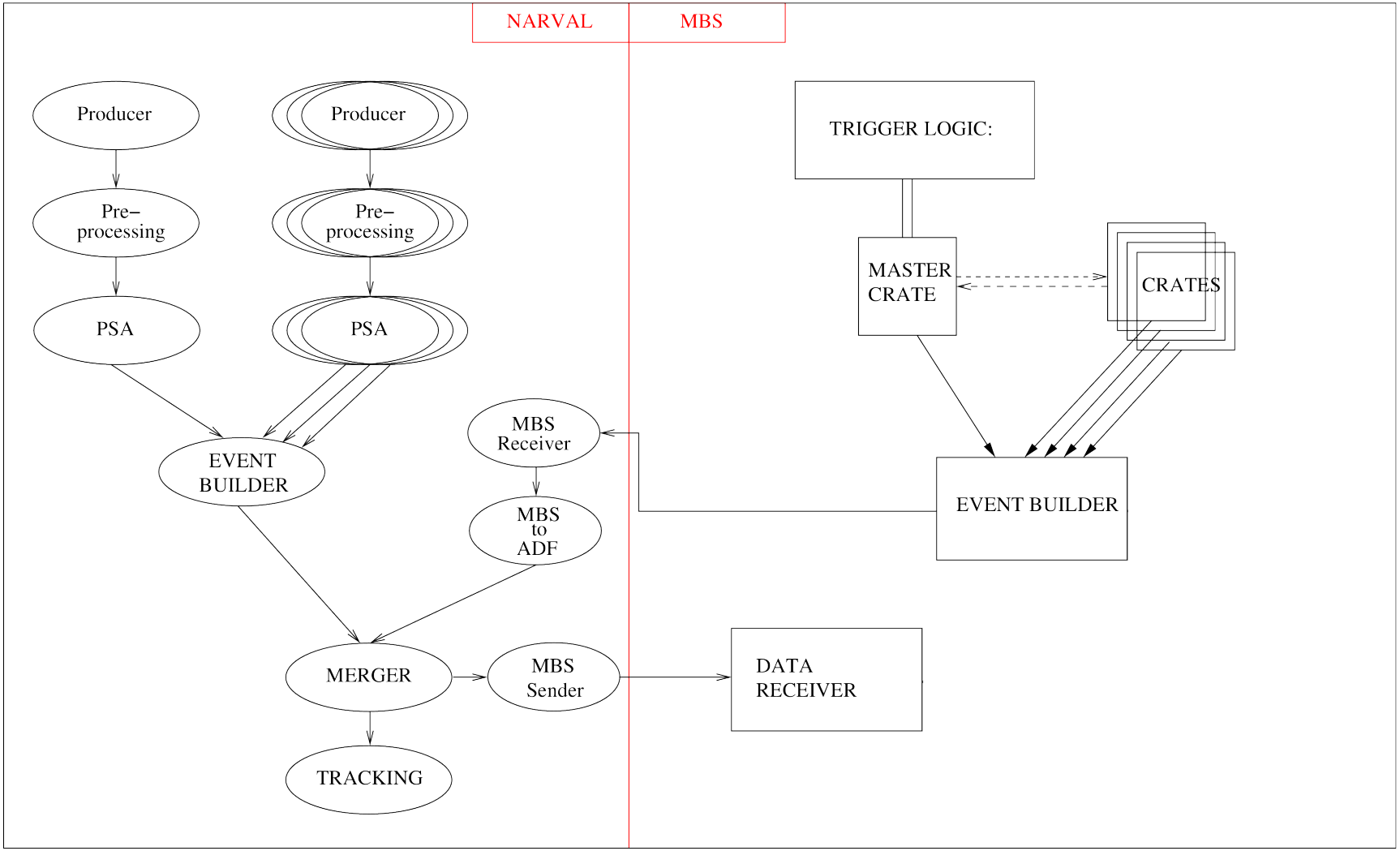
Data-flow handling

Coupling of both data-flow



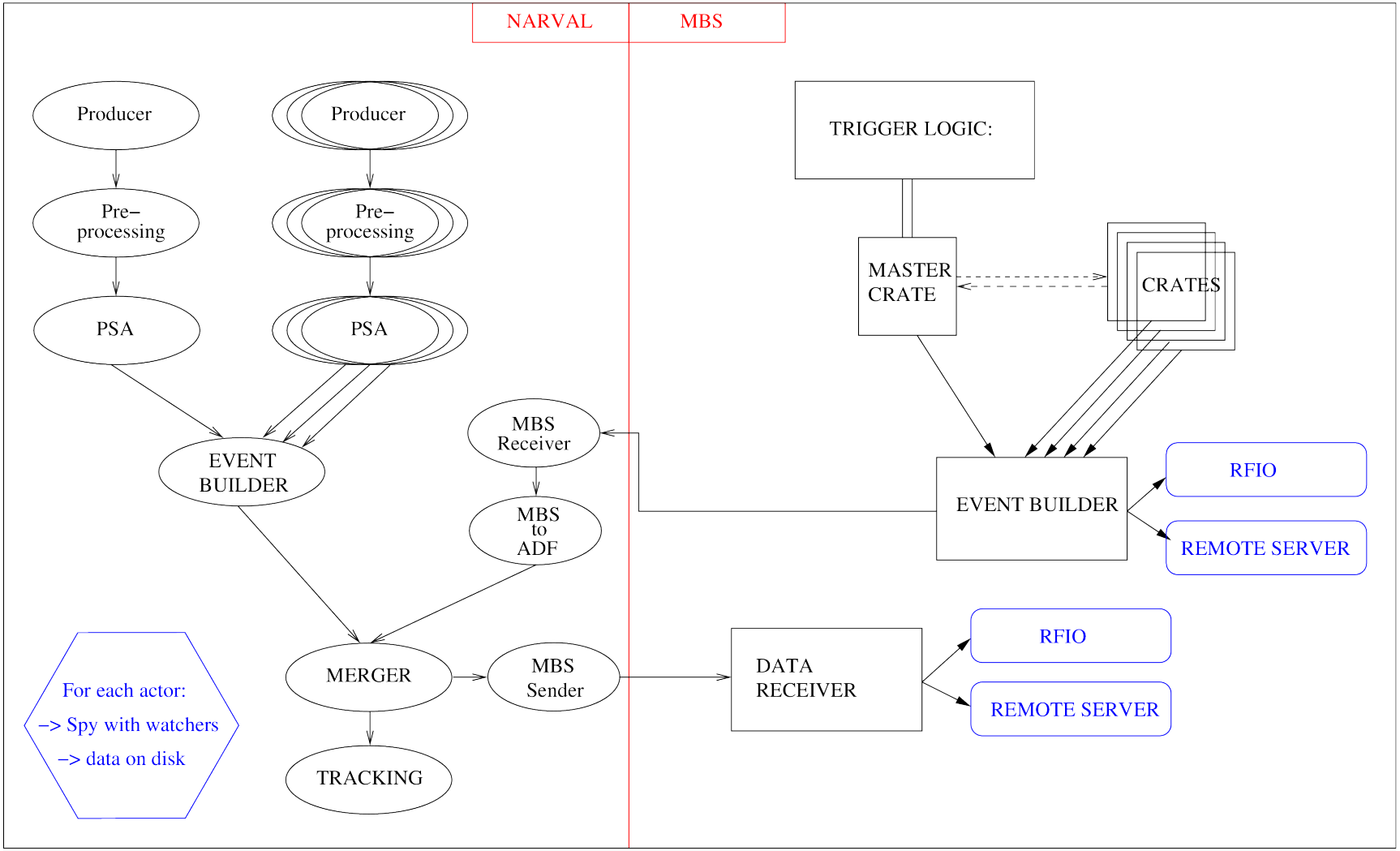
Data-flow handling

Duplication of data: integrity checks



Data-flow handling

Monitoring



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In flight spectroscopy

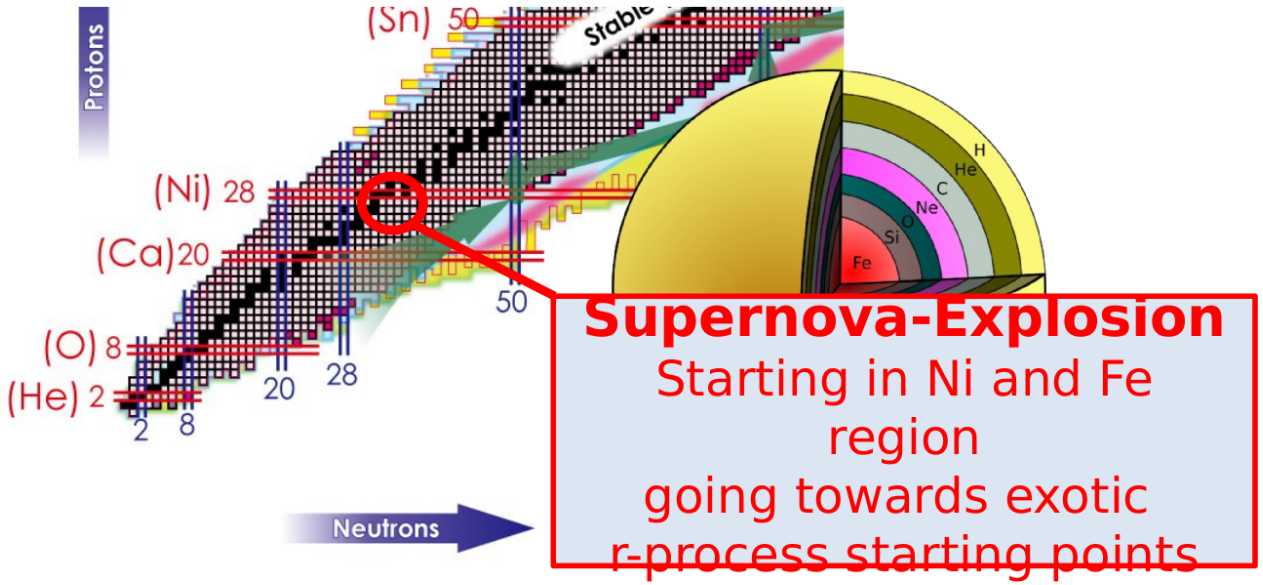
In flight data

Courtesy: O. Wieland, R. Avigo

Wieland: Pygmy Dipole Resonance in ^{64}Fe and the properties of neutron skin

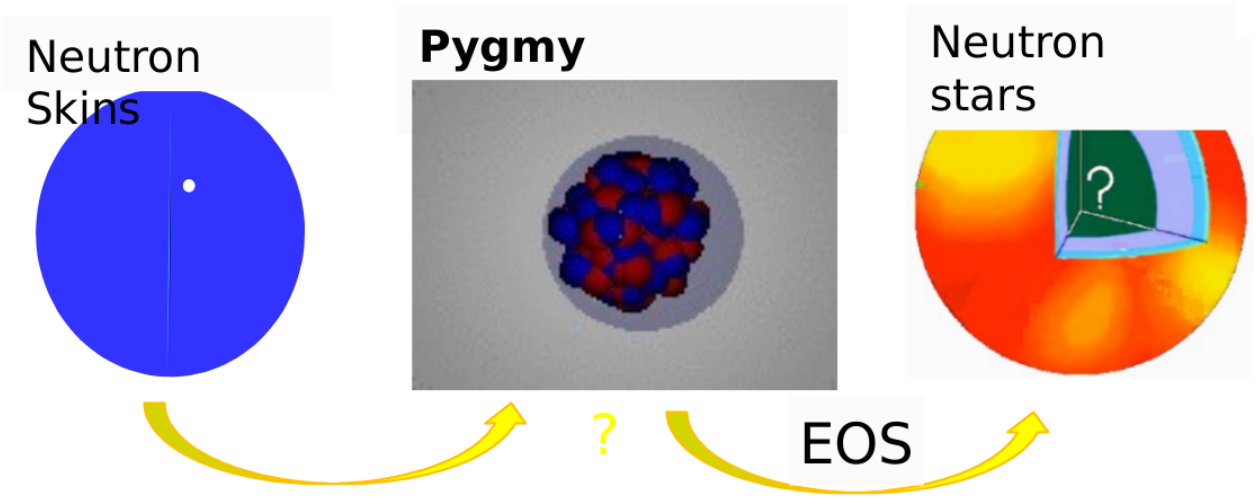
Courtesy: O. Wieland, R. Avigo

Study of nuclei toward the r-process



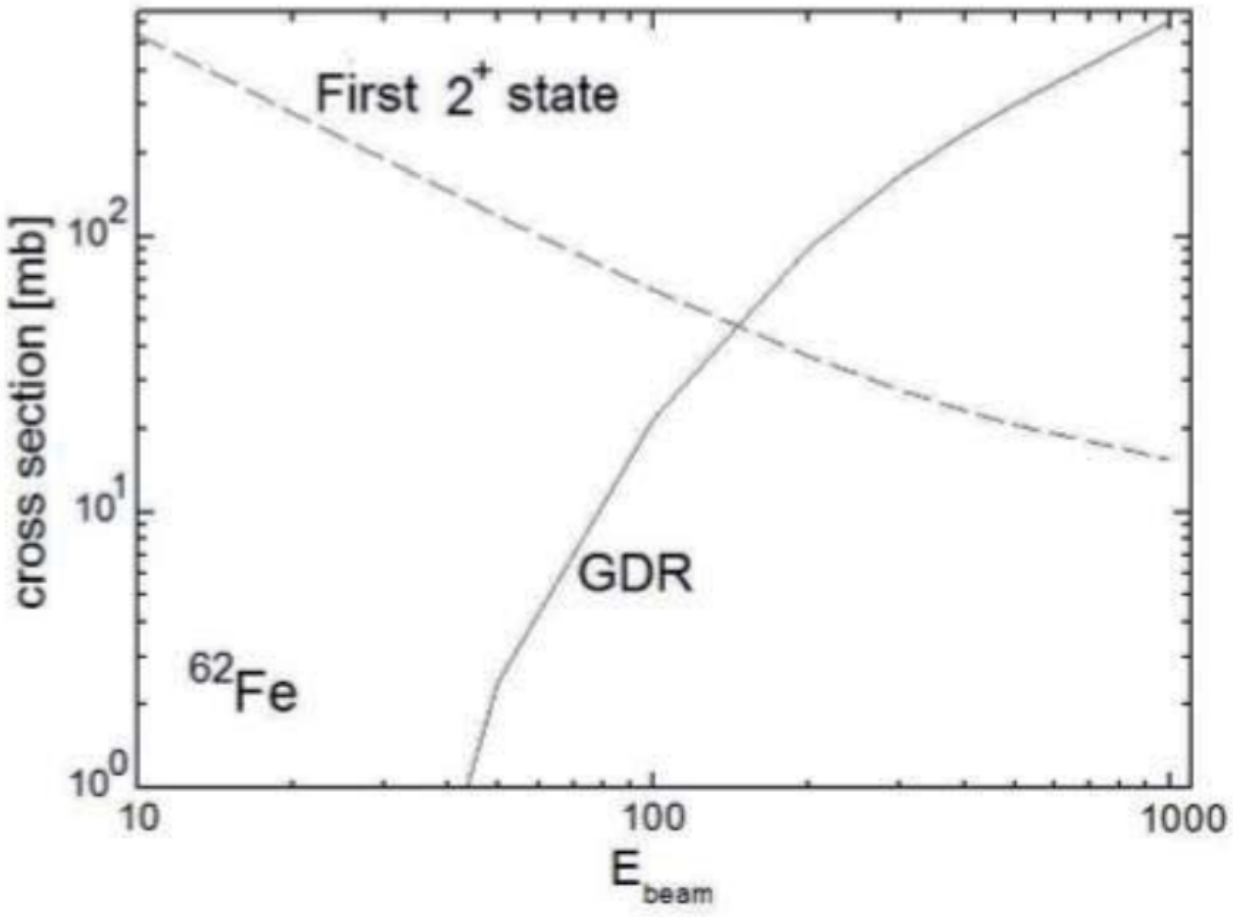
Courtesy: O. Wieland, R. Avigo

Study of the dipole strength



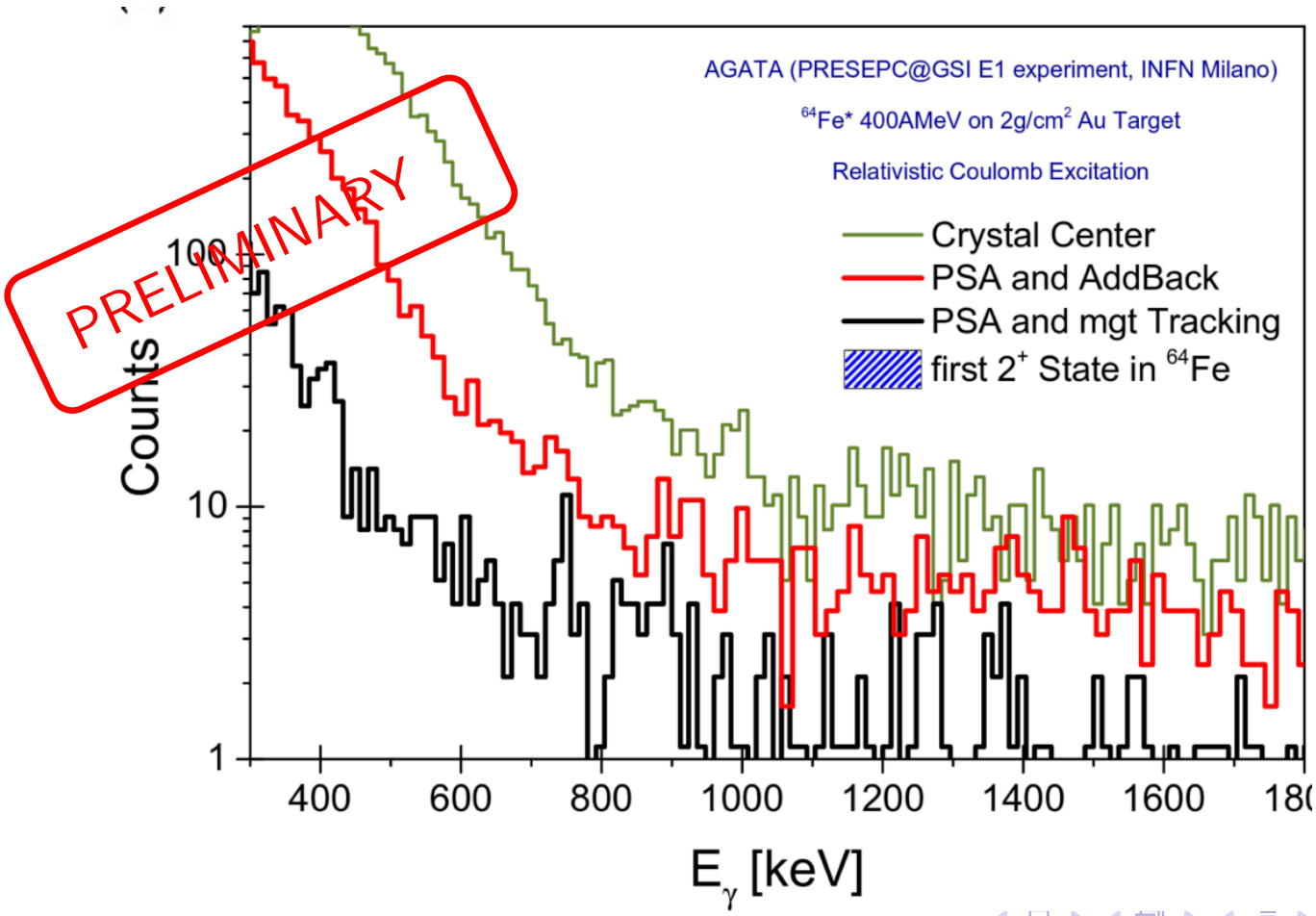
Courtesy: O. Wieland, R. Avigo

Access the dipole strength via relativistic coulomb excitation ($\beta \sim 0.7$)



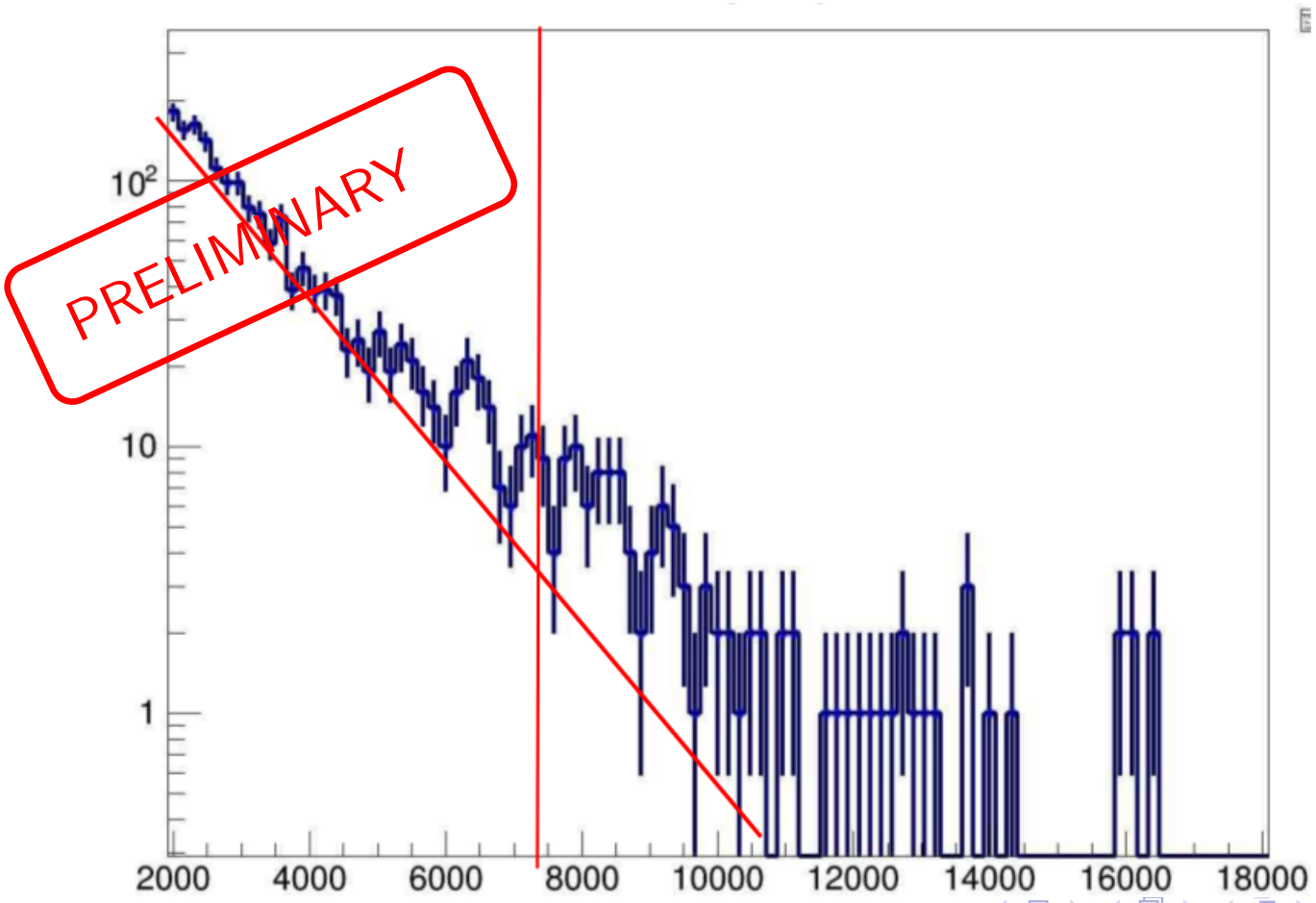
Courtesy: O. Wieland, R. Avigo

Observation of the 2^+ of ^{64}Fe: Essential for normalisation



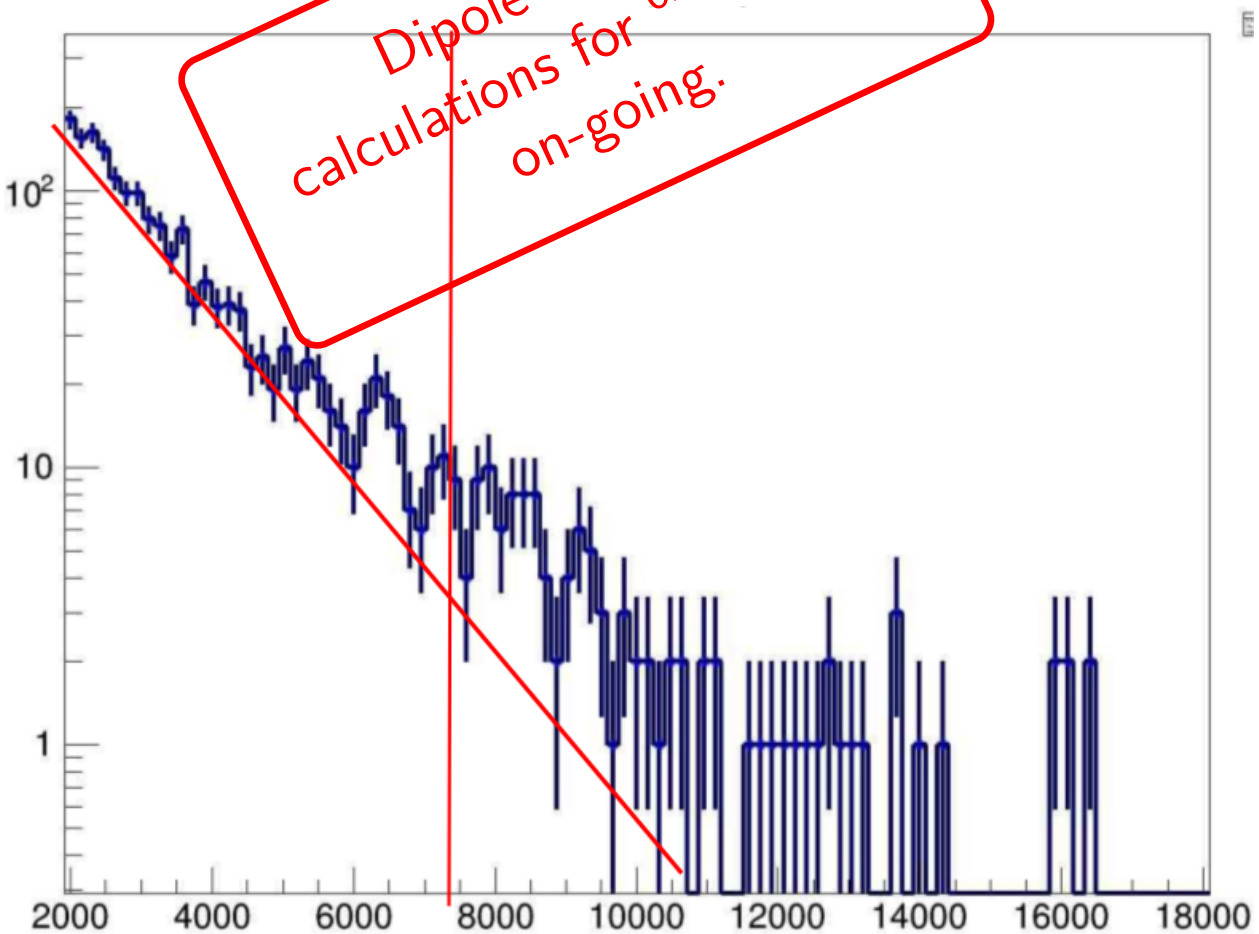
Courtesy: O. Wieland, R. Avigo

High energy structure observed with AGATA



Courtesy: O. Wieland, R. Avigo

High energy structure observed with AGATA

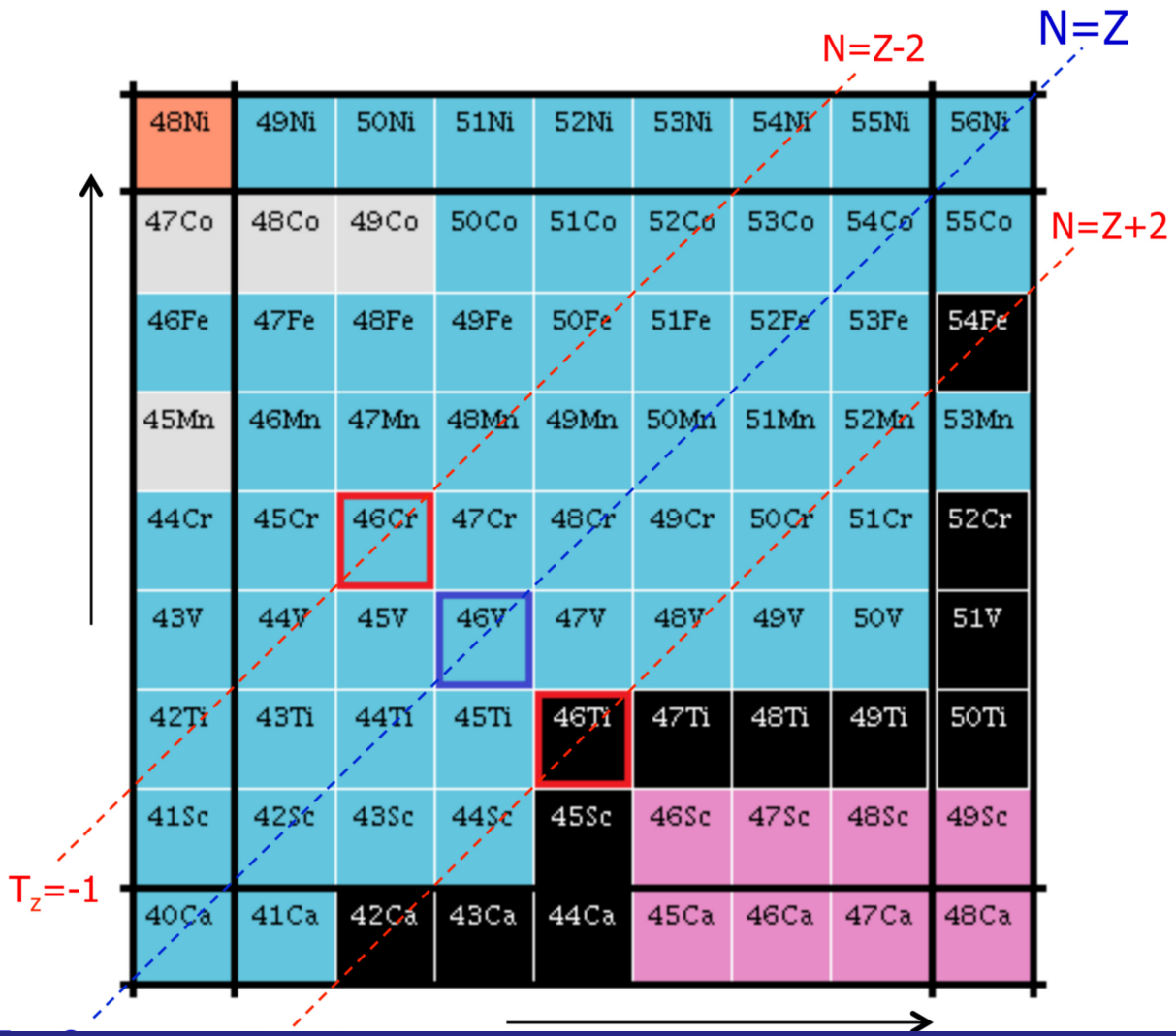


Courtesy: A. Boso, S. Milne, M. Bentley

Recchia/Bentley: Transition rates and mirror energy differences in isobaric multiplets

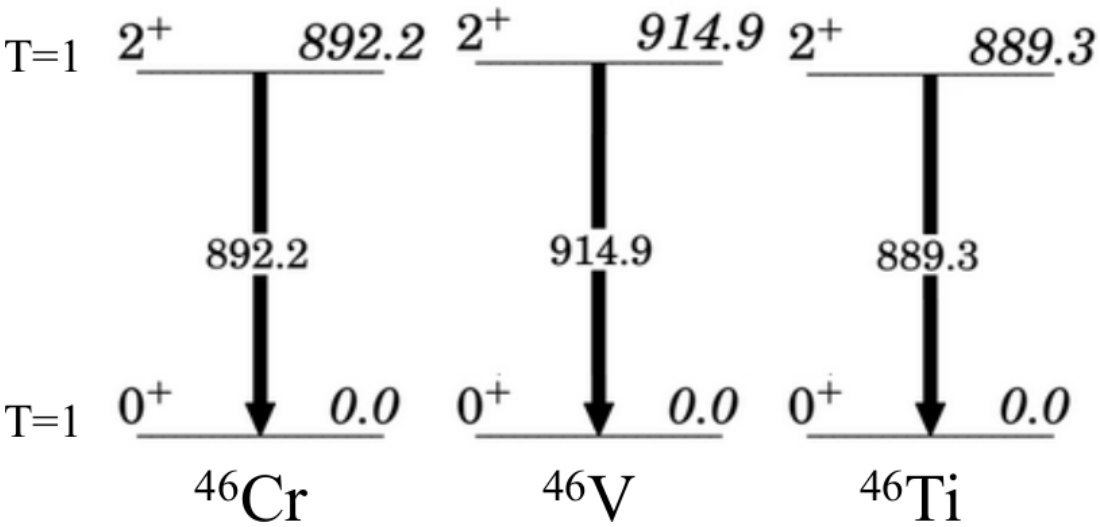
Courtesy: A. Boso, S. Milne, M. Bentley

Isospin triplet $A = 46$



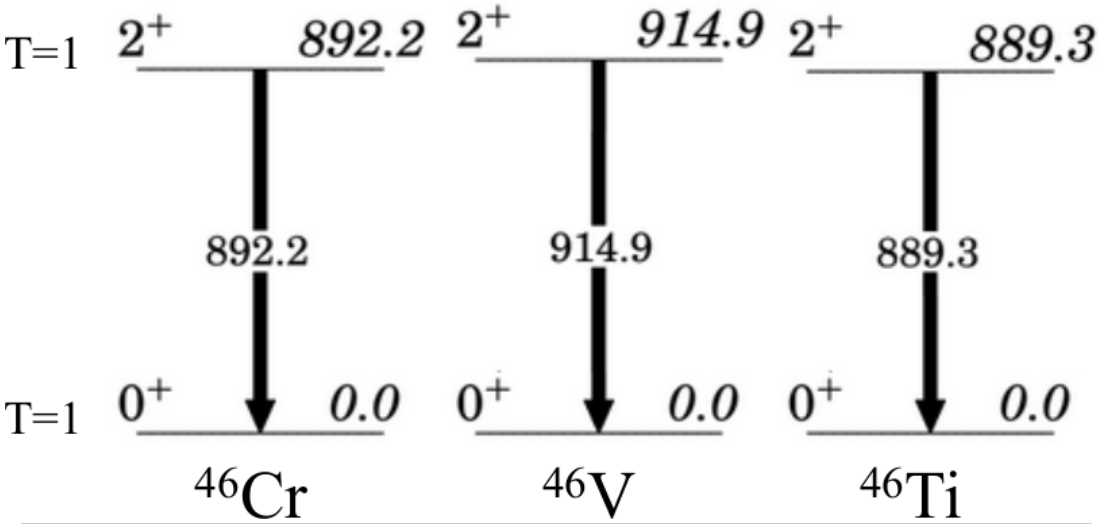
Courtesy: A. Boso, S. Milne, M. Bentley

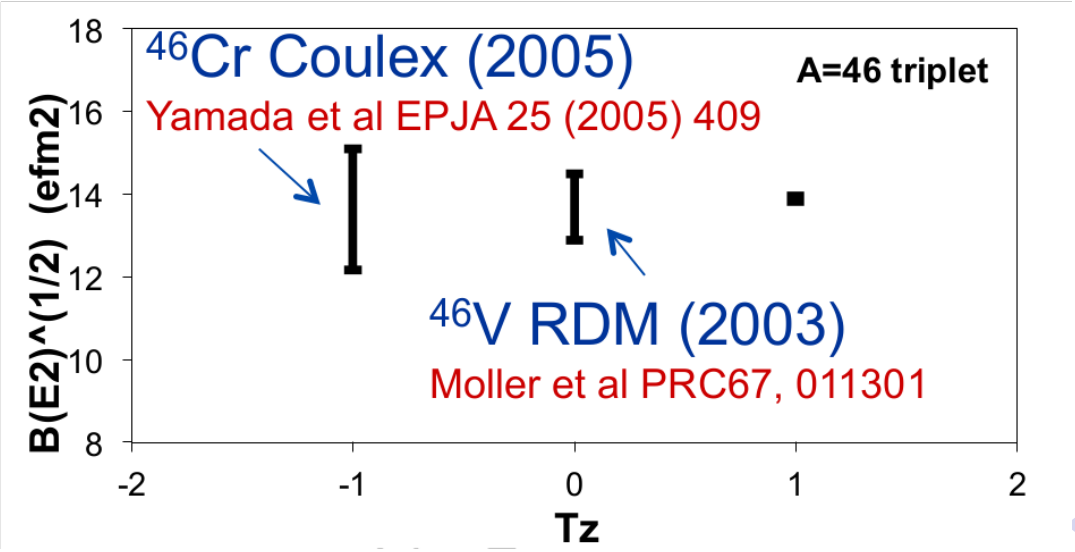
First 2^+ energy are similar in the $A = 46$ isospin triplet



Courtesy: A. Boso, S. Milne, M. Bentley

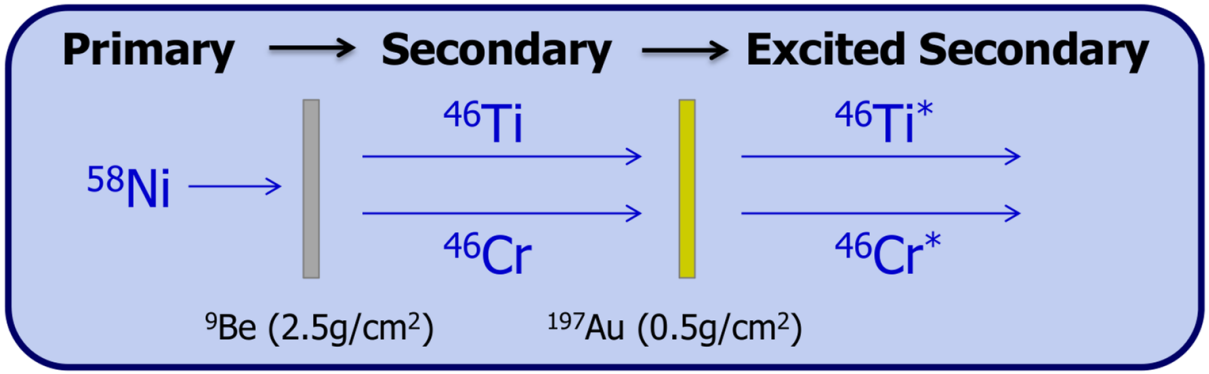
$B(E2; 2^+ \rightarrow 0^+)$ measurement with large uncertainties
Not clear if there is a linear dependence





Courtesy: A. Boso, S. Milne, M. Bentley

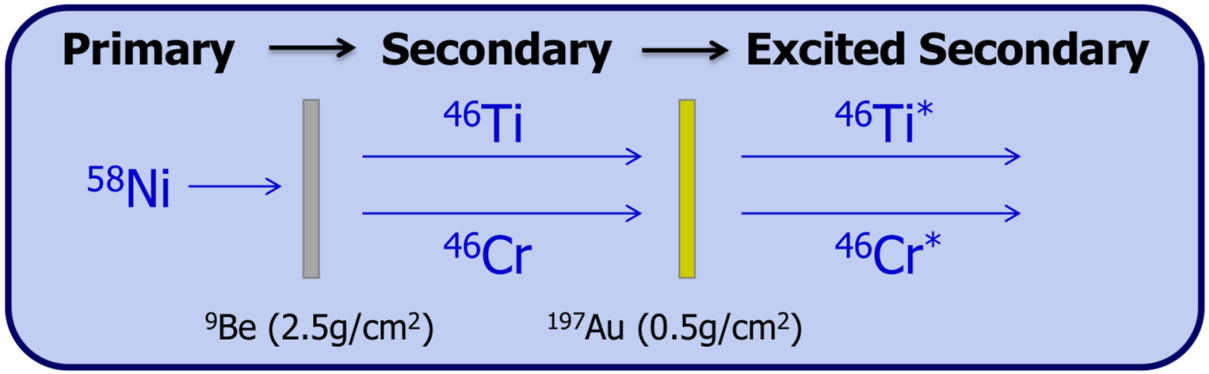
$B(E2; 2^+ \rightarrow 0^+)$ measurement with same conditions



Coulex:
Cross section

Courtesy: A. Boso, S. Milne, M. Bentley

$B(E2; 2^+ \rightarrow 0^+)$ measurement with same conditions



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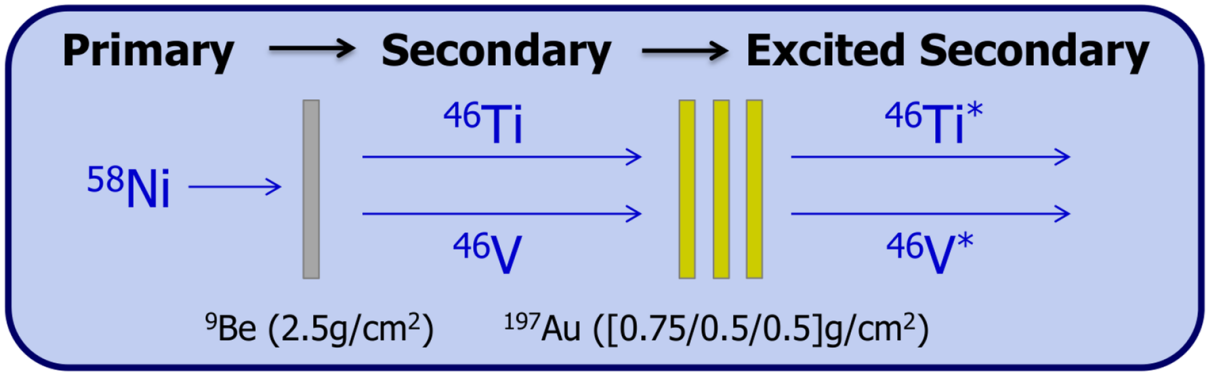
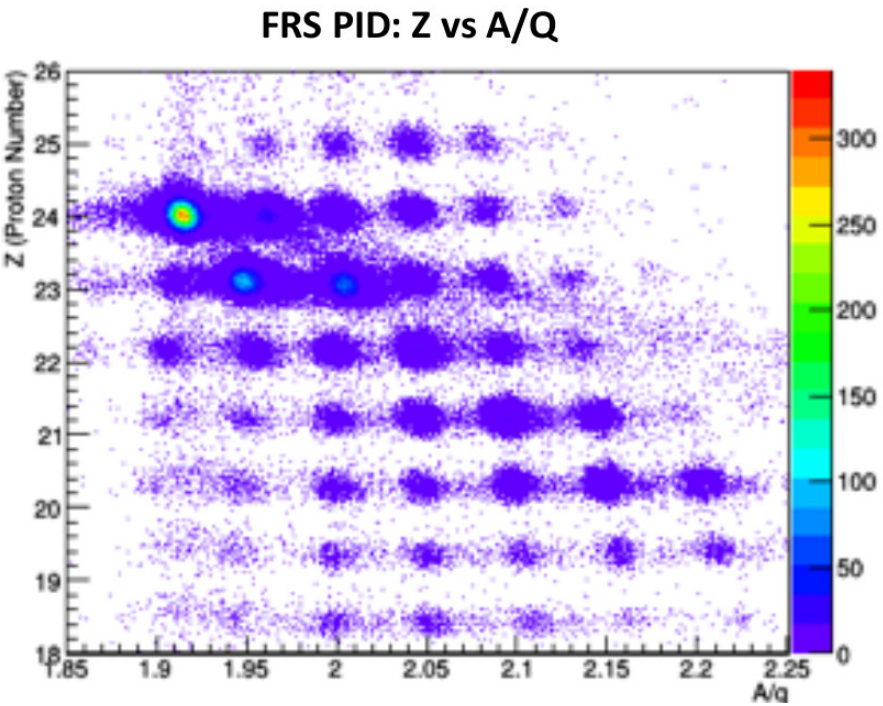
Cross section

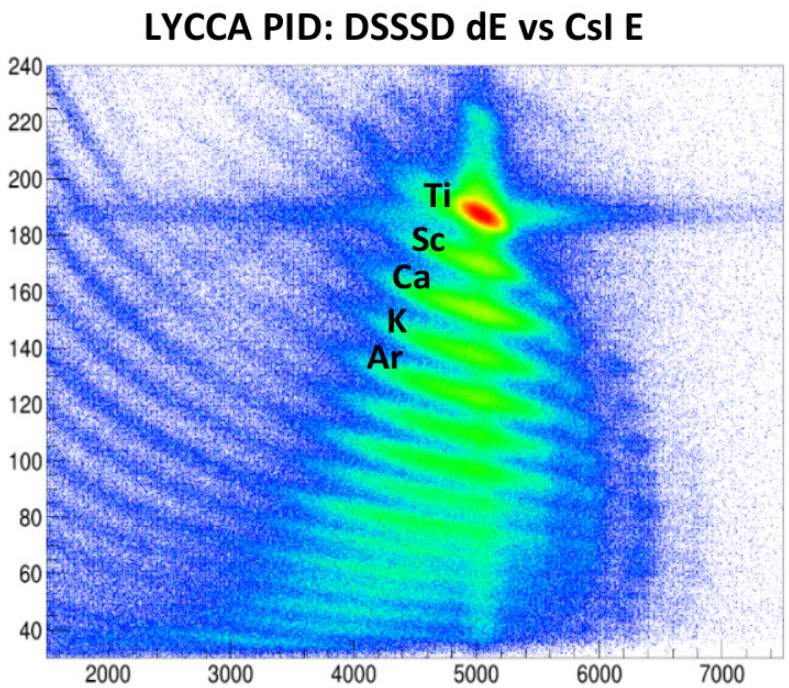


TCP:
Lifetime

Courtesy: A. Boso, S. Milne, M. Bentley

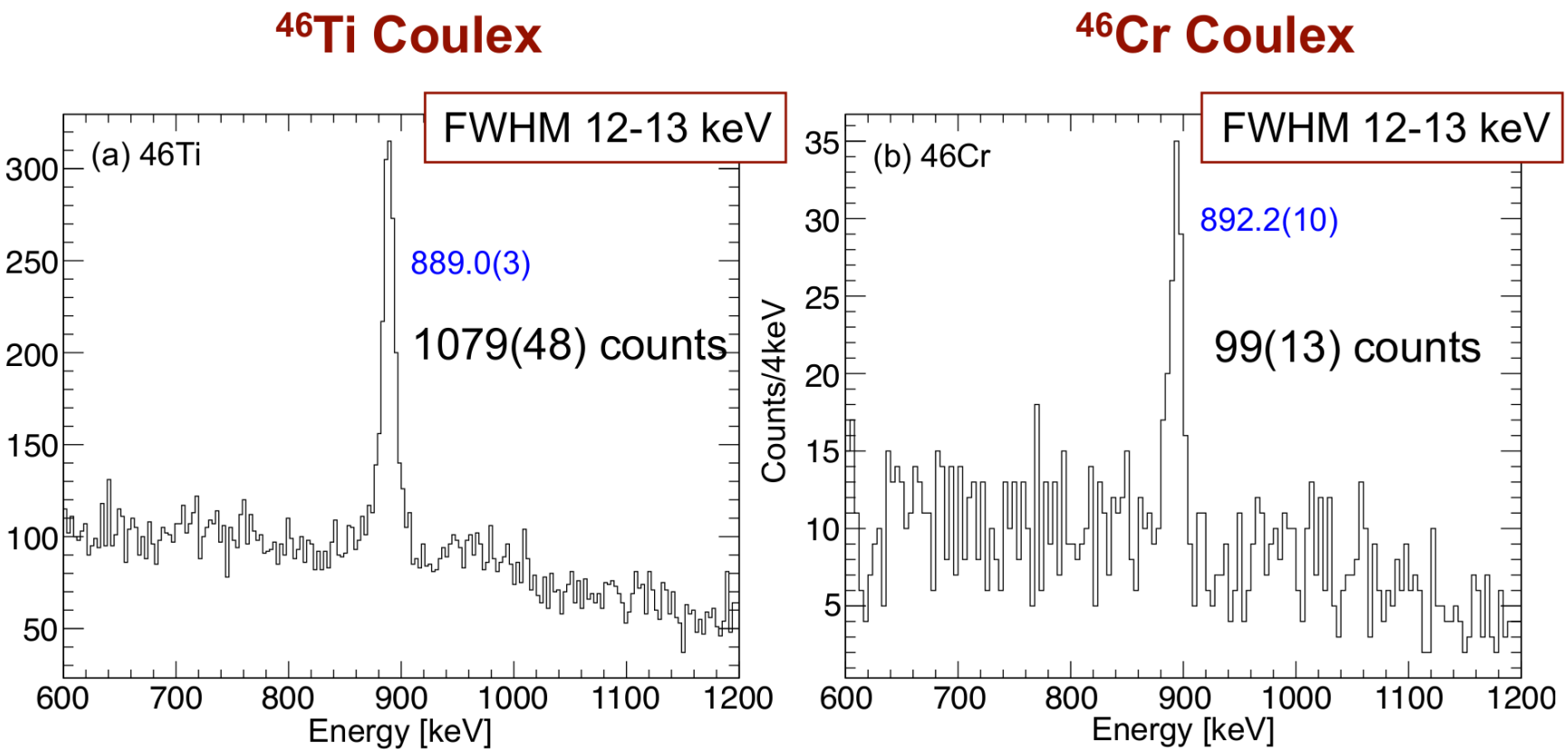
Fragmentation of ^{58}Ni at 600 MeV/A





Courtesy: A. Boso, S. Milne, M. Bentley

γ-ray spectra obtained after safe coulomb excitation criteria



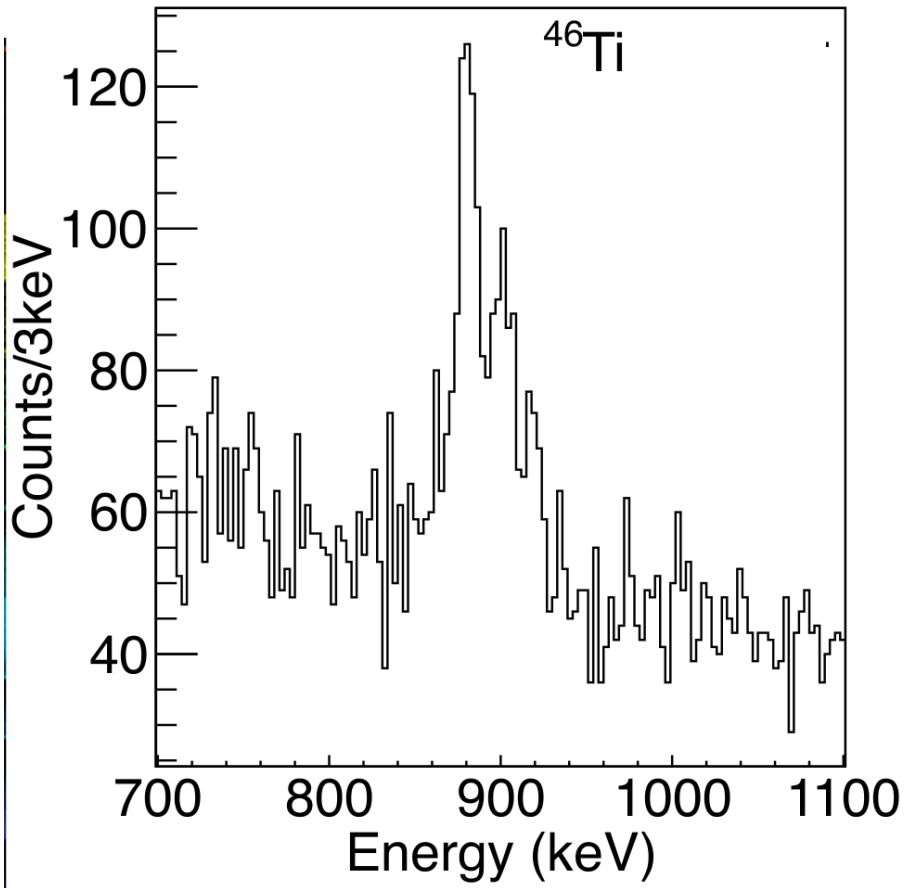
Courtesy: A. Boso, S. Milne, M. Bentley

γ-ray spectra obtained after safe coulomb excitation criteria

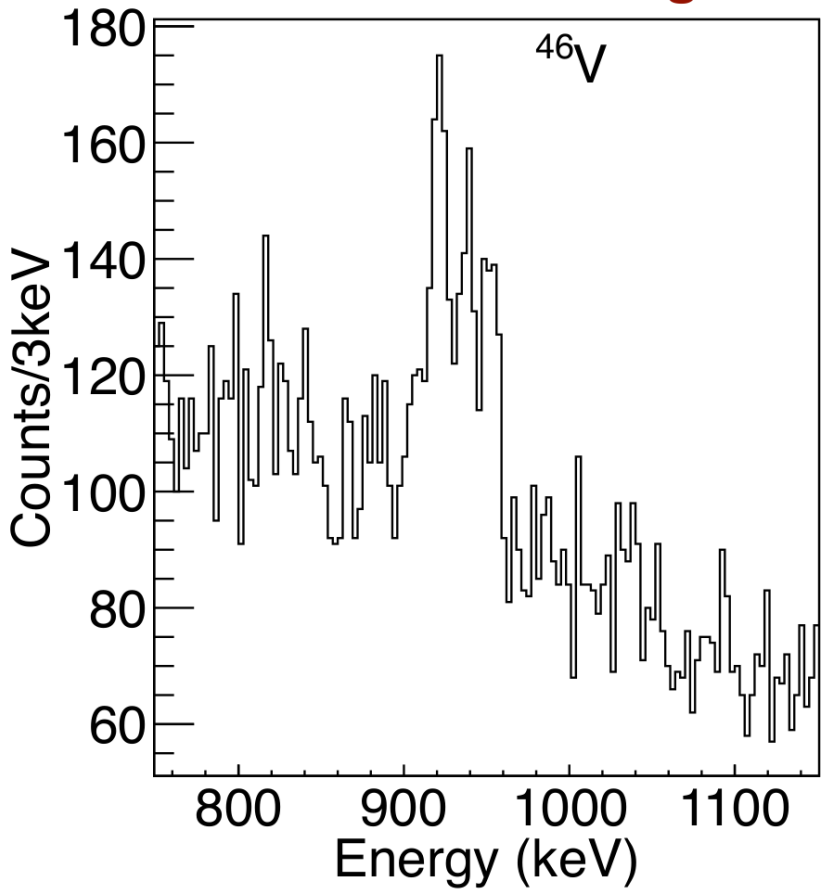
With the triple target stack

nice separation between the components

^{46}Ti Stretched Target

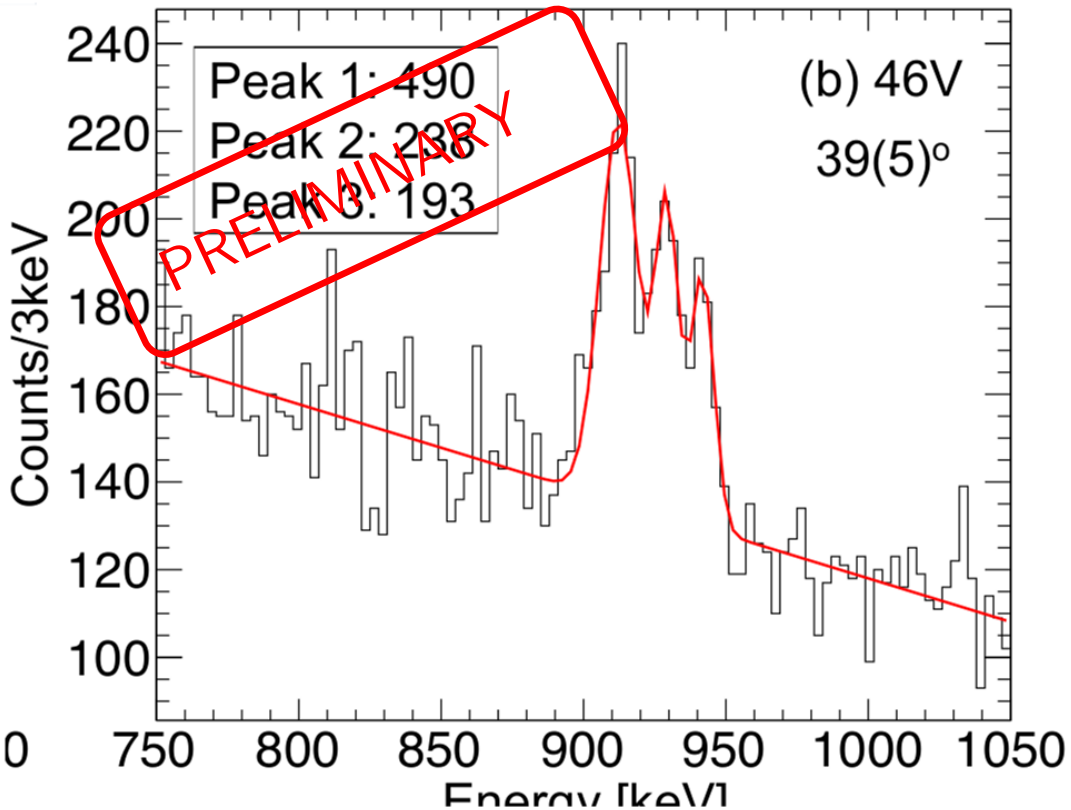


^{46}V Stretched Target



Courtesy: A. Boso, S. Milne, M. Bentley

Estimation with a "plunger" type analysis

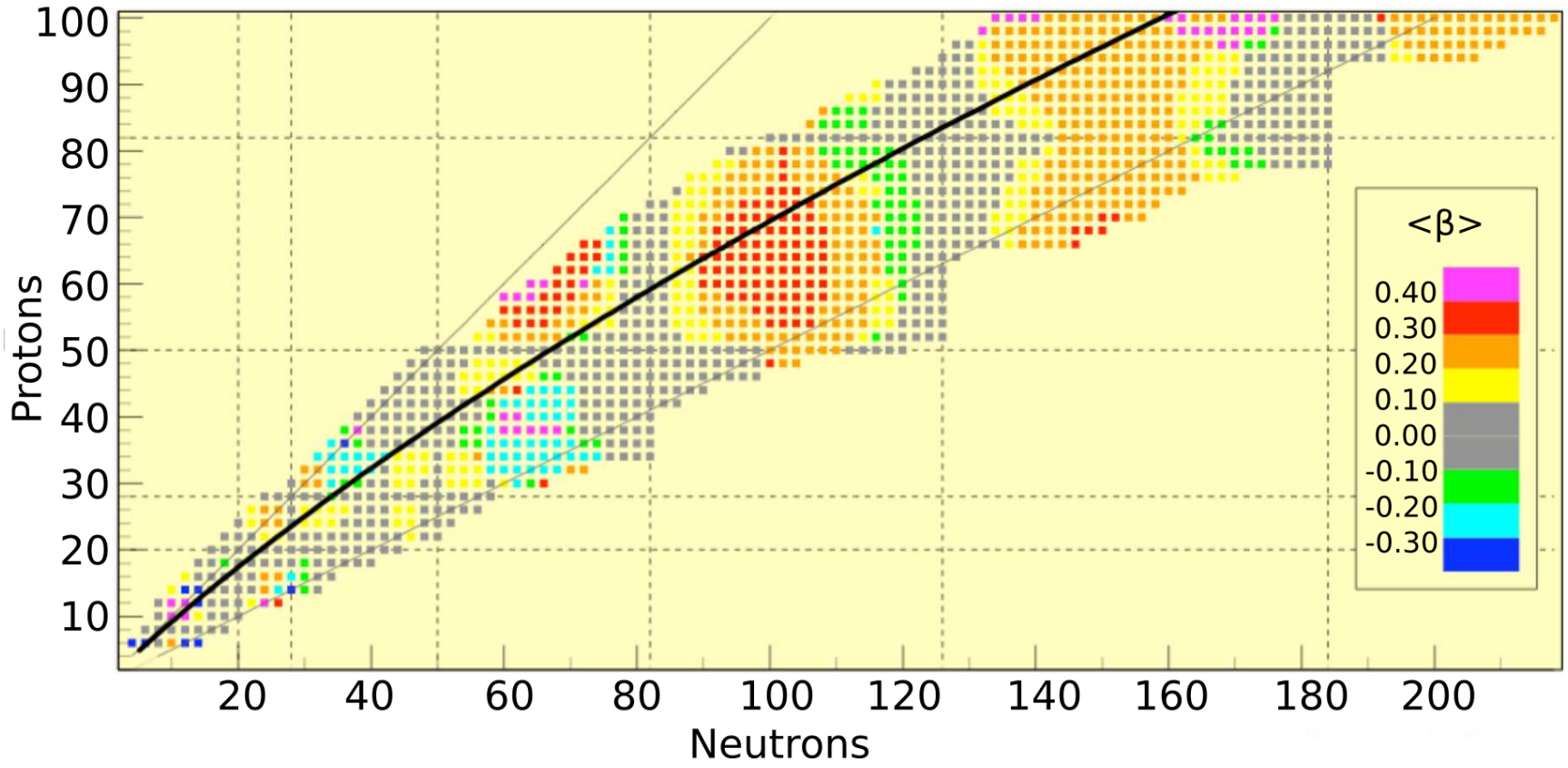


Estimate of half life from basic simulation:
5.3(4) ps
Literature:
4.7(6) ps

Pietri: Shape evolution in neutron-rich Zr

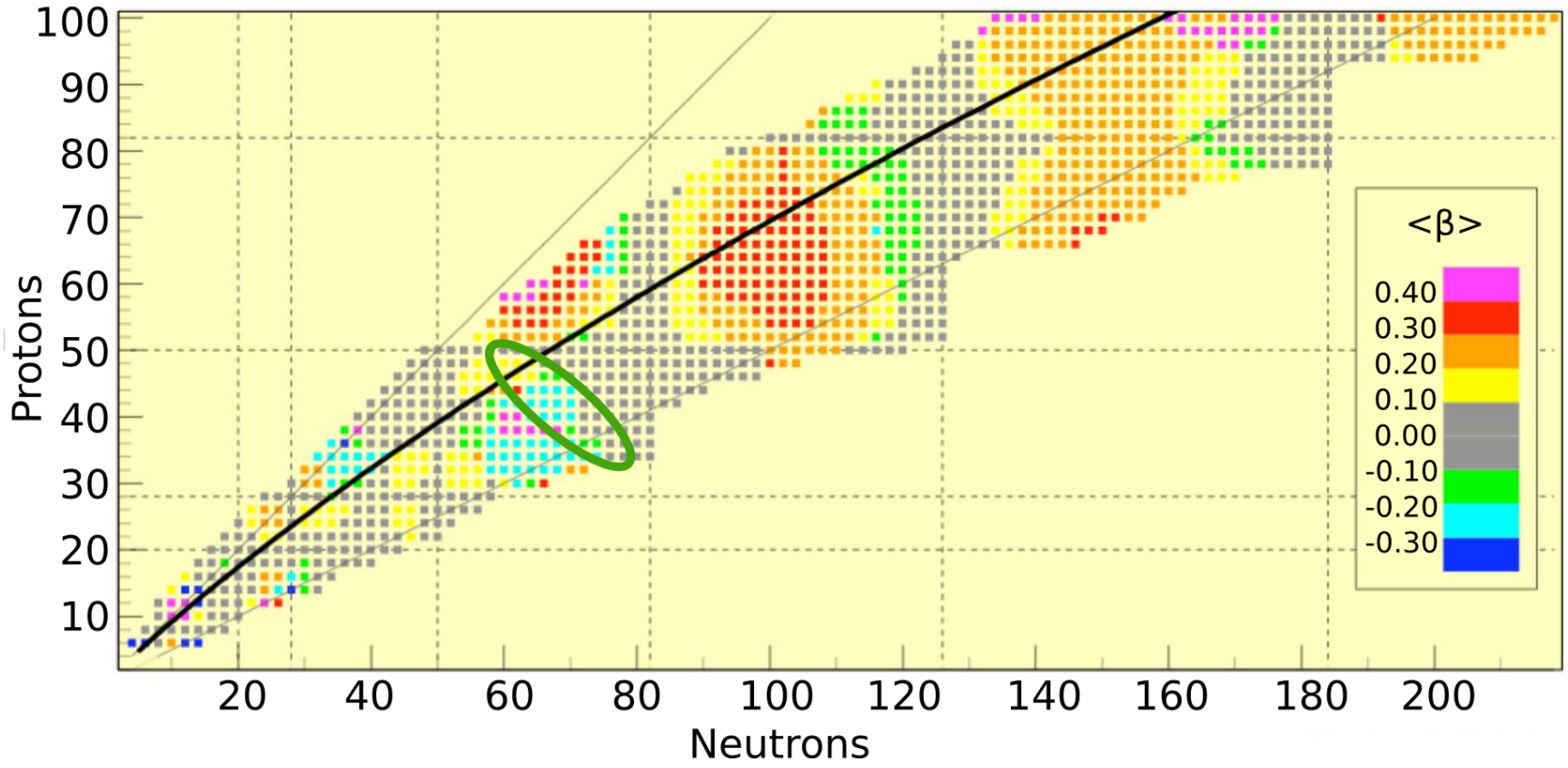
Hartree-Fock-Bogoliubov shape predictions

J.P. Delaroche, Phys. Rev. C 81:014303 (2010)

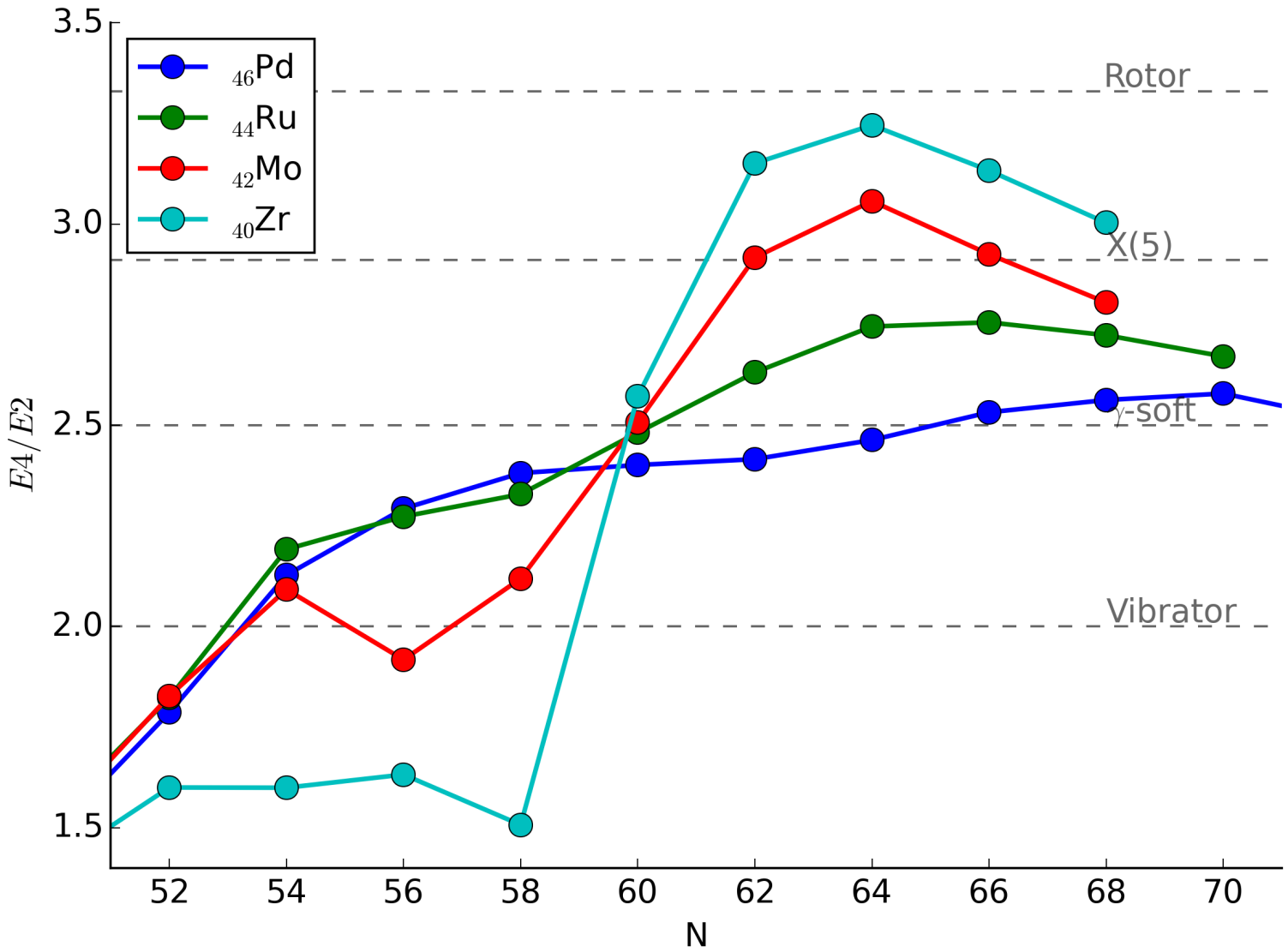


$^{100-108}$Mo

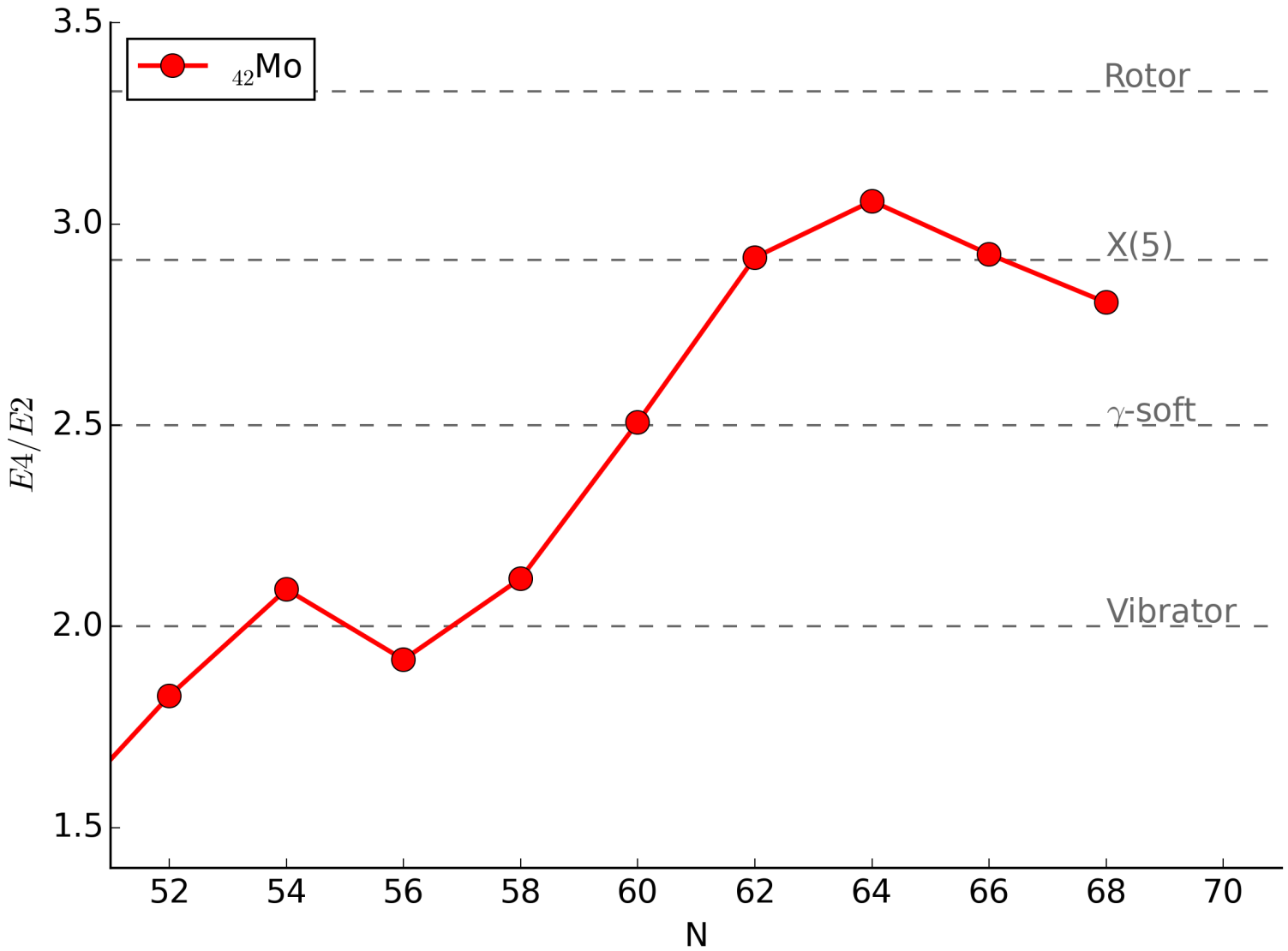
J.P. Delaroche, Phys. Rev. C 81:014303 (2010)



$^{100-108}$Mo

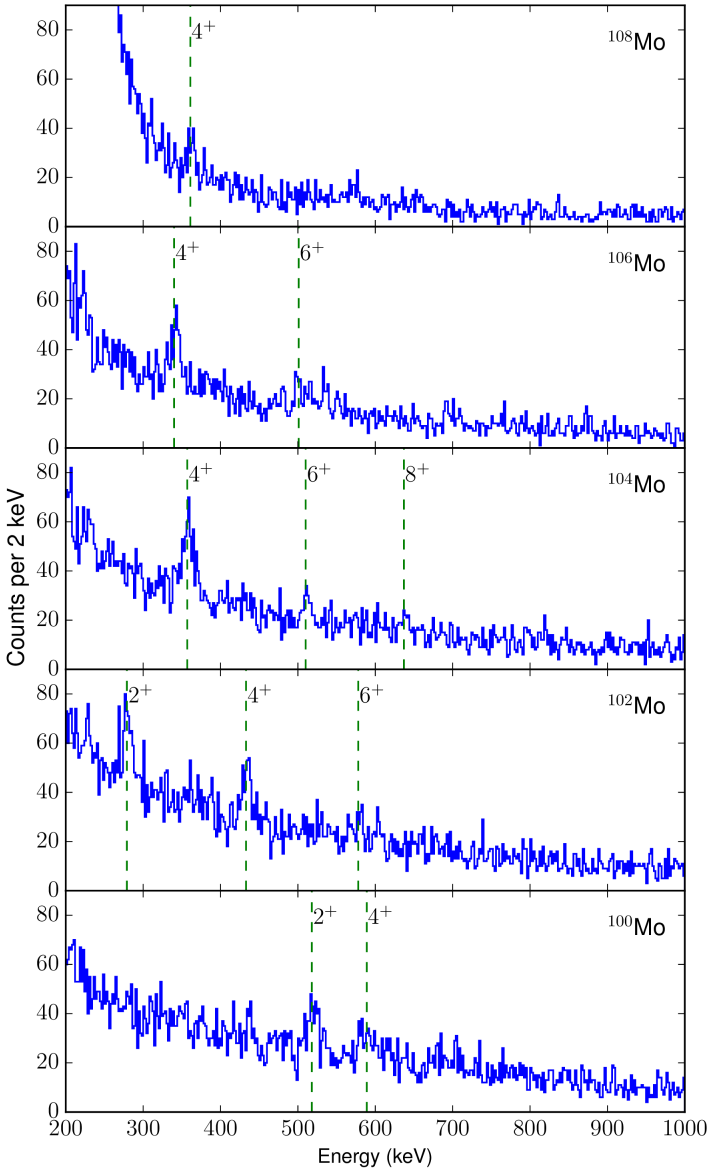

$_{46}$Pd
$_{44}$Ru
$_{42}$Mo
$_{40}$Zr
Rotor
X(5)
γ-soft
Vibrator
$E4/E2$
N
3.5
3.0
2.5
2.0
1.5
52
54
56
58
60
62
64
66
68
70

$^{100-108}$Mo


$_{42}$Mo
Rotor
X(5)
γ-soft
Vibrator
E4/E2
N
3.5
3.0
2.5
2.0
1.5
52
54
56
58
60
62
64
66
68
70

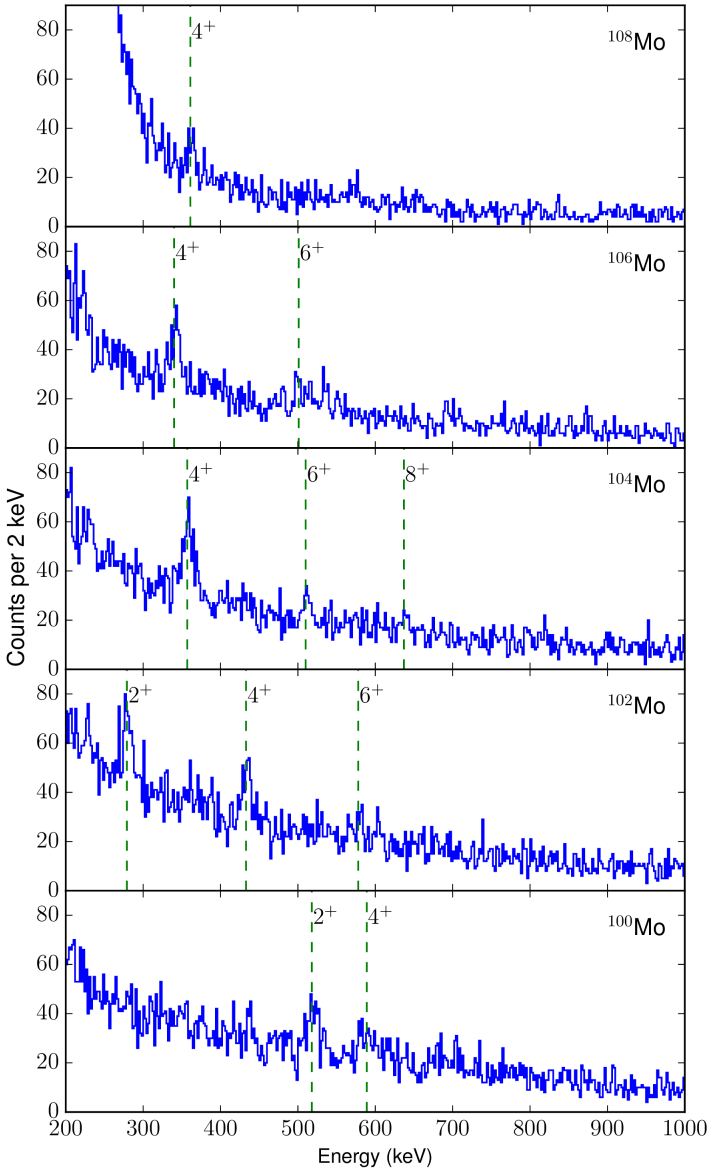
D. Ralet, submitted to PRC

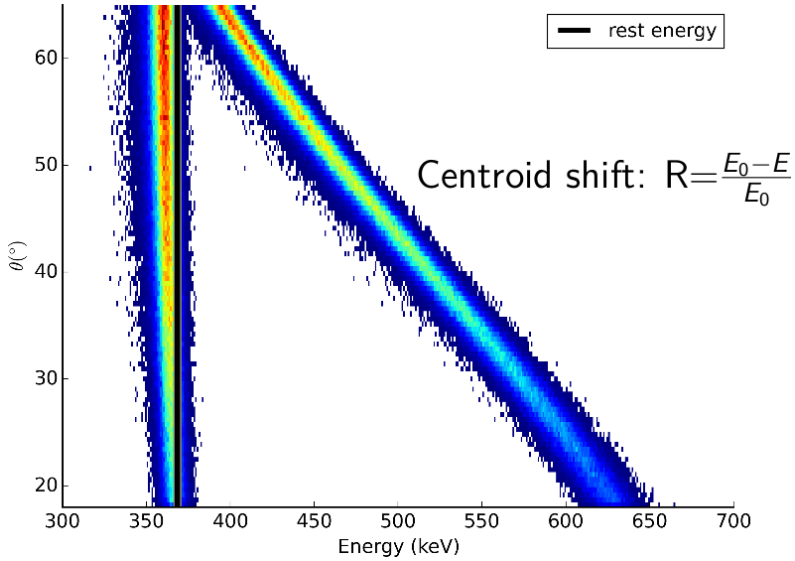
Observed transition in $^{100-108}$Mo



D. Ralet, submitted to PRC

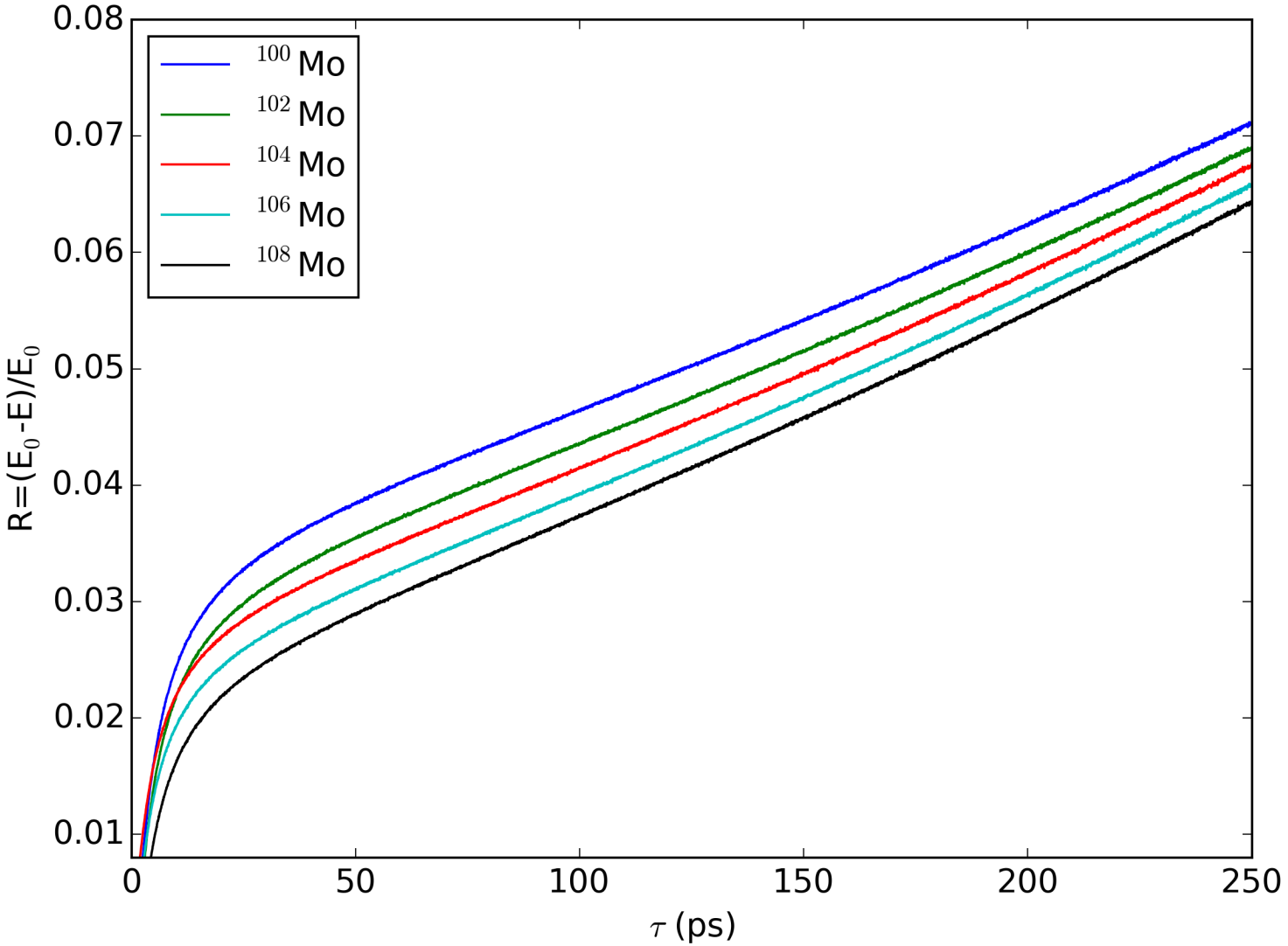
Observed transition in $^{100-108}$Mo





D. Ralet, submitted to PRC

Simulated centroid shift as a function of the half-life



$^{100-108}$Mo

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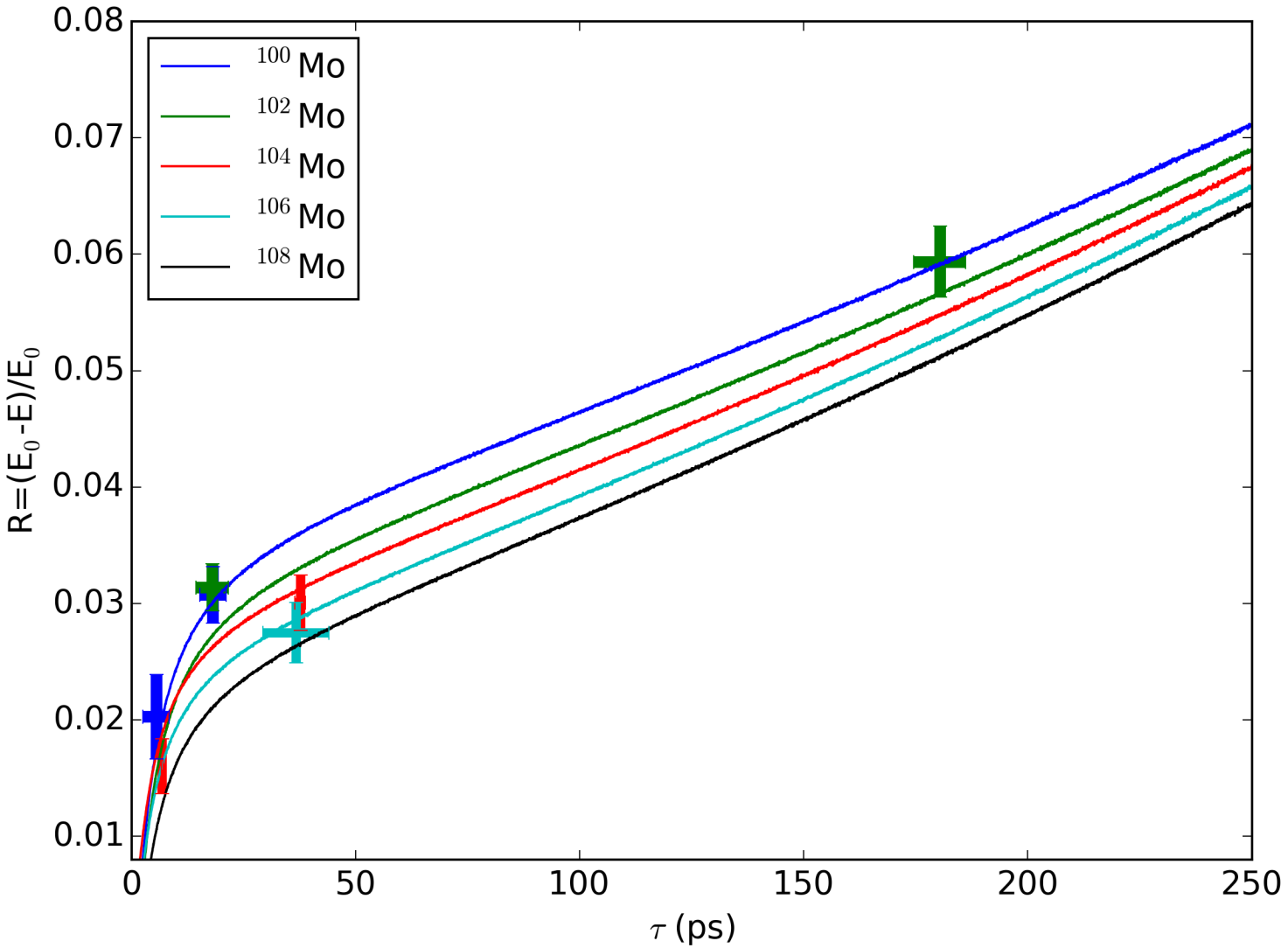

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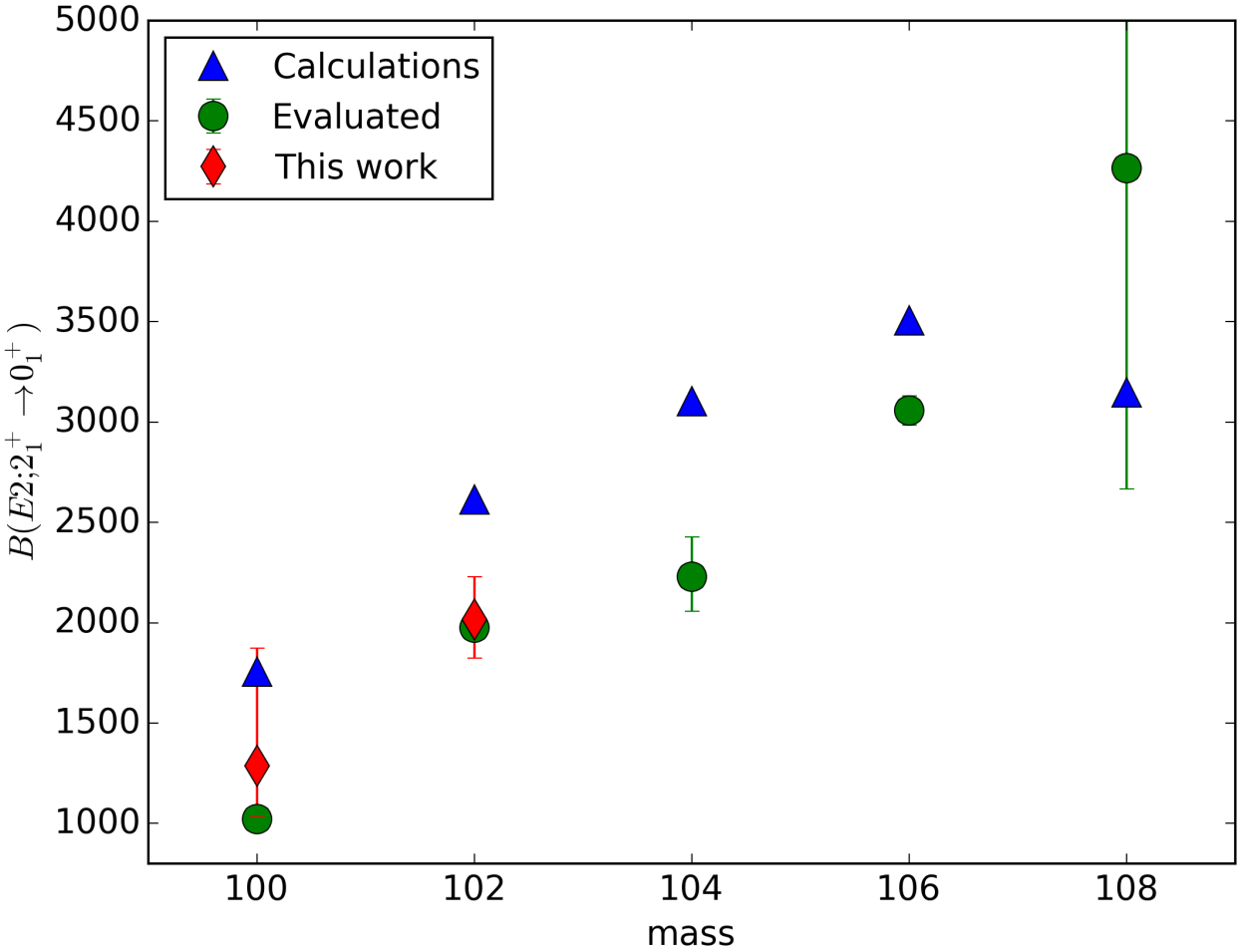
Systematics $B(E2; 2^+ \rightarrow 0^+)$

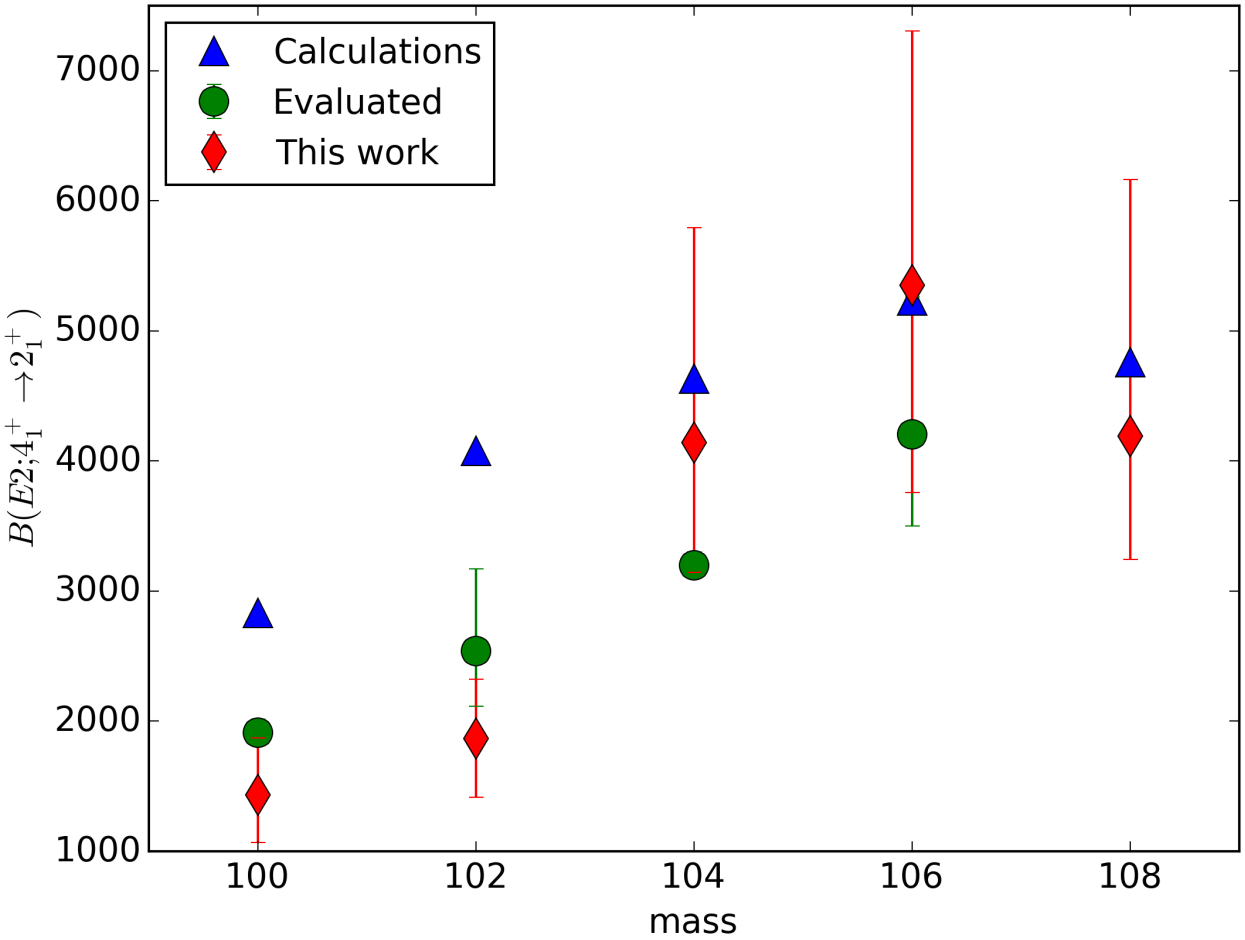
T. R. Rodríguez et al. PRC 81, 064323 (2010)



D. Ralet, submitted to PRC

Systematics $B(E2; 4^+ \rightarrow 2^+)$

T. R. Rodríguez et al. PRC 81, 064323 (2010)



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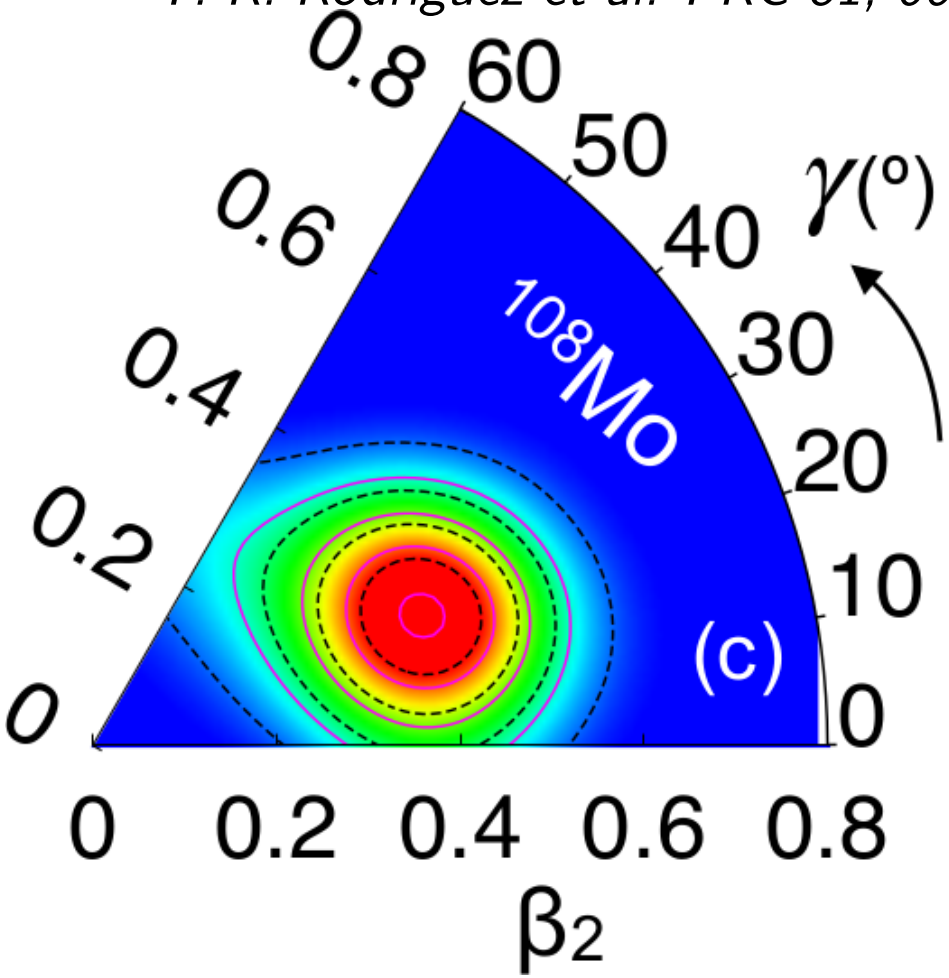
^{108}Mo potential energy surface

T. R. Rodríguez et al. PRC 81, 064323 (2010)



- Introduction
- Standard setup
- Specifities of the setup
- Selected experiments (techniques)
- Conclusion

Combining AGATA with high velocity fragments open great measurement opportunities

New tools and techniques have been tested and provided physics results

4 years after the first part of the AGATA@GSI campaign the first paper are being published

Thank to all the people that send me the material needed for this presentation:

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and the PreSPEC and AGATA collaborations