PRESPEC-AGATA at GSI

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GSI Darmstadt, Germany

presented at

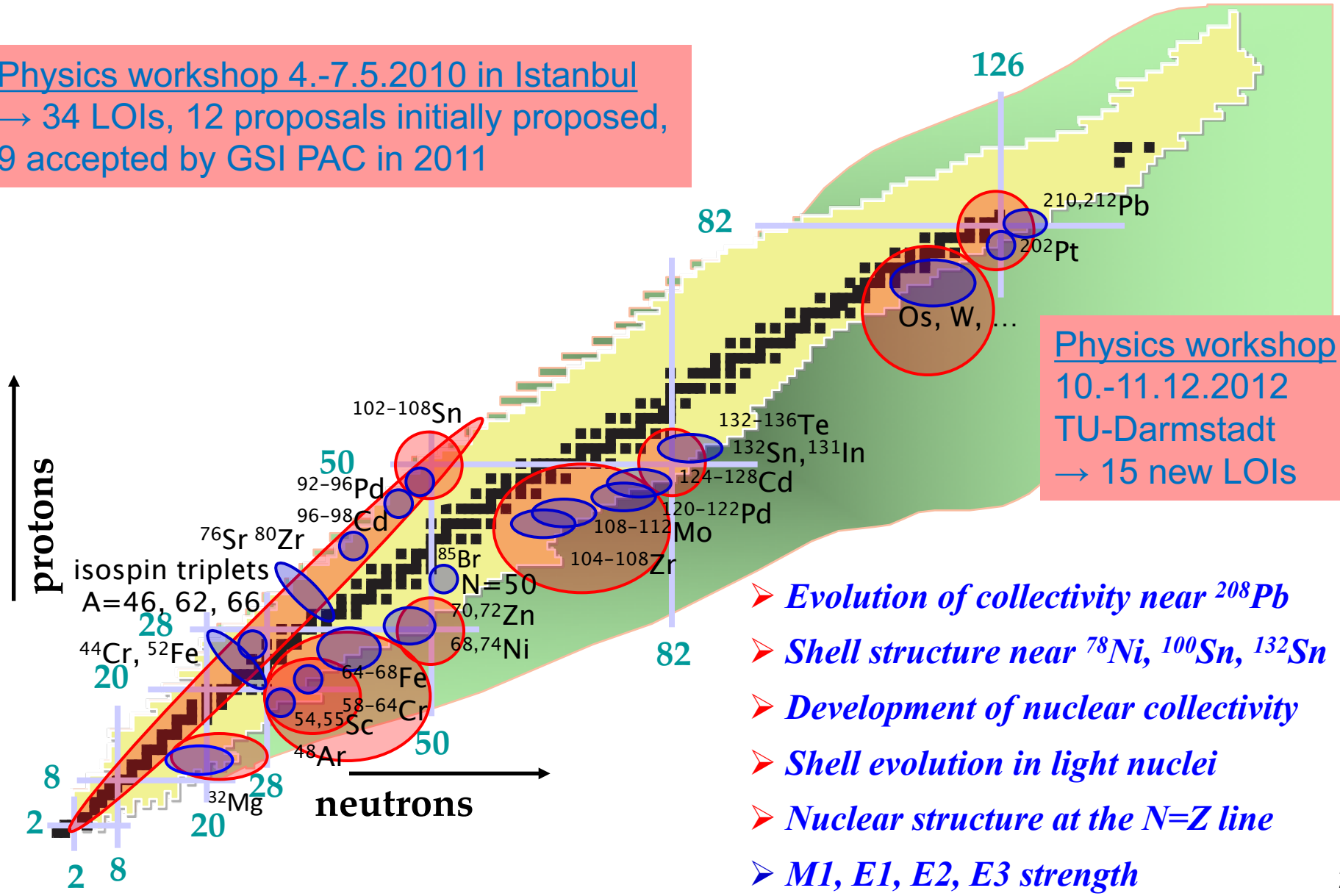
AGATA Week

September 13, 2017

Milano, Italy

PRESPEC-AGATA Physics Campaign 2012-2014

Physics workshop 4.-7.5.2010 in Istanbul
→ 34 LOIs, 12 proposals initially proposed,
9 accepted by GSI PAC in 2011



Physics workshop
10.-11.12.2012
TU-Darmstadt
→ 15 new LOIs

- ***Evolution of collectivity near ^{208}Pb***
- ***Shell structure near ^{78}Ni, ^{100}Sn, ^{132}Sn***
- ***Development of nuclear collectivity***
- ***Shell evolution in light nuclei***
- ***Nuclear structure at the N=Z line***
- ***M1, E1, E2, E3 strength***

Approved proposals and runs in 2012 and 2014

S424: **Korten/Gerl**

Performance commissioning (PRESPEC-AGATA)

S429: **Rudolph / Podolyák / Gerl**

Quadrantic evolution of collectivity around ^{208}Pb

S430: **Wieland / Gorská**

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

S426: **Pietralla / Rainovski / Gerl**

Relativistic *M*1-Coulomb excitation of ^{85}Br

S433: **Gadea / Gorská**

Coulomb excitation of the band-terminating 12^+ yrast trap in ^{52}Fe

S428: **Pietri**

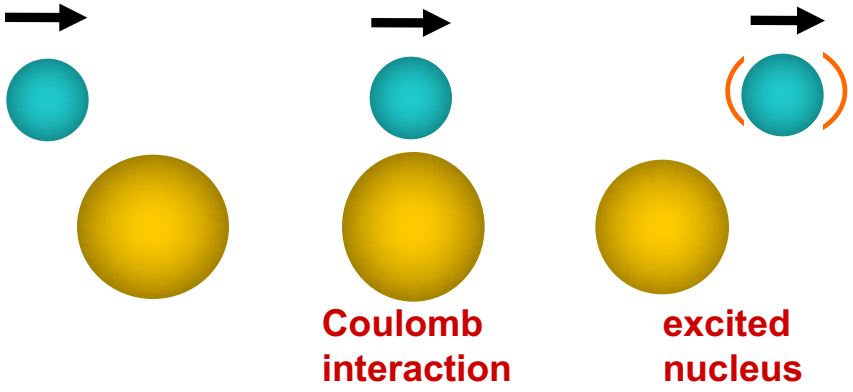
Shape evolution in neutron-rich Zr

S434: **Recchia / Bentley**

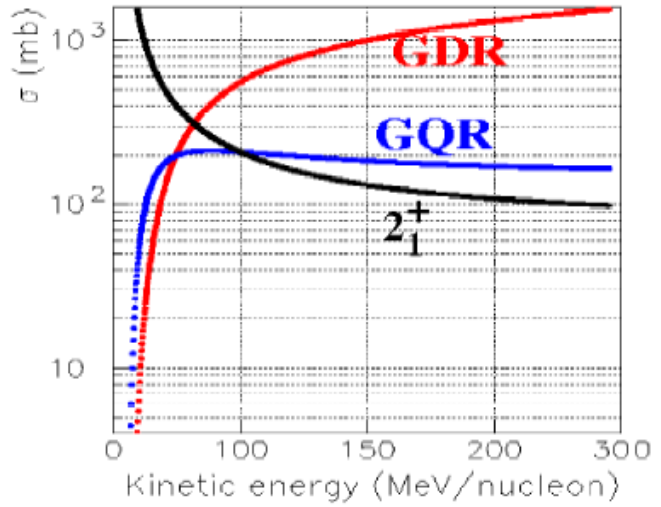
Transition rates and mirror energy differences in isobaric multiplets

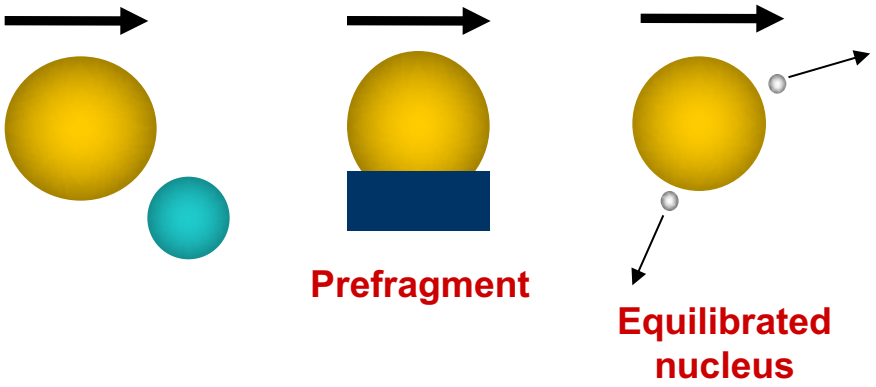
Campaign suffered from severe beam time cuts (imposed by BMBF) and unexpected beam intensity problems in 2014

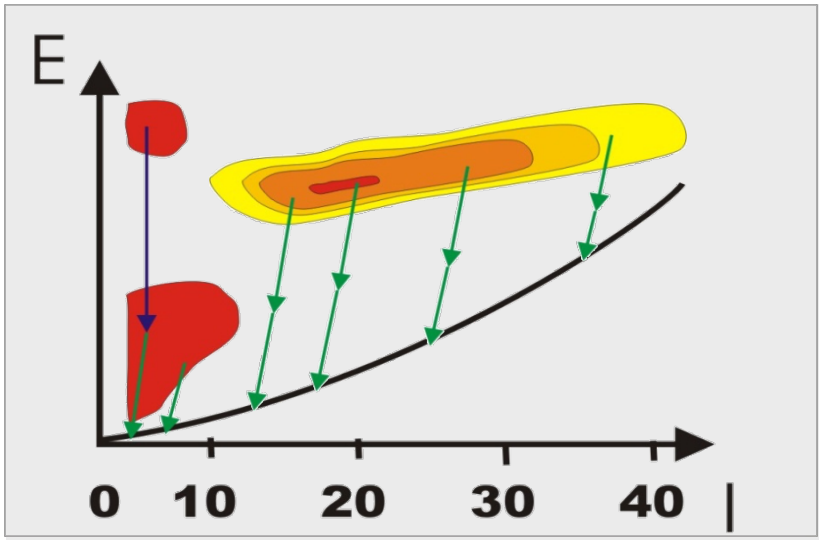
Relativistic Coulomb excitation / fragmentation



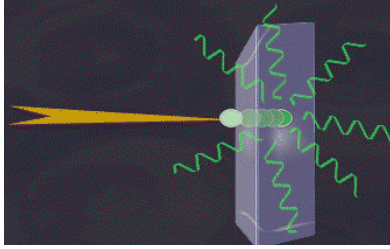
^{112}Sn →Au







Atomic Background Radiation
Bremsstrahlung



- Radiative electron capture (REC)
  capture of target electrons into bound states of the projectile:

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- Primary Bremsstrahlung (PB)
  capture of target electrons into continuum states of the projectile:

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- Secondary Bremsstrahlung (SB)
  Stopping of high energy electrons in the target:

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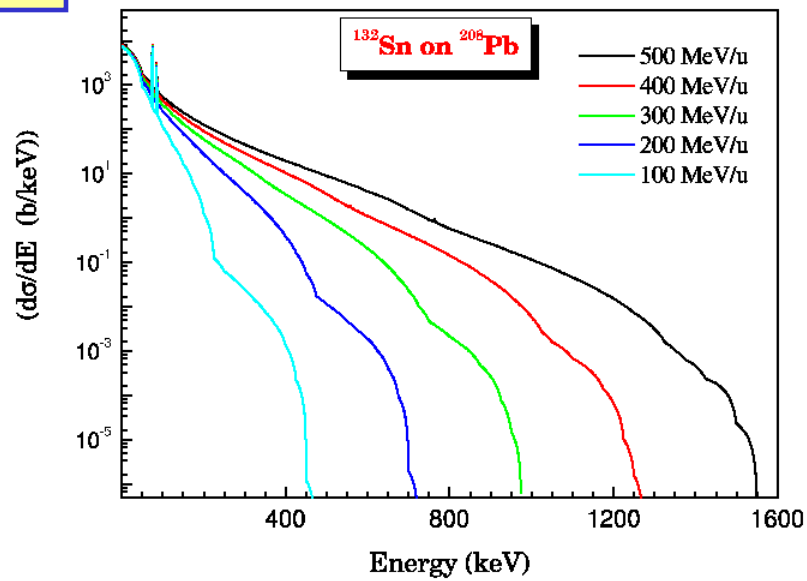
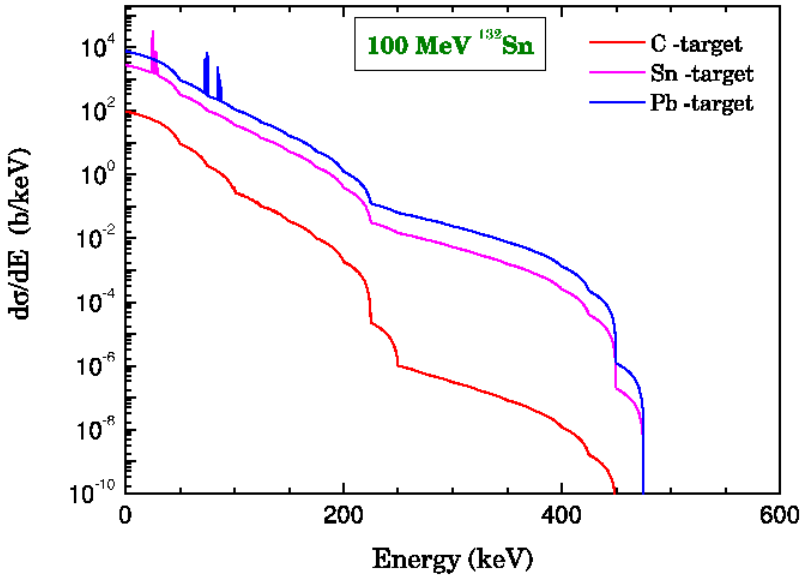
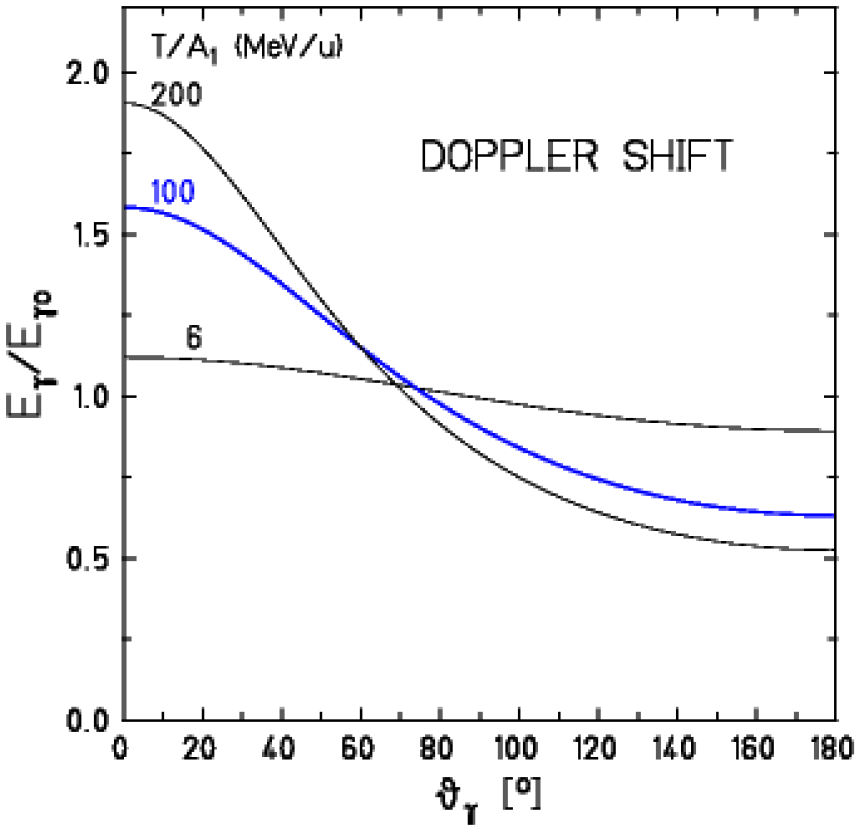




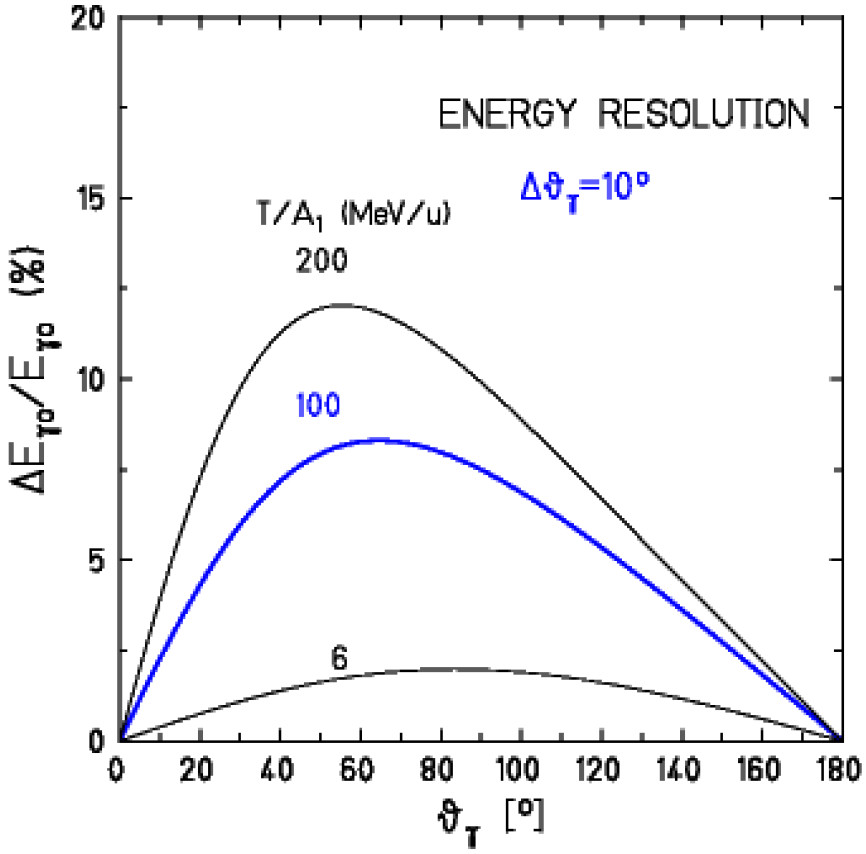
High granularity γ detector

Doppler Effect

Doppler shift



Doppler broadening



→ **position sensitive γ detector**

In-beam Spectroscopy

production

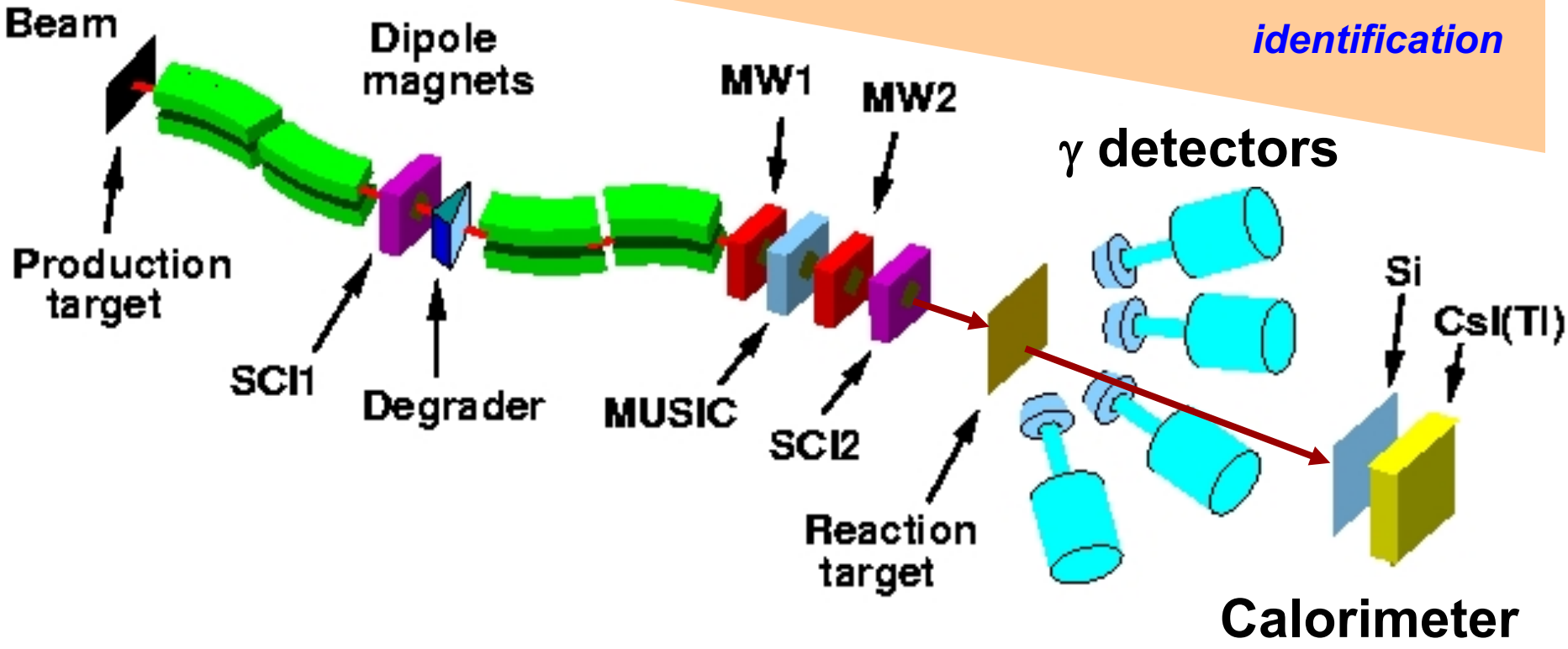
selection

identification

reaction

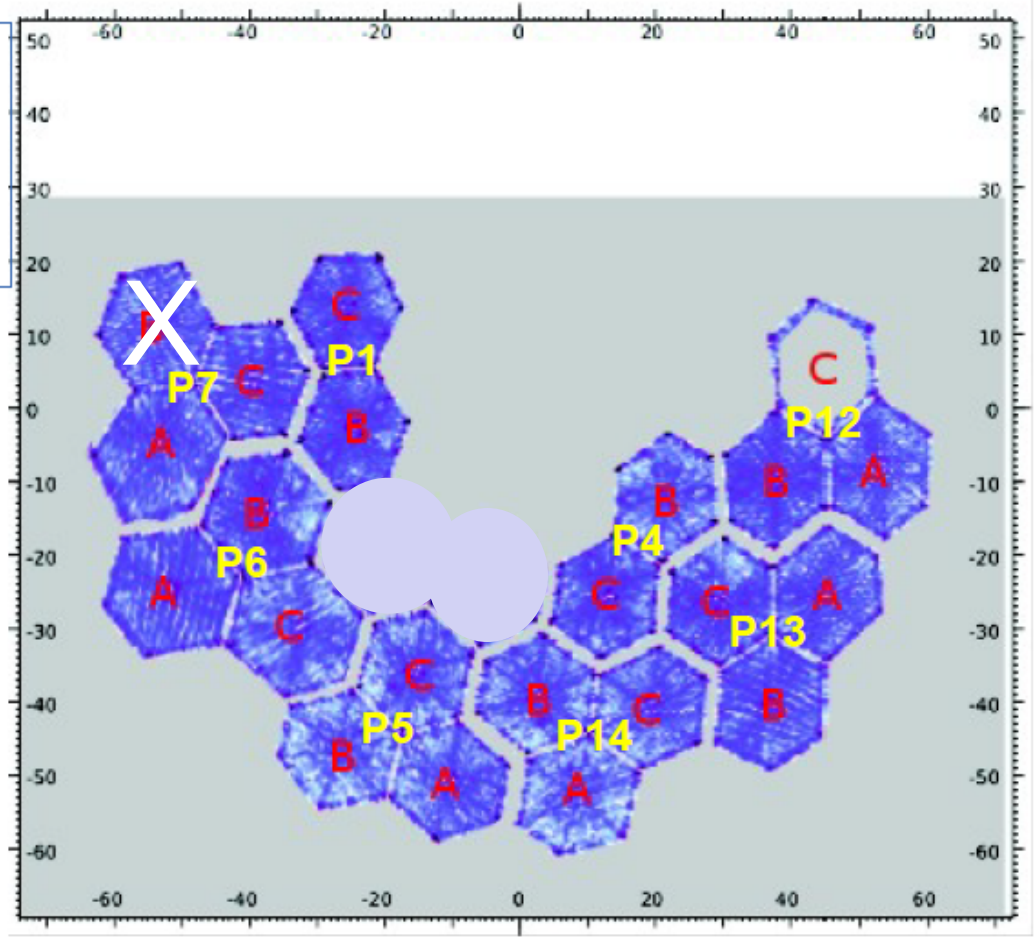
identification

spectroscopy



AGATA detector layout – Status 24-2-2014

Notes:
23 crystals
10 cry - beam R
12 cry - beam L



ADC01: B008, C006
ADC02: B012, C010
ADC03: B011, C008

ATC01: A008, B001, C003

ATC02: A003, B003, C005

ATC03: A002, B010, C001

ATC04: A007, B007, C007

ATC05: A004, B002, C004

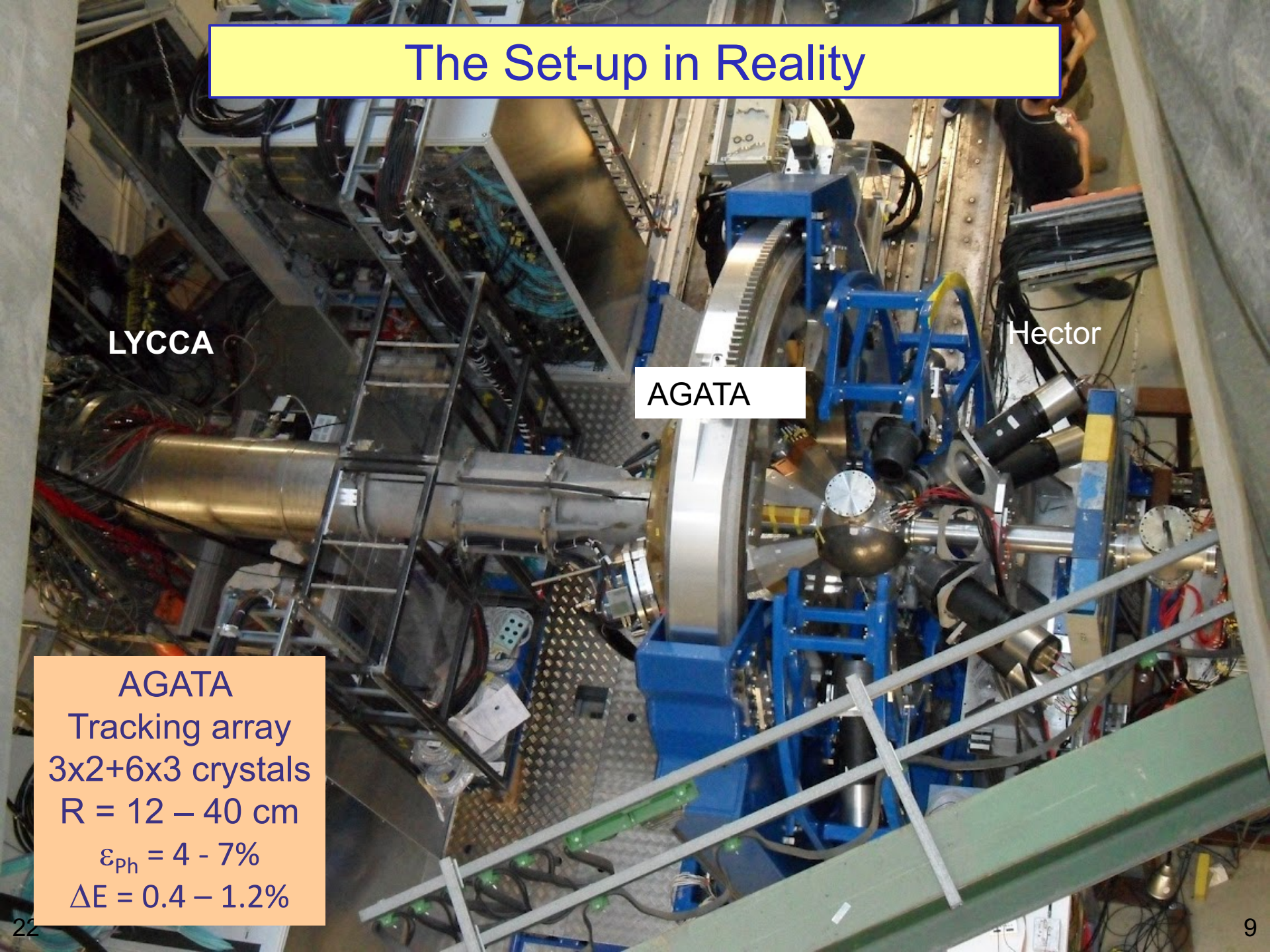
ATC06: A001, B004

P0 - ADC02
P1 - ADC03
P4 - ADC01

P12 – ATC06 (new mech. Adj.)
P13 – ATC03
P14 – ATC04 (new A007, B007, C007)

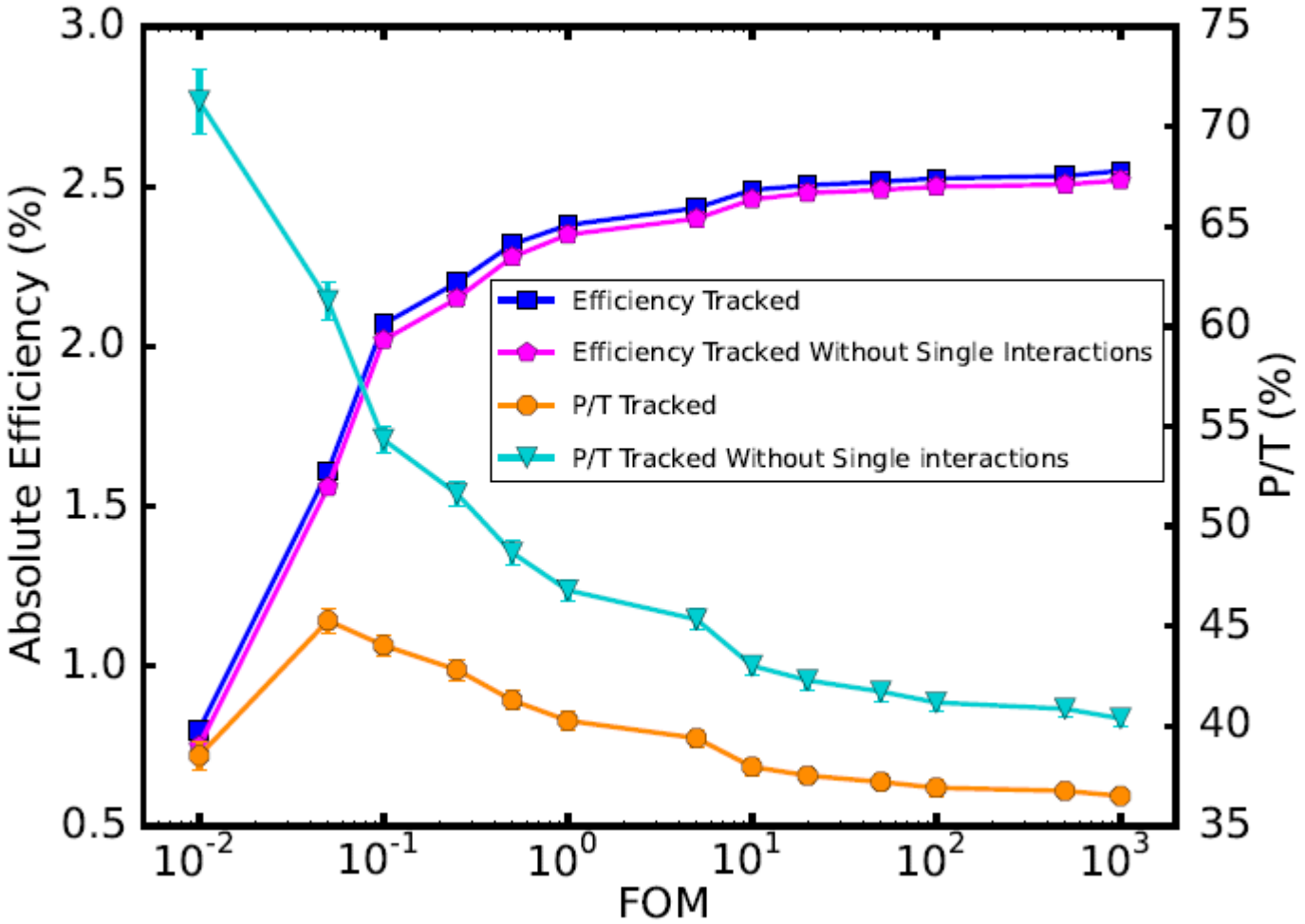
P5 – ATC05
P6 – ATC01 (new mech. Adj.)
P7 – ATC02

The Set-up in Reality



AGATA
Tracking array
3x2+6x3 crystals
R = 12 – 40 cm
ε_{Ph} = 4 - 7%
ΔE = 0.4 – 1.2%

AGATA Efficiency versus P/T

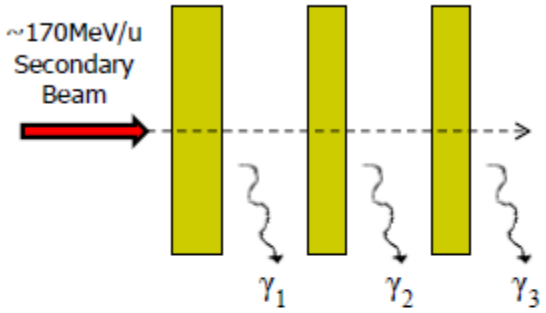


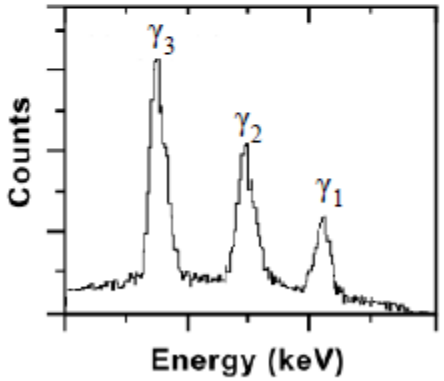
^{60}Co at nominal position

Natasa Lalovic et al. NIM A806 (2016) 258-266

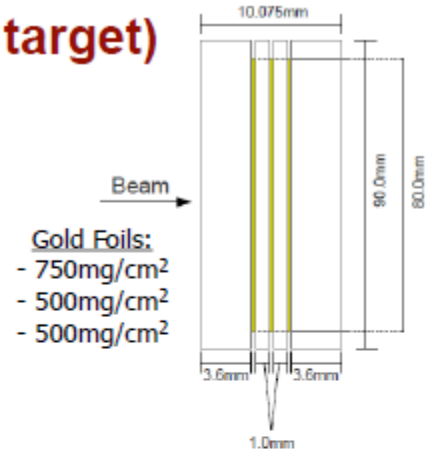
Triple DSAM at relativistic energies

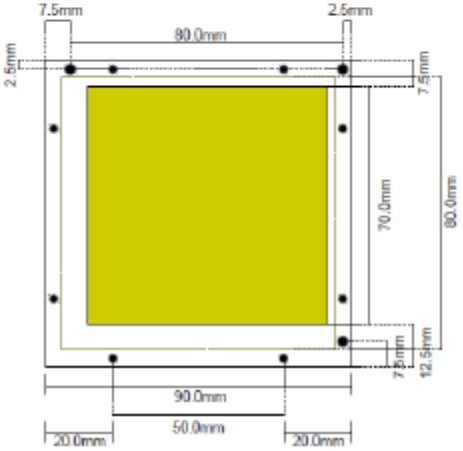
Triple Gold Foil (stretched target)



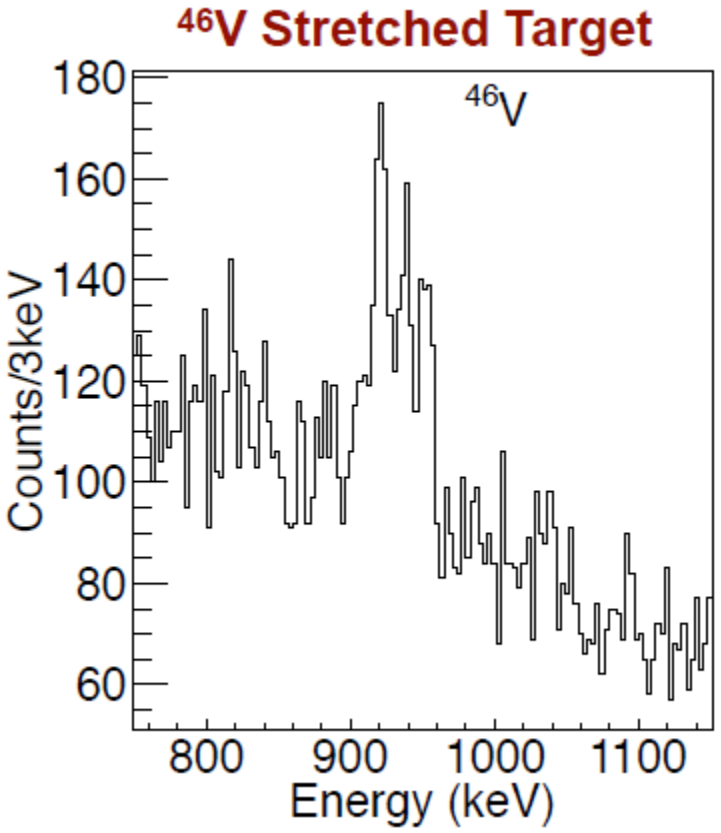


Doppler Shift: $E_{exp} = E_{cor} \frac{\sqrt{(1-\beta^2)}}{[1-\beta Cos(\theta_{dop})]}$





A=46 multiplet

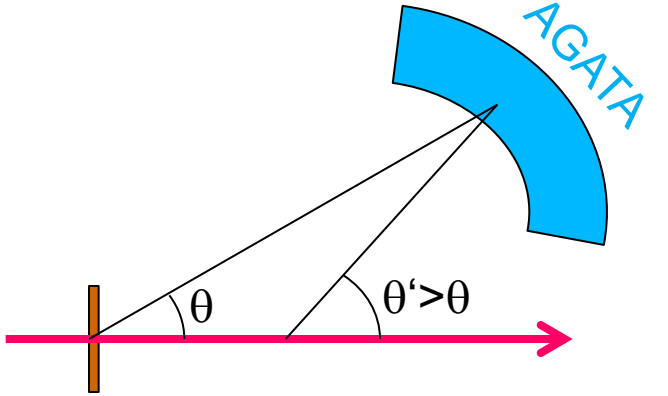


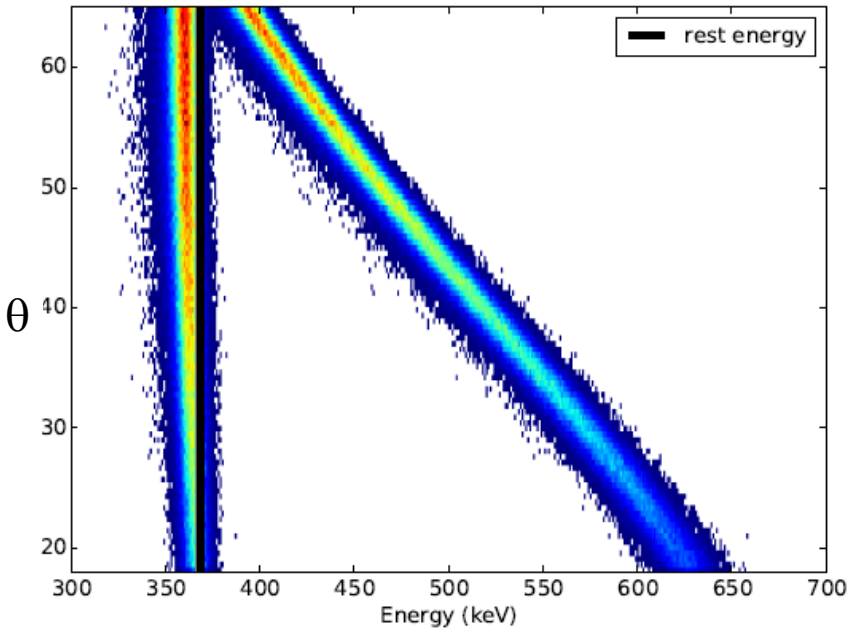
Only possible with ultra-high position resolution of AGATA

Alberto Boso, Mike Bentley et al.

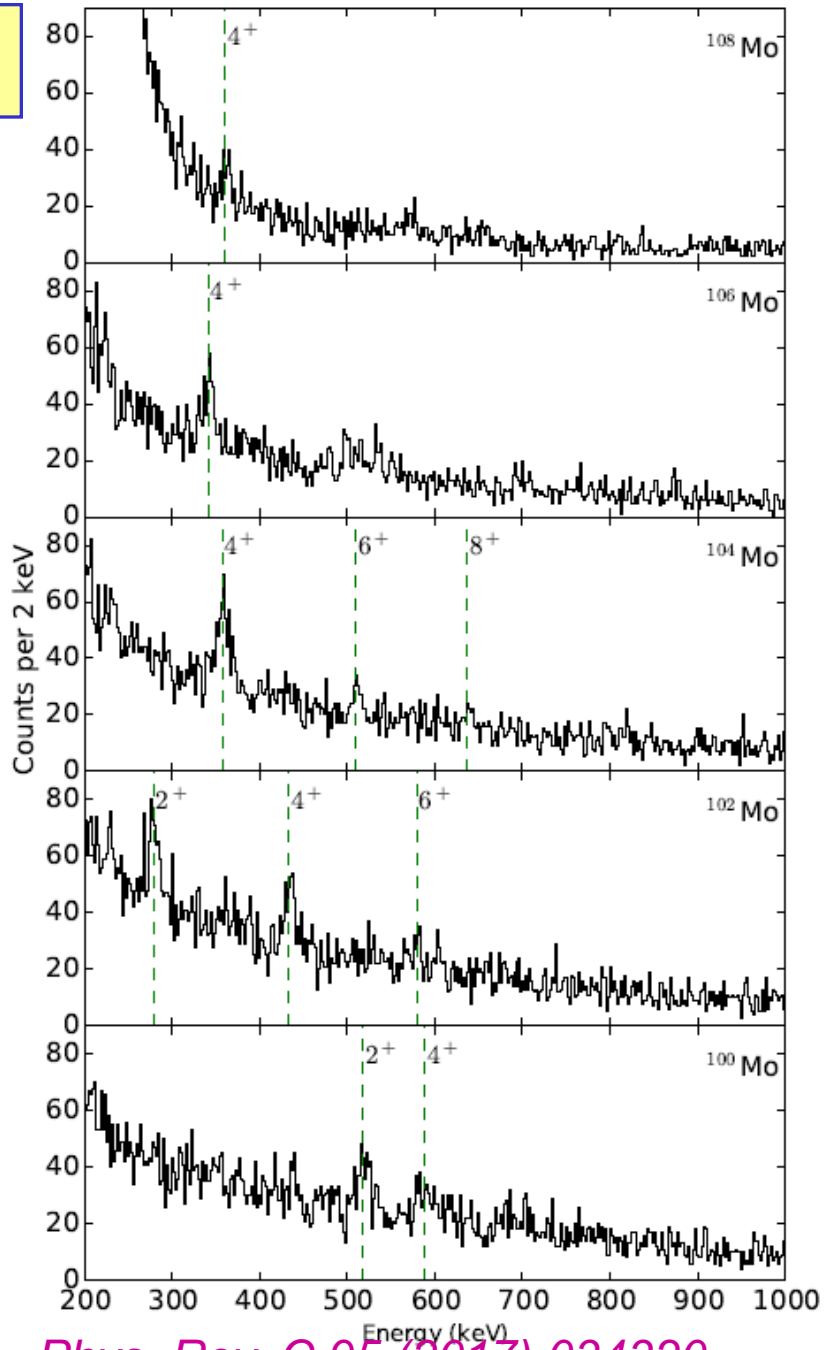
Lifetimes from decay position

Triaxiality in heavy Mo isotopes



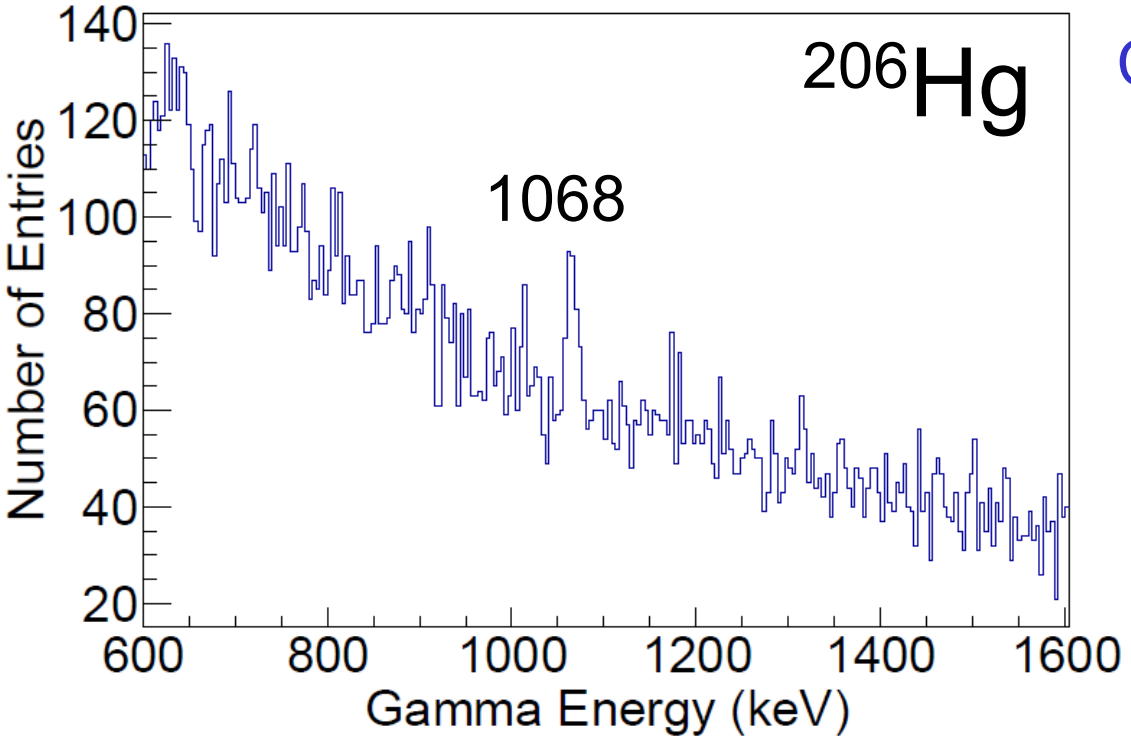


Only possible with relativistic beams



Damian Ralet et al., Phys. Rev. C 95 (2017) 034320

Relativistic Coulomb excitation



Collectivity around ^{208}Pb

Pt to Po;
A = 202...214

Referenz: ^{206}Pb

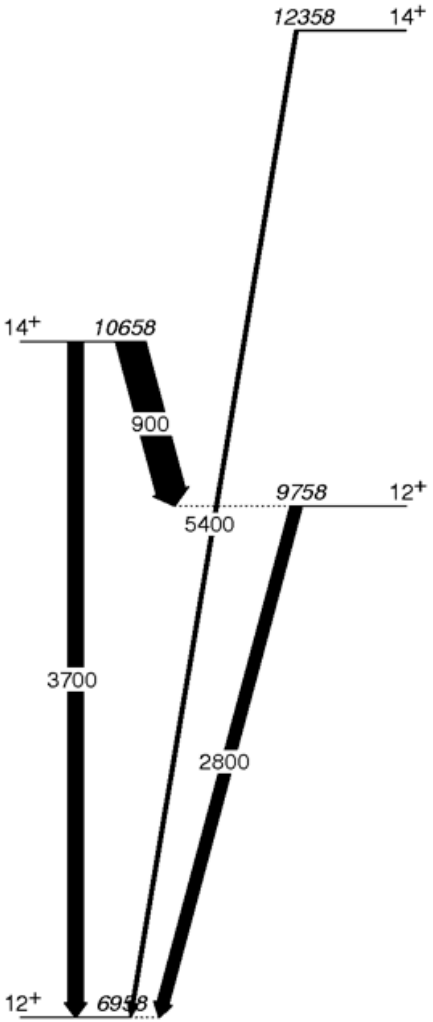
preliminary

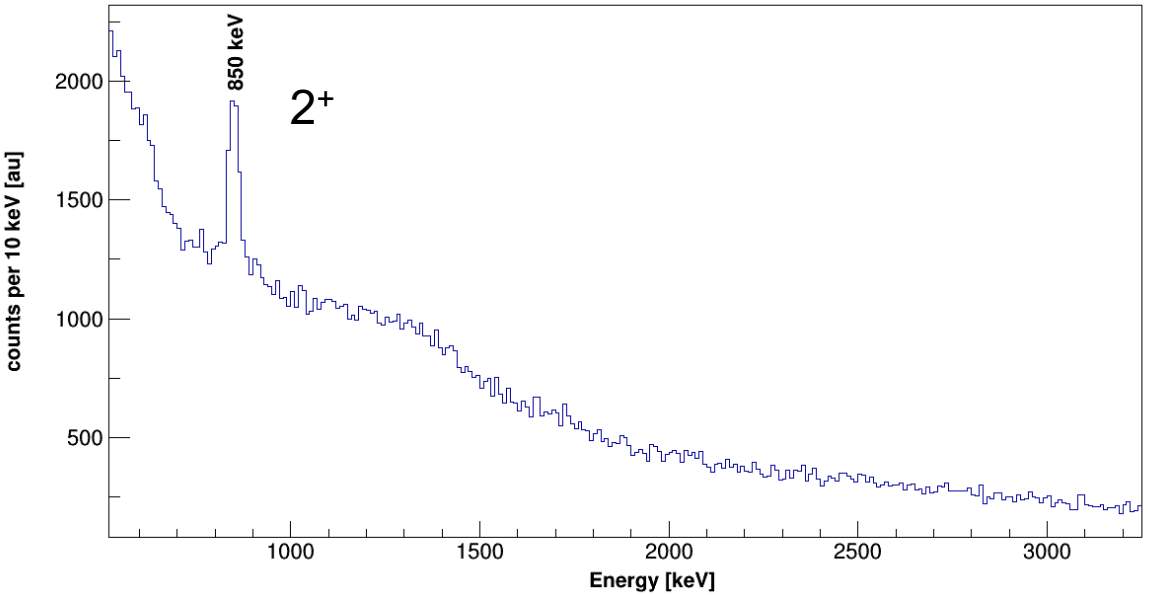
Fragment	Particles (millions)	Cross-Section (mb)	B(E2) (e^2b^2)
^{206}Pb	166	124	0.101 (3)
^{206}Hg	410	58	$0.05^{(4)}_{(2)}$

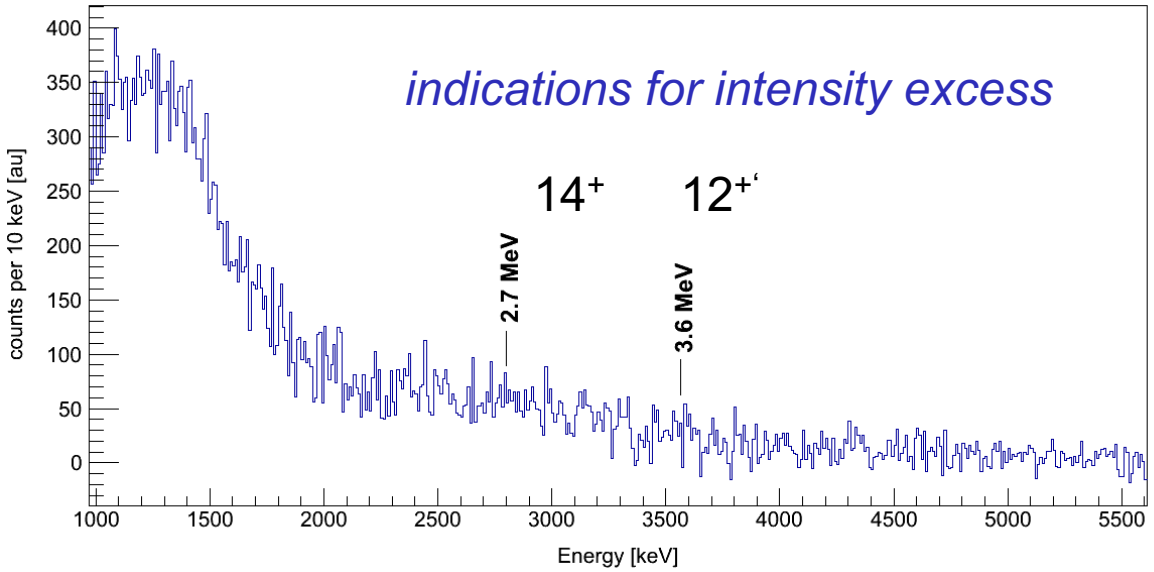
Shell model predicts: 0.18 e^2b^2

Tom Alexander

^{52}Fe Isomer Coulex







Tayfun Hüyük

Status proposals and runs of 2012 and 2014

S424: Korten/Gerl

Performance commissioning (PRESPEC-AGATA)

S429: Rudolph / Podolyák / Gerl

Quadrantic evolution of collectivity around ^{208}Pb

S430: Wieland / Gorská

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

S426: Pietralla / Rainovski / Gerl

Relativistic *M*1-Coulomb excitation of ^{85}Br

S433: Gadea / Gorská

Coulomb excitation of the band-terminating 12^+ yrast trap in ^{52}Fe

S428: Pietri

Shape evolution in neutron-rich Zr

S434: Recchia / Bentley

Transition rates and mirror energy differences in isobaric multiplets

	Analysis	Conferences	Publications
S424	●	●	●
S429	●	●	●
S430	●	●	●
S426	●	●	●
S433	●	●	●
S428	●	●	●
S434	●	●	●

Conclusions

- The PRESPEC-AGATA campaign at GSI in 2012-2014 could run only a limited experimental programme
- Data analysis is very complex and time consuming
- Novel experimental methods emerge from the combination of relativistic beams and AGATA
- Analysis is ongoing
- First physics results are popping up


Was a Great Collaboration