Status and perspectives of the GANIL Campaign

2016 ACC meeting - Venice

The GANIL Campaign

Neutron and charged particles detected in NEDA/DIAMANT

Charged particles detectors for Coulex and nucleon transfer

Separated and tagged by their decay in the VAMOS GFM

Recoils identification by the VAMOS magnetic spectrometer

Post-accelerated RIB from SPIRAL1

Fusion-evaporation

Multinucleon Transfer and fusion-fission

The physics case of AGATA@GANIL is the in-beam γ-ray spectroscopy of exotic nuclei populated by heavy-ions collisions at the Coulomb Barrier

The GANIL Campaign organization

The AGATA campaign at GANIL is approved between 2014 and 2019

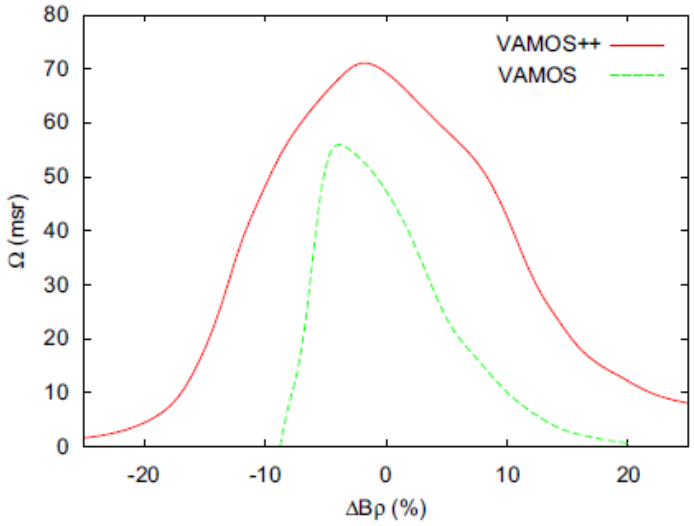
- The GANIL campaign is organized in different sub-campaigns associated to a main setup
- They are organized between the ACC, the GANIL management and the campaign manager (S. Lenzi from the University of Padova)

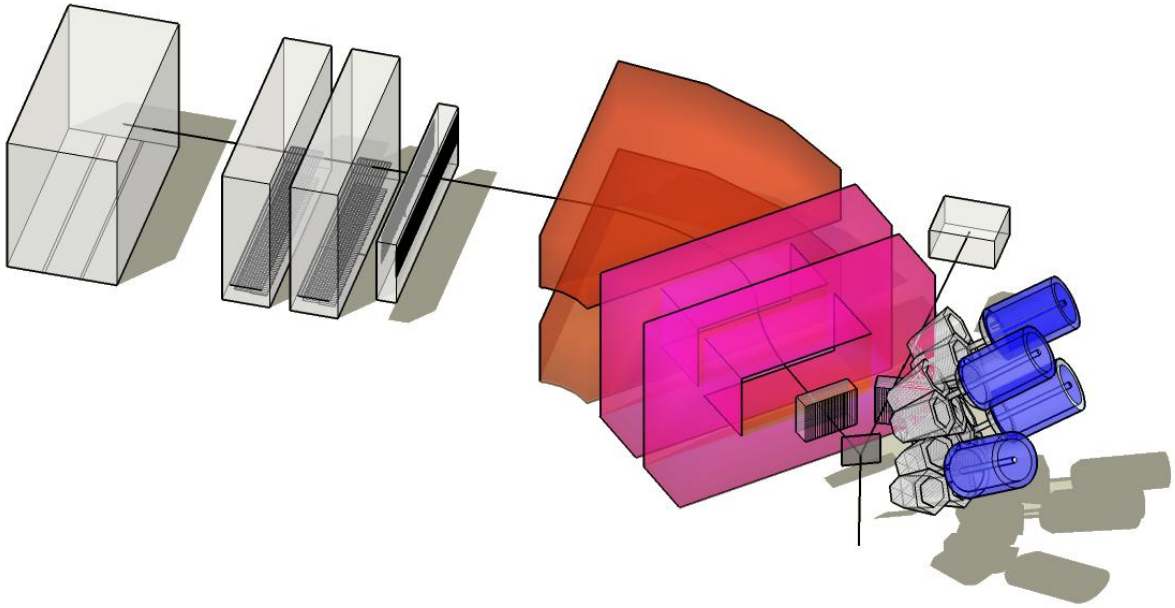
Each GANIL PAC has a "PrePac" workshop with a specific call : ***AGATA Collaboration Meeting***

- 1st PAC in 2014 : VAMOS (10 experiments approved)
- 2nd PAC in 2015 : VAMOS || NEDA (10 experiments approved)
- 3rd PAC in 2016 : NEDA (6 experiments approved)

Multinucleon Transfer fusion-fission 2014-2017

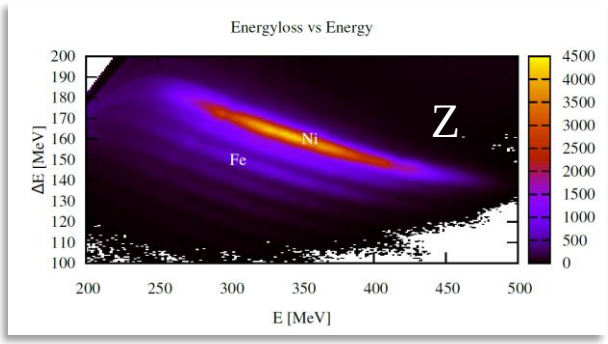
Recoils identification by the VAMOS++ magnetic spectrometer

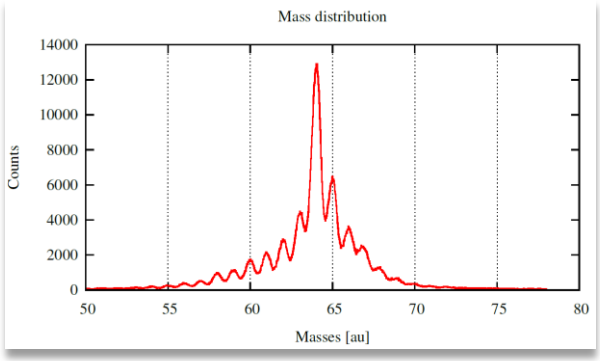


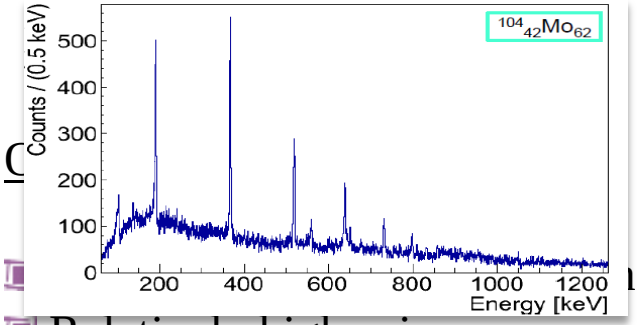


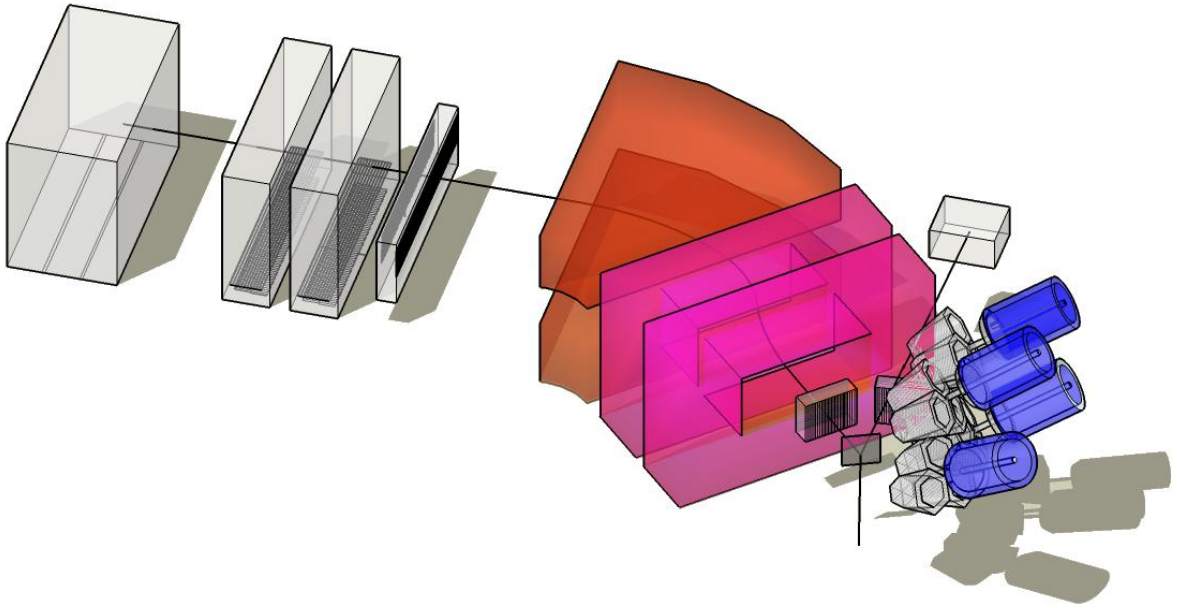
Full reconstruction over the whole acceptance
Mass resolution ~ 1/220
Z identification up to Z= 62

H. Savajols et al, NIM B 204 (2003) 146-153
S. Pullanhiotan, et al NIM A, 593(2008)
M. Rejmund et al, NIM A 646 (2011) 184–191
M. Vandebrouck et al, NIM A 812 (2016) 112–117

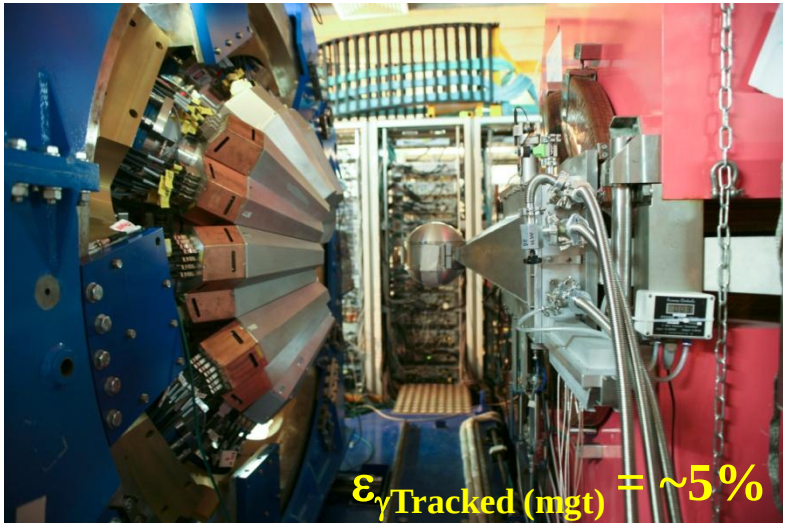


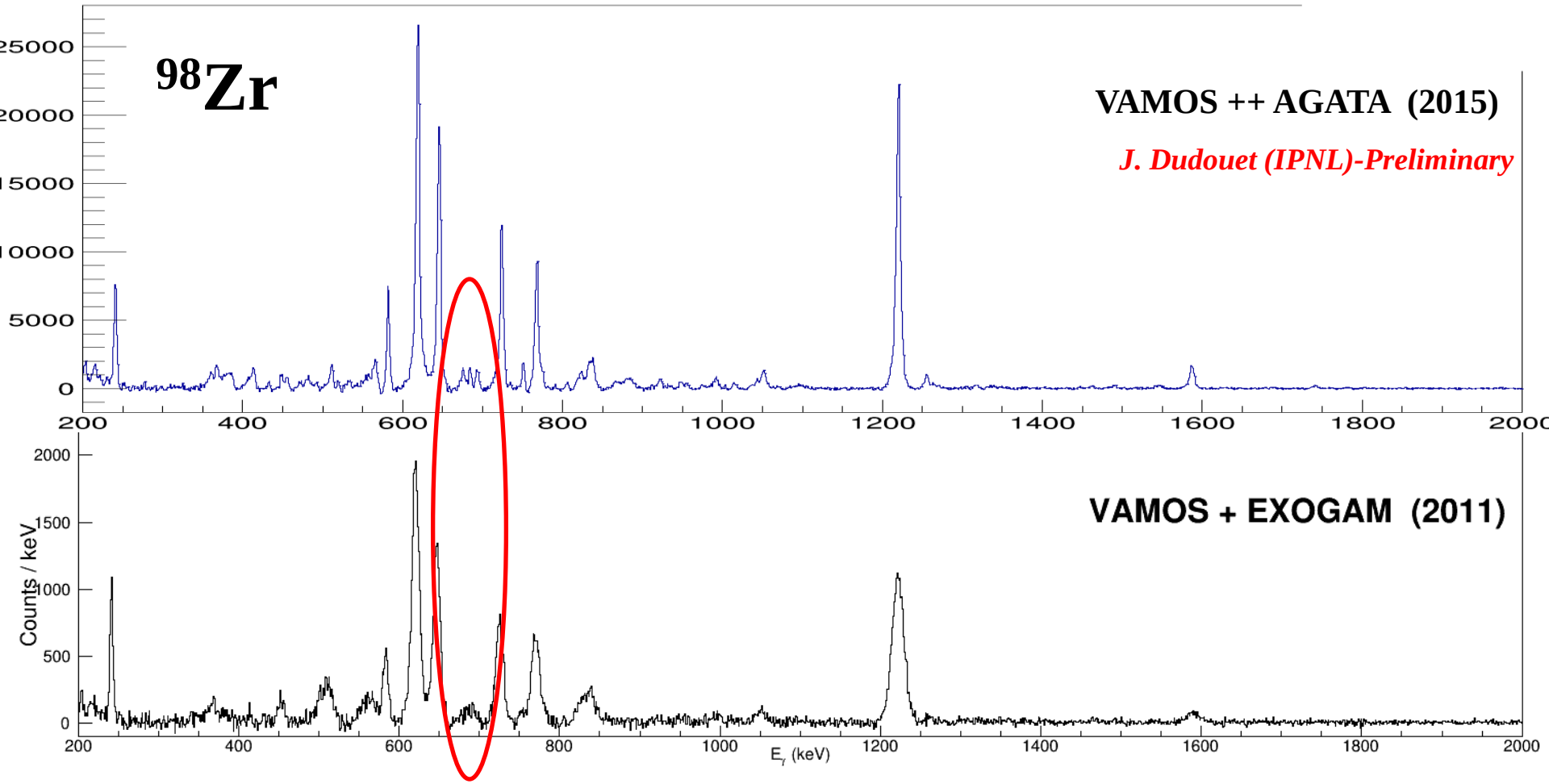






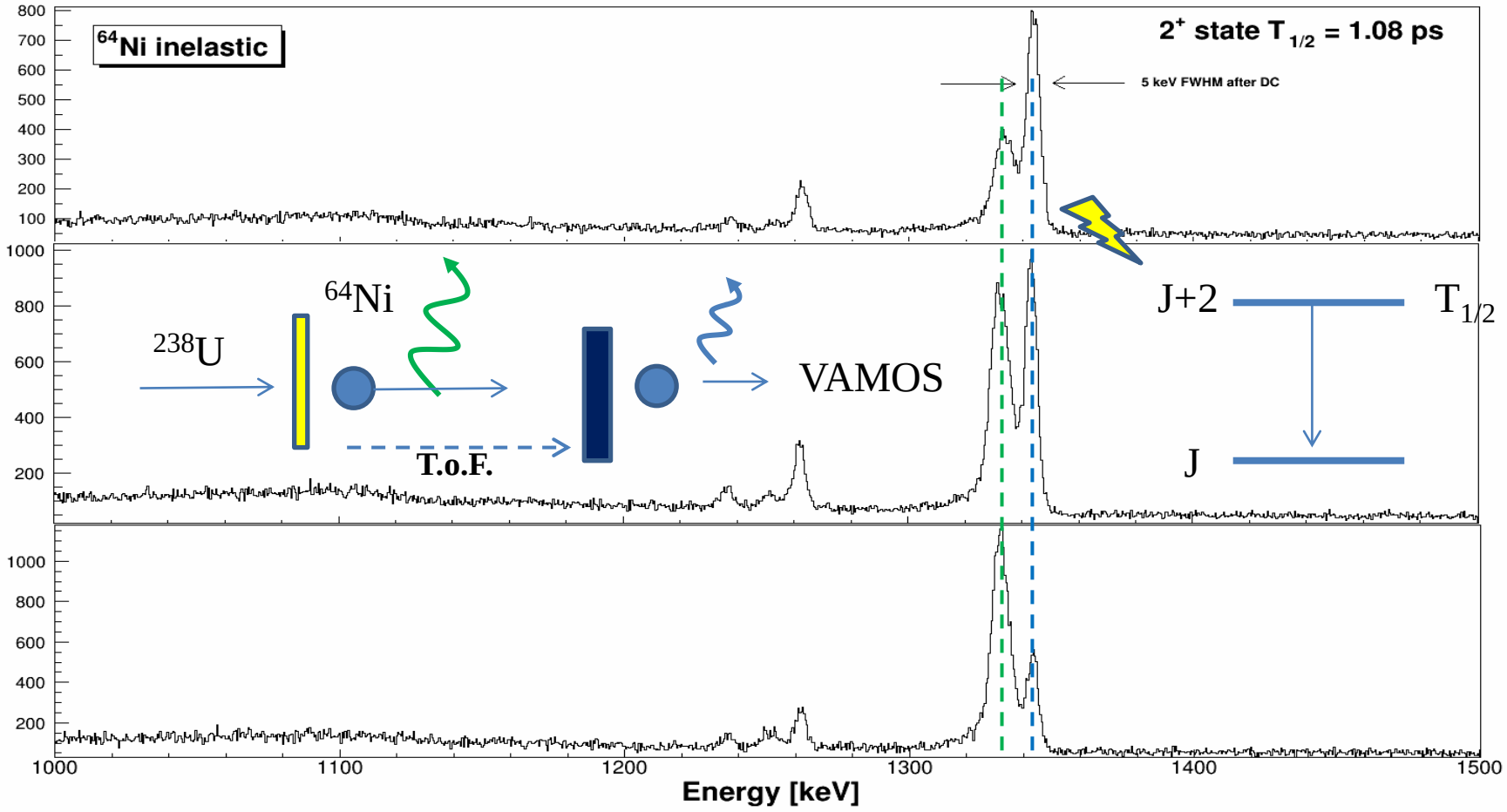
- C
- / MNT)
- Relatively high spins
- High Resolution
- Lifetimes measurements [fs to μs]




98Zr
VAMOS ++ AGATA (2015)
J. Dudouet (IPNL)-Preliminary
VAMOS + EXOGAM (2011)
Counts / keV
Eγ (keV)

Lifetime measurement at AGATA@GANIL

Not simulation , Real in-beam data



*To be completed by the FastTiming method with the use of LaBr3 and the continus 2D DSAM***

Physics cases of the 1st run AGATA at GANIL : Nuclear structure in the vicinity of doubly magic nuclei

2015 Run

- *p-n , n-n correlations in the vicinity ^{132}Sn;^{100}Sn, ^{68}Ni, ^{48}Ca*
- *Terra-incognita ^{208}Pb*
- *Tensor force and monopole migration around ^{78}Ni*
- *3 body forces*

G. Georgiev et al; 2^+ lifetimes and g factor $^{204,206,208}Hg$: 17th -29th July

C. Domingo-Pardo et al ; 4^+, 2^+ lifetime in ^{94}Ru and ^{96}Pd

^{208}Pb

J. J. Valiente Dobon et al 4^+, 2^+ lifetime in $^{106,108}Sn$

P. R. John et al ; Shape transition in W isotopes: ^{190}W and ^{192}W spectroscopy and fast timing

^{100}Sn

^{132}Sn

A. Navin et al ; $i_{13/2}$ single particle state in ^{133}Sn and high spin in ^{108}Zr

^{68}Ni

^{78}Ni

D. Verney et al; lifetime measurement in ^{83}Ge.

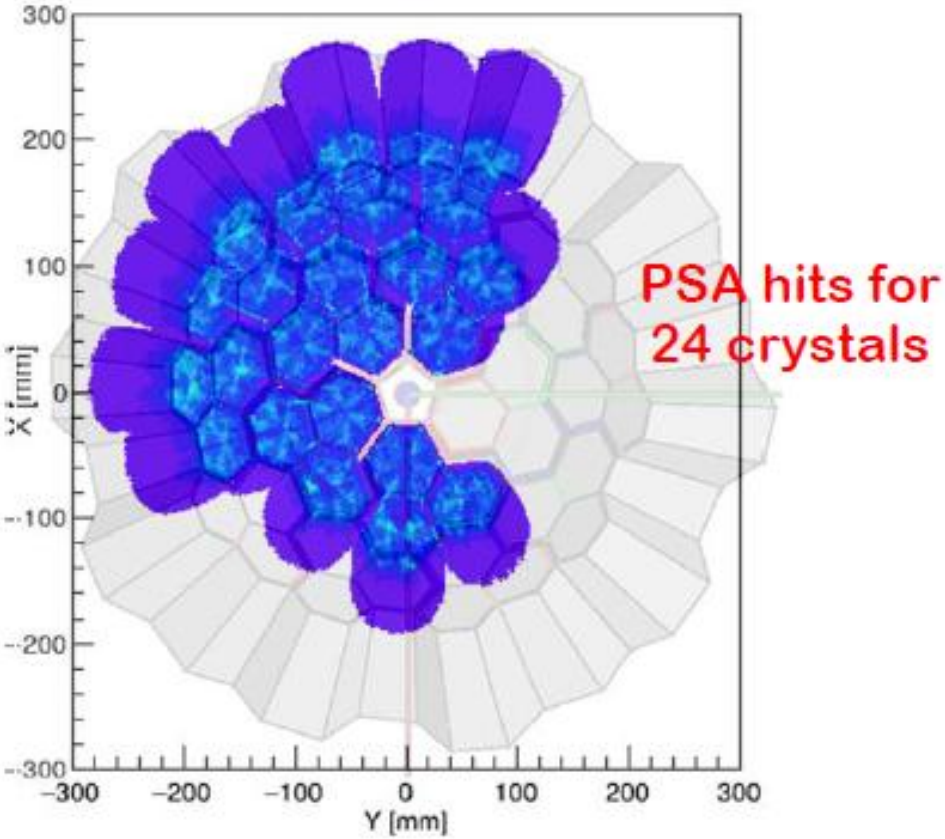
G. Duchêne et al; ^{80}Zn and ^{82}Ge highest spin structures

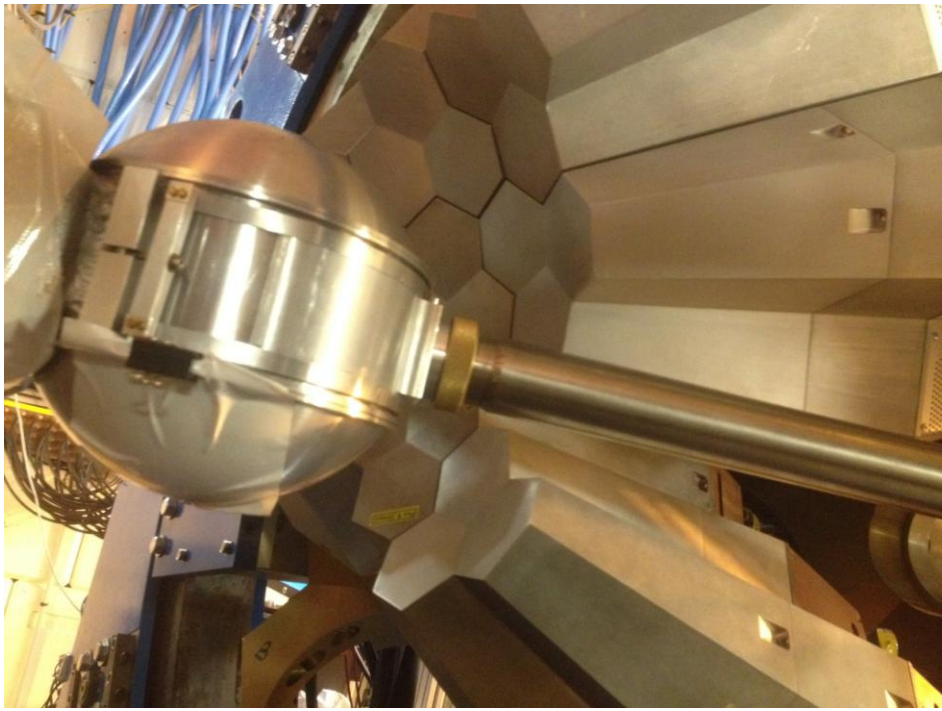
J. Ljungvall et al ; 2^+, 4^+ 6^+ lifetime and g-factor in $^{62,64,66}Fe$

^{48}Ca

A. Lemasson et al : spectroscopy of $^{39,41,43}S$

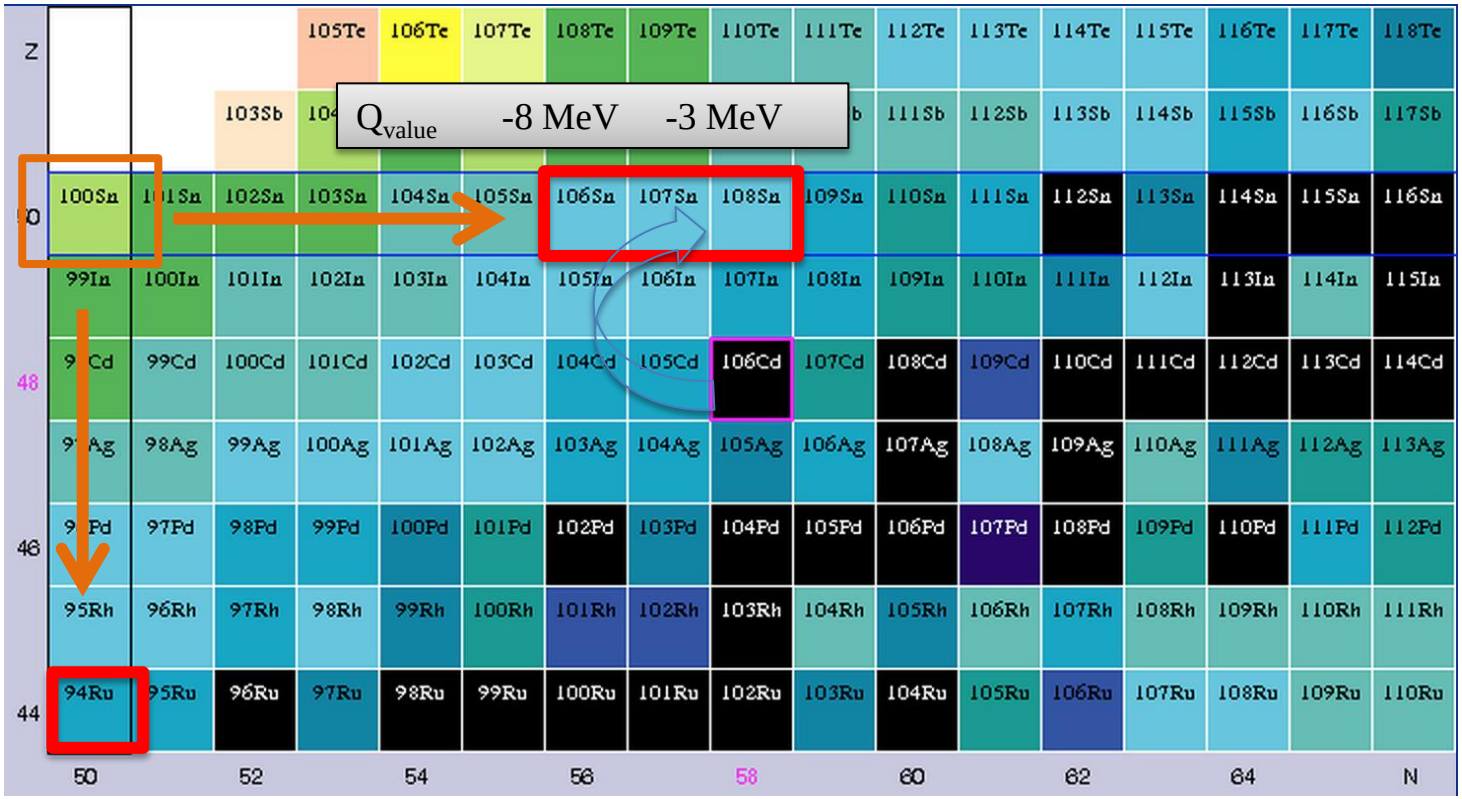
S. Leoni et al ; Lifetime in n-rich C and O isotopes: test of the three body forces





AGATA@GANIL – April 2015

Liftetime measurement in the ^{100}Sn region

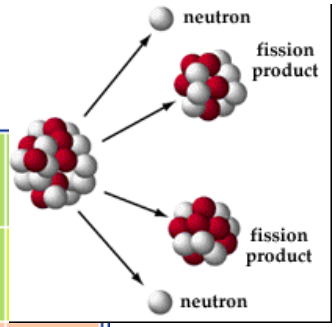


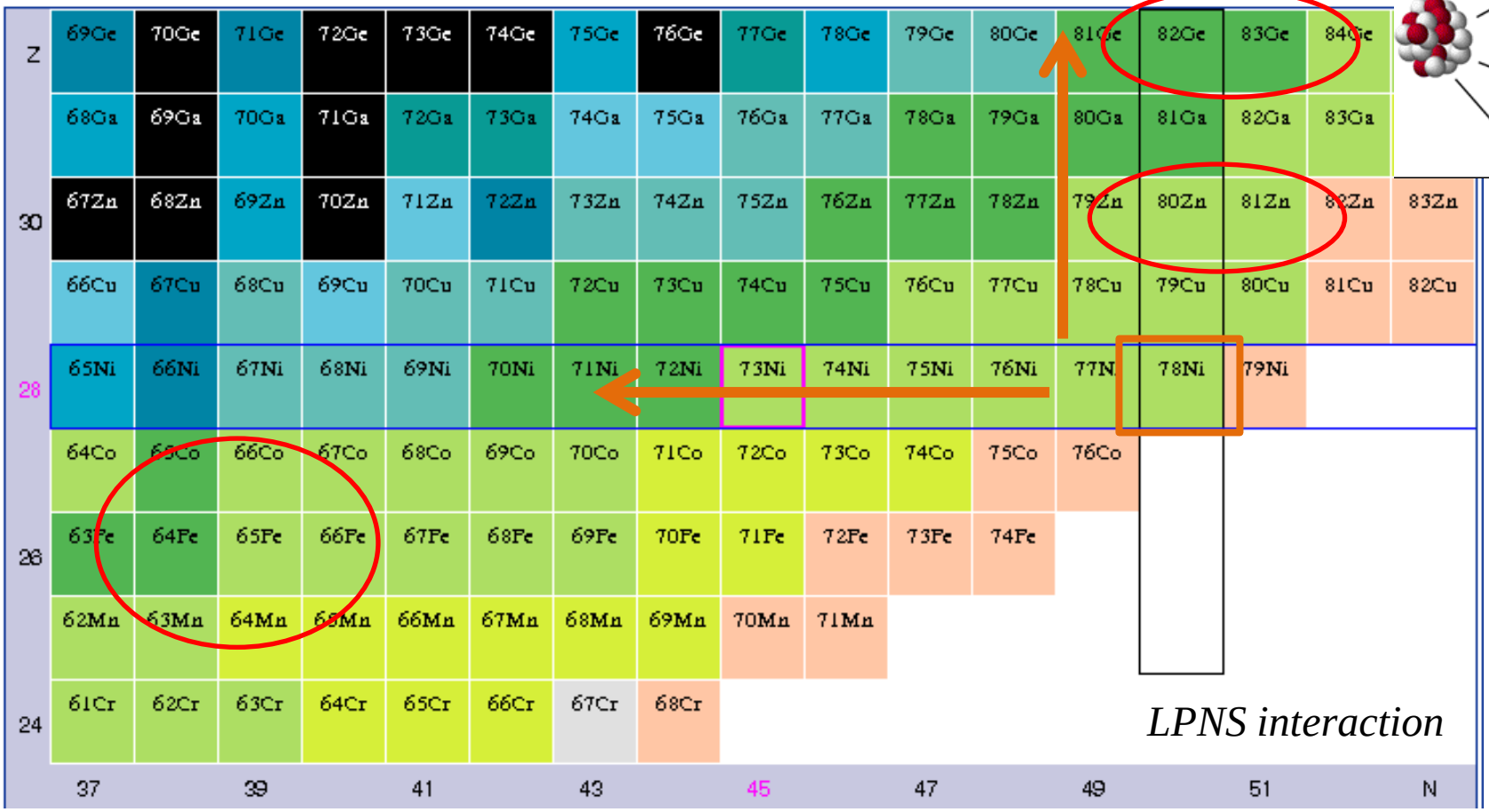
Multinucleon-transfer reactions in the neutron-deficient side to populate the Sn/Ru isotopes and measure the lifetimes of the 2^+ and 4^+ states

→ See R. Perez-Vidal's and M. Siciliano's presentations

^{208}Pb region : → See D. Ralet's talk

Spectroscopy in the $^{68\text{-}78}$Ni region





→ See J. Lungvall's and J. Dudouet's presentations

Physics cases for the 2nd run (2016-2017) : nuclear structure in the vicinity of doubly magic nuclei, N=Z nuclei, astrophysic and deformation

J. Nyberg et al. : Studies of excited states in ^{102,103}Sn to deduce two-body neutron interactions, single-particle energies and N=Z=50 core excitations

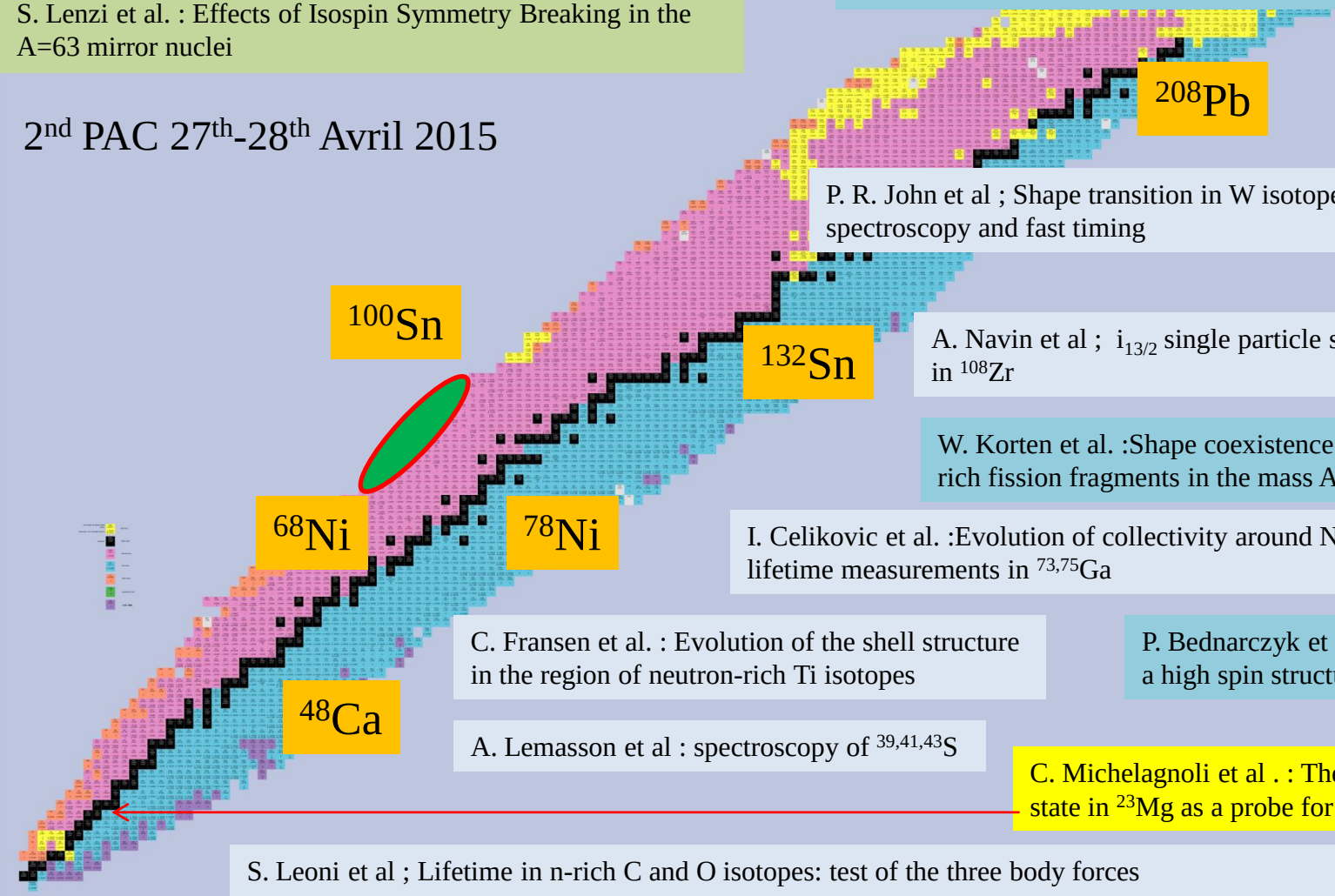
M. Doncel et al. :Production test for spectroscopy and lifetime measurements in the A=78 isobaric triplet using multi-nucleon transfer reactions

S. Lenzi et al. : Effects of Isospin Symmetry Breaking in the A=63 mirror nuclei

A. Jungclauss et al. :Exploration of alpha-cluster structures in heavy nuclei: The unique case of ^{212}Po (^{208}Pb + α)

P. Regan et al. : Understanding Nuclear Collectivity Approaching the π−ν Valence Maximum: Transition Quadrupole Moments in ^{166,168}Dy.

2nd PAC 27th-28th Avril 2015



P. R. John et al ; Shape transition in W isotopes: ^{190}W and ^{192}W spectroscopy and fast timing

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W. Korten et al. :Shape coexistence and triaxiality in neutron-rich fission fragments in the mass A=100-120

I. Celikovic et al. :Evolution of collectivity around N=40: lifetime measurements in ^{73,75}Ga

C. Fransen et al. : Evolution of the shell structure in the region of neutron-rich Ti isotopes

P. Bednarczyk et al. : Investigation of a high spin structure in ^{44}Ti

A. Lemasson et al : spectroscopy of ^{39,41,43}S

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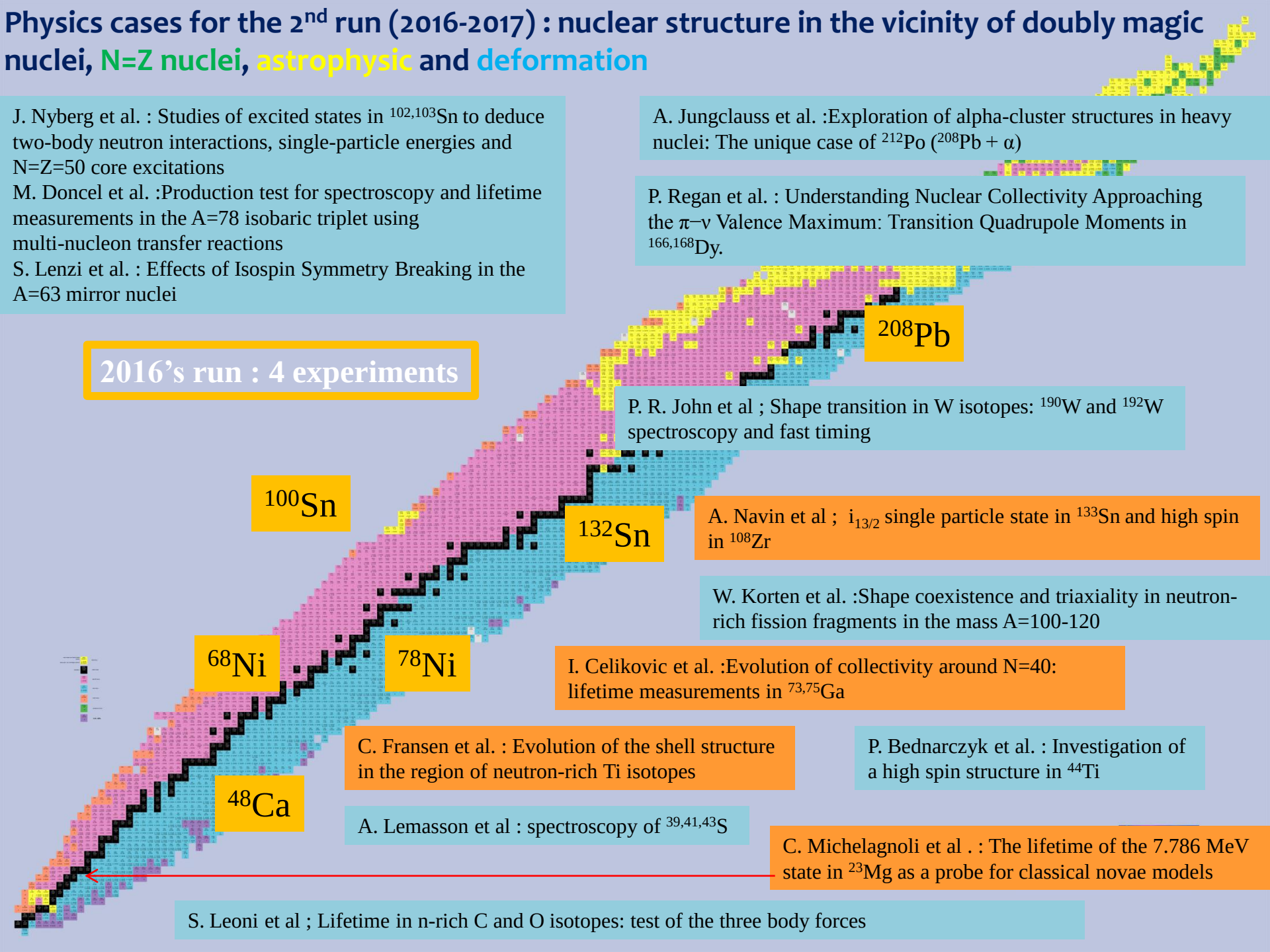

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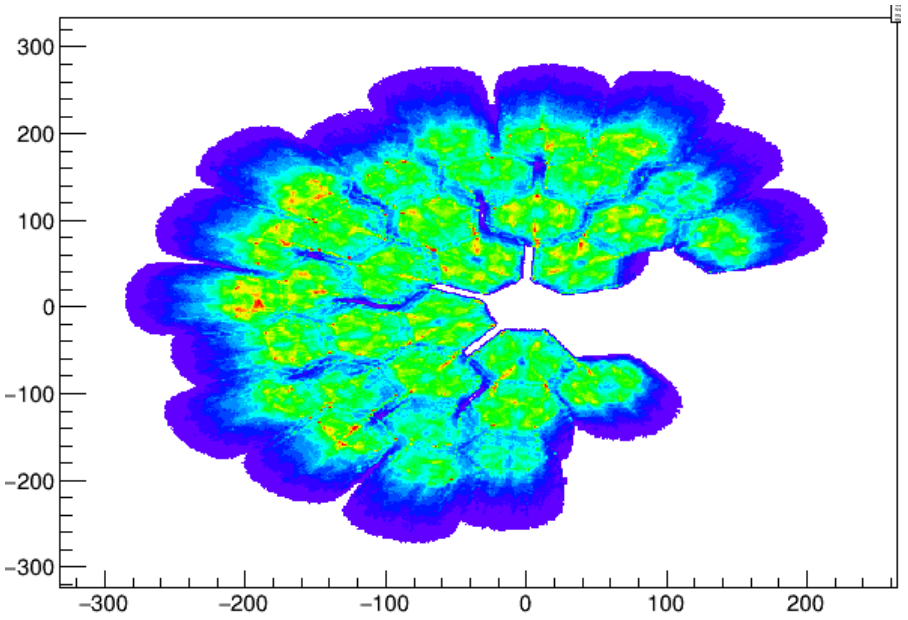
2016 run

- 10 Triple Clusters and 1 Double Cluster
(32 caps ε~5% after tracking @1.3 MeV nominal)
- 32 channels operational with phase1 (ATCA) and advanced phase 1 (GGP) electronic chains + 1 spear
(1184 hpGe Channels)
- DAQ infrastructure is running smoothly
(last experiment ~40T)

→ See A. Korichi's talk

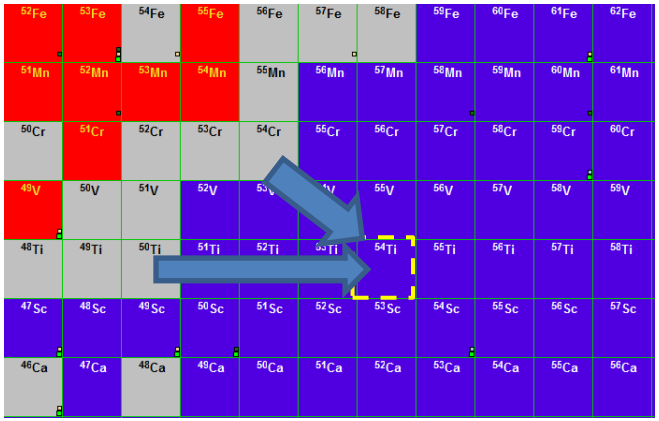


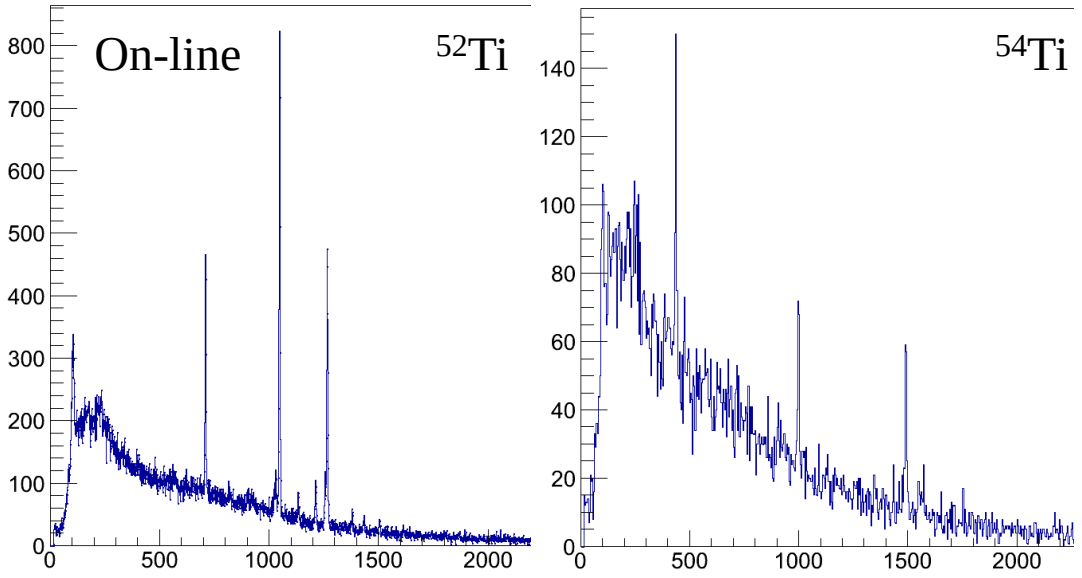
→ This is a great success of the AGATA collaboration

2016 run

C. Fransen et al. : Evolution of the shell structure in the region of neutron-rich Ti isotopes

- ✓ 29 capsules running (limited by the availability of FEBEE)
- ✓ Plunger target issues which has limited the beam intensity
- ✓ ^{50,52,54}Ti lifetime measurement





2016 run

I. Celikovic et al. :Evolution of collectivity around N=40: lifetime measurements in ^{73,75}Ga

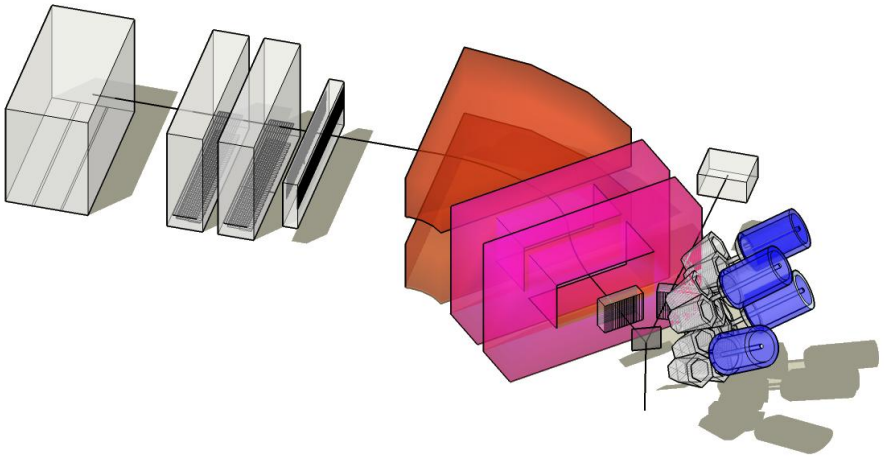
- ✓ 29 caps running (ATC7 out)
- ✓ ^{76}Ge, Plunger target issues which has limited the beam intensity
- ✓^{75}Ga lifetime measurement

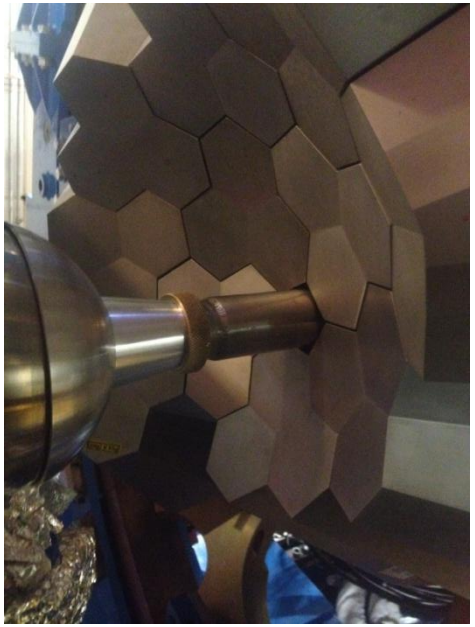
A. Navin et al ; $i_{13/2}$ single particle state in ^{133}Sn and high spin in ^{108}Zr

- ✓ 32 caps running
- ✓Some issues with the 2nd arm
- ✓Delayed gamma with EXOGAM at the focal plane
- ✓ Ran very smoothly and very promising on-line spectra

C. Michelagnoli et al . : The lifetime of the 7.786 MeV state in ^{23}Mg as a probe for classical novae models

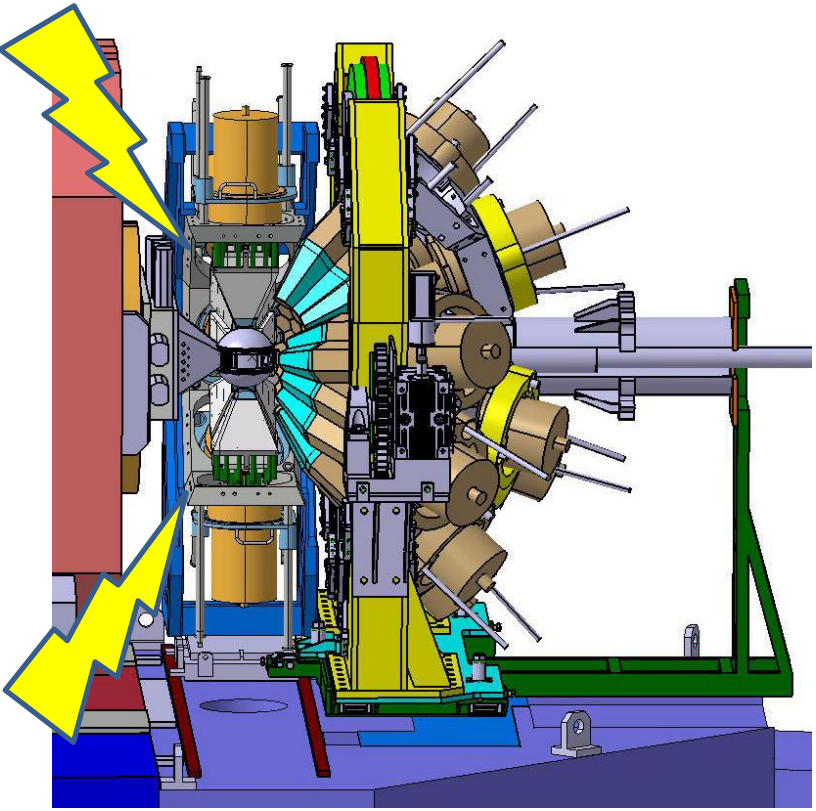
- ✓ 32 caps running
- ✓Additionnal DSSD in the chamber
- ✓DSAM



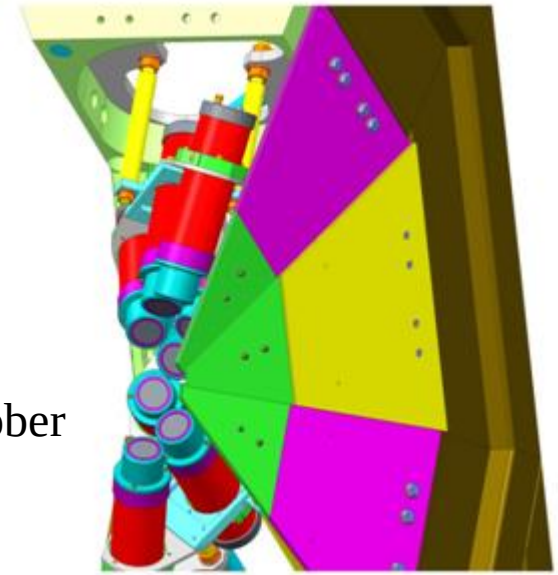


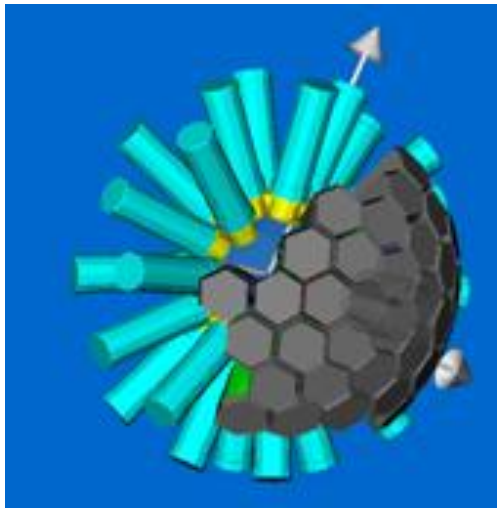
2017 run *LaBr3 campaign – VAMOS backlog*

FATIMA-PARIS detectors coupled to AGATA and VAMOS (4 experiments)



- ❑ Mechanical integration
- ❑ Electronic coupling
- ❑ Detailed simulations to evaluate the impact on AGATA performances'
- ❑ Magnetic shielding

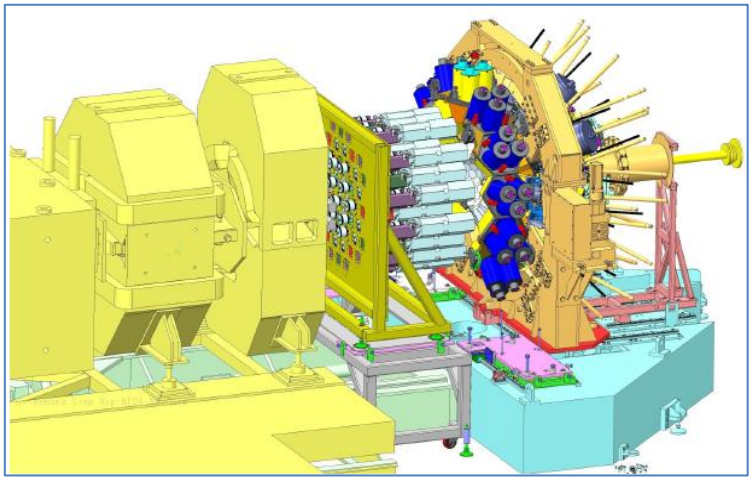


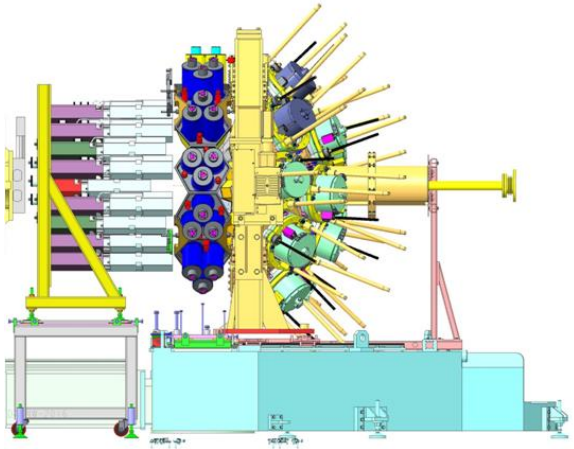


Starting the integration in the cave in October
Be ready for March 2017

2018 run *NEDA campaign*

8 experiments approved using AGATA+NEDA (+DIAMANT) (+LaBr3) (+plunger)



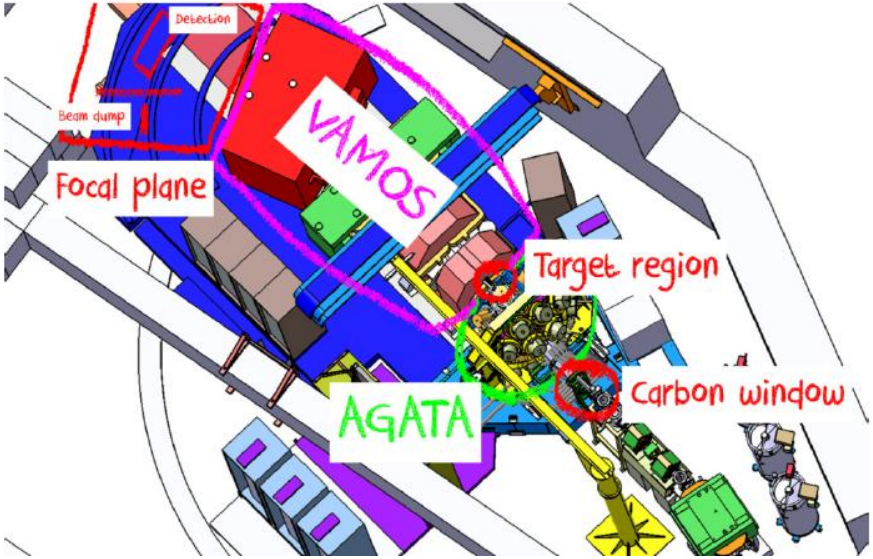


Design phase for the mechanical integration (STFC-IPNL-GANIL)
Electronic Development in progress
Detailed planning for the 2017 installation and 2018 to be clarified when GANIL schedule is clarified

- J. Nyberg et al. : Studies of excited states in ^{102,103}Sn to deduce two-body neutron interactions, single-particle energies and N=Z=50 core excitations
- S. Lenzi et al. : Effects of Isospin Symmetry Breaking in the A=63 mirror nuclei
- M. Bentley et al. : Prompt gamma/proton spectroscopy in ^{65}As – isospin symmetry at the limits of proton-binding
- B. Cederwall et al. : Search for isoscalar pairing in the N=Z nucleus ^{88}Ru
- B. Fornal et al. : Gamma decay from near-threshold states in ^{14}C: a probe of clusterization phenomena in open quantum systems
- E. Clément et al : Shell evolution of neutron-deficient Xe isotopes: Octupole and Quadrupole Correlations above ^{100}Sn
- A. Boso et al :Isospin Symmetry Breaking and Shape Coexistence in Mirror Nuclei ^{71}Kr-^{71}Br
- M. Palacz et al : Purity of the $g_{9/2}$ configuration based on lifetime measurements and energies of excited states in ^{94}Pd

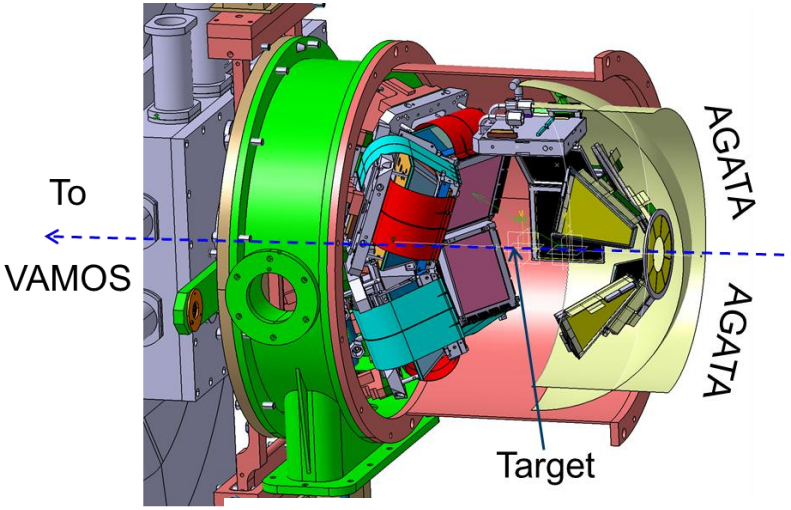
2019-20XX run *MUGAST-GFM*

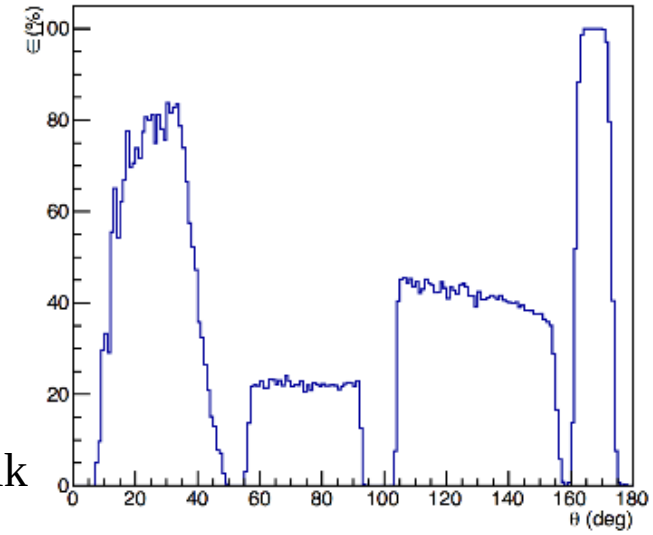
VAMOS in GFM for prompt spectroscopy of Heavy Elements



→ Ch. Theisen's talk

Nucleons transfer spectroscopy using SPIRAL1 ISOL beams





→ F. Flavigny's talk

✓The AGATA collaboration is operating 32 capsules in the array at GANIL

✓The second AGATA run at GANIL is almost completed

✓The physics program is rich, ambitious and broad

✓The AGATA campaign will keep us busy until 2019 (at least)

✓2017 : LaBr3 campaign
✓2018 : AGATA-NEDA campaign