AGATA
ADVANCED GAMMA
TRACKING ARRAY

AGATA Campaign at GANIL Scientific Programme

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Unique physics opportunities with AGATA@GANIL setup

GANIL:
High intensity stable beams (C to U)
Possibility to perform reactions in inverse kinematics
Exotic beams from SPIRAL1 (since late 2016)

AGATA:
High efficiency and position resolution

VAMOS:
Large acceptance due to the new focal plane detectors.
Improved DAQ readout, higher counting rate capabilities.
High transmission.
Different modes of operation.

Many complementary devices available or under development

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AGATA at GANIL : Complementary devices

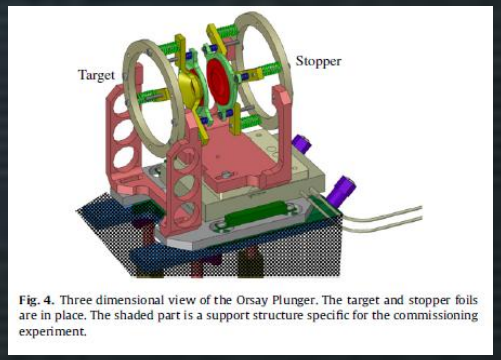
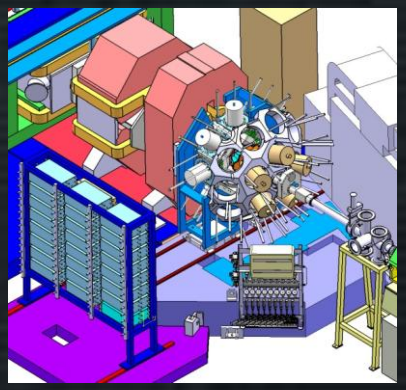
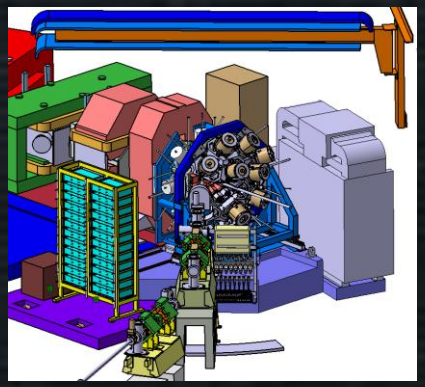


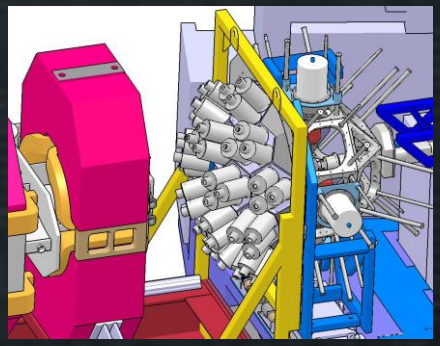
Fig. 4. Three dimensional view of the Orsay Plunger. The target and stopper foils are in place. The shaded part is a support structure specific for the commissioning experiment.

At 0° as separator (vacuum/gas-filled)

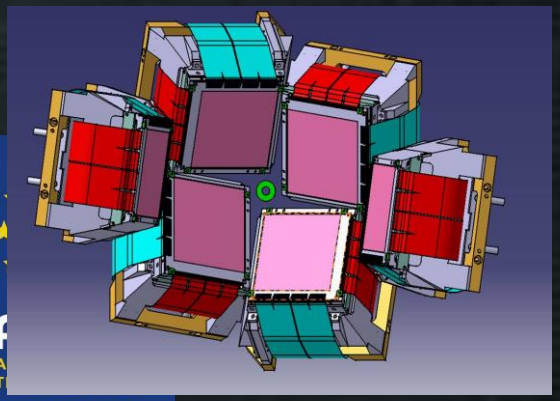


Angles >10 deg for fission & MNT





In G1 coupled to VAMOS (+ EXOGAM2): SIBs, RIBs



- Neutron detector (NEDA/N-Wall)
- Charged particle array for prompt tagging: DIAMANT
- Charged particle array for Recoil Decay Tagging: MUSETT
- Charged particle array for transfer reaction MUST2/TIARA
- High-energy gamma detectors: LaBr3
- Future detectors: GASPARD, PARIS (LaBr3)

Organization of the AGATA Physics Campaign in GANIL

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First Workshop
18-20 February 2013

Dedicated to the physics campaign of AGATA in GANIL following the call for Letters of Intent launched on October 2012

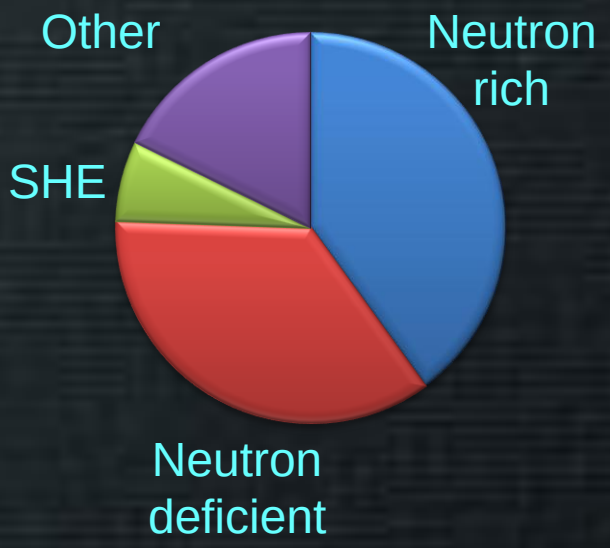
→Create the basis for defining the priorities for a detailed scientific program of the campaign in a bottom-up approach

→Assess the technical feasibility, constrain the infrastructure and ancillary detectors integration.

→Identify common setups to be run in a row, common physics cases and encouraging collaborations

The research with AGATA at GANIL

A total of 47 Letters of Intent were submitted



Four sub-campaigns were identified corresponding to 4 main setups:

- VAMOS in vacuum mode
- NEDA/NWALL+DIAMANT
- VAMOS in gas-filled mode
- SPIRAL1 upgrade.

The equivalent of ~2000 UT were proposed
~ 16000 hours of beam on target (667 days)

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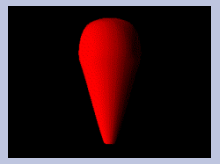
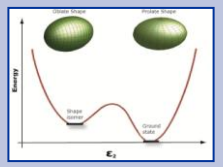
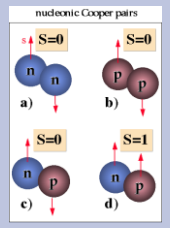
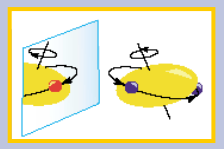
Physics cases for the AGATA campaign in GANIL









^{256}Rf

^{254}No

48Ca,50Ti→ SHE

Cm,Bk

Cf,Es

^{194}Pb

^{176}Hg

Sm,Pm

^{206}Hg

^{102}Sn

Dy,Er,Yb

^{100}In

Ru, Pd

58Ni,40Ca→ N=Z

Xe,Te

^{80}Zr

Zr, Mo

^{77}Y

^{132}In

^{75}Sr

^{78}Ni

^{80}Zn

Zr, Sr

^{63}Ge

^{68}Ni,Fe,Co,Cu

^{46}Ti

^{38}K

238U,208Pb → n-rich

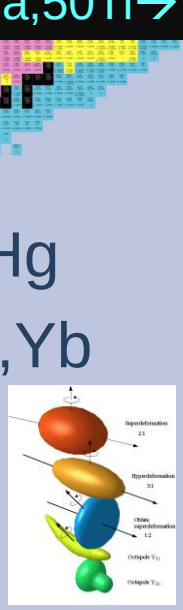
^{34}Ar

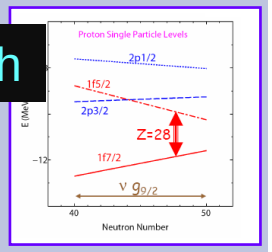
^{46,48}Ca

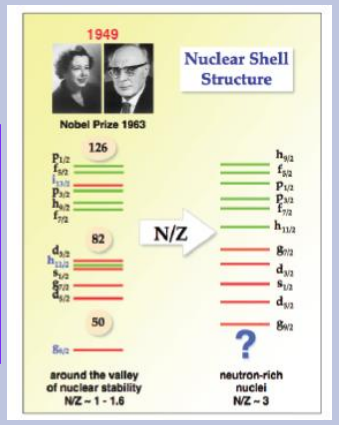
S,Cl,Ar,K

SPIRAL1

Ne,Na







neutron-rich nuclei

In different mass regions
produced in deep-inelastic, multi-nucleon transfer and induced fission reactions.

- Nuclear spectroscopy near shell or sub-shell closures
- Evolution of magic numbers and deformation
- Development of collectivity along isobaric and isotonic chains
- Shape and K isomers: prompt-delayed coincidences
- Shape coexistence
- Effective single-particle energies
- Reaction mechanisms

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proton-rich nuclei

In different mass regions
produced mainly in fusion-evaporation reactions.

- Nuclear spectroscopy near shell or sub-shell closures
- Evolution of magic numbers and deformation
- Enhanced proton-neutron correlations
- Delayed alignment in deformed N=Z nuclei
- High-spin states
- Isospin symmetry
- Isospin mixing
- Coupling to the continuum
- Shape coexistence
- Octupole correlations
- Search for exotic shapes

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heavy nuclei and towards SHE

produced in deep-inelastic and fusion-evaporation reactions.

- Low and high-spin structure
- Look for rotational bands in transfermium nuclei
- Lifetime measurements
- Challenging studies of reaction mechanisms
- Location of shell gaps at superdeformation

nuclear astrophysics

- Isotopic abundances in novae models
- Thermonuclear reaction rates
- Spectroscopy of sd-shell nuclei with stable and radioactive beams

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Physics Cases and Methods

✓ Gamma-ray spectroscopy of neutron-rich nuclei populated in deep inelastic collisions, MNT or induced fission using VAMOS to identify the reaction products.

✓Spectroscopy of proton-rich nuclei at the N=Z line using N-Wall/NEDA + DIAMANT

✓ Spectroscopy of heavy elements towards SHE and N~Z nuclei populated by fusion–evaporation with VAMOS in gas-filled mode.

✓ Spectroscopy using existing and new SPIRAL1 radioactive beams

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The campaign schedule

The excellent response from the community and the large amount and variety of the LoI received induced us to organize subcampaigns by setups and investigate the technical issues case by case.

The scheduling has to be flexible and dynamical in order to satisfy as much as possible the request of beam time from the users and compatible with the efficient installation and commissioning of the different setups and the programming of SPIRAL2.

- 1st campaign (2015-2016): AGATA+VAMOS (+EXOGAM2, +plunger) : MNT and fission fragments

- 2016-2018: NWALL and DIAMANT, VAMOS gas-filled mode, SPIRAL1 beams: DSSD-Coulex

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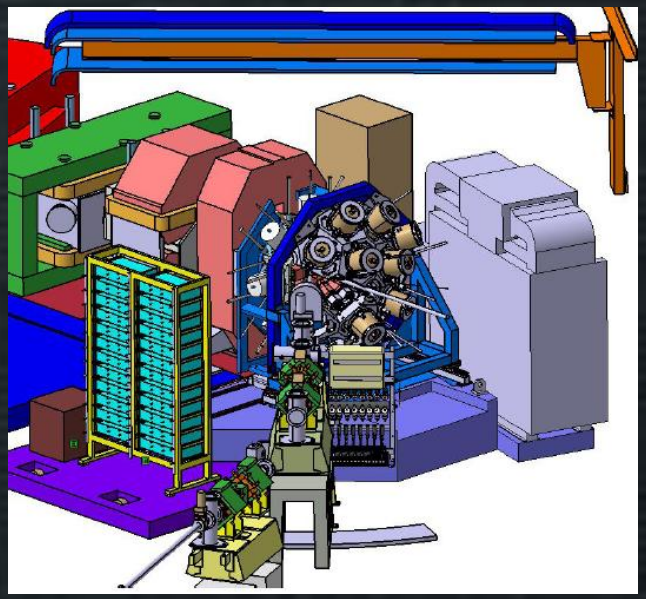
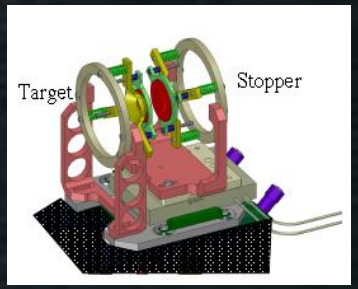
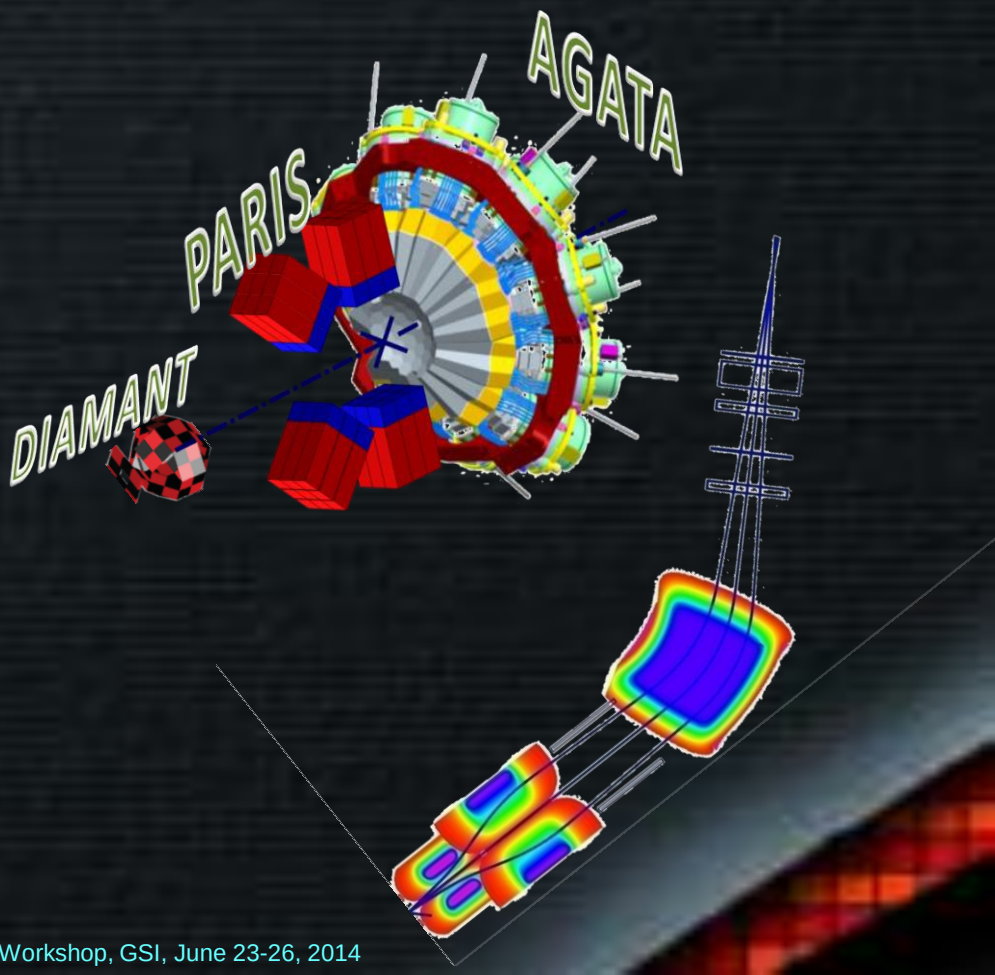
First Sub-campaign

Pre-PAC Workshop
11-12 February 2014

AGATA + VAMOS std. (+ EXOGAM2, + Plunger, + PARIS, + $LaBr_3$)







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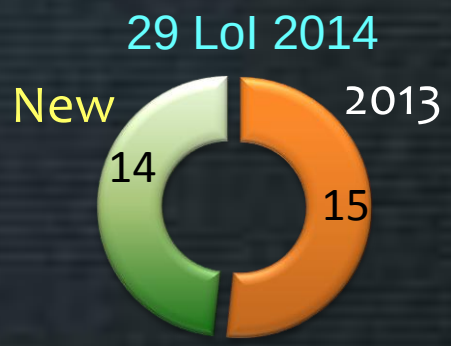
Physics cases for the First Campaign



^{238}U region

^{208}Pb region

Hg

W, Os

Nd

^{106}Sn, ^{108}Sn

Ce,La

^{94}Ru, ^{96}Pd

^{135}Te

^{132}Sn

Zr,Mb,Ru,Pd

^{46}Ti

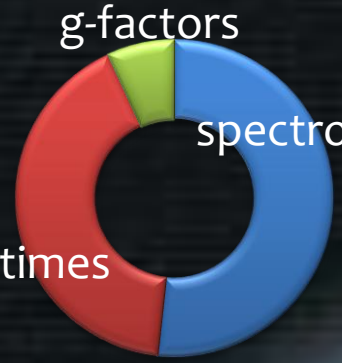
N~50:Ni, Zn,Ge

N~40: Ni,Fe,Co,Cu

Ar,Ca

S,Cl

C,O



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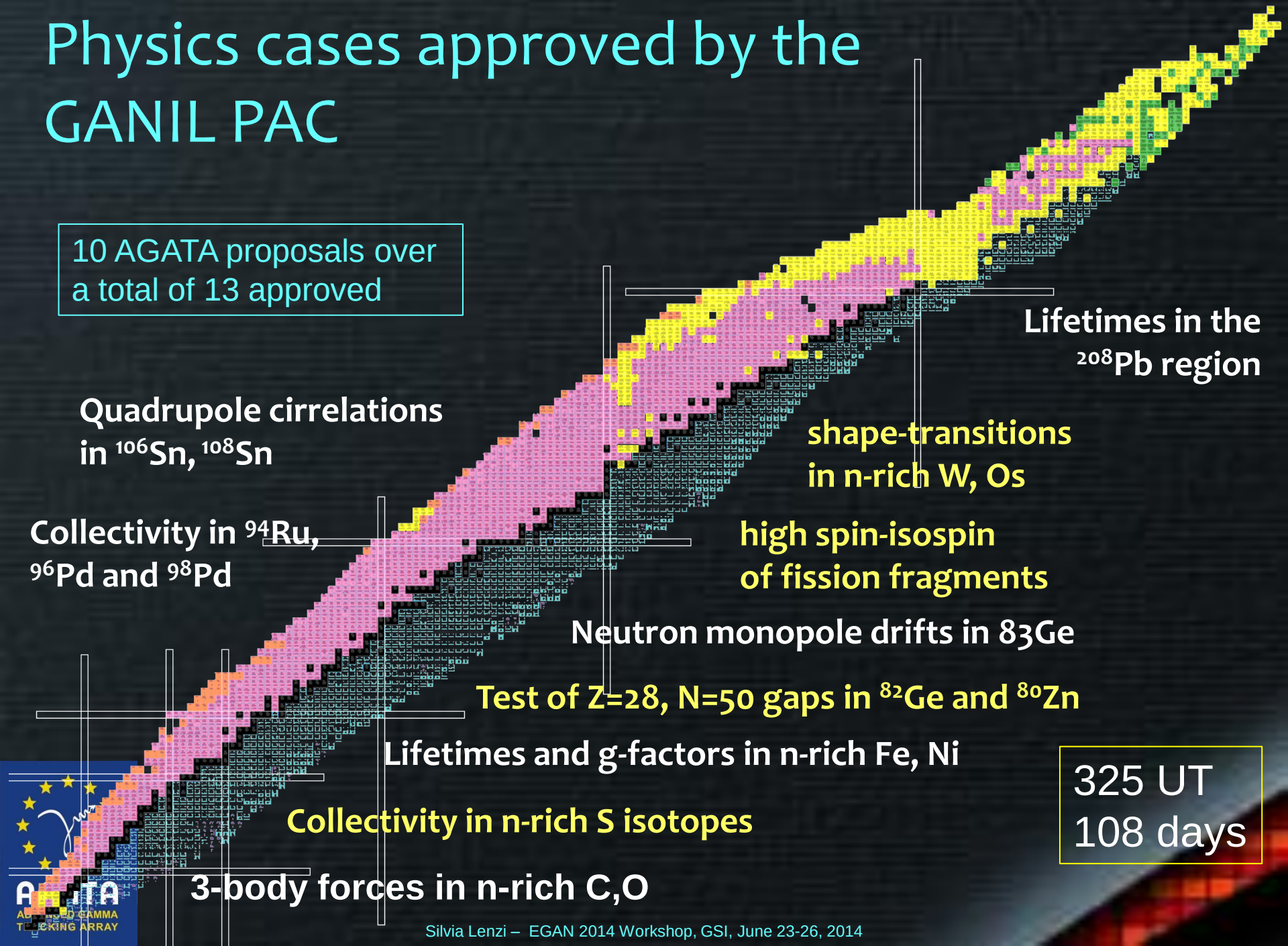
Physics cases approved by the GANIL PAC

10 AGATA proposals over a total of 13 approved



325 UT
108 days

Training new users

The third EGAN Training Course will be organized in Padova on 1-3 October for training on data analysis for the AGATA + VAMOS campaign in GANIL (and also for data analysis of the GSI campaign). Contact person: Daniele Mengoni.

We will also organize a schedule for the (off and in-beam) commissioning.
Every research team with an approved proposal will have to send a number of key participants to be trained to run the experimental setup.

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Next Campaign

Around two months before the next GANIL PAC meeting we will organize a Pre-PAC Workshop to:

→Assess the technical feasibility.

→ Help improving the proposals with the discussion within the AGATA community

→ Identify similar proposals and encourage collaborations in order to convergence in a common proposal

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LoI for an extension of the AGATA campaign at GANIL

The experimental program proposed by the collaboration is ambitious and of very high quality and cannot be completed in 2 years.

Following the call for LoI for the period 2017 and beyond by the AGATA Collaboration, the Director of GANIL has submitted an LoI proposing an extension of the GANIL campaign for additional 2 years until the end of 2018. It is stated that the GANIL cyclotrons will provide approximately 5 months of beam in 2017-2018 for the experiments with AGATA.

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Approved Proposals : 108 days

1. Study of quadrupole correlations in the 106,108Sn isotopes via lifetime measurements: Spokesperson: J.J. Valiente Dobon: 25 UT
2. Test of the Z=28 proton- and N=50 neutron- gaps in 82Ge and 80Zn nuclei. Impact on the magicity of 78Ni Spokesperson: G. Duchêne, G. de Angelis, 46 UT
3. Lifetime and g-factor measurements of short-lived states in the vicinity of 208Pb Spokesperson: G. Georgiev, E.Stuchbery D.L.Balabanski, 34 UT
4. Shape transition in the neutron-rich W isotopes. Spokesperson: P.R. John, P.-A. Söderström 25 UT
5. Collectivity in neutron-rich Sulfur isotopes. Spokesperson: A. Lemasson, S. Bhattacharyya, 25 UT
6. Lifetime measurements of excited states in neutron-rich C and O isotopes: a stringent test of the three body forces with the AGATA+PARIS+VAMOS setup. Spokesperson: S. Leoni, B. Fornal, M. Ciemała 43 UT
7. Lifetime and gfactor measurements in the vicinity of 68Ni using AGATA, Oups and VAMOS Spokesperson: J. Ljungvall, A. Görgen, 25 UT
8. Neutron monopole drifts near the N=50 closed shell towards 78Ni Spokesperson: D. Verney, G. de Angelis 31 UT
9. Collectivity along the neutron-magic 94Ru and 96Pd, spokespersons: C.Domingo-Pardo, A. Gadea, 25 UT
10. Probing the high spin-isospin frontier using isotopically identified fission fragments with VAMOS++ and the AGATA demonstrator, spokesperson: A. Navin, M. Rejmund, 46 UT