



AGATA Campaign at GANIL Scientific Programme

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Campaign Spokesperson

Unique physics opportunities with AGATA@GANIL

GANIL:

High intensity stable beams (from 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.

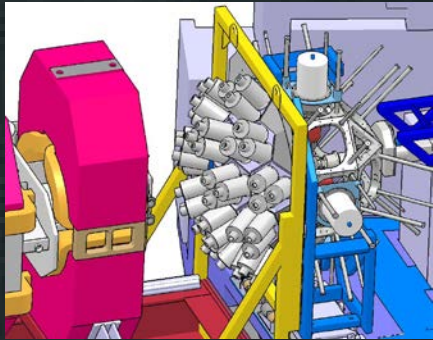
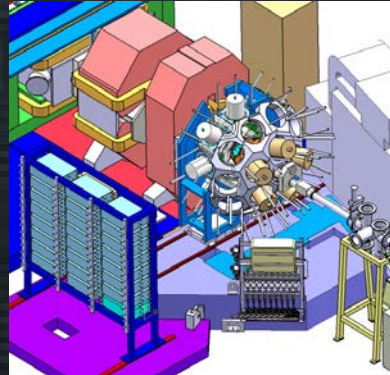
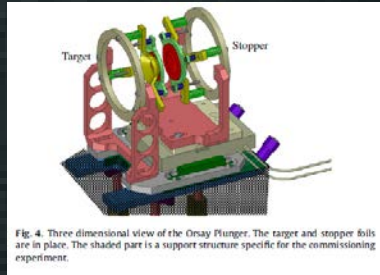
Different modes of operation.

Many complementary devices available or under development

AGATA at GANIL : Complementary devices

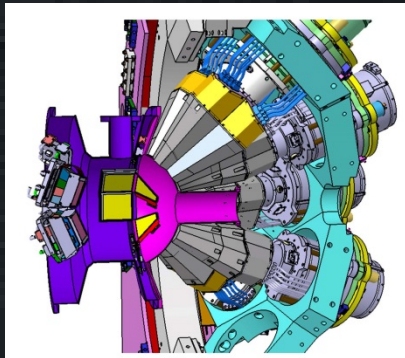
At 0° as separator (vacuum/gas-filled)

Angles >10 deg for fission & MNT



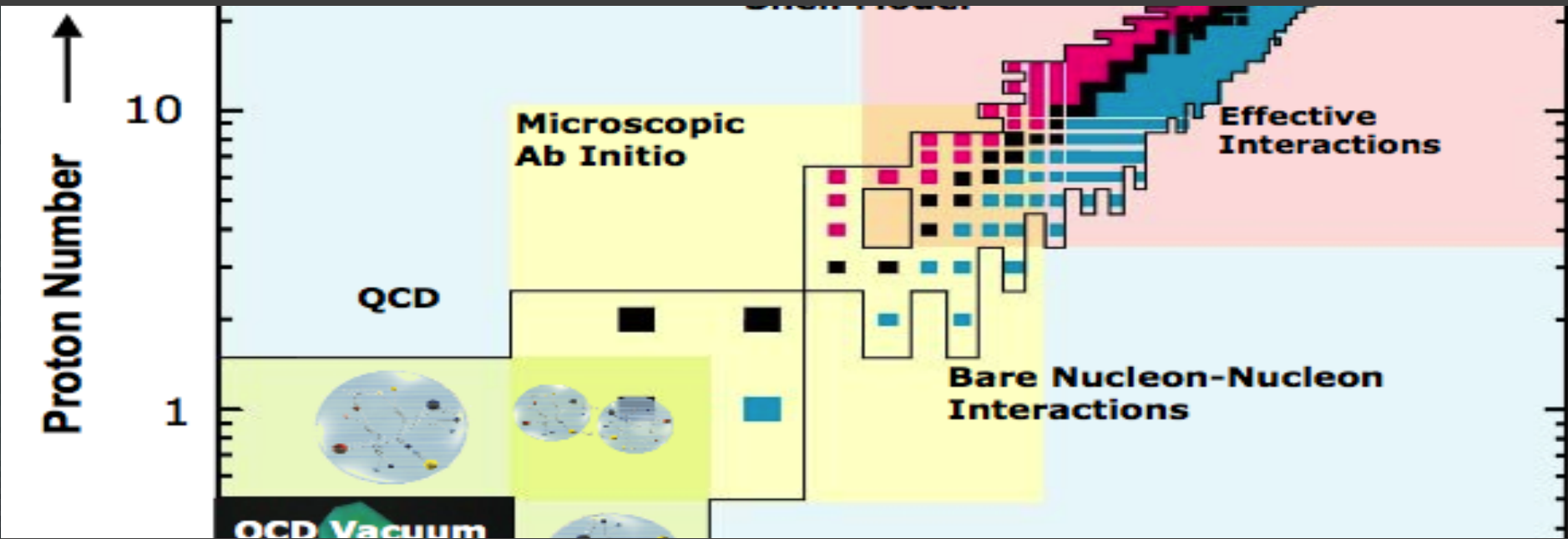
In G1 coupled to VAMOS (+ EXOGAM2): SIBs, RIBs

- 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 reactions: MUGAST
- High-energy gamma detectors: PARIS, Fatima



Some open questions

- How does the nuclear force depend on isospin?
- How do regular patterns and collective behavior emerge in complex nuclei?



- Which are the properties of exotic nuclei at the limits of binding?
- How do the underlying symmetries manifest in collective motion or single-particle behaviour and how these modes compete?
- What's new? collective modes, shapes, decay modes?

Organization of the AGATA Physics Campaign in GANIL



First Workshop

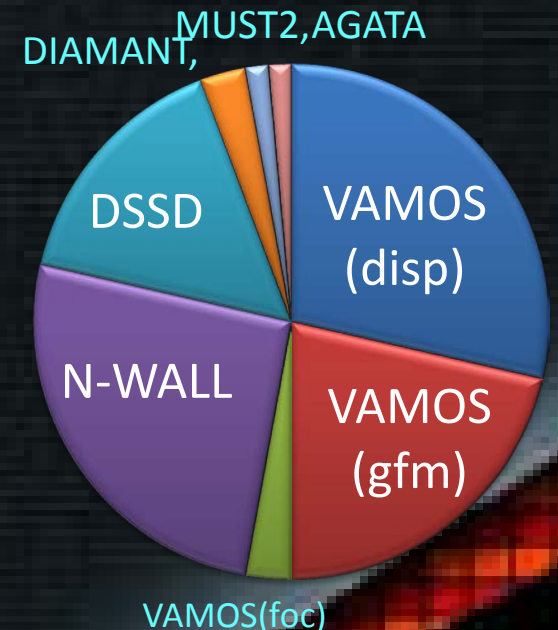
18-20 February 2013

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.

47 LoI were submitted



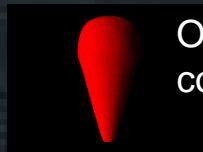
Physics cases 2013: 47 Lol

Nuclear astrophysics



Coupling to the continuum

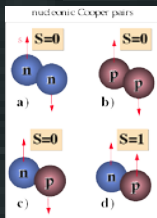
Octupole correlations



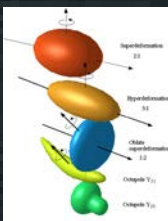
Location of shell gaps and high spin in VHE

Production and structure of VHE

Enhanced p-n correlations

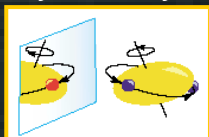


Search for exotic shapes

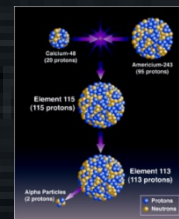


Shape and K isomers

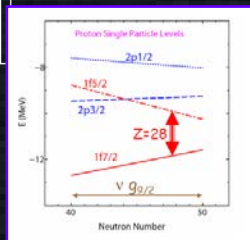
Isospin symmetry



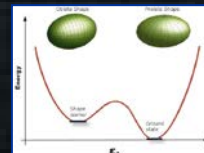
Reaction mechanisms



Effective single-particle energies



Shape coexistence



Evolution of magic numbers and deformation



Campaign timeline

2015-
2016

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

2017

Spectroscopy of proton-rich nuclei at the $N=Z$ line using **N-Wall/NEDA**

2017-
2018

Spectroscopy using existing and new **SPIRAL1** radioactive beams

2018

Spectroscopy of heavy elements towards SHE and $N \sim Z$ nuclei populated by fusion–evaporation with **VAMOS** in gas-filled mode.

From the Scientific Council of GANIL

“The SC is impressed by the preparatory work done by the collaboration to define the first AGATA experimental campaign at GANIL.” ...

“The SC also appreciates the efforts done to carefully define the physics goals and the technical aspects of the proposals.”

...
“The SC congratulates the collaboration for the present status of the device, and for its timely installation.” ...

“The SC also endorses the extension of the AGATA experimental campaign at GANIL until the end of 2018, as recently decided by the AGATA steering committee. Such an extension will enable the completion of a broad physics program addressing a large number of important issues.

In this context, it encourages the AGATA community to consider experiments which require ancillary detectors other than VAMOS in order to expand the physics reach as much as possible.” ... (and) “in conjunction with VAMOS in gas-filled mode”

“The SC encourages the AGATA collaboration to pay particular attention to this point and to provide the resources (financial and human) necessary to ensure that the largest possible number of detectors is indeed available.”

Preparing the Campaign

The installation was done as scheduled, implementing the detectors that arrived from Cologne.

A source commissioning started in October, followed by 3 in-beam runs for the commissioning of AGATA and VAMOS.

The spokespersons of the approved experiments and their collaborators have been invited to participate to these commissionings.

The commissioning has been successful.

Working groups

- Neutron Wall and/or Diamant
Coordinator: Gilles de France
- VAMOS in gas filled mode
Coordinator: Christoph Theisen/Christelle Schmitt
- Plunger
Coordinator: Joa Ljungvall
- DSSD detectors
Coordinator: Peter Reiter
- MUGAST
Coordinator: ?

Complementary equipment

- VAMOS (M. Rejmund)
- EXOGAM2 (G. de France)
- MUST2 and Tiara (O. Sorlin)
- PARIS (A. Maj)
- OUPS Plunger (J. Ljungval)
- Cologne Plunger (Ch. Fransen)
- MUGAST ?

Training new users

The third EGAN Training Course has been organized in LNL in the framework of the European Gamma and Ancillary Detectors Network (EGAN) of ENSAR on 1-3 October for training on data analysis for the AGATA campaigns (pulse-shape analysis, tracking, polarization, etc.).

30 young researchers participated to theoretical and hands-on training sessions.

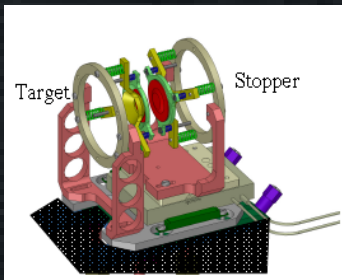
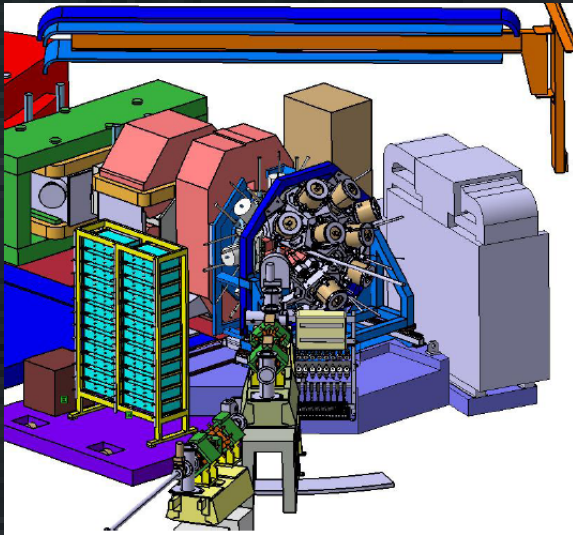
<https://agenda.infn.it/conferenceDisplay.py?ovw=True&confId=8442>

First sub-campaign

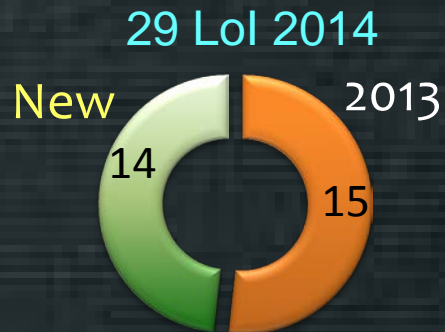
Experimental setup

Pre-PAC Workshop
11-12 February 2014

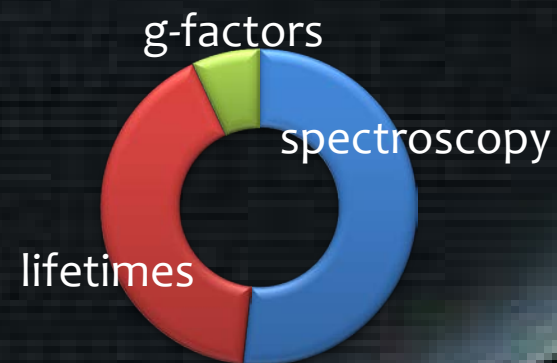
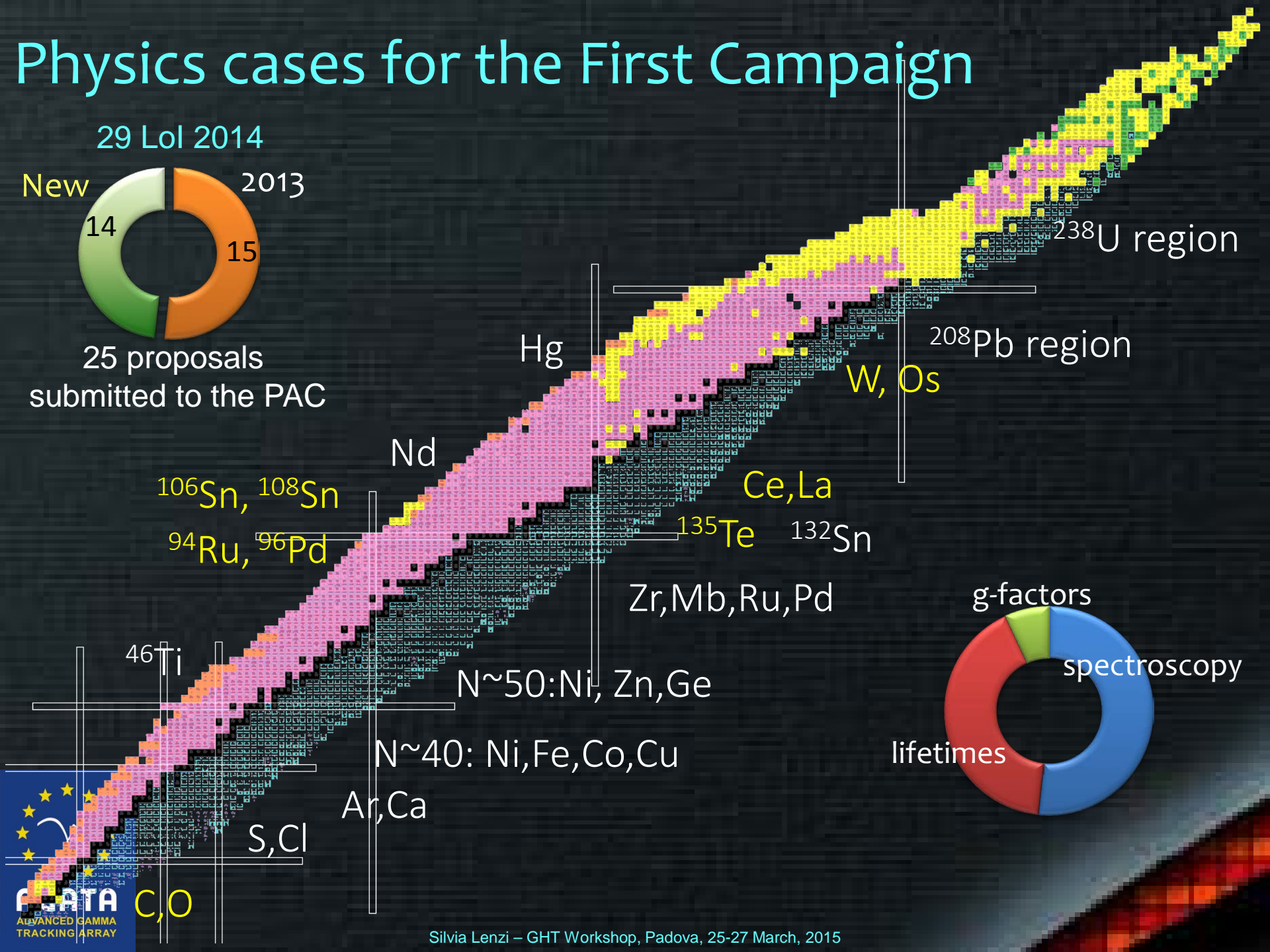
AGATA + VAMOS std. (+ EXOGAM2, + Plunger, + PARIS, + LaBr₃)



Physics cases for the First Campaign



25 proposals
submitted to the PAC



Physics cases approved by the GANIL PAC

10 AGATA proposals over
a total of 13 approved by the PAC

Quadrupole correlations
in ^{106}Sn , ^{108}Sn

Collectivity in ^{94}Ru ,
 ^{96}Pd and ^{98}Pd

Lifetimes in the
 ^{208}Pb region

Shape-transitions
in n-rich W, Os

High spin-isospin
of fission fragments

Neutron monopole drifts in ^{83}Ge

Test of $Z=28$, $N=50$ gaps in ^{82}Ge and ^{80}Zn

Lifetimes and g-factors in n-rich Fe, Ni

Collectivity in n-rich S isotopes

3-body forces in n-rich C, O

325 UT
108 days

Scheduling the experiments

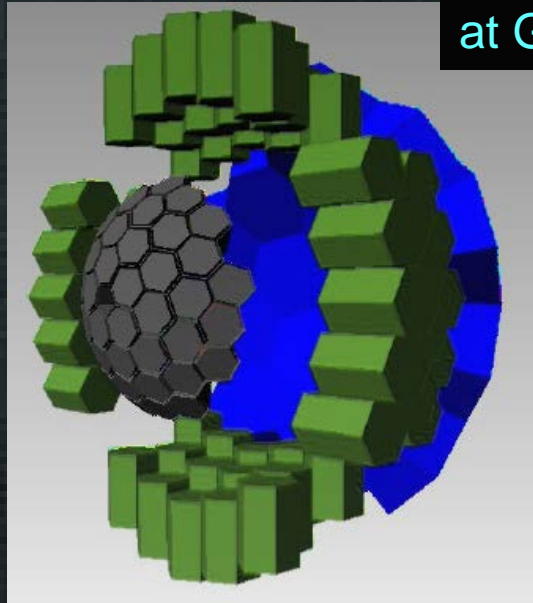
The first AGATA experiment took place two weeks ago (J. Ljungvall).

The first series of 6 AGATA experiments will finish in July 2015.

Four AGATA experiments will run later in 2015 or beginning 2016.

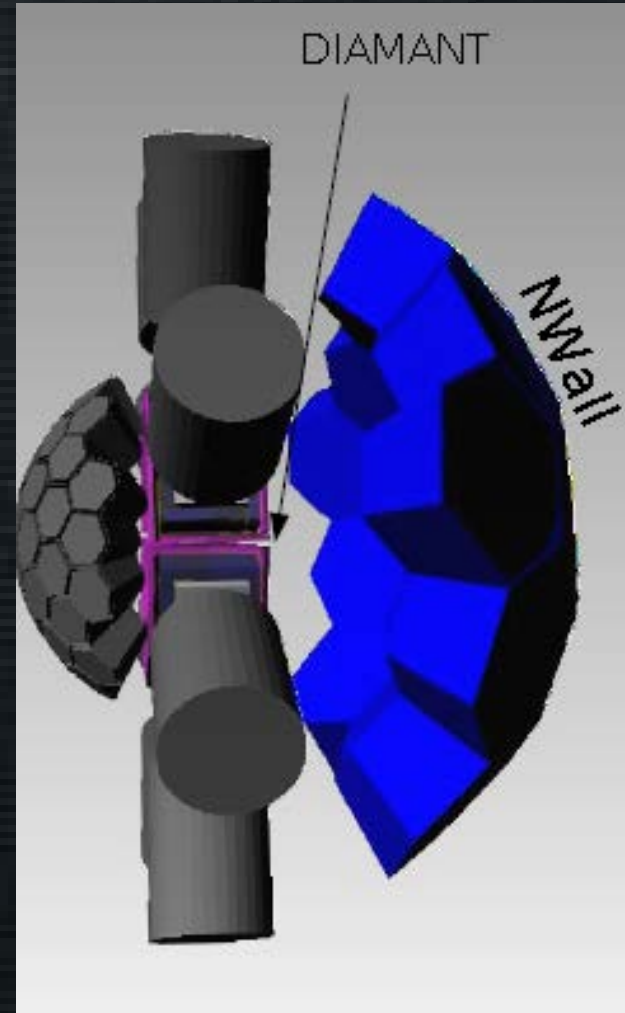
Second sub-campaign

Neutron Wall/NEDA + DIAMANT



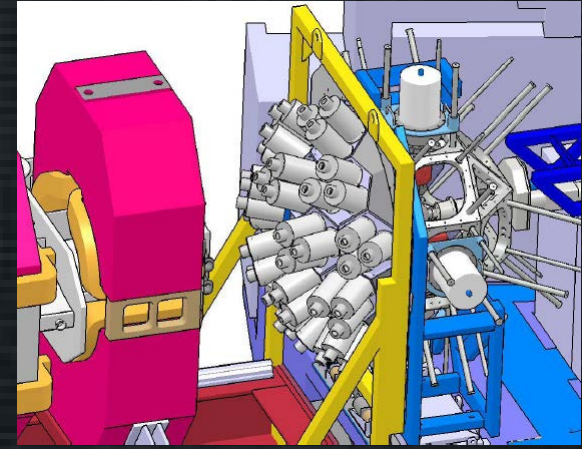
NEDA +Nwall
at GANIL

26% of the Lol of 2013



Courtesy of M. Palacz

AGATA+NEDA Campaign



The second setup will consist on AGATA coupled to N-Wall/NEDA

This setup will be available in the beginning of 2017

A Second pre-PAC Workshop was organized on February 11-13, 2015 in GANIL

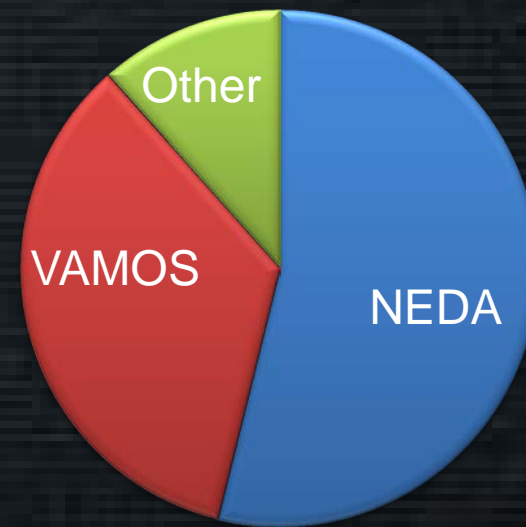
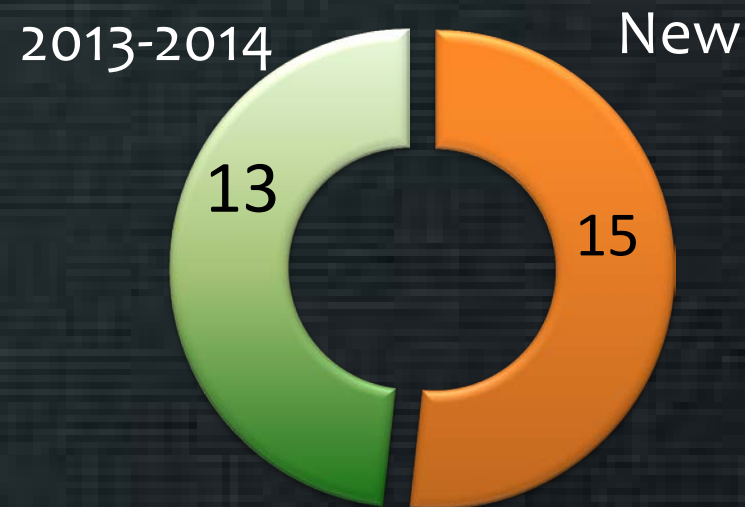
Aims of the pre-PAC Workshop

- Assess the technical feasibility.
- Help improving the proposals with the discussion within the AGATA community
- Identify similar LoI and encourage collaborations in order to convergence in a common proposal
- Identify common setups to be run in a row

The Lol for the second campaign

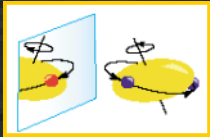
28 Lol submitted

Apparatus

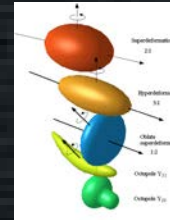


Beam time requested : 723 UT ~ 240 days

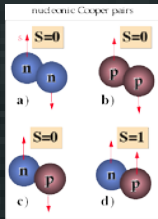
Physics cases



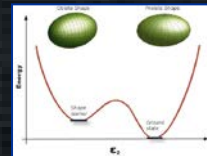
Isospin symmetry



Exotic shape
High spin



p-n pairing
correlations



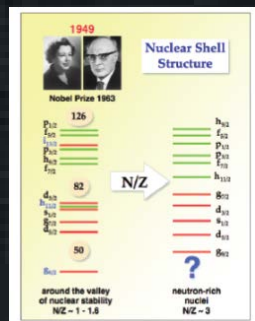
Shape
coexistence



Nuclear
Astrophysics



Island of inversion
Shape evolution



Single particle
vs collectivity
near closed shells



Proton vs gamma decay
unbound states

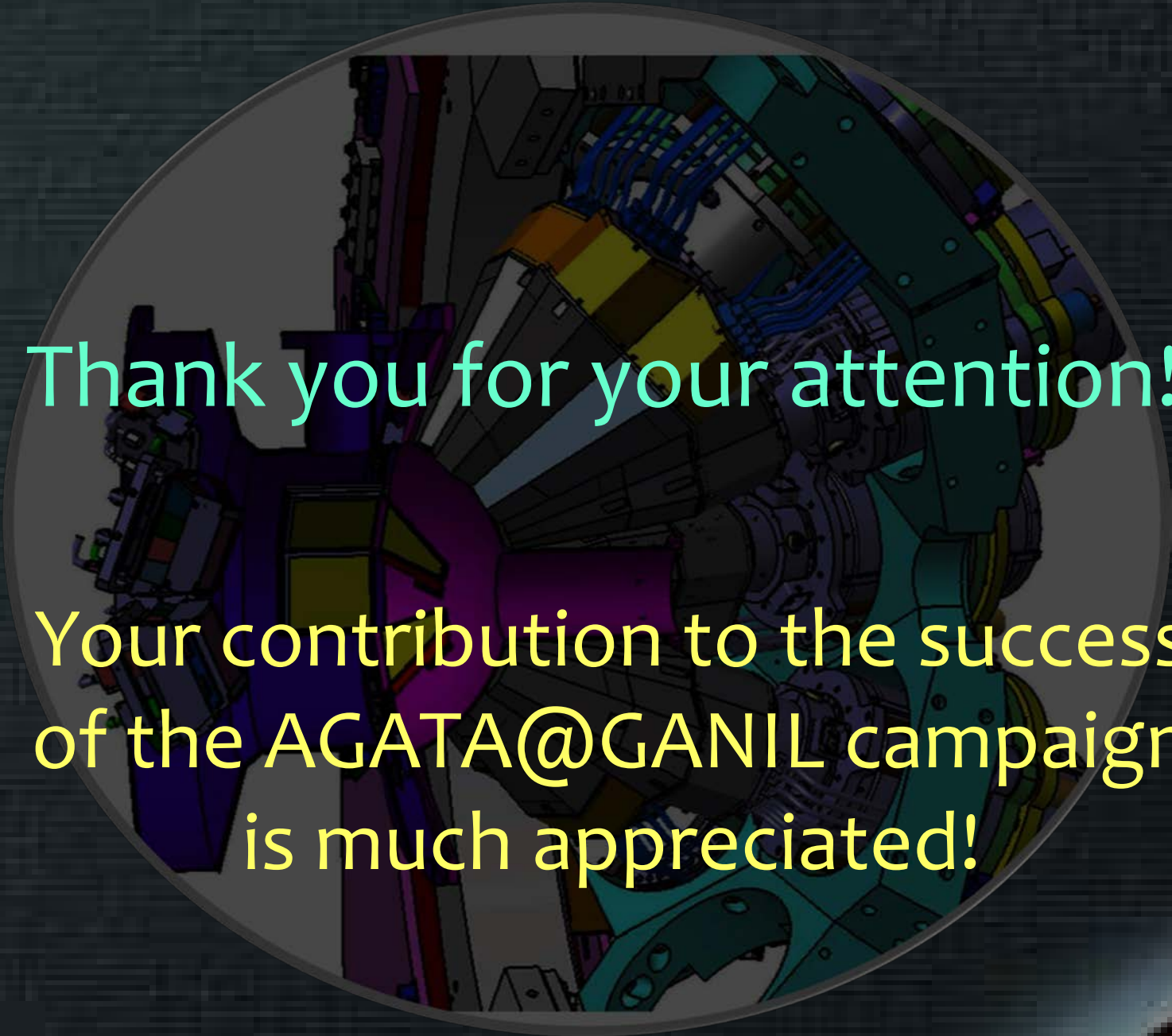
Future steps

17 proposals were submitted to the next PAC meeting
on March 20, 2015

PAC Meeting: April 27 and 28, 2015

There will be another PAC meeting in October 2015
with some room for AGATA experiments.

N-Wall will be coupled to GALILEO in 2015.
A Workshop on N~Z physics with both, AGATA
and GALILEO is being organized in San Servolo
(Venice) on 4-5 May, 2015.



Thank you for your attention!

Your contribution to the success
of the AGATA@GANIL campaign
is much appreciated!