AGATA@GANIL
Status report

AGATA week 2019
AGATA campaigns @ GANIL

2015-2017
VAMOS Campaign
24-35 capsules

2018
NEDA/DIAMANT
Campaign
35 capsules

2019-2020
MUGAST Campaign
41-44 capsules

2021
?? Campaign
~ 44 capsules
The AGATA campaign at GANIL has been extended to 2017, 2018, 2020, 2021.

- 5th PAC in November 2018: call for MUGAST-AGATA-VAMOS experiments only
  - 5 MUGAST-AGATA-VAMOS experiments proposed
  - 2 experiments approved (E. Clément/A. Goasduff & A. Gottardo/M. Assié)

- 6th PAC 17-18 October 2019: call for MUGAST-AGATA-VAMOS experiments only
  - 3 MUGAST-AGATA-VAMOS experiments only proposed due to Spiral1 beam test canceled: $^{24}\text{Ne}(^{6}\text{Li},d)$, $^{26}\text{Al}(d,p)$ and $^{47}\text{K}(d,p)$

899 UT have been already approved spanned on 33 experiments
709 UT have been spanned on 25 experiments

Backlog is
3 NEDA (+ DIAMANT, PARIS, FATIMA) 66 UT
4 VAMOS 92 UT
1 MUGAST 32 UT

- 2020 beam time should be ~3 months; starting first week of February
- The 7th and LAST PAC in 2020 for the 2021 beam time is to be defined
2019 Technical achievements

- **Operation**
  * We ran 25 experiments since 2015
  * In-beam data since 2014, the campaign is approved until 2021 (8 years operation)
  * Detectors maintained cold since October 2014
  * 41 Detectors took data in 2019 in unstable conditions

- **Upgrades**
  * DCOD upgrade with trigger soft, on-line event builder and AGASPY watchers
  * 7 new GGP channels were installed and put in operation from the 2nd production batch, 5 more are installed in the last workstation delivery batch. 24 ATCA** channels + 23 GGP channels are delivered at GANIL
  * Delivery of the last batch of workstation for the next GGP production
  * Several maintenance and re-ordering in the DAQ-box
  * Migration of the Muscade client to Java OpenJDK for the Autofill
  * Continus upgrades of the data-analysis tool (femul upgrade, Cubix, AGATASPY, GRID …)
  
  *All the hardware is delivered at GANIL for the 1π

41 detectors on-line in 2019
Cumulative [TB]

- 2014**: 0.0
- 2015
- 2016
- 2017
- 2018*
- 2019

*Without Traces
** Commissionning

0.5 PB !!
2019 Technical Problems Summary

- Relatively easy GTS and DAQ coupling between AGATA-VAMOS-MUGAST
- EXOGAM2 TP is not 100% reliable at > 25kHz/core due to non-ordered request from GGP’s.
- The 2019 run was performed in TriggerLess
- Aging of the V0 electronic (several digitizers with sever problems and first ATCA carrier off)
- 2/3 of the experiments performed with the CEPH spear
- GTS instabilities during the 2\textsuperscript{nd} experiment (12h lifetime) solved after a complete disassembly of the GTS Tree
- More and more detectors are requesting a refill before the 6h period
The MUGAST–AGATA–VAMOS setup

- MUGAST
- AGATA
- VAMOS
- Spiral1 radioactive beams
- BTD
Commissioning / E744 efficiencies : 37 capsules
AGATA is approached by 51 mm for the MUGAST campaign

Efficiencies @ 1.4 MeV
AddBack 6.3(1)%
Tracked 5.5(1)%
According to G4 with adjusted crystal relative efficiencies

No loss at low energy was measured due to MUGAST
AddBack efficiencies
867 keV: $152\text{Eu} = 7.7(2)\%$
870 keV $^{17}\text{O} = 7.8\%$
Geant4 = 7.5\%

AGATA in full trigger less
$\rightarrow$ In-beam efficiencies

E.Clément
UNBOUND STATES

Above barrier narrow resonances in $^{15}\text{F}$

$^{14}\text{O}(p,p')$ inelastic scattering
- Search for new negative parity states
- Type of two-proton decay
- Gamma transition within unbound nucleus (extremely rare)

I. Stefan (IPN), F. de Oliveira (GANIL)

→ Expected $\gamma$-rays not seen (would have been a real discovery)

fs scale sensitivity
Eu energies calibration
calibrate well the 6.1 MeV line of $^{16}\text{O}$

E.Clément
MUGAST campaign 2019

SHELL MODEL

Is there a problem with protons in N=28 nucleus $^{46}\text{Ar}$?

$^{46}\text{Ar}(^{3}\text{He},d)^{47}\text{K}$ to probe proton WF and study vacancies in $s_{1/2}$ and $d_{3/2}$ shells.

$^{3}\text{He}$ cryogenic target!

A. Gottardo INFN, M. Assié IPN

K masses isotopes in coincidence with particle at backward angle
NUCLEAR ASTROPHY.

Determining the $\alpha+^{15}\text{O}$ radiative capture rate

$^{15}\text{O}(^7\text{Li},t)^{19}\text{Ne}$ indirect measure

Important reaction for breakout from Hot-CNO cycle to rp-process in Type I X-ray bursts

C. Diget (York), N De Séréville (IPN)

→ Expected transition not seen
It is a result, ie that the $C_s\alpha$ is small

E.Clément

AGATA spectrum in triple coincidence with MUGAST and $^{19}\text{Ne}$
Recent Publication from past campaigns
The quenching of the N=50 gap towards $^{78}$Ni can be investigated looking at the Spectroscopy of excited states involving particle-hole excitations across the N=50 gap

- First lifetime of excited states measured in $^{88}$Kr
- Lifetime measured with better accuracy in $^{86}$Se
- First lifetime measured in the very exotic $^{84}$Ge
- Unexpected enhancement of collectivity in $^{84}$Ge

Sudden rise of collectivity after the N=50 shell closure

… in contradiction with shell model calculation

$^{81}$Ga spectroscopy

$J.\text{Dudouet et al, Phys.Rev. C 100, 011301 (2019)}$

Effects of one valence proton on seniority and angular momentum of neutrons in neutron-rich $^{122-131}$Sb isotopes

LSSM calculations in the $^{132}$Sn vicinity constrained by combined prompt-spectroscopy, isomer spectroscopy and related B(E2) in Sb isotopes

Modifications of several components of the shell-model interaction were introduced to obtain a consistent agreement in neutron-rich Sn and Sb isotopes
Shell evolution around $^{208}\text{Pb}$

Study of the two-phonon vibrational states in the $^{208}\text{Pb}$ region
Case of the $^{207}\text{Pb}$ $\nu(i_{13/2})^{-1}$ state band structure

Evidence of octupole-phonons at high spin in $^{207}\text{Pb}$

The measured reduced transition probability is compatible with a contribution from the two-to-one-octupole-phonon $E3$ transition.

Further information on the double-octupole-phonon state can be obtained by a more precise lifetime measurement of the $19/2^-$ state in $^{207}\text{Pb}$

$$B(E3) = 40(8) \text{ W.u}$$

$D. \text{Ralet et al Physics Letters B 797 (2019) 134797}$
Cumulative number of publications (Technical excluded)

Up-to-date 1st of September 2019

#Years after the first experiment

→ On good track
Conclusion

• AGATA is operated since 2014 at GANIL and 25 experiments have been performed

• The number of detectors is approaching the \(1\pi\)

• In 2019, we observed a clear aging of the electronic and detectors

• Successful start of the MUGAST-VAMOS-AGATA campaign in 2019 to be continued in 2020

• Many results are coming all along the nuclear chart for many different physics topics

• **Publications are important for GANIL and AGATA**

• **Many thanks to all AGATA collaborators!**