



Status and perspectives of the GANIL Campaign

AGATA ACC June 2017

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

$^{48}\text{Ca}, ^{50}\text{Ti} \rightarrow \text{SHE}$

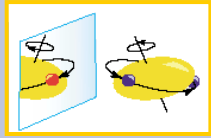
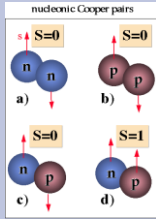
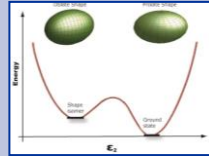
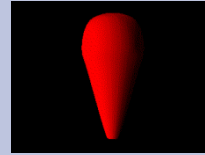
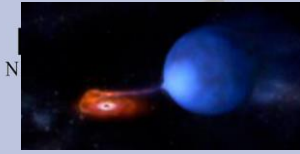


TABLEAU PÉRIODIQUE DES ÉLÉMENTS

-Nanogan - surFace - Febiad - ecr HD

$^{58}\text{Ni}, ^{40}\text{Ca} \rightarrow N=Z$

$^{238}\text{U}, ^{208}\text{Pb} \rightarrow \text{n-rich}$

SPIRAL1

^{256}Rf
 ^{254}No

Cm, Bk
Cf, Es

Ru, Pd

^{38}K
 ^{34}Ar

S, Cl, Ar, K

Ne, Na

^{176}Hg

Sm, Pm

^{102}Sn

^{100}In

^{88}Zr

^{194}Pb

^{206}Hg

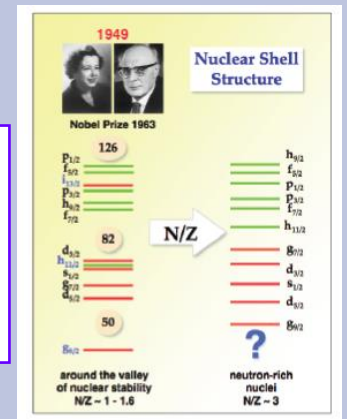
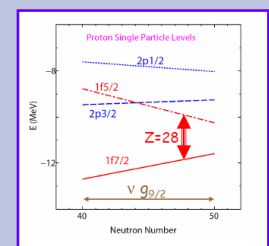
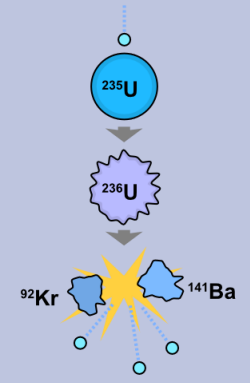
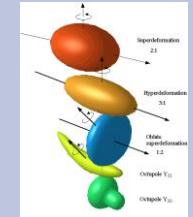
Dy, Er, Yb

Xe, Te

Zr, Sr

^{78}Ni ^{80}Zn

$^{68}\text{Ni}, ^{66}\text{Fe}, ^{64}\text{Co}, ^{63}\text{Cu}$



The GANIL Campaign organization

The AGATA campaign at GANIL has been extended to end of 2019 included

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)

E724	M.A. Bentley	20	1	1	18		B
E725	B. Cederwall	36	1	1	30	4	A
E727	B. Fornal	22	2	3	15	2	A
E730	J.J. Valiente-Dobon E. Clément	32	1	1	30		A
E731	A. Boso	20	1	1	18		A
E735	M. Palacz	23	1	1	21		B

γ decay from near-threshold states in ^{14}C

Prompt γ /proton spectroscopy in ^{65}As .

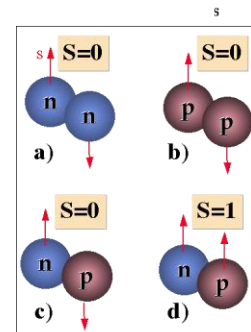
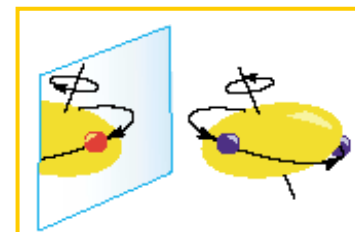
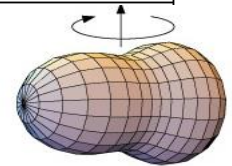
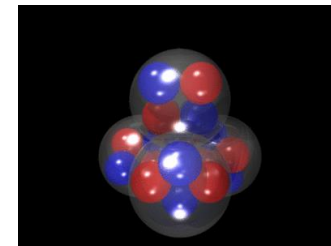
Isospin Symmetry Breaking in the $A=63,71$ mirror nuclei

Search for isoscalar pairing in the $N=Z$ nucleus ^{88}Ru

Purity of the $g_{9/2}$ configuration in ^{94}Pd

Studies of excited states in $^{102,103}\text{Sn}$

Octupole shape in ^{112}Xe



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- 3rd PAC in 2016 : NEDA (6 experiments approved)
- 4th PAC late 2017 : On-going definition of the call

Presently 708 UT have been already approved and 404 UT have been performed

2 scientific papers published

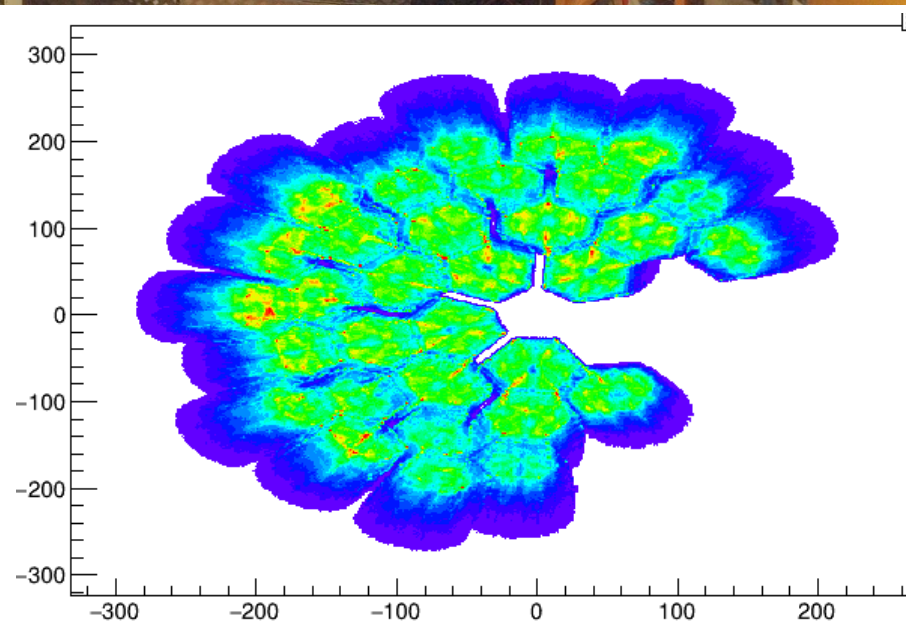
M. Klintefjord et al , *Measurement of lifetimes in $^{62, 64}\text{Fe}$, $^{61, 63}\text{Co}$, and ^{59}Mn ,* Phys.Rev. C 95, 024312 (2017)

J. Dudouet et al. $^{96}_{36}\text{Kr}_{60}$ -- *Low-Z boundary of the island of deformation at $N=60$,* J. Dudouet et al. Phys. Rev. Lett. 118, 162501 (2017)

E. Clément, et al, *Conceptual design of the AGATA array at GANIL,* NIMA 855, 21 May 2017, Pages 1-12



- ❑ 10 Triple Clusters and 1 Double Cluster
- ❑ up to 32 channels operational with phase1 (ATCA) and advanced phase 1 (GGP) electronic chains + 1 spare (1184 hpGe Channels)
- ❑ DAQ infrastructure was running smoothly
- ❑ Detectors Infrastructure were perfectly running



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

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

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

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

✓ 29 capsules running (limited by the availability of FEBEE)

✓ Cr/Ti Plunger **target** issues which has limited the beam intensity

→ See Ch. Fransen's talk

✓ 29 capsules running (ATC7 out)

✓ ^{76}Ge , Plunger **target** issues which has limited the beam intensity

→ See C. Michelagnoli's talk

✓ 32 capsules running

✓ Issues with the 2nd arm

✓ Delayed gamma with EXOGAM at the focal plane → See Y. H. Kim's talk

✓ 31 capsules running (1 GGP channel)

✓ Additional DSSD in the chamber

✓ **Target** integrity (^3He)

2017 preparation

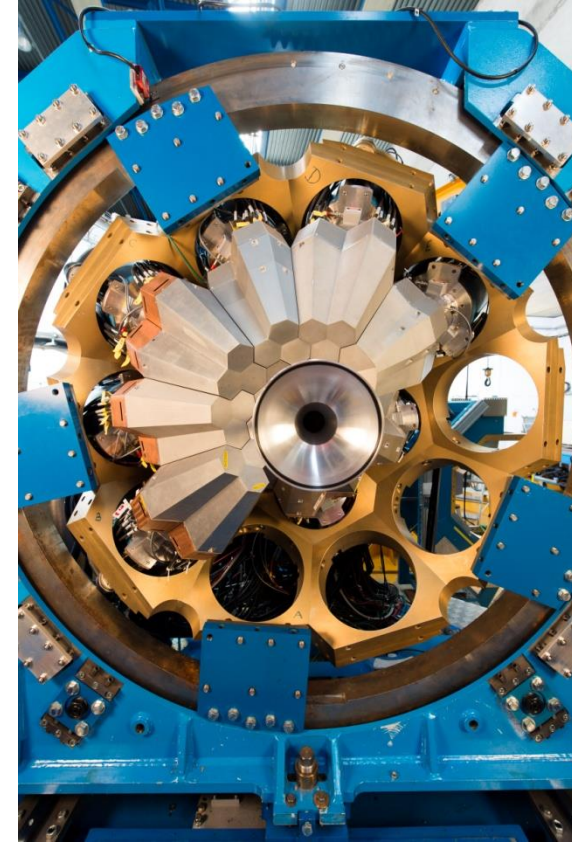
- ✓ DAQ services upgrade (network, software, disks)
 - ✓ Re-cabling of the DAQ box and the detectors
 - FATIMA/PARIS preparation (Mechanics, FEBEE, DAQ)
 - ATC1 refurbishment (swap of capsules for annealing ; 1 failed)
 - ATC11 and ATC13 deliveries
 - ATC3 at the lab after a beginning of warming up due to a vacuum problem. An annealing is scheduled. Reminder: ATC3 was the first installed in November 2014
- In 2017, 38 detectors (12 ATC and 1 ADC) are in GANIL.
35 are running

Installation of the remaining produced advanced phase 1 channels
35 channels (24 ATCA+11 GGP) channels are running with 1 full GGP channel spare

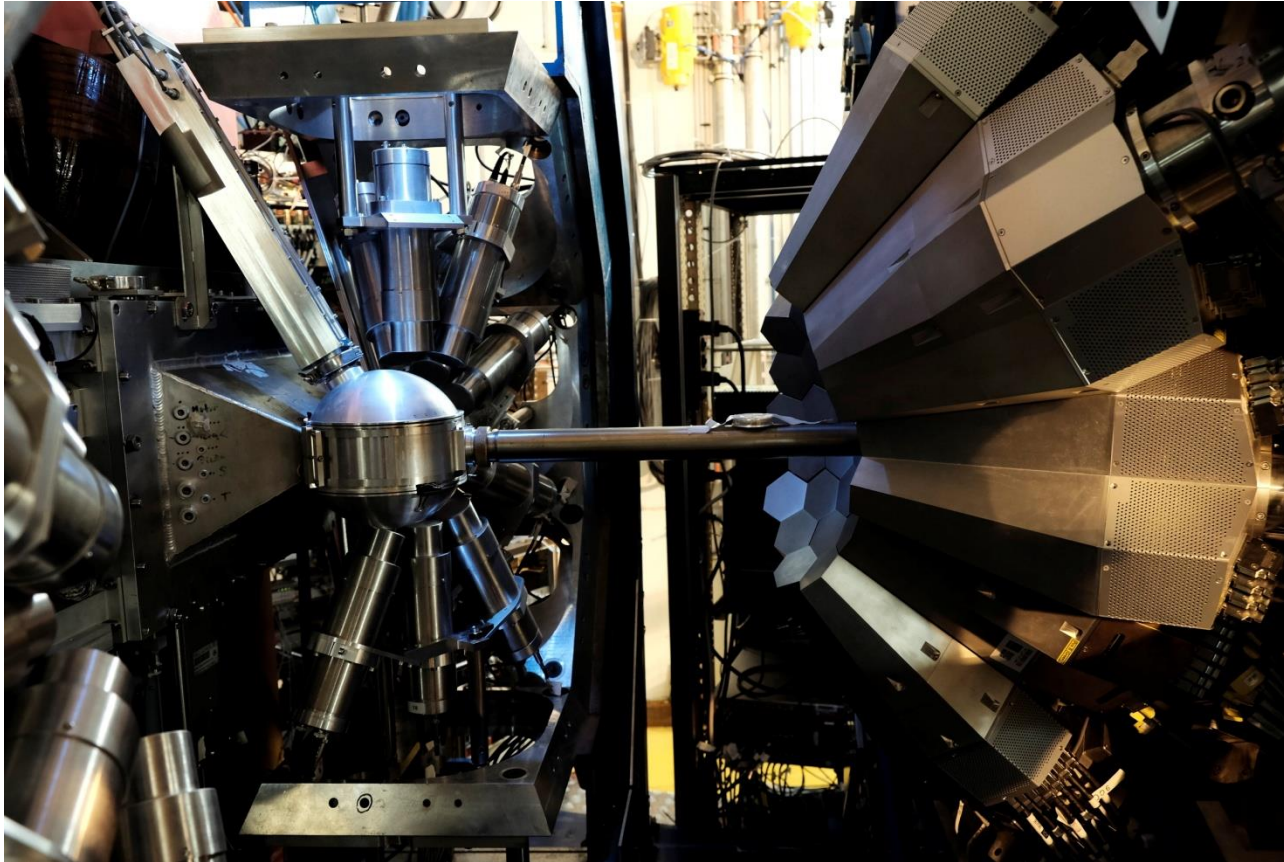
7 GGP from GALILEO installed on the 20th of March and swapped with non-working AGATA channels

→ Max available channels is 36 channels

Analysis workshop organized in GANIL last 17th -21st of October 2016



FATIMA-PARIS detectors coupled to AGATA and VAMOS (4 experiments)
DSSD detector coupled to AGATA (1 experiment)

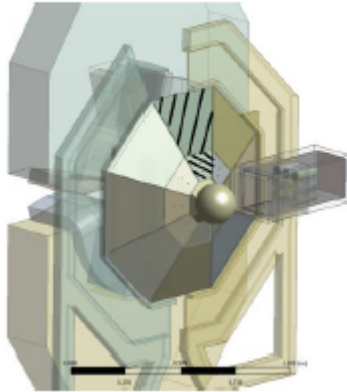


35 detectors on-line : Single efficiency measured at 3.4(1)% in nominal position at 1.408 MeV (GEANT4 = 3.6%)

Preparatory work with the FATIMA and PARIS collaboration

Magnetic field shields studies

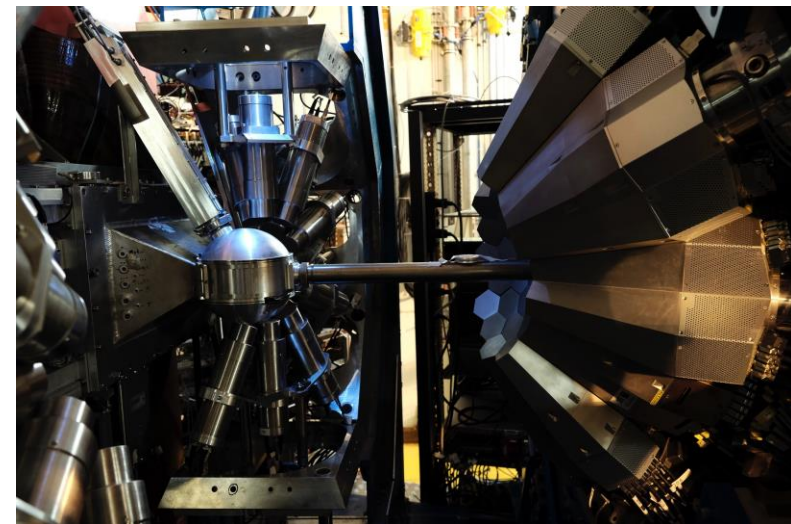
On the top side, the vertical petal and its extension miss (cf black cross-hatching).



petal	Bx (mT)	By (mT)	By (mT)	Module (mT)
1	0,6	-13,9	4,6	14,7
2	-2,1	-13,6	2,6	14,0
3	-1,1	-8,9	-8,3	12,2
4	0,9	5,7	-10,9	12,3
5	3,5	15,4	-0,2	15,8
6	1,8	13,0	2,4	13,3
7	-9,3	7,8	0,1	12,1
8	-7,3	-3,5	0,8	8,1
9	1,0	-13,7	-2,3	13,9
10	5,2	-15,5	-0,7	16,4

See P. Regan's presentation

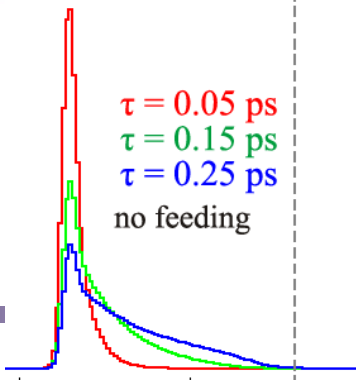
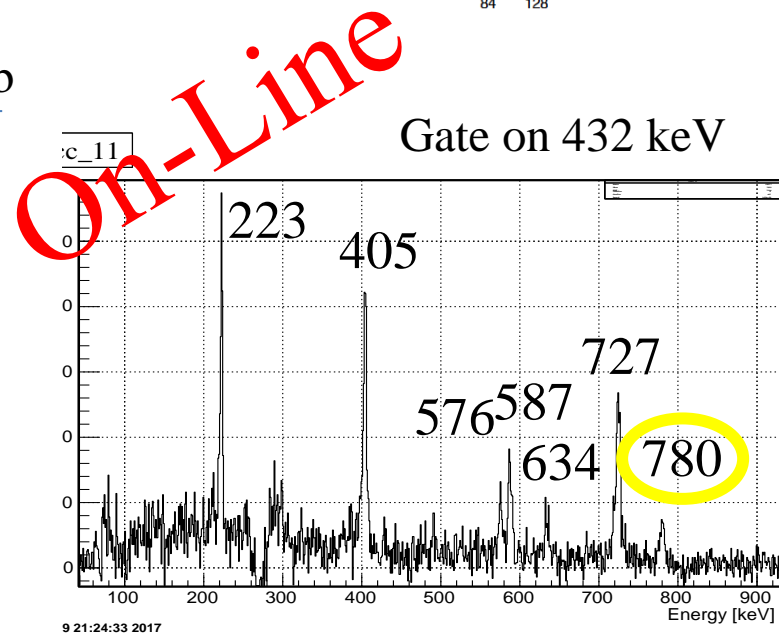
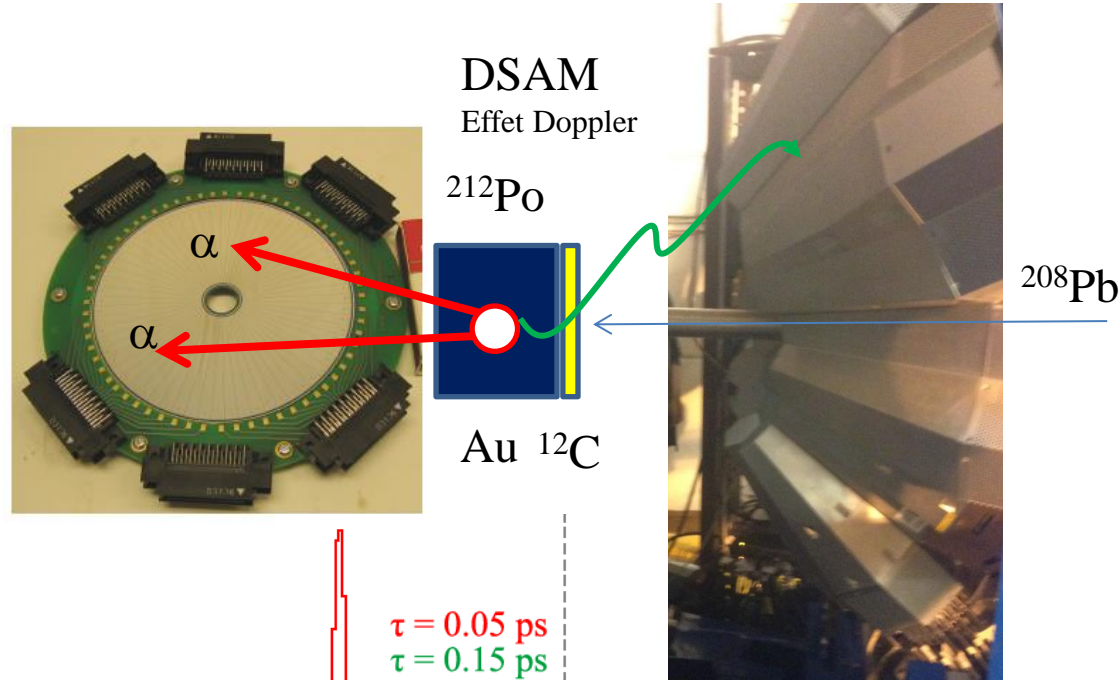
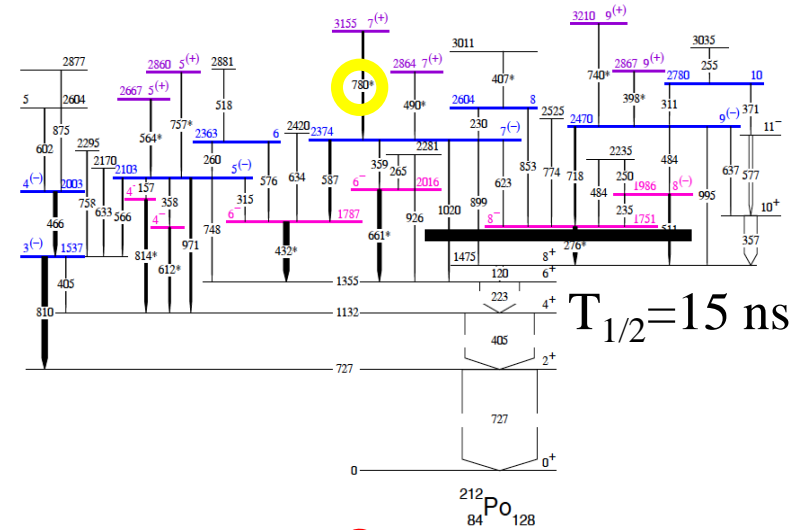
- E693 : A. Jungclaus AGATA –DSSD
- E705 : P. Regan AGATA-FATIMA
- E673 : P. John AGATA FATIMA
- E706 : W. Korten AGATA FATIMA VAMOS Plunger
- E676 : S. Leoni AGATA PARIS VAMOS Plunger



E693 : A. Jungclaus - AGATA – DSSD

4th-11th may - 35 detectors running

Search for the alpha cluster structure in heavy elements : case of ^{212}Po ($^{208}\text{Pb} + \alpha$) using the $^{12}\text{C}(^{208}\text{Pb}, ^8\text{Be})^{212}\text{Po}$ reaction. Lifetime measurement of the non-yrast states using the DSAM method

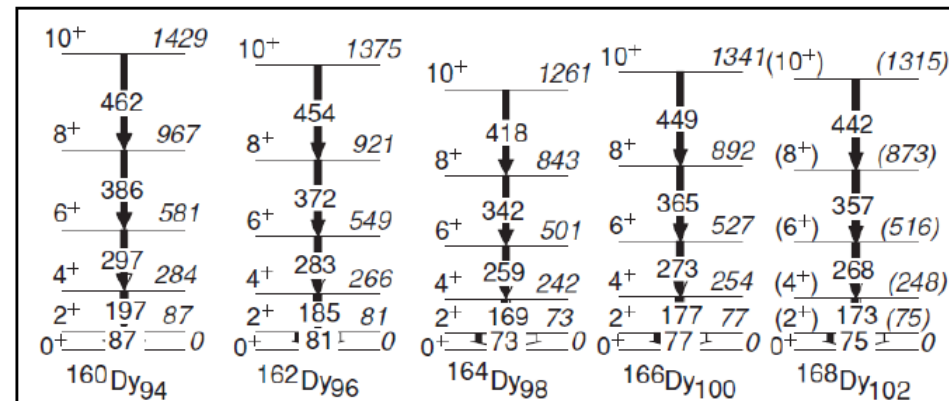
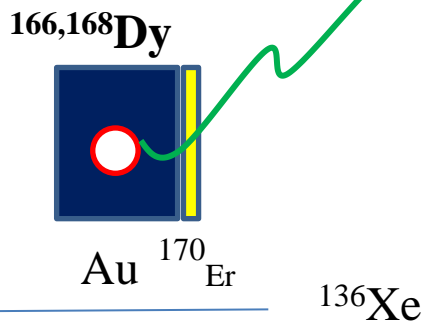


E705 : P. Regan AGATA-FATIMA - 22nd – 27th may

35 detectors running

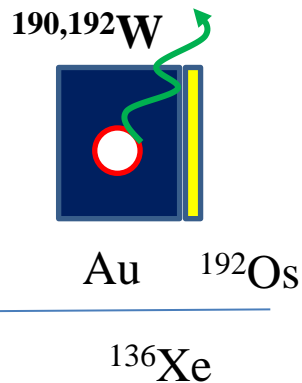
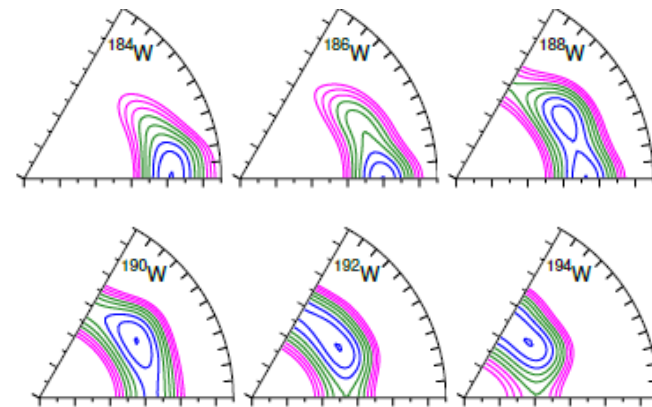
Study of the deformation in the vicinity of ^{170}Dy by lifetime measurement using the FATIMA array using the $^{170}\text{Er}(^{136}\text{Xe}, ^{140,138}\text{Ba})^{166,168}\text{Dy}$ reaction

The experiment was stopped due to a failure of the Er targets

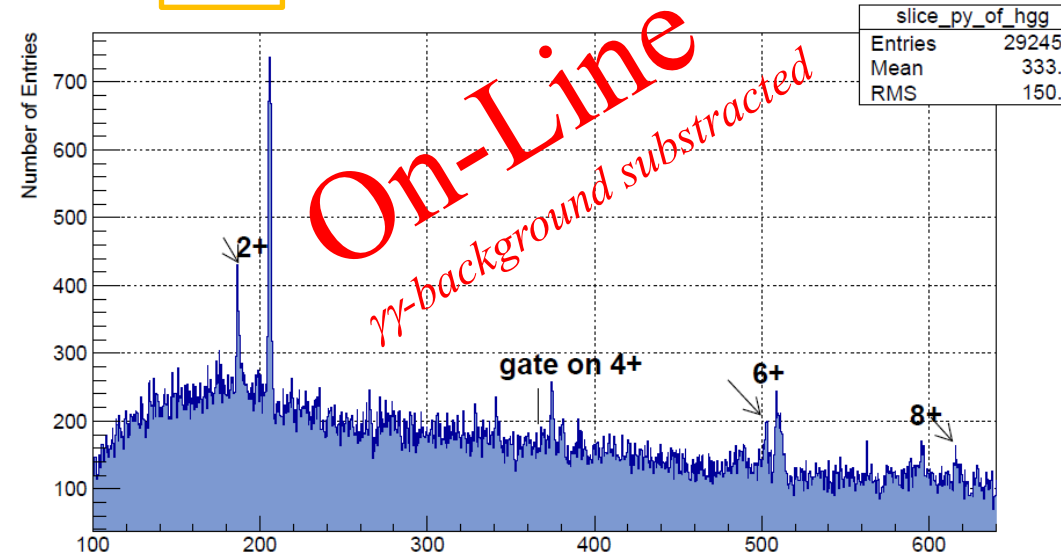


E673 : P. John AGATA FATIMA – du 27th April to 5th of June ; 35 detectors running

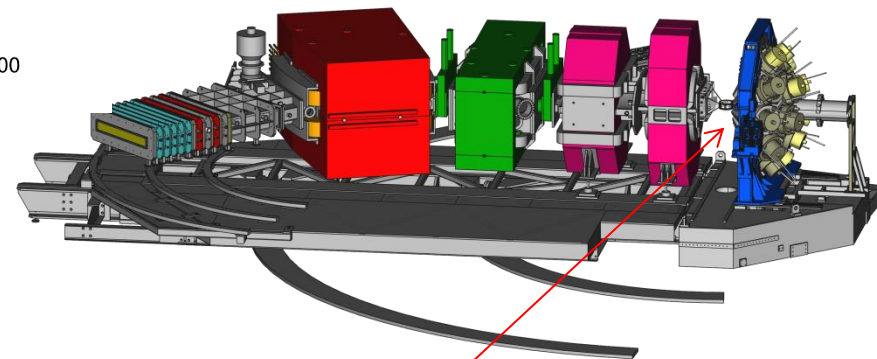
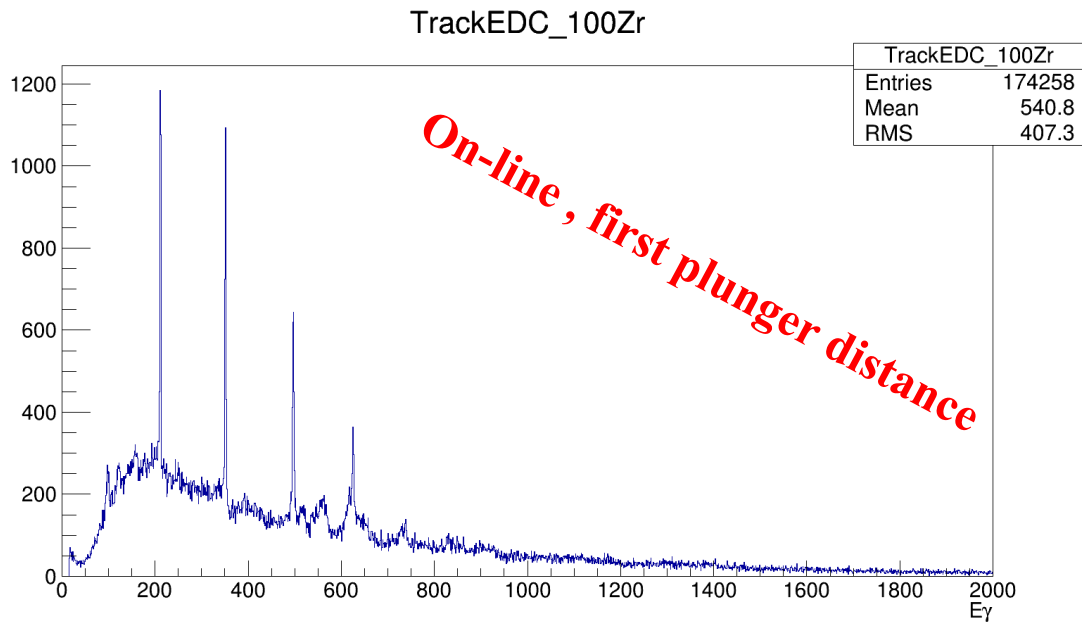
Investigating the shape transition in the W isotopes using by fast timing using the FATIMA array using the $^{192}\text{Os} (^{136}\text{Xe}, ^{138,136}\text{Ba})^{190,192}\text{W}$



^{190}Os in parts of the data gamma-gamma with fatima



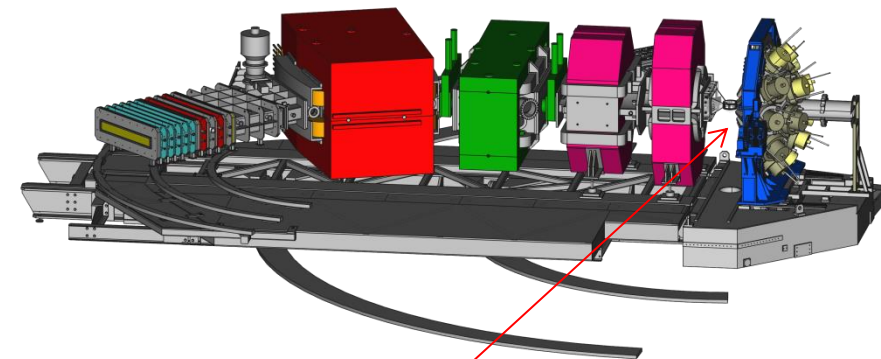
Shape evolution in fission fragments in the A~100 region combining AGATA-VAMOS and a plunger + FATIMA for lifetime measurements using the ${}^9\text{Be}({}^{238}\text{U},\text{FF})$ reaction



+ Plunger

Lifetime measurement in the non-yrast excited states of neutron rich C and O isotopes to probe the 3 body- contribution in the nuclear interaction using the $^{198}\text{Pt}(^{18}\text{O}, ^{16,18}\text{C})^{198,200}\text{Hg}$ reaction.

Branching ratio using the PARIS array and ideally E2/M1 ratio will be measured



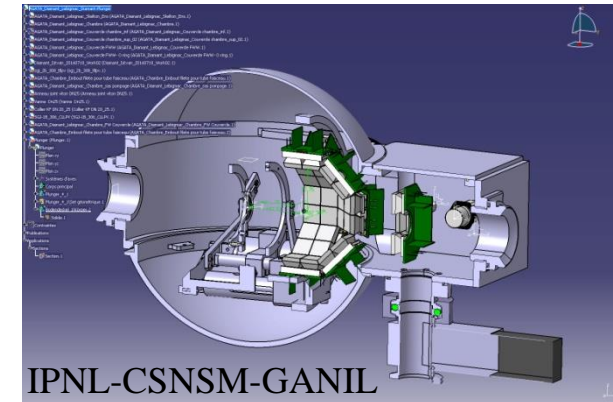
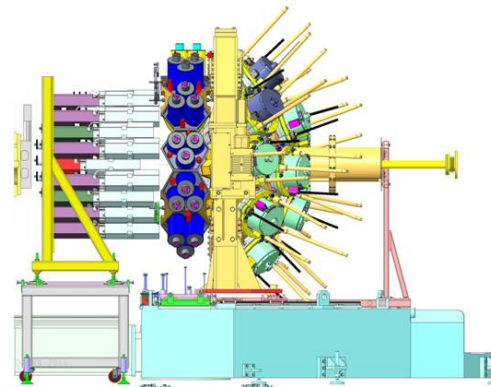
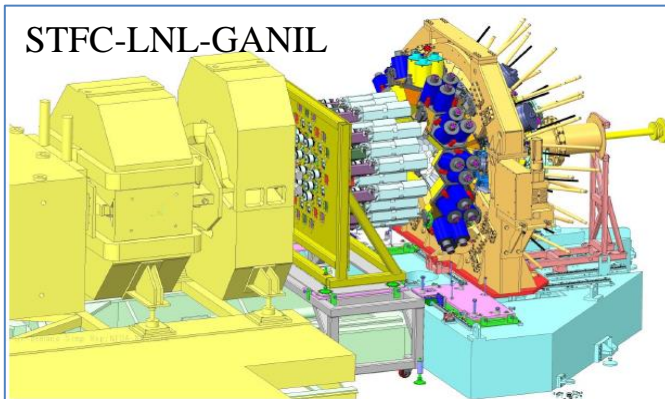
+ Plunger

A third run will be scheduled between mid-October and beginning of December 2017

The remaining AGATA-VAMOS experiment by A. Lemasson et al using the ^{48}Ca target will be scheduled if the target is available. This will empty the VAMOS backlog.

Two other fission-run by C. Schmitt and M. Caamano can be scheduled

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



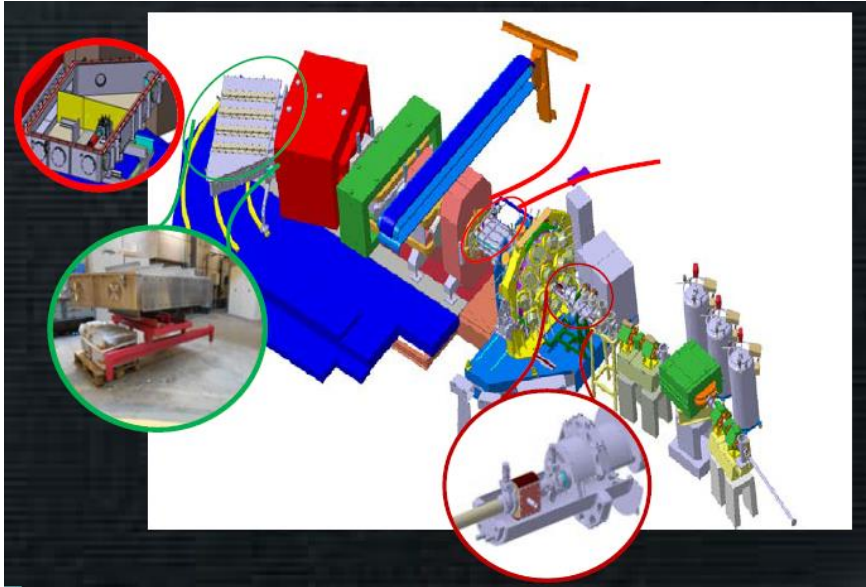
The final mechanical design of NEDA + NWALL foresees the use of 54 self produced NEDA detectors at forward angles and 14 NWALL detectors at around 90 degrees

Start of the campaign : Early 2018 – not yet known how long will be the beam time in 2018

→ See G. de France's presentation

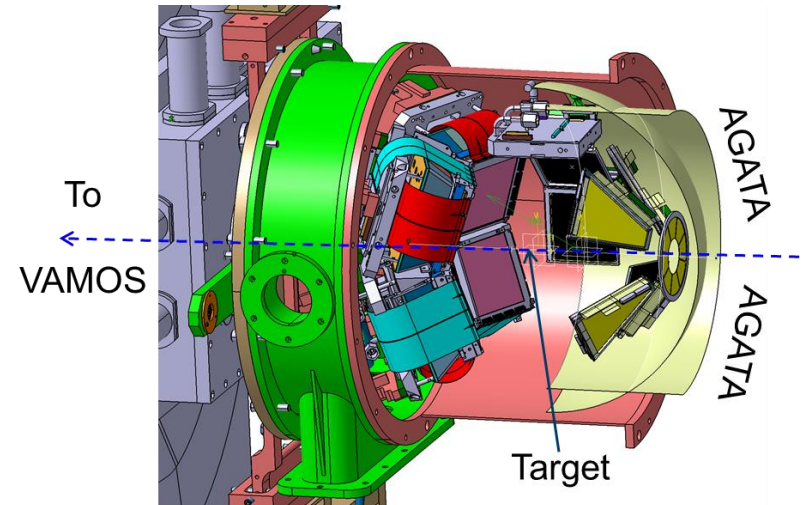
2019-(2020) run *MUGAST-GFM*

VAMOS in GFM for prompt spectroscopy of Heavy Elements



The project will be completed in 2017 and ready for commissioning.

Nucleons transfer spectroscopy using SPIRAL1 ISOL beams



Corresponding call for PAC to be announced.

Conclusion

First results from the 2015 data set have been published or presented in conferences

Four experiments have been performed in 2016 with some limitations due to the targets.

The 2017 run has started with 35 capsules taking data

AGATA was successfully coupled to VAMOS, DSSD, FATIMA and PARIS detectors

Analysis are in progress and more results will come

The next campaign will be the NEDA-DIAMANT setup coupled to AGATA in 2018

Call for the next PAC and schedules beyond 2018 will be released soon

You are welcome to help

Many thanks to all AGATA collaborators!