Istituto Nazionale di Fisica Nucleare
LABORATORI NAZIONALI DI LEGNARO

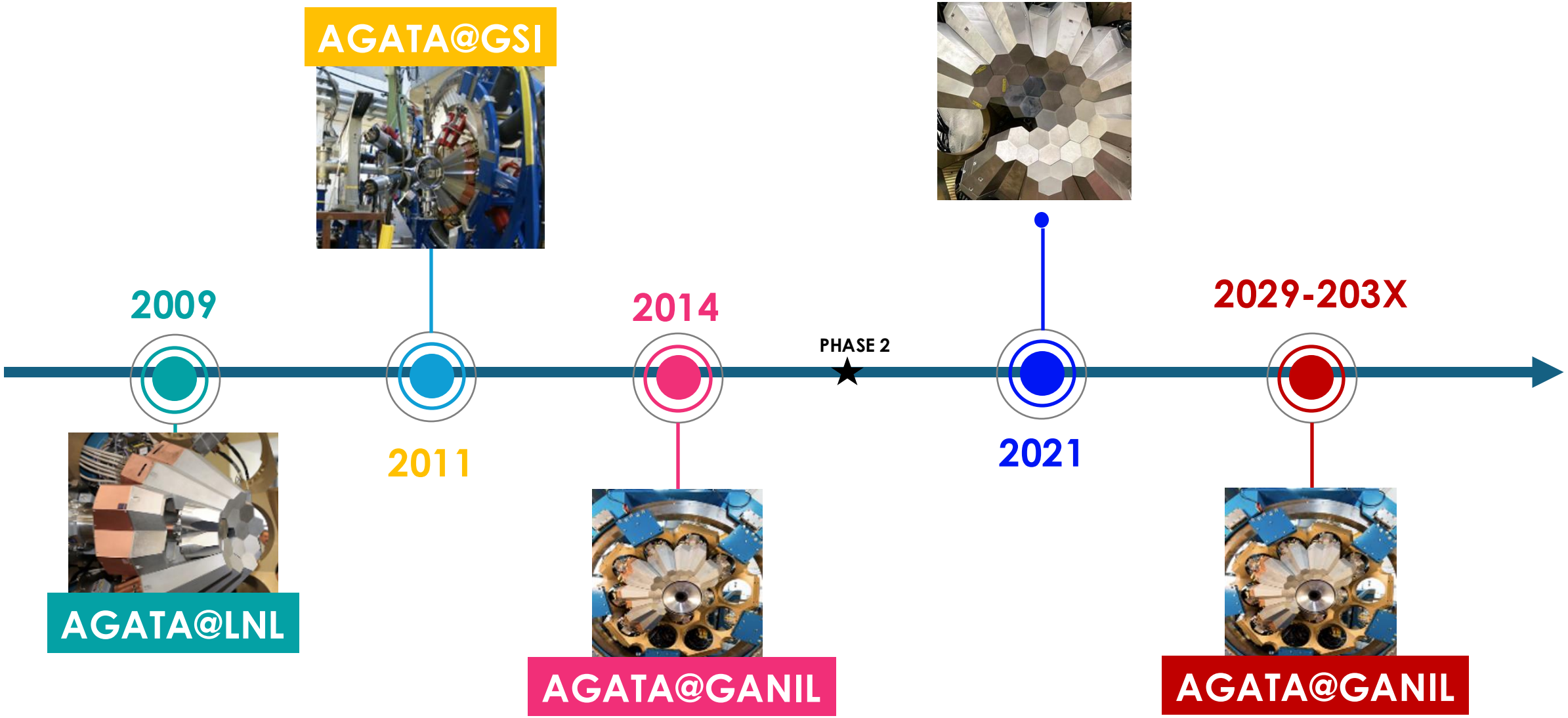
The AGATA campaign at LNL

25th Agata Week GSI
Alain Goasduff (INFN LNL)

The AGATA Timeline

Local project manager
J.J. Valiente-Dobón – A. Goasduff

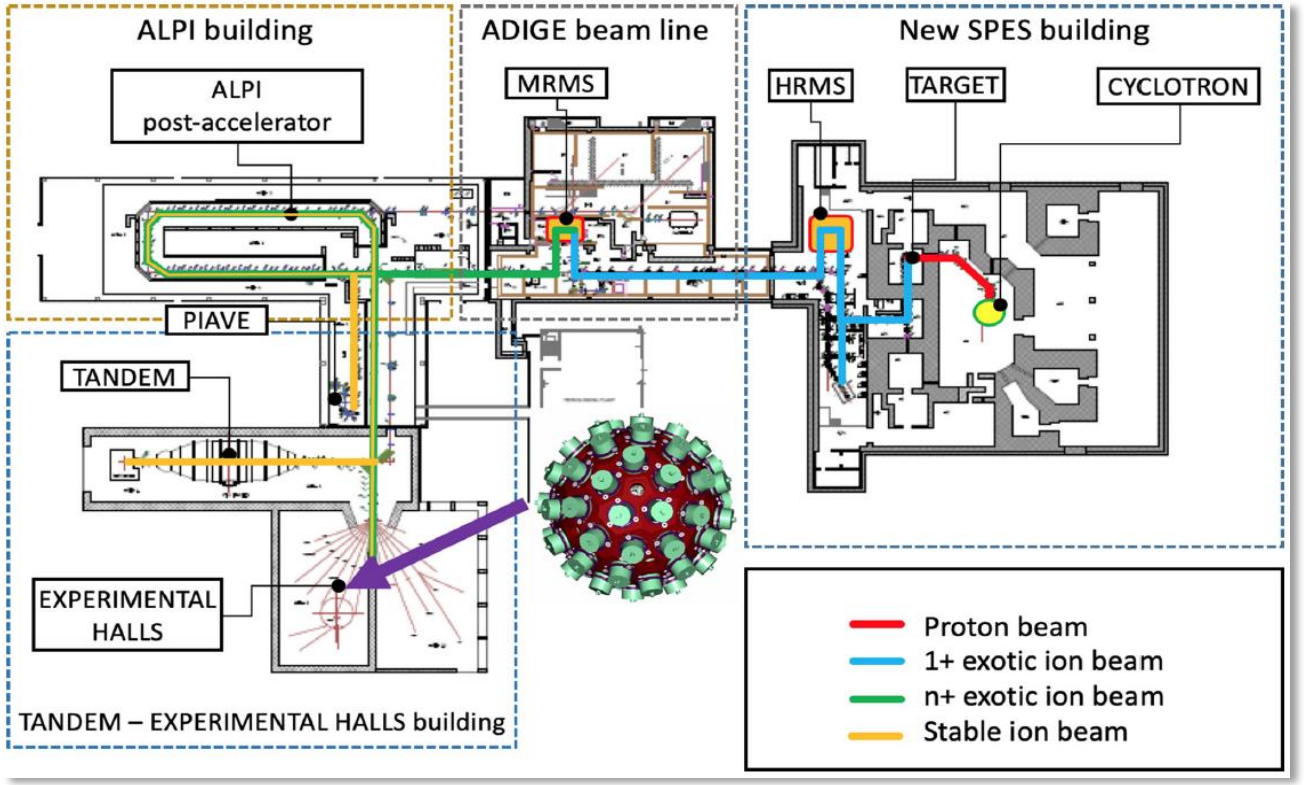
Scientific coordinator
M. Zielinska



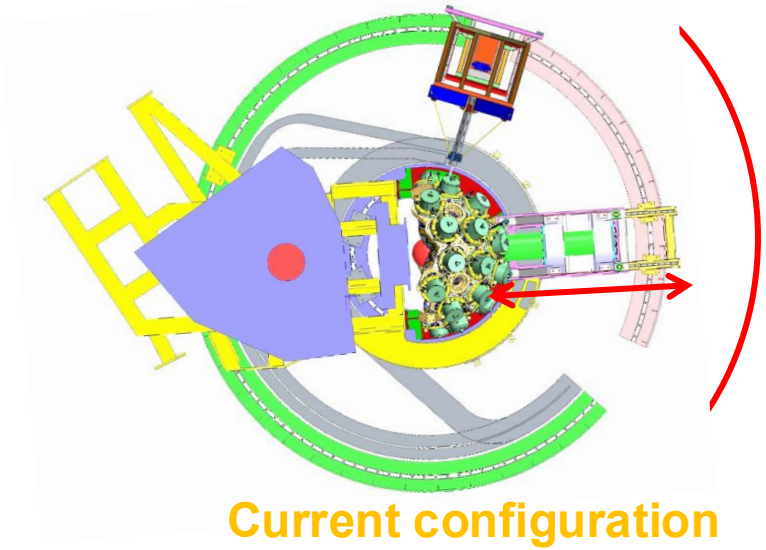
AGATA @ LNL: 2021 - 2028

Two configurations:

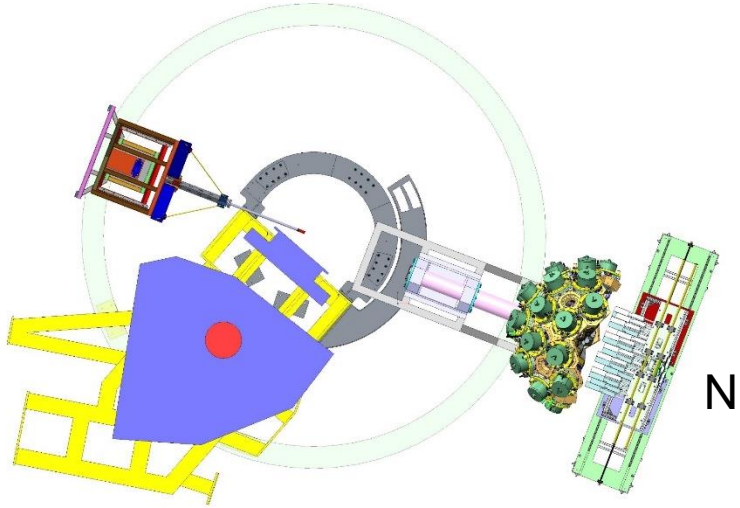
- 2021 – mid-2026: AGATA coupled to PRISMA
- Mid-2026 – mid-2028: AGATA at “zero-degree”



AGATA coupled with PRISMA



Current configuration

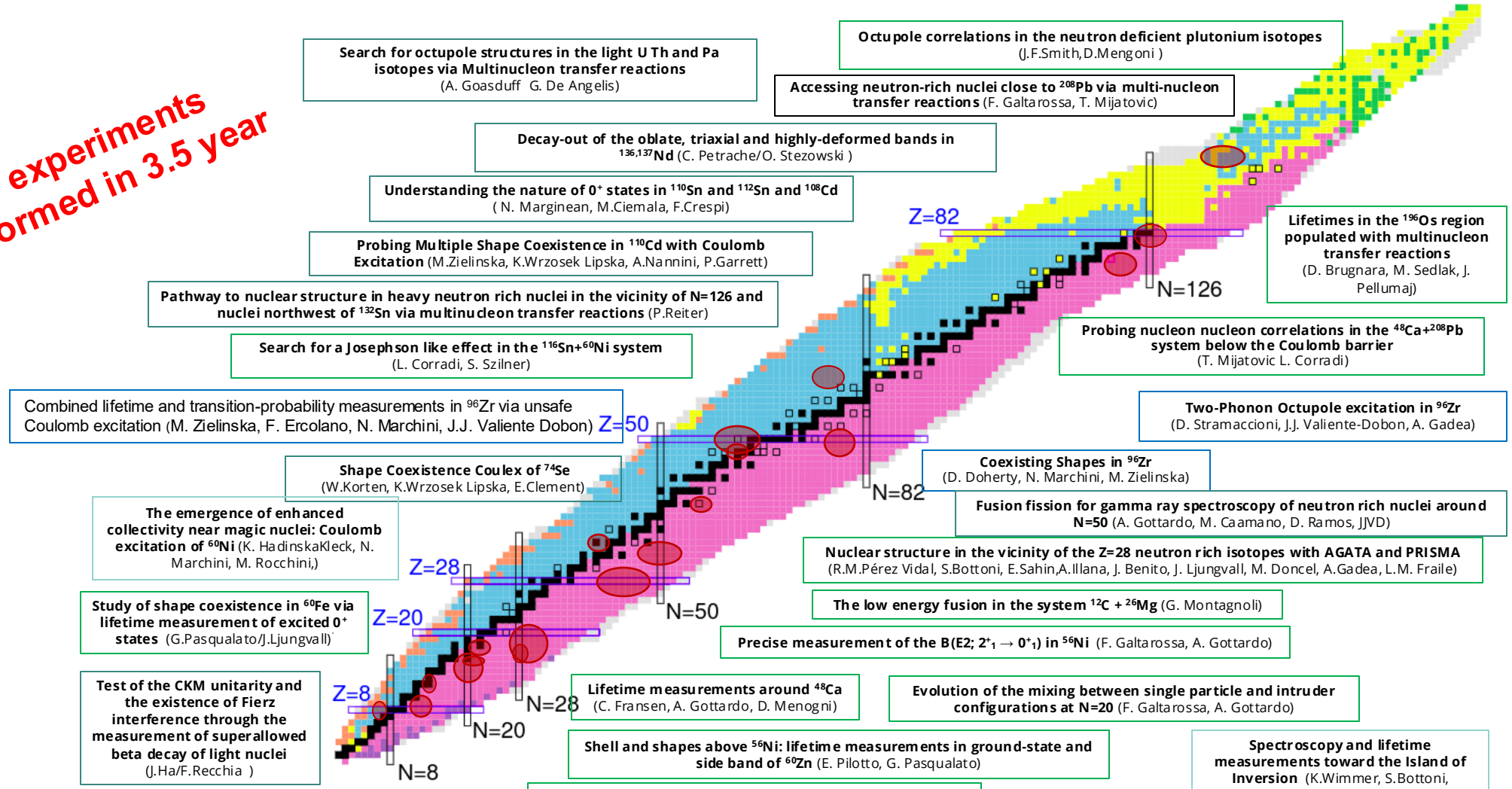


NEDA

AGATA zero degrees

The physics campaign (so far)

45 experiments performed in 3.5 year



Search for octupole structures in the light U Th and Pa isotopes via Multinucleon transfer reactions (A. Goasduff G. De Angelis)

Octupole correlations in the neutron deficient plutonium isotopes (J.F.Smith, D.Mengoni)

Accessing neutron-rich nuclei close to ^{208}Pb via multi-nucleon transfer reactions (F. Galtarossa, T. Mijatovic)

Decay-out of the oblate, triaxial and highly-deformed bands in ^{136,137}Nd (C. Petrache/O. Stezowski)

Understanding the nature of 0^+ states in ^{110}Sn and ^{112}Sn and ^{108}Cd (N. Marginean, M.Ciemala, F.Crespi)

Probing Multiple Shape Coexistence in ^{110}Cd with Coulomb Excitation (M.Zielinska, K.Wrzosek Lipska, A.Nannini, P.Garrett)

Pathway to nuclear structure in heavy neutron rich nuclei in the vicinity of N=126 and nuclei northwest of ^{132}Sn via multinucleon transfer reactions (P.Reiter)

Search for a Josephson like effect in the ^{116}Sn+^{60}Ni system (L. Corradi, S. Szilner)

Combined lifetime and transition-probability measurements in ^{96}Zr via unsafe Coulomb excitation (M. Zielinska, F. Ercolano, N. Marchini, J.J. Valiente Dobon)

Shape Coexistence Coulex of ^{74}Se (W.Korten, K.Wrzosek Lipska, E.Clement)

The emergence of enhanced collectivity near magic nuclei: Coulomb excitation of ^{60}Ni (K. HadinskaKleck, N. Marchini, M. Rocchini,)

Study of shape coexistence in ^{60}Fe via lifetime measurement of excited 0^+ states (G.Pasqualato/J.Ljungvall)

Test of the CKM unitarity and the existence of Fierz interference through the measurement of superallowed beta decay of light nuclei (J.Ha/F.Recchia)

Lifetimes in the ^{196}Os region populated with multinucleon transfer reactions (D. Brugnara, M. Sedlak, J. Pellumaj)

Probing nucleon nucleon correlations in the ^{48}Ca+^{208}Pb system below the Coulomb barrier (T. Mijatovic L. Corradi)

Two-Phonon Octupole excitation in ^{96}Zr (D. Stramaccioni, J.J. Valiente-Dobon, A. Gadea)

Coexisting Shapes in ^{96}Zr (D. Doherty, N. Marchini, M. Zielinska)

Fusion fission for gamma ray spectroscopy of neutron rich nuclei around N=50 (A. Gottardo, M. Caamano, D. Ramos, JJVD)

Nuclear structure in the vicinity of the Z=28 neutron rich isotopes with AGATA and PRISMA (R.M.Pérez Vidal, S.Bottoni, E.Sahin, A.Illana, J. Benito, J. Ljungvall, M. Doncel, A.Gadea, L.M. Fraile)

The low energy fusion in the system ^{12}C + ^{26}Mg (G. Montagnoli)

Precise measurement of the B(E2; $2^+_1 \rightarrow 0^+_1$) in ^{56}Ni (F. Galtarossa, A. Gottardo)

Lifetime measurements around ^{48}Ca (C. Fransen, A. Gottardo, D. Menogni)

Evolution of the mixing between single particle and intruder configurations at N=20 (F. Galtarossa, A. Gottardo)

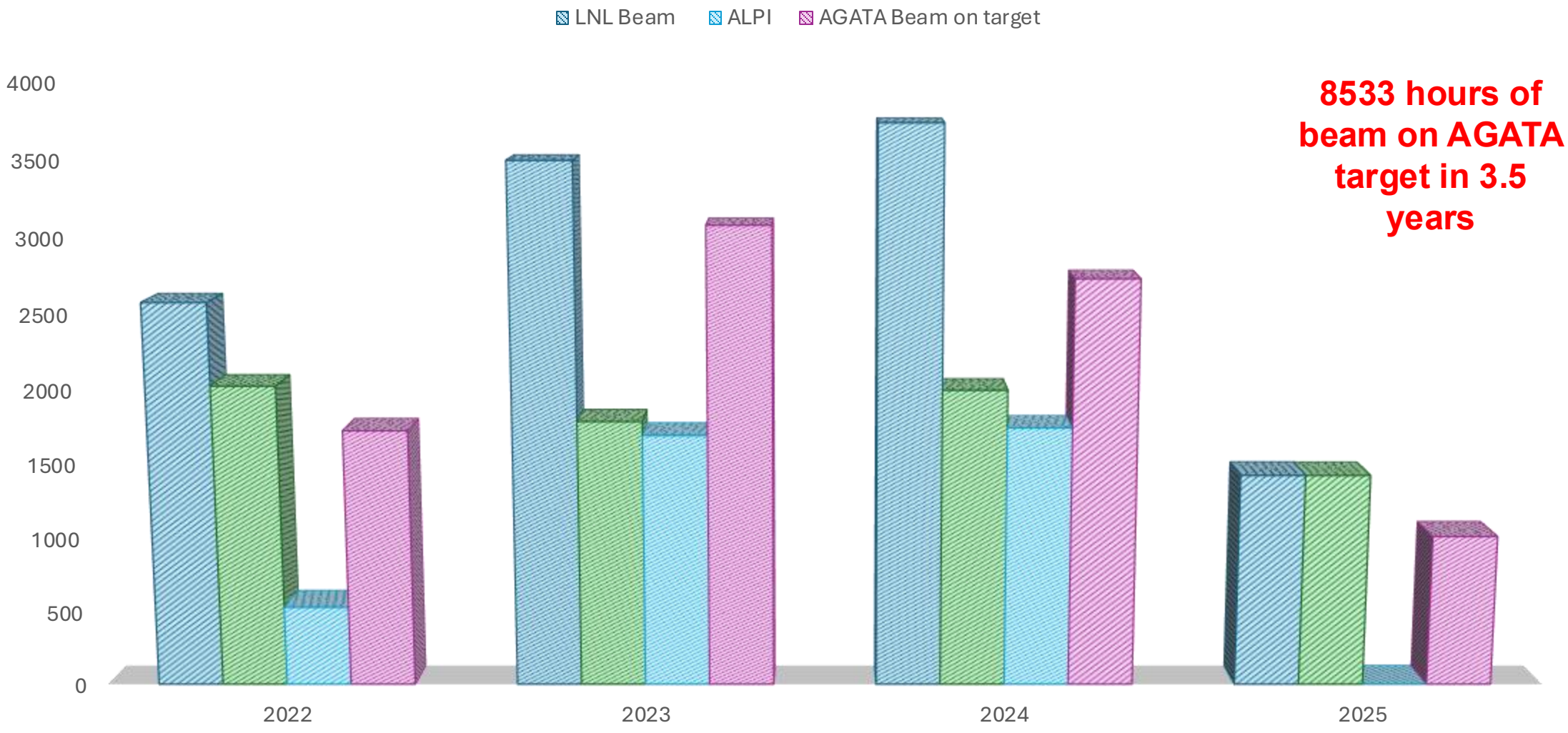
Shell and shapes above ^{56}Ni: lifetime measurements in ground-state and side band of ^{60}Zn (E. Pilotto, G. Pasqualato)

Spectroscopy and lifetime measurements toward the Island of Inversion (K.Wimmer, S.Bottoni, G.Benzoni, F.Recchia, P.Aguilera)

Lifetime of the 6793 keV state in ^{15}O (J.Skowronski, E. Pilotto)

Lifetime measurements intruder states towards the island of inversion along the N=20 shell closure (Z. Irene, D. Brugnara)

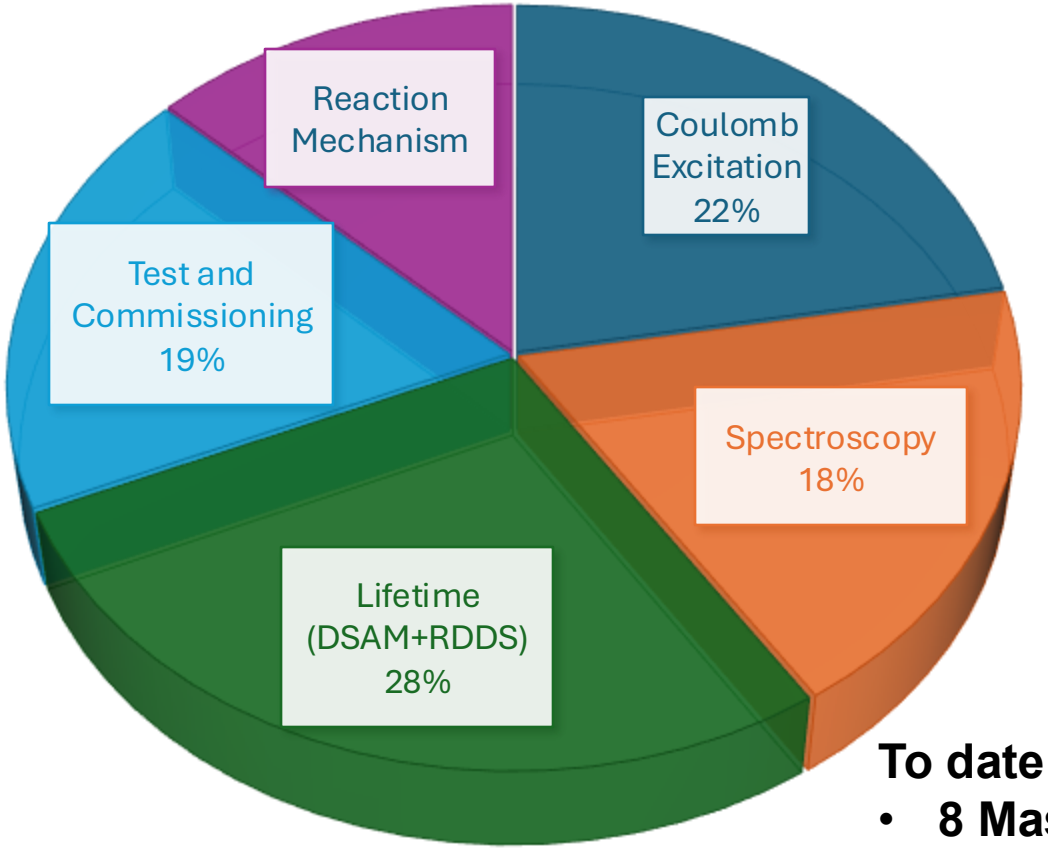
The physics campaign (so far)

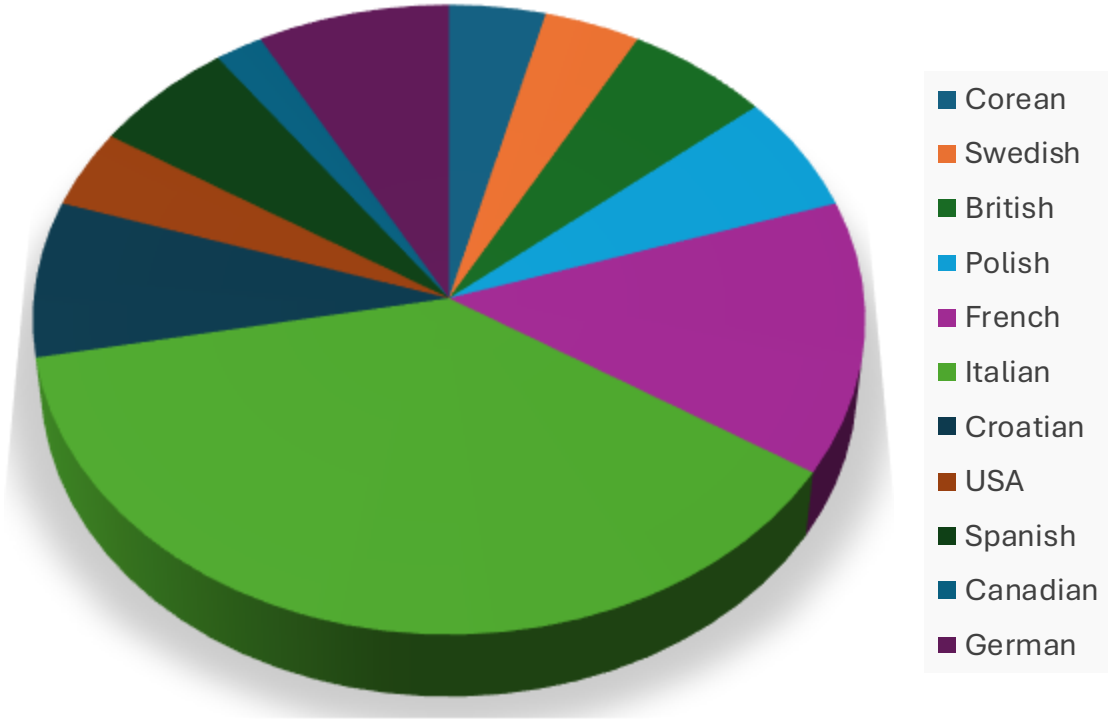


8533 hours of beam on AGATA target in 3.5 years

The Physics Campaign (so far)

EXPERIMENTS





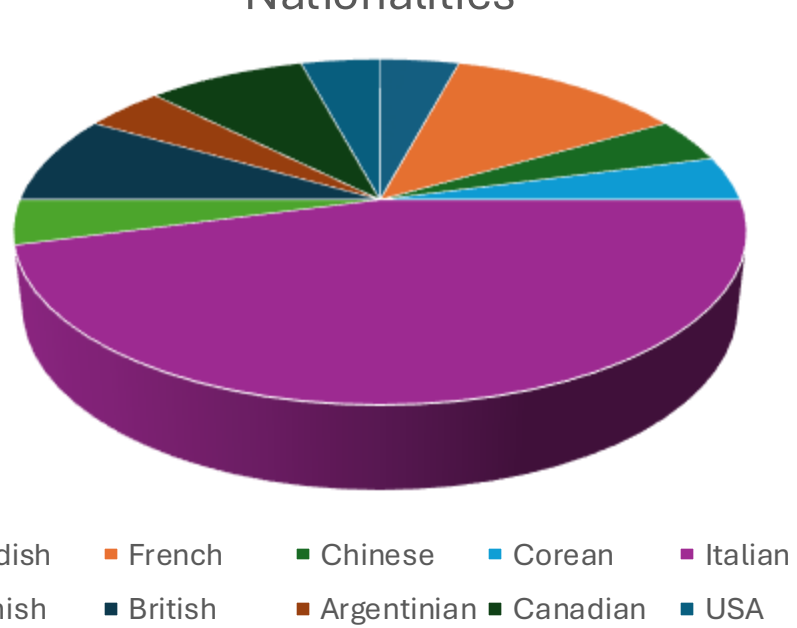
To date, data from the AGATA@LNL campaign are used for:

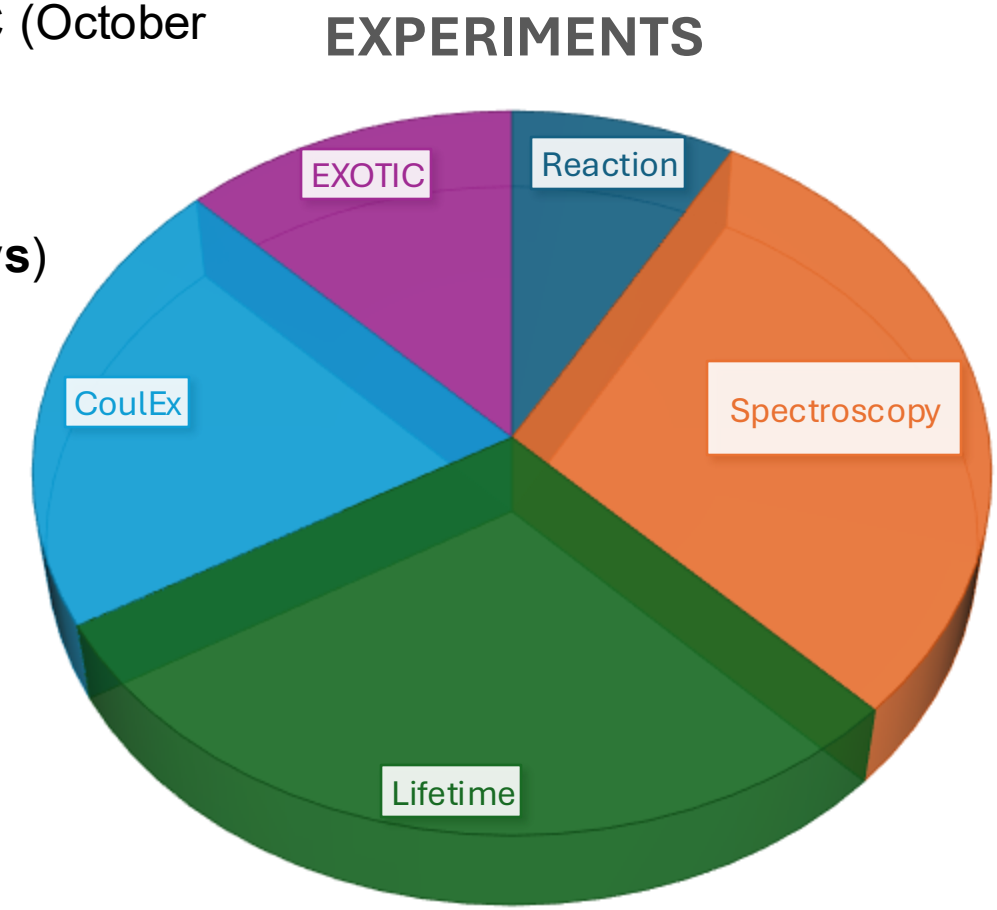
- **8 Master thesis**
- **17 Ph.D. Thesis**
- **2 draft of publications already circulating, more to come**

The Physics Campaign to come (2025-2026)

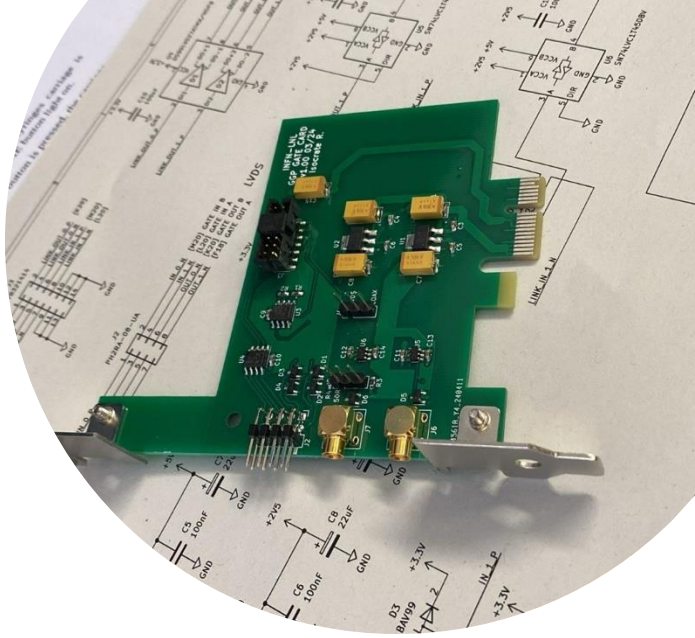
24 Experiments (250 days) with AGATA submitted to the last PAC (October 2025):

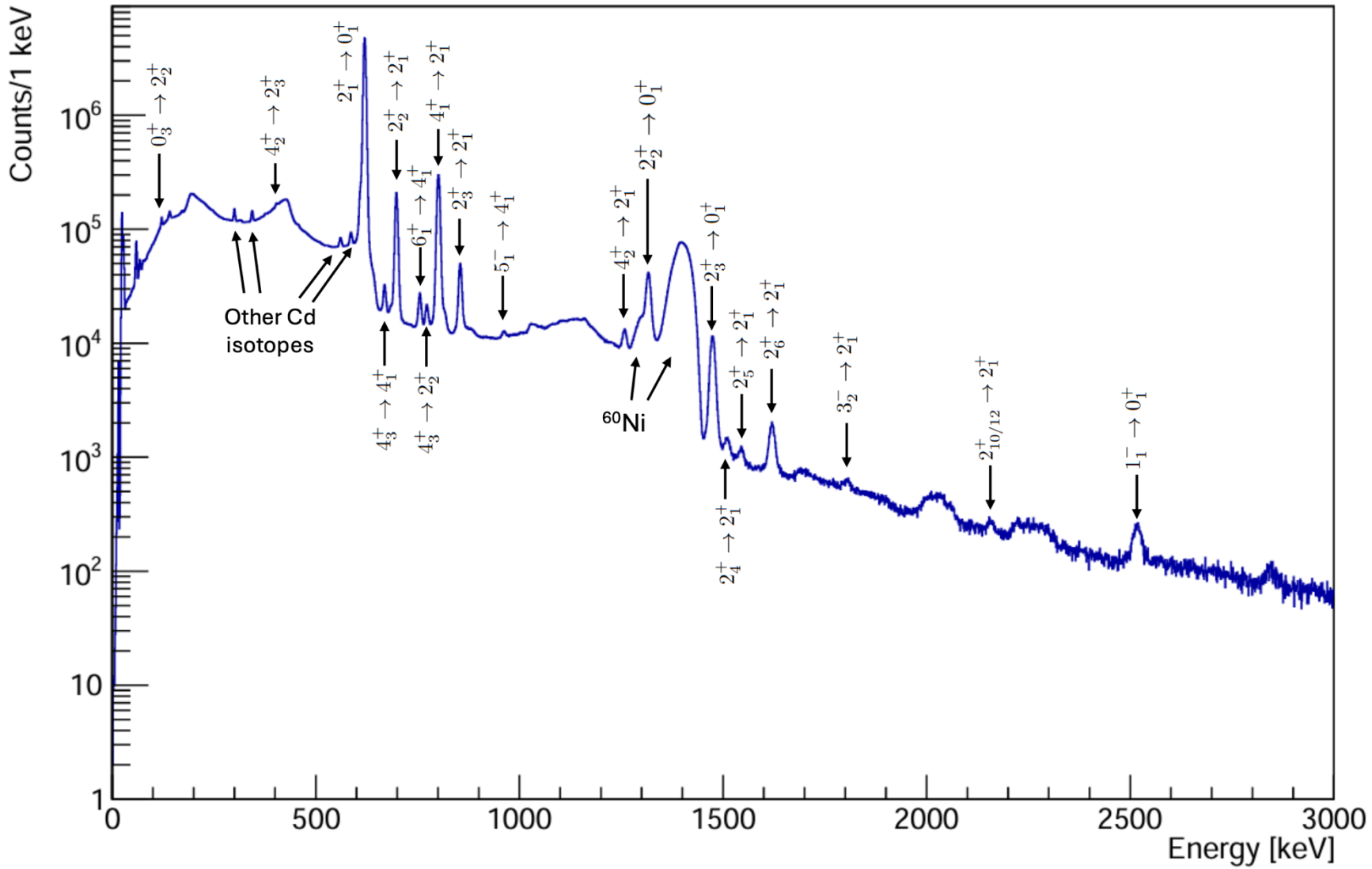
- 11 TANDEM Only (**97 days**)
- 2 TANDEM+ALPI (**20 days**)
- 11 PIAVE+ALPI (**133 days**) mostly with the ^{238}U beam (**87 days**)





New low level hardware trigger system for external gate on AGATA





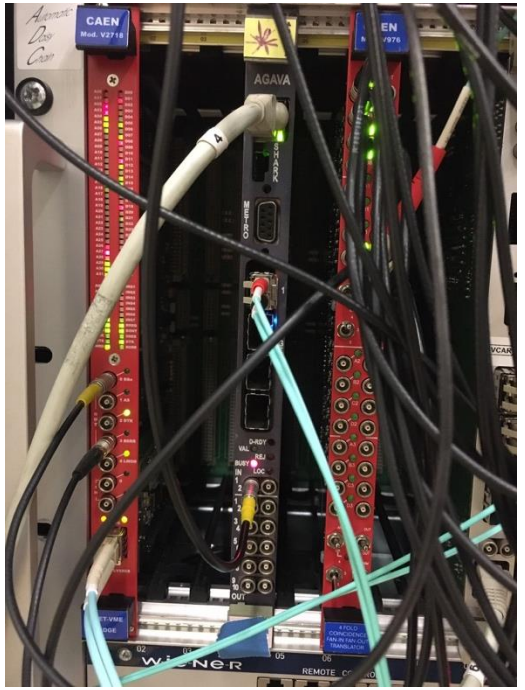
Courtesy of T. La Marca

Low level external gate application

1. Beam-on / Beam-off measurement for decay spectroscopy
2. External gate from ancillary detectors by-passing the AGAVA

PRISMA (1 trigger channel)
SPIDER (56 trigger channels)
EUCLIDES (55 trigger channels)
SAURON (32 trigger channels)

CAEN VX2740 – Ethernet readout 64ch
1 Trigger output / board

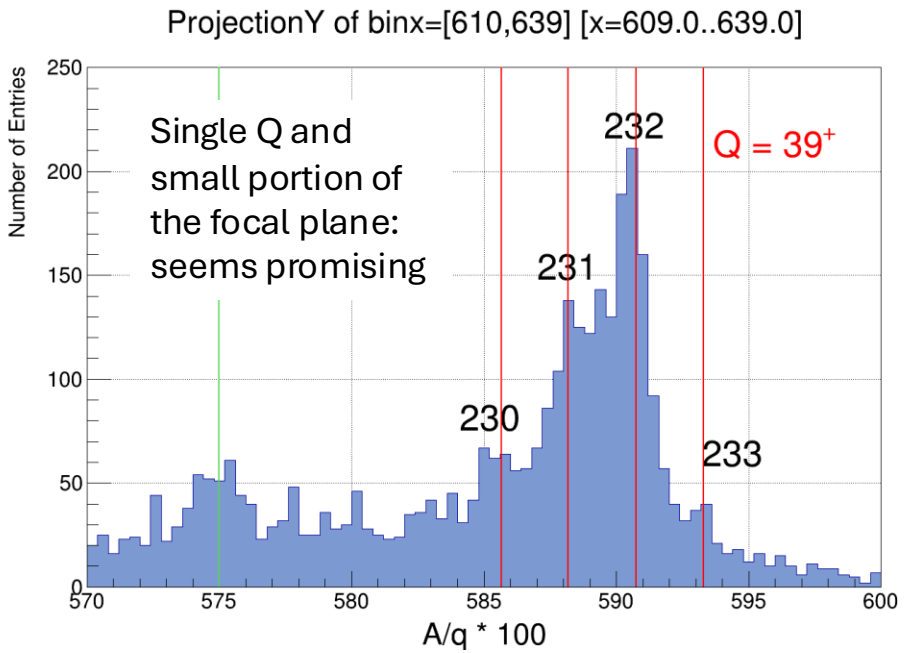


V2495 used as FIFO for the logical GATE
Signal sent directly to the GGP FPGA to act at the local trigger level

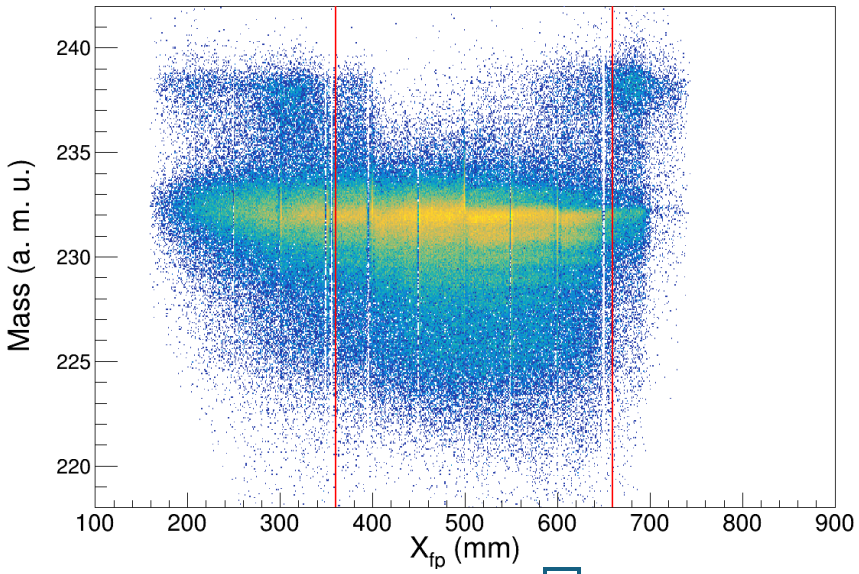
SPIDER (1 trigger channel) @ 1kHz
EUCLIDES (2 trigger channels) @ 20 kHz
SAURON (2 trigger channels) @ 40 kHz

Courtesy of D. Bazzaco – R. Isocrate

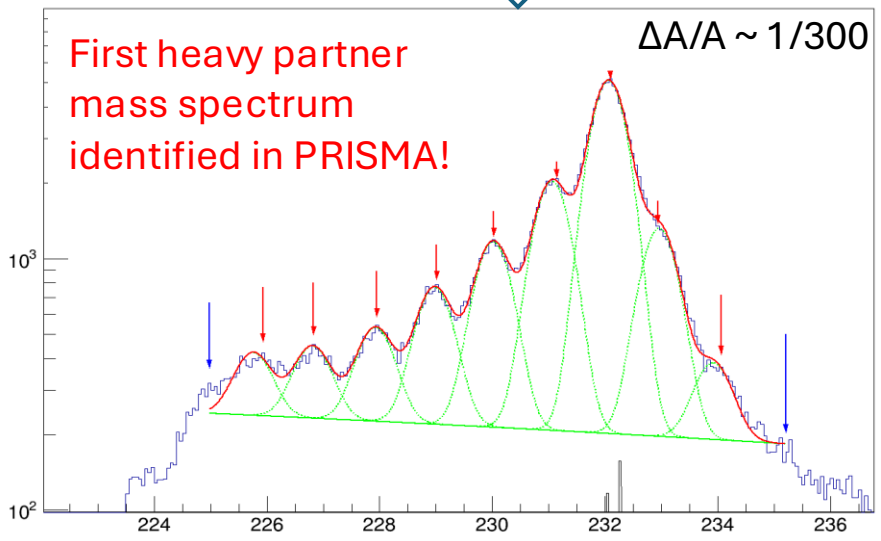
Direct mass identification in PRISMA of ions in the actinide region



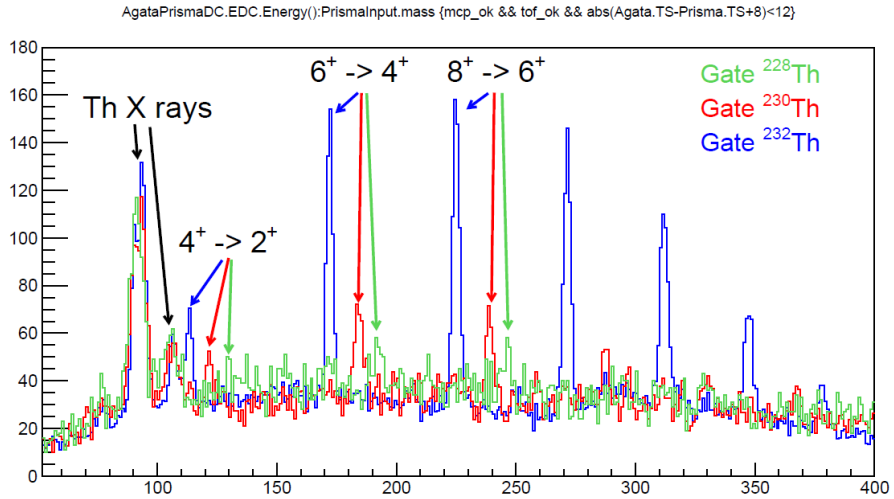
Summing over all 12 charge states and correcting for aberrations



Taking a portion of the focal plane…

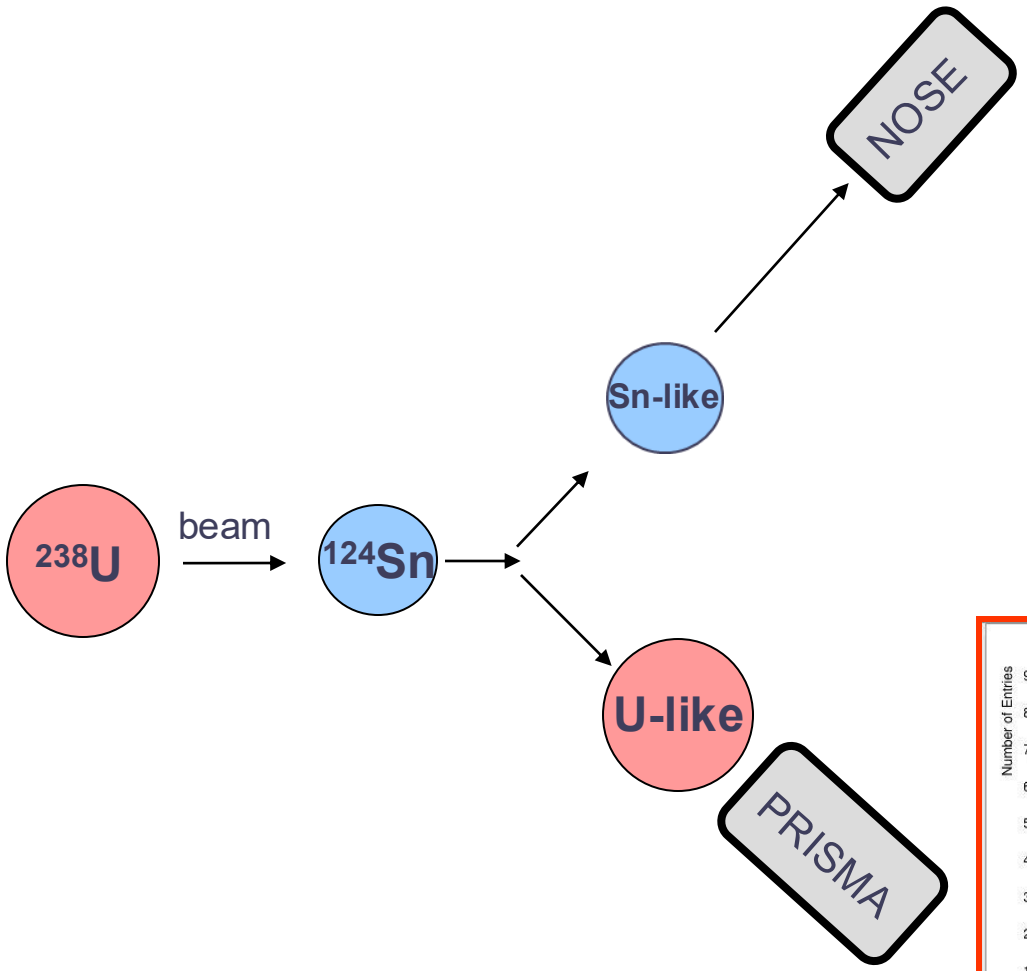


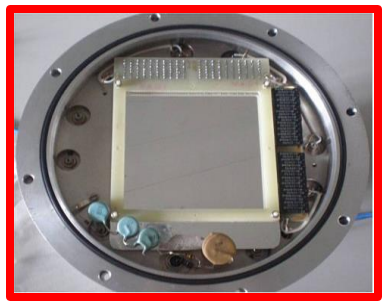
Gamma rays confirm the identification

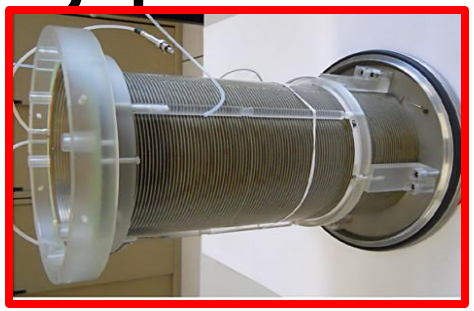


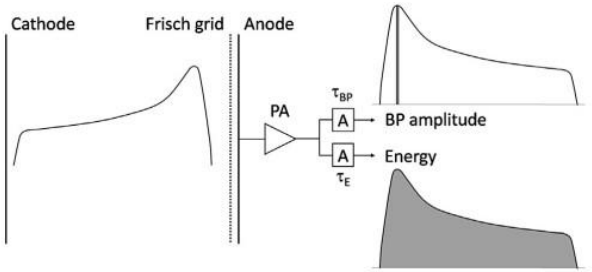
Courtesy of F. Galtarossa – See his talk at EUNPC25

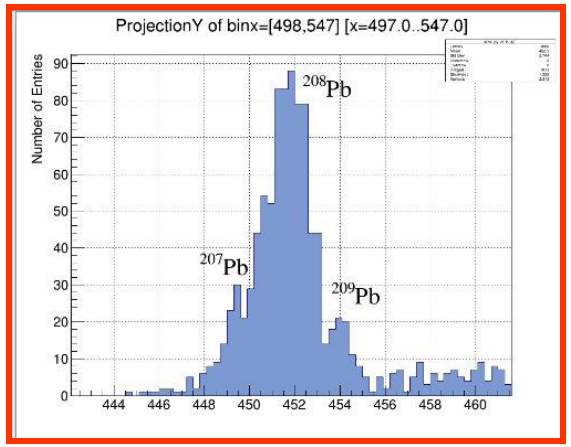
Z-identification from the binary partner

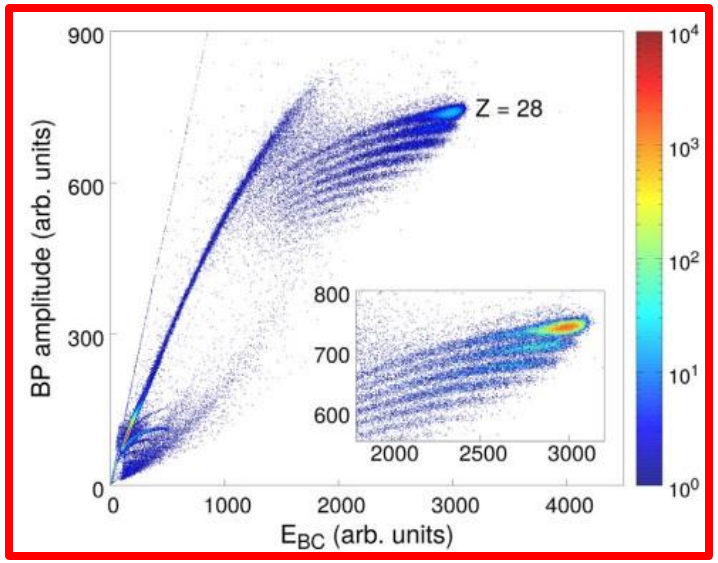








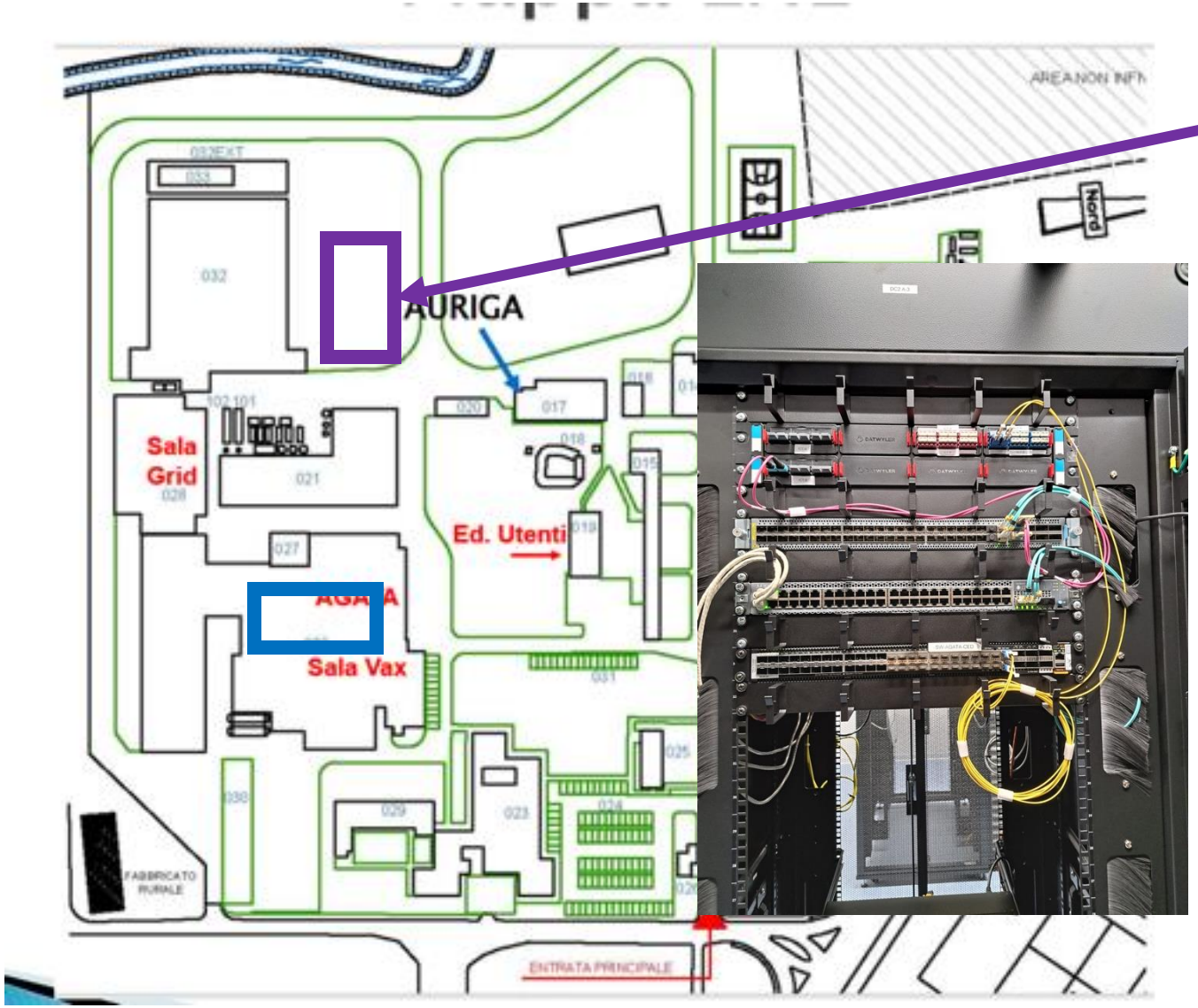




Courtesy of F. Galtarossa – L. Corradi

E. Fioretto et al. Nucl. Inst. Meth. A **899** (2018) 73

Status of LNL Infrastructure



New Data Center has been delivered

- AGATA Services Network has been ported to the new CC
- Test of the link with ancillary servers foreseen for **fall 2025**
- Move of all ancillary machines + AGATA analysis and services nodes **Winter 2025**

Courtesy of N. Toniolo

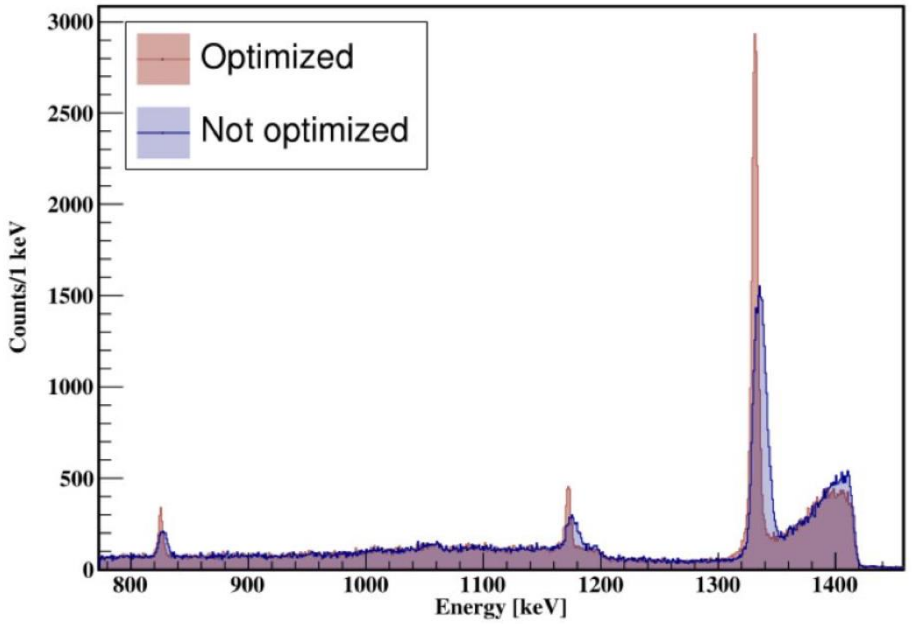
NEAR-LINE analysis

Dedicated new analysis package:

- Using the ROOT output of the agapro package
- Distributed analysis on 4 analysis nodes
- Full analyzed of the ancillaries+AGATA data

Full analysis package citable:

DOI 10.5281/zenodo.8329198



IP2IGAMMA / agapro

agapro

Star 0

prod | agapro | History | Find file | Code

Forked from IPNL_GAMMA / agapro
47 commits behind, 310 commits ahead of the upstream repository.

Merge branch 'preprod' into 'prod'
Guillaume Baulieu authored 1 year ago
ef1d72e7

Name	Last commit	Last update

Project information
This is a fork of agapro from IPNL_gamma. It is intended to contain the software for the AGATA Phase 2

1,513 Commits
12 Branches
8 Tags

gamma / AgataSelector

AgataSelector

Star 2

main | agataselector | History | Find file | Code

Adds check for a valid events in ancillaries
Daniele Brugnara authored 5 days ago
63e391ef

Name	Last commit	Last update
Images	Updates the README.md	1 year ago
Scripts	Fixes a couple of bugs of R...	1 week ago
Tests	Adds the possibility to calcu...	3 weeks ago

Project information
Data analysis code for the AGATA+ancillary data based on the ROOT framework.

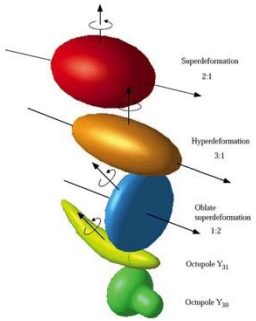
data analysis | Physics

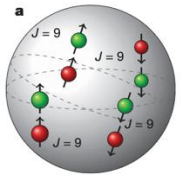
1,403 Commits
8 Branches
6 Tags
6 Releases

Courtesy of D. Brugnara – G. Baulieu

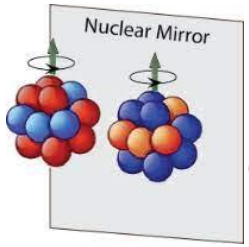
The future zero degree campaign: 2027 – mid 2028

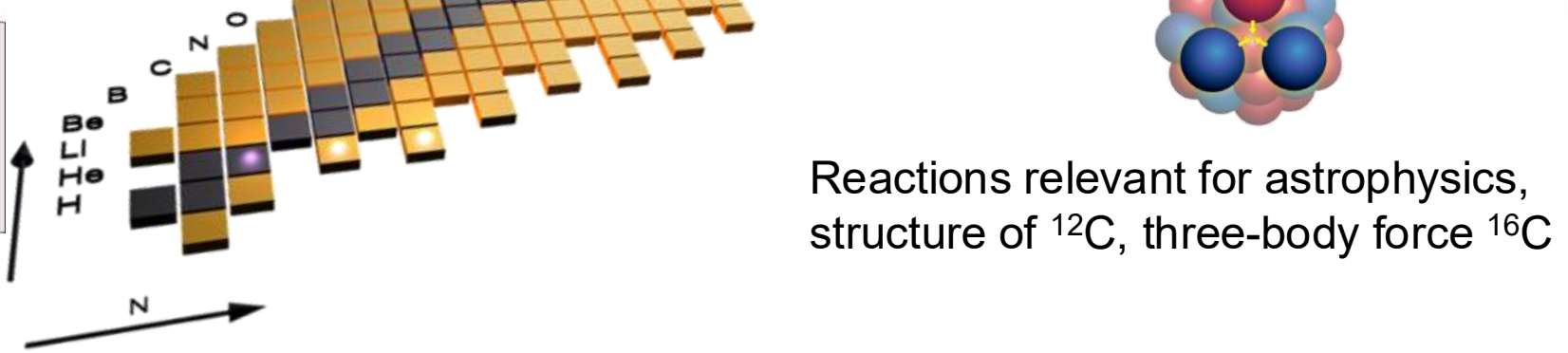
Hot rotating nuclei, GDR, superdeformation, high-spin states…

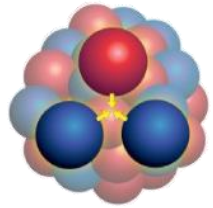




Isospin symmetry, proton neutron pairing and spectroscopy of N~Z nuclei



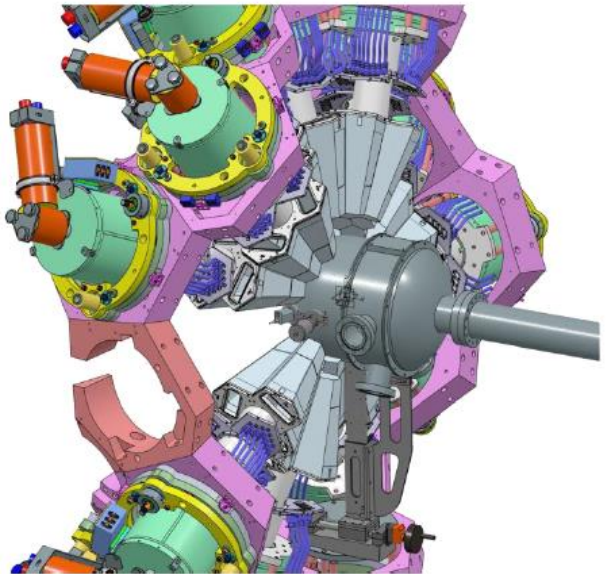


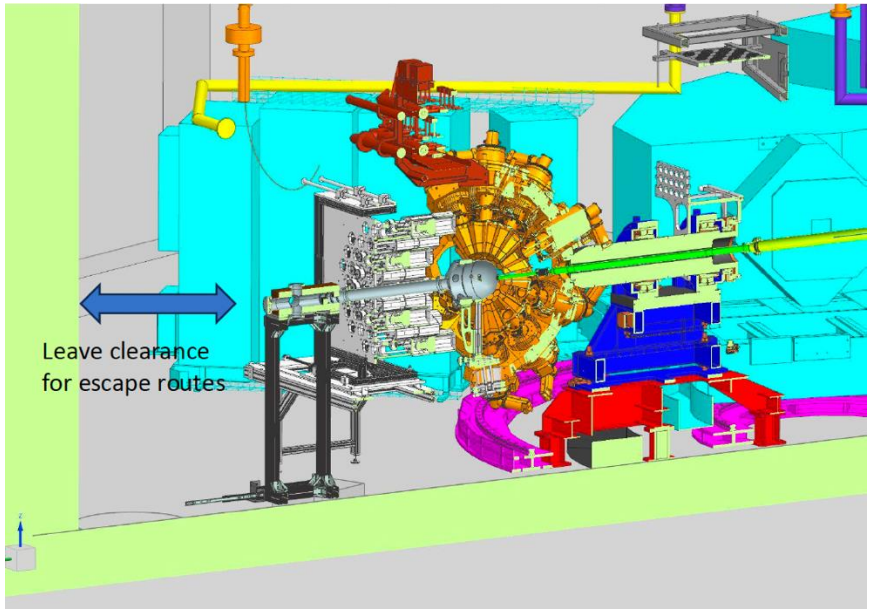


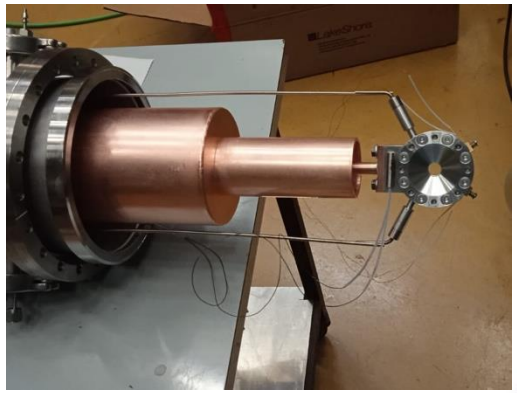
Reactions relevant for astrophysics, structure of ^{12}C, three-body force ^{16}C

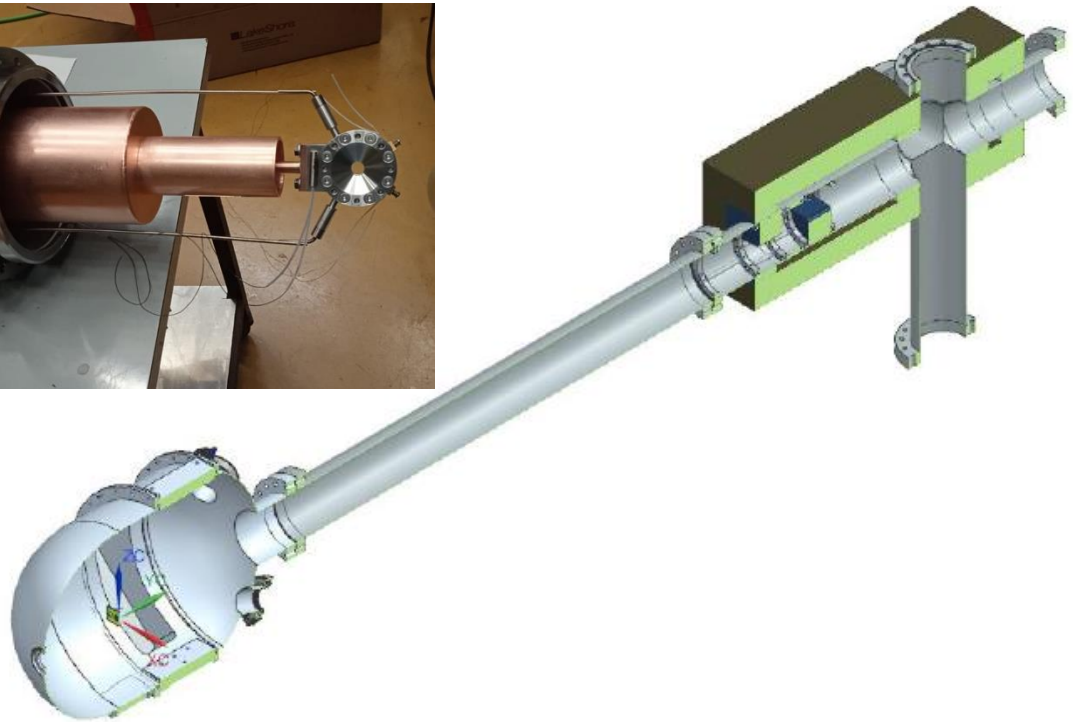
Status of the zero degree campaign

- Mechanical design have been finalized.
- Production of the new AGATA support has been made.
- All infrastructure (LN2, …) is finalized
- Production of the new reaction chamber and beam dump is on-going
- Integration of the ancillaries and new target system on-going



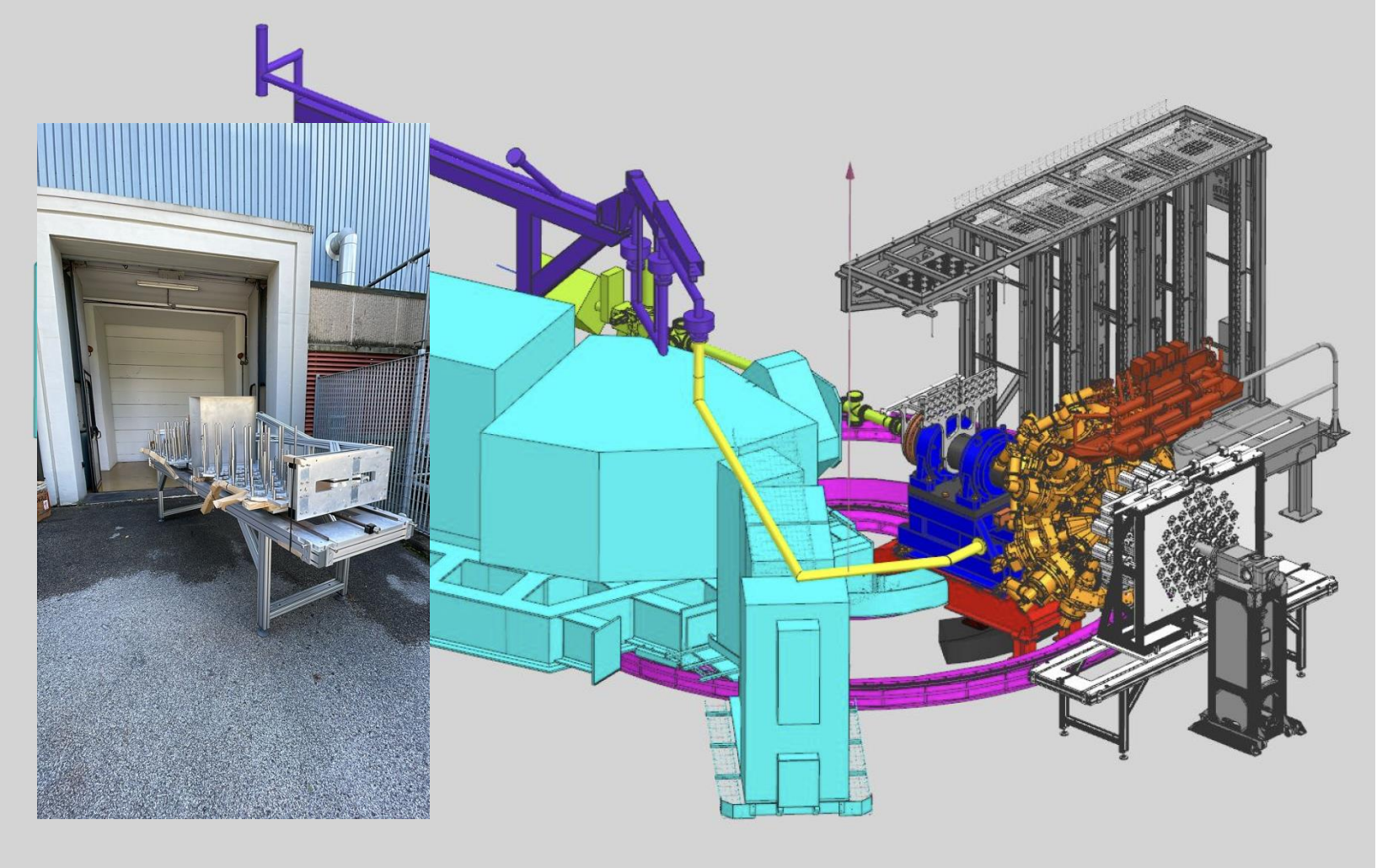






Courtesy of G. Benzoni

Zero degree campaign “bulky” ancillaries

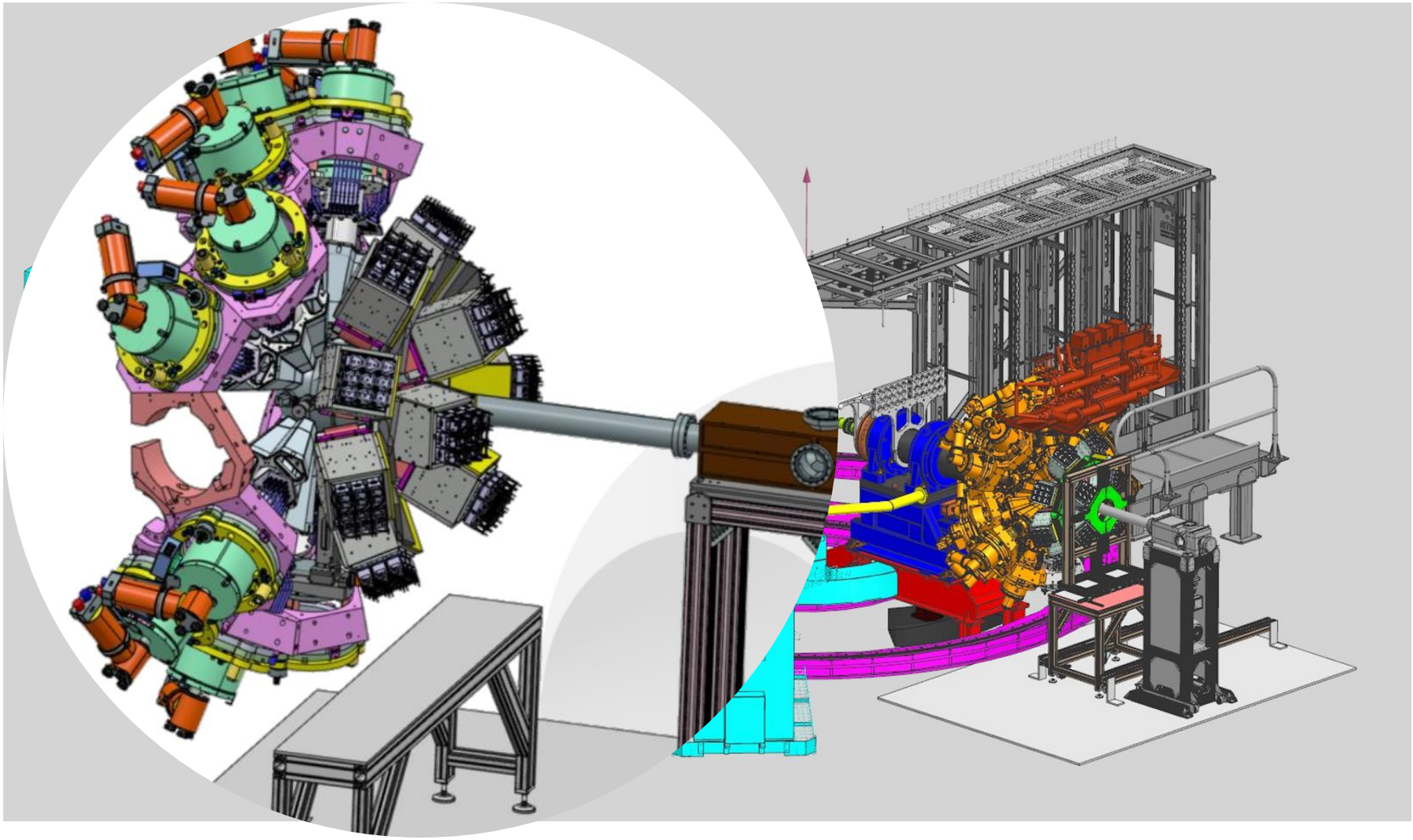


NEDA Neutron Detector Array

- 54 liquid scintillator cells
- 50 cm from the target
- Neutron discimination:
  - PSA
  - Time of flight
- Digital electronics compatible with AGATA
- DAQ integration is on-going

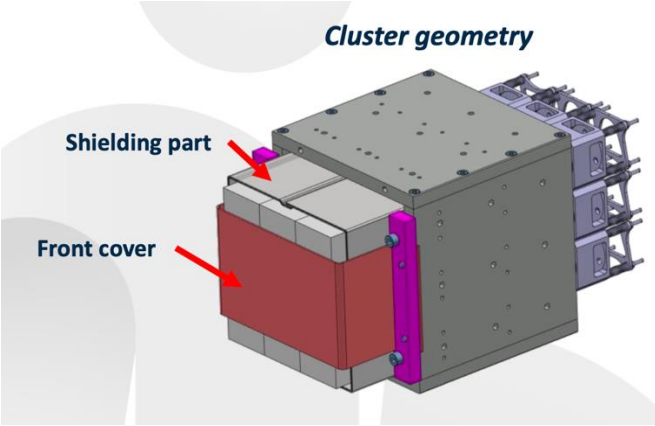
J.J. Valiente Dobón, Nucl. Inst. Meth. A **927** (2019) 81

Zero degree campaign “bulky” ancillaries



PARIS phoswich array

- 10 cluster made of 9 phoswiches
- 2 rings at forward angles:
  - 6 clusters at 60 degrees
  - 4 clusters at 15 degrees
- Same electronics than present $LaBr_3$ – fully integrated



http://paris.ifj.edu.pl

Conclusions

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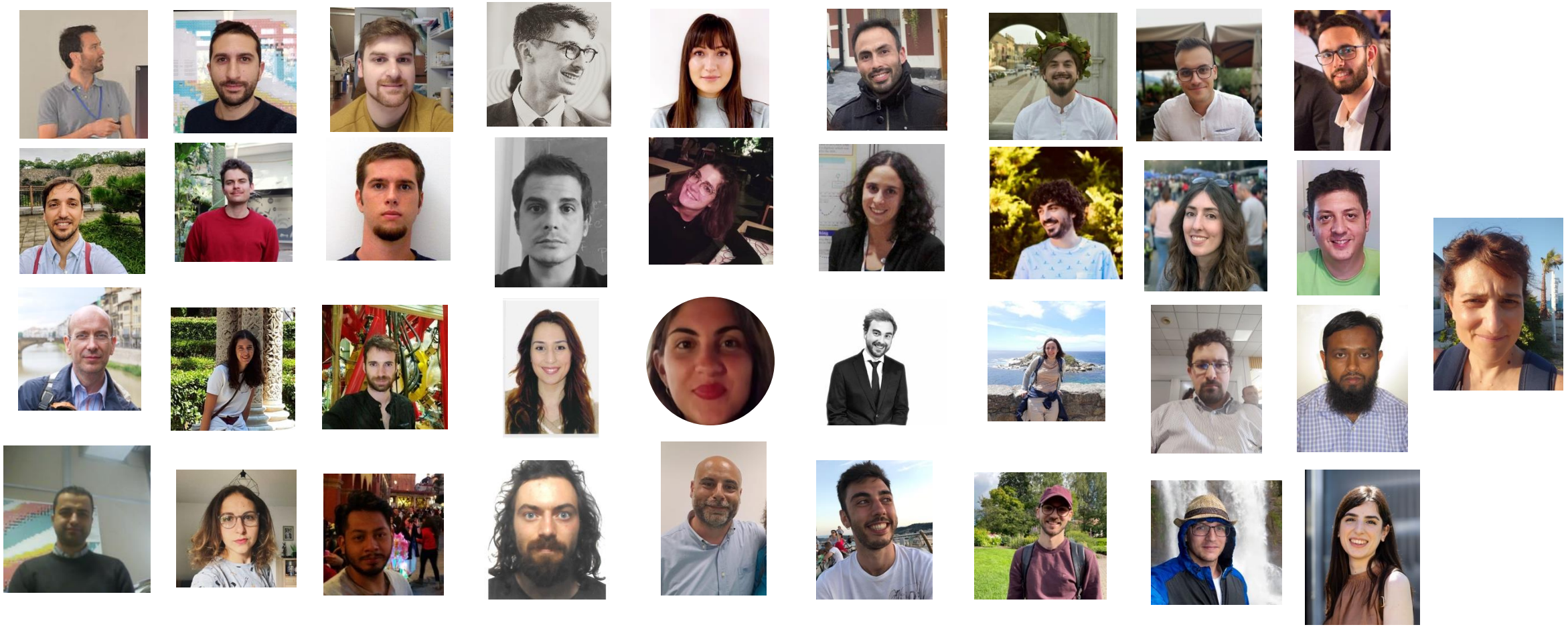
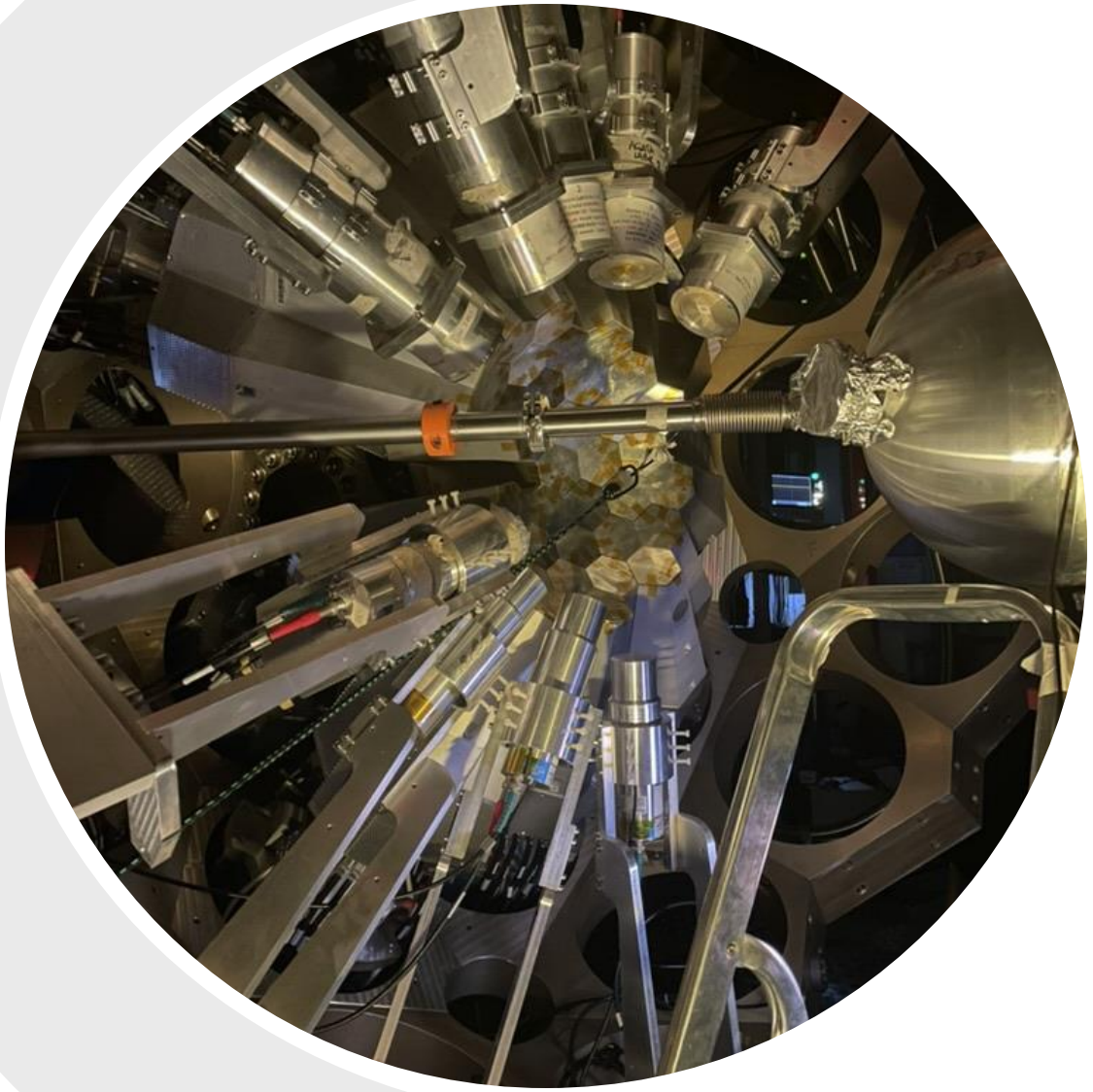
- Very successful campaign
- The official end of the LNL campaign is set to mid-2028
- New complementary detectors will be installed to fully exploit the next campaign beams
- The zero degrees campaign will be divided in two sub-campaign: PARIS – NEDA
  - Preparation of the two is on-going in parallel
  - Order of the sub-campaign will be driven by
    - Availability of the two arrays
    - Users requests
- Strong collaboration with well established and documented procedure for data analysis.

Thanks to the local team



Big thanks to the
AGATA collaboration, GAMMA group and
LNL/PD/Mi technical staff



Istituto Nazionale di Fisica Nucleare
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THANK YOU

ALAIN.GOASDUFF@LNL.INFN.IT

HTTP://GAMMA.LNL.INFN.IT
HTTPS://WWW.AGATA.ORG