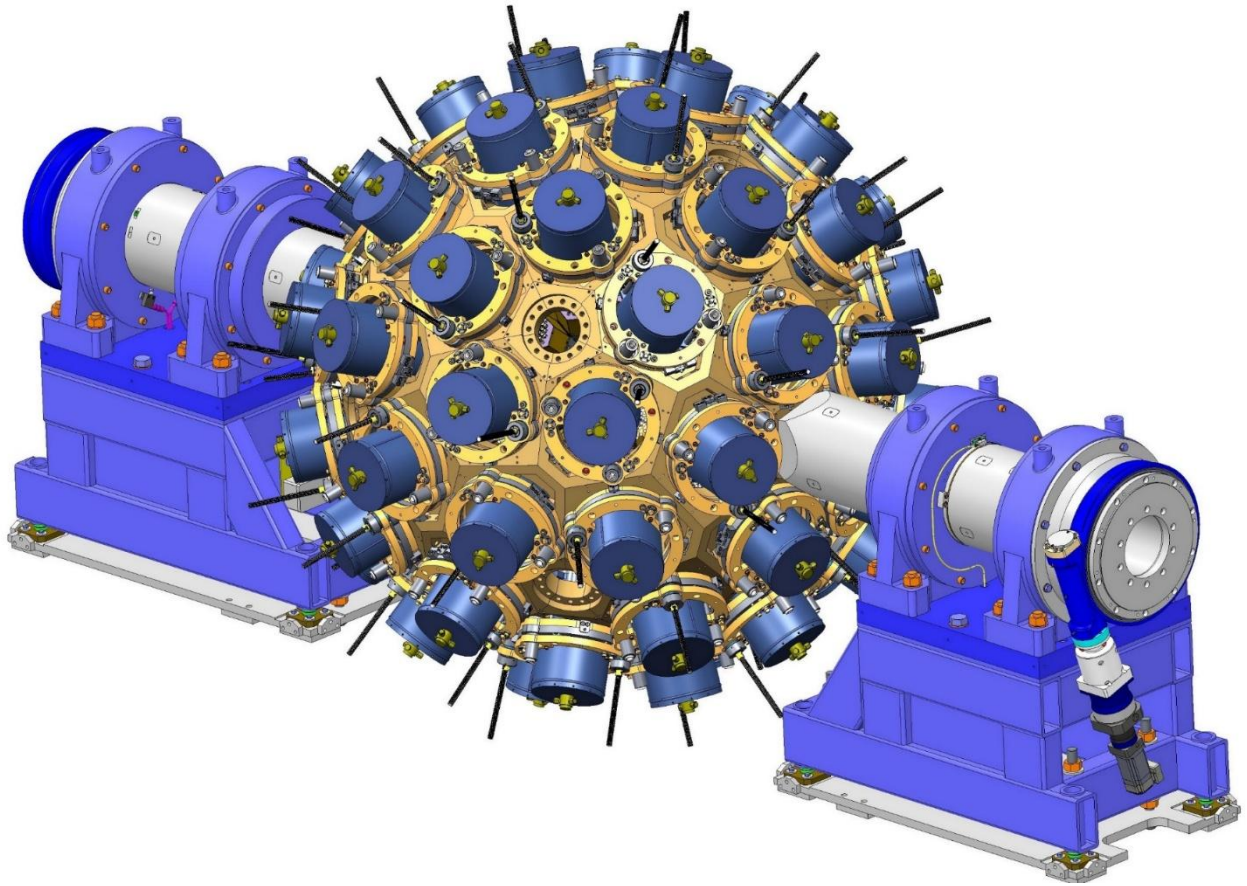
The AGATA multi-detector for Nuclear Structure



What about Nuclear Data ?

Why the AGATA collaboration can shed new light on our definition of nuclear data ?

The main goals of Nuclear Structure

How do nuclei and nuclear matter emerge from the underlying fundamental interactions?

What is the limit of nuclear existence and which phenomena arise from open quantum systems?

How do nuclear shells evolve across the nuclear landscape, what kind of shapes can nuclei take, and what is the role of nuclear correlations?

How can we better understand the synthesis of heavy elements and the chemical evolution of the visible universe?

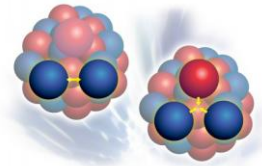
Explore the **limits of nuclear existence**: discovery of new isotopes/elements, the evolution of nuclear structure, nuclear shapes and their spectra.

Study **unstable nuclei**, their decay modes, and the mechanisms governing **nuclear reactions** and **fission**.

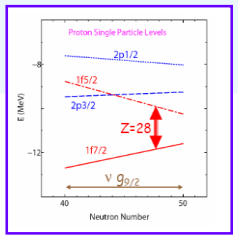
Investigate **exotic structures** related to weakly bound and open quantum systems.

Our contribution : We measure gamma's ! (electromagnetic decay of a quantum system)

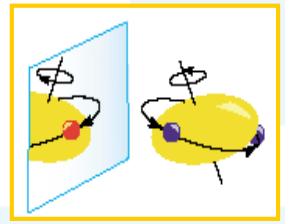
3-body force



Shell evolution



Isospin symmetry

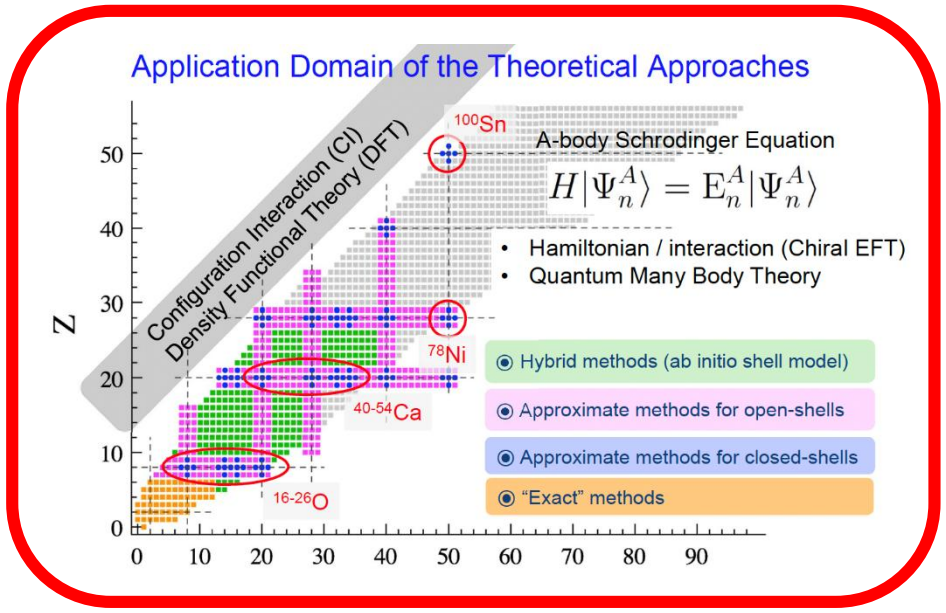


Clustering, pairing, nuclear deformation, astrophysics, fission …

How to approach such endevour?

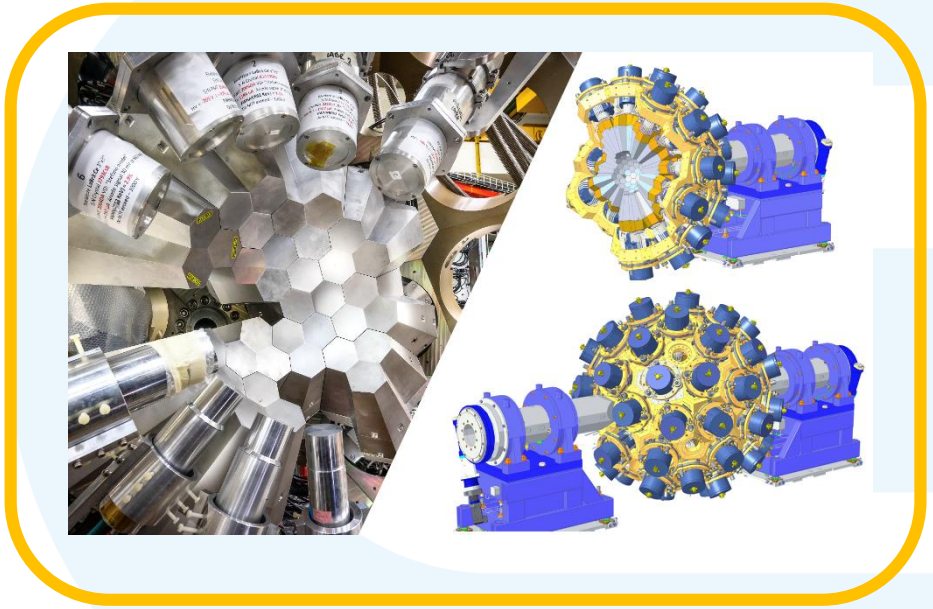
The nuclear structure is not an observable. The nucleus is a many body object → need to measure in the laboratory various observables to constrain the nuclear models

The progress in the understanding of nuclei is driven by major advances of **theoretical and experimental tools**.



Theory development

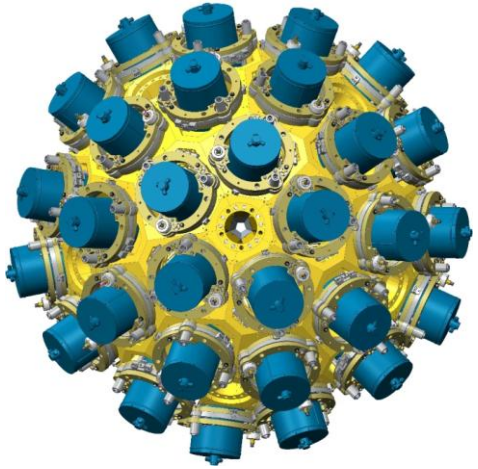
Evaluated data



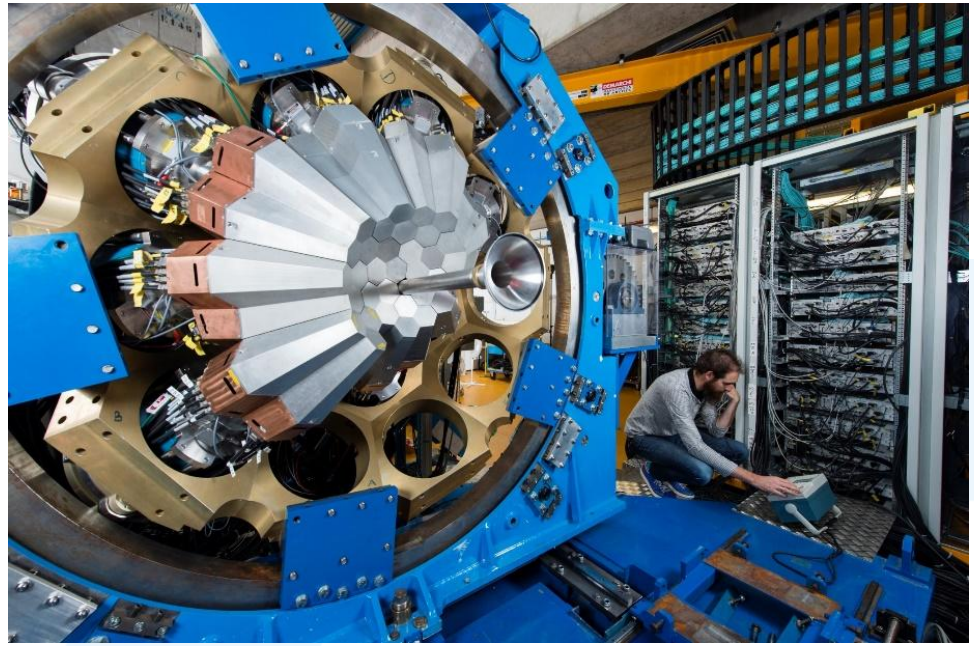
Experimental apparata and facilities

The AGATA project : THE ultimate spectrometer

www.agata.org

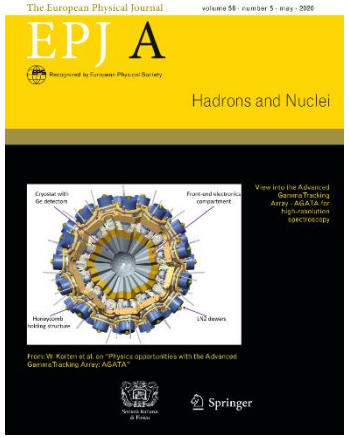


- 180 (60 triple-clusters) crystals
- Mass of Germanium: 362 kg
- Solid Angle: 82 %
- Acquisition rate >50 kHz
- Efficiency: 43% (M_γ=1) , 28% (M_γ=30)
- Angular resolution: ~1º



S. Akkoyun *et al.*, Nucl. Instrum. Methods Phys. Res., Sect. A 668, 26 (2012).

AGATA White Book : W. Korten et al, Eur. Phys. J. A (2020) 56:137



Topical Issue EPJA :
https://epja.epj.org/component/toc/?task=topic&id=1878
The European Physical Journal A
AGATA: Advancements in Science and Technology
Editors : Nicolas Alamanos, Maria Jose Garcia Borge, Angela Bracco, Emmanuel Clement, Andres Gadea, Wolfram Korten, Silvia Leoni and John Simpson

HISTORY AND CULTURE

Eiffel honour for women physicists

When the Eiffel Tower opened for the 1889 Exposition Universelle, its girders bore in gold lettering the names of scientists whom Gustave Eiffel said had honoured France since 1789. Every one of them was a man. 137 years later, on 26 January 2026, Anne Hidalgo, the mayor of Paris, accepted the nomination of 72 women scientists to join them.

The list spans nearly 250 years and multiple disciplinary domains. Many made important contributions to nuclear and particle physics, and several had close associations with strong partners to CERN such as the Centre national de la recherche scientifique (CNRS) and the Commissariat à l'énergie atomique et aux énergies alternatives (CEA).

Foremost among the women to be honoured is Polish–French physicist Marie Skłodowska Curie (1867–1934), who discovered polonium and radium, helping to establish radioactivity as an intrinsic property of atoms. She carried out systematic measurements of radioactive substances, determined radium's atomic weight and developed methods to isolate radioactive elements from pitchblende. She shared the 1903 Nobel Prize in Physics and later won the 1911 Nobel Prize in Chemistry, becoming the first woman laureate and the only person to receive Nobel prizes in two different scientific fields.

A pioneer in X-ray spectroscopy, Yvette Cauchois (1908–1999) invented the Cauchois spectrometer, a curved-crystal spectrometer widely used for the analysis of X-rays and gamma rays. She introduced X-ray spectroscopy using synchrotron radiation to Europe and later studied the X-ray spectrum of the Sun.

A trailblazer for women physicists in Japan, nuclear physicist Toshiko Yuasa (1909–1980) studied the continuous spectrum of beta radiation emitted by artificial radioactive substances and developed her own double-focusing spectrometer. In 1955 she warned of the dangers of nuclear tests at Bikini Atoll.

Eiffel honour *The women set to be honoured include (clockwise from top left): Marie Skłodowska Curie, Yvette Cauchois, Toshiko Yuasa, Marie-Antoinette Tonnelat, Cécile DeWitt-Morette, Yvonne Choquet-Bruhat and Lydie Koch.*

In the 1960s, promoted to senior research fellow at CNRS, she studied nuclear reactions using a synchrocyclotron.

Marie-Antoinette Tonnelat (1912–1980) worked on early unified theories that sought to connect gravity and electromagnetism. She served as director of research at CNRS.

Henriette Faraggi (1915–1985) introduced new techniques with photographic emulsions and directed the CEA Department of Nuclear Physics from 1972 to 1978. She also served as chair of the Nuclear Physics Commission of IUPAP and became the first woman elected president of the French Physical Society. Convinced early on of the importance of high-energy heavy-ion physics for studying quark-gluon plasma, she played a key role in the decision to build GANIL in Caen.

Cécile DeWitt-Morette (1922–2017) worked in quantum field theory and gravitation, and founded the Les Houches Summer School in 1951, which became a major international centre for theoretical physics training. She later contributed to path-integral methods in quantum theory.

Yvonne Choquet-Bruhat (1923–2025) placed Einstein's field equations of general relativity on a firmer mathematical ground, showing how their behaviour follows from appropriate initial conditions. In 1979 she became the first woman elected as a full member of the Académie des Sciences.

A specialist in cosmic radiation, Lydie Koch (1931–2023) led stratospheric-balloon experiments to detect cosmic rays, contributed to the development of innovative germanium and silicon detectors for the HEAO-3 and COS-B satellites, and advanced X-ray and gamma-ray astronomy. She played a central role in the development of astrophysics at the CEA and was head of the Astrophysics Section from 1967 to 1979.

"It is time for this highly symbolic landmark to embrace the cause of equality between women and men, and to restore women to their rightful place on this monument dedicated to the glory of science and scientists," said Hidalgo.

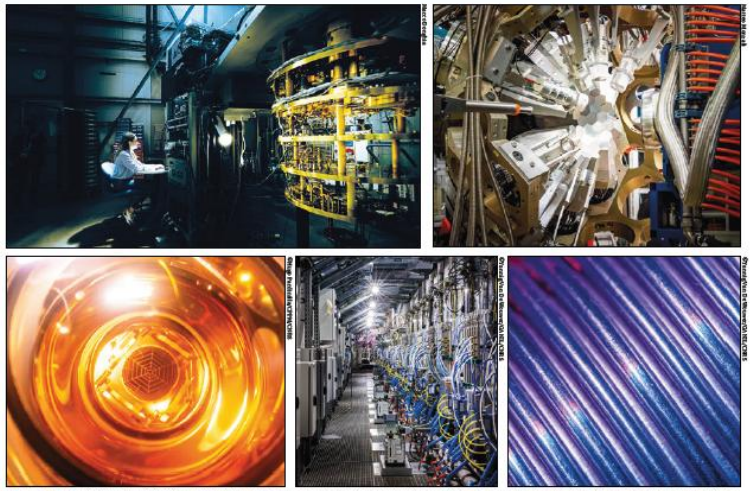
OUTREACH

Physics labs under the lens

Physics is beautiful in its ideas and in the people who pursue them across borders. What better, then, than for 16 laboratories across Asia, Europe and North America to throw open their doors for a photography competition, allowing the aesthetically inclined to immortalise on film the wonders within. The votes are now in.

Immortalising on film the wonders within

The winning image of the 2025 Global Physics Photowalk, by photographer Marco Donghia, shows INFN National Laboratories of Frascati researcher Raffaella Donghia seated beside an open cryostat during installation of an ultra-cold experiment at COLD, the CryOgenic Laboratory for Detectors (see "First place" image). The apparatus houses an axion haloscope – a cryogenic antenna consisting of a microwave cavity resonating at about 9 GHz, immersed in a powerful 9 tesla magnetic field and connected to an ultra-low-noise amplification system designed to search for ultralight ▷



Award winners *(From top left, left to right)* **First place** *Research at COLD by Marco Donghia.* **Runner up** *The AGATA–PRISMA Setup for Nuclear Physics Experiments by Matteo Monzali.* **Third place** *Eye of a Neutrino Telescope by Hugo Pardinilla.* **Public preference** *The Tunnel by Yannig Van De Wouwer.* **Public runner up** *Vacuum by Yannig Van De Wouwer.*

dark-matter candidates such as axions or dark photons (*CERN Courier* January/February 2026 p21). If ultralight dark matter circulates in a galactic halo, it could excite the resonant cavity at a frequency corresponding to the particle's mass, appearing as a minute increase in electromagnetic power at that frequency. Cooling the system to 10 mK suppresses thermal noise to the point that quantum noise dominates.

"The image stood out for its clear visual storytelling and masterful use of light, which leads the eye through the scene and emphasises the moment of discovery," said judge Tabea Rauscher, then creative lead at the European Molecular Biology Laboratory. "The researcher appears small in relation to the cryostat, highlighting the scale of the technology while keeping the human presence at the centre. The lighting creates a quiet, almost cinematic atmosphere that captures both the intensity and the solitude of scientific work."

The photographs move between abstraction and lived experience

Fellow judge Dmitri Denisov, deputy associate laboratory director for high-energy physics at Brookhaven National Laboratory in the US, noted that while the judges chose Donghia's photograph for its ability to convey the "deep connection between the apparatuses used in particle physics and the human developing them," the second- and third-place photographs were chosen for their "deep looks into the inner workings of experiments and impressive display of colours."

The judges awarded second place to Matteo Monzali for his photograph of a nuclear-physics experiment at INFN National Laboratories of Legnaro in Italy (see "Runner up" image) and third place to Hugo Pardinilla for a close-up image of a photomultiplier from the KM3NeT/ORCA experiment, a neutrino telescope currently being installed in the Mediterranean Sea at a depth of 2500 metres off the coast of Provence, France (see "Third place" image). Members of the public awarded first and second place to Yannig Van De Wouwer's photographs of GANIL, the heavy-ion accelerator in Caen, France, featuring pipes and cables serving the SPIRAL2 linear accelerator and iridescent patterns in a beam pipe (see "Public preference" image). The public's third choice went to Monzali's snap of the AGATA–PRISMA setup in INFN Legnaro.

Deeply human

"Serving as a judge for the 2025 Global Physics Photowalk, I was struck by the range and sensitivity of the submissions," concludes judge Will Warasila, a freelance photographer for the *New York Times*. "The photographs move between abstraction and lived experience – finding form, rhythm and quiet beauty in scientific spaces, while foregrounding the people whose labour and curiosity make this work possible. Across geographies and institutions, these images show how photography can slow us down, make complex systems legible and remind us that science is not only technical, but deeply human."

The Global Physics Photowalk is organised by the Interactions Collaboration (interactions.org), an international network of particle-physics institutions including CERN and over 20 partner laboratories and research infrastructures around the world.

CERNCOURIER
VOLUME 66 NUMBER 2 MARCH/APRIL 2026

GANIL

Global Physics Photowalk

https://www.interactions.org

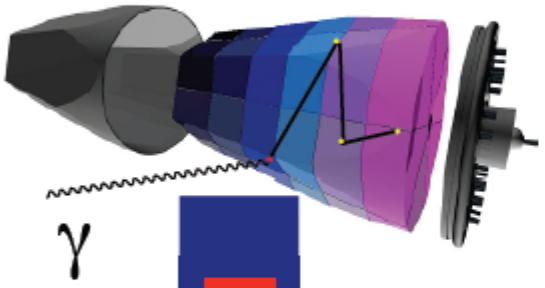
2026 Second place (judges)
2026 Third place (public)

AGATA : How does it work ?

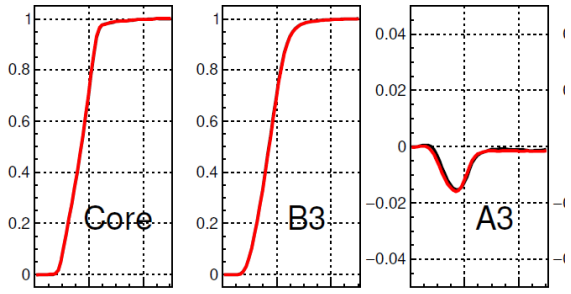
AGATA
ADVANCED GAMMA TRACKING ARRAY

GANIL

1 Highly segmented HPGe detectors



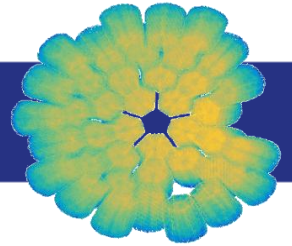
2 Digital electronics to record and process segment signals



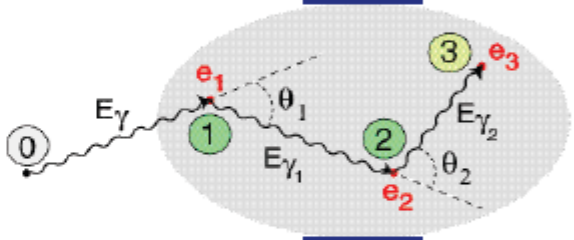
3 Pulse Shape Analysis to decompose recorded waves

Identified interaction points

$(x,y,z,E)_i$



4 Reconstruction of scattering sequence from Compton vertices



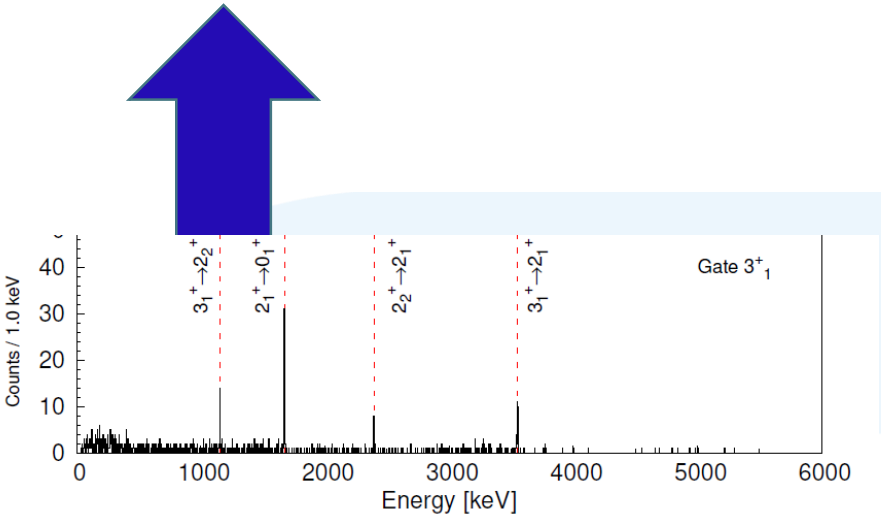
$$E_{\gamma'} = \frac{E_\gamma}{1 + \frac{E_\gamma}{m_0 c^2}(1 - \cos\theta)}$$

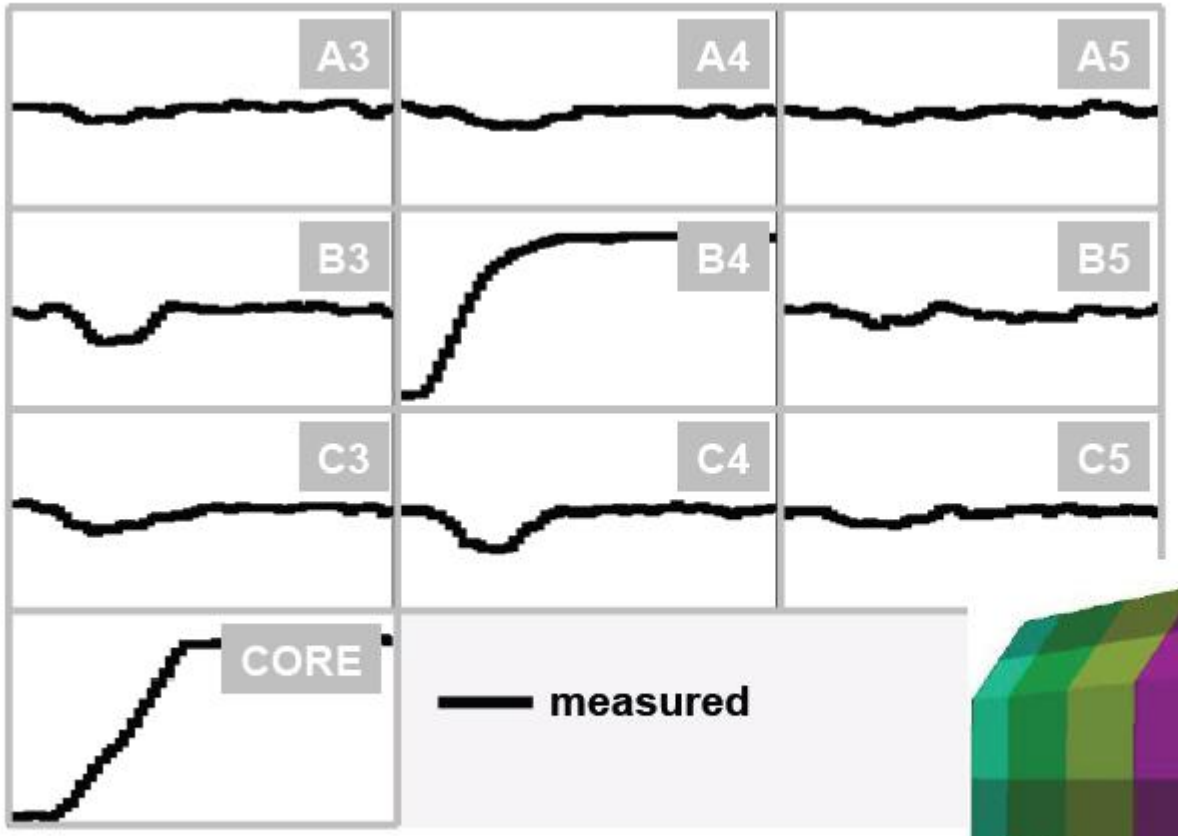
Reconstructed gamma-rays

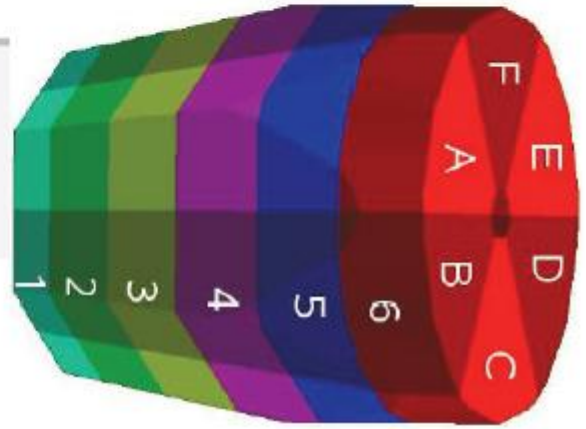
5 Complementary Detectors

β, θ, ϕ, E*

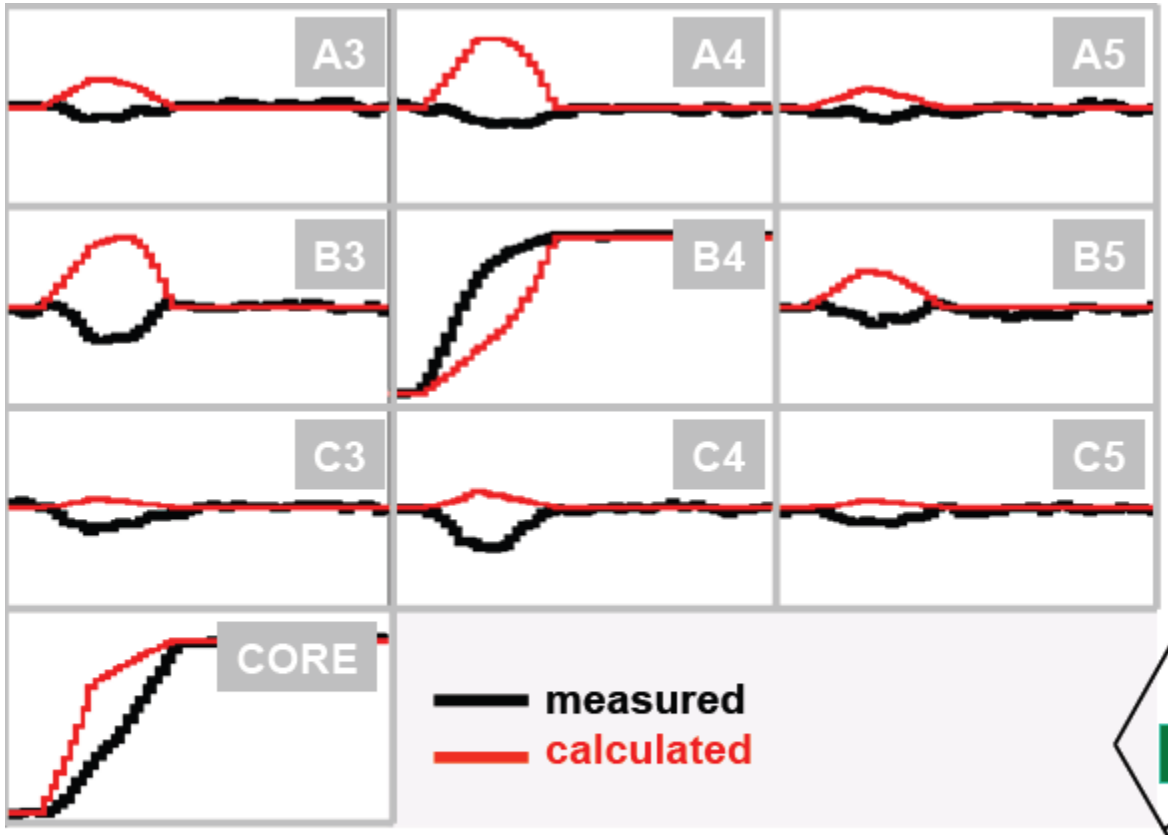
6 Doppler Correction



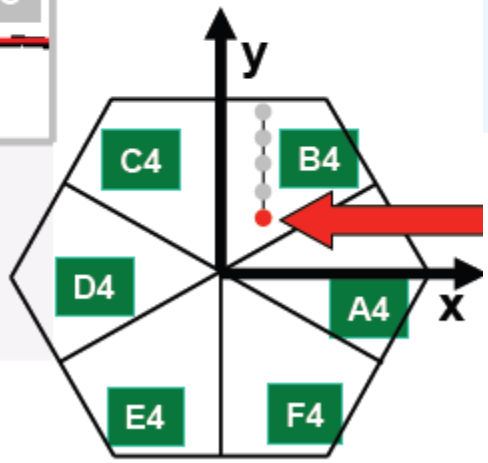




791 keV deposited in segment B4

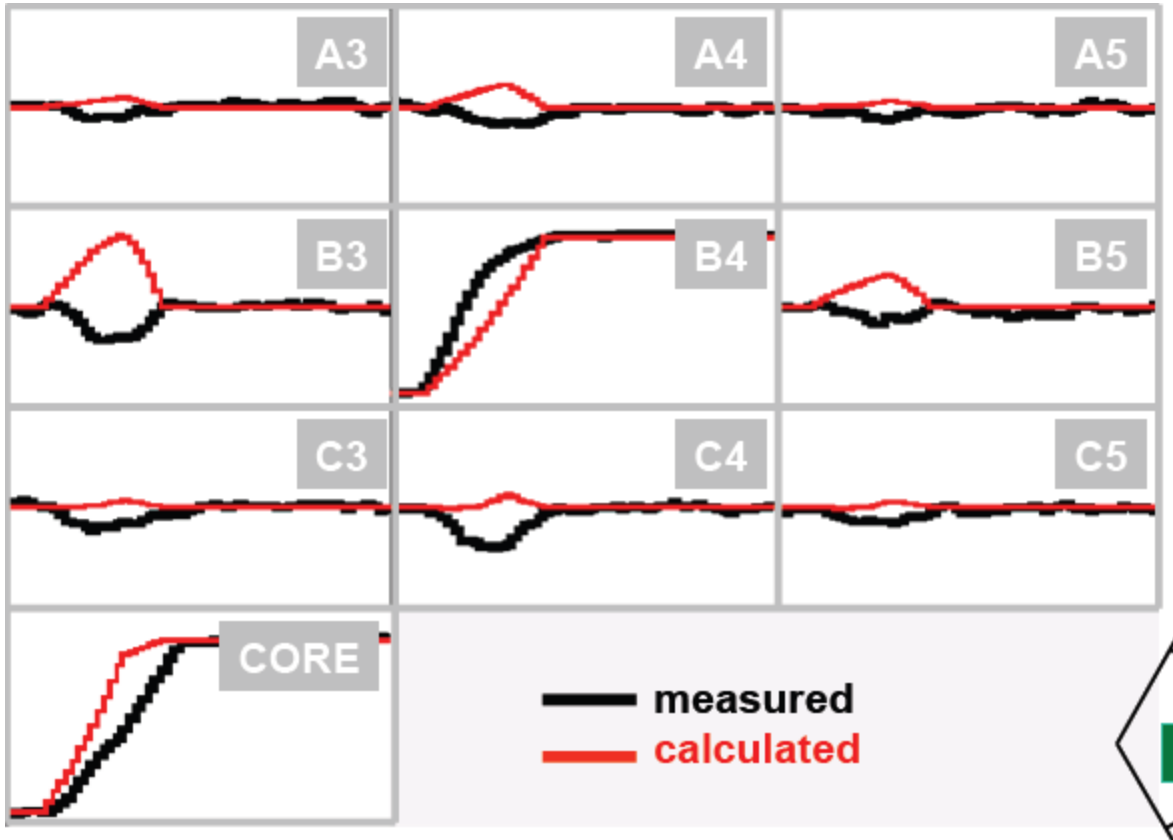


(10,10,46)



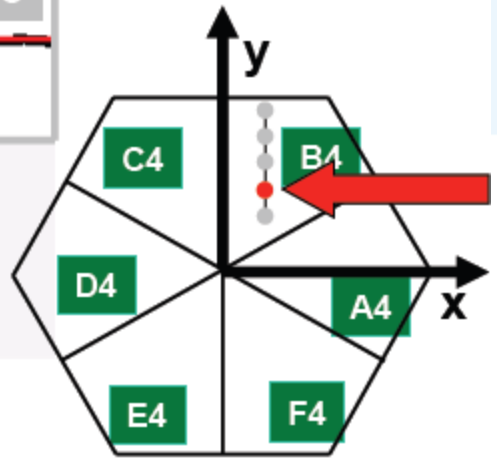
z = 46 mm

791 keV deposited in segment B4

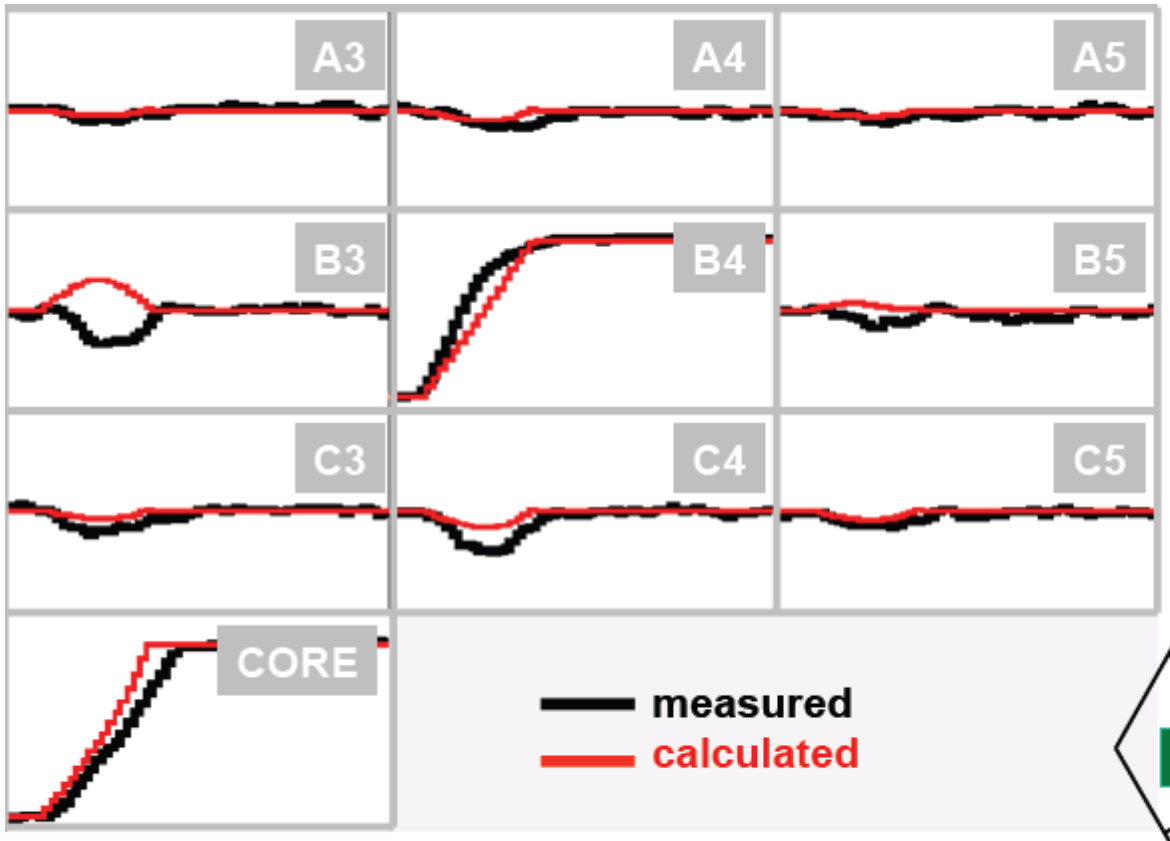


791 keV deposited in segment B4

(10,15,46)

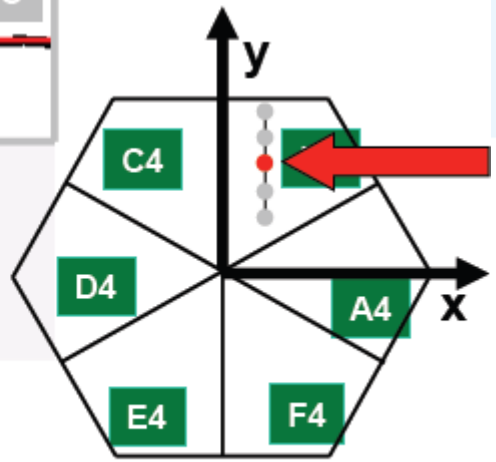


z = 46 mm

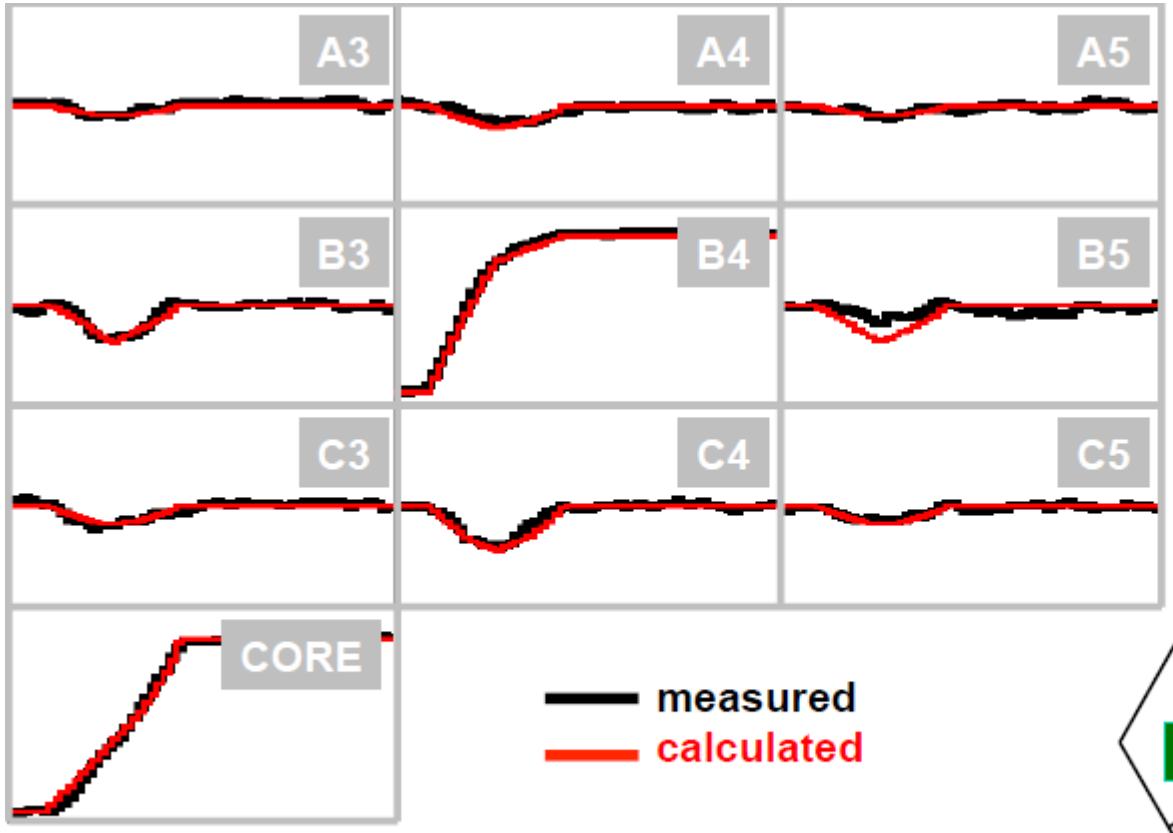


791 keV deposited in segment B4

(10,20,46)

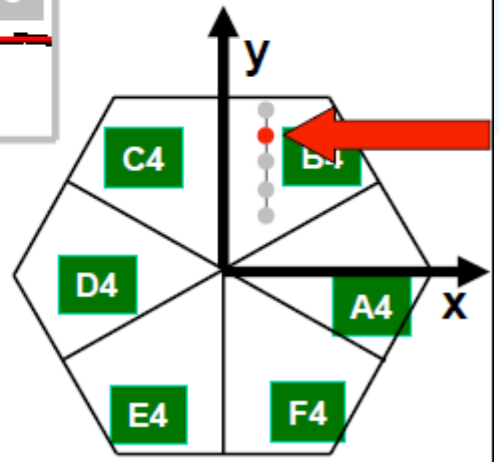


z = 46 mm

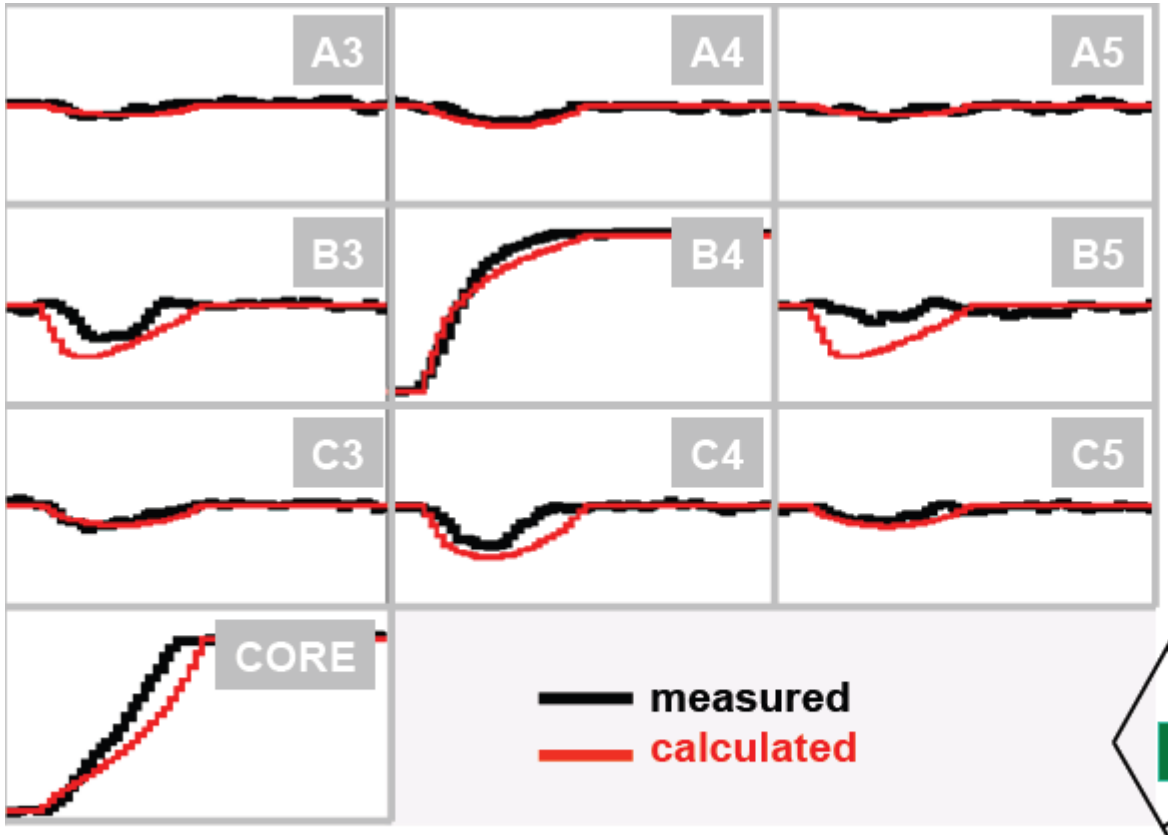


791 keV deposited in segment B4

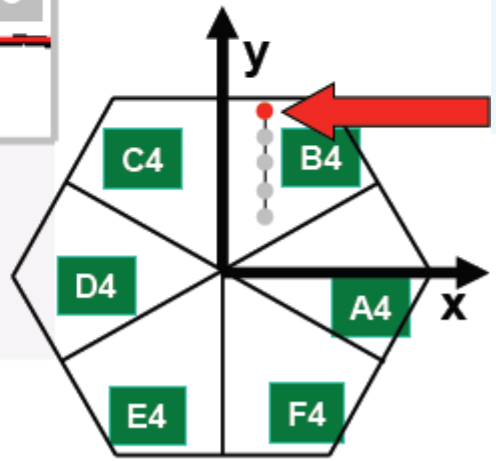
(10,25,46)



z = 46 mm

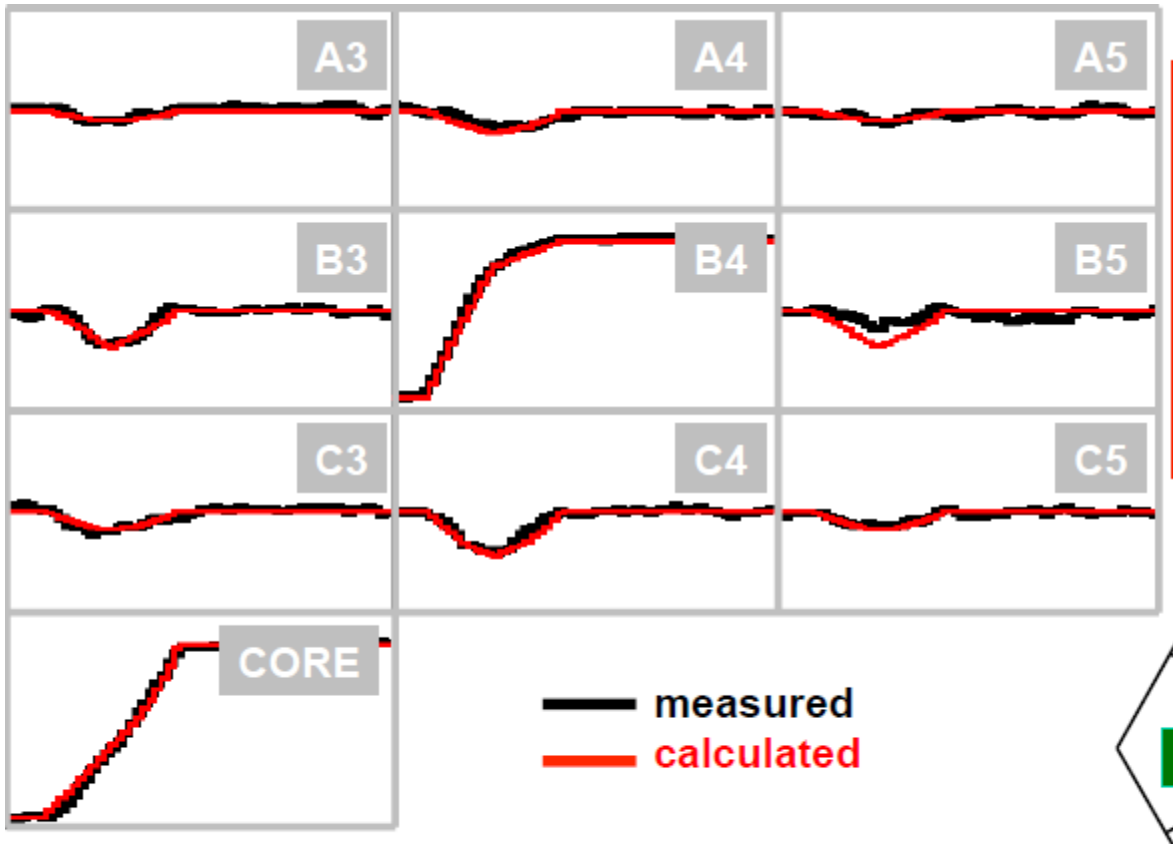


(10,30,46)



z = 46 mm

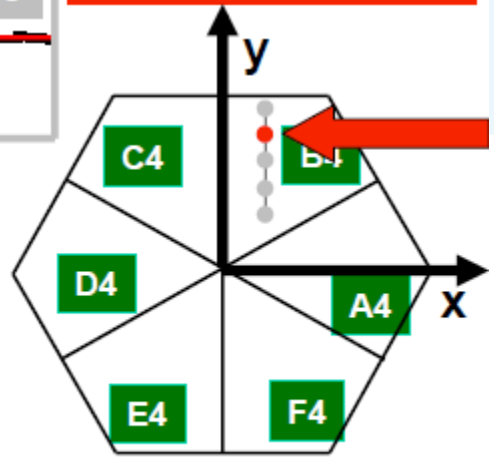
791 keV deposited in segment B4



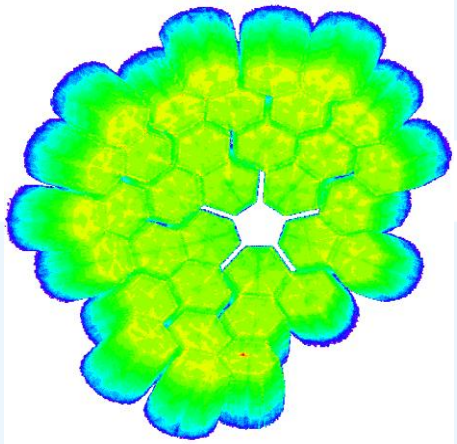
791 keV deposited in segment B4

Result of *Grid Search* Algorithm

(10,25,46)

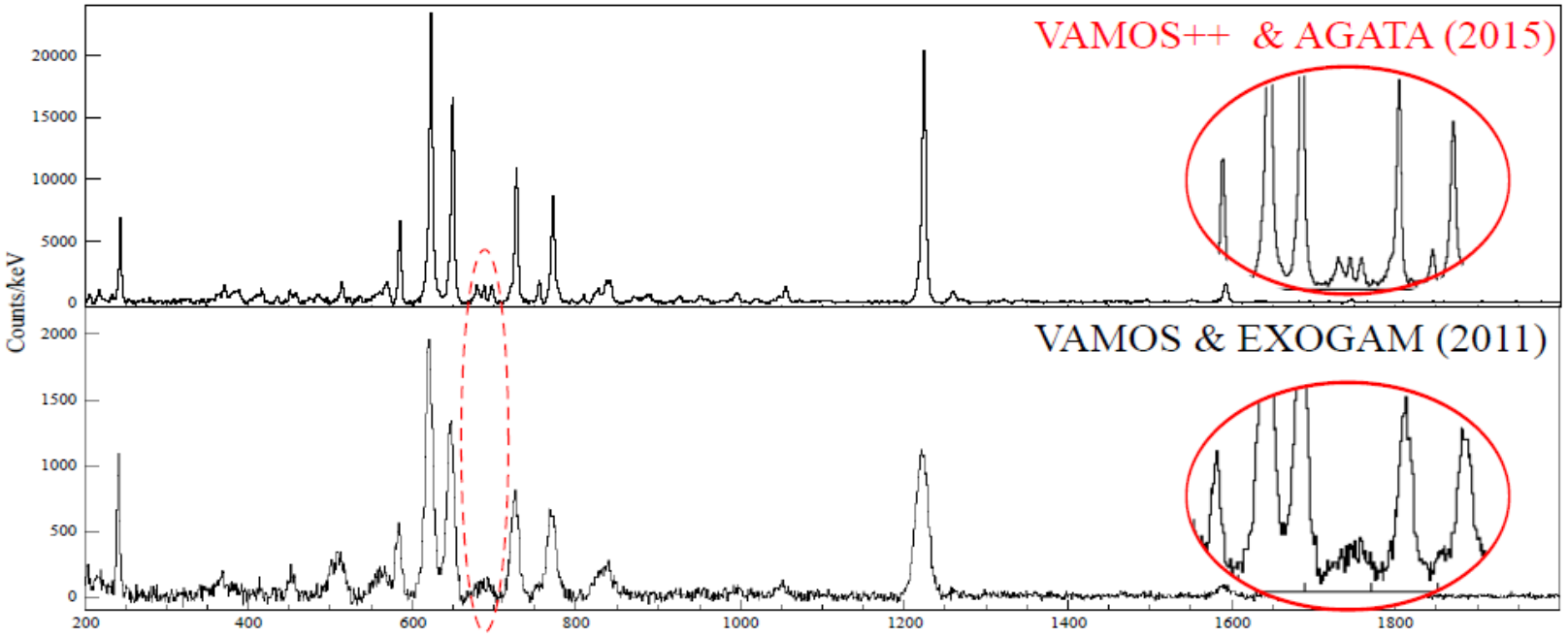


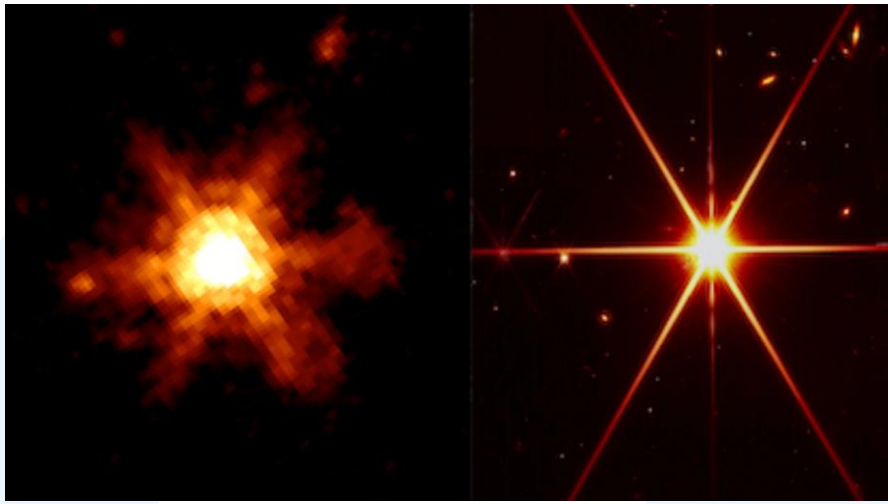
z = 46 mm



AGATA : At the end

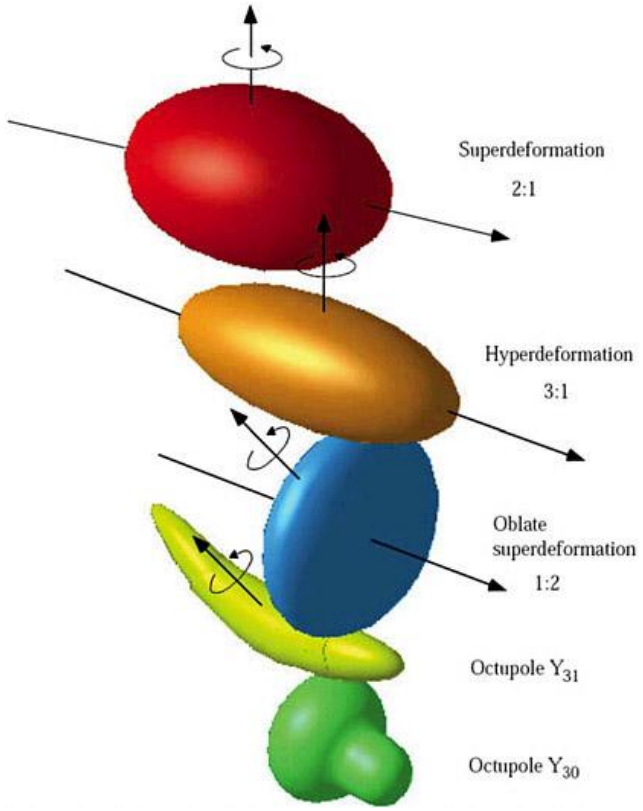
J. Dudouet et al (IP2I)



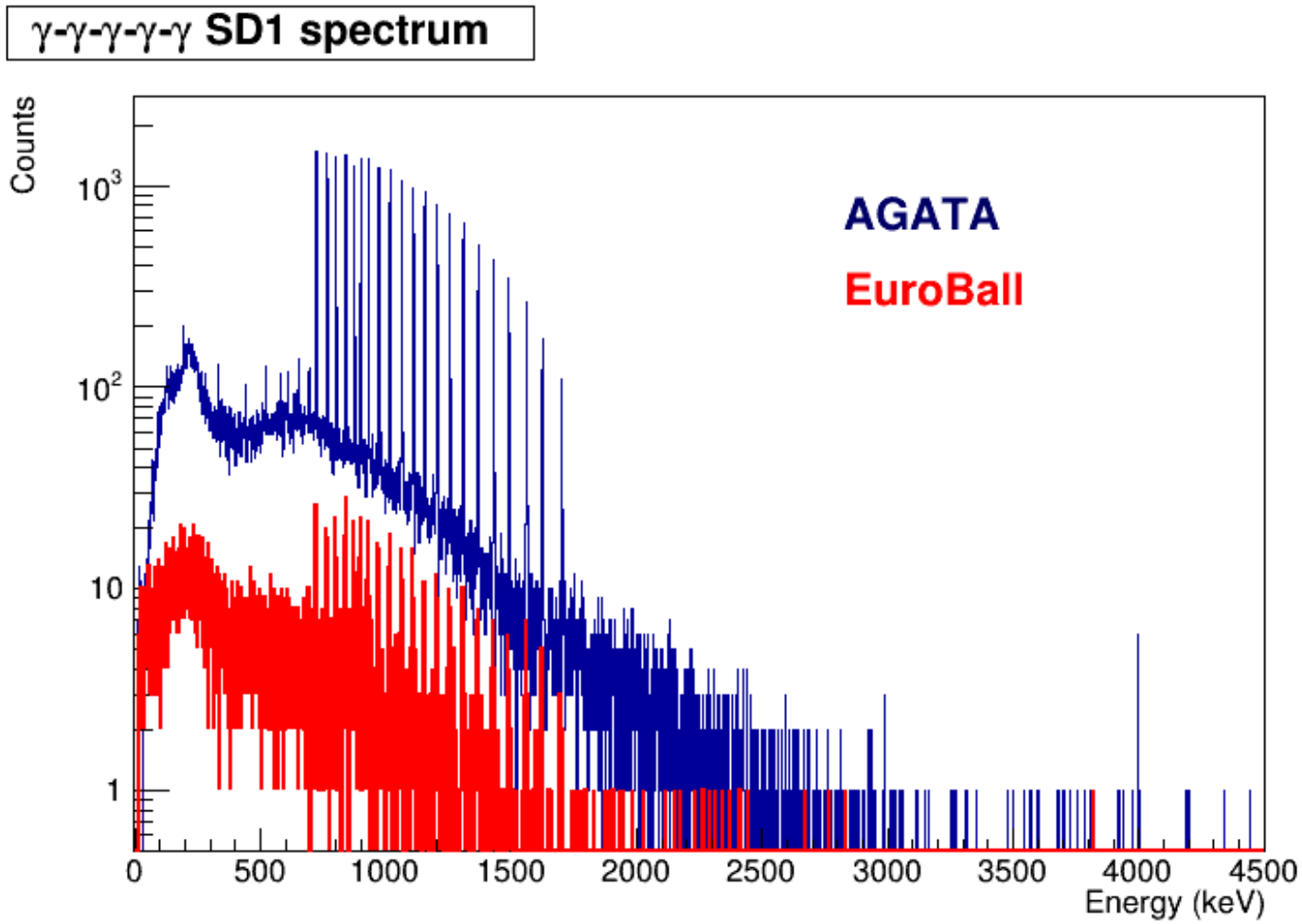


Spitzer (left), JWST (right).

Discovery potential of AGATA when completed



Super Deformation (one of the most famous discovery of the 2nd half of the XX century → Hyper Deformation High γ multiplicity→ gain factor **300!!**



The AGATA project : THE ultimate spectrometer

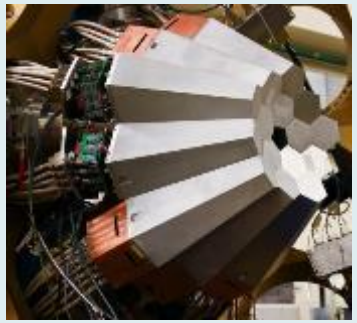
1st AGATA Steering Committee and Management Board (2002)

MoU Phase 1 + Addendum

March 2022

MoU Phase 2

2010-2012
Legnaro, Italy
Intense stable beams
15 detectors

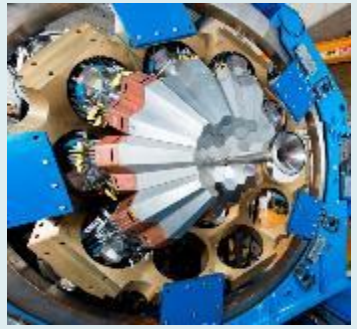


AGATA Demonstrator + PRISMA at LNL

2012-2014
GSI, Germany
Fast fragmentation beams
25 detectors

AGATA at GSI

2014- 2021
GANIL, France
ISOL and stable beams
approaching 1π (45)

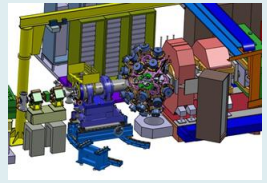


AGATA at GANIL

2021- 2028
LNL, Italy
Stable beams
EXOTIC beams

LNL 2.0

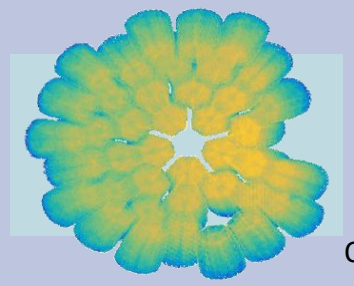
2028- 2030(+1 ?)
GANIL, France
ISOL beams from
SPIRAL1



GANIL 2.0

2031 –
LNL, SPES, Italy
FAIR, Germany
ISOLDE, CERN

Experiments performed in 2015-2021 at GANIL with AGATA



RIB

SHE Cross section $^{238}U+^{238}U$ in MNT

Search for Double Gamma decay in ^{137}Cs source

Reaction mechanism : Fission of Light Hg

Octupole – Quadrupole correlation in ^{112}Xe

^{208}Pb

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

Octupole correlation in ^{207}Pb

Evolution of collectivity around N=50: lifetime measurements $^{104,106}Sn$

Exploration of alpha-cluster : the unique case of ^{212}Po (^{208}Pb + α)

N=126 Xe+Pt spectroscopy after MNT

Evolution of collectivity around N=50: lifetime measurements ^{94}Ru

Shape transition in the neutron-rich W isotopes

Transition Quadrupole Moments in $^{166,168}Dy$.

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

^{100}Sn

$i_{13/2}$ single particle state in ^{133}Sn and high spin in ^{108}Zr

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

^{132}Sn

Shape evolution in neutron rich fission fragments in the mass A~100 region

Above barrier narrow resonances in ^{15}F

^{68}Ni

^{78}Ni

Shell evolution around N=50: ^{81}Ga spectroscopy

Deter. the $\alpha+^{15}O$ radiative capture rate

Evolution of collectivity around N=52: lifetime measurements in $^{83,84}Ge$

Evolution of collectivity around N=40: lifetime measurements in $^{73,75}Ga$

^{48}Ca

Evolution of collectivity around N=40: lifetime measurements in ^{64}Fe

Proton-neutron interactions across the N = 28 shell closure via $^{47}K(d,p)^{48}K$

Lifetime measurements of excited states in neutron-rich C and O isotopes

Evolution of the shell structure in the region of neutron-rich Ti isotopes

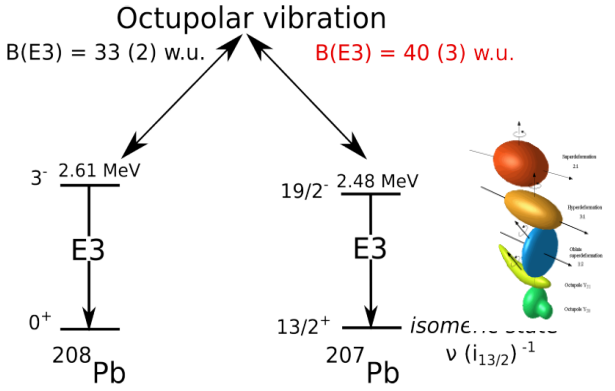
The lifetime in ^{23}Mg as a probe for classical novae models

3-body contribution in ^{20}O structure

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

Some highlights of AGATA@GANIL.1

Evidence of octupole-phonon at high spin in ^{207}Pb : Study of the octupole phonon in the ^{208}Pb region.

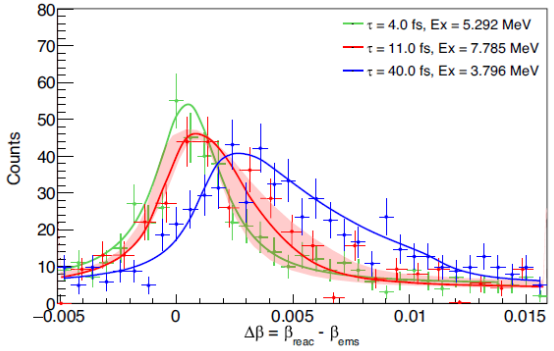


D. Ralet et al Phys. Lett. B 797, 134797 (2019),

Search for ^{22}Na in novae supported by a novel method for measuring femtosecond nuclear lifetimes

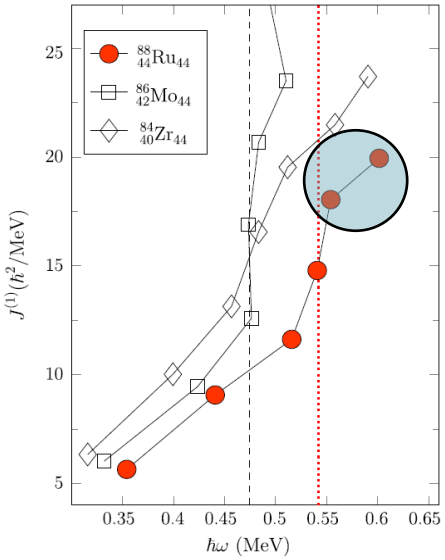
Constraining the ^{22}Na(p, γ)^{23}Mg reaction from the spectroscopy of the 7785.0(7) keV resonance in ^{23}Mg.

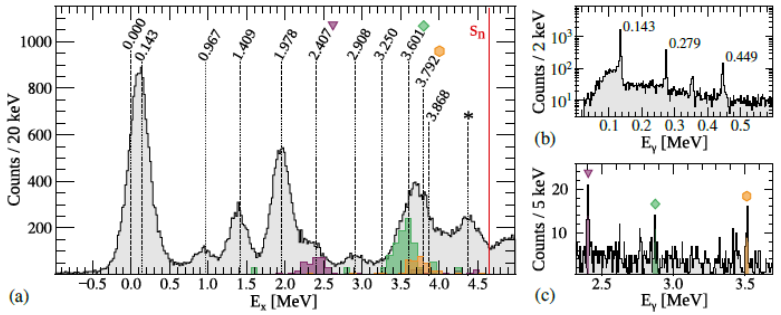
Ch. Fougère et al Nature Communications volume 14, 4536 (2023)



Direct observation of a "delayed" rotational alignment in a deformed N = Z nucleus (^{88}Ru), in agreement with theoretical predictions related to the presence of strong isoscalar neutron-proton pair correlations.

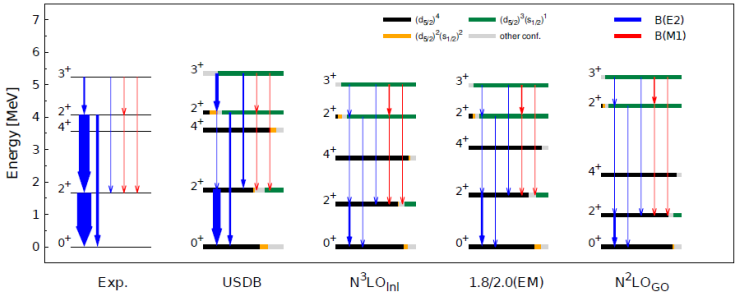
B. Cederwall et al, Phys. Rev. Lett. 124,062501 (2020)

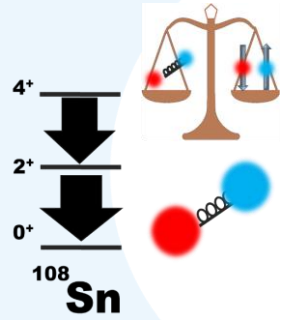


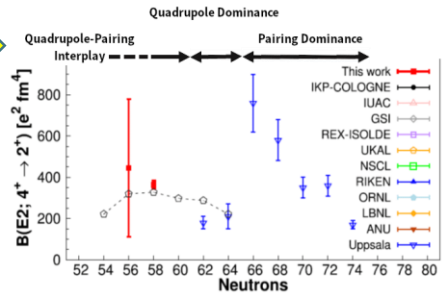


Direct transfer to ^{46,48}K as a survey of the $\pi s_{1/2}$-νsdpf interaction; N=28 **.J. Paxman Phys. Rev. Lett. 134, 162504 (2025)**

Accurate and holistic description of ^{20}O using 3-body term from ab initio VS-IMSRG at MUGAST-AGATA data, **Phys. Rev. Lett. 131, 262501 (2023), I. Zanon, E. Clément, et al.**







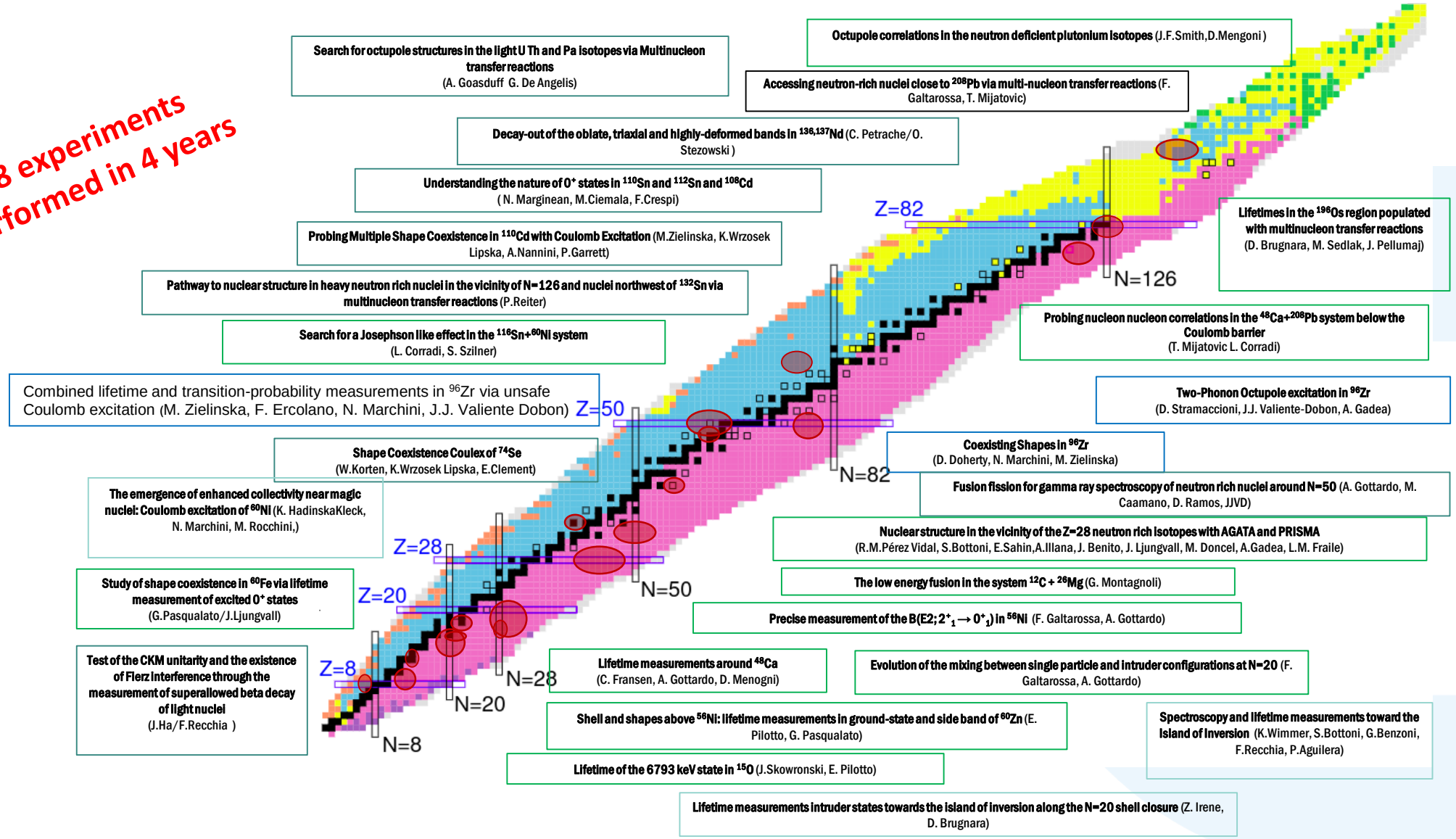
M.Siciliano et al, Physics Letters B 806 (2020) 135474

2^+ wave function is dominated by the p-n quadrupole interaction
4+ wave function is a balance p-n quadrupole and pairing interactions
Revisit our predictions on the ^{100}Sn structure to be investigated at S3

R.M. Pérez-Vidal et al, Phys. Rev. Lett 129, 112501 (2022)
Investigation of the Seniority Conservation in the $\pi g_{9/2}$ shell

The physics campaign (so far) at LNL

48 experiments performed in 4 years



The physics campaign (so far) at LNL

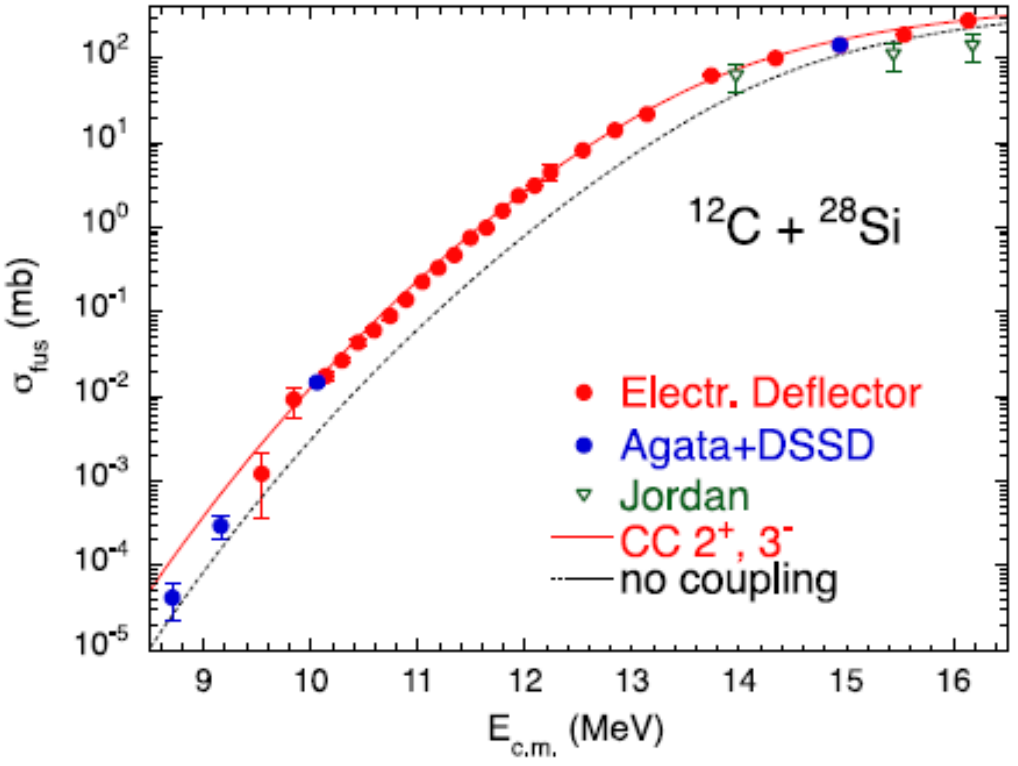
First paper

Physics Letters B
Volume 872, January 2026, 140084

Letter

Fusion of $^{12}C+^{28}Si$ at deep sub-barrier energies

A.M. Stefanini [a] ✉, G. Montagnoli [b c], M. Del Fabbro [b c], A. Goasduff [a], P.A. Aguilera Jorquera [b c], G. Andreetta [b c], F. Angelini [a b], L.V. D'Auria [b], M. Balogh [a], D. Bazzacco [c], J. Benito [b c], G. Benzoni [d], M.A. Bentley [e], N. Bez [c], A. Bonhomme [f], S. Bottoni [d g], A. Bracco [d g], D. Brugnara [a], L. Busak [h], S. Capra [d]...M. Zielińska [v]



nuclear reaction cross section

How to place AGATA in the Framework of **International Workshop on Nuclear Data for the Next Decade ?**

For researchers working on **experimental and theoretical methods related to [nuclear data production](#).**

AGATA collaboration
VAMOS / PRISMA device
GRIT collaboration
GANIL / LNL facility
P.I from *XYZ* university

Proposal

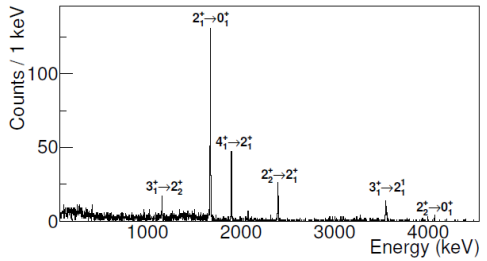
In-beam Exp.
Raw data

Analysis

Publication

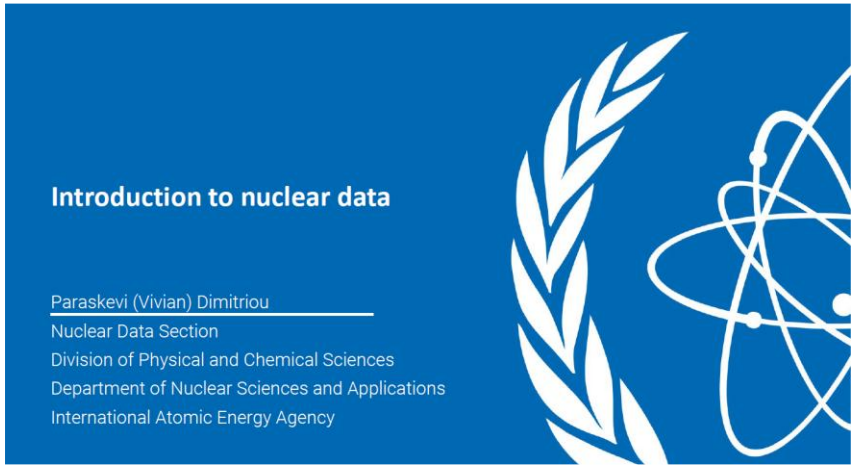
Evaluated databases
(ENSDF, ENDF, MIRD,
NuDAT, EXFOR)

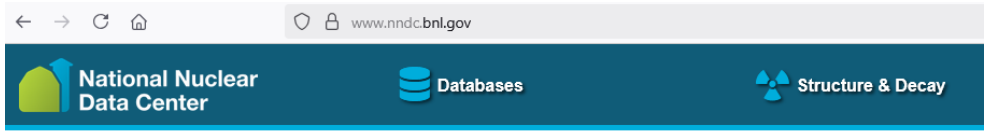
AGATA (or GRETA) → Nuclear Data → Spectroscopy Data Base

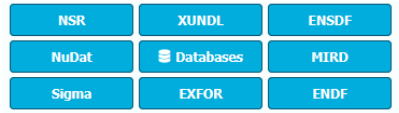


	Exp.	USDB	N^3LO_{tnl}	1.8/2.0(EM)	N^2LO_{GO}
$B(E2; 2_1^+ \to 0_1^+)$	5.9(2)	3.25	0.79	0.89	0.80
$B(E2; 2_2^+ \to 0_1^+)$	1.3(2)	0.77	0.21	0.20	0.26
$B(E2; 2_2^+ \to 2_1^+)$	4(2)	0.0005	0.089	0.070	0.18
$B(M1; 2_2^+ \to 2_1^+)$	0.05(2)	0.019	0.014	0.017	0.012
$B(E2; 3_1^+ \to 2_1^+)$	0.32(7)	0.57	0.16	0.17	0.17
$B(M1; 3_1^+ \to 2_1^+)$	0.016(4)	0.029	0.023	0.028	0.0089
$B(E2; 3_1^+ \to 2_2^+)$	0.7(2)	1.24	0.14	0.15	0.11
$B(M1; 3_1^+ \to 2_2^+)$	0.19(4)	0.32	0.53	0.55	0.56
Binding energy	-23.74 [64]	-23.63	-19.67	-20.51	-22.71

International Atomic Energy Agency, nuclear data definition



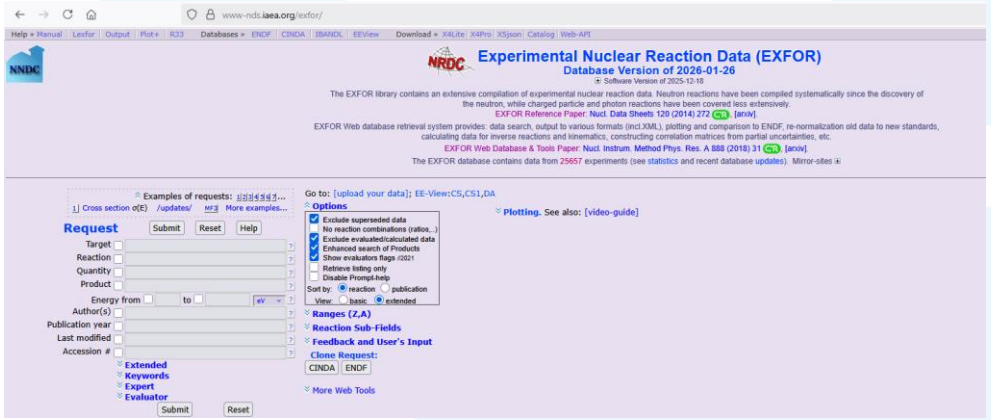




Number of nuclides covered: > 3,000
Number of entries (e.g., γ-rays): ~200,000

Fundamental nuclear data

- Fundamental parameters describing the structure properties of the nucleus and emitted radiation
  - ✓ Level energy
  - ✓ Spin and parity
  - ✓ Transition multipolarities
  - ✓ Half-life
  - ✓ Branching modes
  - ✓ Energy and intensity of emitted radiation
- Parameters describing the dynamics of nuclear reactions
  - ✓ Reaction cross sections
  - ✓ Angles and energies of reaction products
  - ✓ Polarization data
  - ✓ Thick target yields
  - ✓ Multiplicities
  - ✓ Resonance parameters
  - ✓ Fission yields



To access these γ-data, many tools have been developed

ENSDF Analysis codes and web tools

https://nds.iaea.org/public/ensdf_pgm/

ENSDF Analysis and Utility Codes

This is a webpage for re-distribution of ENSDF Analysis and Utility Codes maintained by members of the NSDD network. Problems with bugs should be reported as specified for each code. Legacy codes are no longer maintained by the network.

NSDD GitHub Repository

The software codes are now placed on GitHub in the **NSDD Repository**. The **main page** has an overview of the codes and the last modifications.
To download a package, go to its page and click on the "Code" button, then choose the "Download zip" option.

Please address any issue regarding this page to nds.contact-point@iaea.org
The list below provides a summary with links to the single packages.

Analysis Codes

AlphaHF 10-01-25 Calculates hindrance factors and nuclear radius parameter R0 for alpha decays	**Betashape v2.4** Improves nuclear data related to beta emission and electron capture	**BrIcc 2.3e** Calculates the conversion electron, electron-positron pair conversion coefficients and the EO electronic factors.	**BrIccMixing 2.3d** Calculates the multipole mixing ratio - Requires BrIcc.	**GABS 12** Gamma-ray absolute intensity and normalization calculation.	**JGAMUT 05-17** Produces an Adopted Levels, Gammas (ALG) dataset from all other input data sets.
Java-Ruler 04-25 test phase Ruler with improved uncertainties.	**RadiationReport 16-04-25** Calculates energies, intensities, and doses of all radiations as well as logft	**GLSC 04-2025** Fits gammas to obtain level energies and calculates level feedings and absolute gamma emission probabilities from decay	**EvaluationToolkit 04-2025** A toolkit that combines all ENSDF Java codes and some common tools in one application		

Utility Codes

AME-NUBASE-viewer 16-04-25 Retrieves and displays AME2020 data entries.	**AveTools 3.0** Combines three different statistical methods to calculate averages of experimental data with uncertainties.	**KeynumberCheck 12-03-25** Checks possible missing references by searching NSR database and write them into the output.	**ConsistencyCheck 30-03-25** Check data consistency among ENSDF datasets, group levels and gammas, and average values from different datasets.	**FormatCheck 02-2025** Java code for ENSDF format and syntax checking.	**McMaster MSU Java NDS 3.0 21-04-2025** ENSDF publishing code From an ENSDF file, produces a Nuclear Data Sheet pdf file.
V.AveLib 06-22 Averaging Experimental Values. Determines a recommended value for a measure.	**Excel2ENSDF 16-04-25** Creates ENSDF formatted file from Excel.				

Legacy codes

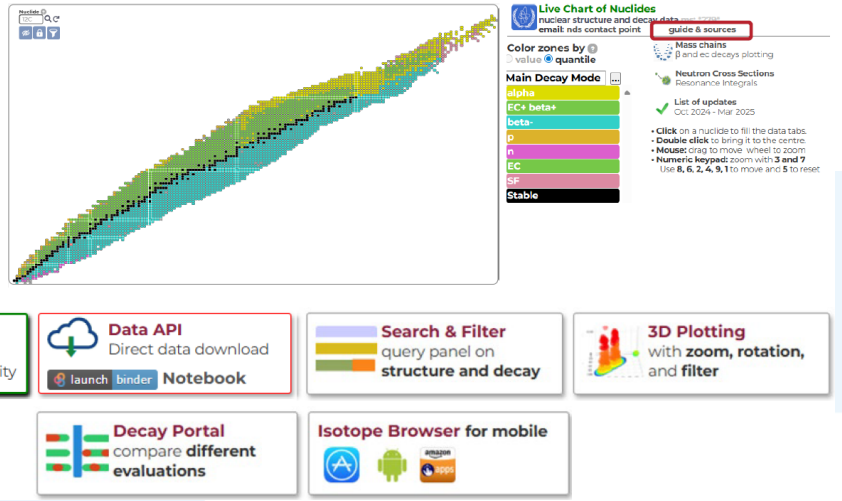
ALPHAD 2.0d Calculates alpha HFs and theoretical half-lives.	**ALPHAD-RadD 1.0** ALPHAD extension, calculates radius parameter.	**DELTA 1.01** Analyzes gamma-gamma angular correlations from unaligned states.	**GTOL 7.2b** Performs a least-squares fit to the gamma-energies to obtain level energies and calculates the net feedings to levels.	**LOGFT 7.3** Calculates log ft values for beta and electron-capture decay, average beta energies, and capture fractions.	**PANDORA 7.0b** Performs some basic physics checks for the ENSDF file.
RadD 1.0	**ADDGAM 1.4**	**FMTCHK 10.5d**	**TREND 8.3**	**NSDFLIB 1.6g**	**SETMDC 6.10**

Web-based

ENSDF interactive @ IAEA

LiveChart

30% of user traffic @ IAEA



New in Livechart
Decay Radiation
order data by intensity

Data API
Direct data download
launch binder **Notebook**

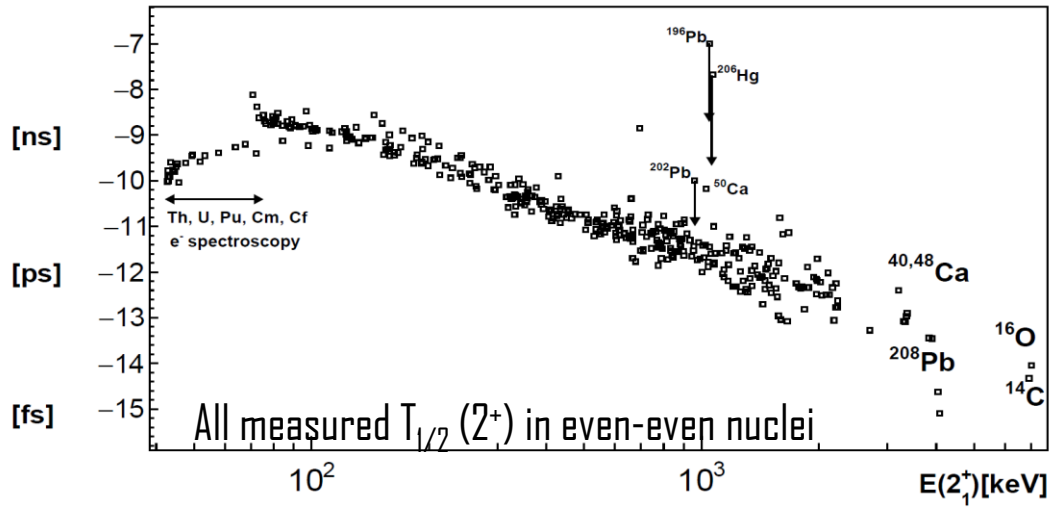
Search & Filter
query panel on
structure and decay

3D Plotting
with **zoom, rotation,** and **filter**

Decay Portal
compare **different evaluations**

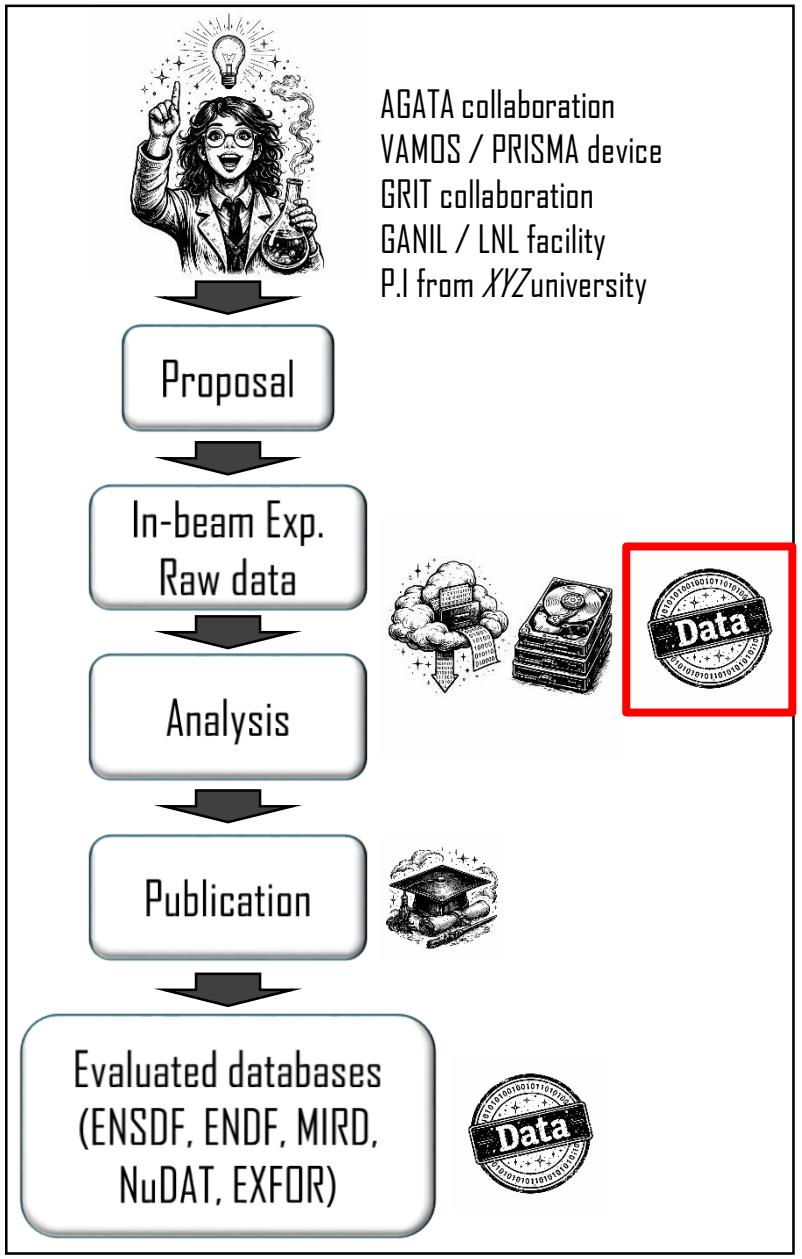
Isotope Browser for mobile

Or script-able



Powered by https://tkn.in2p3.fr/

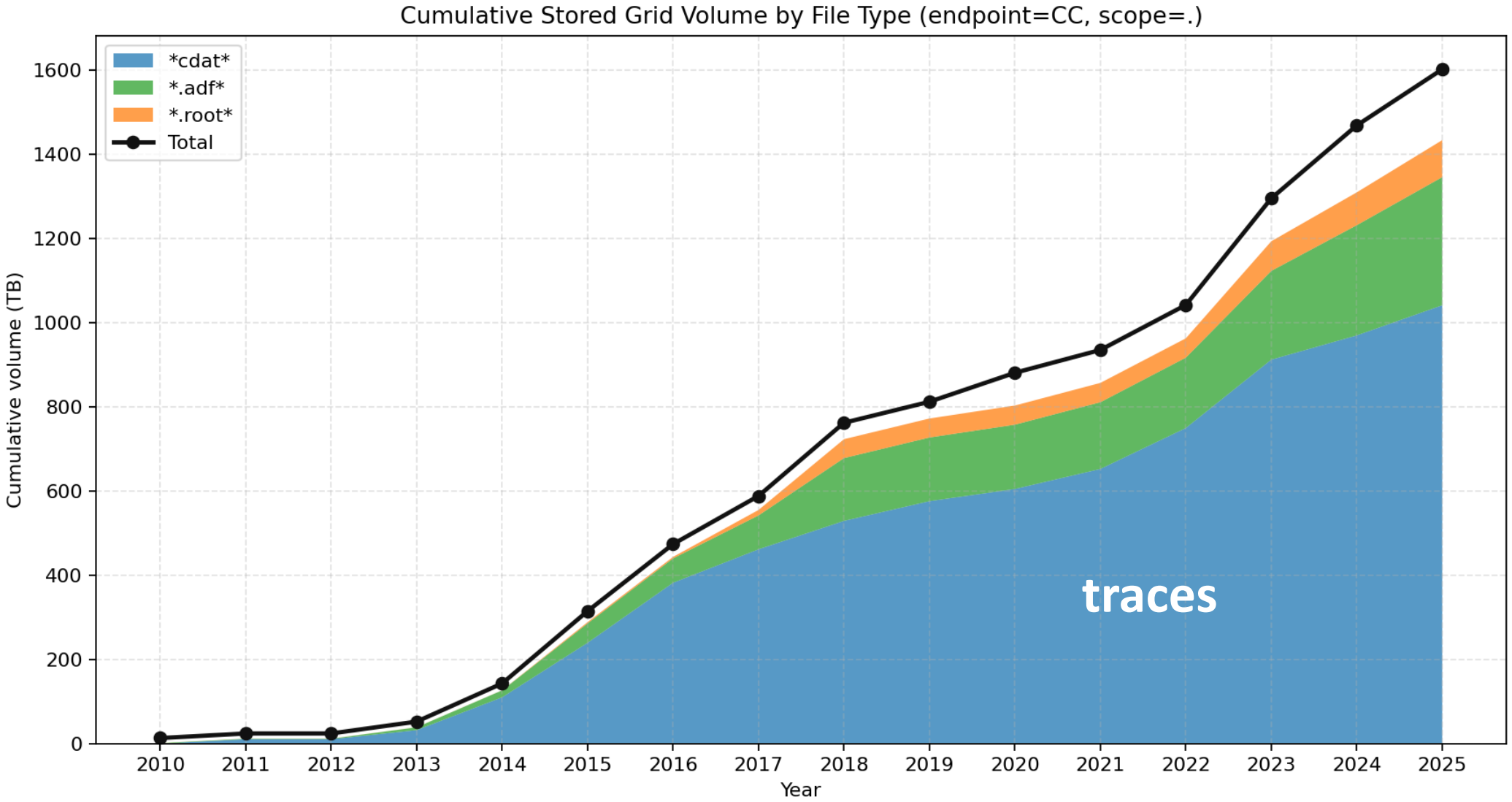
What we want…
Where we want to go…



The L2,L3 data are valuable data

GANIL campaign is 29 experiments
LNL.1 campaign is 25 experiments
GSI campaign is 5 experiments
LNL.2 campaign is so far 48 experiments, counting

~1400 To of data archived in TIER's 1 (CCIN2P3, CNAF)



« metadata »

Analyzed

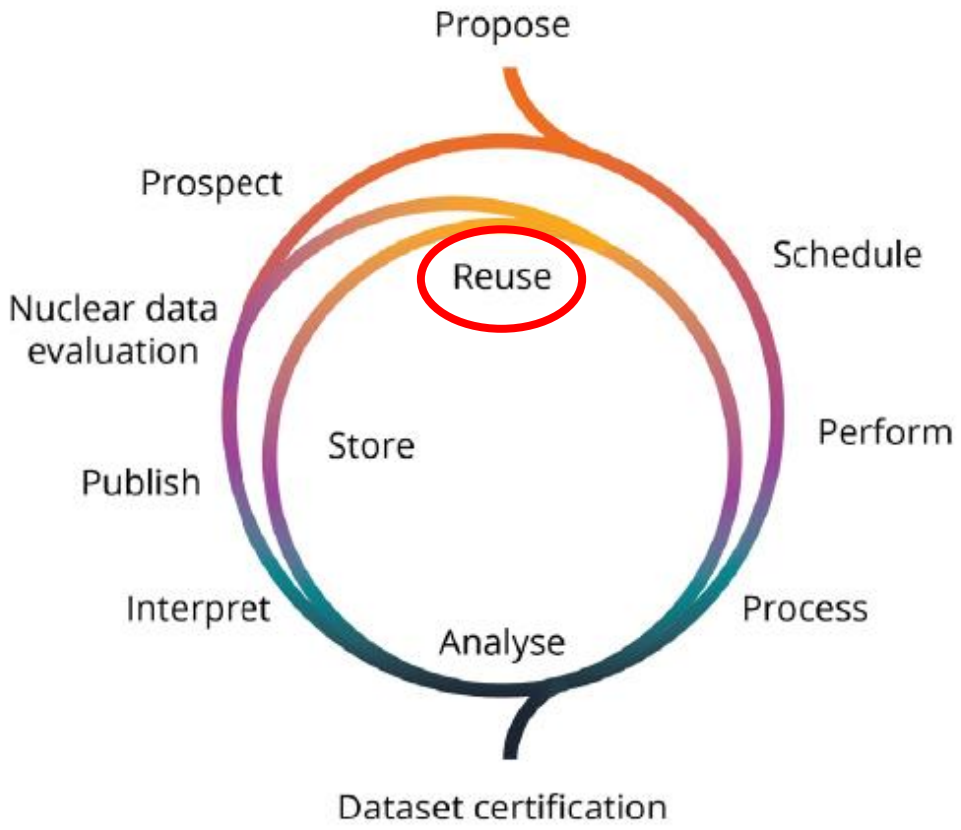
Processed

MySQL data base extracted from GRID – completed (2026)

→ AGATA Data catalogue

Courtesy J. Dudouet (IP2i)

What we want…
Where we want to go…

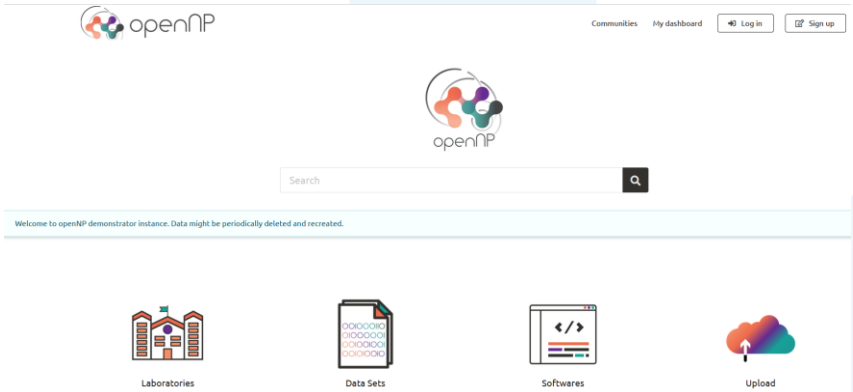


A. Lemasson et al, Nupecc LRP 2024

Long term storage of Data after processing beyond the primary goal of the experiment

Keeping this analysed data for future (hypothetic) use

We need catalogues
We need metadata and reliable workflow
We need to manage the access and data collection
We need to manage the authorship and policies
We need to manage multiple collaborations
We need code and processing reviews
We need more standards



https://opennp.in2p3.fr/

First Observation of Multiphonon γ-Vibrations in an Odd-Odd Nuclear System

E. H. Wang [1,2,3,*], M. Abushawish [4], J. H. Hamilton [3], A. Navin [5,†], S. Bhattacharyya [6,7], J. Dudouet [4], G. H. Bhat [8], J. A. Sheikh [9,10], S. Jehangir [11] *et al.*

Show more

Phys. Rev. Lett. **136**, 072501 – **Published 18 February, 2026**

DOI: https://doi.org/10.1103/1gy6-v3sb

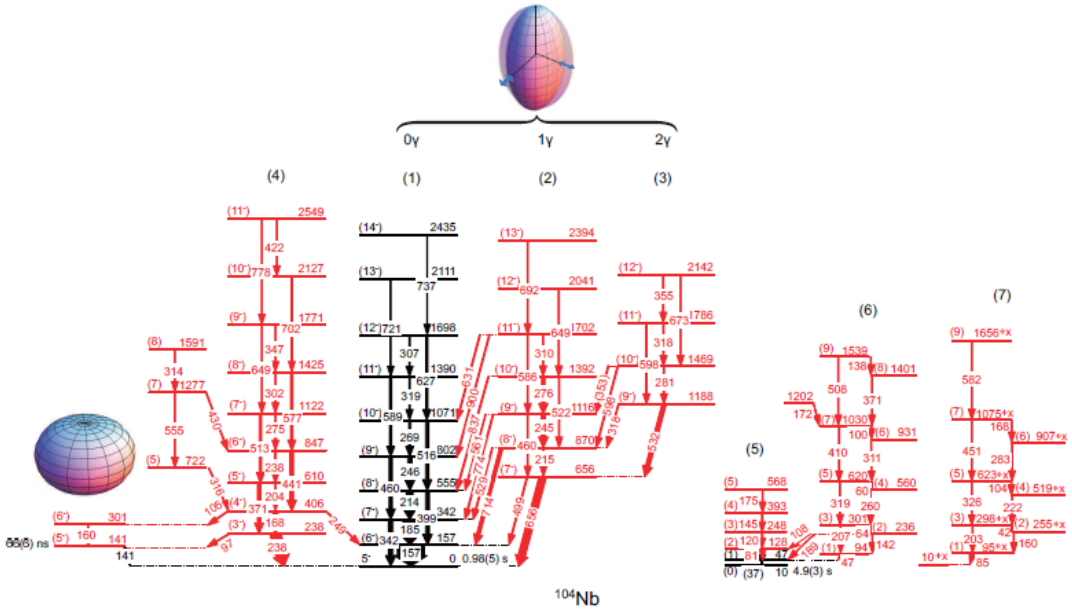
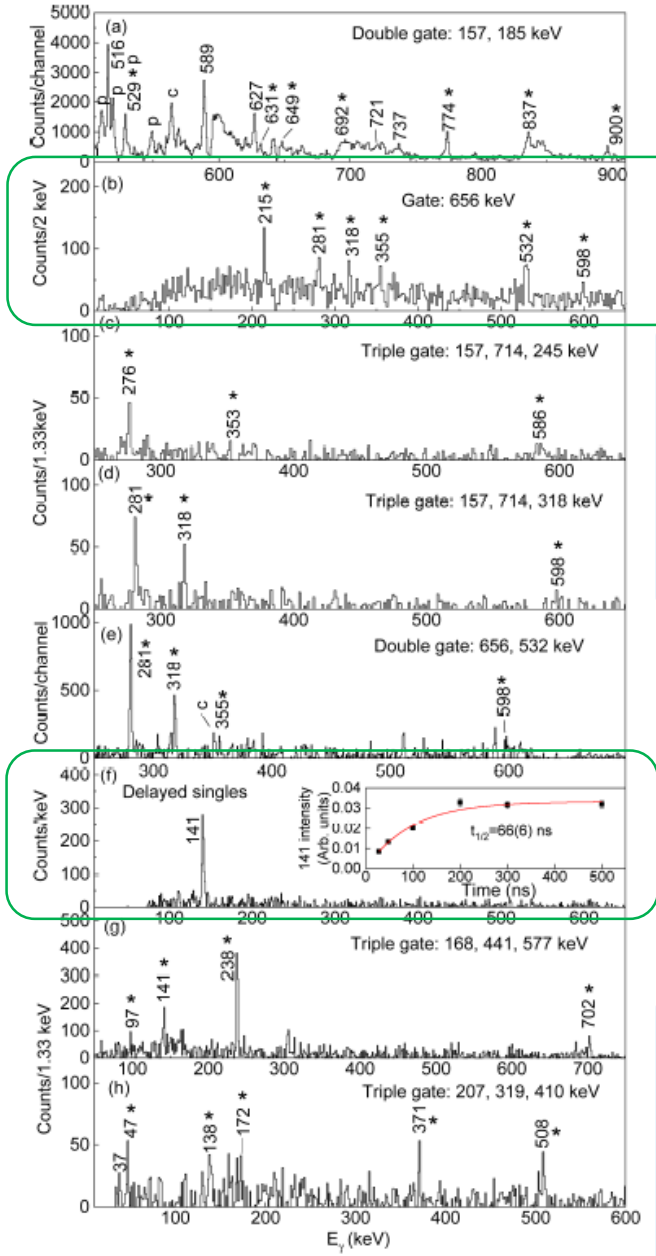


FIG. 1. Level scheme of ^{104}Nb. New transitions and levels are labeled in red. For the excitation energy of band 7, x is either 0 or 8.7 keV. Half-lives of the ground state and the 10 keV isomer are taken from NUBASE2020 [42].



AGATA VAMOS

^{252}Cf – High fold GS
1995 + 2000 run's

Use-case : reusable data with INDRA-FAZIA

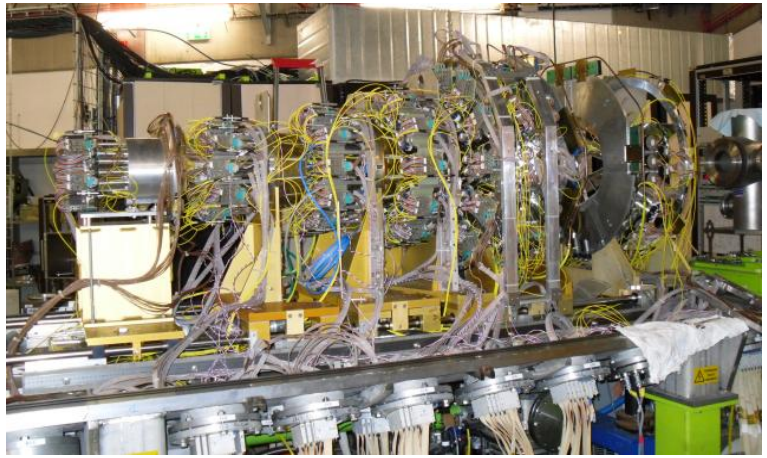
Experiments at GANIL:

- **e789 experiment (2019)**
  - → Title: “Isospin transport and the Density Dependence of the Symmetry Energy”
  - → Setup: INDRA-FAZIA
  - → Systems: ^{58,64}Ni+^{58,64}Ni at 32 and 52 MeV/nuc
  - → Publications:
    - https://doi.org/10.1103/PhysRevC.106.024603 (2022)
    - https://doi.org/10.1103/PhysRevC.108.054611 (2023)

Isospin equilibration

Use-case : reusable data with INDRA-FAZIA

- ^{58}Ni+^{58}Ni at 32 MeV/nuc also studied in a former INDRA campaign
-
- **INDRA 2nd campaign (1994)**
  - → Title: “Multifragmentation process for different mass asymmetry”
  - → Setup: INDRA (solo)
  - → Systems:
    - ^{181}Ta+^{238}U, 197Au @ 33 MeV/nuc
    - ^{238}U+^{238}U @ 23 MeV/nuc
    - ^{58}Ni+^{58}Ni @ 32-90 MeV/nuc
    - ^{58}Ni+^{197}Au @ 10-90 MeV/nuc
  - → Publications:
    - https://doi.org/10.1103/PhysRevC.65.044604 (2002)
    - https://doi.org/10.1103/PhysRevC.67.064603 (2002)
    - https://doi.org/10.1016/S0375-9474(02)00988-0 (2003)
    - https://doi.org/10.1103/PhysRevC.79.064614 (2009)
  -



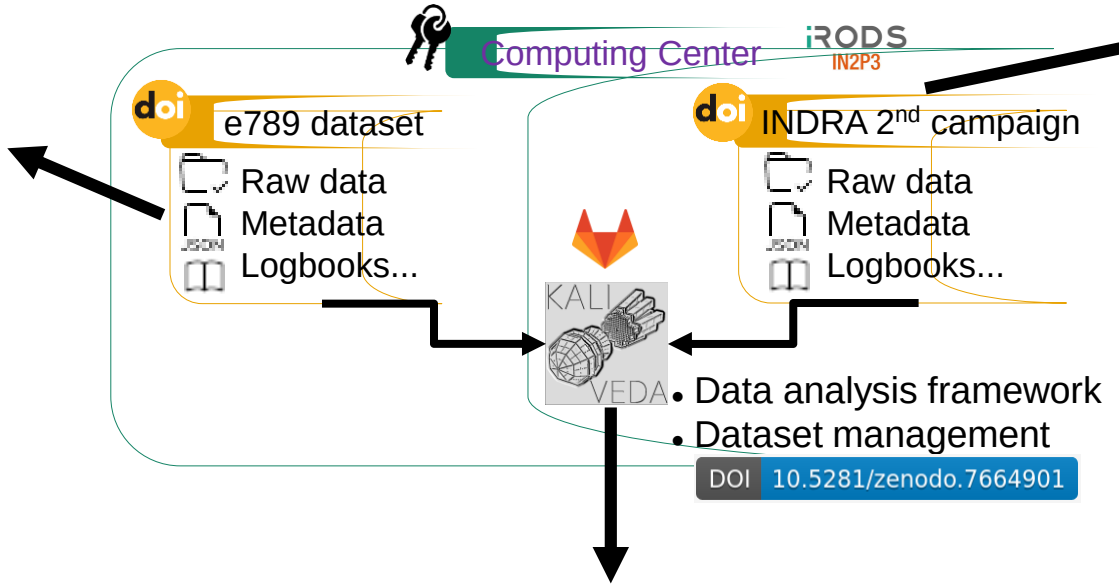
Sideward Flow

Multifragmentation

Isospin equilibration

Use-case : reusable data with INDRA-FAZIA

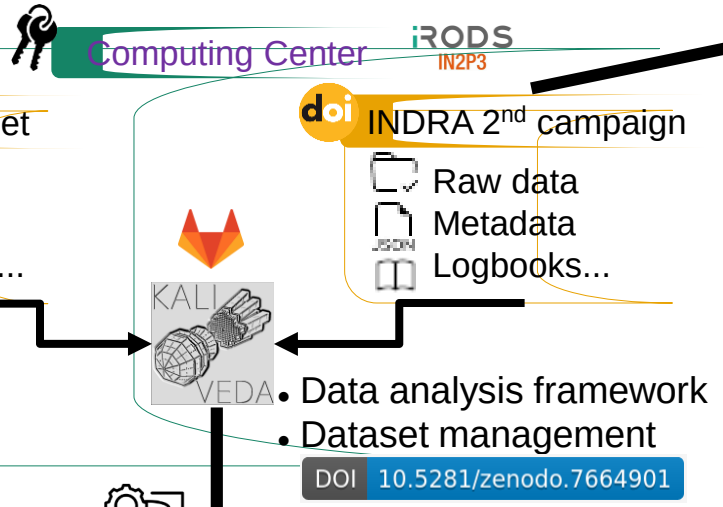
e789 (2019)
- “Isospin transport and the Density Dependence of the Symmetry Energy”
- Setup: INDRA-FAZIA
- Systems: ^{58,64}Ni+^{58,64}Ni @ 32 and 52 MeV/nuc



INDRA 2nd campaign (1994)
- “Multifragmentation process for different mass asymmetry”
- Setup: INDRA (solo)
- Systems:
- → ^{181}Ta+^{238}U, 197Au @ 33 MeV/nuc
- → ^{238}U+^{238}U @ 23 MeV/nuc
- → ^{58}Ni+^{58}Ni @ 32-90 MeV/nuc
- → ^{58}Ni+^{197}Au @ 10-90 MeV/nuc

Use-case : reusable data with INDRA-FAZIA

e789 (2019)
- "Isospin transport and the Density Dependence of the Symmetry Energy"
- Setup: INDRA-FAZIA
- Systems: ^{58,64}Ni+^{58,64}Ni @ 32 and 52 MeV/nuc



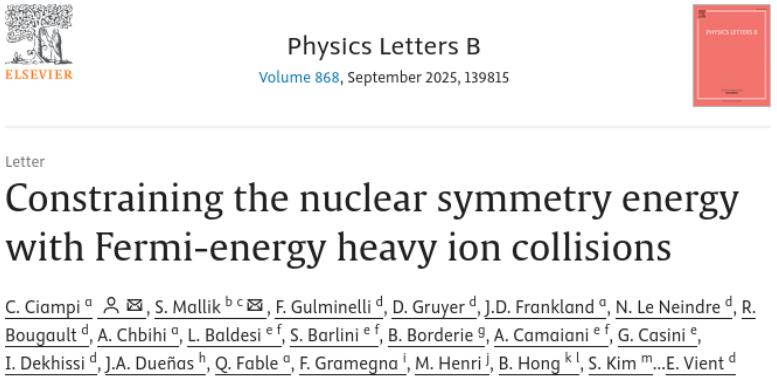
INDRA 2nd campaign (1994)
- "Multifragmentation process for different mass asymmetry"
- Setup: INDRA (solo)
- Systems:
- → ^{181}Ta+^{238}U, 197Au @ 33 MeV/nuc
- → ^{238}U+^{238}U @ 23 MeV/nuc
- → ^{58}Ni+^{58}Ni @ 32-90 MeV/nuc
- → ^{58}Ni+^{197}Au @ 10-90 MeV/nuc

Pre-processed data

The physics analysis

- ^{58,64}Ni+^{58,64}Ni @ 32 Mev/nuc
- Observable = Isospin transport ratio
- [e789] → **exp. isospin diffusion**
- [e789 + 2nd camp.]
- → **model-independent impact parameter reconstruction**
- [e789 + 2nd camp. + simulations]
- → **Symmetry energy constraints**

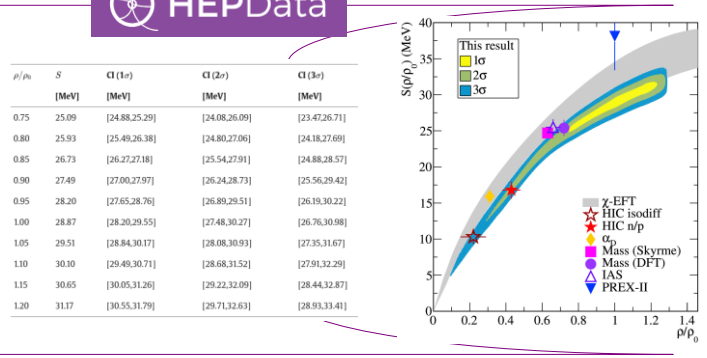
Publication


ELSEVIER
Physics Letters B
Volume 868, September 2025, 139815
Letter

Constraining the nuclear symmetry energy with Fermi-energy heavy ion collisions

C. Ciampi [a], S. Mallik [b c], F. Gulminelli [d], D. Gruyer [d], J.D. Frankland [a], N. Le Neindre [d], R. Bougault [d], A. Chbihi [a], L. Baldesi [e f], S. Barlini [e f], B. Borderie [g], A. Camaiani [e f], G. Casini [e], I. Dekhissi [d], J.A. Dueñas [h], Q. Fable [a], F. Gramegna [i], M. Henri [j], B. Hong [k l], S. Kim [m]...E. Vient [d]

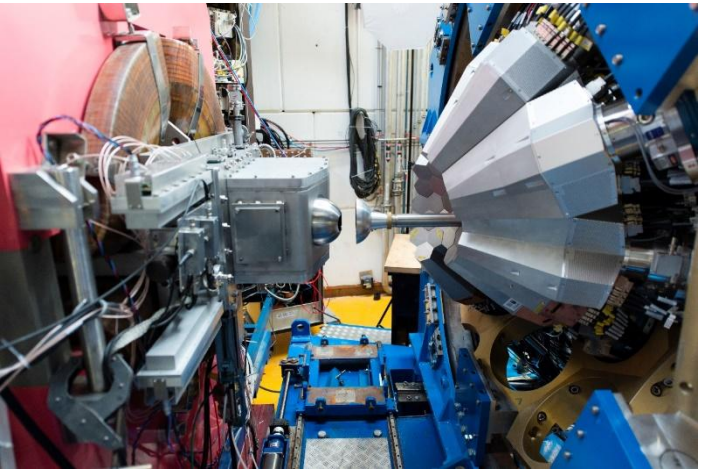
HEPData



These cases are somehow a bit simpler because one deals with a unique apparatus's or single collaboration with a relatively low data taking frequency

AGATA@GANIL.1 were many sub-campaigns

2015-2017

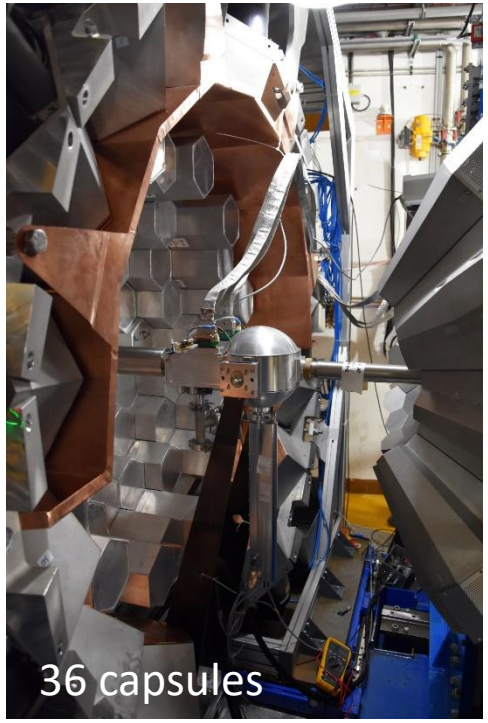


AGATA coupled to VAMOS, FATIMA, PARIS

24-34 capsules

Exotic nuclei spectroscopy by MNT transfer and fission reaction

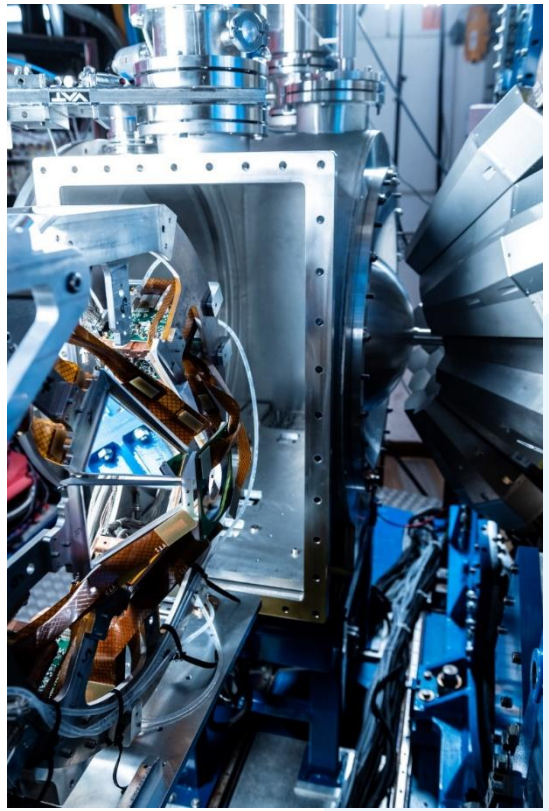
2018



AGATA coupled to NEDA- DIAMANT

N~Z nuclei spectroscopy by fusion evaporation

2019-2021

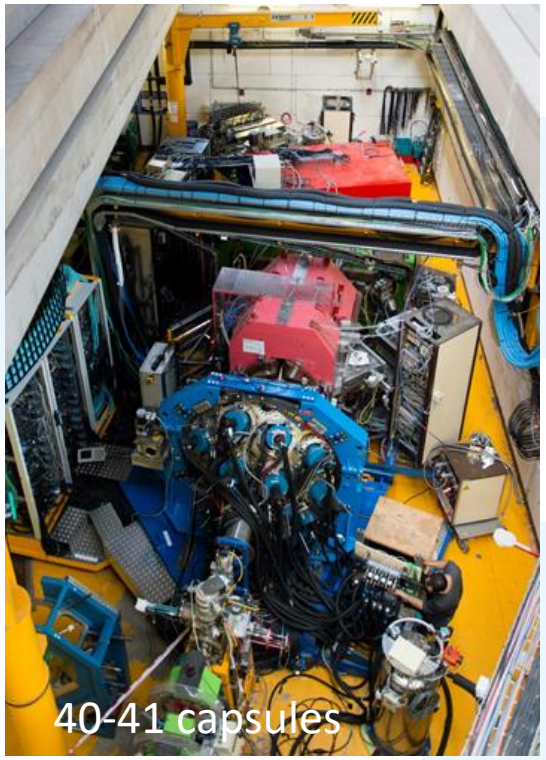


AGATA coupled to VAMOS MUGAST

40-41 capsules

Exotic nuclei spectroscopy by transfer reaction using RIB

2021



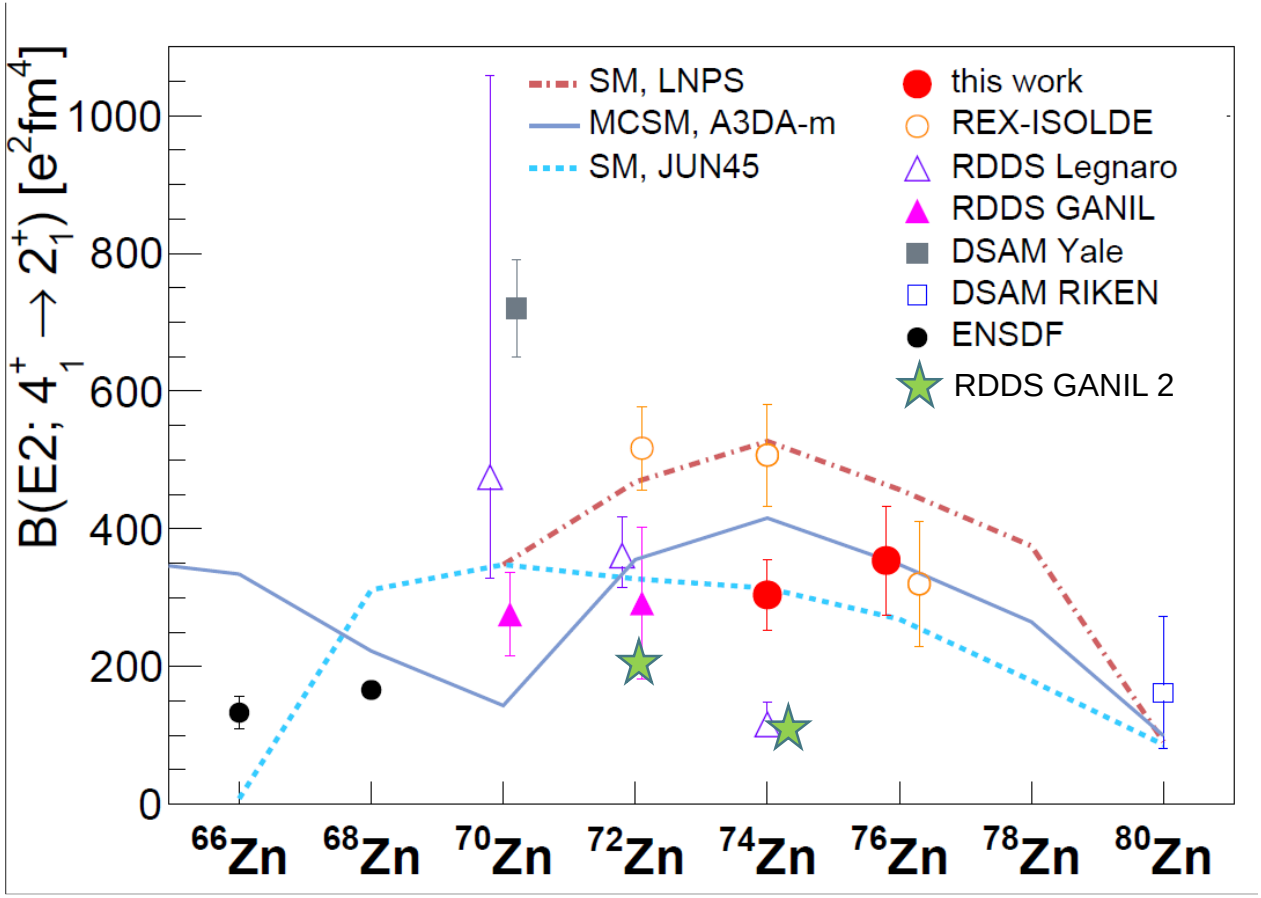
AGATA coupled to VAMOS, EXOGAM, 2nd Arm, LEPS

Exotic nuclei spectroscopy by MNT transfer

If time allows

More examples

Spectroscopy of the 4^+_1 state in ^{74}Zn



Strong anomaly /inconsistency

HIE-ISOLDE A. Illana et al. Phys. Rev. C 108, 044305 (2023)

J. Van de Walle *et al.* Phys. Rev. Lett. 99, (2007) ; Phys. Rev. C 79, 014309 (2009)

(AGATA)C. Louchart et al. Phys. Rev. C 87, 054302 – (2013)

(EXOGAM) I. Celikovic, et al Acta Phys. Pol. B 44, 375 (2013).

D. Mücher, Phys. Rev. C 79, 054310 (2009)

Y. Shiga *et al.* Phys. Rev. C 93, 024320 (2016)

(AGATA) T. Milanović et al Acta Phys. Pol. B 51, 837 (2020), in preparation.

The lifetime experiments have been (certainly) contaminated by a long-lived feeder or several feeders

Feeding is reaction-dependent (nearly unpredictable)

The dream : gather all reactions used, make a $\gamma\gamma$, gather all plunger distances measured and compute all data set to seek for anomalies

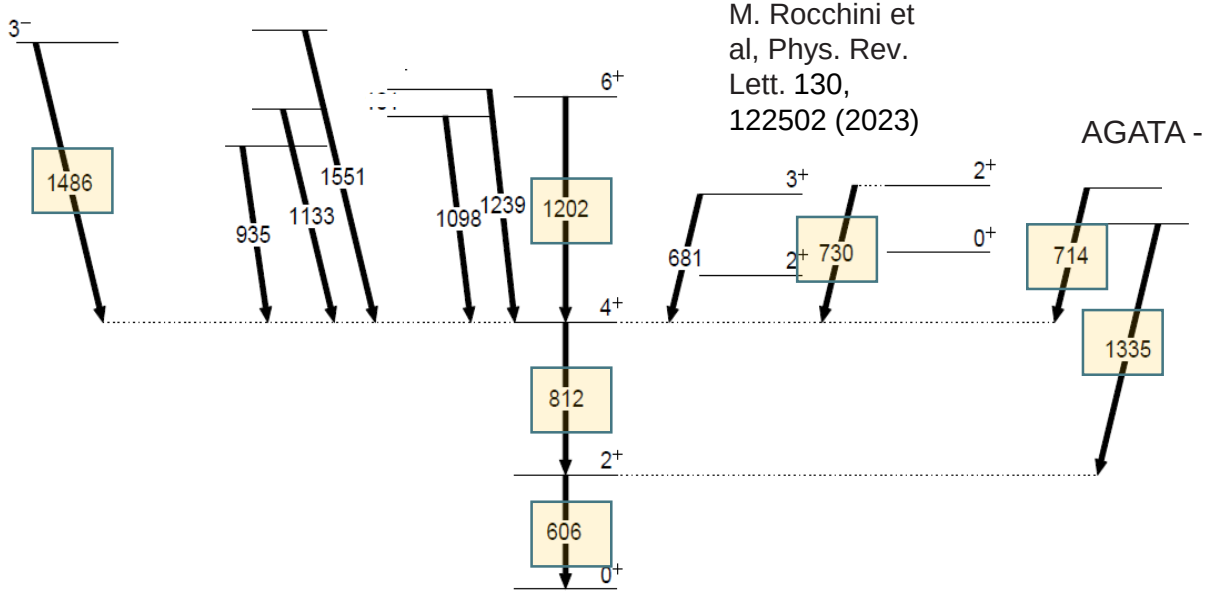
Spectroscopy of the 4^+_1 state in ^{74}Zn

J. L. Tracy Jr. et al
PRC 98, 034309
(2018)

M. Rocchini et al, Phys. Rev. Lett. 130, 122502 (2023)

AGATA - Fission

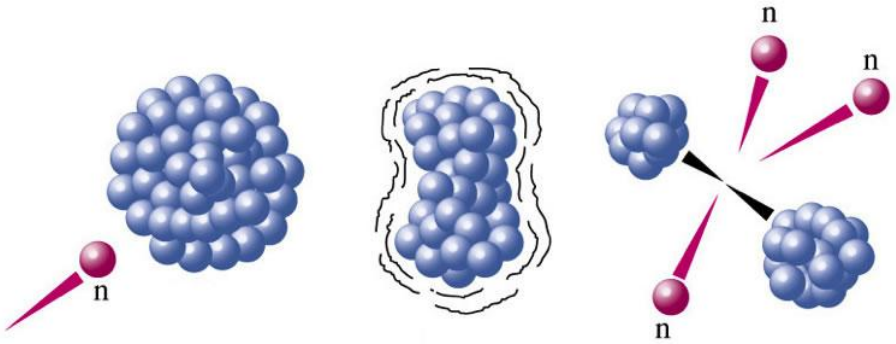
G. Duchêne in preparation



^{238}U+ ^{76}Ge PRISMA	AGATA	**plunger**	MNT	(2010)	
^{238}U+ ^{76}Ge VAMOS	AGATA	**plunger**	MNT	(2016)	
^{238}U + Be VAMOS	AGATA		FISSION	(2015)	light mass rigidity
^{238}U + Be VAMOS	AGATA		FISSION	(2016)	heavy mass rigidity
^{238}U + Be VAMOS	AGATA	**plunger**	FISSION	(2015)	
^{238}U + ^{76}Ge PRISMA	CLARA	**plunger**	MNT	(<2010)	
^{238}U + ^{70}Zn VAMOS	EXOGAM	**plunger**	MNT	(<2010)	
^{208}Pb + ^{70}Zn VAMOS	EXOGAM		MNT	(<2010)	

What we want…
Where we want to go…

Being able to gather all these data set to crack the case without collecting again new in-beam data



Fission → Spectroscopy of fission fragments for nuclear structure
Fission→ Reaction mechanism studies

EXOGAM VAMOS FISSION
AGATA VAMOS FISSION
PARIS VAMOS FISSION
FATIMA AGATA VAMOS FISSION

What a potential !

What a potential !

Similar for Multi-Nucleon transfer

My take home message is

Large collaborations within the EU nuclear low-energy physics community are working towards the objective of ensuring that the data to be evaluated and archived (with open access) includes not only the final products (numbers), but also the L3 data.


GANIL