ISOLDE Workshop and Users meeting 2025

Report of Contributions

Contribution ID: **1** Type: **Poster (In person)**

Production Cross Section Measurements of the natPd(α,x)111Ag Reaction

Wednesday 3 December 2025 19:02 (1 minute)

The radionuclides used in targeted radionuclide therapy emit charged particles, such as α, β- and Auger electron, that makes possible the delivery of a significant dose to the tumour cells while sparring the healthy tissues surrounding them. The radioisotope 111Ag (T1/2 = 7.45 days, Emax,β- = 1.04 MeV) is a β- emitter that is promising for this kind of application. Its low energy β- has a medium tissue penetration of average 1.8 mm which enables the targeting of medium tumours. Additionally, its γ-rays at 245 keV (1.3 %) and 342 keV (6.7 %) are well suited for SPECT imaging which is helpful for monitoring more precisely the in vivo dose delivered. Several routes have been studied to produce
111Ag either with research reactors, cyclotrons or photonuclear reactions. The production cross sections of natPd(α,x)111Ag, one of the reaction for the alpha route, has only been measured by two teams. However, these measurements do not cover the whole region of the peak and what's happening after it.

For this reason, several measurements of the production cross section of the natPd(α,x)111Ag reaction have been performed at the GIP ARRONAX with an alpha beam of 68 MeV to get experimental data above 40 MeV. The area of the peak will be thus better defined and the shape of the curve after the peak will be known. The "stacked-foils"method has been used during our experiments. The intensity of the beam has been monitored through the natAl(α,x)24Na and natAl(α,x)22Na nuclear reactions. HPGe detectors were used to perform the γ-spectrometry of each foil: short acquisitions were done directly after the irradiation to measure short-lived radionuclides and longer acquisitions days after to measure 111Ag and the contaminants 105Ag, 106mAg and 110mAg. The analysis of the spectra was performed using multiple γ-rays for each radionuclide when possible.

The measurement made at the GIP ARRONAX of the natPd(α,x)111Ag cross sections up to 68 MeV will be presented. The experimental data obtained will be confronted with the literature and with TENDL 2023. Furthermore, the excitation function obtained with the new measurements and with the literature makes it possible to pick optimal parameters for the production of 111Ag. Thus, allowing its comparison with the other production routes in terms of yield, purity and specific activity.
These new experimental data could also help in refining the theoretical models to better describe the nuclear reactions.

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Presenter: PUREN, Laurine (Laboratoire Subatech)

Session Classification: Poster Session

Contribution ID: **2** Type: **Poster (In person)**

Preliminary Results on the Gamma-Spectroscopy of 229Ac Following the Beta Decay of 229Ra

Wednesday 3 December 2025 19:00 (1 minute)

The isotope ^{229}Th is of particular interest because of its exceptionally low-energy isomeric state (8.2 eV), which can be probed via vacuum ultraviolet (VUV) spectroscopy and holds significant potential for the development of a nuclear clock [1,2]. Understanding this isomer's properties, including its excitation and decay modes, is hereby essential and involves investigating the nuclear structure in the actinide region. In recent work at ISOLDE, the isomer was populated through the beta decay of ^{229}Ac, enabling the observation of its radiative decay [2,3].
The odd-even nucleus ^{229}Ac, as part of the beta-decay chain from ^{229}Ra to ^{229}Th, is directly linked to the population and depopulation of nuclear states that influence the feeding of the isomer. However, despite its relevance, the structure of ^{229}Ac remains poorly studied, with little experimental data available.

To address this, we have performed a gamma-spectroscopy study of ^{229}Ac following the beta-decay of ^{229}Ra. The data were collected at the ISOLDE facility at CERN using the ISOLDE Decay Station (IDS) [4], which provides high-resolution gamma-ray detection capabilities. This study aims to refine the level scheme of ^{229}Ac, identify key transitions, and improve our understanding of the nuclear structure in this region. The preliminary results presented in this work, aim to contribute to a more comprehensive picture of the nuclear properties of the actinide region of the nuclear chart.

[1] C. Zhang et al., Frequency ratio of the ^{229m}Th nuclear isomeric transition and the ^{87}Sr atomic clock, Nature 633, 63–70 (2024).

[2] S. Kraemer et al., Observation of the radiative decay of the ^{229m}Th nuclear clock isomer, Nature 617, 706–710 (2023).

[3] S. V. Pineda et al., Radiative decay of the ^{229}Th nuclear clock isomer in different host materials, Phys. Rev. Research 7, 013052 (2024).

[4] ISOLDE Decay Station (IDS), http://isolde-ids.web.cern.ch/

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Session Classification: Poster Session

Contribution ID: **5** Type: **Submitted oral (In person)**

Stable triaxial rotation as the main mode of excitation at or around magic numbers

Thursday 4 December 2025 11:50 (12 minutes)

Here I will present our new experimental and theoretical work on nuclear shapes based on electric quadrupole (E2) matrix elements. New beam development and experimental facilities funded through the GAMKA project have allowed the precise determination of E2 matrix elements at iThemba LABS [1,2]. The large oblate deformation determined in 60Ni is is inconsistent with the near-zero quadrupole moment expected for simple harmonic surface vibrations around the Z=28 shell closure. Instead, we show stable triaxial rotations about the three axis as the main mode of collective excitation near magic numbers, assuming the gamma dependence is provided by the irrotational flow [3]. The empirically determined triaxial deformation gamma is consistent with collective wave functions calculated using the projected generator coordinate method with the D1S nuclear interaction. We will further generalize these findings for nuclei typically considered as surface vibrators at or close to shell closures as well as propose new ideas for a new research program aimed at the empirical determination of triaxiality for unstable nuclei at HIE-ISOLDE.

[1] Mehl CV, Orce JN, et al., Phys. Rev. C. 111(5), 054318 (2025).
[2] Orce JN, Zulu A et al., submitted to Phys. Rev. Lett. (2025).
[3] E. A. Lawrie, E. A. and Orce, J. N. At. Data Nucl. Data Tables 164, 101730 (2025).

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Session Classification: Session 6

Contribution ID: **6** Type: **Poster (In person)**

On the design of a flexible Ion source for COLLAPS

Wednesday 3 December 2025 18:59 (1 minute)

Technical poster on the future flexible ion source for COLLAPS, detailing the specific and unique requirements of an ion source for fast beam spectroscopic purposes. This source will function as a metal ion source capable of vapourising a variety of metals into atomic gasses using a fibre laser before ionising them using electron impact ionisation. This technique will also allow the source to function as a residual gas source while fed with feed gas enhancing its flexibility.

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Session Classification: Poster Session

Contribution ID: **7** Type: **Submitted oral (In person)**

Particle boundary in agglomerates induces magnetoelectric coupling in bismuth ferrite nanoparticles

Friday 5 December 2025 10:05 (12 minutes)

The magnetoelectric coupling effects and ferromagnetic properties of multiferroic bismuth ferrite ($BiFeO_3$, BFO) nanoparticles at the microscopic scale remain subjects of ongoing scientific discourse. In this study, two local hyperfine interaction techniques—time differential perturbed angular correlation (TDPAC) spectroscopy and transmission Mössbauer (TMS) spectroscopy—were employed to investigate local atomic-scale fields without altering the structural integrity of materials. The TDPAC data provide clear evidence of ferrimagnetic ordering at the non-magnetic sublattice Bi ions within BFO nanoparticles (BFO NPs). Additionally, the combined analysis of TDPAC and TMS reveals a pronounced magnetostrictive magnetoelectric coupling effect in BFO NPs, primarily governed by inhomogeneous compressive strain. To achieve a comprehensive characterization of the material, supplementary techniques—including high-resolution transmission electron microscopy, scanning electron microscopy, X-ray diffraction, and vibrating sample magnetometry - were utilized. The findings suggest that lattice strain induced by particle boundaries in aggregates plays a pivotal role in modulating ferromagnetism and magnetoelectric coupling in BFO NPs.

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Session Classification: Session 9

Contribution ID: **8** Type: **Poster (In person)**

Coulomb excitation of ^{212}Ra at HIE-ISOLDE

Wednesday 3 December 2025 18:58 (1 minute)

The generalised seniority scheme is a truncated version of the nuclear shell model [1]. It is able to describe the structure of atomic nuclei in the vicinity of shell closures. The number of unpaired nucleons, the seniority ν, is considered a good quantum number.
The region of the even-even Po-Rn-Ra nuclei with $N = 124$ exhibits strong signs of seniority-like behaviour. This can be observed, e.g. in the energy spacing between excited yrast states which decreases at higher angular momenta. However, no experimental data is available to confirm or falsify the anticipated parabolically increasing trend in the absolute $E2$ transition strength with the filling of the j-shell for the $\Delta\nu = 2$ seniority-changing $2^+_1 \rightarrow 0^+_1$ transition [2]. Therefore, a Coulomb-excitation experiment was conducted at HIE-ISOLDE in 2024 in order to obtain the $B(E2; 2^+_1 \rightarrow 0^+_1)$ value of ^{212}Ra. The ^{212}Ra beam was impinged on a ^{120}Sn target with 4.51 MeV/u to ensure safe Coulomb excitation. γ rays of deexciting ^{212}Ra nuclei were observed by the high-purity germanium detectors of the Miniball array [3] while ejectiles and recoiling particles were recorded by a double-sided silicon strip detector at forward angles. From the γ-ray yields the $E2$ strength of the $2^+_1 \rightarrow 0^+_1$ transition can be then deduced. The current state of the analysis will be presented.

[1] I. Talmi, Nucl. Phys. A **172**, 1 (1971).
[2] J. J. Ressler *et al.*, Phys. Rev. C **69**, 034317 (2004).
[3] N. Warr *et al.*, Eur. Phys. J. A **49**, 40 (2013).

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Session Classification: Poster Session

Contribution ID: **9** Type: **Invited (In person)**

Halo orbits and the nuclear radius

Thursday 4 December 2025 11:00 (20 minutes)

The nuclear radius is one of the fundamental properties of the atomic nucleus. While the direct measurement is not always possible, one can infer its size by measuring other observables.
Recent theoretical studies by Bonnard and collaborators have put in evidence the role of the large radius of low-l orbits in a main nuclear shell in determining the nuclear radius and its evolution when varying their occupancy.
Isotope shifts allow to follow the evolution of radii with increasing the neutron number far from stability.
Another sensitive tool to study these properties is the measurement of the differences in excitation energy of mirror nuclei in different mass regions.
Recent experimental studies for both isotope shifts and mirror energy differences can be reproduced by shell model calculations that include the effect of low-l (halo) single-particle orbitals.
They will be discussed in this presentation.

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Presenter: LENZI, Silvia Monica (Universita e INFN, Padova (IT))

Session Classification: Session 6

Contribution ID: **10** Type: **Poster (In person)**

Towards King-plot nonlinearity searches with radioactive ion beams

Wednesday 3 December 2025 18:57 (1 minute)

Isotope shift measurements and the King plot are an established method to determine the nuclear charge radius [1]. Nonlinear effects in King plots have recently gained additional interest as probes for higher-order nuclear deformation and beyond-standard-model physics [2,3]. Methods like the generalized King plot allow to extract multiple effects such as higher-order nuclear deformation and couplings to ultra-light dark matter [4]. For these contributions, high-precision measurements of the isotope shift in multiple narrow transitions between multiple isotope pairs are required and many alkali-earth atoms and singly charged ions show a suitable atomic structure. However, the amount of spinless stable isotopes is a limiting factor. Measurements have been performed at highest precision in stable Yb and Ca [5,6]. In order to overcome the limitation in stable isotopes, deceleration and spectroscopy of radioactive ion beams for precision isotope shift spectroscopy is discussed in this contribution. Strontium ions are chosen as proof-of-concept and the implementation of fluorescence spectroscopy of the S1/2 ↔ D3/2 and S1/2 ↔ D5/2 transitions is propounded.

[1] W. H. King, Isotope Shifts in Atomic Spectra. Springer US, (1984).
[2] J. C. Berengut et al., Phys. Rev. Lett., 120, 091801 (2018).
[3] Flambaum, V. V., et al., Phys. Rev. A 97, 032510 (2018).
[4] J. C. Berengut et al., Phys. Rev. Research, 2, 4 (2020)
[5] Door, M. et al., Phys. Rev. Lett. 134, 063002 (2025).
[6] 1. Wilzewski, A. et al., Phys. Rev. Lett. 134, 233002 (2025).

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Session Classification: Poster Session

Contribution ID: **11** Type: **Poster (In person)**

Lifetime measurements in neutron-rich lanthanides with the GRIFFIN Spectrometer using the fast-timing technique

Wednesday 3 December 2025 18:56 (1 minute)

The neutron-rich lanthanides are expected to exhibit octupole collectivity, which can lead to asymmetric nuclear shapes. The study of low-lying negative-parity states in the even-even nuclei in this region is key to understanding the magnitude of collectivity and whether the nucleus adopts a static or dynamic asymmetric shape. Lifetimes of these states are particularly sensitive to electric-dipole transition strengths, where an enhancement can signify octupole deformation.

The fast-timing technique can be used to measure lifetimes of short-lived states in radioactive nuclei by analysing γ-γ and β-γ coincidences following β-decay. In this work, the lifetimes of low-lying states in barium, cerium, and neodymium isotopes with A = 146, 148, and 150 have been measured using the GRIFFIN spectrometer based at the ISAC-I facility at TRIUMF, Vancouver.

Primary beams of $^{146,148,150}Cs$ were delivered on to a moving tape collector at the centre of the GRIFFIN spectrometer, which consists of an array of 16 HPGe clover detectors, supplemented with an array of 8 $LaBr_3$ scintillator detectors for fast timing, and a zero-degree scintillator for the detection of electrons emitted during β-decay. This poster will present preliminary results of these measurements obtained using both the convoluted decay-curve method and the generalised centroid-shift method.

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Session Classification: Poster Session

Contribution ID: **12** Type: **Submitted oral (online)**

Magnetic co-doping in $Al_xGa_{1-x}N$: An emission Mössbauer spectroscopy study

Friday 5 December 2025 11:25 (12 minutes)

The charge states and lattice sites of Fe ions in both virgin and Mn-doped $Al_xGa_{1-x}N$ samples have been investigated by employing ^{57}Fe emission Mössbauer spectroscopy (eMS) using radioactive $^{57}Mn^{+}$ ion implantation at ISOLDE, CERN. In undoped $Al_xGa_{1-x}N$, Fe^{2+} ions occupying Al/Ga lattice sites associated with nitrogen vacancies, as well as substitutional Fe^{3+} ions, have been identified. Upon Mn doping, a substantial suppression of the Fe^{3+} signal is observed. This is accompanied by the emergence of a single-line component, attributed to Fe^{4+} ions on Al/Ga sites that are enabled by the presence of nearby substitutional Mn^{2+} ions. The experimental results are supported by density functional theory calculations. This work establishes co-doping as a new avenue for tailoring magnetic properties in doped III-nitride semiconductors.

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Presenter: ADHIKARI, Rajdeep (Johannes Kepler University (AT))

Session Classification: Session 10

Contribution ID: **13** Type: **Invited (In person)**

Fission studies at ISS

Wednesday 3 December 2025 09:40 (20 minutes)

The study of nuclear fission remains a critical area of research, not only for understanding fundamental nuclear properties but also for its implications in the production of heavy elements in astrophysical environments. In r-process nucleosynthesis, fission plays a crucial role as it ultimately limits the mass of nuclei that can be produced. Currently, very limited data on fission barriers of neutron-rich nuclei are available. Moreover, studying fission barriers is essential for investigating the influence of nuclear structure on fission dynamics.

The ISOLDE Solenoidal Spectrometer (ISS) offers a new approach to investigate fission probabilities of neutron-rich actinides via (d,pF) reactions using Radioactive Ion Beams. This approach utilises a novel setup designed to enhance the detection efficiency for fission fragments in coincidence with transfer-like protons in a solenoidal field. This optimised method provides access to the fission probability as a function of the excitation energy. Additionally, complementary γ-ray measurements offer insight into the total energy and multiplicity of γ-rays emitted during the fission process.

In this context, the measurement of the fission barrier of ^{233}U has been performed, as a first step to establish this new approach.

In this contribution, the experimental setup will be presented, and preliminary results of the experiment will be discussed, highlighting its potential for advancing our understanding of nuclear fission.

Beyond this study, this method has the potential to be extended to investigate even more exotic nuclei farther from the valley of stability, opening new opportunities to explore fission in regions of the nuclear chart that have so far remained experimentally inaccessible.

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Session Classification: Session 1

Contribution ID: **14** Type: **Poster (In person)**

Recent developments on terbium mass separation from tantalum target materials at CERN-MEDICIS facility.

Wednesday 3 December 2025 18:55 (1 minute)

The growing field of nuclear medicine theranostics relies on radionuclides that combine diagnostic and therapeutic functions [1]. Among these, the four isotopes of Terbium Tb-149, Tb-152, Tb-155, and Tb-161 offer complementary decay modes suitable for PET, SPECT, and targeted alpha and beta therapy, earning Terbium the title of the "Swiss army knife"of nuclear medicine [2,3].
To produce non-conventional medical radionuclides with high-molar purity, CERN established the MEDICIS (MEDical Isotopes Collected from ISOLDE) facility in 2017. Operating in synergy with ISOLDE, MEDICIS utilizes the unused fraction of the 1.4 GeV proton beam from the Proton-Synchrotron Booster to irradiate dedicated targets. After irradiation, targets are heated up to 2000 - 2300 ℃ to release the reaction products, which are then ionized and mass-separated to obtain isotopically pure samples [4]. MEDICIS has successfully delivered several radionuclides - including Tb-149, Tb-152, Tb-155, Sm-153 and Ac-225 - for medical research. However, despite recent advancements in mass separation at CERN-MEDICIS and other different facilities, the efficiency and yield for some radionuclides known as "difficult to extract"such as Tb, remain sub-optimal for medically relevant activities [5].
The selection of the target material is critical for optimizing isotope yield and release efficiency. Tantalum remains a preferred choice due to its high atomic mass, excellent thermal stability, and suitability for producing terbium isotopes and other lanthanides. However, despite these favourable properties, the mass separation efficiency has been observed to decrease by approximately an order of magnitude after the first use of the target material.
This study compares the mass separation efficiency of terbium radionuclides produced using tantalum foils and tantalum carbide pellets as target materials. Recent developments at the CERN-MEDICIS facility have demonstrated significant improvements in the production of high-purity Tb samples, with mass separation efficiencies for Tb-155 reaching nearly 2% as well as providing first pure Tb-149 samples to partner institutes. In addition, sintering studies conducted on Ta foils and TaC targets provide insights into the structural and microstructural changes occurring after repeated use, offering possible explanations for the observed reduction in mass separation efficiency during subsequent heating cycles.

[1] Zhang, Siqi, et al. "Radiopharmaceuticals and their applications in medicine." Signal transduction and targeted therapy 10.1 (2025): 1.
[2] Van Laere, Camille, et al. "Terbium radionuclides for theranostic applications in nuclear medicine: from atom to bedside." Theranostics 14.4 (2024): 1720.
[3] Müller, Cristina, and Nicholas P. van der Meulen. "Terbium "Sisters": More Than just a "Swiss Army Knife"." Beyond Becquerel and Biology to Precision Radiomolecular Oncology: Festschrift in Honor of Richard P. Baum. Cham: Springer International Publishing, 2024. 225-236.
[4] Duchemin, Charlotte, et al. "CERN-MEDICIS: a unique facility for the production of non-conventional radionuclides for the medical research." 11th International Particle Accelerator Conference (IPAC2020). 2020.
[5] Bernerd, C., et al. "Production of innovative radionuclides for medical applications at the CERN-MEDICIS facility." Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms 542 (2023): 137-143.

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Session Classification: Poster Session

Contribution ID: **15** Type: **Poster (In person)**

PROPOSAL FOR A NEW GENERAL TIMING SYSTEM AT ISOLDE

Wednesday 3 December 2025 18:54 (1 minute)

Due to the ever-increasing demands and the interconnectedness of the different machines operating at ISOLDE, a general timing system is proposed for the facility to synchronize the operation for the different sub-systems, such as the new mass separator beamline RC6, the HRS and GPS beamgates, the upcoming central beamline switching, ISCOOL, RILIS laser trigger generation, etc. The different sub-systems of the machine requiring a new timing system or a timing system consolidation are described, followed by a summary of the different triggers that will be needed to operate synchronously. Lastly, an abstract layout for the realization of such timing network is proposed.

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Session Classification: Poster Session

Contribution ID: **16** Type: **Submitted oral (In person)**

Probing the Nuclear Shape of Triple Point E(5) Symmetry Candidate 140Sm

Thursday 4 December 2025 10:05 (12 minutes)

In this gamma spectroscopy analysis, we aim to measure the spectroscopic quadrupole moments of excited states and electromagnetic transition rates in neutron-deficient 140Sm. The experimental data was collected during a Coulomb excitation experiment at ISOLDE in 2017, utilizing a 140Sm beam on a 208Pb target and the Miniball HPGe array alongside a CD particle detector.
The chain of samarium isotopes exhibits a diverse range of nuclear shapes, from spherical at the N=82 shell closure to well-deformed for both the neutron-rich isotopes beyond A=154 and the very neutron-deficient ones below A=134. The nucleus 152Sm is a well-known example for so-called X(5) symmetry at the transition from spherical vibrational to deformed rotational behavior. The case of 140Sm, on the other hand, is a candidate for a nucleus with E(5) symmetry, corresponding to the triple point in the phase diagram for shape phase transitions between spherical, oblate, and prolate shapes. This makes electromagnetic matrix elements in 140Sm sensitive benchmarks for theoretical nuclear structure models. We will present preliminary results from our analysis during the workshop.

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Co-author: GÖRGEN, Andreas (University of Oslo)

Presenter: TORVUND, Gulla (University of Oslo (NO))

Session Classification: Session 5

Contribution ID: **17** Type: **Invited (In person)**

ISOLDE Safety - Lessons learned from past events

Wednesday 3 December 2025 16:40 (20 minutes)

Safety is a core value at CERN and at the ISOLDE facility. This talk will outline how safety is managed within this framework and clarify the distinct roles of the different involved Safety Officers. It will also explain the Safety Incident Management process existing at CERN, including the definition of incident and the available tools. Using examples from past incidents at ISOLDE, the presentation will highlight key lessons learned, and how these experiences have strengthened current safety practices. The aim is to share practical insights that support a proactive safety culture.

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Presenter: DI GIULIO, Letizia (CERN)

Session Classification: Session 4

Contribution ID: **18** Type: **Poster (In person)**

NMR shielding constants and rederivation of accurate magnetic dipole moments of stable Se and Te isotopes

Wednesday 3 December 2025 18:53 (1 minute)

Ab initio calculations of NMR shielding constants have made it possible to re-evaluate nuclear magnetic dipole moments from NMR experiments, offering a substantial improvement over traditional diamagnetic corrections.

In this work, we report accurate ab initio NMR shielding constants for selenium and tellurium compounds: (1) $Se(CH_3)_2$ and $Te(CH_3)_2$, which define the current NMR standards for these elements, and (2) the water-solvated anions SeO_3^{2-} and TeO_3^{2-}, previously used to determine the magnetic moments of ^{77}Se, ^{123}Te, and ^{125}Te nuclei. All key factors influencing NMR shielding—relativistic effects, electron correlation, and solvent interactions—are systematically analyzed. Relativistic effects are treated using four-component density functional theory (DFT), electron correlation is accounted for at the coupled-cluster level, and solvent effects are modeled through both implicit and explicit solvent approaches.

Using the computed shielding constants for the NMR standards $Se(CH_3)_2$ and $Te(CH_3)_2$, we rederived the nuclear magnetic dipole moments and recommend the following updated values: $\mu(^{77}\text{Se})$ = 0.53380(3)μ_N, $\mu(^{123}\text{Te})$ = −0.7341(1)μ_N, and $\mu(^{125}\text{Te})$ = −0.8850(1)μ_N.

These revised magnetic dipole moments provide robust reference values for nuclear physics applications, particularly for high-precision spectroscopic measurements across isotopic series.

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Presenter: Mr HURAJT, Andrej (Faculty of Natural Sciences, Comenius University in Bratislava)

Session Classification: Poster Session

Contribution ID: **19** Type: **Poster (In person)**

Combined Collinear Laser Spectroscopy and Gas-Cell Ionization Feasibility Studies on Stable Fluorine: Development and Optimization at LIAF–COLLAPS

Wednesday 3 December 2025 18:52 (1 minute)

Understanding nuclear structure requires precise experimental data on ground-state properties across isotopic chains. Collinear Laser Spectroscopy (CLS) provides a powerful means to determine nuclear spins, magnetic dipole and electric quadrupole moments, and changes in the mean square charge radii through measurements of hyperfine structures and isotope shifts. However, extending these studies to light elements such as fluorine remains particularly challenging due to low trapping efficiencies, their strong tendency to form molecular compounds, and the difficulty of reaching the extreme ultraviolet (EUV) wavelength range required for transitions from the ground state of both atomic and ionic species.
To overcome these limitations, a new experimental setup has been developed within the Laser Induced Atomic Fluorescence and Ionization (LIAF) laboratory at COLLAPS, ISOLDE-CERN. This configuration combines CLS with a complementary state-selective collisional ionization technique within a gas cell, enabling spectroscopy on continuous ion beams of short-lived isotopes in the light-element region.
Our work focuses on determining the optimal experimental parameters for the study of fluorine isotopes using this combined approach. In this context, three optical transitions were investigated—at 677 nm, 685 nm, and 690 nm. The influences of different buffer gases (He, Ar, and SF_6), gas target pressures, and laser powers were systematically evaluated, using the quality of the re-ionization signal as the performance criterion. These developments aim to establish a robust experimental methodology for future investigations of light exotic nuclei, providing stringent benchmarks for nuclear models and advancing our understanding of nuclear structure far from stability.

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Session Classification: Poster Session

Contribution ID: **22** Type: **Poster (In person)**

Recent technical developments and measurements at ISOLTRAP

Wednesday 3 December 2025 18:51 (1 minute)

The ISOLTRAP setup is a high-precision mass spectrometer designed to measure the masses of short-lived, exotic radionuclides far from the valley of stability. Utilizing both multi-reflection time-of-flight (MR-ToF) and Penning-trap mass spectrometry, ISOLTRAP performs precise absolute and relative mass measurements. Converting these measured masses into nuclear binding energies (via the mass-energy equivalence) provides critical insights into the underlying nuclear forces and structures.

This contribution will present the current status of ISOLTRAP and highlight recent technical developments, such as the implementation of a second linear Paul trap to rebunch mass-selected ion beams, the addition of a temperature-stabilization system for the MR-ToF mass spectrometer, and improvements of our laser ablation ion source for the production of reference ions. This years beamtime results will also be shown, focusing on the first mass measurement of neutron-deficient ^{96}Cd in the vicinity of the doubly-magic ^{100}Sn, as well as the first mass measurement of the neutron-rich ^{49}Ar that was enabled by the new mass selective retrapping.

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Presenter: GIESEL, Paul Florian (University of Greifswald (DE))

Session Classification: Poster Session

Contribution ID: **23** Type: **Poster (In person)**

In-trap molecular formation at ISOLDE Offline 2

Wednesday 3 December 2025 18:50 (1 minute)

The main purpose of Offline 2 mass separator as part of the CERN-ISOLDE offline facilities is to perform preparatory studies and to benchmark new beam production and manipulation techniques or new beam instrumentation before their online implementation.
Similarly to GPS and HRS, the Offline 2 frontend comprises a gas mixing system to allow the introduction of reactant gases into the target unit for in-target molecular formation.
To extend the research capabilities on stable molecules, an additional gas mixing system has been installed for the radiofrequency quadrupole cooler-buncher (RFQcb) that allows to add reactant gases to the He buffer gas.
This poster provides an overview of the first in-trap molecular formation studies performed at Offline 2 with a Ba^+ ion beam and methanol (CH_3OH) as well as water (H_2O) as reactant gases.

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Presenter: SCHMIDT, Alexander

Session Classification: Poster Session

Contribution ID: **24** Type: **Invited (In person)**

RILIS operation and developments 2025

Friday 5 December 2025 11:00 (20 minutes)

The Resonance Ionization Laser Ion Source (RILIS) continues to provide element-selective radioactive ion beams to users at the ISOLDE facility[1], serving as the laser ion source for over 50% of experiments in 2025. In addition to its high efficiency in producing pure radioactive ion beams, RILIS has been advancing its capabilities through the Laser Ion Source and Trap (LIST) technique, employing perpendicular laser-atom interaction to enhance spectral resolution beyond Doppler broadening, achieving linewidths on the order of a few hundred MHz[2]. RILIS has also improved its laser systems to expand spectral coverage and enhance high-resolution performance.

In this talk, we will present RILIS operational activities for 2025, including recent progress in laser upgrades and the characterization and optimization of the LIST ion source, enabling continuous, stable operation with broader spectral coverage and improved high-resolution spectroscopy. A new dedicated data recorder for RILIS was successfully used for online operation and will also be discussed. Growing demand for the LIST ion source has prompted further upgrades, with several ISOLDE proposals requesting its use. In terms of research output, RILIS with LIST has been exploring its spectroscopic capabilities on exotic isotopic species affected by isobaric contamination. Two recent measurements on Pm isotopes (N=71–92) and Ni isotopes (N=41–46) will be presented[3,4]. Finally, we will discuss planned RILIS upgrades, including developments for LS3 and the Knowledge-Transfer funded project for automation of the MEDICIS laser laboratory.

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Authors: AJAYAKUMAR, Anjali; JARADAT, Asar A H (The University of Manchester (GB)); BERNERD, Cyril (CERN); MCELROY, David Thomas (The University of Manchester (GB)); CRANS, Emanuel (Eindhoven Technical University (NL)); BUKER, Hendrik (KIT - Karlsruhe Institute of Technology (DE)); REILLY, Jordan Ray (The University of Manchester (GB)); WESSOLEK, Julius Wilhelm (The University of Manchester (GB)); CHRYSALIDIS, Katerina (CERN); NIES, Lukas (CERN); ELLE, Manikanta (KU Leuven (BE)); AU, Mia (CERN); ROSSEL, Ralf Erik (CERN); MANCHEVA, Ralitsa Ivaylova (KU Leuven (BE)); HEINKE, Reinhard (The University of Manchester (GB)); ROTHE, Sebastian (CERN); FEDOSSEEV, Valentine (CERN)

Presenter: AJAYAKUMAR, Anjali

Session Classification: Session 10

Contribution ID: **25** Type: **Submitted oral (In person)**

Investigation of coexisting structures in ^{182}Pt via detailed β-decay studies of ^{182}Au

Thursday 4 December 2025 12:20 (12 minutes)

Gold and platinum nuclei near the N = 104 mid-shell, such as ^{182}Au and ^{182}Pt, have attracted considerable interest due to rapid changes in ground-state deformation compared to heavier isotopes. Additionally, a coexistence of at least two configurations, a weakly oblate and a prolate, has been observed for platinum isotopes in this region [1,2]. These phenomena have been extensively studied using various experimental methods, including laser spectroscopy [3] and β-delayed γ-ray spectroscopy [4]. The latter approach provides access to excited levels in the daughter nucleus up to relatively high excitation energies. Since β decay is sensitive to changes in nuclear structure, β-decay feeding patterns and log ft values can be used to probe shape coexistence and configuration mixing in the daughter nucleus.
In this contribution, we present results of a detailed γ–γ coincidence analysis of ^{182}Pt deexcitation following the electron capture/β^+ decay of ^{182}Au studied at the ISOLDE facility. Element-selective laser ionisation and mass separation were employed, resulting in a high-purity ^{182}Au sample measured at the ISOLDE Decay Station (IDS) [5], with four HPGe Clover detectors and an array of silicon PIN diodes. Transitions known from the previous β-decay study [4] were confirmed, and the level scheme of ^{182}Pt was significantly expanded [6]. Log ft values for decays to the first three 2^+ states in ^{182}Pt indicate mixing between different band structures. Moreover, an unexpectedly high β-decay feeding intensity to 4^+ levels was observed, which is inconsistent with the second forbidden non-unique β decay expected from the currently known (2^+) ground state of ^{182}Au [7]. We discuss several possible explanations, namely the reassessment of the ^{182}Au ground state assignment, the existence of a new isomeric state, and the pandemonium effect.

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Presenter: MIŠT, Jozef (Comenius University (SK))

Session Classification: Session 6

Contribution ID: **26** Type: **Submitted oral (In person)**

The PI-LIST: High-resolution crossed-beams laser spectroscopy inside the ISOLDE laser ion source

Wednesday 3 December 2025 12:30 (12 minutes)

Laser resonance ionization spectroscopy in the ion source coupled directly to the isotope production target has been proven to be a highly sensitive tool for nuclear structure investigations on
isotopes with low production and extraction yields [1]. While the efficiency of this technique is unrivalled, the spectral resolution is ultimately limited by Doppler broadening. At the ion source temperature of ˜2000 ℃ typically required for efficient operation, Doppler broadening results in a 1-
10 GHz experimental resolution limit whereas precise measurements of nuclear magnetic and quadrupole moments often require resolving hyperfine structure splittings below the GHz regime.
A new laser ion source design has been implemented at ISOLDE recently to provide in-source spectroscopy capabilities down to experimental linewidths of 100 –200 MHz, an order of magnitude below usual limitations. It is based on the high beam purity Laser Ion Source and Trap (LIST) [2, 3],
featuring spatial separation of the hot cavity where potential ion beam contamination can arise from
non-laser related ionization mechanisms such as surface ionization. Laser-atom interactions take place in an RFQ structure directly downstream, where solely element-selective laser ionization takes
place. In the so-called Perpendicularly Illuminated LIST (PI-LIST) [4] a crossed laser/atom beam geometry is used for spectroscopy, therefore only the transverse velocity spread of the effusing atom
ensemble contributes to the experimentally observed Doppler broadening.
Following the integration of this device as the standard tool for high-resolution spectroscopy applications at the off-line mass separator facility at Mainz University [5, 6], we present its first online application at ISOLDE for nuclear structure investigations. Neutron-rich actinium isotopes in the
region of assumed octupole deformation [7] were studied with the highest spectral resolution ever achieved for in-source resonance ionization spectroscopy at ISOLDE.
The applicability of this technique to ISOL facilities in general, its limits especially in terms of significant efficiency loss, and technical implementation challenges are discussed.

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Presenter: JARADAT, Asar A H (The University of Manchester (GB))

Session Classification: Session 2

Contribution ID: **27** Type: **Poster (In person)**

Measurements of Nuclear Deformation in A=144 Isobars via Coulomb Excitation.

Wednesday 3 December 2025 18:48 (1 minute)

As part of the IS708 experiment carried out at ISOLDE, safe Coulomb excitation measurements with the Miniball detector were performed to investigate octupole and quadrupole collectivity in neutron rich 144Ba. The data from this experiment also provided the opportunity to study such deformation in a selection of other observed A=144 isobars including stable 144Nd, 144Sm as well as radioactive 144Ce and 144Cs. All of which appearing as isobaric contaminants in the beam, despite efforts to optimise the production of 144Ba. The Miniball germanium array coupled with a double-sided silicon strip detector were employed to measure particle-γ coincidences, allowing precise Doppler corrections to be performed.

Initial analysis has identified the population of a range of low-lying collective states, including some for which there are no previously measured transition strengths, e.g., in 144Nd and 144Ce. Clear peaks are also observed for the (3-⟶2+) transitions in both 144Nd and 144Sm, meaning a remeasurement of B(E3) values can also be made. Matrix elements will be extracted by performing an analysis of the gamma-ray yields using the GOSIA code. It has also been possible, using the timing structure of the proton impact, to isolate transitions in the odd-odd nucleus of 144Cs and identify low-lying collective states for the first time.

This poster presents the beam composition analysis from the 144Ba experiment and preliminary spectroscopy of the odd-odd nucleus 144Cs.

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Presenter: CURRY, Josh Alex David (University of Liverpool (GB))

Session Classification: Poster Session

Contribution ID: **28** Type: **Invited (In person)**

Implementation of the recoil distance Doppler-shift technique at ISOLDE

Friday 5 December 2025 09:25 (20 minutes)

Absolute transition strengths between excited states yield fundamental information on nuclear structure. These observables can be determined from level lifetimes. The recoil distance Doppler-shift (RDDS) technique employing so-called plunger devices provides a valuable method for the determination of lifetimes in the picosecond range and has been in the focus of our Cologne group since many years.

In this talk, we will present the first experimental campaign with the RDDS technique at ISOLDE using the MINIBALL spectrometer. Particular emphasis will be paid to the special conditions for such experiments at this radioactive beam facility, e.g., with respect to the sophisticated plunger device which was constructed at Cologne and is needed for such RDDS experiments, the kinematics, the requirements for targets, and the separation of the reaction channel of interest. We will focus on an experiment on ^{144}Ba that was done recently by our group aiming for (i) the implementation of the RDDS technique at ISOLDE and (ii) the search for octupole correlations in ^{144}Ba.

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Session Classification: Session 9

Contribution ID: **29** Type: **Submitted oral (In person)**

High-resolution laser spectroscopy of light gold isotopes at CRIS: investigation of the island of deformation and shape coexistence

Thursday 4 December 2025 15:35 (12 minutes)

Since the discovery of large shape staggering in neutron-deficient mercury isotopes $Z = 80$ [1], the region around $Z = 82$ and $N = 104$ has been extensively studied using in-source laser spectroscopy, due to its intriguing nuclear structure phenomena [2-3]. Recent experiments have revealed substantial shape staggering in neighbouring bismuth isotopes $Z = 83$ starting at neutron number $N = 105$ [4], which contrasts sharply with lead isotopes $Z = 82$ that remain predominantly spherical [5]. For gold isotopes $Z = 79$, earlier studies indicated an onset of strong deformation starting from neutron number $N = 107$ and persisting down to $N = 101$ [6-7].
We report recent high-resolution collinear resonance ionization spectroscopy measurements of neutron-deficient gold isotopes performed at the CRIS experiment, ISOLDE/CERN. Our experimental campaign includes high-resolution studies of the isotopes 181−197Au ($N = 102 - 118$), enabling spin measurements and determination of spectroscopic quadrupole moments. These results will shed light on our understanding of nuclear shapes and deformation phenomena near the closed-shell nucleus lead $Z = 82$.

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Presenter: AHMAD, Osama (KU Leuven (BE))

Session Classification: Session 7

Contribution ID: **30** Type: **Poster (In person)**

The new ion-implantation chamber in the General Low Mass (GLM) area of ISOLDE.

Wednesday 3 December 2025 18:49 (1 minute)

A new ion-implantation chamber has been commissioned at the General Low Mass (GLM) beamline of ISOLDE to improve operational efficiency and safety in handling radioactive ion beams. Replacing the former single-chamber system, the new setup features a dual-chamber load-lock design comprising an implantation chamber and a loading/unloading chamber, separated by a DN200 gate valve. Each chamber is evacuated by an independent turbomolecular pump (HiPace 700 and 1200), allowing rapid evacuation to 1E-6 mbar within minutes without relying on the beamline vacuum. The system integrates computer-controlled stepper motors that automate sample transfer, collimator alignment, and Einzel-lens focusing, enabling precise and reproducible implantation conditions. This configuration maintains continuous high-vacuum integrity during sample exchange, reduces manual intervention, and minimizes radiological exposure to users. The upgraded chamber represents a significant advancement in the automation, throughput, and safety of radioactive isotope implantation experiments at ISOLDE.

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Session Classification: Poster Session

Contribution ID: **31** Type: **Poster (In person)**

Prospects for future molecular spectroscopy measurements using 223RaF

Wednesday 3 December 2025 18:47 (1 minute)

In the past few years, spectroscopy of radioactive molecules has been performed at ISOLDE (CERN) using the Collinear Resonance Ionization Spectroscopy (CRIS) experiment [1]. Given their structure and chemical properties, radioactive molecules are promising candidates for studies in different fields [2], including for more efficient extraction of refractory elements from ISOLDE targets [3].
Many reference electric quadrupole moments (EQM) have been extracted from spectroscopy on stable diatomic molecules, e.g., for K, Cl, I, using KF, HCl, and HI [4,5,6]. However, given the small electric field gradient in these atomic systems or the difficulty of studying the elements in atomic form, no quadrupole moments have been measured for radioactive isotopes, using laser techniques.
Following the successful high-resolution studies of 225,226RaF [7,8], the CRIS experiment at ISOLDE performed the first hyperfine-resolved resonance ionization spectroscopy of 223RaF, revealing the quadrupole splitting of the I=3/2 223Ra isotope. The charge radii of 223,225,226Ra have been extracted from the hyperfine structure in these RaF isotopologues with a precision comparable to atomic studies [9,10]. Moreover, the hyperfine structure of 223Ra (I = 3/2) allowed the first measurement of the EQM in a short-live radioactive molecule (t1/2 = 11.4 days), exhibiting the large sensitivity of molecules to the EQM.
This contribution will focus on the retrieved nuclear moments of 223Ra from 223RaF studies and compare them with the atomic and ionic measurements found in the literature. Due to its great agreement with literature and the increased precision of the EQM in Ra isotopes, molecular laser spectroscopy could offer a new pathway towards extracting unknown quadrupole moments of radioactive isotopes using suitable molecules [11].

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Presenter: FAJARDO ZAMBRANO, Carlos Mario (KU Leuven (BE))

Session Classification: Poster Session

Contribution ID: **32** Type: **Poster (In person)**

Testing the Standard Model with the WISArD Experiment

Wednesday 3 December 2025 18:15 (1 minute)

The WISArD experiment aims to probe possible manifestations of new physics in the weak interaction sector of the Standard Model through precision studies of beta decay. In particular, the experiment targets the angular correlation parameter a and the Fierz interference term b, which are sensitive to exotic scalar and tensor currents beyond the vector and axial-vector interactions of the Standard Model. By investigating the β-delayed proton decay of 32Ar, WISArD seeks to determine these parameters with a precision of about 0.1%, providing constraints on new interactions that are competitive with direct searches at the highest energies accessible at the LHC. The experiment is performed at ISOLDE, CERN. Analysis of the 2024 and 2025 data-taking campaigns demonstrates that statistical uncertainties at the per-mil level have been achieved. Several systematic effects have already been evaluated, including those related to the beam profile and shape, random coincidences, catcher thickness, and solid angle. The next stage of the analysis will focus on assessing the impact of beta backscattering models and the calibration accuracy of the beta detector on the total uncertainty budget.

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Session Classification: Poster Session

Contribution ID: **33** Type: **Submitted oral (In person)**

Laser spectroscopy and CP-violation sensitivity of AcF

Wednesday 3 December 2025 15:05 (12 minutes)

To explain the significant baryon asymmetry observed in the universe, a larger source of charge and parity (CP) violation is required [1]. Signatures of such CP-odd properties could be observed as small shifts in the transition frequencies of atoms and molecules [2,3]. Particularly, molecules have become the current most sensitive approach for CP-violation studies due to their strong internal electric field [4]. Furthermore, nuclear CP-violating sources are enhanced in heavy radioactive nuclei with static octupole deformation [5]. Among them, the long-lived 225,227Ac isotopes are expected to be extremely sensitive to nuclear CP-violating moments [6].

In this contribution, we present the first spectroscopy of AcF using the Collinear Resonance Ionization Spectroscopy (CRIS) experiment [7] at ISOLDE. Thanks to its high volatility, the measured 227AcF extraction rates of 6×10ˆ7 ions per second [8] are compatible with current high-precision CP-violation experiments [9]. The excitation energy of the strongest electronic transition from the X1Σ+ ground state, critical for future beyond the SM experiments, was measured and an upper limit on its radiative lifetime was estimated [10]. Our state-of-the-art relativistic coupled cluster and nuclear density functional calculations reveal that AcF is particularly sensitive to measurements of different nuclear CP-odd sources. Due to this enhanced sensitivity, AcF has the potential to constrain the global CP-violation parameter landscape by three orders of magnitude compared to the current limits using a conservative precision setup and lower precision than previously demonstrated in homoelectronic systems [10,11].

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Session Classification: Session 3

Contribution ID: **34** Type: **Poster (In person)**

A study of seniority-2 configurations in N=126 isotonic chain. Coulomb excitation of 214Ra.

Wednesday 3 December 2025 18:46 (1 minute)

The nuclear shell model, combined with pairing correlations, offers a straightforward explanation of the low-energy spectra of semi-magic nuclei. In a single high-j orbital with more than two particles, low-lying $J > 0$ states arise from recoupling of unpaired nucleons and group into multiplets labeled by seniority ν—the number of unpaired particles. The generalized seniority scheme is essentially a truncated shell-model description~\cite{Talmi1971}. To study how well the seniority picture holds near the $N = 126$ shell closure, we carried out a safe Coulomb-excitation experiment on $^{214}\mathrm{Ra}$. A post-accelerated $^{214}\mathrm{Ra}$ beam was directed onto a $^{120}\mathrm{Sn}$ target at HIE-ISOLDE, and the resulting γ rays were measured with the Miniball detector~\cite{Warr2013}. Our main goal is to extract $B(E2; 2_1^+ \to 0_1^+)$ transition strength and compare it with expectations from the nuclear shell model and with trends seen in neighboring $N = 126$ isotones. With data taking completed and analysis in progress, we present the current status along with preliminary $B(E2)$ values. Once finished, these results will test whether the low-lying states of $^{214}\mathrm{Ra}$ are dominated by a simple $\pi(1h_{9/2})^2$ configuration, and they will provide useful constraints for model parameters used in this region.

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Session Classification: Poster Session

Contribution ID: **35** Type: **Submitted oral (In person)**

SPELS@WISArD : Spectrum of 32P ELectron Shape at WISArD

Wednesday 3 December 2025 12:15 (12 minutes)

Anaïs Lépine on behalf of the WISArD collaboration

The Standard Model (SM) has proven to be a successful theory describing three of the four fundamental interactions. However, some open questions remain and motivate precise measurements to search for evidence of physics Beyond the SM predictions. For instance, the measurement of the shape of the β energy spectrum can be used to search for exotic currents in the weak interaction by extracting the Fierz term bF. To constrain possible extension of the SM at the same level as direct searches at high energy, the required precision on bF must be at the level of a few 10−3. This raises several experimental challenges, in particular the partial energy deposition caused by electron backscattering.
The SPELS (Spectrum of 32P ELectron Shape) project addresses this issue
by placing two detectors, facing each other, inside the magnetic field of WISArD's superconducting magnet. This setup ensures a 4π solid angle and guides the backscattered particles from one detector to the opposite one.
Following the first measurement at WISArD in 2020, using scintillators and silicon photomultipliers, significant upgrades have been made. A key improvement is the use of lithium-drifted silicon (Si(Li)) detectors, which provide a higher energy resolution and a lower energy threshold. To cool these detectors down, a new cooling system has been developed in Leuven, based on active glycol circulation and Peltier elements. The setup has been optimized at LP2iB in Bordeaux, a first test was conducted at WISArD in September 2025 and the first calibration campaign will begin end of 2025.

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Presenter: LÉPINE, Anaïs (CENBG)

Session Classification: Session 2

Contribution ID: **36** Type: **Poster (In person)**

Laser Spectroscopy measurements of ^(151-175)Tm. On behalf of the COLLAPS collaboration

Wednesday 3 December 2025 18:45 (1 minute)

High resolution laser spectroscopy has been used to study the atomic hyperfine structure of thulium isotopes (Z=69) leading towards the proton emitter 147Tm. This technique results in a model independent measurement of the nuclear magnetic dipole moments, electric quadrupole moments and change in mean-square charge radii, with respect to the stable 169Tm. Collinear laser spectroscopy measurements were performed using the COLLAPS experiment based at ISOLDE, CERN. These measurements were taken over a series of three beamtimes, resulting in 25 isotopes being measured, with many of the properties being measured for the first time. The status of the data analysis will be presented.

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Session Classification: Poster Session

Contribution ID: **37** Type: **Poster (In person)**

Combining high-resolution laser spectroscopy and beta-gamma spectroscopy using the CRIS Decay Spectroscopy Station

Wednesday 3 December 2025 18:44 (1 minute)

The Collinear Resonance Ionization Spectroscopy (CRIS) experiment at CERN ISOLDE is used to perform hyperfine structure and isotope shift measurements [1]. The resonance ionization in collinear geometry provides selectivity over different nuclear isomeric states, which decay can be measured at the Decay Spectroscopy Station (DSS). The DSS setup has been under development over the years [2,3] and found its main applications in isomer-selective alpha-decay measurements of francium isotopes [4,5]. Furthermore, it was used in decay tagging, a technique previously used at CRIS to suppress background in hyperfine spectra generated by a 104 excess of stable isobaric contamination in the beam [6].
The DSS has been recently upgraded with a tape system for removal of long-lived activity, a newly designed in-vacuum plastic scintillator and an array of High Purity Germanium detectors, $LaBr_3$ and $CeBr_3$ scintillation detectors. A measurement campaign was performed in the context of the IS772 experiment at ISOLDE [7], where beta-gamma spectroscopy of resonantly ionized isomeric states in ^{106}In and ^{104}In was performed. In this contribution, the recent developments of the DSS and the performance of the setup will be discussed, along with preliminary results on the decay of ^{104m}In.

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Session Classification: Poster Session

Contribution ID: **38** Type: **Invited (In person)**

Advancements in Power Supply Systems

Wednesday 3 December 2025 17:35 (20 minutes)

This talk explores the latest advancements in power supply technologies designed by CAEN: it will give a quick overview of the EASY power supply system for the High-Luminosity Large Hadron Collider (HL-LHC) upgrades: notable for its enhanced radiation tolerance: up to 150 Gy, 3x10ˆ11 HeH/cmq, 1.5x10ˆ12 Neq/cmq, and resilience to magnetic fields up to 0.6 T.
Furthermore, we will also discuss new research and development (R&D) concerning standard environment power supplies in the most prevalent formats, including NIM, standalone, and CAEN multichannel system.
All these R&D initiatives possess unique characteristics, but they are all driven by the evolution of physics experiments that seek granularity far surpassing current standards. These experiments necessitate sophisticated electronics for powering detectors and processing vast amounts of data. Key parameters such as space constraints, cabling, cooling, and overall efficiency are crucial in designing these experiments to achieve superior data acquisition performance.
During the talk, we will illustrate their characteristics, the R&D process that we have followed and its results, plus underline significant figure of merits.

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Session Classification: Session 4

Contribution ID: **39** Type: **Poster (In person)**

Emission channeling and photoluminescence spectroscopy studies of lead-related quantum emitters in diamond

Wednesday 3 December 2025 18:43 (1 minute)

Colour centres based on group-IV impurities (SiV, GeV, SnV, and PbV) in diamond are intensively investigated in the context of quantum nanophotonic applications, with some of their attractive properties stemming from the inversion symmetry of their split-vacancy configuration and their high Debye-Waller factor. In addition to inheriting the inversion symmetric properties of a split-vacancy defect, the negatively charged PbV defect is also known to have a very high zero-field splitting of its ground and excited states, leading to four optical transitions which are distinguishable in a PL spectroscopy experiment [1]. The theoretically predicted neutrally charged PbV defect is expected to have an observable transition at either 2.170 eV or 2.216 eV [2] and is speculated to retain high coherence times at significantly higher temperatures than the other group-IV colour centres [3]. As part of experiment IS668, using a combination of electron emission channeling and photoluminescence spectroscopy,.we investigate the structural formation and optical activation of PbV colour centres, varying the implantation fluence and temperature as well as the annealing temperature.

In this poster, we present the initial findings for the structural formation of PbV defects for implantation at 30, 600 and 900◦C, in addition to the corresponding annealing temperature steps, as determined by the fraction of sites occupying the bond-centered site of diamond. Our emission channeling results with ^{209}Pb (t1/2=3.25 h) indicate that the PbV defects form immediately upon implantation at room temperature, and remain stable as the annealing temperature is increased up to 900 ◦C. The reduction of the mean-squared displacement of Pb in the substitutional site corroborates the decrease of lattice disorder for higher annealing and implantation temperatures.

To complement these findings, we performed photoluminescence spectroscopy for diamond implanted with stable ^{208}Pb at ISOLDE with fluences varied between 1e11 and 1e13 atoms/cm^2 and annealing temperatures of 600, 900 and 1100 ◦C. PL spectroscopy was performed separately with 457 nm and 532 nm laser excitation energy, reproducing the expected peaks at 542 nm, 552 nm and 556 nm of the negatively charged PbV colour centre. Additionally, after 1100 ◦C annealing we observed the emergence of a new peak at 575 nm with a phonon sideband structure similar to that of the 552 nm peak in the measurements performed with 457 nm excitation energy. This new peak, as well as the 542 nm and 718 nm peaks tentatively attributed to PbV, will be the subject of an element-specific radiotracer PL experiment with radioactive ^{209}Pb which will allow to determine whether they are indeed associated with the PbV defect in diamond.

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Session Classification: Poster Session

Contribution ID: **40** Type: **Poster (In person)**

Stabilization of Actinide and Lanthanide Carbides for ISOLDE Target Elimination

Wednesday 3 December 2025 18:42 (1 minute)

Uranium carbide (UC_x), thorium carbide (ThC_x), and lanthanum carbide (LaC_x) constitute approximately 85% of the target materials used at CERN-ISOLDE. These carbides are highly pyrophoric and must be chemically stabilized after proton irradiation to enable their safe handling and disposal as radioactive waste, preventing ignition and thermal runaway upon exposure to ambient air or oxidizing atmospheres.

The chemical stabilization process, including scale-up experiments, was successfully demonstrated for lanthanum carbide (LaC_x) [1,2]. The operational experience and data obtained from these studies enabled the initiation of uranium carbide (UC_x) stabilization experiments using a dedicated system integrated to an inert-atmosphere nuclear glovebox working at negative pressure [3]. UC_x hydrolyzed under controlled water vapor concentrations, releasing hydrogen and hydrocarbons monitored via non-dispersive infrared spectroscopy (NDIR) and residual gas analysis (RGA). The solid product is being characterized to prove its stability in ambient air. A similar strategy will also be applied to ThC_x and nano-UC_x.

The objective is to develop a controlled stabilization process for these materials within ISOLDE hot cells, ensuring radiological and chemical safety. The stabilized materials will subsequently be conditioned, packaged, and prepared for long-term disposal in Swiss deep geological repositories.

Keywords: uranium carbide, ISOLDE target, radioactive waste, pyrophoricity, thermal runaway, chemical stabilization

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[3] UCx Reoxidation [EDMS No.: 3299121]

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Presenter: USTA, Serdar

Session Classification: Poster Session

Contribution ID: **41** Type: **Submitted oral (In person)**

Probing Unstable Nuclei with low-energy Antiprotons - Status and Progress of the PUMA experiment

Thursday 4 December 2025 17:35 (12 minutes)

The antiProton Unstable Matter Annihilation (PUMA) experiment aims to use low-energy antiprotons as a probe to investigate the proton-to-neutron ratio at the tail of nuclear density of unstable nuclei. Since no existing facility provides a collider of low-energy antiprotons and low-energy radioactive ions, PUMA proposes to bridge this gap by storing up to one billion antiprotons in a portable Penning trap, to be transferred from the Antimatter Factory to ISOLDE.

This involves significant technological challenges and requires theoretical understanding of the annihilation. In this contribution, I present an overview of the PUMA experiment, its current status, and progress toward the first physics measurements. Particular emphasis will be placed on the progress at the Antiproton Decelerator (AD) and the ongoing construction of the new RC-6 and RC-7 beamlines at ISOLDE.

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Session Classification: Session 8

Contribution ID: **42** Type: **Submitted oral (In person)**

Fission isomer studies on 240,242Am at IGISOL facility.

Friday 5 December 2025 11:40 (12 minutes)

Multi-humped fission barriers, as observed in the actinide region, give rise to isomeric fission [1]. Such barrier shapes can be described using various theoretical models [2]. Experimentally measured observables of nuclear fission isomers - such as the half-life, excitation energy, kinetic-energy spectra of fission fragments, and the isomer-to-ground-state population ratio - serve as important tests of theoretical models and help verify the influence of shell effects on nuclear structure.
Studies of fission isomer properties of 240,242Am were performed at the IGISOL facility of the JYFL Accelerator Laboratory, University of Jyvskyla, Finland [3]. Isomeric states were populated via deuteron-induced fusion–evaporation reactions on a 242Pu target. The decays of the isomers were detected using silicon detectors positioned downstream of a dipole magnet for mass separation.
The kinetic energy spectra of single fission fragments and the isomeric half-lives were measured using silicon detectors calibrated with a 252Cf fission source. A typical double-peaked kinetic-energy distribution characteristic of fission was observed. For the 242Am isomer, the two peak was found at EL= (78.10 ± 0.11) MeV and at EH = (105.93 ± 0.15) MeV. For the 240Am isomer, the corresponding values were EL = (78.9 ± 0.2) MeV and EH = (105.4 ± 0.7) MeV. The total kinetic energy (TKE) reached maximum values of TKE = (184.03 ± 0.04) MeV for 242Am and TKE = (184.3 ± 0.3) MeV for 240Am. A half-life of T1/2 = (14 ± 1) ms was determined for the 242Am isomer.
The mass distributions of 240,242Am were derived from the kinetic-energy spectra of single fission fragments using the 2E method. The results were compared with GEF (General Description of Fission Observables) model calculations and previous measurements, showing good agreement. The mass distribution for 242Am was found to be strongly asymmetric, with a heavy-fragment peak at A = 104.1 ± 0.2 and a light-fragment peak at A = 137.7 ± 0.2. For 240Am, the distribution exhibited a two-peak structure with a heavy-fragment peak at A = 101.9±0.9 and a light-fragment peak at A = 138.2±0.9.
The measurements of 240,242Am fission isomers at the IGISOL facility have provided detailed information on their kinetic energy spectra, total kinetic energies, and pre-neutron emission mass distributions. The results are consistent with GEF model predictions and confirm the asymmetric character of fission in these isotopes. These findings contribute to a better understanding of shell effects and barrier structures in the actinide region.

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Session Classification: Session 10

Contribution ID: **43** Type: **Invited (In person)**

Comparison of bulk and interfacial diffusion of $^{8}Li^{+}$ in solid-state battery materials with β-NMR at VITO

Thursday 4 December 2025 11:25 (20 minutes)

Solid-state battery (SSB) technology presents a transformative alternative to conventional liquid-state batteries, addressing many of their inherent weaknesses. However, current SSB materials are limited by poor charge-discharge rates, primarily due to restricted ion diffusion and low conductivity across buried interfaces. Conventional characterization and ion diffusion measurements focus mainly on bulk properties, are inherently destructive, or offer limited resolution to observe interfacial behavior.

In contrast, by using β-NMR at VITO, it is possible to determine the interfacial ion mobility non-destructively through low-energy ion implantations. Li^{+} diffusion in the bulk electrolyte and anode-electrolyte interface of commercially relevant SSBs (Li-Li_7PS_6 and Li-$Li_{5.5}PS_{4.5}Cl_{1.5}$ half-cells) was investigated by ^{8}Li implantations at 30keV and with varying Li layer thicknesses to observe diffusion and the width of the Li-electrolyte interface. Results from β-NMR were corroborated by μSR experiments using bulk and surface muons at the SμS facility of the Paul Scherrer Institute, Switzerland.

These measurements were also part of the commissioning of a new end station at VITO with the ability to: (a) heat and cool samples, (b) insert multiple air-sensitive samples via a load-lock system, (c) accommodate new RF coils and β-detectors, (d) transport samples through the beamline using external manipulators, and (e) maintain compatibility with high vacuum and a strong magnetic field exhibiting ppm-level homogeneity.

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Session Classification: Session 6

Contribution ID: **44** Type: **Submitted oral (In person)**

Laser Spectroscopy on exotic cadmium isotopes at MIRACLS

Wednesday 3 December 2025 17:05 (12 minutes)

Remarkable advances have been made in recent years with the theoretical description of electromagnetic properties of atomic nuclei, stimulated by a wealth of high-quality experimental data on short-lived radionuclides (see references [1-6]). In this context, nuclear charge radii are highly rewarding observables which serve as a sensitive probe of phenomena such as pairing, deformation, or shell closures, and thus represent intriguing experimental benchmarks for modern nuclear structure theory.

Density functional theory (DFT) has emerged as a powerful theoretical approach for the prediction of nuclear charge radii. In particular, the Fayans functional has been successful in predicting the odd-even staggering of charge radii along the calcium isotopic chain as well as the unexpectedly large charge radius of ^{52}Ca [1, 7]. The same functional has been extended into the mid-mass regions for predictions of Ni [4], Cu [3], and Sn [8] charge radii, and has even been applied to Fm (Z=100)[9].

For cadmium (Z=48), DFT calculations utilizing the same Fayans functional have been successful in predicting the odd-even staggering in the charge radii of $^{100-130}$Cd [2], however, its description of mid-shell region tends to overestimate the slope and curvature of differential radii. Hence, a new Fayans functional was recently introduced which added an isovector component in its pairing functional [6, 10]. Measurements of the still undetermined charge radii of ^{98,99}Cd down to the N=50 shell closure would thus represent powerful experimental benchmark for the the Fayans functional, especially with the addition of the isovector term.

In order to make such charge radii measurements, Collinear Laser Spectroscopy (CLS) has proven to be a highly effective tool for precise measurements of nuclear ground state properties of radionuclides such as the nuclear spin, electromagnetic moments, and charge radius. The Multi Ion Reflection Apparatus for Collinear Laser Spectroscopy (MIRACLS) is a new experimental setup at ISOLDE which aims to improve the sensitivity of conventional CLS by conducting it in a high-energy (> 10 keV) multi-reflection time-of-flight (MR-ToF) device [11, 12]. This is a type of ion trap which utilizes two electrostatic mirrors to reflect ion bunches back and forth for several thousands of revolutions. Hence, the ion bunches can be probed by the laser multiple times per measurement cycle to obtain higher statistics than with conventional fluorescence-based CLS, which can study the ion bunch only once. The resulting improvement in sensitivity allows isotopes with yields as low as 5 ions per μC to become accessible.

In August of this year, MIRACLS had a successful beamtime measuring the charge radii of ^{98,99}Cd as well as the electromagnetic moments for ^{99}Cd. In this contribution, I will discuss the latest experimental results at MIRACLS for these cadmium measurements.

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Session Classification: Session 4

Contribution ID: **45** Type: **Poster (In person)**

Design and simulation of a dedicated ion beamline for LARIS within CERN-ISOLDE

Wednesday 3 December 2025 18:41 (1 minute)

The Resonance Ionisation Laser Ion Source (RILIS) continues to be the ion source chosen most often to provide radioactive ion beams (RIBs) for experiments at CERN-ISOLDE, as ionisation through optical resonance offers high chemical selectivity and efficiency [1,2]. To suppress potentially contaminating surface ionisation whilst maintaining laser ionisation, Laser Ion Source and Trap (LIST) was introduced, addressing the contamination of other isobars within the RIBs [3,4]. The development of laser ionisation schemes and ion sources like LIST currently requires the use of either the RILIS setup at ISOLDE or the associated Offline laboratories at CERN. [5]

The constant demand for the ISOLDE-RILIS facility and the Offline laboratories as well as the current allocated space limits the available time and room for dedicated laser scheme development, laser ion source development, and new techniques for ion beam preparation. This highlights both the scientific and practical need for a dedicated development beamline. To support these development and characterisation studies, apart from the vast array of laser systems, this new beamline will be equipped with the necessary positively charged particle optics and a Time-of-Flight Mass Spectrometer (ToF-MS).

The offline LARIS (LAser Resonance Ionisation Spectroscopy) beamline will provide the space for laser scheme development, characterisation studies of laser-atom interactions and novel laser ion source and target units, and provide controlled test beams for new beam preparation techniques, while significantly reducing the load on the current facilities. This presentation will be focussed on the design and simulation towards construction of the new LARIS beamline. Current progress will be presented including COMSOL ion trajectory and beamline simulations.

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Session Classification: Poster Session

Contribution ID: **46** Type: **Poster (In person)**

ASCII - The Apparatus for Surface Physics and Interfaces at CERN's Ion Implantation Chamber

Wednesday 3 December 2025 18:21 (1 minute)

The Apparatus for Surface Physics and Interfaces at CERN (ASPIC) was previously installed in the solid-state physics section of the ISOLDE experimental hall, where it operated under ultra-high vacuum conditions (UHV, $\leq 10^{-8}$ mbar). ASPIC enabled studies of metallic surfaces, magnetic thin films, and interface dynamics, and supported experiments using radioactive isotopes and a range of thin-film fabrication and modification techniques. ASPIC is no longer in regular operation at the GLM area, and its development informed the design of the follow-up system.

The Apparatus for Surface Physics and Interfaces at CERN's Ion Implantation Chamber (ASCII) represents this next-generation setup and is currently under commissioning. It is designed for tunable ultra-low-energy implantation ($gtrsim20$ eV) of radioisotopes in UHV conditions down to $\leq 10^{-9}$ mbar. The system enables implantation depth control on the order of a few angstroms and precise placement of probes such as $^{111\mathrm{m}}$Cd and $^{204\mathrm{m}}$Pb into materials ranging from two-dimensional systems (graphene, transition-metal dichalcogenides) to (multi)ferroic compounds, nanoparticles, and topological insulators. A first demonstration of ^{111}Ag implantation using ASCII was successfully performed at the Universität Göttingen.

The current commissioning and integration work includes the design of an additional differential vacuum chamber (DVC) to ensure UHV integrity within the ASCII chamber itself, as well as engineering measures to meet CERN safety requirements. These measures include a floating equipment cabinet, a rack with segregated power supplies with approved interconnections, and an integrated Faraday cage for the chamber, which handles grounding and electromagnetic shielding. Ongoing tasks concentrate on completing the DVC and vacuum system installation, validating implantation procedures, verifying electrical and grounding arrangements, and finalising the safety interlocks and approvals required for radioactive-ion operation. Once fully commissioned, ASCII will be available to the ISOLDE community as a versatile tool for investigations of surfaces and interfaces in solid-state nuclear condensed-matter physics.

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Session Classification: Poster Session

Contribution ID: **47** Type: **Invited (In person)**

Status of the SHiP experiment

Thursday 4 December 2025 14:00 (20 minutes)

The **Search for Hidden Particles (SHiP)** experiment targets searching for feebly interacting particles (FIPs) with extremely weak couplings to the known standard model particles. For this, it will exploit the high-intensity proton beam from CERN's Super Proton Synchrotron (SPS) in beam-dump mode to produce FIPs, such as heavy neutral leptons (HNLs), dark photons, dark scalars, axion-like particles (ALPs) that will be searched for by their decay signatures. SHiP will also host a dedicated detector for precise studies of tau neutrinos and other neutrino interactions and for light dark matter searches.

The initial phase of SHiP comprises the muon shield, the veto systems, a helium-filled decay volume, the tracking system, and the spectrometer magnet. This "minimal" setup can measure backgrounds and improve current experimental FIP limits by 1-2 orders of magnitude, depending on the model. It will be followed by the full physics programme of SHiP with planned exploration for 15 years of data-taking.

In this talk, I will discuss the current status of the SHiP experiment, its timeline, and physics goals, which can already be achieved during the first physics run before the long shutdown 4 of the LHC, as well as the full potential of the facility.

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Session Classification: Session 7

Contribution ID: **48** Type: **Poster (In person)**

Upcoming End-Station for Laser-RF Double-Resonance Spectroscopy at the VITO Beamline

Wednesday 3 December 2025 18:40 (1 minute)

We present the status of the design and simulations of a future end-station at the VITO beamline aimed at performing collinear Laser-Radiofrequency (RF) Double-Resonance Spectroscopy. The future experiment is intended to significantly enhance the precision in determining the Hyperfine Structure (HFS) constants of short-lived exotic nuclei (e.g., K isotopes), with an expected reduction in uncertainty to the order of tens of kHz.
The project includes the development of the RF transmission line, which has been optimized via electromagnetic simulations to maintain a 50 Ω impedance and ensure efficient power transfer for HFS transitions up to 4 GHz frequency range. Simulations show a sufficient field uniformity and the necessary power transfer for exciting resonances in isotopes like 47-49K.
The problem of magnetic shielding of the interaction area was also investigated as part of the planning. Results indicate that passive shielding is insufficient, highlighting the necessity of active shielding or the removal of external magnetic sources for the successful implementation of the future experiment.

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Session Classification: Poster Session

Contribution ID: **49** Type: **Submitted oral (In person)**

Decay-fraction measurements of the radiative decay of the ^{229}Th nuclear-clock isomer in solid-state hosts

Friday 5 December 2025 12:10 (12 minutes)

Due to its low excitation energy around 8.4 eV, the unique ^{229}Th isomer is the ideal candidate for developing a nuclear clock [1]. Such a clock would be particularly suited for fundamental physics studies [1]. In the past, measuring the isomer's radiative decay from a large-bandgap crystal doped with ^{229}Th, has proven difficult: the commonly used population of the isomer via the ^{233}U α-decay has a limited branching ratio towards the isomer and creates a high-radioluminescence background [2, 3]. However, recently, a new approach to populate the isomer through the β-decay of ^{229}Ac was proposed [2]. This approach made it possible to observe, for the first time, the radiative decay of the ^{229}Th isomer with vacuum-ultraviolet (VUV) spectroscopy, which allowed to successfully determine the resulting photon's wavelength at a value of $\lambda = 148.7 \pm 0.4$ nm ($E = 8.338 \pm 0.024$ eV) and the isomer's radiative half-life in a MgF_2 crystal at a value of $t_{1/2} = 670 \pm 102$ s [4, 5]. Based on this work, narrow-band laser excitation of the nuclear isomer was achieved [6] with a frequency comb, determining the energy to 10^{-12} precision, boosting the development of a solid-state nuclear clock.

A new measurement campaign in July 2023 took place at ISOLDE, aimed at investigating different large-bandgap crystals and accurately determining the time behaviour of the radiative decay of ^{229m}Th, embedded in different crystal materials. This allowed to (1) observe, for the first time, the radiative decay in a $LiSrAlF_6$ crystal, (2) determine the radiative decay fraction of the isomer in different crystals [7], and (3) study the time behaviour of an ensemble of ^{229}Th isomers. These studies revealed the presence of a crystal-material-dependent quenching mechanism induced by the β-decay of the precursor isotopes. Results of these experiments will be presented, as well as the results of the most recent ISOLDE campaign which took place in May 2025. This campaign extended the earlier radiative-decay fraction measurements with new crystalline materials, and further investigated the α- and β-decay-induced quenching mechanism in order to link it to laser- and X-ray-induced quenching as reported in [8, 9].

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Session Classification: Session 10

Contribution ID: **50** Type: **Poster (In person)**

Recent development of SiC targets at ISOL@MYRRHA and CERN-ISOLDE

Wednesday 3 December 2025 18:39 (1 minute)

Silicon carbide (SiC) has historically been employed as a target material at ISOLDE (CERN) [1] and ISAC (TRIUMF) [2] and is currently under evaluation and development at emerging facilities including ISOL@MYRRHA (SCK CEN) [3] and SPES (INFN) [4]. Thanks to its high thermal conductivity, excellent emissivity, and chemical stability at elevated temperatures, SiC is under investigation for developing towards a material.
In the framework of the MYRRHA Phase-1 project [5], SCK CEN is focusing on the development of SiC targets to produce Al and Mg isotopes. A collaborative effort with the ISOLDE Target and Ion Source Development (TISD) team has been initiated to support the upcoming production of F17 beams, of particular interest for the COLLAPS [6] experiment.
Five different SiC powder samples, pre-selected by the TISD team, were characterized at SCK CEN using Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS), and Wavelength Dispersive X-ray Fluorescence (WDXRF). Based on microstructural analysis, two powders were identified as promising candidates due to their submicron grain sizes (<0.6 μm), which, as reported in literature [7], promote the diffusion of the produced isotopes though the grains. Nevertheless, the presence of aluminum impurities poses a limitation for both Al and F beam production. To mitigate this, fluorination treatments are being applied to the SiC pellets to reduce impurity levels prior to offline and online tests.
Subsequent sintering tests are planned post-fluorination to assess the thermo-mechanical stability of the material under irradiation-relevant conditions (1600–1700℃). The final target assembly is scheduled to be deployed in the mentioned COLLAPS experiment at ISOLDE by the end of November 2025.

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Session Classification: Poster Session

Contribution ID: **51** Type: **Submitted oral (In person)**

Experimental and theoretical studies of β-delayed fission

Thursday 4 December 2025 17:50 (12 minutes)

Beta-delayed fission (βDF) is a two-step process where a parent nucleus β-decays into a daughter nucleus that can then fission with a certain probability from an excited state [1]. The experimentally measured βDF probability (P_{DF}) is often very small and has been studied mostly for neutron-deficient isotopes, while only a few cases have been reported on the neutron-rich side of the nuclear chart. To expand the limited information in the neutron-rich region, the LOI216 experiment was performed at ISOLDE to study βDF in ^{230,232,234}Ac [2]. Since no fission fragments were observed, only upper limits for the P_{DF} could be deduced [3].

The limited results obtained from the experiment motivated the development of a theoretical framework based on an EDF approach to model the different ingredients required for calculating P_{DF} values, and the code PyNEB [4] to extract the fission paths. All the inputs are fed into TALYS [5] to calculate the final P_{DF} for all the experimentally measured cases of βDF. The nuclei for which finite P_{DF} values are reported were used to calculate a root mean square (RMS) deviation between the calculated probabilities and the experimental ones. After accounting for modelling deficiencies, an RMS deviation of about two orders of magnitude was found. This result is similar to what can be found from the βDF systematics approach based purely on the exponential dependence of the P_{DF} on the difference between the Q-value of the mother and the fission barrier of the daughter (see for example [6]). However, the theoretical framework developed using the EDF approach is based on a microscopic description of the nuclei, and, therefore, offers a more realistic description of the process studied. The results of this combined experimental and theoretical characterization of βDF will be discussed in this contribution, along with new cases identified as potential βDF candidates to be studied in the future at ISOLDE or other facilities.

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Session Classification: Session 8

Contribution ID: **52** Type: **Submitted oral (In person)**

The quadrupole moments of the 2_1^+ state in the even neutron deficient Sn isotopes

Wednesday 3 December 2025 12:00 (12 minutes)

Recent Monte Carlo Shell Model (MCSM) calculations made by T. Togashi et. al. [Phys. Rev. Lett. 121, 062501 (2018)] attempt to account for discrepancies observed between measurements and previous theoretical calculations of the reduced transition probability B(E2;$2_1^+ -> 0_1^+$) in the neutron deficient Sn isotopes. One of the predictions of the MCSM calculation is that a shape change should occur for the 2_1^+ state between ^{108}Sn and ^{110}Sn. In this work we present the first experimental results for the quadrupole moment for this state in ^{110}Sn, along with preliminary results for ^{106}Sn and ^{108}Sn in order to address this question. The measurement results were obtained through a safe Coulomb excitation experiment at HIE-ISOLDE, using the Miniball setup. A novel analysis approach combining GOSIA and GOSIA2 codes with a DSAM measurement was used to calculate both diagonal and transitional matrix elements. Preliminary results are compared to MCSM calculations and observations regarding a shape change in the 2_1^+ state are discussed.

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Session Classification: Session 2

Contribution ID: **53** Type: **Poster (In person)**

Laser spectroscopy of neutron deficient lutetium (Z=71) with PI-LIST

Wednesday 3 December 2025 18:38 (1 minute)

Laser spectroscopy of neutron-deficient lutetium isotopes (Z=71) can provide insights into the evolution of nuclear structure towards the proton drip line, independent of any nuclear models. Probing the hyperfine structure with laser spectroscopy allows the measurement of nuclear spins, magnetic moments, quadrupole moments and isotope shifts of these exotic nuclei. The isotope shift can then be used to determine the charge radii across the isotopic chain, which in turn reveals how the nucleus deforms with varying neutron number [1].

This work investigated a more efficient ionization scheme compared to previous work done on lutetium in 1998 [2]. Additionally, this experiment was an opportunity to test the Laser Ion Source and Trap (LIST) and its newly-developed variant, the Perpendicularly Illuminated Laser Ion Source and Trap (PI-LIST). These are both useful methods for achieving high selectivity in resonance ionization spectroscopy. In LIST, resonance ionization occurs within a radiofrequency (RF) quadrupole, allowing only laser-ionized species to pass through while suppressing background ions. PI-LIST extends the capability of the LIST configuration by reducing doppler broadening effects, resulting in a higher resolution with spectral linewidths in the range of 200-300 MHz [3].

In September 2023 tests (LOI278) on lutetium isotopes conducted at ISOLDE utilised these techniques to investigate the sensitivity of a new resonance ionization scheme to the isotope shift, in preparation for future in-source laser spectroscopy of neutron-deficient lutetium with the PI-LIST setup.

Additionally, this project involves the commissioning of an RF transducer device to enhance the efficiency of the LIST setup. This device will incorporate phase-locking within a resonant LCL circuit to optimise signal stability and RFQ efficiency for improved performance. It has been demonstrated to achieve symmetric AC signals in the range of 2 MHz at 150 Vpp, which will optimise the transmission of ions through LIST and PI-LIST, particularly when dealing with low-yield isotopes. Upcoming plans will enable remote control of this device as well as modifications to improve thermal stability in operation.

This contribution presents an overview of the motivation for investigating neutron-deficient lutetium isotopes, a summary of the PI-LIST technique, results from Lu LOI278 and upgrades to the RF transducer box that planned for installation during LS3.

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Session Classification: Poster Session

Contribution ID: **54** Type: **Submitted oral (In person)**

Exploring the Nuclear Structure and Collectivity of Neutron-Rich Tin Isotopes around ^{132}Sn

Wednesday 3 December 2025 10:05 (12 minutes)

The evolution of nuclear collectivity and structure in the region surrounding the doubly-magic nucleus ^{132}Sn remains a central open question in nuclear structure physics. Recent shell-model calculations, employing realistic interactions, predict an enhancement of collectivity in the neighboring even-even isotopes of ^{132}Sn [1]. Despite this, a long-standing discrepancy between experimental data for ^{130}Sn and ^{134}Sn and theoretical predictions persists [2]. To address this issue, two Coulomb excitation experiments were conducted at ISOLDE in 2023 and 2025. Post-accelerated radioactive ion beams, delivered by the HIE-ISOLDE accelerator at 4.4 MeV/u, were incident on ^{206}Pb and ^{194}Pt targets. The first excited states of ^{130}Sn and ^{134}Sn were selectively populated via safe Coulomb excitation. Deexciting γ rays were detected with the highly efficient MINIBALL γ-ray spectrometer in coincidence with scattered particles. Results from the 2023 experiment provide new experimental B(E2) data that resolve the previously observed discrepancy between theory and experiment in ^{130}Sn. The contribution will also include results concerning Coulomb excitation of the long-lived 7^- isomer in ^{130}Sn and present the current status of the analysis of the 2025 data for ^{134}Sn.

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[2] T. Togashi *et al.*, Phys. Rev. Lett. **121**, 062501 (2018).

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Session Classification: Session 1

Contribution ID: **55** Type: **Submitted oral (In person)**

Terbium-149 production and separation: IS688 and beyond

Wednesday 3 December 2025 15:20 (12 minutes)

Terbium-149 has been regarded as an attractive candidate for Targeted Alpha Therapy (TAT) since the 1990's [1], due to its favourable physical decay properties (T1/2 = 4.1 h, Eα = 3.97 MeV, 17%; Eβ+mean = 720 keV, 7%) [2]. Preclinical studies have demonstrated its therapeutic potential [3-6], as well as its potential for therapy monitoring via positron emission tomography (PET) [4]. The absence of its daughter nuclides emitting relevant quantities of α-particles, make it particularly promising for therapy despite its current limited availability.
Terbium-149 was produced at ISOLDE/CERN via spallation induced in a tantalum target using high-energy (1.4 GeV) protons, followed by release and ionization of the spallation products, which were mass-separated online. The mass 149 isobars were collected in zinc-coated Au/Pt/Ta foils and, subsequently, transported to PSI for processing. The desired Tb nuclide was chemically separated from its isobaric impurities, as well as the collection material, using cation exchange and extraction chromatography, employing an optimized process [7]. The quality of the radionuclide produced was assessed analytically and by means of radiolabelling experiments. To date, up to 1.9 GBq terbium-149 were collected and transported to PSI. Upon arrival, the foil was placed into a dedicated hot cell and processed. The four-hour radiochemical separation process yielded up to 400 MBq final product. The product radiochemical purity, measured by γ-spectrometry, was determined to be 99.8%. Quality control was performed using DOTATATE, which was successfully labeled at molar activities up to 50 MBq/nmol with >99% radiochemical purity [7]. The chemical purity was further proven by ICP-MS measurements, which showed Pb, Cu, Fe and Zn contaminants at ppb levels.
Based on the successful collaboration between PSI and ISOLDE, the TATTOOS project (Targeted Alpha Tumour Therapy and Other Oncological Solutions) as part of the Swiss Large Facilities project IMPACT [8] was submitted and, subsequently, approved by the Swiss parliament in December 2024. TATTOOS intends to address the means of producing 149/152/155Tb in large quantities towards potential clinical application.
The authors thank CERN and PSI radiation safety and logistics teams for their contribution to this project, as well as Hanne Heylen for run coordination.
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[7] Favaretto et al. SciRep 2024,14:3284
[8] IMPACT Project: https://www.psi.ch/en/impact

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Session Classification: Session 3

Contribution ID: **56** Type: **Submitted oral (In person)**

Evidence of fully aligned neutron-proton pair dominance in ^{128}Cd

Friday 5 December 2025 09:50 (12 minutes)

The region of the nuclear landscape around the doubly-magic ^{132}Sn is rich in nuclear structure phenomena. A relevant feature in the region is the presence of long-lived isomeric states, which may undergo both β and γ decay [1-3]. Spin-gap isomers arising from hindered decay routes to lower-lying levels due to a large change in nuclear spin the need for the emission of high-multipolarity γ rays have been identified . Seniority isomers have also been found in this region [4] arising from the coupling of identical nucleons in the same nuclear shell. This coupling may lead to fully aligned states with a small energy gap for electromagnetic decays to other levels.

Another type of spin-gap isomers are those arising from fully aligned proton and neutron pairs. Examples of these isomers can be found in the nuclear chart, such as the 12^+ $(\nu 0f^{-2}_{7/2} \times \pi 0f^{-2}_{7/2})$ ^{52}Fe [5] and the 16^+ $(\nu 0h^{-2}_{9/2} \times \pi 0g^{-2}_{9/2})$ in ^{96}Cd [6]. In both cases, the lower energy of the fully aligned state relative to the states with similar but lower J^π states from the same multiplet result in β-decaying states. The case of ^{96}Cd along with the spreading in energy of the yrast band in ^{92}Pd [7] was considered to be an evidence for the dominance of a neutron-proton aligned scheme in $N = Z$ nuclei. These studies prompted a large theoretical discussion, indicating that the dominance of aligned pn pairs may be a generic feature in nuclei with valence nucleons in high-j orbitals. In the study provided by Y.H. Kem \textit{et al} [8], it was suggested that this dominance of pn pairs is not only confined to $N = Z$ nuclei but it should be expected in other regions of the nuclear chart. In their study, it was shown how the energies of the yrast state could be explained mainly by the influence of pn aligned pairs. An strong evidence of the pn pair dominance in ^{128}Cd would be the existence of a fully-aligned 18^+ β-decaying state based on the $\nu 0h^{-2}_{11/2} \times \pi 0g^{-2}_{9/2}$ configuration, analog to the 16^+ state in ^{96}Cd. Different studies have predicted their existence [9,10], and some isomeric states have already been reported in this nucleus. A 10^+ isomer with $T_{1/2}$ = 3.56(6) μs and 2714-keV excitation has been assigned to the two-neutron $0h^{-2}_{11/2}$ hole configuration [11] . On the other hand, a longer-lived isomer with $T_{1/2}$ = 6.3(8) ms has also been proposed at 1572 keV above the 10^+ isomeric level based on de-exciting transitions, and tentatively proposed as 15^- [9]. However, none of them correspond with the fully aligned state.

In this contribution, we present the results of a high-statistics β-decay experiment conducted at the ISOLDE facility at CERN, utilizing pure Cd beams. Strong evidence for a new β-decaying high-spin isomer in ^{128}Cd has been found. This isomeric state is a very good candidate for the fully aligned state. A detailed discussion of the experimental evidence will be provided, alongside a comparison of the findings with state-of-the-art shell-model calculations and calculations using the Symmetry Conserving Configuration Mixing Method (SCCM) with the Gogny D1S interaction.

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Session Classification: Session 9

Contribution ID: **57** Type: **Poster (In person)**

Development and testing of nanostructured uranium carbide targets for ISOLDE physics

Wednesday 3 December 2025 18:37 (1 minute)

Development and testing of nanostructured uranium carbide targets for ISOLDE physics

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The intensity of a radioactive ion beam at CERN-ISOLDE depends on multiple factors, including the primary beam intensity, target thickness, production cross-section for specific isotopes, as well as the efficiency of isotope extraction, ionization, and purification. To allow for a reasonably fast release of the produced nuclei, the target should be tailored to optimize these parameters by selecting target materials that are chemically and thermally stable under operational conditions and facilitate rapid diffusion and effusion rates of the elements of interest [1].
Uranium carbide (UC_x) targets represent the majority of targets routinely employed at ISOLDE, accounting for nearly 60% of the total usage in recent years. Carbide materials are particularly attractive for the production of challenging radioactive ion beams (RIBs), as their chemical inertness and high thermal stability facilitate the extraction of refractory isotopes that are otherwise difficult to obtain. Given these favourable properties and encouraged by significant performance gains observed with other sub-micron and nanostructured materials tested at ISOLDE (e.g., Y_2O_3, SiC, CaO), the development of nanostructured UC_x has become a priority for the ISOLDE community.
In this work, we will present the outcome of the ISOLDE Type A laboratories'commissioning programme, as well as first experiences of producing nanostructured UC_x targets in the Nanolab. We will also report on results from the latest online testing campaign, evaluating the performance of nano-UC_x targets against conventional UC_x targets and earlier nanostructured UC_x materials produced within the ActILab project [2–4].

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Presenter: BERLIN, Valentina (SY group)

Session Classification: Poster Session

Contribution ID: **58** Type: **Poster (In person)**

Engineering of the Upgraded VITO β-NMR Beamline

Wednesday 3 December 2025 18:36 (1 minute)

This work presents the engineering design and analysis of the upgraded beta-NMR end station at the VITO beamline. The upgrade was aimed at enabling studies of air-sensitive samples in a wide range of temperatures in 4.7 T magnetic field. This led to the requirements of non-magnetic materials, ultra-high vacuum, load-lock system for sample changes, and heating and cooling capability. The redesigned system integrates a new internal motion assembly for precise sample positioning inside the magnet bore without the need to break vacuum, a modular vacuum chamber, and a dedicated sample change mechanism enabling studies on air-sensitive materials. Structural, thermal and electromagnetic simulations were performed to validate the design. An LN2 trap has been also added to reduce residual-gas load.

The upgraded setup has been already successfully used during β-NMR measurements on 8Li and 47-49K. In this poster, we present the detailed design and simulations and show the performance of the new system.

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Presenter: JALUVKA, Jiri (Brno University of Technology (CZ))

Session Classification: Poster Session

Contribution ID: **59** Type: **Submitted oral (In person)**

Neutron capture studies at FIPPS

Thursday 4 December 2025 14:50 (12 minutes)

Capture of thermal neutrons is a well-established experimental method to probe the structure of nuclei in the vicinity of the path of stability. This technique allows for population of excited states below the single-neutron separation energy and for studies of their properties via, for example, angular correlations or fast timing methods. However, the relatively large energy window that results in a presence of high-energy gamma rays requires a high-efficiency high-resolution detection setup.
In this talk, I will introduce FIPPS, Fission Product Prompt gamma-ray Spectrometer, a permanent gamma-ray detection setup at the Institut Laue-Langevin in Grenoble, France. Its capabilities, results from recent experimental cycles and plans for the upcoming year will be presented. A particular focus will be put on the most recent experiment dedicated to studies of excited states in 89Zr produced in the neutron capture of the short-lived 88Zr (T1/2 ~ 90d).

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Session Classification: Session 7

Contribution ID: **60** Type: **Submitted oral (In person)**

ISRS project R&D status and plans for CERN LS3

Wednesday 3 December 2025 17:20 (12 minutes)

L. Acosta(1), R. Berjillos(2), I. Bustinduy(4), J. Correa-Laorden(1), Y. Fontenla(3), C. García-Ramos(2), J. Giner-Navarro(3), D. Gómez-Domínguez(2), Carlos A. Gonzalez(2), G. Kirby(2), T. Kurtukian-Nieto(1), I. Martel(2), J. L. Muñoz(4), A. Perea(1), J. Resta-Lopez(3), S. Sanchez-Navas(1), F. Taft(3), F. Torabi(2),for the ISRS collaboration(5)

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Abstract

The HIE-ISOLDE facility supplies over 1000 radioactive ion beams up to 10 MeV/u [1]. Very recently, the ISRS Collaboration [2] proposed the development of a Superconducting Recoil Separator to investigate nuclear structure and dynamics of exotic nuclei by particle-gamma correlations and focal plane decay spectroscopy. ISRS is based on a compact particle storage iron-free mini-ring design composed of superconducting magnets cooled by cryocoolers, and FFAG beam dynamics to achieve unprecedented mass-resolving power [3]. The primary function of the ISRS is to achieve efficient separation of exotic reaction recoils from the much more intense primary ion beam, allowing for gamma-particle correlation experiments using the reaction chamber and focal plane detector arrays. During the CERN LS3 (2026-2028) period collaboration aims to install the multi-harmonic buncher and the superconducting magnet MAGDEM at ISOLDE [4], the later integrated in the ISOLDE Superconducting Linear Spectrometer (ISLS). In this contribution we will discuss physics opportunities as well as ISRS plans during LS3.

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Session Classification: Session 4

Contribution ID: **61** Type: **Invited (In person)**

The ISOLDE Improvement Program, and what will happen in the hall

Wednesday 3 December 2025 11:10 (20 minutes)

The ISOLDE Long Shutdown starts at the end of December and will last two years to accomodate the replacement of the ISOLDE dumps as well as the upgrade of the BTY line for 2GeV proton beam, the refurbishement of HIE ISOLDE Cryo Module 1 and many other improvements, consolidation and maintenance to the facility and the experimental setups.
This talk will give you an overview and timeline of the ISOLDE Improvement Program and the work to be expected in the ISOLDE Experimental hall.

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Presenter: SIESLING, Erwin (CERN)

Session Classification: Session 2

Contribution ID: **62** Type: **Submitted oral (In person)**

Compact Dynamic Nuclear Polarisation setup for medical applications

Thursday 4 December 2025 10:20 (12 minutes)

Dynamic Nuclear Polarisation (DNP) is powerful technique for enhancing the sensitivity of Nuclear Magnectic Resonance (NMR). Originally developed in 1960s, the DNP has been deployed in nuclear polarised targets around the world for high-energy scattering experiments. In the last 20 years DNP found its way back in modern NMR spectroscopy and imagining. There are currently very few commercially available DNP polarisers and they come with prohibitively high cost.
In 2023 the CERN Medical Applications funding gave financial support to develop compact and relatively cheap DNP polariser. The system employs custom built superconducting magnet, microwave system and NMR detection. The cooling is provided by conventional liquid helium dewar, decreasing the cost and complexity of such a system.
In this presentation I will give a brief overview of the project, the current status and future development. I will also describe the plans for using the system for the first ever polarisation of radioactive nuclei using DNP. If successful this would open the possibility of deploying the radiation-detected NMR technique outside of facilities like VITO at ISOLDE and thus allowing for more widespread use of the radiation-detected NMR technique.

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Session Classification: Session 5

Contribution ID: **63** Type: **Submitted oral (In person)**

First ever α-scattering with radioactive ion beams: a novel technique to determine α-nuclear potentials away from stability.

Wednesday 3 December 2025 10:20 (12 minutes)

The α-nuclear potential in exotic nuclei, a key input in modeling the astrophysical p-process [1,2], remains a source of uncertainty due to the lack of experimental data. This potential can be constrained experimentally by measuring the differential cross-section of α-scattering near the Coulomb barrier and identifying the best-fit interaction model.

In the context of experiment IS698, we performed the first measurement of α-scattering elastic distributions with radioactive isotopes in inverse kinematics. Thin silicon films with high ^{4}He amount trapped in the matrix [3] were bombarded with four tin isotopes beams (^{108}Sn, ^{109}Sn, ^{110}Sn, and ^{112}Sn) at energies around the Coulomb Barrier. The resulting data were benchmarked against previous direct kinematics measurements of ^{112}Sn(^{4}He, ^{4}He)^{112}Sn. [4]

In this talk, I will detail the experimental setup, data analysis procedures, and present the first-ever differential cross-section measurements of α-scattering involving radioactive tin isotopes, demonstrating the viability and precision of this new method.

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Presenter: SANTOS LIMA GERALDES BARBA, Francisco Maria (Laboratory of Instrumentation and Experimental Particle Physics (PT))

Session Classification: Session 1

Contribution ID: **64** Type: **Submitted oral (In person)**

Towards determination of distribution of magnetisation in 47-49K

Friday 5 December 2025 11:55 (12 minutes)

Following the N=28 shell closure, a pronounced change in the slope of the charge radii, often referred to as a "kink", has been observed in neutron-rich calcium isotopes [1,2]. However, the exact amplitude of this kink and the underlying reasons for this phenomenon remain unclear. Theoretical predictions suggest that several factors could contribute to this behaviour, including the presence of large nuclear deformations or significant radial extensions of the nuclear density distribution. To address these questions and explore the origins of the observed kink, we aim to determine the difference in the distribution of magnetisation for 47,48,49K by measuring their differential hyperfine anomalies (also known as Bohr-Weisskopf effect. To achieve this, we set out to measure precise magnetic dipole moments and hyperfine structure constants at the VITO beam line.
In October 2025, we performed the first part of these studies: we measured precisely magnetic moments of 47-49K using beta-NMR at VITO in solid (KCl) and liquid (EMIM-DCA ionic liquid) samples, thus reaching ppm precision [3]. In this contribution I will present the measurement principle, the upgraded experimental setup, the analysis of the collected data, and preliminary values of differential hyperfine anomaly between the isotopes. I will also mention how we aim to determine the hyperfine structure constants with improved precision. Finally, I will present our magnetic moment calculations using DFT with angular momentum symmetry restoration [4,5].

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Session Classification: Session 10

Contribution ID: **65** Type: **Poster (In person)**

First-Principles EFG Calculations and PAC Probing of Octahedral Distortions in AYTiO4 (A = Na, Ag) Layered Perovskites

Wednesday 3 December 2025 18:35 (1 minute)

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The engineering of material properties in perovskite-related oxides is strongly influenced by distortions of the oxygen octahedral framework. In Ruddlesden-Popper (RP) compounds such as $AYTiO_4$ (A = Na, Ag), the interplay between competing octahedral distortions gives rise to functionalities like acentricity and negative thermal expansion (NTE). While octahedral rotations are common in simple ABO_3 perovskites, the emergence of acentric or ferroelectric behavior, via inversion symmetry breaking, is rare except in layered perovskite structures.

A notable example is the A-site ordered RP compound $NaRTiO_4$ (R = rare-earth metal), long considered centrosymmetric for R = Y. However, Akamatsu et al. \cite{akamatsu2014} showed that its low-temperature phase adopts the acentric space group $P\overline{4}2_1m$ (113). In a separate study, Yoshida et al. investigated octahedral distortions in the $AgRTiO_4$ family and revealed biaxial NTE behavior. Unlike typical NTE materials, DFT calculations indicated that this biaxial NTE results from the competition between octahedral rotation and deformation \cite{yoshida2022}.

To probe these effects at the atomic scale, we employed Perturbed Angular Correlations (PAC) spectroscopy on $NaYTiO_4$ and $AgYTiO_4$ across a broad temperature range (10–1200 K). PAC enabled us to follow the evolution of the hyperfine electric field gradient (EFG) at the A-site nuclei, offering detailed insights into local structural distortions and temperature-driven phase transitions.
PAC has recently demonstrated its effectiveness in resolving oxygen distortions in RP systems, providing direct confirmation of the corkscrew-like atomic mechanism underlying NTE in these layered perovskites \cite{rocha2020}.

Furthermore, we performed \textit{ab-initio} calculations of the EFGs in these layered oxides an area still largely unexplored in the literature. The EFG sensitivities to different crystallographic symmetries (P4/nmm (s.g. 129), $P\overline{4}2_1m$ (s.g. 113), Pbcm (s.g. 57)) were assessed and compared with total energies and lattice parameters from previous structural refinements based on synchrotron and neutron diffraction data \cite{akamatsu2014,yoshida2022}. Comparing experimental PAC data with simulated EFGs enables the unambiguous identification of the dominant octahedral distortions in these systems.

In summary, we will show how the comparison between experimental EFG data and ab initio EFG simulations may enable the identification of the dominant octahedral distortion modes across temperature, possibly providing insights into the structural mechanisms driving the functional properties of these layered perovskites.

This work was supported by Fundação para a Ciência e Tecnologia (FCT), through IFIMUP projects LA/P/0095/2020, UIDB/04968/2025 and UIDP/04968/2025, and C2TN through the project (CERN/FIS-TEC/0003/2021).

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Session Classification: Poster Session

Contribution ID: **66** Type: **Submitted oral (In person)**

HISTARS: A High-Performance Detector for Nuclear Excited-State Lifetimes at HIE-ISOLDE

Thursday 4 December 2025 15:20 (12 minutes)

To exploit the vast possibilities offered for research in nuclear structure, nuclear astrophysics and other fields at ISOLDE, the HIE-ISOLDE Timing Array for Reaction Studies (HISTARS) project aims at building a detection device for the measurement of lifetimes of excited states populated in reactions. Nuclear excited-state lifetimes are essential to have direct access to electromagnetic transition rates, which are sensitive to the details of nuclear wavefunctions.

HISTARS combines a charged particle inner detector system with enhanced capabilities for reaction tagging with excellent timing response and an external gamma fast-timing array based on $LaBr_3$(Ce) detectors. The system aims to benefit from recent advancements in instrumentation and electronics, utilizing improvements in digital signal processing and innovative analysis techniques based on genetic algorithms. The project will expand research opportunities for the large community of accelerated beam users at ISOLDE.

The presentation will address the HISTARS conceptual design, the technical design study including Monte Carlo simulations, and the performance evaluation of fast-scintillator systems for gamma rays and charged particles. Test physics cases to showcase the potential of the instrument will be also introduced.

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Session Classification: Session 7

Contribution ID: **67** Type: **Submitted oral (In person)**

Beta-delayed two-neutron spectroscopy of 134In: a novel window into nuclear structure

Thursday 4 December 2025 09:50 (12 minutes)

Neutron-rich nuclei near doubly-magic 132Sn offer a valuable testing ground for exploring both nuclear structure and the astrophysical r-process. Investigation of neutron-branching ratios in this region offers benchmark testing of theoretical descriptions of neutron-rich nuclei, and the N = 82 shell closure provides an isotonic chain of waiting-point nuclei critical to r-process trajectories and the final pattern of elemental abundances [1-2]. Thanks to the advanced radioactive beam production and high-purity mass separation at CERN [3-4], the opportunity to study nuclei in this region with minimal contamination is possible. This presentation will focus on a recent beta-decay spectroscopy measurement performed at the ISOLDE Decay Station, where the decay of 134In was measured to further test the statistical model description of spherical delayed neutron emitters with low, nuclear-level densities [5]. For the first time, energy correlations in two-neutron emission were measured using the Neutron dEtector with multi-neutron (Xn) Tracking (NEXT) array for an r-process nucleus. This capability made it possible to identify two-neutron-emitting states in the 134Sn daughter and, subsequently, the long-sought i13/2 neutron single-particle state in 133Sn [6-9]. Both the experimental results and comparison with theoretical models will be presented, which provides crucial information towards nuclear structure in the 132Sn region.

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Session Classification: Session 5

Contribution ID: **68** Type: **Poster (In person)**

Determination of half-lives, alpha-beta branching and hindrance factors of ^{219,220}Po; implications on nuclear shape

Wednesday 3 December 2025 18:34 (1 minute)

Abstract

Octupole deformations are predicted to occur in nuclei in the region $130 \leq N \leq 140$ and $85 \leq Z \leq 92$ [1]. Nuclei that exhibit octupole deformations are of interest for ongoing searches for permanent atomic electric-dipole-moments and beyond Standard Model physics.
Recent studies suggest the octupole deformed region north-east of ^{208}Pb extends down to At ($Z = 85$) [2]. However, no evidence for octupole deformation has been observed in the Po ($Z = 84$) isotopes up to $N = 135$ [3].

To investigate the lower boundary of the octupole deformed region north-east of ^{208}Pb, decay spectroscopy studies of ^{219,220}Po were performed at CERN ISOLDE with the ISOLDE Decay Station (IDS) and the Alpha SETup (ASET). The Laser Ion Source and Trap (LIST) [4] was utilized to reduce isobaric contamination from surface ionised francium isotopes, which previously prevented measurements at ISOLDE in this region.

In this work, we further delineate the octupole deformed region north-east of ^{208}Pb by presenting improved values for the half-life and α-β branching ratio of ^{219}Po ($N = 135$) and first values for these quantities for ^{220}Po ($N = 136$). From these results we calculate the alpha decay hindrance factors and discuss their implications on nuclear structure in this region.

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Session Classification: Poster Session

Contribution ID: **69** Type: **Invited (In person)**

Solid-state physics at ISOLDE at the interface with quantum technologies, nuclear physics and fundamental interactions

Friday 5 December 2025 09:00 (20 minutes)

In this talk, I will present an overview of recent research at ISOLDE that bridges solid-state physics, quantum technologies, nuclear physics, and fundamental interactions. One of our main research directions focuses on understanding and controlling optically active impurity–vacancy complexes (color centers) in diamond, using radioactive isotopes as probes [1]. This work establishes quantitative links between the structural incorporation of impurities (e.g. Sn, Mg, Ge) and the formation efficiency and optical properties of their corresponding color centers (e.g. SnV, MgV, GeV) relevant for quantum photonic applications [2-4].
A more recent research line builds on this expertise, extending it to color centers in diamond based on actinides such as Pa and Th, which are being explored as solid-state probes for electric dipole moment (EDM) physics [5].
I will also review our contribution to the ongoing efforts at ISOLDE to study the thorium-229 isomer [6-8], and how it connects to our ongoing work on developing solid-state nuclear clock implementations based on ion implantation of thorium-229 and photonic devices.
The work reviewed in this talk has largely relied on two complementary techniques: emission channeling (EC) and radiotracer photoluminescence (rPL). EC has been a cornerstone at ISOLDE for decades, while rPL has seen rapid development more recently, particularly in studies of color centers in diamond. I will highlight these advances and introduce the new Quantum Photonics Laboratory at ISOLDE, established to further explore these directions. Finally, I will place this research within the broader scientific framework of collaborative programs between KU Leuven, the University of Lisbon, and a wide international network.

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[5] LOI-281 - Quantum emitters in diamond containing octupole-deformed nuclei for electric dipole moment experiments
[6] IS715 - Study of the radiative decay of the low-energy isomer in 229Th
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Session Classification: Session 9

Contribution ID: **70** Type: **Invited (In person)**

Advances in Ion Beam Manipulation at ISOLDE: Beam Switching and Beam Gating

Thursday 4 December 2025 16:40 (20 minutes)

The ISBM (Ion Sources and Beam Manipulation) team at ISOLDE is dedicated to the development and application of advanced techniques for radioactive ion beam (RIB) purification and preparation. This includes molecular beam extraction, laser ionization and background suppression methods, specialized devices such as fast beam gates, timed beam delivery systems, ion traps, and a variety of specialized ion sources. Two major ongoing projects illustrate these efforts: the central beamline switching of CA0 and fast beam gating.

The beam switching project addresses one of ISOLDE's central challenges: the demand for RIB beam time far exceeds supply, with a backlog of shifts awaiting scheduling. To increase efficiency, ISOLDE aims to transition from a single user to a multi-user facility. The proposed automated beam switching system will enable alternating delivery of beams from the General-Purpose Separator (GPS) and the High-Resolution Separator (HRS) on a pulse-to-pulse basis, allowing two experiments to run in parallel. Recent tests with solid-state switching confirmed the technical feasibility of sub-microsecond switching times of arbitrary voltages up to 5kV, paving the way for integration into ISOLDE's infrastructure and potentially increasing operational days by 20–30 per year.

Closely related is the fast beam gate project, which underpins the switching scheme. ISOLDE's existing beam gate system has faced persistent reliability issues since 2021, stemming from outdated hardware and incomplete upgrades. A new generation of beam gates is being developed to support high-frequency operation (up to 10 kHz) for laser-ion time-of-flight gating and to achieve microsecond-level beam control with full remote operation and logging.

It is foreseen that the developments in beam switching and beam gating will significantly enhance ISOLDE's capacity, flexibility, and experimental throughput post LS3.

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Session Classification: Session 8

Contribution ID: **71** Type: **Submitted oral (In person)**

Exploring shape coexistence across N=60 in Sr isotopes using IDS

Thursday 4 December 2025 12:05 (12 minutes)

The region around N≈60 with Z≤40 has generated considerable interest as it features the most abrupt shape transition known to date in the nuclear chart, when crossing from N=58 to N=60 [1]. This transition is closely linked to shape coexistence [2], a phenomenon where two or more states with different intrinsic shapes coexist within the same nucleus at low excitation energy and within a narrow energy range. Specifically, the sharp change arises from the inversion of two distinct quantum nuclear configurations, each corresponding to different nuclear shapes. These shifts are interpreted as quantum phase transitions [3], indicating a fundamental transformation in nuclear properties. This phase transition emphasises the importance of nuclear deformations and the variety of shapes present in neutron-rich nuclei such as strontium.

The IS709 experiment at the ISOLDE Decay Station (IDS) [4] aims to investigate the phenomenon of shape coexistence across the N=60 region in $^{96-102}$Sr isotopes, with particular emphasis on ^{100}Sr. Excited nuclear states were populated via β and β–n decay of Rb beams and studied with 13 Clover HPGe detectors optimised for γ–γ angular correlation measurements, allowing a precise determination of transition multipolarities and spin assignments. In parallel, the SPectrometer for Electron DEtection (SPEDE) [5] was employed to measure internal conversion electrons, providing direct access to E0 transition strengths, which jointly enable the identification of excited 0^+ states.

In this contribution, we will present preliminary results from the IS709 experiment (September 2025). Together with the IS622 fast-timing lifetime measurements [6], this experiment provides a coherent and comprehensive picture of the nuclear structure and shape deformation in neutron-rich strontium isotopes in the N≈60 region, and further illustrates the broad range of capabilities and the versatility of the IDS setup.

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Session Classification: Session 6

Contribution ID: **72** Type: **Poster (In person)**

A Space for Developing New Non-Radioactive Target Materials –Extension of the Chemical Lab for Development and Production of Nanometric Materials

Wednesday 3 December 2025 18:33 (1 minute)

Demands with respect to yield, purity, reliability are driving development efforts. Recent years focus on nanomaterials: release bottleneck in RIB production where nanometric size is promising for diffusion-limited isotopes. This often goes hand in hand with increase in surface area, which significantly impact effusion efficiency for open pores. Nanotechnology has been considered for addressing both pathways by nano-structurisation of the target material, e.g. reducing material dimensionality or additionally to increase, maintain or at least retain porosity and surface area through anti-sintering agents under operational conditions. Some submicron and nanometric materials are already routinely employed, e.g. SiC, Y2O3, CaO and potential was demonstrated by 10-yield increase for many isotopes even for a low-density nano material due to increased diffusion times.[1]
Nevertheless, controlled development remains challenging. Additionally, the risks of this technology for health and environment are not fully understood yet, adopted measures for containing these materials should be applied. Therefore, not only the materials itself but subsequently the infrastructure for reliable development, production and safe handling need to evolve.
Because of this many organizations enforce tight regulations which render difficult the research of nanomaterials, leading to the construction of a completely new laboratory: the NANOLAB to produce and develop nano-actinide target materials. With the NANOLAB recently begun operation for the development and production of nano-actinide materials, adequate infrastructure for non-radioactive materials is limited. Therefore, we combine the existing separated laboratories into one classified laboratory complex including Nano 3 –Production, Nano 2 –Development, Nano 1 – Chemical and thermal activities and an adjunctive chemical storage, to streamline the production of established and the implementation of newly developed materials under safe yet efficient conditions by adopting EPFL methodology for working with engineered nanomaterials for CERN.[2]
The motivation for this laboratory complex, the status and design will be presented.

Keywords: nanomaterials, target material, chemical lab, more yield, non-radioactive

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Presenter: GRASSER, Matthias Alexander

Session Classification: Poster Session

Contribution ID: **73** Type: **Poster (In person)**

Beam Optics Modelling and Bayesian Analysis for Enhanced Beam Delivery to ISOLDE Experiments

Wednesday 3 December 2025 18:32 (1 minute)

A comprehensive optics model of the ISOLDE low-energy transfer lines has been developed and validated to support improved beam delivery for experiments such as PUMA. The model, implemented in MAD-X and Xsuite, incorporates survey data, apertures, and CST-validated electrostatic quadrupole fields. Benchmarking through quadrupole scans, kick-response measurements, and tomographic reconstruction provided detailed characterisation of beam transport and emittance. Building on this framework, Bayesian analysis techniques are being explored to extract beam parameters more efficiently and improve model consistency with measurements. Together, these developments establish a predictive and data-driven foundation for optimising ISOLDE beam transport and ensuring reliable conditions for upcoming physics experiments.

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Session Classification: Poster Session

Contribution ID: **74** Type: **Submitted oral (In person)**

MULTIPAC and PACBit - Third Generation TDPAC Spectroscopy

Wednesday 3 December 2025 15:35 (12 minutes)

With its unique combination of an external magnetic field of up to 8.5 Tesla and the ability to heat and cool samples during measurements, the MULTIPAC Time-Differential Perturbed Angular Correlation (TDPAC) setup creates new possibilities for studying materials and their phase transitions. Building on this advanced instrumentation, the dedicated control and analysis software PACBit enables high-performance data acquisition, streamlined experiment control, and efficient post-processing. An outline of the detector configuration is given, followed by an exposition on how the system increases the effective resolution beyond the 10-bit limit of the U5310A digitizer through advanced signal processing techniques. Operating in streaming mode, the data acquisition (DAQ) delivers high throughput and allows the collection of more data than in previous setups. Post-processing features include signal smoothing, removal of secondary pulses, precise timestamp calculation and integration. These processes are all automated, to achieve a real-time R(t) spectrum. Finally, a coincidence search algorithm is presented that exploits the increased dataset to deliver more accurate event correlations, paving the way for better experimental results and new opportunities in high-resolution TDPAC spectroscopy.

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Session Classification: Session 3

Contribution ID: **75** Type: **Invited (In person)**

Status of the JYFL Accelerator Laboratory and future opportunities

Wednesday 3 December 2025 14:00 (20 minutes)

The JYFL Accelerator Laboratory (JYFL-ACCLAB) is one of the leading stable beam facilities in Europe, conducting world class research on basic natural phenomena. Presently the laboratory hosts four accelerators with a variety of ion sources and innovative instrumentation for fundamental research, ion-beam based materials physics and applications. The current main research facilities includes the on-line isotope separator IGISOL producing low-energy radioactive ion beams (RIBs) which are coupled to ion/atom traps and laser systems, two recoil separators (gas-filled, RITU, and vacuum mode, MARA) with novel multi-detector systems for low cross-section in-beam and stopped-beam spectroscopy experiments, infrastructure for a variety of ion beam analysis methods and a RADiation Effects Facility, RADEF.

The IGISOL facility explores ground- and isomeric state properties of nuclei via mass spectrometry as well as laser and decay spectroscopy for nuclear structure and astrophysics, and fundamental interactions. Recent developments include combining laser resonance ionization with sensitive mass separation and detection resulting in almost background free measurements at the $N = Z$ line. New international projects MORA and SEASON are under commissioning or data taking. Future programs include novel laser- and sympathetic cooling techniques for ultra-high precision measurements, coupling the MR-TOF mass spectrometer for collinear laser spectroscopy as well as a decay spectroscopy station.

The nuclear spectroscopy team, with state-of-the-art detector systems coupled with recoil separators, have produced a wealth of in-beam and decay studies, probing structures and phenomena in proton drip-line nuclei and heavy elements produced via heavy-ion fusion-evaporation reactions. The JUROGAM3 array of Ge detectors can be moved with ease between the target positions of both separators, and ongoing developments towards realizing a gas cell at the focal plane of MARA to deliver exotic beams to a new low-energy branch continues.

In this presentation I will present an overview of the status of the facility and will highlight the current research activities as well as new projects underway and soon to be realized. I will also endeavor to show the important complementarity with the ISOLDE facility, through our joint physics programs and infrastructure development.

Author: MOORE, Iain

Presenter: MOORE, Iain

Session Classification: Session 3

Contribution ID: **76** Type: **Submitted oral (In person)**

From stellar explosions to medical isotopes: recent results from the TAS at ISOLDE

Wednesday 3 December 2025 14:50 (12 minutes)

Recent Total Absorption Spectroscopy (TAS) experiments at the ISOLDE have provided new nuclear data with implications spanning from nuclear astrophysics to medical applications.

In the astrophysical domain, the beta+/EC decay of the waiting-point nucleus 64Ge has been measured with the *Lucrecia* TAS setup. The resulting B(GT) distribution has been compared with theoretical calculations using QRPA and the Projected Shell Model, providing key constraints for modelling the rp-process reaction network and Type I X-ray burst light curves.

In the A=64–66 mass region, new TAS results on the beta decay of 64Ga and 66Ga have enabled the extraction of the Fermi transition strength B(F) for the forbidden 0+–>0+ decay to the ground state of the daughter nucleus. From this, the degree of isospin mixing in the parent nuclei has been deduced, confirming previous findings.

Finally, in the area of nuclear medicine, the beta+/EC decay of 152Tb has been studied. This isotope is part of the promising theranostic pairs 152Tb-177Lu, -149Tb or -166Tb, and our results show significant deviations from the evaluated data in ENSDF, with direct relevance for dosimetry and radiopharmaceutical modelling.

These results highlight the broad impact of TAS measurements carried out at ISOLDE on nuclear data for fundamental and applied research.

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Session Classification: Session 3

Contribution ID: **77** Type: **Submitted oral (In person)**

Low energy reactions at the CMAM tandem for the development of HISTARS

Friday 5 December 2025 10:20 (12 minutes)

In the framework of the HISTARS (HIE-ISOLDE Timing Array for Reaction Studies) project at ISOLDE/CERN, an array is being developed to measure lifetimes of excited nuclear states populated in reactions at HIE-ISOLDE. For particles detection, plastics or fast inorganic scintillators such as GAGG:Ce and YSO are promising candidates due to their non-hygroscopic nature, high density, high light yield, and fast scintillation decay time [Wang2020, Tsuchida1997]. These detectors are intended to be combined with $LaBr_3$(Ce) crystals for gamma detection, which are well established for their excellent time and energy resolution [Vedia2017].
In this work, a cubic GAGG:Ce crystal (10 × 10 × 10 mm^3), a thin square GAGG:Ce crystal (20 × 20 × 1 mm^3), and a thin square YSO crystal (20 × 20 × 1 mm^3) were each coupled to an array of four SiPMs (Hamamatsu 14160-6075, 6 × 6 mm^2) using a custom-designed circuit. These were used together with a cylindrical $LaBr_3$(Ce) detector (2″ height × 1.5″ diameter) coupled to a customized version of the 2-inch, 8-stage bialkali photocathode R9779 PMT (assembly H10570). All signals were read out with a CAEN D5742b DRS4 DAQ, and the data were fully processed digitally.
The detectors were tested at the CMAM facility (Centro de Micro-Análisis de Materiales, Universidad Autónoma de Madrid) 5-MV tandetron, which provides accelerated ion beams and instrumentation for material characterization, irradiation studies and nuclear experiments [Redondo-Cubero2021]. The presentation will discuss the development of instrumentation and the Coulomb excitation 169Tm(α, α′γ)169Tm* experiment performed at CMAM, where $LaBr_3$(Ce) was used for gamma detection and the other three detectors for alpha measurements.

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Presenter: CABALLERO RODRIGUEZ, Miriam (Universidad Complutense (ES))

Session Classification: Session 9

Contribution ID: **78** Type: **Poster (In person)**

Developments for a high-throughput laser ion source for CERN-MEDICIS

Wednesday 3 December 2025 18:31 (1 minute)

Resonant laser ionization is an efficient and highly selective method for producing radioisotopes. In the laser ion source of ISOLDE –RILIS (Resonance Ionization Laser Ion Source), the laser interaction region is inside a metal tube which is heated to temperatures of up to 2200 degrees Celsius. This heating induces surface ionization from the walls of this so-called "hot cavity". If the overall ion load of laser and surface ionized species reaches a certain threshold, the efficient extraction of these ions is compromised. This effect is especially prevalent in facilities like CERN-MEDICIS which demand a high ion throughput and fast extraction. This work aims to present the limits of the current laser ion source at MEDICIS and introduce recent developments towards a new high throughput ion source. Parameters used to describe the ion confinement potential inside the ion source are presented (such as temperature distribution, neutrals density, electron density, ion survival, ion extraction etc). Experimental results as well as ion beam simulations are discussed, and the coupling of the ion source parameters is explored.

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Presenter: MANCHEVA, Ralitsa Ivaylova (KU Leuven (BE))

Session Classification: Poster Session

Contribution ID: **79** Type: **Poster (In person)**

Studies of excited states in ^{118}Ag

Wednesday 3 December 2025 18:30 (1 minute)

The investigation of β-decay properties of neutron-rich nuclei in the A $\approx$ 120 region provides essential input for testing modern nuclear-structure models and for constraining astrophysical r-process simulations. In this context, the β^- decay of ^{118}Pd (Z = 46, N˜=˜72) populating excited states in ^{118}Ag was studied at the Ion Guide Isotope Separator On-Line (IGISOL) facility of the University of Jyväskylä.

The ^{118}Pd isotopes were produced in proton-induced fission of uranium and
mass- separated using the JYFLTRAP system to ensure isotopic purity. The decay spectroscopy setup consisted of three high-purity germanium detectors for γ-ray detection, a plastic scintillator for β tagging, and a movable tape-transport system for activity collection and removal.

Analysis of β-γ and γ–γ coincidence data resulted in a significant revision of the known decay scheme of ^{118}Pd \cite{Janas}. Several new γ transitions and previously unobserved excited states in ^{118}Ag were identified. Moreover, a cascade of transitions potentially feeding a new isomeric state \cite{Borne} has been proposed. The ongoing analysis includes the determination of β-feeding intensities and log ft values, which will enable more precise spin–parity assignments and improved modeling of β-decay strength in this mass region.

These results contribute to the systematic study of neutron-rich palladium and silver isotopes, relevant both for understanding nuclear structure near the N = 70 region and for providing experimental constraints to r-process nucleosynthesis calculations. A review of the most recent results will be given and discussed.

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Session Classification: Poster Session

Contribution ID: **80** Type: **Poster (In person)**

β-decay spectroscopy studies of ^{124}In

Wednesday 3 December 2025 18:29 (1 minute)

Over the past several years, extensive studies have been devoted to the structure of neutron-rich tin isotopes, which possess a closed proton shell, with ^{132}Sn being a doubly magic nucleus. For this reason, these nuclei play a particularly important role in testing the validity of the nuclear shell model and serve as a benchmark for theoretical predictions. Information obtained in this region of the nuclear chart is essential for developing reliable extrapolations toward even more neutron-rich isotopes.

In the experiments studied, the tin nuclei are produced by the β^- decay of indium isotopes and via the emission of β^- delayed neutrons or, in some cases, two β^- delayed neutrons ~\cite{MA1,MA2}. Data from this mass region are also highly relevant from an astrophysical perspective, as they contribute to a better understanding of the r-process nucleosynthesis responsible for the formation of heavy elements in the universe.

In the present study, we focus on the excited states in ^{124}Sn populated in the β^- decay of ^{124}In investigated in an experiment performed at the ISOLDE Decay Station (IDS). In addition to the aforementioned motivations, an additional driving factor for studying the structure of this nucleus is the possible occurrence of the rare two-neutrino double beta decay ($2\beta^-$) in ^{124}Sn. Although ^{124}Sn is a stable nucleus and the single β^- decay is energetically forbidden, the $2\beta^-$ decay is allowed and has been the subject of several investigations ~\cite{BB1, BB2, BB3}. A better understanding of the nuclear structure of ^{124}Sn will improve the reliability of theoretical predictions for this process and may help identify excited states that are more likely to be involved in the transition.

The current analysis of the β^- decay of the two isomeric states of ^{124}In includes β–γ, β–γ–γ, and γ–γ coincidence spectra. A detailed comparison of the previously established decay scheme with the new experimental data led to the reassignment of six γ transitions to different positions in the level scheme. These changes were reinforced by finding new gammas that fit the changed scheme very well. To sum up the preliminary analysis, 21 new transitions were identified and included in the scheme, and 17 new excited levels were obtained.

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Session Classification: Poster Session

Contribution ID: **81** Type: **Invited (In person)**

Recent mass measurements and developments including the first application of mass-selective re-trapping at ISOLTRAP

Wednesday 3 December 2025 11:35 (20 minutes)

The ISOLTRAP mass spectrometer [1], located at ISOLDE/CERN, performs high-precision mass measurements of short-lived, exotic nuclides far from stability. These measurements provide direct access to nuclear binding energies, which reflect the underlying nuclear interactions, thereby enabling studies in nuclear structure and nuclear astrophysics, among others.
For this, the ISOLTRAP mass spectrometer uses various ion traps, including a tandem Penning trap system and a multi-reflection time-of-flight mass spectrometer (MR-ToF MS) [2], where the latter is suitable for both efficient mass separation and fast, precise mass measurements.

Focusing on nuclear structure studies near doubly-magic nuclei, particularly the shell evolution near ^{100}Sn [3-5], ISOLTRAP recently performed mass measurements of neutron-deficient cadmium isotopes. These include the first mass measurement of the self-conjugate nucleus ^{96}Cd, located in the immediate vicinity of the doubly-magic nucleus ^{100}Sn, which will be presented.
In addition, ISOLTRAP advanced in ion purification with the first application of the mass-selective re-trapping technique [6]. This technique, enabled by a newly implemented mini-RFQ following the MR-ToF MS, allowed the mass measurement of the neutron-rich ^{49}Ar, which will be presented and demonstrates the feasibility of low-yield experiments in the presence of extremely abundant isobaric contamination.

With an overview of the recent technical developments, such as the temperature stabilization of the MR-ToF MS, an improved laser ablation ion source and an additional data acquisition system for ToF measurements, current limitations and future developments planned for the Long Shutdown 3 will be outlined.

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Presenter: LANGE, Daniel (Max Planck Society (DE))

Session Classification: Session 2

Contribution ID: **82** Type: **Poster (In person)**

β-decay spectroscopy studies at VITO with laser-polarised beams of potassium isotopes

Wednesday 3 December 2025 18:17 (1 minute)

By introducing spin polarisation into β-decay studies, one can overcome the difficulty of conventional β-decay spectroscopy to firmly determine the spins and parities of nuclear states involved in allowed transitions. This is because the sign and degree of asymmetry in β-decay from polarised nuclei depends on the spin difference between the initial and final states.
This novel approach to β-decay experiments, pioneered by a group from the University of Osaka [1,2], has been recently adopted at the VITO beamline [3], where a new decay-spectroscopy station, called "DeVITO", has been implemented, allowing thus for measurements of β-emission asymmetry in coincidence with γ-rays and/or neutrons.
The new setup was commissioned with beams of neutron-rich potassium isotopes, including strong β-delayed neutron emitters 49K and 51K [4]. In particular, measurements with a 47K beam successfully demonstrated DeVITO's capability to measure β–decay asymmetry in coincidence with γ-rays and its use for the determination of spin values for excited states populated in daughter nuclei.
In this contribution, details on the new experimental setup, as well as preliminary results obtained for 47K and 49K [4] will be presented, including β-particle emission asymmetry measured in coincidence with γ-rays following the 47K β decay.

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Presenter: MICHELON, Ilaria (Universite de Geneve (CH))

Session Classification: Poster Session

Contribution ID: **83** Type: **Poster (In person)**

Theoretical predictions for transfer reactions supporting the ISOLDE Linear Spectrometer (ILS)

Wednesday 3 December 2025 18:28 (1 minute)

The ISOLDE Superconducting Linear Spectrometer (ILS) [1] marks the start of the operational phase of the ISOLDE Superconducting Recoil Separator (ISRS) [2-3] project. Designed as the first operational stage of ISRS, the ILS provides a compact experimental platform to test the key superconducting magnet and beam optics technologies that will be implemented in the full separator. The system, prepared for installation at HIE-ISOLDE after Long Shutdown 3, represents a major step toward a fully functional recoil separator for high-precision nuclear reaction studies. Built around MAGDEM, a superconducting, iron-free Canted-Cosine-Theta (CCT) combined-function magnet, the ILS will enable detailed exploration of reaction mechanisms using radioactive ion beams.
Within the scope of the ISRS–ILS project, transfer reactions play a key role in the overall physics program. They provide crucial spectroscopic information on single-particle configurations, nuclear structure evolution, and the interaction between direct and compound processes. Accurate theoretical descriptions of these reactions, using the Distorted Wave Born Approximation (DWBA) and the Coupled Reaction Channels (CRC) formalism, are included in the optimization program of our recoil separator. These models underpin the theory behind designing and interpreting ILS measurements, ensuring experimental conditions and detection setups are optimized for each system under investigation.
Using the FRESCO code [4], several representative systems have already been examined within the DWBA framework as a baseline to improve future ISRS–ILS performance, with particular focus on developing CRC calculations for some selected cases, such as ^{9}Li and ^{68}Ni. These studies aim to set quantitative benchmarks for the upcoming experimental program and to create a consistent framework for data interpretation within the ISRS–ILS physics program.
Among the wide range of candidate reactions, the ^{19}Ne-induced transfer reaction has been selected as a priority for the initial ILS experiment. This decision is driven by the high beam intensity available at ISOLDE and by ILS's unique ability to analyze ^{19}Ne+d transfer channels, including (d,p) and (d,n), which can only be effectively studied with the advanced focusing and detection capabilities of the ILS setup. Corresponding theoretical calculations have been performed to prepare for the Day-1 experiment, using the ^{19}Ne case as a reference system.

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Session Classification: Poster Session

Contribution ID: **84** Type: **Poster (In person)**

Magnetic field mapping and validation of the MAGDEM CCT superconducting magnet for ISRS

Wednesday 3 December 2025 18:27 (1 minute)

The ISOLDE Superconducting Recoil Separator (ISRS)[1] under development at CERN aims to achieve unprecedented mass resolution and transmission efficiency through a compact, Fixed Field Alternating Gradient (FFAG) storage ring composed of Canted Cosine Theta (CCT) multifunction superconducting magnets. Each MAGDEM prototype integrates combined dipole and quadrupole fields within a cryogen-free architecture, representing a critical milestone in the ISRS magnet technology program. To experimentally validate its electromagnetic performance, a dedicated 3D Magnetic Field Scanner System (MFSS) has been designed at the University of Huelva.
The MFSS combines a computer-controlled positioning system with a HallinSight® 32×2-pixel 3D Hall sensor array, achieving sub-millimeter spatial resolution (1 mm step, 0.05 mm precision) and magnetic sensitivity better than 100 µT. The integrated software suite provides automated motion control, synchronized data acquisition, and real-time comparison with COMSOL-based field simulations. The system demonstrates alignment precision below 1.9 mrad and calibration accuracy of 0.2% for a 15 mT reference field.
Preliminary mapping results confirm excellent agreement between measured and simulated fields, consistent with the quench-protection design studies. This successful implementation establishes the MFSS as an essential diagnostic platform for field verification, calibration, and quality assurance of future ISRS superconducting elements and test-bench installations at ISOLDE.

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Session Classification: Poster Session

Contribution ID: **85** Type: **Poster (In person)**

Detector simulations for beta delayed particle emission from 8He

Wednesday 3 December 2025 18:26 (1 minute)

The beta decay of 8He was measured at IDS in 2022. 16% of decays populate excited states in 8Li which decay by neutron emission and alpha-neutron-triton breakup. Due to significant background the double alpha breakup of 8Be following the beta decay of 8Li, a triple coincidence must be made to identify alpha-neutron-triton events. Owing to the complexity of detecting neutrons, the response and acceptance of the setup and subsequent analysis is non-trivial and must be cleared up with simulations.

In this poster I will present how I have found the neutron detection response from GEANT4 simulations and tuned it to a 49K neutron-spectrum also acquired during the experiment. I will also show how this is used to estimate the alpha-neutron-triton coincidence efficiency, and correct the excitation spectrum in 8Li for these events.

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Session Classification: Poster Session

Contribution ID: **86** Type: **Poster (In person)**

Dion-Jacobson ANdNb2O7 (A = Rb,Cs) Layered Perovskite Systems: Bulk Study, Ion Exchange and Exfoliation

Wednesday 3 December 2025 18:25 (1 minute)

The $RbNdNb_2O_7$ (RNNO) and $CsNdNb_2O_7$ (CNNO) systems exhibit a sequence of phase transitions before reaching their hig temperature $P4/mmm$ aristotype phase. In RNNO, the structure evolves from a polar $I2cm$ phase at room temperature to an antipolar $Cmca$ phase at $790\,K$, and finally to a distorted $I4/mcm$ structure at $865\,K$ [1]. These transitions arise from rotations and tilts of the NbO_6 octahedra, which stabilize the polar ferroelectric phase but also induce negative thermal expansion (NTE) in the c-axis. However, such distortions may not be fully resolved by macroscopic techniques, making local-probe studies essential to clarify the microscopic mechanisms involved. To address this, we performed Raman spectroscopy and Perturbed Angular Correlation (PAC) studies across wide temperature ranges, aiming to investigate the phase behaviour and structural evolution of these materials. The PAC technique, in particular, employs a local probe that is highly sensitive to atomic-scale dynamics and allows for the measurement of the electric field gradient (EFG) at specific sites, capturing information on local symmetry and NbO_6 rotational environments.

The large size of Rb and Cs ions produces an interlayer with a large spacing and weak bonding, which opens up the possibility for exfoliation through facile and scalable methods. We performed liquid-phase sonication of the RNNO sample mixed in N-methyl-2-pyrrolidone (NMP), and collected the exfoliated products from the supernatant after centrifugation of the sonicated solution [2]. We've also used an intermediate step of protonation of the RNNO powder with HNO_3, in order to replace the Rb ions and weaken the interlayer bonds even further.

The polar behaviour via hybrid improper ferroelectricity present in RNNO, CNNO and similar compounds already make them highly interesting for energy applications, but their chemical exfoliation opens up even more possibilities in this domain due to enhanced surface area, tunable electronic properties, and integration into next-generation nanoscale devices. We'll present our results both for the bulk sample characterisation and the exfoliated material.

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Presenter: ALMEIDA PEREIRA, Jose Miguel (Universidade do Porto (PT))

Session Classification: Poster Session

Contribution ID: **87** Type: **Poster (In person)**

Production of intense, high-purity beams of neutron-rich Cd isotopes at ISOLDE

Wednesday 3 December 2025 18:24 (1 minute)

The IS685 experiment studies exotic, neutron-rich In isotopes populated in the Cd β decay using high-resolution γ-ray spectroscopy and fast-timing techniques˜[1]. Understanding nuclear structure in this region requires the systematic investigation of nuclei around the double $Z = 50$ and $N = 82$ shell closure, where collective effects set in with only few extra nucleons. Exotic nuclei in the vicinity of ^{132}Sn are also relevant due to the potential impact of nuclear properties on the astrophysical r-process path, which influences the predicted isotopic abundances.

ISOLDE enables the population of the structure of exotic In isotopes via the β-decay of Cd isotopes, directly or through β-delayed neutron emission. High beam purity and intensity are essential for this purpose. This is achieved through: (1) a UC$_x$ target coupled to a neutron converter, where 1.4˜GeV protons from the CERN PS Booster generate spallation neutrons that induce fission, limiting the Cs isobar production˜[2]; (2) a temperature-controlled quartz transfer line acting as a chemical filter, delaying the release of alkali elements such as Cs˜[3,4]; (3) enhanced laser ionization with RILIS˜[5], offering isotopic and isomeric selectivity exploiting hyperfine structure splitting, as already used for similar IDS experiments˜[5]. Mass separation is additionally performed, the ISOLDE General Purpose Separator was used in this case.

The production yields and the purity of the Cd beams are presented in this work. The beam intensity and purity were evaluated using the IDS setup with six Clover HPGe detectors. Yields were derived from experimental γ-ray intensities, branching ratios, and release fractions using the characteristic release curves, and compared for RILIS on and off conditions for $A = 124$ to $A = 132$. The measurements are compared with previously reported yields in Ref.˜[7], and with the estimates given in Ref.˜[1]. These results confirm the excellent purity of the Cd beams achieved with this procedure, showing that for the most neutron-rich isotopes Cs is undetectable and In is suppressed by over three orders of magnitude.

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Session Classification: Poster Session

Contribution ID: **88** Type: **Submitted oral (In person)**

Energy-Resolved Beta Detectors for Beta-NMR Studies at VITO

Thursday 4 December 2025 17:05 (12 minutes)

β-detected Nuclear Magnetic Resonance (β-NMR) is the method employed at VITO to measure the nuclear magnetic moments of unstable nuclei. In a β-NMR experiment at VITO, the main observable is the asymmetry between β-particles emitted along or opposite to the nuclear polarization direction, measured with detectors placed on opposite sides of the sample. The asymmetry for a given β-transition depends on the spin and parity difference between the initial and final states and it can be positive or negative. In some nuclei, such as ^{11}Be and ^{49}K, the asymmetries from the various transitions cancel each other, leading to a low total β-decay asymmetry when no distinction between transitions is made. Thus, by selecting β-particles corresponding to only one transition, it is possible to increase the measured asymmetry. This can be achieved using energy-resolving β-detectors to select the highest-energy transition(s), thereby excluding events populating higher-lying states with opposite asymmetry.

Energy-resolving β-detectors have recently been introduced at VITO. These detectors, based on plastic scintillators and silicon photomultipliers, are designed to operate in a 4.7~T magnetic field. Their energy resolution was optimized through Geant4 simulations of light transport within the detector volume.

The two new detectors have been employed during 2025 β-NMR beamtimes on ^{8}Li and $^{47-49}$K, and one detector was previously used in a 2024 beamtime on ^{11}Be. The detectors have already proven essential in the measurement of the ^{49}K magnetic moment, where strong cancellation between transition asymmetries occurs.

This contribution details the design and simulations of the detectors, their integration into the VITO beamline, their performance during online beamtimes, and their role in the clear identification of resonances in ^{49}K.

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Session Classification: Session 8

Contribution ID: **89** Type: **Invited (In person)**

Radionuclide production by mass separation at CERN-MEDICIS for biomedical research and the PRISMAP European program

Wednesday 3 December 2025 16:15 (20 minutes)

CERN-MEDICIS aims at producing and purifying by mass separation non-conventional radionuclides for research and development in diagnostics and radiation therapy.
It triggered PRISMAP and PRISMAP+ EU projects –furthering the European medical radionuclides programme, supporting the ongoing research across Europe and beyond in radiopharmaceutics.

CERN-MEDICIS exploits in a dedicated classified nuclear work sector, an isotope mass separator, a radiochemistry laboratory, a target irradiation station receiving1.4 GeV protons from the Proton Synchroton Booster (PSB). It also receives activated targets from external institutes, notably during the forthcoming CERN Long Shut-Down LS3.
Medical radionuclides are collected by implantation of the radioactive ion beam (RIB) into foils that are afterwards dispatched to a research center.

CERN-MEDICIS has been providing collaborating institutes in Europe, Pakistan and USA with several mass separated radionuclides among this non-exhaustive list: K-43, Sc-43/44/47, Eu-145, Tb/Gd-149, Sm-153, Tb-155, Tm-165/Er-165, Tm-167, Er-169, Yb-175, Ra-223/224/225, Ac-225 and for the first time Cu-67 and Ac-226. They have been produced both from irradiated targets at CERN as well as from externally irradiated samples. The progresses in the efficiencies and in the final activities triggered the interest to launch therapeutic clinical testing at hospitals.

Specific developments, such as for Sc and for Tb radionuclides, notably on target material preparations, on-line implantation measurements, isotope release studies and molecular ion beams were undertaken.

The latest developments and operation outcomes of the facility will be reported.

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Presenter: MAMIS, Edgars

Session Classification: Session 4

Contribution ID: **90** Type: **Poster (In person)**

Decay spectroscopy of the Ac-225 decay chain for medical applications

Wednesday 3 December 2025 18:23 (1 minute)

^{225}Ac has been identified as a promising isotope for Targeted Alpha Therapy (TAT) treatment of metastasized tumors [1]. For logistic and medical purposes, a better understanding of the nuclear data along the entire ^{225}Ac decay chain is required. Currently discrepancies are observed when measuring the activity using techniques that utilize different daughter nuclides and different methods. As an attempt to resolve these discrepancies, the IS741 collaboration aims to determine the decay properties along the decay chain by implanting specific isotopes of the decay sequence (^{225}Ac, ^{221}Fr, ^{213}Bi and ^{209}Tl) separately in dedicated beam times [2]. For this, the ISOLDE Decay Station (IDS) was employed utilizing its tape station for the implantations [3]. Special focus was put on extracting the angular distribution of coincident γ-rays, by placing twelve HPGe detectors in defined angles around the implantation point. The study of ^{225}Ac and ^{221}Fr was performed in December 2024, and the ^{213}Bi and ^{209}Tl experiment is planned as the last experiment before LS3. This contribution will discuss the current status of the IS741 experiment.

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Session Classification: Poster Session

Contribution ID: **91** Type: **Poster (In person)**

Probing the nuclear magnetisation distribution with the Bohr-Weisskopf effect using collinear laser spectroscopy

Wednesday 3 December 2025 18:22 (1 minute)

Exploring ground-state nuclear properties is a powerful tool to investigate our understanding of nuclear structure. Laser spectroscopy gives access to nuclear ground-state properties, such as the nuclear spin, electromagnetic moments and changes in the mean-squared charge radius of short-lived ($\geq$10 ms) nuclei by measuring the hyperfine A-and B-parameters and isotope shift [1]. Conventionally, the nuclear magnetic dipole moment is extracted from the hyperfine A-parameter, assuming the magnetic field generated by the electron cloud is uniform over the nuclear volume. While generally true, this assumption breaks down for atomic states where its wavefunction significantly overlaps with the nuclear wavefunction, e.g. in $S_{1/2}$ atomic states. In these cases, the Bohr-Weisskopf (BW) contribution to the hyperfine A-parameter becomes significant, accessible to the precision of collinear laser spectroscopy and atomic theory calculations [2].
The BW effect arises from the non-uniformity of the nuclear magnetisation distribution and its interaction with the electrons; therefore, measuring the hyperfine structure in a BW-sensitive atomic state gives insight into the nuclear magnetisation distribution for short-lived ($\geq$10 ms) nuclei, so far only extracted for stable or long-lived nuclei [3,4].
I will present the significance of the BW effect on the extracted nuclear magnetic dipole moments from measurements on radioactive silver at CRIS in ISOLDE. Additionally, I will show how the absolute BW contribution can be extracted from collinear laser spectroscopy and atomic theory and the results obtained for silver. Lastly, I will present an outlook on comparing the BW effect to DFT calculations to gain insight into the nuclear magnetisation distribution.

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Presenter: VAN DEN BORNE, Bram (KU Leuven (BE))

Session Classification: Poster Session

Contribution ID: **92** Type: **Invited (In person)**

Recent Developments in ISOLDE Targets and Glimpse of Future Proton Beam Delivery to ISOLDE

Thursday 4 December 2025 09:25 (20 minutes)

The target and ion source groups are responsible for developing the ISOLDE target and ion source units. In order to fulfill the high demand for new beams, higher beam purity and intensity, and more resistant targets, development of beams and targets is necessary. Recent developments in ISOLDE targets will be presented.
In addition, future experiments at CERN will require protons, which will affect the PSB operation. Different beam sharing scenarios are currently being discussed, including options with fewer proton cycles per supercycle for ISOLDE. To compensate for such a scenario, mitigation by increasing the protons per pulse is currently being explored. First results of a study investigating the effects of high proton intensity on yield will be presented.

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Presenter: FRANK, Isabel (CERN)

Session Classification: Session 5

Contribution ID: **94** Type: **Submitted oral (In person)**

Decay spectroscopy of neutron-rich Zn isotopes by total absorption

Thursday 4 December 2025 17:20 (12 minutes)

The region near the doubly magic nucleus ^{78}Ni (Z = 28, N = 50) plays a key role in understanding shell evolution and the balance between single-particle and collective degrees of freedom [1]. It represents a critical testing ground for theories of nuclear structure far from stability and for constraining models of r-process nucleosynthesis. In this context, neutron-rich zinc isotopes provide valuable insight into the strength of the N = 50 neutron shell gap and the onset of correlations as protons fill the $f_{5/2}$ and $p_3/2$ orbitals. Previous studies in the region have suggested a competition between allowed Gamow–Teller (GT) and First-Forbidden (FF) β transitions [2, 3], as well as between neutron and γ-ray emission from unbound states, but available high-resolution data remain incomplete and sometimes inconsistent.

To address these questions, β-decay studies of $^{80-82}$Zn were performed at ISOLDE (CERN) using the Lucrecia Total Absorption γ-ray Spectrometer (TAGS) [4] in the IS684 experiment. The technique provides high detection efficiency and is ideally suited to determine β-feeding distributions to high-lying states in the daughter Ga isotopes, avoiding systematic uncertainties inherent to high-resolution spectroscopy. The experiment aims to quantify the competition between GT and FF transitions beyond ^{78}Ni and to identify γ-decay cascades from neutron-unbound states, providing experimental constraints on (n,γ) reaction rates relevant for astrophysical modeling [5, 6].

In this contribution, the status of the IS684 analysis will be presented. The experiment achieved high-quality data for the β decays of $^{80-82}$Zn, benefitting from the purity and intensity of the ISOLDE beams and the high efficiency of the Lucrecia setup for the detection of gamma cascades. The aim is to provide improved β-strength distributions, accurate ground-state feedings, and revised β-delayed neutron emission probabilities (P_n), allowing for a deeper understanding of the structure of Ga isotopes and to examine the persistence of the N = 50 shell closure. The results will contribute to refining nuclear-structure models and improving astrophysical reaction networks involving zinc isotopes near the doubly magic ^{78}Ni.

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Session Classification: Session 8

Contribution ID: **95** Type: **Poster (In person)**

l-forbidden M1 transitions in N = 50 isotones

Wednesday 3 December 2025 18:19 (1 minute)

Regions near closed shells in areas of the nuclear chart far from stability are very interesting from the point of view of nuclear structure, since a shell model description based on single-particle states can be challenged by collective effects. One of the most interesting regions is the one around the doubly-magic ^{78}Ni nucleus, with $Z = 28$ and $N = 50$ [1].

The systematics of transitions from the first-excited to ground states of the odd-A $N = 50$ isotones [2,3] is very enlightening, since M1 transitions are expected to be l forbidden, resulting in long half-lives with small transition probabilities [4,5,6]. A more complete understanding of these l forbidden M1 transition could be achieved by extending the systematics. To this end, two complementary experiments were performed at the ISOLDE (CERN) facility and ILL reactor in Grenoble, France.

The nuclei of interest were populated in β decay and investigated by fast-timing techniques. The first experiment was aimed at the study the half-life of the first excited state of the ^{83}As via a β-decay experiment of ^{83}Ga at the ISOLDE Decay Station.
In the second experiment, the half-lives of the first excited states in ^{85}Br and ^{87}Rb [7] were investigated at ILL, where the parent nuclei, ^{85}Se and ^{87}Kr, were transported and mass-separated by the LOHENGRIN is a recoil mass spectrometer.

The presentation will address the analysis of both experiments, discussing the methodologies used and the preliminary results obtained. Additionally, conclusions regarding the systematics of the l-forbidden M1 transitions in $N = 50$ isotones will be drawn, highlighting the implications for nuclear structure.

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2015.09.001.

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Session Classification: Poster Session

Contribution ID: **96** Type: **Submitted oral (In person)**

Nuclear structure of neutron-rich Ge isotopes

Thursday 4 December 2025 15:05 (12 minutes)

Abstract

The region near ^{78}Ni is crucial for nuclear structure studies, as it lies around a doubly-magic shell closure ($Z = 28$, $N = 50$), making it an ideal testing ground for shell evolution and the interplay between single-particle and collective effects. Currently, many experimental and theoretical efforts are dedicated to investigating this region of the nuclear chart [1-3], aiming to comprehend the robustness of nuclear shells far from stability and the emergence of collective effects as nucleons are added. The interaction among valence nucleons may be capable of attenuating the magic nature of a nucleus very close to shell closures [4]. From this perspective, isotopes of Ge ($Z = 32$), could be of significant interest to understand the evolution of the $N = 50$ gap.

In the recent IS771 experimental campaign, neutron-rich Ge isotopes were investigated via decay spectroscopy at the ISOLDE Decay Station (ISOLDE, CERN) using very neutron-rich Ga beams, produced using the PSB protons impinging on a proton-to-neutron converter to fission a thick UC_x target. High production yields were achieved for isotopes such as $^{83-85}\mathrm{Ga}$ [5], populating $^{83-85}\mathrm{Ge}$ through β-decay and β-delayed neutron emission. The calculated yields for the different decays of this experiment were consistent with previous measurements.

The high yields together with the spectroscopic capabilities of the ISOLDE Decay Station, equipped with 10 HPGe detector clovers in a compact geometry, enabled a significant expansion of previous knowledge, including the identification of new transitions and levels, as well as the ability to carry out angular correlations measurements for spin-parity assignments. In addition, two LaBr_3 and three beta detectors were used to perform lifetime measurements of excited states in the sub-nanosecond range via fast-timing techniques.

In this contribution, the current status of the analysis of the experiment will be presented, focusing on the obtained yields, the extended level schemes extracted through high-resolution γ-ray spectroscopy and the preliminary results for lifetime measurements.

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Presenter: GONZALEZ-TARRIO VICENTE, Pablo (Universidad Complutense (ES))

Session Classification: Session 7

Contribution ID: **97** Type: **Submitted oral (In person)**

Coulomb excitation in ^{185g,m}Hg - Shape coexistence in the neutron-deficient lead region

Shape coexistence in the neutron-deficient lead region around $N \approx 104$ has been discovered in different nuclei especially in the mercury isotopes, where a staggering effect was found between even- and odd-mass nuclei using charge radii measurements [1,2]. In addition the study of the even-even ^{182,184,186,188}Hg isotopes via Coulomb excitation reactions showed a mixing of weakly deformed oblate and more deformed prolate configurations which coexists at low excitation energies [2,3].
To investigate collective behavior of low-lying states on top of the $(1/2^-)$ ground-state in ^{185g}Hg and the different deformed $(13/2^+)$ isomeric state in ^{185m}Hg, a Coulomb excitation experiment was performed at HIE-ISOLDE. The complete separation of the isomer and ground state in ^{185}Hg using RILIS offers an unique opportunity to study the weakly oblate deformed and strongly prolate deformed structures. The ^{185g,m}Hg beams were accelerated onto ^{120}Sn and ^{48}Ti targets with an energy of 4 MeV/u. The emitted γ rays were detected utilising the Miniball array in coincidence to the scattered particles measured in the DSSSD detector. Preliminary results of excited states of ^{185g,m}Hg will be shown for both targets. Excited states in ^{185g}Hg were populated and identified up to a spin of $25/2^-$. The signature partner band of the ground-state band was observed and established through the identification of several mixed $M1 + E2$ transitions between both. Comparisons with neighboring odd-mass Hg and Pt isotopes reveal similar band structures. The preliminary GOSIA analysis to extract deformation parameters will be presented.

[1] J. Bonn et al., Zeitschrift für Physik A Hadrons and Nuclei 276(3), 203 (1976)
[2] N. Bree et al., Physical Review Letters 112, 162701 (2014)
[3] B. Marsh et al., Nature 14, 1163 (2018)
[4] K. Wrzosek-Lipska et al., The European Physical Journal A 55, 130 (2019)

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Presenter: KLEIS, Hannah (University of Liverpool (GB))

Session Classification: Session 7

Contribution ID: **98** Type: **Poster (In person)**

Neutron background monitoring for the IAXO-D0 detector prototype

Wednesday 3 December 2025 18:18 (1 minute)

Helium-3 gas-filled proportional counters are extensively used as neutron detectors for measurements in a wide range of applications. A recent example are (α,n) reactions measured by the MANY collaboration using the miniBELEN detector [1]. This kind of neutron counters are also commonplace as neutron monitors, both for the study of cosmic rays and solar weather [2], as well as background monitors for rare-event experiments and detectors.
One such experiment is the International Axion Observatory (IAXO) [3], a planned gaseous detector helioscope designed to detect axions, hypothetical particles proposed as a solution for the strong CP problem, which have also been theorised to be dark matter candidates. A smaller prototype, BabyIAXO [4], is currently in manufacturing and is expected to be installed at DESY (Hamburg, Germany). A baseline detector prototype, IAXO-D0, is at present undergoing tests at the premises of the Universidad de Zaragoza. The prototype is sensitive to background that could induce false positive axion detections, and in particular to ambient neutrons of high energy.
A neutron monitor has been proposed as a way to provide a continuous measurement of ambient neutrons and its variability. Neutron Monitors typically consist of several neutron counter detectors surrounded by a series of layers that act as reflector, multiplier and moderator for the neutrons.
In this work a prototype neutron monitor was designed and assembled. It consists of three identical LND He-3 proportional counter tubes, surrounded by a high density polyethylene (HDPE) moderator, a layer of lead that acts as multiplier, and an outer layer of HDPE as reflector. The neutron monitor has been in operation since March 2024, producing an almost continuous measurement of the count rate of neutrons detected inside the laboratory where IAXO-D0 is being commissioned.
We will present the Monte Carlo simulations performed to characterise the monitor and the first results of the neutron count rate during the Forbush decrease observed in May 2024, once noise and pile-up have been taken care of, and atmospheric pressure effects have been corrected.
The information obtained from this prototype neutron monitor, as well as the data from IFIC's High Efficiency Neutron Spectrometry Array (HENSA) measured at the same location, will guide the design of a neutron monitor optimised for neutrons of around >100 MeV tailored to the IAXO-D0 needs. The design of the new device will be briefly presented.

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Presenter: MARTINEZ NOUVILAS, Victor (Universidad Complutense (ES))

Session Classification: Poster Session

Contribution ID: **99** Type: **Invited (In person)**

CERN Open Science Policy and Open Science Office

Thursday 4 December 2025 16:15 (20 minutes)

This presentation provides an overview of CERN's Open Science policy and the comprehensive suite of services and tools available to support the CERN community in meeting policy requirements. We will explore the key principles underpinning CERN's commitment to open science, including open access to publications, research data management, and knowledge sharing. The session will showcase the practical resources offered by the CERN Open Science Office, including open access mechanisms, repository services, and data preservation platforms. The presentation aims at giving a clear understanding on how to effectively ensure research outputs are openly accessible, FAIR-compliant, and aligned with CERN's mission to advance scientific collaboration and transparency.

Author: GENTIL-BECCOT, Anne (CERN)

Presenter: GENTIL-BECCOT, Anne (CERN)

Session Classification: Session 8

Contribution ID: **100** Type: **Invited (In person)**

Science Results and Technical Advances Enabled by the Multi-Ion Reflection Apparatus for Collinear Laser Spectroscopy (MIRACLS)

Wednesday 3 December 2025 14:25 (20 minutes)

The MIRACLS collaboration at CERN–ISOLDE has developed a novel experimental platform that combines ion-bunch confinement in a multi-reflection time-of-flight (MR-ToF) device with high-resolution collinear laser spectroscopy (CLS). When ions are bouncing back and forth between between the two electrostatic mirrors of the MR-ToF device, the ion-laser interaction time is dramatically increased compared to conventional single-passage CLS, thereby allowing a significant boost in experimental sensitivity.

Exploiting the MIRACLS approach has recently enabled fluorescence-based CLS measurements of nuclear ground-state properties such as electromagnetic moments and charge radii of short-lived, low-yield radionuclides that were previously inaccessible. Moreover, it has facilitated the determination of the electron affinity (EA) in stable chlorine with a precision competitive to conventional methods, yet requiring a factor of 150,000 fewer ions. Such a high sensitivity paves the way for precision measurements of hitherto unknown EAs in heavy and superheavy elements.

To accomplish its scientific mission, the development of MIRACLS has both required and simulated a suite of technological innovations that serve a wide range of applications across rare isotope research. For instance, the need for fast ion beams in high-resolution CLS motivated the design of an MR-ToF device capable of operating at unprecedented beam energies, also offering a promising route to mitigate space-charge effects and thus to achieve highly selective, high-ion-flux mass separation. Moreover, the demanding emittance requirements of MIRACLS have driven advances in ion-beam cooling for radioactive ions, including Doppler laser, sympathetic, and cryogenic buffer-gas cooling at temperatures approaching liquid helium, thereby creating intriguing opportunities for next-generation precision experiments with radioactive ions and molecules.

This presentation will showcase the scientific achievements and technological innovations of the MIRACLS project, and explore how its methods and (reconfigured) instrumentation will in the near future be applied at ISOLDE and in related facilities worldwide.

Author: MALBRUNOT, Stephan (TRIUMF (CA))

Presenter: MALBRUNOT, Stephan (TRIUMF (CA))

Session Classification: Session 3

Contribution ID: **101** Type: **Invited (In person)**

Nuclear structure for searches of new physics

Thursday 4 December 2025 09:00 (20 minutes)

Several of the most promising searches of physics beyond the standard model of particle physics are led by low-energy experiments. Typically, these searches involve atoms and the sensitivity to new physics is given by interactions involving the atomic nucleus. Therefore, the structure of these nuclei is key to interpret the experimental results. This information is usually encoded into a nuclear matrix element.

In my talk I will focus on searches of neutrinoless double-beta decay, electric dipole moments, and the direct detection of dark matter. I will discuss recent progress in calculations of the nuclear matrix elements, and emphasize the connection between them and the known nuclear structure of the nuclei involved, as well as to future nuclear structure experiments.

Author: MENENDEZ, Javier (University of Barcelona)

Presenter: MENENDEZ, Javier (University of Barcelona)

Session Classification: Session 5

Contribution ID: **102** Type: **not specified**

Workshop Dinner

Thursday 4 December 2025 19:30 (3h 30m)

Contribution ID: **103** Type: **Invited (In person)**

SPES progress and first beams

Thursday 4 December 2025 14:25 (20 minutes)

Presenter: MARCHI, Tommaso (INFN - National Institute for Nuclear Physics)

Session Classification: Session 7

Contribution ID: **104** Type: **not specified**

Closing Remarks and Prizes

Friday 5 December 2025 12:25 (20 minutes)

Presenter: Prof. FRAILE, Luis M (CERN)

Session Classification: Session 10

Contribution ID: **105** Type: **not specified**

Welcome

Wednesday 3 December 2025 09:00 (5 minutes)

Session Classification: Welcome

Contribution ID: **106** Type: **not specified**

ISOLDE Collaboration news

Wednesday 3 December 2025 09:05 (10 minutes)

Presenter: Prof. FRAILE, Luis M (CERN)

Session Classification: Welcome

Contribution ID: **107** Type: **not specified**

HIE-ISOLDE 10 years

Wednesday 3 December 2025 09:15 (20 minutes)

Presenter: KADI, Yacine (CERN)

Session Classification: Session 1

Contribution ID: **108** Type: **Poster (In person)**

The evolution of nuclear structure near the N = 20 Island of Inversion - a measurement of 30Mg(d,p)31Mg reaction

Wednesday 3 December 2025 19:03 (1 minute)

The region of the nuclear chart centred around ^{32}Mg, known as the Island of Inversion (IOI), is characterised by the onset of deformed configurations in the ground states due to particle excitations across a weakening N=20 shell gap. The IOI has been described using numerous observables, but information regarding the single-particle structure of nuclei in this region is limited. The aim of this work is to portray the evolution of the single-particle properties across the boundary of the IOI, through comparison with previous measurements of nuclei located outside of it. This offers valuable insights into the mechanisms of cross-shell interactions and acts as a robust test of modern shell model calculations that have struggled to describe the transition to this region in the past.

The ^{30}Mg(d,p)^{31}Mg reaction was performed in inverse kinematics at the incident beam energy of 8 MeV/u. Using the ISOLDE Solenoidal Spectrometer at CERN to analyse the outgoing protons, the experiment probed the single-particle structure of both the bound and unbound states of ^{31}Mg up to the excitation energy of 3 MeV. Combining the results with previously obtained data on ^{29}Mg, allowed for a characterisation of the evolution of single-particle properties across the boundary of the IOI.

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Co-authors: Dr SHARP, David (The University of Manchester (GB)); BROWNE, Frank (The University of Manchester (GB)); FREEMAN, Sean John (CERN)

Presenter: WLODARCZYK, Michal (The University of Manchester (GB))

Session Classification: Poster Session

Contribution ID: **109** Type: **not specified**

Words by the CERN Director for Research and Computing

Wednesday 3 December 2025 11:00 (10 minutes)

Presenter: MNICH, Joachim Josef (CERN)

Session Classification: Session 2

Contribution ID: **110** Type: **Poster (In person)**

Delivering molecular ion beams for CP-violating searches

Wednesday 3 December 2025 19:04 (1 minute)

We report several advances in the field of ion beam development towards the study of radioactive molecules. Radioactive molecules are predicted to be powerful tools in the study of physics beyond the standard model, as they potentially enhance permanent dipole moments in the leptonic (electron electric dipole moment - eEDM) or hadronic (Nuclear Schiff moment, Magnetic Quadrupole Moment - NSM, MQM) sector.

We report the creation of molecules from an offline mass separator and the design and assembly of a light collection region (LCR) enabling laser spectroscopic study of molecular ions of interest.

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Presenter: BERBALK, Justus (KU Leuven (BE))

Session Classification: Poster Session