JYFL Accelerator News 1/2025 (volume 33, issue 1)
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JYFL Accelerator News

Acclerator Laboratory,
Department of Physics, University of Jyväskylä,
Finland

In this newsletter:

This is the first and last JYFL Accelerator News this year. As the new-year time is good for making wishes and promises, I will make also one: from 2026 onwards, we will publish this newsletter at least twice per year! I was asked already many times by people about the next newsletter issue. When I started to collect contributions, I was pleased to notice that you are really interested in participating and making this together. This newsletter means something for us. Thank you everybody!

Who are we and what is the work we are doing? Who are the new people you see in the lab? To get answers, please read the stories and especially the introductions written by our new members in the "New Faces at the Lab" section.

Our Accelerator Laboratory is continuously transforming to something else. Stories in this issue are also telling about that. It must be like that — we have to adapt ourselves as the world changes around. To see the change, you can head into the JYFL ACCLAB News archive (https://www.jyu.fi/en/science/accelerator-laboratory/jyfl-accelerator-news) and see the development taking place all the time.

— Jan Sarén

JYFL Accelerator Laboratory: https://www.jyu.fi/en/science/accelerator-laboratory

Head of the laboratory: Iain Moore, iain.d.moore@jyu.fi (since 1st of January 2026).
JYFL Acclerator News: Taneli Kalvas, taneli.kalvas@jyu.fi; Jan Sarén, jan.saren@jyu.fi

Quite a Ride

Paul Greenlees, Head of the Accelerator Laboratory

Paul Greenlees Head of the Accelerator Laboratory 2018–2025.

Exit planning for the post Centre of Excellence period, needed for the first time in over eighteen years. The commissioning of two new innovative ion sources, bringing new openings for the laboratory users. Two successful Finnish Research Infrastructure Roadmap applications. JUROGAM3. MORA. Sales of ToF-ERDA beamlines around the world. Continuation of the National Task. The first hiring of a Staff Scientist in the whole University. The sudden death of a young, beloved, talented colleague. Brexit. Trump. The Ukraine. A visit to the British Embassy in Helsinki and shaking hands with Prince William. Lots of Ambassadors. A serious accident and injury of a young member of staff. Retirements of ever-present legends and the hiring of new and enthusiastic guarantors of future successes. The first real shutdown, ever. COVID-19. An RF refit and COVID-19. A celebration of 30/15 years. Hope for the MCC30. High profile results for nuclei on the key experiment lists of every major laboratory. An honorary doctorate for a mentor and visionary. Ylistö renovation. TV interviews and an invitation to the President’s Independence Day reception for a young physicist. A Professor in Practice. A new DI program. Meetings. Lots of meetings. Amazing, inspiring, young people.

All of these events and memories would be enough for a lifetime career, but incredibly, have fitted into the period of eight years from 2018 since I took over as Head of the Accelerator Laboratory. What a rollercoaster it has been! Some of the events, of course, have filled me with great sadness, but life has gone on and we have recovered to continue with dedication to our work. COVID-19! I had almost forgotten!

But what fantastic times we have had – so many great memories and things to celebrate! Overall, I am filled with a great sense of honour and pride that I have been able to act as the representative of our incredible staff and the laboratory that they collectively have made one of the best in the world. Our results speak for themselves and we are certainly punching above our weight. The laboratory is in a good position and the prospects for the future are bright. The events of the past have helped me to develop personally and professionally and to give me a staff to lean on for my future challenges. I know that they will be manifold, but I also know that there will also be fun. I look forward to it.

JYFL has housed accelerators already for half a century! The very first accelerator, MC-20, arrived in JYFL 50 years ago. Today we have two cyclotrons, the K130 and the MCC30, and a linear 1.7 MV tandem accelerator for production of high energy ions. Additionally, there is a cLINAC for production of 15 MeV photons and 20 MeV electrons.

RADEF is Preparing to Move and More Requests for Space-Electronics Tests

Heikki Kettunen, RADEF

RADEF, RADiation Effects Facility, is specialized in applied research related to nuclear and accelerator-based technologies, to study of radiation effects in electronics and related materials. RADEF officially became an ESA supported European Component Irradiation Facility (ECIF) in 2005. Since then, irradiation tests have been carried out not only for ESA and the European space industry, but also for other world leading space organizations, companies and universities (e.g. NASA, JAXA, CNES). In 2023, the contract with ESA was again extended to continue till the end of 2027.

RADEF offers wide variety of different sorts of radiation from gammas and electrons to protons and heavy ions. For these beams, the LINAC electron accelerator and combination of JYFL's ion sources and K-130 cyclotron are utilized. More than 90 % of the time, heavy ions beam, from boron to gold, are used for irradiation tests at RADEF. Therefore, the variety of ions in available heavy ion cocktails is under continuous development. Currently, three cocktails are available with beam energies of 10, 16.3 and 22 MeV/n, containing 19 different ions.

Even if the beams are called cocktails, not all the ion species from B to Au are sent to the target at the same time. But because cocktail ions have almost the same mass to charge state ratio, they can be separated just with a small change in the cyclotron settings. This enables the change from ion to ion inside a cocktail just in 10 – 15 min, which is very important in electronics tests, when measuring error cross-sections.

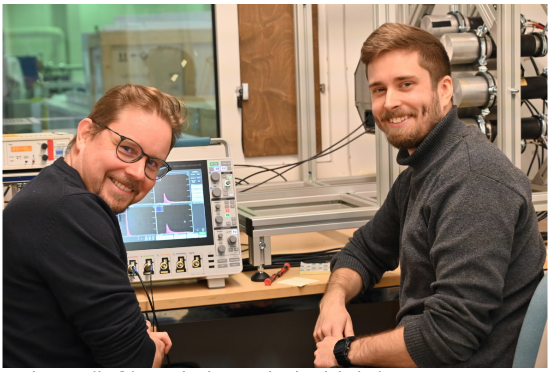
RADEF is facing major change next year, when it has to move to a new cave in the target hall. Current RADEF area is needed for a coming 3 MV Tandetron accelerator and therefore a new cave is under construction just behind the RADEF’s side wall. The major parts of Oxyphen and RADEF equipment are planned to move starting in May and June 2026, respectively, and both should be back online at the end of August. Varian cLinac, which is in the same cave system as RADEF, will be located to newer target hall, behind the MCC-30 cyclotron. As it is not our major research tool, its construction will be started after RADEF and Oxyphen are fully operational again.

In general, the satellite industry has grown at an accelerating pace in recent years. As well, the complexity and development speed of the electronics components have increased with the same trend. Both reasons increase the need for electronics tests for space industry. This trend has also been observed at RADEF based on increased number of requests for radiation beam times. On the other hand, this may also be an indication that RADEF has been very successful in meeting the needs of the space/satellite industry.

Mikko Rossi

Neutrinos and Astroparticle Physics (NAPP)

Kai Loo, NAPP



Kai Loo (left) and Timo Ahola (right)

The 'group' is the foundation for greater involvement in the field of experimental neutrino physics. The Academy Research Fellow project lies at the intersection of nuclear and particle physics and consists of three main areas of focus: contributing to existing/upcoming world-class neutrino experiments; pushing the limits of neutrino detection techniques; and increasing our understanding of background signals originating from radioactivity not only in neutrino experiments, but also in all rare event searches, such as those investigating dark matter and neutrinoless double-beta decay. The keyword for all the current activities is liquid scintillator.

In experimental neutrino physics, there are two main areas of study: the properties of neutrinos themselves, and using neutrinos as messengers from distant environments, such as the Sun or stars. The Jiangmen Underground Neutrino Observatory (JUNO), a world-class experiment in which we are involved, focuses on measuring the so-called neutrino mass ordering. As a "side product", it will provide a precise measurement of several already-measured neutrino oscillation parameters, followed by measurements of solar neutrinos, possible supernova neutrinos, geoneutrinos, etc. JUNO consists of a vast 20,000-tonne liquid scintillator target. For this type of measurement, all target and detector materials must be extremely pure. Our main contribution so far has been to participate in the radiopurity screening of the target material and determine the residual contamination of the uranium and thorium chains using a standalone detector next to the JUNO detector. Filling of the large JUNO detector was completed in August 2025, marking the start of the main data-taking period.

Although liquid scintillators have long been standard workhorses in neutrino physics, there have been some very interesting recent developments. The ability to separate the tiny Cerenkov signal from the bright scintillation signal will enable new methods of event identification, and furthermore, background discrimination. We are involved in characterising slow scintillators, where the scintillation emission is delayed, but the total light yield is preserved, enabling excellent energy measurement. This work is being carried out in collaboration with JGU Mainz, TU Munich and Uni Padova. We are particularly interested in applying this technique to next-generation experiments searching for neutrinoless double beta decay.

Finally, in terms of in-house activities, we are putting together a proof-of-concept setup to study the shapes of the energy spectra of beta-plus/beta-minus decaying isotopes using a liquid scintillator in coincidence with gamma detectors. This work forms the basis of Timo Ahola's PhD thesis. The motivation behind this is to study the effective axial-vector coupling constant g_A and thus provide experimental data for nuclear structure model builders. As part of the project, we plan to measure one isotope (e.g. Nb94 or Tc98), which is known to be sensitive to g_A quenching. The mechanical design of the setup is complete, and we are currently focusing on developing the DAQ and characterising its response and sensitivity.

The Heaviest Proton Emitter to Date Discovered in JYFL-ACCLAB

Henna Kokkonen, NUCSPEC

The lightest known isotope of astatine, 188At, was discovered to decay via proton emission. The recent study extends the knowledge about the known proton emitters. Prior to these results, approximately 50 proton emitters were known between 108I and 185Bi. The latter was discovered already in 1996, so this is the first instance in nearly three decades expanding these observations towards heavier nuclei.

The experiment was conducted in the JYFL-ACCLAB by employing the K130 cyclotron and RITU recoil separator. The nuclei were produced via fusion-evaporation reaction using a natural silver target and 84Sr beam. Production cross sections and half-lives of these neutron-deficient nuclei beyond the proton dripline are remarkably low, posing challenges for the study. The gamma- or laser spectroscopy techniques are no longer feasible, however, these nuclei can still be studied via decay spectroscopy. The detector setup at the RITU focal plane was used to distinguish the nuclei of interest and to determine their decay energies, half-lives, and masses. With these data, the fundamental properties of these nuclei can be studied.

Well-deformed proton emitters are complex to model, thus, to interpret the measured data more thoroughly the non-adiabatic quasiparticle model was extended to treat heavy nuclei. The model suggests a strongly prolate-deformed state the proton is emitted from. According to the model, the dominant proton state is low in angular momentum. Such states are known to favor the Thomas-Ehrman shift. The shift refers to a phenomenon where the repulsive Coulomb energy is reduced as the wave function of the valence proton extends outside the nuclear interior. It has been observed in light and medium-mass nuclei, however despite multiple attempts, never in heavy nuclei. The present study suggests a first possible experimental sign of the effect in heavy nuclei.

Henna Kokkonen

The research article was made in collaboration with experimental and theoretical nuclear physicists, and it was published in the Nature Communications on May 2025 [1]. The study is a follow-up to the master’s thesis study of Henna Kokkonen and is part of her doctoral thesis.

[1] Kokkonen, H., Auranen, K., et al. Nat Commun 16, 4985 (2025) https://doi.org/10.1038/s41467-025-60259-6

New faces at the LAB

I am one of two experimental neutrino physicists working in the accelerator lab. My PhD project involves measuring beta-spectral shapes, which are dependent on gA and/or sNME. You can find me in my office running simulations or in the MARA-LEB barrack preparing measurements.
— Timo Ahola

I am a postdoc in the IGISOL group. Currently, my research focuses on ion trapping and high-precision mass measurements.
— Brian Kootte

I joined the nuclear spectroscopy group a little over a year ago as a PhD student from the Netherlands as part of the TOPI program. The goal of my research is to develop techniques to learn about the multi-nucleon transfer mechanism. In particular, techniques to detect both multi-nucleon transfer fragments with RITU separator, here at the university of Jyväskylä.
— Niels Landsman

I am Denise and I started my PhD in November 2024 in the Nuclear Spectroscopy Group. Currently, I'm studying the 3n-evaporation channel cross sections of proton-rich nuclei close to the N=Z line. In the future, I will study the gamma-ray spectroscopy of 45Cr.
— Denise Lazzaretto

I've just recently started my PhD as part of the IGISOL group, and I'll be working on high-precision mass measurements of exotic nuclei for studies of cosmic-neutrino background physics and weak interactions. For this, I'll be using Penning trap mass spectrometry, and I'm obviously expected to become an expert at trapping. I'll do my best!😄

I am a postdoctoral researcher in the IGISOL group. My main focus is on the operation of the JYFLTRAP mass spectrometer and related high-precision measurements of nuclear masses, but I am also involved in other IGISOL projects with exotic ions.
— Simon Rausch

I started as a PhD student in August 2024 in the IGISOL group. I have been working with the JYFLTRAP, a double Penning-trap mass spectrometer, and my research focuses on the mass measurements of neutron-rich nuclei. The improved mass values are then applied in nuclear astrophysics simulations, mainly in the rapid neutron-capture process simulations, to improve our knowledge how elements heavier than iron are formed in the universe.
— Miikka Winter

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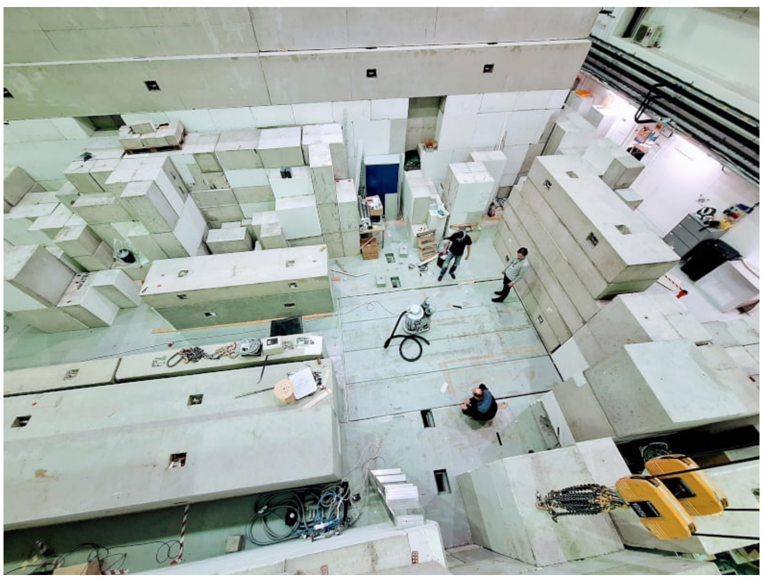
3 MV Tandetron Accelerator on the Way

Taneli Kalvas

The University of Jyväskylä Accelerator Laboratory is acquiring a new 3 MV electrostatic Tandetron accelerator to replace the aging 1.7 MV Pelletron. The new system will significantly broaden our experimental capabilities, extending applications from the current material physics programme to new research opportunities in nuclear and life sciences.

The new accelerator has already been ordered and is scheduled for delivery at the end of 2026. The procurement is funded through FIRI infrastructure funding from the Research Council of Finland.

Installation will take place at the far end of the main target hall, in the area currently occupied by the RADEF facilities. This means that over the next 12 months we will not only prepare the necessary infrastructure for the Tandetron, but also relocate RADEF – one of our major beamtime users – to the neighbouring cave (formerly known as the LSC, Large Scattering Chamber).



The future RADEF cave still looks like a concrete block storage facility in December 2025 – a lot of work to be done.

RADMEP+ Gets Erasmus Mundus Funding — The Story Continues

The European radiation effects community has a reason to celebrate (again): the RADMEP+ Erasmus Mundus Joint Master programme has been officially awarded funding. Building on the success of the original RADMEP programme launched in 2020, RADMEP+ will continue to shape the next generation of experts in radiation, microelectronics, and photonics technologies—fields increasingly central to Europe's technological future.

RADMEP+ is a two-year, 120-ECTS multidisciplinary master's programme designed to give students not only a strong scientific foundation but also hands-on experience with the challenges posed by natural and man-made radiation environments. By combining advanced theory, practical methodologies, and real-world applications, the programme aims to meet the growing demands of industry, space agencies, and society in general.

Coordinated by Université Jean Monnet (France)—as was the earlier programme—RADMEP+ brings together a strong consortium of European partners: the University of Jyväskylä, University of Montpellier (France), KU Leuven (Belgium), Vrije Universiteit Brussel (Belgium), and Ghent University (Belgium). Together, they offer students a rich academic landscape and a diverse cultural experience, while strengthening Europe's capabilities in key enabling technologies.

The programme not only equips students with technical expertise but also fosters valuable professional and soft skills that will support their careers worldwide. With Erasmus Mundus funding secured, RADMEP+ is ready to welcome its first cohort: call for applications is open until 9 February 2026.

A new phase begins—continuing the legacy of RADMEP, and pushing the boundaries of education and innovation even further.

More information on the program:
https://master-radmep.org/
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