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JYFL Accelerator News

– Accelerator Laboratory, Department of Physics University of Jyväskylä, Finland –

Celebration of 30 years of K130 and 15 years of Pelletron research

As reported in the previous edition of the Accelerator News, 28th January 2022 marked the thirtieth anniversary of an ion beam being extracted from the K130 with the first heavy ions being delivered on 14th May 1992. In addition, 2022 marked fifteen years since the installation and inauguration of the 1.7MV Pelletron accelerator in Jyväskylä. Of course it was necessary to celebrate these momentous events and it was decided to arrange a series of meetings in late August. From 23rd to 25th August, on consecutive days, there was a meeting of the International Advisory Board, where an update of the laboratory status and future strategy was presented, a Users Meeting and finally on 25th August a series of talks celebrating the history of the laboratory and the steps taken to get where we are today. The majority of speakers were those involved in the early days of the laboratory, such as Juha Äystö, Rauno Julin, Ari Virtanen and Pauli Heikkinen. A large number of alumni and former employees were also present. The days event was followed by an evening cruise and celebratory dinner at Savutuvan Apaja.

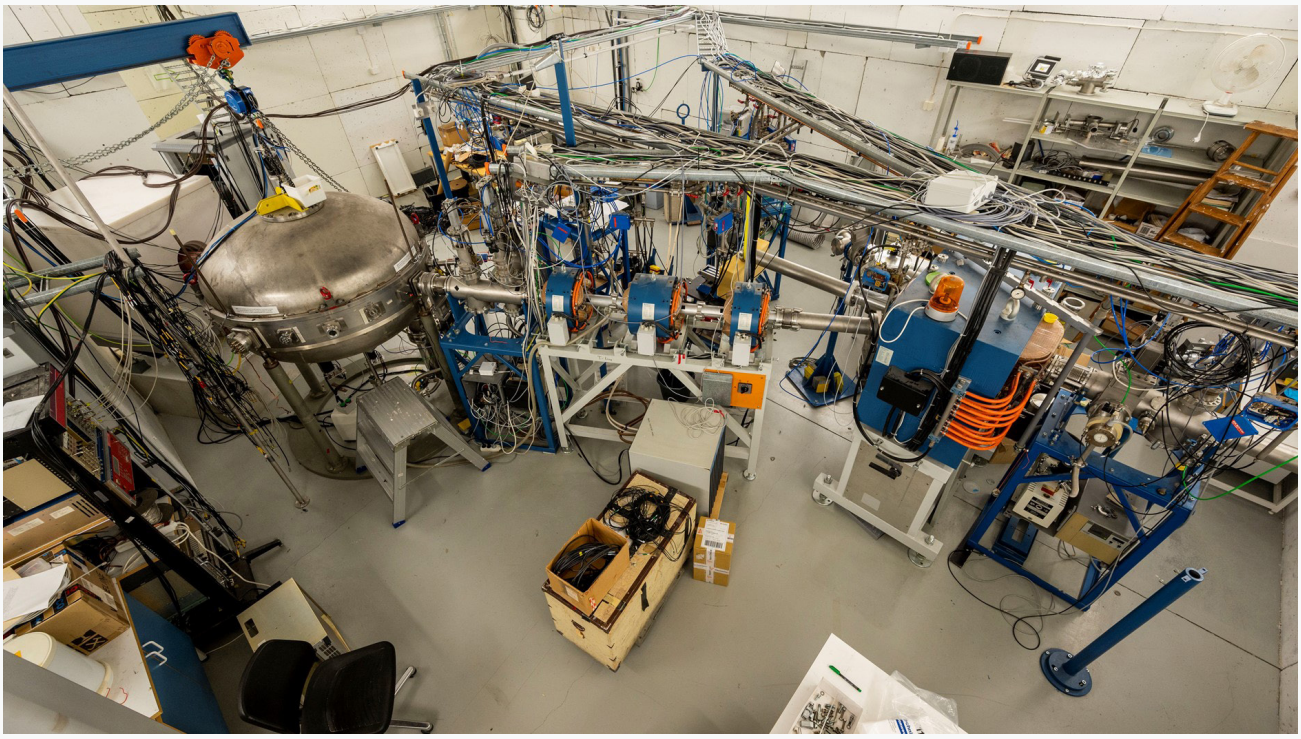
Prof. Emeritus Juha Äystö told about the first phases of the K130 cyclotron project.

Top left:
Rector Keijo Hämäläinen opened the 30/15 Years Celebration event.

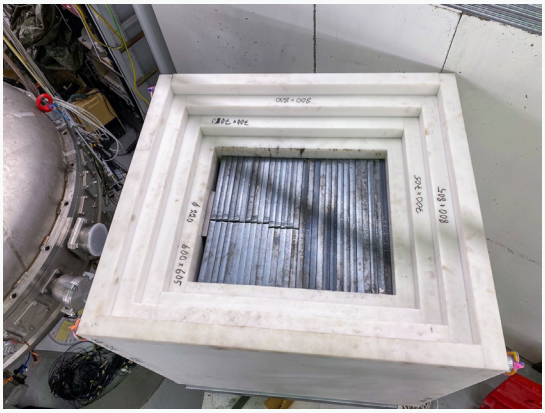
Middle left:
A boat cruise from Hotel Alba took us to the celebratory dinner at Savutuvan Apaja.

Down left:
Prof. Peter Butler delivered the after-dinner speech.

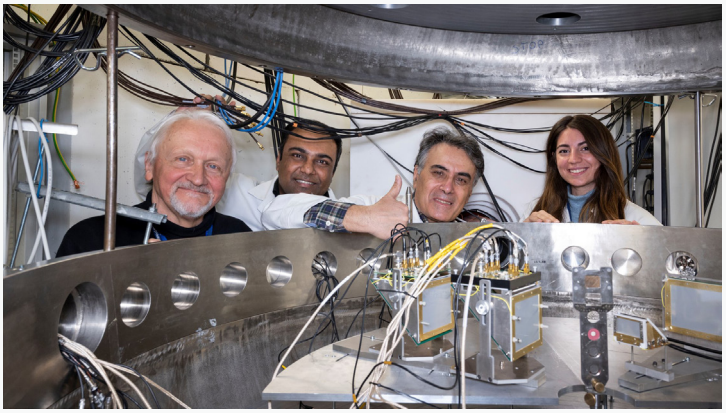
Large Scattering Chamber cavern extension



The enlarged LSC cavern with better acces to the scattering chamber from all sides.



New beam dump without the PE cover.



Wladyslaw H. Trzaska, Tathagata Banerjee, Emanuele Vardaci and Daniela Mercogliano behind the Large Scattering Chamber with some instruments inside.

The reconstruction of the cavern housing the Large Scattering Chamber (LSC) is now completed. The new, significantly enlarged cavern has a higher ceiling and allows unobstructed LSC access from all sides. On the LSC beam exit is now a new, well-shielded beam dump. It consists of a Faraday Cup with a carbon stopper surrounded by an iron core placed in a hollow 1 m^3 polyethylene (PE) cube. PE is loaded with 5% of boron. The new beam dump will significantly reduce the gamma and neutron background in the cavern allowing for measurements also with high-intensity light ion beams. All cables between the LSC and the dedicated electronics racks outside are routed through a chicane in the concrete wall shielding.

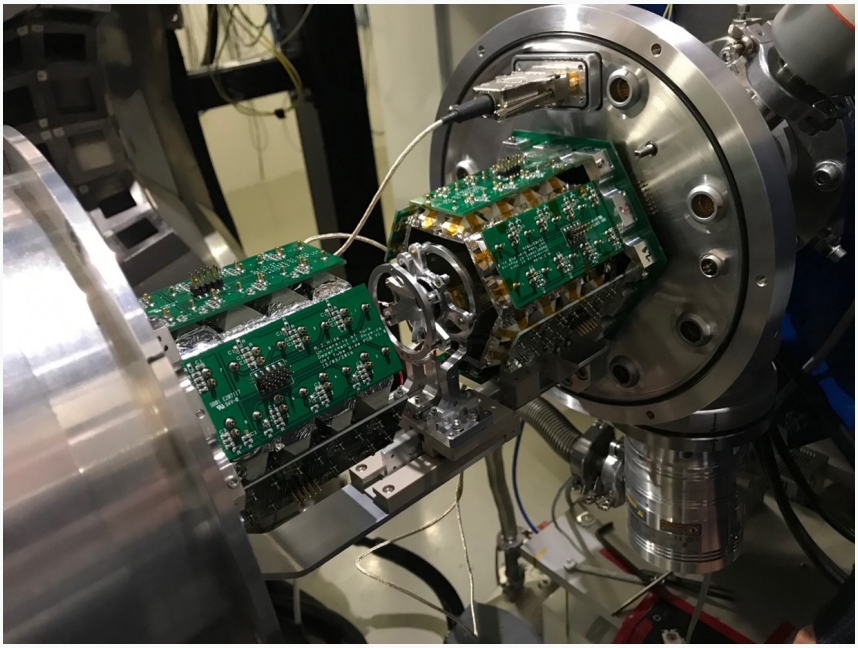
In May 2022, the new cavern was inaugurated by the team from Naples testing an MCP-based detector system in the LSC with a beam cocktail. Thanks to the outstanding commitment and expertise of the AccLab technical team, everything worked flawlessly. This was a noticeable achievement considering that all the services (vacuum, water cooling, power supplies, etc.) had to be cut and reconnected to accomplish this major reconstruction project.

LSC is now ready for proposals and experiments. There is also ample space in the expanded cavern for new experimental setups. Currently, the 0° and +30° exit lines from the switching magnet are used for irradiations with low-intensity beams and for time-of-flight-based measurements.

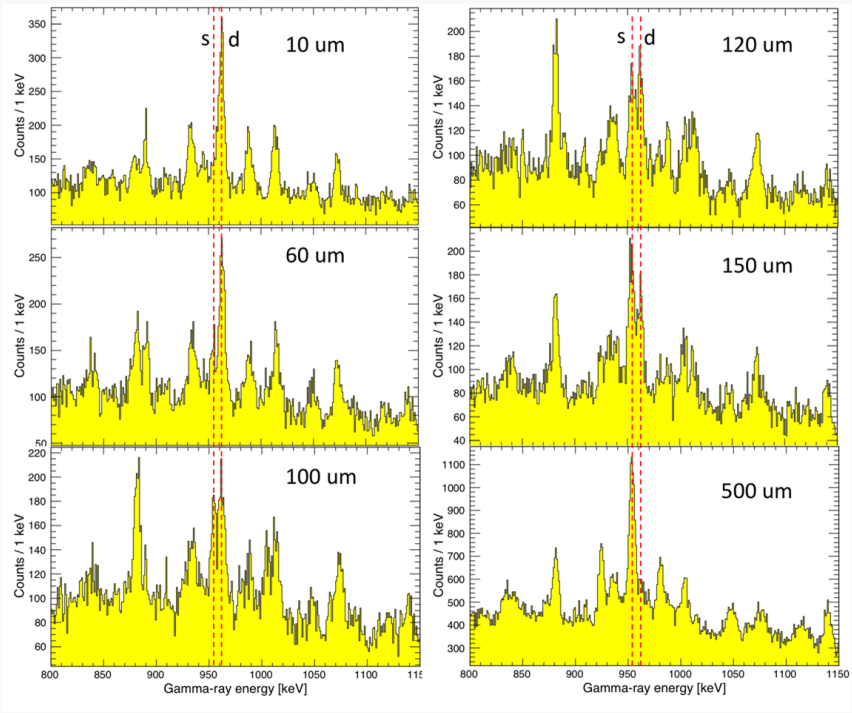
Increasing sensitivity for the plunger lifetime measurements

A new piece of equipment has been recently developed in collaboration with researchers from the University of Cologne, Germany to measure lifetimes of short-lived excited states in exotic nuclei. The Advanced Plunger-Particle detector Array (APPA) is specifically developed to be used for lifetime measurements around the N=Z line, but its use is not limited to these cases only. APPA, to be used with MARA/RITU separators and JUROGAM 3, combines a newly developed compact Cologne plunger design with the charged-particle detector array JYtube. Having the capability of vetoing charged particles associated with high cross-section proton evaporation channels increases the experimental sensitivity to measure lifetimes in exotic nuclei produced with significantly lower rates. The particular physics case behind the development of APPA is the N=Z nucleus ^{66}As, where the lifetime of the excited T=1, 2^+ state is not currently known. The plan is to use APPA also to measure the lifetime of the corresponding state in ^{62}Ga. These measurements aim to test the isospin symmetry breaking effects within isobaric triplets and to find fingerprints of the debated isoscalar pn pairing mode in N=Z nuclei.

APPA was commissioned successfully in-beam at the end of May 2022 during a 4 day test beamtime using ^{40}Ca+^{24}Mg and ^{40}Ca+^{28}Si reactions at MARA+JUROGAM 3. Several important experimental parameters, such as MARA transmission efficiency, charged-particle detection efficiency and performance of the ^{28}Si targets, were established during the test beam time. This was critically important to prepare for the extremely demanding ^{66}As measurement. In addition, experimental data was collected for ^{62}Zn at several plunger-to-degrader distances to extract the lifetime of the 2^+ state, which is known from previous measurements. This is to verify the correct plunger operation. After the successful commissioning run APPA was used, without the charged-particle array, to measure the excited states' lifetimes in heavy ^{222}Th nucleus employing the charge-plunger technique. Full physics campaigns with APPA are planned to be performed during the first half of 2023 utilizing both RITU/MARA separators and the JUROGAM 3 array.



The Advanced Plunger-Particle detector Array APPA almost ready to take beam at the MARA beam line.



The JUROGAM 3 gamma-ray spectra showing lifetime data collected with APPA for the 2^+ state in ^{62}Zn. The shifted (s) and degraded (d) components of the 2^+ -> 0^+ gamma-ray transition in ^{62}Zn are clearly observed, which can be used to extract the lifetime of the 2^+ state.

Greetings from the student lounge!

Eetu, Jasmiina and Henna

This summer we, Jasmiina Ahokas, Henna Kokkonen and Eetu Kuusisto, were working as summer interns at the Accelerator Lab. We all had different job descriptions: Jasmiina and Henna worked at the nuclear spectroscopy group, NucSpec, with a goal to get an overall picture of the research in this group. Jasmiina was focusing six weeks mainly to combine theory in a versatile way with the experimental side of nuclear physics. Henna had a three months long internship, awith her own project in addition to general work at NucSpec. Eetu Kuusisto worked in an outreach activity project for the accelerator laboratory for two months.

Henna and Eetu learned together how to cast light guides for plastic scintillators. As a part of light guide design Eetu and his supervisor Jan Sarén also developed a computer simulation code for tracking photons. Eetu's outreach project was to build a standalone muon detector, currently having the workname MOTTI (fin. Myonien Observointiin Tarkoitettu TuikeIlmaisin). Henna's project was to study and develop a scintillator-based veto detector for beta particles. It is planned to be used at the MARA focal plane. Jasmiina and Henna were able to actively participate in the research process, which included the maintenance of the instrumentation, setting up detectors for an experiment, taking shifts during the experiment and trying to understand the numerous online spectra.

The fact that the accelerator lab is in the same building, where we as master students are studying every day, provides a great opportunity to participate in the front line research in nuclear physics. We were all very satisfied for the learning experience of the training and thankful for this opportunity.

-Jasmiina, Henna and Eetu

NEWS

The next deadline for submission of proposals is 15th March, 2023. Proposals should include an abstract/summary along with the scientific case and a justification of the beam time requested, based on cross-sections, detector efficiencies, etc. Proposals should preferably be of the order of 5-7 pages long. If a proposal is the continuation of an existing experimental program at the JYFL Accelerator Laboratory, a summary of the status of the project should be attached. Proposers are encouraged to contact anyone in the Contact List at the end of this Newsletter for more information about the available instrumentation. Proposals should be submitted via the JYU VASARA platform. The link for submission will be shared with the official announcement through the JYFL email list (Link to subscribe) or by a direct request to the Program Advisory Committee (PAC) scientific secretary. For more information click here.

From 1st of September 2022, JYFL-ACCLAB is one of the EUROpean Laboratories for Accelerator Based Sciences (EURO-LABS). Thereby access is supported for eligible external research teams performing or planning experiments at JYFL. Proposals for experiments will be evaluated and selected on the basis of scientific merit through an independent peer review procedure. For research groups with accepted proposals, the research facilities including accelerators and experimental instrumentation are provided by JYFL free of charge. Details concerning eligibility of research groups can be found from the EURO-LABS web page. All publications resulting from supported work done at JYFL are required to acknowledge the EURO-LABS project:

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More information: https://web.infn.it/EURO-LABS/

How to contact us:

Name	Responsibility	e-mail
Paul Greenlees	*Scientific Director, γ- and e--spectroscopy*	paul.greenlees@jyu.fi
Ari Jokinen	*IGISOL*	ari.s.a.jokinen@jyu.fi
Juha Uusitalo	*RITU, MARA*	juha.uusitalo@jyu.fi
Pauli Heikkinen	*Technical Director*	pauli.heikkinen@jyu.fi
Taneli Kalvas	Cyclotron operations	taneli.v.m.kalvas@jyu.fi
Andres Illana Sison	*Beam-time schedule, PAC secretary*	andres.a.illana@jyu.fi
Iain Moore	*Laser spectroscopy, IGISOL*	iain.d.moore@jyu.fi
Wladyslaw Trzaska	*HENDES, LSC, dE/dx*	wladyslaw.h.trzaska@jyu.fi
Heikki Kettunen	*Applications*	heikki.i.kettunen@jyu.fi
Timo Sajavaara	*Accelerator-based materials physics*	timo.sajavaara@jyu.fi
Hannu Koivisto	*ECR ion sources*	hannu.a.koivisto@jyu.fi
Arto Lassila	*Control system*	arto.s.lassila@jyu.fi
Sami Rinta-Antila	Radiation safety	sami.rinta-antila@jyu.fi

The Programme Advisory Committee

Hans Otto Fynbo (Chair), Aarhus University, Denmark
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Department of Physics
P.O. Box 35 (YFL)
FI-40014 University of Jyväskylä
Finland

→ **jyu.fi/physics**

Accelerator News editor: Pauli Heikkinen