NEWS letter

MIRROR

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Highlights

- Breakthrough in rapid cooling for BASE antiprotons
- CIRCUS: how to automate physics research
- Installation start of the FAIR accelerator machine: First magnets successfully installed in the tunnel, 17 meters underground

Dear friends of low energy antimatter physics,

It is with great sadness that I learned about the passing of Professor Walter Oelert, an extraordinary scientist, mentor, friend and cherished colleague. Walter's pioneering work, including the first production of antihydrogen at CERN, redefined our understanding of the universe and inspired generations of researchers. Beyond his scientific achievements, his warmth, kindness, and never-ending encouragement made him a guiding light to many, certainly myself. His wisdom and generosity shaped countless careers and fostered a spirit of collaboration that I have no doubt will endure. To his family and loved ones, my heartfelt condolences. Walter was truly remarkable, and his legacy will forever inspire us.

As AVA Coordinator, it is my pleasure to congratulate the BASE collaboration on their remarkable achievement, published in Physical Review Letters. By reducing the cooling time for antiprotons from 15 hours to just 8 minutes, they've significantly improved the way we can carry out precision antimatter studies. Well done to the entire team for this incredible milestone! You will find more details about their study, which was published this summer, in this issue of the MIRROR.

In our last MIRROR, we reported on the breakthrough result of the AEgIS collaboration in Positronium laser cooling. This has found a lot of media attention including major outlets in Austria, Switzerland and Germany such as the ORF, SRF Wissenschaftsmagazin, Der Standard, MDR Wissen. The work also became the cover story of the NEWS.AT magazine this August, and helped explain the fascination of antimatter research to the general public.

Finally, I am delighted to announce the IPAC'29, the world's largest conference on particle accelerator R&D will be hosted in Liverpool, UK between 20 – 25 May 2029. Against strong competition from Spain, Poland and Switzerland, the UK proposal received the most votes from the international selection committee and accelerator science will now be "coming home". We can't wait!

Prof Carsten P Welsch, Editor

Breakthrough in rapid cooling for BASE antiprotons

BASE physicist Barbara Latacz in front of the experiment's cryostat. This cylinder, which is kept at 4 kelvins (-269°C), houses the system of traps that cool and measure the antiprotons and a very strong magnet. (Image credit: CERN)

To study antimatter particles, experiments must cool them to the lowest possible temperatures. The BASE experiment, located at CERN who are a partner in the AVA project, has just reached a new milestone in this regard. In an article published by the journal Physical Review Letters, the collaboration presents a new device that reduces the time required to cool an antiproton from 15 hours to just 8 minutes. This considerable improvement makes it possible to measure antiprotons' properties with unparalleled precision.

BASE, located in CERN's antimatter factory, specialises, specialises in studying antiprotons by measuring their fundamental properties, such as the intrinsic magnetic moment and the charge-to-mass ratio, with the highest possible precision. By comparing these measurements with those of protons, the collaboration furthers our understanding of antimatter. One of the goals is to help resolve the fundamental question of the asymmetry between matter and antimatter in the Universe.

To determine the magnetic moments of antiprotons, the experiment measures the frequency of the spin quantum transitions (spin flips) of single antiprotons, which is in itself an amazing feat. Under the influence of a magnetic field, the antiproton's spin changes direction, alternating between -1/2 and +1/2, its two possible values. This measurement is possible only with extremely cold antiprotons. *"To get a clear measurement of an antiproton's spin transitions, we need to cool the particle to less than 200 mK,"* explains Barbara Latacz, the lead author of the study.

BASE's previous device could achieve this, but only after 15 hours of cooling. *"As we need to perform 1000 measurement cycles, it would have taken us three years of non-stop measurements, which would have been unrealistic,"* continues Barbara Latacz. By reducing the cooling time to 8 minutes, BASE can now obtain all of the 1000 measurements it needs – and thereby improve its precision – in less than a month. As a result, the experiment has announced that its error rate for the detection of antiproton spin transitions is three orders of magnitude lower than previously.

To perform its measurements, BASE uses antiprotons that have been decelerated by the Antiproton Decelerator (AD and then the Extra Low Energy Antiproton ring (ELENA). It then stores around a hundred antiprotons in a Penning trap, which holds them in place using electrical and magnetic fields. An antiproton is then extracted into a system made up of two Penning traps. The first trap measures the temperature of the particle. If it is too high, the antiproton is transferred to a second trap to be cooled. The particle then goes back and forth between the two traps until the desired temperature is reached.

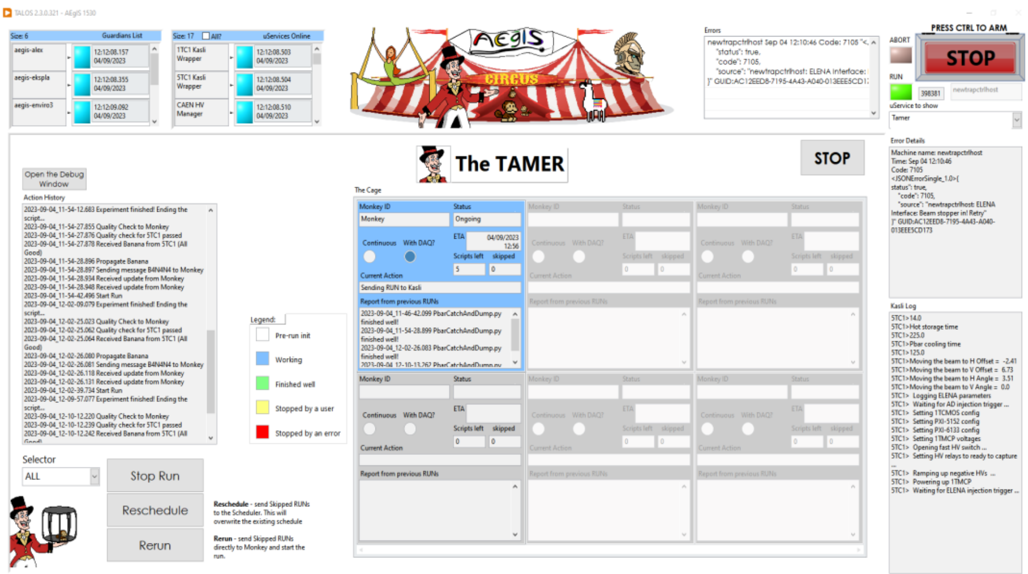
The key to the breakthrough announced by BASE is the improvement of the cooling trap. Its diameter has been reduced to just 3.8 mm, less than half the size of that used in previous experiments. It has been equipped with an innovative segmented-electrode system to reduce the amplitude of one of the antiproton oscillations – the cyclotron mode – more effectively. The "temperature" of the antiproton is correlated with its oscillations, which have several superimposed modes. The cyclotron mode, which is linked to the particle's movement in a magnetic field, must be reduced to allow spin state measurement. The readout electronics have also been optimised to reduce background noise, which translates into disturbances and therefore heat for the antiproton. The time spent by the antiproton in the cooling trap during each cycle has thus been reduced from 10 minutes to 5 seconds. Further improvements to the measurement trap have also made it possible to reduce the measurement time fourfold.

With its new device, BASE intends to further improve on its own precision records. *"Up to now, we have been able to compare the magnetic moments of the antiproton and the proton with a precision of one part per billion. Our new device will allow us to reach a precision of a tenth or even a hundredth of a billionth,"* says BASE spokesperson Stefan Ulmer. *"The slightest discrepancy could help solve the mystery of the imbalance between matter and antimatter in the Universe."*

This article is based on an original article published on the CERN website

Full article:
"Orders of Magnitude Improved Cyclotron-Mode Cooling for Non-destructive Spin Quantum Transition Spectroscopy with Single Trapped Antiprotons", B.M. Latacz et al. ,Phys. Rev. Lett. 133, 053201 – Published 1 August 2024
https://doi.org/10.1103/PhysRevLett.133.053201

CIRCUS: how to automate physics research



A view of the CIRCUS control system GUI running a schedule of experiments with antiprotons. This main window is provided by TALOS.

Precision and consistency are paramount in scientific research. At CERN, scientists are exploring antimatter, the mysterious counterpart to ordinary matter, an especially daunting task. Among others, the AEgIS experiment aims to unravel why the universe is composed mostly of matter rather than an equal mix of matter and antimatter; in particular, it is interested in how anti-hydrogen behaves under gravity. This research demands exceptional control over experimental conditions, including particle confinement and ultra-high vacuum environments at near absolute-zero temperatures. Achieving this requires synchronizing hundreds of devices with nanosecond accuracy.

Initially, researchers at AEgIS spent considerable time manually adjusting equipment, which was tedious and error-prone. Manual control limited their ability to focus on data analysis and further physics studies. To overcome this, the AEgIS Collaboration developed an advanced control system known as the CIRCUS (Computer Interface for Reliably Controlling, in an Unsupervised Manner, Scientific Experiments). Central to this system is TALOS (Total Automation of LabVIEW Operations for Science), built using NI LabVIEW, which automates experimental sequences and optimizes parameters based on real-time data.

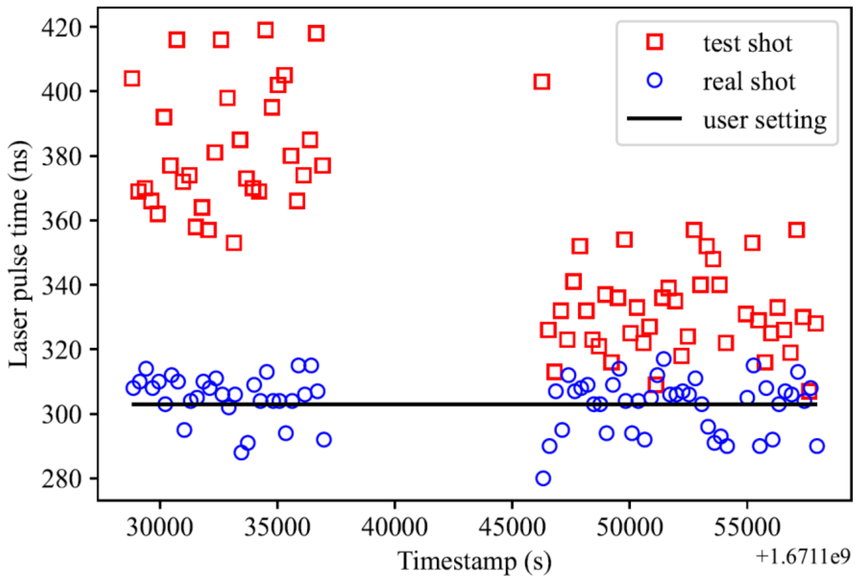
The CIRCUS control system, with TALOS as its core, automates the complex coordination required by the experiment. TALOS acts as the conductor, managing each experimental component as a microservice in a modular setup. This architecture enables flexibility and future-proofness, as individual parts can be updated without disrupting the entire system—a critical feature in high-stakes research environments where uptime is essential.

The transition from manual to automated control has transformed AEgIS' operations. For example, during a 69-day data collection period, TALOS's automation saved 18% of data-taking time — a significant boost in efficiency for experiments that often span months. Additionally, TALOS's error management features allow rapid issue resolution, ensuring smooth operation even during nights and weekends. This autonomy has freed researchers to focus more on data analysis and theoretical work, increasing productivity and enhancing the quality of data gathered.

Moreover, TALOS's precision and synchronization capabilities have opened new research possibilities, especially with the addition of an optimisation algorithm based on live-data feedback. This enabled, for instance, the automated steering of the antiproton beam, once a manual process taking weeks, that now runs in hours, doubling trapping efficiency. Furthermore, TALOS's real-time adjustments, such as fine-tuning positronium laser timing, enabled the world's first laser-cooling of positronium atoms, an achievement sought for over 30 years .

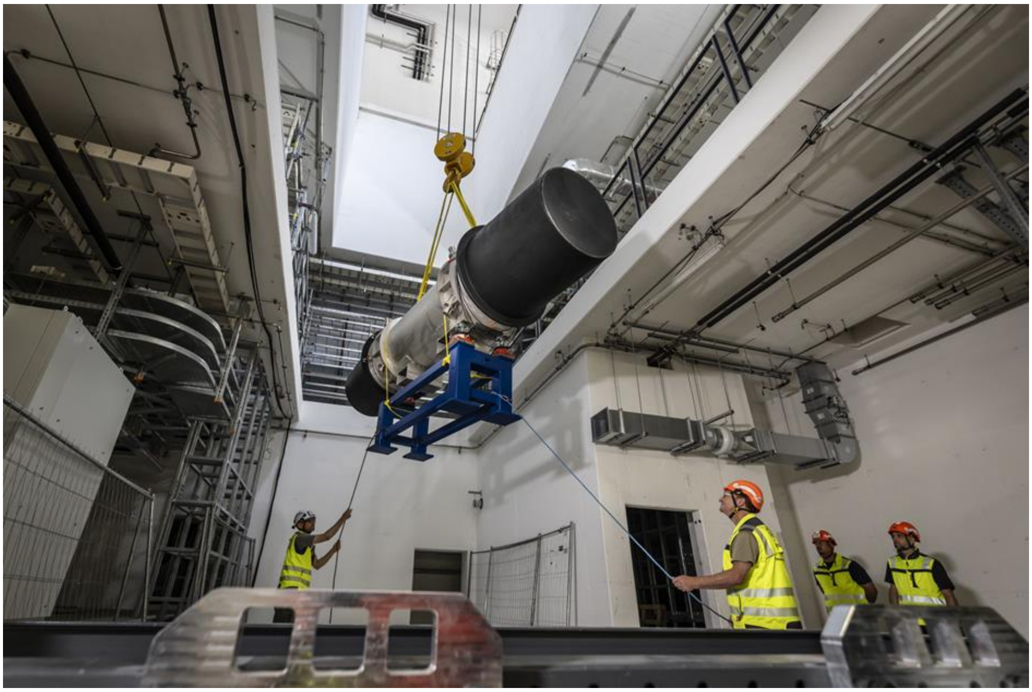
The CIRCUS (and TALOS) highlights the power of advanced automation in scientific research. This system not only improves operational efficiency but also sets a standard for autonomous control in various scientific and industrial applications With its robust error handling, modular design, and precise orchestration, the CIRCUS has enabled breakthroughs in antimatter research: being released open-source, other experiments can benefit from it.

Full article: Volponi, M., Huck, S., Caravita, R. et al. CIRCUS: an autonomous control system for antimatter, atomic and quantum physics experiments. EPJ Quantum Technol. 11, 10 (2024). https://doi.org/10.1140/epjqt/s40507-024-00220-6



A feedback loop uses the uncorrected laser pulse timings (red squares) to calculate the deviation from the user setting (solid black line) over the course of an hour and corrects the timing of the subsequent desired laser pulse that is used for the actual experiment (blue circles). Independent of short-term to long-term drifts or even sudden jumps, the resulting timing is always close to the desired value.

Installation start of the FAIR accelerator machine: First magnets successfully installed in the tunnel, 17 meters underground



The installation of the FAIR accelerator machine has begun with the positioning of the first superconducting high-tech magnets (Image credit: GSI)

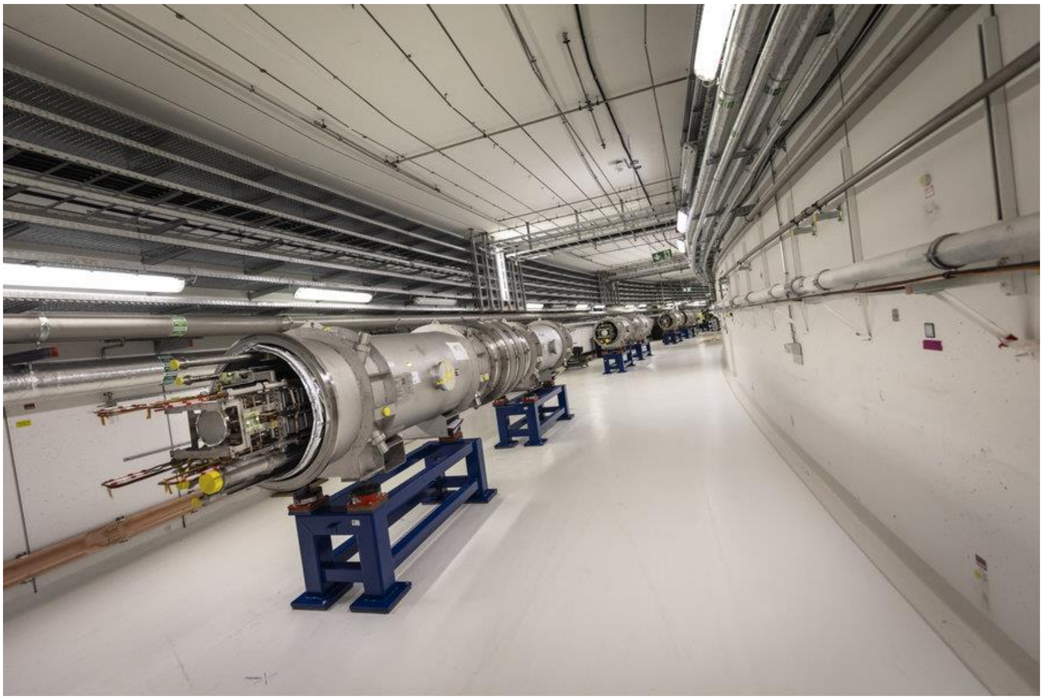
The starting signal for the installation of the FAIR accelerator machine has been given. The high-precision assembly work in the buildings of the international FAIR accelerator facility in Darmstadt has begun: The first magnets each weighing tons were successfully positioned in the ring tunnel, 17 meters underground. This marks a decisive step forward in the realization of the state-of-the-art accelerator, which will accelerate ions of all elements up to 99 percent of the speed of light. The Facility for Antiproton and Ion Research (FAIR) is being built at the GSI Helmholtzzentrum für Schwerionenforschung (a partner in the AVA project) in close international collaboration.

FAIR is one of the largest projects and one of the most innovative high-tech facilities for research worldwide. Groundbreaking new discoveries about matter and the universe can be expected from FAIR's cutting-edge research. Scientists from all over the world will conduct a wide range of novel experiments at FAIR, from astrophysics to cancer research.

The buildings for the current realization stage of FAIR are completed and the installation of the technical building equipment is at a very advanced stage. In the coming years, several thousands of high-tech components of the FAIR accelerator and experimental facilities will be installed. The first components now installed are superconducting magnets, each weighing around three tons. A total of 108 of these will be installed. They will be part of the 1.1 km ring accelerator SIS100, which will be able to accelerate ions of all elements to up to 99 per cent of the speed of light. The function of the magnets is to steer the particles in the ring accelerator and keep them on course on the circular path.

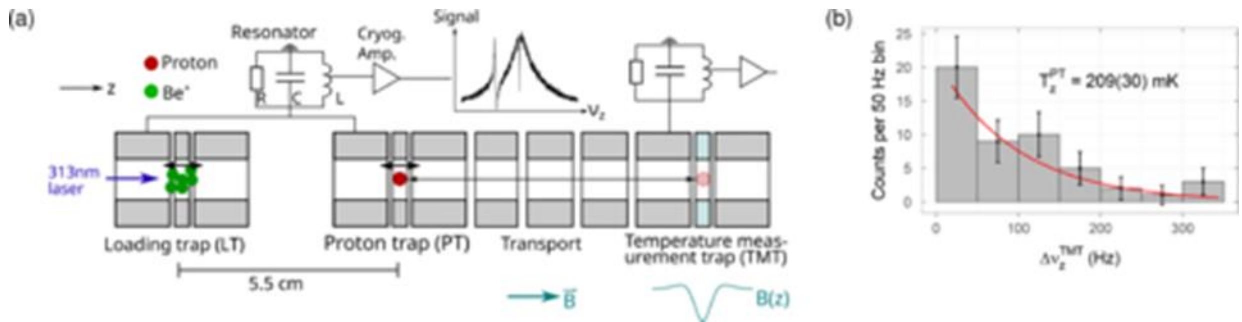
“With the high-tech superconducting magnets, we are now starting to install the FAIR accelerator machine. We have been working towards this consistently and with the greatest commitment for years," says Jörg Blaurock, Technical Managing Director of GSI and FAIR. "All of the high-tech components manufactured worldwide and now ready for installation, were previously developed and tested in sophisticated procedures. This success is the result of careful planning and the enormous commitment of everyone involved. I am proud of the outstanding collaboration between our employees, the cooperation partners from research and industry, the many planning experts and supporters and, of course, our shareholders, who have made possible this transition into the next realization phase of FAIR."

This article was originally published on the GSI website and can be found here



More than 100 of the superconducting dipole magnets weighing several tons are required (Inage credit: GSI)

Image-Current Mediated Sympathetic Laser Cooling of a Single Proton in a Penning Trap Down to 170 mK Axial Temperature



(a) Schematic of the experimental setup. A cloud of beryllium ions is trapped in the loading trap (LT) and a single proton in the proton trap (PT). Both traps are connected to a common resonator. The proton is transported from the PT into the temperature measurement trap (TMT) for measuring its modified cyclotron energy via a quadratic magnetic field inhomogeneity. (b) Typical Boltzmann distribution of a temperature measurement. The red line corresponds to the Boltzmann distribution with a temperature as determined by the maximum-likelihood method.

The BASE collaboration at CERN have set a new temperature record for cooling a single proton, achieving a temperature of just 170 mK. This breakthrough, which was reported in Physical Review Letters, was accomplished using a novel technique called image-current mediated sympathetic cooling. The temperature achieved is a 15 fold improvement on the previous record so this new achievement represents a significant improvement.

The new technique involves using two independent Penning traps to confine a single proton in one and a beryllium ion in the other. The beryllium ion is then cooled using lasers, and the cold ion transfers its energy to the proton through the interaction of their electric fields. This process, known as sympathetic cooling, allows the proton to be cooled to an extremely low temperature.

This new technique is significant because it could be used to cool other types of particles, such as antiprotons and electrons. This could lead to new experiments in particle physics and quantum mechanics such as CPT reversal symmetry tests via magnetic moment and charge-to-mass ratio measurements with protons and antiprotons, magnetic moment measurements of light nuclei, tests of quantum electrodynamics via precision (mass) spectroscopy of highly charged ions, tests of the electroweak force with single molecular ions, as well precision mass measurements of radioactive ions.

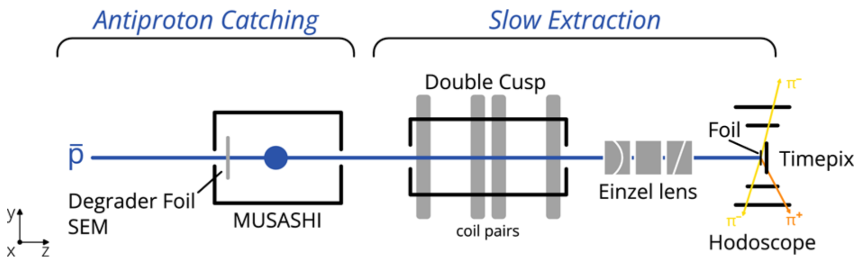
Cooling schemes which rely on image-current coupling can in principle be applicable to any trapped charged particle and experimental systems beyond Penning traps. In particular, once even lower temperatures of about 10 mK (axial) can be reached, the sympathetic cooling will significantly boost the sampling rate and spin state detection fidelity of future g-factor measurements on protons, antiprotons, and other nuclear moments, as well as reduce the dominant systematic uncertainties in mass measurements with the highest precision.

For further information please see the original paper:

C. Will et al. (BASE Collaboration), Image-Current Mediated Sympathetic Laser Cooling of a Single Proton in a Penning Trap Down to 170 mK Axial Temperature, Phys. Rev. Lett. 133, 023002,

DOI:
https://doi.org/10.1103/PhysRevLett.133.023002

Antiproton annihilation at rest in thin solid targets and comparison with Monte Carlo simulations



Schematic overview of the experimental setup. The x-axis points to the reader

The mechanism of antiproton–nucleus annihilation at rest is not fully understood, despite substantial previous experimental and theoretical work. A recently published paper described how slow extracted antiprotons from the ASACUSA apparatus at CERN were used to measure the charged particle multiplicities and their energy deposits from antiproton annihilations at rest on three different nuclei.

The study investigated antiproton-nucleus annihilation at rest in thin (1-2 µm) targets using a 150 eV antiproton beam. The goal was to validate Monte Carlo simulation models (Geant4 and FLUKA) by comparing their predictions of charged particle emission from carbon, molybdenum, and gold targets to experimental data.

FLUKA demonstrated superior performance in predicting the production of Minimum Ionizing Particles (MIPs) and Heavy Ionizing Particles (HIPs), two quantities tightly bound to final-state interactions between initially produced mesons and residual nuclei. FLUKA's predictions agreed with experimental data within 20% relative precision. However, a larger discrepancy (15%) was observed for HIP production in gold targets compared to a previous study, potentially due to the thinner target used in our experiment. This thinner target allowed for the detection of lower-energy particles that could not escape thicker targets.

Among the Geant4 models, CHIPS and INCL showed similar performance, outperforming FTFP in reproducing fragment multiplicities. However, CHIPS has been discontinued. While FTFP underestimates HIP production significantly, it provides the most accurate predictions of deposited energy for heavy prongs.

To further investigate annihilation mechanisms and final-state interactions, new experiments are needed to improve particle identification capabilities, particularly for heavy ionizing particles. A promising approach involves studying annihilations in light nuclei (e.g., Be, C) to isolate specific final-state interactions. Our next project at the AD/ELENA facility will involve a detailed, systematic study of antiproton-nucleus annihilation at rest, covering approximately 15 different nuclei. This study will measure the total multiplicity, kinetic energy, and angular distribution of charged prongs in nearly 4π solid angle, providing valuable insights into final-state interactions and enhancing our understanding of antiproton-nucleus interactions at low energies. The resulting dataset will also serve as a benchmark for validating current and future simulation models.

For further information please see:

Amsler, C., Breuker, H., Bumbar, M. et al. Antiproton annihilation at rest in thin solid targets and comparison with Monte Carlo simulations. Eur. Phys. J. A 60, 225 (2024). https://doi.org/10.1140/epja/s10050-024-01428-x

BASE experiment takes a big step towards portable antimatter

The BASE-STEP transportable trap system, lifted by crane through the AD hall before being loaded onto a lorry. The team monitored all the parameters during transport. (Image credit: CERN)

A team of scientists and engineers have taken an important step towards the goal of being able to store and transport antimatter by transporting a cloud of 70 protons in a truck across CERN's main site.

At the CERN Antiproton Decelerator(AD), scientists produce and trap antiprotons every day. The BASE experiment, which was part of the AVA project, can even contain them for more than a year. However, transporting the antiprotons to another location has so far eluded them, but this is something that scientists working on the BASE experiment hope to change one day with their subproject BASE-STEP: an apparatus designed to store and transport antimatter.

"If you can do it with protons, it will also work with antiprotons," said Christian Smorra, the leader of BASE-STEP. *"The only difference is that you need a much better vacuum chamber for the antiprotons."* This is the first time that loose particles have been transported in a reusable trap that scientists can then open in a new location and then transfer the contents into another experiment. The end goal is to create an antiproton-delivery service from CERN to experiments located at other laboratories.

The BASE experiment aims to answer the question of why the universe is dominated by matter by precisely measuring the properties of antiprotons, such as their intrinsic magnetic moment, and then comparing these measurements with those taken with protons. However, the precision the experiment can achieve is limited by its location.

"The accelerator equipment in the AD hall generates magnetic field fluctuations that limit how far we can push our precision measurements," said BASE spokesperson Stefan Ulmer. *"If we want to get an even deeper understanding of the fundamental properties of antiprotons, we need to move out."*

This is where BASE-STEP comes in. The goal is to trap antiprotons and then transfer them to a facility where scientists can study them with a greater precision. To be able to do this, they need a device that is small enough to be loaded onto a truck and can resist the vibrations that are inevitable during ground transport. The current apparatus weighs 1000 kilograms and needs two cranes to be lifted out of the experimental hall. Even though it weighs a tonne, BASE-STEP is much more compact than any existing system used to study antimatter. Its footprint is five times smaller than the original BASE experiment and it is narrow enough to fit through ordinary laboratory doors.

During the rehearsal, the scientists used trapped protons as a stand-in for antiprotons, but storing protons as loose particles and then moving them onto a truck is a challenge because any tiny disturbance will draw the un-bonded protons back into an atomic nucleus.

While bumpy roads are problematic Smorra noted that the biggest potential hurdle isn't currently the bumpiness of the road but traffic jams: "If the transport takes too long, we will run out of helium at some point," he said. Liquid helium keeps the trap's superconducting magnet at a temperature below 8.2 Kelvin: its maximum operating temperature.

"Eventually we want to be able to transport antimatter to our dedicated precision laboratories at the Heinrich Heine University in Düsseldorf, which will allow us to study antimatter with at least 100-fold improved precision," Smorra said. *"In the longer term, we want to transport it to any laboratory in Europe."* After this successful test the team plans to refine its procedure with the goal of transporting antimatter next year.

Another experiment, PUMA, is also preparing a transportable trap. Next year, it plans to transport antiprotons 600 metres from the AD hall to CERN's ISOLDE facility to study the properties and structure of exotic atomic nuclei.

This article is based on an original article published on the CERN website which can be found here

The BASE-STEP team celebrating the successful transport at the end of the operation. The green signal on the computer screen shows that the 70 loose protons are still "alive", maintained by the magnetic field in the trap. (Image: CERN)

Stern-Gerlach Medal for Klaus Blaum

Prof Dr Klaus Blaum (© Stefanie Aumiller / Max-Planck-Gesellschaft)

Prof Dr Klaus Blaum has been honoured with the Stern-Gerlach Medal by the German Physical Society (DPG) "In recognition of his pioneering developments of Penning ion traps into spectroscopic precision measuring instruments and their applications for tests of the four fundamental interactions, their symmetries, the fundamental constants and thus the standard model of particle physics". This is the DPG's most prestigious honour for outstanding achievements in experimental physics, and it is awarded for work covering the whole field of physics. The award will be presented in March 2025 during the 88th Annual Meeting of the DPG in Bonn.

As Director at the MPI for Nuclear Physics (a partner in the AVA project), Klaus Blaum heads the division "Stored and cooled ions". It deals with precision experiments to determine atomic and nuclear ground state properties of stored ions for tests of fundamental interactions and their symmetries as well as with the study of elementary processes of molecular ions. For this purpose, short-lived radionuclides, antimatter, highly charged ions or simple molecular ions are trapped in Penning traps or in the cryogenic storage ring CSR under space conditions. The development of new storage, cooling and detection techniques for future experiments is also an important research focus of the division.

Klaus Blaum (*1971 in Bad Sobernheim) studied physics at the Johannes Gutenberg University in Mainz, where, after receiving his diploma in 1997 and several research stays at the Pacific Northwest National Laboratory (PNNL) in Richland, USA, he received his doctorate in 2000 under Ernst-Wilhelm Otten (1934 - 2019). Subsequently, he was a research associate at the GSI Helmholtz Centre for Heavy Ion Research in Darmstadt until 2002 and worked at the European Nuclear Research Centre CERN near Geneva. There he was project leader for "Mass Spectrometry of Exotic Nuclei with ISOLTRAP at ISOLDE" until 2004. In October 2004, Blaum took over the position of project leader of the Helmholtz-University Young Investigators Group "Experiments with Stored and Cooled Ions" at the Johannes Gutenberg University Mainz for four years. In 2006 he habilitated there on high-precision mass spectrometry with Penning traps for charged particles and storage rings. Blaum taught at the University of Mainz from 2004 to 2008. He was awarded the 2006 teaching prize of the state of Rheinland-Pfalz for his teaching activities. In 2007 he was appointed Scientific Member of the Max Planck Society and Director at the Max Planck Institute for Nuclear Physics in Heidelberg. This was followed in April 2008 by his appointment as Honorary Professor of the Ruprecht Karls University in Heidelberg. From 2020 to 2023, as one of three Vice Presidents of the Max Planck Society, he was responsible for the Chemical-Physical-Technical Section.

For his ground breaking scientific work with a focus on precision experiments on stored and cooled ions, he has received numerous awards, including the Lise Meitner Prize of the European Physical Society in 2020 and the Otto Hahn Prize of the City of Frankfurt am Main, the Society of German Chemists and the German Physical Society in 2021. He has twice gained an Advanced Grant from the European Research Council, in 2019 he was accepted as an external member of the physics class at the Royal Swedish Academy of Sciences and in 2022 he was admitted to the Heidelberg Academy of Sciences. Since 2024 he has been a member of the "German Academy of Sciences Leopoldina - National Academy of Sciences".

Congrats, Klaus!

This article is based on an article published on the Max Planck Institute for Nuclear Physics website which can be found here

20 years of the Stefan Meyer Institute

On 11 Nov 2024 the Stefan Meyer Institute for subatomic Physics (SMI) in Vienna celebrated its 20 year anniversary. The institute itself is part of a longer history dating back to 1910 when the Institute for Radium Research of the Austrian Academy of Sciences was founded, which was later renamed twice to become SMI. The anniversary was celebrated with a scientific symposium, a ceremony, and a dinner party.

K. Kirch, C. Curceanu, Eberhard Widmann, M. Van Leeuven (Image credit ©Frank Helmrich Photographie)

The symposium covered the research topics of SMI in the study of fundamental interactions and symmetries, spanning the last 20 years. Catalina Curceanu of INFN-LNF spoke about X-ray spectroscopy of kaonic atoms in the SIDDHARTA and SIDDHARTA-2 experiments at LNF Frascati, Marco Van Leeuwen (NIKHEEF) about studies of the Quark Gluon Plasma by the ALICE collaboration at the LHC. Klaus Kirch (PSI and ETH Zürich) presented the opportunities offered at PSI for low-energy precision experiments with neutrons, pions, and muons. Antihydrogen and hydrogen spectroscopy experiments by the ASACUSA collaboration at CERN-AD were presented by Chloé Malbrunot (TRIUMF), and, as the latest addition to SMI's research programme, optical, microwave, and gravitational spectroscopy of cold and ultra cold hydrogen undertaken within the GRASIAN collaboration by Pauline Yzombard (LKB Paris).

The ceremony consisted of greetings by representatives of the Austrian Academy of Sciences, the University of Vienna, and TU Wien, and an overview of the history and achievement of SMI by its director, Eberhard Widmann. The event ended by a reception and a dinner party allowing to contemplate the overview of a broad range of physics topics in a relaxed atmosphere.

C. Malbrunot, Eberhard Widmann, P. Yzombard (Image credit ©Frank Helmrich Photographie)

EXA/LEAP 2024 takes place in Vienna

Delegates at the EXA/LEAP 2024 conference (Image credit: ©Frank Helmrich Photographie)

This year's editions of the Conference on Exotic Atoms and Related Topics (EXA) and the Conference on Low Energy Antiprotons (LEAP) took place from 26 – 30 August 2024 in Vienna in a joint event, EXA/LEAP 2024. It was organized by the Stefan Meyer Institute for Subatomic Physics of the Austrian Academy of Sciences in the impressive premises of the Academy's headquarters.

Due to the dual-track approach, the scientific program included a wide range of topics covering areas such as hadronic physics with antiprotons, exotic hadronic and leptonic atoms, tests of CPT and gravity with antimatter, antimatter in the universe and related experimental techniques.

The recent conference was a resounding success, bringing together researchers from around the world to discuss the latest advances in exciting topics in subatomic physics. The event, which included a mixture of plenary and parallel sessions, was attended by 150 participants who gave more than 100 talks. These included posters, which were exhibited during a special poster session that provided a platform for young researchers to present and discuss their work. The best posters were honoured with a prize donated by NuPECC, which provided additional excitement and motivation.

The program was rounded off by a public evening lecture in which Professor Stefan Ulmer from the University of Düsseldorf presented the topic of antimatter to a wider audience.

The variety of topics and the lively participation of researchers from all over the world helped to make this meeting an enjoyable and significant event, and we are already looking forward to the next edition, which is due to take place in three years' time.

Prof. Eberhard Widmann, chairman of the conference said: *"The depth and clarity of communication shown in the sessions has been truly impressive. I would like to take this opportunity to commend all the presenters for their excellent contributions."*

Obituary: Walter Oelert

Walter Oelert

Our highly esteemed colleague and good friend Walter Oelert passed away on November 25th 2024.

Walter was born in Dortmund on July 14th 1942. He studied physics in Hamburg and Heidelberg, got his diploma in 1969 with a work on solid state detectors in Hamburg and finished his doctoral thesis in 1973 with a work on transfer reactions on samarium isotopes in Hamburg.

As postdoc he stayed for two years from 1973 to 1975 with Prof. Cohen in Pittsburg doing nuclear physics mainly in the field of transfer reactions on rare earth elements.

In 1975 he got a position at the Institute for Nuclear Physics (IKP1) at that time the KFA, later renamed to FZJ (Forschungszentrum Jülich) where he worked on nuclear physics experiments at the Jülich cyclotron.

With the decision to build the cooler synchrotron COSY at FZJ he terminated his work on transfer reactions, summarized it in a review article and switched to the field of medium energy physics. At the end of 1985 he conducted a research stay at CERN contributing with his working group to the PS185 and the JETSET (PS202) experiments at the antiproton storage ring LEAR.

Another external activity was the collaboration with the Swedish partners at the CELSIUS synchrotron in Uppsala.

In 1986 he habilitated at the Ruhr-University Bochum and in 1996 was granted an APL professorship in Bochum.

With the experience gained in the CERN activities he proposed various experiments for the COSY accelerator. As spokesman of an international collaboration he built the COSY-11 experiment, which began data production in 1996. For more than 11 years the COSY-11 experiment was sucessfully in operation and produced important results for various meson production channels. It was an internal experiment for threshold production studies providing full acceptance for the reaction products.

Beside the activities at COSY he continued the investigations at CERN and as a last experiment before the shutdown of LEAR he proposed the production of antihydrogen in the interaction of the antiproton beam with a xenon cluster target.

In 1995 the experiment was performed resulting in the production of 9 antihydrogen atoms. This result was an important factor for the decision of the CERN management to build the antiproton-decelerator (AD). In order to continue anti hydrogen-studies he got substantial support from Jülich for a partnership in the new ATRAP experiment with the spokesman Jerry Gabrielse aiming for CPT violation studies in the anti hydrogen spectroscopy.

In 2008 Walter officially retired but he kept active with the antiproton activities at the AD for more than 10 years, during which he was affiliated with the Johannes Gutenberg-University of Mainz. He was a main driving force on the way to the extra low energy antiproton ring (ELENA) which finally was built and drastically improves the performance for the antimatter experiments.

During his activities he received a number of honors, notably are the awarding of the Merentibus Medal of the Jagiellonian University of Cracow and the election as an external member of the Polish Academy of Arts and Sciences.

Walter's personality: competent, inspiring, open minded and friendly was the type of glue which made active, successful and happy collaborations.

Dieter Grzonka, Kurt Kilian and Thomas Sefzick

FCC Virtual Challenge reloaded

The QUASAR Group based at the Cockcroft Institute / University of Liverpool is re-launching "Run the Length of the Future Circular Collider," a virtual fitness challenge designed to help you reach your health goals while exploring the exciting world of physics!

This virtual challenge invites you to run or walk the distance of the Future Circular Collider, a proposed accelerator for the post-LHC era that would span an astonishing 91km circumference, at your own pace, between 1 and 31 December 2024. You can walk or run anywhere, tracking your progress and submitting your results through our easy-to-use registration website: https://shorturl.at/0ISV9

Position Vacancies

Open positions at the University of Liverpool/The Cockcroft Institute:

The QUASAR Group offers several ***Fellowships and PhD positions*** over a range of projects.

Find out more

Events

1st – 6th June 2025	International Particle Accelerator Conference (IPAC25), Taipei, Taiwan
1st - 6th June 2025	International Conference on Positron Annihilation (ICPA20) Takamatsu, Japan.
8 – 10 August 2025	International Workshop on Low-Energy Positron + Positronium Physics, Matsue, Japan
7th - 11th Sep 2025	14th International Beam Instrumentation Conference (IBIC25), Liverpool, UK
20th – 25th May 2029	International Particle Accelerator Conference (IPAC29), Liverpool, UK

Notice Board

Help us communicate interesting events, updates and latest R&D in antimatter physics and send us your news and updates.

MIRROR – A newsletter for friends of antimatter physics

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