MS 8: Poster

Time: Thursday 16:00–18:00 Location: Lichthof

MS 8.1 Th 16:00 Lichthof

An optimized ion-optical setup for AMS of ^{10}Be with a degrader foil — •Martin Martschini, Oliver Forstner, Robin Golser, Walter Kutschera, Leonard Michlmayr, Alfred Priller, Peter Steier, and Anton Wallner — VERA Laboratory, Universität Wien - Fakultät für Physik - Isotopenforschung, Austria

The challenge in accelerator mass spectrometry (AMS) of ^{10}Be ($t_{1/2}$=1.4 Ma) is the suppression of the stable isobar ^{10}B. One method established in recent years at VERA (Vienna Environmental Research Accelerator), is the use of a thin degrader foil to introduce an energy difference between ^{10}Be and ^{10}B, followed by an additional energy-sensitive bending element and a split-anode ionization chamber. While this setup has considerably reduced our background (^{10}Be/^{9}Be $< 10^{-15}$), it initially suffered from a poor transmission after the degrader foil.

In order to optimize our setup, we have measured the phase space of a ^{9}Be^{2+}-beam and determined the transverse emittance and energy distribution of the beam. These results were used in ion-optical simulations of our high energy beamline. They allowed to identify the beamline elements responsible for transmission losses and helped to plan modifications of our quadrupole doublet and the switcher magnet chamber. Thereby, the transmission increased by a factor of 3. At VERA, the degrader foil method now clearly outperforms other established methods for samples with ^{10}Be/^{9}Be ratios lower than 10^{-13}.

MS 8.2 Th 16:00 Lichthof

TRIGA-TRAP: High-precision mass measurements on neutron-rich fission products and actinoids — •J. Ketelaer[1], T. Beyer[2,3], M. Block[4], K. Eberhardt[1], M. Eibach[1,3], F. Herfurth[4], Sz. Nagy[2,4], C. Smorra[1,3], W. Nörtershäuser[1,4], and K. Blaum[2,3] — [1]Johannes Gutenberg-Universität, 55128 Mainz — [2]Max-Planck-Institut für Kernphysik, 69117 Heidelberg — [3]Ruprecht-Karls-Universität, 69117 Heidelberg — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt

Triga-Trap is currently the only Penning trap mass spectrometer installed at a nuclear reactor. High-precision mass measurements on neutron-rich fission products and actinoids will be performed here to provide valuable input data for tests of nuclear structure models as well as for astrophysical calculations of the r-process. The setup also serves as a test bench for the development of new detection techniques which will be implemented at other experiments at the future GSI facility FAIR. As an example, a non-destructive image current detection system will allow mass measurements on single stored singly-charged ions whereas a few hundred to thousands are typically needed with the traditionally used time-of-flight resonance method. Triga-Trap is presently the only on-line Penning trap mass spectrometer where simultaneously the destructive and non-destructive detection techniques are implemented. The poster will show the technical developments and give an overview on first time-of-flight mass measurements already performed on rare earth elements and actinoids.

MS 8.3 Th 16:00 Lichthof

Minimization of environmental influences for precision mass measurements — •Sebastian Streubel[1], Christoph Diehl[1], Jochen Ketter[1], Martin Höcker[1], David B. Pinegar[1], Robert S. Van Dyck Jr.[2], and Klaus Blaum[1] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany — [2]Department of Physics, University of Washington, Seattle, WA 98195-1560, USA

In an experiment with a double-Penning trap mass spectrometer, we aim to measure the mass ratio of ^{3}H to ^{3}He with a precision of 10^{-11} and below. This mass ratio gives an independent measurement of the tritium Q-value and is thus of relevance for the determination of the electron antineutrino mass by the Karlsruhe Tritium Neutrino Experiment (KATRIN). To obtain the desired precision, it is important to control the environmental influences. For the best B-field control possible, we stabilize the pressure and the height of the liquid He surrounding the traps and the temperature of the room in which the magnet stands. We actively compensate the drift of the geomagnetic field, and reduce the coupling of vibrations to the magnet from the movement of the building.

MS 8.4 Th 16:00 Lichthof

Ion cyclotron resonance detection techniques at TRIGA-TRAP — •K. Knuth[1], T. Beyer[2,3], K. Blaum[2,3], M. Block[4], K. Eberhardt[1], M. Eibach[1,3], F. Herfurth[4], J. Ketelaer[1], C. Smorra[1,3], and Sz. Nagy[2,4] — [1]Johannes Gutenberg-Universität, 55128 Mainz — [2]Max-Planck-Institut für Kernphysik, 69117 Heidelberg — [3]Ruprecht-Karls-Universität, 69120 Heidelberg — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt

In Penning trap mass spectrometry the mass of stored ions is obtained via a determination of the cyclotron frequency $\nu_c = qB/(2\pi m)$, for which two different techniques are available. The destructive time-of-flight ion cyclotron resonance (TOF-ICR) technique, based on the measurement of the flight time of excited ions, is the established method for measurements on short-lived radionuclides. It is not ideally suited for rarely produced ion species, since typically some hundred ions are required for a single resonance spectrum. At the Penning trap mass spectrometer TRIGA-TRAP therefore a non-destructive narrow-band Fourier transform ion cyclotron resonance (FT-ICR) detection system is being developed. It is based on the detection of the image currents induced by the stored ions in the trap electrodes and will ultimately reach single ion sensitivity. TRIGA-TRAP also features broad-band FT-ICR detection for the coarse identification of the trap content. Additionally, the TOF-ICR detection system has been recently improved to utilize the Ramsey excitation technique to gain in precision, and the position information of the ion impact to further suppress background events in the final time-of-flight spectrum.

MS 8.5 Th 16:00 Lichthof

Detection System for a ^{3}H/^{3}He Mass-Ratio measurement — •Jochen Ketter[1], Christoph Diehl[1], Martin Höcker[1], David B. Pinegar[1], Sebastian Streubel[1], Robert S. Van Dyck Jr.[2], and Klaus Blaum[1] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Deutschland — [2]Department of Physics, University of Washington, Seattle, WA 98195-1560, USA

More precise knowledge of the Q-value of the β-decay of ^{3}H to ^{3}He will complement the determination of the electron antineutrino's mass by the Karlsruhe Tritium Neutrino Experiment (KATRIN) [1]. In order to improve the presently accepted Q-value [2] by a factor of 25 to an uncertainty of 50 meV, the mass ratio of ^{3}H to ^{3}He has to be measured with an uncertainty of less than 10^{-11}. Penning trap mass spectrometry has the prospect of doing so. To this end, a double Penning trap mass spectrometer [3], originally developed and built at the University of Washington, has been commissioned in a dedicated laboratory in Heidelberg. The mass measurement relies on the determination of the ion's three eigenfrequencies in the trap. While a frequency-locked loop keeps the ion's axial frequency in resonance with a tuned circuit, the other two frequencies are determined via shifts induced in the axial frequency due to higher-order couplings when sweeping through resonances. Details of the detection system will be given.

[1] E. W. Otten *et al.*, Int. J. Mass Spectrom. 251 (2006) 173–178
[2] Sz. Nagy *et al.*, Europhys. Lett., **74** (3), pp. 404–410 (2006)
[3] D. B. Pinegar *et al.*, Hyperfine Interactions (2007) 174:47–53

MS 8.6 Th 16:00 Lichthof

PENTATRAP: A cryogenic multi-Penning trap experiment for high-precision mass measurements on highly charged ions. — •Julia Repp[1,2], Christine Böhm[1,2], José Crespo López-Urrutia[1], Sergey Eliseev[1], Yuri Novikov[5], David Pinegar[1], Wolfgang Quint[2,4], Andreas Rosa[1,2], Christian Roux[1,2], Sven Sturm[3], Stefan Ulmer[1,2,3], and Klaus Blaum[1,2] — [1]Max-Planck-Institut für Kernphysik, D-69117 Heidelberg — [2]Ruprecht-Karls-Universität Heidelberg, D-69120 Heidelberg — [3]Institut für Physik, Johannes Gutenberg-Universität Mainz, D-55099 Mainz — [4]GSI Helmholtzzentrum für Schwerionenforschung, D-64291 Darmstadt — [5]St. Petersburg Nuclear Physics Institute, Gatchina Russia

The PENTATRAP experiment is under construction at the Max-Planck-Institut für Kernphysik Heidelberg. It aims for high-precision mass measurements of stable, highly charged nuclides up to uranium with an accuracy of $\delta m/m \approx 10^{-11}$. Primary goals are for example tests of quantum electrodynamics and of electron correlations in the regime of extreme fields as well as neutrino oriented mass measurements on *e.g.* ^{163}Ho. In order to achieve the desired accuracy, a setup

of five cryogenic Penning traps including a dedicated detection system is designed. This setup will guarantee a fast ion exchange between a reference ion and an ion of interest as well as an observation of the magnetic field over the measurement time. The planned experimental setup as well as its present status will be presented.

MS 8.7 Th 16:00 Lichthof

A multi-passage spectrometer for charge-state separation at MLLTRAP [*] — •Christine Weber[1], Eva Gartzke[1], Dietrich Habs[1], Veli Kolhinen[2], Kevin Krug[1], Jerzy Szerypo[1], and Peter Thirolf[1] — [1]Fakultät für Physik, LMU - München — [2]Department of Physics, University of Jyväskylä

MLLTRAP is a Penning trap mass spectrometer facility which is currently being commissioned at the Maier-Leibnitz Tandem Accelerator Laboratory in Garching. Here, atomic mass values are determined by comparison of cyclotron frequencies, $\omega_c = qB/m$, of stored ions with mass m and charge q in a strong magnetic field B, relative to those of well-known ion species. One of the future goals of MLLTRAP is to utilize highly-charged ions for an improvement in the achievable mass accuracy $\delta m/m$. For this purpose, singly-charged ions will have to be injected into a charge-breeding device, such as an EBIT, and transferred back towards the Penning traps, while being q/A selected. A multi-passage-spectrometer (MPS) is being built to fulfill these tasks. It consists of a fast-ramping, round-pole dipole magnet with a four-way electrostatic mirror system [2]. In this presentation, the planned MLLTRAP setup focussing on the q/A-selection with the MPS system will be presented.

[1] V.S. Kolhinen *et al.*, Nucl. Instr. and Meth. A **600** (2009) 391.
[2] A. Lakatos, Diploma Thesis, University of Frankfurt (1992).
[*] Supported by the DFG under contract HA 1101/14-1 and MLL.

MS 8.8 Th 16:00 Lichthof

Commissioning of the double Penning trap system MLLTRAP and first studies on mass-dependent systematic uncertainties* — •Kevin Krug[1], Christine Weber[1], Peter G. Thirolf[1], Jerzy Szerypo[1], Veli Kolhinen[1,2], Eva Gartzke[1], and Dietrich Habs[1] — [1]Fakultät für Physik, LMU München — [2]Department of Physics, University of Jyväskylä

The cylindrical double Penning trap system MLLTRAP in its commissioning phase at the Maier-Leibnitz-Laboratory (MLL) Tandem accelerator in Garching is designed to perform high-accuracy mass measurements on fusion-reaction products. As the mass uncertainty is inversely proportional to the ionic charge state, the ions of interest will be charge bred prior to injection into the Penning trap system. In the future setup, both traps are foreseen to be operated as measurement traps with a relative homogeneity of the magnetic field at the trapping sites of $\Delta B/B \leq 0.3$ ppm. In the commissioning phase, an offline surface ionization source is used for iterative optimization of the apparatus and studies on mass-dependent systematic uncertainties. Mass measurements via the time-of-flight ion cyclotron resonance method (TOF-ICR) of reference ions with well-known masses (^{85}Rb, ^{87}Rb, ^{39}K, ^{133}Cs) were carried out to analyze mass-dependent systematic effects. Together with previous studies on the uncertainty due to magnetic-field fluctuations the current status with respect to the limits of mass accuracy of the apparatus will be presented.

* Supported by DFG under contract HA 1101/14-1 and by Maier-Leibnitz-Laboratory,Garching.

MS 8.9 Th 16:00 Lichthof

A complementary laser system for ISOLDE-RILIS — •Sebastian Rothe[1,2], Christoph Mattolat[2], Bruce Marsh[1], Klaus Wendt[2], and Valentin Fedosseev[1] — [1]CERN, Geneva, Switzerland — [2]Institut für Physik, Universität Mainz

The resonant laser ion source (RILIS) is a well-established tool for efficient and selective production of radioactive ion beams (RIBs) at ISOL facilities. Element selectivity is achieved by applying stepwise resonant ionization using up to three different laser wavelengths. Due to their advantages in terms of stability and reliability, an all solid-state titanium:sapphire (ti:sa) system is used or is planned to be installed at the majority of on-line facilities worldwide. Ti:sa lasers are pumped by frequency doubled Nd:YAG lasers at a repetition rate of typically 10 kHz and generate radiation in the near infrared between 690 nm and 960 nm at output powers of 3 W and a typical spectral line width of 3 GHz.

Such an all solid-state ti:sa laser system is going to be installed at the ISOLDE-RILIS, CERN alongside the well-established dye laser system. Primary objective of this complementary laser system is a reduction in the RILIS downtime during laser configuration changes for ionization of different elements requested by ISOLDE users. Secondary benefits such as better beam quality and power stability, and therefore lower maintenance during operation, are expected.

The progress of these activities at CERN will be discussed and future projects such as in-source spectroscopy and refined on-line laser surveillance will be covered.

MS 8.10 Th 16:00 Lichthof

Novel techniques for laser ionization at the IGISOL facility - an inductively-heated RF hot cavity and the gas jet method — •Volker Sonnenschein, Iain Moore, Mikael Reponen, and Juha Äystö — University of Jyväskylä, Finland

Experiments have revealed a (21^+) isomeric state in ^{94}Ag. Recently the observed decay modes, including a two proton decay, have been brought into question. For further investigation an inductively-heated hot cavity designed to operate at temperatures of up to 2300 K has been developed at JYFL for the production of radioactive silver ion beams. An efficient laser ionization scheme for silver has already been tested, though a further search for autoionizing states using a grating-based Ti:Sapphire laser is planned.

The SPIG (Sextupole Ion Guide) allows for element selective ionization of the on-line produced radioactive species at IGISOL by using resonant laser ionization of atoms in an expanding gas jet and trapping the produced ions by RF fields. Visualization of the jet by a DC discharge showed a large angular spread of the gas jet, which would result in a poor overlap geometry between the atoms and the counter-propagating laser beams. Offline studies of the gas flow as a function of nozzle design, gas cell pressure and background extraction chamber pressure have been carried out. The velocity of the jet has been probed using resonance ionization spectroscopy of nickel atoms evaporated from a filament. A clear shift in the resonance centroid compared to ionization in the gas cell indicates a supersonic jet expansion.

MS 8.11 Th 16:00 Lichthof

Zweiphotonen- und Einphotonen-Circulardichroismus — •Christoph Logé und Ulrich Boesl — Technische Universität München, Deutschland

Nichtlineare Photonen-Prozesse sind aufgrund ihrer besonderen und oftmals zu linearen Prozessen unterschiedlichen Charakteristika interessant. Die Verknüpfung von Zweiphotonenabsorption mit Circulardichroismus lässt eine Reihe neuer Effekte erwarten. Ein großer Vorteil ist, dass nun spektrale Bereiche im VUV mit sichtbarem und nahem UV-Licht erreichbar sind. Erste Hinweise auf die Besonderheiten des Zweiphotonen-Circulardichroismus sind aus theoretischen Betrachtungen abzuleiten. Aktuelle detaillierte quantenmechanische Berechnungen der Effekte zeigen, dass bei Zweiphotonen-Circulardichroismus teilweise wesentlich höhere Effekte als bei Einphotonen-Circulardichroismus zu erwarten sind. Die vorliegenden Untersuchungen mittels enantiosensitiver Lasermassenspektrometrie wurden an verschiedenen elektronischen Übergängen des Moleküls 3-Methylcycopentatnon durchgeführt. Die resonante Multiphotonenionisation über die ersten angeregten Zustände konnte sowohl im Ein- als auch im Zweiphotonenprozess durchgeführt werden. Höher angeregte Zustände wurden ebenfalls untersucht. Es konnte gezeigt werden, dass der Zweiphotonen-Circulardichroismus teilweise um Größenordnungen über dem Einphotonen-Circulardichroismus liegt. Der Effekt ist besonders interessant für die Untersuchung elektronisch erlaubter Übergänge, deren lineare optische Aktivität normalerweise gering ist.

MS 8.12 Th 16:00 Lichthof

Festkörper-Massenspektrometrie an SiO_2-Proben durch Nd:YAG-Laserpuls-induzierte Si-O-Plasmaerzeugung — •Bernhard Wiedemann[1], Michael Deveaux[1], Michael Petri[1], Christoph Schrader[1], Tobias Tischler[1] und Karl-Heinz Wiedemann[2] — [1]Institut für Kernphysik, Max-von-Laue-Str. 1, D-60438 Frankfurt am Main — [2]Heraeus Quarzglas, D-63450 Hanau

Mit einem grünen Q-switch Nd:YAG-Laser hoher Leistungsdichte werden unter Ultrahochvakuum-Bedingungen Silicium-Sauerstoff-Plasmen erzeugt. Es werden transparente und hochreine Siliciumdioxid-Scheiben verwendet und derart bewegt, dass im Laserfokus und im Takt der Laserpulse an der Oberfläche Krater (Durchmesser < 40 μm) gebildet und aneinander gereiht werden. Es entstehen Atom-, Molekül- und Cluster-Ionen, die simultan mit einem Massenspektrometer, Typ 21-110, nachgewiesen und für Elemente von Wasserstoff bis Uran qualitativ und quantitativ analysiert werden.

MS 8.13 Th 16:00 Lichthof

An RFQ beam preparation system for SHIPTRAP — •Thorsten Schäfer[1], Emma Haettner[1,2], Wolfgang Plass[1,2], Arno Becker[1], Ulrich Czok[2], Timo Dickel[1], Hans Geissel[1,2], Wadim Kinsel[2], Felix Lautenschläger[1], Martin Petrick[1], Christoph Scheidenberger[1,2], Richard Thöt[1], and Josephina Werner[1] — [1]Justus Liebig Universität, Gießen — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

A radio frequency quadropole (RFQ) system for beam preparation, reduction and matching of the phase-space has been developed for the Penning trap facility SHIPTRAP. The system consists of an RFQ cooler, an RFQ mass filter and an RFQ buncher and will allow to cool, mass seperate and bunch the nuclei of interest from unwanted species, which contaminate the ion sample and often deteiorate the quality of the measurement, sometimes even obscure the measured data.

The targeted performance of the mass filter are highest possible transmission at unit mass resolution. For this purpose the RFQ cooler, mass filter and buncher have been developed and built in a matched combination. High quality RF coils have been built, which enable RF voltages with amplitudes up to 2 kV, and the RF voltage has been stabilized to the level of 0.1%.

For highest quality of the extracted ion bunches RF-free, dipolar extraction from the RF buncher has been implemented. The RF-free extraction of the buncher has been realised using a special damping circuit. In order to increase its efficiency, the RFQ buncher is designed as a two stage trap system.

MS 8.14 Th 16:00 Lichthof

Extremely high mass resolution and sensitivity - comparison of two novel proton transfer reaction time-of-flight mass spectrometers (PTR-TOFMS) — Alfons Jordan[1], •Philipp Sulzer[1], Simone Jürschik[1], Stefan Jaksch[1], Gernot Hanel[1], Eugen Hartungen[1], Hans Seehauser[1], Lukas Märk[1], Stefan Haidacher[1], Ralf Schottkowsky[1], and Tilmann Märk[1,2] — [1]IONICON Analytik GmbH, Technikerstr. 21a, 6020 Innsbruck, Austria — [2]Institut für Ionenphysik und Angewandte Physik, Universität Innsbruck, Technikerstr. 25, 6020 Innsbruck, Austria

Since many years PTR-MS is a well established technique in trace gas analysis with its major advantages of having very short response times of below 100ms and outstanding detection limits in the single digit pptv region. However, the quadrupole mass filter based instruments used so far cannot separate isobaric compounds due to lack of mass resolution. To overcome this problem Ionicon developed the so called PTR-TOF 8000 instrument, which couples the well established PTR ionization technique with a high resolution time-of-flight (TOF) mass analyzer. In contrast to a quadrupole based PTR-MS where only one nominal mass at a time can be monitored, the PTR-TOF acquires whole mass spectra in split-seconds at a resolution of up to 8.000 m/Δm (FWHM). As there might be applications where an enormous mass resolution is not necessarily needed, but the sensitivity has to be as high as possible, we now developed an instrument (called PTR-TOF 2000) that performs with an enhanced sensitivity at the expense of a somewhat lower mass resolution.

MS 8.15 Th 16:00 Lichthof

Distinguishing isomers and entering the ppqv detection limit region - latest developments in PTR-MS instruments — Alfons Jordan[1], Philipp Sulzer[1], Simone Jürschik[1], Stefan Jaksch[1], Gernot Hanel[1], Eugen Hartungen[1], Hans Seehauser[1], •Lukas Märk[1], Stefan Haidacher[1], Ralf Schottkowsky[1], and Tilmann Märk[1,2] — [1]IONICON Analytik GmbH, Technikerstr. 21a, 6020 Innsbruck, Austria — [2]Institut für Ionenphysik und Angewandte Physik, Universität Innsbruck, Technikerstr. 25, 6020 Innsbruck, Austria

We report on the latest instrumental developments, namely i) the improvement of the detection limit that now allows for measuring trace gas compounds in a concentration range from several ppmv down to the ppqv (parts-per-quadrillion) region with a typical response time well below 100ms and, in case a TOF mass analyzer is used, a mass resolution better than 5.000 m/Δm and ii) the possibility to switch between H3O+, NO+ and O2+ as reagent ions. We show, that the sensitivities obtained with NO+ and O2+ are comparable or even better to the outstanding sensitivity of the established PTR-MS instruments and therefore well above those from e.g. SIFT-MS instruments. To demonstrate the advantages of the new setup we e.g. measured acetone and propanal (isomeric molecules at nominal mass 58amu) utilizing NO+ as the precursor ion. We see the isomeric compounds on different nominal masses and can identify them unambiguously. Furthermore, by using O2+ precursor ions we are able to ionize molecules that cannot be measured via hydronium proton transfer reaction.

MS 8.16 Th 16:00 Lichthof

Direct aqueous injection analysis of trace compounds in water with proton-transfer-reaction mass spectrometry (PTR-MS) — Simone Jürschik[1], Philipp Sulzer[1], Stefan Jaksch[1], Stefan Haidacher[1], Alfons Jordan[1], Ralf Schottkowsky[1], Eugen Hartungen[1], Gernot Hanel[1], Hans Seehauser[1], •Lukas Märk[1], and Tilmann Märk[1,2] — [1]IONICON Analytik GmbH, Technikerstr. 21a, 6020 Innsbruck, Austria — [2]Institut für Ionenphysik und Angewandte Physik, Universität Innsbruck, Technikerstr. 25, 6020 Innsbruck, Austria

Here we report on a new instrumental development that allows for direct analysis of liquid samples. The direct aqueous injection (DAI) technique which we will present here turns out to be an ideal solution for direct analysis of liquid samples with PTR-MS. Water solutions were prepared with 1 to 1000 ppbw (part per billion weight) concentrations of methanol, acetonitrile, pyridine (in this case additional mixtures down to 125 pptw were prepared) and cyclohexanol in distilled water. We found that the detection of trace compounds in water is possible over several orders of magnitude down to a concentration level of about 100 pptw (for pyridine at protonated mass m/z = 80 and for about 5 min integration time) with great linearity, while only consuming about 100 ul of the sample. The response time of the setup is between 20 and 25 seconds. This method is applicable to the analysis of all substances and not limited by the permeability of a membrane. Therefore it will open completely new fields of application for the PTR-MS technique.

MS 8.17 Th 16:00 Lichthof

Design and Construction of an Energy Buncer for a Multiple-Reflection Time-of-Flight Isobar Separator — •Felix Lautenschläger[1], Timo Dickel[1], Hans Geissel[1,2], Christian Jesch[1], Wolfgang R. Plass[1,2], Christoph Scheidenberger[1,2], and Mikhail I. Yavor[3] — [1]Justus-Liebig-Universität Giessen — [2]GSI, Darmstadt — [3]Inst. for Analytical Instrum., Russian Academy of Sci., St. Petersburg

A high resolution, multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) has been developed. It can be used as an isobar separator delivering an isobarically clean beam of short-lived nuclei to connected experiments. The ions are injected into the MR-TOF-MS analyser by an ion trap system with a kinetic energy of 1.5 keV. The longitudinal spatial distribution of the ions inside the ion trap causes an energy spread of the injected ion population. In order to efficiently recapture these ions after mass separation, it is necessary to reduce the energy spread.This is achieved by employing a homogenous electric field, in which the ions are retarded until they have almost the same kinetic energy. Then, the field is pulsed down and the almost monenergetic ions are injected into an accumulation trap. The energy buncher consists of two systems of ring electrodes. The first system reduces the energy spread, while the second decelerates and focuses the ions into the accumulation trap.
In the simulation, the average energy spread of the ions has been reduced by a factor of 13. The design of the energy buncher, simulations and first experimental results will be shown.

MS 8.18 Th 16:00 Lichthof

Untersuchung von Oktupolanregung in der Präparationspenningfalle von ISOLTRAP — Marco Rosenbusch[1], Klaus Blaum[2], Christopher Borgmann[2], Martin Breitenfeldt[1], Daniel Fink[2], Alexander Herlert[3], Magdalena Kowalska[3], Susanne Kreim[2], Dave Lunney[4], Gerrit Marx[1], Sarah Naimi[4], Lutz Schweikhard[1] und •Robert Wolf[1] — [1]Universität Greifswald — [2]Mpi für Kernphysik, Heidelberg — [3]Cern, Genf, Schweiz — [4]Csnsm, Orsay, Frankreich

In vielen Bereichen der Physik werden Penningfallen zum Speichern und Präparieren von Ionen genutzt. Für die Kernmassenspektroskopie bei ISOLTRAP [1] ist das massenselektive Kühlen von Ionen mit hohem Auflösungsvermögen ($R = \frac{m}{\delta m} = 10^5$) eine wirksame Technik, um Ionen von isobaren Kontaminationen zu separieren. Dazu wird in einer puffergasgefüllten Präparationspenningfalle eine azimutale Quadrupolanregung auf der Zyklotronfrequenz $\nu_c = q/m \cdot B$ der zu zentrierenden Ionen eingestrahlt, um die Magnetronbewegung der Ionen in die schnellere Zyklotronbewegung umzuwandeln und diese im

Puffergas zu kühlen [2]. In diesem Beitrag werden Untersuchungen zur Oktupolanregung als alternative Anregungsform vorgestellt, mit dem Ziel der Erhöhung des Auflösungsvermögens.

[1] M. Mukherjee *et al.*, Eur. Phys. J. A 35, 1-29(2008)
[2] G. Savard *et al.*, Phys. Lett. A 158, 247-252(1991)