MS 7: Poster

Zeit: Dienstag 16:00–18:00 Raum: VMP 9 Poster

MS 7.1 Di 16:00 VMP 9 Poster

The MPIK/UW-PTMS: a tool for a precision measurement of the ^{3}H/^{3}He mass ratio — •Christoph Diehl[1,2], David Pinegar[1], Robert Van Dyck Jr.[3], and Klaus Blaum[1,2] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany — [2]Physikalisches Institut, Ruprecht-Karls-Universität, 69120 Heidelberg, Germany — [3]Department of Physics, University of Washington, Seattle, WA 98195-1560, USA

The MPIK/UW-PTMS (Max-Planck-Institut für Kernphysik/University of Washington-Penning trap mass spectrometer) is a high precision tool for the measurement of the ^{3}H/^{3}He mass ratio. A determination of this ratio to a precision of 1 part in 10^{11} would help the data analysis of the KATRIN (Karlsruhe tritium neutrino) experiment. The spectrometer was developed at the University of Washington, Seattle and is set up again at the Max-Planck-Institut für Kernphysik in Heidelberg. We present our measurement principle together with newly developed techniques. To minimize contaminations an external Penning ion source is utilized. The mass measurements are performed in a double Penning trap sitting in an ultrastable (field drift of only 17 ppt/h) 6-T magnet, where both a single ion of ^{3}H and ^{3}He will be stored and their masses are alternately measured. This will help to suppress long-term drift effects in the electric and magnetic fields of the spectrometer. The experiment is completely installed in Heidelberg and starts measurements in 2009.

MS 7.2 Di 16:00 VMP 9 Poster

Measurement principle and setup of detection electronics at the PENTATRAP project — •Christian Roux[1], Jose Crespo Lopez-Urrutia[1], Christoph Diehl[1], Sebastian George[1], Jens Ketelaer[2], Szilard Nagy[2], Yuri Novikov[3], David Pinegar[1], Wolfgang Quint[4], Julia Repp[1], Andreas Rosa[1], Stefan Ulmer[2], and Klaus Blaum[1] — [1]Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany — [2]Institut für Physik, Johannes Gutenberg-Universität, 55128 Mainz, Germany — [3]St. Petersburg Nucl. Phys. Inst., 188300 Gatchina, Russia — [4]Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt

The PENTATRAP project is a new cryogenic Penning trap setup currently under construction at the MPI-K in Heidelberg. It is dedicated to mass measurements of single highly-charged ions. To achieve high precision, a stack of five cylindrical Penning traps will be utilized. Mass measurements will take place in the central precision trap. Additionally, there are two preparation traps, which enable a fast exchange of the ion of interest and the reference ion. On each end of the trap tower a monitor trap will be placed, where permanent storage of single ions and continuous observation of their cyclotron frequency is possible. For detection of the ions the non destructive image current technique will be applied for each trap. Therefore, the trap electrodes are connected to tuned circuits consisting of high-Q inductors followed by very low-noise cryogenic amplifiers or a SQUID.

On this poster the measurement process as well as the individual detection circuits and their present design status will be presented.

MS 7.3 Di 16:00 VMP 9 Poster

Quadrupole deflector of the double Penning trap system MLLTRAP [*] — •Eva Gartzke, Veli Kolhinen, Dietrich Habs, Jürgen Neumayr, Christian Schürmann, Jerzy Szerypo, and Peter Thirolf — Fakultät für Physik, LMU München and Maier-Leibnitz Laboratory, Am Coulombwall 1, 85748 Garching, Germany

A cylindrical double Penning trap has been installed and successfully commissioned at the Maier-Leibnitz Laboratory in Garching. This trap system has been designed to isobarically purify low energy ion beams and perform highly accurate mass measurements [1].

An electrostatic quadrupole deflector has been designed and installed at the injection line of the Penning trap system enabling a simultaneous use of an online ion beam with reference ions from an offline ion source. Alternatively two offline sources can be used concurrently e.g. an α recoil sources providing heavy radioactive species (e.g ^{240}U) together with reference mass ions (which in the future will be e.g. a carbon cluster ion source).

The bender has been designed for beam energies up to 1 keV with q/A ratios 1/1-1/250.

This presentation will show the technical design and the operating parameters of the quadrupole beam bender and its implementation at the MLLTRAP system.

[*] Supported by DFG under contract HA 1101/14-1.

[1] V.S. Kolhinen et al., Nucl. Instr. Meth B 266 (2008) 4547.

MS 7.4 Di 16:00 VMP 9 Poster

Carbon cluster mass calibration at the double Penning trap mass spectrometer TRIGA-TRAP — •Christian Smorra[1,2], Klaus Blaum[1,3], Klaus Eberhardt[2], Martin Eibach[5], Frank Herfurth[4], Jens Ketelaer[5], Jochen Ketter[5], Konstantin Knuth[5], and Szilard Nagy[3] — [1]Physikalisches Institut, Universität Heidelberg, D-69120 Heidelberg — [2]Institut für Kernchemie, Universität Mainz, D-55128 Mainz — [3]Max-Planck Institut für Kernphysik, D-69117 Heidelberg — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt — [5]Institut für Physik, Universität Mainz, D-55128 Mainz

TRIGA-TRAP is a facility which aims for mass measurements on neutron-rich short-lived fission products and actinides with relative mass uncertainties of 10^{-7} and below [Ket08]. To this end the cyclotron frequency of a stored ion in a Penning trap is determined. In high-precision mass spectrometry the investigation of systematic errors is of utmost importance. In order to demonstrate the accuracy of the measured values, various carbon cluster ions have been used in cross reference measurements. The results will be presented and the accuracy limit of TRIGA-TRAP is going to be discussed.

[Ket08] J. Ketelaer et al., Nucl. Instr. Meth. A 594 (2008) 162-177.

MS 7.5 Di 16:00 VMP 9 Poster

Manipulation der Ionenbewegung in einer Paulfalle — •Steffi Bandelow, Gerrit Marx und Lutz Schweikhard — Institut für Physik, Ernst-Moritz-Arndt Universität, D-17489 Greifswald

Paulfallen in Form von dreidimensionalen harmonisch oszillierenden elektrischen Feldern, sog. Führungsfeldern, erlauben die Speicherung geladener Teilchen. Bei geeigneten Fallenparametern erfahren die Ionen im zeitlichen Mittel eine zum Fallenzentrum rücktreibende lineare Kraft. Mittels Einstrahlung weiterer Hochfrequenzfelder können die Ionenbewegungen beeinflusst werden. Zusätzlich zum Studium axialer Anregungsmoden wurden Untersuchungen zu radialen Anregungstypen sowohl in Simulationen als auch im Experiment durchgeführt.

MS 7.6 Di 16:00 VMP 9 Poster

Design of a switchable low-noise power supply — •Jochen Ketter[1], Klaus Blaum[2], Jens Ketelaer[1], Szilard Nagy[2], and Sven Sturm[1] — [1]Institut für Physik, Johannes Gutenberg-Universität, 55099 Mainz, Germany — [2]Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany

Triga-Trap [1] aims at mass measurements of heavy ions and neutron-rich fission products. Such on-line mass measurements using small-band and broad-band Ft-Icr in this setup, also allowing for the traditional Tof-Icr method, are particularly challenging. The voltages applied to the trap's electrodes must be switched within the order of 100 ns for capture and optional ejection, while remaining stable with low noise during the detection of image currents. Switching requires a supply with high power output, but comparatively long idle time with constant trapping voltage does not warrant a fully-featured amplifier. The double-headed approach to the problem capitalizes on these peculiarities to design a power supply specially tailored to the needs of on-line Ft-Icr detection. An electronic switch is at the heart of the power supply. The precision output voltage in the range of ± 200 V is set by a regulator operating a push-pull stage with its own high-voltage supply. The principle of each component and first results will be presented.

[1] J. Ketelaer *et al.*, Nucl. Instr. Meth. A, 594 (2008) 162–177

MS 7.7 Di 16:00 VMP 9 Poster

Entwicklung einer direkten Online-Einbringung für die Resonazionisations - Massenspektrometrie — •Silke Fies[1], Sebastian Raeder[1], Norbert Trautmann[2] und Klaus Wendt[1] — [1]Institut für Physik - Universität Mainz — [2]Institut für Kernchemie- Universität Mainz

Die Methode der hochauflösenden Resonanzionisations-Massenspektrometrie (HR-RIMS) erlaubt durch die gezielte Nutzung der ato-

maren Hüllenstruktur eine element- und isotopenselektive Ionisation mittels schmalbandiger frequenzstabilisierter cw-Laser. Für die Ultraspurenanalyse am ^{236}U wurden Selektivitäten von $> 10^9$ erreicht und ^{236}U / ^{238}U-Isotopenverhältnisse bis in den Bereich von $< 10^{-8}$ mit ausreichender Präzision bestimmt.

Um den Zeitaufwand des Probenwechsels im Hinblick auf Routinemessungen zu reduzieren, wurde eine direkte Einbringung für flüssige Proben über eine Kapillare in die HR-RIMS entwickelt und für erste spektrometrische Untersuchungen genutzt. Eine solche direkte Einbringung erlaubt zusätzlich eine Kopplung der isotopenselektiven HR-RIMS mit speziesselektiven chromatographischen Trennmethoden wie der High Performance Liquid Chromatography (HPLC) oder der Kapillarelektrophorese (CE).

MS 7.8 Di 16:00 VMP 9 Poster

An electrostatic mass separator for ISOLTRAP — •Robert Wolf[1], M. Breitenfeldt[1], Alexander Herlert[2], Gerrit Marx[1], and Lutz Schweikhard[1] — [1]Inst. f. Physik, Ernst-Moritz-Arndt-Universität, D-17489 Greifswald — [2]Physics Department, CERN, 1211 Geneva 23, Switzerland

An electrostatic ion beam trap was built as a test device for future separation and removal of isobaric ions at ISOLTRAP. Electrostatic ion beam traps consist of two ion mirrors between which ions are oscillating and are separated by their mass-over-charge ratio m/q. Flight paths of several hundreds of meters are folded to an apparatus length of less than one meter. It is planned to install the device at the ISOLTRAP experiment at CERN/Geneva to support the contamination removal of isobaric masses caused by the production of short-lived nuclides at the ISOLDE facility. First tests resulted in a mass resolving power of up to $m/\Delta m \approx 10^5$ and the separation was demonstrated for the isobaric ions CO and N_2. Further improvements concerning trapping techniques will be presented, in particular with respect to the injection and ejection of ions without switching the mirror potentials.