HK 49: Instrumentation

Zeit: Dienstag 16:45–19:00 Raum: WIL-C207

HK 49.1 Di 16:45 WIL-C207

Shaping of Cluster-Jet Beams for Storage Ring Experiments — •Ann-Katrin Hergemöller, Silke Grieser, Esperanza Köhler, Alexander Täschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

With a cluster-jet target high and constant densities at the interaction point can be achieved and adjusted continuously during operation. At the University of Münster the prototype of the cluster-jet target for the PANDA experiment was built up in PANDA geometry and set successfully into operation. Due to observed structures within the cluster beam, a tilting system was installed, allowing for an adjustment of the nozzle system relative to the experimental setup. With this installation target densities of more than 2×10^{15} atoms/cm^2 were achieved at 2.1 m behind the nozzle. By the use of special shaped skimmers it is possible to determine the size and shape of the cluster beam at the later scattering chamber. Beside the absolutely target density also a low residual gas background at the interaction region is of high interest. Thus the identification of an optimized skimmer geometry will be of high relevance for the experimental conditions at PANDA. From measured cluster beam profiles it is possible to calculate both the expected areal density at the interaction point as well as the gas background. The results of target beam properties with a shaped cluster beam by slit collimators will be presented and discussed. Supported by EU (FP7), BMBF, and GSI F+E.

HK 49.2 Di 17:00 WIL-C207

Cluster Beam Visualization with MCPs — •Esperanza Köhler, Silke Grieser, Ann-Katrin Hergemöller, Alexander Täschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

A cluster-jet target will be the first installed internal target for the PANDA experiment at HESR/FAIR. For performance studies a cluster-jet target prototype in complete PANDA geometry was already built up and set successfully into operation at the University of Münster. At present this target prototype is routinely operated with hydrogen and the use of other materials such as deuterium is also possible. The observation of distinct density structures within the jet beam behind the nozzle and the use of a new tilting system lead to areal target densities of more than 2×10^{15} atoms/cm^2 at a distance of 2.1 m. The thickness is reproducible, constant in time, and variable over several orders of magnitude. Depending on the experimental program the target beam size and shape is variable. This can be visualized by a new monitoring system based on a Micro Channel Plate (MCP), which allows for a direct observation of an ionized cluster beam. Therefore, the cluster beam is ionized by an electron beam and the signals in the MCP are observed by a phosphor screen in combination with a CCD camera. In this talk the performance of the cluster-jet target and MCP images of the cluster beam will be presented and discussed. Supported by EU (FP7), BMBF, and GSI F+E.

HK 49.3 Di 17:15 WIL-C207

Optimization of Atomic Beam Sources for Polarization Experiments — •Martin Gaisser, Alexander Nass, and Hans Ströher — IKP, Forschungszentrum Jülich

For experiments with spin-polarized protons and neutrons a dense target is required. In current atomic beam sources an atomic hydrogen or deuterium beam is expanded through a cold nozzle and a system of sextupole magnets and RF-transition units selects a certain hyperfine state. The achievable flux seems to be limited to about 10^{17} particles per second with a high nuclear polarization. A lot of experimental and theoretical effort has been undertaken to understand all effects and to increase the flux. However, improvements have remained marginal. Now, a Monte Carlo simulation based on the DSMC part of the open source C++ library OpenFOAM is set up in order to get a better understanding of the flow and to optimize the various elements. It is intended to include important effects like deflection from magnetic fields, recombination on the walls and spin exchange collisions in the simulation and make quantitative predictions of changes in the experimental setup. The goal is to get a tool that helps to further increase the output of an atomic beam source. So far, a new binary collision model, magnetic fields, RF-transition units and a tool to measure the collision age are included. The next step will be to couple the whole simulation with an optimization algorithm implementing **A**daptive **S**imulated **A**nnealing (ASA) in order to automatically optimize the atomic beam source.

HK 49.4 Di 17:30 WIL-C207

Production of short lived radioactive molecular ion beams at ISOLDE/CERN — •Christoph Seiffert[1,2], Thierry Stora[1], Thorsten Kroell[2], Alexander Gottberg[1], and Matthias Kronberger[1] — [1]CERN — [2]TU Darmstadt

The ISOLDE facility at CERN offers a wide range of radioactive isotopes all over the nuclear chart with half lives down to milliseconds for various types of experiments in nuclear structure. Nevertheless some isotopes are not yet extractable in a decent amount. The reasons for this are diverse. For the case of Carbon and Boron isotopes one reason is, that the boiling point of these elements is above the maximum achievable operation temperature of the target units. Forming with these elements more volatile molecules, e.g. oxides or fluorides, enables their *extraction* at accessible temperatures. Even when the molecules are produced, the extraction is not necessarily possible. For instance chemical reactivity might cause an irreversible interaction and losses of the molecules with the target container material. When a chemically inert material is used high adsorption enthalpies of the molecules on the surface can induce sticking times for a multiple of the half live of the isotope and thus leads to decay losses. The presentation shows the progress of the investigations and on-line results.

HK 49.5 Di 17:45 WIL-C207

Measurement of Nuclear Polarization in H_2 and D_2 Molecules after Recombination of polarized H or D Atoms — •Robert Gorski — Institut für Kernphysik, FZ Jülich, Germany

The increased interest in spin-dependent observables requires the production of polarized internal gas targets (PIT) and ion beams like at ANKE/COSY. The ABS beam intensity seems to saturate and limits, therefore, the target-gas density. By cooling down the storage cell, the polarized atoms become slower and this results in an increase of the target-gas density. But temperatures below $\sim$ 100 Kelvin are not possible due to large polarization losses. One option to cross the limit is the use of polarized molecular hydrogen or deuterium which results from the recombination of polarized atoms before, because the polarization of the gas molecules should not depend much on the temperature. It is known that polarized hydrogen atoms, recombining on a copper surface, maintain up to one half of their nuclear polarization in sufficiently strong magnetic fields. It is the aim of the present project to study the nuclear polarization of recombined hydrogen and deuterium molecules by variation of the boundary conditions like temperature, magnetic field and surface material. It might be possible to increase the figure of merit of double polarized experiments by increasing the target density without too large polarization losses. This experience may help to produce gas of polarized molecular deuterium for future nuclear fusion experiments with polarized fuel.

HK 49.6 Di 18:00 WIL-C207

Detector for polarized internal target experiments — •Christian Weidemann for the PAX-Collaboration — Institut für Kernphysik, FZ-Jülich — University of Ferrara, Italy

The PAX collaboration is aiming to reveal the mystery of the proton spin and its interpretation in terms of its internal constituents. A multitude of findings, e.g. the transversity, which are accessible via $\vec{p}$(bar)$\vec{p}$ scattering experiments, led the Polarized Antiproton eXperiments (PAX) collaboration to propose such investigations at the High Energy Storage Ring (HESR) of the Facility for Antiproton and Ion Research (FAIR).
Already the production of intense polarized antiproton beams is still an unsolved problem. A dedicated experimental program with protons at the COSY storage ring in Jülich confirmed the validity of the spin-filtering method to polarize a stored beam. Subsequently, spin filtering has to be realized with antiprotons. The $\vec{p}$(bar) beam polarization will be measured by elastic $\vec{p}$(bar)$\vec{p}$ scattering. For this purpose a ϕ-symmetric detection system based on 24 silicon microstrip detectors

of different thickness, that allows the measurement of all spin observables, is under development. The operation close to the target region within the accelerator vacuum, demands for UHV capability and a dedicated cooling system. Its versatility is essential for additional experiments, such as the study of three nucleon continuum in proton deuteron breakup reactions or time reversal invariance tests at COSY. The talk outlines the status of the detector development.

HK 49.7 Di 18:15 WIL-C207

New fiber detector with nXyter readout for tracking of radioactive beams — •Philipp Schrock for the R3B-Collaboration — Institut für Kernphysik, TU Darmstadt

The R^3B setup (Reactions with Relativistic Radioactive Beams) at FAIR will allow kinematically complete measurements in order to study various astrophysical and nuclear structure questions. The mass number A of the beamlike particles will be determined from the deflection in a magnetic field. To achieve an adequate mass resolution a new fiber detector for tracking of heavy fragments has been designed and tested.

The detector is built of 1024 scintillating optical fibers with a width of 250 μm each. All individual fibers are read out separately. The needed 1024 electronic channels are realized by using position sensitive photomultiplier tubes and nXyter (neutron-X-Y-time-energy readout) chips. The nXyter is a self-triggered ASIC with 128 independent channels which buffer charge and time information for each hit in each fiber. It is included in the triggered R^3B-LAND setup with the help of "Gemex" front-end boards. Each board has implemented two nXyter and an FPGA which controls the nXyter and which sorts their data to packages with respect to external triggers.

The detector was in use with different modifications of Gemex boards during several experiments, partially in vacuum. Besides the detector itself a first analysis of its data will be presented.

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HK 49.8 Di 18:30 WIL-C207

Messungen der elektronischen Spin-Gitter-Relaxationszeiten mit Hilfe der NEDOR-Methode — •Jonas Herick, Alexander Berlin, Christian Hess, Werner Meyer, Gerhard Reicherz und Hendrik Vondracek — Institut für Experimentalphysik I - AG, Ruhr-Universität Bochu,

Ein Parameter, der entscheidenden Einfluss auf den Prozess der Dynamischen Nukleonen Polaristion (DNP) hat, ist die elektronische Spin-Gitter-Relaxationszeit T_{1e} der eingebrachten paramagnetischen Zentren. Einen Zugang zu diesem Parameter bietet die sogenannte NEDOR-Methode (**N**uclear-**E**lectron **Do**uble **R**esonance), mit deren Hilfe der Einfluss verschiedener Größen auf diese Zeit untersucht wurde.

HK 49.9 Di 18:45 WIL-C207

UF_6 as a Detector Gas for Fission Studies* — •Christian Eckardt[1], Joachim Enders[1], Martin Freudenberger[1], Alf Göök[2], Peter von Neumann-Cosel[1], Andreas Oberstedt[3,4], and Stephan Oberstedt[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Institute for Reference Materials and Measurements,JRC, European Commission, 2440 Geel, Belgium — [3]Akademin för naturvetenskap och teknik, Örebro Universitet, 70182 Örebro, Sweden — [4]Fundamental Fysik, Chalmers Tekniska Högskola, 41296 Göteborg, Sweden

A Frisch-grid ionization chamber has been built to test a mixture of argon with gaseous UF_6 and to study its properties as a counting gas. We present first results using increasing mass fractions of $^{238}UF_6$ mixed into argon. The drift velocity of the electrons increases with the content of $^{238}UF_6$, while a good signal quality and energy resolution of the ionization chamber is preserved.

Using uranium hexafluoride in the detector gas may give access to experiments where extremely high luminosity is required in combination with good angular and energy and/or mass resolution. Examples comprise the investigation of spontaneous fission of ^{238}U, the study of parity non-conservation in the fission process, or precision measurements of fission fragments with good resolution using tagged photons in the entrance channel.

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