HK 26: Instrumentation

Zeit: Mittwoch 14:00–16:00 Raum: P 2

Gruppenbericht HK 26.1 Mi 14:00 P 2

The HIE-ISOLDE project — •Magdalena Kowalska and ISOLDE Collaboration — CERN, Geneva, Switzerland

The HIE-ISOLDE (High Intensity Energy) Project is a major upgrade of the ISOLDE/CERN facility which will increase the energy, intensity and quality of the delivered radionuclide beams. It comprises the construction of a new superconducting linear accelerator for the energy increase and a Design Study for the intensity and quality improvements. Its science case covers many of the key questions in nuclear structure and astrophysics.

The energy of the post-accelerated beams will be increased from 3 MeV to 10 MeV thanks to a new superconducting linear accelerator made of 6 cryomodules with sputtered acceleration cavities. Transfer and fusion reactions will become accessible for the first time for many exotic nuclear species. Users are expected to design and build new instrumentation to make best use of these beams.

The new LINAC4 injector installed for the LHC combined with the upgraded PSB injector will boost the energy and intensity of the proton beams impinging on the ISOLDE targets. To profit from this for the production of beams and ensure containment of the increased radiation, a redesign of the target area and of the targets will be undertaken. Upgrades to ion sources and magnetic separators will also enhance the quality and purity of the delivered beams.

Here, we give an overview of the project, timeline, and present status, followed by a presentation of the Letters of Intent for experiments.

HK 26.2 Mi 14:30 P 2

The cluster-jet target for the PANDA experiment — •Alexander Täschner, Ann-Katrin Hergemöller, Esperanza Köhler, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

The PANDA experiment will be one of the key experiments of the planned accelerator center FAIR at Darmstadt in Germany. The study of proton-antiproton annihilations at this fixed-target experiment in a dedicated storage ring will enable the precise investigation of the strong interaction, especially the QCD spectrum and the hadron structure.

In order to achieve these physics goals a hydrogen target with a high target density of up to 4×10^{15} atoms/cm^2 is needed which provides a target material of highest purity and a target density which is both constant in time and homogeneous in space. With a prototype setup at Münster it could be shown that these challenging demands can be met with a Münster type cluster-jet target which can produce cluster-jets of up to 1.5×10^{15} atoms/cm^2 at a distance of 2 m behind the nozzle. Therefore it was decided to implement a cluster-jet target at PANDA which can be interchanged with a pellet target depending on the physics program to be investigated.

In this presentation the design of the cluster-jet target for the PANDA experiment will be described. The detailed implementation into the detector setup and the expected operation properties will be shown.

Supported by EU (FP6+FP7), BMBF, and GSI F+E.

HK 26.3 Mi 14:45 P 2

Systematic Investigations on High Intense Cluster-Jet Beams for Storage Ring Experiments — •Esperanza Köhler, Ann-Katrin Hergemöller, Alexander Täschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

A high-density cluster-jet target will be one of two planned internal target stations for the PANDA experiment at the antiproton accelerator and storage ring HESR/FAIR. For the investigation of elementary $\bar{p}N$ interactions hydrogen and deuterium are of highest interest as used target material. Cluster-jet targets allow high and constant target densities at the interaction point, i.e. 2 m behind the nozzle, with the possibility of a continuous variation during operation. At the University of Münster a cluster-jet target prototype was designed, built up and set succesfully into operation. The system is installed in complete PANDA geometry, so that the observed cluster beam characteristics can be directly transferred to the later situation at PANDA. Recent optical investigations on the cluster beam directly behind the nozzle resulted in the observation of distinct density structures when the target is operated at highest densities. The development and installation of a special nozzle tilting system allows for the extraction of these high-intense core beams, leading to a significant improvement of the target density. The performance and achieved densities of cluster beams will be presented. Supported by EU (FP6+FP7), BMBF, and GSI F+E.

HK 26.4 Mi 15:00 P 2

Studies on cluster beam shapes for storage ring experiments — •Ann-Katrin Hergemöller, Esperanza Köhler, Alexander Täschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

One of the two planned internal targets for the PANDA experiment at the accelerator center FAIR will be a cluster-jet target. With this type of 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 this cluster-jet target was built up in PANDA geometry and set successfully into operation. With this installation hydrogen target densities of 1.5×10^{15} atoms/cm^2 were achieved at 2 m behind the cluster source. 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. Since parallel to the absolute target density also a low residual gas background at the interaction region is of high interest, 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. First results of beam properties with a shaped cluster beam by slit collimators will be presented and discussed. Supported by EU (FP6+FP7), BMBF, and GSI F+E.

HK 26.5 Mi 15:15 P 2

Reliability Studies of the Nozzle/Piezo units for the WASA-at-COSY Pellet Target* — •Florian Bergmann, Christina Husmann, Kay Demmich, Paul Goslawski, Alfons Khoukaz, and Alexander Täschner for the WASA-at-COSY-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

At the fixed target experiment WASA-at-COSY a pellet target provides a stream of micrometer sized frozen hydrogen particles (pellets) for hadron physics experiments. The main part of the pellet source, a glass nozzle, is driven by a piezoelectric transducer working at high frequencies ranging from 30 to 80 kHz to produce regularly shaped droplets which freeze due to evaporation cooling and form pellets. For a good performance of the pellet target the quality of the nozzle and the attached piezo are of great importance. Due to the small opening of the nozzles ($\approx 13\,\mu$m) these components are very sensitive with respect to blocking. To avoid such problems a production line has been established at the Forschungszentrum Jülich which includes several cleaning steps and quality checks for the nozzles. To further improve the reliability of the prepared nozzle/piezo unit a dedicated setup has been built up in Münster. This device allows to operate the nozzles in vacuum with typical gas input pressures and with the piezo in operation. Furthermore, beside these tests with respect to nozzle blocking this setup allows for systematic tests on the piezoelectric transducers and their influence on possible working points for target operation. The design concept and first results will be presented and discussed.

*Supported by COSY-FFE grants

HK 26.6 Mi 15:30 P 2

Konstruktion eines aktiven polarisierten Targets für das Crystal-Ball-Experiment am Mainzer Mikrotron — •Maik Biroth und Patrick Achenbach — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Das Crystal-Ball-Experiment am Elektronen-Beschleuniger MAMI zur Streuung reeller Photonen wurde 2009 um ein polarisiertes Frozen-Spin-Target ergänzt, welches mit Hilfe eines ^{3}He-^{4}He-Mischerkryostaten bei Temperaturen von 25 mK betrieben wird.

Zum Nachweis niederenergetischer Protonen im Kryostaten soll ein aktives Target als Stapel aus polarisierbaren Szintillatorplättchen realisiert werden. Die Kühlung wird durch das in den Zwischenräumen zirkulierende flüssige Helium gewährleistet. Die Lichtpulse sollen mit-

tels Wellenlängen schiebender Fasern aus dem Kältereservoir geführt und von Silizium-Photomultipliern detektiert werden.
Mehrere Prototypen aus 1 mm dünnen Plättchen wurden angefertigt, wobei die geometrischen Randbedingungen wie Biegeradius der Fasern, Breite des Photonenstrahls und verfügbarer Raum im Kryostaten das Design bestimmten. Um den optischen Kopplungsgrad an die Fasern zu studieren wurden Faserprofil, Faserdurchmesser und die Größe der Kontaktfläche variiert und mit einer ^{90}Sr-Quelle die Lichtausbeute bestimmt. Zwecks Optimierung wurde mit verschiedenen Szintillator-Ummantelungen experimentiert. Untersucht wurde auch die Temperaturabhängigkeit der Ausleseelektronik.
Diese Arbeit wurde gefördert durch die Carl Zeiss Stiftung, die inneruniversitäre Forschungsförderung und den SFB 443.

HK 26.7 Mi 15:45 P 2

A Wide Temperature Range Irradiation Cryostat for Reasearch on Solid State Targets — Scott Reeve, •Hartmut Dutz, Stefan Goertz, Stefan Runkel, and Thomas Voge — Physikalisches Institut, Universität Bonn, Nußallee 12, 53115, Bonn

To qualitatively improve the data obtained in asymmetry measurements of scattering experiments the figure of merit (FOM) plays a major role and can reduce the data acquisition time when a certain precision in the measurement is needed. One of the defining factors for the improvement of the polarised experiment lies in the target choice and preparation, in particular the method employed to introduce the paramagnetic defects for the use of dynamic nuclear polarisation (DNP). To this end the Polarized Target Group in Bonn has developed a wide range temperature cryostat for the irradiation of potential target materials in which materials can be irradiated to varying doses at specified temperatures. The stable irradiation temperature of the materials can be controlled to within $\pm 1\,\mathrm{K}$ over a range of $90\,\mathrm{K} < T < 270\,\mathrm{K}$.