HK 59: Instrumentation XIV

Time: Thursday 17:30–18:45 Location: SR Exp1B Chemie

HK 59.1 Thu 17:30 SR Exp1B Chemie

The New Jet and Static Gas Target System at the Felsenkeller Underground Laboratory — •Anup Yadav[1,2], Konrad Schmidt[1], and Daniel Bemmerer[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

A newly developed windowless gas-target system, tailored to meet the precision measurement demands of modern nuclear astrophysics, has recently been installed at the Felsenkeller underground ion accelerator laboratory. The system can be operated either in jet or static modes. Real-time monitoring of the jet is facilitated by laser interferometry validated by alpha-energy-loss measurements. Areal jet densities of up to 3×10^{18} atoms/cm^2 have been determined. Continuing optimization of the jet-nozzle geometry involves comprehensive computational fluid dynamics simulations. For the extended static gas target setup, pressure and temperature profiles have been measured to construct the density profile. A beam calorimeter is used to measure the beam intensity. The setup has undergone development and testing at the HZDR Rossendorf campus and now is in the commissioning phase at the Felsenkeller underground ion accelerator laboratory.

HK 59.2 Thu 17:45 SR Exp1B Chemie

Commissioning of the First Gas System Line for the CBM-TRD — •Felix Fidorra for the CBM-Collaboration — Institut für Kernphysik Münster, Münster, Deutschland

The Compressed Baryonic Matter (CBM) experiment is a fixed target heavy-ion experiment which is currently under construction at FAIR in Darmstadt. It will explore the QCD phase diagram at high net-baryon densities. The Transition Radiation Detector (TRD) of the CBM experiment will be based on Multi Wire Proportional Chambers (MWPCs) filled with Xe/CO2 85:15 as detector gas. This talk reports on the commissioning of the first regulated line of the future gas system for the CBM-TRD. During operation, the gas flow through the chambers has to be regulated such that the relative pressure in the detector volume stays within -0/+1 mbar. A part of the gas system, as, e.g., the main regulation valves, the circulation pump and the PLC layer will be located in a service level above the experiment. The first gas line, including already the final tube lengths and the PLC controls, has been set up in the laboratories in Münster and test runs of the system have been successfully performed. This work was supported by BMB through ErUM-Pro FSP-T06.

HK 59.3 Thu 18:00 SR Exp1B Chemie

Analysis of the hydrogen cluster sizes using shadowgraphy measurements — •Clara Fischer, Hanna Eick, and Alfons Khoukaz — Institute for Nuclear Physics, University of Münster

The $\overline{\text{P}}$ANDA cluster-jet target will be installed at the High Energy Storage Ring at FAIR and will provide a target thickness of more than 10^{15} atoms/cm^2 at the interaction point, which is more than 2 meters away from the origin.

To study the properties of the cluster beam and the cluster themselves, one can use shadowgraphy measurements. This method is based on the illumination of a cluster beam using a pulsed laser in e.g., the nanosecond regime. By the analysis of the shadowgraphy images, one can determine the cluster sizes, size distribution and investigate the dependency of the clusters on target parameters. This information is of special interest for both the later data analysis and simulation of storage ring data.

Initial shadowgraphy measurements carried out with a Münster cluster-jet target have already demonstrated the feasibility of this method and provided important initial information on cluster sizes. Based on this, more refined and comprehensive measurements will now be carried out to determine the granularity and size distribution of the cluster jets as well as the trajectories of the individual target particles.

This talk gives an overview of the planning and initial realisation of the shadowgraphy measurements in Münster. This research project was supported by the EU Horizon 2020 programme (824093), BMBF (05P21PMFP1) and NRW Netzwerke (NW21-024-E).

HK 59.4 Thu 18:15 SR Exp1B Chemie

Nozzle production and vacuum simulations for the $\overline{\text{P}}$ANDA cluster-jet target — •Michael Weide, Philipp Brand, Sophia Vestrick, Hanna Eick, and Alfons Khoukaz — Institut für Kernphysik, Universität Münster, 48149 Münster, Germany

In antiproton-proton annihilation experiments such as the upcoming $\overline{\text{P}}$ANDA experiment at FAIR, internal targets have a key role as they allow the accelerator beam to be utilized for multiple interactions with the target. Initially, this target will be realized by a cluster-jet target (CJT) operated with H_2, that produces clusters of sizes ≤ 10 microns in diameter.

A challenge of such an experiment is minimizing background reactions due to the costly production of antiprotons, thus good vacuum conditions are mandatory. To study the effect of various residual gas sources such as flash evaporation and beam induced evaporation, vacuum simulations are performed and compared with experimental data.

The core piece of a CJT is a copper Laval nozzle, which was previously produced at CERN. In order to be able to influence the geometry and shape of the nozzle, a manufacturing process is currently being developed at the Institute of Nuclear Physics at the University of Münster. The current status of the process and the first very promising results will be presented.

The research project was supported by EU Horizon 2020 program (824093), BMBF (05P21PMFP1) and NRW Netzwerke (NW21-024-E).

HK 59.5 Thu 18:30 SR Exp1B Chemie

The windowless gas jet target for e-p scattering experiments at MAGIX at MESA: Development and optimization — •Liridon Deda, Philipp Brand, Jost Froning, and Alfons Khoukaz for the MAGIX-Collaboration — Institut für Kernphysik, Universität Münster, 48149 Münster, Germany

The future MAGIX experiment will use the MESA energy-recovering beam in combination with a windowless gas jet target. With this innovative target, a next phase of high-precision measurements with a reduced background compared to previous e-p scattering experiments is possible. The MAGIX gas jet target delivers a thickness of more than 10^{18} atoms/cm^2 at the interaction point when using hydrogen as target material. Providing such a target thickness requires a high gas flow rate at a cryogenic temperature, which is then pressed through a convergent-divergent nozzle. The geometry of the nozzle defines how the target expands, thus influencing the jet target's shape and temperature. Therefore, for further target optimization, numerical simulations of the jet's formation and propagation are necessary to refine the stagnation conditions and nozzle geometry. Additionally, a new approach—the generation of a filament jet structure with the MAGIX gas jet target—to reach even a higher thickness with better vacuum conditions is under development. The setup, performance, and development of the MAGIX gas jet target will be presented and discussed.

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