HK 14: Instrumentation V

Time: Tuesday 17:00–18:45 Location: SCH/A.101

Group Report HK 14.1 Tue 17:00 SCH/A.101

A State-of-the-Art Cluster-Jet Target for the PANDA Experiment at FAIR — •Philipp Brand, Daniel Bonaventura, Hanna Eick, Jost Froning, Lennart Halstenberg, Christian Mannweiler, Sophia Vestrick, Michael Weide, and Alfons Khoukaz for the PANDA-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The PANDA cluster-jet target that will be installed at the High Energy Storage Ring (HESR) at FAIR is the world's leading target of its kind. It allows for hydrogen target thicknesses of more than 10^{15} atoms/cm^2 at the interaction point, which is located more than 2 m below the nozzle. This is achieved by a complex machine that has been developed over the last years, including several systems for adjustment and diagnosis. Most of them are special developments just for this purpose. This also includes the diagnostic systems that will be mounted into a modified version of the cluster-jet beam dump, which is the latest development.

Furthermore, the target has already been tested extensively in our institute but also at the COoler SYnchrotron (COSY) at FZ Jülich, where the interaction of a proton beam with the target in presence of the HESR stochastic cooling devices has been studied.

The target with all the technical developments that will be installed at its final version will be presented and some results of measurements with the PANDA target will be discussed.

This project has received funding from BMBF (05P21PMFP1), GSI FuE (MSKHOU2023) and the EU's Horizon 2020 programme (824093).

Group Report HK 14.2 Tue 17:30 SCH/A.101

LHCspin: First Tests of the SMOG2 gas target at the LHC — •Erhard Steffens[1], Paolo Lenisa[2], Vito Carassiti[2], Giuseppe Ciullo[2], Pasquale Di Nezza[3,4], Luciano L. Pappalardo[2,4], and Marco Santimaria[3,4] — [1]FAU, Erlangen-Nürnberg, Germany — [2]U. Ferrara and INFN, Italy — [3]INFN Lab. Nat. di Frascati, Italy — [4]LHCb Collaboration, CERN

The LHCspin project aims at unpolarized (SMOG2) and polarized fixed-target measurements by means of a gas target upstream of the LHCb detector, close to the vertex detector VELO. The forward geometry of the LHCb spectrometer ($2 < \eta < 5$) allows for the reconstruction of particles produced in fixed-target collisions, with CM energies from $\sqrt{s_{NN}} = 72$ GeV with Pb beam, to $\sqrt{s} = 115$ GeV in pp collisions.

SMOG2 is an openable storage cell with wake field suppressors and unpolarized gas feed system, producing a localized pressure bump inside the 200mm long storage tube, with i.d. 10 mm in the closed state. The two halves of the cell are connected to and moving with the VELO detector boxes, opening during beam injection. The 7 TeV/1A beam traversing the target might develop instabilities which must be suppressed by a suitable coating and shape of the conducting surfaces. - The target was successfully tested with beams (p, Pb) in November 2022. It has been verified that beam-beam and beam-gas events can be measured simultaneously by the detector.

HK 14.3 Tue 18:00 SCH/A.101

Clustersize distribution measurement using the three wavelength extinction method — •Sophia Vestrick, Philipp Brand, Hanna Eick, Jost Froning, ErenCem Göktas, Lennart Halstenberg, Christian Mannweiler, Michael Weide, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

In a cluster source, cryogenic hydrogen, gaseous or liquid, is forced through a Laval nozzle and expanded into a vacuum. The hydrogen formes droplets consisting of millions of atoms. The diameters of the resulting clusters vary by severeral orders of magnitude. When starting, e.g., with liquid hydrogen, the clusters can reach diameters from some nanometers up to several micrometers, but the specific distribution is not yet known. In the three wavelength extinction method (3WEM), three lasers with different wavelengths are aligned to an interaction region and collimated onto one detector each. When the cluster-jet crosses the interaction region the intensity of all three lasers is reduced. Since the resulting extinction ratio depends on the known wavelength of the laser as well as on the clustersizes, this method can be used to determine the size distribution of the clusters. The 3WEM was first tested with sprays of known diameter distribution for verification and afterwards installed at a Münster Cluster-Jet Target. First results are presented in this talk. This project has received funding from BMBF (05P21PMFP1), GSI FuE (MSKHOU2023) and the EU's Horizon 2020 programme (824093).

HK 14.4 Tue 18:15 SCH/A.101

Determination of hydrogen cluster size distributions for different cluster-jet target stagnation conditions — •Hanna Eick, Philipp Brand, Christian Mannweiler, Sophia Vestrick, and Alfons Khoukaz — Institute for Nuclear Physics, Westfälische Wilhelms-Universität Münster

The internal and windowless cluster-jet targets from the WWU Münster are a key component of several experiments at various research facilities. One of them is the HHU Düsseldorf where the 200 TW ARCTURUS laser was used to investigate the laser-cluster interaction. In this context measurements are performed in order to study some important properties of the used hydrogen clusters, like the size of the clusters and their size distribution. To find out the size of the clusters, they are visualized by the shadowgraphy method. For this purpose, the ultrashort pulse ARCTURUS laser is illuminating the cluster beam and shadowgrapy images are taken. The evaluation of cluster diameters has to be automated due to the large number of recorded photos. This talk provides an overview of the results of the analyzed shadowgraphy measurements for various target settings and also for different positions in the cluster beam. By comparing the effective flow of material through the nozzle with the flow of clusters visible in these shadowgraphs, the amount of (invisible) gas embedded in the clusters can be estimated. This project has received funding from BMBF (05P21PMFP1), GSI FuE (MSKHOU2023) and the EU's Horizon 2020 programme (824093).

HK 14.5 Tue 18:30 SCH/A.101

Transforming targets: Adapting a cluster-jet target for use as a droplet target — •Christian Mannweiler, Daniel Bonaventura, Jost Froning, Eva-Maria Hausch, Elena Lammert, and Alfons Khoukaz — WWU, Münster, Deutschland

Internal targets such as H_2 cluster-jet targets and H_2 pellet targets have found widespread use in different fields of physics such as particle- and plasma physics. A prominent example is the future PANDA experiment at FAIR which will employ both target technologies for hadron physics experiments using antiproton accelerator beams.

Both types of target make use of cryogenic hydrogen in different forms. In the cluster-jet target it takes the form of a continuous beam made up of many small hydrogen clusters which achieve sizes from the nanometer scale up to several microns in diameter while a droplet target produces a stream of mono-sized, well separated hydrogen droplets at diameters in the tens of microns. Up until now, both target technologies were considered separately from each other, with a target device either creating cluster-jet beams or pellet beams. However, they remain closely related, which led us to initiate an R&D program on the development of a hybrid target which can produce both types of beam with only short downtime between swapping modes.

In our contribution we will present how we successfully transformed a cluster-jet target into a droplet target as well as first, encouraging results.

This project has received funding from the EU Horizon 2020 programme (824093).