HK 21: Instrumentation IV

Time: Tuesday 17:00–18:30 Location: J-HS D

Group Report HK 21.1 Tue 17:00 J-HS D

The development of the MAGIX experiment for the MESA project in Mainz — •Sabato Stefano Caiazza for the MAGIX-Collaboration — Institut für Kernphysik, JGU Mainz

The new MESA accelerator under development at the Institute for Nuclear Physics in Mainz is planned to be commissioned at the beginning of the new decade. By that time, the MAGIX experiment will sit on the energy recovery line of the accelerator. o take advantage of all the potential of the new machine, MAGIX will use an innovative jet-target system coupled without windows with a couple of magnetic spectrometers. In the focal plane of those spectrometers we will install a GEM-based TPC with additional trigger and veto detectors. Additionally we will integrate a recoil detector in the scattering chamber, a Moeller luminosity detector and zero-degree spectrometer in the forward direction. All the instrumentation is currently under development and the most recent updates will be presented in this talk.

HK 21.2 Tue 17:30 J-HS D

Studies on proton acceleration via laser-cluster interaction — •Lukas Lessmann[1], Bastian Aurand[2], Christian Mannweiler[1], Kerstin Maria Schwind[2], Oswald Willi[2], and Alfons Khoukaz[1] — [1]Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany — [2]Institut für Laser- und Plasmaphysik, Heinrich-Heine-Universität Düsseldorf, 40223 Düsseldorf, Germany

The CryoFlash experiment investigates the interaction of the high intensity, short-pulse Ti:Sa laser of the Arcturus Facility Düsseldorf with a cryogenic cluster-jet target constructed at the WWU Münster. A cluster-jet target provides a continuous flow of nanometer sized particles of approximately solid density by pressing pre-cooled gas or liquid through a very narrow Laval nozzle. This combines the advantages of gas-jet targets (continuous flow) and solid targets (local high density) for an operation at high laser repetition rates with a single-species and debris-free acceleration scheme.

The electric field of the incoming laser ionises the atoms and accelerates the electrons out of the clusters in a few laser cycles. The remaining proton clusters undergo coulomb explosions resulting in proton energies of a few hundred keV. The measured proton spectra show very little shot-to-shot fluctuations and the maximal energy can easily be tuned with the target parameters.

Measurements taken with two Thomson parabola spectrometers in summer 2019 will be presented and discussed.

This project has received funding from BMBF (05K16PM3).

HK 21.3 Tue 17:45 J-HS D

$\overline{\text{P}}$ANDA Cluster-Jet Target - Beam Interaction Studies at COSY — •B. Hetz, P. Brand, D. Klostermann, and A. Khoukaz for the PANDA-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The internal, windowless $\overline{\text{P}}$ANDA cluster-jet target provides a target thickness of more than 2×10^{15} atoms/cm^2 in a distance of more than 2 m from its nozzle and will be the phase one target for the upcoming $\overline{\text{P}}$ANDA experiment at the antiproton storage ring HESR at GSI/FAIR. Despite the ongoing construction of the HESR, the $\overline{\text{P}}$ANDA cluster-jet target already showed its excellent performance not only during its routinely operation at the University of Münster laboratories, but also in several beam times at the COSY accelerator in Jülich. During these beam times detailed studies concerning the proton beam-target interaction, beam energy loss, beam heating, Schottky measurements, and studies of physical data quality using the WASA forward detection system have been performed. Furthermore, studies concerning the beam life time and beam qualities in conjunction with the stochastic cooling system of HESR, which is installed at COSY for test operation, in presence of the $\overline{\text{P}}$ANDA cluster-jet target were started. Both systems showed an excellent performance concerning COSY beam quality and target thickness and stability. Further beam times at COSY at even higher target thicknesses are planed for 2020. Obtained data and the upcoming experimental program of the $\overline{\text{P}}$ANDA cluster target at COSY will be presented. This project has received funding from BMBF (05P19PMFP1) and GSI F&E.

HK 21.4 Tue 18:00 J-HS D

Pellet target development for an EDM measurements at COSY — •Otari Javakhishvili for the JEDI-Collaboration — Forschungszentrum Jüelich GmbH

The JEDI (Jülich Electric Dipole moment Investigation) collaboration in Jülich is conducting a set of experiments at COSY, aiming to develop precise equipment and experimental techniques to measure the EDMs of charged particles. One of the key elements of these experiments is the new modular JEDI polarimeter with a special target system.

In the current configuration, horisontal and vertical block targets are used in polarimeter. Targets are mounted on stepper linear actuators and dedicated hardware and software are used to control target movements. Target control system is EPICS based, it can access accelerator and detector data and use them as a feedback for automatic target movement or finding proper target position in beam. The system is controlled by user friendly GUI. Also it has software and hardware interlock systems. This system was successfully tested in last beam time. In addition, we are working on a special target system, which will allow to oscillate pellet through the beam. Frequency and speed of oscillation must be variable to achieve desired effective target density. Monitoring system must be developed, including precise triggering, track reconstruction and data synchronization units, this allow us to synchronize data of target with other systems in detector. In this talk achievements and experimental results will be summarized and ongoing activities towards dedicated ballistic pellet target development presented.

HK 21.5 Tue 18:15 J-HS D

Concept of high-bandwidth pickups for a novel low charge bunch arrival time monitor as a part of the all-optical synchronization system at the European XFEL and FLASH — Bernhard Scheible[1], Marie Kristin Czwalinna[2], Wolfgang Ackermann[3], Holger Schlarb[2], Herbert De Gersem[3], and •Andreas Penirschke[1] — [1]Technische Hochschule Mittelhessen, Germany — [2]DESY Hamburg, Germany — [3]Technische Universität Darmstadt, Germany

X-ray free-electron lasers open up new frontiers across many areas of research and science. Numerous experiments require pulse durations in the order of a few femtoseconds only - this demands for an overall time resolution with sub-10 fs precision.

Simultaneously the generation of ultrashort X-ray pulses is only feasible by shorter bunches in a low bunch charge operation mode. The European XFEL is currently operated with bunch charges down to 20 pC with a synchronization with sub 10 fs range - future experiments demand operation modes with bunch charges down to 1 pC with an overall timing stability below (5+1) fs rms. Ultra-low charges are a major challenge for the current all-optical synchronization system implemented in FLASH and European XFEL.

In the scope of this contribution a novel ultra-broadband pickup design for frequencies up to 100 GHz is presented. In order to achieve sufficient driving voltage for the attached electro-optical modulator, several pickups circularly assembled in the beamline need to be combined.