# HK 47: Instrumentation XI

Time: Wednesday 16:00–17:30 Location: HK-H3

HK 47.1 Wed 16:00 HK-H3

**Performance of the mSTS detector in O+Ni collisions at 2 AGeV with the mCBM setup at SIS18** — •Dario Alberto Ramirez Zaldivar for the CBM-Collaboration — GSI Helmholtzzentrum f r Schwerionenforschung GmbH, Darmstadt, Germany — Goethe University, Frankfurt, Germany

The Compressed Baryonic Matter (CBM) is one of the experimental pillars at the FAIR facility. CBM focuses on the search for signals of the phase transition between hadronic and quark-gluon matter, the QCD critical endpoint, new forms of strange-matter, in-medium modifications of hadrons, and the onset of chiral symmetry restoration. The Silicon Tracking System is the central detector for momentum measurement and charged-particle identification. It is designed to measure Au+Au collisions at interaction rates up to 10 MHz. It consists have 1.8 million channels, having the most demanding requirements in terms of bandwidth and density of all CBM detectors. In the context of FAIR phase 0, the mini-CBM (mCBM) project is a small-scale precursor of the full CBM detector, consisting of sub-units of all major CBM systems which aim to verify CBM's concepts of free-streaming readout electronics, data transport, and online reconstruction. In the 2021 beam campaign at SIS18 (GSI) O+Ni collisions at 2 AGeV were measured with a beam intensity up to $10^{10}$ ions per spill. The mini-STS (mSTS) setup used for the 2021 campaign consists of 2 stations with 11 sensors. First results obtained from data taken in the 2021 beam campaign will be presented with a focus on the hit reconstruction and mSTS performance studies.

HK 47.2 Wed 16:15 HK-H3

**Mechanics, integration, and assembly of the Silicon Tracking System of CBM** — •Maksym Teklishyn[1,2], Patrick Dahm[1], Ulrich Frankenfeld[1], Johann Heuser[1], Piotr Koczoń[1], Anton Lymanets[1], Jens Thaufelder[1], and Oleg Vasyliev[1] for the CBM-Collaboration — [1]GSI, Darmstadt — [2]KINR, Kyiv

The Silicon Tracking System is the main tracking detector of the future CBM experiment. Its design fulfills competing requirements of low material budget, high granularity, and free-streaming operation of the detector modules.

The sensitive volume of the detector is formed by 8 tracking layers comprising 106 vertical ladders — highly integrated light-weight structures with a particular set of modules mounted on top. Each of the 876 detector modules consists of a rectangular double-sided silicon micro-strip sensor interconnected with the front-end electronics outside the physics aperture through a set of 32 ultra-thin analogue read-out micro cables of up to 500 mm length.

The detector is to be be integrated inside a constrained volume of about $3\,\mathrm{m}^3$ in the aperture of 1 Tm dipole magnet together with its multiple services: high- and low-voltage lines, read-out optical fibres, cooling lines for dry gas and NOVEC liquid at $-40°$C, DCS links and sensors.

A set of dedicated testing routines is foreseen at each step of the system assembly to ensure its adequate performance. The design choices together with the assembly and testing sequences are being validated with various prototypes.

HK 47.3 Wed 16:30 HK-H3

**Präzisionsvermessung der Vakuumbox des PANDA-Luminositätsdetektors** — •Jannik Petersen für die PANDA-Kollaboration — Institut für Kernphysik, Mainz, Deutschland

Beim PANDA-Experiment an der neuen Beschleunigeranlage FAIR bei Darmstadt sollen anhand von Antiproton-Proton-Reaktionen offene Fragen der Hadronenphysik beantwortet werden. Eine Säule des Forschungsprogramms bei PANDA ist die Charmonium-Spektroskopie. Dabei soll auch die Energy-Scan-Methode eingesetzt werden, die die Linienform neuer als auch bereits entdeckter Resonanzen mit noch nie dagewesener Präzision vermessen soll. Bei dieser Methode ist die Luminosität die entscheidende Kenngröße zur Normierung der unabhängigen Scan-Schritte. Daher befindet sich ca. 11 m hinter dem Wechselwirkungspunkt ein dedizierter Detektor, der die Winkelverteilung der am Target elastisch gestreuten Antiprotonen vermessen soll. Aus dieser kann die Luminosität extrahiert werden. Um eine Genauigkeit der Kenntnis der absoluten Luminosität von $< 5\%$ und der relativen Luminosität von $< 1\%$ zu erreichen, muss die Position der verfahrbaren Siliziumpixeldetektoren im Luminositäts-Detektor relativ zum Wechselwirkungspunkt auf 0,2 mm bekannt sein. Diese Sensoren befinden sich in einer Vakuumbox, die sich durch den Atmosphärendruck verformt. Deswegen ist eine präzise Vermessung der Box erforderlich, was während des Vortrags erläutert werden wird.

HK 47.4 Wed 16:45 HK-H3

**Design of a luminosity monitor for the P2 parity violating experiment at MESA** — Sebastian Baunack[1], Boris Gläser[1], Kathrin Imai[1], Rahima Krini[1], Frank Maas[1,2,3], •Tobias Rimke[1], David Rodriguez Pineiro[2], and Malte Wilfert[1] for the P2-Collaboration — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz, Johannes Gutenberg-Universität Mainz — [3]PRISMA Cluster of Excellence, Johannes Gutenberg-Universität Mainz

The P2 experiment at the future MESA accelerator in Mainz plans to measure the weak mixing angle $\sin^2(\theta_W)$ in parity violating elastic electron-proton scattering. The aim of the experiment is a very precise measurement of the weak mixing angle with a accuracy of 0.15% at a low four-momentum transfer of $Q^2 = 4.5 \cdot 10^{-3}$ GeV$^2$. In order to achieve this accuracy, it is necessary to monitor the stability of the electron beam and the liquid hydrogen target. Any helicity correlated fluctuations of the target density lead to false asymmetries.

Therefore, it is planned to install a luminosity monitor in forward direction close to the beam axis. The motivation and challenges for designing an air Cherenkov luminosity monitor will be discussed in this talk.

HK 47.5 Wed 17:00 HK-H3

**Design of a Luminosity Monitor for MAGIX** — •Theodoros Manoussos for the MAGIX-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, D-55099 Mainz, Germany

The MAinz Gas Injection target eXperiment (MAGIX) will be operated in the energy-recovery mode of the Mainz Energy-recovery Superconducting Accelerator (MESA), a high-intensity electron accelerator currently under construction at the Institute of Nuclear Physics of the Johannes Gutenberg University in Mainz. The windowless design of the two multi-purpose spectrometers enables high precision measurements of the electromagnetic form factors of several nuclei, including the proton, the study of nuclear reactions of astrophysical relevance, as well as dark photon searches. Thereby, the luminosity is an important parameter, which needs to be accurately measured. In this talk, a design study for a luminosity monitoring system using the bremsstrahlung process will be presented.

HK 47.6 Wed 17:15 HK-H3

**The Cooling Concept of the CBM Silicon Tracking System** — •Kshitij Agarwal for the CBM-Collaboration — Eberhard Karls Universität Tübingen, Tübingen, Germany

As the core detector of the CBM experiment at the under-construction FAIR facility, the Silicon Tracking System (STS) located in the dipole magnet (1 T.m) provides track reconstruction ($> 95\%$) & momentum determination ($< 2\%$) of charged particles from the beam-target interactions ($sqrt(s_{NN})$ = 2.9 - 4.9 GeV). Due to the expected non-ionising irradiation damage at the end-of-lifetime ($10^{14}$ $n_{eq}$(1MeV)/cm$^2$), the innermost silicon microstrip sensors will dissipate up to 6 mW/cm$^2$ at -10°C. So, it is crucial to always keep the silicon sensors at temperatures close to -10°C to avoid thermal runaway and reverse annealing by introducing minimal material budget in the detector acceptance.

The first part of this contribution will focus on the silicon sensor cooling concept, where cold gas (at -10°C) will be carried via thin carbon-fibre (CF) perforated tubes to directly cool the innermost silicon sensors. This will include the CFD Analysis of the sensor cooling concept with a 'toy model', and manufacturing of the perforated CF-tubes. The second part will touch upon the electronic cooling concept, where mono-phase 3M NOVEC 649 (at -40°C) will be used to keep the electronics temperature at -10°C. This will be substantiated with the CFD & Thermal Analysis. The contribution will be concluded by presenting the status of the thermal demonstrator, which will demonstrate the cooling concept under realistic operating conditions.