# T 147: Pixel/HV-Maps, Si/Diamond

Time: Thursday 17:30–19:00 Location: WIL/A317

T 147.1 Thu 17:30 WIL/A317

**Measuring Large Energy deposition with HV-MAPS** — •Danish Alam for the HD-HVMAPS-Collaboration — Physikalisches Institut, Heidelberg University

In high-energy physics experiments, the increasingly challenging physics demands high-rate detectors with excellent spatial and time resolution. High Voltage - Monolithic Active Pixel Sensor (HV-MAPS) fabricated in HV-CMOS processes provides fast charge collection via drift and enables the implementation of readout and the sensitive volume on the same die. Currently, the first tracking detector utilizing ultra-thin HV-MAPS chips is under construction for the Mu3e experiment.

At present, typical HV-MAPS detectors can measure energy depositions of the order of several 10 keV before the in-pixel charge-sensitive amplifier suffers saturation effects. The primary goal of the test chip Run2021V3 is to extend the measurable range and improve the precision of the measurements, which will allow detailed studies of the energy deposition of traversing particles, e.g., for particle identification. In the scope of this talk, the first characterization results of the Run2021V3 prototype will be presented.

T 147.2 Thu 17:45 WIL/A317

**Charge Deposition and Charge Collection in HV-MAPS** — •Ruben Kolb for the HD-HVMAPS-Collaboration — Physikalisches Institut Universität Heidelberg

Modern particle physics experiments have an ever growing demand on high rate detectors which combine precise spatial and time resolution. These requirements are met by the High Voltage - Monolithic Active Pixel Sensor (HV-MAPS). It combines active detector volume and readout on one chip. Currently, the first tracking detector using ultra thin HV-MAPS is under construction for the Mu3e experiment. The Run2021V2 chip is an HV-MAPS test chip which includes in-pixel electronics such as an amplifier and comparator. It is the most advanced HV-MAPS chip presently available.

The charge deposition and charge collection process in this sensor is investigated to improve the further design of HV-MAPS. The signal was studied in dependency of high voltage for a 4 GeV electron beam, 5.9 keV photons from a $^{55}$Fe and electrons from a $^{90}$Sr source. A complementary study using a test circuit to inject charge directly into the amplifier was performed.

T 147.3 Thu 18:00 WIL/A317

**Charge collection study of thin HV-MAPS** — •David Maximilian Immig for the HD-HVMAPS-Collaboration — Physikalisches Institut Universität Heidelberg

High-voltage monolithic active pixel sensors (HV-MAPS) combine the advantages of MAPS with fast charge collection via drift in a reversely biased diode. The amount of collected signal charge is influenced by two factors, the applied bias voltage and a dependent unknown fraction due to diffusion from the undepleted region. The former, determines the depleted volume intended for charge collection, as well as the detector capacitance. In the case of ultra thin sensors (e.g. 50 um), the depletion depth is limited by the sensor thickness and a contribution by diffusion is no longer applicable at full depletion.
An measurement campaign with sensors of various thickness was performed to investigate and determine the size of these contributions. In this talk, first results extracted from this extensive data set are presented.

T 147.4 Thu 18:15 WIL/A317

**Radiation damage studies of a HV-MAPS detector** — •Maja Lecher, Lucas Dittmann, Sebastian Bachmann, and Ulrich Uwer — Physikalisches Institut, Heidelberg, Germany

As one cornerstone of the prospective LHCb upgrade during Long Shutdown 4 in 2033, the current Scintillating Fibre tracker is set to be replaced by the MightyTracker, which combines scintillating fibres with radiation-hard silicon pixel detectors. The MightyPix sensor proposed as pixel detector employs the relatively new HV-MAPS technology. In preparation for the LHCb upgrade, the AtlasPix 3.1, a detector of similar build as the MightyPix, was studied with an emphasis on radiation damage.

While a number of studies investigating the damage sustained by HV-MAPS from radiation exist, irradiation campaigns to date were carried out using unpowered sensors. In a first proof-of-principle measurement, we irradiated a powered AtlasPix 3.1 with 14 MeV protons at the Bonn Isochronous Cyclotron. Specific sensor characteristics, most notably the leakage current, power consumption, and signal response, were tested before, during, and after the irradiation in an effort to evaluate the performance and viability of HV-MAPS in the radiation environment expected for the MightyPix. Results from these studies are presented and discussed.

T 147.5 Thu 18:30 WIL/A317

**Diamond detector research** — •Holger Stevens, Patrick Hoelken, and Johannes Albrecht — TU Dortmund University, Dortmund, Germany

The need for radiation-hard detectors is growing steadily. Compared to other semiconductor materials, diamond has a low leakage current, due to it's large bandgap and is very radiation-hard. This talk will present the experimental setups, which are developed for characterisation of diamond sensors. The radiation source used in these setups is Strontium (Sr90). In addition, the process to create gold contact surfaces in variable dimensions is described. The possible usage of diamond sensors for the precise dose profile measurement of large radiation fields is discussed and the option for spectrometric energy measurements is presented.

T 147.6 Thu 18:45 WIL/A317

**implementation of diamond as detector material in AllPix Squared** — •Faiz Ur Rahman Is-haqzai — TU Dortmund, Germany. Kabul University, Afghanistan

Monte-Carlo-based simulation of particle interactions with matter is a very important tool for detector development in high-energy physics and related fields since it allows testing of detector concepts in-silico before investing money and time in building the detectors. A widely used software framework in the high-energy physics community is Allpix Squared, based on GEANT4. It was started to simulate testbeam setups with silicon detectors but has garnered interest from a wider community by now. To extend the Allpix Squared framework and make it useful for further detector development, different sensor materials need to be implemented. My work is intended to implement the Diamond material. Diamond sensors are considered superior to others because of their faster signal generation, better radiation hardness, thermal properties, and ability to operate in harsh conditions. To test the implementation, given sensors are used in real test beam measurements where hits on the device under test (DUT) are extrapolated against a row of well-known detectors, called Beam Telescope. Implementation of Diamond sensor material will significantly contribute to the task of R&D of Diamond sensors by making the simulated prototype simply possible. I will present the status of the implementation of the diamond as detector material in Allpix Squared.