11th Beam Telescopes and Test Beams Workshop



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Performance of the MIMOSIS - Monolithic Active Pixel Sensor for CBM MVD and beyond

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MIMOSIS is a Monolithic Active Pixel Sensor (MAPS) designed in CIS Tower Jazz 180 nm technology for the Micro Vertex Detector (MVD) of the CBM heavy ion experiment at FAIR/GSI. In addition, its characteristics pave the road toward sensors equipping future Higgs factories. It is also anticipated to equip beam telescopes and various devices developed in the framework of the HORIZON 2020 large scale infrastructure project EURIZON.

The sensor will host 1024 columns of 504 digital pixels with 27 × 30 μm^2 pixel dimensions. The analog pixel front-end was inspired by the ALPIDE sensor equipping the ALICE-ITS2 but introduces AC-coupled sensing elements, which allow for applying a top depletion voltage of exceeding 20V and thus for fully depleting the pixel. The sensor is read with a time stamping of 5 μs in continuous mode. The internal multi-stage buffering is designed for a hit rate of up to 20 MHz and may buffer peak rates of 80 MHz for up to 50 μs .This talk introduces the first full size prototype MIMOSIS-1, which hosts a total of four different pixel front ends each combined with three different sensing nodes. We discuss the test-beam results obtained with sensors irradiated with radiation loads of up to 3 × 10¹⁴ n_{eq}/cm^2 and 5 MRad ionizing dose. Preliminary results indicate a spatial resolution of about 5.5 μm with more than 99% detector efficiency, even after combined irradiation, thereby complying with the CBM requirements. Finally, an outlook on the MIMOSIS-2 prototype, which was submitted in for fabrication early 2023, is provided.

Author: BUGIEL, Roma (Centre National de la Recherche Scientifique (FR))Presenter: BUGIEL, Roma (Centre National de la Recherche Scientifique (FR))Session Classification: Experiments - Non-LHC