

13th Beam Telescopes and Test Beams Workshop



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Performance and Radiation Tolerance Measurements of TelePix2

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High-Voltage Monolithic Active Pixel Sensors (HV-MAPS) offer $\mathcal{O}(\text{ns})$ timing in combination with a low material budget making them ideal for tracking detectors in high energy physics. With future experiments aiming for higher luminosities, the HV-MAPS technology has to satisfy strict requirements on time resolution and radiation tolerance. One of such experiments is the proposed LHCb Upgrade II with a potential use of HV-MAPS in the main tracking system.

The TelePix2 is a full-size HV-MAPS developed for and used as region-of-interest trigger and timing layer for the beam telescope at DESY test beam. Its excellent performance makes TelePix2 an ideal candidate to study its tolerance against non-ionising radiation damage. For that, TelePix2 sensors have been irradiated to fluences between 1×10^{13} and 1×10^{15} 1-MeV n_{eq}/cm^2 at the TRIGA reactor facilities at Jožef Stefan Institute Ljubljana and at the Johannes Gutenberg University Mainz. The performance of the irradiated sensors was studied at the DESY test beam facility using a MuPix11 beam telescope as reference. These test beam measurements yield a hit efficiency of $\epsilon_{hit} > 99\%$ and a time resolution of $\sigma_t < 2.4$ ns at a fluence of 1×10^{15} 1-MeV n_{eq}/cm^2 . Thus, it demonstrates a tolerance against non-ionising radiation damages. With such tolerance the HV-MAPS technology is suitable for the application in HL-LHC experiments like the LHCb Upgrade II.

The application of TelePix2 as region-of-interest trigger and timing layer is highlighted in this talk. Furthermore, it will focus on the effects of radiation damage on the performance in terms of hit efficiency and time resolution.

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