The LHCb Mighty-Pixel Upgrade: HV-MAPS Silicon Tracking for the HL-LHC

Abstract

**The LHCb experiment at CERN’s Large Hadron Collider is a forward spectrometer optimised for precision studies of heavy-flavour physics, with a particular focus on CP violation and rare decays of beauty (b) and charm (c) hadrons. To fully exploit the High-Luminosity LHC (HL-LHC), where LHCb will operate at a nominal luminosity of** 1×1034 cm−2 s−1**, the detector will undergo a major upgrade during Long Shutdown 4 (2034–35). This upgrade will enable the collection of up to 300 fb⁻¹ of data, providing unprecedented sensitivity to physics beyond the Standard Model.**

**Operating under HL-LHC conditions presents significant challenges, particularly high occupancies and intense radiation levels in the inner tracking regions near the beam pipe. To address these, the central section of the current Scintillating Fibre (SciFi) tracker will be replaced by Mighty-Pixel, a next-generation silicon tracker with high granularity and radiation hardness. It is based on High-Voltage Monolithic Active Pixel Sensors (HV-MAPS) produced using commercial CMOS technology. Covering an active area of ~8 m² across six layers, Mighty-Pixel** is designed to provide the robust tracking performance required in the HL-LHC environment, offering excellent spatial resolution, fast timing, and a low material budget.

**This talk will present the current R&D status of Mighty-Pixel, now entering its second prototyping phase, and will cover sensor design, readout electronics, mechanics, and cooling, as well as the road map toward pre-production, full-scale construction, and installation.**