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The MAPS-based vertex detector for the STAR Experiment: lessons learned and performance

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The PiXeL detector (PXL) of the STAR experiment at RHIC is the first application of the state-of-the-art thin Monolithic Active Pixel Sensors (MAPS) technology in a collider environment. The PXL, together with the Intermediate Silicon Tracker (IST) and the Silicon Strip Detector (SSD), form the Heavy Flavor Tracker (HFT), which has been designed to improve the vertex resolution and extend the STAR measurement capabilities in the heavy flavor domain, providing a clean probe for studying the Quark-Gluon Plasma.

The two PXL layers are placed at a radius of 2.8 and 8 cm from the beam line, respectively, and accommodate 400 ultra-thin (50 μm) high resolution MAPS sensors arranged in 10-sensor ladders to cover a total silicon area of 0.16 m^2. Each sensor includes an array of nearly 1 million pixels with a pitch of 20.7 μm. The sensor features 185.6 μs readout time and 170 mW/cm^2 power dissipation. The detector is air-cooled, allowing a global material budget of 0.4% radiation length on the innermost layer. A novel mechanical approach to detector insertion allows for the installation and integration of the pixel sub detector within a 12 hour period during an on-going STAR run.
The detector was successfully commissioned and took data in Au+Au collisions at 200 GeV during the 2014 RHIC run. With improved reliability, material budget, and tracking capabilities, the HFT took data in p+p, p+Au, and p+Al collisions at $\sqrt{s_{NN}}$ =200 GeV in the 2015 RHIC run.

In this talk we will present detector specifications, experience from the construction and operations, and lessons learned. We will also show preliminary results from 2014 Au+Au data analyses, demonstrating the capabilities of charm reconstruction with the HFT.

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