LA-UR- 10-02857

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Intended for: Imaging 2010 Conference in Stockholm Sweden; June 9, 2010

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Form 836 (7/06)

Title:
The Silicon Vertex Tracker and Custom Electronics Readout for the PHENIX Experiment at RHIC

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Abstract:

We are designing a Forward Silicon Vertex Tracker (FVTX) upgrade for the PHENIX detector at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory to extend the vertex capability of the central PHENIX Silicon Vertex Tracker (VTX) to forward and backward rapidities, (η), and also to extend the reach in the low momentum-fraction region, (x). The FVTX is designed with adequate spatial resolution to separate decay muons coming from the relatively long-lived heavy quark mesons (Charm and Beauty), from particles that originate at the primary collision vertex. These heavy quarks can be used to probe the high density medium, the quark-gluon plasma, that is formed in Au+Au collisions at RHIC. The FVTX is designed as two endcaps. Each endcap is comprised of four silicon disks covering opening angles from 10 to 35 degrees to match the existing muon arm acceptance. Each plane consists of p-on-n, silicon wedges, with ac-coupled mini-strips spaced on 75μm pitch in the radial direction and varying projective length in the phi direction increasing from 3.35 mm at the inner radius to 11.65 mm at the outer radius. The performance criteria of a custom front-end chip, the FPHX, was specified by the FVTX collaboration and designed and laid out by the ASIC Design Group at Fermilab. The chip combines fast trigger capability with data push architecture in a low power design. The production rounds of the sensor and chips are complete. The sensors and readout chip are described in technical detail and test results are presented.