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The CDF Run II Silicon Detector

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The CDF Run II Silicon detector is one of the largest operating Silicon detectors in high energy physics. It has 6m2 of Silicon sensors with 722,432 channels read out by 5456 chips. The Silicon detector allows precision tracking, vertexing and is used in the hardware displaced vertex trigger.

The CDF silicon detector had a very challenging commissioning period of 18 months. However the detector has been operating reliably over the last 3 years and it has recorded more than 1fb-1 of data. There will be a brief review of detector commissioning, the effects of radiation damage and its impact on the CDF physics programme.

Summary

The Run-II CDF Silicon detector is one of the largest operating Silicon detectors. The total surface area covered by the Silicon sensors is ˜6m2. The complete system totals 722,432 channels read out by 5456 chips. The detector is subdivided into three sub-detectors: L00, SVX and ISL.

SVX is the core of the CDF silicon detector. It consists of 5 concentric layers of Silicon arranged as twelve 30o wedges in r⊠. SVX is used by the hardware displaced vertex trigger allowing it to participate in the Level-2 trigger decision making. This allows CDF to trigger directly on B hadrons and other long lived particles.

L00 is a single layer of single sided silicon attached directly to the beam-pipe. This allows precision position measurements before multiple-scattering by inactive material. Due to its proximity to the beam, radiation hard LHC sensors were used which can be depleted to 500V.

The Intermediate Silicon Layer (ISL) was added to extend the forward acceptance of the Silicon tracker to |⊠|=2 and to link tracks from SVX to the Central Outer Tracker (COT); the CDF wire chamber. The sub-detector is arranged as two forward layers and one central layer.

The commissioning of the CDF Silicon detector took considerable effort. It took almost 18 months before the detector was considered as operational. This was due to the large number of problems encountered which included blocked cooling lines, noise on L00 and the wirebond resonance problems. Despite these initial problems, the detector has now been running stably over the last 3 years. 92% of the detector is powered with almost 85% returning data with a digital error rate < 1%.

The Silicon detector has been exposed to 1.5fb-1 of proton-anti proton collisions. Evidence of radiation damage of the sensors has been observed with increases in the bias currents and the evolution of the depletion voltage. There will be a presentation of these results and a discussion on the implications upon detector performance and lifetime.

A highlight of the CDF physics programme has been the measurement of the Bs mixing. This single measurement now defines the world average and the Silicon detector played a critical role in this measurement.

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