Development of a beam telescope based on a hybrid-less micro-strip sensor

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Introduction

The DESY II test beam facility provides $e^+e^-$ beams with energies 1-6 GeV. A new beam telescope is being built to address many user demands for momentum measurements in a 1T solenoid.

Requirements

- Large coverage area: $Y \geq 10 \text{ cm long}$
- Noise level per channel:
- Low material budget: 320
- Fine pitch: 25/50
- Compact: $x \leq 3.5 \text{ cm thick}$
- Less readout channels: floating strips;
- 10mm Beam Precise: Spatial point resolution
- Hybrid-less: Signal routing through a 2nd

Large active area: $\sim 10 \times 10 \text{ cm}^2$

SiD Hybrid-less Micro-strip Sensor

- Large active area: $\sim 10 \times 10 \text{ cm}^2$
- Fine pitch: 25/50 μm sense/readout pitch → spatial resolution of $\sim 7 \mu m$
- Less readout channels: floating strips;
- Low material budget: 320 μm thick (0.3%
- Hybrid-less: Signal routing through a 2nd metallization layer;
- Good electric properties: low leakage current, depletes $\sim 50 \text{ V}$.

Commissioning Results and Discussion

- Forced random triggers;
- Convert ADC to fC by channel;
- Expect a Gaussian charge distribution of per channel;
- Noise level per channel: RMS of the Gauss;
- Full sensor noise level: median of the noise distribution over all the channels.

Signal response verified in First performance measurement (both categories)

Summary

- First application of the SiD hybrid-less micro-strip sensor
  - Sensor with its readout characterized;
  - Promising S/N ratio $\sim 10$;
  - Signal response verified in terms of beam spot location and Landau shape

Outlook

- News from 2019 Feb TestBeam with telescope prototype;
- Tracks found: time and spatial correlation among sensors.
- First performance measurement with a Mimosa telescope;
- Work ongoing for clustering, alignment, and tracking.