AIDA-2020-POSTER-2019-004

AIDA-2020

Advanced European Infrastructures for Detectors at Accelerators

Poster

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

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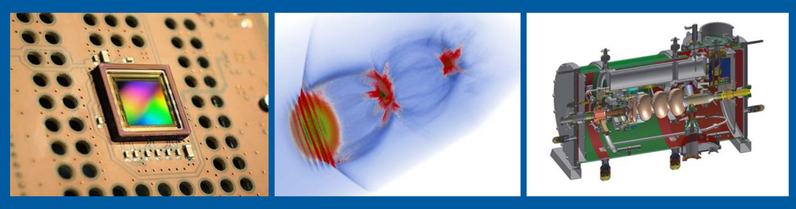
Programme Matter and Technologies

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

DTS-ST3: Detector Systems

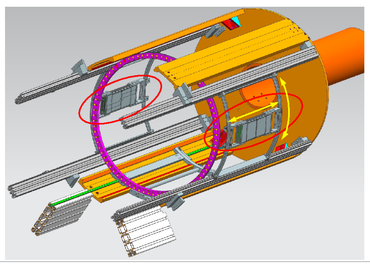


M. Wu, T. Behnke, R.Diener, U. Kraemer, M. Stanitzki (DESY)

M. Breidenbach, D. R. Freytag, R. T. Herbst, B. A. Reese (SLAC)

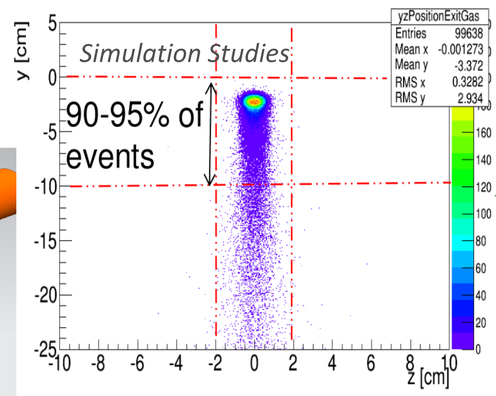
Introduction

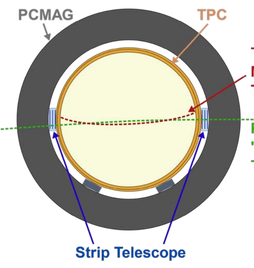
The DESY II test beam facility provides e^+e^- beams with energies 1-6 GeV. A new beam telescope is being built to address many user demands for momentum measurements in a 1T solenoid.

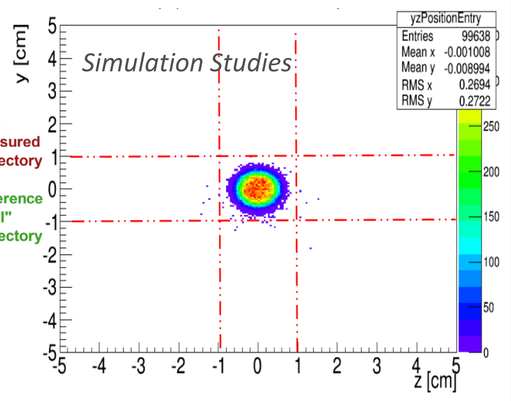


Requirements

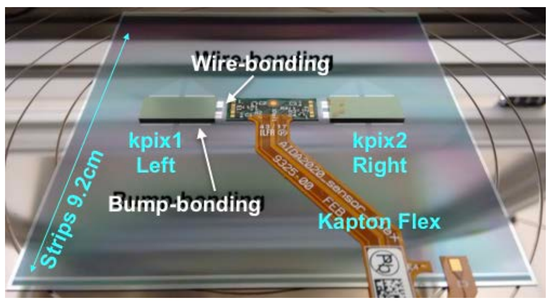
- Large coverage area: Y >= 10 cm long;
- Compact: x <= 3.5 cm thick;
- Precise: Spatial point resolution
  - σ_y <= 10 μm
  - σ_z <= 1 mm







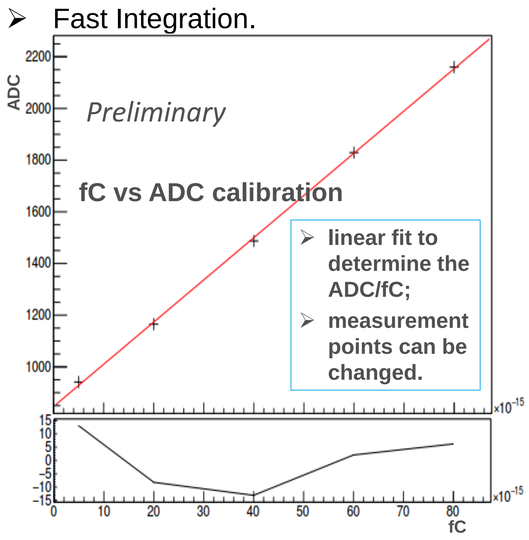
SiD Hybrid-less Micro-strip Sensor



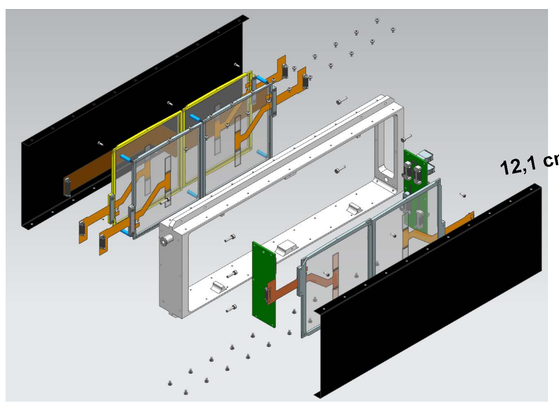
- Large active area: ~10x10 cm^2
- Fine pitch: 25/50 μm sense/readout pitch → spatial resolution of ~7 μm;
- Less readout channels: floating strips;
- Low material budget: 320 μm thick (0.3% X_0);
- Hybrid-less: Signal routing through a 2nd metallization layer;
- Good electric properties: low leakage current, depletes ~50 V.

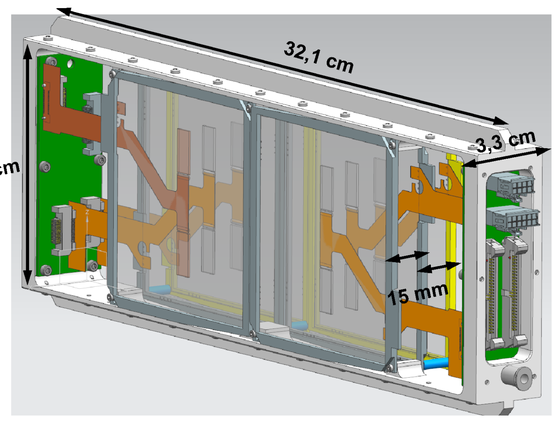
KPiX Readout ASIC

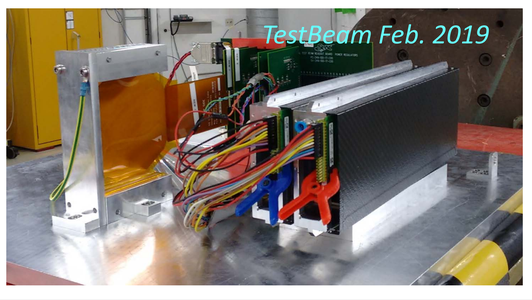
- 13-bit ADC per readout channel;
- Two Trigger modes:
  - Self-trigger or External Trigger;
- Configurable Power cycled;
- Fast Integration.



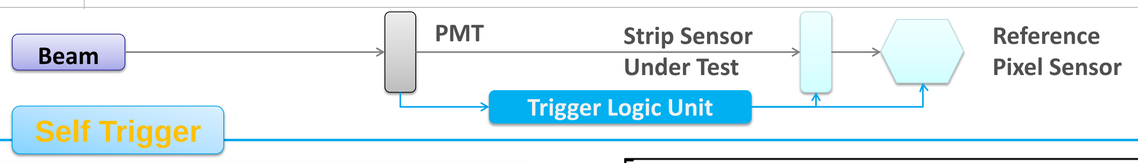
The LYCORIS Telescope



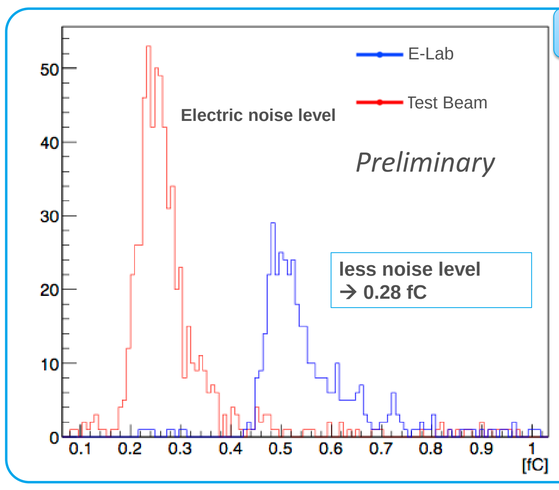




Commissioning Results and Discussion

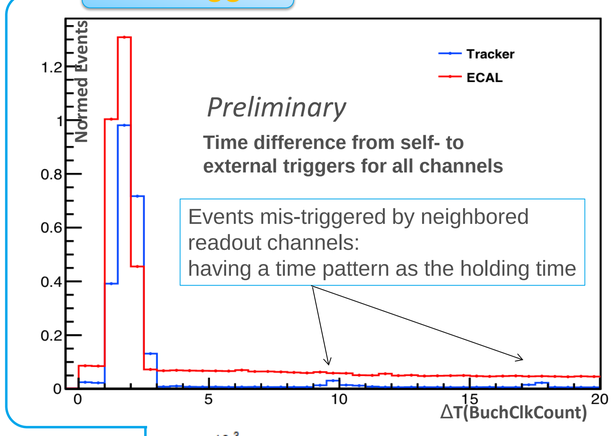


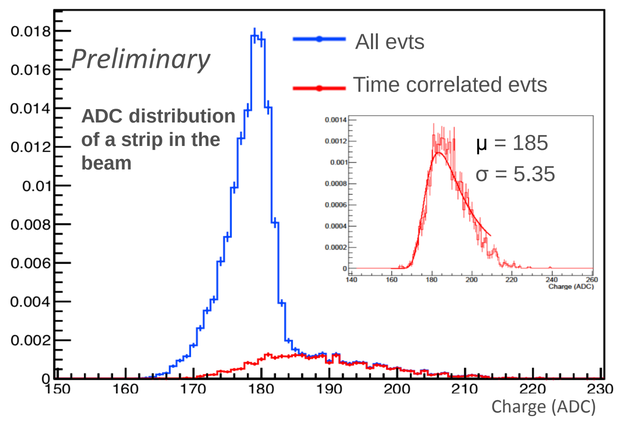
Noise Level

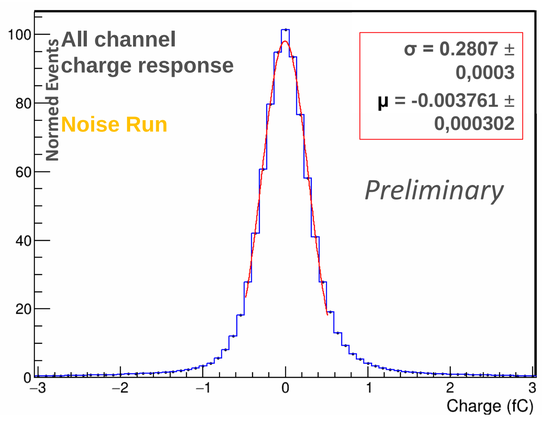


- Forced random triggers;
- Convert ADC to fC by channel;
- Expect a Gaussian charge distribution of per channel;
- Noise level per channel: RMS of the Gaus;
- Full sensor noise level: median of the noise distribution over all the channels.

Self Trigger

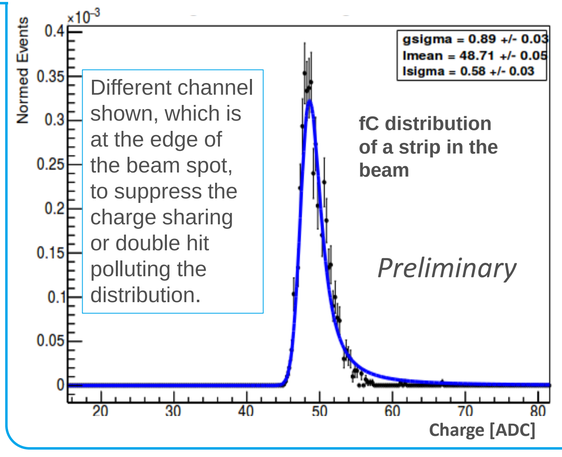


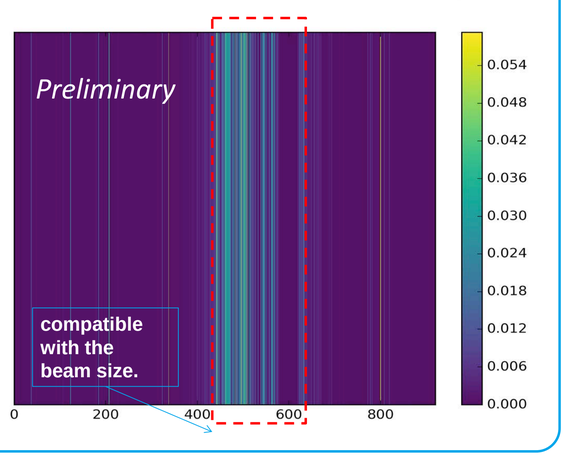




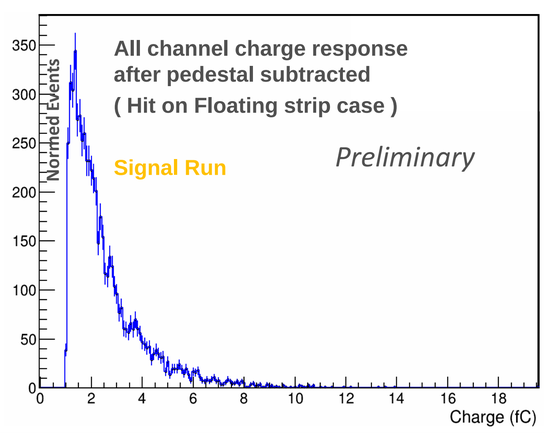
External Trigger -- Full Coincidence

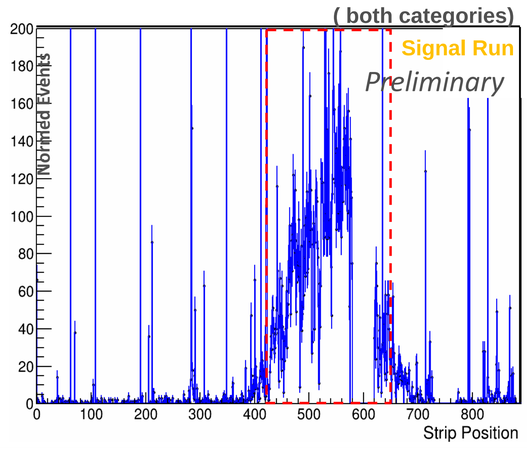
- Pedestal Subtraction;
  - Common noise observed and considered in subtraction algorithm;
- Signal Response:
  - Hit profile into 2 categories: hit on floating or readout strip.





Num of Hits vs Strip position (both categories)





Summary

First application of the SiD hybrid-less micro-strip sensor

- Sensor with its readout characterized;
- Promising S/N ratio ~ 10;
- Signal response verified in terms of beam spot location and Landau shape.

Outlook

10mm

- 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, alignement, and tracking.

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement no. 654168.