

AIDA-2020

Advanced European Infrastructures for Detectors at Accelerators

Poster

Development of a large active area beam telescope based on the SiD micro-strip sensor

Wu, Mengqing (DESY) *et al*

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Development of a large active area beam telescope based on the SiD micro-strip sensor.



U. Krämer, M. Stanitzki, **M. Wu** (DESY, Hamburg, Germany)
 M. Breidenbach, D. R. Freytag, R. T. Herbst, B. A. Reese (SLAC, CA, USA)
 S. Roelofs (La Hague, AL Delft, The Netherlands)



NATIONAL ACCELERATOR LABORATORY

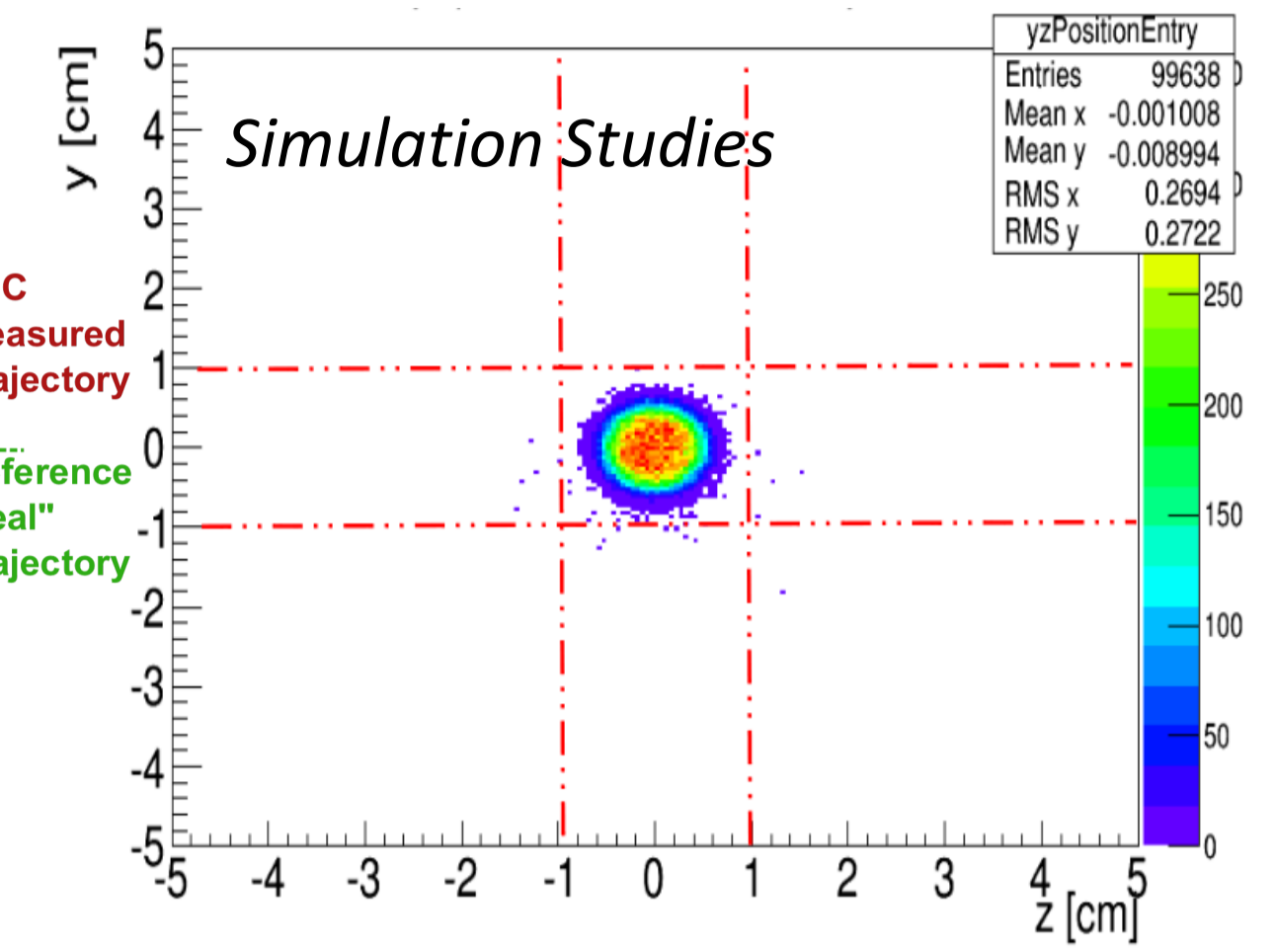
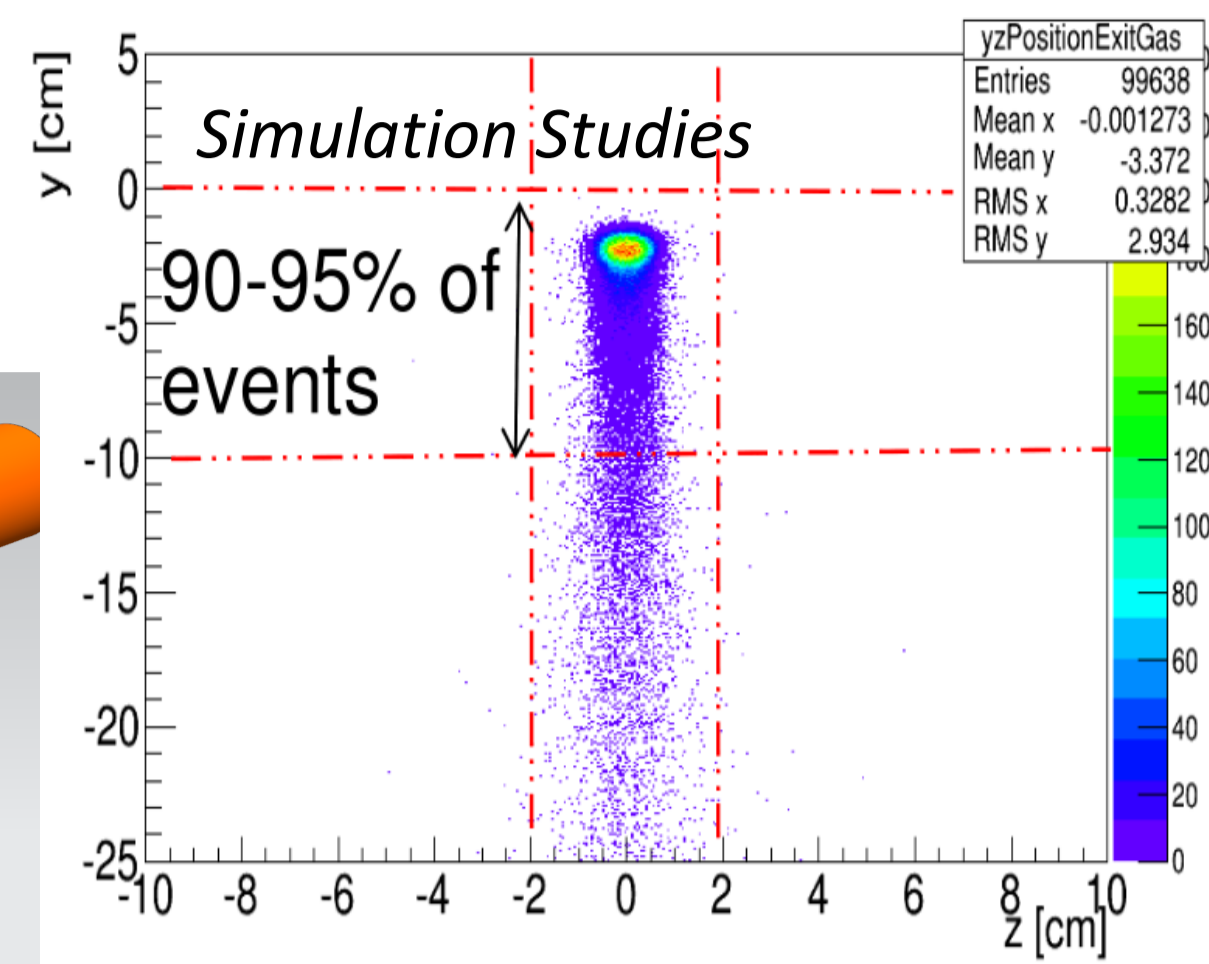
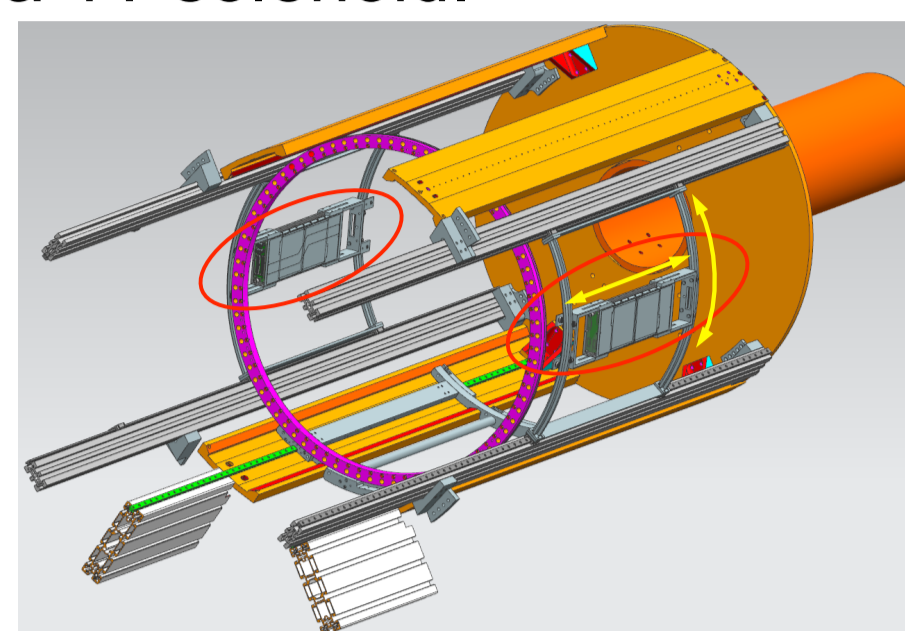


Introduction

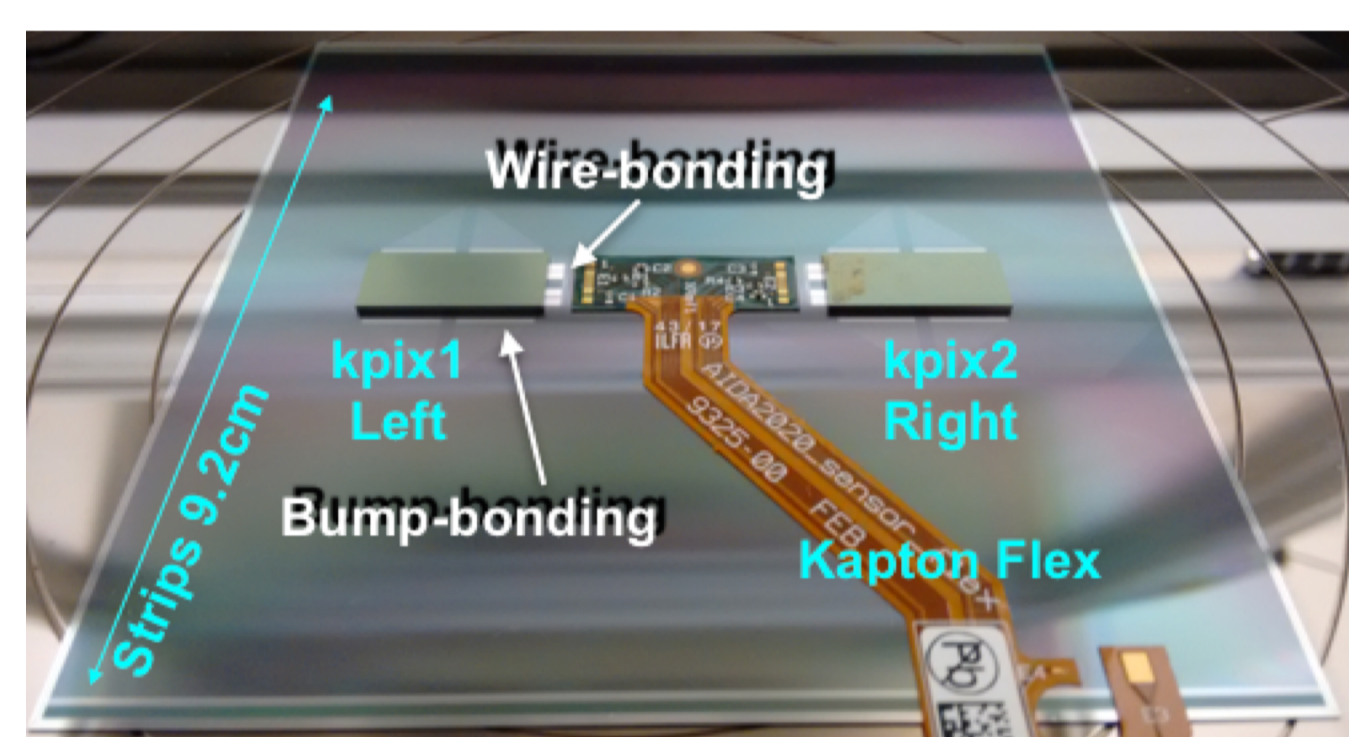
The DESY II test beam facility provides e^+e^- beams with energies 1-6 GeV. A new beam telescope is being built to address many user demands for momentum measurements in a 1T solenoid.

Requirements

- **Large coverage area:** $Y \geq 10$ cm long;
- **Compact:** $x \leq 3.5$ cm thick;
- **Precise:** Spatial point resolution
 - $\sigma_y \leq 10 \mu\text{m}$
 - $\sigma_z \leq 1$ mm



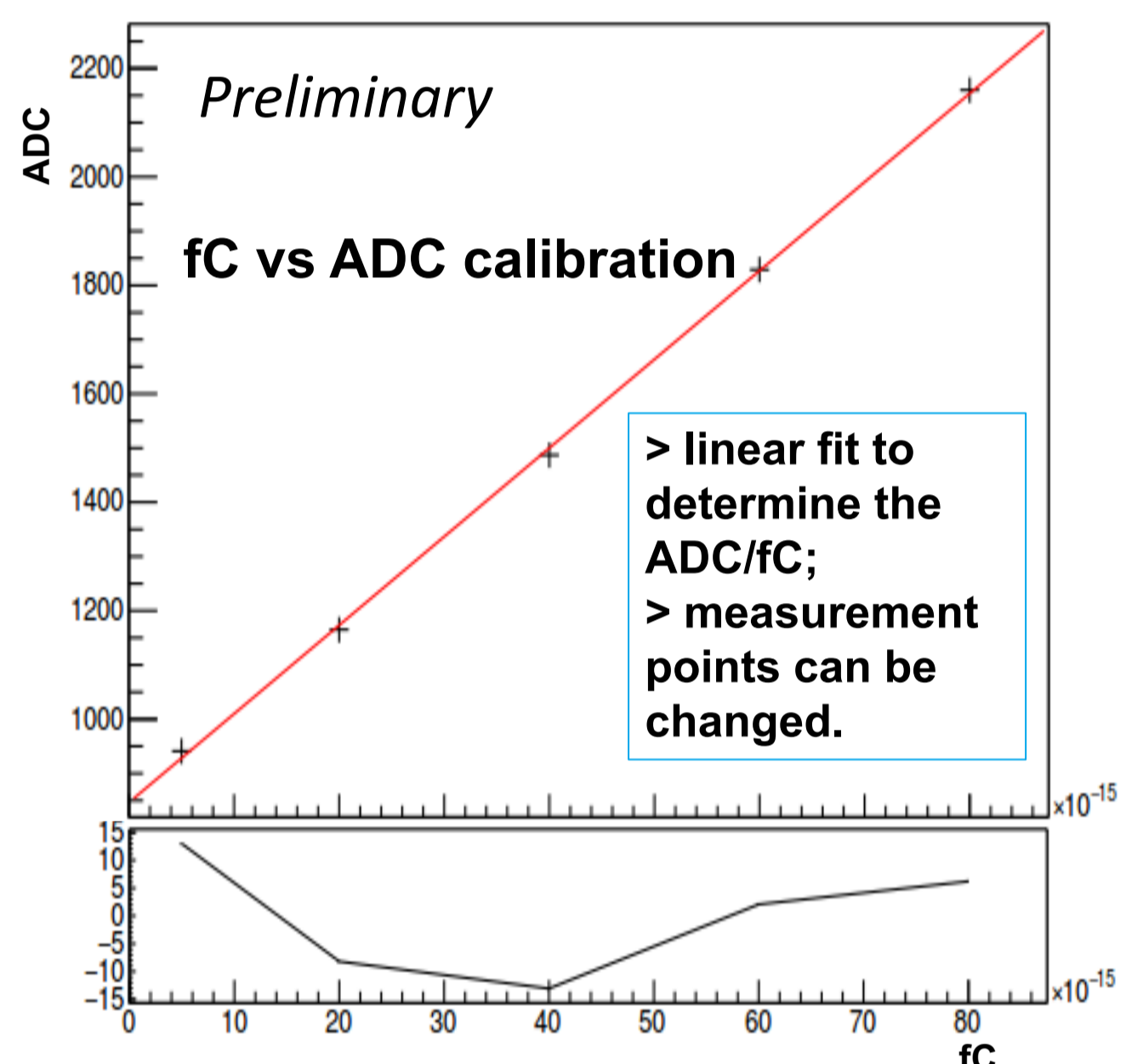
SiD Hybrid-less Micro-strip Sensor



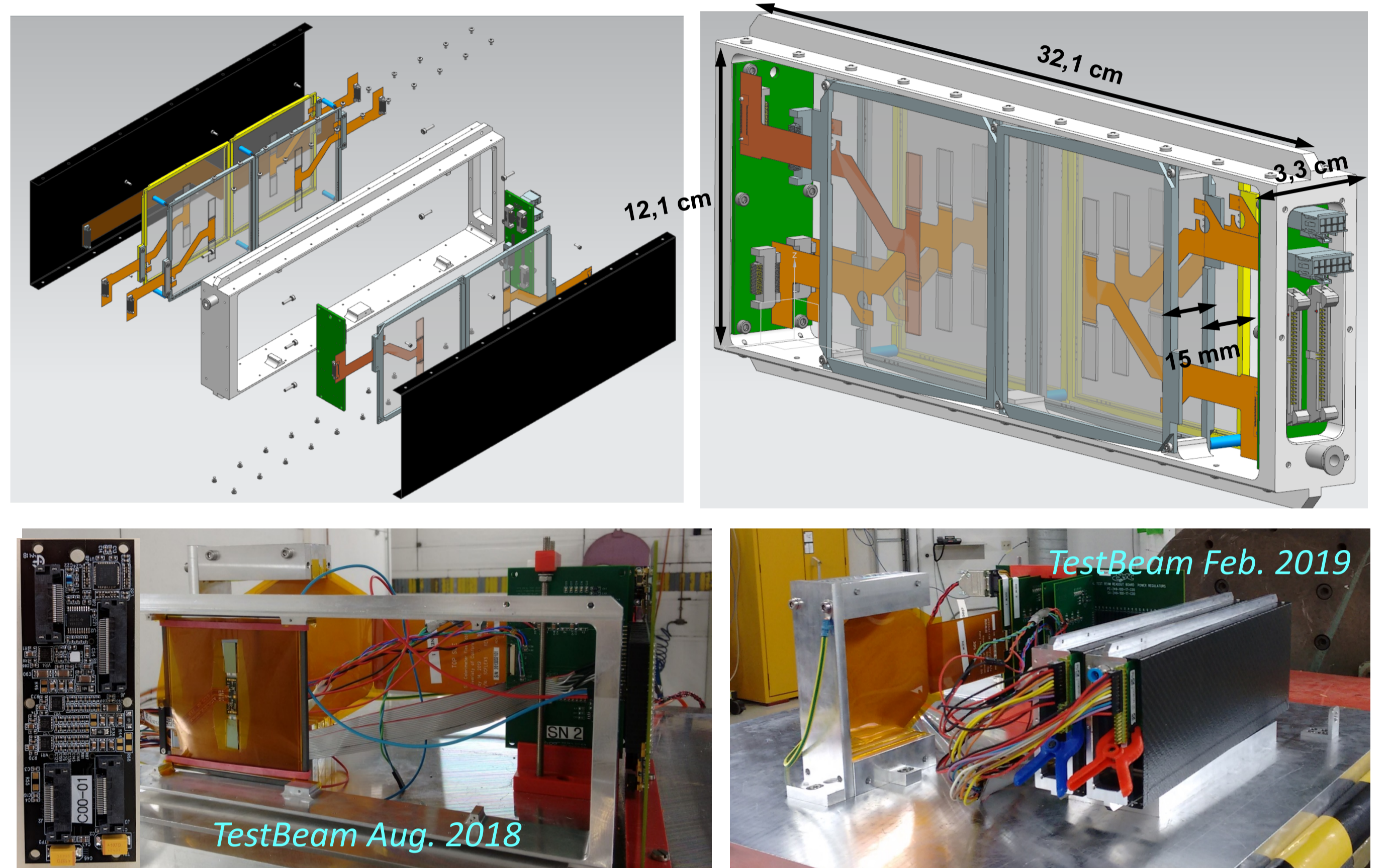
- **Large active area:** $\sim 10 \times 10 \text{ cm}^2$
- **Fine pitch:** 25/50 μm sense/readout pitch \rightarrow spatial resolution of $\sim 7 \mu\text{m}$;
- **Less readout channels:** floating strips;
- **Low material budget:** 320 μm thick ($0.3\% X_0$);
- **Hybrid-less:** Signal routing through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

KPIX Readout ASIC

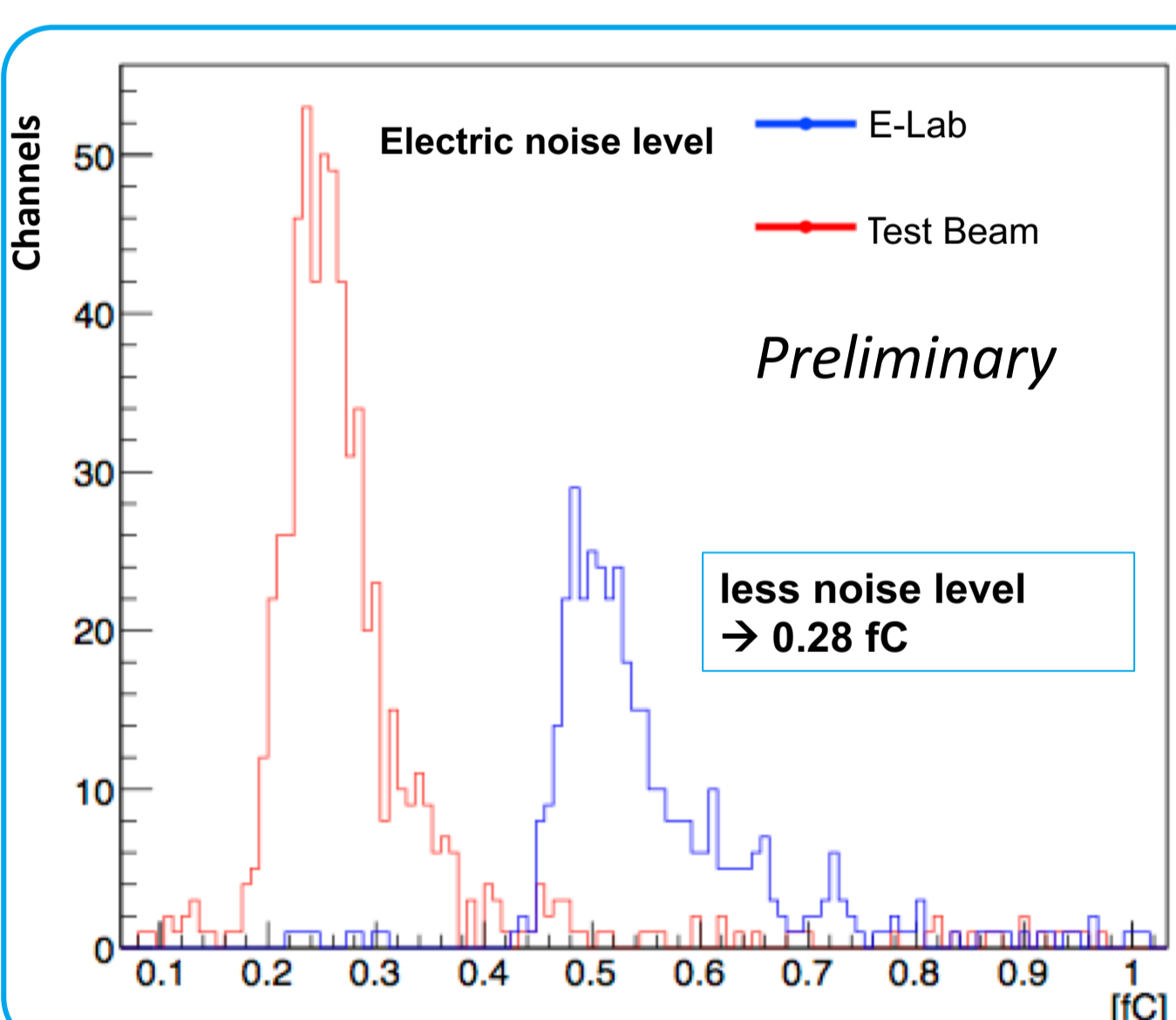
- 13-bit ADC per readout channel;
- Two Trigger modes:
 - Self-trigger or External Trigger;
 - Configurable Power cycled;
 - Fast Integration.



The Large Active Area LYCORIS Telescope



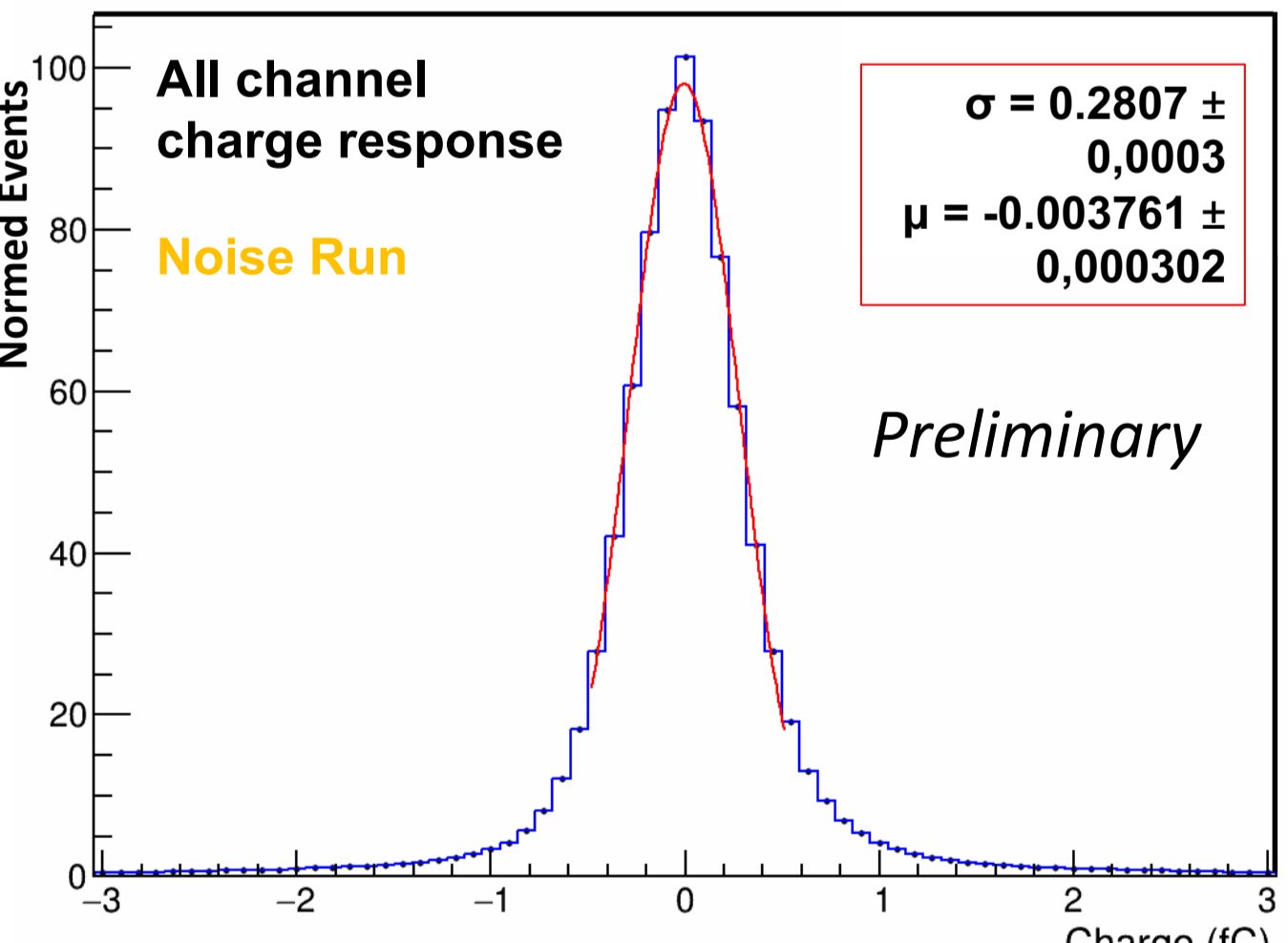
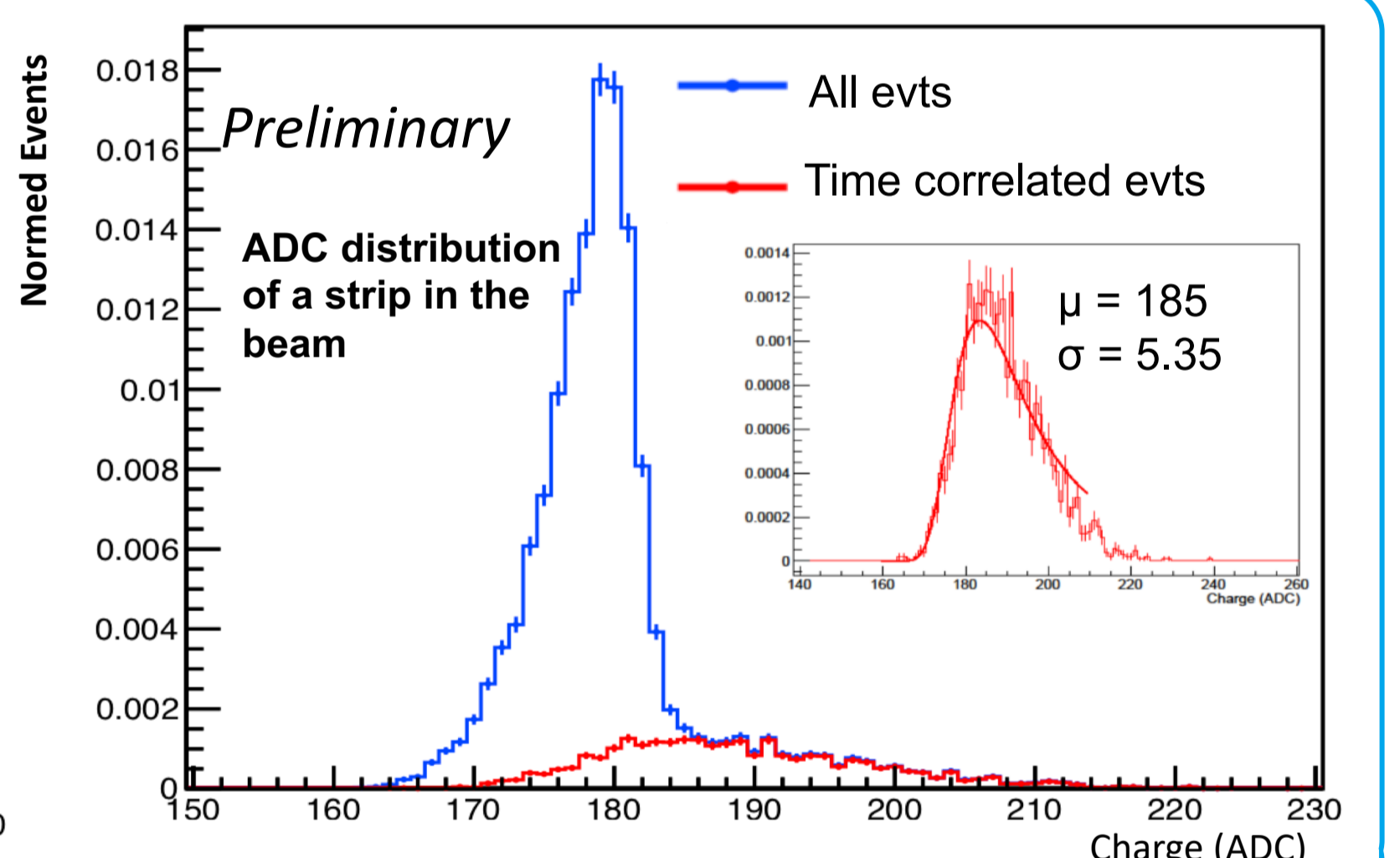
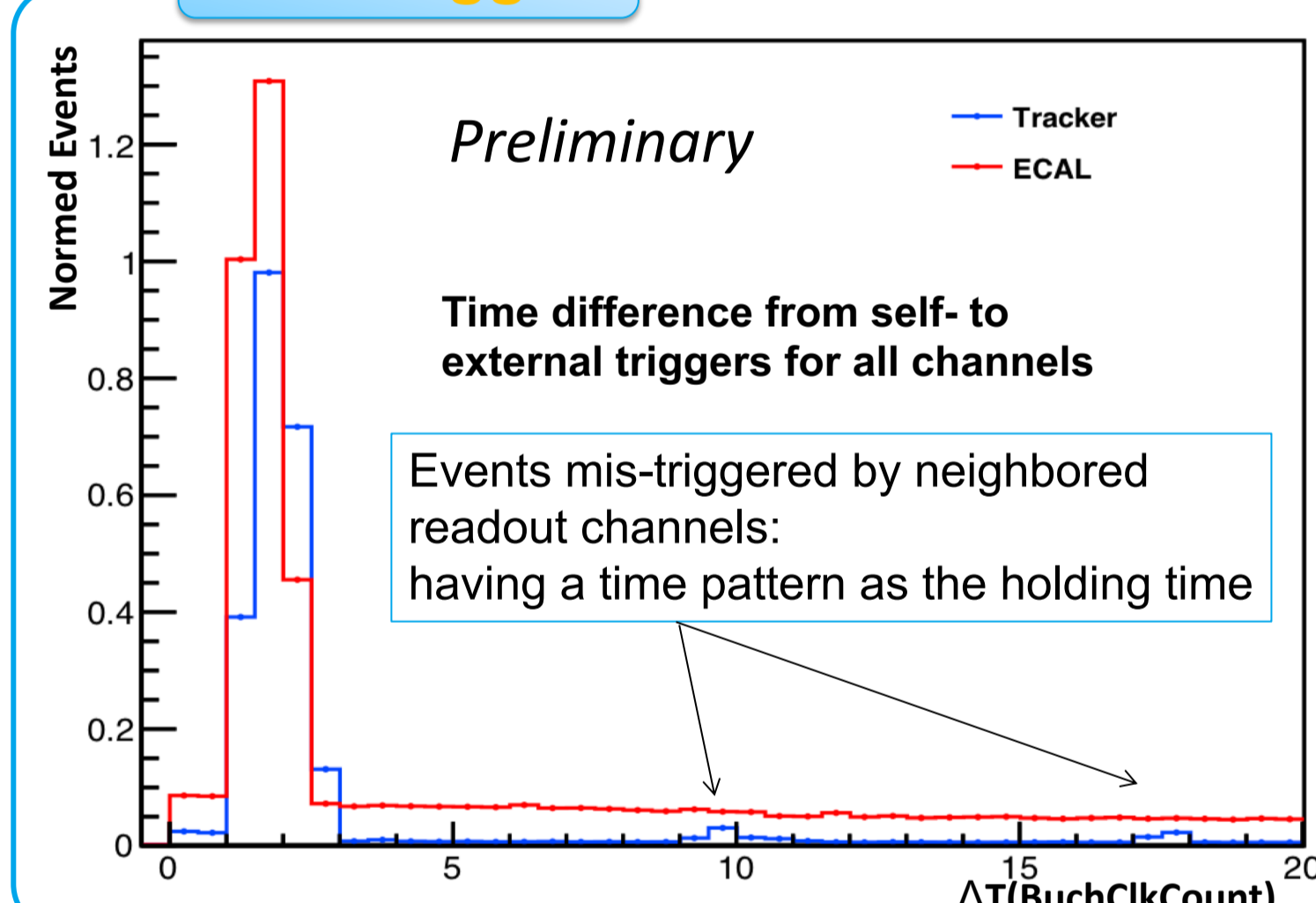
Commissioning Results and Discussion



Noise Level

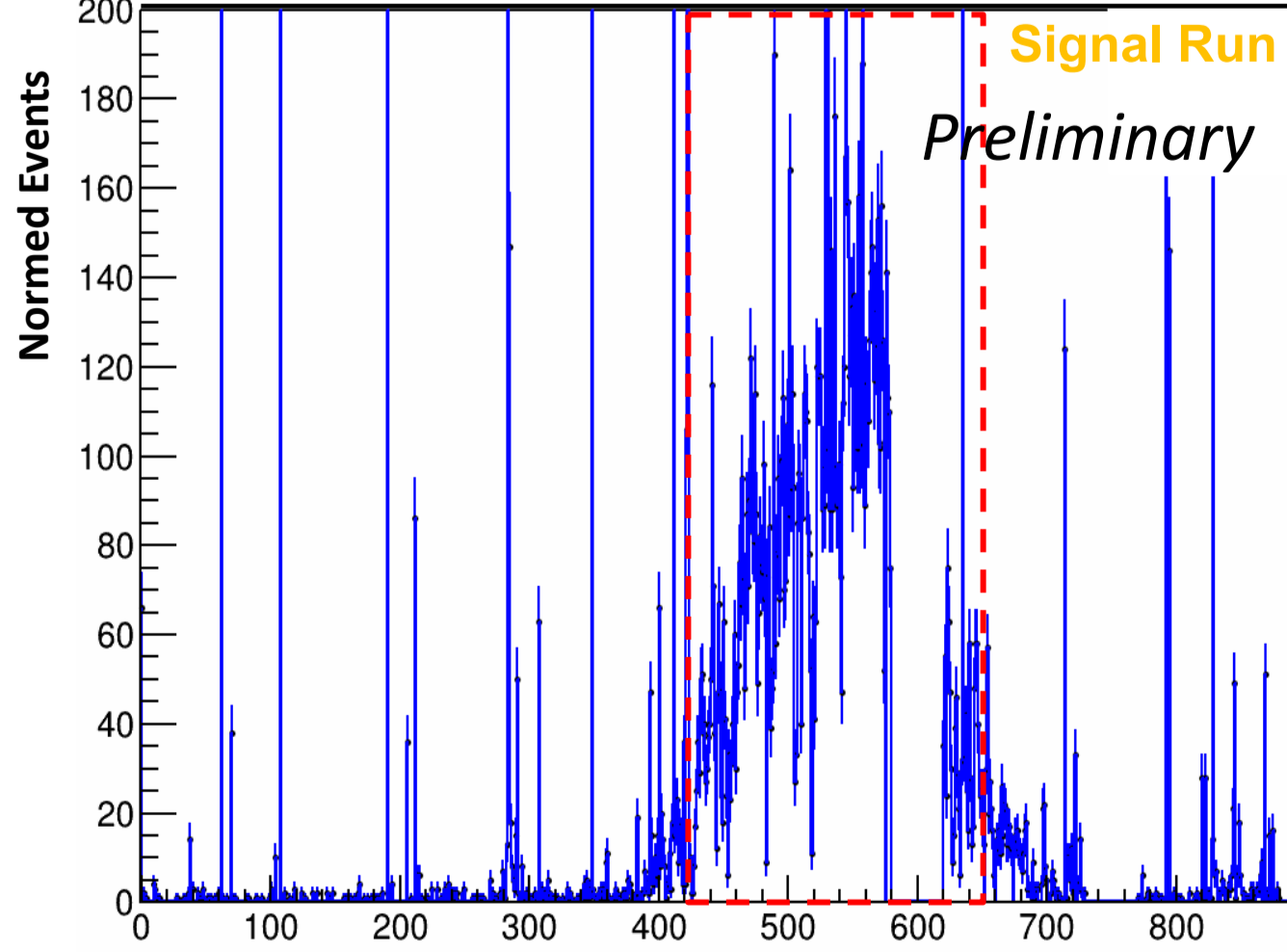
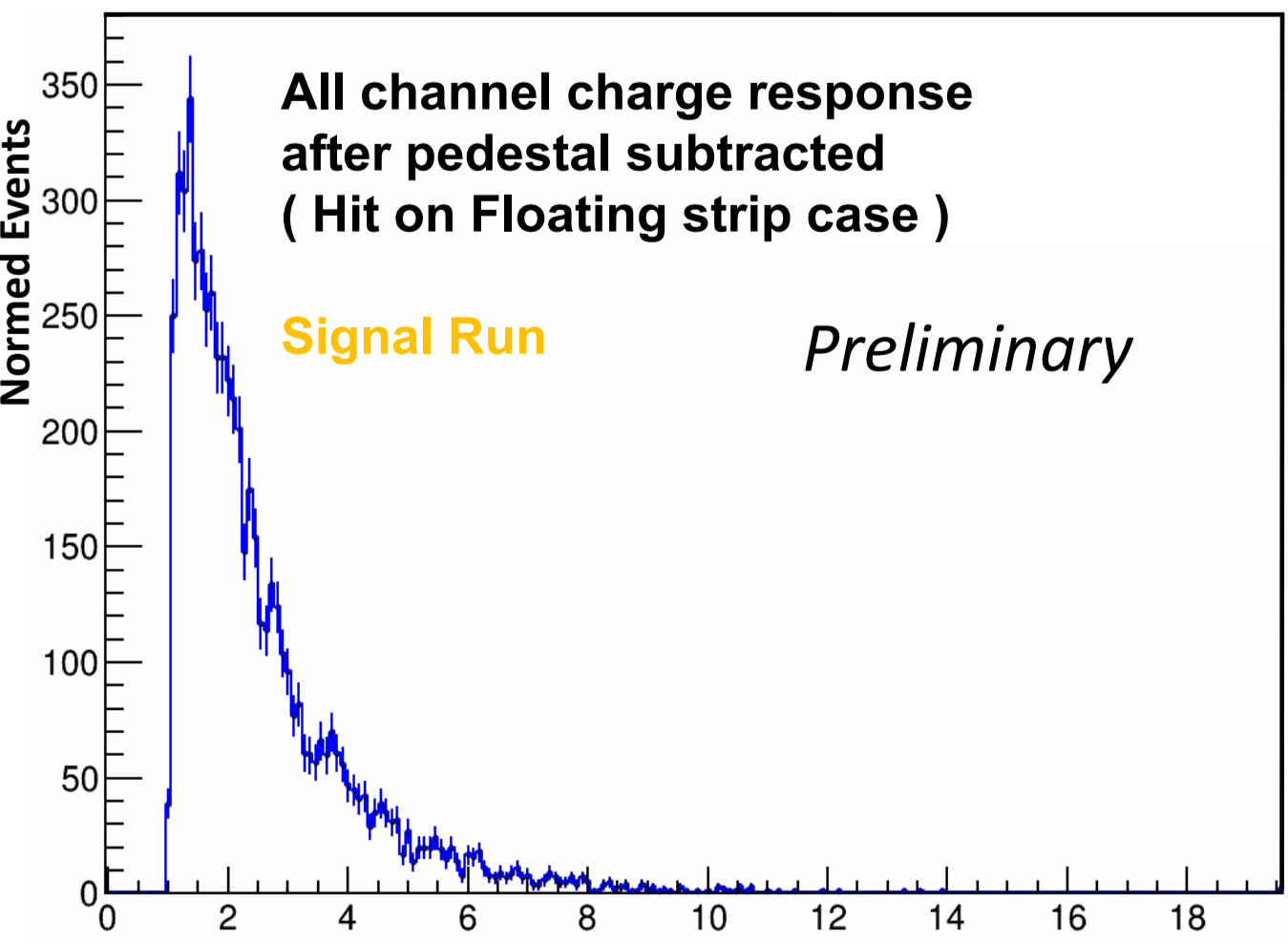
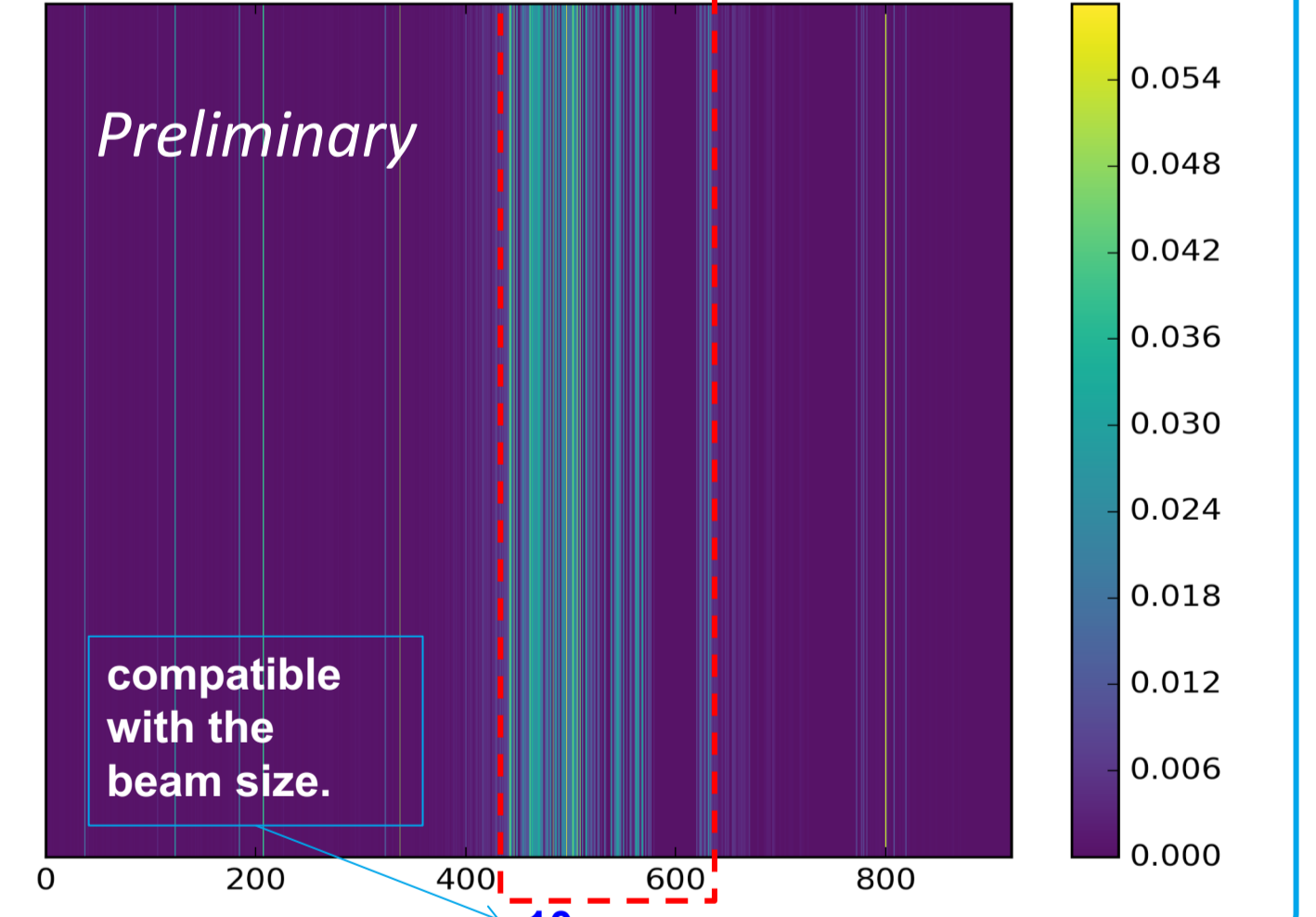
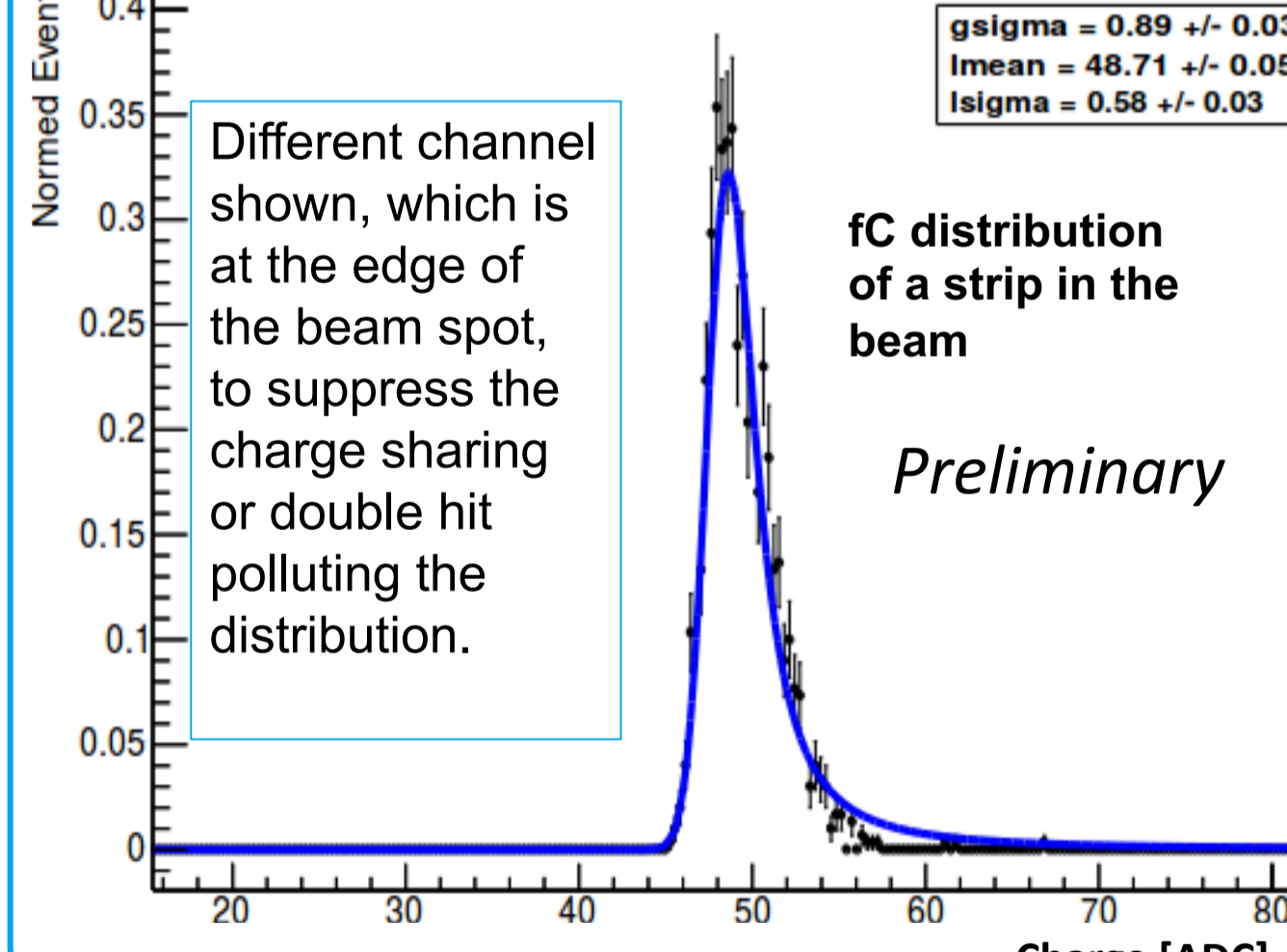
- Forced random triggers;
- Convert ADC to fC by channel;
- Expect a Gaussian charge distribution of per channel;
- **Noise level per channel:** RMS of the Gaus;
- **Full sensor noise level:** median of the noise distribution over all the channels.

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.



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

- 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.



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