Overview and requirements of the PANDA GEM Tracker

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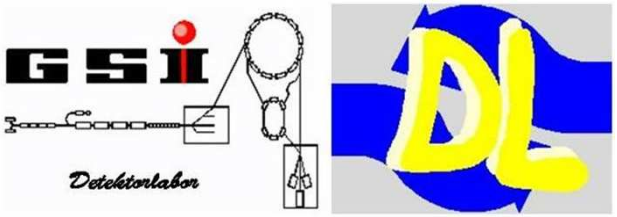
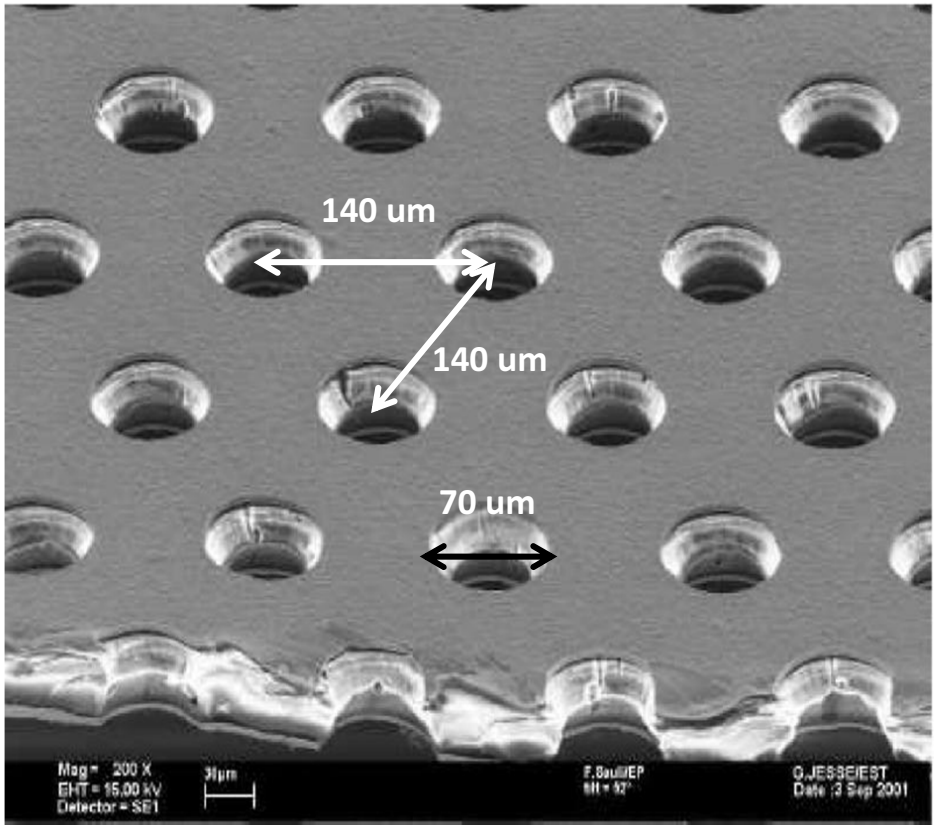
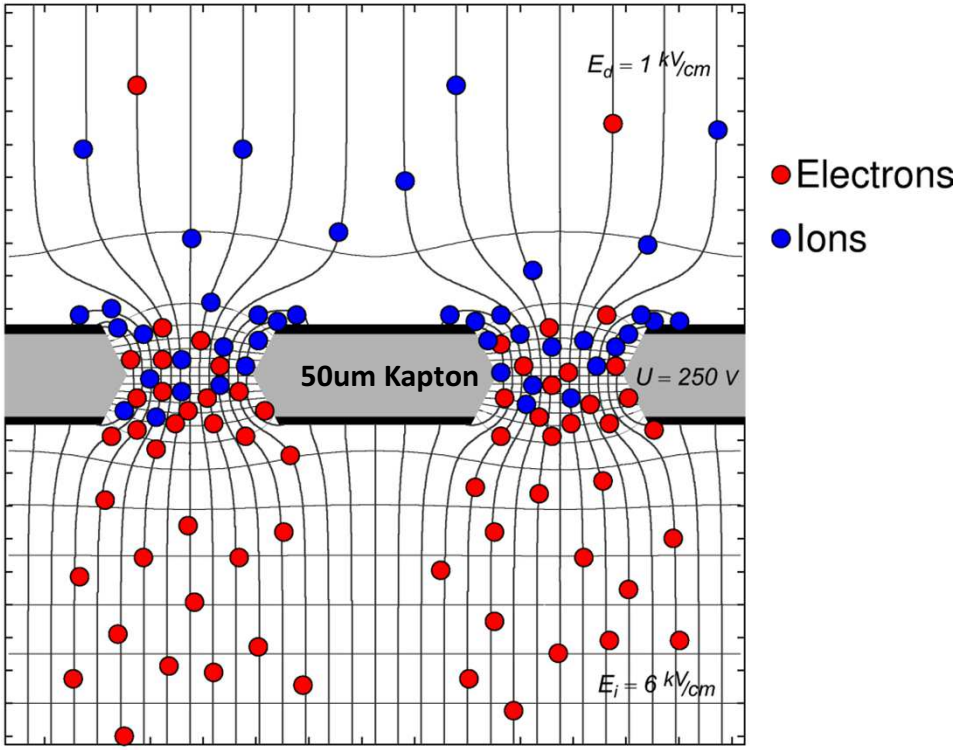
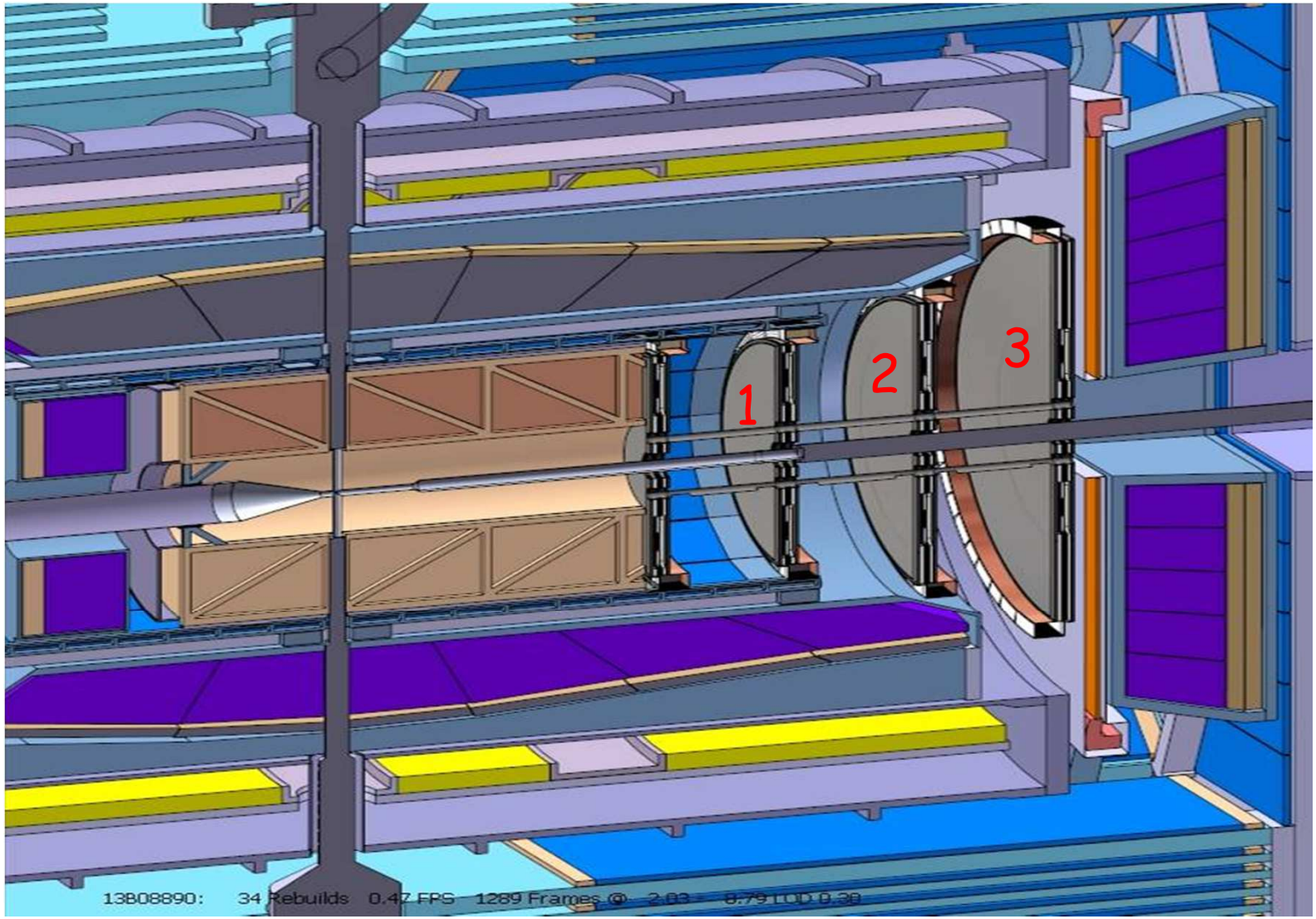


Gas Electron Multiplier (GEM)



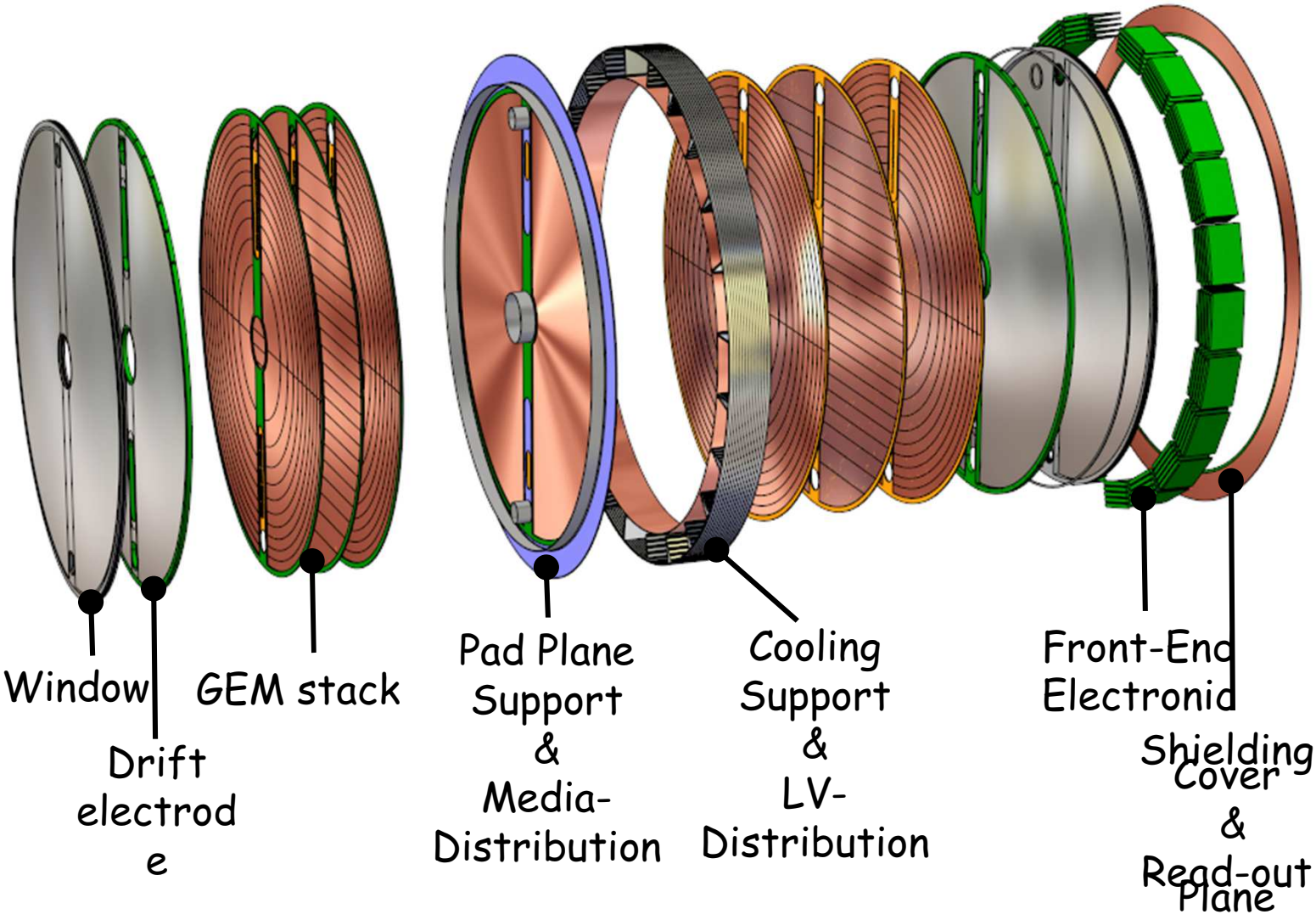


Planar-GEM Trackers



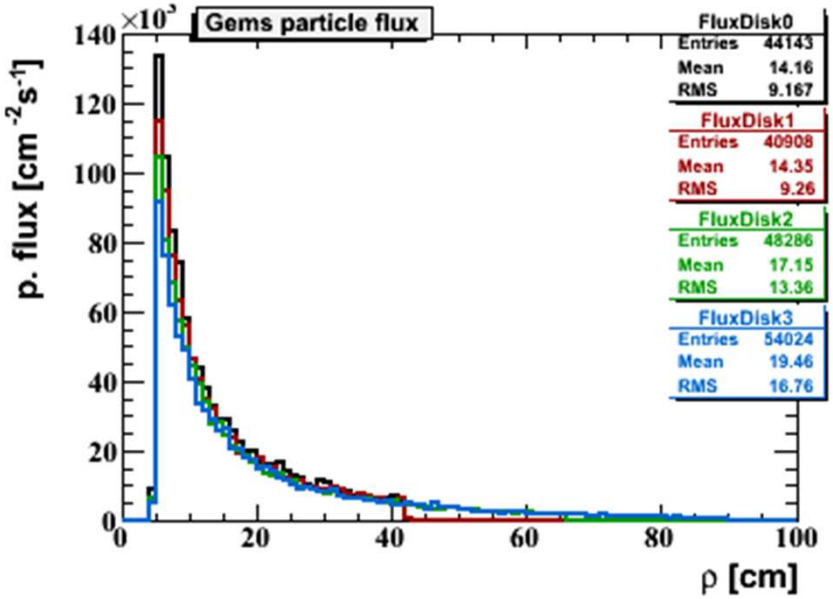
Target spectrometer@PANDA 'V833'

Planar GEM-Trackers : Detector assembly

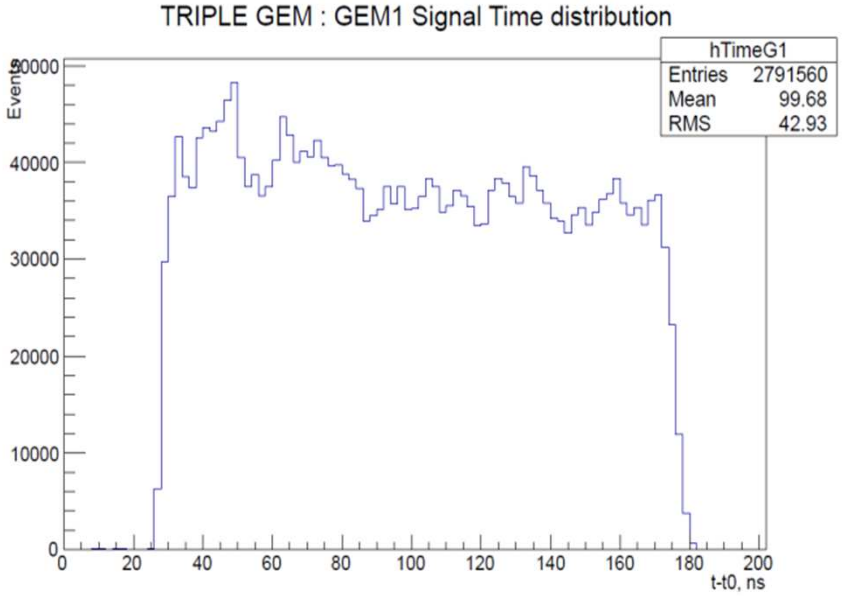


Simulations: Hit Rate and Signal Width

HIT-rate: 5..50(140)k particles/cm^2/s



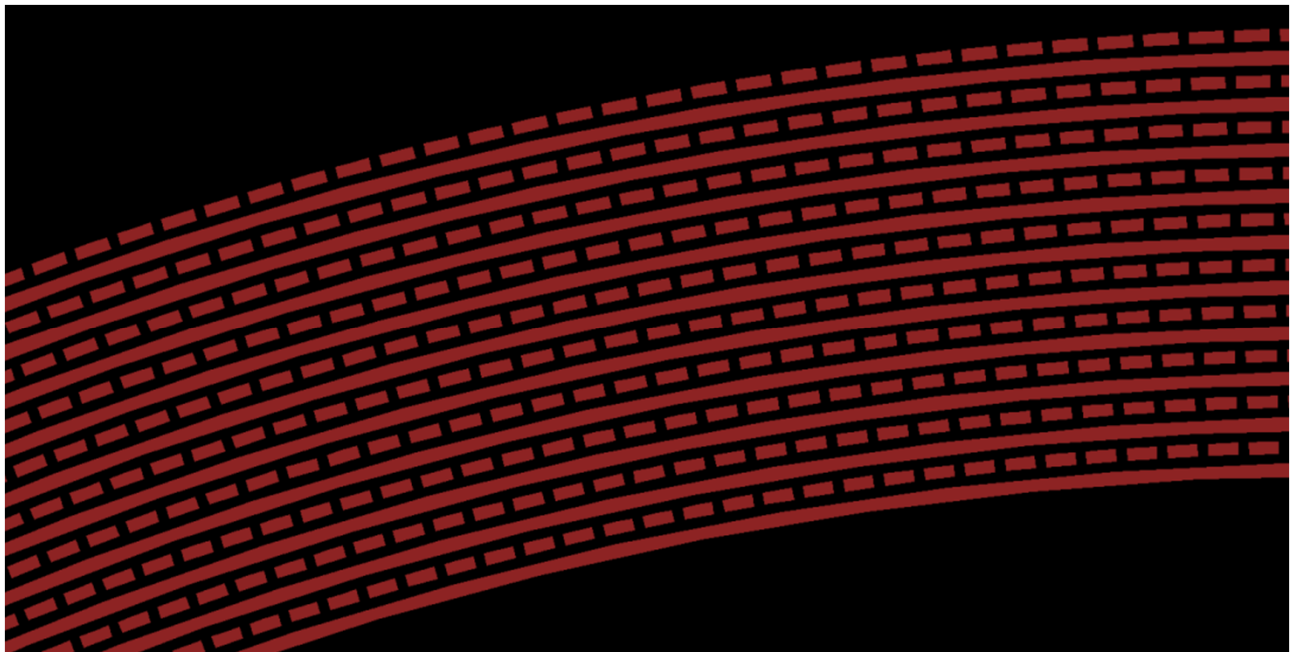
$\Delta T_G \approx 150\ ns$



Strips Capacitance

Circular + Radial strips.
Required Resolution: 150um.
pitch ~400um. Length up to 80cm.

C=10-150 pF

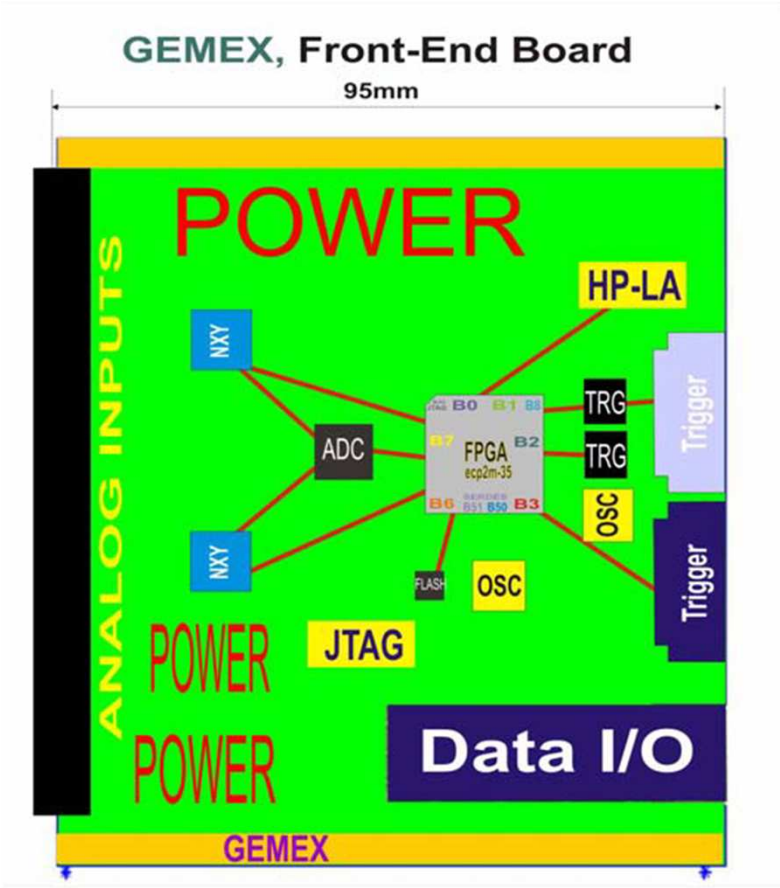


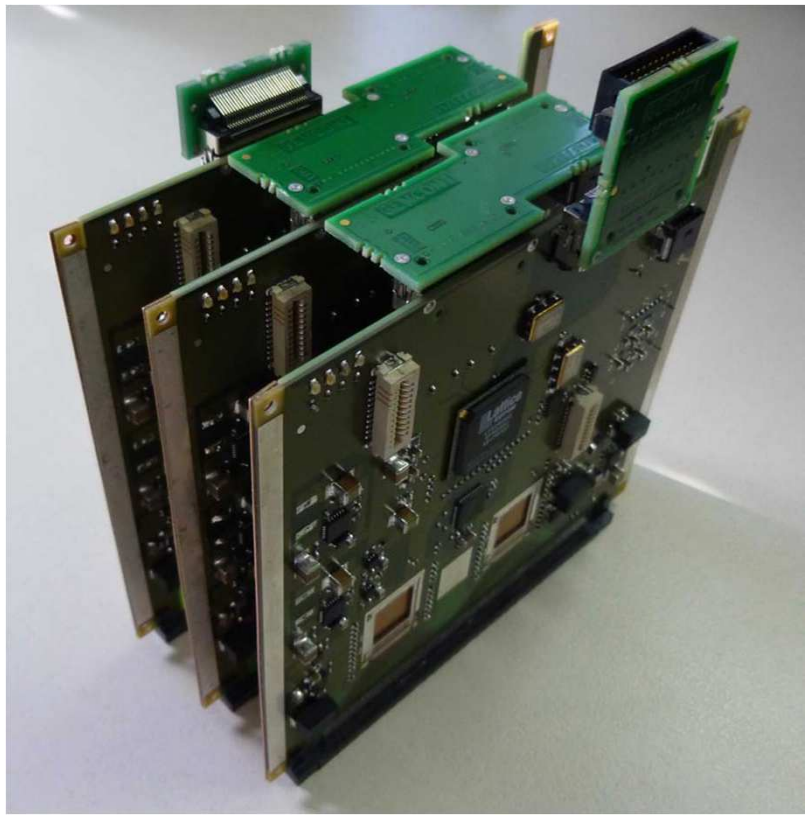
PANDA GEM-Tracker Requirements

- 10-150 pF strips capacitance.
- Up to 10kHz/strip.
- Signal width ~150 ns
- Charge information with an accuracy around 7-8 bits should be enough.
- Time resolution: up to 5ns
- Low power consumption: ~10 mW/channel
- Modularity is limited by plugin connector (~300 pins)

Readout electronics: GEMEX (based on nXYTER)

GEMEX: 2 nXYTER: 128x2 channels. 21 mW/channel → 2,7 W/chip





Front-End Electronics General ideas

- PadPlanes
  (3..4 GEM-Ts)

Structure size	Resolution evolution	Channel no.	
0,3..0.5 mm	decreasing	20..26	kch
	constant	96..116	kch
1 mm	constant	80..95	Kch

- FEE system
  - (n-)XYTER-based FEB cards 180..900 cards
    (2 ASICs à 128 channels each, 100x65mm^2)

  ➔ overall operating power 21 mW/channel → 2,7 W/chip !

  ➔ ≈ 1..5 kW power/cooling requirements, Axial cooling structure,
  ≈ 30% of weight

Summary

- Currently, GEMEX board is using as FEE for PANDA GEM Tracker.
- According to high power consumption of GEMEX(~21mW/channel) we are looking for some better FEE solution.