NA62 GigaTracker

GigaTracker: 3 silicon pixel sensor stations for precise measurement of particle direction and timing.

- Pixel size: 300 μm × 300 μm
- Sensitive area: 27 mm × 60 mm
- Time resolution: 150 ps rms (total)
  200 ps rms (per station)
- Data rate: 0.8÷1 GHz (total)
  1.5 MHz/mm² (max)
- Operational environment: vacuum

Detector to be operated below 5 °C to keep the leakage current under control

Design challenge: obtain a 200 ps resolution with silicon pixel detectors at very high particle rate.

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11th Pisa Meeting on Advanced Detectors – 24-30 May 2009
ASIC prototypes

Two readout options are under investigation:

Pixel matrix: 40 × 45 cells.
Time walk compensation: Constant Fraction Discriminator (CFD).
Time measurement: on pixel TAC based TDC.
Reference clock: 160 MHz.
Four event buffers for data derandomization (on pixel).
SEU protected control logic.
  + each pixel operate independently.
  + only one long distance time critical signal (clock).
  - complex pixel circuitry.
  - more control logic on the beam trajectory.

Pixel matrix: 40 × 45 cells.
Time walk compensation: Time over Threshold (ToT) correction.
Time measurement: DLL based TDC at the end of the pixel column.
Reference clock: 320 MHz.
Pre-emphasis for signal transmission.
  + simple and low power pixel circuitry.
  + only one DLL based TDC needed (plus column registers).
  - many time critical signals to be sent to the EoC (one per pixel).
  - hit arbitration needed (possible event loss).

→ Prototypes of the analog part for the two options (preamp+CFD and ToT correction) have been designed in CMOS 0.13 μm and successfully tested.
→ Two test chip with the full pixel and column circuits are currently in production.

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