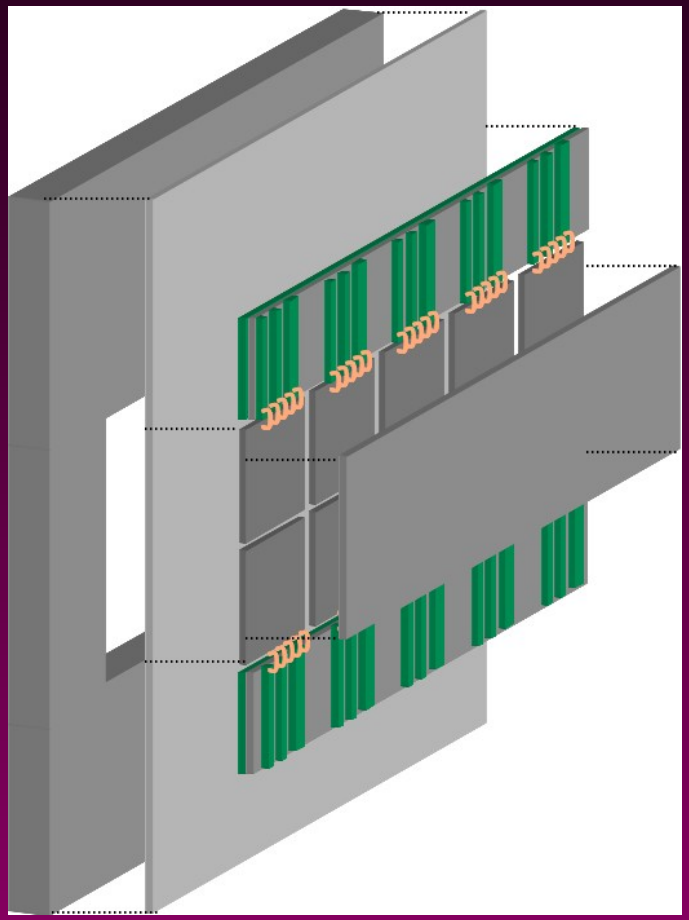
NA62 GigaTracker

Sezione di Torino



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/mm^2 (max)
Operational environment : vacuum

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

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

ASIC prototypes

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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