Contribution ID: **42** Type: **Poster**

# The electro-mechanical integration of the NA62 Giga Tracker time tagging pixel detector

*Thursday, 23 September 2010 16:00 (2 hours)*

The NA62 Giga Tracker is a low mass time tagging hybrid pixel detector operating in a particle rate of 800 MHz. It consists of three stations with a sensor size of 60 x 27 mmˆ2 containing 18000 pixels of the size 300 x 300 µmˆ2 each. The active area is connected to a matrix of 2 x 5 pixel ASICs, which time tags the arrival of the particles with a binning of 100 ps. The detector operates in vacuum at -20 to 0 degree C and the material budget per station is below 0.5% X0. Due to the high radiation environment of 2 x 10**14 1 MeV neutron equivalent cm-2/yr it is planned to exchange the detector modules regularly. The low material budget, cooling requirements and the request of an easy module access has driven the electro-mechanical integration of the Giga Tracker, which will be presented in this paper.

## Summary

The NA62 Giga Tracker is a low mass time tagging hybrid pixel detector placed in an asynchronous beam with a particle rate of 800 MHz. It consists of three stations with a sensor size of 60 x 27 mmˆ2 containing 18000 pixels of the size 300 x 300 µmˆ2 each. The active area is connected to a matrix of 2 x 5 pixel ASICs, which time tags the arrival of the particles with a binning of 100 ps. The detector operates in vacuum at -20 to 0 degree Celsius and the material budget per station is below 0.5 % X0, which is 2-4 times lower than the pixel detectors in the LHC experiments. Due to a high radiation environment, 2 x 10**14 1 MeV neutron equivalent cm-2 per year, it is planned to exchange the detector modules regularly.
The low material budget imposes thin active silicon components. The sensor has a thickness of 200 µm and the read-out is thinned to 100 µm. In order to decrease radiation induced sensor performance degradation and also to avoid overheating and thermal run-away an efficient cooling system must be implemented. For the cooling two options are considered. One is using a 150 µm thick silicon cooling plate containing 100 x 50 µmˆ2 micro channels with C6F14 as cooling fluid. The second option consists of a vessel with two mylar windows placed inside the beam vacuum where a gaseous nitrogen flow ensures the cooling.
Both options aim for a minimum of material in the beam and a uniform temperature distribution along the module. In a safety region of 1 cm around the beam area the material must be kept at a minimum.
The high particle rate and the long experimental trigger latency excludes on-chip storage of the acquired data until the trigger decision. Thus a triggerless architecture has been adopted. Each stations has a data flow of up to 6Gb/s.
The electro-mechanical integration foresees a system which allows the insertion and removal of the station into a pre-aligned detector structure with minimum intervention effort in the experimental setup. The station is pre-assembled and tested on surface. A so called assembly carrier serves to mechanically hold the sensor-pixel ASIC assembly and reference it precisely in place, provide electrical connections to the detector electronics for power, control and the high speed Gigabit electrical transmission lines and provide the mechanical interface between the detector assembly and the cooling. The design is compatible with both cooling options. A prototype of the full station is in design before the final ASICs are made available to advance the design and production optimization with respect to signal integrity, wire bonding tuning and mechanical integration procedures. For this it is planned to produce prototypes of each component.
The cooling requirements, the simple module access, the high data rate and the low material budget has driven the electro-mechanical integration of the Giga Tracker, which will be presented in this paper.

**Primary authors:** KLUGE, Alexander (CERN); MOREL, Michel (CERN)

**Co-authors:** MAPELLI, Alessandro (EPFL Lausanne); CECCUCCI, Augusto (CERN); MARCHETTO, Flavio (INFN Torino); NUESSLE, Georg (UCL Louvain); RINELLA, Gianluca A. (CERN); KAPLON, Jan (CERN); DAGUIN, Jerome (CERN); PERKTOLD, Lukas (CERN); FIORINI, Massimiliano (CERN); NOY, Matthew (CERN); PETAGNA, Paolo (CERN); RIEDLER, Petra (CERN); JARRON, Pierre (INFN Torino); CARASSITI, Vito (INFN Ferrara)

**Presenter:** MOREL, Michel (CERN)

**Session Classification:** POSTERS Session

**Track Classification:** Packaging and interconnects