FRONTIER DETECTORS FOR FRONTIER PHYSICS



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High rate particle tracking and ultra-fast timing with a thin hybrid silicon pixel detector

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The Gigatracker (GTK) is a hybrid silicon pixel detector designed for the NA62 experiment at CERN. The beam spectrometer, made of three GTK stations, has to sustain high and non-uniform particle rate (~1 GHz in total) and measure momentum and angles of each beam track with a combined time resolution of 150 ps. In order to reduce multiple scattering and hadronic interactions of beam particles, the material budget of a single GTK station has been fixed to 0.5% X_0 . The expected fluence for 100 days of running is 2×10^{14} 1 MeV neq/cm², comparable to the one foreseen in the inner trackers of LHC detectors during 10 years of operation. To comply with these requirements, an efficient and very low-mass (<0.15% X_0) cooling system is being constructed, using a novel microchannel cooling silicon plate.

Two complementary read-out architectures have been produced as small-scale prototypes: one is based on a Time-over-Threshold circuit followed by a TDC shared by a group of pixels, while the other makes use of a constant-fraction discriminator followed by an on-pixel TDC. The read-out ASICs are produced in 130 nm IBM CMOS technology and will be thinned down to $100 \, \mu m$ or less.

An overview of the Gigatracker detector system will be presented. Experimental results from laboratory and beam tests of prototype bump-bonded assemblies will be described as well. These results show a time resolution of about 170 ps for single hits from minimum ionizing particles, using 200 µm thick silicon sensors.

for the collaboration

NA62 Gigatracker Working Group

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