

# Research Techniques Seminar

## Fast-timing Tracking Detector for High Pile-up Conditions in Particle Physics Experiments

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**Friday- August 12, 2016**

**10:30 a.m.**

**Libra Conference Room (WH9SW)**

Low-mass pixel tracking detectors with excellent position and time-tagging capabilities are gaining increasing interest in order to disentangle overlapping events in high pile-up environments as, for example, the HL-LHC at CERN. The most challenging requirement for these detectors is the single hit time resolution with such a high channel density. State of the art is represented by the Gigatracker, developed for beam tracking in the NA62 experiment, which studies ultra-rare kaon decays at the CERN SPS. Three detector stations with time resolution in the order of 100 ps are used to measure beam particles momenta and associate the daughter pion to the correct parent kaon track, in a high beam rate environment (750 MHz). Each station is made of a 200  $\mu\text{m}$  thick planar silicon sensor bump-bonded to 2 $\times$ 5 custom 100  $\mu\text{m}$  thick ASICs called TDCpix, produced in 130 nm IBM CMOS technology. Each chip contains 40 $\times$ 45 asynchronous pixels, 300 $\mu\text{m}\times$ 300 $\mu\text{m}$  each, and is instrumented with 720 TDC channels with 98 ps bin and four 3.2 Gb/s serializers. A novel microchannel plate is used for detector cooling in vacuum and allows to keep the material budget per station

at the 0.5%  $X_0$  level. An overview of the Gigatracker detector and its performance will be presented.