

## Sensors and Electronics for 4D tracking: the TIMESPOT project

*Monday 25 February 2019 12:10 (20 minutes)*

High Luminosities planned at colliders of the next decades pose very severe requirements on vertex detector systems in terms of space resolution (tens of  $\mu\text{m}$ ), radiation hardness ( $5$  to  $10 \times 10^{16}$  1 MeV neutron equivalent  $\text{cm}^{-2}$  and some Grad) and data throughput (nTbit/s). Expected event pile-up (more than 100) introduces the need to add high resolution time measurements (better than 100 ps) already at the single pixel level, for both real-time and off-line track reconstruction.

This demand pushes towards a new concept of vertex detector system, where all these features must operate at the same time.

The TIMESPOT project (TIME and SPace real-time Operating Tracker) is a R&D project, financed by INFN, whose strategy consists in facing this experimental challenge at system level. It consists of a research team gathering together state-of-the-art knowledges from different expertises and disciplines, in such a way to finalize existing technologies in the direction of an innovative tracking apparatus.

Many interesting results are already available as an outcome of the TIMESPOT activity. In sensor development, a 3D trench-based geometry has been chosen to be the best one concerning high time resolution applications and has been already submitted for fabrication. Activity on the design of dedicated front-end in 28-nm CMOS has led to the submission of a complete pixel read-out circuit, also integrating a TDC with 15 ps r.m.s. resolution. A special care is being dedicated to the development of real-time reconstruction algorithms for tracking. Pre-processing is based on the concept of so-called stubs or tracklets, which can be pre-constructed and combined already at the front-end level.

In this paper, after a short overview of the project, we will illustrate some of TIMESPOT results obtained so far, with special emphasis on 3D trench sensors and front-end pixel electronics for high resolution timing.

**Primary author:** LAI, Adriano (Universita e INFN, Cagliari (IT))

**Presenter:** LAI, Adriano (Universita e INFN, Cagliari (IT))

**Session Classification:** Session 1: Tracking detectors for HEP experiments