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MAPS FOR LARGE AREA SENSORS WITH NANOSECOND TIMING

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The detectors at future e+e- linear colliders will need unprecedented precision on Higgs physics measurements. These ambitious physics goals translate into very challenging detector requirements on tracking and calorimetry. High precision and low mass trackers, as well as highly granular calorimeters, will be critical for the success of the physics program. To develop the next generation of ultralight trackers, a further reduction of dead material can be obtained by employing Monolithic Active Pixel Sensor (MAPS) technology. In MAPS, sensors and readout circuitry are combined in the same pixels and can be fabricated with commercial CMOS processes. Currently MAPS are widely used in different applications in High Energy Physics (HEP), in astronomy and in photonics. This technology has been utilized for the Inner Tracking System Upgrade (ITS2) of the ALICE experiment at the LHC characterized by a very low power consumption and O(μs) timing capabilities. Future Colliders can benefit from fast detectors with O(ns) timing capabilities. This is feasible at the cost of a relatively high power consumption that could not be compatible with large area constraints. Today some commercial imaging technologies offer the possibility to produce large stitched sensors (with a rectangle area ~30 cm × 10 cm). Such large sensors are very interesting from a physics point of view, but they are very challenging from an engineering point of view.
The first part of this talk will discuss the limits and potentials of MAPS technology for detectors at future colliders.
NAPA-p1 is a prototype Monolithic Active Pixel Sensor designed in 65 nm CMOS imaging technology, developed in collaboration with CERN to meet requirements for future e+e- colliders. The prototype has dimensions of 1.5 mm × 1.5 mm with a pixel pitch of 25 μm. A discussion will be presented on future strategies to allow the scalability of this design into a large-scale sensor of 10 cm × 10 cm

Primary author: VERNIERI, Caterina (SLAC)

Presenter: VERNIERI, Caterina (SLAC)

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