

Development of new semiconductor detectors for high energy physics and other applications

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Research project

Semiconductor-based pixel devices for the detection of particles and radiation are used in a broad spectrum of scientific disciplines, ranging from high-energy physics to medical diagnostics and material sciences. Originally developed for particle physics instrumentation, they essentially consist of a segmented silicon detector, which allows to determine very precisely the position of traversing charged particles.

The Large Hadron Collider (LHC), located at CERN, is currently the most powerful particle accelerator on the planet. Silicon detectors are used by all LHC experiments. As the LHC accelerator is improved to further probe the energy frontier, pixel devices have to be upgraded to maintain their performance. The Pixel group at IFAE is playing a leading role in the ATLAS pixel detector upgrade program. Recently, the group has led the installation of two ATLAS sub-detectors (IBL and AFP) using the state-of-the-art 3D pixel technology, with the idea of pursuing 3D sensors for the high-luminosity LHC era.

The group is also developing a new pixel detector technology, called HV-CMOS, for high-energy, synchrotron and medical applications. In HV-CMOS detectors the electronics is placed inside deep n-wells while a depletion region can be grown on the same substrate to collect the charge generated by the incoming radiation. These “active” sensors combine the electronic and sensing features in a single monolithic device.

Finally, IFAE is participating in the development of silicon timing devices (LGAD) that have been shown to achieve a time resolution of about 25 ps per sensor. This incredible result resulted in the proposal of a new High Granularity Timing Detector (HGTD) for the ATLAS experiment at CERN. IFAE is one of the institutions playing a mayor role in this project. Early HGTD prototypes have been already fabricated and tested at IFAE: with promising results, the effort to consolidate this emerging technology is on-going.

Job position description

The candidate is expected to take a leading role in the development of new silicon pixel devices for high energy physics, and possibly for other applications. The tasks which will be undertaken during the PhD program include the participation in the design of new silicon pixel sensors (if qualification allows), development of readout systems and undertaking the device characterization and performance studies. This includes: device communication, evaluation of the devices through injection circuitry, external radiation sources, and lasers, studies of radiation effects and beam tests at CERN (Switzerland), DESY (Germany) or Fermilab (US).

The position requires a completed university degree in physics (MSc. or equivalent) at the time of the start of the contract. The selected candidate will be able to join the project between 2019 and early 2020.

Contact Information

Name : **Sebastian Grinstein**
Position : ICREA Research Professor
Work Address : Institut de Física d'Altes Energies (IFAE)
E-08193 Bellaterra (Barcelona), Spain
E-mail : sgrinstein@ifae.es