Title
Development of radiation-hard semiconductor sensor devices for particle physics experiments

Abstract
Starting in 2023, the Large Hadron Collider and the ATLAS detector will undergo major upgrades to prepare for the High Luminosity LHC (HL-LHC) that will commence operations in about 2026. The HL-LHC will operate at a significantly higher intensity: the instantaneous luminosity of the proton beams will be seven times that of the design criteria. This significantly enhances the overall physics potential, but also makes the experimental conditions harsher and more challenging. The entire inner tracking detector of ATLAS will need to be replaced with a new silicon Inner Tracker detector (ITk) to cope with this situation. The particle physics group at Carleton University is actively working on this detector upgrade, in particular in the development, prototyping and testing of state-of-the-art radiation hard thin silicon micro-strip sensors and the corresponding on-detector readout electronics.

Beyond the HL-LHC and the ITk project, new challenges are arising as for future colliders the radiation levels will exceed those at the HL-LHC by at least an order of magnitude. New technologies and new material are currently being evaluated for the development of radiation-hard semiconductor devices that will be able to meet these challenges. The particle physics group at Carleton University is gearing up to participate in this effort as a the only Canadian member of the international CERN-based RD50 collaboration.

In this talk a summary of the ITk project will be presented. It will be followed by a review of the main technology challenges that radiation damage on semiconductors poses. Finally, a brief overview of the activities of the Carleton particle physics group in the development of radiation-hard semiconductor devices will be offered. We will conclude with an outlook on the new technologies and a short outline of potential applications beyond particle physics experiments.