MEETING OF THE AMERICAN PHYSICAL SOCIETY DIVISION OF PARTICLES AND FIELDS

Contribution ID: **474** Type: **Presentation**

3D Diamond Sensor Development

Thursday, 3 August 2017 13:30 (21 minutes)

At present most experiments at the CERN Large Hadron Collider (LHC) are planning upgrades in the next 5-10 years for their innermost tracking layers as well as luminosity monitors to be able to take data as the luminosity increases and CERN moves toward the High Luminosity-LHC (HL-LHC). These upgrades will most likely require more radiation tolerant technologies than exist today. As a result this is one area of intense research. Chemical Vapour Deposition (CVD) diamond has been used extensively and successfully in beam conditions/beam loss monitors as the innermost detectors in the highest radiation areas of essentially all LHC experiments. The startup of the LHC in 2015 brought a new milestone where the first diamond pixel modules were installed in an LHC experiment (ATLAS) and successfully began taking data. As a result, this material is now being discussed as a possible sensor material for tracking very close to the interaction region and for pixelated beam conditions/beam loss monitors of the LHC/HL-LHC upgrades where the most extreme radiation conditions will exist.

The RD42 collaboration at CERN is leading the effort to use CVD diamond as a material for tracking detectors operating in extreme radiation environments. During the last three years the RD42 group has succeeded in producing and measuring a number of devices to address specific issues related to use at the HL-LHC. We will present the latest results on material development, the most recent results on the independence of signal size on incident particle rate in poly-crystalline CVD diamond pad and pixel detectors over a range of particle fluxes up to 20 MHz/cm^2 measured. In addition we have been working on a novel detector using chemical vapour deposited (CVD) diamond and resistive electrodes in the bulk forming a 3D diamond device. Detector systems consisting of 3D devices, one based on single-crystal CVD diamond and one based on poly-crystalline CVD diamond were connected to a multi-channel readout and successfully tested in a 120 GeV proton beam at CERN proving for the feasibility of the 3D diamond detector concept for particle tracking applications. Recently the first 3D diamond pixel detector was constructed. This fabrication process of this device will be presented along with the first beam test results.

Primary author: TRISCHUK, William (University of Toronto)

Presenter: GUI, Bin (Ohio State University)

Session Classification: Particle Detectors

Track Classification: Particle Detectors