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Diamond Pixel Modules

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(on behalf of the RD42 collaboration)

With the first LHC run expected in 2009, and the first LHC upgrades expected around 2014, ATLAS and CMS are planning for detector upgrades for their innermost layers requiring radiation hard technologies. Chemical Vapor Deposition (CVD) diamond has been used extensively in beam conditions monitors as the innermost detectors in the highest radiation areas of BaBar, Belle, CDF and now all LHC experiments. Diamonds are considered as an alternate sensor for use very close to the interaction region of the super LHC where the most extreme radiation conditions will exist. Recently the RD42 collaboration constructed, irradiated and tested polycrystalline and single-crystal chemical vapor deposition diamond sensors to the highest fluences available. We present beam test results of chemical vapor deposition diamond up to fluences of 1.8 x E16 protons/cm2 showing that both polycrystalline and single-crystal chemical vapor deposition diamonds follow a single damage curve. As CVD diamonds are considered among possible sensor materials for the next pixel upgrade in ATLAS, the ATLAS Insertable B-Layer to be installed in 2014, we will also summarize the progress in the area of diamond pixel detectors. In particular we will describe results and next plans to build and characterize diamond pixel modules, test their radiation hardness, explore the cooling advantages of diamond and demonstrate industrial viability of bump-bonding of diamond pixel modules.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

The presentation will give as introduction an overview of the present diamond systems in use, measurements of radiation hardness and then focus on diamond pixel modules. We will present recent test results of diamond pixel modules using the ATLAS FEI-3 readout chip. These modules have been constructed to full-size ATLAS pixel modules, i.e. with 16 FEI3 chips on 2 x 6 cm2 diamond sensors. Additionally single-chip diamond modules have been constructed for tests of single-crystal CVD diamonds as pixel detectors. The assemblies were tested in lab tests, beam tests and irradiations and results of those tests will be presented. A particular focus of the presentation will go to the R&D program for diamond pixel modules towards the ATLAS Insertable B-layer, where diamond are considered among planar and 3D silicon sensors as possible sensor material.

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