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Results from the Pilot Runs and Beam Tests of Diamond Pixel Detectors

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Progress in experimental particle physics in the coming decade depends crucially upon the ability to carry out experiments at high energies and high luminosities. These two conditions imply that future experiments will take place in very high radiation areas. In order to perform these complex and perhaps expensive experiments new radiation hard technologies will have to be developed. Chemical Vapor Deposition (CVD) diamond has been developed as a radiation tolerant material for use very close to the interaction region where detectors must operate in extreme radiation conditions. During the past few years many CVD diamond devices have been manufactured and tested. As a detector for high radiation environments, CVD diamond benefits substantially from its radiation hardness, very low leakage current, low dielectric constant, fast signal collection and ability to operate at room temperature. As a result CVD diamond has now been used extensively in beam condition monitors at every experiment in the LHC. In addition, CVD diamond is now being considered as a sensor material for particle tracking detectors, closest to the interaction region where the most extreme radiation conditions exist. We will present the state of the art results of diamond radiation hardness. We will also present results from the pilot run of the Pixel Luminosity Telescope (PLT), a luminosity monitor for the CMS detector based on single-crystal CVD diamond pixel sensors. During the pilot run the PLT sensors experienced high fluences of incoming particles, at which time the sensors showed a deviation from the results of diamond radiation hardness. In order to understand this deviation, a series of beam tests with pixel and pad detectors have been performed. The results of these beam tests will be presented and will shed the light on the anomalous behavior of the PLT sensors.

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