Contribution ID: **49** Type: **Oral**

Nanodiamond photocathodes for MPGD-based single photon detectors

Wednesday 8 November 2023 10:15 (25 minutes)

Gaseous Ring Imaging Cherenkov (RICH) detectors are the natural choice to perform hadron identification at high momenta; they require efficient and accurate detection of single Cherenkov photons over large surfaces. MPGD detectors of single photons are sensitive in the vacuum ultraviolet (VUV) domain. In present, CsI is the only photoconverter adequate with gaseous detector due to its wide wavelength sensitivity (cut-off wavelength ˜210 nm) and high quantum efficiency (QE) in VUV ranges, as well as the deposition ability over large surfaces. Anyhow the hygroscopic nature of CsI and the limited resistance against ion/photon bombardments are severe limits in terms of manipulation, QE preservation and single photon detection efficiency. The key quest to overcome these limits is to develop a faster and more robust photocathode capable of coping with challenging conditions. Hydrogenated nanodiamond (H-ND) particles have emerged as a potential alternative material with intriguing characteristics. Our continuing research focuses on the functionality of ND photocathodes coupled with THGEM-based detectors. The study includes the characterization of THGEM coated with ND layers in the single photon detection mode, along with determining the robustness of its photoconverting properties against the bombardment by ions from the multiplication process in the gaseous detector. In addition, the performance of the ND photocathode in various Ar:CH_4 and Ar:CO_2 gas mixture is thoroughly investigated. The results of the first phase of these studies are reported.

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Session Classification: New detector materials