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Prototype Production of Large Area Picosecond Photodetectors

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We report prototype production results achieved for fully functional sealed Large Area Picosecond Photodetectors (LAPPD™). The LAPPD™ is a microchannel plate (MCP) based photodetector, capable of imaging with single-photon sensitivity at high spatial and temporal resolutions in a hermetic package with an active area of 400 square centimeters. In December 2015, Incom Inc. completed installation of equipment and facilities for demonstration of early stage pilot production of LAPPD™. Initial fabrication trials commenced in January 2016. The "baseline"LAPPD™ employs an all-glass hermetic package with top and bottom plates and sidewalls made of borosilicate float glass. Signals are generated by a bi-alkali Na2KSb photocathode, amplified with a stacked chevron pair of "next generation"MCPs produced by applying resistive and emissive atomic layer deposition coatings to glass capillary array (GCA) substrates. Signals are collected on RF strip-line anodes applied to the bottom plates which exit the detector via pin-free hermetic seals under the side walls. Fully functional, sealed LAPPD™s tested to date have shown electron gains > 7.5 x10ˆ6 @ 850/950 V (entry/exit), low dark rates (9.5 Cts/s cmˆ2), space resolution along strips of 2.9 mm RMS for single photoelectrons, cross strip spatial resolutions of 1.6 mm RMS, and along-strip time difference resolutions of 33.4 psec RMS. Many of these devices also had very high QE photocathodes that were uniform over the full 8"X 8"window area (#15 QE% @ 365nm Max/Avg/Min = 25.8/22.3±3/15.7). LAPPD™ performance results and test methods for product produced and delivered to early adopter customers during the first half of 2018 will be reviewed. In addition, recent advances in the development of LAPPD™ will also be reviewed as the baseline design is adapted to meet the requirements for a wide range of emerging applications including DOE-supported R&D for the Deep Underground Neutrino Experiment (DUNE), nuclear physics applications such as EIC, homeland security, medical imaging applications including for proton therapy and astronomical applications for direct and indirect photon detection.

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