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Recent Advances in LAPPD™ and Large Area Micro-channel Plates

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Recent performance results are presented for Large Area Picosecond Photodetectors (LAPPD™s) that are being developed by Incom, Inc. The LAPPD is a micro-channel plate (MCP) based photodetector containing a bi-alkali photocathode with overall dimensions of 230 mm x 220 mm x 21 mm, an active area of up to 400 cm2, spatial resolution ˜1 mm, and timing resolution of approximately 100 picoseconds for single photoelectrons and better for multiple photoelectrons. Performance will be discussed for LAPPDs that have been fabricated with gains ˜1x106 and quantum efficiency >20%. The low MCP contribution to background rates will also be discussed. LAPPDs are being developed for precision time-of-flight and particle identification measurements in accelerator-based experiments and large water Cherenkov and scintillation detectors.
The key component of the LAPPD is the large area MCP manufactured by Incom. A "hollow-core" process is used to draw and fuse millions of micro-capillaries into blocks that are sliced and polished into glass capillary array (GCA) plates. The glass contains low levels of radioactive isotopes resulting in lower dark noise. The GCAs are then converted into MCPs using an atomic layer deposition (ALD) process. ALD-coating has been shown to extend the life of MCP photomultipliers (Conneelly et al. 2013; Lehmann et al., 2014; Matsuoka et al., 2017). Because the glass fabrication and coating operations are separate they can be independently optimized to produce high performing, large area MCPs at low cost per area. The large format also enables dicing into smaller MCPs of desired shapes with matched resistance. Recent performance results will also be discussed for pairs of 203 mm x 203 mm MCPs with gains >1x107 and uniformity >80% across the full area.

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