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Production of Large Area Picosecond Photo-Detectors –LAPPDTM: Status Update

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Abstract:
Incom Inc is now producing a "baseline"version of the Large Area Picosecond Photo-Detector (LAPPD) – the largest commercially-available planar-geometry photodetector based on microchannel plates (ALD-GCA-MCPs). It features a stacked chevron pair of "next generation"large area 20um pore MCPs produced by applying resistive and emissive Atomic Layer Deposition (ALD) coatings to glass capillary array (GCA) substrates encapsulated in a borosilicate glass hermetic package. The entry window of the detector is coated with a high sensitivity semitransparent bi-alkali photocathode with 350 cm2 detection area. Signals are read out on microstrip anodes applied to the bottom plate. The "baseline"devices have demonstrated electron gains of 107, low dark noise rates (15-30 Hz/cm2), single photoelectron (PE) timing resolution of 52 picoseconds RMS (electronics-limited), and single photoelectron spatial resolution along and across strips of 2.4 mm and 0.76 mm RMS respectively (also electronics-limited), high (up to 28%) QE uniform bi-alkali photocathodes and low sensitivity to magnetic fields up to 0.8 T (no tests at higher field have been performed at this time). A version with a Fused Silica window featuring an extended UV sensitivity photocathode is also being developed.
Production of baseline tiles have increased from one/month in 2018, to four/month in 2020. Apart from the "baseline"LAPPDs, Incom Inc. is developing a Gen II LAPPD product line featuring a capacitively-coupled readout with a resistive anode. Several GEN II LAPPD have been produced. Their performance is now being evaluated.
An effort has been initiated on the development of a smaller format 10 cm X 10 cm High Rate Picosecond Photo-Detector (HRPPD) that, in addition to all of the LAPPD attractive features, would have a fully active area with no x-spacers (structural supports), even lower sensitivity to magnetic fields with new 10um pore MCPs and sub-mm position resolution with a new anode design.
LAPPDs can be employed in particle collider experiments (e.g. SoLID, future EIC), neutrinoless double-beta decay experiments (e.g. THEIA), neutrino experiments (e.g. ANNIE, WATCHMAN, DUNE), medical (PET) and nuclear non-proliferation applications.
We report on the recent progress in the production of the "baseline"LAPPD and discuss new developments.

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