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20 cm sealed tube photon counting detectors with novel microchannel plates for imaging and timing applications

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As part of a collaborative program between university of California, Berkeley, the Argonne National Laboratory, University of Chicago, and several commercial companies, we are developing a 20 cm square sealed tube microchannel plate detector scheme with a proximity focused bialkali photocathode. Sealed tube microchannel plate devices have good imaging and timing characteristics, but large areas have been unavailable up till now. We have made considerable progress in fabricating large size microchannel plates. A key feature is the novel implementation of low cost microchannel plates using borosilicate hollow core tubes. The resistive and photo-emissive surfaces are then applied by atomic layer deposition, eliminating the wet etch and thermal reduction processes for normal glass microchannel plates. Initial results with 33 mm format microchannel plates for gain, pulse width, imaging performance and lifetime are very encouraging. Large 20 cm square microchannel plate prototypes with 20 μm and 40μm pores have been made and are currently being tested. Fabrication for the 20 cm sealed tube assembly is well advanced and includes a borosilicate entrance window, a proximity focused bialkali photocathode, a pair of microchannel plates and a strip-line readout anode. Our design employs a brazed ceramic walled enclosure and a transfer tube type indium seal. Somewhat different packaging techniques are being used to achieve the same goal at Argonne National Laboratory. We have adopted a baseline bialkali photocathode to match our input spectrum, and have made a number of test photocathodes with >20% peak quantum efficiency on our chosen borofloat-33 window material. Stripline anodes are also being developed which will give better than 1mm spatial resolution using novel timing electronics.

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