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Development of a new ultra-fast shower maximum detector based on micro channel plates (MCP) as an active element.

Future calorimeters and shower maximum detectors at high luminosity accelerators need to be very radiation resistant and very fast. In this report we outline the study of the development of such detectors using microchannel plate (MCP) secondary emitters. The first proposal to use secondary emitters in such a detector can be found in Ref. [1]. Our research is based on the use of MCP secondary emitters as active elements that directly amplify the electromagnetic component in showers. A key point is that the method does not require a complete MCP/phototube with photocathode deposited on a vacuum glass container, but can use the bare MCP's in an inexpensive and robust housing. As the photocathode fabrication is the dominant driver of the cost of current MCP-PMTs, the use of bare plates without a photocathode results in much cheaper and more robust assembly. One of the main limitations in using this technique has been the high cost of MCPs. Due to recent progress in developing MCP's consisting of large-area glass-capillary substrates functionalized by Atomic Layer Deposition [2, 3], this approach is becoming feasible.

Test beam measurements of a prototype were performed with 120 GeV primary protons and secondary beams at the Fermi National Accelerator Laboratory.

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