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

One possibility to make a fast and radiation resistant shower maximum (SM) detector is to use a secondary emitter as an active element. We present below test beam results, obtained with different types of the photo detectors based on micro channel plates (MCP) as the secondary emitter. The SM time resolution - we obtained for this new type of detector is at the level of 20-30 ps. We estimate that a significant contribution to the detector response originates from secondary emission of the MCP. This work can be considered as the first step in building a new type of calorimeter based on this principle.

Summary

We made measurements with different types of MCP PMT as shower maximum detector. The measurements were performed at the Fermilab Test Beam Facility with 120 GeV/c primary proton beam and 12 GeV/c and 32 GeV/c secondary beams. We obtained time resolution for the SM detector based on Photek 240 at the level of 20 –30 ps. The SM detector, based on the Photonis MCP-PMT, also achieves a very good TR, ˜35 ps. We feel that this level of performance, even with a large MCP pore size (diameter ˜25 µm), enables the development of SM detectors for collider experiments at a potentially much reduced cost. The success of the LAPPD project [2, 4] in developing affordable MCP's is encouraging in this respect. More savings are possible if it can be shown that bare MCP's without an associated photocathode, can give similar timing performance. We plan on performing a future beam test that can resolve this issue.

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