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Fast Timing for High-Rate Environments with Micromegas

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The current state of the art in fast timing for existing experiments is of the order of 100 picosec[1-2] on the time of arrival of both charged particles and electromagnetic showers. Current R&D on charged particle timing is approaching the level of 10 picosec [1] but is not primarily directed at sustained performance at high rates and under high radiation (as would be needed for HL-LHC pileup mitigation).
We propose a Micromegas based solution to reach this level of performance. The Micromegas acts as a photomultiplier coupled to a Cerenkov-radiator front window, which produces sufficient UV photons to convert the 100-picosec single-photoelectron jitter into an incident particle timing response of order 10 picosec.
A prototype has been built in order to demonstrate this performance. The first laboratory tests with a picosecond laser have shown time resolution of the order of 40 ps for ~50 primary photoelectrons, using a Microbulk readout. Other mesh types in combination with the optimization of the gas mixture are expected to give the desired results. First beam tests are planned for October-November 2015. The status and the latest results of the project are going to be presented here.

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