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New large area Micromegas detector and readout ASIC for the AMBER experiment at CERN

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AMBER (NA66) is a fixed-target experiment at M2 beam line of the SPS, devoted to various fundamental QCD measurements. For this new apparatus we are designing together with the CERN MPT workshop both a ~1.2x0.5 m^2 bulk resistive MICRO-MEsh GAseous Structure (Micromegas) detector and a new custom 64 channel fully digital front-end ASIC ToRA (Torino Readout for AMBER) for timing and energy measurements. The ASIC is closely tailored to the specifications of the Micromegas but also should be fully suited to equip some of the existing Wire type detectors to make them compatible with the future trigger-less Data AcQuisition system (DAQ) of AMBER. This simultaneous design of the ToRA ASIC and of the associated detector should allow for a good optimisation of their common performance. The challenge is coming from the resistive Micromegas with 1.0 -2.5 fC signals at the low end of the charge amplitudes together with ~1.2 m long strips of up to ~550 pF capacitance reaching hit rates of 500 kHz/strip. To face these conditions, we need a good control over the system noise and signal integrity performance of the detector itself together with the full signal path to the ASIC and proper ASICs integration. The first full size prototype of the detector has been delivered in October of 2024 while the ToRA _v1 ASIC is in its final design phase. We will briefly present the first test results of the detector together with the current ASIC concept and integration challenges.

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