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The SHiP timing detector based on MRPC

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SHiP (Search for Hidden Particles) is a new general-purpose experiment [1] to be installed in a beam dump facility at the SPS at CERN to search for hidden particles as predicted by a very large number of recently elaborated models of Hidden Sectors which are capable of accommodating dark matter, neutrino oscillations, and the origin of the full baryon asymmetry in the Universe.

The SHiP detector consists of two complementary apparatuses, the scattering and neutrino detector (SND) and the hidden sector (HS) decay spectrometer. The HS decay spectrometer aims at measuring the visible decays of HS particles by reconstructing their decay vertices in a 50 m long decay volume of a pyramidal frustum shape. The decay volume is followed by a large spectrometer with a rectangular acceptance of 5 m width and 10 m height. The spectrometer is composed by a tracker station, designed to accurately reconstruct the decay vertex, the mass, and the impact parameter, a timing detector, to reduce the muon combinatorial background and identify the particle decays products, an electromagnetic calorimeter followed by a muon detector in order to provide particle identification which is essential in discriminating between the very wide range of HS models.

The timing detector will cover an area of $5 \text{ m} \times 10 \text{ m} = 50 \text{ m}^2$ providing $\sim 100 \text{ ps}$ timing accuracy together with high efficiency. One possible technology for the timing detector is the timing multigap RPC. A first real size prototype of around 2 m^2 has been built and tested in beam showing a timing accuracy $< 60 \text{ ps}$ and an efficiency $> 98\%$ over the entire active area. In this work, the design and result of this prototype will be presented.

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[1] A facility to Search for Hidden Particles (SHiP) at the CERN SPS, Sergey Alekhin et al 2016 Rep. Prog. Phys. 79 124201

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