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An advanced gaseous detector-based telescope for muography

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Muography is being applied in a wide variety of areas, including applications in e.g. multidisciplinary research, industry, homeland security and society. A number of basic detector types have already been used for the construction of muon telescopes. Here, we investigate the usage and combination of advanced gaseous detector technologies to arrive at a high-performance muon telescope for muography. Given its robustness and ease of operation in remote outdoor environments, a scintillator-based muon telescope with silicon photomultiplier readout is being developed as a basic solution. To enhance the telescope performance in a number of ways, the use of multi-gap resistive plate chambers (mRPCs) and thick gas electron multipliers (THGEMs) is proposed. The excellent timing capabilities of mRPCs will be beneficial for detector background rejection, while the improved spatial resolution offered by THGEMs will enhance the muographic image resolution. The latter detectors are also very robust, easily manufacturable, and can be operated with a simple gas mixture. Currently, prototype detectors for each of these aforementioned systems have been constructed. In addition to the hardware efforts, a Geant4-based simulation of a generic four-plane detector is developed to optimize the telescope geometry and study the effectiveness of e.g. improved time information. The overall status of the ongoing activities, the results of the performance studies of the prototype detectors along with the results of the Geant4 simulation studies will be presented.

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