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Design of a large area triple-GEM forward detector system based on industrially produced GEM foils

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The recently completed Forward GEM Tracker (FGT) of the STAR experiment at RHIC took advantage of commercially produced GEM foils based on double-mask chemical etching techniques. With future experiments proposing detectors that utilize very large-area GEM foils such as the CMS muon detector upgrade and a future Electron-Ion Collider facility, there is a need for commercially available large GEM foils.

Double-mask etching techniques pose a clear limitation in the maximum size. In contrast, single-mask techniques developed at CERN would allow one to overcome those limitations. We report on results obtained using large GEM foils produced by Tech-Etch Inc. of Plymouth, MA, USA using single-mask techniques and thus the beginning for large GEM foil production on a commercial basis. A quality assurance procedure has been established through electrical and optical analyses via leakage current measurements and an automated high-resolution CCD scanner. The Tech-Etch foils show excellent optical performance and electrical properties with leakage currents typically measured below 1 nA.

The design of a large novel triple-GEM forward detector system consisting of 12 30 degree sectors employing large single-mask produced GEM foils will be presented along with a detailed discussion of the excellent performance of large single-mask produced GEM foils manufactured on a commercial basis.

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