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Directional Čerenkov Detectors EDWIN NORBECK, YASAR ONEL, PETER BRUECKEN, MITCH MILLER, NATHAN PREMO, University of Iowa — It is sometimes useful to have a particle detector that determines not only the amount of energy deposited in the detector but also the direction from which it came. With a colliding beam machine, such as the LHC, at small angles a detector is exposed both to particles coming from the interaction region and to particles produced by incoming beam particles. A directional detector can identify and enable the elimination of the background from the incoming beam. A charged particle with the velocity of light passing through a medium with an index of refraction n emits (Čerenkov) light at an angle θ_c with respect to its direction such that $\cos\theta_c = 1/n$. This angle is 45° for $n = 1.414$. Directional counters can be made by using the directional properties of the Čerenkov light. A photomultiplier tube, by itself, acts as such a detector by responding to Čerenkov light produced in the glass over the photocathode. Various counter configurations have been studied using cosmic-ray muons identified by cosmic-ray telescopes from the NSF-DOE QuarkNet program. These counters are candidates for Forward Shower Counters (FSC) for the CMS experiment at the LHC.

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