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Performance studies of scintillator tiles for the sPHENIX hadronic calorimeter

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The sPHENIX detector at BNL's Relativistic Heavy Ion Collider (RHIC) will begin taking data in 2023, providing detailed measurements of jets and Upsilons in 200 GeV Au+Au collisions. To make precision jet energy measurements, sPHENIX will be equipped with a Hadronic Calorimeter (HCal) located outside a 1.4T superconducting solenoidal magnet. The HCal is composed of 7,680 plastic scintillating tiles sandwiched between layers of steel absorber plates. Light produced by particles striking the tile is captured by a wavelength shifting fiber that routes the light to Silicon Photomultipliers (SiPM) at one end of the tile. The geometry of the mid-rapidity calorimeter is novel, tilted in azimuth such that particles coming from the interaction region traverse a number of scintillating tiles. The scintillator tiles come in different shapes based on their location in pseudorapidity. Tiles of the same shape are grouped together azimuthally in sets of five forming a "tower," and the readout from a tower is the aggregate of the signals of each tile within a tower. Results of beam tests carried out at Fermilab have shown that the detector has the required energy resolution to accomplish sPHENIX's physics goals; additionally, in order to optimize the performance of the calorimeter, towers will be constructed out of tiles with similar behavior. Testing has begun at Georgia State University to characterize the performance of each individual tile relative to a baseline reference by analyzing their response to cosmic rays. This poster will detail the design of the test setup, the analysis procedure, and the current results of the performance characterization studies of the sPHENIX HCal tiles.

Author: SPHENIX COLLABORATION

Presenter: SPHENIX COLLABORATION

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