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Forward Calorimetry for Heavy-Ion Physics at the STAR Experiment

A forward calorimeter utilizing hadronic and electromagnetic calorimetry at the STAR experiment of RHIC will achieve a variety of physics goals. These goals include studying long-range rapidity correlations, event plane correlations in heavy-ion interactions, and studying the gluon contribution to the proton spin by measuring forward di-jets and forward-mid rapidity jet correlations in proton-proton collisions. Upgrades to the AGS E864 lead-scintillating fiber calorimeter have increased spatial resolution by utilizing cell pixelization. Pixelization increases spatial resolution by replacing a single photosensor on individual 10cm x 10cm cells by a set of nine photosensors, resulting in 3.3cm x 3.3cm pixels. Pixelization was tested with colliding beams at STAR and fixed target test beams at FNAL. Light collection has been optimized and fringe field effects have been minimized by the introduction of Fresnel lenses and mu-metal shielding. A prototype consisting of a 2x3 cell stack was installed into the forward region of STAR for the end of run16. This prototype investigated the introduction of these new techniques as well as a trial of Silicon Photomultipliers (SiPMs) as an alternate to traditional Photomultiplier Tubes (PMTs). SiPMs do not suffer from fringe field effects, but are susceptible to radiation damage by neutrons, so their performance during the prototype operation was analyzed. The prototype observed Au+Au collisions at 200GeV. There is a proposal to install two 9-column x 12-row cell stacks as forward jet detectors at STAR, with 16 cells in each stack pixelized. This poster will discuss the effects of Fresnel lenses on light collection, mu-metal shielding effects on PMTs, and radiation effects on SiPMs.

Preferred Track

Future Experimental Facilities, Upgrades, and Instrumentation

Collaboration

STAR

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