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Development of Future Electromagnetic Calorimeter Technologies and Applications for the Electron-Ion Collider with GEANT 4 Simulations

The Electron-Ion Collider is a future collider planned to be built at BNL in about 2030. It will provide physicists with high luminosity and highly polarized beams of electrons, protons and ions with a wide range of nuclei species at different energies, covering an extensive kinematic range. The EIC physical goals include measuring the generalized parton distribution from Deeply Virtual Compton Scattering (DVCS) and Deeply Virtual Meson Production (DVMP) experiments, performing precision 3D imaging of the nuclei structure, studying color confinement and hadronization mechanisms, and understanding the spin structure of the proton. In order for the EIC to achieve its physics goals, a high-resolution electromagnetic calorimeter (EMCAL) is required to measure electrons and photons and to achieve good particle identification. We propose two design options for EIC EMCALs. The first technique is to improve the resolution tungsten/scintillating fiber (W/SciFi) EMCAL being built for sPHENIX with new technologies. The other possibility is to develop tungsten/shashlik (W/shashlik) EMCAL with a highly segmented readout configuration to achieve better energy and position resolution. In this work, we carry our our studies on EIC EMCAL designs using GEANT 4 simulations. We will first present the general performance of the sPHENIX W/SciFi and shashlik EMCALs. In addition, we study fully reconstructed $\pi^0 \to \gamma\gamma$ from EIC endcap EMCALs in the hadron-going direction. The π^0 merging probability a function of π^0 energy with different EMCAL tower designs and light collection efficiency maps of the shashlik towers modeled by $TracePro$ software will be reported.

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No

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