The Island Algorithm – A Photon Clusterizer at sPHENIX

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The sPHENIX detector is a proposed major upgrade to the PHENIX experiment at the Relativistic Heavy Ion Collider located at Brookhaven National Laboratory. The sPHENIX detector will have an electromagnetic calorimeter (EMCal) comprised of tungsten/scintillating fiber modules to detect the energies and positions of electrons, positrons and photons. In order to properly extract useful physics information from the EMCal, a carefully designed clustering algorithm is required. This research, inspired by the CMS collaboration at the Large Hadron Collider, implemented and analyzed a particular clustering algorithm known as the island algorithm. Given output data consisting of energy depositions at various positions across the EMCal detector geometry, the island algorithm seeks to identify which regions ("islands") of the detector should be associated with a single particle. The performance of the island algorithm can be analyzed by first simulating particle collisions in a detailed model of the sPHENIX detector and then comparing the algorithm's output with the simulation input. For simulations of single-particle events, the results indicate close agreement between the known input particle energies and the reconstructed energies from the island algorithm. Although more simulations are needed for a complete analysis, the island algorithm has proven to be a reliable method, on average, of reconstructing charged particle energies while avoiding background noise.