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Building and Commissioning the sPHENIX Hadronic Calorimeter

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The sPHENIX hadronic calorimeter (HCal) was successfully commissioned in 2023, which marks the very first sampling hadronic calorimeter with large acceptance coverage at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory. The HCal consists of two sections (called Outer and Inner HCal) which sandwiches a super conducting magnet of 1.4T ($\sim 0.4\lambda_0$). The Outer HCal ($\sim 4\lambda_0$) is made of tapered stainless steel plates interleaved with plastic scintillating sheets of 12 η -dependent shapes. Each scintillating sheet is carved with a groove on one side with a unique pattern for embedding a wavelength shifting fiber for light collecting efficiency and uniformity. The same design idea is for the Inner HCal ($\sim 0.25\lambda_0$) but in smaller size and with aluminum plates. The HCal is read out in units of towers which consist of 5 scintillator tiles for the Outer and 4 for the Inner. The towers are arranged projectively toward the collision vertex in a ϕ and η grid for a total of 1,536 towers each for the Outer and the Inner HCal. The HCal provides an unprecedented study in high precision of jet production in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV for characterizing the properties of quark-gluon plasma, which is one of the major scientific objectives of the sPHENIX experiment. A brief summary of the HCal design, beam tests, construction, installation, calibration, and the detailed GEANT4 simulation will be presented in this talk. The emphasis of this presentation includes the most recent HCal performance results.

Author: Prof. HE, Xiaochun (Georgia State University)

Presenter: Prof. HE, Xiaochun (Georgia State University)

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