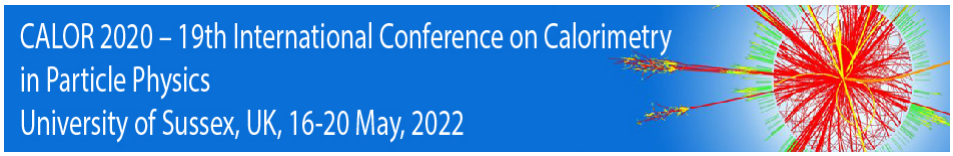

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The (Un)reasonable Effectiveness* of Neural Networks in Cherenkov Calorimetry

We report a greater than factor of two improvement in the hadronic energy resolution of a simulated Cherenkov calorimeter by estimating the energy with machine learning over traditional techniques. The prompt signal formation and energy threshold properties of Cherenkov radiation provide identifiable features that machine learning techniques can exploit to produce a superior model for energy reconstruction. We simulated a quartz-fiber calorimeter in the GEANT4 framework to study the reconstruction techniques in single and multi-hadron events. We compared the machine learning-based reconstruction performance to that of traditional and dual-readout techniques. We describe the reasons for this improvement and game-changing approach to Cherenkov hadron calorimetry as well as our plans for a dedicated beam test to validate these findings with a fast, radiation-hard hadron calorimeter prototype.

(*) inspired by E. P. Wigner

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