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Multiple-Readout Compensated Calorimetry R&D

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Dual Readout Calorimetry measures scintillation light and Cerenkov light on the same hadron shower to correct the jet energy to compensate hadron and jet energy measurements,We present dual readout calorimetry with scintillator and Cerenkov tile readout and beyond to multiple tile readout, with superior energy resolution, radiation resistant ionization sensors in the form of tiles (inorganic scintillators, Si, LArgon). Monte Carlo (MC) studies were used to design a prototype tile dual calorimeters using Fe or Cu absorbers, Cerenkov and plastic scintillator tiles, including an integral Cerenkov-compensated e-m front end using Pb tiles. The MC studies are extended to other tile type appropriate for dual readout and extend to multiple readout with 3 or more types of tile radiation sensors –sensors with different responses and/or higher contrast to component signals to e-m or hadron showers, neutrons and ions. Sensors include tiles with low refractive indices (aerogel, others), transition radiation "tiles", secondary emission tiles sensitive to ions and low energy protons, hydrogenous vs non-hydrogenous ionization-sensing tiles, and neutron sensing tiles. Multiple readout improves dual readout by extending to triple or more readout. Of special interest is application of tile dual or multiple tile readout to high granularity particle/energy flow calorimeters, not possible with parallel fibers.

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