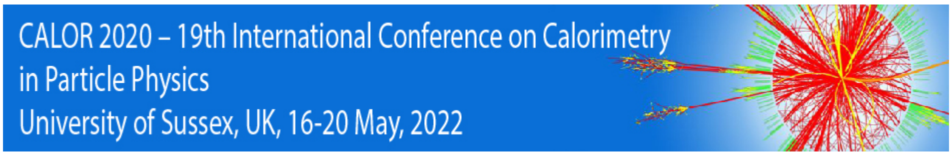

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Secondary Emission Calorimetry

Electromagnetic calorimetry in high-radiation environments, e.g. forward regions of lepton and hadron collider detectors, is quite challenging. Although the total absorption crystal calorimeters have superior performance as electromagnetic calorimeters, the availability and the cost of the radiation-hard crystals are the limiting factors as radiation-tolerant implementations. The sampling calorimeters utilizing Silicon sensors as the active media are also favorable in terms of performance but are challenged by high radiation environments. In order to provide a solution for such implementations, we developed a radiation-hard, fast and cost effective technique, secondary emission calorimetry, and tested prototype secondary emission sensors in test beams. In a secondary emission detector module, secondary emission electrons are generated from a cathode when charged hadron or electromagnetic shower particles penetrate the secondary emission sampling module placed between absorber materials. The generated secondary emission electrons are then multiplied in a similar way as the photoelectrons in photomultiplier tubes. Here we report on the principles of secondary emission calorimetry and the results from beam tests as well as the Monte Carlo simulations of projected, large-scale secondary emission electromagnetic calorimeters.

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