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Noble Liquid Calorimetry for Future Collider Experiments

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Calorimetry based on liquefied noble gases is a well proven technology that has been successfully applied in numerous high-energy physics experiments, such as DØ at the Tevatron, ATLAS at the LHC and NA62 at the SPS. In addition to extreme radiation hardness, noble liquid calorimeters provide excellent energy resolution, linearity, stability, uniformity and timing properties at a reasonable cost. These attributes make it a strong candidate for future particle physics experiments - in both hadron and lepton colliders. Advances in printed circuit board (PCB) technology and manufacturing processes make it possible to add high granularity to the already impressive list of benefits of noble liquid calorimeters. By using multi-layer PCB's as read-out electrodes between the noble liquid and absorbers, we can build a calorimeter with almost arbitrarily high granularity. This in turn allows for four-dimensional imaging, machine learning algorithms and particle-flow reconstruction to be fully exploited. In this talk we present the ongoing R&D work for adapting noble liquid sampling calorimetry to an electromagnetic calorimeter of a lepton collider experiment. We show studies on signal extraction and noise mitigation made with a prototype read-out electrode and compare the measurements to simulations. In addition we will present FCC software based performance studies of the calorimeter concept and conclude by discussing the next steps in the R&D project.

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