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Progress towards a liquid xenon calorimeter for the PIONEER experiment

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PIONEER is a next-generation pion decay experiment that will run at the Paul Scherrer Institute in Switzerland. The initial goal of PIONEER is to improve the precision of the pion branching ratio measurement $R_{e/\mu} = \frac{\Gamma(\pi^+ \rightarrow e^+ \nu_e(\gamma))}{\Gamma(\pi^+ \rightarrow \mu^+ \nu_\mu(\gamma))}$, a stringent, direct test of lepton flavour universality. To achieve this goal, PIO-NEER will employ a modern detector based on two key components: an active highly segmented target, and a large acceptance, 19 radiation length calorimeter. Two calorimeter technology options are being compared: LYSO crystals, and liquid xenon (LXe). Our team at TRIUMF is working on the R&D for the LXe option. Recent progress includes designing and testing components for a large LXe prototype detector and advancing simulations of the full calorimeter to assess its performance of decay positron energy and position reconstruction. In this talk, I will present results from GEANT4 simulations and give a status update of the R&D work.

Keyword-1

PIONEER

Keyword-2

pion decay

Keyword-3

lepton flavour universality

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