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## **79 - WITHDRAWN - First Implementation of CsI(Tl) Pulse Shape Discrimination at a B-Factor Experiment for Improving Hadronic vs Electromagnetic Shower Identification**

*Tuesday 4 June 2019 17:25 (2 minutes)*

This talk presents a novel new method for identifying electromagnetic vs. hadronic showers in the Belle II electromagnetic calorimeter through the first implementation of CsI(Tl) pulse shape discrimination (PSD) at a B-factory experiment. During the first run of collision data-taking of the Belle II experiment in summer 2018, the 8736 CsI(Tl) crystals in the Belle II calorimeter were instrumented with electronics allowing for on-line CsI(Tl) waveform digitization and readout. We show that by analyzing the pulse shapes of the waveforms recorded in this collision data run, PSD allows for calorimeter clusters produced by hadronic interactions to be distinguished from electromagnetic showers. This experimental technique takes advantage of the ionization  $dE/dx$  dependent CsI(Tl) scintillation response allowing for hadronic showers that contain energy deposits from highly ionizing secondary particles such as protons and alpha particles to be separated from electromagnetic showers. To utilize this information for improving particle identification at Belle II, a Boosted Decision Tree multivariate classifier is trained to identify hadronic and electromagnetic showers based on types of CsI(Tl) pulse shapes present in the crystals associated with the calorimeter cluster. Using control samples of photon's and  $K_L^0$ 's isolated from Belle II collision data, the ability to select neutral hadronic showers with high efficiency and low photon backgrounds is demonstrated and compared with shower shape methods employed at past B-Factor experiments.

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