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Contribution ID: **3343** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Improving Muon-Pion & Electron-Pion Separation at Belle II with Machine Learning Using the Novel Pulse Shape Discrimination in CsI(Tl)

Wednesday 8 June 2022 14:00 (15 minutes)

The Belle II experiment, based at SuperKEKB, is collecting e+e- collision data at the Upsilon(4S) resonance energy. Many Belle II analyses require tagging methods that involve electrons, muons or pions, where the misidentification of these particles introduces important systematic uncertainties. The new pulse shape discrimination (PSD) tool implemented in the 8736 CsI(Tl) crystal Electromagnetic CaLorimeter (ECL) exploits the faster rise time of CsI(Tl) signals induced by hadronic interaction relative to those of purely electromagnetic interactions and is part of an effort to improve our ability to identify hadronically interacting particles. This talk will show how PSD, used within machine learning classification models, improves the discrimination between muons and pions, as well as electrons and pions, using only data from the ECL. These models are trained on a GEANT4 simulated data set of electrons, muons and pions at various energies using the energy, shape, type, and hadronic contribution (from PSD) of the associated ECL clusters. This allows the model to recognize the patterns that characterize the pion hadronic clusters from purely electromagnetic clusters, resulting in an output that characterizes how likely a cluster is to originate from a charged hadronic pion versus a non-hadronic lepton. The resulting models are tested on early data from Belle II to determine performance.

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