PHYSICS AND ASTRONOMY SEMINAR

Savino Longo,

"Improving Particle Identification at the Belle II Experiment through the First Application of CsI(Tl) Pulse Shape Discrimination at an e^+e^- Collider"

Abstract

"During its first collision data-taking in summer 2018 the Belle II experiment operating at the SuperKEKB e^+e^- collider was the first B factory experiment to implement CsI(Tl) pulse shape discrimination (PSD) as a novel technique to improve particle identification. This experimental technique uses the particle dependent scintillation response of the CsI(Tl)scintillation crystals that comprise the Belle II electromagnetic calorimeter to identify electromagnetic vs. hadronic interactions.

I will present pulse shape discrimination results from Belle II as well as a testbeam completed at the TRIUMF proton and neutron irradiation facility. I will outline a new method for CsI(Tl) pulse shape characterization that was developed and now applied at the Belle II experiment to achieve pulse shape discrimination, as well as a theoretical model which was formulated to allow for accurate simulations of the CsI(Tl) scintillation response to hadrons. By studying control samples of $e^\pm$, $\mu^\pm$, $p^\pm$, $K^\pm$ and $p/\bar{p}$ selected from Belle II collision data I evaluate the simulation performance and show low momentum $\mu^\pm$ vs $p^\pm$ separation can be achieved using PSD.

The performance of a PSD-based multivariate classifier trained for kaon-long vs. photon identification will be discussed. Using control samples of kaon-longs and photons selected from Belle II collision data I will show pulse shape discrimination allows for high efficiency kaon-long identification to be achieved will low photon backgrounds. The potential impact of CsI(Tl) PSD on improving planned Belle II searches for physics beyond the Standard Model will also be discussed."

Monday, August 12, 2019

1:00 p.m.
ECS Building – Room 124