Lindsey Gray – HEP Seminar – March 31, 2026
FNAL

Title: Smartpixels: Machine Learning Integrated Detector Systems

Abstract:
This talk will discuss the recent status of the *smartpixels* effort that aims to integrate Machine Learning (ML) into radiation hard detector system frontend readout ASICs. Modern hardware codesign concepts like High-Level Synthesis (HLS) have paved the way for rapid development of hardware-based Machine Learning (ML), as seen in the rapid proliferation of ML techniques in FPGA-based systems. This has resulted in highly focused design tools such as HLS4ML, which have greatly decreased the time-to-design and allowed physicist practitioners to rapidly and jointly develop hardware platforms with engineers. The *smartpixels* project is pioneering design techniques and applications that yield new techniques in particle detection, like single-plane tracking in silicon detectors. These new techniques, in turn, yield the possibility for novel detector designs such as having pixel sensors integrated into the CMS Phase 2 Level-One trigger. The testing effort that proves the hardware within the *smartpixels* will be discussed in detail. With this established, we'll proceed to mechanisms of possible physics gains at the LHC and explore possibilities for further experimental applications.