Overview of the software and performance studies of the LHCb Upgrade II Electromagnetic Calorimeter

Thursday, 15 August 2024 14:15 (15 minutes)

LHCb Upgrade II is a proposed detector upgrade for the fourth long-term shutdown of the LHC, which will operate at instantaneous luminosities up to $1.5 \times 10^{34} cm^{-2} s^{-1}$ and integral luminosities totaling about 300 fb^{-1}. The upgrade will fully collect and utilize the flavor physics opportunities offered by the HL-LHC and to explore a wide range of observable physics with unprecedented precision. The required substantial modifications of the current LHCb electromagnetic calorimeter (ECAL) due to high radiation doses in the central region and increased particle densities are referred to as PicoCal.

Currently, a number of scintillating sampling ECAL technologies are under investigation as part of an ongoing research and development effort. These technologies include the Spaghetti Calorimeter (SpaCal) utilizing garnet scintillating crystals with tungsten absorbers, SpaCal utilizing scintillating plastic fibers with tungsten or lead absorbers, and the Shashlik configuration featuring polystyrene tiles, lead absorbers, and fast wavelength-shifting fibers. Additionally, corresponding simulation and reconstruction software packages have been developed in conjunction with these studies. Timing capabilities with tens of picoseconds precision for neutral electromagnetic particles and increased granularity with denser absorber in the central region are needed for pile-up mitigation. A front-to-back longitudinal layered readout structure has also been introduced into the prototype with a view to improving the splitting performance of overlapping clusters. For both the SpaCal and Shashlik modules, we obtained a time resolution better than 20 ps at high energy. And the sampling term for energy resolution is about 10/sqrt(E) meets the requirement. Several typical ands benchmark analyses have been carried out, to demonstrate the performance of the PicoCal.

The talk will highlight the novel software developments for the PicoCal and the related important physics prospects.

Primary author: 费, 家乐 (武汉大学)

Presenter: 费, 家乐 (武汉大学)

Session Classification: 分会场五

Track Classification: 粒子物理实验技术