PHYSICS 594: FINAL PROJECT DETAILS

Area of Study: Particle Physics
Topic: Underlying Event
Group Members: Adam Vendrasco

Background Details

The Large Hadron Collider (LHC) is the world's largest and most powerful particle accelerator. Inside the accelerator, two high-energy particle beams consisting of protons (p^+) travel close to the speed of light and are made to collided at distinct points around the accelerators ring. Most of the inelastic particle production is described by a combination of hadronic jets, originating from hard parton-parton interactions with exchanged momenta above several GeV/c, and of an underlying event consisting of softer parton-parton interactions, and of proton remnants. This underlying event (UE) section of the overall collision is commonly defined as the set of all final-state particles that are not associated with the initial hard-parton scattering and would have relatively small transverse momenta of a few GeV/c, produced in softer multi-parton interactions.

Project Details

Since the majority of the particle interactions are from QCD, there is an extremely high particle multiplicity of the system resulting in the suppression of the UE within the collision. The project idea is to use ML to further constrain the Z-boson invariant mass by incorporating these underlying events. I would do this by looking specifically at $Z \to \mu\mu$ events in the CMS open data (https://opendata.cern.ch).

Resources

- Underlying Event for Jets, 2013: Link
- Underlying Event Studies for LHC Energies, 2011: Link
- Underlying event and Multi-jet final states: Link
- University College of London talk, 2006: Link

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Date: 03/17/2024.