CMS Calibration - Overview

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You will be working in teams this week on a data analysis project. Each team will analyze data collected from the Compact Muon Solenoid detector at the Large Hadron Collider. These filtered data contain information about indirectly observed particles. Your group is to discern as many of this particle's properties as you can.

Goals

Our goals for the week:

- Apply classical physics principles to reduce or explain the observations in data investigations.
- Identify and describe ways that data are organized for determining any patterns that may exist in the data.
- Create, organize and interpret data plots; make claims based on evidence and provide explanations; identify data limitations.
- Develop a plan for raising students from their current level of data use to subsequent levels using activities and/or ideas from the workshop.

Getting Started

Each of you is a member of the CMS Collaboration. Your team will have a milestone seminar with the sometimes-helpful and usually-demanding Level-3 project manager in order to demonstrate comprehension of the milestones in the project. You will gain access to the data once your team successfully demonstrates readiness in that seminar.

The first step in the process is to read the memo, which just arrived today. The memo gives your team its charge for the remainder of the week.

Enduring Understandings

1. Claims are made based on data that constitute the evidence for the claim.
2. Particle physicists use conservation of energy and momentum to discover the mass of fundamental particles.
3. Indirect evidence provides data to study phenomena that cannot be directly observed.
4. Scientists continuously check the performance of their instruments by performing calibration runs using particles with well-known characteristics.
5. Data can be analyzed more effectively when properly organized; charts and histograms provide methods of finding patterns in large data sets.
6. Data can be used to develop models based on patterns in the data.
7. Physicists use models to make predictions about and explain natural phenomena.
8. Particle decays are probabilistic for any one particle.
9. Physicists must identify and subtract “noisy” background events in order to identify the “signal”.
10. Well-understood particle properties such as charge, mass, and spin provide data to calibrate detectors.
11. The Standard Model provides a framework for our understanding of matter.
12. Research questions, experiments, and models are formed and refined by observed patterns in large data sets.