PHY2407S Assignment

January 2015

There will be one assignment, due at the end of the lectures. I will assess, give feedback and assign a grade for this. It will be assessed on completeness, accuracy of physics content and readability. Each student will have a choice of one of the following projects.

Project #1:

The Large Hadron Collider (LHC) has been taking data since 2010, and collected of order 25 fb^{-1} by autumn 2013. After an almost two-year shut-down, it is now starting up at higher energy and instantaneous luminosity. Write a proposal (five pages or less of text, single-spaced, 12 point font, not including tables or figures) for a physics measurement using the datasets that are expected to be acquired, outlining the motivation, the required luminosity, trigger requirements and analysis strategy. Estimate the expected uncertainty of the measurement, including key systematic sources. This proposal should be written assuming it will be peer reviewed, so ensure that it is readable, properly referenced and understandable to the typical particle physicists who is involved in collider physics.

Project #2:

The Large Hadron Collider is expected to be upgraded to 10^{35} $cm^{-2}s^{-1}$ in the timeframe of 2020, after the initial scientific goals are achieved running for several years at 10^{34} $cm^{-2}s^{-1}$. You are proposing a measurement that requires > 1 ab^{-1}, requiring running at this intensity for between one and two years. Identify a physics process that requires a dataset of this sensitivity, outline a strategy for triggering and analyzing the ATLAS detector (assuming appropriate upgrades have been done to maintain excellent charged particle tracking, lepton identification and calorimetry reconstruction) and estimate the key systematic uncertainties. Present your results in the form of a relatively short proposal (fives pages of text or less, single-spaced, 12 point font, not including figures or tables), outlining i) physics motivation, ii) measurement strategy, iii) triggering requirements, iv) systematic uncertainties and v) expected precision or sensitivity. This proposal will be subject to the appropriate peer review, so ensure that it is readable, properly referenced and understandable to the typical particle physicists who is involved in collider physics.

You will have to prepare a short "letter-of-intent" of less than one page that summarizes what you plan to do by Monday, 9 February 2015. You should consult with me ahead of time so that you don't take on a project that has too large or undefined a scope. The length of the project is about the typical Physical Review Letter, so gives you an idea of what it means to be concise!

As discussed in our first meeting, every student will give a 10 min summary of their project, followed by a 5 min question period. These are intended to have the flavor of an APS or CAP parallel session talk. This will constitute 10% of the overall assessment, with the written assignment constituting 90%.