

PHY2407F Assignment

September 2009

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

You will have to prepare a short “letter-of-intent” of less than one page that summarizes what you plan to do by 30 October 2009. 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!

Project #1:

The Large Hadron Collider (LHC) will start data-taking in fall 2009, and will collect of order 200 pb⁻¹ by autumn 2010. Write a proposal (five pages or less of text, single-spaced, 12 point font, not including tables or figures) for a physics measurement using this dataset, outlining the motivation, the required luminosity, trigger requirements and analysis strategy. Assume that all of the data will be collected at 10 TeV centre-of-mass energy. Estimate the expected uncertainty of the measurement, including key systematic sources. 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.

Project #2:

The Large Hadron Collider is expected to be upgraded to $10^{35} \text{ cm}^{-2}\text{s}^{-1}$ in the timeframe of 2015, after the initial scientific goals are achieved running for several years at $10^{34} \text{ cm}^{-2}\text{s}^{-1}$. You are proposing a measurement that requires $> 1 \text{ ab}^{-1}$, 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.