PY 482: Computation for Experimental Particle Physics

1. Instructor, Dates

   - Prof. Kevin Black, kmblack@physics.bu.edu
   - Winter/Spring semester 2012, 6 week course
   - Tuesday and Thursday Afternoon, 2 - 4 pm

2. Course Designator and Title

   - CAS PY 482 : Computational Methods and Statistical Analysis of Experimental Particle Physics, Seminar on Physics
   - 2 credit

3. Prerequisites

   - Familiarity with C++ and UNIX

4. Course Objectives: To provide an introduction to the experimental methods used in modern high energy particle physics. The course will start with a survey of modern experimental particle physics where students will familiarize themselves with the Standard Model of particle physics. We will then cover interactions of particles with matter and several major detector technologies. The course will cover statistical and computational methods for experimental particle physics surveying basic elements of probability, point estimation, fitting, and confidence intervals.

5. Methodology

   - The course will be a mixture of lectures, tutorials, and discussions with hands-on exercises
   - Homework: Will consist of computational exercises covering the lecture topics of each week
   - Presentations: Each student will make a short presentation (30 min) reviewing important historical paper from a high energy physics experiment
   - A take home final project will be given as a final exam which will consist of a computational exercise which will be developed from the methods taught during the seminar

6. Text:

   - Suggested Material : Louis Lyon 'Statistics for Nuclear and Particle Physics', Giffiths 'Introduction to Particle Physics', Ferbel 'Experimental Techniques in High-Energy Nuclear and Particle Physics', Fruthwirth 'Data-Analysis Techniques for High-Energy Physics','Particle Detectors' C Grupen and B Schwartz , Particle Databook (http://pdg.lbl.gov/)

7. Grading

   - Homework (50 %) - 5 homework assignments during the six week period all with equal weight, passed out on the Tuesday and due the following Tuesday at the start of class
   - Presentation (20 %), to be given during the last 3 weeks of the course by schedule
   - Final Project (30 %), due the Tuesday after the final lecture (March 6th)

8. Timeline

Date	Topic	Notes
January 24th	Overview and Introduction	
January 26th	Introduction to Root, Unix, C++	
January 31st	Electronics, Data Acquisition , Trigger	HW 1 Due
February 2nd	Advanced Topics in ROOT for HEP	
Feburary 7th	Event Reconstruction	HW 2 Due
February 9th	Introduction to Probability	
February 14th	The Probability and Statistics with ROOT	HW 3 Due
February 16th	Introduction to Statistical Analysis	
February 21st	Parameter Estimation	HW 4 Due
February 23rd	The Likelihood Principe	
February 28th	Fitting	HW 5 Due
March 1st	Confidence Intervals	

9. Ethics Policy: You are expected to be familiar with and adhere to the College of Arts and Sciences Academic Conduct Code. Evidence of cheating will be reported immediately to your Academic Conduct Committee. Students found guilty of cheating on exams may be penalized by suspension or even expulsion.