PHYS7361-001, the fall Semester of 2018.

Course Description, Prerequisites and Instructors

This course, Elementary Particle Physics II, and as a continuation of the first half of this topic, is for students who plan to be particle physicists, especially experimental particle physicists. It may also be useful for anyone who needs to understand basic physics and techniques in particle detection. It follows PHYS5380, Concepts of Experimental Particle Physics, with a focus on in depth training of a complete experiment, namely the software tools, instrumentation, data acquisition and analysis. This is done via reviews of the software tools and then through the experiment of alpha scattering. In this experiment the students are required to operate the instrument, record data, and write the program that analyze the data.

Prerequisites: the knowledge of a graduate student in physics with adequate math and basic coding skills in C++, together with PHYS5380, PHYS7360.

This course will be guided by Drs Xiandong Zhao, Datao Gong and Andy Liu, and myself. Most of the coding and simulation work will be helped by Xiandong and Datao. Andy and myself will guide discussions on detector related topics.

Learning objectives and textbook

Learning outcomes

The course aims to develop the following abilities: (1) to understand the physics for particle detection, the basic types of detectors for momentum and energy measurements, the basic knowledge of detector readout; (2) the design and layout of a generic detector for collider physics experiment, and how a particle is detected, identified and sometimes reconstructed through such a detector system; (3) the use of GEANT4 (geant4.cern.ch), the simulation tool in particle detection and detector designs.

Textbook

We will follow mostly this textbook: Particle Detectors, Second Edition by Claus Grupen and Boris Shwartz. ISBN-13**:** 978-0-511-38866-8 or 978-0-521-84006-4. You may also want to consult review articles in PDG: http://pdg.lbl.gov/2017/reviews/contents_sports.html, especially these review articles: Passage of particles through

matter, Particle detectors at accelerators, Particle detectors for non-accelerator physics, Probability, Statistics, Monte Carlo techniques and Kinematics.

Course Format and Information

As this is a high level graduate course, it will be mostly based on guided reading, classroom discussions and presentations. Reading materials will be assigned with reports required at the end of each topic. A final extensive report about the alpha scattering experiment, including a description of the physics goal, the instrument, the code that models the setup, and the data analysis and results. We usually have class discussions about progress and provide guidance but for this semester as we only have one student enrolled, we relax on the meeting time and only meet when a face-to-face discussion is needed. Some of the discussions and information exchange are carried out through emails.

Grading policy: Final grades will be computed from the reports of the three assignments (20%, 20% and 60%). Numerical grade and letter grade conversion is based on:

Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Numerical (%)	90.0	85.0	80.0	75.0	70.0	66.6	63.3	60.0	56.6	53.3	50.0	

Other policies:

Disability Accommodations

Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit http://www.smu.edu/Provost/ALEC/DASS to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

Religious Observance

Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No.

1.9.)

Excused Absences for University Extracurricular Activities

Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

Schedule:

Dates	Reading and report	Notes
9/15	a) A review on the C++ language and report on methods about how to self-teach the language within 2 weeks	The reading is outside of class
10/15	a) A review of Root and a report on a concise guide of this software tool	
12/10	a) Bring up the instrument for alpha scattering measurement. b) Design the measurement and carry it out, record data. c) Complete the code from Xiandong that models the setup, check the results and determine if scattering inside the collimator would need to be taken into account. d) Analyze the data and write the report	

Final Exam: there will be no in-class final exam of this course.