Doctoral School Course 2020

Title: Beam manipulation for precision experiments
Teacher: Enrique MINAYA RAMIREZ

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Duration: 15h

Langue du cours: English

Prerequisite: Students should have a basic knowledge of subatomic physics and electromagnetism (M1 level).

Summary
The goal of this lecture is to break down all the required steps to perform a high-precision measurement of an observable in subatomic physics. The lecture will demonstrate the necessity of high-precision measurements in subatomic physics using precise and detailed examples. State-of-the-art experimental tools, present today in almost all research facilities, will be studied. The lecture will follow the three main stages to achieve any precision measurement: transport, preparation and beam manipulation. Measurement techniques and errors determination will also be addressed. Finally, depending on the participants, the course may address more examples in nuclear physics, atomic physics or another field of research. The objective of this course is also to reveal to PhD students about all the possibilities ion traps offer in physics.

Outline
1. Beam dynamics
   1.1. Beam emittance
   1.2. Beam transport
   1.3. Beam preparation
2. Ion traps
   2.1. Paul trap
   2.2. Penning trap
   2.3. Other traps for ion manipulation
3. Detection techniques
   3.1. Destructive techniques
   3.2. Non-destructive techniques
   3.3. Trap assisted techniques
4. Uncertainties for ion traps
   4.1. Systematic uncertainties
   4.2. Statistical uncertainties
   4.3. Data analysis

5. Detailed applications of precision measurements
   5.1. Applications in nuclear physics
   5.2. Applications in atomic physics
   5.3. Applications in other fields

Week scheduled for the course
   24 to 28 February 2020

Schedule
   Lecture: 15 h (3 h every morning for one week)

Location:
   IPN Orsay
   Building 102,
   conference room