UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Nuclear and Subnuclear Measurements Laboratory

2223-1-F1701Q121

Aims

The laboratory course provides an introduction at graduate level of the experimental techniques employed in particle and nuclear physics, including applications to medical and environmental physics.

Contents

The students carry on a full experiment in nuclear and particle physics, including the characterization of the source, detector, front end electronics, data acquisition and analysis

Detailed program

The students work in a team of 3-4 people and carry on a full experiment of nuclear or subnuclear physics. They contribute to the design of the experiment, the characterization of the detectors and front-end electronics, the data taking and analysis.

The experiment that can be built from the laboratory instrumentation are

1) Proof of concept of the Positron Emission Tomography (PET)

2) Measurement of the lifetime of a unstable state of 57Fe from a 57Co source

3) The Compton experiment performed from the annihilation photons of a 22Na source

4) Measurement of the lifetime at rest of the muon

Prerequisites

Experimental and analysis techniques from the Bachelor level lab courses. It is strongly recommended to follow the course on Radiation Detectors, which is normally delivered almost completely before the start of the laboratory.

Teaching form

The experiments are performed in the labs of the Department of Physics and the activities are supervised by the teacher. The results are summarized in a final report written in English.

Textbook and teaching resource

The final reports from the previous years. We also suggest the reading of a few chapter (depending on the experiment) from

G. F. Knoll, “Radiation Detection and Measurement”, 4th ed., Wiley & Sons

K. Grupen, “Particle Detectors”, 2nd ed., Cambridge University Press

G. Gilmore, “Practical gamma ray spectroscopy”, 2nd ed., Wiley & Sons

F. Terranova, "A modern primer in particle and nuclear physics", 1st ed., Oxford Univ. Press

Semester

First semester

Assessment method

One week before the scheduled examination, the group must send in digital format the final report (in English) of the lab work to the teachers. The report will have to illustrate the procedures used for carrying out the various "steps" faced to carry out the experiment, as set out in the "Detailed Program". The team that performed the experiment presents the report and discusses it with the teachers. During the discussion, the techniques that were implemented will be discussed with each student, together with the issues encountered during the run of the apparatus and possible sources of systematic errors in the measurements.

Office hours

Under request by the team.

Sustainable Development Goals

QUALITY EDUCATION