Laurea:	Magistrale Fisica
Type:	Optional course
Insegnamento:	Detectors for Particle Physics
Anno:	TBD
Semester:	First
Assessment method:	Oral exam
Prerequisites:	Introductory Courses to Particle Physics, Physics Laboratory I and II (Nuclear Physics)
CFU:	6
SSD:	FIS/01
Ore lezione:	60
Canali:	Nessuna canalizzazione
Docente:	Francesco Lacava

Objectives:

- Knowledge of interaction of radiation with matter.
- Knowledge of most used particle detectors.
- Introduction to Accelerators Physics.
- Introduction to present experiments at colliders.
- Introduction to papers on detectors and experimental apparatus.

Detailed syllabus:

- Passage of radiation in matter.
  - Interactions of photons and charged particles with matter.
  - Energy loss for charged particles, e.m. and hadronic showers.
- Detectors
  - Gaseous detectors (proportional tube, MWPC, drift chamber, resistive plate counter, micromegas, GEM.
  - Scintillators and photodetectors.
  - Cerenkov counters.
  - Calorimeter: e.m. and hadronic calorimeters, compensation, dual readout method.
  - Silicon detectors: microstrips and pixels.
  - Particle identification detectors (ionization measuremet, Cerenkov light, transition radiation, time of flight).
  - Spectrometers.
- Accelerators
  - Introduction to the physics of accelerators, betatron and synchrotron oscillations, alternate gradient accelerators. Motion of the beam in phase space and matrix lattice for an accelerator.
  - Linear accelerators, cyclotron, synchrotron, protonsynchrotron,
  - Present accelerators: LHC, etc.
  - Future accelerators: linear and circular colliders, muon collider.
- Underground experiments
  - Neutrino experiments.
  - Dark matter and other passive experiments.
- Health Physics
  - Neutron detection.

    - Hadroterapy, dedicated accelerators: CNAO.
- Examples of Special Topics Lectures (given by invited lecturers)
    - Trigger in high energy experiments.
    - Astroparticle dtectors.
    - Dark matter experiments.
    - New acceleration techniques.

Reading list:

- Slides and documentation suggested during the lectures
- Particle Data Group 2018: Section 33 *Passage of particle through matter*
- Particle Data Group 2018: Section 34 *Particle detectors at accelerators*
- Particle Data Group 2018: Section 30 *Accelerator Physics of colliders*
- G.F.Knoll, *Radiation Detection and measurement*, J.Wiley & Sons
- R.Leo, *Techniques for Nuclear and Particle Physics Experiments*, Springer
- R.Wigmans, *Calorimetry*, Oxford University Press
- F.Sauli, *Principles of operation of multi wire proportional and drift chambers*, Yellow Report CERN 77-09
- Nuclear Instrument and Methods in Physics Research A 666 (2012)
- E.Segrè, *Nuclei and Particles*, W.A.Benjamin/ Zanichelli
- E.J.Wilson, *An Introduction to Particle Accelerators*, Oxford Univ. Press
- E.J.Wilson, *Proton Synchrotron Accelerator Theory*, Yellow Report CERN 77-07