Project: Introduction to Accelerator Technology

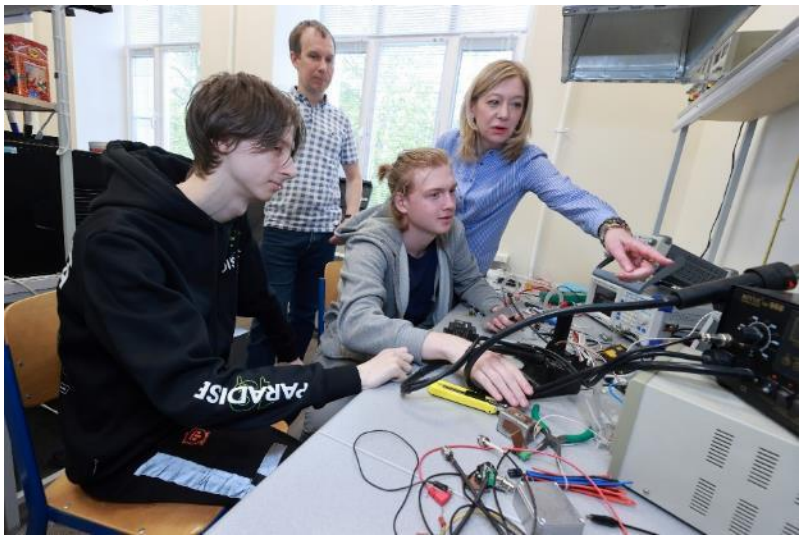
1. Introduction

Almost every person whose work involves particle accelerators needs a basic knowledge of their systems. This practical course is designed to get the basic knowledge and skills in electronics, RF and vacuum technology, physical facility controls and particle detector basics.

2. Description

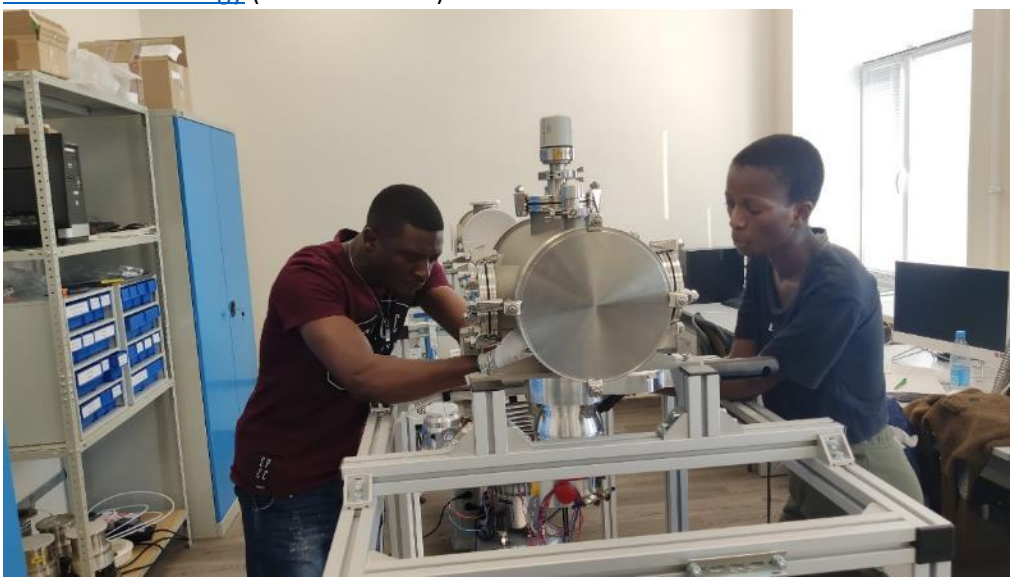
The course includes introductory parts of the following courses of the JINR UC Engineering and Physics Training:

2.1. Electronics (Lab Works 1 and 2).



2.2. RF Technology (Lab Works 0–5).

2.3. Vacuum Technology (Lab Works 0–3).



2.4. Automation (stages 1, 2, 4 and 5).

2.5. Medipix particle detector (Lab Works 1–6).

3. Prerequisites

1. Theoretical Knowledge:
    - Math: mathematical analysis, linear algebra, analytic geometry, computer logic basics.
    - Physics: electricity, electromagnetic fields, metric prefixes, nuclear physics.
    - Fundamentals of Computer Networks: IP address, switch, patch cord.
2. Practical Skills:
    - Software Skills: MS Windows, MS Office (especially PowerPoint).
    - Data Visualization: plotting graphs and preparing presentations.
3. Appropriate glasses/lenses if the student has poor eyesight: the training includes work with small elements.

4. Recommended number of participants

2–6 persons.

5. Supervisors

- General:
    - Dr Mikhail Nozdrin, DLNP / UC.
    - Dr Kirill Gikal, FLNR / UC.
- Electronics: Mr Dmitriy Belozerov, FLNR / UC.
- RF Technology: Mr Kirill Verlamov, FLNR / UC.
- Vacuum Technology: Mr Dmitriy Zlydenny, FLNR / UC.
- Automation: Mr Andrey Andreev, UC.
- Medipix:
    - Mr Lev Pavlov, FLNR / UC.
    - Mr Konstantin Timoshenko, FLNR / UC.

6. Recommended literature

Electronics:

[1] J. Walker, D. Halliday, R. Resnick. Halliday & Resnick Fundamentals of Physics. Tenth edition. Hoboken, NJ: John Wiley & Sons, Inc., 2014.

[2] P. Horowitz, W. Hill. The Art of Electronics. Cambridge University Press, any edition.

[3] M. Jones. A Practical Introduction to Electronic Circuits, 3rd Edition. Cambridge University Press, 1995.

[4] John R. Barnes. Electronic System Design: Interference and Noise Control Techniques, Englewood Cliffs, New Jersey, 1987.

RF Technology:

[1] Joseph F. White. High frequency techniques. An introduction to RF and microwave engineering. A John Wiley & Sons, Inc., 2004.

[2] Adam S.F. Microwave Theory and Applications. §2.3.

[3] Wangler T.P. Introduction to Linear Accelerators. §1.10.

Vacuum and Automation:

[1] Nagamitsu Yoshimura. Vacuum Technology: Practice for Scientific Instruments. Springer, 2008.

[2] Siemens LOGO! PLC manual.

Medipix particle detector:

[1] V. Vicha. Experiments Using Pixel Detectors in Teaching Nuclear and Particle Physics.

[2] F. Knoll. Radiation detection and measurement.