Project: Pixel detector medipix MX-10

1. Introduction

The project focuses on the progressive detector technology of pixel detectors. Medipix is a family of readout chips and detector assemblies for particle detection and imaging developed by the Medipix Collaborations (https://medipix.web.cern.ch). The original concept of Medipix is that it works like a camera, detecting and counting each individual particle hitting the pixels when its electronic shutter is open. This enables high-resolution, high-contrast, noise hit free images – making it unique for imaging applications. Pixelman SW for control and evaluation of Medipix/Timepix detectors was developed and licensed by the Institute of Experimental and Applied Physics (IEAP) of the Czech Technical University in Prague. The R/O interface MX-10, based on the Medipix/Timepix detector, is produced by the Czech company Jablotron in cooperation with IEAP.

Students will learn how to work with a pixel detector, learn how to set measurement parameters and evaluate their own measurements. The basic types of radiation of several emitters will be distinguished according to measured tracks. Students will also examine the radiation background including cosmic rays muons. They will learn how to build simple experiments for the examination of properties of radioactivity.

2. Description

Students' workplaces will be equipped with a MX-10 Edukit set. Students will work in pairs. At first, students will learn how to control the pixel detector, understand the measured data, and draw charts under the guidance of a lecturer. In pairs, they will independently perform their own experiments according to the book Experiments Using Pixel Detectors in Teaching Nuclear and Particle Physics.

Students will present the results of their own measurements during the final presentation.

3. Practice structure

- Common measurement supervised by a supervisor
- Self-study and independent work with the pixel detectors
- Common measurement supervised by a supervisor
  - Introduction
  - familiarity with the detector MX-10
  - work with detector MX-10 (with different ion sources)
  - energy loss of alpha particles in air
  - energy loss of alpha particles in matter
  - gamma radiation
- Own measurement and preparation of the final presentation
- Discussion of the results with a supervisor
  Presentation of the measurement results

4. Prerequisites

- Basics of mathematical analysis, linear algebra, and analytic geometry
- Basics of physics
- Basics of computer knowledge: MS Windows, MS Office (especially PowerPoint)
- If it possible each student may have their own notebook with Windows and MS Office Excel.

5. Recommended participants amount

Up to 8 persons.

6. Supervisors

Kirill Gikal, senior engineer of the Scientific-Engineering Group of the JINR University Centre.
Kirill Papenkov, engineer of the Scientific-Engineering Group of the JINR University Centre.

7. Recommended literature

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