APPLICATION OF ALPIDE PIXEL DETECTOR FOR HEAVY-ION NUCLEAR EXPERIMENT AND ION THERAPY

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The ALICE Pixel Detector (ALPIDE) is the Monolithic Active Pixel Sensor (MAPS) for the upgrade of the Inner Tracking System (ITS) of the ALICE experiment at CERN. The ALPIDE sensor is based on the TowerJazz technology, which uses a several metal layers which in combination with a small size of pixel implements high density and low power digital circuits. A single 25 μm thick sensor measures 15 mm × 30 mm and contains half a million pixels distributed in 512 rows and 1024 columns. Each pixel of the ALPIDE has an analog front-end circuit for signal amplification, hit discrimination, and a 3 hit buffer. The detection efficiency of the sensors is higher than 99%, fake-hit rate is orders of magnitude lower than the required 10^{-6} pixel^{-1} event^{-1}, and spatial resolution is within the required 5μm [1].

Radiation therapy is one of the most effective ways to fight cancer. In order to successfully irradiate tumour within target volume and minimize the damage of healthy tissue, there is a need to control the dose delivery. Today, irradiation is carried out using photons or charged particles (for example, protons). Protons have the Bragg peak at the end of their trajectory, where they lose most of their energy. Therefore, the absorbed dose for healthy tissues after irradiation with protons is less than after photons. For the accurate determination of the Bragg peak position within a tumour volume, one needs to know the stopping power of organs and tissues of patients when the planning of proton radiation therapy [2]. ALPIDE has perfect position resolution and radiation tolerance allowing precise positioning of a particle beam in hadron therapy [3]. The purpose of the work was to study the characteristics of the ALPIDE pixel detector.

The work describes an operational principle of the ALPIDE sensor, compares the beam test data taken at the Proton Synchrotron at CERN. We also present laboratory measurements of Fake Hite Rate of the selected ALPIDE chips for Outer Barrel of new ITS. The results were compared with ITS ALICE requests.

REFERENCES

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