CONTROL AND CHARACTERIZATION OF A CYCLOTRON PROTON BEAM

Maslina Mohd Ibrahim

Dr. John Gahl, Thesis Supervisor

ABSTRACT

The cyclotron proton beam accelerator at the University of Missouri Research Reactor (MURR) is used for positron emission tomography (PET) applications. Pharmaceutical radioisotopes are produced and delivered to local hospitals for cancer diagnosis and nuclear imaging. The proton beam's energy is 16.5 MeV and the diameter of the beam is approximately 1 mm. A system to control the proton beam's position has been developed by using a magnetic coil. The position of the beam can be controlled to move in the *x* and *y* directions; with the beam in the *z*-direction. A Faraday cup was used as a diagnostic to monitor and characterize the beam after deflection. The system was designed by using magnetic circuit theory and fundamental electromagnetic theory. A software package called finite element method magnetic (FEMM) has been used as a simulation tool to conduct finite element analysis of the designed circuit. The beam steering experiment was conducted in two steps. First by using "low" and "high" current experiments in the laboratory and measuring magnetic fields produced. Then. by testing the magnetic circuit in the cyclotron facility at MURR. The beam was successfully deflected and the distant of the deflection can be control by the user by changing the value and orientation of the current used to drive the magnetic circuit.