

10 DEPARTMENT OF ACCELERATOR PHYSICS AND TECHNOLOGY

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Overview

The activities of Department P-10 in 2006 were as follows:

- continuation of development of radiographic 5-6 MeV electron accelerator,
- study of very compact accelerating standing wave RF structures for electrons and ions,
- Monte Carlo simulations applied to ion radiotherapy

The compact 6 MeV electron linac constructed in Department P-10 were further developed. Some equipment (low input impedance amplifier for beam transformer, up-to-date power supplies for beam position steering coils, magnetron frequency control unit) was added or replaced. The old control racks were replaced by a new single more compact control console. This will allow us to introduce a PLC based control system of accelerator (when money for necessary PLCs is granted). After additional amelioration of radiation shielding followed by Radiological Inspection, the permanent permission No D-15917 for routine operation of this accelerator in electron and X-ray mode was issued by the National Atomic Energy Agency. This allows us to render services to external customers. As it was already reported in 2005, two regimes of operation are actually possible: with X ray output beam or electron beam, depending on user demand.

The triode gun, originally thought of as a part of the 6/15 MeV medical accelerator is still showing excellent performance on experimental stand; it was opened to air for about 2 hours to repair the broken wire of the beam scanner. This confirms the possibility of repeated formation of gun dispenser cathode. A new pulse modulator was routinely used in these tests.

The special set-up, designed and made in our Department for the TiN coating of accelerator components, was routinely used for coating of various types of RF high power vacuum windows for conventional and superconducting 1.3 GHz accelerating structures. Cooperation with foreign enterprises is promising.

Accel Instruments GmbH ordered the coating of two sets (in total 18 pieces) of coaxial and cylindrical vacuum windows for superconducting cavity RF power couplers.

18 MeV Electron Accelerator Stand with the linear accelerator - Saturn was prepared for experimental work, and can be used in neutron detectors investigation and for accelerating structures research. To increase the reliability of operation, upgrading of the computer control system is foreseen next year.

The aim of the preliminary study of accelerating structures in C-band is the search for electron accelerator miniaturization. At higher frequencies, much higher accelerating fields can be applied and as the wavelength becomes shorter, the overall size of the structure and various components becomes smaller. In 2006 the main physical parameters of 5720 MHz SW side coupled structures were optimized. For that frequency there exist on the market suitable high power klystrons and a variety of necessary microwave equipment.

Monte Carlo simulations using the BEAMnrc/EGSnrc were carried out to study the influence of possible errors in assigning of CT (coefficients of X ray attenuation in tissue) on calculated ion range in hadron therapy. This work was done in Heidelberg by A. Wysocka-Rabin in the frame of our collaboration with DKFZ.

In ENEA-Frascati a linear accelerator for protons called TOP (Terapia Oncologica con Protoni, Oncological Proton Therapy) is under realization. Basically it is a proton linac of modified Alvarez type working on 3000MHz frequency and delivering a beam in the energy range from 65 MeV to 200 MeV. In 2005 the contract was signed between ENEA and IPJ-Świerk on the basis of which the Accelerator Physics Dpt. of IPJ will design, produce and deliver to Frascati the input section of the 65 MeV linac. This section of SCDTL type will increase the proton energy from 7 to 17 MeV. The design is almost finished; many elements are manufactured and ready for assembling. This will take place in of 2007.

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