

10 DEPARTMENT OF ACCELERATOR PHYSICS AND TECHNOLOGY

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Overview

The activities of P-10 Department in year 2005 were devoted to:

- development of radiographic 4 MeV electron accelerator,
- development of accelerating and deflecting types travelling (TW) and standing wave (SW) RF structures for electrons and ions,
- MC simulations applied to photon and ion radiotherapy

The compact 6 MeV electron linac constructed in Department P-10 was put in the beginning of reported year into experimental operation. The request for permission to use ionisation source (6 MeV linac) was submitted to National Atomic Energy Agency. On the basis of all necessary documents the permission for routine using of our linac was granted.

Actually the e/X conversion tungsten target has been moved from vacuum to air. To improve the safety of accelerator operation, the new collimator and some shielding walls were added. Two regimes of operation are actually possible: X ray output beam or electron beam depending on user demand. Some old non-reliable sub-units of accelerator were replaced, and energy and intensity optimisation for e⁻/X-ray conversion were made. The MC calculations of photon beams produced on e⁻/X converter were repeated taking into account the new collimator and additional shields.

The triode gun, originally thought of as a part of 6/15 MeV medical accelerator is still on long term tests showing excellent performance; it was twice opened to air to confirm the possibility of repeated formation of gun dispenser cathode. New pulse modulator was routinely used in these tests.

The sublimation set-up designed and made in our Department for the TiN coating of accelerator components underwent successfully the technological test including coating quality of several ceramic RF power vacuum windows.

Within the German heavy ion therapy program the DKFZ Heidelberg is responsible for medical physics problems of treatment planning and modeling of ion beams for GSI Radiotherapy Facility. The MC simulations are used to calibrate the X-ray CT scanners to obtain accurate correlations between Hounsfield units and ion ranges in the tissue. These simulations based on MC code BEAMnrc/EGSnrc were made in 2005 in DKFZ by a member of the P-10 Department.

The scientific collaboration and negotiation with the foreign laboratories (CERN, INFN - Frascati, INFN-Milano, and ENEA-Frascati) resulted in signing of 3 contracts for delivery of special RF equipment of accelerating or deflecting type in SW or TW modes.

The RF deflecting unit composed of two tuneable resonators working in deflecting TM11 mode on 1.5GHz was made and delivered to CERN where it is working in CTF3 system (CLIC Test Facility 3).

For INFN Milano the test set called "compressor coupler assembly" was designed and produced. It is a part of Italian SPARC project and was made to check the high RF power handling capability of critical parts of TW (travelling wave) accelerating sections of special type (high group velocity + thermally regulated phase velocity).

In ENEA - Frascati the TOP (Therapy Oncological Protons) linac is designed to accelerate protons up to 200MeV. Part of this project is 3 GHz medium energy section (booster) increasing proton energy from 7 up to 65 MeV. It is SCDTL structure consisting of DTL tanks coupled together by a side cavity in an arrangement like a Side Coupled (biperiodic) structure. In the frame of SINS-ENEA collaboration and contract signed this year, P-10 Department is engaged in the project and realization of SCDTL sub-section increasing the energy from 7 to 15-16 MeV. Part of design calculation and technical documentation is already well advanced and during 2006 the sub-section should be produced and ready for tests.

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