10 DEPARTMENT OF ACCELERATOR PHYSICS AND TECHNOLOGY

Head of Department: MSc. Marian Pachan
phone: (22) 718-05-38
e-mail: p10@ipj.gov.pl

Overview

Due to financial shortages, the Extensive Research Programme "Isotopes and Accelerators" did not come into effect. This in consequence limited the scope of new design and construction works. As the most important topic remained the continuation of work on Ordered Project for new therapeutical accelerator "6/15". It has to be emphasized that during realization of this task, several significant modifications were introduced to get a final solution better matched to future implementation of the prototype.

The initially adopted "classical" solution of accelerating structure with separate bunching and accelerating sections, was replaced by a single mechanical unit with both incorporated functional subsystems. This solution is more convenient for future production and servicing, but in order to cover the broad range of energy variation is was necessary to recalculate the beam dynamics and to find the method for internal phase correction.

Another important feature was an additional design of two possible injection systems, the first with a diode gun for 40 keV energy, and the second one with triode gun 15-20 keV. These solutions provide a contingency for two production versions of an accelerator equipped with different RF power systems - klystron or magnetron. Substantial effort was directed to completion and operation of an experimental facility for testing accelerating structures. This facility is equipped with a RF high - power source in the form of 6 MW klystron, and high - vacuum pumping system. External apparata connected to the facility are - magnetic spectrometer and computerized water phantom, which enable the diagnostics of accelerated electron beam.

Several structure models were tested, and for the first time an electron energy in the vicinity of 15 MeV was registered.

Other important subjects in the Department's activity were:

- Implementation of new versions of MC codes, for analysis of electron and photon beams distribution at the output of accelerator radiation head. These programmes enable us to take into account the data of all components along the beam transportation path, and facilitate the design of beam forming systems, e.g. narrow photon beams for stereotactic radiosurgery.
- Preliminary studies of a bunching system for high power electron accelerator. Such an accelerator for radiation technology was planned in the programme "Isotopes and Accelerators" which was accepted by the Government but not put in operation. It is worthwhile to prepare for possible work on this task by a study of most crucial problems of new design. In effect it was proposed to divide the accelerating structure into two separate parts - bunching and accelerating sections. This solution should improve the efficiency of beam capture and transport. This is very important but not easy for a beam with high space charge.
- An interesting item was the study of possible solutions of a linear energy booster for upgrading proton energy achievable in existing cyclotrons, to get an energy useful for hadron therapy. The principal feature of this idea is to use typical structures of proton linear accelerators, with the RF frequency band in the range of 3000 MHz. It gives the possibility to diminish the dimensions of the structure, and also to achieve high gradients of the accelerating field. In this way it is possible in the module with length about 1.2 m, to get the energy increase of about 15 MeV.

In the international collaboration, the Italian INFN-Frascati proposed to undertake a common task on the design and construction of travelling wave sections operating in a deflecting mode, for application in CLIC Test Facility as beam kickers. CLIC is the CERN competitor to the TESLA project of high energy linear beam collider, operating at room temperature but at extremely high frequency, 30 GHz. To join the proposed task it was necessary to make an initial theoretic study and to build an aluminium model in order to formulate the principal design features and technology of execution. At the end of the year, the contract was concluded, and in summer 2002 two ordered sections will be completed.

In view of money shortages, the problem emerges for the coming year, to discuss and to define the future role of accelerator physics and technology in our Institute.