10 DEPARTMENT OF ACCELERATOR PHYSICS AND TECHNOLOGY

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Overview

Due to the drastic reduction (in previous years) of scientific and technical staff of the Department, our basic work in 2003 was limited to the following subjects:

- the development of radiographic 4 MeV electron accelerator,
- computational verification of basic parameters of a simplified version of "6/15 MeV" medical accelerator,
- continuation of the study of photon and electron spectra of narrow photon beams with the use of the BEAMnrc Monte Carlo codes,
- a study of accelerating and deflecting travelling wave RF structures based on experience already gained.

The small 4-6 MeV electron linac was constructed in the Department as a tool for radiographic services which may be offered by our Institute. In 2003, the most important sub-units of the accelerator were constructed and completed. Accelerated electron beam intensity up to 80 mA was already obtained and for the following year the energy spectrum measurement, energy and intensity optimisation for e^-/X-ray conversion and also first exposures are planned.

Because in the realisation of the 6/15MeV Accelerator Project, the Department was responsible for calculations of beam guiding and acceleration (accelerating section with triode electron gun, beam focusing, achromatic deviation), last year some verifying computations were done. This concerned mainly the influence of the variation of gun injection energy and RF frequency shifts on beam dynamics. The computational codes written in the Department are still used and continuously developed for this and similar purposes. The triode gun, originally thought as a part of 6/15 MeV medical accelerator, is on long term testing, showing very good performance; a new pulse modulator for that sub-unit was designed.

The Monte Carlo calculations of narrow photon beams are continued. Intensity modulated radiation therapy (IMRT) is expected to play a dominant role in the years to come. Our principal researcher her after receiving PhD degree collaborates on IMRT problems with DKFZ Heidelberg, where she participates in the development so called scanning collimators.

As a result of a collaboration with LNF INFN Frascati, apart from two travelling wave RF structures now operated in the CTF3 experiment at CERN, one additional TW structure was made in our Department. It serves as an experimental unit for further study of TW technology.

The collaboration with the DESY TESLA-FEL Project during the past years concerned mainly the RF accelerating super-conducting superstructures. This work ended with good results; it was reported in a common international oral session held during PAC2003 in Portland, USA. The superstructures have a chance to be mass-produced if the TESLA Superconducting Collider gets international financial approval. The work on RF vacuum windows upgrading against the multipactor effects in high power couplers was continued at DESY till the end of 2003. The original new technologies of thin TiN coating of ceramic windows were applied using newly constructed coating set-up. The summary of our 2003 results on coating will be presented in the TESLA Report 2004-02.

A prerequisite of practising Accelerator Physics is understanding its importance in the wider context. Looking to professional literature on accelerators applications, one finds that in the developed world roughly 20000 accelerators exist (excluding electron units below 0.2 MeV) and yearly this number increases by at least 10%. More than half are used for material modification and roughly 30 % in radiotherapy. The most advanced technically and technologically are accelerators for subatomic physics and synchrotron radiation sources, where the total number of existing or under construction machines surpasses 200. New solutions, new technologies, cost reductions are still being investigated.

So, in spite of difficult financial conditions, there is real motivation to keep accelerator physics alive in our Institute.

Eugeniusz Pławski