PROPOSAL FOR A UNIVERSITY ACCELERATOR FACILITY FOR PHYSICS AND MEDICINE

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Abstruct

An accelerator for a university facility for research in the physical sciences, radiotherapy and for isotope production is proposed. The machine is a linear accelerator which will be able to accelerate a 100 μA average proton-beam up to energies of 800 MeV. The main parameters of the proton linac are given.

Introduction

Several years ago in Kyoto University future demands of nuclear physics, neutron physics, radiotherapy and of radiotsotope production was discussed by researchers who were using accelerators. The analysis showed that a reasonably large accelerator would be required to meet the needs. After meetings for discussion were held a 800 MeV proton linac was proposed as an accelerator facility for joint use by groups of different fields of many universities. At the present state of accelerator technology a proton linac has an excellent feature, and a construction cost is not so high as thought from costs of old machines. Recent year in many countries proton linear accelerator projects are being proposed. Among others a PIGMI project is very attractive. Many technical innovations are introduced. Although extensive work about PIGMI was done at Los Alamos, the more studies should be made to reach a final goal. We made use of the PIGMI concept at designing of the Kyoto University proton linac. Now technical and theoretical studies are going on to ascertaine the feasibility of the PIGMI technology.

Accelerator system

The linac consists of two injectors, a RFQ linac, a Alvarez linac, a disc and washer (DAW) linac, two 440 MHz rf systems, eight 1320 MHz rf systems and a control system as shown in Fig. 1. From a H^+-ion source and H^--ion source ions are injected simultaneously into the RFQ linac. Ions are bunched and accelerated to a 2.5 MeV energy in the RFQ linac. The Alvarez linac accepts 2.5 MeV ions from the RFQ linac and accelerates to a 115 MeV energy and the DAW linac accepts the 115 MeV ions from the Alvarez linac and accelerates to a 800 MeV energy. Finally 800 MeV H^+- and H^-- ions are separated by a magnet system and are guided to experimental area. At a 200 MeV port of the DAW linac H^--ions are able to be ejected by a separation system for the proton therapy. Basic parameters are shown in table 1.
Total power consumption of the linac operation is estimated to be obout 1.5 MW. The rf filling time of the cavity of the alvarez linac and of the DAW linac is 8μsec and 4μsec respectively. A pulse width of output beam shorter than the rf filling time of the cavity is not economical from the power consideration. The shortest beam width is 5μsec and this width is short enough for most thermal and cold neutron researches.

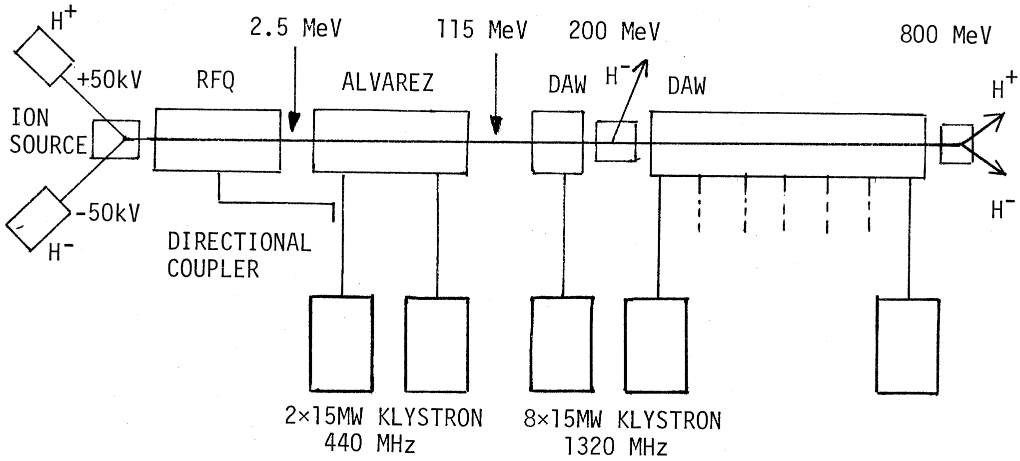

Fig. 1. Components of linac.

Final energy	: 800 MeV
Peak beam current	: 85 mA(H^+), 0.85 mA(H^-)
Pulse length	: 20 μs, 10 μs, 5 μs
Repetition rate	: 60 Hz
Average beam current	: 100 μA(H^+), 1 μA(H^-)

Table 1. Basic parameters of proton linac

Research Program

800 MeV H^--beam will be mostly used for nuclear physics. Pions and neutrons will be generated by H^+-beam, and isotopes will be produced by H^+-beam at the beam dump. The main research program are shown in Table 2.

1. Proton, neutron, pion therapy
2. Nuclear physics and fundamental particles physics
3. Material science using neutrons, pions and muons
4. Production of short-lived radioisotopes

Table 2. Main research program

Reference

1) compiled by L. D. Hansborough LA-8880 (1982)