Fast Proton Radiography on the PSI Gantry FROG ◇

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1. Introduction

The system consists of two position-sensitive fiber hodoscopes on the entry and exit side of the patient, respectively, followed by a range telescope. The previously described device [1] was tested and found to be working according to specifications. First radiographs were recently recorded and the permanent installation of the system on the PSI Gantry is currently in progress.

2. The fiber hodoscope

Fig. 1 shows the fiber hodoscope.

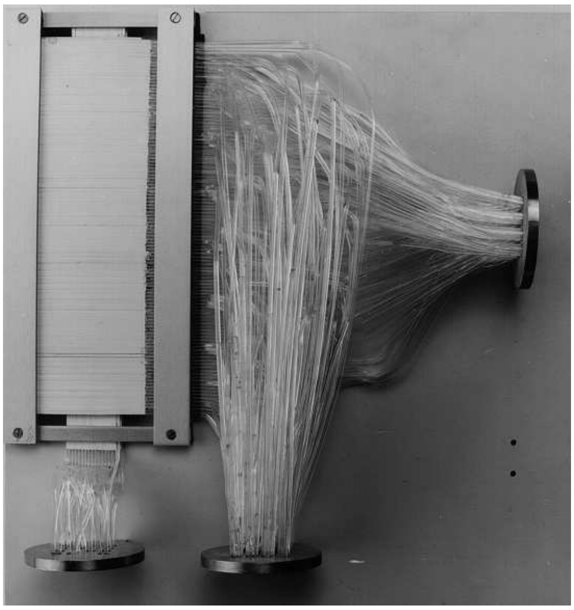

Fig. 1: fiber hodoscope for proton radiography

An important property of the hodoscope is the accuracy of the displacement of the two layers by half a fiber diameter. A misalignement results in an inhomogeneous distribution of the number of protons accumulated in each pixel and therefore a considerable difference in density revolution of the system for each pixel (figure 2).

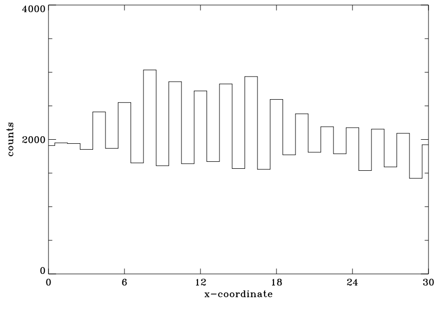

Fig. 2: inhomogeneous distribution of the number of protons

The homemade logic modules for signal reduction were successfully tested, and the results agree with those where signals are fed directly into the acquisition memory.

3. The range telescope

The following pictures show two typical range spectra, one for a homogeneous medium (fig. 3) and one for an inhomogeneity (fig. 4, metal/air) parallel to the proton beam.

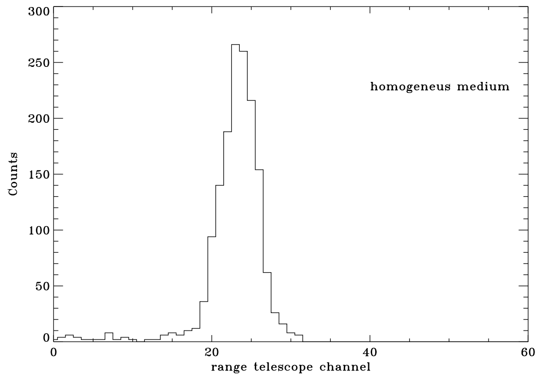

Fig. 3: Range spectrum for a homogeneous medium in the beam

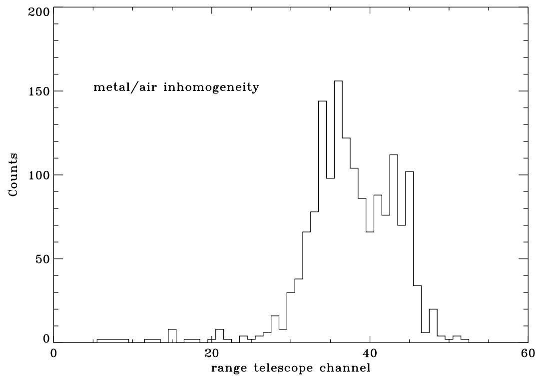

Fig. 4: Range spectrum for a metal/air inhomogeneity parallel to the beam

The increased range uncertainty stems from multiple scattering in and out of the metal. This information can be used as input to treatment-planning programms thereby improving the quality of proton therapy.

References

[1] P. Pemler *et al.*, Jahresbericht 1995

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