

NEW TIME-STRUCTURE PROBES BETWEEN INJECTOR AND RING CYCLOTRON

R. Dölling

INTRODUCTION

In addition to the time-structure probe at the exit of the Injector 2 cyclotron described in [1], two similar probes have been recently installed (Fig. 1). The new probes each use only a single scintillator and photo-multiplier. The time resolution of the measurement is ~ 35 ps fwhm at the first two locations and worse in the ring cyclotron due to strong background noise. Further, the timing and read-out electronics have been renewed while full software support still has to be produced.

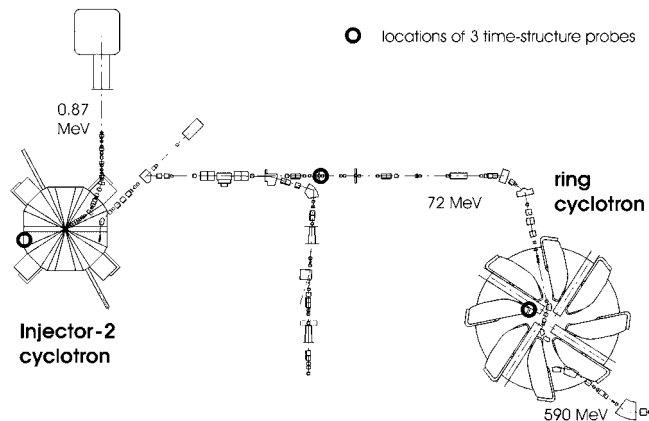


Fig. 1: Setup. All probes are sensitive to a vertical slice of the beam and can be moved horizontally.

FIRST RESULTS

During one outer turn in Injector 2 no longitudinal broadening of the very short bunches occurs (Fig. 3a). After a similar path length in the transfer line, a significant elongation is visible, probably mainly due to space-charge forces (Fig. 3b). During the further path to the ring cyclotron the elongation progresses (Fig. 3c). Nevertheless, here the measurement is disturbed by background noise. The dependence of the bunch length on the beam current measured in the transfer line (Fig. 2) shows a similar characteristic as at the exit of Injector 2 [1]. Nearly no dependency is seen at the first turn of the ring cyclotron.

These observations as well as the visible longitudinal structures and the influence of the background noise have to be studied in more detail.

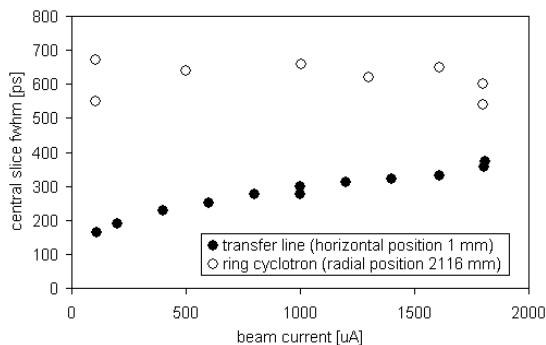


Fig. 2: Bunch lengthening with beam current.

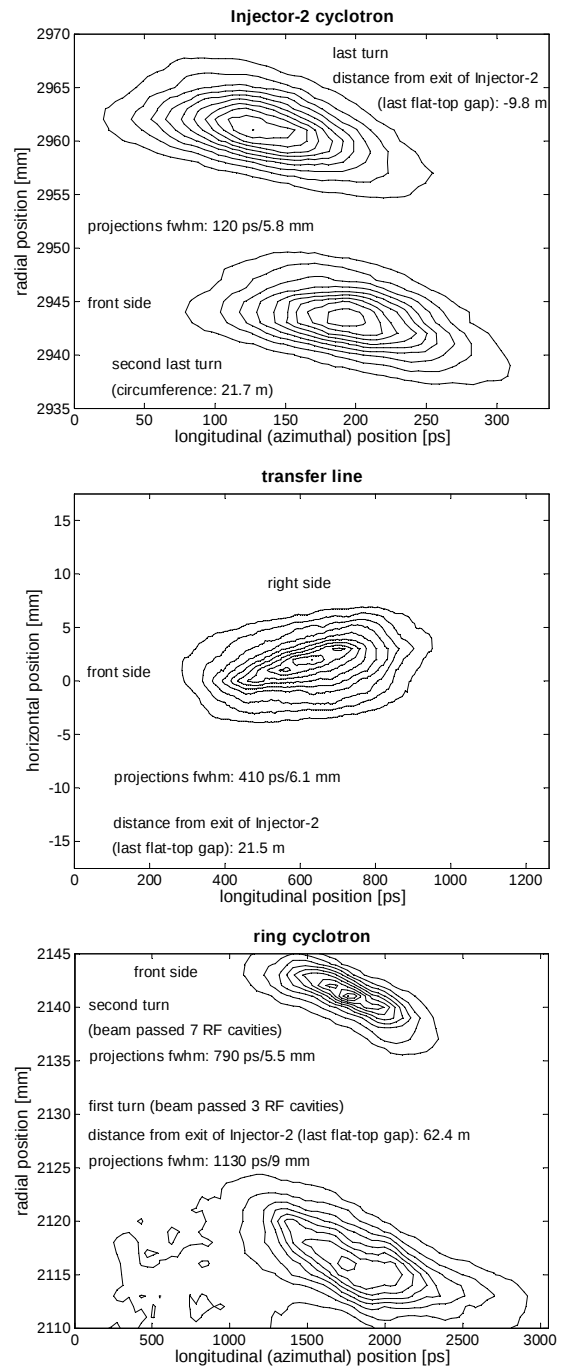


Fig. 3: Bunch shapes as "seen" from above at a beam current of 1800 μ A. (Contour lines at multiples of 10 %. 100 ps $\approx$ 11 mm.) The lower integral signal of the 2nd compared to the 1st turn of the ring cyclotron is due to the impact of the magnetic field on the photo-multiplier tube. This in combination with the strong background noise results in the artefact of the different bunch shapes of the two turns.

REFERENCE

- [1] R. Dölling, *Measurement of the time-structure of the 72 MeV proton beam in the PSI Injector 2 cyclotron*, DIPAC 2001, Grenoble, p. 111 (2001).