ISR-BT/BdeR/EEK 2nd November, 1970

ISR RUNNING-IN

Run 1, October 29th, 1970

First half of run, injection tests

The aim was to achieve a circulating beam and then to adjust the injection parameters such that the amplitude of coherent betatron oscillations resulting from injection errors would be smaller than 5 mm, so that RF studies could start.

At 20.00h. the MPS Division started to set up an ejected beam of 4 bunches at 15 GeV/c which was stopped by dump D1, at 30 m after the PS ejection straight section. The beam was centered on LS 102 and LS 103. Subsequently the intensity was reduced to 1 bunch per pulse and the beam centered again on LS 102 and LS 103.

The currents in the magnets of the transfer line TT2 up to QF 349 were adjusted to practical values, which had been optimized during previous runs of TT2. The currents in the last magnets of TT2, the injection system and the main ring were set to calculated values. The main ring current was adjusted to a central momentum of 15.175 GeV/c so that the nominal injection orbit at mid F, corresponding to $\Delta p/p = -1.16\%$, would be at $x = -26$ mm.

After the dump D1 was removed, the first pulse injected into the Ring I at 20.32h. immediately produced a circulating beam with an injection efficiency of about 50%.

After the first turn beam stopper ST 749 was put into the beam, the injected beam spot could be observed on LS 7175 and LS 7174, which are, respectively, just before and just after the inflector. It was approximately at $z = +5$ mm and $r = -18$ mm, which is 8 mm to the right of the calculated position.

Vertically the beam could be centered in the inflector by increasing the current of the steel septum magnets by 0.53%. Under those conditions the beam was vertically centered within $\pm$ 1 mm on LS 351, LS 352, LS 7175 and LS 7174 and when ST 749 was removed, the vertical coherent oscillations of the circulating beam were at most a few mm on PU 721.

An attempt was made to minimize the horizontal coherent oscillations first by changing the HV of the inflector, but this made little difference, and subsequently by moving the injected beam inwards at the position of the inflector. The inflector itself was always displaced radially by a corresponding amount.

The horizontal coherent oscillations on PU 665 were reduced to an amplitude of about 5 mm when the injected beam in the inflector was at x = - 14 mm after which injection adjustments were stopped. The injection efficiency was then 100%.

The RF group calculated the average radial position of the beam on the injection orbit from a measurement of its revolution frequency, as $\langle x \rangle$ = - 20 mm in the F straight sections. This result was approximately confirmed by inspection of photographs of PU electrode signals. Since α_p = 2.3 m in the F - straight sections, this would indicate, assuming that the ISR magnetic field is correctly set, that the momentum of the PS beam is about 0.26% higher than its nominal value of 15 GeV/c.

A similar result has been found during the running in of the transfer lines. Measurements of the beam positions on the LS's after large horizontal and vertical bends, with the magnet currents set to the calculated values, can be explained by assuming that the momentum of the PS beam is about 0.28% higher than the nominal value of 15 GeV/c. The required adjustment of the steel septum

magnet current mentioned above, confirms at least qualitatively this result. It is suggested, while leaving in the future runs the momentum of the ejected PS beams at its nominal 15 GeV/c, to treat this in calculations as being 15.04 GeV/c.

The stability of the position of the injected beam was excellent, the beam spot size was roughly as expected from computations and previous runs of TT2. The signals of the three SEM G monitors which are used in the Ring to observe the first turn showed some unexplained vertical offsets but there was no time to look closer at this effect which should be studied better in future runs.

In order to limit the radioactivity due to beam loss along the ring the dump magnets were used during the setting-up of injection and the subsequent RF studies. They were triggered from the last M-pulse of each PS cycle so that each injected pulse was kicked entirely onto the dump after having circulated during about 1 second, before the next pulse was injected.

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