

MULTITURN INJECTION INTO THE MAIN ACCELERATOR

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So far, only single turn injection into the main accelerator has been contemplated. In this scheme the beam from the booster is injected from above through a septum magnet into a medium straight of the main accelerator. The injected beam is straightened out by a fast kicker magnet at the point where the beam crosses the midplane. The rise and fall times of the kicker magnet are short enough so that it can be turned on or off in between bunches of beam injected from various pulses of the booster. In this manner 13 bunches of beam from 13 pulses of the booster can be injected into a single turn of the main accelerator fitted head-to-tail.

Multiturn injection into the main accelerator stacking the beam in betatron oscillation phase space can be accomplished simply by adding a second kicker magnet (K_2) located upstream from the first (K_1) at a half betatron oscillation wavelength away. As shown in Fig. 1, immediately after the tail of beam bunch A, which has already been injected into the main accelerator, passes K_2 , this kicker is turned on. The following injected beam bunch B will then travel along the half oscillation orbit as shown. The beam bunch C from the booster to be injected should be so timed that the heads of bunches B and C should reach K_1 simultaneously. At that time K_1 should be turned on and serves to straighten out both bunches B and C together. Clearly, kickers K_2 and K_1 should be turned off immediately after the tail of beam bunch B has passed the respective kicker.

In the phase diagram, Fig. 2, at the position I (Fig. 1), the phase ellipses (circles) of bunches B and C are separated spatially by the septum thickness. At the position II and before kicker K_1 the phase ellipses of bunches B and C are both on the midplane with negative y' and separated in y' . After kicker K_1 both phase ellipses are brought back to the neighborhood of the origin. In this manner we can inject 26, 39, etc. pulses from the booster into the main accelerator by stacking the second, third, etc. 13 pulses in the betatron oscillation phase space.

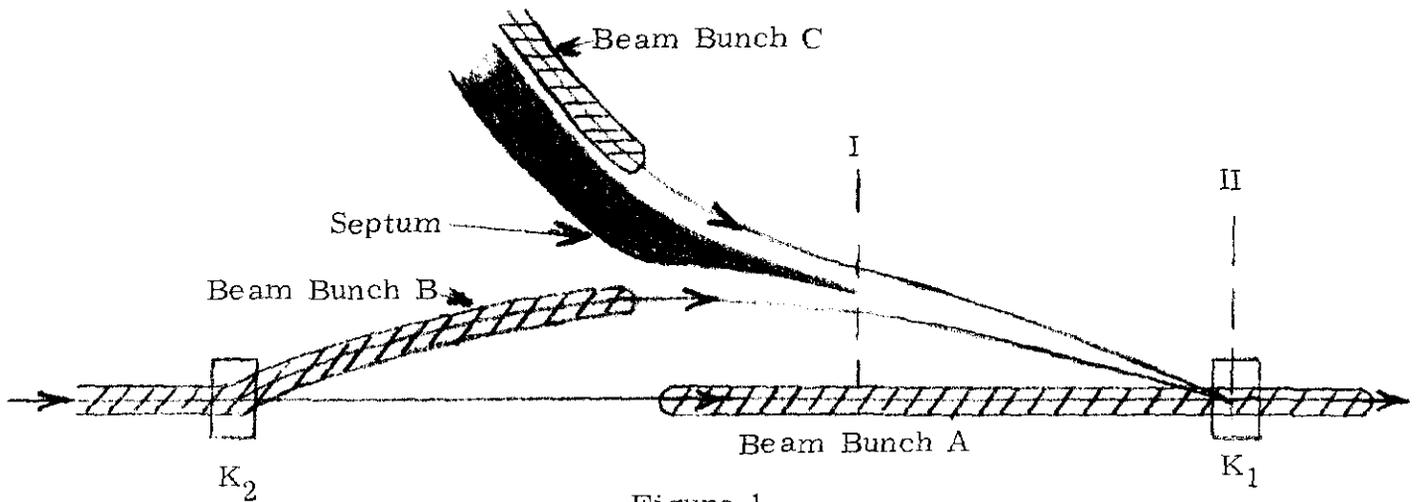


Figure 1

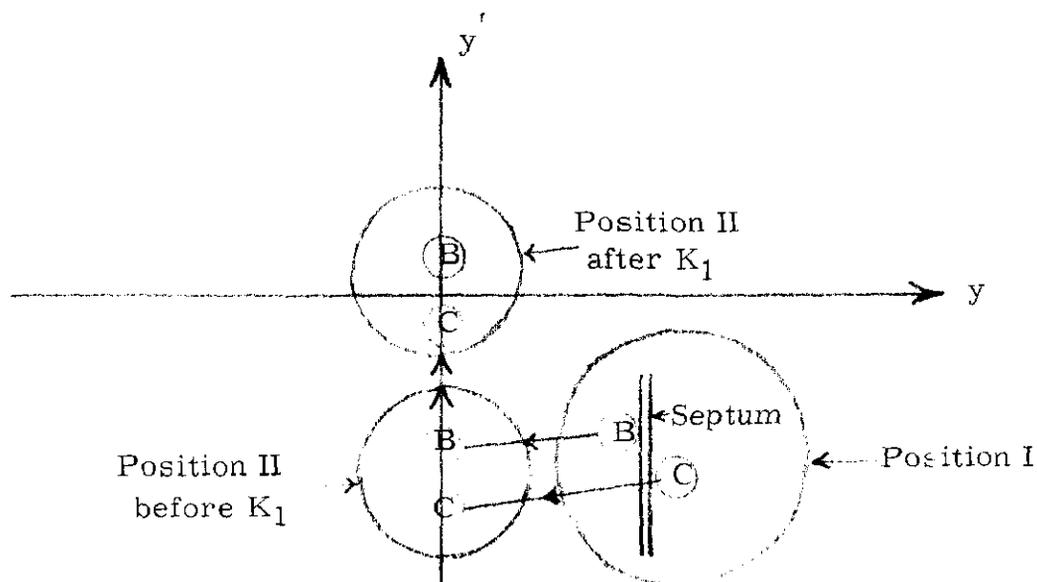


Figure 2