MPS/DL - Note 68-16
17.6.1968

PS MACHINE STUDY TEAM

NOTES ON THE INFORMAL DISCUSSION OF JUNE 14 ON

BEAM BEHAVIOUR OBSERVATIONS NEAR TRANSITION

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1. TEST TO CONFIRM THE BUNCH BLOW UP THEORY BASED ON THE COUPLING BETWEEN BETATRON AND SYNCHROTRON OSCILLATIONS (see MPS/Int. DL 68-3).

The parameter D of the theory which characterizes the blow up was measured and compared with theory.

	Intensity	D (calculated)	D (measured)
a	$105 \cdot 10^{10}$	1.10	1.20
b	$21 \cdot 10^{10}$	1.06	$\sim$ 1.0
c	$21 \cdot 10^{10}$	1.11	$\sim$ 1.0

a) Normal conditions,

b) Intensity reduced by shutters in the Linac beam,

c) Intensity reduced by shutters in the Linac beam and transverse blow up by double pulsing of the inflector in order to have about the same betatron amplitudes as with full intensity.

These results indicate that although the coupling theory was not proved wrong it is not sufficient to explain the observations.

2. IMPROVED OBSERVATION TECHNIQUES (J. Gareyte)

2.1. Selection of 1 or 2 bunches by gating the beam signal

This technique produces pictures which are much clearer because the effects which are looked after are not blurred by the intensity variation of the different bunches.

- A new phenomenon was observed. A modulation of bunch amplitude at the synchrotron frequency Ω_s, superposed to the normal 2 Ω_s modulation. This effect seems to be linked to the state of the machine.
  Observation of 2 adjacent bunches (a small and a large one). The difference in optimum transition timing (minimization of synchrotron oscillations) for the 2 bunches can be well explained by the space-charge theory.

2.2. Multiple sweep photographs ('Mountain range' display or 'Cappi' technique)

They show clearly oscillations of bunch length and height and also oscillations between different bunch shapes.

Sometimes the bunch is strongly asymmetrical and sometimes it develops two maxima.

3. DISCUSSION.

As an alternative explanation for the observed blow up, I. Gumovski suggested the influence of beam control error (The center of the bunch shifted with respect to the bucket center could produce bunch shape distortions).

Other opinions (Y. Baconnier, A. Sørenssen) were that the present space charge theory is linear while the strongly deformed bunches must certainly produce non-linear forces.

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