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PROPOSAL FOR A NEW SYSTEM OF LENSES TO PASS TRANSITION IN THE CPS AT HIGH INTENSITY (γ_{tr}-JUMP)

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Introduction

The technique of a fast decrease of the transition energy has been demonstrated in 1969 as an effective method to avoid bunch mismatch and subsequent blow-up at transition. The rapid change of the transition energy is generated by eight standard F-quadrupoles having all the same polarity and is limited by the fact that the change of the horizontal Q_H-value which, of course, must be kept sufficiently far away from the stop-bands. Scaling of the space charge parameters (power + 1 for intensity; power - $\frac{3}{2}$ for bunch area) from the present to the future PS leads to values of three to five times larger then the present one.

The present system falls short[2] and should be replaced by a more powerful system. Fortunately parts of the present system can be used.

Description of the new system

As pointed out by L. Teng, two sets of quadrupoles driven with opposite polarity are capable to produce a change of the transition energy much larger than the change of the $Q_{\frac{}{}}$-value. Various arrangements of those quadrupoles have been studied and are described in ref. [1,3]. The limitation is no longer the change in Q, but in the distortion of the momentum compaction function and the β-function. Changes of γ_{tr} by 0.5 or a bit more can be generated partly even without a change of Q. The main difficulty consists in finding space in the CPS for placing the required new lenses. Various possibilities were compared in a meeting on 11 May, 1971 (O. Barbalat, W. Hardt, U. Jacob, G. Plass, F. Rohner, H. Schönauer) with respect to their merits. The conclusion was to recommend the scheme described in ref. [1].

The disadvantage of this scheme which has some Q-variation is judged to be compensated by the advantages of having the smaller beam radius at transition and the pure fact that space for the lenses could be found most easily.

Five new fairly slow and weak lenses are needed with the following principal specifications:

Peak strength $(\hat{gl})_+ = 0.33$ T

Overall length $l_+ \leq 0.17$ m

Voltage corresponding to a 50 Hz sine wave.

The length is given by the limited space in straight section 59. In the other straight sections (19, 39, 79, 99) the new lenses could be longer but it is thought better to build only one type of lenses.

In addition, a new power supply and the cabling is required.

The existing standard quadrupoles in straight sections 9, 29, 49, 69, 89 would be maintained and serve as the fast lenses. The peak strength would be 0.76 T and should be excited in about 1 ms. A new power supply is needed for the five fast quadrupoles as well, but parts of the old power supply can be used.

Cost estimate

Although the detail design has still to be done, a preliminary figure for the costs can be given:

Slow lenses	120	k fr.
Cabling	15	"
Power supply	10	"
Fast lenses	-	
Cabling	15	"
Power supply	20	"
Miscellaneous	10	"
Total	200	k fr.

Estimated time: 1 year.

References

1) W. Hardt, How to pass transition in the CPS at high intensity? Part 1. A large change of γ_{tr}. CERN/MPS/DL 70-16. 9.12.1970.

2) W. Hardt and A. Sørenssen, How to pass transition in the CPS at high intensity? Part 2. Bunch dynamics. CERN/MPS/DL 71-6. 29.4.1971.

3) W. Hardt and H. Schönauer, How to pass transition in the CPS at high intensity? Part 3. A large change of γ_{tr} without Q-change. CERN/MPS/DL 71-7, May 1971.

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