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DESY - H 6

MODIFIED TART-LATTICE WITH REDUCED TOTAL BENDING

Summary

A modification of the TART magnet lattice, as recently proposed for the CERN-PS twin booster synchrotron[1], is suggested. In this modified structure, the twin accelerators intersect in bending magnets instead of quadrupoles. Thus, total bending is reduced by a factor 2/3, which should permit a reduction of stored energy and ohmic losses.

Introduction

In the TART-lattice, the two accelerators folded into a twin ring structure intersect in 40 common quadrupoles and have 20 separate bending magnets each. In order to obtain a more economic use of bending magnets, a modified lattice with intersection in 20 common bending magnets is considered.

Description

The modified magnet lattice is shown schematically in Fig. 1. In addition to the 20 common bending magnets, 10 separate bending magnets are installed in each ring for providing a sufficient spatial separation (maximum 81 cm instead of 61 cm in the original structure). All 40 magnets are identical; their bending angle (12°) is by a factor of 2/3 smaller than in the original scheme (18°). The total number of quadrupoles is increased from 80 to 100.

No attempt has been made yet to optimize the magnet parameters in this lattice. Fig. 2 merely shows the closed orbit and envelope functions $P_{(s)}$ and $E_{(s)}$ for a rather unsymmetric example (phase shift $4 \cdot 82^{\circ}$ per superperiod in both coordinates). It is expected that parameters can be chosen such that, in each beam, the aperture requirements for a given emittance and momentum spread are not significantly increased as compared to the original scheme.

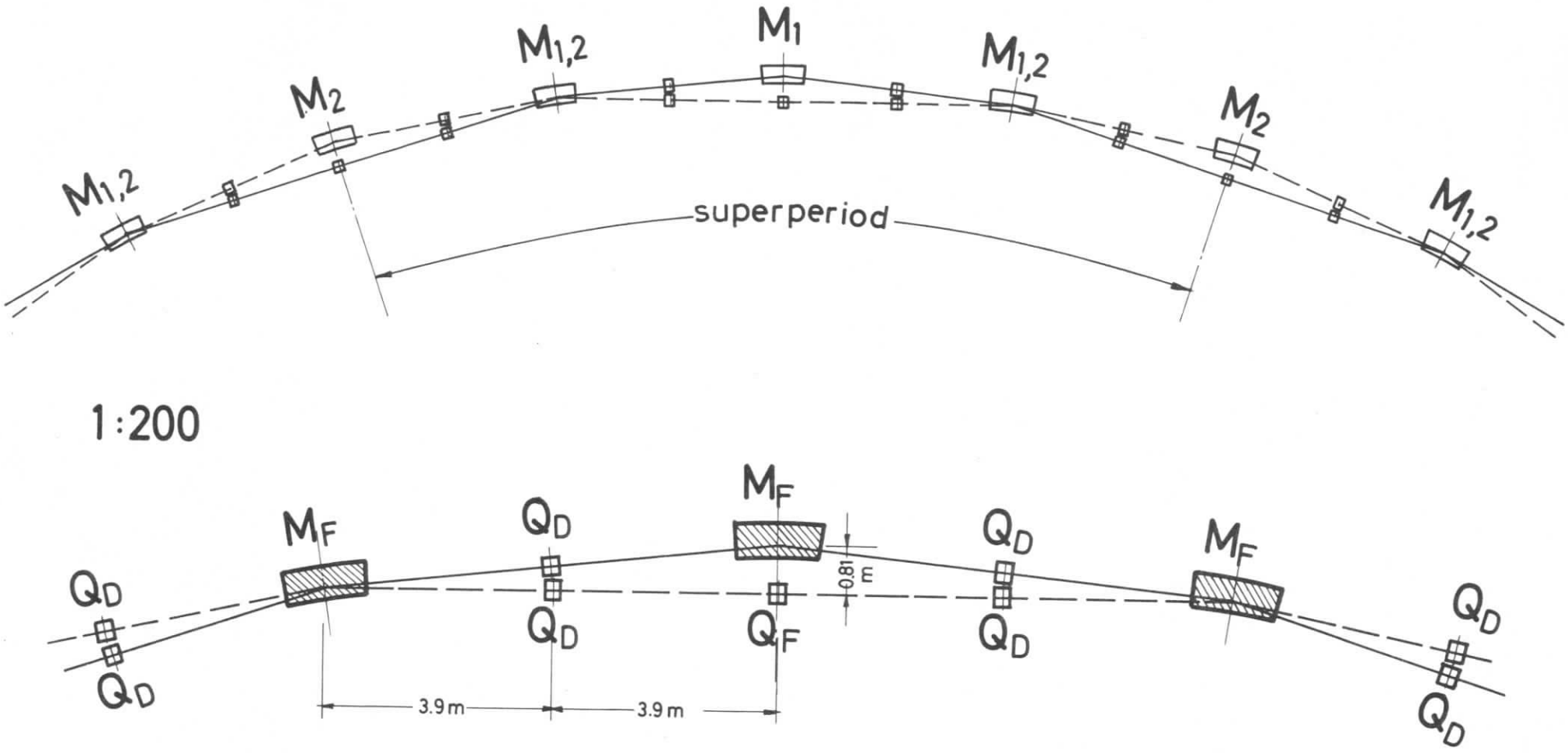

Fig.1 Modified TART-lattice

The crossing angle of 6° between the two beams, however, necessitates an increased aperture width in the bending magnets. If, for instance, these magnets are made 1.4 m long (i.e. 30 % shorter than in the original structure), their useful aperture width must be increased by 50 %, which means a corresponding increase of stored energy of about 20 % (assuming that the useful aperture width covers about 40 % of the total flux). Regarding, on the other hand, the reduced magnet length and excitation, one finds, nevertheless, an overall saving of about 25 % in stored energy and of about 10 % in ohmic losses.

Reference:

1) W. Hardt, "A circular Injector for the CPS (Tart-scheme)", CERN AR/Int. SG/65-10 (May 14, 1965)

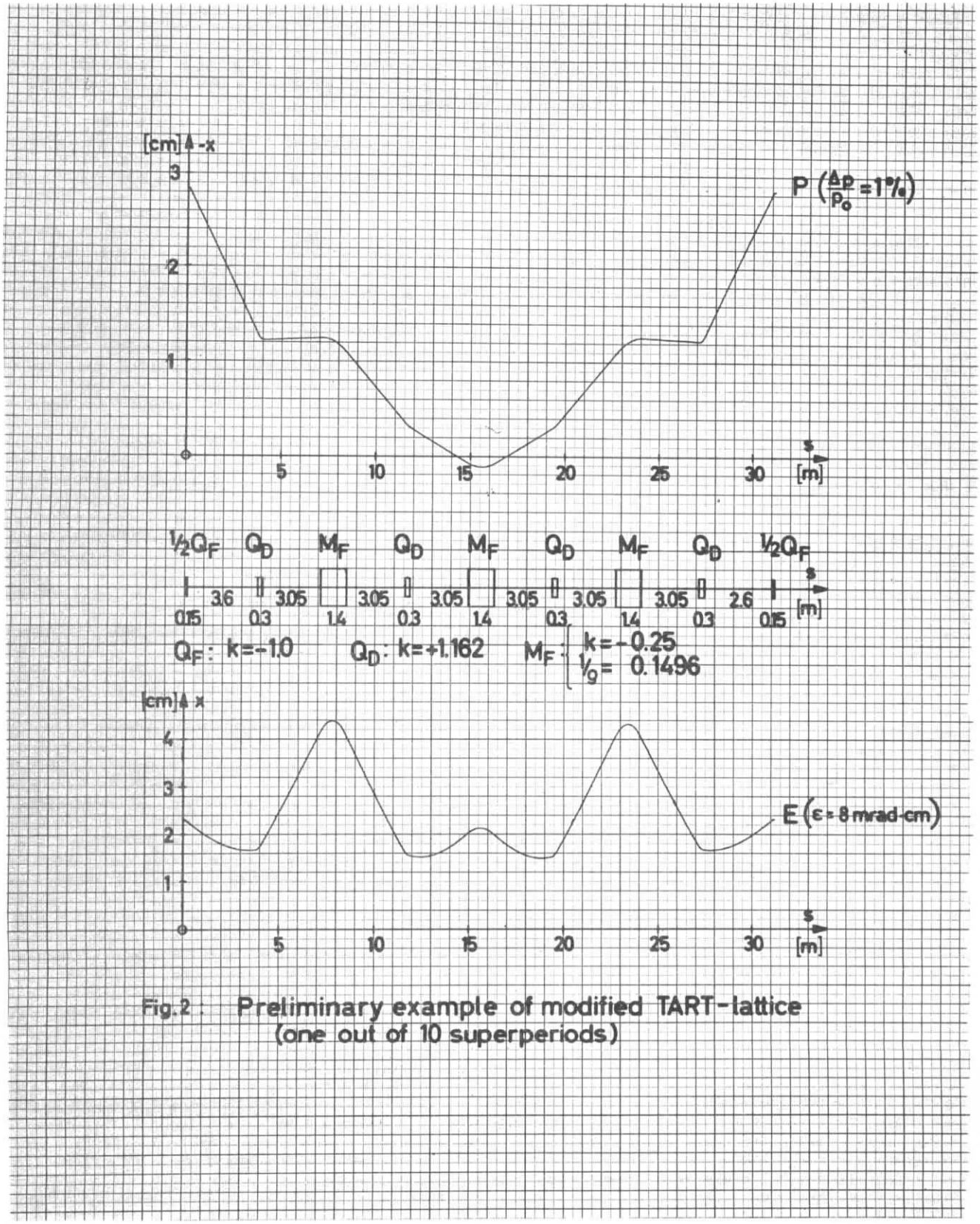

Fig.2 : Preliminary example of modified TART-lattice (one out of 10 superperiods)