Fermilab

MR Harmonic Quad study

M-J Yang, 7/25/95

Objective

To understand the effect of Main Ring harmonic quadrupole correctors. Previous data taken with the harmonic quads did not agree well with the SYNCH calculation. The ultimate goal of this study was to be able to change the harmonic quads and verify the changes in lattice function.

Data

The effect of harmonic quads as a family

There are four harmonic quad families, Q36, Q42, Q39, and Q45. If the lattice matches the design lattice each family can be ramped with a +,-,+,-,+,- pattern without any change to the tune. Each family was ramped by about 40 units in this pattern to see if significant tune changes were observed. The result are shown in table 1. No obvious tune change was seen.

The effect of individual harmonic quads

Each harmonic quad setting was changed individually over more than 100 units and the tune measurement taken. A quick analysis of the data for beta function is shown in table 2, assuming that we know the quad strength well.

SYNCH analysis

A comparison of the data with SYNCH calculation is not available at this time.

Tune/HQ family,

M-J Yang, 07/25/95

HQ family	set	Amp	tune H	Tune V
Q36	4.953	0.192	0.430	0.3857
Q36	25.14	0.976	0.425	0.3848
Q36	45.27	1.757	0.441	0.3867
Q39	-7.172	-0.278	0.430	0.3887
Q39	13.95	0.542	0.423	0.3857
Q39	33.64	1.306	0.429	0.3877
Q42	-4.863	-0.189	0.430	0.3877
Q42	16.45	0.639	0.427	0.3828
Q42	36.51	1.417	0.428	0.3906
Q45	-19.61	-0.761	0.433	0.3848
Q45	1.824	0.071	0.426	0.3848
Q45	22.01	0.854	0.433	0.3848

TABLE I

Horz & Vert tunes as a function of Harmonic quad family setting

HQuad/beta,

M-J Yang, 07/25/95

HQ name	Tune (H)/amp	Beta (H), m	Tune (V)/amp	Beta (V), m
QA36	7.11e-3	106.292		
QA39			-5.06e-3	75.6
QA42	6.05e-3	90.446		
QA45			-5.554e-3	83.0
QB36	5.209e-3	77.873		
QB39			-5.521e-3	82.5
QB42	7.233e-3	108.131		
QB45			-5.674e-3	84.8
QC36	5.764e-3	86.170		
QC39			-5.377e-3	80.4
QC42	6.899e-3	103.138		
QC45			-6.128e-3	91.6
QD36	5.579e-3	83.404		
QD39			-5.4666e-3	81.7
QD42	5.820e-3	87.007		
QD45			-6.451e-3	96.4
QE36	7.558e-3	112.990		
QE39			-6.153e-3	92.0
QE42	7.917e-3	118.357		
QE45			-6.801e-3	101.7
QF36	4.153e-3	62.086		
QF39			-5.404e-3	80.8
QF42	6.921e-3	103.467		
QF45			-5.78e-3	86.4

TABLE II
Beta Function Measurement using Harmonic Quads

MR lattice function measurement, M-J Yang, 7/25/95

Objective

To document the lattice function at the end of run 1b the lattice function of MR. In particular, the lattice function at A1 & A2 where the 8 GeV proton is injected to the MR and at D3 & D4 where the 150 GeV proton is extracted to the Tevatron.

Data

A1 & A2 TBT BPM data with MR at 8 GeV.

D3 & D4 TBT BPM data with MR at 150 GeV.

Analysis

Not yet complete.