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A Chromatic Correction Scheme for the Antisymmetric RHIC Lattice. The First Approximation.

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A Chromatic Correction Scheme for the Antisymmetric RHIC Lattice. The First Approximation.

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Abstract

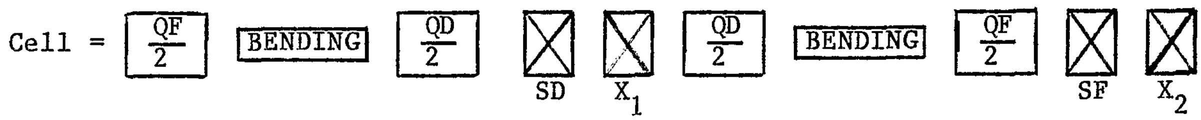
We use special families of sextupoles in the arcs, with antisymmetric distribution. The chromatic behavior of the machine functions are , in general, better than with only two families.

I. Introduction

In reference 1 we used a symmetric sextupole scheme for correcting the symmetric RHIC3 lattice. There, we suggested that an antisymmetric scheme can correct an antisymmetric lattice. In this work we explore such idea for the current RHIC lattice[2], and without optimizing the scheme we see that, in general, chromatic effects are reduced.

II. Description of the RHIC Lattice

Each typical cell has the structure



where X_1, X_2,... will be special sextupoles that we can use. SF and SD adjust the chromaticity to the desired value.

The insertions are made as follows.

I = Q8I Q7I Q6I BS2 Q5I BS1 Q4I QXI Q3I Q2I Q1I BC2I BC1I
CR BC10 BC20 Q10 Q20 Q30 QX0 Q40 BS1 Q50 BS2 Q60 Q70 Q80

In the arcs, for $\Delta p/p = 0$, β and η have values

	β_x	β_y	η_x
QF	49.6	8.8	1.5
QD	8.8	49.6	.7

Natural Chromaticity: ξ_x =-56.6, ξ_y =-56.5

tunes: ν_x = 28.40867, ν_y = 28.37187

Sextupoles: SF = -.15194, SD = +.3111 for $\xi_x = \xi_y = 1$

$\beta^*_x = \beta^*_y = 3.00001$

Special Families of Sextupoles

In Figure 5 we show the distribution of the sextupole. There are four families in one arc with a total number of eight families. The dashed lines in all the figures correspond to the values of sextupoles that we next are giving and obviously they have to be optimized by Harmon[3] or SYNCH[4]. On the other hand, the scheme must be optimized to reduce the phase space distortions related with the linear contribution to the W-vector introduced by Guignard[5]. For the moment, the four families per arc is in accordance with the number he suggests for a 90° lattice.

For one arc:

Family one:	S80=D2=H2=Z2= -.04934
Family two:	B2=F2=J2= .045
Family three:	A2=E2=I2= .03533
Family four:	C2=G2=K2= -.15268

For the other arc:

Family five:	S8I=D1=H1=Z1= .01953
Family six:	B1=F1=J1= .0037
Family seven:	A1=E1=I1= -.075
Family eight:	C1=G1=K1= .1120

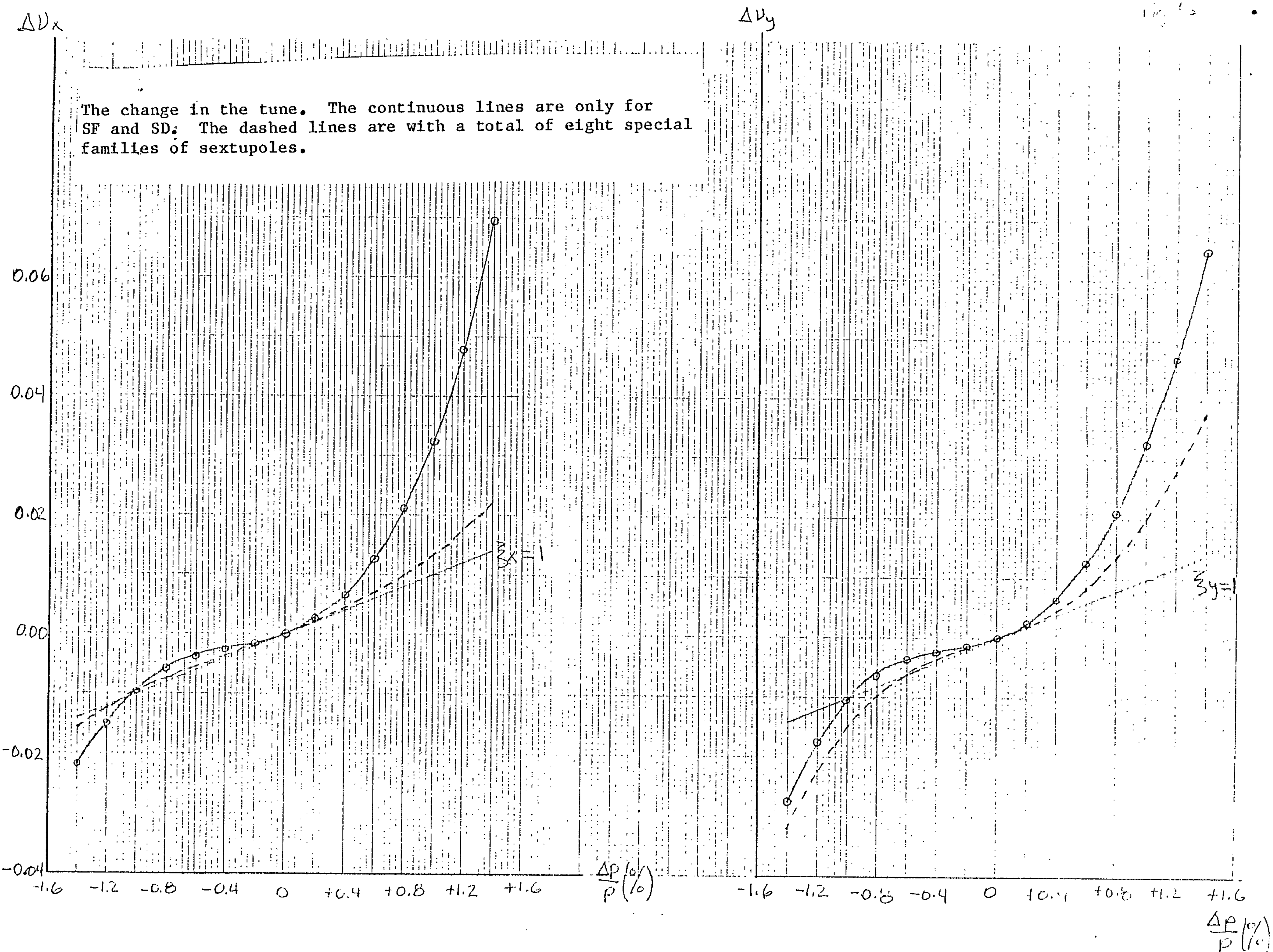
The effective sextupole will be SF or SD plus one of the above ones. We see that the larger sextupole is about 1.5 larger than SD. For these values, SF and SD have to be readjusted to keep $\xi_x=\xi_y=1$. The new values are

SF = -.1301

SD = +.3052

The change with respect to the original values is small.

1. A. Antillón, RHIC-8, BNL (1985).
2. S. Y. Lee, private communication.
3. G. Guignard reported at Sardinia School very good results using Harmon.
4. J. Claus, private communication.
5. G. Guignard. Lecture given at Sardinia School, March 1985.



The change in the tune. The continuous lines are only for SF and SD. The dashed lines are with a total of eight special families of sextupoles.
ΔνX
0.06
0.04
0.02
0.00
-0.02
-0.04
-1.6
-1.2
-0.8
-0.4
0
+0.4
+0.8
+1.2
+1.6
ξx=1
Δp/p (%)
Δνy
ξy=1
-1.6
-1.2
-0.8
-0.4
0
+0.4
+0.8
+1.2
+1.6
Δp/p (%)

Figure 1.

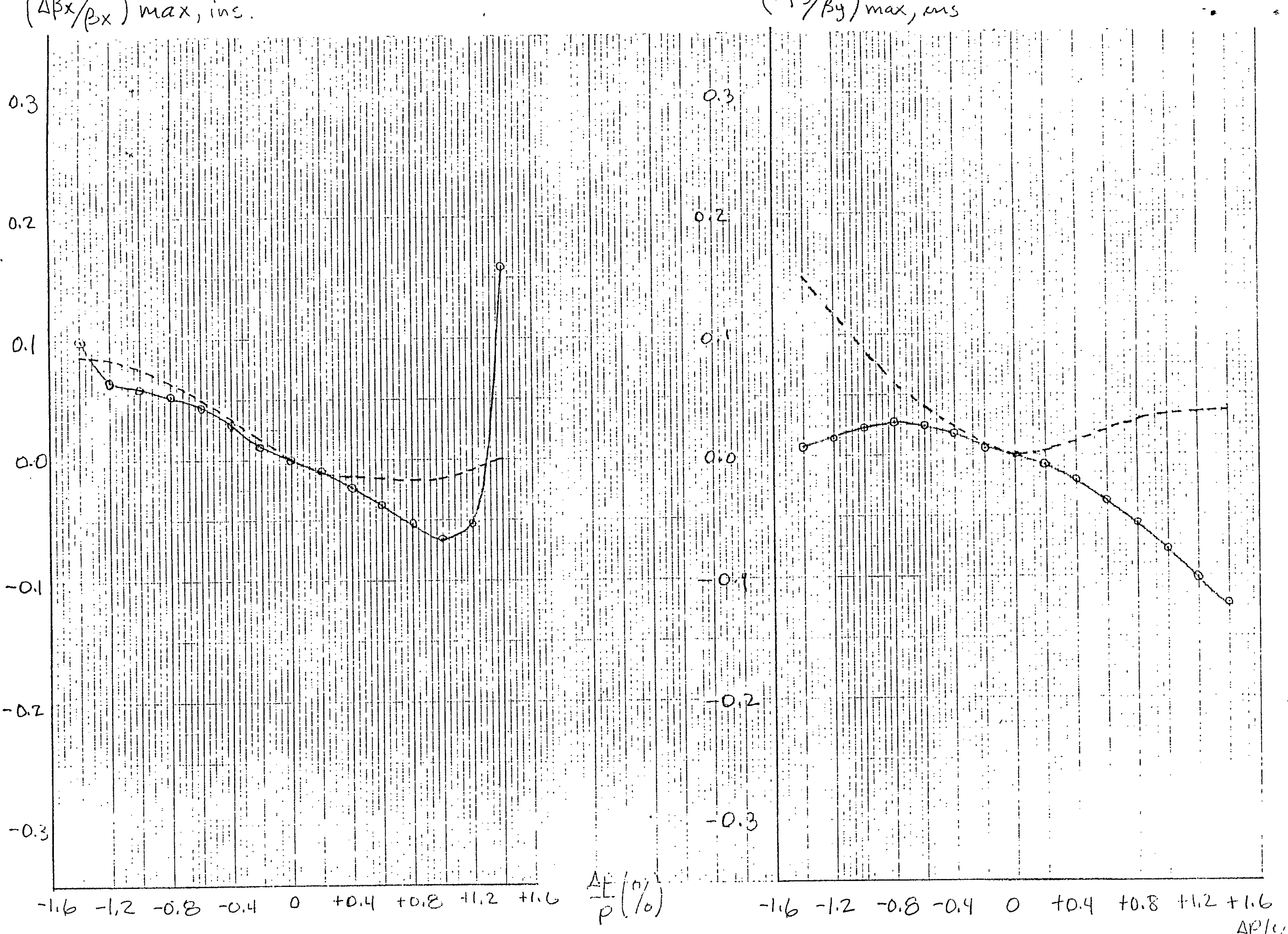


Figure 2. Δβ/β maximum in insertions.

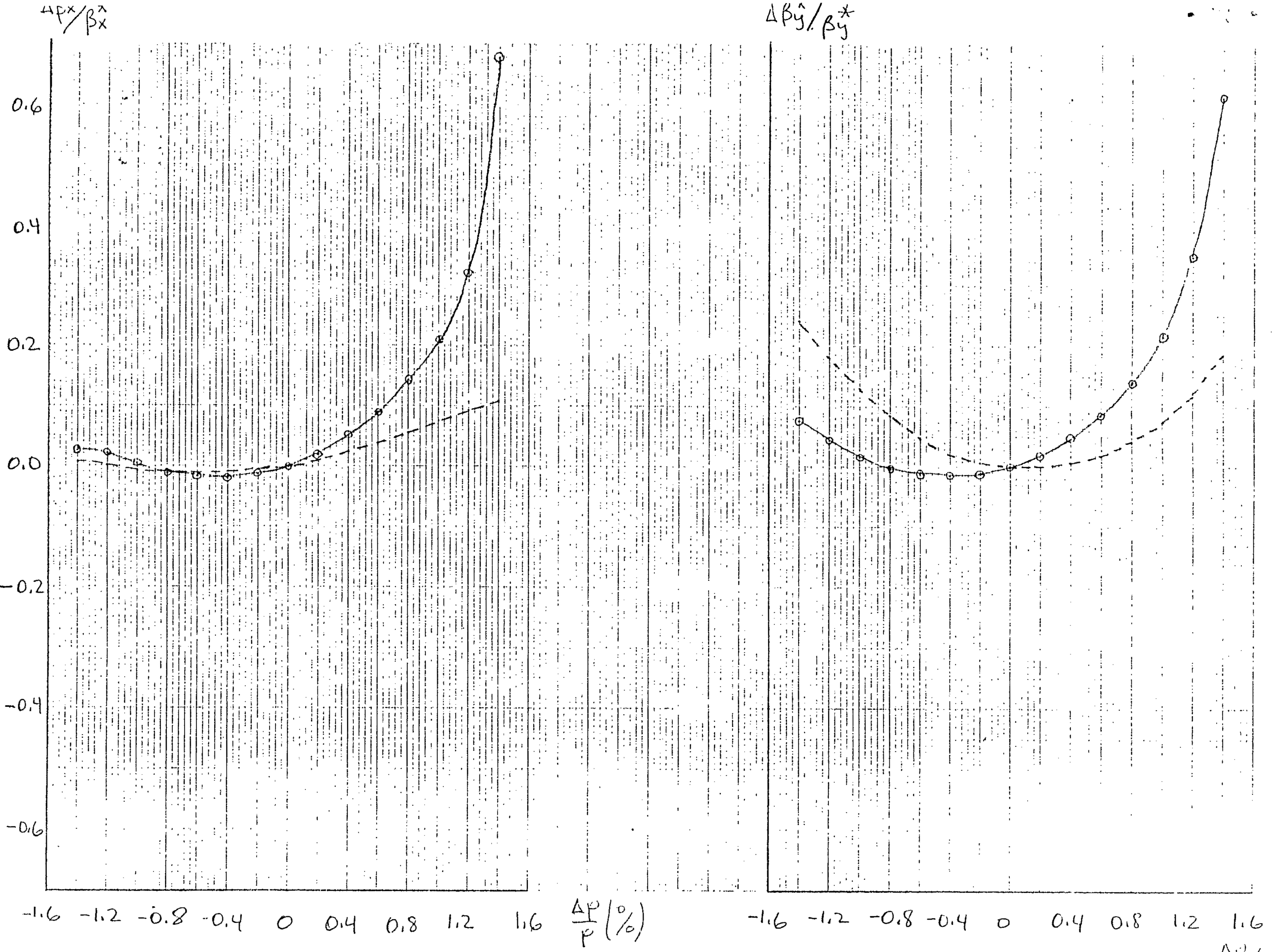


Figure 3. $\Delta\beta/\beta$ at crossing points.

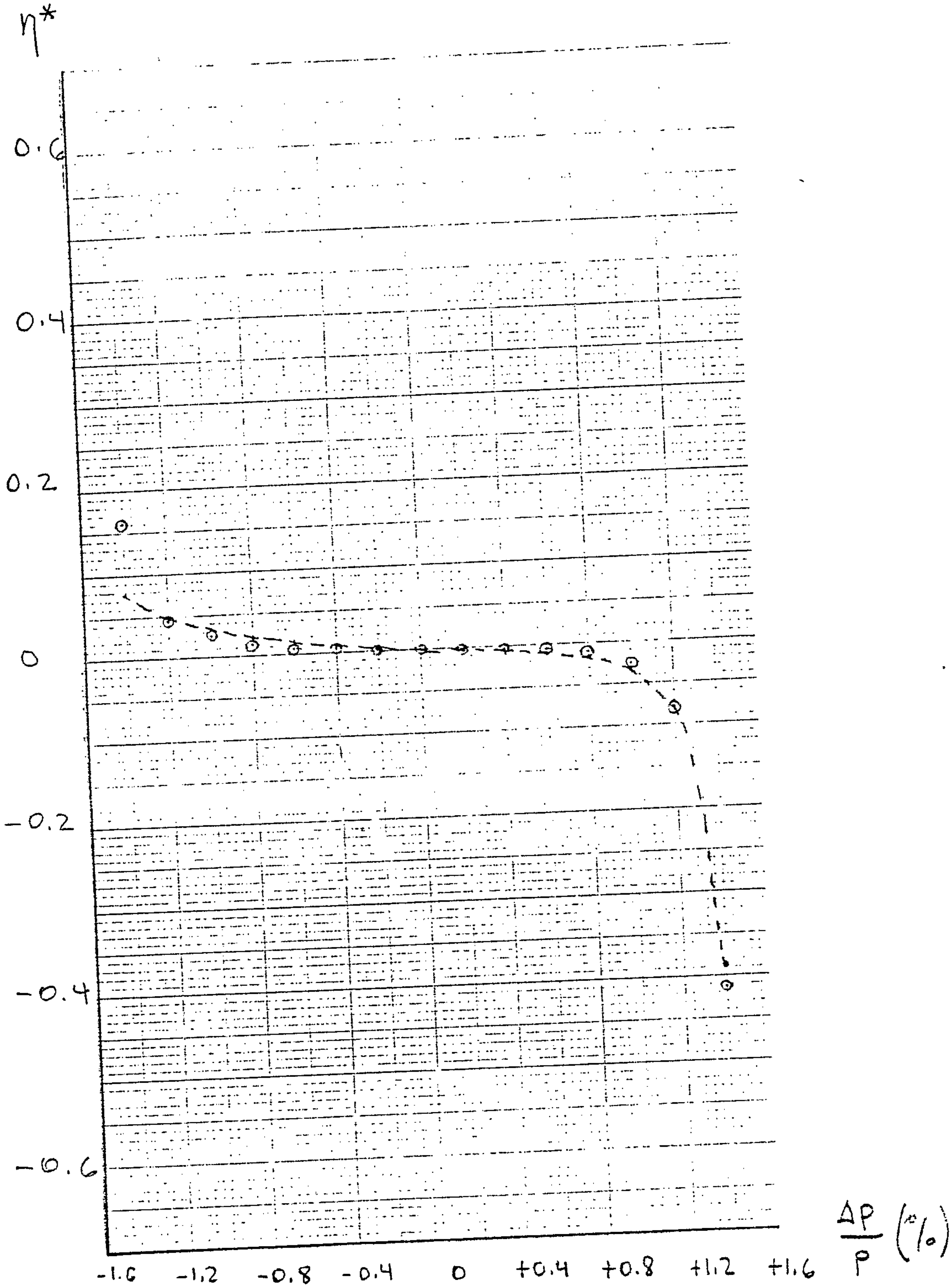


Figure 4. Dispersion at crossing points.

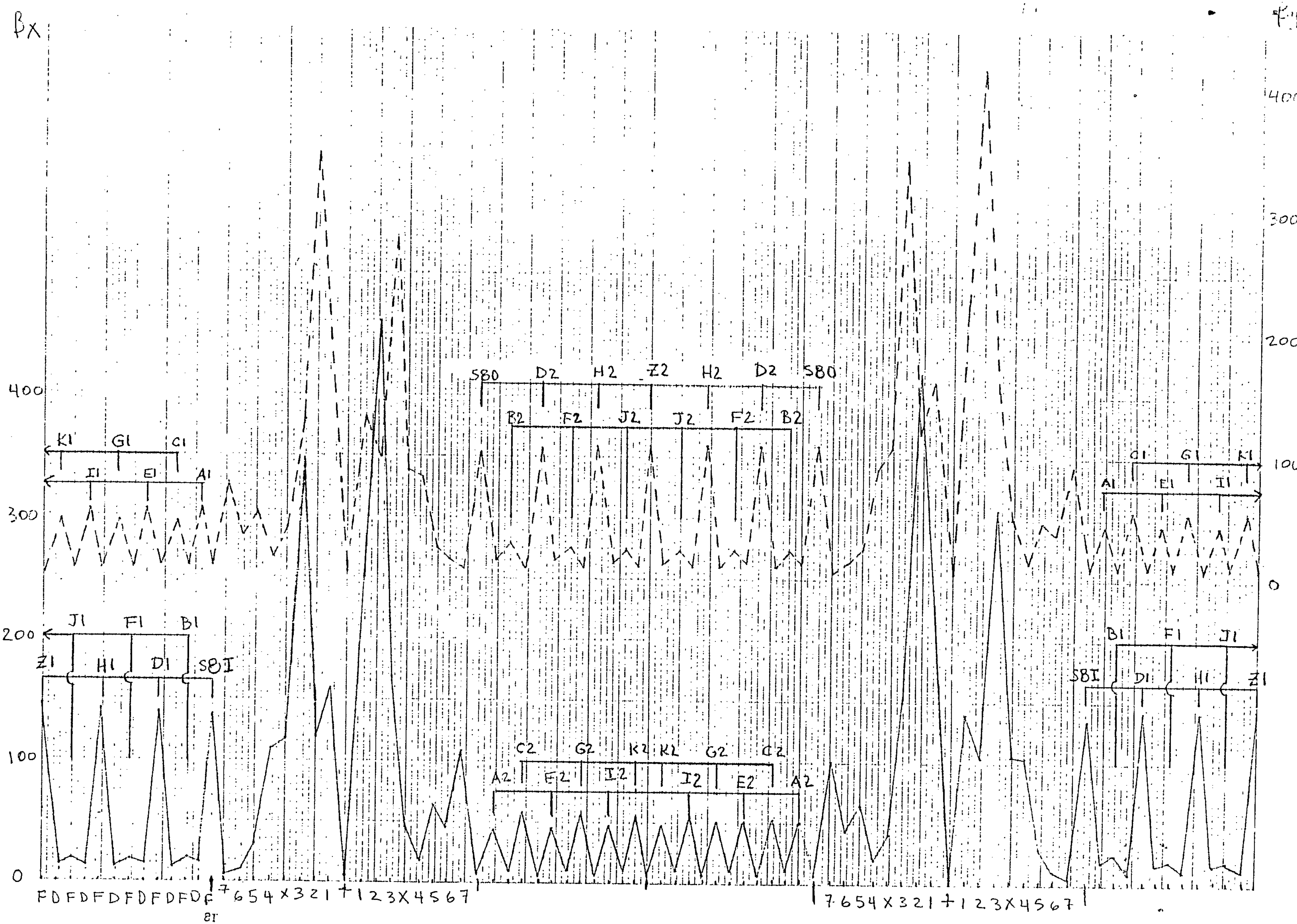


Figure 5. Behaviour of β_x, β_y in one superperiod for $\Delta p/_p = +1.4\%$ and <u>only</u> SF, SD. We show in this figure the distribution of special families.

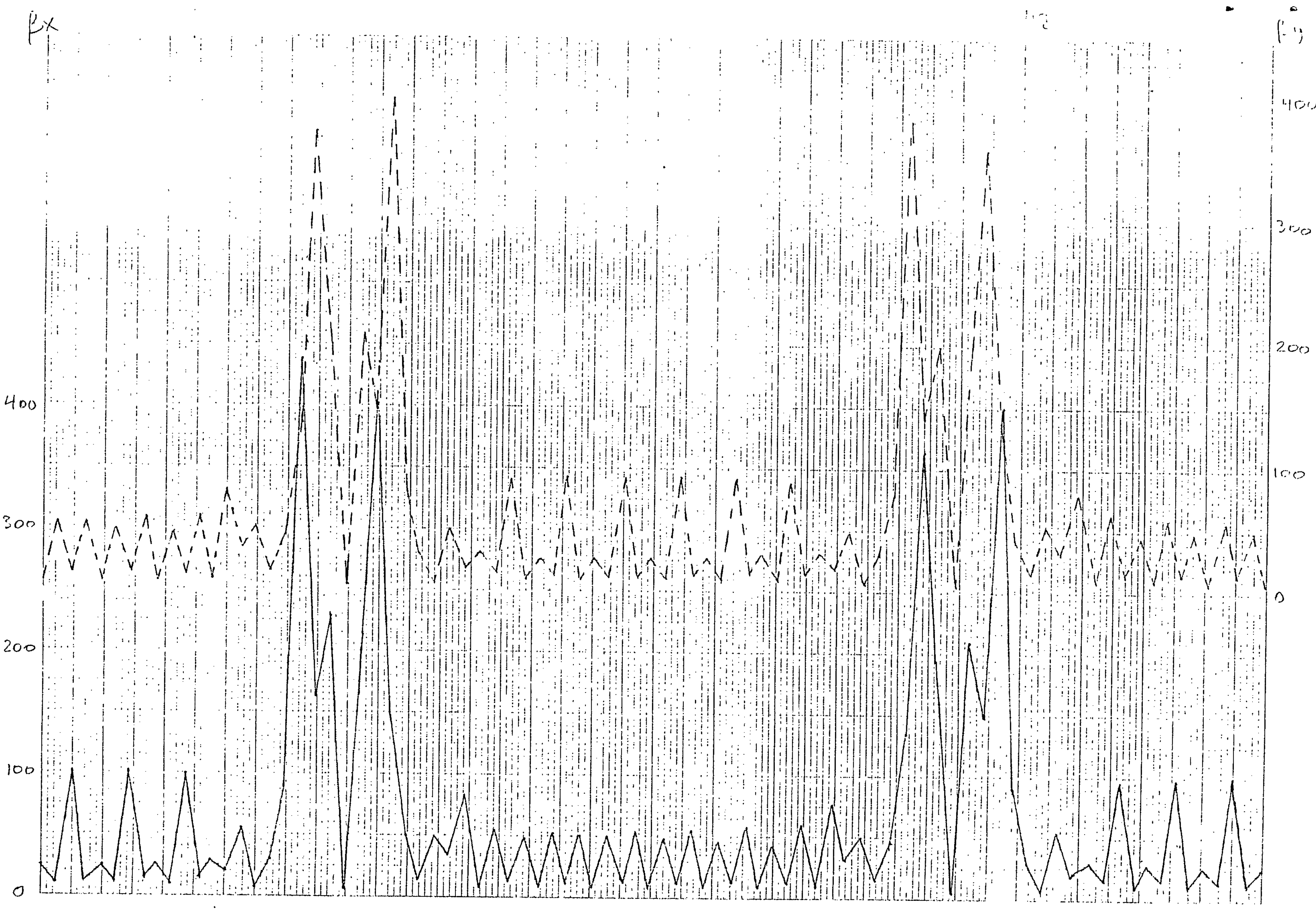


Figure 6. β_x, β_y for $\Delta p/_p = -1.4\%$. SF, SD only. The characteristic pattern in arcs fits again with the sextupole distribution of Figure 5.

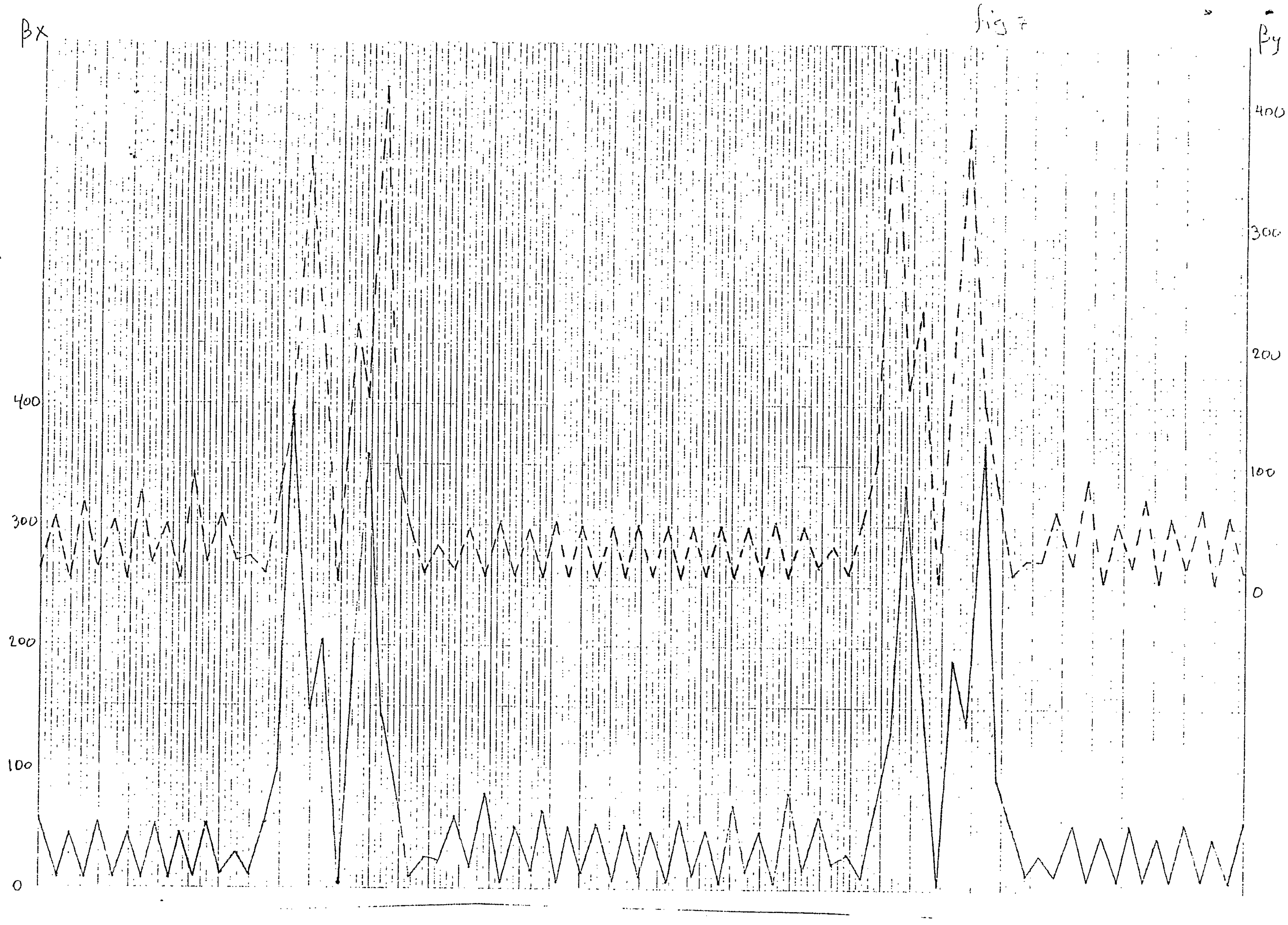


Figure 7. β_x, β_y for $\Delta p/_p$ = +1.4 and special families.

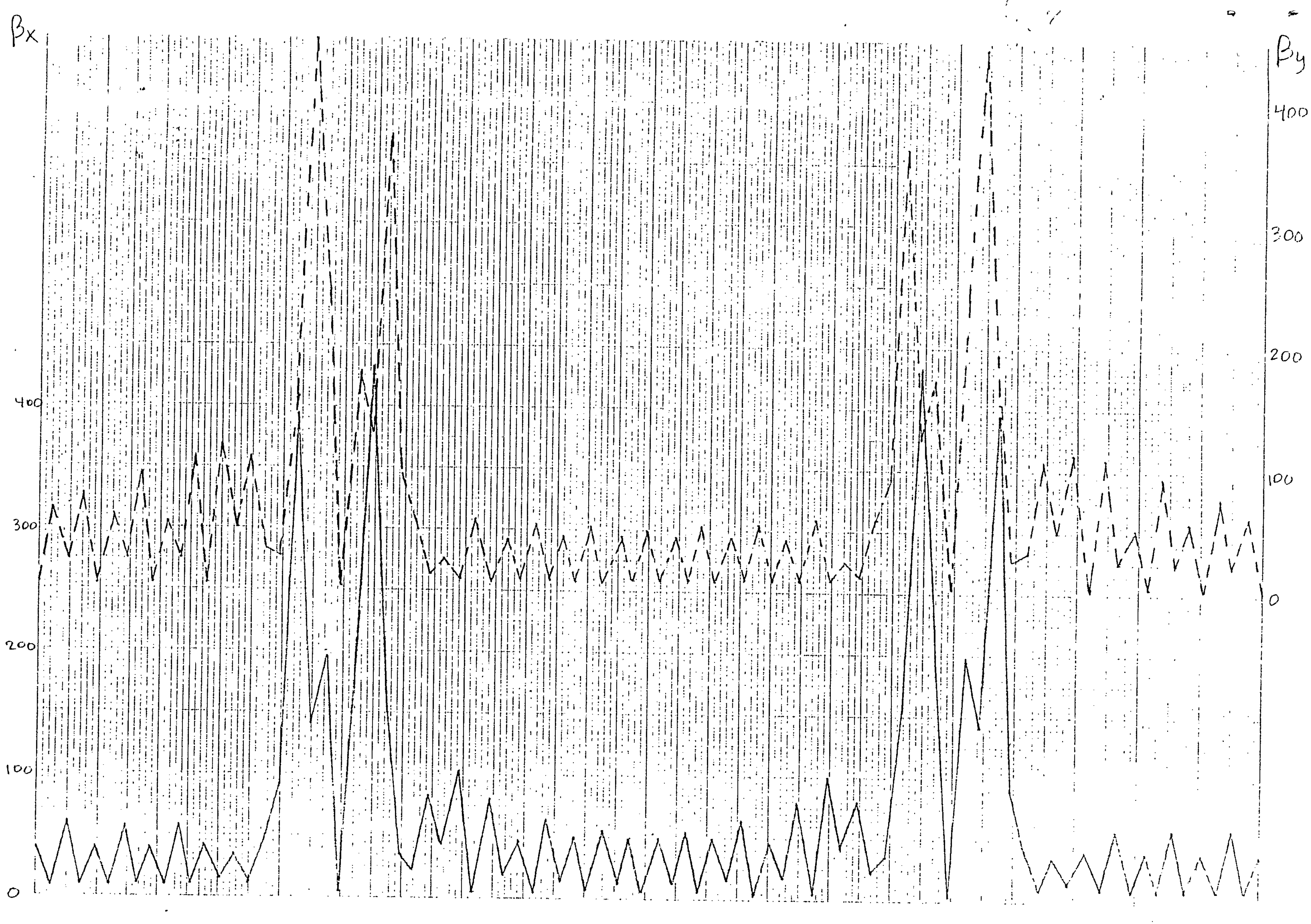


Figure 8. β_x, β_y for $\Delta p/_p$ = -1.4 and special families.