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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.

Armando Antillon<sup>1</sup>

March 7, 1985

Abstract

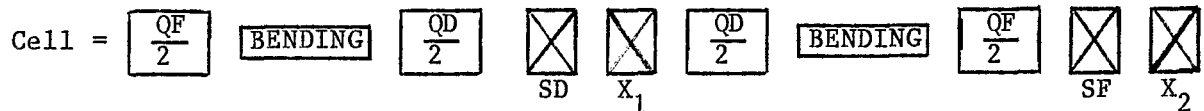
We use special families of sextupoles in the arcs, with antisymmetric distribution. The chromatic behavior of the machine functions are, in general, better than with only two families.

## 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<sup>2</sup>, 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  $X_1, X_2, \dots$  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  $\Delta p/p = 0$ ,  $\beta$  and  $\eta$  have values

	$\beta_x$	$\beta_y$	$\eta_x$
QF	49.6	8.8	1.5
QD	8.8	49.6	.7

Natural Chromaticity:  $\xi_x = -56.6$ ,  $\xi_y = -56.5$

tunes:  $\nu_x = 28.40867$ ,  $\nu_y = 28.37187$

Sextupoles: SF =  $-0.15194$ , SD =  $+0.3111$  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<sup>3</sup> or SYNCH<sup>4</sup>. 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<sup>5</sup>. 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=  $-0.04934$

Family two: B2=F2=J2=  $.045$

Family three: A2=E2=I2=  $.03533$

Family four: C2=G2=K2=  $-0.15268$

For the other arc:

Family five: S8I=D1=H1=Z1=  $.01953$

Family six: B1=F1=J1=  $.0037$

Family seven: A1=E1=I1=  $-0.075$

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 =  $-0.1301$

SD =  $+0.3052$

The change with respect to the original values is small.

1. A. Antillon, 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.

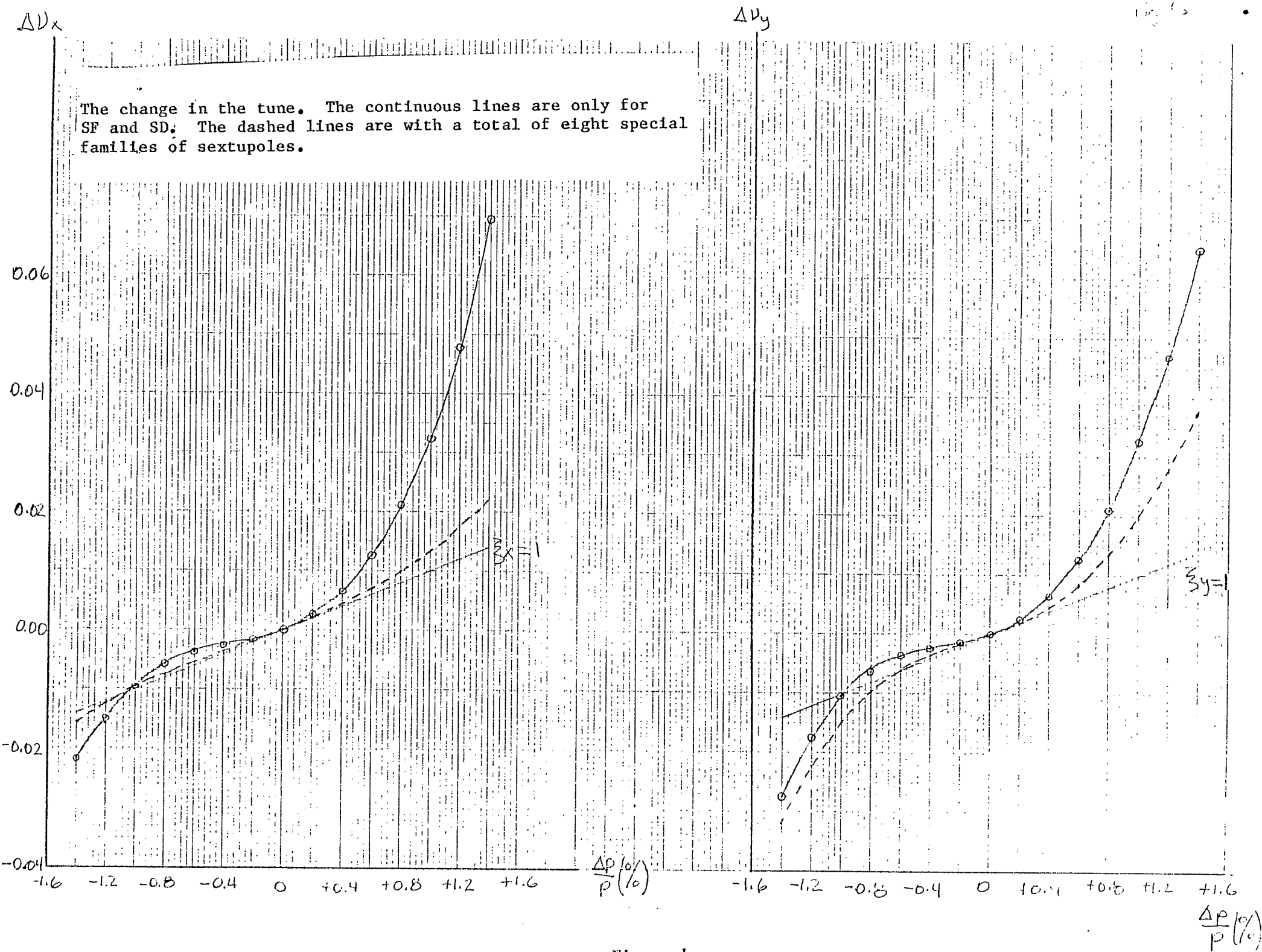
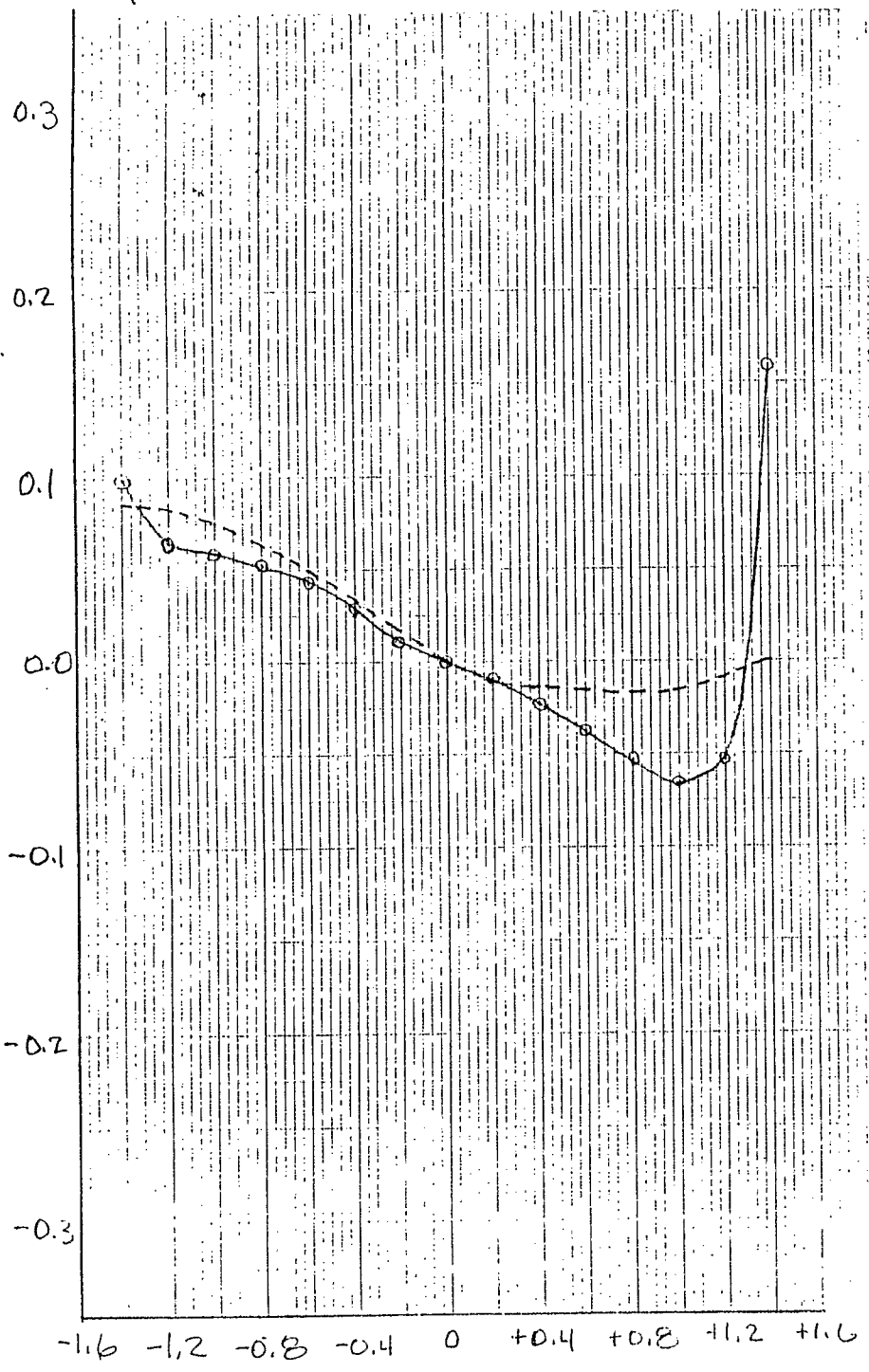


Figure 1.

$(\Delta\beta_x/\beta_x)_{\max}$ , inc.



$(\Delta\beta_y/\beta_y)_{\max}$ , inc

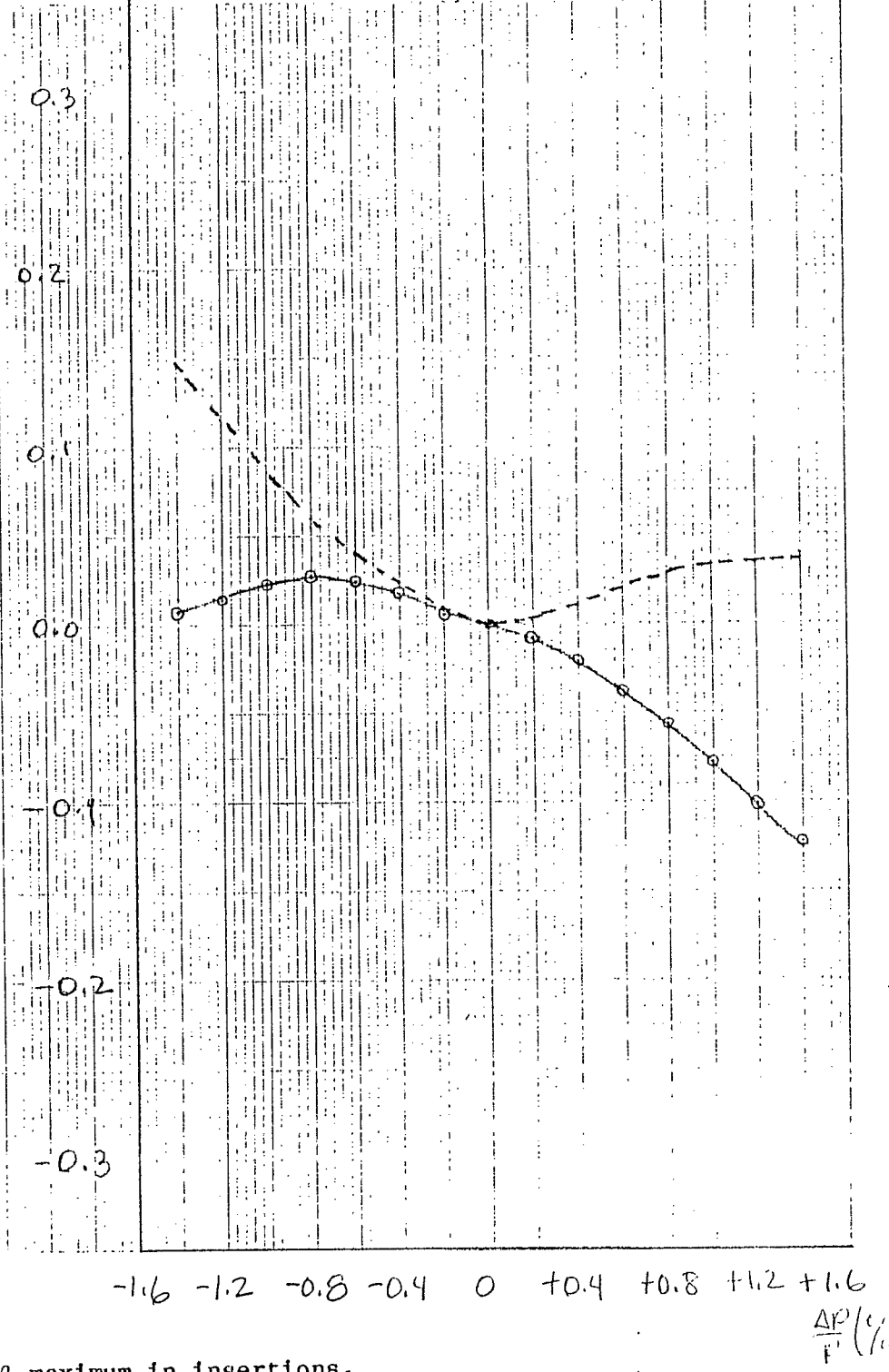


Figure 2.  $\Delta\beta/\beta$  maximum in insertions.

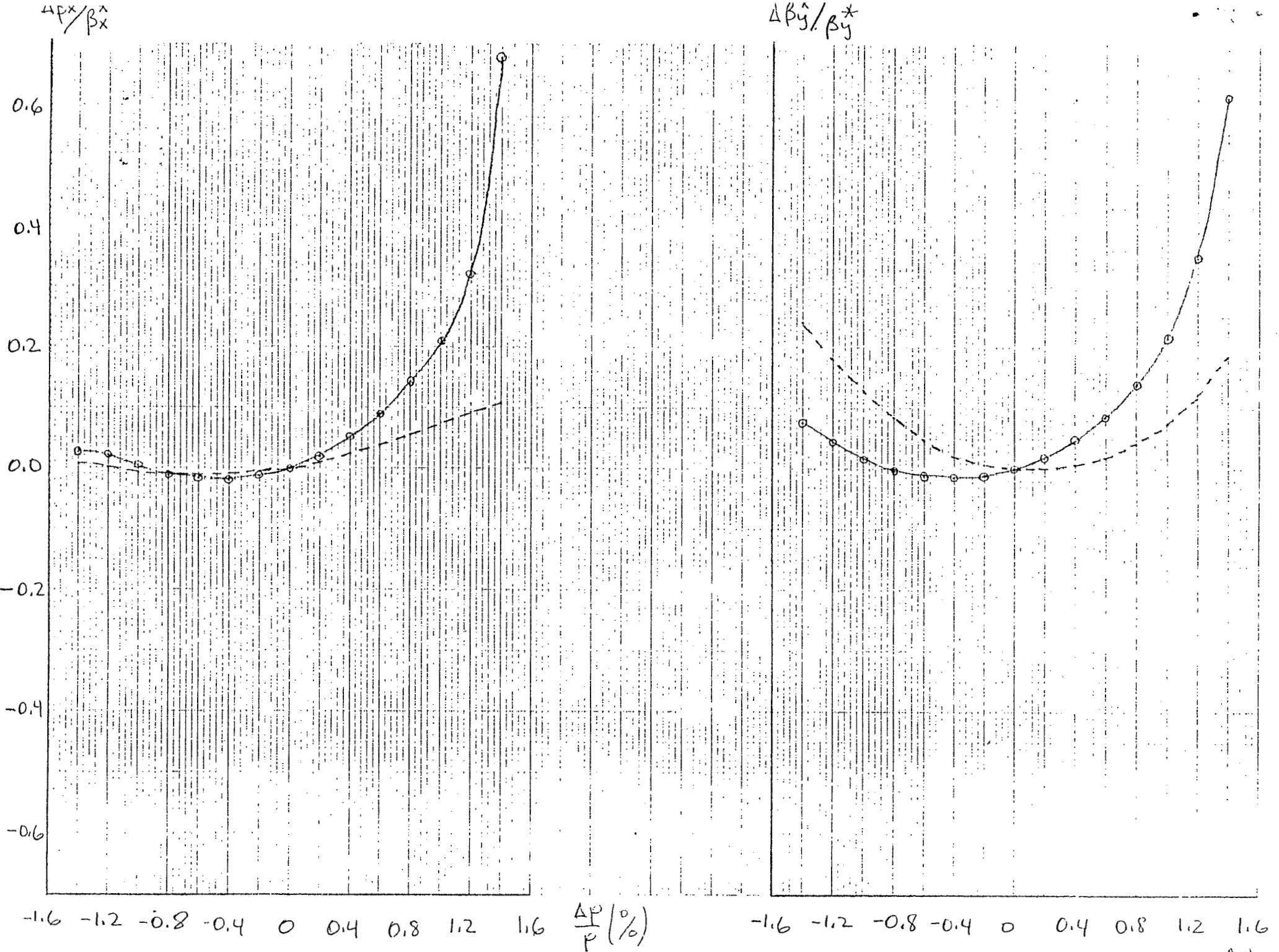


Figure 3.  $\Delta\beta/\beta$  at crossing points.

$\frac{\Delta p}{p} (\%)$



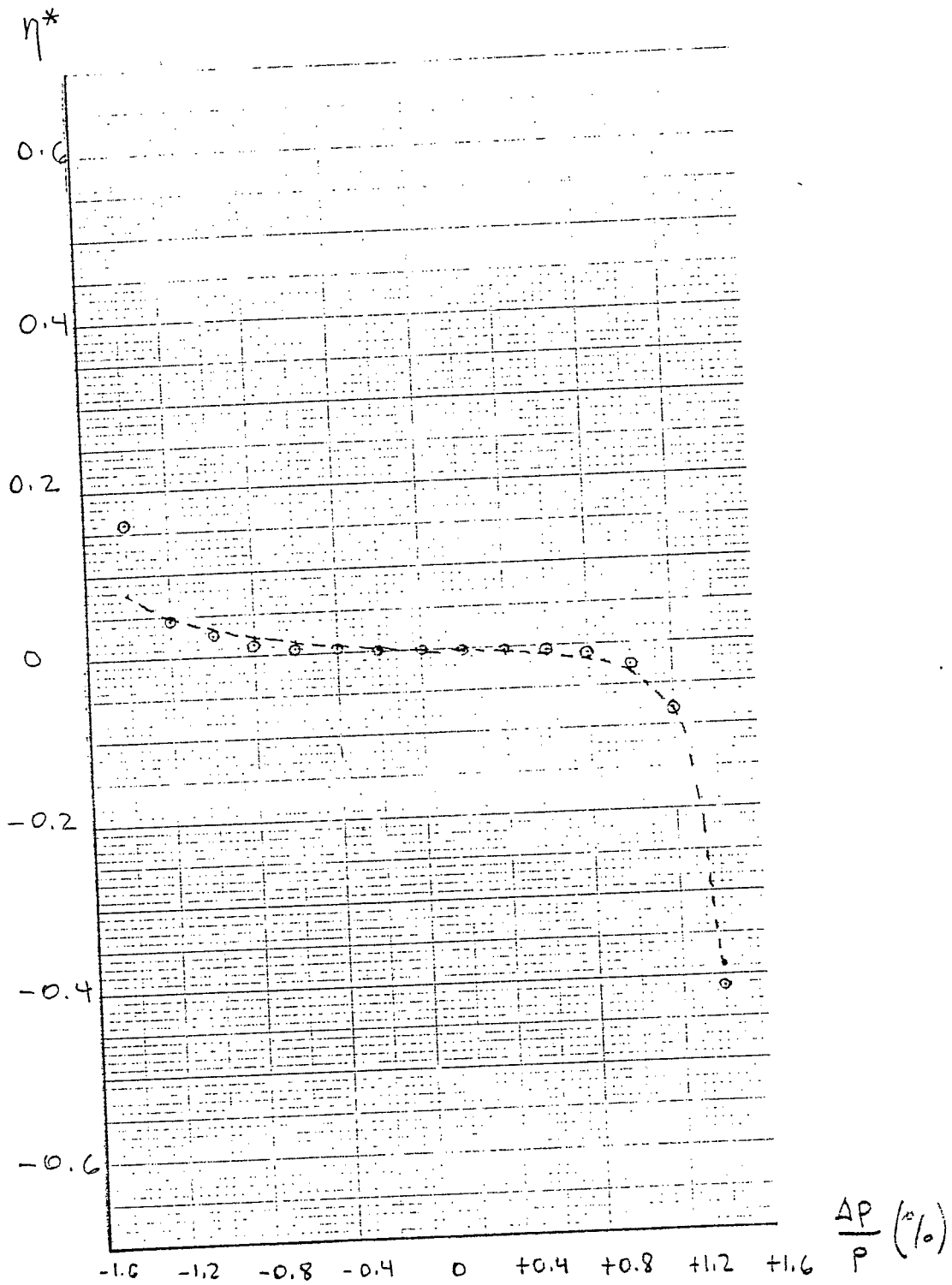


Figure 4. Dispersion at crossing points.

$\beta_x$

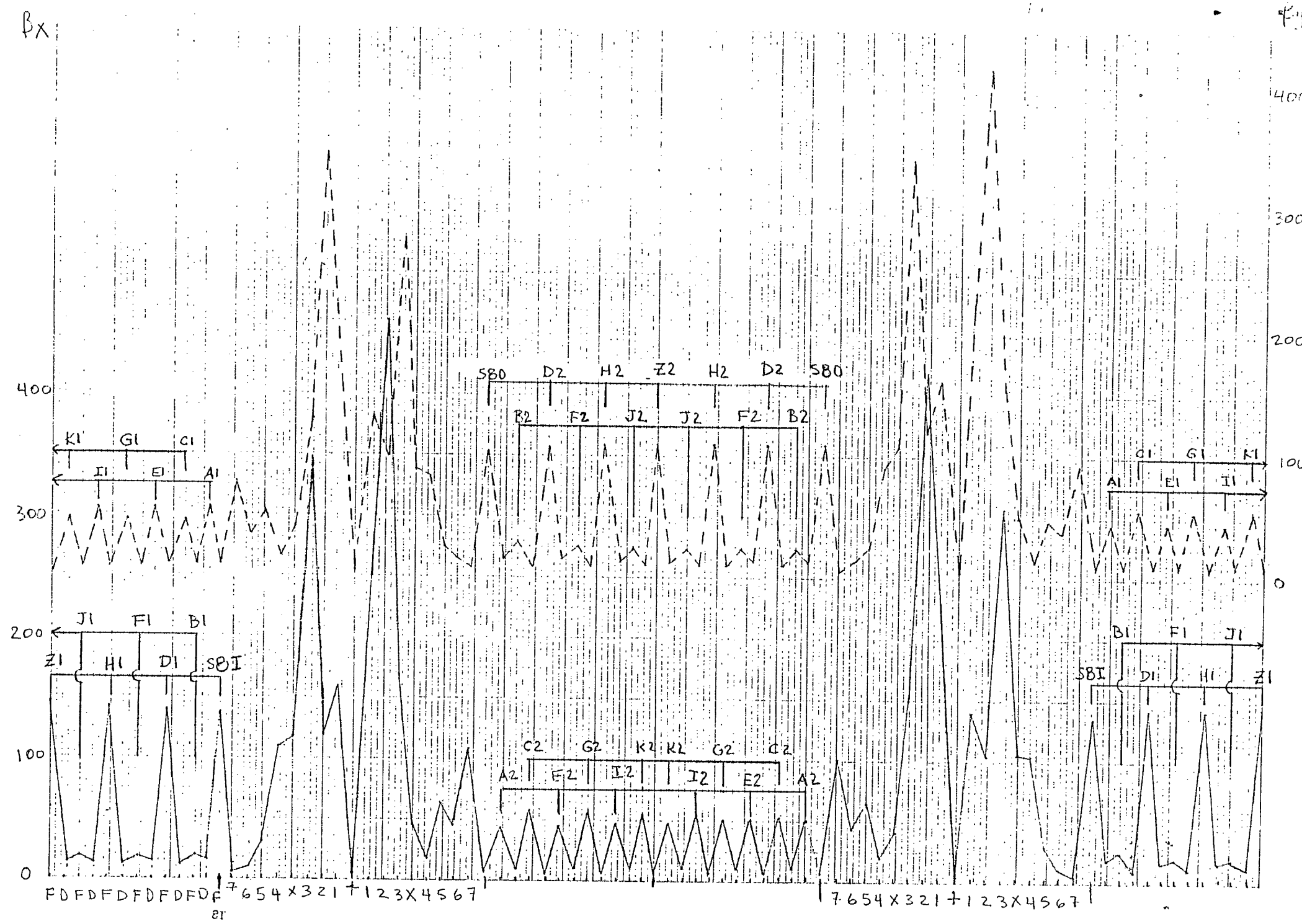


Figure 5. Behaviour of  $\beta_x$ ,  $\beta_y$  in one superperiod for  $\Delta p/p = +1.4\%$  and only SF, SD. We show in this figure the distribution of special families.

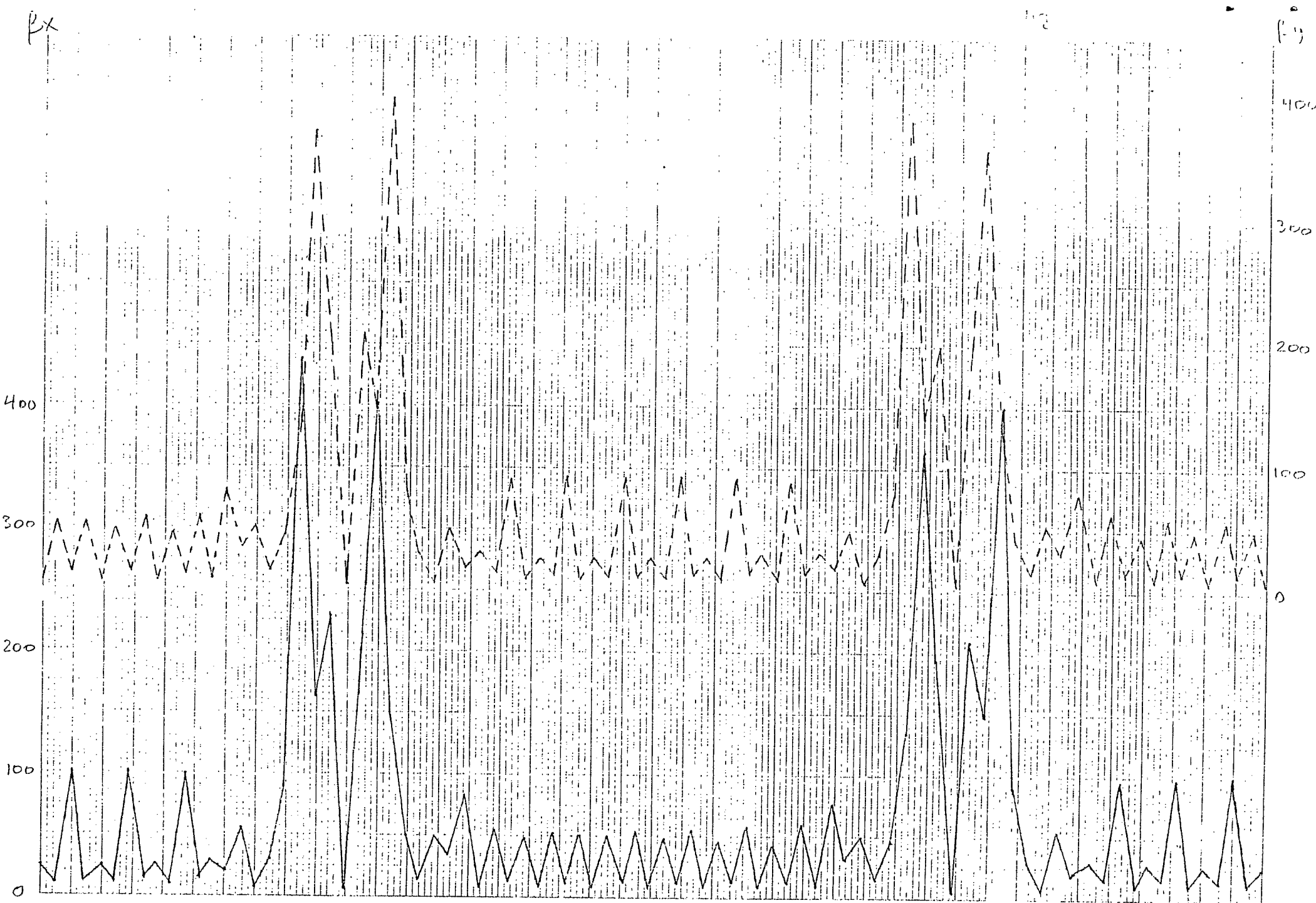


Figure 6.  $\beta_x, \beta_y$  for  $\Delta p/p = -1.4\%$ . SF, SD only. The characteristic pattern in arcs fits again with the sextupole distribution of Figure 5.

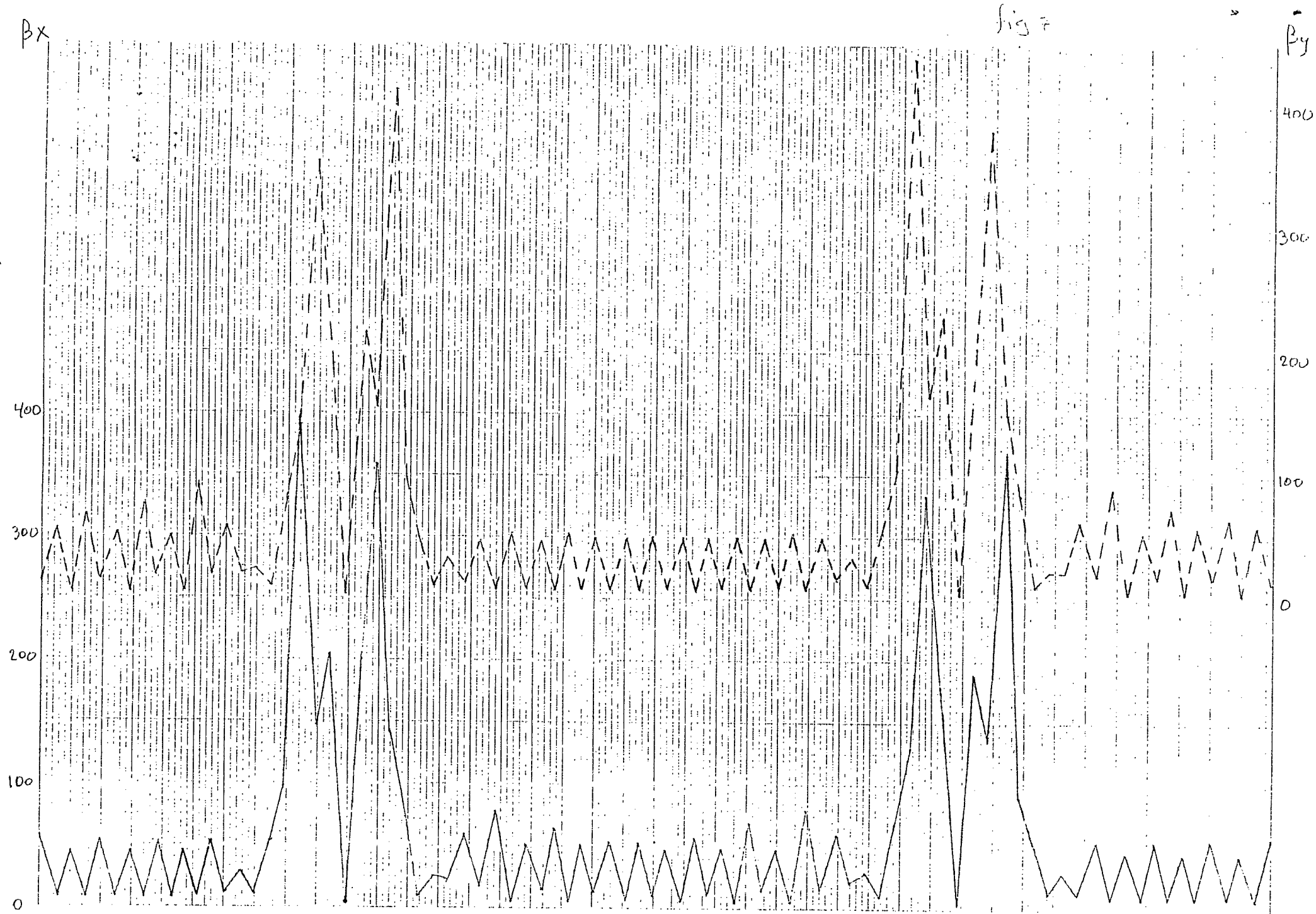


Figure 7.  $\beta_x$ ,  $\beta_y$  for  $\Delta p/p = +1.4$  and special families.

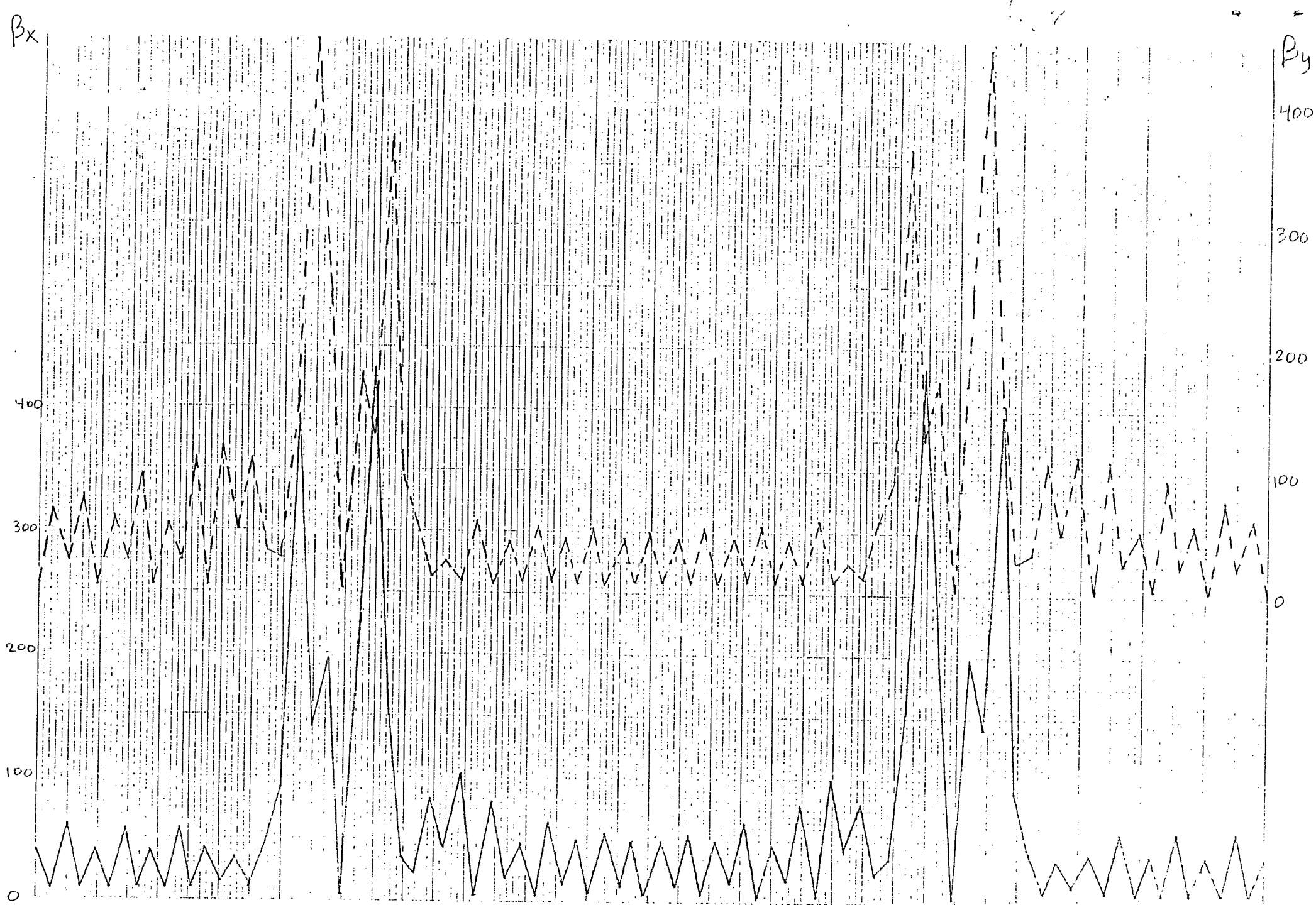


Figure 8.  $\beta_x, \beta_y$  for  $\Delta p/p = -1.4$  and special families.