DAΦNE TECHNICAL NOTE

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DAΦNE : a tracking program for the Frascati Φ-factory

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1. INTRODUCTION

The DAΦNE Φ-factory, under construction in Frascati, presents, among its unique features, the necessity to compensate the high solenoidal field of the detectors KLOE and FI.NU.DA.[1,2], which will be installed on the two Interaction Regions. Due to the relatively low energy, the coupling and focusing effects of these devices have a great influence on the beam behaviour and their compensation must be carefully studied. In Table I a) and I b) the principal characteristics of the two detectors are summarized. Here $K_S = B_Z/(2B\rho)$ and $\theta_S = K_S L_S$, the value printed is the rotation from I.P. to one solenoid's edge.

Table I a) - The KLOE field

B_Z (T)	.6
L_S (m)	4.5
K_S (m^{-1})	.176
$\theta_S/2$ (deg)	22.7

Table I b) - The FI.NU.DA. field *

B_Z (T)	1.5
L_S (m)	2.3
K_S (m^{-1})	.442
$\theta_S/2$ (deg)	29.

As we said before, the main effects of a solenoidal field on the beam are the focusing on both planes and the rotation. For instance at the end of the KLOE detector the trajectory coordinate frame has a rotation around the main axis of about 23°, at 510 MeV, and the beam experiences a focusing equivalent to a quadrupole with a strength of .031 m^{-2}. The rotation must be corrected since it leads to a coupling between the horizontal and vertical betatron oscillations, that must be absolutely avoided in a low-coupling machine (k=1%) like DAΦNE. The correction scheme[3] foresees a rotation of each low-β triplet quadrupole, corresponding to the rotation of the beam at the quadrupole position, plus two compensating solenoids at both I.R. ends, to fully decouple the two phase-planes. In Table II a) and II b) are summarized the two I.R. layouts.

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* preliminary design.

Table II a) - The KLOE half Interaction Region layout.

TYPE	*NAME*	*L (m) (Projected)*	*K2 (m-2)*	*Bz (T)*	*ANGLE (rad)*
IP1					
SOL	**KLOE**	0.460		0.6	
QUAD	**QKFI1004**	0.200	3.4839635	0.6	.10423
SOL	**KLOE**	0.170		0.6	
QUAD	**QKDI1005**	0.350	-6.049274	0.6	.17689
SOL	**KLOE**	0.150		0.6	
QUAD	**QKFI1006**	0.270	3.101060	0.6	.25371
SOL	**KLOE**	0.350		0.6	
SOL	**KLOE**	0.300		0.3	
DRIFT	**O**	1.105			
DIAG	**BPSI1003**	0.000			
DRIFT	**O**	0.100			
COMP	**SOLI1002**	0.300		-.759	
COMP	**SOLI1002**	0.540		-1.52	
COMP	**SOLI1002**	0.300		-.759	
DRIFT	**O**	0.305			
CORR	**CHVI1008**	0.100			
DRIFT	**O**	0.050			

Table II b) - The FI.NU.DA. half Interaction Region layout.

TYPE	*NAME*	*L (m) (Projected)*	*K2 (m-2)*	*Bz (T)*	*ANGLE (rad)*
IP2					
SOL	**FINUDA**	0.46000		1.5	
QUAD	**QFFI2004**	0.20000	3.0	1.5	0.24933
SOL	**FINUDA**	0.19000		1.5	
QUAD	**QFDI2005**	0.30000	-6.5	0.75	0.40555
DRIFT	**0**	0.27400			
QUAD	**QFFI2006**	0.20000	4.0		0.43378
DRIFT	**0**	1.32900			
DIAG	**BPSI2009**	*0.00000*			
COMP	**SOLI2002**	0.30000		-.759	
COMP	**SOLI2001**	0.69600		-1.52	
COMP	**SOLI2002**	0.30000		-.759	
DRIFT	**O**	0.65100			
CORR	**CHVI2008**	0.10000			
DRIFT	**O**	0.05000			
DIAG	**BPSI2010**	*0.00000*			

This compensation scheme is valid only for on-energy particles, so a careful study of the off-energy behaviour, to evaluate the residual coupling, is required.

Moreover, the choice to horizontally cross at an angle ranging between 10 and 15 mrad, makes the two beams pass off-axis in the low-β triplet, so this angle must be included in the simulation. The particles arrive at the splitter entrance, where the vacuum chamber splits in two parts, the short half of one ring and the long half of the other, with a beam-to-beam half separation ranging from 4.7 cm to 7.1 cm and a half divergence ranging from 3.5 mrad to 5.3 mrad. Then, to take into account that in the two rings the beam travels on-axis, a translation and a rotation of the horizontal coordinates (x,x') must be performed.

These peculiarities and the lack of a computer code capable to simulate them is the reason for the developing of a new tracking program, suitable for DAΦNE.

2. THE DAΦNE PROGRAM MAIN FEATURES

DAΦNE is a kick-code tracking program. The elements like quadrupoles, bendings, drifts, solenoids, etc. are treated as matrices and stored, once for each tracking energy, in a three index array containing the matrix product for all the elements between two sextupoles. The sextupoles, or other non-linear elements (for example the octupoles) are treated as kicks. This method ensures the symplecticity of the code, and allows to save CPU time.

A detailed description of the input and output files is given in § 3,4,5, relative to the DAΦNE lattice with two KLOE I.R.'s (structure D15[4]).

The Fortran code is on VAXLNF::D17:[BIAGINI.TRACK]DAFNE.FOR, and so are the object and executive files. The file COMBLOCK.FOR in the same directory contains the COMMON blocks, and it is used for compiling and linking the main program.

In Appendix A are the command file, the lattice file (Unit 55), the tracking file (Unit 54), the IR matrices file (Unit 56). In Appendix B is the corresponding output (Unit 6).

In Figs. 1a), b), c) is the dynamic aperture respectively for $\Delta p/p$ = -1%, 0, +1%.

In Figs. 2a), b), c) is the horizontal tune shift vs. amplitude, respectively for $\Delta p/p$ = -1%, 0, +1%.

In Figs. 3a), b), c) is the vertical tune shift vs. amplitude, respectively for $\Delta p/p$ = -1%, 0, +1%.

In Fig. 4 are the horizontal and vertical tune shifts vs. $\Delta p/p$.

In Figs. 5a), b), c) is the (x, x') phase-space diagrams for three test particle with initial coordinates N_x = 3, 6, 9 and N_z = 0, for the three energy deviations.

One of the two input files, containing the lattice specifications, is the LEDA[5] program input, with minor modifications as described in § 3. In the second one is the information about the tracking and the sextupole configuration.

The maximum number of turns per particle is 512. The maximum number of tracked particles is 500. When calculating a dynamic aperture (flag IDYNA set to 1), in number of σ, the scale must be chosen in order to have:

$$(|N_x^{min}| + |N_x^{max}| + 1) * N_z^{max} < 500$$

if the step is 1σ, or must be scaled proportionally to the step.

For each stable particle, at the last turn a Fast Fourier Transform analysis, to calculate the tune shifts with the particle amplitude, is performed.

The program can also read on a third data file the I.R. matrices, previously calculated, if the flag ISOL is set to 1.

It calculates the optical functions for $\Delta p/p = 0$, flag IBET set to 1, and the sextupole strengths for one or two SF and SD families, in order to correct the horizontal and vertical chromaticities to zero.

Before tracking, it is possible (flag IDPP set to 1) to calculate the off-energy horizontal (x_c) and vertical (z_c) closed orbits and the corresponding tunes as a function of the energy deviation $\Delta p/p$. In this case the sextupoles are treated as thin lens matrices as the one below:

$$\begin{vmatrix} 1 & 0 & 0 & 0 & 0 \\ \frac{h\,x_c}{1+Dp/p} & 1 & 0 & \frac{-h\,z_c}{1+Dp/p} & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ \frac{-h\,z_c}{1+Dp/p} & 0 & 0 & \frac{-h\,x_c}{1+Dp/p} & 1 \end{vmatrix}$$

Here h is sextupole strength in m^{-3}. The off-energy closed orbits are propagated along the lattice starting from their calculated value at I.P. At each sextupole these trajectories experience the standard sextupolar kick and that value x_c after the kick is the one used in the previous matrix.

In case of strong coupling, if the flag ICOUP is set to 1 the program calculates the eigenvalues for the off-energy one turn matrices, and prints them together with the tunes.

It is of course possible to track also single particles, whose trajectories are stored on three different graphic output files for the (x, x'), (z, z') and (x, z) planes. In this case the particles coordinates are read from the second input file, or they can be random extracted following a uniform (IEX=1) or a gaussian (IEX=2) distribution.

3. THE INPUT FILES

The input files are two: the lattice is read from unit **55**, following the LEDA fixed format. The specifications for the tracking and the sextupole configuration are read from unit **54**. If necessary from unit **56** the two half-I.R. matrices, previously calculated, are read.

3 a. The lattice file

i) the values for η', α_x, α_z at the Interaction Point must be added to the line 23, when the BX0,BZ0,ETAW0 values are read (they are usually set to zero);
ii) in the list of elements, where the field IDENT is read, for each sextupole the sequential number corresponding to its position in the ring is given (1 for the first sextupole and so on);
iii) for the I.R. elements a 1. is written in the field BL, to exactly calculate the on-energy tunes when IBET=1.

ii) and iii) don't really modify the LEDA file, but i) must be corrected when a LEDA run has to be performed.

Let's recall here the LEDA fixed format for the lattice input. For each element **I** is read (in parenthesis is the fixed format):

I(I4) **IDENT**(I4) **NEL**(I4) **A**(G10.6) **B**(G10.6) **RAG**(G10.6) **BL**(G10.6)

Here NEL is the element type, as specified in the following list:

NEL=**1** : DRIFT. In the field A the length in *m* is given. If the element belongs to the I.R. a 1. is written in the field BL.

NEL=**2** : FOCUSING QUADRUPOLE. In the field A the length, in the field B **the absolute value** of the strength in m^{-2} are given. If the element belongs to the I.R. a 1. is written in the field BL.

NEL=**3** : DEFOCUSING QUADRUPOLE. Same as above.

NEL=**4** : HORIZONTAL SECTOR DIPOLE. In the field A the length, in the field RAG the bending radius in *m* are given. A particle bent towards the center of the ring has a positive radius. If the element belongs to the I.R. a 1. is written in the field BL. A parallel faces magnet is represented by a edge-sector-edge (6-4-6) sequence. The edge angle, in *degrees*, is half of the bending angle.
NEL=**5** : WIGGLER. The wiggler matrix has not been implemented yet. For the moment the wiggler is represented by a sequence of parallel faces dipoles with alternating bending radius sign.

NEL=**6** : DIPOLE EDGE. In the field B the angle in *degrees*, in the field RAG the bending radius in *m* are given.

NEL=**7** : FOCUSING SEXTUPOLE. In the field IDENT the number corresponding to its position in the lattice, as sextupole, is given. In the field A the length set to 0. In the field B **the absolute value** of the strength in m^{-2}, is given. In the file 55 for simplicity the strengths are all set to zero, and read instead from the file 54. In the linear lattice calculation (IBET = 1) the optical functions are kept the same as the previous element.

NEL=**8** : DEFOCUSING SEXTUPOLE. Same as above.

N.B. The sextupole strengths are given in absolute value in the lattice and tracking files. Actually they have in the kick calculations the same sign with respect to PATRICIA, that is the SD's are set to a positive strength and the SF's to a negative one.

NEL=**9** : UNIFORM SOLENOID WITH ONLY FOCUSING. In the field A the length in m is given. In the field RAG the solenoidal field in Tesla, with its sign, is given. If the element belongs to the I.R. a 1. is written in the field BL. To be used in connection with the elements 22 and 33 ("*quadrusoles*").

NEL=**10** : the matrix of the right side of the I.R. (with respect to I.P.) is read from unit 56.

NEL=**11** : the matrix of the left side of the I.R. (with respect to I.P.) is read from unit 56.

N.B. The two matrices must be written in this order.

NEL=**12** : TILTED FOCUSING QUADRUPOLE. In the field A the length (for the thin lens approximation, used for the DAΦNE I.R., A is zero), in the field B the absolute value of the strength in m^{-2} are given. In the field RAG the angle θ in *rad*, with its sign, is given. If the element belongs to the I.R. a 1. is written in the field BL.

NEL=**13** : TILTED DEFOCUSING QUADRUPOLE. Same as above. In the matrix calculation the angle is set to $\pi/2+\theta$.

NEL=**14** : UNIFORM SOLENOID. In the field A the length in *m* is given. In the field RAG the solenoidal field in *Tesla*, with its sign, is given. If the element belongs to the I.R. a 1. is written in the field BL.

NEL=**15** : OCTUPOLE. Used sometimes to introduce a tune-shift function of the particle amplitude, avoiding the sextupole induced aberrations. In the field A the length is set to zero. In the field B the strength in m^{-3} , with its relative sign, is given. The octupolar kick is:

$$x' = x_0' + B\,(x_0^3 - 3\,x_0\,z_0^2)/6$$

$$z' = z_0' - B\,(3\,x_0^2\,z_0 - z_0^3)/6$$

NEL=**16** : TRANSLATION AND ROTATION OF HORIZONTAL TRAJECTORIES. This element is used at the splitter entrance when performing tracking with a crossing angle at the I.P., to put the particles on-axis in the regular lattice after the splitter. In the field A the separation x in *m* and in the field B the slope x' in *rad* at each splitter entrance, **with their relative sign**, are given.

NEL=**17** : DISPERSION AND ITS SLOPE. In the field A the matrix element A_{13} in *m*, in the field B the element A_{23} in *rad*, **with their relative sign**, are given. When there are in the I.R. solenoids and quadrupoles, and the particles cross at I.P. with an angle, we must take into account the fact that they pass off-axis in the quadrupoles: we define at the splitter a dispersion D and a slope D' different from zero, calculated as a trajectory derivative at two different energy deviations $\Delta p/p$. So, at that point in the machine matrix the A_{13} and A_{23} elements are forced. They are used to exactly compute the dispersion in the regular lattice, so that the sextupole calculation for chromaticity correction is correct. It is not used in the tracking procedure.

N.B.: Pay attention to the signs. In fact the signs of A_{13} and A_{23} depend on the direction of motion: entering in a splitter from IP the signs are the same as for D and D', while going out from the splitter to IP the sign of A_{13} is the opposite with respect to D. For the DAΦNE lattice D15, for example, we have:

$A_{13} < 0$,	$A_{23} < 0$	entering in the short half
$A_{13} > 0$,	$A_{23} < 0$	going out from the short half
$A_{13} > 0$,	$A_{23} > 0$	entering in the long half
$A_{13} < 0$,	$A_{23} > 0$	going out from the long half.

NEL=**22** : THICK FOCUSING QUADRUPOLE IMMERSED IN A SOLENOIDAL FIELD. This is used when we want to take into account only the focusing effect of the solenoid ("*quadrupole*" scheme). In the field A the length, in the field B the absolute value of the strength in m^{-2} are given. In the field RAG the solenoidal superimposed field in Tesla is given. If the element belongs to the I.R. a 1. is written in the field BL .

NEL=**33** : THICK DEFOCUSING QUADRUPOLE IMMERSED IN A SOLENOIDAL FIELD. Same as above.

N.B. All the magnetic element strengths are divided by (1+Δp/p) to take into account the off-energy particles behaviour.
For the solenoid it is : B --> B/(1+Δp/p)^2. For the bendings is : ρ --> ρ(1+Δp/p).

3 b. The tracking file

On unit 54 the tracking instructions are read. The format is free, and each data line is preceded by a title line, explaining the meaning on the following data.

The file contains :

• A title line:

TITLE

• N. of turns, n. of particles, sampling element (where the trajectories are observed), and a sequence of flags:

NTURN NPART ISAMPLE ICROM IDPP IBET
IPRIN ISOL IDYNA ICOUP IAUTO IORB

where:
ISAMPLE=**0** : observation at I.P.
ICROM=**1** : the chromaticity correction to zero is performed.
IDPP=**1** : the off-energy closed orbits at different Δp/p, with a number of energy steps NDP chosen by the user, are calculated by a Newton-Raphson minimization procedure. The one turn matrix with the sextupoles treated as matrices is computed, and from its half-trace the tunes as a function of the energy deviation are calculated. Their values and the closed orbits values are printed as a function of the energy deviations.
IBET=**1** : the lattice optical functions are calculated. **If ICROM = 1 it must be IBET = 1.**

IPRIN=**1** : the calculated optical functions are printed. Of course, it is valid only in connection with IBET=1.
ISOL=**1** : the I.R. right and left matrices are read sequentially from unit 56.
IDYNA=**1** : the dynamic aperture calculation is performed. If the variable NEN is set to 1 only the dynamic aperture at the energy specified by DPP, read in a following line, is computed. If NEN=3, and DPP is not zero, three dynamic apertures are calculated, respectively for $\Delta p/p$ = -DPP,0,+DPP. The particle initial coordinates are calculated uniformly filling a plane (N_x, N_z), whose limits are given in a data line below, with a step NSTEP.
ICOUP=**1** : the eigenvalues of the one turn matrix for various $\Delta p/p$ are computed and printed with the tunes vs. $\Delta p/p$.
IAUTO=**1** : the auto-β and auto-dispersion at the IP are calculated when computing the optical functions.
IORB=**1**: the one turn orbit for the central trajectory (0, θ_c) is calculated and printed at each block. It is useful to check that the input data are correct when dealing with crossing angles. To correctly use this option:
- NTURN = 1,
- NPART = 1,
- ICROM = 1,
- NEN =1 and DPP = 0.0,
- NSFIX= total number of sextupoles (including SF and SD),
- **all** the sextupoles (including SF and SD) must be listed on file 54 with their strengths set to zero,
- NX = 0, NXP = 0, NZ = 0 , NZP = 0, NE = 0.

This option works also by putting ICROM = 0 and setting to zero the two natural chromaticities.

• Type of extraction, seed, n. of energies, step in energy:

IEX SEED NEN NDP

where:
IEX=0 : means no extraction of random particle initial coordinates;
IEX=1 : means random uniform extraction;
IEX=2 : means random Gaussian extraction.
SEED : is the seed for the random extraction (5 digits, less than 60000).
NEN : is the number of energies for which dynamic aperture must be calculated. Usually is set to 3.
NDP : is the number of steps in $\Delta p/p$, usually 10 or 20. It is used if IDPP = 1.

• Beam dimensions and maximum energy deviation:

SIGAX0 SIGAXP0 SIGAP0 SIGAZ0 SIGAZP0 DPP

where:
SIGAX0 : is the off-coupling horizontal r.m.s. beam dimension at I.P. in *mm*.
SIGAXP0 : is the horizontal r.m.s. beam slope at I.P. in *mrad*.
SIGAP0: is the natural energy spread.
SIGAZ0 : is the full-coupling vertical r.m.s. beam dimension at I.P. in *mm*.
SIGAZP0 : is the horizontal r.m.s. beam slope at I.P. in *mrad*.
DPP : is the maximum relative energy deviation $\Delta p/p$.

- The following two lines contain the variables used in the minimization procedure of finding the off-energy closed orbits In the first line are:

NEQ DELTA MXCALL EPS ESPF ESPFMN IPRINT

where:
NEQ= n. of equations (2 if only horizontal closed orbits are wanted, 4 if both horizontal and vertical).
DELTA : is the increment of the variables when calculating the linear tangent solution. Usually is 10^{-8}.
MXCALL : is the maximum number of calls to be used. If no solution is found for a number of calls > MXCALL, then the minimization fails. Usually is 500 or 1000.
EPS : is the precision required in the minimization. Usually is 10^{-24}.
ESPF, ESPFMN : variables used in the convergence procedure. Usual values are -16. and -25.
IPRINT=1 : the one turn matrices with and without sextupoles, and some information about the convergence at each energy is printed. Usually is set to zero.

N.B. : Do not confuse IPRIN with IPRINT !!!

• In the second one is the array:

XIN(5)

where:
XIN(1) : is the horizontal initial value for the closed orbit in *m*.
XIN(2) : is the horizontal initial value for the closed orbit slope in *rad*.
XIN(3) : is the energy deviation.
XIN(4) : is the vertical initial value for the closed orbit in *m*.
XIN(5) : is the vertical initial value for the closed orbit slope in *rad*.

- Horizontal and vertical maximum pipe apertures (+/-) in *mm*, and crossing angle in *rad* (preceded by two comment lines):

HPIPE VPIPE TETAC

Usually the first two are set to 1000. mm, θ_c = -12.5 mrad for DAΦNE.

- N. of fixed sextupoles, horizontal and vertical natural chromaticities, n. of variable sextupole families, variable NVAR:

NSFIX CXN CZN NS NVAR

where:
NSFIX : is the number of fixed sextupoles.
CXN : is the natural horizontal chromaticity.
CZN : is the natural vertical chromaticity.
NS : is number of variable sextupole families to correct the chromaticity to zero. The program accepts 1 or 2. Obviously 2 is to be used only with completely symmetric lattices!
NVAR=0 : means that the chromaticity correction is not performed, the sextupole arrangement is kept fixed, then in the list of the sextupoles it must be included also the normally variable sextupoles. It is used to compare dynamic apertures at fixed sextupole configurations.

• Position, among all the sextupoles, of the SF and SD to be varied:

JF **JD** (in this order!)

where:
JF : is the sequential number of the first SF sextupole (ex. 1, 2....).
JD : is the sequential number of the first SD sextupole.
This line must be repeated if NS = 2, with the next SF and SD position in the lattice.

• Sextupoles arrangement in the lattice, with the same format as in input 55:

I(I4) **IDENT**(I4) **NEL**(I4) **A**(G10.6) **B**(G10.6) **RAG**(G10.6) **BL**(G10.6)

• Dynamic aperture limits:

NXMIN **NXMAX** **NZMIN** **NZMAX** **NSTEP**

where:
NXMIN : is the minimum number of horizontal sigma.
NXMAX : is the maximum number of horizontal sigma.
NZMIN : is the minimum number of vertical sigma.
NZMAX : is the maximum number of vertical sigma.
NSTEP : is the step in number of sigma (holds both for horizontal and vertical scaling).
The phase-plane limited by these variables is scanned with a NSTEP, and for each the particle initial coordinates are calculated as (see below for definitions):

$$X_{in} = NX * \sigma_x$$
$$X'_{in} = NXP * \sigma'_x + TETAC$$
$$Z_{in} = NZ * \sigma_z$$
$$Z'_{in} = NZP * \sigma'_z$$

- If IDYNA = 0, the initial NPART particle coordinates are read in the following NPART lines, as:

NX **NXP NZ** **NZP NP**

where:
NX = number of horizontal σ,
NXP = number of horizontal σ',
NZ = number of vertical σ,
NZP = number of vertical σ',
NP = number of σ_p.

4. THE OUTPUT FILE

The output file on unit 6 contains the results of the tracking. That is:
- the optical functions if IBET=1 and IPRIN=1;
- the sextupoles configuration if ICROM=1,IBET=1;
- the minimization results for the off-energy closed orbit calculation, if IDPP=1 and IPRINT=1;
- the tunes and the closed orbits vs. $\Delta p/p$, if IDPP=1;
- the efficiency, defined as the number of stable particles over the total number of tracked particles for each energy deviation;

- if only single particles are tracked, the initial particle coordinates and the tunes calculated by FFT at the last turn for the stable particles are printed. For the unstable particles a message with the last stable turn, the element where the particle was lost and its horizontal and vertical amplitudes is printed.

5. THE GRAPHIC OUTPUT FILES

Several graphic outputs are produced by the program.

On Unit 99 the dynamic aperture for each required energy is plotted.

On Unit 97 the fractional part of the horizontal tune as a function of the horizontal particle amplitude is plotted.

On Unit 98 the fractional part of the vertical tune as a function of the vertical particle amplitude is plotted.

If IDPP=1, on Unit 8 the fractional part of the horizontal and vertical tunes as a function of the energy deviation $\Delta p/p$ are plotted on the same scale.

If IDYNA=0, on Unit 11 the (x, x') phase-plane diagram for all the stable particles is plotted, the same for (z, z') on Unit 22 and for (x, z) on Unit 33. Then, it is recommended to track a limited (up to 6) number of single particles for one energy (NEN=1), or if NEN>1 in the tracking input file 54 the particle initial coordinates must be repeated NEN times.

6. CHROMATICITY CALCULATION

When solenoids are inserted in the I.R. it is not easy to calculate the natural chromaticity, due both to the focusing and the rotation, with the optics programs. A possibility to calculate it with the DAΦNE program is to:

- set ICROM= 0,
- insert in the tracking file **all** the lattice sextupoles, included those normally left free to vary by the program, **with their strengths set to 0**, (here NSFIX must be the number of fixed sextupoles only),
- perform the tunes calculation as a function of the energy (IDPP=1) for **very small** energy deviations.

The slope of the tunes around the on-energy value is the chromaticity. In general, being this behaviour not linear, it is advisable to calculate the average value between the positive and the negative energy deviation.

REFERENCES

[1] - The KLOE design proposal.
[2] - The FI.NU.DA. design proposal.
[3] - M. Bassetti et al., "DAΦNE Interaction Region Design", presented at the 1993 Particle Accelerator Conference, Washington, May 17-20, 1993.
[4] - M. Biagini et al., "DAΦNE lattices", Technical Note, in preparation.
[5] - G. Vignola, unpublished.

APPENDIX A - INPUT FILES

A1. Command file

```
$ ASSIGN DAD15.DAT FOR099
$ ASSIGN QXD15.DAT FOR097
$ ASSIGN QZD15.DAT FOR098
$ ASSIGN XX.TOP FOR011
$ ASSIGN ZZ.TOP FOR022
$ ASSIGN XZ.TOP FOR033
$ ASSIGN NUD15.DAT FOR008
$ ASSIGN TD15.DAT FOR054
$ ASSIGN TD15.OUT FOR006
$ ASSIGN D15.DAT FOR055
$ R/NODEB DAFNE
```

A2. Tracking file

```
  D15 CON KLOE & KLOE    dati per AD
#TURN  #PART.  #SAMP.EL.  ICROM   IDPP   IBET   IPRIN  ISOL  IDYNA  ICOUP  IAUTO
 256     1       0         1      1      1       1      0     1      1      0
TYPE OF EXTR. (0=none,1=LINEAR,2=GAUSS)  SEED(5digit<60000) N.ENERGIES  NDP
          0                                    13333              3       20
SIGMAX (mm)     SIGMAX'(mrad)   SIGMAP     SIGMAZ(mm)  SIGMAZ'(mrad)  DPP (%)
 2.12132           0.          3.96D-04      .15          0.            0.01
VARIABILI PER IL NOLISY SE DPP.NE.0. : NEQ,DELTA,MXCALL,EPS,ESPF,ESPFMN,IPRINT
 4     1.0D-8   1000   1.D-24   -16.D0   -25.D0   0
VETTORE XIN (m,rad)  INNESCO PER CALCOLO ETA OFF-ENERGY
 0.001       12.5D-5   -.01    0.001    0.001
PIPE APERTURE (+-) AND CROSSING ANGLE
HORIZ(mm)   VERT(mm)  TETAC(rad)
 1000.      1000.      -12.5D-3
 # FIXED SEXT.  CROM. X   CROM. Z  #VARIABLE FAM.(SF,SD)  NVAR(IF=0 DOESN'T CALCULATE SF,SD)
   12           -9.       -20.4          2                  1
 JF     JD   =   POSITION OF SF AND SD (IN THIS ORDER!) BETWEEN SEXTUPOLES, REPETED TWICE IF NS=2
  3      2
  6      7
 POS.  # TYPE LENGHT K(m-2) OF FIXED SEXTUPOLES
  82   1   7 .0       1.
 172   4   8 .0       0.0
 189   5   8 .0       0.0
 279   8   7 .0       1.
 445   9   8 .0       3.0
 453  10   7 .0       8.3
 522  11   8 .0       5.9
 530  12   7 .0       .0
 551  13   7 .0       .0
 559  14   8 .0       5.9
 628  15   7 .0       8.3
 636  16   8 .0       3.0
DYNAMIC APERTURE LIMITS : NXMIN,NXMAX,NZMIN,NZMAX,NSTEP
 -15    15      0       10    1
PARTICLE COORDINATES (NX,NXP,NZ,NZP,NP)
 1      0      0      0     0
 2      0      0      0     0
 3      0      0      0     0
 4      0      0      0     0
 5      0      0      0     0
```

A3. Lattice file

```
     KLOE & KLOE (D15)
# OF ELEMENTS  ----  # OF FAMILIES  -----  # OF CONDITIONS     (FREE FORMAT)
 719    8    4
# OF PERIODS  -----  NM1,NM2.....NM10( MATCHING POINTS)        (11 DATA F.F.)
   1      218 0 0 0   0 0    0    0  0  0  0  0  0  0  0  0  0  0
ENERGY(MeV) -----TRANSPORT(0=NO,1=YES)-----ACCURACY              (3 DATA F.F.)
  510.                      0.                1.d+17
PAR FLAG (0/1) -- SYMFLAG(0=NO,1=YES) --SCREENFLAG(0/1) -- DISPERS MULTIPLIER
  0                  0                    0                      1.
IDENTIFIERS OF VARIABLES (MUST BE = # OF CONDITIONS)             (FREE FORMAT)
103 105 108 110  319 321 323 325
     QxW           QzW
     5.15          6.18
CORRECTED CHROMATICITIES(CRXCOR,CRZCOR)
      0       0
FIT CHROMATICITIES and EMITTANCE ( CRXW,CRZW,EMW  --- when used)
-9.1  -4.1              1.D-06
RF RELATED PARAMETERS ( MUST BE OK WHEN  PAR-FLAG=1)
 I(mA) - COUPL - VRF(KV) - RF HARMONIC - HOR APERT(m) - VERT AP(m) - Z/n(Ohm)
  43.75     .01       254.        120             .04           .03          2
ADDITONAL CONSTANTS:
BX0     BZ0   ETA0W   ETAP0    ALFAX0    ALFAZ0          --> new
4.5     .045     0.      0.       0.        0.
BX1          BZ1          ETA1W                BX2          BZ2       ETA2w
5.7           1.199             0.               10.       1.        0.
BX3          BZ3          ETA3W                BX4          BZ4       ETA4w
 -.66         -.66              1                  1            1         1
BX5          BZ5          ETA5W                BX6          BZ6       ETA6w
 1             1                 1                 1            1         1
BX7          BZ7          ETA7W                ETAZi        DETAZi    ETA8w
 0             0                 0                 0            0         0
BXi          BZi          ETAXi                AXi          AZi       DETAXi
 4.5           .045              0.                0.             0.      0.
ALCOST(# 0)      FRFW
  1.22e-2          0
xxxx
xxxxx
xxxx
 CELL INPUT : FORMAT(3I4-4G(10.6)    (FOLLOW THE FIELD INDICATOR)
iiiijjjjiiiiLLLLLLLLLLKKKKKKKKKKRRRRRRRRRRFFFFFFFFFF
   1       14 .46                      .6          1.
   2       14 .01                      .6          1.
   3       12 .0         .069679270 -.1042305      1.
   4       14 .02                      .6          1.
   5       12 .0         .069679270 -.1042305      1.
   6       14 .02                      .6          1.
   7       12 .0         .069679270 -.1042305      1.
   8       14 .02                      .6          1.
   9       12 .0         .069679270 -.1042305      1.
  10       14 .02                      .6          1.
  11       12 .0         .069679270 -.1042305      1.
  12       14 .02                      .6          1.
  13       12 .0         .069679270 -.1042305      1.
  14       14 .02                      .6          1.
  15       12 .0         .069679270 -.1042305      1.
  16       14 .02                      .6          1.
  17       12 .0         .069679270 -.1042305      1.
  18       14 .02                      .6          1.
  19       12 .0         .069679270 -.1042305      1.
  20       14 .02                      .6          1.
  21       12 .0         .069679270 -.1042305      1.
  22       14 .01                      .6          1.
  23       14 .17                      .6          1.
  24       14 .0175                    .6          1.
  25       13 .0         .2117246    -.1768889     1.
  26       14 .035                     .6          1.
```

```
27       13 .0        .2117246    -.1768889   1.
28       14 .035                   .6          1.
29       13 .0        .2117246    -.1768889   1.
30       14 .035                   .6          1.
31       13 .0        .2117246    -.1768889   1.
32       14 .035                   .6          1.
33       13 .0        .2117246    -.1768889   1.
34       14 .035                   .6          1.
35       13 .0        .2117246    -.1768889   1.
36       14 .035                   .6          1.
37       13 .0        .2117246    -.1768889   1.
38       14 .035                   .6          1.
39       13 .0        .2117246    -.1768889   1.
40       14 .035                   .6          1.
41       13 .0        .2117246    -.1768889   1.
42       14 .035                   .6          1.
43       13 .0        .2117246    -.1768889   1.
44       14 .0175                  .6          1.
45       14 .15                    .6          1.
46       14 .0135                  .6          1.
47       12 .0        .08372863   -.2537126   1.
48       14 .027                   .6          1.
49       12 .0        .08372863   -.2537126   1.
50       14 .027                   .6          1.
51       12 .0        .08372863   -.2537126   1.
52       14 .027                   .6          1.
53       12 .0        .08372863   -.2537126   1.
54       14 .027                   .6          1.
55       12 .0        .08372863   -.2537126   1.
56       14 .027                   .6          1.
57       12 .0        .08372863   -.2537126   1.
58       14 .027                   .6          1.
59       12 .0        .08372863   -.2537126   1.
60       14 .027                   .6          1.
61       12 .0        .08372863   -.2537126   1.
62       14 .027                   .6          1.
63       12 .0        .08372863   -.2537126   1.
64       14 .027                   .6          1.
65       12 .0        .08372863   -.2537126   1.
66       14 .0135                  .6          1.
67       14 .35                    .6          1.
68       14  .3                    .3          1.
69        1  1.205                             1.
70       14 .3                    -.74381854   1.
71       14 .54                   -1.4876371   1.
72       14 .3                    -.74381854   1.
73        1 .455                               1.
74       16 .05875    .004375
75       17 .035      .020
76        4 1.45                  +9.4954552
77        1 .375
78        1 .25
79        1 .375
80        2 .3        1.5877255
81        1 .2
82   1    7 .0        0.
83        1 .2
84        3 .3        2.6259437
85        1 .3
86        1 .3
87        2 .3        .55945964
88        1 .80
89        4.99                    1.4005635
90        1 0.6
91        3 .30       1.7513375
92        1 .2
```

```
 93   2   7 .0        0.
 94       1 .4
 95       2 .3        2.2700186
 96       1 .6
 97       6           1.217382   1.888884
 98       4.08026743             +1.888884
 99       6           1.217382   1.888884
100       6           1.217382   0.944442
101       4.040133715            +0.944442
102       6           1.217382   0.944442
103       6           1.217382   1.888884
104       4.08026743             +1.888884
105       6           1.217382   1.888884
106       6           1.217382   1.888884
107       4.08026743             -1.888884
108       6           1.217382   1.888884
109       6           4.869526   0.944442
110       4.16053486             -0.944442
111       6           4.869526   0.944442
112       6           1.217382   1.888884
113       4.08026743             -1.888884
114       6           1.217382   1.888884
115       6           1.217382   1.888884
116       4.08026743             +1.888884
117       6           1.217382   1.888884
118       6           4.869526   0.944442
119       4.16053486             +0.944442
120       6           4.869526   0.944442
121       6           1.217382   1.888884
122       4.08026743             +1.888884
123       6           1.217382   1.888884
124       6           1.217382   1.888884
125       4.08026743             -1.888884
126       6           1.217382   1.888884
127       6           4.869526   0.944442
128       4.08026743             -0.944442
129       4.08026743             -0.944442
130       6           4.869526   0.944442
131       6           1.217382   1.888884
132       4.08026743             -1.888884
133       6           1.217382   1.888884
134       6           1.217382   1.888884
135       4.08026743             +1.888884
136       6           1.217382   1.888884
137       6           4.869526   0.944442
138       4.16053486             +0.944442
139       6           4.869526   0.944442
140       6           1.217382   1.888884
141       4.08026743             +1.888884
142       6           1.217382   1.888884
143       6           1.217382   1.888884
144       4.08026743             -1.888884
145       6           1.217382   1.888884
146       6           4.869526   0.944442
147       4.16053486             -0.944442
148       6           4.869526   0.944442
149       6           1.217382   1.888884
150       4.08026743             -1.888884
151       6           1.217382   1.888884
152       6           1.217382   1.888884
153       4.08026743             +1.888884
154       6           1.217382   1.888884
155       6           1.217382   0.944442
156       4.040133715            +0.944442
157       6           1.217382   0.944442
158       6           1.217382   1.888884
```

```
159         4.08026743              +1.888884
160         6           1.217382     1.888884
161         1 .225
162    3    8 .0
163         1 .375
164         2 .30       1.0258862
165         1 .6
166         6           20.25       1.4005635
167         4.99                    1.4005635
168         6           20.25       1.4005635
169         1 .75
170         3.30        2.0618852
171         1 .2
172    4    8 0.        0.
173         1 .2
174         2.3         3.0554795
175         1 1.11
176         1 1.11
177         3 .3        2.9834573
178         1 .2
179         1 .41419696
180         2 .15       6.3780512
181         2 .15       6.3780512
182         1 .41419696
183         1 .2
184         3 .3        2.9834573
185         1 1.11
186         1 1.11
187         2.3         3.0554795
188         1 .2
189    5    8 0.        0.
190         1 .2
191         3.30        2.0618852
192         1 .75
193         6           20.25       1.4005635
194         4.99                    1.4005635
195         6           20.25       1.4005635
196         1 .6
197         2 .30       1.0258862
198         1 .375
199    6    8 .0
200         1 .225
201         6           1.217382     1.888884
202         4.08026743              +1.888884
203         6           1.217382     1.888884
204         6           1.217382     0.944442
205         4.040133715             +0.944442
206         6           1.217382     0.944442
207         6           1.217382     1.888884
208         4.08026743              +1.888884
209         6           1.217382     1.888884
210         6           1.217382     1.888884
211         4.08026743              -1.888884
212         6           1.217382     1.888884
213         6           4.869526     0.944442
214         4.16053486              -0.944442
215         6           4.869526     0.944442
216         6           1.217382     1.888884
217         4.08026743              -1.888884
218         6           1.217382     1.888884
219         6           1.217382     1.888884
220         4.08026743              +1.888884
221         6           1.217382     1.888884
222         6           4.869526     0.944442
223         4.16053486              +0.944442
224         6           4.869526     0.944442
```

```
225        6           1.217382   1.888884
226        4.08026743             +1.888884
227        6           1.217382   1.888884
228        6           1.217382   1.888884
229        4.08026743             -1.888884
230        6           1.217382   1.888884
231        6           4.869526   0.944442
232        4.08026743             -0.944442
233        4.08026743             -0.944442
234        6           4.869526   0.944442
235        6           1.217382   1.888884
236        4.08026743             -1.888884
237        6           1.217382   1.888884
238        6           1.217382   1.888884
239        4.08026743             +1.888884
240        6           1.217382   1.888884
241        6           4.869526   0.944442
242        4.16053486             +0.944442
243        6           4.869526   0.944442
244        6           1.217382   1.888884
245        4.08026743             +1.888884
246        6           1.217382   1.888884
247        6           1.217382   1.888884
248        4.08026743             -1.888884
249        6           1.217382   1.888884
250        6           4.869526   0.944442
251        4.16053486             -0.944442
252        6           4.869526   0.944442
253        6           1.217382   1.888884
254        4.08026743             -1.888884
255        6           1.217382   1.888884
256        6           1.217382   1.888884
257        4.08026743             +1.888884
258        6           1.217382   1.888884
259        6           1.217382   0.944442
260        4.040133715            +0.944442
261        6           1.217382   0.944442
262        6           1.217382   1.888884
263        4.08026743             +1.888884
264        6           1.217382   1.888884
265        1 .6
266        2 .3        2.2700186
267        1 .4
268   7    7 .0        0.
269        1 .2
270        3 .30       1.7513375
271        1 0.6
272        4.99                   1.4005635
273        1 .80
274        2 .3        .55945964
275        1 .3
276        1 .3
277        3 .3        2.6259437
278        1 .2
279   8    7 .0        0.
280        1 .2
281        2 .3        1.5877255
282        1 .375
283        1 .25
284        1 .375
285        4 1.45                 +9.4954552
286       17 -.035      .020
287       16 -.05875    .004375
288        1 .455                            1.
289       14 .3                   -.74381854  1.
290       14 .54                  -1.4876371  1.
```

291	14	.3		-.74381854	1.
292	1	1.205			1.
293	14	.3		.3	1.
294	14	.35		.6	1.
295	14	.0135		.6	1.
296	12	.0	.08372863	.2537126	1.
297	14	.027		.6	1.
298	12	.0	.08372863	.2537126	1.
299	14	.027		.6	1.
300	12	.0	.08372863	.2537126	1.
301	14	.027		.6	1.
302	12	.0	.08372863	.2537126	1.
303	14	.027		.6	1.
304	12	.0	.08372863	.2537126	1.
305	14	.027		.6	1.
306	12	.0	.08372863	.2537126	1.
307	14	.027		.6	1.
308	12	.0	.08372863	.2537126	1.
309	14	.027		.6	1.
310	12	.0	.08372863	.2537126	1.
311	14	.027		.6	1.
312	12	.0	.08372863	.2537126	1.
313	14	.027		.6	1.
314	12	.0	.08372863	.2537126	1.
315	14	.0135		.6	1.
316	14	.15		.6	1.
317	14	.0175		.6	1.
318	13	.0	.2117246	.1768889	1.
319	14	.035		.6	1.
320	13	.0	.2117246	.1768889	1.
321	14	.035		.6	1.
322	13	.0	.2117246	.1768889	1.
323	14	.035		.6	1.
324	13	.0	.2117246	.1768889	1.
325	14	.035		.6	1.
326	13	.0	.2117246	.1768889	1.
327	14	.035		.6	1.
328	13	.0	.2117246	.1768889	1.
329	14	.035		.6	1.
330	13	.0	.2117246	.1768889	1.
331	14	.035		.6	1.
332	13	.0	.2117246	.1768889	1.
333	14	.035		.6	1.
334	13	.0	.2117246	.1768889	1.
335	14	.035		.6	1.
336	13	.0	.2117246	.1768889	1.
337	14	.0175		.6	1.
338	14	.17		.6	1.
339	14	.01		.6	1.
340	12	.0	.069679270	.1042305	1.
341	14	.02		.6	1.
342	12	.0	.069679270	.1042305	1.
343	14	.02		.6	1.
344	12	.0	.069679270	.1042305	1.
345	14	.02		.6	1.
346	12	.0	.069679270	.1042305	1.
347	14	.02		.6	1.
348	12	.0	.069679270	.1042305	1.
349	14	.02		.6	1.
350	12	.0	.069679270	.1042305	1.
351	14	.02		.6	1.
352	12	.0	.069679270	.1042305	1.
353	14	.02		.6	1.
354	12	.0	.069679270	.1042305	1.
355	14	.02		.6	1.
356	12	.0	.069679270	.1042305	1.

357	14	.02		.6	1.
358	12	.0	.069679270	.1042305	1.
359	14	.01		.6	1.
360	14	.46		.6	1.
361	16	.0	.0		
362	14	.46		.6	1.
363	14	.01		.6	1.
364	12	.0	.069679270	-.1042305	1.
365	14	.02		.6	1.
366	12	.0	.069679270	-.1042305	1.
367	14	.02		.6	1.
368	12	.0	.069679270	-.1042305	1.
369	14	.02		.6	1.
370	12	.0	.069679270	-.1042305	1.
371	14	.02		.6	1.
372	12	.0	.069679270	-.1042305	1.
373	14	.02		.6	1.
374	12	.0	.069679270	-.1042305	1.
375	14	.02		.6	1.
376	12	.0	.069679270	-.1042305	1.
377	14	.02		.6	1.
378	12	.0	.069679270	-.1042305	1.
379	14	.02		.6	1.
380	12	.0	.069679270	-.1042305	1.
381	14	.02		.6	1.
382	12	.0	.069679270	-.1042305	1.
383	14	.01		.6	1.
384	14	.17		.6	1.
385	14	.0175		.6	1.
386	13	.0	.2117246	-.1768889	1.
387	14	.035		.6	1.
388	13	.0	.2117246	-.1768889	1.
389	14	.035		.6	1.
390	13	.0	.2117246	-.1768889	1.
391	14	.035		.6	1.
392	13	.0	.2117246	-.1768889	1.
393	14	.035		.6	1.
394	13	.0	.2117246	-.1768889	1.
395	14	.035		.6	1.
396	13	.0	.2117246	-.1768889	1.
397	14	.035		.6	1.
398	13	.0	.2117246	-.1768889	1.
399	14	.035		.6	1.
400	13	.0	.2117246	-.1768889	1.
401	14	.035		.6	1.
402	13	.0	.2117246	-.1768889	1.
403	14	.035		.6	1.
404	13	.0	.2117246	-.1768889	1.
405	14	.0175		.6	1.
406	14	.15		.6	1.
407	14	.0135		.6	1.
408	12	.0	.08372863	-.2537126	1.
409	14	.027		.6	1.
410	12	.0	.08372863	-.2537126	1.
411	14	.027		.6	1.
412	12	.0	.08372863	-.2537126	1.
413	14	.027		.6	1.
414	12	.0	.08372863	-.2537126	1.
415	14	.027		.6	1.
416	12	.0	.08372863	-.2537126	1.
417	14	.027		.6	1.
418	12	.0	.08372863	-.2537126	1.
419	14	.027		.6	1.
420	12	.0	.08372863	-.2537126	1.
421	14	.027		.6	1.
422	12	.0	.08372863	-.2537126	1.

```
      14 .027                          .6          1.
      12 .0         .08372863  -.2537126          1.
      14 .027                          .6          1.
      12 .0         .08372863  -.2537126          1.
      14 .0135                         .6          1.
      14 .35                           .6          1.
      14  .3                          .3          1.
       1  1.205                                    1.
      14 .3                      -.74381854        1.
      14 .54                     -1.4876371        1.
      14 .3                      -.74381854        1.
       1 .455                                     1.
      17 -.035      -.020
      16 -.05875    -.004375
       4 1.45                    -9.4954552
       1 .375
       1 .25
       1 .375
       2 .3         .94342508
       1 .4
       3 .3         2.3339084
       1 .3
   9   7 .0
       1 .3
       2 .3         .77927344
       1 .80
       41.21                  1.4005635
       1 0.6
       3 .30        2.2490473
       1 .2
  10   7 .0
       1 .4
       2 .3         3.1697701
       1 .6
       6            1.217382   1.888884
      4.08026743              +1.888884
       6            1.217382   1.888884
       6            1.217382   0.944442
      4.040133715             +0.944442
       6            1.217382   0.944442
       6            1.217382   1.888884
      4.08026743              +1.888884
       6            1.217382   1.888884
       6            1.217382   1.888884
      4.08026743              -1.888884
       6            1.217382   1.888884
       6            4.869526   0.944442
      4.16053486              -0.944442
       6            4.869526   0.944442
       6            1.217382   1.888884
      4.08026743              -1.888884
       6            1.217382   1.888884
       6            1.217382   1.888884
      4.08026743              +1.888884
       6            1.217382   1.888884
       6            4.869526   0.944442
      4.16053486              +0.944442
       6            4.869526   0.944442
       6            1.217382   1.888884
      4.08026743              +1.888884
       6            1.217382   1.888884
       6            1.217382   1.888884
      4.08026743              -1.888884
       6           1.217382    1.888884
       6           4.869526    0.944442
      4.08026743               -0.944442
```

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491         6             1.217382     1.888884
492         4.08026743                -1.888884
493         6             1.217382     1.888884
494         6             1.217382     1.888884
495         4.08026743                +1.888884
496         6             1.217382     1.888884
497         6             4.869526     0.944442
498         4.16053486                +0.944442
499         6             4.869526     0.944442
500         6             1.217382     1.888884
501         4.08026743                +1.888884
502         6             1.217382     1.888884
503         6             1.217382     1.888884
504         4.08026743                -1.888884
505         6             1.217382     1.888884
506         6             4.869526     0.944442
507         4.16053486                -0.944442
508         6             4.869526     0.944442
509         6             1.217382     1.888884
510         4.08026743                -1.888884
511         6             1.217382     1.888884
512         6             1.217382     1.888884
513         4.08026743                +1.888884
514         6             1.217382     1.888884
515         6             1.217382     0.944442
516         4.040133715               +0.944442
517         6             1.217382     0.944442
518         6             1.217382     1.888884
519         4.08026743                +1.888884
520         6             1.217382     1.888884
521         1 .225
522  11     8 .0
523         1 .375
524         2 .30         2.0986011
525         1 .6
526         6             24.75        1.4005635
527         41.21                      1.4005635
528         6             24.75        1.4005635
529         1 1.35
530  12     7 0.          0.           -
531         1 .2
532         3 .30         1.3326668
533         1 .48
534         2 .3          4.1891137
535         1 1.34
536         1 .30
537         3 .3          3.2901483
538         1 .45
539         2 .3          2.8138162
540         11.87759151
541         11.87759151
542         2 .3          2.8138162
543         1 .45
544         3 .3          3.2901483
545         1 .3
546         1 1.34
547         2 .3          4.1891137
548         1 .48
549         3 .30         1.3326668
550         1 .2
551  13     7 0.          0.
552         1 1.35
553         6             24.75        1.4005635
554         41.21                      1.4005635
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555         6           24.75      1.4005635
556         1 .6
557         2 .30       2.0986011
558         1 .375
559   14    8 .0
560         1 .225
561         6           1.217382    1.888884
562         4.08026743              +1.888884
563         6           1.217382    1.888884
564         6           1.217382    0.944442
565         4.040133715             +0.944442
566         6           1.217382    0.944442
567         6           1.217382    1.888884
568         4.08026743              +1.888884
569         6           1.217382    1.888884
570         6           1.217382    1.888884
571         4.08026743              -1.888884
572         6           1.217382    1.888884
573         6           4.869526    0.944442
574         4.16053486              -0.944442
575         6           4.869526    0.944442
576         6           1.217382    1.888884
577         4.08026743              -1.888884
578         6           1.217382    1.888884
579         6           1.217382    1.888884
580         4.08026743              +1.888884
581         6           1.217382    1.888884
582         6           4.869526    0.944442
583         4.16053486              +0.944442
584         6           4.869526    0.944442
585         6           1.217382    1.888884
586         4.08026743              +1.888884
587         6           1.217382    1.888884
588         6           1.217382    1.888884
589         4.08026743              -1.888884
590         6           1.217382    1.888884
591         6           4.869526    0.944442
592         4.08026743              -0.944442
593         4.08026743              -0.944442
594         6           4.869526    0.944442
595         6           1.217382    1.888884
596         4.08026743              -1.888884
597         6           1.217382    1.888884
598         6           1.217382    1.888884
599         4.08026743              +1.888884
600         6           1.217382    1.888884
601         6           4.869526    0.944442
602         4.16053486              +0.944442
603         6           4.869526    0.944442
604         6           1.217382    1.888884
605         4.08026743              +1.888884
606         6           1.217382    1.888884
607         6           1.217382    1.888884
608         4.08026743              -1.888884
609         6           1.217382    1.888884
610         6           4.869526    0.944442
611         4.16053486              -0.944442
612         6           4.869526    0.944442
613         6           1.217382    1.888884
614         4.08026743              -1.888884
615         6           1.217382    1.888884
616         6           1.217382    1.888884
617         4.08026743              +1.888884
618         6           1.217382    1.888884
619         6           1.217382    0.944442
620         4.040133715             +0.944442
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621         6           1.217382    0.944442
622         6           1.217382    1.888884
623         4.08026743              +1.888884
624         6           1.217382    1.888884
625         1 .6
626         2 .3        3.1697701
627         1 .4
628  15     7 .0
629         1 .2
630         3 .30       2.2490473
631         1 0.6
632         41.21                   1.4005635
633         1 .80
634         2 .3        .77927344
635         1 .3
636  16     7 .0
637         1 .3
638         3 .3        2.3339084
639         1 .4
640         2 .3        .94342508
641         1 .375
642         1 .25
643         1 .375
644         4 1.45                  -9.4954552
645        17 .035      -.020
646        16 .05875    -.004375
647         1 .455                                  1.
648        14 .3                    -.74381854      1.
649        14 .54                   -1.4876371      1.
650        14 .3                    -.74381854      1.
651         1  1.205                                1.
652        14  .3                      .3           1.
653        14 .35                      .6           1.
654        14 .0135                    .6           1.
655        12 .0        .08372863      .2537126     1.
656        14 .027                     .6           1.
657        12 .0        .08372863      .2537126     1.
658        14 .027                     .6           1.
659        12 .0        .08372863      .2537126     1.
660        14 .027                     .6           1.
661        12 .0        .08372863      .2537126     1.
662        14 .027                     .6           1.
663        12 .0        .08372863      .2537126     1.
664        14 .027                     .6           1.
665        12 .0        .08372863      .2537126     1.
666        14 .027                     .6           1.
667        12 .0        .08372863      .2537126     1.
668        14 .027                     .6           1.
669        12 .0        .08372863      .2537126     1.
670        14 .027                     .6           1.
671        12 .0        .08372863      .2537126     1.
672        14 .027                     .6           1.
673        12 .0        .08372863      .2537126     1.
674        14 .0135                    .6           1.
675        14 .15                      .6           1.
676        14 .0175                    .6           1.
677        13 .0        .2117246       .1768889     1.
678        14 .035                     .6           1.
679        13 .0        .2117246       .1768889     1.
680        14 .035                     .6           1.
681        13 .0        .2117246       .1768889     1.
682        14 .035                     .6           1.
683        13 .0        .2117246       .1768889     1.
684        14 .035                     .6           1.
685        13 .0        .2117246       .1768889     1.
686        14 .035                     .6           1.
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687	13 .0	.2117246	.1768889	1.
688	14 .035		.6	1.
689	13 .0	.2117246	.1768889	1.
690	14 .035		.6	1.
691	13 .0	.2117246	.1768889	1.
692	14 .035		.6	1.
693	13 .0	.2117246	.1768889	1.
694	14 .035		.6	1.
695	13 .0	.2117246	.1768889	1.
696	14 .0175		.6	1.
697	14 .17		.6	1.
698	14 .01		.6	1.
699	12 .0	.069679270	.1042305	1.
700	14 .02		.6	1.
701	12 .0	.069679270	.1042305	1.
702	14 .02		.6	1.
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704	14 .02		.6	1.
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706	14 .02		.6	1.
707	12 .0	.069679270	.1042305	1.
708	14 .02		.6	1.
709	12 .0	.069679270	.1042305	1.
710	14 .02		.6	1.
711	12 .0	.069679270	.1042305	1.
712	14 .02		.6	1.
713	12 .0	.069679270	.1042305	1.
714	14 .02		.6	1.
715	12 .0	.069679270	.1042305	1.
716	14 .02		.6	1.
717	12 .0	.069679270	.1042305	1.
718	14 .01		.6	1.
719	14 .46		.6	1.

APPENDIX B - OUTPUT FILE

CROMATISMO NATURALE: CX= -9.0890 CZ = -25.4800

CROMATISMO CON I SOLI SESTUPOLI FISSI: CX= -0.5351 CZ = -10.2288

CROMATISMO CON TUTTI I SESTUPOLI: CX= 0.0000 CZ = -0.0002

HF= 5.9894 m-2 HD= -0.4204 m-2

NEL	NSEX	TYP	BETAX	BETAZ	ETAX	QX	QZ	K2(m-2)
82	1	7	5.770	11.487	0.371	0.184	0.667	-1.000
93	2	7	1.630	4.420	1.069	0.362	0.738	-0.420
142	3	8	4.207	1.269	1.136	0.694	1.160	5.989
172	4	8	11.832	4.230	0.000	0.777	1.310	0.000
189	5	8	11.832	4.230	0.000	1.560	1.764	0.000
199	6	8	4.207	1.269	1.136	1.643	1.924	5.989
268	7	7	1.638	4.428	1.069	1.956	2.337	-0.420
279	8	7	5.770	11.486	0.371	2.153	2.408	-1.000
445	9	8	7.353	11.969	-0.585	2.541	3.751	3.000
493	10	7	1.196	5.553	1.049	2.665	3.814	-0.300
522	11	8	10.332	1.269	1.200	3.066	4.225	5.900
530	12	7	0.769	0.459	0.000	3.266	4.267	0.000
551	13	7	0.769	0.459	0.000	4.252	4.858	0.000
559	14	8	10.332	1.269	1.200	4.451	4.999	5.900
628	15	7	1.196	5.552	1.049	4.852	5.489	-0.300
634	16	8	7.353	11.967	-0.585	4.974	5.473	3.000

DP/P	X-CO	XP-CO	Z-CO	ZP-CO
-0.0100	0.46884E-02	-0.12833E-01	-0.11435E-05	0.22728E-02
-0.0090	0.41341E-02	-0.12750E-01	-0.19491E-05	0.13001E-02
-0.0080	0.35985E-02	-0.12691E-01	-0.21001E-05	0.89851E-03
-0.0070	0.30771E-02	-0.12634E-01	-0.21483E-05	0.51136E-03
-0.0060	0.25679E-02	-0.12587E-01	-0.19739E-05	0.32678E-03
-0.0050	0.20721E-02	-0.12550E-01	-0.17153E-05	0.19411E-03
-0.0040	0.15934E-02	-0.12524E-01	-0.14064E-05	0.10953E-03
-0.0030	0.11302E-02	-0.12507E-01	-0.10608E-05	0.54624E-04
-0.0020	0.71468E-03	-0.12498E-01	-0.71048E-06	0.21527E-04
-0.0010	0.33208E-03	-0.12494E-01	-0.36654E-06	0.47418E-05
0.0000	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
0.0010	-0.27167E-03	-0.12509E-01	0.31010E-06	0.36733E-05
0.0020	-0.47414E-03	-0.12532E-01	0.62509E-06	0.12434E-04
0.0030	-0.59966E-03	-0.12533E-01	0.92227E-06	0.21672E-04
0.0040	-0.64182E-03	-0.12547E-01	0.12037E-05	0.32320E-04
0.0050	-0.59885E-03	-0.12559E-01	0.14750E-05	0.36798E-04
0.0060	-0.45725E-03	-0.12570E-01	0.17447E-05	0.32798E-04
0.0070	-0.22423E-03	-0.12577E-01	0.20354E-05	0.16160E-04
0.0080	0.10509E-03	-0.12581E-01	0.23462E-05	-0.17996E-04
0.0090	0.53318E-03	-0.12581E-01	0.27717E-05	-0.75199E-04
0.0100	0.10564E-02	-0.12576E-01	0.33149E-05	-0.14291E-03

DP/P	QX	QZ	MU1	MU2
-0.01000	0.23113	0.08754	0.08754	0.23116
-0.00900	0.22213	0.10227	0.10214	0.22221
-0.00800	0.21421	0.11416	0.11399	0.21420
-0.00700	0.20699	0.12370	0.12357	0.20709
-0.00600	0.20074	0.13161	0.13138	0.20084
-0.00500	0.19534	0.13754	0.13745	0.19543
-0.00400	0.19077	0.14230	0.14224	0.19082
-0.00300	0.18696	0.14586	0.14580	0.18699
-0.00200	0.18393	0.14826	0.14825	0.18391
-0.00100	0.18156	0.14967	0.14967	0.18155
0.00000	0.17986	0.15016	0.15014	0.17986
0.00100	0.17887	0.14976	0.14974	0.17887
0.00200	0.17848	0.14864	0.14852	0.17849
0.00300	0.17867	0.14659	0.14656	0.17878
0.00400	0.17944	0.14395	0.14391	0.17947
0.00500	0.18074	0.14069	0.14064	0.18079
0.00600	0.18257	0.13684	0.13678	0.18262
0.00700	0.18489	0.13247	0.13240	0.18495
0.00800	0.18768	0.12762	0.12756	0.18774
0.00900	0.19091	0.12232	0.12226	0.19096
0.01000	0.19454	0.11662	0.11656	0.19459

EFFICIENCY (%) FOR DP/P= -1.000000000000000E-02 IS : 49.26666994191436
Xmin-max(mm) -810.5185897154185 850.5208510362740
Zmin-max(mm) -147.3242057454253 141.5819514664599
EFFICIENCY (%) FOR DP/P= 0.000000000000000E+00 IS : 82.69794446111328
Xmin-max(mm) -542.1828419088501 727.8781232277034
Zmin-max(mm) -176.8093386462028 82.31462275162967
EFFICIENCY (%) FOR DP/P= 1.000000000000000E-02 IS : 74.78005981465323
Xmin-max(mm) -586.7371266212646 836.7161766163135
Zmin-max(mm) -57.73063006921054 314.3101280829096

NEL	TYPE	LEN	BETAX	ALFAX	BETAZ	ALFAZ	ETAX	ETAXP	QX	QZ
0	0	0.000	4.500	0.000	0.045	0.000	0.000	0.000	0.000	0.000
1	14	0.460	4.488	-0.037	4.706	-10.110	0.000	0.000	0.016	0.235
2	14	0.470	4.487	-0.038	4.908	-10.325	0.000	0.000	0.017	0.235
3	12	0.470	4.487	0.273	4.908	-10.665	0.000	0.000	0.017	0.235
4	14	0.490	4.474	0.271	5.341	-11.225	0.000	0.000	0.017	0.235
5	12	0.490	4.474	0.581	5.341	-11.494	0.000	0.000	0.017	0.235
6	14	0.510	4.448	0.578	5.807	-11.981	0.000	0.000	0.018	0.236
7	12	0.510	4.448	0.887	5.807	-12.384	0.000	0.000	0.018	0.236
8	14	0.530	4.409	0.881	6.309	-12.903	0.000	0.000	0.019	0.237
9	12	0.530	4.409	1.187	6.309	-13.342	0.000	0.000	0.019	0.237
10	14	0.550	4.359	1.178	6.849	-13.895	0.000	0.000	0.019	0.237
11	12	0.550	4.359	1.482	6.849	-14.372	0.000	0.000	0.019	0.237
12	14	0.570	4.297	1.469	7.431	-14.963	0.000	0.000	0.020	0.237
13	12	0.570	4.297	1.768	7.431	-15.480	0.000	0.000	0.020	0.237
14	14	0.590	4.224	1.750	8.057	-16.111	0.000	0.000	0.021	0.238
15	12	0.590	4.224	2.044	8.057	-16.672	0.000	0.000	0.021	0.238
16	14	0.610	4.139	2.021	8.731	-17.346	0.000	0.000	0.022	0.238
17	12	0.610	4.139	2.309	8.731	-17.955	0.000	0.000	0.022	0.238
18	14	0.630	4.044	2.279	9.457	-18.675	0.000	0.000	0.022	0.239
19	12	0.630	4.044	2.561	9.457	-19.335	0.000	0.000	0.022	0.239
20	14	0.650	3.940	2.524	10.238	-20.105	0.000	0.000	0.023	0.239
21	12	0.650	3.940	2.799	10.238	-20.820	0.000	0.000	0.023	0.239
22	14	0.660	3.882	2.777	10.654	-21.232	0.000	0.000	0.024	0.239
23	14	0.830	2.977	2.393	18.932	-28.115	0.000	0.000	0.031	0.241
24	14	0.847	2.891	2.353	19.910	-28.809	0.000	0.000	0.032	0.241
25	13	0.847	2.891	1.748	19.910	-24.633	0.000	0.000	0.032	0.241
26	14	0.882	2.765	1.699	21.629	-25.630	0.000	0.000	0.034	0.241
27	13	0.882	2.765	1.119	21.629	-21.082	0.000	0.000	0.034	0.241
28	14	0.917	2.683	1.092	23.084	-21.738	0.000	0.000	0.036	0.242
29	13	0.917	2.683	0.528	23.084	-16.876	0.000	0.000	0.036	0.242
30	14	0.952	2.641	0.514	24.230	-17.251	0.000	0.000	0.038	0.242
31	13	0.952	2.641	-0.043	24.230	-12.138	0.000	0.000	0.038	0.242
32	14	0.987	2.639	-0.052	25.033	-12.302	0.000	0.000	0.040	0.242
33	13	0.987	2.639	-0.610	25.033	-7.610	0.000	0.000	0.040	0.242
34	14	1.022	2.676	-0.623	25.469	-7.041	0.000	0.000	0.042	0.242
35	13	1.022	2.676	-1.190	25.469	-1.646	0.000	0.000	0.042	0.242
36	14	1.057	2.754	-1.214	25.526	-1.623	0.000	0.000	0.044	0.242
37	13	1.057	2.754	-1.799	25.526	3.794	0.000	0.000	0.044	0.242
38	14	1.092	2.875	-1.844	25.202	3.788	0.000	0.000	0.046	0.243
39	13	1.092	2.875	-2.457	25.202	9.147	0.000	0.000	0.046	0.243
40	14	1.127	3.042	-2.532	24.506	9.032	0.000	0.000	0.048	0.243
41	13	1.127	3.042	-3.181	24.506	14.253	0.000	0.000	0.048	0.243
42	14	1.162	3.261	-3.296	23.459	13.951	0.000	0.000	0.050	0.243
43	13	1.162	3.261	-3.994	23.459	18.960	0.000	0.000	0.050	0.243
44	14	1.180	3.398	-4.077	22.771	18.680	0.000	0.000	0.051	0.243
45	14	1.330	4.678	-4.774	17.297	16.266	0.000	0.000	0.056	0.244
46	14	1.343	4.802	-4.835	16.842	16.047	0.000	0.000	0.057	0.244
47	12	1.343	4.802	-4.436	16.842	14.653	0.000	0.000	0.057	0.244
48	14	1.370	5.033	-4.537	16.023	14.289	0.000	0.000	0.058	0.245
49	12	1.370	5.033	-4.119	16.023	12.959	0.000	0.000	0.058	0.245
50	14	1.397	5.246	-4.200	15.295	12.658	0.000	0.000	0.058	0.245
51	12	1.397	5.246	-3.763	15.295	11.385	0.000	0.000	0.058	0.245
52	14	1.424	5.438	-3.827	14.651	11.141	0.000	0.000	0.059	0.245
53	12	1.424	5.438	-3.373	14.651	9.919	0.000	0.000	0.059	0.245
54	14	1.451	5.608	-3.421	14.086	9.725	0.000	0.000	0.060	0.246
55	12	1.451	5.608	-2.951	14.086	8.547	0.000	0.000	0.060	0.246
56	14	1.478	5.754	-2.986	13.594	8.396	0.000	0.000	0.061	0.246
57	12	1.478	5.754	-2.503	13.594	7.256	0.000	0.000	0.061	0.246
58	14	1.505	5.875	-2.525	13.172	7.143	0.000	0.000	0.061	0.246
59	12	1.505	5.875	-2.031	13.172	6.036	0.000	0.000	0.061	0.246
60	14	1.532	5.970	-2.044	12.816	5.955	0.000	0.000	0.062	0.246
61	12	1.532	5.970	-1.540	12.816	4.875	0.000	0.000	0.062	0.246
62	14	1.559	6.037	-1.546	12.519	4.822	0.000	0.000	0.063	0.247

63	12	1.559	6.037	-1.036	12.519	3.763	0.000	0.000	0.063	0.247
64	14	1.586	6.077	-1.037	12.284	3.732	0.000	0.000	0.063	0.247
65	12	1.586	6.077	-0.522	12.284	2.691	0.000	0.000	0.063	0.247
66	14	1.600	6.083	-0.521	12.195	2.683	0.000	0.000	0.064	0.247
67	14	1.950	6.196	-0.495	9.954	2.465	0.000	0.000	0.072	0.252
68	14	2.250	6.378	-0.520	8.365	2.234	0.000	0.000	0.078	0.256
69	1	3.455	7.865	-0.715	3.979	1.406	0.000	0.000	0.102	0.286
70	14	3.755	8.660	-0.674	3.332	1.303	0.000	0.000	0.107	0.297
71	14	4.295	9.752	0.200	2.196	1.198	0.000	0.000	0.116	0.327
72	14	4.595	9.642	0.308	1.576	0.892	0.000	0.000	0.121	0.353
73	1	5.050	9.385	0.256	1.000	0.374	0.000	0.000	0.129	0.412
74	16	5.050	9.385	0.256	1.000	0.374	0.000	0.000	0.129	0.412
75	17	5.050	9.385	0.256	1.000	0.374	0.035	0.020	0.129	0.412
76	4	6.500	8.674	0.231	2.312	-1.279	0.174	0.171	0.154	0.613
77	1	6.875	8.518	0.185	3.432	-1.706	0.238	0.171	0.161	0.635
78	1	7.125	8.433	0.155	4.356	-1.991	0.281	0.171	0.166	0.645
79	1	7.500	8.334	0.109	6.010	-2.419	0.345	0.171	0.173	0.657
80	2	7.800	7.150	3.649	8.611	-6.662	0.371	-0.001	0.179	0.663
81	1	8.000	5.770	3.248	11.487	-7.716	0.371	-0.001	0.184	0.667
82	7	8.000	5.770	3.248	11.487	-7.716	0.371	-0.001	0.184	0.667
83	1	8.200	4.551	2.848	14.784	-8.770	0.371	-0.001	0.190	0.669
84	3	8.500	3.918	-0.574	16.486	3.612	0.415	0.302	0.202	0.672
85	1	8.800	4.293	-0.676	14.376	3.356	0.505	0.302	0.214	0.675
86	1	9.100	4.729	-0.777	12.439	3.100	0.596	0.302	0.226	0.679
87	2	9.400	4.975	-0.032	11.231	0.994	0.671	0.195	0.234	0.683
88	1	10.200	5.155	-0.192	9.753	0.853	0.827	0.195	0.259	0.695
89	4	11.190	3.413	1.648	8.238	0.677	1.142	0.414	0.294	0.713
90	1	11.790	1.827	0.995	7.489	0.571	1.391	0.414	0.315	0.725
91	3	12.090	1.572	-0.101	6.677	3.887	1.629	1.198	0.362	0.732
92	1	12.290	1.638	-0.229	4.628	3.357	1.869	1.198	0.382	0.738
93	7	12.290	1.638	-0.229	4.628	3.357	1.869	1.198	0.382	0.738
94	1	12.690	1.925	-0.486	2.367	2.296	2.348	1.198	0.418	0.757
95	2	12.990	1.865	0.671	1.566	0.552	2.459	-0.468	0.442	0.783
96	1	13.590	1.340	0.204	1.204	0.052	2.179	-0.468	0.504	0.855
97	6	13.590	1.340	0.189	1.204	0.066	2.179	-0.443	0.504	0.855
98	4	13.670	1.312	0.157	1.199	-0.001	2.143	-0.449	0.514	0.865
99	6	13.670	1.312	0.142	1.199	0.012	2.143	-0.425	0.514	0.865
100	6	13.670	1.312	0.113	1.199	0.039	2.143	-0.377	0.514	0.865
101	4	13.710	1.302	0.140	1.197	0.006	2.127	-0.431	0.519	0.871
102	6	13.710	1.302	0.111	1.197	0.033	2.127	-0.383	0.519	0.871
103	6	13.710	1.302	0.096	1.197	0.046	2.127	-0.359	0.519	0.871
104	4	13.791	1.289	0.063	1.195	-0.021	2.098	-0.364	0.529	0.881
105	6	13.791	1.289	0.049	1.195	-0.008	2.098	-0.340	0.529	0.881
106	6	13.791	1.289	0.034	1.195	0.006	2.098	-0.317	0.529	0.881
107	4	13.871	1.286	0.001	1.199	-0.063	2.069	-0.406	0.539	0.892
108	6	13.871	1.286	-0.014	1.199	-0.048	2.069	-0.383	0.539	0.892
109	6	13.871	1.286	-0.130	1.199	0.060	2.069	-0.196	0.539	0.892
110	4	14.031	1.311	-0.020	1.201	-0.074	1.994	-0.733	0.558	0.913
111	6	14.031	1.311	-0.138	1.201	0.034	1.994	-0.553	0.558	0.913
112	6	14.031	1.311	-0.153	1.201	0.048	1.994	-0.531	0.558	0.913
113	4	14.112	1.338	-0.185	1.199	-0.019	1.948	-0.618	0.568	0.924
114	6	14.112	1.338	-0.200	1.199	-0.006	1.948	-0.596	0.568	0.924
115	6	14.112	1.338	-0.216	1.199	0.008	1.948	-0.574	0.568	0.924
116	4	14.192	1.375	-0.247	1.203	-0.059	1.902	-0.575	0.577	0.935
117	6	14.192	1.375	-0.263	1.203	-0.046	1.902	-0.553	0.577	0.935
118	6	14.192	1.375	-0.387	1.203	0.063	1.902	-0.382	0.577	0.935
119	4	14.353	1.479	-0.254	1.205	-0.071	1.827	-0.548	0.595	0.956
120	6	14.353	1.479	-0.387	1.205	0.038	1.827	-0.383	0.595	0.956
121	6	14.353	1.479	-0.404	1.205	0.051	1.827	-0.362	0.595	0.956
122	4	14.433	1.546	-0.432	1.202	-0.016	1.798	-0.361	0.604	0.967
123	6	14.433	1.546	-0.449	1.202	-0.002	1.798	-0.340	0.604	0.967
124	6	14.433	1.546	-0.467	1.202	0.011	1.798	-0.320	0.604	0.967
125	4	14.513	1.623	-0.494	1.205	-0.055	1.769	-0.403	0.612	0.977
126	6	14.513	1.623	-0.512	1.205	-0.042	1.769	-0.383	0.612	0.977
127	6	14.513	1.623	-0.658	1.205	0.067	1.769	-0.223	0.612	0.977
128	4	14.593	1.722	-0.574	1.200	0.000	1.741	-0.466	0.619	0.988

129	4	14.674	1.807	-0.473	1.205	-0.067	1.694	-0.706	0.626	0.998
130	6	14.674	1.807	-0.636	1.205	0.042	1.694	-0.553	0.626	0.998
131	6	14.674	1.807	-0.656	1.205	0.055	1.694	-0.534	0.626	0.998
132	4	14.754	1.914	-0.677	1.202	-0.011	1.648	-0.614	0.633	1.009
133	6	14.754	1.914	-0.698	1.202	0.002	1.648	-0.596	0.633	1.009
134	6	14.754	1.914	-0.720	1.202	0.016	1.648	-0.577	0.633	1.009
135	4	14.834	2.031	-0.738	1.205	-0.051	1.602	-0.571	0.640	1.020
136	6	14.834	2.031	-0.761	1.205	-0.038	1.602	-0.553	0.640	1.020
137	6	14.834	2.031	-0.944	1.205	0.071	1.602	-0.409	0.640	1.020
138	4	14.995	2.294	-0.678	1.203	-0.063	1.527	-0.521	0.652	1.041
139	6	14.995	2.294	-0.885	1.203	0.046	1.527	-0.383	0.652	1.041
140	6	14.995	2.294	-0.911	1.203	0.059	1.527	-0.366	0.652	1.041
141	4	15.075	2.441	-0.920	1.199	-0.008	1.498	-0.367	0.657	1.052
142	6	15.075	2.441	-0.947	1.199	0.006	1.498	-0.340	0.657	1.052
143	6	15.075	2.441	-0.975	1.199	0.019	1.498	-0.325	0.657	1.052
144	4	15.155	2.598	-0.981	1.202	-0.048	1.469	-0.399	0.662	1.062
145	6	15.155	2.598	-1.010	1.202	-0.034	1.469	-0.383	0.662	1.062
146	6	15.155	2.598	-1.244	1.202	0.074	1.469	-0.250	0.662	1.062
147	4	15.316	2.940	-0.869	1.199	-0.060	1.394	-0.679	0.671	1.084
148	6	15.316	2.940	-1.134	1.199	0.048	1.394	-0.553	0.671	1.084
149	6	15.316	2.940	-1.167	1.199	0.062	1.394	-0.537	0.671	1.084
150	4	15.396	3.127	-1.161	1.195	-0.006	1.348	-0.611	0.676	1.094
151	6	15.396	3.127	-1.196	1.195	0.008	1.348	-0.596	0.676	1.094
152	6	15.396	3.127	-1.232	1.195	0.021	1.348	-0.581	0.676	1.094
153	4	15.476	3.324	-1.221	1.197	-0.046	1.302	-0.568	0.679	1.105
154	6	15.476	3.324	-1.259	1.197	-0.033	1.302	-0.553	0.679	1.105
155	6	15.476	3.324	-1.334	1.197	-0.006	1.302	-0.524	0.679	1.105
156	4	15.516	3.427	-1.213	1.199	-0.039	1.281	-0.540	0.681	1.110
157	6	15.516	3.427	-1.290	1.199	-0.012	1.281	-0.511	0.681	1.110
158	6	15.516	3.427	-1.329	1.199	0.001	1.281	-0.496	0.681	1.110
159	4	15.597	3.639	-1.312	1.204	-0.066	1.241	-0.482	0.685	1.121
160	6	15.597	3.639	-1.352	1.204	-0.052	1.241	-0.468	0.685	1.121
161	1	15.822	4.287	-1.527	1.269	-0.240	1.136	-0.468	0.694	1.150
162	8	15.822	4.287	-1.527	1.269	-0.240	1.136	-0.468	0.694	1.150
163	1	16.197	5.542	-1.819	1.566	-0.552	0.961	-0.468	0.706	1.193
164	2	16.497	6.139	-0.110	2.144	-1.435	0.778	-0.738	0.716	1.220
165	1	17.097	6.330	-0.209	4.380	-2.291	0.336	-0.738	0.730	1.251
166	6	17.097	6.330	-1.876	4.380	-1.137	0.336	-0.649	0.730	1.251
167	4	18.087	6.847	1.445	7.144	-1.655	0.000	0.000	0.752	1.279
168	6	18.087	6.847	-0.359	7.144	0.227	0.000	0.000	0.752	1.279
169	1	18.837	7.478	-0.483	6.887	0.116	0.000	0.000	0.768	1.296
170	3	19.137	9.296	-5.948	5.637	3.789	0.000	0.000	0.774	1.304
171	1	19.337	11.832	-6.731	4.230	3.244	0.000	0.000	0.777	1.310
172	8	19.337	11.832	-6.731	4.230	3.444	0.000	0.000	0.777	1.310
173	1	19.537	14.681	-7.514	3.042	2.699	0.000	0.000	0.780	1.319
174	2	19.837	15.047	6.405	2.293	0.021	0.000	0.000	0.783	1.338
175	1	20.967	4.269	3.305	2.783	-0.463	0.000	0.000	0.805	1.410
176	1	22.057	0.373	0.205	4.349	-0.947	0.000	0.000	0.976	1.462
177	3	22.357	0.611	-1.068	3.790	2.641	0.000	0.000	1.090	1.473
178	1	22.557	1.179	-1.769	2.818	2.220	0.000	0.000	1.128	1.483
179	1	22.971	3.245	-3.220	1.340	1.348	0.000	0.000	1.162	1.517
180	2	23.121	3.752	0.000	1.146	0.000	0.000	0.000	1.169	1.537
181	2	23.271	3.245	3.220	1.340	-1.349	0.000	0.000	1.175	1.557
182	1	23.685	1.178	1.769	2.818	-2.220	0.000	0.000	1.209	1.591
183	1	23.885	0.611	1.068	3.790	-2.641	0.000	0.000	1.247	1.601
184	3	24.185	0.373	-0.205	4.349	0.947	0.000	0.000	1.361	1.612
185	1	25.295	4.269	-3.305	2.783	0.463	0.000	0.000	1.532	1.664
186	1	26.405	15.048	-6.405	2.293	-0.021	0.000	0.000	1.554	1.736
187	2	26.705	14.681	7.514	3.042	-2.699	0.000	0.000	1.558	1.755
188	1	26.905	11.832	6.731	4.230	-3.244	0.000	0.000	1.560	1.764
189	8	26.905	11.832	6.731	4.230	-3.244	0.000	0.000	1.560	1.764
190	1	27.105	9.296	5.948	5.637	-3.789	0.000	0.000	1.562	1.771
191	3	27.405	7.478	0.483	6.887	-0.116	0.000	0.000	1.569	1.778
192	1	28.155	6.847	0.359	7.144	-0.227	0.000	0.000	1.586	1.795
193	6	28.155	6.847	-1.445	7.144	1.655	0.000	0.000	1.586	1.795
194	4	29.145	6.330	1.876	4.380	1.137	0.336	0.649	1.608	1.823

195	6	29.145	6.330	0.209	4.380	2.291	0.336	0.738	1.608	1.823
196	1	29.745	6.139	0.110	2.144	1.435	0.778	0.738	1.623	1.855
197	2	30.045	5.542	1.819	1.566	0.552	0.961	0.468	1.631	1.881
198	1	30.420	4.287	1.527	1.269	0.240	1.136	0.468	1.643	1.924
199	8	30.420	4.287	1.527	1.269	0.240	1.136	0.468	1.643	1.924
200	1	30.645	3.639	1.353	1.204	0.052	1.241	0.468	1.652	1.953
201	6	30.645	3.639	1.312	1.204	0.066	1.241	0.482	1.652	1.953
202	4	30.725	3.427	1.329	1.199	-0.001	1.281	0.496	1.656	1.964
203	6	30.725	3.427	1.290	1.199	0.012	1.281	0.511	1.656	1.964
204	6	30.725	3.427	1.213	1.199	0.039	1.281	0.540	1.656	1.964
205	4	30.765	3.324	1.334	1.197	0.006	1.302	0.524	1.658	1.969
206	6	30.765	3.324	1.259	1.197	0.032	1.302	0.553	1.658	1.969
207	6	30.765	3.324	1.222	1.197	0.046	1.302	0.568	1.658	1.969
208	4	30.846	3.127	1.232	1.195	-0.021	1.348	0.581	1.662	1.980
209	6	30.846	3.127	1.197	1.195	-0.008	1.348	0.596	1.662	1.980
210	6	30.846	3.127	1.161	1.195	0.006	1.348	0.611	1.662	1.980
211	4	30.926	2.940	1.167	1.199	-0.062	1.394	0.537	1.666	1.991
212	6	30.926	2.940	1.134	1.199	-0.048	1.394	0.553	1.666	1.991
213	6	30.926	2.940	0.869	1.199	0.060	1.394	0.679	1.666	1.991
214	4	31.087	2.598	1.244	1.202	-0.074	1.469	0.250	1.675	2.012
215	6	31.087	2.598	1.010	1.202	0.034	1.469	0.383	1.675	2.012
216	6	31.087	2.598	0.981	1.202	0.048	1.469	0.399	1.675	2.012
217	4	31.167	2.441	0.975	1.199	-0.019	1.498	0.323	1.680	2.023
218	6	31.167	2.441	0.948	1.199	-0.006	1.498	0.340	1.680	2.023
219	6	31.167	2.441	0.920	1.199	0.008	1.498	0.357	1.680	2.023
220	4	31.247	2.294	0.911	1.203	-0.059	1.527	0.366	1.686	2.033
221	6	31.247	2.294	0.885	1.203	-0.046	1.527	0.383	1.686	2.033
222	6	31.247	2.294	0.678	1.203	0.063	1.527	0.521	1.686	2.033
223	4	31.408	2.031	0.944	1.205	-0.071	1.602	0.409	1.698	2.055
224	6	31.408	2.031	0.761	1.205	0.038	1.602	0.553	1.698	2.055
225	6	31.408	2.031	0.738	1.205	0.051	1.602	0.571	1.698	2.055
226	4	31.488	1.914	0.720	1.202	-0.016	1.648	0.577	1.704	2.065
227	6	31.488	1.914	0.699	1.202	-0.002	1.648	0.596	1.704	2.065
228	6	31.488	1.914	0.677	1.202	0.011	1.648	0.614	1.704	2.065
229	4	31.568	1.807	0.656	1.205	-0.065	1.694	0.534	1.711	2.076
230	6	31.568	1.807	0.636	1.205	-0.042	1.694	0.553	1.711	2.076
231	6	31.568	1.807	0.473	1.205	0.067	1.694	0.706	1.711	2.076
232	4	31.648	1.722	0.574	1.200	0.000	1.741	0.466	1.718	2.086
233	4	31.729	1.623	0.658	1.205	-0.067	1.769	0.223	1.726	2.097
234	6	31.729	1.623	0.512	1.205	0.042	1.769	0.383	1.726	2.097
235	6	31.729	1.623	0.494	1.205	0.055	1.769	0.403	1.726	2.097
236	4	31.809	1.546	0.467	1.202	-0.011	1.798	0.320	1.734	2.108
237	6	31.809	1.546	0.450	1.202	0.002	1.798	0.340	1.734	2.108
238	6	31.809	1.546	0.432	1.202	0.016	1.798	0.361	1.734	2.108
239	4	31.889	1.479	0.404	1.205	-0.051	1.827	0.362	1.742	2.118
240	6	31.889	1.479	0.387	1.205	-0.038	1.827	0.383	1.742	2.118
241	6	31.889	1.479	0.254	1.205	0.071	1.827	0.548	1.742	2.118
242	4	32.050	1.375	0.387	1.203	-0.063	1.902	0.362	1.760	2.140
243	6	32.050	1.375	0.263	1.203	0.046	1.902	0.553	1.760	2.140
244	6	32.050	1.375	0.247	1.203	0.059	1.902	0.575	1.760	2.140
245	4	32.130	1.338	0.216	1.199	-0.008	1.948	0.574	1.770	2.150
246	6	32.130	1.338	0.200	1.199	0.006	1.948	0.596	1.770	2.150
247	6	32.130	1.338	0.185	1.199	0.019	1.948	0.618	1.770	2.150
248	4	32.210	1.311	0.153	1.202	-0.048	1.994	0.531	1.779	2.161
249	6	32.210	1.311	0.138	1.202	-0.034	1.994	0.553	1.779	2.161
250	6	32.210	1.311	0.020	1.202	0.074	1.994	0.733	1.779	2.161
251	4	32.371	1.286	0.130	1.199	-0.060	2.069	0.196	1.799	2.182
252	6	32.371	1.286	0.014	1.199	0.048	2.069	0.383	1.799	2.182
253	6	32.371	1.286	-0.001	1.199	0.062	2.069	0.406	1.799	2.182
254	4	32.451	1.289	-0.038	1.195	-0.006	2.098	0.317	1.809	2.193
255	6	32.451	1.289	-0.049	1.195	0.008	2.098	0.340	1.809	2.193
256	6	32.451	1.289	-0.063	1.195	0.021	2.098	0.364	1.809	2.193
257	4	32.531	1.302	-0.096	1.197	-0.046	2.127	0.359	1.819	2.204
258	6	32.531	1.302	-0.111	1.197	-0.032	2.127	0.383	1.819	2.204
259	6	32.531	1.302	-0.140	1.197	-0.006	2.127	0.431	1.819	2.204
260	4	32.572	1.312	-0.113	1.199	-0.039	2.143	0.377	1.824	2.209

261	6	32.572	1.312	-0.142	1.199	-0.012	2.143	0.425	1.824	2.209
262	6	32.572	1.312	-0.157	1.199	0.001	2.143	0.449	1.824	2.209
263	6	32.652	1.340	-0.189	1.204	-0.066	2.179	0.443	1.833	2.220
264	6	32.652	1.340	-0.204	1.204	-0.052	2.179	0.468	1.833	2.220
265	1	33.252	1.865	-0.671	1.566	-0.552	2.459	0.468	1.895	2.292
266	2	33.552	1.925	0.486	2.467	-2.296	2.348	-1.198	1.930	2.317
267	1	33.952	1.638	0.229	4.628	-3.357	1.869	-1.198	1.956	2.337
268	7	33.952	1.638	0.229	4.628	-3.357	1.869	-1.198	1.956	2.337
269	1	34.152	1.572	0.101	6.077	-3.887	1.629	-1.198	1.976	2.343
270	3	34.452	1.827	-0.995	7.489	-0.571	1.391	-0.414	2.005	2.350
271	1	35.052	3.413	-1.648	8.238	-0.677	1.142	-0.414	2.043	2.362
272	4	36.042	5.156	0.192	9.753	-0.853	0.827	-0.195	2.070	2.379
273	1	36.842	4.976	0.032	11.230	-0.994	0.671	-0.195	2.103	2.391
274	2	37.142	4.729	0.777	12.438	-3.100	0.596	-0.302	2.113	2.396
275	1	37.442	4.293	0.676	14.376	-3.356	0.505	-0.302	2.124	2.399
276	1	37.742	3.918	0.574	16.465	-3.612	0.415	-0.302	2.135	2.402
277	3	38.042	4.551	-2.846	14.783	8.769	0.371	0.001	2.147	2.405
278	1	38.242	5.770	-3.248	11.486	7.715	0.371	0.001	2.153	2.408
279	7	38.242	5.770	-3.248	11.486	7.715	0.371	0.001	2.153	2.408
280	1	38.442	7.150	-3.649	8.611	6.662	0.371	0.001	2.158	2.411
281	2	38.742	8.334	-0.109	6.009	2.418	0.345	-0.171	2.164	2.418
282	1	39.117	8.433	-0.155	4.356	1.991	0.281	-0.171	2.171	2.429
283	1	39.367	8.518	-0.165	3.432	1.706	0.238	-0.171	2.176	2.440
284	1	39.742	8.674	-0.231	2.312	1.279	0.174	-0.171	2.283	2.461
285	4	41.192	9.385	-0.256	1.000	-0.374	0.035	-0.020	2.209	2.662
286	17	41.192	9.385	-0.256	1.000	-0.374	0.000	0.000	2.209	2.662
287	16	41.192	9.385	-0.256	1.000	-0.374	0.000	0.000	2.209	2.662
288	1	41.647	9.641	-0.308	1.576	-0.890	0.000	0.000	2.216	2.721
289	14	41.947	9.752	-0.200	2.196	-1.198	0.000	0.000	2.221	2.747
290	14	42.487	8.659	0.674	3.432	-1.303	0.000	0.000	2.230	2.777
291	14	42.787	7.865	0.715	3.979	-1.406	0.000	0.000	2.235	2.789
292	1	43.992	6.377	0.520	8.365	-2.234	0.000	0.000	2.259	2.818
293	14	44.292	6.196	0.495	9.954	-2.465	0.000	0.000	2.266	2.822
294	14	44.642	6.082	0.521	12.194	-2.683	0.000	0.000	2.274	2.827
295	14	44.655	6.077	0.522	12.283	-2.691	0.000	0.000	2.274	2.827
296	12	44.655	6.077	1.036	12.283	-3.731	0.000	0.000	2.274	2.827
297	14	44.682	6.037	1.036	12.529	-3.765	0.000	0.000	2.275	2.828
298	12	44.682	6.037	1.546	12.519	-4.821	0.000	0.000	2.275	2.828
299	14	44.709	5.969	1.540	12.814	-4.875	0.000	0.000	2.275	2.828
300	12	44.709	5.969	2.044	12.814	-5.955	0.000	0.000	2.275	2.828
301	14	44.736	5.875	2.031	13.171	-6.036	0.000	0.000	2.276	2.828
302	12	44.736	5.875	2.525	13.171	-7.145	0.000	0.000	2.276	2.828
303	14	44.763	5.754	2.502	13.594	-7.256	0.000	0.000	2.277	2.828
304	12	44.763	5.754	2.985	13.594	-8.396	0.000	0.000	2.277	2.828
305	14	44.790	5.608	2.951	14.086	-8.546	0.000	0.000	2.277	2.829
306	12	44.790	5.608	3.421	14.086	-9.724	0.000	0.000	2.277	2.829
307	14	44.817	5.438	3.373	14.651	-9.918	0.000	0.000	2.278	2.829
308	12	44.817	5.438	3.827	14.651	-11.141	0.000	0.000	2.278	2.829
309	14	44.844	5.246	3.763	15.294	-11.385	0.000	0.000	2.279	2.829
310	12	44.844	5.246	4.200	15.294	-12.657	0.000	0.000	2.279	2.829
311	14	44.871	5.033	4.119	16.023	-12.958	0.000	0.000	2.280	2.830
312	12	44.871	5.033	4.537	16.023	-14.288	0.000	0.000	2.280	2.830
313	14	44.898	4.802	4.436	16.841	-14.652	0.000	0.000	2.281	2.830
314	12	44.898	4.802	4.834	16.841	-16.047	0.000	0.000	2.281	2.830
315	14	44.912	4.678	4.774	17.297	-16.265	0.000	0.000	2.281	2.830
316	14	45.062	3.398	4.077	22.771	-18.679	0.000	0.000	2.287	2.831
317	14	45.079	3.261	3.994	23.458	-18.959	0.000	0.000	2.288	2.831
318	13	45.079	3.261	3.296	23.458	-13.951	0.000	0.000	2.288	2.831
319	14	45.114	3.042	3.181	24.505	-14.253	0.000	0.000	2.289	2.831
320	13	45.114	3.042	2.532	24.505	-9.032	0.000	0.000	2.289	2.831
321	14	45.149	2.875	2.457	25.201	-9.147	0.000	0.000	2.291	2.832
322	13	45.149	2.875	1.844	25.201	-3.798	0.000	0.000	2.291	2.832
323	14	45.184	2.754	1.799	25.525	-3.794	0.000	0.000	2.293	2.832
324	13	45.184	2.754	1.214	25.525	1.625	0.000	0.000	2.293	2.832
325	14	45.219	2.676	1.190	25.468	1.646	0.000	0.000	2.295	2.832
326	13	45.219	2.676	0.623	25.468	7.041	0.000	0.000	2.295	2.832

327	14	45.254	2.648	0.610	25.032	7.030	0.000	0.000	2.297	2.832
328	13	45.254	2.638	0.052	25.032	12.302	0.000	0.000	2.297	2.832
329	14	45.289	2.641	0.043	24.229	12.137	0.000	0.000	2.299	2.832
330	13	45.289	2.641	-0.514	24.229	17.250	0.000	0.000	2.299	2.832
331	14	45.324	2.682	-0.528	23.083	16.876	0.000	0.000	2.301	2.833
332	13	45.324	2.682	-1.092	23.083	21.737	0.000	0.000	2.301	2.833
333	14	45.359	2.765	-1.119	21.628	21.082	0.000	0.000	2.303	2.833
334	13	45.359	2.765	-1.699	21.628	25.629	0.000	0.000	2.303	2.833
335	14	45.394	2.891	-1.748	19.909	24.632	0.000	0.000	2.305	2.833
336	13	45.394	2.891	-2.353	19.909	28.808	0.000	0.000	2.305	2.833
337	14	45.412	2.977	-2.393	18.931	28.114	0.000	0.000	2.306	2.833
338	14	45.582	3.882	-2.777	10.653	21.231	0.000	0.000	2.314	2.835
339	14	45.592	3.939	-2.799	10.237	20.819	0.000	0.000	2.314	2.835
340	12	45.592	3.939	-2.524	10.237	20.104	0.000	0.000	2.314	2.835
341	14	45.612	4.044	-2.561	9.456	19.334	0.000	0.000	2.315	2.836
342	12	45.612	4.044	-2.279	9.456	18.674	0.000	0.000	2.315	2.836
343	14	45.632	4.139	-2.309	8.731	17.954	0.000	0.000	2.316	2.836
344	12	45.632	4.139	-2.020	8.731	17.345	0.000	0.000	2.316	2.836
345	14	45.652	4.224	-2.044	8.057	16.672	0.000	0.000	2.316	2.836
346	12	45.652	4.224	-1.750	8.057	16.110	0.000	0.000	2.316	2.836
347	14	45.672	4.297	-1.768	7.431	15.479	0.000	0.000	2.317	2.837
348	12	45.672	4.297	-1.460	7.431	14.962	0.000	0.000	2.317	2.837
349	14	45.692	4.359	-1.482	6.849	14.371	0.000	0.000	2.318	2.837
350	12	45.692	4.359	-1.178	6.849	13.895	0.000	0.000	2.318	2.837
351	14	45.712	4.409	-1.187	6.309	13.341	0.000	0.000	2.319	2.838
352	12	45.712	4.409	-0.881	6.309	12.903	0.000	0.000	2.319	2.838
353	14	45.732	4.447	-0.887	5.807	12.384	0.000	0.000	2.319	2.838
354	12	45.732	4.447	-0.578	5.807	11.980	0.000	0.000	2.319	2.838
355	14	45.752	4.473	-0.581	5.341	11.493	0.000	0.000	2.320	2.839
356	12	45.752	4.473	-0.271	5.341	11.122	0.000	0.000	2.320	2.839
357	14	45.772	4.487	-0.273	4.908	10.665	0.000	0.000	2.321	2.839
358	12	45.772	4.487	0.038	4.908	10.324	0.000	0.000	2.321	2.839
359	14	45.782	4.488	0.037	4.705	10.110	0.000	0.000	2.321	2.840
360	14	46.242	4.500	0.000	0.045	0.000	0.000	0.000	2.337	3.074
361	16	46.242	4.500	0.000	0.045	0.000	0.000	0.000	2.337	3.074
362	14	46.702	4.488	-0.037	4.705	-10.110	0.000	0.000	2.354	3.309
363	14	46.712	4.487	-0.038	4.908	-10.324	0.000	0.000	2.354	3.309
364	12	46.712	4.487	0.273	4.908	-10.665	0.000	0.000	2.354	3.309
365	14	46.732	4.473	0.271	5.341	-11.122	0.000	0.000	2.355	3.310
366	12	46.732	4.473	0.581	5.341	-11.493	0.000	0.000	2.355	3.310
367	14	46.752	4.448	0.578	5.807	-11.980	0.000	0.000	2.355	3.310
368	12	46.752	4.448	0.887	5.807	-12.384	0.000	0.000	2.355	3.310
369	14	46.772	4.409	0.881	6.309	-12.903	0.000	0.000	2.356	3.311
370	12	46.772	4.409	1.187	6.309	-13.341	0.000	0.000	2.356	3.311
371	14	46.792	4.359	1.178	6.849	-13.895	0.000	0.000	2.357	3.311
372	12	46.792	4.359	1.482	6.849	-14.372	0.000	0.000	2.357	3.311
373	14	46.812	4.297	1.460	7.431	-14.962	0.000	0.000	2.358	3.312
374	12	46.812	4.297	1.768	7.431	-15.480	0.000	0.000	2.358	3.312
375	14	46.832	4.224	1.750	8.057	-16.116	0.000	0.000	2.358	3.312
376	12	46.832	4.224	2.044	8.057	-16.672	0.000	0.000	2.358	3.312
377	14	46.852	4.139	2.020	8.731	-17.345	0.000	0.000	2.359	3.313
378	12	46.852	4.139	2.309	8.731	-17.954	0.000	0.000	2.359	3.313
379	14	46.872	4.044	2.279	9.456	-18.674	0.000	0.000	2.360	3.313
380	12	46.872	4.044	2.561	9.456	-19.334	0.000	0.000	2.360	3.313
381	14	46.892	3.939	2.524	10.237	-20.104	0.000	0.000	2.361	3.313
382	12	46.892	3.939	2.799	10.237	-20.819	0.000	0.000	2.361	3.313
383	14	46.902	3.882	2.777	10.653	-21.231	0.000	0.000	2.361	3.313
384	14	47.072	2.977	2.393	18.931	-28.114	0.000	0.000	2.369	3.315
385	14	47.089	2.891	2.353	19.909	-28.808	0.000	0.000	2.370	3.315
386	13	47.089	2.891	1.747	19.909	-24.632	0.000	0.000	2.370	3.315
387	14	47.124	2.765	1.699	21.629	-25.629	0.000	0.000	2.372	3.316
388	13	47.124	2.765	1.119	21.629	-21.083	0.000	0.000	2.372	3.316
389	14	47.159	2.683	1.092	23.083	-21.737	0.000	0.000	2.374	3.316
390	13	47.159	2.683	0.528	23.083	-16.876	0.000	0.000	2.374	3.316
391	14	47.194	2.641	0.514	24.229	-17.250	0.000	0.000	2.376	3.316
392	13	47.194	2.641	-0.043	24.229	-12.137	0.000	0.000	2.376	3.316

393	14	47.229	2.639	-0.052	25.032	-12.302	0.000	0.000	2.378	3.316
394	13	47.229	2.639	-0.610	25.032	-7.009	0.000	0.000	2.378	3.316
395	14	47.264	2.676	-0.623	24.468	-7.040	0.000	0.000	2.380	3.317
396	13	47.264	2.676	-1.190	25.468	-1.646	0.000	0.000	2.380	3.417
397	14	47.299	2.754	-1.214	25.525	-1.624	0.000	0.000	2.382	3.317
398	13	47.299	2.754	-1.799	25.525	3.794	0.000	0.000	2.382	3.317
399	14	47.334	2.875	-1.844	25.201	3.788	0.000	0.000	2.384	3.317
400	13	47.334	2.875	-2.457	25.201	9.147	0.000	0.000	2.384	3.317
401	14	47.369	3.042	-2.532	24.505	9.032	0.000	0.000	2.385	3.317
402	13	47.369	3.042	-3.181	24.505	14.253	0.000	0.000	2.385	3.317
403	14	47.404	3.261	-3.296	23.459	13.952	0.000	0.000	2.387	3.317
404	13	47.404	3.261	-3.994	23.459	18.960	0.000	0.000	2.387	3.317
405	14	47.422	3.398	-4.077	22.771	18.680	0.000	0.000	2.388	3.317
406	14	47.572	4.678	-4.774	17.297	16.265	0.000	0.000	2.394	3.319
407	14	47.585	4.802	-4.835	16.841	16.047	0.000	0.000	2.394	3.319
408	12	47.585	4.802	-4.436	16.841	14.653	0.000	0.000	2.394	3.319
409	14	47.612	5.033	-4.537	16.023	14.288	0.000	0.000	2.395	3.319
410	12	47.612	5.033	-4.119	16.023	12.958	0.000	0.000	2.395	3.319
411	14	47.639	5.246	-4.200	15.295	12.658	0.000	0.000	2.396	3.319
412	12	47.639	5.246	-3.763	15.295	11.385	0.000	0.000	2.396	3.319
413	14	47.666	5.438	-3.827	14.651	11.141	0.000	0.000	2.396	3.320
414	12	47.666	5.438	-3.373	14.651	9.919	0.000	0.000	2.396	3.320
415	14	47.693	5.608	-3.421	14.086	9.725	0.000	0.000	2.397	3.320
416	12	47.693	5.608	-2.951	14.086	8.546	0.000	0.000	2.397	3.320
417	14	47.720	5.754	-2.986	13.594	8.396	0.000	0.000	2.398	3.320
418	12	47.720	5.754	-2.503	13.594	7.256	0.000	0.000	2.398	3.320
419	14	47.747	5.875	-2.525	13.171	7.145	0.000	0.000	2.399	3.320
420	12	47.747	5.875	-2.031	13.171	6.036	0.000	0.000	2.399	3.320
421	14	47.774	5.970	-2.064	12.814	5.955	0.000	0.000	2.399	3.321
422	12	47.774	5.970	-1.540	12.814	4.875	0.000	0.000	2.399	3.321
423	14	47.801	6.037	-1.546	12.519	4.821	0.000	0.000	2.400	3.321
424	12	47.801	6.037	-1.035	12.519	3.763	0.000	0.000	2.400	3.321
425	14	47.828	6.077	-1.037	12.283	3.731	0.000	0.000	2.401	3.321
426	12	47.828	6.077	-0.522	12.283	2.691	0.000	0.000	2.401	3.321
427	14	47.842	6.093	-0.521	12.194	2.684	0.000	0.000	2.401	3.322
428	14	48.192	6.196	-0.495	9.954	2.465	0.000	0.000	2.409	3.326
429	14	48.492	6.378	-0.520	8.365	2.234	0.000	0.000	2.416	3.331
430	1	49.697	7.865	-0.715	3.979	1.406	0.000	0.000	2.440	3.360
431	14	49.997	8.660	-0.674	3.431	1.103	0.000	0.000	2.445	3.372
432	14	50.537	9.753	0.200	2.196	1.198	0.000	0.000	2.455	3.402
433	14	50.837	9.642	0.308	1.576	0.892	0.000	0.000	2.458	3.427
434	1	51.292	9.385	0.256	1.000	0.374	0.000	0.000	2.466	3.486
435	17	51.292	9.385	0.256	1.000	0.374	-0.035	-0.020	2.466	3.486
436	16	51.292	9.385	0.256	1.000	0.374	-0.035	-0.020	2.466	3.486
437	4	52.742	8.674	0.231	3.312	-1.279	-0.174	-0.171	2.492	3.688
438	1	53.117	8.518	0.185	3.432	-1.706	-0.238	-0.171	2.499	3.709
439	1	53.367	8.433	0.155	4.356	-1.981	-0.281	-0.171	2.504	3.719
440	1	53.742	8.334	0.109	6.010	-2.419	-0.345	-0.171	2.510	3.731
441	2	54.042	7.595	2.284	8.175	-5.002	-0.481	-0.668	2.516	3.738
442	1	54.442	5.899	1.957	12.686	-6.275	-0.409	-0.068	2.526	3.744
443	3	54.742	5.960	-2.177	13.739	-4.045	-0.473	-0.371	2.534	3.748
444	1	55.042	7.353	-2.465	11.969	-2.821	-0.585	-0.371	2.541	3.751
445	8	55.042	7.353	-2.465	11.969	2.821	-0.595	-0.471	2.541	3.751
446	1	55.342	8.919	-2.754	10.344	2.556	-0.696	-0.371	2.547	3.756
447	2	55.642	9.968	-0.663	9.524	0.201	-0.782	-0.197	2.552	3.760
448	1	56.442	11.122	-0.729	9.273	0.133	-0.969	-0.197	2.564	3.774
449	4	57.652	5.932	3.944	4.159	-0.019	0.325	1.142	2.585	3.795
450	1	58.252	2.204	2.270	8.220	-0.086	0.256	1.142	2.612	4.805
451	3	58.552	1.397	0.601	7.530	5.334	0.747	2.508	2.640	3.811
452	1	58.752	1.196	0.406	5.453	4.552	1.049	1.508	2.665	3.816
453	7	58.752	1.196	0.406	5.553	4.552	1.049	1.508	2.665	3.816
454	1	59.152	1.027	0.016	2.537	2.987	1.052	1.508	2.724	3.833
455	2	59.452	0.832	0.569	2.566	0.552	1.853	-0.199	2.774	3.848
456	1	60.052	0.722	-0.385	1.204	0.052	1.734	-0.198	2.919	3.930
457	6	60.052	0.722	-0.394	1.204	0.066	1.734	-0.180	2.915	3.930
458	4	60.132	0.794	-0.504	1.198	-0.001	1.719	-0.176	2.941	3.941

459	6	60.132	0.794	-0.515	1.198	0.012	1.719	-0.159	3.941	3.941
460	6	60.132	0.794	-0.531	1.198	0.039	1.719	-0.118	3.941	3.941
461	4	60.172	0.838	-0.558	1.197	0.006	1.714	-0.153	3.939	3.946
462	6	60.172	0.838	-0.577	1.197	0.032	1.714	-0.114	3.939	3.946
463	6	60.172	0.838	-0.596	1.197	0.046	1.714	-0.095	3.939	3.946
464	4	60.252	0.941	-0.694	1.195	-0.021	1.707	-0.091	3.954	3.957
465	6	60.252	0.941	-0.705	1.195	-0.006	1.707	-0.072	3.954	3.957
466	6	60.252	0.941	-0.715	1.195	0.006	1.707	-0.052	3.954	3.957
467	4	60.333	1.064	-0.820	1.199	-0.062	1.699	-0.133	3.966	3.967
468	6	60.333	1.064	-0.852	1.199	-0.048	1.699	-0.114	3.966	3.967
469	6	60.333	1.064	-0.928	1.199	0.060	1.699	0.029	3.966	3.967
470	4	60.493	1.371	-0.963	1.201	-0.074	1.667	-0.435	3.988	3.989
471	6	60.493	1.371	-1.086	1.201	0.034	1.667	-0.284	3.988	3.989
472	6	60.493	1.371	-1.102	1.201	0.048	1.667	-0.266	3.988	3.989
473	4	60.574	1.555	-1.196	1.199	-0.029	1.643	-0.345	3.996	3.999
474	6	60.574	1.555	-1.214	1.199	-0.006	1.643	0.327	3.996	3.999
475	6	60.574	1.555	-1.231	1.199	0.008	1.643	-0.308	3.996	3.999
476	4	60.654	1.760	-1.322	1.203	-0.059	1.618	-0.304	4.004	4.010
477	6	60.654	1.760	-1.342	1.203	-0.046	1.618	-0.284	4.004	4.010
478	6	60.654	1.760	-1.500	1.203	0.063	1.618	-0.148	4.004	4.010
479	4	60.814	2.229	-1.395	1.205	-0.073	1.586	-0.257	4.017	4.031
480	6	60.814	2.229	-1.596	1.205	0.040	1.586	-0.114	4.017	4.031
481	6	60.814	2.229	-1.621	1.205	0.061	1.586	-0.096	4.017	4.031
482	4	60.895	2.496	-1.695	1.203	-0.016	1.579	-0.089	4.022	4.042
483	6	60.895	2.496	-1.723	1.202	-0.002	1.579	0.072	4.022	4.042
484	6	60.895	2.496	-1.751	1.202	0.011	1.579	-0.054	4.022	4.042
485	4	60.975	2.783	-1.820	1.205	-0.056	1.571	-0.132	4.027	4.053
486	6	60.975	2.783	-1.851	1.205	-0.042	1.571	-0.114	4.027	4.053
487	6	60.975	2.783	-2.102	1.205	0.067	1.571	0.028	4.027	4.053
488	4	61.055	3.111	-1.978	1.200	0.000	1.565	-0.198	4.032	4.063
489	4	61.135	3.415	-1.797	1.205	-0.067	1.560	-0.423	4.036	4.074
490	6	61.135	3.415	-2.105	1.205	0.042	1.560	-0.284	4.036	4.074
491	6	61.135	3.415	-2.144	1.205	0.055	1.560	-0.267	4.036	4.074
492	4	61.216	3.763	-2.191	1.202	-0.011	1.515	-0.344	4.039	4.084
493	6	61.216	3.763	-2.233	1.202	0.002	1.515	-0.327	4.039	4.084
494	6	61.216	3.763	-2.275	1.202	0.014	1.515	-0.310	4.039	4.084
495	4	61.296	4.131	-2.314	1.205	-0.061	1.491	-0.351	4.042	4.095
496	6	61.296	4.131	-2.360	1.205	-0.048	1.491	-0.284	4.042	4.095
497	6	61.296	4.131	-2.733	1.205	0.073	1.491	-0.130	4.042	4.095
498	4	61.456	4.926	-2.170	1.203	-0.063	1.459	-0.248	4.048	4.116
499	6	61.456	4.926	-2.619	1.203	0.046	1.459	-0.114	4.048	4.116
500	6	61.456	4.926	-2.670	1.203	0.059	1.459	0.098	4.048	4.116
501	4	61.537	5.356	-2.682	1.199	-0.008	1.451	-0.088	4.050	4.127
502	6	61.537	5.356	-2.742	1.199	0.006	1.451	-0.072	4.050	4.127
503	6	61.537	5.356	-2.803	1.199	0.019	1.451	-0.055	4.050	4.127
504	4	61.617	5.806	-2.805	1.202	-0.048	1.444	-0.130	4.053	4.138
505	6	61.617	5.806	-2.870	1.202	-0.034	1.444	-0.114	4.053	4.138
506	6	61.617	5.806	-3.394	1.202	0.074	1.444	0.018	4.053	4.138
507	4	61.778	6.764	-2.514	1.199	-0.060	1.412	0.412	4.057	4.159
508	6	61.778	6.764	-3.124	1.199	0.048	1.412	-0.284	4.057	4.159
509	6	61.778	6.764	-3.200	1.199	0.062	1.412	0.264	4.057	4.159
510	4	61.858	7.276	-3.170	1.195	-0.006	1.398	-0.340	4.059	4.170
511	6	61.858	7.276	-3.252	1.195	0.008	1.398	-0.327	4.059	4.170
512	6	61.858	7.276	-3.334	1.195	0.021	1.398	-0.311	4.059	4.170
513	4	61.938	7.808	-3.292	1.197	-0.046	1.383	-0.400	4.060	4.180
514	6	61.938	7.808	-3.379	1.197	-0.033	1.383	-0.284	4.060	4.180
515	6	61.938	7.808	-3.555	1.197	-0.006	1.383	-0.254	4.060	4.180
516	4	61.978	8.081	-3.261	1.199	-0.039	1.352	-0.272	4.061	4.186
517	6	61.978	8.081	-3.443	1.199	-0.014	1.352	-0.242	4.061	4.186
518	6	61.978	8.081	-3.534	1.199	0.001	1.352	-0.227	4.061	4.186
519	4	62.058	8.644	-3.474	1.204	-0.066	1.335	-0.214	4.063	4.196
520	6	62.058	8.644	-3.571	1.204	-0.052	1.335	-0.199	4.063	4.196
521	1	62.283	10.332	-3.829	1.269	-0.259	1.290	-0.199	5.066	4.235
522	8	62.283	10.332	-3.929	1.269	-0.249	1.290	-0.199	5.066	4.235
523	1	62.658	13.502	-4.535	1.566	-0.553	1.245	-0.199	5.071	4.268
524	2	62.958	13.629	4.130	2.335	2.171	1.044	-0.922	5.075	4.294

525	1	63.558	9.150	3.535	5.622	-3.619	0.451	-0.923	4.320
526	6	63.558	9.150	0.324	5.622	1.723	0.451	-0.760	4.320
527	4	64.768	3.549	3.092	10.990	2.548	0.000	0.000	4.344
528	6	64.768	3.549	1.924	10.990	1.069	0.000	0.000	4.344
529	1	66.118	0.769	0.136	8.459	0.806	0.000	0.000	4.367
530	7	66.118	0.769	0.136	8.459	0.806	0.000	0.000	4.367
531	1	66.318	0.767	-0.129	8.144	0.767	0.000	0.000	4.371
532	3	66.618	1.071	-0.924	6.798	3.538	0.000	0.000	4.377
533	1	67.098	2.357	-1.754	3.860	2.584	0.000	0.000	4.392
534	2	67.398	2.518	1.284	3.740	-2.134	0.000	0.000	4.400
535	1	68.738	0.966	-0.125	12.126	-0.125	0.000	0.000	4.427
536	1	69.038	1.136	-0.441	14.735	-4.570	0.000	0.000	4.440
537	3	69.338	1.931	-2.466	13.139	9.386	0.000	0.000	4.474
538	1	69.788	4.893	-4.116	6.083	6.323	0.000	0.000	4.498
539	2	70.088	6.131	0.342	3.950	1.370	0.000	0.000	4.506
540	1	71.966	5.489	0.000	1.362	0.000	0.000	0.000	4.559
541	1	73.844	6.131	-0.342	3.951	-1.379	0.000	0.000	4.611
542	2	74.144	4.893	4.116	6.084	-6.334	0.000	0.000	4.619
543	1	74.594	1.931	2.466	13.140	-9.356	0.000	0.000	4.645
544	3	74.894	1.136	0.441	14.737	4.573	0.000	0.000	4.677
545	1	75.194	0.966	0.125	12.128	4.125	0.000	0.000	4.727
546	1	76.534	2.518	-1.284	3.740	2.134	0.000	0.000	4.888
547	2	76.834	2.357	1.754	3.860	-3.584	0.000	0.000	4.896
548	1	77.314	1.071	0.924	6.798	-3.538	0.000	0.000	4.848
549	3	77.614	0.767	0.129	8.144	-0.767	0.000	0.000	4.810
550	1	77.814	0.769	-0.136	8.459	-0.806	0.000	0.000	4.858
551	7	77.814	0.769	-0.136	8.459	-0.806	0.000	0.000	4.858
552	1	79.164	3.549	-1.924	10.990	-1.069	0.000	0.000	4.880
553	6	79.164	3.549	-3.092	10.990	2.548	0.000	0.000	4.880
554	4	80.374	9.150	-0.325	5.621	1.723	0.451	0.760	4.904
555	6	80.374	9.150	-3.535	5.621	3.619	0.451	0.923	4.904
556	1	80.974	13.639	-4.130	2.335	2.171	1.044	0.923	4.942
557	2	81.274	13.502	4.525	1.566	0.552	1.215	0.199	4.946
558	1	81.649	10.332	3.929	1.269	0.239	1.290	0.199	4.951
559	8	81.649	10.332	3.939	1.269	0.239	1.290	0.199	4.951
560	1	81.874	8.644	3.571	1.204	0.052	1.335	0.199	4.955
561	6	81.874	8.644	3.474	1.204	0.066	1.335	0.214	4.955
562	4	81.954	8.081	3.534	1.199	-0.001	1.452	0.227	4.956
563	6	81.954	8.081	3.443	1.199	0.012	1.352	0.262	4.956
564	6	81.954	8.081	3.261	1.199	0.035	1.452	0.272	4.956
565	4	81.994	7.808	3.555	1.197	0.005	1.365	0.254	4.957
566	6	81.994	7.808	3.379	1.197	0.032	1.364	0.284	4.957
567	6	81.994	7.808	3.292	1.197	0.046	1.464	0.700	4.957
568	4	82.074	7.276	3.534	1.196	-0.021	1.363	0.211	4.959
569	6	82.074	7.276	3.252	1.196	-0.008	1.388	0.427	4.959
570	6	82.074	7.276	3.170	1.196	0.006	1.388	0.343	4.959
571	4	82.155	6.764	3.200	1.199	-0.062	1.412	0.269	4.961
572	6	82.155	6.764	3.126	1.199	-0.040	1.412	0.284	4.961
573	6	82.155	6.764	2.514	1.199	0.060	1.412	0.412	4.961
574	4	82.315	5.806	3.394	1.202	-0.074	1.444	-0.016	4.965
575	6	82.315	5.806	2.870	1.202	0.034	1.444	0.114	4.965
576	6	82.315	5.806	2.805	1.202	0.048	1.446	0.130	4.965
577	4	82.395	5.356	2.803	1.199	-0.019	1.451	0.056	4.967
578	6	82.395	5.356	2.742	1.199	-0.006	1.451	0.072	4.967
579	6	82.395	5.356	2.682	1.199	0.008	1.452	0.088	4.967
580	4	82.476	4.926	2.670	1.203	-0.059	1.459	0.099	4.969
581	6	82.476	4.926	2.616	1.203	-0.046	1.459	0.114	4.969
582	6	82.476	4.926	2.170	1.203	0.065	1.459	0.246	4.969
583	4	82.636	4.131	2.733	1.205	-0.072	1.491	0.150	4.975
584	6	82.636	4.131	2.360	1.205	0.038	1.491	0.284	4.975
585	6	82.636	4.131	2.314	1.205	0.051	1.493	0.301	4.975
586	4	82.717	3.763	2.275	1.202	-0.010	1.515	0.320	4.978
587	6	82.717	3.763	2.233	1.202	0.002	1.515	0.337	4.978
588	6	82.717	3.763	2.191	1.202	0.011	1.515	0.344	4.978
589	4	82.797	3.415	2.244	1.205	-0.055	1.540	0.267	4.982
590	6	82.797	3.415	2.105	1.205	-0.041	1.540	0.284	4.982	5.151

591	6	82.797	3.415	1.797	1.205	0.067	1.540	0.427	4.482	5.151
592	4	82.877	3.111	1.978	1.200	0.030	1.566	0.198	4.486	5.161
593	4	82.957	2.783	2.102	1.205	-0.067	1.571	-0.028	4.490	5.172
594	6	82.957	2.783	1.851	1.205	0.043	1.571	0.114	4.490	5.172
595	6	82.957	2.783	1.820	1.205	0.355	1.571	0.142	4.490	5.172
596	4	83.038	2.496	1.751	1.202	-0.021	1.579	0.054	4.495	5.182
597	6	83.038	2.496	1.724	1.202	0.062	1.579	0.083	4.495	5.182
598	6	83.038	2.496	1.695	1.202	0.016	1.579	0.084	4.495	5.182
599	4	83.118	2.229	1.621	1.205	-0.051	1.586	0.096	4.500	5.193
600	6	83.118	2.229	1.596	1.205	-0.038	1.586	0.114	4.500	5.193
601	6	83.118	2.229	1.395	1.205	0.071	1.586	0.257	4.500	5.193
602	4	83.278	1.760	1.500	1.203	-0.063	1.619	0.138	4.513	5.214
603	6	83.278	1.760	1.342	1.203	0.046	1.619	0.284	4.513	5.214
604	6	83.278	1.760	1.322	1.203	0.059	1.619	0.303	4.513	5.214
605	4	83.359	1.555	1.231	1.199	-0.008	1.643	0.308	4.521	5.225
606	6	83.359	1.555	1.214	1.199	0.006	1.643	0.327	4.521	5.225
607	6	83.359	1.555	1.196	1.199	0.019	1.643	0.345	4.521	5.225
608	4	83.439	1.371	1.102	1.202	-0.048	1.667	0.266	4.530	5.236
609	6	83.439	1.371	1.088	1.202	-0.034	1.667	0.286	4.530	5.236
610	6	83.439	1.371	0.963	1.202	0.074	1.667	0.435	4.530	5.236
611	4	83.599	1.064	0.928	1.199	-0.060	1.699	-0.039	4.551	5.257
612	6	83.599	1.064	0.832	1.199	0.048	1.699	0.114	4.551	5.257
613	6	83.599	1.064	0.820	1.199	0.062	1.699	0.133	4.551	5.257
614	4	83.680	0.941	0.715	1.195	-0.006	1.707	0.052	4.564	5.268
615	6	83.680	0.941	0.705	1.195	0.008	1.707	0.072	4.564	5.268
616	6	83.680	0.941	0.694	1.195	0.021	1.707	0.091	4.564	5.268
617	4	83.760	0.838	0.586	1.197	-0.046	1.714	0.095	4.578	5.278
618	6	83.760	0.838	0.577	1.197	-0.032	1.714	0.114	4.578	5.278
619	6	83.760	0.838	0.568	1.197	-0.005	1.714	0.153	4.578	5.278
620	4	83.800	0.794	0.531	1.199	-0.039	1.719	0.118	4.586	5.284
621	6	83.800	0.794	0.513	1.199	-0.013	1.719	0.157	4.586	5.284
622	6	83.800	0.794	0.504	1.199	0.001	1.719	0.176	4.586	5.284
623	4	83.880	0.722	0.394	1.204	-0.046	1.734	0.180	4.603	5.296
624	6	83.880	0.722	0.385	1.204	-0.052	1.734	0.199	4.603	5.296
625	1	84.480	0.842	-0.569	1.666	-0.552	1.853	0.199	4.744	5.366
626	2	84.780	1.027	-0.016	2.537	-2.987	1.662	1.508	4.754	5.392
627	1	85.180	1.196	-0.406	5.552	-4.551	1.049	-1.508	4.852	5.409
628	7	85.180	1.196	-0.406	5.552	-4.551	1.049	-1.508	4.852	5.409
629	1	85.380	1.597	-0.601	7.529	-5.333	0.747	1.508	4.877	5.413
630	3	85.680	2.204	-2.270	9.219	0.084	0.356	-1.142	4.900	5.419
631	1	86.280	5.932	-3.944	9.157	0.009	-0.329	-1.142	4.937	5.429
632	4	87.490	11.122	0.779	9.272	-0.113	-0.940	0.197	4.953	5.450
633	1	88.290	9.969	0.663	9.523	-0.202	-0.782	0.197	4.965	5.464
634	2	88.590	8.919	2.754	10.343	-2.596	-0.696	0.371	4.970	5.469
635	1	88.890	7.353	2.465	11.967	2.820	-0.585	0.371	4.976	5.473
636	8	88.890	7.353	2.465	11.967	-2.820	-0.585	0.371	4.976	5.473
637	1	89.190	5.960	2.177	13.727	-3.044	-0.473	0.371	4.986	5.487
638	3	89.490	5.899	-1.967	12.684	6.274	-0.409	0.068	4.991	5.490
639	1	89.890	7.595	-2.284	8.174	5.061	-0.481	0.068	5.001	5.497
640	2	90.190	8.334	-0.109	6.009	2.418	-0.445	0.171	5.007	5.494
641	1	90.565	8.443	-0.155	4.356	1.991	-0.281	0.171	5.014	5.505
642	1	90.815	8.516	-0.186	4.431	1.706	-0.248	0.171	5.019	5.515
643	1	91.190	8.674	-0.231	2.317	1.479	-0.174	0.171	5.026	5.537
644	4	92.640	9.385	-0.256	1.000	-0.374	-0.935	0.020	5.051	5.738
645	17	92.640	9.385	-0.256	1.000	-0.374	0.000	0.000	5.051	5.738
646	16	92.640	9.385	-0.256	1.000	-0.374	0.000	0.000	5.051	5.738
647	1	93.095	9.642	-0.308	1.576	-0.892	0.000	0.000	5.048	5.747
648	14	93.395	9.753	-0.206	2.196	-1.198	0.000	0.000	5.064	5.825
649	14	93.935	8.660	0.674	3.331	-1.303	0.000	0.000	5.073	5.853
650	14	94.235	7.865	0.715	3.979	-1.406	0.000	0.000	5.078	5.865
651	1	95.440	6.378	0.520	6.465	-2.234	0.000	0.000	5.101	5.894
652	14	95.740	6.196	0.495	6.953	-2.469	0.000	0.000	5.108	5.898
653	14	96.090	6.083	0.521	12.193	-2.684	0.000	0.000	5.116	5.903
654	14	96.104	6.077	0.522	12.282	-2.690	0.000	0.000	5.117	5.903
655	12	96.104	6.077	1.037	12.282	-3.751	0.000	0.000	5.117	5.903
656	14	96.131	6.037	1.036	12.518	-3.763	0.000	0.000	5.117	5.903

657	12	96.131	6.037	1.546	12.518	-4.821	0.000	0.000	5.117	5.903
658	14	96.158	5.970	1.540	12.813	-4.875	0.000	0.000	5.118	5.904
659	12	96.158	5.970	2.044	12.813	-5.955	0.000	0.000	5.118	5.904
660	14	96.185	5.875	2.031	13.170	-6.035	0.000	0.000	5.119	5.904
661	12	96.185	5.875	2.525	13.170	-7.143	0.000	0.000	5.119	5.904
662	14	96.212	5.754	2.503	13.593	-7.255	0.000	0.000	5.119	5.904
663	12	96.212	5.754	2.988	13.593	-8.395	0.000	0.000	5.119	5.904
664	14	96.239	5.608	2.951	14.085	-8.540	0.000	0.000	5.120	5.905
665	12	96.239	5.608	3.421	14.085	-9.734	0.000	0.000	5.120	5.905
666	14	96.266	5.438	3.373	14.650	-9.910	0.000	0.000	5.121	5.905
667	12	96.266	5.438	3.827	14.650	-11.140	0.000	0.000	5.121	5.905
668	14	96.293	5.246	3.763	15.293	-11.304	0.000	0.000	5.122	5.905
669	12	96.293	5.246	4.200	15.293	-12.657	0.000	0.000	5.122	5.905
670	14	96.320	5.033	4.119	16.021	-12.957	0.000	0.000	5.122	5.905
671	12	96.320	5.033	4.537	16.021	-14.287	0.000	0.000	5.123	5.905
672	14	96.347	4.802	4.436	16.840	-14.641	0.000	0.000	5.123	5.906
673	12	96.347	4.802	4.835	16.840	-16.046	0.000	0.000	5.123	5.906
674	14	96.360	4.678	4.774	17.295	-16.264	0.000	0.000	5.124	5.906
675	14	96.510	3.398	4.077	22.769	-18.678	0.000	0.000	5.129	5.907
676	14	96.528	3.261	3.994	23.457	-18.958	0.000	0.000	5.130	5.907
677	13	96.528	3.261	3.296	23.457	-13.950	0.000	0.000	5.130	5.907
678	14	96.563	3.042	3.181	24.503	-14.252	0.000	0.000	5.132	5.907
679	13	96.563	3.042	2.532	24.503	-9.031	0.000	0.000	5.132	5.907
680	14	96.598	2.875	2.457	25.199	-9.146	0.000	0.000	5.134	5.907
681	13	96.598	2.875	1.804	25.199	-3.788	0.000	0.000	5.134	5.907
682	14	96.633	2.754	1.799	25.823	-3.794	0.000	0.000	5.135	5.908
683	13	96.633	2.754	1.216	25.823	1.623	0.000	0.000	5.135	5.908
684	14	96.668	2.676	1.190	26.466	1.646	0.000	0.000	5.137	5.908
685	13	96.668	2.676	0.623	26.466	7.048	0.000	0.000	5.137	5.908
686	14	96.703	2.639	0.610	26.930	7.099	0.000	0.000	5.140	5.908
687	13	96.703	2.639	0.052	26.930	12.505	0.000	0.000	5.140	5.908
688	14	96.738	2.641	0.043	24.227	12.136	0.000	0.000	5.142	5.908
689	13	96.738	2.641	-0.514	24.227	17.249	0.000	0.000	5.142	5.908
690	14	96.773	2.683	-0.528	23.081	16.874	0.000	0.000	5.144	5.909
691	13	96.773	2.683	-1.092	23.082	22.716	0.000	0.000	5.144	5.909
692	14	96.808	2.765	-1.119	21.627	21.081	0.000	0.000	5.146	5.909
693	13	96.808	2.765	-1.699	21.627	25.627	0.000	0.000	5.146	5.909
694	14	96.843	2.891	-1.747	19.908	24.630	0.000	0.000	5.148	5.909
695	13	96.843	2.891	-2.353	19.908	28.866	0.000	0.000	5.148	5.909
696	14	96.860	2.977	-2.593	18.929	28.113	0.000	0.000	5.148	5.909
697	14	97.030	3.882	-2.777	10.653	31.236	0.000	0.000	5.156	5.911
698	14	97.040	3.939	-2.799	10.246	20.817	0.000	0.000	5.157	5.911
699	12	97.040	3.939	-2.524	10.246	30.102	0.000	0.000	5.157	5.911
700	14	97.060	4.044	-2.562	9.456	19.344	0.000	0.000	5.157	5.912
701	12	97.060	4.044	-2.279	9.456	18.673	0.000	0.000	5.157	5.912
702	14	97.080	4.139	-2.309	8.730	17.954	0.000	0.000	5.158	5.912
703	12	97.080	4.139	-2.020	8.730	17.344	0.000	0.000	5.158	5.912
704	14	97.100	4.224	-2.044	8.056	16.670	0.000	0.000	5.159	5.912
705	12	97.100	4.224	-1.750	8.056	16.109	0.000	0.000	5.159	5.912
706	14	97.120	4.297	-1.768	7.430	15.478	0.000	0.000	5.160	5.913
707	12	97.120	4.297	-1.468	7.430	14.961	0.000	0.000	5.160	5.913
708	14	97.140	4.359	-1.482	6.848	14.370	0.000	0.000	5.160	5.913
709	12	97.140	4.359	-1.178	6.848	13.894	0.000	0.000	5.160	5.913
710	14	97.160	4.409	-1.187	6.300	13.340	0.000	0.000	5.161	5.914
711	12	97.160	4.409	-0.881	6.300	12.902	0.000	0.000	5.161	5.914
712	14	97.180	4.447	-0.887	5.806	12.385	0.000	0.000	5.162	5.914
713	12	97.180	4.447	-0.578	5.806	11.979	0.000	0.000	5.162	5.914
714	14	97.200	4.473	-0.581	5.341	11.492	0.000	0.000	5.163	5.915
715	12	97.200	4.473	-0.271	5.341	11.121	0.000	0.000	5.163	5.915
716	14	97.220	4.487	-0.274	4.908	10.664	0.000	0.000	5.163	5.915
717	12	97.220	4.487	0.038	4.908	10.324	0.000	0.000	5.163	5.915
718	14	97.230	4.488	0.037	4.705	10.109	0.000	0.000	5.164	5.916
719	14	97.690	4.500	0.000	0.045	0.000	0.000	0.000	5.180	5.150

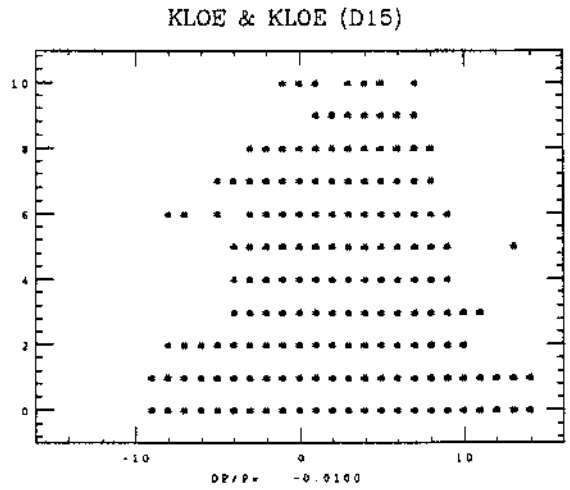

Fig. 1a) - Dynamic aperture for $\Delta p/p = -1\%$

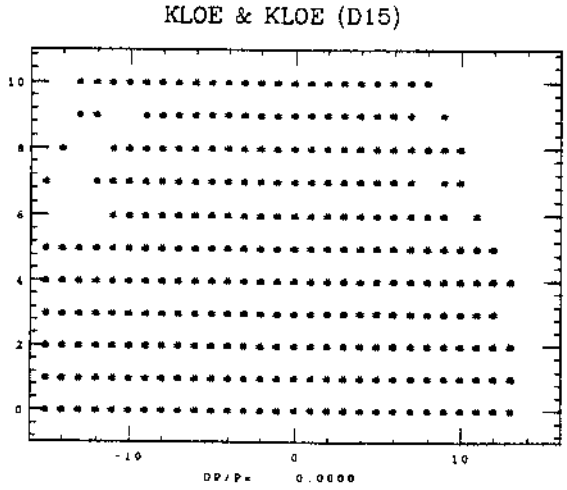

Fig. 1b) - Dynamic aperture for $\Delta p/p = 0$

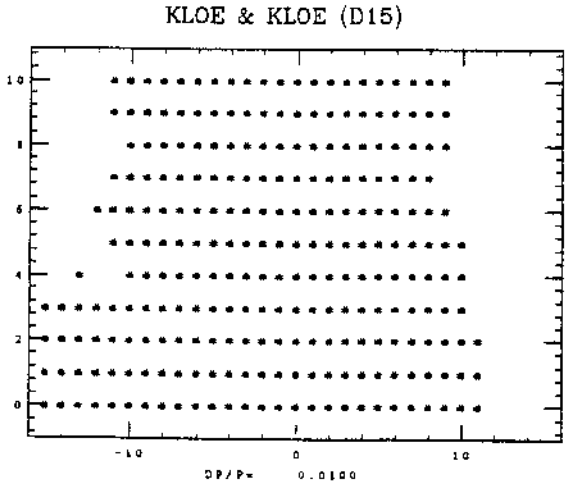

Fig. 1c) - Dynamic aperture for $\Delta p/p = +1\%$

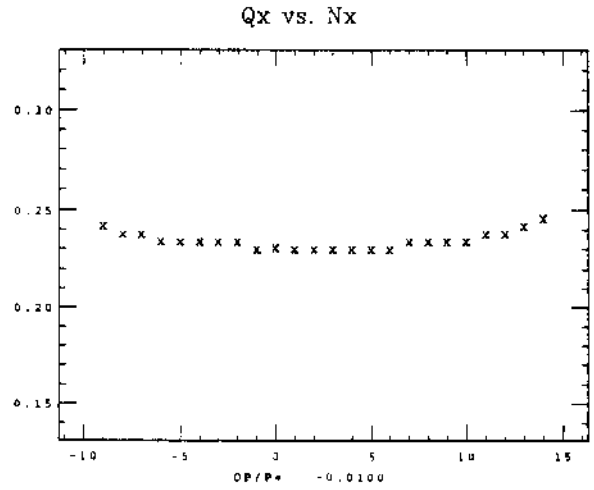

Fig. 2a) - Horizontal tune shift vs. amplitude for $\Delta p/p = -1\%$

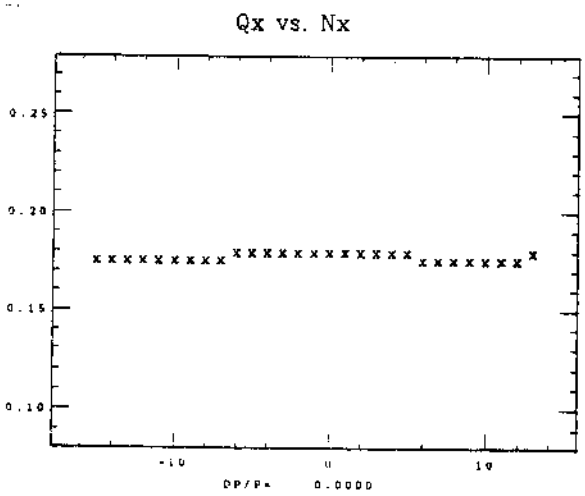

Fig. 2b) - Horizontal tune shift vs. amplitude for $\Delta p/p = 0$

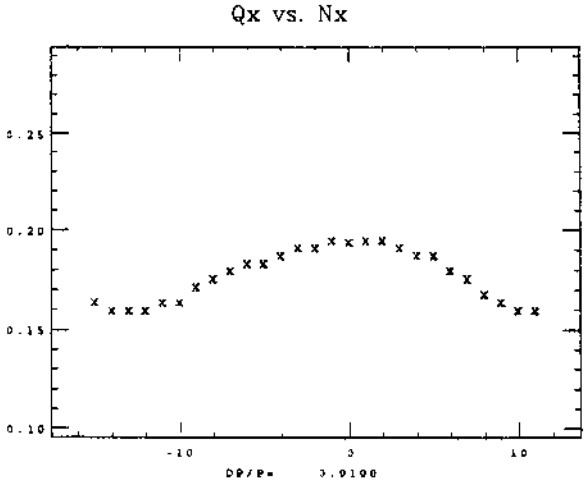

Fig. 2c) - Horizontal tune shift vs. amplitude for $\Delta p/p = +1\%$

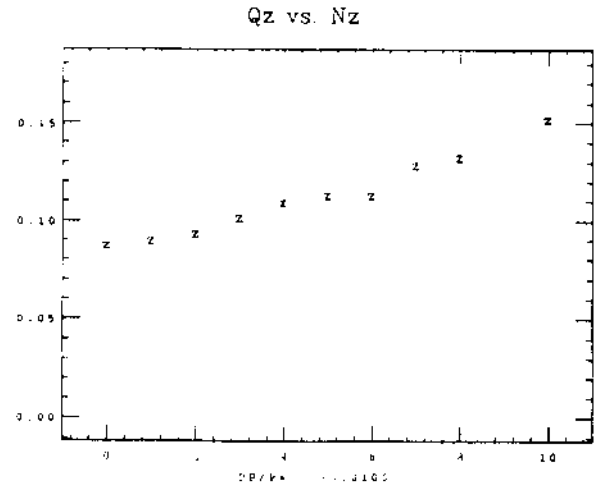

Fig. 3a) - Vertical tune shift vs. amplitude for $\Delta p/p = -1\%$

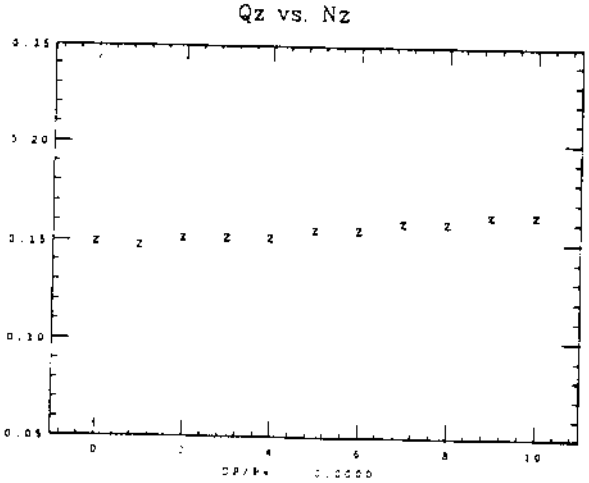

Fig. 3b) - Vertical tune shift vs. amplitude for $\Delta p/p = 0$

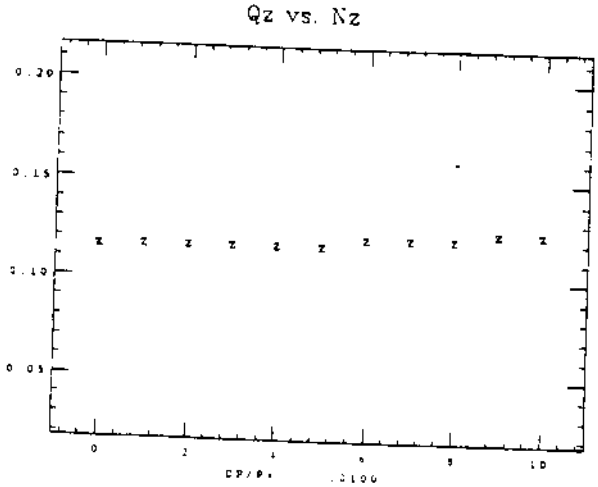

Fig. 3c) - Vertical tune shift vs. amplitude for $\Delta p/p = +1\%$

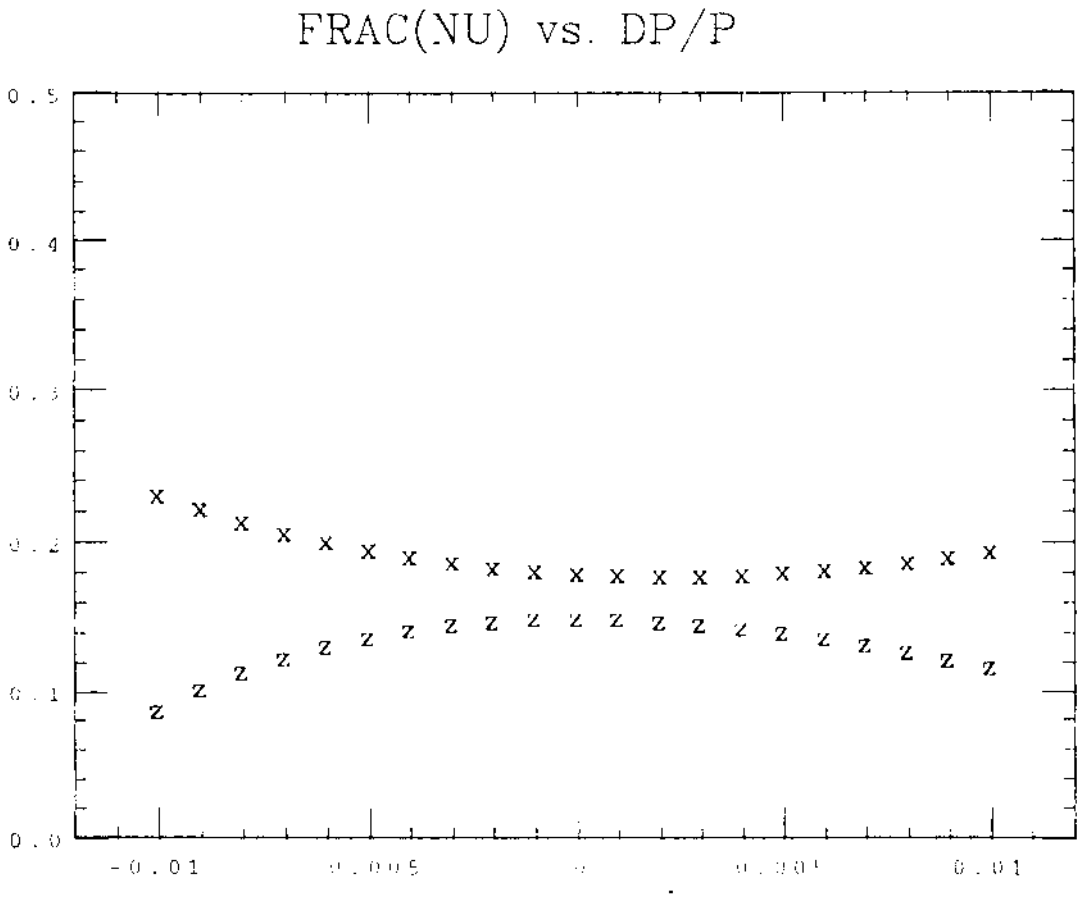

Fig. 4 - Horizontal and vertical tune shifts vs. Δp/p

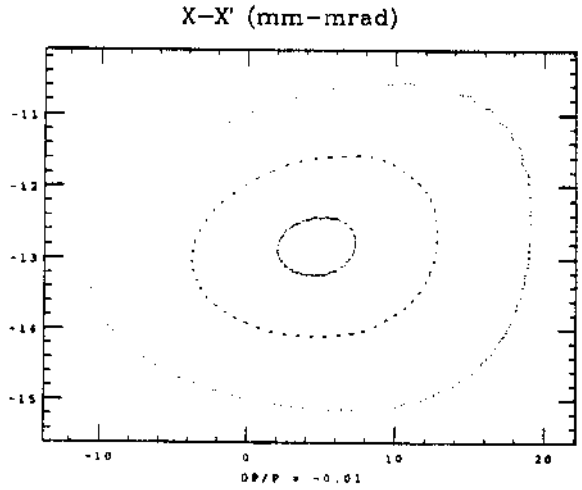

Fig. 5a) - (x,x') phase-space for N_X= 3,6,9, N_Z=0 and $\Delta p/p$= -1%

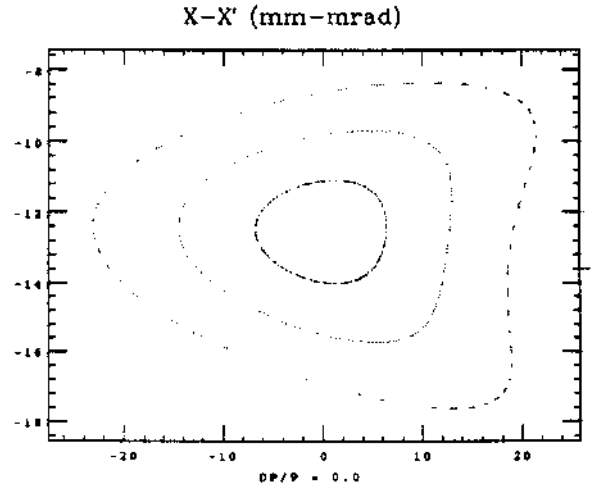

Fig. 5b) - (x,x') phase-space for N_X= 3,6,9, N_Z=0 and $\Delta p/p$= 0

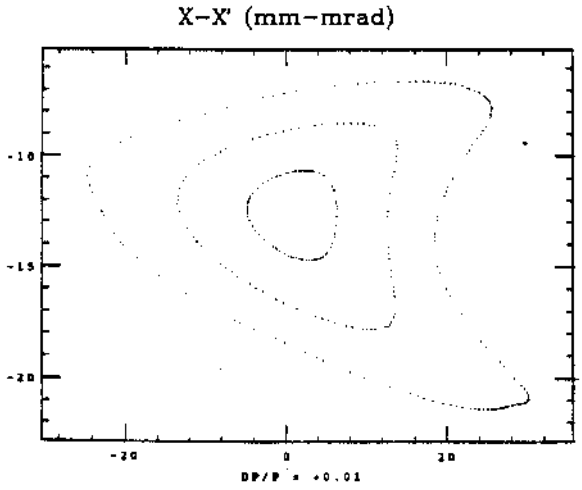

Fig. 5c) - (x,x') phase-space for N_X= 3,6,9, N_Z=0 and $\Delta p/p$= +1%