DAΦNE TECHNICAL NOTE

INFN - LNF, Accelerator Division

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Note: **L-22**

DAΦNE MAIN RINGS LATTICE UPDATE

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1. INTRODUCTION

Since the last review of the DAΦNE Main Ring optics[1], several modifications in the magnetic layout and in the IRs design, due to optics, aperture or space requirements, have been done. Moreover magnetic measurements on elements already shipped at the LNF have been performed, and their results introduced in the optical models of the lattice. An update is therefore mandatory. In the following we remind the most relevant changes and their consequences on the lattice and on the beam lifetime. In Table I the DAΦNE optics main parameters are summaized.

Table I - *DAΦNE optics main parameters*

β_x (m) @ IP	4.5	σ_x (mm) @ IP	2.1
β_y (m) @ IP	.045	σ_y (mm) @ IP	.021
ε_x (m·rad) @ IP	10^{-6}	κ	1%
θ_x (m·rad) @ IP	10÷15		

1.1 Working point

The most significant item, from the operational point of view, is the change in the working point. Actually, with analytical calculations and computer simulations[2] of the beam-beam interactions, taking also into account the effect of the non linear synchro-betatron resonances, a new working point had already been chosen, and the lattice modified, with in addition equal vertical phase advance between the two IPs. A further study of the beam-beam case for our lattice, with a more general computer code[3], has been performed, with the aim of maximising the peak luminosity. Two different working points have been chosen, one above the integer, the other one above the half-integer for the horizontal plane only. They ensure maximum luminosity and are far enough from the integer to have a good dynamic aperture. The new values are:

(a) $Q_x = 5.09$, $Q_y = 6.07$

(b) $Q_x = 4.53$, $Q_y = 6.06$

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1 M.E. Biagini, C. Biscari, S. Guiducci, J. Lu, M.R. Masullo, G. Vignola, "Review of DAΦNE Lattices", DAΦNE Tech. Note L-9, Oct. 1993.

2 M.E. Biagini, M. Zobov, "Beam-beam Incoherent Resonances in DAΦNE", DAΦNE 8th Review Committee, Feb. 1995.

3 K. Hirata, M. Zobov, private communication.

1.2 Wiggler Model

The linear gradient term along the trajectory in the wiggler, due to the quadratic behaviour of the field amplitude along the horizontal direction, has been introduced in the wiggler model. This gradient has been estimated by integrating the equations of motions of the particles in the actual field measured on the first wiggler prototype[4,5,6] and results in an integrated value corresponding to a defocusing quadrupole, with L=2 m and strength K^2=0.3 m^{-2} @ B_w=1.8 T. To take into account this effect in our optical model, consisting of a sequence of small rectangular dipoles, the strength of the thin lenses corresponding to the edge effect of the dipoles has been increased by 25%.

1.3 Injection configuration

As a consequence of the previous section, the behaviour of the optical functions in the injection section has changed. Since the physical layout of the elements is already frozen, in order to obtain the required phase advance between the injection kickers and a reasonably high value of β_x at the septum the option of zero dispersion in the injection section has been given up. A negative dispersion of the order of 1 m at the injection point, with zero slope, is indeed a good solution to have an easy matching in all the configurations. Due to the small value of the energy spread of the beam injected from the Accumulator, this dispersion doesn't increase the aperture requirements for injection.

This modification has strongly changed the momentum compaction value, rising its value by a factor 3~4, influencing also the rf acceptance and the beam lifetime, as will be shown in the following.

1.4 IR optics

The IR lattices have been modified, with a slight decrease of the vertical phase advance. The result is that the very low β_y value (about 0.5 m) which was obtained in the splitter region is now raised to values above 1.5 m, thus giving a smoother behaviour of β_y which makes the chromaticity correction much easier. This change and the use of a sextupole family located in the injection region to correct also the chromaticity, since the dispersion is not zero, has increased the dynamic aperture to values much larger than the physical aperture, making us much more confident about colliding beams operation. In fact a good dynamic aperture is maintained also when changing the tunes and the IRs configurations, and with some modification of the sextupole settings it is easy to reoptimize the stability region in all the investigated cases.

1.5 DEAR Interaction Region

Following the proposal of a third experiment, DEAR[7] consisting of a small detector placed around the IP, a new design for the IR has been considered. This IR optics follows the DAY ONE configuration apart from the quadrupole placed around the IP which will be removed. This quadrupole, which is very useful during the machine commissioning, to allow flexibility and lower chromaticity in the ring, can be removed, and readjusting the quadrupole strengths in the other quads of the IR the optics can match the transparency condition of the ring[1].

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4 R. Walker, "Wigglers", CAS Rhodes, Greece, CERN 95-06.

5 B. Bolli et al., "Measurements on the Wiggler Magnet for the DAΦNE Main Rings" - Technical DAΦNE Note M-4, Apr. 1994.

6 M. Bassetti et al., "Optical Characteristics of the DAΦNE Wiggler" - Technical DAΦNE Note G-27, Sep. 1994.

7 R. Baldini et al., "The DEAR Proposal", LNF-95/055, Oct. 1995.

The machine configuration for the DEAR experiment is symmetric: both the IRs have the same design as the DEAR IR. The IR quadrupole settings are slighly different for the two different working points (see Table V).

2. INTERACTION REGIONS DESIGN

Four nominal configurations correspond to the different IR designs. Their layouts, including magnetic element positions, strengths and rotation angles, are summarized in Tables II to V. Figs. 1 to 4 show the optical functions and beam trajectory for a 12.5 mrad half-crossing angle.

Table II - *DAY-ONE IR layout for half insertion*

Element	Length (m)	Position (m from IP)	K^2 (m^{-2})
Q1	0.150	0.000	2.292494
Drift	0.300	0.150	
Q2	0.300	0.450	-0.512318
Drift	0.300	0.750	
Q3	0.400	1.050	-3.753269
Drift	0.350	1.450	
Q4	0.400	1.800	2.049011
Drift	2.850	2.200	
IR end	0.000	5.050	

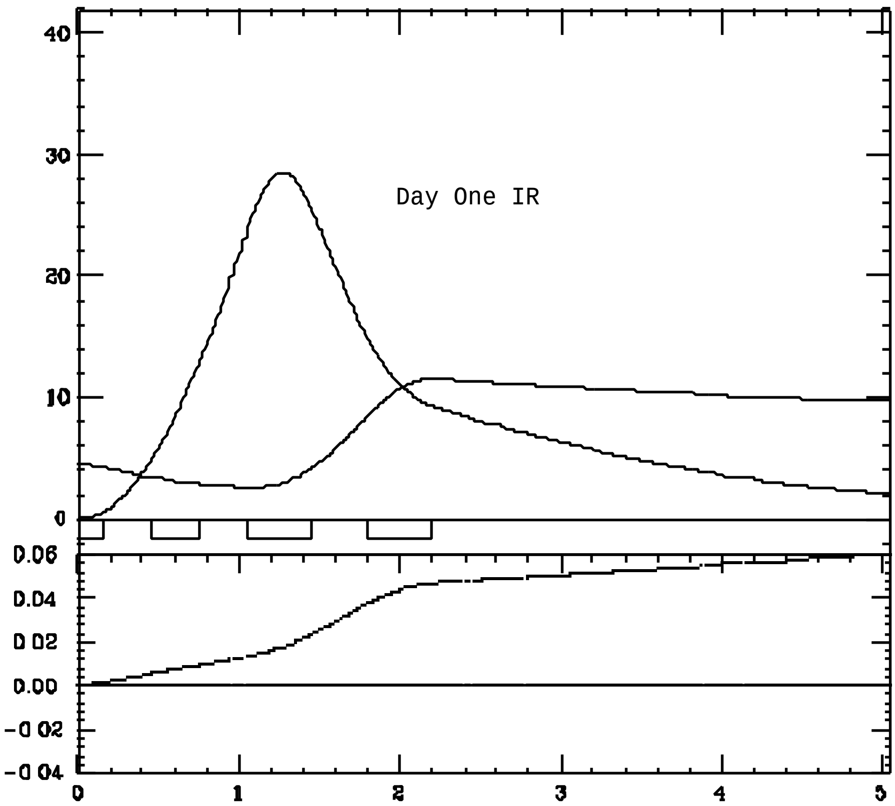

Fig. 1 - *DAY ONE IR optical functions and beam trajectory*

Table III - *KLOE IR layout for half insertion*

Element	Length (m)	Position (m from IP)	K2 (m-2)	B (T)	θ (deg)	δ (deg)
KLOE solenoid	0.460	0.0		0.6		
Q1 + KLOE solenoid	0.200	0.46	3.483964	0.6	+5.66°	+0.29°
KLOE solenoid	0.2	0.66		0.6		
Q2 + KLOE solenoid	0.350	0.86	-6.049274	0.6	+10.15°	-0.02°
KLOE solenoid	0.2	1.21		0.6		
Q3 + KLOE solenoid	0.270	1.41	3.101060	0.6	+14.80°	-0.27°
KLOE solenoid	1.32	1.68		0.6		
Drift	.485	3.		0.0		
Compensator	1.15	3.485		1.4876	-21.22°	-0.134°
Drift	0.415	4.635		0.0		
IR end	0.000	5.050				

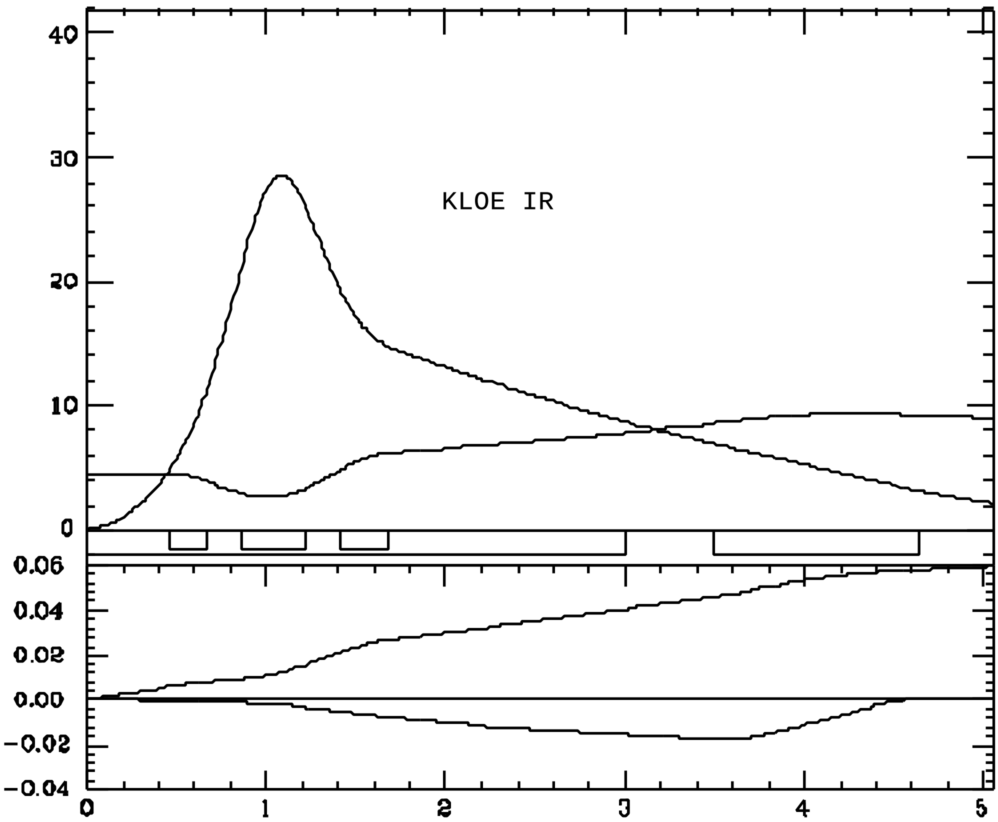

Fig. 2 - *KLOE IR optical functions and beam trajectory*

Table IV - *FI.NU.DA. IR layout for half insertion*

Element	Length (m)	Position (m from IP)	K2 (m-2)	B (T)	Q (deg)	δQ (deg)
FINUDA solenoid	0.34625	0.0		1.1		
Q1 + FINUDA solenoid	0.15750	0.34625	5.6782	1.1	+9.4°	+1.31°
FINUDA solenoid	0.13375	0.50375		1.1		
Q2 + FINUDA solenoid	0.30000	0.63750	-6.7704	1.1	+14.8°	-0.48°
FINUDA solenoid	0.56250	0.93750		1.1		
Drift	0.55000	1.5000				
Q3	0.40000	2.05	1.8739		+22.0°	-0.16°
Drift	0.20000	2.45				
Q4	0.40000	2.65	-1.2362		+22.0°	-0.16°
Drift	0.43500	3.05				
Compensator	1.15000	3.485		1.4983	-22.0°	-0.66°
Drift	0.41500	4.635				
IR end	0.00000	5.05				

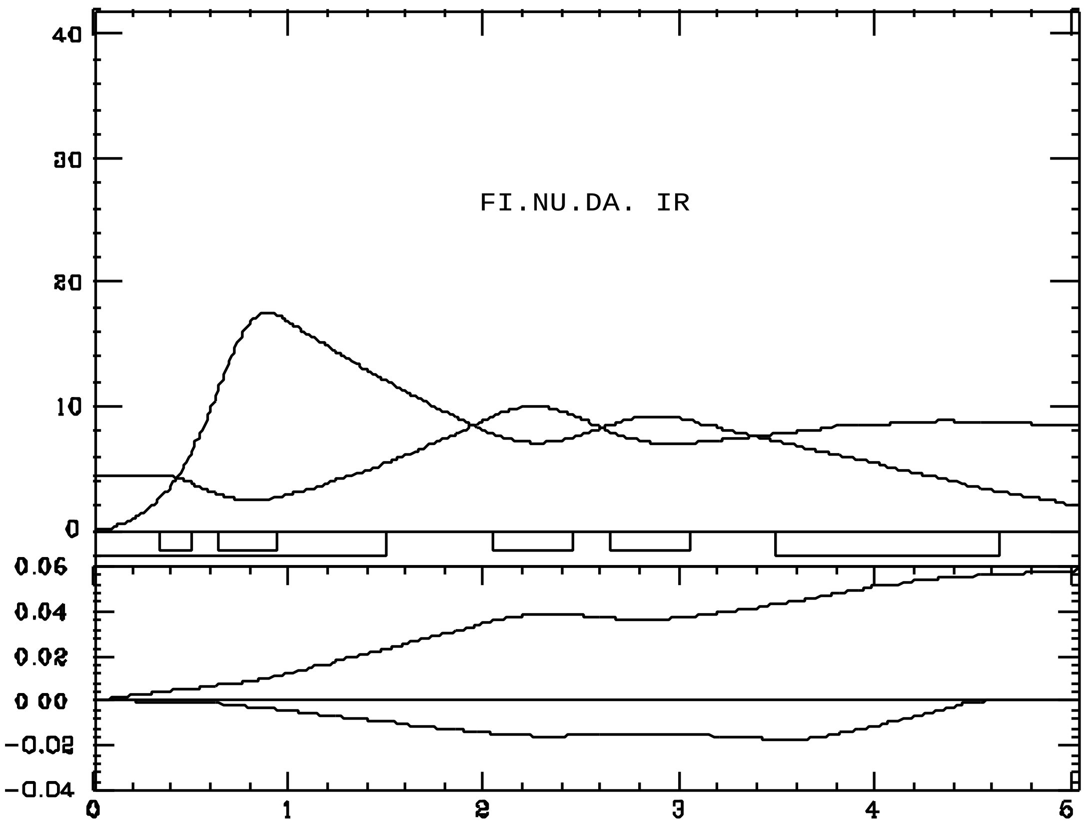

Fig. 3 - *FINUDA IR optical functions and beam trajectory*

Table V - *DEAR IR layout for half insertion*

Element	Length (m)	Position (m from IP)	K^2 (a) (m^{-2})	K^2 (b) (m^{-2})
Drift	0.450	0.000		
Q1	0.300	0.450	1.70	1.56
Drift	0.300	0.750		
Q2	0.400	1.050	-4.10	-4.08
Drift	0.350	1.450		
Q3	0.400	1.800	1.86	1.85
Drift	2.850	2.200		
IR end	0.000	5.050		

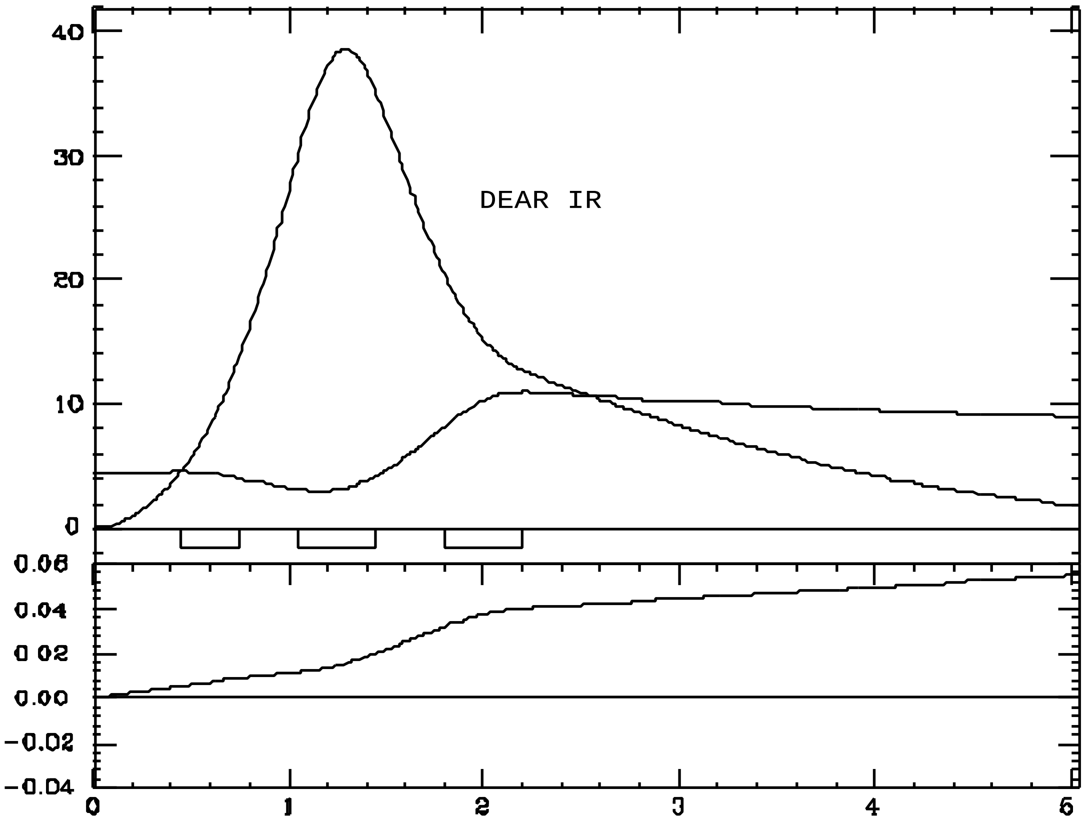

Fig. 4 - *DEAR IR (a) optical functions and beam trajectory*

Table VI summarizes the optics parameters, Table VII gives the first order matrices for the 4 IRs.

Table VI - *Interaction Region main parameters summary*

	KLOE	FI.NU.DA.	DAY-ONE	DEAR
@ Splitter entrance				
β_x (m)	9.0648	8.2837	8.8221	9.2643
α_x	.1199	.1887	2359	-0.0565
δQ_x	.1375	.1374	.134	0.1270
D_x(m)*	-.035	-.037	-.040	-0.39
D'_x *	-.020	-.021	-.020	-0.20
β_y (m)	2.053	2.0405	1.9286	1.9671
α_y	1.00	1.1341	.4181	0.8314
δQ_y	.342	.348	.370	0.343
Δx (mm) *	60.72	58.01	58.75	57.78
$\Delta x'$ (mrad) *	4.915	4.665	4.375	6.435
C_x**	-.43	-.46	-.39	-0.29
C_y**	-3.12	-2.19	-2.64	-3.55

* for a half crossing angle θ = 12.5 mrad
** for half IR
N.B.: The D_x and D'_x are negative entering the SHORT and positive entering the LONG.

Table VII - *Half IR first order transfer matrices*

KLOE IR

Horizontal		*Vertical*	
0.9215	4.8577	-3.7030	0.2542
-0.1313	0.3932	-0.9478	-0.2050

FINUDA IR

Horizontal		*Vertical*	
0.8815	4.6411	-3.8878	0.2474
-0.1446	0.3732	-0.5534	-0.2233

DAY ONE IR

Horizontal		*Vertical*	
0.9325	4.7000	-4.4814	0.2147
-0.1433	0.3500	-1.5030	-0.1511

DEAR(a)

Horizontal		*Vertical*	
1.0018	4.6222	-3.6385	0.2484
-0.1048	0.5148	-1.2685	-0.1882

3. LATTICE CONFIGURATIONS

The possible DAΦNE lattice configurations, corresponding to the four IRs, are summarized in the following Table:

Table VIII - *Lattice configurations*

	IR1	IR2
1 (DD)	DAY ONE	DAY ONE
2 (GD)	DEAR	DEAR*
3 (KD)	KLOE	DAY ONE
4 (DF)	DAY ONE	FINUDA
5 (KF)	KLOE	FINUDA

* The IR design, with the DAY ONE configuration, is symmetric to the DEAR one.

In Figs. 5a, 5b and 6a, 6b the Short and Long halves optical functions are shown for the 1(a) and 1(b) lattices only (a and b are the two working points in Section 1.1).
The complete listing of these optical functions are presented in Appendix A and B.

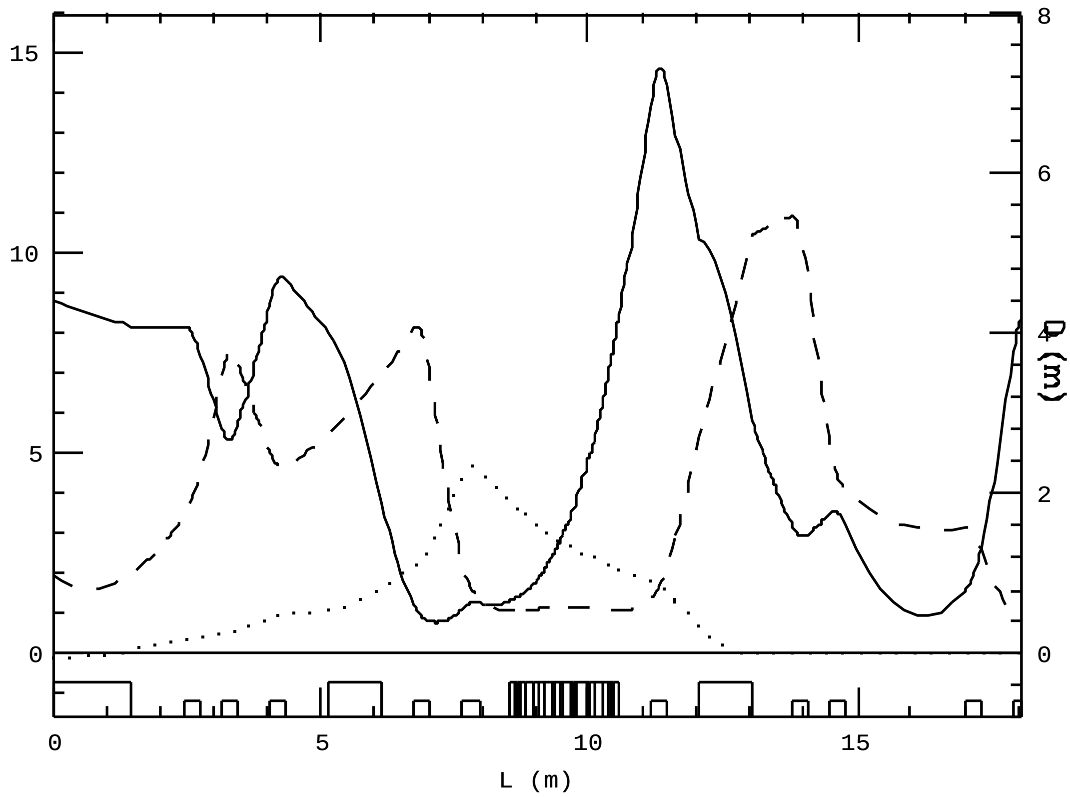

Fig. 5a - *Short half optical functions for DD(a)*

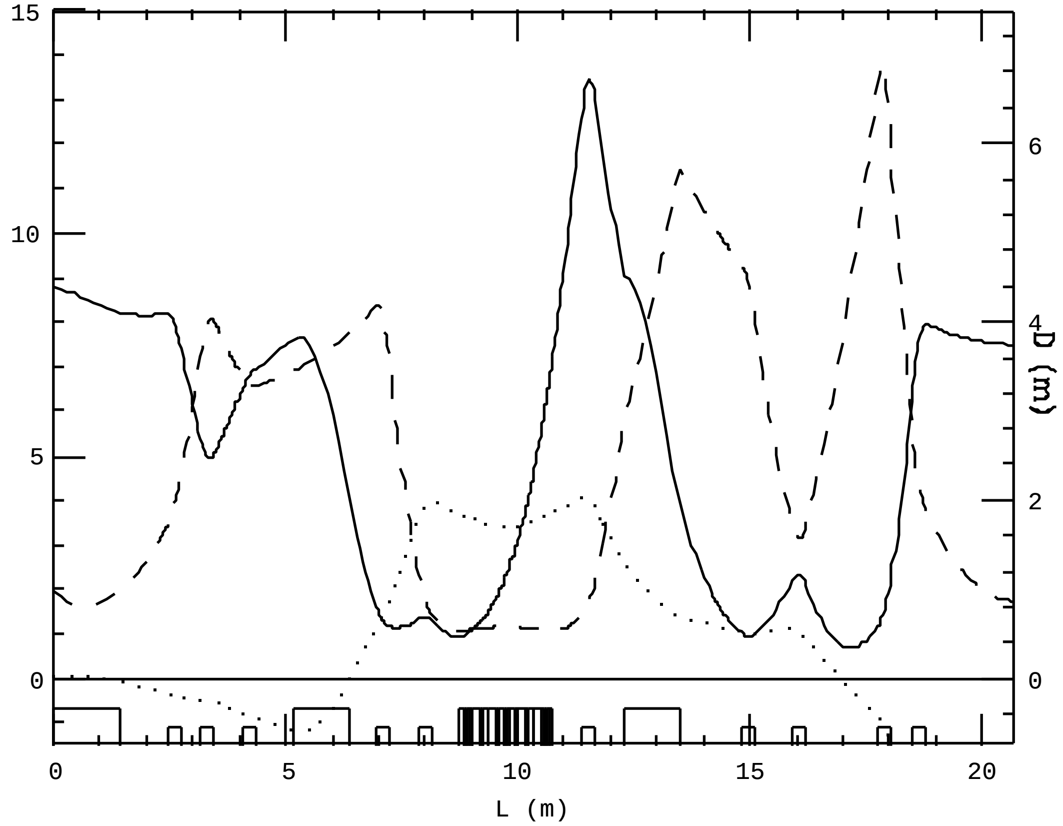

Fig. 5b - *Long half optical functions for DD(a)*

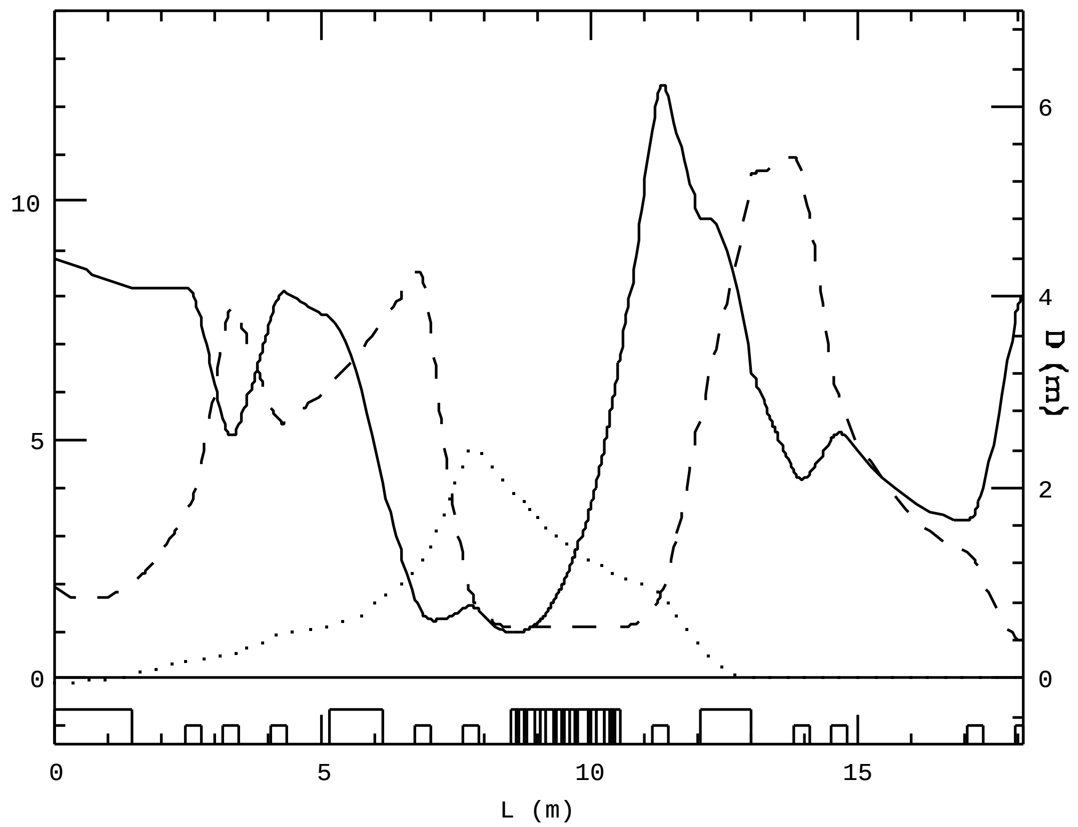

Fig. 6a - *Short half optical functions for DD(b)*

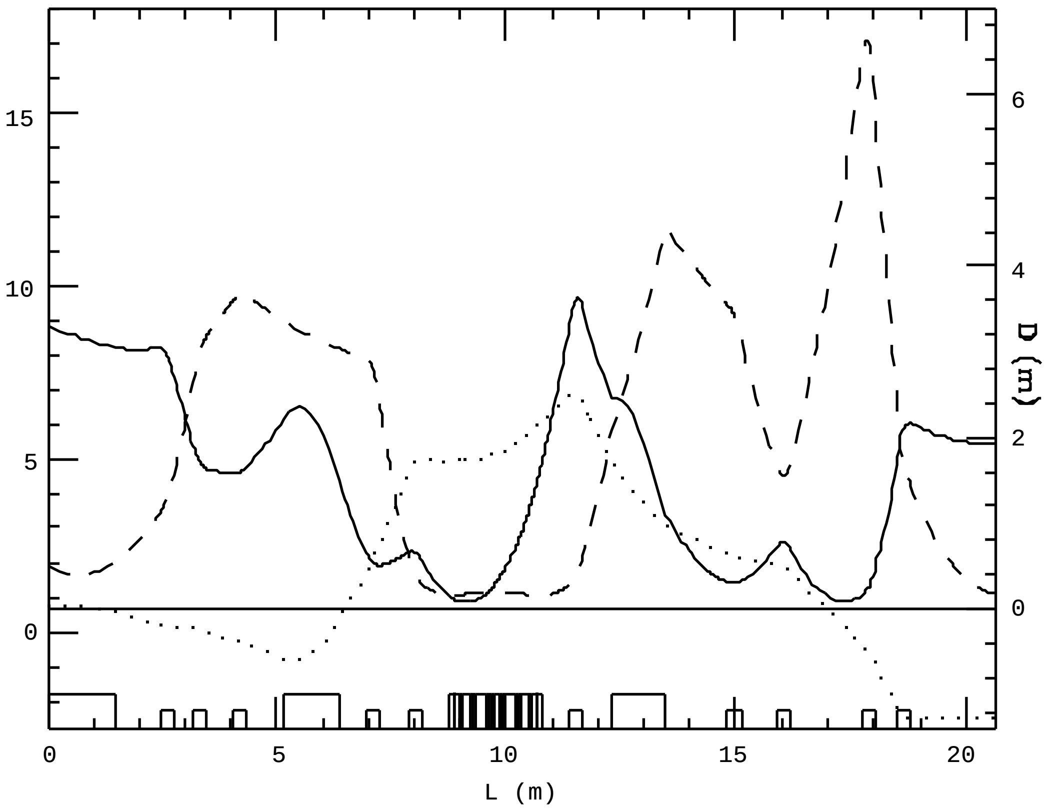

Fig. 6b - *Long half optical functions for DD(b)*

The quadrupole settings of the five configurations are given in Appendix C(a) and C(b).

Figures 7 and 8 show how much the quadrupole strengths change with the different configurations; it shows to what extent the lattice of the different IR's satisfy the transparency condition. The two figures refer to the two working point. In the abscissa the quadrupole numbers are represented, and for each of them the average value of <K^2> for the 5 configurations is plotted with the corresponding variance. The IR's quadrupoles are not included.

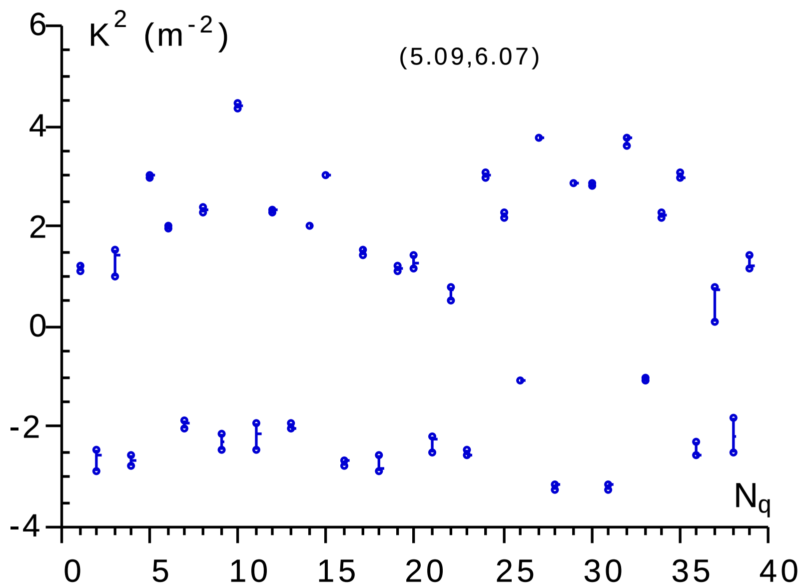

Fig. 7 - *Average value and setting range of K^2 for the 39 quadrupoles. Working point (a)*

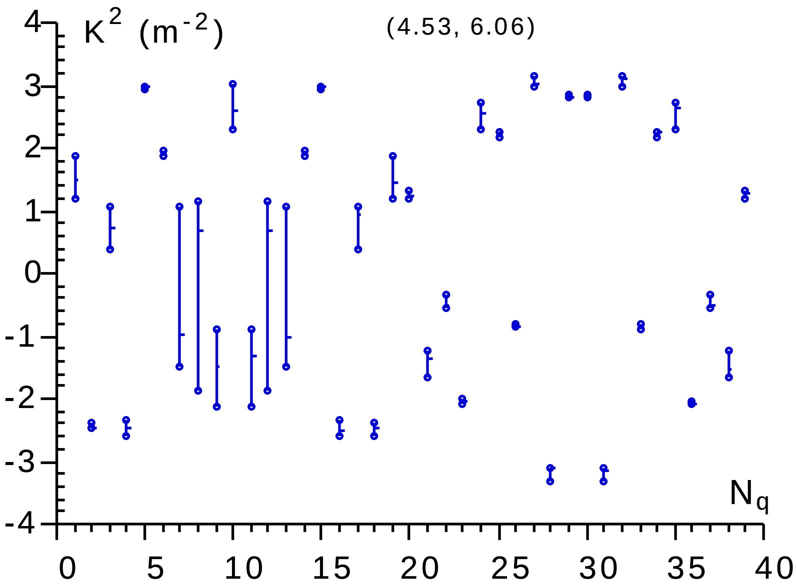

Fig. 8 - *Average value and setting range of K^2 for the 39 quadrupoles. Working point (b)*

Tables IX(a) and IX(b) summarize, for the two working points, the optics parameters for all the lattices, including: horizontal β function and dispersion at the Long midpoint, β_y at the wiggler center, splitter and corrector bending angles for those structures having a nominal trajectory different from the design one. The emittance has the nominal value 1×10^{-6} m·rad for all the configurations; in the tables the contributions of the Short and Long part are listed separately ($\varepsilon_x{}^S$, $\varepsilon_x{}^L$). When two values are given the first one refers to the value of the arc matched to IR1, the second one to IR2. The lattices with a * are those with equal vertical phase advance between IP1 and IP2 because they correspond to a collider configuration with two experiments and therefore with two possible IPs. If only one experiment is working, at the second IP the beams will be separated. The chromaticity values correspond to the total machine.

Table IX(a) - *Optics parameters for Q_x=5.09, Q_y=6.07*

	#1 (a) DD*	**#2 (a) GD***	**#3 (a) KD**	**#4 (a) DF**	**#5 (a) KF***
δQ_x **SHORT**	2.815546	2.28960	2.369292	2.26330	2.32986
δQ_y **SHORT**	3.035	3.035	3.013999	3.00990	3.035
δQ_x **LONG**	2.274454	2.80045	2.720708	2.82670	2.76014
δQ_y **LONG**	3.035	3.035	3.056101	3.06010	3.035
C_x **TOT**	-8.41	-7.84	-8.06	-8.00	-8.60
C_y **TOT**	-18.85	-22.50	-18.44	-17.68	-19.40
$\varepsilon_x{}^S$ **(mm.mrad)**	1.15	1.32	1.0/.85	1.0/1.2	1.10/1.17
$\varepsilon_x{}^L$ **(mm.mrad)**	.85	0.80	1.0/1.15	0.9/0.9	0.896/0.90
α_c	.0186	0.0235	.0236	0.0181	0.0176
$\beta_y{}^{wig}$ **(m)**	1.15	1.2(S) / 1.05(L)	1.15	1.36/1.29 (S) 1.2/1.2 (L)	1.2065/1.1508 (S) 1.100/1.000 (L)
$\beta_x{}^{long}$ **(m)**	4.5	5.0	5.5	5.0	5.5
$D_x{}^{long}$ **(m)**	-1.0	-1.341903	-1.2	-1.0	-0.8714
α_{split} **(mrad)**	± 152.705/ ±152.705	± 152.380/ ±152.380	±150.51227/ ±152.705	± 152.380/ ±152.380	± 152.380/ ±152.380
$\alpha_{corr.}$ **(mrad)**	0.0/0.0	0.0/0.0	±1.652554/ 0.0	0.0/0.0	0.0/0.0

Table IX(b) - *Optics parameters for Q_x=4.53 Q_y=6.06*

	#1 (b) DD*	**#2 (b) GD***	**#3 (b) KD***	**#4 (b) DF**	**#5 (b) KF***
δQ_x^{SHORT}	1.862	2.01891	1.862	1.881761	1.880799
δQ_y^{SHORT}	3.03	3.03000	3.03	3.01822	3.03
δQ_x^{LONG}	2.668	2.51109	2.668	2.648339	2.64920
δQ_y^{LONG}	3.03	3.03000	3.03	3.041779	3.03
C_x^{TOT}	-6.62	-6.42	-7.0	-6.65	-6.63
C_y^{TOT}	-18.77	-21.60	-19.9	-17.57	-18.3
ε_x^S (mm.mrad)	1.15	0.73	1.15	1.0	1.15
ε_x^L (mm.mrad)	.85	1.30	.85	1.0	.76/1.0
α_c	.026	.039	.027	.025	.028
β_x^{long} (m)	5.4012	6.00	4.78	5.5	3.9346
D_x (m)	-1.2	-1.83218	-1.3	-1.16	-1.2
β_y^{wig} (m)	1.15	1.17(S)/1.05(L)	1.15	1.15	1.15
α_{split} (mrad)	±152.705/ ±152.705	± 152.380/ ±152.380	±150.51227/ ±152.75	±152.705/ ±152.7822	±150.5127/ ±152.721
$\alpha_{corr.}$ (mrad)	0.0/0.0	0.0/0.0	±1.652554/ 0.0	0.0/ ±0.36736	±1.652554/ ±0.36736

4. DYNAMIC APERTURE

The dynamic apertures have been computed with the 'DAΦNE' code[8]. The new lattices have a D.A. larger than the physical aperture, which is $10\sigma_x$ off coupling in the horizontal plane and $10\sigma_y$ full coupling in the vertical one[9].

Appendices D.I(a-b) to D.X(a-b) show the stability region for all the different lattices and the corresponding sextupole integrated strengths.

We have seen that even changing the quadrupole settings (see Figs. 7, 8) to match the different configurations the D.A. does not decrease to the physical aperture limits: this is a measure of how the machine is flexible on a wide range of stability. This is true even when the machine loses its symmetry with respect to the utility straight section midpoints.

5. BEAM LIFETIME

The beam lifetime is calculated by taking into account the design of the vacuum chamber aperture. The horizontal aperture of the arc vacuum chamber and the apertures of the different IRs are given in Appendix E.

A residual gas pressure P=10^{-9} Torr (biatomic gas, Z=8) is assumed. The rf voltage has been chosen in order to get 1% energy acceptance.

In Table X the beam lifetime and the related parameters corresponding to three different choices of the bunch length and the coupling factor are shown for the DD(a) lattice.

The Touschek scattering effect is the dominant contribution to the beam lifetime and therefore it is listed separately in the table. It is proportional to the bunch density and therefore the beam lifetime increases when the bunch volume is larger.

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[8] M.E.Biagini, "DAΦNE: a tracking program for the Frascati Φ-factory", DAΦNE Tech. Note L-7, May 1993.
[9] C. Biscari, "DAΦNE Stay Clear Apertures", DAΦNE Tech. Note L-6, March 1993.

The Touschek scattering contribution and the total single beam lifetime for all the lattices presented are listed in Table XI**.** The values are calculated for the parameters shown in the first column of Table X.

Table X - *Beam lifetime parameters for DD(a) lattice*

N/bunch	8.9 10^{10}	8.9 10^{10}	8.9 10^{10}
κ	**.01**	**.01**	**.02**
Momentum compaction	.019	.019	.019
V_{rf} (kV)	254	254	254
harmonic number	120	120	120
rf acceptance	1.2 10^{-2}	1.2 10^{-2}	1.2 10^{-2}
σ_p	5.5 10^{-3}	5.5 10^{-3}	5.5 10^{-3}
σ_l (m)	**.02**	**.03**	**.03**
Touschek scattering lifetime (min)	113	170	238
Single beam lifetime (min)	**101**	**143**	**187**

Table XI - *Single beam lifetime*

	$\tau_{Touschek}$*(min)*	τ_{total} *(min)*
DD(a)	113	101
GD(a)	115	99
KD(a)	105	94
DF(a)	111	99
KF(a)	123	108
DD(b)	102	92
GD(b)	75	68
KD(b)	106	95
DF(b)	101	90
KF(b)	109	90

6. PARASITIC CROSSINGS

The tune shift due to the parasitic crossings has been calculated to give an estimate of their influence on the luminosity. The tune shift is to the lowest order:

$$\Delta\nu_{x,y} = \frac{r_o N \beta_{x,y}}{2\pi\gamma d^2}$$

where *d* is the distance between the bunch centers.

The beta-functions, the bunch distance *d* and the tune shifts at the parasitic crossings are listed in Table XII for all the IRs. Moreover the parameter d/σ_x, which is a measure of the overlap between the two bunches, is shown. All the values are calculated for a half crossing angle θ=12.5mrad and a number of particles per bunch N=8.9 10^{10}. The parasitic tune shifts are always less than 6% of that one at the IP.

Table XII - *Parasitic crossings @θ=12.5mrad*

KLOE

s *(m)*	β_x *(m)*	β_y *(m)*	**d** *(m)*	$\Delta\nu_x$	$\Delta\nu_y$	d/σ_x
0.4	4.52	3.59	1.00E-02	-0.0018	-0.0014	4.70
0.8	3.19	17.67	1.75E-02	-0.0004	-0.0023	9.81
1.2	3.17	26.59	3.01E-02	-0.0001	-0.0012	16.91
1.6	5.94	15.46	5.10E-02	-0.0001	-0.0002	20.91

FI.NU.DA.

s *(m)*	β_x *(m)*	β_y *(m)*	**d** *(m)*	$\Delta\nu_x$	$\Delta\nu_y$	d/σ_x
0.4	4.37	3.65	9.80E-03	-0.0018	-0.0015	4.69
0.8	2.44	16.64	1.72E-02	-0.0003	-0.0023	11.00
1.2	3.83	14.84	3.35E-02	-0.0001	-0.0005	17.11
1.6	6.06	11.22	5.12E-02	-0.0001	-0.0002	20.79

DEAR

s *(m)*	β_x *(m)*	β_y *(m)*	**d** *(m)*	$\Delta\nu_x$	$\Delta\nu_y$	d/σ_x
0.4	4.54	3.6	1.00E-02	-0.0018	-0.0014	4.69
0.8	3.87	16.13	1.88E-02	-0.0004	-0.0018	9.54
1.2	3.02	37.25	2.75E-02	-0.0002	-0.0020	15.81
1.6	5.74	28.39	5.02E-02	-0.0001	-0.0005	20.96

DAY-ONE

s *(m)*	β_x *(m)*	β_y *(m)*	**d** *(m)*	$\Delta\nu_x$	$\Delta\nu_y$	d/σ_x
0.4	3.59	3.75	9.80E-03	-0.0015	-0.0016	5.17
0.8	2.87	14.33	2.00E-02	-0.0003	-0.0014	11.78
1.2	2.77	27.99	3.20E-02	-0.0001	-0.0011	19.23
1.6	5.81	20.71	5.88E-02	-0.0001	-0.0002	24.41

APPENDIX A(a) -*Short half optical functions for DAY-ONE,* Q_x*=5.09,*Q_y*=6.07*

EL.	TIP	BETX	ALFX	BETY	ALFY	DX	DPX	QX	QY
0	0	8.8221	0.2359	1.9286	0.4181	-0.039000	-0.020400	0.000000	0.000000
9	4	8.1941	0.1938	1.9968	-0.4652	0.042485	0.132574	0.027169	0.132323
10	3	8.1941	0.0610	1.9968	-0.4328	0.042485	0.133263	0.027169	0.132323
11	1	8.1655	0.0151	2.4051	-0.6558	0.092458	0.133263	0.034468	0.159692
12	1	8.1655	0.0151	2.4051	-0.6558	0.092458	0.133263	0.034468	0.159692
13	1	8.1657	-0.0155	2.7701	-0.8044	0.125774	0.133263	0.039341	0.175131
14	1	8.1657	-0.0155	2.7701	-0.8044	0.125774	0.133263	0.039341	0.175131
15	1	8.1945	-0.0615	3.4570	-1.0274	0.175747	0.133263	0.046640	0.194465
16	2	7.4549	2.4452	4.5240	-2.6456	0.206442	0.069676	0.052650	0.206751
17	1	5.6485	2.0707	6.9234	-3.3529	0.234312	0.069676	0.062467	0.218136
18	3	5.6957	-2.2399	7.3186	2.1380	0.283410	0.263877	0.071215	0.224592
19	1	6.6340	-2.4512	6.4938	1.9857	0.336186	0.263877	0.076394	0.229209
20	1	7.6567	-2.6625	5.7300	1.8335	0.388961	0.263877	0.080861	0.234429
21	1	8.7639	-2.8738	5.0270	1.6812	0.441736	0.263877	0.084747	0.240361
22	2	9.3751	0.9230	4.6655	-0.4259	0.491601	0.065042	0.089905	0.250436
23	1	8.0247	0.7650	5.5090	-0.6285	0.543635	0.065042	0.104605	0.275656
24	4	3.7452	2.8126	7.0015	-0.8791	0.808112	0.446820	0.131134	0.301135
25	1	1.2266	1.3851	8.1476	-1.0311	1.076204	0.446820	0.176291	0.313791
26	3	0.8082	0.1205	6.8766	4.9207	1.348416	1.404335	0.227058	0.319918
27	1	0.8102	-0.1306	5.0550	4.1874	1.629283	1.404335	0.266808	0.325317
28	1	0.8102	-0.1306	5.0550	4.1874	1.629283	1.404335	0.266808	0.325317
29	1	1.1155	-0.6327	2.2917	2.7208	2.191017	1.404335	0.335926	0.344065
30	2	1.2574	0.2034	1.3880	0.5588	2.303311	-0.672695	0.374832	0.372207
31	1	1.3114	-0.2935	1.0578	-0.0084	1.899694	-0.672695	0.452209	0.454654
32	3	1.3114	-0.3120	1.0578	0.0065	1.899694	-0.645980	0.452209	0.454654
33	4	1.3645	-0.3485	1.0628	-0.0694	1.847849	-0.645640	0.461762	0.466713
34	3	1.3645	-0.3677	1.0628	-0.0545	1.847849	-0.619653	0.461762	0.466713
35	3	1.3645	-0.4060	1.0628	-0.0246	1.847849	-0.567681	0.461762	0.466713
36	4	1.3960	-0.3775	1.0663	-0.0624	1.824257	-0.607805	0.466389	0.472715
37	3	1.3960	-0.4167	1.0663	-0.0324	1.824257	-0.556496	0.466389	0.472715
38	3	1.3960	-0.4364	1.0663	-0.0174	1.824257	-0.530842	0.466389	0.472715
39	4	1.4689	-0.4718	1.0752	-0.0927	1.781719	-0.528909	0.475313	0.484657
40	3	1.4689	-0.4924	1.0752	-0.0776	1.781719	-0.503853	0.475313	0.484657
41	3	1.4689	-0.5131	1.0752	-0.0624	1.781719	-0.478797	0.475313	0.484657
42	4	1.5541	-0.5472	1.0912	-0.1374	1.739985	-0.560918	0.483769	0.496462
43	3	1.5541	-0.5690	1.0912	-0.1220	1.739985	-0.536449	0.483769	0.496462
44	3	1.5541	-0.7443	1.0912	0.0010	1.739985	-0.340253	0.483769	0.496462
45	4	1.7695	-0.5848	1.1145	-0.1461	1.646938	-0.816163	0.499127	0.519713
46	3	1.7695	-0.7843	1.1145	-0.0204	1.646938	-0.630458	0.499127	0.519713
47	3	1.7695	-0.8092	1.1145	-0.0048	1.646938	-0.607297	0.499127	0.519713
48	4	1.9021	-0.8415	1.1211	-0.0768	1.595014	-0.686271	0.506090	0.531152
49	3	1.9021	-0.8682	1.1211	-0.0610	1.595014	-0.663841	0.506090	0.531152
50	3	1.9021	-0.8950	1.1211	-0.0453	1.595014	-0.641410	0.506090	0.531152
51	4	2.0482	-0.9249	1.1341	-0.1170	1.543811	-0.634222	0.512562	0.542491
52	3	2.0482	-0.9537	1.1341	-0.1011	1.543811	-0.612511	0.512562	0.542491
53	3	2.0482	-1.1847	1.1341	0.0268	1.543811	-0.438435	0.512562	0.542491
54	4	2.3927	-0.9401	1.1482	-0.1148	1.465127	-0.539471	0.524058	0.564956
55	3	2.3927	-1.2099	1.1482	0.0146	1.465127	-0.374266	0.524058	0.564956
56	3	2.3927	-1.2435	1.1482	0.0308	1.465127	-0.353662	0.524058	0.564956
57	4	2.5946	-1.2706	1.1489	-0.0392	1.437131	-0.343813	0.529185	0.576087
58	3	2.5946	-1.3071	1.1489	-0.0230	1.437131	-0.323602	0.529185	0.576087
59	3	2.5946	-1.3436	1.1489	-0.0069	1.437131	-0.303392	0.529185	0.576087
60	4	2.8123	-1.3671	1.1556	-0.0768	1.409783	-0.377922	0.533913	0.587183

APPENDIX A(a)

EL.	TIP	BETX	ALFX	BETY	ALFY	DX	DPX	QX	QY
61	3	2.8123	-1.4066	1.1556	-0.0605	1.409783	-0.358096	0.533913	0.587183
62	3	2.8123	-1.7237	1.1556	0.0698	1.409783	-0.199132	0.533913	0.587183
63	4	3.0765	-1.5599	1.1500	0.0000	1.385321	-0.410013	0.538252	0.598274
64	4	3.3107	-1.3510	1.1556	-0.0698	1.344041	-0.617933	0.542250	0.609365
65	3	3.3107	-1.7243	1.1556	0.0605	1.344041	-0.466382	0.542250	0.609365
66	3	3.3107	-1.7709	1.1556	0.0768	1.344041	-0.447481	0.542250	0.609365
67	4	3.5967	-1.7902	1.1489	0.0069	1.305215	-0.519787	0.545951	0.620461
68	3	3.5967	-1.8408	1.1489	0.0230	1.305215	-0.501432	0.545951	0.620461
69	3	3.5967	-1.8914	1.1489	0.0392	1.305215	-0.483077	0.545951	0.620461
70	4	3.9017	-1.9058	1.1482	-0.0308	1.266978	-0.469514	0.549361	0.631593
71	3	3.9017	-1.9606	1.1482	-0.0146	1.266978	-0.451697	0.549361	0.631593
72	3	3.9017	-2.4006	1.1482	0.1148	1.266978	-0.308835	0.549361	0.631593
73	4	4.5903	-1.8474	1.1341	-0.0268	1.212990	-0.362154	0.555370	0.654057
74	3	4.5903	-2.3649	1.1341	0.1011	1.212990	-0.225380	0.555370	0.654057
75	3	4.5903	-2.4295	1.1341	0.1170	1.212990	-0.208322	0.555370	0.654057
76	4	4.9812	-2.4381	1.1211	0.0453	1.196883	-0.192933	0.558041	0.665397
77	3	4.9812	-2.5082	1.1211	0.0610	1.196883	-0.176102	0.558041	0.665397
78	3	4.9812	-2.5782	1.1211	0.0768	1.196883	-0.159270	0.558041	0.665397
79	4	5.3955	-2.5801	1.1145	0.0048	1.181317	-0.228526	0.560505	0.676835
80	3	5.3955	-2.6560	1.1145	0.0204	1.181317	-0.211914	0.560505	0.676835
81	3	5.3955	-3.2643	1.1145	0.1461	1.181317	-0.078711	0.560505	0.676835
82	4	6.3243	-2.4652	1.0912	-0.0010	1.138107	-0.458326	0.564858	0.700086
83	3	6.3243	-3.1783	1.0912	0.1220	1.138107	-0.329996	0.564858	0.700086
84	3	6.3243	-3.2673	1.0912	0.1374	1.138107	-0.313991	0.564858	0.700086
85	4	6.8486	-3.2614	1.0752	0.0624	1.110178	-0.381786	0.566799	0.711891
86	3	6.8486	-3.3577	1.0752	0.0776	1.110178	-0.366174	0.566799	0.711891
87	3	6.8486	-3.4540	1.0752	0.0927	1.110178	-0.350561	0.566799	0.711891
88	4	7.4022	-3.4390	1.0663	0.0174	1.082751	-0.332731	0.568593	0.723833
89	3	7.4022	-3.5431	1.0663	0.0324	1.082751	-0.317505	0.568593	0.723833
90	3	7.4022	-3.7513	1.0663	0.0624	1.082751	-0.287052	0.568593	0.723833
91	4	7.6929	-3.4867	1.0628	0.0246	1.071109	-0.293014	0.569439	0.729835
92	3	7.6929	-3.7031	1.0628	0.0545	1.071109	-0.262888	0.569439	0.729835
93	3	7.6929	-3.8113	1.0628	0.0694	1.071109	-0.247825	0.569439	0.729835
94	4	8.3031	-3.7864	1.0578	-0.0065	1.051961	-0.229209	0.571037	0.741895
95	3	8.3031	-3.9032	1.0578	0.0084	1.051961	-0.214416	0.571037	0.741895
96	1	10.1585	-4.3431	1.1019	-0.2043	1.003718	-0.214416	0.574936	0.775309
97	1	10.1585	-4.3431	1.1019	-0.2043	1.003718	-0.214416	0.574936	0.775309
98	1	13.6909	-5.0764	1.3880	-0.5588	0.923312	-0.214416	0.579998	0.824341
99	2	14.2051	3.4675	2.1238	-2.0405	0.778270	-0.737839	0.583319	0.853157
100	1	10.3741	2.9174	5.4477	-3.4993	0.335567	-0.737839	0.591189	0.881379
101	3	10.3741	0.1848	5.4477	-2.0644	0.335567	-0.649448	0.591189	0.881379
102	4	5.8253	3.6179	10.4818	-3.0205	0.000000	0.000000	0.609854	0.902290
103	3	5.8253	2.0835	10.4818	-0.2596	0.000000	0.000000	0.609854	0.902290
104	1	4.6577	1.8084	10.6467	-0.2901	0.000000	0.000000	0.619025	0.906810
105	1	4.1358	1.6709	10.7360	-0.3054	0.000000	0.000000	0.624466	0.909043
106	1	3.2158	1.3958	10.9284	-0.3359	0.000000	0.000000	0.637573	0.913452
107	3	2.9801	-0.5632	9.2506	5.5864	0.000000	0.000000	0.653493	0.918059
108	1	3.4822	-0.7343	5.4482	4.2390	0.000000	0.000000	0.672659	0.926739
109	2	3.2201	1.5460	4.0946	0.5839	0.000000	0.000000	0.686442	0.937213
110	1	1.5847	-0.8175	3.1233	-0.1513	0.000000	0.000000	0.954135	1.045228
111	3	2.6283	-2.9131	2.5892	1.7989	0.000000	0.000000	0.978495	1.061436
112	1	7.4457	-5.0867	1.0160	0.8137	0.000000	0.000000	1.000228	1.121978
113	2	8.2350	0.0000	0.8978	0.0000	0.000000	0.000000	1.003227	1.147500

APPENDIX A(b) - *Short half optical functions for DAY-ONE,* $Q_x=4.53 Q_y=6.06$

EL.	TIP	BETX	ALFX	BETY	ALFY	DX	DPX	QX	QY
0	0	8.8221	0.2359	1.9286	0.4181	-0.039000	-0.020400	0.000000	0.000000
9	4	8.1941	0.1938	1.9968	-0.4652	0.042485	0.132574	0.027169	0.132323
10	3	8.1941	0.0610	1.9968	-0.4328	0.042485	0.133263	0.027169	0.132323
11	1	8.1655	0.0151	2.4051	-0.6558	0.092458	0.133263	0.034468	0.159692
12	1	8.1655	0.0151	2.4051	-0.6558	0.092458	0.133263	0.034468	0.159692
13	1	8.1657	-0.0155	2.7701	-0.8044	0.125774	0.133263	0.039341	0.175131
14	1	8.1657	-0.0155	2.7701	-0.8044	0.125774	0.133263	0.039341	0.175131
15	1	8.1945	-0.0615	3.4570	-1.0274	0.175747	0.133263	0.046640	0.194465
16	2	7.3965	2.6265	4.5555	-2.7634	0.205734	0.064870	0.052666	0.206723
17	1	5.4661	2.1993	7.0696	-3.5218	0.231682	0.064870	0.062685	0.217951
18	3	5.3164	-1.6649	7.6341	1.7772	0.277254	0.244381	0.071869	0.224221
19	1	6.0108	-1.8068	6.9450	1.6683	0.326131	0.244381	0.077501	0.228593
20	1	6.7619	-1.9487	6.2994	1.5594	0.375007	0.244381	0.082494	0.233406
21	1	7.5697	-2.0906	5.6975	1.4504	0.423883	0.244381	0.086944	0.238720
22	2	8.0955	0.3952	5.3913	-0.3970	0.475623	0.097759	0.092947	0.247480
23	1	7.5545	0.2810	6.1640	-0.5688	0.553830	0.097759	0.109256	0.269638
24	4	4.0976	2.6089	7.5007	-0.7814	0.845623	0.466971	0.135393	0.292893
25	1	1.6528	1.4658	8.5156	-0.9102	1.125805	0.466971	0.172421	0.304853
26	3	1.2335	0.0394	7.1514	5.0962	1.406127	1.438239	0.207467	0.310736
27	1	1.2502	-0.1230	5.2638	4.3419	1.693775	1.438239	0.233212	0.315925
28	1	1.2502	-0.1230	5.2638	4.3419	1.693775	1.438239	0.233212	0.315925
29	1	1.4785	-0.4478	2.3937	2.8333	2.269070	1.438239	0.280741	0.333898
30	2	1.4036	0.6746	1.4484	0.5963	2.381934	-0.702818	0.312626	0.360839
31	1	0.9673	0.0526	1.0697	0.0347	1.960244	-0.702818	0.398716	0.440889
32	3	0.9673	0.0390	1.0697	0.0498	1.960244	-0.675251	0.398716	0.440889
33	4	0.9660	-0.0224	1.0678	-0.0254	1.905995	-0.676246	0.411942	0.452853
34	3	0.9660	-0.0360	1.0678	-0.0104	1.905995	-0.649442	0.411942	0.452853
35	3	0.9660	-0.0632	1.0678	0.0196	1.905995	-0.595835	0.411942	0.452853
36	4	0.9710	-0.0612	1.0677	-0.0180	1.881221	-0.638548	0.418538	0.458837
37	3	0.9710	-0.0885	1.0677	0.0120	1.881221	-0.585638	0.418538	0.458837
38	3	0.9710	-0.1022	1.0677	0.0271	1.881221	-0.559182	0.418538	0.458837
39	4	0.9923	-0.1634	1.0694	-0.0482	1.836357	-0.558505	0.431563	0.470803
40	3	0.9923	-0.1774	1.0694	-0.0331	1.836357	-0.532681	0.431563	0.470803
41	3	0.9923	-0.1913	1.0694	-0.0181	1.836357	-0.506856	0.431563	0.470803
42	4	1.0279	-0.2521	1.0783	-0.0932	1.792322	-0.590181	0.444221	0.482710
43	3	1.0279	-0.2665	1.0783	-0.0780	1.792322	-0.564976	0.444221	0.482710
44	3	1.0279	-0.3824	1.0783	0.0436	1.792322	-0.362878	0.444221	0.482710
45	4	1.1474	-0.3547	1.0883	-0.1056	1.694907	-0.847836	0.467719	0.506383
46	3	1.1474	-0.4841	1.0883	0.0171	1.694907	-0.656722	0.467719	0.506383
47	3	1.1474	-0.5002	1.0883	0.0324	1.694907	-0.632887	0.467719	0.506383
48	4	1.2326	-0.5600	1.0890	-0.0414	1.640887	-0.712917	0.478466	0.518128
49	3	1.2326	-0.5773	1.0890	-0.0261	1.640887	-0.689841	0.478466	0.518128
50	3	1.2326	-0.5946	1.0890	-0.0108	1.640887	-0.666766	0.478466	0.518128
51	4	1.3328	-0.6528	1.0967	-0.0845	1.587607	-0.660586	0.488437	0.529828
52	3	1.3328	-0.6716	1.0967	-0.0691	1.587607	-0.638260	0.488437	0.529828
53	3	1.3328	-0.8218	1.0967	0.0546	1.587607	-0.459245	0.488437	0.529828
54	4	1.5855	-0.7375	1.1027	-0.0922	1.504968	-0.567825	0.505964	0.553145
55	3	1.5855	-0.9163	1.1027	0.0321	1.504968	-0.398129	0.505964	0.553145
56	3	1.5855	-0.9386	1.1027	0.0476	1.504968	-0.376964	0.505964	0.553145
57	4	1.7408	-0.9947	1.1009	-0.0253	1.475065	-0.367990	0.513654	0.564750
58	3	1.7408	-1.0191	1.1009	-0.0098	1.475065	-0.347246	0.513654	0.564750
59	3	1.7408	-1.0436	1.1009	0.0056	1.475065	-0.326502	0.513654	0.564750
60	4	1.9127	-1.0969	1.1059	-0.0673	1.445829	-0.401864	0.520655	0.576339

APPENDIX A(b)

EL.	TIP	BETX	ALFX	BETY	ALFY	DX	DPX	QX	QY
61	3	1.9127	-1.1238	1.1059	-0.0517	1.445829	-0.381532	0.520655	0.576339
62	3	1.9127	-1.3395	1.1059	0.0730	1.445829	-0.218503	0.520655	0.576339
63	4	2.1223	-1.2656	1.1000	0.0000	1.419684	-0.432554	0.526990	0.587932
64	4	2.3171	-1.1552	1.1059	-0.0730	1.376473	-0.643481	0.532745	0.599525
65	3	2.3171	-1.4165	1.1059	0.0517	1.376473	-0.488273	0.532745	0.599525
66	3	2.3171	-1.4491	1.1059	0.0673	1.376473	-0.468916	0.532745	0.599525
67	4	2.5539	-1.4991	1.1009	-0.0056	1.335897	-0.541932	0.537996	0.611113
68	3	2.5539	-1.5350	1.1009	0.0098	1.335897	-0.523146	0.537996	0.611113
69	3	2.5539	-1.5709	1.1009	0.0253	1.335897	-0.504359	0.537996	0.611113
70	4	2.8099	-1.6167	1.1027	-0.0476	1.295925	-0.491467	0.542764	0.622718
71	3	2.8099	-1.6562	1.1027	-0.0321	1.295925	-0.473243	0.542764	0.622718
72	3	2.8099	-1.9730	1.1027	0.0922	1.295925	-0.327117	0.542764	0.622718
73	4	3.3953	-1.6383	1.0967	-0.0546	1.238599	-0.385358	0.551000	0.646035
74	3	3.3953	-2.0211	1.0967	0.0691	1.238599	-0.245696	0.551000	0.646035
75	3	3.3953	-2.0689	1.0967	0.0845	1.238599	-0.228278	0.551000	0.646035
76	4	3.7309	-2.1098	1.0890	0.0108	1.220868	-0.213447	0.554588	0.657735
77	3	3.7309	-2.1622	1.0890	0.0261	1.220868	-0.196278	0.554588	0.657735
78	3	3.7309	-2.2147	1.0890	0.0414	1.220868	-0.179109	0.554588	0.657735
79	4	4.0895	-2.2498	1.0883	-0.0324	1.203688	-0.248887	0.557858	0.669481
80	3	4.0895	-2.3073	1.0883	-0.0171	1.203688	-0.231959	0.557858	0.669481
81	3	4.0895	-2.7684	1.0883	0.1056	1.203688	-0.096234	0.557858	0.669481
82	4	4.8984	-2.2216	1.0783	-0.0436	1.157356	-0.479604	0.563541	0.693153
83	3	4.8984	-2.7740	1.0783	0.0780	1.157356	-0.349103	0.563541	0.693153
84	3	4.8984	-2.8429	1.0783	0.0932	1.157356	-0.332828	0.563541	0.693153
85	4	5.3573	-2.8712	1.0694	0.0181	1.127898	-0.401038	0.566034	0.705060
86	3	5.3573	-2.9465	1.0694	0.0331	1.127898	-0.385177	0.566034	0.705060
87	3	5.3573	-3.0218	1.0694	0.0482	1.127898	-0.369315	0.566034	0.705060
88	4	5.8443	-3.0422	1.0677	-0.0271	1.098950	-0.351867	0.568316	0.717027
89	3	5.8443	-3.1244	1.0677	-0.0120	1.098950	-0.336413	0.568316	0.717027
90	3	5.8443	-3.2887	1.0677	0.0180	1.098950	-0.305504	0.568316	0.717027
91	4	6.1007	-3.0953	1.0678	-0.0196	1.086553	-0.312178	0.569386	0.723010
92	3	6.1007	-3.2669	1.0678	0.0104	1.086553	-0.281618	0.569386	0.723010
93	3	6.1007	-3.3527	1.0678	0.0254	1.086553	-0.266338	0.569386	0.723010
94	4	6.6402	-3.3643	1.0697	-0.0498	1.065906	-0.248053	0.571392	0.734974
95	3	6.6402	-3.4577	1.0697	-0.0347	1.065906	-0.233063	0.571392	0.734974
96	1	8.2949	-3.8967	1.1328	-0.2453	1.013467	-0.233063	0.576218	0.767736
97	1	8.2949	-3.8967	1.1328	-0.2453	1.013467	-0.233063	0.576218	0.767736
98	1	11.4918	-4.6284	1.4484	-0.5963	0.926068	-0.233063	0.582332	0.815024
99	2	12.2239	2.3322	2.2074	-2.0799	0.778270	-0.737839	0.586245	0.842652
100	1	9.6149	2.0161	5.5719	-3.5276	0.335567	-0.737839	0.595058	0.870015
101	3	9.6149	-0.5165	5.5719	-2.0599	0.335567	-0.649448	0.595058	0.870015
102	4	6.3831	3.2183	10.5727	-2.9914	0.000000	0.000000	0.613578	0.890601
103	3	6.3831	1.5370	10.5727	-0.2065	0.000000	0.000000	0.613578	0.890601
104	1	5.5083	1.3790	10.7055	-0.2361	0.000000	0.000000	0.621634	0.895090
105	1	5.1064	1.2999	10.7785	-0.2509	0.000000	0.000000	0.626136	0.897312
106	1	4.3739	1.1419	10.9379	-0.2805	0.000000	0.000000	0.636246	0.901710
107	3	4.2848	-0.8318	9.7067	4.2008	0.000000	0.000000	0.647531	0.906242
108	1	4.9878	-0.9847	6.7429	3.4574	0.000000	0.000000	0.660870	0.913858
109	2	5.0659	0.7335	5.4334	1.0598	0.000000	0.000000	0.670208	0.921889
110	1	3.3028	0.0519	2.6444	0.1825	0.000000	0.000000	0.762675	1.022774
111	3	3.9656	-2.3999	2.1093	1.4863	0.000000	0.000000	0.776307	1.042405
112	1	7.4742	-3.4263	0.8709	0.5701	0.000000	0.000000	0.793947	1.115678
113	2	8.0000	0.0000	0.7873	0.0000	0.000000	0.000000	0.797000	1.145000

APPENDIX B(a) - *Long half optical functions for DAY-ONE,* $Q_x=5.09, Q_y=6.07$

EL.	TIP	BETX	ALFX	BETY	ALFY	DX	DPX	QX	QY
0	0	8.8221	0.2359	1.9286	0.4181	0.039000	0.020400	0.000000	0.000000
9	4	8.1941	0.1938	1.9968	-0.4652	-0.042485	-0.132574	0.027169	0.132323
10	3	8.1941	0.0610	1.9968	-0.4328	-0.042485	-0.133263	0.027169	0.132323
11	1	8.1638	-0.0040	2.6241	-0.7485	-0.113247	-0.133263	0.037509	0.169581
12	1	8.1638	-0.0040	2.6241	-0.7485	-0.113247	-0.133263	0.037509	0.169581
13	1	8.1796	-0.0442	3.1791	-0.9436	-0.156958	-0.133263	0.043899	0.187694
14	1	8.1796	-0.0442	3.1791	-0.9436	-0.156958	-0.133263	0.043899	0.187694
15	1	8.1945	-0.0615	3.4570	-1.0274	-0.175748	-0.133263	0.046640	0.194465
16	2	7.4258	2.5357	4.5397	-2.7041	-0.206090	-0.067282	0.052658	0.206737
17	1	5.4723	2.1154	7.1341	-3.4732	-0.234349	-0.067282	0.063152	0.218494
18	3	5.2721	-1.4049	7.7999	1.4009	-0.278564	-0.232292	0.072340	0.224689
19	1	5.7660	-1.5008	7.3346	1.3363	-0.318054	-0.232292	0.077248	0.228266
20	1	6.3889	-1.6136	6.8153	1.2604	-0.364512	-0.232292	0.082493	0.232769
21	1	7.0915	-1.7320	6.3027	1.1806	-0.413293	-0.232292	0.087459	0.237869
22	2	7.6765	-0.1750	6.0236	-0.2299	-0.468628	-0.134572	0.093861	0.245707
23	1	8.0424	-0.2824	6.5033	-0.3697	-0.576285	-0.134572	0.110094	0.266106
24	4	3.9351	2.7871	7.6540	-0.5812	-0.026615	0.985890	0.140407	0.293537
25	1	1.3927	1.4502	8.4144	-0.6861	0.564919	0.985890	0.181658	0.305448
26	3	0.9437	0.1589	6.9974	5.0436	0.937985	1.548473	0.225465	0.311437
27	1	0.9236	-0.0584	5.1311	4.2879	1.247680	1.548473	0.259826	0.316750
28	1	0.9236	-0.0584	5.1311	4.2879	1.247680	1.548473	0.259826	0.316750
29	1	1.1442	-0.4930	2.3052	2.7766	1.867069	1.548473	0.323435	0.335303
30	2	1.1875	0.3621	1.3880	0.5588	2.056849	-0.312714	0.362930	0.363394
31	1	1.0958	-0.2094	1.0578	-0.0084	1.869221	-0.312714	0.451078	0.445840
32	3	1.0958	-0.2248	1.0578	0.0065	1.869221	-0.286427	0.451078	0.445840
33	4	1.1361	-0.2762	1.0628	-0.0694	1.846255	-0.285726	0.462534	0.457900
34	3	1.1361	-0.2922	1.0628	-0.0545	1.846255	-0.259763	0.462534	0.457900
35	3	1.1361	-0.3242	1.0628	-0.0246	1.846255	-0.207835	0.462534	0.457900
36	4	1.1616	-0.3109	1.0663	-0.0624	1.837102	-0.248212	0.468094	0.463902
37	3	1.1616	-0.3436	1.0663	-0.0324	1.837102	-0.196542	0.468094	0.463902
38	3	1.1616	-0.3599	1.0663	-0.0174	1.837102	-0.170707	0.468094	0.463902
39	4	1.2235	-0.4105	1.0752	-0.0927	1.823451	-0.169388	0.478815	0.475844
40	3	1.2235	-0.4277	1.0752	-0.0776	1.823451	-0.143745	0.478815	0.475844
41	3	1.2235	-0.4449	1.0752	-0.0624	1.823451	-0.118103	0.478815	0.475844
42	4	1.2989	-0.4943	1.0912	-0.1374	1.810623	-0.201488	0.488953	0.487649
43	3	1.2989	-0.5126	1.0912	-0.1220	1.810623	-0.176025	0.488953	0.487649
44	3	1.2989	-0.6590	1.0912	0.0010	1.810623	0.028136	0.488953	0.487649
45	4	1.4975	-0.5659	1.1145	-0.1461	1.775413	-0.465735	0.507224	0.510900
46	3	1.4975	-0.7347	1.1145	-0.0204	1.775413	-0.265544	0.507224	0.510900
47	3	1.4975	-0.7558	1.1145	-0.0048	1.775413	-0.240576	0.507224	0.510900
48	4	1.6227	-0.8035	1.1211	-0.0768	1.752800	-0.322771	0.515421	0.522338
49	3	1.6227	-0.8264	1.1211	-0.0610	1.752800	-0.298121	0.515421	0.522338
50	3	1.6227	-0.8492	1.1211	-0.0453	1.752800	-0.273472	0.515421	0.522338
51	4	1.7628	-0.8947	1.1341	-0.1170	1.730979	-0.270165	0.522975	0.533678
52	3	1.7628	-0.9195	1.1341	-0.1011	1.730979	-0.245822	0.522975	0.533678
53	3	1.7628	-1.1182	1.1341	0.0268	1.730979	-0.050641	0.522975	0.533678
54	4	2.0971	-0.9441	1.1482	-0.1148	1.711553	-0.190789	0.536215	0.556143
55	3	2.0971	-1.1805	1.1482	0.0146	1.711553	0.002201	0.536215	0.556143
56	3	2.0971	-1.2100	1.1482	0.0308	1.711553	0.026271	0.536215	0.556143
57	4	2.2949	-1.2527	1.1489	-0.0392	1.713821	0.030235	0.542038	0.567274
58	3	2.2949	-1.2850	1.1489	-0.0230	1.713821	0.054337	0.542038	0.567274
59	3	2.2949	-1.3173	1.1489	-0.0069	1.713821	0.078438	0.542038	0.567274
60	4	2.5096	-1.3565	1.1556	-0.0768	1.716863	-0.002659	0.547361	0.578370
61	3	2.5096	-1.3918	1.1556	-0.0605	1.716863	0.021485	0.547361	0.578370
62	3	2.5096	-1.6748	1.1556	0.0698	1.716863	0.215074	0.547361	0.578370

APPENDIX B(a)

EL.	TIP	BETX	ALFX	BETY	ALFY	DX	DPX	QX	QY
63	4	2.7688	-1.5470	1.1500	0.0000	1.724500	-0.024902	0.552202	0.589461
64	4	3.0039	-1.3747	1.1556	-0.0698	1.712870	-0.264698	0.556627	0.600552
65	3	3.0039	-1.7134	1.1556	0.0605	1.712870	-0.071559	0.556627	0.600552
66	3	3.0039	-1.7556	1.1556	0.0768	1.712870	-0.047471	0.556627	0.600552
67	4	3.2887	-1.7907	1.1489	0.0069	1.705809	-0.128433	0.560691	0.611648
68	3	3.2887	-1.8370	1.1489	0.0230	1.705809	-0.104444	0.560691	0.611648
69	3	3.2887	-1.8832	1.1489	0.0392	1.705809	-0.080456	0.560691	0.611648
70	4	3.5937	-1.9134	1.1482	-0.0308	1.699519	-0.076266	0.564406	0.622779
71	3	3.5937	-1.9639	1.1482	-0.0146	1.699519	-0.052366	0.564406	0.622779
72	3	3.5937	-2.3691	1.1482	0.1148	1.699519	0.139268	0.564406	0.622779
73	4	4.2839	-1.8889	1.1341	-0.0268	1.710887	0.002018	0.570888	0.645244
74	3	4.2839	-2.3719	1.1341	0.1011	1.710887	0.194933	0.570888	0.645244
75	3	4.2839	-2.4322	1.1341	0.1170	1.710887	0.218993	0.570888	0.645244
76	4	4.6765	-2.4565	1.1211	0.0453	1.728620	0.222799	0.573742	0.656584
77	3	4.6765	-2.5223	1.1211	0.0610	1.728620	0.247108	0.573742	0.656584
78	3	4.6765	-2.5881	1.1211	0.0768	1.728620	0.271418	0.573742	0.656584
79	4	5.0937	-2.6056	1.1145	0.0048	1.747134	0.189813	0.576358	0.668022
80	3	5.0937	-2.6773	1.1145	0.0204	1.747134	0.214383	0.576358	0.668022
81	3	5.0937	-3.2516	1.1145	0.1461	1.747134	0.411386	0.576358	0.668022
82	4	6.0299	-2.5241	1.0912	-0.0010	1.774068	-0.076637	0.580947	0.691273
83	3	6.0299	-3.2040	1.0912	0.1220	1.774068	0.123403	0.580947	0.691273
84	3	6.0299	-3.2888	1.0912	0.1374	1.774068	0.148351	0.580947	0.691273
85	4	6.5590	-3.2985	1.0752	0.0624	1.782666	0.065836	0.582978	0.703078
86	3	6.5590	-3.3908	1.0752	0.0776	1.782666	0.090905	0.582978	0.703078
87	3	6.5590	-3.4830	1.0752	0.0927	1.782666	0.115974	0.582978	0.703078
88	4	7.1185	-3.4836	1.0663	0.0174	1.792068	0.118259	0.584847	0.715020
89	3	7.1185	-3.5837	1.0663	0.0324	1.792068	0.143460	0.584847	0.715020
90	3	7.1185	-3.7839	1.0663	0.0624	1.792068	0.193864	0.584847	0.715020
91	4	7.4125	-3.5366	1.0628	0.0246	1.799081	0.155562	0.585726	0.721022
92	3	7.4125	-3.7451	1.0628	0.0545	1.799081	0.206162	0.585726	0.721022
93	3	7.4125	-3.8493	1.0628	0.0694	1.799081	0.231462	0.585726	0.721022
94	4	8.0300	-3.8399	1.0578	-0.0065	1.817735	0.233273	0.587381	0.733082
95	3	8.0300	-3.9528	1.0578	0.0084	1.817735	0.258836	0.587381	0.733082
96	1	9.9136	-4.4187	1.1019	-0.2043	1.875973	0.258836	0.591395	0.766496
97	1	9.9136	-4.4187	1.1019	-0.2043	1.875973	0.258836	0.591395	0.766496
98	1	13.5187	-5.1950	1.3880	-0.5588	1.973036	0.258836	0.596552	0.815528
99	2	13.8530	4.1569	2.1614	-2.1903	1.852018	-1.051991	0.599925	0.844186
100	1	9.3398	3.3652	5.7554	-3.7998	1.220823	-1.051991	0.608324	0.871394
101	3	9.3398	0.2909	5.7554	-1.9053	1.220823	-0.650148	0.608324	0.871394
102	4	3.6687	3.1674	11.5442	-2.8787	0.591426	-0.324651	0.637442	0.895107
103	3	3.6687	1.9598	11.5442	0.9211	0.591426	-0.129978	0.637442	0.895107
104	1	1.5715	1.0362	10.3331	0.8090	0.500442	-0.129978	0.684525	0.905315
105	1	1.0685	0.6403	9.8621	0.7610	0.461448	-0.129978	0.721709	0.910045
106	1	0.7820	0.1785	9.3490	0.7049	0.415956	-0.129978	0.784246	0.915848
107	3	0.8686	-0.4765	8.0911	3.3519	0.396613	-0.000014	0.844551	0.921250
108	1	2.4715	-1.5784	3.7822	2.1724	0.396602	-0.000014	0.933898	0.943766
109	2	2.5821	1.2524	3.7532	-2.0651	0.331066	-0.424444	0.951784	0.957185
110	1	1.2335	0.4765	7.8282	-3.1592	0.000000	-0.424444	1.023773	0.980167
111	1	1.0838	-0.2795	13.4404	-4.2253	-0.322577	-0.424444	1.137924	0.991970
112	3	1.7366	-2.1059	12.0384	8.4308	-0.504894	-0.820666	1.174788	0.995543
113	1	4.2656	-3.5141	5.6631	5.7365	-0.874193	-0.820666	1.201224	1.004221
114	2	5.2834	0.4172	3.7719	1.0989	-1.000000	0.000000	1.210862	1.015009
115	1	4.8147	0.2644	2.5374	0.6965	-1.000000	0.000000	1.232627	1.050680
116	1	4.5939	0.1444	1.9559	0.3804	-1.000000	0.000000	1.250942	1.089646
117	1	4.5000	0.0000	1.7087	0.0000	-1.000000	0.000000	1.273773	1.147500

APPENDIX B(b) - *Long half optical functions for DAY-ONE, Q_x=4.53Q_y=6.06*

EL.	TIP	BETX	ALFX	BETY	ALFY	DX	DPX	QX	QY
0	0	8.8221	0.2359	1.9286	0.4181	0.039000	0.020400	0.000000	0.000000
9	4	8.1941	0.1938	1.9968	-0.4652	-0.042485	-0.132574	0.027169	0.132323
10	3	8.1941	0.0610	1.9968	-0.4328	-0.042485	-0.133263	0.027169	0.132323
11	1	8.1638	-0.0040	2.6241	-0.7485	-0.113247	-0.133263	0.037509	0.169581
12	1	8.1638	-0.0040	2.6241	-0.7485	-0.113247	-0.133263	0.037509	0.169581
13	1	8.1796	-0.0442	3.1791	-0.9436	-0.156958	-0.133263	0.043899	0.187694
14	1	8.1796	-0.0442	3.1791	-0.9436	-0.156958	-0.133263	0.043899	0.187694
15	1	8.1945	-0.0615	3.4570	-1.0274	-0.175748	-0.133263	0.046640	0.194465
16	2	7.3984	2.6205	4.5545	-2.7595	-0.205758	-0.065028	0.052666	0.206724
17	1	5.3847	2.1739	7.2062	-3.5540	-0.233070	-0.065028	0.063264	0.218403
18	3	4.7059	0.1726	8.5696	-0.8201	-0.266115	-0.157327	0.072933	0.224367
19	1	4.6535	0.1354	8.8541	-0.8532	-0.292861	-0.157327	0.078716	0.227474
20	1	4.6081	0.0917	9.2032	-0.8923	-0.324326	-0.157327	0.085592	0.231000
21	1	4.5793	0.0457	9.5866	-0.9333	-0.357365	-0.157327	0.092870	0.234559
22	3	4.7840	-0.7387	9.7143	0.5140	-0.413143	-0.215944	0.103157	0.239469
23	1	6.1727	-0.9972	8.9751	0.4099	-0.585898	-0.215944	0.126672	0.253122
24	4	4.3494	2.1090	8.1736	0.2525	-0.119520	0.938262	0.159620	0.275682
25	1	2.2695	1.3575	7.9175	0.1744	0.443437	0.938262	0.190202	0.287563
26	3	1.9259	-0.1407	6.4293	4.4690	0.776545	1.317400	0.213856	0.294048
27	1	2.0033	-0.2466	4.7722	3.8166	1.040025	1.317400	0.230089	0.299796
28	1	2.0033	-0.2466	4.7722	3.8166	1.040025	1.317400	0.230089	0.299796
29	1	2.2854	-0.4585	2.2409	2.5118	1.566985	1.317400	0.260018	0.319312
30	2	2.0470	1.1871	1.3880	0.5588	1.758639	-0.065847	0.281267	0.347651
31	1	1.0463	0.4809	1.0578	-0.0084	1.719131	-0.065847	0.348501	0.430097
32	3	1.0463	0.4662	1.0578	0.0065	1.719131	-0.041671	0.348501	0.430097
33	4	0.9771	0.3948	1.0628	-0.0694	1.715940	-0.037815	0.361145	0.442157
34	3	0.9771	0.3810	1.0628	-0.0545	1.715940	-0.013684	0.361145	0.442157
35	3	0.9771	0.3535	1.0628	-0.0246	1.715940	0.034578	0.361145	0.442157
36	4	0.9488	0.3500	1.0663	-0.0624	1.716631	-0.000156	0.367779	0.448158
37	3	0.9488	0.3233	1.0663	-0.0324	1.716631	0.048126	0.367779	0.448158
38	3	0.9488	0.3100	1.0663	-0.0174	1.716631	0.072266	0.367779	0.448158
39	4	0.9049	0.2376	1.0752	-0.0927	1.722585	0.076075	0.381579	0.460101
40	3	0.9049	0.2249	1.0752	-0.0776	1.722585	0.100300	0.381579	0.460101
41	3	0.9049	0.2121	1.0752	-0.0624	1.722585	0.124524	0.381579	0.460101
42	4	0.8767	0.1391	1.0912	-0.1374	1.729317	0.043188	0.395937	0.471906
43	3	0.8767	0.1268	1.0912	-0.1220	1.729317	0.067507	0.395937	0.471906
44	3	0.8767	0.0279	1.0912	0.0010	1.729317	0.262501	0.395937	0.471906
45	4	0.8719	0.0013	1.1145	-0.1461	1.732722	-0.220185	0.425185	0.495156
46	3	0.8719	-0.0970	1.1145	-0.0204	1.732722	-0.024807	0.425185	0.495156
47	3	0.8719	-0.1092	1.1145	-0.0048	1.732722	-0.000440	0.425185	0.495156
48	4	0.8953	-0.1823	1.1211	-0.0768	1.729417	-0.081891	0.439660	0.506595
49	3	0.8953	-0.1949	1.1211	-0.0610	1.729417	-0.057571	0.439660	0.506595
50	3	0.8953	-0.2075	1.1211	-0.0453	1.729417	-0.033250	0.439660	0.506595
51	4	0.9345	-0.2800	1.1341	-0.1170	1.726893	-0.029634	0.453640	0.517935
52	3	0.9345	-0.2931	1.1341	-0.1011	1.726893	-0.005349	0.453640	0.517935
53	3	0.9345	-0.3985	1.1341	0.0268	1.726893	0.189372	0.453640	0.517935
54	4	1.0649	-0.4060	1.1482	-0.1148	1.745871	0.046496	0.479239	0.540399
55	3	1.0649	-0.5261	1.1482	0.0146	1.745871	0.243356	0.479239	0.540399
56	3	1.0649	-0.5411	1.1482	0.0308	1.745871	0.267908	0.479239	0.540399
57	4	1.1575	-0.6125	1.1489	-0.0392	1.767498	0.270883	0.490752	0.551531
58	3	1.1575	-0.6288	1.1489	-0.0230	1.767498	0.295739	0.490752	0.551531
59	3	1.1575	-0.6451	1.1489	-0.0069	1.767498	0.320595	0.490752	0.551531
60	4	1.2668	-0.7148	1.1556	-0.0768	1.789923	0.238072	0.501307	0.562627
61	3	1.2668	-0.7326	1.1556	-0.0605	1.789923	0.263244	0.501307	0.562627
62	3	1.2668	-0.8755	1.1556	0.0698	1.789923	0.465071	0.501307	0.562627

APPENDIX B(b)

EL.	TIP	BETX	ALFX	BETY	ALFY	DX	DPX	QX	QY
63	4	1.4065	-0.8608	1.1500	0.0000	1.817339	0.217626	0.510872	0.573718
64	4	1.5418	-0.8213	1.1556	-0.0698	1.824818	-0.031390	0.519541	0.584808
65	3	1.5418	-0.9951	1.1556	0.0605	1.824818	0.174373	0.519541	0.584808
66	3	1.5418	-1.0168	1.1556	0.0768	1.824818	0.200035	0.519541	0.584808
67	4	1.7105	-1.0843	1.1489	0.0069	1.837517	0.116331	0.527408	0.595904
68	3	1.7105	-1.1083	1.1489	0.0230	1.837517	0.142172	0.527408	0.595904
69	3	1.7105	-1.1324	1.1489	0.0392	1.837517	0.168013	0.527408	0.595904
70	4	1.8976	-1.1968	1.1482	-0.0308	1.851045	0.169017	0.534499	0.607036
71	3	1.8976	-1.2235	1.1482	-0.0146	1.851045	0.195048	0.534499	0.607036
72	3	1.8976	-1.4375	1.1482	0.1148	1.851045	0.403767	0.534499	0.607036
73	4	2.3373	-1.2747	1.1341	-0.0268	1.902486	0.235564	0.546584	0.629501
74	3	2.3373	-1.5382	1.1341	0.1011	1.902486	0.450084	0.546584	0.629501
75	3	2.3373	-1.5711	1.1341	0.1170	1.902486	0.476839	0.546584	0.629501
76	4	2.5945	-1.6319	1.1211	0.0453	1.940737	0.476102	0.551771	0.640840
77	3	2.5945	-1.6683	1.1211	0.0610	1.940737	0.503395	0.551771	0.640840
78	3	2.5945	-1.7048	1.1211	0.0768	1.940737	0.530687	0.551771	0.640840
79	4	2.8729	-1.7611	1.1145	0.0048	1.979864	0.444078	0.556450	0.652279
80	3	2.8729	-1.8015	1.1145	0.0204	1.979864	0.471921	0.556450	0.652279
81	3	2.8729	-2.1254	1.1145	0.1461	1.979864	0.695166	0.556450	0.652279
82	4	3.5090	-1.7990	1.0912	-0.0010	2.048782	0.161368	0.564462	0.675530
83	3	3.5090	-2.1947	1.0912	0.1220	2.048782	0.392384	0.564462	0.675530
84	3	3.5090	-2.2441	1.0912	0.1374	2.048782	0.421196	0.564462	0.675530
85	4	3.8736	-2.2950	1.0752	0.0624	2.079025	0.332256	0.567926	0.687335
86	3	3.8736	-2.3495	1.0752	0.0776	2.079025	0.361493	0.567926	0.687335
87	3	3.8736	-2.4040	1.0752	0.0927	2.079025	0.390730	0.567926	0.687335
88	4	4.2633	-2.4485	1.0663	0.0174	2.110207	0.386101	0.571069	0.699277
89	3	4.2633	-2.5085	1.0663	0.0324	2.110207	0.415776	0.571069	0.699277
90	3	4.2633	-2.6284	1.0663	0.0624	2.110207	0.475127	0.571069	0.699277
91	4	4.4693	-2.5017	1.0628	0.0246	2.128217	0.422261	0.572532	0.705278
92	3	4.4693	-2.6274	1.0628	0.0545	2.128217	0.482119	0.572532	0.705278
93	3	4.4693	-2.6902	1.0628	0.0694	2.128217	0.512048	0.572532	0.705278
94	4	4.9045	-2.7279	1.0578	-0.0065	2.169090	0.506203	0.575260	0.717338
95	3	4.9045	-2.7968	1.0578	0.0084	2.169090	0.536707	0.575260	0.717338
96	1	6.2541	-3.2016	1.1019	-0.2043	2.289849	0.536707	0.581727	0.750753
97	1	6.2541	-3.2016	1.1019	-0.2043	2.289849	0.536707	0.581727	0.750753
98	1	8.9083	-3.8761	1.3880	-0.5588	2.491114	0.536707	0.589727	0.799784
99	2	9.3808	2.4099	2.1656	-2.2071	2.396414	-1.157250	0.594774	0.828426
100	1	6.7502	1.9745	5.7902	-3.8339	1.702063	-1.157250	0.606786	0.855524
101	3	6.7502	-0.2474	5.7902	-1.9280	1.702063	-0.597003	0.606786	0.855524
102	4	3.3677	2.3101	11.6488	-2.9138	0.960566	-0.551415	0.642639	0.879058
103	3	3.3677	1.2016	11.6488	0.9205	0.960566	-0.235237	0.642639	0.879058
104	1	2.0410	0.6936	10.4378	0.8095	0.795900	-0.235237	0.685654	0.889169
105	1	1.6902	0.4759	9.9664	0.7619	0.725329	-0.235237	0.711474	0.893851
106	1	1.4459	0.2220	9.4524	0.7064	0.642996	-0.235237	0.747412	0.899591
107	3	1.4800	-0.3382	8.3970	2.7269	0.594906	-0.087285	0.780687	0.904887
108	1	2.4658	-0.9256	4.7542	1.9433	0.526824	-0.087285	0.847628	0.924585
109	2	2.3480	1.2802	4.9346	-2.6002	0.428922	-0.549900	0.866591	0.934923
110	1	1.0347	0.4036	9.9479	-3.8271	0.000000	-0.549900	0.950000	0.952678
111	1	1.0704	-0.4505	16.6735	-5.0224	-0.417924	-0.549900	1.078420	0.962075
112	3	1.8607	-2.4399	14.7630	10.7462	-0.654941	-1.069207	1.114256	0.964970
113	1	4.8133	-4.1215	6.6891	7.1957	-1.136084	-1.069207	1.138279	0.972180
114	2	6.0539	0.3476	4.2409	1.6542	-1.300000	0.000000	1.146753	0.981540
115	1	5.6634	0.2203	2.3827	1.0484	-1.300000	0.000000	1.165486	1.016240
116	1	5.4794	0.1203	1.5073	0.5727	-1.300000	0.000000	1.180938	1.062228
117	1	5.4012	0.0000	1.1351	0.0000	-1.300000	0.000000	1.200000	1.145000

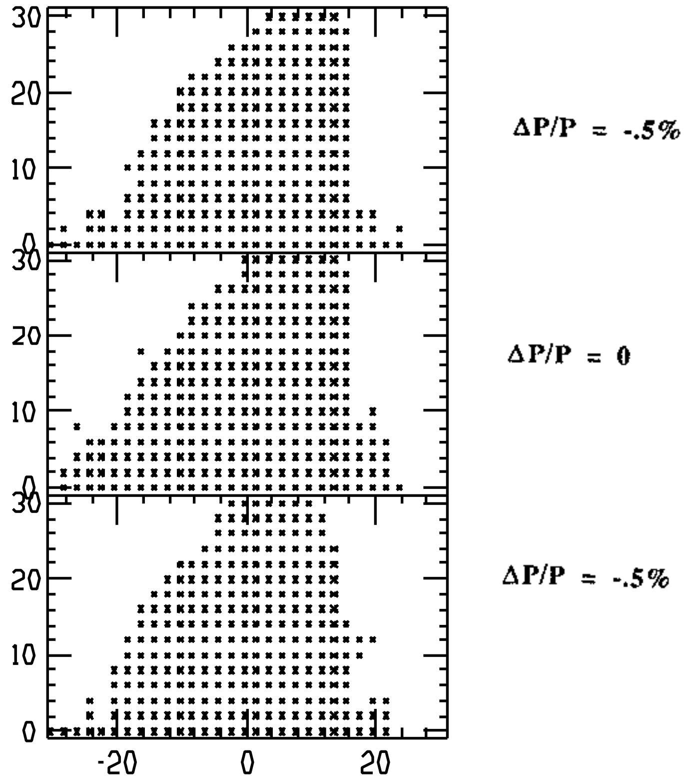
APPENDIX C(a) - *Quadrupole strengths (m^{-2}) for Q_x=5.09, Q_y=6.07*

Quad name	**DD**	**GD**	**KD**	**DF**	**KF**
QUAES101	1.1000000	1.2279481	1.3550098	1.3587141	1.1300085
QUAES102	-2.5483232	-2.8594201	-1.0955927	-2.7827615	-3.0401855
QUAES103	1.4052427	1.5086058	-0.93532610	1.2991428	1.7655281
QUAES104	-2.6855695	-2.7539565	-1.9342864	-2.6620590	-2.6799668
QUAES105	3.0110705	3.0288058	2.8275292	3.0119944	2.9878375
QUAES106	2.0195756	2.0111872	1.7905869	1.9817346	2.1082363
QUAES107	-2.0144863	-1.9377728	-1.5389856	-2.0390593	-1.8426838
QUAES108	2.3303249	2.2804539	2.8110209	2.4043923	2.1233033
QUAES109	-2.4498012	-2.1258713	-3.0407741	-2.1295272	-1.7366695
QUAES110	4.4188313	4.4348892	4.9290681	4.2500000	3.7000000
QUAES201	-2.4498012	-2.1258713	-1.5030518	-1.9676553	-1.6919635
QUAES202	2.3303249	2.2804539	2.8314633	2.1899286	2.0623669
QUAES203	-2.0144863	-1.9377728	-2.5342338	-1.8610855	-1.8075203
QUAES204	2.0195756	2.0111872	2.0195756	2.0220833	2.1148845
QUAES205	3.0110705	3.0288058	3.0110705	2.9928982	3.0001373
QUAES206	-2.6855695	-2.7539565	-2.6855695	-2.6010246	-2.6678770
QUAES207	1.4052427	1.5086058	1.4052427	1.4463975	1.7707121
QUAES208	-2.5483232	-2.8594201	-2.5483232	-3.0113936	-3.0687403
QUAES209	1.1000000	1.2279481	1.1000000	1.2873416	1.1516625
QUAEL201	1.1420997	1.4532054	1.1638199	1.3474687	1.3253723
QUAEL202	-2.1796811	-2.5143911	-2.1630342	-2.6254439	-1.6708589
QUAEL203	0.73461562	0.81439512	0.68434978	0.78026199	-0.35620447
QUAEL204	-2.5429502	-2.5512732	-2.5191691	-2.4514805	-2.1540043
QUAEL205	3.0885336	2.9619075	3.0485704	3.0695331	2.9502841
QUAEL206	2.2460177	2.1754695	2.2237418	2.2619758	2.3772414
QUAEL207	-1.0748690	-1.0702920	-1.1076844	-1.1169629	-1.0420182
QUAEL208	3.7776940	3.7519791	3.9098437	3.8693562	3.4629681
QUAEL209	-3.2701457	-3.1667445	-3.2828188	-3.0883191	-3.0532927
QUAEL210	2.8563719	2.8375517	2.8586583	2.8230769	2.8165553
QUAEL101	2.8563719	2.8375517	2.8337488	2.8288620	2.8196163
QUAEL102	-3.2701457	-3.1667445	-3.1460478	-3.0950043	-3.0697093
QUAEL103	3.7776940	3.7519791	3.0818377	3.9031517	3.4512077
QUAEL104	-1.0748690	-1.0702920	-0.90795785	-1.1247317	-1.0525483
QUAEL105	2.2460177	2.1754695	2.3205693	2.2620402	2.4031828
QUAEL106	3.0885336	2.9619075	2.6151087	3.1060387	2.9562170
QUAEL107	-2.5429502	-2.5512732	-1.8412288	-2.5283833	-2.1030510
QUAEL108	0.73461562	0.81439512	-1.1202236	0.64467267	-0.54634149
QUAEL109	-2.1796811	-2.5143911	-0.75278604	-2.1266928	-1.4346729
QUAEL110	1.1420997	1.4532054	1.0812297	1.1245294	1.2062907

APPENDIX C(b) - *Quadrupole strengths (m^{-2}) for Q_x=4.53, Q_y=6.06*

Quad name	**DD**	**GD**	**KD**	**DF**	**KF**
QUAES101	1.1845756	1.8558153	1.4093733	1.3715492	1.5295683
QUAES102	-2.3935125	-2.4763259	-2.8665407	-2.1990812	-2.3181074
QUAES103	1.0778880	0.37519540	1.2631725	0.59529340	0.29581470
QUAES104	-2.6071973	-2.3334637	-2.6010938	-2.4678471	-2.3433549
QUAES105	2.9995978	2.9464041	2.9935203	2.9736967	2.9412982
QUAES106	1.9455798	1.8915355	1.9796405	1.8726928	1.8153391
QUAES107	-1.4801244	1.0810576	-1.0635613	-1.6466899	-1.7457542
QUAES108	1.1685529	-1.8583894	0.49425265	1.6150404	2.0475696
QUAES109	-2.1133258	-0.90389575	-1.3729476	-1.6152683	-1.4128243
QUAES110	3.0037196	2.5793589	2.5523620	2.2719052	1.1701875
QUAES201	-2.1133258	-0.90389575	-1.7214292	-1.3132982	-0.45605090
QUAES202	1.1685529	-1.8583894	1.3005046	1.2184911	1.5337809
QUAES203	-1.4801244	1.0810576	-1.5520539	-1.5118166	-1.6976569
QUAES204	1.9455798	1.8915355	1.9094837	1.9717096	1.9614809
QUAES205	2.9995978	2.9464041	2.9901857	2.9779840	2.9802528
QUAES206	-2.6071973	-2.3334637	-2.5583150	-2.5003827	-2.5198050
QUAES207	1.0778880	0.37519540	0.90451717	1.1079592	1.1279922
QUAES208	-2.3935125	-2.4763259	-2.3411672	-2.8847046	-2.8450506
QUAES209	1.1845756	1.8558153	1.2382774	1.4992720	1.3902623
QUAEL201	1.1817908	1.3375699	1.2594891	1.3795052	1.0048734
QUAEL202	-1.2441413	-1.6700968	-1.5870652	-1.8589998	-0.48991820
QUAEL203	-0.50911009	-0.33249150	-0.19062065	-0.28193101	-1.3731737
QUAEL204	-2.1044183	-2.0304393	-2.1892519	-2.0660260	-1.5908176
QUAEL205	2.7161870	2.3179993	2.7079608	2.7176216	2.4060040
QUAEL206	2.2710931	2.1824434	2.2497046	2.2925470	2.3073724
QUAEL207	-0.80157769	-0.84885557	-0.92138267	-0.92619228	-0.80827030
QUAEL208	3.1503003	2.9675713	3.1568308	3.1052544	2.6765778
QUAEL209	-3.3065448	-3.0877901	-3.1521440	-3.1112893	-2.9240548
QUAEL210	2.8629265	2.8229786	2.8348701	2.8273346	2.7921827
QUAEL101	2.8629265	2.8229786	2.8340929	2.8268733	2.8082156
QUAEL102	-3.3065448	-3.0877901	-3.1479182	-3.1087968	-3.0087775
QUAEL103	3.1503003	2.9675713	3.1519198	3.1030529	3.1247601
QUAEL104	-0.80157769	-0.84885557	-0.92272949	-0.92854691	-0.93191090
QUAEL105	2.2710931	2.1824434	2.2647614	2.3056164	2.2626735
QUAEL106	2.7161870	2.3179993	2.6804867	2.7128558	2.7287467
QUAEL107	-2.1044183	-2.0304393	-2.1078422	-2.0617657	-2.1672601
QUAEL108	-0.50911009	-0.33249150	-0.27686977	-0.73594010	-0.87604950
QUAEL109	-1.2441413	-1.6700968	-1.8364476	-0.88881892	-2.0350536
QUAEL110	1.1817908	1.3375699	1.4602569	0.97859210	1.5384303

APPENDIX D.I(a) - *Dynamic Aperture and sextupole settings for DD(a) lattice*



Dynamic Aperture in units of $\sigma_x{}^*$ *(off coupling) and* $\sigma_y{}^*$ *(full coupling) @ IP.*

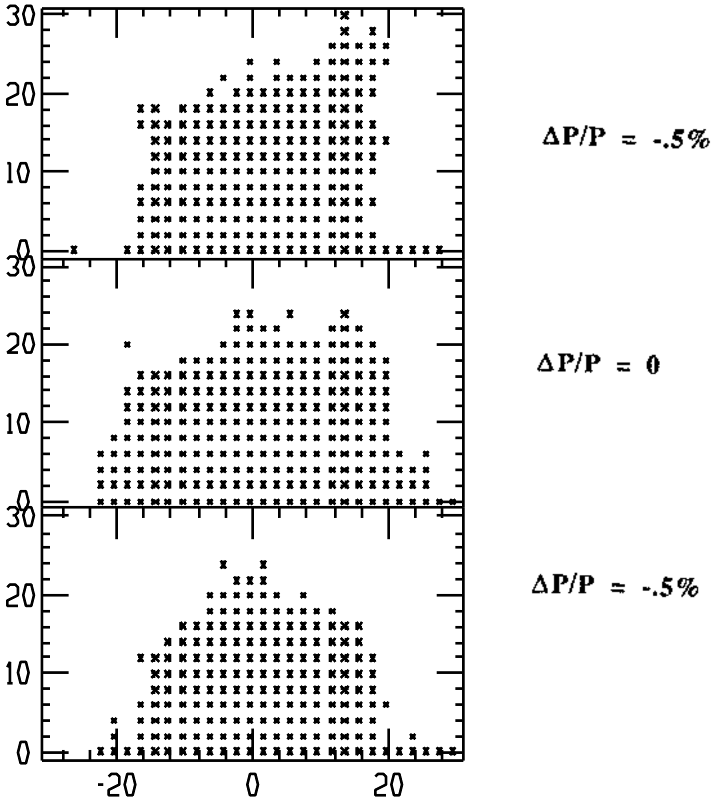
NATURAL CHROMATICITY: CX = -8.4 CY = -18.9

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -0.9963 CY = -12.0793

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = -0.0

	NEL	NS	TY	β_x	β_y	η_x	Q_x	Q_y	K_S (m^{-2})
SXPES101	20	1	7	6.514	5.653	0.220	0.191	0.583	-1.00000000
SXPES102	30	2	8	0.810	5.055	1.629	0.401	0.695	9.46209758
SXPES103	99	3	7	10.159	1.102	1.004	0.709	1.145	-1.83880480
SXPES104	109	4	7	3.243	7.009	0.000	0.799	1.292	-0.20000000
SXPES201	124	5	7	3.243	7.009	0.000	1.476	1.743	-0.20000000
SXPES202	134	6	7	10.159	1.102	1.004	1.566	1.890	-1.83880480
SXPES203	203	7	8	0.810	5.055	1.629	1.874	2.340	9.46209758
SXPES204	213	8	7	6.514	5.653	0.220	2.083	2.452	-1.00000000
SXPEL201	255	9	7	5.766	7.335	-0.318	2.486	3.633	-2.00000000
SXPEL202	263	10	8	0.924	5.131	1.248	2.668	3.722	5.00000000
SXPEL203	332	11	7	9.914	1.102	1.876	3.000	4.171	-3.00000000
SXPEL204	340	12	8	0.906	9.637	0.442	3.155	4.317	3.20000000
SXPEL101	360	13	8	0.906	9.637	0.442	4.210	4.787	3.20000000
SXPEL102	368	14	7	9.914	1.102	1.876	4.365	4.934	-3.00000000
SXPEL103	437	15	8	0.924	5.131	1.248	4.696	5.383	5.00000000
SXPEL104	445	16	7	5.766	7.334	-0.318	4.879	5.472	-2.00000000

APPENDIX D.I(b) - *Dynamic Aperture and sextupole settings for DD(b) lattice*



Dynamic Aperture in units of σ_x^* *(off coupling) and* σ_y^* *(full coupling) @ IP.*

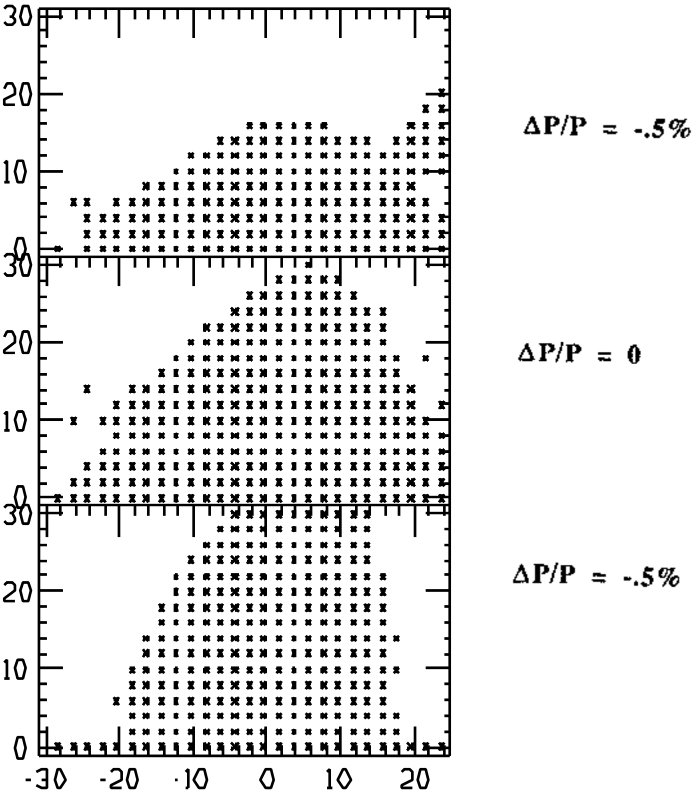
NATURAL CHROMATICITY: CX = -6.62 CY = -18.77

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -1.0120 CY = -11.6455

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = 0.0

	NEL	NS	TY	β_x	β_y	η_x	Q_x	Q_y	K_S (m^{-2})
SXPES101	20	1	7	6.389	5.737	0.219	0.191	0.583	-0.80000000
SXPES102	30	2	8	1.250	5.264	1.694	0.367	0.686	8.58275206
SXPES103	99	3	7	8.295	1.133	1.013	0.710	1.138	-2.91819714
SXPES104	109	4	7	4.661	7.989	0.000	0.789	1.280	-0.20000000
SXPES201	124	5	7	4.661	7.989	0.000	1.073	1.750	-0.20000000
SXPES202	134	6	7	8.295	1.133	1.013	1.152	1.892	-2.91819714
SXPES203	203	7	8	1.250	5.264	1.694	1.495	2.344	8.58275206
SXPES204	213	8	7	6.389	5.737	0.219	1.671	2.447	-0.80000000
SXPEL201	255	9	7	4.654	8.855	-0.293	2.075	3.627	-2.00000000
SXPEL202	263	10	8	2.003	4.772	1.040	2.226	3.700	7.40000000
SXPEL203	332	11	7	6.254	1.102	2.290	2.578	4.151	-3.80000000
SXPEL204	340	12	8	1.564	9.741	0.690	2.722	4.296	2.00000000
SXPEL101	360	13	8	1.564	9.741	0.690	3.670	4.794	2.00000000
SXPEL102	368	14	7	6.254	1.102	2.290	3.814	4.939	-3.80000000
SXPEL103	437	15	8	2.003	4.772	1.040	4.166	5.390	7.40000000
SXPEL104	445	16	7	4.653	8.854	-0.293	4.317	5.463	-2.00000000

APPENDIX D.II(a) - *Dynamic Aperture and sextupole settings for GD(a) lattice*



Dynamic Aperture in units of σ_x^* *(off coupling) and* σ_y^* *(full coupling) @ IP.*

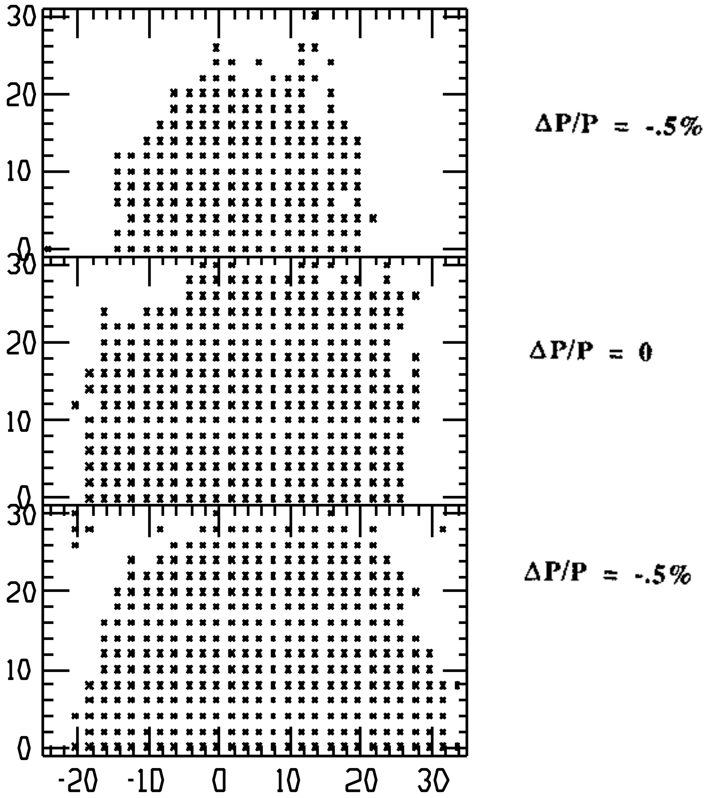
NATURAL CHROMATICITY: CX = -7.84 CY = -22.5

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -1.2905 CY = -10.7384

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = 0.0

	NEL	NS	TY	β_x	β_y	η_x	Q_x	Q_y	K_S (m^{-2})
SXPES101	13	1	7	6.679	4.852	0.218	0.199	0.609	-1.00000000
SXPES102	23	2	8	0.870	4.870	1.630	0.380	0.732	8.75243868
SXPES103	92	3	7	11.094	1.074	1.005	0.716	1.181	-1.84002568
SXPES104	102	4	8	3.972	6.951	0.000	0.791	1.333	0.40000000
SXPES201	117	5	8	3.972	6.951	0.000	1.498	1.702	0.40000000
SXPES202	127	6	7	11.094	1.074	1.005	1.574	1.854	-1.84002568
SXPES203	197	7	8	0.870	4.870	1.630	1.909	2.302	8.75243868
SXPES204	207	8	7	6.679	4.852	0.218	2.091	2.426	-1.00000000
SXPEL201	234	9	7	5.329	7.015	-0.305	2.510	3.660	-1.00000000
SXPEL202	242	10	8	0.879	5.465	1.269	2.714	3.749	8.00000000
SXPEL203	311	11	7	9.339	1.167	2.132	3.017	4.203	-2.65000000
SXPEL204	319	12	8	1.037	9.893	0.604	3.166	4.339	4.00000000
SXPEL101	338	13	8	1.037	9.894	0.604	4.214	4.766	4.00000000
SXPEL102	346	14	7	9.339	1.167	2.131	4.363	4.902	-2.65000000
SXPEL103	415	15	8	0.879	5.465	1.269	4.666	5.356	8.00000000
SXPEL104	423	16	7	5.329	7.015	-0.305	4.870	5.444	-1.00000000

APPENDIX D.II(b) - *Dynamic Aperture and sextupole settings for GD(b) lattice*



Dynamic Aperture in units of σ_x^* *(off coupling) and* σ_y^* *(full coupling) @ IP.*

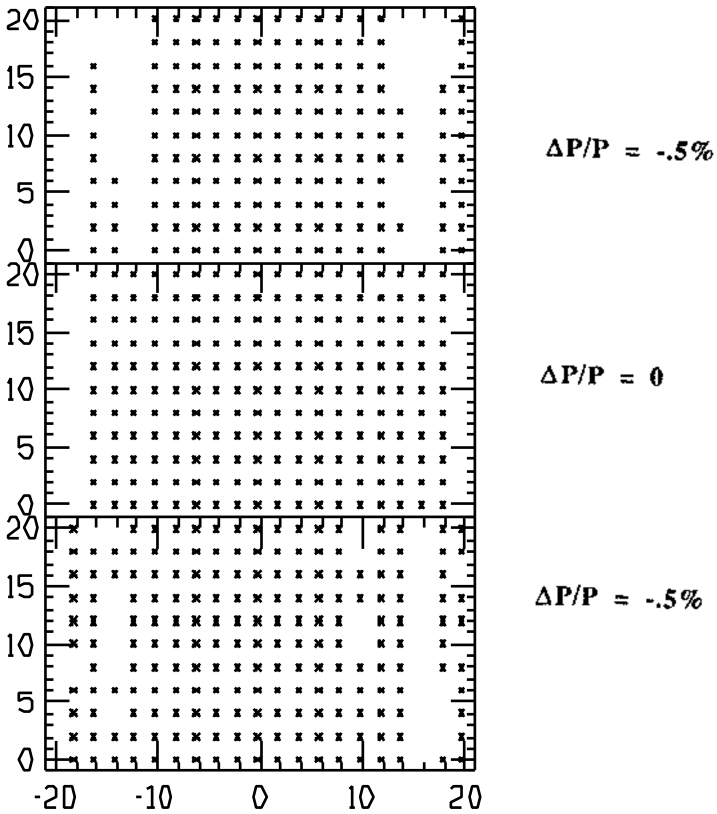
NATURAL CHROMATICITY: CX = -6.42 CY = -21.6

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -0.4506 CY = -8.5593

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = 0.0

	NEL	NS	TY	β_x	β_y	η_x	Q_x	Q_y	K_S (m^{-2})
SXPES101	13	1	7	6.811	6.105	0.206	0.177	0.618	-0.70000000
SXPES102	23	2	8	1.554	4.911	1.759	0.409	0.705	6.75407465
SXPES103	92	3	7	5.109	1.091	1.021	0.702	1.155	-4.08253876
SXPES104	102	4	8	2.190	13.250	0.000	0.825	1.304	0.80000000
SXPES201	117	5	8	2.190	13.250	0.000	1.194	1.726	0.80000000
SXPES202	127	6	7	5.108	1.090	1.021	1.317	1.875	-4.08253876
SXPES203	197	7	8	1.554	4.910	1.758	1.610	2.325	6.75407465
SXPES204	207	8	7	6.811	6.105	0.206	1.842	2.412	-0.70000000
SXPEL201	234	9	7	5.776	8.896	-0.293	2.214	3.663	-0.80000000
SXPEL202	242	10	8	2.237	4.807	1.032	2.330	3.737	9.10000000
SXPEL203	311	11	7	6.992	1.168	2.974	2.689	4.193	-3.30000000
SXPEL204	319	12	8	2.053	9.924	1.053	2.804	4.329	4.50000000
SXPEL101	338	13	8	2.053	9.925	1.053	3.745	4.761	4.50000000
SXPEL102	346	14	7	6.992	1.167	2.974	3.860	4.897	-3.30000000
SXPEL103	415	15	8	2.237	4.806	1.032	4.219	5.353	9.10000000
SXPEL104	423	16	7	5.775	8.894	-0.293	4.336	5.427	-0.80000000

APPENDIX D.III(a) - *Dynamic Aperture and sextupole settings for KD(a) lattice*



Dynamic Aperture in units of σ_x^* *(off coupling) and* σ_y^* *(full coupling) @ IP.*

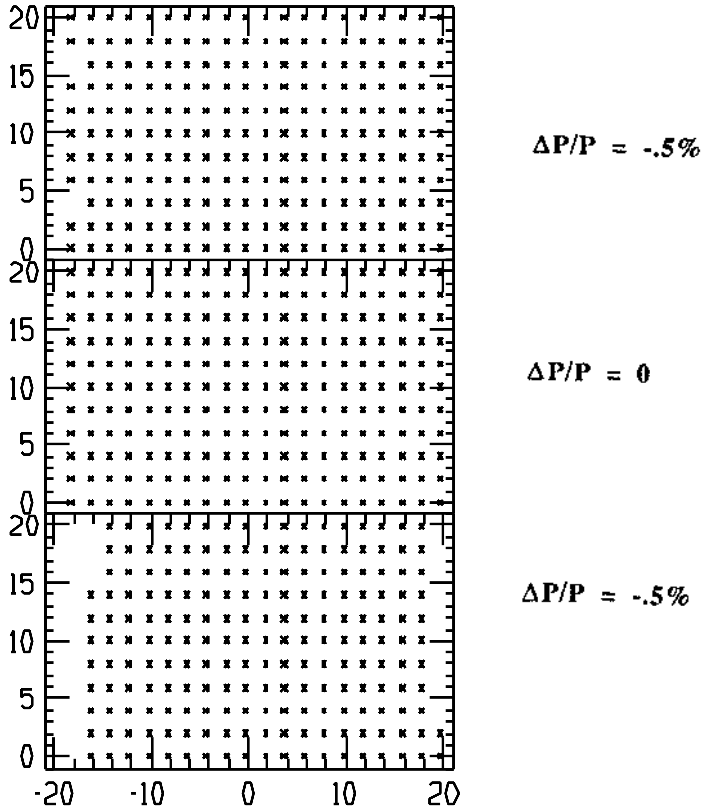
NATURAL CHROMATICITY: CX = -8.1 CY = -18.44

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -0.5766 CY = -1.4150

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = 0.00

	NEL	NS	TY	β_x	β_y	η_x	Q_x	Q_y	K_s (m^{-2})
SXPES101	200	1	7	6.789	5.728	0.212	0.191	0.639	-2.60000000
SXPES102	211	2	8	3.370	5.090	1.890	0.350	0.711	2.49265243
SXPES103	280	3	7	4.223	1.133	1.034	0.718	1.163	-5.29612871
SXPES104	290	4	7	9.057	7.349	0.000	0.800	1.308	0.00000000
SXPES201	308	5	8	3.617	6.095	0.000	1.572	1.721	0.40000000
SXPES202	318	6	7	10.159	1.102	1.004	1.660	1.869	-5.00000000
SXPES203	387	7	8	0.810	5.055	1.629	1.969	2.319	10.00000000
SXPES204	398	8	7	6.514	5.653	0.220	2.178	2.431	-1.50000000
SXPEL201	436	9	7	5.647	7.421	-0.316	2.581	3.612	-2.50000000
SXPEL202	444	10	8	0.968	5.092	1.237	2.761	3.700	10.00000000
SXPEL203	513	11	7	9.664	1.102	1.943	3.094	4.150	-3.00000000
SXPEL204	521	12	8	1.025	9.545	0.505	3.238	4.296	3.30000000
SXPEL101	543	13	8	1.748	9.949	0.667	4.247	4.757	3.30000000
SXPEL102	551	14	7	6.483	1.102	2.294	4.376	4.901	-3.00000000
SXPEL103	620	15	8	2.677	4.677	0.969	4.754	5.353	10.00000000
SXPEL104	628	16	7	5.150	9.960	-0.280	4.880	5.417	-1.50000000

APPENDIX D.III(b) - *Dynamic Aperture and sextupole settings for KD(b) lattice*



Dynamic Aperture in units of σ_x^* *(off coupling) and* σ_y^* *(full coupling) @ IP.*

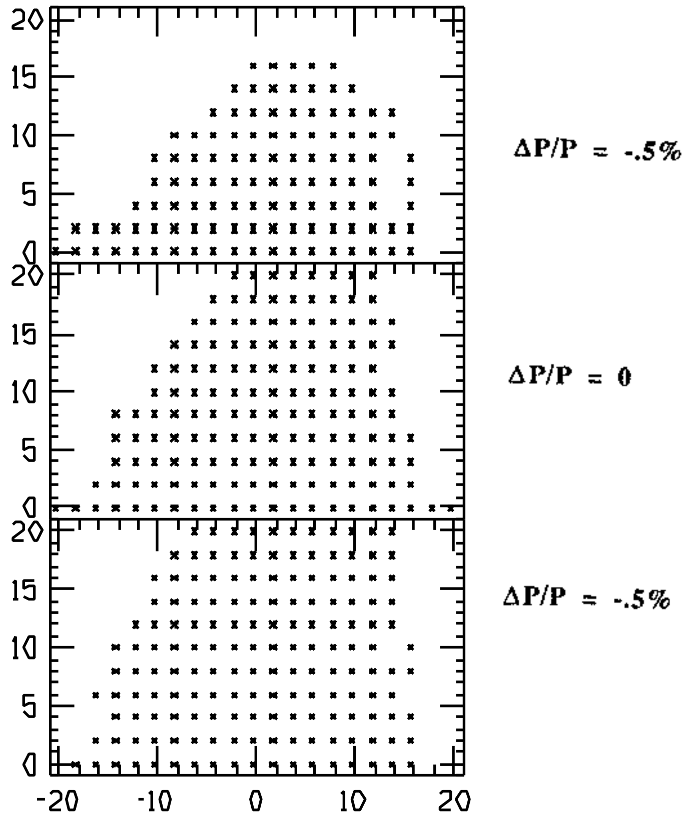
NATURAL CHROMATICITY: CX = -7.0 CY = -19.9

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -0.6216 CY = -6.6418

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = 0.0

	NEL	NS	TY	β_x	β_y	η_x	Q_x	Q_y	K_S (m^{-2})
SXPES101	200	1	8	6.703	5.779	0.211	0.191	0.639	1.00000000
SXPES102	211	2	8	1.011	5.064	1.667	0.383	0.742	10.24819614
SXPES103	280	3	7	9.134	1.105	1.014	0.710	1.193	-2.70659779
SXPES104	290	4	7	3.421	8.759	0.003	0.795	1.339	0.00000000
SXPES201	308	5	7	5.717	7.523	-0.002	1.075	1.747	0.00000000
SXPES202	318	6	7	7.481	1.102	1.014	1.151	1.895	-3.45000000
SXPES203	387	7	8	1.541	5.035	1.727	1.505	2.345	6.00000000
SXPES204	398	8	7	6.310	5.790	0.222	1.671	2.447	0.00000000
SXPEL201	436	9	7	4.662	8.573	-0.298	2.075	3.627	-1.20000000
SXPEL202	444	10	8	1.750	4.762	1.077	2.233	3.704	7.00000000
SXPEL203	513	11	7	6.620	1.101	2.372	2.575	4.155	-3.50000000
SXPEL204	521	12	8	1.450	9.648	0.709	2.722	4.301	4.00000000
SXPEL101	543	13	8	1.457	10.163	0.710	3.670	4.747	4.00000000
SXPEL102	551	14	7	6.581	1.153	2.371	3.817	4.884	-3.50000000
SXPEL103	620	15	8	1.837	5.084	1.048	4.163	5.338	7.00000000
SXPEL104	628	16	7	4.651	9.400	-0.294	4.317	5.408	-1.20000000

APPENDIX D.IV(a) - *Dynamic Aperture and sextupole settings for DF(a) lattice*



Dynamic Aperture in units of σ_x^* *(off coupling) and* σ_y^* *(full coupling) @ IP.*

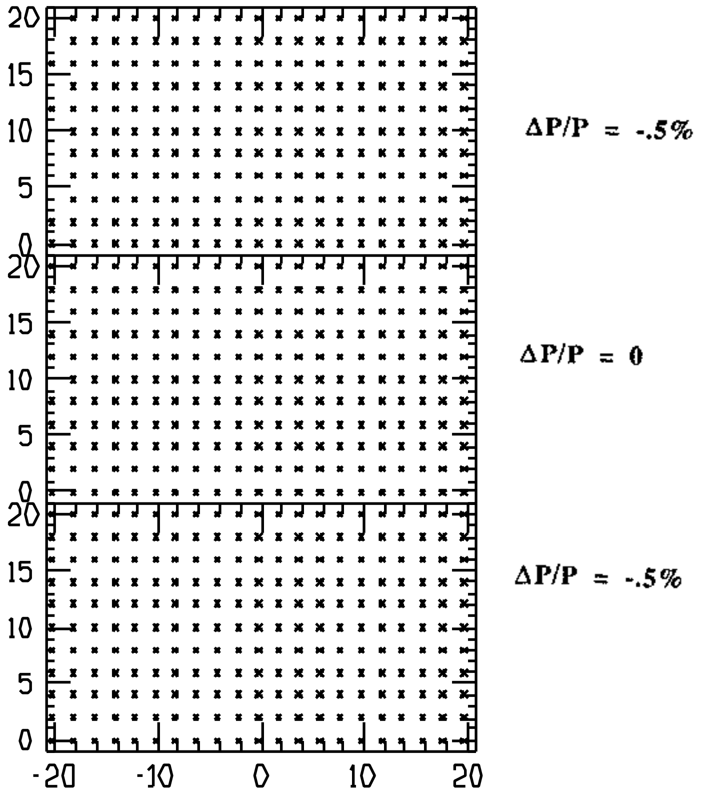
NATURAL CHROMATICITY: CX = -8.0 CY = -17.68

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -0.4982 CY = -4.8911

CHROMATICITY WITH ALLSEXTUPOLES: CX = 0.0 CY = 0.0

	NEL	NS	TY	β_x	β_y	η_x	Q_x	Q_y	K_S (m^{-2})
SXPES101	13	1	7	6.135	5.912	0.221	0.191	0.583	-2.50000000
SXPES102	23	2	8	0.970	3.541	1.660	0.408	0.712	10.90873209
SXPES103	92	3	7	8.307	0.922	1.002	0.712	1.145	-2.86176329
SXPES104	102	4	8	3.563	5.780	-0.003	0.808	1.346	0.60000000
SXPES201	117	5	8	3.833	6.847	-0.001	1.464	1.680	1.00000000
SXPES202	127	6	7	9.894	1.032	0.998	1.545	1.842	-2.50000000
SXPES203	197	7	8	1.012	4.516	1.633	1.884	2.287	5.00000000
SXPES204	207	8	7	6.091	6.236	0.205	2.066	2.396	-2.00000000
SXPEL201	234	9	7	5.253	8.725	-0.299	2.483	3.737	-2.50000000
SXPEL202	242	10	8	1.090	4.908	1.229	2.649	3.821	5.00000000
SXPEL203	311	11	7	9.806	1.074	1.856	2.999	4.269	-2.80000000
SXPEL204	319	12	8	1.002	9.460	0.438	3.143	4.420	4.60000000
SXPEL101	338	13	8	0.988	9.460	0.433	4.219	4.783	4.80000000
SXPEL102	346	14	7	9.968	1.074	1.834	4.363	4.935	-2.90000000
SXPEL103	415	15	8	1.063	4.943	1.222	4.714	5.383	10.50000000
SXPEL104	423	16	7	5.791	7.359	-0.319	4.879	5.472	-2.00000000

APPENDIX D.IV(b) - *Dynamic Aperture and sextupole settings for DF(b) lattice*



Dynamic Aperture in units of σ_x^* *(off coupling) and* σ_y^* *(full coupling) @ IP.*

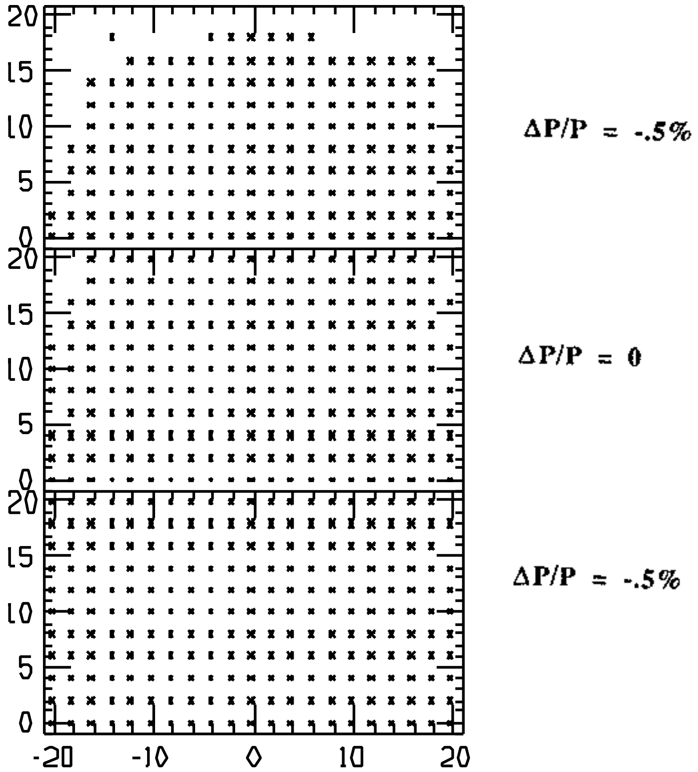
NATURAL CHROMATICITY: CX = -6.7 CY = -17.6

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = 1.2547 CY = -7.4341

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = 0.0

	NEL	**NS**	**TY**	β_x	β_y	η_x	Q_x	Q_y	K_S (m^{-2})
SXPES101	11	1	7	5.795	6.454	0.197	0.198	0.664	-1.00000000
SXPES102	22	2	8	1.336	5.023	1.683	0.387	0.759	11.22053321
SXPES103	91	3	7	7.328	1.102	1.009	0.722	1.209	-1.27871415
SXPES104	101	4	8	4.123	7.805	-0.003	0.812	1.356	1.20000000
SXPES201	119	5	8	6.053	7.420	-0.003	1.084	1.747	1.20000000
SXPES202	129	6	7	6.010	1.133	1.023	1.168	1.891	-7.00000000
SXPES203	198	7	8	1.792	5.238	1.766	1.514	2.343	3.00000000
SXPES204	209	8	7	6.116	5.925	0.215	1.690	2.435	-1.00000000
SXPEL201	247	9	7	5.125	8.719	-0.300	2.093	3.617	-1.00000000
SXPEL202	255	10	8	2.468	4.769	1.010	2.221	3.687	8.00000000
SXPEL203	324	11	7	6.618	1.102	2.269	2.596	4.138	-3.50000000
SXPEL204	332	12	8	1.738	9.886	0.643	2.725	4.283	4.00000000
SXPEL101	354	13	8	1.734	9.831	0.643	3.675	4.718	4.00000000
SXPEL102	362	14	7	6.643	1.102	2.265	3.804	4.863	-4.00000000
SXPEL103	431	15	8	2.362	4.774	1.041	4.176	5.314	7.00000000
SXPEL104	439	16	7	4.410	10.168	-0.274	4.309	5.384	-1.00000000

APPENDIX D.V(a) - *Dynamic Aperture and sextupole settings for KF(a) lattice*



Dynamic Aperture in units of σ_x^* *(off coupling) and* σ_y^* *(full coupling).*

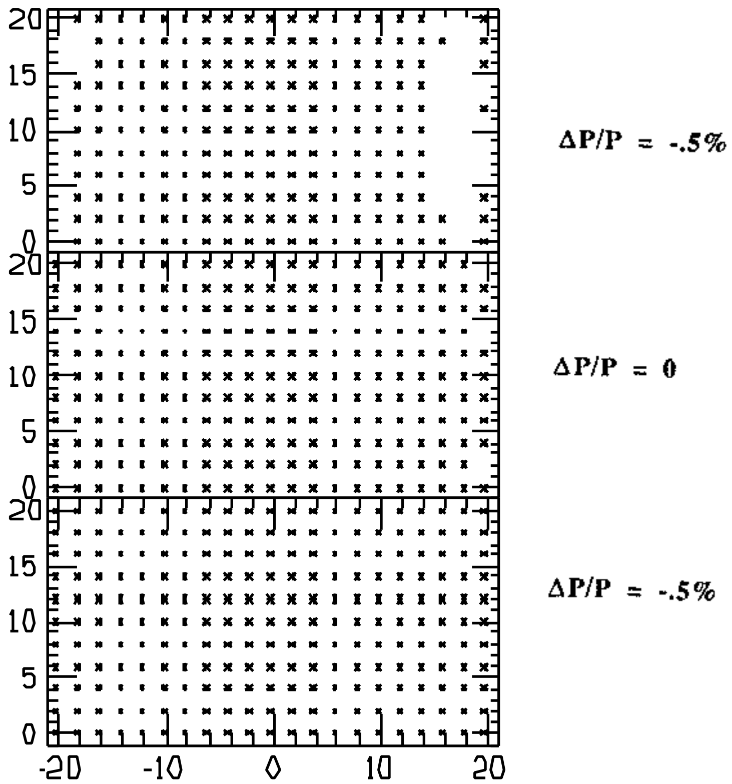
NATURAL CHROMATICITY: CX = -8.6 CY = -19.4

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -1.2371 CY = -5.3376

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = 0.0

	NEL	**NS**	**TY**	β_x	β_y	η_x	Q_x	Q_y	K_s (m^{-2})
SXPES101	13	1	7	6.084	5.984	0.226	0.197	0.648	-1.00000000
SXPES102	23	2	8	0.614	4.769	1.565	0.457	0.763	9.27327014
SXPES103	92	3	7	11.845	1.046	0.992	0.715	1.210	-2.08082350
SXPES104	102	4	8	1.573	7.574	0.000	0.836	1.362	1.20000000
SXPES201	117	5	8	1.658	7.908	0.000	1.501	1.666	1.20000000
SXPES202	127	6	7	12.482	1.074	0.991	1.614	1.811	-2.50000000
SXPES203	197	7	8	0.590	5.003	1.556	1.887	2.260	9.30000000
SXPES204	207	8	7	6.285	6.098	0.202	2.133	2.371	-1.00000000
SXPEL201	234	9	7	4.458	10.327	-0.277	2.550	3.711	-1.00000000
SXPEL202	242	10	8	2.338	5.716	1.049	2.687	3.773	6.40000000
SXPEL203	311	11	7	7.219	1.207	1.888	3.072	4.229	-4.00000000
SXPEL204	319	12	8	1.390	11.193	0.438	3.210	4.356	5.20000000
SXPEL101	338	13	8	1.400	10.604	0.440	4.208	4.755	5.20000000
SXPEL102	346	14	7	7.132	1.133	1.887	4.346	4.893	-4.00000000
SXPEL103	415	15	8	2.553	5.220	0.996	4.736	5.345	6.40000000
SXPEL104	423	16	7	4.400	10.050	-0.301	4.870	5.409	-1.00000000

APPENDIX D.V(b) - *Dynamic Aperture and sextupole settings for KF(b) lattice*



Dynamic Aperture in units of σ_x^* (off coupling) and σ_y^* (full coupling).

NATURAL CHROMATICITY: CX = -6.6 CY = -18.3

CHROMATICITY WITH ONLY FIXED SEXTUPOLES: CX = -1.0901 CY = -2.7367

CHROMATICITY WITH ALL SEXTUPOLES: CX = 0.0 CY = 0.0

	NEL	NS	TY	β_x	β_y	η_x	Q_x	Q_y	K_S (m^{-2})
SXPES101	200	1	7	6.515	5.893	0.209	0.191	0.639	-0.50000000
SXPES102	211	2	8	2.534	4.987	1.824	0.341	0.727	4.51548800
SXPES103	280	3	7	5.705	1.102	1.031	0.714	1.177	-5.87932362
SXPES104	290	4	7	8.870	6.876	0.000	0.786	1.328	-0.50000000
SXPES201	308	5	7	5.184	7.417	0.000	1.087	1.672	-0.50000000
SXPES202	318	6	7	7.997	1.102	1.011	1.165	1.819	-6.50000000
SXPES203	387	7	8	1.468	5.025	1.688	1.520	2.270	9.00000000
SXPES204	398	8	8	5.946	6.341	0.198	1.687	2.366	0.50000000
SXPEL201	422	9	7	4.597	11.348	-0.268	2.102	3.707	-1.10000000
SXPEL202	430	10	8	2.807	4.486	0.942	2.237	3.767	9.10000000
SXPEL203	499	11	7	5.602	1.102	2.497	2.599	4.219	-3.00000000
SXPEL204	507	12	8	1.797	9.894	0.758	2.740	4.364	4.00000000
SXPEL101	529	13	8	1.265	9.706	0.668	3.652	4.736	4.00000000
SXPEL102	537	14	7	6.658	1.102	2.318	3.814	4.882	-3.00000000
SXPEL103	606	15	8	1.580	4.784	1.083	4.144	5.333	8.10000000
SXPEL104	614	16	7	4.457	9.296	-0.285	4.316	5.408	-1.00000000

APPENDIX E

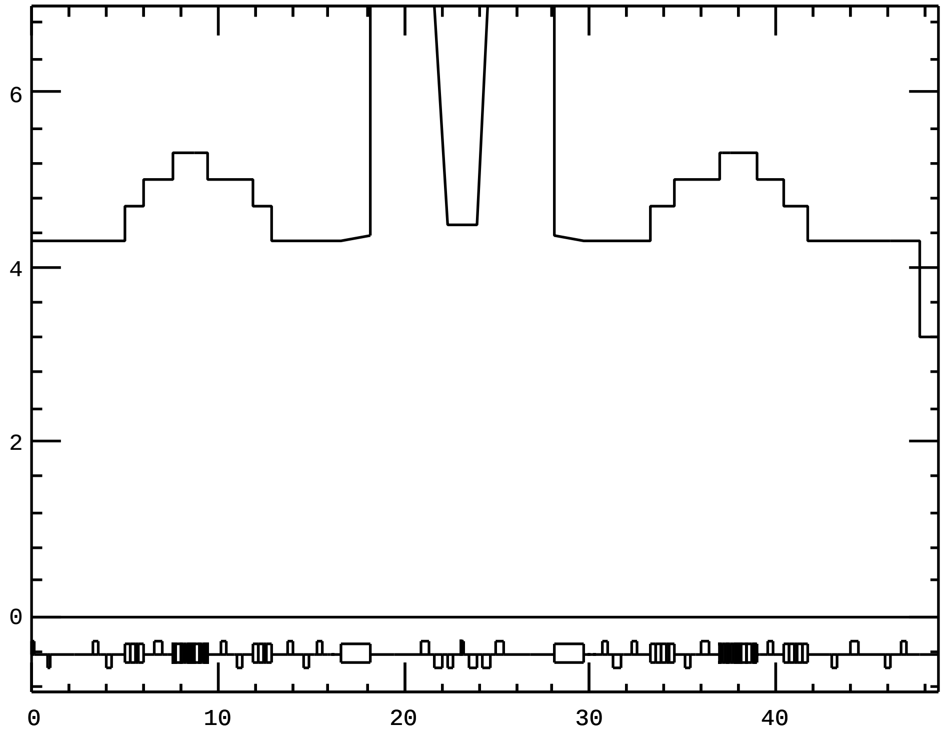


Fig. E1 - *Horizontal half aperture for half ring.*

Table E.I - *Horizontal half aperture in the DAY-ONE IR*

s(m)	Ax(mm)	Ax' (mrad)
0.000	45.0	0.0
0.865	45.0	28.0
1.400	60.0	50.0
2.200	100.0	0.0
3.673	100.0	5.1
4.675	105.0	0.0

Table E.II - *Horizontal half aperture in the KLOE IR*

s(m)	Ax(mm)	Ax' (mrad)
0.000	43.0	0.0
0.660	43.0	27.2
1.035	53.0	0.0
1.210	53.2	40.2
1.380	60.0	20.2
3.353	100.0	0.0
3.673	100.0	5.1
4.675	105.0	0.0

Table E.III - *Horizontal half aperture in the FI.NU.DA. IR*

s(m)	Ax(mm)	Ax' (mrad)
0.000	53.0	0.0
1.000	53.0	39.2
2.200	100.0	0.0
3.673	100.0	5.1
4.675	105.0	0.0