DAΦNE TECHNICAL NOTE

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Note: **I-10**

TOLERANCES AND CORRECTION SCHEME IN DAΦNE TRANSFER LINES

C. Biscari, F. Sannibale

Introduction

The transfer lines for the injection into DAϕNE have been described in [1]. The updated version is presented including minor changes in length, position and field of the elements. The spectrometer line and the updated version of the beam test facility (BTF), already described in [2,3], are also included.

Orbit distortions caused by quadrupole misalignments and field errors in dipoles have been studied. A correction scheme is presented together with a list of the foreseen diagnostics. Effects of the multipolar field components on beam dynamics, apertures and field tolerances have been assessed.

We will refer to the line from Linac to Accumulator as 'INPO' and 'INEL' for positrons and electrons respectively, and to the line from the Accumulator to DAϕNE as 'POUT' and 'EOUT' respectively for positrons and electrons. The spectrometer line is 'SP' and the BTF is of course 'BTF'. The elements are named following the general rule[4]: each name is composed by a field of 7 characters; the first three refer to the element type, the following two identify the location and the last two are the identification number of the element in its category.

General description

The general design of the lines is described in [1]. The beam characteristics are listed in Table 1. According to the latest simulations concerning positron production, the emittance and energy spread are better than those given in the table (emittance of the order of 8 mm mrad and $\Delta p/p$ of about ±1% have been obtained[5]). However, the lines are designed to accept beams with the more relaxed parameters of Table 1.

Table 1 - Beam Characteristics

Beams from Linac

	Positrons	Electrons
ε_x (m rad)	10^{-5}	10^{-6}
ε_y (m rad)	10^{-5}	10^{-6}
$\Delta p/p$	± 1.5 %	± 0.5 %

$$\text{Envelope} = \sqrt{\varepsilon\beta + \left(D\,\Delta p/p\right)^2}$$

Beams from Accumulator

	Positrons	Electrons
ε_x (m rad)	2.8×10^{-7}	2.8×10^{-7}
ε_y (m rad)	1.4×10^{-7}	1.4×10^{-7}
$\Delta p/p$	± 1 ‰	± 1 ‰

$$\text{Envelope} = C\sqrt{\varepsilon\beta + \left(D\,\Delta p/p\right)^2} \quad (C = 3)$$

Fig. 1 shows the layout of the lines. We recall that preexisting buildings and facilities have almost completely determined the layout of the whole complex, so that a part of the line is used both to inject into and to extract from the Accumulator the beams, thus imposing serious restrictions on the optic design and the use of two pulsed magnets (DHPTT01,2) with a pulse shorter than 100 ms. Furthermore, the beam lines are on different levels, which are reached by means of five vertical chicanes.

Figs. 2÷7 represent the optical functions and the beam envelopes for all the lines; the envelopes are computed according to the formulae given in Table 1, where the distribution in each phase plane is assumed uniform for the beams produced by the Linac, and gaussian for the beams from the Accumulator. Three sigmas are used in this case and in addition a factor 2.5 on the natural values of the energy spread ($\sigma_p = 4 \times 10^{-4}$) is assumed to take into account the effect of microwave instabilities.

The most critical beam transport is the one for positrons from Linac to Accumulator because of the larger emittance and higher energy spread: the line presenting a lower dispersion function has been chosen for it and corresponds to the counter clock-wise direction inside the ring. In lines INPO and INEL the beam size is less than 2.5 cm all along the transport; the maximum gradient in quadrupoles is 7.4(7.1) T/m in INPO(INEL).

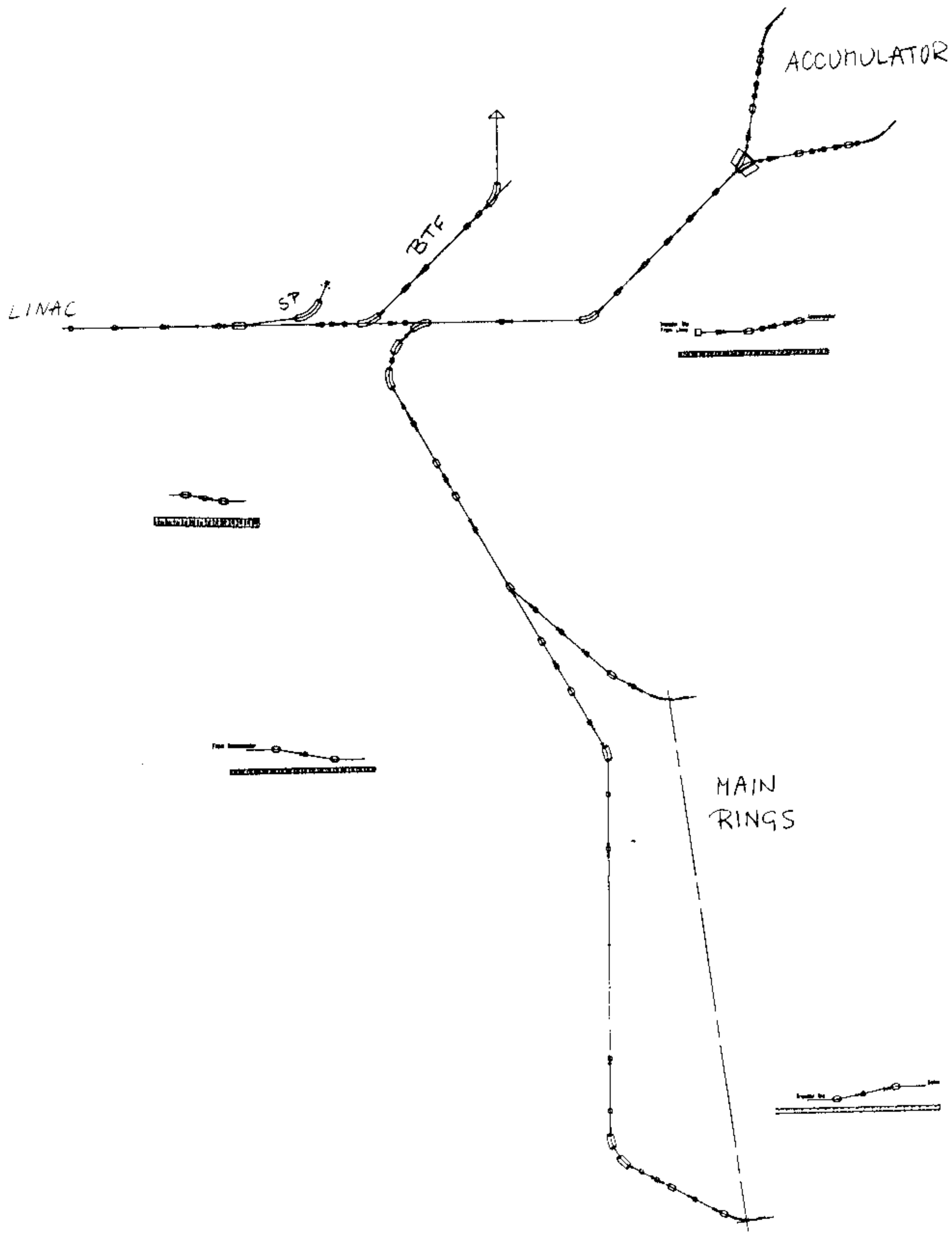
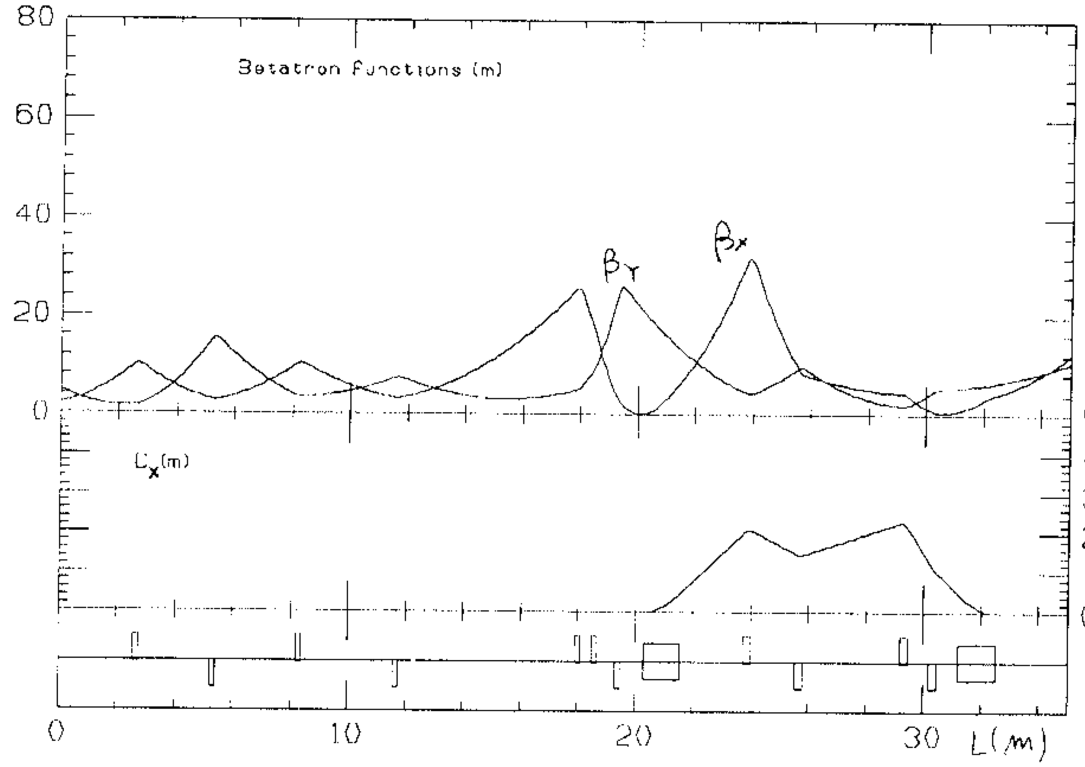


Fig. 1 - Transport line layout.

a)



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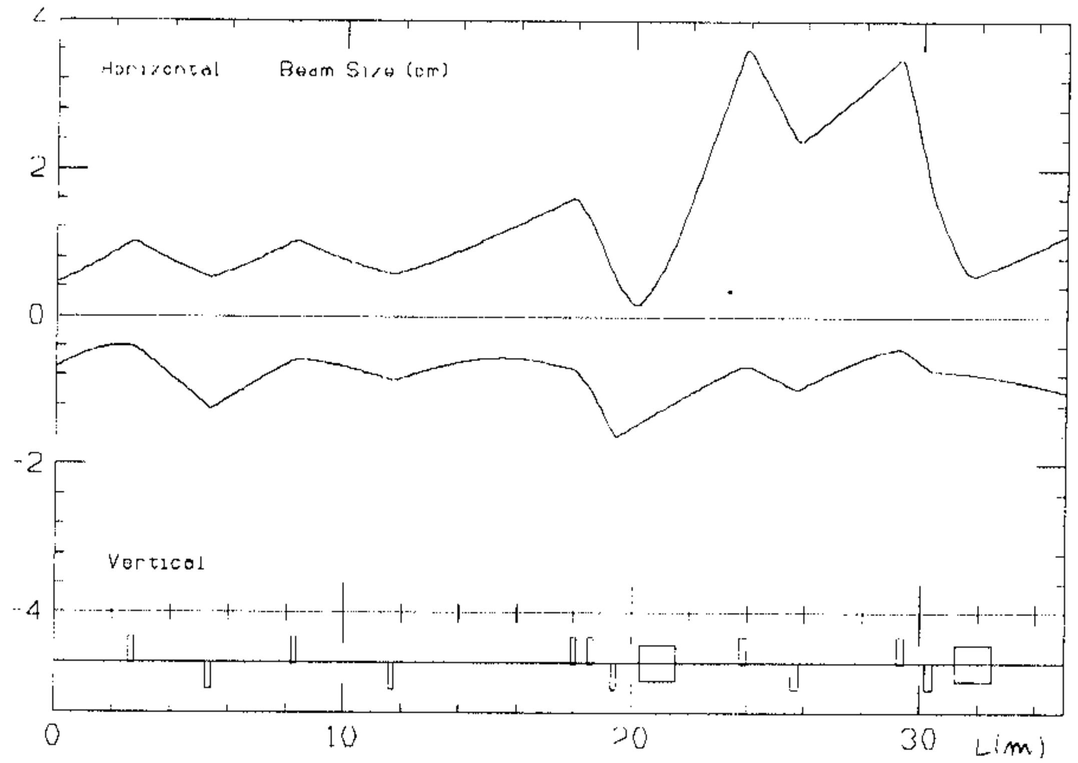
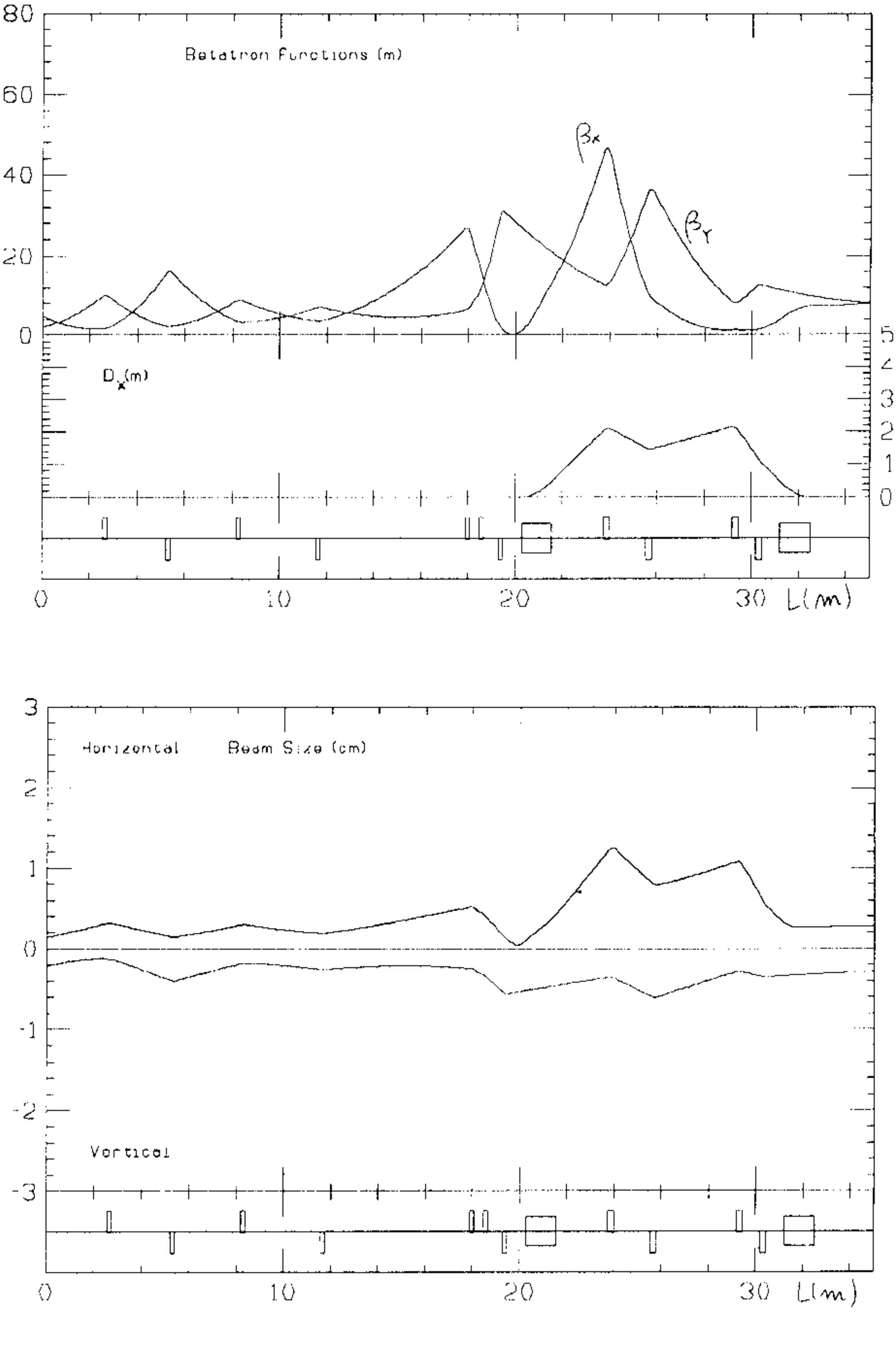


Fig. 2 - a) Optical functions along BTF in the configuration of positron transport;
b) Beam envelopes for $\varepsilon_x = \varepsilon_y = 1 \times 10^{-5}$ m rad, $\Delta p/p = \pm 1.5\%$.

a)



b)

Fig. 3 - a) Optical functions along BTF in the configuration of electron transport; b) Beam envelopes for $\varepsilon_x = \varepsilon_y = 1x10^{-6}$ m rad, $\Delta p/p = \pm .5\%$.

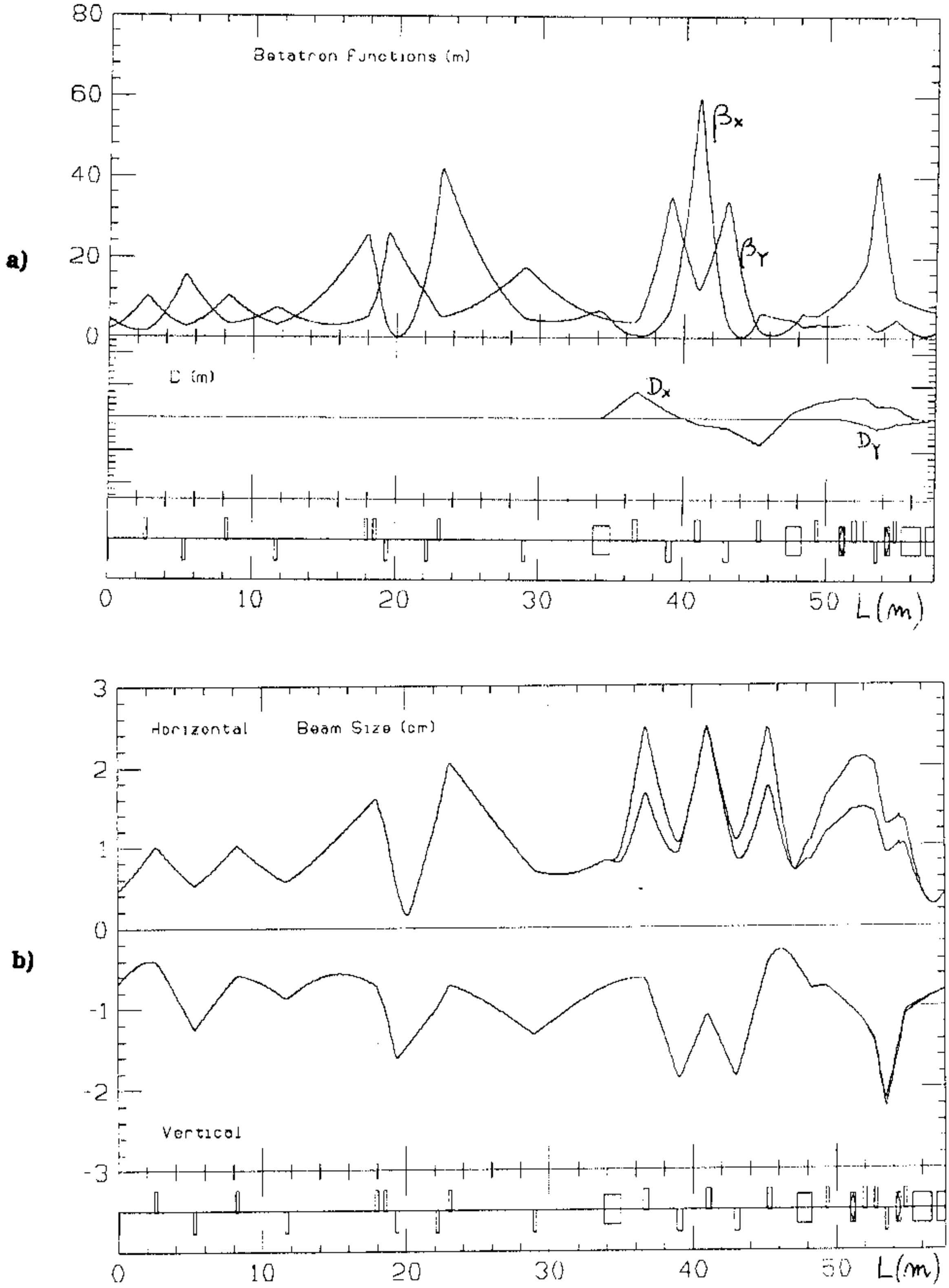


Fig. 4 - a) Optical functions along INPO in the configuration of positron transport; b) Beam envelopes for $\varepsilon_x = \varepsilon_y = 1x10^{-5}$ m rad, $\Delta p/p = \pm 1.5\%$ and $\Delta p/p = \pm 1.0\%$.

a)

b)

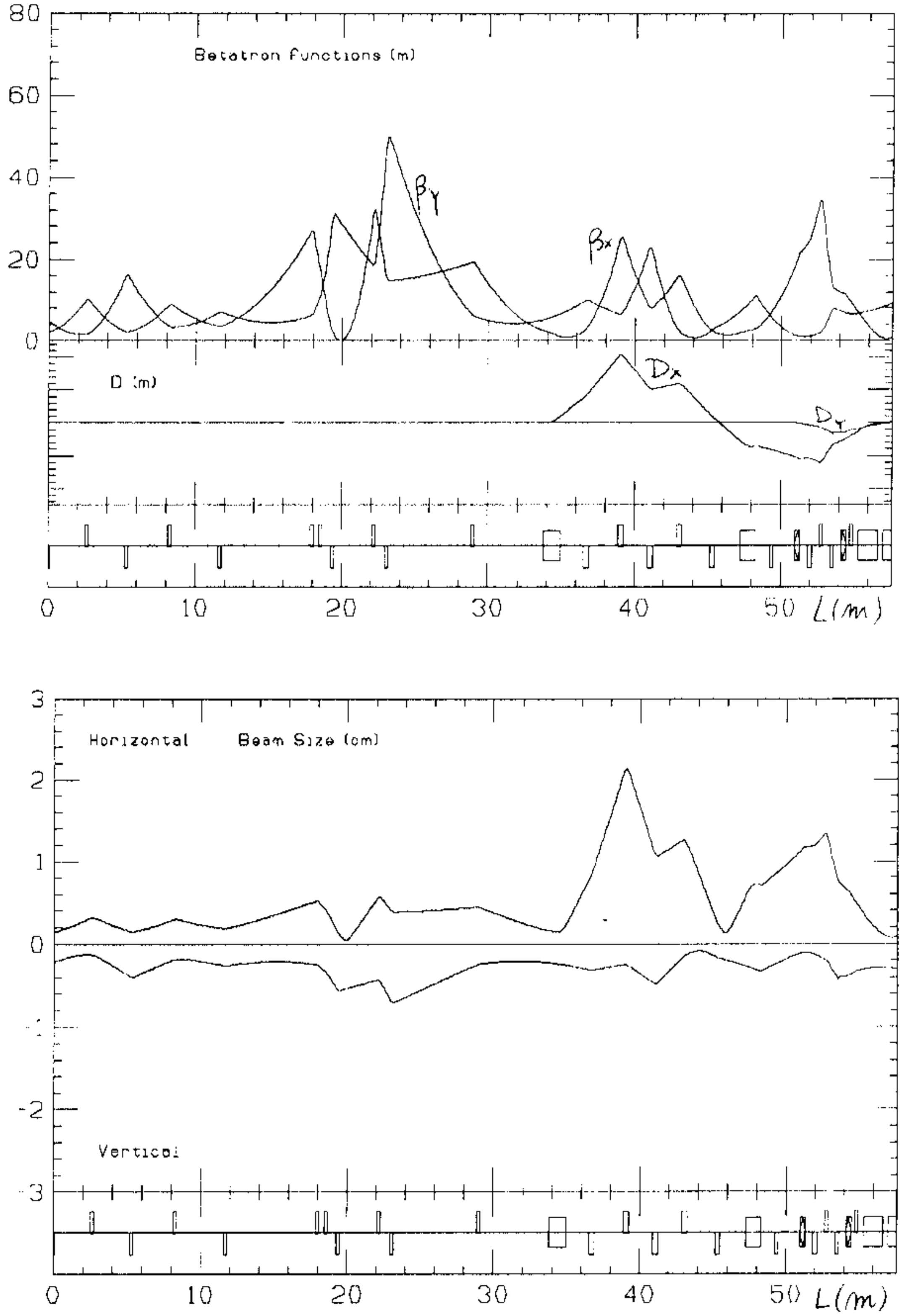


Fig. 5 - a) Optical functions along INEL in the configuration of electron transport;
b) Beam envelopes for $\varepsilon_x = \varepsilon_y = 1x10^{-6}$ m rad, $\Delta p/p = \pm 0.5\%$.

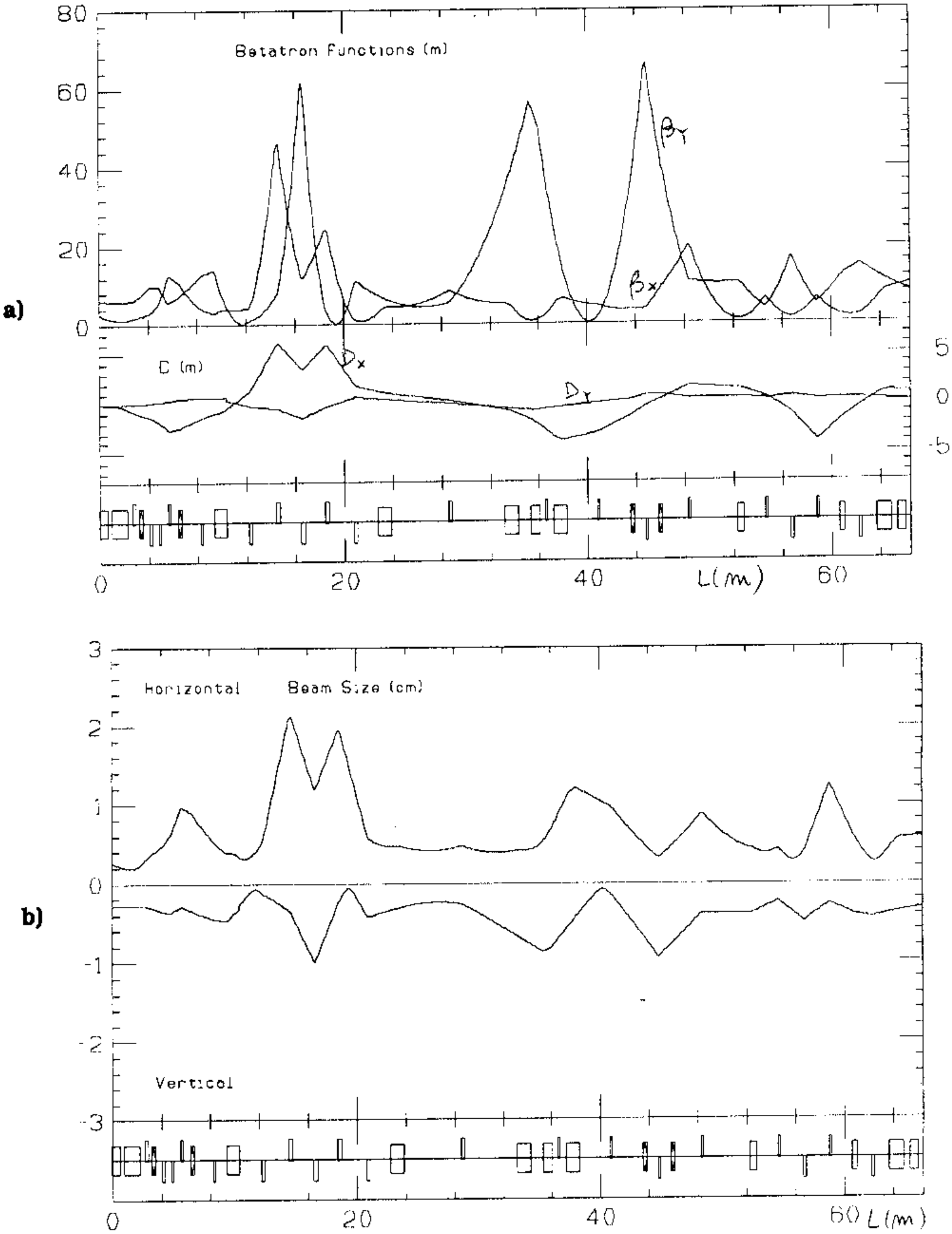


Fig. 6 - a) Optical functions along POUT in the configuration of positron transport;
b) 3 sigma beam envelopes for $\varepsilon_x = 2.8\ x10^{-7}$ *m rad,* $\varepsilon_y = 1.4\ x10^{-7}$*m rad,* $\Delta p/p = \pm\ .1\%$.

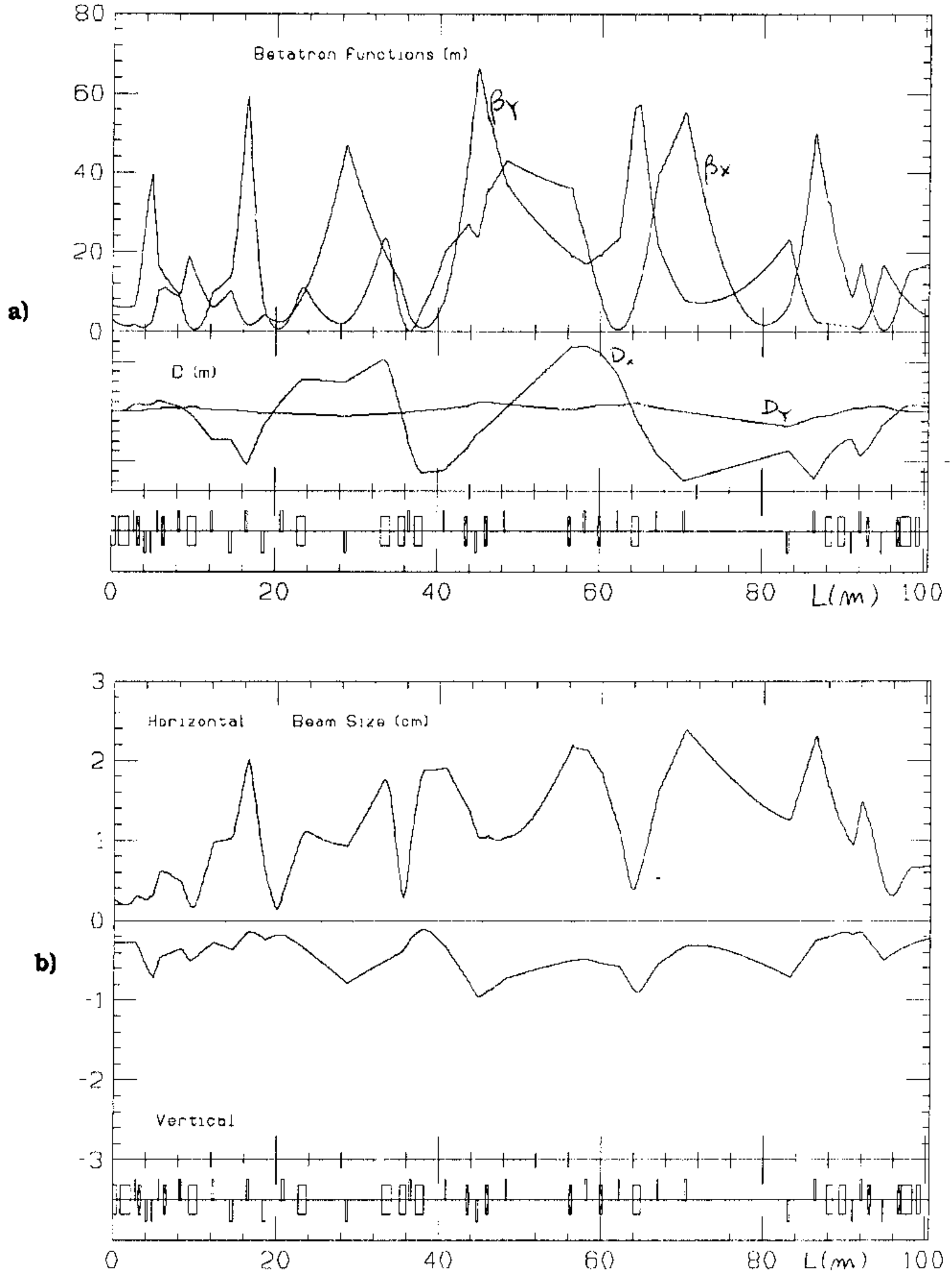


Fig. 7 - a) Optical functions along EOUT in the configuration of electron transport; b) 3 sigma beam envelopes for ε_x = 2.8 x10^{-7} m rad, ε_y = 1.4 x10^{-7}m rad, $\Delta p/p$ = ± .1% .

In the transport from the Accumulator to DAΦNE the shorter line has been dedicated to positrons. The maximum beam size in POUT and EOUT is about 2.3 cm; the maximum gradient in quadrupoles is 6.4(6.8) T/m in POUT(EOUT).

Table 2 gives the dipole characteristics: maximum field, bending angle, apertures, Beam Stay Clear (BSC) region, field uniformity. The pulsed dipoles have small gaps in order to simplify the design, so in the optic design the beam size has been optimized to be as small as possible in the zone occupied by the magnets, also taken into account that a concrete wall between the two pulsed dipoles DHPTT01,2 prevents the use of any magnetic element except a quadrupole placed in a hole in the middle of the wall. All ten vertical dipoles are of the same type. The line BTF is designed to accept a beam of up to 800 MeV.

Table 2 - Dipole characteristics

Name	**B(510 MeV)**	**Angle**	**BSCH**	**BSCV**	**Gap**	**Good Field Region (mm)**
	(T)	(deg)	(mm)	(mm)	(mm)	ΔB/B <0.2 %
DHPTT01	1.20	45	30	18	25	±15
DHPTT02	1.20	45	54	18	25	±25
DHRTT01	1.18	30	54	24	30	±25
DHSTT01	1.20	45	54	19	25	±25
DHRTP01	1.20	18.26	54	24	30	±15
DHRTP02	0.89	13.55	54	24	30	±15
DHRTE01	1.18	30	54	25	30	±25
DHRTE02	1.22	31	54	14	20	±25
DHRTE03	1.22	31	54	14	20	±25
DVRT...	0.93	11	50	50	54	±22.5
DHYTT01	1.07	36	30	24	31	±15
DHPTS01	0.45 *	6.52	40	18	25	±20
DHSTS01	1.55 *	60	80	22	30	±40
DHSTB01,2	1.55 *	45	54	36	42	±20

* values @ 800 MeV
DHP : Horizontal Pulsed; DHR : Horizontal Rectangular; DHS : Horizontal Sector; DHY : Horizontal Y; DVR : Vertical Rectangular.

The quadrupoles are divided into two families according to their aperture; the distinctive features are described in Table 3; many of them will work in fact at a much lower gradient of the maximum reacheable (see Appendix).

Table 3 - Quadrupole characteristics

Family	QUATT01/5 QUATB01/4	All other quads
Aperture (Total)	70 mm	60 mm
BSC (Total)	62 mm	53 mm
Magnetic Length	300 mm	200 mm
Maximum Gradient	7 T/m	10 T/m
Field Uniformity	$\Delta G/G \leq 2.5 \times 10^{-3}$	$\Delta G/G \leq 2.5 \times 10^{-3}$

Orbit Correction

The reference orbit distortions caused by misalignment of quadrupole and field errors in bending magnets have been calculated using the misalignment values given in Table 4, which are multiplied by the values of a gaussian distribution whose sigma is 1, truncated at 2 sigmas.

Table 4 - Misalignments and field errors

Quadrupole misalignments:	
- displacement	$\Delta x = \Delta y = 0.3$ mm
- tilt around transverse axes	0.25 mrad
Bending magnet field errors	$\Delta B/B = 0.2$ %
Monitors	$\Delta x = \Delta y = 0.3$ mm

Field errors in quadrupoles have not been taken into account because of their negligible effect on orbit. Tilt of quadrupoles around the longitudinal axis up to 2 mrad have been checked to give a completely negligible effect on the orbit.

The first step in the orbit correction of a transfer line is the adjustment step by step of the element positions and power supplies, using the beam as diagnostic tool: a set of flags in the critical points of the line will ensure the possibility of following the beam from the Linac to the Accumulator and backward from the Accumulator to the injection lines toward DAΦNE in such a way that a first (and hopefully effective) correction of the orbit is carried out. The flags are named FL1.. and FL2.. according if they work in one or two directions.

For a second step, which should work with the beam on, a set of position monitors from which one can read on-line the orbit values is distributed all along the lines in order to correct the orbit more carefully, taking care also of possible variations in the input orbit values which can change during a machine run.

At present we have used the code DIMAD[6] to simulate both the perturbed orbit and its correction.

Correctors (CHV..) have been simulated by zero length dipolar kicks; monitors (BPS..) are also considered as zero length elements, working in both planes; their transverse position is subject to errors. Flags have not been used in the simulation except for the lines BTF and SP.

All correctors can work in both transverse planes; in the simulations some of them are used only in one plane, because only the most effective correctors are used in the minimization of the orbit. The correctors are generally placed nearby the quadrupoles, where by one side the betatron functions are more separated and the overall correction is more effective, and by the other side also the local correction is easier because of the nearness of the correctors to the error source. Monitor positions have been optimized to control suitably the orbit inside the bending magnets, especially in the two pulsed horizontal dipoles (DHPTT01,2), whose vertical BSC is 18 mm and has to accept the positron beam of about 16 mm diameter.

In Table 5 the number of correctors and monitors along each line and in total is given; the number of horizontal or vertical correctors refer to the number of them used in the correction simulation.

Table 5 - Correctors and Monitors

	Correctors	CH	CV	Monitors
INPO	12 7	7		9+1*
INEL	12 7	6		9+1*
POUT	15	8	9	12+1*
EOUT	18	12	11	10+1*
SP	2	1	1	1+2Flags
BTF	5	2	3	2+2Flags
TOTAL	30			23

* *The additional monitor, used for the correction simulation, is inside the Accumulator or the Main Rings, and is not included in the total count.*

For lines INPO and INEL five simulations with the nominal errors have been performed. The results are given in Table 6; the rms value of the whole orbit, the maximum orbit value and the maximum vertical orbit in the two pulsed dipoles are given. In addition the vertical orbit in the Y magnet and the horizontal orbit in the vertical chicane dipoles have been checked and turned out to be always less than 0.5 mm. The maximum corrector strength $\theta_{x,y}$ averaged over the five simulations is also given in the table for each plane.

Table 6 - Perturbed orbit of the lines for injection into the Accumulator in presence of displacement and tilt errors in quadrupoles, field errors in dipoles and displacement errors in monitors. Orbit values are given in mm and correctors in mrad.

	<x>	<y>	x_{max}	y_{max}	y_{DHP1}	y_{DHP2}	θ_x	θ_y
	Before correction							
INPO	3.3±1.5	2.2±1.2	9.8±5.0	6.2±3.4	1.7±1.1	1.1±0.9		
INEL	2.8±0.9	2.6±2.2	8.1±3.3	6.0±4.8	3.6±3.6	1.3±1.5		
	After correction							
INPO	0.7±0.2	0.6±0.2	2.4±1.0	1.8±0.6	0.2±0.2	0.2±0.2	.43±.08	.54±.17
INEL	1.1±0.5	0.4±0.1	2.6±1.4	1.1±0.5	0.3±0.1	0.2±0.1	.66±.41	.39±.11

For the lines POUT and EOUT a different approach has been used: in the line which is common for the injection into and for the extraction from the Accumulator the corrector settings do not change between the two operations; so the correctors have been set for the optimization of the correction in the direction towards the Accumulator. In the opposite direction their contribution is less effective, because the betatron function maxima correspond to minima in the other direction and viceversa. Simulations have shown that with the nominal misalignment values the residual orbit for the beam extracted from the accumulator could reach values of about 1 cm in the DHPTT02 magnet in the horizontal (vertical) plane for the line EOUT (POUT). Therefore, it is necessary that quadrupoles in this zone (from QUATT01 to QUATT06) are better aligned (± 0.15 mm, ±0.125 mrad), and expecially, that a local correction is done, because it will be effective in both directions, being independent of the betatron function values.

Three simulations have been performed for lines EOUT and POUT, with the following assumptions: errors and correctors in the zone common to the beam in - beam out are fixed by previous runs for lines INEL and INPO. The errors in this zone are $\Delta x = \Delta y = \pm.15$mm, $\delta\theta$ = 125 mrad. In the rest of the line the errors follow the nominal distributions. The orbit is well corrected in the first part, up to the Y-magnet, reaches values up to 5 mm at the input of DHPTTO2 magnet, oscillates around those values inside the zone occupied by DHPTTO2/DHSTTO1 magnets and again can be well corrected in the rest of the line to values of less than 1 mm. The vertical orbit in all the other horizontal dipoles is also below 1 mm, and so is the horizontal orbit in the vertical dipoles. No table has been produced with these results because of the meaningless series of many numbers.

The maximum corrector strength is now higher (values near 2 mrad have been obtained). This is due both to the presence of the field errors in the very many dipoles and to the relatively large orbit at the input of the third part of the line; in fact the stronger correctors occur always nearby the stronger dipoles to correct the orbit produced there or transmitted by the common zone. The horizontal orbit can be corrected by the three dipoles themselves, while in the vertical plane a more powerful corrector must be foreseen.

However another solution has also been investigated with pulsed correctors in the common part to optimize the correction schemes in both directions; this could be feasible because of the low field required. Furthermore only three pulsed correctors would be necessary instead of the five d.c. magnets now foreseen.

Table 7 shows the results of 5 simulations with errors only on quadrupoles and monitors: in the two shorter lines INPO and INEL the residual orbits are slightly reduced and the corrector strengths are almost the same as before. In the longer lines, POUT and EOUT, the horizontal correction is much more effective and the maximum correction kick is less than 0.5 mrad. The orbit in the dipoles is of course smaller than in the previous cases. In this case three pulsed correctors are placed near quadrupoles QUATT01/6 and nominal values of errors are used all along the lines. In the table simulations of correction in the Spectrometer and BTF lines are included. The orbit correction of the BTF has been done with the main aim of optimizing the situation at the line front end. In this optics an orbit of few mm in the middle of the line, where we have a reasonably large quadrupole aperture, is accepted.

For the SPECTR the most critical point is the pulsed magnet DHPTS01 because of its very narrow gap. The correction has been successfully obtained by means of two vertical and one horizontal corrector (upstream DHPTS01) and two flags at the beginning respectively of the magnets DHPTS01 and DHPTS02.

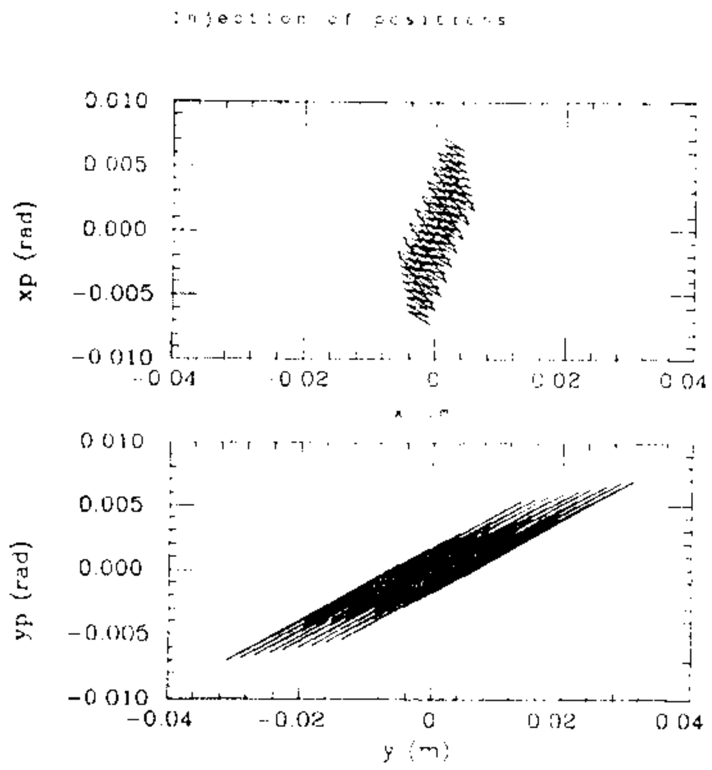
Table 7 - Perturbed orbit of the lines in the presence of displacement and tilt errors in quadrupoles, and displacement errors in monitors. Orbit values are given in mm and correctors in mrad.

	<x>	<y>	x_{max}	y_{max}	MN	θ_x	θ_y
		Before correction					
INPO	2.1±1.6	1.2±0.4	6.9±5.7	3.6±1.3			
INEL	1.7±.9	2.1±0.9	4.7±2.9	4.7±1.8			
POUT	1.8±0.6	8.9±4.7	4.3±1.9	21.3±10.9			
EOUT	3.9±2.5	1.8±1.1	7.6±4.3	5.1±3.2			
BTFP	1.1±0.4	1.0±0.6	2±1	2±2	2±1*		
BTFE	1.0±0.4	1.1±0.3	2.2±0.7	2±1	2±1*		
SPP	1.2±0.2	0.7±0.2	2±2	1.2±0.3	1.2±0.3**		
SPE	1.1±0.5	1.1±0.5	1.9±0.9	1.6±0.7	1.6±0.7**		
		After correction					
INPO	0.5±0.2	0.5±0.2	1.4±0.6	1.3±0.7		.47±.14	.34±.20
INEL	0.4±0.1	0.4±0.2	1.2±0.4	1.2±0.7		.34±.06	.28±.08
POUT	0.3±0.1	0.4±0.1	0.9±0.4	1.1±0.3		.33±.09	.33±.15
EOUT	0.2±0.1	0.4±0.1	0.7±0.2	1.1±0.4		.41±.10	.29±.20
BTFP	0.9±0.5	0.5±0.2	2±2	0.9±0.5	0.3±0.2*	0.4±0.3	0.2±0.1
BTFE	0.7±0.4	0.6±0.3	1.4±0.9	1.0±0.7	0.3±0.1*	0.3±0.1	0.4±0.2
SPP	0.8±0.2	0.19±0.03	0.6±0.1	0.3±0.1	0.13±0.08**	0.1±0.1	0.4±0.1
SPE	0.5±0.4	0.33±0.07	0.4±0.2	0.5±0.3	0.2±0.2**	0.2±0.1	0.5±0.3

* monitor @ the BTF front end.
** monitor upstream the DHPTS01 magnet.

As a conclusion the correction is ensured by maximum corrector strengths of 2 mrad. Monitor positioning should be better than ±0.3 mm; the alignment precision requested is the already listed one, except for the line in common to the beam in - beam out, which needs an improvement by a factor 2. A value of ± 0.2% of field error in magnets seems acceptable.

In the lines to inject the beam into the Accumulator there are three correctors on each side between the Y-magnet and the septum. The range in the transverse phase planes at the end of the last septum, that can be swept by these correctors, is plotted in Fig. 8 (for e^+ and e^- respectively, which means right or left branch).



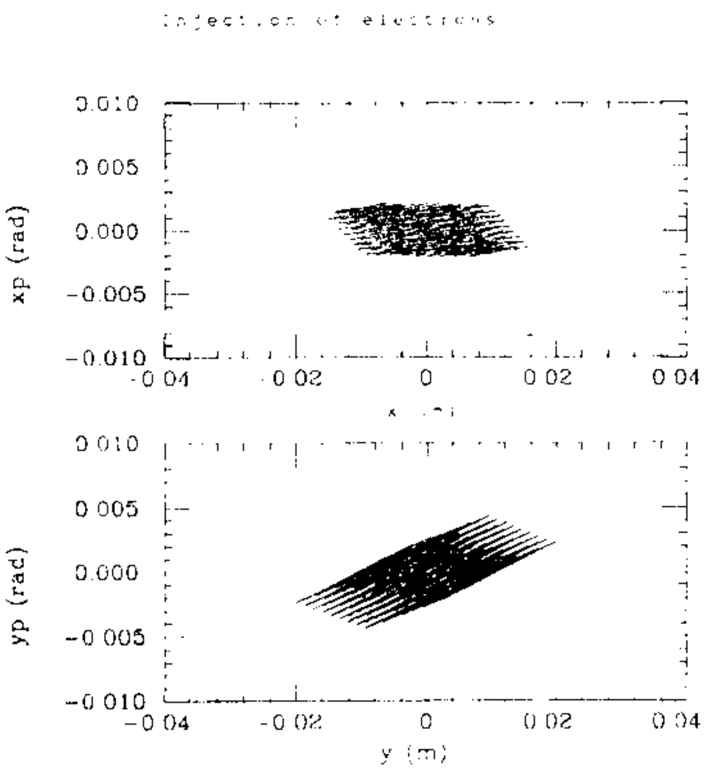


Fig. 8 - a) Phase planes swept by the three last correctors in the positron injection into the Accumulator plotted at the end of last septum (SPTA201);
b) Phase planes swept by the three last correctors in the electron injection into the Accumulator plotted at the end of last septum (SPTA101).

Multipolar field term effect on beam dynamics.

An analysis of the effects of the multipolar field components on beam dynamics has been carried out. The resulting beam envelopes have been used to set quadrupole apertures, gaps and pole widths in the bending magnets.

The tracking code MULTITRANS [7] has been used. Each multipole is simulated by kicks occurring every two centimeters in the magnets. A cross-check between MULTITRANS and DIMAD codes has been performed, showing good agreement.

The lower order components have been taken into account: 12-polar and 20-polar terms in quadrupoles and 6-polar in dipoles.

The quadrupole pole faces will have a three straight line profile which approximates the ideal hyperbola. According to preliminary simulations[8] with a gradient uniformity $\leq 2.5 \times 10^{-3}$ the values of the main multipolar terms are

$\partial_5/\partial_1 \leq 10^5 \text{ m}^{-4}$ (12-polar term normalized to the 4-polar one)

$\partial_9/\partial_1 \leq 10^{15} \text{ m}^{-8}$ (20-polar term normalized to the 4-polar one)

where

$$\partial_n = (\partial^n B_y/\partial x^n)_{x,y=0}$$

These values are therefore scaled to each quadrupole gradient and they show to have no relevant effects on the beam envelope.

Several runs have been performed with different sextupole values in dipoles, together with the above specified multipoles in quadrupoles, showing that if the magnets will be built with a field error smaller than

0.2 % in the good field region (see Table 2)

no important variations of the beam envelope (few percent) will occur.

Only in the line EOUT a very small effect on beam envelopes has been found: Fig. 9 shows the situation, without and with multipolar terms in both quadrupoles and dipoles. In all the other lines the effects are negligible. The uniform field requirements, the apertures, and dipole gaps as specified for all the transfer line magnets in Tables 2/3, have been cross checked in this way.

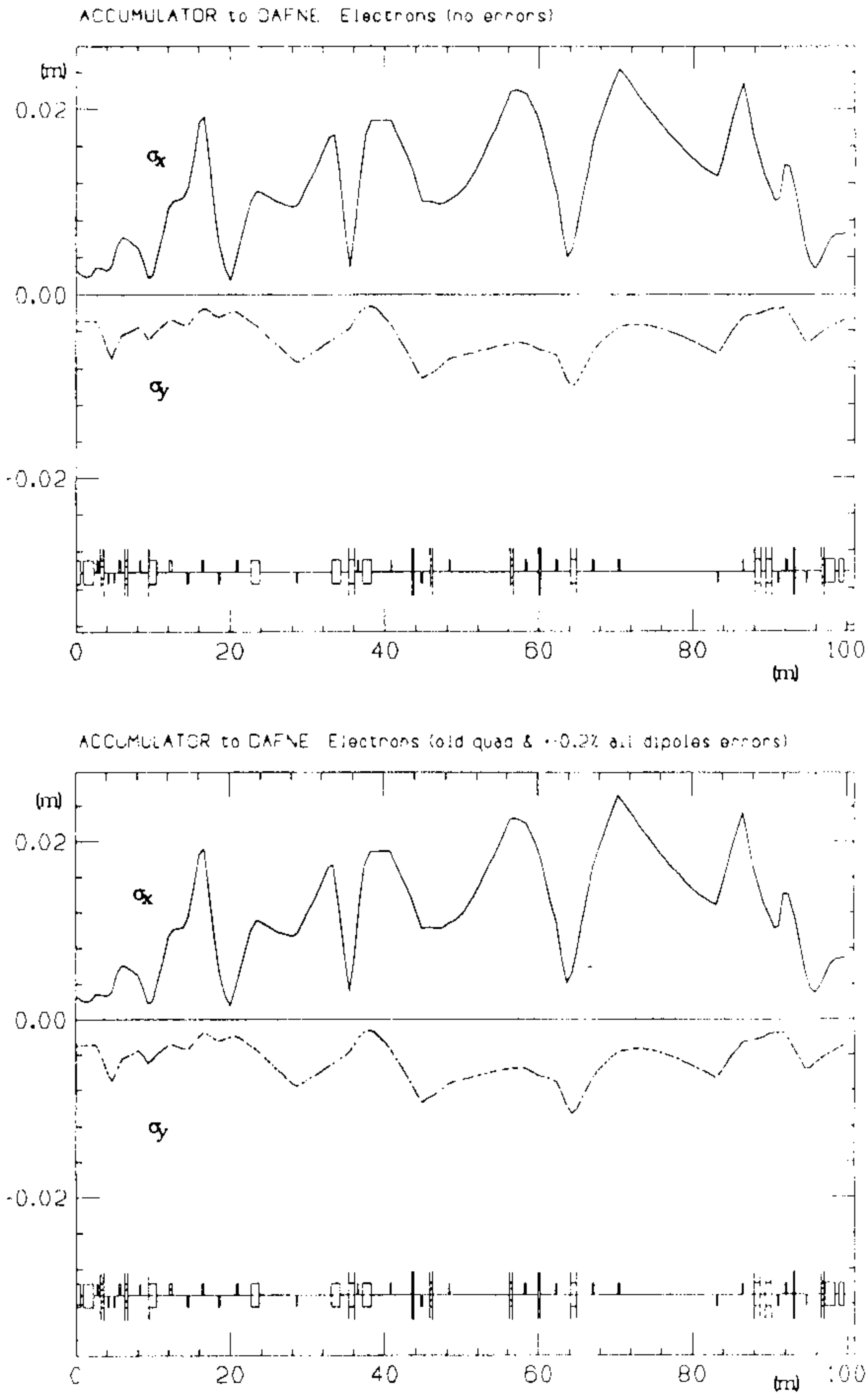


Fig. 9 - Beam envelopes as obtained by tracking simulation in absence (a) and in presence (b) of multipolar field components for the line EOUT.

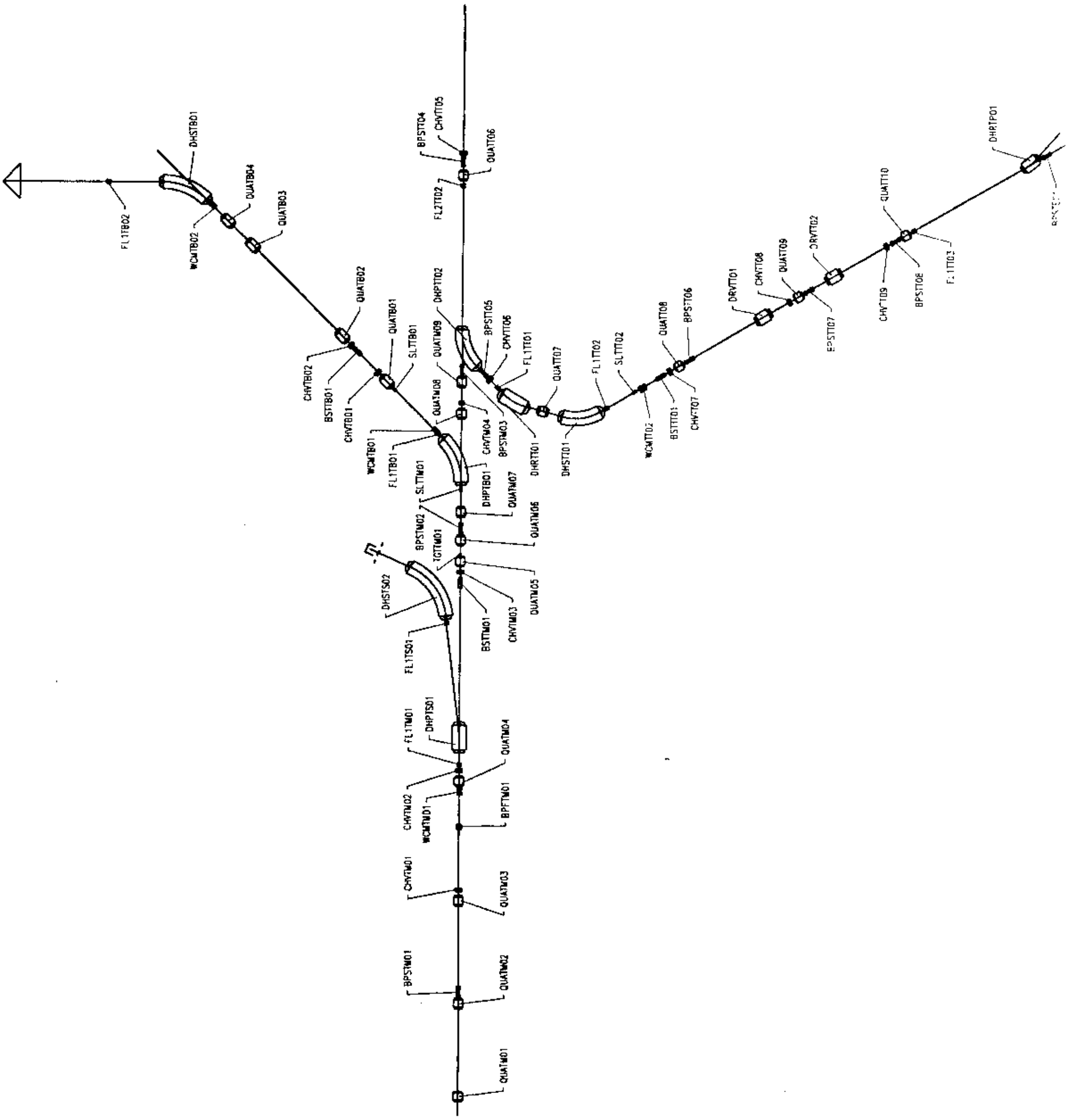


Fig. 10a) - Lines TM , TS, TB, and part of TT.

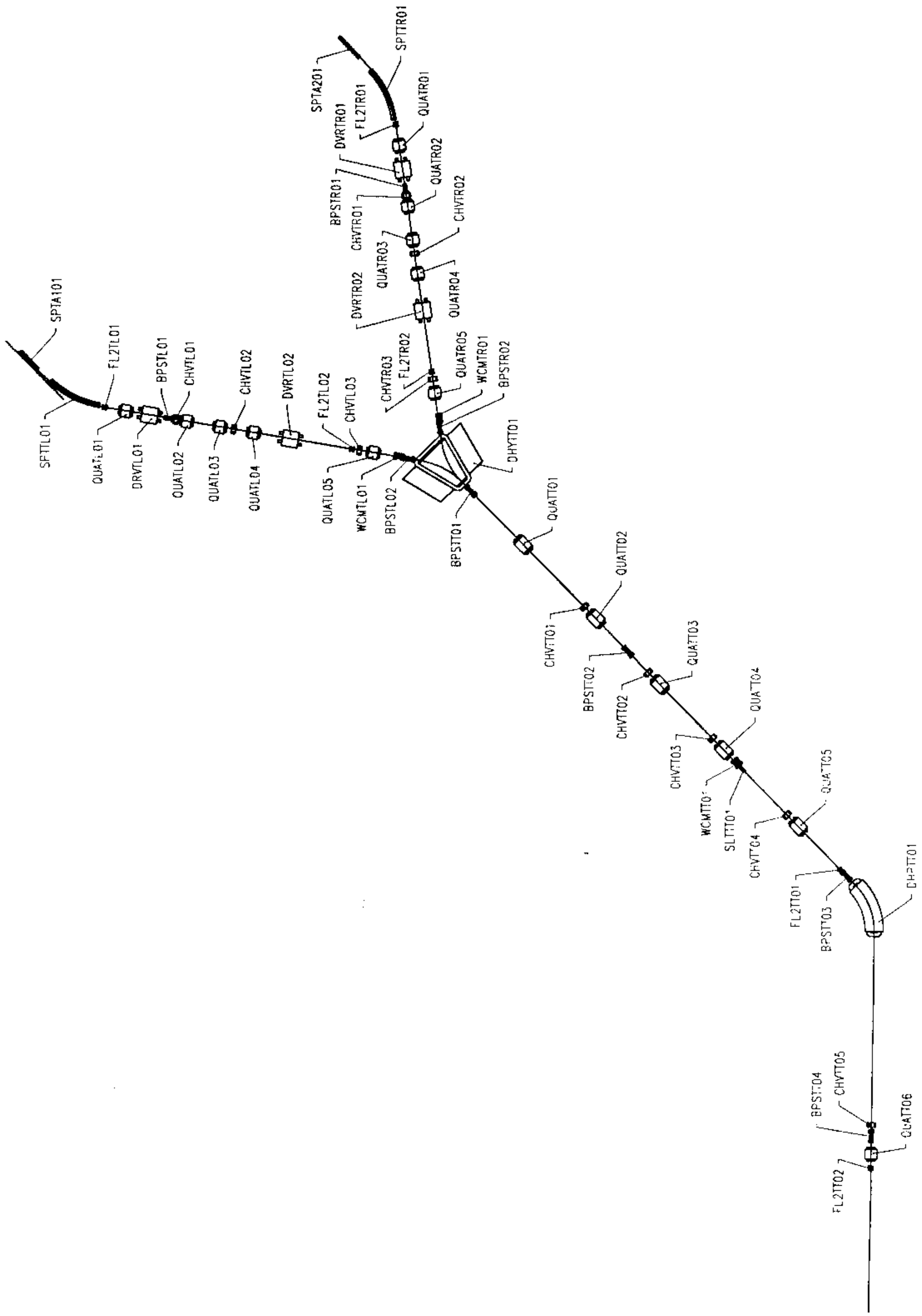


Fig. 10b) - LinesTL, TR and part of TT.

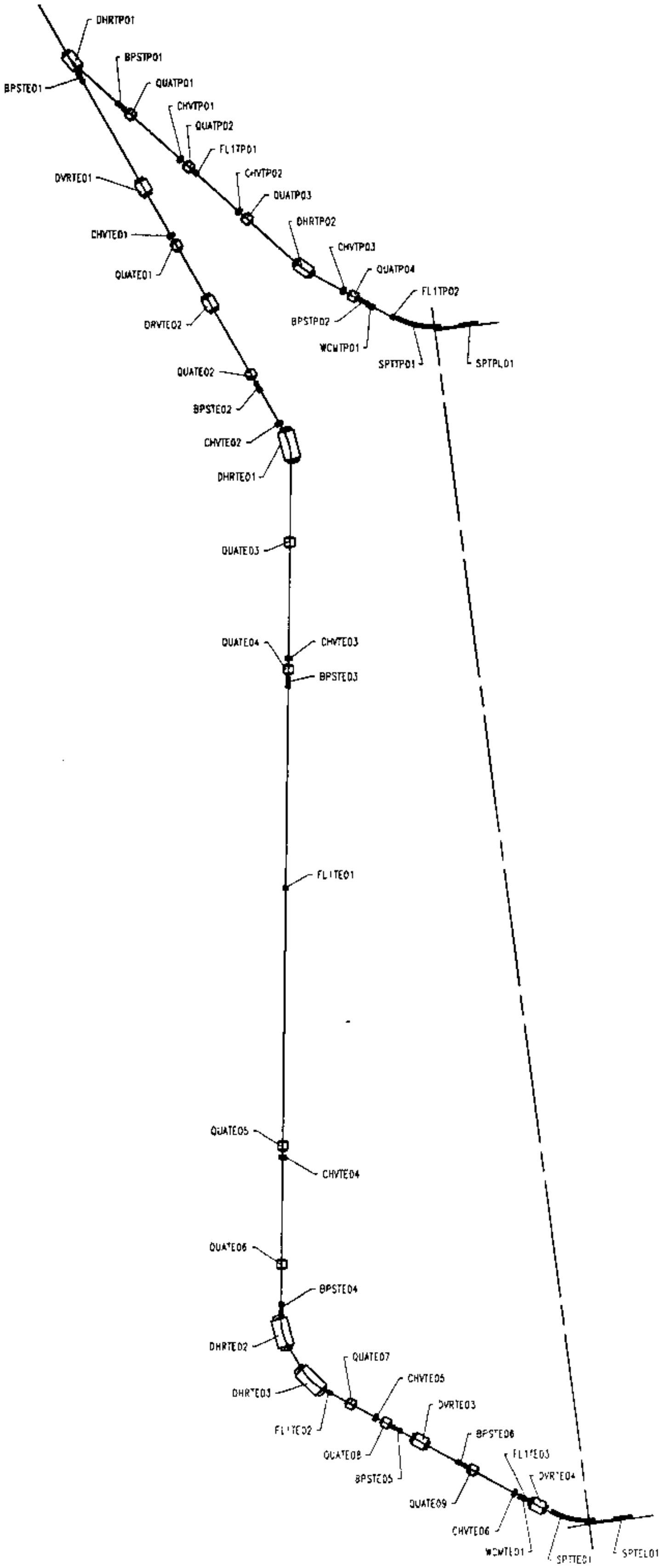


Fig. 10c) - Lines TP and TE.

Diagnostics

A list of the foreseen diagnostics follows:

23 beam position monitors (strip lines) (BPS)

13 fluorescent flags 6 of which must work in both directions

7 current monitors (WCM)

4 slits (SLT) followed by one of the above WCM, set in high dispersion regions to cut the tails in beam energy distribution, one for the beam injected into the Accumulator, one for the beam injected into the Main Rings.

One target for the BTF (TGT)

One Beam Profile Monitor for emittance measurements (BPF)

3 beam stoppers (BST) will allow to stop the beam in the critical points.

In Fig. 10 a sketch of the line with the position of all diagnostics and the names of all the elements are given; the scales in the three parts of this figure are different.

In the Appendix a complete list of the line elements including the diagnostics is given. All the diagnostics is given as zero length elements.

References

[1] C. Biscari - 'Transfer line for Daϕne injection' Daϕne Technical Note I-8- 1992.

[2] F. Sannibale, M. Vescovi 'Linac to Accumulator Area Transferline & Daϕne-Linac Spectrometer' Daϕne Technical Note LC-3, Feb.1,1992.

[3] F. Sannibale, G. Vignola 'Daϕne-Linac Test Beam' Daϕne Technical Note LC-2 Oct. 29, 1991.

[4] 'DAΦNE Parameter List'.

[5] Titan Beta 'Conceptual Design Review' Apr. 15, 1992.

[6] R.V. Servranckx, K.L. Brown, D. Douglas - 'User guide to the program DIMAD' - SLAC report 285 UC-28 (A) - 1985.

[7] F. Sannibale - MULTITRANS Code - Unpublished.

[8] G. Qiao - Unpublished work.

APPENDIX

The complete list of the transfer line elements, including diagnostic, is given. The elements are named following the general rule[4]: each name is composed by a field of 7 characters; the first three refer to the element type, the following two identify the location and the last two are the identification number of the element in its category.

The different locations are identified by:

TM : matching between Linac and Accumulator
TS : Spectrometer line
TB : Beam Test Facility
TT : Transfer line from Accumulator to Main Rings, up to the e^+/e^- branches bifurcation
TL : Left branch from the Y-magnet to Accumulator
TR : Right branch from the Y-magnet to Accumulator
TE : Transfer for electrons from TT to Main Ring
TP : Transfer for positrons from TT to Main Ring
A1,2 : 1^{st},2^{nd} Accumulator quadrant, clockwise direction.

The first three characters, identyfing the element type have the following meaning:

TYPE	NAME	NOTE
DIPOLE	DHR	Horizontal Rectangular
	DHP	Horizontal Pulsed
	DHY	Horizontal Y
	DVR	Vertical Rectangular
QUADRUPOLE	QUA	General quad.
CORRECTOR	CHV	Vertical & Horizontal
BEAM STOPPER	BST	
DIAGNOSTIC:		
BEAM POSITION	BPB	Buttons
	BPS	Stripline
FLAG	FL1	One direction
	FL2	Two directions
CURRENT MONITOR	WCM	Wall current monitor
SLIT	SLT	
BEAM PROFILE	BPF	
TARGET	TGT	

Line SPT for positrons

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m^{-2})	ANGLE (rad)	E1 (rad)	E2 (rad)
QUAD	QUALIXX	0.125	0.000	-2.44000			
DRIFT	DL1	2.448	0.125	0.00000			
QUAD	QUATM01	0.200	2.573	2.28451			
DRIFT	DL2	2.450	2.773	0.00000			
QUAD	QUATM02	0.200	5.223	-2.37187			
DIAG	BPSTM01	0.000	5.423	0.00000			
DRIFT	DL3	2.750	5.423	0.00000			
QUAD	QUATM03	0.200	8.173	1.81069			
CORR	CHVTM01	0.000	8.373	0.00000			
DRIFT	DL4	3.200	8.373	0.00000			
DIAG	BPFTM01	0.000	11.573	0.00000			
DIAG	WCMTM01	0.000	11.573	0.00000			
QUAD	QUATM04	0.200	11.573	-1.52761			
CORR	CHVTM02	0.000	11.773	0.00000			
DIAG	FL1TM01	0.000	11.773	0.00000			
DRIFT	DSP1	0.800	11.773	0.00000			
DIPOLE	DHPTS01	0.683	12.573		0.1138	0.0000	0.1138
DRIFT	DSP2	3.181	13.256	0.00000			
DIAG	FL1TS01	0.000	16.437	0.00000			
DIPOLE	DHSTS01	1.804	16.437		1.0472	0.0000	0.0000
DRIFT	DSP3	0.995	18.241	0.00000			
DIAG	HODOSCOP	0.000	19.236	0.00000			
DIAG	FAR CUP	0.000	19.236	0.00000			

Line SPT for electrons

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m^{-2})	ANGLE (rad)	E1 (rad)	E2 (rad)
QUAD	QUALIXX	0.125	0.000	-2.44000			
DRIFT	DL1	2.448	0.125	0.00000			
QUAD	QUATM01	0.200	2.573	2.41336			
DRIFT	DL2	2.450	2.773	0.00000			
QUAD	QUATM02	0.200	5.223	-2.40741			
DIAG	BPSTM01	0.000	5.423	0.00000			
DRIFT	DL3	2.750	5.423	0.00000			
QUAD	QUATM03	0.200	8.173	1.84452			
CORR	CHVTM01	0.000	8.373	0.00000			
DRIFT	DL4	3.200	8.373	0.00000			
DIAG	BPFTM01	0.000	11.573	0.00000			
DIAG	WCMTM01	0.000	11.573	0.00000			
QUAD	QUATM04	0.200	11.573	-1.31176			
CORR	CHVTM02	0.000	11.773	0.00000			
DIAG	FL1TM01	0.000	11.773	0.00000			
DRIFT	DSP1	0.800	11.773	0.00000			
DIPOLE	DHPTS01	0.683	12.573		0.1138	0.0000	0.1138
DRIFT	DSP2	3.181	13.256	0.00000			
DIAG	FL1TS01	0.000	16.437	0.00000			
DIPOLE	DHSTS01	1.804	16.437		1.0472	0.0000	0.0000
DRIFT	DSP3	0.995	18.241	0.00000			
DIAG	HODOSCOP	0.000	19.236	0.00000			
DIAG	FAR CUP	0.000	19.236	0.00000			

Line BTF for positrons

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m^{-2})	ANGLE (rad)	E1 (rad)	E2 (rad)
QUAD	QUALIXX	0.125	0.000	-2.44000			
DRIFT	DL1	2.448	0.125	0.00000			
QUAD	QUATM01	0.200	2.573	2.28451			
DRIFT	DL2	2.450	2.773	0.00000			
QUAD	QUATM02	0.200	5.223	-2.37187			
DIAG	BPSTM01	0.000	5.423	0.00000			
DRIFT	DL3	2.750	5.423	0.00000			
QUAD	QUATM03	0.200	8.173	1.81069			
CORR	CHVTM01	0.000	8.373	0.00000			
DRIFT	DL4	3.200	8.373	0.00000			
DIAG	BPFTM01	0.000	11.573	0.00000			
DIAG	WCMTM01	0.000	11.573	0.00000			
QUAD	QUATM04	0.200	11.573	-1.52761			
CORR	CHVTM02	0.000	11.773	0.00000			
DIAG	FL1TM01	0.000	11.773	0.00000			
DRIFT	DL5	6.100	11.773	0.00000			
DIAG	BSTTM01	0.000	17.873	0.00000			
CORR	CHVTM03	0.000	17.873	0.00000			
QUAD	QUATM05	0.200	17.873	2.52310			
DIAG	TGTTM01	0.000	18.073	0.00000			
DRIFT	DL5B	0.400	18.073	0.00000			
QUAD	QUATM06	0.200	18.473	1.37801			
DIAG	BPSTM02	0.000	18.673	0.00000			
DRIFT	DL6	0.600	18.673	0.00000			
QUAD	QUATM07	0.200	19.273	-3.14950			
DRIFT	DL7A	0.757	19.473	0.00000			
DIAG	SLTTM01	0.000	20.230	0.00000			
DIPOLE	DHSTB01	1.353	20.230		0.7854	0.0000	0.0000
DIAG	FL1TB01	0.000	21.583	0.00000			
DIAG	WCMTB01	0.000	21.583	0.00000			
DRIFT	DTB1	2.150	21.583	0.00000			
DIAG	SLTTB01	0.000	23.733	0.00000			
QUAD	QUATB01	0.300	23.733	1.75019			
CORR	CHVTB01	0.000	24.033	0.00000			
DRIFT	DTB2	1.500	24.033	0.00000			
DIAG	BSTTB01	0.000	25.533	0.00000			
CORR	CHVTB02	0.000	25.533	0.00000			
QUAD	QUATB02	0.300	25.533	-1.41112			
DRIFT	DTB3	3.320	25.833	0.00000			
QUAD	QUATB03	0.300	29.153	2.12745			
DRIFT	DTB4	0.700	29.453	0.00000			
QUAD	QUATB04	0.300	30.153	-1.40094			
DRIFT	DTB5	0.725	30.453	0.00000			
DIAG	WCMTB02	0.000	31.178	0.00000			
DIPOLE	DHSTB02	1.353	31.178		0.7854	0.0000	0.0000
DRIFT	DTB6	1.500	32.531	0.00000			
DIAG	FL1TB02	0.000	34.031	0.00000			
DRIFT	DTB7	1.000	34.031	0.00000			
DIAG	SCNTB01	0.000	35.031	0.00000			

Line BTF for electrons

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m-2)	ANGLE (rad)	E1 (rad)	E2 (rad)
QUAD	QUALIXX	0.125	0.000	-2.44000			
DRIFT	DL1	2.448	0.125	0.00000			
QUAD	QUATM01	0.200	2.573	2.41336			
DRIFT	DL2	2.450	2.773	0.00000			
QUAD	QUATM02	0.200	5.223	-2.40741			
DIAG	BPSTM01	0.000	5.423	0.00000			
DRIFT	DL3	2.750	5.423	0.00000			
QUAD	QUATM03	0.200	8.173	1.84452			
CORR	CHVTM01	0.000	8.373	0.00000			
DRIFT	DL4	3.200	8.373	0.00000			
DIAG	BPFTM01	0.000	11.573	0.00000			
DIAG	WCMTM01	0.000	11.573	0.00000			
QUAD	QUATM04	0.200	11.573	-1.31176			
CORR	CHVTM02	0.000	11.773	0.00000			
DIAG	FL1TM01	0.000	11.773	0.00000			
DRIFT	DL5	6.100	11.773	0.00000			
DIAG	BSTTM01	0.000	17.873	0.00000			
CORR	CHVTM03	0.000	17.873	0.00000			
QUAD	QUATM05	0.200	17.873	2.68712			
DIAG	TGTTM01	0.000	18.073	0.00000			
DRIFT	DL5B	0.400	18.073	0.00000			
QUAD	QUATM06	0.200	18.473	1.42700			
DIAG	BPSTM02	0.000	18.673	0.00000			
DRIFT	DL6	0.600	18.673	0.00000			
QUAD	QUATM07	0.200	19.273	-2.86400			
DRIFT	DL7A	0.757	19.473	0.00000			
DIAG	SLTTM01	0.000	20.230	0.00000			
DIPOLE	DHSTB01	1.353	20.230		0.7854	0.0000	0.0000
DIAG	FL1TB01	0.000	21.583	0.00000			
DIAG	WCMTB01	0.000	21.583	0.00000			
DRIFT	DT1	2.150	21.583	0.00000			
DIAG	SLTTB01	0.000	23.733	0.00000			
QUAD	QUATB01	0.300	23.733	1.75500			
CORR	CHVTB01	0.000	24.033	0.00000			
DRIFT	DT2	1.500	24.033	0.00000			
DIAG	BSTTB01	0.000	25.533	0.00000			
CORR	CHVTB02	0.000	25.533	0.00000			
QUAD	QUATB02	0.300	25.533	-1.34099			
DRIFT	DT3	3.320	25.833	0.00000			
QUAD	QUATB03	0.300	29.153	1.98062			
DRIFT	DT4	0.700	29.453	0.00000			
QUAD	QUATB04	0.300	30.153	-1.00333			
DRIFT	DT5	0.725	30.453	0.00000			
DIAG	WCMTB02	0.000	31.178	0.00000			
DIPOLE	DHSTB02	1.353	31.178		0.7854	0.0000	0.0000
DRIFT	DT6A	1.500	32.531	0.00000			
DIAG	FL1TB02	0.000	34.031	0.00000			
DRIFT	DT6B	1.000	34.031	0.00000			
DIAG	SCNTB01	0.000	35.031	0.00000			

Line INPO for positrons

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m-2)	ANGLE (rad)	E1 (rad)	E2 (rad)
DRIFT	D0	0.000	0.000	0.00000			
QUAD	QUALIXX	0.125	0.000	-2.44000			
DRIFT	DL1	2.448	0.125	0.00000			
QUAD	QUATM01	0.200	2.573	2.28451			
DRIFT	DL2	2.450	2.773	0.00000			
QUAD	QUATM02	0.200	5.223	-2.37187			
DIAG	BPSTM01	0.000	5.423	0.00000			
DRIFT	DL3	2.750	5.423	0.00000			
QUAD	QUATM03	0.200	8.173	1.81069			
CORR	CHVTM01	0.000	8.373	0.00000			
DRIFT	DL4	3.200	8.373	0.00000			
DIAG	BPFTM01	0.000	11.573	0.00000			
DIAG	WCMTM01	0.000	11.573	0.00000			
QUAD	QUATM04	0.200	11.573	-1.52761			
CORR	CHVTM02	0.000	11.773	0.00000			
DIAG	FL1TM01	0.000	11.773	0.00000			
DRIFT	DL5	6.100	11.773	0.00000			
DIAG	BSTTM01	0.000	17.873	0.00000			
CORR	CHVTM03	0.000	17.873	0.00000			
QUAD	QUATM05	0.200	17.873	2.52310			
DIAG	TGTTM01	0.000	18.073	0.00000			
DRIFT	DL5B	0.400	18.073	0.00000			
QUAD	QUATM06	0.200	18.473	1.37801			
DIAG	BPSTM02	0.000	18.673	0.00000			
DRIFT	DL6	0.600	18.673	0.00000			
QUAD	QUATM07	0.200	19.273	-3.14950			
DRIFT	DL7A	0.757	19.473	0.00000			
DIAG	SLTTM01	0.000	20.230	0.00000			
DRIFT	DL7B	1.843	20.230	0.00000			
QUAD	QUATM08	0.200	22.073	-0.56021			
DRIFT	DL8	0.700	22.273	0.00000			
CORR	CHVTM04	0.000	22.973	0.00000			
QUAD	QUATM09	0.200	22.973	2.55819			
DIAG	BPSTM03	0.000	23.173	0.00000			
DRIFT	DL9	1.351	23.173	0.00000			
DRIFT	D17	4.349	24.524	0.00000			
DIAG	FL2TT02	0.000	28.873	0.00000			
QUAD	QUATT06	0.200	28.873	-1.02192			
DIAG	BPSTT04	0.000	29.073	0.00000			
CORR	CHVTT05	0.000	29.073	0.00000			
DRIFT	D16	4.750	29.073	0.00000			
DIPOLE	DHPTT01	1.113	33.823		0.7854	0.0000	0.0000
DIAG	BPSTT03	0.000	34.936	0.00000			
DIAG	FL2TT01	0.000	34.936	0.00000			
DRIFT	D15	1.650	34.936	0.00000			
QUAD	QUATT05	0.300	36.586	2.59936			

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m-2)	ANGLE (rad)	E1 (rad)	E2 (rad)
CORR	CHVTT04	0.000	36.886	0.00000			
DRIFT	D14	2.045	36.886	0.00000			
DIAG	SLTTT01	0.000	38.931	0.00000			
DIAG	WCMTT01	0.000	38.931	0.00000			
QUAD	QUATT04	0.300	38.931	-1.74271			
CORR	CHVTT03	0.000	39.231	0.00000			
DRIFT	D13	1.700	39.231	0.00000			
QUAD	QUATT03	0.300	40.931	2.47149			
CORR	CHVTT02	0.000	41.231	0.00000			
DRIFT	D12B	0.850	41.231	0.00000			
DIAG	BPSTT02	0.000	42.081	0.00000			
DRIFT	D12A	0.850	42.081	0.00000			
QUAD	QUATT02	0.300	42.931	-1.94918			
CORR	CHVTT01	0.000	43.231	0.00000			
DRIFT	D11	1.970	43.231	0.00000			
QUAD	QUATT01	0.300	45.201	2.91460			
DRIFT	D10	1.770	45.501	0.00000			
DIAG	BPSTT01	0.000	47.271	0.00000			
DIPOLE	DHYTT01	1.000	47.271		-0.6283	0.0000	-0.6283
DIAG	BPSTR02	0.000	48.271	0.00000			
DIAG	WCMTR01	0.000	48.271	0.00000			
DRIFT	D9	0.965	48.271	0.00000			
QUAD	QUATR05	0.200	49.236	0.99759			
CORR	CHVTR03	0.000	49.436	0.00000			
DIAG	FL2TR02	0.000	49.436	0.00000			
DRIFT	D8	1.550	49.436	0.00000			
V DIPOL	DVRTR02	0.350	50.986		-0.1920	-0.0960	-0.0960
DRIFT	D7	0.550	51.336	0.00000			
QUAD	QUATR04	0.200	51.886	0.39748			
DRIFT	D6	0.550	52.086	0.00000			
CORR	CHVTR02	0.000	52.636	0.00000			
QUAD	QUATR03	0.200	52.636	2.41645			
DRIFT	D5	0.543	52.836	0.00000			
QUAD	QUATR02	0.200	53.380	-4.32769			
CORR	CHVTR01	0.000	53.580	0.00000			
DRIFT	D4	0.550	53.580	0.00000			
DIAG	BPSTR01	0.000	54.130	0.00000			
V DIPOL	DVRTR01	0.350	54.130		0.1920	0.0960	0.0960
DRIFT	D3	0.250	54.480	0.00000			
QUAD	QUATR01	0.200	54.730	3.45308			
DRIFT	D2	0.475	54.930	0.00000			
DIAG	FL2TR01	0.000	55.405	0.00000			
SEPT	SPTTR01	1.233	55.405		0.5934	0.0000	0.0000
DRIFT	D1	0.375	56.638	0.00000			
SEPT	SPTA201	0.623	57.013		0.0380	0.0000	0.0000

Line INEL for electrons

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m-2)	ANGLE (rad)	E1 (rad)	E2 (rad)
DRIFT	D0	0.000	0.000	0.00000			
QUAD	QUALIXX	0.125	0.000	-2.44000			
DRIFT	DL1	2.448	0.125	0.00000			
QUAD	QUATM01	0.200	2.573	2.41336			
DRIFT	DL2	2.450	2.773	0.00000			
QUAD	QUATM02	0.200	5.223	-2.40741			
DIAG	BPSTM01	0.000	5.423	0.00000			
DRIFT	DL3	2.750	5.423	0.00000			
QUAD	QUATM03	0.200	8.173	1.84452			
CORR	CHVTM01	0.000	8.373	0.00000			
DRIFT	DL4	3.200	8.373	0.00000			
DIAG	BPFTM01	0.000	11.573	0.00000			
DIAG	WCMTM01	0.000	11.573	0.00000			
QUAD	QUATM04	0.200	11.573	-1.31176			
CORR	CHVTM02	0.000	11.773	0.00000			
DIAG	FL1TM01	0.000	11.773	0.00000			
DRIFT	DL5	6.100	11.773	0.00000			
DIAG	BSTTM01	0.000	17.873	0.00000			
CORR	CHVTM03	0.000	17.873	0.00000			
QUAD	QUATM05	0.200	17.873	2.68712			
DIAG	TGTTM01	0.000	18.073	0.00000			
DRIFT	DL5B	0.400	18.073	0.00000			
QUAD	QUATM06	0.200	18.473	1.42700			
DIAG	BPSTM02	0.000	18.673	0.00000			
DRIFT	DL6	0.600	18.673	0.00000			
QUAD	QUATM07	0.200	19.273	-2.86400			
DRIFT	DL7A	0.757	19.473	0.00000			
DIAG	SLTTM01	0.000	20.230	0.00000			
DRIFT	DL7B	1.843	20.230	0.00000			
QUAD	QUATM08	0.200	22.073	4.17736			
DRIFT	DL8	0.700	22.273	0.00000			
CORR	CHVTM04	0.000	22.973	0.00000			
QUAD	QUATM09	0.200	22.973	-2.86791			
DIAG	BPSTM03	0.000	23.173	0.00000			
DRIFT	DL9	1.351	23.173	0.00000			
DRIFT	D17	4.349	24.524	0.00000			
DIAG	FL2TT02	0.000	28.873	0.00000			
QUAD	QUATT06	0.200	28.873	0.93050			
DIAG	BPSTT04	0.000	29.073	0.00000			
CORR	CHVTT05	0.000	29.073	0.00000			
DRIFT	D16	4.750	29.073	0.00000			
DIPOLE	DHPTT01	1.113	33.823		0.7854	0.0000	0.0000
DIAG	BPSTT03	0.000	34.936	0.00000			
DIAG	FL2TT01	0.000	34.936	0.00000			
DRIFT	D15	1.650	34.936	0.00000			

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m-2)	ANGLE (rad)	E1 (rad)	E2 (rad)
QUAD	QUATT05	0.300	36.586	-0.73829			
CORR	CHVTT04	0.000	36.886	0.00000			
DRIFT	D14	2.045	36.886	0.00000			
DIAG	SLTTT01	0.000	38.931	0.00000			
DIAG	WCMTT01	0.000	38.931	0.00000			
QUAD	QUATT04	0.300	38.931	1.77207			
CORR	CHVTT03	0.000	39.231	0.00000			
DRIFT	D13	1.700	39.231	0.00000			
QUAD	QUATT03	0.300	40.931	-2.08216			
CORR	CHVTT02	0.000	41.231	0.00000			
DRIFT	D12B	0.850	41.231	0.00000			
DIAG	BPSTT02	0.000	42.081	0.00000			
DRIFT	D12A	0.850	42.081	0.00000			
QUAD	QUATT02	0.300	42.931	1.56565			
CORR	CHVTT01	0.000	43.231	0.00000			
DRIFT	D11	1.970	43.231	0.00000			
QUAD	QUATT01	0.300	45.201	-1.23012			
DRIFT	D10	1.770	45.501	0.00000			
DIAG	BPSTT01	0.000	47.271	0.00000			
DIPOLE	DHYTT01	1.000	47.271		0.6283	0.0000	0.6283
DIAG	BPSTL02	0.000	48.271	0.00000			
DIAG	WCMTL01	0.000	48.271	0.00000			
DRIFT	D9	0.965	48.271	0.00000			
QUAD	QUATL05	0.200	49.236	-0.11981			
CORR	CHVTL03	0.000	49.436	0.00000			
DIAG	FL2TL02	0.000	49.436	0.00000			
DRIFT	D8	1.550	49.436	0.00000			
V DIPOL	DVRTL02	0.350	50.986		-0.1920	-0.0960	-0.0960
DRIFT	D7	0.550	51.336	0.00000			
QUAD	QUATL04	0.200	51.886	-0.69528			
DRIFT	D6	0.550	52.086	0.00000			
CORR	CHVTL02	0.000	52.636	0.00000			
QUAD	QUATL03	0.200	52.636	3.83407			
DRIFT	D5	0.543	52.836	0.00000			
QUAD	QUATL02	0.200	53.380	-3.84971			
CORR	CHVTL01	0.000	53.580	0.00000			
DRIFT	D4	0.550	53.580	0.00000			
DIAG	BPSTL01	0.000	54.130	0.00000			
V DIPOL	DVRTL01	0.350	54.130		0.1920	0.0960	0.0960
DRIFT	D3	0.250	54.480	0.00000			
QUAD	QUATL01	0.200	54.730	0.52790			
DRIFT	D2	0.475	54.930	0.00000			
DIAG	FL2TL01	0.000	55.405	0.00000			
SEPT	SPTTL01	1.233	55.405		-0.5934	0.0000	0.0000
DRIFT	D1	0.375	56.638	0.00000			
SEPT	SPTA101	0.623	57.013		-0.0380	0.0000	0.0000

Line POUT for positrons

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m-2)	ANGLE (rad)	E1 (rad)	E2 (rad)
DRIFT	D0	0.000	0.000	0.00000			
SEPT	SPTA101	0.623	0.000		-0.0380	0.0000	0.0000
DRIFT	D1	0.375	0.623	0.00000			
SEPT	SPTTL01	1.233	0.998		-0.5934	0.0000	0.0000
DIAG	FL2TL01	0.000	2.231	0.00000			
DRIFT	D2	0.475	2.231	0.00000			
QUAD	QUATL01	0.200	2.706	0.71481			
DRIFT	D3	0.250	2.906	0.00000			
V DIPOL	DVRTL01	0.350	3.156		0.1920	0.0960	0.0960
DIAG	BPSTL01	0.000	3.506	0.00000			
DRIFT	D4	0.550	3.506	0.00000			
CORR	CHVTL01	0.000	4.056	0.00000			
QUAD	QUATL02	0.200	4.056	-0.85726			
DRIFT	D5	0.543	4.256	0.00000			
QUAD	QUATL03	0.200	4.800	-1.67410			
CORR	CHVTL02	0.000	5.000	0.00000			
DRIFT	D6	0.550	5.000	0.00000			
QUAD	QUATL04	0.200	5.550	2.88386			
DRIFT	D7	0.550	5.750	0.00000			
V DIPOL	DVRTL02	0.350	6.300		-0.1920	-0.0960	-0.0960
DRIFT	D8	1.550	6.650	0.00000			
DIAG	FL2TL02	0.000	8.200	0.00000			
CORR	CHVTL03	0.000	8.200	0.00000			
QUAD	QUATL05	0.200	8.200	-0.48597			
DRIFT	D9	0.965	8.400	0.00000			
DIAG	WCMTL01	0.000	9.365	0.00000			
DIAG	BPSTL02	0.000	9.365	0.00000			
DIPOLE	DHYTT01	1.000	9.365		0.6283	0.6283	0.0000
DIAG	BPSTT01	0.000	10.365	0.00000			
DRIFT	D10	1.770	10.365	0.00000			
QUAD	QUATT01	0.300	12.135	-2.91460			
DRIFT	D11	1.970	12.435	0.00000			
CORR	CHVTT01	0.000	14.405	0.00000			
QUAD	QUATT02	0.300	14.405	1.94918			
DRIFT	D12A	0.850	14.705	0.00000			
DIAG	BPSTT02	0.000	15.555	0.00000			

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m-2)	ANGLE (rad)	E1 (rad)	E2 (rad)
DRIFT	D12B	0.850	15.555	0.00000			
CORR	CHVTT02	0.000	16.405	0.00000			
QUAD	QUATT03	0.300	16.405	-2.47149			
DRIFT	D13	1.700	16.705	0.00000			
CORR	CHVTT03	0.000	18.405	0.00000			
QUAD	QUATT04	0.300	18.405	1.74271			
DIAG	WCMTT01	0.000	18.705	0.00000			
DIAG	SLTTT01	0.000	18.705	0.00000			
DRIFT	D14	2.045	18.705	0.00000			
CORR	CHVTT04	0.000	20.751	0.00000			
QUAD	QUATT05	0.300	20.751	-2.59936			
DRIFT	D15	1.650	21.051	0.00000			
DIAG	FL2TT01	0.000	22.701	0.00000			
DIAG	BPSTT03	0.000	22.701	0.00000			
DIPOLE	DHPTT01	1.113	22.701		0.7854	0.0000	0.0000
DRIFT	D16	4.750	23.813	0.00000			
CORR	CHVTT05	0.000	28.563	0.00000			
DIAG	BPSTT04	0.000	28.563	0.00000			
QUAD	QUATT06	0.200	28.563	1.02192			
DIAG	FL2TT02	0.000	28.763	0.00000			
DRIFT	D17	4.349	28.763	0.00000			
DIPOLE	DHPTT02	1.113	33.112		-0.7854	0.0000	0.0000
DIAG	BPSTT05	0.000	34.225	0.00000			
CORR	CHVTT06	0.000	34.225	0.00000			
DRIFT	D18	1.077	34.225	0.00000			
DIAG	FL1TT01	0.000	35.302	0.00000			
DIPOLE	DHRTT01	0.757	35.302		-0.5236	-0.2618	-0.2618
DRIFT	D19	0.400	36.059	0.00000			
QUAD	QUATT07	0.200	36.459	0.19171			
DRIFT	D20	0.476	36.659	0.00000			
DIPOLE	DHSTT01	1.113	37.134		-0.7854	0.0000	0.0000
DIAG	FL1TT02	0.000	38.247	0.00000			
DRIFT	D21A	1.250	38.247	0.00000			
DIAG	SLTTT02	0.000	39.497	0.00000			
DIAG	WCMTT02	0.000	39.497	0.00000			
DRIFT	D21B	1.250	39.497	0.00000			
DIAG	BSTTT01	0.000	40.747	0.00000			
CORR	CHVTT07	0.000	40.747	0.00000			

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m-2)	ANGLE (rad)	E1 (rad)	E2 (rad)
QUAD	QUATT08	0.200	40.747	0.58620			
DIAG	BPSTT06	0.000	40.947	0.00000			
DRIFT	D22	2.500	40.947	0.00000			
V DIPOL	DVRTT01	0.350	43.447		0.1920	0.0960	0.0960
DRIFT	D23	0.907	43.797	0.00000			
CORR	CHVTT08	0.000	44.705	0.00000			
QUAD	QUATT09	0.200	44.705	-1.96634			
DIAG	BPSTT07	0.000	44.905	0.00000			
DRIFT	D24	0.900	44.905	0.00000			
V DIPOL	DVRTT02	0.350	45.805		-0.1920	-0.0960	-0.0960
DRIFT	D25	2.100	46.155	0.00000			
CORR	CHVTT09	0.000	48.255	0.00000			
DIAG	BPSTT08	0.000	48.255	0.00000			
QUAD	QUATT10	0.200	48.255	1.94175			
DIAG	FL1TT03	0.000	48.455	0.00000			
DRIFT	D26	3.832	48.455	0.00000			
DIPOLE	DHRTP01	0.451	52.287		-0.3188	-0.1594	-0.1594
DRIFT	D27	1.800	52.738	0.00000			
DIAG	BPSTP01	0.000	54.538	0.00000			
QUAD	QUATP01	0.200	54.538	3.76337			
DRIFT	D28	1.900	54.738	0.00000			
CORR	CHVTP01	0.000	56.638	0.00000			
QUAD	QUATP02	0.200	56.638	-2.48039			
DIAG	FL1TP01	0.000	56.838	0.00000			
DRIFT	D29	1.900	56.838	0.00000			
CORR	CHVTP02	0.000	58.738	0.00000			
QUAD	QUATP03	0.200	58.738	3.15038			
DRIFT	D30	1.691	58.938	0.00000			
DIPOLE	DHRTP02	0.452	60.629		-0.2365	-0.1182	-0.1182
DRIFT	D31	1.200	61.081	0.00000			
CORR	CHVTP03	0.000	62.281	0.00000			
QUAD	QUATP04	0.200	62.281	-0.72910			
DIAG	BPSTP02	0.000	62.481	0.00000			
DIAG	WCMTP01	0.000	62.481	0.00000			
DRIFT	D32	1.205	62.481	0.00000			
DIAG	FL1TP02	0.000	63.686	0.00000			
SEPT	SPTTP01	1.233	63.686		-0.5934	0.0000	0.0000
DRIFT	D33	0.500	64.919	0.00000			
SEPT	SPTPL01	0.623	65.419		-0.0380	0.0000	0.0000

Line EOUT for electrons

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m^{-2})	ANGLE (rad)	E1 (rad)	E2 (rad)
DRIFT	D0	0.000	0.000	0.00000			
SEPT	SPTA201	0.623	0.000		0.0380	0.0000	0.0000
DRIFT	D1	0.375	0.623	0.00000			
SEPT	SPTTR01	1.233	0.998		0.5934	0.0000	0.0000
DIAG	FL2TR01	0.000	2.231	0.00000			
DRIFT	D2	0.475	2.231	0.00000			
QUAD	QUATR01	0.200	2.706	4.00000			
DRIFT	D3	0.250	2.906	0.00000			
V DIPOL	DVRTR01	0.350	3.156		0.1920	0.0960	0.0960
DIAG	BPSTR01	0.000	3.506	0.00000			
DRIFT	D4	0.550	3.506	0.00000			
CORR	CHVTR01	0.000	4.056	0.00000			
QUAD	QUATR02	0.200	4.056	-0.84171			
DRIFT	D5	0.543	4.256	0.00000			
QUAD	QUATR03	0.200	4.800	-3.53584			
CORR	CHVTR02	0.000	5.000	0.00000			
DRIFT	D6	0.550	5.000	0.00000			
QUAD	QUATR04	0.200	5.550	3.28901			
DRIFT	D7	0.550	5.750	0.00000			
V DIPOL	DVRTR02	0.350	6.300		-0.1920	-0.0960	-0.0960
DRIFT	D8	1.550	6.650	0.00000			
DIAG	FL2TR02	0.000	8.200	0.00000			
CORR	CHVTR03	0.000	8.200	0.00000			
QUAD	QUATR05	0.200	8.200	2.64979			
DRIFT	D9	0.965	8.400	0.00000			
DIAG	WCMTR01	0.000	9.365	0.00000			
DIAG	BPSTR02	0.000	9.365	0.00000			
DIPOLE	DHYTT01	1.000	9.365		-0.6283	-0.6283	0.0000
DIAG	BPSTT01	0.000	10.365	0.00000			
DRIFT	D10	1.770	10.365	0.00000			
QUAD	QUATT01	0.300	12.135	1.23012			
DRIFT	D11	1.970	12.435	0.00000			
CORR	CHVTT01	0.000	14.405	0.00000			
QUAD	QUATT02	0.300	14.405	-1.56565			
DRIFT	D12A	0.850	14.705	0.00000			
DIAG	BPSTT02	0.000	15.555	0.00000			
DRIFT	D12B	0.850	15.555	0.00000			
CORR	CHVTT02	0.000	16.405	0.00000			
QUAD	QUATT03	0.300	16.405	2.08216			
DRIFT	D13	1.700	16.705	0.00000			
CORR	CHVTT03	0.000	18.405	0.00000			
QUAD	QUATT04	0.300	18.405	-1.77207			
DIAG	WCMTT01	0.000	18.705	0.00000			
DIAG	SLTTT01	0.000	18.705	0.00000			
DRIFT	D14	2.045	18.705	0.00000			

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m^{-2})	ANGLE (rad)	E1 (rad)	E2 (rad)
CORR	CHVTT04	0.000	20.751	0.00000			
QUAD	QUATT05	0.300	20.751	0.73829			
DRIFT	D15	1.650	21.051	0.00000			
DIAG	FL2TT01	0.000	22.701	0.00000			
DIAG	BPSTT03	0.000	22.701	0.00000			
DIPOLE	DHPTT01	1.113	22.701		0.7854	0.0000	0.0000
DRIFT	D16	4.750	23.813	0.00000			
CORR	CHVTT05	0.000	28.563	0.00000			
DIAG	BPSTT04	0.000	28.563	0.00000			
QUAD	QUATT06	0.200	28.563	-0.93050			
DIAG	FL2TT02	0.000	28.763	0.00000			
DRIFT	D17	4.349	28.763	0.00000			
DIPOLE	DHPTT02	1.113	33.112		-0.7854	0.0000	0.0000
DIAG	BPSTT05	0.000	34.225	0.00000			
CORR	CHVTT06	0.000	34.225	0.00000			
DRIFT	D18	1.077	34.225	0.00000			
DIAG	FL1TT01	0.000	35.302	0.00000			
DIPOLE	DHRTT01	0.757	35.302		-0.5236	-0.2618	-0.2618
DRIFT	D19	0.400	36.059	0.00000			
QUAD	QUATT07	0.200	36.459	1.76354			
DRIFT	D20	0.476	36.659	0.00000			
DIPOLE	DHSTT01	1.113	37.134		-0.7854	0.0000	0.0000
DIAG	FL1TT02	0.000	38.247	0.00000			
DRIFT	D21A	1.250	38.247	0.00000			
DIAG	SLTTT02	0.000	39.497	0.00000			
DIAG	WCMTT02	0.000	39.497	0.00000			
DRIFT	D21B	1.250	39.497	0.00000			
DIAG	BSTTT01	0.000	40.747	0.00000			
CORR	CHVTT07	0.000	40.747	0.00000			
QUAD	QUATT08	0.200	40.747	0.60807			
DIAG	BPSTT06	0.000	40.947	0.00000			
DRIFT	D22	2.500	40.947	0.00000			
V DIPOL	DVRTT01	0.350	43.447		0.1920	0.0960	0.0960
DRIFT	D23	0.907	43.797	0.00000			
CORR	CHVTT08	0.000	44.705	0.00000			
QUAD	QUATT09	0.200	44.705	-1.19557			
DIAG	BPSTT07	0.000	44.905	0.00000			
DRIFT	D24	0.900	44.905	0.00000			
V DIPOL	DVRTT02	0.350	45.805		-0.1920	-0.0960	-0.0960
DRIFT	D25	2.100	46.155	0.00000			
CORR	CHVTT09	0.000	48.255	0.00000			
DIAG	BPSTT08	0.000	48.255	0.00000			
QUAD	QUATT10	0.200	48.255	0.28682			
DIAG	FL1TT03	0.000	48.455	0.00000			
DRIFT	D26	3.832	48.455	0.00000			
DIAG	BPSTE01	0.000	52.287	0.00000			
DRIFT	D51	3.945	52.287	0.00000			
V DIPOL	DVRTE01	0.350	56.232		0.1920	0.0960	0.0960

TYPE	NAME	LENGTH (m)	IN.POS (m)	K1 (m^{-2})	ANGLE (rad)	E1 (rad)	E2 (rad)
DRIFT	D52	1.558	56.582	0.00000			
CORR	CHVTE01	0.000	58.140	0.00000			
QUAD	QUATE01	0.200	58.140	0.37240			
DRIFT	D53	1.560	58.340	0.00000			
V DIPOL	DVRTE02	0.350	59.900		-0.1920	-0.0960	-0.0960
DRIFT	D54	1.950	60.250	0.00000			
QUAD	QUATE02	0.200	62.200	1.29935			
DIAG	BPSTE02	0.000	62.400	0.00000			
DRIFT	D55	1.699	62.400	0.00000			
CORR	CHVTE02	0.000	64.099	0.00000			
DIPOLE	DHRTE01	0.757	64.099		0.5236	0.2618	0.2618
DRIFT	D56	2.100	64.856	0.00000			
QUAD	QUATE03	0.200	66.956	0.75869			
DRIFT	D57	3.200	67.156	0.00000			
CORR	CHVTE03	0.000	70.356	0.00000			
QUAD	QUATE04	0.200	70.356	0.73832			
DIAG	BPSTE03	0.000	70.556	0.00000			
DRIFT	D58	5.800	70.556	0.00000			
DIAG	FL1TE01	0.000	76.356	0.00000			
DRIFT	D59	6.800	76.356	0.00000			
QUAD	QUATE05	0.200	83.156	-1.39414			
CORR	CHVTE04	0.000	83.356	0.00000			
DRIFT	D60	3.000	83.356	0.00000			
QUAD	QUATE06	0.200	86.356	1.68424			
DRIFT	D61	1.386	86.556	0.00000			
DIAG	BPSTE04	0.000	87.942	0.00000			
DIPOLE	DHRTE02	0.757	87.942		-0.5411	-0.2705	-0.2705
DRIFT	D62	0.736	88.699	0.00000			
DIPOLE	DHRTE03	0.757	89.435		-0.5411	-0.2705	-0.2705
DIAG	FL1TE02	0.000	90.192	0.00000			
DRIFT	D63	0.762	90.192	0.00000			
QUAD	QUATE07	0.200	90.954	-3.50747			
DRIFT	D64	0.870	91.154	0.00000			
CORR	CHVTE05	0.000	92.024	0.00000			
QUAD	QUATE08	0.200	92.024	2.96009			
DIAG	BPSTE05	0.000	92.224	0.00000			
DRIFT	D65	0.770	92.224	0.00000			
V DIPOL	DVRTE03	0.350	92.994		-0.1920	-0.0960	-0.0960
DRIFT	D66	1.358	93.344	0.00000			
DIAG	BPSTE06	0.000	94.701	0.00000			
QUAD	QUATE09	0.200	94.701	-2.11848			
CORR	CHVTE06	0.000	94.901	0.00000			
DIAG	WCMTE01	0.000	94.901	0.00000			
DIAG	FL1TE03	0.000	94.901	0.00000			
DRIFT	D67	1.760	94.901	0.00000			
V DIPOL	DVRTE04	0.350	96.661		0.1920	0.0960	0.0960
DRIFT	D68	0.213	97.011	0.00000			
SEPT	SPTTE01	1.233	97.224		-0.5934	0.0000	0.0000
DRIFT	D69	0.500	98.457	0.00000			
SEPT	SPTEL01	0.623	98.957		-0.0380	0.0000	0.0000