PS/AA/AC-11 20 June 1983

AN AC LATTICE TO FIT AROUND THE AA

S.X. Fang and E.J.N. Wilson

A recent note[1] by R. Billinge proposed a lattice for the AC which would allow the machine to be situated in the AA hall around the existing AA. We attach printouts for a fully developed version of this idea. The lattice assumes 1.8 T in the dipoles and has an η near 0.025. The number of free straight sections is larger than the reference machine and PATRICIA tells us it is stable to 400π mm mradians over ±3% momentum spread. Preliminary studies of injection and transfer demonstrate feasibility.

Lattice Version 83.03

AC LATTICE D-D   PS-AGS 75.03   14/06/83 17.32.24

CIRCUMFERENCE = 182.43302   2 HALF SUPERPERIODS   STRAIGHT MAGNETS   ALL VALUES AT EXIT OF ELEMENTS

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

NO	ELEM	L(M)	ANG(MR)	K(1/M2)	BETAV(M)	BETAH(M)	ALPHAV	ALPHAH	MUV/2PI	MUH/2PI	ALPHAP(M)	ALPHAP'
INITIAL					10.051	2.439	0.000	0.000	0.00000	0.00000	-.000	.000
1	L0	.0000	0.0000	0.0000000	10.051	2.439	-.000	-.000	.00000	.00000	-.000	.000
2	QD1	.3500	0.0000	.5243929	9.431	2.650	1.733	-.617	.00566	.02222	-.000	-.000
3	L1	.4091	0.0000	0.0000000	8.084	3.242	1.560	-.830	.01312	.04451	-.000	-.000
4	L2	1.7140	0.0000	0.0000000	3.985	7.617	.832	-1.723	.06195	.10055	-.000	-.000
5	L1	.4091	0.0000	0.0000000	3.375	9.114	.658	-1.936	.07974	.10837	-.000	-.000
6	QF1	.3500	0.0000	-.5468770	3.178	9.874	-.082	-.189	.09698	.11418	-.000	.000
7	QF1	.3500	0.0000	-.5468770	3.495	9.366	-.845	1.608	.11391	.11991	-.000	.000
8	L1	.4091	0.0000	0.0000000	4.269	8.115	-1.046	1.451	.13080	.12738	-.000	.000
9	L2	1.7140	0.0000	0.0000000	9.296	4.265	-1.887	.795	.17465	.17443	-.000	.000
10	L1	.4091	0.0000	0.0000000	10.922	3.679	-2.087	.639	.18112	.19089	-.000	.000
11	QD1	.3500	0.0000	.5243929	11.693	3.502	-.069	-.122	.18599	.20661	-.000	.000
12	QD1	.3500	0.0000	.5243929	11.015	3.857	1.966	-.914	.19085	.22195	-.000	.000
13	L1	.4091	0.0000	0.0000000	9.480	4.685	1.785	-1.109	.19722	.23729	-.000	.000
14	L2	1.7140	0.0000	0.0000000	4.658	9.885	1.028	-1.925	.23874	.27782	.000	.000
15	L1	.4091	0.0000	0.0000000	3.891	11.540	.848	-2.120	.25406	.28391	.000	.000
16	QF1	.3500	0.0000	-.5468770	3.592	12.259	.024	.110	.26915	.28855	.000	.000
17	QF1	.3500	0.0000	-.5468770	3.856	11.392	-.794	2.311	.28431	.29321	.000	.000
18	L1	.4091	0.0000	0.0000000	4.576	9.594	-.967	2.083	.29983	.29944	.000	.000
19	L2	1.7140	0.0000	0.0000000	9.132	4.087	-1.691	1.129	.34254	.34356	.000	.000
20	L1	.4091	0.0000	0.0000000	10.587	3.257	-1.864	.902	.34916	.36145	.000	.000
21	QD1	.3500	0.0000	.5243929	11.222	2.881	.089	.193	.35422	.37987	.000	.000
22	QD1	.3500	0.0000	.5243929	10.467	2.975	2.021	-.465	.35931	.39915	.000	.000
23	L5	.3591	0.0000	0.0000000	9.078	3.361	1.846	-.612	.36517	.41726	.000	.000
24	SD	.0500	0.0000	0.0000000	8.895	3.423	1.822	-.632	.36606	.41961	.000	.000
25	L0	.0000	0.0000	0.0000000	8.895	3.424	1.822	-.632	.36606	.41961	.000	.000
26	B	1.7395	261.7993	0.0000000	3.642	6.807	1.094	-1.335	.41549	.47758	.226	.263
27	L0	.0000	0.0000	0.0000000	3.642	6.807	1.094	-1.335	.41549	.47758	.226	.263
28	SF	.0500	0.0000	0.0000000	3.534	6.942	1.064	-1.356	.41771	.47873	.240	.263
29	L5	.3591	0.0000	0.0000000	2.847	7.968	.847	-1.503	.43577	.48642	.334	.263
30	QF1	.3500	0.0000	-.5468770	2.498	8.500	.173	.015	.45695	.49312	.414	.191
31	QF1	.3500	0.0000	-.5468770	2.595	7.947	-.454	1.529	.47915	.49982	.467	.107
32	L5	.3591	0.0000	0.0000000	2.981	6.903	-.621	1.379	.49975	.50754	.505	.107
33	SF	.0500	0.0000	0.0000000	3.044	6.766	-.644	1.358	.50240	.50871	.510	.107
34	L0	.0000	0.0000	0.0000000	3.044	6.766	-.644	1.358	.50240	.50871	.510	.107
35	B	1.7395	261.7993	0.0000000	6.409	3.340	-1.223	.635	.56682	.56762	.920	.370
36	L0	.0000	0.0000	0.0000000	6.409	3.340	-1.223	.635	.56682	.56762	.920	.370
37	SD	.0500	0.0000	0.0000000	6.532	3.277	-1.243	.614	.56805	.57003	.938	.370
38	L5	.3591	0.0000	0.0000000	7.475	2.890	-1.383	.463	.57624	.58864	1.071	.370
39	QD1	.3500	0.0000	.5243929	7.979	2.795	-.026	-.183	.58337	.60850	1.237	.580
40	QD1	.3500	0.0000	.5243929	7.509	3.158	1.338	-.877	.59050	.62750	1.482	.829
41	L5	.3591	0.0000	0.0000000	6.596	3.860	1.205	-1.079	.59862	.64389	1.779	.829
42	SD	.0500	0.0000	0.0000000	6.477	3.970	1.186	-1.107	.59984	.64593	1.821	.829
43	L0	.0000	0.0000	0.0000000	6.477	3.970	1.186	-1.107	.59984	.64593	1.821	.829
44	B	1.7395	261.7993	0.0000000	3.178	9.433	.645	-2.070	.66246	.69127	3.472	1.092
45	L0	.0000	0.0000	0.0000000	3.178	9.433	.645	-2.070	.66247	.69127	3.472	1.092

46	SF	.0500	0.0000	0.0000000	3.115	9.642	.623	-2.098	.66499	.69210	3.527	1.092
47	L5	.3591	0.0000	0.0000000	2.725	11.221	.463	-2.300	.68466	.69760	3.919	1.092
48	QF1	.3500	0.0000	-.5468770	2.629	12.092	-.182	-.133	.70577	.70233	4.166	.314
49	QF1	.3500	0.0000	-.5468770	2.992	11.399	-.877	2.069	.72591	.70702	4.136	-.485
50	L5	.3591	0.0000	0.0000000	3.698	9.972	-1.089	1.903	.74312	.71238	3.962	-.485
51	SF	.0500	0.0000	0.0000000	3.808	9.783	-1.119	1.879	.74524	.71319	3.938	-.485
52	L3	2.1410	0.0000	0.0000000	11.310	3.859	-2.385	.888	.79813	.76983	2.899	-.485
53	SD	.0500	0.0000	0.0000000	11.550	3.771	-2.415	.864	.79883	.77192	2.874	-.485
54	L5	.3591	0.0000	0.0000000	13.361	3.210	-2.627	.698	.80343	.78837	2.700	-.485
55	QD1	.3500	0.0000	.5243929	14.353	2.969	-.146	.006	.80741	.80665	2.616	-.000
56	QD1	.3500	0.0000	.5243929	13.557	3.202	2.371	-.685	.81136	.82495	2.700	.485
57	L5	.3591	0.0000	0.0000000	11.917	3.753	2.196	-.850	.81586	.84146	2.874	.485
58	SD	.0500	0.0000	0.0000000	11.699	3.839	2.171	-.873	.81653	.84356	2.899	.485
59	L3	2.1410	0.0000	0.0000000	4.640	9.680	1.125	-1.855	.86346	.90067	3.937	.485
60	SF	.0500	0.0000	0.0000000	4.529	9.867	1.101	-1.878	.86519	.90149	3.962	.485
61	L5	.3591	0.0000	0.0000000	3.801	11.275	.926	-2.043	.87898	.90691	4.136	.485
62	QF1	.3500	0.0000	-.5468770	3.445	11.959	.113	.134	.89457	.91165	4.166	-.314
63	QF1	.3500	0.0000	-.5468770	3.635	11.096	-.668	2.276	.91052	.91643	3.919	-1.092
64	L5	.3591	0.0000	0.0000000	4.167	9.533	-.811	2.076	.92522	.92199	3.527	-1.092
65	SF	.0500	0.0000	0.0000000	4.249	9.327	-.831	2.048	.92711	.92283	3.472	-1.092
66	L0	.0000	0.0000	0.0000000	4.249	9.327	-.831	2.048	.92711	.92283	3.472	-1.092
67	B	1.7395	261.7993	0.0000000	7.956	3.929	-1.227	1.090	.97547	.96868	1.821	-.829
68	L0	.0000	0.0000	0.0000000	7.956	3.929	-1.227	1.090	.97547	.96868	1.821	-.829
69	SD	.0500	0.0000	0.0000000	8.079	3.821	-1.243	1.062	.97647	.97073	1.779	-.829
70	L5	.3591	0.0000	0.0000000	9.012	3.130	-1.356	.862	.98317	.98729	1.482	-.829
71	QD1	.3500	0.0000	.5243929	9.392	2.776	.293	.173	.98916	1.00644	1.236	-.580
72	QD1	.3500	0.0000	.5243929	8.619	2.878	1.869	-.472	.99528	1.02641	1.071	-.370
73	L5	.3591	0.0000	0.0000000	7.344	3.271	1.682	-.624	1.00247	1.04508	.938	-.370
74	SD	.0500	0.0000	0.0000000	7.177	3.335	1.656	-.645	1.00357	1.04749	.920	-.370
75	L0	.0000	0.0000	0.0000000	7.177	3.335	1.656	-.645	1.00357	1.04749	.920	-.370
76	B	1.7395	261.7993	0.0000000	2.707	6.811	.826	-1.376	1.06814	1.10624	.510	-.107
77	L0	.0000	0.0000	0.0000000	2.707	6.811	.826	-1.376	1.06814	1.10624	.510	-.107
78	SF	.0500	0.0000	0.0000000	2.626	6.950	.795	-1.397	1.07112	1.10740	.505	-.107
79	L5	.3591	0.0000	0.0000000	2.135	8.008	.571	-1.550	1.09535	1.11507	.467	-.107
80	QF1	.3500	0.0000	-.5468770	1.941	8.571	-.005	-.024	1.12316	1.12172	.414	-.191
81	QF1	.3500	0.0000	-.5468770	2.142	8.039	-.582	1.509	1.15093	1.12835	.334	-.263
82	L5	.3591	0.0000	0.0000000	2.641	7.008	-.807	1.362	1.17505	1.13597	.240	-.263
83	SF	.0500	0.0000	0.0000000	2.723	6.873	-.838	1.342	1.17801	1.13712	.226	-.263
84	L0	.0000	0.0000	0.0000000	2.723	6.873	-.838	1.342	1.17802	1.13712	.226	-.263
85	B	1.7395	261.7993	0.0000000	7.245	3.462	-1.672	.641	1.24206	1.19446	.000	.000
86	L0	.0000	0.0000	0.0000000	7.245	3.462	-1.672	.641	1.24206	1.19446	.000	.000
87	SD	.0500	0.0000	0.0000000	7.413	3.399	-1.698	.621	1.24315	1.19678	.000	.000
88	L5	.3591	0.0000	0.0000000	8.700	3.006	-1.886	.474	1.25027	1.21470	.000	.000
89	QD1	.3500	0.0000	.5243929	9.480	2.908	-.295	-.188	1.25634	1.23379	.000	.000
90	QD1	.3500	0.0000	.5243929	9.096	3.280	1.370	-.899	1.26227	1.25206	.000	.000
91	L1	.4091	0.0000	0.0000000	8.028	4.108	1.241	-1.125	1.26990	1.26983	.000	.000
92	SD	.0500	0.0000	0.0000000	7.905	4.222	1.225	-1.152	1.27089	1.27174	.000	.000
93	L4	1.2890	0.0000	0.0000000	5.273	8.109	.817	-1.863	1.30289	1.30709	.000	.000
94	SF	.0500	0.0000	0.0000000	5.192	8.297	.801	-1.891	1.30441	1.30806	.000	.000
95	L1	.4091	0.0000	0.0000000	4.589	9.936	.672	-2.116	1.31776	1.31523	.000	.000
96	QF1	.3500	0.0000	-.5468770	4.452	10.768	-.270	-.205	1.33023	1.32056	.000	.000
97	QF1	.3500	0.0000	-.5468770	4.984	10.211	-1.286	1.759	1.34220	1.32581	.000	-.000
98	L1	.4091	0.0000	0.0000000	6.126	8.839	-1.504	1.595	1.35400	1.33267	.000	-.000
99	SF	.0500	0.0000	0.0000000	6.277	8.680	-1.530	1.575	1.35528	1.33358	.000	-.000
100	L4	1.2890	0.0000	0.0000000	11.107	5.286	-2.216	1.058	1.37995	1.36405	.000	-.000
101	SD	.0500	0.0000	0.0000000	11.330	5.181	-2.243	1.038	1.38066	1.36557	.000	-.000
102	L1	.4091	0.0000	0.0000000	13.254	4.399	-2.461	.874	1.38597	1.37923	.000	-.000
103	QD1	.3500	0.0000	.5243929	14.134	4.099	.000	.000	1.39000	1.39250	.000	.000

p.3.

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 104 L0          .0000    0.0000  0.0000000     14.134      4.099     -.000       .000   1.39000   1.39250      .000       .000
    DP/P  COSMU(H)        Q(H)  QPRIME(H)  BETAMAX(H)  COSMU(V)        Q(V)  QPRIME(V)  BETAMAX(V)     XMAX(H)   GAMMA TR.
  0.0000    .21814      5.5700    -6.6727     12.2591    .18738      5.5600    -5.9989     14.3526      4.1662      5.0915
DP/P = 0.0000      AVERAGE X = 0.0000                          AVERAGE ALPHAP = 1.1200          R.F. GAMMA TR. =  5.0915
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TIME =    .105 SECONDS
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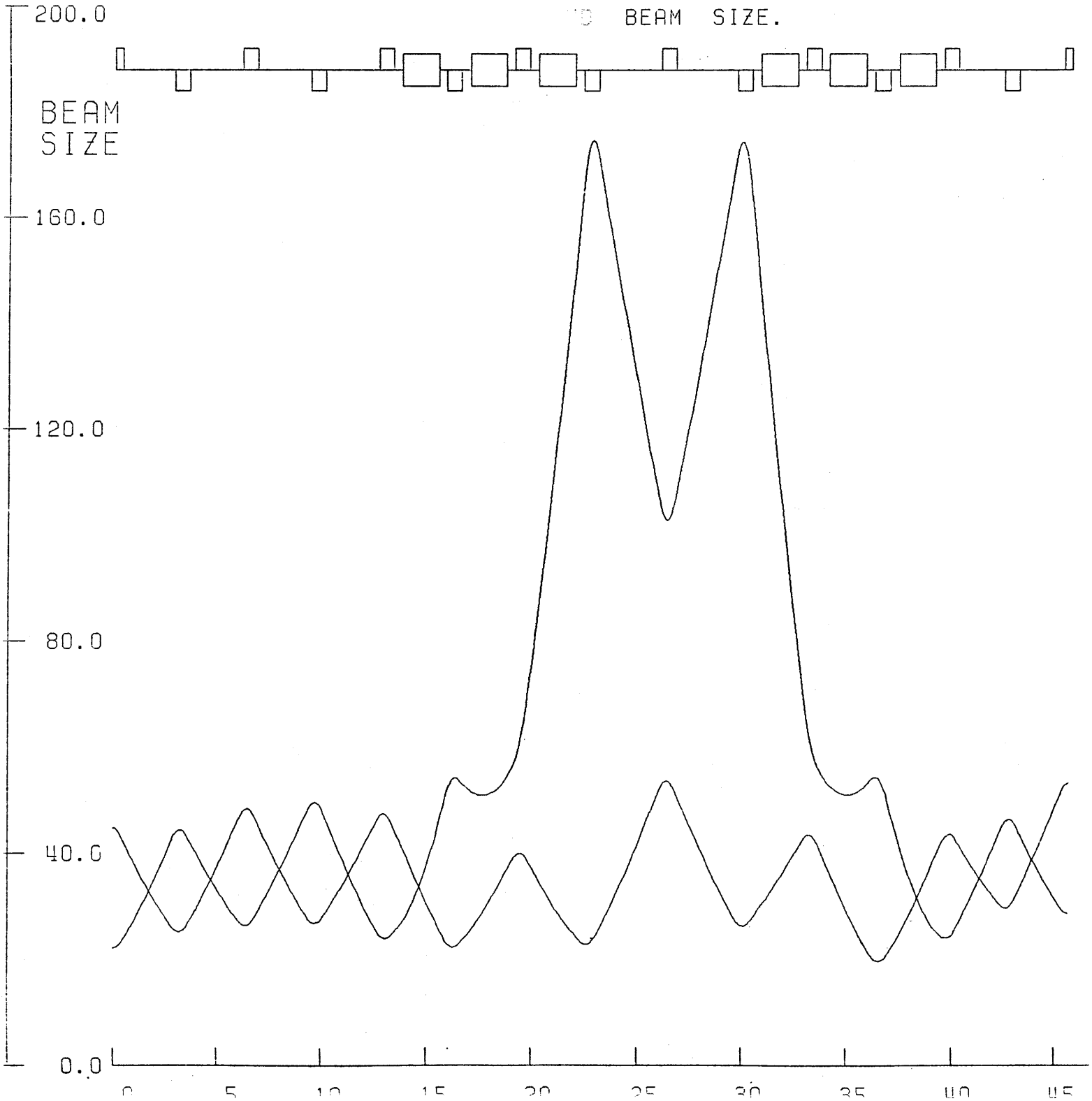
BEAM SIZE.
BEAM
SIZE
200.0
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120.0
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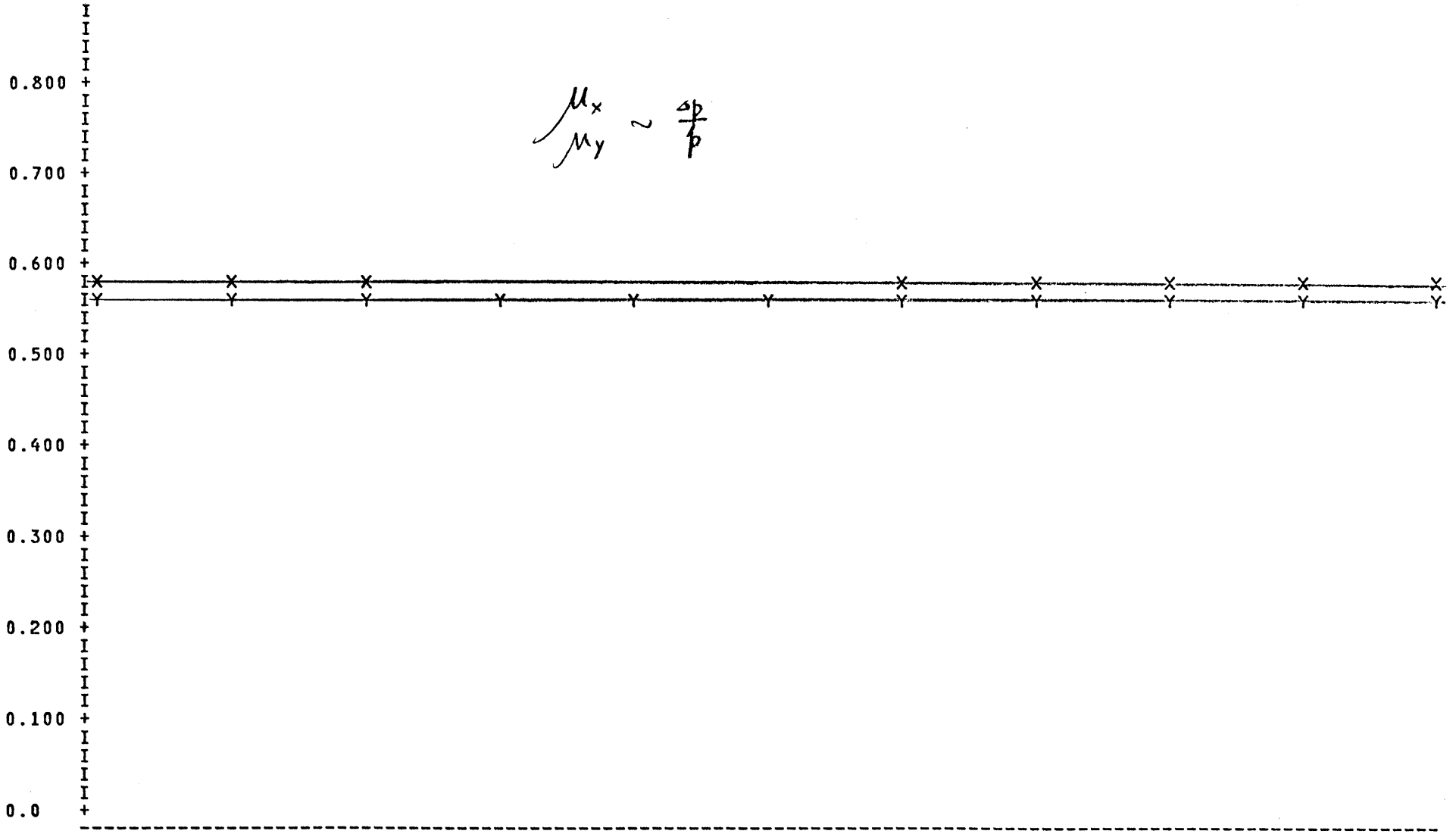
40.0
0.0
0
5
10
15
20
25
30
35
40
45

Chromaticity

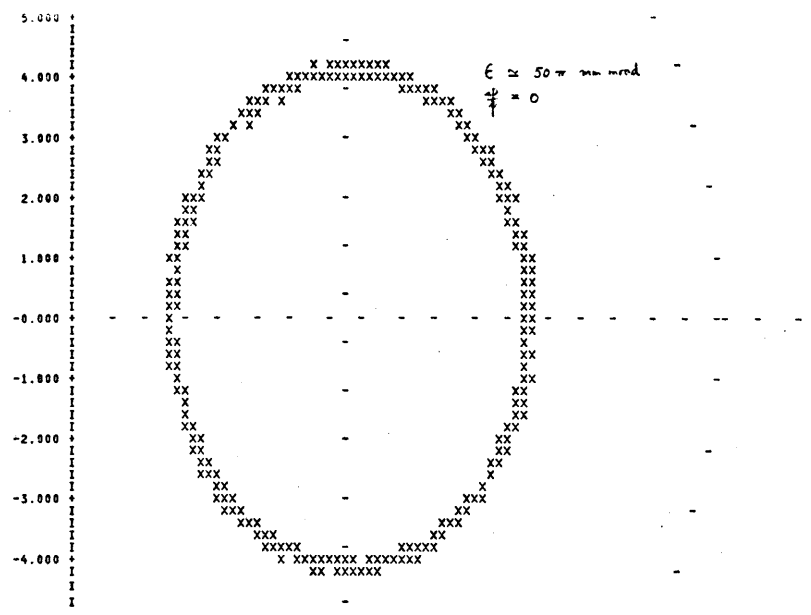
$$\begin{matrix} \mu_x \\ \mu_y \end{matrix} \sim \frac{\Delta p}{p}$$

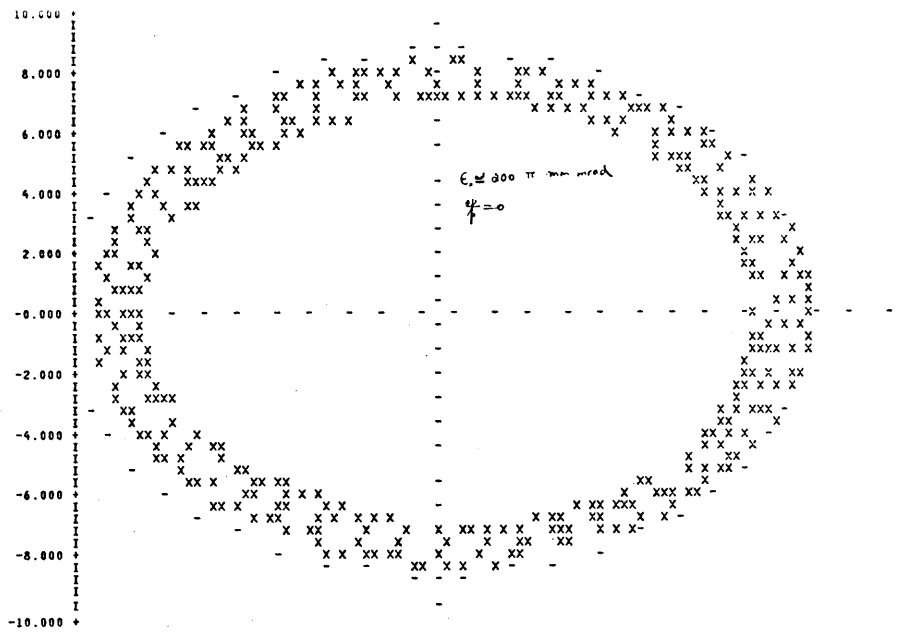


NUEX	0.5725	0.5712	0.5703	0.5700	0.5699	0.5700	0.5703	0.5706	0.5709	0.5713	0.5717
NUEY	0.5546	0.5564	0.5580	0.5591	0.5598	0.5600	0.5597	0.5589	0.5575	0.5556	0.5531

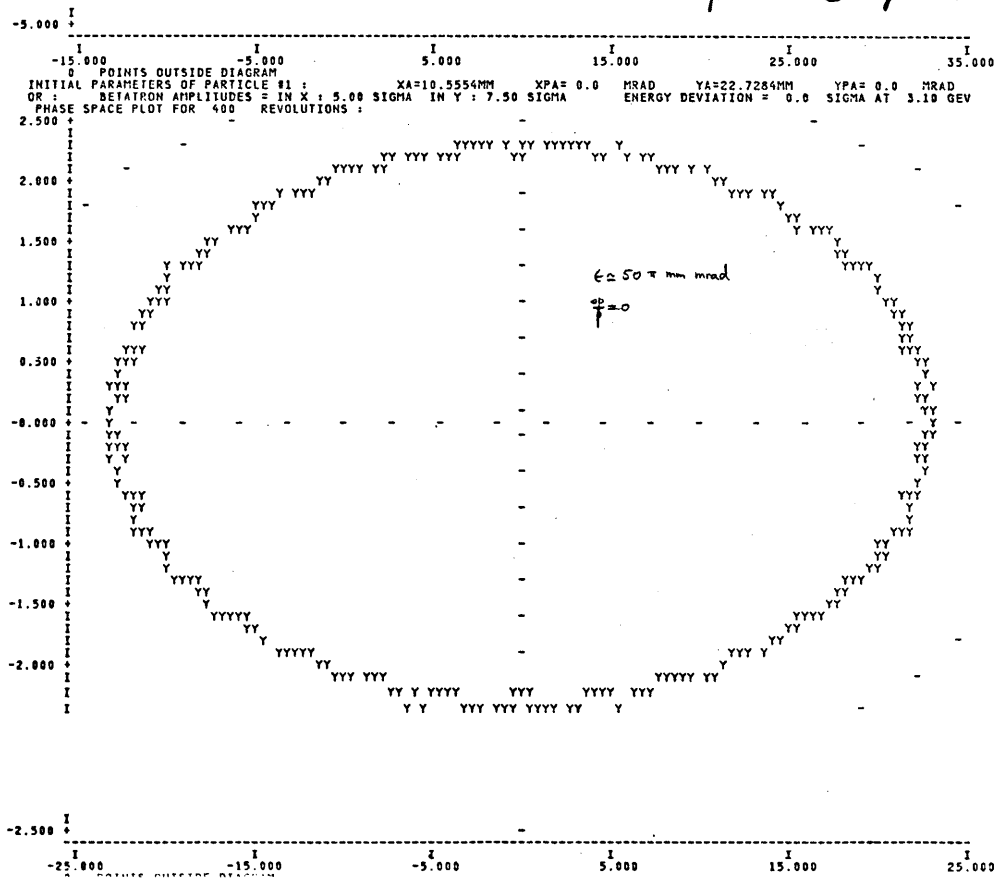
CPU-TIME SO FAR = 1268 MSEC

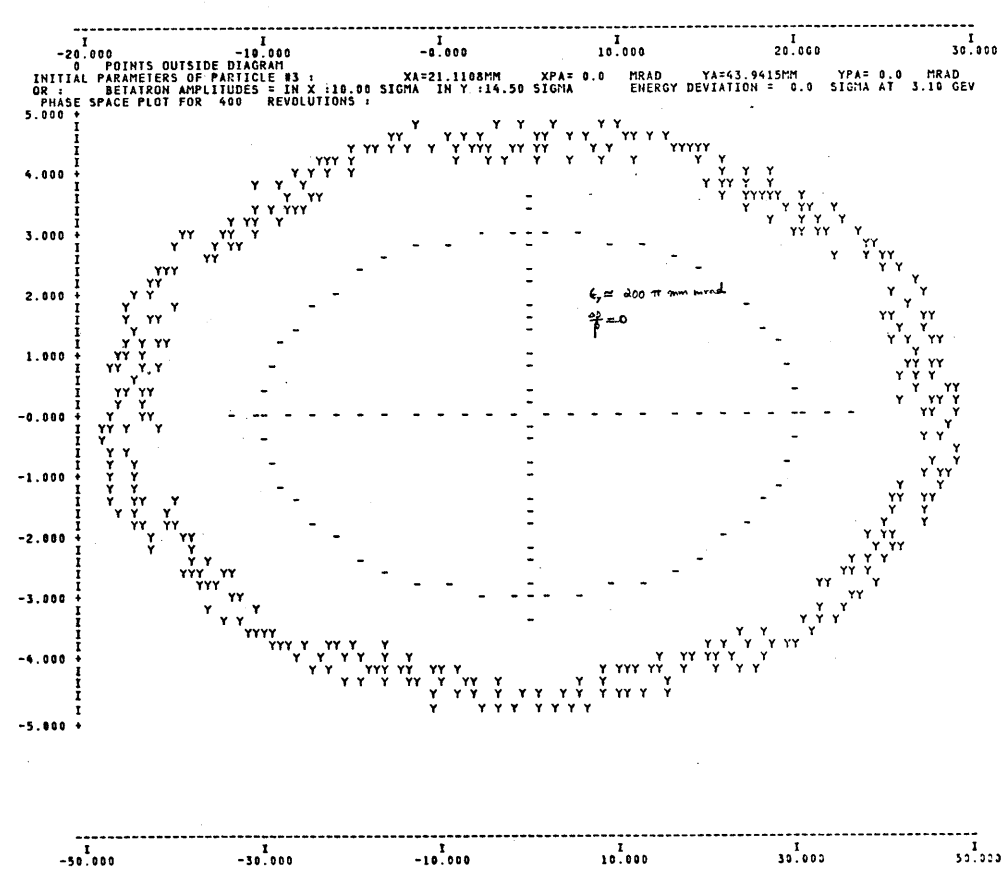
**** HARMONIC ANALYSIS OF BETA*(K-M*ETA) (SEE H.WIEDEMANN PEP-NOTE 220) **** KW(6)= 1

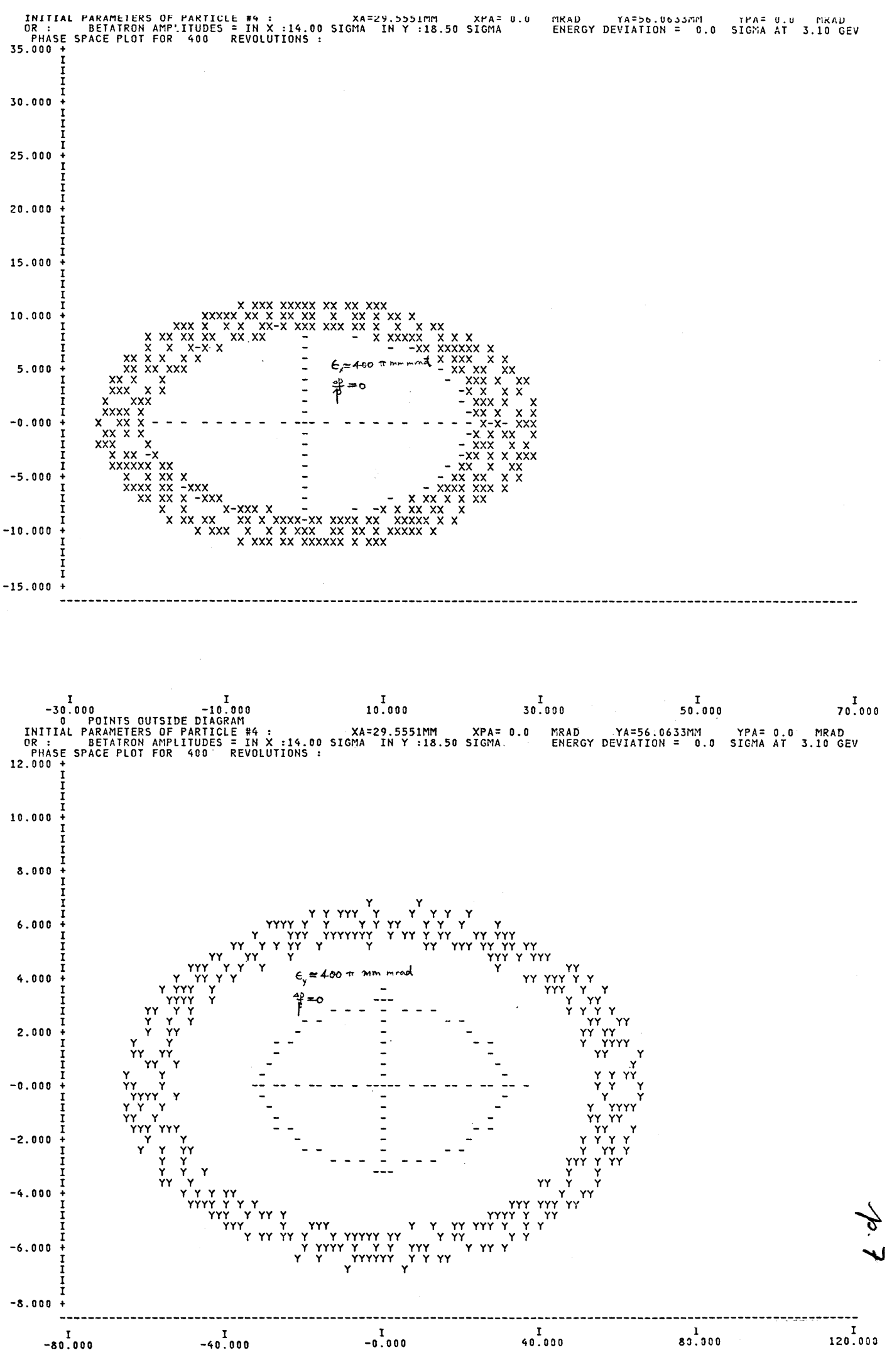




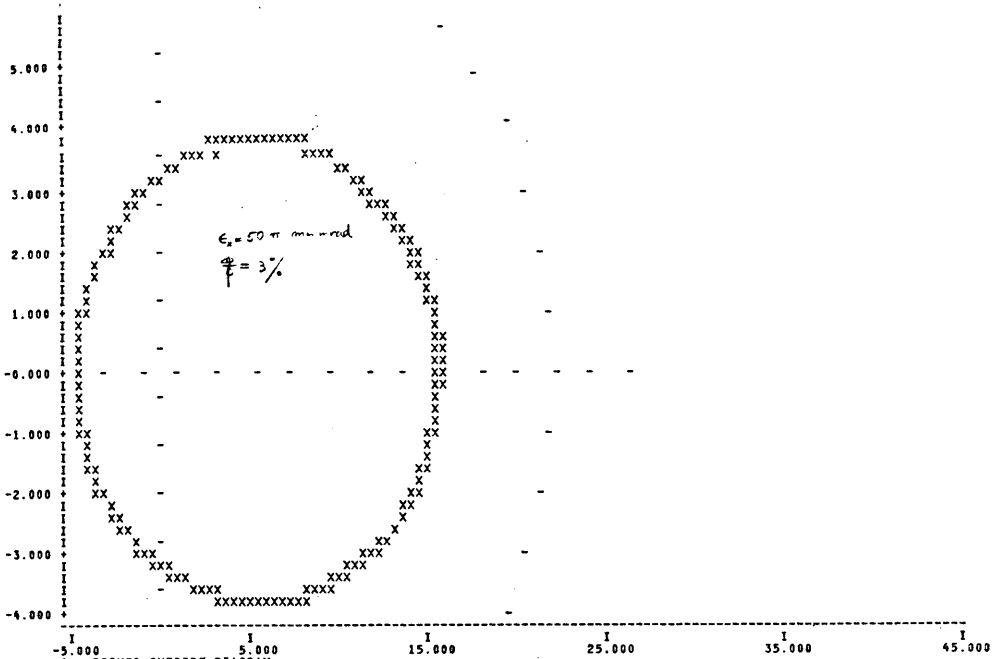
phase plot by PATRICIA.



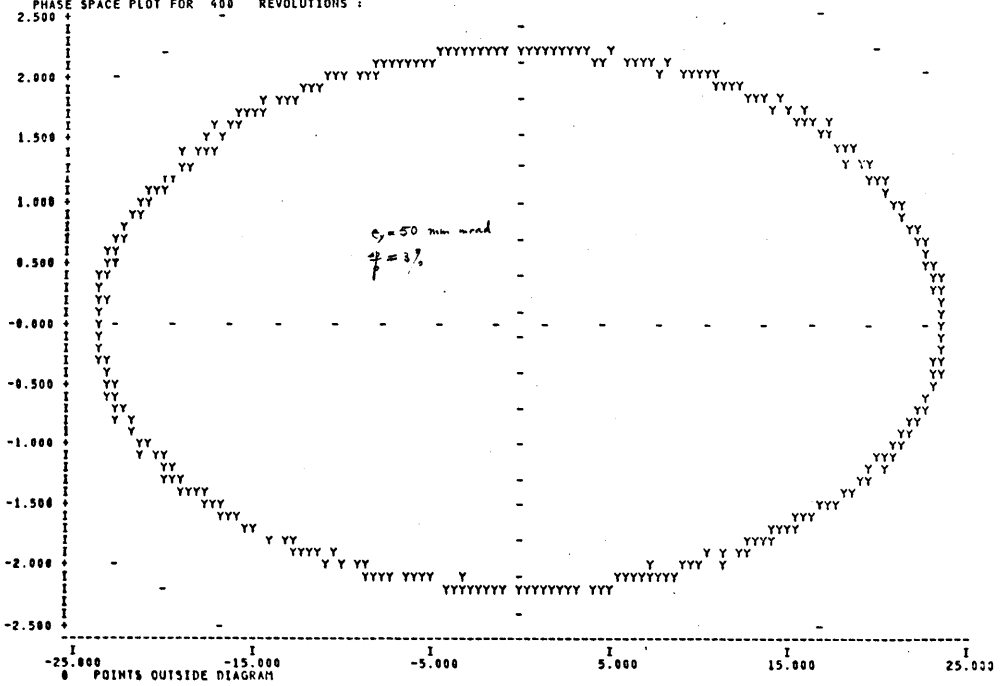



INITIAL PARAMETERS OF PARTICLE #4 : XA=29.5551MM XPA= 0.0 MRAD YA=56.0633MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X :14.00 SIGMA IN Y :18.50 SIGMA ENERGY DEVIATION = 0.0 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :
$\epsilon_x \approx 400\ \pi$ mm mrad
$\frac{\Delta p}{p} = 0$
-30.000
-10.000
10.000
30.000
50.000
70.000
0 POINTS OUTSIDE DIAGRAM
INITIAL PARAMETERS OF PARTICLE #4 : XA=29.5551MM XPA= 0.0 MRAD YA=56.0633MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X :14.00 SIGMA IN Y :18.50 SIGMA ENERGY DEVIATION = 0.0 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :
$\epsilon_y \approx 400\ \pi$ mm mrad
$\frac{\Delta p}{p} = 0$
-80.000
-40.000
-0.000
40.000
80.000
120.000

p. 7

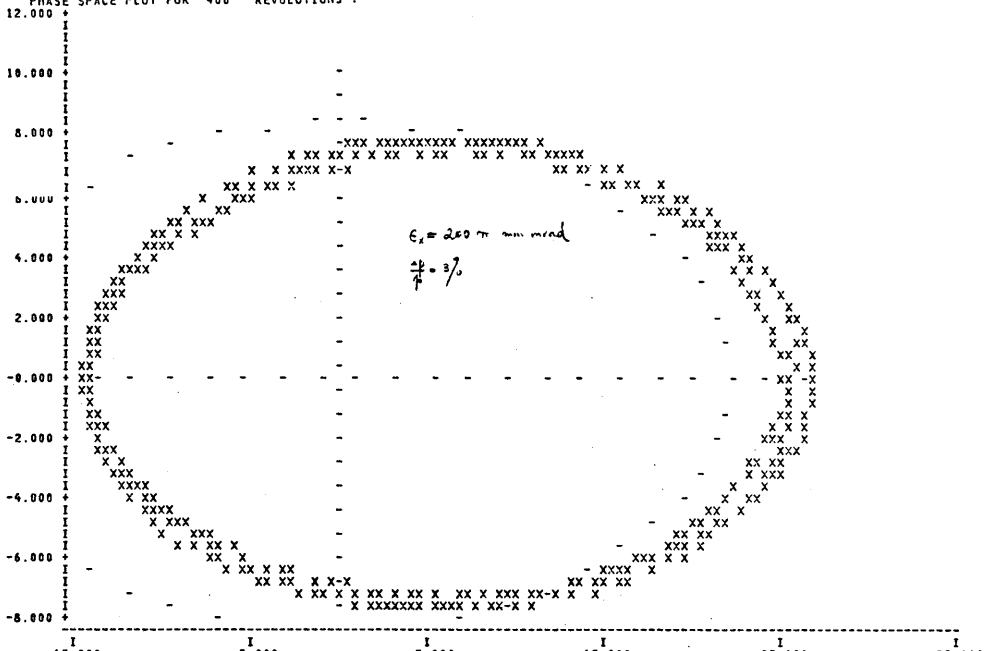


INITIAL PARAMETERS OF PARTICLE #1 : XA=15.8450MM XPA=-0.0000MRAD YA=23.5319MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X : 5.00 SIGMA IN Y : 7.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :



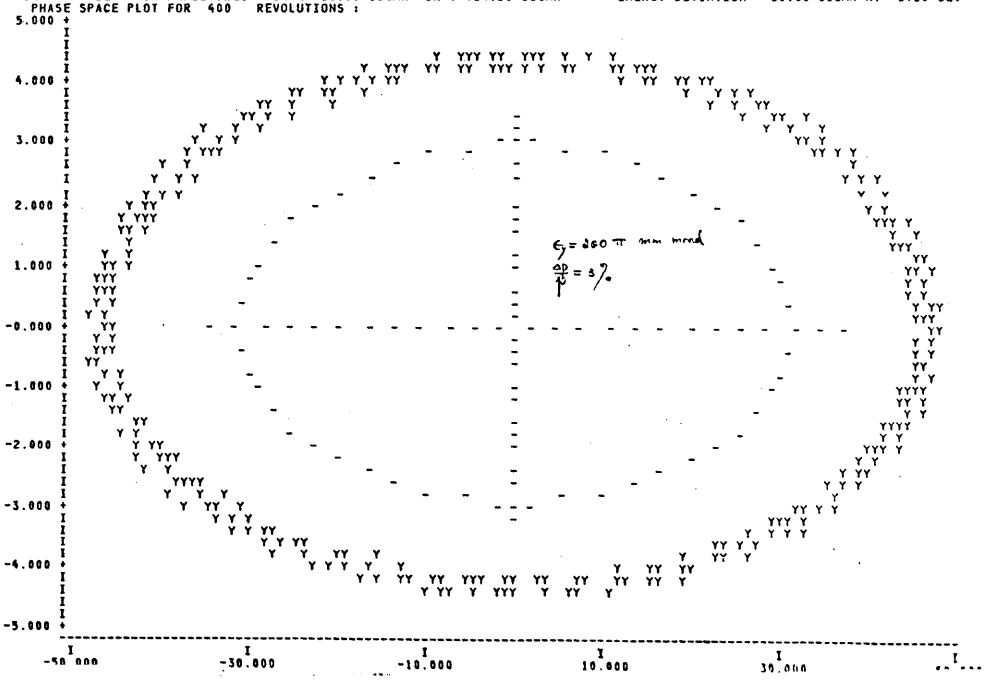
0 POINTS OUTSIDE DIAGRAM

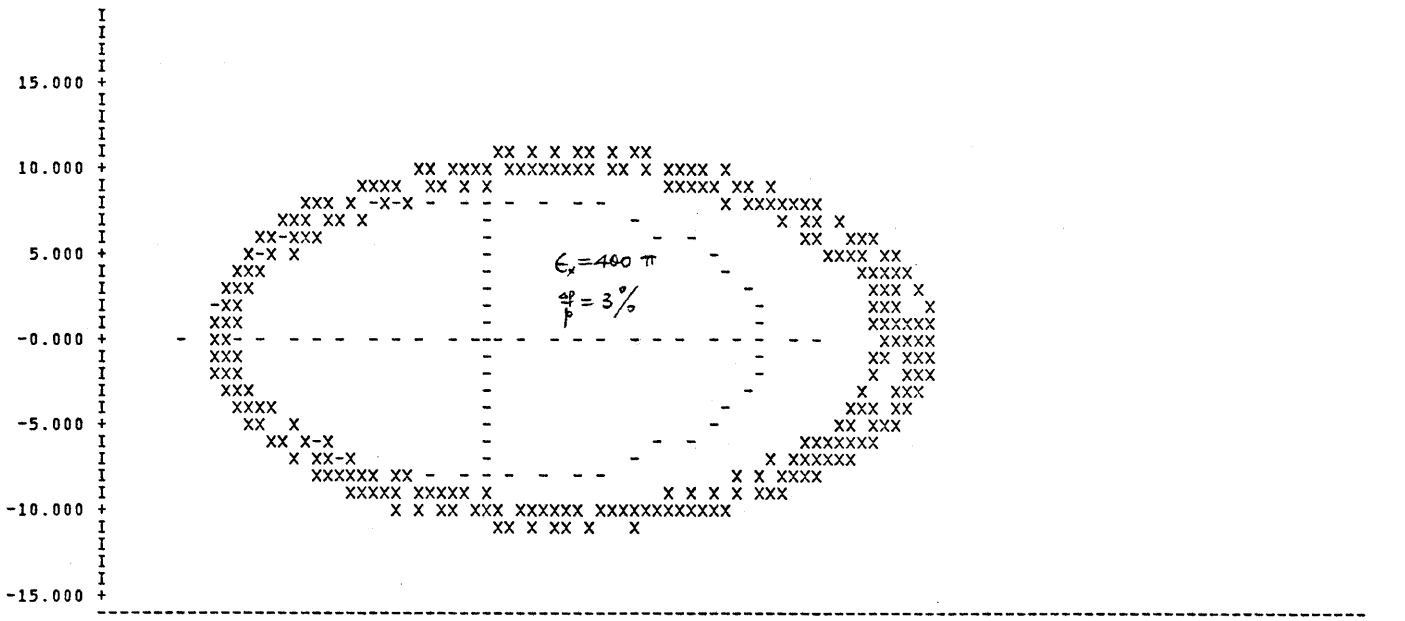
INITIAL PARAMETERS OF PARTICLE #3 : XA=26.8504MM XPA=-0.0000MRAD YA=45.4951MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X :10.00 SIGMA IN Y :14.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :



0 POINTS OUTSIDE DIAGRAM

INITIAL PARAMETERS OF PARTICLE #3 : XA=26.8504MM XPA=-0.0000MRAD YA=45.4951MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X :10.00 SIGMA IN Y :14.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :



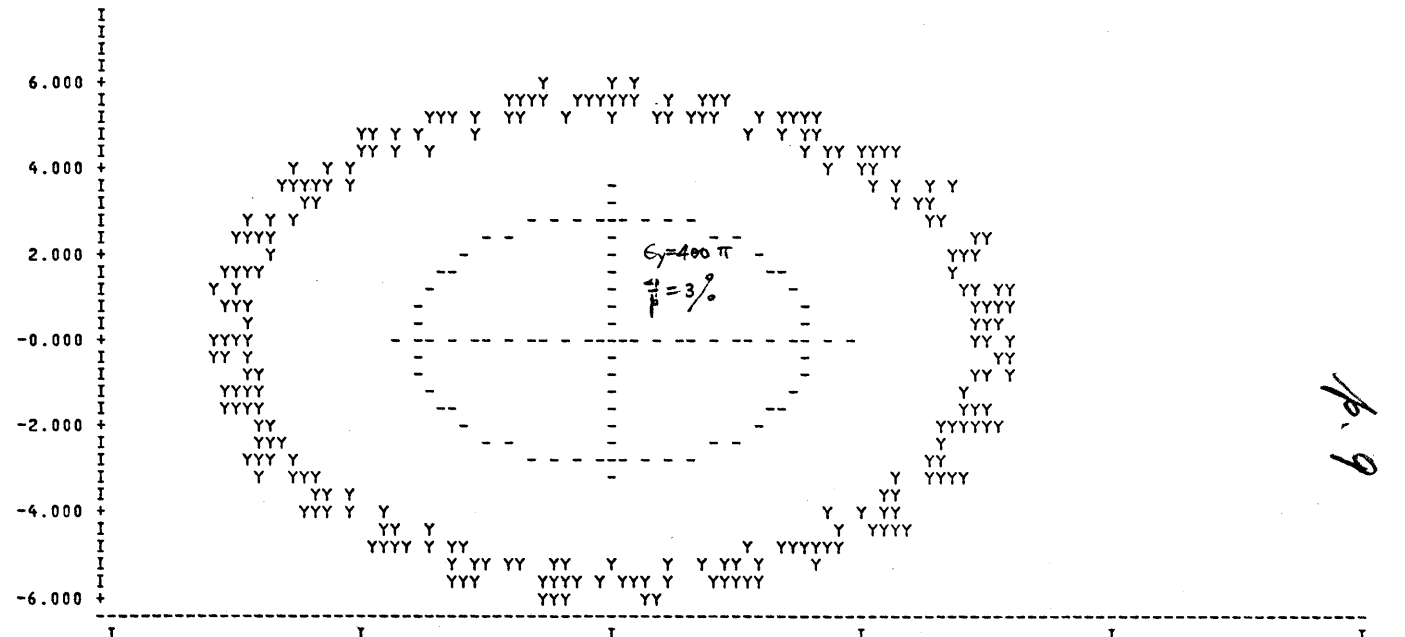


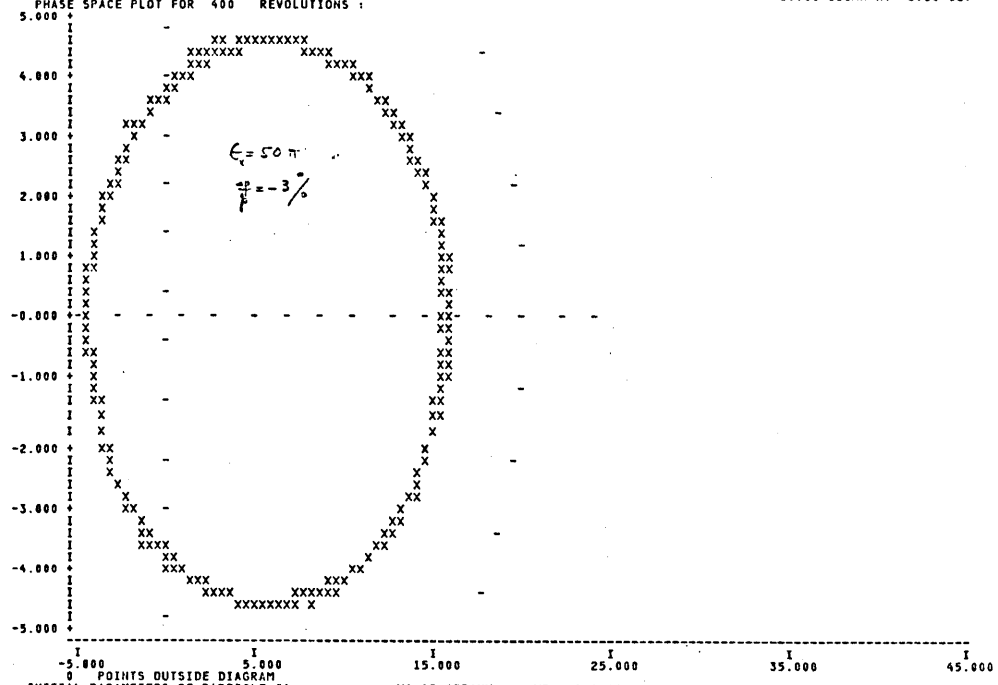
0 POINTS OUTSIDE DIAGRAM

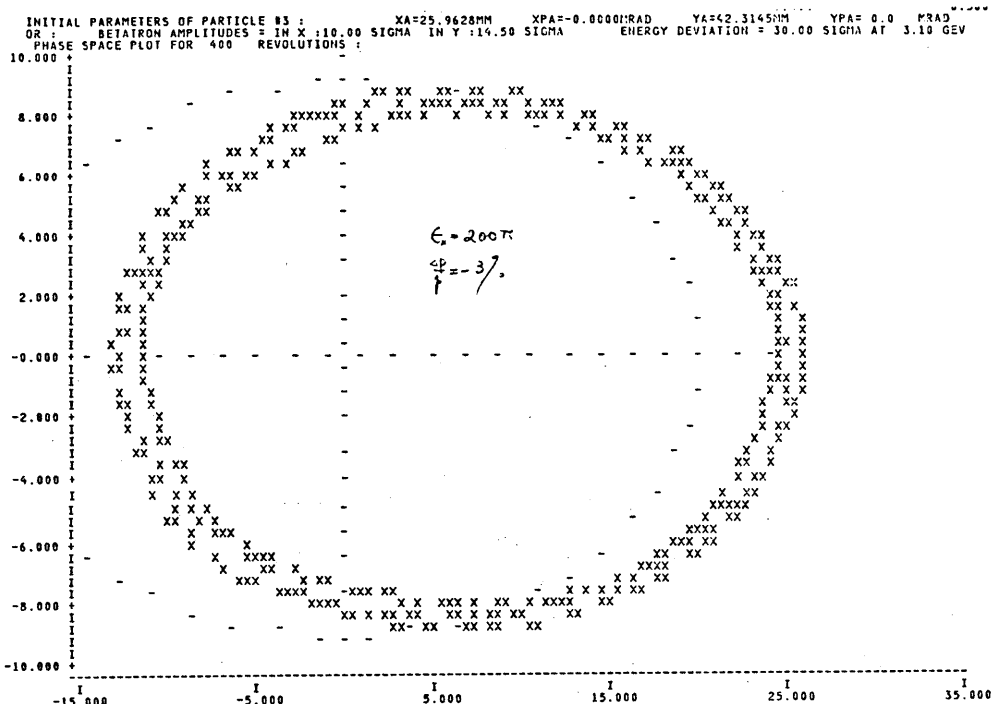
INITIAL PARAMETERS OF PARTICLE #4 : XA=35.6547MM XPA=-0.0000MRAD YA=58.0455MM YPA= 0.0 MRAD

OR : BETATRON AMPLITUDES = IN X :14.00 SIGMA IN Y :18.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV

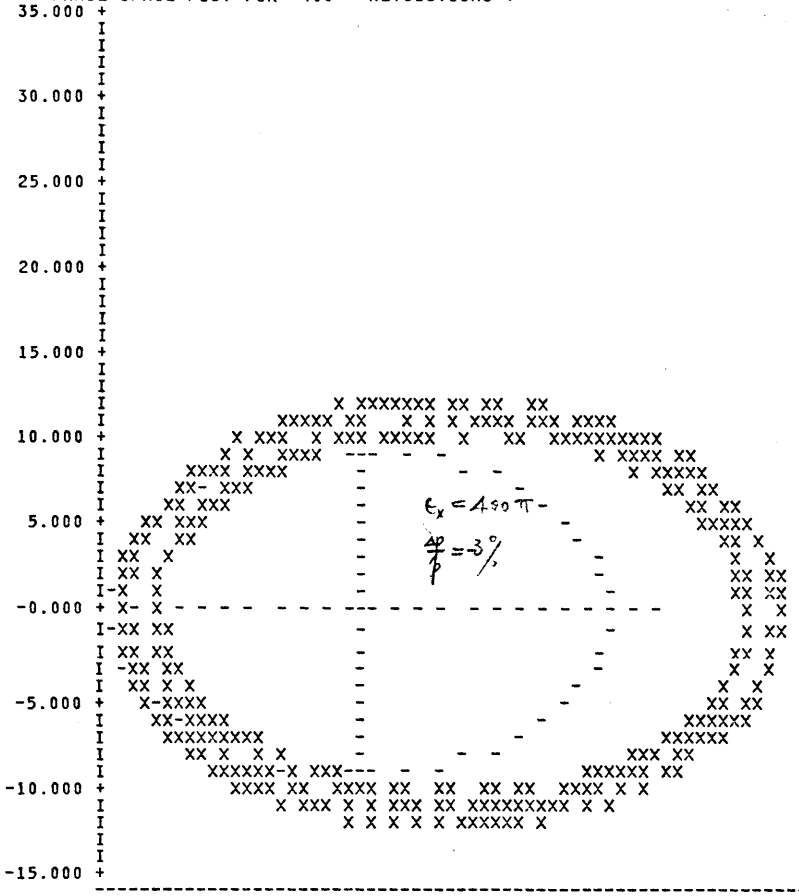
PHASE SPACE PLOT FOR 400 REVOLUTIONS :




INITIAL PARAMETERS OF PARTICLE #3 :
OR : BETATRON AMPLITUDES = IN X : 5.00 SIGMA IN Y : 7.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :
$\epsilon_x = 50\pi$
$\frac{\Delta p}{p} = -3\%$
0 POINTS OUTSIDE DIAGRAM
INITIAL PARAMETERS OF PARTICLE #3 : XA=15.9376MM XPA=-0.0000MRAD YA=21.8868MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X : 5.00 SIGMA IN Y : 7.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :
$\epsilon_y = 50\pi$
$\frac{\Delta p}{p} = -3\%$

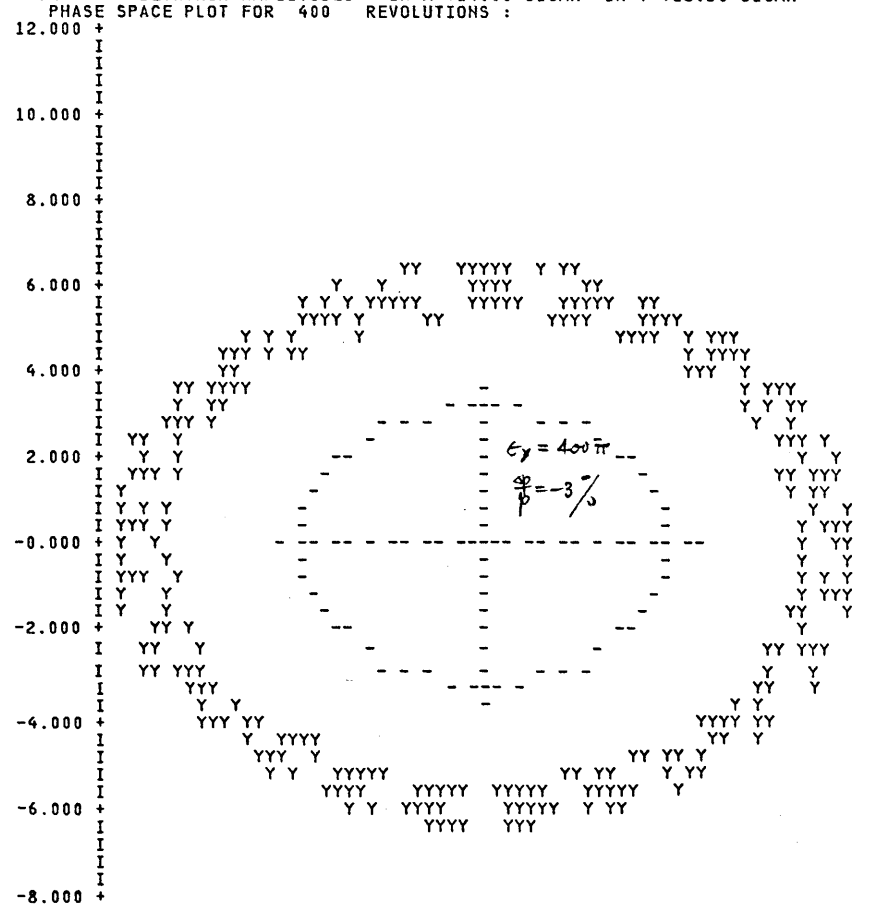

INITIAL PARAMETERS OF PARTICLE #3 : XA=25.9628MM XPA=-0.0000MRAD YA=42.3145MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X :10.00 SIGMA IN Y :14.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :
$\epsilon_x = 200\pi$
$\frac{\Delta p}{p} = -3\%$
0 POINTS OUTSIDE DIAGRAM
INITIAL PARAMETERS OF PARTICLE #3 : XA=25.9628MM XPA=-0.0000MRAD YA=42.3145MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X :10.00 SIGMA IN Y :14.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :
$\epsilon_y = 200\pi$
$\frac{\Delta p}{p} = -3\%$

INITIAL PARAMETERS OF PARTICLE #4 : XA=33.9830MM XPA=-0.0000MRAD YA=53.9874MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X :14.00 SIGMA IN Y :18.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :



0 POINTS OUTSIDE DIAGRAM

INITIAL PARAMETERS OF PARTICLE #4 : XA=33.9830MM XPA=-0.0000MRAD YA=53.9874MM YPA= 0.0 MRAD
OR : BETATRON AMPLITUDES = IN X :14.00 SIGMA IN Y :18.50 SIGMA ENERGY DEVIATION = 30.00 SIGMA AT 3.10 GEV
PHASE SPACE PLOT FOR 400 REVOLUTIONS :



0 POINTS OUTSIDE DIAGRAM