July 2007 Optics for the hall D line at 8 degrees

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Civil Engineering approved a change request in May 2007 moving hall D approximately 10m towards Canon Blvd. Ramp to hall D now is to begin at the same location as in the CDR but the slope is 7.8 degrees instead of 10 degrees. The author received from R. Yasky on July 11 a spreadsheet which locates the start and end of the ramp, the radiator and the collimator, among other major items. I constructed an optics file which matched these locations. I then found an error dating to 1999 - input betas and alphas used were those at the exit of arc 10, not the exit of linac B. Beta X increased a factor of two and beta Y a factor of 4/3 over previous, erroneous values. Quad values in the new layout were adjusted to work with the correct values. The nine sets of input conditions which I have previously used to check optics robustness were then applied. These cover the best decile of matches in the 6 GeV machine.

The first three quads in the line are QCs. These have 2" beam pipe with 23.8mm inner radius. The remaining quads are assumed to be 50 cm long with the "QP" profile, 1.375" beam pipe with 15.9mm inner radius. The length of these quads will be set by the headroom agreed to after negotiation. Length 40 cm is required for 10% headroom above the highest quad setting found in the ten variations, which variations are not exhaustive. Another pass through the system will be required once length is decided.

Horizontal emittance of 6 nm and vertical emittance of 1 nm is assumed in the beam envelope plots which follow. Beam envelope plots therefore show beam sigma.

The variations considered are defined in the Optim file headers as follows. Dimensions cm

trial	xbscale	ybscale	xaldiff	yaldiff
T1	0.5	0.5	-1	-1
T2	0.5	1	0	0
T3	0.5	2	1	1
T4	1	0.5	0	1
T5	1	1	1	-1
T6	1	2	-1	0
T7	2	0.5	1	0
T8	2	1	-1	1
T9	2	2	0	-1
orig	1	1	0	0

$xbscale=1; => 1
$betax=35682.7*$xbscale; => 35682.7
$ybscale=1; => 1
$betay=24332.7*$ybscale; => 24332.7
$xaldiff=0; => 0
$xalpha=-0.218819+$xaldiff; => -0.218819
$yaldiff=0; => 0
$yalpha=-1.42063+$yaldiff; => -1.42063

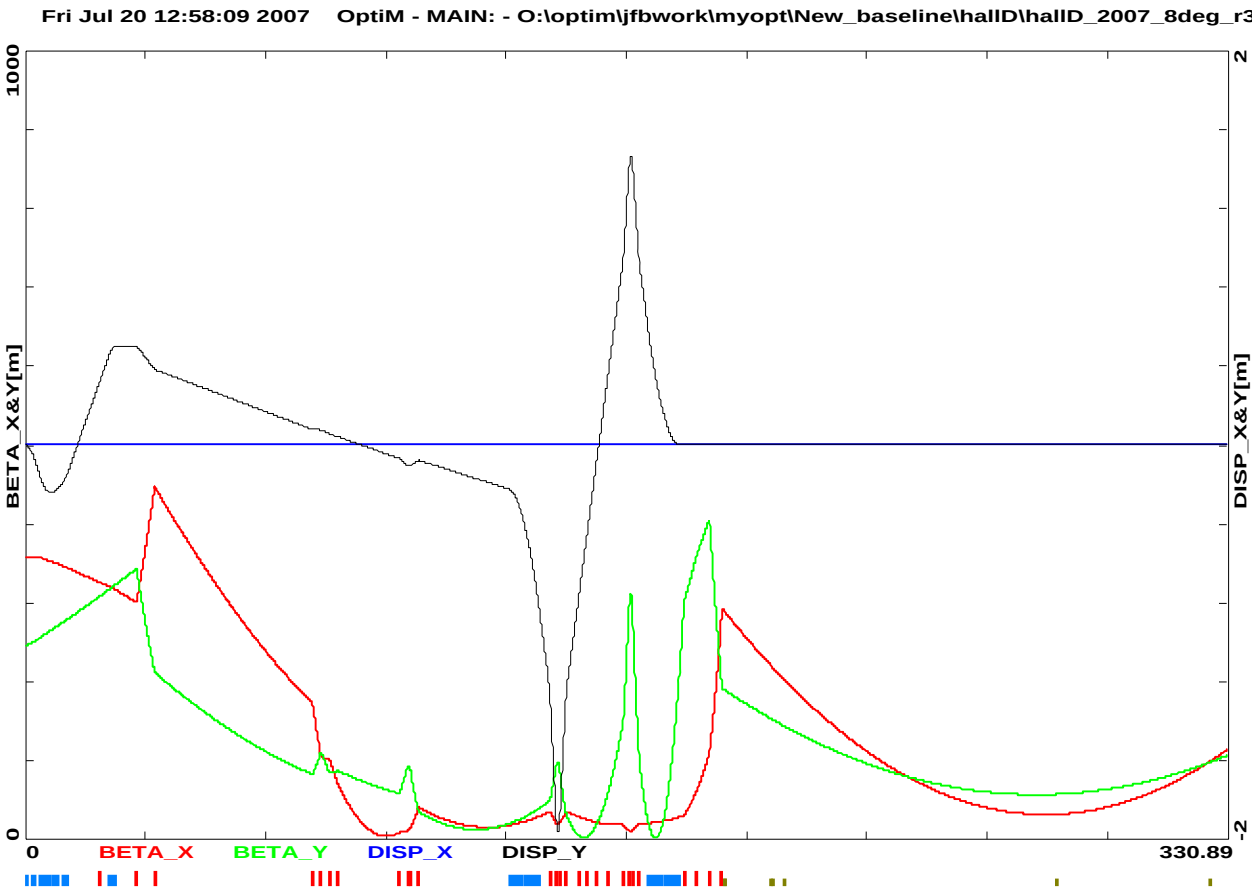

Figure 1A. Baseline optics

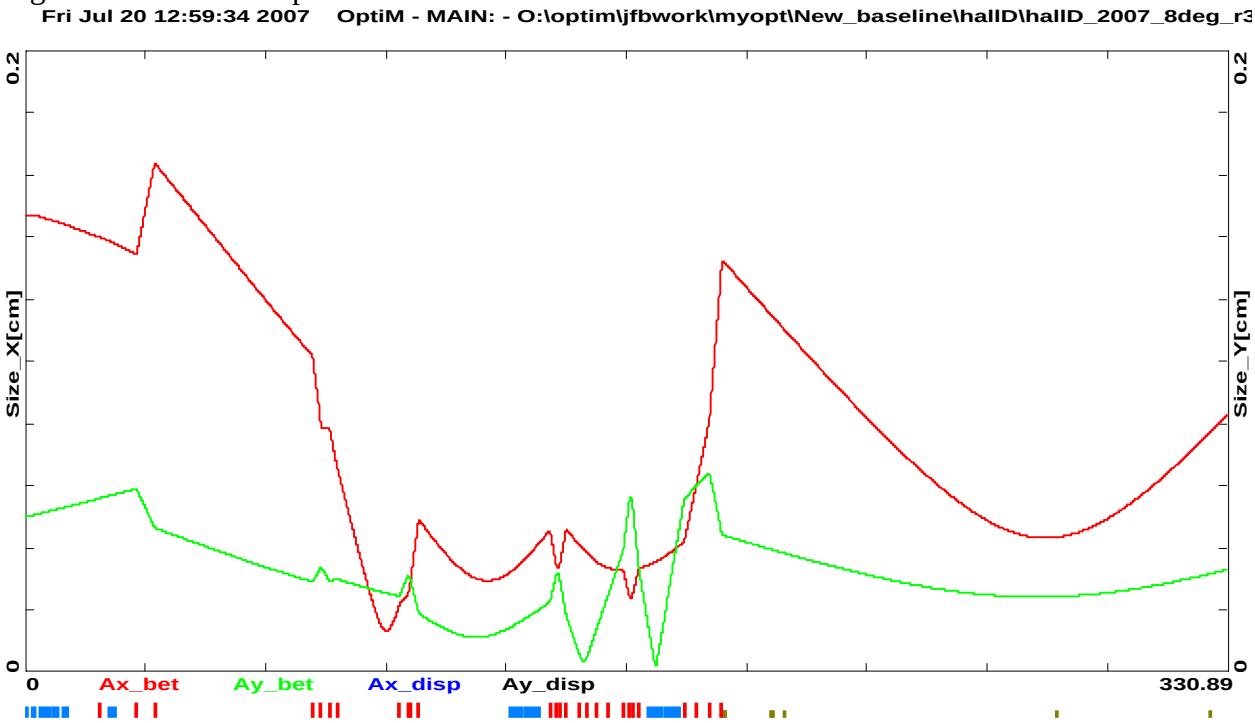

Figure 1B baseline envelopes. 2mm vertical scale.

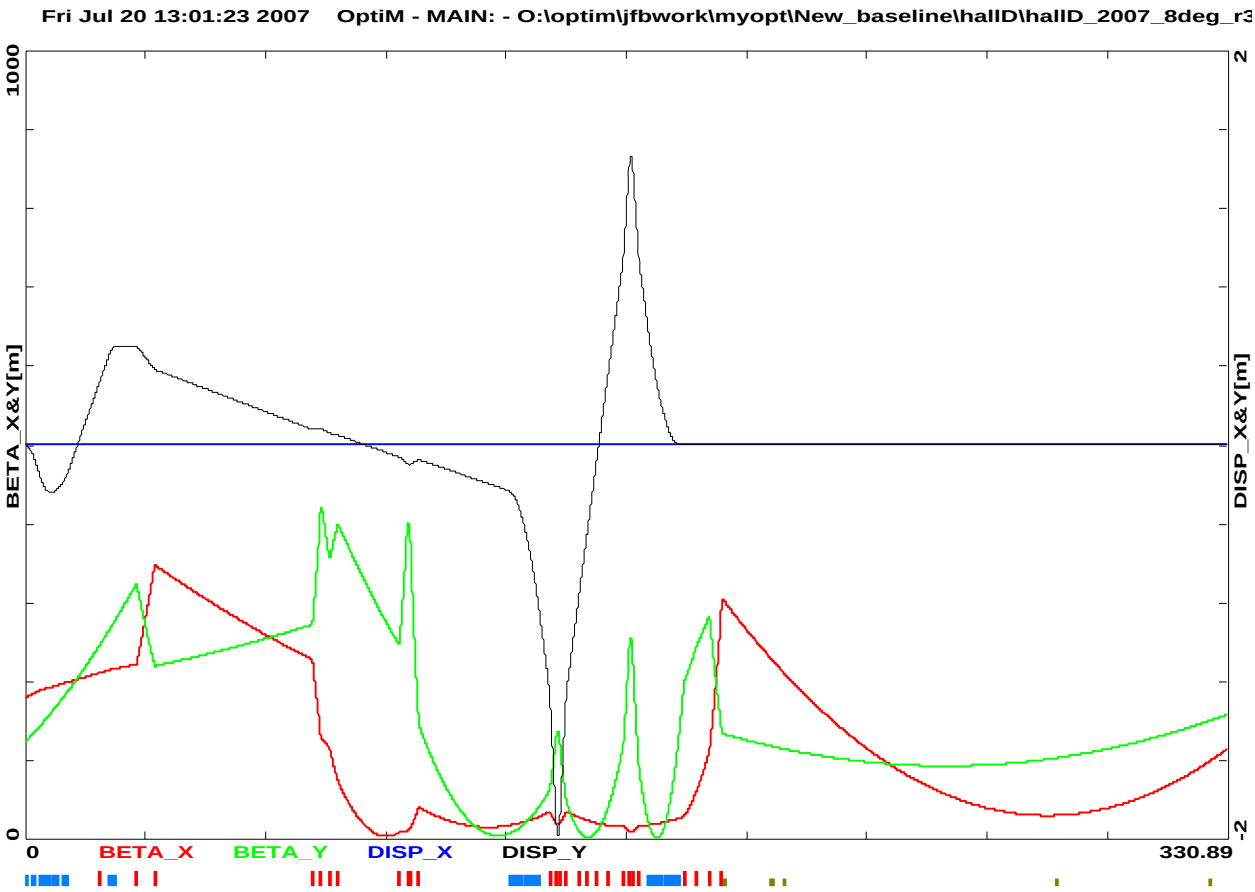

Figure 2A Optics for case T1

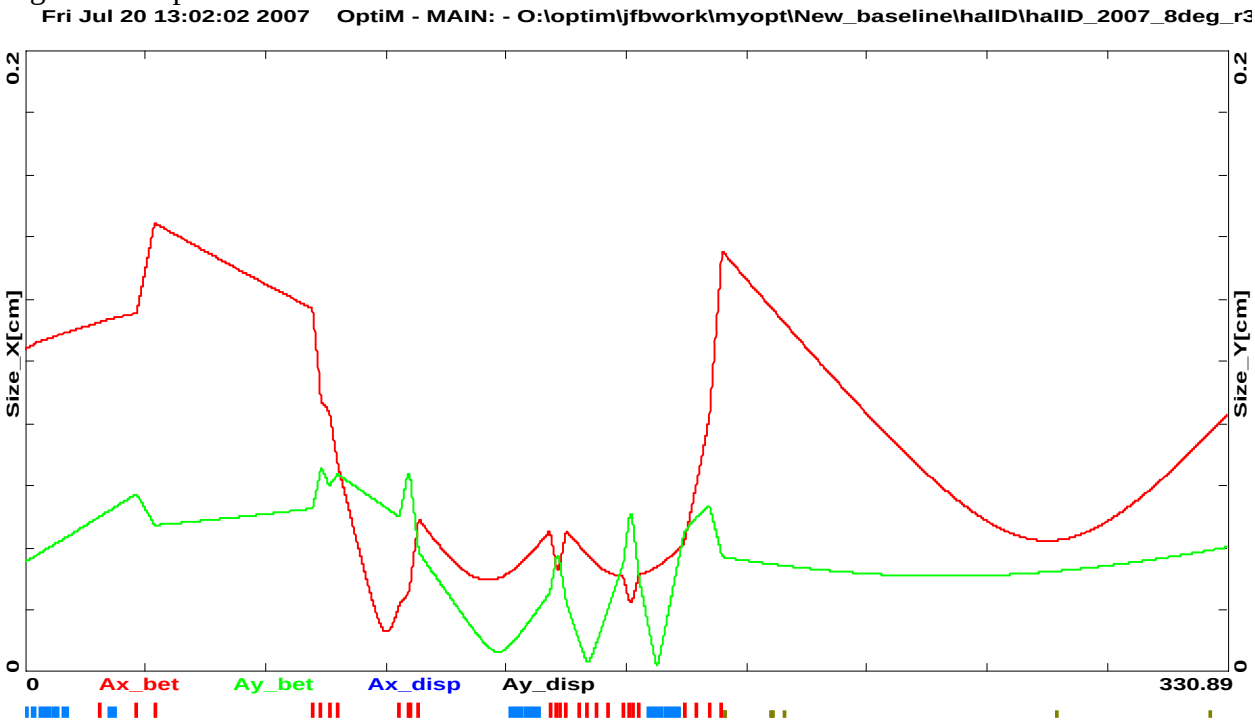

Figure 2B Envelopes for case T1

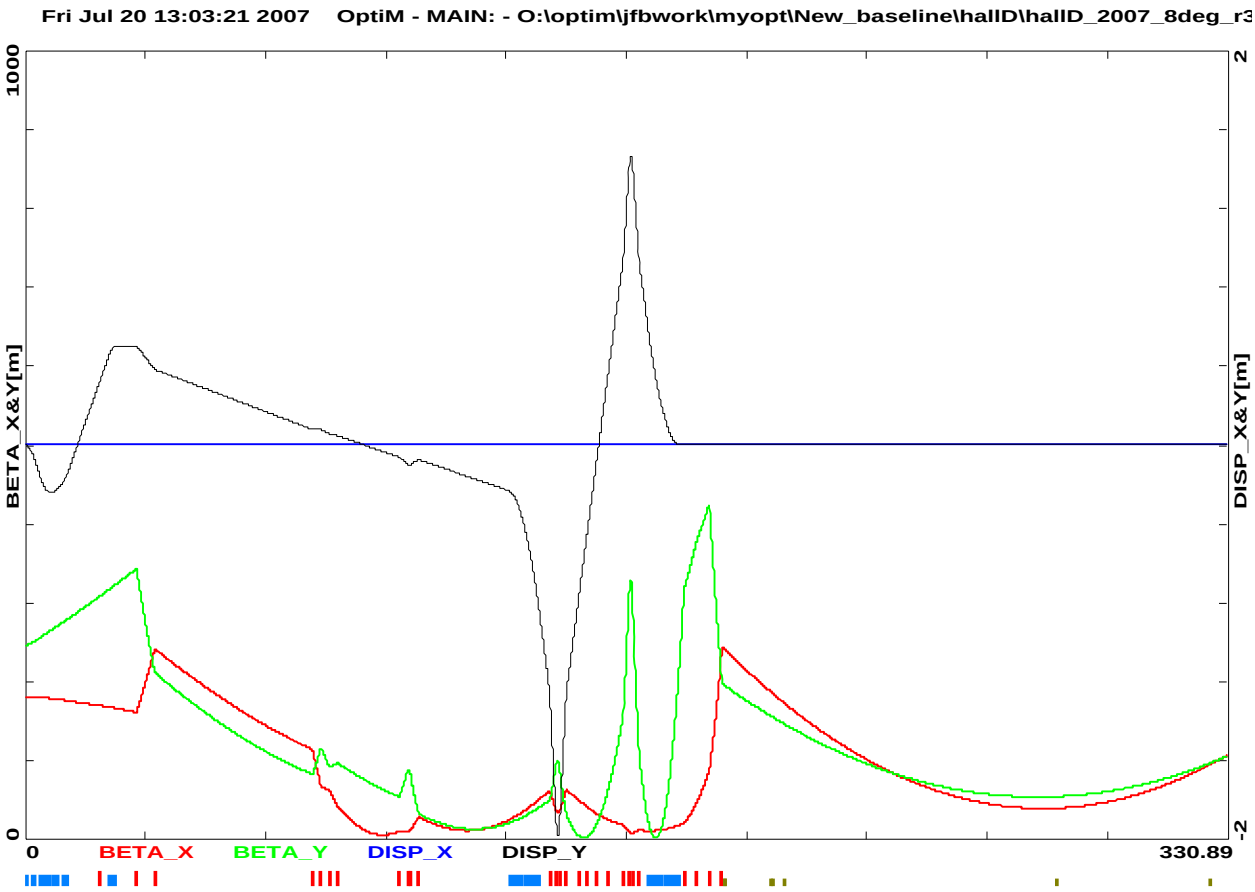

Figure 3B Optics for case T2

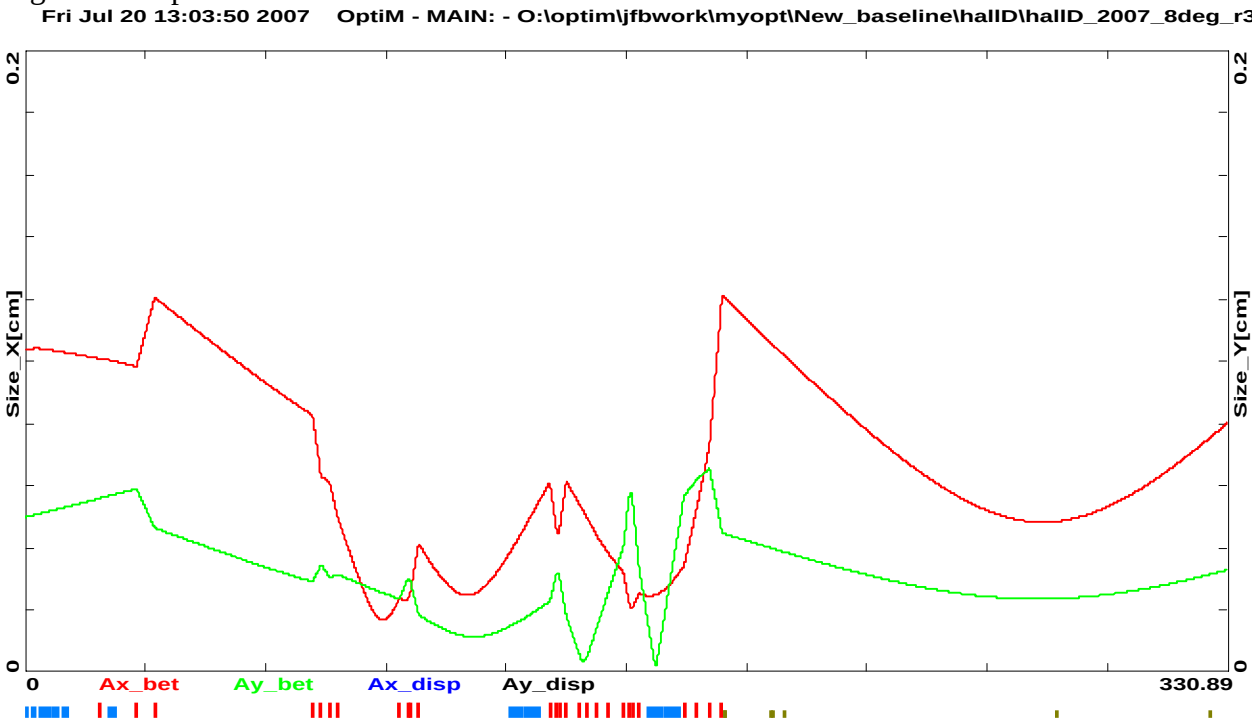

Figure 3B Envelopes for case T2

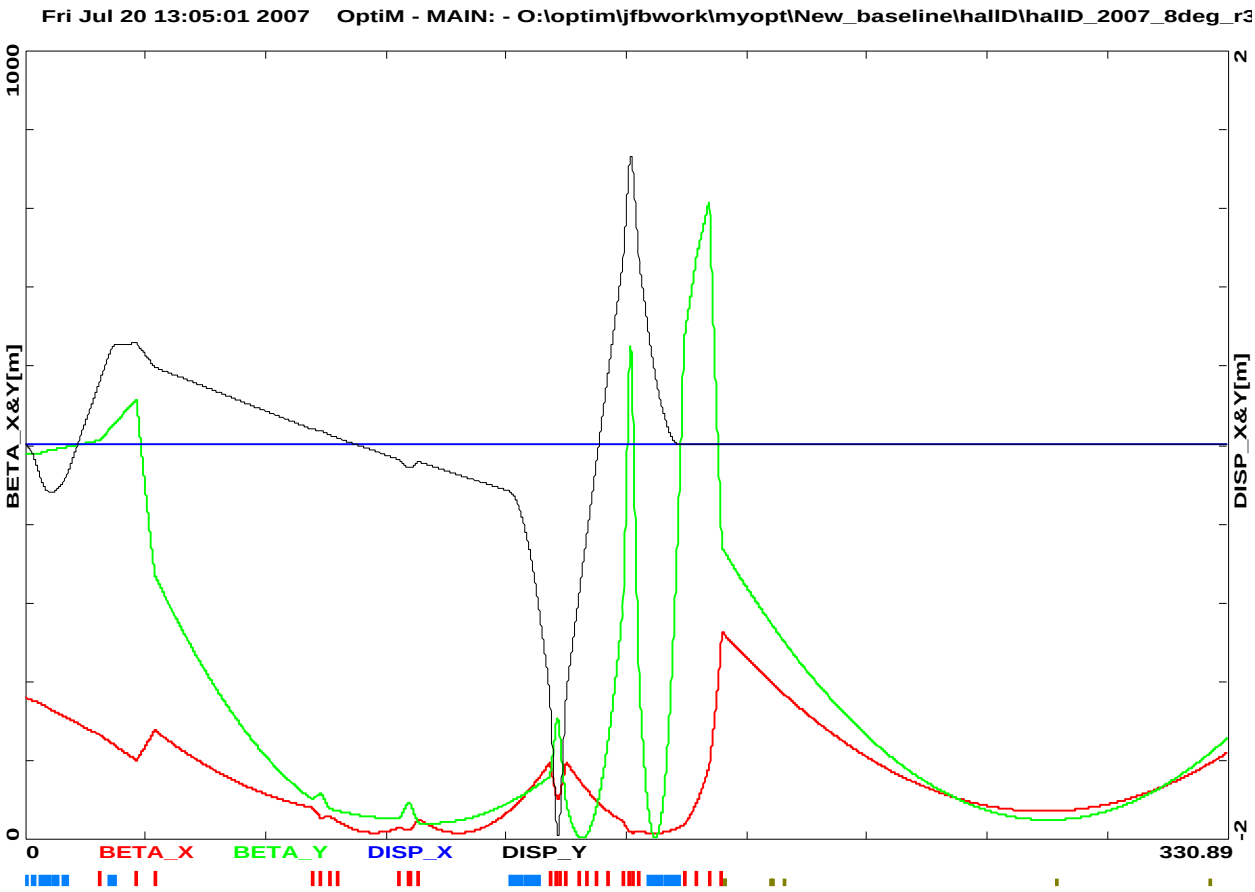

Figure 4A Optics for case T3

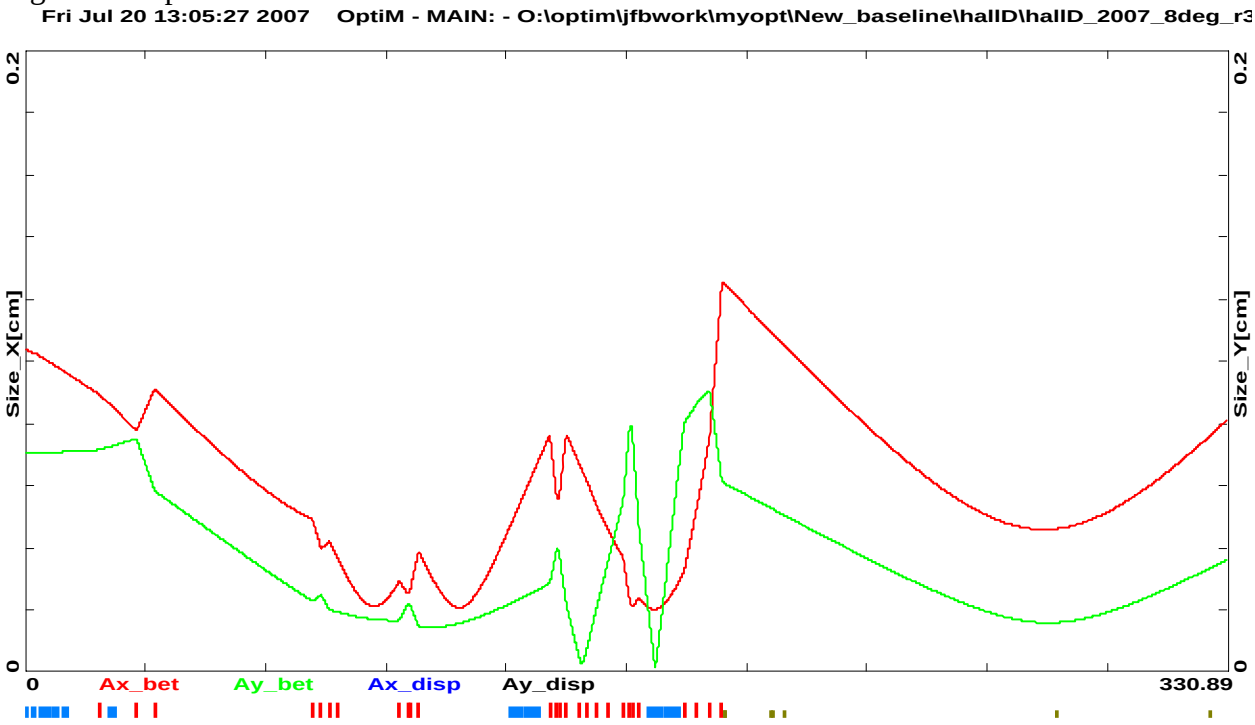

Figure 4B Envelopes for case T3

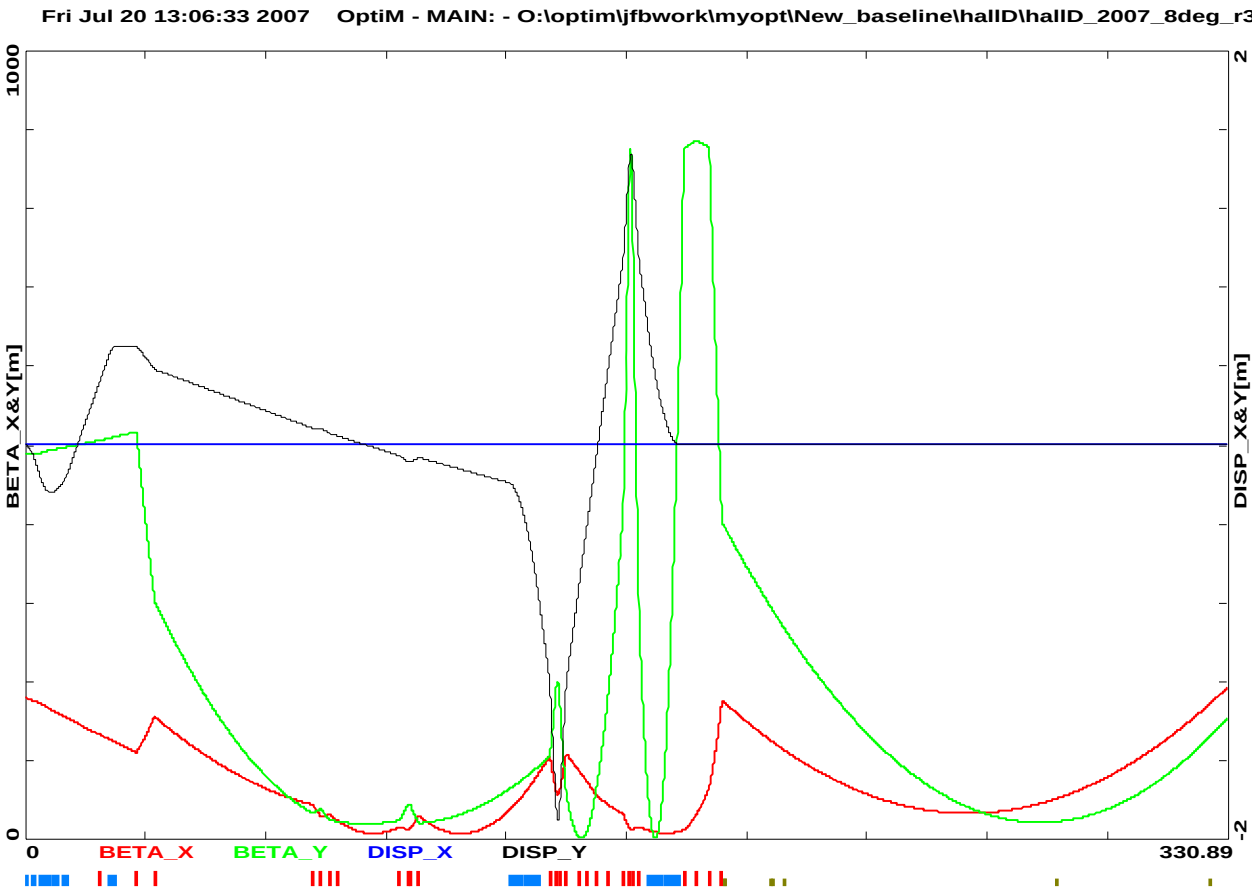

Figure 5A Optics for case T4

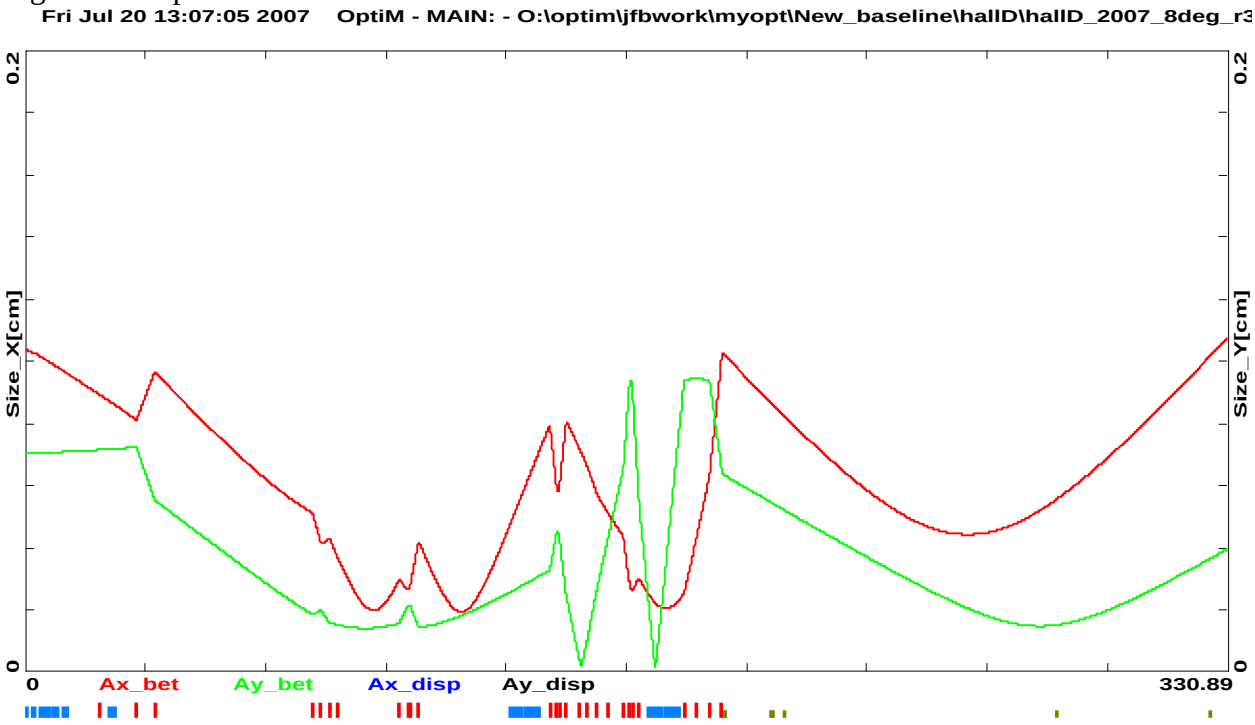

Figure 5B Envelopes for case T4

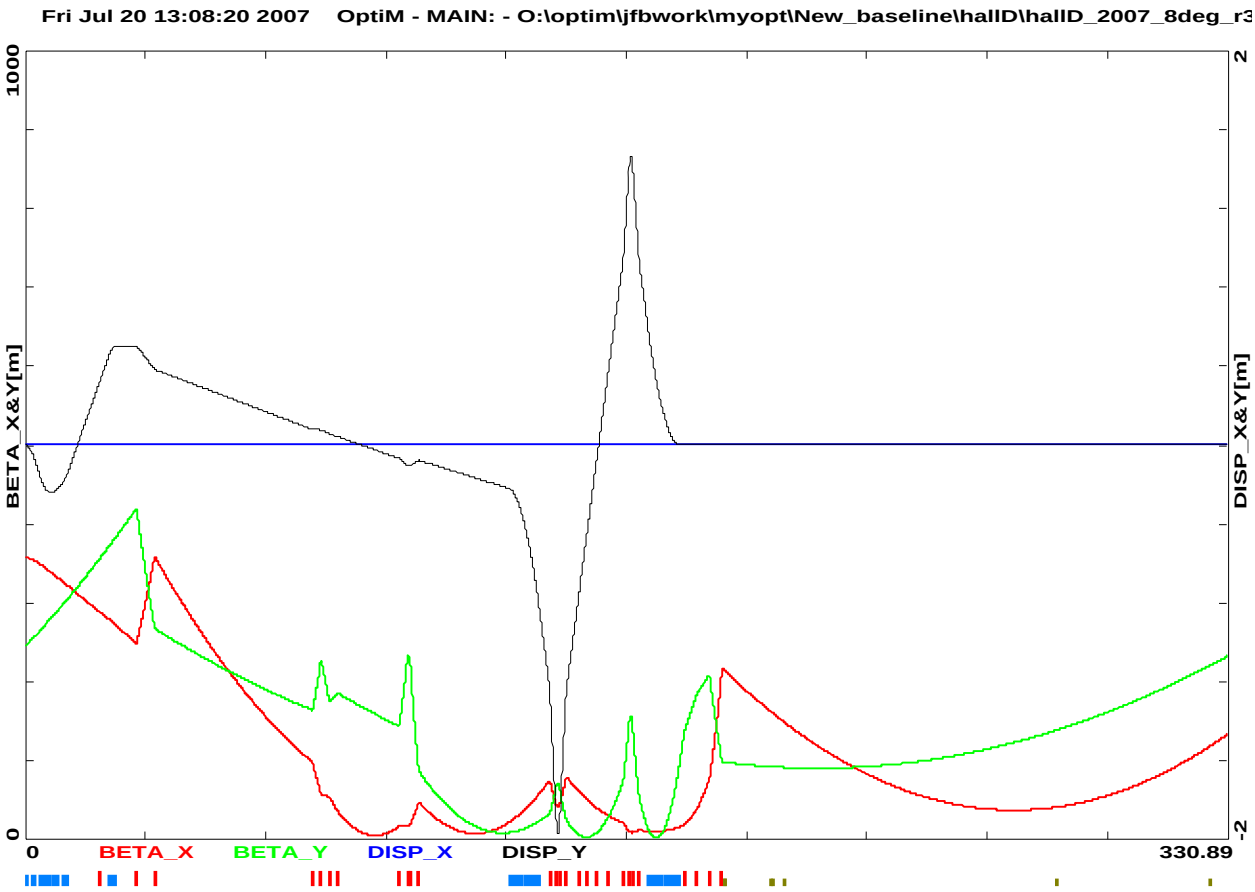

Figure 6A Optics for case T5

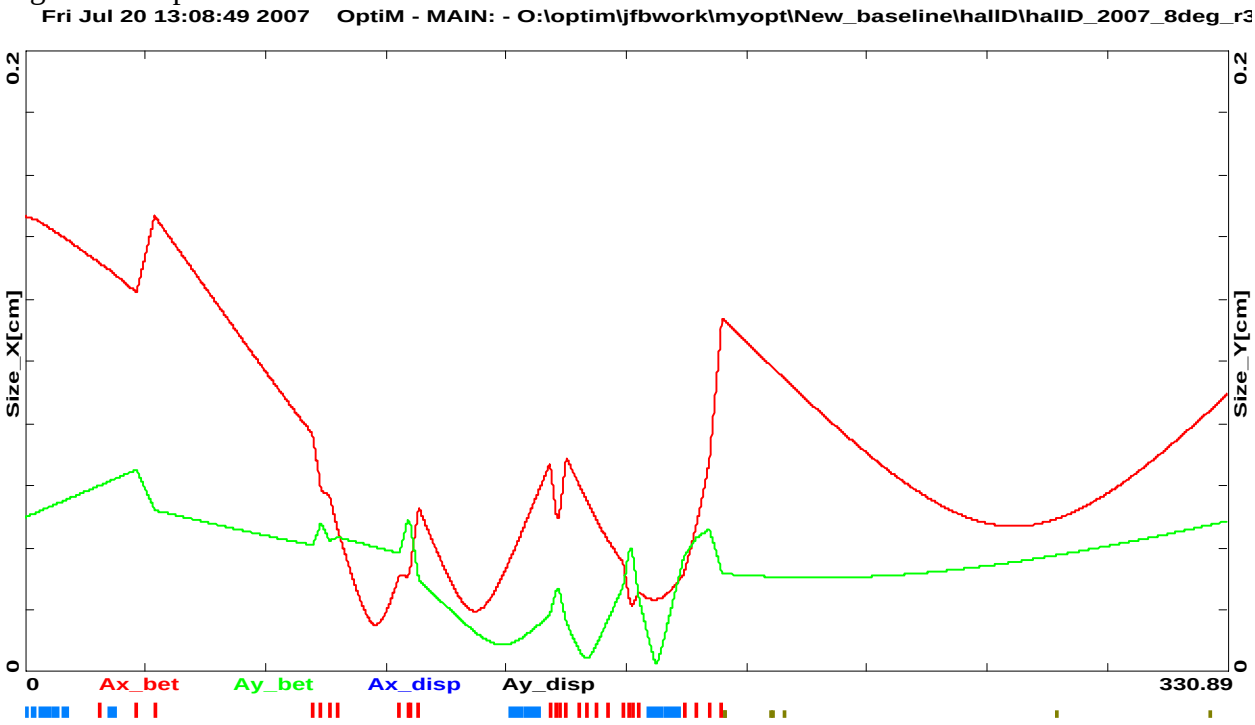

Figure 6B Envelopes for case T5

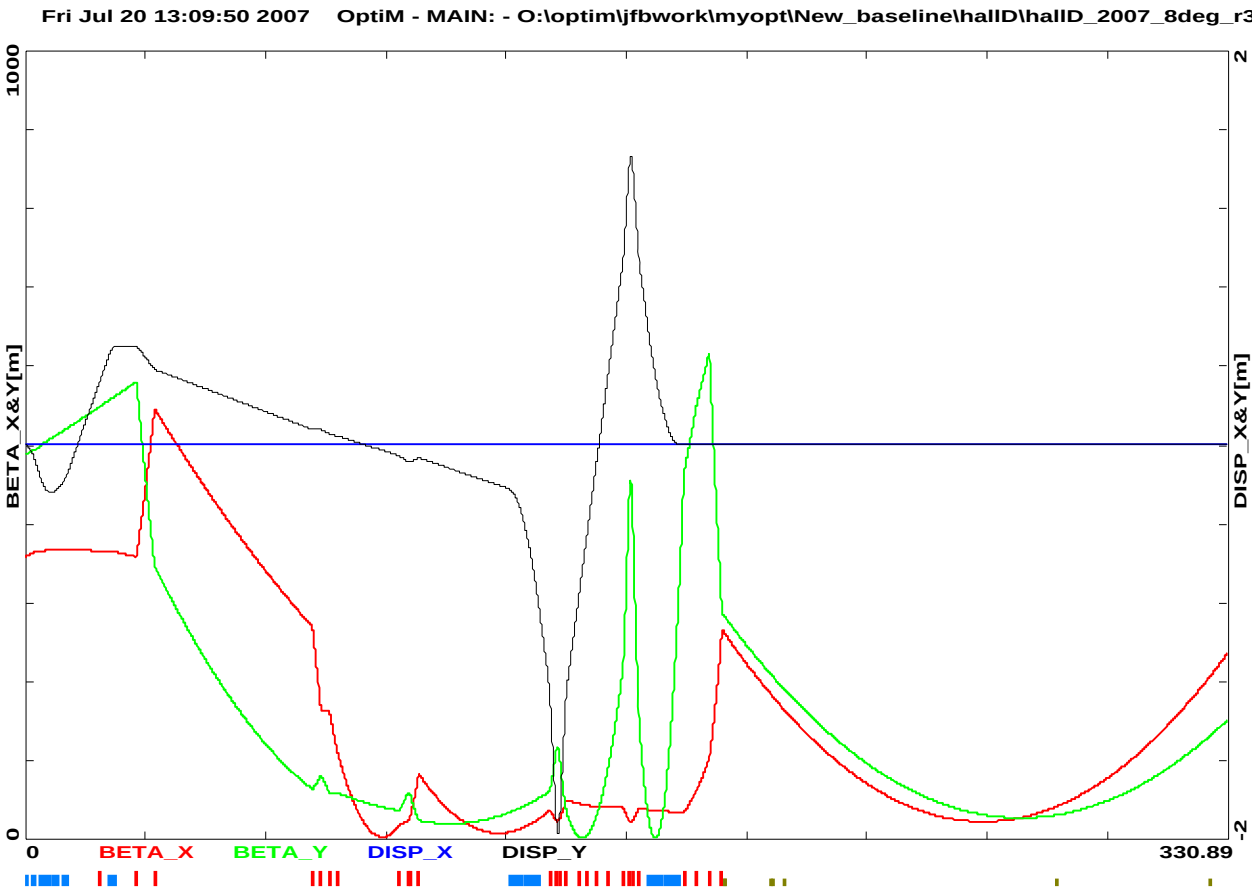

Figure 7A Optics for case T6

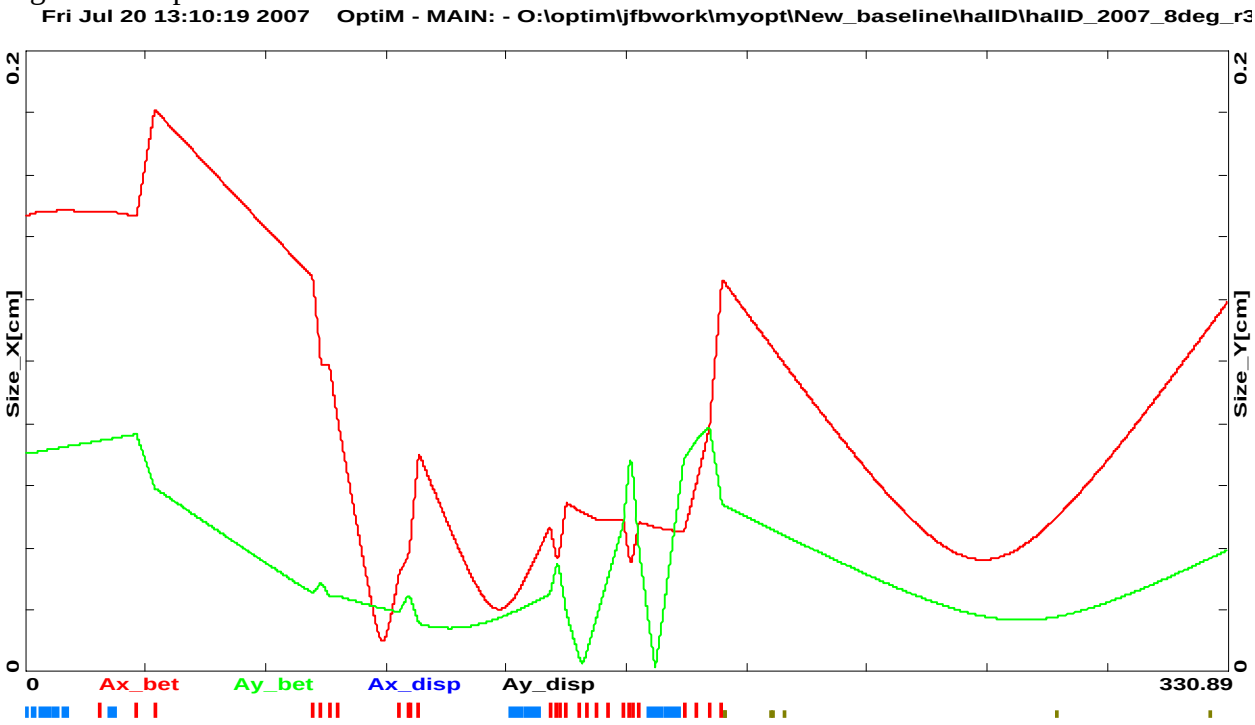

Figure 7B Envelopes for case T6

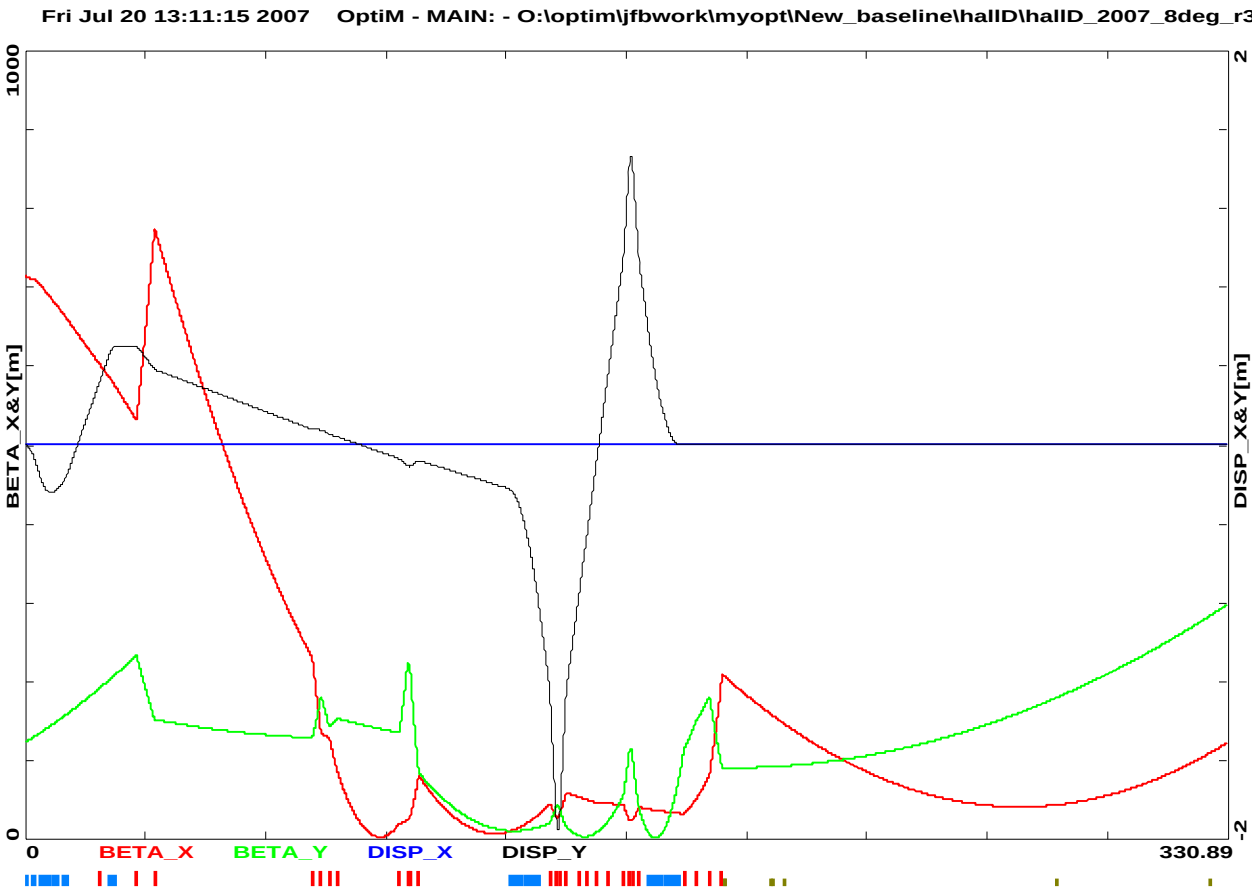

Figure 8A Optics for case T7

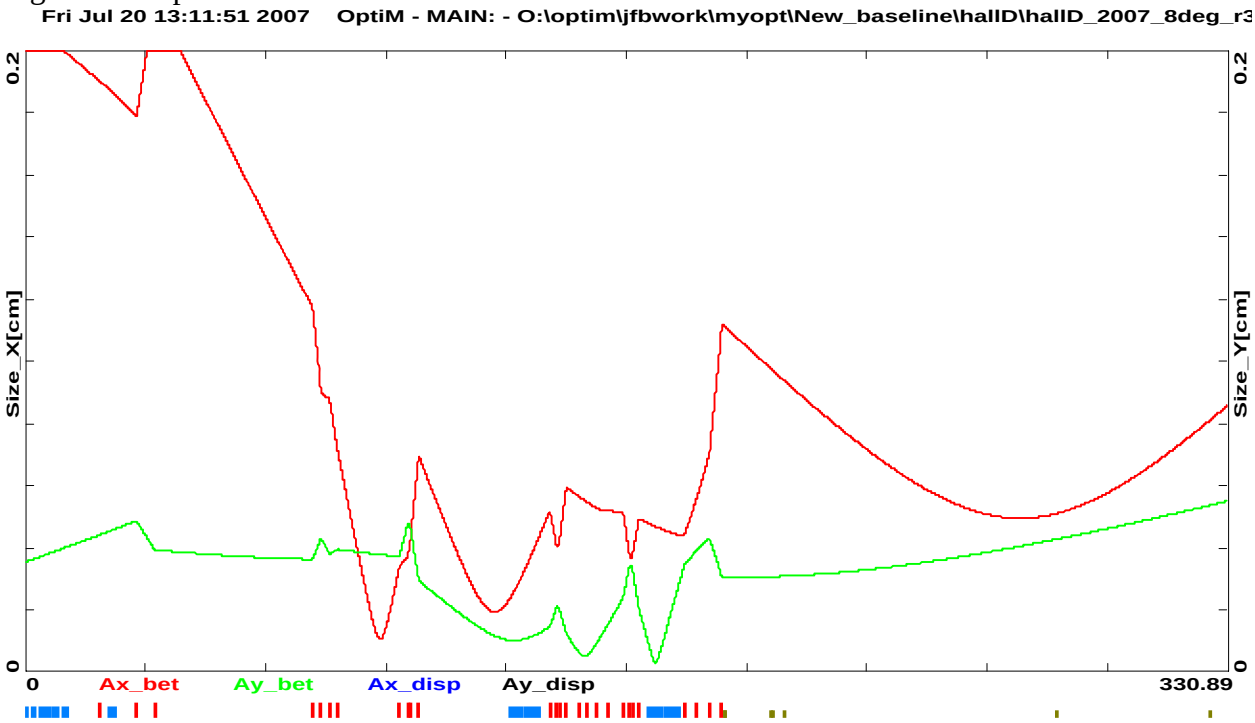

Figure 8B. Envelopes for case T7. Vertical scale was kept at 2mm for comparison even though incoming beam is clipped.

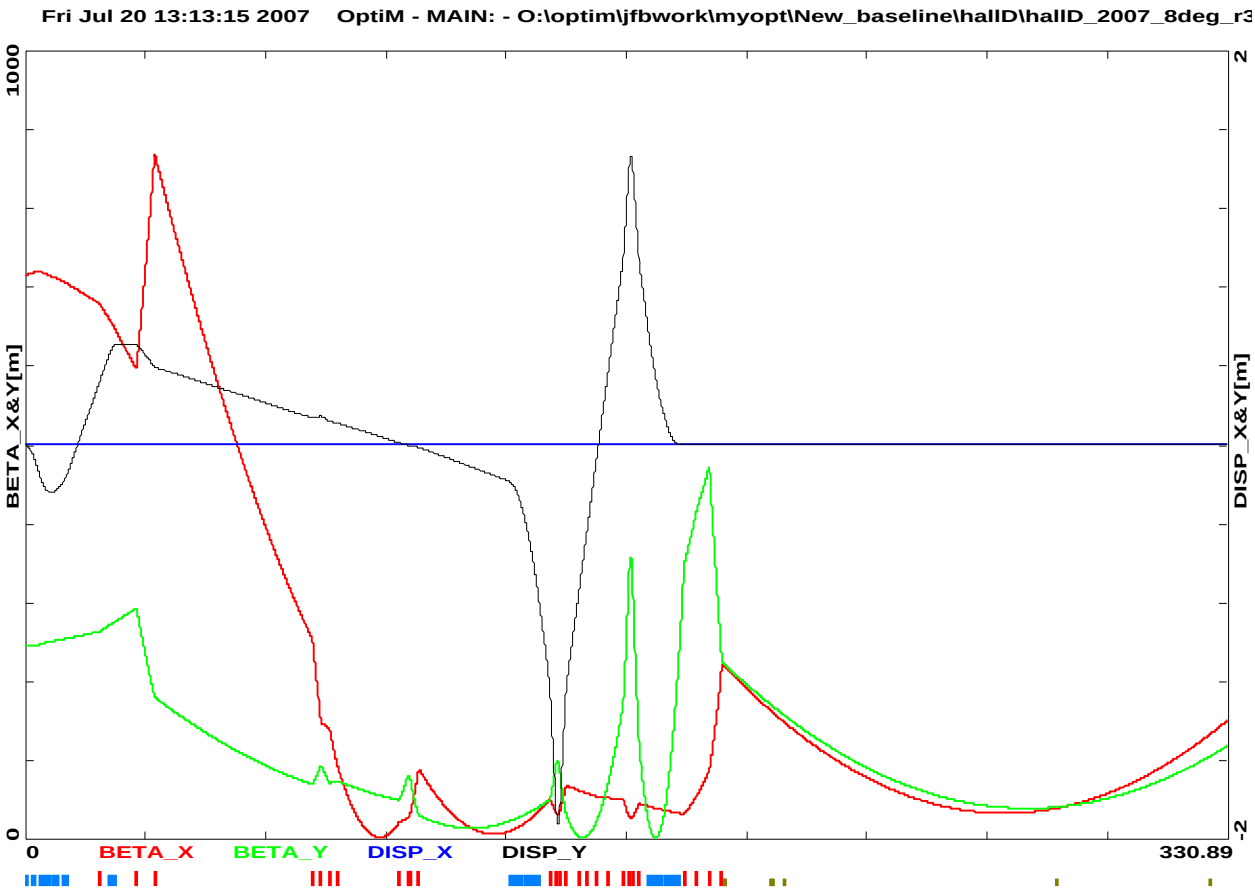

Figure 9A Optics for case T8

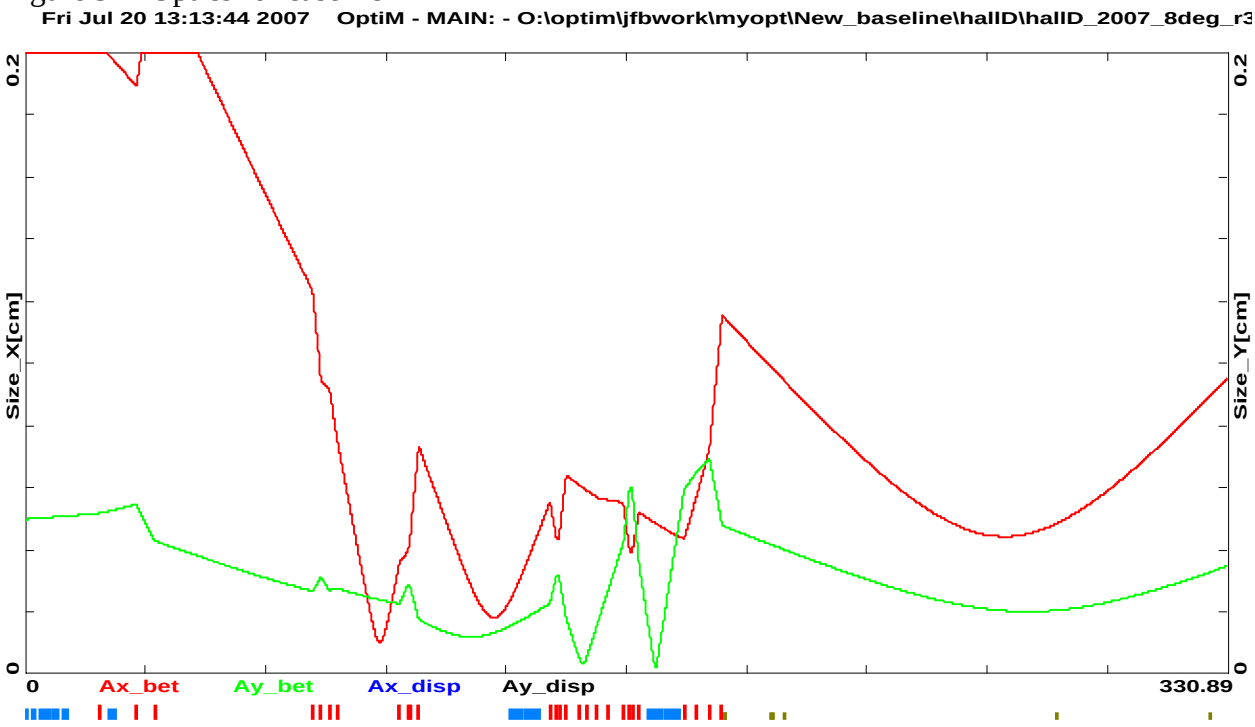

Figure 9B Envelopes for case T8.

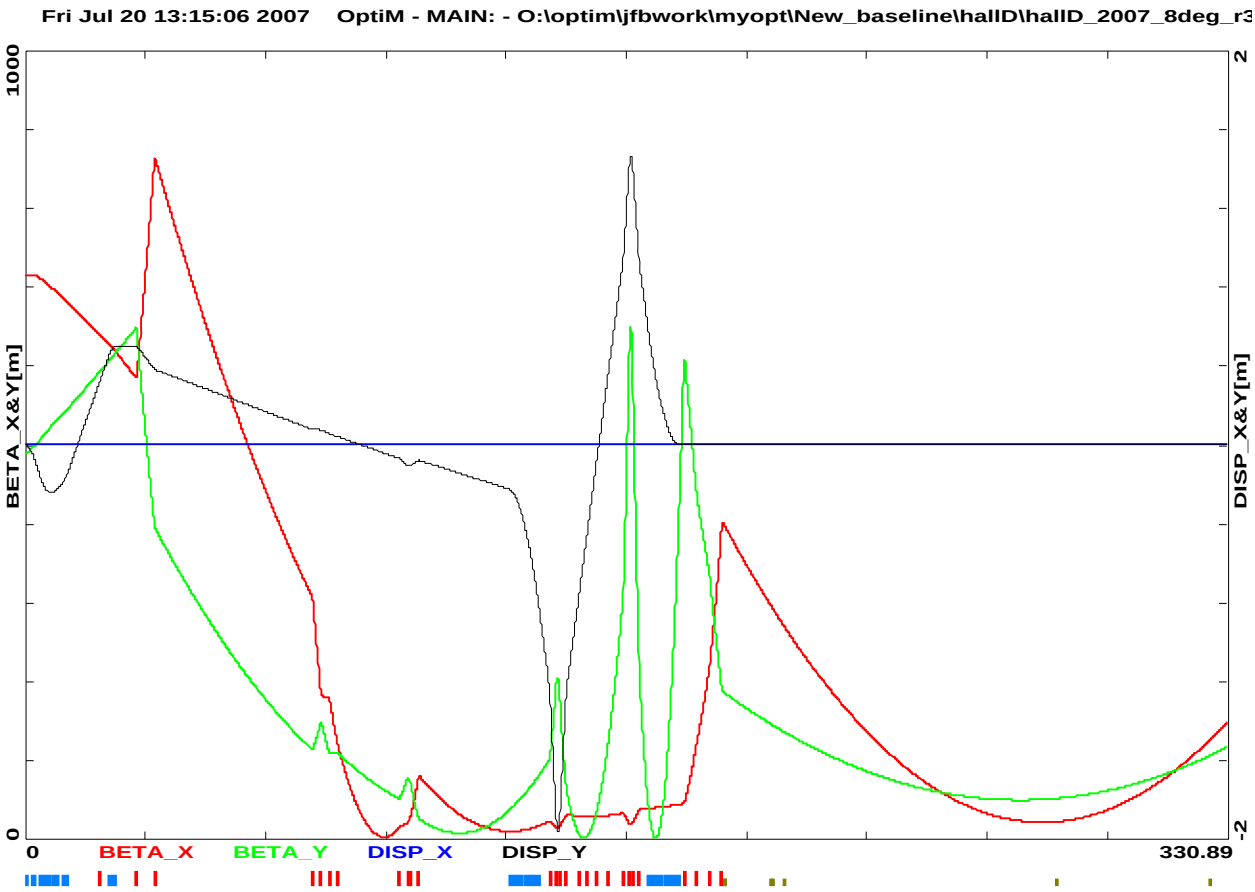

Figure 10A Optics for case T9

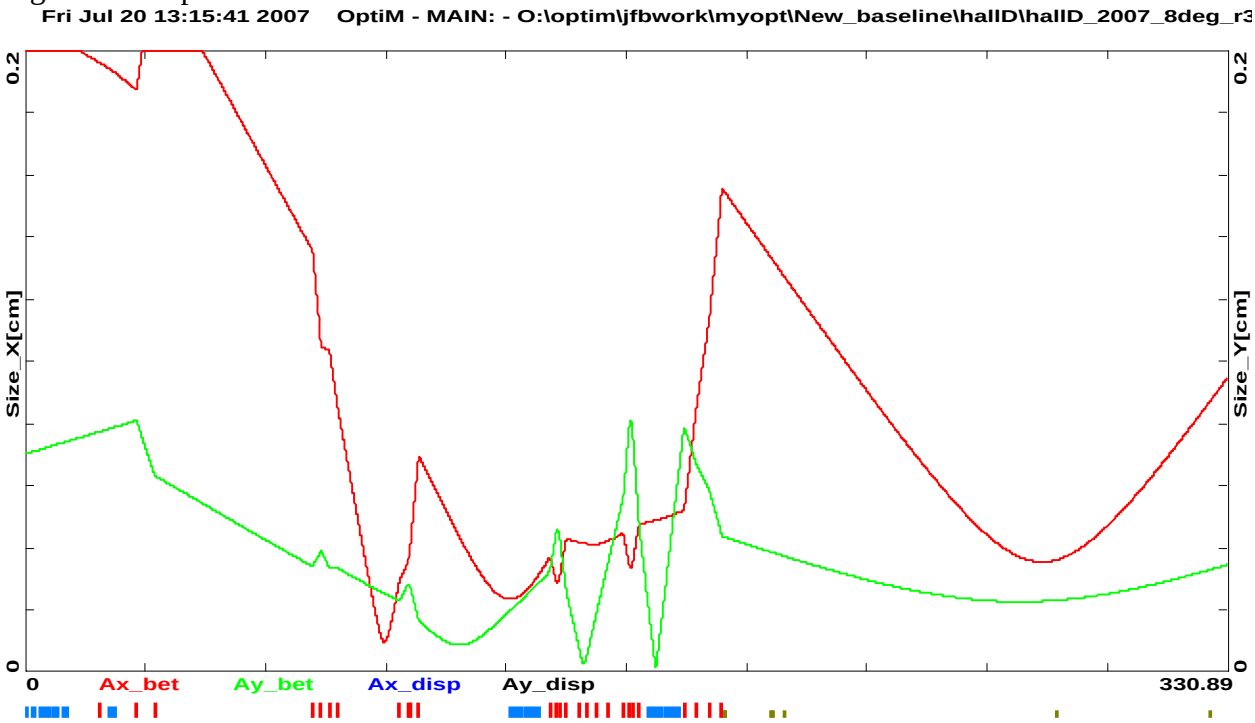

Figure 10B Envelopes for case T9

Discussion

As you will see in Appendix 1, quad settings for the ten cases, I often used quads outside the nominal tuning set. As the figures show, even using most or all of the quads in the line I could not maintain a round spot with 0.5mm sigma at the collimator for most input conditions. I can keep both planes below 0.5mm, but I generally can't compensate adequately for the 6:1 emittance ratio.

I tried moving the BE quadruplet and BT triplet downstream as a unit with the goal of creating a set of four quads which could rematch transverse parameters to design at the start of the ramp without screwing up dispersion too much. I was unable to find a superior location so I reverted to my original spot. I have not attempted to spread out the elements in these two grouping to lengthen the focal lengths and lower the fields. The last BT quad is the strongest in the line, Bdl ~90,000 vs 80,000 peak in the ramp, so altering these groupings might influence the decision on the QP quad length.

Two of the four quads in the central grouping of the ramp are zero in all ten cases. Neither I manually nor Optim automatically found a use for these quads. They are needed only if one decides to have a single unipolar dispersion peak instead of negative and positive peaks as shown. Since hall D will use only polarized photons and will accept a wide photon energy range, an improvement in energy measurement capability of perhaps 40% likely isn't worth the expense of these two girders. They can be added later if hall operation shows that a change is desirable. They will likely be deleted after this design is reviewed by CASA.

2007 8 degree	base	T1	T2	T3	T4	T5	T6	T7	T8	T9	max_amplitude
MQCBS02.BDL	0	0	0	1637	54	0	0	0	1350	0	1637
MQCBS03.BDL	-19612	-19612	-19612	-20212	-19590	-19612	-19612	-19612	-19689	-19612	20212
MQCBS04.BDL	18296	18296	18296	17538	18360	18296	18296	18296	18312	18296	18360
MQWBE01.BDL	34281	43032	38772	29528	29613	34281	35305	33986	34033	34281	43032
MQWBE02.BDL	-50061	-51728	-50550	-50604	-50553	-50061	-48832	-50132	-50141	-50061	51728
MQWBE03.BDL	30659	27952	29418	36059	36089	30659	31782	30584	30504	30659	36089
MQWBE04.BDL	-8201	-15550	-12108	-676	-668	-8201	-7001	-8191	-8293	-8201	15550
MQWBT01.BDL	52761	56483	57189	57138	56732	52761	53614	52715	52829	52761	57189
MQWBT02.BDL	-53415	-53986	-53951	-53245	-54846	-53415	-52333	-53562	-53358	-53415	54846
MQWBT03.BDL	-53415	-53986	-53951	-53245	-54846	-53415	-52333	-53562	-53358	-53415	54846
MQWBT04.BDL	90811	90811	90811	86818	90568	90164	90811	90544	90757	90811	**90811**
MQW5C01.BDL	72321	72321	72321	72322	72274	74692	72321	72170	72293	72321	**74692**
MQW5C03.BDL	-76745	-76745	-76745	-76745	-77383	-77838	-76745	-76703	-77129	-76745	**77838**
MQW5C04.BDL	-76745	-76745	-76745	-76745	-77383	-77838	-76745	-76703	-77129	-76745	**77838**
MQW5C06.BDL	72321	72321	72321	72322	72274	74692	72321	72170	72293	72321	**74692**
MQW5C07.BDL	0	0	0	0	0	0	0	0	0	0	0
MQW5C08.BDL	0	2244	2232	2193	4989	641	83	-168	-16	0	4989
MQW5C11.BDL	-3462	-3294	-3304	-3850	-9688	-3013	-3446	-3642	-3480	-3462	9688
MQW5C14.BDL	0	0	0	0	0	0	0	0	0	0	0
MQW5C15.BDL	64057	64601	64764	64974	66860	63769	64074	63929	64050	64057	**66860**
MQW5C16.BDL	-81067	-81280	-81349	-81425	-81812	-80874	-81090	-80996	-80890	-81067	**81812**
MQW5C17.BDL	-81067	-81280	-81349	-81425	-81812	-80874	-81090	-80996	-80890	-81067	**81812**
MQW5C19.BDL	64057	64601	64764	64974	66860	63769	64074	63929	64050	64057	**66860**
MQW5C20.BDL	-41283	-41659	-41385	-42343	-51154	-33889	-41266	-34234	-41101	-71668	**71668**
MQW5C23.BDL	-2584	-3249	-2822	-2993	-1181	-9223	-2576	-3885	-2395	8285	9223
MQW5C24.BDL	-43769	-44605	-44042	-43339	-37063	-43973	-43780	-44758	-43611	-13575	44758
MQW5C26.BDL	49491	50196	50546	51200	50338	51753	49376	47710	47997	35520	51753

Quad values for ten cases and the maximum amplitude for each. Highest values in bold.

Exit locations for all elements in hall D file

N	name	S[cm]	X[cm]	Y[cm]	Z[cm]	TetaX[deg]	TetaY[deg]	Energy[MeV]
0		680045.186	8060.000	10000.000	9055.372	0.0000	0.0000	12112.4890
1	oD11000	680045.186	8060.000	10000.000	9055.372	0.0000	0.0000	12112.4890
2	gMAQ1S01	680045.186	8060.000	10000.000	9055.372	0.0000	0.0000	12112.4890
3	bMAQ1S01	680145.203	8060.000	10001.596	9155.372	0.0000	1.8283	12112.4890
4	GMAQ1S01	680145.203	8060.000	10001.596	9155.372	0.0000	1.8283	12112.4890
5	oD11001	680245.254	8060.000	10004.788	9255.372	0.0000	1.8283	12112.4890
6	gMAS3S02	680245.254	8060.000	10004.788	9255.372	0.0000	1.8283	12112.4890
7	bMAS3S02	680345.367	8060.000	10009.456	9355.373	0.0000	3.5177	12112.4890
8	GMAS3S02	680345.367	8060.000	10009.456	9355.373	0.0000	3.5177	12112.4890
9	oD11002	680433.721	8060.000	10014.878	9443.560	0.0000	3.5177	12112.4890
10	gMYR7S03	680433.721	8060.000	10014.878	9443.560	0.0000	3.5177	12112.4890
11	bMYR7S03	680733.910	8060.000	10024.090	9743.561	0.0000	0.0000	12112.4890
12	GMYR7S03	680733.910	8060.000	10024.090	9743.561	0.0000	0.0000	12112.4890
13	oD11003	680793.911	8060.000	10024.090	9803.562	0.0000	0.0000	12112.4890
14	gMYR9S04	680793.911	8060.000	10024.090	9803.562	0.0000	0.0000	12112.4890
15	bMYR9S04	680993.931	8060.000	10021.655	10003.562	0.0000	-1.3952	12112.4890
16	GMYR9S04	680993.931	8060.000	10021.655	10003.562	0.0000	-1.3952	12112.4890
17	oD11004	681053.948	8060.000	10020.193	10063.561	0.0000	-1.3952	12112.4890
18	gMYRBS05	681053.948	8060.000	10020.193	10063.561	0.0000	-1.3952	12112.4890
19	bMYRBS05	681253.954	8060.000	10012.535	10263.414	0.0000	-2.9938	12112.4890
20	GMYRBS05	681253.954	8060.000	10012.535	10263.414	0.0000	-2.9938	12112.4890
21	oD11005	681719.594	8060.000	9988.216	10728.418	0.0000	-2.9938	12112.4890
22	oDquad	681749.594	8060.000	9986.649	10758.377	0.0000	-2.9938	12112.4890
23	oD11006	682079.879	8060.000	9969.399	11088.212	0.0000	-2.9938	12112.4890
24	qMQCBS02	682109.879	8060.000	9967.832	11118.171	0.0000	-2.9938	12112.4890
25	oD11007	682351.223	8060.000	9955.227	11359.185	0.0000	-2.9938	12112.4890
26	gMBBBS06	682351.223	8060.000	9955.227	11359.185	0.0000	-2.9938	12112.4890
27	bMBBBS06	682551.246	8060.000	9950.002	11559.117	0.0000	0.0000	12112.4890
28	GMBBBS06	682551.246	8060.000	9950.002	11559.117	0.0000	0.0000	12112.4890
29	oD11008	683096.964	8060.000	9950.002	12104.835	0.0000	0.0000	12112.4890

30	qMQCBS03	683126.964	8060.000	9950.002	12134.835	0.0000	0.0000	12112.4890
31	oD11009	683596.067	8060.000	9950.002	12603.938	0.0000	0.0000	12112.4890
32	qMQCBS04	683626.067	8060.000	9950.002	12633.938	0.0000	0.0000	12112.4890
33	oD11012	687935.269	8060.000	9950.002	16943.140	0.0000	0.0000	12112.4890
34	qMQWBE01	687985.269	8060.000	9950.002	16993.140	0.0000	0.0000	12112.4890
35	oD11013	688165.269	8060.000	9950.002	17173.140	0.0000	0.0000	12112.4890
36	qMQWBE02	688215.269	8060.000	9950.002	17223.140	0.0000	0.0000	12112.4890
37	oD11013	688395.269	8060.000	9950.002	17403.140	0.0000	0.0000	12112.4890
38	qMQWBE03	688445.269	8060.000	9950.002	17453.140	0.0000	0.0000	12112.4890
39	oD11013	688625.269	8060.000	9950.002	17633.140	0.0000	0.0000	12112.4890
40	qMQWBE04	688675.269	8060.000	9950.002	17683.140	0.0000	0.0000	12112.4890
41	oD11020	690322.269	8060.000	9950.002	19330.140	0.0000	0.0000	12112.4890
42	qMQWBT01	690372.269	8060.000	9950.002	19380.140	0.0000	0.0000	12112.4890
43	oD11017	690552.269	8060.000	9950.002	19560.140	0.0000	0.0000	12112.4890
44	qMQWBT02	690602.269	8060.000	9950.002	19610.140	0.0000	0.0000	12112.4890
45	oD12001	690622.269	8060.000	9950.002	19630.140	0.0000	0.0000	12112.4890
46	qMQWBT03	690672.269	8060.000	9950.002	19680.140	0.0000	0.0000	12112.4890
47	oD11018	690852.269	8060.000	9950.002	19860.140	0.0000	0.0000	12112.4890
48	qMQWBT04	690902.269	8060.000	9950.002	19910.140	0.0000	0.0000	12112.4890
49	oD11019	693355.896	8060.000	9950.002	22363.767	0.0000	0.0000	12112.4890
50	gMAR5C01	693355.896	8060.000	9950.002	22363.767	0.0000	0.0000	12112.4890
51	bMAR5C01	693755.907	8060.000	9963.577	22763.471	0.0000	3.8903	12112.4890
52	GMAR5C01	693755.907	8060.000	9963.577	22763.471	0.0000	3.8903	12112.4890
53	oD11015	693805.907	8060.000	9966.970	22813.356	0.0000	3.8903	12112.4890
54	gMAR5C02	693805.907	8060.000	9966.970	22813.356	0.0000	3.8903	12112.4890
55	bMAR5C02	694205.919	8060.000	10007.632	23211.218	0.0000	7.7807	12112.4890
56	GMAR5C02	694205.919	8060.000	10007.632	23211.218	0.0000	7.7807	12112.4890
57	oD4002	694458.040	8060.000	10041.764	23461.018	0.0000	7.7807	12112.4890
58	qMQW5C01	694508.040	8060.000	10048.533	23510.558	0.0000	7.7807	12112.4890
59	oD4005	694653.040	8060.000	10068.164	23654.223	0.0000	7.7807	12112.4890
60	qMQW5C03	694703.040	8060.000	10074.933	23703.763	0.0000	7.7807	12112.4890
61	oD12002	694718.040	8060.000	10076.963	23718.624	0.0000	7.7807	12112.4890
62	qMQW5C04	694768.040	8060.000	10083.732	23768.164	0.0000	7.7807	12112.4890

63	oD4006	694913.040	8060.000	10103.363	23911.829	0.0000	7.7807	12112.4890
64	qMQW5C06	694963.040	8060.000	10110.132	23961.369	0.0000	7.7807	12112.4890
65	oD4007	695290.540	8060.000	10154.469	24285.854	0.0000	7.7807	12112.4890
66	qMQW5C07	695340.540	8060.000	10161.238	24335.393	0.0000	7.7807	12112.4890
67	oD4008	695490.540	8060.000	10181.545	24484.012	0.0000	7.7807	12112.4890
68	qMQW5C08	695540.540	8060.000	10188.314	24533.552	0.0000	7.7807	12112.4890
69	oD12002	695555.540	8060.000	10190.345	24548.414	0.0000	7.7807	12112.4890
70	oDqw	695605.540	8060.000	10197.114	24597.954	0.0000	7.7807	12112.4890
71	oD12003	695705.540	8060.000	10210.652	24697.033	0.0000	7.7807	12112.4890
72	oDqw	695755.540	8060.000	10217.421	24746.573	0.0000	7.7807	12112.4890
73	oD12002	695770.540	8060.000	10219.452	24761.435	0.0000	7.7807	12112.4890
74	qMQW5C11	695820.540	8060.000	10226.221	24810.974	0.0000	7.7807	12112.4890
75	oD12002	695835.540	8060.000	10228.252	24825.836	0.0000	7.7807	12112.4890
76	oDqw	695885.540	8060.000	10235.021	24875.376	0.0000	7.7807	12112.4890
77	oD4012	695985.540	8060.000	10248.559	24974.455	0.0000	7.7807	12112.4890
78	oDqw	696035.540	8060.000	10255.328	25023.995	0.0000	7.7807	12112.4890
79	oD12002	696050.540	8060.000	10257.359	25038.857	0.0000	7.7807	12112.4890
80	qMQW5C14	696100.540	8060.000	10264.128	25088.397	0.0000	7.7807	12112.4890
81	oD4009	696475.540	8060.000	10314.895	25459.944	0.0000	7.7807	12112.4890
82	qMQW5C15	696525.540	8060.000	10321.665	25509.484	0.0000	7.7807	12112.4890
83	oD4011	696658.040	8060.000	10339.603	25640.764	0.0000	7.7807	12112.4890
84	qMQW5C16	696708.040	8060.000	10346.372	25690.304	0.0000	7.7807	12112.4890
85	oD12002	696723.040	8060.000	10348.402	25705.166	0.0000	7.7807	12112.4890
86	qMQW5C17	696773.040	8060.000	10355.171	25754.705	0.0000	7.7807	12112.4890
87	oD4043	696905.540	8060.000	10373.109	25885.985	0.0000	7.7807	12112.4890
88	qMQW5C19	696955.540	8060.000	10379.878	25935.525	0.0000	7.7807	12112.4890
89	oD4031	697195.540	8060.000	10412.370	26173.316	0.0000	7.7807	12112.4890
90	gMAR5C03	697195.540	8060.000	10412.370	26173.316	0.0000	7.7807	12112.4890
91	bMAR5C03	697595.551	8060.000	10453.032	26571.178	0.0000	3.8903	12112.4890
92	GMAR5C03	697595.551	8060.000	10453.032	26571.178	0.0000	3.8903	12112.4890
93	oD11015	697645.551	8060.000	10456.425	26621.062	0.0000	3.8903	12112.4890
94	gMAR5C04	697645.551	8060.000	10456.425	26621.062	0.0000	3.8903	12112.4890
95	bMAR5C04	698045.563	8060.000	10470.000	27020.767	0.0000	0.0000	12112.4890

96	GMAR5C04	698045.563	8060.000	10470.000	27020.767	0.0000	0.0000	12112.4890
97	oD4023	698151.869	8060.000	10469.999	27127.073	0.0000	0.0000	12112.4890
98	qMQW5C20	698201.869	8060.000	10469.999	27177.073	0.0000	0.0000	12112.4890
99	oD4038	698501.869	8060.000	10469.999	27477.073	0.0000	0.0000	12112.4890
100	qMQW5C23	698551.869	8060.000	10469.999	27527.073	0.0000	0.0000	12112.4890
101	oD4038	698851.869	8060.000	10469.999	27827.073	0.0000	0.0000	12112.4890
102	qMQW5C24	698901.869	8060.000	10469.999	27877.073	0.0000	0.0000	12112.4890
103	oD4038	699201.869	8060.000	10469.999	28177.073	0.0000	0.0000	12112.4890
104	qMQW5C26	699251.869	8060.000	10469.999	28227.073	0.0000	0.0000	12112.4890
105	oD4044	699270.542	8060.000	10469.999	28245.746	0.0000	0.0000	12112.4890
106	kMBD5C12H	699285.542	8060.000	10469.999	28260.746	0.0000	0.0000	12112.4890
107	oD4040	699290.542	8060.000	10469.999	28265.746	0.0000	0.0000	12112.4890
108	kMBD5C12V	699305.542	8060.000	10469.999	28280.746	0.0000	0.0000	12112.4890
109	oD4041	700555.542	8060.000	10469.999	29530.746	0.0000	0.0000	12112.4890
110	kMBD5C13H	700570.542	8060.000	10469.999	29545.746	0.0000	0.0000	12112.4890
111	oD4040	700575.542	8060.000	10469.999	29550.746	0.0000	0.0000	12112.4890
112	kMBD5C13V	700590.542	8060.000	10469.999	29565.746	0.0000	0.0000	12112.4890
113	oD4042	700934.175	8060.000	10469.999	29909.379	0.0000	0.0000	12112.4890
114	KRADIATOR	700934.175	8060.000	10469.999	29909.379	0.0000	0.0000	12112.4890
115	oD4028	708434.175	8060.000	10469.999	37409.379	0.0000	0.0000	12112.4890
116	KCOLLIM	708434.175	8060.000	10469.999	37409.379	0.0000	0.0000	12112.4890
117	oD4029	712634.175	8060.000	10469.999	41609.379	0.0000	0.0000	12112.4890
118	Kbackwall	712634.175	8060.000	10469.999	41609.379	0.0000	0.0000	12112.4890
119	oD4030	713134.175	8060.000	10469.999	42109.379	0.0000	0.0000	12112.4890

Lattice listing for hall D file

N	Name	S[cm]	L[cm]	B[kG]	G[kG/cm]	S[kG/cm/cm]	Tilt[deg]	Tilt_out	BendAng[deg]
1	oD11000	0	0						
2	gMAQ1S01	0	0	12.8911	Angle[deg]=0	Eff.Length[cm]=1.90844	Tilt[deg]=90		
3	bMAQ1S01	100.017	100.017	12.8911	0	0	-90	-90	1.82833
4	GMAQ1S01	100.017	0	12.8911	Angle[deg]=1.82833	Eff.Length[cm]=1.9133	Tilt[deg]=90		
5	oD11001	200.068	100.051						
6	gMAS3S02	200.068	0	11.9	Angle[deg]=-1.82833	Eff.Length[cm]=2.39549	Tilt[deg]=90		
7	bMAS3S02	300.181	100.113	11.9	0	0	-90	-90	1.68939
8	GMAS3S02	300.181	0	11.9	Angle[deg]=3.51772	Eff.Length[cm]=2.412	Tilt[deg]=90		
9	oD11002	388.535	88.354						
10	gMYR7S03	388.535	0	-8.2637	Angle[deg]=3.51772	Eff.Length[cm]=1.27854	Tilt[deg]=90		
11	bMYR7S03	688.724	300.189	-8.2637	0	0	-90	-90	-3.51772
12	GMYR7S03	688.724	0	-8.2637	Angle[deg]=0	Eff.Length[cm]=1.26656	Tilt[deg]=90		
13	oD11003	748.725	60.001						
14	gMYR9S04	748.725	0	-4.91908	Angle[deg]=0	Eff.Length[cm]=1.27	Tilt[deg]=90		
15	bMYR9S04	948.745	200.02	-4.91908	0	0	-90	-90	-1.39524
16	GMYR9S04	948.745	0	-4.91908	Angle[deg]=1.39524	Eff.Length[cm]=1.27188	Tilt[deg]=90		
17	oD11004	1008.76	60.017						
18	gMYRBS05	1008.76	0	-5.63627	Angle[deg]=0.799274	Eff.Length[cm]=1.27	Tilt[deg]=90		
19	bMYRBS05	1208.77	200.006	-5.63627	0	0	-90	-90	-1.59855
20	GMYRBS05	1208.77	0	-5.63627	Angle[deg]=0.799274	Eff.Length[cm]=1.27	Tilt[deg]=90		
21	oD11005	1674.41	465.64						
22	oDquad	1704.41	30						
23	oD11006	2034.69	330.285						
24	qMQCBS02	2064.69	30	0	0	0	0		
25	oD11007	2306.04	241.344						
26	gMBBBS06	2306.04	0	10.5548	Angle[deg]=1.4969	Eff.Length[cm]=1.27	Tilt[deg]=90		
27	bMBBBS06	2506.06	200.023	10.5548	0	0	-90	-90	2.99379
28	GMBBBS06	2506.06	0	10.5548	Angle[deg]=1.4969	Eff.Length[cm]=1.27	Tilt[deg]=90		
29	oD11008	3051.78	545.718						
30	qMQCBS03	3081.78	30	0	-0.653731	0	0		

31	oD11009	3550.88	469.103									
32	qMQCBS04	3580.88	30	0	0.609859	0	0					
33	oD11012	7890.08	4309.2									
34	qMQWBE01	7940.08	50	0	0.685622	0	0					
35	oD11013	8120.08	180									
36	qMQWBE02	8170.08	50	0	-1.00121	0	0					
37	oD11013	8350.08	180									
38	qMQWBE03	8400.08	50	0	0.613178	0	0					
39	oD11013	8580.08	180									
40	qMQWBE04	8630.08	50	0	-0.164018	0	0					
41	oD11020	10277.1	1647									
42	qMQWBT01	10327.1	50	0	1.05522	0	0					
43	oD11017	10507.1	180									
44	qMQWBT02	10557.1	50	0	-1.06829	0	0					
45	oD12001	10577.1	20									
46	qMQWBT03	10627.1	50	0	-1.06829	0	0					
47	oD11018	10807.1	180									
48	qMQWBT04	10857.1	50	0	1.81622	0	0					
49	oD11019	13310.7	2453.63									
50	gMAR5C01	13310.7	0	6.85839	Angle[deg]=2.052	Eff.Length[cm]=1.27054	Tilt[deg]=-90					
51	bMAR5C01	13710.7	400.011	6.85839	0	0	-90	-90	3.89033			
52	GMAR5C01	13710.7	0	6.85839	Angle[deg]=2.052	Eff.Length[cm]=1.27054	Tilt[deg]=-90					
53	oD11015	13760.7	50									
54	gMAR5C02	13760.7	0	6.85839	Angle[deg]=2.052	Eff.Length[cm]=1.27054	Tilt[deg]=-90					
55	bMAR5C02	14160.7	400.011	6.85839	0	0	-90	-90	3.89033			
56	GMAR5C02	14160.7	0	6.85839	Angle[deg]=2.052	Eff.Length[cm]=1.27054	Tilt[deg]=-90					
57	oD4002	14412.9	252.121									
58	qMQW5C01	14462.9	50	0	1.44642	0	0					
59	oD4005	14607.9	145									
60	qMQW5C03	14657.9	50	0	-1.5349	0	0					
61	oD12002	14672.9	15									
62	qMQW5C04	14722.9	50	0	-1.5349	0	0					
63	oD4006	14867.9	145									

64	qMQW5C06	14917.9	50	0	1.44642	0	0					
65	oD4007	15245.4	327.5									
66	qMQW5C07	15295.4	50	0	0	0	0					
67	oD4008	15445.4	150									
68	qMQW5C08	15495.4	50	0	0	0	0					
69	oD12002	15510.4	15									
70	oDqw	15560.4	50									
71	oD12003	15660.4	100									
72	oDqw	15710.4	50									
73	oD12002	15725.4	15									
74	qMQW5C11	15775.4	50	0	-0.0692496	0	0					
75	oD12002	15790.4	15									
76	oDqw	15840.4	50									
77	oD4012	15940.4	100									
78	oDqw	15990.4	50									
79	oD12002	16005.4	15									
80	qMQW5C14	16055.4	50	0	0	0	0					
81	oD4009	16430.4	375									
82	qMQW5C15	16480.4	50	0	1.28114	0	0					
83	oD4011	16612.9	132.5									
84	qMQW5C16	16662.9	50	0	-1.62133	0	0					
85	oD12002	16677.9	15									
86	qMQW5C17	16727.9	50	0	-1.62133	0	0					
87	oD4043	16860.4	132.5									
88	qMQW5C19	16910.4	50	0	1.28114	0	0					
89	oD4031	17150.4	240									
90	gMAR5C03	17150.4	0	6.85839	Angle[deg]=2.052	Eff.Length[cm]=1.27054	Tilt[deg]=90					
91	bMAR5C03	17550.4	400.011	6.85839	0	0	90	90	3.89033			
92	GMAR5C03	17550.4	0	6.85839	Angle[deg]=2.052	Eff.Length[cm]=1.27054	Tilt[deg]=90					
93	oD11015	17600.4	50									
94	gMAR5C04	17600.4	0	6.85839	Angle[deg]=2.052	Eff.Length[cm]=1.27054	Tilt[deg]=90					
95	bMAR5C04	18000.4	400.011	6.85839	0	0	90	90	3.89033			
96	GMAR5C04	18000.4	0	6.85839	Angle[deg]=2.052	Eff.Length[cm]=1.27054	Tilt[deg]=90					

97	oD4023	18106.7	106.306					
98	qMQW5C20	18156.7	50	0	-0.825659		0	0
99	oD4038	18456.7	300					
100	qMQW5C23	18506.7	50	0	-0.0516822		0	0
101	oD4038	18806.7	300					
102	qMQW5C24	18856.7	50	0	-0.875388		0	0
103	oD4038	19156.7	300					
104	qMQW5C26	19206.7	50	0	0.989813		0	0
105	oD4044	19225.4	18.673					
106	kMBD5C12H	19240.4	15	1	0	0	0	
107	oD4040	19245.4	5					
108	kMBD5C12V	19260.4	15	0	0	0	90	
109	oD4041	20510.4	1250					
110	kMBD5C13H	20525.4	15	-1	0	0	0	
111	oD4040	20530.4	5					
112	kMBD5C13V	20545.4	15	0	0	0	90	
113	oD4042	20889	343.633					
114	KRADIATOR	20889	0	0	0	0	0	
115	oD4028	28389	7500					
116	KCOLLIM	28389	0	0	0	0	0	
117	oD4029	32589	4200					
118	Kbackwall	32589	0	0	0	0	0	
119	oD4030	33089	500					