Method of Correcting the LHC β^* at Collision

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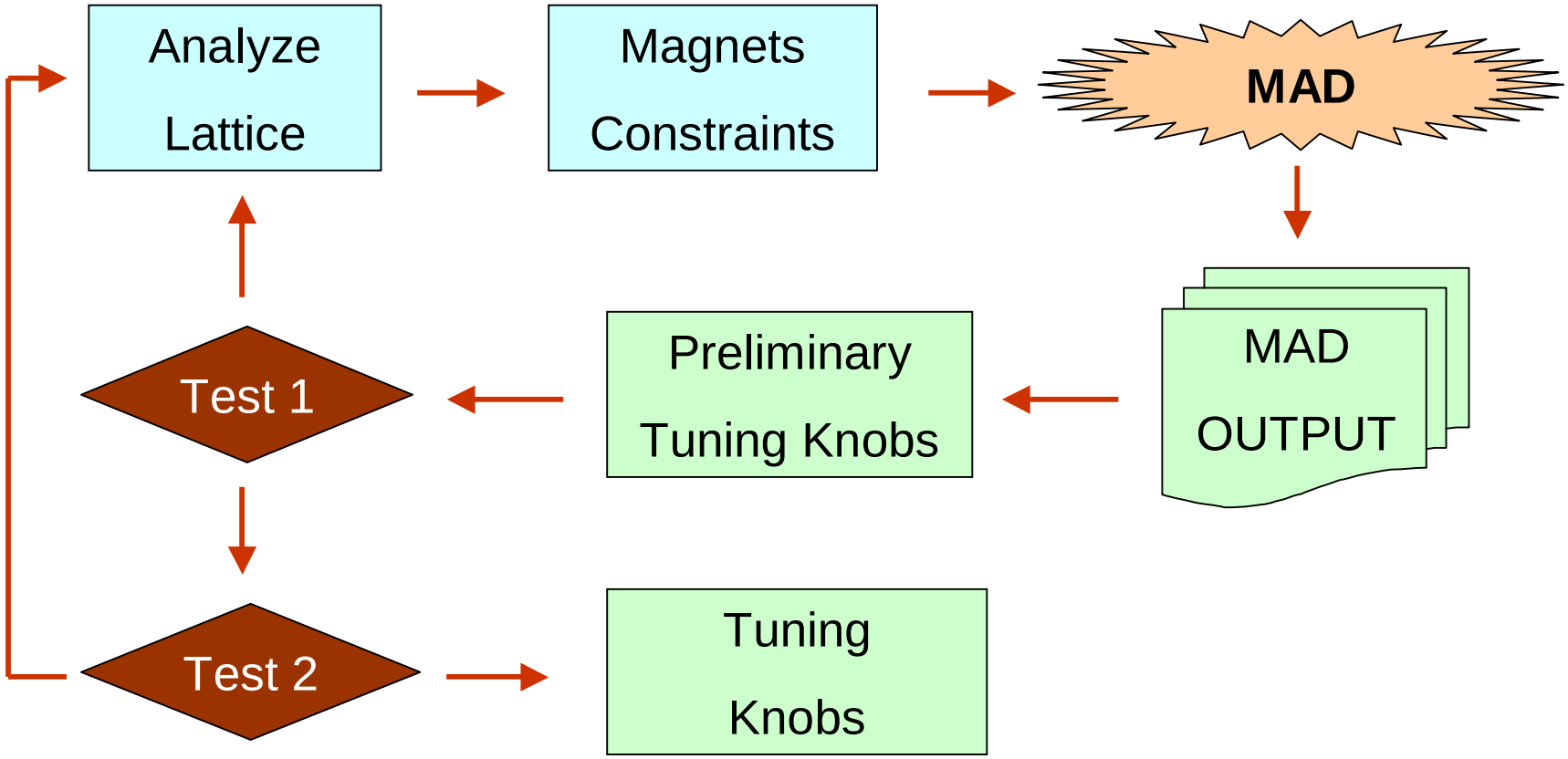
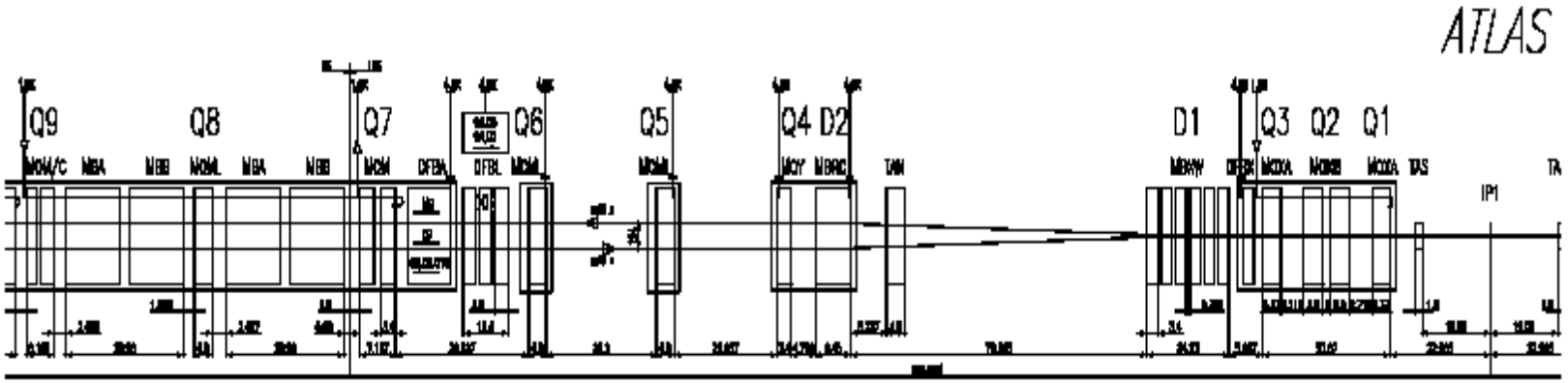
Calculating β* Tuning Knobs



LHC Insertion Layout V6.2



Tables of Lattice Analysis

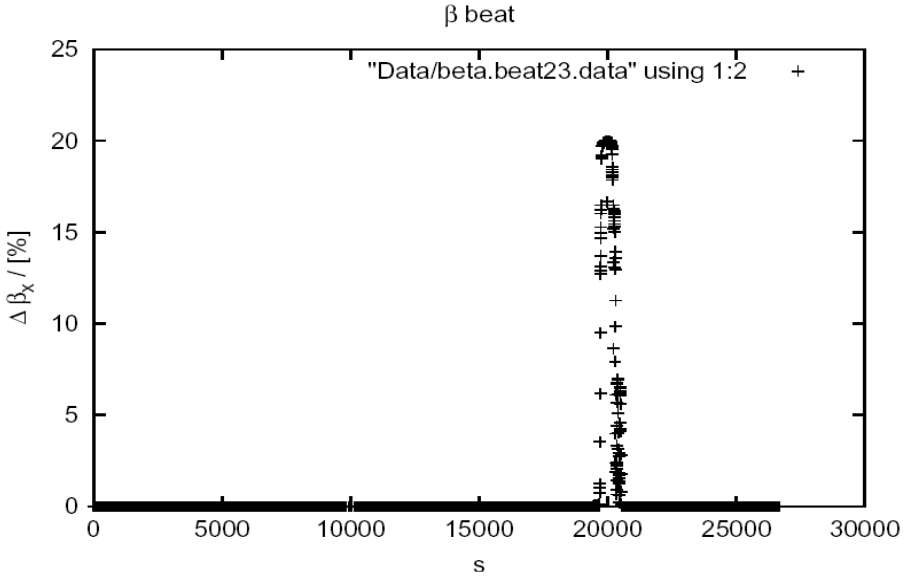
Relation of Beta Functions at IR1

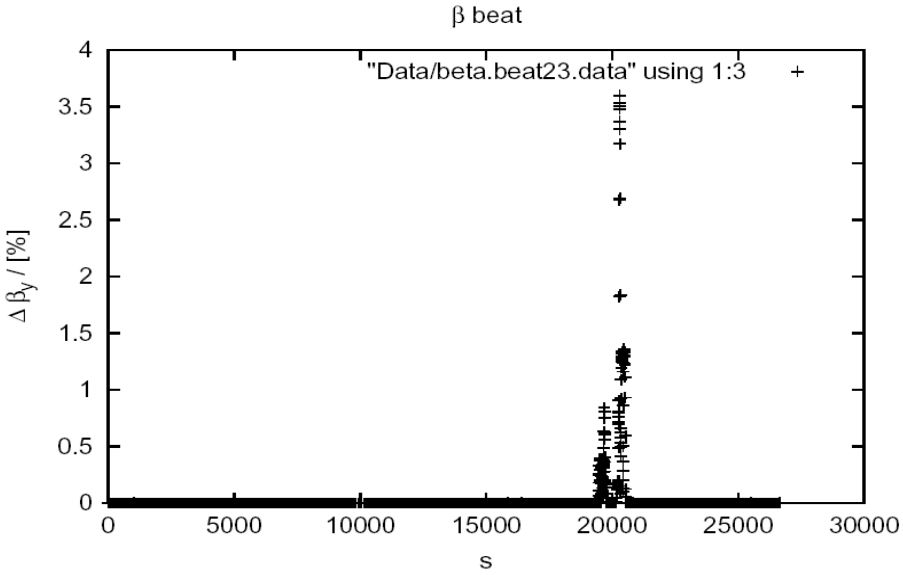
NAME	BETX	BETY	betx/bety	bety/betx
"KQ9.L1B1"	13.3884	163.777		12.2328
"KQ8.L1B1"	141.876	10.5264	13.4781	
"KQ7.L1B1"	76.4196	167.610		2.19329
"KQ6.L1B1"	515.796	6.69436	77.0493	
"KQ5.L1B1"	745.398	180.832	4.12205	
"KQ4.L1B1"	1648.63	363.751	4.5323	
"IP1"	0.500000	0.500000	1	
"KQ4.R1B1"	363.751	1648.63		4.5323
"KQ5.R1B1"	180.832	745.397		4.12204
"KQ6.R1B1"	6.69436	515.796		77.0493
"KQ7.R1B1"	167.927	76.2554	2.20217	
"KQ8.R1B1"	12.2194	133.042		10.8878
"KQ9.R1B1"	132.846	37.8208	3.51251	

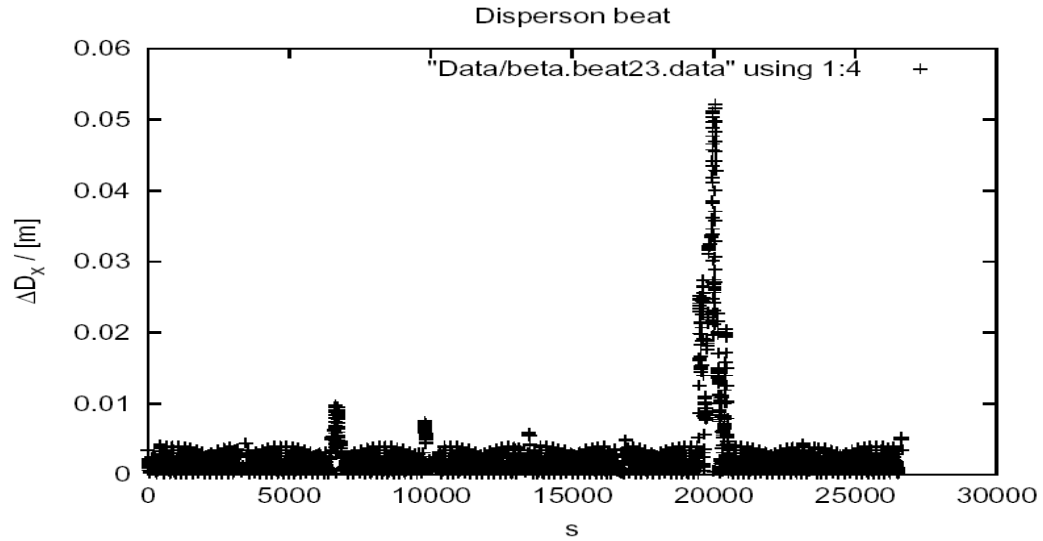
		dmux	dmuy
IP1	KQ9.L1B1	0.5370	1.0764
	KQ8.L1B1	0.3661	0.8894
	KQ7.L1B1	0.2996	0.7063
	KQ6.L1B1	0.2708	0.4787
	KQ5.L1B1	0.2623	0.2804
	KQ4.L1B1	0.2584	0.2637
	KQ4.R1B1	0.2637	0.2584
	KQ5.R1B1	0.2804	0.2623
	KQ6.R1B1	0.4787	0.2708
	KQ7.R1B1	0.7063	0.2996
	KQ8.R1B1	0.8654	0.3679
	KQ9.R1B1	1.0778	0.4723

		DeltaBetaX	DeltaBetaY
IP1	KQ9.L1B1	0.0005	0.0086
	KQ8.L1B1	0.0027	0.0006
	KQ7.L1B1	0.0009	0.0078
	KQ6.L1B1	0.0045	0.0002
	KQ5.L1B1	0.0059	0.0018
	KQ4.L1B1	0.0124	0.0029
	KQ4.R1B1	0.0029	0.0124
	KQ5.R1B1	0.0018	0.0059
	KQ6.R1B1	0.0002	0.0045
	KQ7.R1B1	0.0078	0.0009
	KQ8.R1B1	0.0006	0.0025
	KQ9.R1B1	0.0070	0.0011

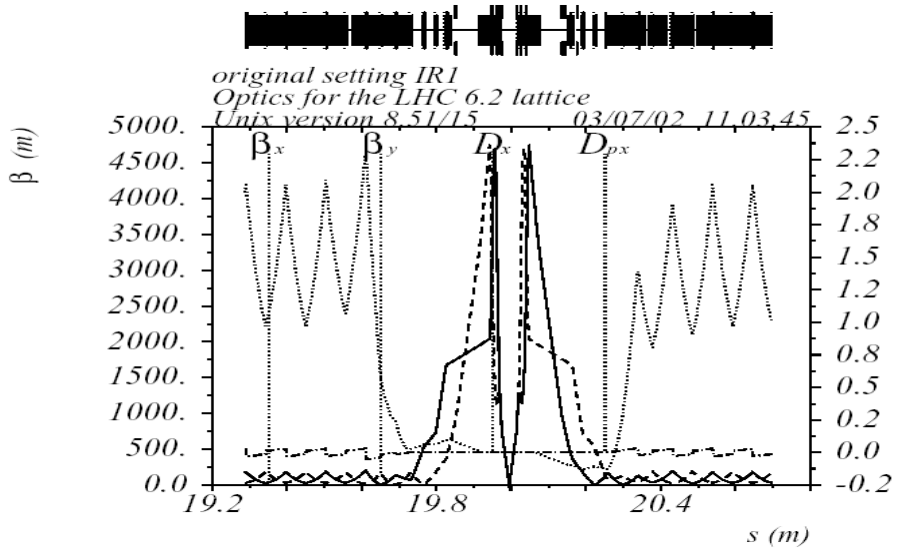
MAD 8 Output for Constraints 1

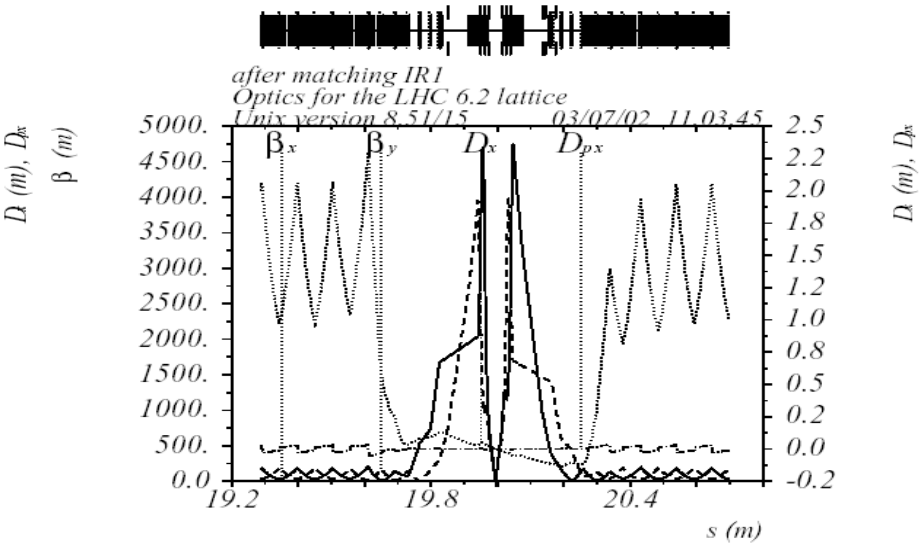






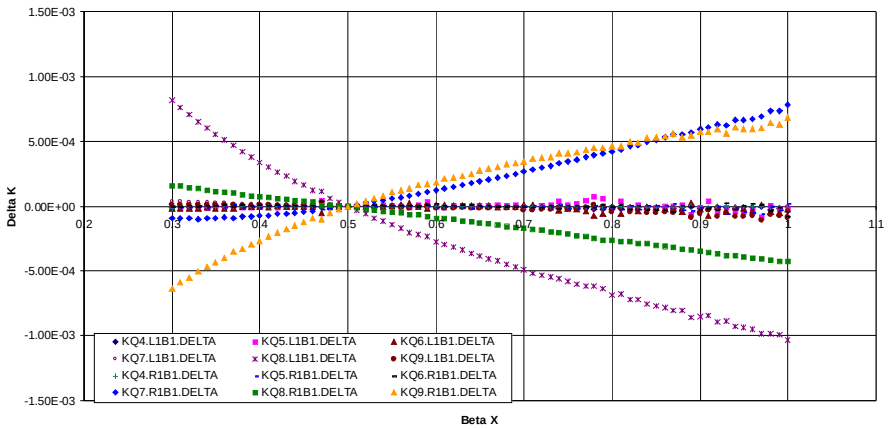
MAD 8 Output for Constraints 2



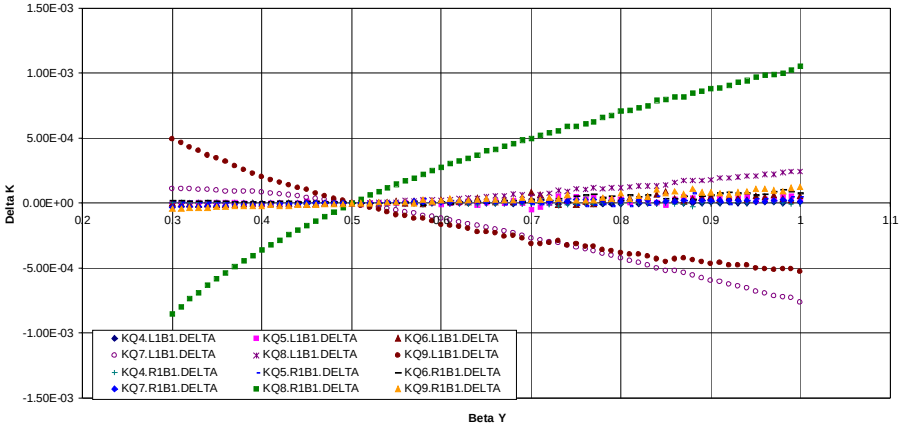


β* Tuning Knobs

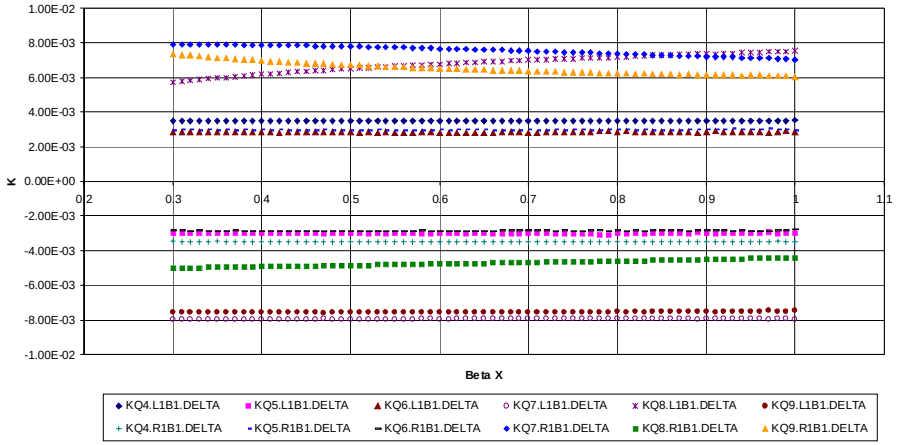
Linearity of the Quadrupoles of the Tuning Knob



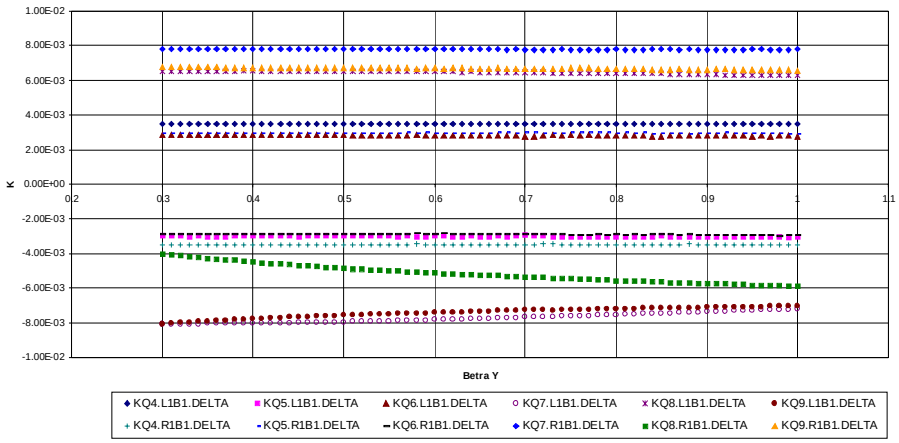
Linearity of the Quadrupoles of the Tuning Knob



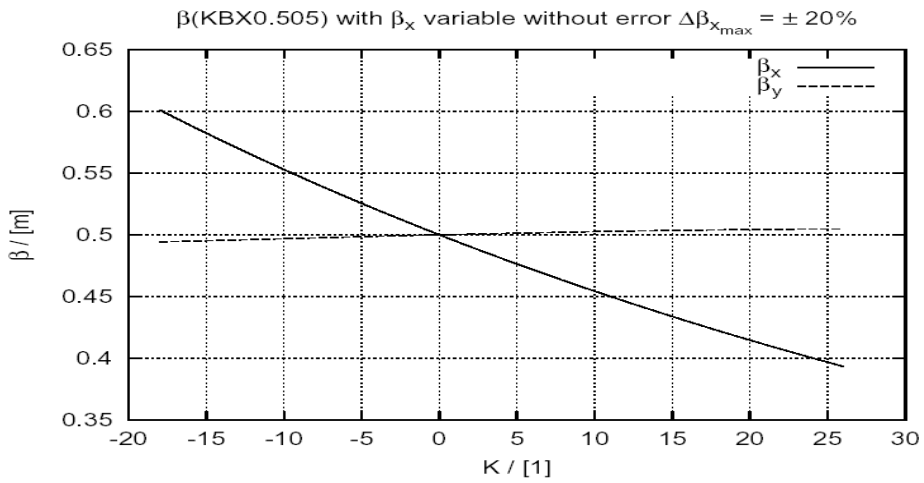
Linearity of the Quadrupoles of the Tuning Knob

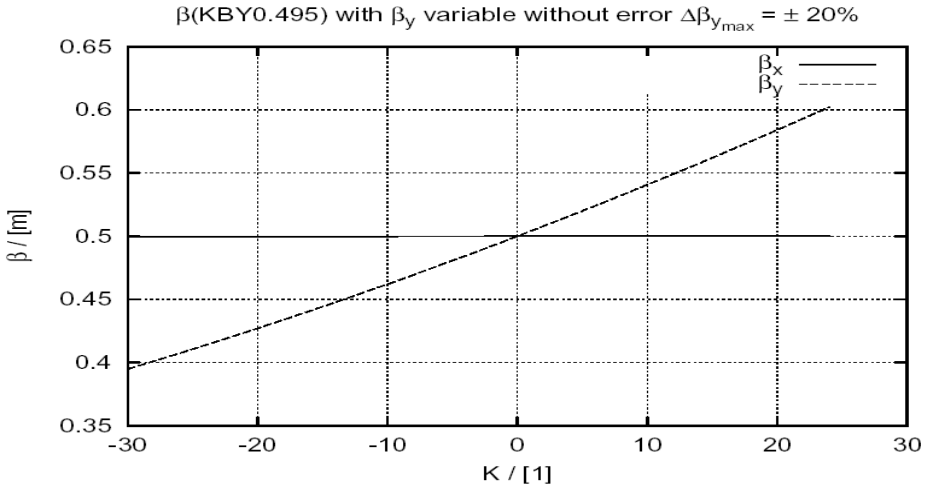


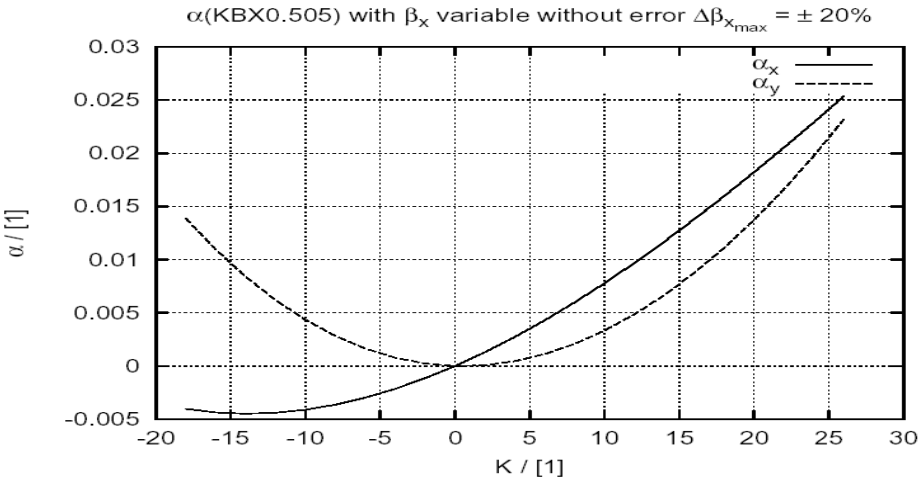
Linearity of the Quadrupoles of the Tuning Knob

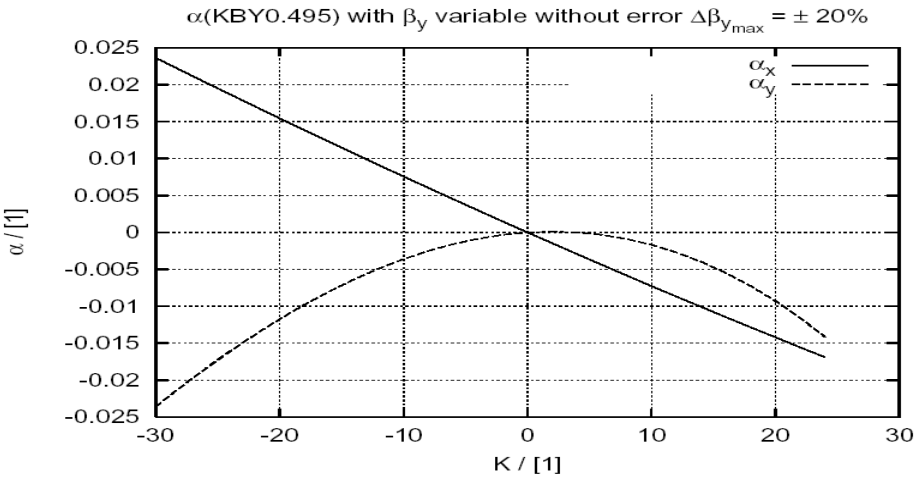


Chosen Tuning Knobs

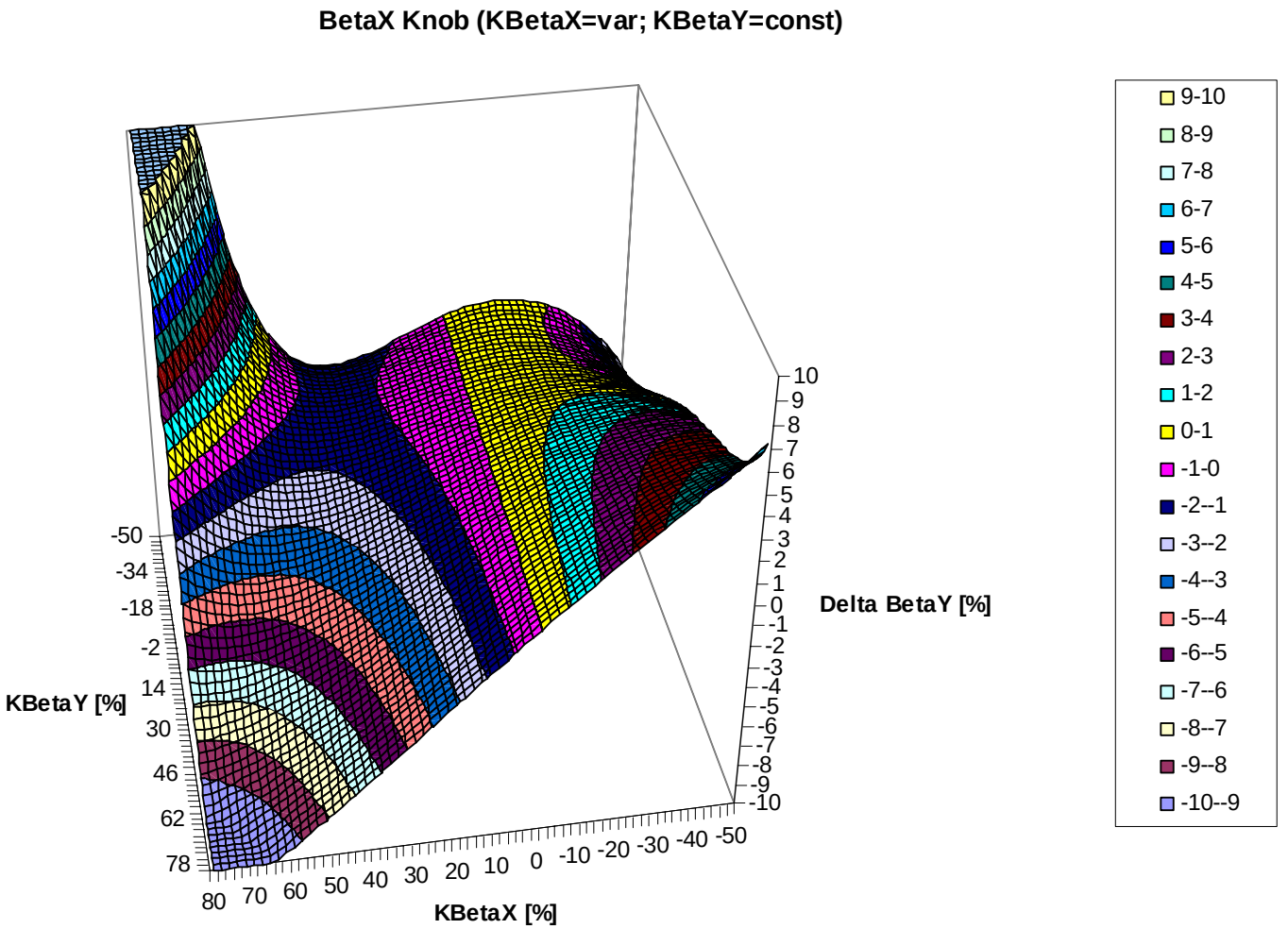




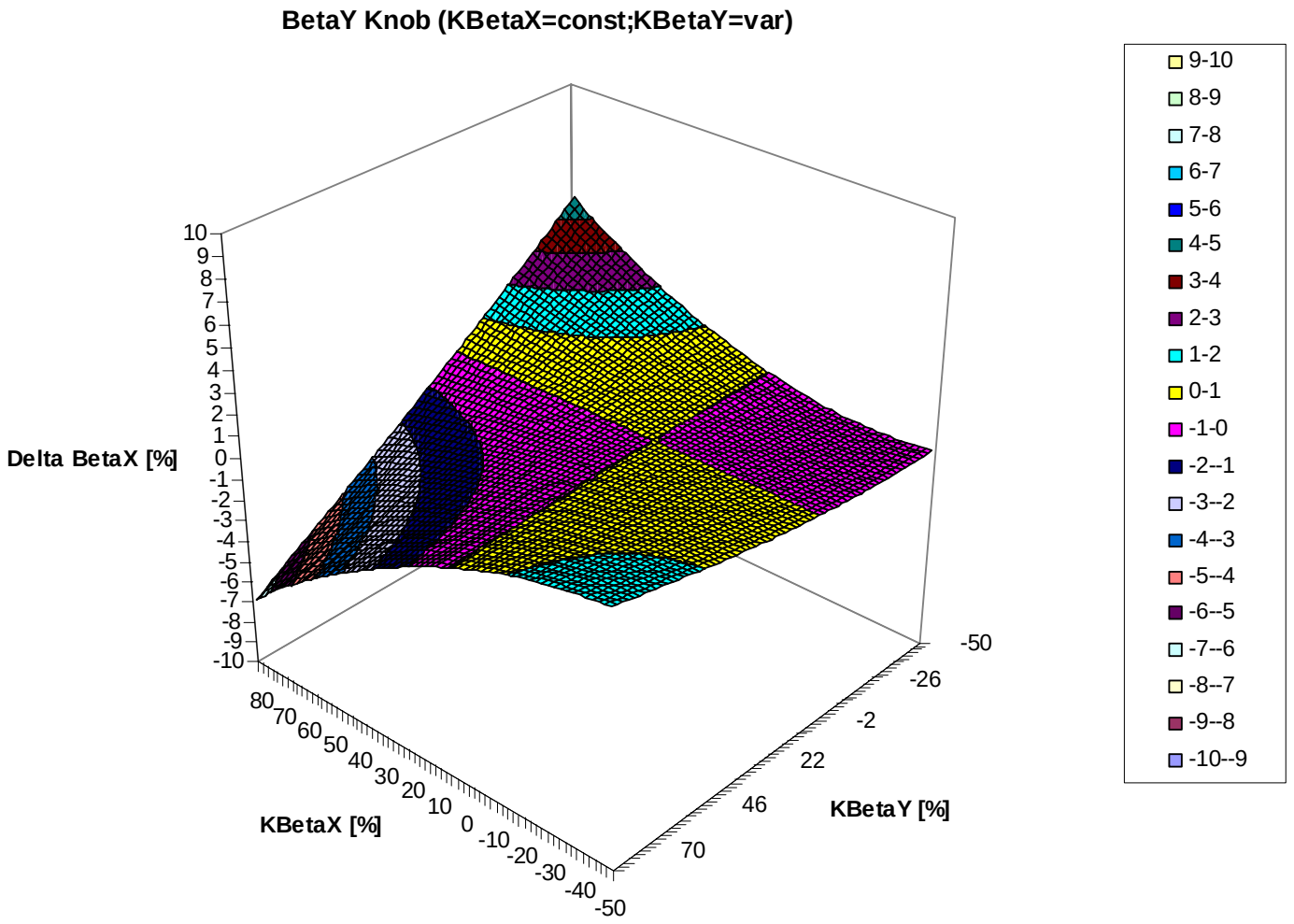




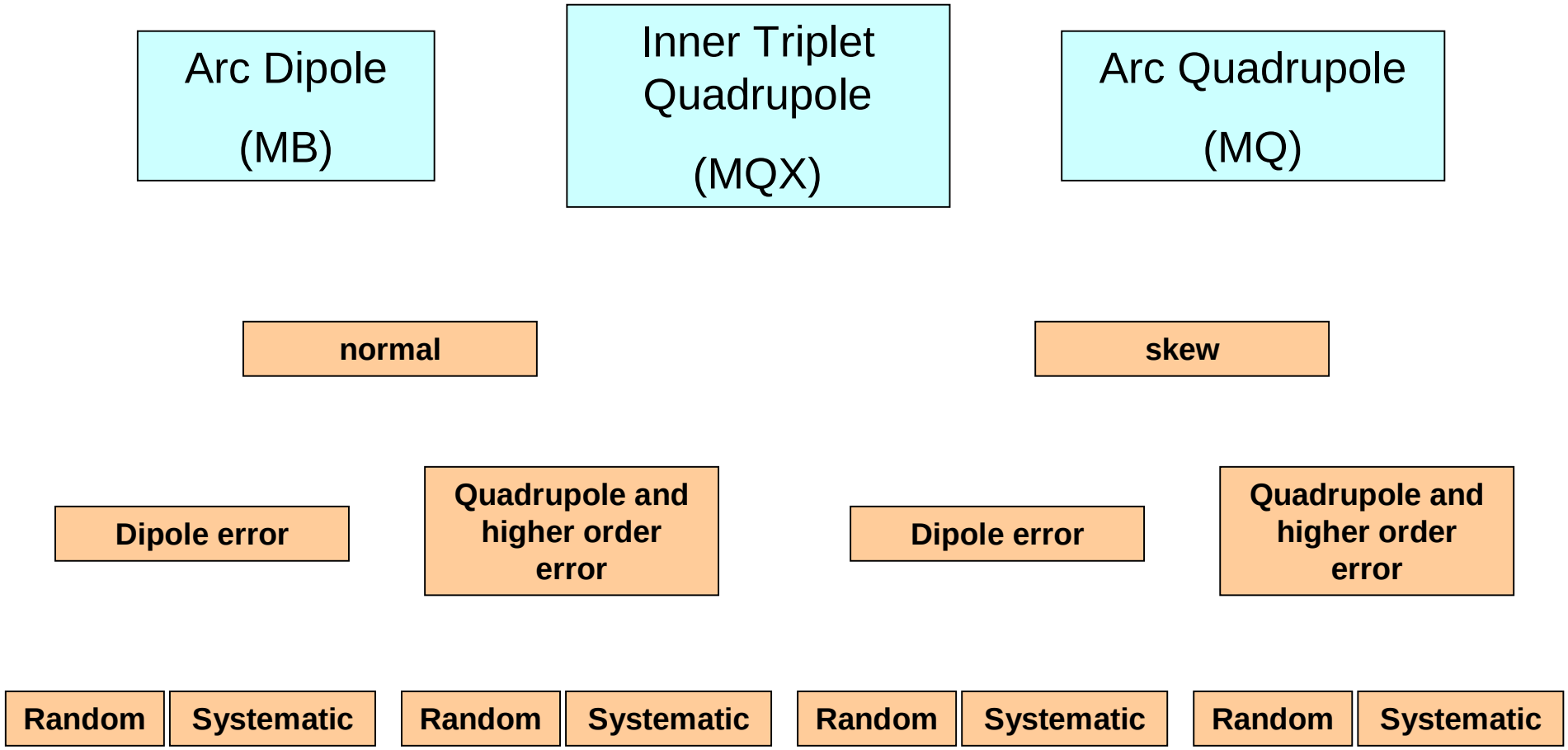
Orthogonality Beta X Knob



Orthogonality Beta Y Knob



Program to Test the Tuning Knobs



Results of the Tests

error_Seed_37	0.483086	0.475971	1.24827E-02	4.44374E-02	-3.57539E-03	-2.19802E-02	47.7352	44.3199
match_Seed_37	0.500000	0.500000	4.86636E-03	4.71446E-02	-2.96753E-03	-2.16084E-02	47.7398	44.3148
error_Seed_38	0.537327	0.475148	7.29927E-02	5.36437E-02	2.43888E-03	-1.26464E-02	47.7443	44.3139
match_Seed_38	0.500005	0.499999	7.02449E-02	6.07947E-02	2.06567E-03	-1.55468E-02	47.7386	44.3110
error_Seed_39	0.525497	0.529842	-2.97024E-02	5.50231E-02	3.26287E-03	1.19421E-02	47.7269	44.3282
match_Seed_39	0.500003	0.499999	-2.30105E-02	5.64220E-02	2.05075E-03	1.19565E-02	47.7210	44.3337
error_Seed_40	0.488429	0.464007	-6.21102E-03	3.50432E-02	8.51396E-03	-1.29865E-02	47.7174	44.3296
match_Seed_40	0.500001	0.500001	-1.50367E-02	4.05880E-02	9.27734E-03	-1.35840E-02	47.7216	44.3227
error_Seed_41	0.514641	0.483528	-2.51665E-02	-6.05815E-02	1.36745E-03	3.11343E-02	47.7507	44.3204
match_Seed_41	0.500000	0.500000	-2.69000E-02	-5.88593E-02	1.22361E-03	3.07676E-02	47.7489	44.3177
error_Seed_42	0.520761	0.512952	3.58783E-02	1.75836E-02	-1.01498E-02	-3.02019E-04	47.7093	44.3282
match_Seed_42	0.500000	0.500000	3.97838E-02	1.77819E-02	-1.06668E-02	-9.95388E-04	47.7047	44.3313
error_Seed_43	0.511043	0.501890	-8.67306E-02	-5.94347E-02	1.23372E-03	3.56238E-02	47.7377	44.3239
match_Seed_43	0.500161	0.499976	-8.49449E-02	-5.97096E-02	9.35081E-04	3.56753E-02	47.7357	44.3248
error_Seed_44	0.508243	0.494054	-6.67744E-02	1.41421E-02	-5.83538E-03	-5.96087E-02	47.7705	44.2921
match_Seed_44	0.500104	0.500042	-6.67778E-02	1.45424E-02	-5.76362E-03	-6.07862E-02	47.7693	44.2913
error_Seed_45	0.493877	0.472726	3.27786E-02	-1.72740E-02	1.65976E-03	-6.31936E-03	47.7324	44.3319
match_Seed_45	0.500000	0.500000	2.61858E-02	-1.38220E-02	2.27600E-03	-6.71732E-03	47.7351	44.3265
error_Seed_46	0.583301	0.513858	9.81528E-02	-6.39298E-02	5.14403E-03	-6.77358E-02	47.7119	44.3385
match_Seed_46	0.500083	0.499983	9.36121E-02	-5.90336E-02	5.93345E-03	-6.82692E-02	47.6972	44.3439
error_Seed_47	0.468359	0.480720	-9.16252E-03	8.10634E-02	3.61927E-03	1.29581E-02	47.7017	44.3512
match_Seed_47	0.500005	0.499998	-2.00530E-02	8.34137E-02	4.51489E-03	1.31535E-02	47.7090	44.3467
error_Seed_48	0.490343	0.487403	-1.87227E-02	1.27330E-02	3.15531E-03	1.68393E-02	47.7282	44.3404
match_Seed_48	0.500120	0.500102	-2.27576E-02	1.36882E-02	3.69374E-03	1.65578E-02	47.7307	44.3379
error_Seed_49	0.493882	0.498854	4.84646E-02	-8.30475E-04	6.42687E-03	1.40254E-03	47.7390	44.2996
match_Seed_49	0.500060	0.499992	4.75017E-02	-5.57269E-04	6.72290E-03	1.64612E-03	47.7403	44.2990
error_Seed_50	0.513090	0.507624	2.33327E-02	-5.43616E-02	2.91525E-03	-6.27017E-03	47.7358	44.3037
match_Seed_50	0.500223	0.499992	2.60232E-02	-5.46683E-02	2.37783E-03	-6.73184E-03	47.7330	44.3060
error_Seed_51	0.550209	0.489853	1.63542E-02	1.28926E-02	1.77324E-02	-4.85020E-02	47.7117	44.3476
match_Seed_51	0.500018	0.499998	1.57237E-02	1.75696E-02	1.70095E-02	-5.25868E-02	47.7034	44.3477

Graz University of Technology
Erzherzog-Johann-University

Next Steps

- **Finish the Test Run**
- **Rerun with MAD X**
- **Setup a Model**
- **Implement the Results into LHC**