Nonlinear chromaticity correction based on off-momentum tune respose matrix

(*Session: May 22-23, 2007*)

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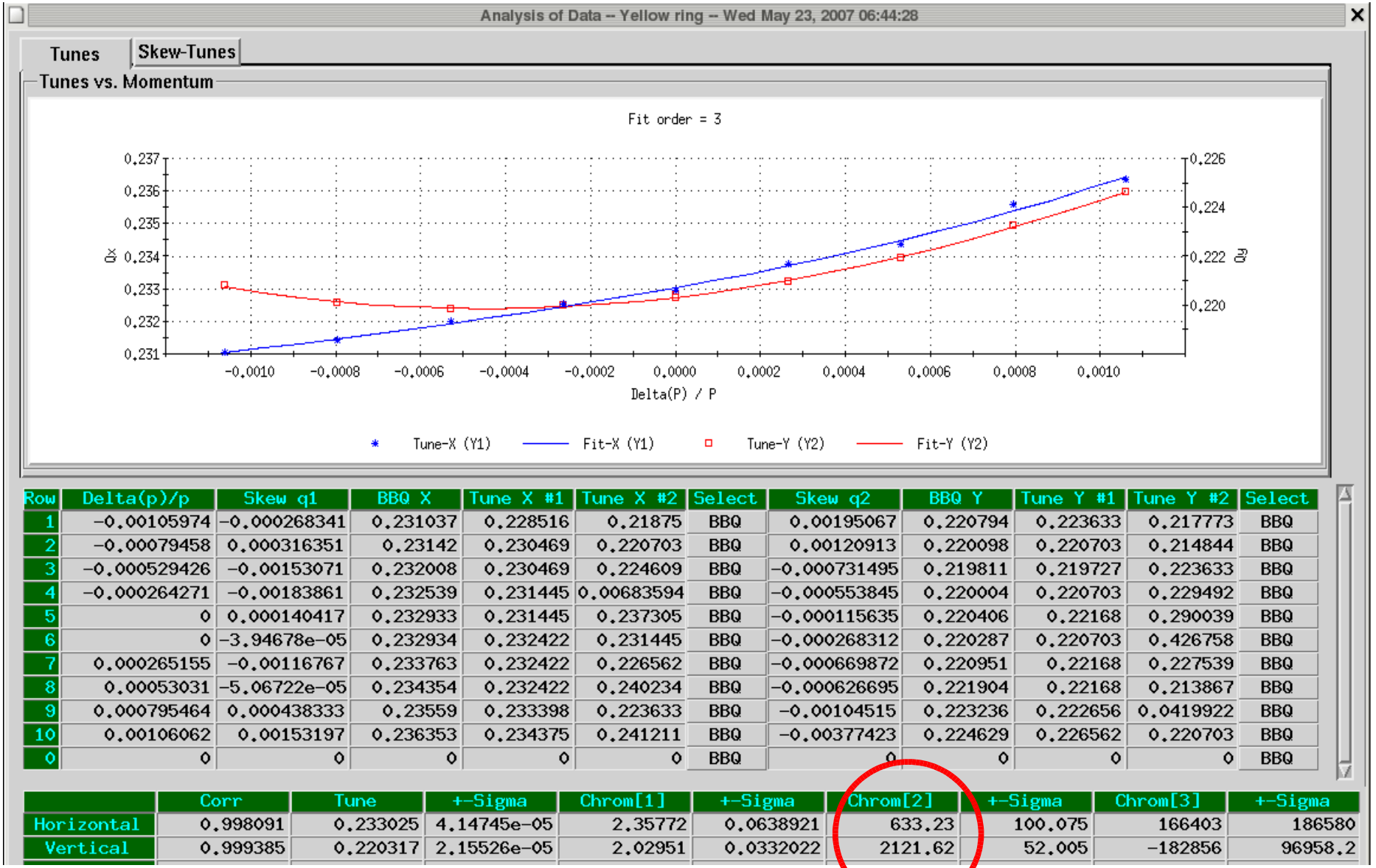
1. The story
2. The plan

Beam test 1 : nonlinear chromaticity correction with RM



Row	Delta(p)/p	Skew q1	BBQ X	Tune X #1	Tune X #2	Select	Skew q2	BBQ Y	Tune Y #1	Tune Y #2	Select
1	-0.00105974	-0.000268341	0.231037	0.228516	0.21875	BBQ	0.00195067	0.220794	0.223633	0.217773	BBQ
2	-0.00079458	0.000316351	0.23142	0.230469	0.220703	BBQ	0.00120913	0.220098	0.220703	0.214844	BBQ
3	-0.000529426	-0.00153071	0.232008	0.230469	0.224609	BBQ	-0.000731495	0.219811	0.219727	0.223633	BBQ
4	-0.000264271	-0.00183861	0.232539	0.231445	0.00683594	BBQ	-0.000553845	0.220004	0.220703	0.229492	BBQ
5	0	0.000140417	0.232933	0.231445	0.237305	BBQ	-0.000115635	0.220406	0.22168	0.290039	BBQ
6	0	-3.94678e-05	0.232934	0.232422	0.231445	BBQ	-0.000268312	0.220287	0.220703	0.426758	BBQ
7	0.000265155	-0.00116767	0.233763	0.232422	0.226562	BBQ	-0.000669872	0.220951	0.22168	0.227539	BBQ
8	0.00053031	-5.06722e-05	0.234354	0.232422	0.240234	BBQ	-0.000626695	0.221904	0.22168	0.213867	BBQ
9	0.000795464	0.000438333	0.23559	0.233398	0.223633	BBQ	-0.00104515	0.223236	0.222656	0.0419922	BBQ
10	0.00106062	0.00153197	0.236353	0.234375	0.241211	BBQ	-0.00377423	0.224629	0.226562	0.220703	BBQ
0	0	0	0	0	0	BBQ	0	0	0	0	BBQ

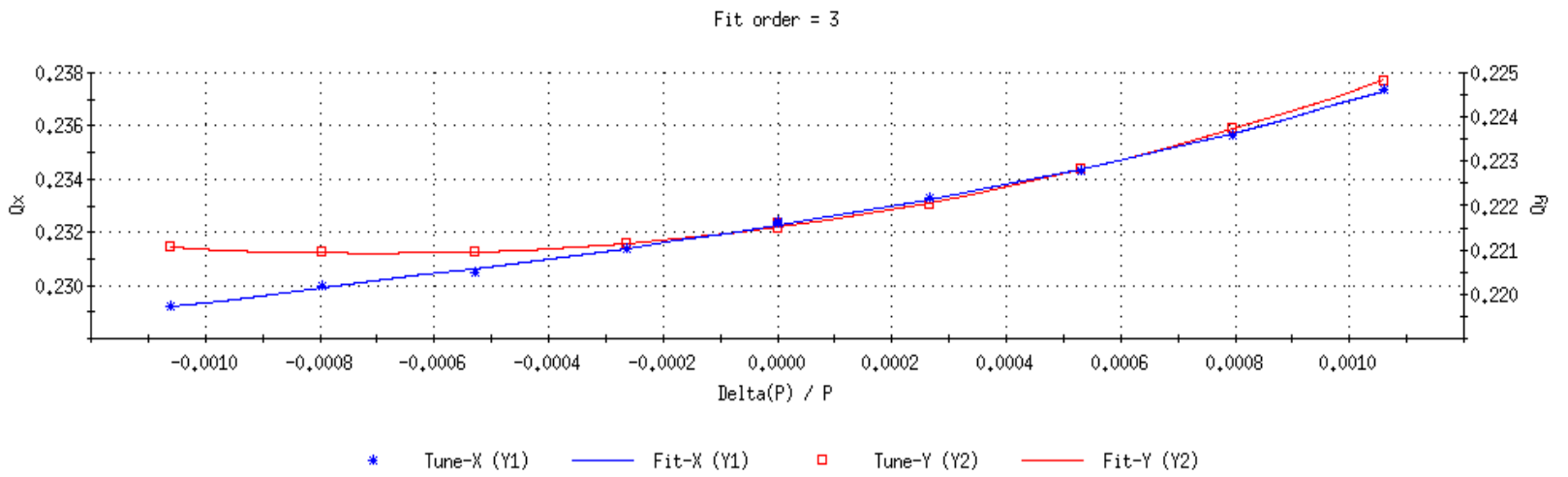
	Corr	Tune	+-Sigma	Chrom[1]	+-Sigma	Chrom[2]	+-Sigma	Chrom[3]	+-Sigma
Horizontal	0.998091	0.233025	4.14745e-05	2.35772	0.0638921	633.23	100.075	166403	186580
Vertical	0.999385	0.220317	2.15526e-05	2.02951	0.0332022	2121.62	52.005	-182856	96958.2

before correction

Analysis of Data -- Yellow ring -- Wed May 23, 2007 07:07:04

Tunes | Skew-Tunes

Tunes vs. Momentum



Row	Delta(p)/p	Skew q1	BBQ X	Tune X #1	Tune X #2	Select	Skew q2	BBQ Y	Tune Y #1	Tune Y #2	Select
1	-0.00105974	-0.00427558	0.229199	0.224609	0.216797	BBQ	0.00602324	0.221061	0.222656	0.140625	BBQ
2	-0.00079458	-0.00539092	0.229975	0.226562	0.00683594	BBQ	0.00350799	0.220944	0.220703	0.226562	BBQ
3	-0.000529426	-0.00384192	0.230454	0.227539	0.00488281	BBQ	0.00113463	0.220946	0.220703	0.226562	BBQ
4	-0.000264271	0.000211548	0.231395	0.229492	0.00488281	BBQ	-0.000360105	0.221148	0.223633	0.210938	BBQ
5	0	2.71898e-05	0.232335	0.229492	0.258789	BBQ	-0.000710019	0.221615	0.22168	0.0429688	BBQ
6	0	-0.000529715	0.232374	0.229492	0.222656	BBQ	8.52102e-07	0.22148	0.22168	0.214844	BBQ
7	0.000265155	0.000202491	0.233263	0.231445	0.22168	BBQ	-0.00205034	0.222008	0.222656	0.264648	BBQ
8	0.00053031	0.00129212	0.234329	0.231445	0.22168	BBQ	-0.00221633	0.222825	0.222656	0.0859375	BBQ
9	0.000795464	0.000569297	0.235631	0.232422	0.239258	BBQ	-0.00253183	0.223739	0.224609	0.231445	BBQ
10	0.00106062	-0.00108404	0.23739	0.234375	0.225586	BBQ	-0.000933421	0.224826	0.225586	0.21582	BBQ
0	0	0	0	0	0	BBQ	0	0	0	0	BBQ

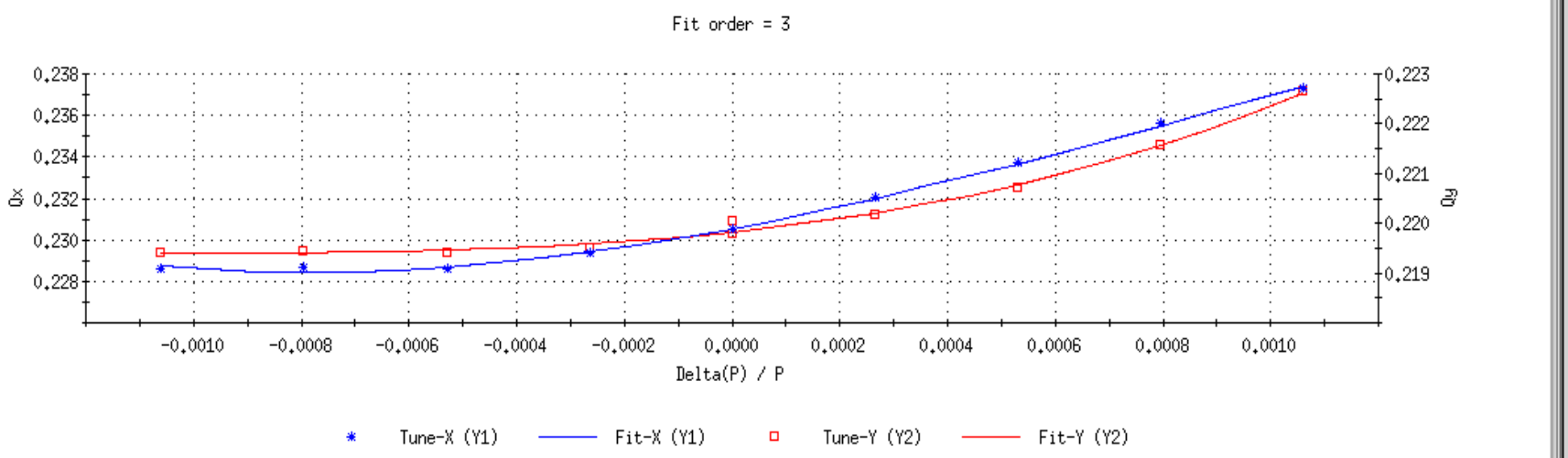
	Corr	Tune	+-Sigma	Chrom[1]	+-Sigma	Chrom[2]	+-Sigma	Chrom[3]	+-Sigma
Horizontal	0.999383	0.232261	3.5188e-05	3.43718	0.0542077	882.05	84.9061	355245	158299
Vertical	0.999513	0.221524	1.60757e-05	1.7274	0.0247648	1268.87	38.7894	43858.4	72319.1

after first correction

Analysis of Data -- Yellow ring -- Wed May 23, 2007 07:20:00

Tunes | Skew-Tunes

Tunes vs. Momentum



Row	Delta(p)/p	Skew q1	BBQ X	Tune X #1	Tune X #2	Select	Skew q2	BBQ Y	Tune Y #1	Tune Y #2	Select
1	-0.00105974	-0.0052083	0.228637	0.224609	0.21875	BBQ	0.00720655	0.21939	0.219727	0.225586	BBQ
2	-0.00079458	-0.00547199	0.22864	0.224609	0.21875	BBQ	0.00694818	0.219446	0.219727	0.225586	BBQ
3	-0.000529426	-0.00567616	0.228614	0.225586	0.219727	BBQ	0.00599755	0.219408	0.220703	0.226562	BBQ
4	-0.000264271	-0.00212847	0.229399	0.226562	0.220703	BBQ	0.000337203	0.219507	0.220703	0.246094	BBQ
5	0	-0.000330608	0.230495	0.226562	0.219727	BBQ	-0.000311599	0.220041	0.220703	0.300781	BBQ
6	0	-0.00246002	0.23048	0.226562	0.220703	BBQ	3.8454e-05	0.219794	0.220703	0.477539	BBQ
7	0.000265155	-0.00179498	0.232023	0.228516	0.219727	BBQ	-0.000257306	0.220177	0.220703	0.230469	BBQ
8	0.00053031	-0.00708213	0.233687	0.228516	0.22168	BBQ	0.00279013	0.220708	0.22168	0.21582	BBQ
9	0.000795464	-0.00313724	0.235616	0.230469	0.237305	BBQ	0.00106286	0.22157	0.222656	0.231445	BBQ
10	0.00106062	-0.000842776	0.237332	0.232422	0.22168	BBQ	-0.000589444	0.222637	0.223633	0.210938	BBQ
0	0	0	0	0	0	BBQ	0	0	0	0	BBQ

	Corr	Tune	+-Sigma	Chrom[1]	+-Sigma	Chrom[2]	+-Sigma	Chrom[3]	+-Sigma
Horizontal	0.999511	0.230545	3.77057e-05	4.93103	0.0580862	2245.39	90.9812	-755745	169626
Vertical	0.996922	0.219825	3.28744e-05	1.13581	0.0506436	1048.4	79.3237	345602	147891

after second correction

Trim settings during the corrections

	Original	First corr.	Second corr.
y-sxd-ip	0.00587	0.02248	0.03870
y-sxf-ip	-0.02281	0.09775	0.20209
y-sxd-im	0.00587	-0.00817	-0.00976
y-sxf-im	-0.02281	-0.09776	-0.16972
y-sxf-om	-0.02281	-0.05585	-0.09282
y-sxd-op	0.00587	0.19623	0.31467
y-sxf-op	-0.02281	-0.02395	-0.02550
y-sxd-om	0.00587	-0.22192	-0.35315

From simulation:

Knobbing (SDMO+ SDPO-) will largely change Q''y, slightly Q''x

Knobbing (SFMI+ SFPI-) will largely change Q''x, no effect on Q''y

Suspect:

pair (SFMI , SFPI) swapped in the simulation code ?
or even in the real machine ?

Beam Test 2: using 8 families to replace 2 families

Demonstrated in session April 24, 2007,
==> (Q"x, Q"y) = (399, 290)

In this session:
==> (Q"x, Q"y)= (1097, 793)

Don't know why this idea didn't work well in this session.
Maybe the offline Q" matching didn't converge well.

The plan

- Request 2hrs to **CLOSE** this beam experiment

(please consider the fact that we lose 2.0hrs in May 16 session because of too fast sextupole ramping.)

- To-do list:

1) knobing sextupole pairs to correct Q''x,y and compare with model predication. (30min.)

2) Test the idea again: using 8 families to replace 2 families (30 min.)

3) Test correction based on Blue b2 measurement (20 min.)