Status of RHIC Models and Ramping System

2008 APEX Workshop - Studies in RHIC for higher PP luminosity

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Many thanks to K. Brown, T. D'Ottavio, Y. Luo, N. Malitsky, T. Satogata, S. Tepikian

Outline

- I – Update plans: non-linear chromaticity correction
- II - Proposed changes
- III - Other models – Plans for PTC
- IV - Updates on RHIC Ramping system

I - Update plans: non-linear chromaticity correction

- Major update for the coming run: upgrade the non-linear (2nd and 3rd order) chromaticity correction module.

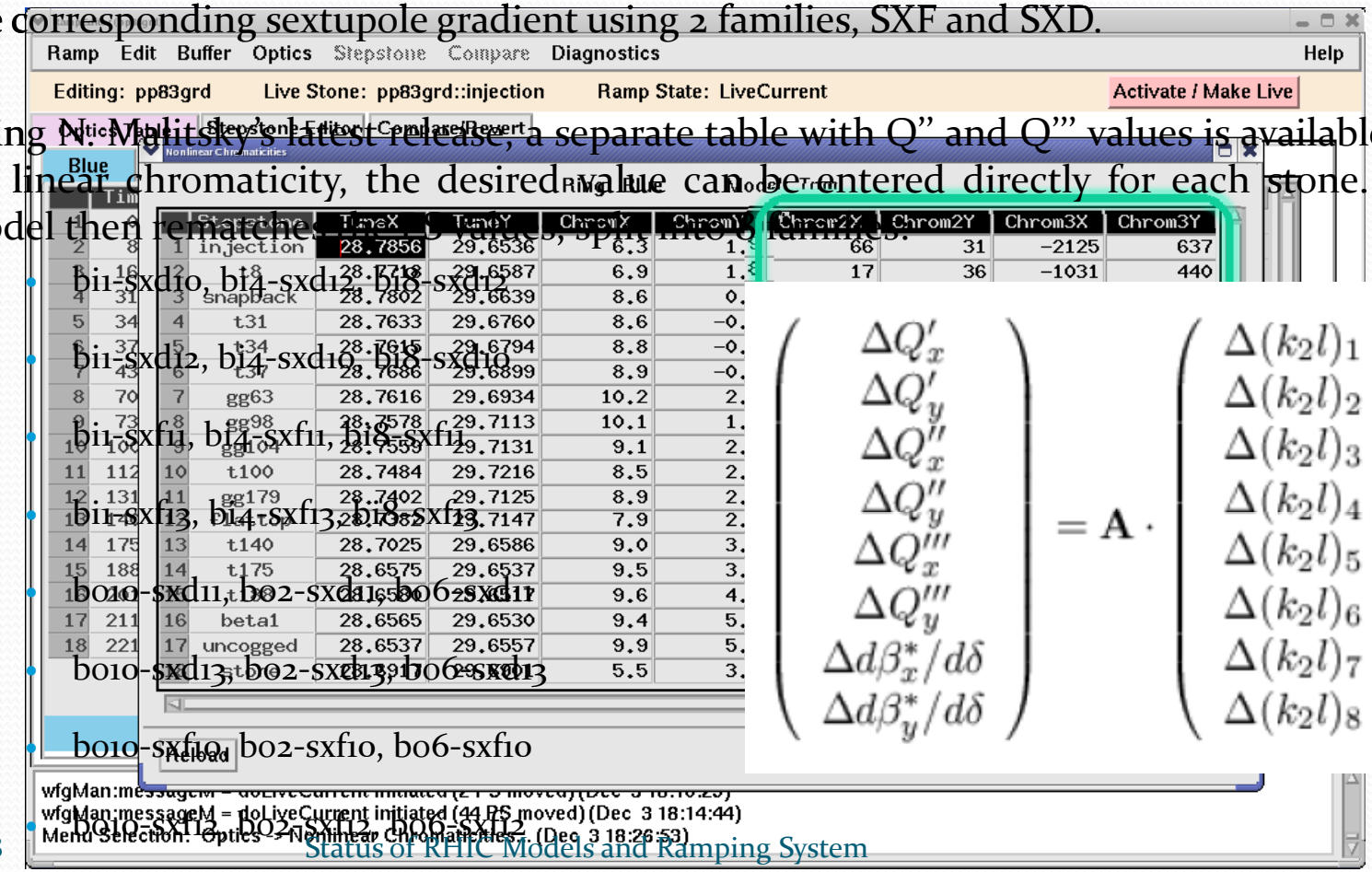
- <u>Current model:</u> calculation of Q'' and Q''' is based on HARMON and corresponds to a sequence of integrals on the linear terms. Preliminary checks show a nice agreement between model calculations and live measurements.

- The correction module (optimizer) uses a χ^2 (LMDIF) method on the requested value of Q', Q'' and Q'''. The iterations are done over the PS currents, while RampManager uses magnets strengths: OptiCalc (model) does the conversion.

- Tune and chromaticity corrections are decoupled; linear and non-linear chromaticity optimizations use the same sextupole family distribution.

Correction methods in latest release

- From RampManager, one can change ChromX and ChromY; the model then calculates the corresponding sextupole gradient using 2 families, SXF and SXD.
- Using N. Malitsky's latest release, a separate table with Q'' and Q''' values is available. As for linear chromaticity, the desired value can be entered directly for each stone. The model then rematches the values, split into 8 families:
  - bi1-sxd10, bi4-sxd12, bi8-sxd12
  - bi1-sxd12, bi4-sxd10, bi8-sxd10
  - bi1-sxf11, bi4-sxf11, bi8-sxf11
  - bi1-sxf13, bi4-sxf13, bi8-sxf13
  - b010-sxd11, b02-sxd11, b06-sxd11
  - b010-sxd13, b02-sxd13, b06-sxd13
  - b010-sxf10, b02-sxf10, b06-sxf10
  - b010-sxf12, b02-sxf12, b06-sxf12



$$\begin{pmatrix} \Delta Q'_x \\ \Delta Q'_y \\ \Delta Q''_x \\ \Delta Q''_y \\ \Delta Q'''_x \\ \Delta Q'''_y \\ \Delta d\beta^*_x/d\delta \\ \Delta d\beta^*_y/d\delta \end{pmatrix} = \mathbf{A} \cdot \begin{pmatrix} \Delta(k_2 l)_1 \\ \Delta(k_2 l)_2 \\ \Delta(k_2 l)_3 \\ \Delta(k_2 l)_4 \\ \Delta(k_2 l)_5 \\ \Delta(k_2 l)_6 \\ \Delta(k_2 l)_7 \\ \Delta(k_2 l)_8 \end{pmatrix}$$

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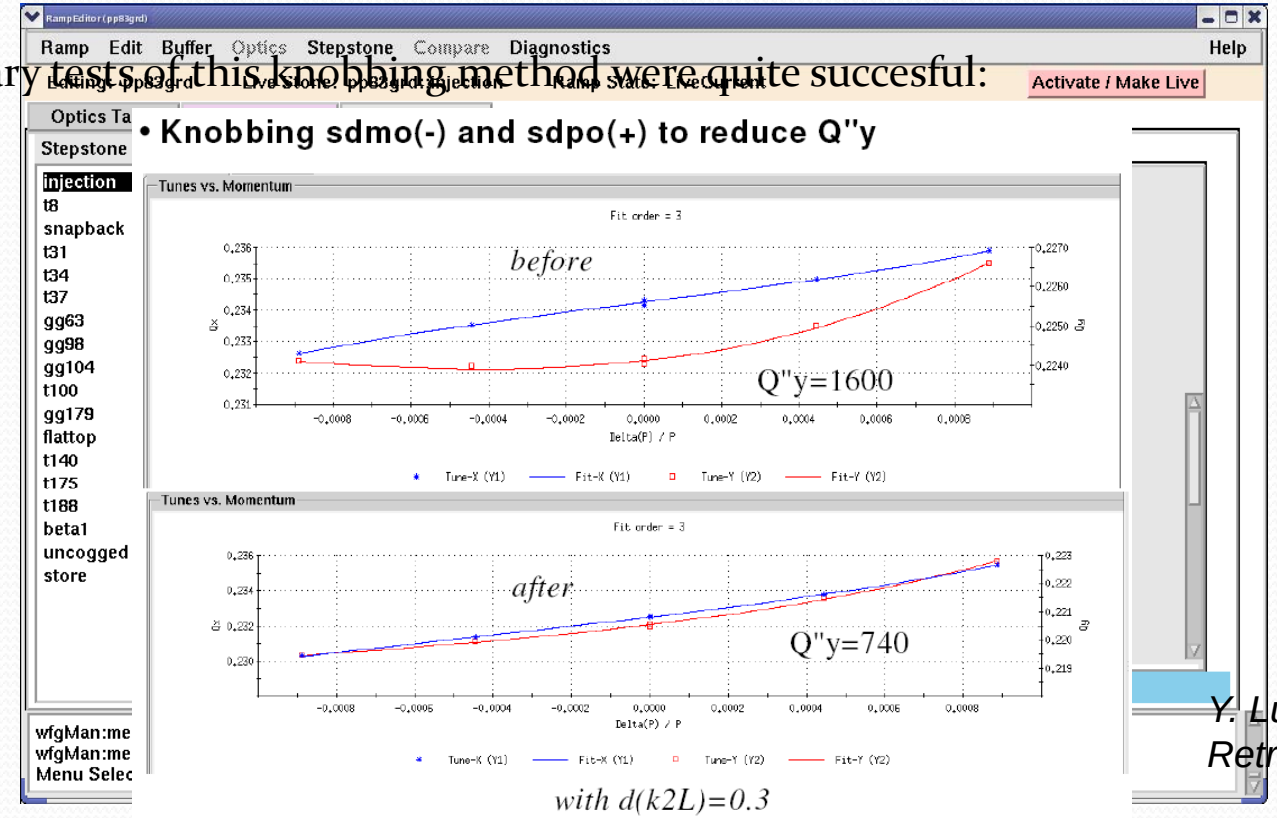
II – Proposed changes

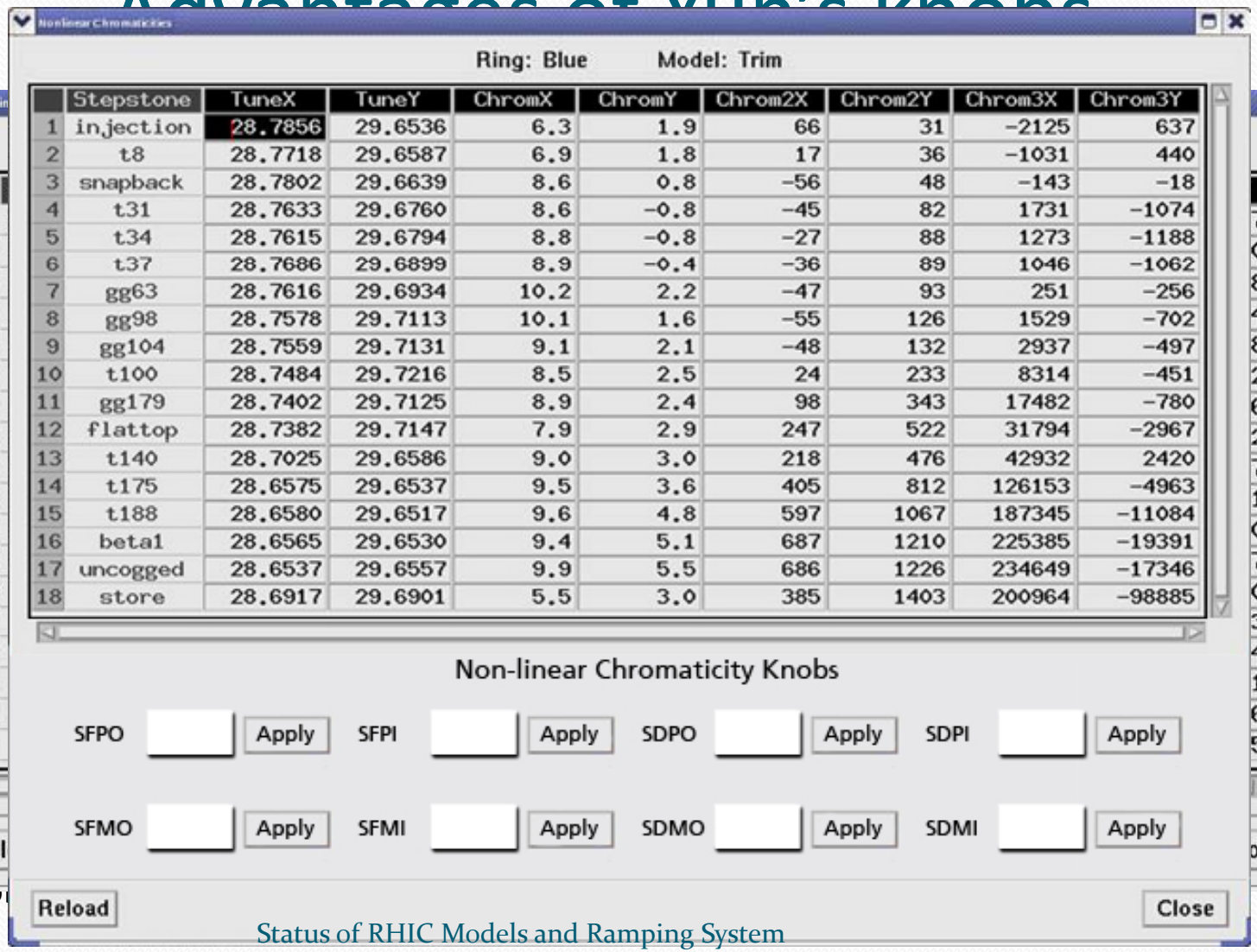
- During Run7 APEX, Y. Luo tried another response matrix solution based on a different set of 8 sextupole families: SFPO, SFMO, SFPI, SFMI, SDPO, SDMO, SDPI, SDMI.
- Preliminary tests of this knobbing method were quite succesful:



with d(k2L)=0.3

Y. Luo, RHIC Retreat 2007

Advantages of Yun's knobs



	Stepstone	TuneX	TuneY	ChromX	ChromY	Chrom2X	Chrom2Y	Chrom3X	Chrom3Y
1	injection	28.7856	29.6536	6.3	1.9	66	31	-2125	637
2	t8	28.7718	29.6587	6.9	1.8	17	36	-1031	440
3	snapback	28.7802	29.6639	8.6	0.8	-56	48	-143	-18
4	t31	28.7633	29.6760	8.6	-0.8	-45	82	1731	-1074
5	t34	28.7615	29.6794	8.8	-0.8	-27	88	1273	-1188
6	t37	28.7686	29.6899	8.9	-0.4	-36	89	1046	-1062
7	gg63	28.7616	29.6934	10.2	2.2	-47	93	251	-256
8	gg98	28.7578	29.7113	10.1	1.6	-55	126	1529	-702
9	gg104	28.7559	29.7131	9.1	2.1	-48	132	2937	-497
10	t100	28.7484	29.7216	8.5	2.5	24	233	8314	-451
11	gg179	28.7402	29.7125	8.9	2.4	98	343	17482	-780
12	flattop	28.7382	29.7147	7.9	2.9	247	522	31794	-2967
13	t140	28.7025	29.6586	9.0	3.0	218	476	42932	2420
14	t175	28.6575	29.6537	9.5	3.6	405	812	126153	-4963
15	t188	28.6580	29.6517	9.6	4.8	597	1067	187345	-11084
16	beta1	28.6565	29.6530	9.4	5.1	687	1210	225385	-19391
17	uncogged	28.6537	29.6557	9.9	5.5	686	1226	234649	-17346
18	store	28.6917	29.6901	5.5	3.0	385	1403	200964	-98885

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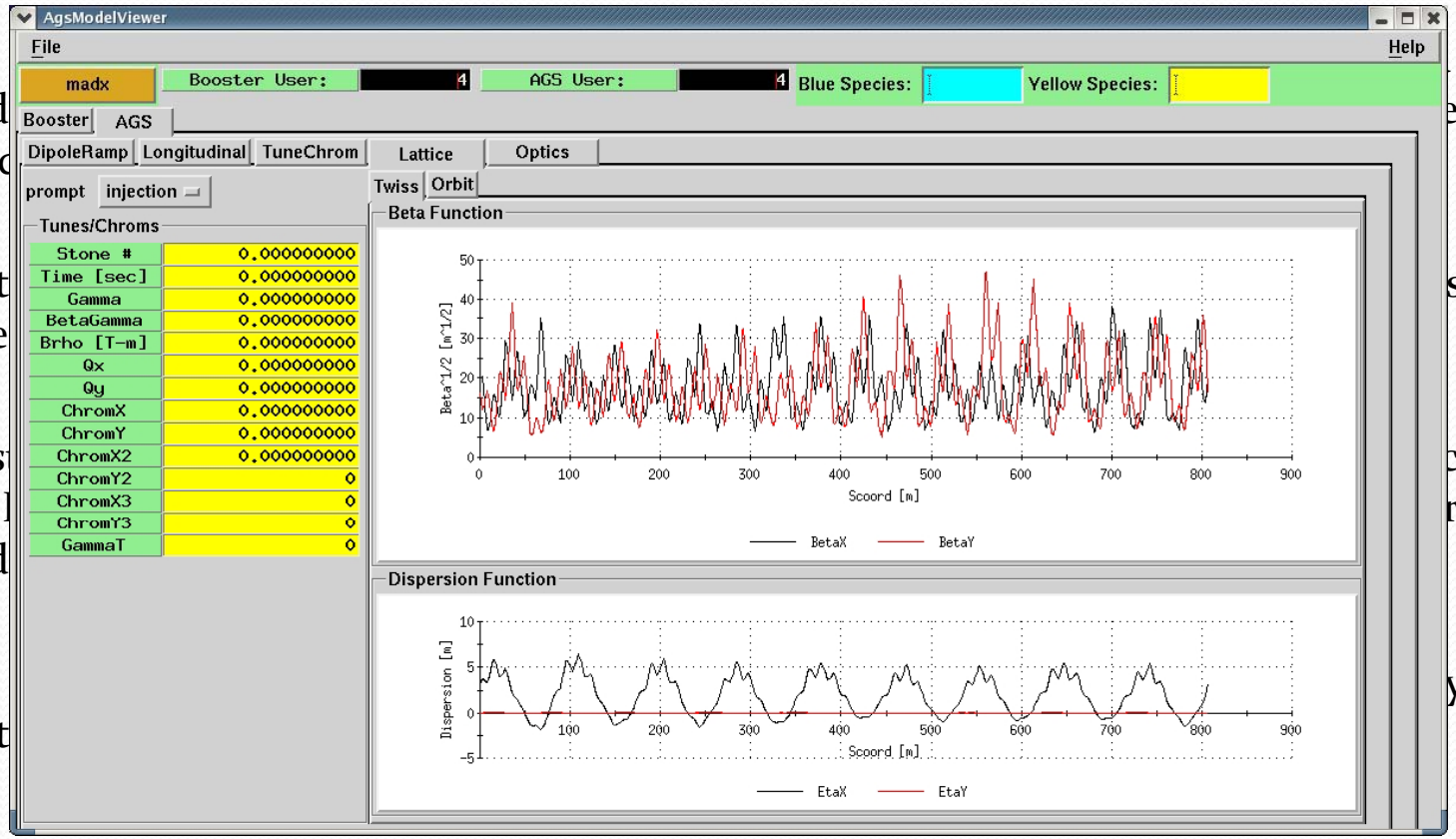
III – Other models – Plans for PTC

- AGS and Booster models: working group lead by K. Brown.



- AGS … stop band … ed on (need …
- Most … splay, Tune …
- Boos … check that … r stop band …
- New … y link toget …

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IV – Updates on RHIC Ramping system

- 2 working groups: RHIC Ramping Features WG and RHIC Ramping Reliability WG.
- From Controls Wiki: "collect, prioritize, design, implement and track improvements in the RHIC Ramping system".
- FY09 run top priorities:
  - Clean up RampManager/OptiCalc memory from unused/stale ramps => DONE;
  - Disable unanchoring of tune/chromaticity settings (disallow interpolation);
  - Tune and Chromaticity values logged at injection and store stone for later use in Logview;
  - Include replay settings when restoring a ramp.
- Outside of MCR, users should only be able to launch software (e.g. RampEditor) in test mode and write into a separate cache file.

CONCLUSION

- Taking over from N. Malitsky; lots of effort were brought into current NLC correction method, will still be used in early release of upcoming upgrade.
- New methods to be implemented has already been tested both with simulations and during previous APEX time => first step towards making Q”/Q”’ correction automatic.
- Early release of manual knobbing should be ready for testing during the dry run.
- AGS and Booster are having their model, model server and model viewer software refined; PTC is also seen as a solution to ensure matching between elements of the injection chain.
- Ramping system have a list of “hot topics” to be dealt with before the start of the run.