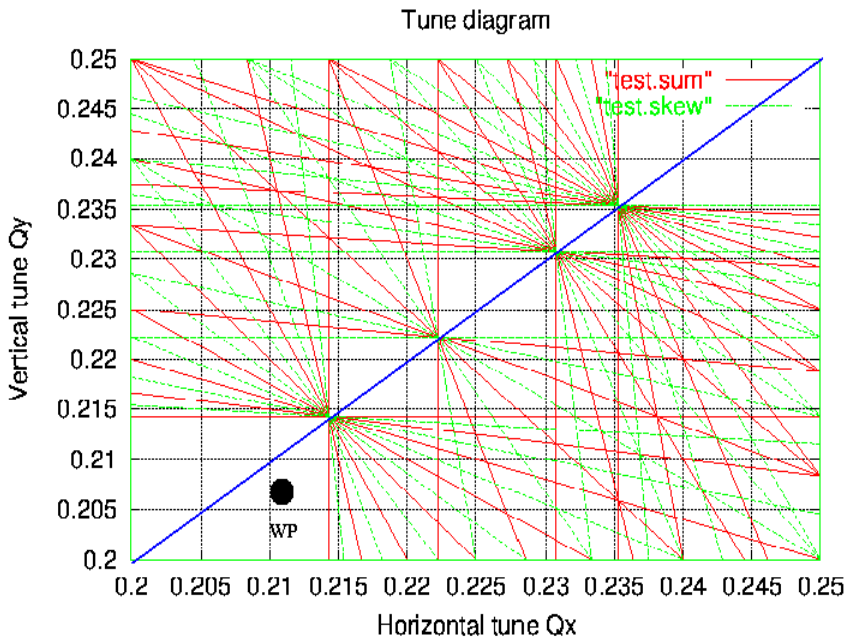
Coupling and working point

Fulvia Pilat

Summary

- WP at flattop – Au , PP
- Coupling: run 2001 → 2003
- Summary of coupling correction methods on the drawing board for 2003
- Sussix method (MB)
- N-turn transfer function (WF)
- Phase Jump (JC)

Working Point – Au, PP



GOLD 2001

- Close to diagonal, resonance free
- 0.2 weaker than 0.25

GOLD 2003

- Avoid coherent bb → B and Y tunes different
- Tune scan: correlation tune, resonance, lifetime (→ triplet correction)

PP 2001

- Spin depolarizing resonances at .2145 and .25→ vertical tune flattop ~0.23

PP 2003

- explore tunes < 0.20

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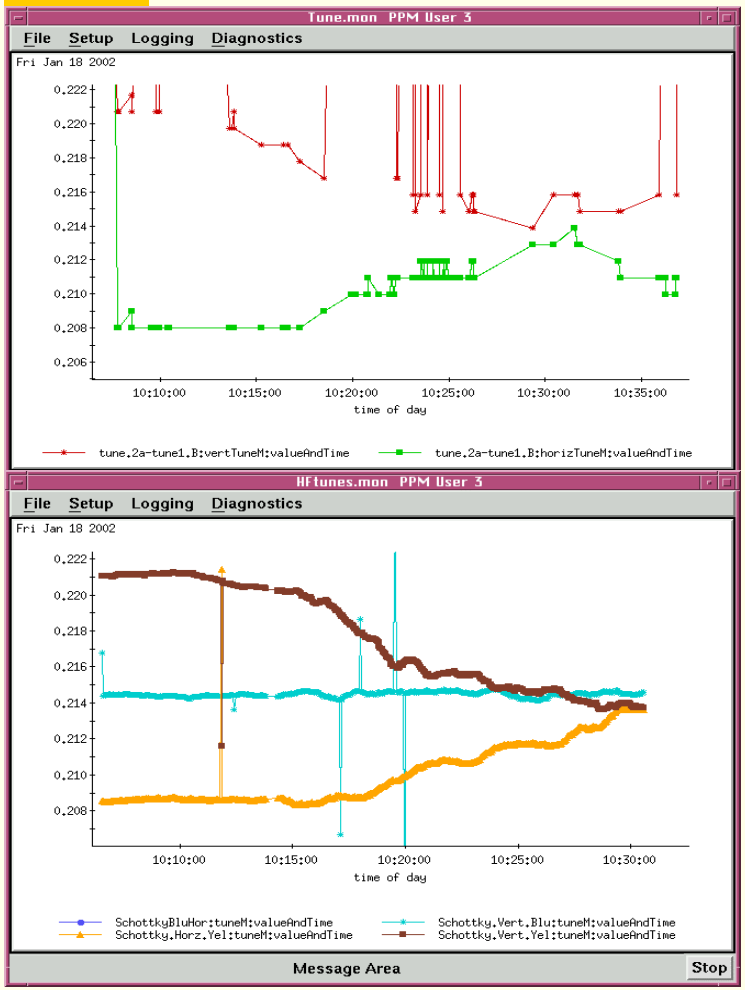
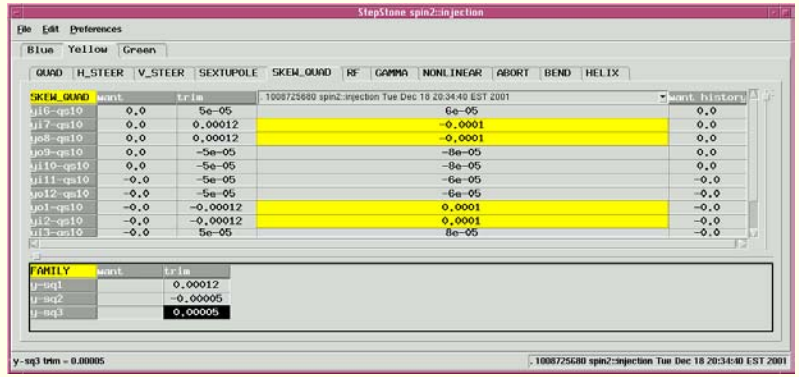
Coupling 2001→2003





2001: **local IR** + **ΔQmin**

2003 requirements:

- **Faster ΔQmin** (scripts/application)
- **Coupling correction on the ramp** (stepstones) for tune control, PLL, etc.
- **Flattop configurations** (optics, exp.magnets..)

Developing and evaluating different techniques (**global** and **local** corrections)

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Coupling Developments for 2003

METHOD	measure	correction	on ramp?	Global/ local
ΔQmin scripts (JBW)	not direct	YES	NO	global
Kick+TBT all BPM (TS)	YES	NO	YES	local
N-turn transfer matrix (WF)	YES	possible	YES	global
Sussix method (MB, FS)	YES	YES	YES	global corr. local meas.
Phase jump (JC)	YES	possible	YES	Local (IR)
Teapot/Talman (FP)	YES	YES	YES	local

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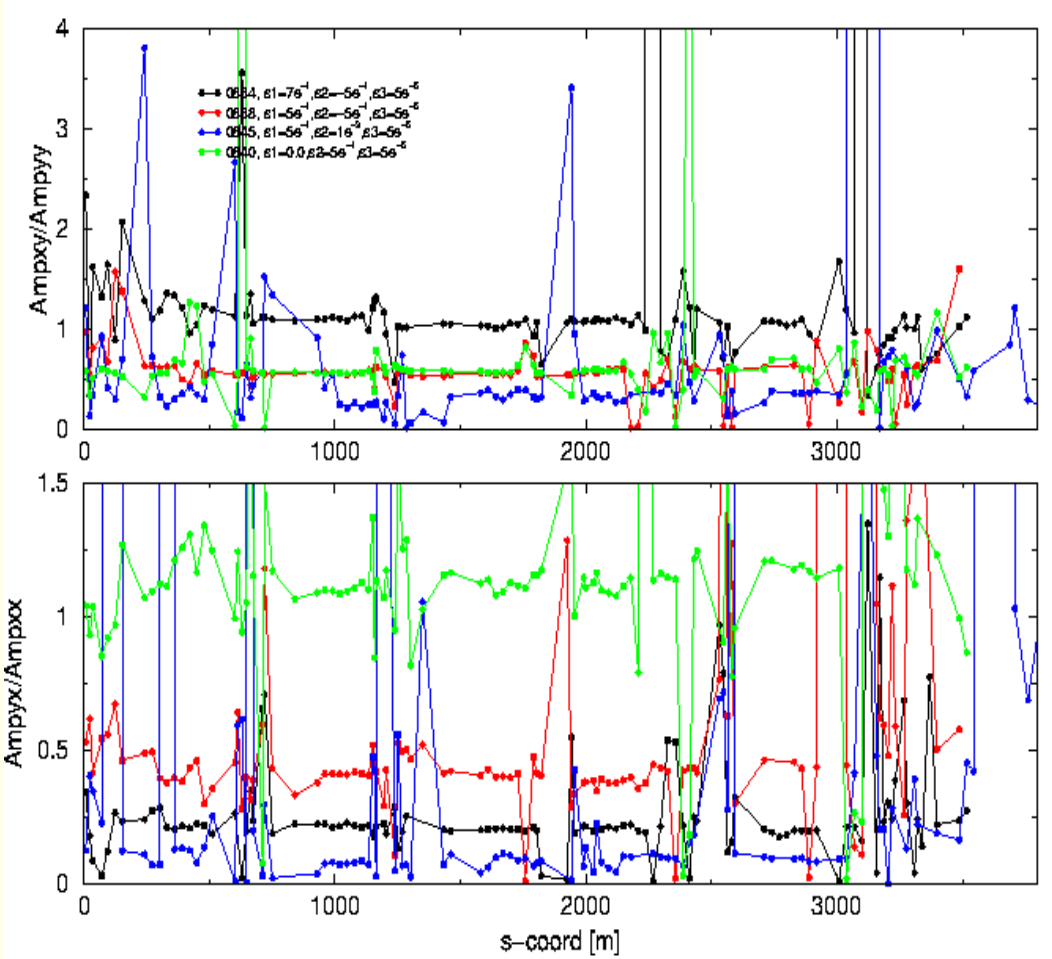
SUSSIX Method (coupling resonance) M.Bai

- Measure the coupling resonance by comparing the amplitude of the vertical tune with the horizontal tune line if the excitation is on the horizontal plane, and vice versa
- The advantage of this method is that it can be done without moving the working point of the machine (on the ramp)
- Used successfully for coupling correction at the SPS, promising results RHIC beam studies 2001
- plan for 2003: online application available



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N-turn map method (W.Fischer)

Data from Run 2001:

BEFORE the decoupling (01/08/2001 08:35):

COUPLING: **42-turn map** out:

0.39351	-1.12146	**-1.45541**	**4.61847**
-0.00406	0.38223	**-0.08377**	**-0.08652**
0.53187	**-13.79447**	0.29471	1.53989
-0.01464	**0.94799**	-0.00558	0.15270

AFTER the decoupling (01/09/2001 19:06):

COUPLING: **123-turn map** out:

-0.06765	3.07652	**1.85068**	**2.66604**
-0.00562	0.16563	**0.08342**	**0.39680**
0.09610	**3.00914**	-0.18475	0.98200
-0.05633	**1.00728**	-0.01367	-0.29169

- **1-turn transfer map**: off-diagonal terms 10^{-4} smaller than the diagonal ones
- **N-turn map** (**N=half beat period**, from measured tunes): off-diagonal term same order of diagonal terms
- **Model prediction** on change of off diagonal terms of the N-turn map → coupling **correction method**. (to be verified)

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Phase-action jump method (JC)

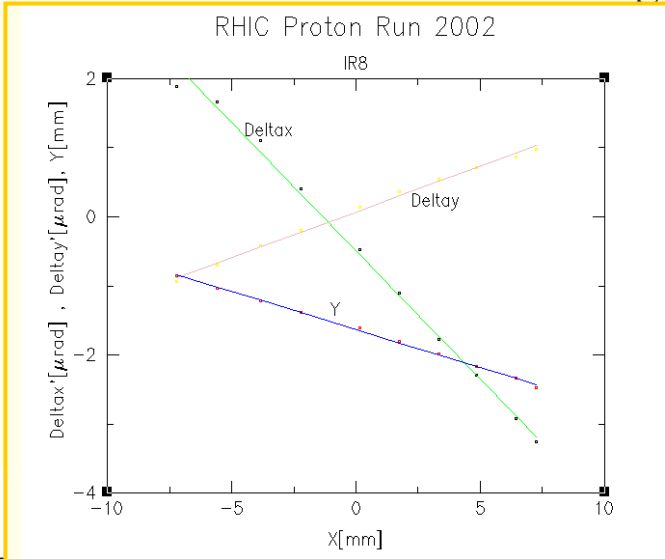
$$\Delta x' = -\sum_{Magnets_{IR}} \frac{B_y l}{B_\rho}$$
$$\Delta y' = \sum_{Magnets_{IR}} \frac{B_x l}{B_\rho}$$

Changes in **action** and **phase** observed before and after each IR.
Effective kick produce by dipole, quadrupole, or non-linear errors

$$\Delta x' = (-A_1 y_0 - B_1 x_0 + B_2 x_0^2 - 2A_2 x_0 y_0 + ...)$$
$$\Delta y' = (-A_1 x_0 + B_1 y_0 + A_2 x_0^2 + 2B_2 x_0 y_0 + ...)$$

Assume that all errors are coming from an **unique location** inside the IR (BPM at the position of the corrector Package.

Work in progress on derivation of **gradient** and **coupling** errors



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Conclusions

- Local and global coupling corrections worked in 2001
- Several methods are being developed for 2003, to have coupling correction that is:

  at the operating tune

  working on the ramp

  able to provide local information