Summary of Commissioning and Tuning session

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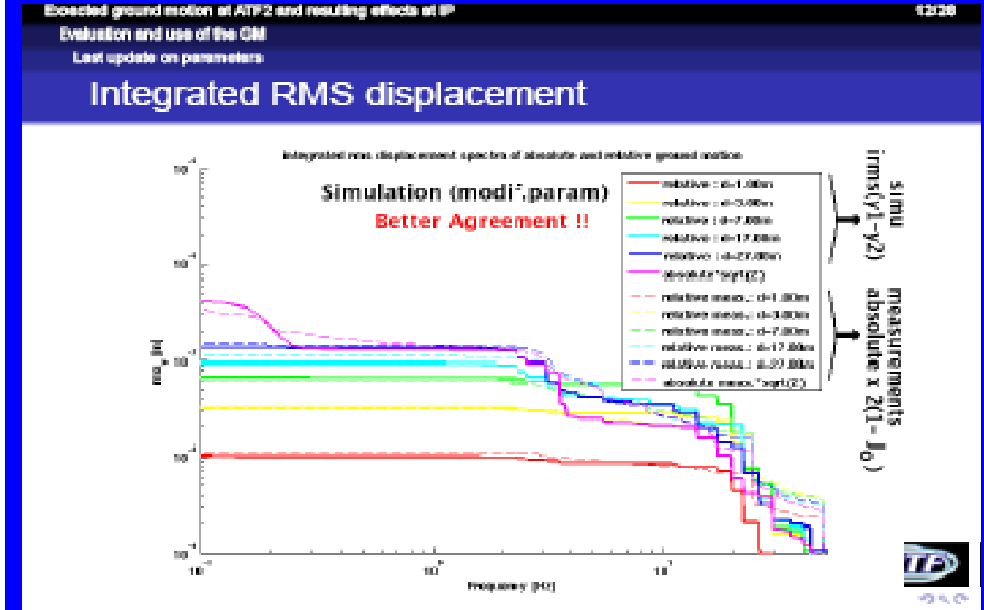
LAL-Orsay

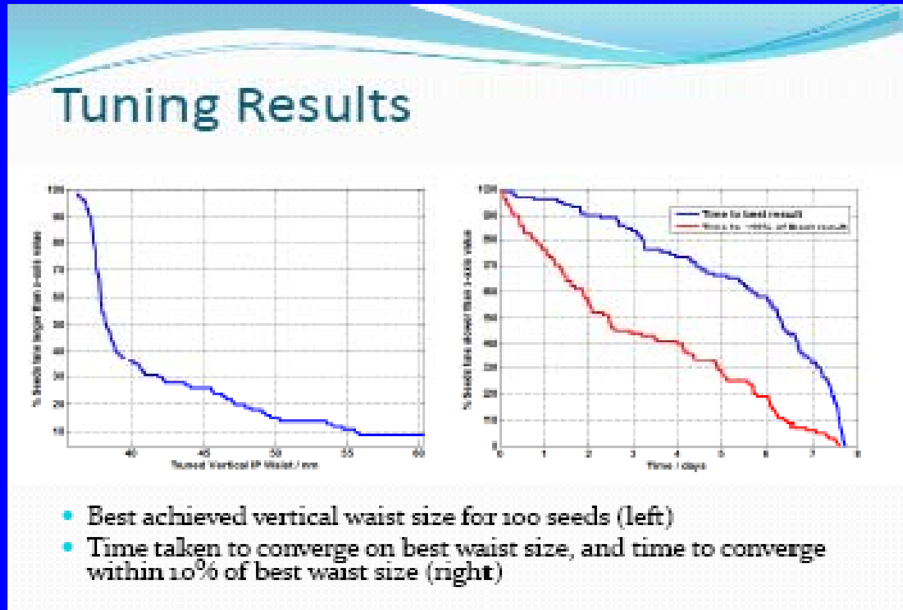
5th ATF2 project meeting
KEK, 21 December 2007

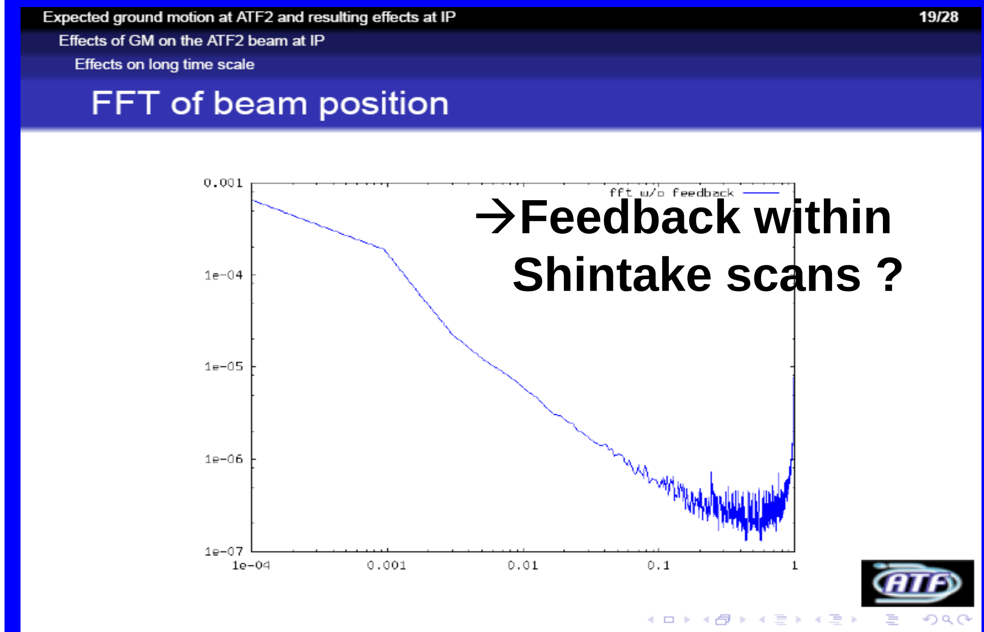
Agenda

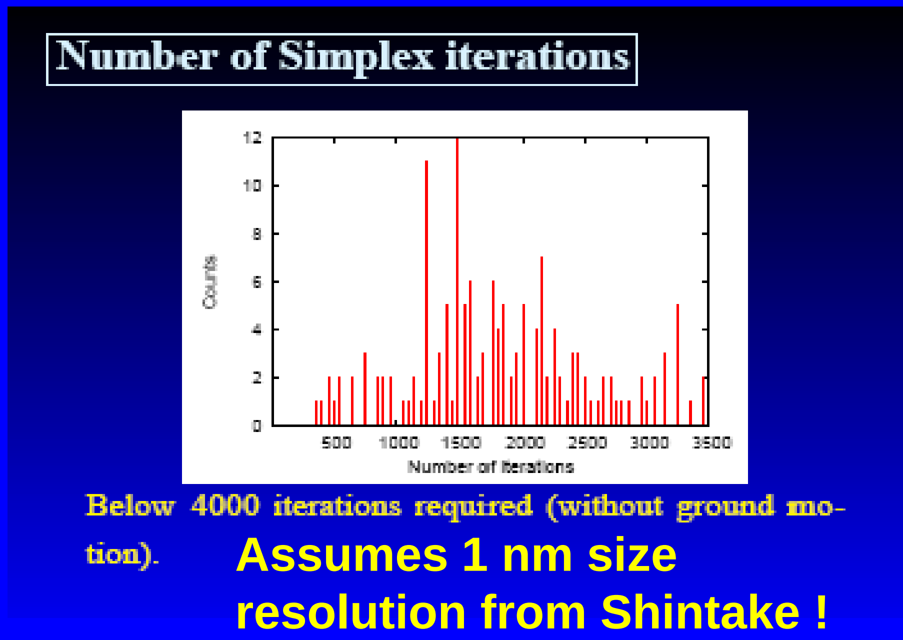
1. Using TBT data at ATF DR	Eliana Wendt (FNAL)
2. Extraction line + Final Focus System beam-based alignment and IP spot-size tuning	Glen White (SLAC)
3. Orbit Control and beam-based feedback in EXT and FFS Studies	
4. ATF2 as a test bench for CLIC BDS tuning, also	Rogelio Thomas (CERN)
5. Expected ground motion at ATF2 and resulting effects at IP	Yves Rénier (LAL)
6. Vertical emittance growth due to non-linearity in the ATF EXT	Maria Alabau (IFIC / LAL)
7. Emittance measurements with multiple wire-scanners and quadrupole	Julien Brossard (LAL) Cécile Rimbault (LAL)
8. Intermediate beta configurations at the IP for commissioning and optimisation	Sha Bai (IHEP / LAL)

GM + other jitter →IP stability feedback & tuning

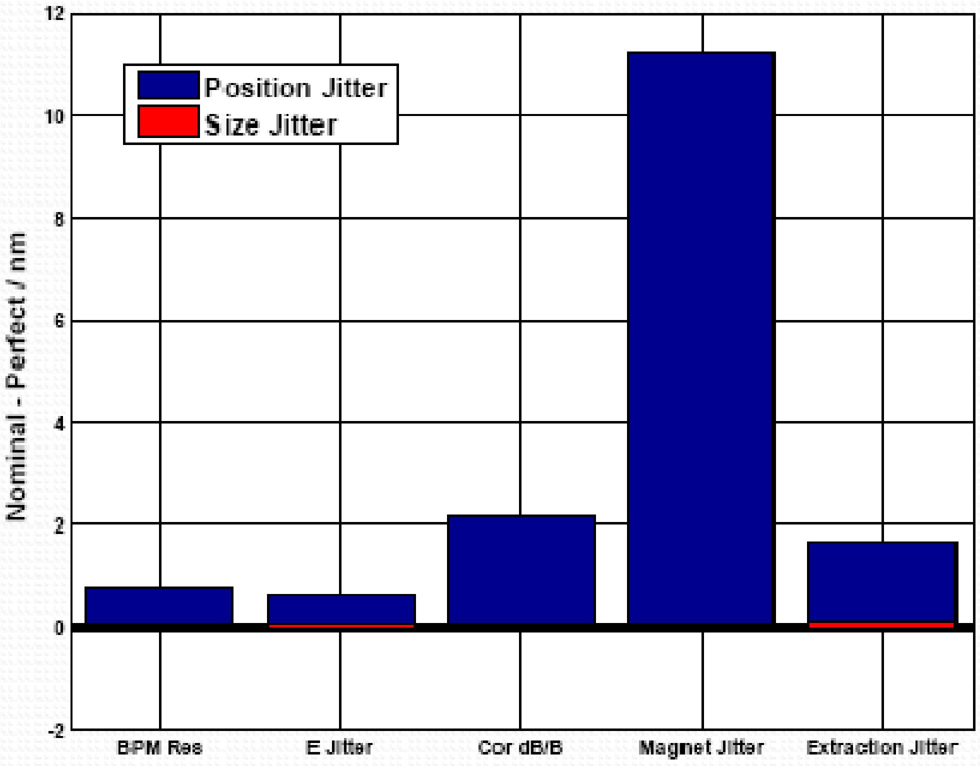








Fast Jitter Summary



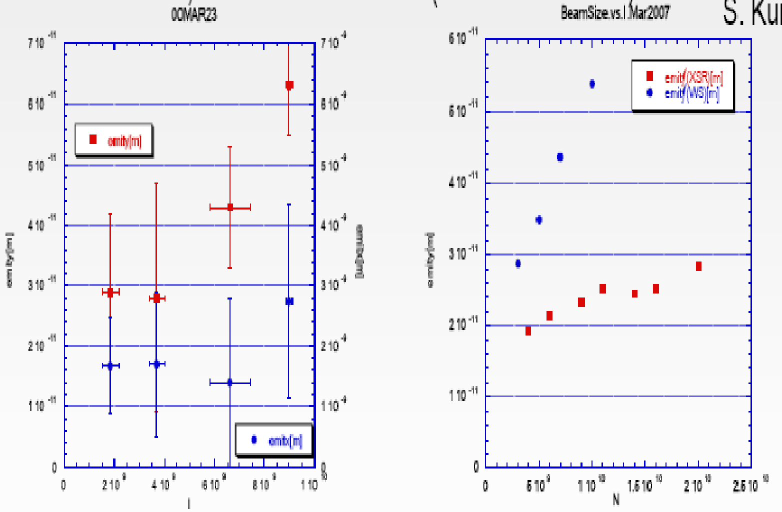
- Chart of improvements made if different jitter sources are removed
- Magnet jitter is clearly dominant, all other sources do not make appreciable differences if removed.

ATF EXT emittance investigation

Vertical emittance growth in ATF Extraction Line

Measured vertical emittances are higher than expected, and there is a dependence with the beam current.

(Results from 2000) (Results from 2007) S. Kuroda et al.



Hypotheses

-Non-linearity (coupling)

-Emittance measurement accuracy

-Intensity dependence: wakefields, orbit (BPM) ?

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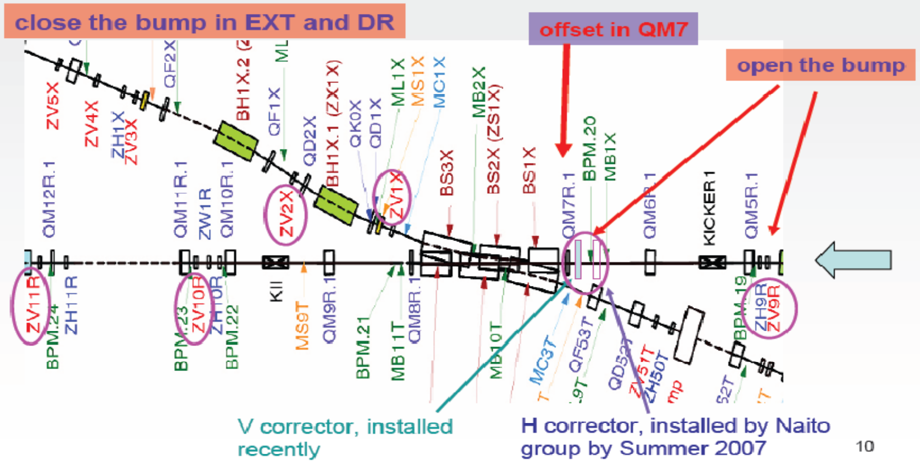
Creating bumps in QM7



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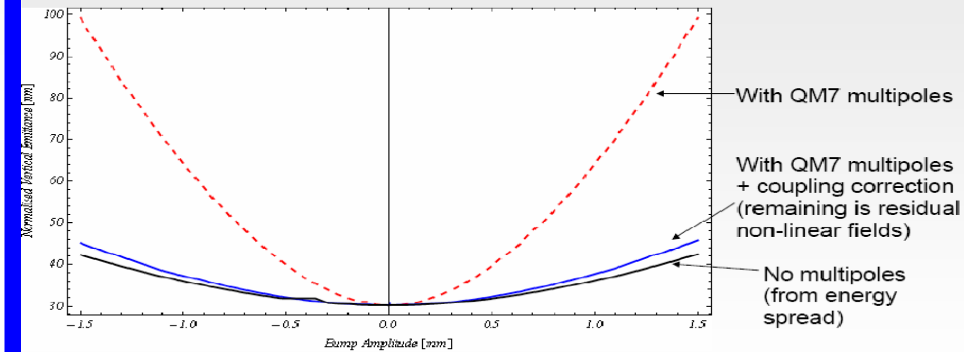
Simulations for variable bump in QM7 with linear coupling correction



Linear coupling induced by QM7 multipoles corrected by adjusting four skew quadrupoles in diagnostic section.

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→ Must make sure this won't limit ATF2 !

First results with bump in QM7

Reconstructed magnitude -0.81 mm

Emittance reconstruction

No bump

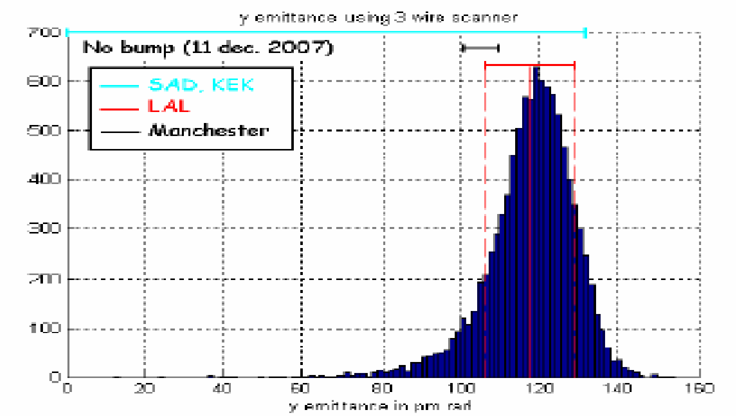
Vertical emittance =

118 +/- 11 pm.rad (J. Brossard, LAL)*

108 +/- 7 pm.rad (A. Scarfe, Manchester)

(52 +84 -52) pm.rad (SAD result)

*Results based on 10 000 test within the error bar. (rejection level of 0.02 %)



With bump

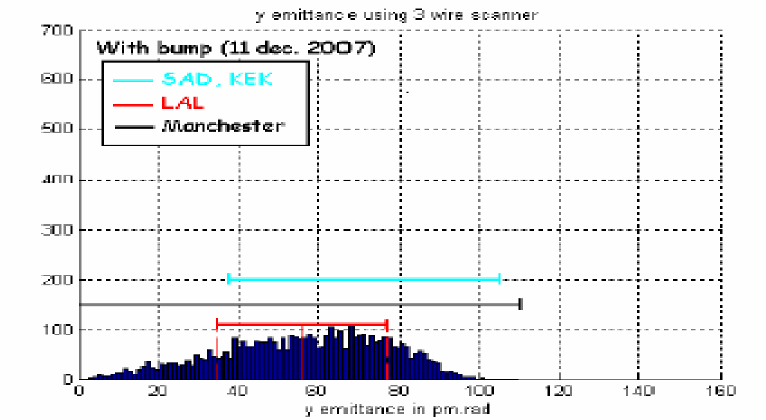
Vertical emittance =

56 +/- 21 pm.rad (J. Brossard, LAL)**

40 +/- 70 pm.rad (A. Scarfe, Manchester)

(47 +58 -9) pm.rad (SAD result)

**Results based on 10 000 test within the error bar. (rejection level of 54.42 %)



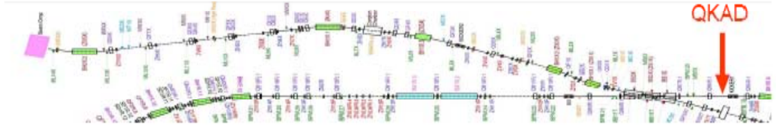
Learning control room work

→ will continue more systematically in 2008

Investigate emittance reconstruction methods:

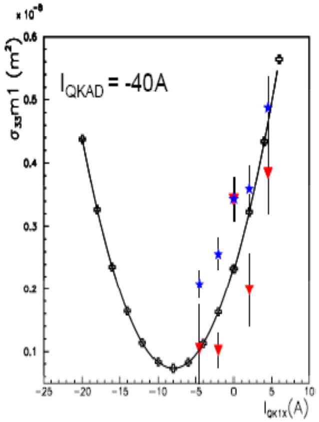
1. Multiple wire scanners → χ^2 minimisation (constraints ?)
2. Combine normal + skew quad scans → reliable xy coupling ?

QK1X scan at MW1X wire scanner: coupling estimation using MAD8



- A "virtual" skew, QKAD, quad. of type QK1X is introduced at the beginning of the Ext line.
- Its strength varies until fitting with the measured points at MW1X with QK1X scan.

→the coupling is reproduced for I_{QKAD} : [-50; -35]A ≡ Ks[-0.258 ; -0.180]m^{-1}



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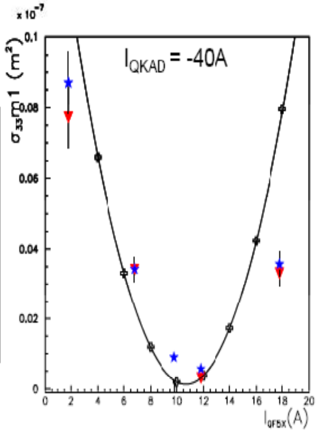
QK1X scan at MW1X wire scanner: coupling estimation using MAD8

- A scan of QF5X is simulated with different value of Ks_{QKAD}, and emittances are recontructed.

I_{QKAD} (A)	Ks_{QKAD}(m^{-1})	ε_x (nm.rad)	ε_y(pm.rad)
0	0	1.12 ± 0.20	317 ± 73
-35	-0.1804	2.02 ± 0.09	248 ± 17
-40	-0.2062	2.02 ± 0.09	284 ± 21
-45	-0.2320	2.03 ± 0.09	319 ± 27
-50	-0.2578	2.02 ± 0.09	354 ± 33



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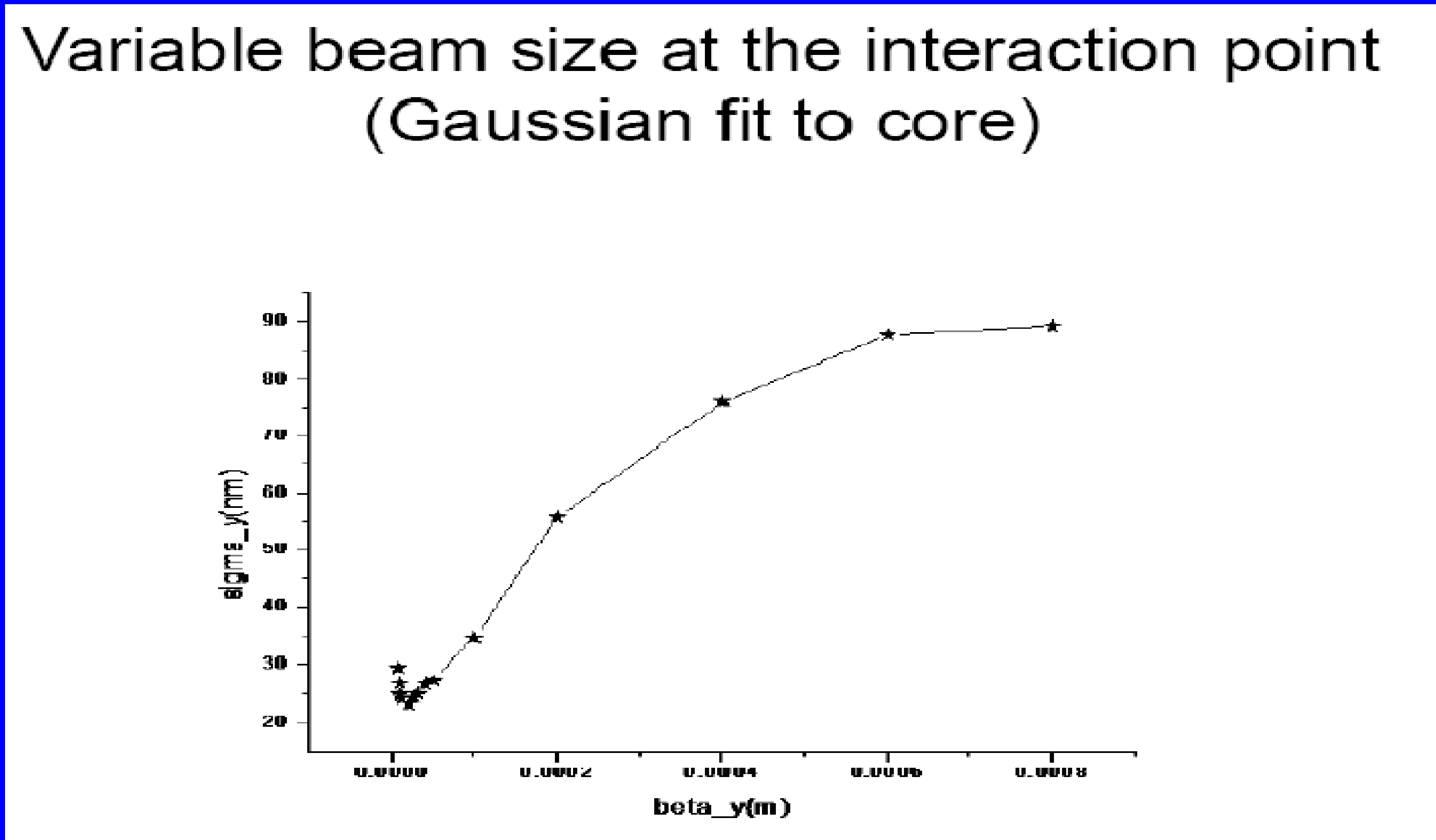
→ Dedicated schemes for flat beams (error analysis…)

→ Develop practical tools for efficient control room work

1. **Increasing β_y → gradual approach with looser tolerances**
2. **Reducing β_y → enhanced performance**
3. **Idem at Honda-monitor and wire-scanner locations**



→ Check magnet variation ranges

Fermilab
http://www.fnal.gov

Using TBT data at ATF DR

Contents:

- Betatron Coupling correction
  - Theoretical Background
  - Examples from Tevatron
  - Simulation for ATF DR
- Machine modeling

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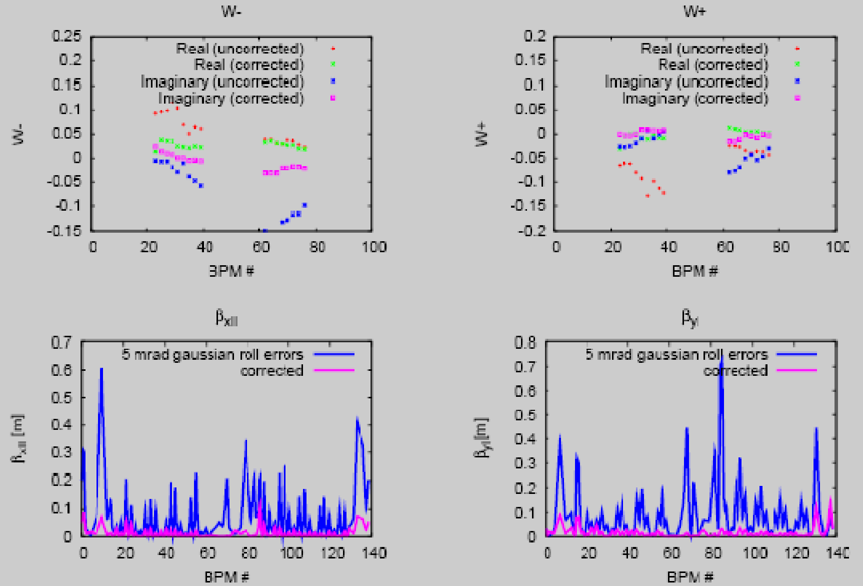

ε_y=0.022 nm (only betatron coupling correction)

ε_y=0.004 nm (betatron coupling + dispersion correction)

Table 1: Transverse Emittance

	ε_x (nm)	ε_y (nm)
Nominal	0.973	0.000
with errors	0.971	0.042
β-tron coupling correction	0.973	0.012
D_y correction	0.970	0.013
correcting both	0.973	0.001