Steering in the ATF2 Extraction Line

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Outline

Description of the measurement

Motivation

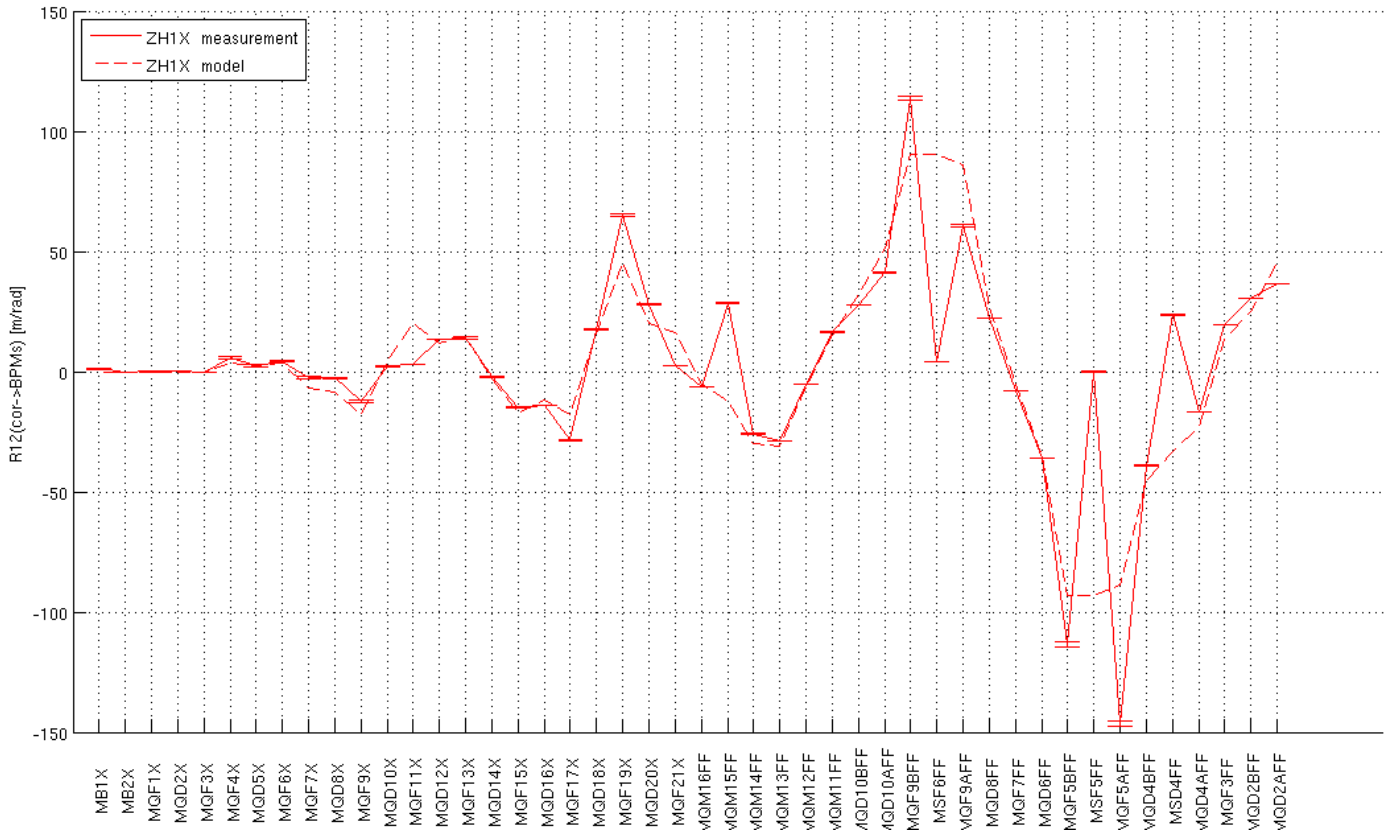
- Steering algorithm rely on transfer matrices.
- Sign problem evidences was found.
- It must be corrected before try any steering correction.

How was made the measurements

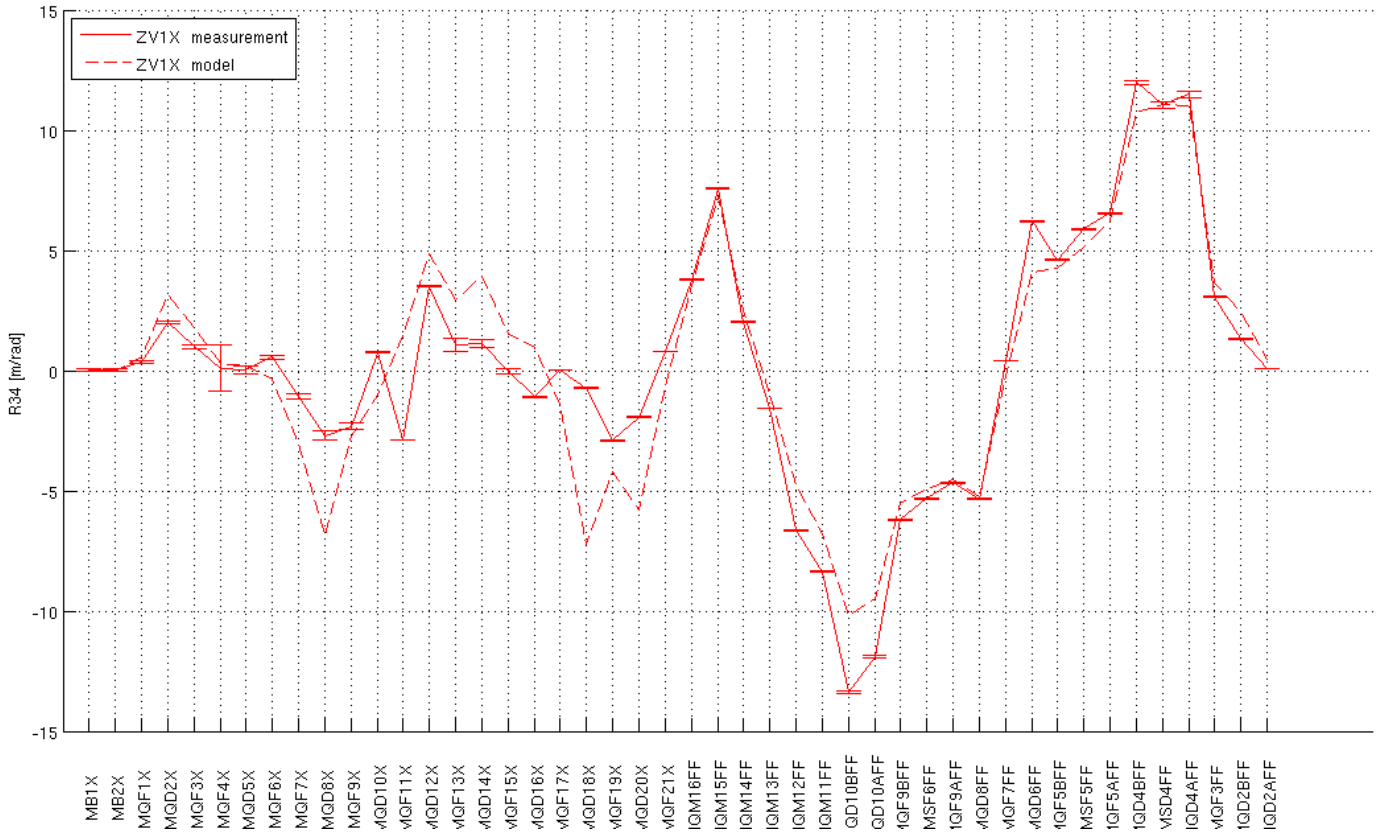
- BPM measurements are made for 11 corrector strengths.
- Linear fit of the displacement function of the angle.
- Slope : R12 or R34 between the corrector and BPMs.
- Compare with theoretical R12 and R34 from online model.
- If sign problems are found, they are corrected in FS.

Outline

R12 from ZH1X to all BPMs



R34 from ZV1X to all BPMs



Outline

Agreed errors (thanks to Glen)

Relevant Error Parameter for EXT section

Error Type	Level
x/y/z Post-Survey	$200\mu m$
Roll Post-Survey	$300\mu rad$
BPM - Magnet field center alignment (initial install) (x, y)	$30\mu m$
BPM - Magnet alignment (post-BBA, if BBA not simulated) (x, y)	$10\mu m$
Relative Magnetic field strength (dB/B) (systematic)	10^{-4}
Relative Magnetic field strength (dB/B) (random)	10^{-4}
C/S - band BPM nominal resolution (x, y)	$100nm$
Stripline BPM nominal resolution (x, y)	$10\mu m$
IP BPM nominal resolution (x, y)	$2nm$
EXT magnet power-supply resolution	$11 - bit$
FFS magnet power-supply resolution	$20 - bit$
Corrector magnet pulse-pulse relative field jitter	10^{-4}

Outline

Summary of EXT steering results

quantity	results	
	mine	Antony's
rms X (EXT) [mm]	0.2 ± 0.1	3 ± 2
rms Y (EXT) [mm]	0.3 ± 0.1	$.5 \pm .5$
rms X (EXT+FF) [mm]	$.5 \pm .5$	10 ± 10
rms Y (EXT+FF) [mm]	$.7 \pm .6$	2 ± 2
BPM measurements	10	60 ± 10

legend

- rms (EXT) : standard deviation of EXT BPM readings after EXT steering.
- rms (EXT+FF) : standard deviation of EXT+FF BPM readings after EXT steering.
- BPM measurements : number of measurements to obtain presented results.

Outline

Comparison simulation/true lattice

Difference from standard errors

Error Type	Nominal	observed
Relative Magnetic field strength (dB/B) (systematic)	10^{-4}	10^{-2} (rare standardization)
C/S - band BPM resolution (x, y)	$100nm$	$5\mu m$ (no S-band)
Stripline BPM resolution (x, y)	$10\mu m$	$50\mu m$
Stripline BPM scale factor (x,y)	1	$0.5 - 3$

Remark

- My algorithm need then 3 iterations to obtain comparable results.
- Scale factor effect was not simulated => may have a large influence.

Comparison simulation/true lattice

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Outline

Description of the test

Description

- A reference orbit is taken.
- An angle is introduce with a corrector.
- Use the steering algorithm to find a correction.
- Check if the corrector strength is set back to its previous value.
- If it is not the case, check if the correction improve the orbit.

Outline

Anthony Scarfe's test

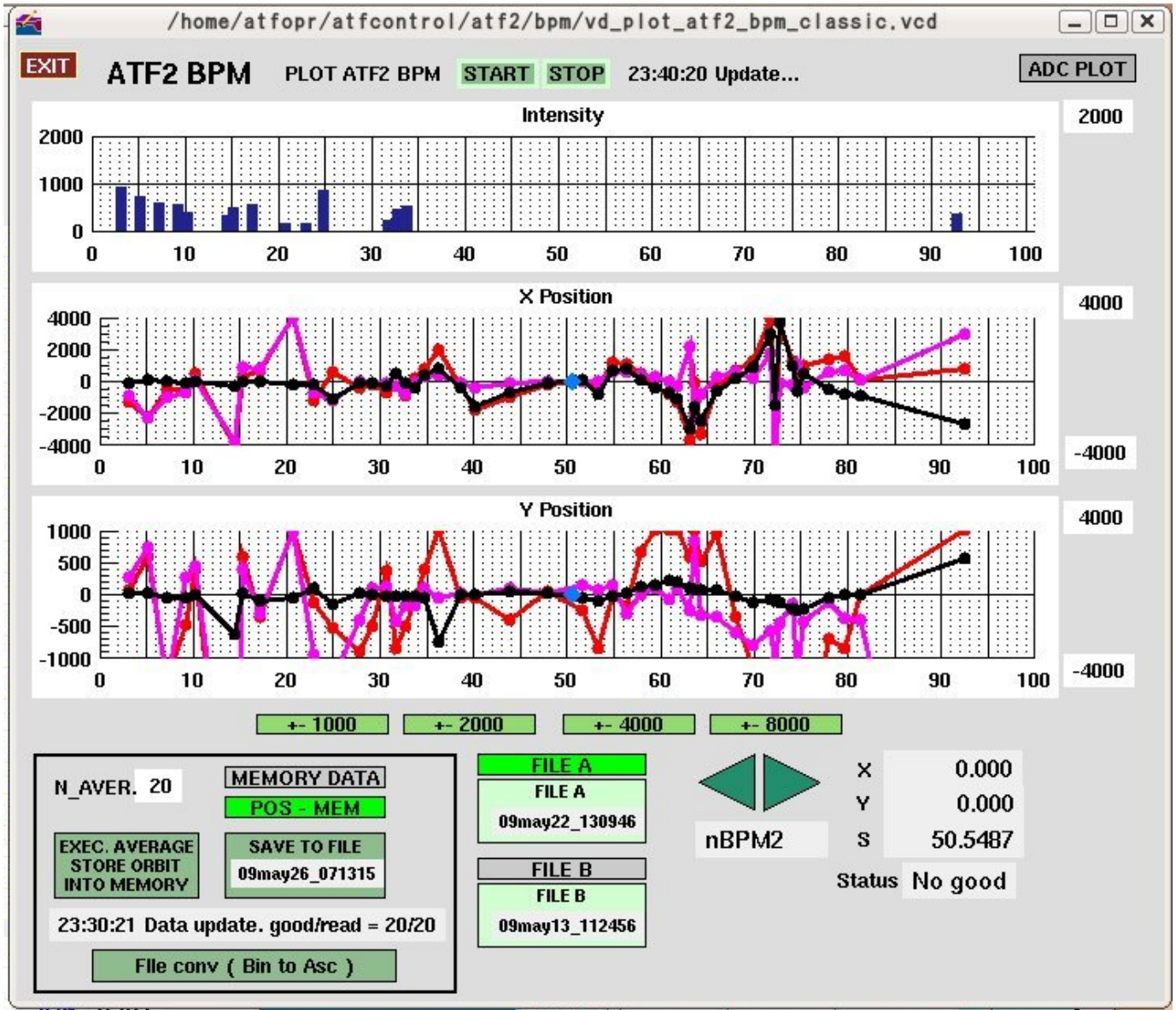
What was tested

- Angle was introduiced at ZH2X.
- Test using just ZH2X to correct.
- test using all horizontal correctors.
- test using all correctors (horizontal and vertical).

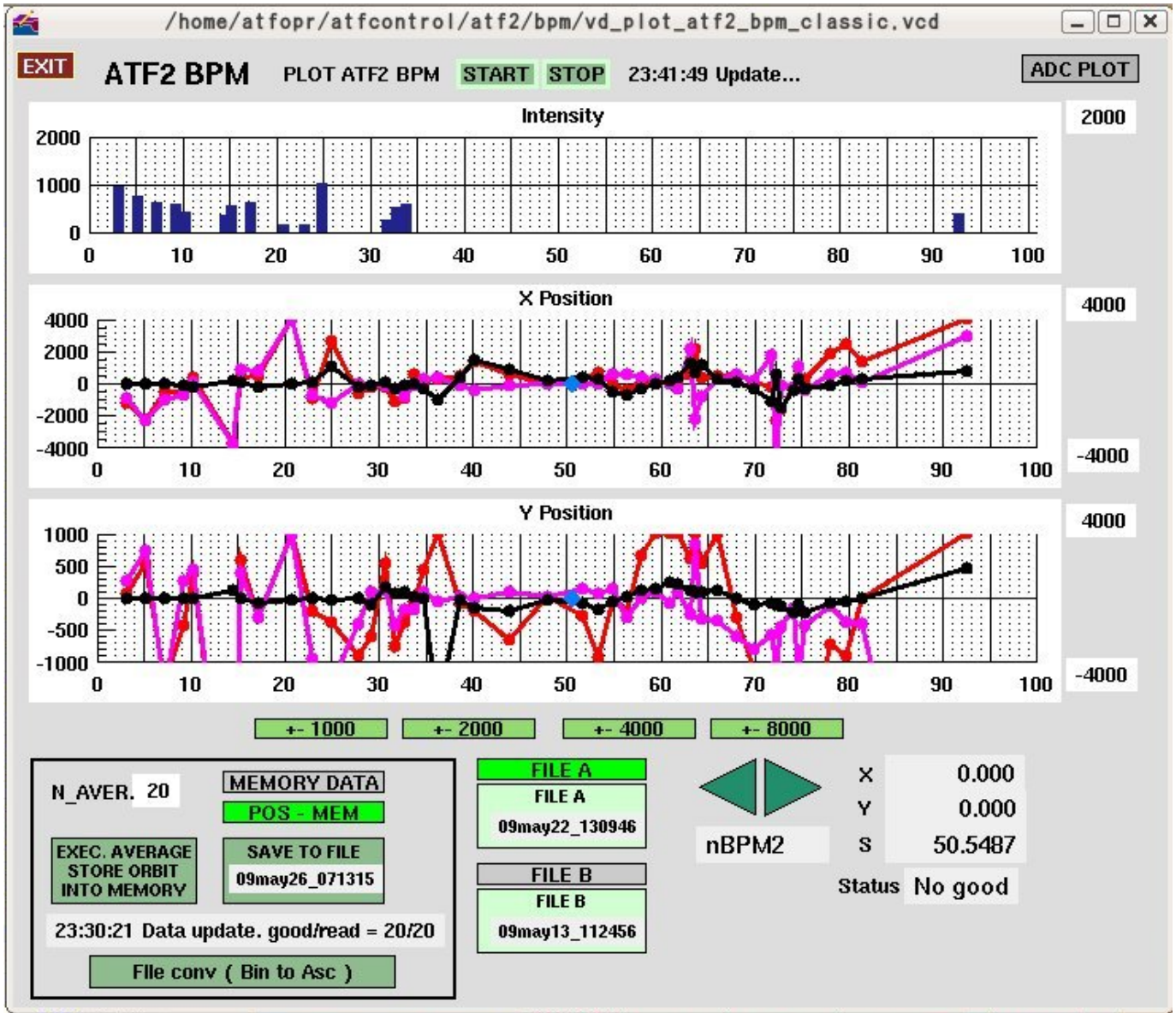
Result

- The correction is 2x too large.
- Good correction with a gain of $\frac{1}{2}$.
- The good corrector is used to correct when all horizontal are used.
- Vertical and horizontal correction are separated, try to correct in vertical even if not needed.

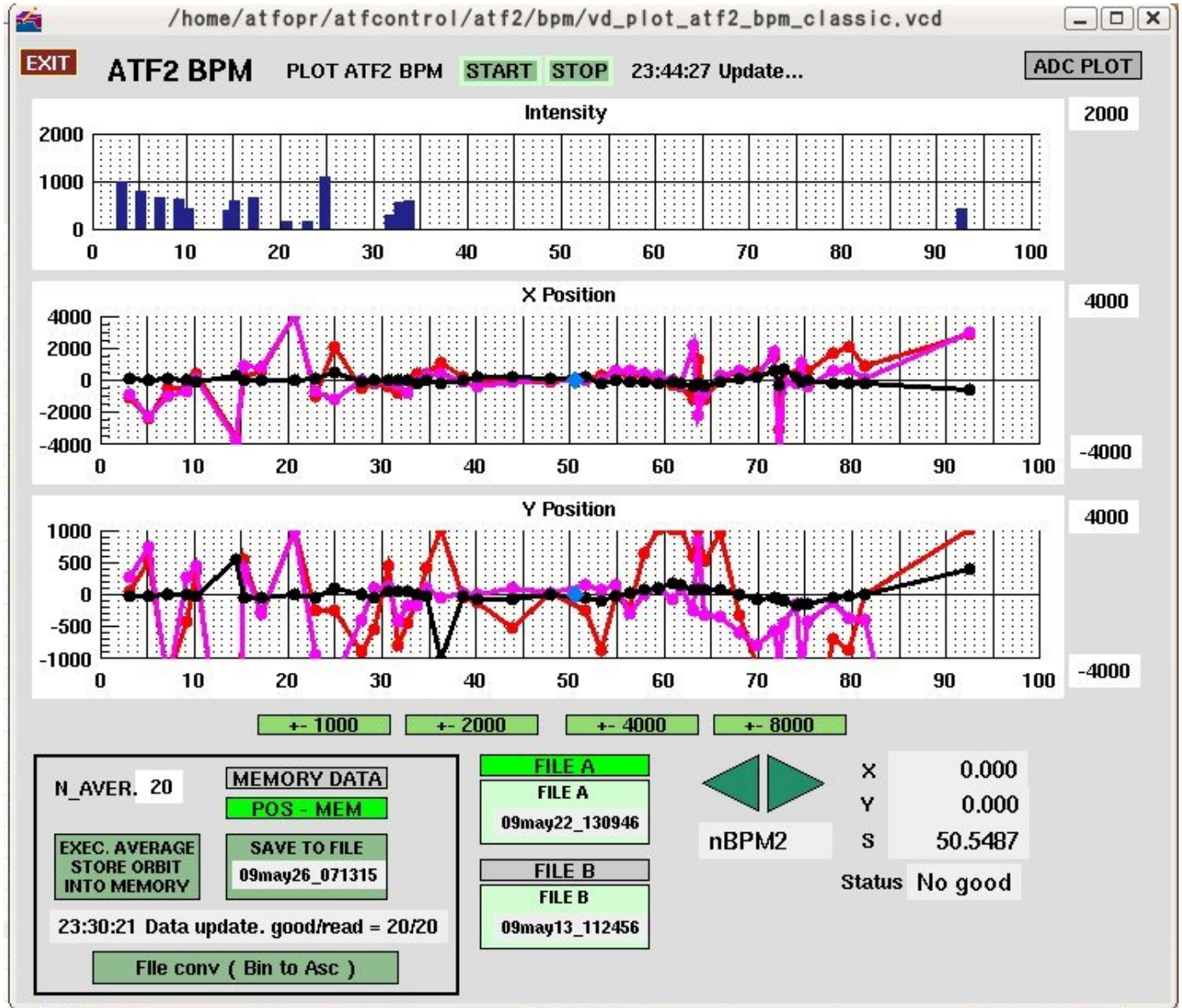
BPM reading before correction



BPM reading after correction



BPM reading after correction (gain of $\frac{1}{2}$)



Outline

my test

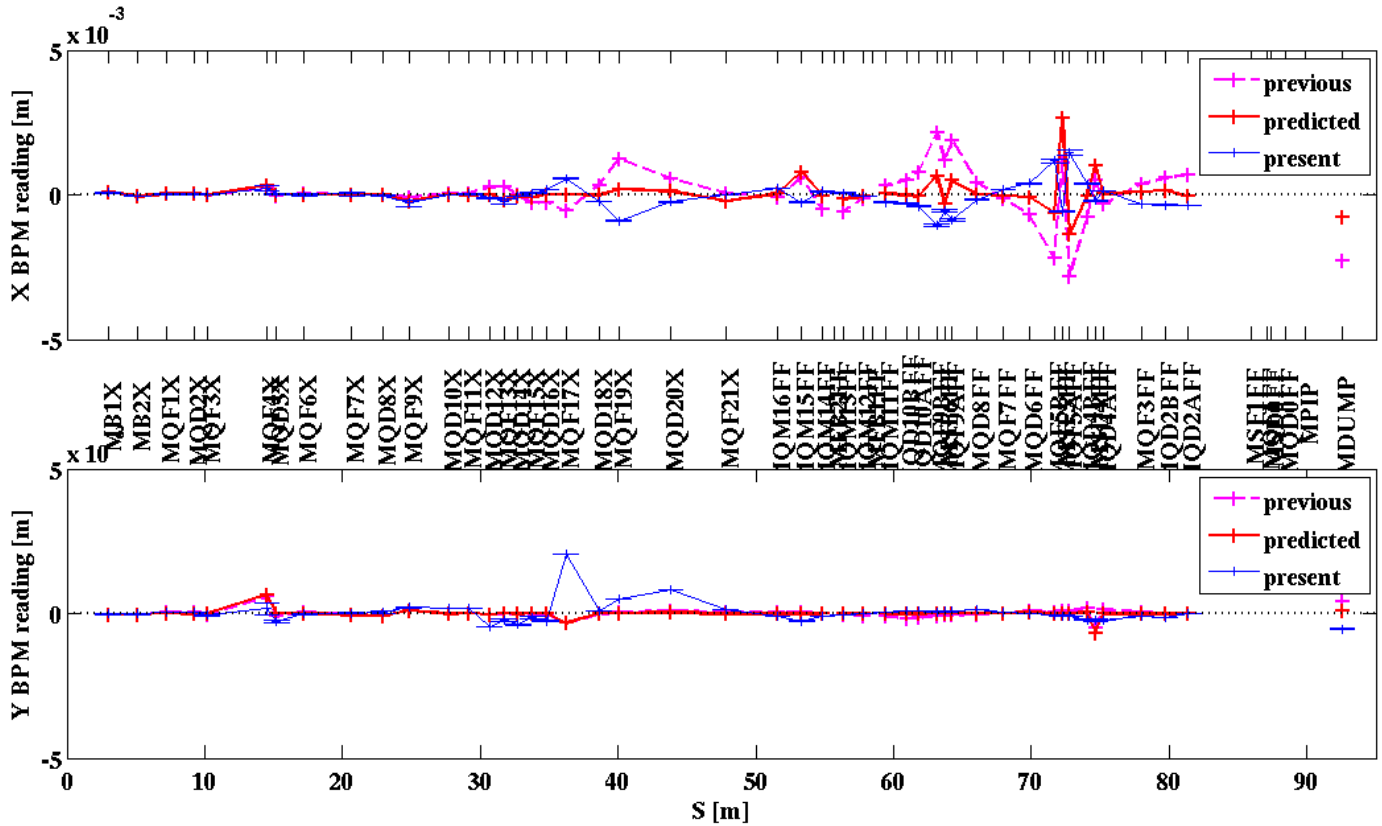
What was tested

- Angle was introduiced at ZH2X.
- test using all correctors (horizontal and vertical).
- Angle was introduiced at ZV2X.
- test using all correctors (horizontal and vertical).

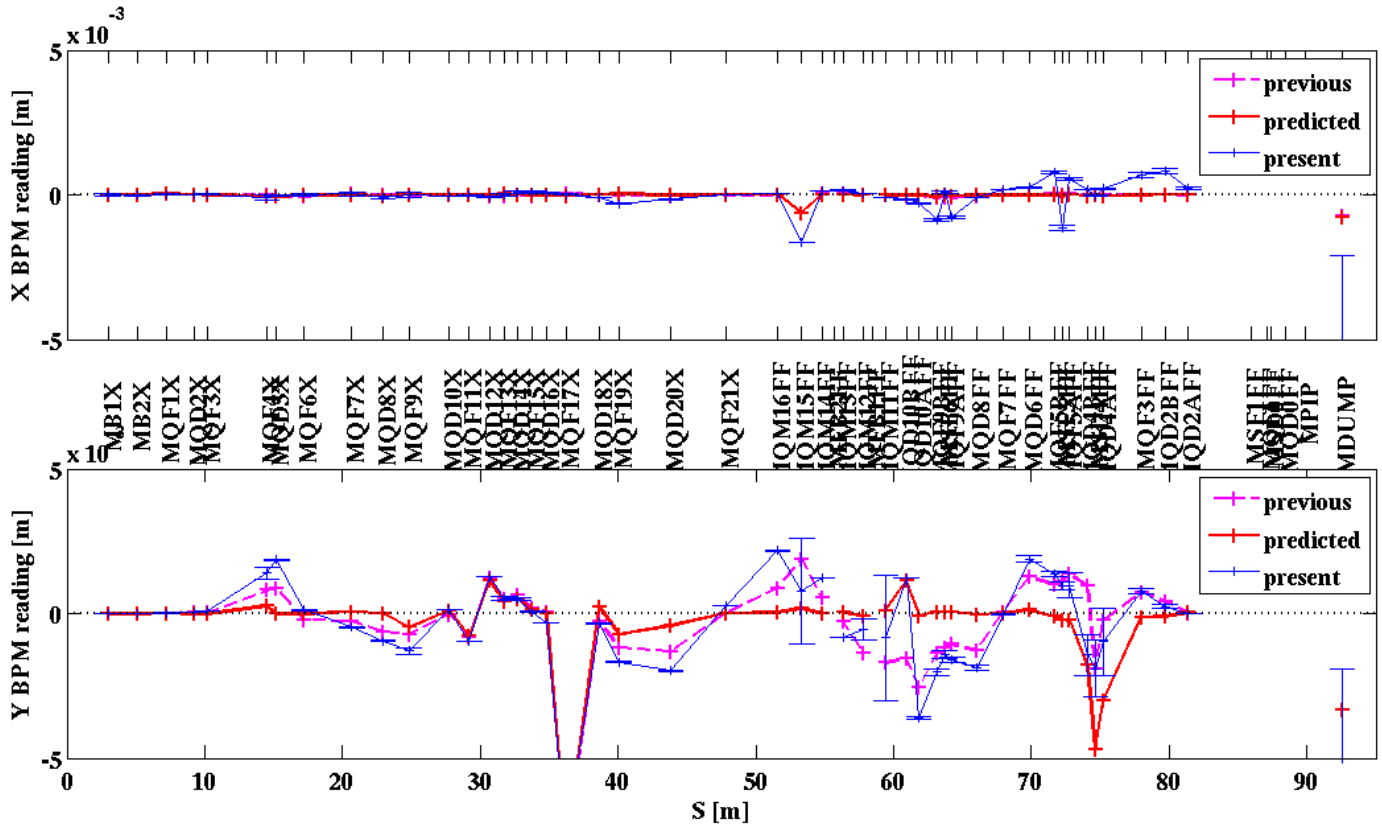
Result

- The correction is 2x too large in horizontal (same as Anthony).
- The good corrector is used to correct.
- Correction seems to have the bad sign in vertical.
- After that results, transfer matrices check has been performed using ZH2X and ZV2X, strange results, analysing on-going.

horizontal correction



vertical correction



Conclusion and prospects

Conclusion

- Tools for check transfer matrices ready and working.
- Transfer matrices were checked from ZH1X and ZV1X.
- Very good agreement for the cavity BPMS.
- Non-constant scale factor for stripline BPMs.
- All sign are now correct. Thanks a lots to Glen and Mark !
- Steering works well in simulation, need to test effects of scale factors.
- Still problems with experimental steering, but getting close.

Prospect

- We would like to make a complete transfer matrices check.