

Feed forward with GM sensors

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Concept of Feed Forward with GM Sensors

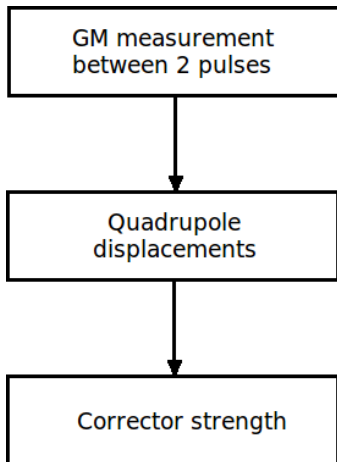
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Goal and motivation of the ATF2 experiment

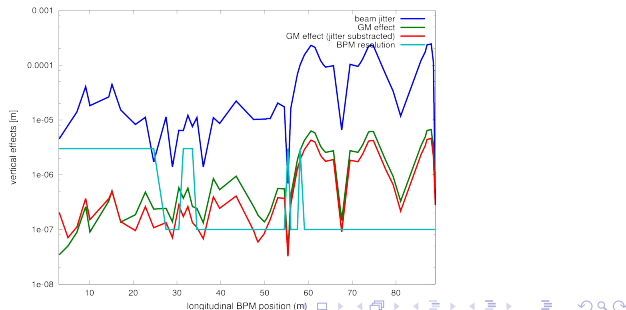
Goal

- ▶ Detect Ground Motion (GM) effect on beam trajectory.

Motivation

- ▶ GM sensors are usually only compared to other GM sensors
- ▶ It would demonstrate possibility to make a feed forward with GM sensors.
- ▶ Feed forward would allow trajectory correction based on GM measurements in CLIC.
- ▶ Feed forward would allow big saving (avoid quadrupole stabilization in CLIC)

- ▶ Remove incoming jitter from BPM measurements (first 5 SVD modes).
- ▶ Evaluate GM effect on BPM readings from GM sensor measurements.
- ▶ Subtract the part remove by jitter subtraction.
- ▶ Compare these two residuals.



Conditions

- ▶ ATF2 nominal lattice (sextupoles off).
- ▶ Elements misaligned initially (RMS=100 μ m).
- ▶ Trajectory is then steered.
- ▶ Ground Motion (GM) model based on measurements.
- ▶ Elements are displaced by the amount of relative motion compared with the 1st element.
- ▶ Incoming beam jitter.
- ▶ Quadrupoles errors of $\frac{dK}{K} = 10^{-4}$ included.
- ▶ BPM resolution included.
- ▶ GM measurement included (sensors TF included).

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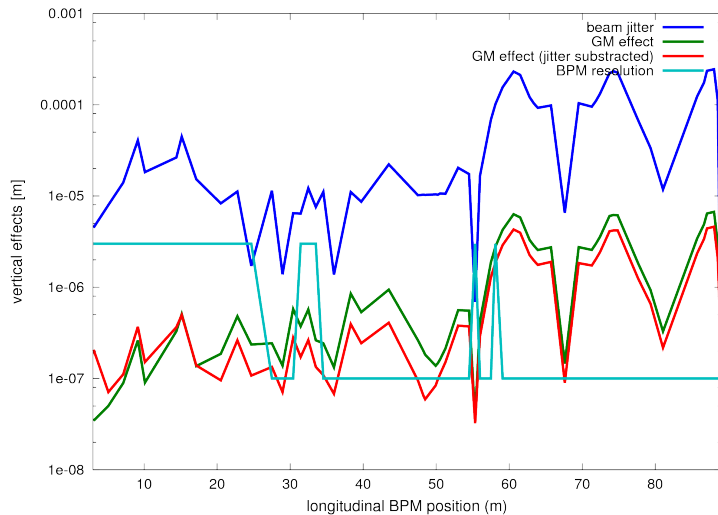
Conclusion and Prospects

- ▶ R_1 is the GM effect obtained from GM sensors.
- ▶ R_2 is the GM effect obtained from BPMs.

$$\rho = \frac{\|R_1 - R_2\|_2}{\|R_1 + R_2\|_2}$$

- ▶ $\rho = 1$ if R_1 and R_2 independent.
- ▶ $\rho = 0$ if $R_1 = R_2$.
- ▶ The lower ρ is, the best is the determination from the GM sensors.

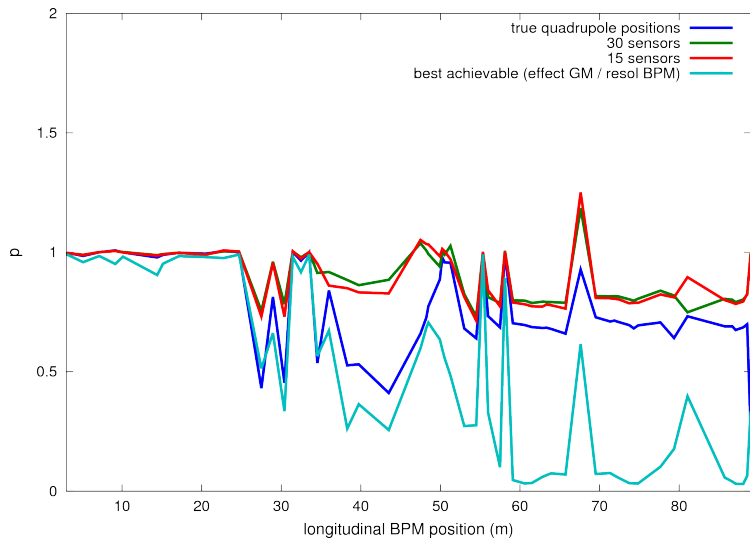
Nominal Lattice



Nominal Lattice

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0.5 μm resolution stripline BPMs

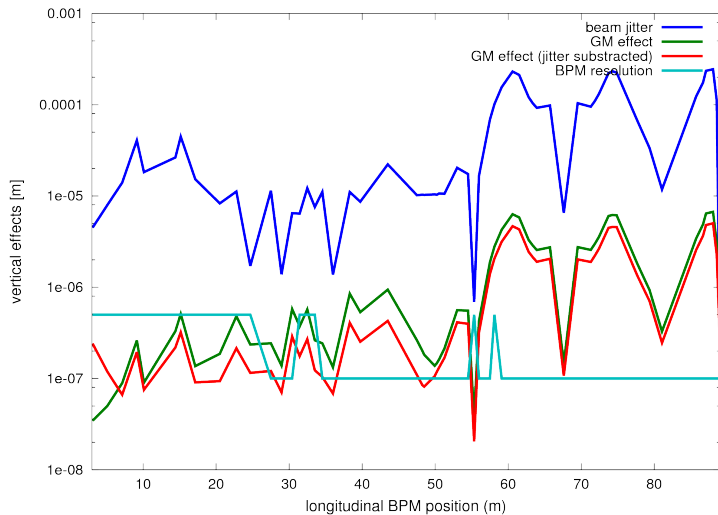
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0.5 μm resolution stripline BPMs

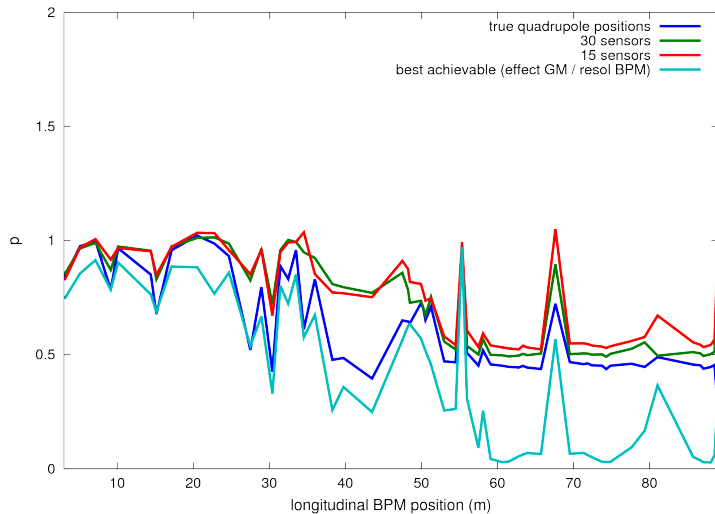
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Conclusion

- ▶ Beam jitter subtraction is critical.
- ▶ Detection seems difficult but should be feasible with the current configuration.
- ▶ Diminution of beam jitter, higher beta function in FF or better resolution stripline BPMs improve the detection.

Prospects

- ▶ Analyze jitter.
- ▶ Determine results for ultra-low lattice.
- ▶ Test of the acquisition at CERN this summer.
- ▶ Installation at ATF2 before fall runs.