

Usefulness of a stabilization for ATF2 final focus quadrupoles?

Consistency of results

Ground motion used

| | Description | Notation | ATF2 | GM2 | ATF Ring | GM4 |
|----------|-------------|-------------------------|-----------------------|----------------------|---------------------|-----------------------|
| 1st wave | Frequency | f1 [Hz] | 0.2 | 0.15 | 0.1 | 0.18 |
| | Amplitude | a1 [m ² /Hz] | 1.0*10 ⁻¹³ | 2*10 ⁻¹³ | 2*10 ⁻¹² | 1.2*10 ⁻¹³ |
| | Width | d1 [1] | 1.1 | 1.0 | 5.0 | 1.0 |
| | Velocity | v1 [m/s] | 1000 | 1000 | 1000 | 900 |
| 2nd wave | Frequency | f2 [Hz] | 2.9 | 2.4 | 2.5 | 2.7 |
| | Amplitude | a2 [m ² /Hz] | 6.0*10 ⁻¹⁵ | 10*10 ⁻¹⁵ | 5*10 ⁻¹⁵ | 6.2*10 ⁻¹⁵ |
| | Width | d2 [1] | 3.6 | 3.1 | 3.0 | 3.5 |
| | Velocity | v2 [m/s] | 300 | 300 | 300 | 280 |
| 3rd wave | Frequency | f3 [Hz] | 10.4 | 8.0 | 15 | 10.2 |
| | Amplitude | a3 [m ² /Hz] | 2.6*10 ⁻¹⁷ | 6*10 ⁻¹⁷ | 3*10 ⁻¹⁷ | 2.8*10 ⁻¹⁷ |
| | Width | d3 [1] | 2.0 | 1.5 | 2.8 | 1.9 |
| | Velocity | v3 [m/s] | 250 | 250 | 250 | 230 |

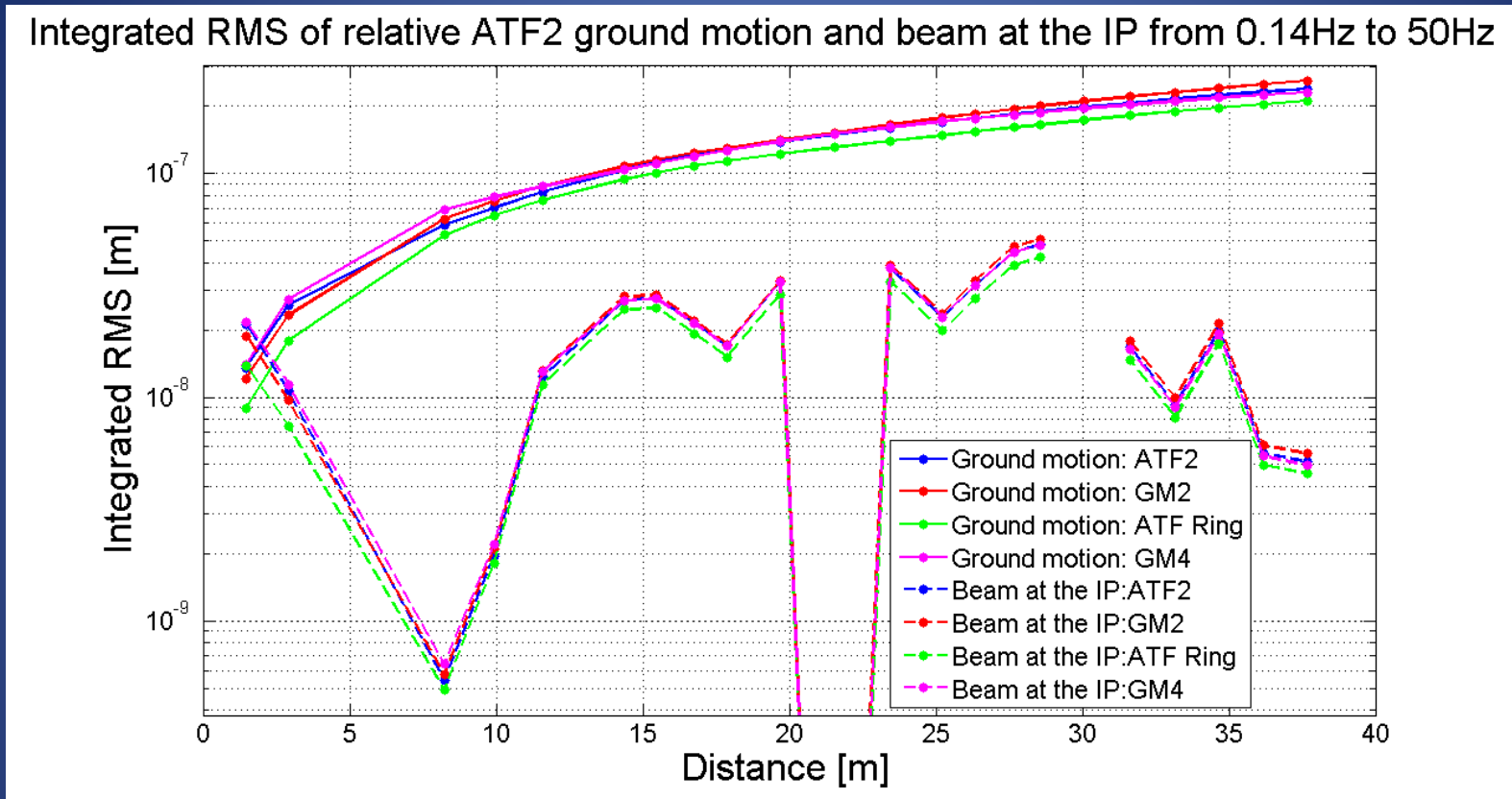
Presented last time: ATF2 GM (reference)

Absolute GM higher but same velocity

Tuning of Y.Renier for ATF Ring

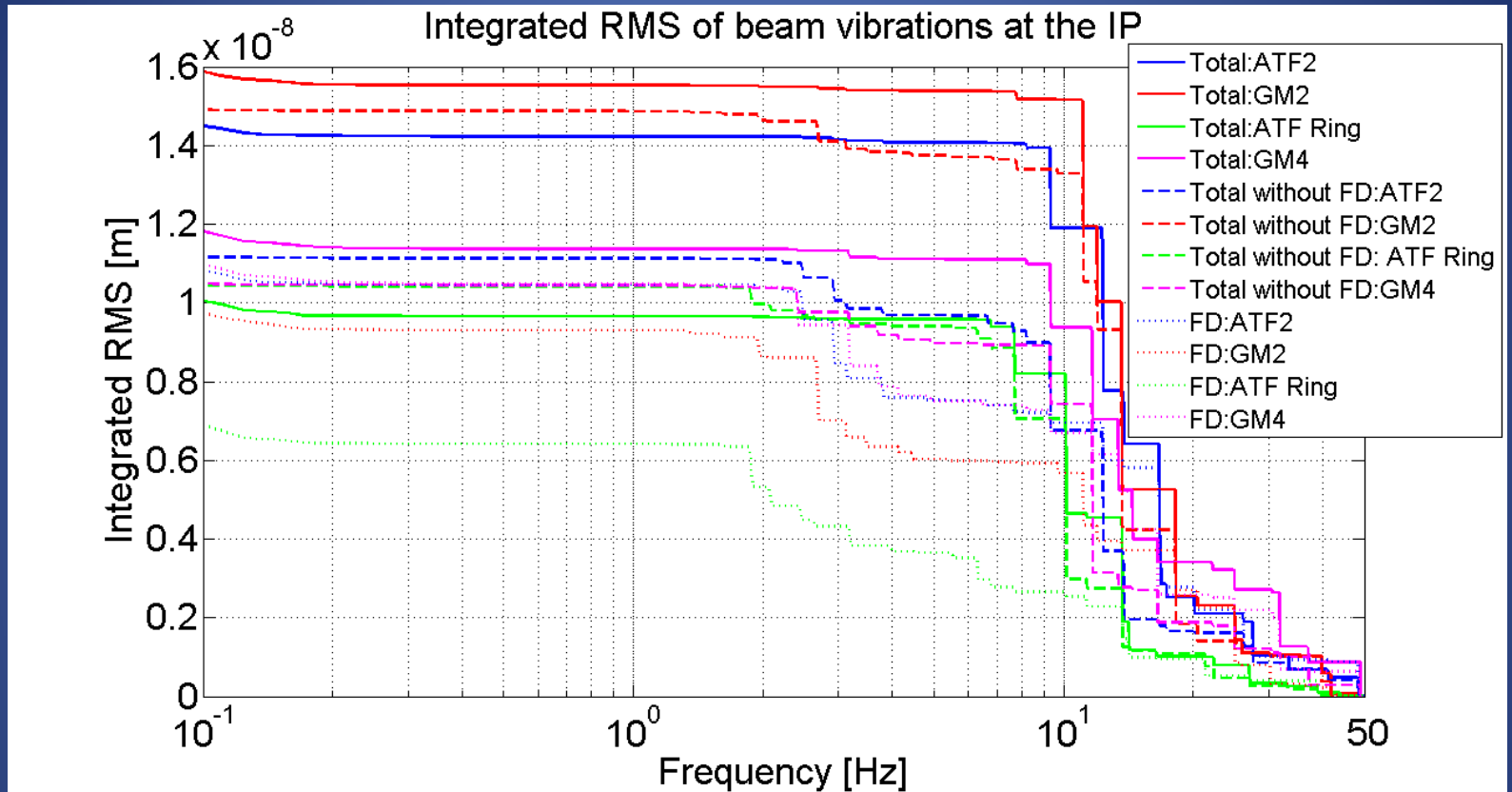
Absolute GM slightly higher and velocity slightly lower

Beam relative motion to IP due to jitter of each QFF_i



- ✓ Beam relative motion (RM) to IP from 0.1Hz to 50Hz due to motion of:
 - QD0/QF1FF=around 20nm/10nm (slightly lower for ATF Ring)
 - QD10A/B=around 45nm/50nm: huge (slightly lower for ATF Ring)
- ✓ GM4 parameters very slightly different from ATF2 ones
 - ➔ very slightly difference in terms of ground and beam relative motion

Beam relative motion to IP due to jitter of all QFF_i




✓ By summing the effect of all the quads motion, lucky compensation on the relative motion beam/IP for 4 different ground motion

→ **Lucky compensation seems to be well reproducible!!**

Summary

| Rel. motion beam/IP (nm) | ATF2 | GM2 | ATF Ring | GM4 |
|--------------------------|------|------|----------|------|
| QD0 | 21.0 | 18.8 | 13.8 | 21.6 |
| QF1 | 10.7 | 9.7 | 7.4 | 11.4 |
| QD10A | 44.7 | 47.2 | 39.0 | 44.5 |
| QD10B | 48.2 | 51.0 | 42.1 | 47.8 |
| QD0/QF1 | 10.5 | 9.5 | 6.5 | 10.5 |
| All QFF except FD | 11.1 | 14.9 | 10.4 | 10.7 |
| All QFF | 14.3 | 15.7 | 9.8 | 11.5 |

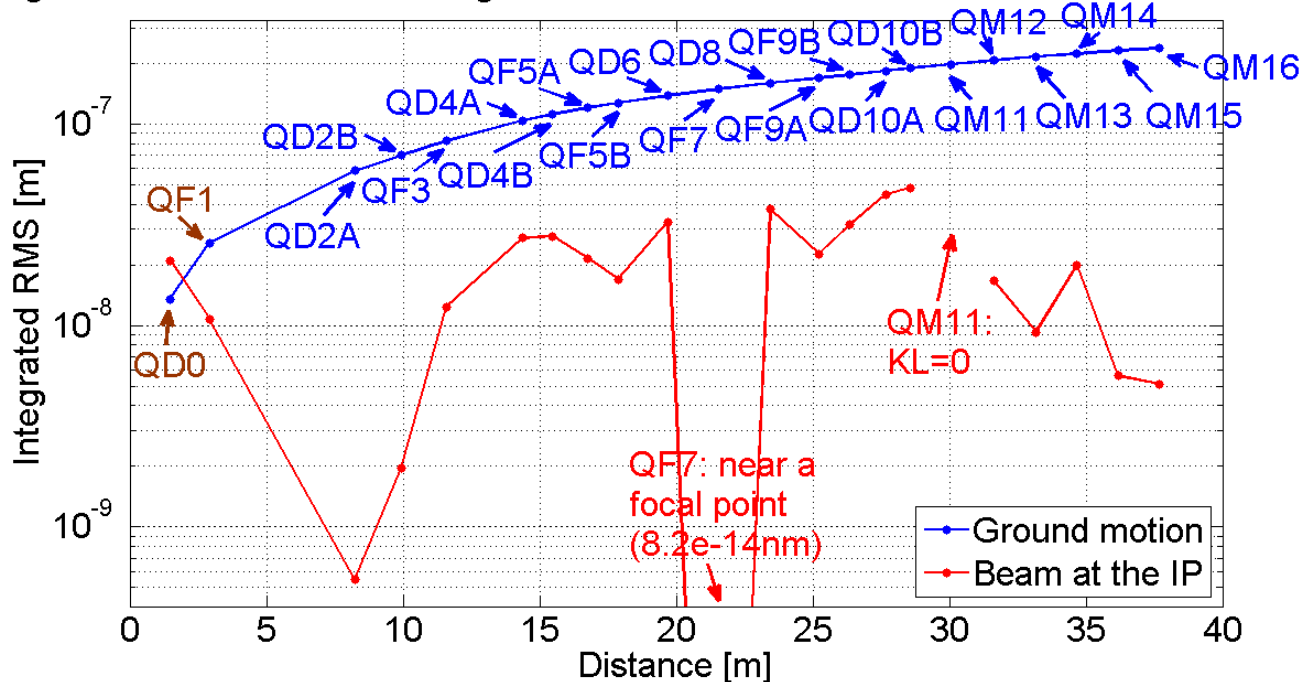
- ✓ GM4 parameters very slightly different from ATF2 ones
 - almost same results obtained in terms of relative motion beam/IP
 - ✓ Relative motion of ATF Ring slightly lower from ATF2 one
 - Slightly lower relative motion beam/IP at ATF Ring than at ATF2
-  **Compensation seems to be not random (good point!!)**

ANNEXES

Beam relative motion to IP due to jitter of each QFF_i

ATF2

Integrated RMS of relative ATF2 ground motion and beam to the IP from 0.14Hz to 50Hz

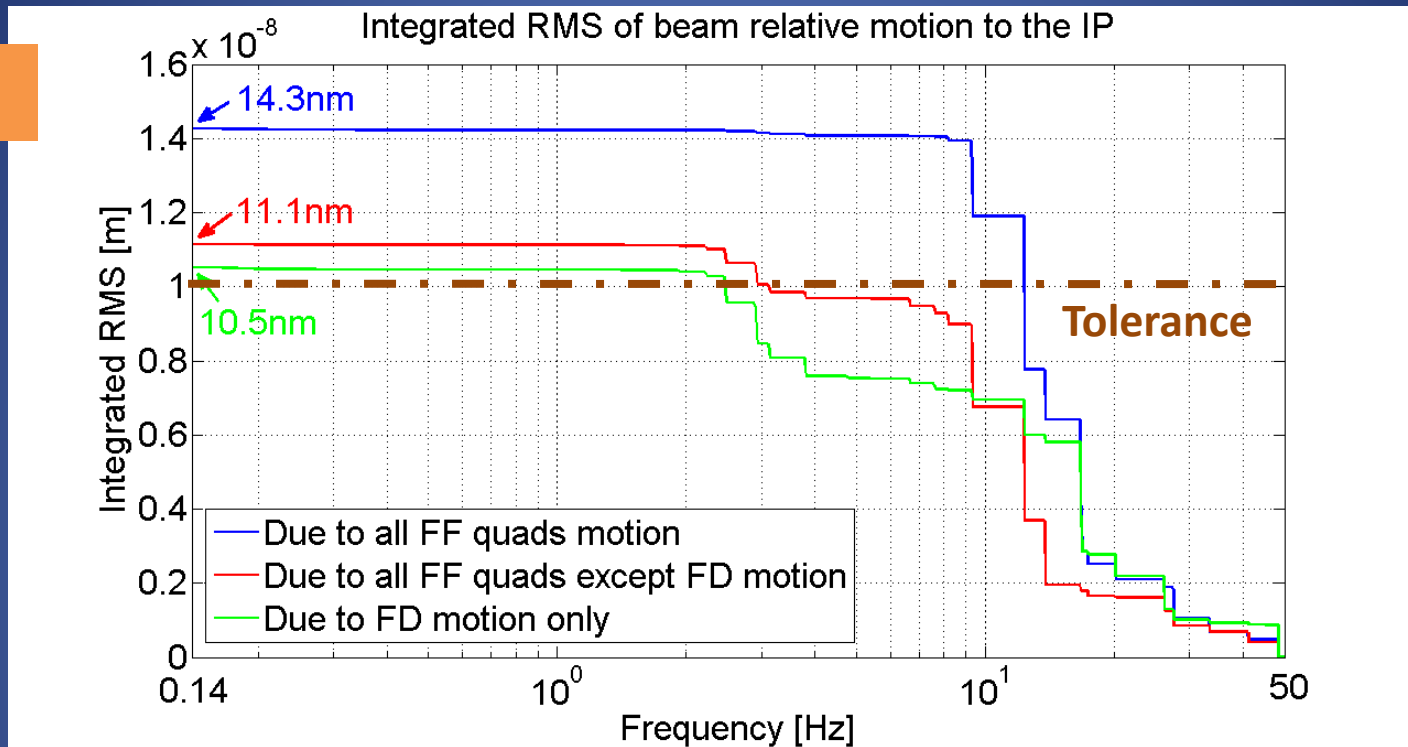


- ✓ Increase of relative ground motion to the IP with increase of distance
- ✓ Beam relative motion to IP from 0.1Hz to 50Hz due to motion of:
 - QD0/QF1FF=21.0/10.7nm: high β but good coherence with the IP
 - QD10A/B=44.7/48.2nm: very high due to high β /coherence loss

➔ Necessity to look at beam relative motion due to jitter of all quads

Beam relative motion to IP due to jitter of all QFF_i

ATF2



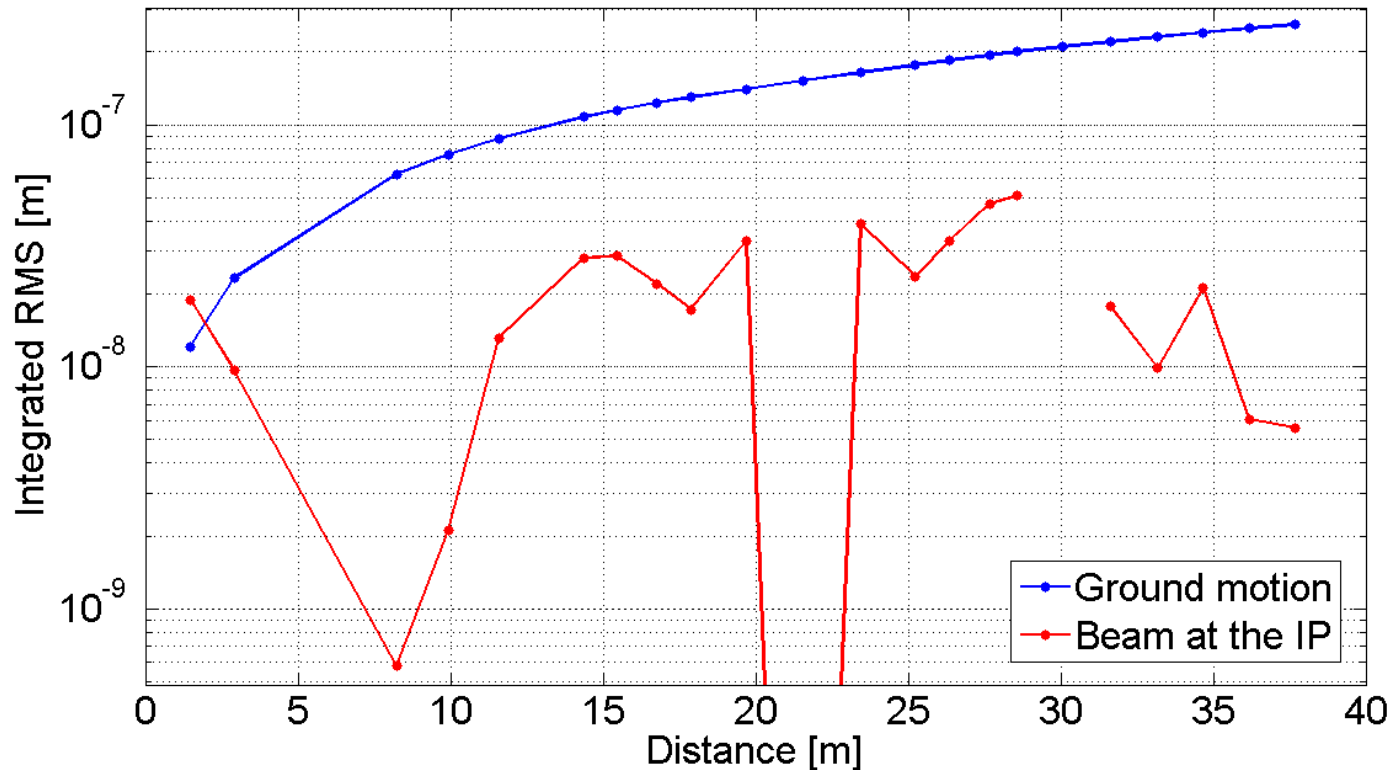
- ✓ Beam relative motion to IP from 0.1 Hz to 50 Hz due to jitter of:
 - Both QD0/QF1: 10.5 nm (low due to compensation of D and F)
 - All FF quads except FD: 11.1 nm (low due to lucky compensation)
 - All FF quads: 14.3 nm (low due to lucky compensation)

Beam relative motion to IP due to jitter of all FF quads almost within tolerances for 5% error on beam size measurements and high ATF2₈GM

Beam relative motion to IP due to jitter of each QFF_i

Integrated RMS of relative ATF2 ground motion and beam at IP from 0.14Hz to 50Hz; GM2

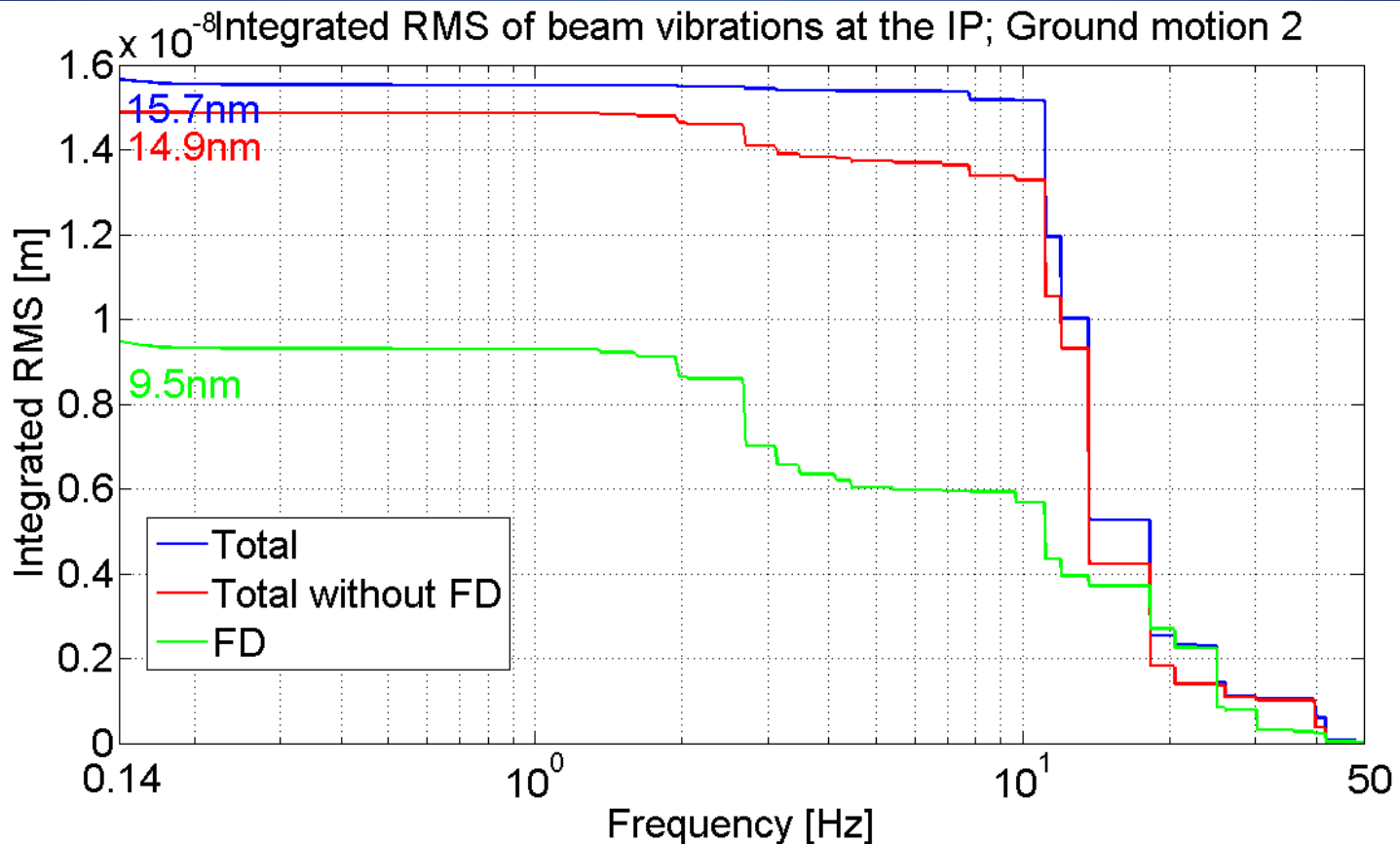
GM2



- ✓ Beam relative motion to IP from 0.1Hz to 50Hz due to motion of:
 - QD0/QF1FF=18.8/9.7nm
 - QD10A/B=47.2nm/51.0nm

Beam relative motion to IP due to jitter of all QFF_i

GM 2

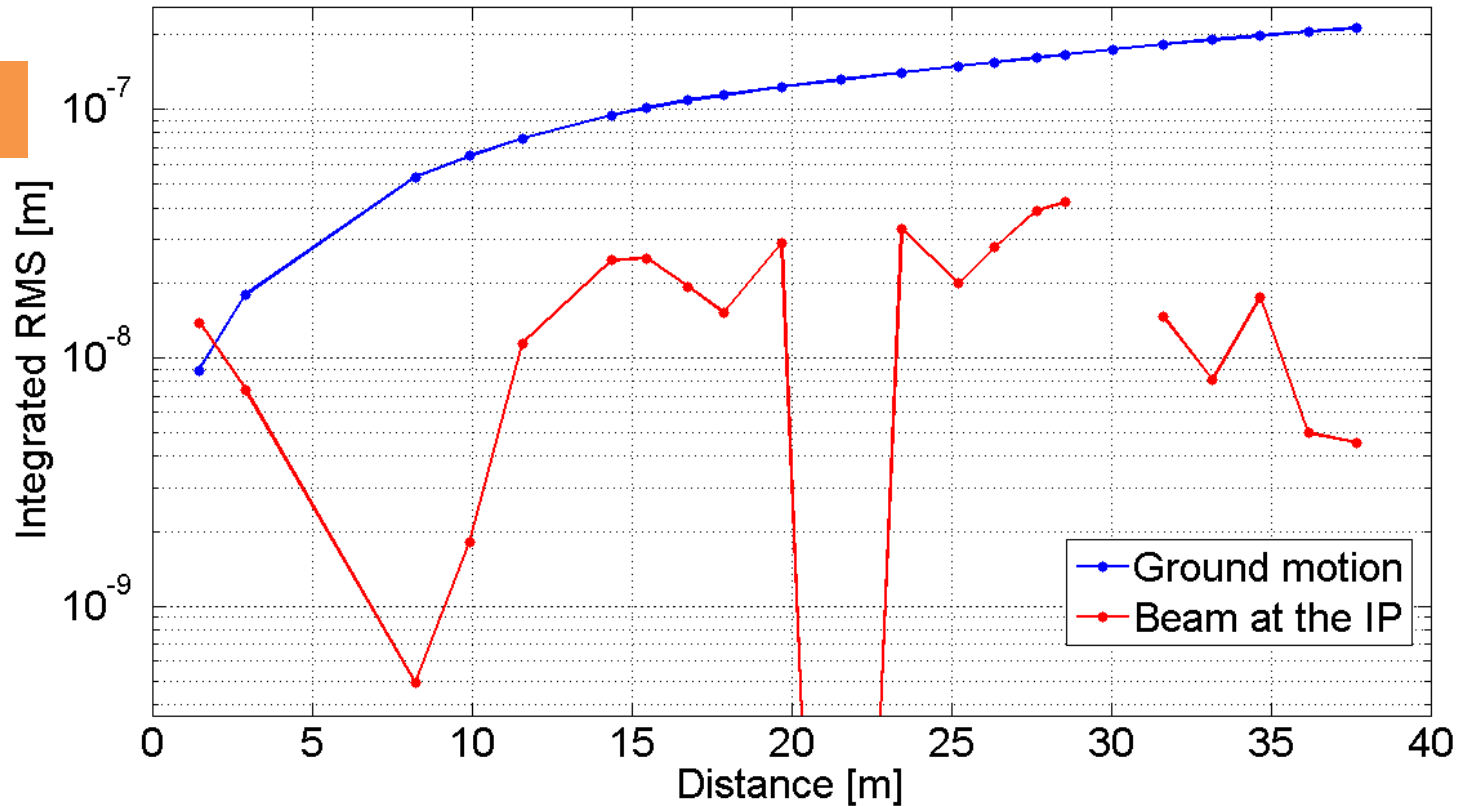


- ✓ Beam relative motion to IP from 0.1Hz to 50Hz due to jitter of:
 - Both QD0/QF1: 9.5nm
 - All FF quads except FD: 14.9nm
 - All FF quads: 15.7nm

Beam relative motion to IP due to jitter of each QFF_i

Integrated RMS of relative ATF2 ground motion and beam at IP [0.14;50]Hz; ATF Ring GM

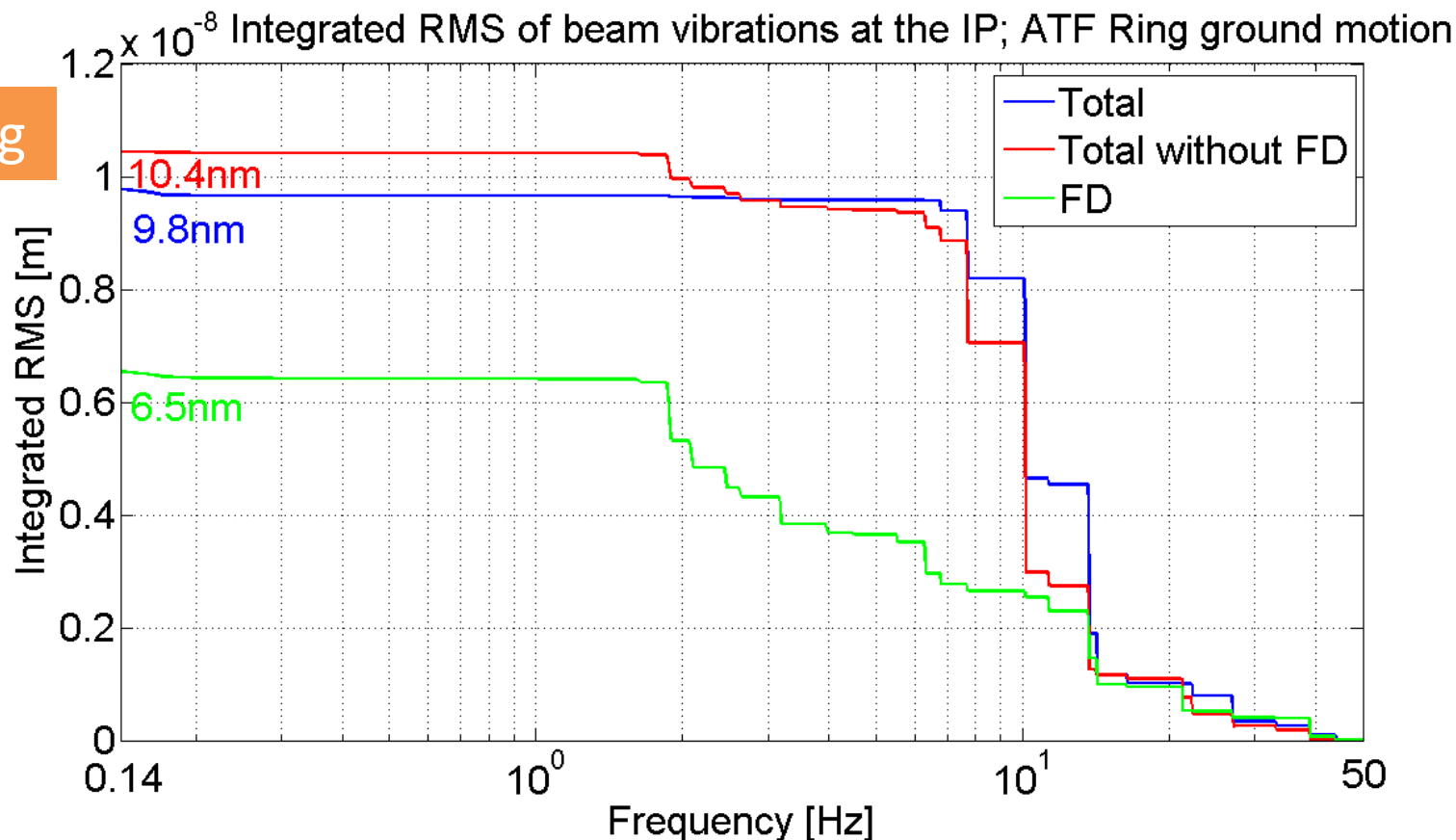
ATF Ring



- ✓ Beam relative motion to IP from 0.1Hz to 50Hz due to motion of:
 - QD0/QF1FF=13.8/7.4nm
 - QD10A/B=39.0nm/42.1nm

Beam relative motion to IP due to jitter of all QFF_i

ATF Ring

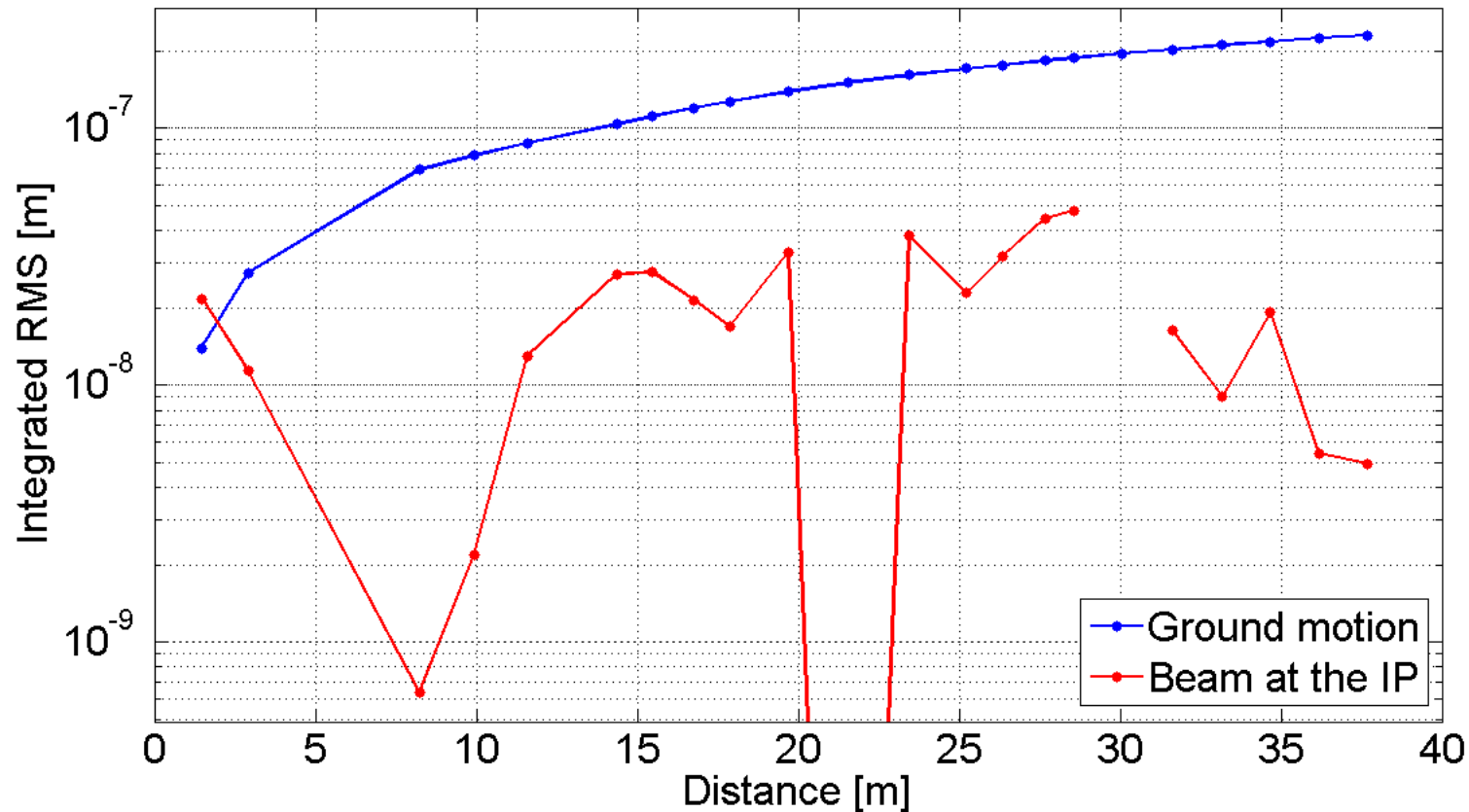


- ✓ Beam relative motion to IP from 0.1 Hz to 50 Hz due to jitter of:
 - Both QD0/QF1: 6.5 nm
 - All FF quads except FD: 10.4 nm
 - All FF quads: 9.8 nm

Beam relative motion to IP due to jitter of each QFF_i

Integrated RMS of relative ATF2 ground motion and beam at IP from 0.14Hz to 50Hz; GM4

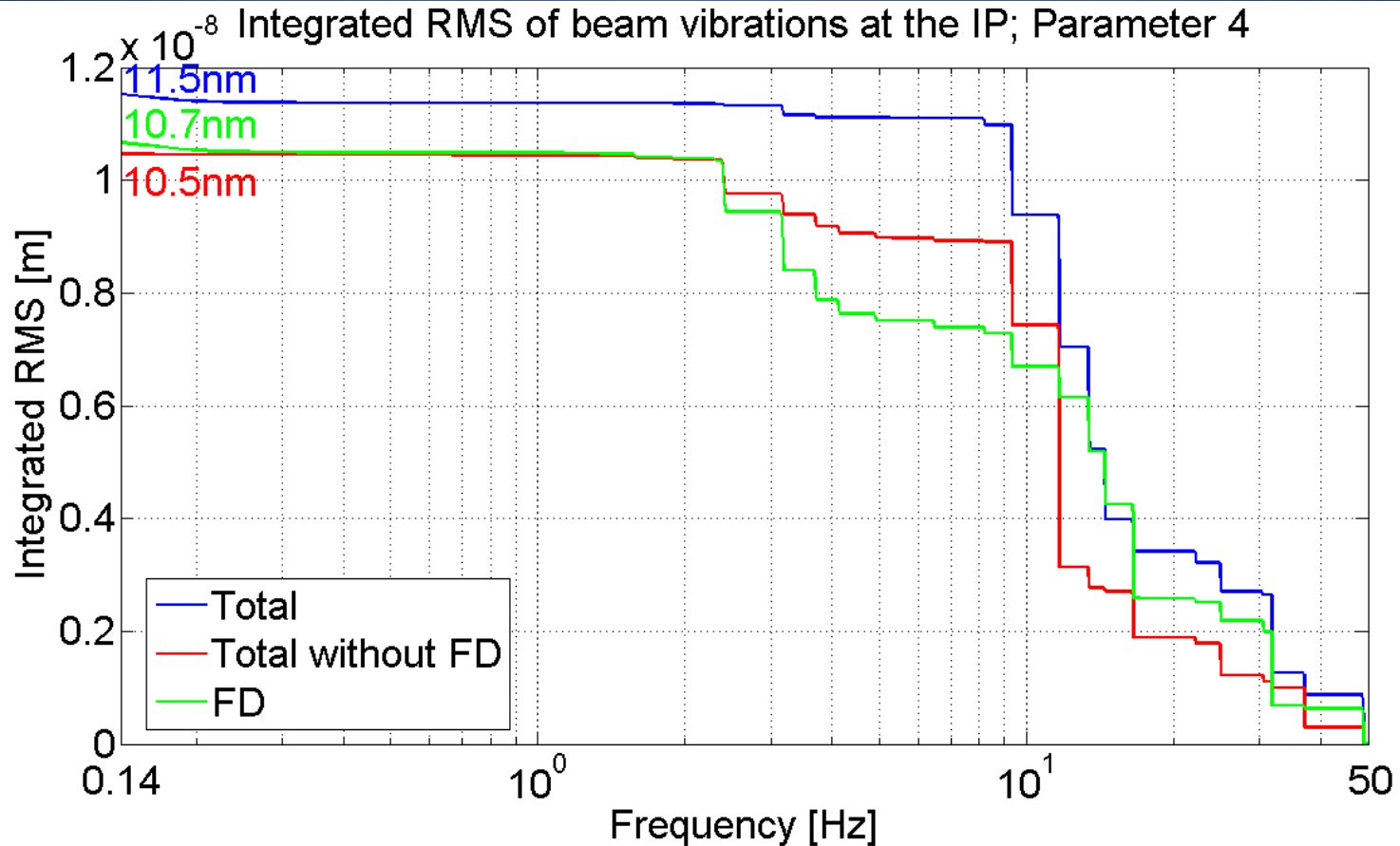
GM 4



- ✓ Beam relative motion to IP from 0.1Hz to 50Hz due to motion of:
 - QD0/QF1FF=21.6/11.4nm
 - QD10A/B=44.5nm/47.8nm

Beam relative motion to IP due to jitter of all QFF_i

GM4



- ✓ Beam relative motion to IP from 0.1Hz to 50Hz due to jitter of:
 - Both QD0/QF1: 10.5nm
 - All FF quads except FD: 10.7nm
 - All FF quads: 11.5nm