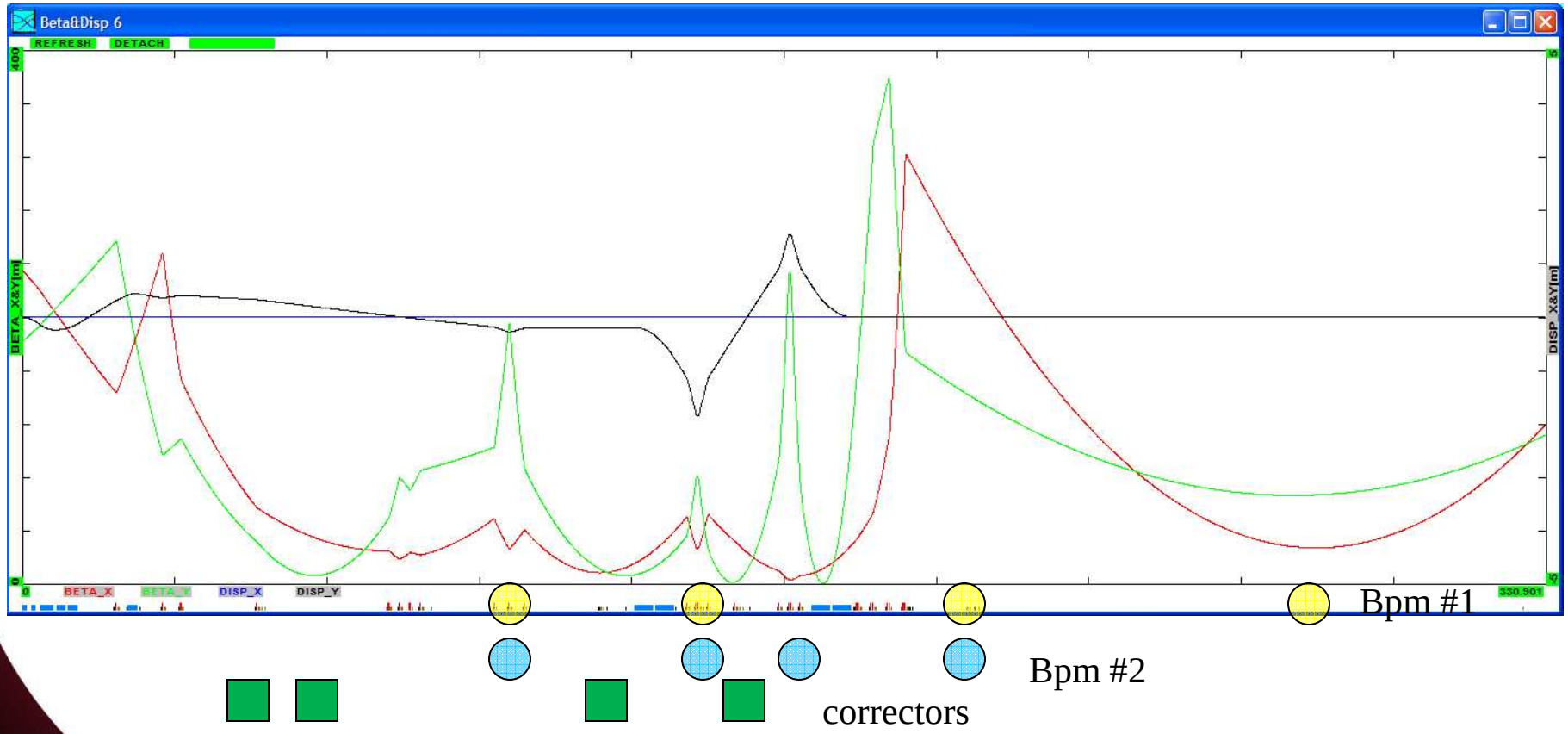
Hall D Fast Feedback System

Performance and configuration

Fast Feedback specifications

- Stability σ_x <200μm, σ_y <200μm at collimator
- Ability to run without active collimator
- Current range 500nA <I <5 μA
- σ_x <200μm, σ_y <200μm at radiator
- I<1 μA f up to third harmonic of 60Hz
- I>1 μA f up to 1Khz
- Alternate bpm choices must be available

Hall D optics configuration



Input conditions

- Simulated Mismatching/rematching the beamline
  - 9 different mismatched configurations

- Simulated incoming orbit fluctuations:
  - σ_x ,σ_y =1mm RMS, $\sigma_{x'}$,$\sigma_{y'}$ =1 μrad RMS

Performance with active collimator for various input conditions

Trial	β_x	β_y	α_x	α_y	correctors	σ_x	σ_y
Base	1.0	1.0	0.0	.0.0	FFB5C00H,FFB5C04H,FFBBE00V,FFBBS04V	47	10
T1	0.5	0.5	-1.0	-1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	41	16
T2	0.5	1.0	0.0	0.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	72	18
T3	0.5	2.0	1.0	1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	101	20
T4	1.0	0.5	0.0	1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	57	21
T5	1.0	1.0	1.0	-1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	55	20
T6	1.0	2.0	-1.0	0.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	32	14
T7	2.0	0.5	1.0	0.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	65	23
T8	2.0	1.0	-1.0	1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	34	15
T9	2.0	2.0	0.0	-1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	31	12

IPMBT02,IPM5C02,IPM5C12,ACTCOL

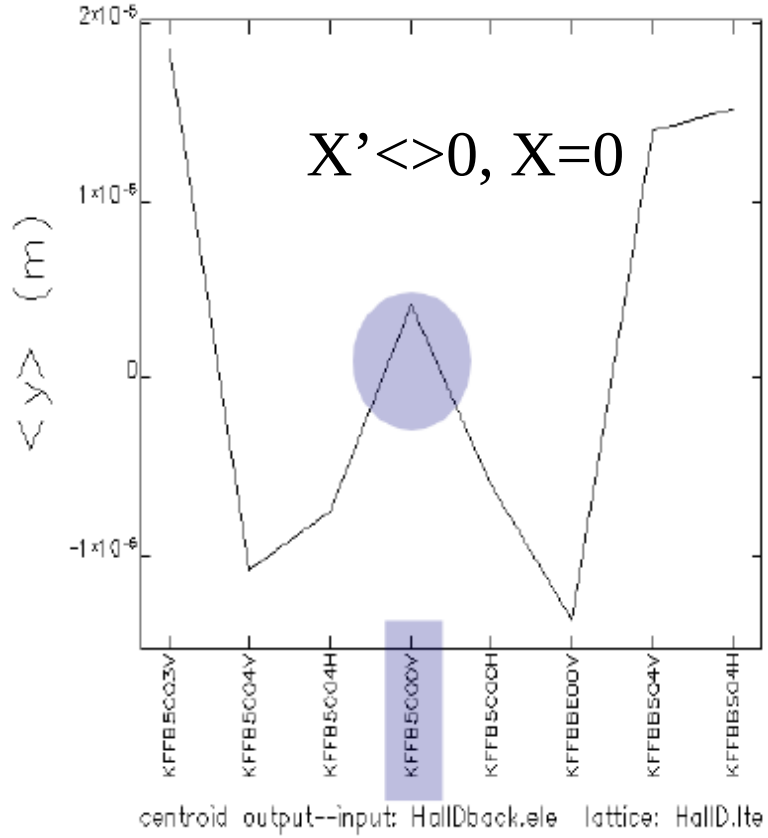
Performance without active collimator for various input cond.

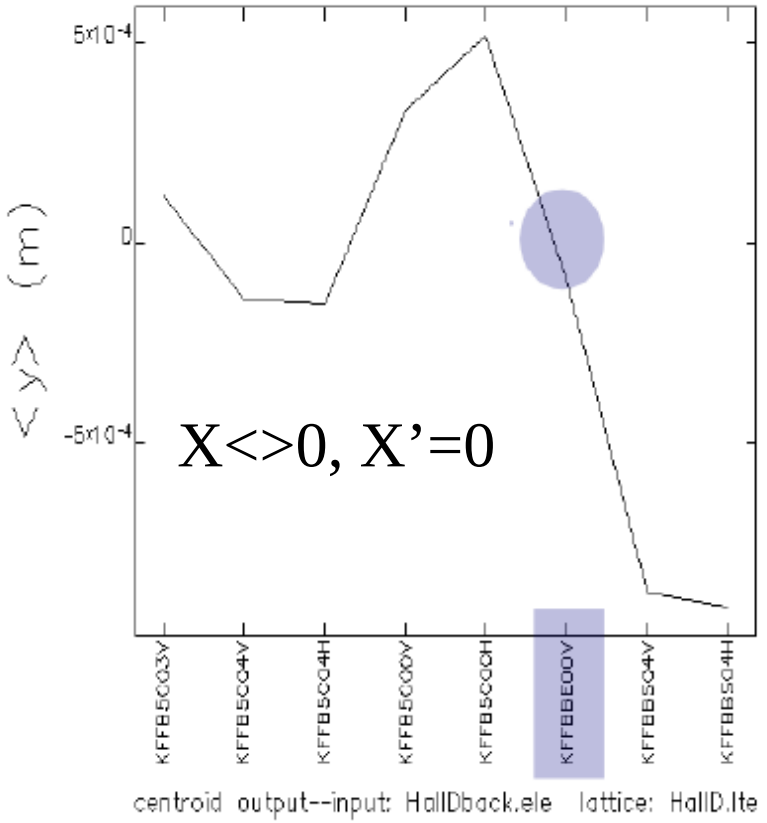
Trial	β_x	β_y	α_x	α_y	correctors	σ_x	σ_y
Base	1.0	1.0	0.0	.0.0	FFB5C00H,FFB5C04H,FFBBE00V,FFBBS04V	180	18
T1	0.5	0.5	-1.0	-1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	139	27
T2	0.5	1.0	0.0	0.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	246	21
T3	0.5	2.0	1.0	1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	176	160
T4	1.0	0.5	0.0	1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	239	26
T5	1.0	1.0	1.0	-1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	196	19
T6	1.0	2.0	-1.0	0.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	107	15
T7	2.0	0.5	1.0	0.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	175	26
T8	2.0	1.0	-1.0	1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	104	17
T9	2.0	2.0	0.0	-1.0	FFB5C00H, FFB5C04H, FFBBE00V,FFBBS04V	72	13

IPMBT02,IPM5C02,IPM5C07,IPM5C12

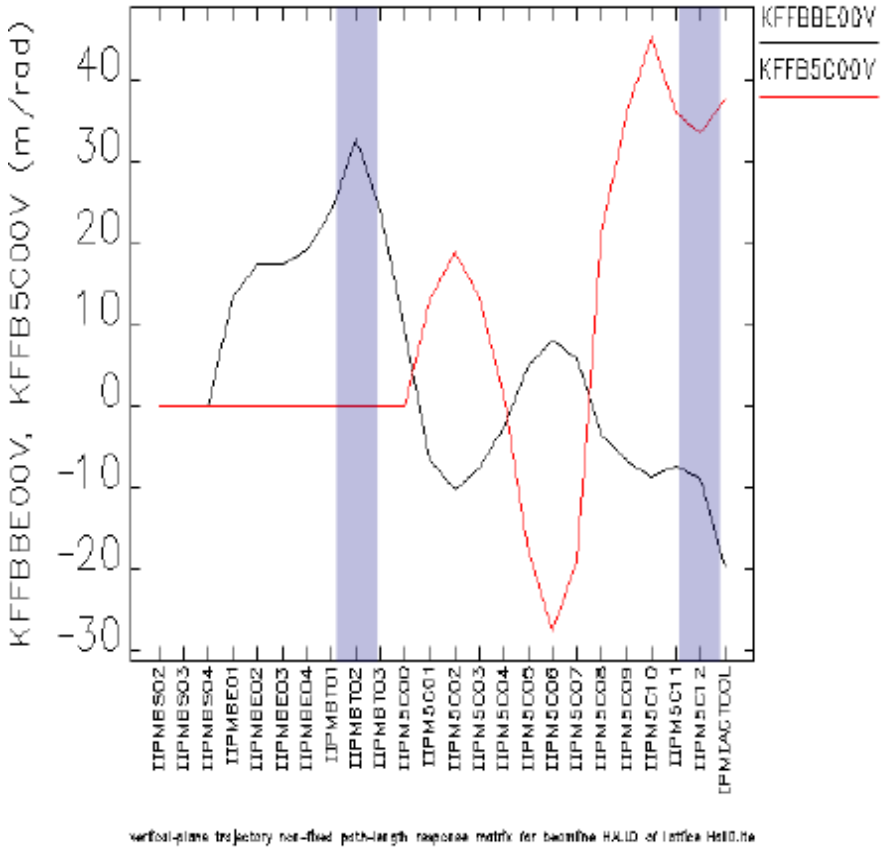
Choosing the correctors

to radiator

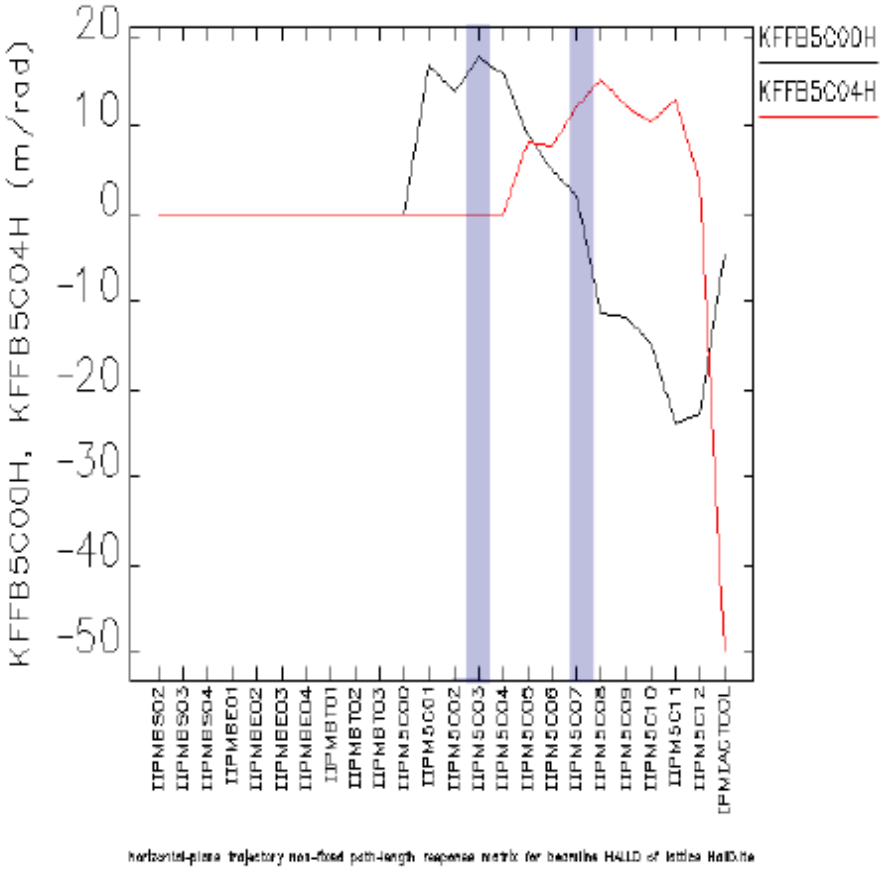




Choosing the bpms

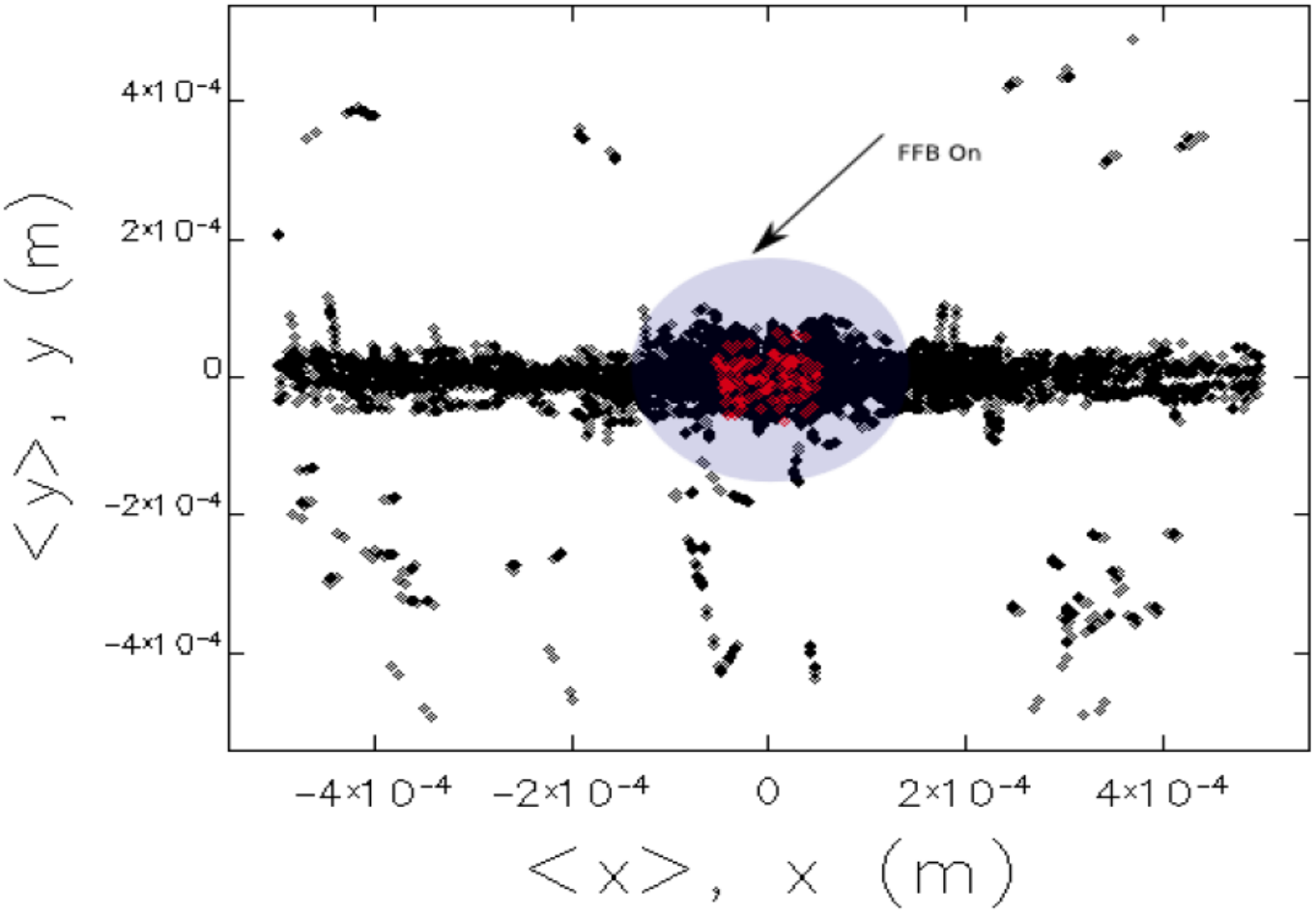


vertical-plane trajectory non-fixed path-length response matrix for beamline HALD of lattice Hall0.lte



horizontal-plane trajectory non-fixed path-length response matrix for beamline HALD of lattice Hall0.lte

FFB on vs FFB off at collimator



Dynamic range

- FFB is currently configured to taper off correction past 400 Hz
- May be modified to go up to 1Khz if necessary
- Actual bandwidth is around 2Khz so could in principle correct up to 1Khz.

conclusions

- FFB system can meet all (most) of the requirements
- System is robust to tuning of line due to mismatches
- If mismatch greater, then will need to tune upstream of hallD
- Several choices of bpm and correctors are possible
- Correctors can easily be moved on beamline once we determine optimal configuration
- System can work with/without active collimator