

Upstream feedback performance and propagation downstream

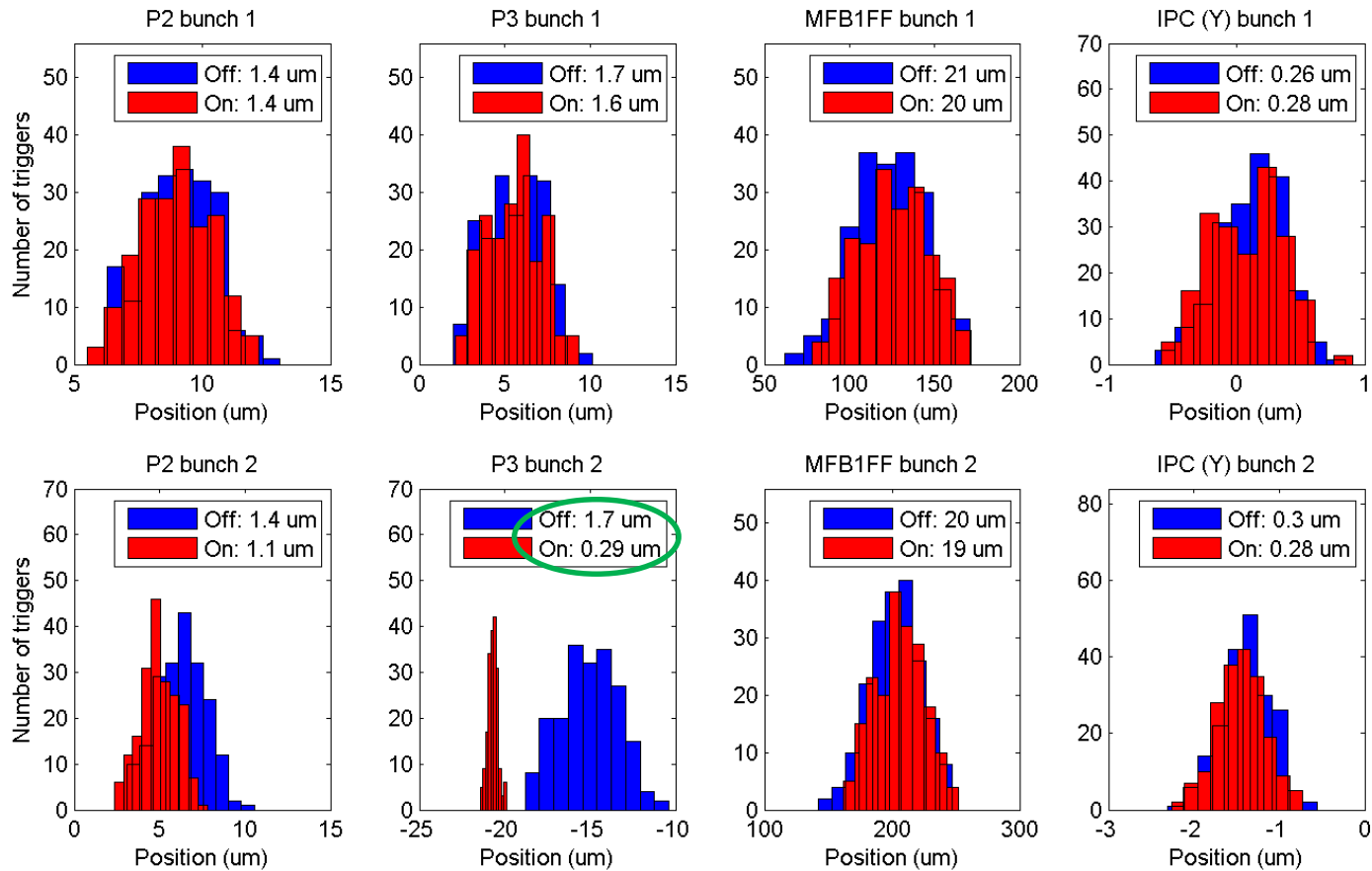
N. Blaskovic, T. Bromwich & R. Ramjiawan

Contents

- Upstream feedback at high charge ($\sim 10^{10}$):
 - K2-P3 single-loop feedback
 - Coupled-loop feedback
- Witness at MFB1FF & IPC (close to waist) with nominal optics

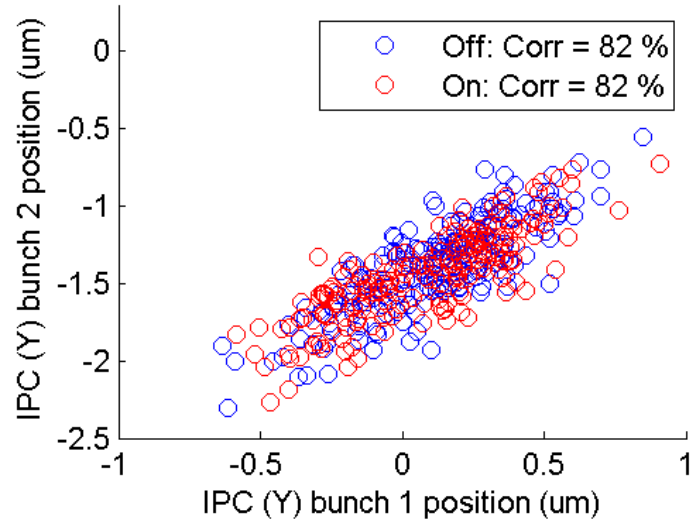
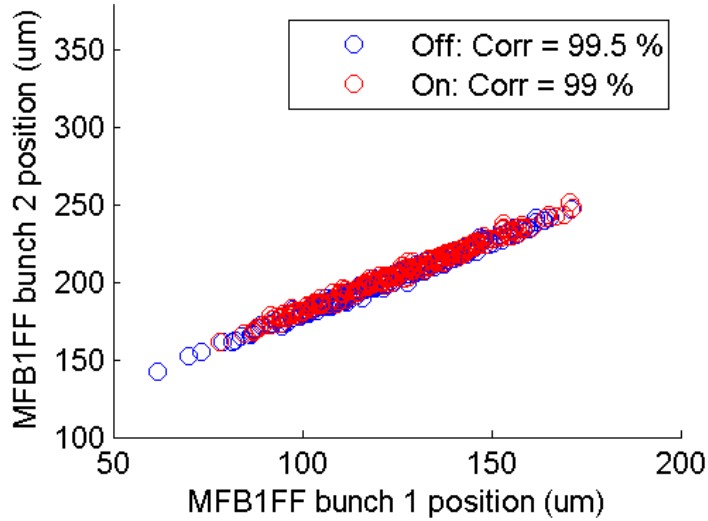
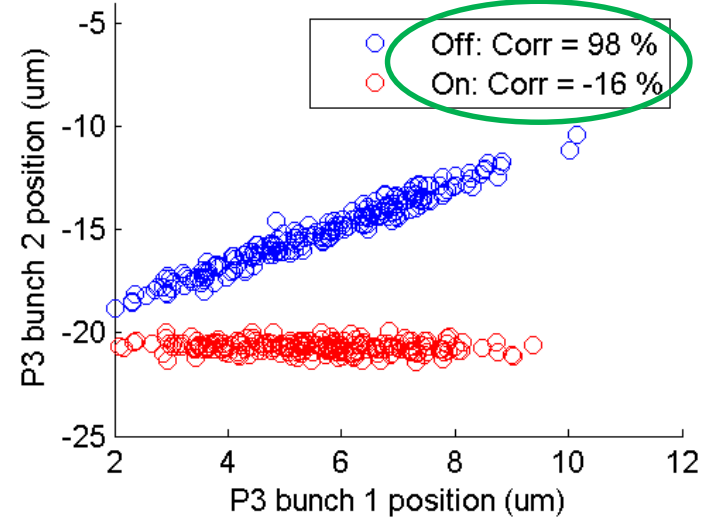
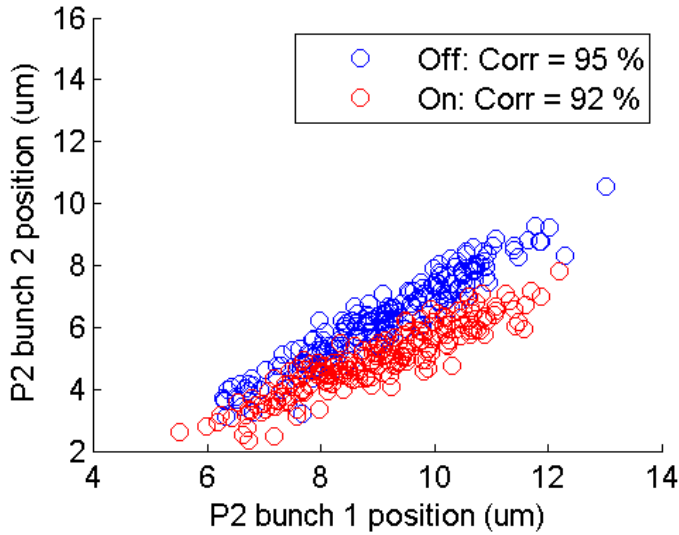
Single-loop feedback

- K2-P3 single-loop feedback, 22 February
- Charge: $\sim 0.9 \times 10^{10}$
- Stripline phase shifters set up on P2 & P3 (one of them not responding)
- Offline phase subtraction for MFB1FF
- Waist close to IPC (QD0FF: 123.4 A)
- 3-BPM geometric resolution: 443 nm (with 6 dB attenuation on MFB1FF strips)



stabilisation to 290 nm

correlation removed

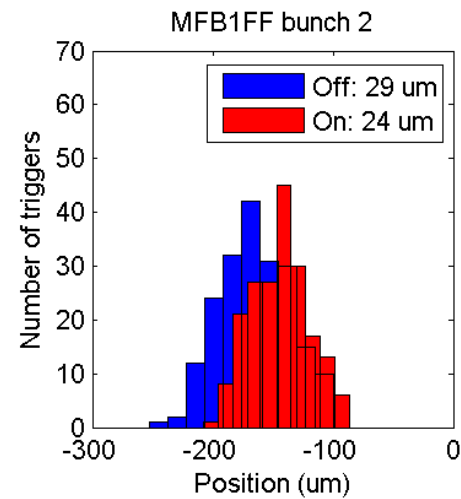
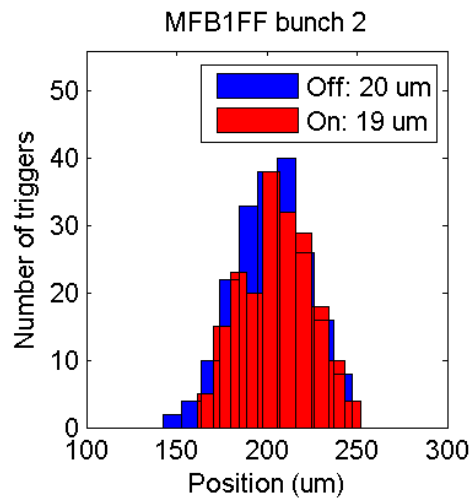
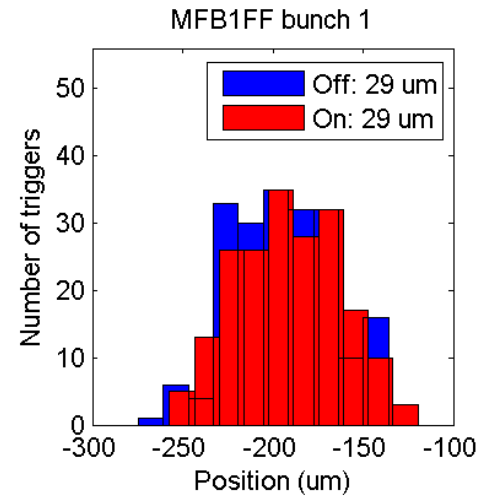
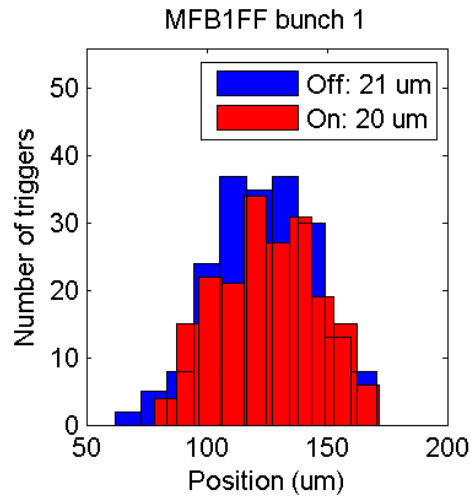


Jitter propagation

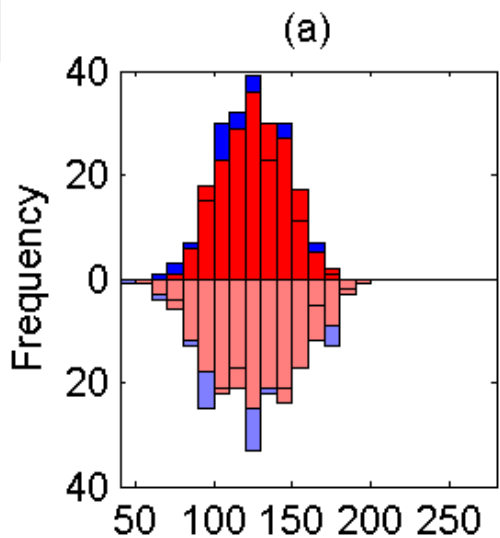
- Feedback results propagated to MFB1FF, IPC and the IP waist using P2 and P3 data

measured at MFB1FF

propagated to MFB1FF

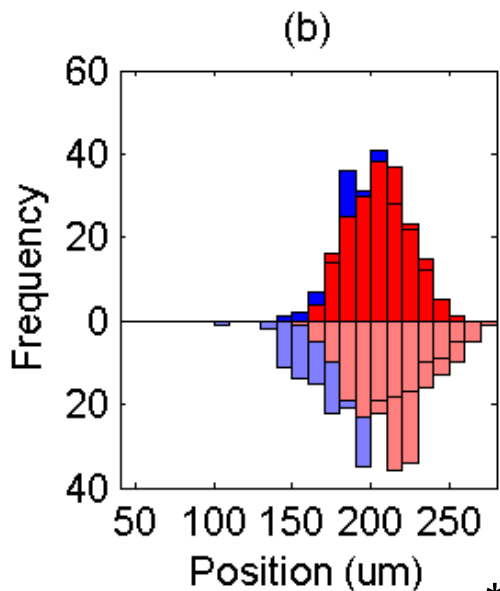


MFB1FF



bunch 1 measured

bunch 1 propagated*

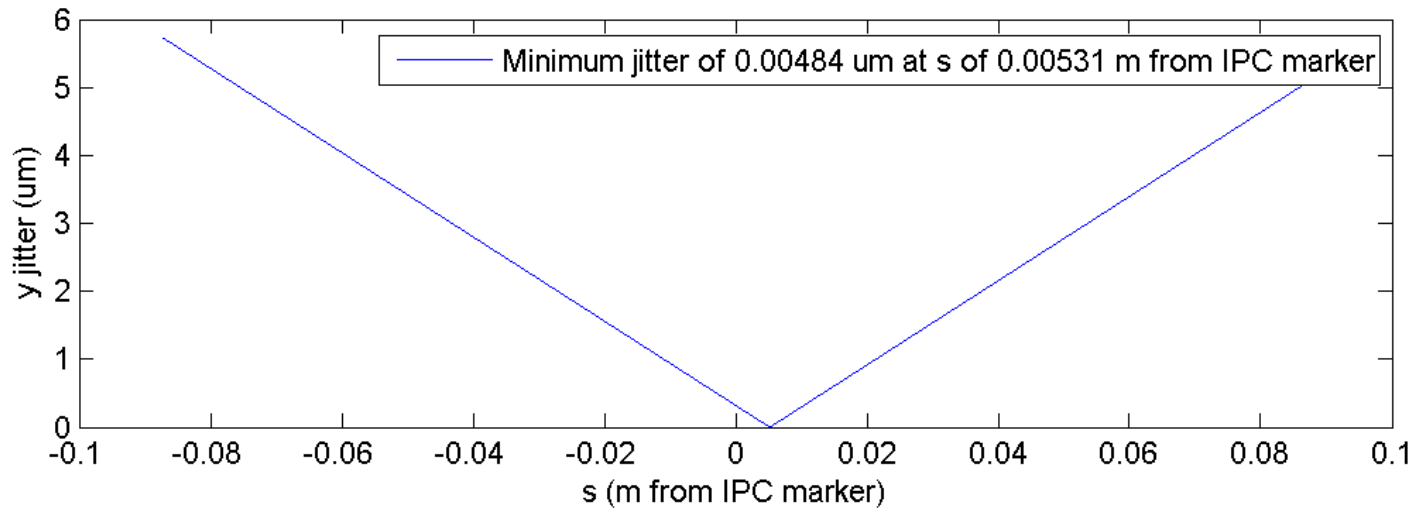
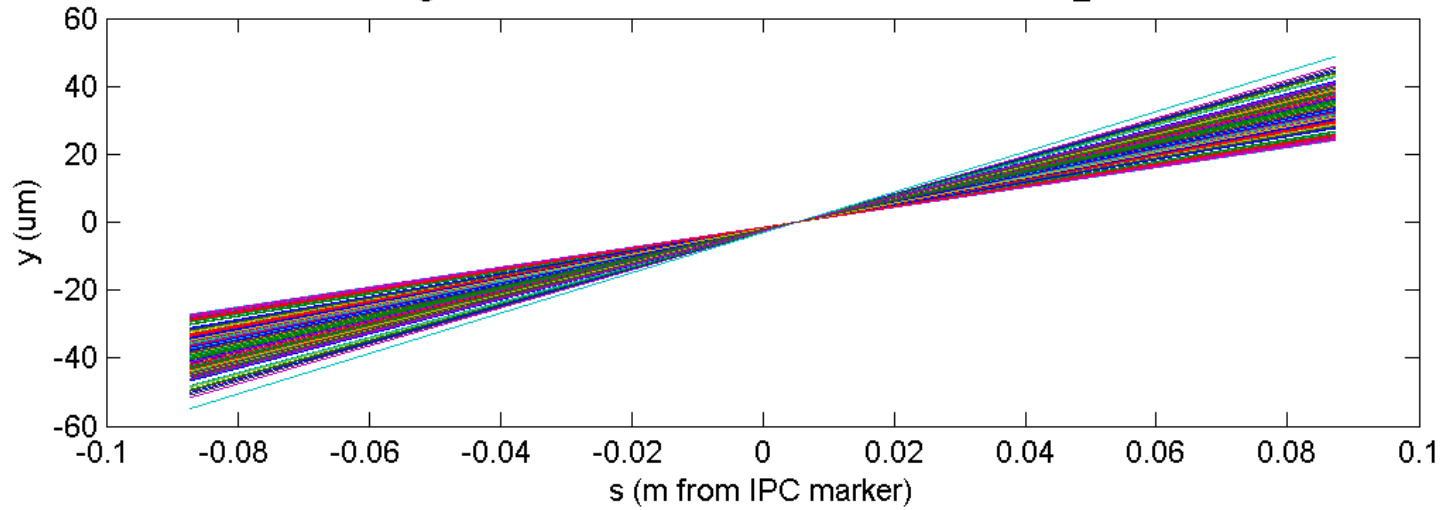


bunch 2 measured

bunch 2 propagated*

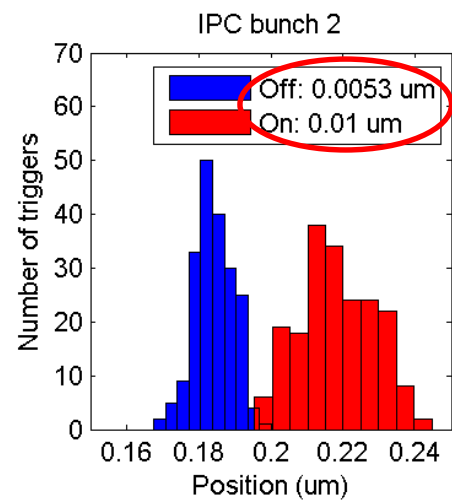
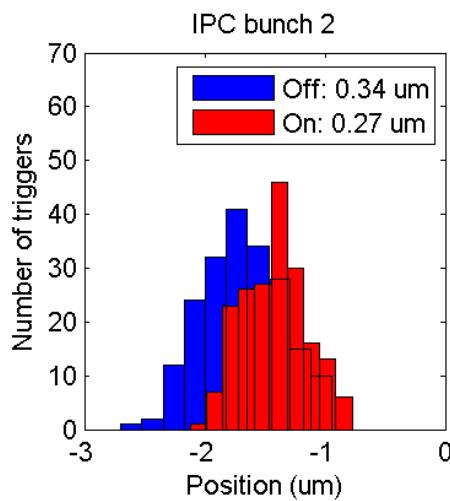
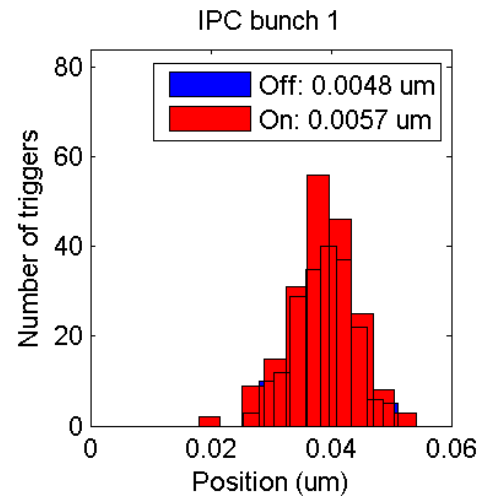
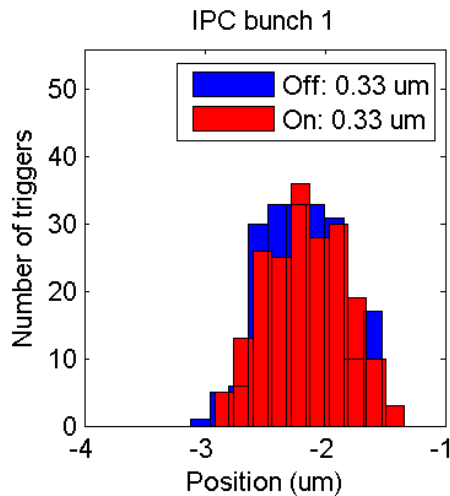
*with mean measured position subtracted

Tracking P2 and P3 positions to IPC region
for fbRun6 on 220217 using only FbOff data for bunch 1
using linear transfer matrices from setfile set17feb22_0336

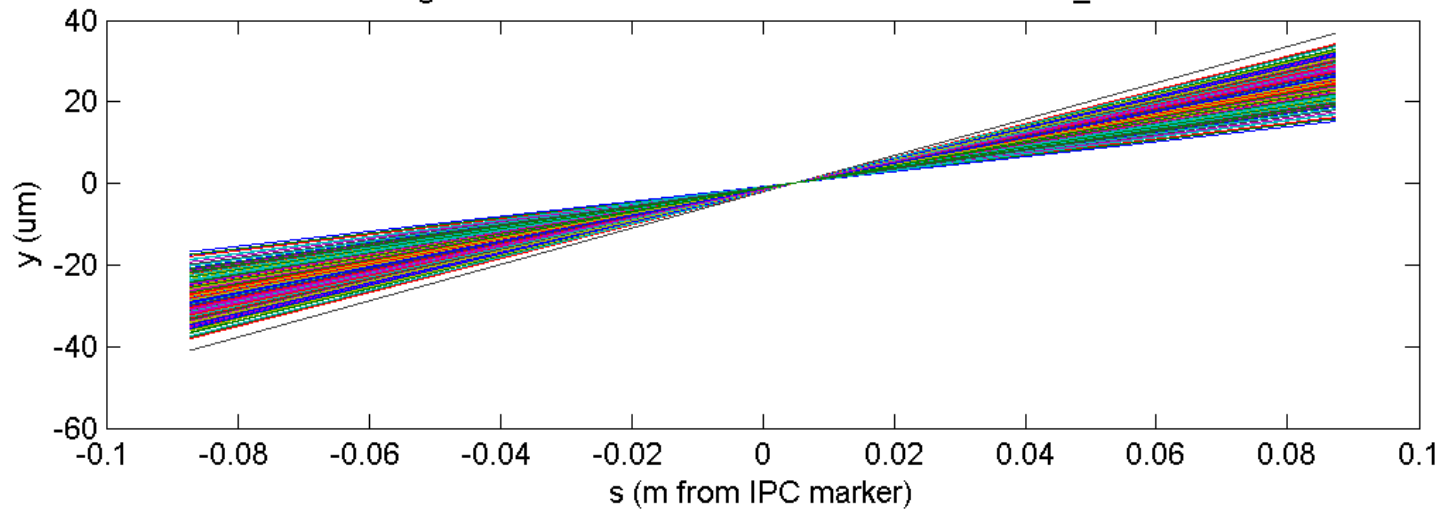


propagated to IPC

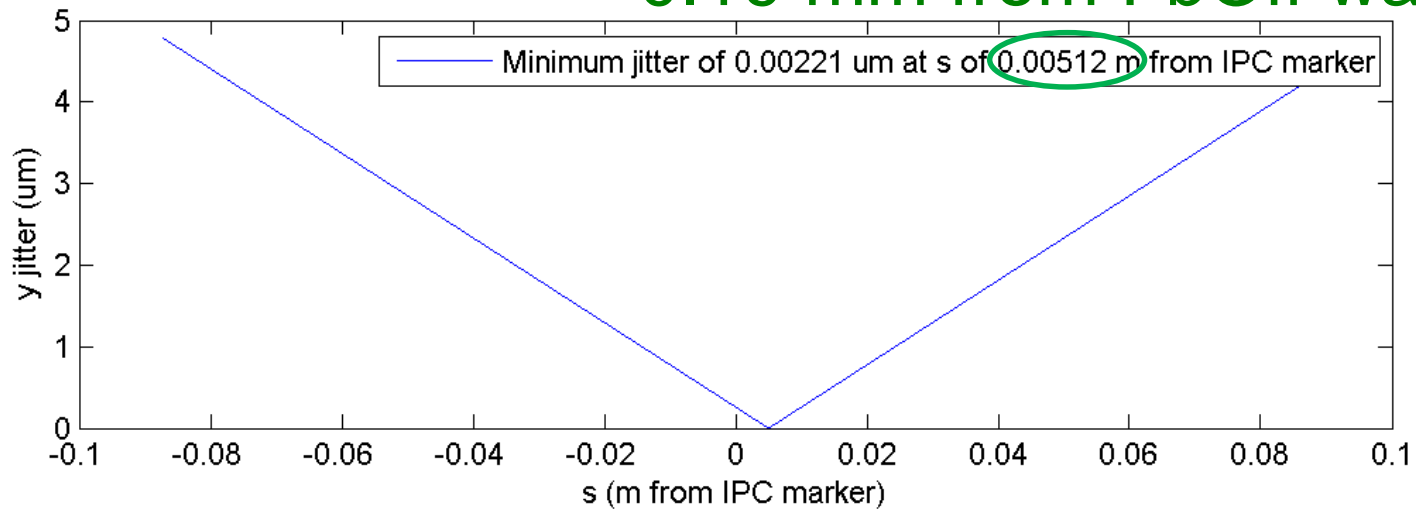
propagated to waist



Tracking P2 and P3 positions to IPC region
for fbRun6 on 220217 using only FbOn data for bunch 2
using linear transfer matrices from setfile set17feb22_0336

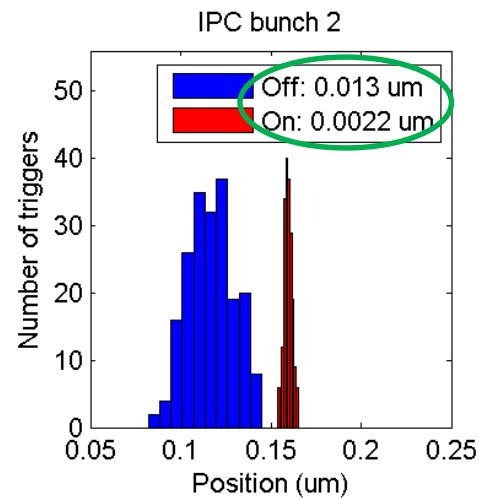
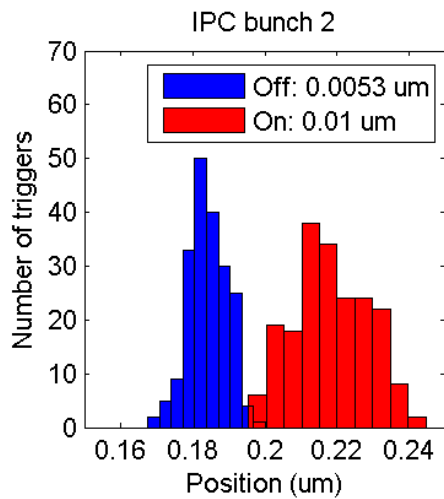
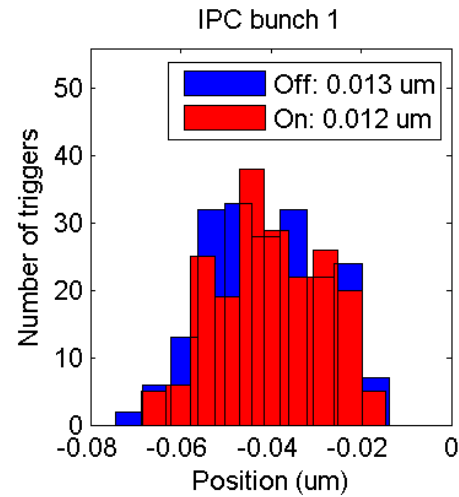
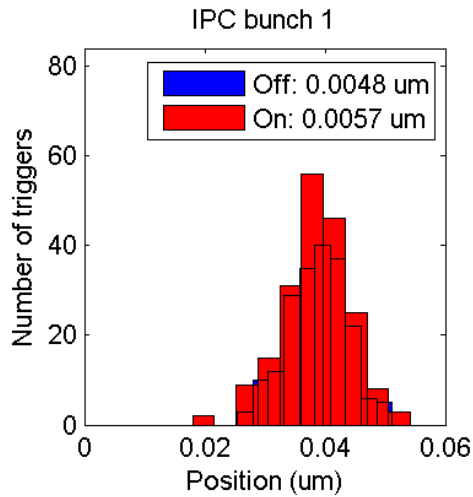


0.19 mm from FbOff waist



propagated to FbOff waist

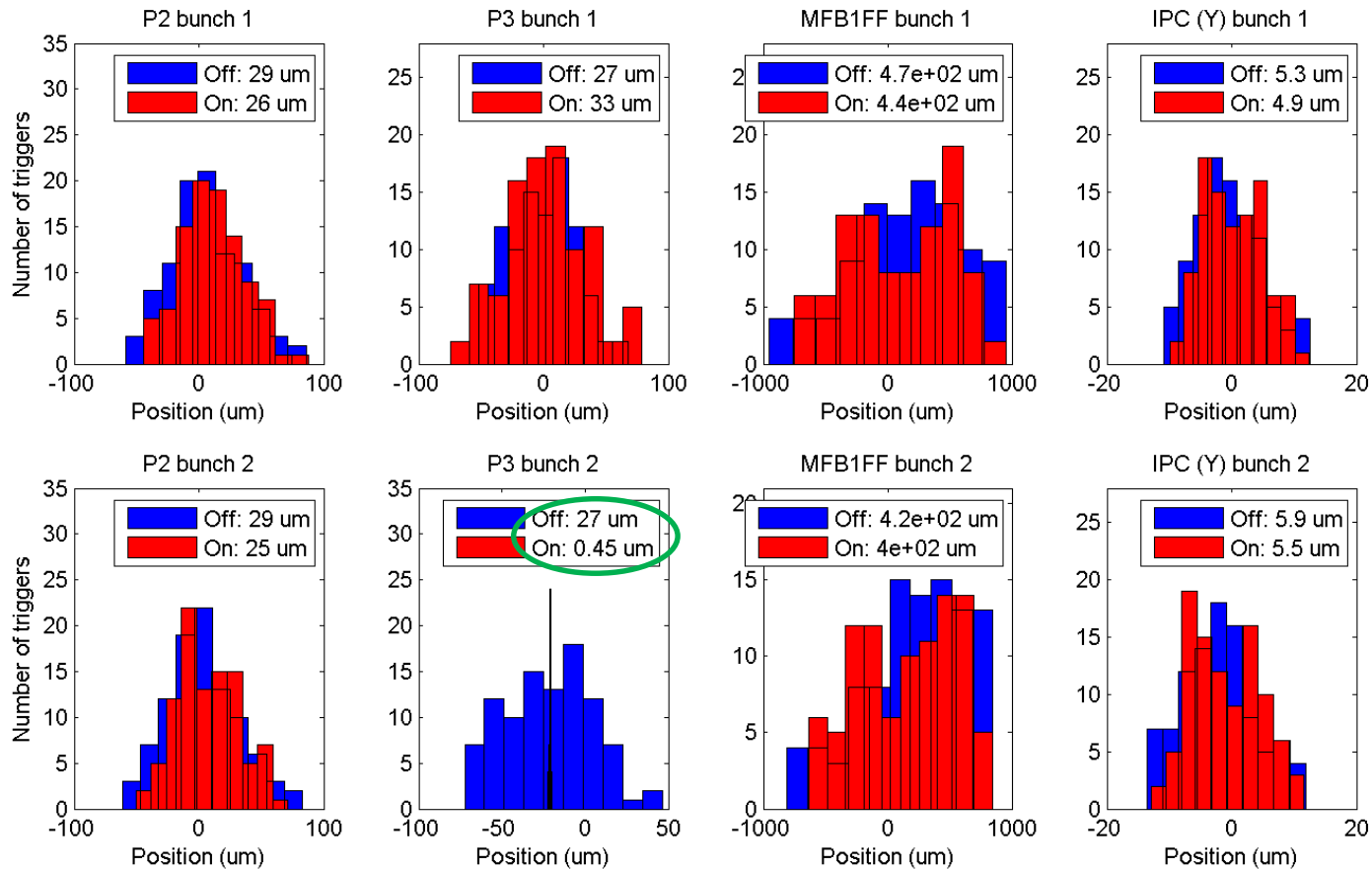
propagated to FbOn waist



Random jitter scan

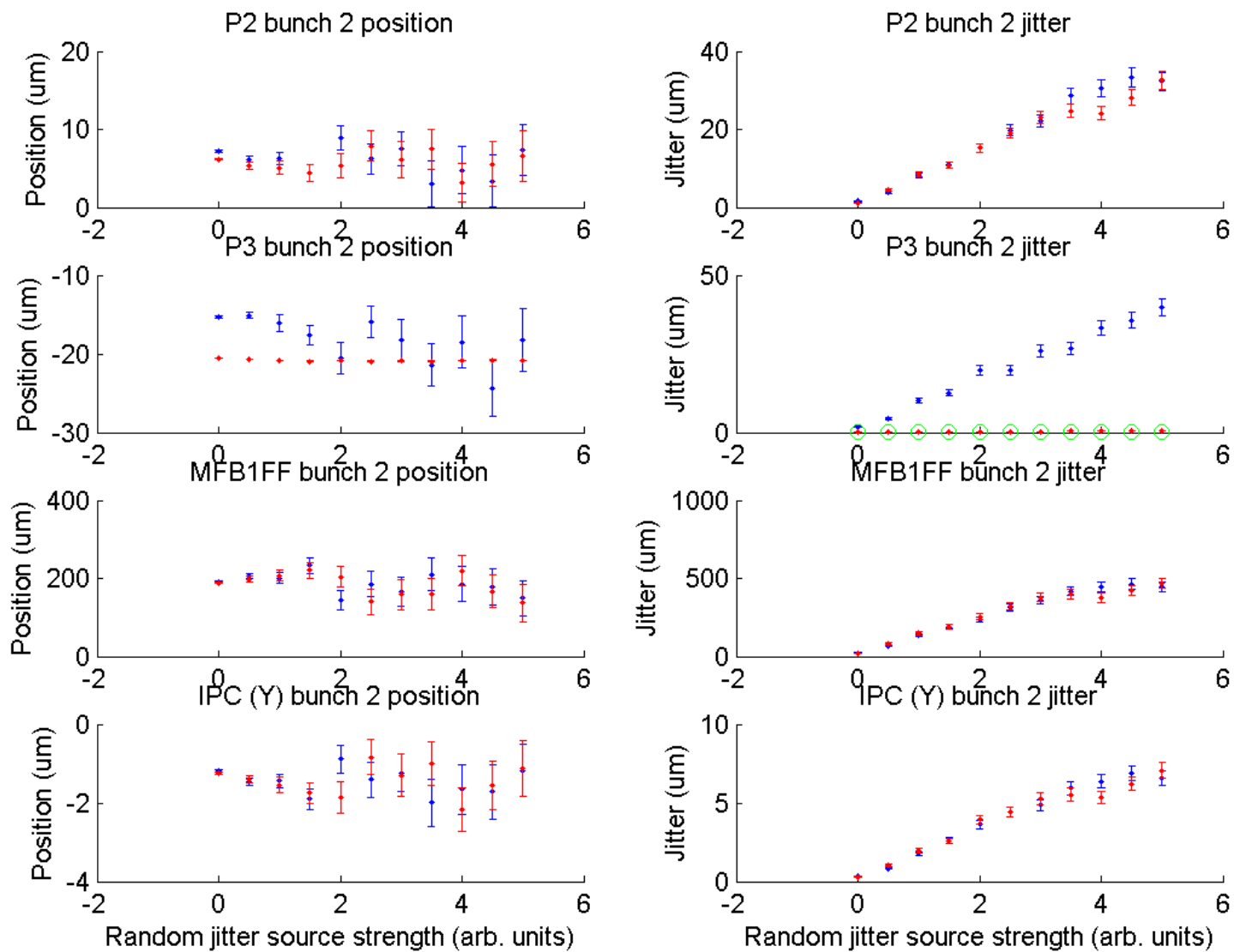
- K2-P3 single-loop feedback, 22 February
- Predicted performance at P3 for incoming position jitter & bunch-to-bunch correlation (green circles)
- Only scan performed as FONT5A boards subsequently sample jumped

Random jitter source strength: 3.5 arb. units



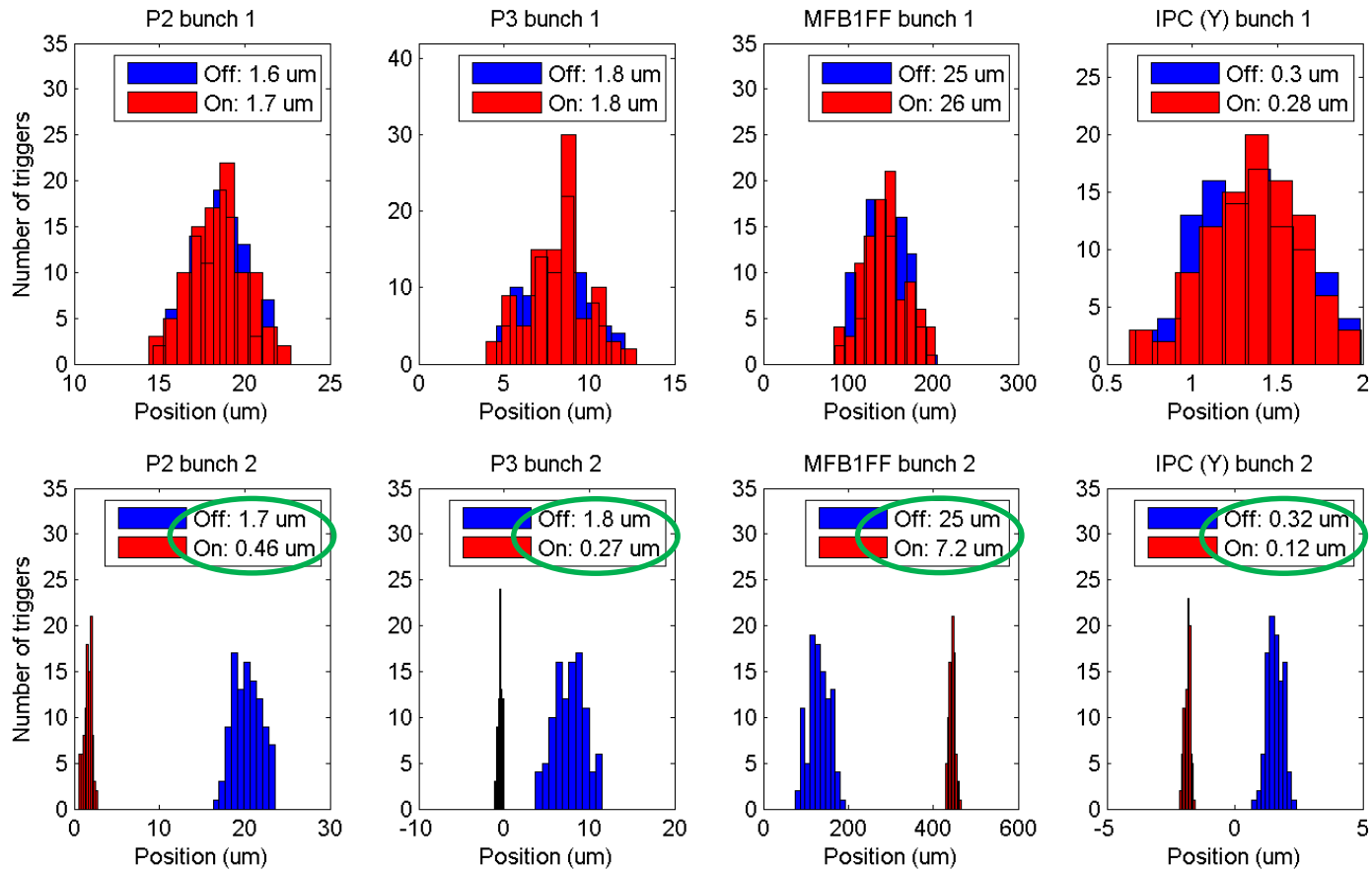
factor 60 stabilisation

fbRandomJitterScan1 on 220217



Coupled-loop feedback

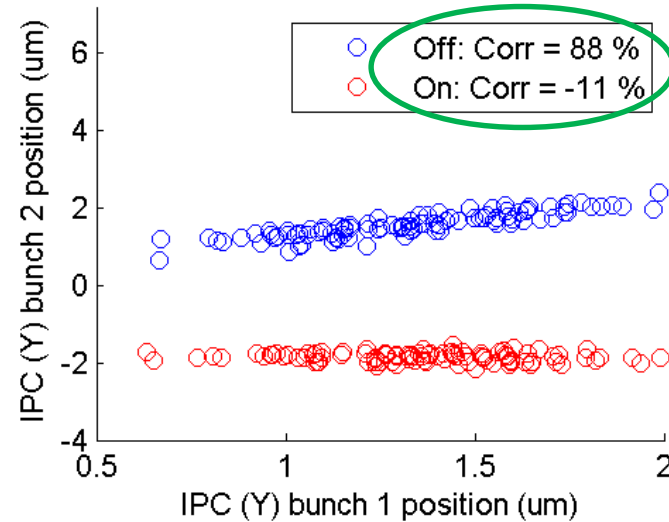
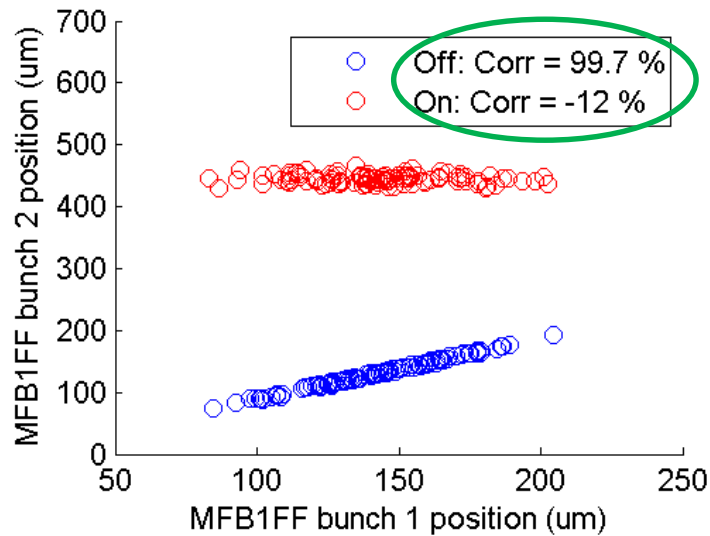
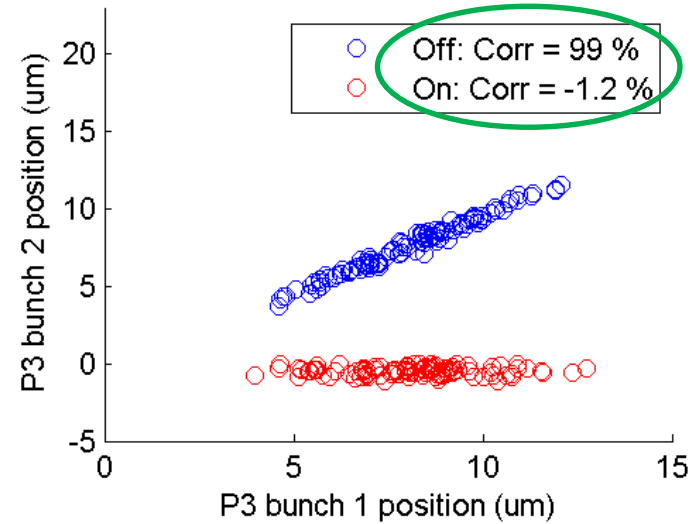
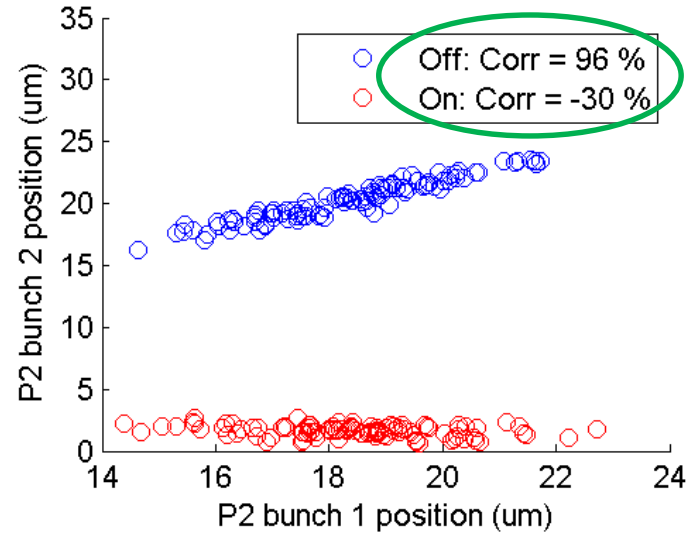
- Coupled-loop upstream feedback, 24 Feb
- Charge: $\sim 0.85 \times 10^{10}$
(~ 1800 , ~ 2200 Σ counts for bunches 1, 2)
- Waist close to IPC (QD0FF: 123.4 A)
- 3-BPM geometric resolution: 479 nm
(with 6 dB attenuation on MFB1FF strips)
- Only one feedback run as FONT5A boards subsequently sample jumped



stabilisation to
<500 nm upstream

factor 3 stabilisation
downstream

correlation removed at all BPMs

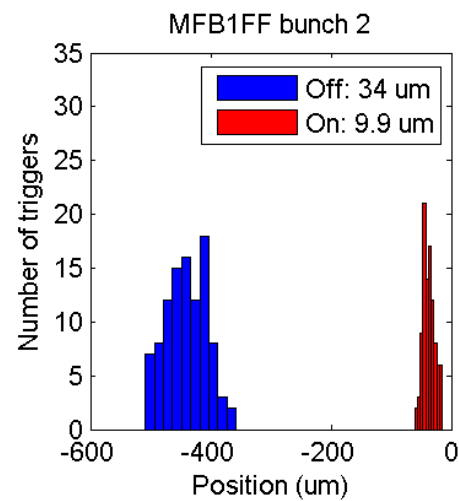
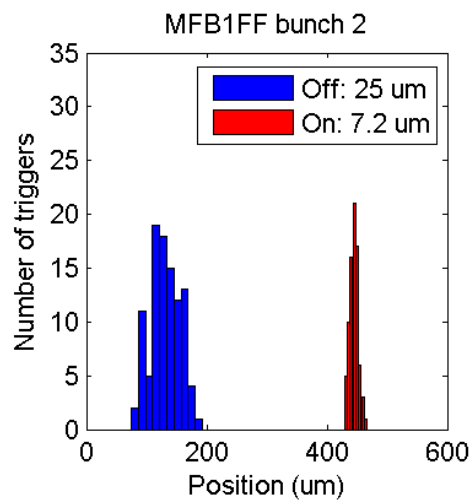
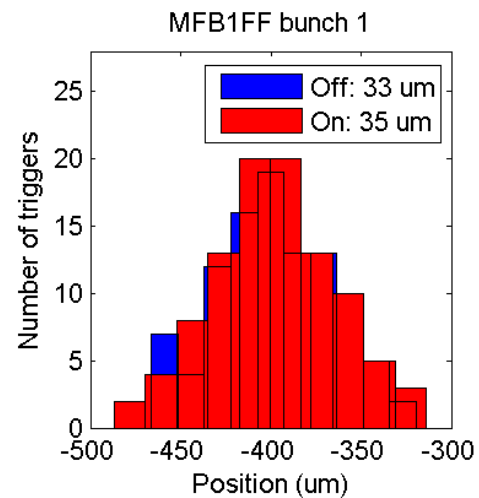
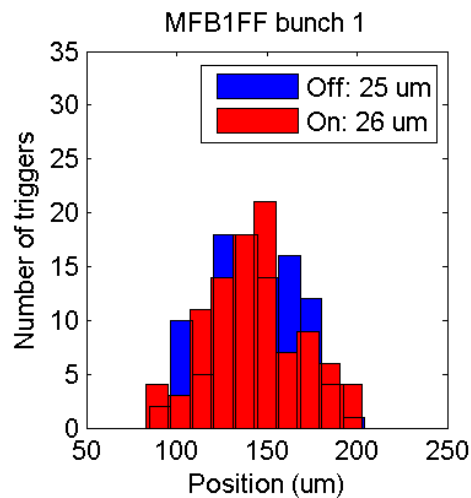


Jitter propagation

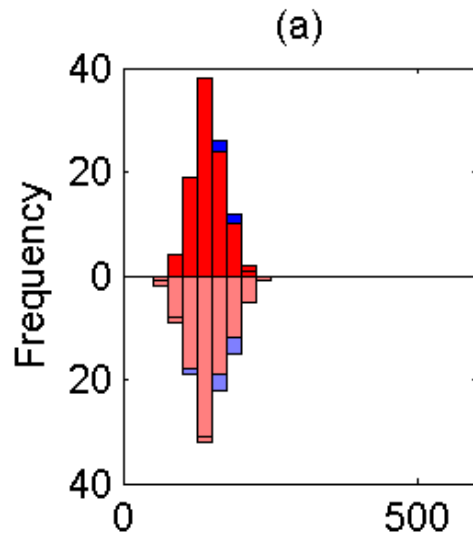
- Feedback results propagated to MFB1FF, IPC and the IP waist using P2 and P3 data

measured at MFB1FF

propagated to MFB1FF

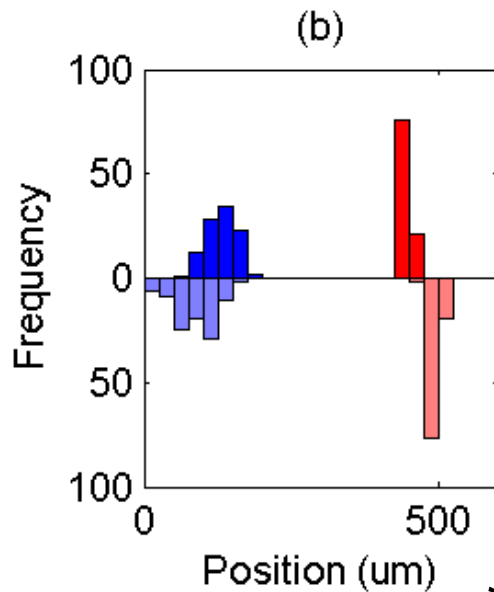


MFB1FF



bunch 1 measured

bunch 1 propagated*

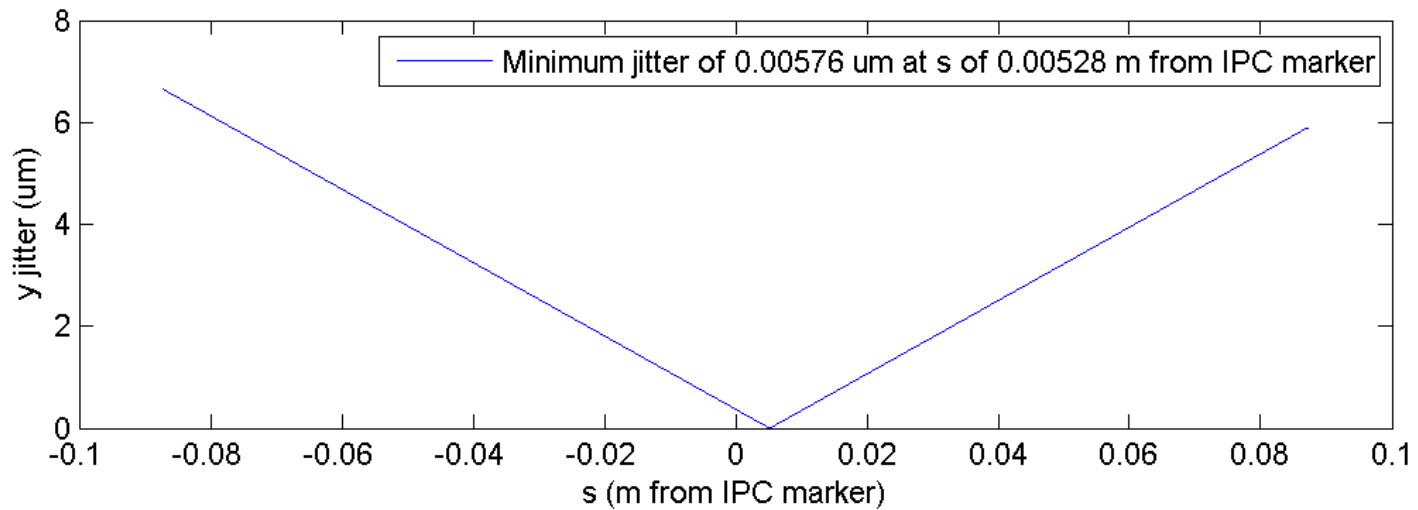
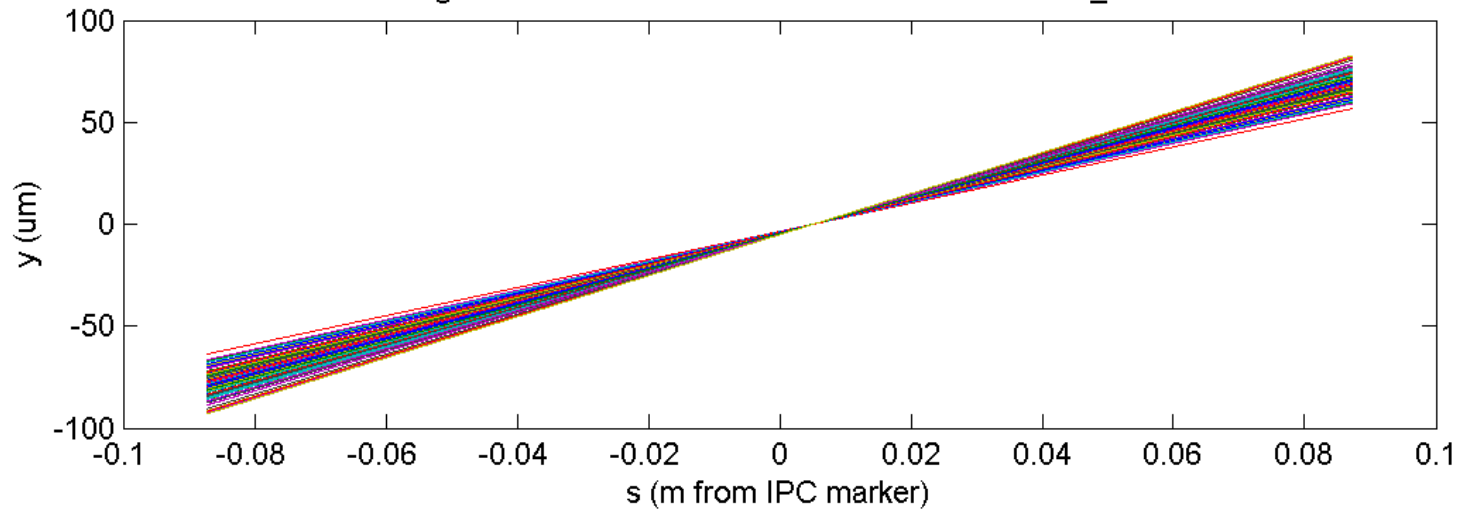


bunch 2 measured

bunch 2 propagated*

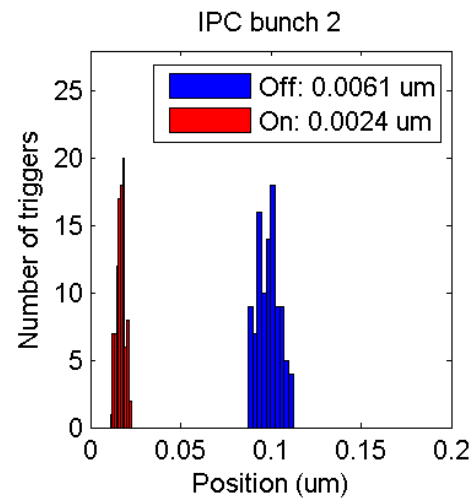
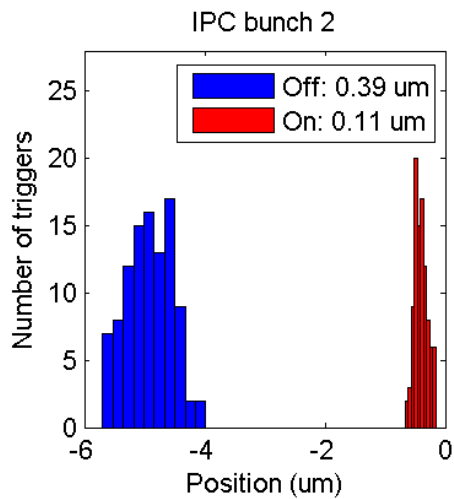
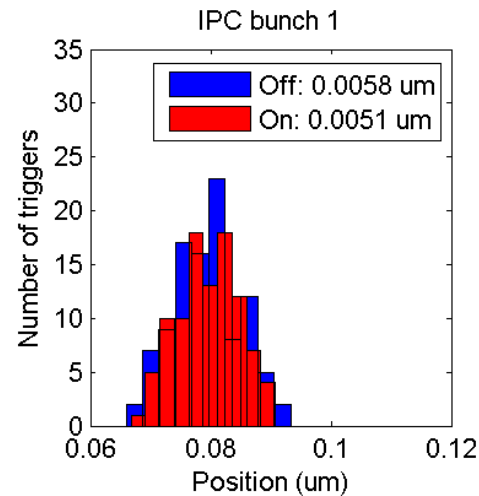
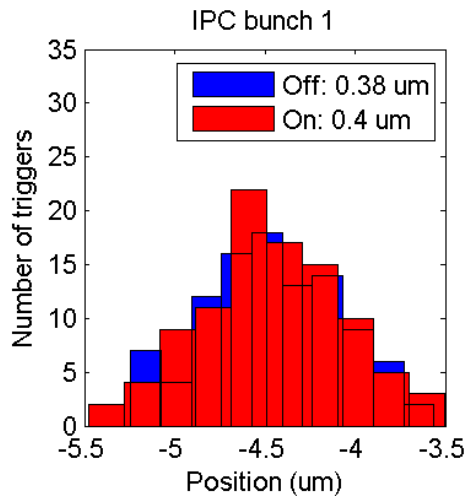
*with mean measured position subtracted

Tracking P2 and P3 positions to IPC region
for fbRun1 on 240217 using only FbOff data for bunch 1
using linear transfer matrices from setfile set17feb24_0929

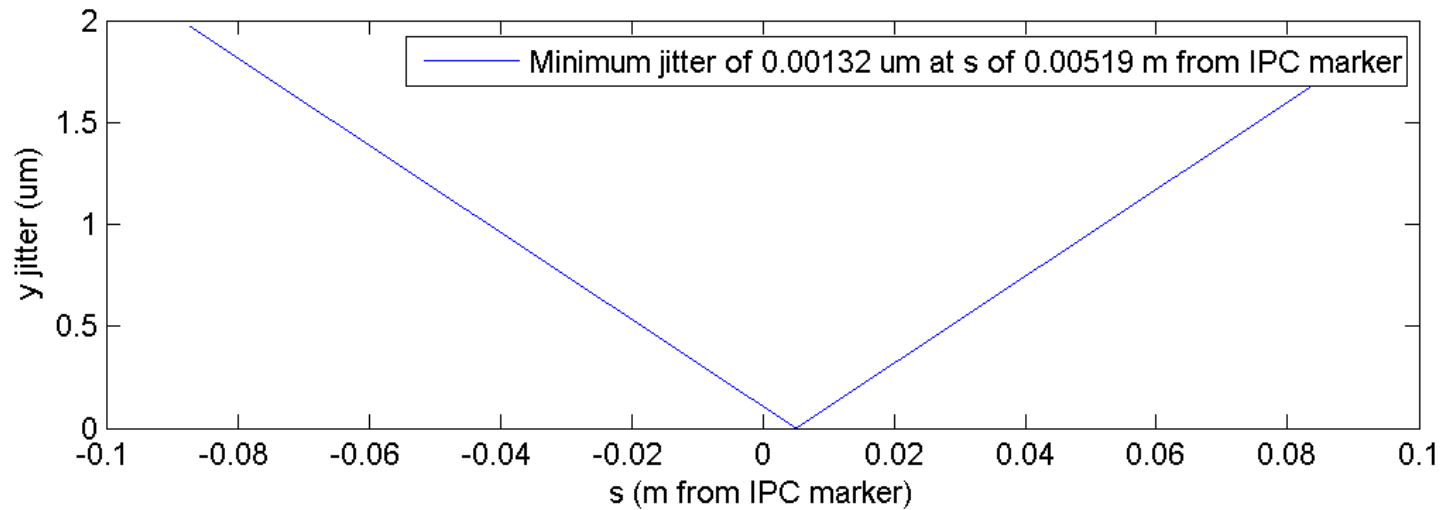
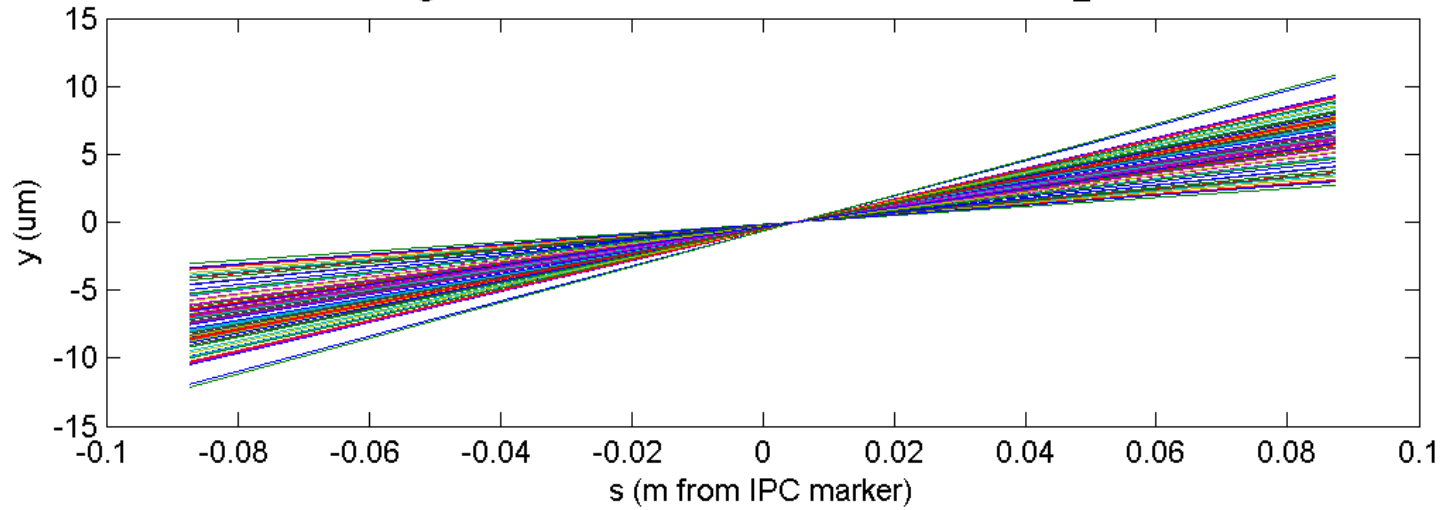


propagated
to IPC

propagated
to waist

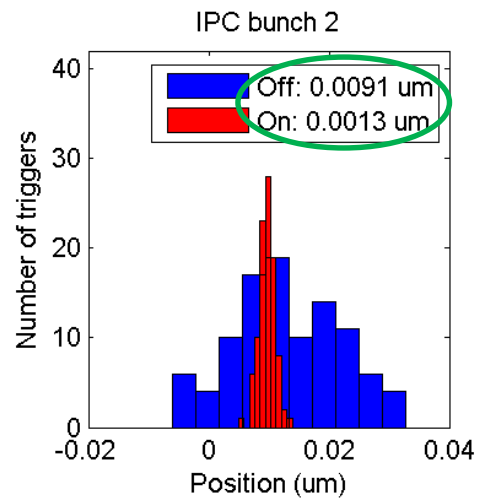
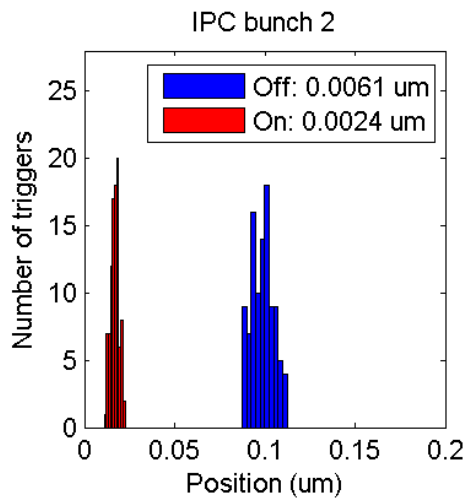
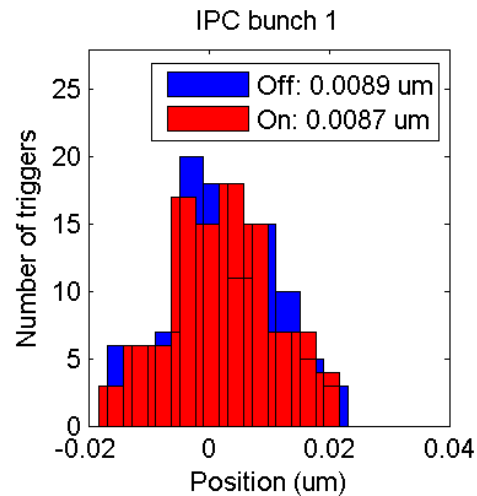
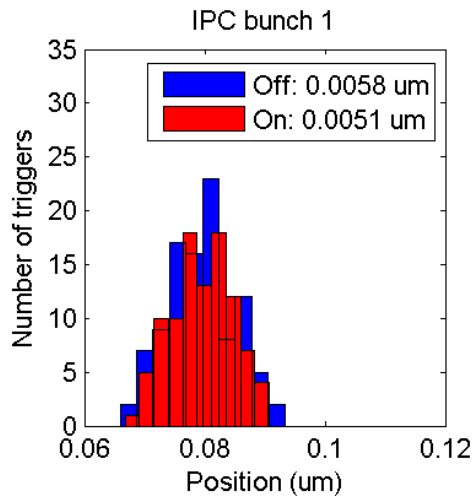


Tracking P2 and P3 positions to IPC region
for fbRun1 on 240217 using only FbOn data for bunch 2
using linear transfer matrices from setfile set17feb24_0929



propagated to FbOff waist

propagated to FbOn waist



Conclusions

- K2-P3 single-loop feedback
 - Beam jitter stabilised to < 300 nm at P3
 - No correction at MFB1FF or off IP waist, in agreement with propagated results
 - With extra jitter: factor 60 jitter reduction
- Coupled-loop upstream feedback
 - Beam stabilised: 460 nm at P2, 270 nm at P3
 - Factor 3 reduction in jitter at MFB1FF and IPC in agreement with propagated results