FONT status

Feedback On Nanosecond Timescales (FONT):

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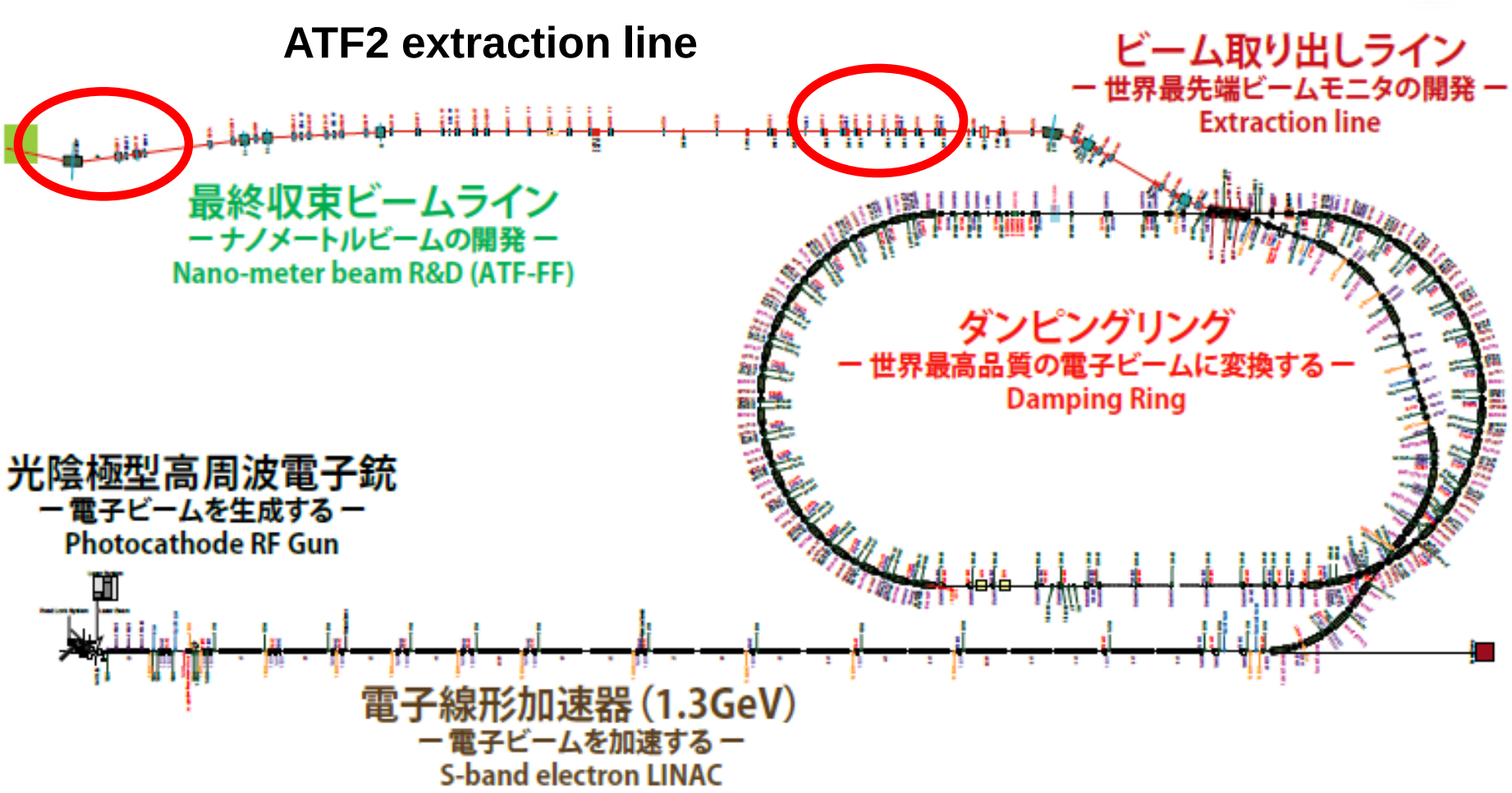
John Adams Institute

Oxford University

Outline

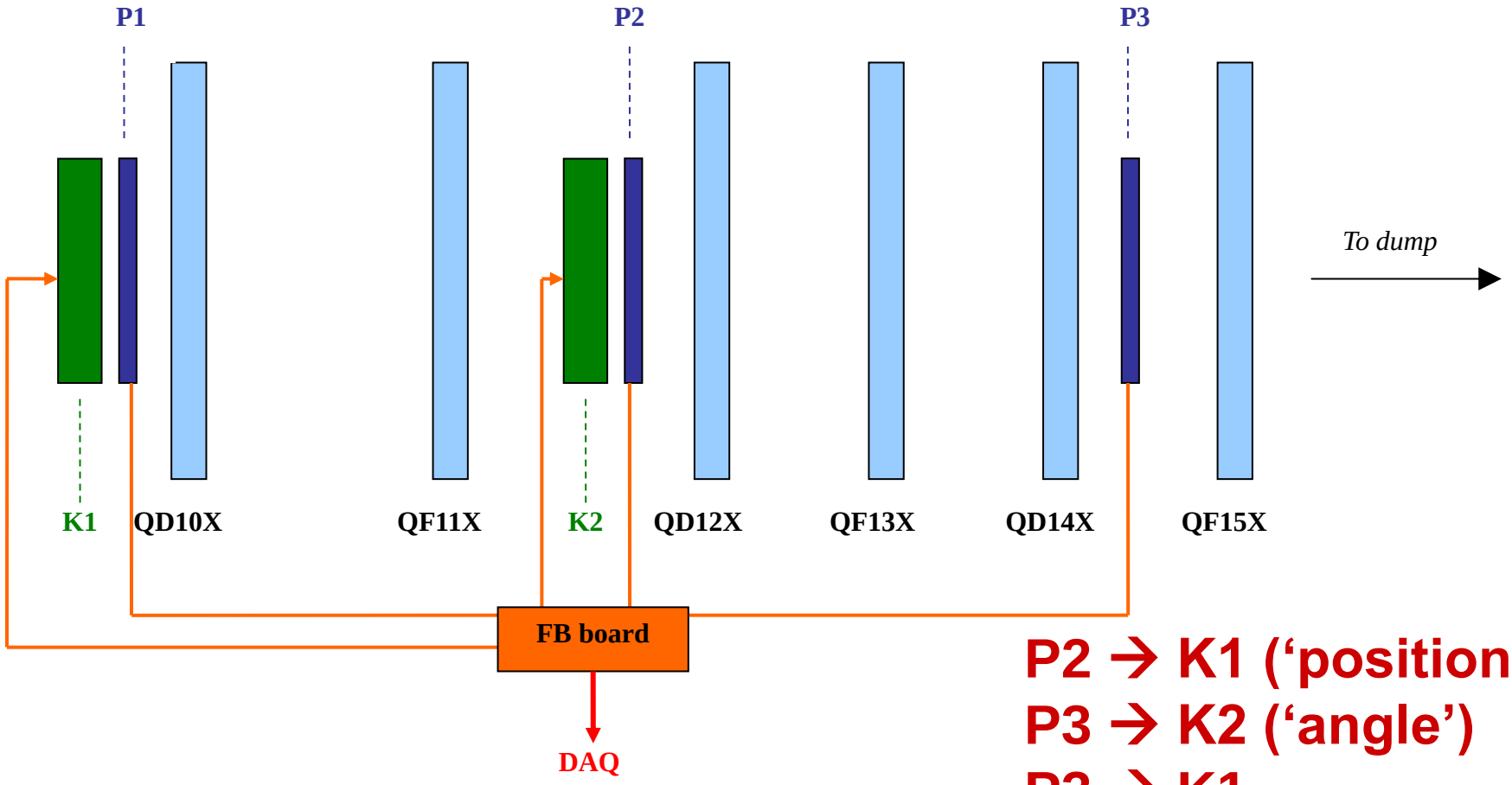
- **Reminder of FONT layout**
- **Upstream FB system performance**
- **Results of recent beam tests**
- **Possible additional improvements**

FONT5 installation at ATF2



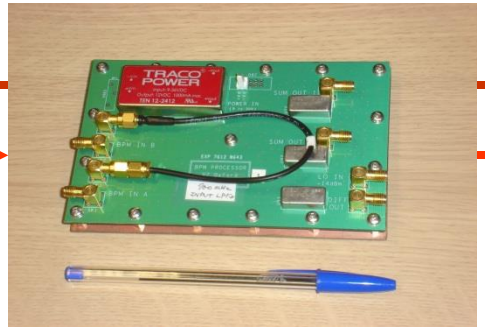
Upstream system

FONT5 upstream setup



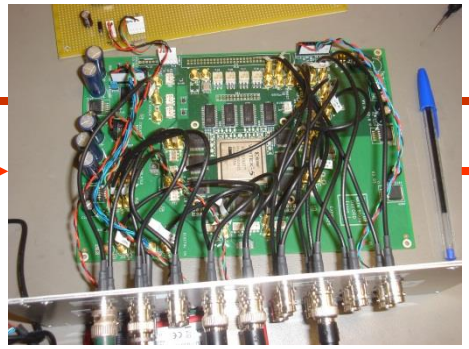
P2 → K1 (‘position’)
P3 → K2 (‘angle’)
P3 → K1
P2 → K2

Upstream FONT5 System



Analogue Front-end

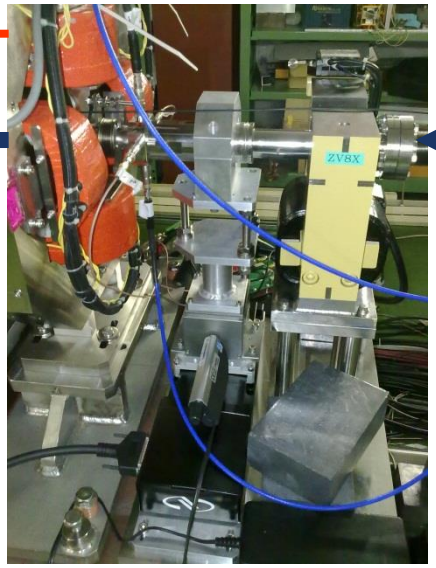
BPM processor



FPGA-based digital processor

Kicker drive amplifier

Beam



Stripline BPM with mover system

Strip-line kicker

BPM Resolution	< 350nm
Dynamic range of the BPM system	+/-500µm
System Latency	<150 ns
Amplifier Bandwidth	~30 MHz

Upstream system

- **Operation routine + ‘turn-key’**

Upstream system

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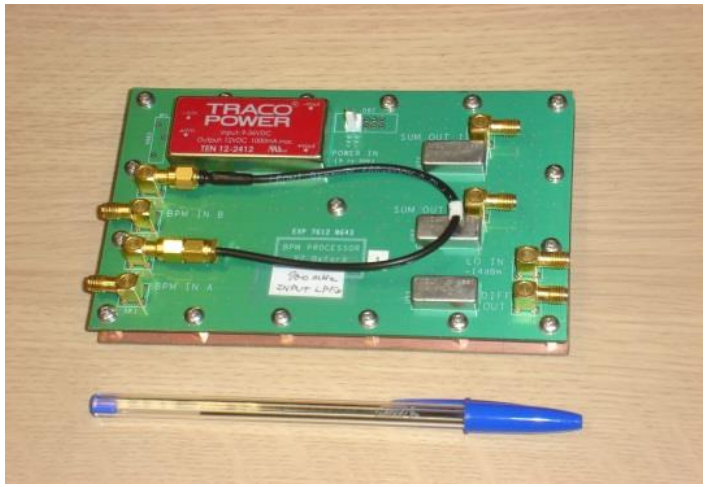
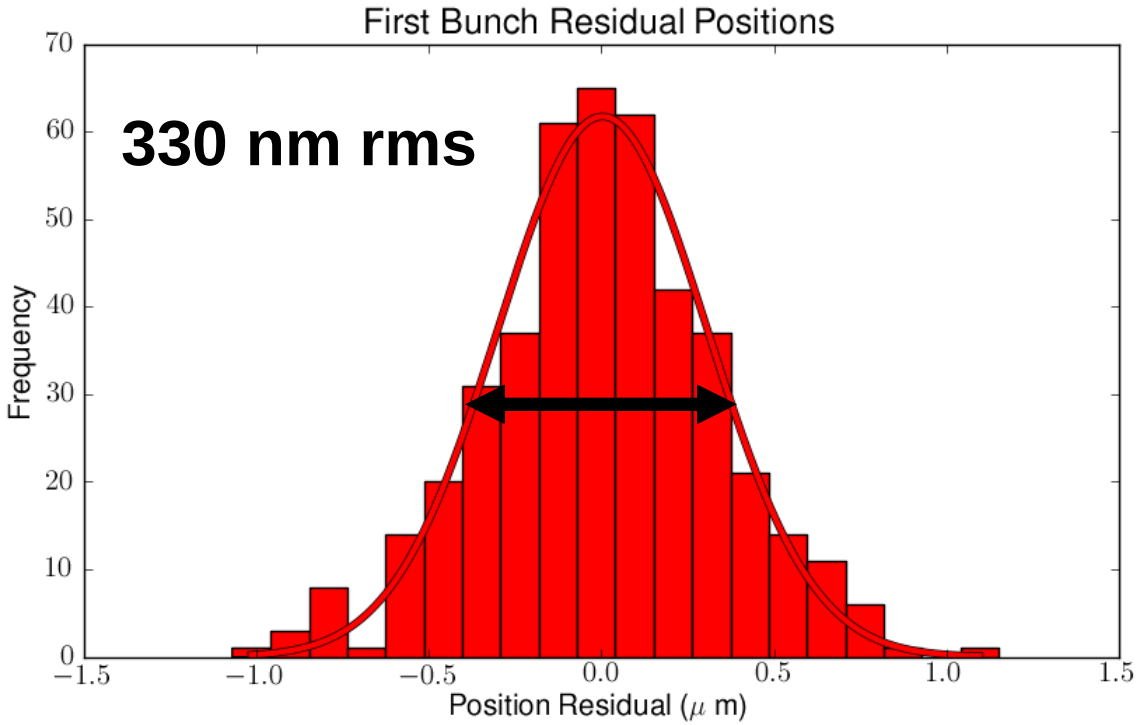
- **After many years of operation and system improvements, stripline resolution << 1 um**

Stripline BPM resolution

ATF2 stripline BPMs: single-pass beam, bunch Q ~ 1 nC





Upstream system

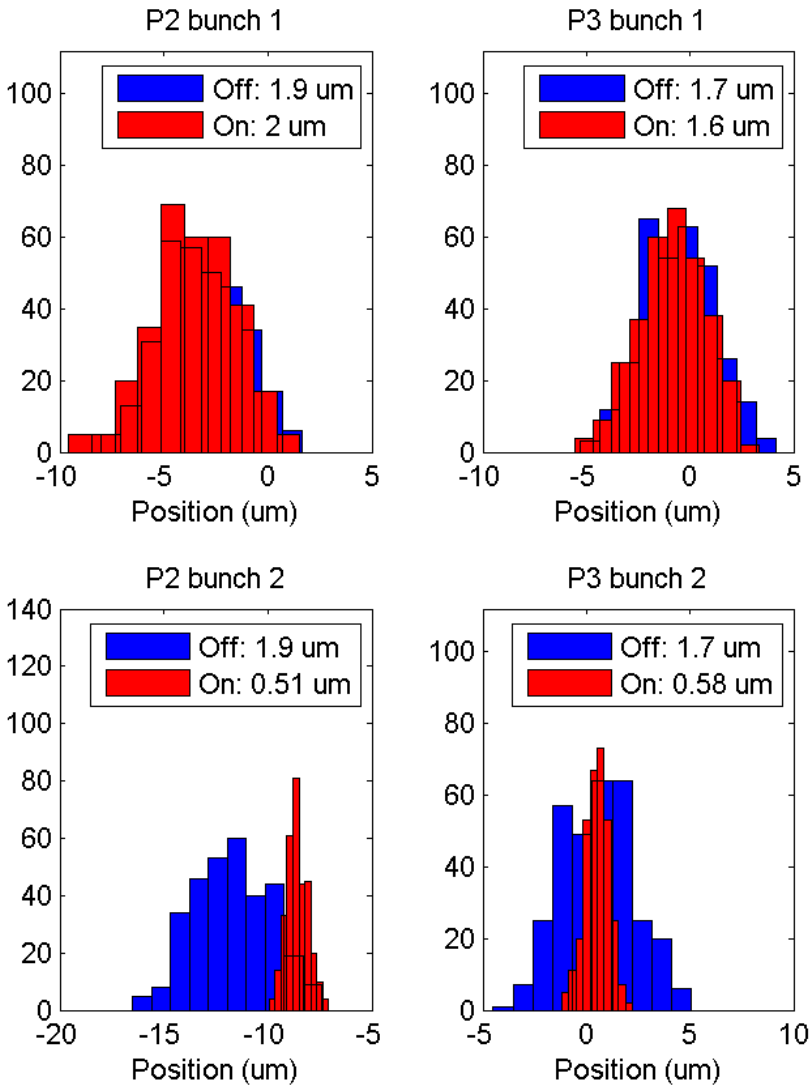
- **Operation routine + ‘turn-key’**
- **After many years of operation and system improvements, stripline resolution << 1 um**
- **FB works at limit of BPM resolution:**

  beam jitter correction = sqrt(2) * resolution

Upstream FB performance

Bunch 1:
Incoming jitter ~ 2um
not corrected

Bunch 2:
corrected to ~ 0.5um



Upstream system

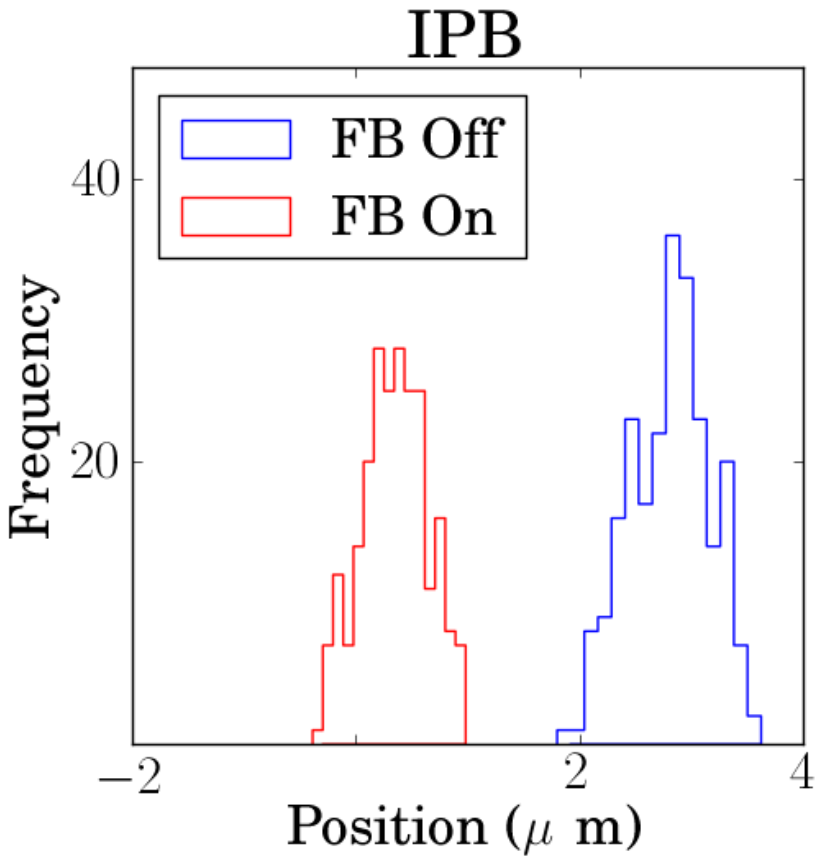
- **Operation routine + ‘turn-key’**
- **After many years of operation and system improvements, stripline resolution << 1 um**
- **FB works at limit of BPM resolution:**

  beam jitter correction = sqrt(2) * resolution
- **Studying correction downstream**

Further improvements

- **Eventually monitor performance at IP using IPBPMs**
- **First tests performed June 2013 using old IPBPMs**
- **Beam waist set to IPB**
- **Effect of beam correction observed in IPB**

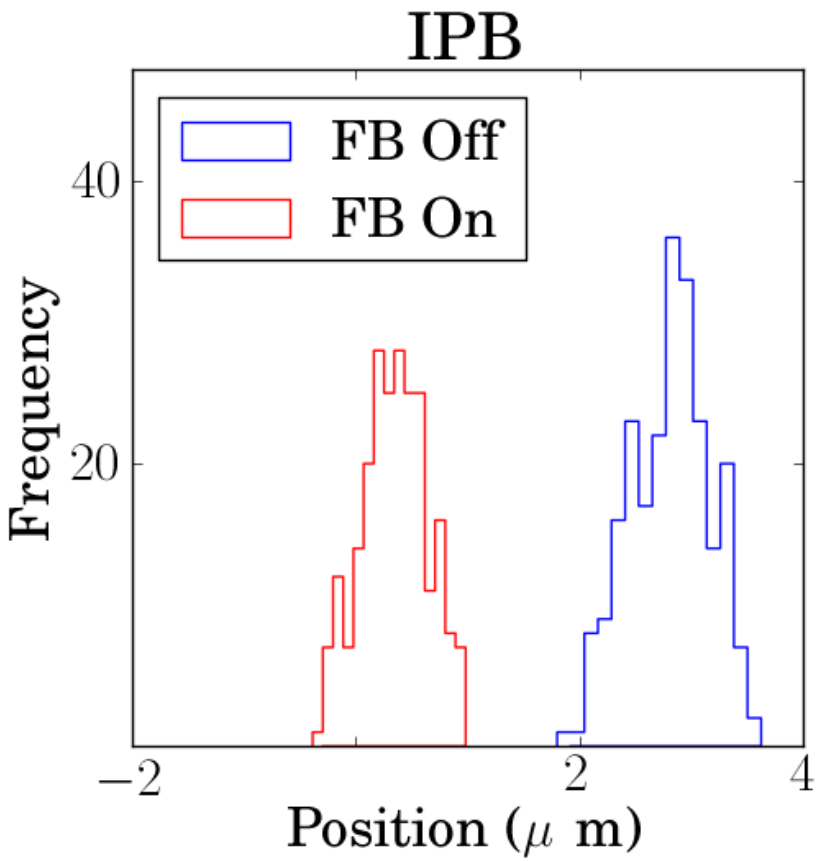
Upstream FB (Measured at IPB)

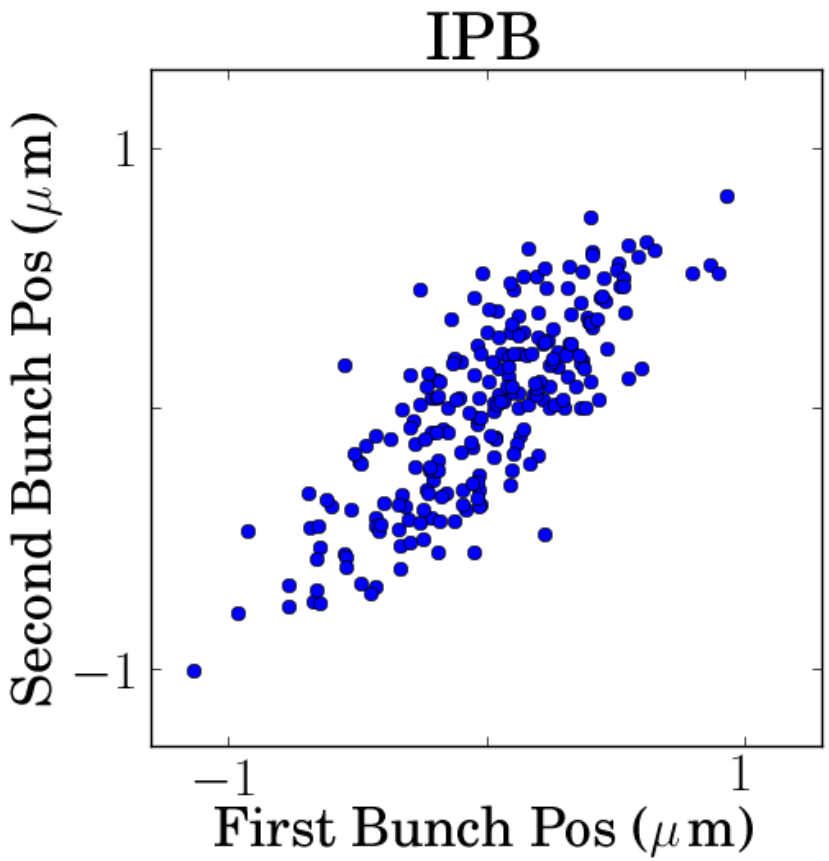


FB Off Jitter: 0.35 ± 0.02 μm

FB On Jitter: 0.30 ± 0.01 μm

Upstream FB (Measured at IPB)





FB Off Jitter: 0.35 ± 0.02 μm

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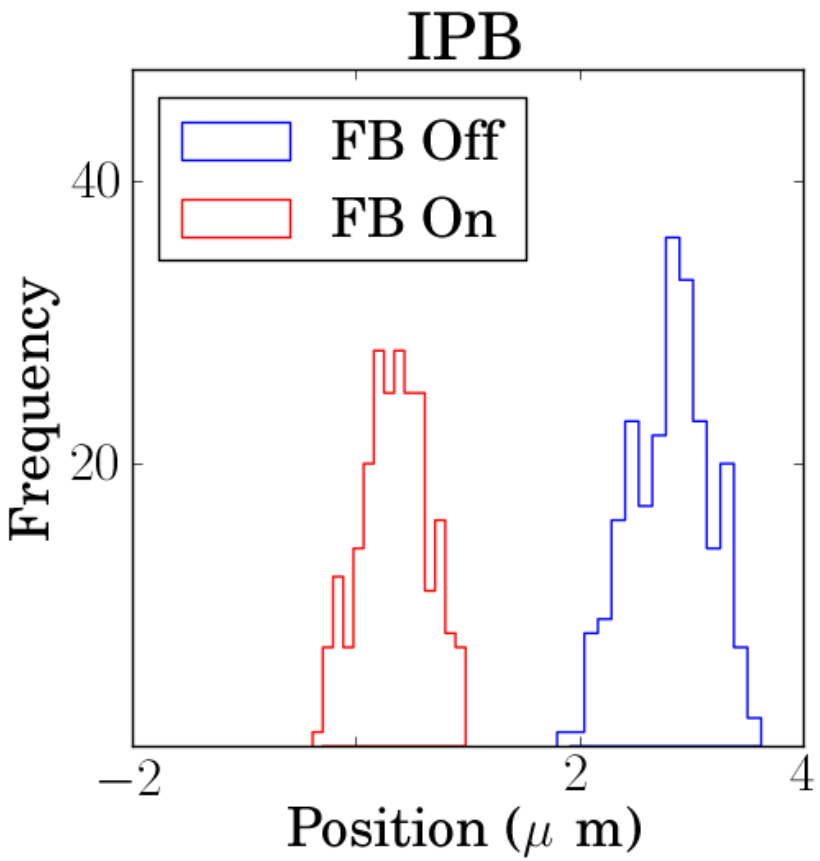
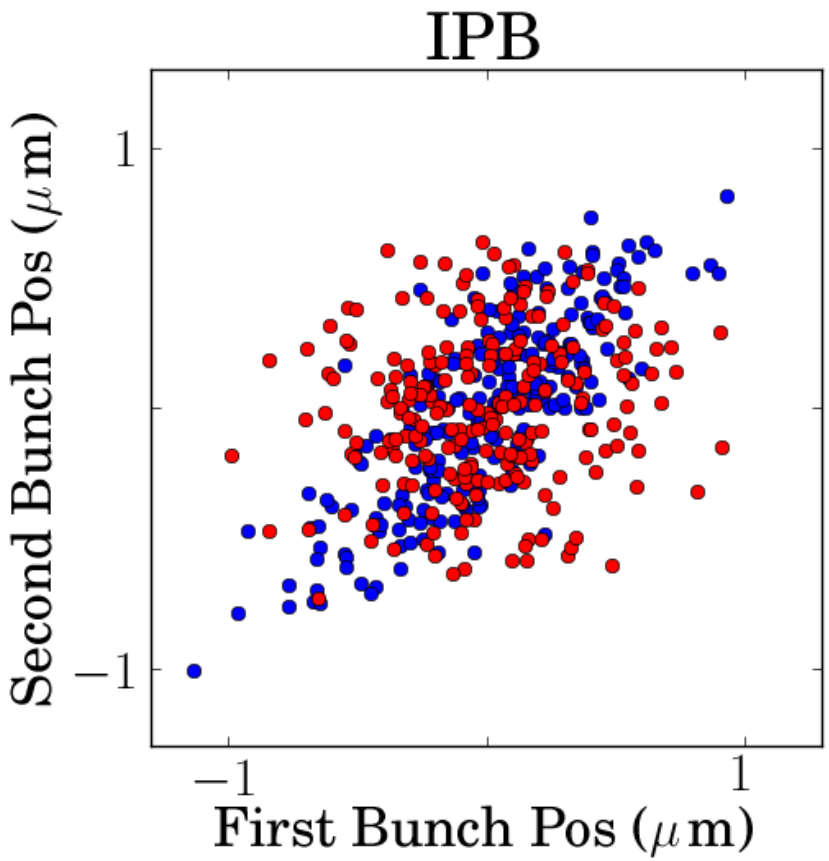
FB Off Correlation: 79%

Upstream FB (Measured at IPB)





FB Off Jitter: 0.35 ± 0.02 μm
FB On Jitter: 0.30 ± 0.01 μm

FB Off Correlation: 79%
FB On Correlation: 14%

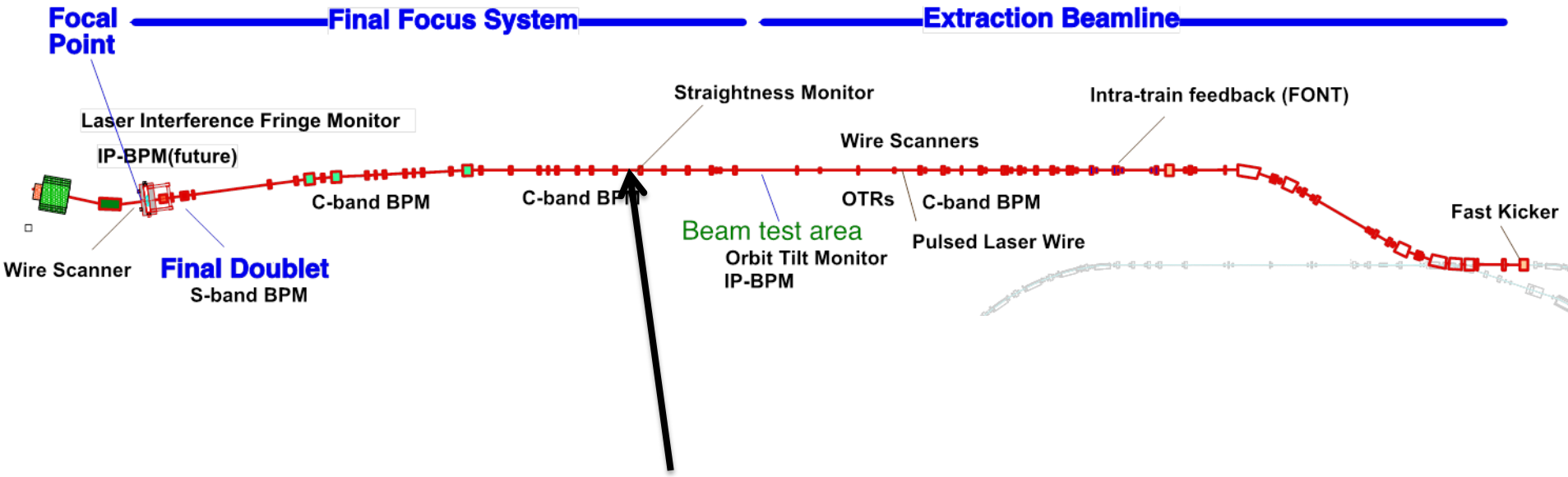
Further improvements

- **Eventually monitor performance at IP using IPBPMs**
- **First tests performed June 2013 using old IPBPMs**
- **Beam waist set to IPB**
- **Effect of beam correction observed in IPB**
- **Upstream FB working at its limit to remove correlated jitter component, but modest reduction in jitter at IPB**

Further improvements

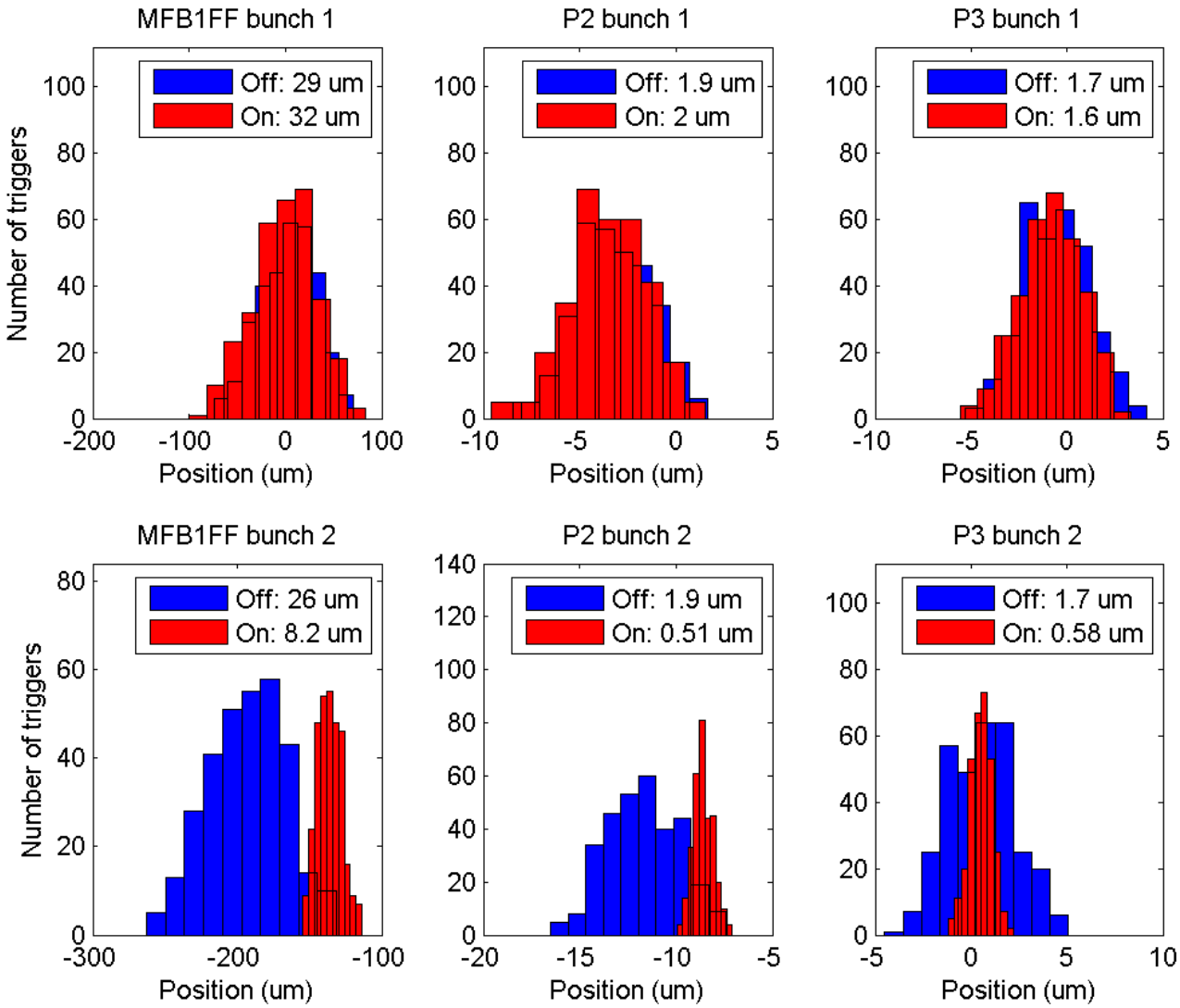
- **Eventually monitor performance at IP using IPBPMs**
- **First tests performed June 2013 using old IPBPMs**
- **Beam waist set to IPB**
- **Effect of beam correction observed in IPB**
- **Upstream FB working at its limit to remove correlated jitter component, but modest reduction in jitter at IPB**
- **Investigate by instrumenting stripline between FONT region and IP**

FB performance downstream



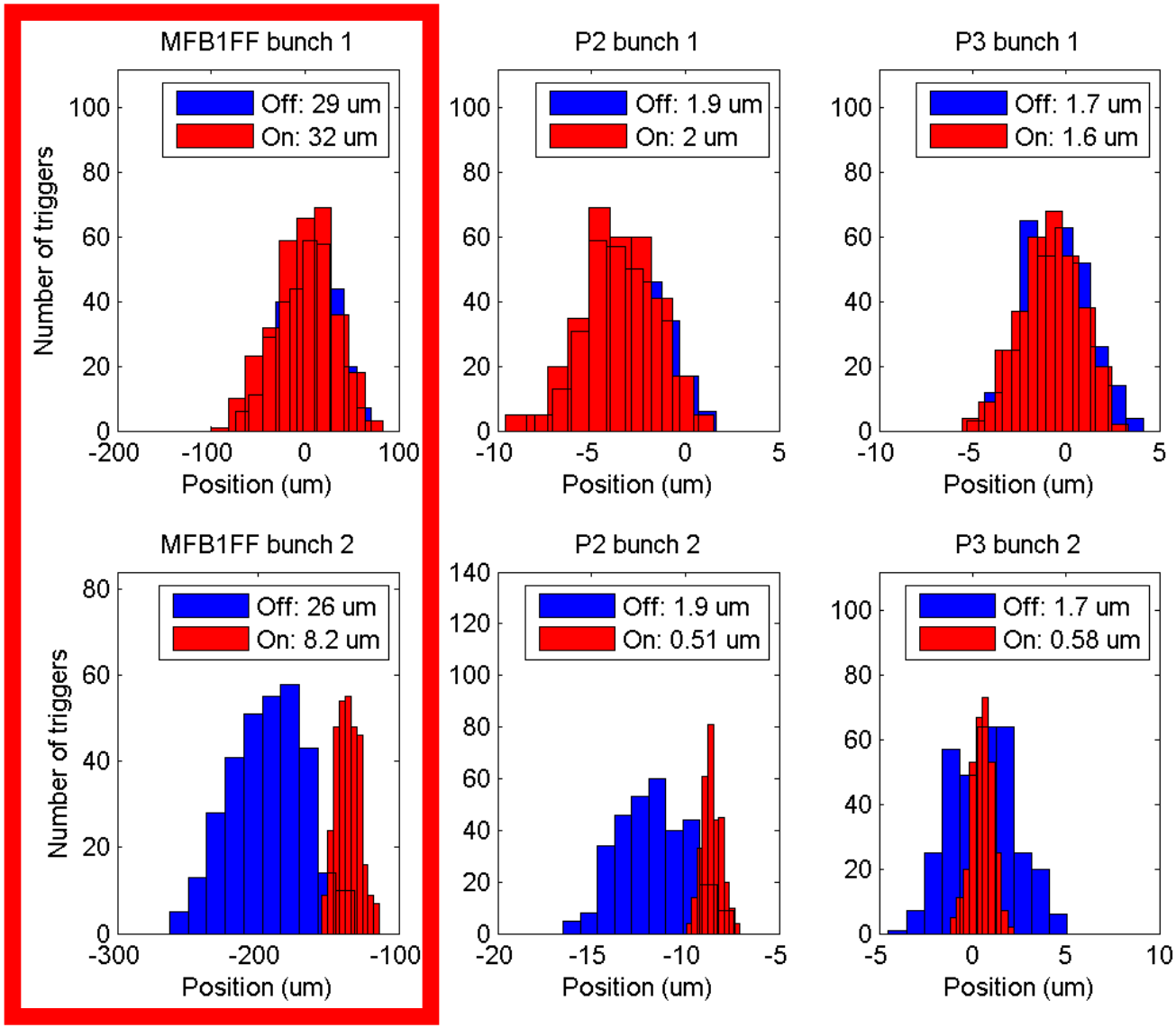
January 2014: instrumented MFB1FF stripline with FONT BPM processor

FB performance downstream



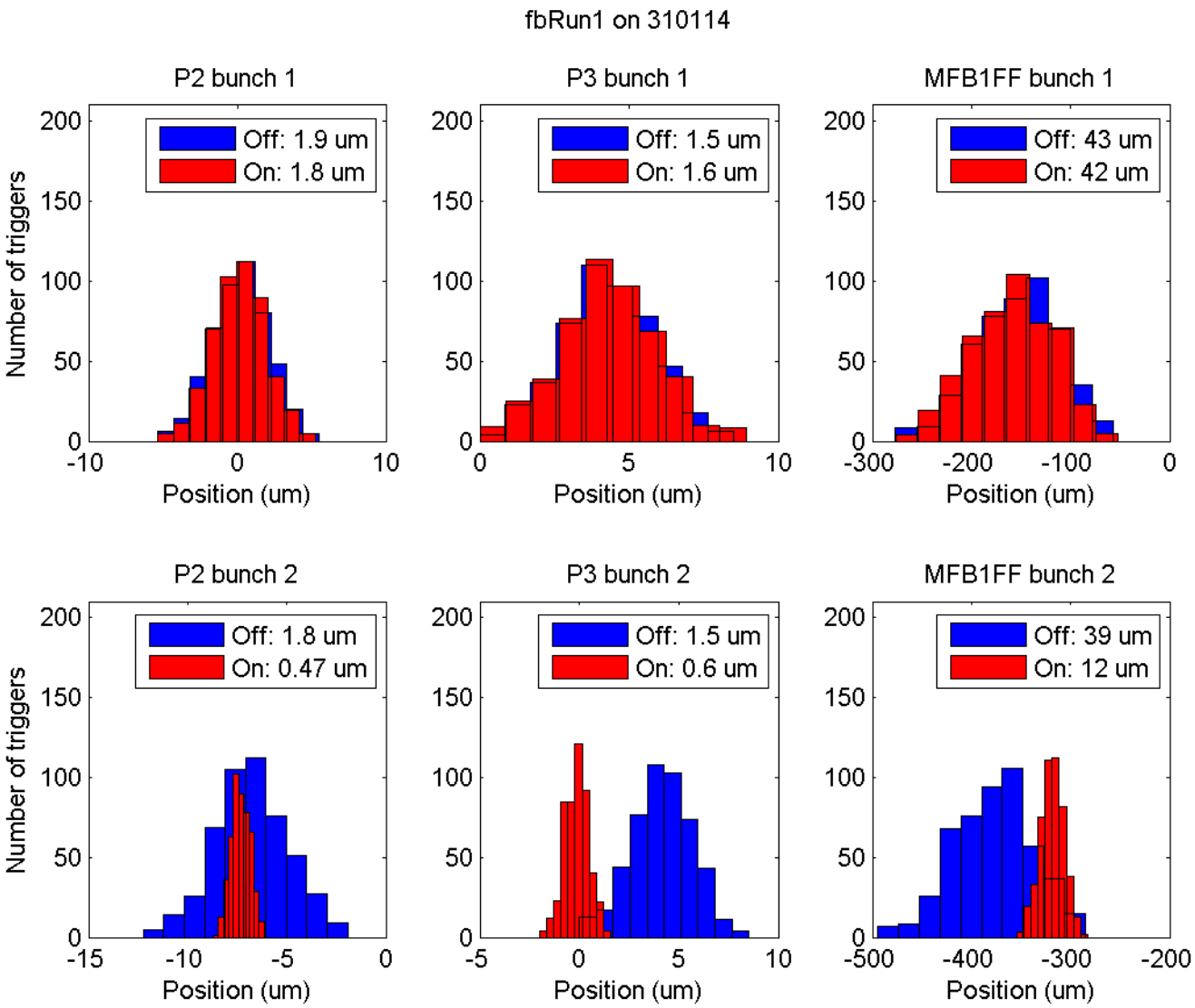
FB performance downstream

Beam correction preserved at MFB1FF (factor x3)

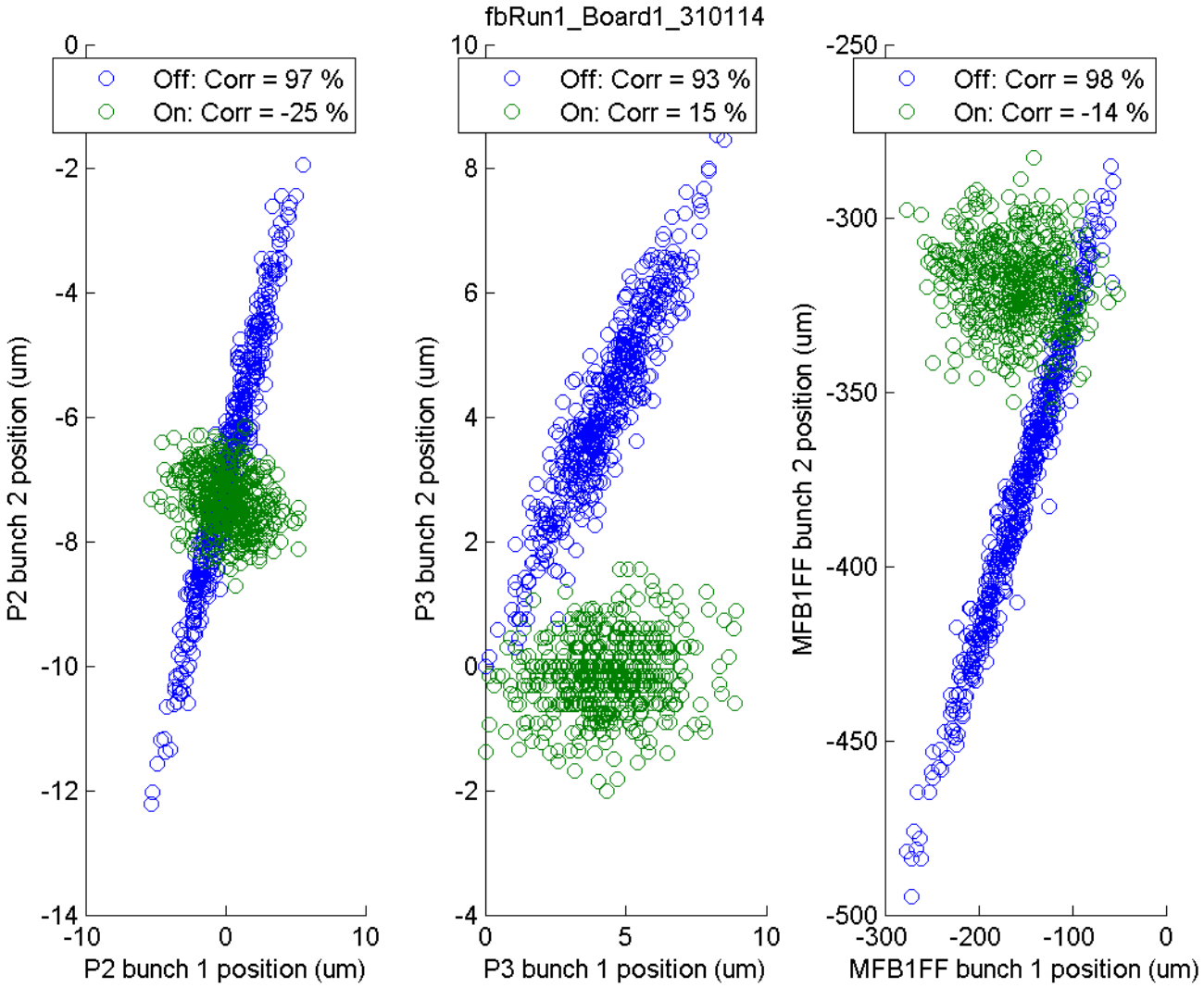


Data from 31/1/14

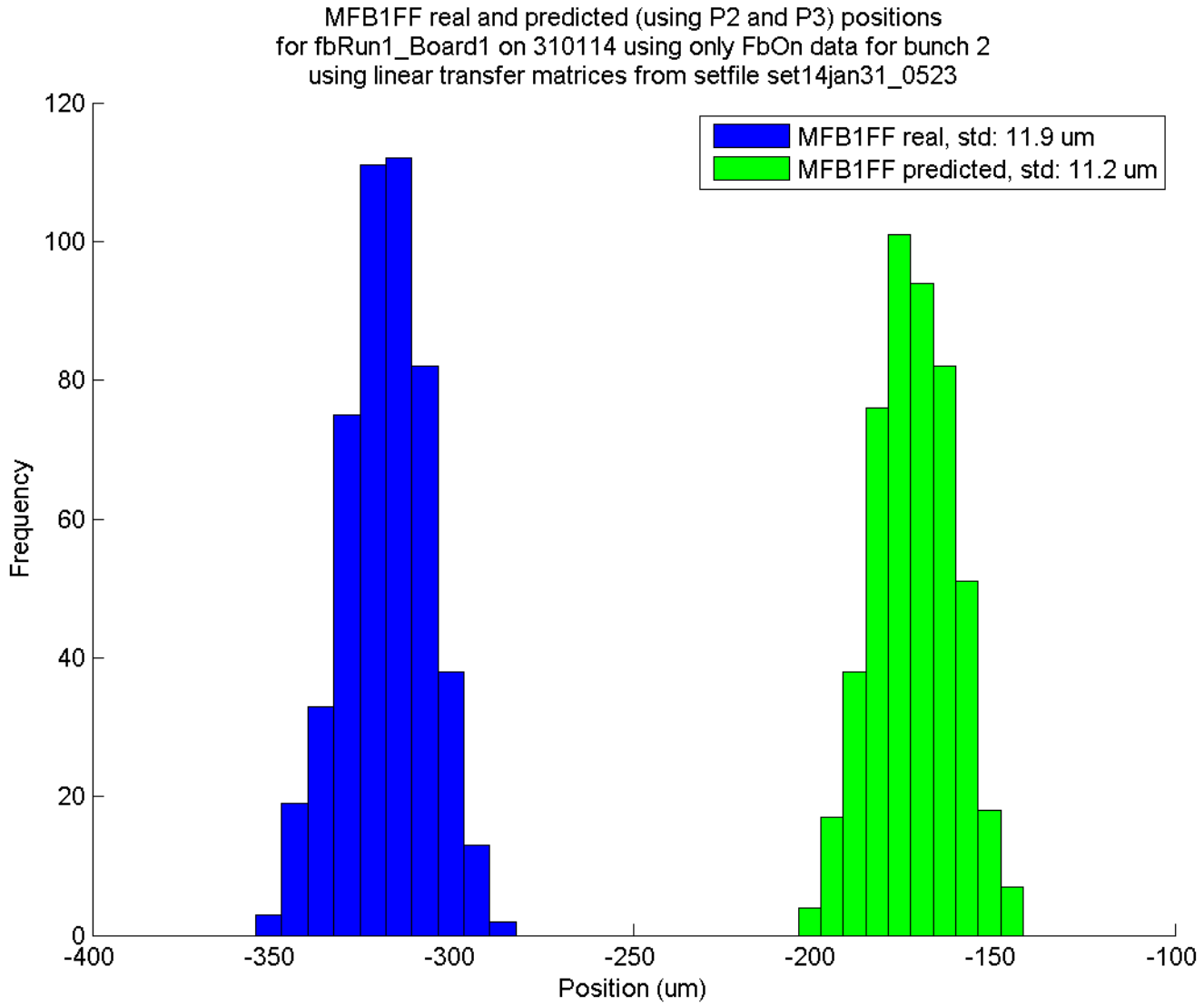
FB performance



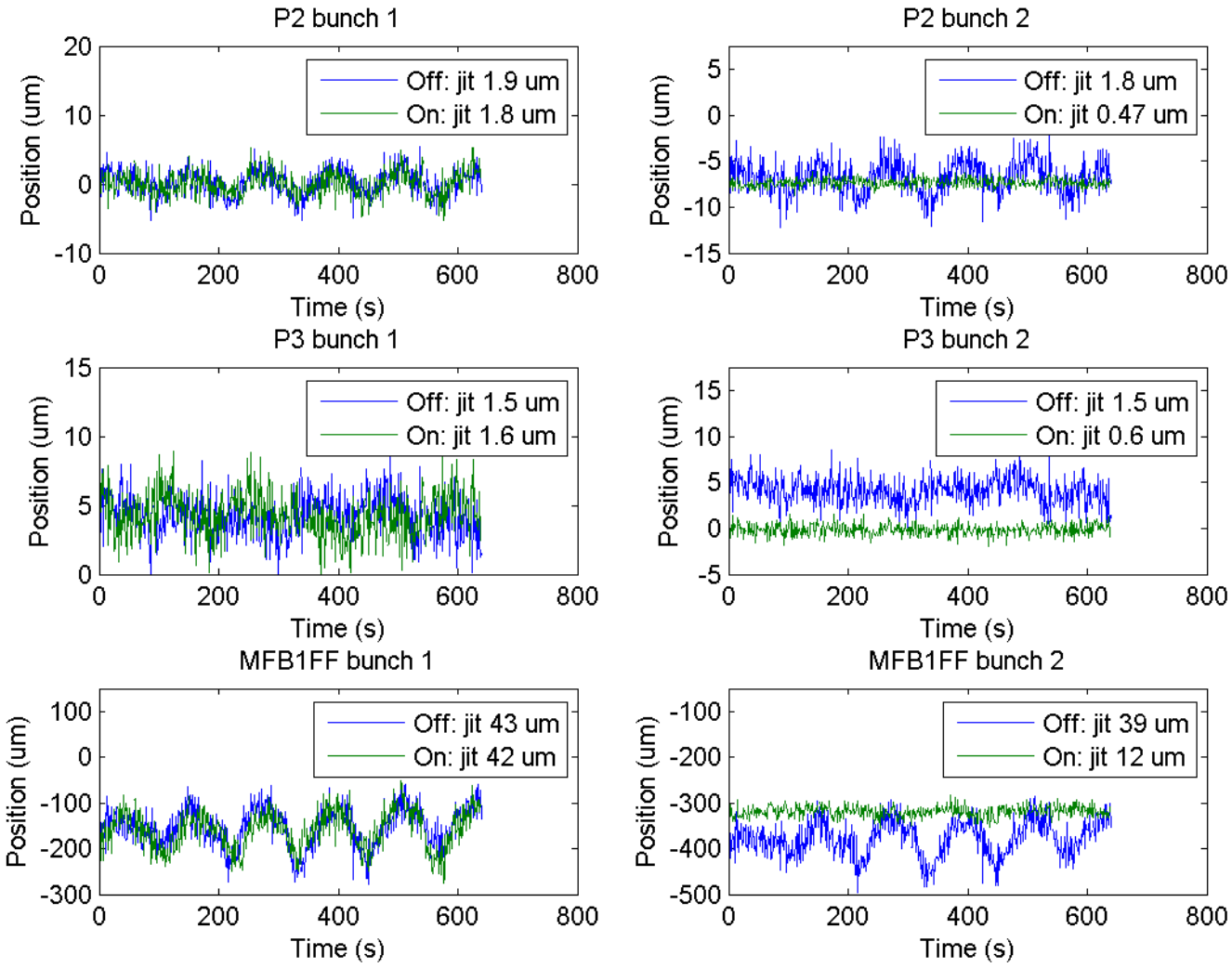
Bunch-bunch correlations



Model comparison at MFB1FF



FB performance vs. time



Further improvements?

- **Upstream beam correction preserved at MFB1FF**

Further improvements?

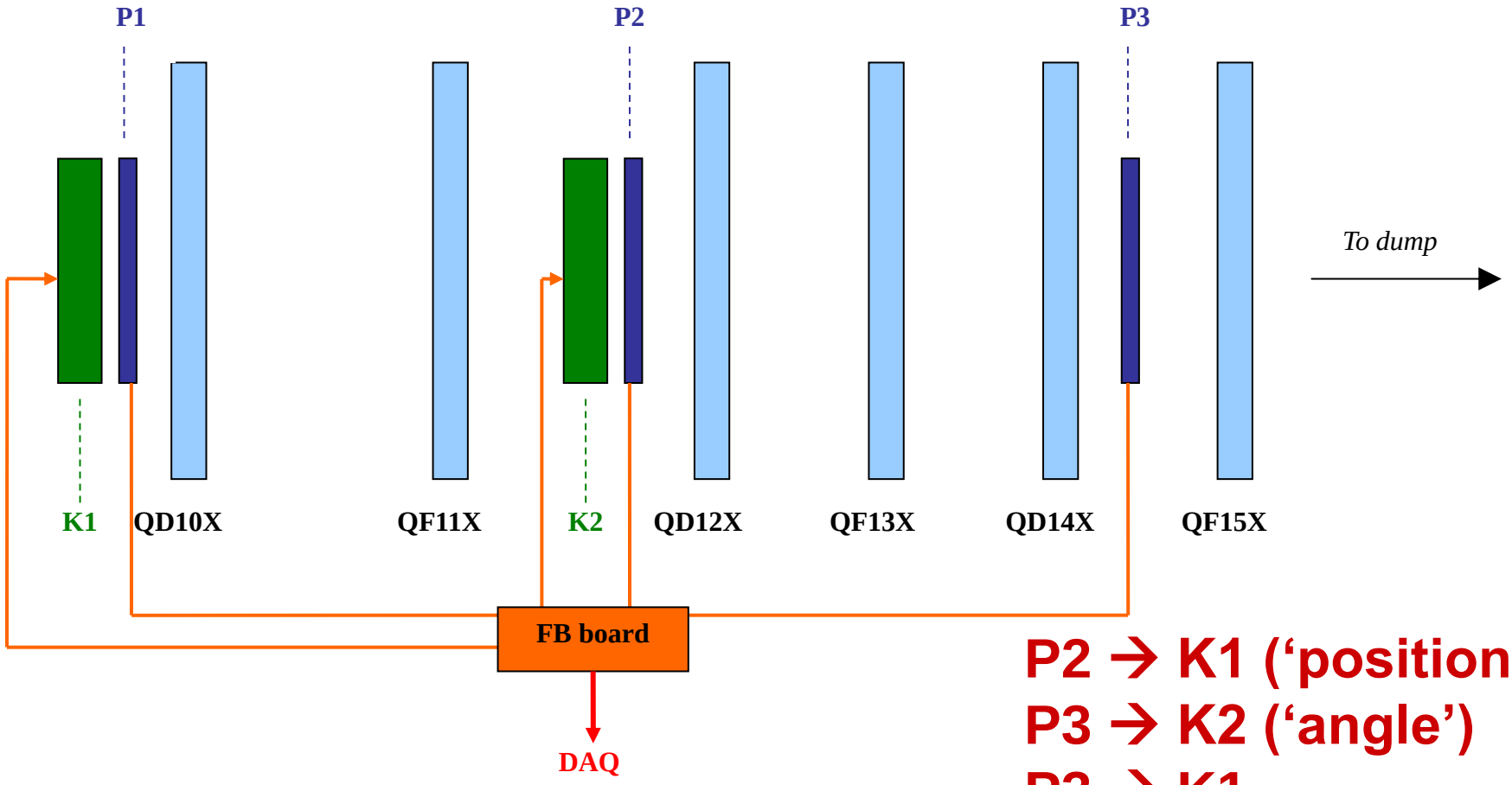
- **Upstream beam correction preserved at MFB1FF**
- **Instrument another stripline even closer to IP?**

Further improvements?

- **Improve phase shift between P2 and P3?**

  → optimum is 90 degrees

FONT5 upstream setup



P2 → K1 (‘position’)
P3 → K2 (‘angle’)
P3 → K1
P2 → K2

Further improvements?

- **Improve phase shift between P2 and P3?**

  → optimum is 90 degrees

BPM	Phase advance setfile set14jan31_0523
K1	0
K2	152
P2	156
P3	174
MFB1FF	503

only 18 degrees!

Further improvements?

- **Improve phase shift between P2 and P3?**

  → optimum is 90 degrees

BPM	Phase advance setfile set14jan31_0523
K1	0
K2	152
P2	156
P3	174
MFB1FF	503

almost same as P2

Further improvements?

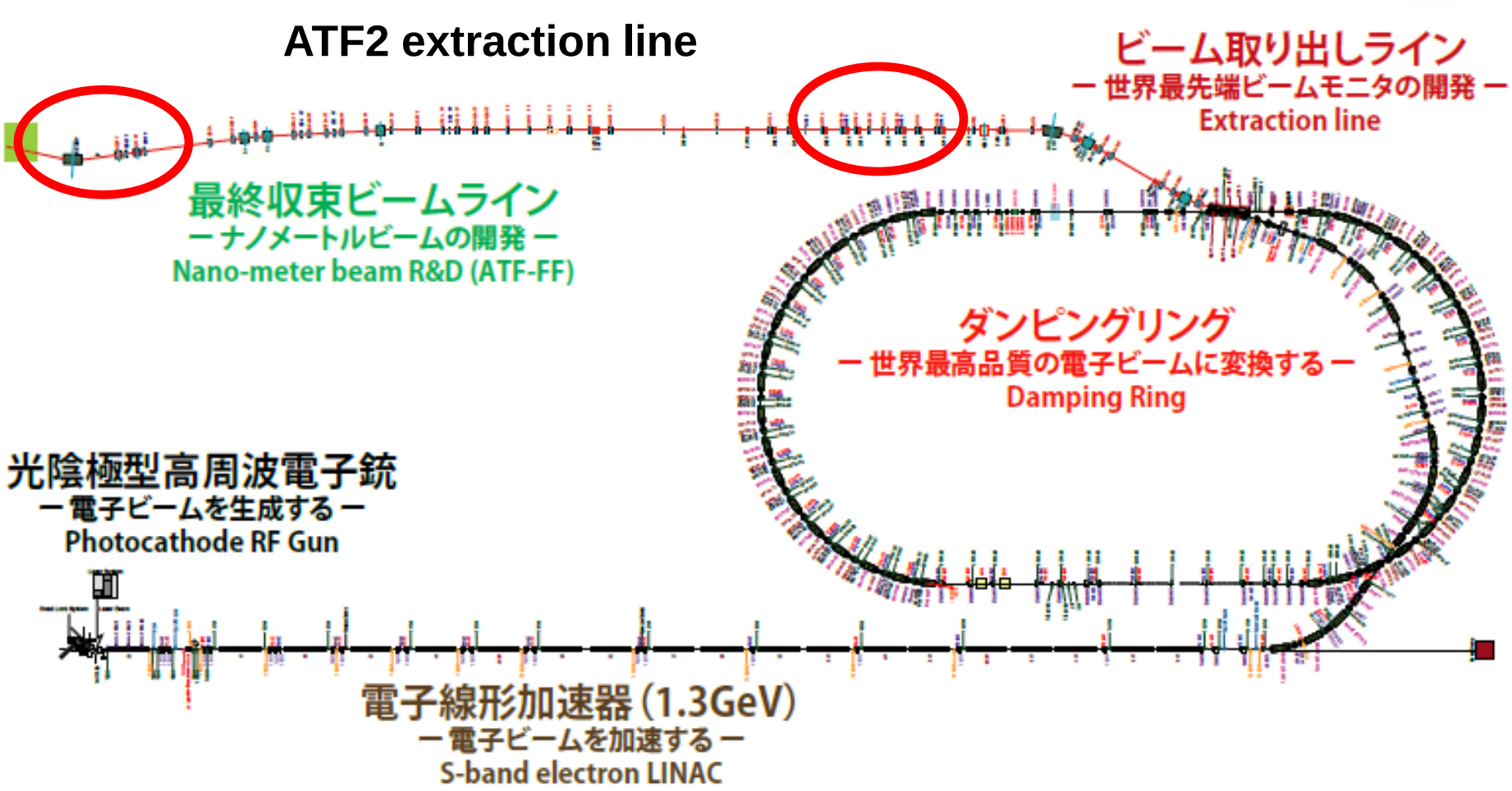
- **Improve phase shift between P2 and P3?**

  → optimum is 90 degrees

- **Find optics in FONT region with larger phase advance between P2 and P3 (Glen)**

  → should yield substantially improved correction downstream for all beam phases

FONT5 installation at ATF2



IP system

To be discussed on Friday

Upstream FB summary

- **Upstream FONT FB operation routine**
- **Stripline BPM resolution ~ 330nm**
- **Upstream FB works at BPM resolution limit:**
  beam corrected to ~ 500nm
- **Beam correction observed at MFB1FF**
- **Performance improvement by optimising phase?**