Overall: hardware status and R&D

N.Terunuma, KEK

Agenda

Agenda of the 10th TB and SGCs joint meeting, ATF International Collaboration

	Open Session: Status reports from December 2009 and			
14:00	Opening address			J. Urakawa
14:00-15:00	Summary reports	Overall: hardware status and R&D	20	N. Terunuma
		ATF2: summary of project meeting	30	P.Bambade
		Multi-bunch beam stability	10	K. Kubo
15:00-15:45	Status/upgrade	Fast Kicker	15	T. Naito
		Fiber laser for the EXT laser wire	15	L. Corner
		4-mirror Cavity Compton System	15	F. Zomer
	Break		15	
16:00-16:40	Proposals	X-ray monitor R&D at ATF2 extraction line	20	J. Flanagan
		SC-Q for ATF2 Final Doublet (reviced)	20	A. Seryi
	(Break)			
16:40-17:45	Closed Session:	TB and SGC Joint Discussion , Preparation of Summary	65	
	(Break)			
17:45~18:00	Open Session:	Concluding remarks		
18:30~	Banquet			

Please simplify the report to have a time for discussions

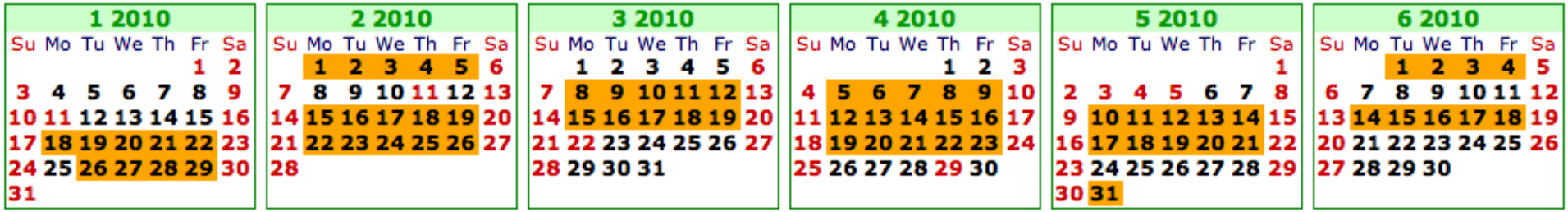
Contents of the status report

- Upgrade of Beam Instruments
  - DR BPM readout (FNAL digitizer)
  - EXT Stripline BPM readout (SLAC-LCLS digitizer)
  - Multi-OTR monitors

- Upgrade of Accelerator
  - Two LINAC klystron Modulators
  - EXT corrector PS

- R&Ds
  - Fast Kicker ……. status report by T. Naito
  - EXT LW ……. upgrade report by L. Corner
  - ATF2 related (FONT, IPBSM) ….. summary report by P. Bambade
  - the 4-mirror Compton system ….. status report by F. Zomer
  - Cold BPM
  - Multi-bunch instability …….. status/plan for study by K. Kubo

ATF/ATF2: 2010 Jan-Jun



1 2010

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4 2010

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6 2010

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6	7	8	9	10	11	12
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20	21	22	23	24	25	26
27	28	29	30			

Beam operation: 14 weeks

- Fast kicker mode … 3 weeks
- ATF2 continuous run … 1 week

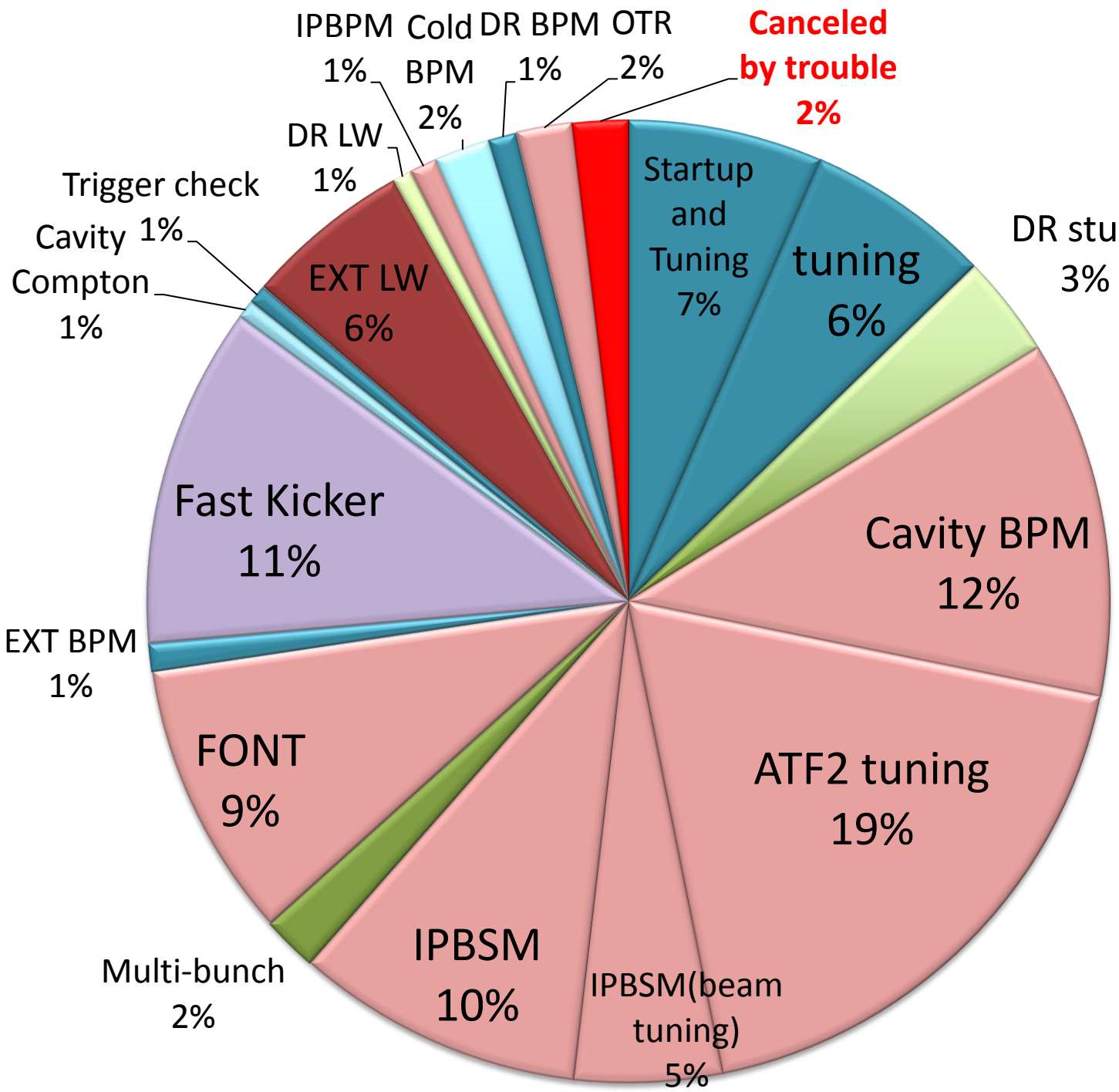
Major hardware troubles

- PS for DR main dipole was broken (lost 2 days)
- CAMAC communication (several hours/day after April, hot days)
- down of LINAC klystron modulators (several min/event)

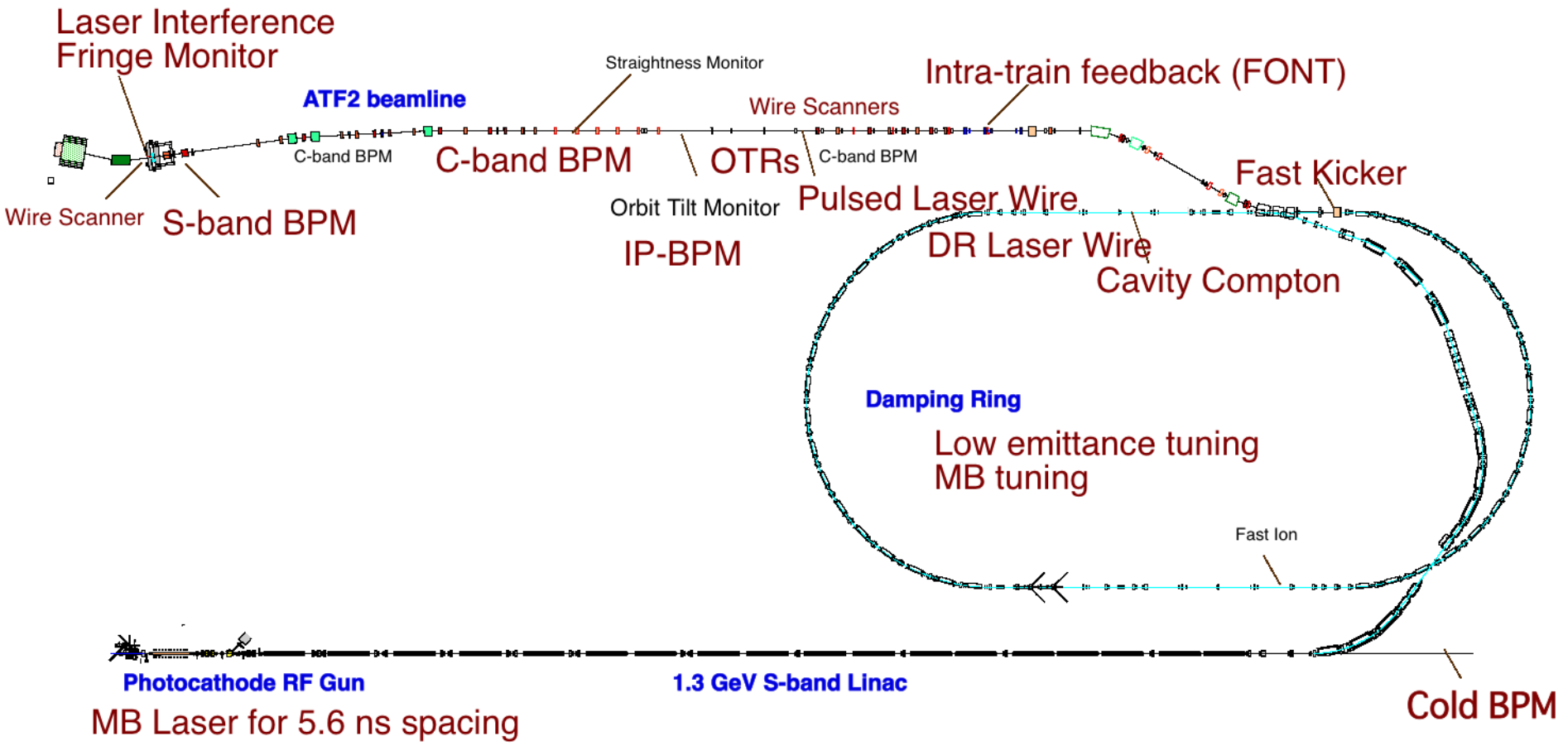
Poor quality beams

- Multi bunch instability
- lead the inefficient runs … FONT, Cavity Compton, Fast kicker,…

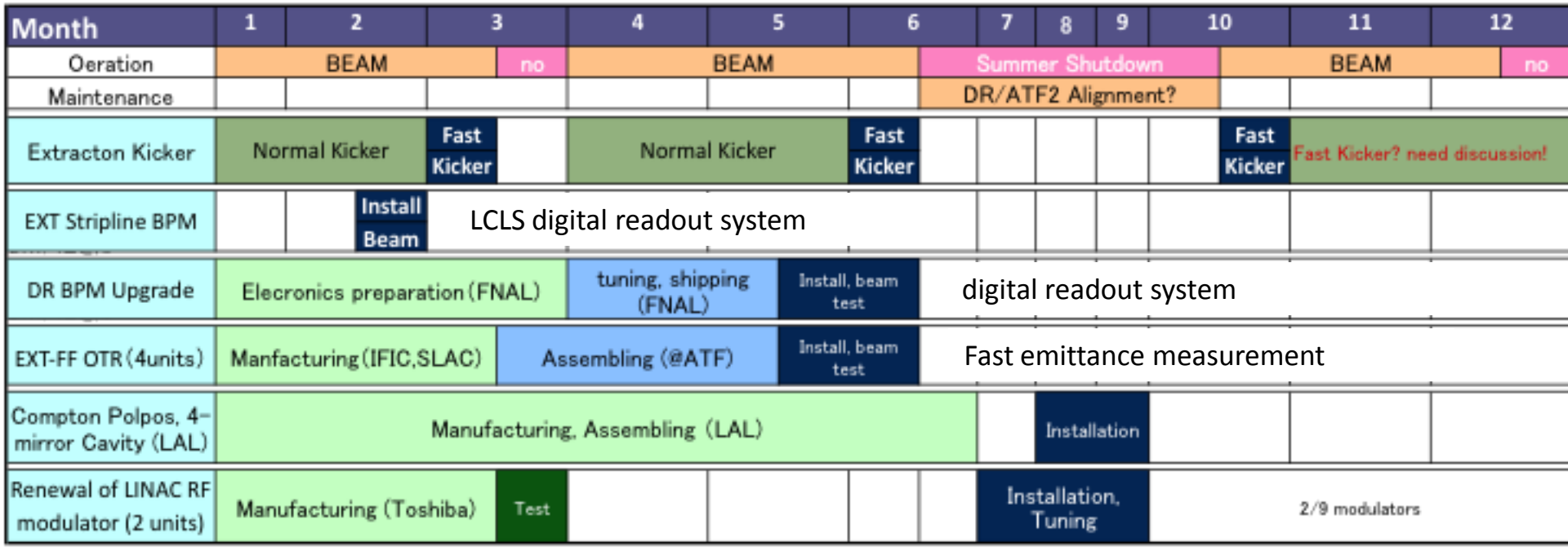
Beam Time Assignment in 2010 (Jan-Jun)



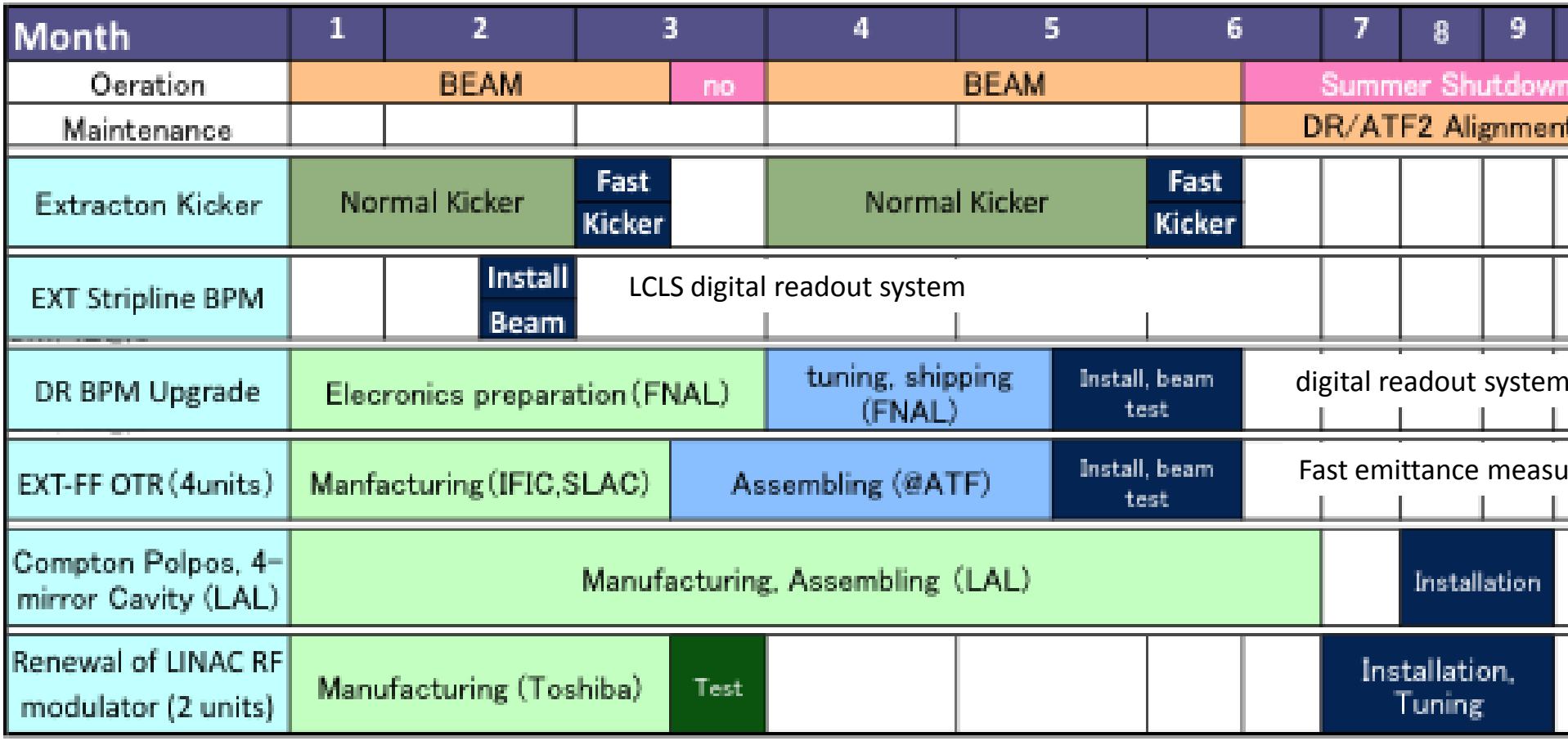
R&Ds: 2010 Jan-Jun



Major Hardware Installation in 2010



Major Hardware Installation in 2010



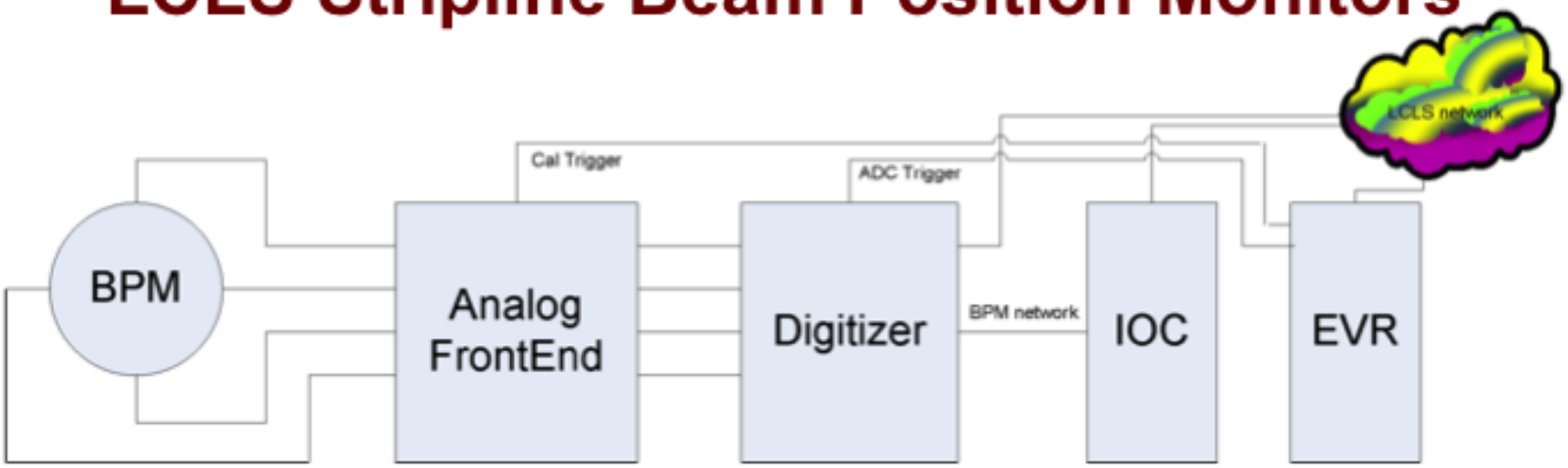
Stripline BPM Electronics Upgrade Report

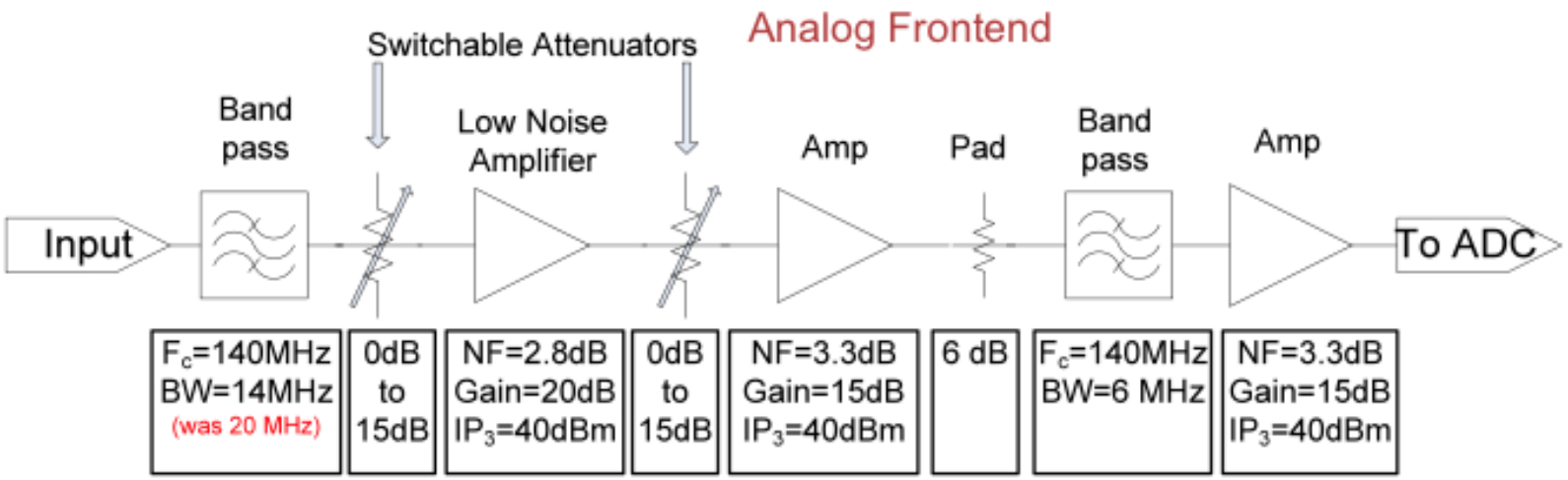
Glen White

30 June 2010

10th ATF2 Collaboration Meeting

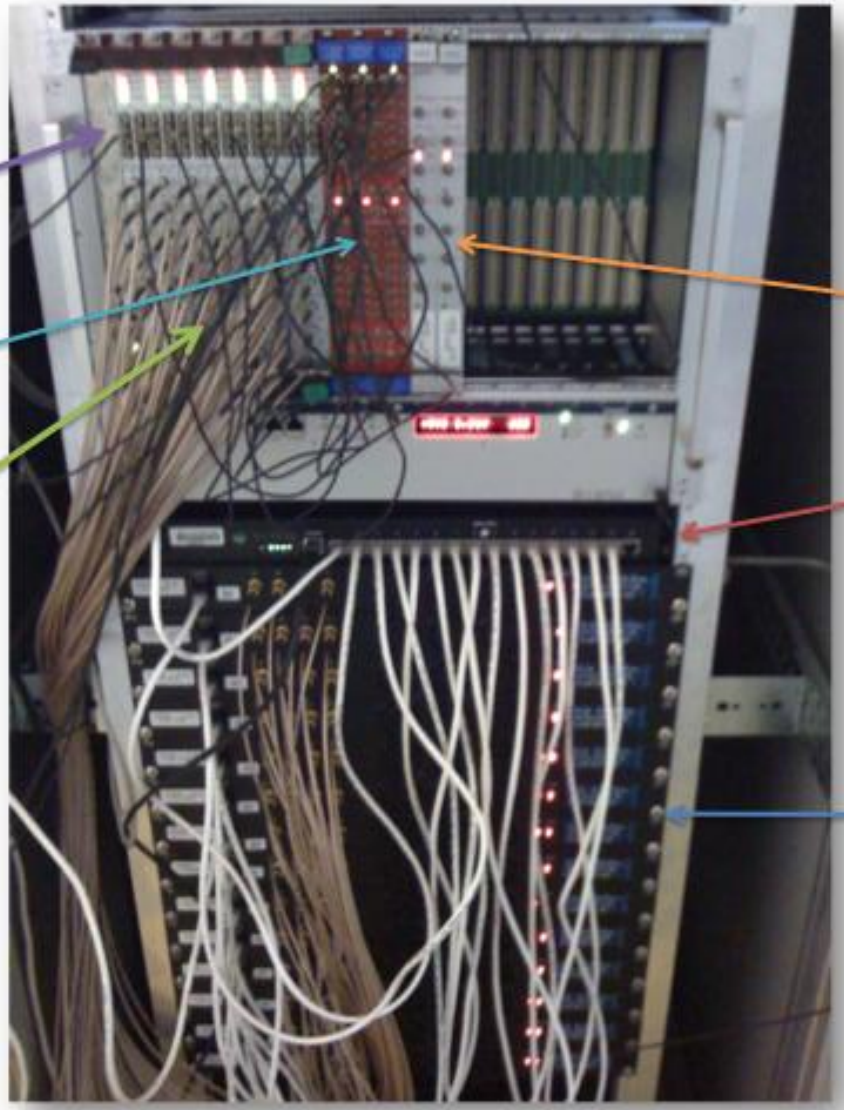
LCLS Stripline Beam Position Monitors



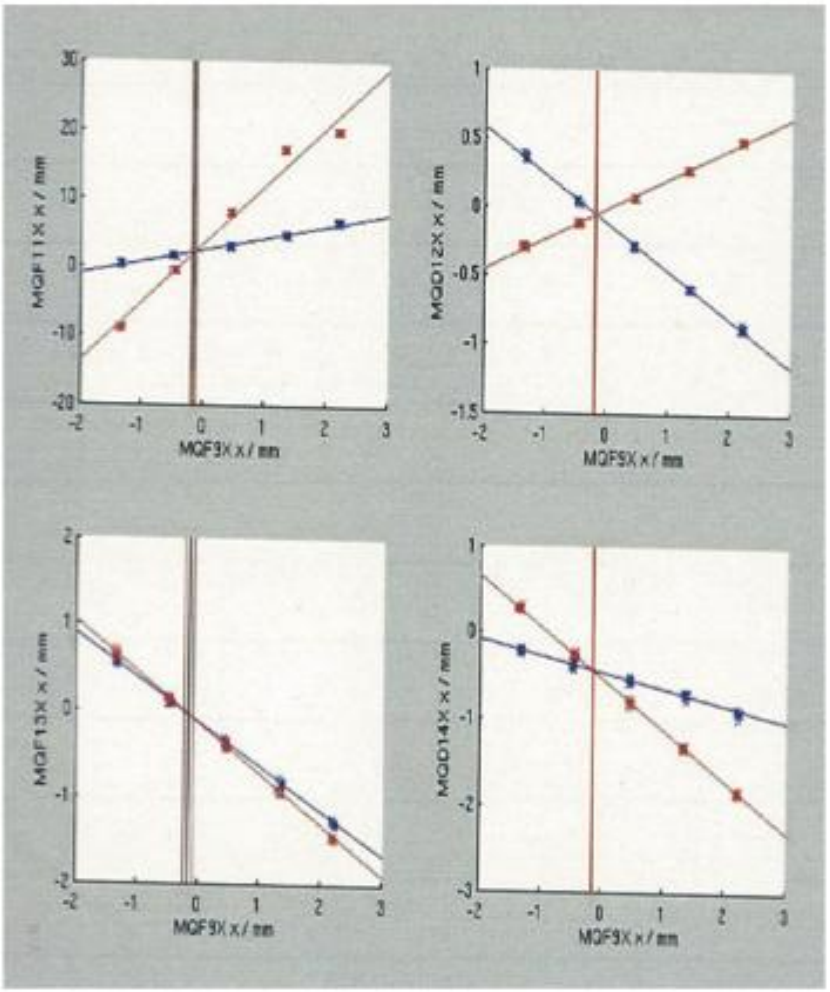


Signal is ~8 MHz band centered at 140 MHz

ATF2 Installation



BBA Test (QF9X)



- Quad shunting BBA for QF9X.
- For quad at 100% and 80% nominal strength.
- Alignment from crossing of steered beam position at MQF9X vs. downstream magnet BPMs.

Summary

- New EXT stripline BPMs all setup and available for use.
- Resolutions ~<10um, insensitive to Q.
- MQF4X now working ok after disconnecting and re-connecting cables!
- MQD5X, suspect cables responsible for high gain in x channel (and drift?).
- Configuration, monitoring and control through Matlab GUI
  - Instructions on wiki.

The ATF Damping Ring BPM Upgrade

Nathan Eddy, Eliana Gianfelice-Wendt

Fermilab

for the ATF Damping Ring BPM Team

New Hardware

Improvements on the analog downconverter

- CAN-bus controls, IF filter, remote diagnostics, etc.

New RF, DC & CAN-bus distribution. Grounding of tunnel hardware.

Switch to in-house VME digitizer

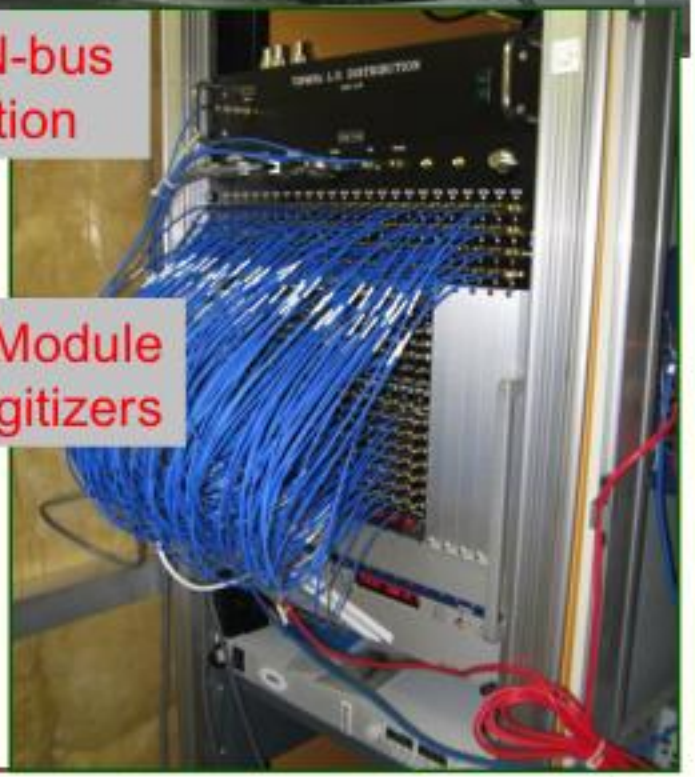
- 8-ch. ,125 MSPS ADC (serial outputs), Cylcone III FPGA, PLL-locked CLK distribution

- Able to measure Injection TBT, Narrowband Orbit, Narrowband Calibration , and Last Turn on every injection

New Downmix & Calibration

LO & CAN-bus Distribution

New Timing Module & Custom Digitizers

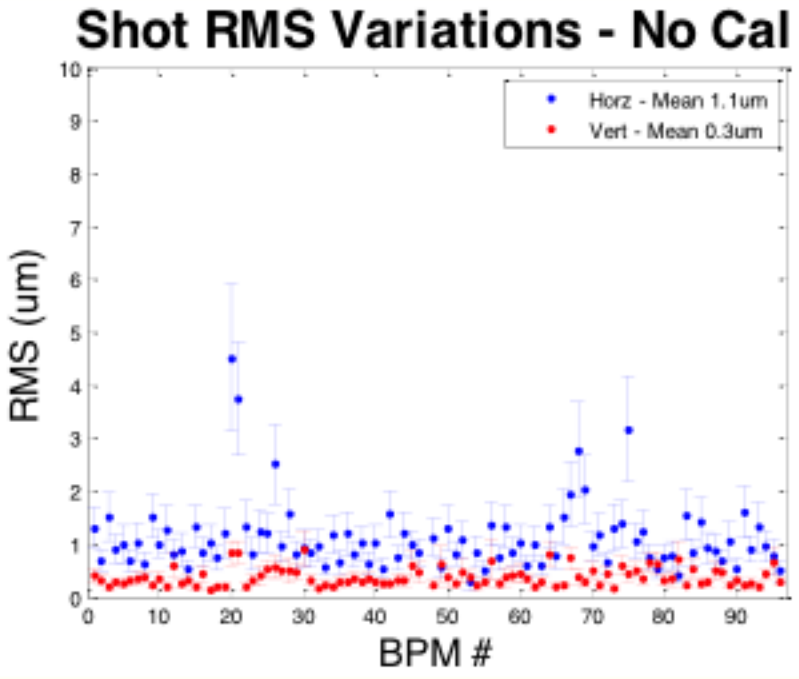


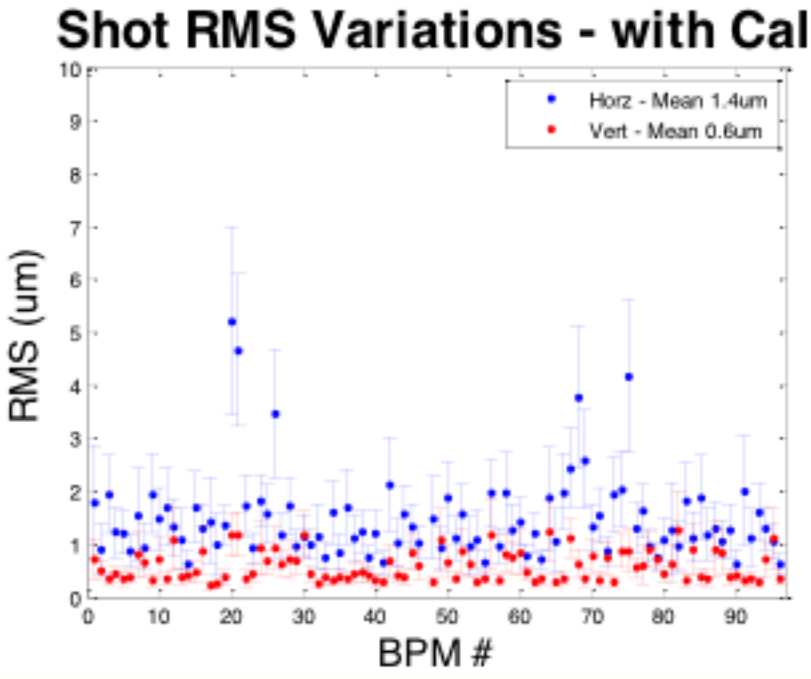
Current Status

- 95 of 96 Ring BPMs were switched to the new system during the May shutdown
- Beam commissioning began the last week of May
  - Initial Timing tests revealed an issue with clock synchronization
  - The echoteks used a 69.2MHz clock (32 samples/turn) synthesized from the 714MHz
    - The turn by turn data collection was initiated by an external turn marker
    - Fine for 1024 turns
  - The new system counts turns internally from injection to provide turn by turn data at any turn and last turn data
    - The synthesized 69.2MHz clock was found to drift over a full machine cycle
    - This caused problems with the turn by turn data at the end of the cycle
  - The solution was to bypass the clock synthesizer on the Timing Module
    - Simply use the clock divider, 714MHz/10 = 71.4MHz (33 samples/turn)
    - Solved the locking issue but required a major system modifications
- Operation of all bpms was demonstrated over the remaining shifts
  - Orbit data was read into the ATF control system
  - First beam studies
    - Two Sets of Narrowband Orbits were collected, without and then with calibration
    - Several Turn by Turn data files were collected both at injection and by kicking the beam after 500k turns

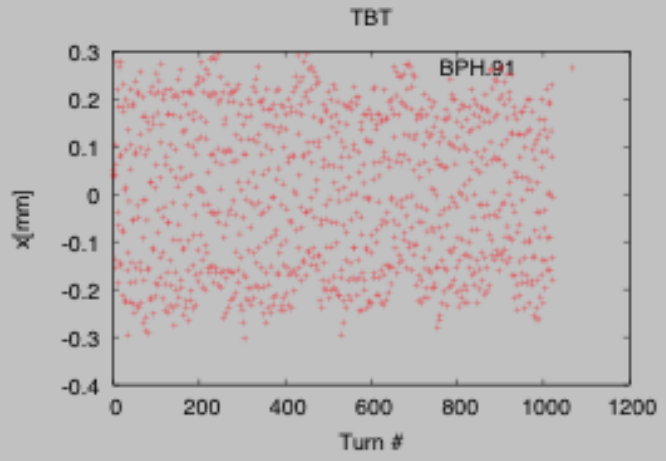
Narrowband Orbits

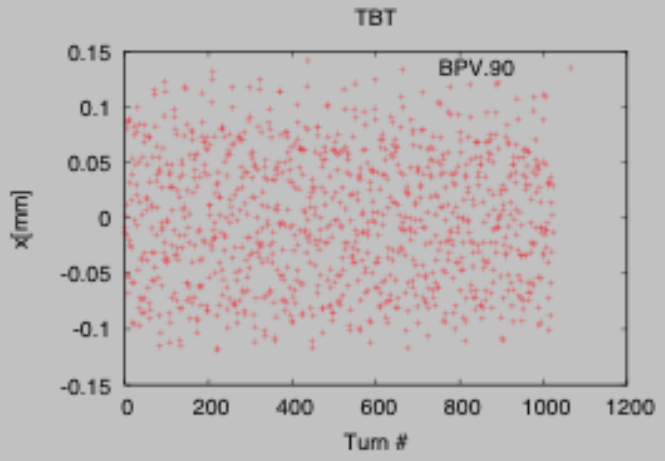
- **Single shot RMS is much smaller than shot to shot orbit variations**
  - **Plotted as mean shot RMS with variation on RMS as error bars**
  - **Observe larger RMS in Horizontal than Vertical -> Beam related**
  - **Data with Calibration has larger RMS than without Calibration**

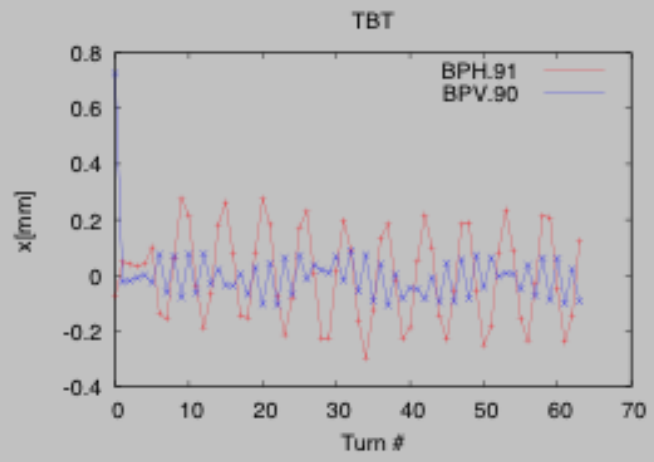




TBT_kick499775_9.txt





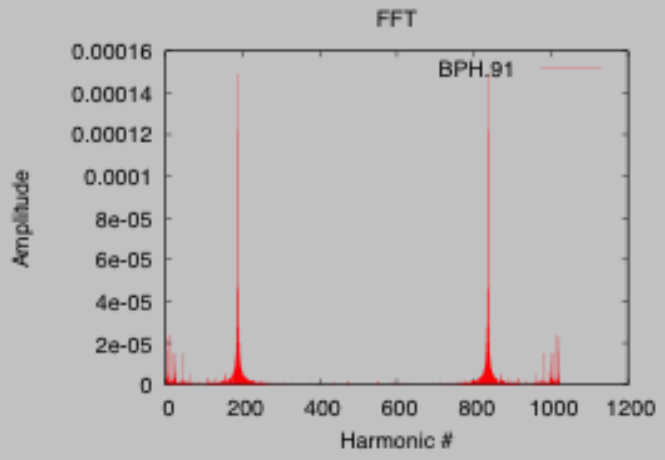


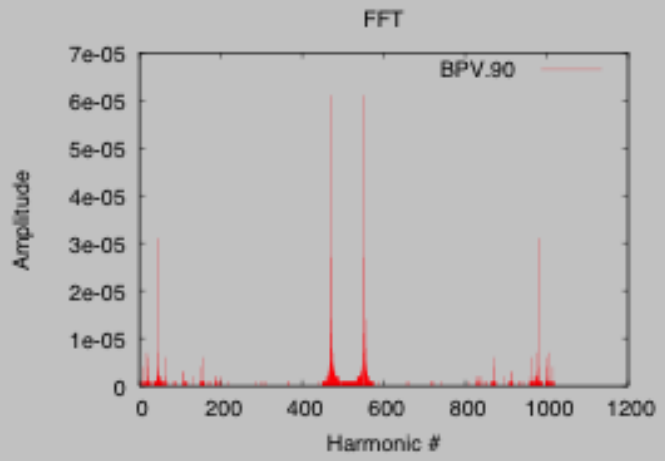
$\beta_x^0 = 1.6$ m @ BPH.91

$\beta_y^0 = 2.0$ m @ BPV.90

Oscillation amplitude is rather small and is not damped: small chromaticity?

Kick in the vertical plane is a factor 2.4 weaker.

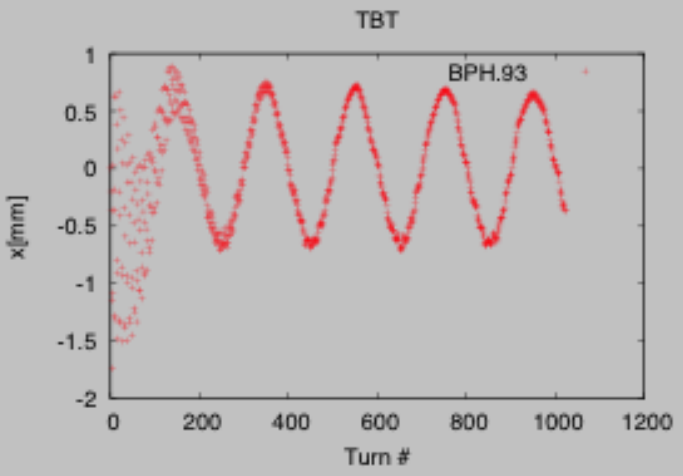


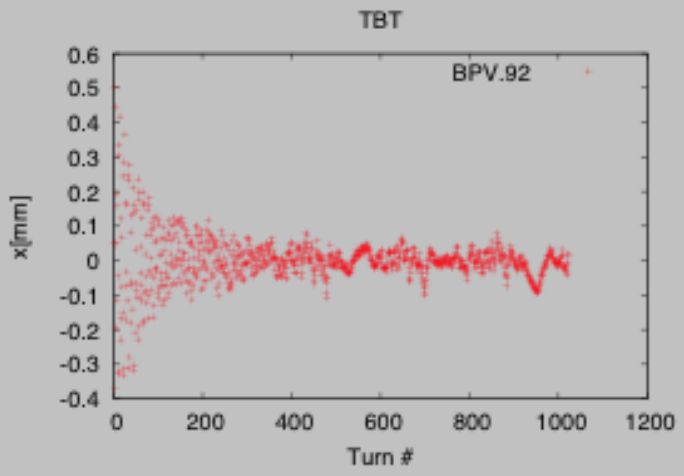


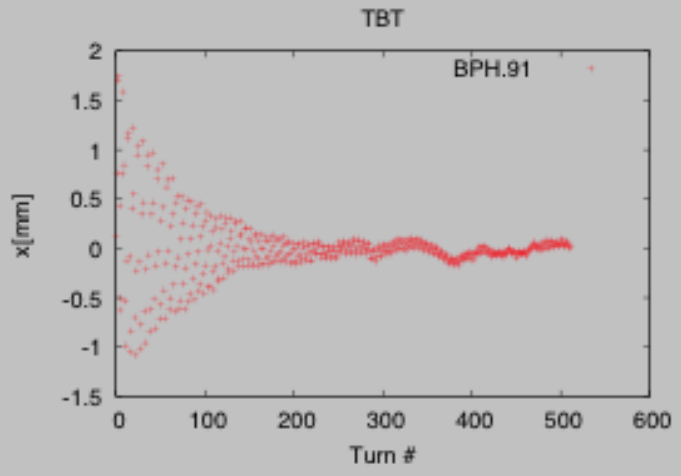
Tunes: 0.1831
0.5398

Small coupling between planes.

Injection data show large synchrotron oscillations in the horizontal plane.







The synchrotron oscillation is fitted and subtracted from horizontal TBT data.

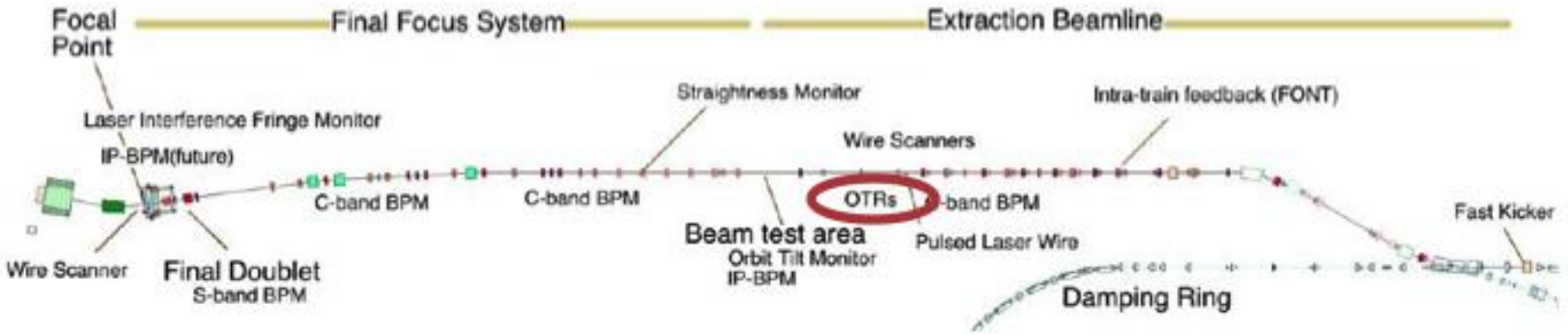
Summary

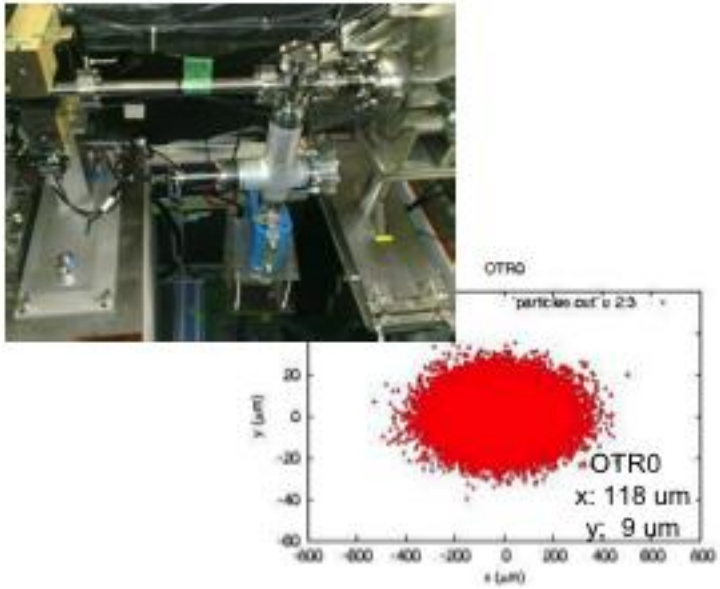
- The Damping Ring BPM upgrade installation is now complete and commissioning has begun
  - Major change to digitizer clock during commissioning
- The Narrowband Orbit data and Turn by Turn data are available
- Preliminary Analysis of the Narrowband data
  - Horizontal RMS > Vertical RMS -> measuring beam not noise!
  - Clear problem with the Calibrated orbit data
    - Should be resolved before operation resumes
  - Large shot to shot orbit variations…
    - Variations are larger than observed with Echotek system in 12/07
    - Simple estimate of system resolution from shot to shot data is slightly better with new system
- Results from Turn by Turn Analysis are presented next

Multi-OTR Status

A.Faus-Golfe, J.Alabau, C.Blanch,
J.V.Civera, J.J.García Garrigós
IFIC (CSIC-UV)
D.McCormick, G.White, J. Cruz
SLAC
and
KEK team

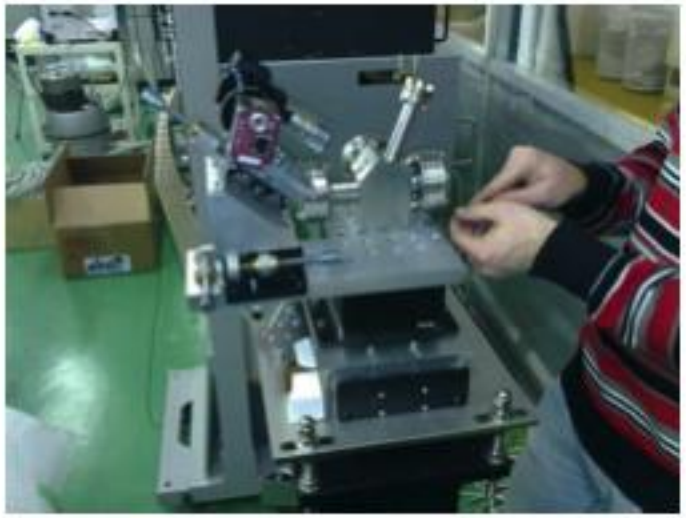
Overview



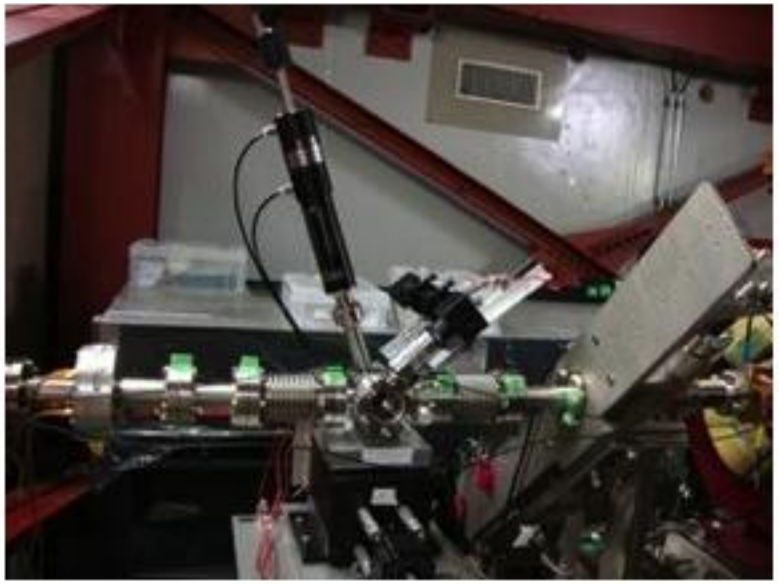


- **4 OTR monitor** has been installed in the zero-dispersion part of EXT line
- They will take **fast size and emittance measurements** with high statistics
- Design based on existing OTR1X with improved features and **2um resolution**
- They are **installed near WS** for comparison and confirmation of OTR as a beam emittance diagnostic device

H/W installation



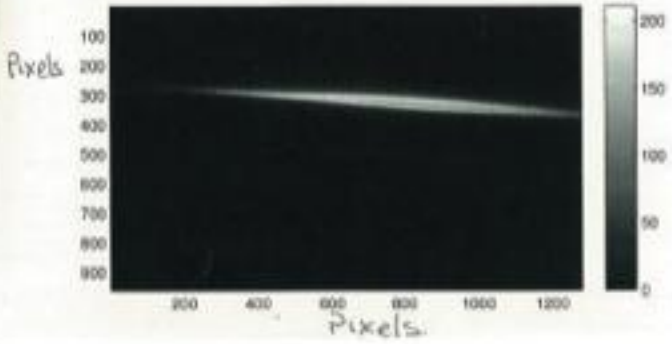
April 2010:
the 4 OTRs were assembled at ATF clean room



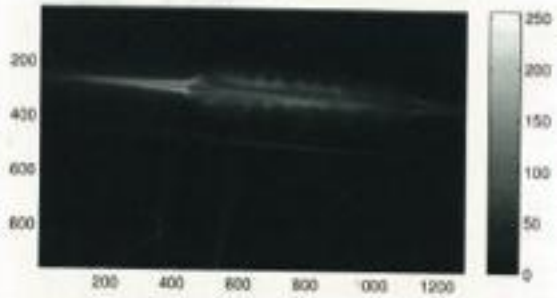
May 2010:
the 4 OTRs were installed in the EXT line

OTR Beam Tests - Target Damage Seen

06:30 taking some data with OTR1



06:45 After observing the OTR1 spot for several min.

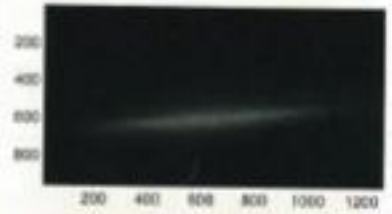


I see damage damage. Looks like the mylar is melting.

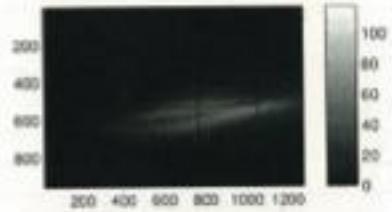
0825
taking OTR # spot.

Found OTR # spot
H pos 4.97
V pos 6.90

The pictures of Dorian Gray.

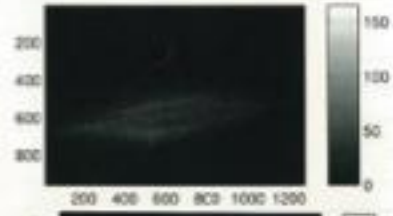


The beam looks good

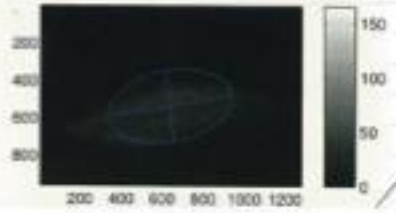


The beam continues to look good

~ 10 min.



At the picture becomes uglier



and uglier.

Target research

Ongoing:

-Research about most adequate target material is on going. Possible candidates for the fall running are: aluminum coated mylar, aluminum coated kapton or 100um aluminum foils

- In addition to the new types of targets, we are going to modify the existing target holders to hold a vertical and horizontal 10um tungsten wires. By using the vertical and horizontal movers each OTR can be used as a wire scanner. The normal step size in the vertical plane is 2um and 10um in the horizontal. That way we can compare the size measured by the wire and the size measured by the OTR. Both measurements will be in the exact same Z position so calibration will be easy and unquestionable.

S/W development

To do:

Single OTR features:

- Stage movement and position readback
- Machine protection
  - Status displays
  - Limit switches
  - Target in/out
  - OTR Working/Off modes
- Setting eventual new calibration or Working mode start point
- Automatic beam finding
  - Scanning an area
  - Using loss monitor to center beam
  - Using neighbour cavity bpm's to track the beam (optics issue)
- Ellipse fitting when beam spot found

Multi OTR features:

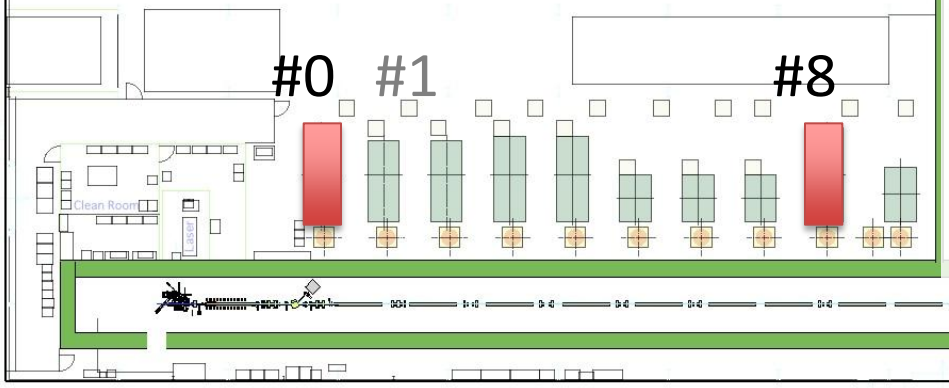
- Emittance measurements (assuming beam found in all 4 OTRs)
- Automatic emittance calculation procedure
  - User just press a button and receive the emittance value

Other: OTR1X integration, realistic beam simulations, non-zero dispersion contribution...

Major Hardware Installation in 2010

Month	1	2	3	4	5	6	7	8	9
Oeration	BEAM			no	BEAM		Summer Shutdown		
Maintenance							DR/ATF2 Alignment		
Extracton Kicker	Normal Kicker		Fast Kicker		Normal Kicker	Fast Kicker			
EXT Stripline BPM		Install Beam	LCLS digital readout system						
DR BPM Upgrade	Elecronics preparation (FNAL)			tuning, shipping (FNAL)	Install, beam test	digital readout system			
EXT-FF OTR (4units)	Manfacturing (IFIC,SLAC)			Assembling (@ATF)	Install, beam test	Fast emittance measu			
Compton Polpos, 4-mirror Cavity (LAL)	will be presented in Fabian's talk								
Renewal of LINAC RF modulator (2 units)	Manufacturing (Toshiba)		Test				Installation, Tuning		

Renewal of the LINAC klystron modulators(#0 and #8)



Manufactured in 1988

- **Availability**
  we had a lot of troubles in past beam operations
- **Stability**
  Inverter charging

Two modulators were manufactured in JFY2009 by stimulated/supplemental budget.

Old modulators were removed in last week.
Installation of new modulators will be end of July.
Commissioning will be in August.

Upgrade of the ATF2 corrector PSs

- 18 corrector dipoles
- recycled from TRISTAN collider
  - before 1986, 10bits resolution
  - Can not repair (except FAN)
  - No spares
- PLC controlled 16bits
- EPICS PVs
- Installed in Feb.

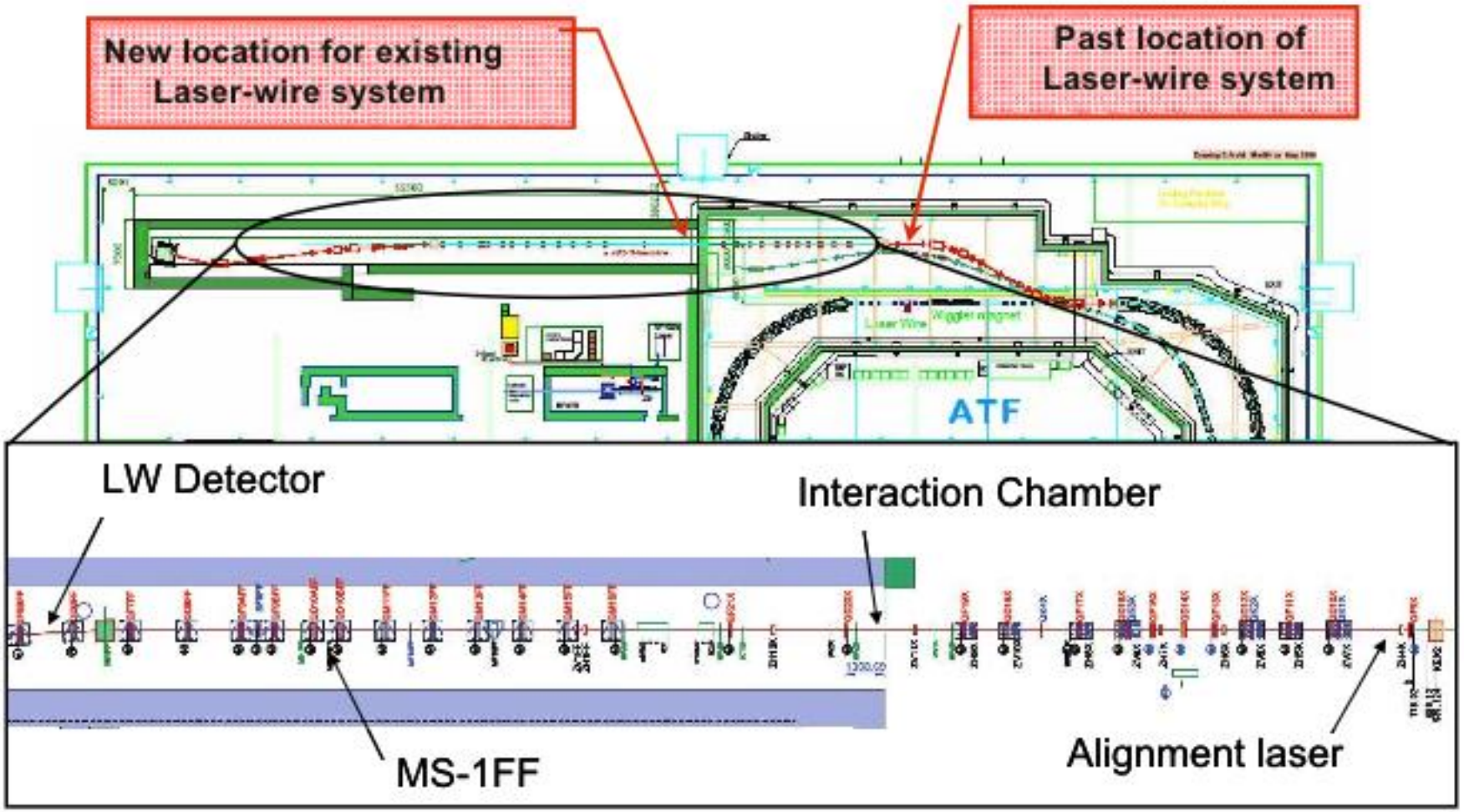
Royal Holloway
University of London

Micron Size Laser-Wire System at the ATF-II Extraction Line

Alexander Aryshev [c], Stewart Boogert [a], Grahame Blair [a], Gary Boorman [a]
Lawrence Deacon [a], Pavel Karataev [a]
Nicolas Delerue [b], Laura Corner [b], Brian Foster [b]
David Howell [b], Laurie Nevay [b], Roman Walczak [b]
Hitoshi Hayano [c], Nobihiro Terunuma [c], Junji Urakawa [c]

[a] John Adams Institute at Royal Holloway, Egham, Surrey, TW20 0EX, UK
[b] John Adams Institute at Oxford University, Nuclear and Astrophysics Laboratory, Keble Road, Oxford OX1 3RH, UK
[c] KEK, 1-1 Oho, Tsukuba, Ibaraki 305-0801, Japan

ATF-II Laser-wire system



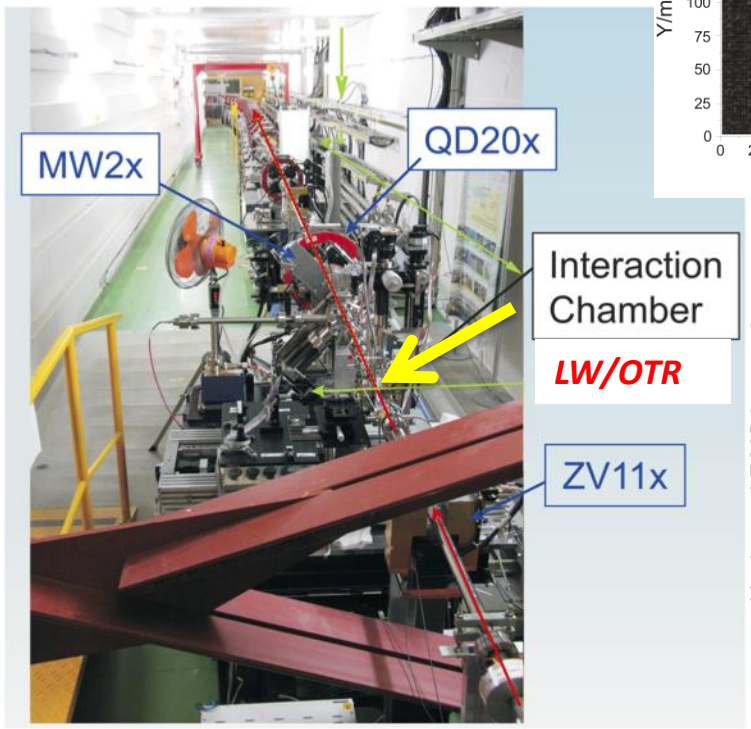
Upgrade of Laser wire monitor

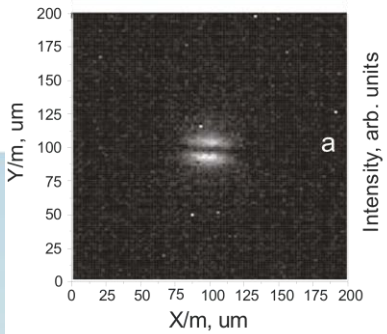
JAI(RHUL,Oxford) / KEK

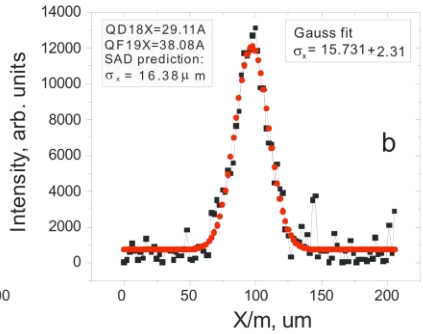
The system has been re-commissioned in the ATF2 after the re-location.

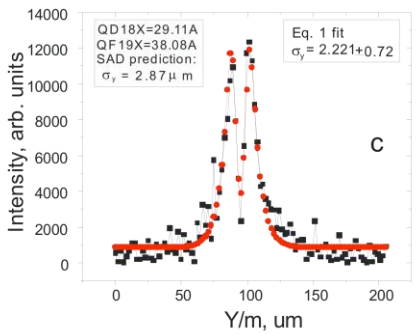
Improvement for ATF2

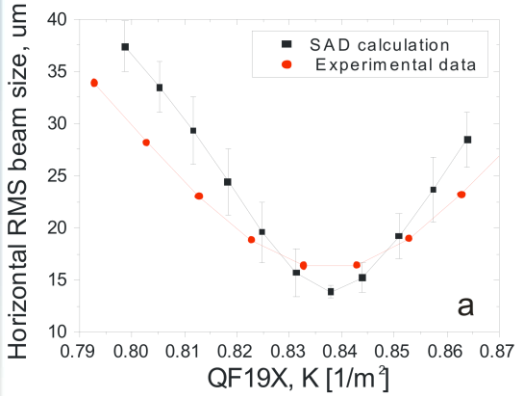
*inclusion of an **OTR target** in the system for **collision optimisation** and **cross calibration**.*

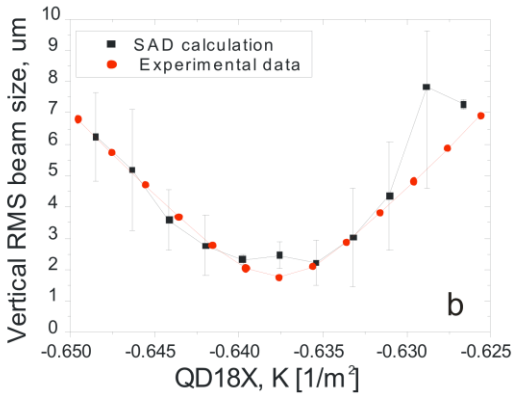












Beam size scanning by LW-OTR

- further R&D tools (Fiber laser) for EXT-LW will be presented by Laura.

FONT5 @ ATF2: Status Update

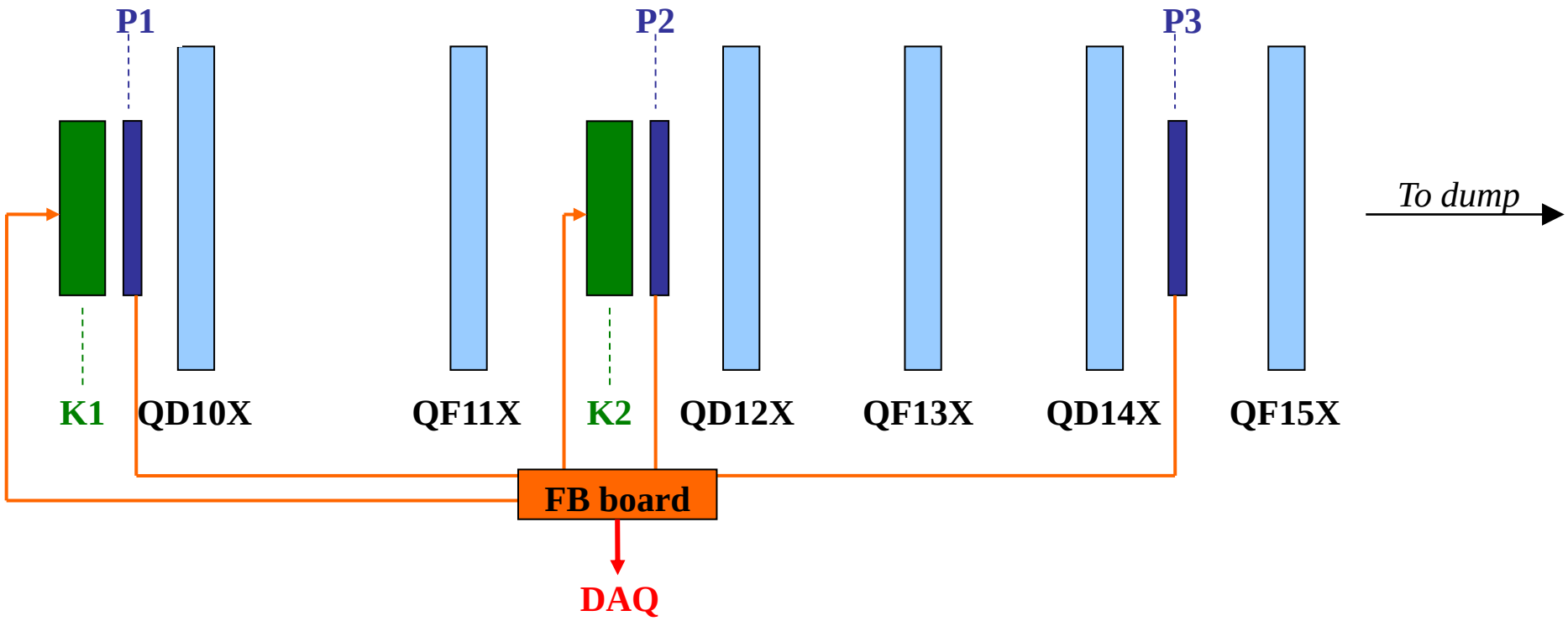
Glenn Christian
(on behalf of FONT group)

10th ATF Project Meeting

Abridged Summary – December 2009

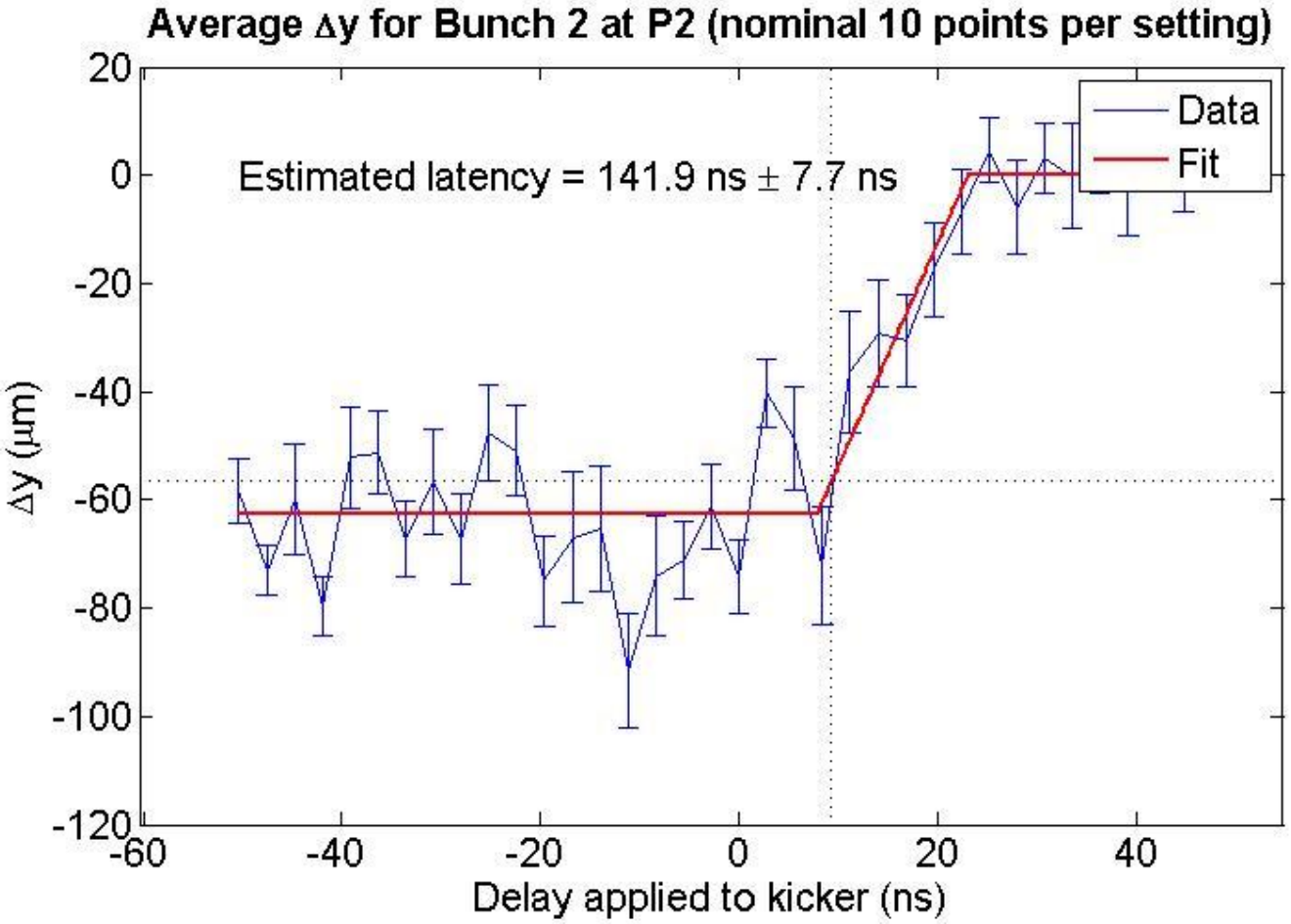
- **Initial operation of first feedback loop (P2-K1)**
- **Large jitter and lack of correlation between bunches are major problems (sometimes jitter is small and well correlated!)**
- **Resolution consistently measured at around 3 microns**
- **A lot of progress made since then!**

Layout of FONT upstream feedback system

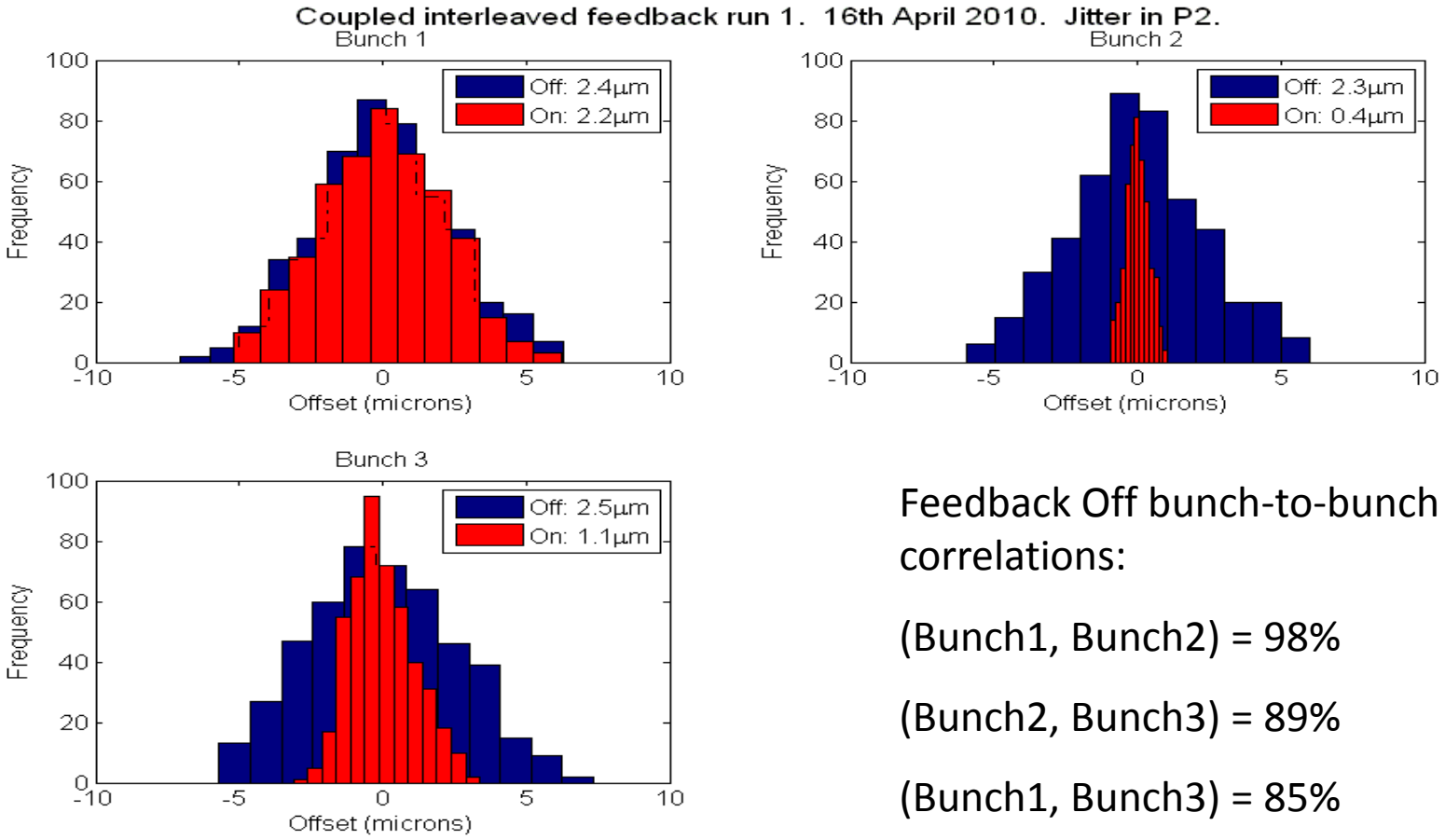


- Position and angle feedback: 3 stripline BPMs, 2 stripline kickers
- Ideal: Loop1 (P2-K1) corrects position (angle) at P2 (P3); Loop 2 corrects angle (position) at P2 (P3).
- As phase advance is not exactly $\pi/2$ between pairs of kickers/BPMs, both loops coupled
  - kicker drive signals linear function of both P2 and P3 measurements.
- P3 – K1 longest latency path is system

Latency estimate (worst case P3 – K1)



Feedback Performance on Jitter @ P2: Coupled Interleaved Run (16 April)



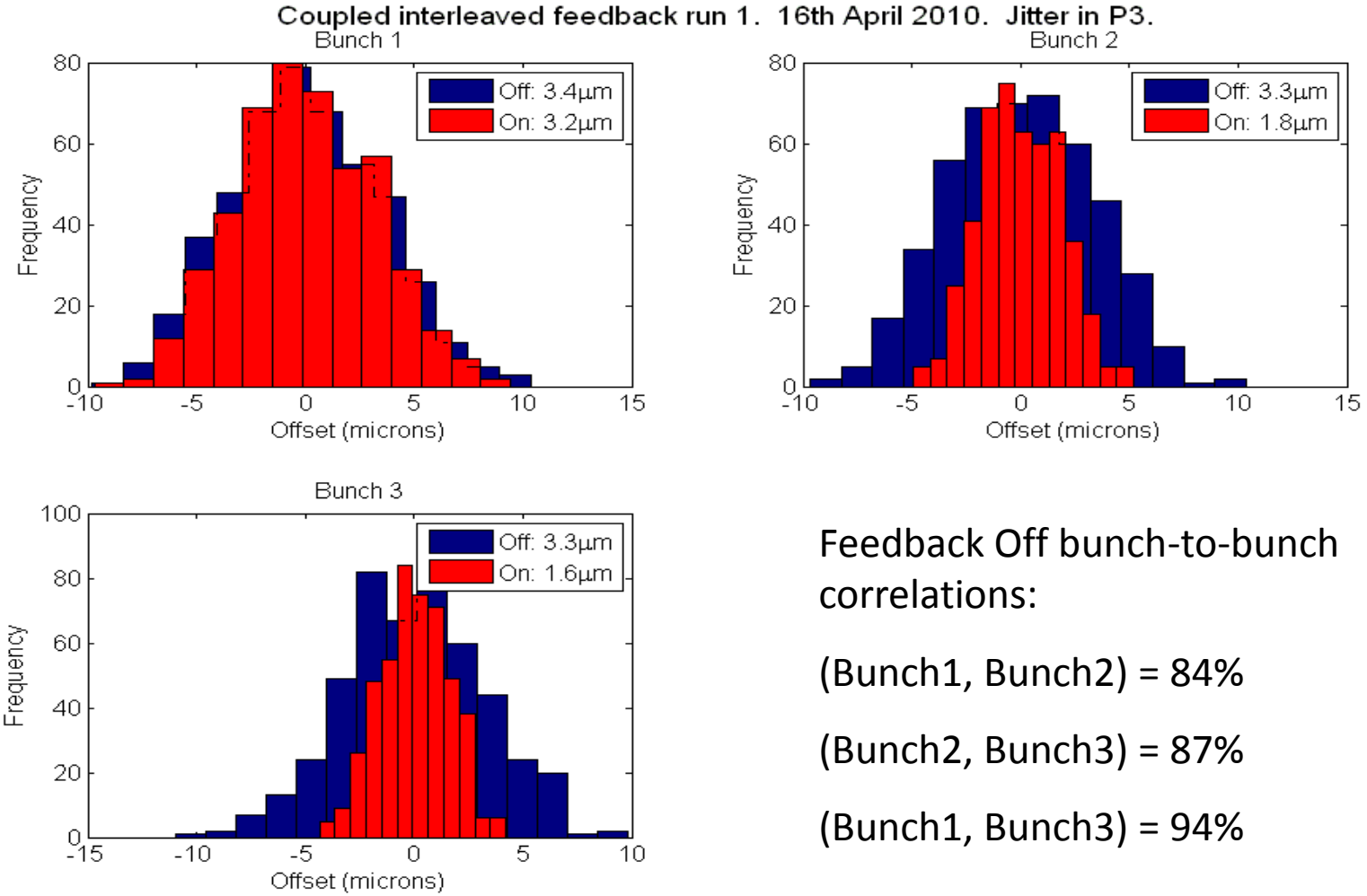
Feedback Off bunch-to-bunch correlations:

(Bunch1, Bunch2) = 98%

(Bunch2, Bunch3) = 89%

(Bunch1, Bunch3) = 85%

Feedback Performance on Jitter @ P3: Coupled Interleaved Run (16 April)



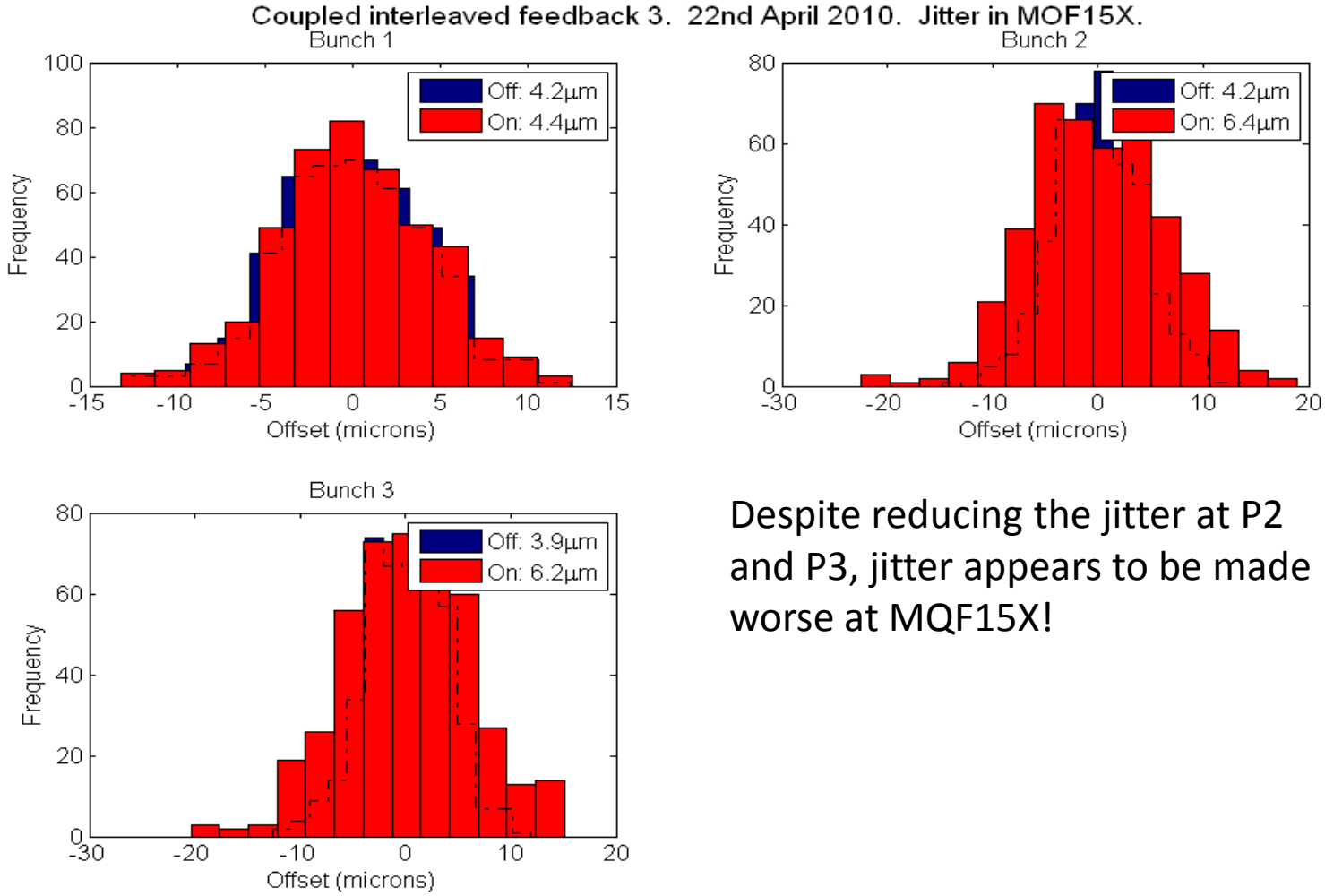
Feedback Off bunch-to-bunch correlations:

(Bunch1, Bunch2) = 84%

(Bunch2, Bunch3) = 87%

(Bunch1, Bunch3) = 94%

Feedback Performance on Jitter @ MQF15X: Coupled Interleaved Run (22 April)



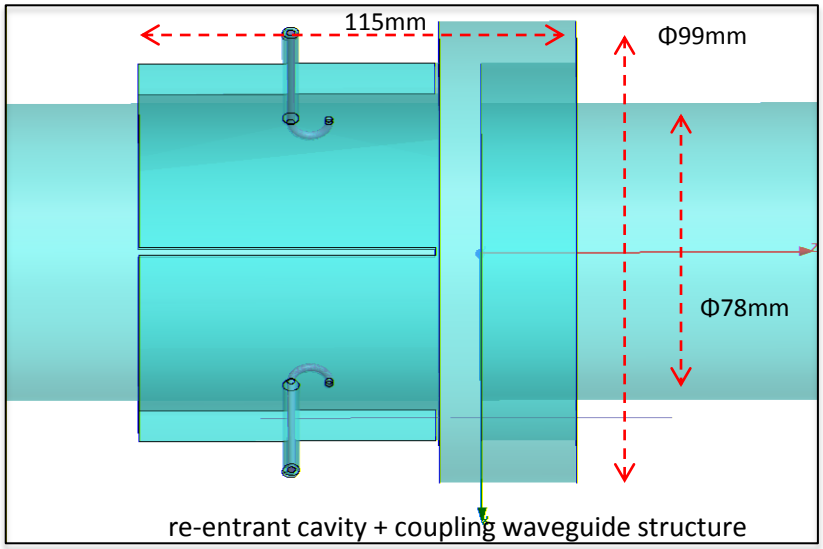
Despite reducing the jitter at P2 and P3, jitter appears to be made worse at MQF15X!

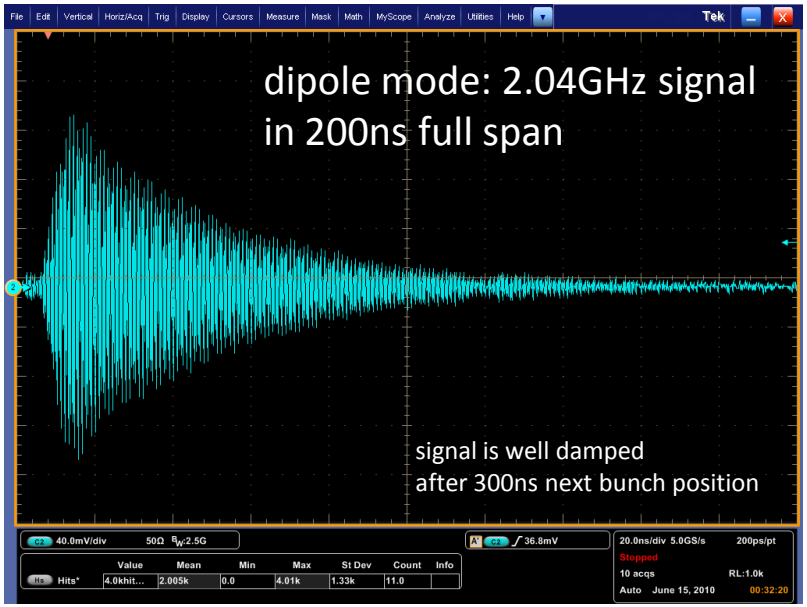
R&D of Cold BPM for ILC-ML

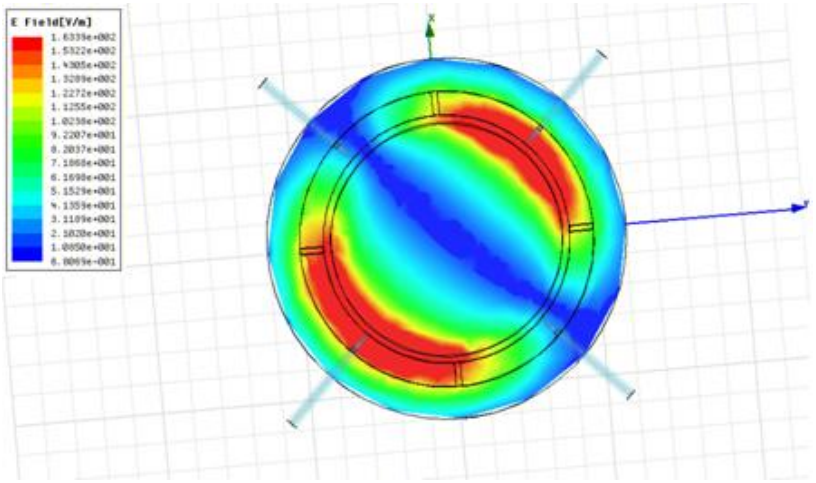
- at ATF LINAC end

Beam test of Re-entrant BPM (2.0GHz) for ILC Main Linac

YoungIm Kim (KNU), Jinyeong Ryu (KNU), Sunyoung Ryu (PNU), H. Hayano (KEK)







dipole mode: 2.04GHz