Summary for TB

July 2, 2010

10th ATF2 Project Meeting

Philip Bambade, Andrei Seryi, Toshiaki Tauchi

Sessions, 1-st day …

- Intro
  - Greetings, Junji Urakawa
  - Goal of the meeting, Toshiaki Tauchi
- Instrumentation
  - Ring BPM upgrade & Orbit analysis, Nathan Eddy, Eliana Gianfelice-Wendt
  - FONT 5 status, Glenn Christian , et al
  - C/S-band cavity BPMs, Stewart Boogert , et al
  - IPBSM status, Masahiro Oroku , et al
  - IPBPM status, Youngim Kim , et al
  - ATF2/Extraction line Laserwire, Alexander Aryshev , et al
  - Stripline Fast kicker, Takashi Naito , et al
  - ATF2 extraction line Stripline BPM upgrade, Glen White , et al
  - Multi OTR, Angeles Faus-Golfe, Glen White, et al

… Sessions, 1-st day

- Beam tuning
  - EXT beam measurements and corrections, Mark Woodley
  - Beam-Based Alignment, Eduardo Marin
  - Beam Orbit Feedbacks in EXT and FFS, Glen White
  - IP tuning with multiknobs, Glen White
  - May 2010 Continuous Run Operations, Andrei Seryi
  - Re-Alignment of QF1FF, Ryuhei Sugahara
  - Plans for continuous run operations in 2010, Toshiyuki Okugi

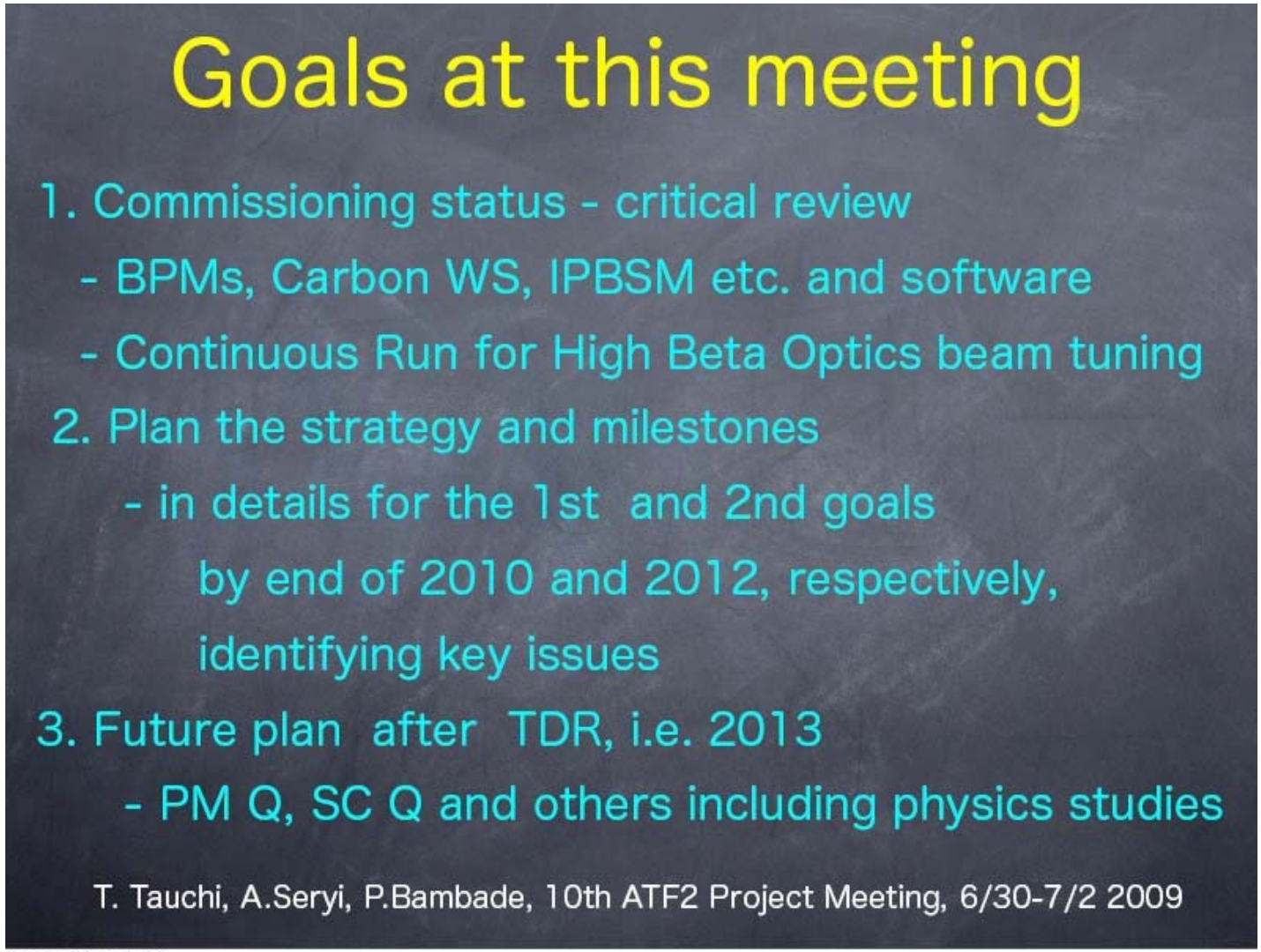
Sessions, 2-nd day …

- Toward the first goal
  - IP instrumentation configuration and FD field quality issues for Autumn 2010 ATF2 runs, Toshiyuki Okugi
  - Review and status of software tools for ATF2, Shigeru Kuroda
  - Background study plan toward goal 1 in 2010-2011, Marc Verderi
  - Priority issues to study for goal 1, Glen White
  - Discussion
- Future plan after April 2013
  - International workshop on physics in intense field, Tohru Takahashi
  - Permanent Q at IP as well as at the upstream, Yoshihisa Iwashita
  - KEK cryogenics system for SC-FF, Nobuhiro Kimura
  - American regional team recommendation for the focus of efforts with respect to superconductive final doublet development, Andrei Seryi
  - Discussion

… Sessions, 2-nd day

- Toward the second goal by end of March 2013
  - ATF DR beam stability (including multi-bunch), needed studies and improvements, Kiyoshi Kubo
  - Fast bicker performance and plans, Takashi Naito
  - IPBPM plans, YoungIm Kim
  - FONT and integrated performance, Philip Burrows
  - Discussion on the schedule plan or road map

Goal of the meeting



2010年 6月 30日 水曜日

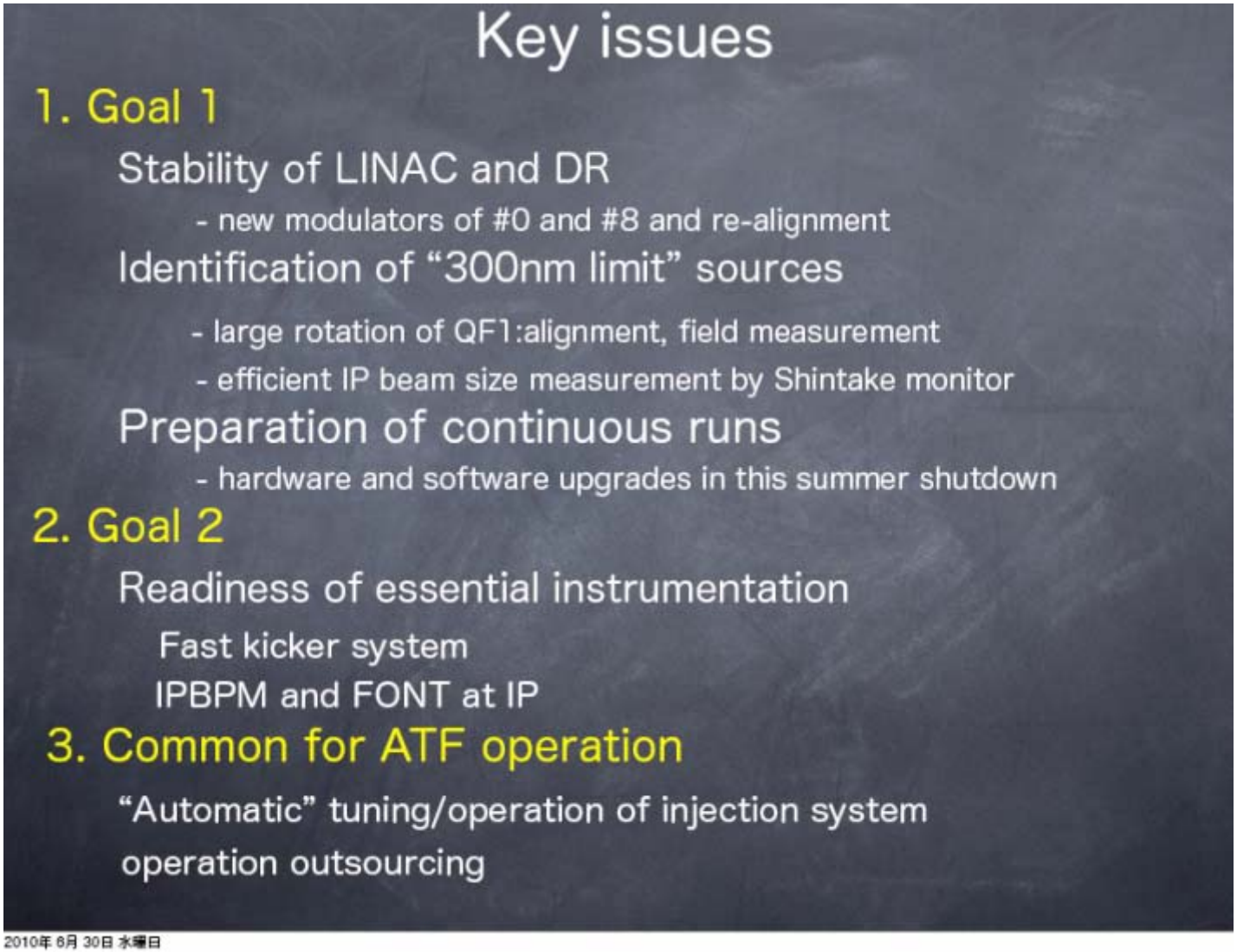
Goal of the meeting

Parameters at ATF2

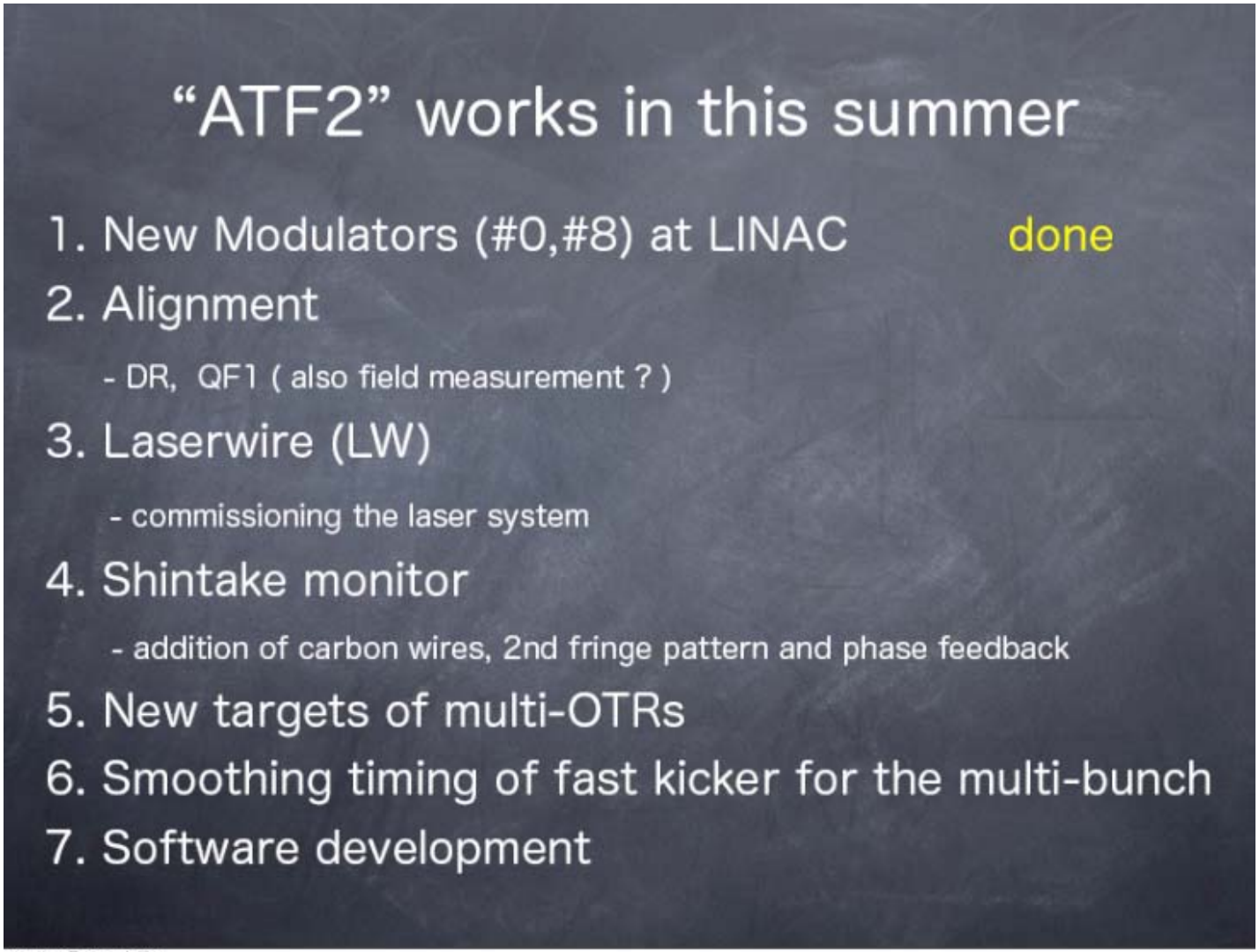
IP Parameter	nominal	May 2009	Dec. 2009	April 2010	May 2010
Beam energy	1.3GeV	1.3GeV	1.3GeV	1.3GeV	1.3GeV
Emittance in x	2 nm	1.7nm	1.7nm	1.7nm	1.7nm
Emittance in y	12 pm	11pm	<10pm	<10pm	<10pm
Beta function in x	4 mm	8cm	8cm	4cm	4cm
Beta function in y	0.1mm	1cm	1cm	1mm	1mm
beam size in x	2.8 μm	~10 μm	~10 μm	~10 μm	~10 μm
beam size in y	35 nm	not yet	1.5 μm	900 nm	300 nm

2010年 6月 30日 水曜日

Goal of the meeting

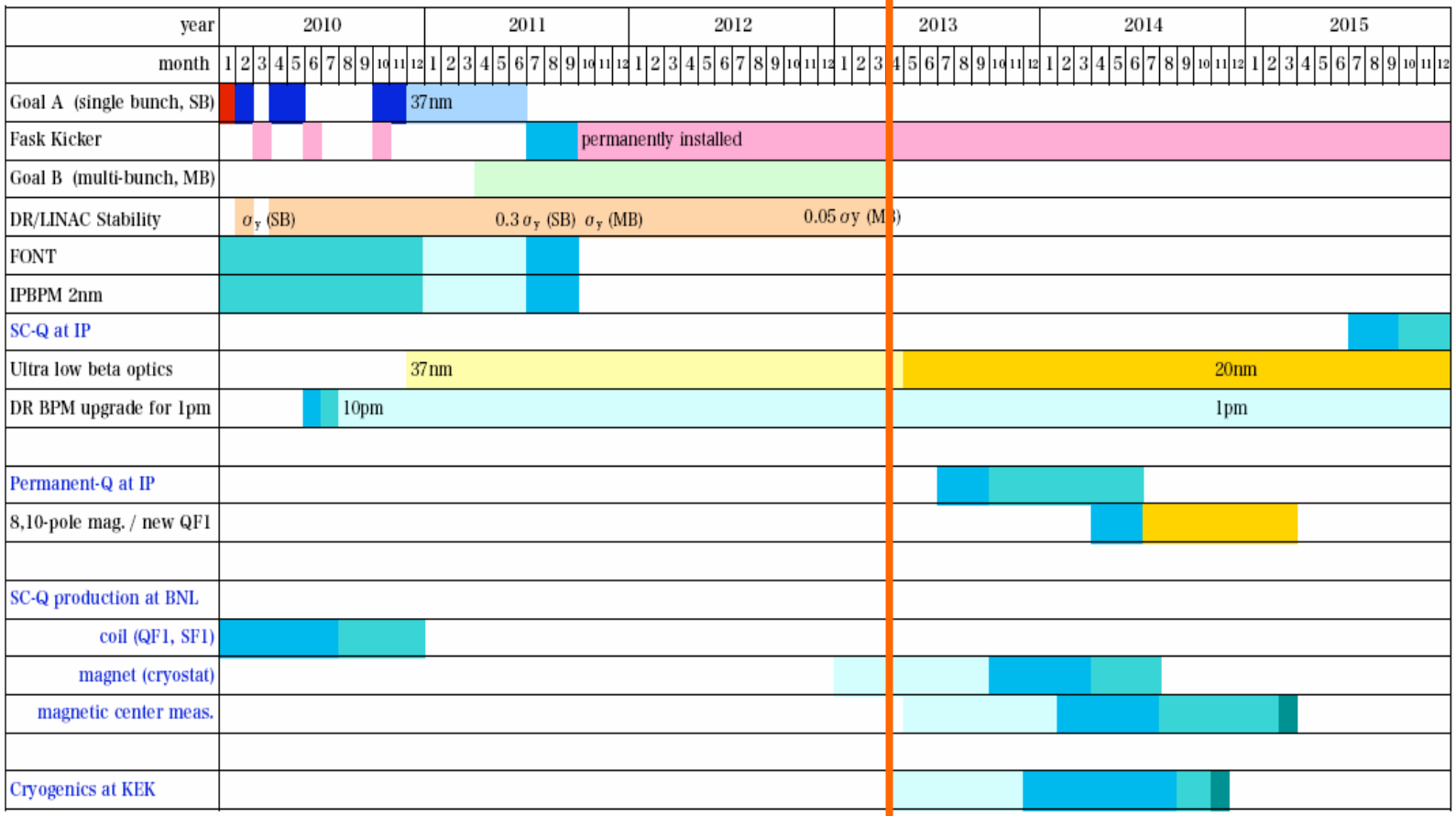


Goal of the meeting



Tentative research schedule for 2010-2015

not funded, to be reviewed



Instrumentation
Ring BPM upgrade

Current Status

Fermilab

- 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

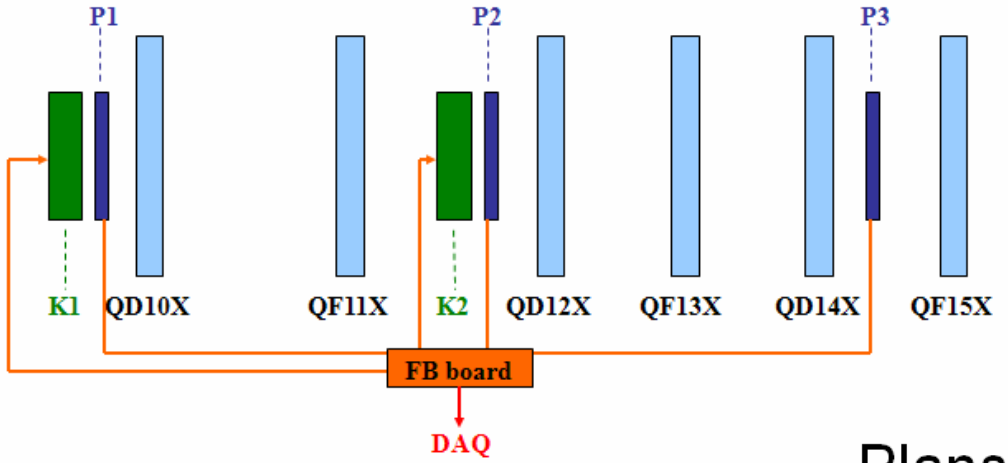
6/30/2010 ATF2 Project Meeting 3

The ATF Damping Ring BPM Upgrade

Nathan Eddy, Eliana Gianfelice-Wendt
Fermilab
for the ATF Damping Ring BPM Team

Instrumentation, FONT 5 status

Layout of FONT upstream feedback system



Glenn Christian
(on behalf of FONT group)

Abridged Summary – December 2009

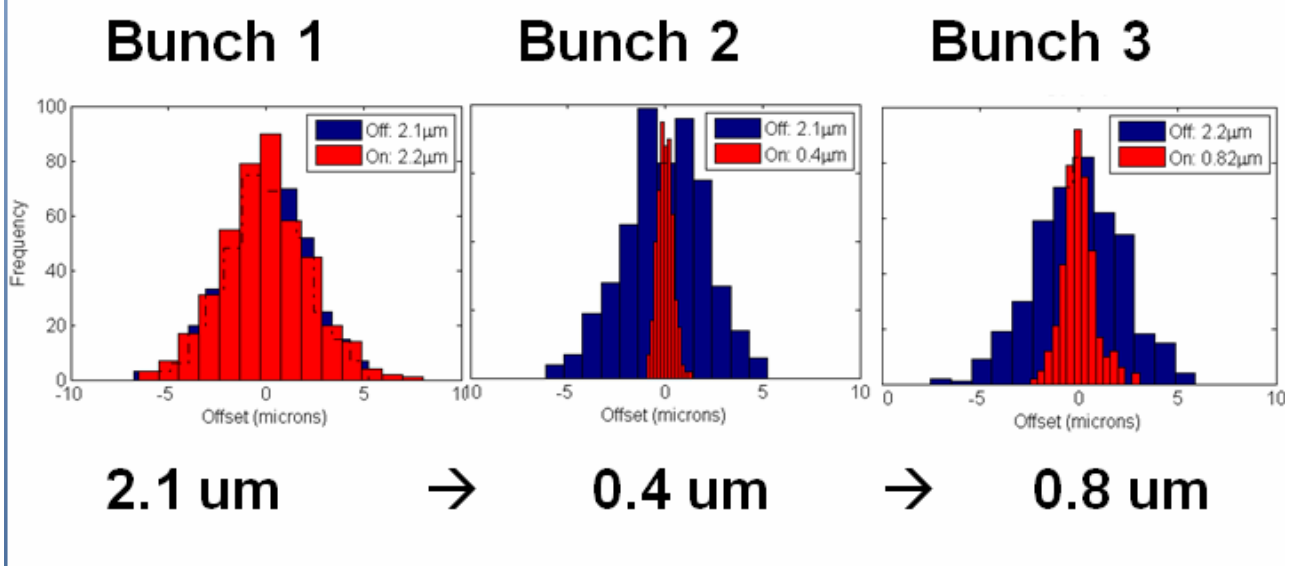
- **Initial operation of first feedback loop (P2-K1)**
- **Large jitter and lack of correlation between bunches are major problems (sometimes jitter is small and well correlated!)**
- **Resolution consistently measured at around 3 microns**
- **A lot of progress made since then!**

Plans for Early 2010

- Demonstrate good performance with feedback loop 1 (P2-K1)
- Demonstrate feedback with loop 2 (P3-K2)
- Investigate coupling between feedback loops and operate both loops uncoupled/coupled
- Understand source of instability (in DR?) affecting multi-bunch jitter
- Reduce noise / improve resolution (1 micron goal)

Instrumentation, FONT 5 status

P2 → K1 loop jitter reduction
(April 16 2010)



- With the current ATF2 setup (existing kicker system and 3 bunches) we occasionally see good correlations, usually after a lot of tuning

Summary of Collaboration discussion

Summary

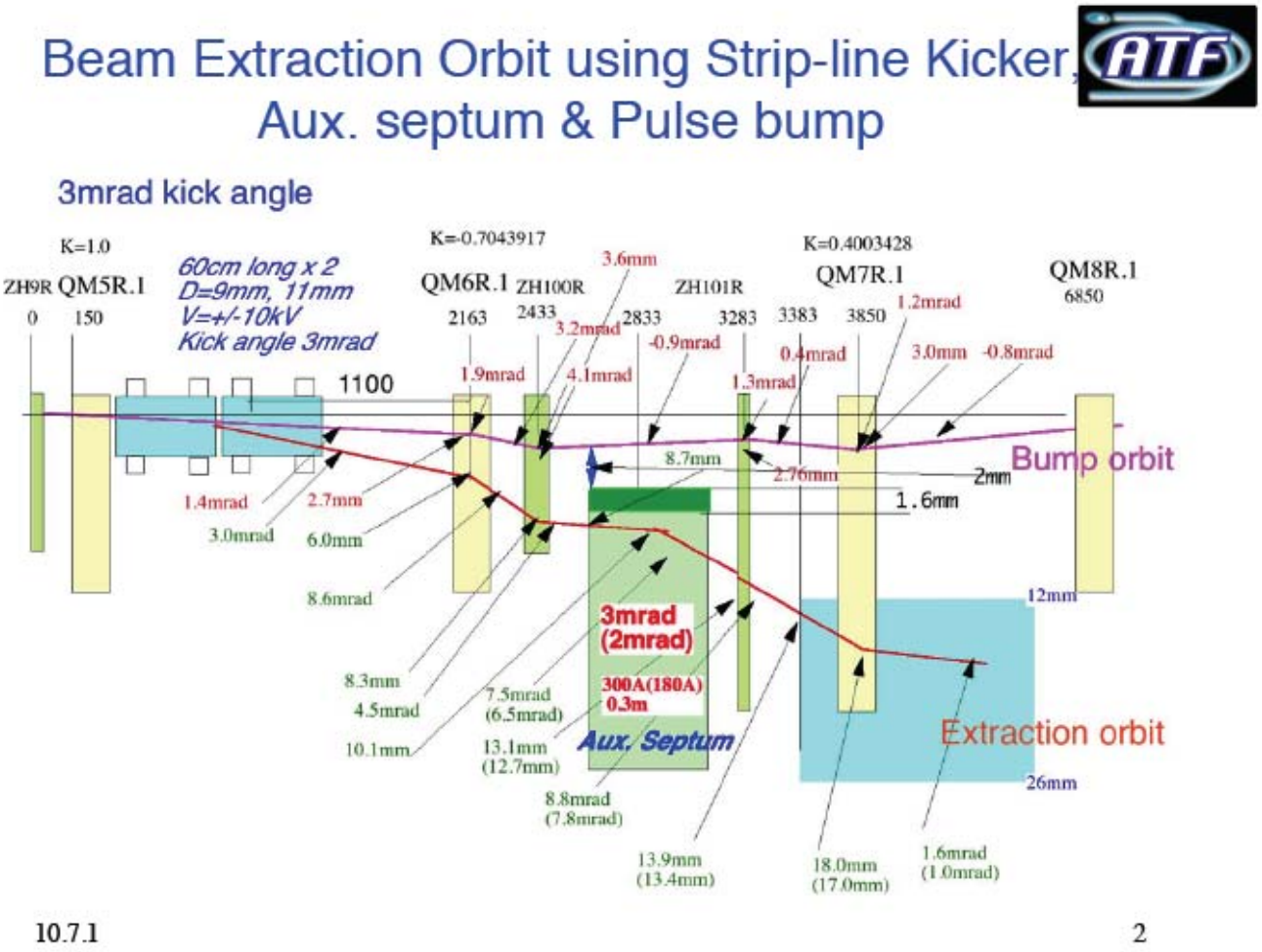
- Single bunch beam is stable
  - Jitter is smaller than beam size (< 0.5 sigma)
- Multibunch instabilities have been observed
  - 3 train (single bunch/train) and multibunch (single train)
  - Need systematic studies
    - Survey parameters
    - Measure oscillation in detail
  - Dedicated 1 week of multibunch operation is proposed

Proposal of "multibunch operation week"

- In October 2010, one week dedicated to multibunch studies
  - Perform experimental studies listed in previous slides
    - Probably, about 16 hours/day, 4 days (depends on manpower)
- Need more detailed plans.
  - Should have meeting of a small group?

K. Kubo

Summary of Collaboration discussion



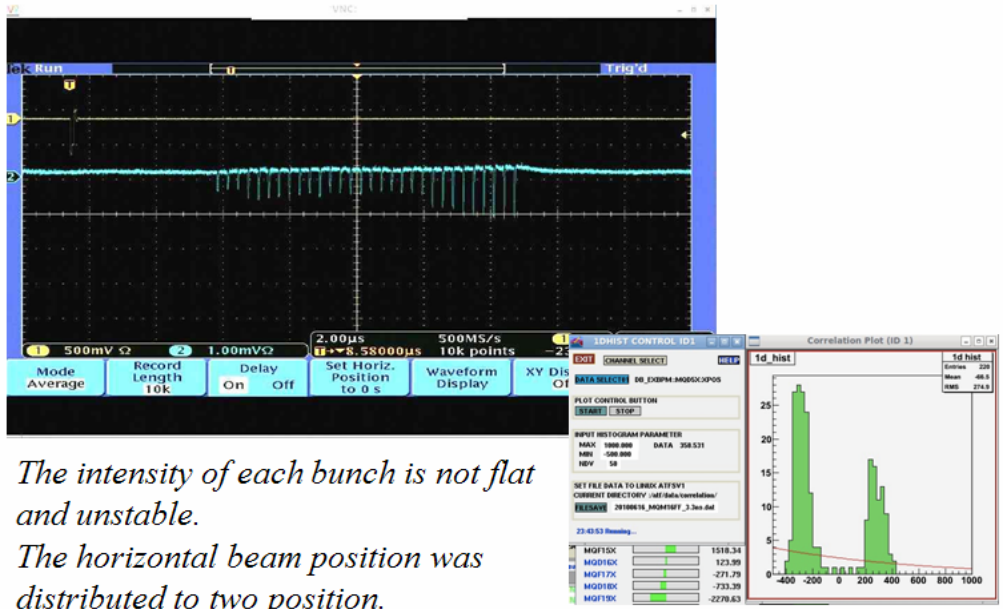
T. Naito

Instrumentation, Fast kicker

Improvements from Oct09

1. *Wrong trigger timing for multi-bunch was corrected. We found that the multi-bunch were injected to the unintended bucket number of DR at Oct09.*
2. *Puslers were repaired. The waveforms were improved. One of pulsers did not work 3MHz at Oct09.*
3. *Laser 2.8ns -> 56.ns*
4. *Trigger circuit - fine delays use same version, which was caused the trigger jitter.*
5. *Re-trigger circuit - a trigger from DR BPM is used for the kicker trigger to cure the 2.8ns jitter.*
6. *Strip-line - 9mm gap x2 -> 9mm + 11mm to get aperture .*

Multi-bunch extraction (30 bunches) with 308ns bunch spacing
2010/06/17



The intensity of each bunch is not flat and unstable.
The horizontal beam position was distributed to two position.

Fast kicker study

Machine Time
2010/03/08~03/19(2 weeks)
2010/06/07~06/11(1 week)

ATF2 project meeting
2010/06/30 T.Naito

Instrumentation, EXT Stripline BPM upgrade

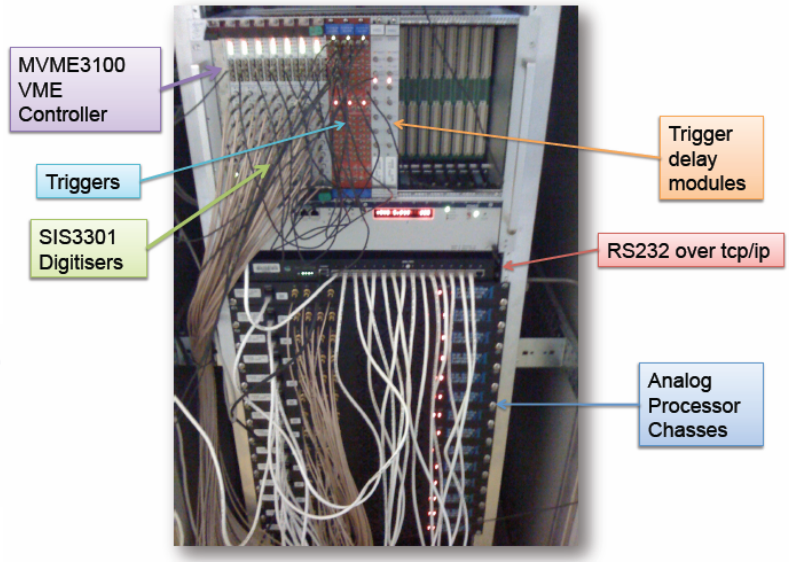
- 14 BPM processing modules of the same style used in LCLS currently were assembled for use in ATF2 extraction line.
- Installed electronics and tested during February 2010 2 week run period.
- Installed for 12 EXT stripline BPMs MQF1X through MQF15X + MFB1FF stripline BPM in FFS (+ 1 spare).

Stripline BPM Electronics Upgrade Report

Glen White
30 June 2010
10th ATF2 Collaboration Meeting

- Resolutions ~<10um, insensitive to Q.
- Configuration, monitoring and control through Matlab GUI
  - Instructions on wiki.

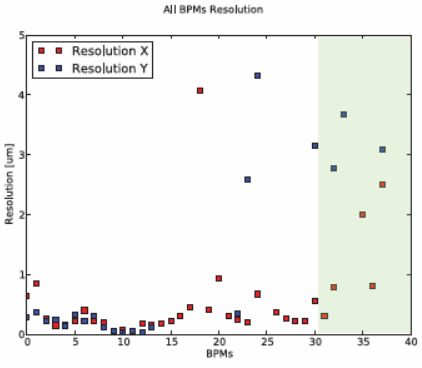
ATF2 Installation

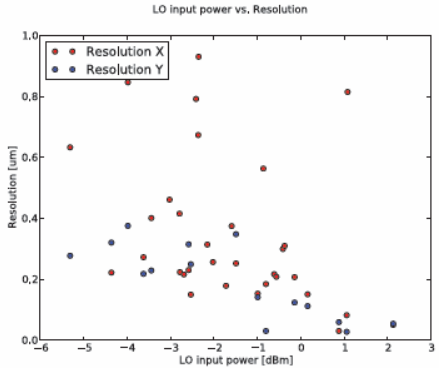


Instrumentation, C/S-band cavity BPMs

Overall BPM performance

- Typical C-band performance with attenuators
  - Between 400 to 200 nm
  - 25 nm for BPMs without attenuators
  - Depends on Local Oscillator power
  - Variation in resolution depends on electrons gain





C-band summary

- Overall good performance during this last operations year but
  - LO and CAL power too low to drive electronics
    - Non-linearities, gain variations etc.
    - LO : Upgrade LO distribution amplifier (4-5 W)
    - CAL : Remove cal tone attenuator (Tests promising)
  - Problems with trigger clock for MFB2FF and M-PIP
    - Will investigate over summer

C/S-band cavity BPMs

A. Aryshev (KEK), S. T. Boogert (JAI@RHUL), G. Boorman, A. Heo, Y. Honda, J. Y. Huang, S. J. Hwang, E-S Kim, Y. I. Kim, A. Lyapin, D. McCormick, S. Molloy, J. Nelson, Y. J. Park, S. J. Park, C. Swinson, T. Tauchi, N. Terunuma, G. White.

SLAC, KNU, PAL, KEK, JAI-RHUL, UCL
KEK, ATF

Instrumentation, C/S-band cavity BPMs

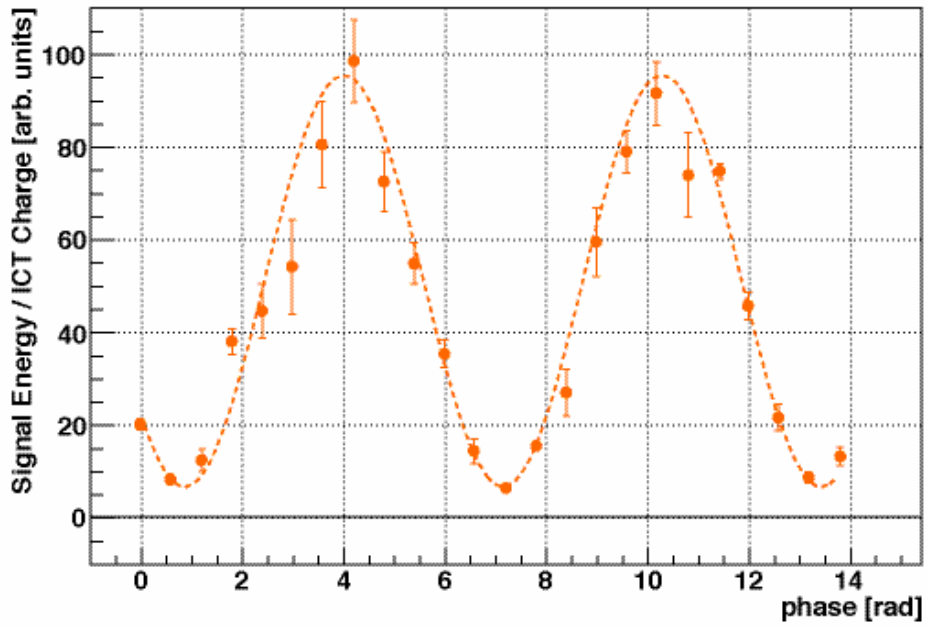
S-band problems

- X-Y cross coupling is quite bad
  - -20 dB compared with -30 to 40 dB for C-band system
  - Can mechanically tune BPMs in situ (to be investigated over the summer)
  - How much of the problem can be removed in software
    - Difficult needs major rewrite of the control software
  - Probably not the entire story
    - 2 or three effects probably operating, electronics phase instability, cross coupling all confused by the difficult beam conditions (large jitter, from beta functions and dispersion)

Tuning, discussion of continuous run

Best result of continuous tune week: May 17-21, 2010

Yoshio Kamiya and Shintake monitor group.
Modulation Depth = 0.87 @ 8.0 deg. mode
Beam Size is 310 +- 30 (stat.) +0-40 (syst.) nm



- First dedicated attempt at tuning ATF2 beamline in the week of May 17-21 was proven to be very useful
- 300nm vertical beam size at IP waist achieved
  - Factor of ~4 from the intermediate "ILC scaled" milestone of ~80nm
- The 300nm size measured by 8deg mode and reproduced by measurement with 30deg BSM mode
- Improvements discussed & some being implemented

Instrumentation, IPBSM status

Next Plan

- Focal point scan
- Phase Monitor
- Laser position stabilization with PSDs
- (Carbon wire scanner install)
- IPBPM install (need to discuss?)

IPBSM status and plan

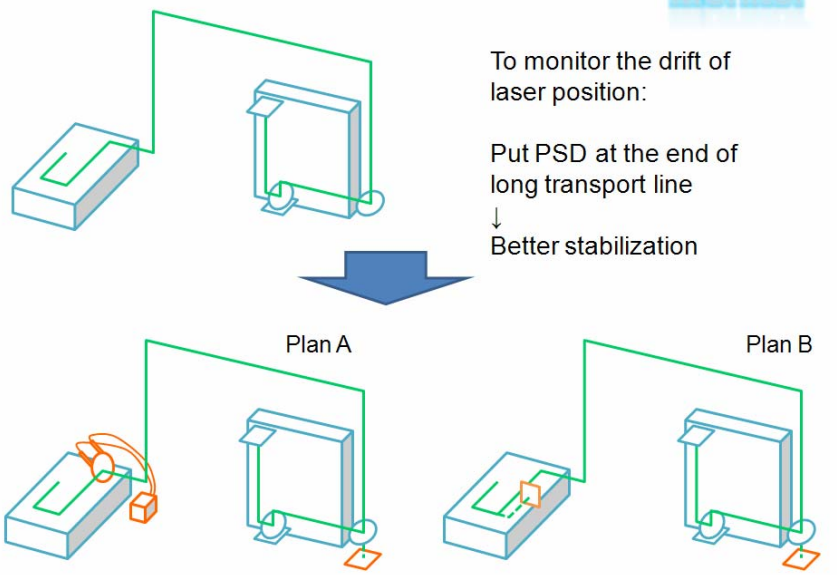
ATF project meeting

M.Oroku

Laser position stabilization with PSDs (1)

Oroku@The Univ. of Tokyo

Shintake Monitor



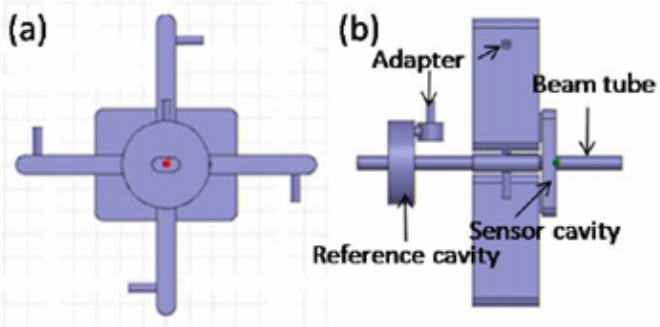
Instrumentation, IPBPM status

Low-Q IP BPM

Low-Q IP BPM

Y. I. Kim*, A. Heo, E-S. Kim (KNU)
S. T. Boogert (JAI)
D. M. McCormick, J. May, J. Nelson, T. Smith, G. R. White (SLAC)
Y. Honda, N. Terunuma, T. Tauchi, T. Naito (KEK)

Structure of the low-Q cavity BPM



Design parameters for low-Q IP BPM

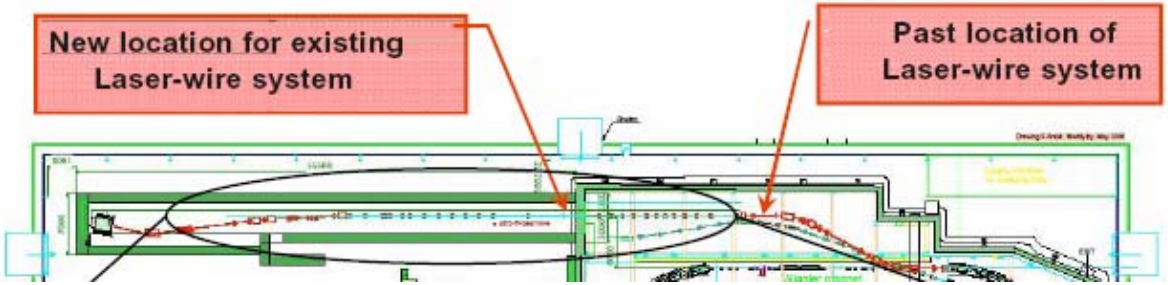
	X	Y	Reference
f (GHz)	5.712	6.426	6.426
β	8	9	0.0117
Q_0	5900	6020	1170
Q_{ext}	730	670	100250
τ (ns)	20.35	16.60	2484.19

We have developed a low-Q cavity BPM in order to achieve shorter timing resolution with a high position resolution. The developed low-Q cavity BPM consists of a one-cell sensor cavity and a one-cell reference cavity.

2010.06.30 bluekyi83@knu.ac.kr

Low-Q IP BPM electronics: latency : 17 ns; Sensitivity : -80 dBm; Expected resolution : 10 nm; Desired resolution : 2 nm (More development is required)
Position sensitivity : 64.7 DDC/μm

Instrumentation, EXT Laserwire



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

Review of ATF-II LW upgrade

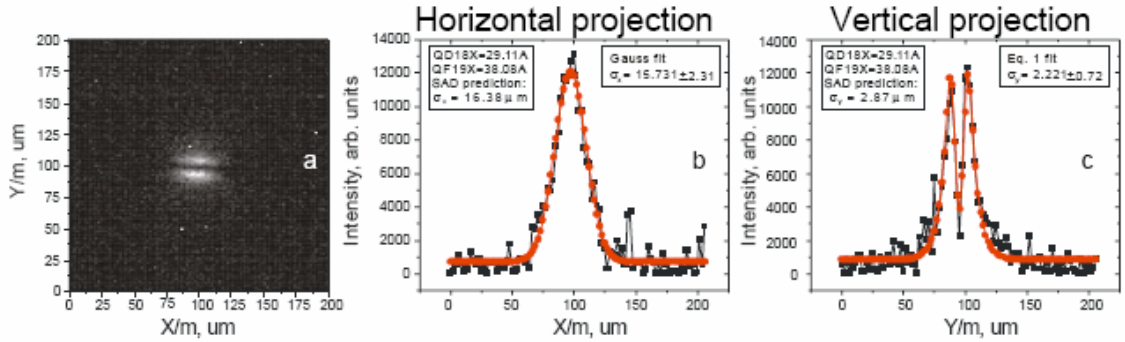
- Interaction chamber relocation
- Alignment laser installation
- Transverse beam size cross-check OTR monitor
- New electron beam optics
- Detector relocation
- Laser Transport Line (LTL) simulation, design & installation
- Laser diagnostics upgrade
- DAQ upgrade
- Laser relocation and upgrade:
  mode quality improvement aiming to achieve 1 μm resolution.

General Aims:

- Robust laser diagnostics
  (+ major laser diagnostics out of the tunnel)
- Upgradeability
- Automation

Instrumentation, EXT Laserwire

OTR image with a polarizer and optical filter



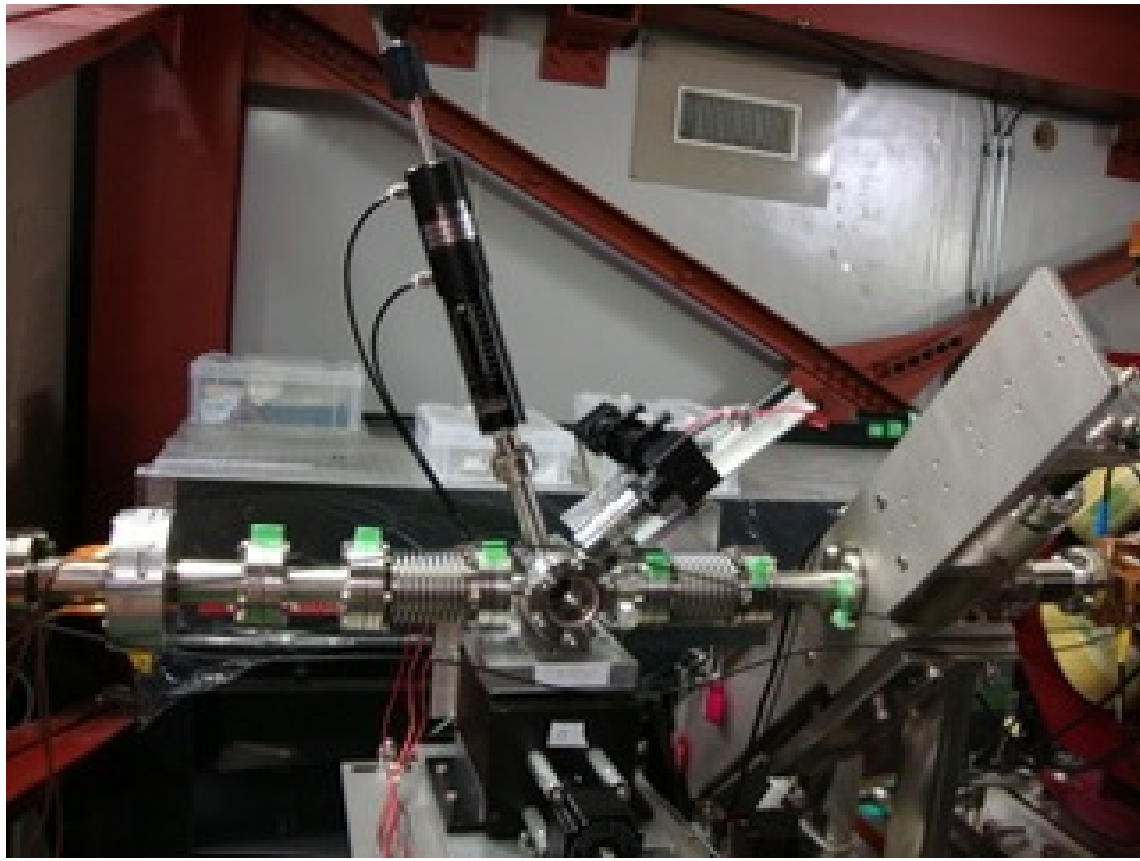
General plan for autumn run (November – December 2010)

- LW optics and background study continue
- Laser diagnostics improvement continue
- Achieving of the stable electron beam transverse size measurements
- Further improvements towards automated scans

Instrumentation, Multi-OTR

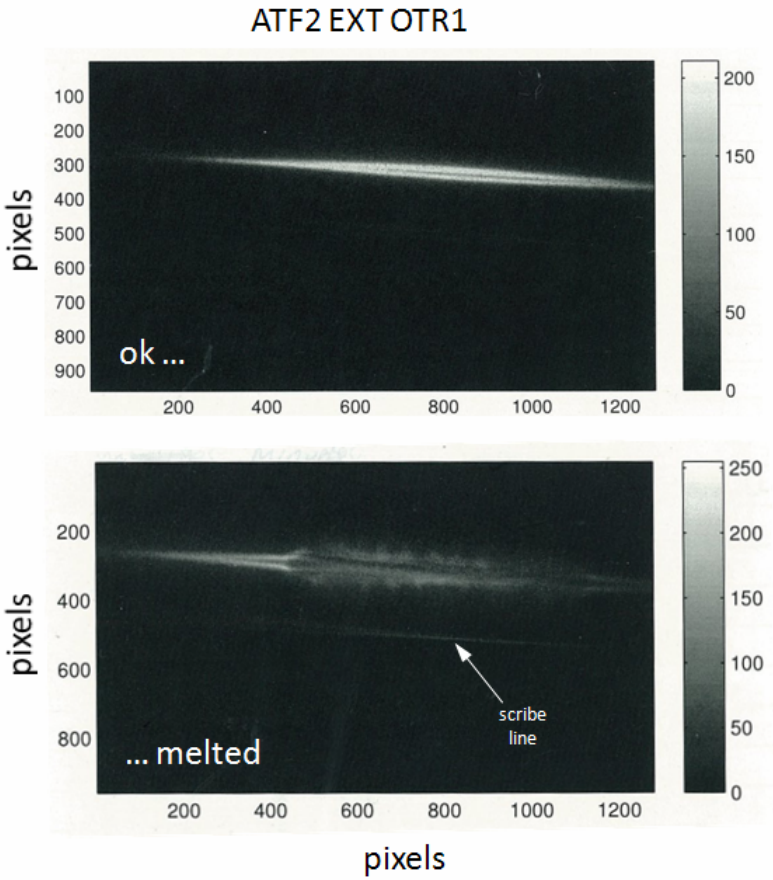
Multi-OTR Status

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



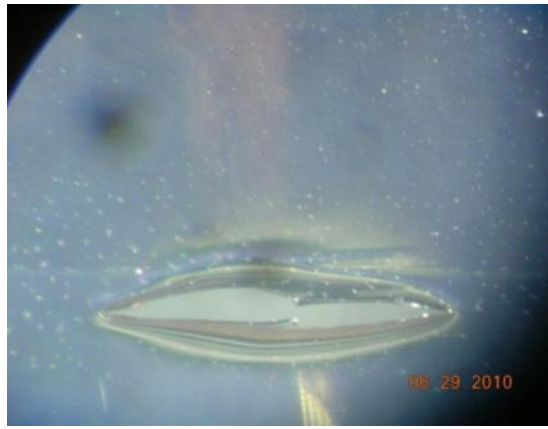
May 2010:
the 4 OTRs were installed in the EXT line

Instrumentation, Multi-OTR



- June 2, 2010
- single bunch beam
- Q ≈ 4×10^9 e-/bunch (0.64 nC)
- 1.56 Hz
- $\sigma_x \approx 140$ µm ; $\sigma_y \approx 10$ µm
- 2 µm nitrocellulose / 1200 Å Al
- ~4 minutes in beam until damage

- damaged targets will be replaced
  > 6 µm kapton / 1200 Å Al
  > 100 µm Al foil
- 10 µm tungsten X/Y wires will be added to target holders



OTR Beam Tests - Target Damage Seen
And was then understood

Tuning, EXT emittance

Observed that first 2 EXT vertical correctors (ZV1X and ZV2X) needed to be strong to properly launch into EXT (since before EXT rebuild for ATF2 …)

- hypothesize that correctors are compensating for a kick error in extraction channel
- simulate error kick by rolling individual elements; use ZV1X and ZV2X to correct orbit
- find error that gives best fit to actual ZV1X/ZV2X values → BS3X septum magnet roll
- BS3X was physically rolled ~ -4 mrad (March 17, 2010) to relieve ZV1X and ZV2X
- projected vertical emittance in EXT before coupling correction was improved (~20-40 pm before → ~10-20 pm after)

Horizontal EXT Emittance Measurements

Date	N_{wire}	Emit (nm)	BMAG
May 18 2010	4	1.905 ± 0.078	1.08 ± 0.03
Apr 21 2010	4	1.212 ± 0.065	1.26 ± 0.03
Mar 17 2010	BS3X rolled ~4 mrad (CCW)		
Feb 25 2010	4	1.868 ± 0.336	1.15 ± 0.12
Feb 17 2010	4	negative	
Feb 3 2010	4	1.626 ± 0.095	1.10 ± 0.06
Jan 28 2010			
Dec 8 2009	3	2.921 ± 0.129	1.05 ± 0.03

Vertical EXT Emittance Measurements

Date	N_{wire}	Emit (pm)	BMAG
May 18 2010	5	11.7 ± 2.3	1.43 ± 0.25
Apr 21 2010	5	15.4 ± 2.0	1.78 ± 0.17
Mar 17 2010	BS3X rolled ~4 mrad (CCW)		
Feb 25 2010	5	38.33 ± 1.1	1.10 ± 0.02
Feb 17 2010	5	22.6 ± 1.4	1.15 ± 0.04
Feb 3 2010	5	16.1 ± 0.7	1.06 ± 0.03
Jan 28 2010	5	31.6 ± 1.2	1.03 ± 0.01
Dec 17 2009	5	28.4 ± 1.7	1.01 ± 0.01
Dec 8 2009	4	32.2 ± 1.9	1.35 ± 0.13

EXT Beam Measurements & Corrections

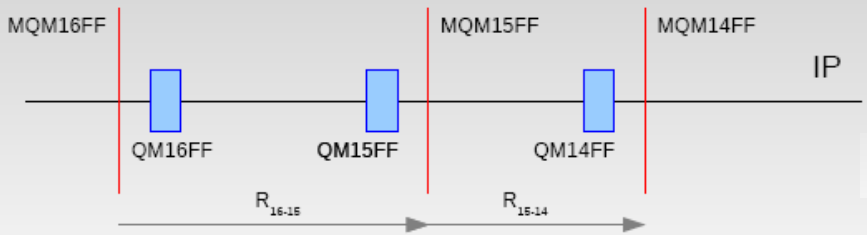
Dispersion, Coupling, Beta Matching

M. Woodley

Anomalous DR → EXT vertical emittance growth fixed (?)

Tuning, BBA

MEASUREMENT DESCRIPTION (I)



QUADRUPOLE SHUNTING

Edu Marin (Phd Student-CERN)

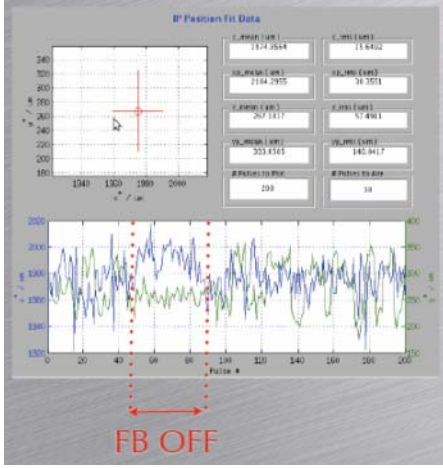
- QM16FF sets the orbit at QM15FF, at each orbit QM15FF is scanned. The beam position is recorded in all BPMs.
- QM15FF is displaced vertically by the mover, at each position QM15FF is scanned. The beam position is recorded in all BPMs.

- Two sets of measurements were taken:
  - 1st SET:
    - The magnet strengths of QM16FF and QM15FF were varied within 17% in 5 steps.
    - QM15FF was displaced vertically and scanned within 17% in 5 steps.
    - QM14FF was displaced vertically and scanned within 17% in 5 steps.
  - 2nd SET:
    - The magnet strengths of (QM16FF, QM15FF), (QM14FF,QM13FF), (QM13FF,QM12FF) were varied within 27% in 3 steps. at each configuration 200 bpm readings were recorded.

Tuning, Orbit feedbacks

- Keep beam within measurement range of IPBSM (drift ~<100nm vertically at IP).
- 3 horizontal correctors
  - ZH1X; ZH10; ZH1FF
- 4 vertical correctors
  - ZV1X; ZV2X; ZV11X; ZV1FF
- 6 BPMs (x & y)
  - MQD2X; MQF4X; MQF9X; MQM16FF; MS6FF; MFB2FF

IP Position Monitor



- Fit IP pos & ang from MQD0FF & M-PIP
- Useful for monitoring and restoring orbit trajectory through IPBSM region.

EXT & FFS Orbit Feedback

Glen White, SLAC

Improvements

- Interface to BPM resolution data to auto select best FB BPMs to use.
- Use Sext movers to zero sext bpms, incorporated into FB.
  - Include input from multiknob applications to define Sextupole BPM setpoints.
- Use IP monitor & QD0 moves to maintain IP trajectory desired by IPBSM.

Cont. run: Identified issues, ideas & prospects

- Need to ease "jumping" from 8deg to 30deg mode
  - Can we enlarge angle for 8ded mode to ~10deg? (NO)
  - Use beta-squeeze to jump between modes, but ensure in advance that beta-squeeze works within single BSM mode (BBA for quads done, etc)
  - Need to reduce drift (increase) of beam size (both e-beamline & laser lines issue)
- Final doublet mounting & alignment precision (rotation)
- Additional possibilities for tuning (not yet tried)
  - Minimize sigma_x from time to time
  - Measure & check chromaticity (& verify values of sextupoles)
  - Analysis and correction of critical R matrix elements
- Apparently need a more handy online tool
  - to quickly verify how various knobs, suggested to be tried, are expected to act
  - This may become a more comprehensive online model with guesstimated errors, which would be gradually reduced, based on measurements and analysis

Tuning, QF1 realignment

Alignment of QF1

R. Sugahara

There was a problem in fiducialization table for QF1 at the time of alignment performed last summer.

According to the original SLAC fiducialization table, we have to rotate QF1 by +6.6 mrad from the mechanical level, which looked strange both for SLAC and KEK alignment people.

As a result, KEK adjusted the QF1 to be mechanically level last summer.

But in the beam tuning, they had to rotate the QF1 by +5.6 mrad (max. value of cam movers), and they needed to rotate more.

Although we do not know why, the original SLAC fiducialization table looks correct.

→Should we adjust the alignment of QF1 following the original SLAC fiducialization Table?

Discussion of KEK and SLAC colleagues followed by email, recommendation is being prepared

Tuning, plans for Cont Oper

Plans for continuous run operations in 2010 autumn run period

Toshiyuki OKUGI, KEK

The candidate reason not to make the design beam size

1. Imperfect of the beam size tuning
2. The effect of multi-pole fields of FD magnets
3. The effect of the beam jitter
4. The effect of the phase jitter of IP-BSM

However, we have never change the strength of FF sextupoles to check the chromaticity and geometric aberration.

We need to scan the strength of FF sextupoles in 2010 autumn run.

It is better to check the multipole field of FD magnets again.
But, it is difficult to measure in KEK for no appropriate coils.

Will we replace the FD magnets in this summer shutdown ?

To confirm the amount of the beam jitter, I propose to install the IP-BPM (KEK IP-BPM).

The works in the summer shutdown.

1. Installation of phase monitor for IP-BSM
2. Installation of IP-BPM (??)
3. Check of the FD magnets (?? difficult in KEK)
4. Realignment and replace of FD magnets (??)

Discussions of FD issues (rotation, strength) and IP-BPM installation are ongoing

Summary of Collaboration discussion

Review and status of software tools for ATF2

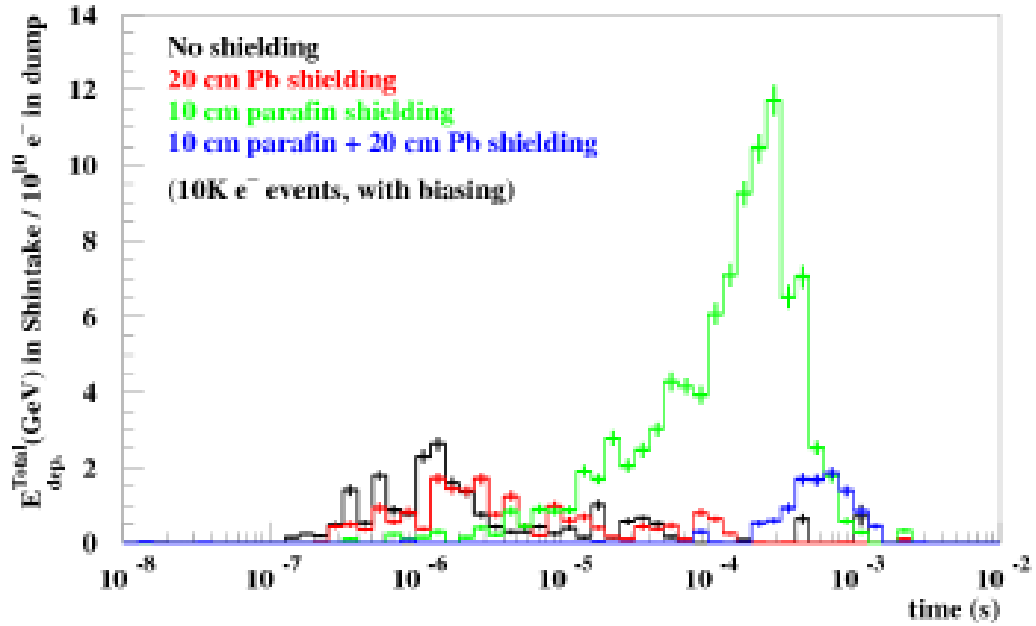
S.Kuroda(KEK)

- Dispersion correction
- Coupling correction
- Emittance measurement & beta-matching
- Linear knob
- Beam size measurement at IP
- …

A workshop to review software tools' status ?

Summary of Collaboration discussion

Effect of shielding on Shintake neutron background level



M. Verderi

⇒ Splitting biasing technique actually provides a solution to tackle the statistics issue in case of neutron production and transport studies

Summary of Collaboration discussion

Conclusion

- Over the past year, key components have reached a workable state:
  - Detectors, acquisition and simulation
- Neutron background analysis is the focus at the moment
- EM background analysis has to follow next
  - With already potentially interesting data "on tape"
- A new EM background measurement technique for 2011 is proposed
  - still at the preliminary stage
  - but may be interesting if naïve expectations could be achieved

M. Verderi

Summary of Collaboration discussion

Shift Tasks Week 1

- Establish nominal optics
  - Background studies with LLR system
  - IP match check
- Tuning setup procedure with IPBSM
  - Steering / orbit bumps to fix beam orbit in IPBSM and through to IPBSM
- Detailed model checks
  - Response matrix checks with high-res BPMs
  - Tilt error assessment from magnet moves of all FFS magnets and coupled orbit measurements with BPM system

Shift Tasks Week 2

- Steering software tests
- Software automation tests for IP tuning
- Model tests
- Feedback software improvement tests
  - Sext position feedback
  - IP position feedback

Shift Tasks Week 3

- Tune beam to ~<500nm
- Multi-hour beam stabilisation tests
- Multiknob orthogonality tests

Shift Tasks Week 4

- Cont. Run week preparation.

Shift Tasks Week 5

- Continuous run
- 174-degree mode IPBSM checkout

Compatibilities, draft

Schedule

- W0
  - Prep for fast kicker
- W1 (LCWS)
  - Fast kicker
- W2
  - DR multi-bunch stability
  - FONT
- W3
  - Laser wire
  - Tuning software tests
  - BSM tests
- W4
  - Mini-continuous run
  - Other R&D
- W5
  - Laser wire
  - Any other R&D
- W6
  - Continuous run only
- W7
  - Any R&D
  - Project meeting

Summary of SC FD

RECOMMENDATION:

At present time, the efforts at BNL will focus on ILC-like prototype of SC FD. The work on ILC-technology-like ATF2-compatible SC FD will be ***deferred without prejudice***, so that in half a year or a year time scale we can come back to the discussion of the development of ATF2-compatible SC FD.

The delay will allow several ongoing developments to converge, in particular:

- Predictive capabilities of FEM models, which may connect ILC FD and ATF-compatible FD, would be investigated and clarified;
- Synergy with Super-B, including for measurements of magnetic center with coils, and possibilities of performing this work under US-Japan framework will be investigated;
- A detailed plan of construction, funding and study, without beam, and as an added benefit, with beam, of the ATF2-compatible FD will be developed;
- The operation of ATF/ATF2 beyond 2012 will be determined, based on the entirety of its potential scientific program

- This recommendations was prepared by ART team, discussed and accepted at the ATF2 Project Meeting

  → see Andrei Seryi's presentation

Summary of Collaboration discussion

International Workshop on Physics in Intense Field

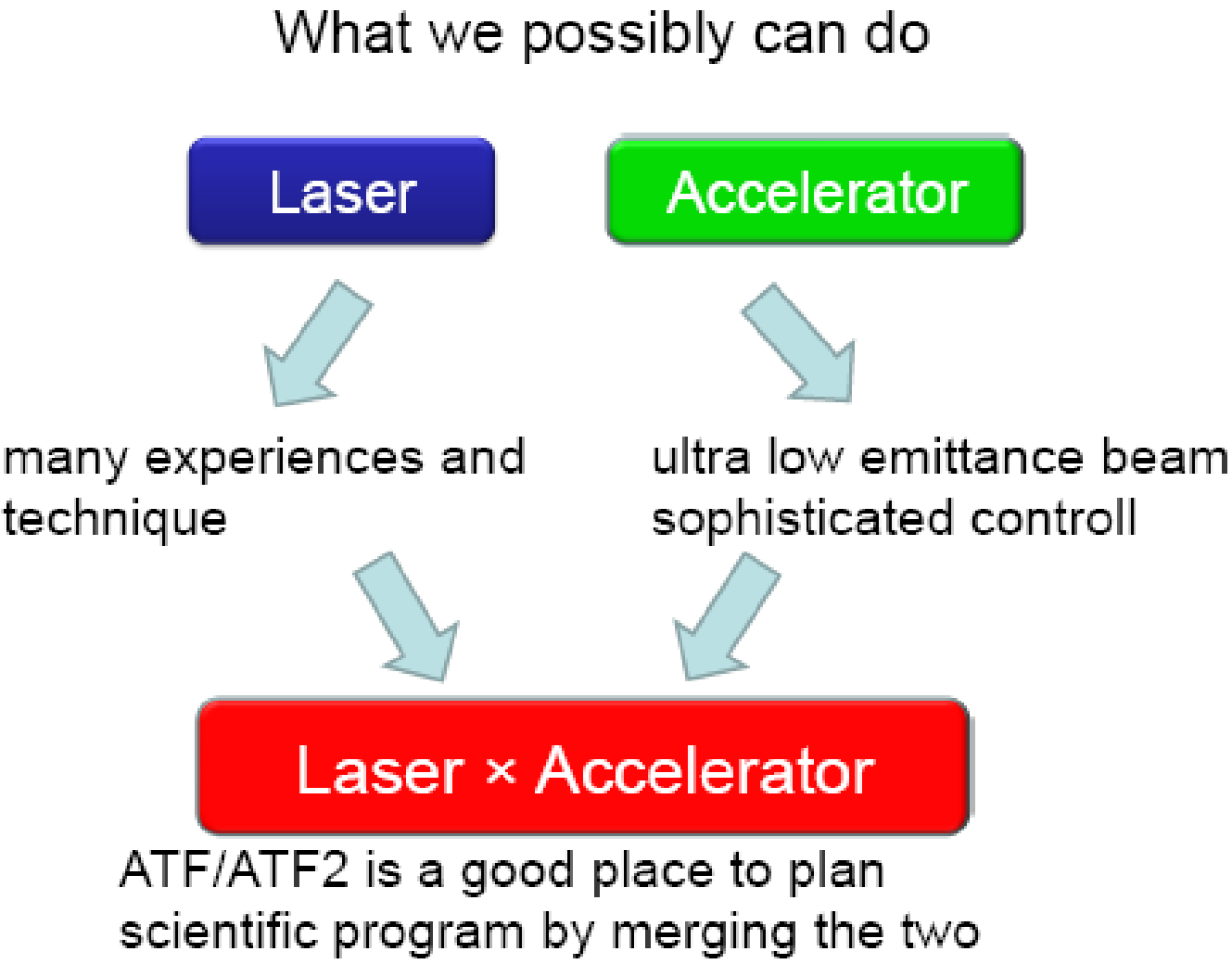
November 24 – 26, 2010

T.Takahashi
Hiroshima Univ.

June 10 2009
ATF2 meeting

T.Takahashi Hiroshima

Summary of Collaboration discussion

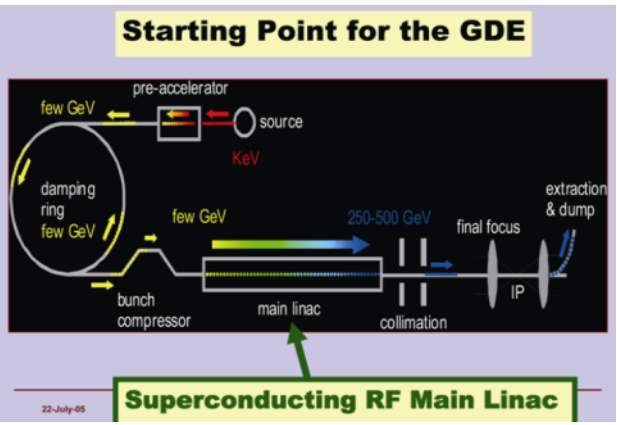


Messages from Suzuki-san

1. Financial Consideration
2. Requirements of New Proposal
3. Requirements of Global Organization

Risk and Incompleteness
in One World-Big Laboratory

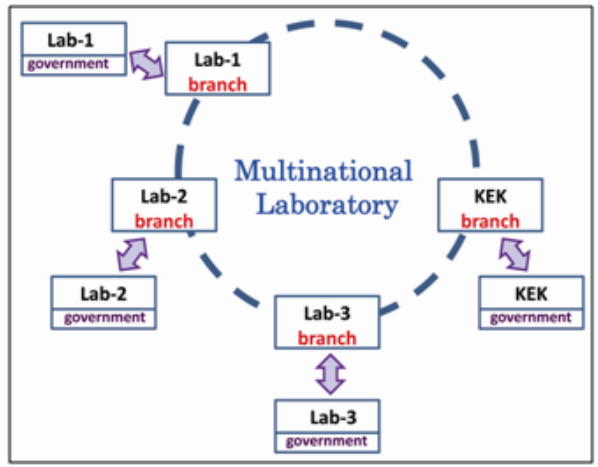
Most of R&D need to be done by 2012
Need new proposals after 2012
One proposal relater to…
ATF and STF => a proposal of mini LC at KEK as first step toward ILC



Globalization of International Collaboration
for Big Science Projects

not "One-CPU Processor"
but "Multi-CPU Processor"
, based on sharing rich infrastructures
in laboratories

Decentralization
&
Partnership



Discussion of future collaboration organization

1) Should ATF remain a dedicated R&D facility for linear colliders ILC & CLIC ? Can it evolve to support broader science goals ?

2) Should our international collaboration evolve towards deeper enhanced support and participation, and how ?

Future collaboration at ATF

some ideas and issues for discussion

Philip Bambade
LAL &KEK

ATF / ATF2 beyond 2012

A) Dedicated facility for continued R&D and training in linear collider design and operation

B) Multi-purpose facility for beam physics and instrumentation with basic and applied goals

➔ Organizational model of HEP experiments may be considered

Organizational model of HEP experiments

1) Treat ATF / ATF2 research facility as an experiment in which not only the construction, but also operation and maintenance are supported by the entire collaboration ?

2) Departure from ICFA guidelines from 1980 and 1993 ?

"operating laboratories should not require experimental groups to contribute to the running costs of the accelerators or colliding beam machines nor to the operating costs of their associated experimental areas".

Discussion of future collaboration organization

Future collaboration at ATF

some ideas and issues for discussion

preferred scenario: A + some of B

Philip Bambade
LAL &KEK

1) Keep ATF / ATF2 as facility for continued R&D and training in linear collider design and operation, to support ILC and CLIC projects
2) Organize as HEP experiment, with contributing stake-holders sharing responsibilities for programs and operation in the form of tasks and funds for general interest purposes
3) Consider more basic beam operation by dedicated staff
4) Openness to host other experiments with different science goals and applications, for a fraction of the beam time, in which case the collaboration would serve as provider

➔ International workshop in 2011 on the future usage of the ATF / ATF2 low emittance nano-scale beam ?

➔ Could be organized with working groups discussions and meetings over an extended period and conclusions at a final meeting at KEK

The audience generally supported this direction. These ideas will be further developed.

Summary of Collaboration discussion

- ART & SLAC (Glen W., Andrei S.)
  - ART continues support of ATF/ATF2. Consider high priority. (FNAL – Ring BPMs, BNL – ATF2 FD (funding & schedule discussed), SLAC (...))
  - Ideas of increased participation at SLAC (IP-BPMs, maybe DR dynamics and feedbacks?)
- CERN (Frank Z.)
  - Continue support; Visitors; Tuning & commissioning; Low-β; re-opt FF with Mapclass; BBA;
  - Goals for 2012 depend on achievement of goals; (Frank: Need prioritization !)
  - CERN Council opens doors for greater integration
- KNU (Eun-San Kim)
  - Graduate student at ATF/ATF2; Hope to make R&D funds for Korea-KEK collaboration work
- UK (Stewart B., Andrei S.)
  - A lot of contribution to instrumentation, commissioning, etc; recognize importance of ATF/ATF2; discussion of the way to keep future engagement
- KEK (Junji U.)
  - Future research programs: High field physics; THz micro-wave beam for laser acceleration; $\gamma\gamma$ collider R&D; super-FD r&d to make smaller beam size;
  - Need common fund from collaborative institutes for Operation – to be proposed to ICFA

Summary

- Good progress toward ATF/ATF2 goals
- Next steps, schedules and priorities have been discussed
- Future directions of the research program are being discussed – accelerator science & also physics program
- ATF Collaboration is discussing new ways how such facilities can be supported and may pioneer their implementation

Back-up slides

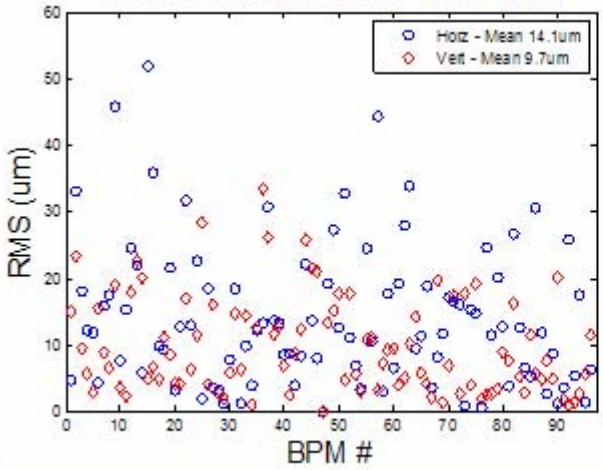
Instrumentation
Ring BPM upgrade

First Look at Narrowband Orbit

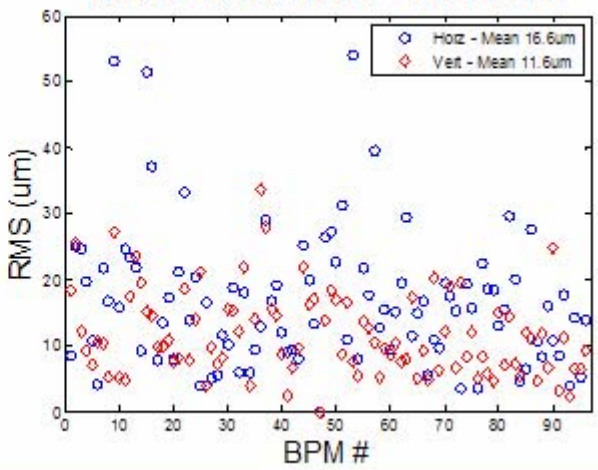
Fermilab

- Narrowband orbit for each injection (shot) is measured
  - The mean orbit and rms over 160ms is reported for Horz, Vert
- For each data set, 128 shots are collected
  - Large shot to shot mean orbit variations are observed in both
  - Horizontal shows larger RMS than vertical -> Beam related

Orbit Variations - No Cal



Orbit Variations - with Cal



6/30/2010 ATF2 Project Meeting 4

Instrumentation
Ring BPM upgrade

Summary

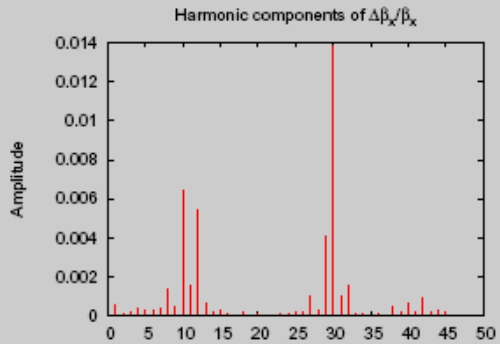
- The Damping Ring BPM upgrade installation is now complete and commissioning has begun
  - Major change to digitizer clock during commissioning
- The Narrowband Orbit data and Turn by Turn data are available
- Preliminary Analysis of the Narrowband data
  - Horizontal RMS > Vertical RMS -> measuring 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

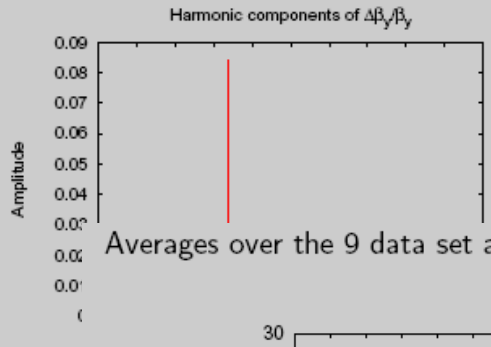
The Future

- Continue Commissioning the system
  - Optics and Machine studies – more analysis needed
  - Determine resolutions for all measurements
- Update the position scaling for the injection bpms
  - Use correct bpm geometry for bpms 20 & 21
- Investigate odd behavior of bpm 53
  - Flagged by SVD and TBT analysis
- Implement a history for the calibration data
  - Allow tracking of channel performance
  - Show large drifts which may indicate impending failure
- User requests?

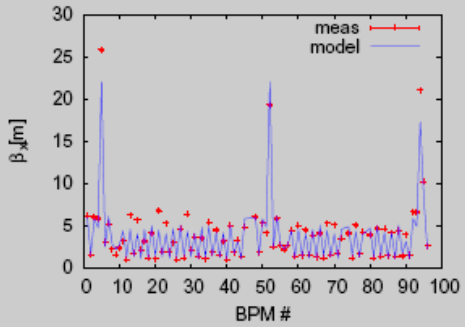
Instrumentation
Ring BPM upgrade

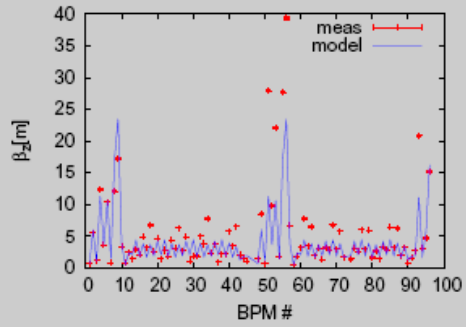
Harmonic analysis of the average $\Delta\beta/\beta$ shows large components at h=30 for the horizontal plane and h=17 for the vertical one, which correspond to $2\times Q$ (Q_x=15.18, Q_y=8.54). Thus the beating is a *true* beating. The fact that it is larger in the vertical plane is likely due to the fact that the vertical tune is closer to a half integer than the horizontal one is to an integer.





Averages over the 9 data set after taking out those two BPMs.





$\Delta\beta_x/\beta_x \simeq 18$ % (85 BPMs)

$\Delta\beta_y/\beta_y \simeq 22$ % (51 BPMs)

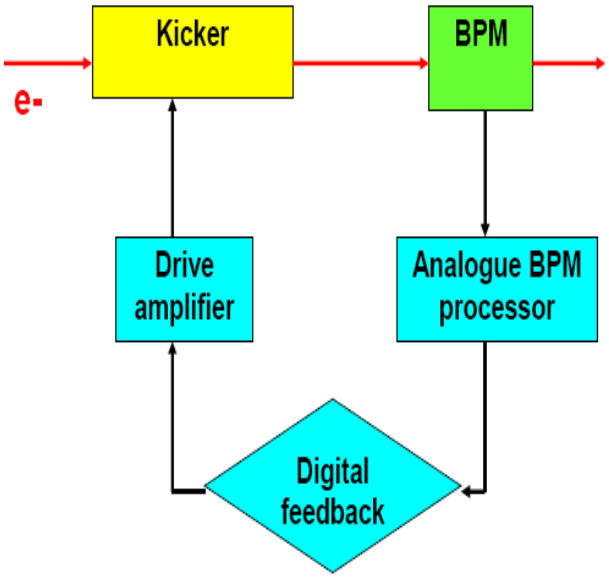
nb: BPMs with $\Delta\beta/\beta > 40$ % were excluded from the average.

Summary

- The analysis of the TBT data shows that
  - the broad-band measurement is in good shape
  - the machine optics is close to the model; there is some true beta beating, especially in the vertical plane.
- The strange behavior of BPM.53 (remarked also in the narrow band mode) must be investigated.
- BPM.20 and BPM.21 must be better calibrated, as it was expected.

Summary of Collaboration discussion

FONT system loop (schematic)



Philip Burrows 3 ATF2 project meeting 1/07/10

Latency estimate

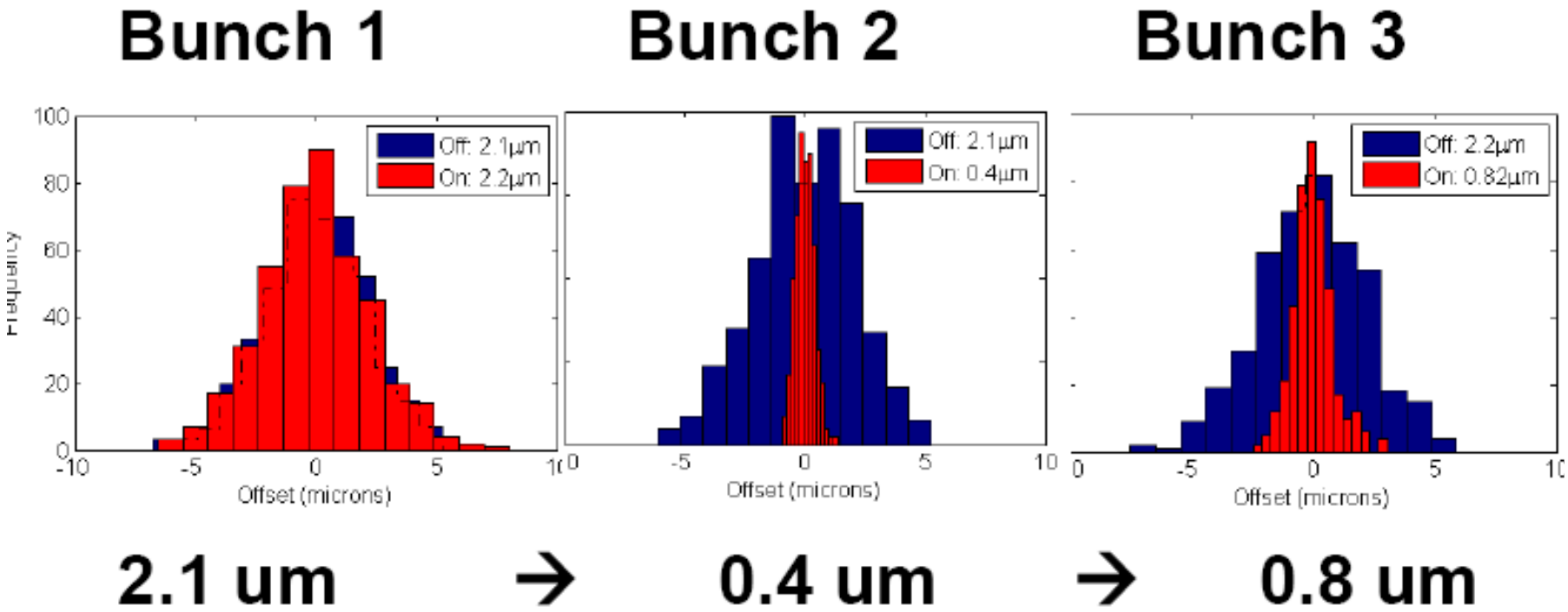
• Amplifier (as described)	5ns
• Kicker fill (15cm)	0.5ns
• Beam flight time amplifier → IPBPM	4ns
• Cables (3 x 1.5m?)	23ns
• FONT digital board	60ns
• IPBPM electronics	40ns?
Total	133ns

Philip Burrows 12 ATF2 project meeting 1/07/10

P. Burrows

Summary of Collaboration discussion

P2 → K1 loop jitter reduction
(April 16 2010)



P. Burrows

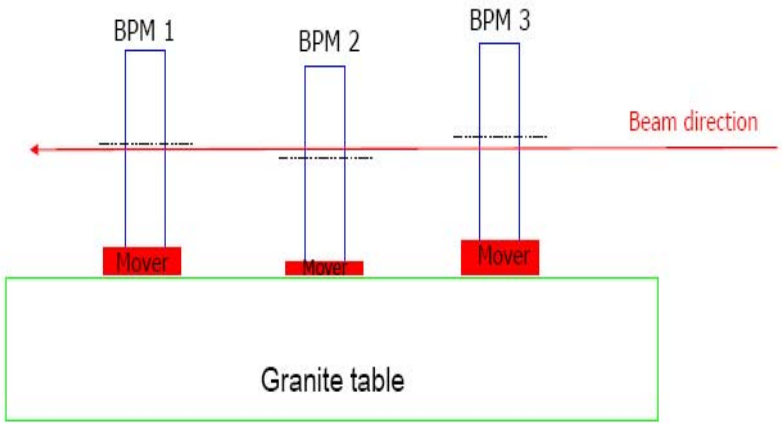
Instrumentation, C/S-band cavity BPMs

Work plan for BPM systems

- Fix residual problems with C-band systems
  - Frees Boogert and Kim
  - Possibility to add more personnel Tonee Smith and Alexey Lyapin for more hardware and analysis support
- S-band cavities need more work
  - Cross coupling bad, so confuses digital downconversion which expects clearer signal
  - Main focus of operations in new year
- Aim for fully functioning S-band system and long term calibrated C-band system Sept/Oct 2010

Summary of Collaboration discussion

Proposed BPM Installation



July 1, 2010 bluekyi83@knu.ac.kr

Plan

- Summer
  - Revise design of IPBPM electronics
  - Finalize physical IPBPM installation
    - Cables
    - Mechanical installation (movers etc)
    - Test readout and controls
  - Develop analysis codes
    - SVD (monitor systematics)
- October
  - Alignment of 3 BPMs on beam line
  - 1st generation electronics test – one week
  - Decision on fabrication of new IPBPM electronics
- November/December
  - Test of new electronics
  - Systematics studies

Y.I. Kim

Instrumentation, Fast kicker

Multi-bunch beam extraction

There is two problems,

- *Pulse timing of FID pulser - the timing delay of each pulse is different.*
- *Multi-bunch(Multi-train) instability - It makes unstable storage current.(K.Kubo)*

Next Beam Test

Fast kicker beam test,
2010 Oct(Sep) 2weeks

Goal of the next beam test,

1. *To install and test of the pulse train delay circuit.*
2. *To confirm the stable beam extraction up to 30 bunches, to measure the each orbit of multi-bunch.*
3. *To confirm the long term stability of the fast kicker.*

Summary of Collaboration discussion

Next Beam Test

Fast kicker beam test,
2010 Oct(Sep) 2weeks

Goal of the next beam test,

1. To install and test of the pulse train delay circuit.
2. To confirm the stable beam extraction up to 30 bunches, to measure the each orbit of multi-bunch.
3. To confirm the long term stability of the fast kicker.

10.7.1 19

Fast kicker until 2013

"Replace from pulse magnet to strip-line and use as ordinary kicker"

Single bunch : same quality of the double kicker
-> can use for the other study
-> need to check long term stability

Multi bunch : 30 bunches extracted
-> need to cure the problem of FID pulser timing
-> need to cure the instability in DR
-> check to the quality of each bunch

10.7.1 20

T. Naito

Tuning, BBA

CONCLUSIONS AND FUTURE WORK

- From the results of the first set of measurements:
  - Moving the magnet is a preferable solution rather than changing the orbit.
- From the results of the second set of measurements:
  - Contributions from the y' term seems to be more severe.
- A complete model should be applied in order to reduce the error when determining the magnetic center.
- From the linear fit to obtain the coefficient c', there is an inconsistency when comparing the linear coefficient with the expected l/6. This may suggests :
  - Should incorporate the R-matrice between the quad and the BPM.
  - Should consider a quadratic contribution from the y' term.
  - Should take into account fringe fields.

Summary of 2nd day

Summary of IP instrumentation configuration for Autumn 2010 ATF2 runs

T. Okugi

We will have two special meeting
- to discuss the FD magnet issues.
- to discuss the IP-BPM issues.
  - whether will we install the IP-BPM or not ?
  - what kind of readout electronics will we use ?
  - who will do the commissioning of the IP-BPM ?

We will install the IP-carbon wire scanner.

We will have upgrade plans of the beam size measurement.
- We will monitor the IP laser position with PSDs
  in order to monitor the laser position with respect to beam.
- We will monitor the horizontal beam position with IP-BSM, if agreed in the meeting.
- We will put several TDCs in each timing station
  in order to identify the module with the timing jump.

We will monitor the beam position jitter with respect to the IP-BSM laser fringe.
- The IP-BSM group plan to prepare the phase monitor.
- We will monitor the vertical beam position jitter with IP-BSM, if agreed in the meeting.