

# Goals at this meeting

1. Critical review of beam instrumentation and beam tuning status
2. Make a strategy to achieve the first goal and a preparation for the second goal until next project meeting, summer 2012
3. Encourage contributions from young researchers, especially PhD students as much as possible

T. Tauchi, N.Terunuma, A.Seryi, G.White and P.Bambade,  
13th ATF2 Project Meeting, KEK, 1/11-13, 2012

# 2011 before summer

1 2011							2 2011							3 2011							4 2011							5 2011							6 2011										
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa				
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16	17	18	19	20	21	22	20	21	22	23	24	25	26	20	21	22	23	24	25	26	17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25				
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30	31																																												

Recovery from the earthquake damage

... 7 weeks

The 30 degree mode of IPBSM was studied in Jan. to Feb.

Excellent beam stability in February.

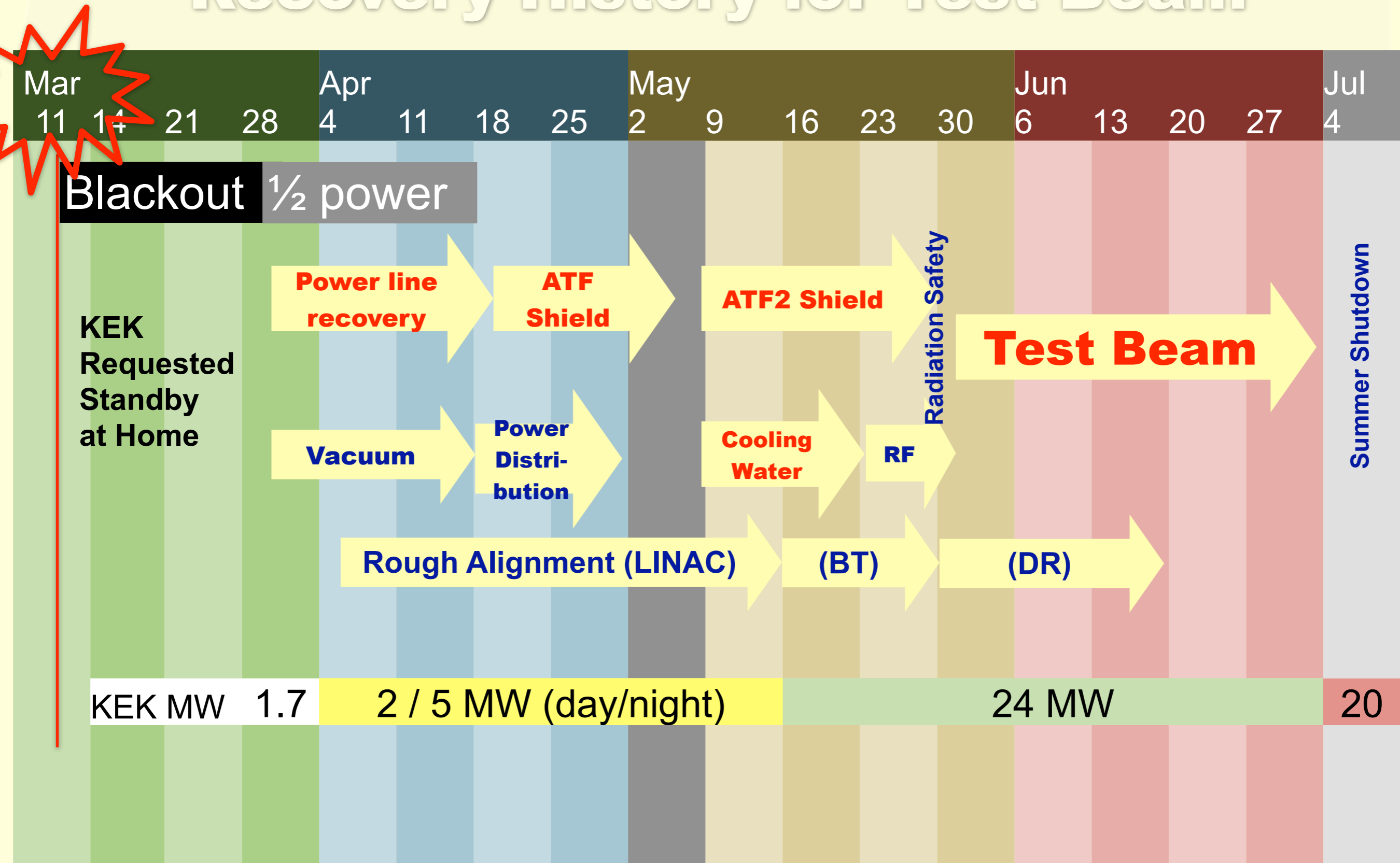
However ;

16 Feb. fire at the modulator #0 at the ATF-LINAC

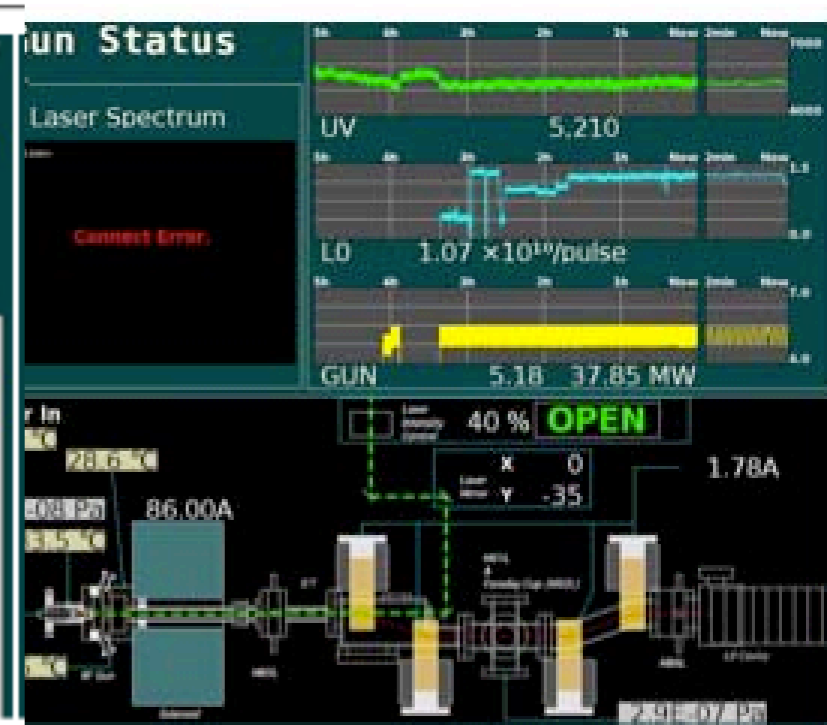
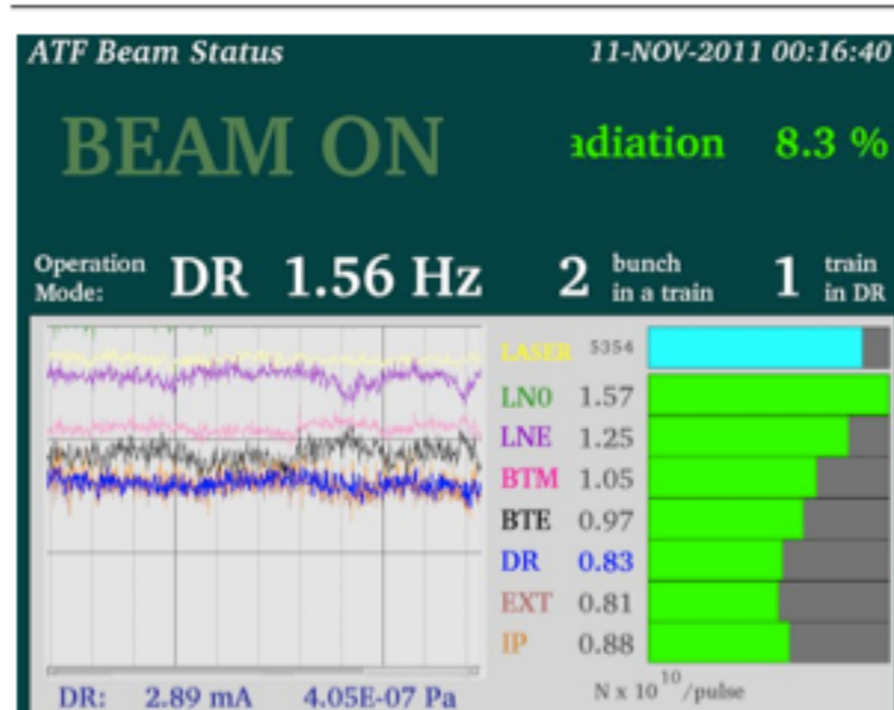
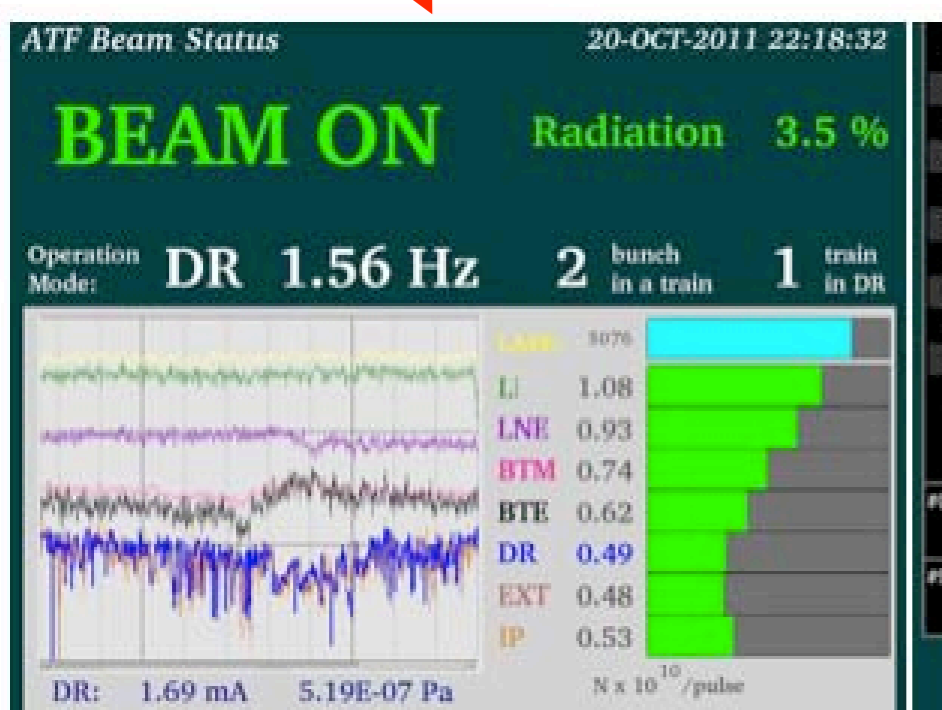
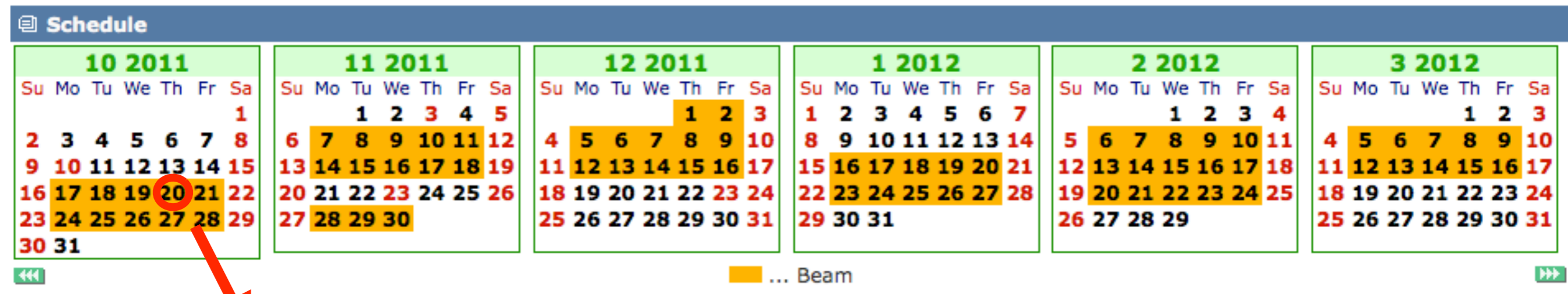
10 Mar. resume the ATF operation and ATF2 beam tuning  
the stability was re-produced, i.e. stable !

11 Mar. Great Eastern Japan Earthquake (M9.0)

# Recovery History for Test Beam



# Beam time in JFY 2011 and Present Status



DR status, 21 October, 2011  
 vertical emittance = 12.7 pm (XSR)  
 beam intensity =  $0.5 \times 10^{10}/\text{bunch}$   
 repetition rate = 1.56Hz

EXT-FF beam tuning, 8 Nov. 2011  
 → 12.8 pm (XSR)  
 →  $> 1 \times 10^{10}/\text{bunch}$   
 vertical emittance at FF ~ 20pm (OTR)  
 w/o corrections

# Planning for goal-1 : Autumn shifts

## October (2 weeks)

- alignment day-time → beam evenings & nights
- DR tuning (emittance ~ 10 pm, reproducible extraction orbit), extraction

## November week-1

- if needed, further DR tuning (emittance reduction, reproducible & stable extraction)
- initial R-matrix, BBA, steering, linear optics, BSM laser wire test

## November week-2

- Trial run with “goal 1” 6-shift block; →  
recover 300 nm spot in BSM interference mode

## December week-1

- further R-matrix, BBA, steering, linear optics
- IP beam stability test with IP-BPM, slow feedback
- decision on whether to increase  $\beta^*$  by factor 5

## December week-2

## December week-3

- focus on “goal-1” 6-shift blocks in weeks 2 and 3; →  
validate 30° BSM fringe mode with  $\sigma_y < 300$  nm; - initial  
test of 174° BSM mode if possible

**Beam time for ATF2 instrumentation R&D items to be added according to visitor schedule**

# Parameters at ATF2

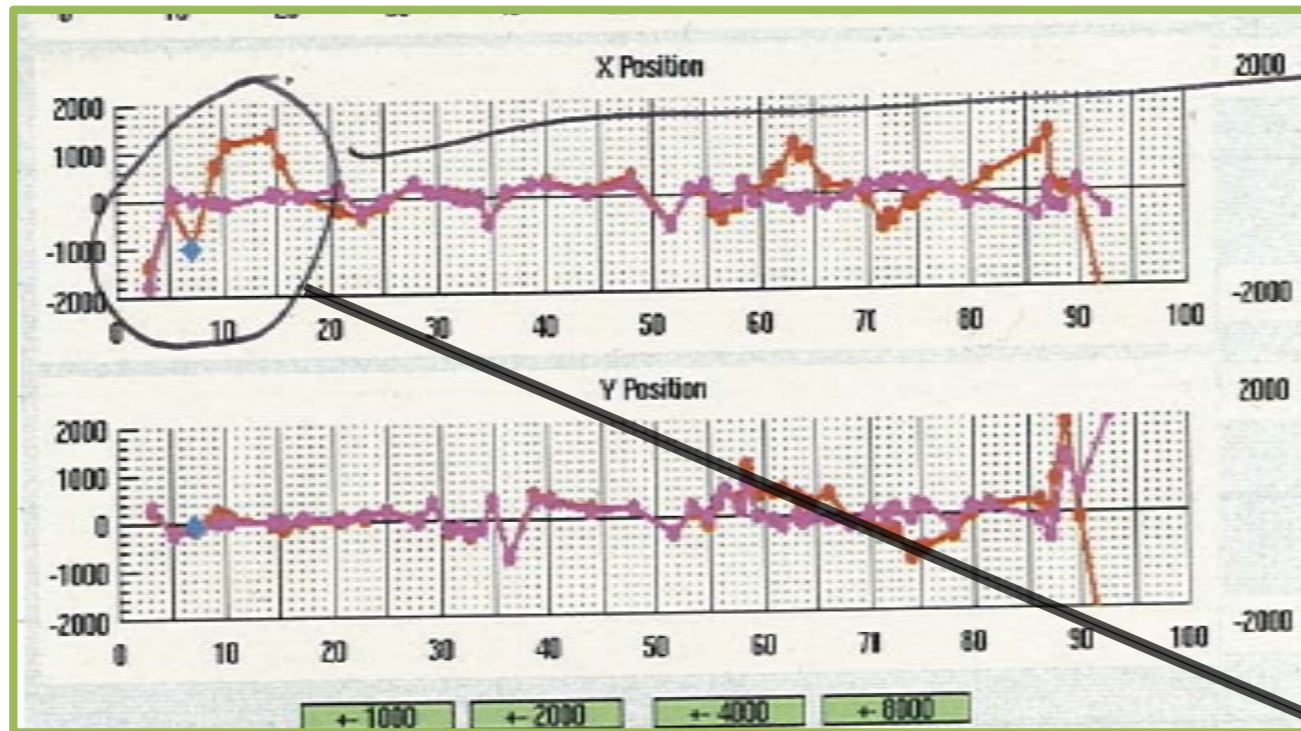
to be updated



IP Parameter	nominal		May 2010	Dec 2010	Feb 2011	Dec 8 2011
Beam energy	1.3GeV		1.3GeV	1.3GeV	1.3GeV	1.3GeV
Emittance in x	2 nm		1.7nm	1.8-2.7nm	1.8-1.7nm	2nm
Emittance in y	12 pm		<10pm	28-64pm	27-28pm	~55 pm
Beta function in x	4 mm		4cm	10mm	10mm	4cm
Beta function in y	0.1mm		1mm	0.1mm	0.1mm	1mm
beam size in x	2.8 $\mu$ m		~10 $\mu$ m	7.5 $\mu$ m	-	9.3um
beam size in y	35 nm		300 nm	439(247) nm	1.8um@PIP C-wire	2.4um

# EXT Emittance Study

G. White, ATF operation meeting, Feb 4, 2011



EXT Kicker Setting	$y / \mu\text{m}$
43,000	33
44,000	28
45,000	31
46,000	35

- OTR measured emittance, dispersion measured and coupling corrected at each scan point
- QF3X/QF4X bump generated with BH1X
- Bump generated coupling at QK2X phase
- Bump only had detectable effect on emittance at 46,000 EXT kicker setting, presumably correcting for emittance growth caused by whatever EXT kicker orbit drives

QF3X/QF4X Bump Amplitude	$y / \mu\text{m}$
0.5 mm	43
0.1 mm	44
1 mm	37
2 mm	35
3 mm	35

# Major issues

## 1. Commissioning of the 30 degree mode at IPBSM

good collaborate between beam tuning and Tokyo groups

signal, i.e. laser focus is a key issue **done**

background control is a key issue **done**

## 2. Choice of optics, i.e. $\beta^*_x = 1$ cm and $\beta^*_y = 0.1$ mm

background in IPBSM - 2nd collimator in the chamber, **installed**

jitters of incoming beam monitored by BPM system with IPBPMs

## 3. Vertical emittance growth in EXT

DR to EXT ?, e.g. monitoring the orbit and re-productibility

## 4. Large coupling correction needed at IP

rotation of IPBSM fringes ? **Alignment of optics system will be checked.**

## 5. Effect of the Multipole components in the FF

especially important for beam with  $\sigma^*_y < 100$  nm

mitigation by 2.5 times nominal horizontal beta function at IP



# Session Organization

13th Mtg.	11th January, 2012 Wednesday	12th January, 2012 Thursday	13th January, 2012 Friday
9:00	<p><b>Introduction</b></p> <p>greeting, goal at this meeting</p> <p><b>Instrumentation-1</b></p> <p>Multi-OTR, BPM, nano-resolution and possible feedback by High-Q IPBPM and discussion</p>	<p><b>Beam Tuning-2</b></p> <p>EXT tuning, IP tuning, Issues to be studied</p> <p>optics matching, EXT-IP optics matching, first attempts with orbit measurement</p>	<p><b>Discussion : 1st goal</b></p> <p>with TB discussions; IPBPM-strategy for next runs</p> <p>Emittance growth</p> <p>Detailed inspection of the beam lines and to a consensus of strategy of beam tuning for 37nm</p>
12:00			
13:30	<p><b>Alignment&amp;DR status</b></p> <p>optics, BBA, emittance alignment at all beam lines</p> <p><b>Instrumentation-2</b></p> <p>IPBPM, BKG, FONT, LW</p> <p><b>Beam Tuning-1</b></p> <p>Summary of fall 2011 run</p>	<p><b>13th TB/SGC Meeting</b></p> <p>Opening and status reports of the KEK/LAL Compton, 1-2 pm DR emittance R&amp;D, ATF2 status and new proposals of ; the OTR resolution study, measurements of beam halo / the Compton recoil electrons and overview of CERN contributions</p> <p>reviews and discussions</p> <p><b>18:00 - Banquet</b></p>	<p><b>Discussion : 2nd goal</b></p> <p>IPBPM : electronics, design, production and beam test plan, FONT for IP feedback and milestones/schedule until the installation</p> <p><b>ATF Operation Meeting</b></p> <p><b>CERN contributions</b></p> <p>the new high field quality Q, the feed-forward by GM (6Hz operation), CLIC DR extraction kicker and test at ATF</p> <p><b>Summary</b></p>
18:00			

## PhD Candidates to be updated, January 2012

Year	university	country	Name	temporary title	publication
2012.12.1	University of Tokyo	Japan	Masahiro Oroku	Beam Tuning with the Nanometer Beam Size Monitor at ATF2	
2014.12.1	University of Tokyo	Japan	Jacqueline Yan	IPBSM and	
2013.3.31	Hiroshima university	Japan	T. Akagi	4 mirror cavity COMPTON	
2012.5.1	Kyungpook National University	Korea	Youngim Kim	IPBPM high resolution study	
2012.2.xx	University of Tohoku	Japan	Taisuke Okamoto	cavity-type tilt monitor of beam orbit for ILC	
2012.12.1	Kyungpook National University	Korea	Siwon Jang	IPBPM and IP feedback	
	Kyungpook National University	Korea	Ae-Young Heo	IPBPM electronics	
2012.12.1	CERN	Spain	Eduardo Marin Lacoma	Ultra Low Beta Optics	
	CERN	Spain	Hector Garcia Morales	Orbit control	
	Oxford university	UK	Douglas Bett	FONT , especially for a long bunch-train	
	Oxford university	UK	Michael Davis	IP feedback (FONT)	
2012.12.1	ICIF, Valencia University	Spain	Javier Alabau-Gonzalvo	Emittance, coupling measurements with multi-OTR system	
2012	Royal Holloway, University of London	UK	Nirav Joshi	Cavity beam position monitors for future linear colliders	
2013	Royal Holloway, University of London	UK	Francis Cullinan	Cavity beam position monitors for the Compact Linear Collider	
	university of Paris Sud 11 (Orsay)	Colombia	TBA	CLIC final focus and also include work on ATF2	
Year	university	country	Name	temporary title	public

# Dr Theses since 2006, to be updated, January 2012

Year	university	country	Name	title	publication
2006.2.1	Queen Mary University of London	UK	Stephen Molloy	A Fast Feedback System Designed to Maintain Luminosity at a Linear Collider	
2007	Soken-dai	Japan	Takashi Naito	Development of the Fast Kicker System	Development of a 3 ns rise and fall time strip-line kicker for the International Linear Collider, NIMA 571 (2007) 599–607
2007.11.12	Université de Savoie	France	Benoit Bolson	Etude des vibrations et de la stabilisation a l'echelle sous-nanometrique des doublets finaux d'un collisionneur lineaire	International Linear Collider
2007.12.21	University of Tokyo	Japan	Taikan Suehara	Development of a Nanometer Beam Size Monitor for ILC/ATF2	Nuclear Instruments and Methods in Physics Research A 616 (2010) 1–8
2008.2.1	Oxford university	UK	Christine Clarke	The Interaction Point Collision Feedback System at the International Linear Collider and its Sensitivity to Expected Electromagnetic Backgrounds	
2009.4.14	Royal Holloway, University of London	UK	Lawrence Deacon	A Micron-Scale Laser-Based Beam Profile Monitor for the International Linear Collider	Micron-scale laser-wire scanner for the KEK Accelerator Test Facility extraction line, Stewart T. Boogert* et al., Phys. Rev. ST Accel. Beams 13, 122801 (2010) [16 pages]
2010.6.8	UNIVERSITAT DE VALÈNCIA	Spain	María del Carmen Alabau Pons	Optics Studies and Performance Optimization for a Future Linear Collider: Final Focus System for the e-e- Option (ILC) and Damping Ring Extraction Line (ATF)	
2010.5.8	IHEP CAS	China	Sha Bai	ATF2 Optics System Optimization and Experiment Study	First beam waist measurements in the final focus beam line at the KEK Accelerator Test Facility” Sha Bai et al., Physical Review Special Topics - Accelerators and Beams 13(2010)092804- 1-092804-7
2010.6.11	Université Paris-Sud 11	France	Yves Renier	Implementation and Validation of the Linear Collider Final Focus Prototype ATF2 at KEK (Japan)	in preparation to be submitted to PRSTAB
2010.8.1	Oxford university	UK	Christina Swinson	Development of Beam Position Monitors for Final Focus Systems at the International Linear collider	
2011.7.1	Oxford university	UK	Ben Constance	Design and beam testing of a fast, digital intra-train feedback system and its potential for application at the International Linear Collider	
2011.11.9	Oxford University	UK	Laurie Nevay	Results from the Laser-wire at ATF2 and Development of a Fibre Laser for its Upgrade	
2011.xx.x	Oxford university	UK	Robert Apsimon	The development and implementation of a beam position monitoring system for use in the FONT feedback system at ATF2	stripline BPM in FONT5
2011.xx.x	Hiroshima University	Japan	Shuhei Miyoshi	Development of a Polarized Positron Source by laser Compton Scattering using an Optical Resonant Cavity	Photon generation by laser-Compton scattering at the KEK-ATF, NIMA623(2010)576–578
2011.xx.x	IHEP	China	Dou Wang	ILC physical design and key experimental study	
Year	university	country	Name	title	publication