

ATF/ATF2 R&D status in JFY2009

- R&Ds reported at the last TB meeting → next talk.
- Overall activity
- R&Ds not reported at last TB meeting
- Updates since last TB meeting
 - Beam extraction by the Fast Kicker

Nobuhiro Terunuma (KEK)

ICB meeting, ILC2010, Beijing, 2010/3/29

ATF International Collaboration



CERN
DESY
IN2P3

LAL
LAPP
LLR

John Adams Inst.
Oxford Univ.
Royal Holloway Univ.
Cockcroft Inst.
STFC, Daresbury
Univ. of Manchester
Univ. of Liverpool
University College London
INFN, Frascati
IFIC-CSIC/UV
Tomsk Polytechnic Univ.

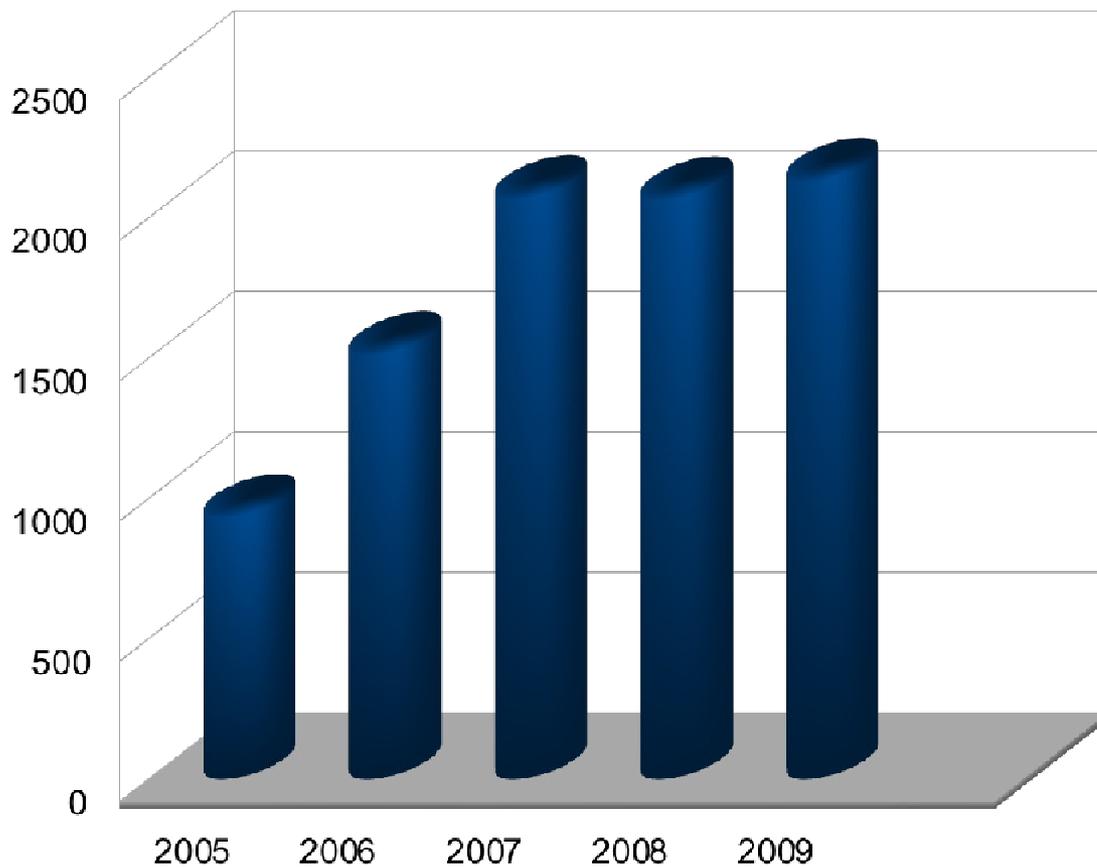
KEK
Waseda U.
Nagoya U.
Tokyo U.
Kyoto U.
Tohoku Univ.
Hiroshima U.
IHEP
PAL
KNU
RRCAT

SLAC
LBNL
FNAL
Cornell Univ.
LLNL
BNL
Notre Dome Univ.

ATF International Collaboration



Overseas Collaborators visiting ATF (JFY)



Overseas
25 Institutes,
~70 people,
~2000 people-
days
+
KEK and
Japanese
Universities(6)

Necessary Deliverables from TF for BDS and DR

Test Facility	Deliverable	Date
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Hardware development, Optics and stabilisation demonstrations: JFY

ATF	Demo. of reliable operation of fast kickers meeting the specifications for the ILC damping ring.	2010
	Generation of 1 pm-rad low emittance beam	2009
ATF2	Demo. of compact Final Focus optics (design demagnification, resulting in a nominal 35 nm beam size at focal point).	2010
	Demo. of prototype SC and PM final doublet magnets	2012
	Stabilisation of 35 nm beam over various time scales.	2012

Electron cloud mitigation studies:

CESR-TA	Re-config. (re-build) of CESR as low-emittance e-cloud test facility. First meas. of e-cloud build-up using instrumented sections in dipoles and drifts sections (large emittance).	2008
	Achieve lower emittance beams. Meas. of e-cloud build up in wiggler chambers.	2009
	Characterisation of e-cloud build-up and instability thresholds as a func. of low vertical emittance (≤ 20 pm)	2010
DAΦNE	Fast kicker design and pulser reliability check	2010
	Characterisation of e-cloud build-up and instability thresholds	2010
SLAC/LLNL	Fast kicker pulser development	2010

Running R&Ds

ATF

low emittance beam

- Tuning, XSR, SR, Laser wire,...
- **1pm emittance** (DR BPM upgrade,...)

Multi-bunch

- Instability (Fast Ion,...)
- **extraction by Fast Kicker**

Others

- Cavity Compton
- SR monitor at EXT

ATF2

35 nm beam size

- Beam tuning (Optics modeling, Optics test, debugging soft&hard tools,...)
- Cavity BPM (C&S-band, IP-BPM)
- Beam-tilt monitor
- IP-BSM (Shintake monitor)
- Multi-OTR

Beam position stabilization (2nm)

- Intra-train feedback (FONT)
- feed-forward DR->ATF2

- 多くのR&Dが密接に関連
- 有限のビーム時間
- サブグループ間での相互理解・交通整理

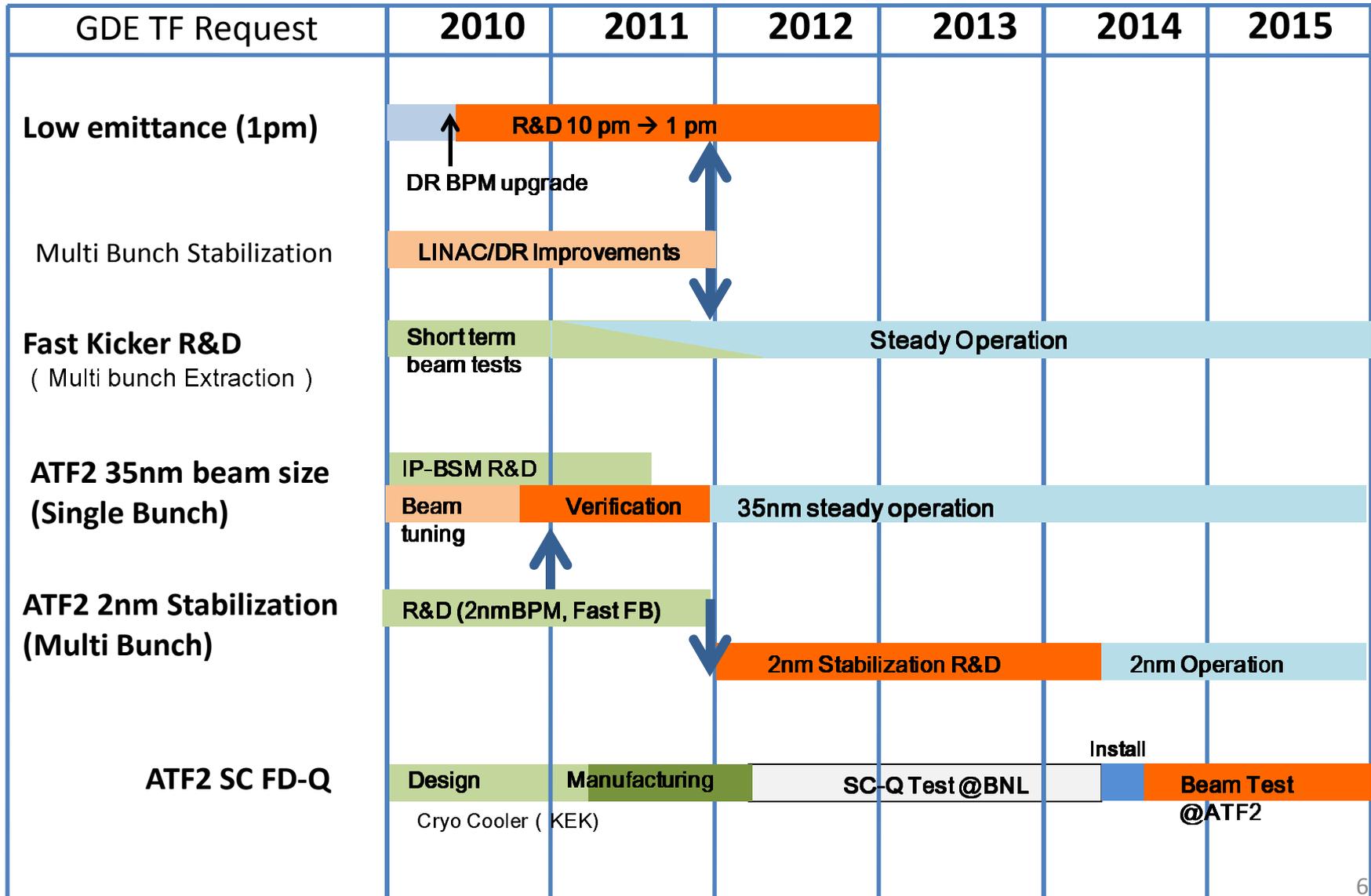
Improve the R&D efficiency

← **LINAC/DR Stabilization**

Others

- Pulsed 1um Laser Wire
- Cold BPM
- Liquid Pb target
- **Permanent FD Q**
- **SC Final doublet Q/Sx**

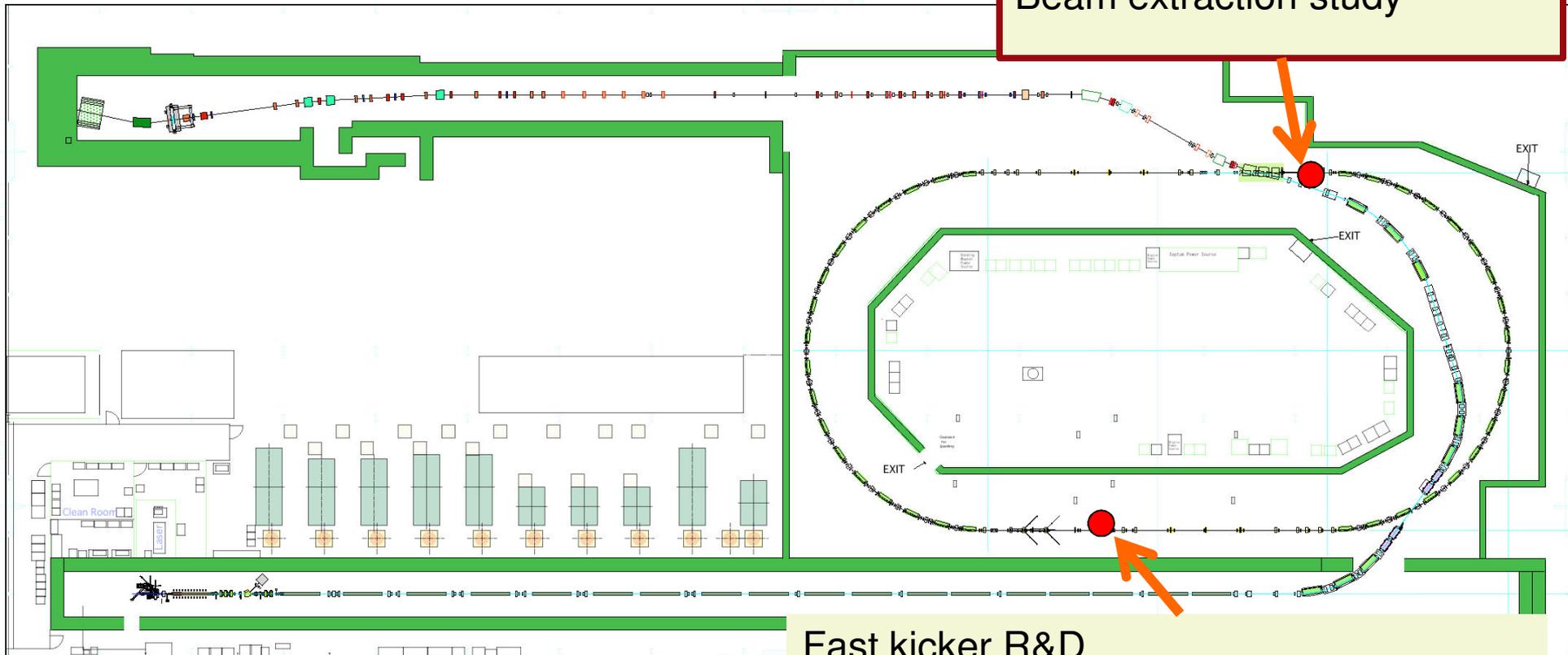
ATF long term plan



PRELIMINARY RESULTS OF FAST KICKER STUDY AT KEK-ATF IN MAR/2010*

T. Naito[#], S. Araki, H. Hayano, K. Kubo, S. Kuroda, N. Terunuma, T. Okugi, J. Urakawa,
KEK, Tsukuba, Japan

Fast kicker R&D
Beam extraction study



Fast kicker R&D
Initial test of Pulsar performance

Fast kicker Experiments JFY2009

- Dedicated beam time

- need to swap the kicker in DR (pulse magnet <--> fast kicker)
- avoid the waste of beam time, especially for ATF2, due to the lack of the experience of the ATF2 beam tuning with the fast kicker

- 2009. Jan. (1 week)

Two pulsers were broken by the radiation damage during only a few hours.

- 2009. June (1 week)

The beam did not come out to the extraction line for lack of the kick angle.
Kicker electrode deformation.

- 2009. Oct. (2 week)

The first beam extraction by the Fast Kicker.

The beam extraction have succeeded up to 17 bunches.

- 2010. Mar. (2 week)

Stability measurements

The beam extraction have succeeded up to 27 bunches.

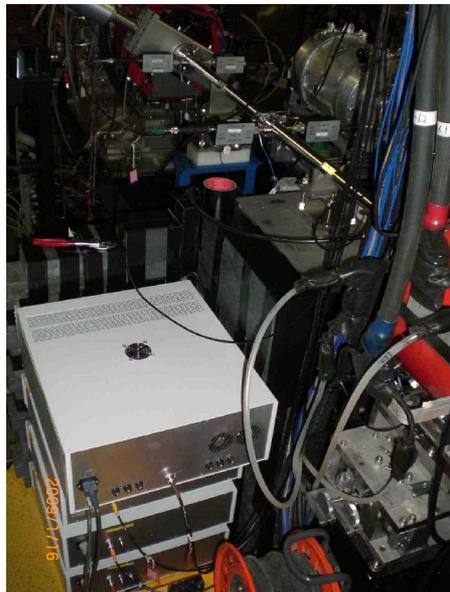
Pictures of the installed components(2009Jan)



Strip-line electrodes



Aux. Septum



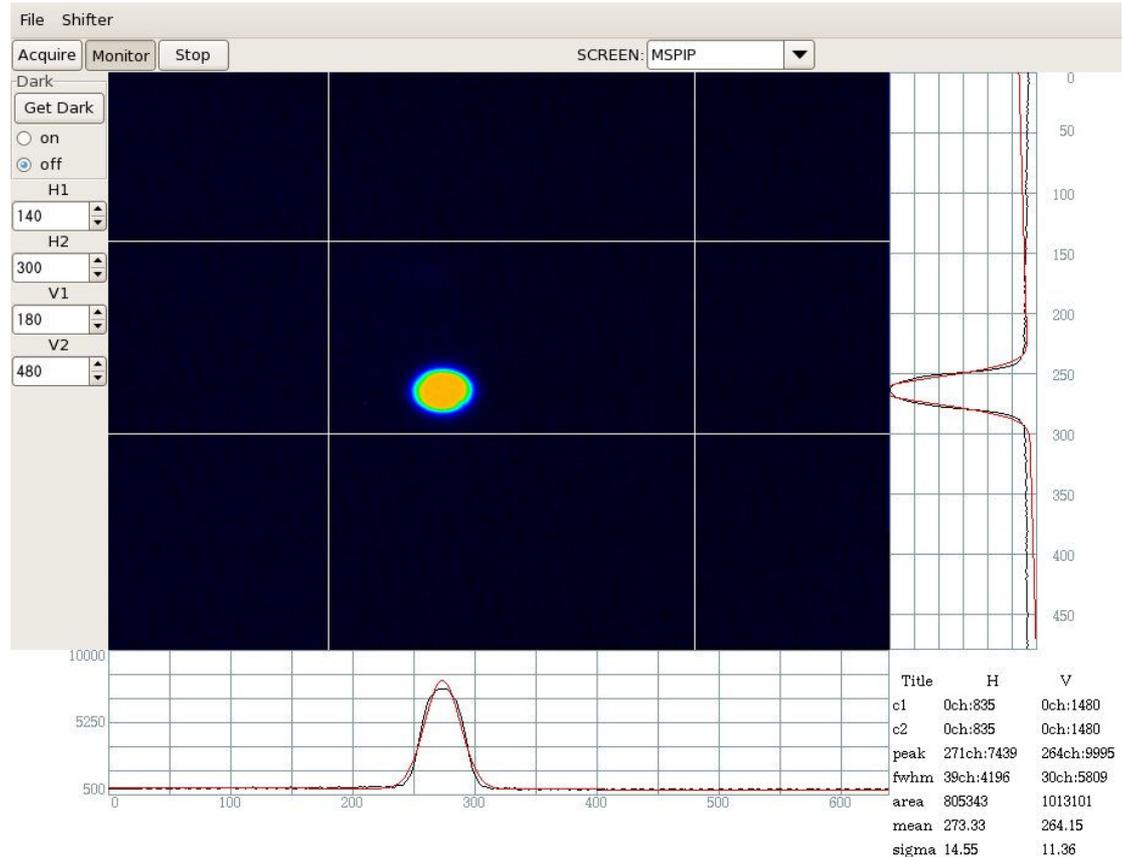
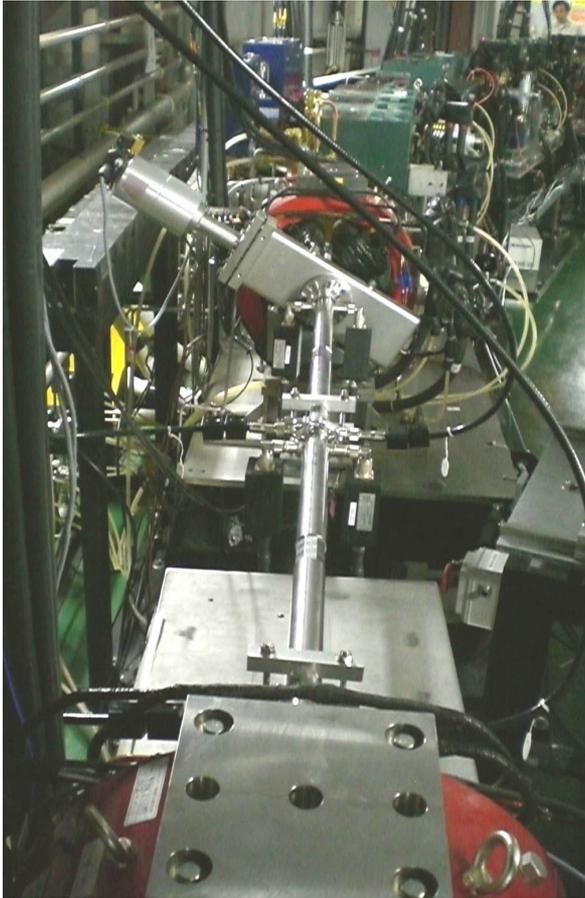
FDI pulsers

The radiation level at the location was
>10msv/h(gamma) and
100u sv/h(neutron).



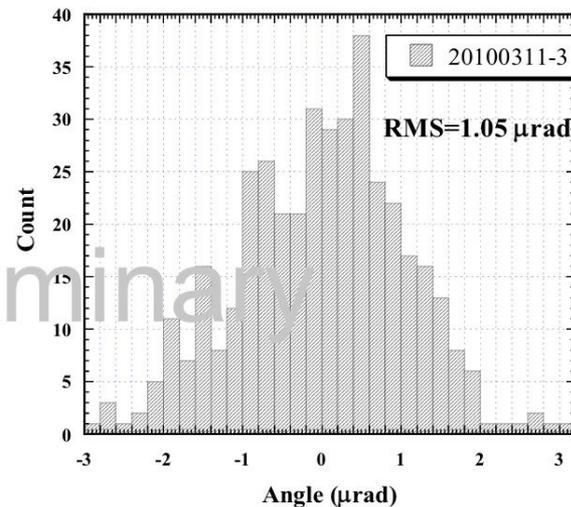
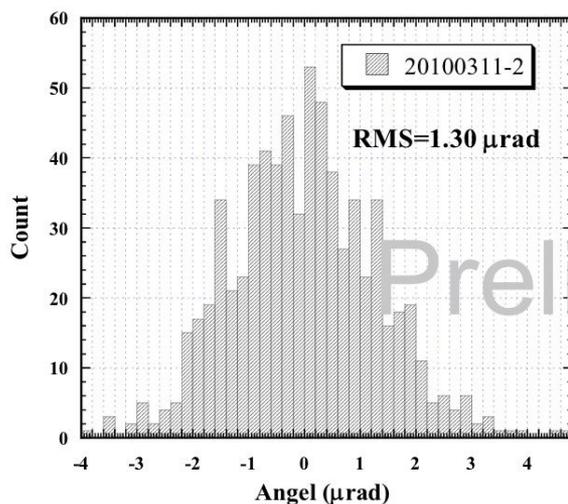
Bump PS and Septum PS

Beam Extraction succeeded from DR to ATF2 2009.Oct. 22.



Beam profile at MS1X screen monitor, which is located at the downstream of the septum magnets.

Kick angle jitter measurement



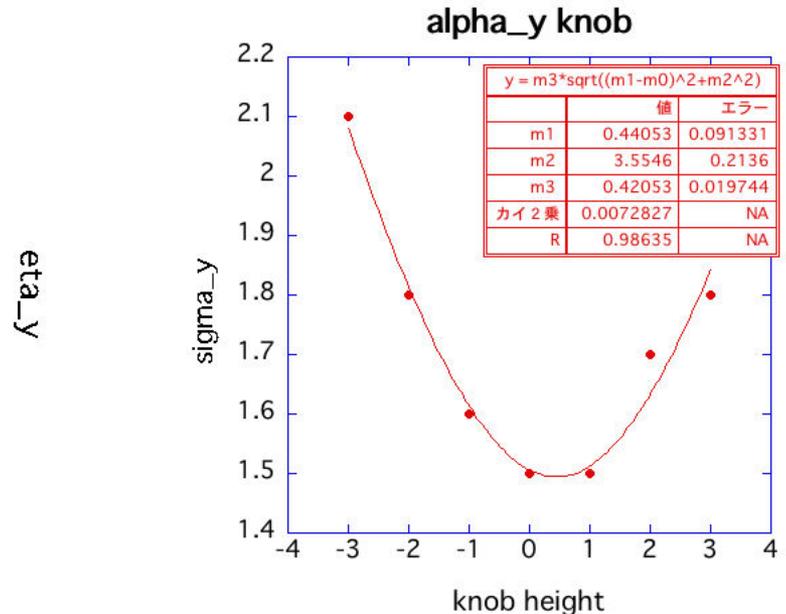
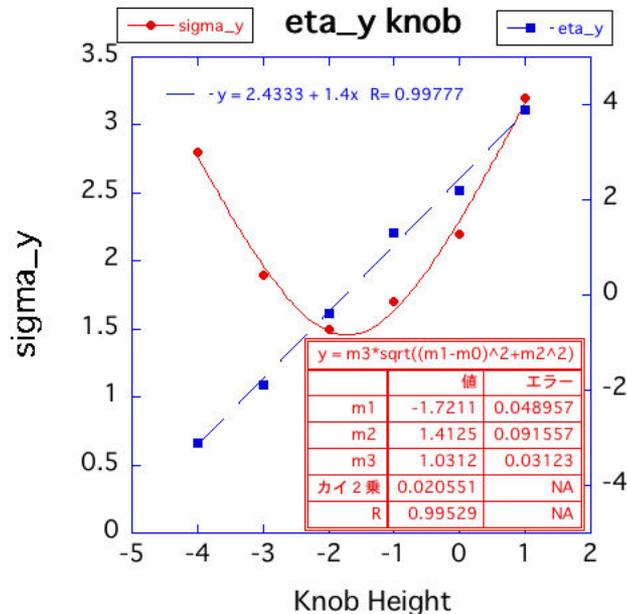
Preliminary

Fast Kicker

ATF2 Cavity BPMs

The kick angle jitter was estimated from the BPM measurement of the ATF2 beamline. The fit from the measured positions and the R12 of each location shows the angle distribution of the kicker. Figure shows the result of two set of the data. Each data used 700 shots and 400 shot, respectively. The measured angle jitters were 1.3micro-rad and 1.05micro-rad, respectively (preliminary). **The angle jitters of the kicker were 4.3×10^{-4} and 3.5×10^{-4} , respectively.**

Post-IP Beam size measurement under the Fast Kicker operation

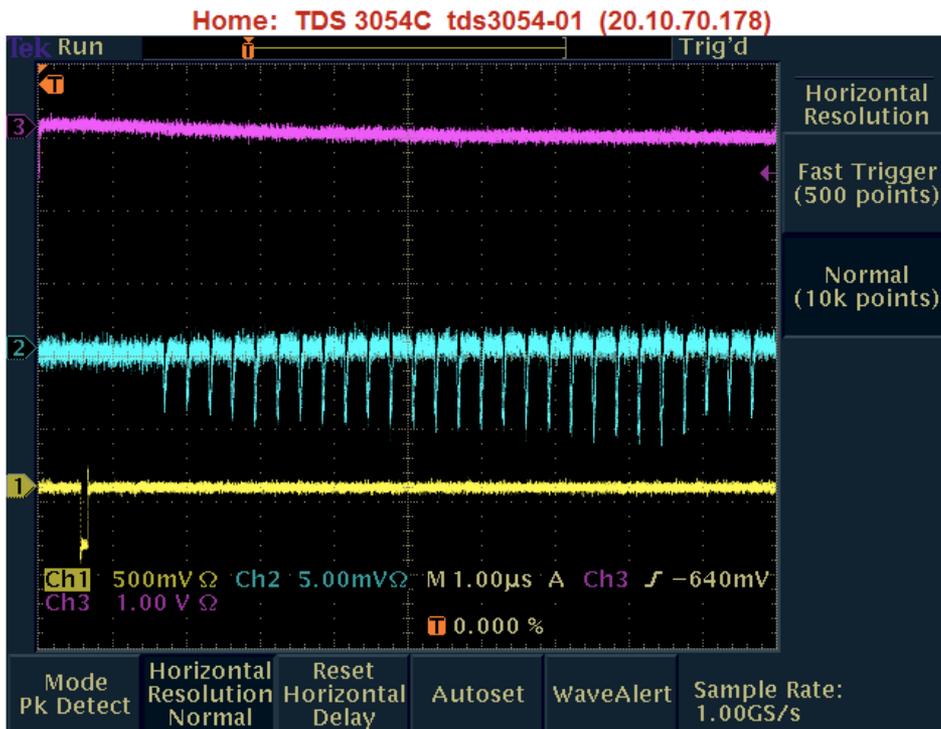
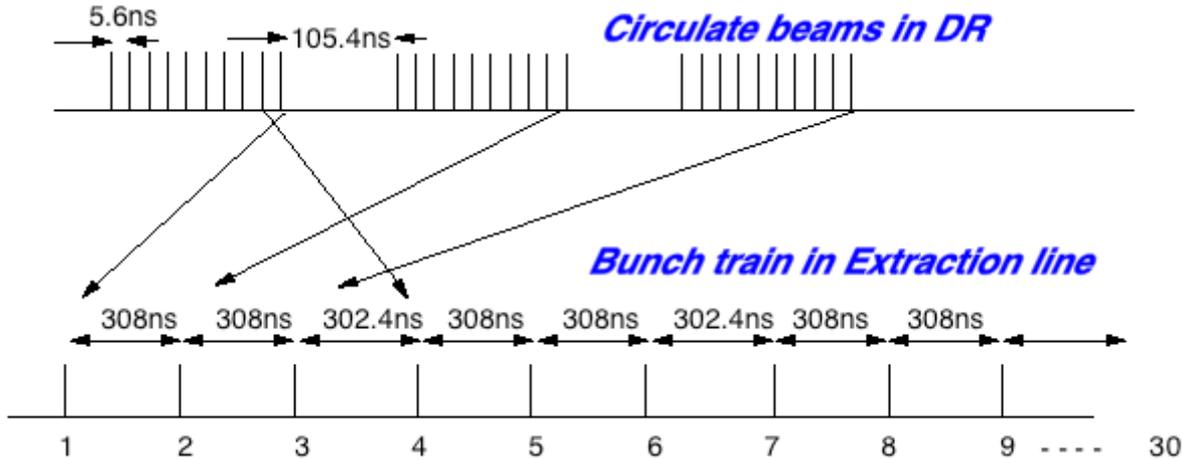


We could minimize the beam size to 1.5um at MW1IP (post-IP Carbon WS) by KEK multi-knob. It reached the measurement limit of this WS.

2010 / 3 / 19 Owl Shift

T. Okugi (KEK)

Multi-bunch beam extraction by the Fast kicker



in DR:

- 3 Trains,
- 9(max 10) bunches/train with 5.6 nsec spacing

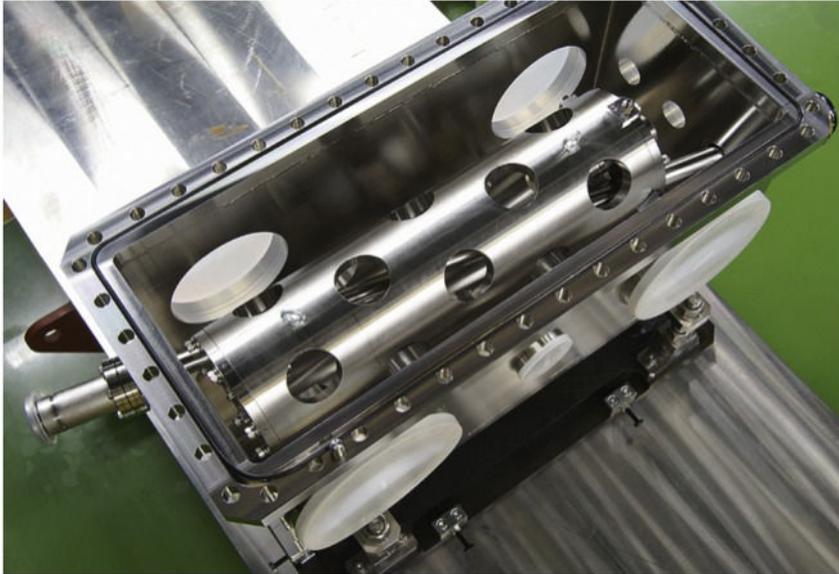
Extracted:

- 27(max 30) bunches with 308 ns spacing
- bunch-by-bunch profile follows that in the DR.
- bunches were extracted from the last bunch to the first bunch.

Further R&D for the uniform extraction should be done.

Compton e^+ : Two Prototype Cavities

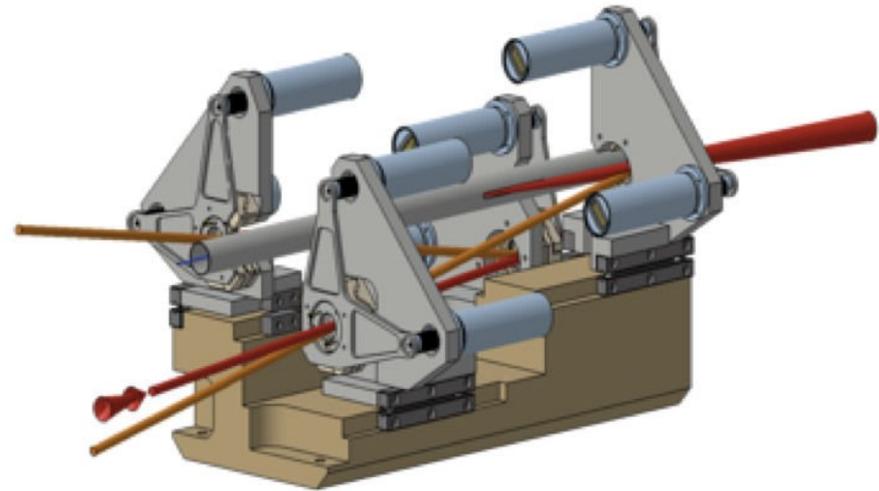
2-mirror cavity (Hiroshima / Weseda /
Kyoto / IHEP / KEK)



moderate enhancement
moderate spot size
simple control

demonstration of γ ray gen.
accum. exp. w/ cavity and acc.

4-mirror cavities
w/LAL



high enhancement
small spot size
complicated control

**Installation of LAL cavity will be
summer 2010**

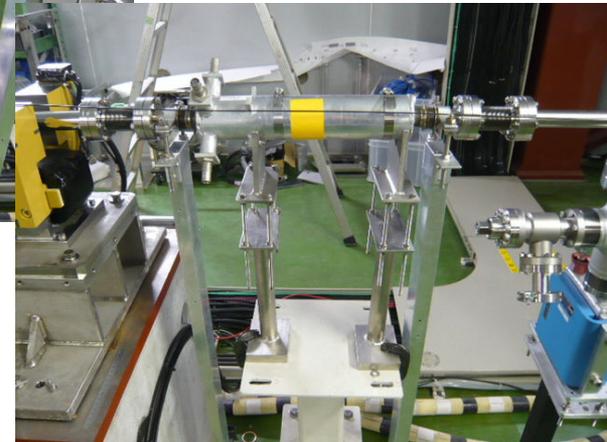
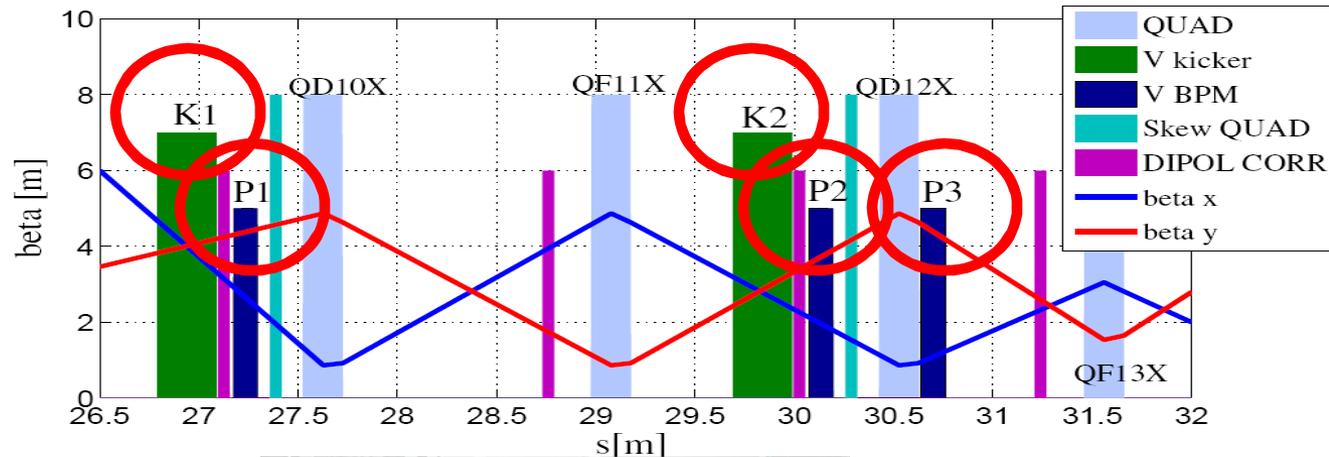
Compton e^+ : Summary

- 2 mirror cavity to demonstrate photon generation and to accumulate experience w/ beams
 - Before summer 2009
 - enhancement of 250, 27 gammas / crossing
 - Higher reflection mirror installed summer 2009.
(99.6%, 99.6%) \rightarrow (99.6%, 99.9%)
 - collision experiment on going with enhancement ~ 750
- 4 mirror ring cavity for higher enhancement and small spot size
 - Basic test on optical table
 - First prototype at KEK and being tested
 - **Installation of LAL cavity will be summer 2010**

ATF2 FB system: FONT5 (Oxford, KEK)

Dedicated system:

- **2 stripline kickers + fast drive amplifiers**
- **3 stripline BPMs + fast analogue front-end electronics**
- **9-channel digital FB processor**



P.N. Burrows
Project Meeting, KEK,
14/12/09

FONT5 summary 2009

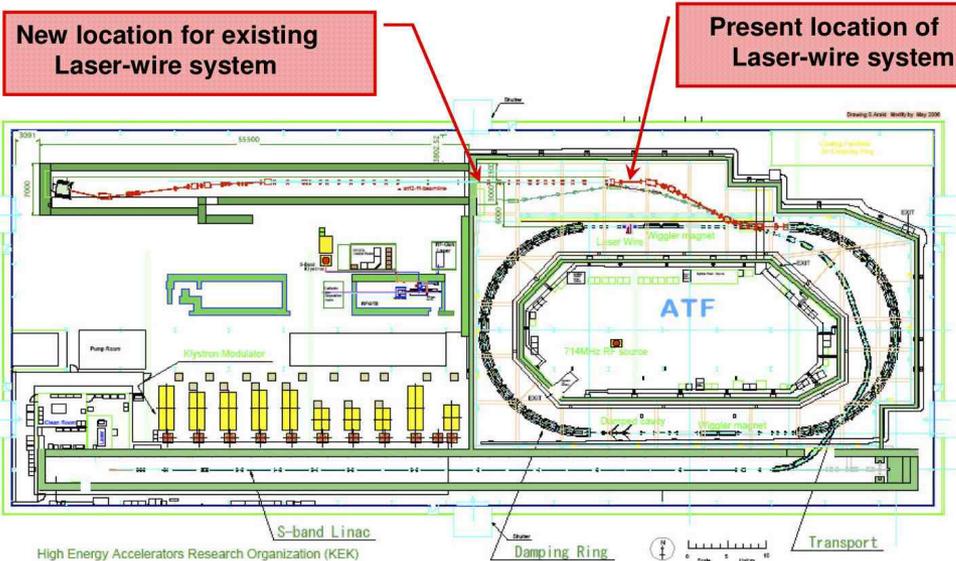
- **New BPMs and kickers installed + working**
- **FONT5 FB board fabricated and commissioned**
- **FB loop closed**
- **Beam quality is a serious issue:**
 - banana-train can be tuned away (or corrected)
 - large jitter** and **lack of correlation between bunches** are major problems.

Plans: 2010

- **Install Valencia movers (January)**
- **Provide 'turn-key' bunch-by-bunch FB system for achievement of ATF2 goals**
- **Plan to replace LO-based BPM processor scheme**

Laser Wire (JAI,KEK)

Stage 1 (continued)

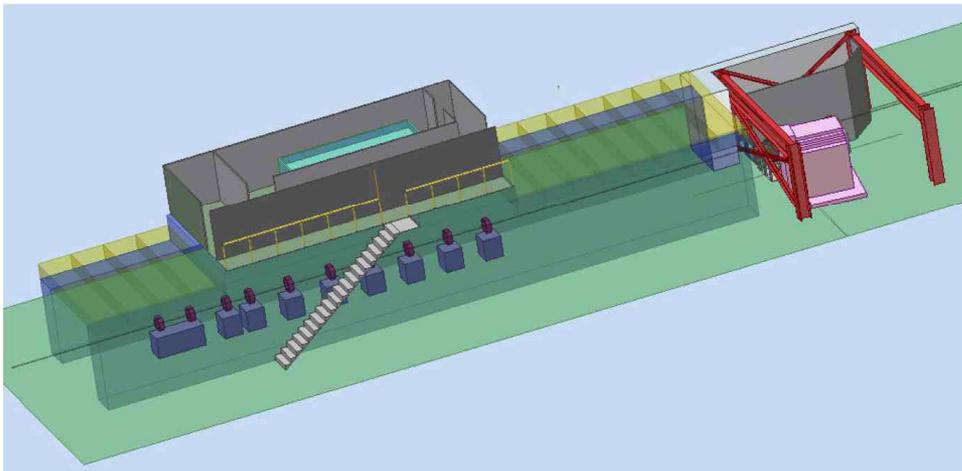


LCWS - 31/5/07 - DESY

Plans for ATF2 Laser-wire - D F Howell

5

Stage 1 (continued) - 3D View of proposed new 'Laser-wire' region



2009

- relocation of the laser room and the collision chamber

2010

- commissioning of the laser system
- commissioning of the laser transport and collision system (2010/Mar/22~)
- beam study will be resumed after April

Challenges toward the 1pm emittance

Simulation:

- BPM offset error should be < 0.1 mm. (“BBA”) --> $\epsilon_y \sim 2$ pm
- Magnet re-alignment, < 30 μm --> $\epsilon_y \sim 1$ pm

DR BPM upgrade (FNAL, SLAC, KEK)

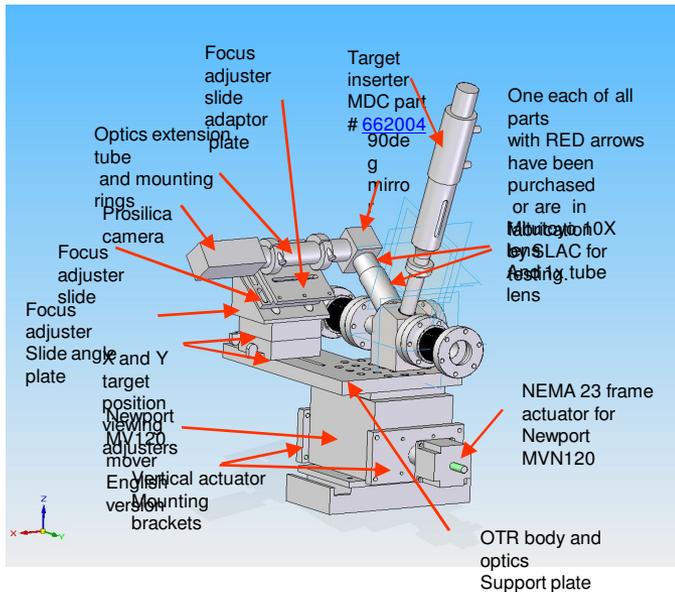
a high resolution BPM system

- a broadband turn-by-turn mode (< 10 μm resolution)
- a narrowband mode with high resolution (~ 100 nm range)
- Electronics for all DR BPM (96) is under preparation at FNAL.
- Installation will be done around the IPAC10 (May).

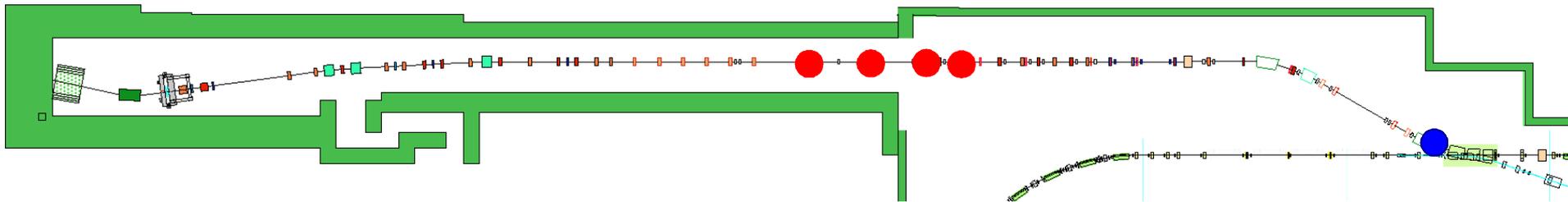
Multi-Optical Transition Radiation System for ATF2

for Fast Emittance Measurement

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



1. Most parts were arrived at ATF.
2. Two persons from IFIC are visiting ATF in this month and are working to assemble OTRs on the test stands.
3. Control cables were put between the beamline and a control hut.
4. Installation of OTR will be done after the full control becomes available. After IPAC?



Major Hardware Installation in 2010

Month	1	2	3	4	5	6	7	8	9	10	11	
Operation	BEAM		no	BEAM			Summer Shutdown			BEAM		
Maintenance							DR/ATF2 Alignment?					
Extractor Kicker	Fast Kicker	Normal Kicker	Fast Kicker		Normal Kicker		Fast Kicker				Fast Kicker	Fast Kicker? n
EXT Stripline BPM			Install Beam	LCLS digital readout system								
DR BPM Upgrade	Electronics preparation (FNAL)			tuning, shipping (FNAL)		Install, beam test	digital readout system					
EXT-FF OTR (4units)	Manufacturing (IFIC,SLAC)		Assembling (@ATF)			Install, beam test	Fast emittance measurement					
Compton Polpos, 4-mirror Cavity (LAL)	Manufacturing, Assembling (LAL)							Installation				
Renewal of LINAC RF modulatoe (2 units)	Manufacturing (Toshiba)		Test					Installation, Tuning		2/9 modulators		

Summary

1. ATF/ATF2 was operated under the higher international activity.
2. There are many progress on the R&Ds.
 - The beam extraction by the fast kicker was successfully done.
 - Kick angle stability was confirmed as low as that of the conventional double kicker system. < ILC requirement.
3. Installation of new instruments are scheduled. They will improve the efficiency of R&Ds.

backup

ATF2 Beam Tuning Progress and Plans



Glen White, SLAC
ILC2010, Beijing
March 28 2010

Optics Configuration

- <2010 used 8cm / 10mm IP beta optics (x / y) [20* / 100* design].
 - Target IP y spot size ~500nm.
- January, attempted establishment of design optics.
 - Backgrounds in IPBSM detector 20* larger than requirements for beam size measurement.
- Currently running with 4cm / 1mm [10* /10* design].
 - Target IP y spot size ~100nm.

Plans Apr - June 2010

April

- IP tuning with IPBSM.
- Test implementation of FFS FB.
- Prepare for May continuous running week.

4 2010						
Su	Mo	Tu	We	Th	Fr	Sa
					1	2
					3	
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

5 2010						
Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

6 2010						
Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May

- OTR installation?
- 17-21 continuous ATF2 tuning.
 - 15 shifts
- Need to demonstrate required tuning software, have good co-ordination of manpower etc...

ATF2 Goals

- ~100nm Spot size by June (30 degree IPBSM mode).
- ~35nm by end 2010 (174 degree IPBSM mode).
- Reliably generate 35nm by end 2011.
- nm-level stabilization 2012.
- “Pushed beta” optics
 - Learn about tuning difficulty vs. FFS chromaticity, IP beamsizes <25nm.