

# Overview of ATF2 Goals and Current Construction Status

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ATF2 Software Review (also as FJPPL)

LAL, Orsay, France, 18-20 June 2008

# ATF2 beam line

Reconfiguration of extraction line  
for reduction of dispersion

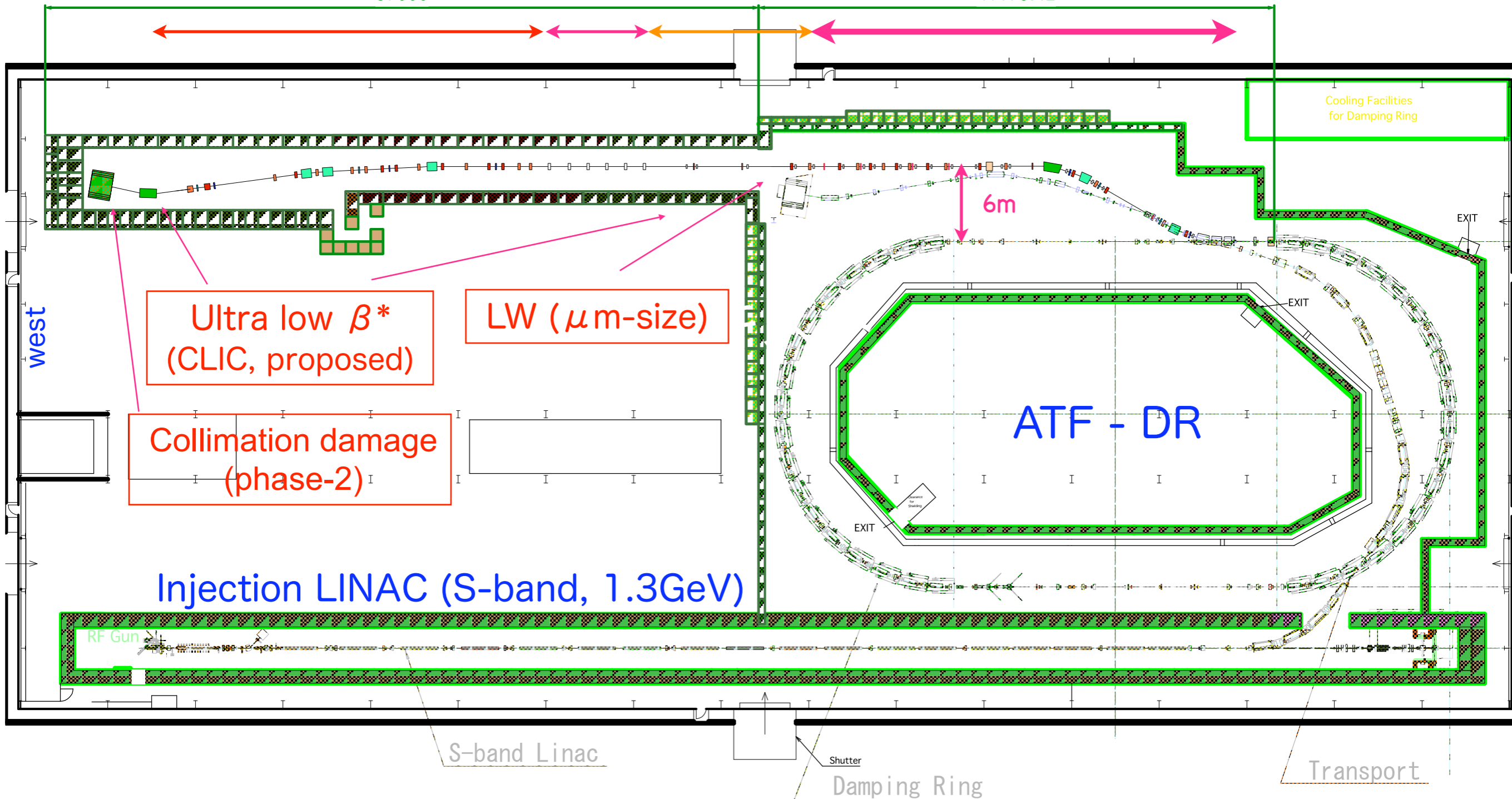
Final Focus System

57000

$\beta$  mat-  
ching

Diagnostic

41179.42



# Motivation I: Chromaticity

Project	Status	$\beta_y^*$ [mm]	$L^*$ [m]	$L^*/\beta_y^*$	$\xi_y$
FFTB	Design	0.1	0.4	4000	17000
FFTB	Measured	0.167	0.4	2400	10000
ATF2	Design	0.1	1.0	10000	19000
ATF2 pushed	Proposed	0.05	1.0	20000	38000
CLIC 500GeV	Design	0.2	4.3	21500	35000
CLIC 3TeV	Design	0.09	3.5	39000	63000
ILC	Design	0.4	3.5	8750	15000
ILC pushed	Design	0.2	3.5	17500	30000

# ATF2 Final Goal

Ensure collisions between nanometer beams; i.e. luminosity for ILC experiment

Reduction of Risk at ILC Optics and beam tuning  
Stabilization

FACILITY construction, first result	ATF2/KEK; 1.3GeV 2005-08-09?	FFTB/SLAC; 47GeV 1991-93-94
Optics	Local chromaticity correction scheme; very short and longer $L^*$ ( $\beta^*_y=100\mu\text{m}$ , $L_{FF}=30\text{m}$ )	Conventional (separate) scheme; non-local and dedicated CCS at upstream; high symmetry in x, y ; i.e. orthogonal tuning ( $\beta^*_y=100\mu\text{m}$ , $L_{FF}=185\text{m}$ )
Design beam size	$2.3\mu\text{m} / 34\text{nm}$ , aspect=82 ( $\gamma \epsilon_y=3 \times 10^{-8} \text{ m}$ )	$1.92\mu\text{m} / 52\text{nm}$ , aspect=37 ( $\gamma \epsilon_y=2 \times 10^{-6} \text{ m}$ )
Achieved	?	70nm ( beam jitter remains !)

# Mode-I

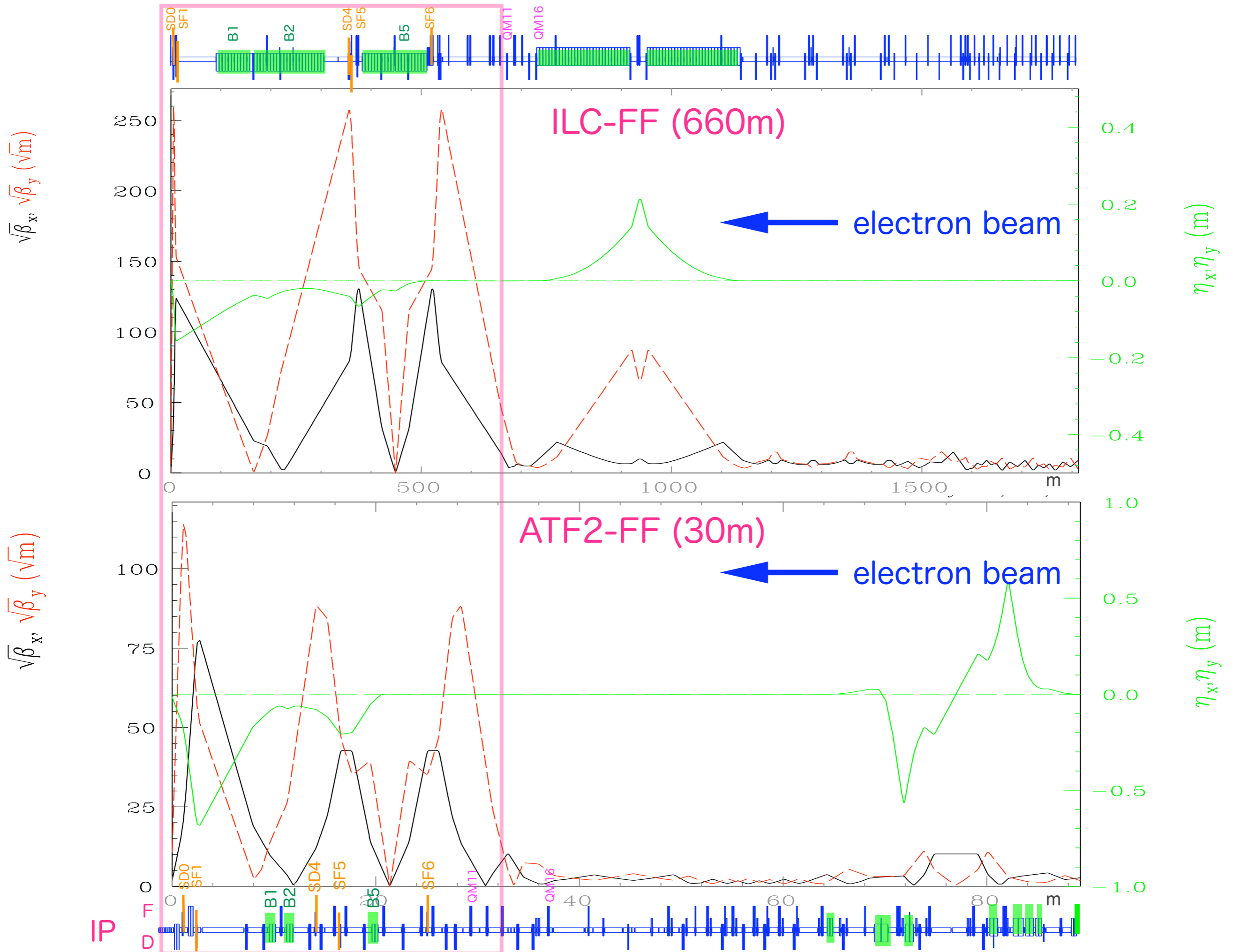
## A. Achievement of 34nm beam size

- A1) Demonstration of a new compact final focus system;  
proposed by P.Raimondi and A.Seryi in 2000,
- A2) Maintenance of the small beam size  
(several hours at the FFTB/SLAC)

# Mode-II

## B. Control of the beam position

- B1) Demonstration of beam orbit stabilization with  
nano-meter precision at IP.  
(The beam jitter at FFTB/SLAC was about 40nm.)
- B2) Establishment of beam jitter controlling technique  
at nano-meter level with ILC-like beam (2008 -?)



# ATF2 Features

- The same number of magnets as the ILC-FF.
- The tuning knob, methods are the same, too.
- Beam instrumentation has been developed with the ILC specifications; BPMs, BSMs, movers, magnet support, laserwires, HA power supplies, FONT-feedback system etc. .
- International participation in the commissioning and operation

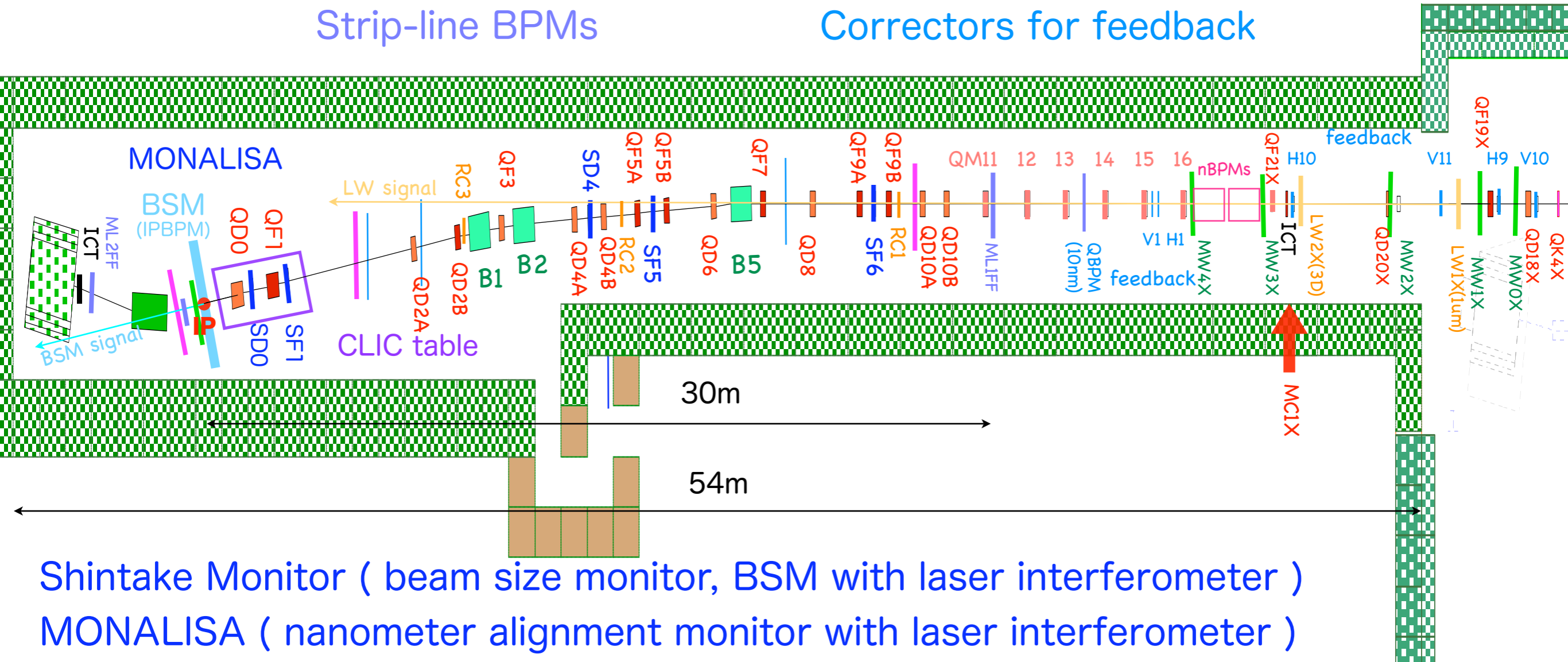
# Magnets and Instrumentation at ATF2

22 Quadrupoles(Q), 5 Sextupoles(S), 3 Bends(B) in downstream of QM16

All Q- and S-magnets have cavity-type beam position monitors(QBPM, 100nm).

3 Screen Monitors  
Strip-line BPMs

5 Wire Scanners, Laserwires  
Correctors for feedback



Shintake Monitor ( beam size monitor, BSM with laser interferometer )

MONALISA ( nanometer alignment monitor with laser interferometer )

Laserwire ( beam size monitor with laser beam for 1  $\mu$ m beam size, 3 axes)

IP intra-train feedback system with latency of less than 150ns (FONT)

Magnet movers for Beam Based Alignment (BBA)

High Available Power Supply (HA-PS) system for magnets



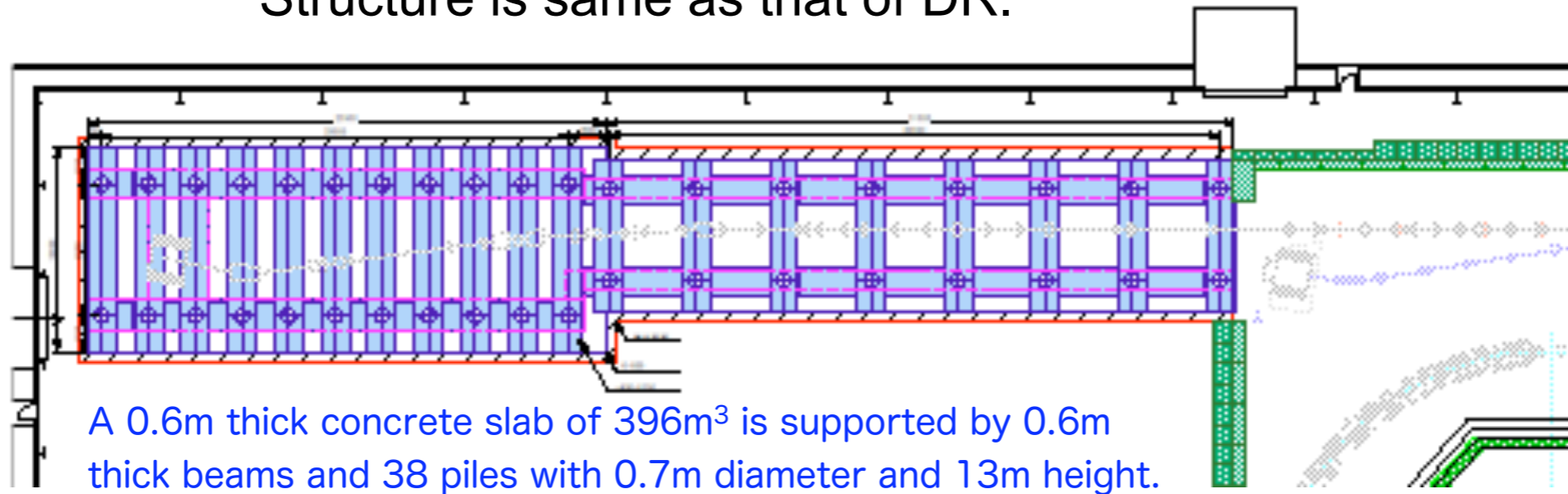
# Schedule of Installation, May 2008

Japanese Fiscal year	JFY2007												JFY2008												
	2007						2008																		
Activity	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
ATF Beam operation	[pink]						[pink]											ATF2 Commissioning							
Reconfiguration of extraction line			partial recons										New ext. line												
Conventional Facilities																									
detailed floor planning	bid						New floor constructed																		
re-location/ site preparation	[pink]																								
floor refurbishment			Floor																						
construction of extended area							side wall and roof																		
utilities; water, AC power									cable, pipe																
construction at ATF-EXT	partial construction														reconfiguration										
laser huts for BSM and LW														LW	BSM										
Installation																									
beam dump													DMP												
magnets & supports & vacuum pipes			magne								magne				magnets										
cooling pipes											cooling														
cable tray installation											c. tray						c.tray								
large DC cable installation											power						p.cable								
small cable installation											cables						cables								
power supply system															PS										
new stable FD system with magnets																					FD				
Shintake monitor with IPBPM													shi	BSM											
Laser wire											light path				1 LW , detector										
wire scanners, screen mon. etc.																	wire scanner								

# Floor structure for ATF2 beam line

Refurbishment from Jun to Sep 2007

Structure is same as that of DR.





29th November 2007



Q-manets installation, 10th January 2008



Beam Dump, 31st March 2008



Shintake mon. optics start, 14th May 2008



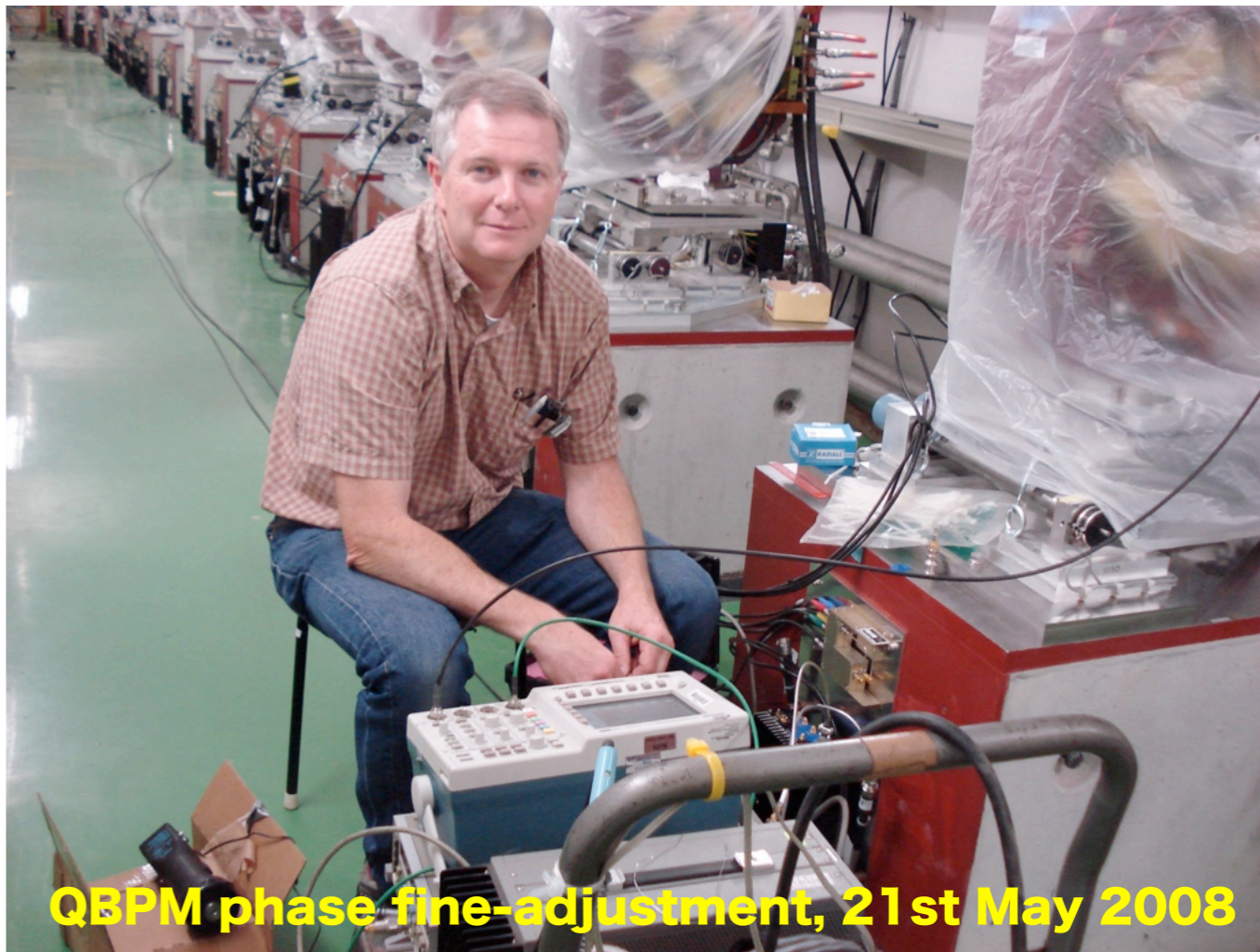
**cabling and piping, 14th May 2008**



**HA-PS installation, 14th May 2008**



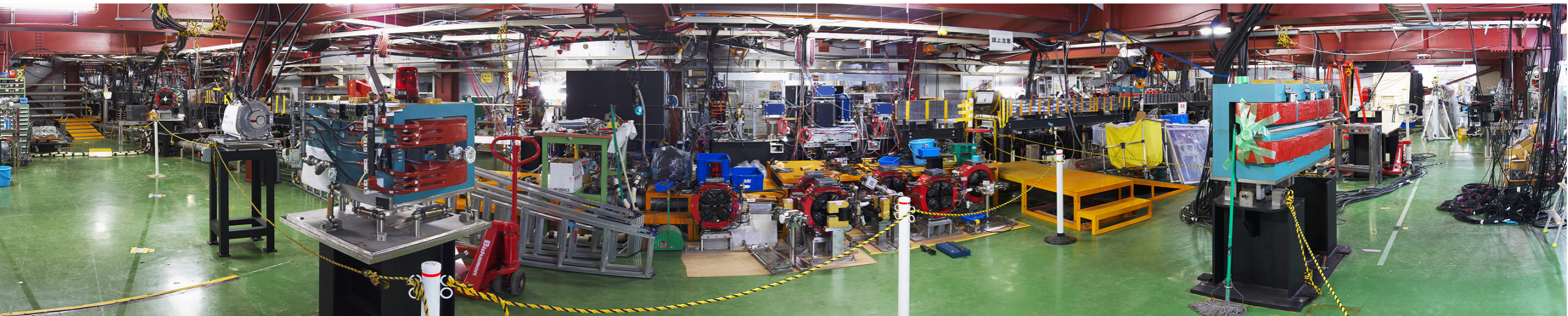
**Laser hut construction(LW), 14th May 2008**



**QBPM phase fine-adjustment, 21st May 2008**

# Clearing the extraction line for the re-configuration

photo taken on 6 June 2008, by Toge-san.



extraction  
from DR

to the  
dump

Only dipoles and kicker are left, which were re-located in last week.

Magnets will be re-located soon.

Component	Sub-component	Number	Comments	Status	Present	New	2007	plan in
Magnet	Quadrupole	28	with QD0,QF1	production	27	1	1	0
	Sextupole	5	4 with 50mm aperture and 2 with 32mm aperture	design	0	5	5	0
	Octupole	0			0	0	0	0
	Bend	3	FF-bends =3	production	0	3	3	0
	H. Steering	4	horizontal with 5A bipolar PS	1 added in v3.7	4	0	0	0
	V. Steering	2	vertical with 5A bipolar PS		2	0	0	0
	Skew Q	2	QK2X, QK3X	v3.7 optics	0	2	0	2
	Cable of ext.kicker	2	re-location of two kickers is alternative solution		0	2	0	2
Magnet Support	Movers	27	20Q-magnets, QD0,QF1 and 5 sextupoles	SLAC	27	0	0	0
	Base (Qs)	23	for each magnet except for the FD support	production	0	23	24	-1
	Bends	3	support system ( 3 bases and 3 interface plates )	design ?	0	3	3	0
	FD support	1	stable tables for QD0,QF1,SD0,SF1	CERN/LAPP	1	0	0	0
Power Supply	HA system	38	8(ExtQ), 6(MatQ), 5(Sext), 0(Oct), 16(FFQ), 3(B) ; 6 bipolar for QM11FF - QM16FF.	production		38	38	0
	Bipolar PS	2	bipolar and 20A for QK1X, QK2X	v3.7 optics		2	0	2
Vacuum	Beam pipe (m)	93.154	ATF extraction line at present and ATF2 beam line (50.613m)	production	0	93.154	46.577	46.58
BPM	Q-BPM for Q & Sext.	33	QD10-12X,16-17X,QD18-21X, IHEP-Qs in FF	production	39	-6	0	-6
	Q-BPM (s-band)	4	with larger diameter (40mm) ,final doublet system	design	0	4	0	4
	stripline	14	for commissioning and at extraction line	production	14	0	0	0
	IP-BPM	3	2nm resolution for position jitter at IP (	production/prototype	0	3	2	1
Wire scanner	Metal wire	5	exsit at the extraction line - relocation	existing	5	0	0	0
	Laserwire	5	upgrade of the metal wire scanners	R&D	0	5	0	1
IP - BSM	Shintake monitor	1	upgrade of the FFTB monitor, 532nm laser: 35-350nm	upgrade/ new design	1	0	0	0
	BSM-support	1	rigid and independent support	design	0	1	1	0
	Urakawa monitor	1	laser cavity type	R&D	0	1	0	0
Fast orbit correction	Feedforward	1	from DR to extraction line	R&D, design	0	1	1	0
	Feedback	1	intra-train fast feedback based on digital circuit	R&D	0	1	1	0
Pulse to pulse feedback	V and H correctors	4	orbit correction at the extraction line	proposed	0	4	0	4
	1um BPMs	4	orbit correction at the extraction line	proposed	0	4	0	4
Commissioning tools	Screen monitor	4		KEK	4	0	0	0
	Carbon wire scanner	1	beam size monitor at IP : up to 1um	SLAC	1	0	0	0
	Honda monitor	1	beam size monitor at IP : 350nm - 1um	proposed	0	1	0	1
	PLIC loss monitor	1	fiber with PMT readout	proposed	0	1	0	1
ICT	beam loss	2	beam current monitor		1	1	0	1
Beam dump	ATF2 Beam dump	1	design is the same as the ATF one		0	1	1	0

# Hardware preparation

## (1) 2006

Q magnets (4 in 2006, 24 in 2005, 28 in total); 27 to be used

Support-concrete bases;

type : 1 (Q+Qk+ZV), 2A(Q+ZH), 2B(Q+ZV), 3(Q+Sx+Q) and 4(Q)

no. : 3, 3, 1, 3 and 14 ,respectively ; so 24 in total

QBPMs (28 in 2006, 11 in 2005, 39 in total ) - 33 to be used

HA power supply system ( 39 )

## (2) 2007-2008

**Conventional facility ( including beam dump )**

Bending(3), sextupole(5), skew(2) and steering(6) magnets

QC3 (2) shimmed for QC0,QF1 - 12 pole component

S-band BPMs (4), IPBPM with New Shintake monitor

Carbon wire scanner, Honda monitor

Rigid supports( FD system, Shintake monitor)

FONT, feedforward, laserwire, Monalisa etc.

# Hardware Issues due to budget shortage in JFY2008

The highest priority is to transfer beam to the dump at ATF2.

(1) There are 14 stripline BPMs in total at new extraction line and ATF2. The cables have to be reused from present ones. It is not clear that their lengths are enough. Some of them may have no cables.

(2) Who provides a PLIC cable system for beam loss monitor at ATF2 ? - Originally, SLAC could do.

(3) There is only one ICT. MC1X will not be available behind QD20X.

(4) There are 4 skew quadrupoles for the coupling correction. At present, only QK1X and QK4X are available together with 20A power supplies. Who provides two remained skew quadrupoles. ?

(5) Honda monitor and sweeping magnet is not funded.

(6) Laser tracker system ( Raika co.) is close to the lifetime ( > 15 years old). It may affect beam line alignment in this summer.

Is it available as rental or who can purchase it ?



# Software Issues

Coordination is important for international collaboration.

(1) Commissioning strategy, tools

The commissioning group will provide them.

(2) Flight simulator for modeling the beam line and tuning.

Demonstration was done at the present extraction line.

Preliminary results will be presented here.

(3) Magnet movers and QBPMs etc.

Corresponding sub groups have responsibilities.

(4) Remoto participation

international-capable phone line, good video equipment will be prepared. Also, ATF data server, eLog system will be improved.

Both are KEK's responsibility.

# Site work Issues

Scheduling is very important particularly in this summer.

- (1) The re-organization and modification of extraction line will be completed **by end of July**, which includes;
  - All the magnets will be aligned in **August - September**.
  - After the movement of two extraction kickers, we need to check the HV-system probably in **July**.
- (2) Commissioning of Shintake monitor system with no beam
  - High power laser system in restrictive area, - **August**
  - The laser system will move in a laser hut, **September**.
- (4) Installation of the FD system - final in this period, **October**
  - Major components will be shipped from LAPP to KEK, including the table, 4 magnets and s-band BPMs with supports

# Summary

ATF2 will be commissioned in end October 2008.

## Recent progress and near future plan

- (1) Re-configuration has been started in early June.
- (2) Concrete shields and beam dump have been completed in April.
- (3) All magnets except for 4 FD-ones have been installed at ATF2 beam line.
- (4) Power cables and cooling pipes have been installed.
- (5) The HA-PS system has arrived at KEK, 1st May.
- (6) S band BPMs (4) will be fabricated by end of June at KNU.  
The electronics is provided by UK group.
- (7) Shintake monitor has been installed at IP. The optics system is setting up and it will be commissioned in May.
- (8) FD system will be arrived in early September from LAPP.

## Meeting schedule

- (1) Weekly meeting, Wednesday
- (2) Mini-workshop on the ATF2 software review, 18-20 June, LAL, Webex