ATF2
test facility

Andrei Seryi, SLAC

for the ATF2 team

to be presented to ILC Accelerator Advisory Panel

April 19, 2009

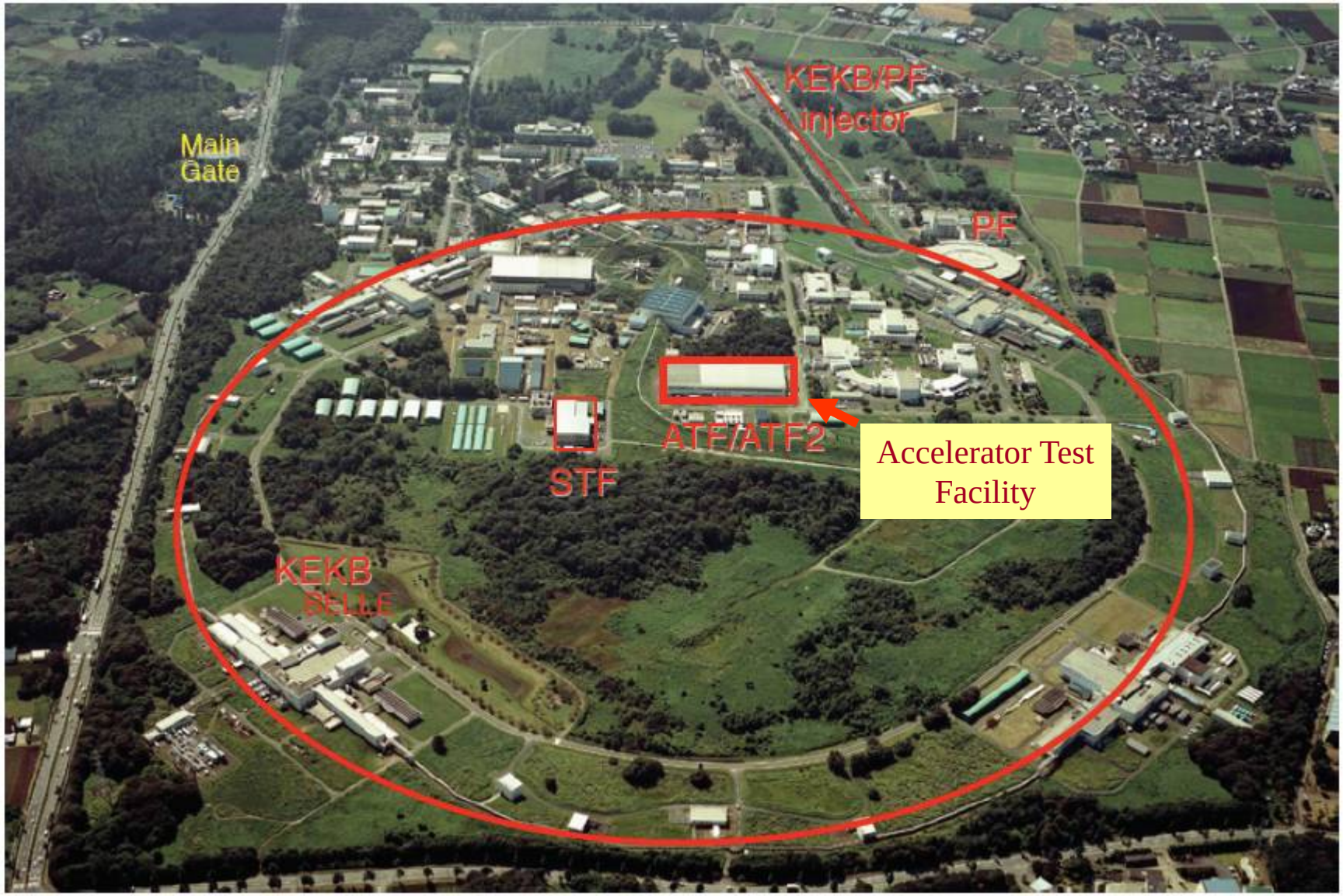
ATF2 team

John Amann, Deepa Angal-Kalinin, Sakae Araki, Alexander Aryshev, Sha Bai, Philip Bambade, Paul Bellomo, Grahame Blair, Benoit Bolzon, Stewart Boogert, Philip Burrows, Glenn Christian, Christine Clarke, Jean-Pierre Delahaye, Eckhard Elsen, Jie Gao, Nicolas Geffroy, Eliana Gianfelice-Wendt, Hitoshi Hayano, Ae-young Heo, Yosuke Honda, Yoshihisa Iwashita, Andrea Jeremie, Alexander Kalinin, Yoshio Kamiya, Pavel Karataev, Eun-San Kim, Hyoung-Suk Kim, Sachio Komamiya, Kiyoshi Kubo, Tatsuya Kume, Shigeru Kuroda, Briant Lam, Alexey Lyapin, Mika Masuzawa, Douglas McCormick, Stephen Molloy, Takashi Naito, Janice Nelson, Toshiyuki Okugi, Masahiro Orouku, Brett Parker, Ewan Paterson, Mauro Pivi, Tor Raubenheimer, Yves Renier, Cecile Rimbault, Marc Ross, Tomoyuki Sanuki, Anthony Scarfe, Andrei Seryi, Cherrill Spencer, Taikan Suehara, Ryuhei Sugahara, Takanori Sugimoto, Tohru Takahashi, Toshiaki Tauchi, Nobuhiro Terunuma, Rogelio Tomas, Junji Urakawa, Manfred Wendt, Glen White, Andy Wolski, Mark Woodley, Takashi Yamanaka, Kaoru Yokoya, Feng Zhou, Frank Zimmermann

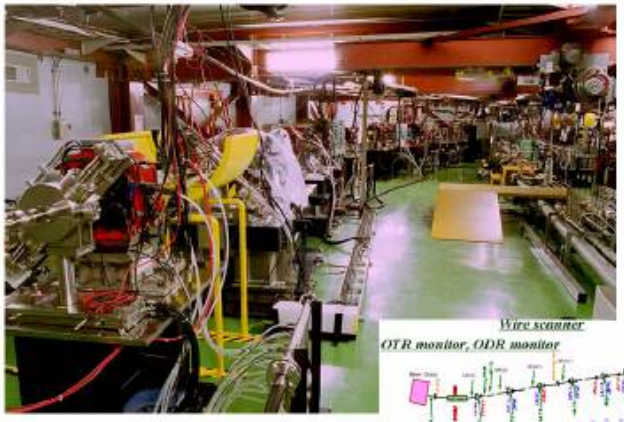
and colleagues who unintentionally missed from the list

Plan of the talk

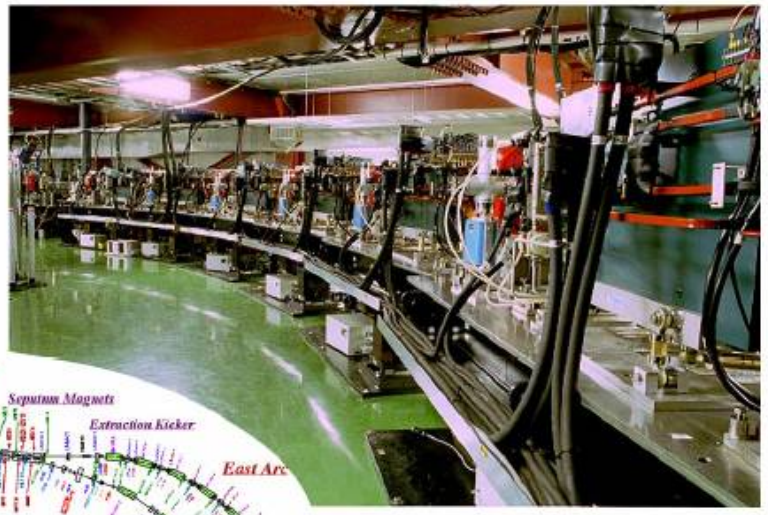
- History and goals
- Organization
- Schedule and construction
- Commissioning organization
- Highlights of recent beam runs
- Near term plans
- Longer term outlook


Main Gate
KEKB/PF injector
PF
ATF/ATF2
STF
KEKB
BELLE
Accelerator Test Facility

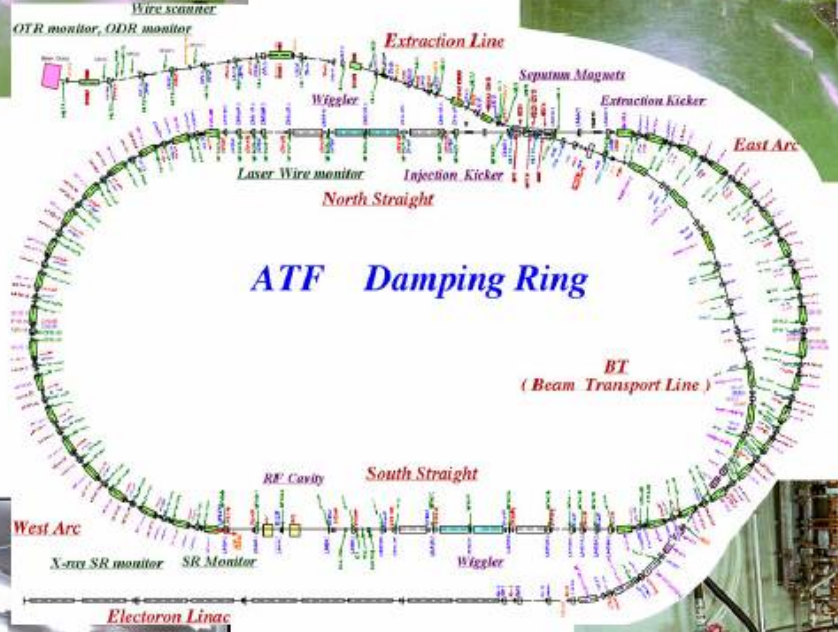
ATF and ATF2



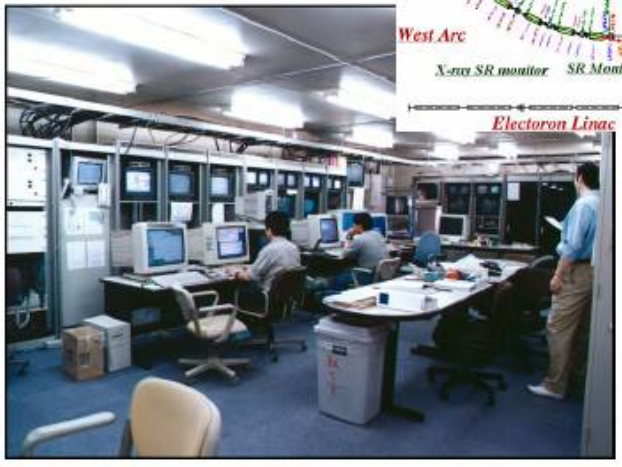
Extraction Line



Damping Ring



Control Room



Linac

Accelerator Test Facility, KEK

1997-2008

Extraction line :utilization of low emittance beam
beam instrmentation, collimator damage

Cavity BPM
nanometer res.

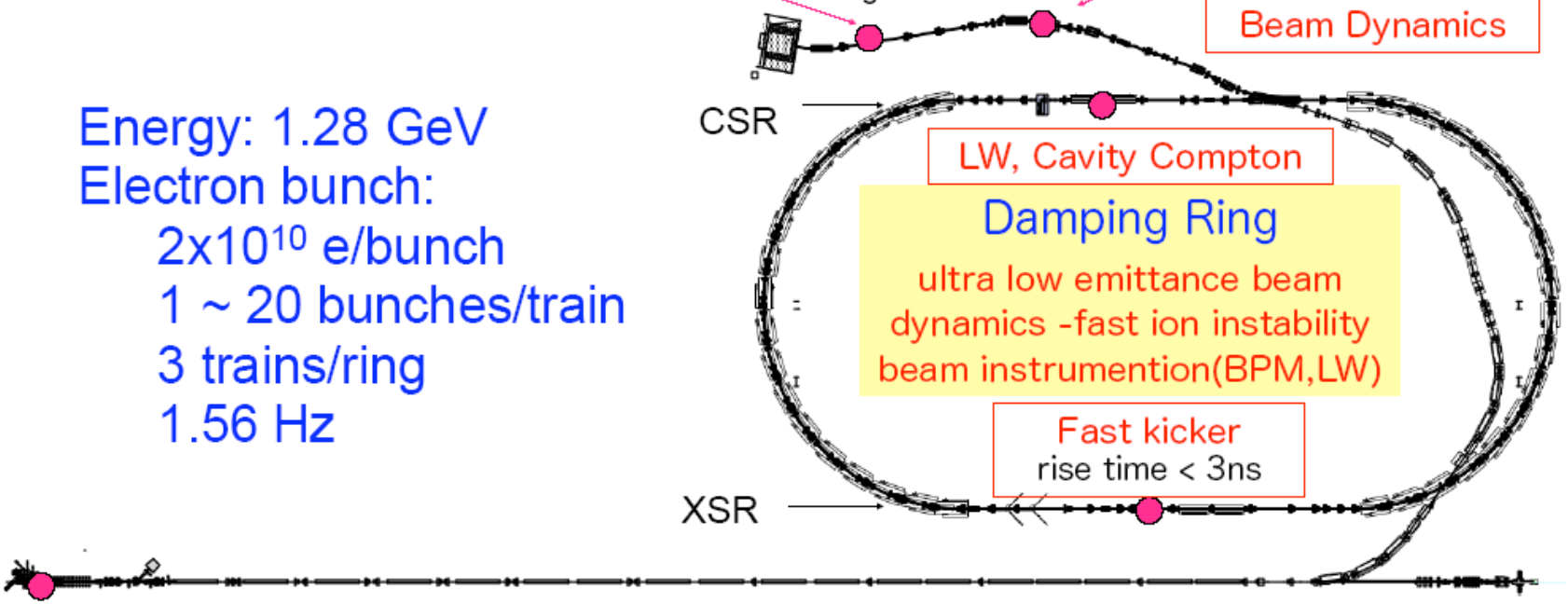
FONT
fast feedback (ns)

Pulsed Laser Wire Scanner
for beam size monitor (μm)

ODR, OTR
single shot meas.

Beam Dynamics

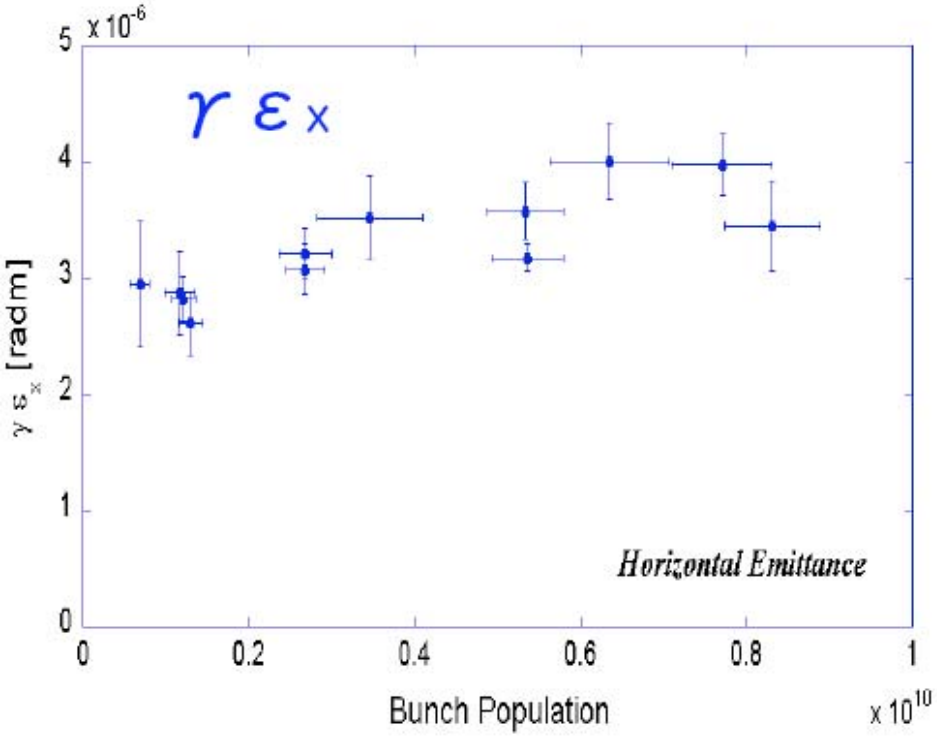
Energy: 1.28 GeV
Electron bunch:
- $2x10^{10}$ e/bunch
- 1 ~ 20 bunches/train
- 3 trains/ring
- 1.56 Hz

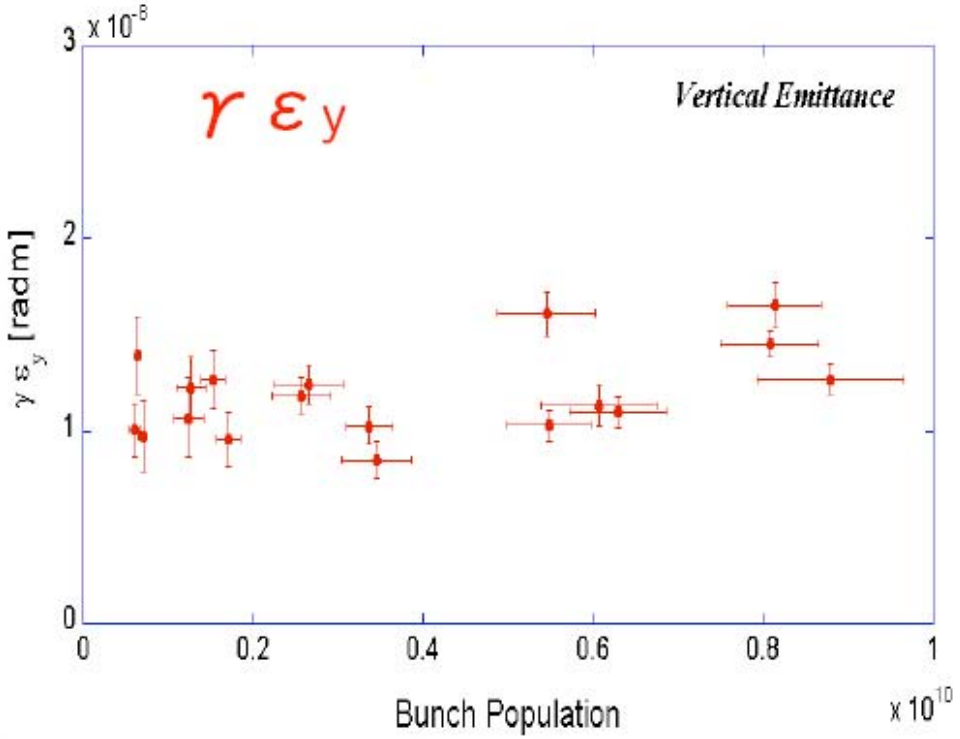


RF Gun
multi-bunch beam

S-band Linac (70m)
multi-bunch acceleration

Low emittance in ATF





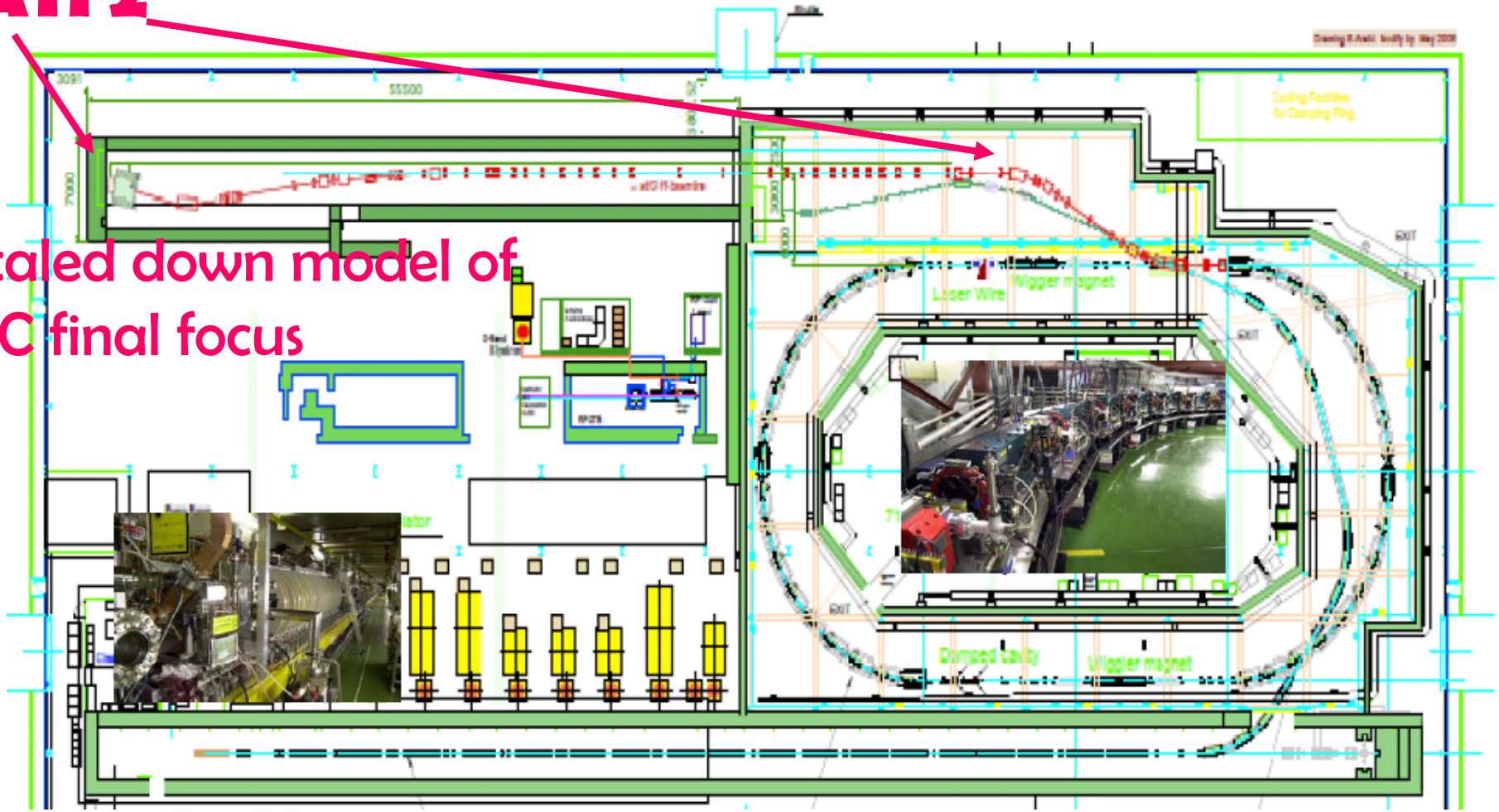
- Best measurements of emittance in ATF DR:
  - the ε_y=4pm is the best achieved value at low intensity and it becomes 1.5 times at the intensity of 1 x 10^10/bunch [Y.Honda et al., PRL 92 (2004) 054802]
- Very recent preliminary vertical emittance:
  - the ε_y=5pm (about 10% error) which was measured by Laser Wire in DR
  - thus, the best conditions are reproducible.

ATF
Accelerator Test Facility

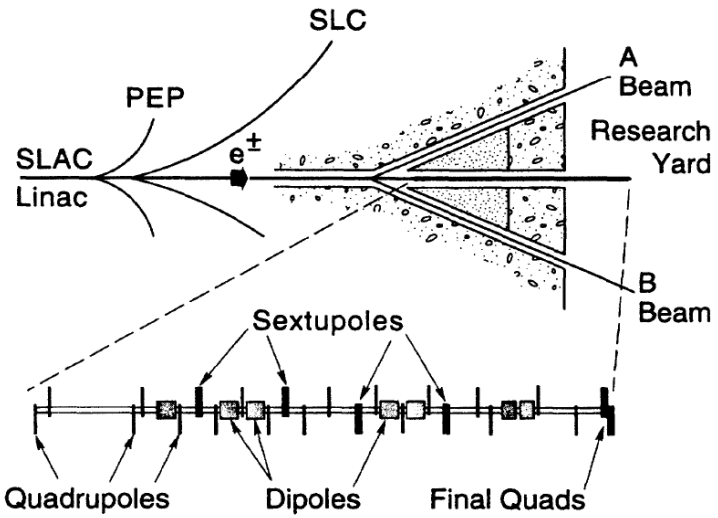
at KEK

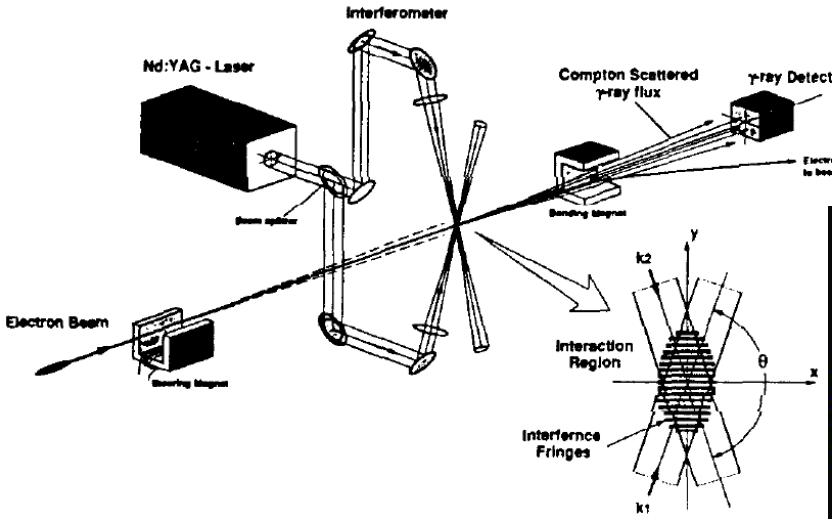
ATF2

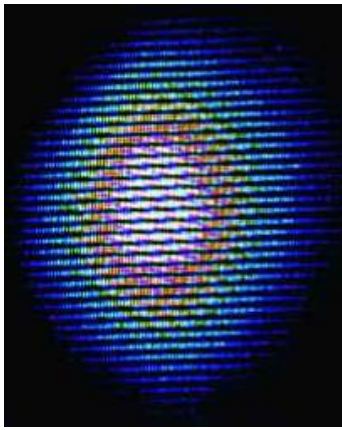
Scaled down model of ILC final focus



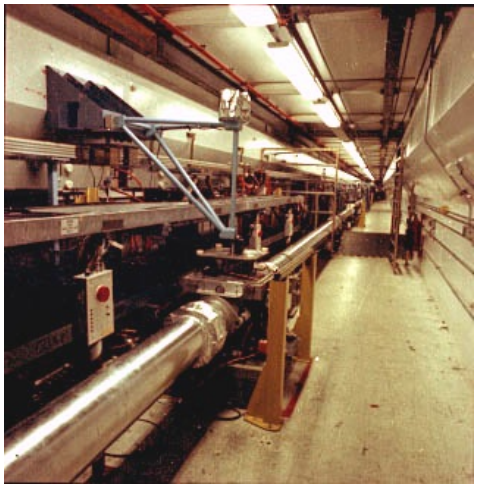
Final Focus Test Beam – optics with traditional **non-local** chromaticity compensation

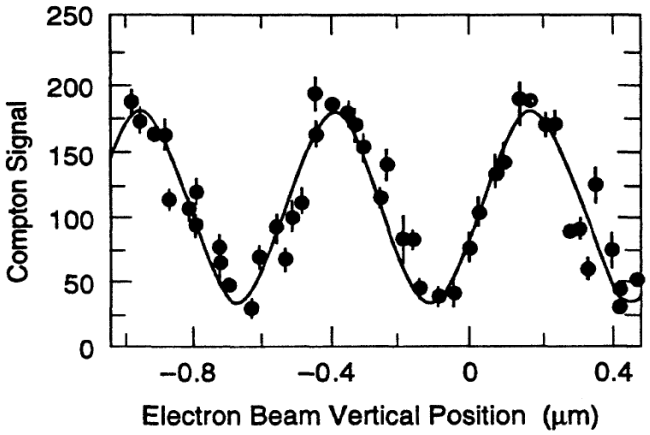






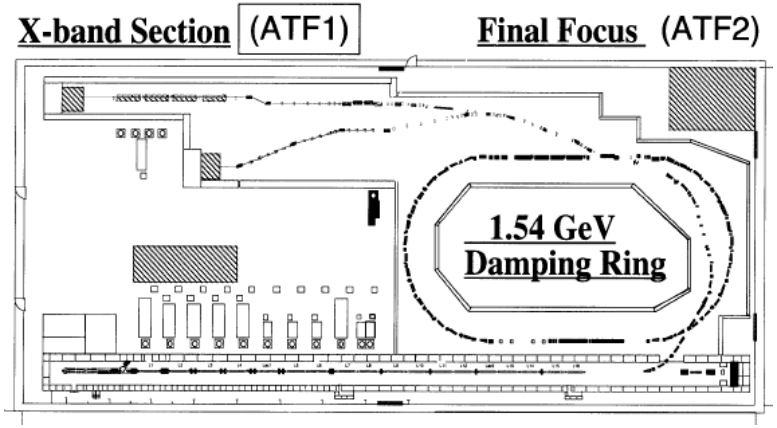
Achieved ~70nm
vertical beam size





ATF2

- The idea of a new test facility at ATF, to prototype the **final focus with local chromatic correction**, was conceived in **2002** at Nanobeam workshop in Lausanne
- Idea evolved, and now being realized in iron and concrete



Early scheme as presented by Junji Urakawa at Nanobeam 2002

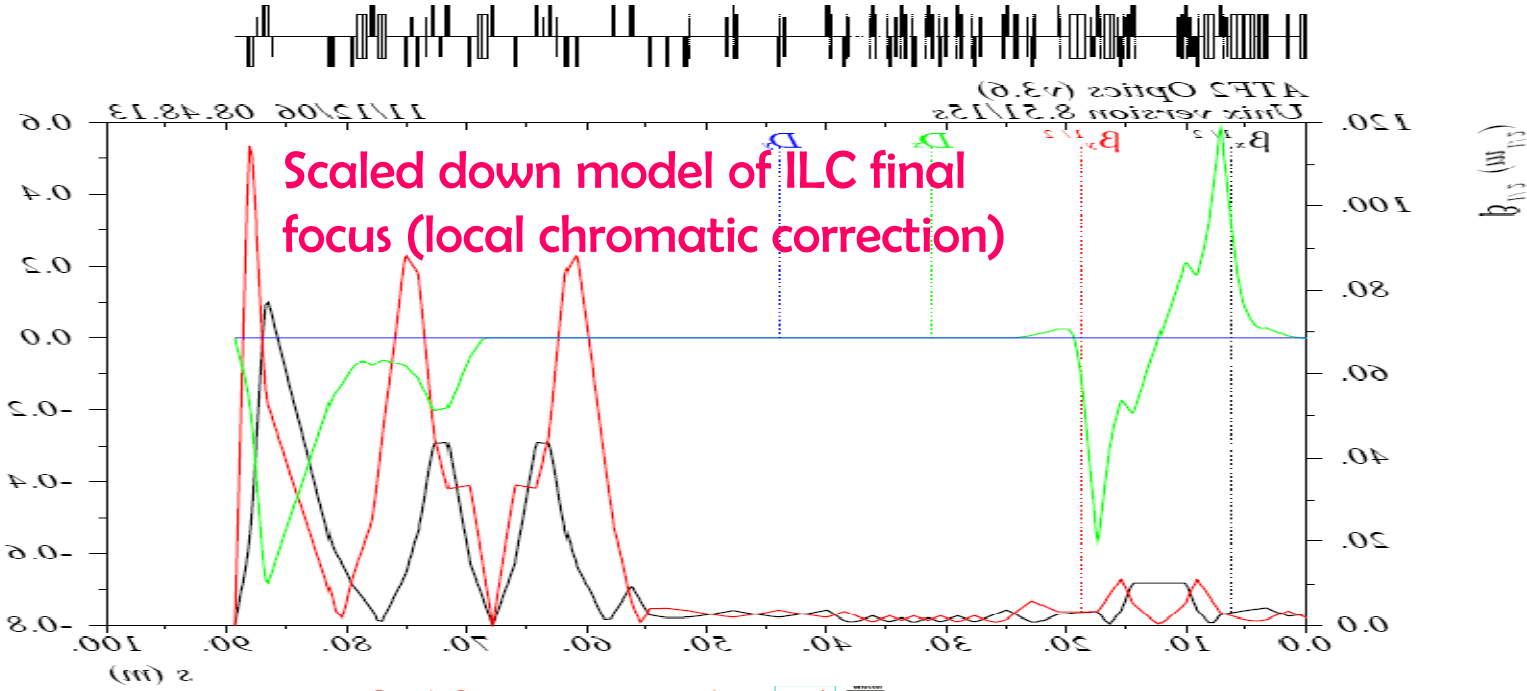
- ATF2 goals
  - prototype ILC Final Focus system
  - develop FF tuning methods, instrumentation (laser wires, fast feedback, submicron resolution BPMs)
  - learn achieving ~35nm size & ~nm stability reliably
  - possibly test ILC Final Doublet prototype with beam
- ATF2 final goal – help to ensure collisions of nanometer beams, i.e. luminosity of ILC

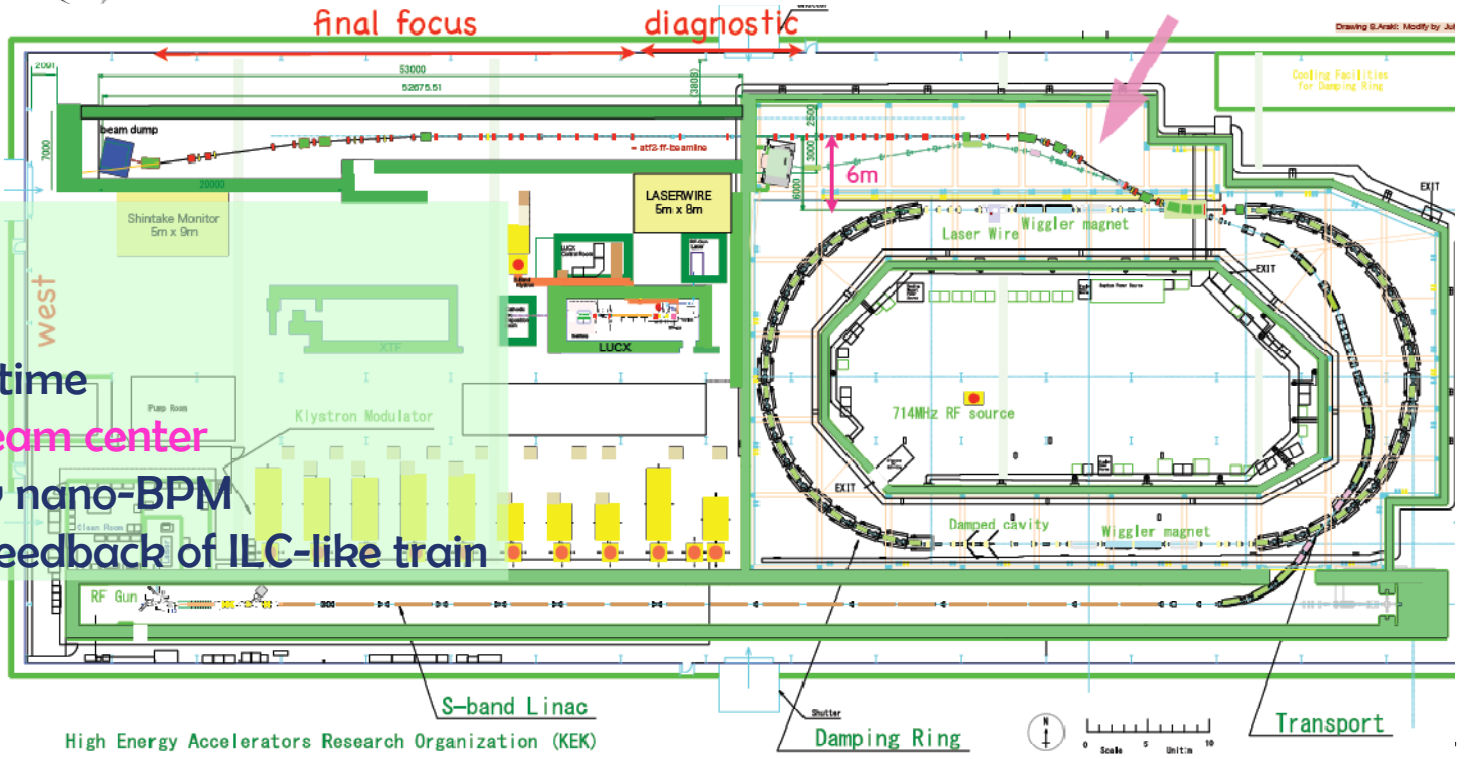
ATF2 major milestones

- September 2002, Nanobeam workshop, Lausanne
  - idea of new Final Focus test facility at ATF
- January 2005, SLAC, first ATF2 workshop
  - compared two optics versions, selected ILC-like design
  - stated the need to document the Proposal
- May 2005, ATF2 mtg at KEK
  - collaboration organization & MOU, task sharing, 1st version of schedule (commissioning start range: 02.2007-02.2008)
- August 2005
  - ATF2 Proposal, Vol.1 (technical description) released
- February 2006, SLAC, 1st ATF2 Project Meeting
  - ATF2 Proposal, Vol.2 (organization, cost & contributions) released
- May 2006, KEK, 2nd ATF2 Project Meeting …
  - detailed design & role sharing
- … May 2008, BINP Novosibirsk, 6th ATF2 Project Meeting
  - Review of construction status and commissioning readiness
- Dec 2008, KEK, 7th ATF2 Project Meeting
  - Focused on review of commissioning readiness, organization & planning

ATF2 Proposal: 110 authors, 25 institutions

ATF2 – model of ILC BDS

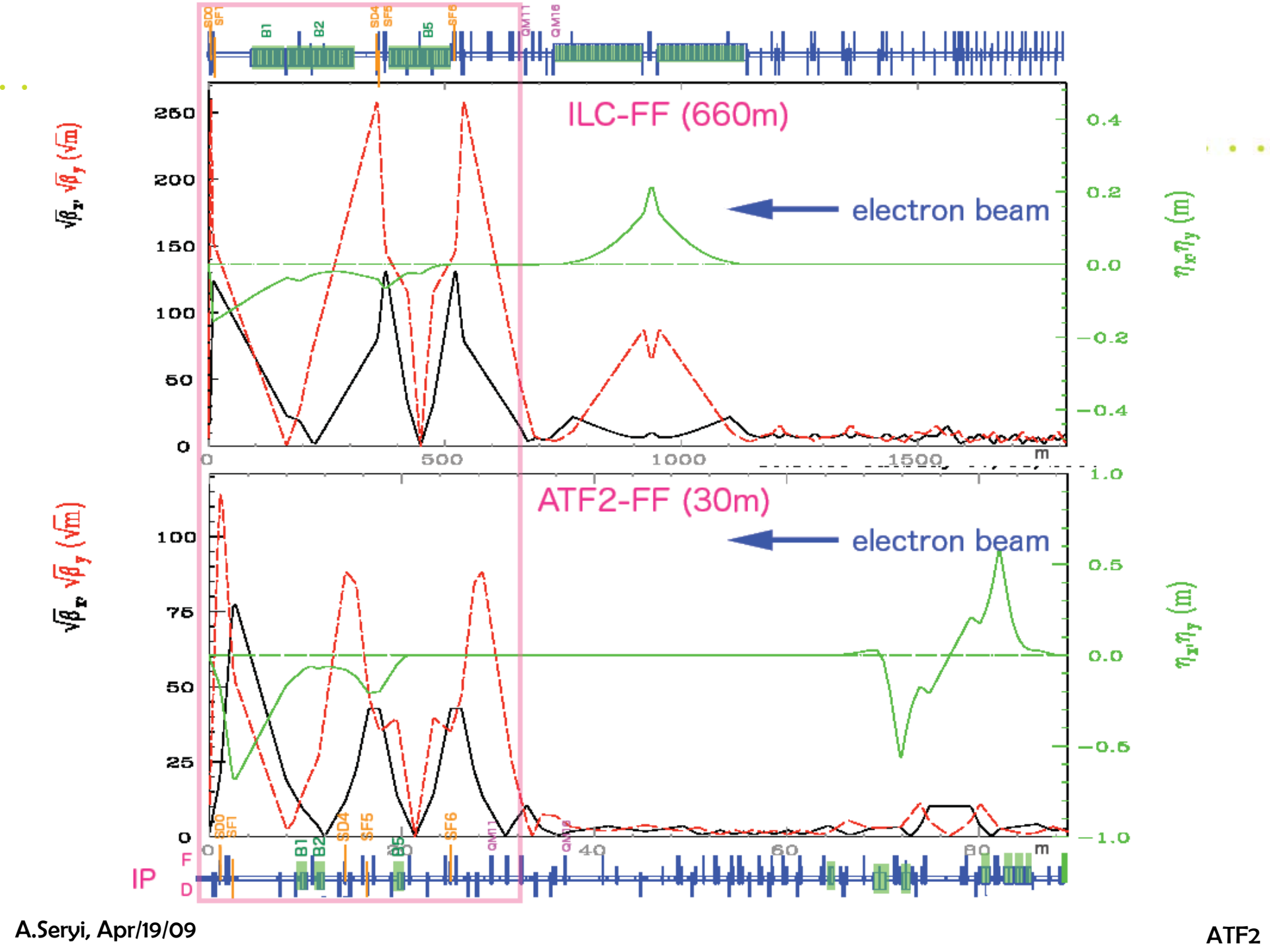




ATF2 goals

(A) Small beam size
Obtain σ_y ~ 35nm
Maintain for long time

(B) Stabilization of beam center
Down to < 2nm by nano-BPM
Bunch-to-bunch feedback of ILC-like train


ILC-FF (660m)
electron beam
ATF2-FF (30m)
electron beam
IP
F
D
m

ATF2 parameters & Goals A/B

Beam parameters achieved at ATF and planned for ATF2, goals A and B. The ring energy is E0 = 1.3 GeV, the typical bunch length and energy spread are σ_z =8 mm and $\Delta E/E$ = 0.08 %.

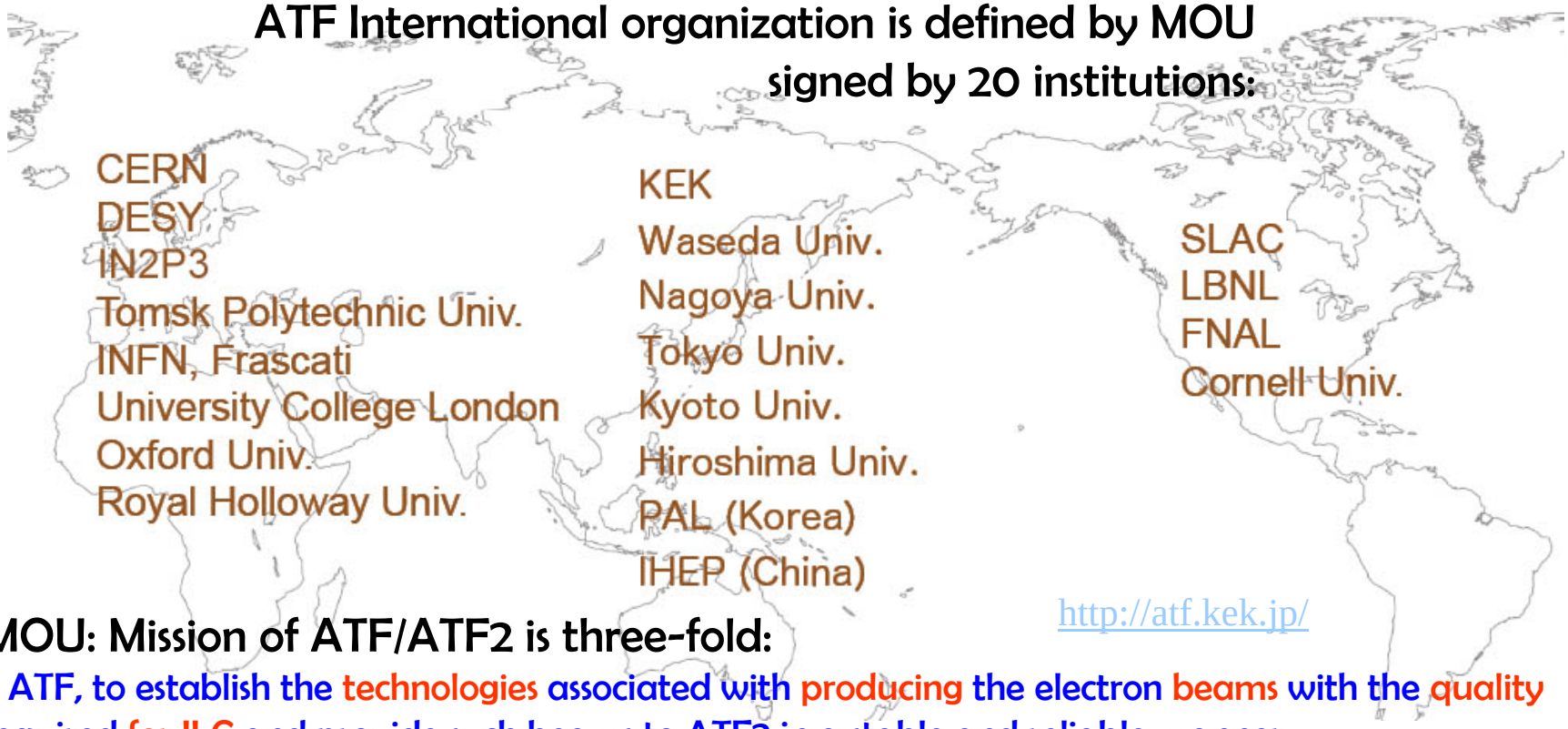
	Measured	(A)	(B)
Single Bunch			
N_{bunch} $[10^{10}]$	0.2 – 1.0	0.5	0.5
DR $\gamma\varepsilon_y$ $[10^{-8}\mathrm{m}]$	1.5	3	3
Extr. $\gamma\varepsilon_y$ $[10^{-8}\mathrm{m}]$	3.0 – 6.5	3	3
Multi Bunch			
$n_{bunches}$	20	1 – 20	3 – 20
N_{bunch} $[10^{10}]$	0.3 – 0.5	0.5	0.5
DR $\gamma\varepsilon_y$ $[10^{-8}\mathrm{m}]$	3.0 – 4.5	3	3
Extr. $\gamma\varepsilon_y$ $[10^{-8}\mathrm{m}]$	~ 6	3	3
IP σ_y^* [nm]		37	37
IP $\Delta y/\sigma_y^*$ [%]		30	5

ATF2 proposed IP parameters compared with ILC

Parameters	ATF2	ILC
Beam Energy [GeV]	1.3	250
L* [m]	1	3.5 – 4.2
$\gamma\,\epsilon_x$ [m-rad]	3×10^{-6}	1×10^{-5}
$\gamma\,\epsilon_y$ [m-rad]	3×10^{-8}	4×10^{-8}
β_x^* [mm]	4.0	21
β_y^* [mm]	0.1	0.4
η' (DDX) [rad]	0.14	0.094
σ_E [%]	~0.1	~0.1
Chromaticity W_y	$\sim 10^4$	$\sim 10^4$

ATF International Collaboration

ATF International organization is defined by MOU signed by 20 institutions:



http://atf.kek.jp/

MOU: Mission of ATF/ATF2 is three-fold:

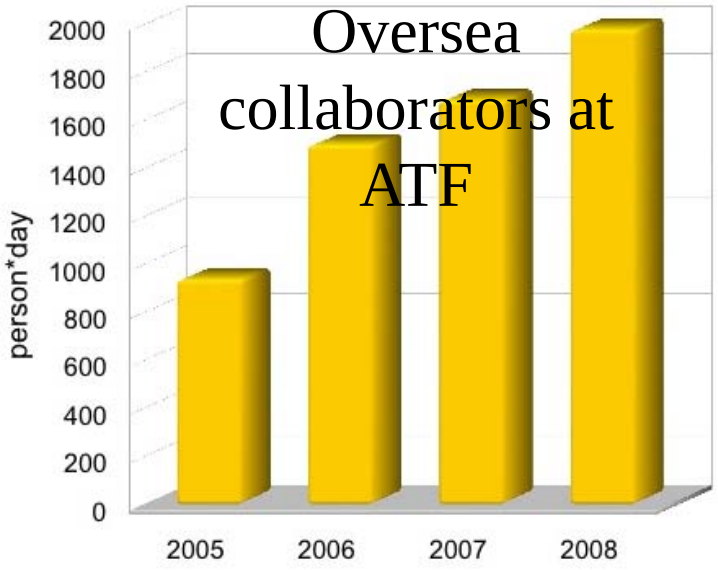
- ATF, to establish the technologies associated with producing the electron beams with the quality required for ILC and provide such beams to ATF2 in a stable and reliable manner.
- ATF2, to use the beams extracted from ATF at a test final focus beamline which is similar to what is envisaged at ILC. The goal is to demonstrate the beam focusing technologies that are consistent with ILC requirements. For this purpose, ATF2 aims to focus the beam down to a few tens of nm (rms) with a beam centroid stability within a few nm for a prolonged period of time.
- Both the ATF and ATF2, to serve the mission of providing the young scientists and engineers with training opportunities of participating in R&D programs for advanced accelerator technologies.

ATF International Collaboration

CERN
DESY
IN2P3
Tomsk Polytechnic Univ.
INFN, Frascati
University College London
Oxford Univ.
Royal Holloway Univ.

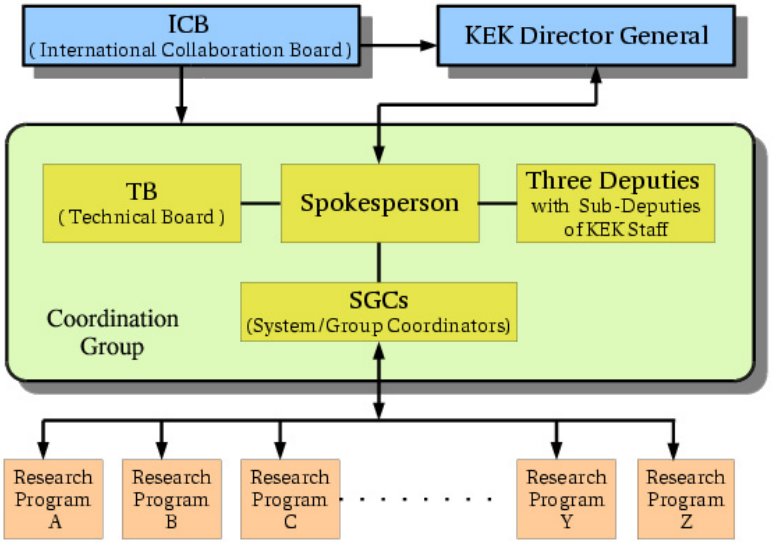
KEK
Waseda Univ.
Nagoya Univ.
Tokyo Univ.
Kyoto Univ.
Hiroshima Univ.
PAL (Korea)
IHEP (C...

SLAC
LBNL
FNAL
Cornell Univ.



ATF2 project meeting, 15-18 December 2008, KEK

ATF International Collaboration



ICB: decision making body for executive matters related to the ATF collaboration (chair: Ewan Paterson, SLAC)

Spokesperson: direct and coordinate the work required at ATF/ATF2 in accordance with the ATF Annual Activity Plan, report the progress to ICB and the progress and the matters related to KEK budget to director of KEK (Junji Urakawa, KEK)

TB: assist the Spokesperson in formulating the ATF Annual Activity Plan, including the budget and beamtime allocation and assist the ICB in assessing the scientific progress (co-chairs: A.Wolski, CI, E.Elsen, DESY)

A.Seryi, Apr/19/09

Three Spokesperson's Deputies with for areas of:

- Beam operation:

Shigeru Kuroda KEK

- Hardware maintenance:

Nobuhiro Terunuma KEK

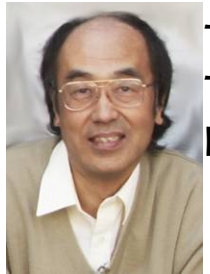
- Design, construction & commissioning of ATF2:

Andrei Seryi SLAC

Sub-Deputies at KEK:

Toshiyuki Okugi KEK

Takashi Naito KEK

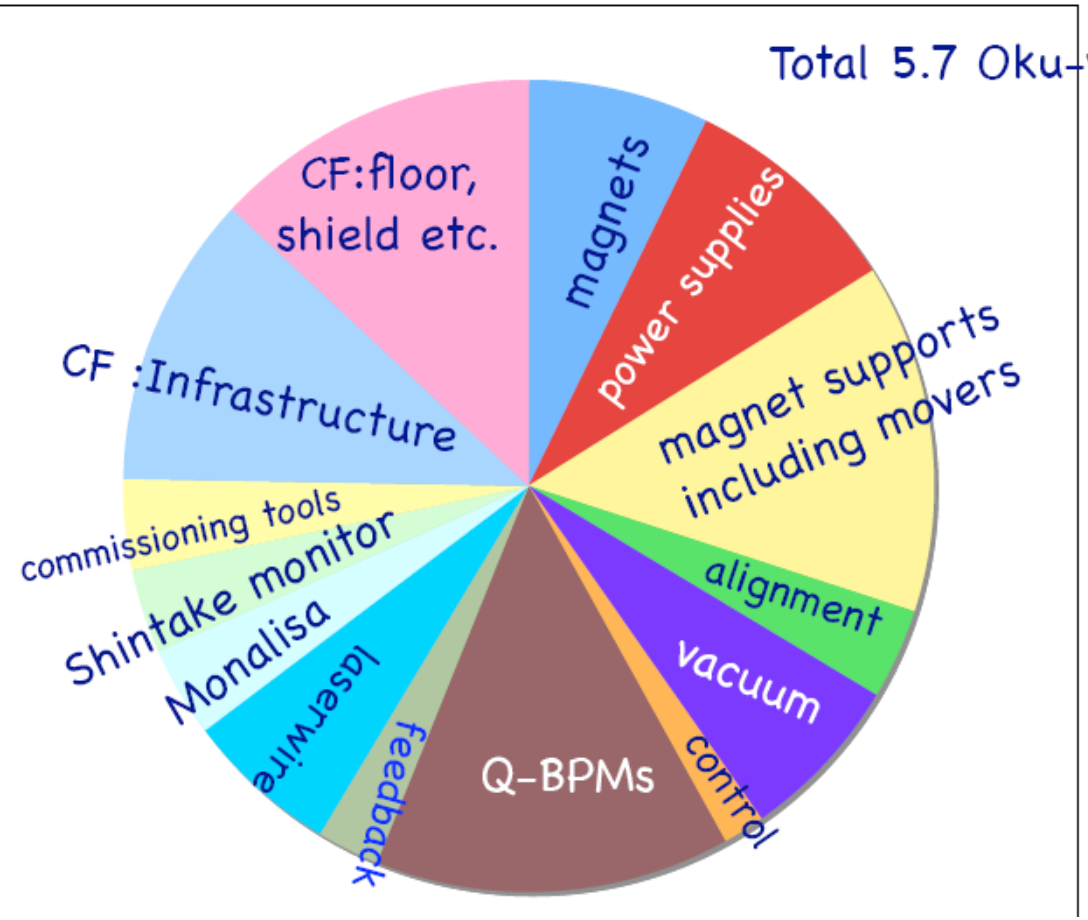


Toshiaki Tauchi KEK

Philip Bambade LAL/KEK acting, pending ICB approval

ATF2 cost

Cost Breakup, 21 Dec.07



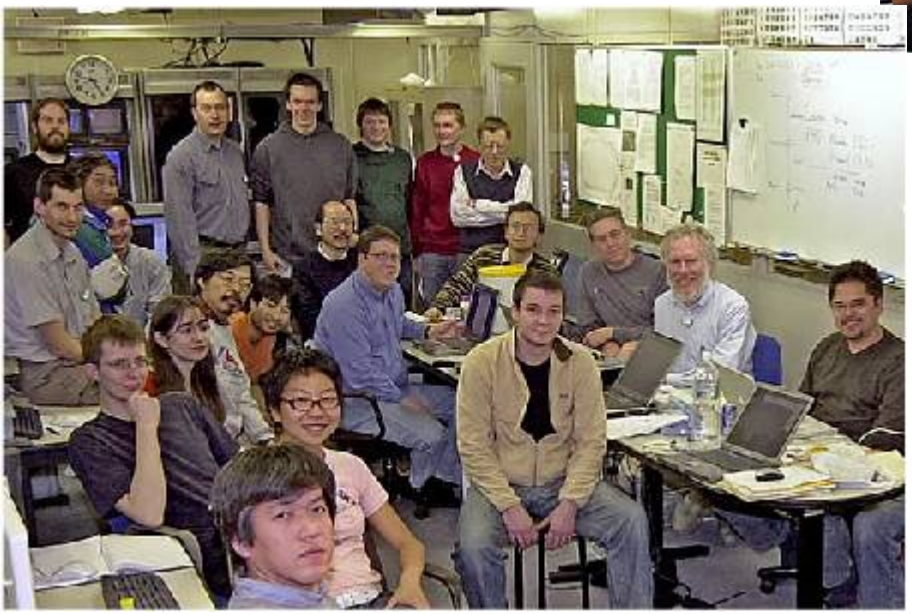
Cost distribution of the components normalized by the total cost, where the in-kind ones are also included

Cost as seen at the end of 2005 (from ATF2 Proposal, Volume 2) was 5.2 Oku-yen

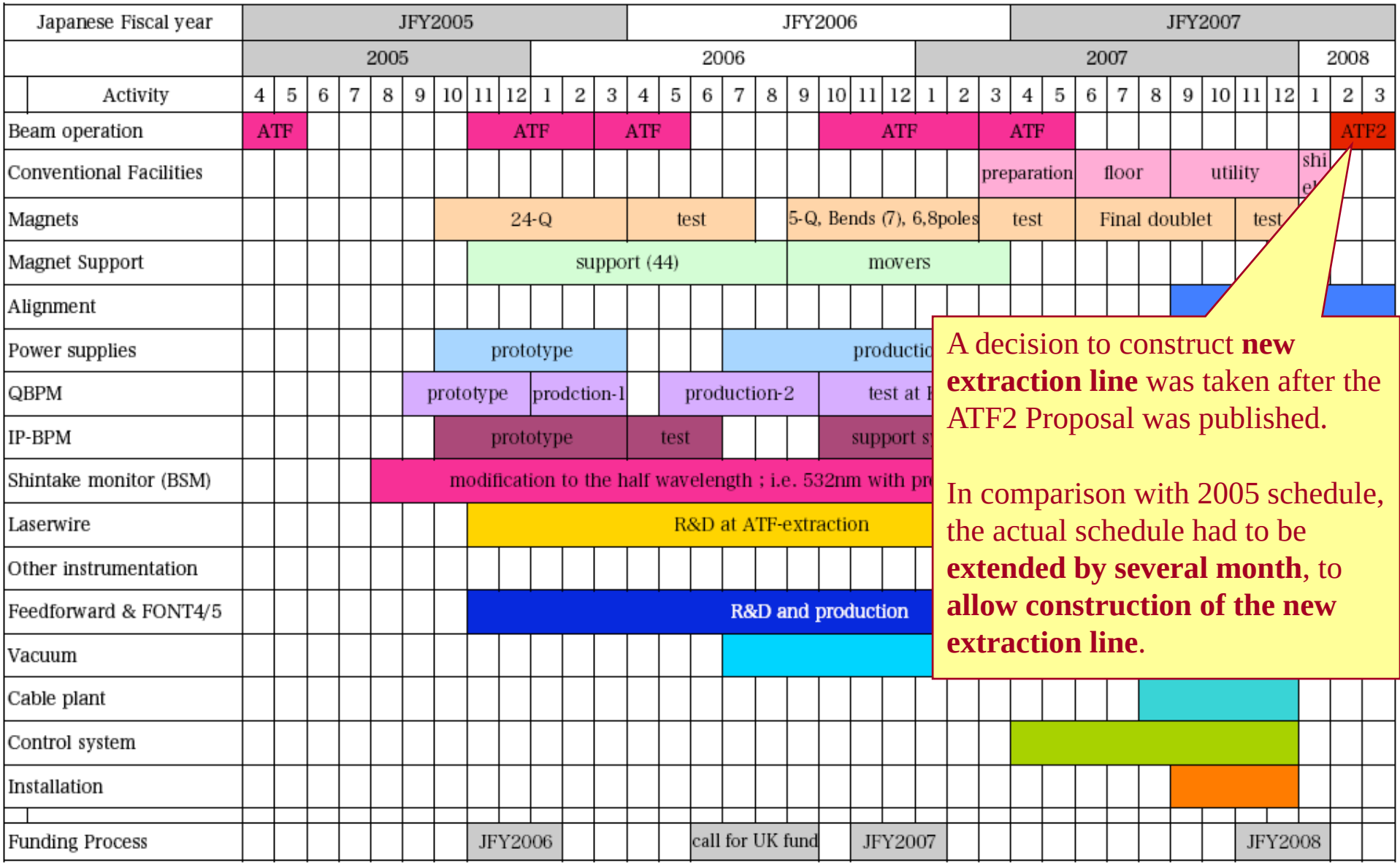
The 2007 cost is ~5.7Oku-yen, partly due to increased scope (additional devices & new Extraction line)

ATF collaboration & ATF2 facility

- ATF2 will prototype FF,
- help development tuning methods, instrumentation (laser wires, fast feedback, submicron resolution BPMs),
- help to learn achieving small size & stability reliably,
- potentially able to test stability of FD magnetic center.



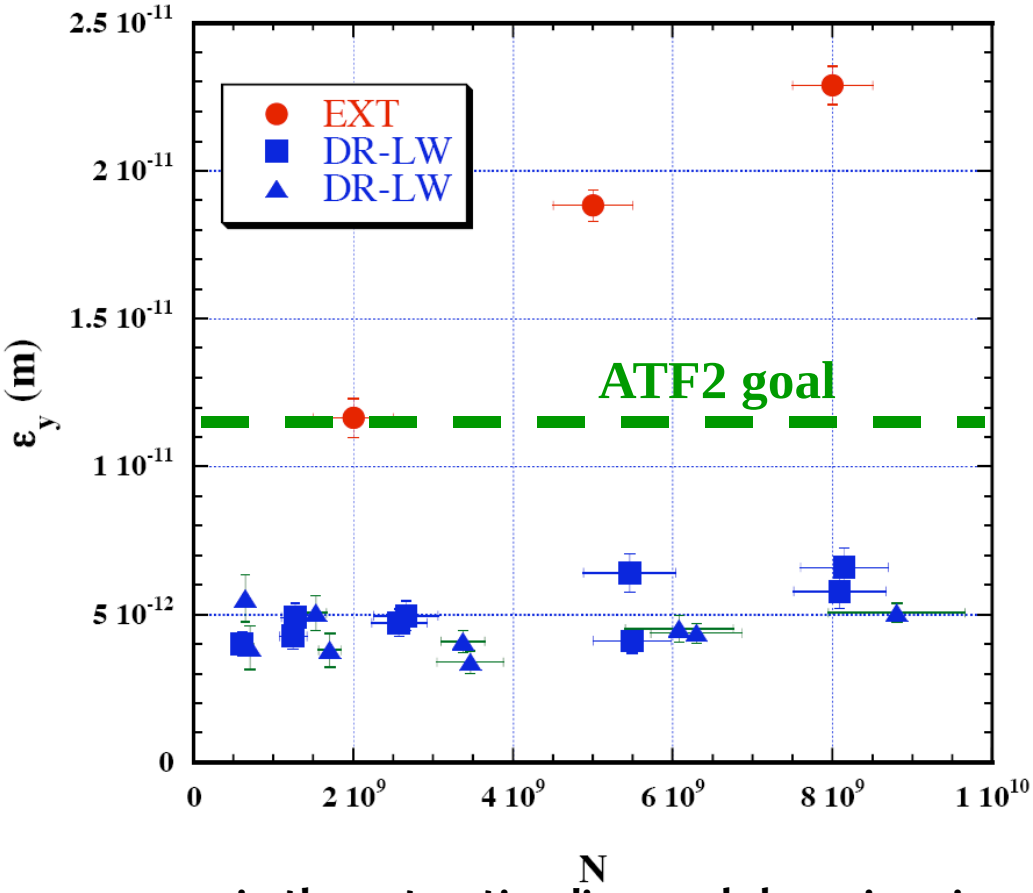
- ATF2 is one of central elements of BDS EDR work, as it will address a large fraction of BDS technical cost risk.
- **Constructed as ILC model, with in-kind contribution from partners and host country providing civil construction**
- ATF2 commissioning will start in Autumn of 2008



Outline of ATF2 schedule, as seen at end of 2005 (from ATF2 Proposal, Volume 2)

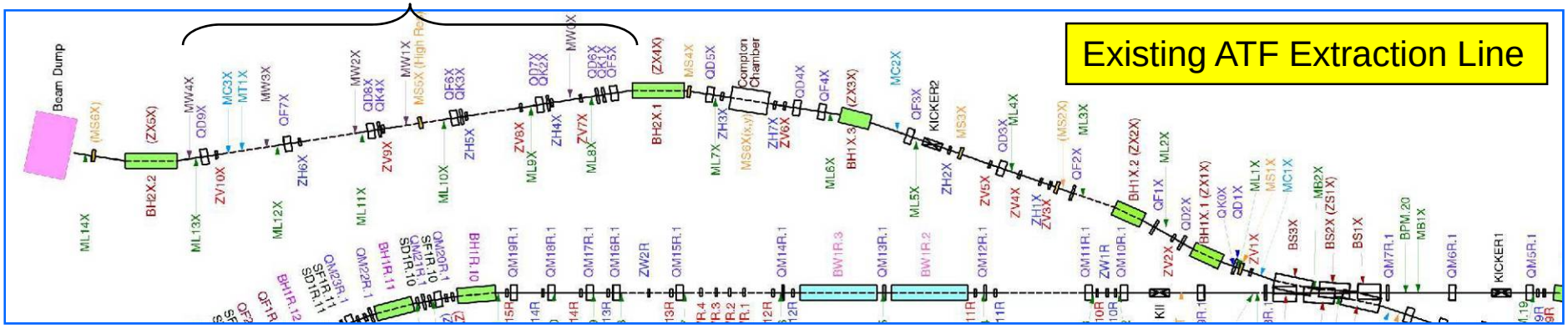
Extraction line

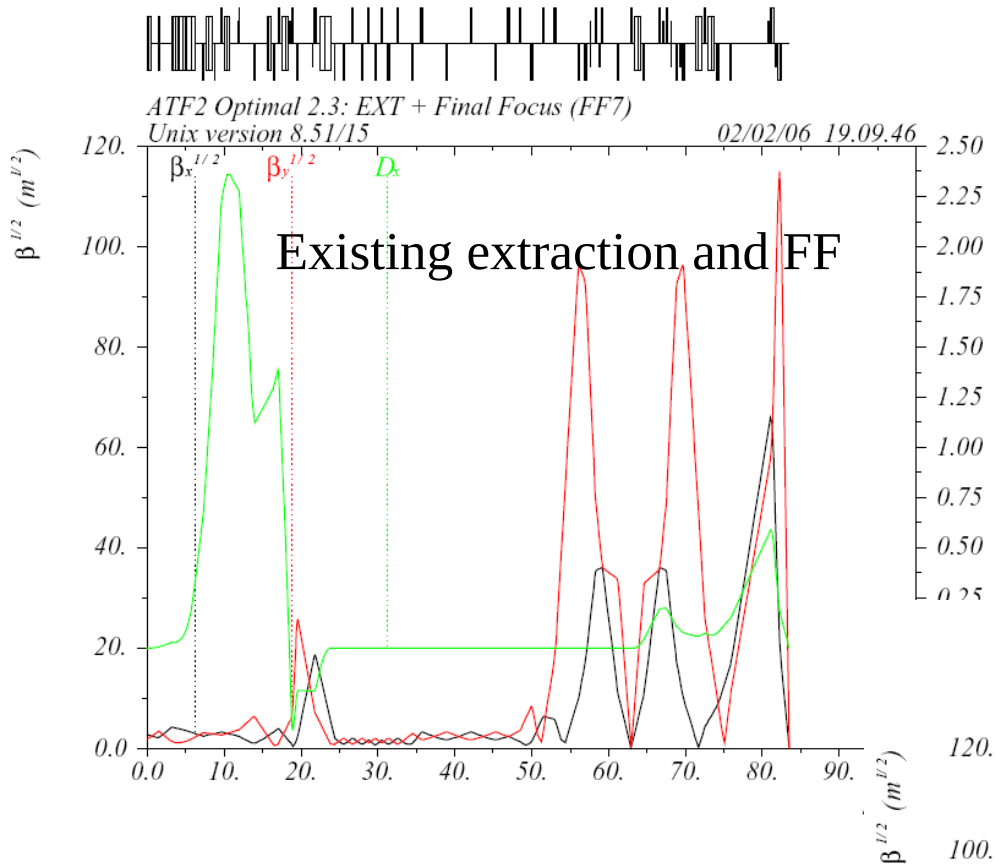
- Optics of existing extraction line not suitable for beam diagnostics and coupling correction
- Large dispersion (~2m) is one of the sources of ε growth
- It was redesigned and has been rebuilt

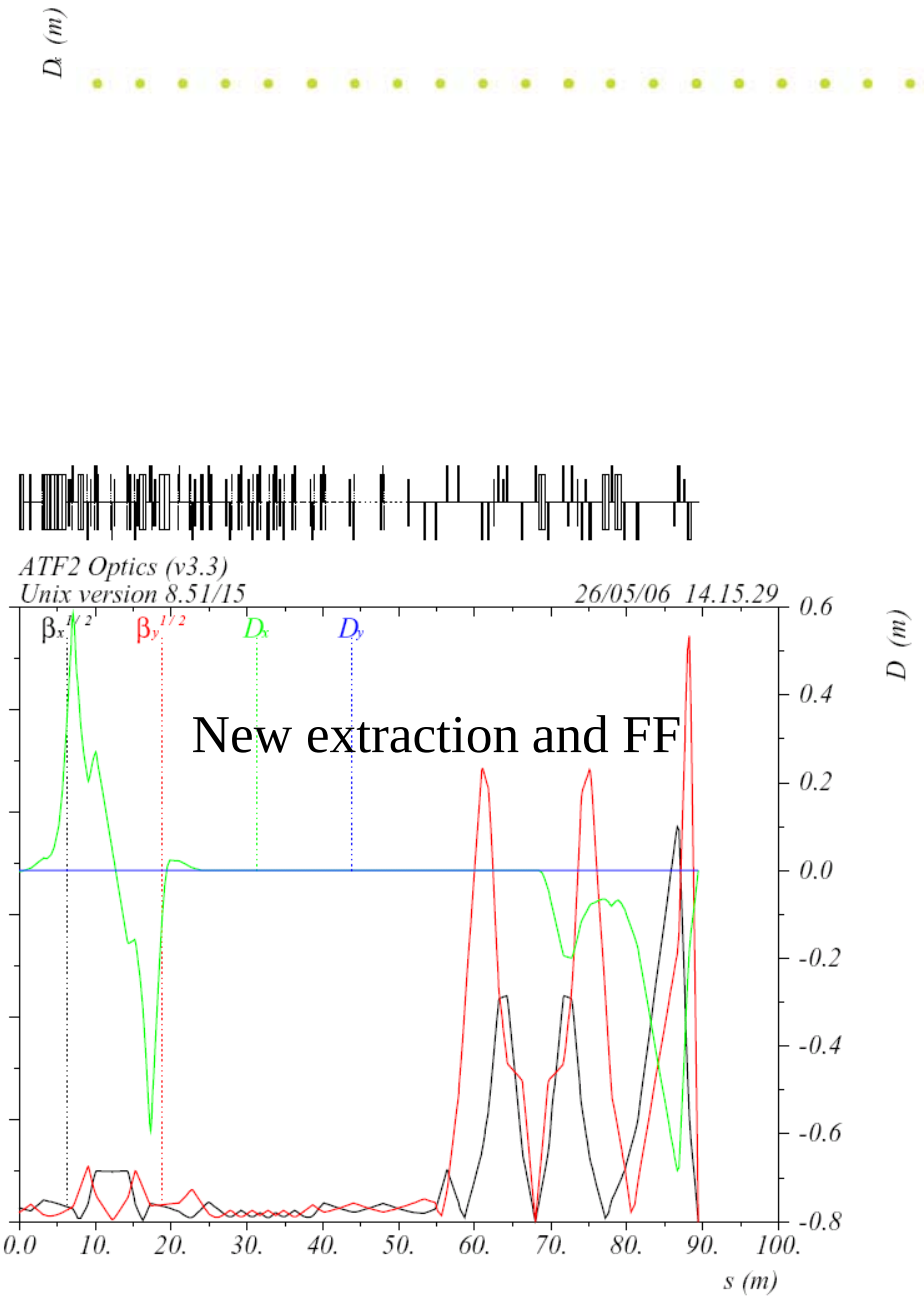


ε_y in the extraction line and damping ring

Coupling Correction / Emittance Diagnostics



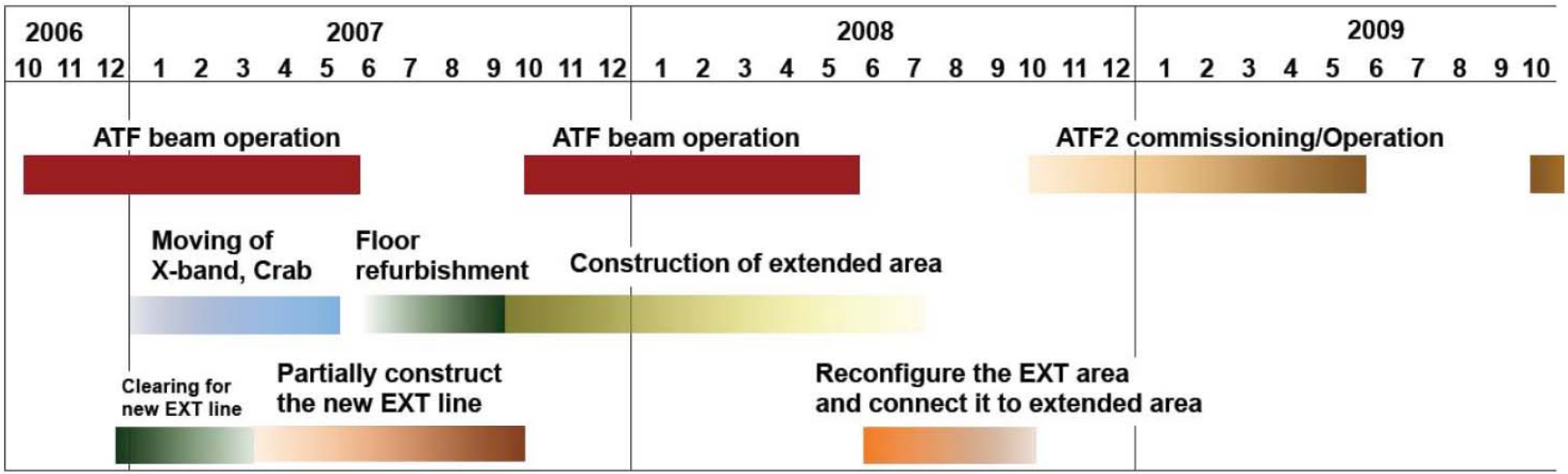




New Extraction:
Reduced dispersion from
2.5m to 0.6m

A.Seryi, Apr/19/09

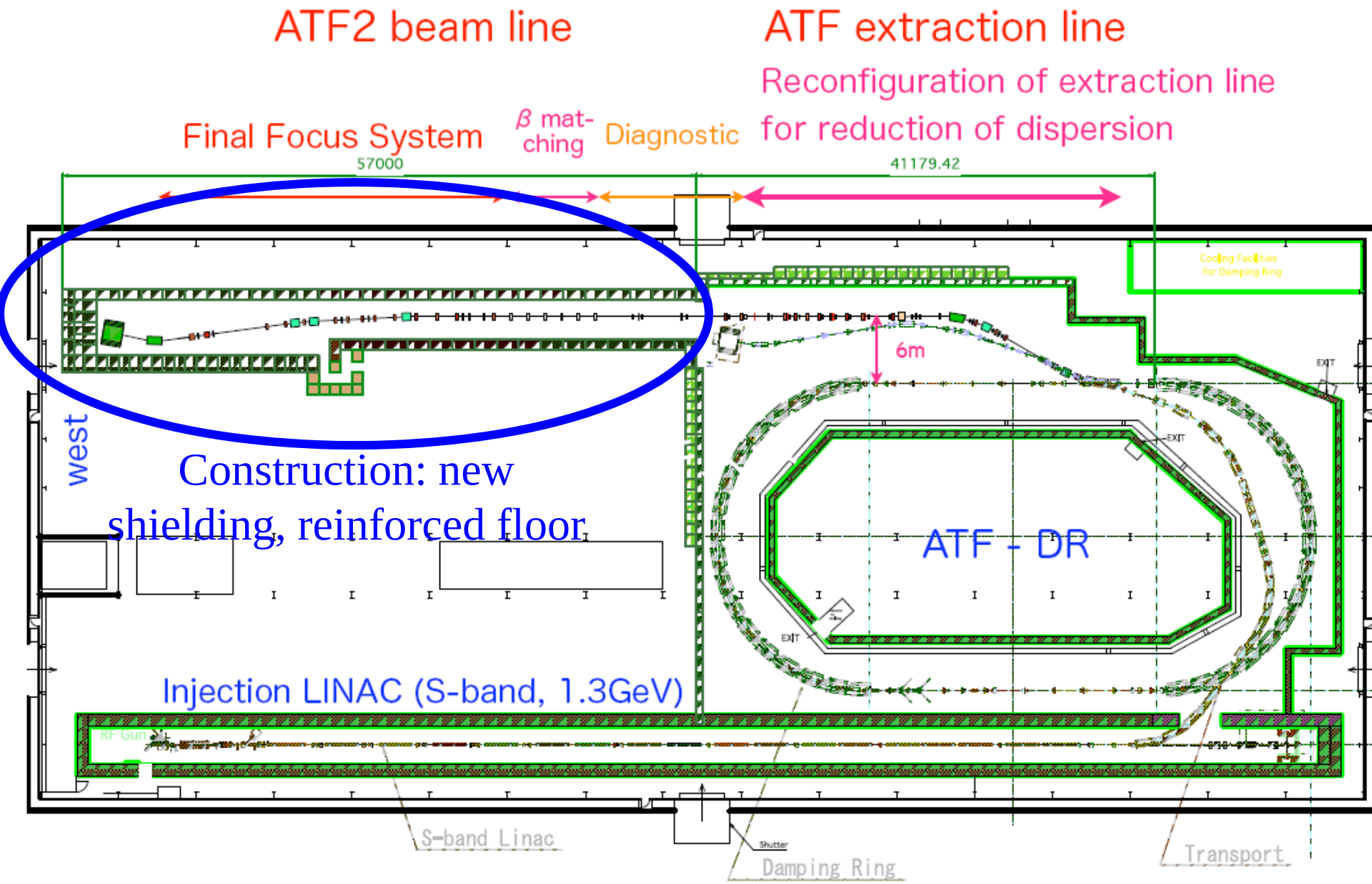
ATF2 schedule



- **Construction of the extended shield area for final focus system can be done during the ATF beam operation.**
- Partial construction beside the current EXT line in shutdown week will release the work load for reconfiguration of the EXT line in summer of 2008.
- **ATF2 beam will come in October, 2008.**

This slide was shown in this way ~2 years ago. The beam came in December 2008.

Layout & civil construction



ATF2 construction in 2007

August – December

"Assembly hall" before construction

"Assembly hall" emptied for construction

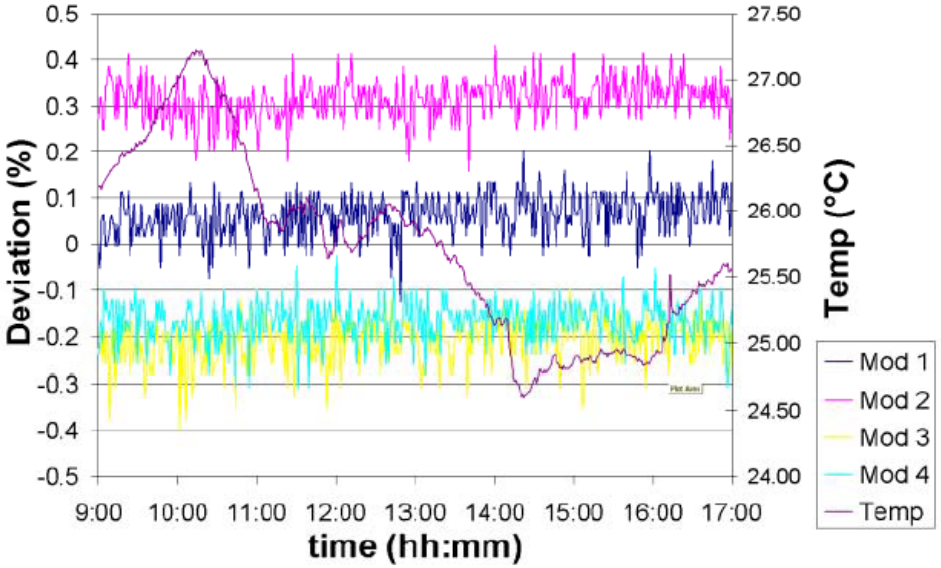
Photos:
Nobu Toge

Construction of reinforced floor

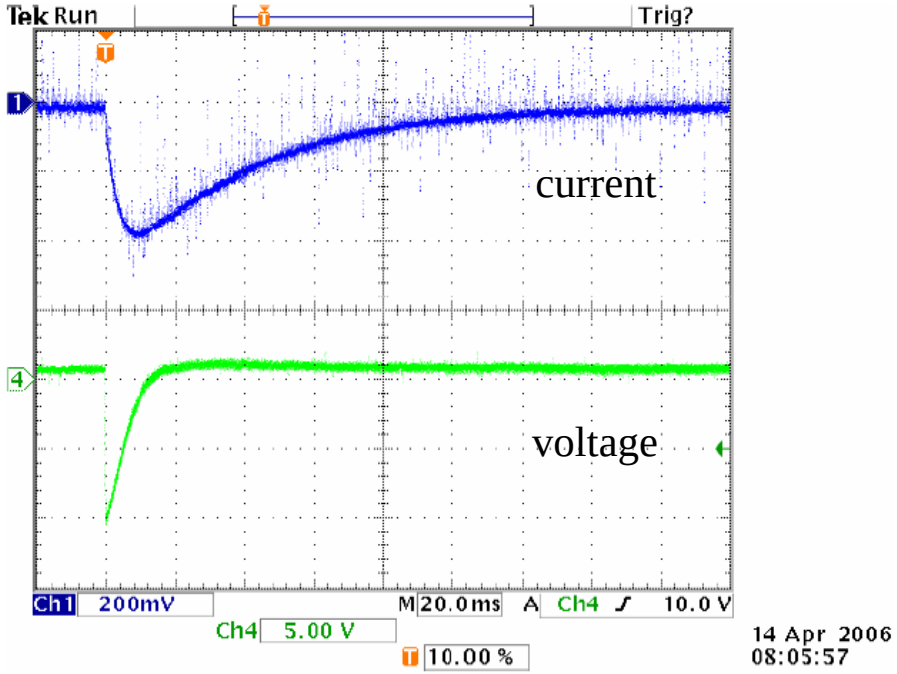
Construction of shielding

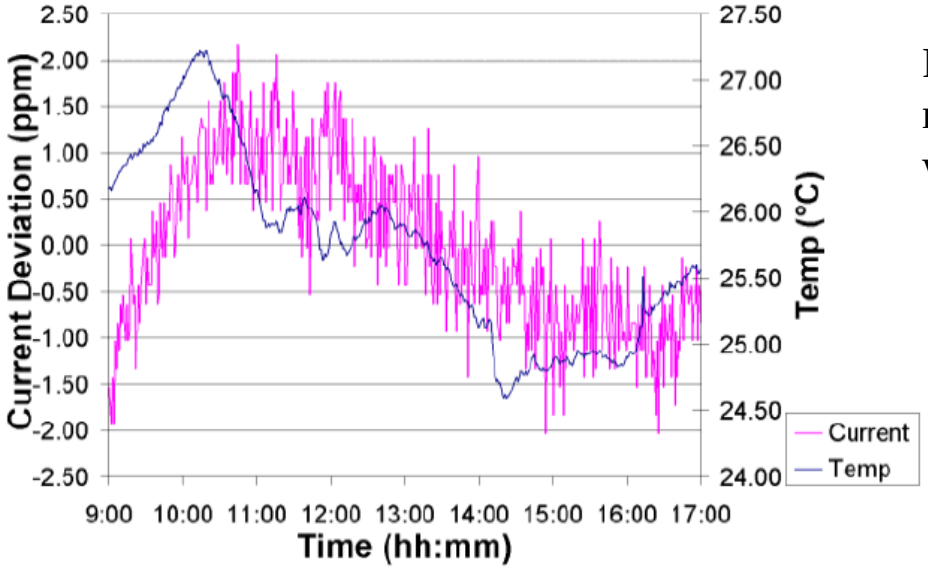
Power Supplies and Magnet system

High Availability Power Supplies installed, connected and tested at ATF2



Current Sharing Deviation of 3 out of 4 module

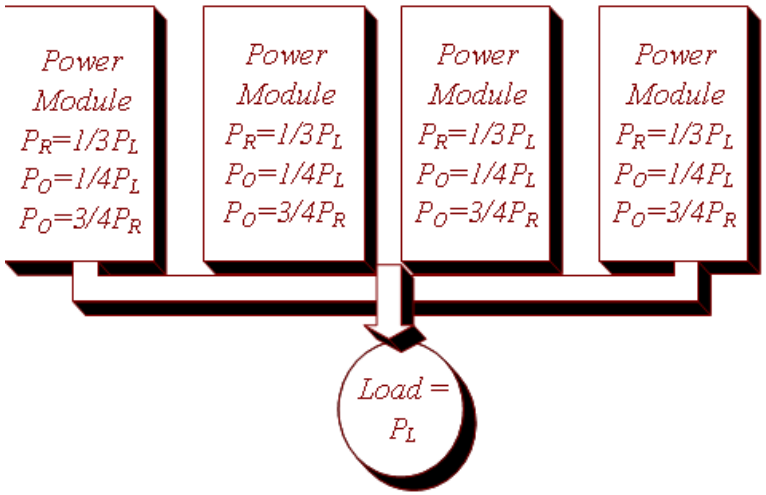


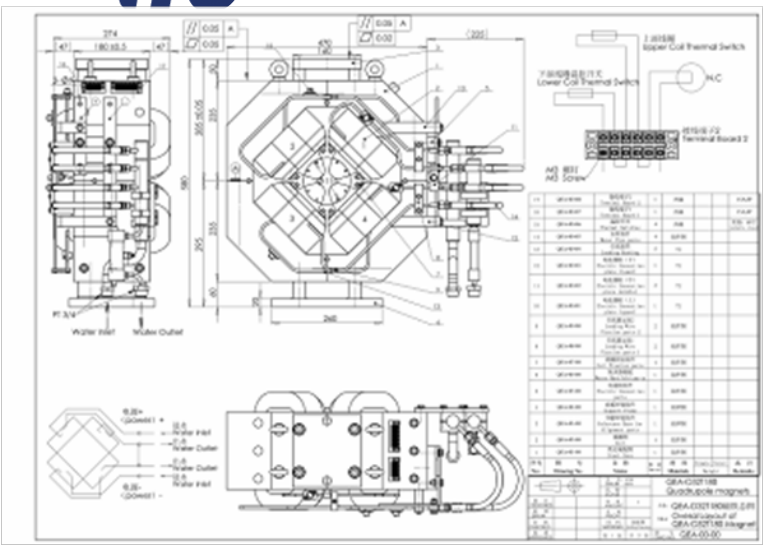


Current Stability and Temperature

Recovery of current during stimulated failure of one module. Current drops by 6 A (from 150A) and recovers within 200 ms with no overshoot.

3 out of 4 power supply configuration

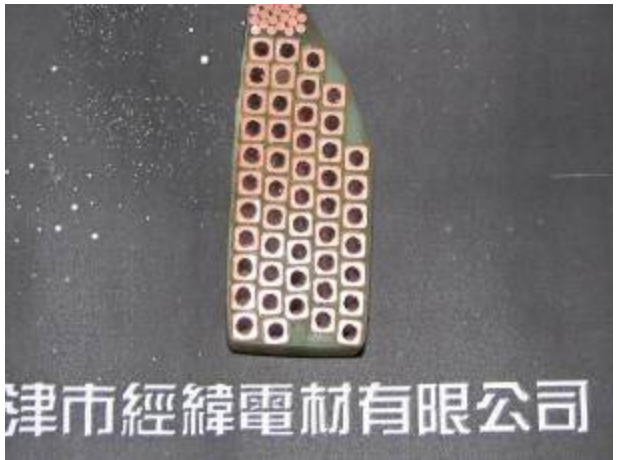


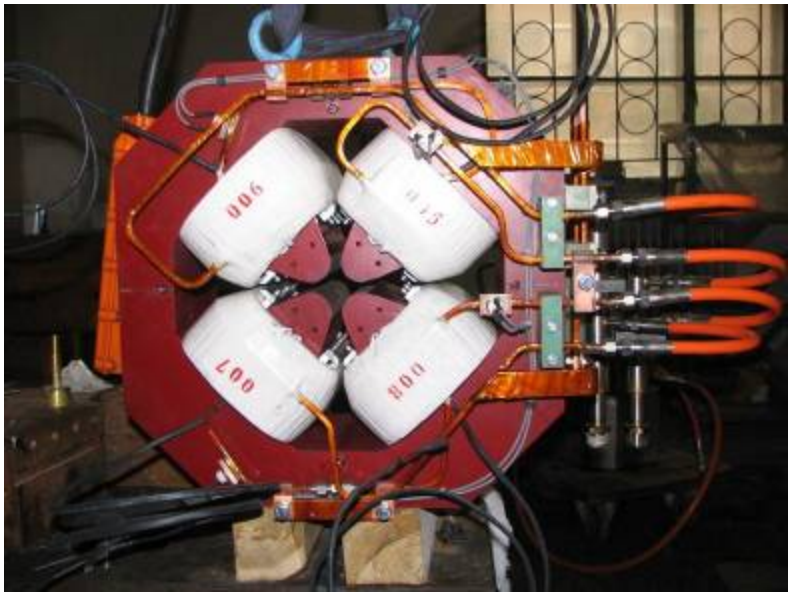


C.Spencer (SLAC) at IHEP, Beijing Dec 2005

Beamline quads: SLAC / IHEP / KEK design, QC / production, measurements / measurements & installation

A.Seryi, Apr/19/09





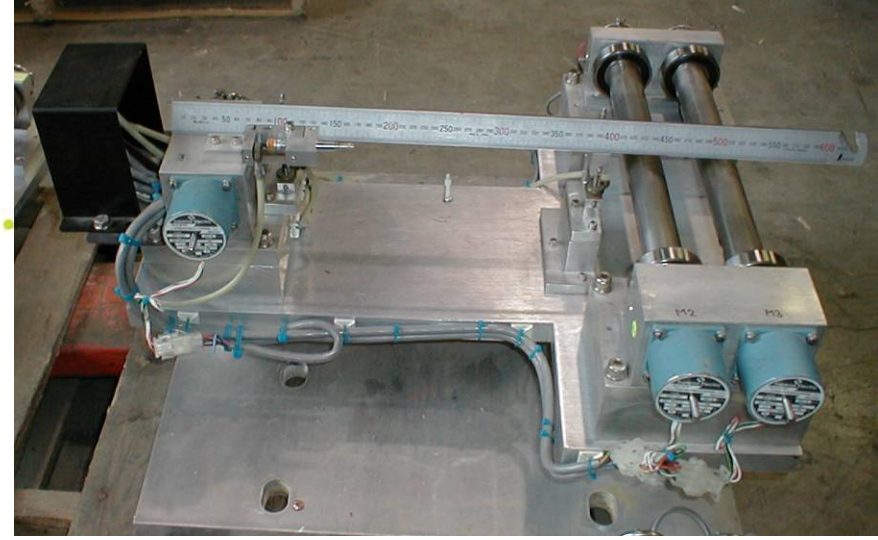
First ATF2 quad, Jan 2006

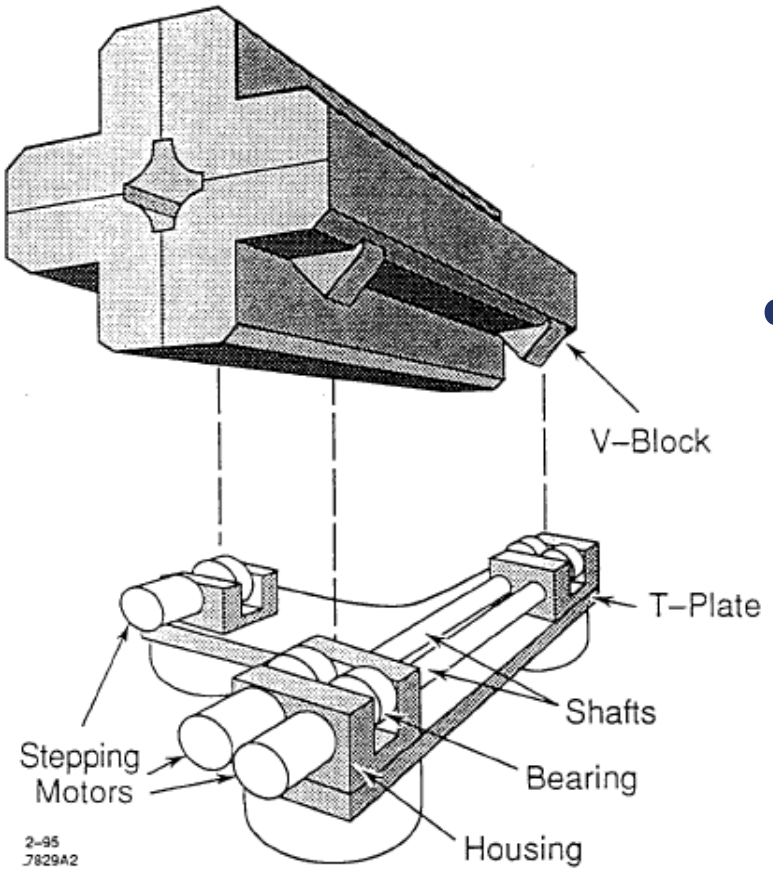
ATF2 construction – January 2008

The last regular quadrupole is going to the destination

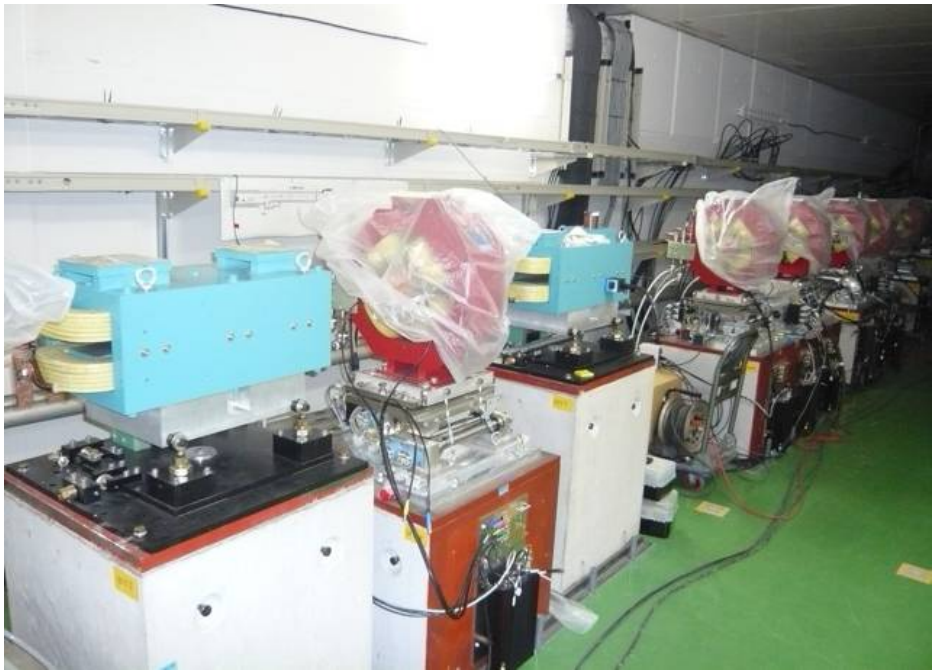
~20 sets of supports, movers & quads were installed in January. R.Sugahara et al

Beamline movers



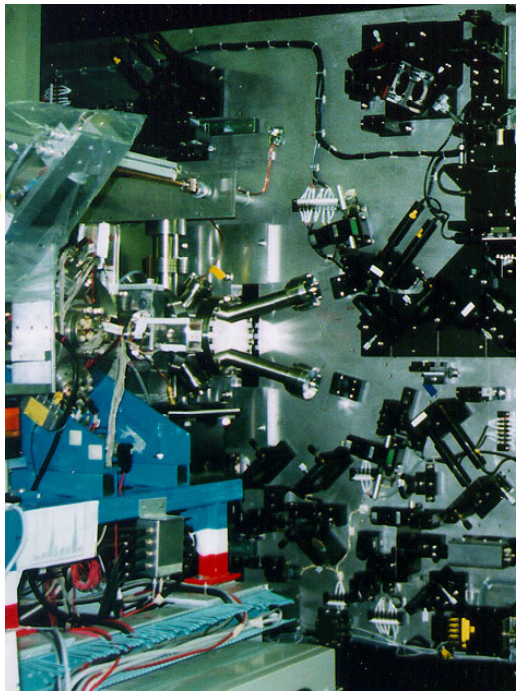


- FFTB cam movers were refurbished and used for all and magnets of ATF2 (except bends)

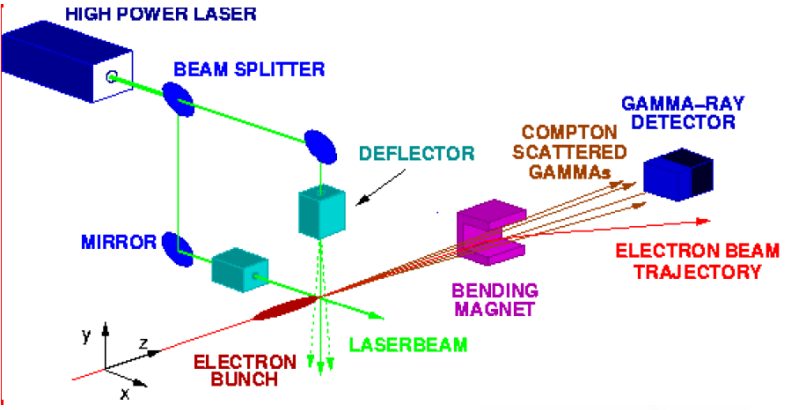


Advanced beam instrumentation at ATF2

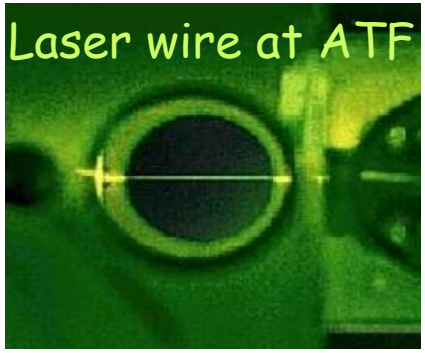
- BSM to confirm 35nm beam size
- nano-BPM at IP to see the nm stability
- Laser-wire to tune the beam
- Cavity BPMs to measure the orbit
- Movers, active stabilization, alignment system
- Intratrain feedback, Kickers to produce ILC-like train

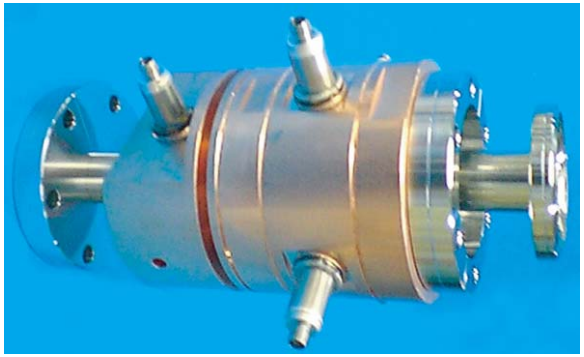


IP Beam-size monitor (BSM) (Tokyo U./KEK, SLAC, UK)

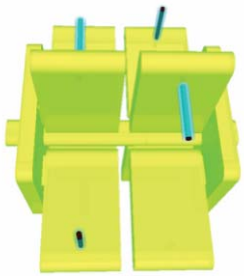


Laser-wire beam-size Monitor (UK group)





C & S band Cavity BPMs, for use with Q/S magnets with 100nm resolution (PAL, SLAC, KEK)



Cavity BPMs with 2nm resolution, for use at the IP (KEK)

Magnets and Instrumentation at ATF2

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

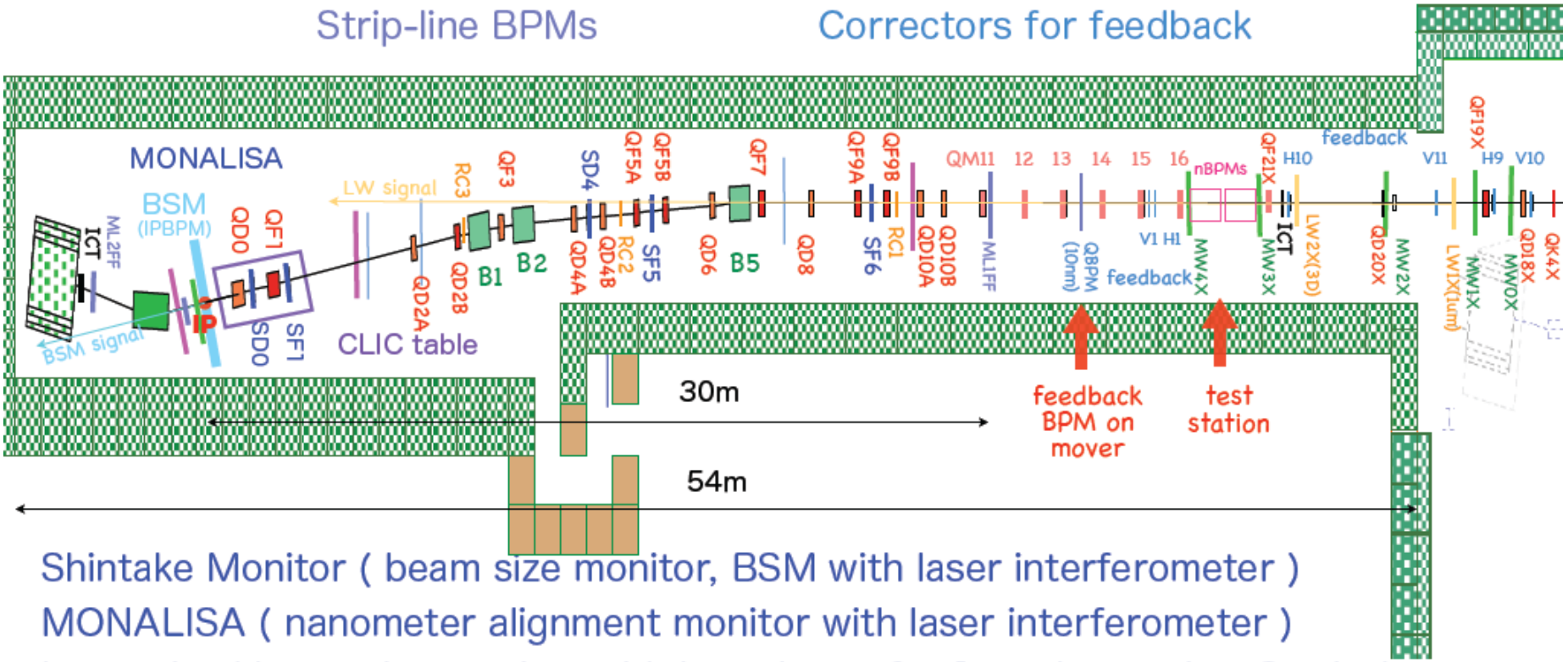
All Q- and S-magnets have cavity-type beam position monitors(QBPM, 100nm)

3 Screen Monitors

5 Wire Scanners, Laserwires

Strip-line BPMs

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 1μm beam size, 3 axies)

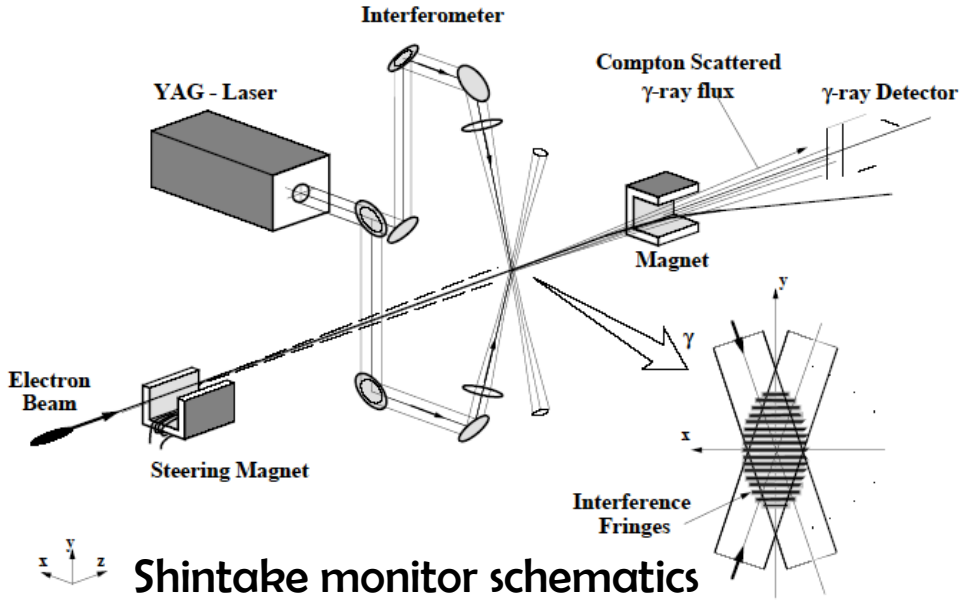
IP intra-train feedback system with latency of less than 150ns (FONT)

Magnet movers for Beam Based Alignment (BBA)

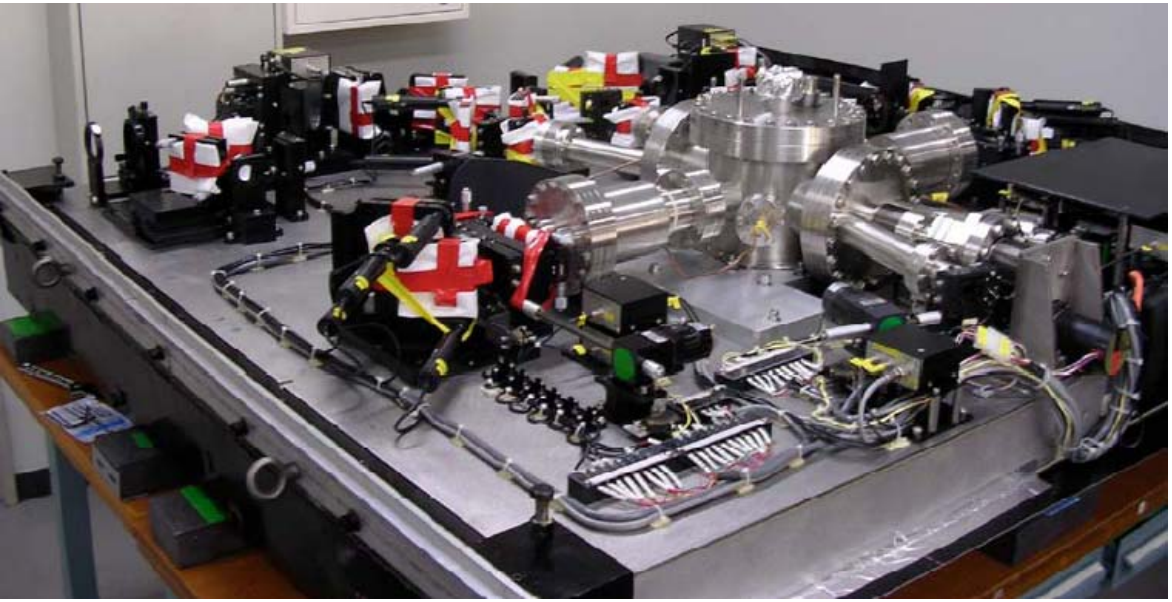
High Available Power Supply (HA-PS) system for magnets

IP Beam Size monitor

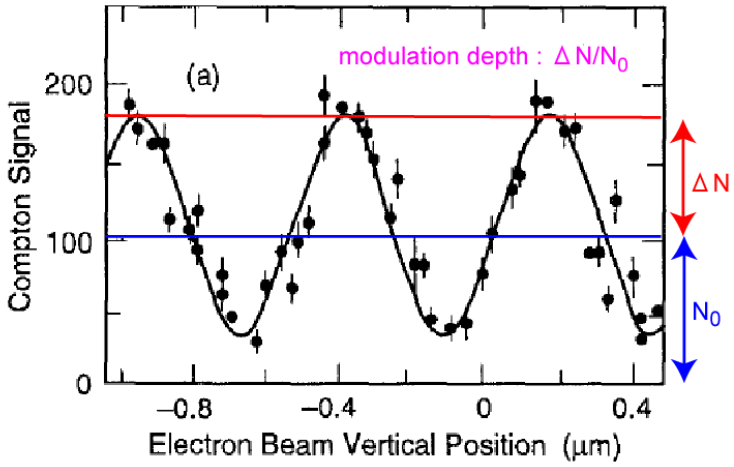
- Initial plan:
  - refurbish & improve FFTB Shintake BSM
  - 1064nm=>532nm



Shintake monitor schematics



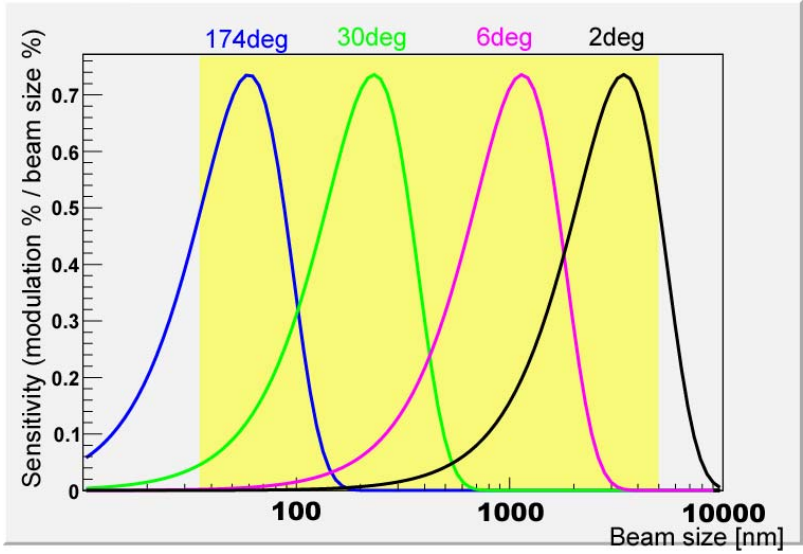
Jul 2005: BSM arrived to Univ. of Tokyo

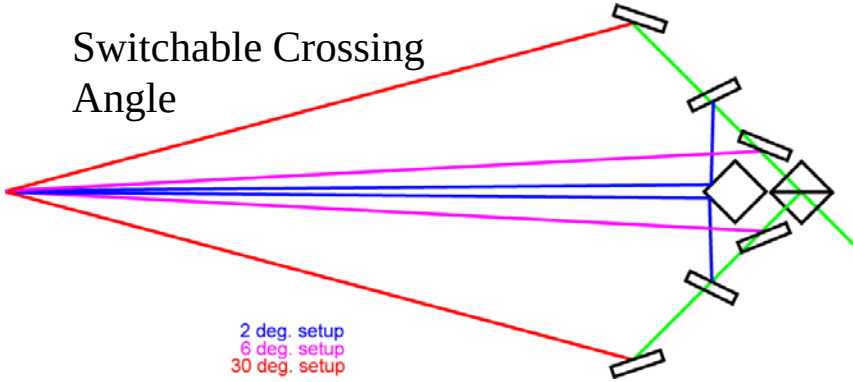


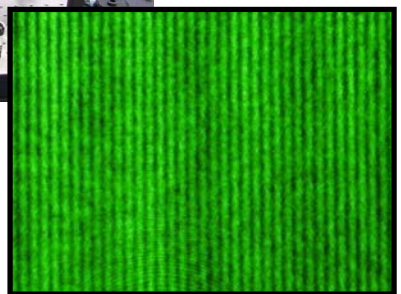
FFTB sample : σ_y = 70 nm

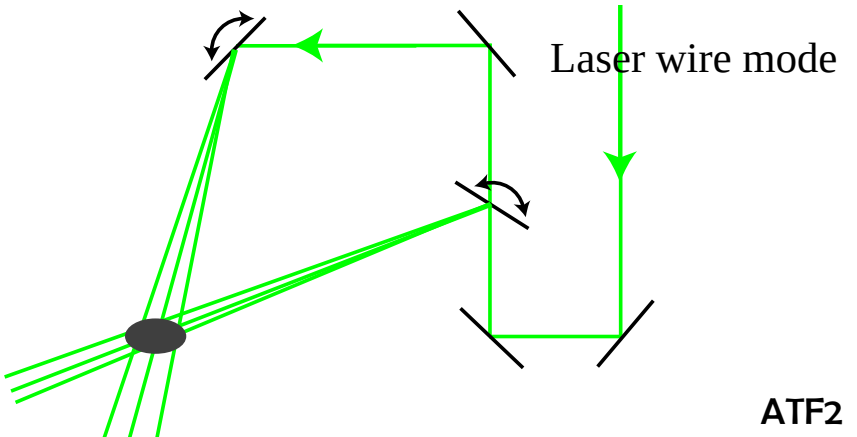
BSM in Tokyo Univ.

- New optical table & laser
- New crossing angles for wider range
  - σ_y: 37nm up to a few μm
- sx measurement by laser wire
  - σ_x design beam size is 2.8μm, too large for interferometer => laser wire mode

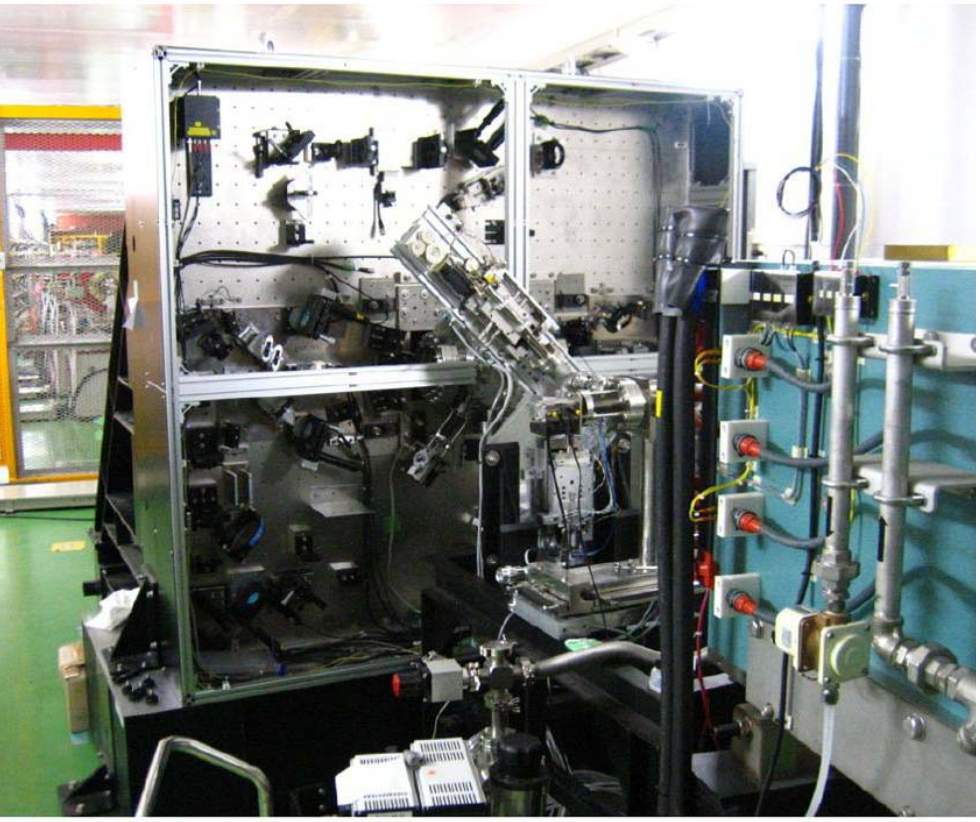


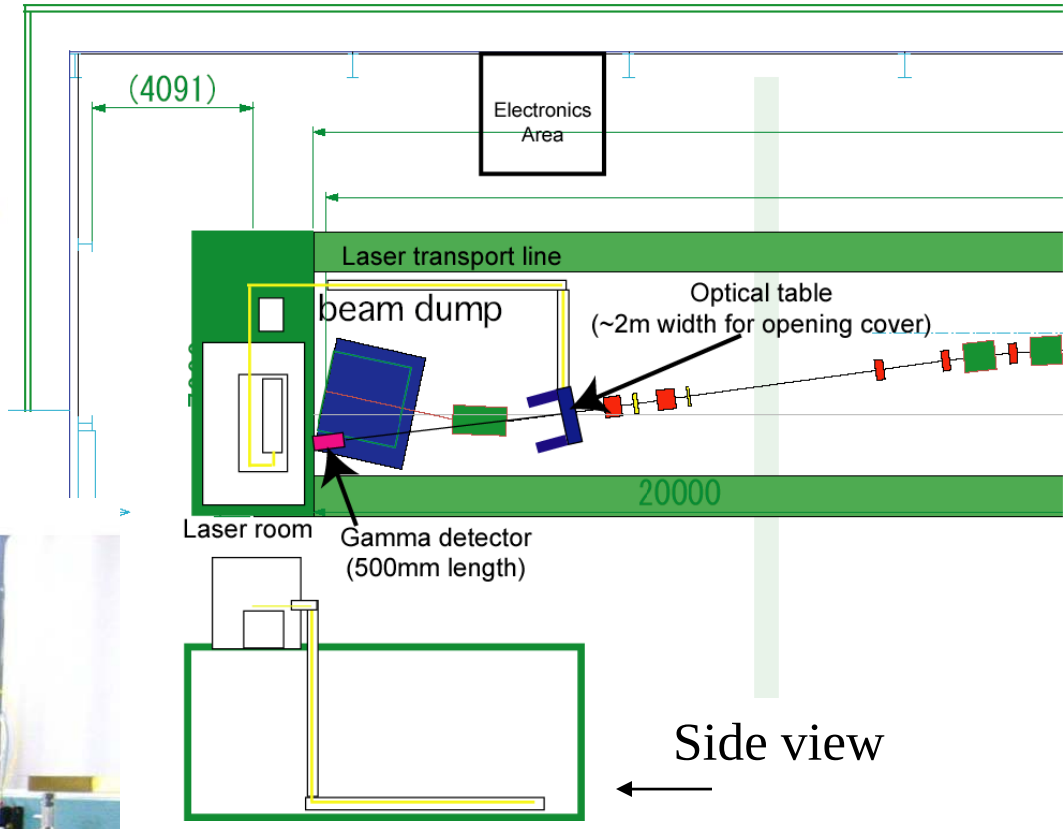






BSM

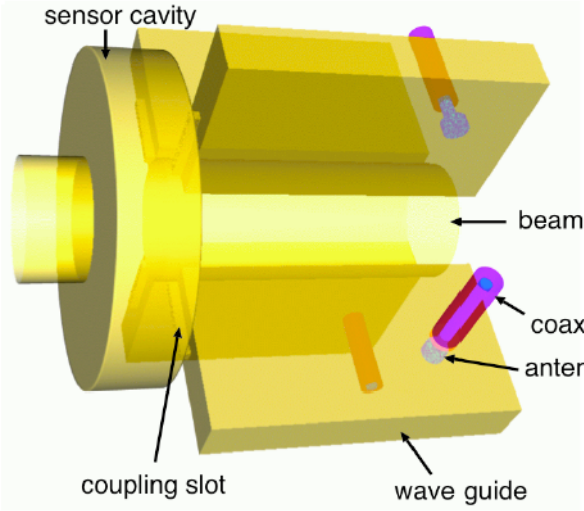




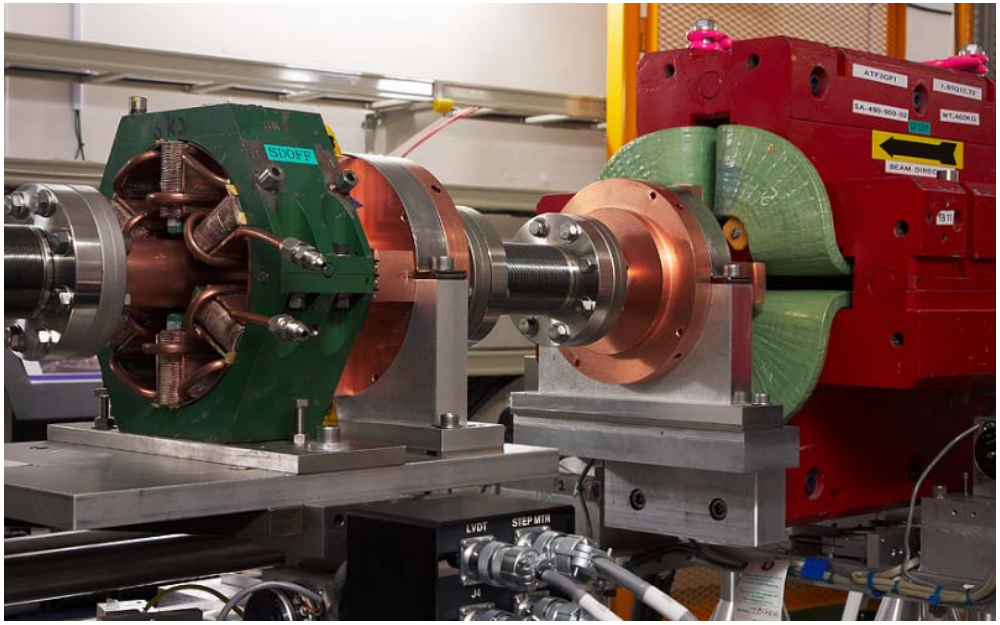
Side view

Installation of Shintake monitor Interferometer table on the ATF2 beam line

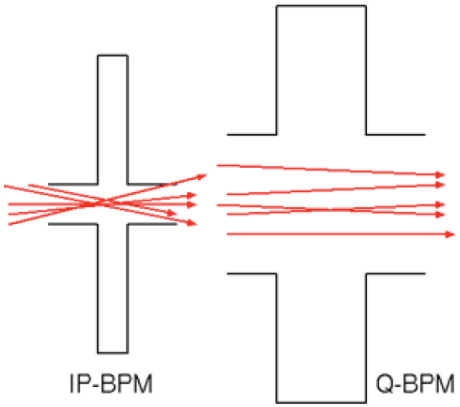
C & S band Cavity BPMs

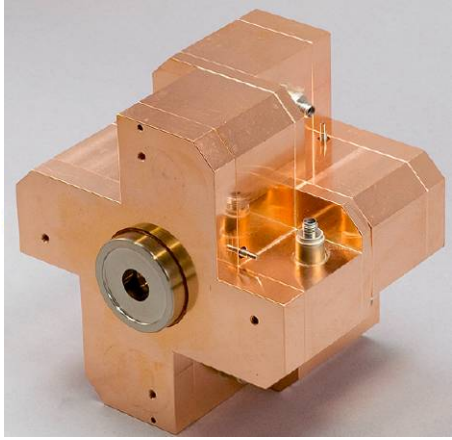


C-band dipole mode
Reference cavity
Downmix to ~25MHz
Digitize at ~100Ms/s, ~14 bit
Sub 100 nanometer resolution
Large dynamic range >500um



IP BPM

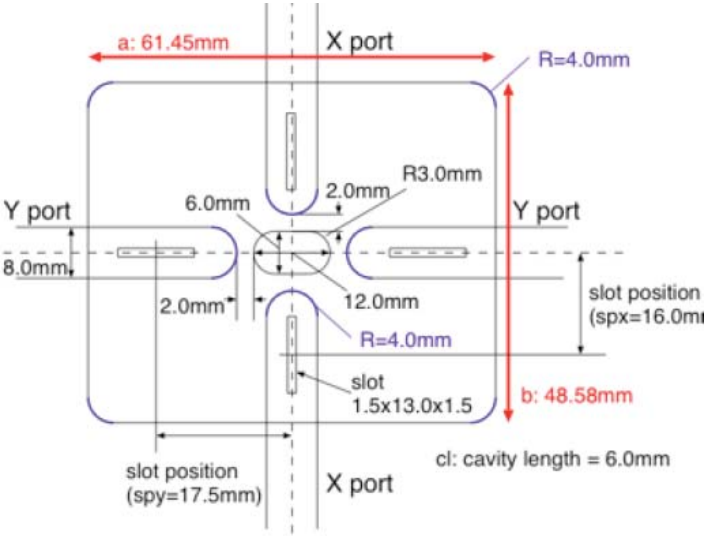


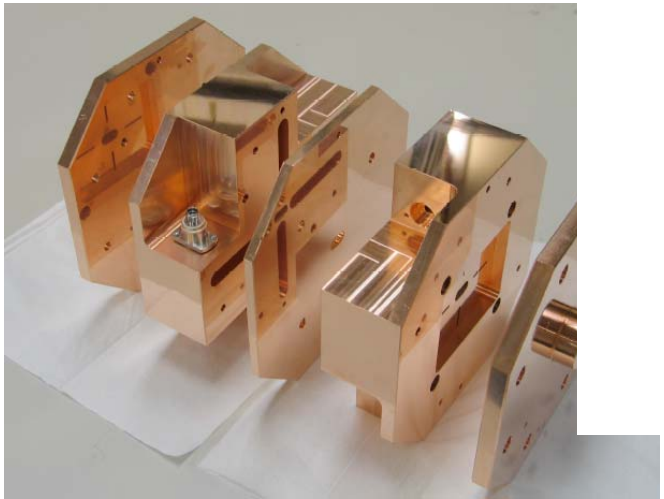


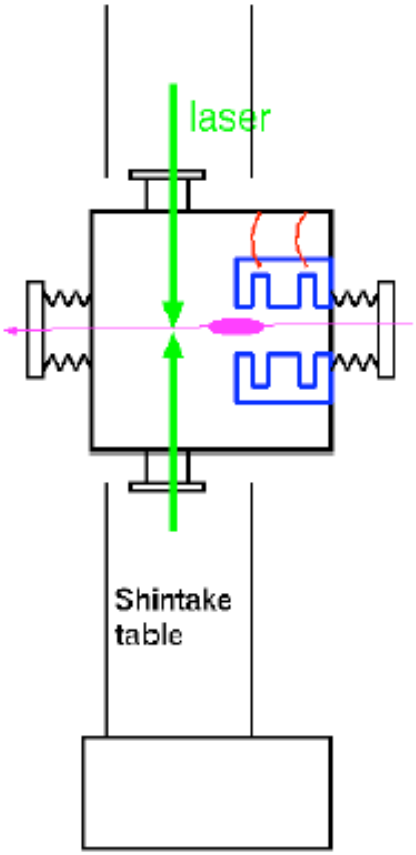
- Creates a reference at IP instead of opposite colliding beam
- => Need ~2nm resolution
- Challenge: ~100μrad angles at IP
- => Thin gap, small aperture, x-y separation

6.426 GHz (Y) and 5.712 GHz (X)

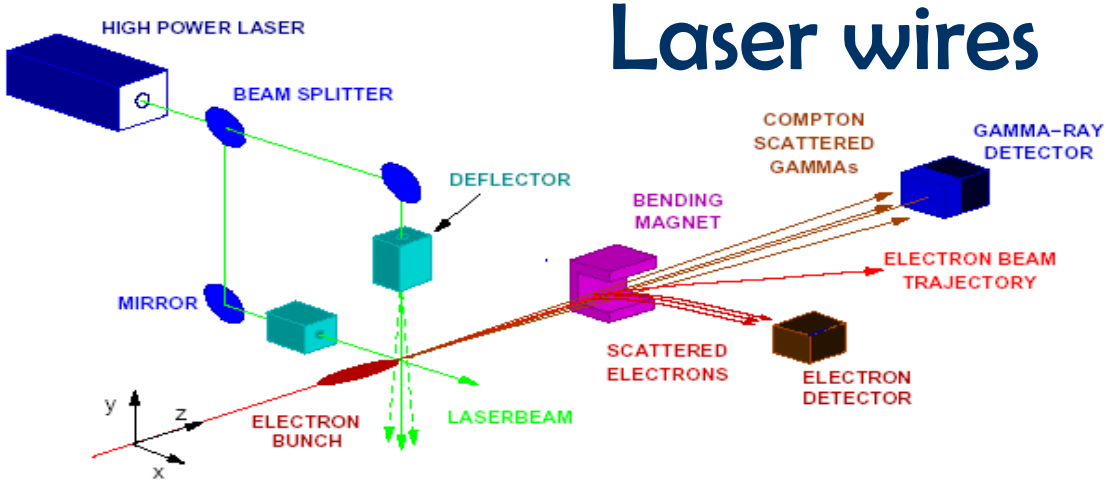
So far achieved resolution 8.7nm, dynamic range ~5 micron

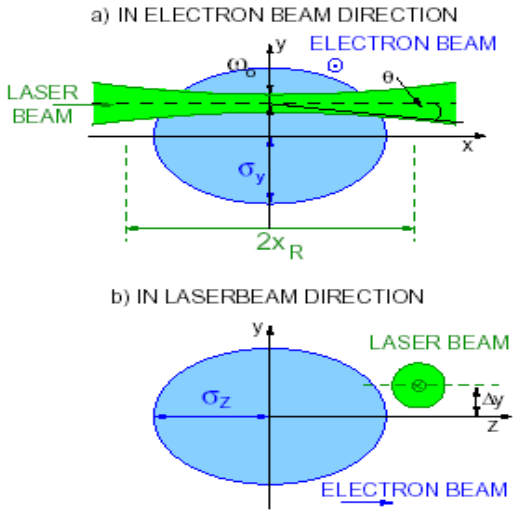




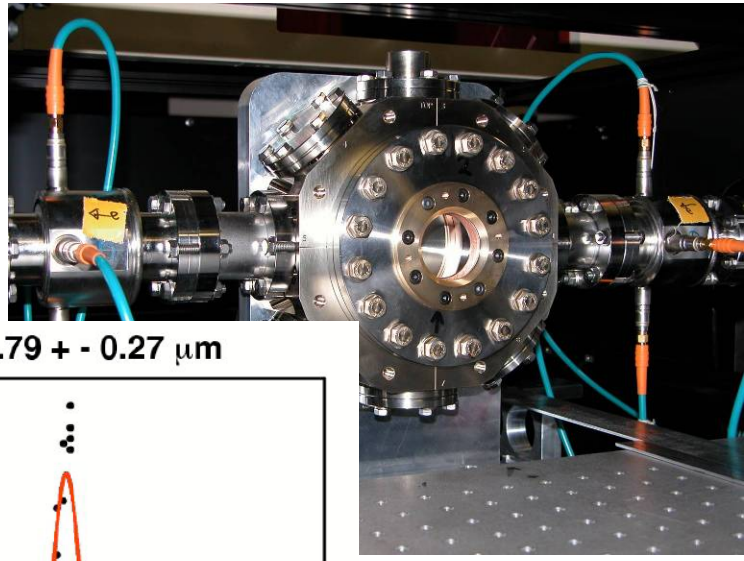


Laser wires

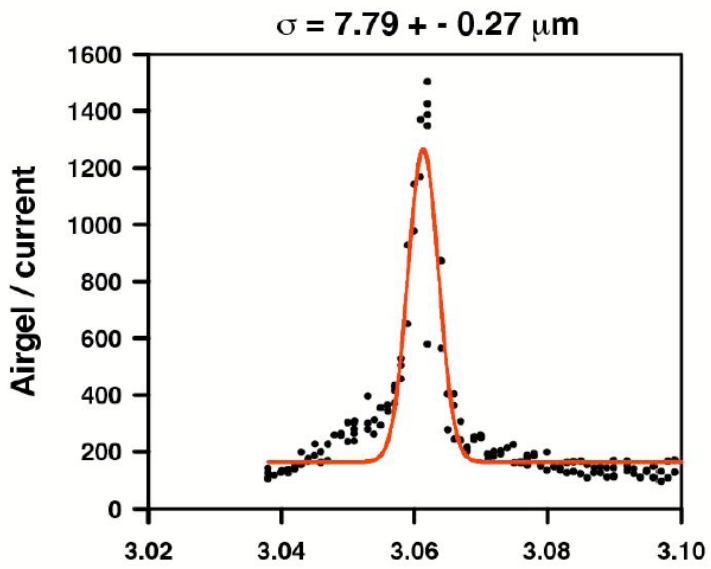




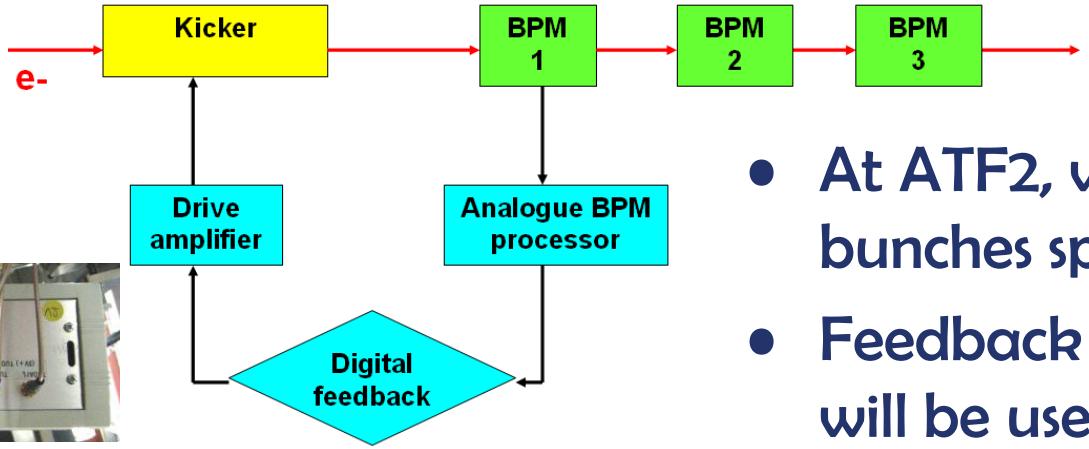
- Goal: non-destructive diagnostics for ILC
- (ATF2 to be tuned with carbon wires)
- Studies in ATF extraction line
- Aim to measure 1 μm spot beam
- Aim at 150ns intra-train scan
- To be located at ATF2 in a place with μm spot
- Presently achieved resolution ~8μm (limit by laser)

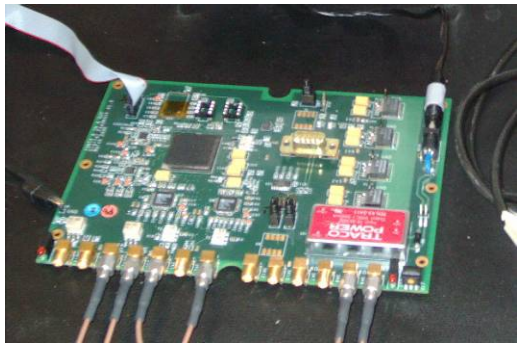


Laser wire chamber at ATF, Oxford



Fast feedback (FONT)



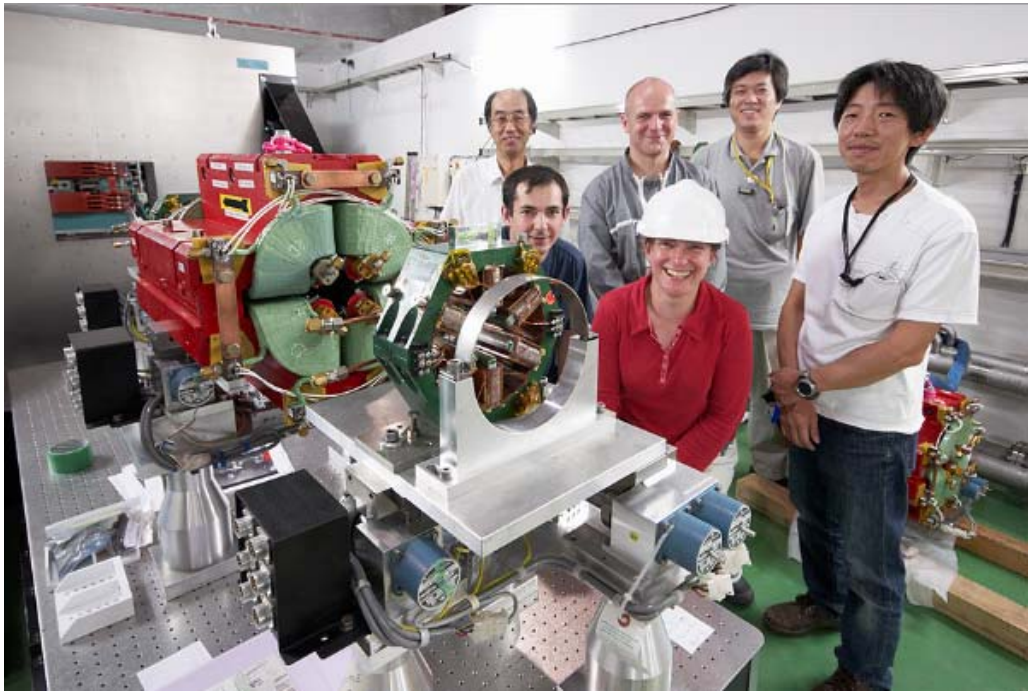


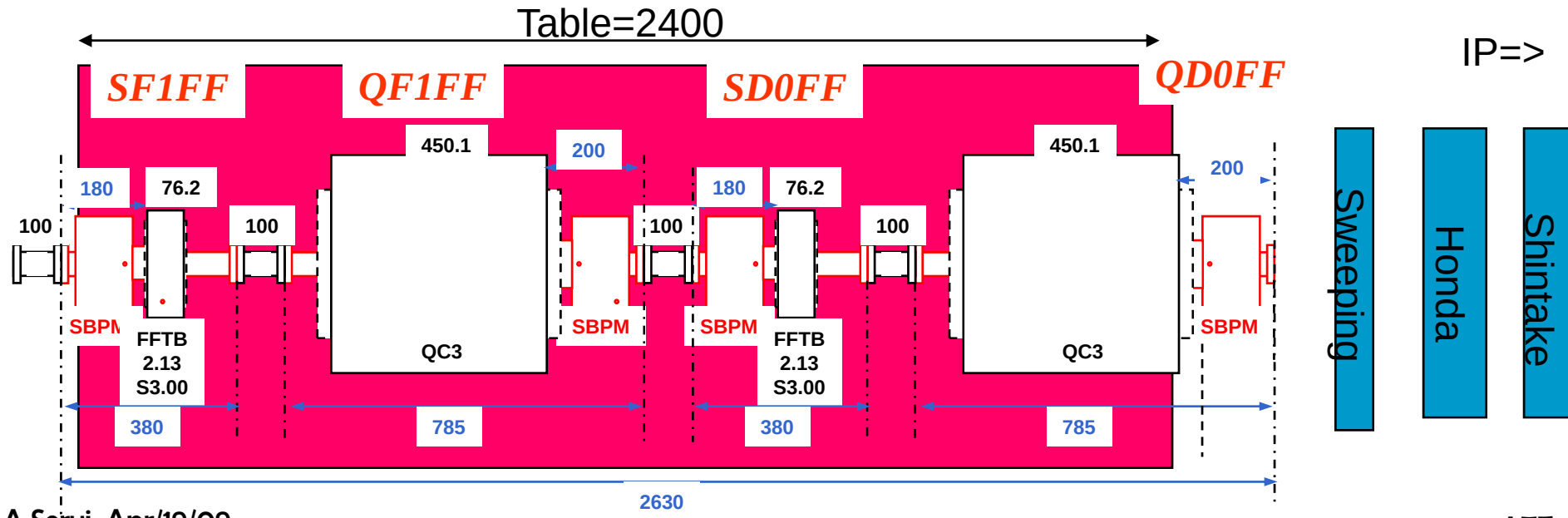
- At ATF2, will have ~20 bunches spaced with 150ns
- Feedback and feedforward will be used to straighten the train
- FONT4: latency estimate
  - Irreducible latency: 14ns
  - Electronics latency: 118ns
  - Total latency: 132ns

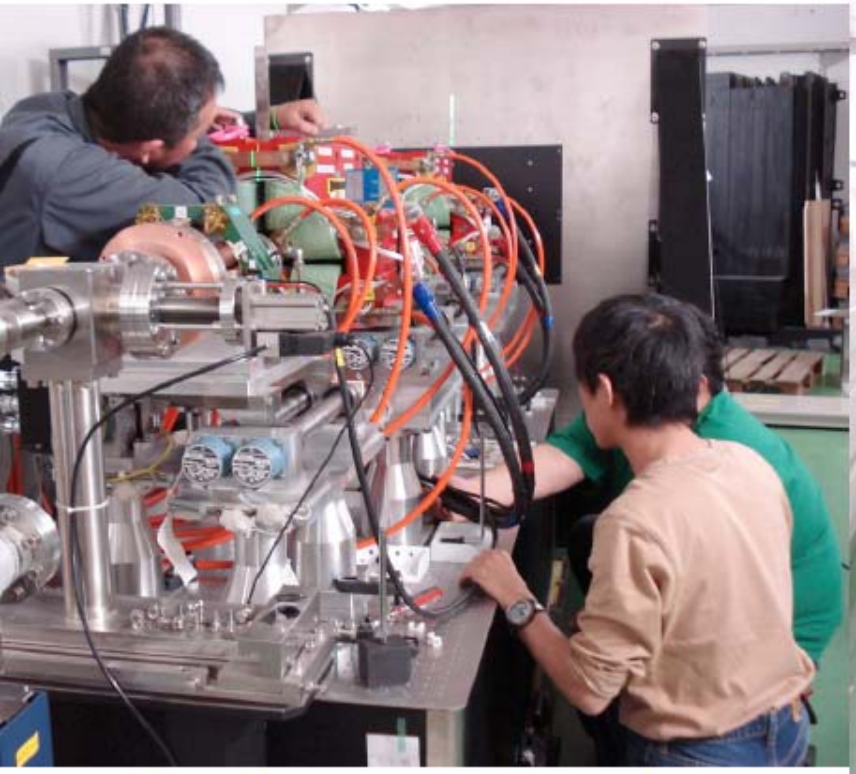
FONT – Feedback On Nanosecond Time scale
the group initially developed analog feedbacks with ~25ns latency.
Developments for ATF – digital, FONT4

FD integration

Stability study and integration of Final Doublet at LAPP, Annecy







FD alignment after the
Radiation Inspection ,
11 December, 2008

Organization of ATF2 Commissioning

- Organization of commissioning was major focus of 7th ATF2 project meeting on Dec 2008
- Overall principles
  - Integration of commissioning efforts for the whole collaboration
  - Importance of longer term plan, intermediate milestones (goals of each run) and detailed schedules of each run
  - Move from doing a collection of individual R&D tasks to focus on a common goal
  - Dedicate 50% of time to ATF2 programs

Commissioning planning

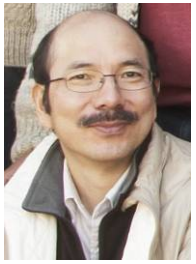
2009	2010

- Aim to achieve reliable observation of design beam size by end of 2010
- Global milestones and detailed schedule developed internally by the ATF collaboration

BSM Laser Wire mode commissioned
First test of fast kicker
Observe several micron beam size
Achieve εy=24pm beam in DR
BSM 8º (0.25-1.5um) commissioned
Observe sub micron beam size
BSM 2º mode (1-6um) commissioned
Achieve εy=24pm beam in DR
Extract and preserve of εy=24pm
BSM 30º (70-400nm) commissioned
First observation of ILC-scaled σy=75nm
Achievement of εy < 12pm in DR
Repeat observation of 75nm beam
Extract & preserve εy=12pm beam
BSM 174º (20-100nm) commissioned
First observation of design 37nm beam
Fast kicker system fully commissioned
Monalisa installed on beamline
Reliable observation of 37nm beam
First tests of mild beta squeeze
Achieve 2nm resolution of IP BPM
Evaluate IR position stability to nm level
Commissioning of Monalisa
Commissioning of FONT feedback
Observe of nm stability of IP position
Initial tests of squeezed β-function

Planning the ATF2 Commissioning & other R&D activities

- Important aspects:
  - ATF2 activities: 50% of total operation time
  - Diverse and reach non-ATF2 R&D program
  - Large international contribution
- ATF2 commissioning is led by the ATF2 Commissioning team leader
- The international aspects of commissioning are addressed by ATF2 International Coordinator (non-KEK person, long term resident at KEK)
- Coordination of non-ATF2 R&D tasks is done by Machine Study Schedule Coordinator in the System/Group Coordinators (SGCs) in the ATF international collaboration
- These three leaders are collaborating on developing of detailed schedule based on global schedule developed by Collaboration at Project meetings & approved by Spokesperson



Machine Study Schedule Coordinator in the SGCs (Kiyoshi Kubo, KEK)

Sub-Deputy and ATF2 Commissioning team leader, (Toshiyuki Okugi, KEK)

Sub-Deputy and ATF2 International Coordinator, resident at KEK (Philip Bambade, KEK/LAL, acting, pending ICB approval)

Organization of tuning tools development

- Essential facts:
  - Many tasks, many tools to be developed
  - Critical to engage international collaborators into development of tools
- Adopt two software environments:
  - (1) in framework of V-system (ATF control system)
    - many tools exist; difficult for external collaborators to contribute to
  - (2) the Flight Simulator
    - designed to allow efficient contribution of international collaborators
- Expression of interests (EoIs) for the projects has been called 24 June, 2008
- Overall coordinator : Shigeru Kuroda (KEK)
- Organizing task groups with priorities and task leaders

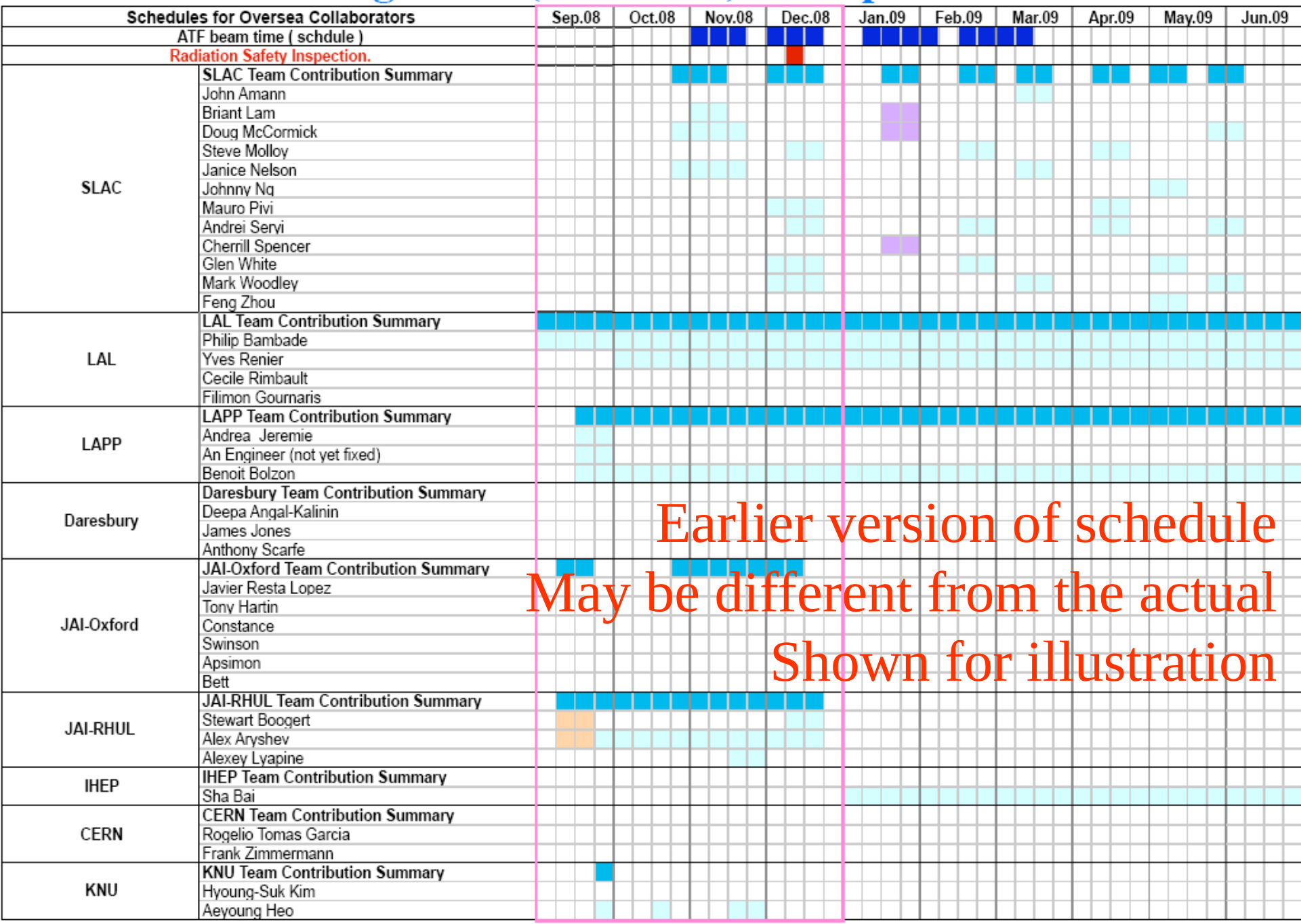
ATF2 Software Task List

ATF2 Software Tasks , Sep. 2008

Beam Tuning Direct	Beam Tuning Direct		
Project Title	Contributing Institutes	Priority	Leader
Coupling Mea.&Corr. in EXT	KEK,SLAC,LAL,CI	VH	C.Rimbault
Dispersion Mea.&Corr. In EXT	KEK,SLAC,CI	VH	J.Jones
EXT Beta-Matching	SLAC, KEK,CI,LAL	VH	K.Kubo
EXT Orbit Corr./FB	SLAC,KEK,LAL,CI, JAI	VH	Y.Renier
FFS Orbit Corr./FB	SLAC,KEK,LAL,CI, JAI	VH	A.Scarfe
Beam Line Modeling Tools	SLAC,CI	M	S.Molloy
IP FB(Pulse-Pulse)	LAL, JAI	H+L	Y.Renier
FB Integration	SLAC, JAI	H	J.R.Lopez
IP Waist&Beta adjustment	LAL(IHEP),CI	H	S.Bai
Non-Mover-Based BBA(EXT)	KEK,LAPP	H	T.Okugi
Mover-Based BBA(FFS)	SLAC,KEK,LAPP	H	J.Nelson
Final IP Spot-Size Tuning	SLAC,KEK,LAL,Tokyo,CERN,CI	M/H	G.White
Bunch-Bunch IP FB(Intra-Pulse)	JAI	M	J.R.Lopez
FS Core Software Dev.	SLAC	M(Ongoir	G.White
EXT Bunch-Bunch FB	JAI,Oxford	L/M	J.R.Lopez
Integrated Automated Tuning	SLAC	L	G.White

Hardware Direct	Hardware Direct		
Project Title	Contributing Institutes	Priority	Leader
EXT Orbit Corr./FB	SLAC,KEK,LAL,CI, JAI	VH	
FFS Orbit Corr./FB	SLAC,KEK,LAL,CI, JAI	VH	
IP FB(Pulse-Pulse)	LAL, JAI	H+L	
C&S-Band Cav.BPM IOC Dev.	JAI,UCL	VH	S.Booget
IP Cav.BPM	KEK	M	Y.Honda
Magnet Mover IOC Dev.	SLAC	M/H	J.Nelson
EPICS Interface for WS/etc	JAI(LW?)	M/H	
Software Interface for IP BSM	Tokyo	M/H	Y.Kamiya
Bunch-Bunch IP FB(Intra-Pulse)	JAI	M	P.Burrows
Controls Infrastructure Dev.	JAI,SLAC,KEK	M(Ongoir	N.Terunuma
EXT Bunch-Bunch FB	JAI,Oxford	L/M	P.Burrows
EPICS Readout of Fiber-PLIC		L	
PS IOC Dev.	SLAC	L	

Commissioning Team (non KEK) and "present" schedule



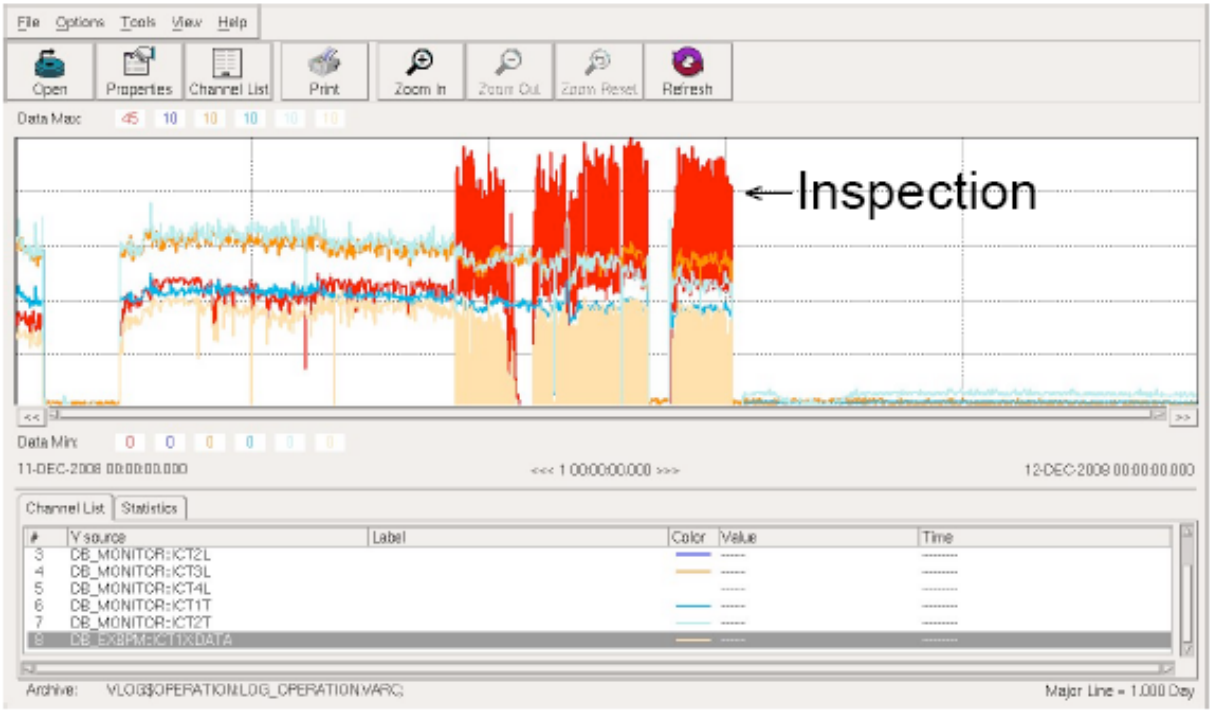
Highlights of recent runs

- December 2008
  - large IP beta optics, semi-ballistic trajectory
  - Establish beam to beam dump, minimize losses, Radiation inspection
  - First tests of hardware and tuning software (FS)
  - BSM commissioning & background characterization
- Jan 2009
  - Continue hardware commissioning & fast kicker study
  - Replace QM7 to one with larger aperture (possible source of EXT ε growth)
- Feb-Mar 2009
  - Large (8cm beta*), all magnets ON
  - Continue hardware commissioning
  - Commission laser wire mode of BSM
  - Tuning tools (EXT disp./coupling corr., IP scans, β/η & ε determ, BBA)
- Current April 2009 run
  - Optics verification for ~1um beam (large, 1cm β^*) / IP wire scanners
  - Commission interferometer mode of BSM

Highlights of December run

Inspection

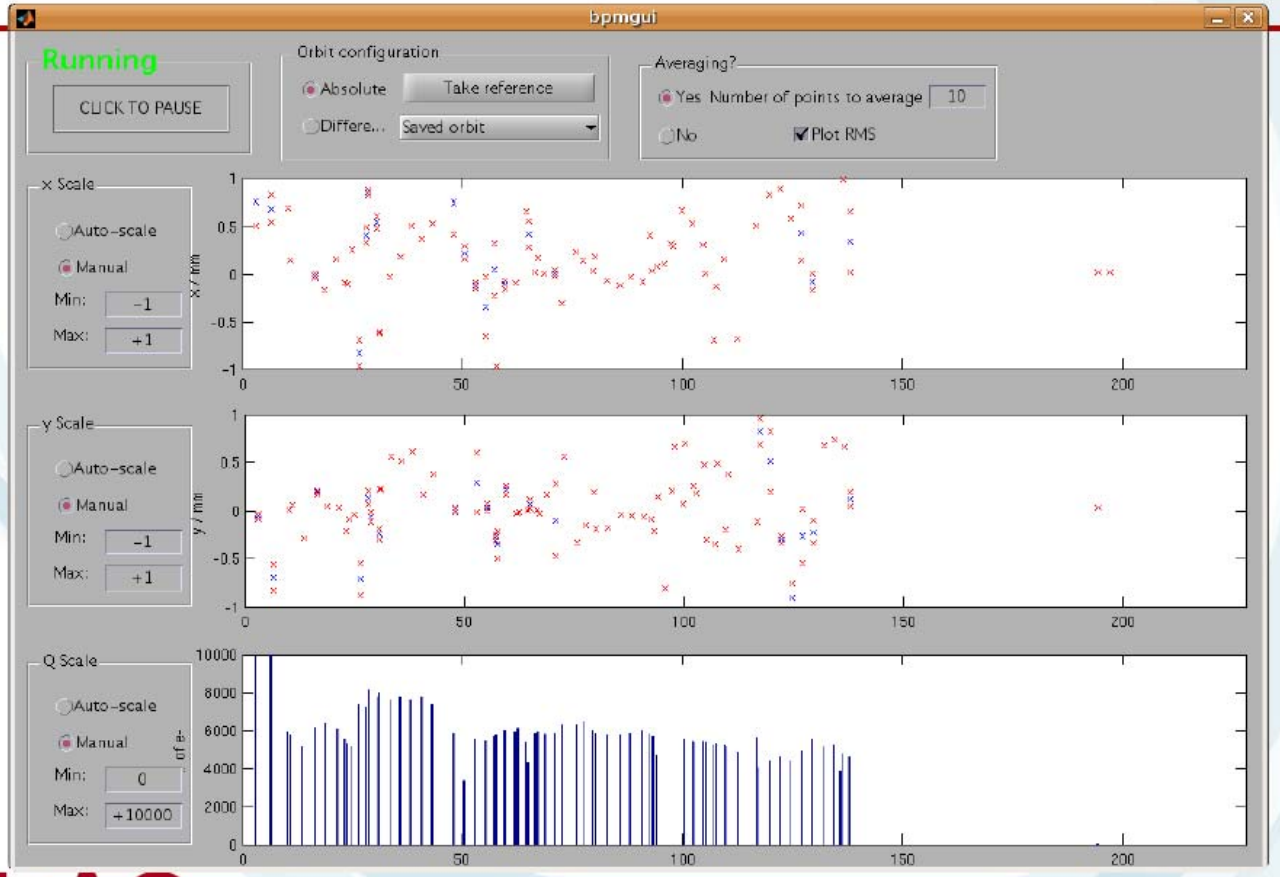
- Inspection was done 11th Dec. 2008.
- Radiation, Inter-lock system,…



Done without big problem!

Highlights of Dec run – start use of FS

BPM Display – real beam!



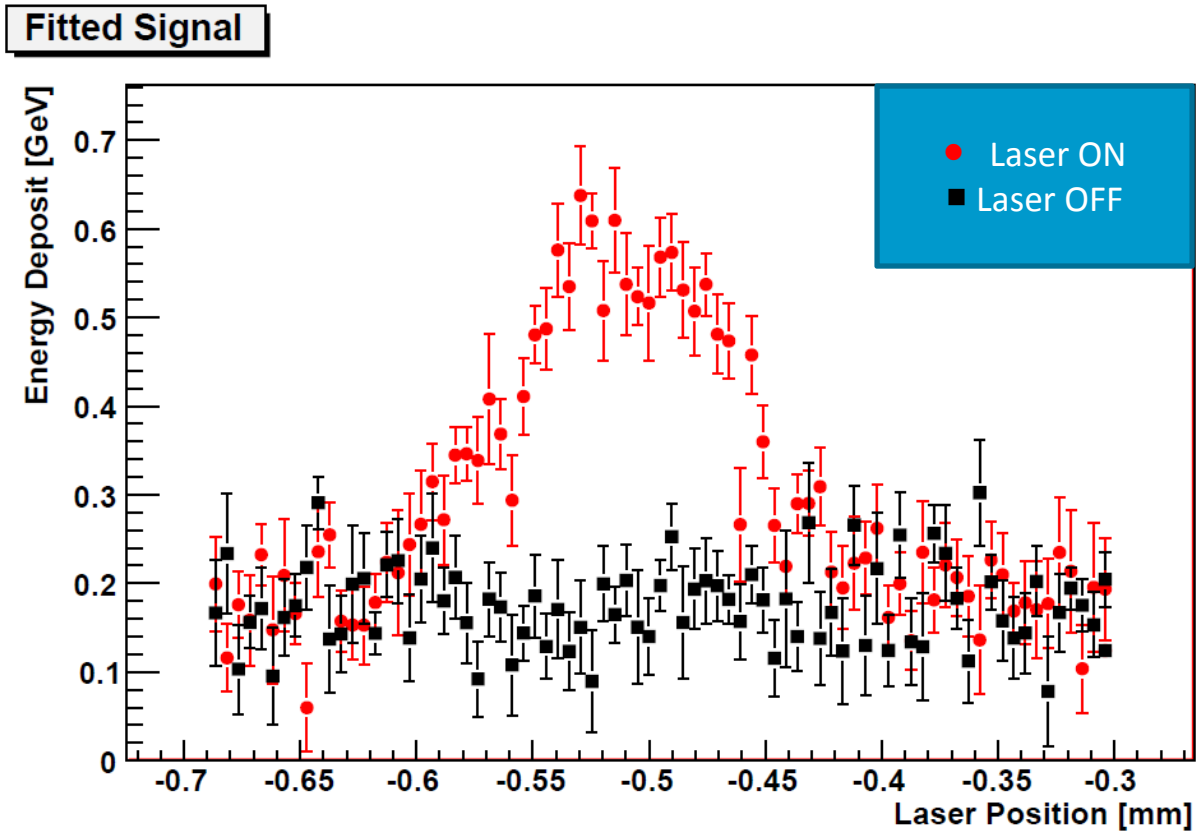
Multibunch beam & uncalibrated BPMs

Highlights of recent runs

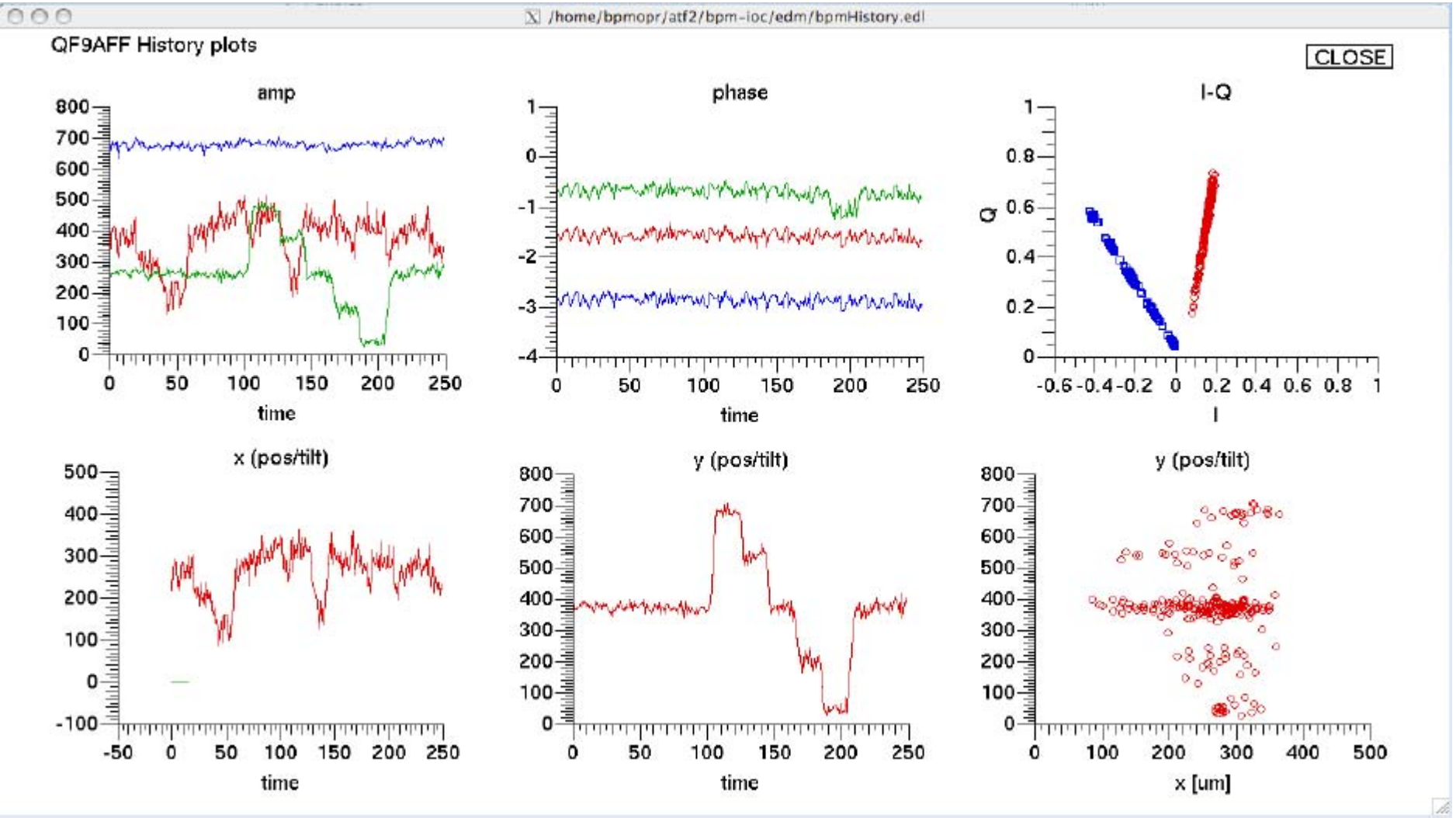
- December 2008
  - large IP beta optics, semi-ballistic trajectory
  - Establish beam to beam dump, minimize losses, Radiation inspection
  - First tests of hardware and tuning software (FS)
  - BSM commissioning & background characterization
- Jan 2009
  - Continue hardware commissioning & fast kicker study
  - Replace QM7 to one with larger aperture (possible source of EXT ε growth)
- Feb-Mar 2009
  - Large (8cm beta*), all magnets ON
  - Continue hardware commissioning
  - Commission laser wire mode of BSM
  - Tuning tools (EXT disp./coupling corr., IP scans, β/η & ε determ, BBA)
- Current April 2009 run
  - Optics verification for ~1um beam (large, 1cm β^*) / IP wire scanners
  - Commission interferometer mode of BSM

Feb-Mar run highlights

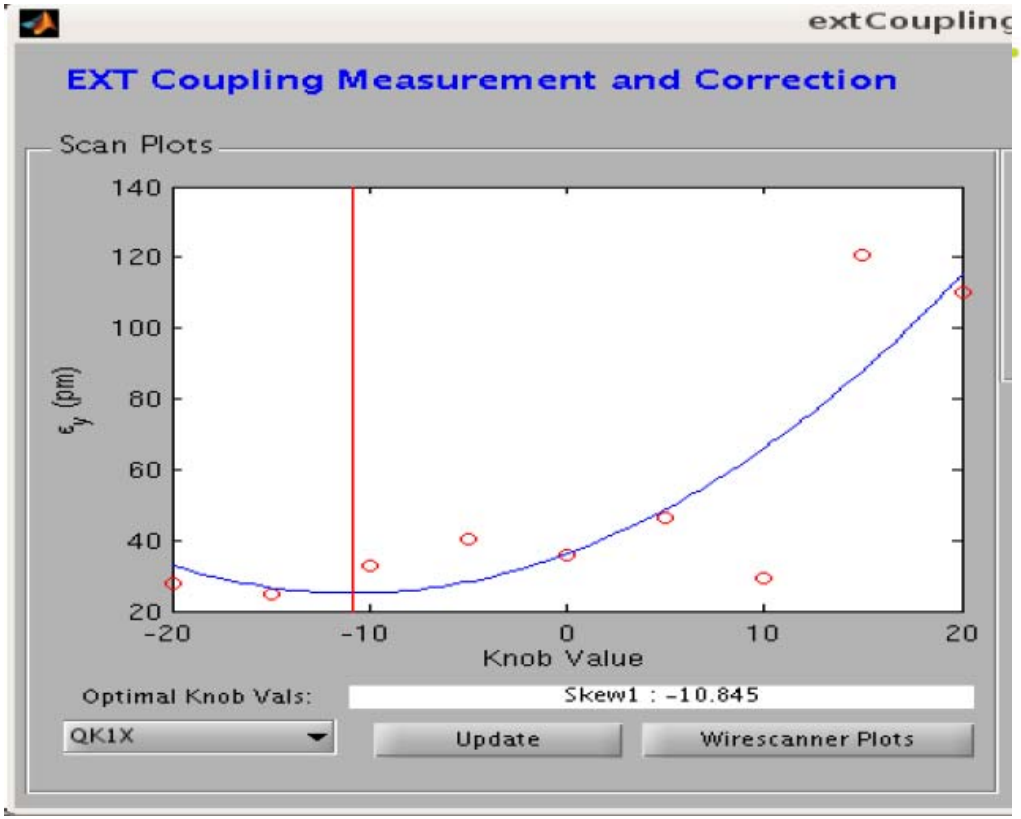
BSM Compton signal in LW mode



Mover & corrector based automated calibration of BPMs

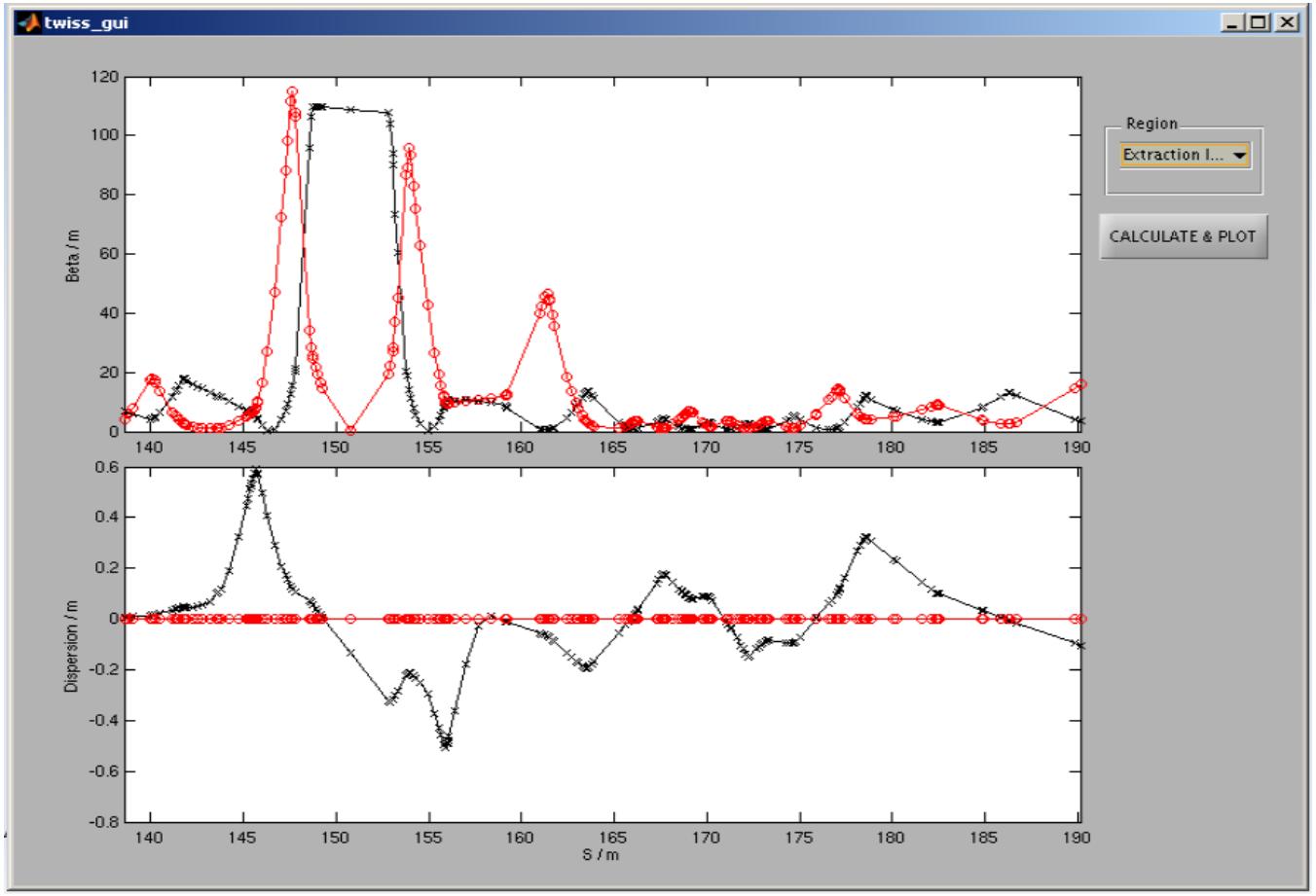


EXT coupling correction



- Vertical emittance scans using 2 available skew quads (QK1X,QK4X)
- Emittance measurement using 5 vertical wire scanners
  - (slow – full scan takes nearly whole shift)

Optics verification tools



- Can verify and correct optics
- DR to EXT well matched, BMAGy~1.04

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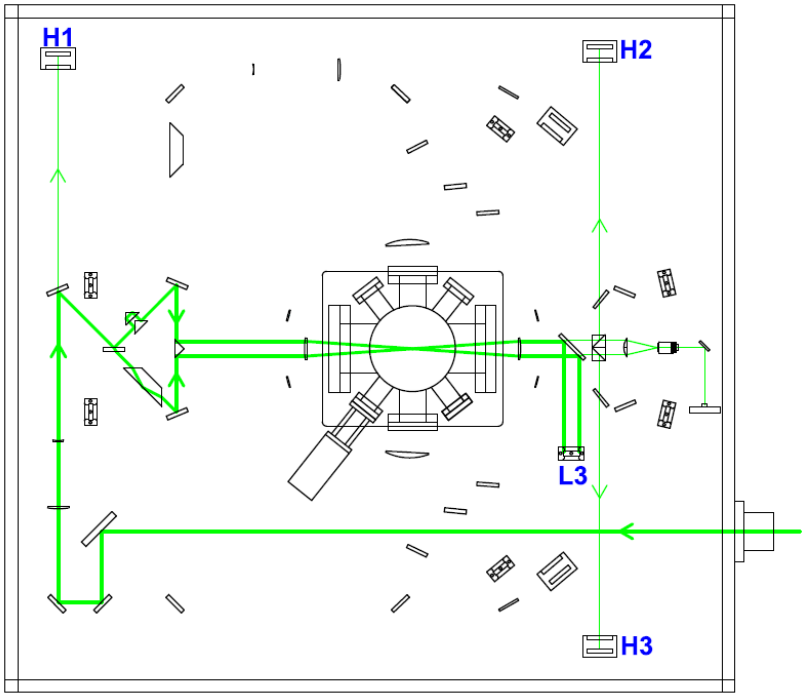
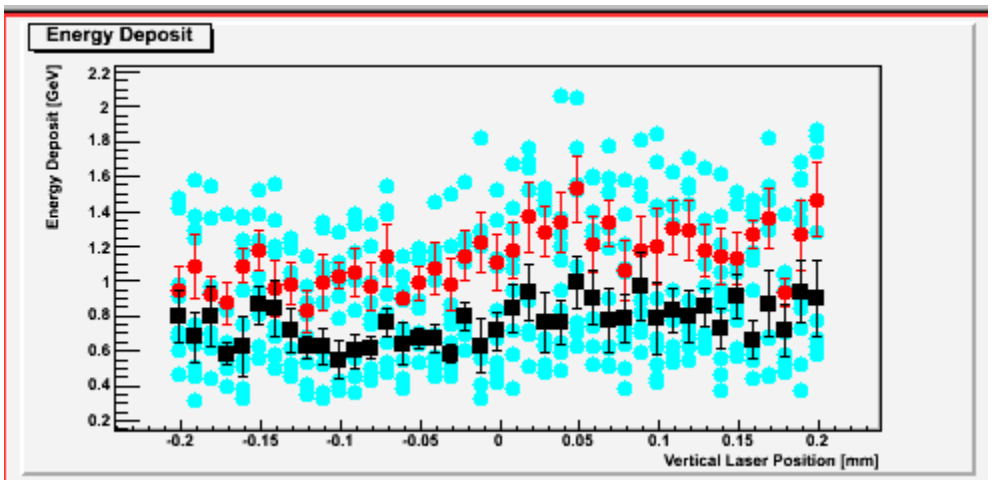
Highlights of April run





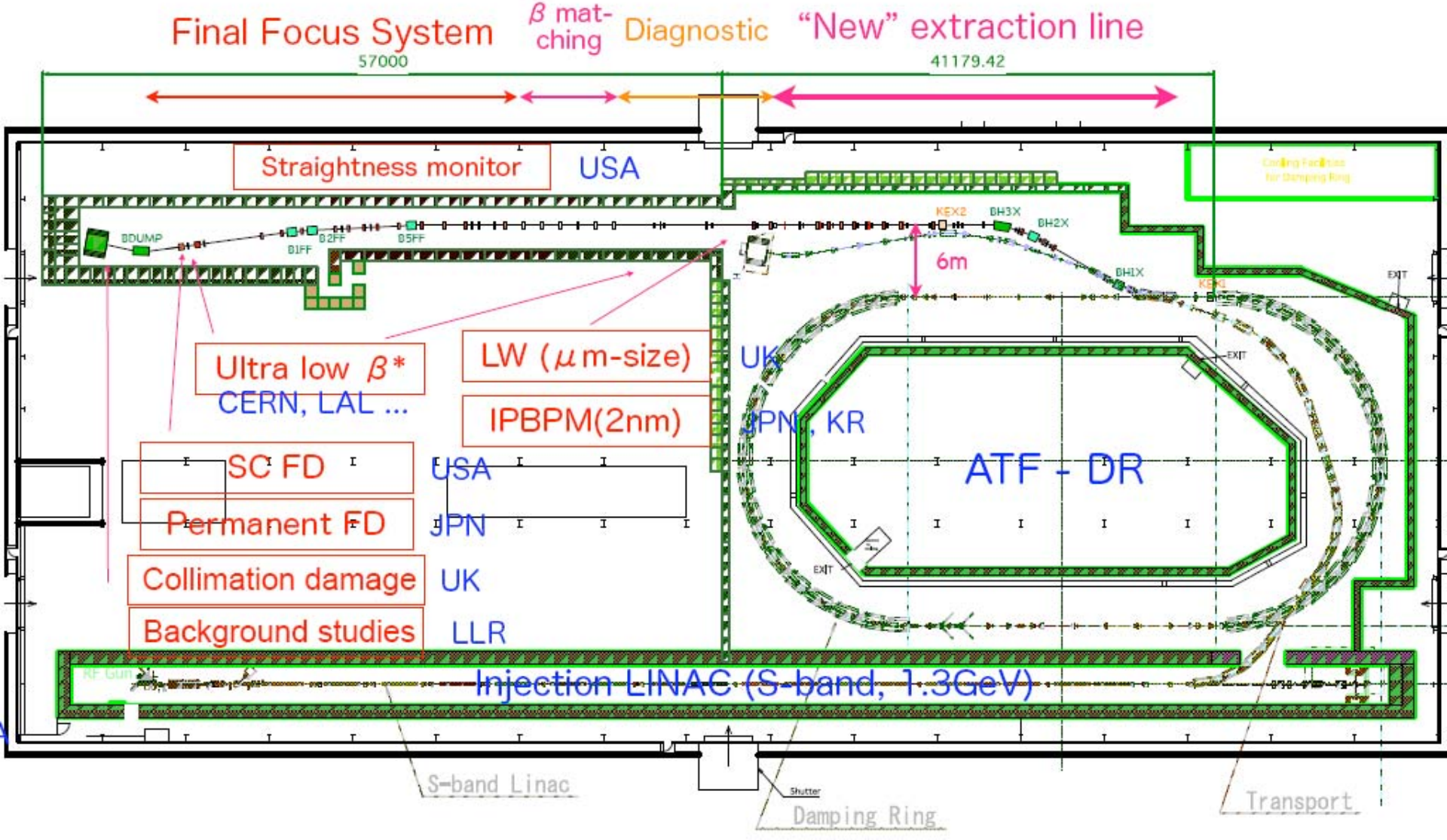
- BSM: 8 deg mode
- Can observe the signal from the start
- Continue working on laser and optics, to achieve beam size and see it by BSM

Long term plans

- As discussed at 7th ATF2 project mtg
- Long term plans
  - Stabilization to nm beam position, Monalisa
  - smaller beta*
  - SC FD
- Much longer Term Plans after ~2012, very tentative
  - Optional Photon facility ; 2015 – 2019
    - laser and optical cavities for photon linear collider
    - generation of photon beam
  - "Strong QED" experiments with Laser
    - Non-linear QED with Laser intensity of > 10^{22} W/cm^2
    - Unruh radiation study

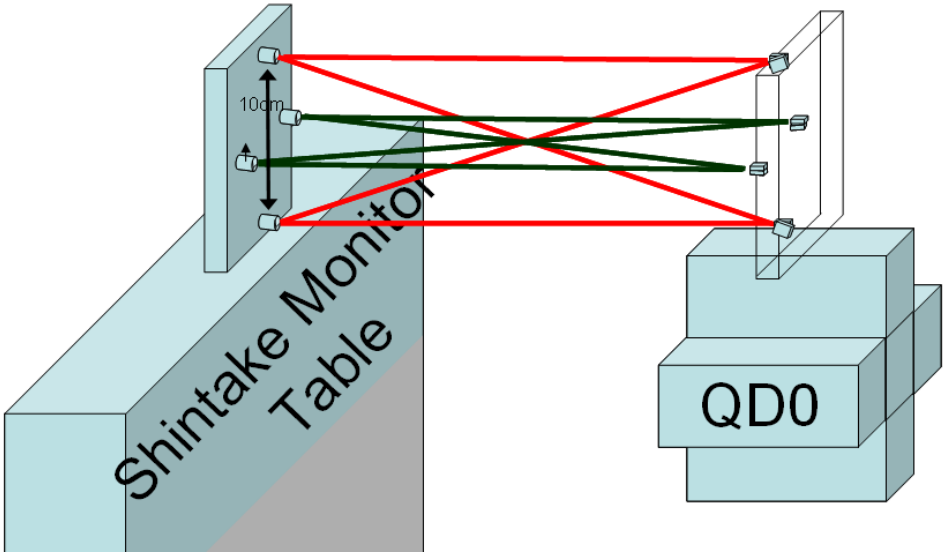
ATF2 beam line and planned/proposed R&Ds

2008 - 2010 - 2012 - 2014



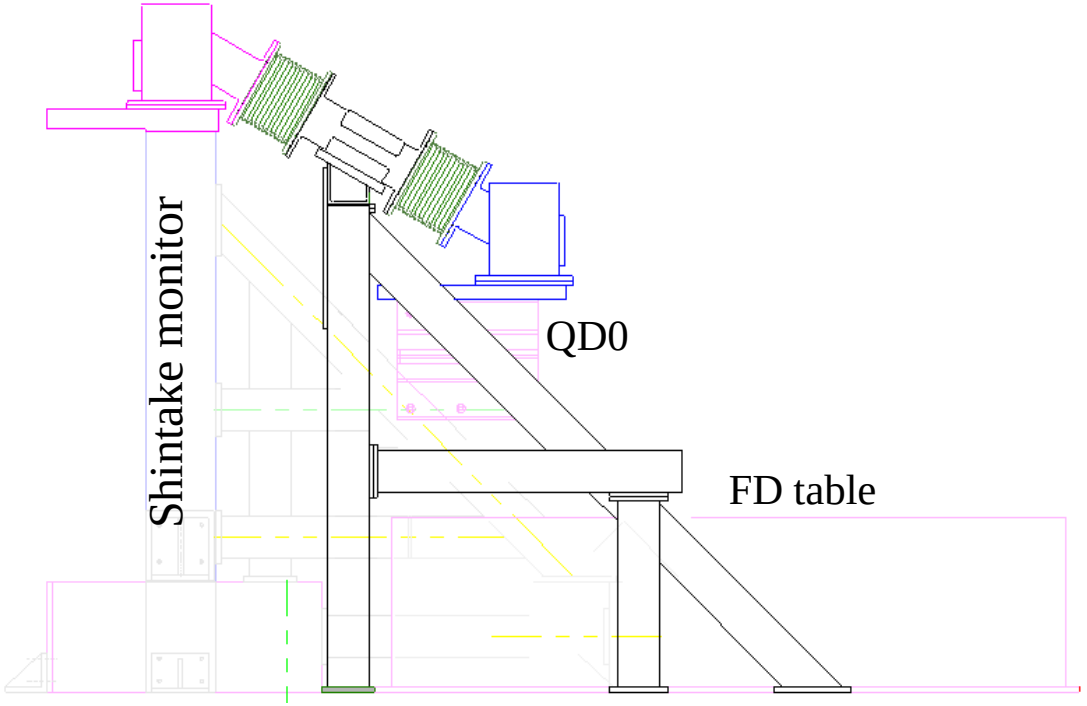
IP Interferometer

Monitoring Alignment & Stabilisation with high Accuracy



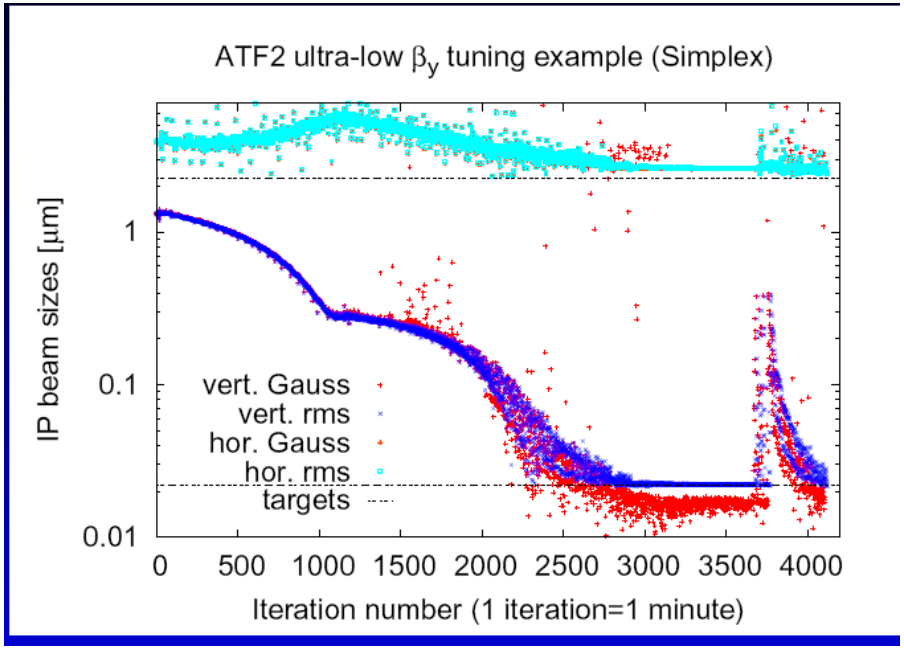
MONALISA Oxford

- MONALISA: measures 6D position of two objects separated by several meters with a precision of nanometres using interferometers
- Expect resolution: σ_y:10nm, distance: 1nm
- Use FFI and FSI (Fixed Frequency and Frequency Scanning Interferometry)
- Measure position of FD with respect to Shintake monitor



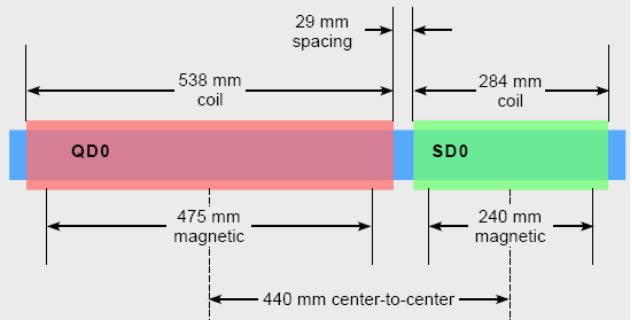
Low beta

- Suggested by CLIC colleagues
  - Rogelio Tomas et al
- Explore & push the limits of optics
- Large aperture QF1 may be necessary

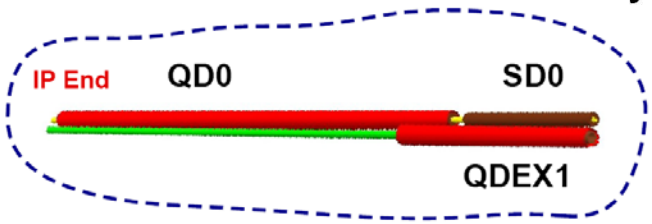


case	Max. tuning time	Success	$\langle\sigma_y\rangle$
β_y=0.1mm	5.5 days	100%	43nm
β_y=0.05mm	8 days	90%	33nm
β_y=0.025mm	10 days	80%	26nm
including multipoles			
β_y=0.025mm	10 days	70%	29nm

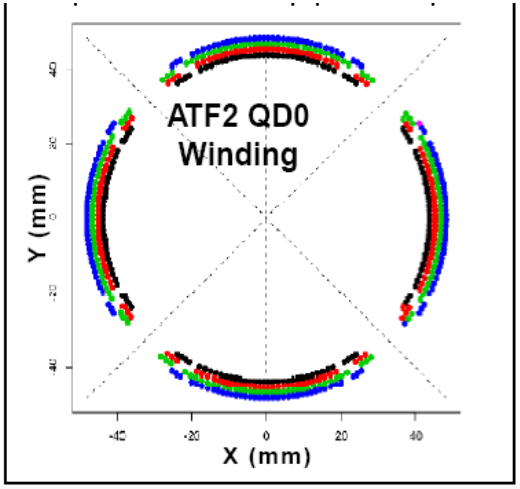
SC FD modified plans and ATF2 tests



QD0 Cryostat Design for L* = 4.5 m.



Earlier plan was to prototype ILC-like QD0 magnet with cryostat & study its stability

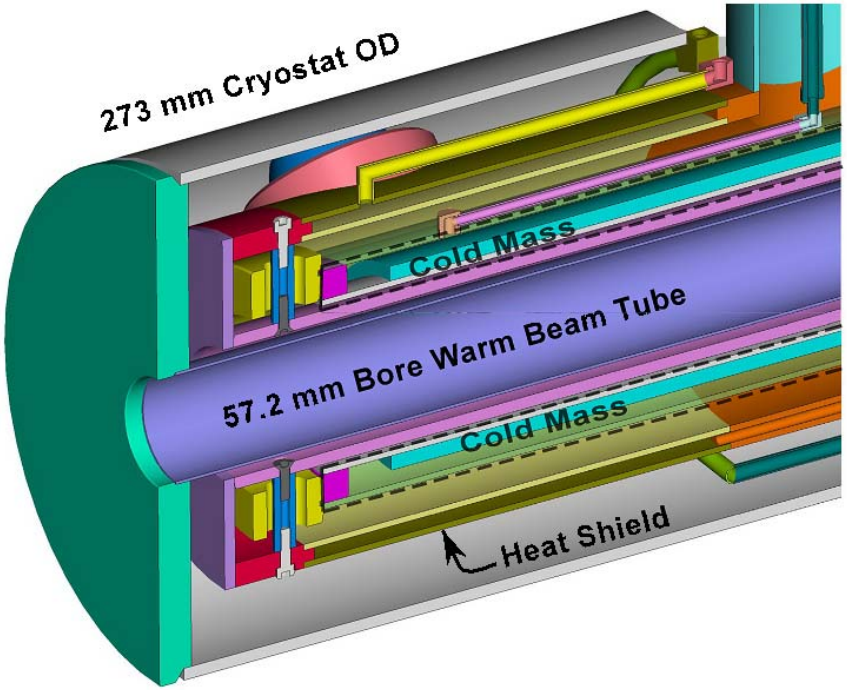


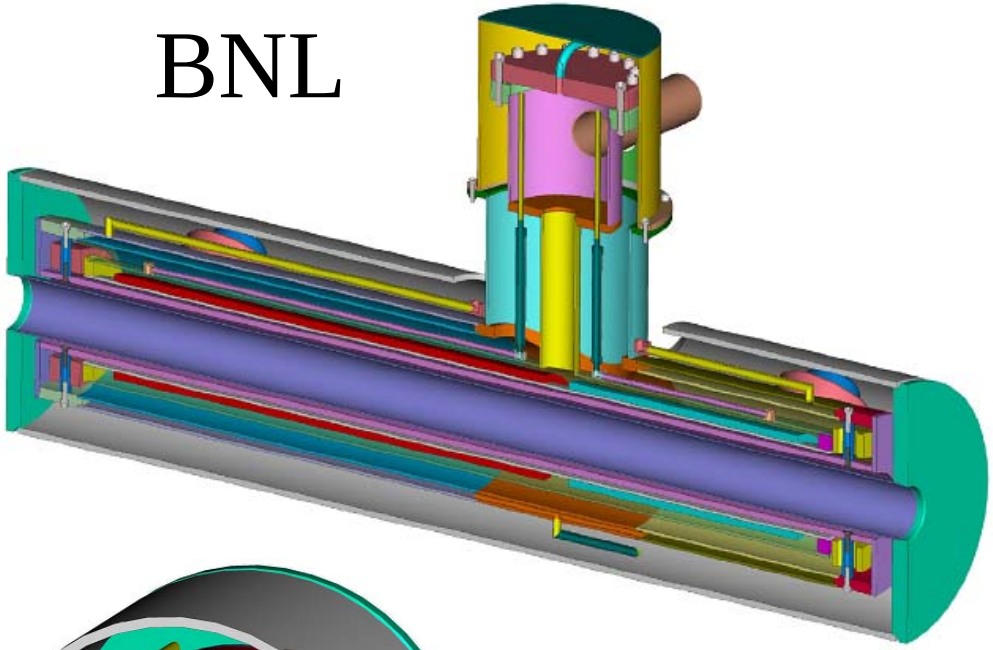
- In TDP, plans for SC FD prototype at BNL were adjusted
  - delay efforts on ILC-like FD prototype; for near-term only make long cold mass and perform its field tests (cryostat later)
  - enhance efforts on ILC-technology-like SC Final Doublet for ATF2 upgrade

- Only produce one quadrupole/sextupole magnet combination (in common cryostat).
- No self-shielding or anti-solenoid (simple).
- KEK Cryogenic system (major challenge).
- 50 mm aperture but with a warm bore (i.e. optimize to limit cold mass heat leak).
- Minimum degrees of freedom (correctors).
- Found it easy to match corrector coils and main coil magnetic lengths.

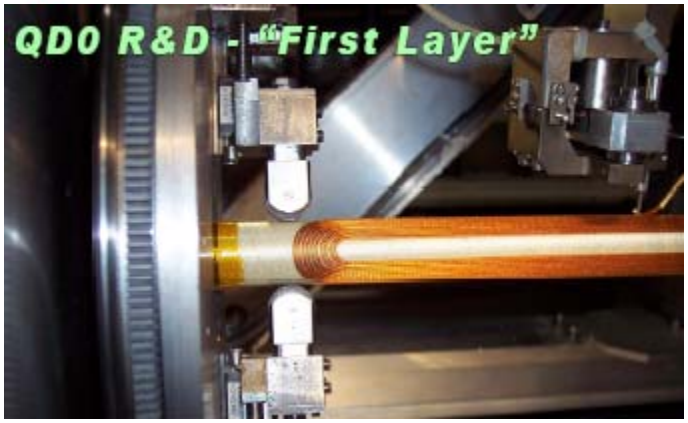
SC FD for ATF2

BNL



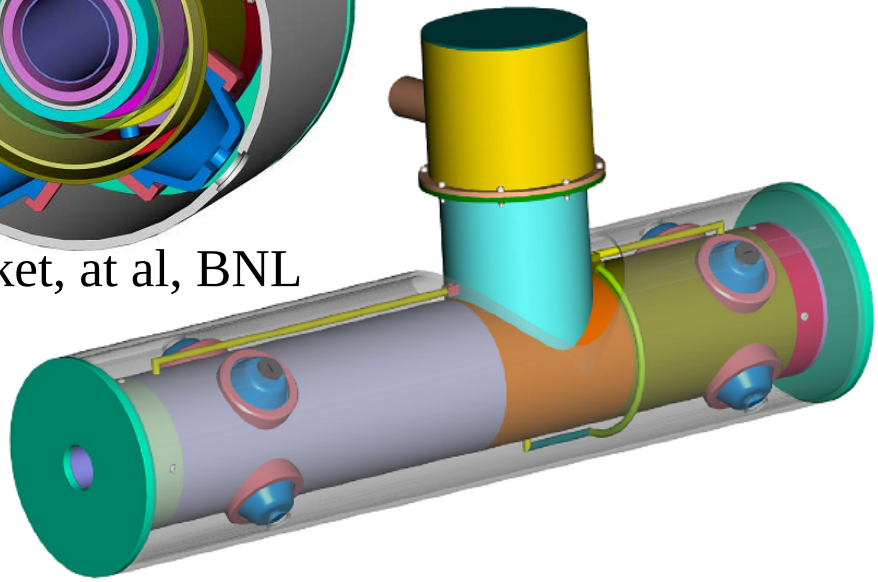


View Inside Cryostat
of Support Structure



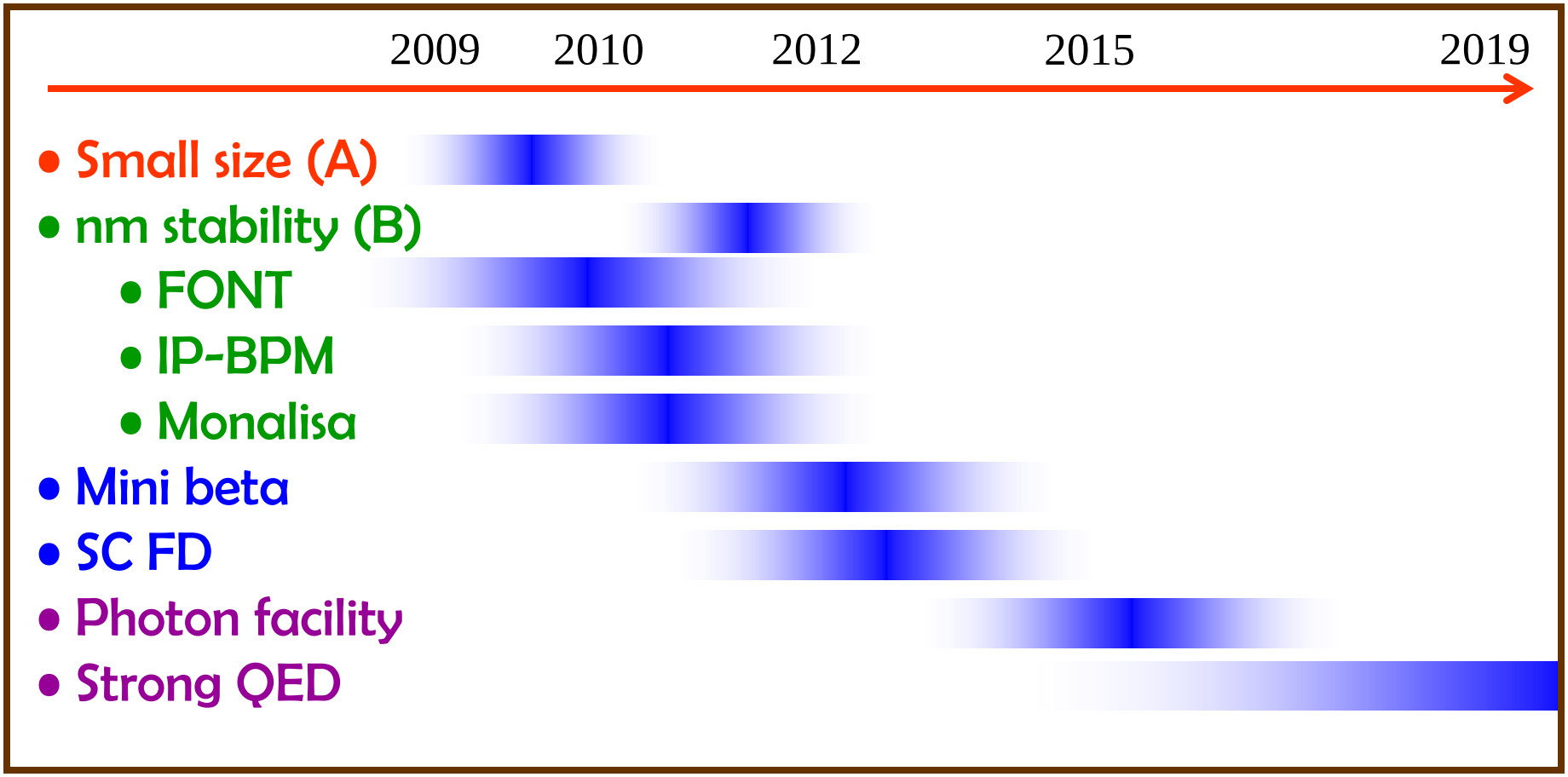
Long coil winding

Brett Parket, at al, BNL



Cross Section View at Support Location

ATF2 Outlook



Conclusion

- ATF collaboration has completed construction of ATF2 facility and has started its commissioning
- ATF collaboration & BDS team is streamlining organization of commissioning to match the challenge and the timescale
- Hardware for the second goal of ATF2 is being developed
- Looking into the future, planning upgrade of ATF2
- Tentative long term plans being developed