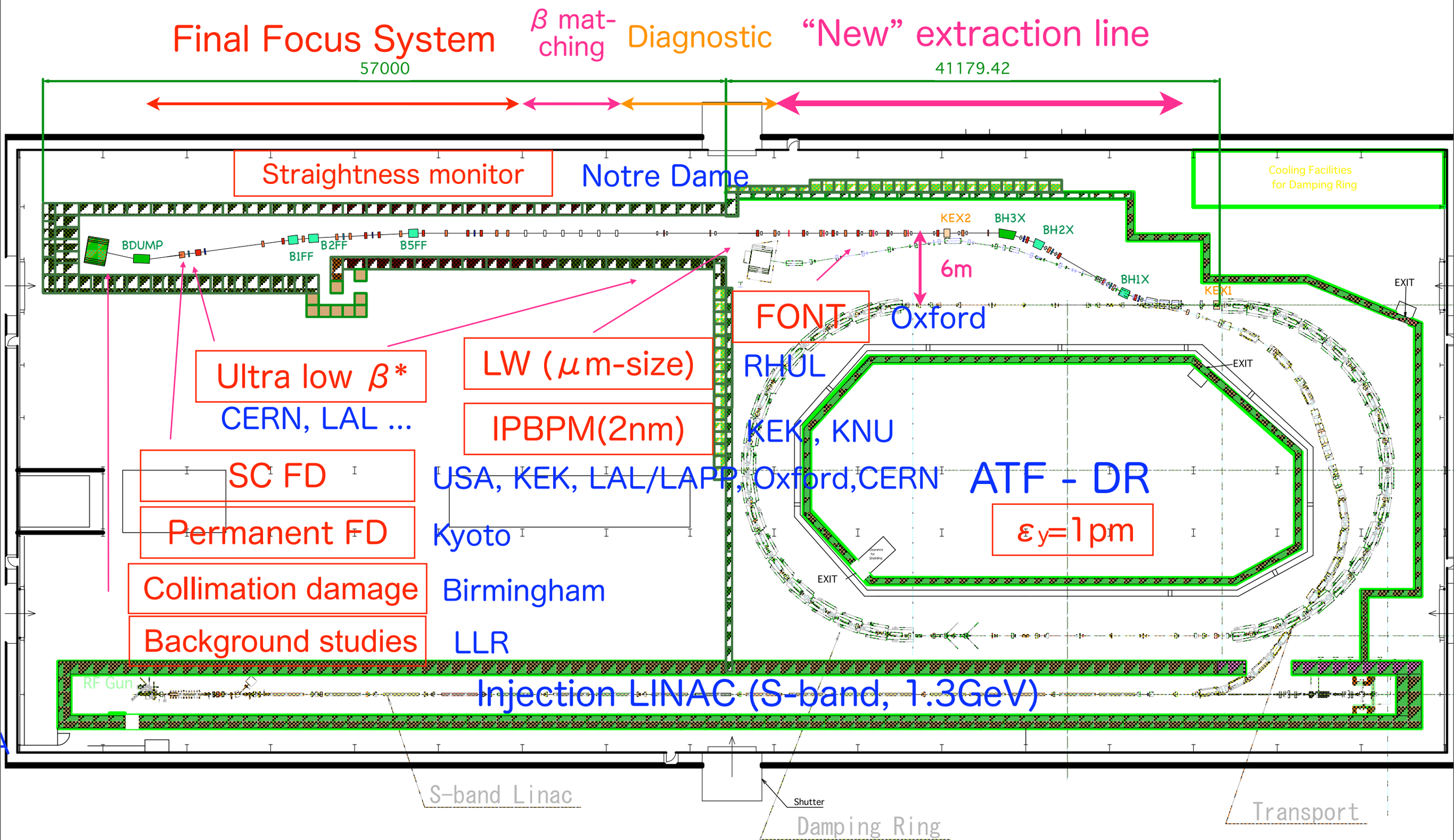
Goals at this meeting

1. Review commissioning status
   - BPMs, Carbon WS, BSM etc. and software
   - High Beta Optics beam tuning
2. Plan the strategy and milestones
   - in details for the 1st and 2nd goals
     up to 2010 and 2012, respectively,
     , identifying key issues
3. Future plan after TDP2, i.e. 2013
   - SC Q proposal Update

T. Tauchi, A.Seryi, P.Bambade, 9th ATF2 Project Meeting, 14-17 December 2009

ATF2 beam line and planned/proposed R&Ds

2008 - 2010 - 2012 - 2014 -



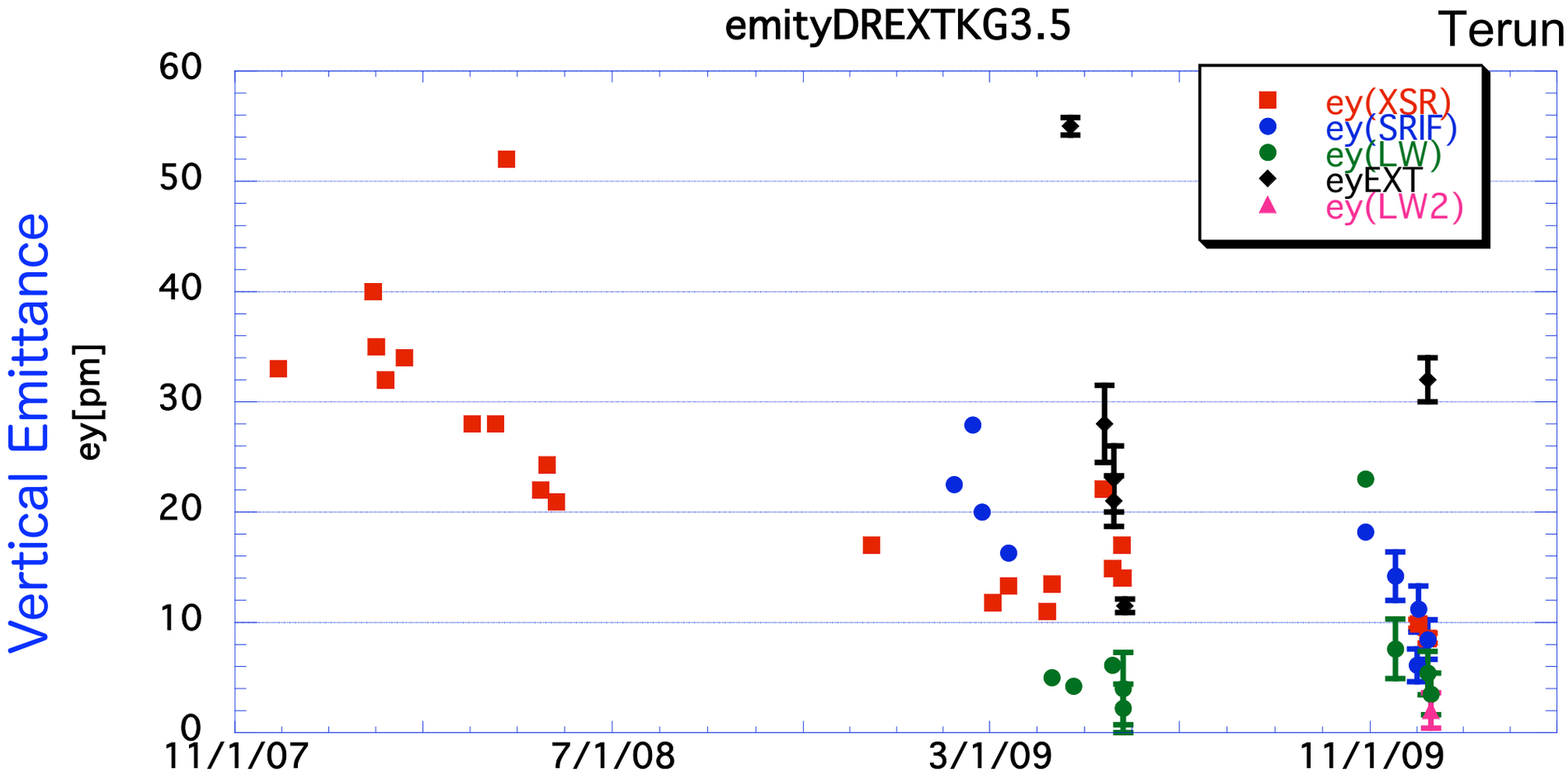
2010年 3月 11日 木曜日

Parameters at ATF2

to be updates

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

DR Emittance Summary



2009 spring
I=5-6x10^9

2009 autum
I=4-5x10^9

Emittance situation is similar to that in May 09.
Measured ε_y=8.56±0.46/ 8.43±1.79/ 3.50±1.78/ 2.00±1.61pm
by XSR/ IF/ LW00/ LW01.
Study for the discrepancy is still on going.

S.Kuroda, 9th ATF2 Project Meting, 14-17 December, 2009

Key issues

1. Beam stability at LINAC and DR

- improvement of cooling water system

i.e. precise temperature control

done

- upgrade of DR-BPM electronics

all in next spring, i.e. 2010

2. Reliable diagnostic tools

- calibrated and reproducible/stable devices

i.e. BPMs, wire scanners, screen monitors, done

OTRs and IP-BSM (Shintake monitor)

3. Softwares : ATF operation and flight simulator

- integration of sub-system controls/monitors done

Hardware, recently commissioned

1. Carbon wire scanner with 5μm at the post IP

note : 45 degree scanner with 10μm tungsten wires have been fully commissioned

- vertical scanner with three 5μm carbon wires

one horizontal and two +/- 1.3 degree wires

2. OTR at the beginning of extraction line
3. Stripline BPMs with short and large aperture

note : long and small aperture ones have been well calibrated.

4. S-band BPMs

- some issue (software?) remains

5. Shintake monitor

note : laser wire mode has been fully commissioned

- Interference mode, 2^o, 8^o, 30^o and 174^o
- IPBPM will be installed in next year

“ATF2” site works in this summer

1. Monalisa done
   - Vibration measurement at IP
2. Straightness monitor done
   - installation
3. Laserwire (LW) done
   - installation/commissioning the laser system
4. Shintake monitor done
   - new screen, wire scanner and new laser
   - RHUL/Oxford-LW laser transport line not yet
5. Alignment at ATF2 beam line done
6. HLS system done
   - a collaborator from SLAC

ATF beam operation schedule

10 2009

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

Fast Kicker Studies

2 x 60cm stripline kickers

11 2009

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					

BPMs, IPBSM, FONT

ATF2 beam tuning

13th Nov. First signals from the interference

All the BPMs are calibrated.

12 2009

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		

BPMs, IPBSM, FONT, Tilt

Carbon wire scanner@PIP

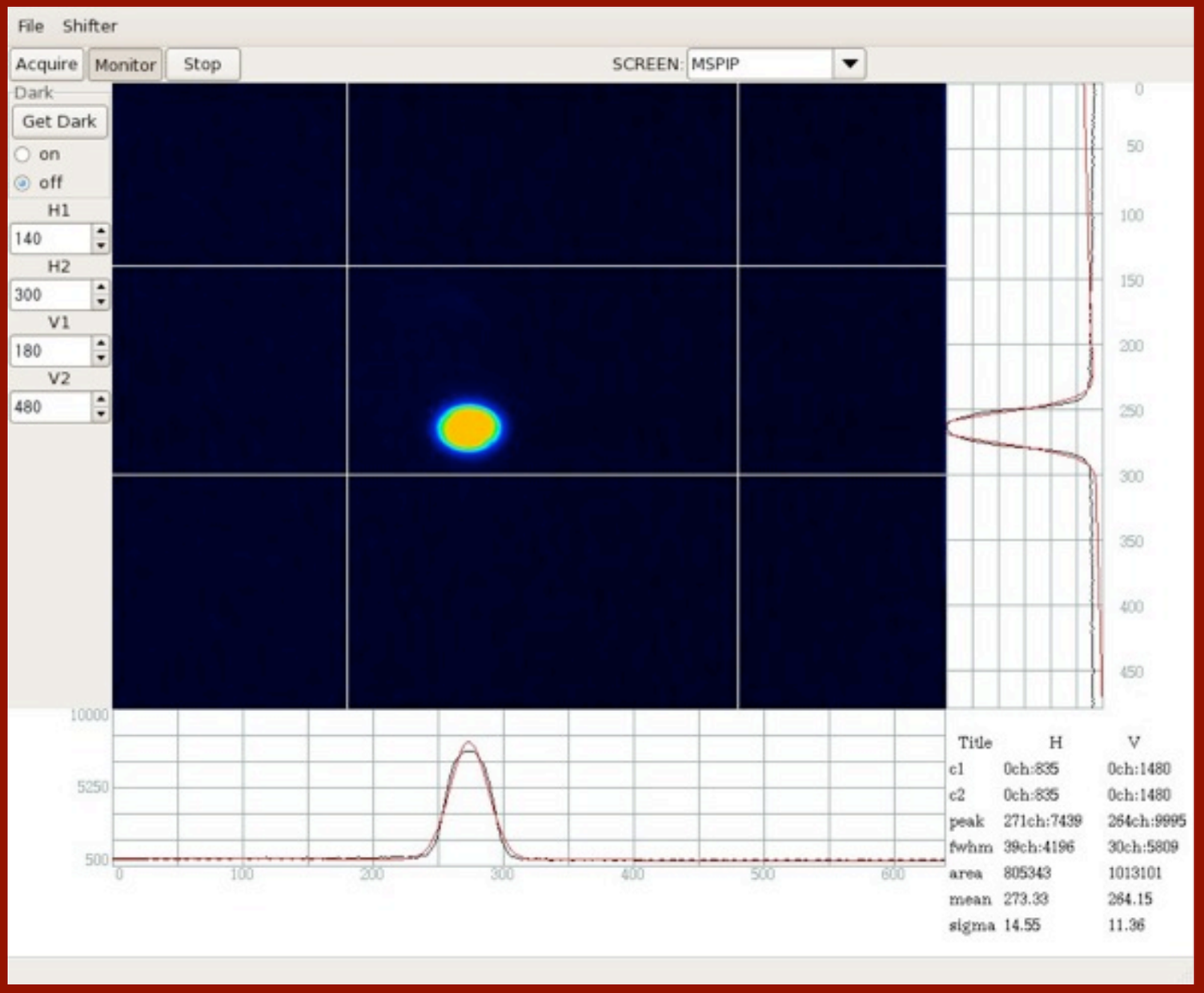
ATF2 beam tuning

1 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						

50% for ATF2 as a general rule

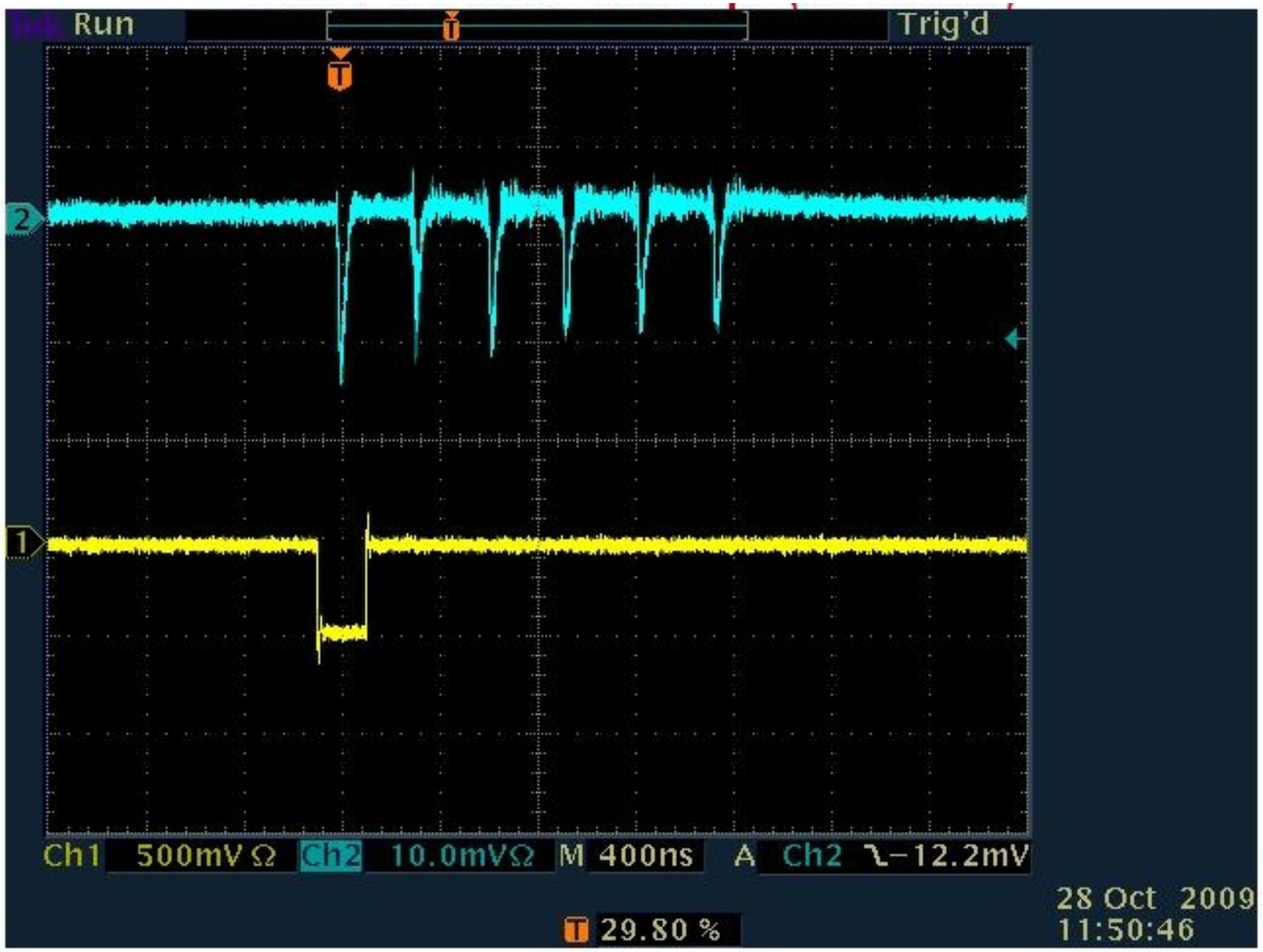
Beam Extraction succeeded from DR to ATF2 by using Fast Kicker



One of the significant technology to realize the International Linear Collider is the fast kicker of the damping ring(DR), which injects/extracts the long bunch train to the DR/ from the DR. The left side picture shows the proto-type of the fast kicker installed in the DR of ATF-KEK. The beam is extracted by using the fast kicker, the right picture shows the beam profile at the end of the ATF2 beam line.

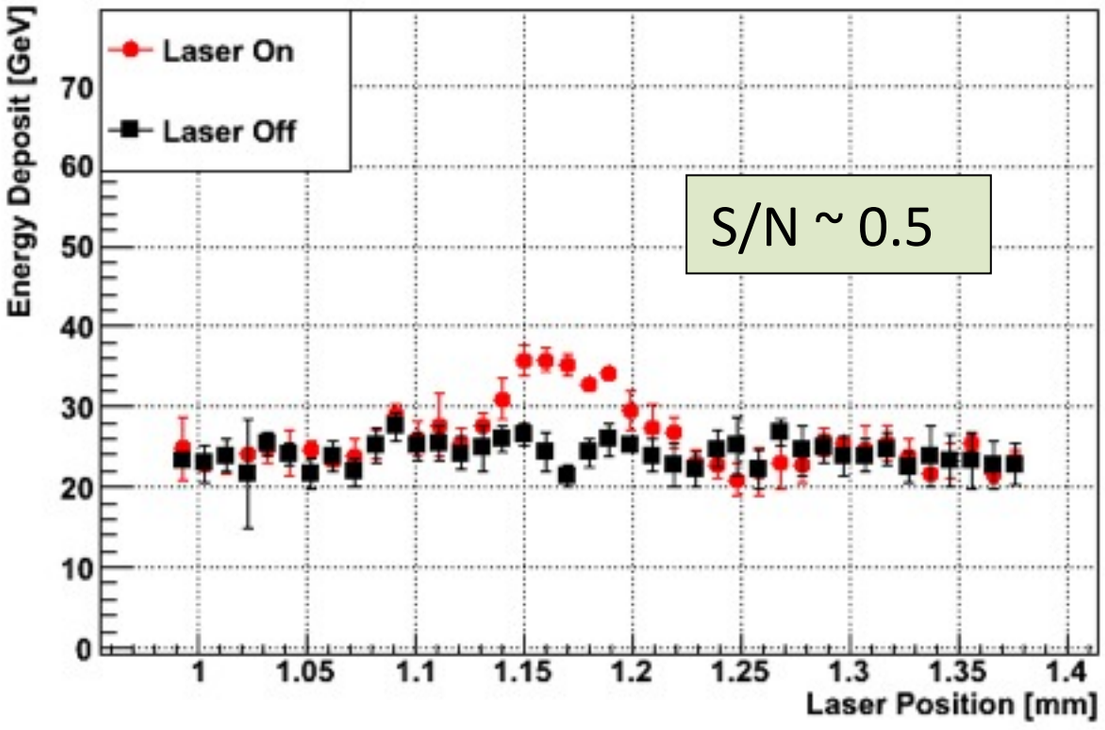
First Multi-bunch Extraction Oct.28

- Bunch interval 5.6ns
- Kicker excitation interval 308ns
- Upper line: bunch charge measured in the extraction line
- Hor: 400ns/div
- Ver: 0.2nC/div

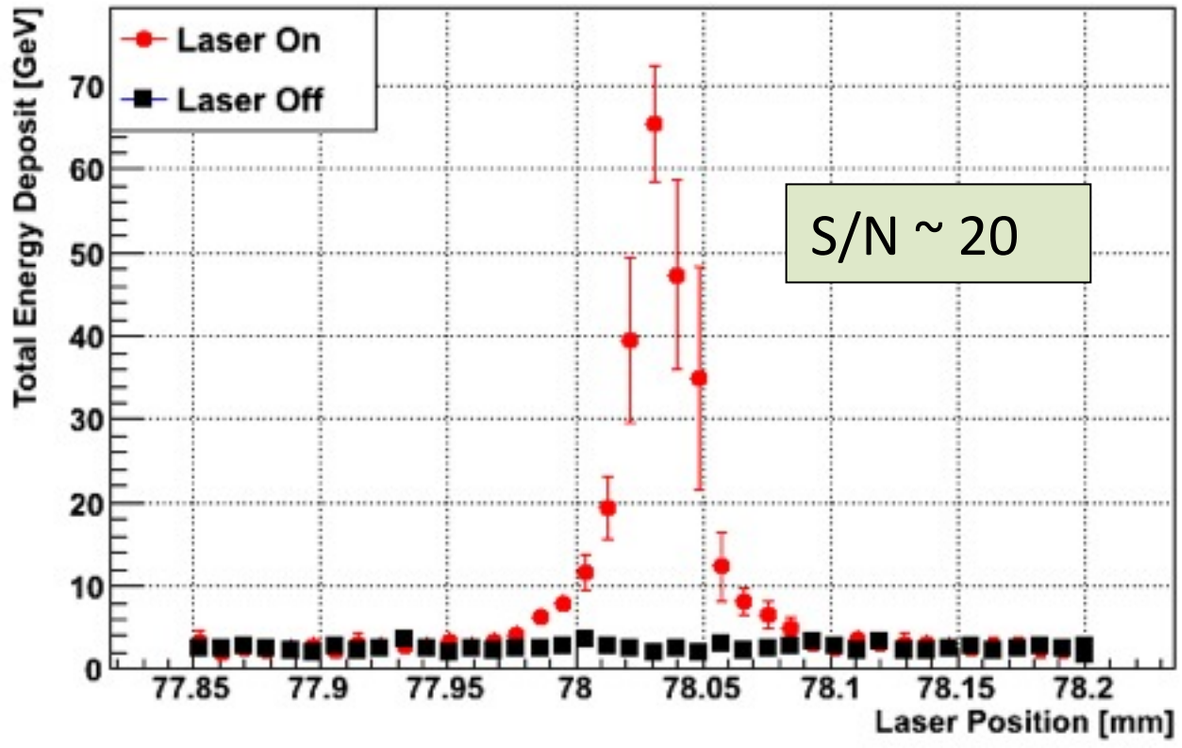


Comparison of Compton Signal

- Comparison of S/N ratio in laser wire mode
  - Beam is focused at the IP
  - Laser width at the IP are almost same (about 20um σ)
  - ICT-DUMP charge 0.5 x 10^{10} electron
- In spring run
  - Background was reduced after the beam orbit tuning from the EXT and fine tuning around the Final Doublet.
- In autumn run
  - Background was reduced relatively easy.
  - Background didn't exceed 10 GeV if the beam was aligned some extent.



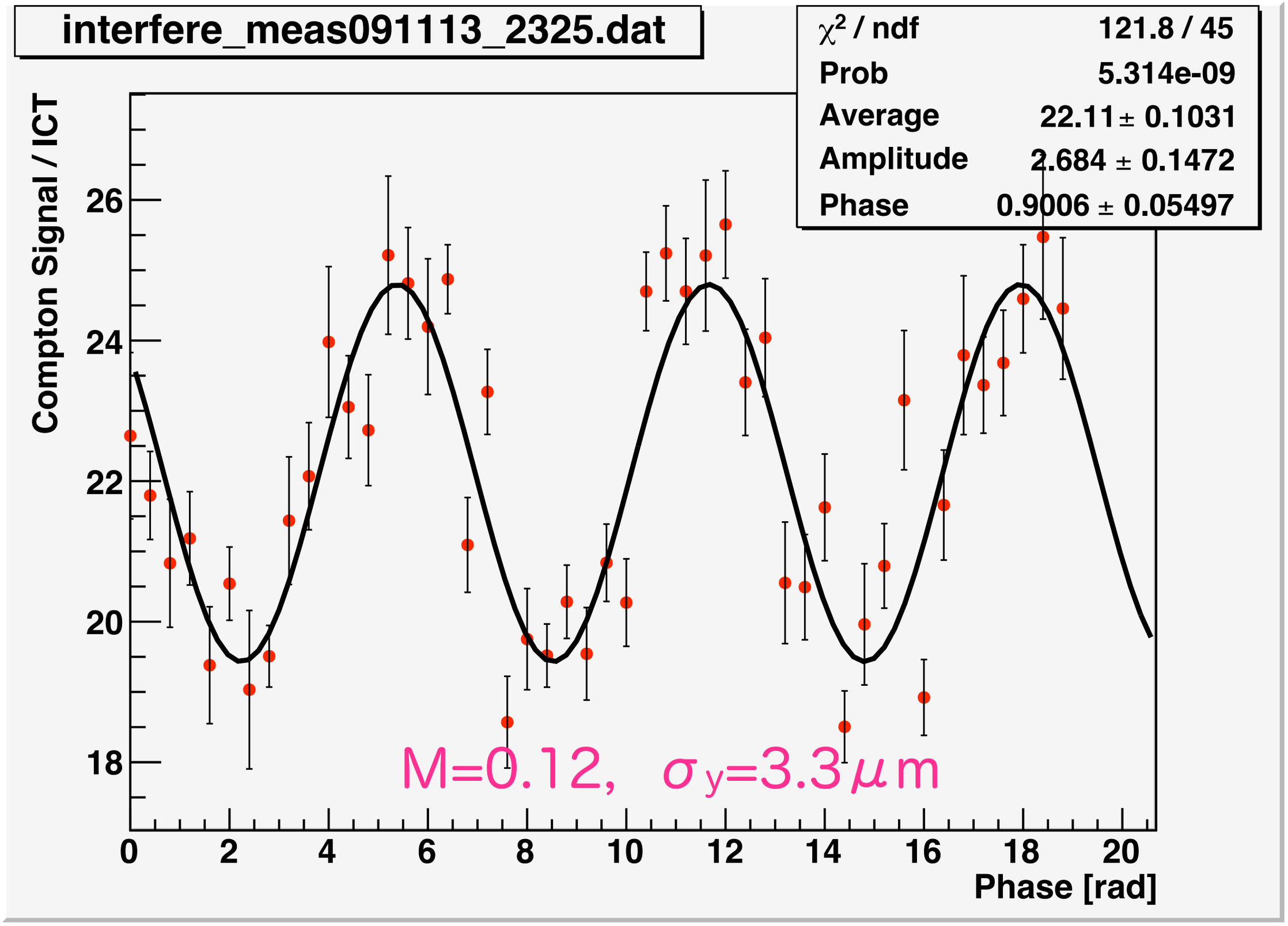
laser wire mode measurement on May 29, 2009



laser wire mode measurement on Nov. 13, 2009

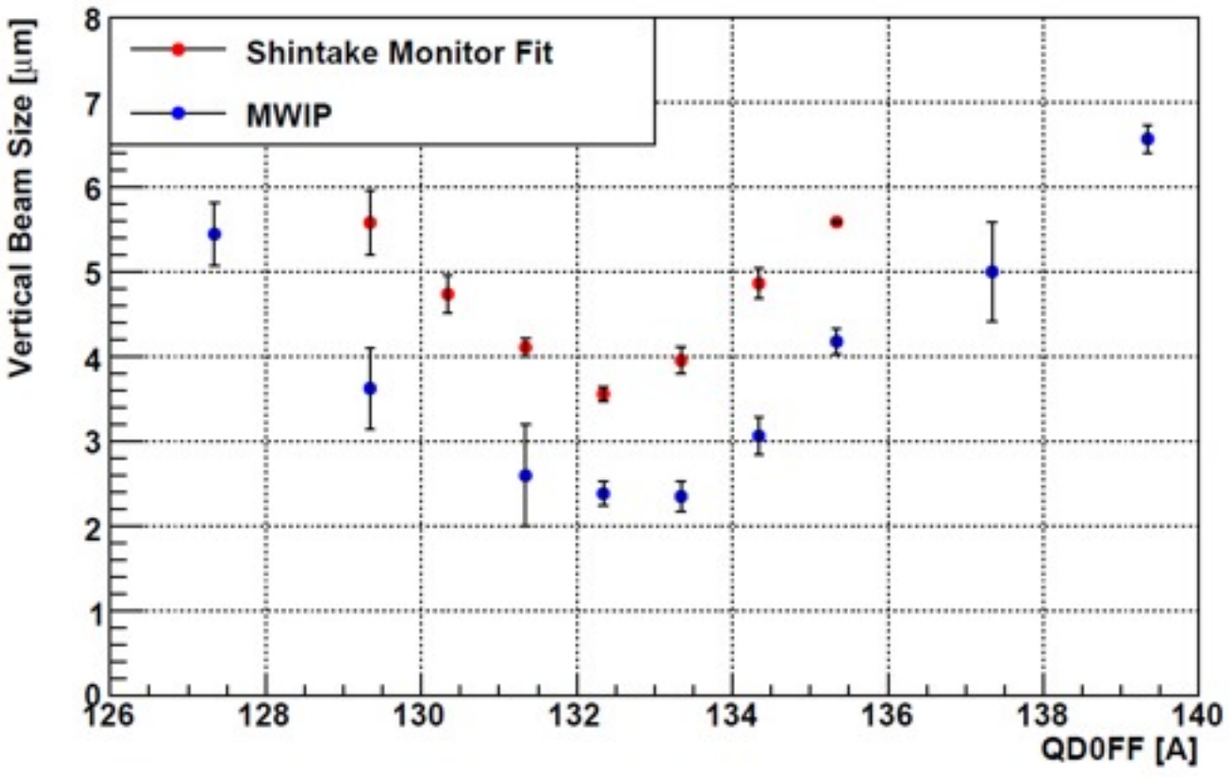
T.Yamanaka, 9th ATF2 Project Meting, 14-17 December, 2009

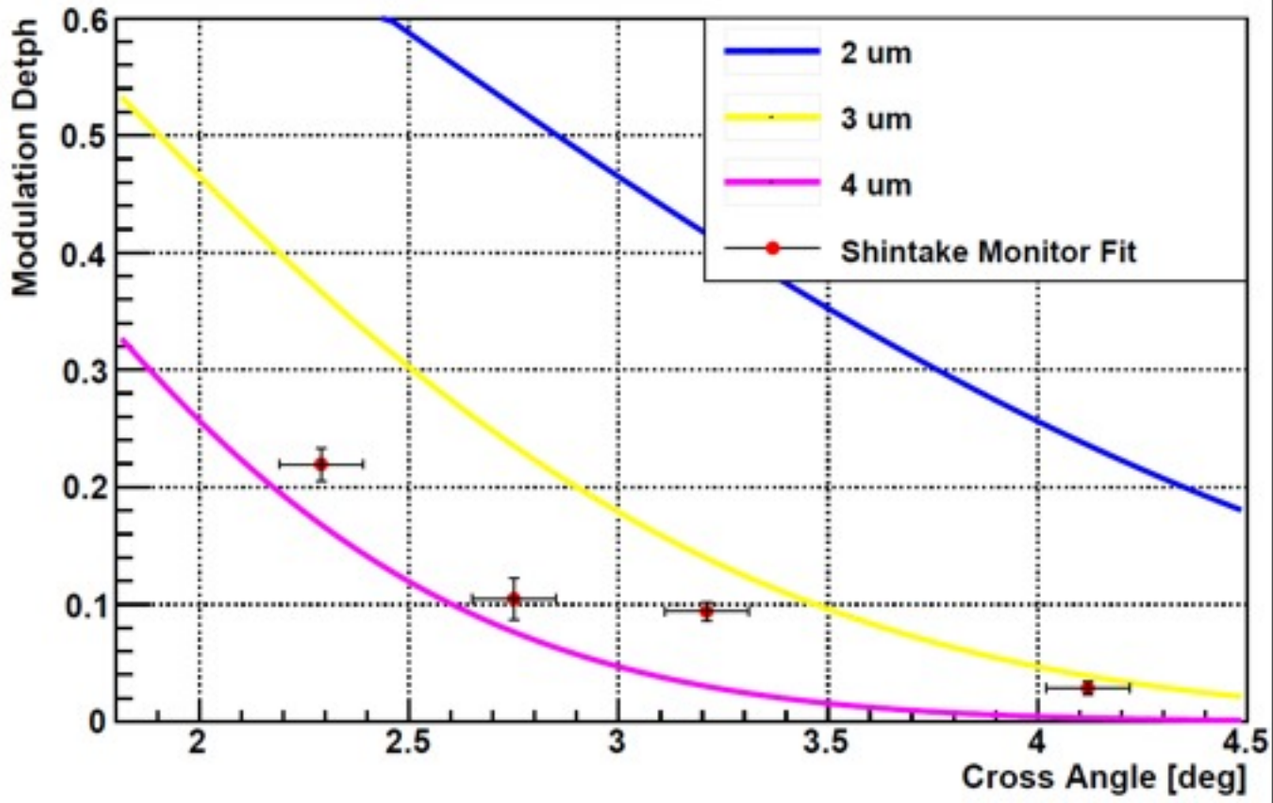
First Interference result by IPBSM



Obtained Result

- Comparison with tungsten wire scanner
  - Curve shape of the Shintake Monitor measurement is similar to the wire scanner measurement
  - Large offset exists in the Shintake Monitor measurement
- Consistency check when the laser crossing angle is changed.
  - rather consistent result

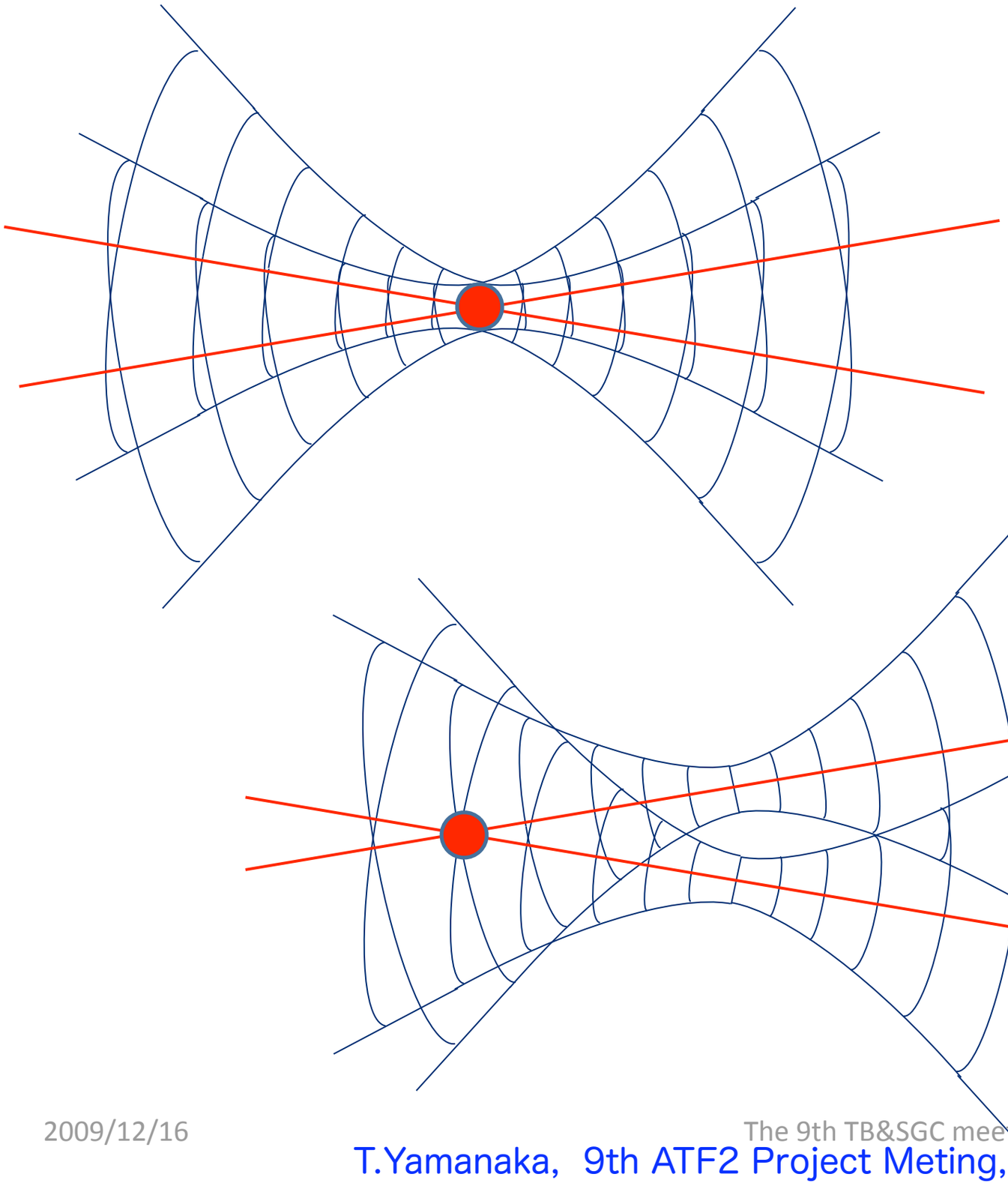


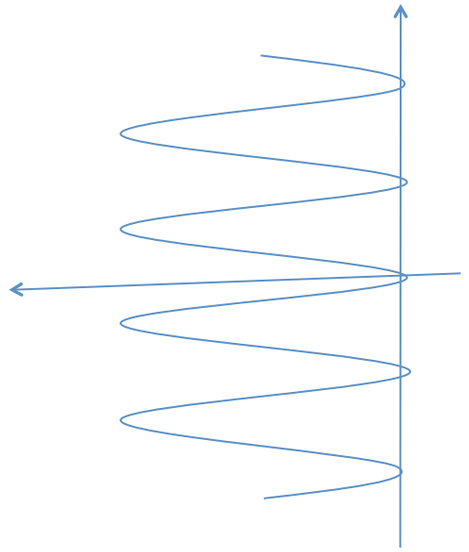


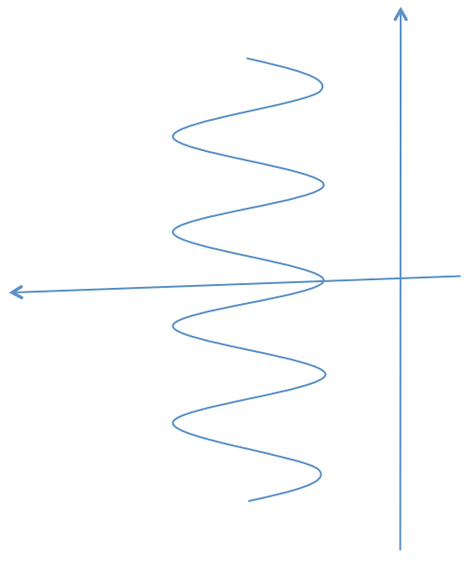
T.Yamanaka, 9th ATF2 Project Meting, 14-17 December, 2009

Issue on the laser waist displacement

The collision point was not set to the laser waist.



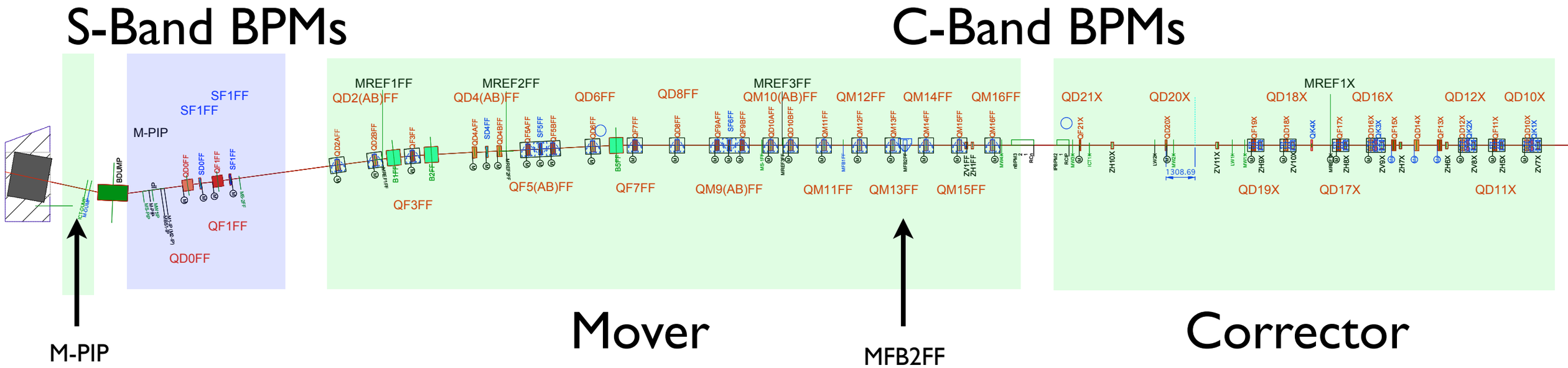




Modulation pattern was deformed.

T.Yamanaka, 9th ATF2 Project Meting, 14-17 December, 2009

ATF2 BPM layout

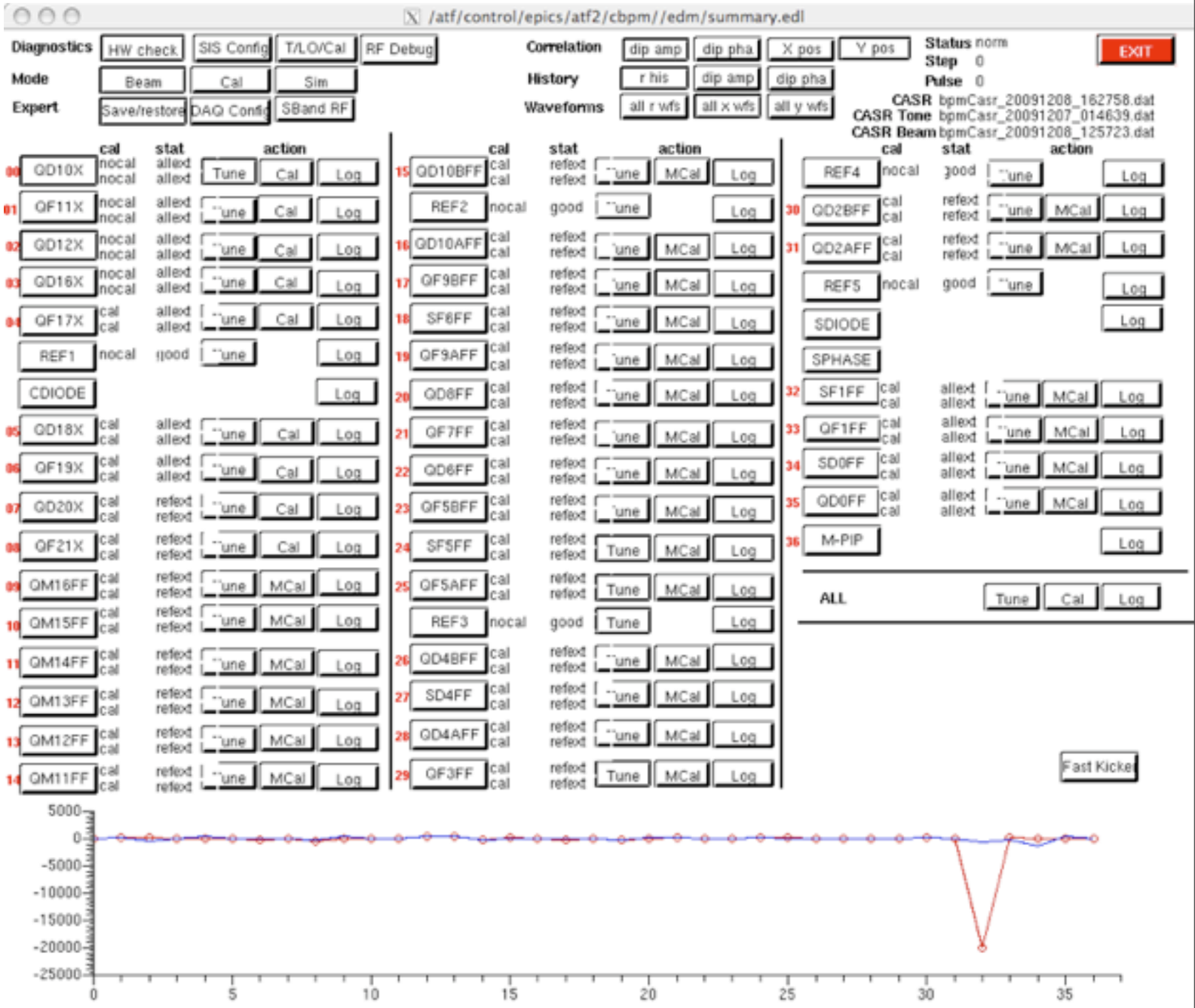


- S-band : 4 (dipole) +1 (ref)
  - Variable attenuation and gain, unlocked local oscillator
- C-band : 33 (dipole) + 4 (ref)
  - Locked LO system
  - Attenuation : 20 db in all channels (1 removed for tests)
  - 10 corrector calibrated
  - 23 mover calibrated

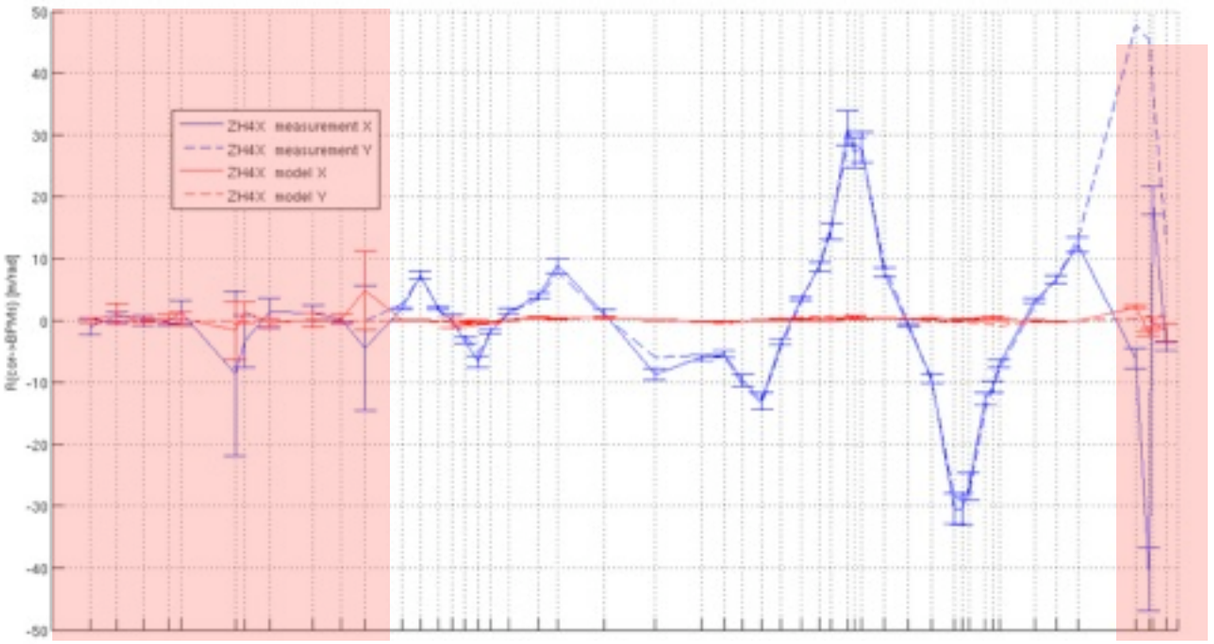
S.Boogert, 9th ATF2 Project Meting, 14-17 December, 2009

Software system

- Key element for cavity BPM usage
  - Quick control of all BPM functionality and operating algorithms
  - EPICS based + EDM + python + scipy + matplotlib + catools + ...
- Complete control of entire system
- Easy to integrate new tests
  - IP-BPM electronics + tilt monitor



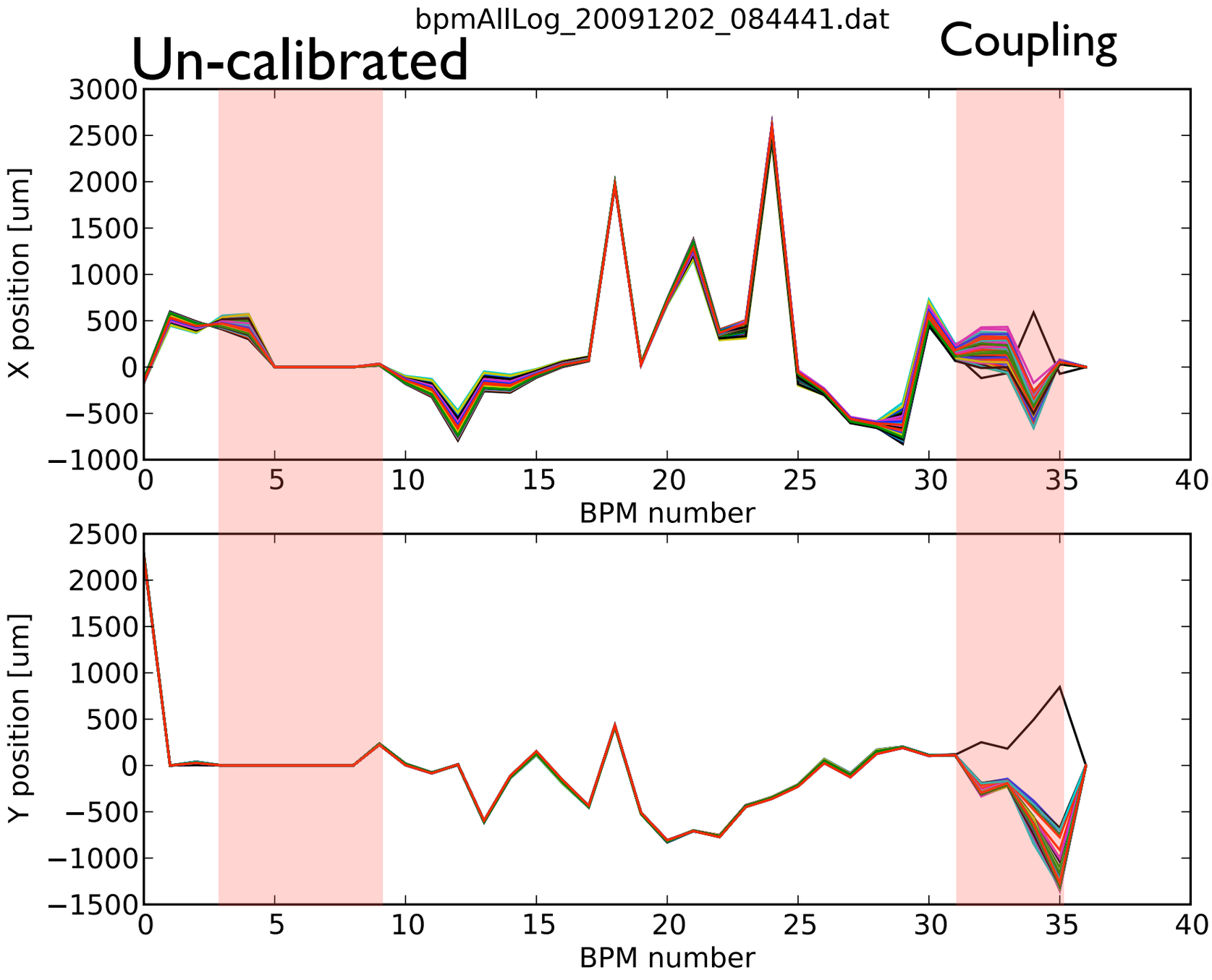
BPM system performance



- Kick beam using correctors
  - ZH4X
  - ZH6X
- Compare
  - Optics model (R matrices)
  - Orbit response with BPM measurements normalised by kick strength

S.Boogert, 9th ATF2 Project Meting, 14-17 December, 2009

Charge dependance



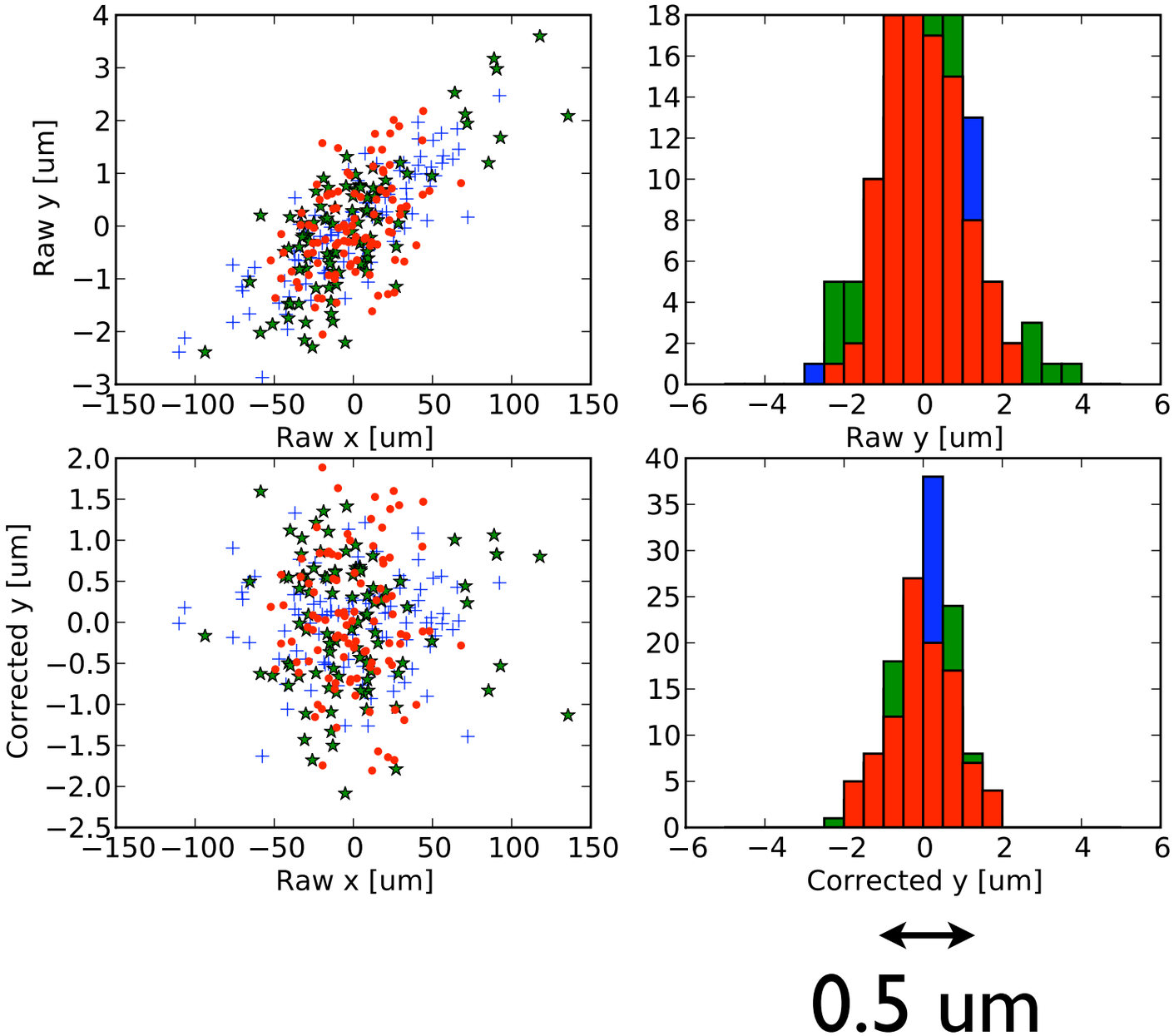
Horizontal orbit jittery due to dispersion

S-band BPMs more noisy

- Similar orbit for charge between 0.1 to 0.5×10^{10}

S.Boogert, 9th ATF2 Project Meting, 14-17 December, 2009

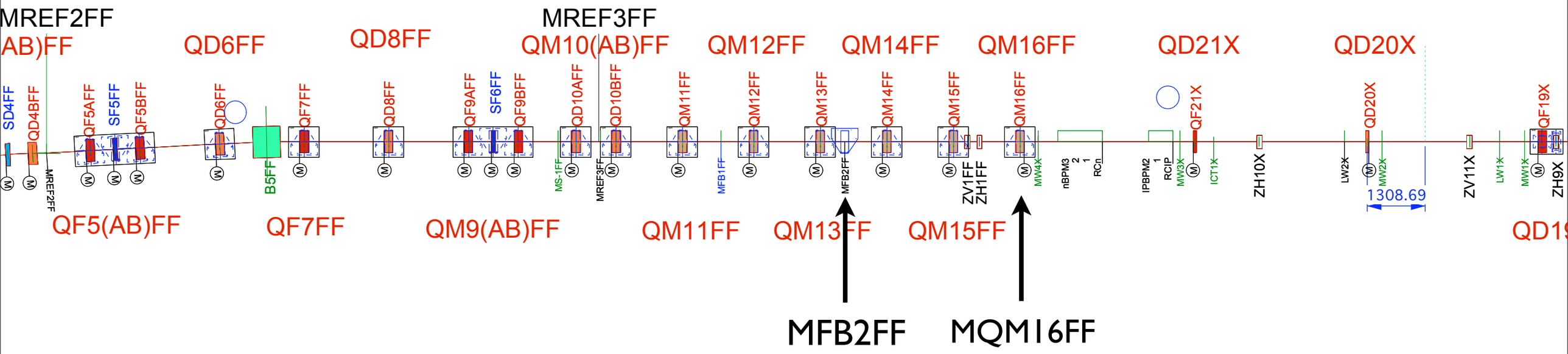
Best resolution (MFB2FF)
no attenuator



- Sub-micron "resolution" confirmed
  - MFB2FF at waist, so beam jitter low
  - BPM rolled
- Beam size ~3 um
- RMS ~ 0.5 um
- Includes beam drift and jitter
- Will correct for this effect this evening (see later)

S.Boogert, 9th ATF2 Project Meting, 14-17 December, 2009

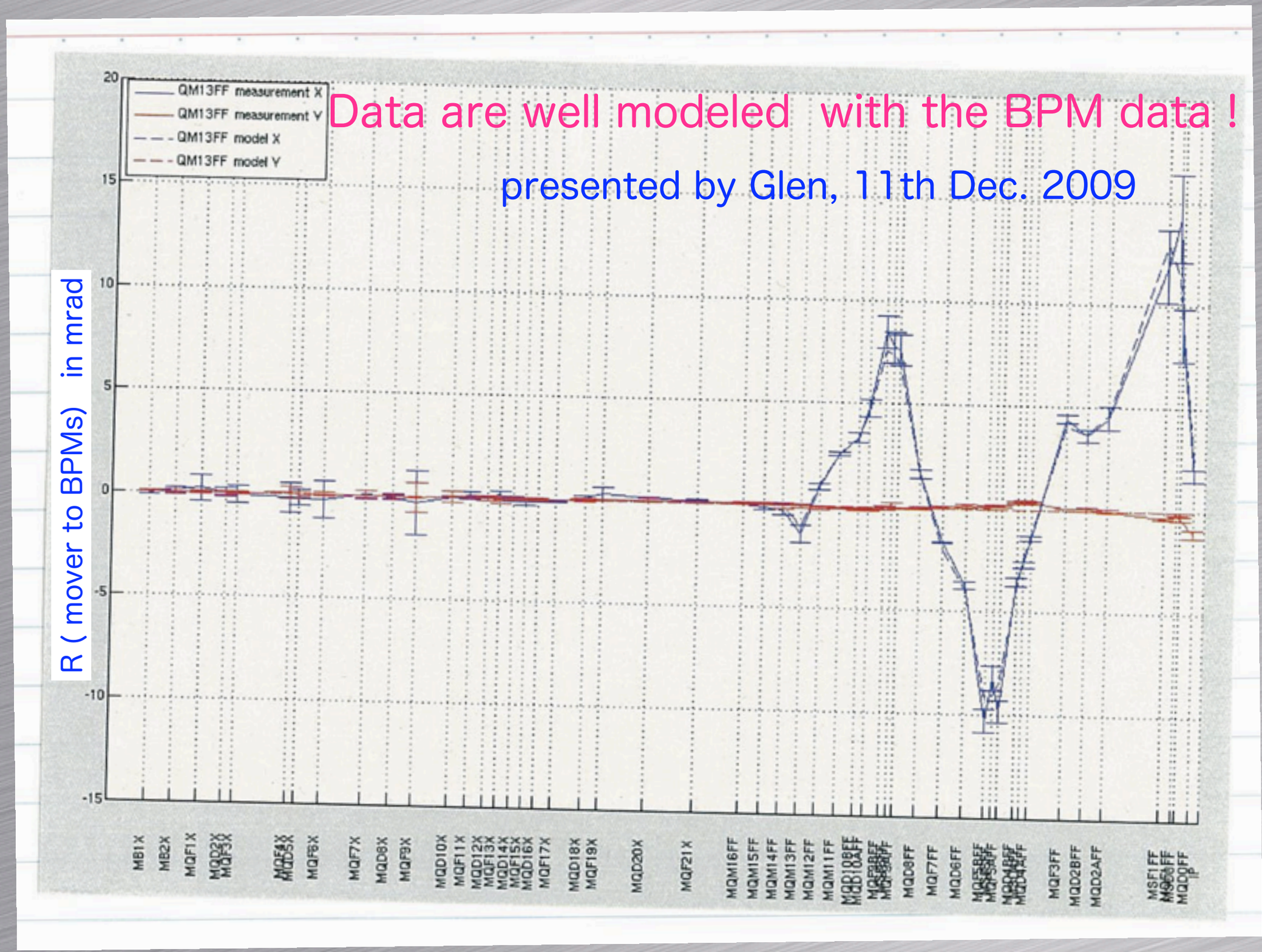
Proper resolution studies



- This remove 20 dB attenuators from MQM16FF
  - QM16FF off in nominal optics
  - Compare MQM16FF with MFB2FF
  - MFB2FF is instrumented with Zygo interferometer to measure relative displacement

S.Boogert, 9th ATF2 Project Meting, 14-17 December, 2009

Online Model Check

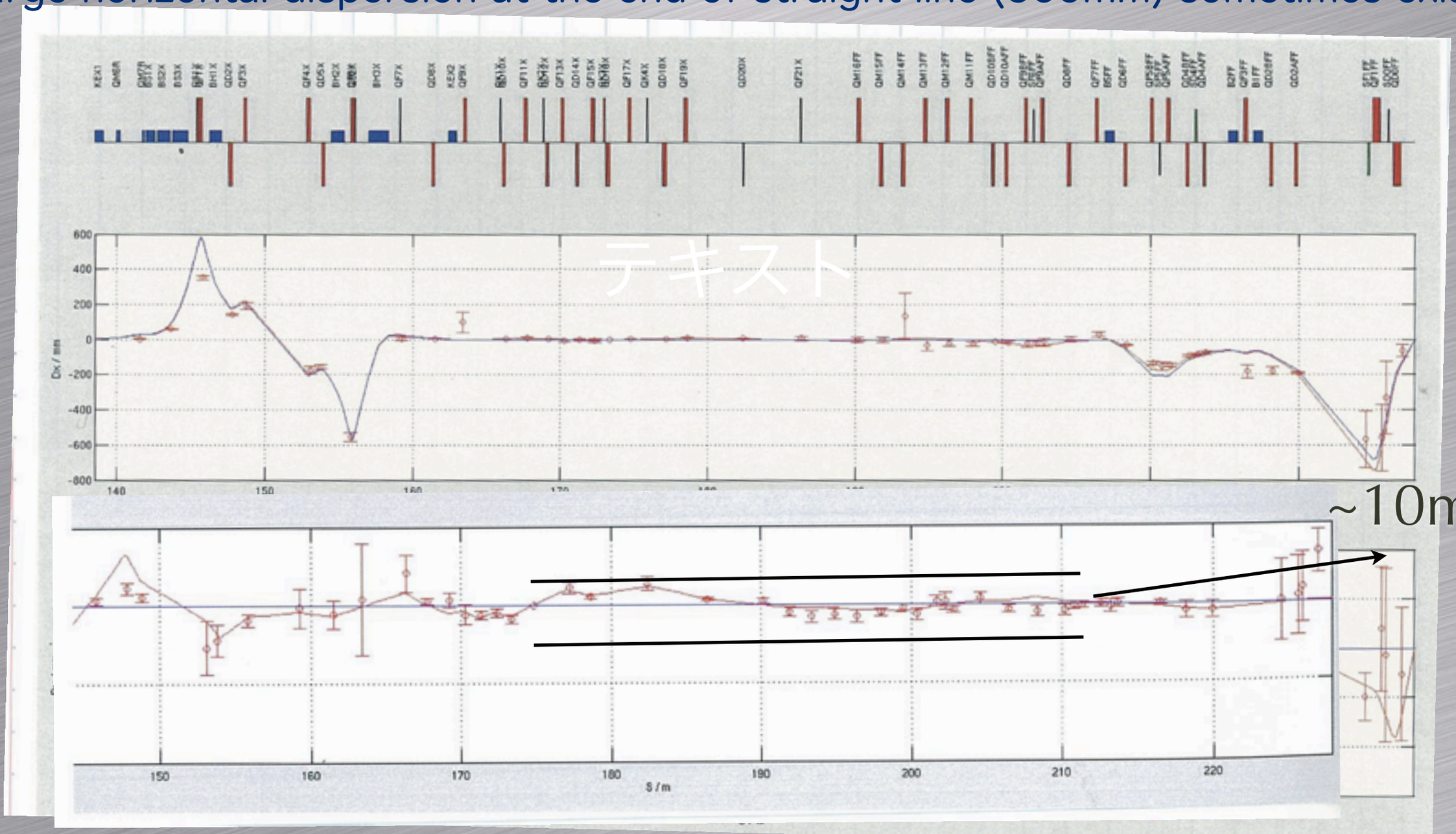


Data are well modeled with the BPM data !

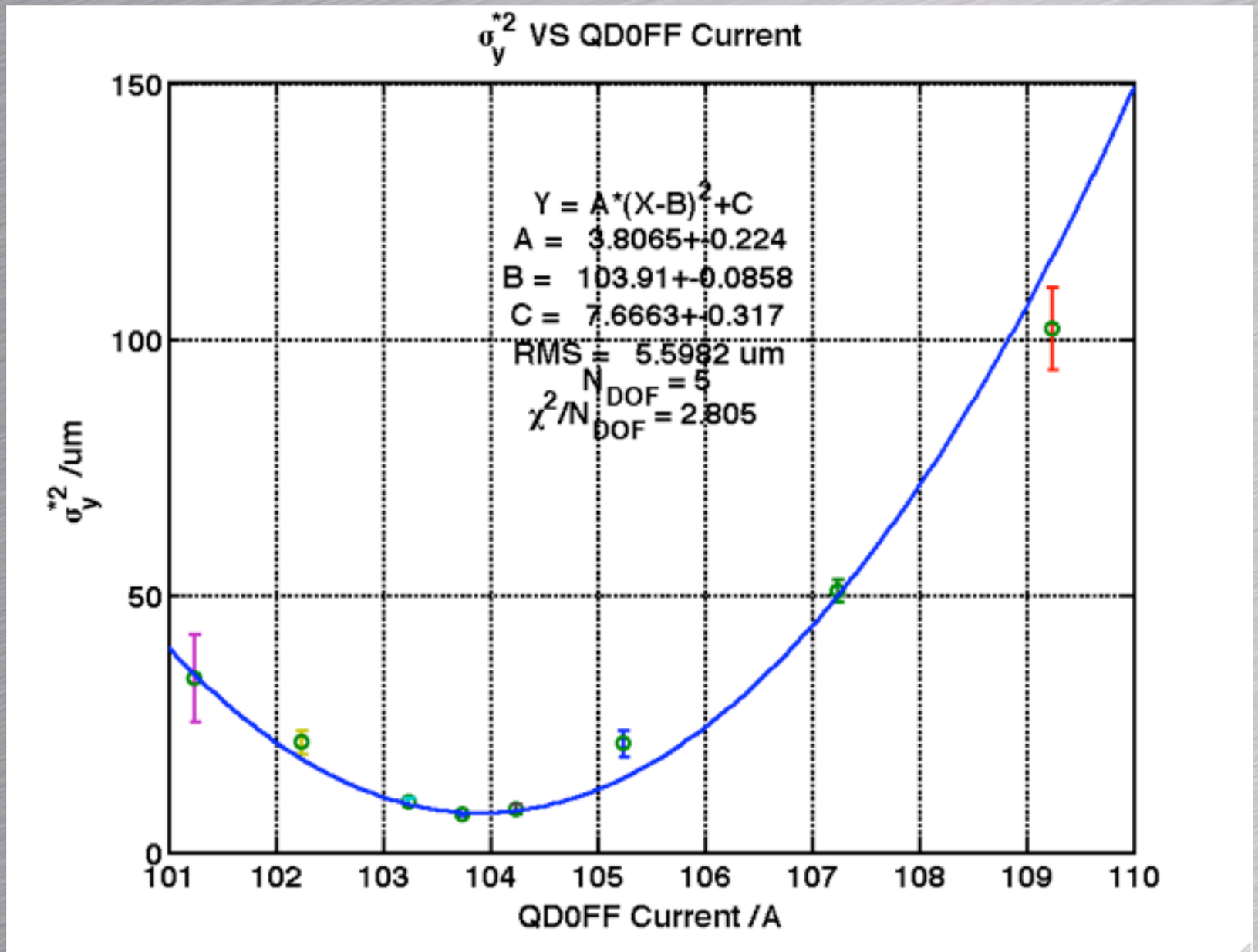
presented by Glen, 11th Dec. 2009

Dispersion Measurements and Fits

- Vertical dispersion for all ATF2 beam line is corrected within 10mm.
- Large horizontal dispersion at the end of straight line (500mm) sometimes exists.



IP Beam Scans with C Wirescaner



- After waist scan and QK1-4X skew quad scans for IP coupling minimisation, min beamsize = **1.48 +/- 0.61 um**
- Close to resolution limit of carbon wirescanner (1.25um)

G.White, 9th ATF2 Project Meting, 14-17 December, 2009

Requirements

Goal	ATF-EXT	ATF2
I/A	Jitter < 30% of σ_y with no feedback $r\,\varepsilon_y$=(4.5➡3) x 10^{-8}m (ε_y = 12pm)	BSM (laser in higher mode) BPMs with 100nm res. at Qs Power supplies of < 10^{-5} Active mover of Final Q
II/B	Jitter < 5% of σ_y (2nm jitter at IP) with feedback	BPM with < 2nm res. at IP IP Intra-bunch feedback for ILC style beam

ATF2 proposed optics IP parameters in comparison with ILC.

params	ATF2	ILC
Beam Energy [GeV]	1.28	250
L* [m] (f*)	1	3.5 – 4.2
$\gamma\,\varepsilon_x$ [m-rad]	3e-6	1e-5
$\gamma\,\varepsilon_y$ [m-rad]	3e-8	4e-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	$\sim 10^4$	$\sim 10^4$
$\sigma_x(\mu\mathrm{m})$	2.8	0.655
$\sigma_y(\mathrm{nm})$	34	5.7
σ_x/σ_y	82	115

ATF2

1.2nm

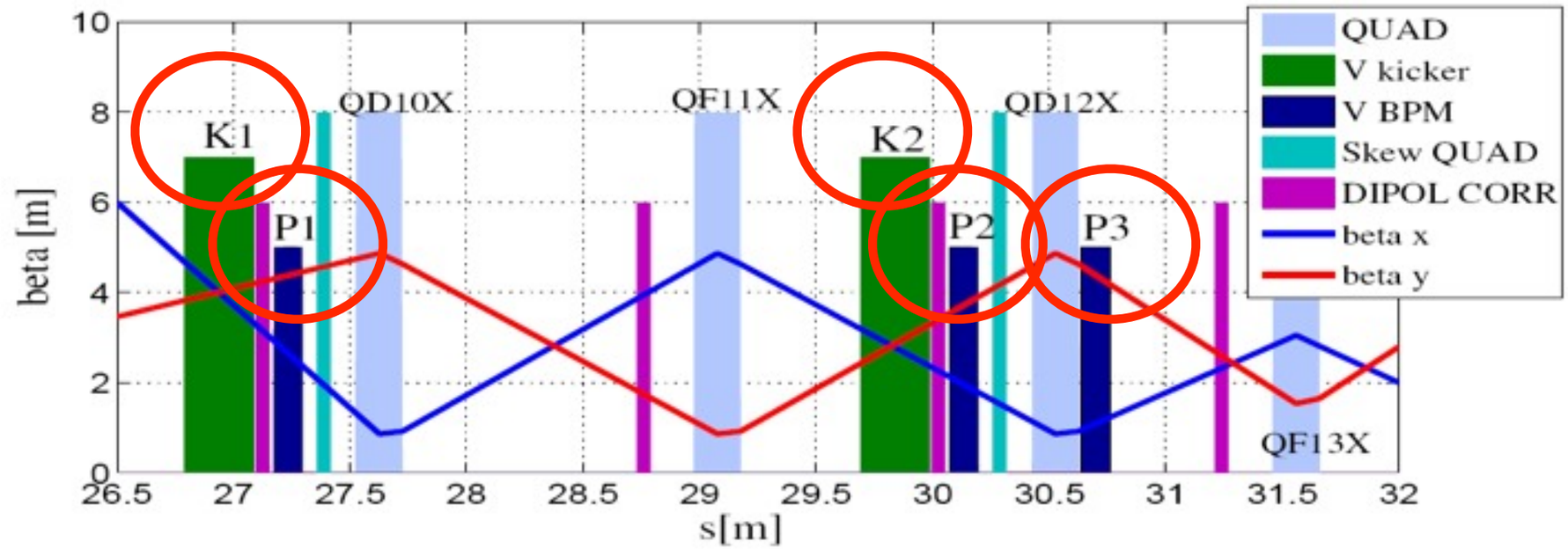
12pm

~ L*/β^*_y

ATF2 FB system: FONT5

Dedicated system:

- **2 stripline kickers + fast drive amplifiers**

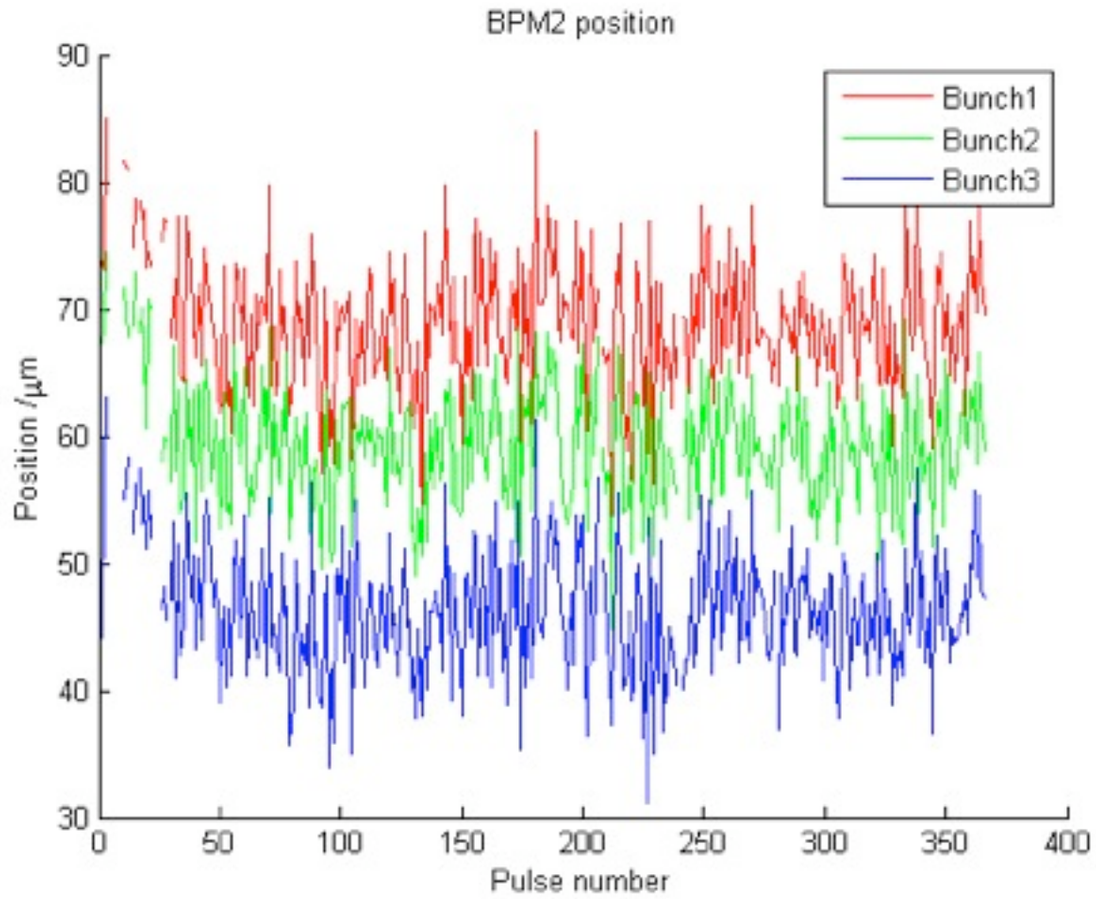


- **3 stripline BPMs + fast analogue front-end electronics**

- **9-channel digital FB processor**

Beam jitter/correlation studies

18 November 2009, Std Optics, 3 train, 151.2 ns BS (with FONT4 electronics, P1 & P2 only)



Mean position +/- RMS jitter at P2:

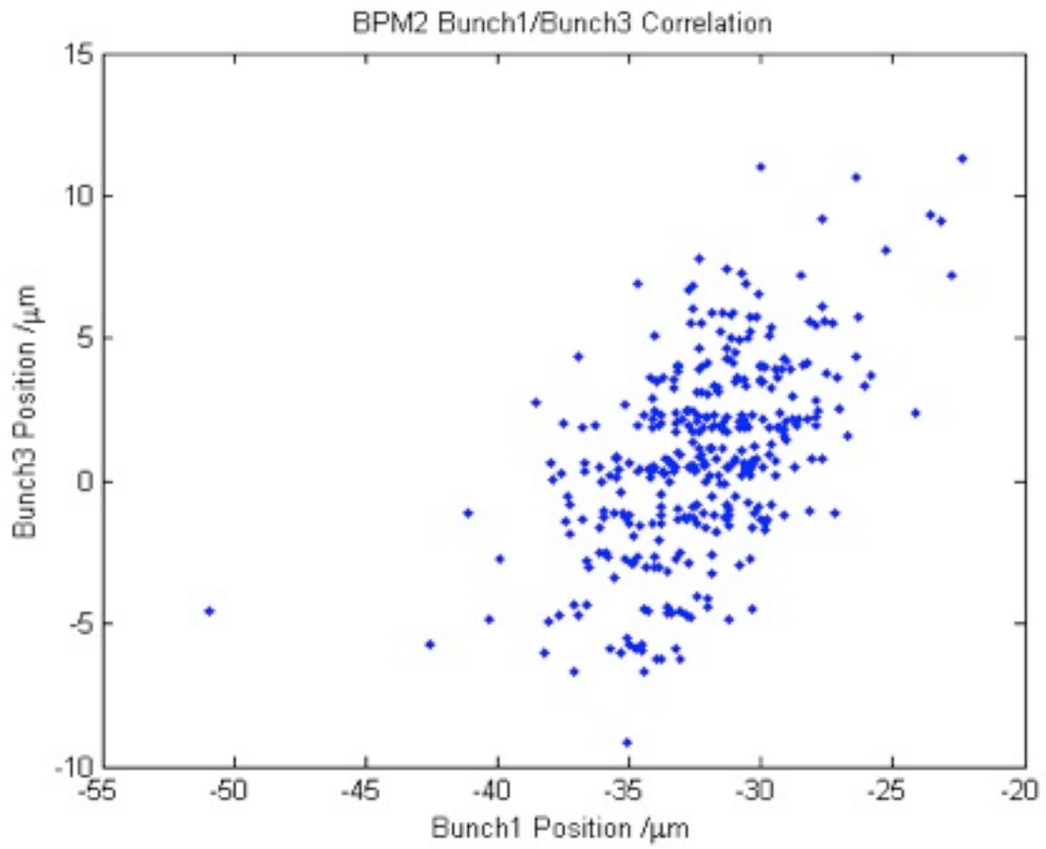
Bunch1: 68.9 +/- 5.1 um

Bunch2: 59.4 +/- 4.7 um

Bunch3: 46.3 +/ 5.0 um

$\sigma_y \sim 6\,\mu m$

RMS sagitta wrt train mean: 11.3 um



Bunch-to-bunch correlations at P2:

B1/B2: 0.76

B2/B3: 0.77

B1/B3: 0.78

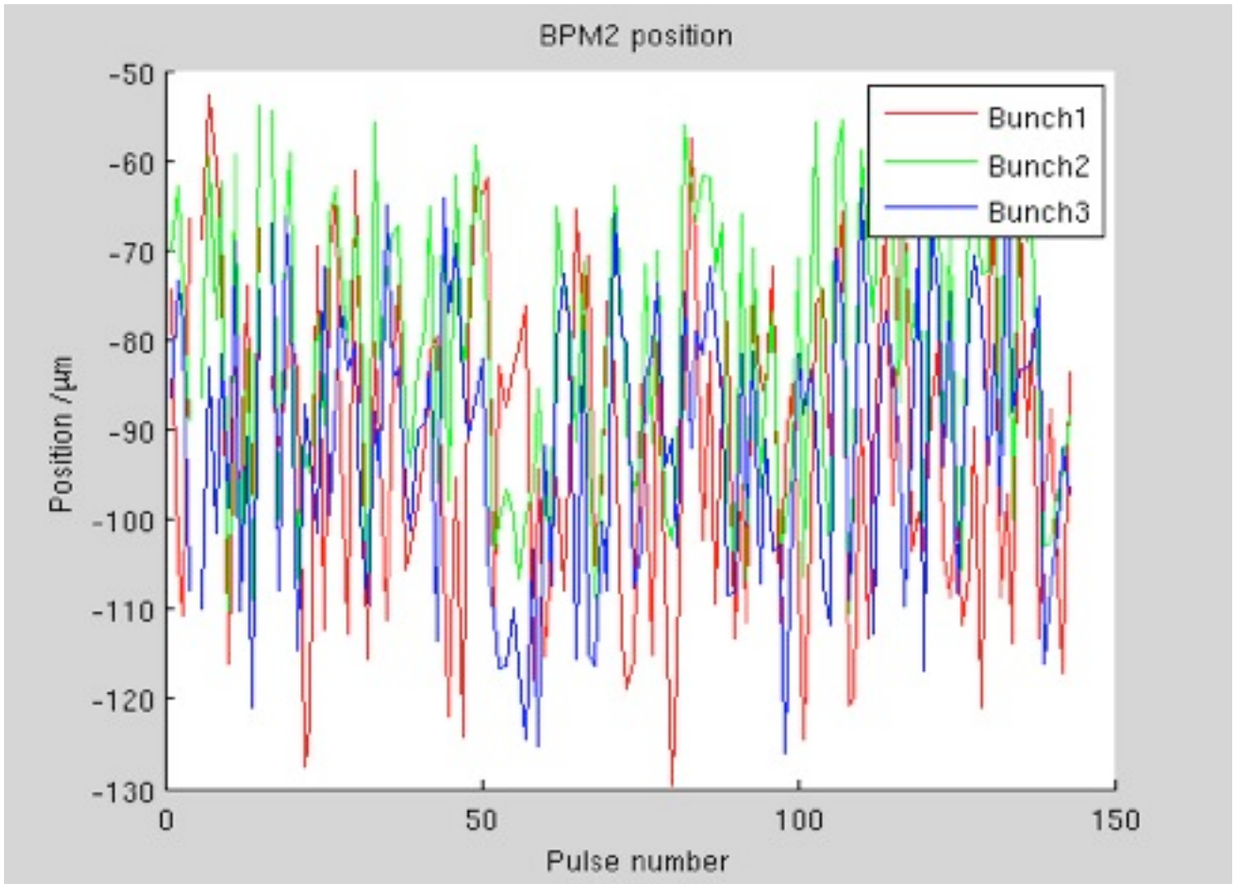
resolution < 2.3 um, based on jitter and correlation observed.

P.N. Burrows

P.Burrows, 9th ATF2 Project Meting, 14-17 December, 2009

Beam jitter/correlation studies

11 December 2009, Std Optics, 3 train, 151.2 ns BS (with FONT5 electronics - P1, P2, & P3)



Mean position +/- RMS jitter at P2:

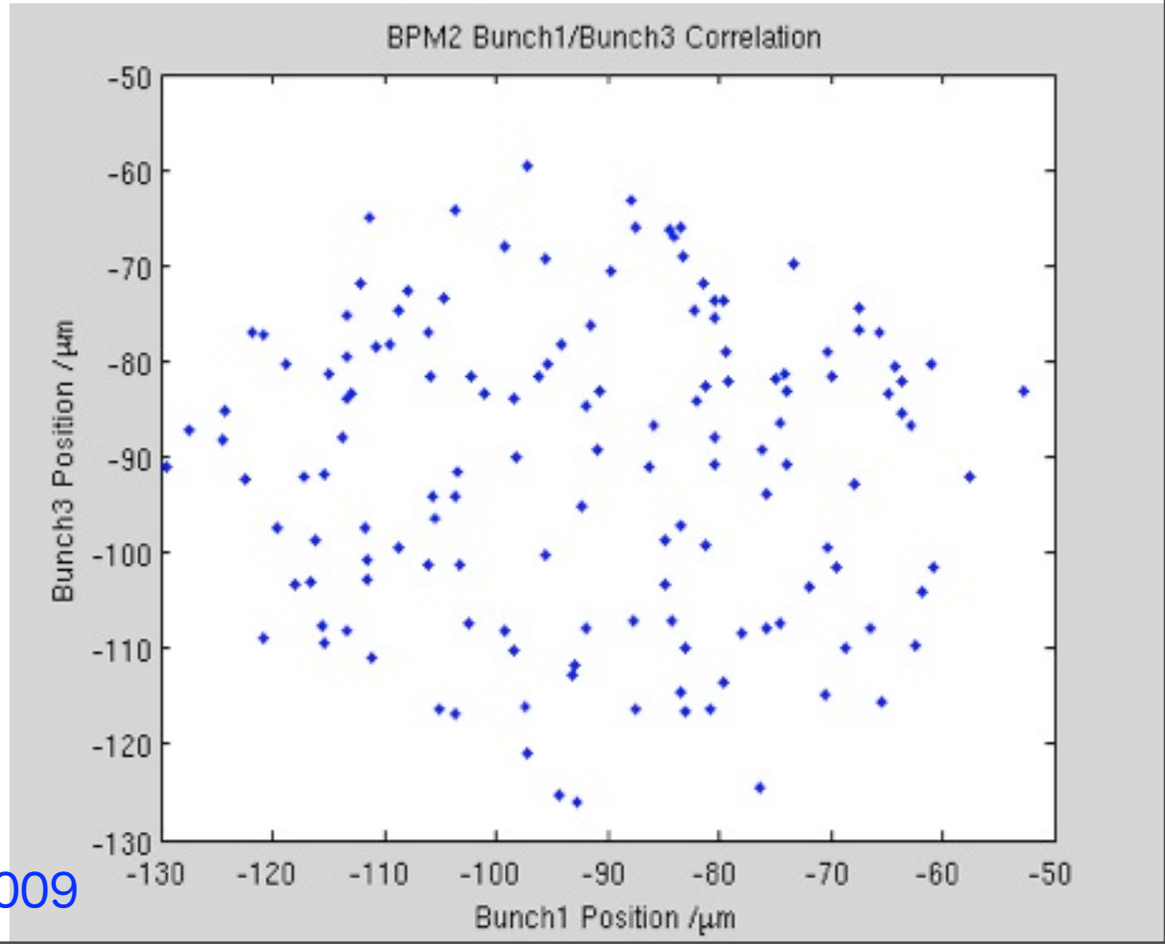
Bunch1: -91.7 +/- 18.4 um

$\sigma_y \sim 6\,\mu m$

Bunch2: -80.9 +/- 16.7 um

Bunch3: -91.3 +/ 15.7 um

RMS sagitta wrt train mean: 6.1 um



Bunch-to-bunch correlations at P2:

B1/B2: 0.48

B2/B3: 0.75

B1/B3: -0.02 (non sign.)

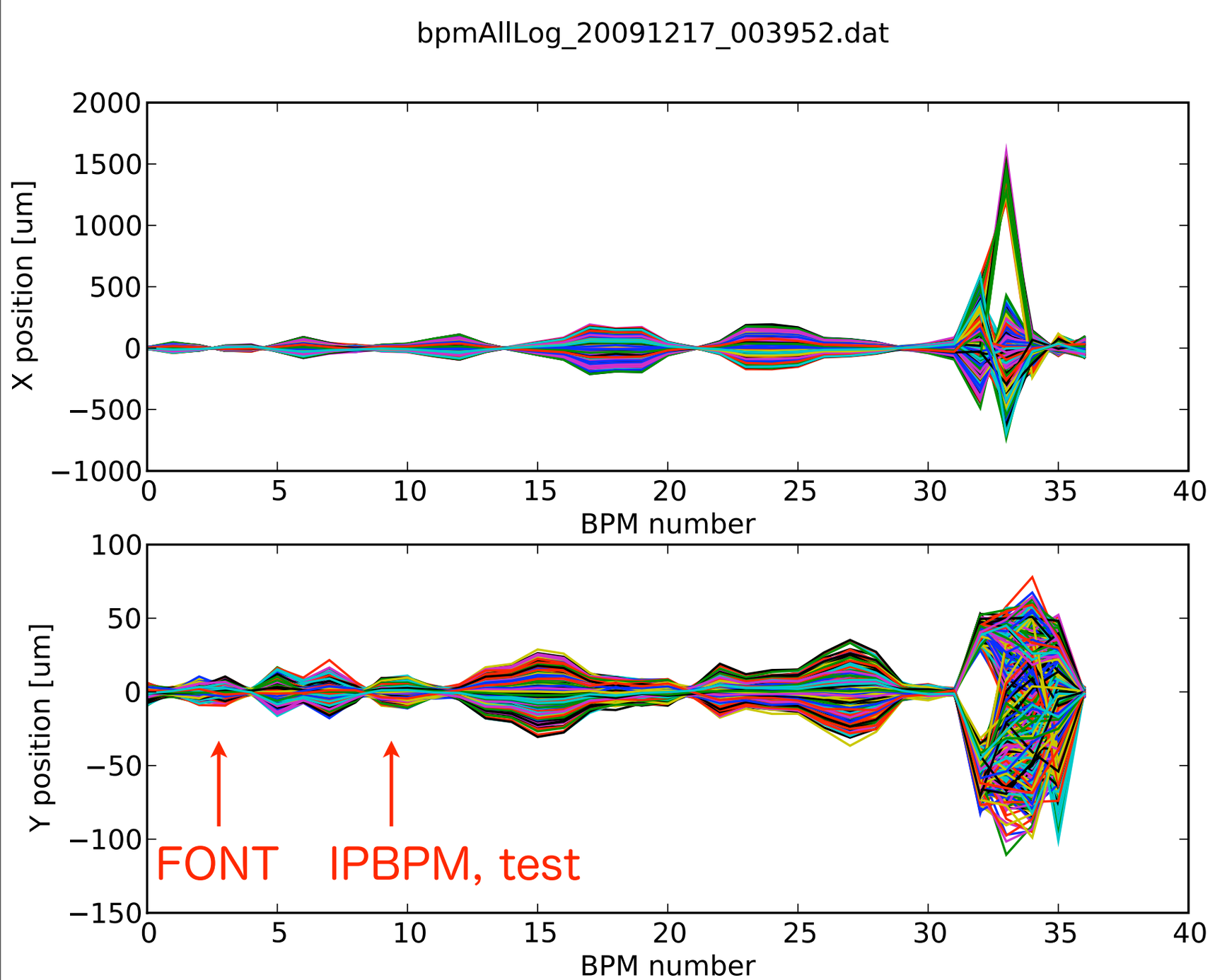
3-BPM resolution estimates:

B1: 3.9 um, B2: 3.3 um, B3 3.4 um

P.N. Burrows

P.Burrows, 9th ATF2 Project Meting, 14-17 December, 2009

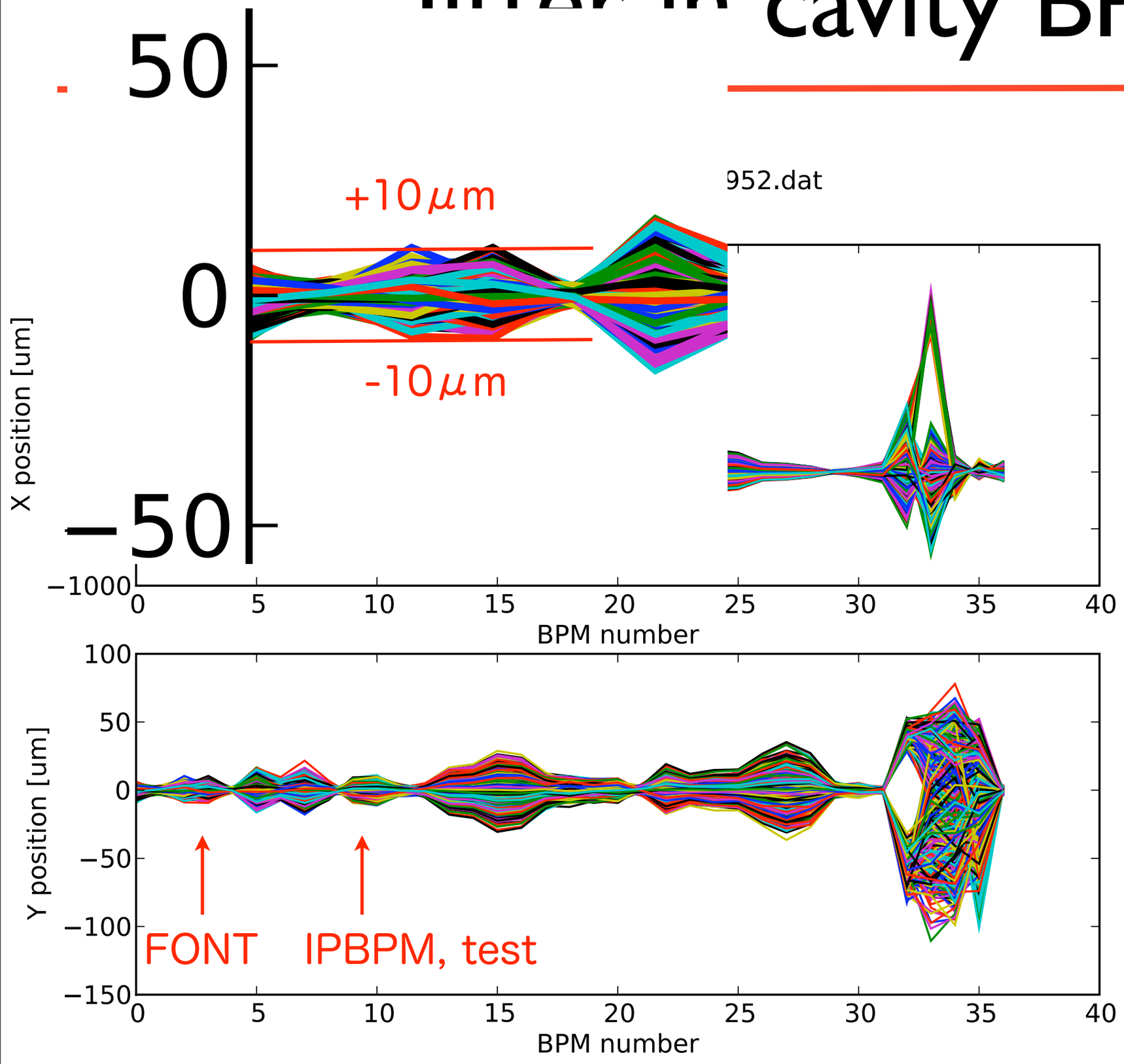
Jitter in cavity BPMs



- Subtract reference orbit
  - S-Band BPMs clearly have some problem
  - Clear beta-function dependence on jitter
  - Typically y jitter less 50 μm

S.Boogert, 9th ATF2 Project Meting, 14-17 December, 2009

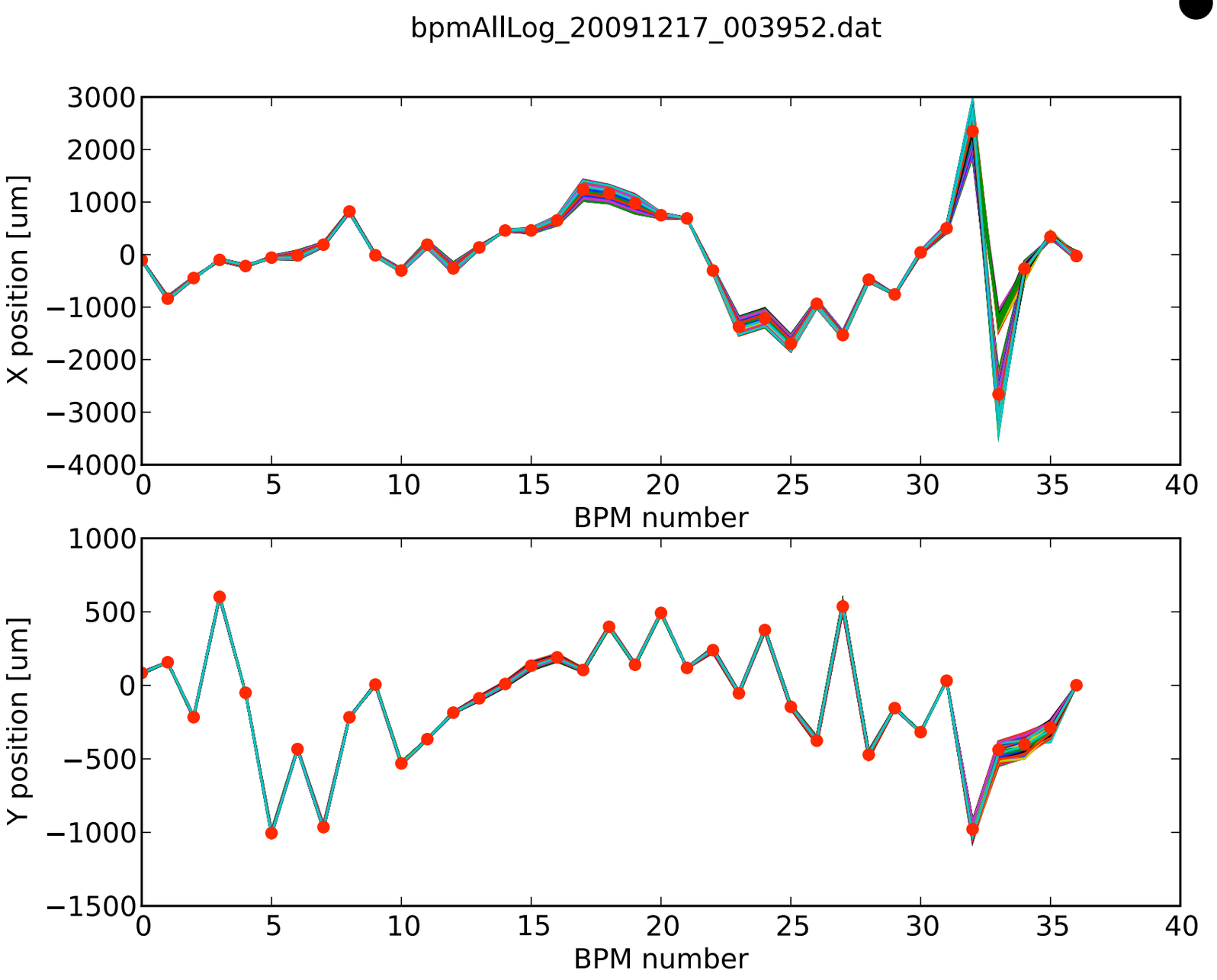
Jitter in cavity BPMs



- Subtract reference orbit
  - S-Band BPMs clearly have some problem
  - Clear beta-function dependence on jitter
- Typically y jitter less 50 μm

S.Boogert, 9th ATF2 Project Meting, 14-17 December, 2009

Reference orbit



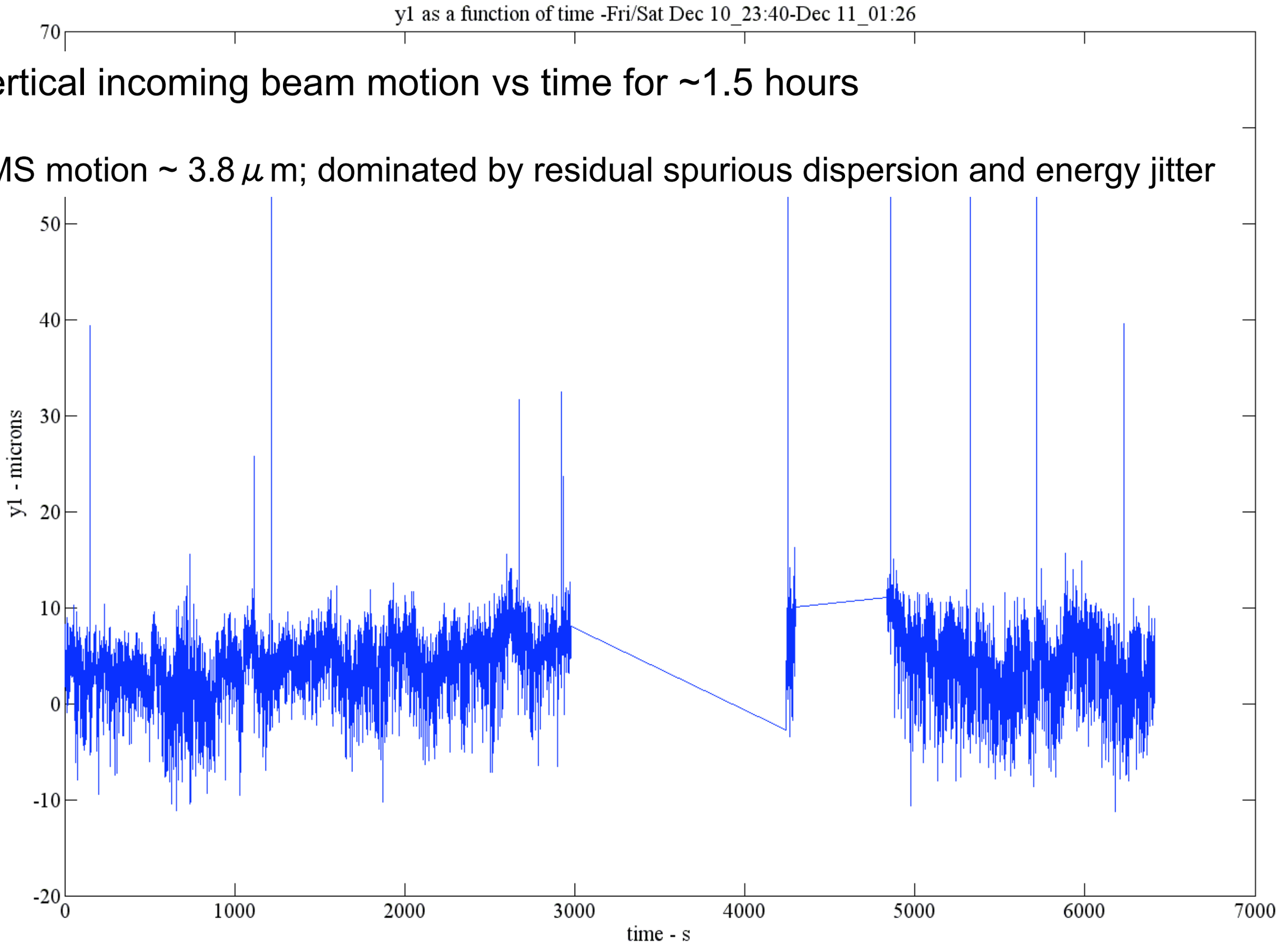
- Cut on reference amplitude and QD10Xx position
  - Bad extracts
  - Low charge

S.Boogert, 9th ATF2 Project Meting, 14-17 December, 2009

measured by the cavity BPM, Dec. 2004, M. Ross

Vertical incoming beam motion vs time for ~1.5 hours

RMS motion ~ 3.8 μm; dominated by residual spurious dispersion and energy jitter

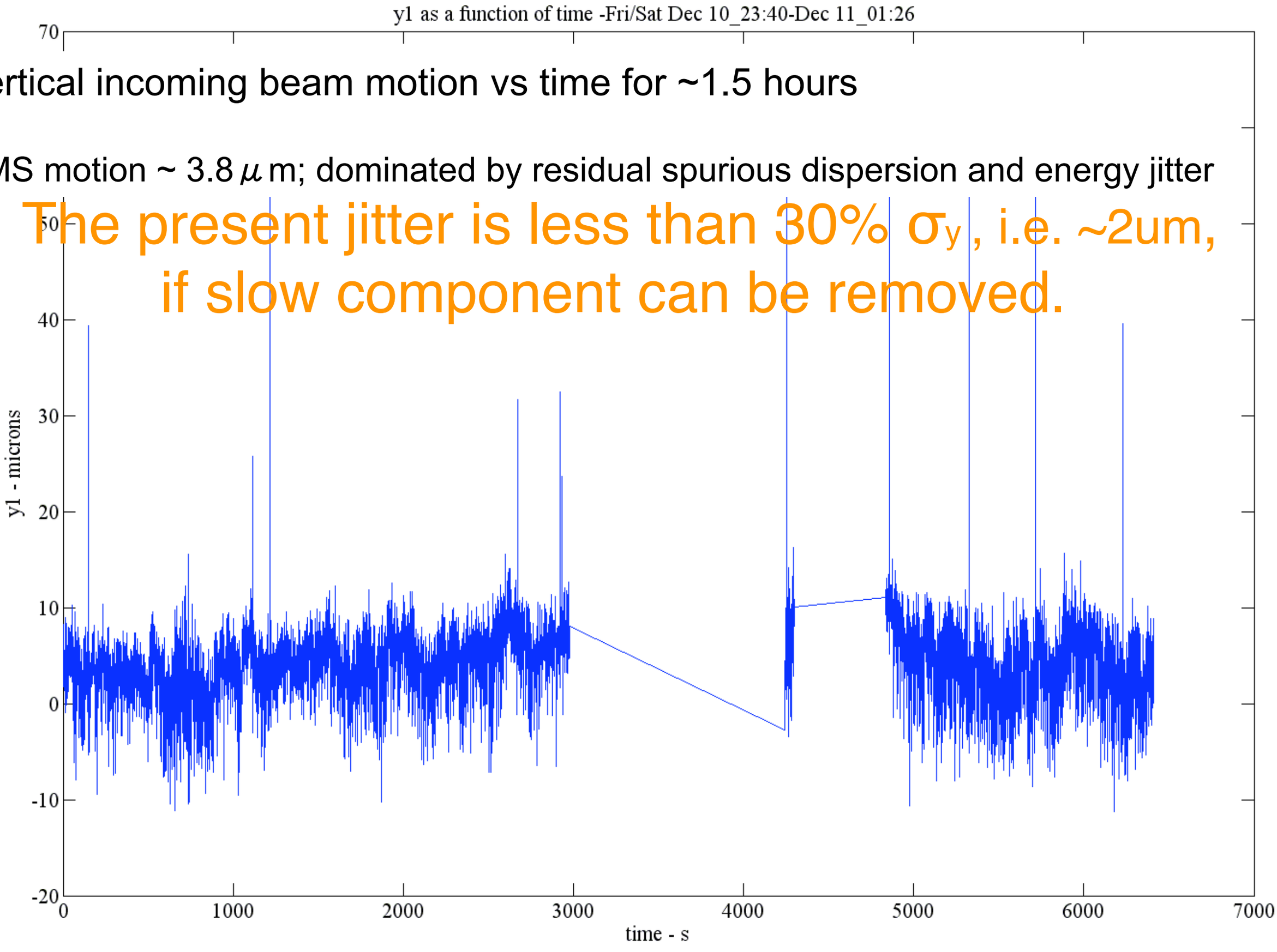


measured by the cavity BPM, Dec. 2004, M. Ross

Vertical incoming beam motion vs time for ~1.5 hours

RMS motion ~ 3.8 μm; dominated by residual spurious dispersion and energy jitter

The present jitter is less than 30% σ_y, i.e. ~2um, if slow component can be removed.



The most critical stability issue at ATF is the variation in the DR stored beam intensity on a pulse-to-pulse basis. Injection beam intensity is directly related to linac energy jitter and drift. The BT orbit is affected by variation in the energy gain in the middle of the linac, which directly affects the injection angle in the septum magnet region. In addition to the energy jitter, bunching jitter also directly affects the energy spread jitter, leading to injection intensity jitter. In order to stabilize the extracted beam current, stabilization of the linac energy and bunch length is the first priority.

ATF, Accelerator Test Facility Study Report JFY 1996-1999

Operation with Large Beta Optics ($\beta^*_{x/y}$=8cm/1cm) ,
IPBSM in LW mode in Feb.-May and the interference mode in Nov.-Dec.

2009 Annual Calendar

January 2009
ATF Operation
new QM7R,HA-PS broken

February 2009
ATF Operation
BPM(1)/week
1st IPBSM LW sig. on 2/27

first LW signal

March 2009
ATF Operation:
BPM(1),FONT(1)/week
DR-BBA

April 2009
ATF Operation
BPM(1),FONT(1)/week
No signal in IPBSM

first try to observe interference signal

no IPBSM signal

May 2009
ATF Operation
BPM(1),FONT(1),LW(1)/week
Signal back in IPBSM, 5/29

IPBSM signal back

June 2009
ATF Operation
fast kicker study at EXT

October 2009
ATF Operation
multibeam was exracted!

multibunch beam extracted by fast kicker

November 2009
ATF Operation
BPM(2),POS(1),FONT(2)
1st IPBSM sig. on 11/13

first interference signal (3° crossing)

December 2009
ATF Operation
BPM(2),POS(2),FONT(3)
seed laser was broken
beam size < 1um by C-wire

σ^*_y<1μm by C -wire (5μmΦ)

ATF Operation
start up
ATF2 beam tuning
IPBSM with 2-3 degree
IPBSM in laser wire mode
Fast Kicker
No beam at EXT

- calibration of the BPM system
- commissioning the 5 wire scanner system
- measurement/ correction of dispersion and coupling
- measurement of emittance at DR and ATF2
- modeling beam line

In summer shutdown;
- alignment
- installation of new screens, wires, knife edge in the IP chamber

- IP beam size tuning by the C-wire scanner

ATF2 internal milestones, Dec.08

2009 | 2010

dec | jan | feb | mar | apr | may | | oct | nov | dec | jan | feb | mar | apr | may | | oct | nov | dec

- BSM Laser Wire mode commissioned
- First test of fast kicker
- Observe several micron beam size
- BSM 8º (0.25-1.5um) commissioned
- Observe sub micron beam size
- BSM 2º mode (1-6um) commissioned
- Achieve ε_y=24pm beam in DR
- BSM 30º (70-400nm) commissioned
- Extract and preserve of ε_y=24pm
- First observation of ILC-scaled σ_y=75nm
- Achievement of ε_y < 12pm in DR
- Repeat observation of 75nm beam
- Extract & preserve ε_y=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
- 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 -function

achieved

VERY TENTATIVE
to be updated

ATF2 Overall Schedule

year	2010												2011												2012												2013												2014											
month	1	2	3	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	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Goal A (single bunch, SB)													37nm																																																
Fask Kicker																									permanently installed																																				
Goal B (multi-bunch, MB)																																																												
DR/LINAC Stability		σ_y (SB)																	$0.3\,\sigma_y$ (SB)											σ_y (MB)																																				$0.05\,\sigma_y$ (MB)											
FONT																																																												
IPBPM 2nm																																																												
SC-Q																																																												
Ultra low beta optics													37nm																																																	20nm
DR BPM upgrade for 1pm																																																											1pm
SC-Q production at BNL																																																												
coil (QF1, SF1)																																																												
magnet (cryostat)																																																												
Cryogenics at KEK																																																											

- IPBSM with 30 and 174 degree
- ATF2 beam commissioning
- Installation around IP
- beam test (R&D)
- beam test and updates
- production
- test
- shipment
- design or parts

2010年 3月 11日 木曜日

Session Organization

	14th Dec. Monday	15th Dec. Tuesday	16th Dec. Wednesday	17th Dec. Thursday
9:00 12:00		Milestones in 2009 - 2010	Future Plan 2013 - SC-Q	Re-examination of strategy for next years followed up the TB discussion
13:30 Introduction -start at 14:00 Comm. status 16:00		Milestones in 2011 - 2012	TB/SGC R&D Status Proposal update of SC-Q closed session Conclusion	Updates of commissioning status Joint w. ILC-BDS
		16:30, ATF Daily operation meeting		18:00- YearEnd Party

Message on the SC-Q to ATF/ATF2 Members ;

Thus, I would like to propose the following -

1. The importance, the validity, the technical contents of the project, and conformity with the ATF2 schedule are the subject of discussion for the coming TB meeting in December, 2009;

2. However, the go or no-go decision for the SC quad project is to be deferred until the ATF TB meeting next year (May, 2010 or later);.
We hope you understand our situation.

Kaoru Yokoya, Head of KEK LC Office

9th December, 2009

Goals at this meeting

1. Update of “monthly” milestones by 2010

- with experiences so far and the goal of 37nm by end of 2010

2. Detailed plan for sub-systems

- Beam tuning procedure automatically as much as possible
- OTR system as a complementary to the wire scanners
- Stripline BPMs, S-band BPMs : monitoring the stability
- IPBPM, tilt monitor, Monalisa, straightness monitor, LW and FONT etc.

3. Update of the SC-Q as future plan

- Essential program for the ILC and CLIC
- Worldwide collaboration
    - SLAC, BNL, KEK, LAL, LAPP, CERN, Oxford univ. and more

" We have to have a well-structured, realistic, feasible and reasonable plan for this, not just a long to-do list."