A_RD_2
Collaboration on the ATF2 project at KEK (FJPPL, FKPPL) and on the ILC machine-detector interface (FJPPL)

Hayg Guler
LLR / Ecole Polytechnique

On behalf of colleagues from :

***LAL** (P. Bambade)*
***LAPP** (A. Jeremie)*
***LLR** (M. Verderi)*
***KEK** (T. Tauchi)*
***KNU** (E.-S. KIM)*

Outline

- ATF2 : general presentation
- ATF2 Updates after great earthquake
- FJPPL and FKPPL contribution to ATF2 :
  - LAPP contributions updates (FJPPL)
  - LLR contributions updates (FJPPL)
  - LAL contributions updates (FJPPL / FKPPL)
- Conclusion

ATF2 GOALS

ATF2 : Goal - I (- 2012)

- Achievement of 37nm beam size
  - Demonstration of a new compact final focus system proposed by P.Raimondi and A.Seryi in 2000,
- Maintenance of the small beam size
  - (several hours at the FFTB/SLAC)

Goal - II (2013 -)

- Control of the beam position
  - Demonstration of beam orbit stabilization with nano-meter precision at IP.
  - (The beam jitter at FFTB/SLAC was about 40nm.)
- Establishment of beam jitter controlling technique

- R&D on nanometer resolution instrumentation
- Training of young accelerator physicists and engineers on “real system”

ATF & ATF2 R&D for linear colliders

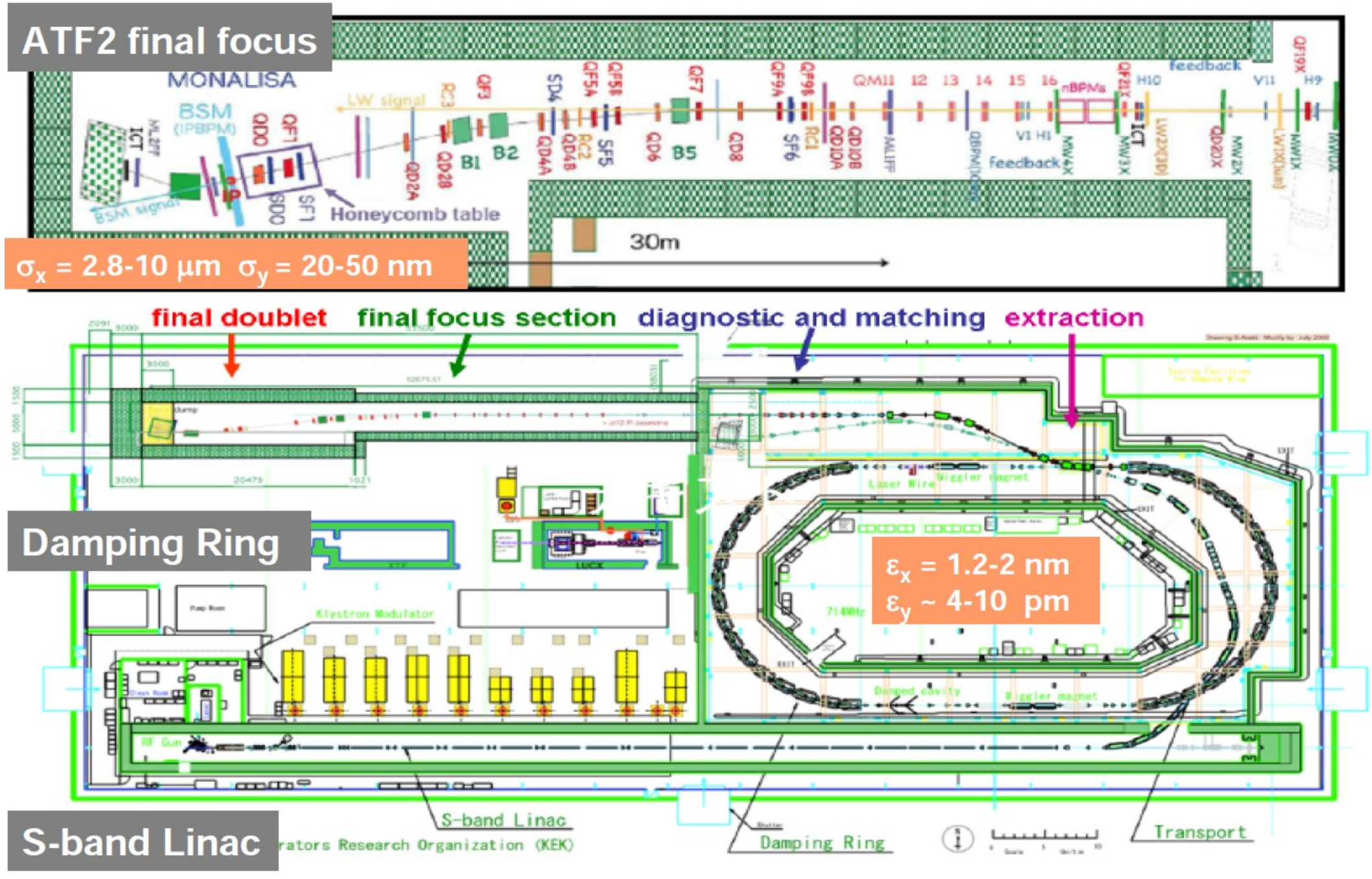
Parameters	unit	ATF2	ILC	CLIC	S-KEKB (LER/HER)
Beam Energy	GeV	1.3	250	1500	4/7
L^*	m	1	3.5-4.5	3.5	0.47/1.3
$\gamma\varepsilon_x$	m-rad	5×10^{-6}	1×10^{-5}	6.6×10^{-7}	$2.5/3.3\times10^{-5}$
ε_x	nm	2	1.0 (DR)	0.1 (DR)	3.2/2.4
$\gamma\varepsilon_y$	m-rad	3×10^{-8}	4×10^{-8}	2×10^{-8}	$1.0/1.2\times10^{-7}$
ε_y	pm	12	2(DR)	1(DR)	13/8.4
β^*_x	mm	4	21	6.9	32/25
β^*_y	mm	0.1	0.4	0.07	0.27/0.41
η'	rad	0.14	0.0094	0.00144	
σ_E	%	~0.1	~0.1	~0.3	0.08/0.06
Chromaticity	L^*/β^*_y	$\sim10^4$	$\sim10^4$	$\sim5\times10^4$	$1.7/3.2\times10^3$
σ^*_x	μm	2.8	0.655	0.039	10.2/7.8
σ^*_y	nm	37	5.7	0.7	59/59

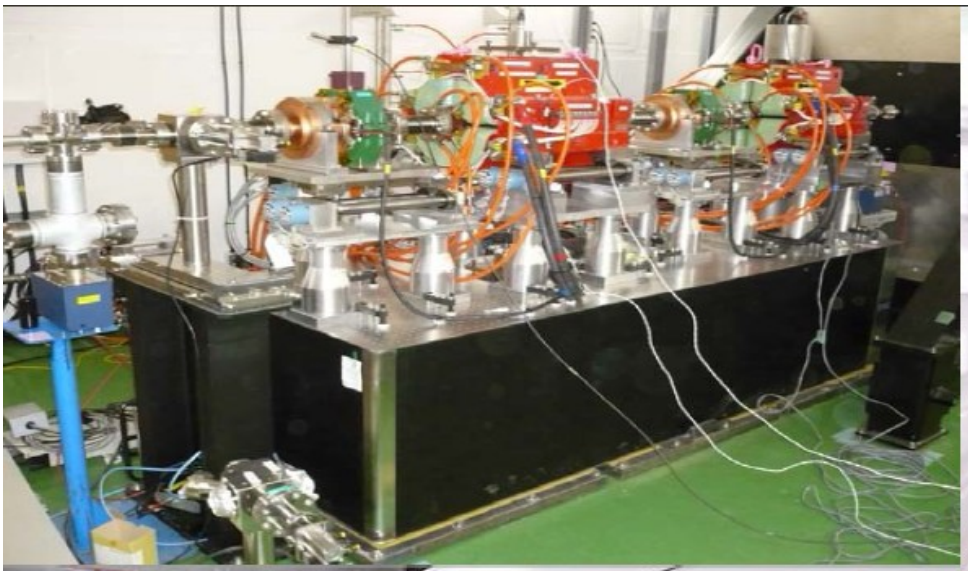
Parameters at ATF2

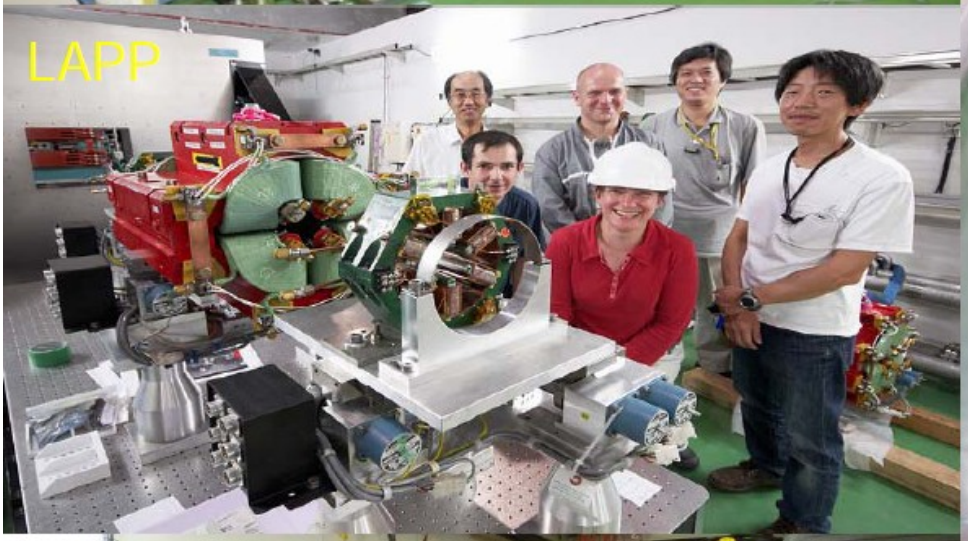
3.11 Earthquake

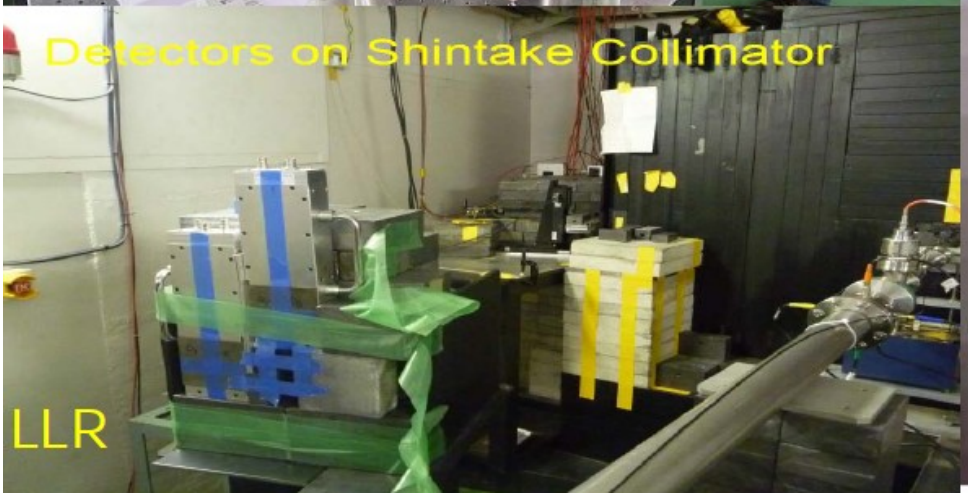
IP Parameter	nominal	May 2010	Feb 2011	Dec 2011	Feb 2012
Beam energy	1.3GeV	1.3GeV	1.3GeV	1.3GeV	1.3GeV
Emittance in x	2 nm	1.7nm	1.8-1.7nm	2nm	1.8nm
Emittance in y	12 pm	<10pm	27-28pm	~50 pm wakefield@mOTR	15.6 pm
Beta function in x	4 mm	4cm	10mm	1cm	4cm
Beta function in y	0.1mm	1mm	0.1mm	0.5mm	0.3mm
beam size in x	2.8 μm	~10 μm	-	9.2μm/2	11.2μm
beam size in y	35 nm	300 nm 8deg.mode	1.8um@PIP C-wire	850nm 5deg.mode	165nm 30deg.mode

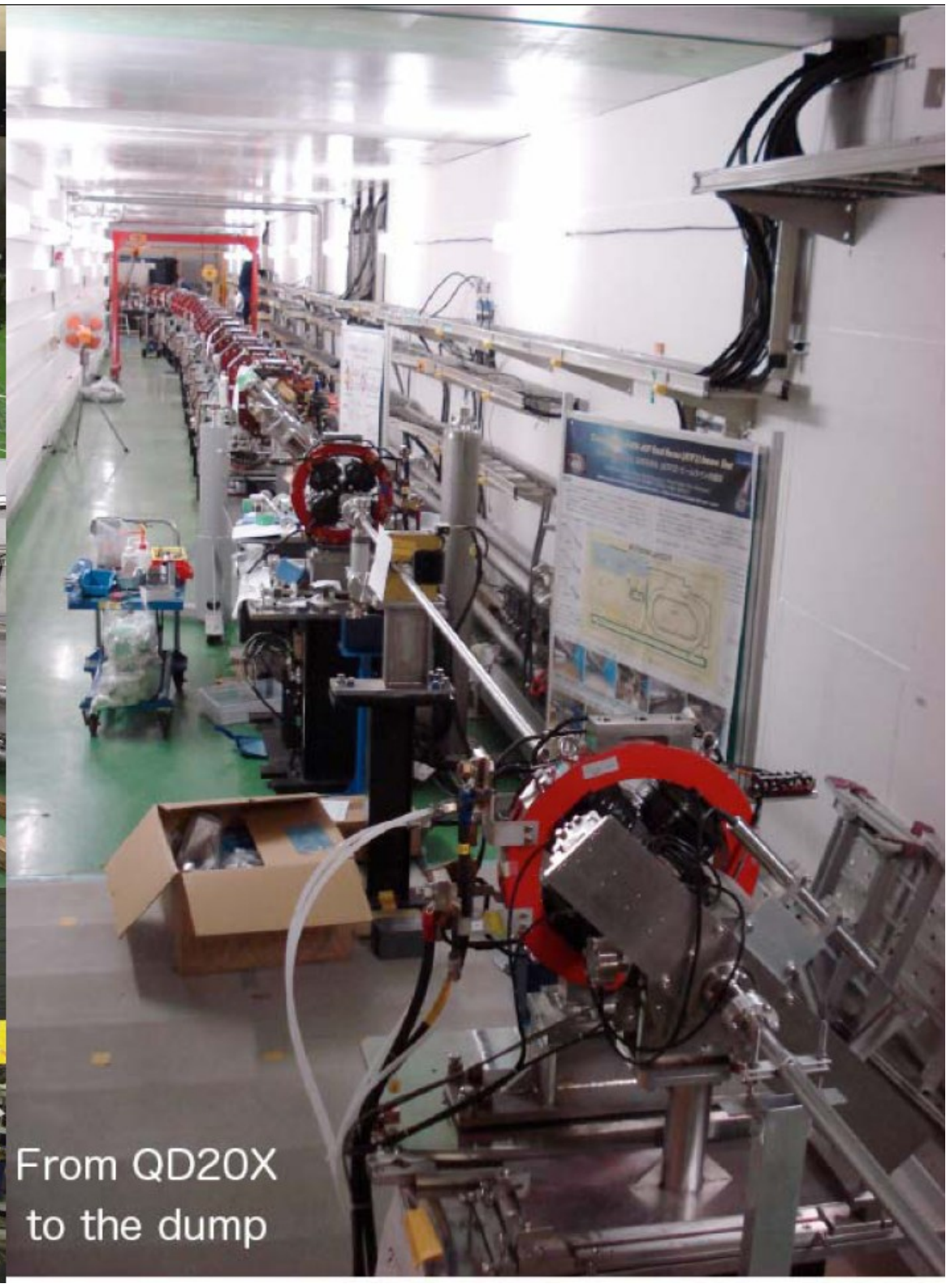
Accelerator Test Facility @ KEK






LAPP


Detectors on Shintake Collimator
LLR


From QD20X
to the dump

ATF International Collaboration

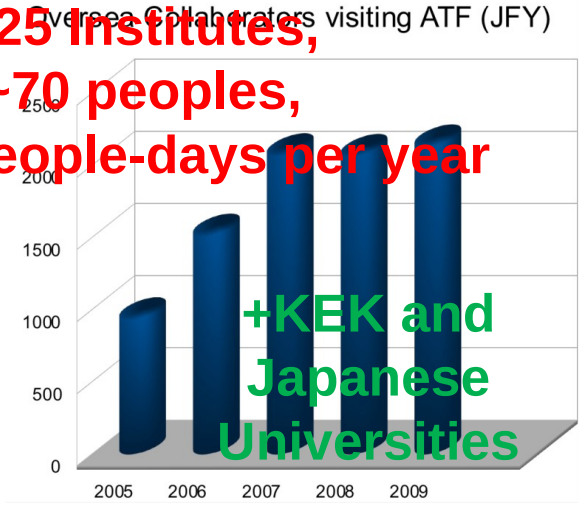
DESY
IN2P3
LAL
LAPP
LLR
John Adams Inst.
Oxford Univ.
Royal Holloway Univ.
Cockcroft Inst.
STFC, Daresbury
Univ. of Manchester
Univ. of Liverpool
University College London
INFN, Frascati
IFIC-CSIC/UV
Tomsk Polytechnic Univ.

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.

Oversea collaborators visited for R&D at ATF

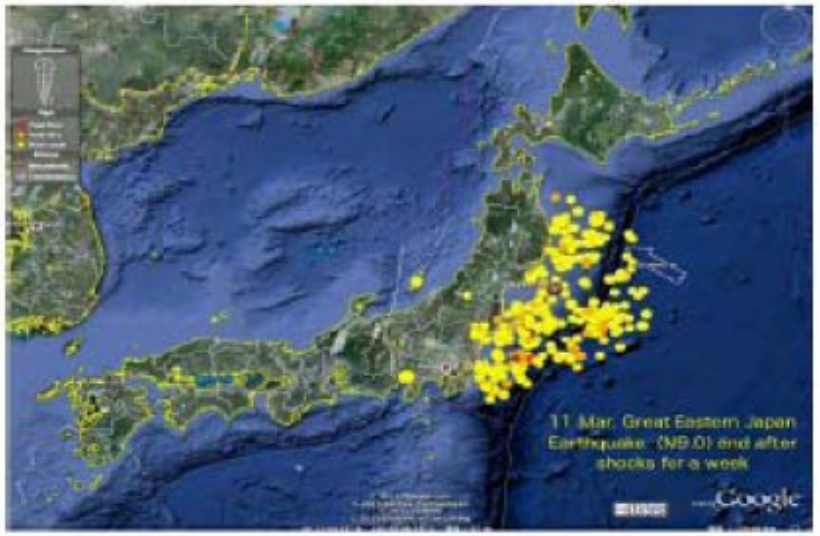
~25 Institutes,
~70 peoples,
~2000 people-days per year



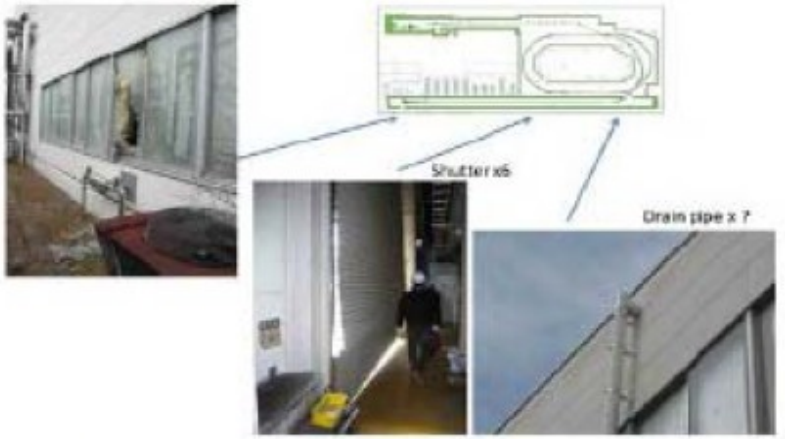
ATF2 Updates :
From the Great Earthquake 03/11 to now

Great Eastern Earthquake – March 11, 2011

Nobuhiro Terunuma (KEK)



Facility Outside Damages



Facility Damages

- Since there is a big earthquake in the northeast Japan, and it also has some influence on KEK and ATF. The ATF building still looks fine, but facility outside damages, and will be expected to recover in June.

Beams recovered in June !

→ but ~9 month delay in ATF2 program…

2011/2012 Beam time summary

2011

- **December** : beam size ~ 300 nm
  - 10x10 nominal optics and 1x2.5 Edu optics

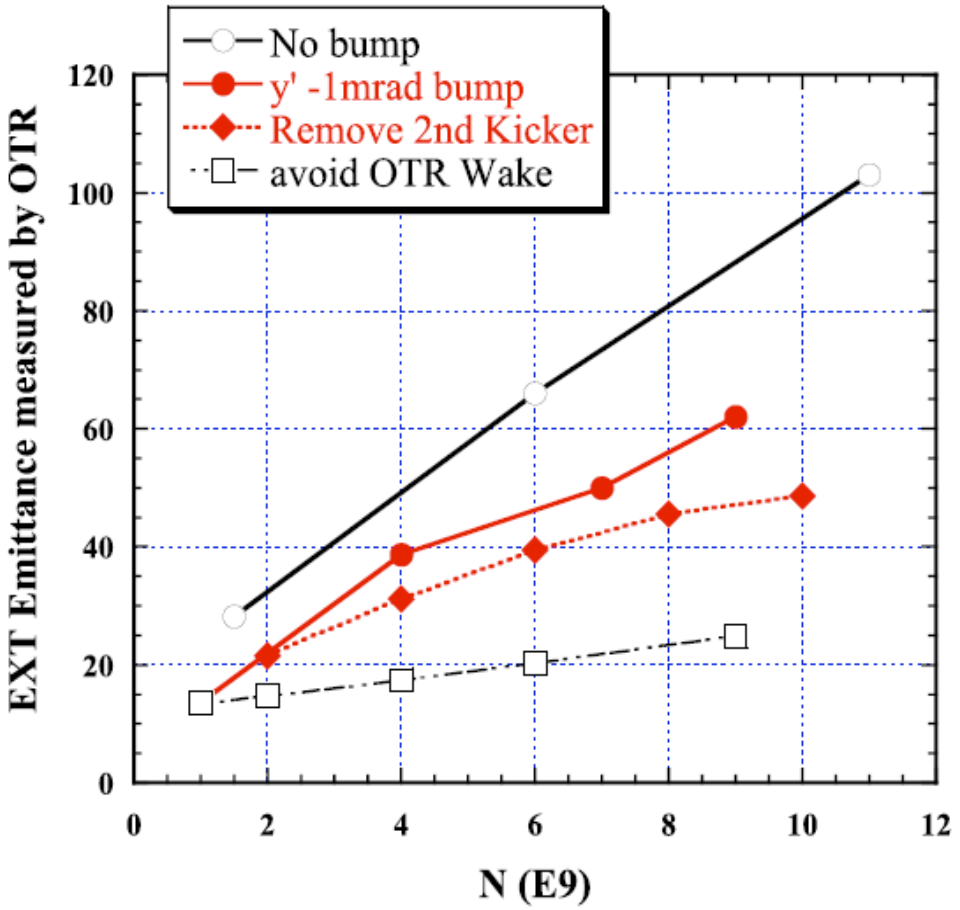
Earthquake

2012

- **November** : restart of ATF2 beam operations
  - Alignment, ATF2/IPBSM tuning operations
- **December** :
  - ATF2 tuning with IPBSM, Optics & Background studies,
  - Minimum beam size : 1 micron

- **January** :
  - Emittance growth study
  - IPBSM : 420 nm by 2-8 deg mode
- **February** :
  - IPBSM : 30 deg mode, beam size : 202 nm (17th), 165 nm (23rd)
  - Check 174 deg mode, no clear signal yet

Summary of EXT Emittance



Vertical orbit change had some effect.
Removal of 2nd kicker had some effect.
Wakefield of OTRs had significant effect.

by K.Kubo, 3 Feb. 2012

New agreement concerning GOAL1

Discussion at the 13th ATF2 project meeting, KEK, 11-13 January, 2012

Input from P.Bambade

Agreed planning for 2012 :

- January – March: R&D and checking
- April - June: Training and R&D
- October - December: Goal 1

Teaching activities :

- Identify the “teachers” for giving the training (G. White, M. Woodley, KEK team…)
- List of contents of the training course
- Coordinator for teaching and organization of the focus Goal 1 period
- Planning group integrated by the responsible of the R&D groups, webex meeting for identify the PhD students/postdocs participating in the effort with a face to face meeting before the training period.

Consensus on new “goal 1” strategy

(1) Prepare 12 “students” for ATF2 operation (coordinated by S. Kuroda)

- 5 students were trained in April, 2012

(2) Eight weeks dedicated “goal 1” operation in October-December

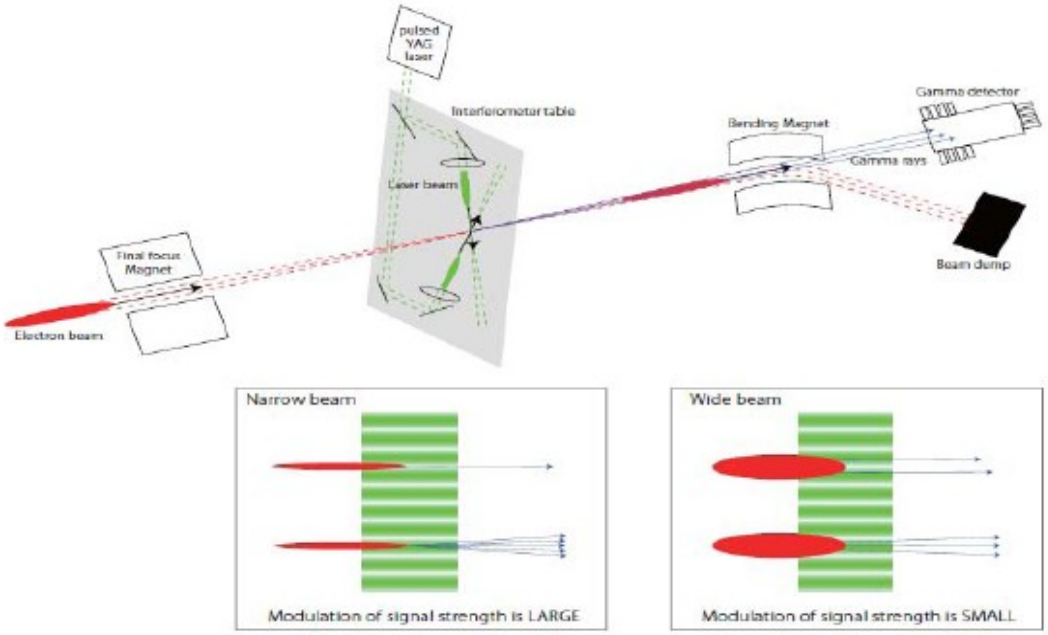
- daily & weekly meetings → review progress, modify the planning,…
- commissioning and operation plan jointly defined and supported:

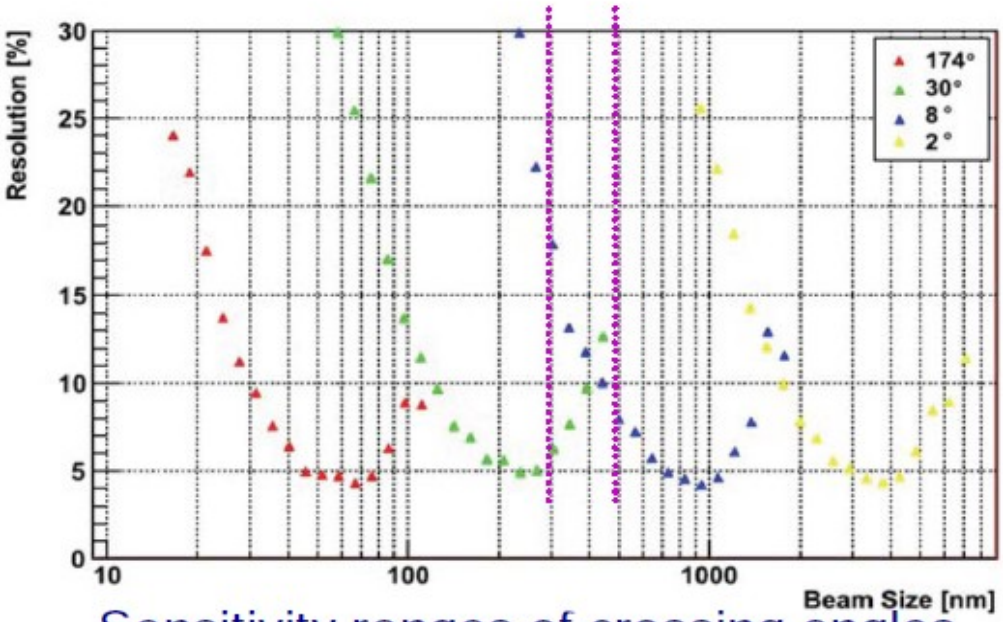
several paths can appear and may be valid, but single decision essential to avoid confusing the “students” in the control room !

overall coordinator in addition to weekly / daily shift management:

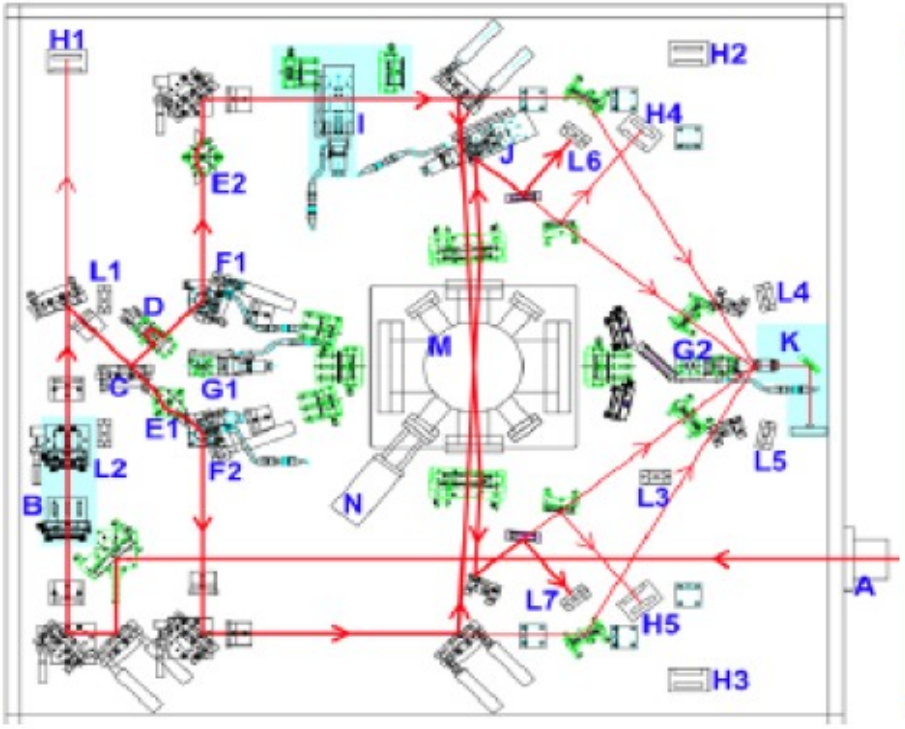
based on-site, experienced in machine physics and management for efficient communication flow between all contributors

"Shintake" beam size monitor at IP

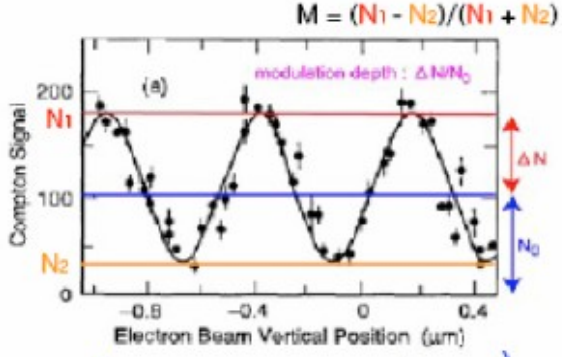




Sensitivity ranges of crossing angles



How it works as follows



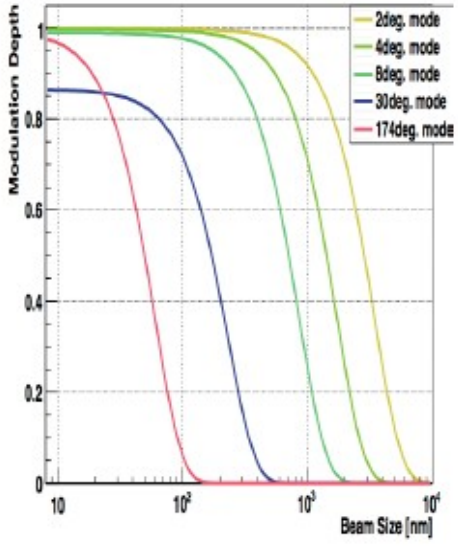
$$\sigma_y = \frac{d}{2\pi}\sqrt{2\cdot\ln(|\cos\theta|/M)} \qquad d = \frac{\lambda}{2\cdot\sin\frac{\theta}{2}}$$

Wave length 532nm, width=8ns

$\Delta\nu/\nu = 1.6 \times 10^{-7}$

Laser intensity = 2.8×10^{13} W/cm²

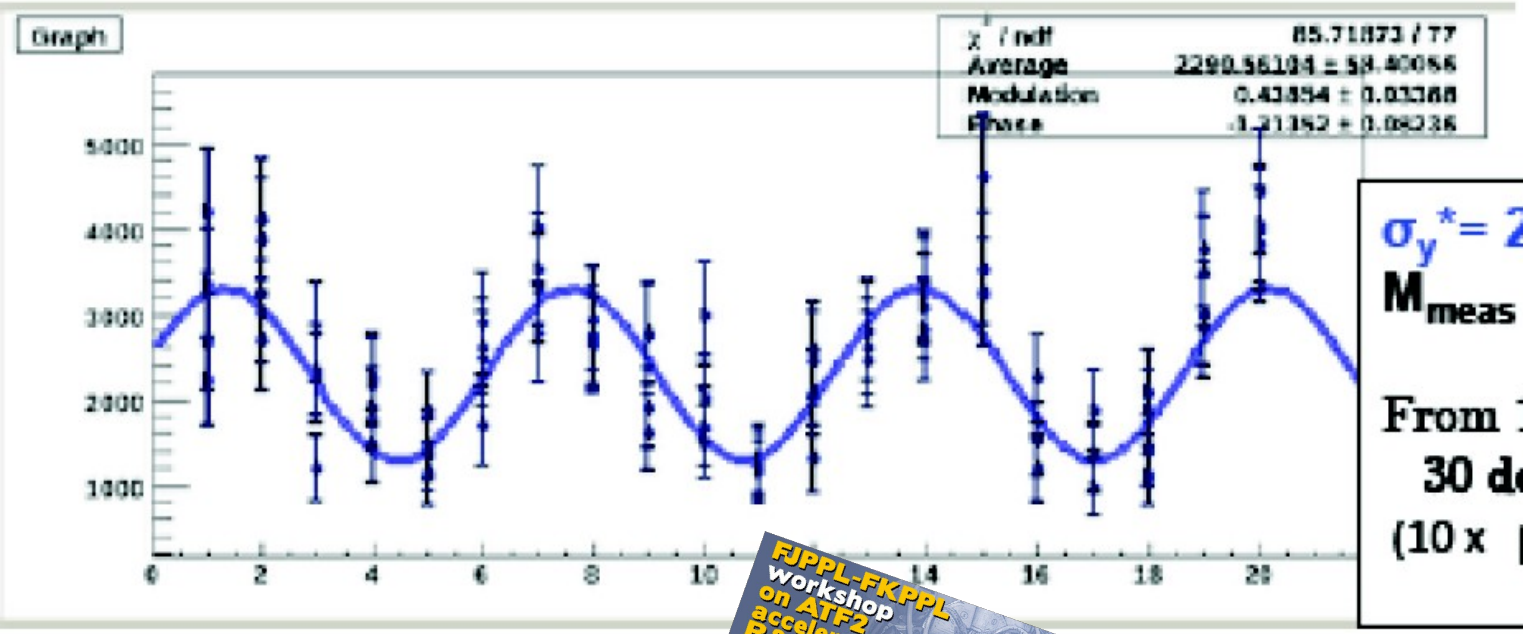
$a_0 = 1.7 \times 10^{-4}$



Commissioning of 30 deg mode

Jacqueline Yan (Tokyo)

February 2012



$\sigma_y^* = 201 \pm 4.4$ (stat.) nm

$M_{meas} = 0.429 \pm 0.012$ (stat.)

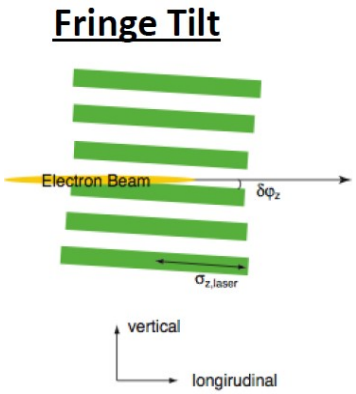
From 10 stable consecutive scans
30 deg, Feb 17, 2012
(10 x β_x^*, 10 x β_y^* optics)

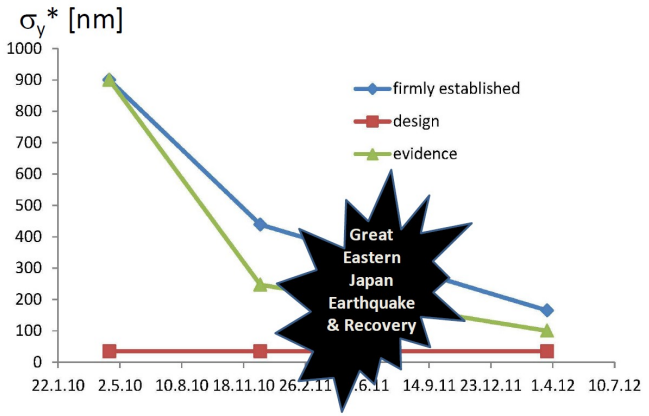
Systematic errors

history of beam size

Dominant errors

- Relative position jitter, Phase jitter
- Fringe tilt (y - z and y - x)





FJPPL and FKPPL contribution to ATF2

LAPP: Stabilization study & Mechanical support for the Super Conducting Magnet, beam tuning & software tools, Ground motion measurement and modeling

A. Jeremie

LLR: Background evaluation (algorithm, GEANT 4) Instrumentation & Experimentation for validation

M. Verderi, *H. Guler*

LAL: Commissioning strategy & organization, ABCD project, IPBPM

P. Bambade, *O. Blanco, H. Hyun, F. Bogard, S. Wallon, (+ S. Liu, from 09 /2012)*

KEK: BSM, beam tuning strategy, Infrastructure, host & direct partner in all activities, MDI issues (stability of the push-pull operation, Japanese candidate sites in mountains, assembling procedures of the ILD detector),IPBPM

T. Tauchi, *J. Urakawa, N . Terunuma, S. Kuroda, T. Okugi, H. Yamaoka*

KNU: IPBPM

E.-S. Kim, *A. Her, H.-J. Him, S.-W. Jang*

Collaborations: UK, SLAC, CERN, IHEP, Valencia

Laboratoire d'Annecy-le-Vieux
de Physique des Particules

ATF2 FJPPL Update

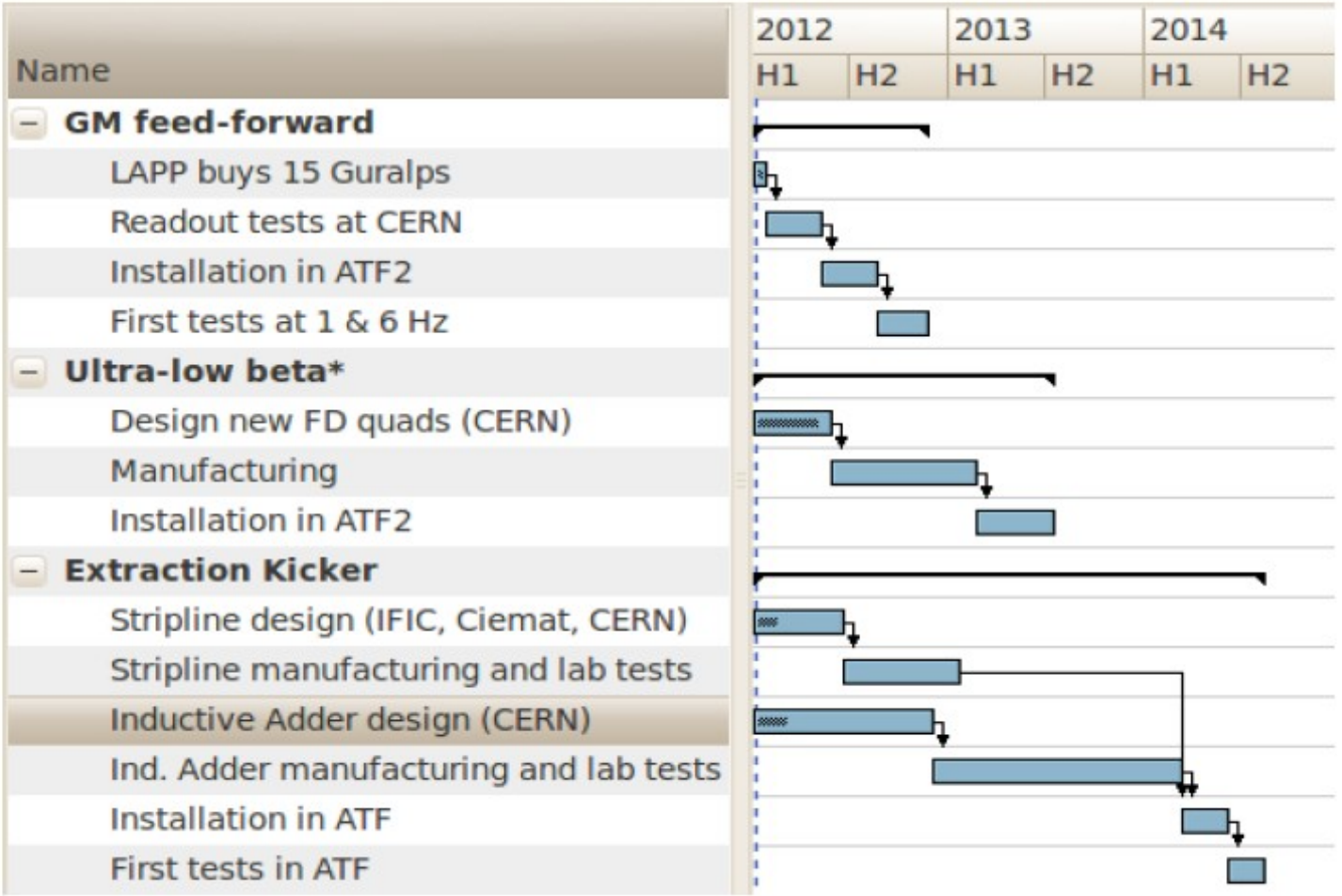
Andrea JEREMIE

Report 2012

LAPP: **The main LAPP activity for 2011 was to prepare for the test for the measurement of the Ground Motion effect on the beam.** New collaborations have emerged on the subject with LAL with our ATF2 and Ground Motion experience, and with CERN on the simulations for the detection of the ground motion effect on the beam and with the sensor instrumentation. **15 Guralp sensors have been purchased in the framework of the French ANR funding in preparation of this experimental test.** A meeting in March 2012 was organized to reinforce the collaboration and to discuss details and plans for the future and in particular the experimental tests with the sensors. **The planned tasks are sensor cabling, sensor validation, choice of acquisition system and preparation and installation under 15 ATF2 quadrupoles of the extraction line.**

Need to measure ground vibrations
=> 15 geophones Guralp 6T bought by LAViSta

Time line until installation and/or first tests **with CERN CLIC group**



Sensor characteristics

Velocity output bandwidth	*1 s – 100 Hz (Model CMG-6T-1), 10 s – 100 Hz (Standard) or 30 s – 100 Hz*
Velocity output sensitivity	*2 × 1200 V/m/s, (Standard) 2 × 2000 V/m/s or 2 × 1000 V/m/s*
Peak output	*±10 V (20 V peak-to-peak)*
Optional high gain sensitivity	*2 × 10000 V/m/s (adjustable)*
Lowest spurious resonance	*450 Hz*
Linearity	*> 90 dB*
Cross-axis rejection	*> 65 dB*
Electronics noise level	*–172 dB (rel. 1m2s-4Hz-1)*
Operating temperature	*–40 to +75 °C*
Temperature sensitivity	*< 0.6 V per 10 °C*
Mass recentring range	*±3 ° from horizontal*
Materials	*Hard anodised aluminium case Gold plated contacts O-ring seals throughout*
Case diameter	*154 mm*
Case height (with handle)	*207 mm*
Weight	*2.49 kg*
Power supply	*10 – 36 V DC*
Optional low power sensor	*5 V DC supply (output ±4.5 V)*
Current at 12 V DC	*38 mA*
Calibration controls	*Common signal & enable lines exposed on sensor connector*
Offset zeroing	*Adjustable through case*
Optional remote control	*Offset zeroing with DC motors*
Optional accessories	*Handheld Control Unit*

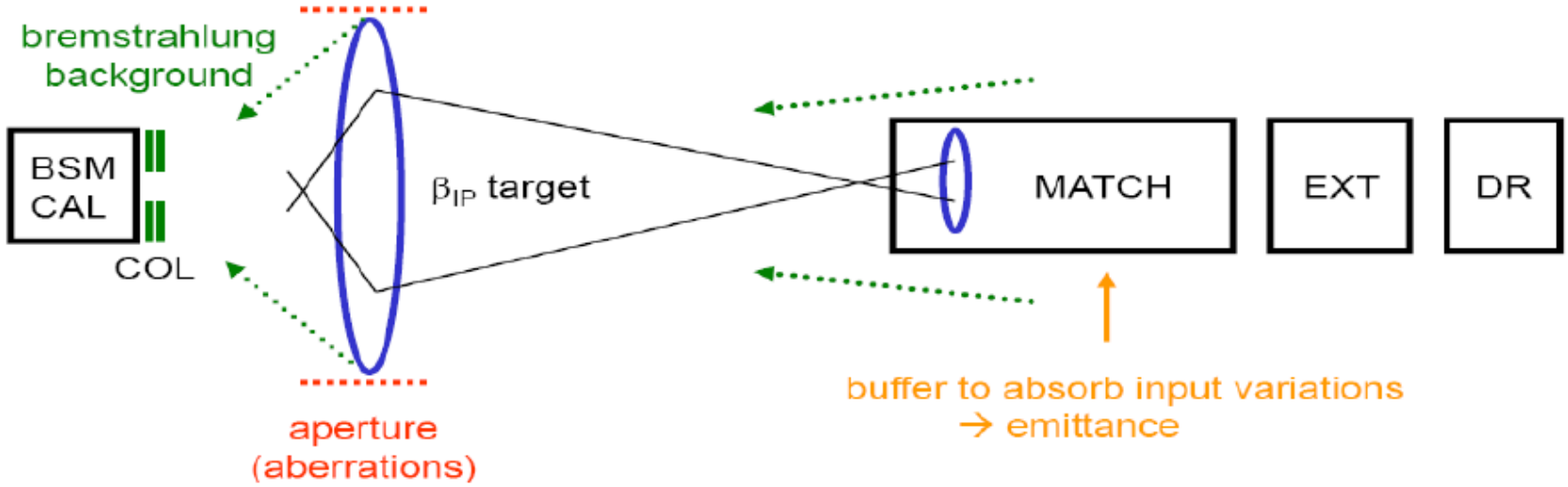
lapp

FJPPL & FKPPL Update

Commissioning strategy & organization,
ABCD project,
IPBPM

Issue of beam halo in HEP colliders and ATF2

1. Beam halo ➔ major issue for IR backgrounds at many colliders, e.g. future linear colliders, B factories – also an important problem at ATF2 !
2. Control of halo via collimation / optics essential to enable the most aggressive optics configurations for luminosity performance



3. Halo population poorly known, involves various mechanisms :
   "dark current", wake-fields, non-linearity, multiple intra-beam Coulomb scattering, scattering off residual beam gas and thermal photons, very low Pt t-channel physics processes,…

Motivation for measurements at ATF2

1. Previous measurements in 2007 (T. Suehara et al.) in old EXT line

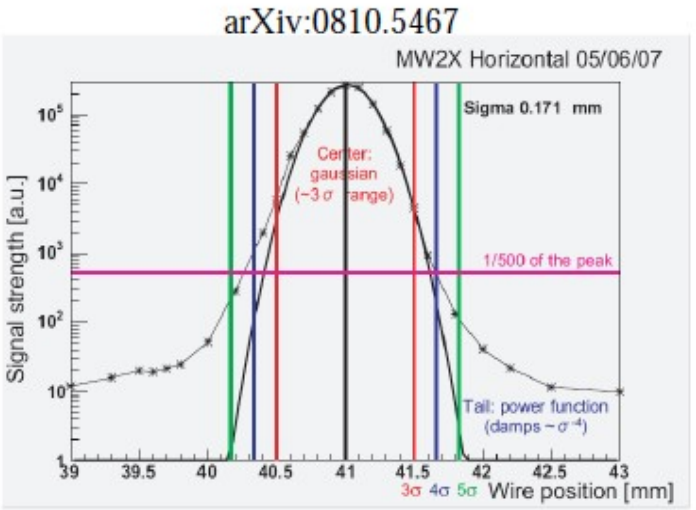


Fig. 25. Measured result of charge distribution using an ATF extraction line wire scanner.

$$\rho_{h1} = 2.2 \times 10^{9} \times x^{-3.5} \quad \text{(horizontal and vertical until 6 } \sigma\text{)}$$
$$\rho_{h2} = 3.7 \times 10^{8} \times x^{-2.5} \quad \text{(vertical outside 6 } \sigma\text{)}$$

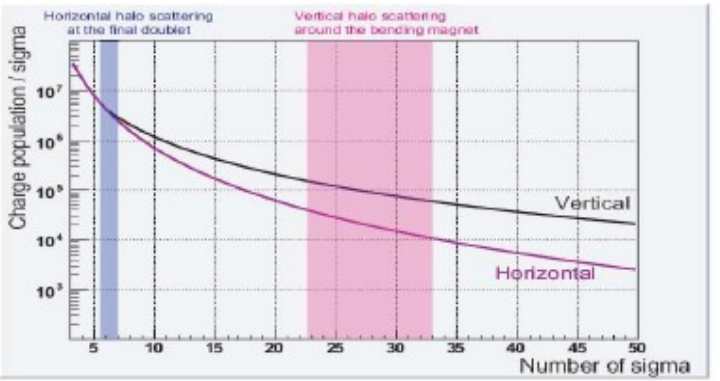
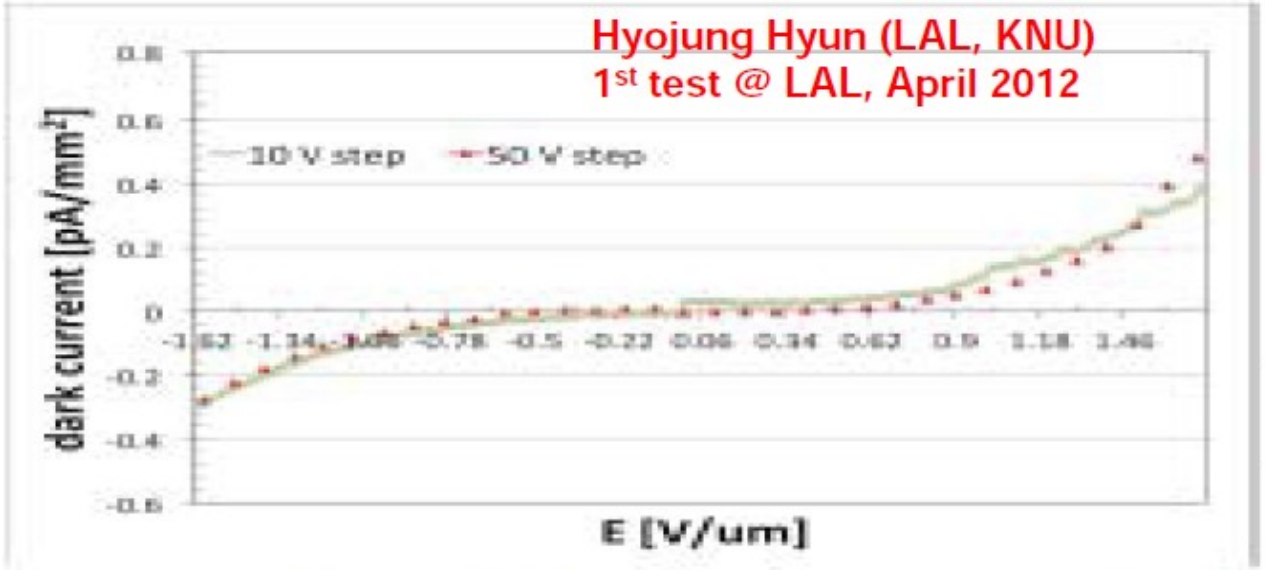
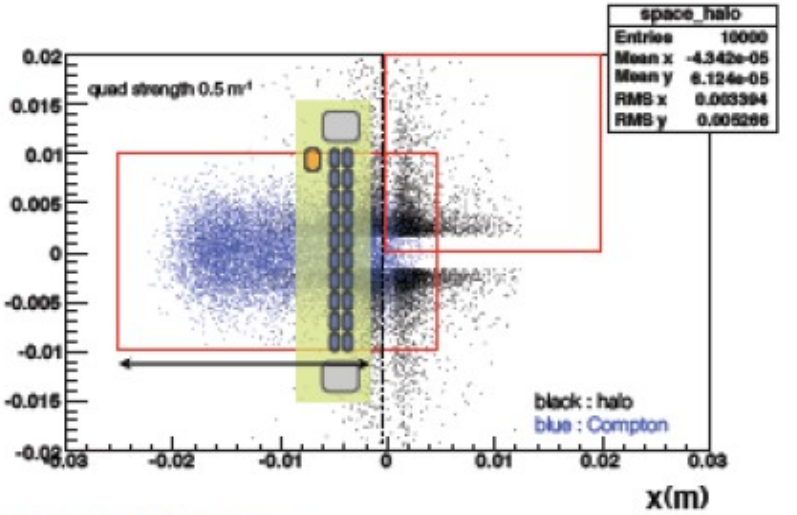


Fig. 27. Maximum charge density of the beam halo estimated by the halo measurement. Blue and purple area shows the concerned region, discussed in Section 6.2.4.

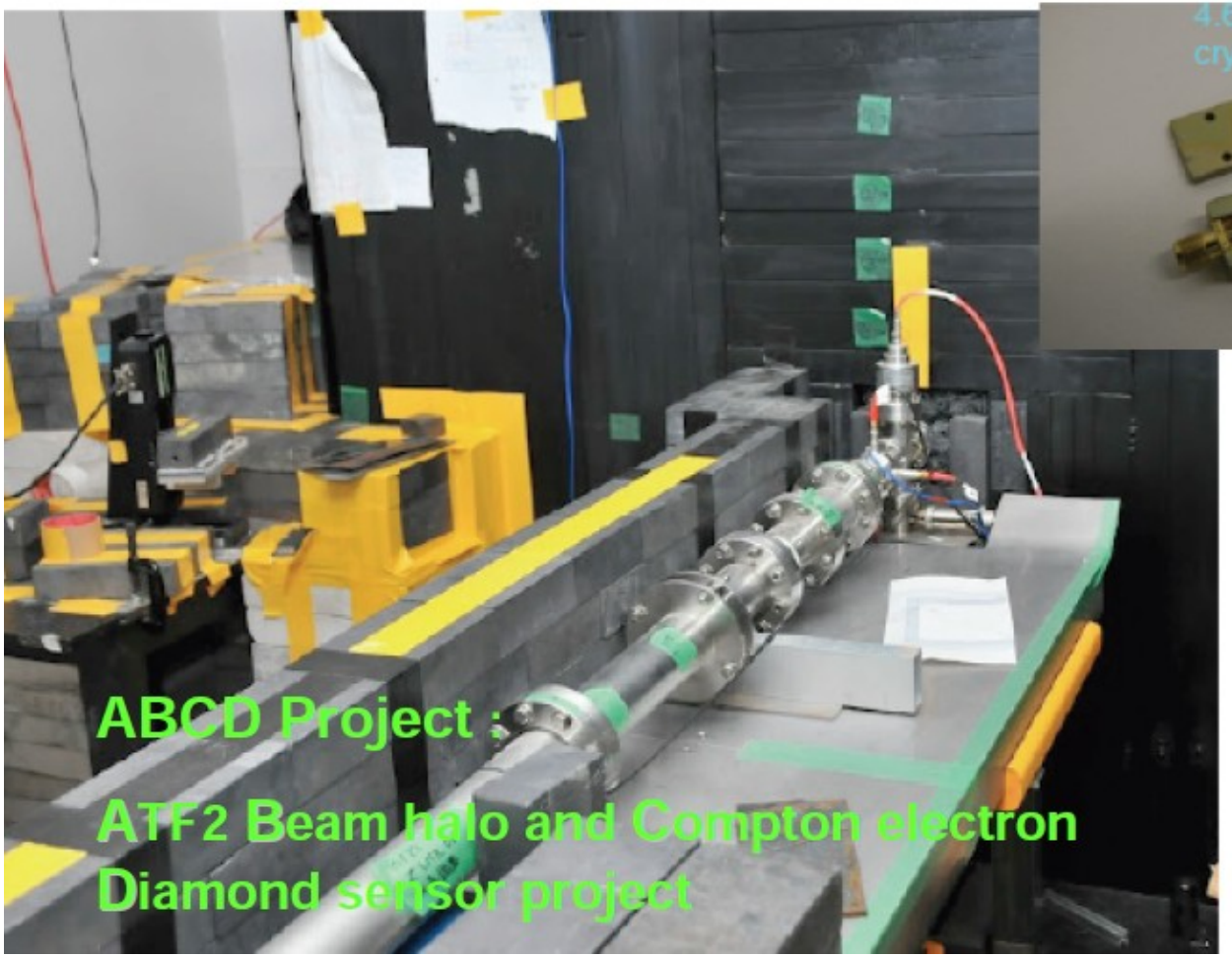
2. Halo transport in ATF2 and direct probe of tails in IP angular spread
3. Investigation of halo modeling / comparing with measurements
4. Check possibility to probe Compton electron recoil distribution during IP-BSM operation (additional observable, also prepares future non-linear QED measurements with very high power laser at "ATF3")

Hyojung Hyun (LAL, KNU)
1st test @ LAL, April 2012



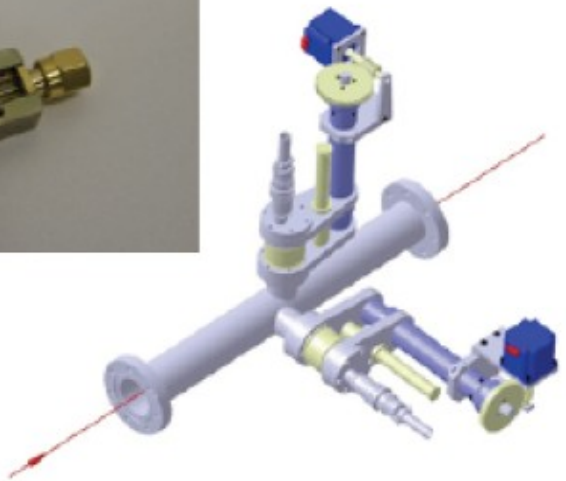


* The plot is one of MAD simulation results



ABCD Project :

ATF2 Beam halo and Compton electron Diamond sensor project



diamond sensor on board

Frédéric Bogard (LAL)

Near term planning

1. R&D grant from P2IO LABEX covering 2012-2014
   PhD grant from CSC-FCPPL (S. Liu, 3 years starting 09-2012)
   Collaboration with KNU and post-doc application (H. Hyun, H. Park)
2. Design / lab test at LAL : mechanics, electronics (PARISROC2) and more detailed simulations. Experience from FCAL coll. at DESY-Zeuthen.
3. New vacuum chamber fabrication and quadrupole installation at KEK
4. Aim to test 1st prototype in ATF2 beam → end 2012 / early 2013

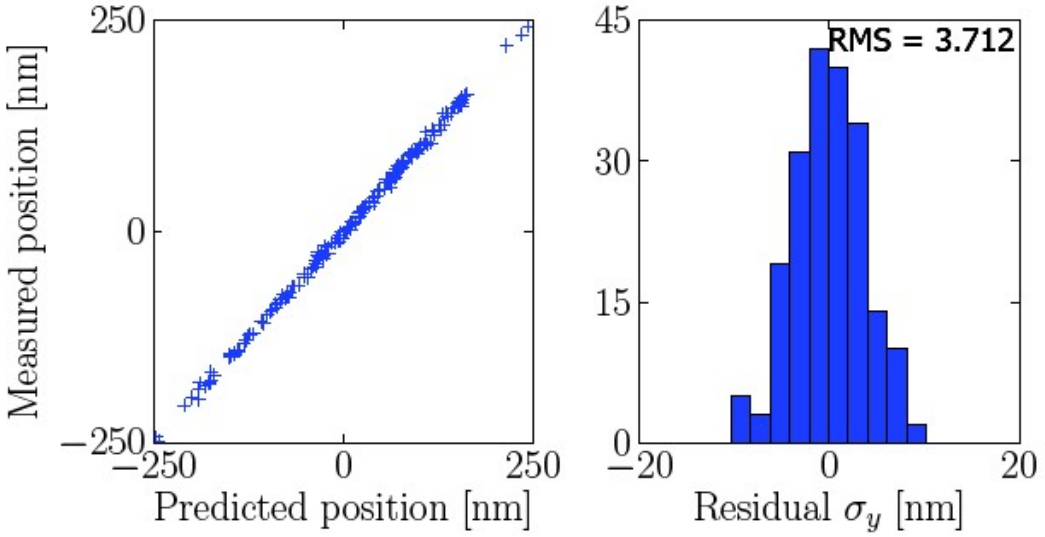
tentative schedule

	2012-S1	2012-S2	2013-S1	2013-S2	2014-S1	2014-S2
Conception (capteur, readout)	■	□				
Test proto au LAL Conception méca.	□	■	□			
Fabrication (méca., readout)		□	■			
Pré-instal. 1er test instal. finale KEK		□	□	■	□	
Expérimentation en faisceau		□	□	□	■	■
Simulations (géné/tracking/G4)	□	□	□	□	□	□
Évaluation autres appl.			□	□	□	□

For Goal 2 :

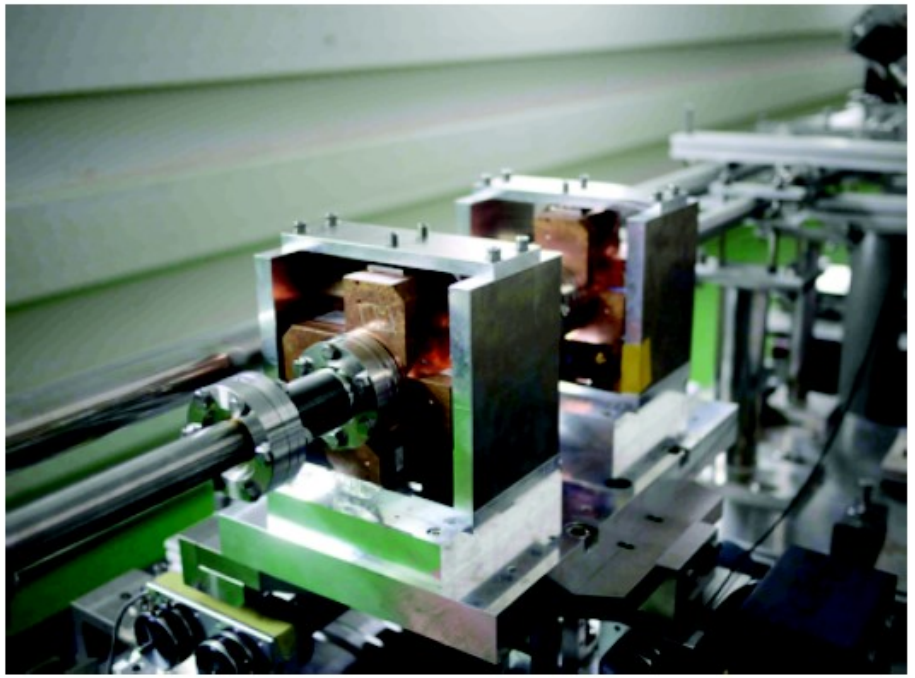
Preliminary result of IPBPM

PhD thesis, YoungIm Kim (KNU)



RMS = 3.7 nm

Charge > 0.70 10^{10} electron/pulse



Data taken three shifts in three weeks in November to December, 2011, i.e. 1shift/week and 8h/shift

Published resolution :

8.72 +- 0.28 (stat.) +- 0.35 (sys.) nm

Y. Inoue et al, Phys. Rev. ST Accel. Beams 11, 062801 (2008)

Plans for 2012

1) **LAL will fabricate the external vacuum chamber** and perform 3D measurements and vacuum tests **with the three KNU IP-BPM blocks** installed before shipment to KEK for pre-installation and beam testing.

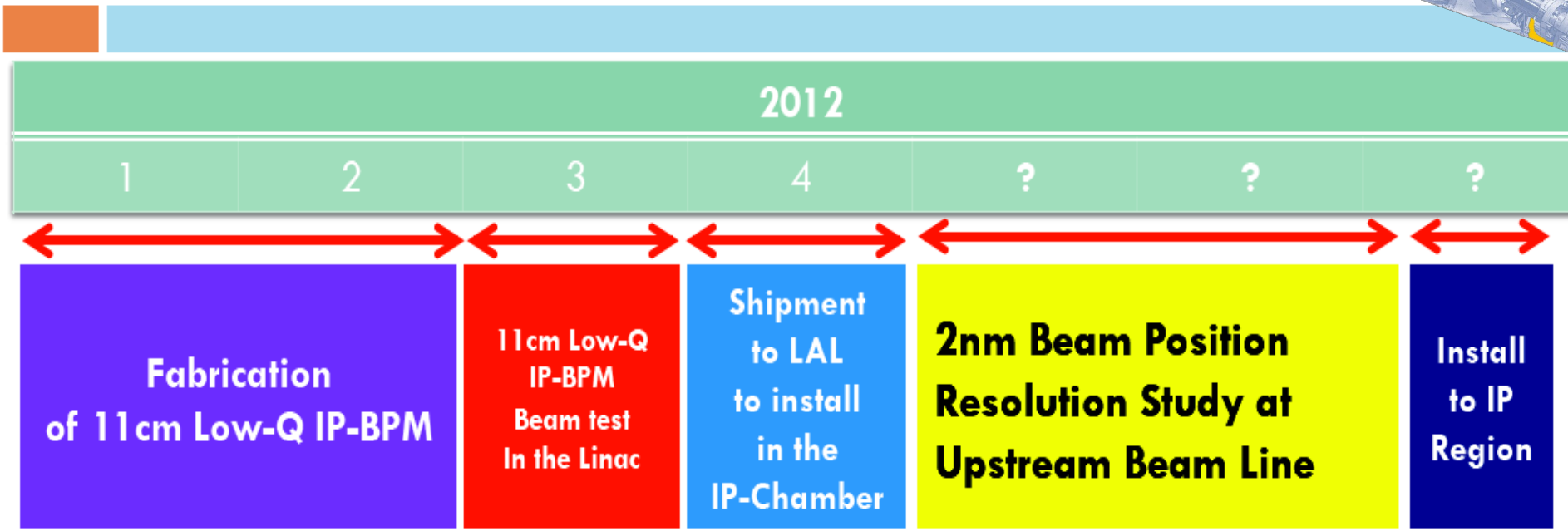
2) **KNU will perform beam tests in the ATF2 diagnostic area of the three low-Q RF beam position monitors and associated electronics that can provide a nanometer level position resolution**. LAL will participate and help commission / operate the remote internal mechanical adjustment function for the 3rd BPM in the new external vacuum chamber.

3) **KNU and LAL will install the 3 BPMs and electronics in IP region in ATF2 and measure the position resolution.**

4) Beam signals from the IP-BPMs will be provided to Oxford FONT group that will be used for the beam feedback system.

5) In addition, **LAL plans to develop a beam-based method for IP-BPM inter-calibration**, which may be important to reach the final goal.

Study Plan of 2012

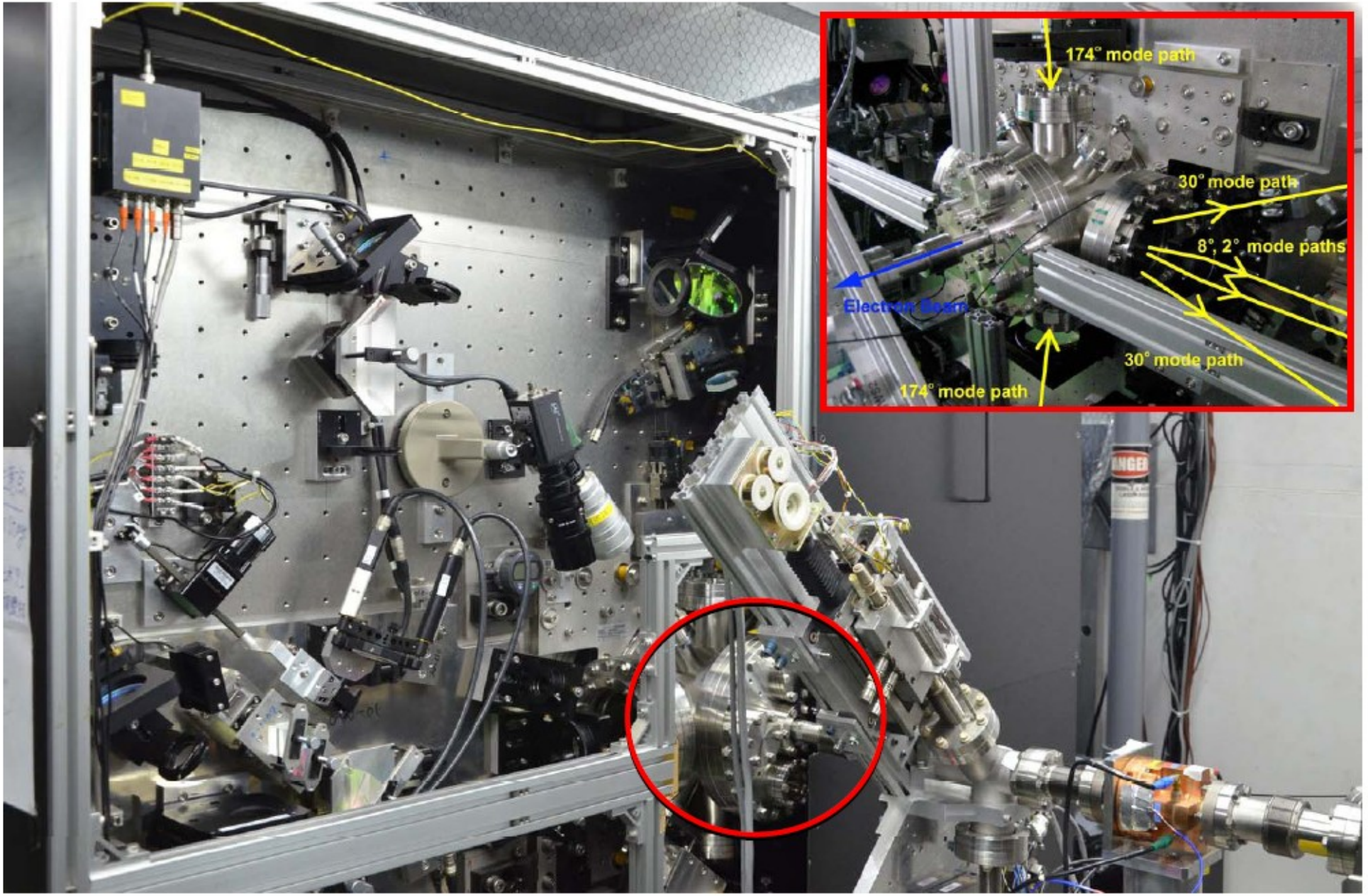


Main Test List for the Low-Q IP-BPM @ 2012

1. Y-port electronics test (Jan.) (Complete!)
2. Three IP-BPM beam test at end of linac with chamber (Mar.) (Complete!)
3. 2nm beam position resolution full study at upstream beam line with IP-chamber (which is undecided)

Siwon Jang
KNU

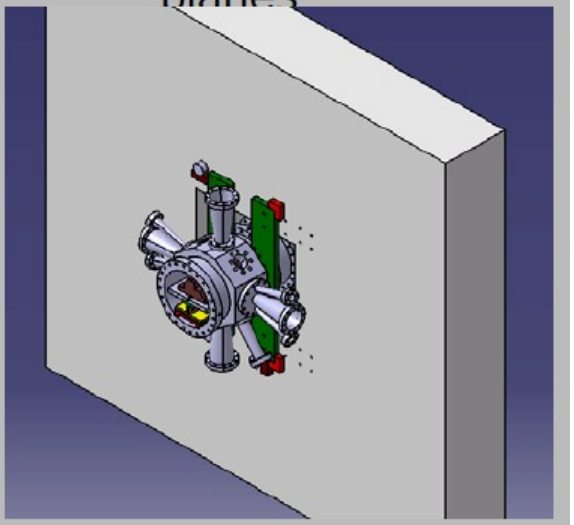
Present IP chamber



New IP Chamber

Targets' holes for surveyor measurements (4 holes per flange)

→ External references bring IP Chamber axis, vertical and horizontal planes



Large aperture viewports / windows

2 Shims holders

Downstream side

4 External (manual) movers to adjust IP-Chamber position

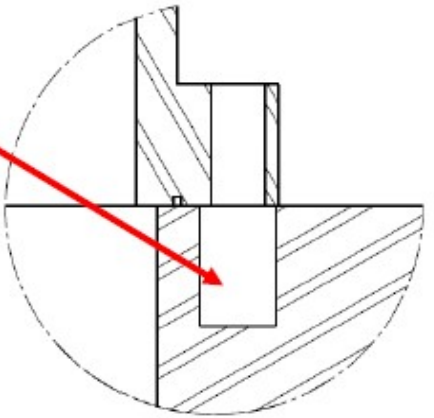
Sandry Wallon &
Frédéric Bogard (LAL)

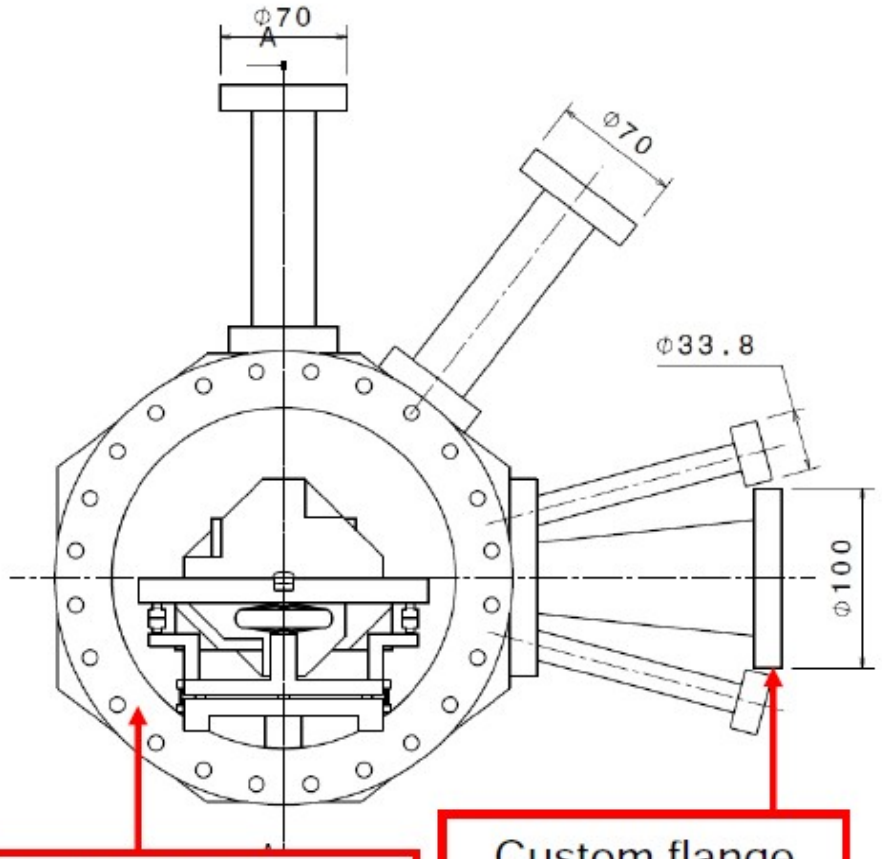
Manufacture vessel and main parts at Annecy (Christine Gasq & Laurent Journet, LAPP)

→ May to August 2012

→ Producer still to be found for a few parts

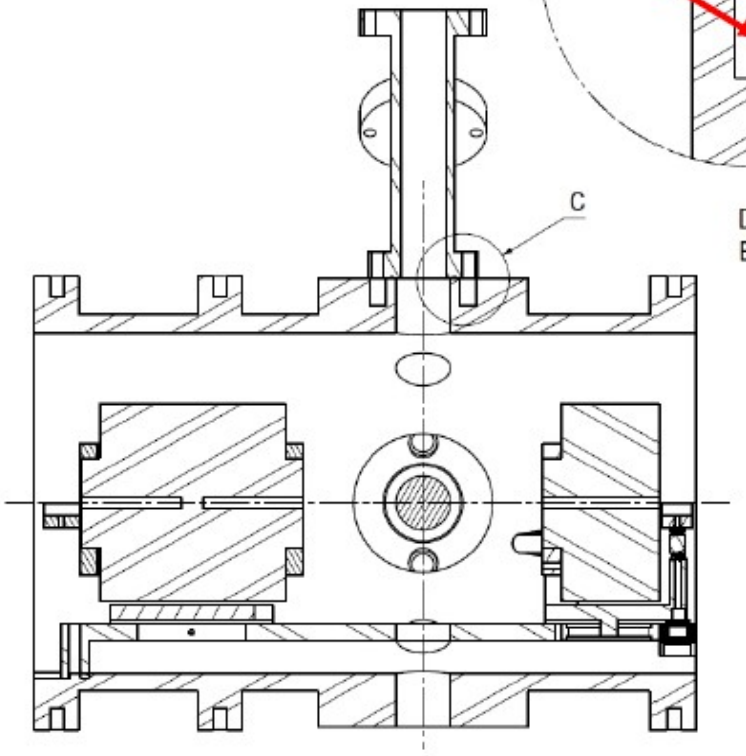
Metal (SS) insert detail





3x DN 200 flanges

Custom flange



Détail C
Echelle : 3:2

Coupe A-A
Echelle : 1:3

IP Chamber assy layout - Flanges interfaces

Schedule for Goal 2

JFY

2012

2013

4 7 10 ATF2 dedicated 1 4 7 10 1

Installation of kicker for IP

Pre-study of IP feedback with IP kicker

FONT R&D

Integration at IP, FONT with IP-BPM

Preparation of new IP chamber

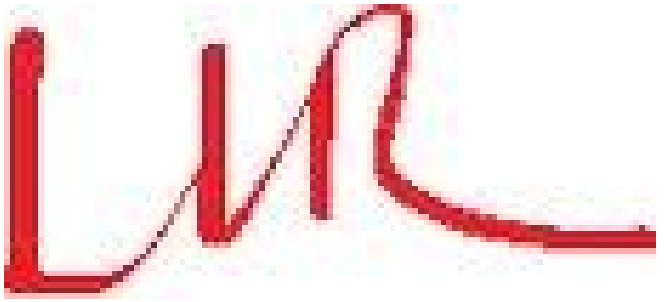
Beam test at FF TEST area
Integration of Chamber, IP-BPMs, Movers and Readout

2nm stabilization

Installation of IP-BPMs at IP

Readout Electronics R&D

N. Terunuma



LLR activity update :
Background modeling @ ATF2
Neutron Background
E.M. Background

H. Guler & M. Verderi

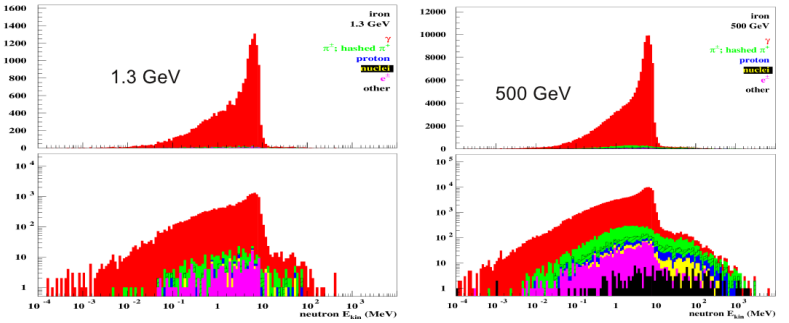
Motivations

- **ATF2 offers opportunities for background studies of:**
  - The Final Focus region
    - Mind this is a scale down of the ILC/CLIC FF
    - Mainly EM background from beam halo
  - Particles backscattered from beam dump
    - Mainly neutrons
    - Interest for ILC/CLIC are neutrons backscattered from dump but also neutrons produced in dense materials near IP by EM background
  - That, beyond ATF2 interest itself

NLC background sources

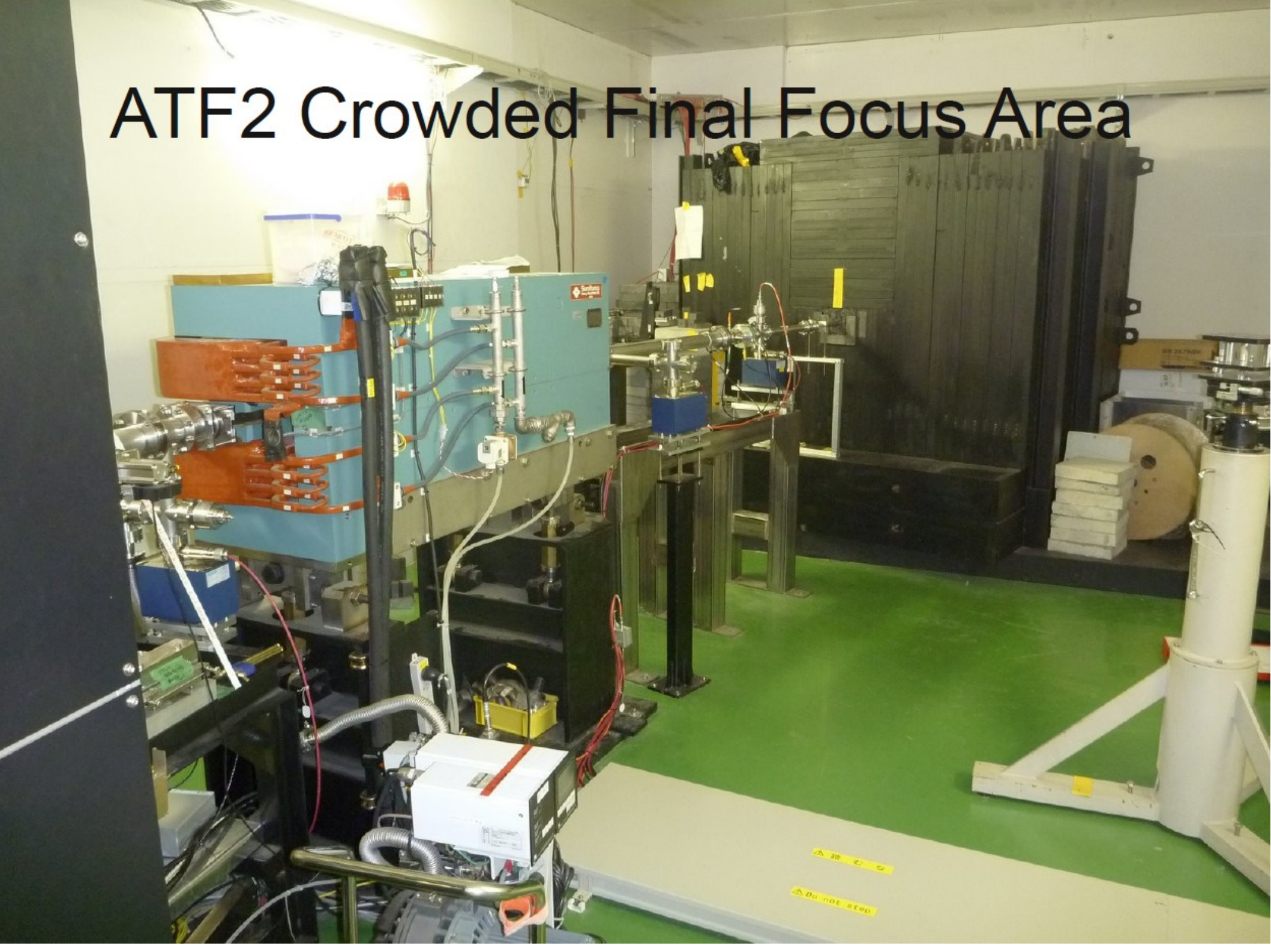
- Machine produced background before IP
  - Beam tails (halo) from linac
  - Synchrotron radiation
  - Muons
  - Beam-gas scattering
- Beam Beam background @ IP
  - Bremsstrahlung
  - Coherent/incoherent pair production
  - Hadron production
- Spent beam background
  - Backscattering of particles (specially neutrons)

Neutron production @ different e- incident energy on iron



- Most of the neutrons are produced via photo-nuclear effect
- Produced neutron kinetic energy mainly < 10 MeV
- ATF2 can produce the major part of the neutron spectrum accessible at 500 GeV

ATF2 Crowded Final Focus Area



ATF2 Crowded Final Focus Area

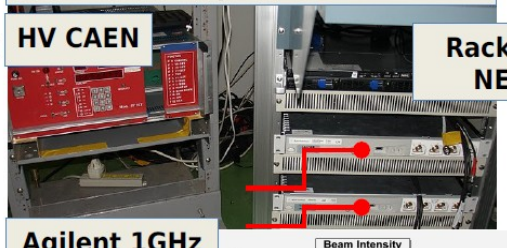
Neutrons

Detectors (example with using a box)

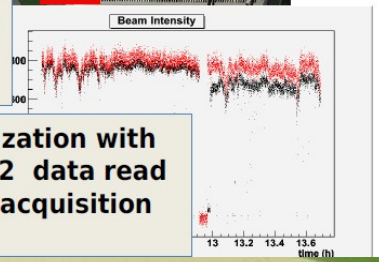
Acquisition

HV CAEN

Rack PC NEC



Agilent 1GHz sampling modules

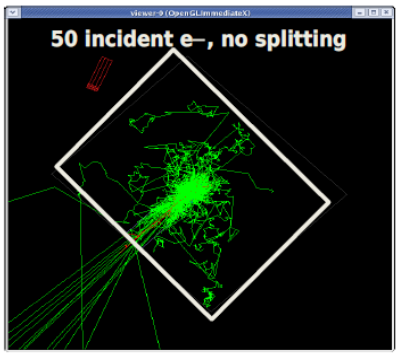


Synchronization with ATF2 : ATF2 data read from LLR acquisition

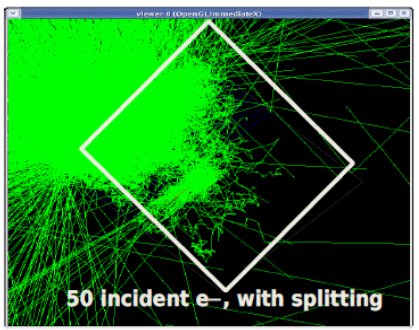
ATF2 Crowded Final Focus Area

Neutrons

G4 + Splitting technique

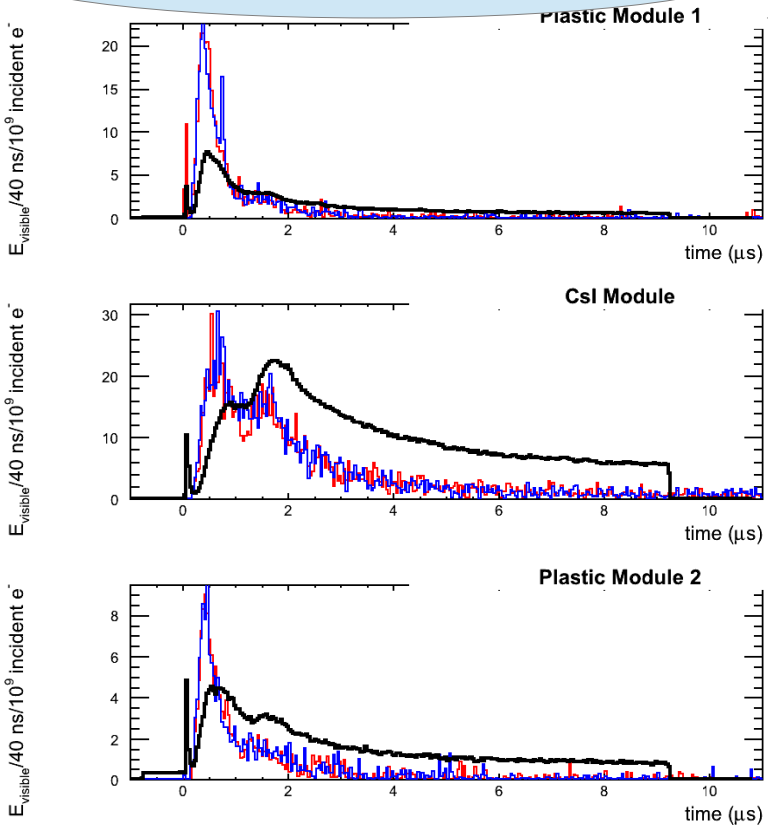


~3 order of magnitudes more Efficient. (12 slices)

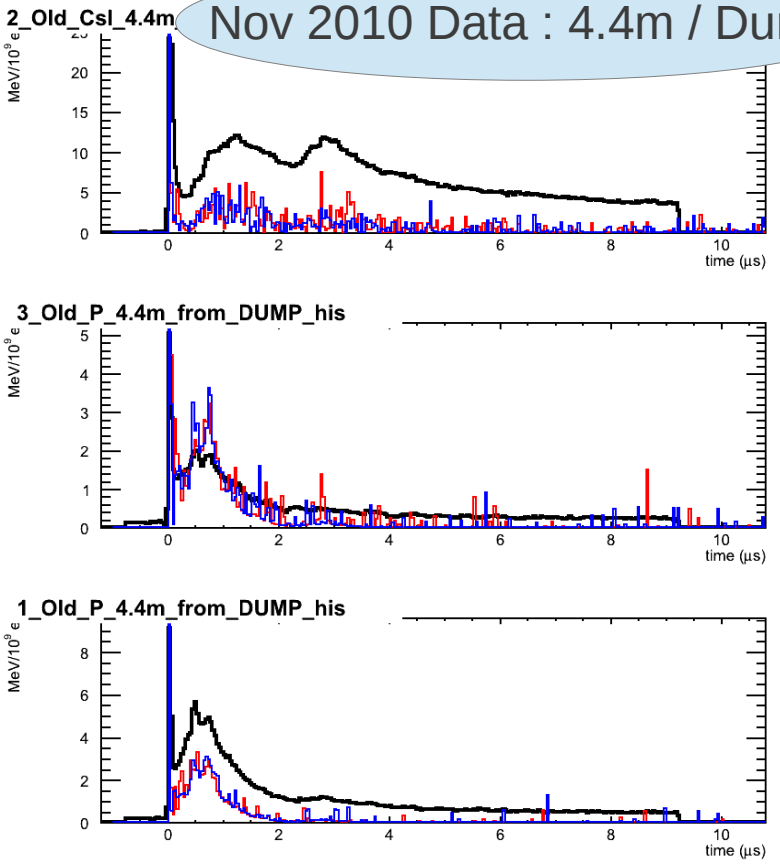


Data vs Geant4

Mai 2010 Data : Dump right side



Nov 2010 Data : 4.4m / Dump



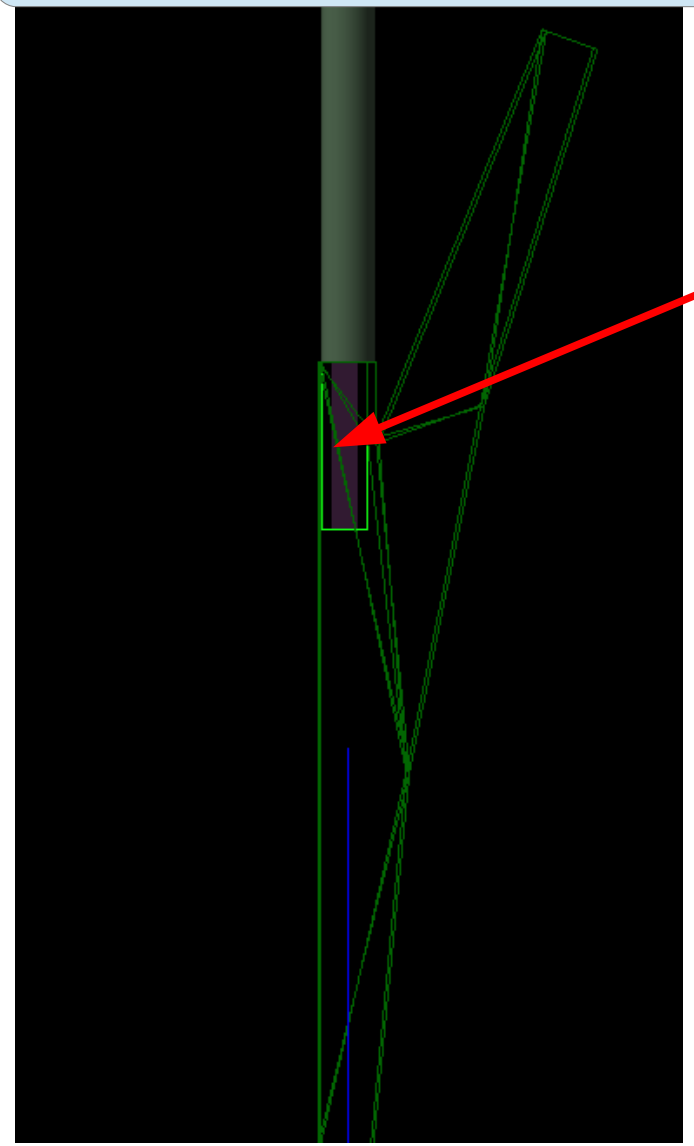
Ongoing analysis, with data taken in 2011 to extract detector response and understand the Data/MC discrepancy.

Simulate IP Background

- Shintake photon detector measures Compton photons between Laser fringe pattern and beam @ IP.
- But, small β means large divergence, and beam hits beam pipe and bend chamber, making bremsstrahlung background.
- Photon detector collects Compton photons and bremsstrahlung which could be separated in shape (calorimeter longitudinal segmentation) but depending on background amount.

BDSIM FF simulation

Last Bending magnet chamber

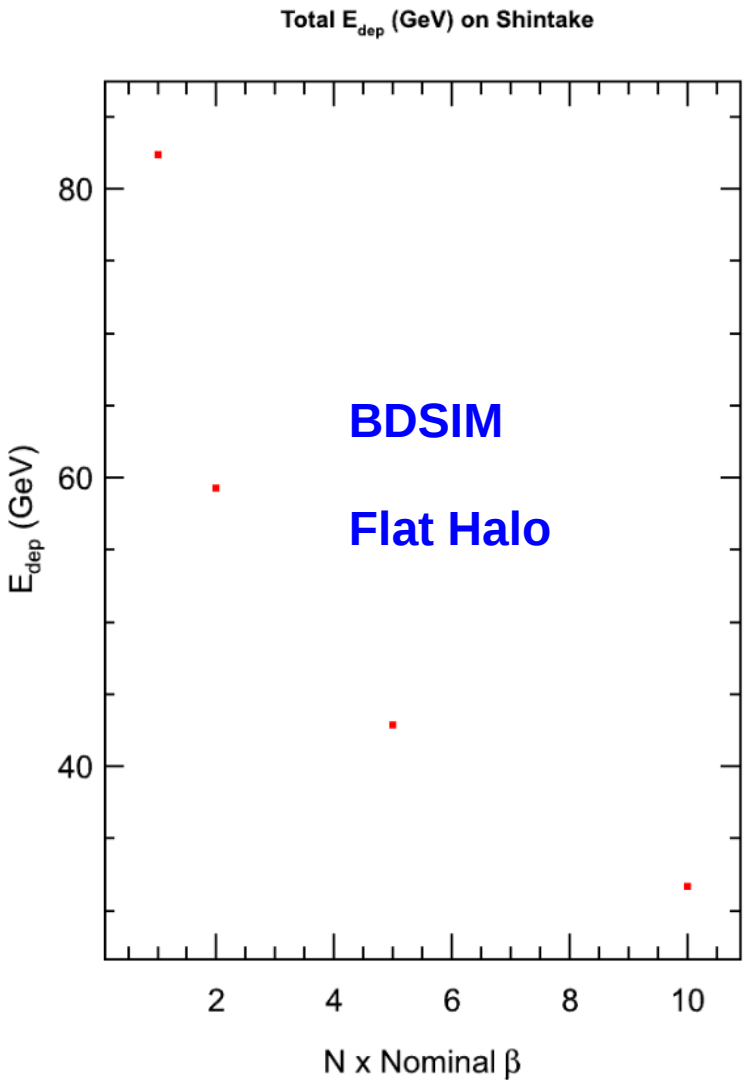


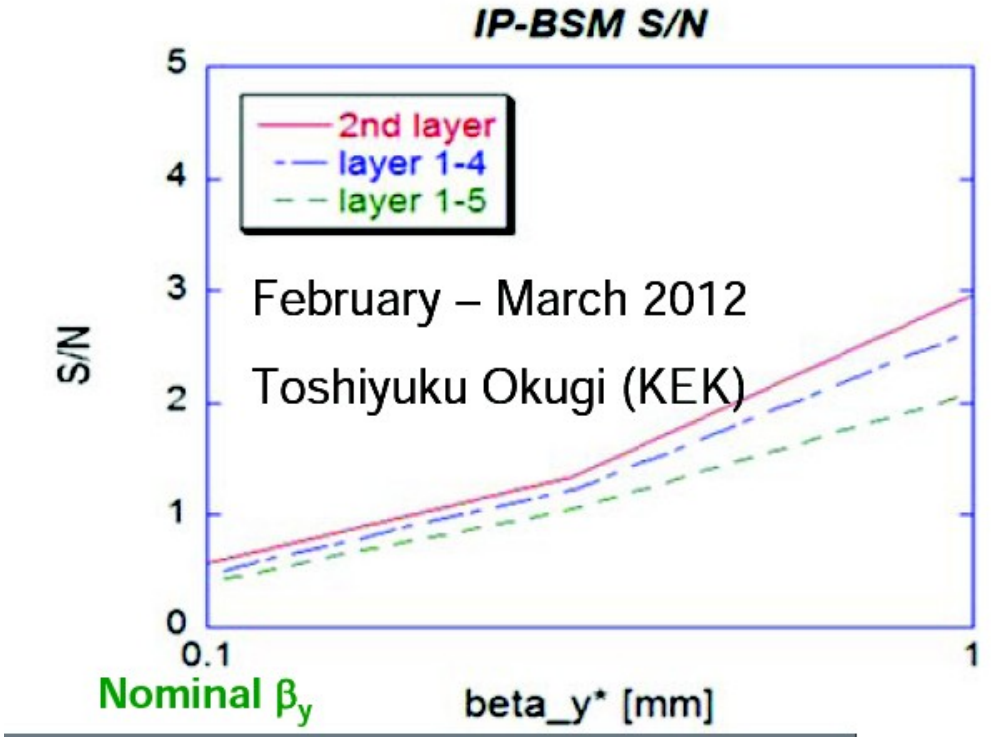
LCDD (GDML) geometry description

New collimator

Shintake
CsI Photon detector

Shintake background at different optics

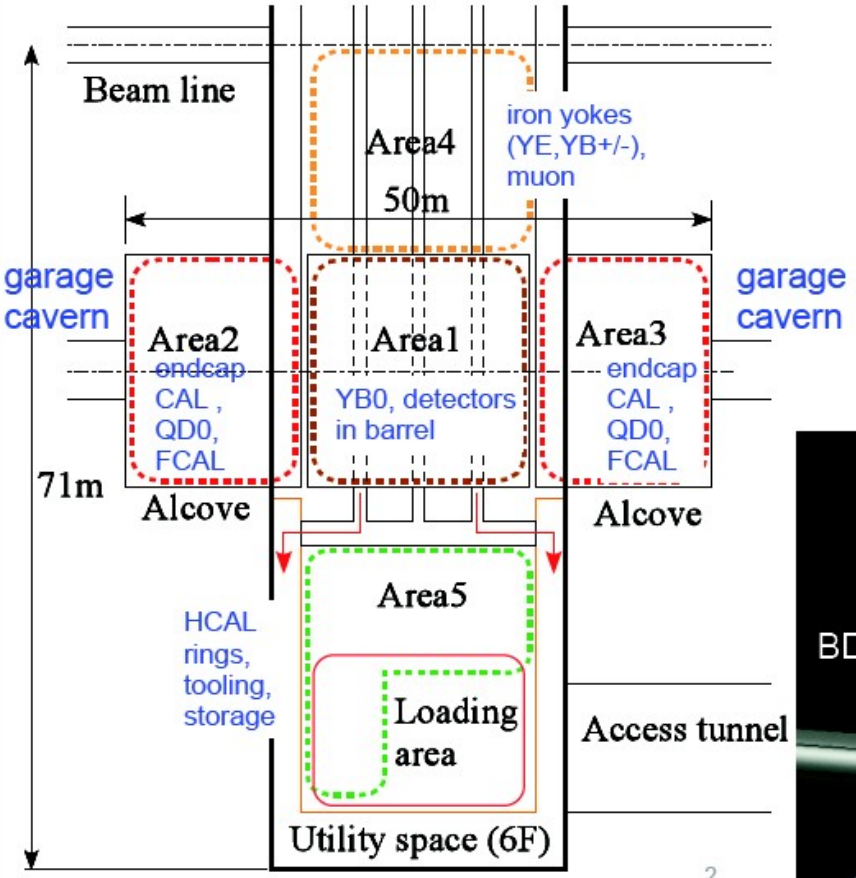


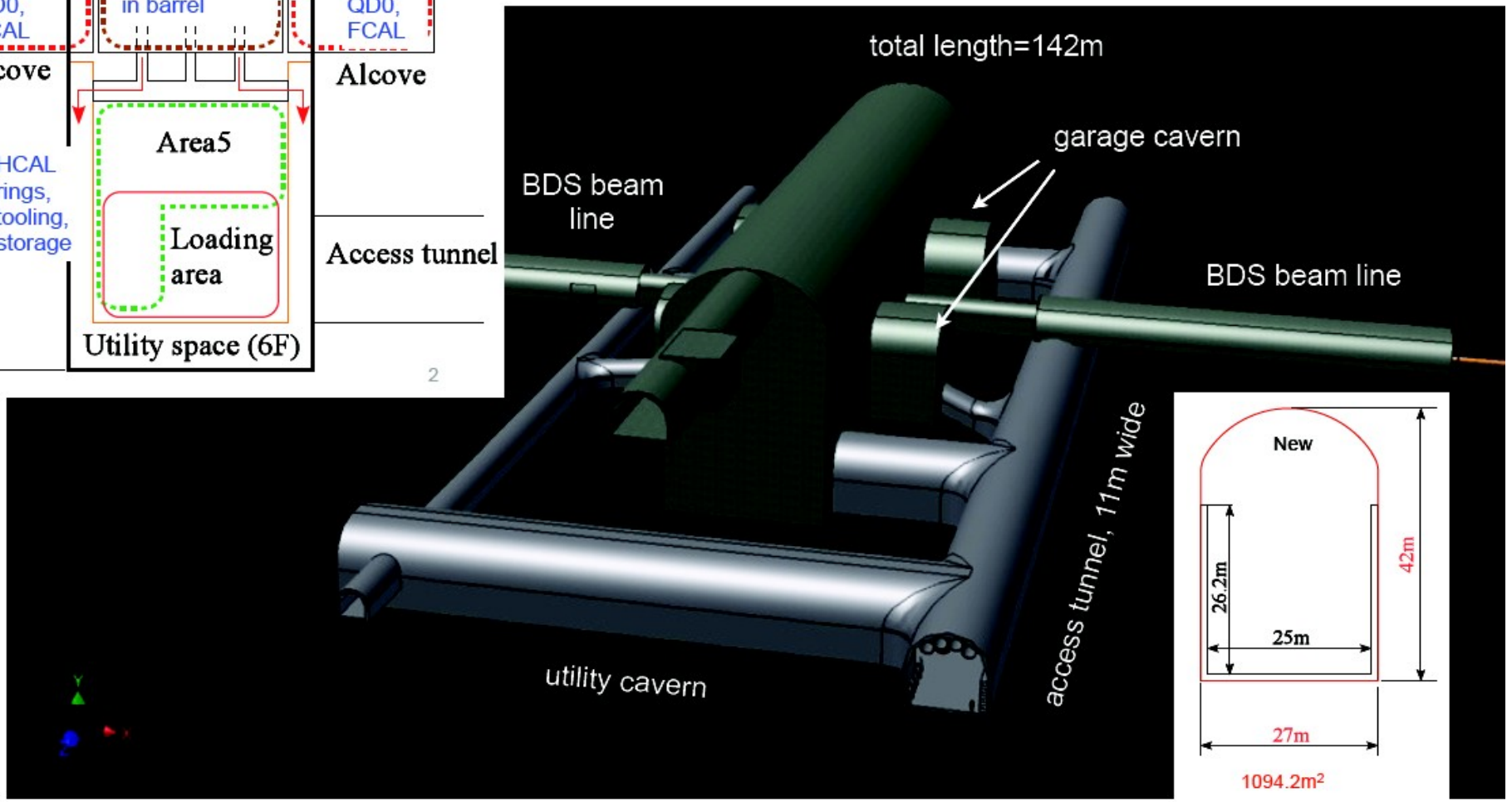


ILC : ILD-MDI at KEK

Experimental hall and detector assembling in Mountainous region, Japan

underground assembling in 3 years





Welcome to LAL !

- FJPPL "Toshiko Yuasa" → supports LAL, LAPP, LLR and KEK joint activities on ATF2 and ILC MDI since 2006 !
- FKPPL → new KNU-LAL collaboration since 2011
- also FCPPL support in the past → collaboration with IHEP continues on ATF2 and LC. Joint work with Dr. Sha Bai, former PhD student, now post-doc at IHEP. New PhD student Shan Liu, funded by FCPPL-CSC agreement

P. Bambade

Goals

1. Review recent activity, plans and progress towards "goals 1 & 2" of ATF2, including the new strategy for training and dedicated continuous operation towards achieving a ~ 37 nm spot size
2. Face to face discussion on several engineering aspects (e.g. new hardware for IPBPM project, for GM sensors, FD quads, extraction kicker,…
3. Emphasis on projects involving FXPPL, but obviously fully open to the whole collaboration

P. Bambade

ATF future plans

GDE | Next KEK Roadmap

CY | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018

ILC | others

Delay by fire and earthquake

Nano beam orbit control
- Develop. (2nmBPM, Fast FB) / Beam study
- Nano beam orbit control (FONT extension)
- 2nm stab. R&D / 2nm steady op.

Small beam
- Beam study / 35nm Steady op.
- Ultra small beam ~ 20 nm

Gamma-gamma collider R&D
- Develop. / beam study 4-mirror optical cavity (LAL/KEK)
- Gamma-gamma laser system R&D

Application
- High Field Physics

General R&D
- Ex) for KEKB; CSR, RF gun, Instrument develop., Low emittance,… Test beamline for detector?

N. Terunuma

BACKUP SLIDES

FKPPL Project application (2012)

Red info should be replaced by the appropriate text in black

ID: Title	A_RD_ATF2: Collaboration between KNU and LAL on the ATF2 project at KEK

Members	French Group			Korean Group		
	Name	Title	Affiliation	Name	Title	Affiliation
	Leader: Philip Bambade	DR2	LAL	Leader: Eun-San Kim	Prof.	KNU (KyoungPook National Univ.)
	Oscar Blanco (from March 2012)	PhD	LAL	Ayoung Her	PhD	KNU
	Sandry Wallon	IR2	LAL	Hye-Jin Kim	Master	KNU
	Frédéric Bogard	IE2	LAL	Si-Won Jang	PhD	KNU

Requested LIA specific funding from France

Description	Euro/unit	Nb of units	Total (euros)	Requested to: *
Cost of attending FKPPL workshop in Clermont-Ferrand, May 2012	500	1	500	IN2P3
Visiting KNU and attending KILC in April 2012 (both in Daegu)	150 euro/day	2 x 5	1500	IN2P3
Travel to Daegu	1000	2	2000	IN2P3
Shipment of LAL produced external vacuum chamber with pre-installed KNU IP-BPMs from LAL to KEK	2500	1	2500	IN2P3
Total			6500	IN2P3

Requested funding from Korea

Description	Won/Unit	Nb of units	Total (Won)	Requested to: **
Student internship on ATF2	1,000,000/month	1 months	1,000,000	KOSEF
Visit to LAL	200,000/day	30 days	6,000,000	KOSEF
Travel to LAL	2.000,000	2	4,000,000	KOSEF
Total			11,000,000	KOSEF

	Additional funding from France	Additional funding from Korea

FJPPL (TYL) application 2012-2013

Fiscal year april 1st 2012 – March 31st 2013

In red are example to be replaced by the appropriate data in black

ID: **A_RD_2**	**A_RD_2: Collaboration on the ATF2 project at KEK and on the ILC Machine Detector Interface**

Leader	**French Group**			**Japanese Group**		
	Name	**Title**	**Lab./Organis.**	**Name**	**Title**	**Lab/Organis.**
Members	**Philip Bambade**	DR2	LAL	**Toshiaki Tauchi**	A.Prof	KEK
	Sandry Wallon	IR2	LAL	Junji Urakawa	Prof.	KEK
	Frédéric Bogard	IE2	LAL	Nobuhiro Terunuma	A.Prof	KEK
	Oscar Blanco	PhD	LAL	Shigeru Kuroda	R.A.	KEK
	Post-doc (tbc)		LAL	Toshiyuki Okugi	R.A.	KEK
	PhD (tbc)		LAL	Hiroshi Yamaoka	Eng.	KEK
	Marc Verderi	CR1	LLR			
	Hayg Guler	CDD-CR	LLR			
	Andrea Jeremie	IR1	LAPP			

Funding from France				
Description	**€/unit**	**Nb of units**	**Total (€)**	**Requested to: [1]**
Travel to KEK for LAL (meetings		8 travels	15000	IN2P3

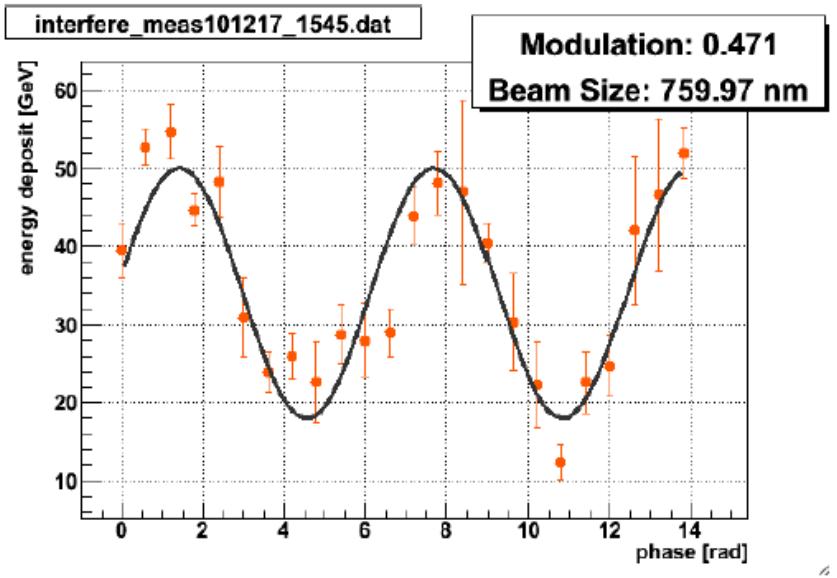
and IPBPM chamber installation)				
LAPP Travel to KEK and FJPPL (meetings/sensor installation)		4 travels	10000	IN2P3
LAPP Sensor transport to KEK			1000	IN2P3
LLR travel to KEK and conference		5 travels	12000	IN2P3
LLR material transport			2000	IN2P3
Total			40000	

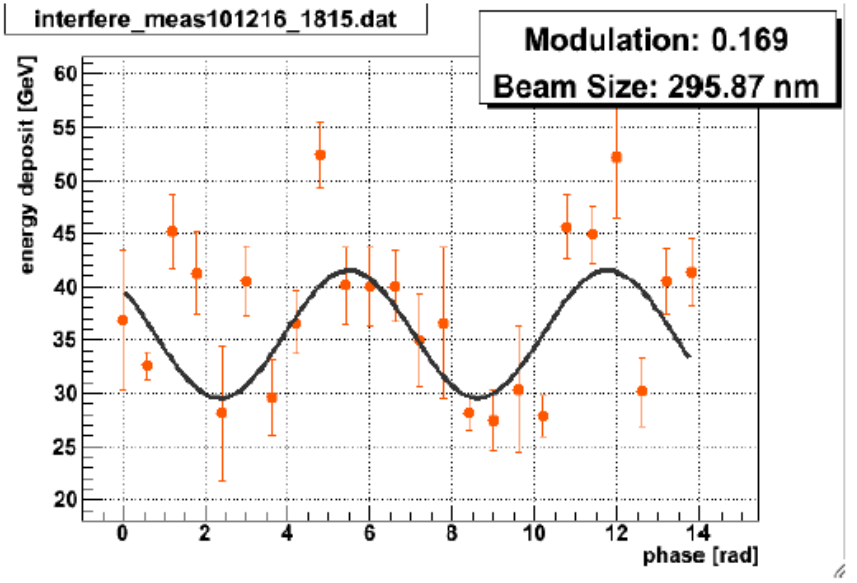
Funding from KEK				
Description	**k¥/Unit**	**Nb of units**	**Total (k¥)**	**Requested to:**
Travel	150	3 travel	450	KEK
Visit to France	20/day	27.5 days	550	KEK
Total			1000	

Additional Funding from France		**Additional Funding from Japan**		
Provided by/ Requested to[2]	**Type**	**Provided by/Requested to[3]**	**Type**	**k¥**
IN2P3	CDD-IR			
ANR	Equipment and travel contributions			
CNRS	Equipment and travel contributions			
Total		Total		

Confusion of signal fluctuation with modulation (if bad S/N)

M. Oroku, 2011





Modulation

phase scan: change length of one laser path by changing distance of the delay line with piezo

Fluctuation

- Fluctuation ("fake modulation") : Δsig / sig ~ 0.18 (for S/N ~ 1/10)
- If fake M > expected M, it becomes confusing

- Expected M : 0.17 (300 nm)
- Expected M : 0.42 (200 nm)

in 2012 laser system is improved compared with 2011; more careful setup & optimization of laser paths, focusing & stability

IP *y* spot size tuning

T. Okugi, 23.02.2012

relaxed optics: $\beta_{x,y}$*=10 mm x 0.3 mm at present

expected vertical beam size ~70 nm (ε_x=1.84 nm, ε_y=15.6 pm)

- IP BSM 30 degree mode (no signal at this mode in early 2011)
- multiknobs for tuning: **always scan α_y, D_y, *x'y*** coupling
- scan of **xy coupling** by upstream skew quadrupole – not orthogonal

  scanning the above three knobs for every step of xy;
  it would be better to rotate IP BSM, but not possible at the moment
- **fluctuations in DR vertical orbit** leads to change in IP beam size

  optimize, re-scan injected orbit with ZV1X corrector (angle at IP),
  the dependence is very strong, a change by 0.01 A (3 μrad kick; Δ orbit < 500 μm)
  changes spot size by ~30%
- first scan of the **skew sextupole** (placed at $D \neq 0$) showed dependence

  this skew sextupole should compensate for net skew sextupole component
  in all ATF2 quadrupoles (why is there such component in the first place?)
- **IP BSM size reduction factor** - significant, various contributions

  the real beam size is (~0.8 times?) smaller than measured
- below about 100 nm one can change to 174 degree mode
- **attempt to scan DR Δf_{rF}** affected timing synchronization with laser

IP *y* spot size tuning cont'd

T. Okugi, &
M. Oroku et al,
23.02.2012

laser wire scan showed **about 165 nm in 10 successive measurements**

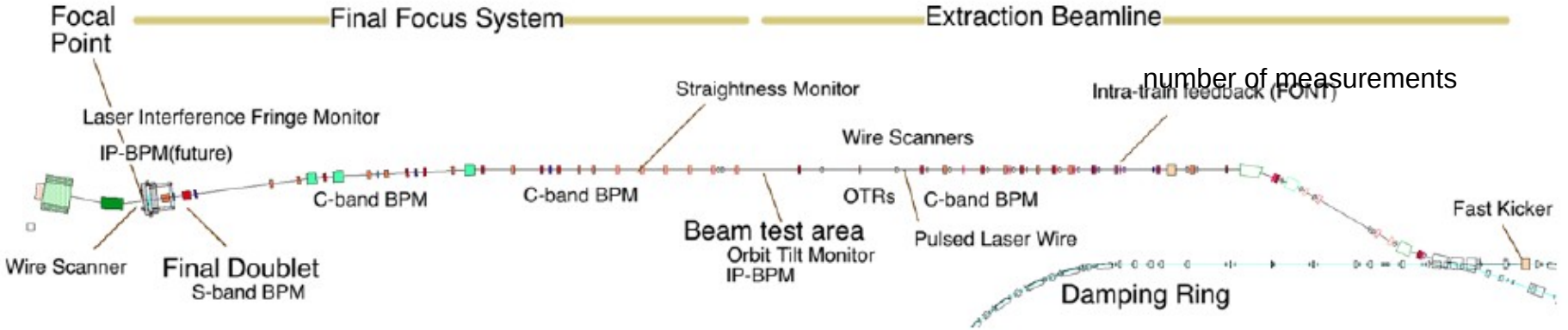
first time switch to 174 degree mode (which should be used for final tuning!): attempt to find optimal focal range position;

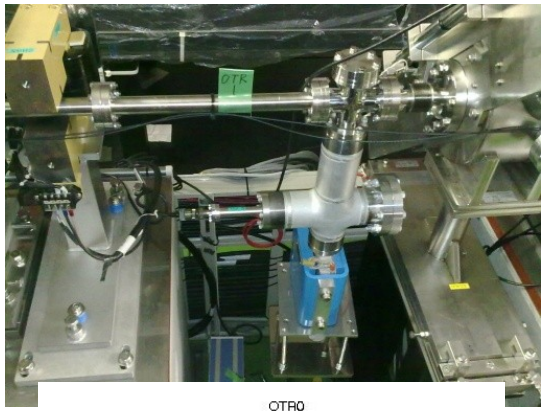
max modulation of 12 % reached; if true signal this would be a beam size **around 100 nm**

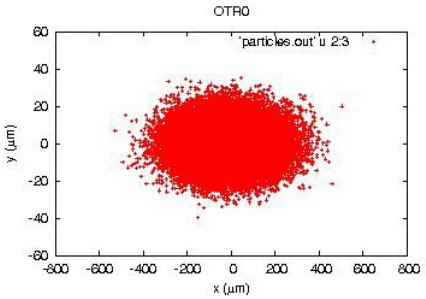
next steps:

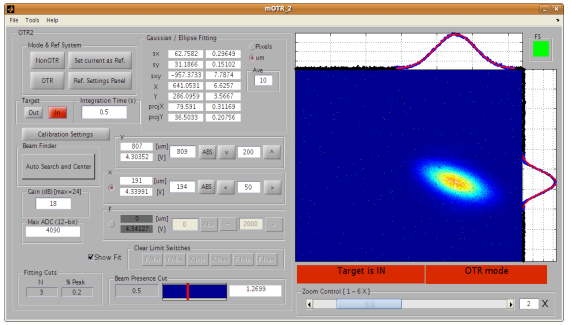
- **towards nominal optics** (more favorable background conditions and reduced sensitivity to orbit drifts in the high beta quads)
- **further strategy – push only β_y^* or both β_x^* and β_y^*?**
  week 13/2: β^*_y=1.0 mm ; 20/2: β^*_y=0.3 mm; 5/3: β^*_y=0.1 mm - however, backed off to higher β^*_y on 15/03; saw clear modulation with 30 degrees mode for all optics, but background level and signal jitter are increased for decreasing β^*_y
- **movable collimator may reduce background**
- **chromaticity and geometric aberration scans not yet applied**
- **understand orbit effect**
- **stabilize extraction line emittance (correlation, orbit feedback?)**
- **longer tuning periods, larger team**

Multi-OTR System Overview









Single OTR Panel

- The multi-OTR system is made of **4 OTRs** installed in the zero-dispersion part of ATF2 EXT line
- **Fast emittance measurements** (single shot for beam size, 1min for emittance) with high statistics with **2um measurement capabilities** with **2x1010 single bunch**
- **Automatic coupling correction in few minutes.**
- Design based on OTR1X at ATF EXT with improved features (compactness, calibration setup and demagnifier system)
- **Installed near WS** for comparison and confirmation of OTR as a beam emittance diagnostic device