The ATF2 Project

ICEPP, Univ. of Tokyo
T. Sanuki

ILC-Asia WG4

Beam Delivery, Interaction Region,....

Everything after Main Linac

Member List

Siba Prasad	Das	Jadavpur U.
Yoshihisa	Iwashita	Kyoto U.
Nobuhiro	Kimura	KEK, CSC
Kiyoshi	Kubo	KEK, Acc
Shigeru	Kuroda	KEK, Acc
Tomoyuki	Sanuki	Tokyo U.
Noboru	Shibata	Hitachi Ltd.
Ryuhei	Sugahara	KEK, Acc
Yasuhiro	Sugimoto	KEK, IPNS
Kazuhiro	Takeuchi	Hitachi Ltd.
Toshiaki	Tauchi	KEK, IPNS
Kiyosumi	Tsuchiya	KEK, CSC
Junji	Urakawa	KEK, Acc
Ken	Watanabe	Tohoku Gakuin U.
Hitoshi	Yamamoto	Tohoku U.
Hiroshi	Yamaoka	KEK IPNS
Satoru	Yamashita	Tokyo U.
Masakazu	Yoshioka	KEK, Acc

Total: 18

KEK: 10

Univ.: 5

Hitachi: 2

Asia: 1*

* hep physicist

Weekly Meeting

Minutes:

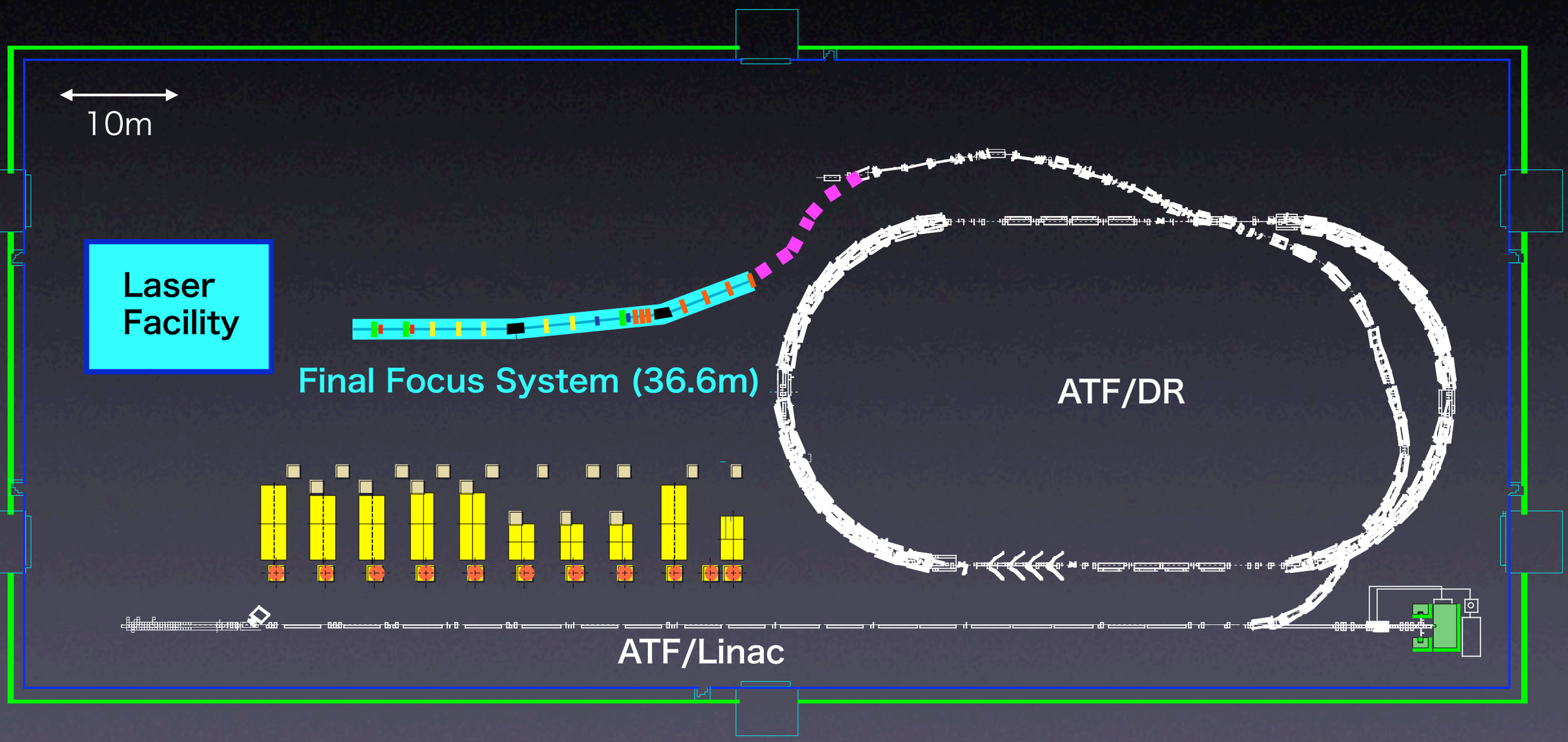
http://lcdev.kek.jp/ILC-AsiaWG/WG4notes/

We've been concentrate on

Final Focus Test Facility at ATF

ATF2
(tentative name)

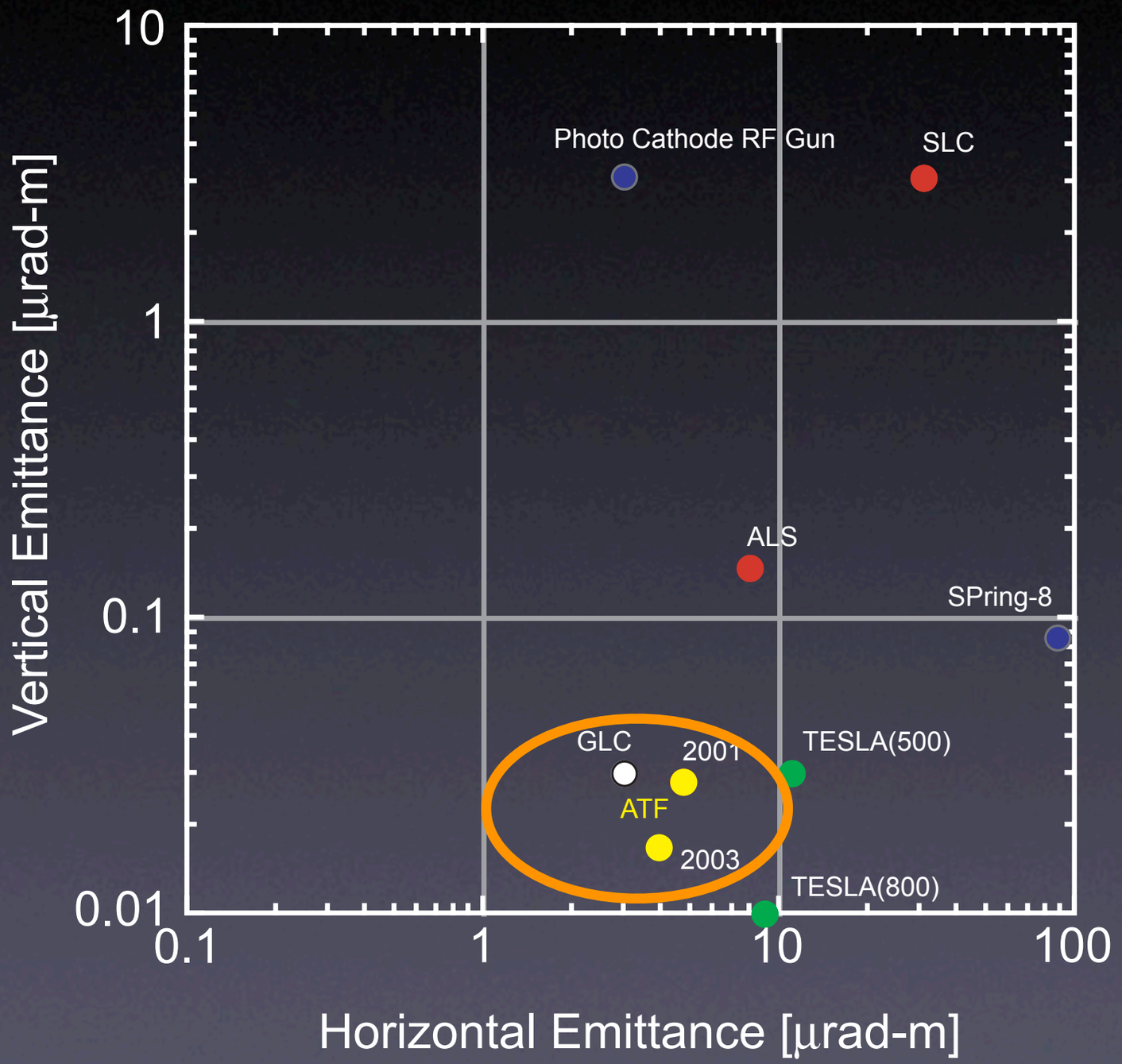
Final Focus Test Facility
ATF2



FFTF(ATF2) by ATF/DR

- High quality ILC-like beam is available.
  - E=1.54 (1.28) GeV
  - $\gamma\varepsilon_x = 3\times10^{-6}$ m
  - $\gamma\varepsilon_x$: $\gamma\varepsilon_y$=100:1
  - d=0.1% Gaussian Beam

ATF



ATF provides ultra-low emittance "ILC-like beam"

Test Facility for Final Focus System

Next stage of R&D

ATF -> ATF2

Goal

A. Small Beam Size

(A1) Obtain σy~37nm

(A2) Maintain for long time

B. Stabilization of beam center

(B1) Down to ~2nm by nano-BPM (cavity BPM)

(B2) Bunch-to-bunch feedback of ILC-type beam (~300ns)

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

FFTB/SLAC

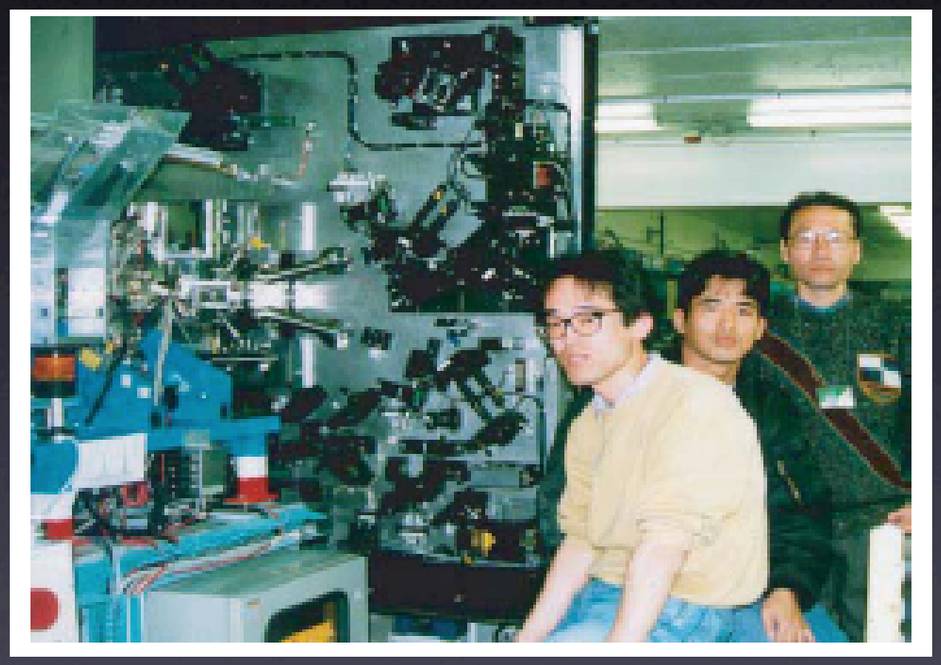
- Collaboration
- Components
- Concepts
- Detectors
- Test Facilities
- NLC Technical
- NLC Home
- Virtual Tours
- Other HEP Labs
- US DOE HEP

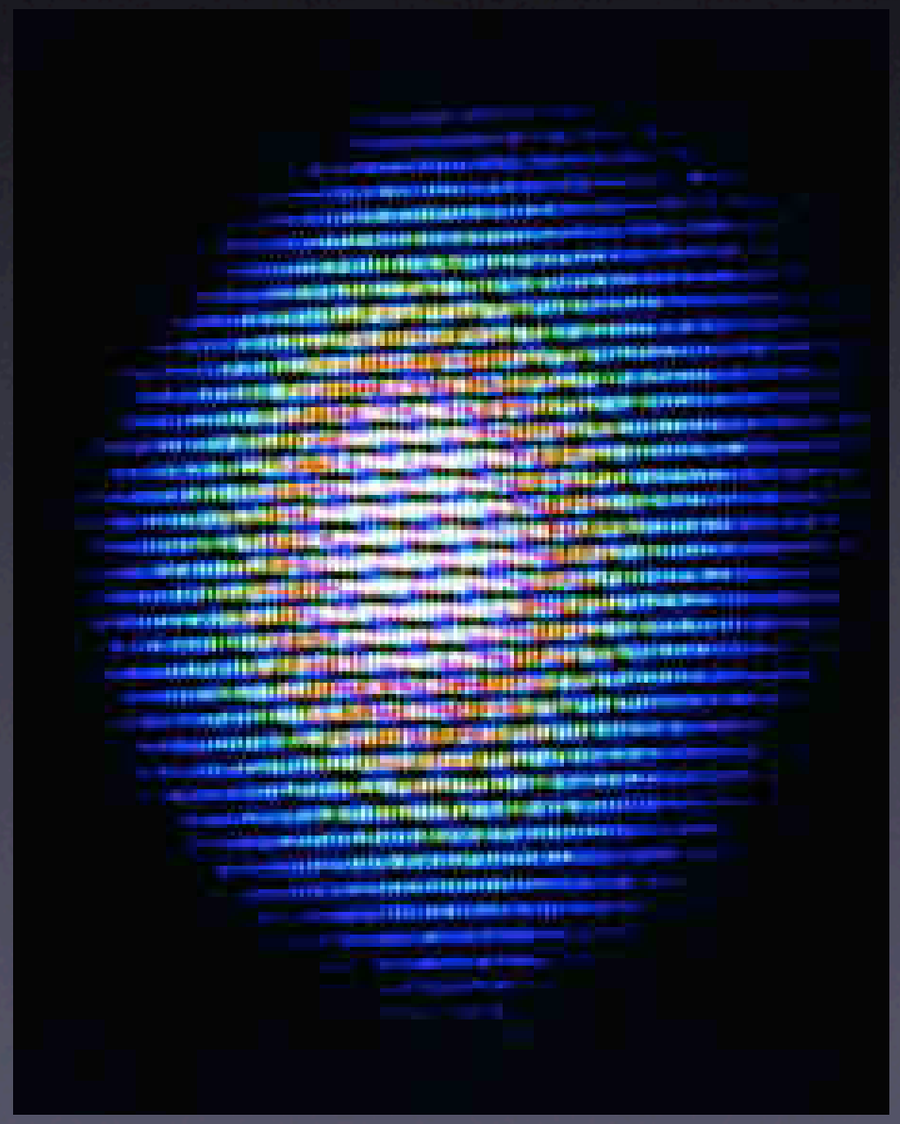
Construction of the Final Focus Test Beam (FFTB) facility was finished in 1993 and includes magnets and other beam elements constructed in Russia, Japan, France, and Germany, as well as the United States.

The purpose of this test facility is to investigate the factors that limit the size and stability of the beam at the collision point of a linear collider. Since the rate of collisions depends on beam density, the ability to focus the beam to a tiny size at the collision point (also called the interaction point or IR) is one of the critical parameters that will determine the research capability of a facility, such as the NLC.

The FFTB facility is a straight-ahead extension of the Stanford Linear Accelerator (SLC). It uses a series of magnetic elements to reduce the size of the beam produced by the linac.

Shintake-monitor





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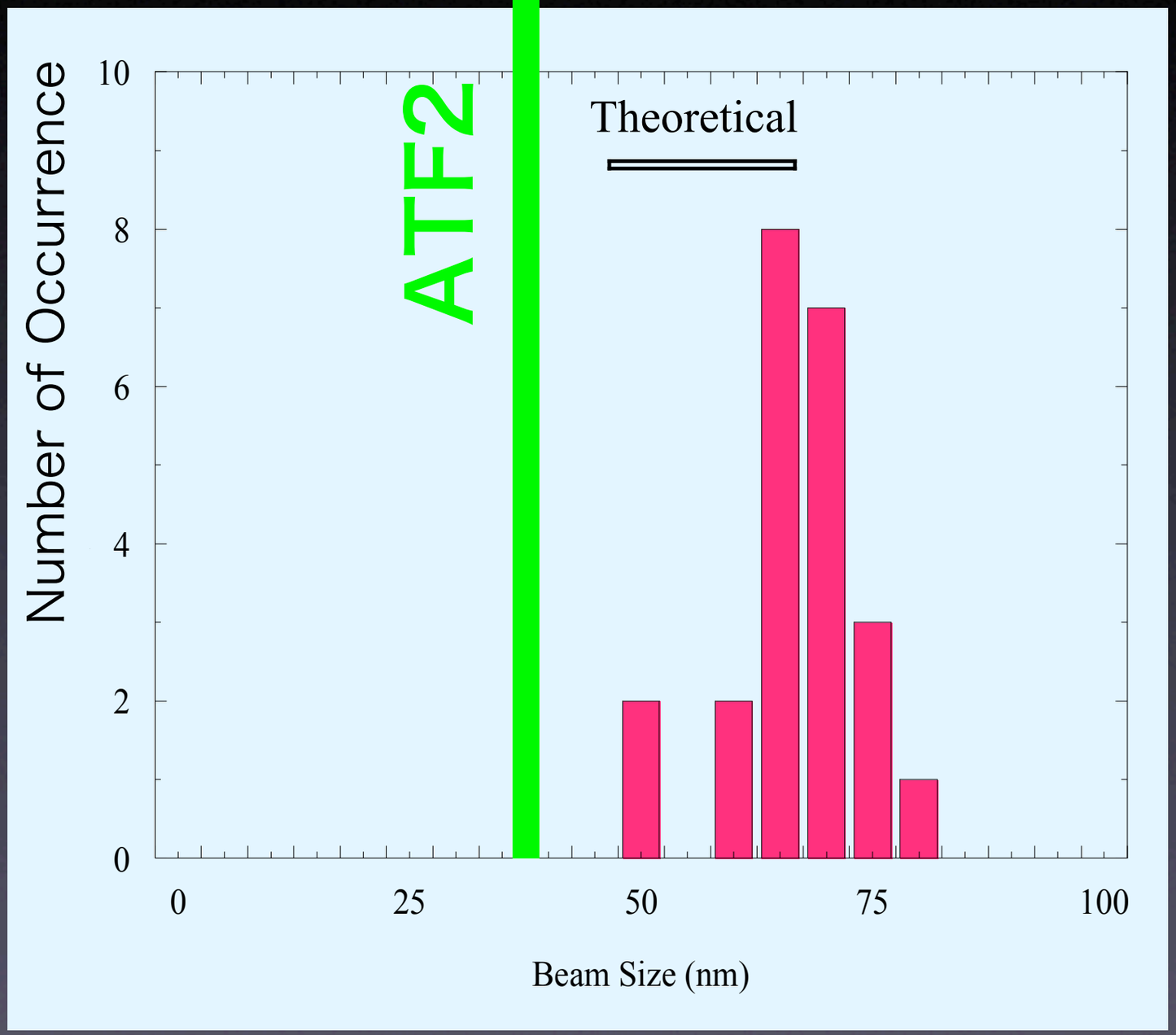
Beam size at FFTB

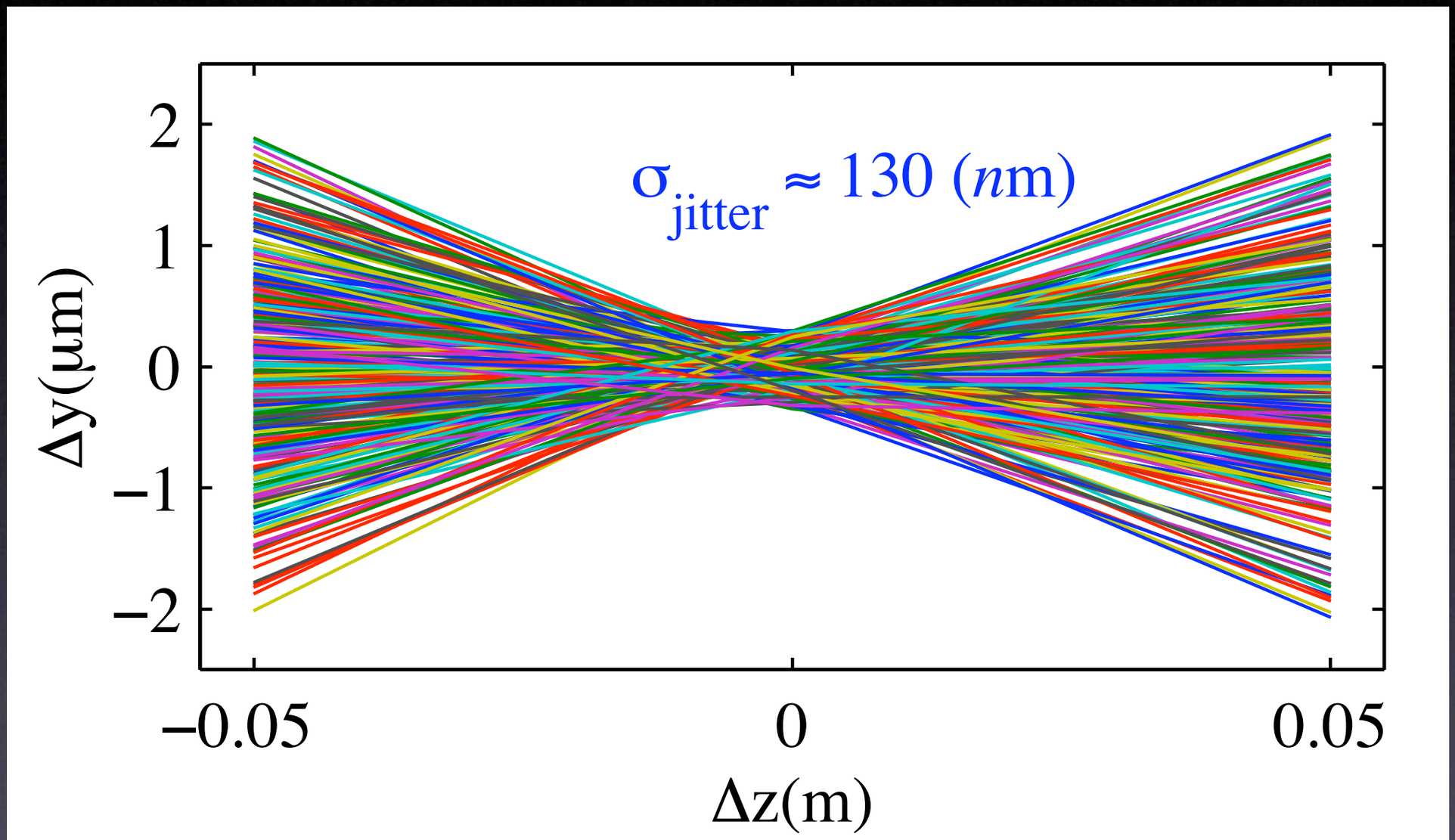


Maintenance of small beam size is indispensable

P.T. ATF2WS at SLAC

T. Shintake et.al. , LINAC98

Beam jitter at FFTB/SLAC



300 pulses at 30Hz

3 RF BPMs are installed at an image focal point.

$\sigma_{RF\text{-}BPM}$ = 25nm

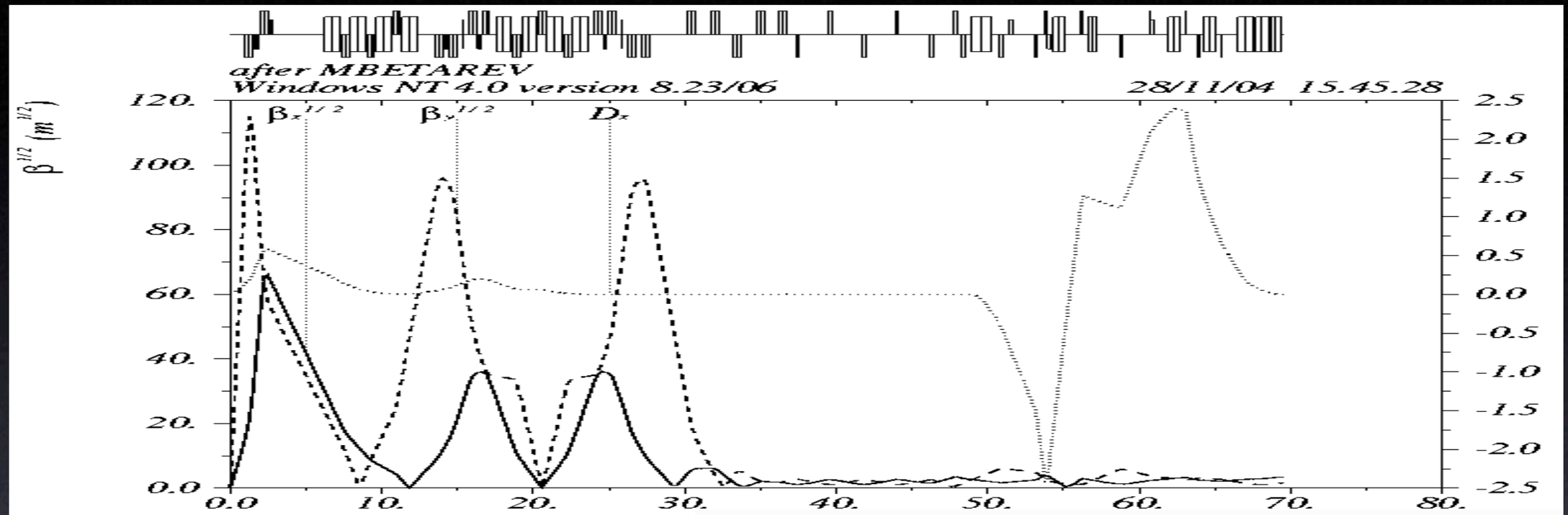
$\sigma_{RF\text{-}BPM}$ = 80nm at IP, σ_θ = 460μrad

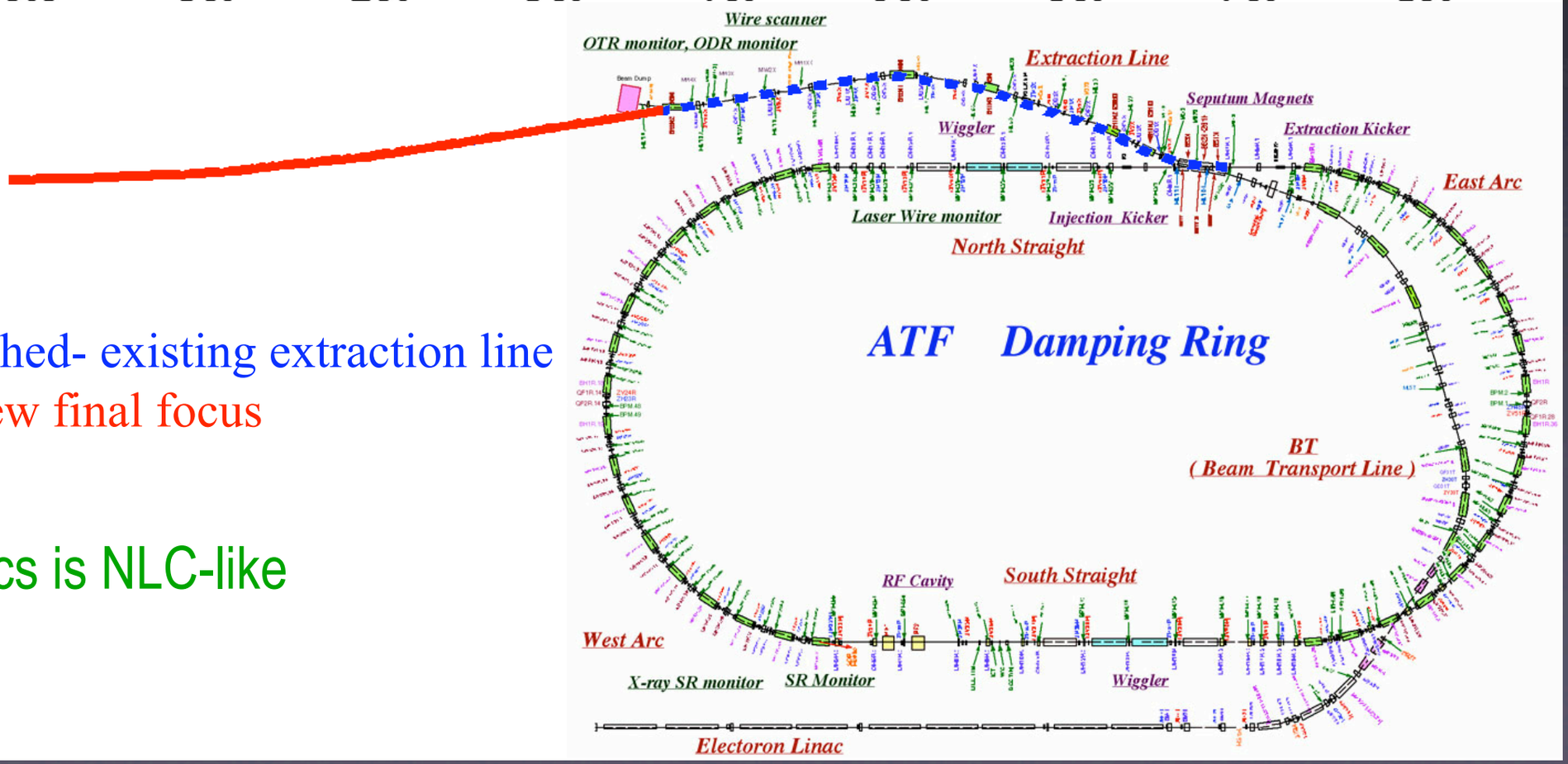
With the demagnification of 7, σ_{jitter} is about 20nm at IP, where, the jitter contributed 30% in the beam spot size.

ATF2 & FFTB/SLAC

FACILITY	ATF2/KEK	FFTB/SLAC
construction first result	2005-07 2007?	1991-93 1994
Optics	***ILC-like*** Pantaleo's local choromaticity correction scheme very short and longer L* (β^*_y=100μm, L_{tot}=36.6m)	Oide's conventional (separate) scheme non-local and dedicated CCS at upstream high symmetry; i.e. orthogonal tuning (β^*_y=100μm,, L_{tot}=185m)
Design beam size	37nm / 3.4μm, aspect=92 ($\gamma\epsilon_y$=3 x 10^{-8} m)	60nm / 1.92μm, aspect=32 ($\gamma\epsilon_y$=2 x 10^{-6} m)
Achieved	?	70nm (beam jitter remains !)

Optics of FF Test Facility



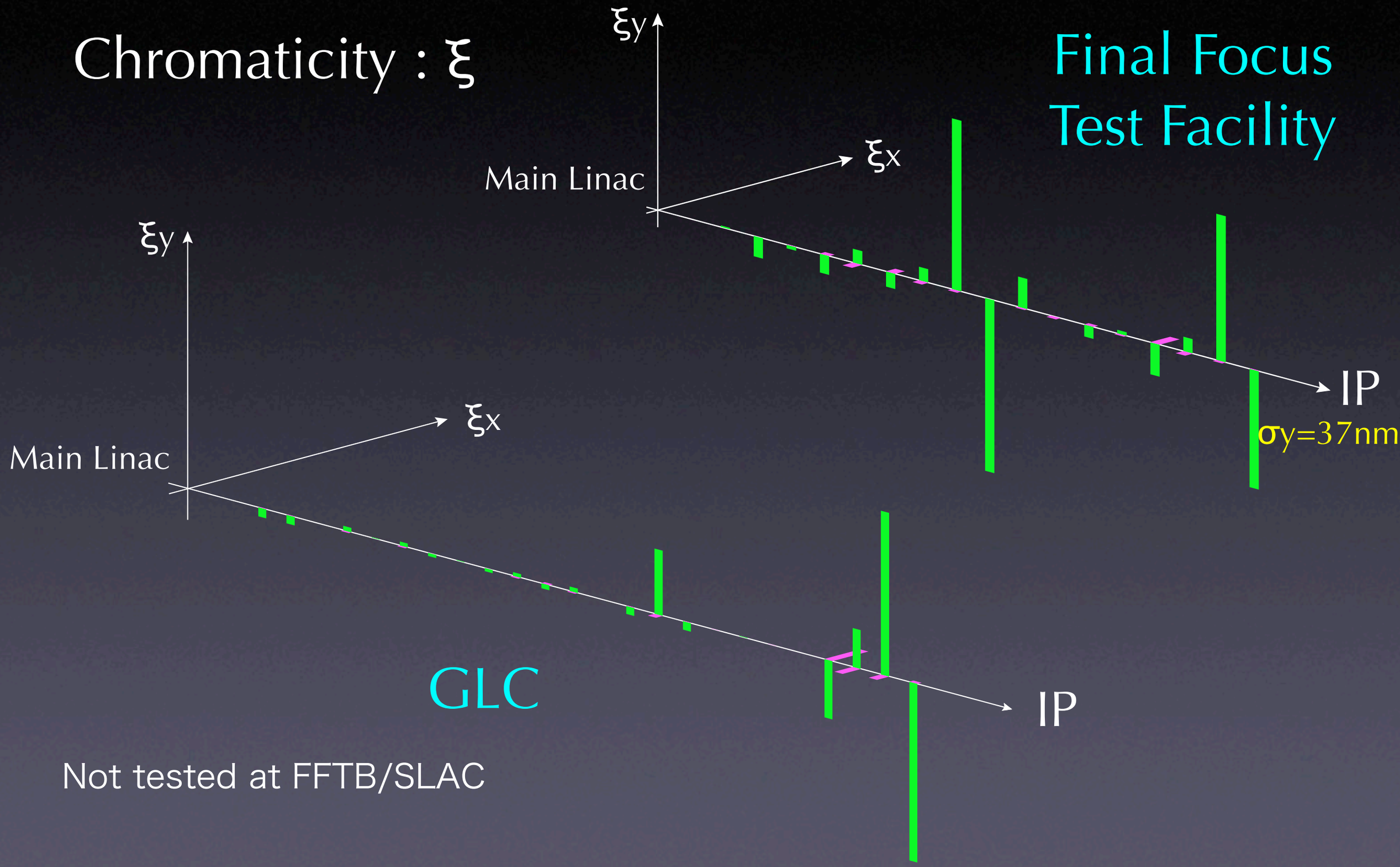


Blue dashed- existing extraction line
Red – new final focus

FF optics is NLC-like

Local Correction

Chromaticity : ξ



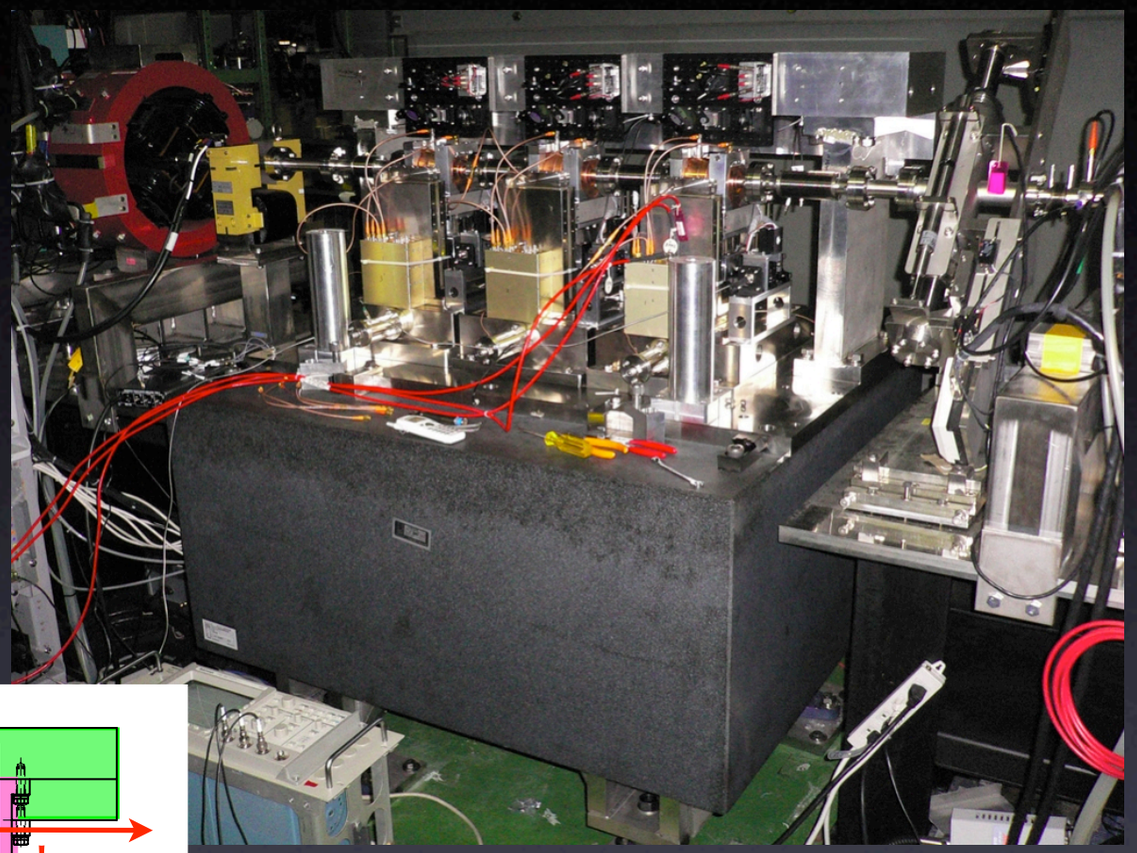
Final Focus Test Facility

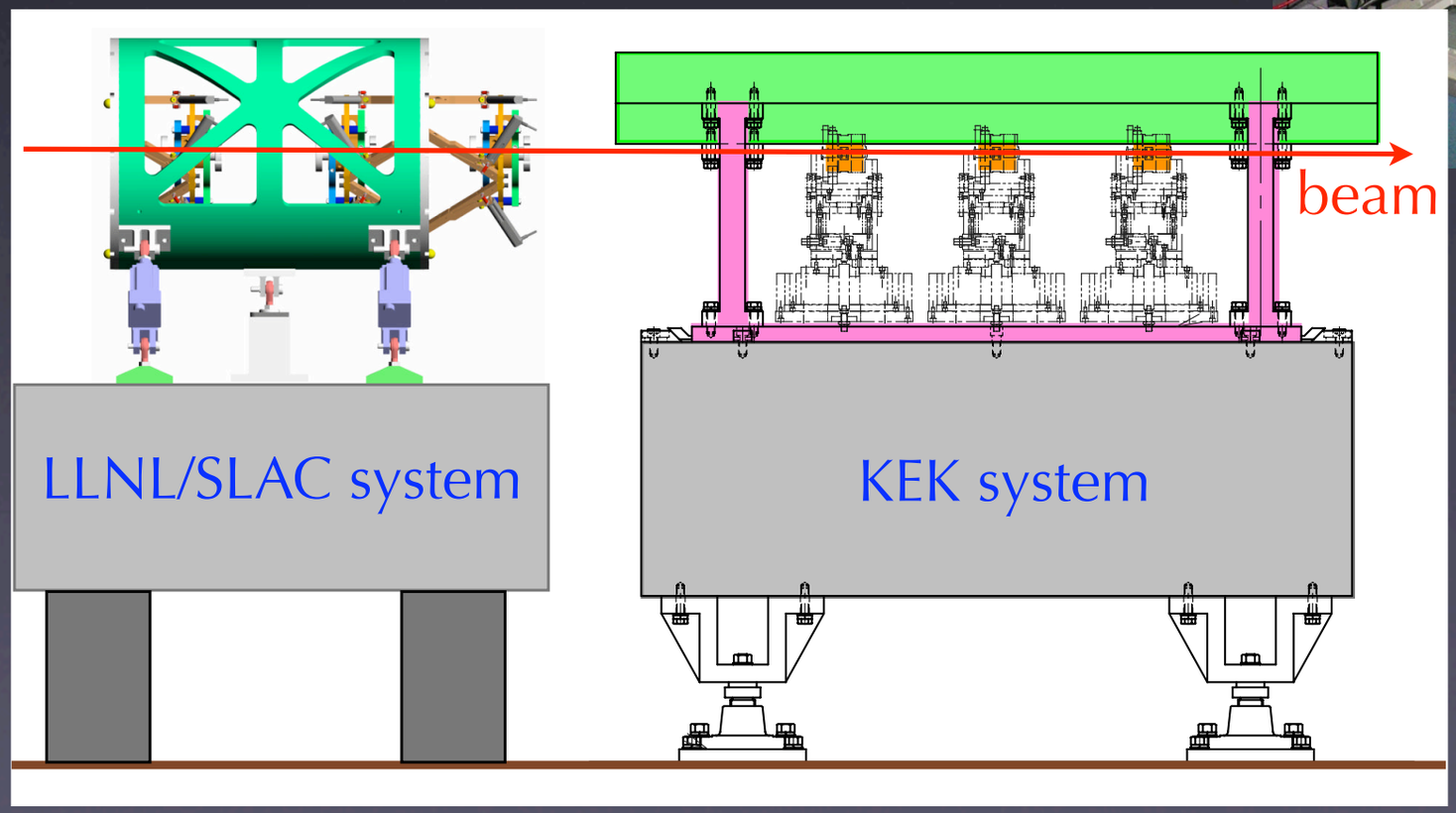
GLC

Not tested at FFTB/SLAC

Instrumentation

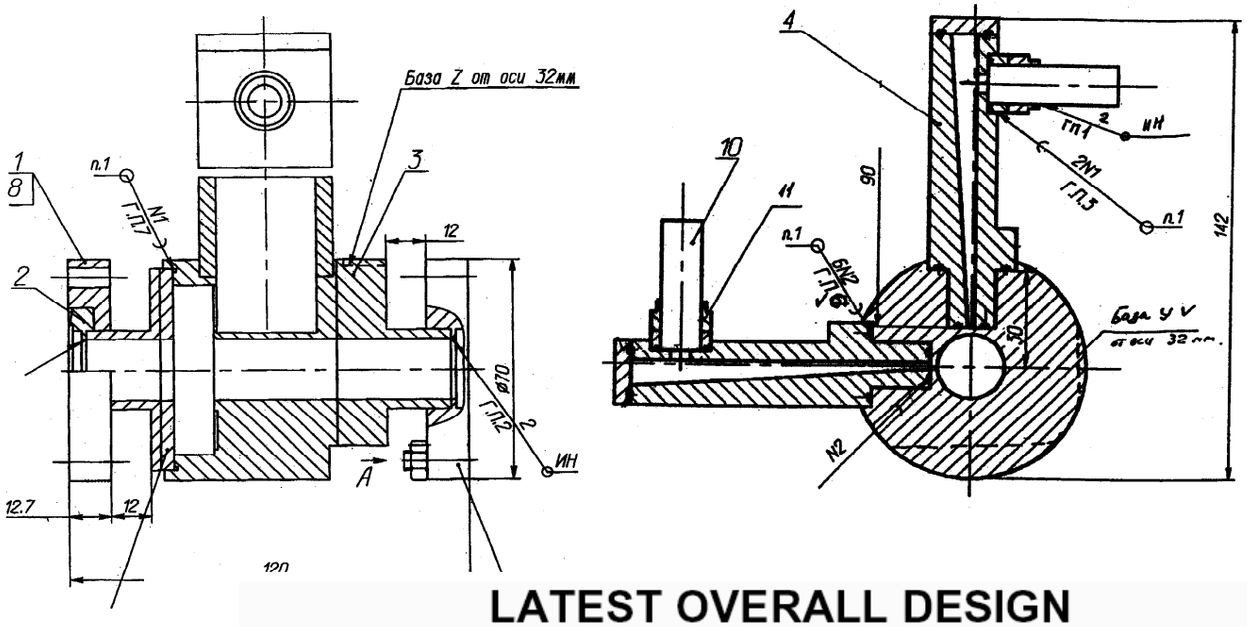
nano-BPM

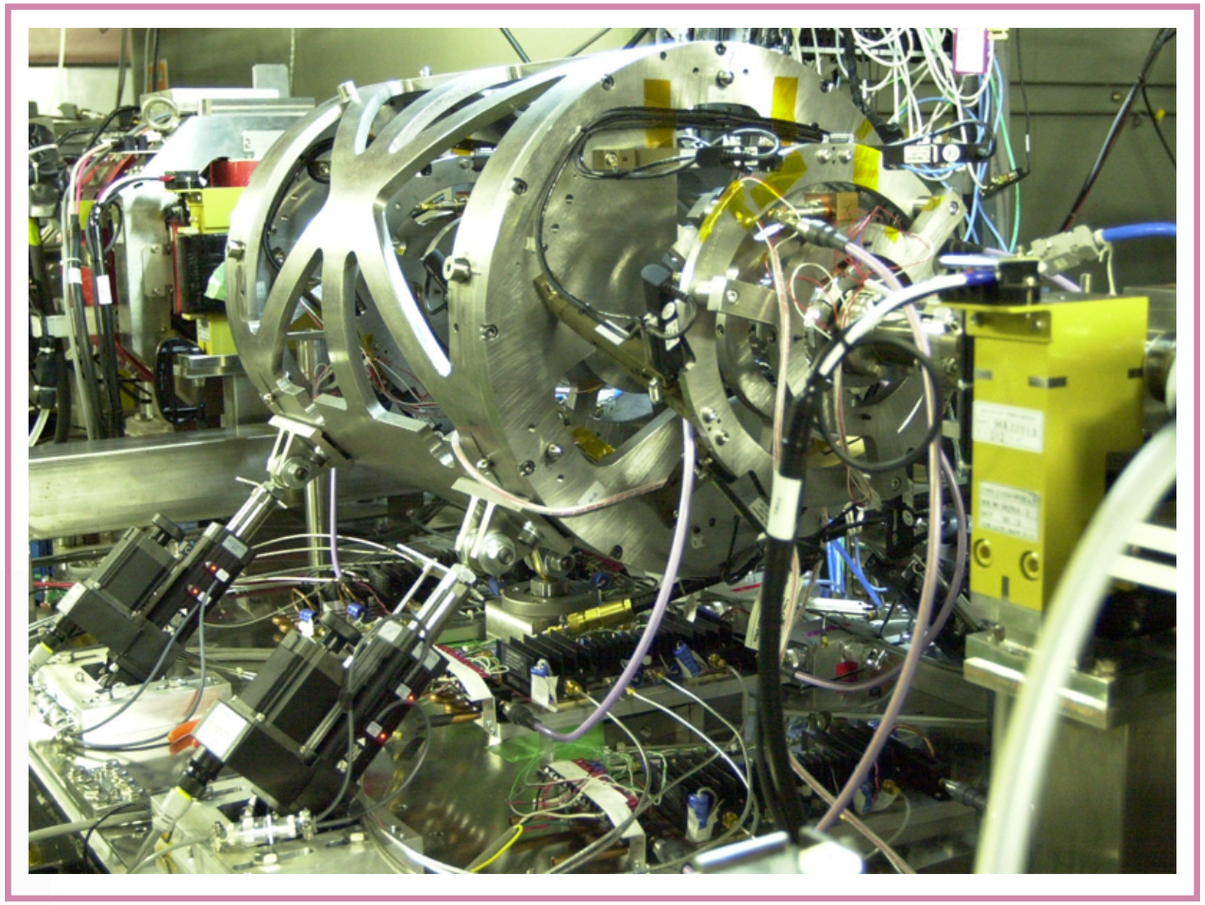


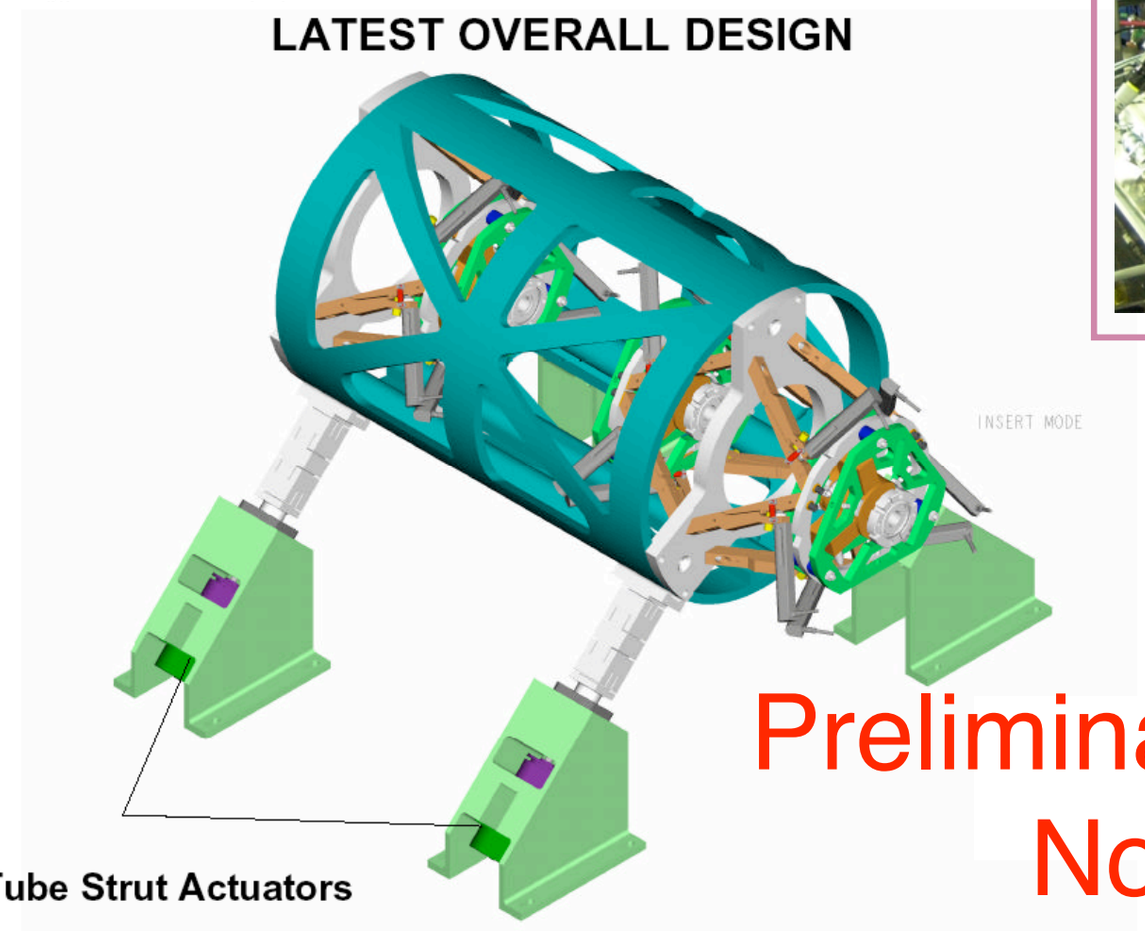


starting demonstration

SLAC-LLNL 3 Cavity BPM system for nm resolution study







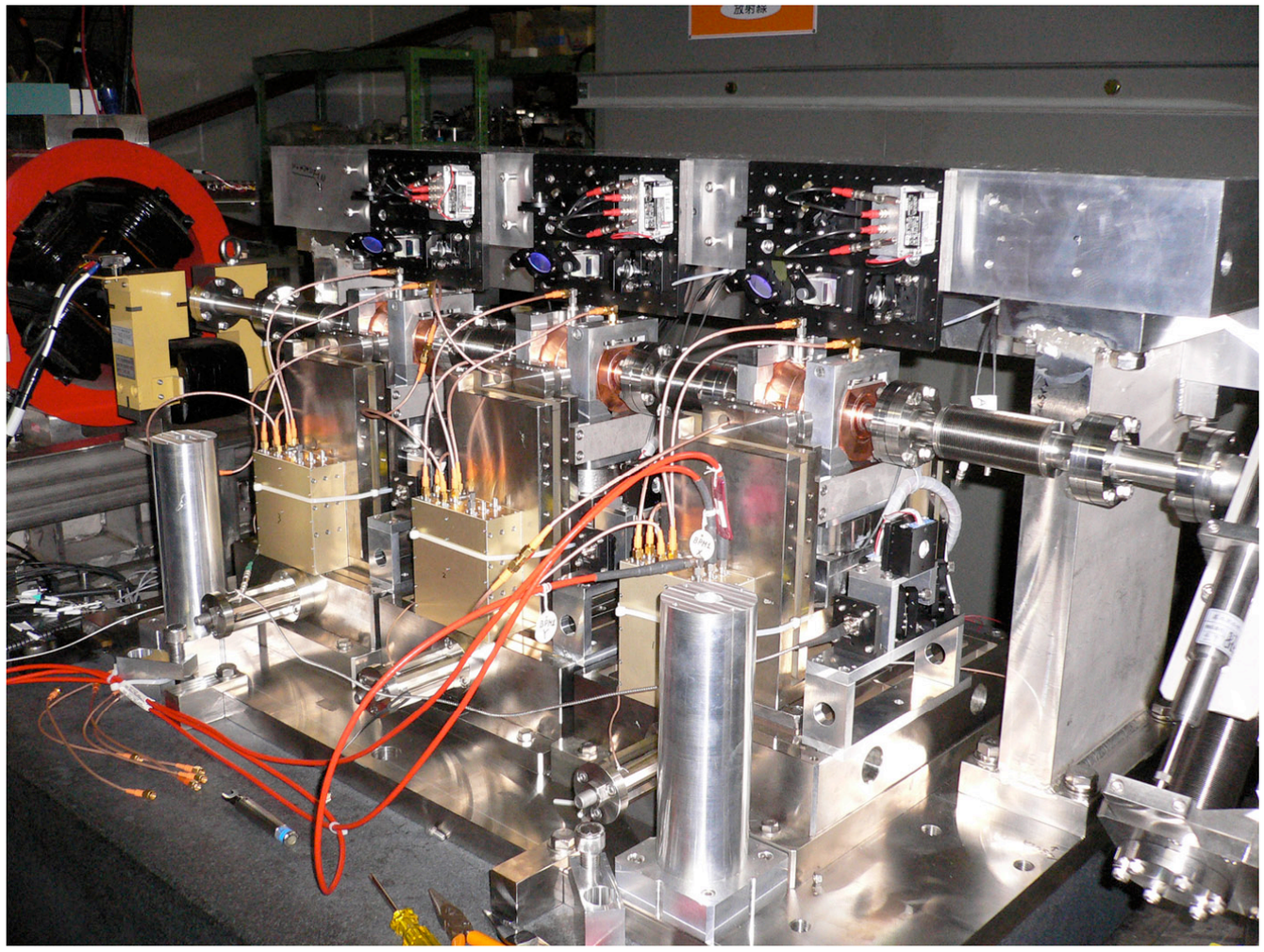
LLNL Design rigid support and nm mover,
SLAC Improved electronics,
BINP Design BPM

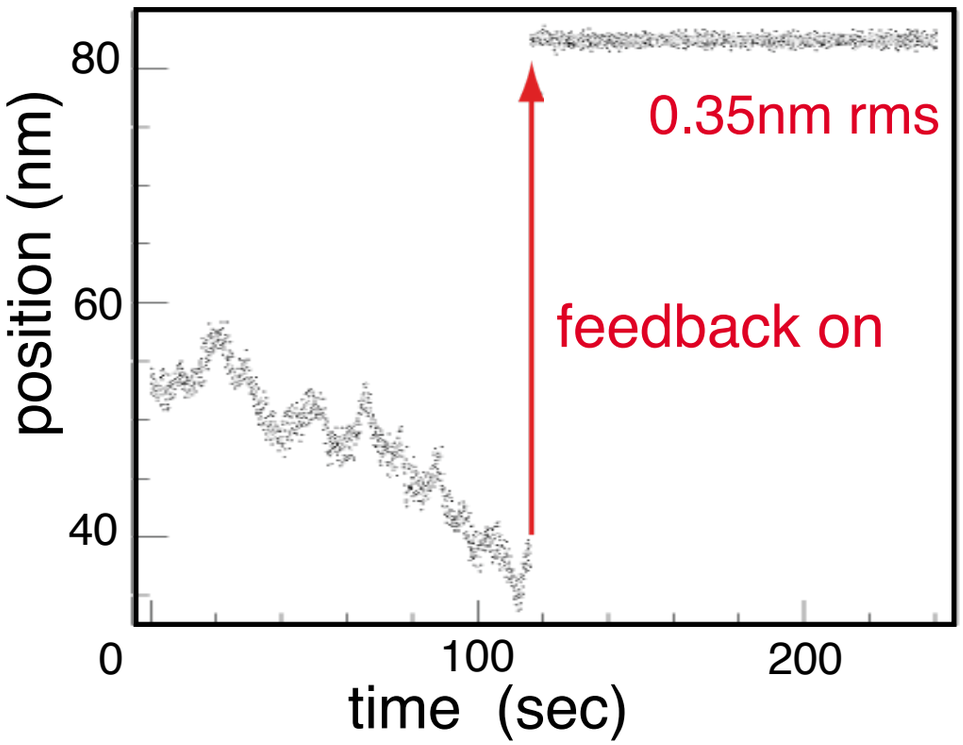
Preliminary result shows 16nm in Nov.29-Dec.17, 2004

KEK 3-Cavity BPM system for nm resolution study

Goal < 2nm

KEK Design nm mover and nm position feedback,
KEK design BPM and electronics





Performance of nm Mover

System is under beam test now

3 BPMs on nm mover,
BPM Y positions are locked by laser interference position monitor and piezo actuator feedback.

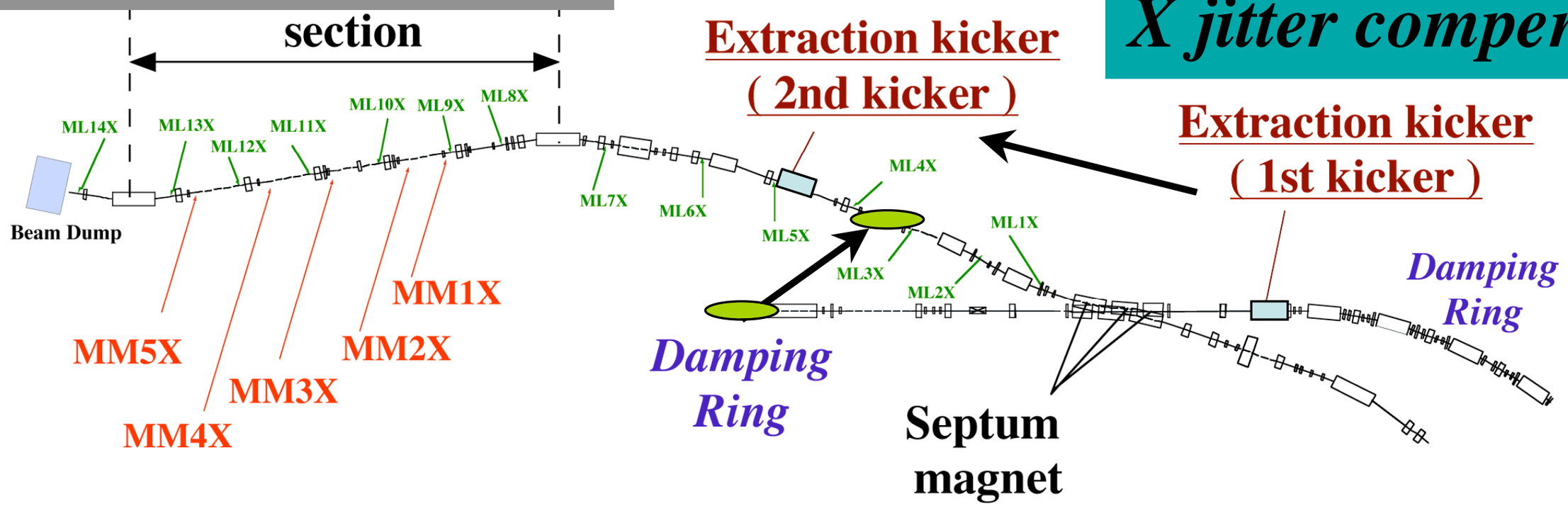
Feed-forward system

Jitter Control for 5% σ_y

Layout of KEK-ATF Extraction Line

Intra-bunch

nm Fast Feedback



Double kicker
X jitter compensation

μm Feedforward
(DR BPM -> EXT Line new stripline kicker)

proposed by H. Hayano

Schedule

2002 optics design (Local correction, S.Kuroda)
2005.3 “international” proposal with ILC-WG4
2005.4 construction starts
2007.3 completion
2007.4-6 achievement of $\sigma_y^* = 37$nm
- 2008 nanometer stabilization of final quadrupole
2009-α PLC test facility
strong QED experiments

SLAC-FFTB schedule
1989 optics design (Oide)
1991.3 proposal (CDR)
1993 summer completed
1994 spring 70nm
1995 RF-BPM
1997 E144:collision with laser (non-linear QED)

2005 2006 2007

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

Floor

Shield

Magnets

Instrumentation (BSM, BPMs, laserwire, feedback....)

Power Supply
Support Tables

Install-
ation

Vacuum pipes, pump

Alignment system

Control system

Proposal Design

Summer shutdown

Summer shutdown

1st beam

Summer shutdown

TDR

Cost Estimation : FF components

magnet	number	cost/unit	cost (yen)
QA	8	1,200,000	9,600,000
QB	8	1,200,000	9,600,000
QC1	2	2,500,000	5,000,000
QC2	2	2,500,000	5,000,000
BH	2	2,500,000	5,000,000
SEXT	4	1,200,000	4,800,000
Power supply	26	1,500,000	39,000,000
Support	26	1,000,000	26,000,000
Cable	0	0	0
cavity-BPM	20	2,300,000	46,000,000
streak camera	0	0	0
laser wire	5	7,000,000	35,000,000
wire scanner	0	0	0
laser interferometer	1	10,000,000	10,000,000
vacuum chamber,pump	36.6	300,000	10,980,000
labor for setup	36.6	70,000	2,562,000
Total	-	-	208,542,000

Cost Estimation : FF facility

FFTB/ATF	thick	width	length	area	cost/area	cost
unit	m	m	m	m^2	yen/m^2	yen
floor	1	7.2	56	403.2	126,960	51,190,078

shield	thick x 2	height	length	volume	cost/volume	cost
unit	m	m	m	m^3	yen/m^3	yen
concrete	2	3	56	336	20,000	6,720,000
concrete	2	3	5.2	31.2	20,000	624,000
total	-	-	-	367.2	20,000	7,344,000

Contributed paper to
PAC05, Knoxville, Tennessee, 16-20 May,2005

PROPOSAL OF THE NEXT INCARNATION OF ACCELERATOR TEST FACILITY AT KEK FOR THE INTERNATIONAL LINEAR COLLIDER

H.Hayano, Y.Higashi, Y.Honda, Y.Iwashita, M.Kuriki, S.Kuroda, K.Kubo, M.Kumada, M.Masuzawa, T.Mihara, T.Okugi, T.Sanuki, R.Sugahara, T.Takahashi, T.Tauchi, J.Urakawa V.Vogel, H.Yamaoka, K.Yokoya Univ.Tokyo/Kyoto/NIRS/KEK, Japan
I.Agapov, D.Angal-Kalinin, R.Appleby, G.A.Blair, S.Boogert, P.N.Burrows, J.Carter, G.Christian, N. Delerue, C.Driouichi, J.Jones, A.Kalinin, S.Malton, S.Molloy, A.Reichold, D.Urner, G.White, CCLRC/Oxford/ QMUL/RHUL/UCL, UK
P.Bambade, O.Napoly, J.Payet, Saclay/Orsay, France
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N.Names, DESY, Germany
B.Grishanov, F.Podgorny, V.Telnov, BINP, Russia
A.Brachmann, J.Gronberg, T.Himel, T.Markiewicz, J.Nelson, M.Pivi, T.Raubenheimer, M.Ross, A.Seryi, C.Spencer, P.Tenenbaum, E.Torrence, M.Woodley, M.Woods, Univ.Oregon/LLNL/SLAC, USA

Abstract

The realization of the International Linear Collider (ILC) will require the ability to create and reliably maintain nanometer size beams. The ATF damping ring is the unique facility where ILC emittancies are possible. In this paper we present and evaluate the proposal to create a final focus facility at the ATF which, using compact final focus optics and an ILC-like bunch train, would be capable of achieving 35nm beam size. Such a facility would enable the development of beam diagnostics and tuning methods, as well as the training of young accelerator physicists.

ATF2 Proposal

http://lcdev.kek.jp/ILC-AsiaWG/WG4notes/atf2

Toward "ATF2" Proposal

http://lcdev.kek.jp/ILC-AsiaWG/WG4notes/atf2/

February 3, 2005

Within the framework of the ILC-WG4

NEWS :

Feb. 12, 2005 Sample files are uploaded.

Feb. 03, 2005 This site is launced.

Dear WG4 participants,

At the recent ATF2 workshop, which was held at SLAC in January 5, (with about 50 people attaened and ~20 reports presented), it was recommended to continue development if the ATF2 proposal.

While further development of the ATF2 design (beam optics, critical beam instrumentation, etc.) will continue, we also need to document the proposal in a detailed and coherent way. A written proposal will help to communicate our intent to the international community and will help in determining the contribution from international partners.

As WG4 conveners, we (Tomoyuki, Andrei, Grahame) volunteered to be the core members of the editorial board for the ATF2 proposal. We have prepared a tentative table of contents and possible authors. The person whose name is listed first is a responsible person. The number of pages is a very rough number. Please check the list carefully and send any comments to the core members of the editorial board at ml-atf2eb@lcdev.kek.jp.

We propose to use LaTeX for typography. However, we can accept MS-Word and simple text file.

Tentative Schedule

Before LCWS05

Feb. 9th Fix authors
Feb. 25th 0th draft
Mar. 11th 1st draft

After LCWS05:
Near final text @ BDIR workshop, UK, 20–23 June

ATF2 Collaboration

- Intl collaboration of ATF2 is forming
  - Please join us
- Important & urgent R&D items
  - Optics, IP-BPM, Feed-forward
  - You can start R&D at your home institute
- Call for nice name for ATF2 project