NANOBEAM2005

Highlights

CLIC Seminar 18.11.2005
Frank Zimmermann

Participants of Nanobeam 2005

(Japan : 64)

Asia : 67

Europe : 23

(~10 UK, 4 DESY, 2 CEA, 1 CERN,…)

Americas : 14

(4 SLAC, 2 BNL, 1 LLNL, 1 LBNL,…),

Total : 104

J. Urakawa

Nanobeam'05 in a nutshell

- **second ICFA Nanobeam workshop** after Nanobeam'02 in Lausanne (which was organized by Ralph and myself)
- **different communities** (ILC, CLIC, light sources, micro- and nanobeam applications, particle physics, lasers, beam sources, magnet design, medical sciences, …)
- discussion of **ATF performance & ATF-2 design** (test s.c. final quadrupoles?, test octupole tail folding?, man power and budgets, design report 2nd volume_, stability issues in ILC, advanced beam diagnostics, fast feedbacks, laser wire, stabilization (nanoBPMs, STAFF etc.)…)
- SCSS SASE FEL (Shintake's project) has been approved
- several **collaborations/contacts with CLIC** (Spring-8, Oxford, KEK, BNL, CEA,…)
- web site http://wwwal.kuicr.kyoto-u.ac.jp/nanobm (all presentations can be found under 'agenda')

Plenary Talks

A. Noda: *Opening*

F. Zimmermann, *Summary of Nanobeam 2002 and Expectation, 'Stability & Ground Motion Issues in CLIC'*

K. Yokoya: *Status of ILC*

A. Seryi: *Issues on Stability and Ground Motion in ILC*

G. Blair: *Test Facility for Final Focus Beam Line of ILC*

T. Yamazaki: *Frontiers of Light Source*

D. Urner: *The StaFF Project*

S. Isoda: *Electron microscope as a nano-beam analyzer*

H. Murayama: *Frontiers of high energy physics at LHC and ILC*

H. Kataoka: *Nanomaterial and its Medical Use*

Y. Kobayashi, *Study of cellular radiation response using heavy-ion microbeams*

W. Yokota: *Microbeam system for heavy ions from cyclotron to irradiate living cells*

H. Tanaka: *Stabilization of Stored Beam in the SPring-8 Storage Ring*

J. Urakawa, *Closing*

Accelerator and Beam Physics Activities at ICR, Kyoto University

Keage Laboratory (1952~1988)

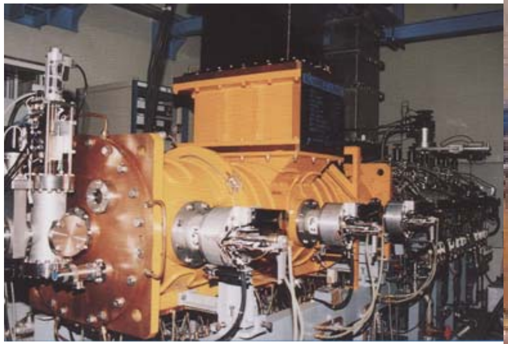
Ordinary Cyclotron (1955~1985)

Proton 7 MeV

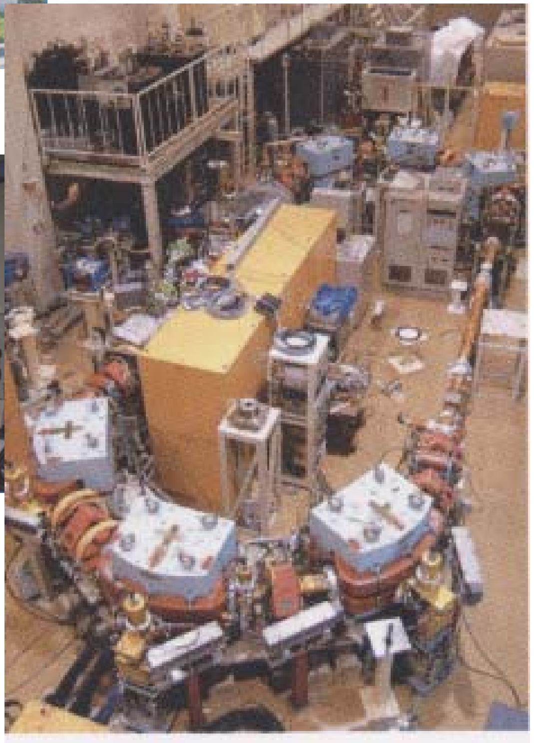
Deuteron 14 MeV

Alpha 28 MeV

Accelerator Building in Uji-Campus (1988~)

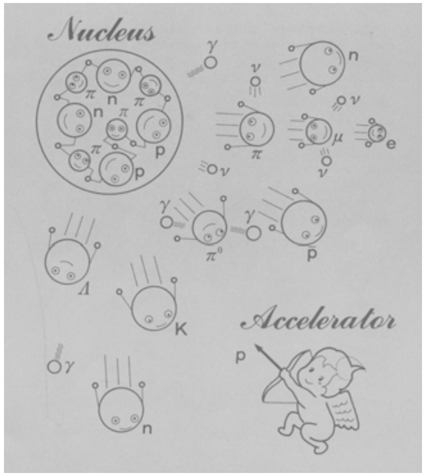


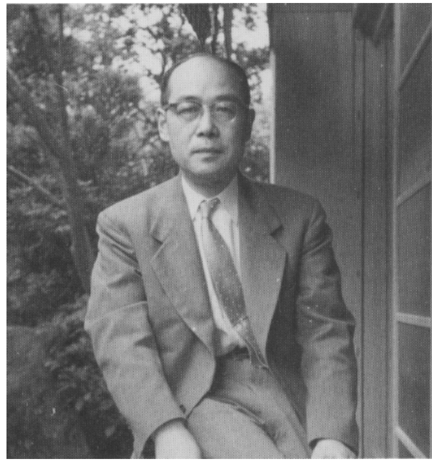
Proton Linac (7MeV:1988~)



Electron Linac (100MeV) +Storage Ring, KSR (300MeV) (1994~)

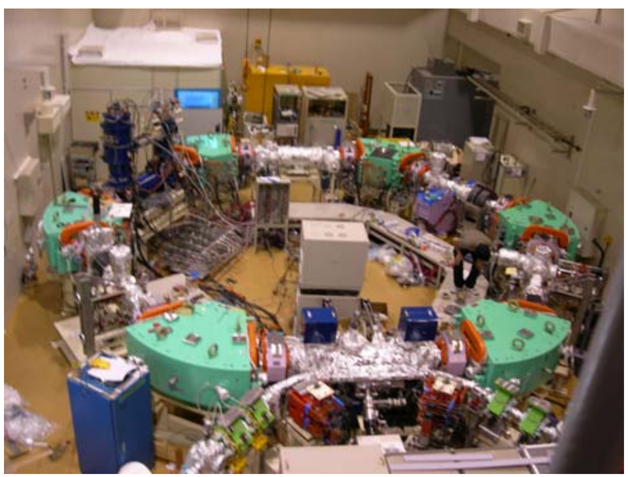
A. Noda





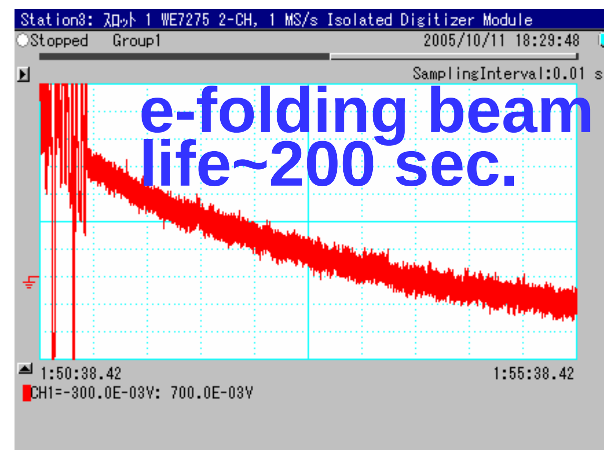
Pi-meson Research Facility Project led by late Prof. Hideki Yukawa (1985~)

J-PARC now under construction by KEK and JAERI



Ion Accumulation and Cooler Ring, S-LSR

- Electron beam cooling
- Laser cooling



e-folding beam life~200 sec.

A. Noda

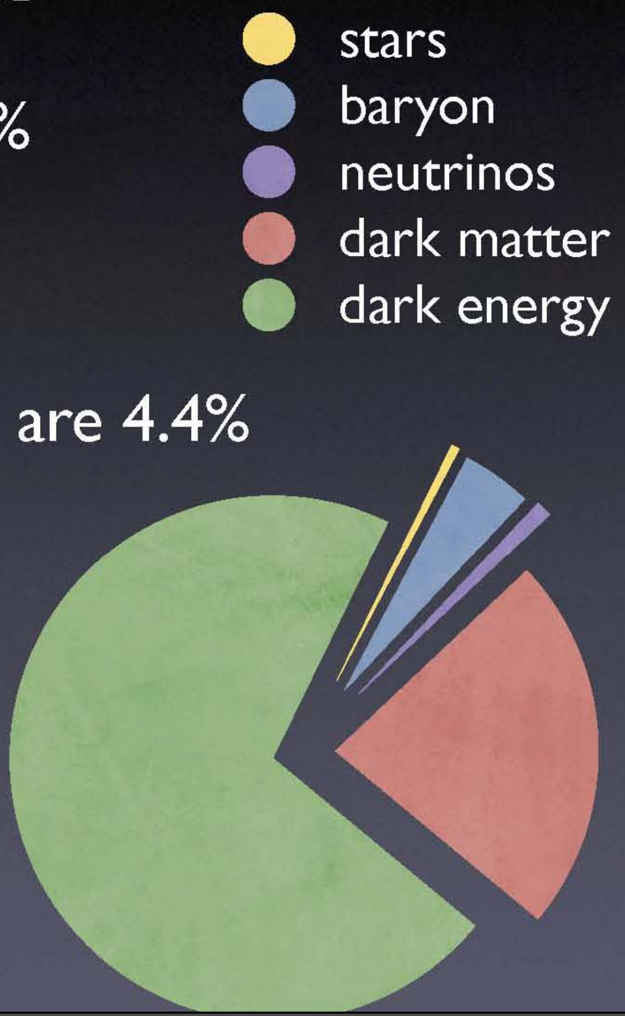
high-power laser laboratory, electron microscope, FEL project, permanent magnet development,…

Succeeded in Multi-turn Injection on the 11th , Oct.2005

Energy budget of Universe

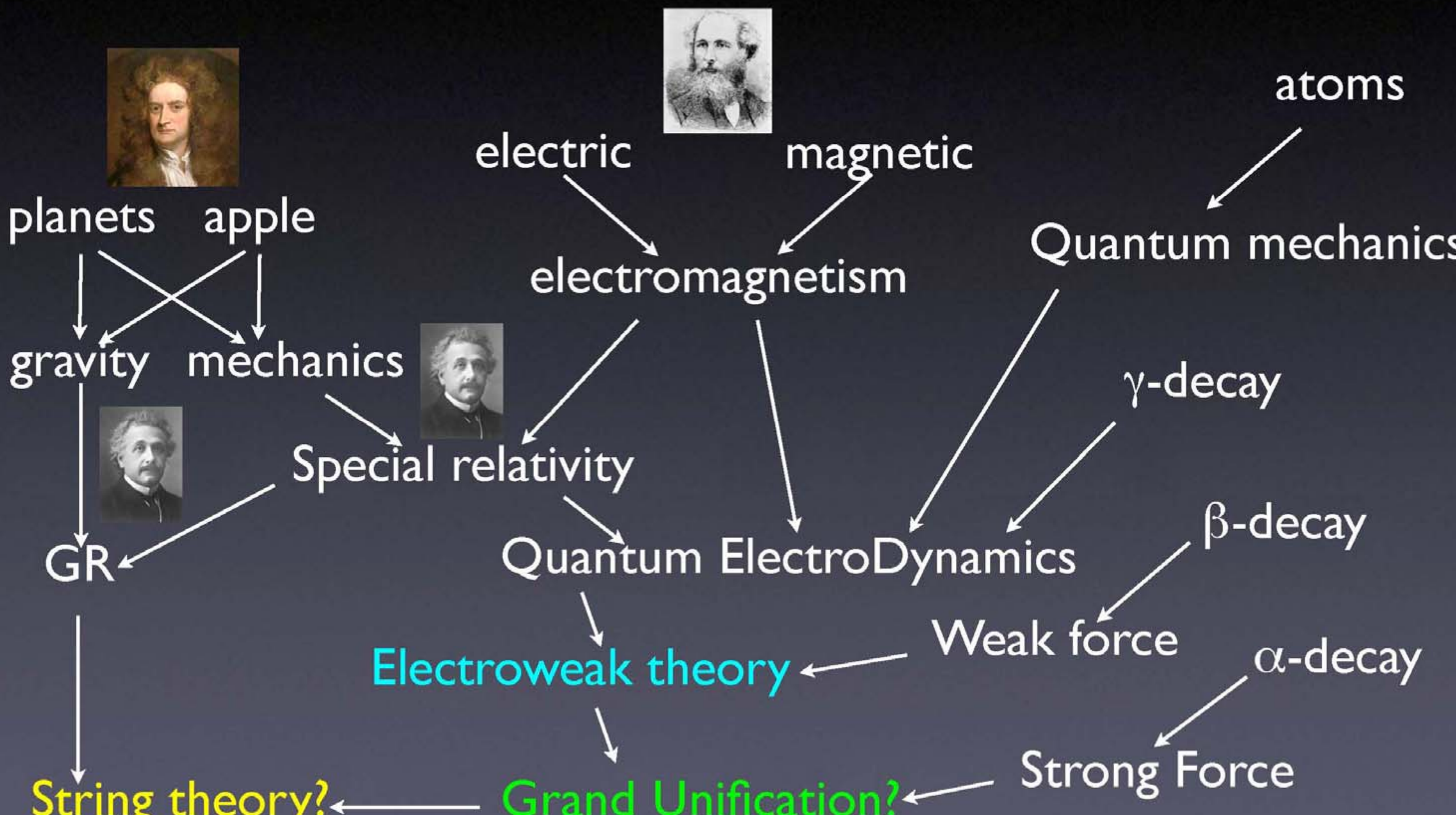
H. Murayama

- Stars and galaxies are only ~0.5%
- Neutrinos are ~0.1–1.5%
- Rest of ordinary matter (electrons, protons & neutrons) are 4.4%
- Dark Matter 23%
- Dark Energy 73%
- Anti-Matter 0%
- Dark Field (Higgs) ~10^{62}%??



H. Murayama

History of Unification

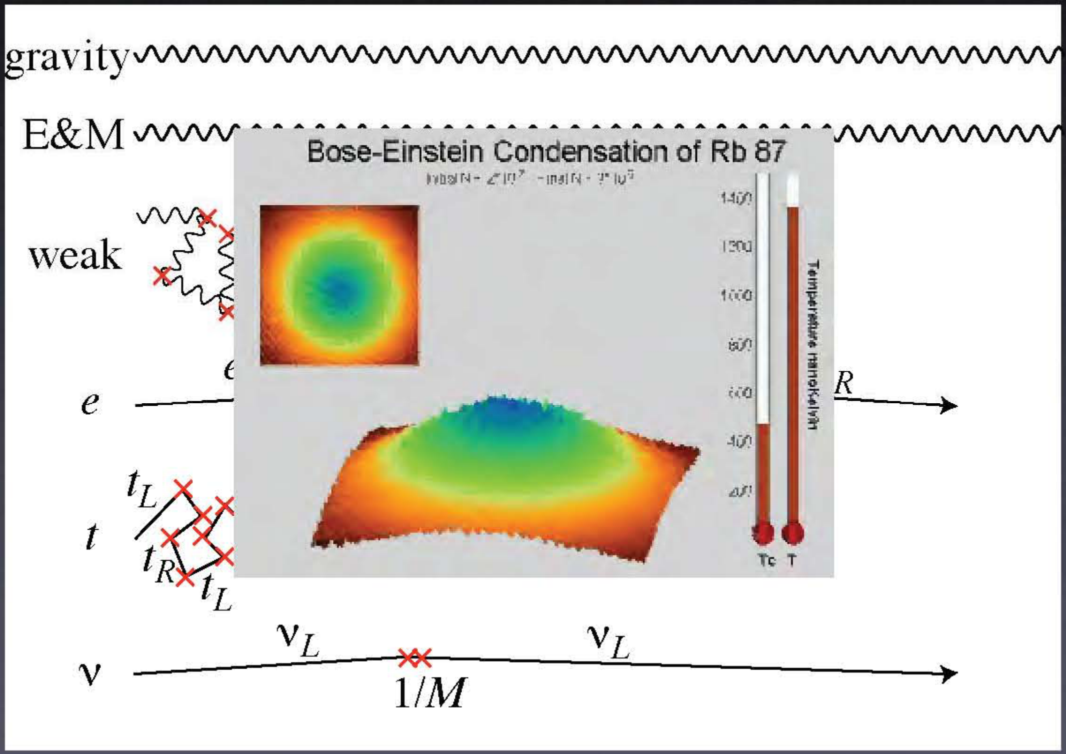


H. Murayama

We are swimming in Dark Field

- There is quantum liquid filling our Universe
- It doesn't disturb gravity or electric force
- It does disturb weak force and make it short-ranged
- It slows down all elementary particles from speed of light
- What is it??

Extremely bizarre theory!



H. Murayama

Cosmic Superconductor

- In a superconductor, magnetic field gets repelled (Meißner effect), and penetrates only over the “penetration length”
  - ⇒ Magnetic field is short-ranged!

Imagine a physicist living in a superconductor

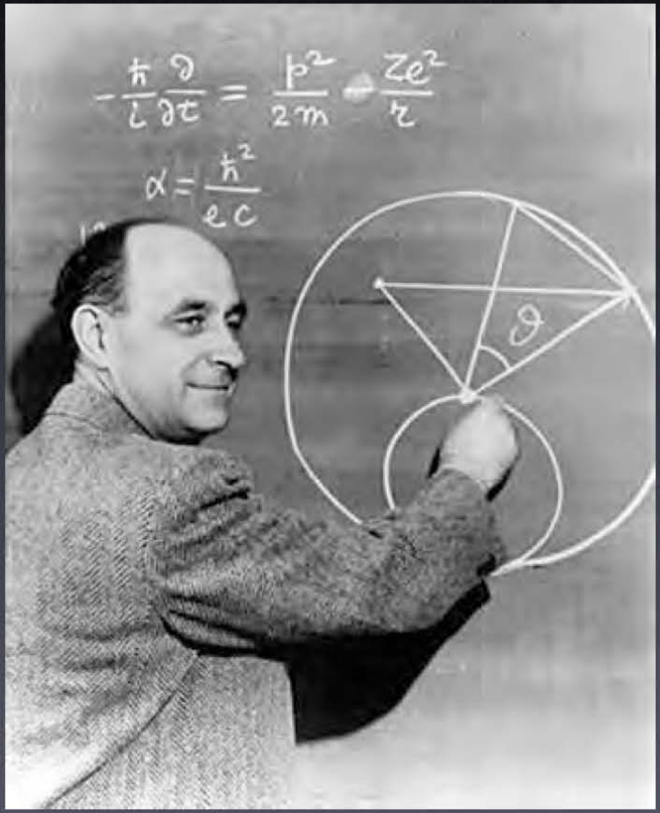
- She finally figured:
  - magnetic field must be long-ranged
  - there must be a mysterious charge-two “Dark Field” in her “Universe”
  - But doesn’t know what the Dark Field is, nor why it is there
  - Doesn’t have enough energy (gap) to break up Cooper pairs

That’s the stage where we are!

H. Murayama

Fermi's dream era

- Fermi formulated the first theory of the weak force (1933)
- The required energy scale to study the problem known since then: ~TeV
- We are finally getting there!



H. Murayama

Three Directions

History repeats itself

- Crisis with electron solved by anti-matter
- Double #particles again ⇒ supersymmetry

Learn from Cooper pairs

- Cooper pairs composite made of two electrons
- Higgs boson may be fermion-pair composite
  ⇒ technicolor

Physics as we know it ends at TeV

- Ultimate scale of physics: quantum gravity
- May have quantum gravity at TeV
  ⇒ hidden dimensions (0.01 cm to 10^{-17} cm)

H. Murayama

More Directions

- Higgs boson as a Pseudo-Nambu-Goldstone boson (Little Higgs)
- Higgs boson as an extra-dimensional gauge boson (Gauge-Higgs Unification)
- Fat Higgs (Composite)
- Higgsless and $W^{\pm}$ as Kaluza-Klein boson
- technicolorful supersymmetry

bosonic TC
composite Higgs
TC-TC
hypercolor
supercolor
techni-GIM
extended TC
pseudo NGB
NOT YET THOUGHT OF
NOT YET THOUGHT OF
NOT YET THOUGHT OF
NOT YET THOUGHT OF
effective SUSY
SUSY
NMSSM
MSSM +νR
nMSSM
unnified SM
axigluon
sterile ν
Z'ψ
Z'χ
Z'SM
Z'η
WR
X Y
heavy Majorana ν
6th gen
5th gen
4th gen
lepto quark
vector-like family
fractionally charged
milli-charged
mono-pole
S,T,U
shadow matter
mirror symmetry
triplet Higgs
doubly charged Higgs
Type I
Type II
general 2HDSM
spontaneous CP
superweak
Weinberg's 3HD
milli-weak
Majoron
axion
saxion axino
familon
NGB
worm-hole
Extra dim
quintessence
k-ssence
Λ
composite W, Z
g, l
contact int.
string
heterotic
matrix
M
IIB
IIA
F
I
N=2
N=4
N=8

H. Murayama

The New York Times

July 23, 2008

The Other Half of the World Discovered

Geneva, Switzerland

As an example, supersymmetry

"New-York Times level" confidence

still a long way to

"Halliday-Resnick" level confidence

"We have learned that all particles we observe have unique partners of different spin and statistics, called superpartners, that make our theory of elementary particles valid to small distances."

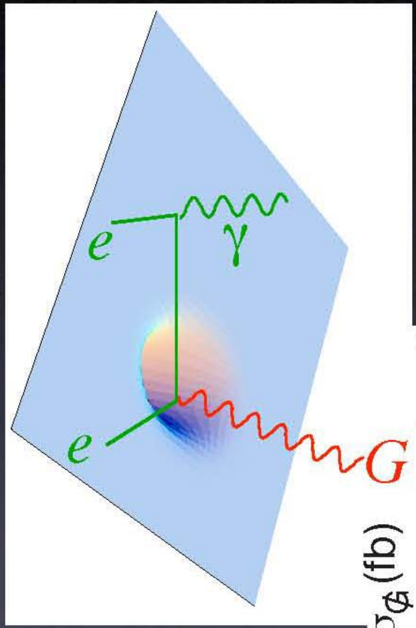
H. Murayama

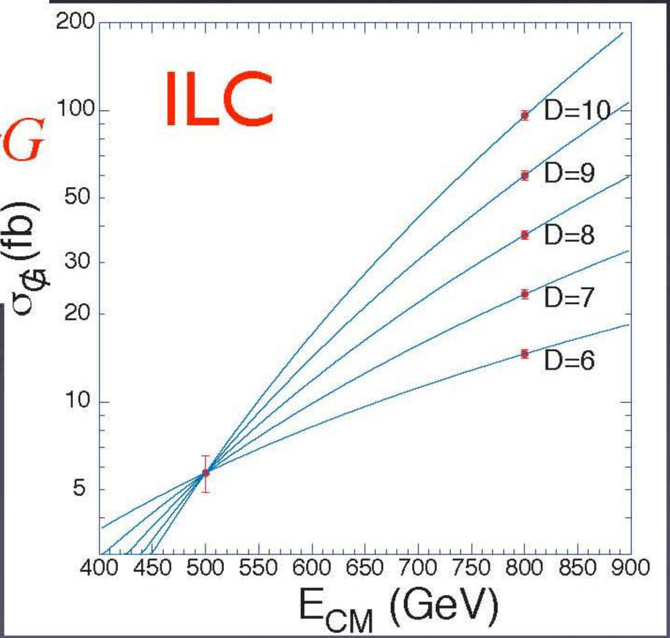
H. Murayama

Hidden Dimensions

- Hidden dimensions
- Can emit graviton into the bulk
- Events with apparent energy imbalance

⇒ How many extra dimensions are there?

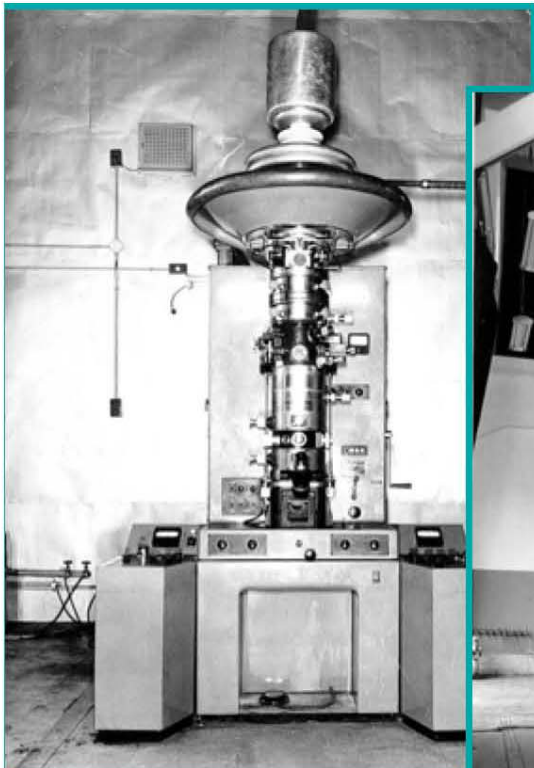




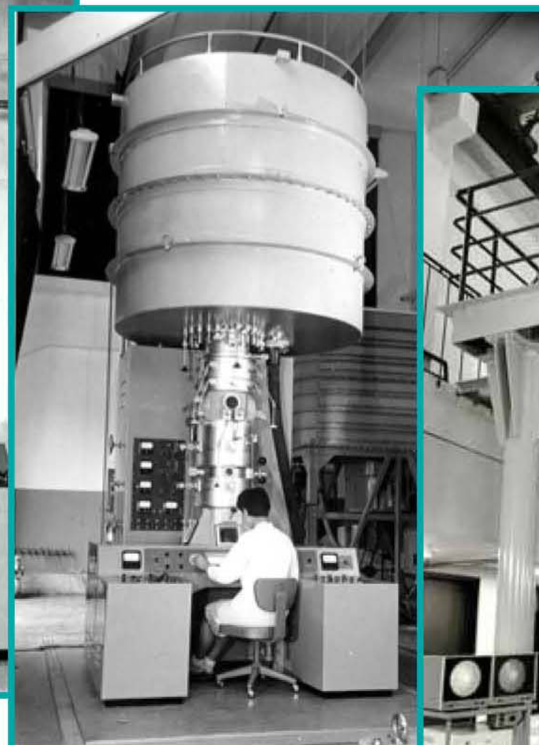
As we know,
There are known knowns.
There are things we know we know.
We also know
There are known unknowns.
That is to say
We know there are some things
We do not know.
But there are also unknown unknowns,
The ones we don't know
We don't know.
—Feb. 12, 2002, Department of Defense news briefing

H. Murayama

High voltage TEMs in Kyoto University



Shimadzu
300kV, 1957



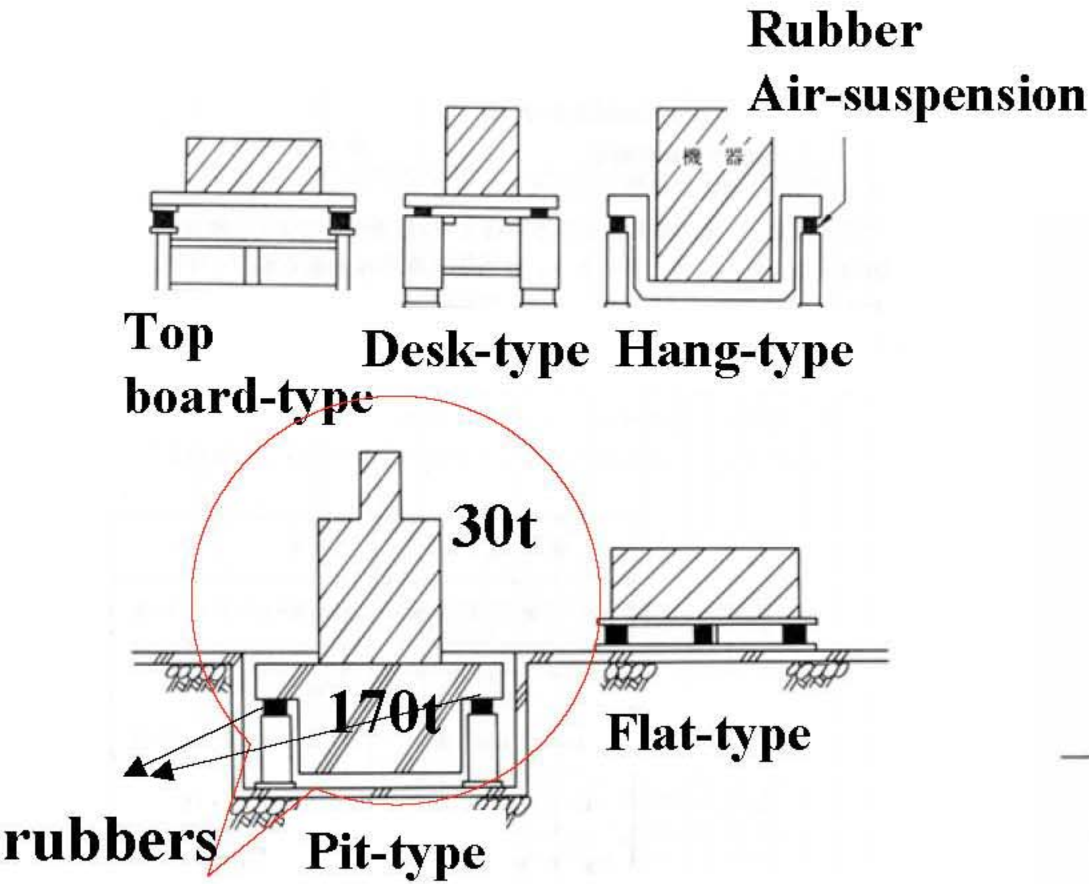
Shimadzu
500kV, 1964

JEOL
500kV, 1971

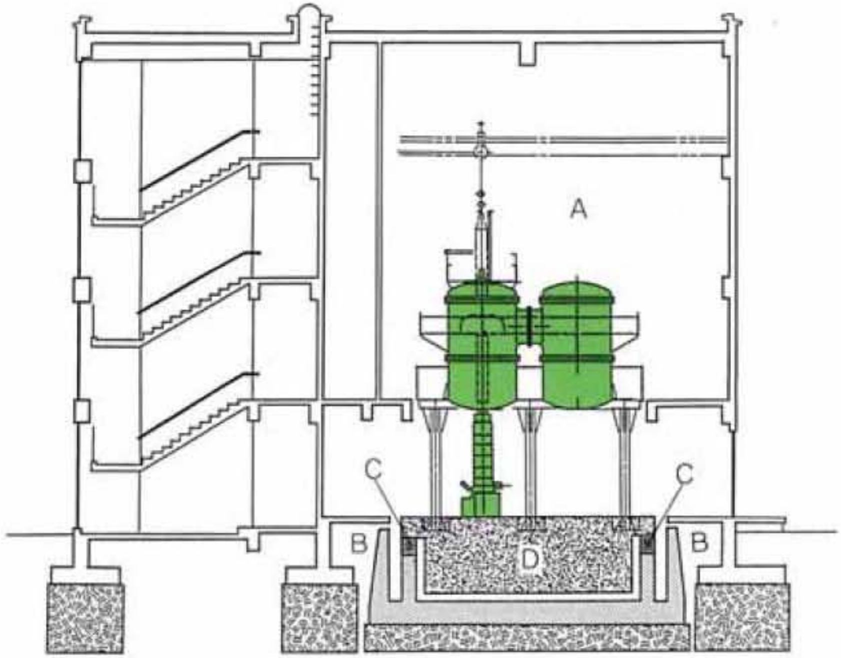
JEOL
1000kV, 1989

S. Isoda

Vibration isolation system



for TEM



Good previous experiences
Easy access for TEM operation
Easy control of the center of gravity

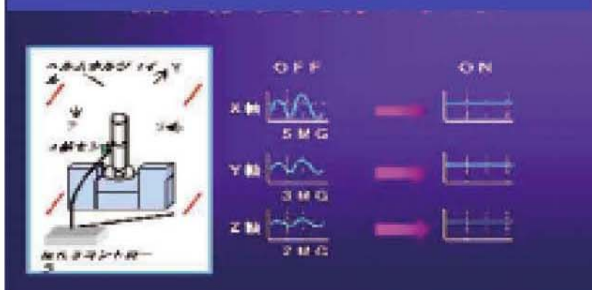
S. Isoda

Active Magnetic-field Canceller

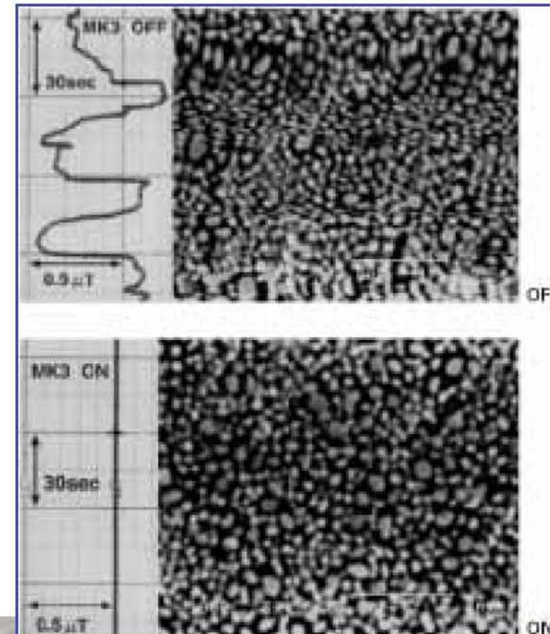
for TEM

External magnetic-fields

Active canceling



Images without and with AMFC



S. Isoda

Science, 1741 (2004) 305.

Direct Sub-Angstrom Imaging of a Crystal Lattice

P. D. Nellist,1 M. F. Chisholm,2 N. Dellby,1 O. L. Krivanek,1 M. F. Mur·tt,1 Z. S. Szilagyi,1 A. R. Lupini,2 A. Borisevich,2 W. H. Sides Jr.,2 S. J. Pennycook2*

1Nion Company, 1102 8th Street, Kirkland, WA 98033, USA. 2Condensed Matter Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6030, USA.

0.07nm (70pm) resolution !!

STEM-HAADF + Cs-correction

(VG HB603U (300kV) + Nion)

STEM

probe beam size

<0.1 nm!

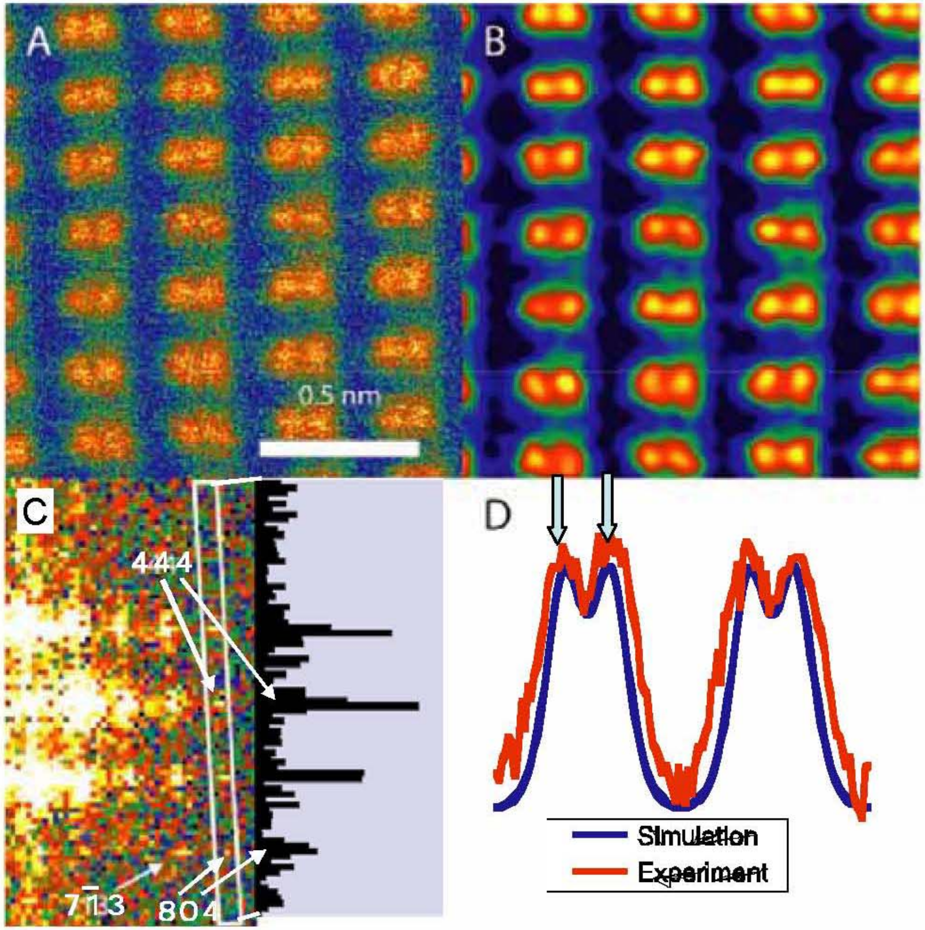


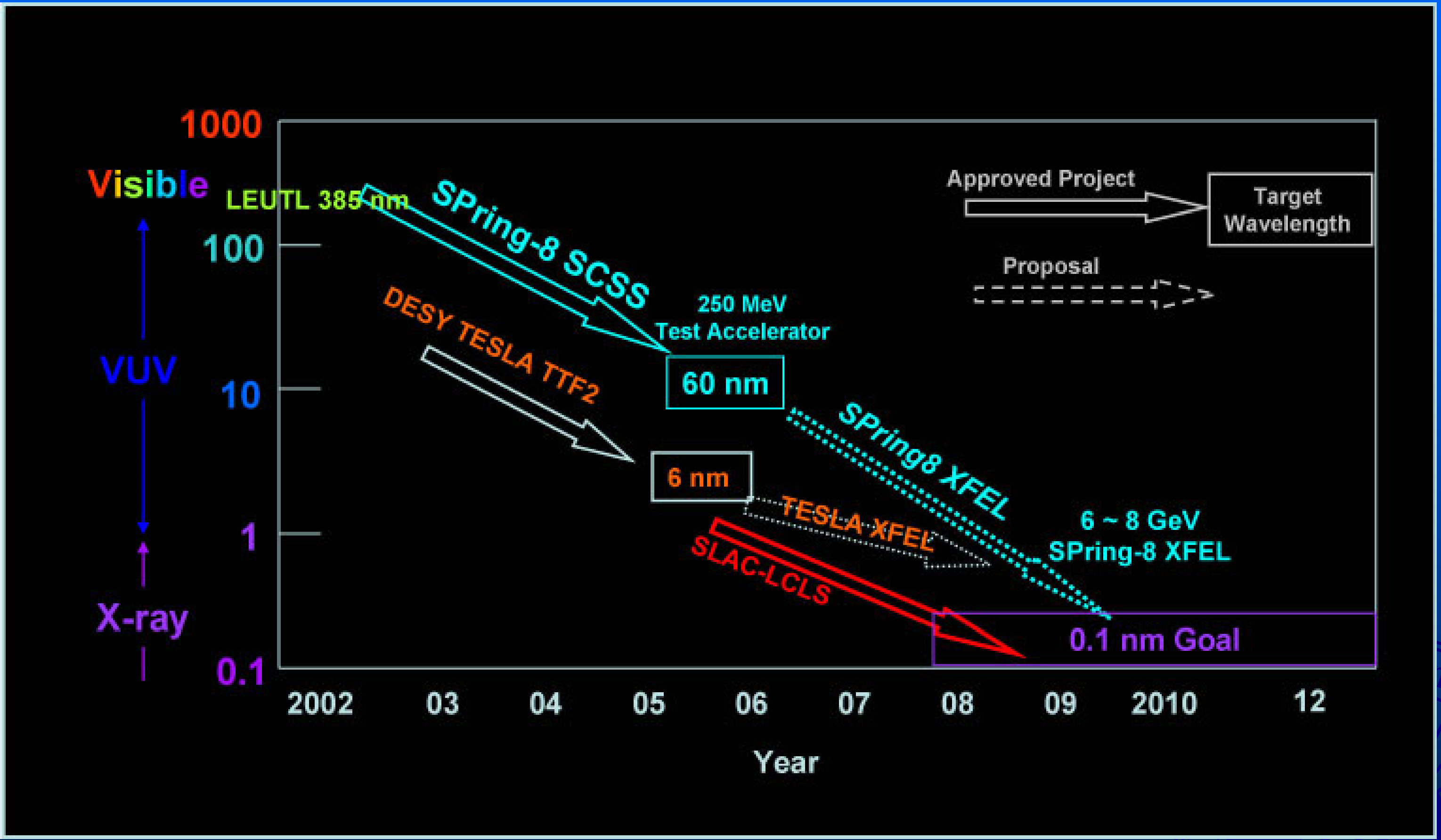
Fig. 1. (**A** and **B**) ADF images of Si[112] recorded with an aberration corrected STEM. The image in (B) has been low-pass filtered to reduce the noise, and the small effects of image drift during the scan have been unwarped. (**C**) The modulus of the Fourier transform of the image data and a pro·le through the spots enclosed by the box. The 444 spacing (78pm) corresponds to the smallest atomic column spacing, and there is information transfer to the 713 (71-pm) spacing and weak transfer at the (804) 61-pm spacing. (**D**) An intensity profile through two column pairs in (A), formed by summing over a width of 10 pixels. A simulated pro·le (6) is shown for comparison.

TEM – coherent image, STEM – incoherent image

S. Isoda

T. Yamazaki
T. Shintake

SASE PROJECTS

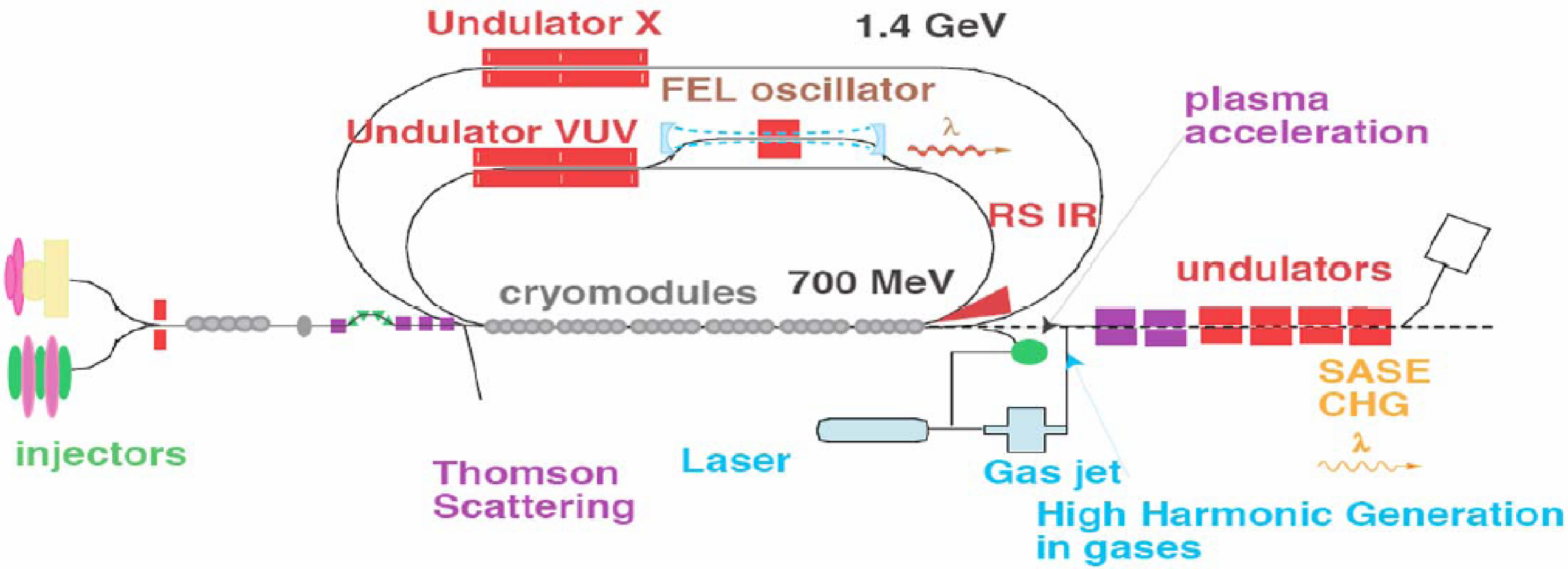


http://www-xfel.spring8.or.jp/cband/e/SCSS.htm#Milestone

ERL FEL

SACLAY

(ARC-EN-CIEL: Accelerator-Radiation Complex
for ENhanced Coherent Intense Extended Light)

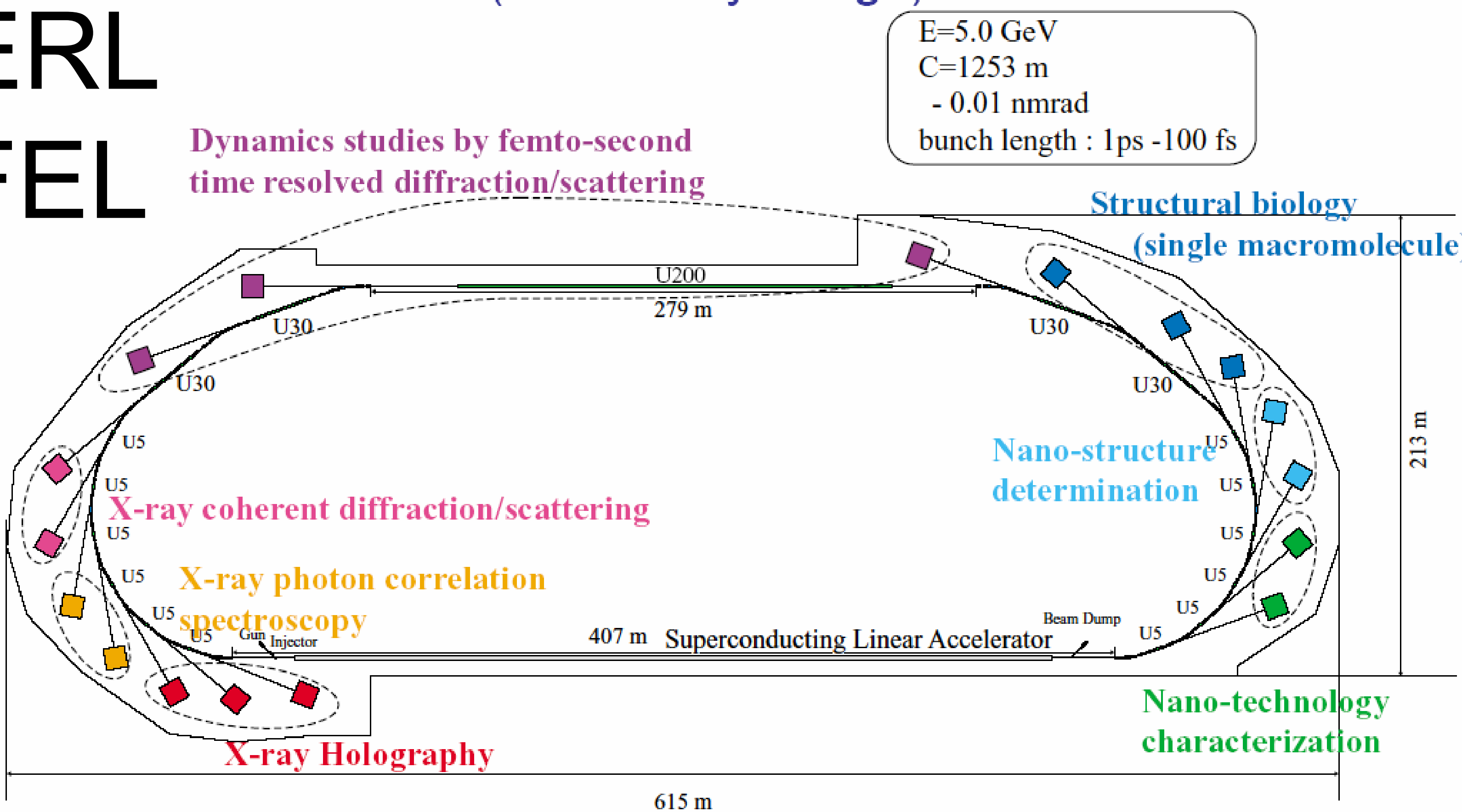


M.E. Couprie et al, "*ARC-EN-CIEL*" *A proposal for a 4th generation light source in France*, Proc. EPAC 2004, 366.

KEK
ERL
FEL

PF ERL(Energy Recovery Linac)

(Preliminary design)



T. Yamazaki

http://pfwww.kek.jp/pf-sympo/21/m04325.pdf

NANOBEAM 2005 discussion topics:

beam dynamics of *low-emittance beam generation, tuning, feedback, beam diagnostics, ground motion*, *stabilization*, and *beam delivery system* for *linear colliders*

related research efforts on *synchrotron light sources*, *permanent and superconducting magnets*, and *photon colliders*

cooling techniques for nanobeams

applications of nano-scale precision beams working groups:

WG1: Laser Wire (with video link to UK)

WG2a: BDS Design and Interaction Region
WG2b: Stabilization and Beam Control
WG2c: Future R&D Plans
(with ATF-2 session, *co-convener)*
WG2d: Final-Focus Q Magnet

WG3a: Low Emittance Sources
WG3b: FELs/Radiation Sources
WG3c: Other Sources

WG4: Physics with High Intensity Laser Beams

stability & ground motion issues for ILC

intratrain feedback is a must for ILC

even w. intratrain FB, *noisy site* causes luminosity loss

hardware jitter needs to be considered

ILC *linac quad stability* is a concern

component *jitter affects linac tuning*

integrated simulations with ground motion, component jitter and feedback

→ goals for tunnel floor stability & add. component jitter:

Linac: up to gm K or C & up to 30 nm

BDS: up to gm B*3 or gm C/3 & up to 10 nm

FFTB quad: small (~2nm at 5Hz) difference to ground (on movers, with water, etc.), lower frequency relevant for 5Hz machine (0.2-0.5Hz), not studied

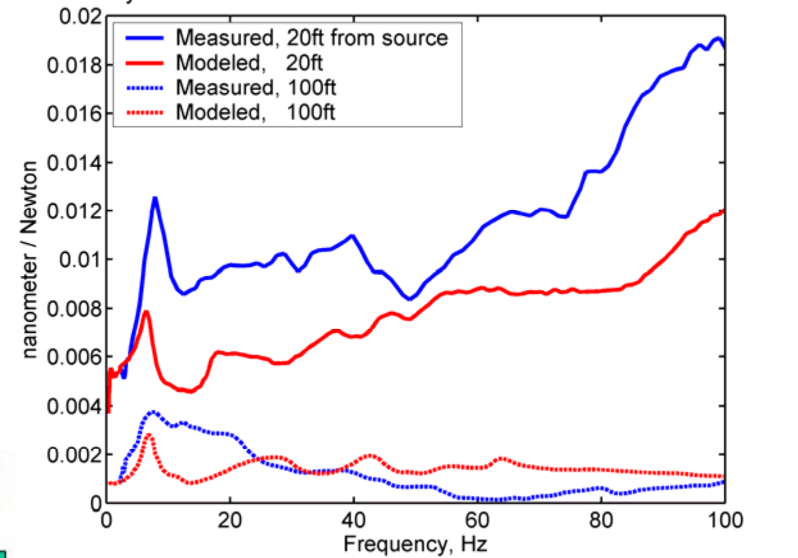
ILC LINAC: insufficient data, goal appears to be 5-10 times below what was observed for vibration of quads in cryostats, XFEL has similar requirements

cold vibration studies w. wire position system & piezo sensors, ILC needs factor ~several improvement from TTF data

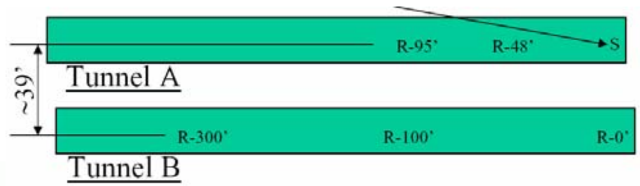
A. Seryi

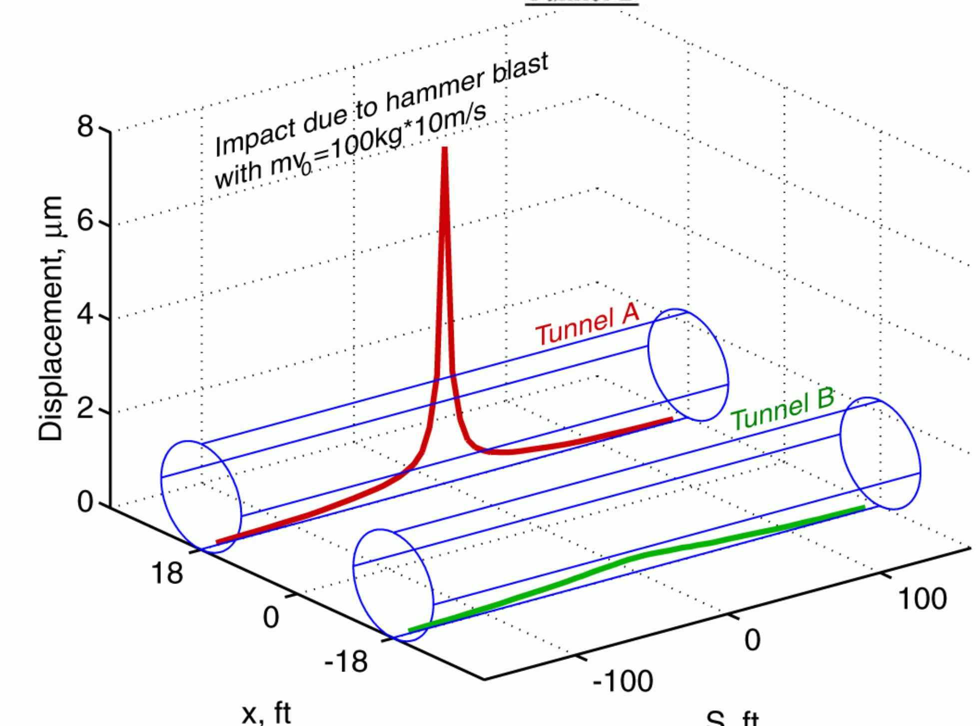
Vibration transmission

- LA twin tunnel: between tunnels and from surface (figs shown)
- Results are valuable for ILC



Mobility (response / driving force) measured in LA metro twin tunnel test and modeled with 3D code SASSI.

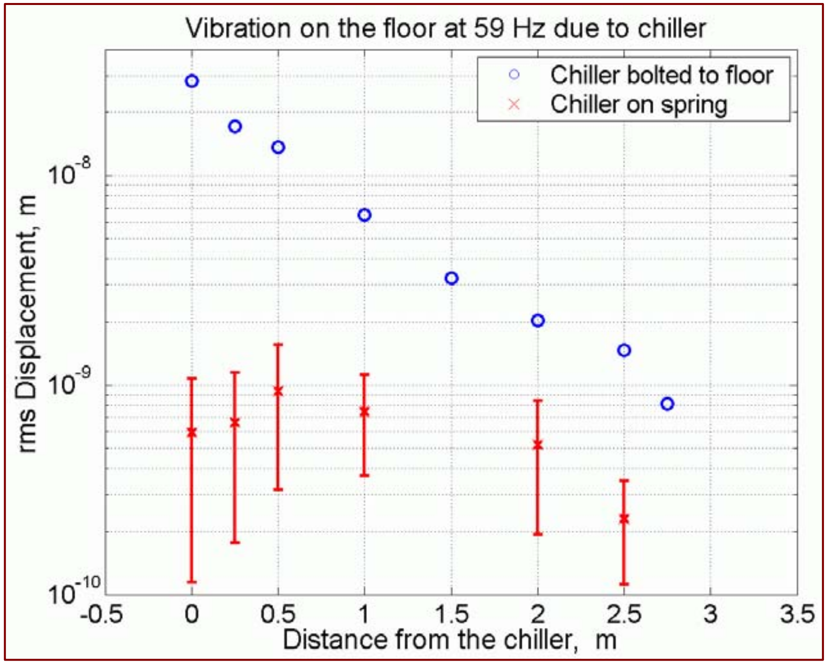




A. Seryi

Vibration isolation of vibration sources

- Should be a standard practice for ILC

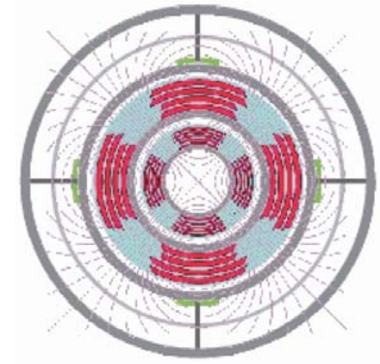


Vibration on the floor vs distance.
For chiller on springs, its vibration effects are indistinguishable on the floor.

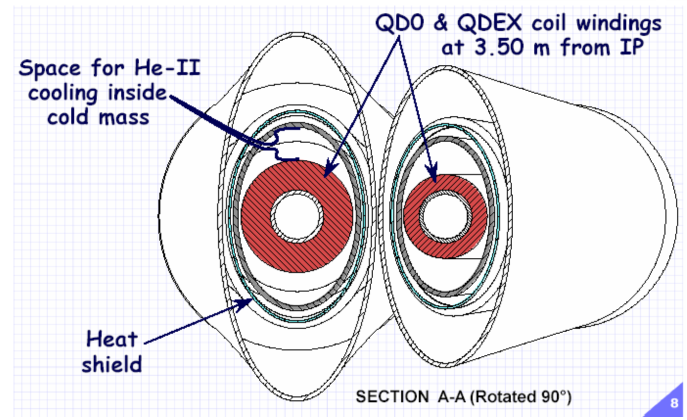
A. Seryi

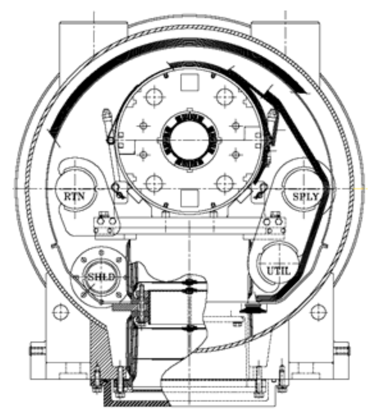
FD magnet stability

A. Seryi

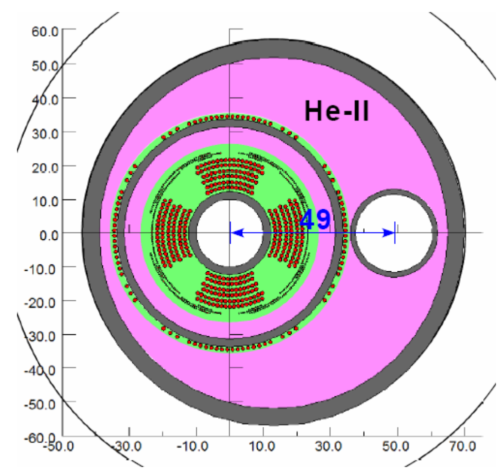


- Stability of FD magnets needs to be studied
- BNL preparing to measure stability of compact SC quads
- First results with CQS quad encouraging
- Annecy group aims to study FD stability (simulation & experiments) with BNL FD design
- Studies at ATF2 ?





RHIC CQS



Evolution of FD design with compact quads, B.Parker et al

s.c. FD quadrupole prototype B. Parker

BROOKHAVEN NATIONAL LABORATORY
Superconducting Magnet Division

Summary of QT Cold Test Results.

FF Q magnets

- QT reached “short sample” with only two training quenches (both of which were above I_{op}).
- QT ran 13% above 140 T/m in 3 T background field at 4.3°K and almost reached operating gradient at 4 and 5 T background at 4.22°K.
- By pulling a vacuum on the test dewar, we brought QT to 3°K & got similar result @ 6 T background.
- At 2.5°K the LHe level fell below the end of the leads and we could not test at lower temperatures (simple pumping with no λ-plate).
- Still from these data we expect that at 1.9°K and 3 T background field I_q should be 1100 A (I_{op} = 664 A).

QT Quench Test Results

Background Solenoid (T)	Temp (ºK)	Gradient (T/m)
3	4.30	158
4	4.22	139
5	4.22	134
6	3.00	137

Note: Operational Target is 140 T/m with 3 T solenoidal background field while cooled with pressurized He-II @ 1.9°K. Above data scale to 232 T/m under these conditions (for 60% short sample current).

Increased background field permits reaching large Lorentz forces but without having to go to excessive test currents.

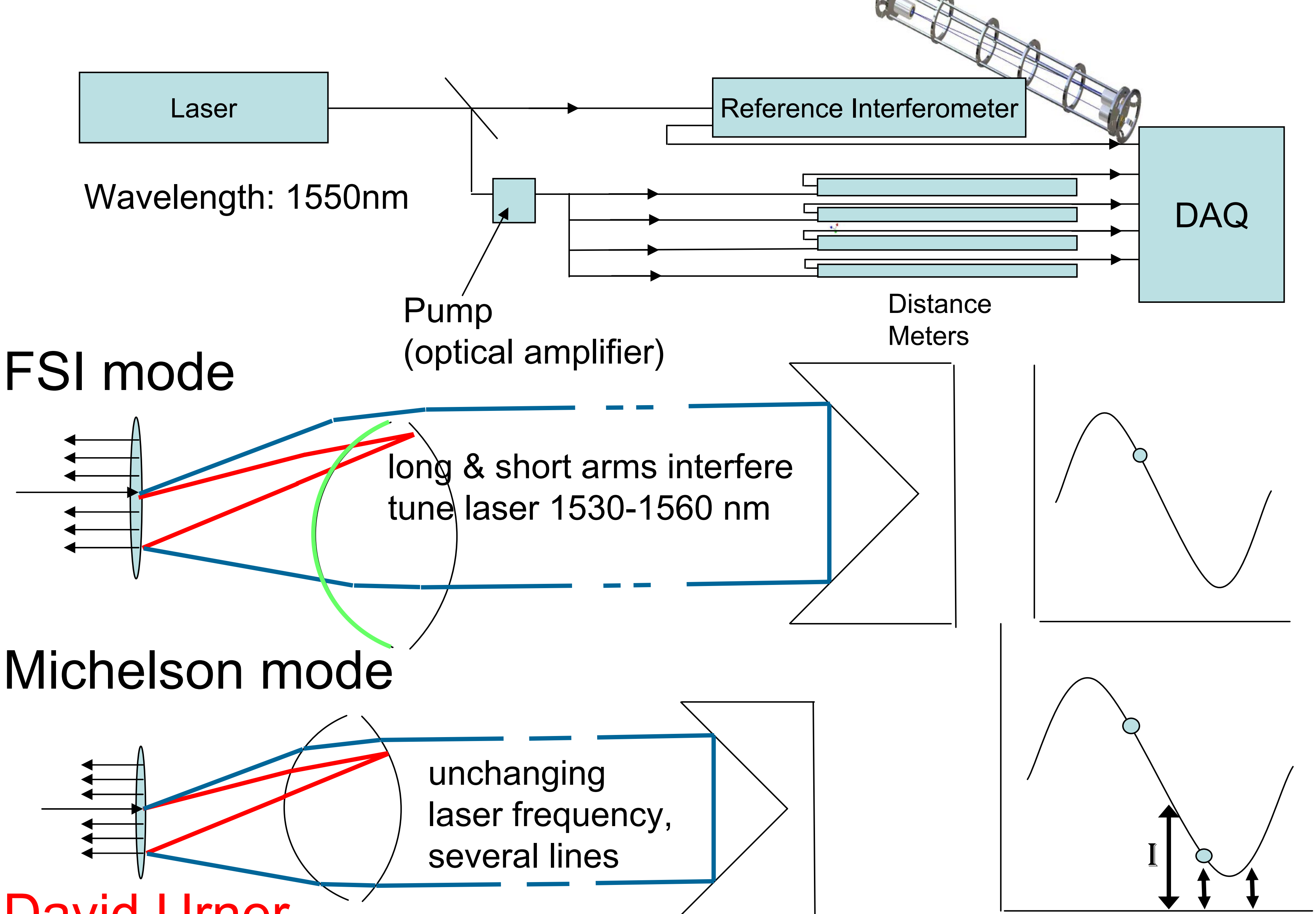
present CLIC optics has 388 T/m

StaFF (Stabilization of Final Focus for the ILC) Project

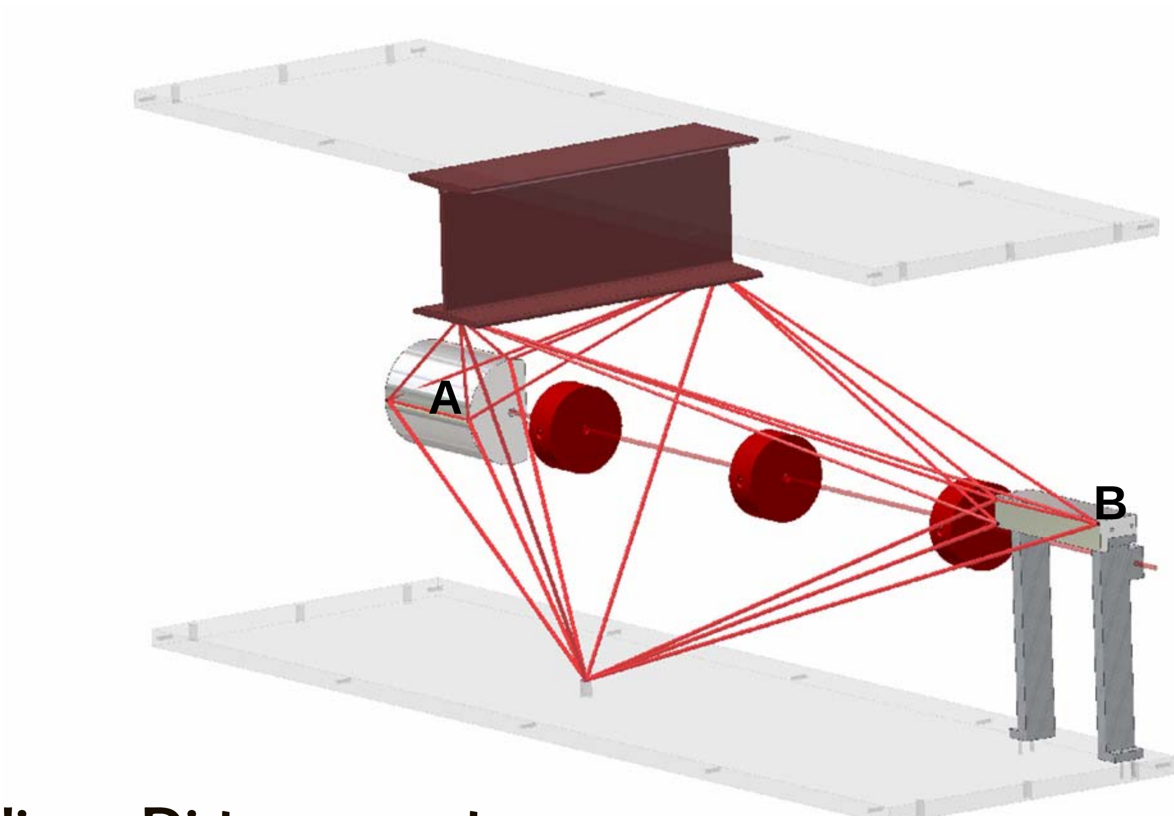
- goals: correlate position information of magnet to stable platform anchored in ground interferometrically, correlate motions of quadrupoles w.r.t. each other;
- s.c. magnets – need access to cold mass!
- generic tools: (1) distance meter with nm resolution (relative Michelson type interferometer), mm precision (absolute FSI (=frequency scanned interferometry) type interferometer) for multilateration.
  (2) straightness monitor with nm resolution.
- technique of FSI developed for ATLAS experiment.
- adapted/refined use for LiCAS. StaFF shares laboratory and resources with LiCAS experiment
- test set ups proposed at SLAC ESA & ATF

David Urner & 5-person Oxford team

Distance Meter: Method of Measurement



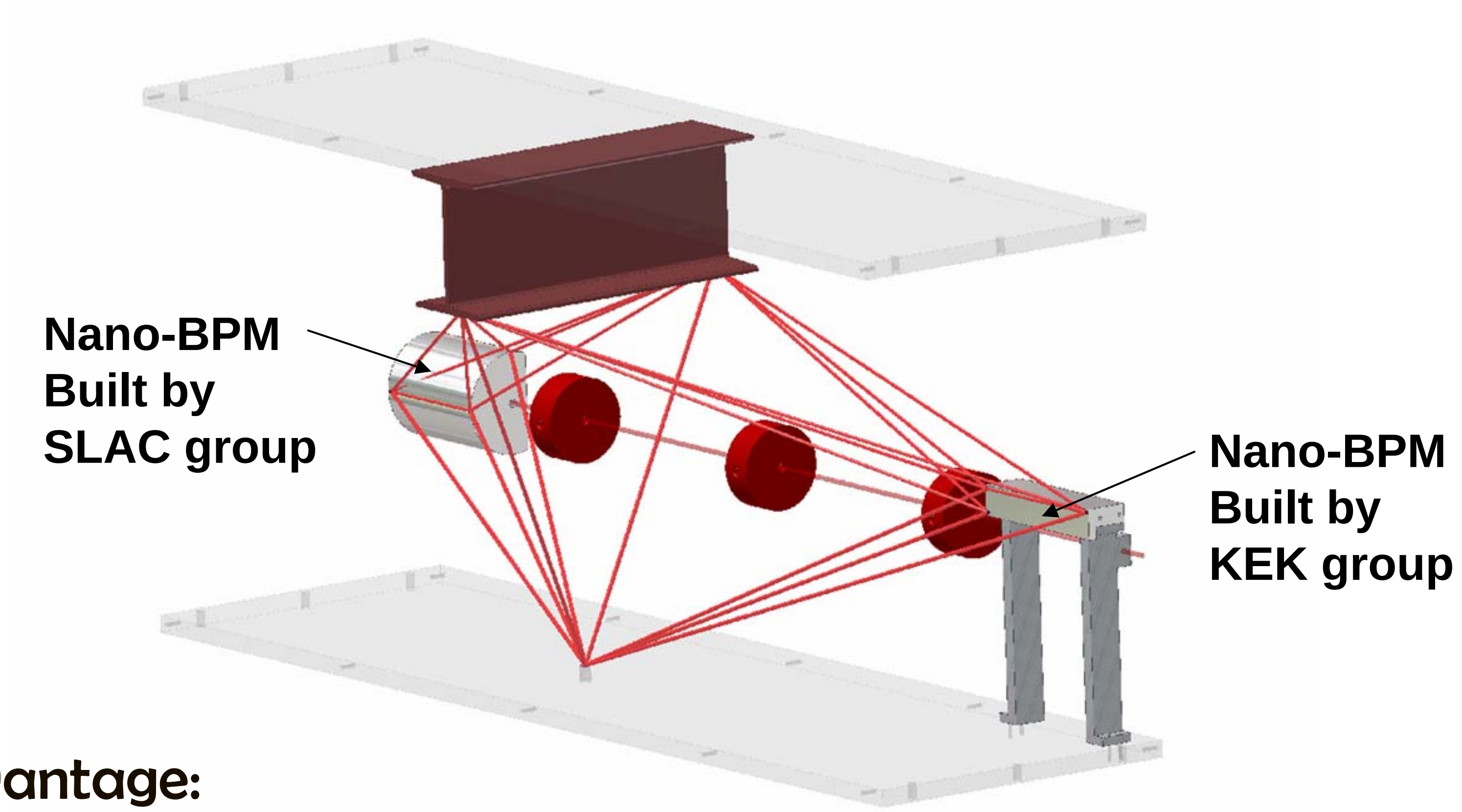
A Straightness Monitor Made from Distance Meters



- Red lines: Distance meter.
- Multilateration measure 6D coord. of A with respect to B.

David Urner

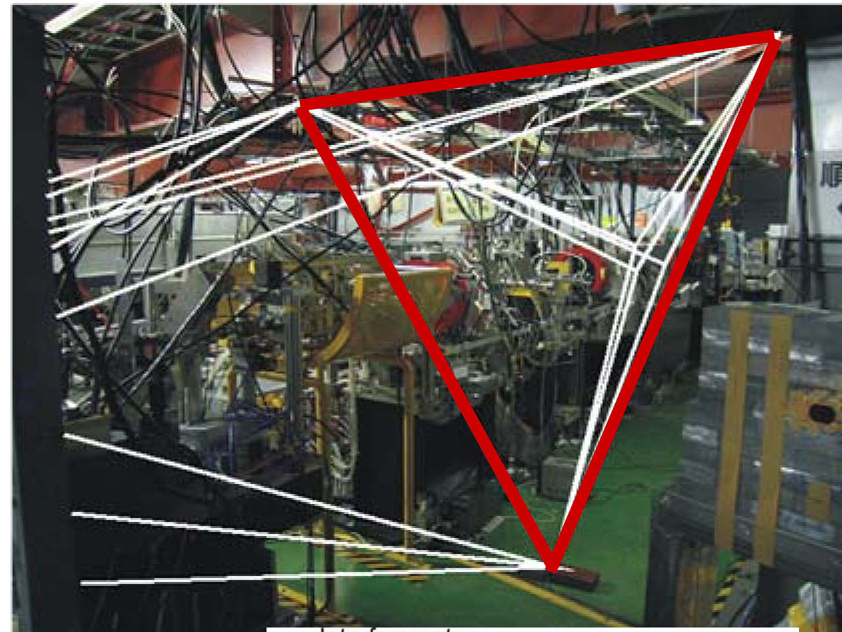
Implement system at ATF/KEK relating positions of nano-BPM's



- Advantage:
  - Nano-BPM have 5-100 nm resolution: cross check of results
  - Test of distance meter in accelerator environment

Spider web Design with Opto-Geometrical Simulation: Simulgeo

- Resolution of distancemeter: 1 nm
- Mount precision of distancemeter: 1 nm
- Angle precision of distancemeter holder: 10 μrad.



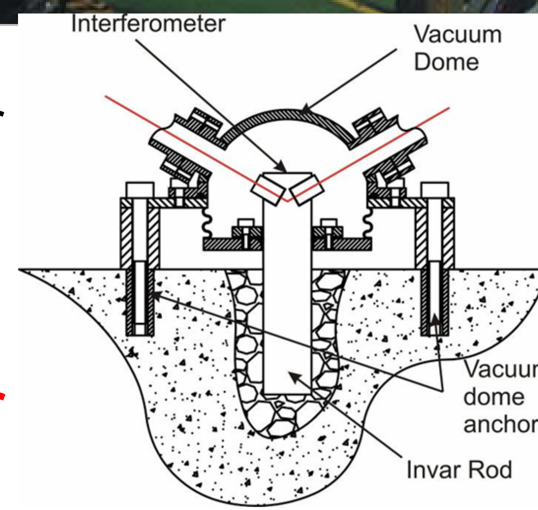
SLAC BPM: reference

KEK BPM variable (6D):

Position: x:32 y:19 z:2 nm

Angle: x:0.01 y:0.01 z:0.1 μrad

triangular nodes:



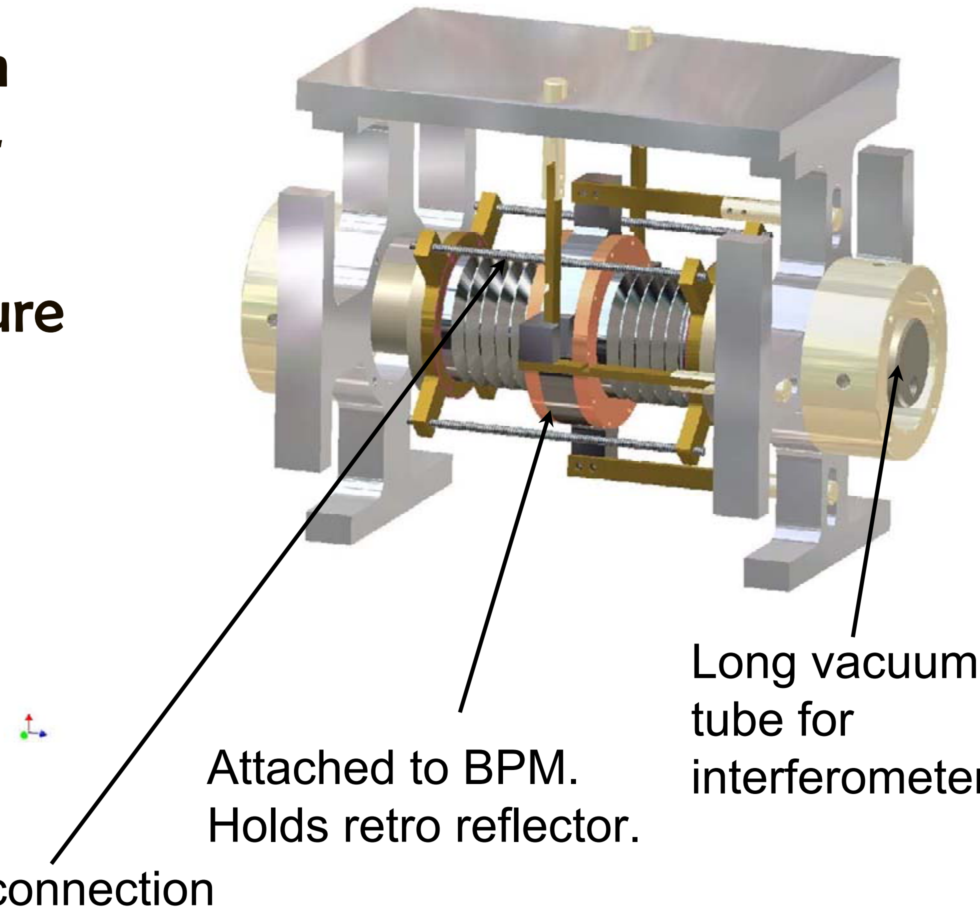
- Big matrix inversion takes into account all errors and constrains 6D position of all points.

David Urner

Force Free Mount for BPM Nodes

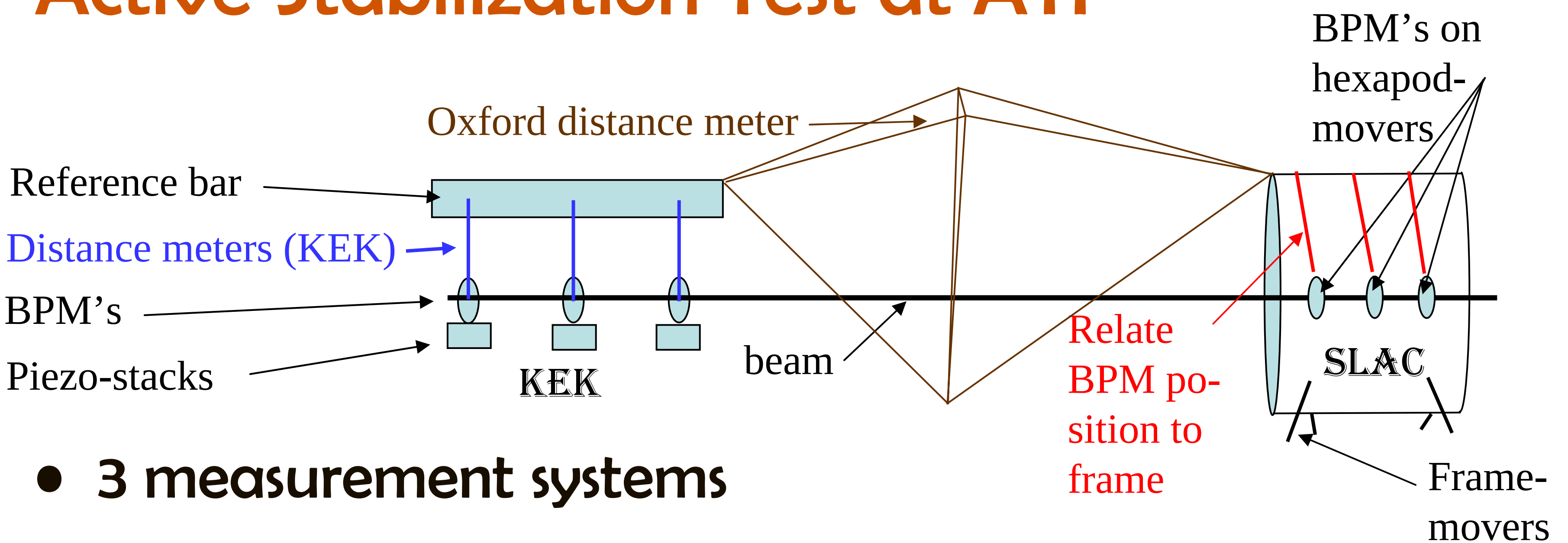
David Urner

- Vacuum mount using double bellow system.
- Allows small motion (~0.5 mm) of BPM-system
- Test stand to measure remaining force



David Urner

Active Stabilization Test at ATF

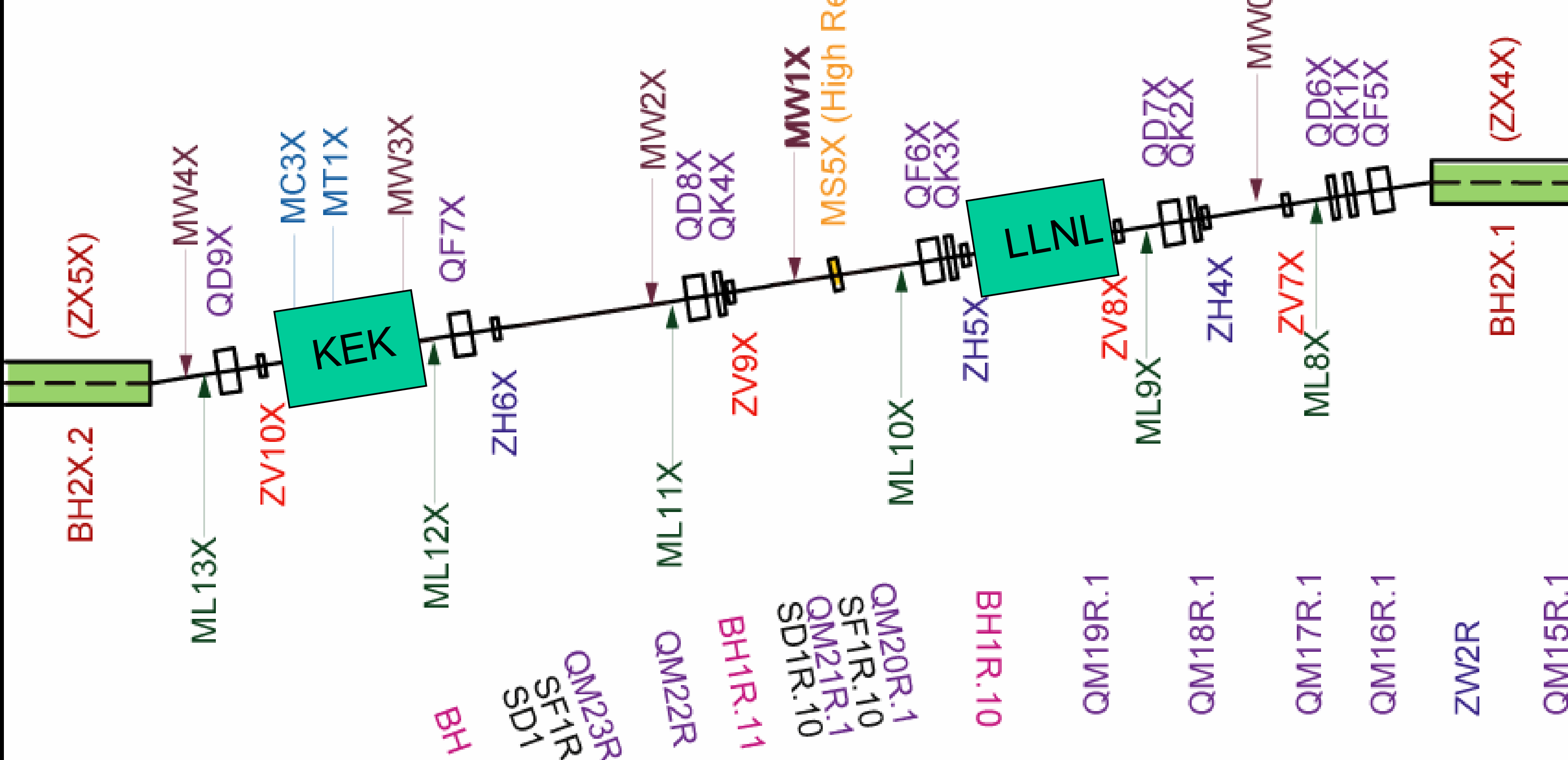


- **3 measurement systems**
  - KEK distance meters relate position of reference bar to BPM
  - BINP-LLNL-SLAC position monitors relate thermal frame to BPM
  - Oxford distance meters relate KEK reference bar to SLAC thermal frame
- Move KEK individual BPM's with piezos
- Use SLAC frame movers to adjust angle.

G. A. Blair

2 Cavity BPM triplets in ATF Extraction Line

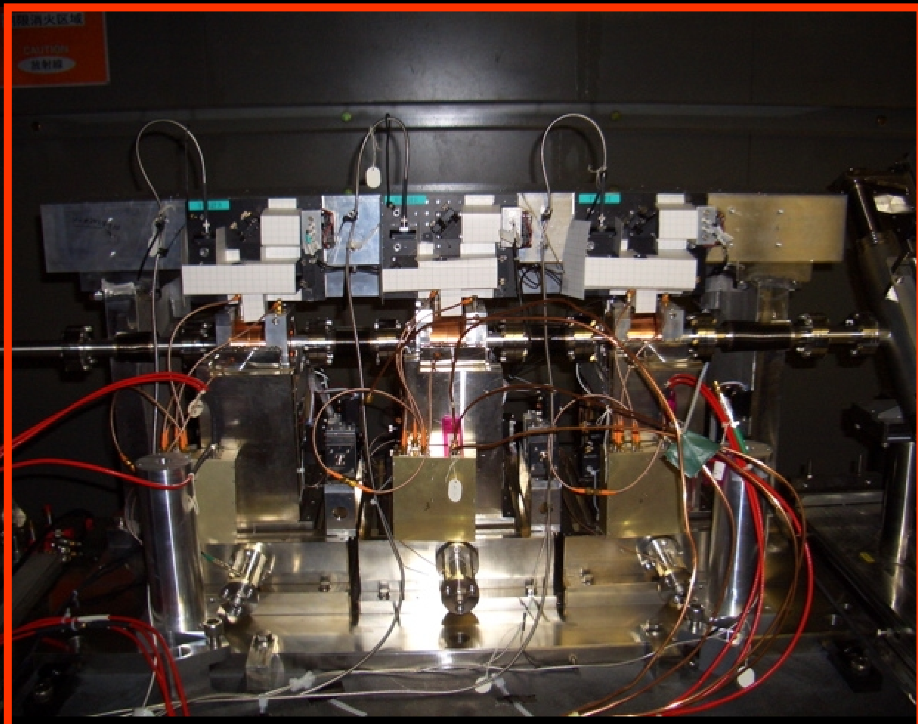
to determine resolution

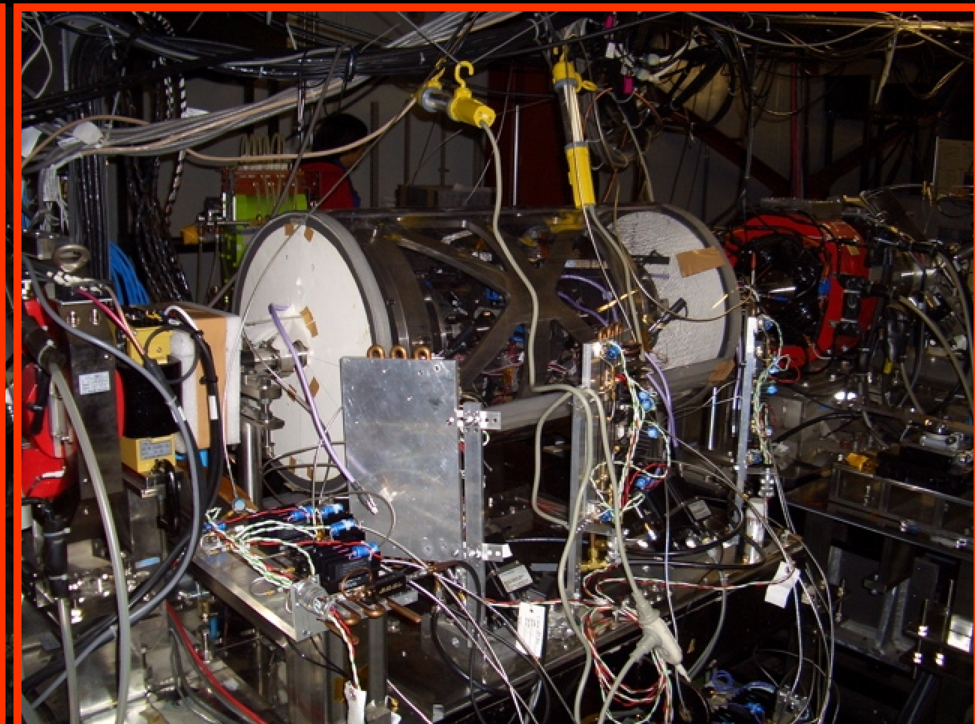


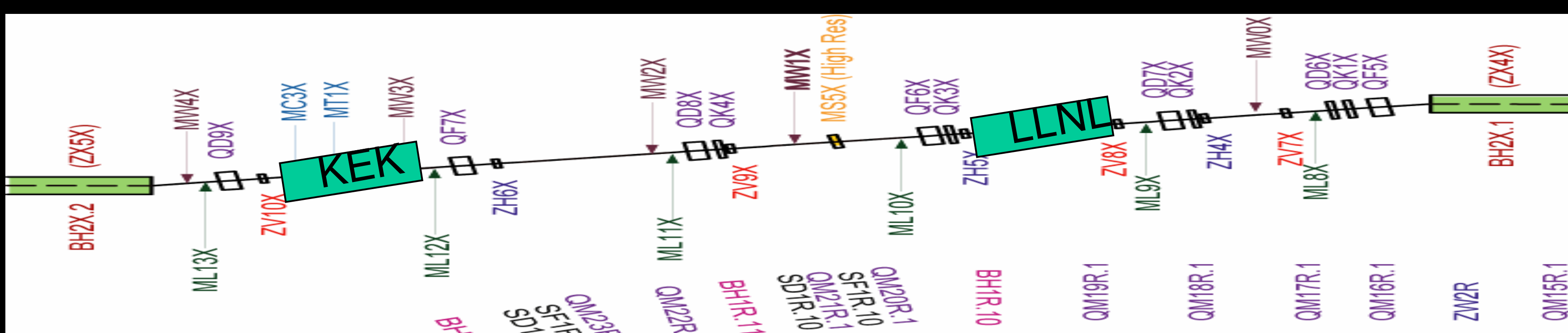
2 x 600 mm triplets of cavity BPM's; spacing ~ 5 m.

G. A. Blair

ATF NanoBPM

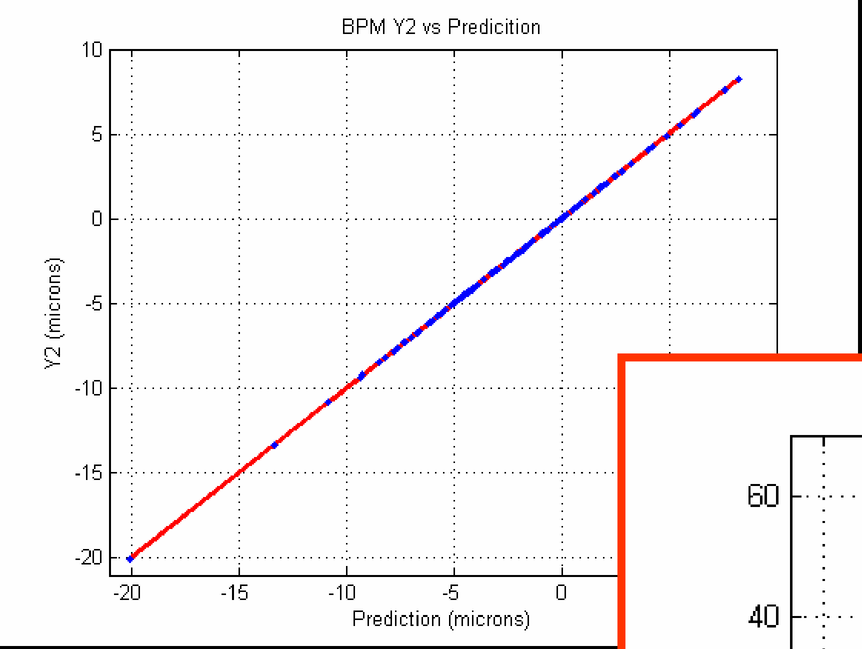






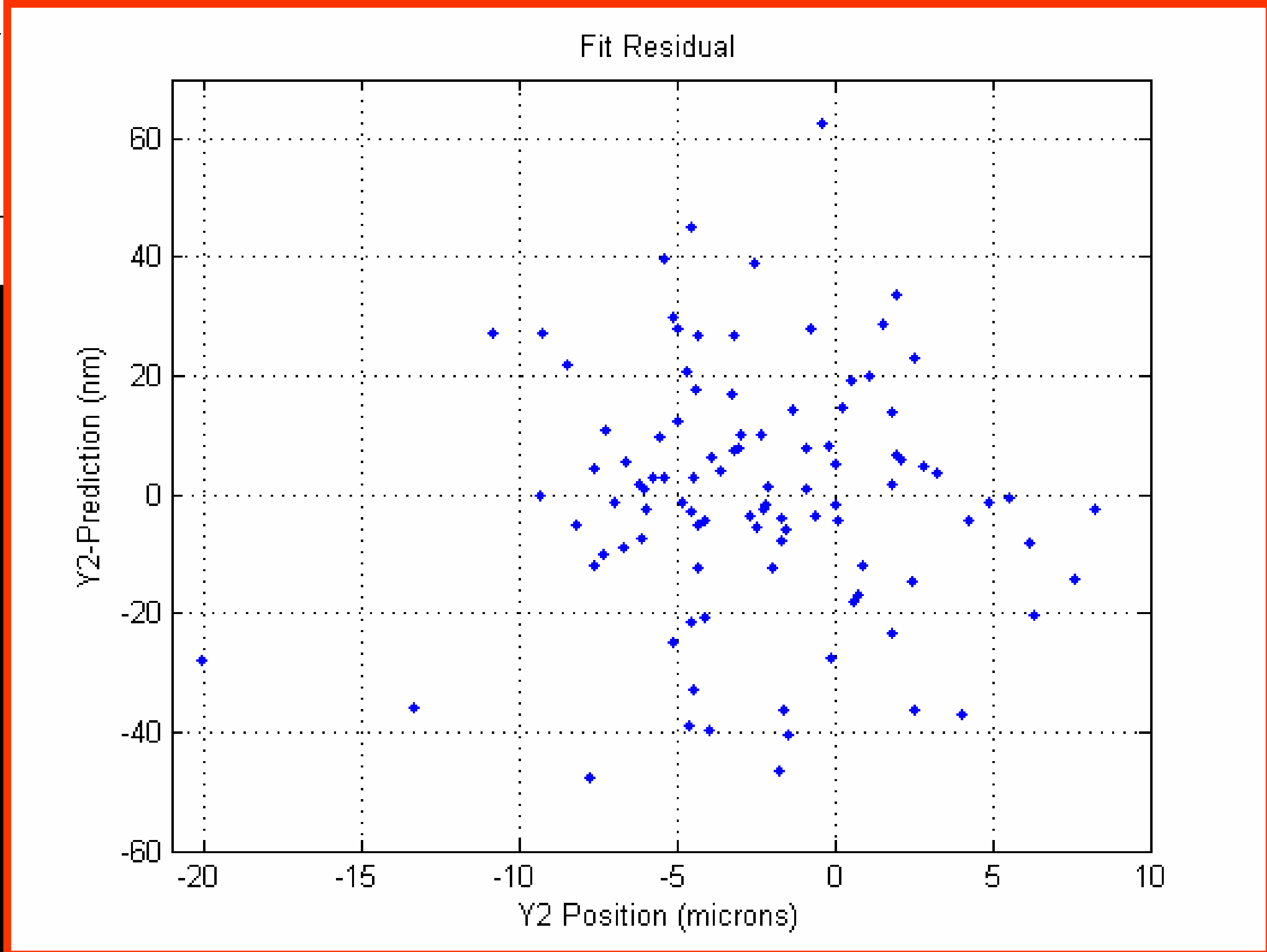
Short Term Resolution

G. A. Blair



Predict Y2 from other BPMs

Linear least-squares fit to (x, y, x', y') at BPMs 1&3

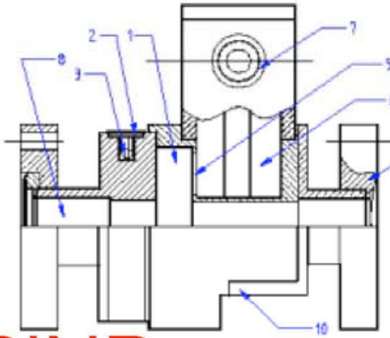
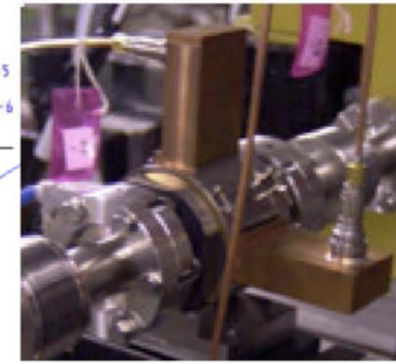


- 1 minute
- 100 pulses
- s = 17 nm
- Is it real ?

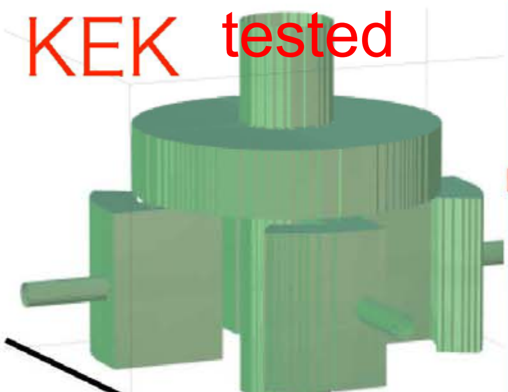
Overview of ATF/ATF2 cavity BPMs

Y. Honda

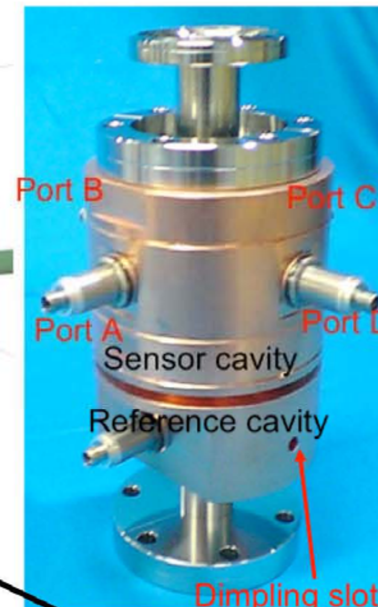
- BINP BPM (existing, used for nanoBPM)
  - 6.429 GHz (originally, 6.426 GHz)
  - 2 ports read out
- KEK BPM (existing, installed in KEK mover system)
  - 6.554 GHz (not applicable for multi-bunch)
  - L-shape wave guide for compactness
  - reference and sensor cavity in a block
- ATF2 Q-mag. (prototype will be ready soon)
  - 6.426 GHz
  - wave guide in longitudinal direction
  - 4 ports read out
- ATF2 IP (designing)
  - rectangular cavity
  - small aperture, small gap

BINP tested

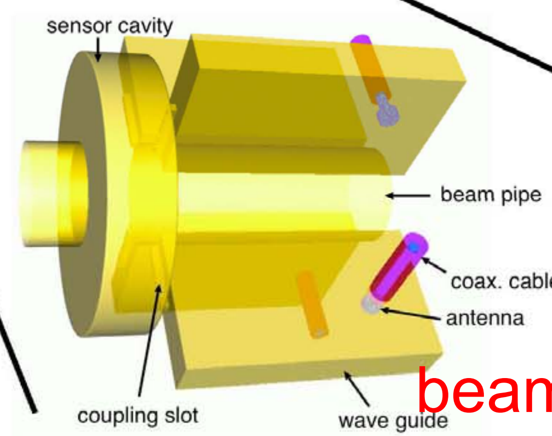


KEK tested



construction & beam test in early 2006

ATF2 IP



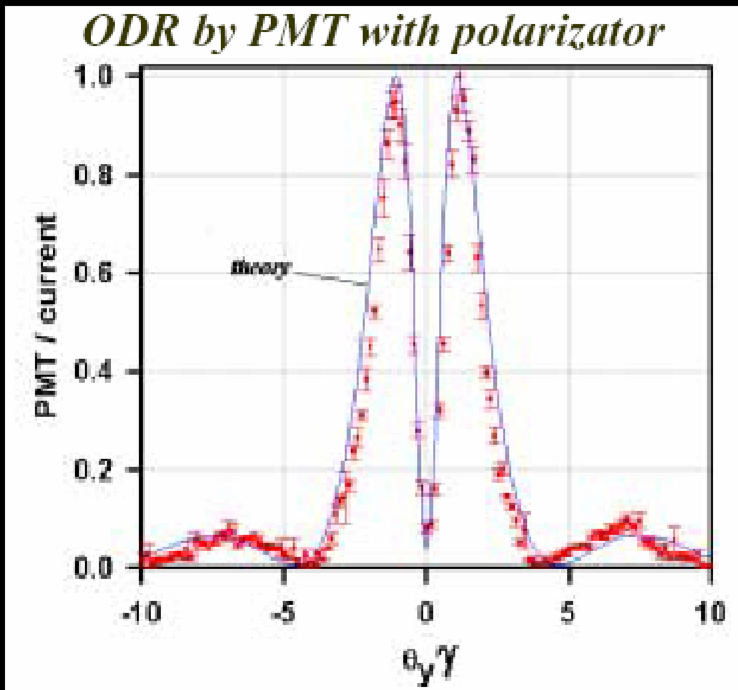
ATF2 Q

beam test end 2005

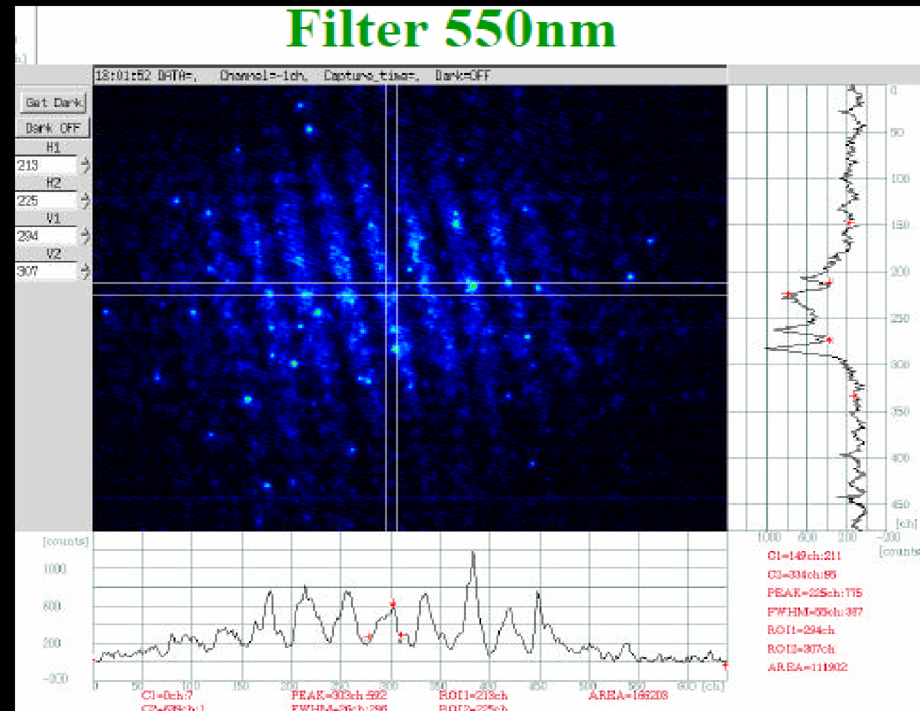
ODR R&D at ATF

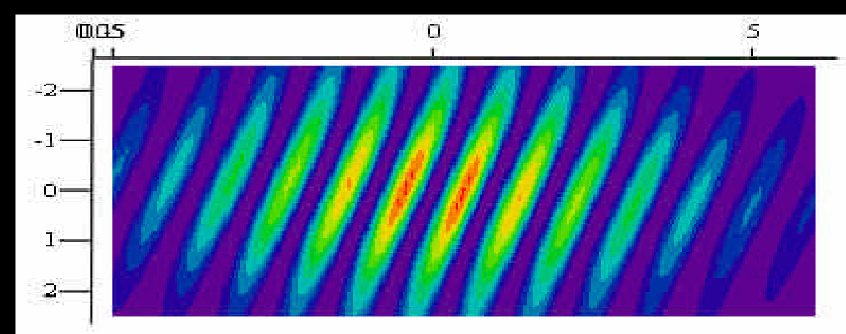
G. A. Blair

Multi-shots Measurement



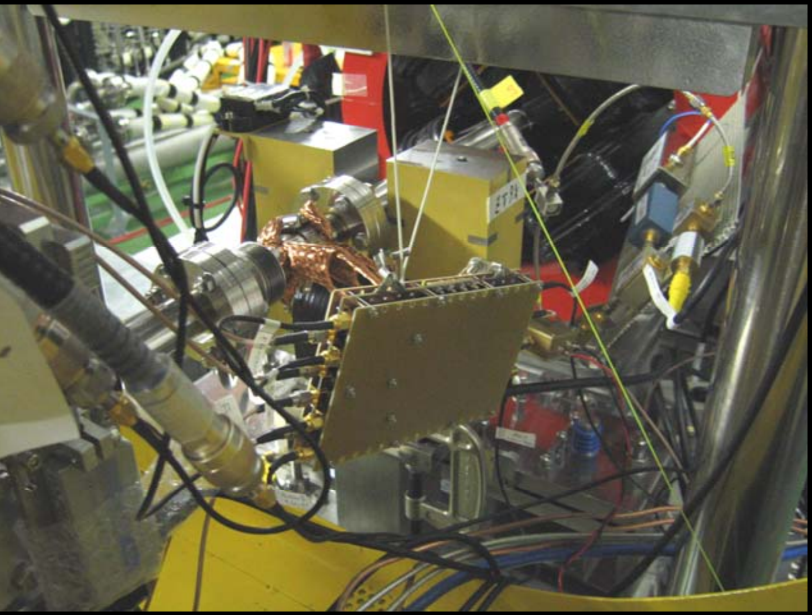
Single-shot Measurement

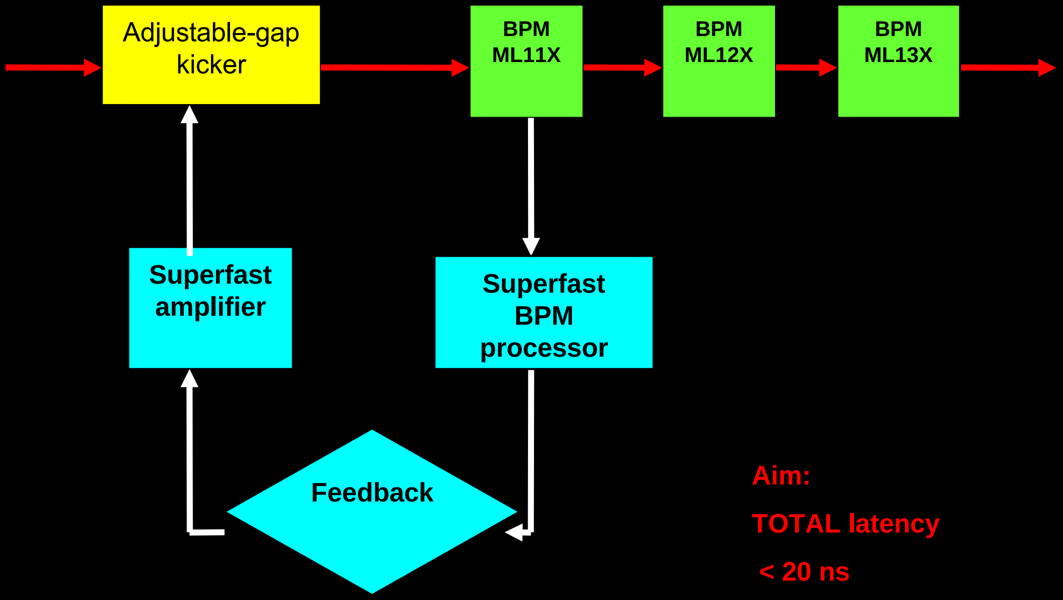




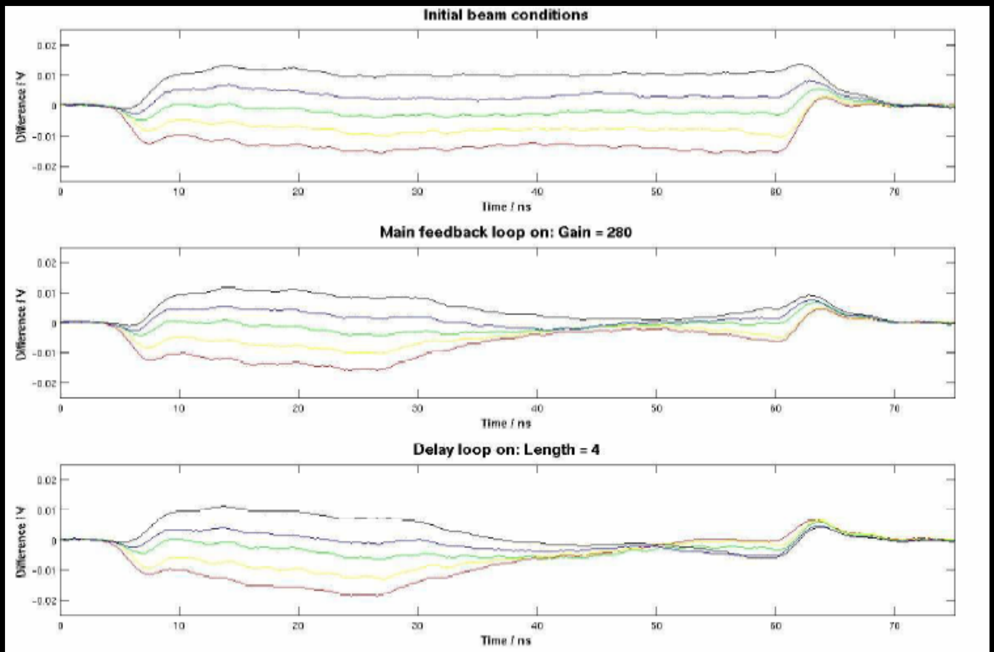
- single shot ODR measurements was performed
- electron beam size was estimated and compared with wire scanner measurements

FONT3 Installation in ATF extraction line





- Demonstrated feedback with delay loop
- Ultra-fast system: total latency 23 ns
- Varied main gain, delay loop length, delay loop gain
- \- system behaves as expected

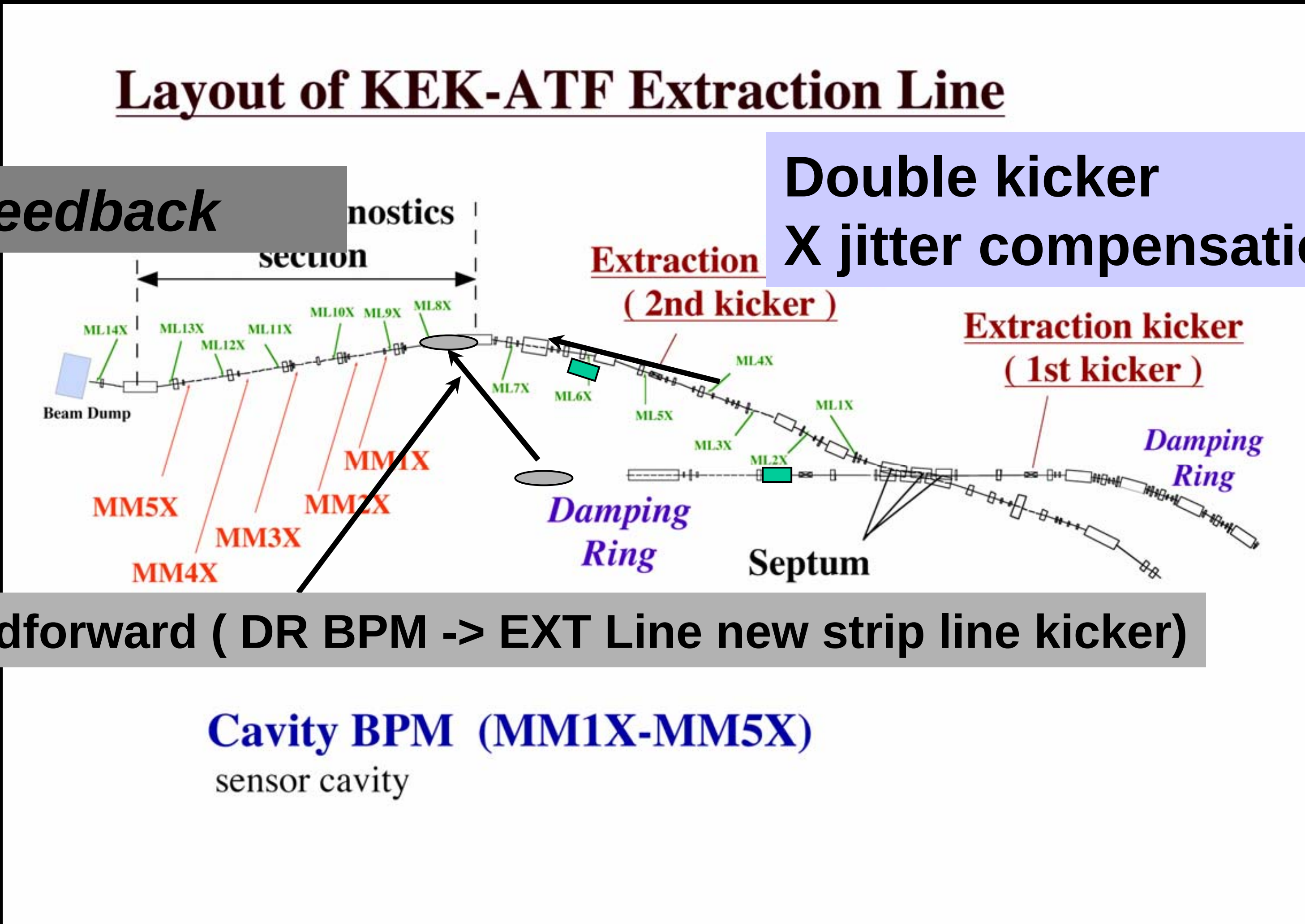


G. A. Blair, P. Burrows

G. A. Blair

FONT project (UK Institutes)

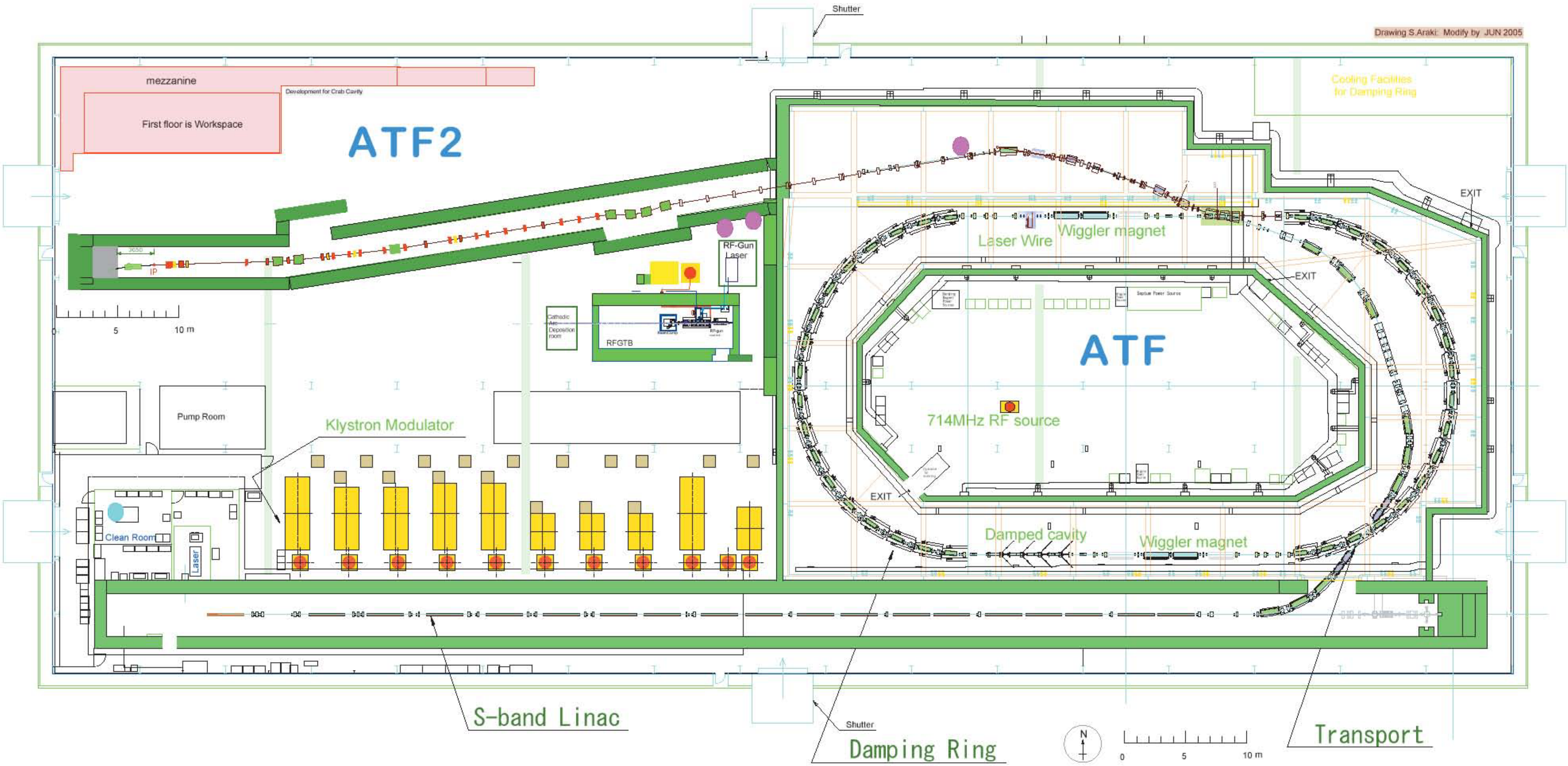
Feedforward to Extraction Line



K. Yokoya

ATF2 at KEK

- Extend ATF extraction line to add Final Focus prototype
- Same optics scheme as ILC Final Focus
- Squeeze down to ~35nm
- Stabilize beam center to ~2nm
- International collaboration from beginning

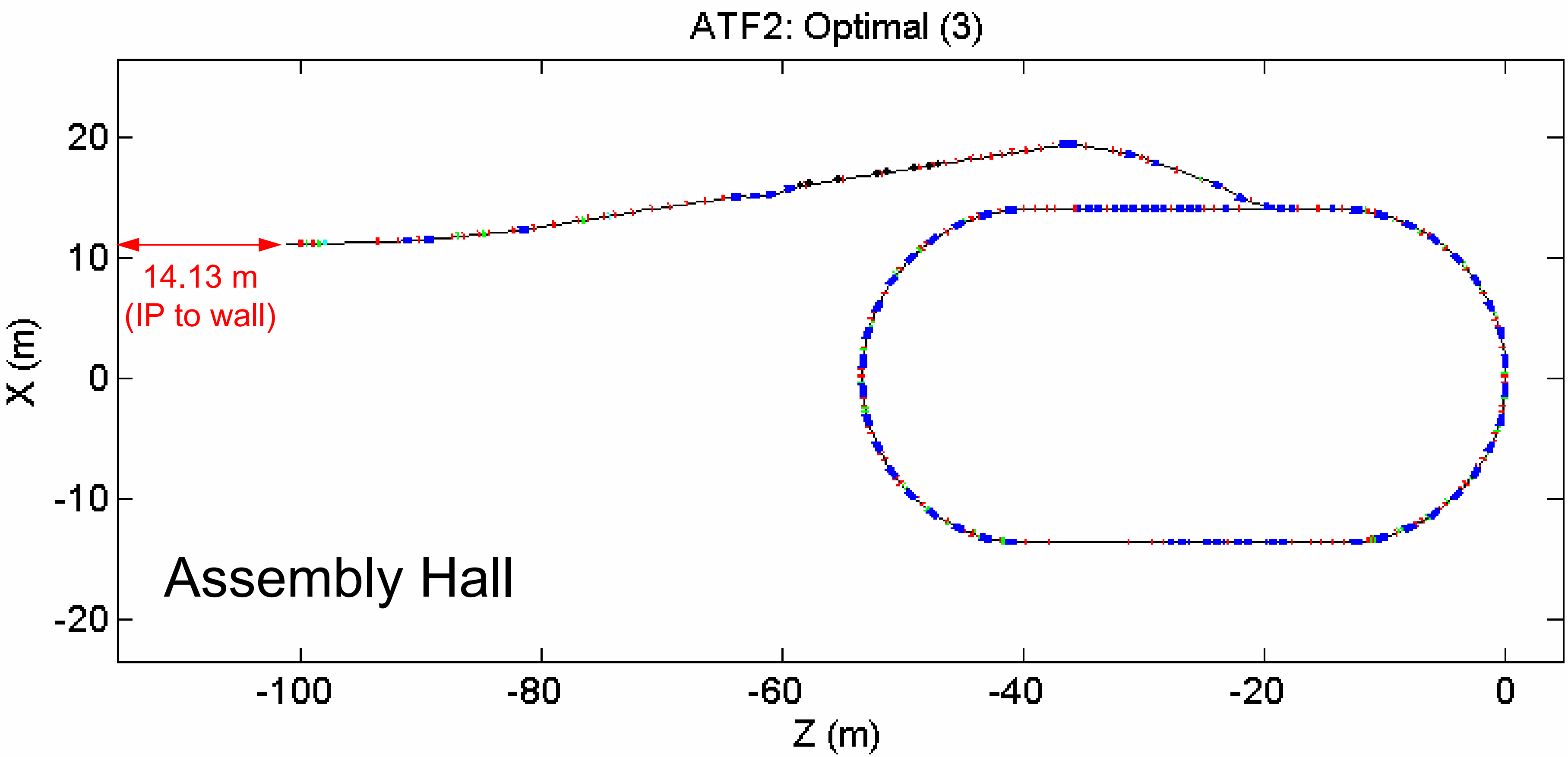


ATF2 Questions

A. Seryi

- Finalizing the layout
  - shortened diagnostics, to allow more space for post-IP diagnostics (M.Woodley)
- Final doublet design (conventional, PM, SC)?
  - conventional, PM or compact SC?
  - or all of them at some stage?
- Should we envision tests of tail-folding octupoles?
  - then need to test if optics is compatible

Layout (Optimal 3)

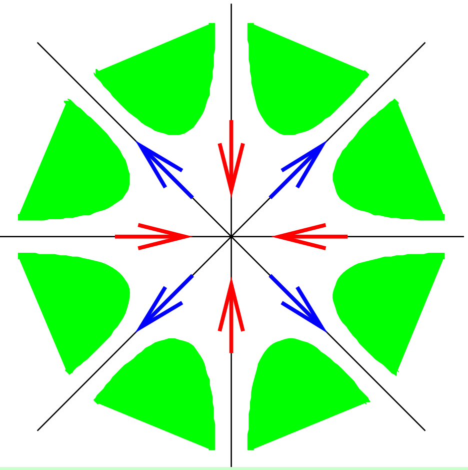


- Close to final?

A. Seryi

A. Seryi

schematic of tail folding with octupoles



Single octupole focus in planes and defocus on diagonals.

An octupole doublet can focus in all directions !

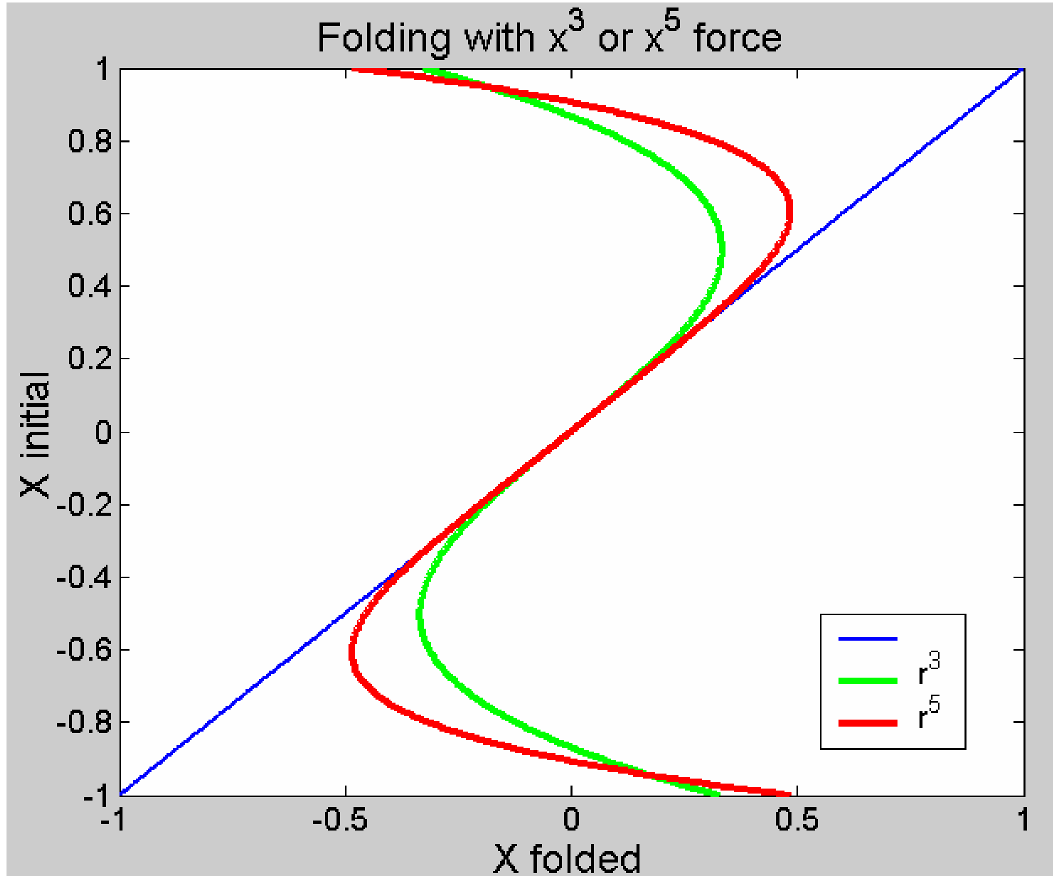


Illustration of folding of the horizontal phase space.

Octupole like force give factor of 3 (but distort diagonal planes)

OD-like force give factor of 2 (OK for all planes)

"Chebyshev Arrangement" of strength.

FD design

A. Seryi

- Start with conventional EM final doublet ?
- Should we foresee to make and try the SC final doublet with BNL technology?
- Test nm stability of field center
- Tuning FF with corrector coils in FD, not magnet movers

ATF operation
International collaboration

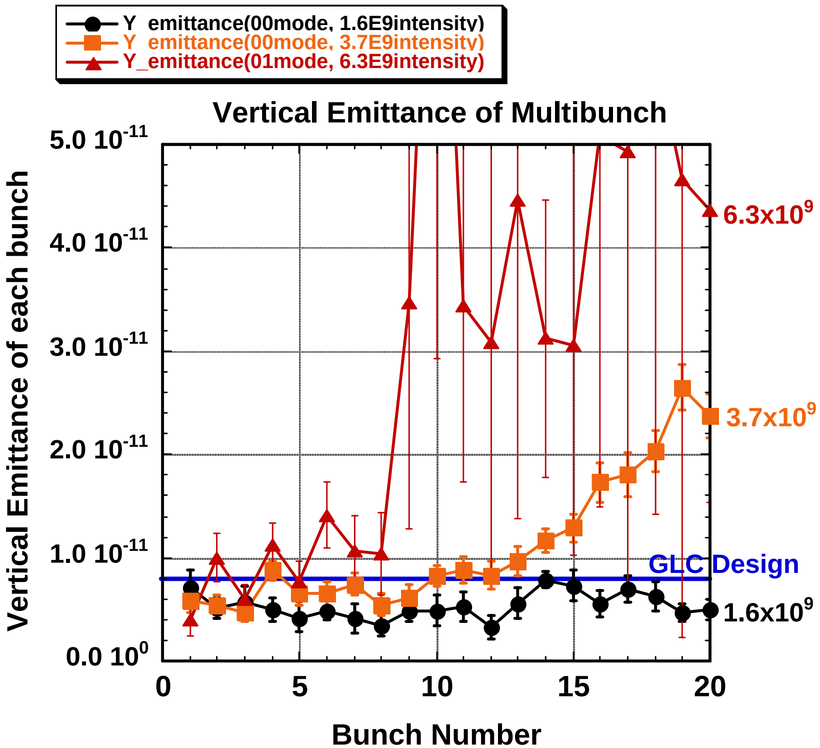
- ATF operates for 21 weeks/year; 110 hours/week
- Participation from outside Japan greatly increased 2004/05 (25 visiting researchers including 10 students/post-docs)
  - Will use 30% of beam time this year
- Host duties shared between KEK/SLAC
- Operation fully supported by KEK

M. Ross

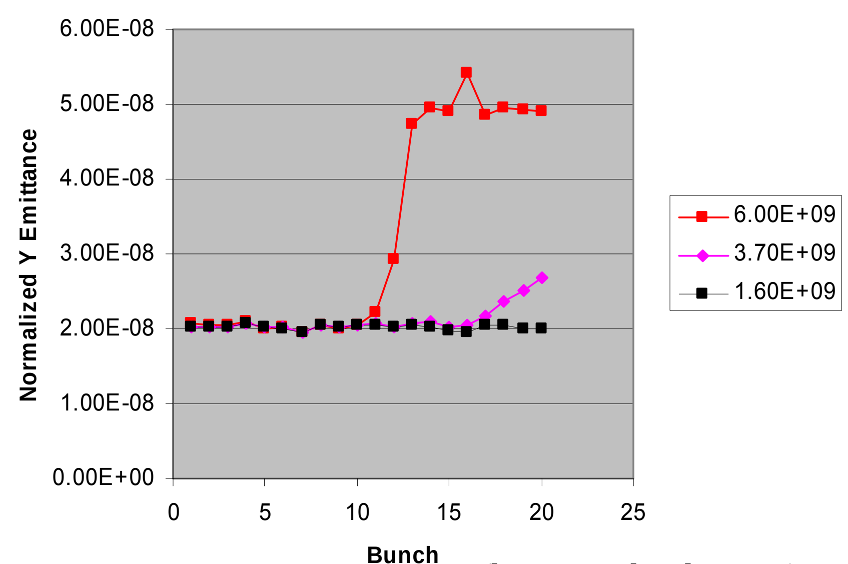
M.Ross

S. Kuroda, M. Kuriki

Multibunch Vertical Emittance in the damping ring measured by Laser wire

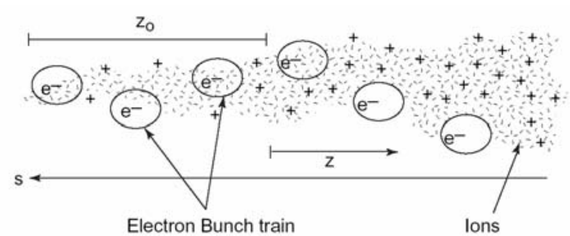


Fast beam ion instability simulation



(by T.Raubenheimer)

Laser wire measures projected profile of many turns.
Oscillation is appeared to be beam size blow up.

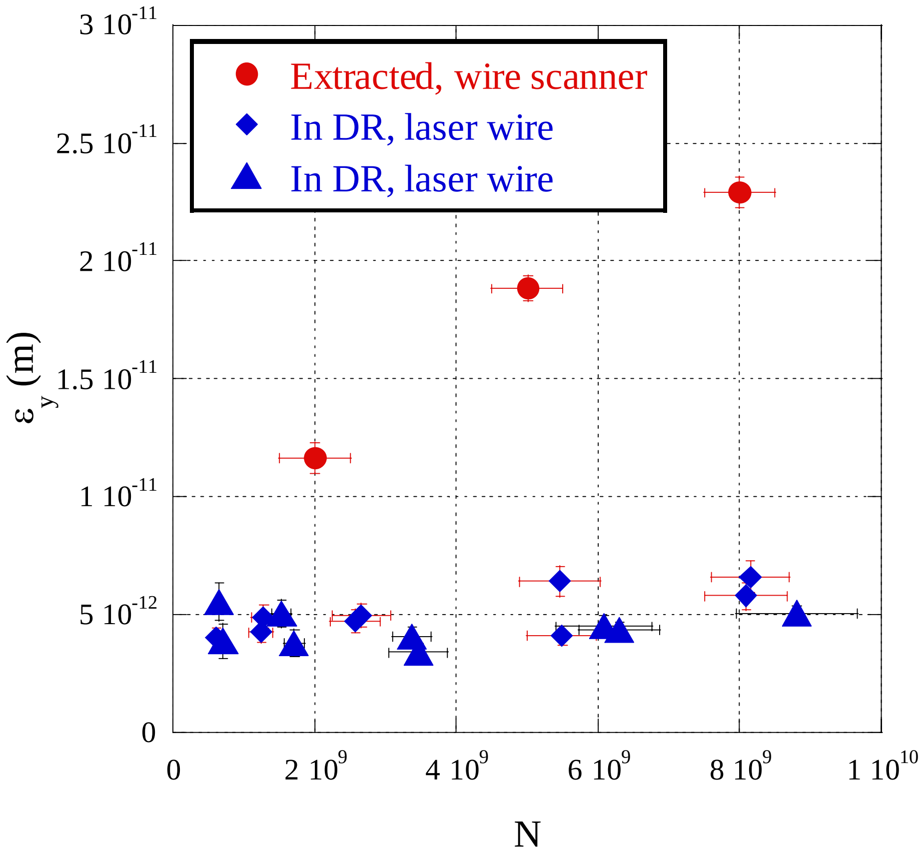


Schematic of the Fast-Beam Ion Instability

S. Kuroda, M. Kuriki

Vertical emittance of extracted beam

Vertical emittance vs. bunch population.

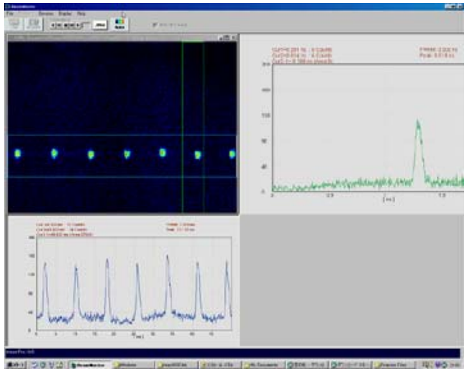


Extracted beam emittance is larger than in the damping ring.
Unknown higher order fields in the kickers and the septum magnets are suspected.
(Kickers have been replaced in this fall.)

Emittance in DR was measured by Laser wire, in extraction line by wire scanners.

(in my own opinion wake fields could be responsible - one of CLIC tasks)

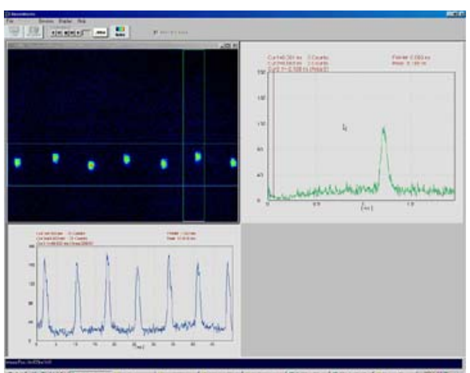
Longitudinal Oscillation in Multi-bunch Beam



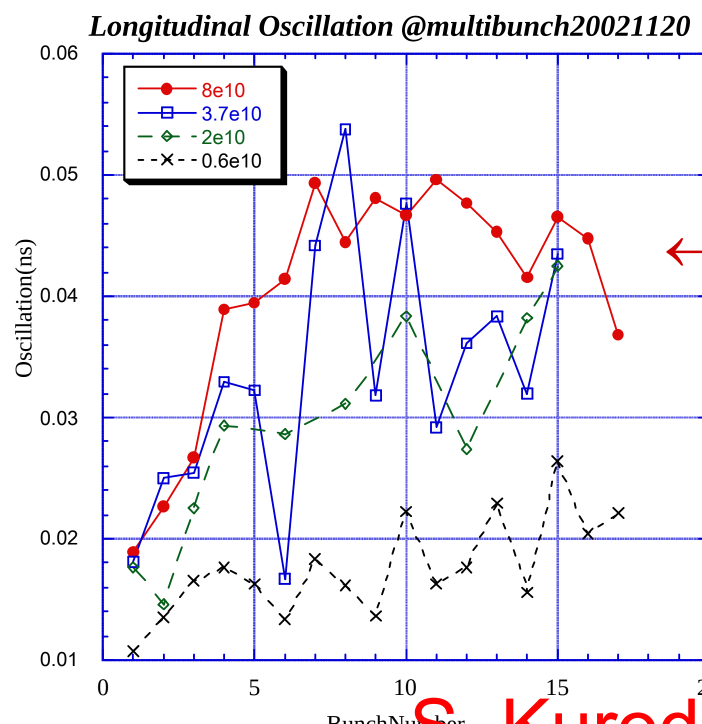
Streak camera observes longitudinal oscillation in multi-bunch beam.

It depends on the bunch number and beam intensity.

1st bunch of 17 bunches



4th bunch of 17 bunches



↔1.5e-4 in $\Delta p/p$

T.Naito

S. Kuroda, M. Kuriki

ATF Plans for 2005-2006

- ***MB emittance study***

  Y emittance will be confirmed by Laser Wire after scrubbing.
- ***Wiggler study***

  Effect of non-linear field to dynamic aperture.
- ***High quality beam extraction***

  multi-pole component of kicker and septum are under study.
- ***nm resolution BPM test & demonstration***

  Development of new precise mover & new cavity-BPM electronics.
- ***Fast feedback test & demonstration***

  Basic test of feedforward and feedback are under way.

  Fast feedback test by 3 train extraction (ILC-like bunch spacing) will be done.
- ***Fast Kicker for ILC damping ring***

  Fast pulse power supply and strip line kicker system will be tested.
- ***Instrumentation developments***

  LW, XSR monitor, ODR monitor, MB-BPM, (SB, MB) longitudinal feedback, etc.
- ***Preparation of 'ATF-2'***

S. Kuroda, M. Kuriki

Present Research programs at ATF

- **1. Pol. Positron generation R&D at EXT (terminated in last June)**
- **2. Laser wire R&D in Damping Ring**
- **3. High quality electron beam generation by photo-cathode RF Gun**
- **4. X-SR Monitor R&D**
- **5. ODR R&D**
- **6. Beam Based Alignment R&D**
- **7. Nano-BPM project of SLAC, LLNL, LBNL and UK**
- **8. Nano-BPM project of KEK and UK**
- **9. FONT project**
- **10. Laser Wire project at EXT**
- **11. Fast Kicker Development project**
- **12. Fast Ion Instability Research**
- **13. Multi-bunch Instability Study**

J. Urakawa

New Proposals

- StaFF : Stabilization of the Final Focus of the ILC
- CSR Study in Damping Ring
- Positron Generation based on Laser Compton Scattering in Damping Ring
- Gamma Collider Study ?
- Photon Nucleon Collision ?

Yellow means big group. White means small group.

J. Urakawa

Specification of Cavity (RF) BPMs in ATF2 beamline

In present ATF2 design, all BPMs are cavity BPMs.

- The BPM cavities are already being developed at PAL.
- The readout electronics are also being developed at SLAC.

Resolution	:	100nm
Dynamic Range	:	250μm

We can expand the dynamic range by signal attenuators for rough beam tuning, beam based alignment, dispersion measurement, etc..

i.e.) When with 20dB attenuators at the front of readout electronics, we expect the dynamic range to be 2.5mm with 1μm resolution.

T. Okugi

But...

Cavity-BPM operation and understanding is not trivial.

We need some experts to operate the BPMs,
especially for the initial commissioning.

The information of BPMs cannot read by online
without the phase adjustment of readout electronics.

The phase adjustment takes roughly 30 minutes per BPM,
and the phase adjustment cannot be done without beam.

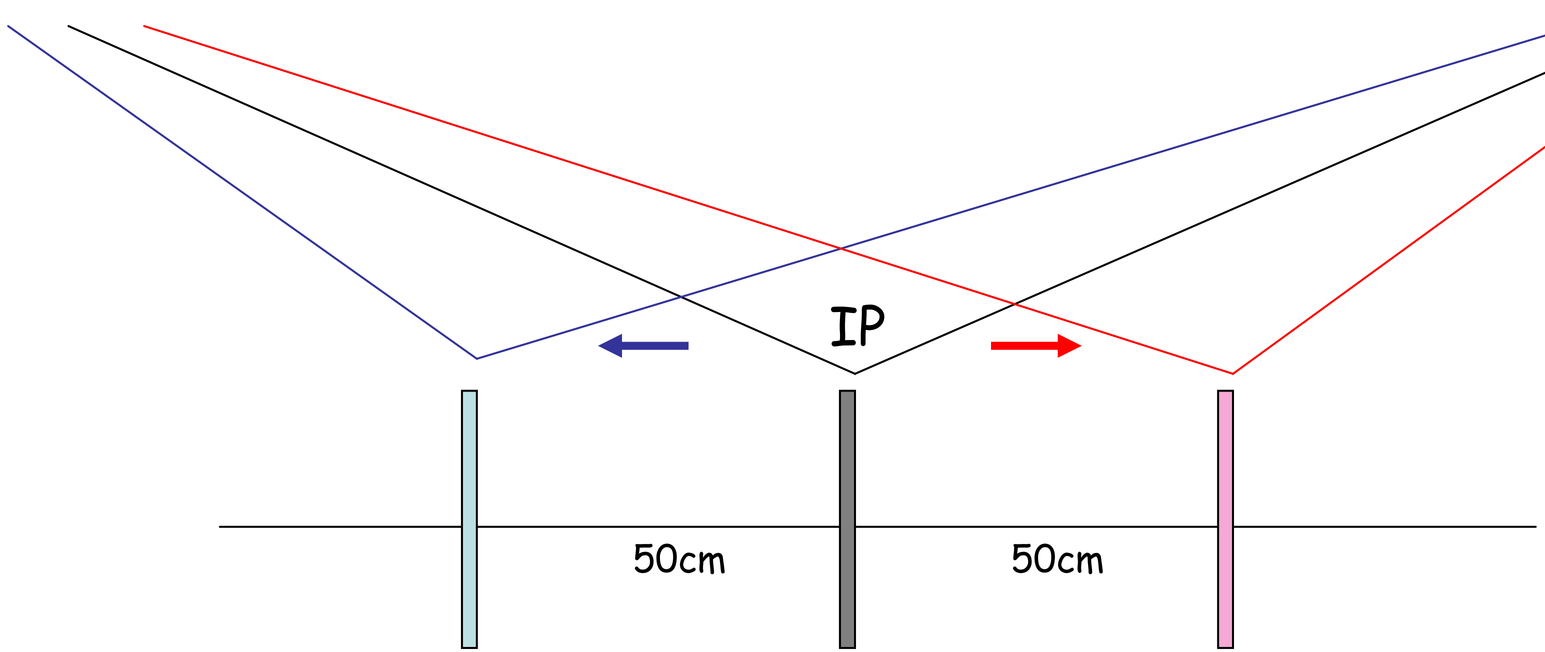
We must pass the beam to the dump without online
beam position information during the initial commissionig.

recommend some additional screen monitors
or striplines (but space is precious)

T. Okugi

ATF2 L* scan with final doublet

Focal point is changed only by changing the final doublet field.



Beam Size Monitor 1
Carbon wire ?
Mitsuhashi/Naito monitor ?

Shintake Monitor

Beam Size Monitor 2
Carbon wire ?
Mitsuhashi/Naito monitor ?

Beam size monitor 1,2 should be fast and easy to operate.

T. Okugi

T. Okugi

Position scan for ATF2 Shintake Monitor

Vertical beam position should be scanned to measure the beam size.

The step range of the vertical position scan is ~ 30nm.

The vertical position scan should be done by changing the quadrupole position with fine guider.

Since ATF2 FF use the local chromatic correction technique, the vertical offset at the sextupoles introduces coupling.

We must select a good knob to scan the beam.
(large dynamic range, easy to make guider)

What ATF2 team should do …

1) We should make a beamline drawing including the magnets, monitors, vacuum components, etc.

2) We should determine whether we put the additional screen monitors, or stripline BPMs or not.

3) We should determine the additional beam size monitors to put on both sides of Shintake monitor.
(Carbon wire scanner, Mitsuhashi/Naito monitor, etc …)

4) We should make a detailed simulation including the alignment errors in order to investigate the tuning procedure of ATF2.

5) We should check the accuracy of L* scan by using the simulation code.

T. Okugi

October 2005

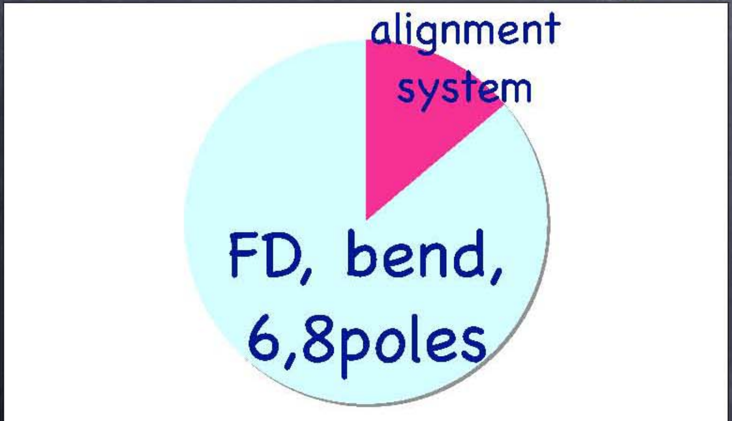
(1) mini-ILC model

equal sharing on the components, while the host country prepares the conventional facility.

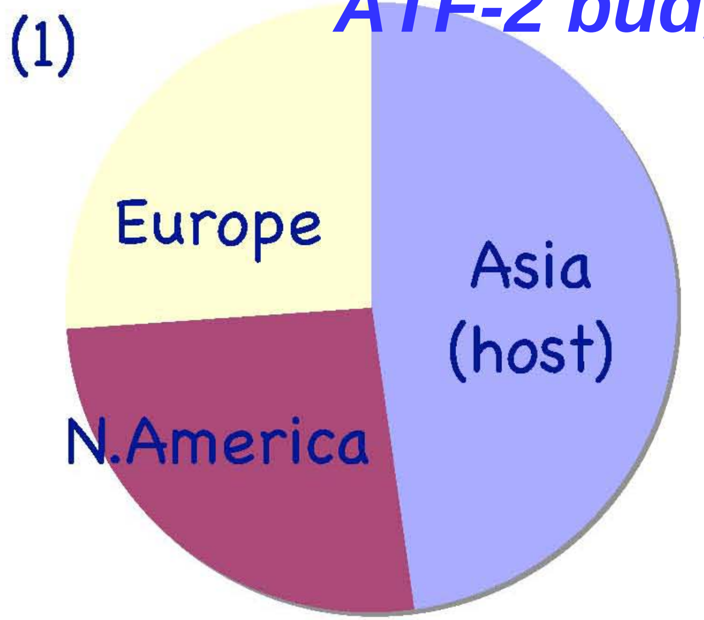
(2) tentative status

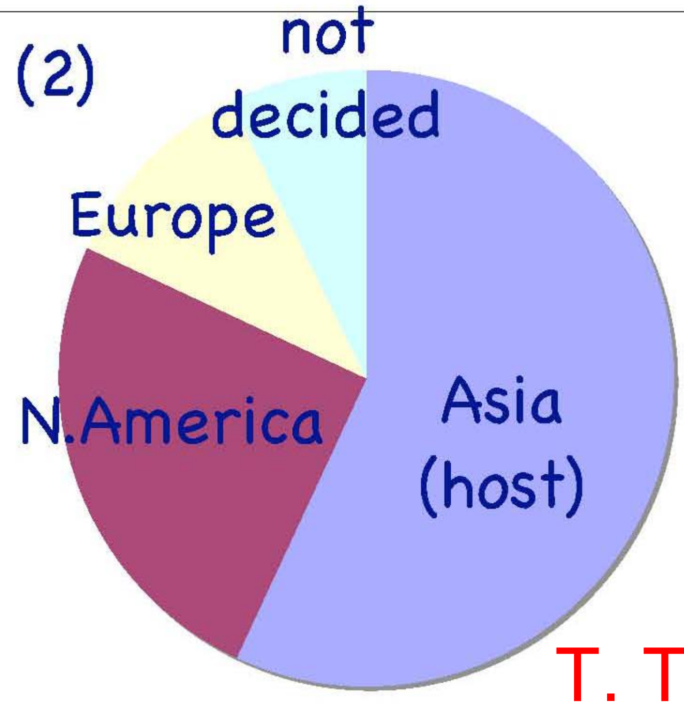
a la Japanese costing rule

"not decided" major components (0.36 Oku-yen)

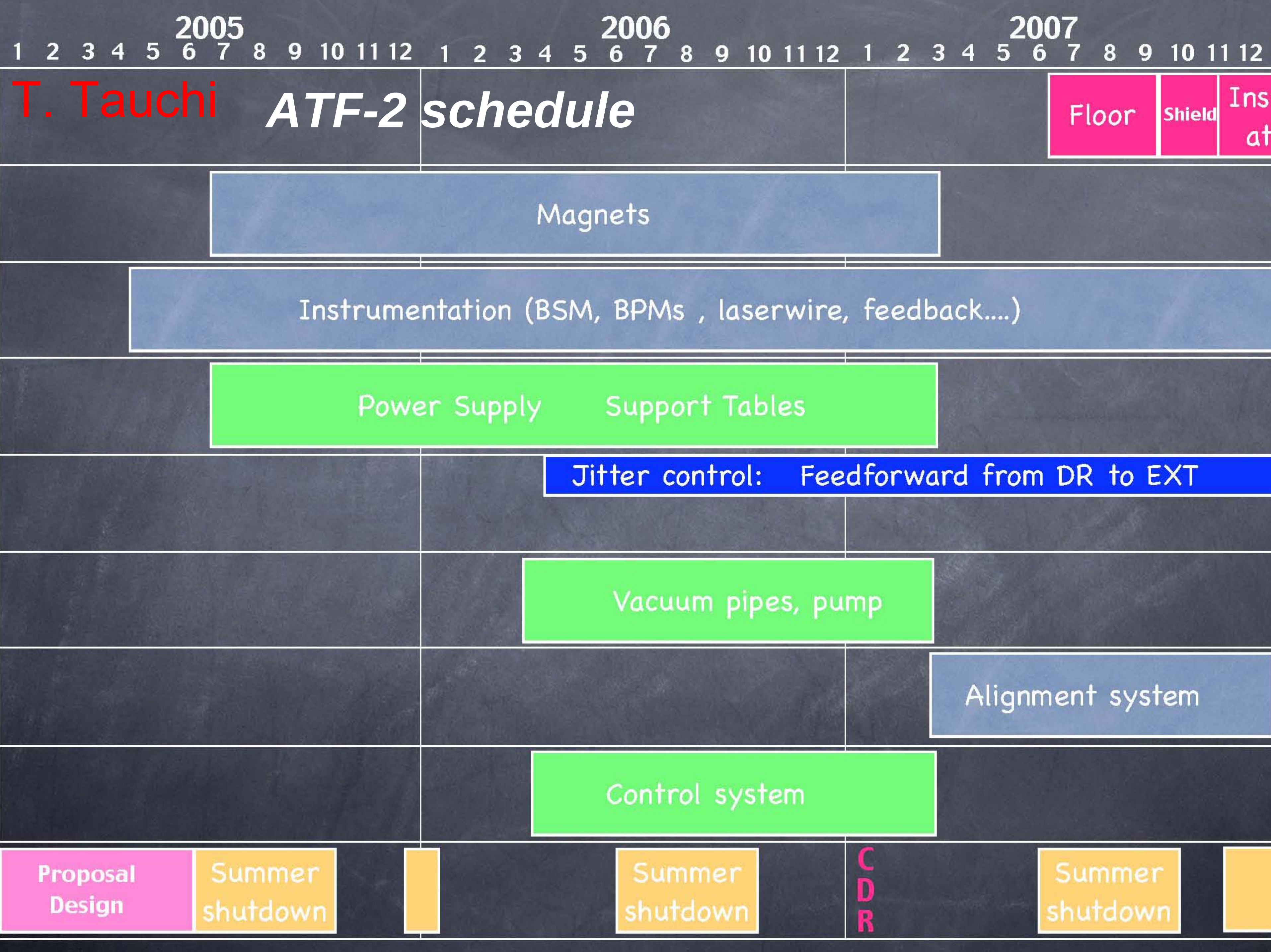


ATF-2 budget





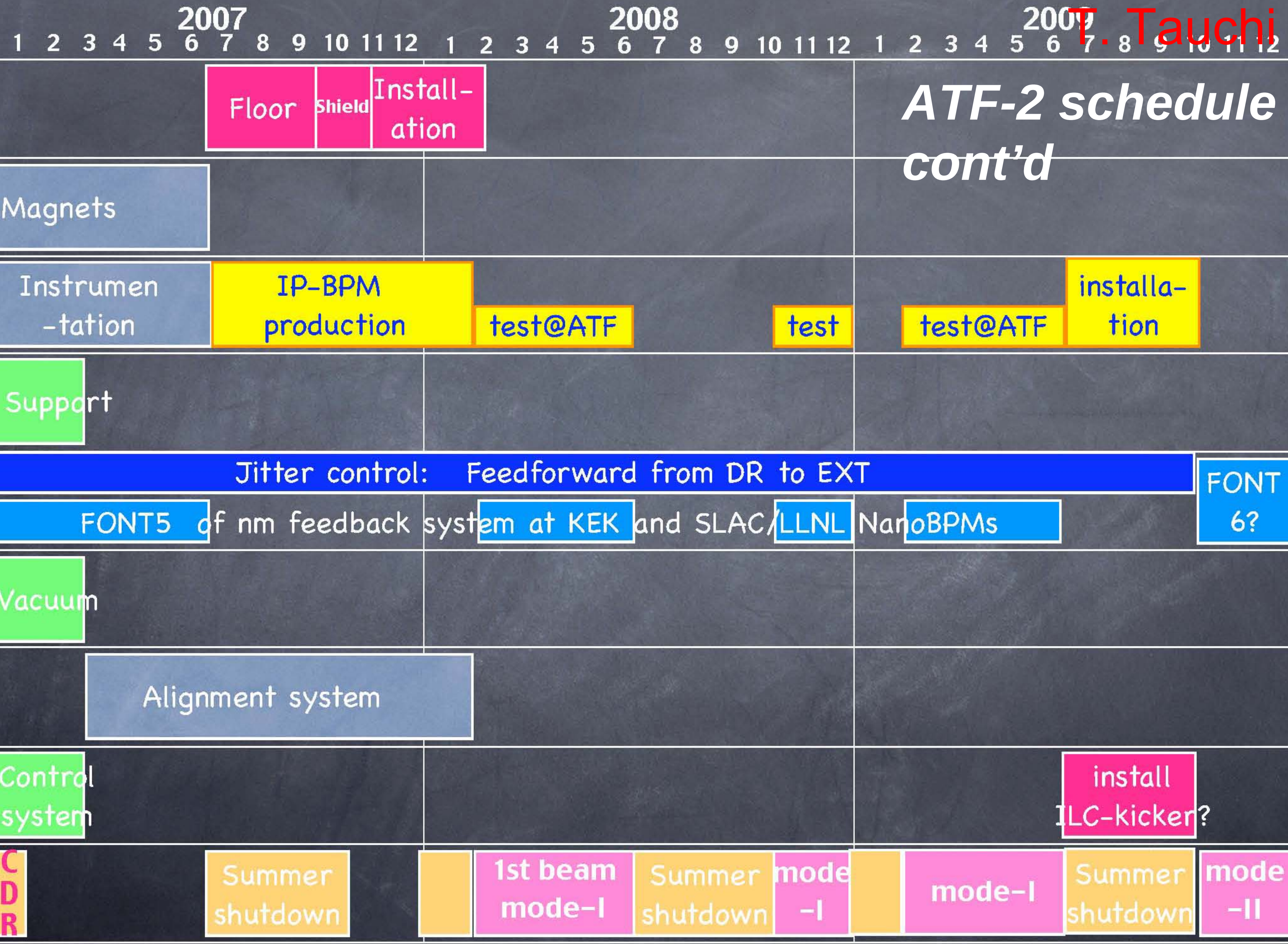
T. Tauchi



T. Tauchi
ATF-2 schedule
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
Ins
at
Magnets
Instrumentation (BSM, BPMs , laserwire, feedback....)
Power Supply Support Tables
Jitter control: Feedforward from DR to EXT
Vacuum pipes, pump
Alignment system
Control system
Proposal Design
Summer shutdown
Summer shutdown
CDR
Summer shutdown

T. Tauchi

ATF-2 schedule cont'd



CERN Contributions to ATF-2 "Studies"

1) development of commissioning strategy;
   already wrote section of design report
   1 person month

2) investigation of optimum beam-based alignment procedures with pertinent specification of BPM ranges
   3 person months

3) simulation of IP tuning and maximum tuning knob ranges ***4 person months***

4) survey of relevant collective effects in ATF-2 and ATF extraction line; particularly wake fields
   1 person month

5) participation in commissioning activities
   3 person months

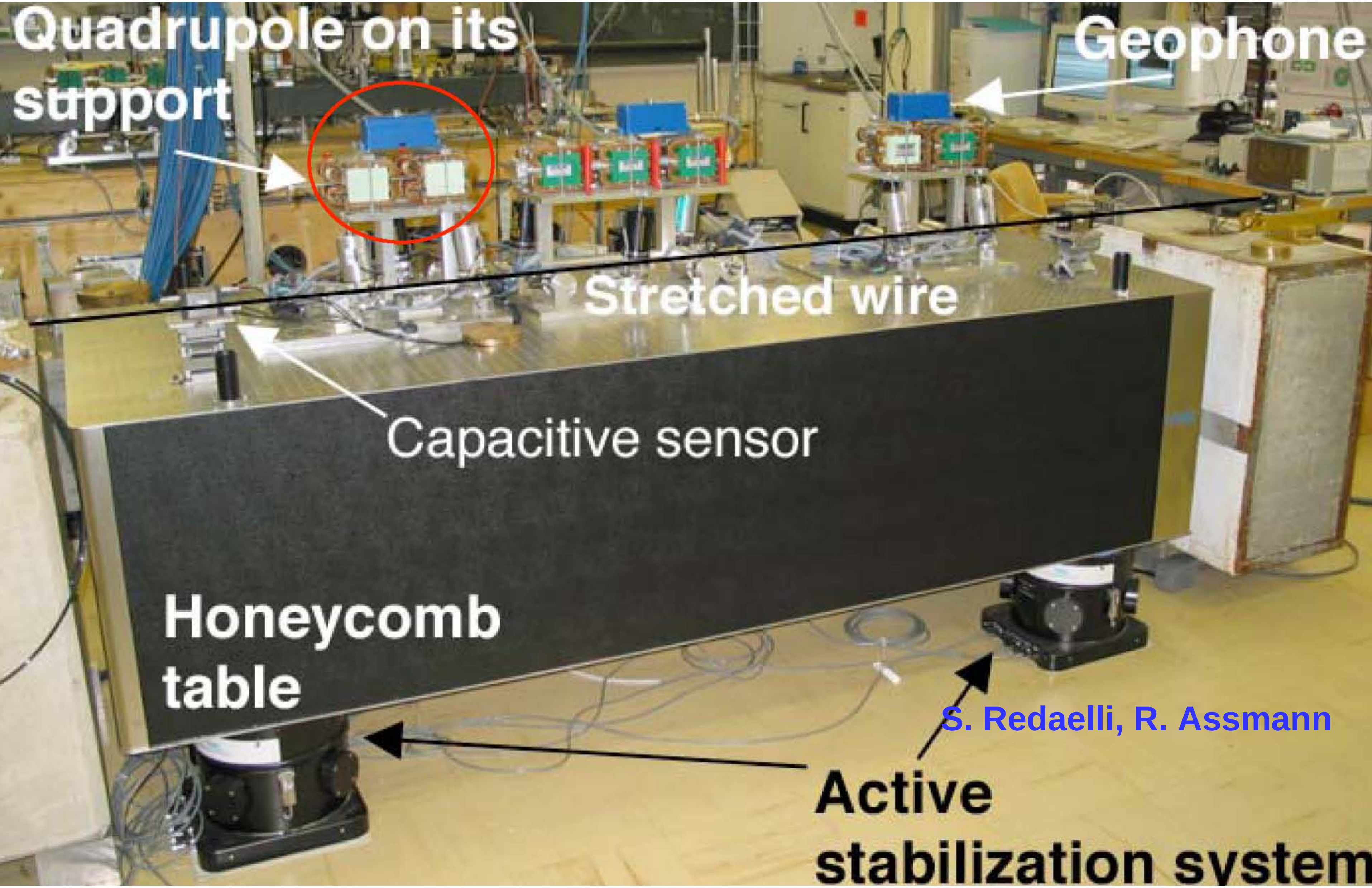
in total:
1 person year
approved by CSC
on 13.10.2005

CERN Hardware Contributions to ATF-2

1) active stabilization table including stabilizing feet (STACIS2000 from TMC);
honeycomb structure with length 2.4 m, width 0.8 m, height 0.8 m;
absence of structural resonance below 230 Hz;
stabilizing feet are equipped with geophones, rubber pads for passive damping, and piezo-electric movers for active damping of load vibrations induced from the ground; table was used for CLIC stabilization study; presently on loan at Annecy; available from mid-2006;
best use at ATF-2 to be identified; e.g., stabilize final quadrupoles and IP monitors

value about 100,000 CHF (8.72 MYen)

CLIC test stand for vibration measurements & magnet stabilization studies



CERN Hardware Contributions to ATF-2

2) Three precision transformer BPMs. Projected spatial resolution 100 nm and time resolution 15 ns; aperture 4 mm; available at the end of 2007;
aperture might be increased within limits
development cost about 160,000 CHF (13.95 MYen)
plus manpower;
co-financed by EU via EUROTeV

presentations related to CLIC studies

F. Zimmermann (plenary):
“Summary of Nanobeam 2002 and Expectation 'Stability and Ground Motion Issues in CLIC’”

Angeles Faus-Golfe (WG2a):
“Alternative Design for Collimation System”

F. Zimmermann (WG2d):
“CLIC R&D”

B. Bolzon (WG2b):
“Active Stabilisation of a Future Linear Collider Final-Focus Quadrupole Mock-Up”

Nanobeam ’05 is one of very few workshops giving a platform to both ILC and CLIC

my presentations triggered some reactions of surprise that CLIC still continues after decision for ‘cold technology’

- Frank Stephan / DESY Zeuthen
- Jim Clendenin / SLAC
- …

a number of participants expressed interest in CLIC and in possible collaborations:

- *Phil Burrows (Oxford)* working on ultra-fast feedback, suitable for CLIC, decided to attend CLIC BDS Day (next week)
- *Junji Urakawa (KEK),* interested in collaborating on Compton-scattering polarized e+ source
- *Brett Parker (BNL) -* more optimistic that a s.c. final quadrupole solution can be found also for CLIC
- *Marie-Emmanuelle Couprie (CEA),* head of ‘arc-en-ciel’, may have common interest in wiggler development
- CLIC contributions to ATF-2 were greatly appreciated
- *Marc Ross (SLAC)* encouraged stronger participation in ATF
- *Junji Urakawa (KEK)* would welcome CLIC involvement in ambitious polarized e+ studies at ATF; meeting with *Masao Kuriki, Tsunehiko Omori & Junji Urakawa* on CLIC e+ source
- *H. Hanaki* (Spring-8) plans to send diagnostics expert to CERN for 1 year

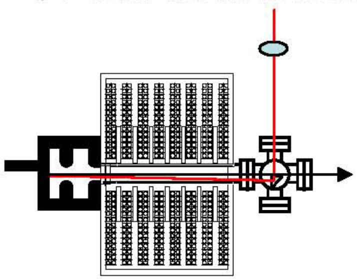

many other topics in the
various working groups…

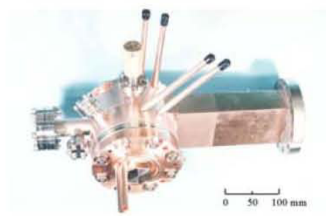
low-emittance e- sources

F. Stephan

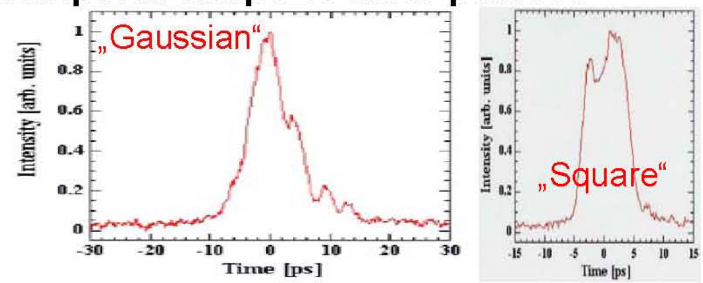
Ultra-Low Emittance & Ultrashort Bunch Production by 1.6-Cell Photocathode RF Gun by Jinfeng Yang (Osaka U.)

- 1.6-cell structure @ BNL GUN-IV with a compensation solenoid magnet
- Cu cathode
- Incident angle of drive laser : ~2°
- Peak electric field : ＞100MV/m@8MW

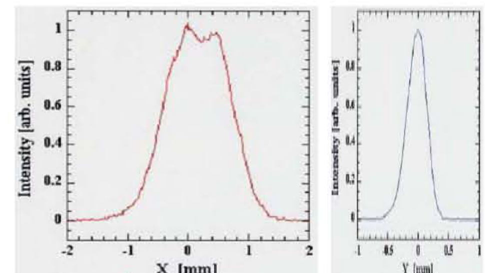


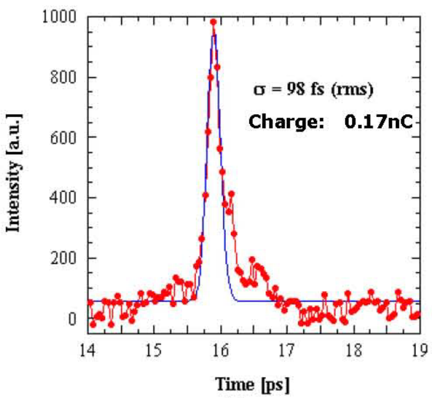


temporal shape of laser pulses:

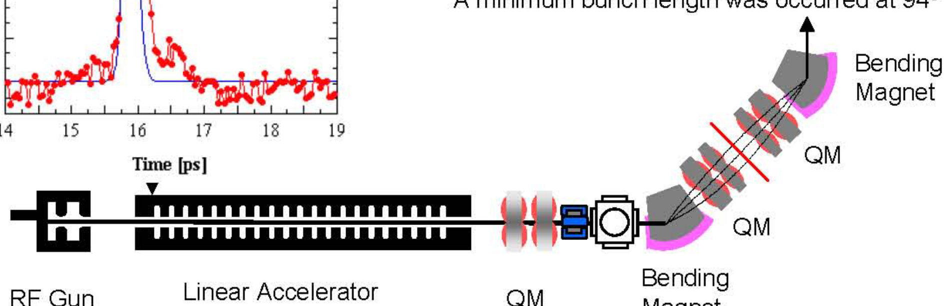


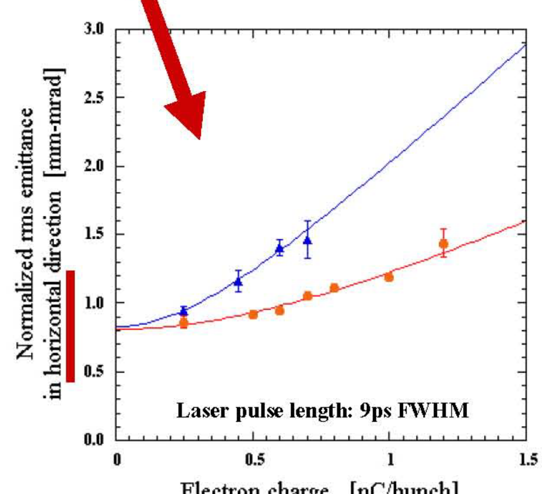
transverse laser distributions @ cathode:





98 fs bunch length was obtained in a compact configuration by the use of RF gun and phase-optimized acc. tube.





also INFN, PITZ, SLAC, BNL, ... photoinjectors

Electron & Photon Beams

Y. Jeong

- γ-ray : 2.4 GeV photon by ***Compton scattering of 6 GeV Spring-8 beam*** and 351 nm Ar+ laser beam *(N. Muramatsu, Osaka Univ.)*
- X-ray :
  - Hard X-ray (~50 keV) ***compact Compton scattering source*** *(F. Sakamoto, Univ. of Tokyo)*
  - Calculation for coherent Attosecond X-ray generation by ***nonlinear Compton scattering*** *(K. Lee, KAERI)*
  - Monochromatic X-ray (4~35 keV) by parametric X-ray generation for imaging application *(Y. Hayakawa, LEBRA)*
- IR : Intense light of 0.8~6 μm radiation from a S-band linac FEL *(Y. Hayakawa, BEBRA)*
- FIR (THz) : High power THz of 100~1200 μm radiation from a compact Microtron FEL *(Y. Jeong, KAERI)*

Compton scattering sources become popular, also ATF, LLNL, MIT, (Ron Ruth), etc.

Next Nanobeam Workshop

BINP

When : 2008, May

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J. Urakawa


thank you for your attention!