ATF2 : Overview

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BDIR Workshop, Jun.20.2005,

Royal Holloway, Univ. of London

- Goals of ATF2
- ATF2 System
- International Collaboration
- Timeline

Technology Challenge of ILC

- High Gradient Acceleration
  Several test facilities: TTF(DESY), STF(KEK), SMTF(FNAL)
- High Luminosity Issues
  - Equally important
  - ATF achieved a small emittance a few pm radian
  - FFTB reached a small beamsize ∼70nm,
    with position jitter 20-40nm
  - Need one more step to nano-meter
    - ⋆ Smaller size by the optics with local chromaticity compensation
    - ⋆ Stabilization
    - ⋆ Learn commissioning/tuning process (recall SLC)

  ⇒ Make use of ATF beam

ATF2 Proposal

- Vol.1
  - Scientific issues
  - Completed yesterday

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

    /WG4notes/atf2/
- Vol.2
  - Collaboration, budget, timeline
  - To be completed by around nanoBeam workshop at Kyoto

Hitoshi Hayano, Yasuo Higashi, Yosuke Honda, Kiyoshi Kubo, Masao Kuriki, Shigeru Kuroda, Mika Masuzawa, Toshiyuki Okugi, Ryuhei Sugahara, Takeshi Takahashi, Toshiaki Tauchi, Junji Urakawa, Vladimir Vogel, Hiroshi Yamaoka, Kaoru Yokoya *(KEK)*

Boris Ivanovich Grishanov, Pavel Logachev, Fedor Podgorny, Valery Telnov *(BINP)*

Deepa Angal-Kalinin, Robert Appleby, James Jones, Alexander Kalinin *(CCLRC/DL/ASTeC)*

Olivier Napoly, Jacques Payet *(CEA/DSM/DAPNIA)*

Hans-Heinrich Braun, Daniel Schulte, Frank Zimmermann *(CERN)*

Tohru Takahashi *(Hiroshima University)*

Yoshihisa Iwashita, Takanori Mihara *(Kyoto ICR)*

Philip Bambade *(LAL)*, Jeff Gronberg *(LLNL)*

Masayuki Kumada *(NIRS)*

Samuel Danagoulian, Sekazi Mtingwa *(North Carolina A&T State Univ.)*

Nicolas Delerue, David Howell, Armin Reichold, David Urner *(OXFORDphysics)*

Jinhyuk Choi, Jung-Yun Huang, Heung Sik Kang, Eun-San Kim, Seunghwan Kim, In Soo Ko *(Pohang Accelerator Lab)*

Philip Burrows, Glenn Christian, Stephen Molloy, Glen White *(Queen Mary Univ. of London)*

Ilya Agapov, Grahame A. Blair, Gary Boorman, John Carter, Chafik Driouichi, Michael Price *(Royal Holloway)*

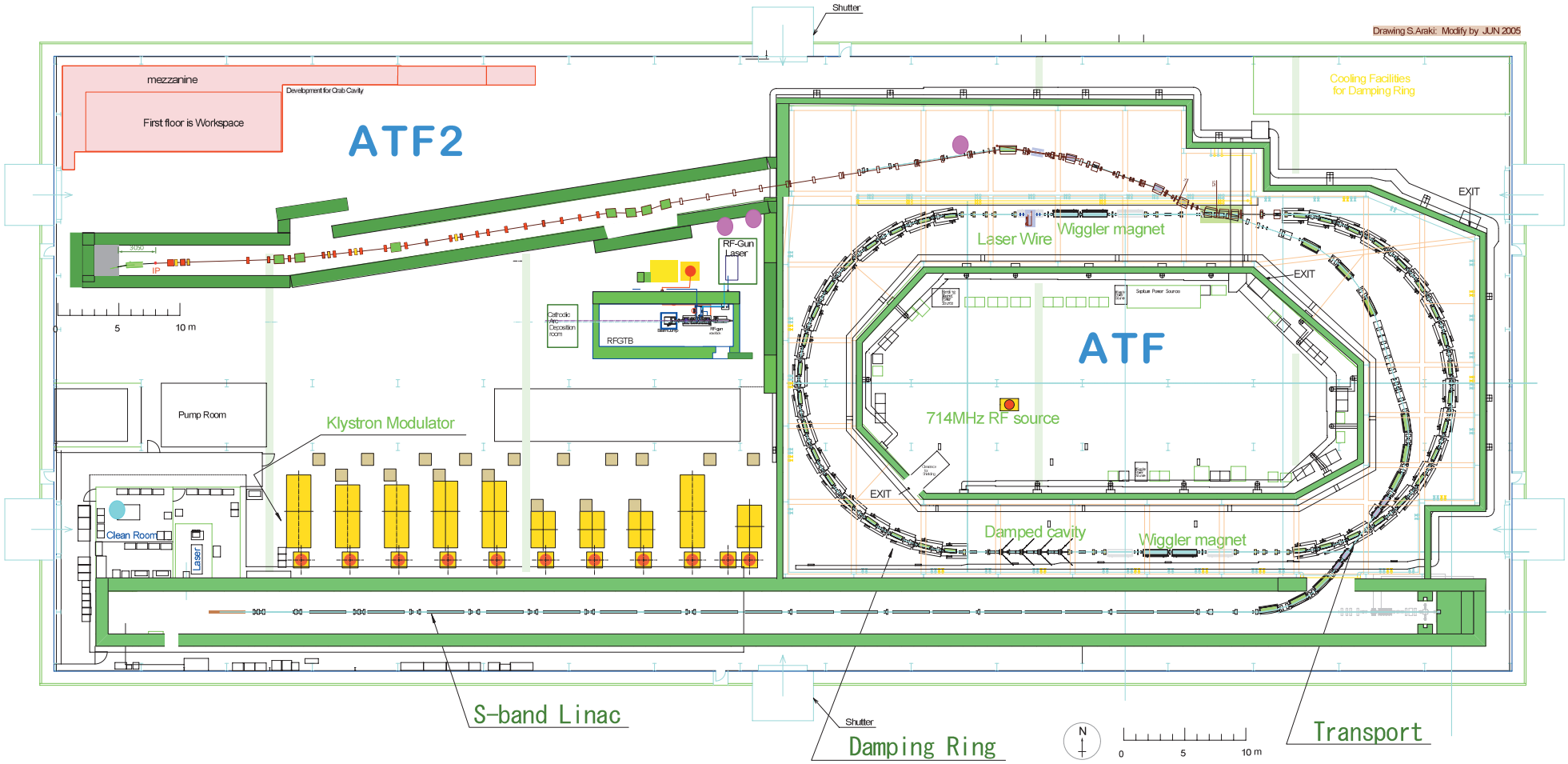
Axel Brachmann, Thomas Himel, Thomas Markiewicz, Janice Nelson, Mauro Torino Francesco Pivi, Tor Raubenheimer, Marc Ross, Robert Ruland, Andrei Seryi, Cherrill M. Spencer, Peter Tenenbaum, Mark Woodley *(SLAC)*

Stewart Takashi Boogert, Stephen Malton *(UCL, London)*

Eric Torrence *(Univ. of Oregon)*

Tomoyuki Sanuki, Taikan Suehara *(Univ. of Tokyo)*

Layout



- So-called optimal layout: Total length of FFS $\approx$ 36m
- Plus diagnostics section and beam-dump

Goals of ATF2

(**A**) Achievement of beam size ∼37nm

(**A1**) Demonstration of a compact final focus system based on local chromaticity correction scheme

(**A2**) Maintenance of the small beam size

(**B**) Control of beam position

(**B1**) Demonstration of beam orbit stabilization with nano-meter precision at IP.

(**B2**) Establishment of beam jitter controlling technique at nano-meter level with ILC-like beam

Optics

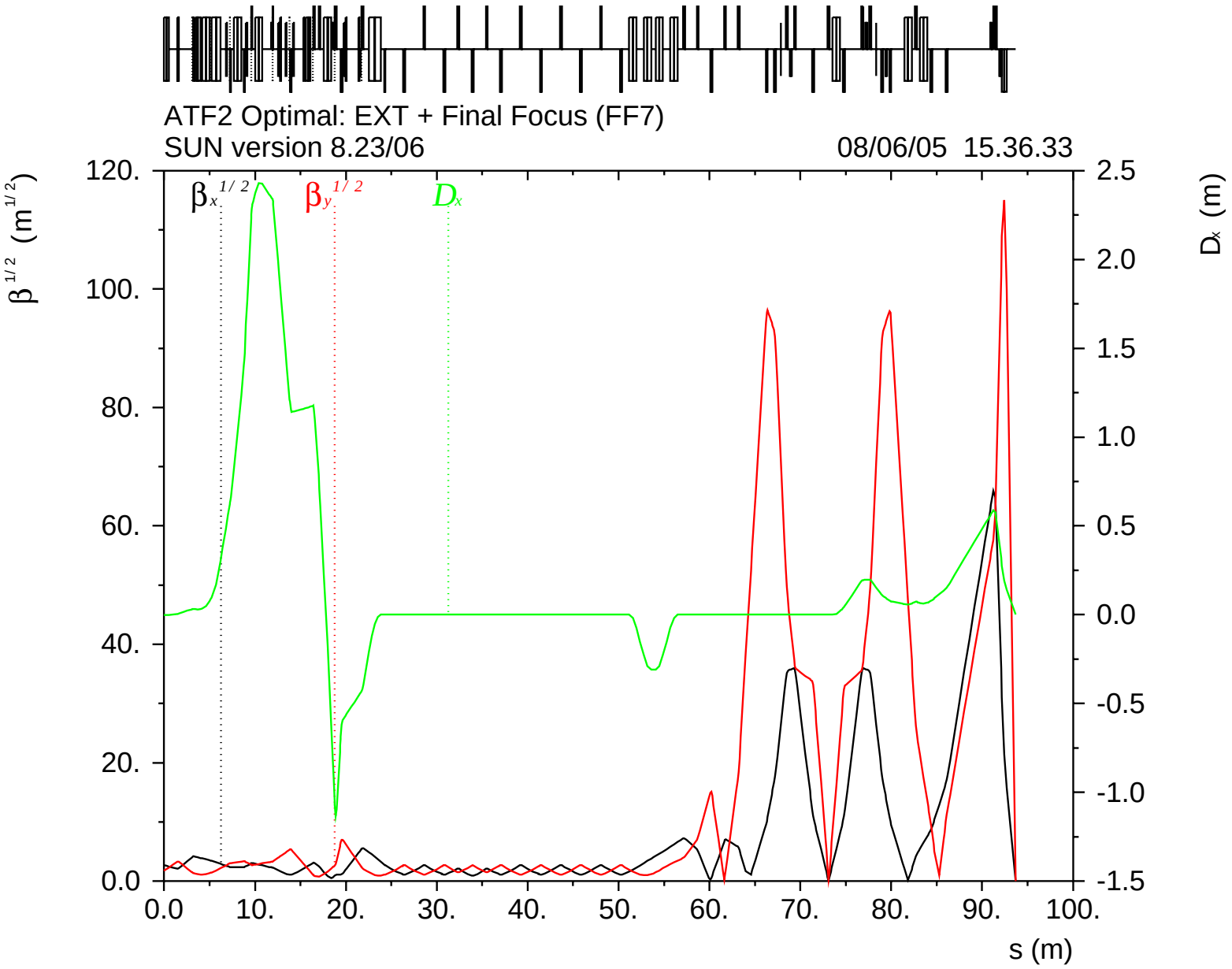
- Local chromaticity correction
- Similar to ILC-FFS in
  - Chromaticity
  - Energy spread similar
  - Aspect ratio
- But different in
  - Geometric emitance
  - Bunch length

ATF2 proposed optics IP parameters in comparison with ILC

	ATF2	ILC
Beam Energy [GeV]	1.3	250
L* [m]	1	3.5 – 4.2
$\gamma\,\epsilon_x$ [m-rad]	3e-6	1e-5
$\gamma\,\epsilon_y$ [m-rad]	3e-8	4e-8
β_x^* [mm]	4.0	21
β_y^* [mm]	0.1	0.4
η' (DDX) [rad]	0.14	0.094
σ_E [%]	~0.1	~0.1
Chromaticity W_y	$\sim 10^4$	$\sim 10^4$
σ_z	8mm	0.3mm

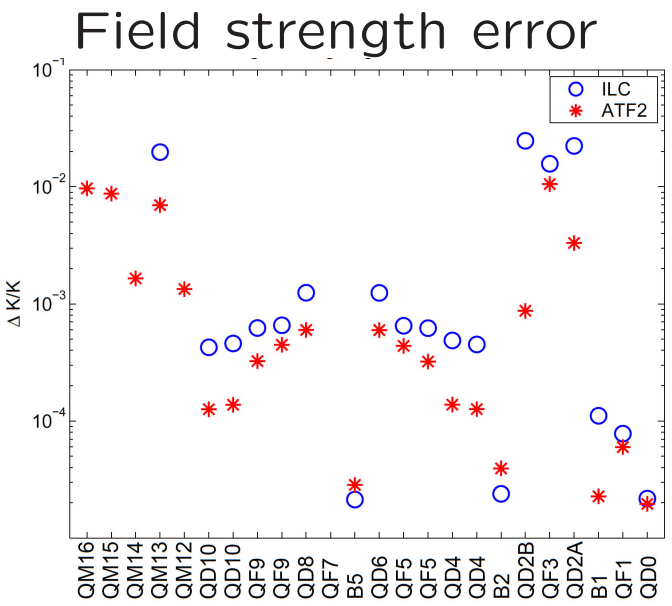
Optics

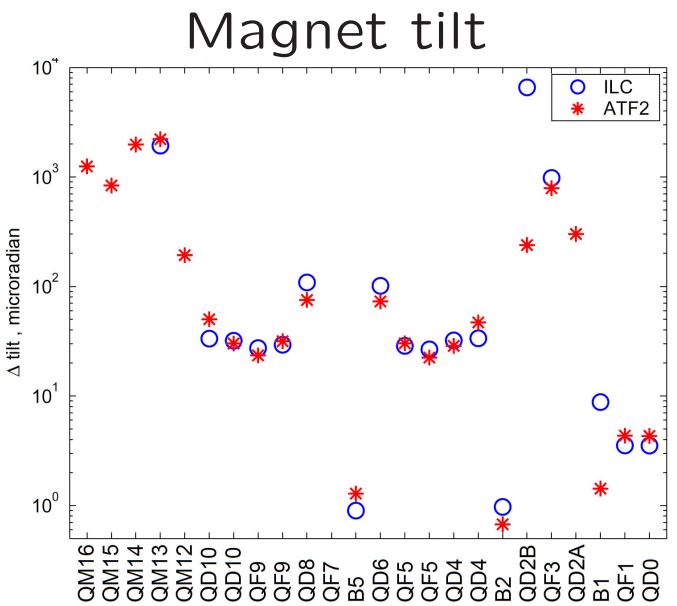
- Scale down from the ILC-FFS (NLC-type)

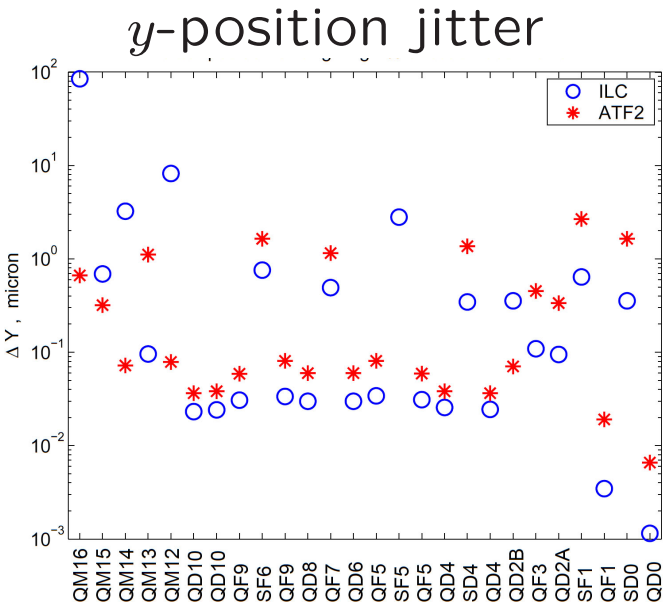


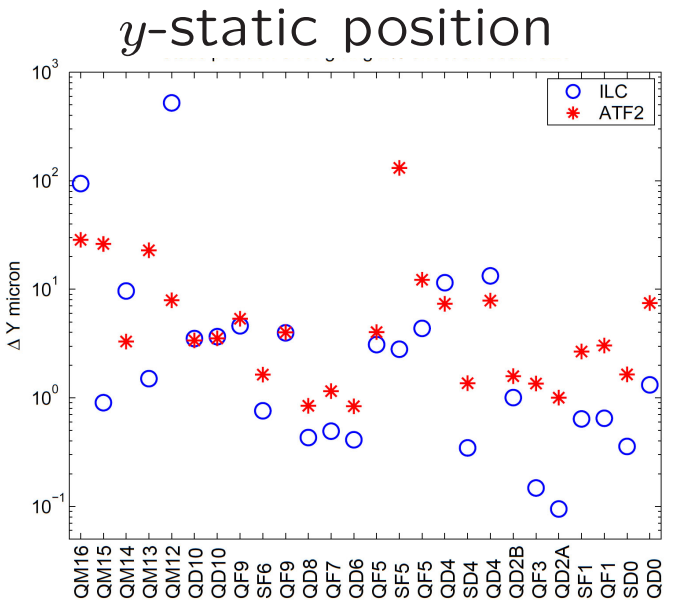
Jitter Tolerances

- For 2% beam size increase
- Mostly lose to ILC-FFS
- Jitter tolerance for beamsize increase is somewhat looser (but tolerance for IP beam position is similar)









Requirements on the ATF Beam

- Position jitter of ATF extracted beam
  - $\lesssim 1/3\ \sigma_y$ for **A** (Present best value almost satisfies this)
  - $\lesssim 1/20\ \sigma_y$ for **B**
- Extracted emittance
  - Nominal value for ATF2 : $\gamma\,\epsilon_y = 3 \times 10^{-8}$ rad·m
  - Present best value : 1.5×10^{-8} (ring), 4.5×10^{-8} (extracted)
- Bunch structure
  - 3 bunches with ∼150ns interval for the 2nd step in **B1**
  - Many bunches with a few nsec interval for **B2**

Required Improvement/Development of Diagnostics Hardware

- Shintake monitor (halve the wavelength from FFTB)
- Cavity BPM ($\sigma_z \approx 8$mm)
  - Q-BPM (100nm resolution)
  - IP-BPM (2nm resolution)
- Extraction kickers
  - One with 300nsec flat-top for **B1** with 3 bunches
  - One with a few nsec rise time for **B2**
- IP feedback system for **B**

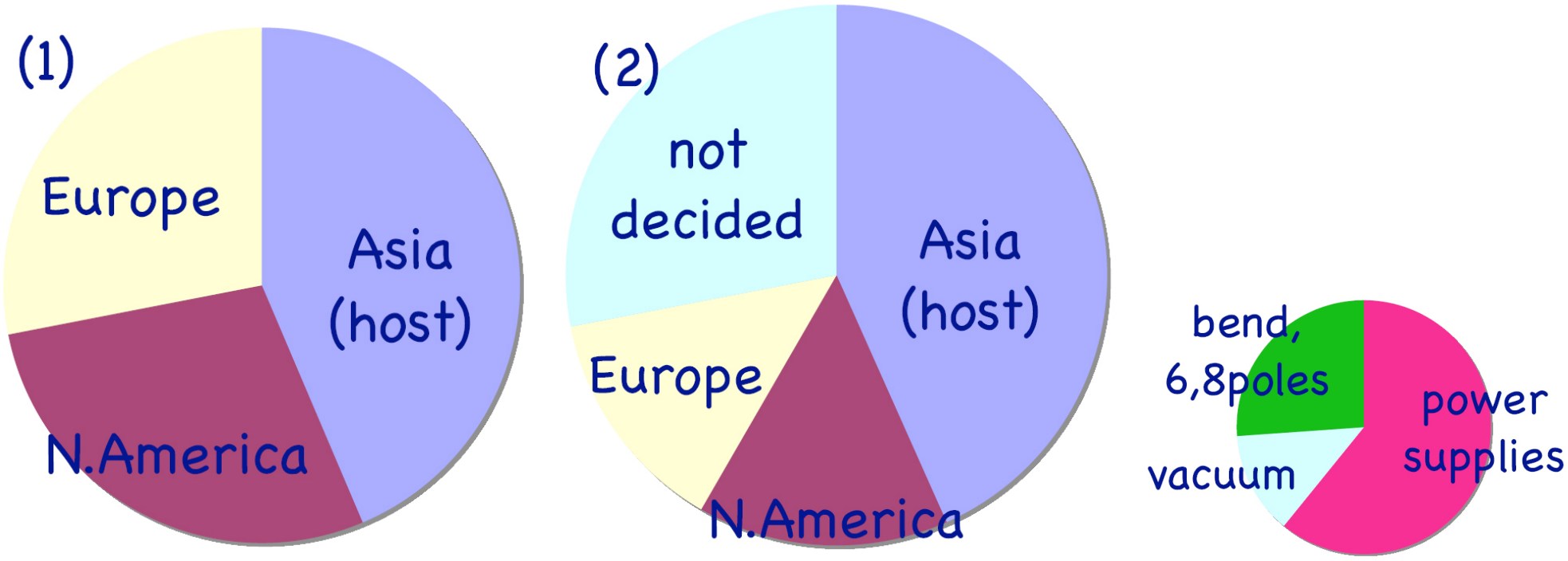
Collaboration for Construction

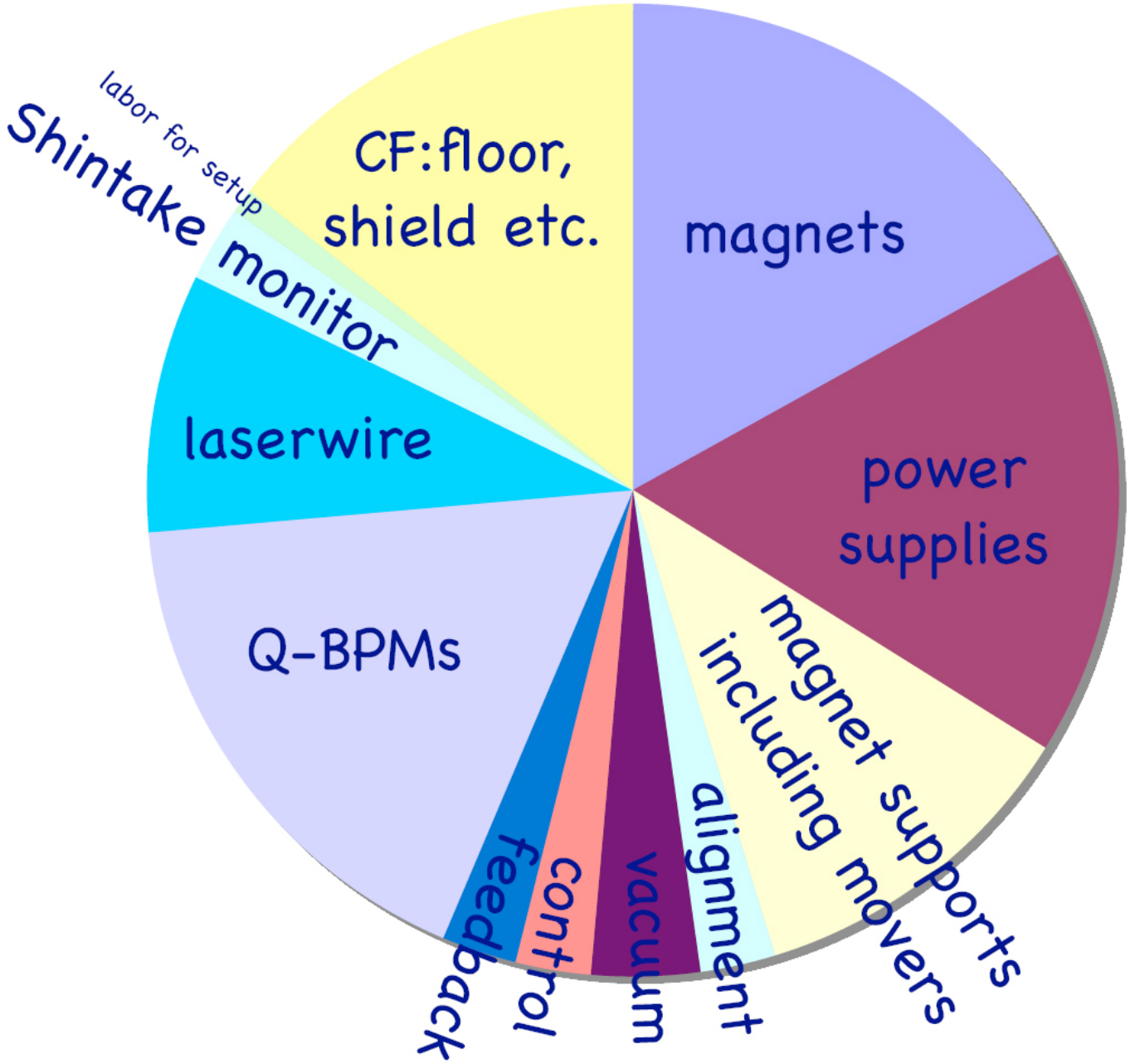
- Design study by all (SLAC is the most active)
- Hardware components

Magnets	Quad body by IHEP, movers by SLAC
Q-BPM	body by PAL, electronics by SLAC
Kicker	SLAC, VLEP
Laser wire	UK
Fast fdbk	UK
Shintake mon.	Tokyo Univ.

Budget Sharing

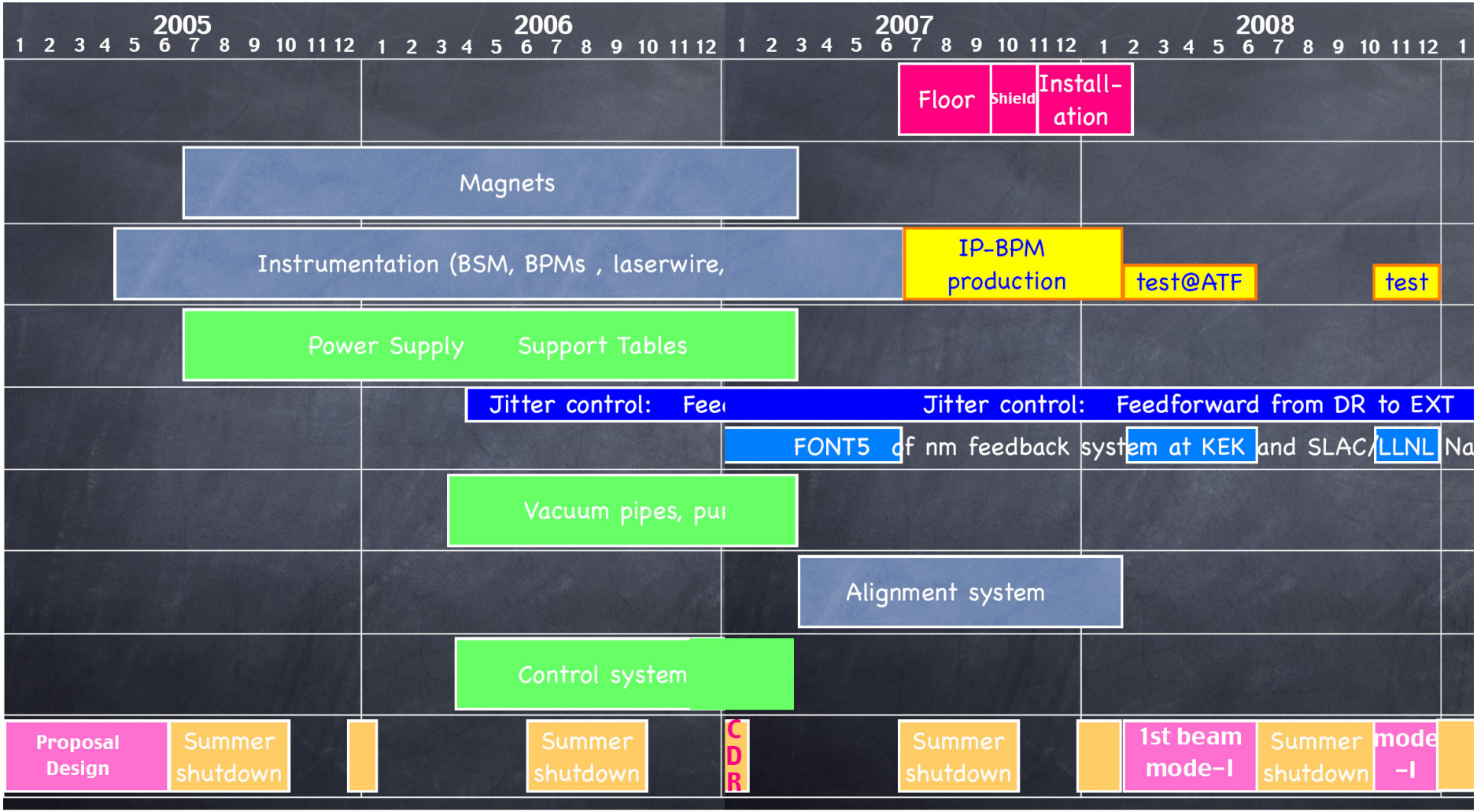
- Total demand $\approx$ 4 Oku¥ (Oku¥ $\approx$ M$)
- Infrastructure (floor refurbishment, shielding) $\approx$ 0.6 Oku¥
- Try to share the rest roughly equally by 3 regions
- Operation cost (incl.ATF) $\sim$ 1.5 Oku¥/year to be paid by KEK




CF:floor,
shield etc.
magnets
power
supplies
magnet supports
including movers
alignment
vacuum
control
feedback
Q-BPMs
laserwire
monitor
Shintake
labor for setup

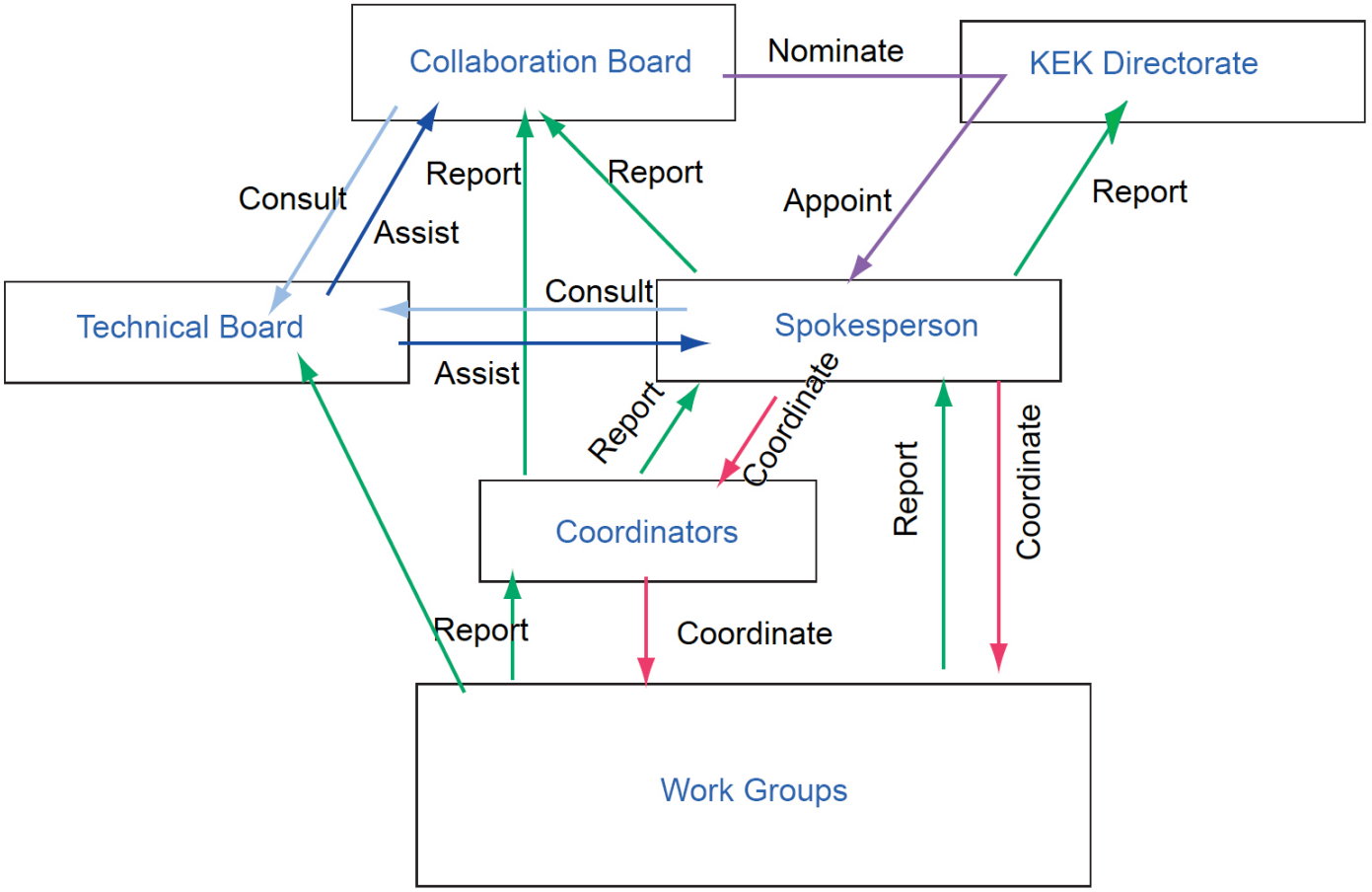
Time Schedule

- 3 possible schedules (commissioning Feb 2007, Oct 2007, Feb 2008)
- The 3rd one preferred



ATF Organization

- ATF MoU
  - Final polishment
  - Signing process s
- Structure
  - Spokesperson (+ deputies)
  - ICB (International Collaboration Board) incl. 3 Regional Dire of GDE
  - TB (Technical Board)
  - System/Group coodinators
- Members of ICB to be nominated soon



Come to ATF2 Sessions

ATF2-I, 13:30-15:30, Jun.22 (Wed)

- Tolerances to the design of Magnet and Power supplies
- Major production components and key instrumentation
- Commissioning strategy

Talks (10 minutes + 5 minutes question/answer)

J.Jones	Optics and tolerances for magnet, mover and power supplies
F.Zimmermann	Commissioning strategy
K.Kubo	Improvement of the ATF extraction line; contents discussion
Y.Honda	Q- and IP-BPM: design and plan
J.Frisch	Electronics of Q-BPMs
T.Sanuki	Shintake monitor (background study at the ATF)
N.Terunuma	Control system

ATF2-II, 16:00-17:00, Jun.22 (Wed)

- International collaboration of the ATF2

Talks (5 minutes or less for each)

J.Urakawa	Important issues on the MOU of the ATF/ATF2 for discussion
K.Yokoya	KEK contribution and comment on the relation to GDE
T.Raubenheimer	SLAC contribution
N.Walker	DESY contribution
D.Schulte	CERN contribution
P.Burrows	UK contribution (including FONT4,5)
P.Bambade	French contribution