Future Plans for the ATF

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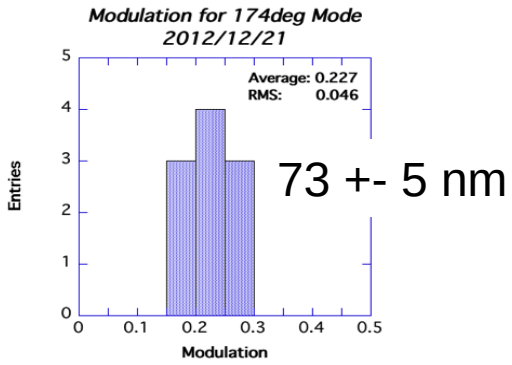
3/12/2013 ILC-TB meeting

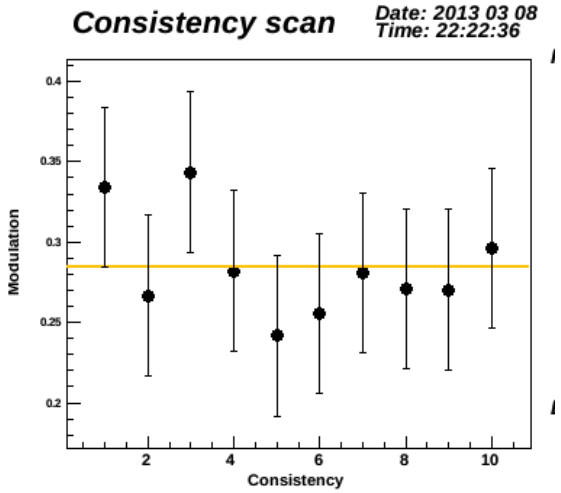
LC related R&Ds at present

- **R&Ds in DR**
  - Low emittance study
    - achieve 2 pm vertical emittance (4-5 pm achieved in 2003)
    - not enough time at present because of the ATF2 priority
  - γ-ray generation by optical cavity
    - positron source, γ-γ,
    - KEK/Hiroshima, LAL
- **R&Ds in ATF2 beamline**
  - Goal-1: small beam, 37 nm
  - Goal-2: 2 nm stabilization

ATF2 status; goal-1, small beam

- **Improvement of the hardware in 2012 was successfully done.**
  - beam size monitor, Quadrupole etc.,…
- **Modulation of the Compton signal, correspond to the 70 nm beam size, was obtained in December 2012.**



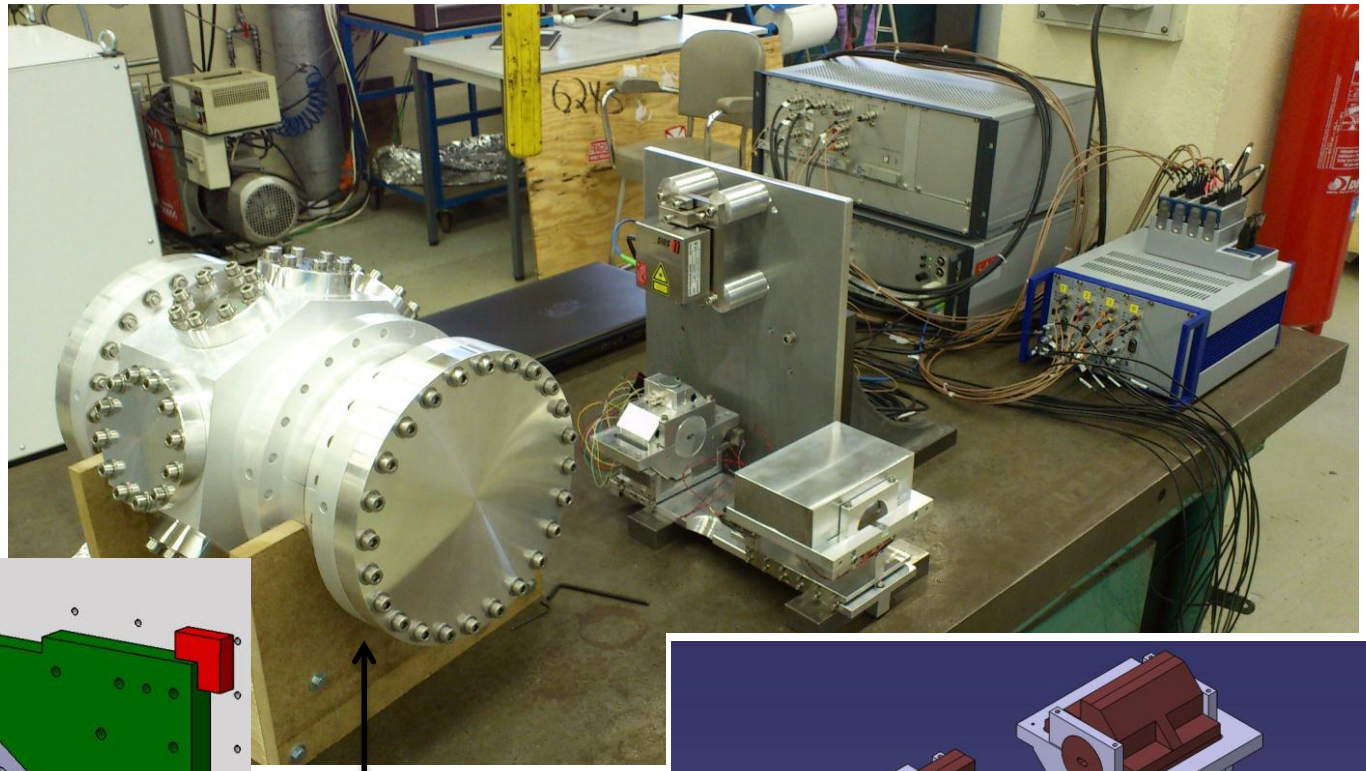


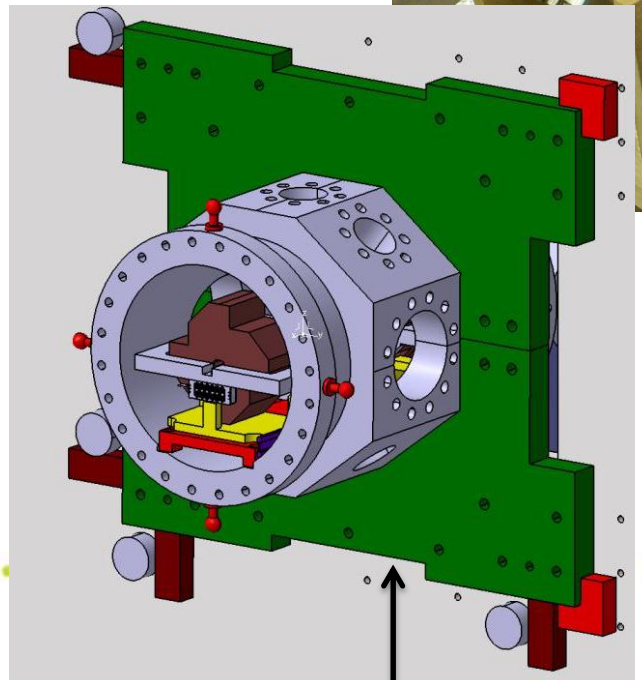
- **Good reproducibility**
- **Study with a beam below 100 nm makes better understandings about …**
  - beamline errors; short coil, magnet miss-alignment
  - beam size monitor errors
    - Errors make the modulation smaller (correspond to larger beam size) than the real
      - alignment of laser against a beam (fringe tilt), laser spatial coherency, polarization etc.,…
  - Wake field effect

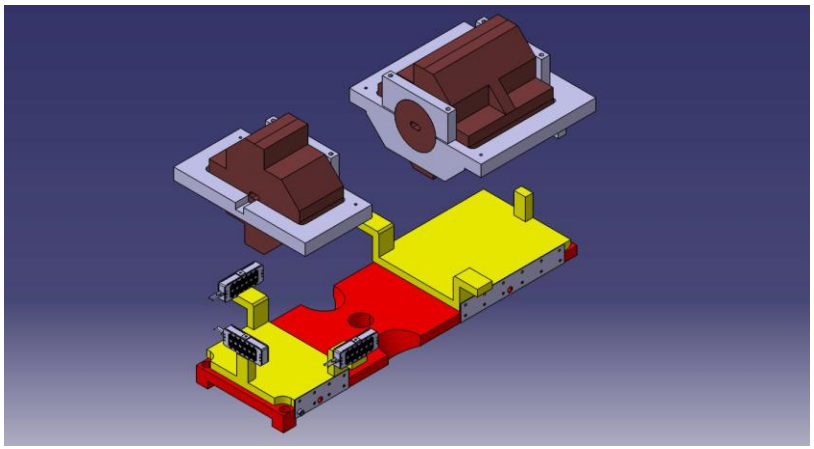
ATF2 status; goal-2, stabilization

- **Proto-type study at ATF2-IP**
  - Intra-train feedback system (FONT) has been installed at the ATF2-IP as a initial study of the nm-level orbit stabilization.
  - It uses a proto-type IP-BPM and readout electronics.
  - Studies are in progress using 2 or 3 bunches/pulse from DR.
- **Preparation of new IP setup**
  - Three cavity BPMs, low-Q for multi-bunch beam, and their readout electronics are fabricated and under testing (KEK/KNU). A beam test at ATF linac had been done.
  - New vacuum chamber with the piezo movers for BPMs are under testing at LAL.
- **Unified system will be set in this summer**

for Goal-2: New IP chamber and BPM movers at LAL



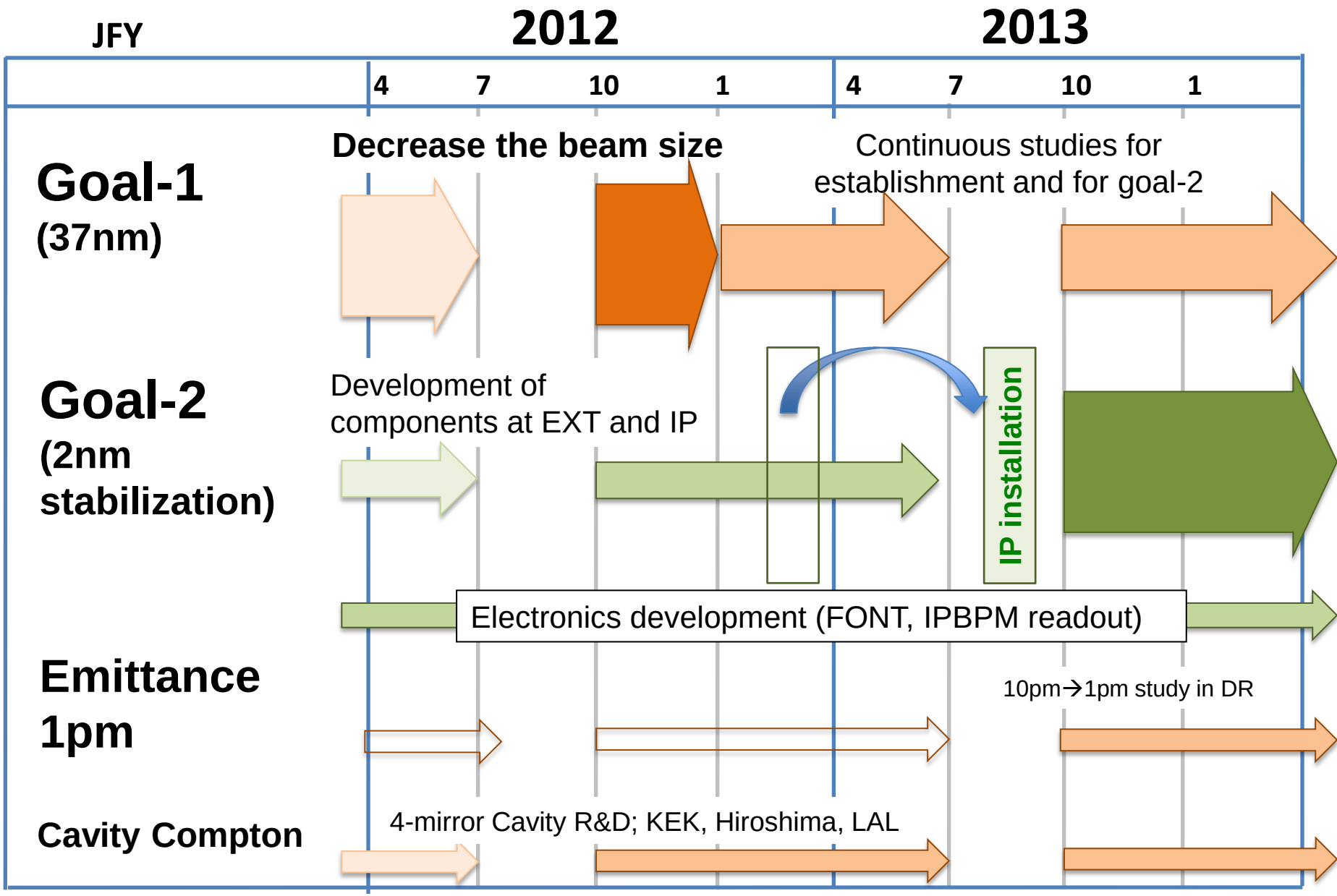




near future schedule

- **GDE/KEK ATF2 Technical Review**
  - April 3-4 (KEK)
- **Dedicated beam runs for ATF2 goal-1**
  - Two weeks, May 13-24
  - 37 nm beam size R&D
  - keep the beamline settings for ATF2 program
- **IP upgrade for the ATF2 goal-2**
  - 2 nm stabilization R&D
  - install three IPBPMs with piezo movers into IP in this summer
  - Intra-train position feedback (FONT) using IPBPM signal
  - Re-alignment of the IP beam size monitor
- **Grand motion feedback study**
  - 15 GM sensors (CERN, LAPP…) will be installed in the ATF2 beamline in this summer

Background: ATF/ATF2 in 2012-2013



Long term plans

- **Past discussions proposed for the KEK roadmap 2014-2018**
  - Present R&D will be reconsidered at the end of JFY 2013
  - Widening the research program not only ILC but also other fields.
  - Obtain grants for new researches
  - researches under the global collaboration

- **Final draft of the new KEK roadmap**
  - http://kds.kek.jp/conferenceDisplay.py?confId=11728
  - 2.3 Development of Particle Accelerators and Related Technologies at KEK
    - KEK will establish the latest component technologies, as discussed above, for use in future accelerators within and outside of Japan. The ATF and Superconducting RF Test Facility (STF) are important vehicles for performing these tasks in the context of both the technology and international collaboration.

Target of the ATF future plan

Researches with low emittance and small beam

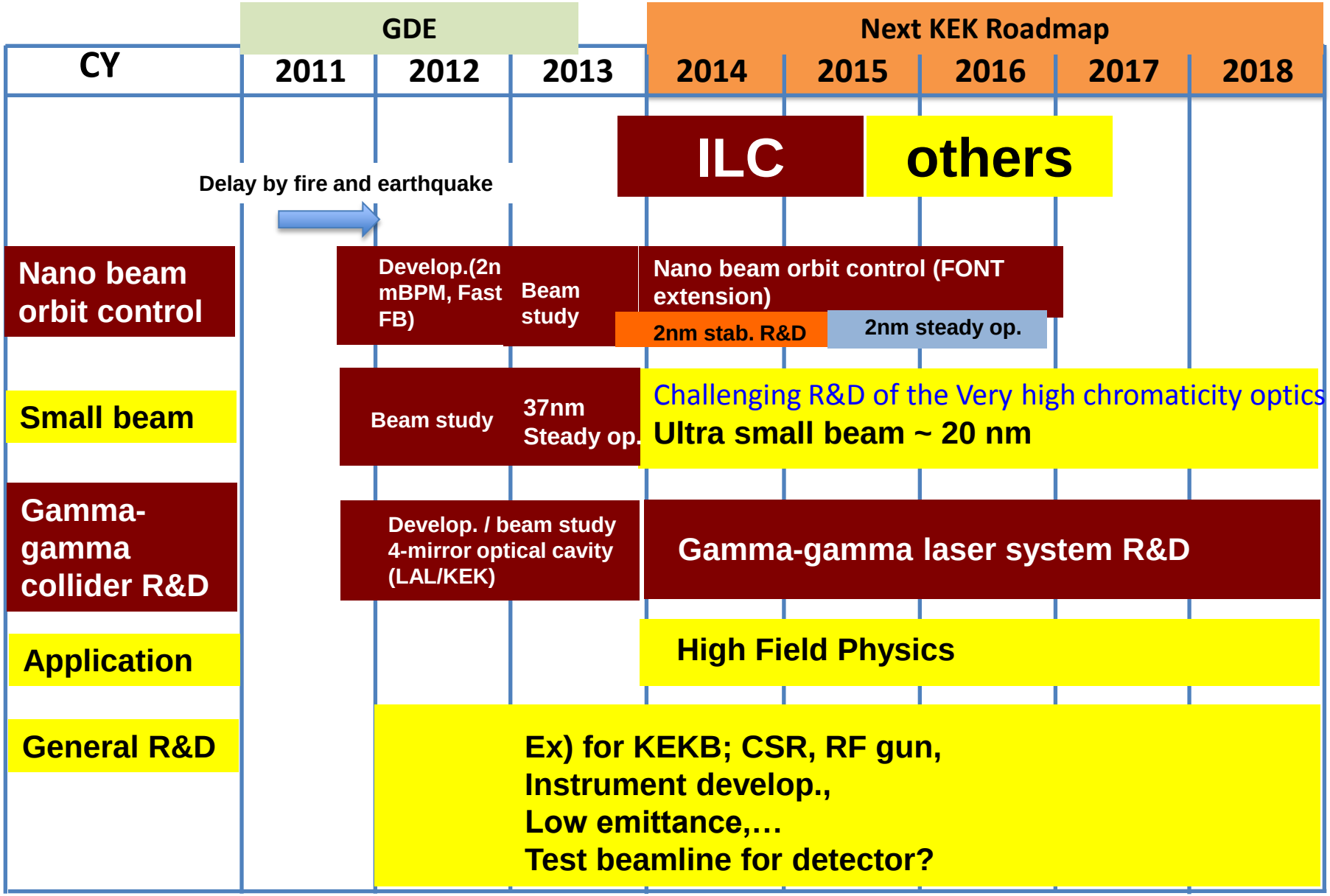
- Advanced Accelerator technology
- **Multilateral cooperation**
- **Education of young researchers**

ILC related R&D（50%）

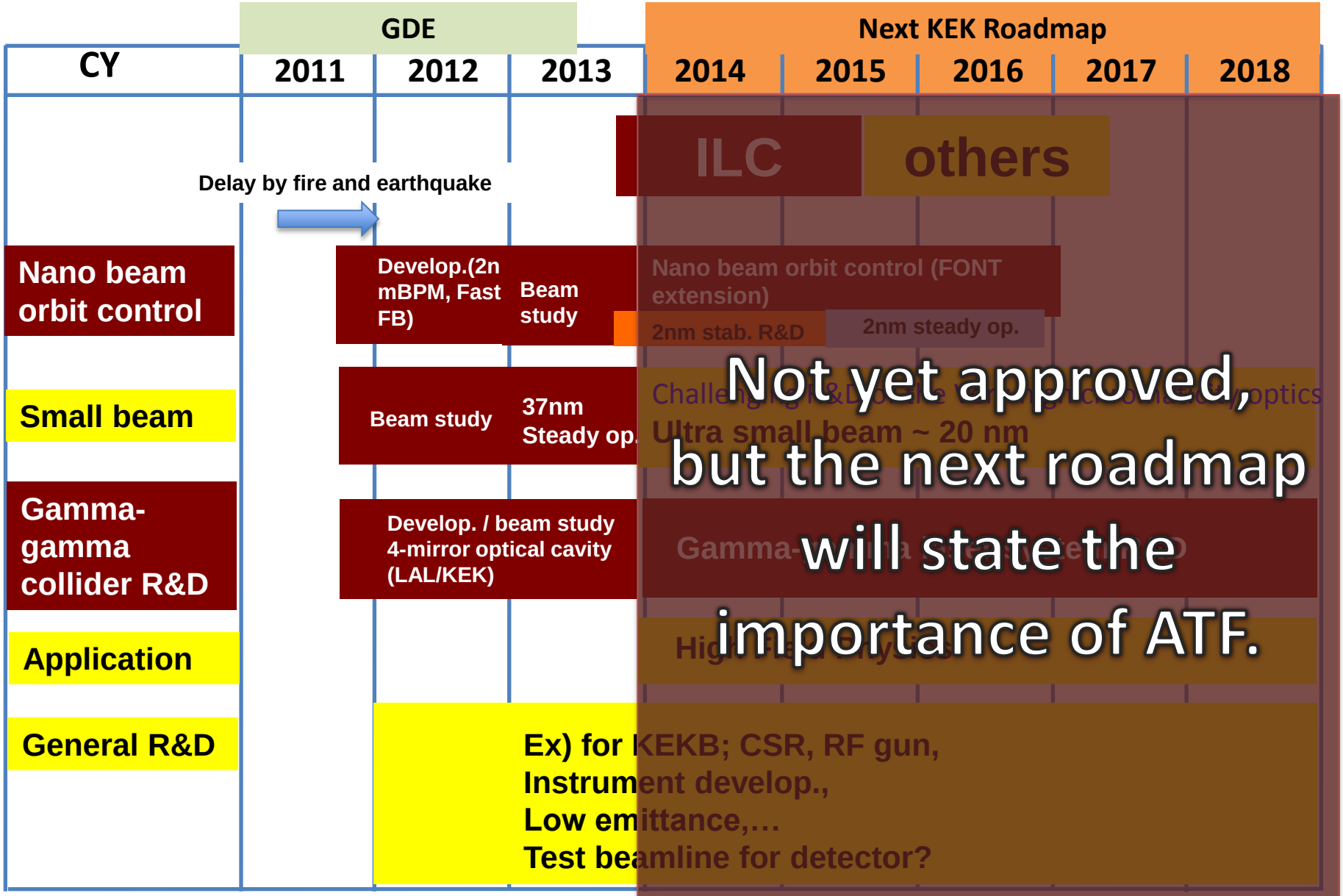
- Achievement of the remaining ATF goal
- Establishment of technology

Other R&D（50%）

ATF Future Plan



ATF Future Plan



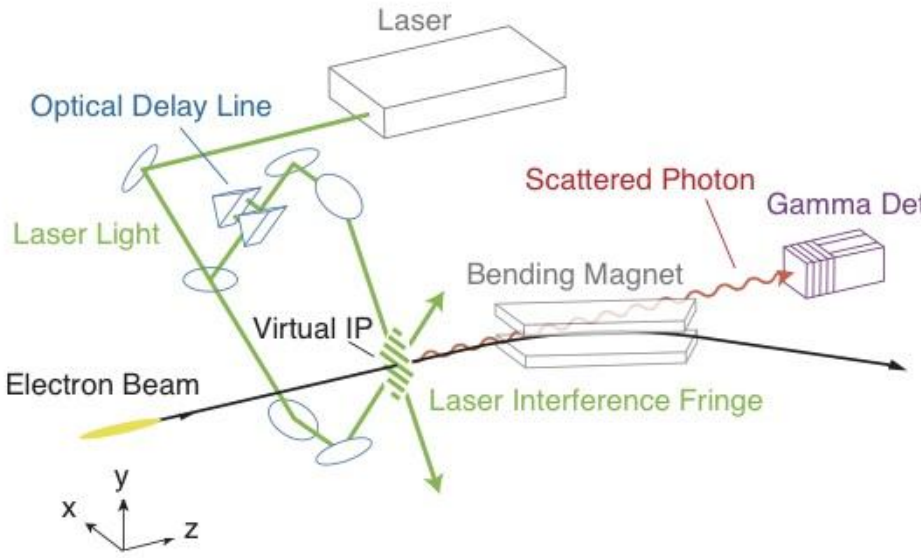
Budget?

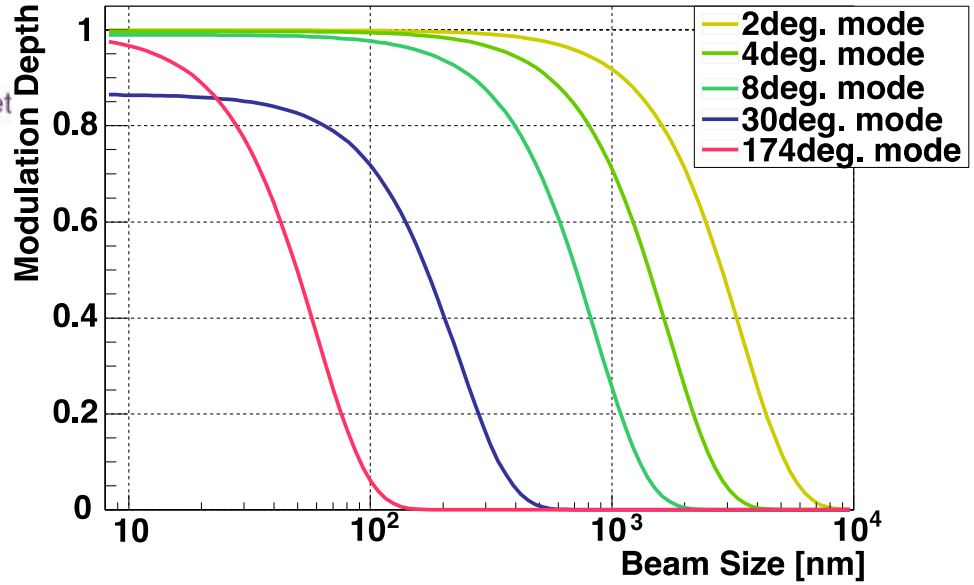
- **We may face with a heavy reduction of budget in coming years.**
  - Down to 60% of the past years?
- **A minimum budget to keep the annual operation is offered by KEK-LC office.**
  - will be spent for the maintenance labor
  - 22 beam weeks in FY2013 (as usual)
  - Installations for ATF2 goal-2 can be done in this summer. A half of them are in-kind contribution.
- **additional budget?**
  - keep trying to apply grants for new researches
  - New budget for ILC?

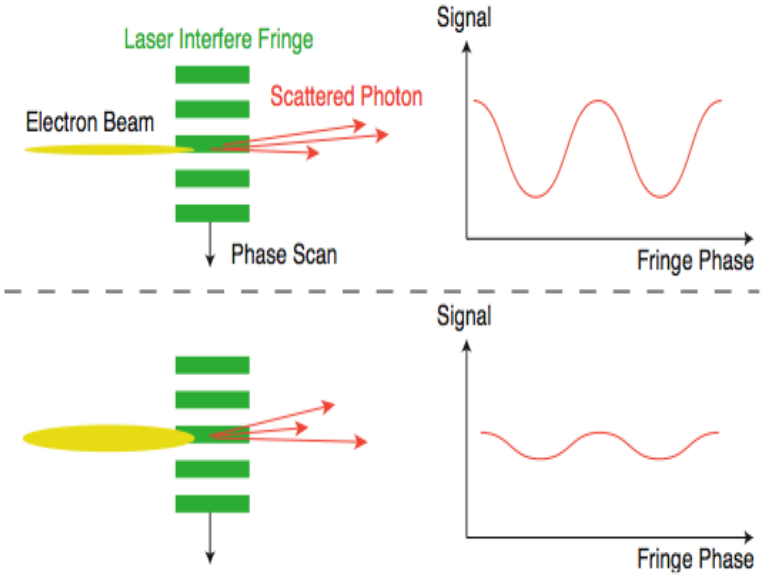
- backups

Nanometer Beam Size Monitor

Univ. Tokyo / KEK







	174°	30°	8°	2°
Fringe pitch	266 nm	1.03μm	3.81μm	15.2μm
Minimum	**25 nm**	100 nm	360 nm	-
Maximum	**100 nm**	360 nm	-	6 μm

Proposal : nm small beam

- Explore the small beam after the 37 nm at ATF2
- Collaborated R&D for CLIC
- Demonstration of the final focus with **the Very high chromaticity optics** and establish the beam tuning method → **20 nm beam**

Critical Developments

- Beam Size Monitor (Highly stable Laser Interference Fringe Monitor at ATF2); Modulation 0.8 (37nm) → 0.9 (20nm)
- Beam Stabilization (IP-BPM + FONT)
- Renew the Final Doublet Quadrupole (QF1) at ATF2;
  CERN proposed In-kind Contribution

CLIC R&D proposals for ATF/2/3

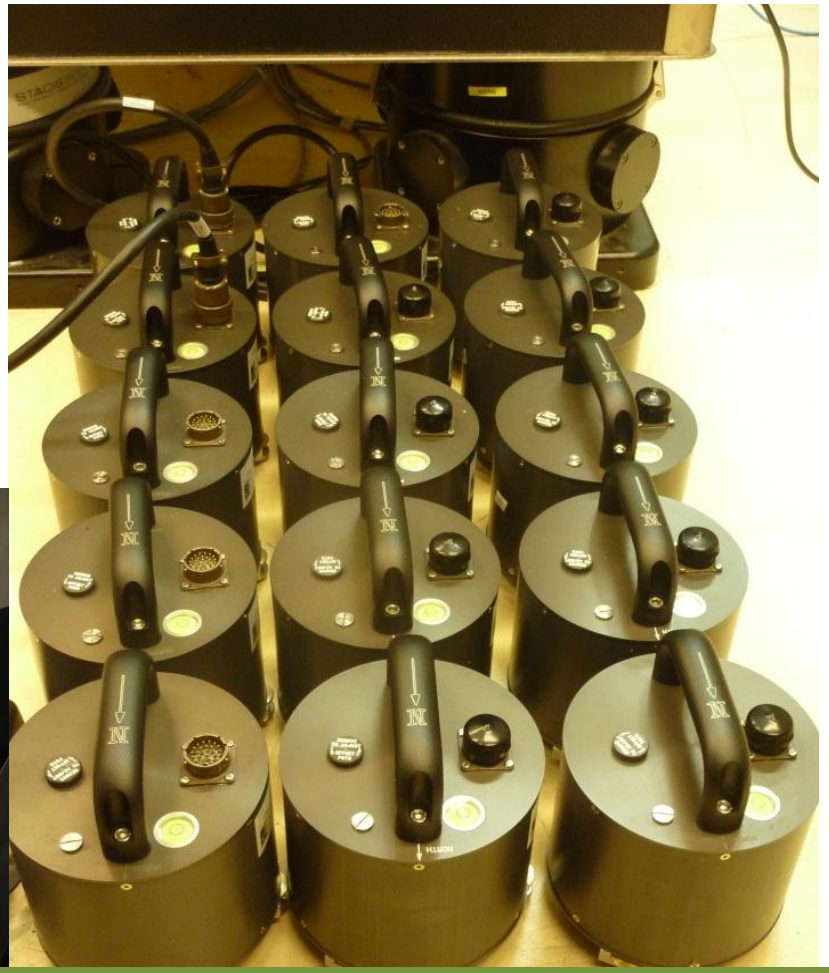
- CLIC challenges are pushing technology in different areas of linear colliders
- Beam tests are a major aspect of the feasibility demonstration
- ATF facility (being half a collider!) represents a unique opportunity for the following topics:
  - **Ground motion orbit feed forward**
  - **Ultra-low beta***
  - **CLIC DR extraction kickers**

Grand Motion Sensors prepared by LAPP

52000€ investment +
approx 3 people from LAPP
(A. Jeremie et al)

CERN is providing low noise cables + approx 5 people.

Past experience
B. Bolzon



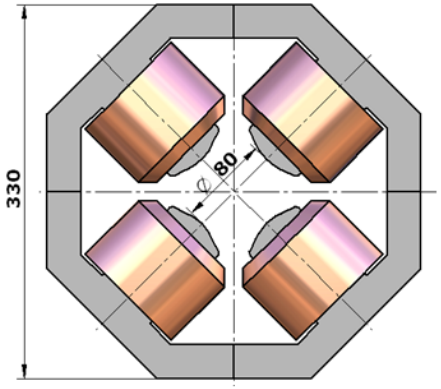
Ultra-low β*

- Pushing the σ^*_y below the 37 nm is of interest for both CLIC and ILC
- Multipolar errors in FD already force an increase of β^*_x for the Nominal lattice
- Replacing FD quads with high accuracy magnets would allow nominal β^*_x for the Nominal lattice and reaching σ^*_y of 25 nm for the Ultra-low β* lattice.
- Goal-1 has to be reached before Ultra-low β*!

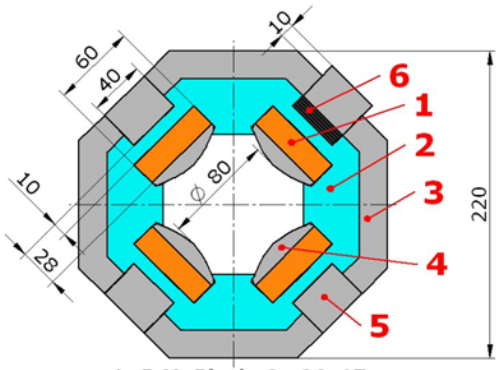
…from FJPPL-FKPPL WS on ATDF2 in March 2012:

Magnet design

1) EM quadrupole:

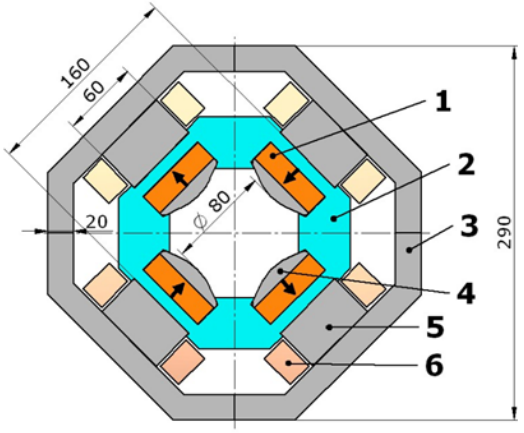


2) PMQ



1- P.M. Block, Sm2Co17
2- Aluminium core
3- Return Yoke, AISI 1010
4- Pole Tip, AISI 1010
5- Tuning block, AISI 1010
6- Spacers, Stainless steel

3) Hybrid(based on PMQ)



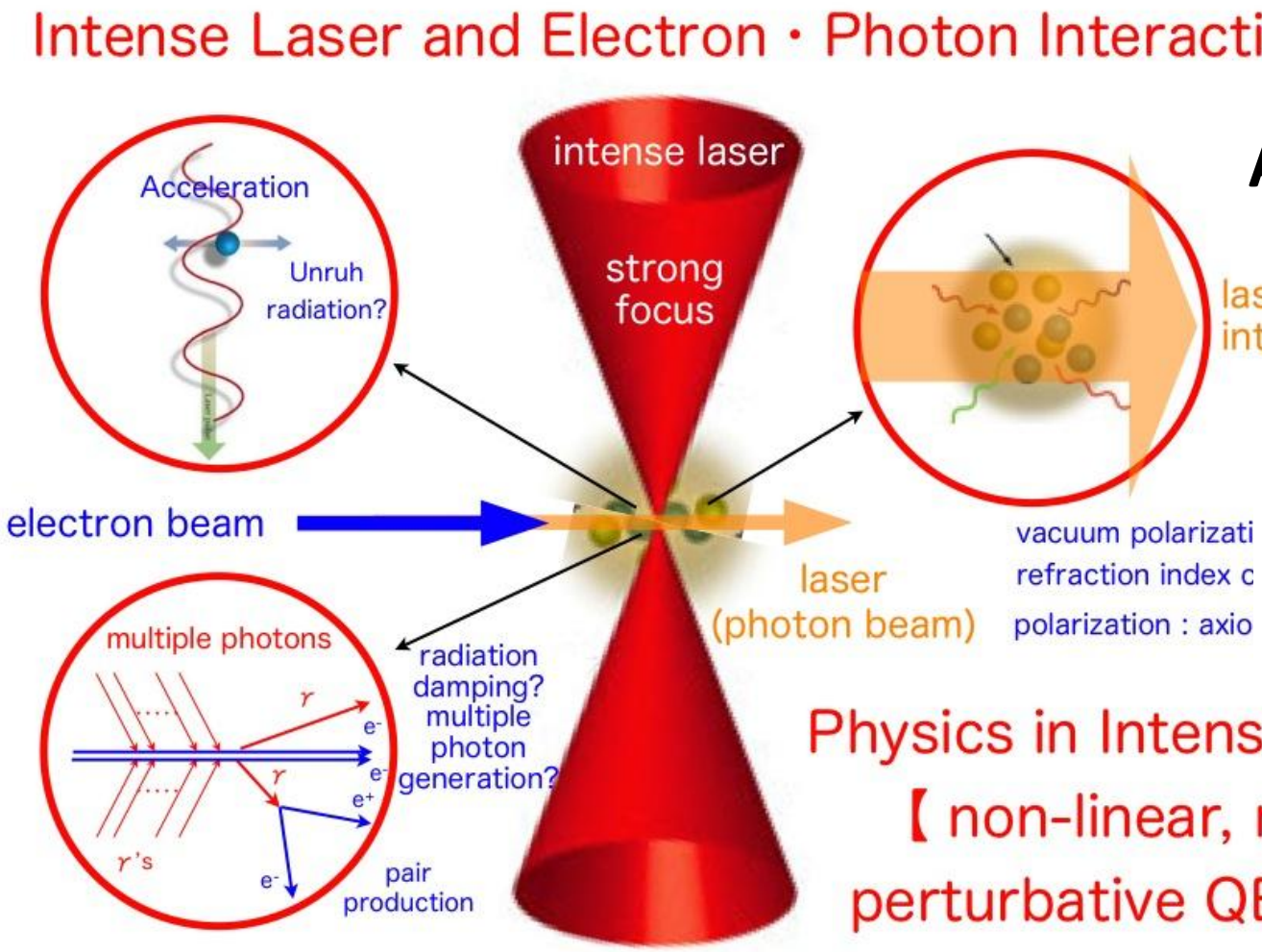
The PMQ solution looks more preferable over than the EMQ and the hybrid magnet due to the following reasons:

- Compactness of the PMQ structure
- No vibration of the magnet induced by an active water cooling system which is required for EMQ option.
- No failures in the power supplies, which increases the reliability of the magnet.
- Maintenance of coils, cables and power supplies is not required.
- Set to zero operational costs related to electrical energy and cooling systems.
- PMQ can be assembled from one or two pieces, while for the EMQ option only four pieces yoke structure is possible.
- The proposed PMQ design has an ability to suppress the possible higher order multipole errors performed by the tuning blocks, while for the EMQ and the hybrid cases an additional trim coils and four independent power supplies are needed.

14th ATF2 Project Meeting 26-27 June 2012: A. Bartalesi, M. Modena, A. Vorozhtsov on "New Final Doublets"

Proposal : High Field Physics

Apply the Grant for Scientific Researches



ATF2 small beam

Development

- **200 TW laser**
- **Detector**