Collaboration Issues

- Resources. Schedule. International collaboration –

Hosting ATF

Nobuhiro Terunuma, KEK

ATF2 Technical Review, April3-4, 2013, KEK

Contents

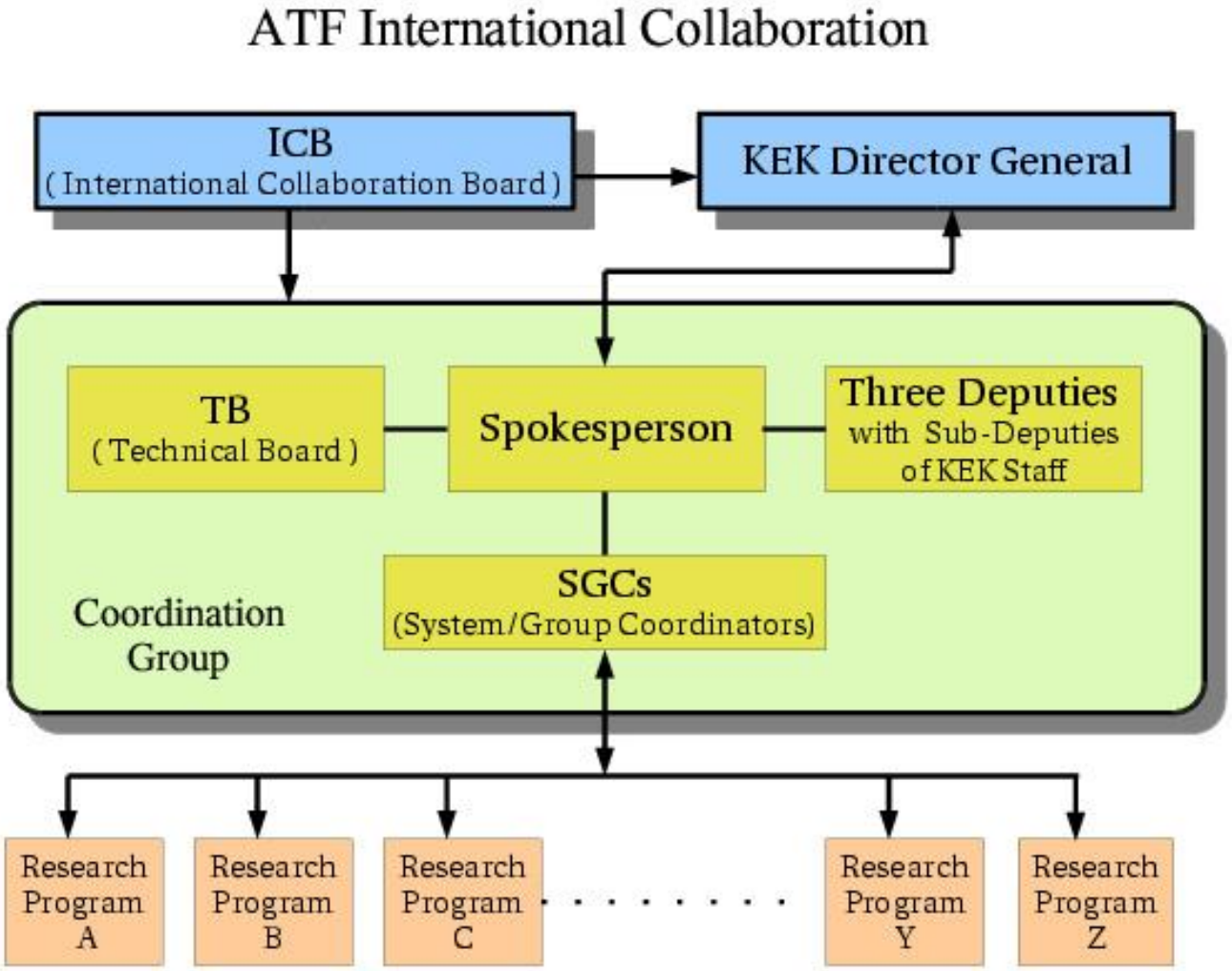
- **Framework of the ATF International Collaboration**
- Human resources
- Budget
- Schedule, Future plans

ATFに参加している代表的研究機関
- ATF International Collaboration -

欧州原子核研究機構(CERN)
ドイツ(Germany)
　電子シンクロトロン研究所(DESY)
フランス(France)
　IN2P3; LAL, LAPP, LLR
イギリス(UK)
　Univ. of Oxford
　Royal Holloway Univ. of London
　STFC, Daresbury
　Univ. of Manchester
　Univ. of Liverpool
　Univ. College London
イタリア(Italy)
　INFN, Frascati
スペイン(Spain)
　IFIC-CSIC/UV
ロシア(Russia)
　Tomsk Polytechnic Univ.

アメリカ(USA)
　SLAC国立加速器研究所
　ローレンス・バークレー国立研究所(LBNL)
　フェルミ国立加速器研究所(FNAL)
　ローレンス・リバモア国立研究所(LLNL)
　ブルックヘブン国立研究所(BNL)
　コーネル大学(Cornell Univ.)
　ノートルダム大学(Notre Dome Univ.)

日本(Japan)
　高エネルギー加速器研究機構(KEK)
　東北大学　(Tohoku Univ.)
　東京大学　(Univ. of Tokyo)
　早稲田大学(Waseda Univ.)
　名古屋大学(Nagoya Univ.)
　京都大学　(Kyoto Univ.)
　広島大学　(Hiroshima Univ.)
中国(China)
　中国科学院高能物理研究所(IHEP)
韓国(Korea)
　ポハン加速器研究所(PAL)
　キョンプク大学(KNU)
インド(India)
　Raja Ramanna Centre for Advanced Technology



ICB meeting; Once/year

TB meeting (joint meeting with SGCs); Twice/year

ICB membership 2012 April

17 members

Philip Burrows (Chair)	JAI			
Kaoru Yokoya	KEK (GDE)			
Junji Urakawa	**KEK**	<< <	Noboru Sasao	Okayama Univ.
Sachio Komamiya	Tokyo Univ.			
Masakazu Washio	Waseda Univ.			
Jie Gao	IHEP			
E. S. Kim	Kyungpook N.Univ.			
Nan Phinney	**SLAC**	<< <	Ewan Paterson	SLAC
John Corlett	LBNL			
Marc Ross	FNAL			
Michael Harrison	BNL (GDE)			
David Rubin	**Cornell Univ.**	<< <	Maury Tigner	Cornell Univ.
Brian Foster	Oxford U. (GDE)			
Grahame Blair	RHUL			
Steinar Stapnes	**CERN**	<< <	J.P. Delahaye	CERN
Eckhard Elsen	DESY			

Updates

TB membership (12)

P. Bambade	LAL (chair)
G. White	SLAC (co-chair)
K. Yokoya	KEK
T. Sanuki	Tohoku Univ.
J. Gao	IHEP
E. S. Kim	KNU
E. Elsen	DESY
A. Jeremie	LAPP
F. Zimmermann	CERN
S. Boogert	RHUL
M. Wendt	FNAL
N. Phinny	SLAC

SGC membership (16) 2012 April

N. Terunuma	KEK	Spokesperson
S. Kuroda	KEK	Deputy for Operation
T. Okugi	KEK	Sub-deputy
A. Seryi	JAI	Deputy for ATF2
G. White	SLAC	Sub-deputy
T. Tauchi	KEK	Deputy for Maintenance
T. Naito	KEK	Sub-deputy
J. Gao	IHEP	IHEP contribution
E. S. Kim	KNU	Low-Q IP-BPM
K. Kubo	KEK	Beam Tuning
T. Sanuki	Tohoku U.	Tohoku-U contribution
P. Burrows	JAI	FONT
F. Zimmermann	CERN	CERN contribution
P. Bambade	LAL	LAL contribution
S. Boogert	RHUL	Laser Wire
M. Wendt	FNAL	DR BPMs

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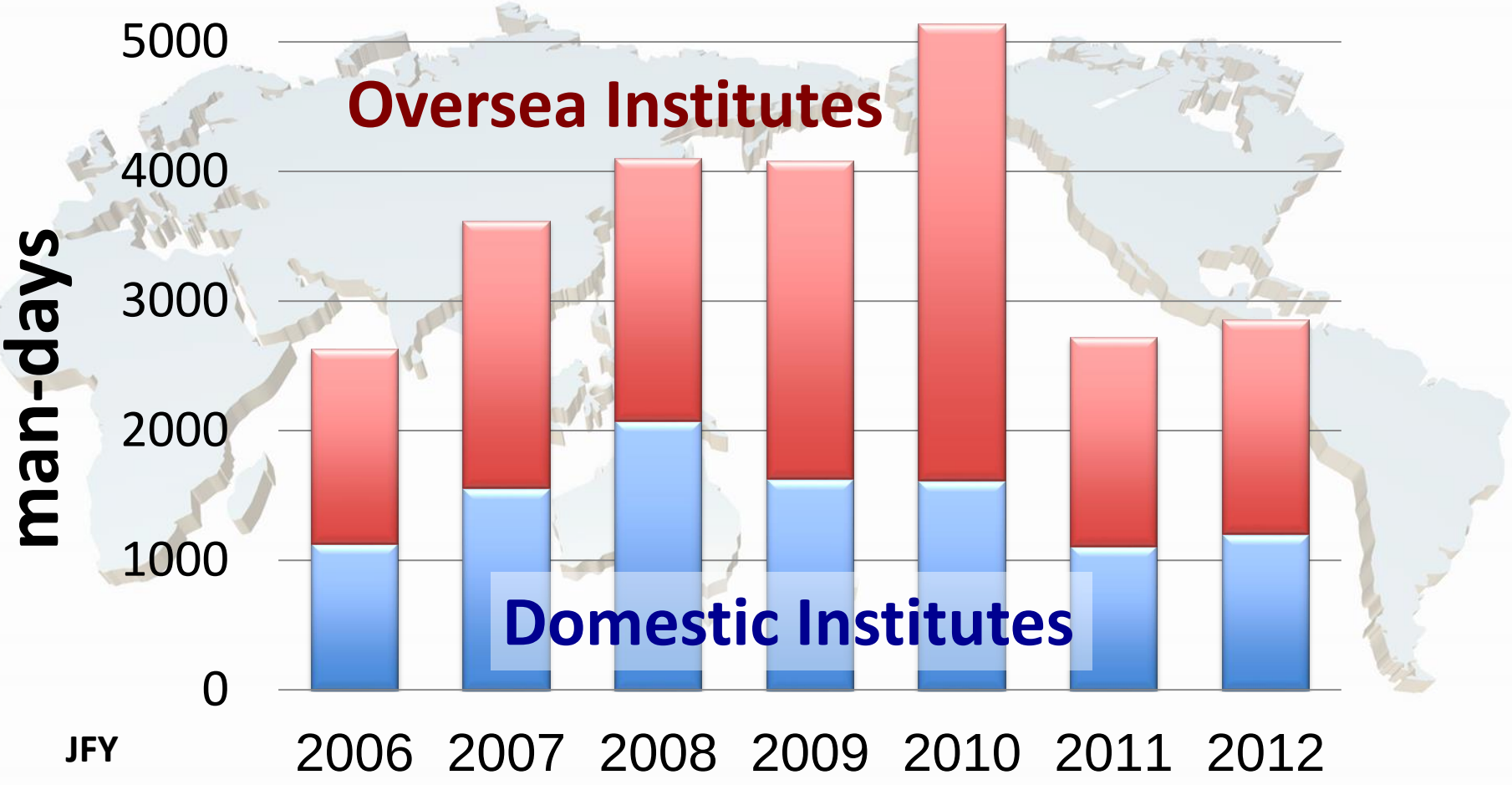
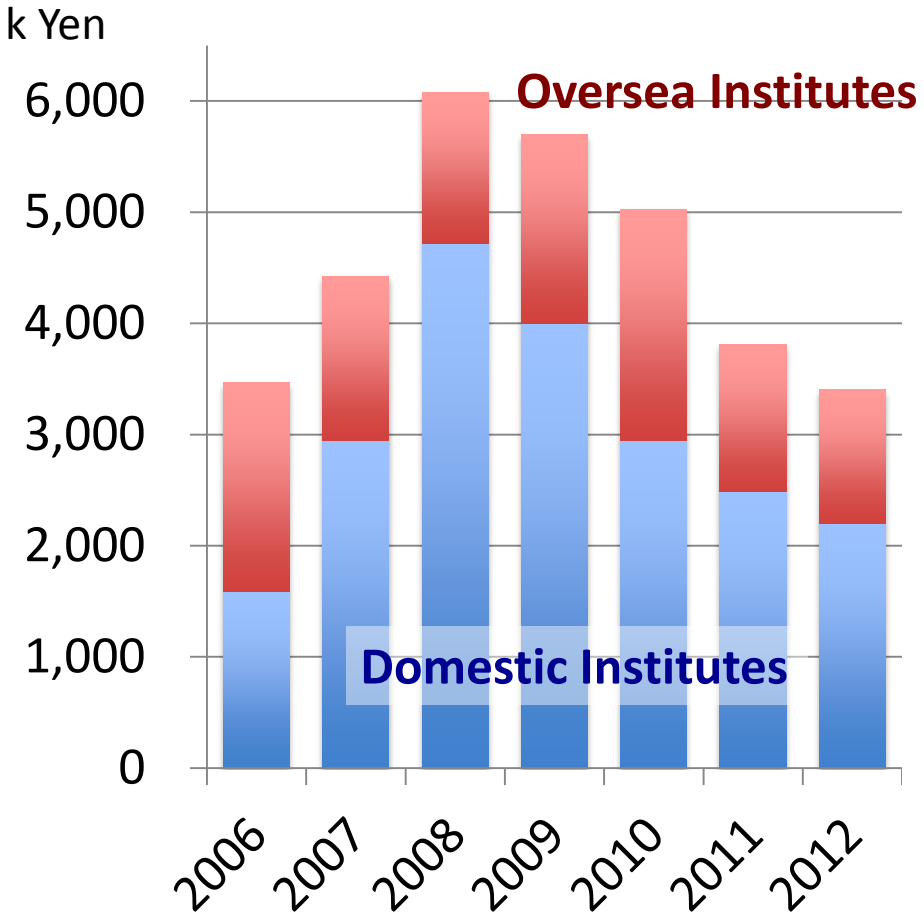
Collaborators visiting ATF

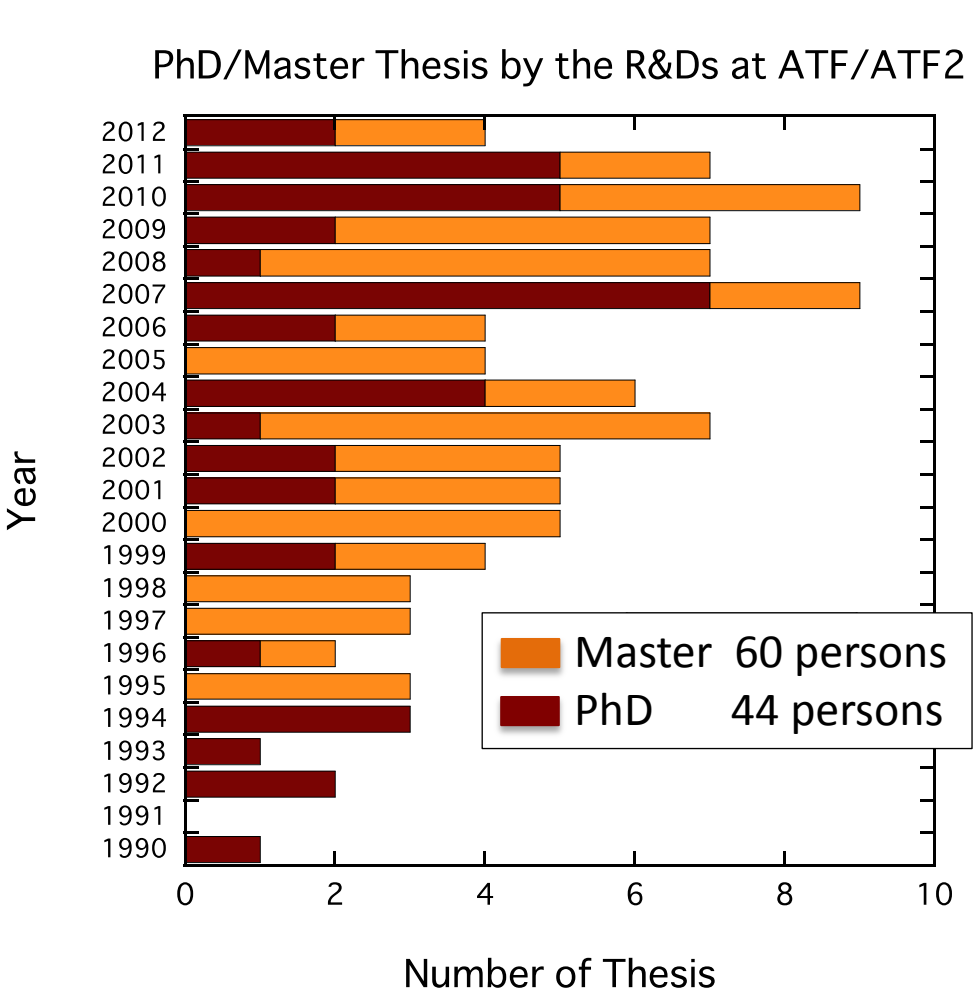


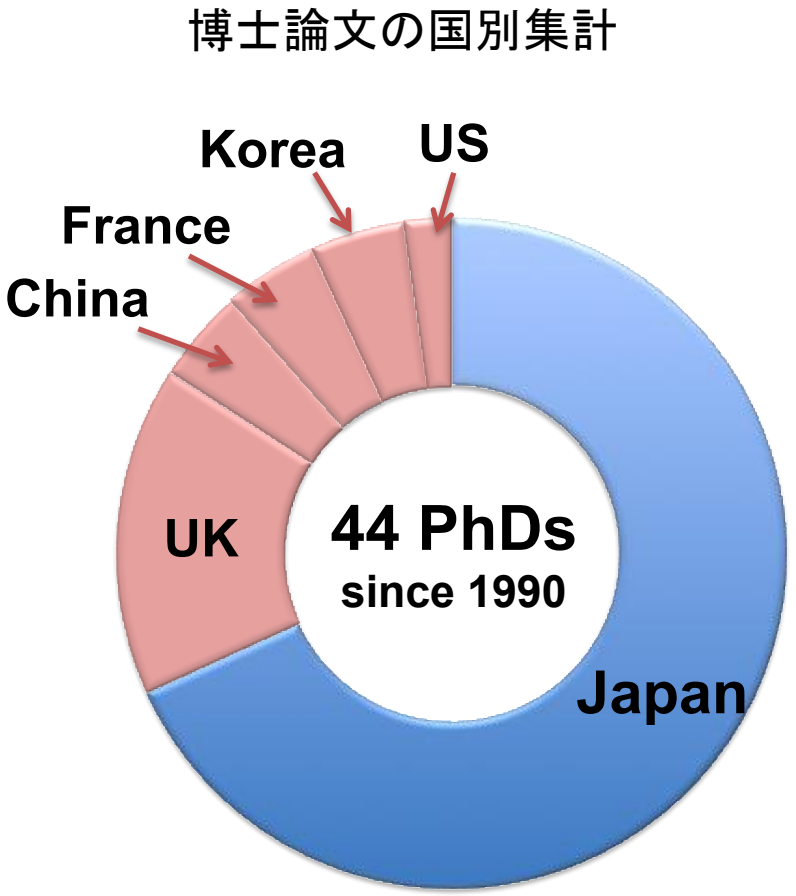
Support for Graduate Students



- Graduate student only
- Daily 680 yen + 2,400 (KEK dormitory) or 4,800 (other hotels)
- Travel Expense for Domestic institute

- Education of the Young Researchers under the International Framework-

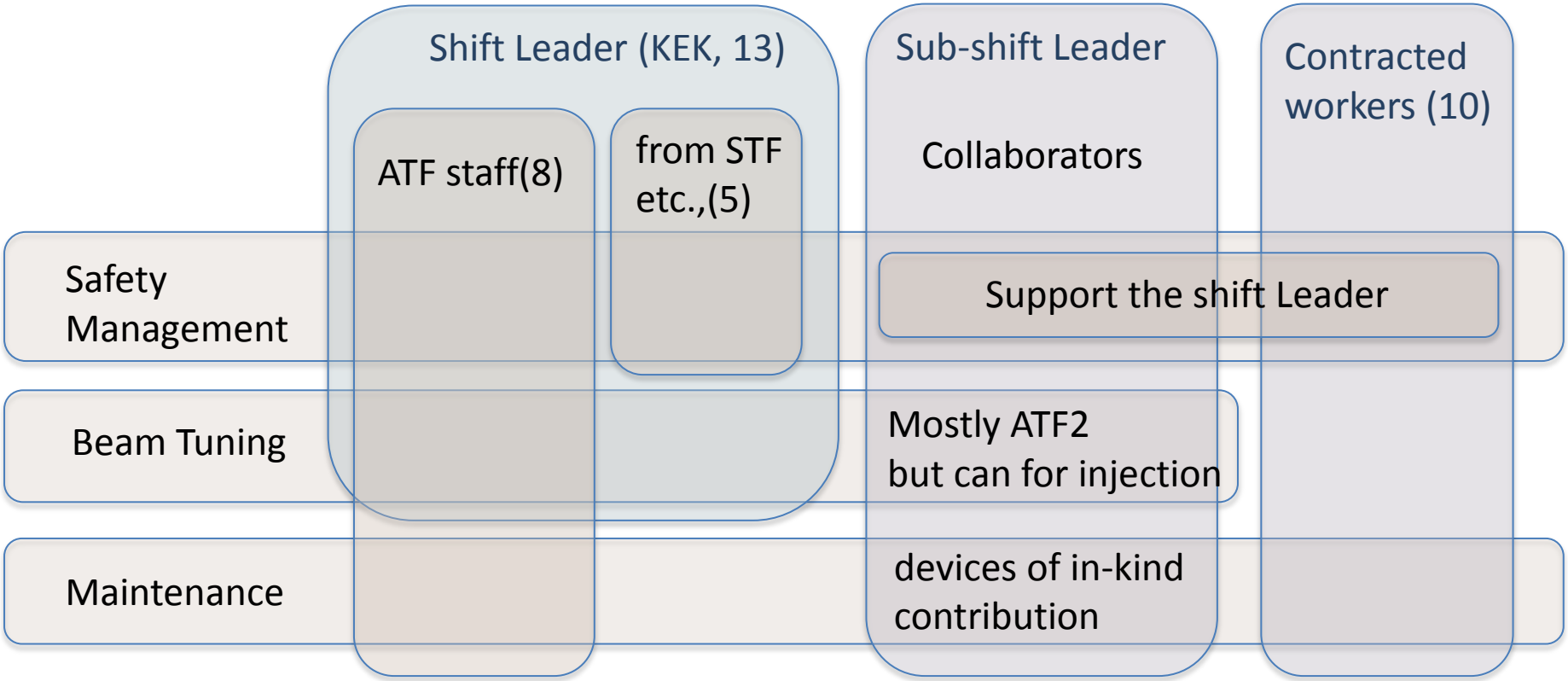




2013 March

for Beam Operation

- Monday to Friday, **12 shifts/week** due to the available manpower
- Each shift have to be controlled by a pair of a shift leader(13) and a sub leader.



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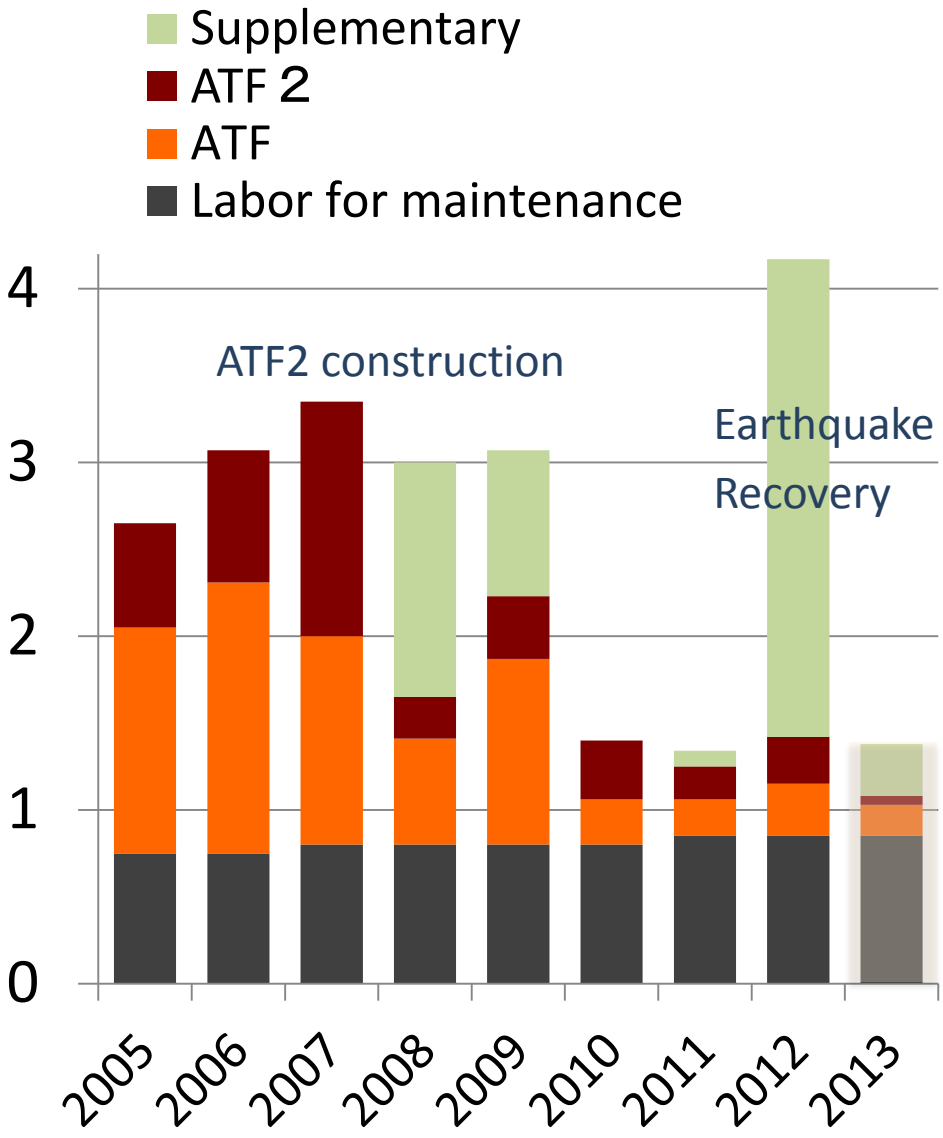
Budget Profile



Severe budget reduction in 2013

- not only for ATF but also all others in KEK.
- Supplementary is remained only for the repair around LINAC.
  - Cooling water facilities
  - Exchange PFN unit of modulators in summer (Units are already delivered)

Priority

- Beam operation (annual)
  - maintenance (minimum)
- Upgrade in summer
  - IP change for goal-2 (In-kind + KEK)
- **No room for others!**

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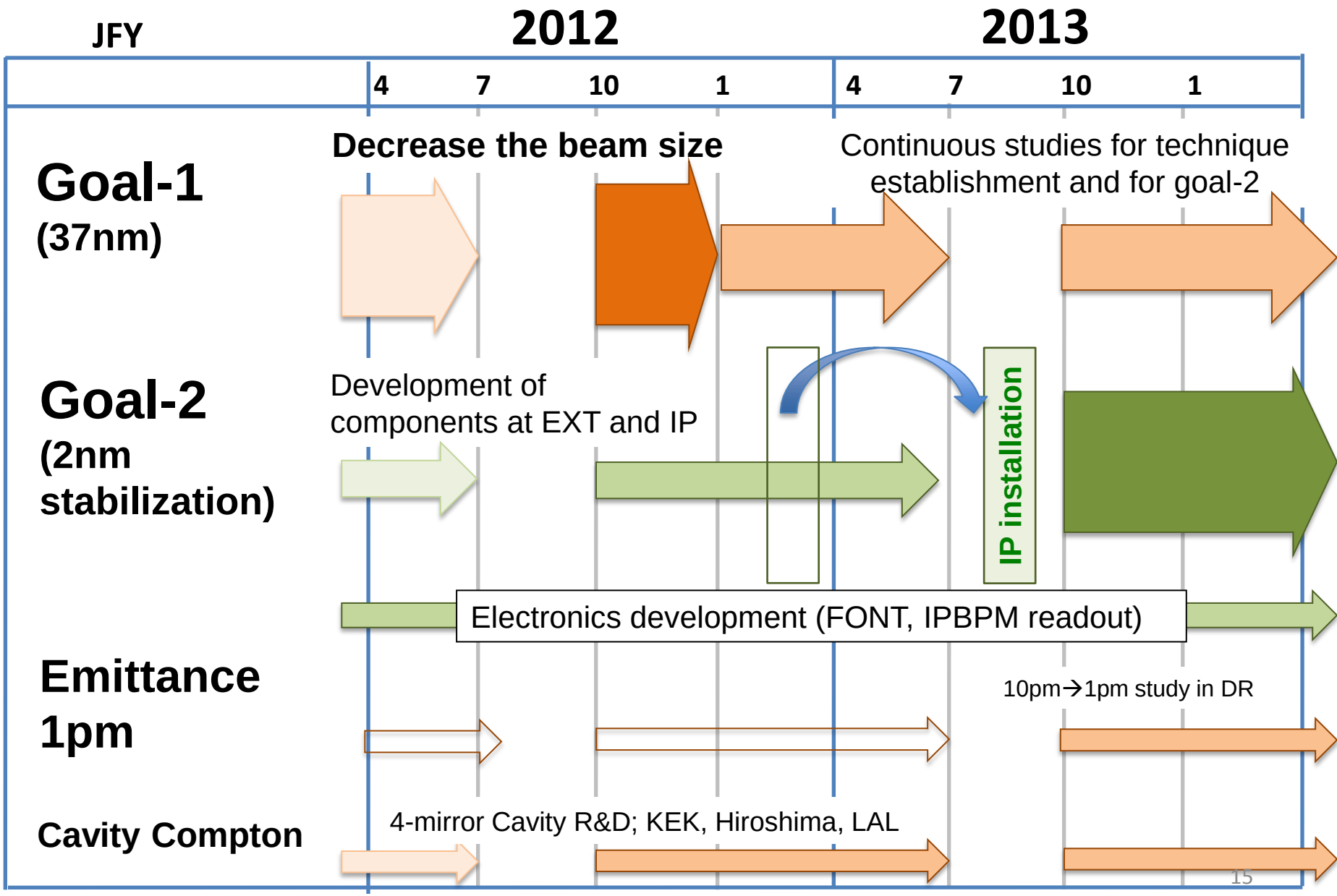
Schedule in 2012-2013

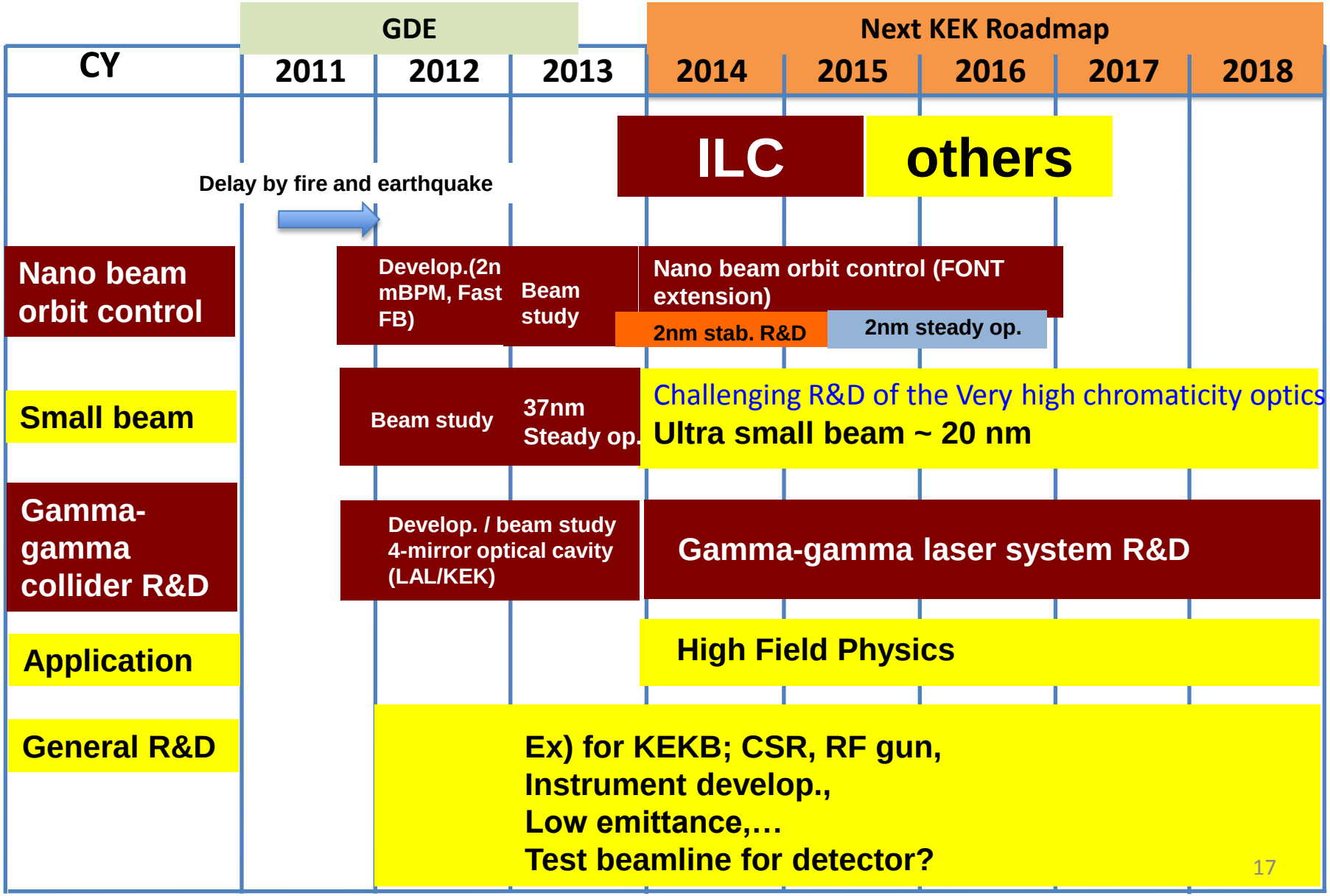


Long term plans

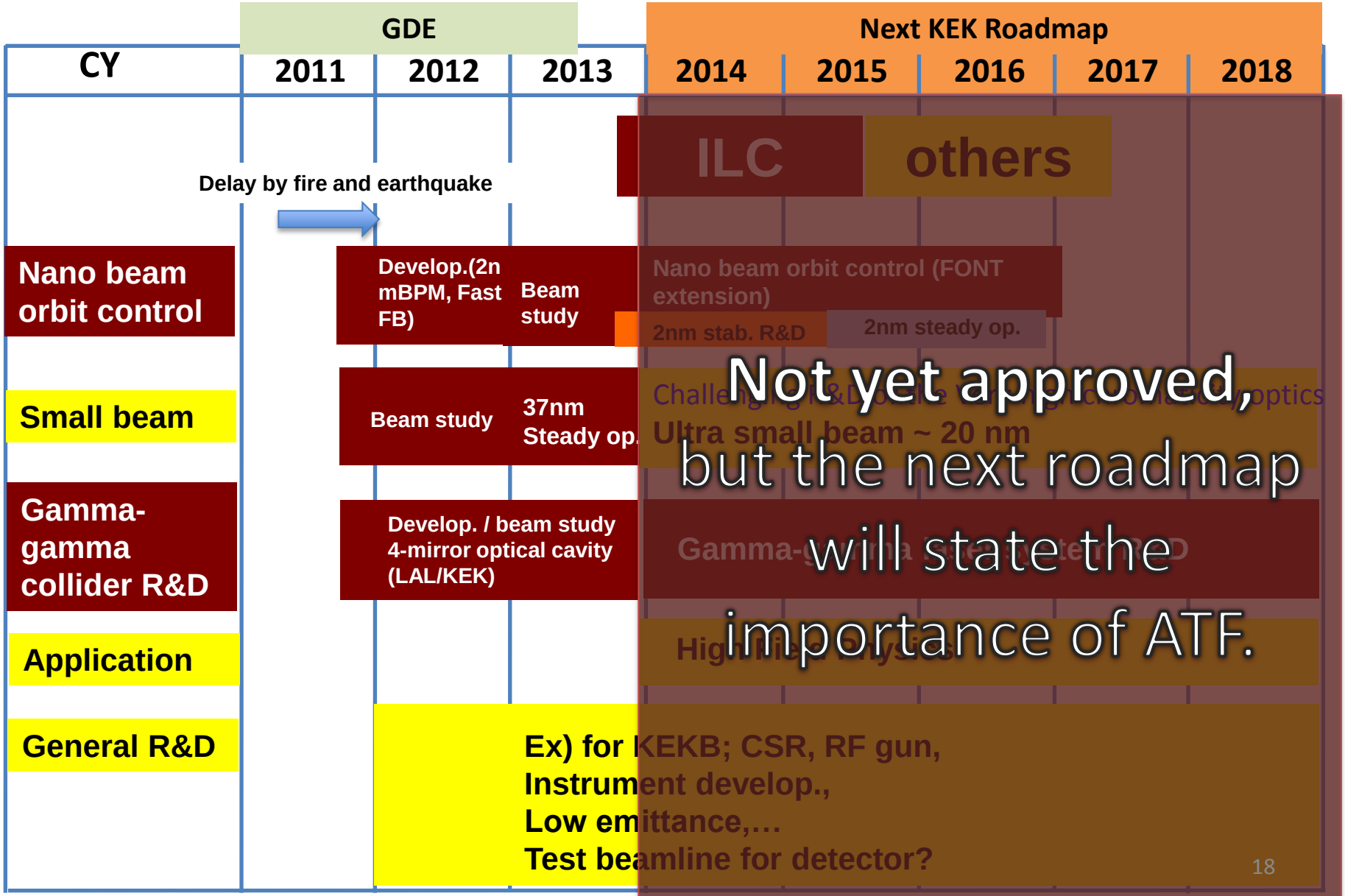
- **Past discussions proposed for the KEK roadmap 2014-2018**
  - Present R&D will be reconsidered at the end of JFY 2013
  - Widening the research program not only ILC but also other fields.
  - Obtain grants for new researches
  - researches under the global collaboration

- **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.

ATF Future Plan



ATF Future Plan



Not yet approved,
but the next roadmap
will state the
importance of ATF.

Hosting Issue

- We are facing the severe budget in 2013.
- then, minimum and cost saving upgrade of ATF2 should be deeply considered.
- Continuous beam through the weekend is limited due to the number of KEK staff for ATF operation.

- These are not easy to solve… but wish to keep the ATF/ATF2 activity.

Backups

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

CERN, KEK, LAPP, LAL, IFIC, CIEMAT

R. Tomas
with contributions from K. Artoos, M. Barnes, B. Bolzon, H. Garcia, A. Jeremie, E. Marin, M. Modena, Y. Renier, T. Tauchi, D. Schulte and A. Vorozhtsov

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**

Ground Motion feed forward

- CLIC train repetition frequency is 50 Hz
- So no beam information during 0.02 s
- Daniel's idea: “Install GM sensors along the beamline to correct beam orbit based on GM”
- Labs involved: CERN, KEK, LAL and LAPP

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*!

Ultra-low beta-function

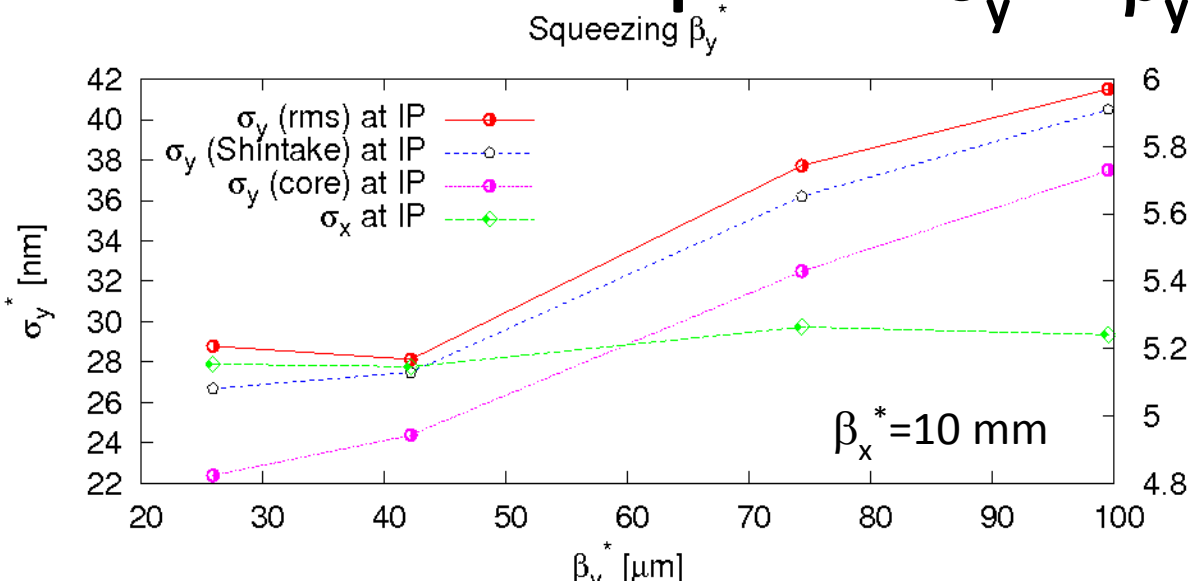
R. Tomas

motivation

project	L^*[m]	β_y^* [μm]	ξ_y
ATF2 nominal	1.0	100	~19000
ILC design	3.5	400	~15000
ATF2 ultra-low	1	25	~76000
CLIC 3 TeV	3.5	90	~63000

To prove CLIC chromaticity levels in ATF2 requires a factor 4 lower IP beta function. The main obstacle is the field quality (already issue for ATF2 nominal)

limitation from multipoles: σ_y^* vs β_y^*

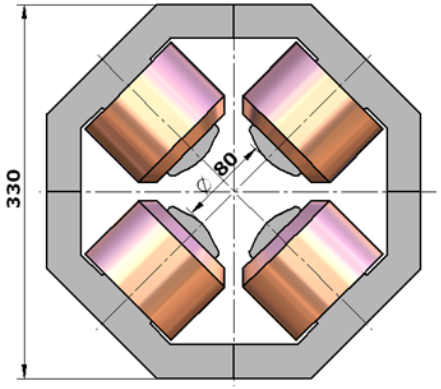


with measured magnetic multipoles; optimization with MAPCLASS; no further reduction when decreasing β_y^* below 40 μm

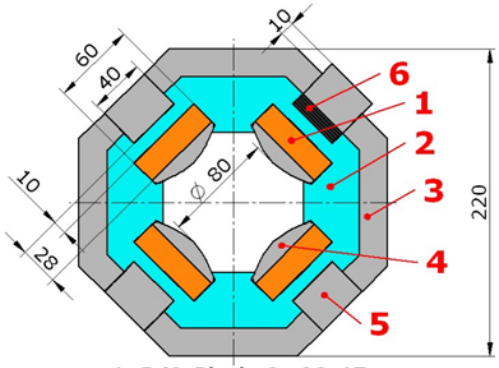
…from FJPPL-FKPPL WS on ATDF2 in March 2012:

Magnet design

1) EM quadrupole:

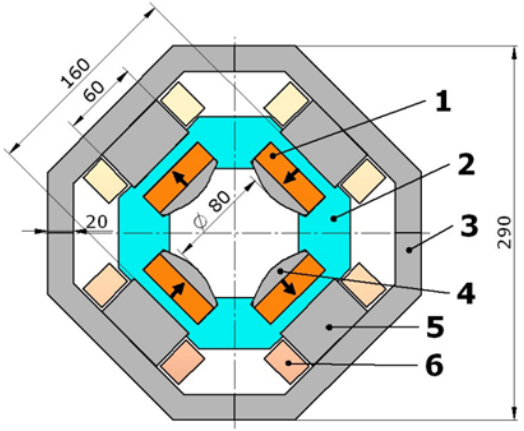


2) PMQ



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)

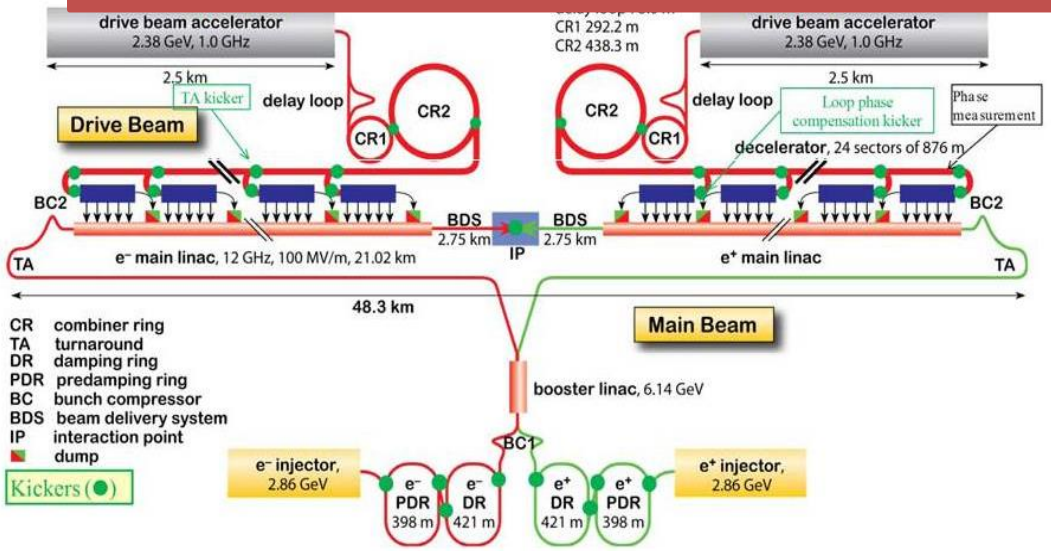


The PMQ solution looks more preferable over than the EMQ and the hybrid magnet due to the following reasons:

- 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"

We propose to install a first prototype stripline kicker, together with the inductive adders for the pulsed power supplies, for testing in a straight section of the extraction line of ATF2. This kicker system is being designed to extract horizontally the beam from the CLIC Damping Rings. The main objective of these tests is the validation of the proposed design from the field stability, field homogeneity and impedance points of view



- Several challenging kicker systems are required to inject the beam into and extract the beam from the PDRs and DRs
- In order to achieve both low beam coupling impedance and broadband impedance matching to the electrical circuit, striplines have been chosen for the kicker elements

A set of protoype striplines will be built by the Spanish company Trinos Vacuum Projects under the Centro de Desarrollo Tecnológico e Industrial (CDTI) program in collaboration with the IFIC and the CIEMAT Accelerators groups

Specifications for the CLIC DR, CLIC PDR and ATF2

Parameter	CLIC PDR		CLIC DR		ATF2		
	1 GHz	2 GHz	1 GHz	2 GHz	1-bunch	3-bunch	20-bunch
Beam energy (GeV)	2.86		2.86			1.30	
Total kick deflection angle (mrad)	2.0		1.5			1.5	
Aperture (mm)	40		20			20	
Effective length (m)	3.4		1.7			1.7	
Field rise time (ns)	428	1000	560	1000		560/1000	
Field fall time (ns)	428	1000	560	1000		560/1000	
Pulse flat top duration (ns)	900	160	900	160		900/160	
Extraction field inhomogeneity (%)	±0.1 (3.5 mm)		±0.01 (1mm)			±0.01 (1mm)	
Repetition rate (Hz)	50		50			1.56	
Vacuum (mbar)	10^{-10}		10^{-10}			10^{-10}	
Pulse voltage per stripline (kV)	± 17.0		± 12.5			± 5.5	
Stripline pulse current (A)	± 335		± 250			± 115	
Longitudinal coupling impedance (Ω)	< 0.05		< 0.05			< 0.05	
Transverse coupling impedance (kΩ/m)	< 200		< 200			< 200	
Peak beam current (A)	70	50	110	120	60	30	20
Bunch length (ps)	10	14	6	5.3		16.7	

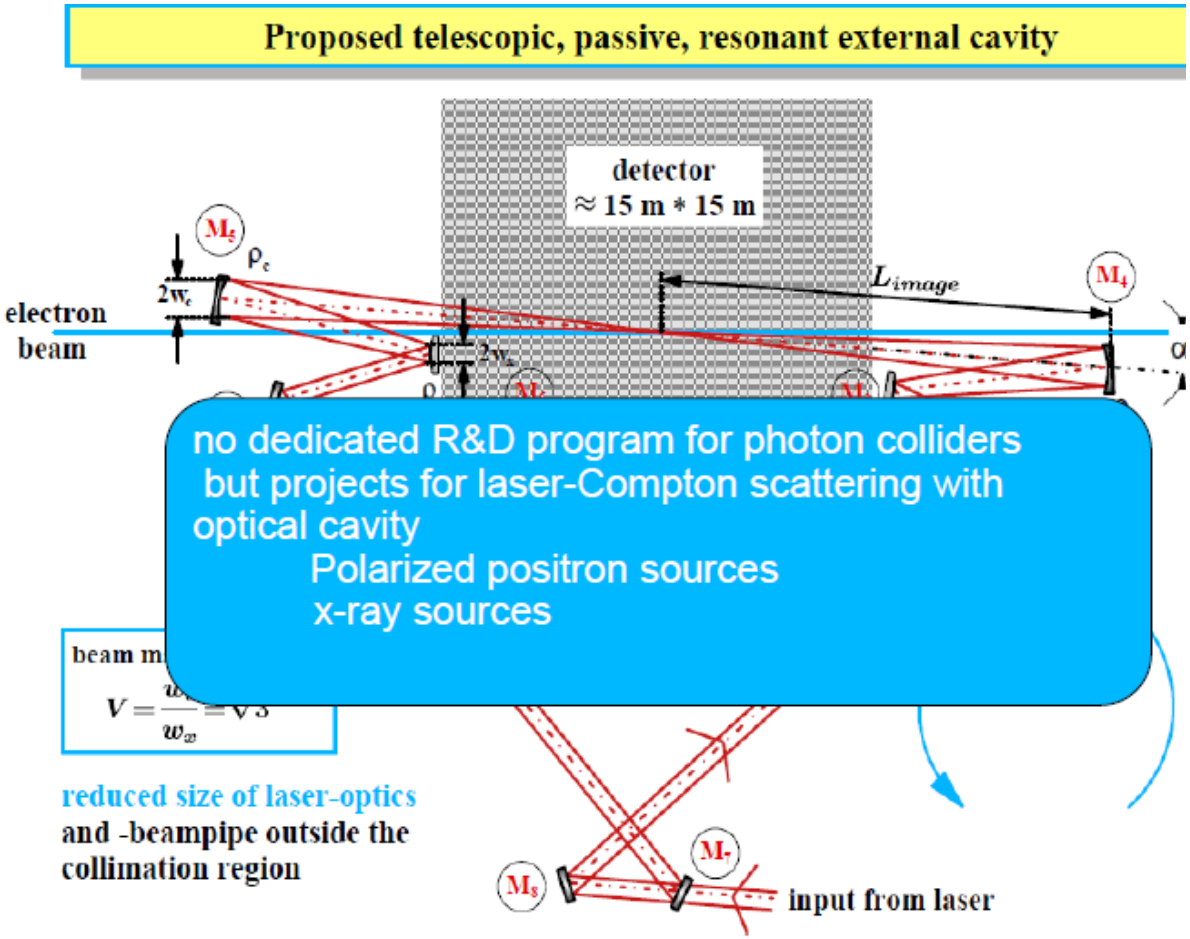
Proposed Schedule and Commissioning

We have essentially finalized the cross section design of the striplines. Once the beam coupling impedance study is finished, the striplines will be manufactured by December 2012. The tests planned by 2013 are the following:

- **Laboratory test at CERN:** verification of the stripline dimensions, field homogeneity, longitudinal and transverse beam coupling impedance, vacuum performance and high voltage performance.
- **Tests and measurements at ALBA:** using d.c. power supplies instead of a pulse generator, to determine transverse beam coupling impedance and, if possible, longitudinal beam coupling impedance. Field homogeneity measurements will be carried out with the d.c. power supplies and a closed bump.
- It is planned that two inductive adders will be built and tested by 2014: hence **our goal is that the kicker striplines and the two inductive adders are installed in ATF2 during 2014**.
- We anticipate being able to commission the kicker system immediately after the kicker has been installed

Proposal : Gamma-gamma R&D

Apply the Grant for Scientific Researches, In-kind contribution (LAL)



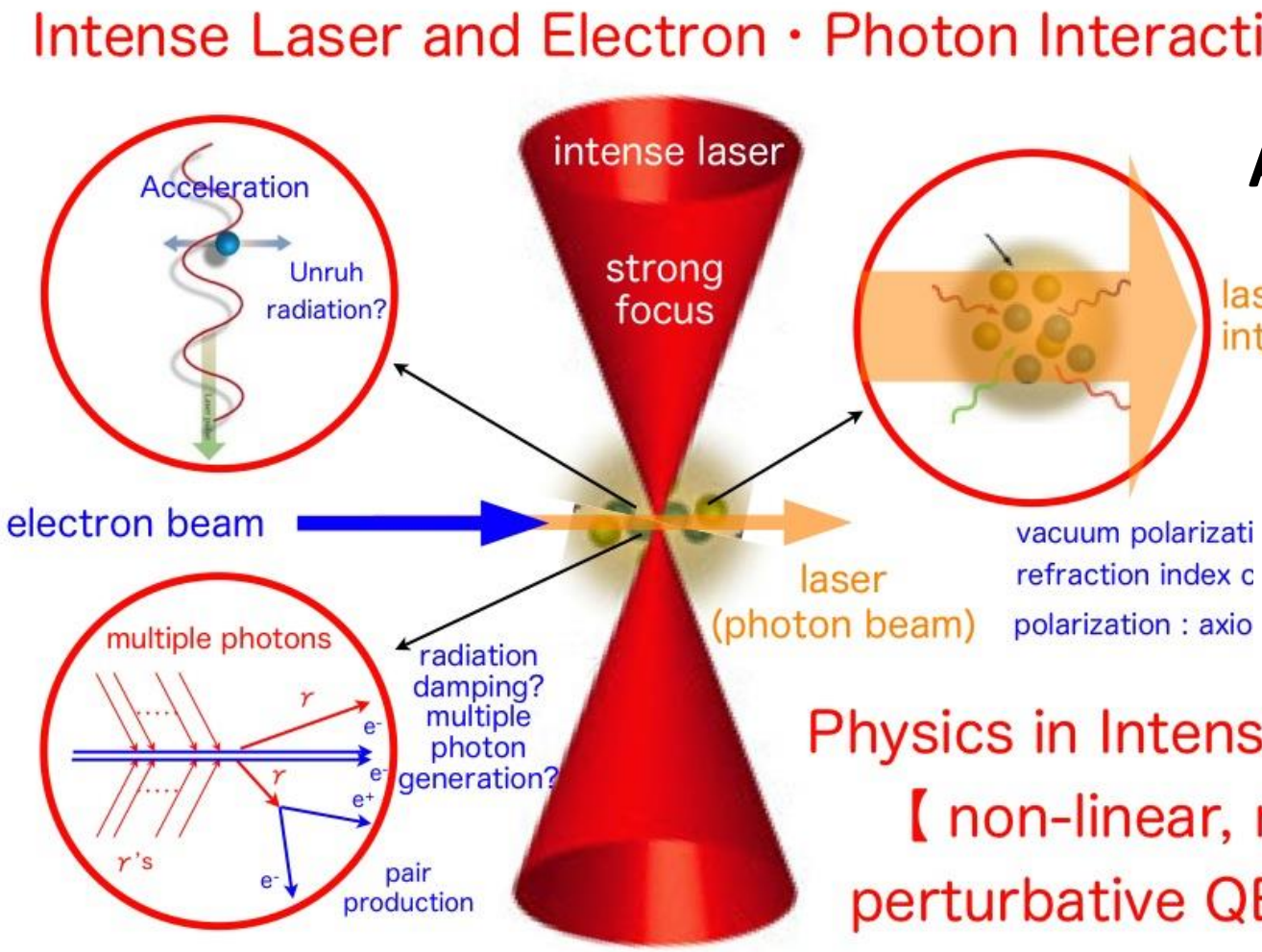
Establish the fundamental technology for Photon LC

- several 10 m scale high power Optical Cavity
- (100 m for PLC)

- Laser cavity system at ATF-EXT line
- Realize several micron laser

Proposal : High Field Physics

Apply the Grant for Scientific Researches



ATF2 small beam

Development

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

Proposal : General beam application

- ATF will be much flexible to accept R&Ds than other accelerators; i.e., Super-KEKB, PF etc.

- Detector R&D group in KEK shows much interest in the practical use of ATF.

Resources (Budget)

<table>
<tr><th></th><th>nm stability</th><th>Small beam</th><th>General R&D</th><th>Gamma-gamma</th><th>High Field Physics</th></tr>
<tr><td>For machine operation</td><td colspan="5">Minimum 2.1 Oku-yen/Year
（maintenance 1.5 Oku + electricity 0.6 Oku）</td></tr>
<tr><td>Preparation of missing items</td><td>In-kind
(UK,KNU)</td><td>In-kind
(CERN)</td><td>In-kind
（each）</td><td rowspan="2">In-kind
＋
New Funds
（＋KEK）

Total: 1 Oku-yen/Year</td><td>New Funds
（8 Oku-yen/5 years）</td></tr>
<tr><td>Installation, maintenance, etc.,…</td><td colspan="3">Total: 0.2 Oku-yen/Year</td><td>New Funds</td></tr>
</table>

Resources (Manpower)

	nm stability	Small beam	General R&D	Gamma-gamma	High Field Physics
For machine operation	ATF stuff (KEK), maintenance workers (Company) ＋ Collaborators				
Critical Items	FONT (Oxford,…) IP-BPM (KNU,…)	IP-BSM (KEK/Tokyo) Quad（CERN）		High power optical cavity （KEK, Hiroshima, LAL）	200TW laser （KEK, LAL,…）
expected manpower	Same as present FTE１５	Same as present +CERN	Same as present	Same as present + new project Cavity develop. (3 Years) Beam study (2 Years)	Same as present + new project Laser develop. (3 Years) Beam study (2 Years)