Overview of ATF/ATF2

T. Tauchi,

ATF2 SC FF Meeting, LAPP, Annecy,14 June 2010

References :

ATF2 Proposal, KEK Report 2005-2

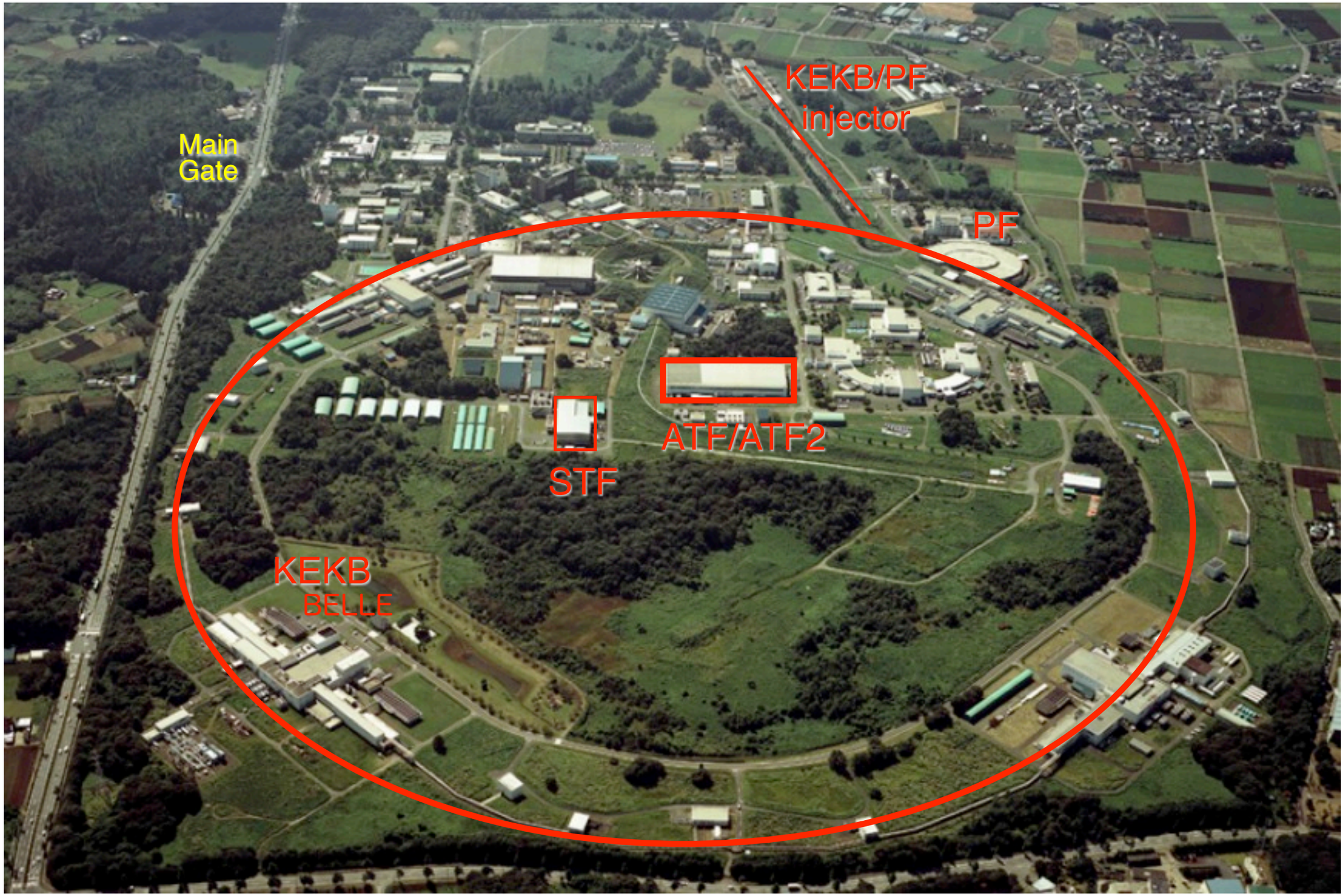
ATF2 Proposal Vol.2, KEK Report 2005-9

ATF home page : http://atf.kek.jp/

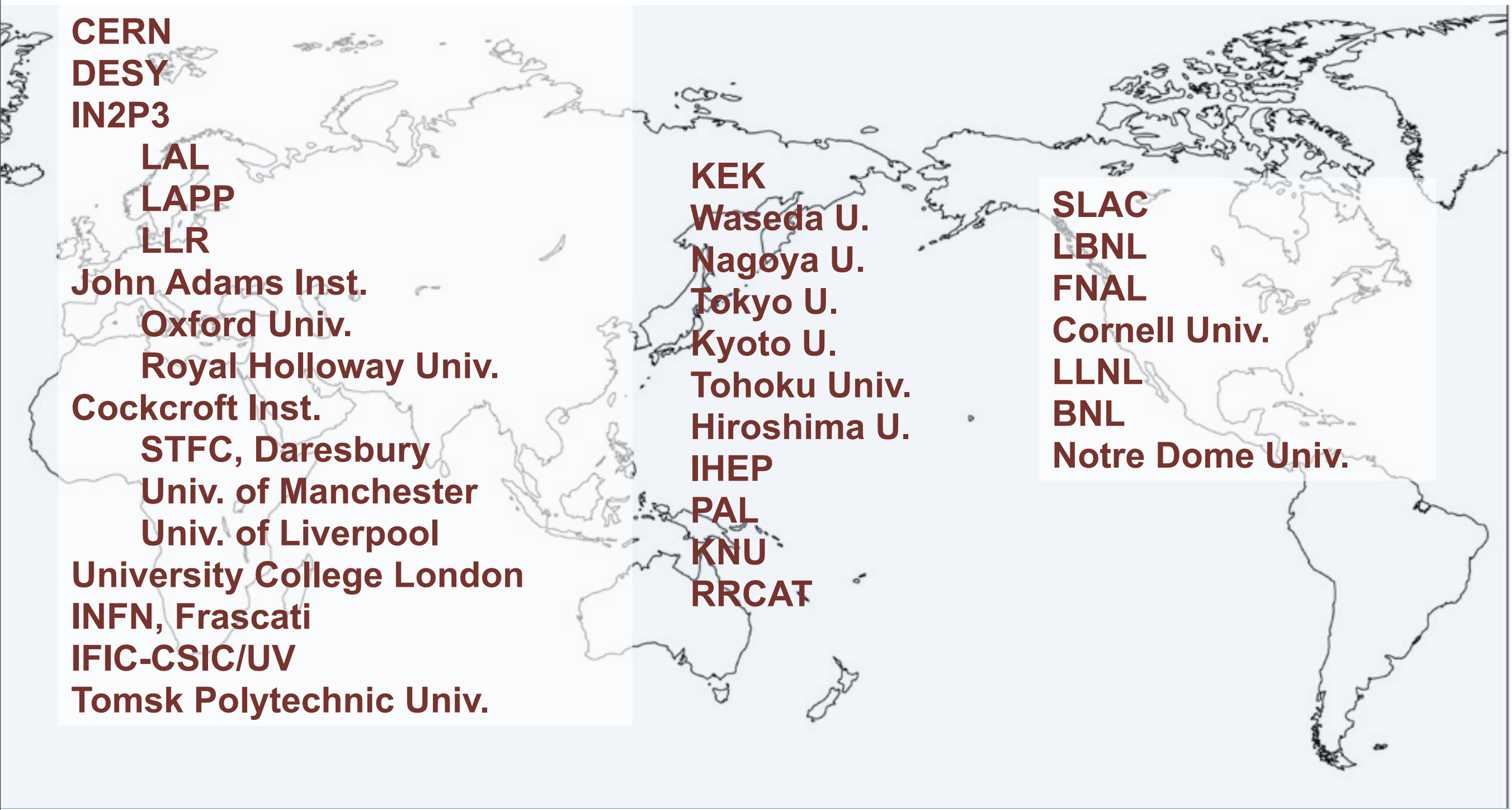
with 110 authors (25 research institutes around the world)

KEK High Energy Accelerator Research Organization

in Tsukuba site, Japan



ATF International Collaboration



CERN
DESY
IN2P3
- LAL
- LAPP
- LLR

John Adams Inst.
- Oxford Univ.
- Royal Holloway Univ.

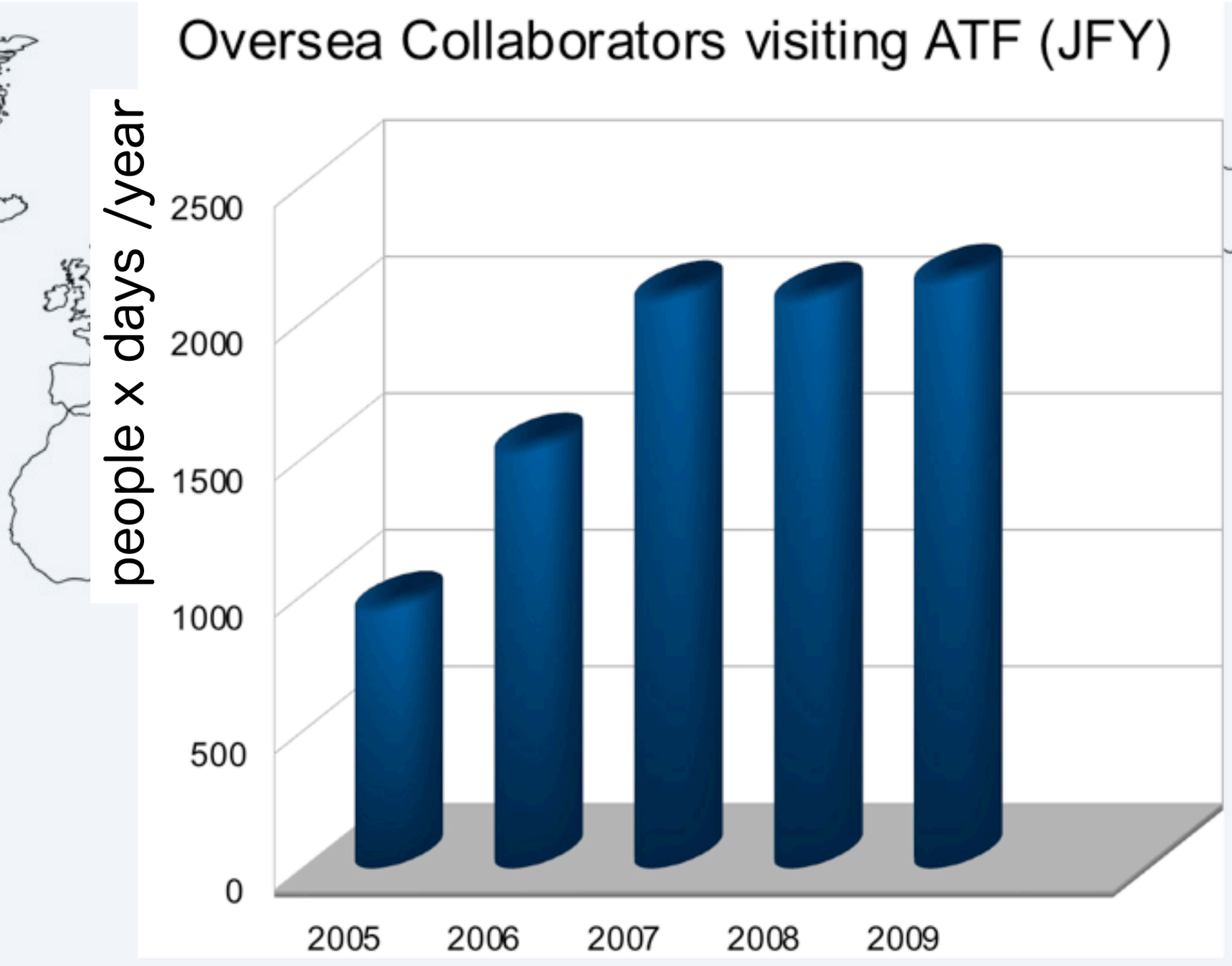
Cockcroft Inst.
- STFC, Daresbury
- Univ. of Manchester
- Univ. of Liverpool

University College London
INFN, Frascati
IFIC-CSIC/UV
Tomsk Polytechnic Univ.

KEK
Waseda U.
Nagoya U.
Tokyo U.
Kyoto U.
Tohoku Univ.
Hiroshima U.
IHEP
PAL
KNU
RRCAT

SLAC
LBNL
FNAL
Cornell Univ.
LLNL
BNL
Notre Dome Univ.

ATF International Collaboration



Overseas

25 Institutes,

~70 people,

~2000 people-days **per year**

\+

KEK and Japanese Universities(6)

ATF2 : Goal - I

A. Achievement of 37nm beam size

A1) Demonstration of a new compact final focus system;
proposed by P.Raimondi and A.Seryi in 2000,

A2) Maintenance of the small beam size
(several hours at the FFTB/SLAC)

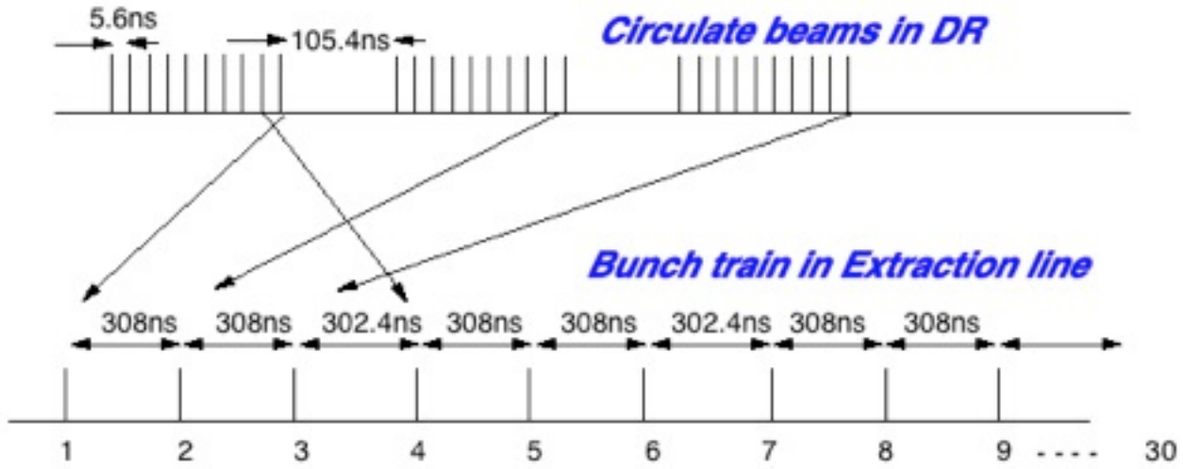
Goal - II

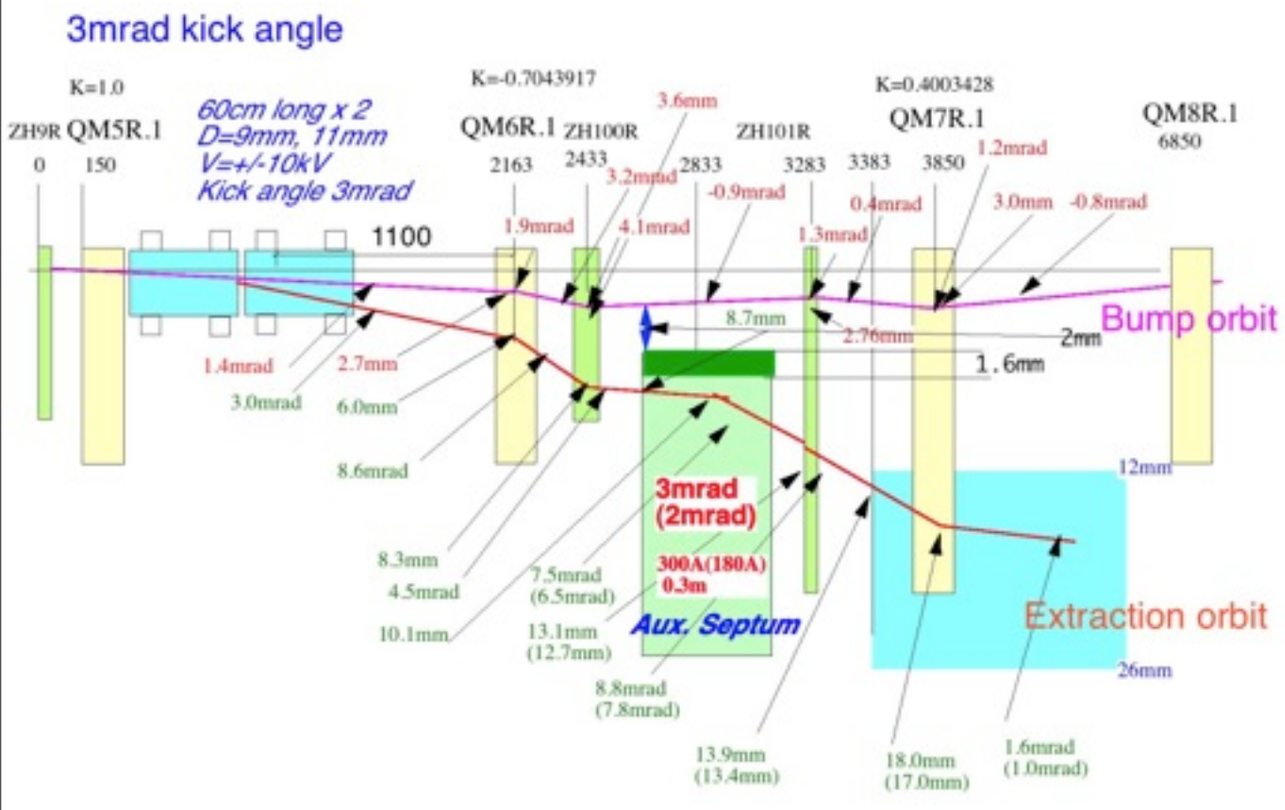
B. Control of the beam position

B1) Demonstration of beam orbit stabilization with
nano-meter precision at IP.
(The beam jitter at FFTB/SLAC was about 40nm.)

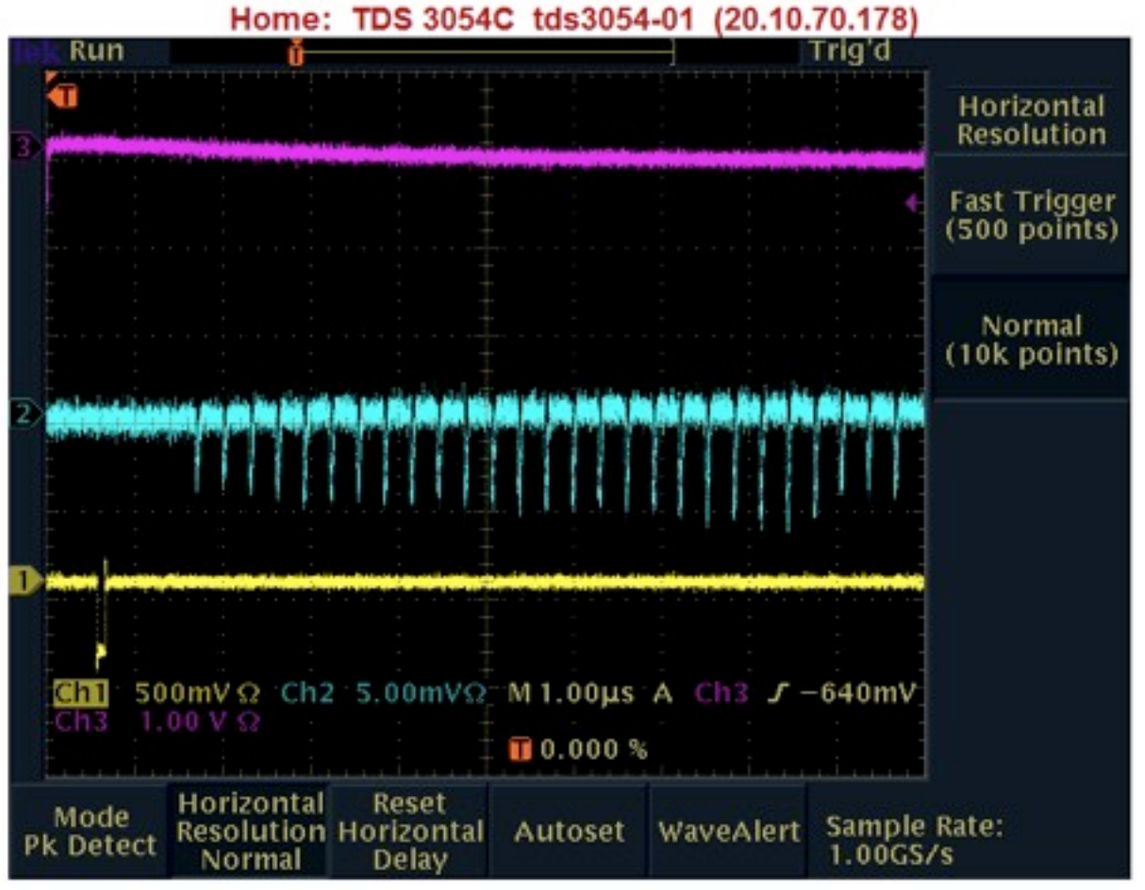
B2) Establishment of beam jitter controlling technique
at nano-meter level with ILC-like beam (2008 -?)

Fast Kicker in March, 2010





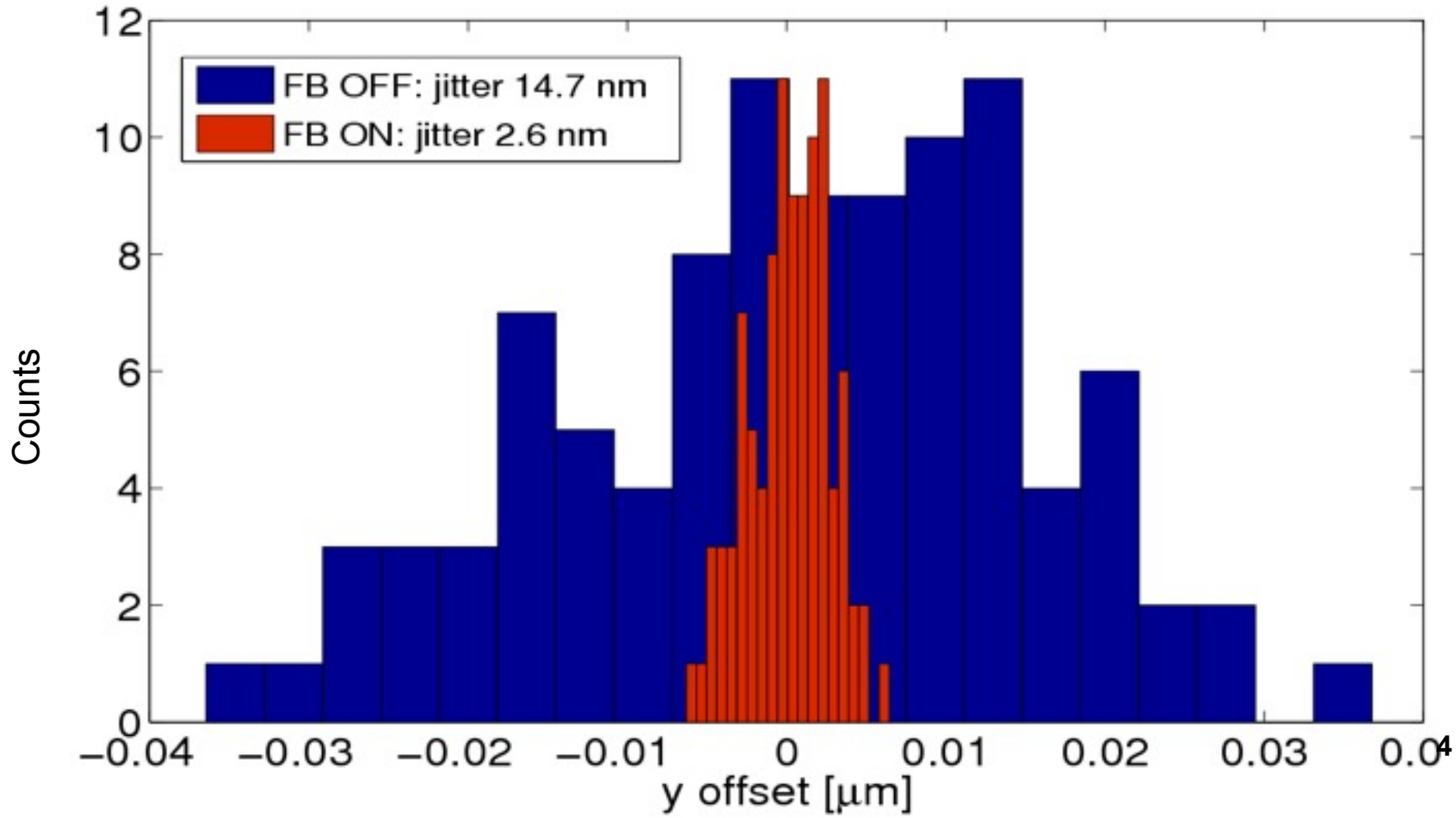
Extraction Orbit



Bunch current at the extraction line

Jitter comparison at IP

Assuming perfect lattice, no further imperfections (!)



Necessary Deliverables from TF for BDS and DR

Test Facility	Deliverable	Date
Hardware development, Optics and stabilisation demonstrations:		***JFY***
ATF	**Demo. of reliable operation of fast kickers meeting the specifications for the ILC damping ring.**	**2010**
	Generation of 1 pm-rad low emittance beam 0.1x ε_{ILC}, 3 x Luminosity	**2009**
ATF2	**Demo. of compact Final Focus optics (design demagnification, resulting in a nominal 35 nm beam size at focal point).**	**2010**
	Demo. of prototype SC and PM final doublet magnets	**2012**
	Stabilisation of 35 nm beam over various time scales.	**2012**
Electron cloud mitigation studies:		
CESR-TA	**Re-config. (re-build) of CESR as low-emittance e-cloud test facility. First meas. of e-cloud build-up using instrumented sections in dipoles and drifts sections (large emittance).**	**2008**
	Achieve lower emittance beams. Meas. of e-cloud build up in wiggler chambers.	**2009**
	Characterisation of e-cloud build-up and instability thresholds as a func. of low vertical emittance (≤20 pm)	**2010**
DAΦNE	**Fast kicker design and pulser reliability check**	**2010**
	Characterisation of e-cloud build-up and instability thresholds	**2010**
SLAC/LLNL	**Fast kicker pulser development**	**2010**

ATF Accelerator Test Facility, KEK

1997-2008

ε_y=11pm ,2002

ε_y= 4pm ,2004

Extraction line :utilization of low emittance beam

beam instrumentation, collimator damage

Cavity BPM
nanometer res.

FONT
fast feedback (ns)

Pulsed Laser Wire Scanner
for beam size monitor (μm)

ODR, OTR
single shot meas.

Collimation damage
phase-1

Beam Dynamics

CSR

LW, Cavity Compton

Damping Ring
ultra low emittance beam (2pm)
dynamics -fast ion instability
beam instrumentation (BPM,LW)

Fast kicker
rise time < 3ns

XSR

Energy: 1.28 GeV
Electron bunch:
$2x10^{10}$ e/bunch
1 ~ 20 bunches/train
3 trains/ring
1.56 Hz

RF Gun
multi-bunch beam

S-band Linac (70m)
multi-bunch acceleration

Publication of First Results by May 2009

in PR-STAB 13, 042801 (2010)

Present status and first results of the final focus beam line at the KEK Accelerator Test Facility

P. Bambade,[1,6,*] M. Alabau Pons,[2] J. Amann,[3] D. Angal-Kalinin,[4] R. Apsimon,[5] S. Araki,[6] A. Aryshev,[6] S. Bai,[7] P. Bellomo,[3] D. Bett,[5] G. Blair,[9] B. Bolzon,[8] S. Boogert,[9] G. Boorman,[9] P. N. Burrows,[5] G. Christian,[5] P. Coe,[5] B. Constance,[5] J.-P. Delahaye,[10] L. Deacon,[9] E. Elsen,[11] A. Faus-Golfe,[2] M. Fukuda,[6] J. Gao,[7] N. Geffroy,[8] E. Gianfelice-Wendt,[12] H. Guler,[13] H. Hayano,[6] A.-Y. Heo,[14] Y. Honda,[6] J. Y. Huang,[15] W. H. Hwang,[15] Y. Iwashita,[16] A. Jeremie,[8] J. Jones,[4] Y. Kamiya,[17] P. Karataev,[9] E.-S. Kim,[14] H.-S. Kim,[14] S. H. Kim,[15] S. Komamiya,[17] K. Kubo,[6] T. Kume,[6] S. Kuroda,[6] B. Lam,[3] A. Lyapin,[18] M. Masuzawa,[6] D. McCormick,[3] S. Molloy,[9] T. Naito,[6] T. Nakamura,[17] J. Nelson,[3] D. Okamoto,[19] T. Okugi,[6] M. Oroku,[17] Y. J. Park,[15] B. Parker,[20] E. Paterson,[3] C. Perry,[5] M. Pivi,[3] T. Raubenheimer,[3] Y. Renier,[1,6] J. Resta-Lopez,[5] C. Rimbault,[1] M. Ross,[12] T. Sanuki,[19] A. Scarfe,[21] D. Schulte,[10] A. Seryi,[3] C. Spencer,[3] T. Suehara,[17] R. Sugahara,[6] C. Swinson,[5] T. Takahashi,[22] T. Tauchi,[6] N. Terunuma,[6] R. Tomas,[10] J. Urakawa,[6] D. Urner,[5] M. Verderi,[13] M.-H. Wang,[3] M. Warden,[5] M. Wendt,[12] G. White,[3] W. Wittmer,[3] A. Wolski,[23] M. Woodley,[3] Y. Yamaguchi,[17] T. Yamanaka,[17] Y. Yan,[3] H. Yoda,[17] K. Yokoya,[6] F. Zhou,[3] and F. Zimmermann[10]

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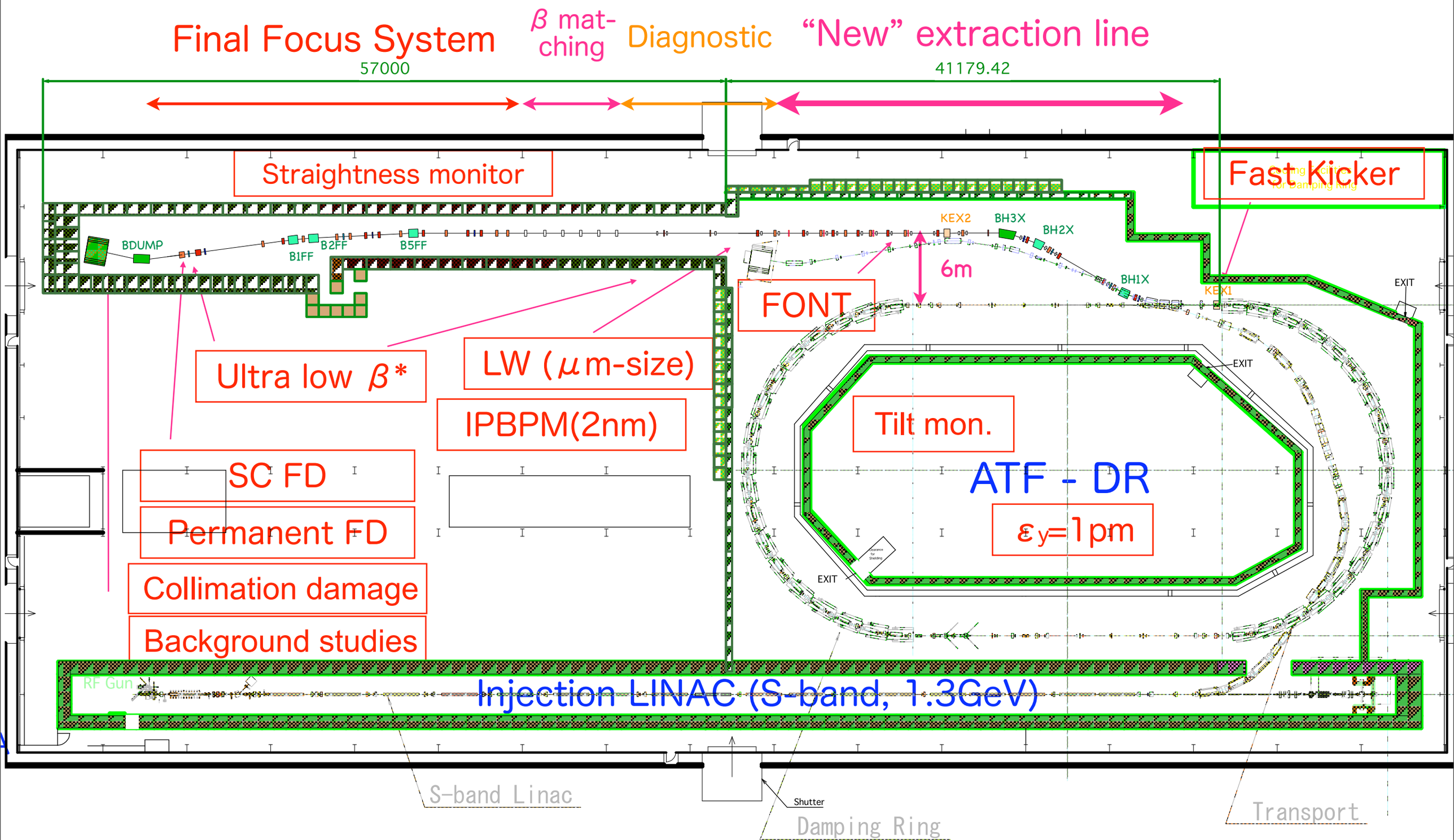
ATF2 is a final-focus test beam line which aims to focus the low emittance beam from the ATF damping ring to a vertical size of about 37 nm and to demonstrate nanometer level beam stability. Several advanced beam diagnostics and feedback tools are used. In December 2008, construction and installation were completed and beam commissioning started, supported by an international team of Asian, European, and U.S. scientists. The present status and first results are described.

ATF2 beam line and planned/proposed R&Ds

2008 - 2010 - 2012 (- 2014 - ?)



ATF2 beam line and planned/proposed R&Ds

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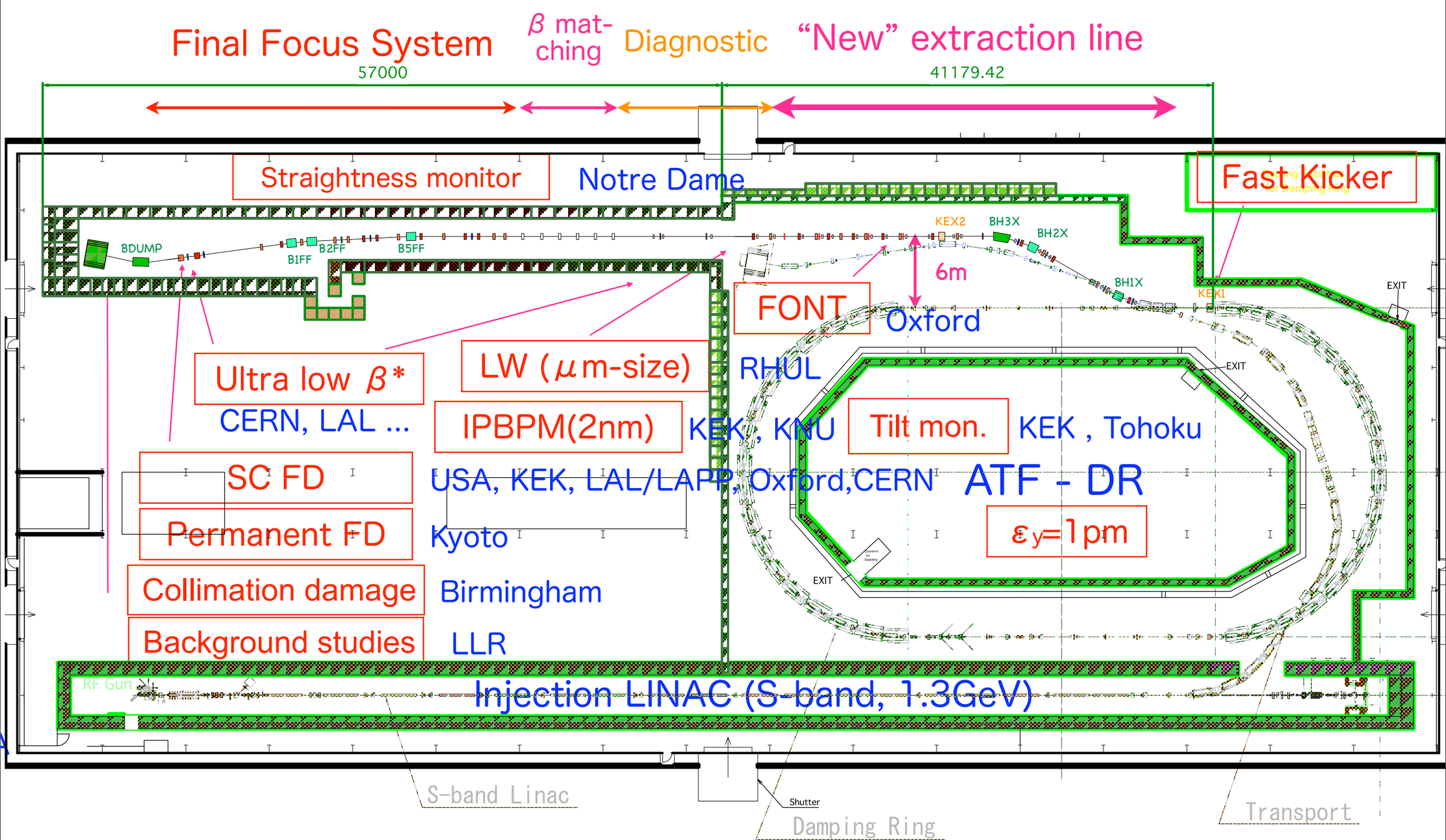
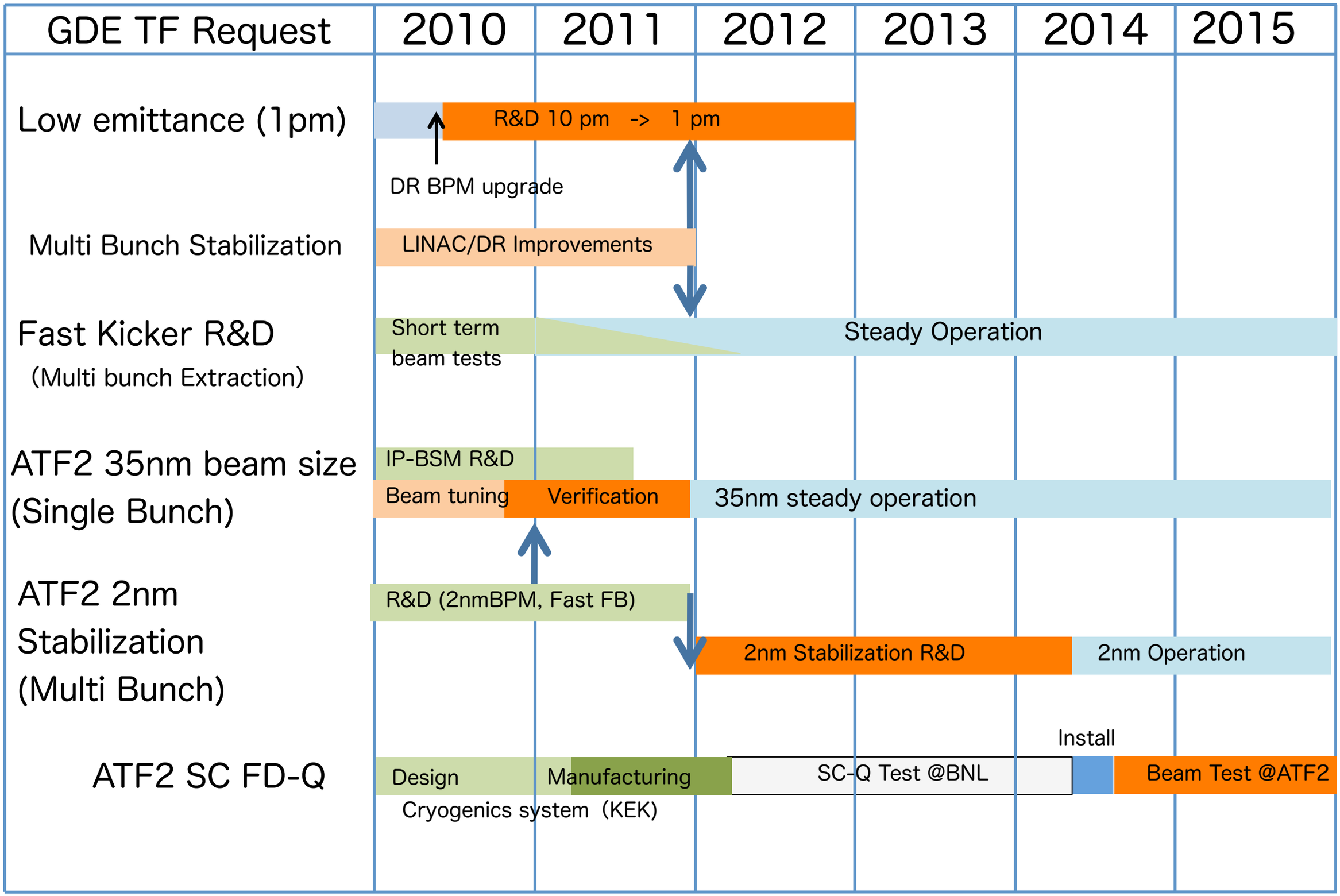
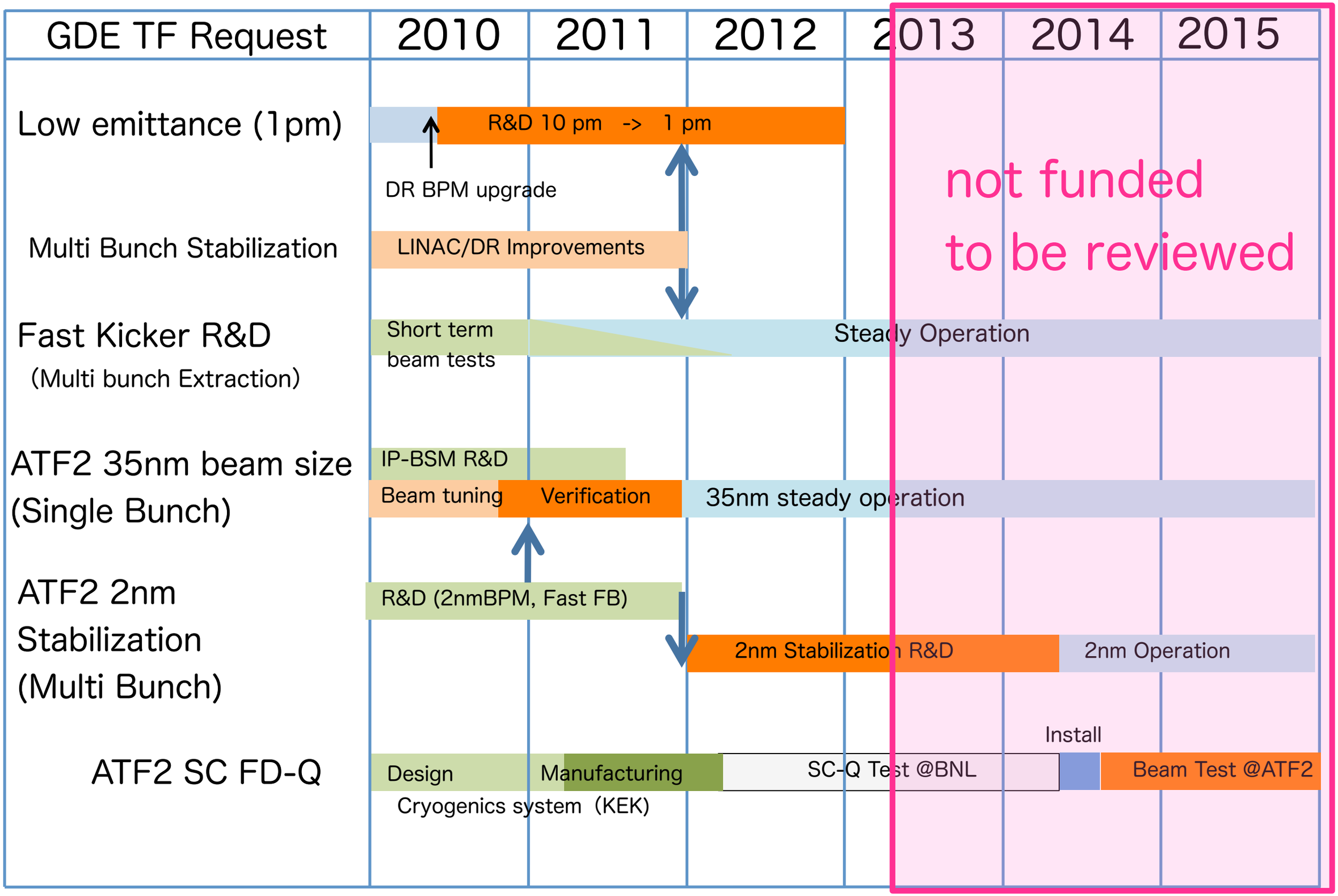


ATF long term plan



ATF long term plan



Parameters	unit	ATF2	ILC	CLIC	S-KEKB (LER/HER)
Beam Energy	GeV	1.3	250	3000	4/7
L*	m	1	3.5-4.5	3.5	0.47/1.3
$\gamma\varepsilon_x$	m-rad	5×10^{-6}	1×10^{-5}	6.6×10^{-7}	$2.5/3.3\times10^{-5}$
ε_x	nm	2	1.0 (DR)	0.1 (DR)	3.2/2.4
$\gamma\varepsilon_y$	m-rad	3×10^{-8}	4×10^{-8}	2×10^{-8}	$1.0/1.2\times10^{-7}$
ε_y	pm	12	2(DR)	1(DR)	13/8.4
β^*_x	mm	4 (8)	21	6.9	32/25
β^*_y	mm	0.1	0.4	0.07	0.27/0.41
η'	rad	0.14	0.0094	0.00144	
σ_E	%	~0.1	~0.1	~0.3	0.08/0.06
Chromaticity	L^*/β^*_y	$\sim10^4$	$\sim10^4$	$\sim5\times10^4$	$1.7/3.2\times10^3$
σ^*_x	μm	2.8(4.0)	0.655	0.039	10.2/7.8
σ^*_y	nm	37	5.7	0.7	59/59