



INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION
HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION

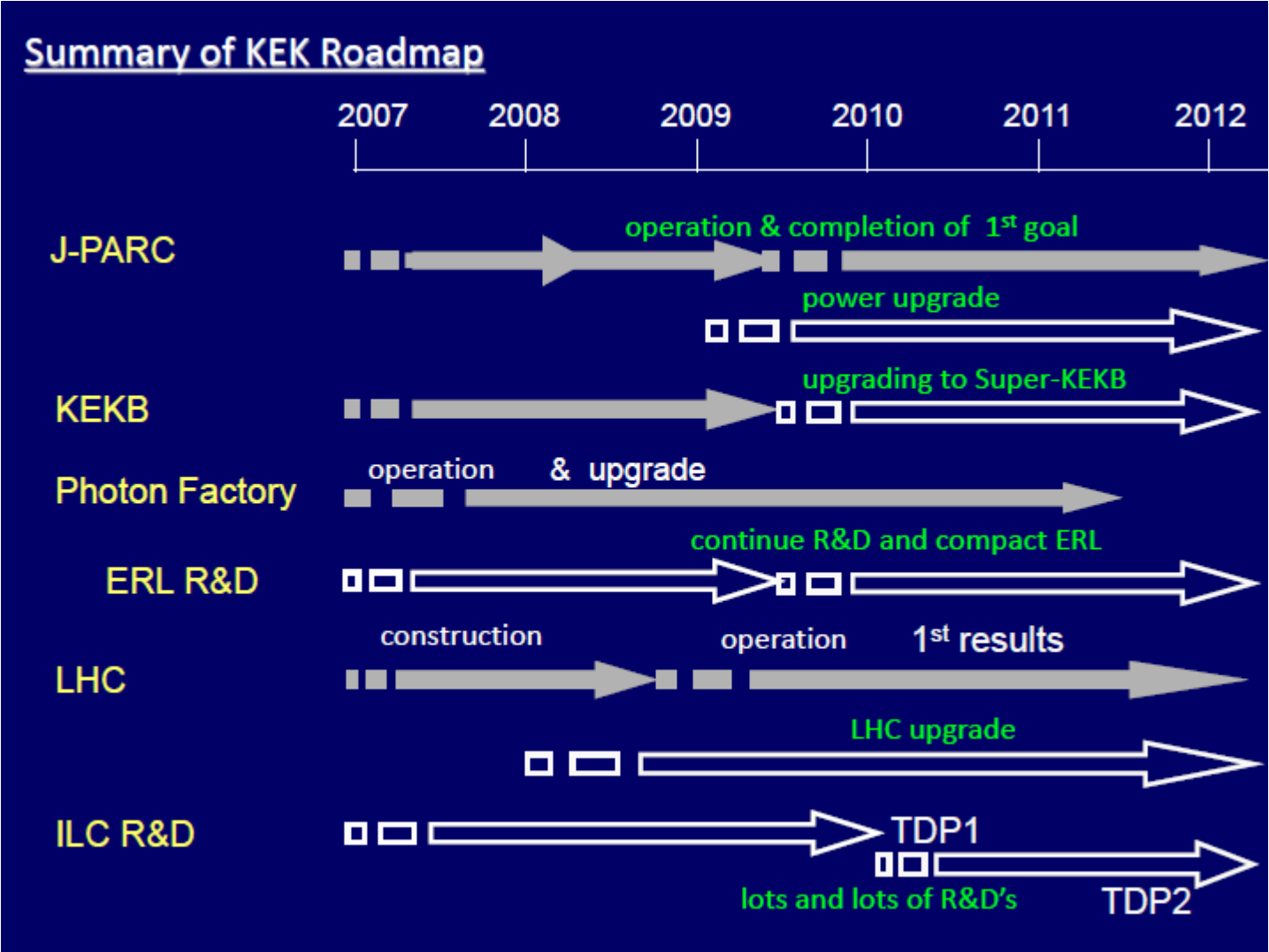
KEK Roadmap

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19th KEKB Accelerator Review Committee
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KEK Roadmap

- KEK established the first research Roadmap (5-year plan) in 2008.
- The update of the KEK roadmap started in 2011 and completed in May, 2013.
- This has been a bottom-up process since KEK is an Inter-University Research Institute Corporation. We took into account inputs from relevant science communities: HEP, Nuclear physics, Synchrotron radiation research, Neutron science, Muon science.
- In October 2012, after the discovery of Higgs-like particle at the LHC, the Japanese HEP community proposed a phased execution of ILC hosted in Japan as a global project.
- KEK roadmap 2013 is available together with the report of the roadmap review committee at the following page.
<http://legacy.kek.jp/Roadmap/index-en.html>

KEK Roadmap 2008



We have been successfully carried out research programs following the roadmap.

KEK Roadmap 2013

1. Preamble
2. Long-Term Prospects and KEK's Role for Each Research Area
3. Strategy for Next Five Years (2014-2018)
 - 3.1 J-PARC
 - 3.2 SuperKEKB/Belle II
 - 3.3 LHC/ATLAS
 - 3.4 ILC
 - 3.5 Photon Science (Synchrotron Radiation Research)
 - 3.6 New Development of Accelerator and Detector Technologies
4. Summary

At the neutrino facility, a significant improvement in the measurement precision of the T2K experiment will be pursued. In addition, new research plans will be developed for the next generation of long-baseline neutrino oscillation experiments, while relevant preparatory studies are pushed forward in parallel.

In research activities **at the Hadron Experimental Facility**, experiments at the present and new primary proton beam lines will be steadily advanced, while additional efforts will be made toward future extension of the facility.

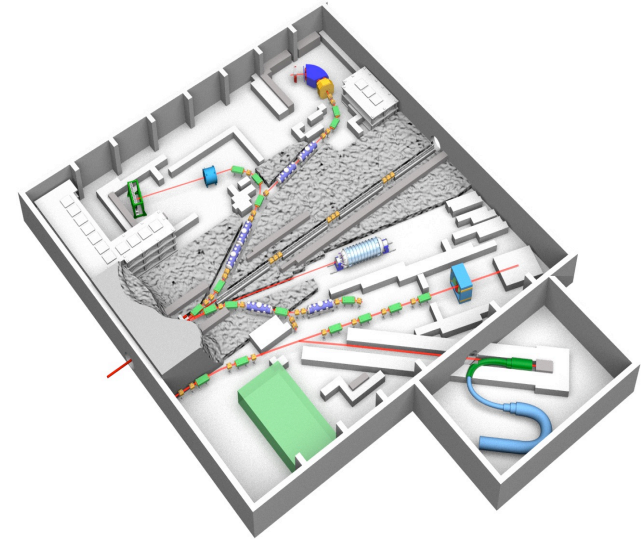
In the neutron program, the high-priority task is to meet the initial performance goal of the pulsed neutron experimental facility; this will require further development, construction, and improvement so as to realize great strides in material and life science.

In the muon program, the muon beam lines will be completed and continuously improved. This will support research in material and life science through sophisticated and creative muon spin rotation, relaxation, and resonance (μ SR) experiments, a wide range of applied research, and research in fundamental physics.

Regarding **the program for improving J-PARC's accelerator systems**, a high-priority item is to rapidly meet the design beam intensity goal, to be supplemented soon thereafter with preparation for the next-stage upgrade plans for the facility, which will enable a major increase in the beam intensity.

Recent developments at J-PARC

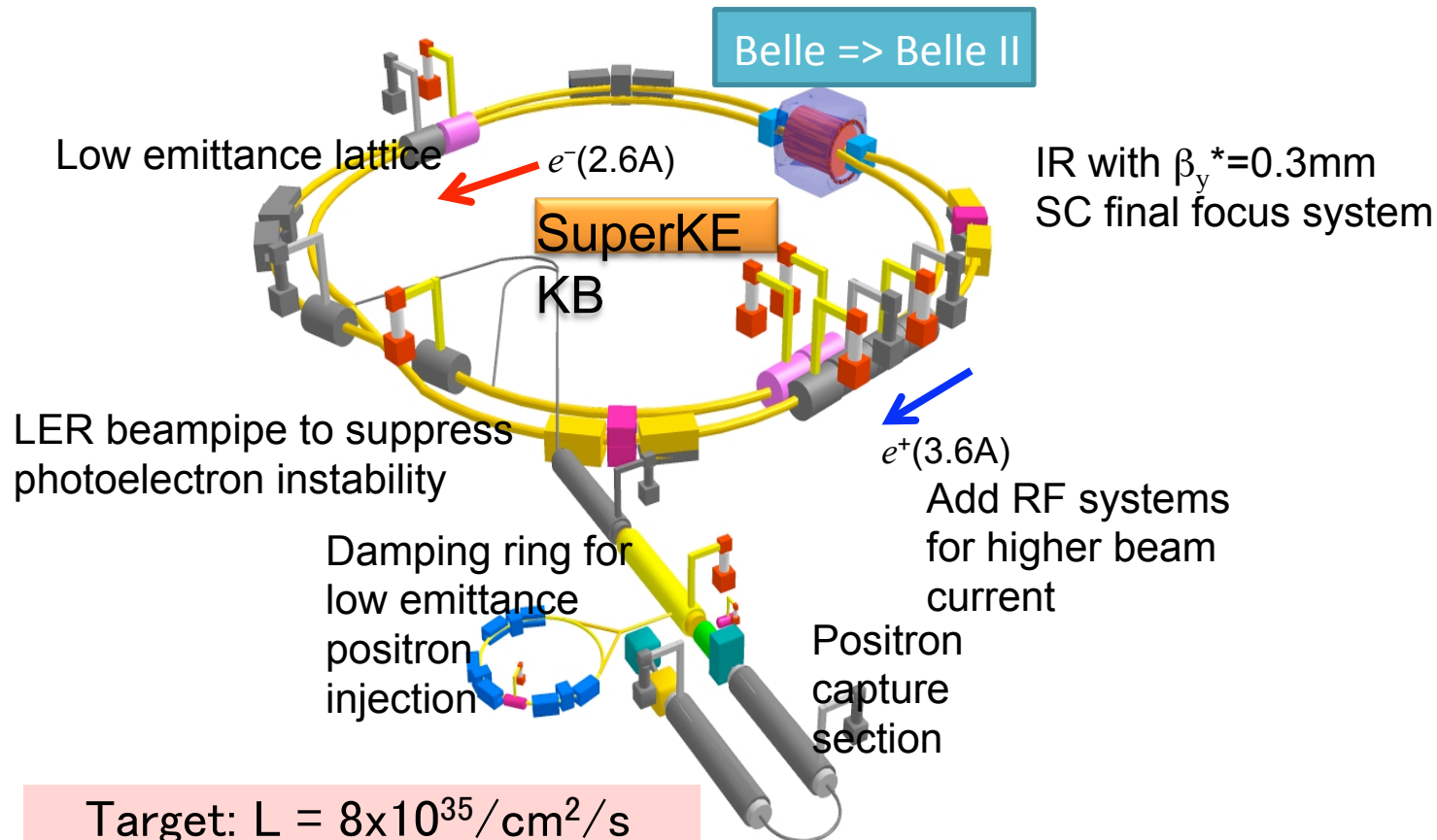
- Construction of the high momentum beam line and the COMET phase I experiment started in FY 2012 at the Hadron Experimental Facility.
- User operations at Materials and Life Science Facility started in February, 2014 for the first time after the J-PARC Hadron Hall radiation leak on May, 23, 2013.
- In order to discuss future neutrino programs in Japan, a series of workshops on Next Generation Accelerator-based Neutrino Experiment has been initiated.



SuperKEKB/Belle II

The goal at **SuperKEKB/Belle II** is to complete the construction of the accelerator and detector facilities, and then to achieve the design luminosity performance on schedule and to initiate in-depth exploration of new physics.

Start the experiment on schedule



LHC/ATLAS

The main agenda at **LHC/ATLAS** is to continually participate in the experiment and to take a proactive initiative in upgrade programs within the international collaboration at both the accelerator and detector facilities.

Intend to participate in the upgrade

International collaboration has started for the design work of the magnet system under HiLumi (FP7)

Challenges:
 Large aperture ($\phi 130\sim 150\text{mm}$) 6 Tesla magnet: saturation, flux leakage
 High radiation dose: selections of rad-hard materials

There is a CERN-KEK collaboration on high-field magnet Nb₃Sn, Nb₃Al

Very fruitful collaboration with CERN

The innermost station of the muon endcap
 Located between endcap calo and toroid

The small wheels

Labels in diagram: New Small Wheels, Micromegas, STGC, El station small wheel, L1 trigger chambers.

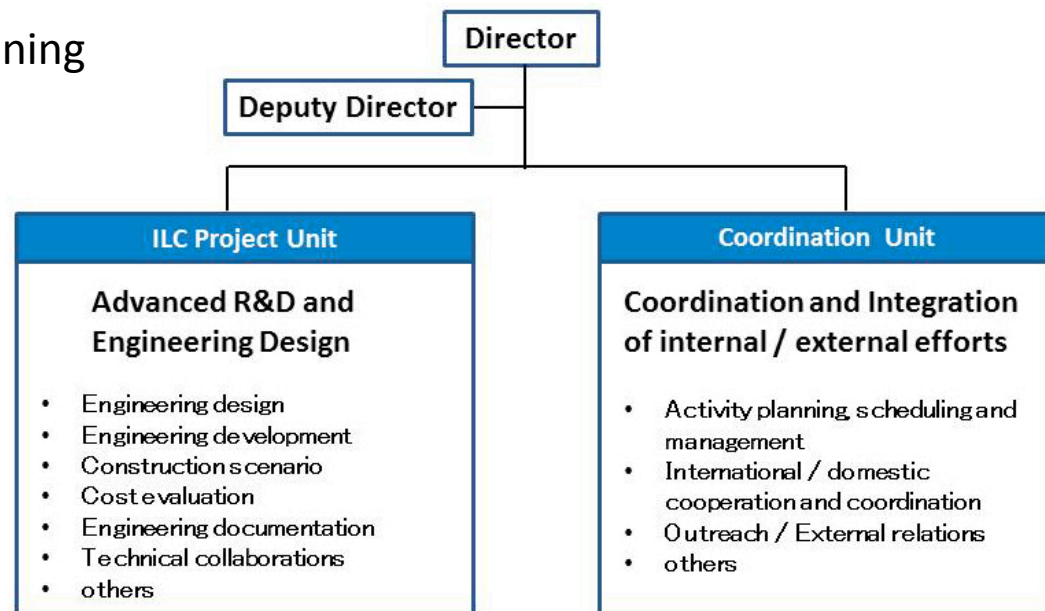
The LHC/ATLAS upgrade review was held by IPNS, KEK in November, 2013.



KEK will play a central role in creating an international preparatory group and will lead the effort on advanced R&D, the engineering design of the apparatus and facility, and the organizational design toward groundbreaking for **the linear collider project** to be hosted in Japan, within the framework of a global collaboration.

In accordance with the Japanese HEP community's proposal

As the first step, KEK set up the Planning Office for the ILC in January 2014.



Photon Science (Synchrotron Radiation Research)

KEK will continue to advance photon science by **upgrading the Photon Factory (PF) and Photon Factory Advanced Ring (PF-AR)** to improve their performance and efficiency. At the same time, KEK will construct and then operate **the compact energy recovery linac (c-ERL)** and will demonstrate the key technologies required for the ERL. By proving the potential of the ERL as a new accelerator to open new scientific frontiers, KEK will work toward construction of a 3 GeV ERL facility. In addition, KEK will continue to play a leading role in **the development of synchrotron radiation (SR) research in Japan.**

Completion of the c-ERL construction this year

Addendum to KEK roadmap 2013 in October 2013

While KEK is engaged in a long-term effort toward construction of a 3 GeV ERL facility, KEK will play a leading role in the realization of a low-emittance storage ring as a high-brilliance light source in the mid-term. KEK is now beginning specific studies on this possibility with eyes on the value of nation-wide effort. Such a light source facility with high brilliance, currently not present in Japan, is strongly desired by user communities in a wide range of academic and industrial fields, and is considered to be an indispensable research platform in the near future.

*Execution of the short term plan and R&D for future:
A mid-term plan to be updated*

New development of accelerator and detector technologies

KEK will contribute its expert knowledge and technical capabilities with respect to particle accelerators and detectors to collaboration with scientists from **research fields of overlapping interest** and to numerous **industrial and medical applications** for the benefit of society. KEK will also promote research that has the potential to **significantly expand accelerator and detector technologies** in the long term.

*Impacts on other fields and society,
development of future technologies*

Japanese HEP roadmap created after the first KEK roadmap

Quest for Birth-Evolution of Universe

International Linear Collider (ILC)

Quest for Unifying Matter and Force



Lepton CP Asymmetry

Power-Upgrade



J-PARC

Scientific Activities
Technology Innovation
Encouraging Human Resources



LHC



KEK-B

Beyond Standard Physics

Super-KEKB

Quark CP Asymmetry

Quest for Neutrinos



Lepton



[Origin of Matter]

Quark



Quest for 6 Quarks

[Origin of Force]

Higgs Particle [Origin of Mass]



Research Administration Department

- KEK established a new department to support research promotion according to the KEK Roadmap. This is a new program to be supported by MEXT for the next 10 years.
- KEK intends to promote cooperation with industries and universities for innovation and global cooperation with research institutes abroad for accelerator based science under this new program.

Summary

- KEK established a new roadmap for research for the next five years (with a possible update for the mid-term plan of the photon science).
- It clarifies goals of on-going programs and preparations for the future.
- Implementation towards realizing the roadmap has started.