



INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION
HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION

KEK Roadmap

Yasuhiro Okada (Trustee, KEK)
18th KEKB Accelerator Review Committee
March 5, 2013, KEK

KEK Roadmap

- KEK established its first Roadmap (5year plan, 2009-2013) in 2008. We have been pursuing realization of research projects according to this roadmap.
- In April, 2012, we started the update process of the KEK roadmap in the KEK Research Steering Committee.
- This is a bottom-up process since KEK is an Inter-University Research Institute Corporation. We took into account inputs from relevant science communities: High Energy Physics, Nuclear Physics, Synchrotron radiation research, Neutron science, Muon science.
- The final draft from the committee is now available <http://kds.kek.jp/conferenceDisplay.py?confId=11728>
- The new roadmap “KEK Roadmap 2013” is open to public after consulting the KEK roadmap review committee held in April 2013.

Current KEK Roadmap (2008)

5 year plan (2009-2013)

1. Operation of JPARC, early realization of the design and reinforcement of the beam intensity =>Strong on-going program
2. KEK B Factory upgrade =>SuperKEKB/Belle II construction
3. PF/PF-AR Operation and Upgrade
4. Commitment to the LHC Experiment => Start of LHC experiments
5. R&D of Advanced Accelerator and Detector Technologies
 - R&D Program for the ERL => Construction of c-ERL
 - R&D Program for the ILC =>R&D at test facilities: STF and ATF/ATF2
 - R&D for the Particle Detectors
 - => Support activities at KEK Detector Technology Project

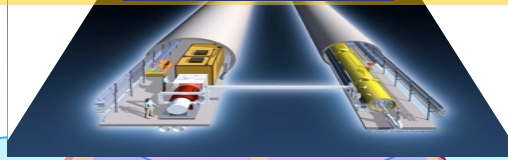
We have been successfully carried out research programs following the roadmap.

Japanese HEP roadmap

Quest for Birth-Evolution of Universe

Quest for Unifying Matter and Force

International Linear Collider (ILC)



Lepton CP Asymmetry

Power-Upgrade



J-PARC

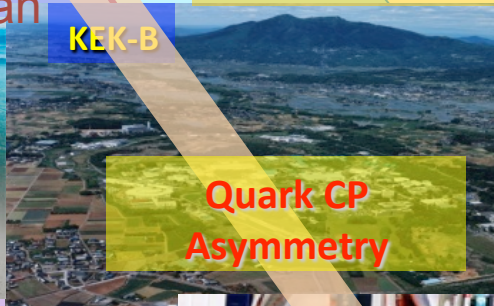
Scientific Activities
Technology Innovation
Encouraging Human Resources



LHC

Beyond Standard Physics

Super-KEKB



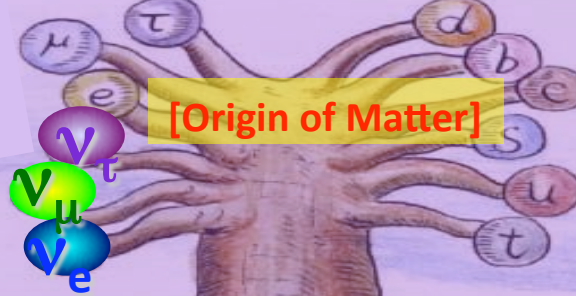
KEK-B

Quark CP Asymmetry

Quest for Neutrinos



Lepton



Quark

[Origin of Matter]

[Origin of Force]

Higgs Particle [Origin of Mass]



Quest for 6 Quarks



New KEK Roadmap (final draft)

1. Preamble
2. Long-Term Prospects and KEK's Role for Each Research Area
 - 2.1 Particles and Nuclear Physics
 - 2.2 Materials and Life Science
 - 2.3 Development of Particle Accelerators and Related Technologies at KEK
 - 2.4 Development of Detector-Related Technologies at KEK
 - 2.5 KEK as a Center for International Cooperation, Human Resource Development, and Social Contribution
3. Strategy for Next Five Years (2014-2018)
4. Summary

- We try to make it clear that in what stage each project should be for the next five years (2014-2018) .
- Timely realization of the programs requires execution plans, taking account of development of relevant science and technologies as well as the availability status of human and financial resources.

Outline of the Strategy for Next Five Years

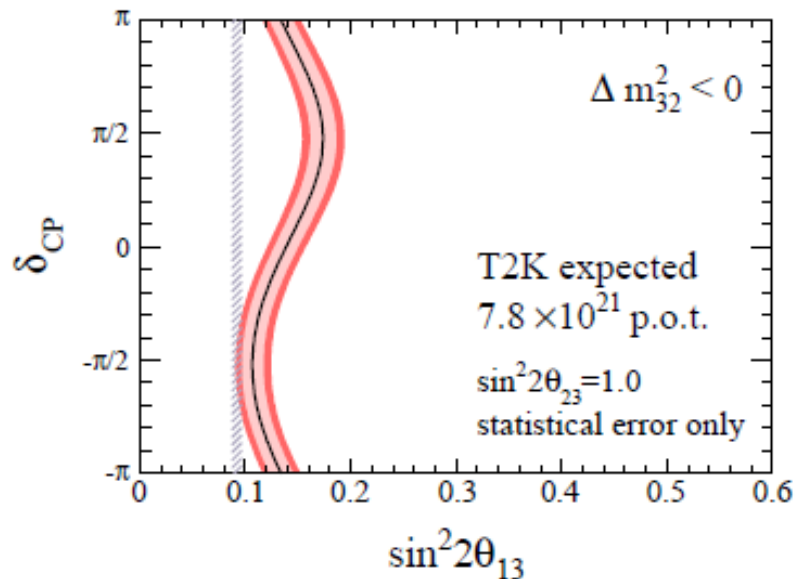
- Japan Proton Accelerator Research Complex (J-PARC)
- SuperKEKB/Belle II
- Large Hadron Collider (LHC)/ATLAS
- International Linear Collider (ILC)
- Photon Science (Synchrotron Radiation Research)
- New development of accelerator and detector technologies

J-PARC (1)

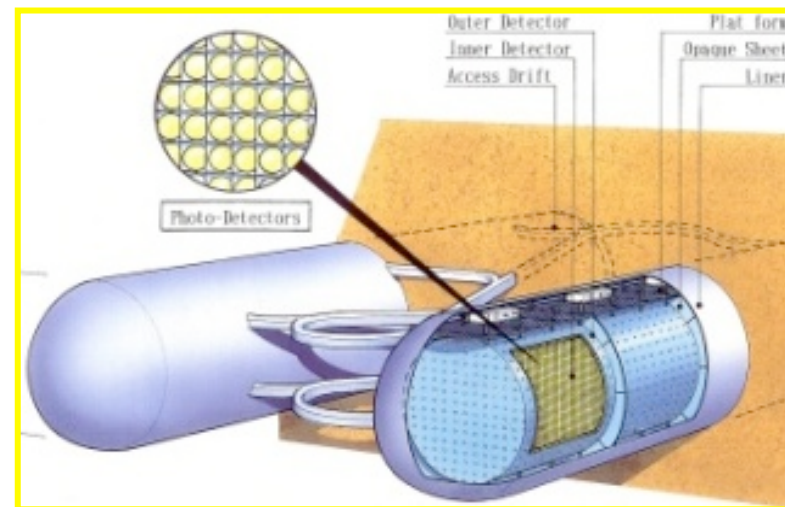
At the neutrino facility, a significant improvement in the measurement precision of the T2K experiment will be pursued. In addition, new research plans will be developed for the next generation of long-baseline neutrino oscillation experiments, while relevant preparatory studies are pushed forward in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

Execution of the T2K experiment
Expected beam power

May 2012	2014	2018
190kW	300kW	750kW



Design and preparatory works for the next generation of long baseline neutrino oscillation experiment for both detector and accelerator aspects.



J-PARC (2)

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.

Construction of the new primary beam line and the COMET (μ -e conversion experiment)

High Resolution Hypernuclei Spectroscopy
 Θ^+ via $p(\pi^-, K^-)$ reaction

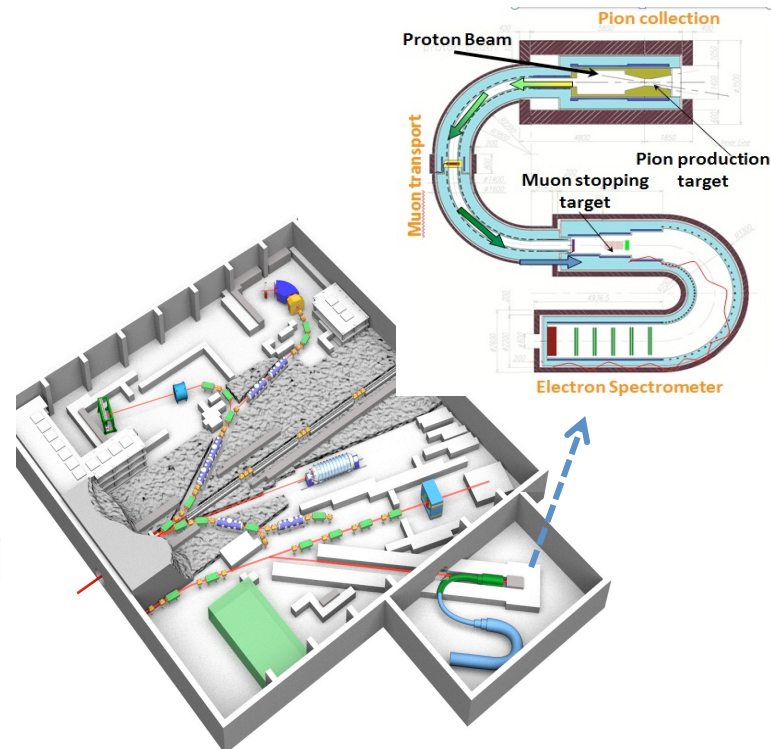
KL Rare Decay
 $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$

Strangeness Nuclear Matter
 $p(\pi^-, K^+) \Sigma @ 1.25 \text{ GeV/c}$

Mass without Mass Puzzle
 Quark (Free quarks, Bound quarks)
 Why are bound quarks heavier?

T-violation
 μ -polarization at $K^+ \rightarrow \pi^0 \mu \nu$

Pentaquark Θ
 $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$

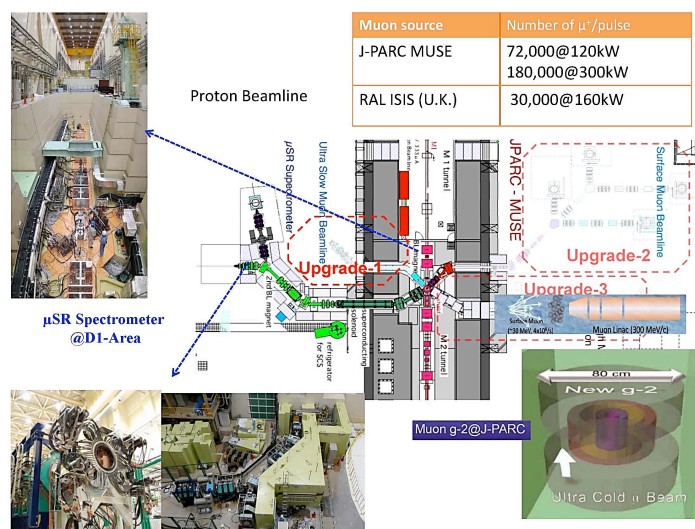


J-PARC (3)

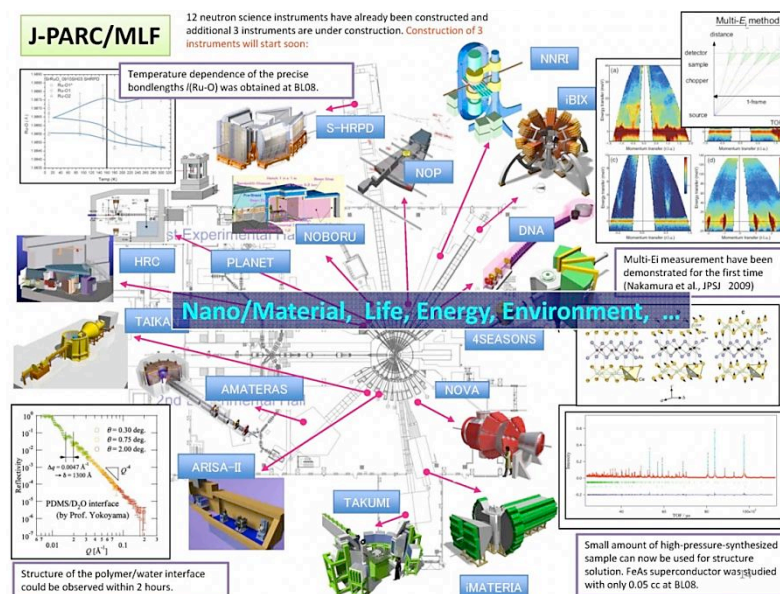
In the neutron program, the high-priority task is to meet the initial performance goal of the pulsed neutron experimental facility; this will require further development, construction, and improvement so as to realize great strides in material and life science.

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.

Muon



Neutron

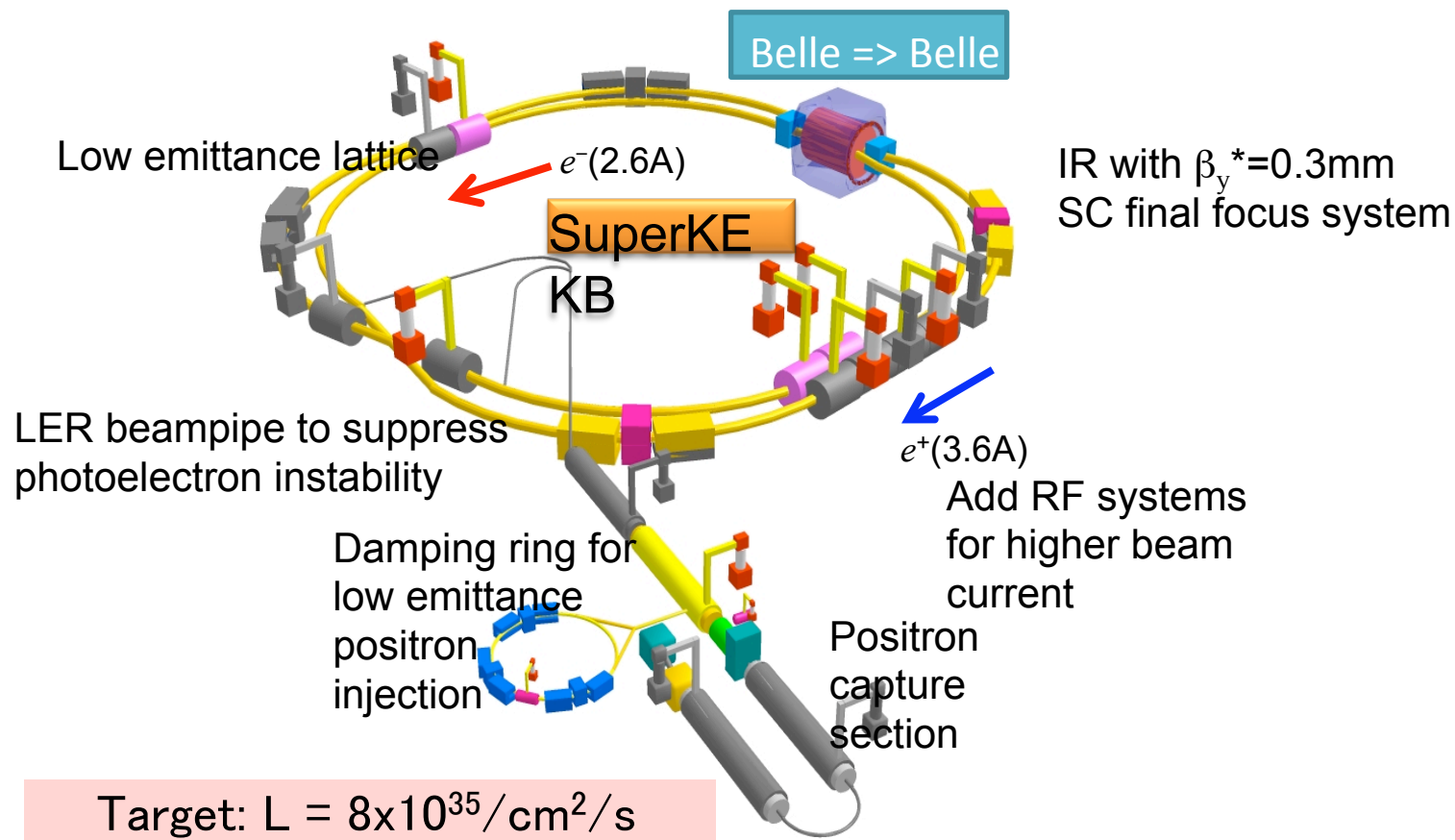


J-PARC (4)

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.

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.



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.

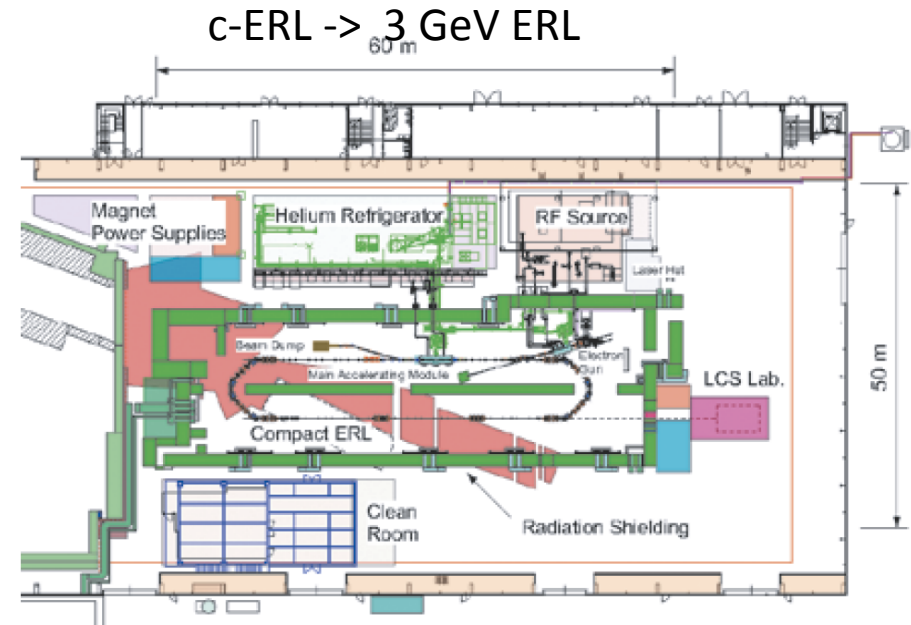
ILC

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.

- Japanese Association of High Energy Physicists (JAHEP) published the final report on Future Projects of High Energy Physics in March 2012.
- Discovery of a Higgs-like particle at LHC was announced in July 2012
- JAHEP published “A Proposal for a Phased Execution of the International Collider Project” in October 2012.
- GDE completed a draft of ILC-TDR in December 2012.
- “Proposed Update of the European Strategy for Particle Physics” was open to the community in January 2013.
- ICFA established Linear Collider Collaboration (LCC) in February 2013.

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.



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.

Summary

- We have completed the final draft of “KEK Roadmap 2013”.
- After consulting the roadmap review committee, the new KEK roadmap will be established.
- This gives an outline of the research programs to be pursued at KEK for the next five years.