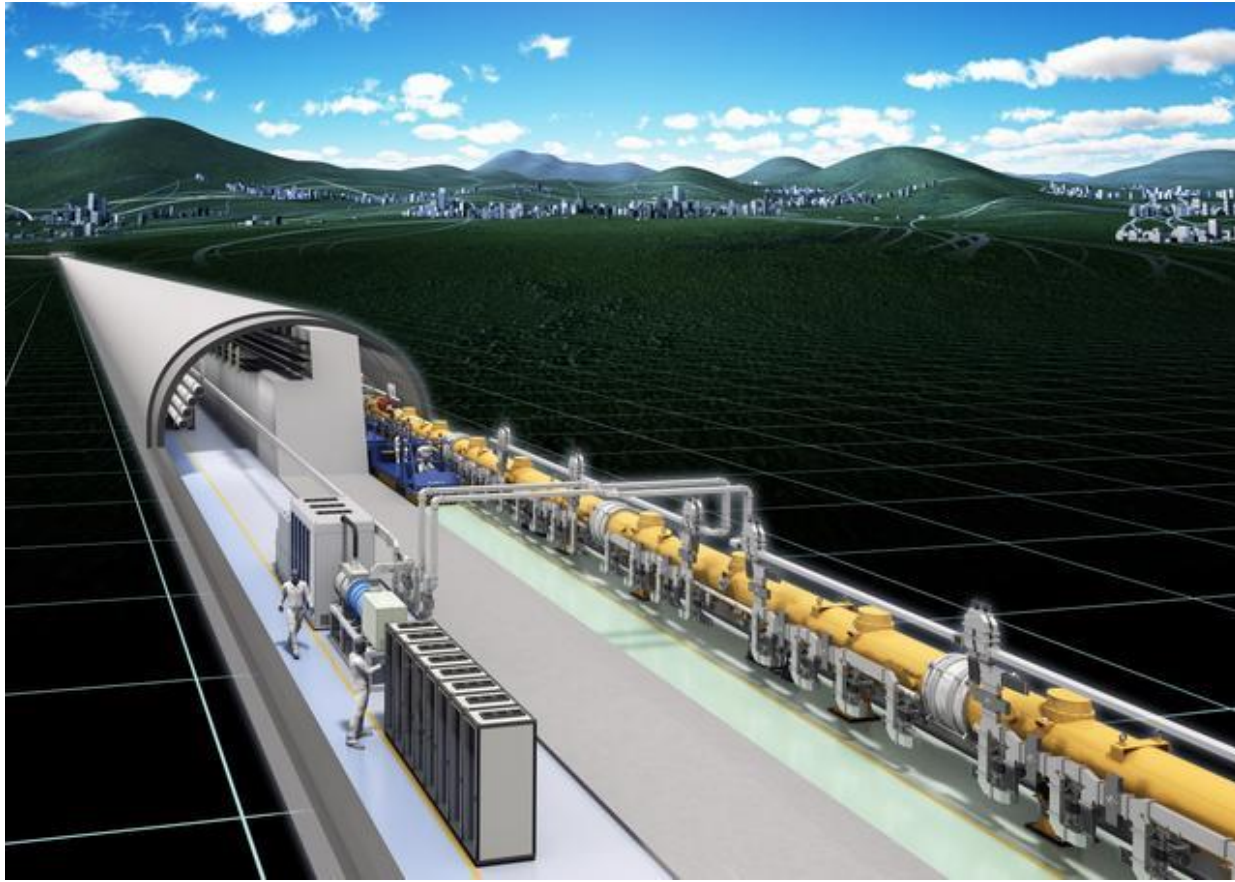


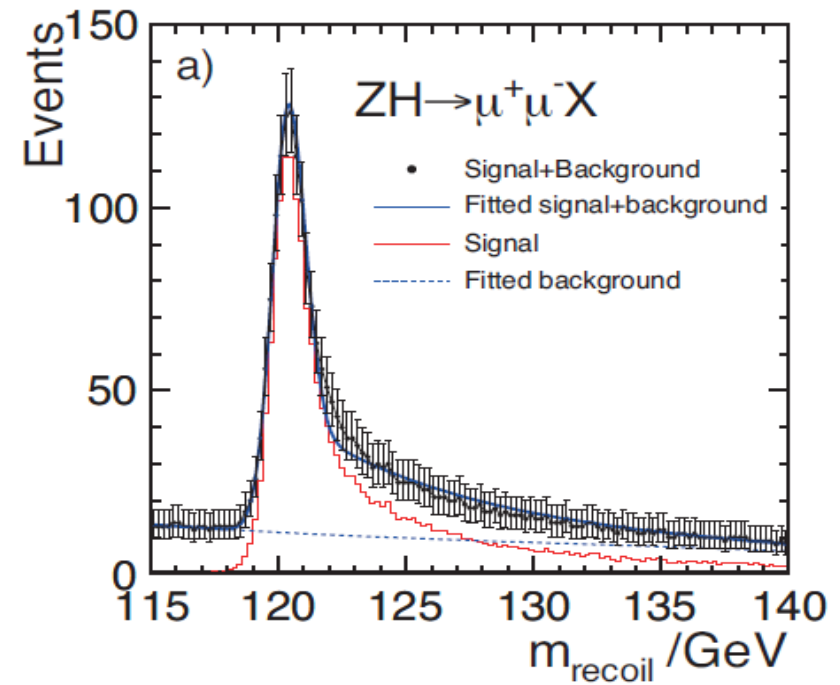
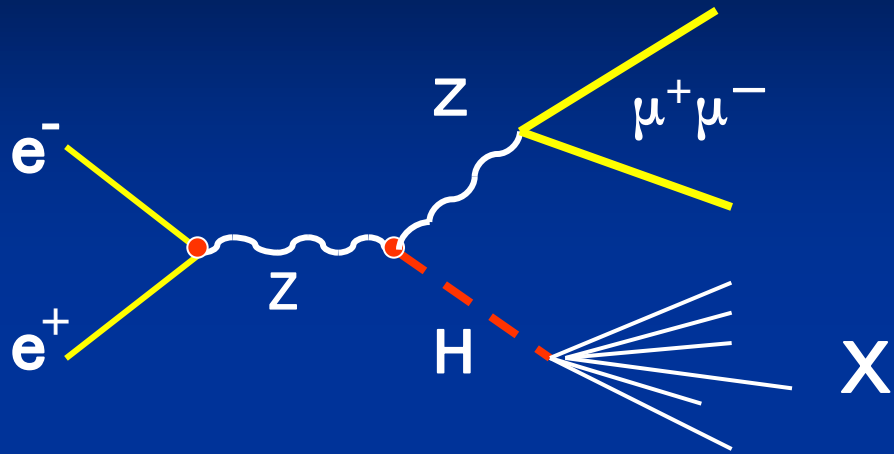
Way Forward

December 19th 2013 Tokushin Workshop 2013 @KEK
School of Science, and ICEPP, the University of Tokyo Sachio Komamiya

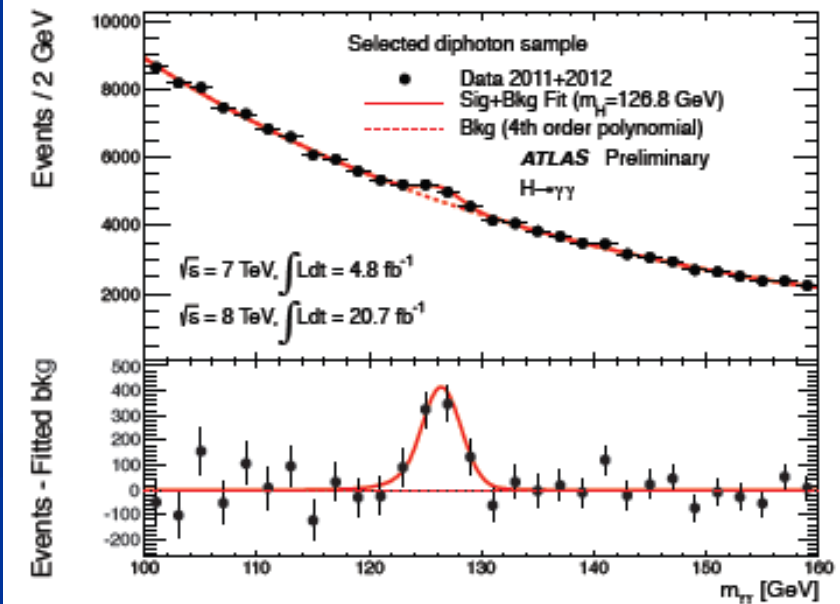
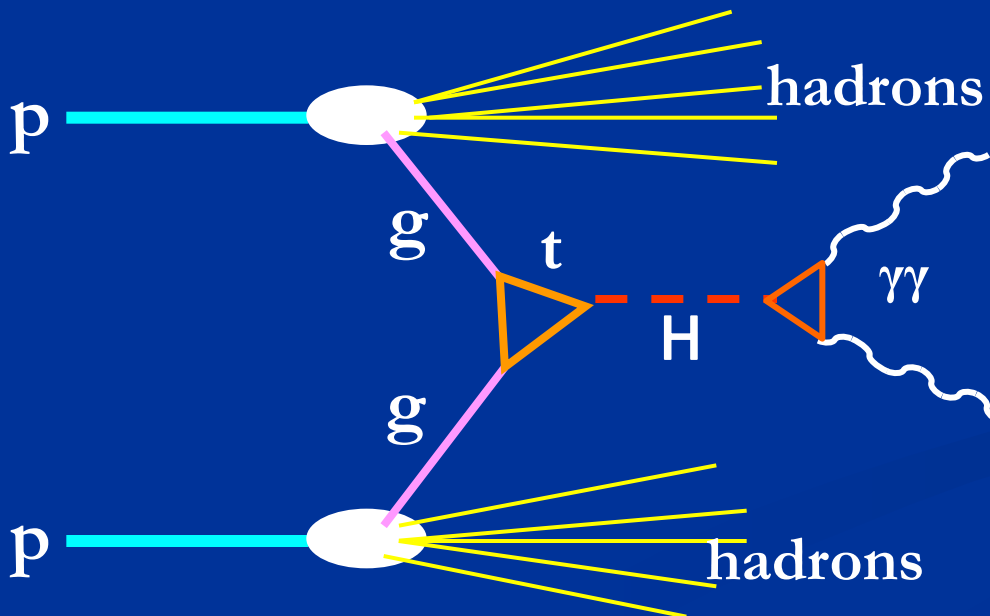


Two measurements are complementary and qualitatively different

ILC $\mu^+\mu^-$ recoil mass distribution

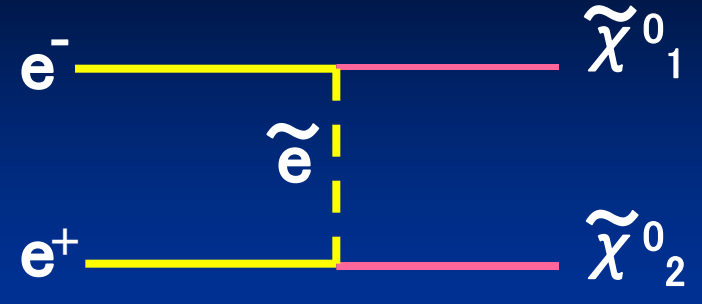
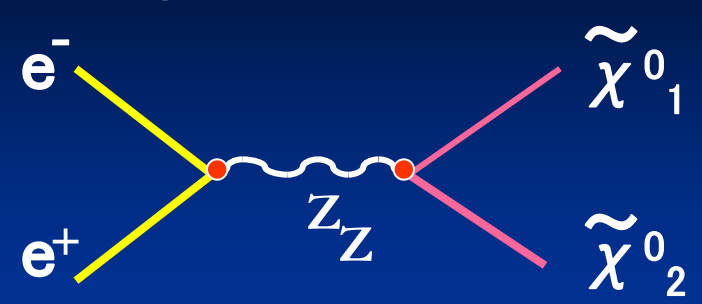


LHC $H \rightarrow \gamma\gamma$ mass distribution

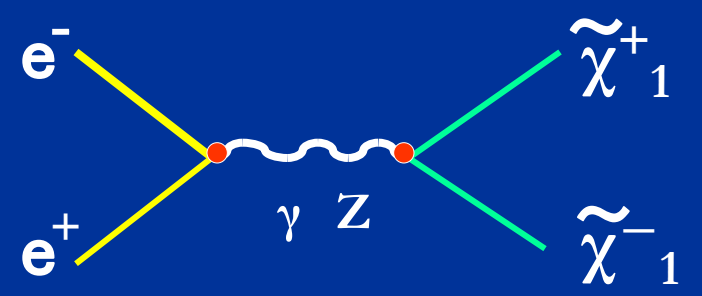


Possible Dark Matter Searches at ILC

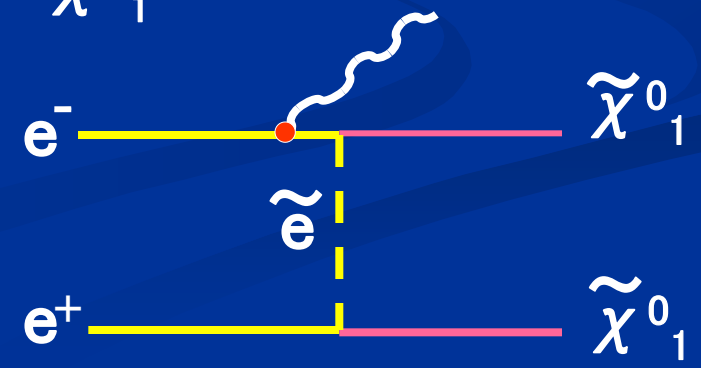
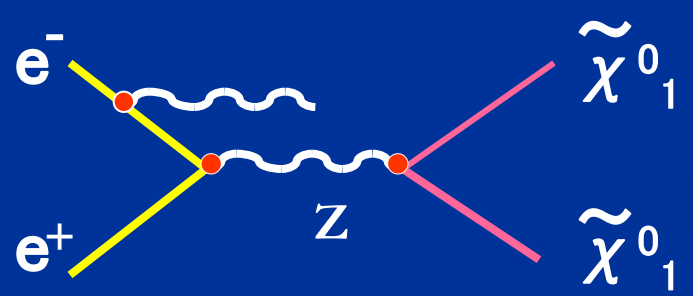
The lightest and the next lightest SUSY particles



$$\tilde{\chi}^0_1 \tilde{\chi}^0_2 \rightarrow \tilde{\chi}^0_1 \tilde{\chi}^0_1 Z \quad \text{or} \quad \tilde{\chi}^0_1 \tilde{\chi}^0_1 h$$

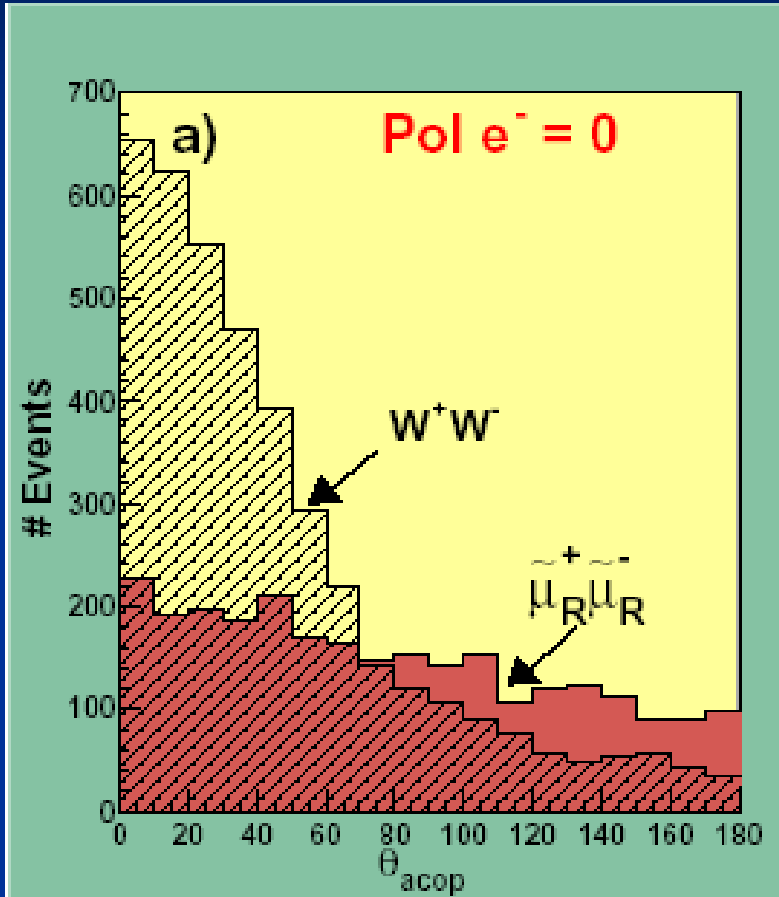


$$\tilde{\chi}^+_1 \tilde{\chi}^-_1 \rightarrow \tilde{\chi}^0_1 W^+ \tilde{\chi}^0_1 W^-$$

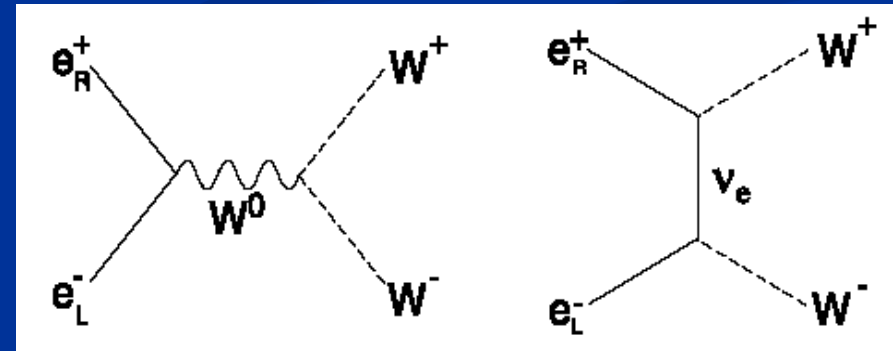
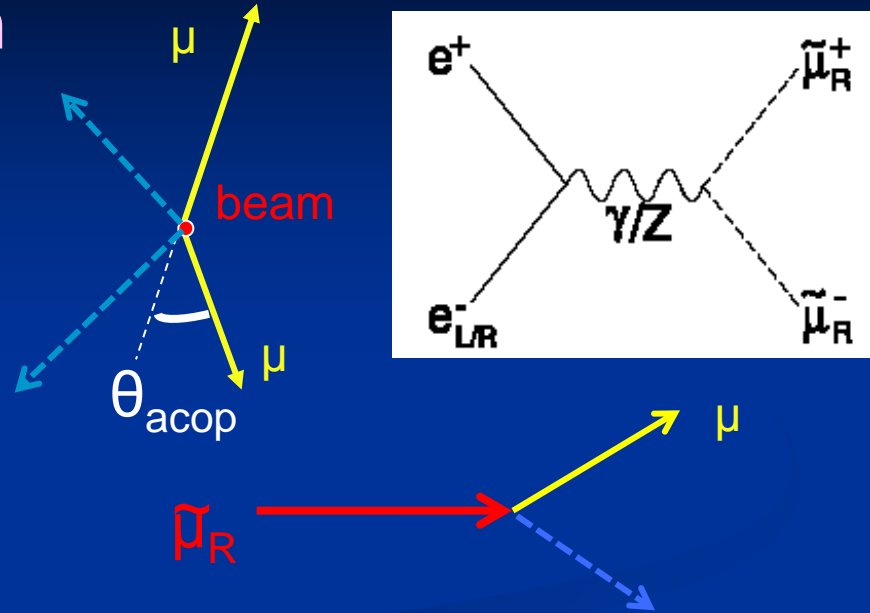


Power of electron polarization at ILC

Scalar muon production



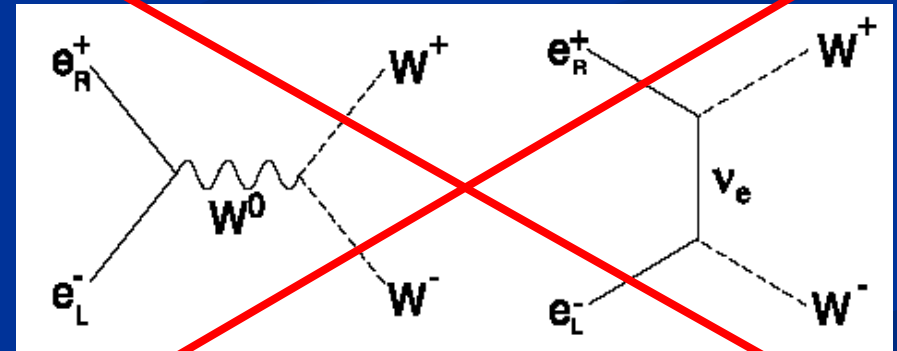
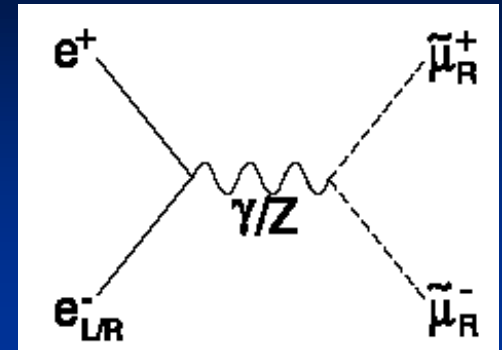
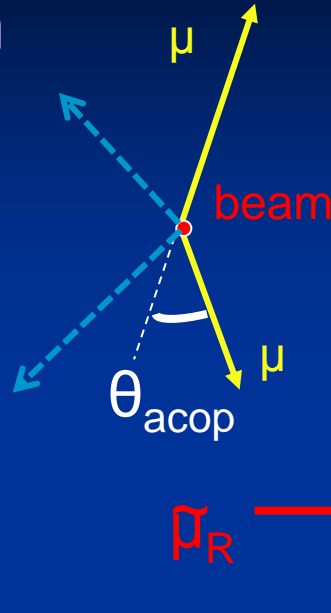
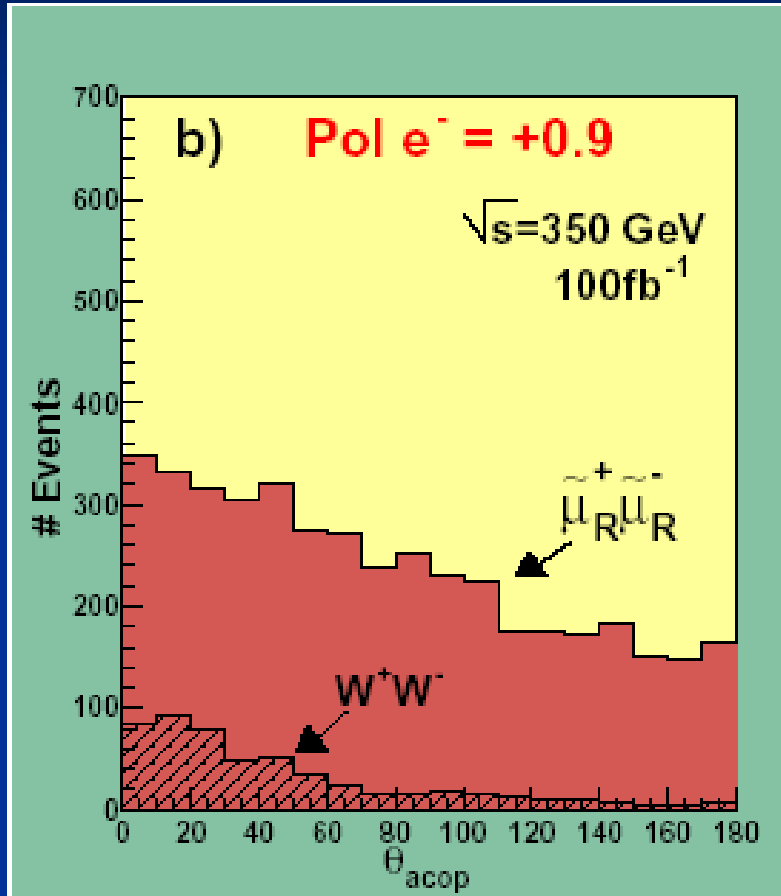
Unpolarized



Background signal

Power of electron polarization at ILC

Scalar muon production



Polarized (90% e^-_R)

Background signal

These English translations are by Hitoshi Murayama.

MEXT asked SCJ to evaluate ILC for only the following points on May 27, 2013.

- (1) Scientific significance of the research using ILC, and the position of ILC project in context of particle physics.
- (2) Position of ILC project in the context of overall science activity in Japan.
- (3) Significance of hosting ILC for Japanese people and society.
- (4) Current state of preparation and necessary conditions for implementation of ILC project, including securement of budget and human resources for construction and operation of ILC.

SCJ submitted the answering report on September 30, 2013.

Precise measurement of Higgs Boson and top quark, and examination of symptoms of new physics beyond the SM which constitute the primary mission of ILC, **are well appreciated**. On the other hand, in regard to the strategy for search for new particles beyond the SM, **a more persuasive and clear description of the plan**, including its relation with the LHC after the upgrade, is desirable so as to justify the huge amount of investment for the project.

The items to be investigated includes:

- (1) a clear scientific strategy at the ILC in view of the future upgrade plan of the LHC,
- (2) funding scheme for the ILC that does not cause any delay in actions taken against many issues of national importance, of stagnation of research in various fields of science,
- (3) scheme of international cost sharing,
- (4) a clear vision for central domestic organization consisting of researchers at KEK and universities,
- (5) Human resource necessary for construction and operation of the ILC, especially, the leadership.

SCJ recommends that a group is set up consisting not only of those promoting the project but also knowledgeable people from other fields of science and relevant government sectors, to carry out intensive investigations of outstanding issues for a few years, as basis of proper assessment of the feasibility of the ILC project. The expenditure for such investigations and assessment should be sufficiently granted.

MEXT is requesting ~\$0.5M to MOF as investigation budget.

MEXT starts unofficial investigation of the possible partners in the world.

My comments:

Some SCJ scientists tend to oppose new projects which have possibility to reduce their own budget, irrespective of scientific importance of the projects. However, they also recognize that they will lose their credibility and authority, if they behave as a group of self-defensive narrow-minded scientists.

Approval of project is a governmental matter.

We know that the project of the size cannot be justified only by academic reasons. Scientists, government officials, politicians, industrialists should trust one another towards the success of the project.

The MEXT is very supportive for the ILC project. We will work out with MEXT the items that SCJ ask us towards the final approval.

Please watch out any positive sign from our government.

ILC site evaluation in Japan by scientists

ILC site evaluation committee (8 physicists)

Kiyotomo Kawagoe (Kyushu) co-chair
Masanori Miyahara (KEK)
Akira Sugiya (Saga)
Tohru Takahashi (Hiroshima)

Hoitoshi Yamamoto (Tohoku) co-chair
Shinya Narita (Iwate)
Atsuto Suzuki (KEK)
Satoru Yamashita (ICEPP, Tokyo)

Technical evaluation subcommittee	16+8 members (civil engineering experts)
Socio-environmental subcommittee	12+8 members (socio-environmental experts)
International review committee	12 members (all scientists)

The ILC site evaluation committee of Japan has assessed the two candidate sites based on technical and socio-environmental criteria and unanimously concluded as follows:

The Kitakami site is evaluated to be the best domestic candidate site for the ILC.

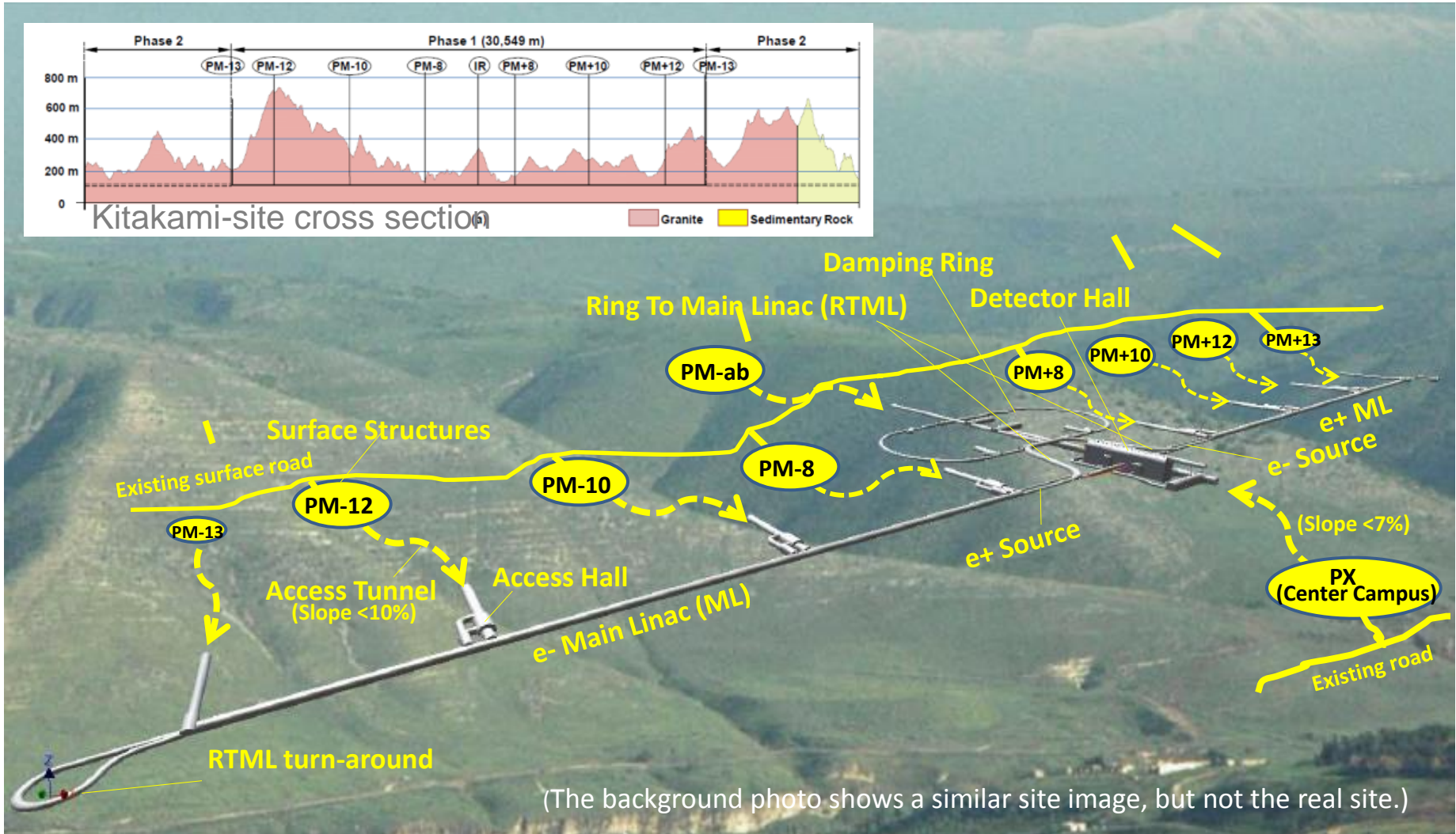
In addition, the committee strongly recommends the central campus of the Kitakami site to have a good environment for living and research and to be located near the Shinkansen line for convenient access to Sendai and Tokyo.

Kitakami mountains (stable granite hilly district) The selected site in Japan



岩手県一関市の資料をもとに作製

Site Specific Design



Need to establish the IP and linac orientation
Then the access points and IR infrastructure
Then linac length and timing

Situation outside of Japan

US

Recovery process from “December crisis in 2007”

Strong recommendation of ILC from community at the Snowmass Meeting in August.

P5 process is going on. P5 members from Japan: Toshinori Mori, Hiroaki Aihara

Discussions on the energy frontier projects (LHC and ILC) is held on 15 December.

Jonathan Bagger and Mike Harrison gave talks on ILC.

CERN

Upgraded LHC program planned up to 2035 This may conflict with ILC budget

SPC and Council were held last week. In the closed session ILC was discussed.

Hitoshi Murayama gave a talk at SPC. Odoi of MEXT attended the Council.

Germany

2012 Recommendation of ILC by HEPC

2013 May, ECFA LCWS

2013 December, Helmholtz Alliance Workshop on Tera-scale physics

R&D budget is secured + Euro-XFEL

France

2012 Recommendation of ILC by LC community

R&D budget is secured (CNRS/IN2P3 and CEA)

UK

2007, ILC budget is terminated (STFC)

Surviving with CERN-CLIC budget

Recovery process

2012 Roadmap Higgs-factory (2013 Nobel Prize Peter Higgs)

2013 September UK-LC workshop

Spain and Netherland are positive on ILC.

In Europe the first priority is the LHC and its upgrade.

China

2013 June, Fragrant Mountain Meeting (Science Council) on HEP

Strong support of ILC (5% contribution)

⇒ ACFA-HEP recommendation on ILC

Circular e+e- Collider (circumference of 50km, later pp-collider) under study

Korea

2013 December, ILC discussions are restarted

ILC corps :Hitoshi Yamamoto, Tomohiko Tanabe, Kaoru Yokoya

Taiwan

2012 September, restart the ILC discussions after the Higgs Boson discovery

LCWS13

Tokyo

11-15 November 2013



~350



Mr. Kawamura's Talk in LCWS13

President of the Federation of Diet members to promote a construction of international laboratory for LC

- Text (in English)

- Can be downloaded from the indico page on 11th November 2013
<http://icepp.s.u-tokyo.ac.jp/LCWS13/>

- Highlights

- We are aware that people are usually worried that an increase of academic budget in one field may mean a decrease in other fields. ... We shall arrange a dedicated budget to accommodate its much wider implications. It is the responsibility of the government to carry this out.
- The Department of Education has requested the Department of Finance to provide an ILC investigation fund of 50 million yen in next year's budget. ... once it has been approved, we members of the house will have achieved one of the most important milestones of recent years.

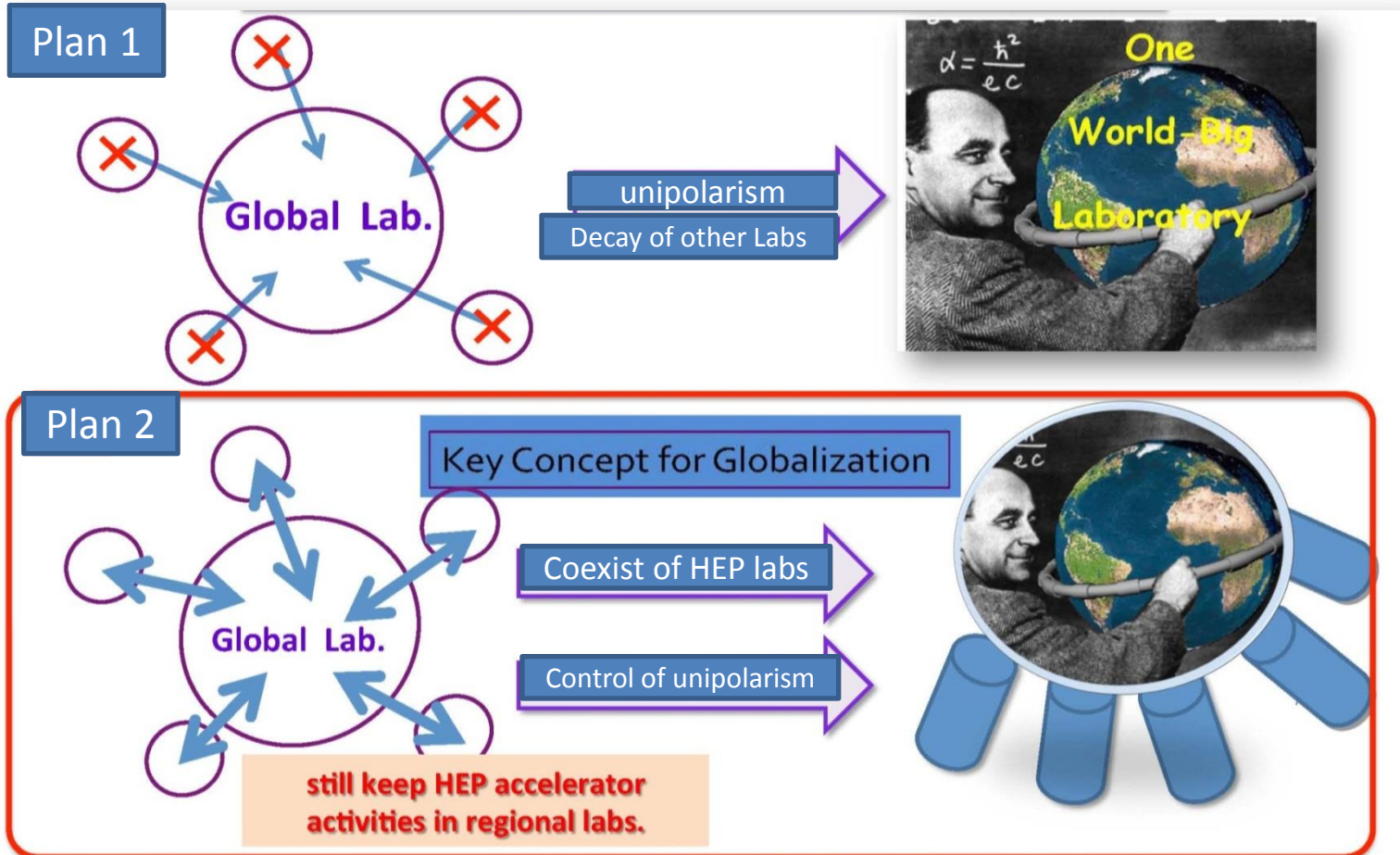
The Next Step for the Global Team

- Move from the Technical Design Phase to **the Engineering Design Phase towards the real construction**
both for accelerator and detectors \Rightarrow LCB set up PAC
 - **Reinforce Public relations: ILC is a truly global project**
 - Study further and establish the **organization/governance of the new ILC laboratory**
refer to the “Project Implementation Plan” of TDR
further developments are needed.
- Work with governments
- Site and host country establishment
 - International negotiation of the cost share etc.

Linear Collider Board (LCB)

- Detailed design of ILC Lab organization
legal framework, human resources, procurement
- Preparation of roadmap for international approval of ILC

Proposal of multinational Lab:
Contract Int. treaty of members of ILC project





ILC Timeline

Proposed by LCC

- **2013 - 2016**
 - Negotiations among governments
 - Accelerator detailed design, R&Ds for cost-effective production, site study, CFS designs etc.
 - Prepare for the international lab.
- **2016 – 2018**
 - ‘Green-sign’ for the ILC construction to be given (in early 2016)
 - International agreement reached to go ahead with the ILC
 - Formation of the ILC lab.
 - Preparation for biddings etc.
- **2018**
 - Construction start (9 yrs)
- **2027**
 - Construction (500 GeV) complete, (and commissioning start)
(250 GeV is slightly shorter)

- KEK is a cooperative and joint research organization of national universities in Japan.
- KEK has to listen to the vision of the scientific community.
- KEK has to cooperate with CERN and Fermilab as one of important international centers for particle physics.
- The Accelerator Division **should not and cannot** decide their own project.
- Development of accelerator technology is mainly driven by particle physics. This experimental fact is still true.
- Revolutionary era is just opened by the discovery of Higgs Boson towards the physics beyond the SM.
- Although ILC cannot be justified by scientific significance alone, scientists should be driven by science.

Just waiting for the positive sign from the Japanese Government is not fruitful.

Clear the items that SCJ asked us.

Scientific strategy of ILC along with LHC upgrade,
Overall cost, Human Resources, Scheme of International cost-share, Organization and Management of ILC-lab,
Local (host) organization KEK-Universities, Leadership.

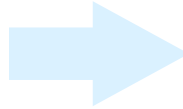
We need a lot of efforts to move the Japanese Government.

Collect information from many countries and regions for MEXT to start the international negotiation with MOFA.
Collaborate with Federation of Diet Members and with industry (AAA).

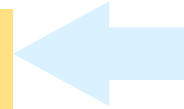
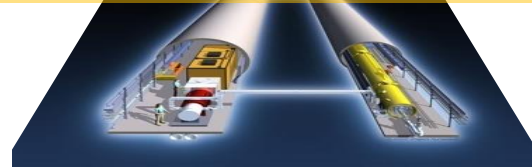
Move LCB and LCC

Study organization and management issues of ILC-lab
Draw a roadmap towards international approval

Quest for Birth-Evolution of Universe



International Linear Collider (ILC)



Quest for Unifying Matter and Force

KEK DG keeps showing this ugly slide since 2008

Lepton CP Asymmetry

*Scientific Activities
Technology Innovation
Encouraging Human Resources*

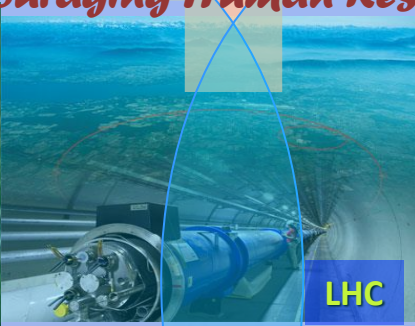
Beyond Standard Physics

Power-Upgrade

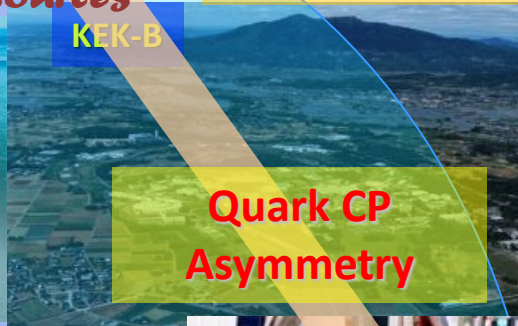
Super-KEKB



J-PARC



LHC



KEK-B

Quark CP Asymmetry

Lepton
Quest for Neutrinos



[Origin of Matter]



Quest for 6 Quarks



[Origin of Force]

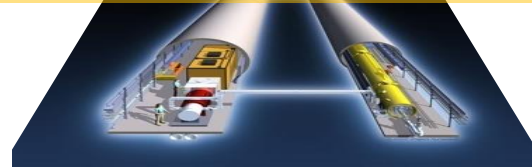
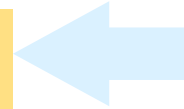
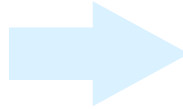
Higgs Particle [Origin of Mass]



Quest for Birth-Evolution of Universe

International Linear Collider (ILC)

Quest for Unifying Matter and Force



Lepton CP Asymmetry

Scientific Activities

Beyond Standard Physics

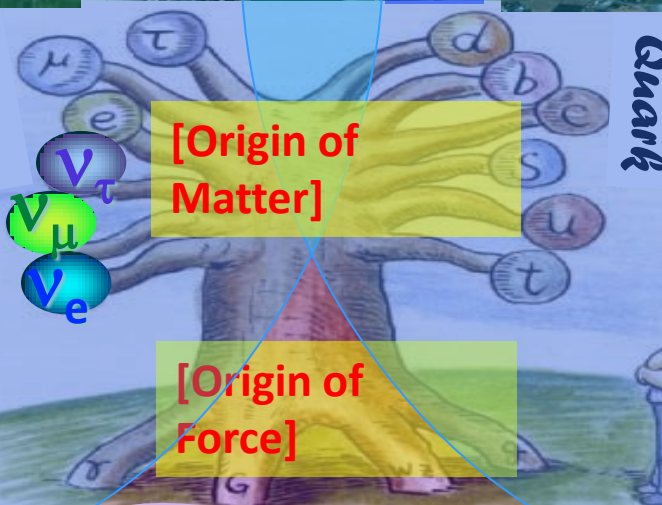
Power-Upgrade

*Technology Innovation
Encouraging Human Resources*

Super-KEKB

All roads lead to ILC

Quest for Neutrinos

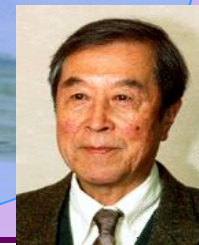


[Origin of Matter]

[Origin of Force]

Higgs Particle [Origin of Mass]

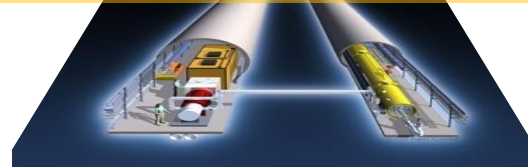
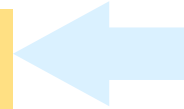
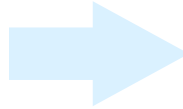
Quest for 6 Quarks



Quest for Birth-Evolution of Universe

International Linear Collider (ILC)

Quest for Unifying Matter and Force



Lepton CP Asymmetry

Scientific Activities

Beyond Standard Physics

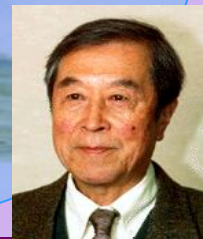
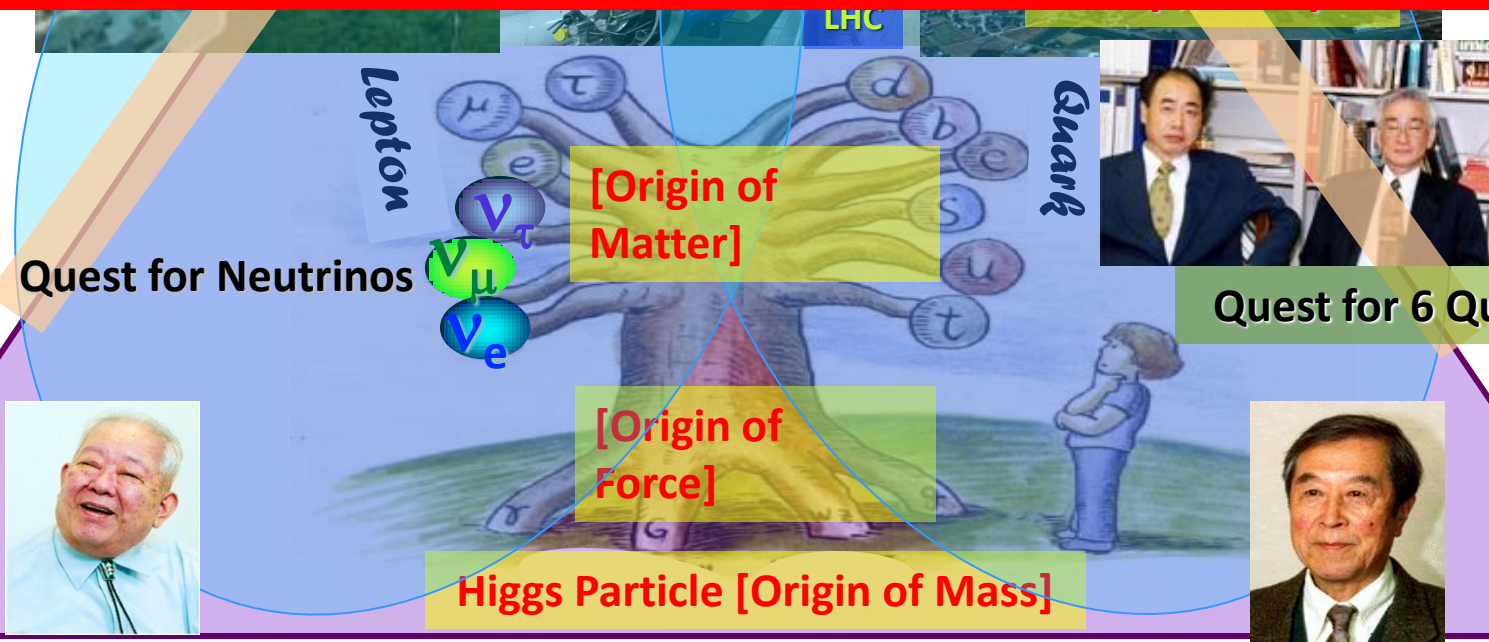
Power-Upgrade

Technology Innovation
Encouraging Human Resources

Super-KEKB

KEK B

We lead all roads to ILC



Quest for Neutrinos

ν_e
 ν_μ
 ν_τ

[Origin of Matter]

Quark

Quest for 6 Quarks

[Origin of Force]

Higgs Particle [Origin of Mass]

LHC