Latest Progress in Realization of ILC in Japan

Rong-Li Geng

Accelerator Seminar, JLab
November 21, 2013

World-wide Event

- On June 12th, ILC TDR was published in Worldwide Event.

- End of major phase in ILC development – now what?

LCWS13 at U. of Tokyo (11/11-15,2013)

- First LC workshop under LCB/LCC
- ILC + CLIC, physics, detector
- 350 participants
- 120 institutions
- 20 countries

Accelerator Working Groups

AWG1: Sources

Steffen Doebert, Wei Gai, Masao Kuriki

AWG2: Damping Rings

Ioannis Papaphilippou, David Rubin

AWG3: Beam Delivery & Machine Detecter Interface

Gao Jie, Lau Gatignon, Rogelio Tomas

AWG4: Beam Dynamics

Kiyoshi Kubo, Andrea Latina, Nikolay Solyak

AWG5: Conventional Facilities

Atsushi Enomoto, Vic Kuchler, John Osborne

AWG6: System Tests and Performance Studies

Roberto Corsini, Marc Ross, Daniel Schulte, Nobuhiro Terunuma

AWG7: Superconducting RF Technologies

Hitoshi Hayano, Eiji Kako, Wolf-Dietrich Moeller, Akira Yamamoto

Physics and Detector R&D

RD1: Higgs / Electroweak Symmetry Breaking

Tim Barklow, Chrstophe Grojean, Howard Haber, Shinya Kanemura, Philipp Roloff, Junping Tian

RD2: Beyond the Standard Model / Cosmology

Max Chertok, Seong-Youl Choi, Debajyoti Choudhury, Keisuke Fujii, Christian Grefe, Geraldine Servant, Georg Weiglein

RD3: Top / QCD / Loopverein

David Asner, Radja Boughezal, German Rodrigo, Frank Simon, Taikan Suehara, Sumino Yukinari

RD4: Gamma-Gamma

Kingman Cheung, Jeff Gronberg, Maria Krawczyk, Tohru Takahashi, Valery Telnov, Mayda Velasco

RD5: Simulation / Detector Performance / Reconstruction

Frank Gaede, Norman Graf, John Marshall, Akiya Miyamoto, Manqi Ruan, Graham Wilson

RD6: Detector Integration / Machine Detector Interface / Polarisation

Karsten Buesser, Guinyun Kim, Tom Markiewicz, Marco Oriunno, Tomoyuki Sanuki

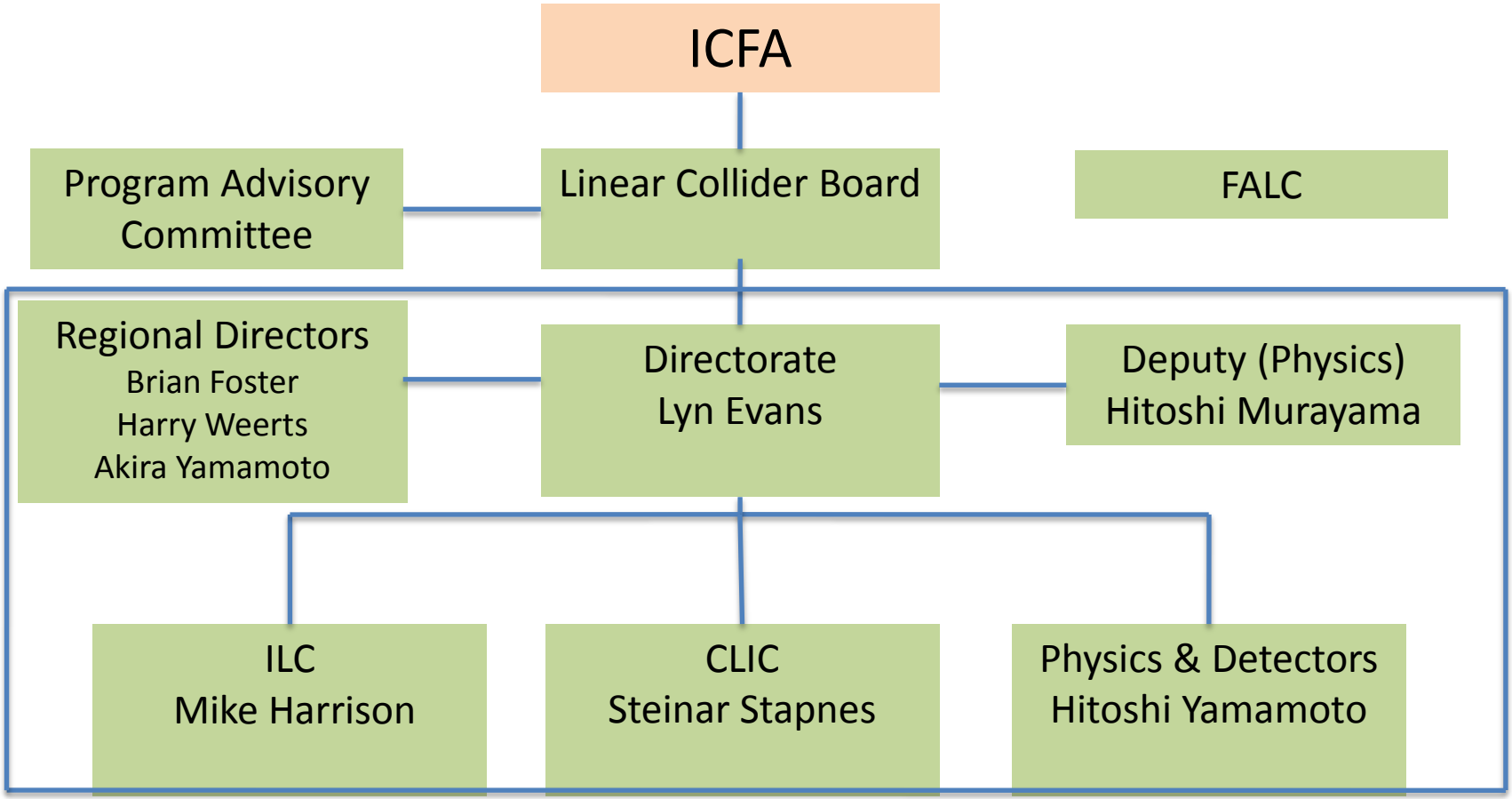
RD7: Tracking / Vertex

Mahdu Dixit, Tim Nelson, Akira Sugiyama, Yasuhiro Sugimoto, Marcel Vos, Marc Winter

RD8: Calorimetry / Muon

Daniel Jeans, Imad Laktineh, Roman Poeschl, Jose Repond, Felix Sefkow, Andy White, Tamaki Yoshioka

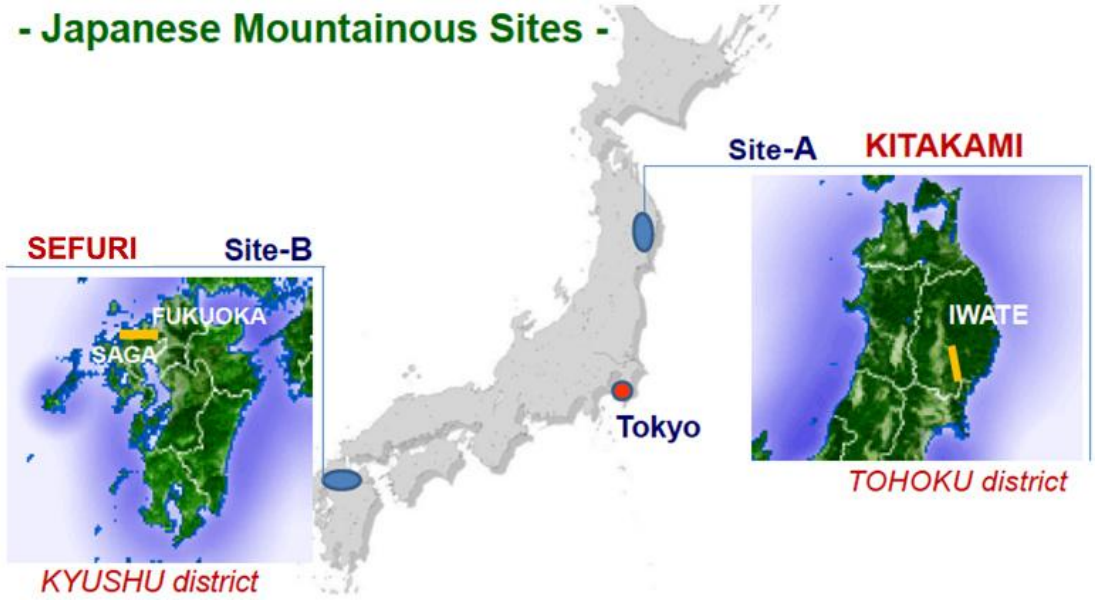
Organization



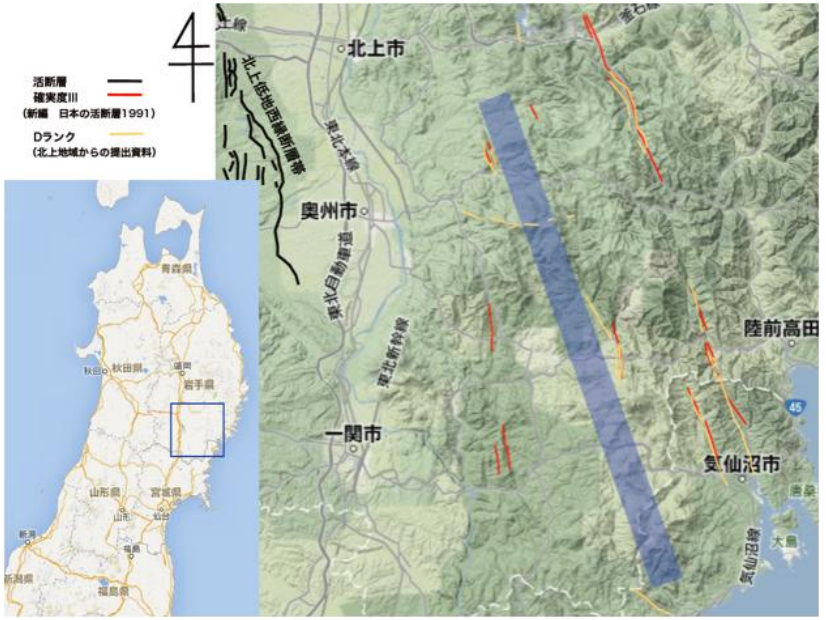
Two Candidate Sites in Asia/Japan

Japan – Preferred Site selection

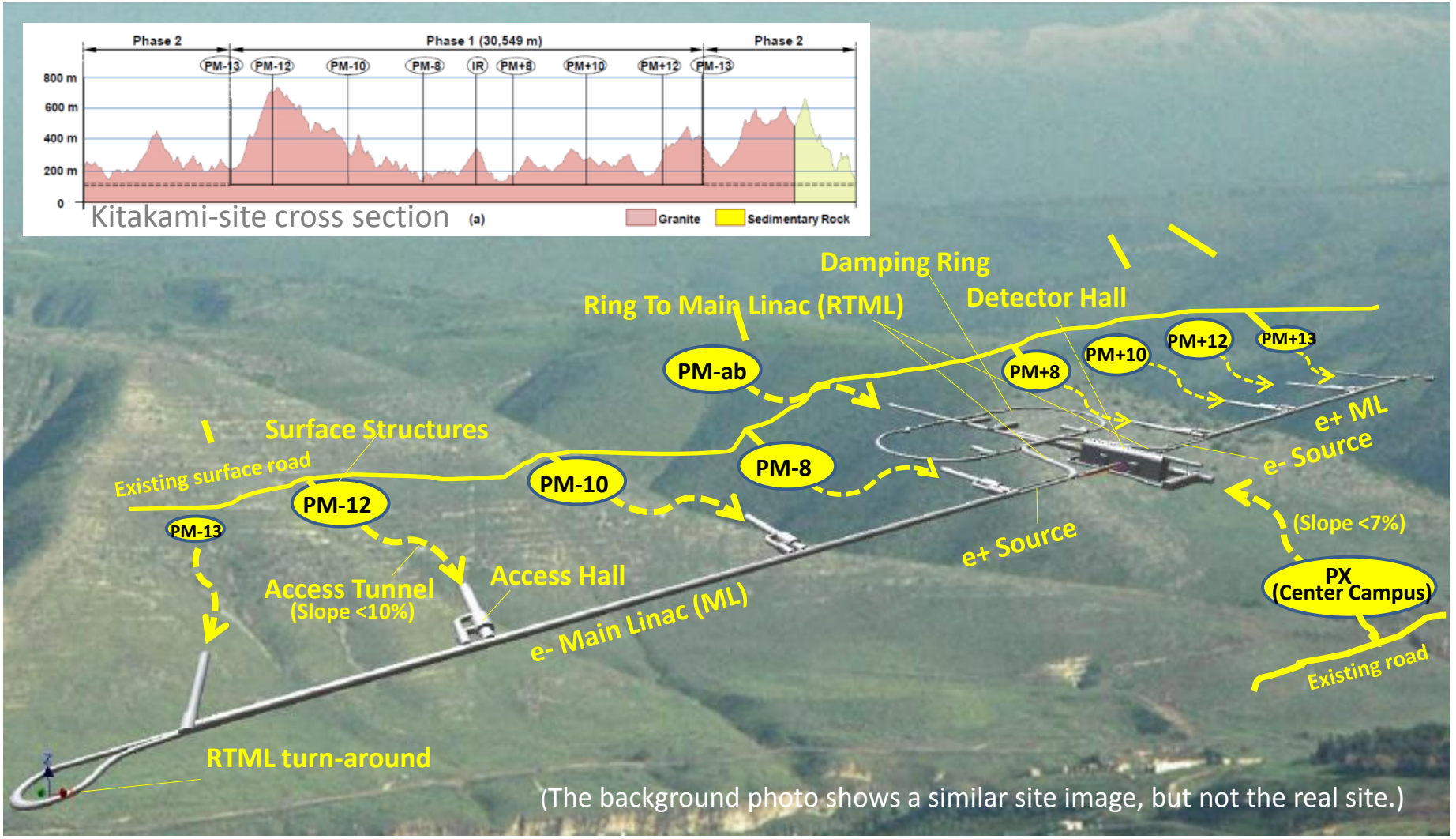
"Issues that could lead to particularly serious difficulties for the Sefuri site are that the route passes under or near a dam lake, and that the route passes under a city zone. Also, the lengths of access tunnels are longer for the Sefuri site than for the Kitakami site leading to a large merit for the latter in terms of cost, schedule, and drainage"



Preferred Site selected



Site Specific Design



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

International review of Japanese candidate site

- Review Committee members
-
- Eckhard Elsen (DESY)
- Lyn Evans (Chairman, Imperial College, London)
- Mike Harrison (BNL)
- Alain Herve (University of Wisconsin)
- Vic Kuchler (FNAL)
- Hitoshi Murayama (LBL/IPMU)
- John Osborne (CERN)
- Steinar Stapnes (University of Oslo/CERN)
- Daniel Schulte (CERN)
- Harry Weerts (ANL)
- Akira Yamamoto (KEK)

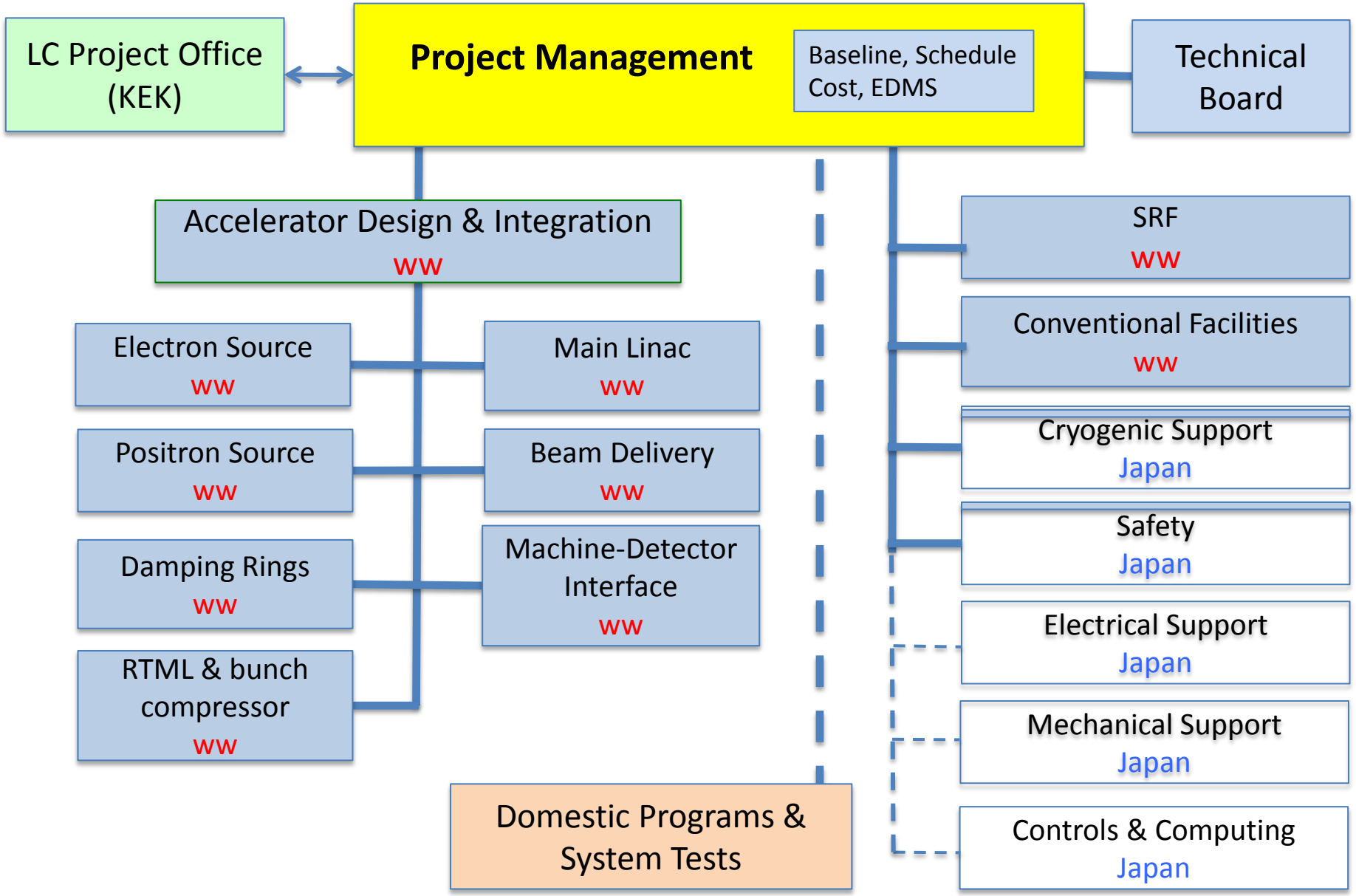
Test Facilities around the world

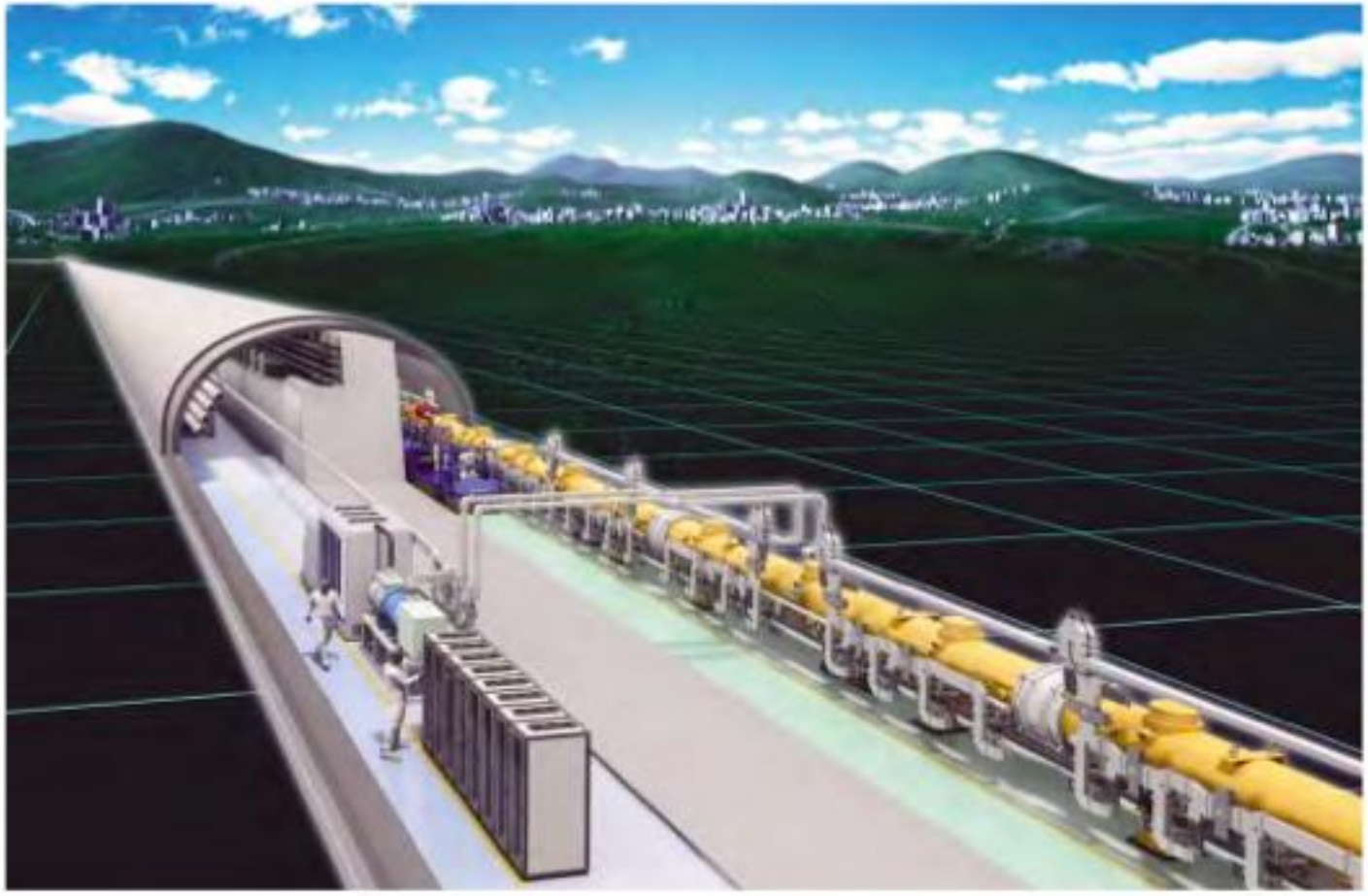
Test facility	Used by	Purpose
Facet-SLAC	CLIC	Beam-based alignment
CTF-CERN	CLIC	Two beam acceleration
ATF2-KEK	ILC/CLIC	Low emittance, final focus
STF-KEK	ILC	High gradient acceleration
FLASH-DESY	ILC	High gradient, high current
NML	ILC	Complete cryomodules
CesrTA	ILC	Electron cloud

Production facilities

Production Facilities		
Cavities and cryomodules	KEK	Cavity R&D
Cavities	DESY	24 cavities from XFEL production
Cavities	JLAB	High-gradient cavities
XFEL	DESY	Industrial production

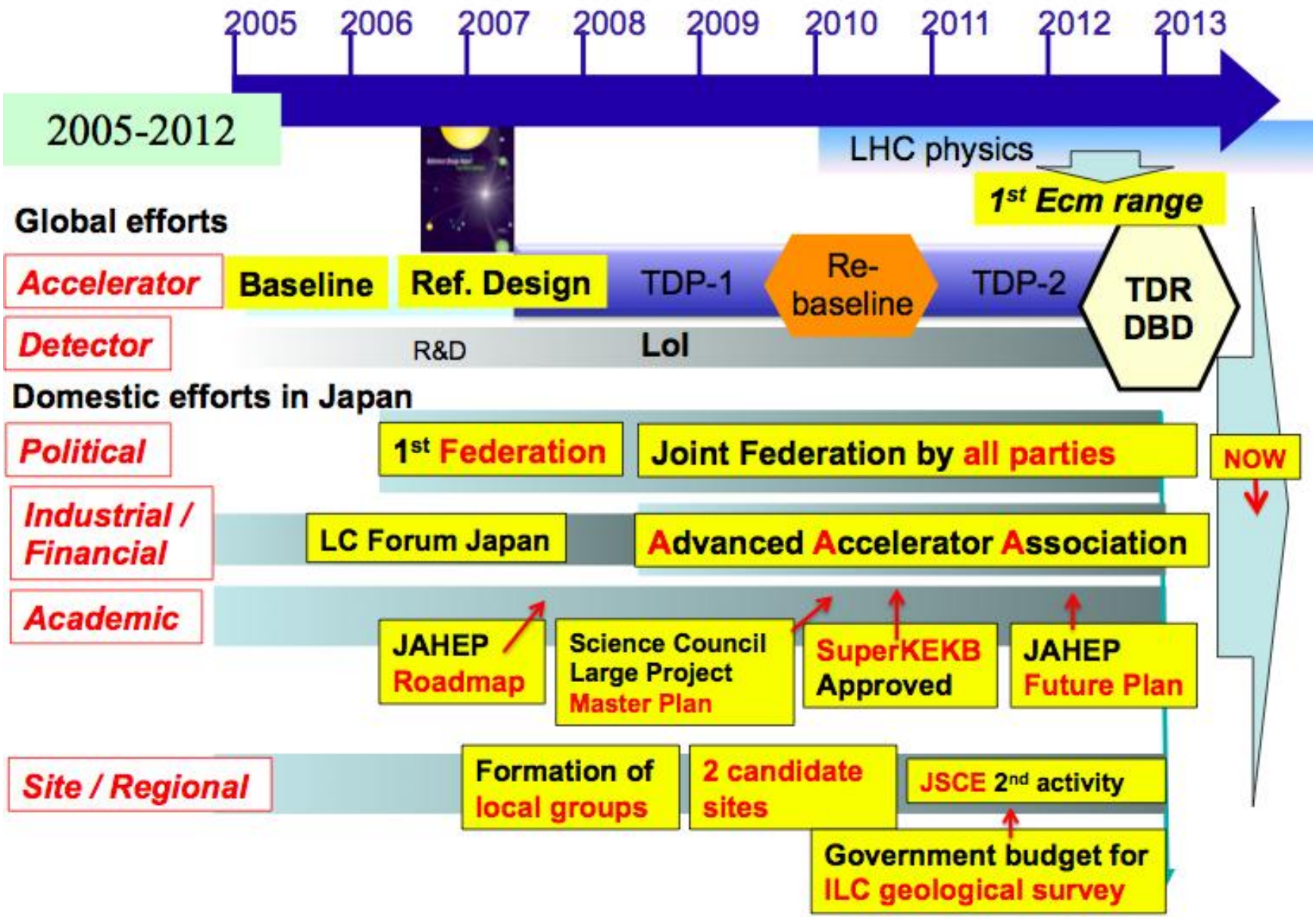
LCC Pre-IL Accelerator Organization





Japanese Status and Prospects

Satoru Yamashita (satoru@icepp.s.u-tokyo.ac.jp)
ICEPP, The University of Tokyo
Advanced Accelerator Association (AAA)


2005
2006
2007
2008
2009
2010
2011
2012
2013
2005-2012
LHC physics
1st Ecm range
Global efforts
Accelerator
Baseline
Ref. Design
TDP-1
Re-baseline
TDP-2
TDR DBD
Detector
R&D
LoI
Domestic efforts in Japan
Political
1st Federation
Joint Federation by all parties
NOW
Industrial / Financial
LC Forum Japan
Advanced Accelerator Association
Academic
JAHEP Roadmap
Science Council Large Project Master Plan
SuperKEKB Approved
JAHEP Future Plan
Site / Regional
Formation of local groups
2 candidate sites
JSCE 2nd activity
Government budget for ILC geological survey

NOW is the time for phase transition!!

- From R&D phase (Scientists only)
- To project preparation phase (Scientists + Governments)
  for the Decision Process if the project goes ahead or not

The official process has been started !

We only have 2-3 years to complete the preparation phase to have the decision and conclusion (for Japan)

Need fully and timely coherent global efforts not only for the full design of the machine but also for the INTERNATIONAL PROCESS, and need timely official evidence of progress in establishing international partnership

MEXT

Ministry for Education, Culture, Sports, Science and Technology

- Establish **official** body: **ILC-Taskforce** in **MEXT**
  headed by vice-Minister (Feb. 2013)
- **Official** request to **SCJ** (Science Council of Japan) to assess the academic significance of ILC and issues to solve (May, 2013)
- Division in MEXT for all accelerator-rerated infrastructure: Quantum radiation research division → Additional **new division** is established in MEXT (June, 2013) : **Particle and Nuclear Research Promotion Division**; Director: S. Odoi
- **Official** hand-in process to MEXT has been done for **TDR** (Oct, 2013)
- **Official** hand-in process to MEXT has been done for Site Assessment (Oct, 2013)
- Direct communications started between MEXT and LCC management team
- **Governmental Budget Request** by MEXT for ILC **Project investigation** for FY2014 (conclusion for request to come early in Jan. 2014)
- **Renewal** of **ILC-Taskforce** in MEXT headed by vice-Minister (Nov. 2013)
- Committees/working groups to be established under the ILC-Taskforce (to come)

Processes

1. **International Partnership in/by Researchers (in good progress)**
2. **Domestic Assessments/Review in academy (Government/MEXT→SCJ) (done)**
3. → International (unofficial/official) Discussions for Partnership
   → International (pre-)Negotiation
4. → Government Assessment / Judgment (MEXT/**CSTP**)
   CSTP = Council for Science and Technology Policy (**総合科学技術会議**)
   Chair: Prime Minister, Approval process (role of politics and government)
5. → Inter-governmental Official negotiations → Agreement → Authorization

Government and Science Council of Japan

CAO（内閣府）
(Cabinet Office)

MEXT（文部科学省）

CSTP

Science Council of Japan （日本学術会議）

Advisory body (only academy side)

In Feb 2013, MEXT formed a "task force" headed by vice Minister of MEXT for the ILC. (current head: Mr. Sakurada)

In May 2013, MEXT asked Science Council of Japan to assess the ILC → SCJ (report back on Sep 30th)

河村建夫先生 御講演
日付　　平成 25 年 11 月 11 日
会場　　リニアコライダー国際会議 LCWS13
　　東京大学 伊藤国際学術研究センター 伊藤謝恩ホール

Takeo Kawamura, former chief Cabinet Secretary and former MEXT Minister, chairman of Federation of Diet Members

From the beginning of 2013, I, Kawamura, have been working as the chairman of the Federation to promote the construction of an international laboratory for the linear collider, succeeding Mr. Yosano, who retired at the last election. It is our duty to realize this ILC project. At the very beginning of our activities in 2006 we started with a few dozen volunteers; today about 160 Diet members are registered in the Federation. There are just over 700 Diet members in total, so I think you can appreciate the significant proportion of Diet members involved.

Particular emphasis was put on the need for a more precise cost estimate, the need to discuss the required budget and international partnerships, and the necessary distribution of manpower over the next 2-3 years. To achieve these goals, 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, in addition to R&D funds for research laboratories.

Although this amount is not large compared to the R&D funds, it will be the first official governmental "investigative budget" aimed at realizing the ILC. This still needs to be approved by the Department of Finance, however once it has been approved, we members of the house will have achieved one of the most important milestones of recent years. We are aware that people are usually worried that an increase of academic budget in one field may mean a decrease in other fields. ILC is not simply an academic project within science. We shall arrange a dedicated budget to accommodate its much wider implications. It is the responsibility of the government to carry this out.

European activities

- N. Walker et al. have drawn up draft indication of how Europe could get involved in site-specific work for next few years prior to project approval. BF & SS looking at mods & expansion.

- Any European plan can only be in world-wide context. Under discussion at LCC Directorate meeting this week.

Summary and Prospects

- There are signs that the monotonic decrease in ILC effort in Europe over the last few years is about to reverse. Many countries are restarting initiatives and getting ready to respond to a Japanese initiative.

- The other side of the coin is that everything depends on such a Japanese initiative – without it these "green shoots of recovery" will wither away.

- Without exception, the funding authorities I have talked to have said that they can give no serious consideration to substantial increase in ILC funding without a Japanese government statement that they wish to negotiate to site ILC in Japan – and that such an initiative must entail Japan putting forward the majority of the necessary funding up front.

Summary and Prospects

- Assuming such a statement is forthcoming, it will be very tough to find a substantial European contribution. LHC upgrade will have priority and many countries are finding it hard to finance that. There is a contention with timing here, although it can be overcome.

- There is a perception, particularly stated by R-J Smits, that in Europe "Physics has had its share" of available funding. This refers to ITER, which has given all large infrastructure projects a bad name. We will need to work round this perception.

- Even so, there is a real sense of anticipation and excitement in Europe about ILC prospects. Given a prompt statement from Japan - & I emphasise time is critical – then I think there will be a positive response from Europe.

Status & Prospects in Americas

H.Weerts

Argonne National Lab & LCC

13 November 2013

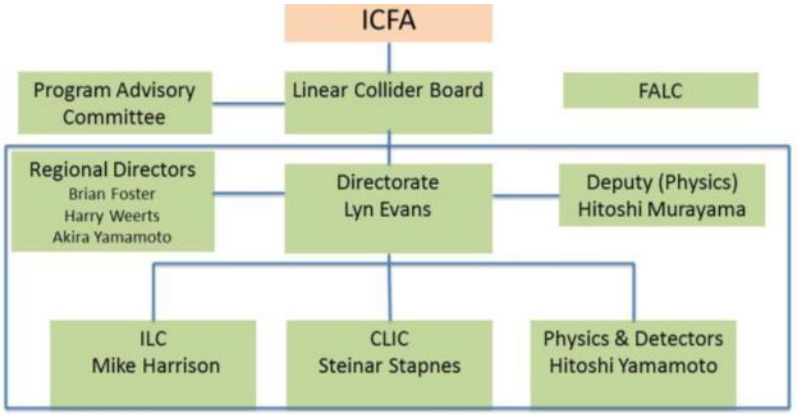
LCWS2013, Tokyo

Some re-organization

After ILCSC, GDE and Research Directorate(RD) completed the TDR they & CLIC transformed into:

ILCS → LCB (S.Komamiya; chair)

GDE,CLIC & RD → LCC (L.Evans, director)



Had "separate" organizations for Accel and Phys & Det's: LCSGA and ALCPG

Americas: They merged into new structure: American Linear Collider Committee (ALCC). Responsible for both.

Current organization

ALCC tasks:

- Be advocate for & enable LC case especially towards funding agencies
- Coordinate activities.
- Cover both ILC and CLIC.
- Provide connection/conduit to LCC
- Organize regional workshops

There is a charge/charter

Membership:

Jonathan Bagger *Johns Hopkins*
Nigel Lockyer *Fermilab*
David MacFarlane *SLAC*
Lia Merminga *TRIUMF*
Hugh Montgomery *JLab*
Director *TRIUMF*
Harry Weerts *ANL,chair*
Jim Brau *Oregon*

Graham Wilson *Kansas*
Mike Harrison *BNL*
Marc Ross *SLAC*
David Rubin *Cornell*
Joe Lykken *Fermilab*
Andy White *UT Arlington*
Paul Grannis *Stony Brook*
Dmitri Denisov *Fermilab*

Try to represent all LC entities and communities

First meeting in June 2013

More later

Recap of US activities/funding for LC

~2005 ----------→ 2012

Build up SCRF expertise-- FNAL, JLAB, Cornell, Argonne– engage industry

Everything: Cavities to cryomodules M.Harrison Monday talk

Plus: sources, damping rings, RF distribution, civil etc

Involve all labs & univ

Physics & Detector: physics, calorimetry, tracking (Si & TPC), vtx, MDI

Collaborations: SiD, ILC, CALICE, LCTPC

Funding available: ~$20-30M/yr for accelerator and ~$2-3M/yr detector R&D

For 2013:	funding set to zero; detector R&D already earlier going away	
Continue on:	carryover funds, generic R&D; Project-X (SCRF), generic research funds	Based on: no LC in sight

US activities 2013

Developments 2013

Conclusion of Snowmass on ILC:

There is a clear and convincing science case for the ILC (250-> 500GeV)
Reiterated by M.Peskin in plenary on Monday here

Snowmass output serves as input into next step

Step 2: Formation of Particle Physics Project Prioritization Panel (P5) in September 2013.

Charge: "develop a strategic plan for U.S High Energy physics that can be executed over a 10 year timescale, in the context of a 20-year global vision for the field"

=fit within a given budget.

Budget scenarios:

- constant funding for 3 years and then +2%/yr
- constant funding for 3 years and then +3%/yr
- Unconstrained funding to mount a leadership program

Indicate priorities

It is clear that only a fraction of proposed fits

P5 membership & activities

Membership

Steve Ritz (UCSC) - chair
Hiroaki Aihara (Tokyo)
Marty Breidenbach (SLAC)
Bob Cousins (UCLA)
André de Gouvea (Northwestern)
Marcel Demarteau (ANL)
Scott Dodelson (FNAL/Chicago)
Jonathan Feng (UCI)
Bonnie Fleming (Yale)
Fabiola Gianotti (CERN)
Francis Halzen (Wisconsin)
JoAnne Hewett (SLAC)
Wim Leemans (LBNL)
Joe Lykken (FNAL)
Dan McKinsey (Yale)
Lia Merminga (TRIUMF)
Toshinori Mori (Tokyo)
Tatsuya Nakada (Lausanne)
Steve Peggs (BNL)
Saul Perlmutter (Berkeley)
Kevin Pitts (Illinois)
Kate Scholberg (Duke)
Rick van Kooten (Indiana)
Mark Wise (Caltech)
Andy Lankford (UCI) – *ex officio*

Members are/were associated with ILC; some are even here

- P5 is currently in "input mode" until end of 2013
- Then formulate roadmap.
- First draft ~March 2014

"input mode": Get time lines and cost profiles from projects

Open Meetings:
2-4 November Fermilab
2-4 December SLAC
15-18 December BNL

P5 interactions "with ILC"

Goal: US ILC community wants to be part of "ILC in Japan"

➡ Need time lines and US cost profiles for "ILC in Japan"

ALCC has started interaction with P5 chair:

- One meeting so far
- Told us what P5 needs from "ALCC"
- ILC will be discussed at BNL meeting
- Public & Executive session presentation on US strategy/plan for "ILC in Japan"
- P5: physics case was made at Snowmass & accepted

ALCC in process of drafting a US strategy for "ILC in Japan" for P5.
Plan is for draft by end of November
ILC director (M.Harrison) identifying possible US lab contributions to accelerator

Difficulty:

- No clear definition of "ILC in Japan"
- Is there an agreed upon time line? (do not want to make one up)
- Are there expectations about contributions? Not known

Inside Japan, ILC is obviously moving forward; however without a clearer sign it is difficult to incorporate in strategic plans of others, who want to participate

Summary

The physics case for a Lepton Collider has been made by the worldwide community & agreed upon

"ILC in Japan" (250 -> 500GeV) is currently the only option worldwide for realizing a lepton collider as the next step for particle physics at the energy frontier.

In US preparing the strategy to be presented to P5 in Dec 2013 for *US participation in "ILC in Japan"* so it becomes part of the US HEP roadmap

In Americas waiting for a clearer sign/indication from Japan on intentions to move forward, so "ILC in Japan" can be better included in the HEP roadmap.

"The car is running, all world regions are on board, but the driver (Japan) has to put it in first gear, so we can start the journey…… and see where it takes particle physics & the world"

Energy Management in Japan, Consequences for Research Infrastructures

Masakazu Yoshioka (KEK)

1. Electric power supply in Japan, before and after March 11, 2011 earthquake
   - High efficiency and "almost" environmental pollution-free electricity generators can save Japan, and contribute to reduce global CO_2 problem
2. KEK Electricity contract as an example of large-scale RIs
3. Accelerator design by considering optimization of luminosity/electricity demand
   - Example: Super-KEKB
   - ILC
4. Accelerator component design by considering high power-efficiency
   - Klystron
   - Availability based on MTBF and MTTR
5. Summary

ILC: an amazing energy transformer

FROM eV TO TeV:

THE GREEN ILC

2nd Energy for Sustainable Sciences, CERN Oct 2013

Denis Perret-Gallix LAPP/IN2P3.CNRS (France)

1

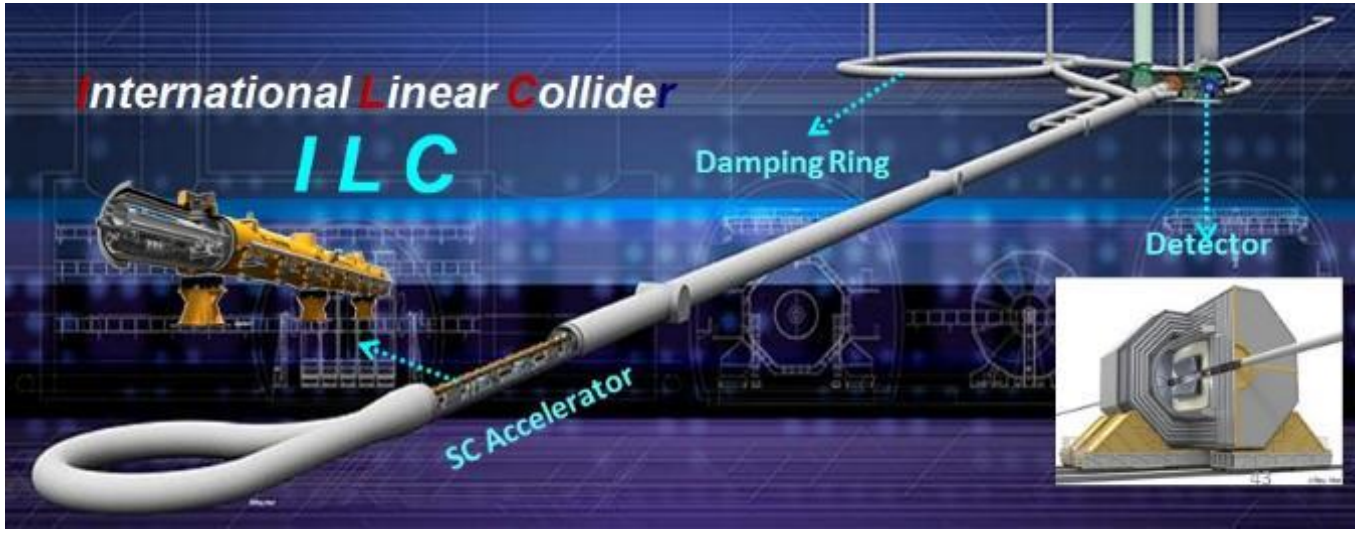
Energy Management at KEK, Strategy on Energy Management, Efficiency, Sustainability

Atsuto Suzuki (KEK)

INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION
HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION

Improve Efficiency of Power Consumption in Accelerator Operation

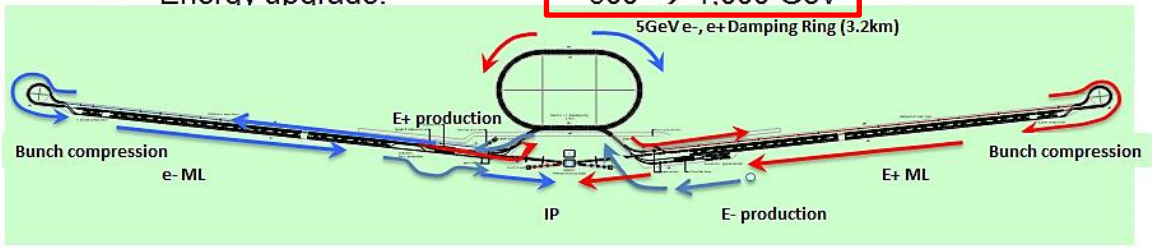
serious issue for ILC



Power Balance of Consumption and Loss in ILC

Requirements from Physics Exp.

- Basic requirements :
  - Luminosity : $\int Ldt$ = 500 fb^{-1} in 4 years
  - E_{cm} : 200 – 500 GeV and the ability to scan
  - E stability and precision: < 0.1%
  - Electron polarization: > 80%
- Extension capability :
  - Energy upgrade: 500 → 1,000 GeV



ILC 500 GeV Total Power : ~200 MW

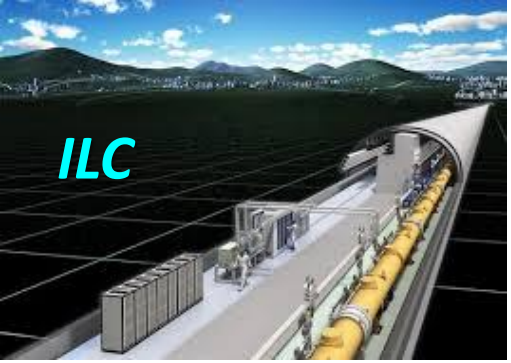
Improve efficiency

Infrastructure : 50 MW
RF System : 70 MW
Cryogenics : 70 MW
Beam Dump : 10 MW
200 MW

loss rate
50 % : 25 MW
50 % : 35 MW
90 % : 60 MW
100 % : 10 MW
~ 130 MW

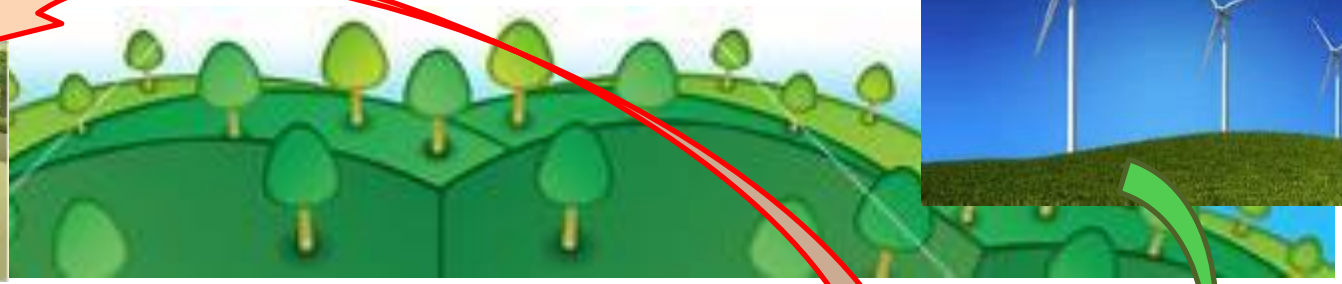
Obligation to Us

Increase recovery



Summary

Reuse Energy



Ross Rate

Infrastructure : 50 MW — 50 % : 25 MW

RF System : 70 MW — 40 % : 28 MW

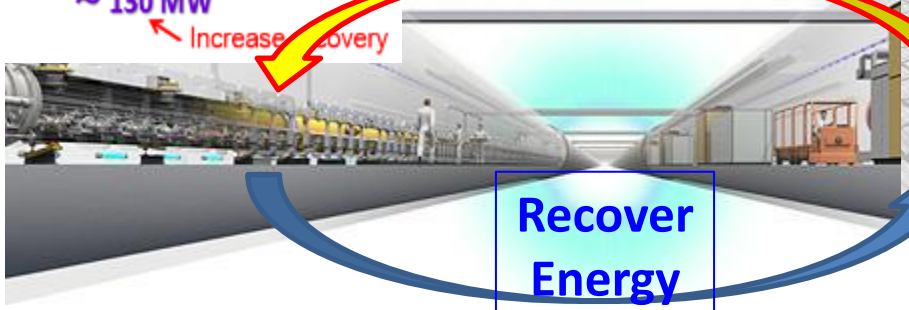
Cryogenics : 70 MW — 100 % : 70 MW

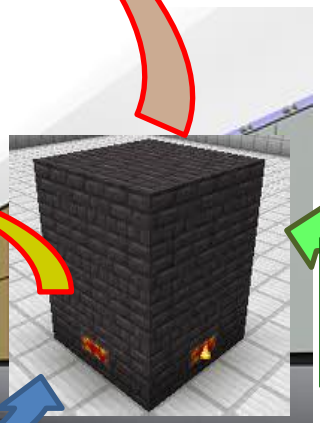
Beam Dump : 10 MW — 100 % : 10 MW

~ 130 MW

Increase ... overy

Reuse Energy



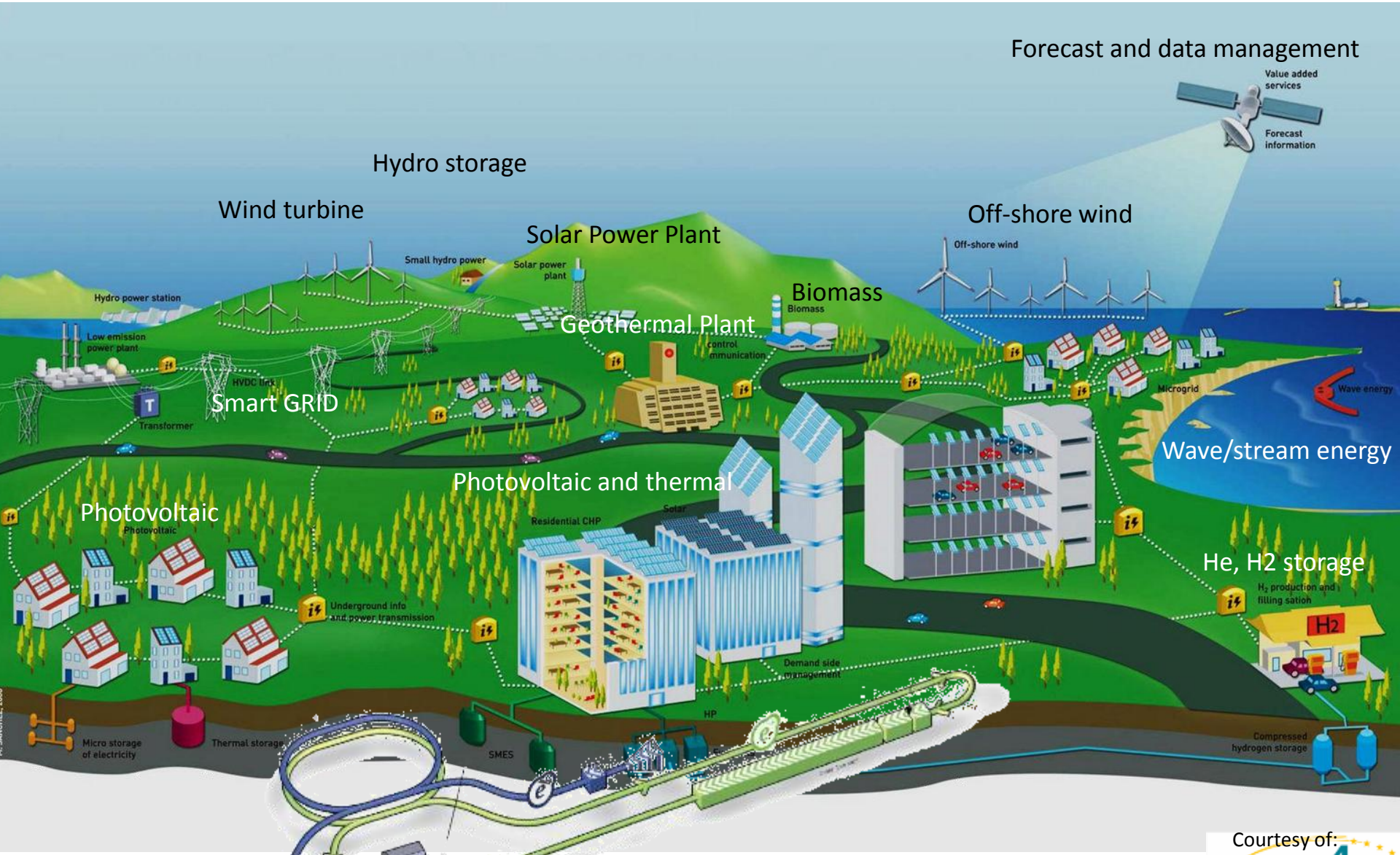


Improve Efficiency

Recover Energy

Stand Alone Energy System

ILC center futuristic view



Denis Perret-Gallix LAPP/IN2P3.CNRS (France)

Courtesy of:

GRID4EU
INNOVATION FOR ENERGY NETWORKS

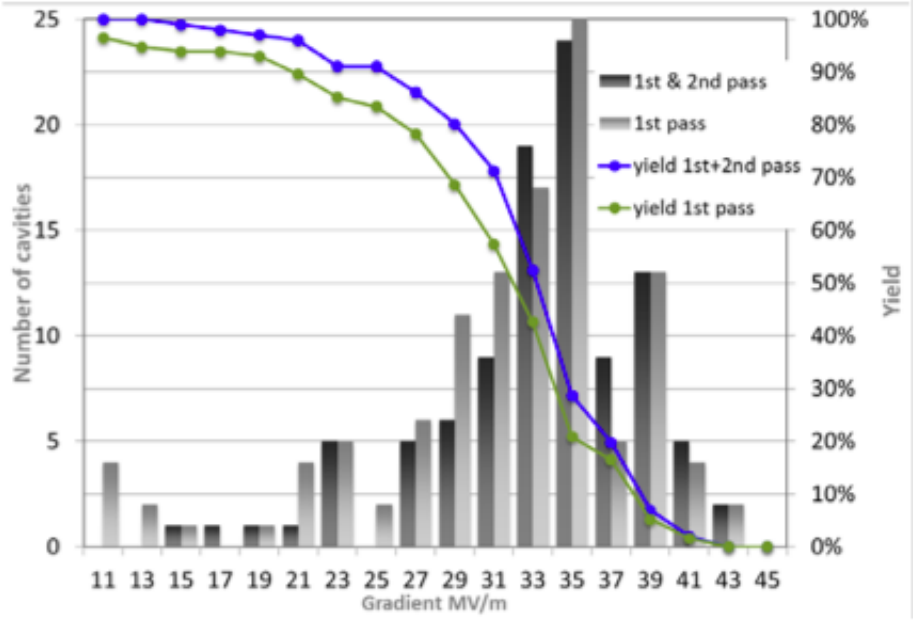
XFEL News

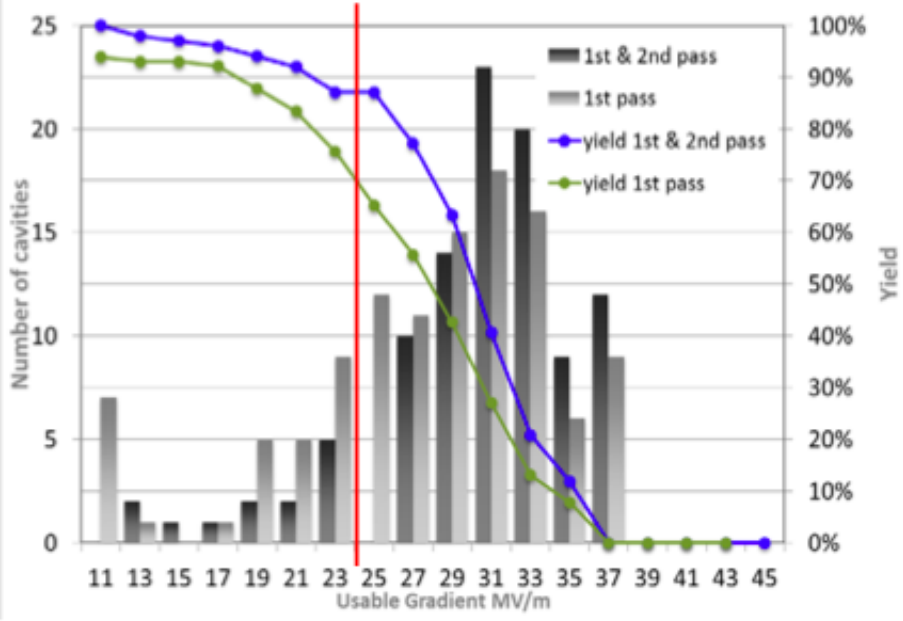
European XFEL Status Report

SL cavities, first test results (Oct. 2013)

- Yield of usable and maximum gradient of 100 cavities (2.pass):
  73 cavities passed in 1.pass + 27 cavities after re-treatment

(Usable gradient = Quench, field emission > $1x10^{-2}$ mGy/min, $Q_0 < 1x10^{10}$)





Average **maximum** gradient:

(31.9 ± 5.5) MV/m

EZ: (30.1 ± 5.2) MV/m
RI: (34.5 ± 4.7) MV/m

Average **usable** gradient:

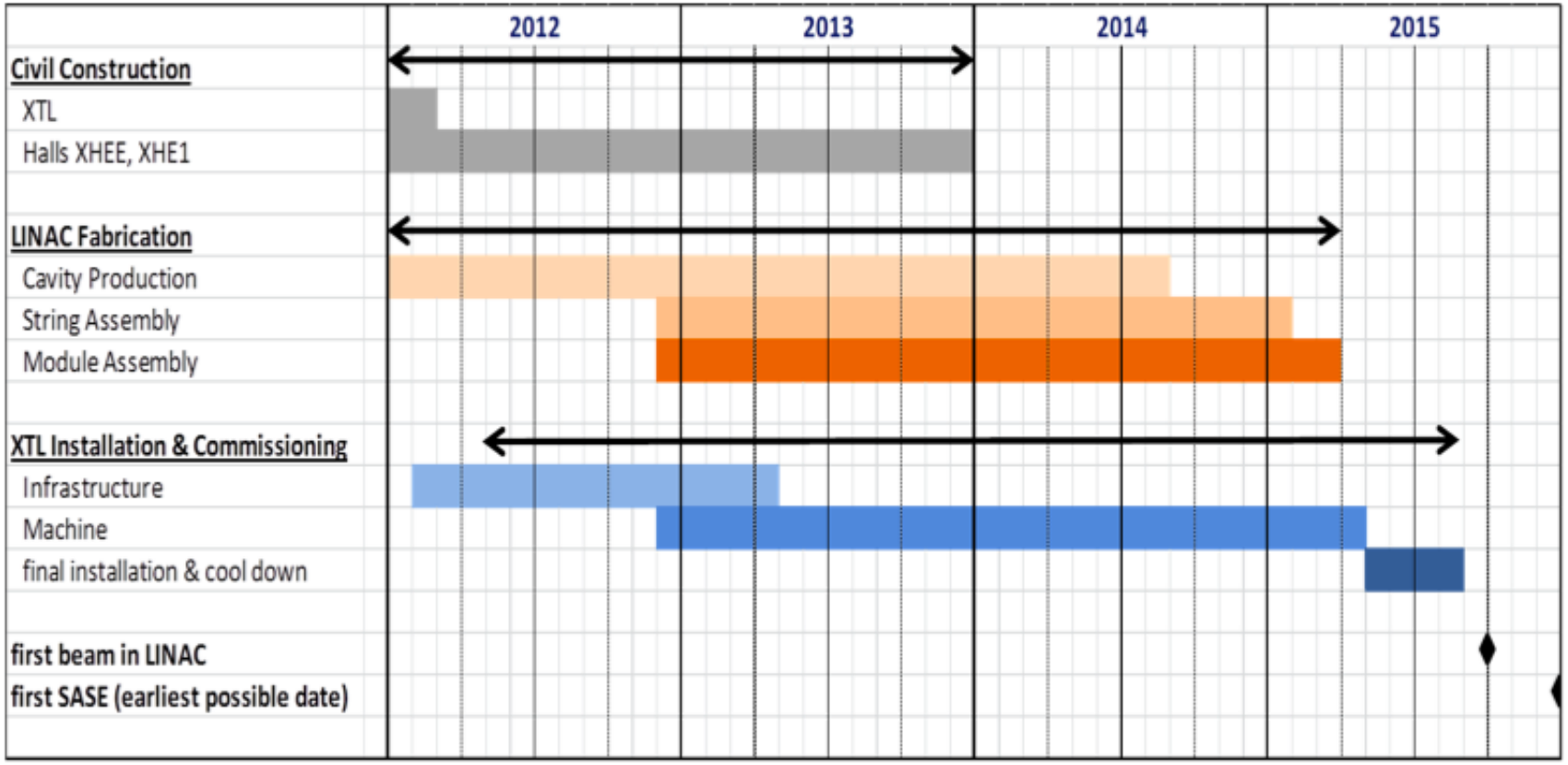
(28.8 ± 5.2) MV/m

EZ: (27.8 ± 5.1) MV/m
RI: (30.2 ± 5.0) MV/m

XFEL news

European XFEL Status Report

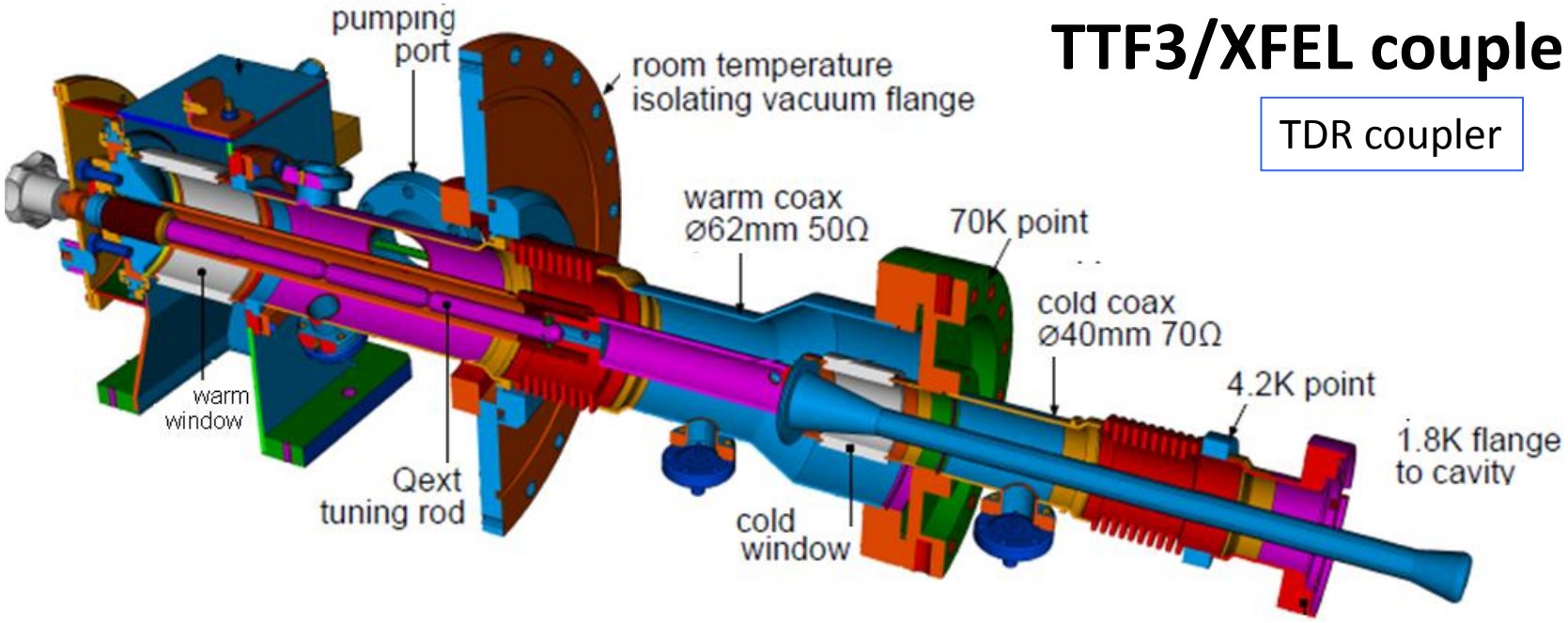
XFEL planned schedule



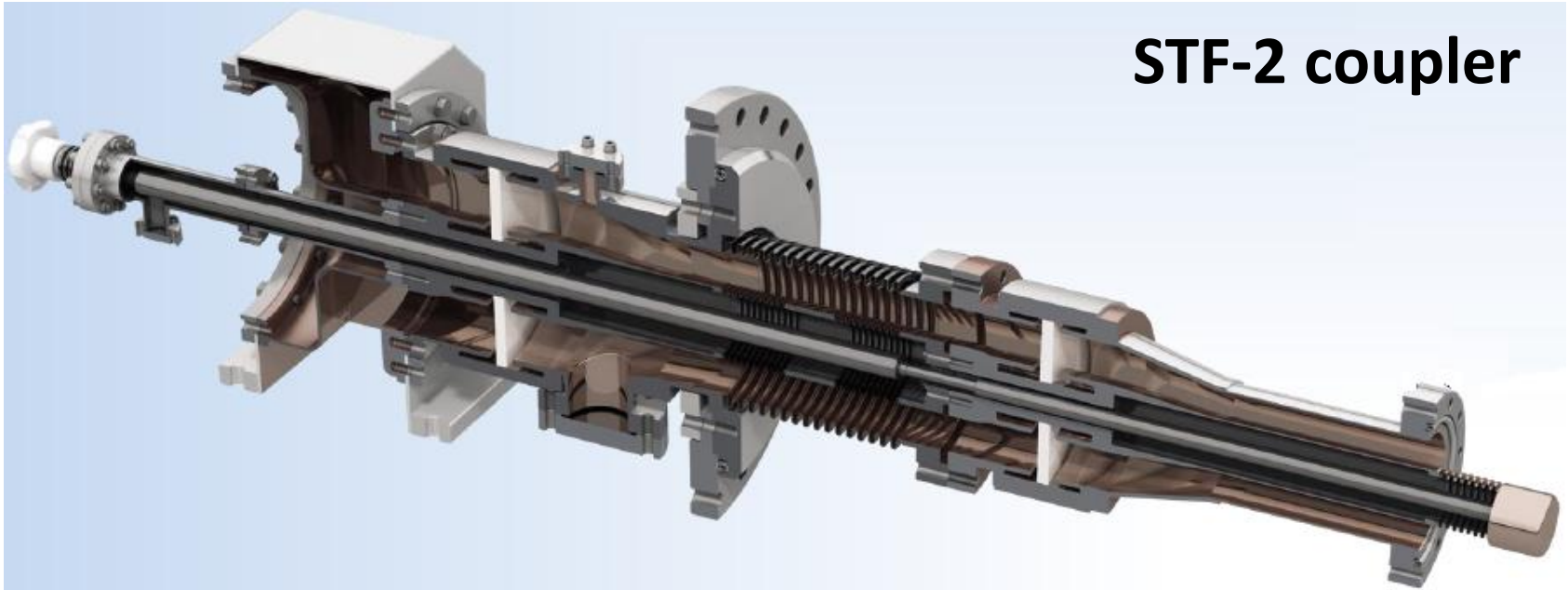
(1) Deep Technical Review of Input Couplers

TTF3/XFEL coupler

TDR coupler



STF-2 coupler



TOWARD HIGHER GRADIENT AND Q_0

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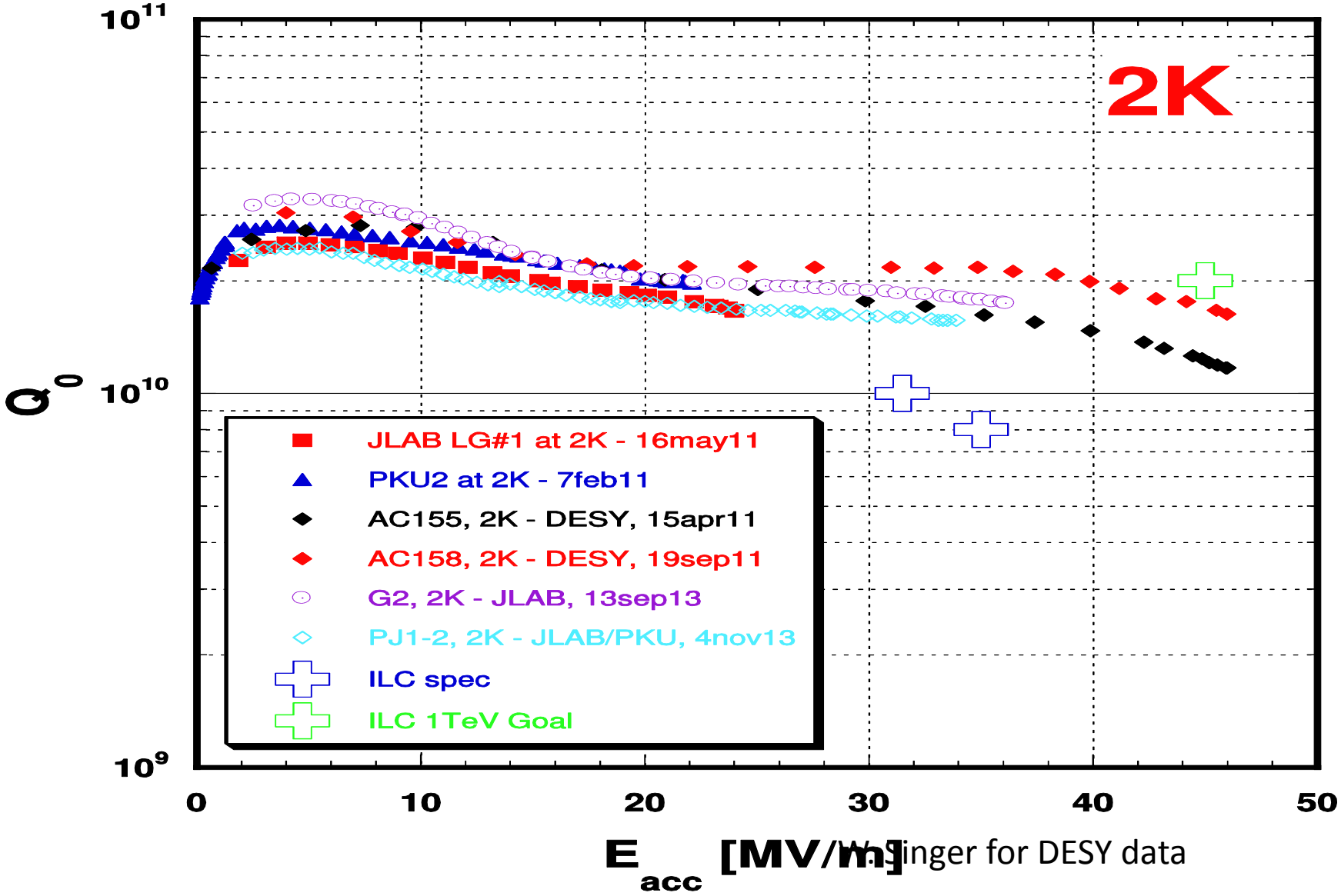
U.S. DEPARTMENT OF ENERGY

Jefferson Lab

Why higher gradient and Q0 R&D

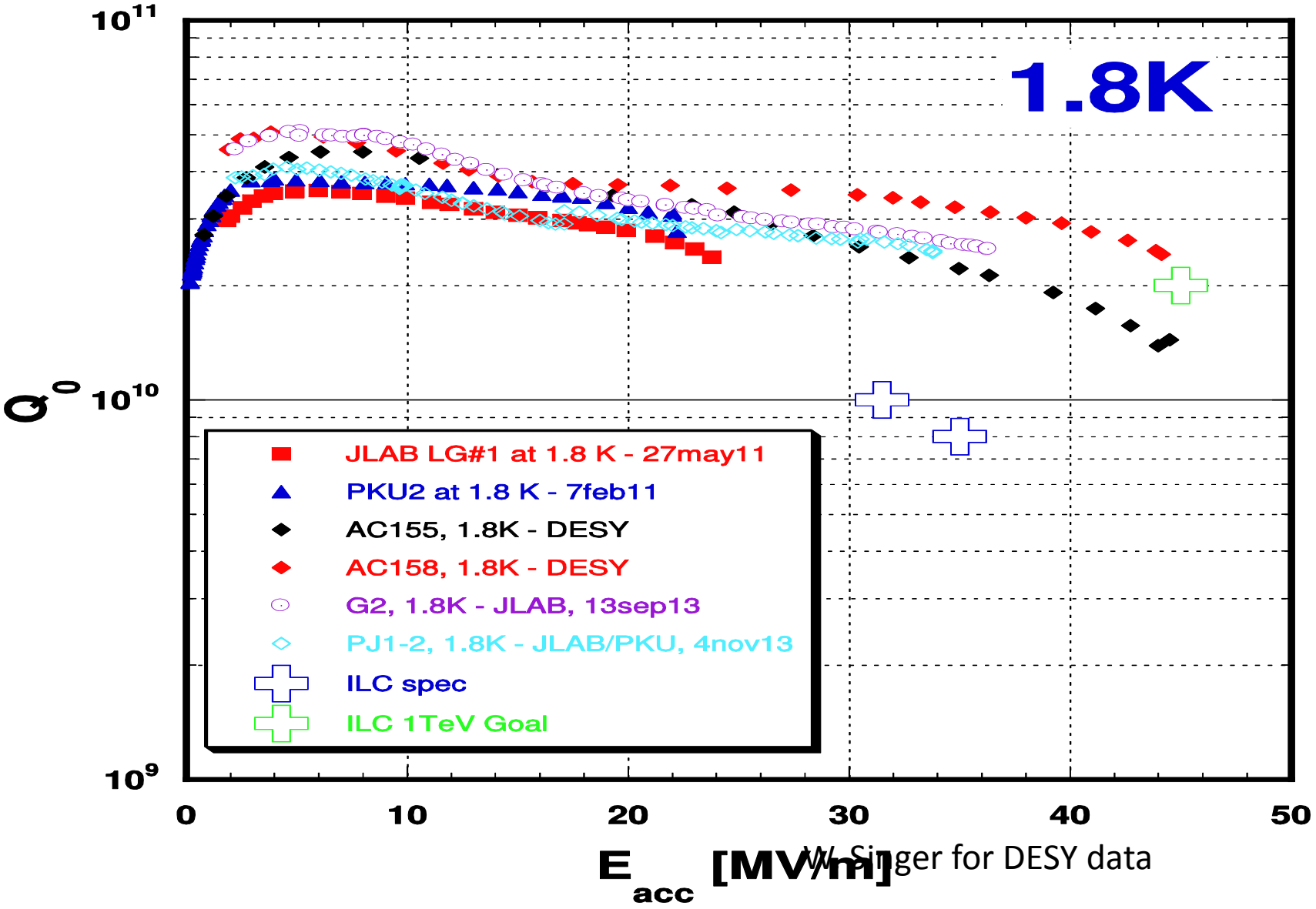
- Enable ILC 1 TeV energy upgrade → Performance
- Enable higher luminosity within cryogenic limit
- Enable reliable and repeatable cavity fabrication → Cost
- Preserve cavity gradient and Q0 → Operation performance

Ingot Niobium Cavity Performance at 2K



W. Singer for DESY data

Ingot niobium Cavity Perfroamnce at 1.8K



W. Singer for DESY data

Summary

- Strong momentum in Japan – a formal government statement anticipated by end of this year
- Other regions show interest to join – timing is critical
- Science case is strong and phased construction is favored – high luminosity at 250 GeV
- LCC has expectation for JLab to continue high gradient cavity work in next 2-3 years – and I believe JLab should be in a good position to contribute cryomodule production whenever ILC in Japan begin to construct