

Introduction

Summary of LCWS13/accelerator

Philip Bambade

Laboratoire de l'Accélérateur Linéaire
Université Paris 11, Orsay, France

Accelerator Session @ JCL

- Introduction and summary of LCWS'13 Philip Bambade, LAL
- Industrialisation XFEL → ILC: production of high power couplers Walid Kaabi, LAL
- Industrialisation XFEL → ILC: cryomodule integration Olivier Napoly, IRFU

Pause café

- R&D: high gradient cavities Fabien Eozénu, IRFU
- R&D: beam focusing and machine-detector interface Andrea Jeremie, LAPP
- R&D: towards a fully equipped cavity 'made in France' Olivier Napoly, IRFU
- Green ILC Denis Perret-Gallix, LAPP

→ ILC Report - Science Council of Japan (ILC Newslines – H. Murayama)

.....

SCJ pointed out obvious issues with international projects, such as cost sharing, its governance model, and **availability of leadership and personnel**. Therefore, the report recommends the government to allocate the funds necessary to study risks and discuss with potential partners in the next two to three years.

.....

SCJ examined the possible issues and challenges if Japan should take the initiative on the ILC project. The council thinks that the ILC should be a project implemented by the international community with the scale and the cost required, and the rigid commitment from the prospective participating countries. The report stated that there were **still some uncertainties** in how the construction costs for the ILC should be shared among participating countries, the prospects **for the participation of foreign scientists** and the readiness of the implementation structure in Japan.

.....

Let's also prepare for an important role in ILC/accelerator !

Summary of LCWS13/accelerator

- **Monday 11/11**

- Plenary 1 & 2 → ILC, CLIC, LC status (Harrison, Stapnes, Evans)

- Message from federation of Diet members promoting ILC (Kawamura)

- Acc. plenary → ILC site, Luminosity, XFEL, WG charge (Miyahara, Schulte, Müller, Stapnes)

- **Tuesday 12/11**

- Working group sessions

- **Wednesday 13/11**

- Working group sessions

- Plenary → Japan, Asia, America, Europe status + panel discussion

- **Thursday 14/11**

- Working group sessions

- **Friday 15/11**

- Working group summaries

- Closing remarks → Strategy, LCC proposed timeline (Suzuki, Yamamoto)

Accelerator working groups at LCWS13

- Sources

Steffen Doebert, Wei Gai, Masao Kuriki

- Damping Rings

Ioannis Papaphilippou, David Rubin

- Beam Delivery & Machine Detector Interface

Gao Jie, Lau Gagnon, Rogelio Tomas

- Beam Dynamics

Kiyoshi Kubo, Andrea Latina, Nikolay Solyak

- Conventional Facilities

Atsushi Enomoto, Vic Kuchler, John Osborne

- System Tests and Performance Studies

Roberto Corsini, Marc Ross, Daniel Schulte, Nobuhiro Terunuma

- Superconducting RF Technologies

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

Emphasize common ILC / CLIC efforts for all WGs (except SC RF technology)

Steinar Stapnes (CERN), Accelerator Plenary

Consideration of luminosity performance issues

Daniel Schulte (CERN), Accelerator Plenary

$$\text{Luminosity} \sim \frac{\eta_{\text{efficiency}} P_{\text{elec}}}{E_{\text{cm}}} \sqrt{\frac{\delta_{\text{beamstrahlung}}}{\epsilon_{y,\text{normalised}}}}$$

- ▶ Electron source
 - ▶ The gun system development is desirable.
- ▶ Undulator :
 - ▶ Technical demonstration of e^+ production target with an enough level is mandate.
 - ▶ Mechanical engineering design of the undulator should be made.
- ▶ 300Hz e^- driven:
 - ▶ Target prototype will be made soon.
 - ▶ Irradiation test of magnetic fluid seal will be made.
 - ▶ Super-B AMD is applicable for ILC.
 - ▶ An integrated simulation for e^+ capture is urgent.



Strategy

- ▶ Undulator is our baseline. At least, the critical devices should be **well established prior to the ground breaking**.
- ▶ **An integrated design of 300Hz conventional scheme** should be completed urgently.
- ▶ These two schemes have to be **compatible** from the CFS point of view. The foot prints should be same.
- ▶ At some point, we will asses these schemes from the project point of view.
- ▶ After that, we will concentrate on a single scheme.



AWG2: Damping Rings

D. Rubin

Key luminosity issues for LC Damping Ring

Electron cloud

- For baseline parameters of the ILC (5Hz, 1312 bunches) estimated cloud density $\sim 1/10$ instability threshold

Evaluation of ecloud effects in ILC DR are revisited in this recent submission

“Investigation into Electron Cloud Effects in the ILC Positron Damping Ring”,
(<http://arxiv.org/abs/1311.2890>) in which

- Cloud model is based on
 - TDR bunch parameters
 - Design mitigations and their measured properties (SEY, PEY, etc.)
 - Radiation pattern based on photon tracking, measured reflectivities, ...
- Instability and emittance dilution threshold computed with CMAD
(Models of cloud growth and instabilities benchmarked with CsrTA measurements)

Vertical emittance

Test facilities \rightarrow synchrotron light sources, ATF

- Damping ring vertical emittance targets (for both ILC and CLIC) have been achieved with electron beams at SLS, ASLS, Diamond, ...
- Considerable progress in developing efficient, effective, reproducible emittance tuning instrumentation and techniques
- And in development of beam size monitors

Wed + Thurs: 7 sessions, 25 Talks

Stabilization
(6 talks)

AWG3: Beam delivery
G. White + **MDI**

Magnets & Alignment
(7 talks)

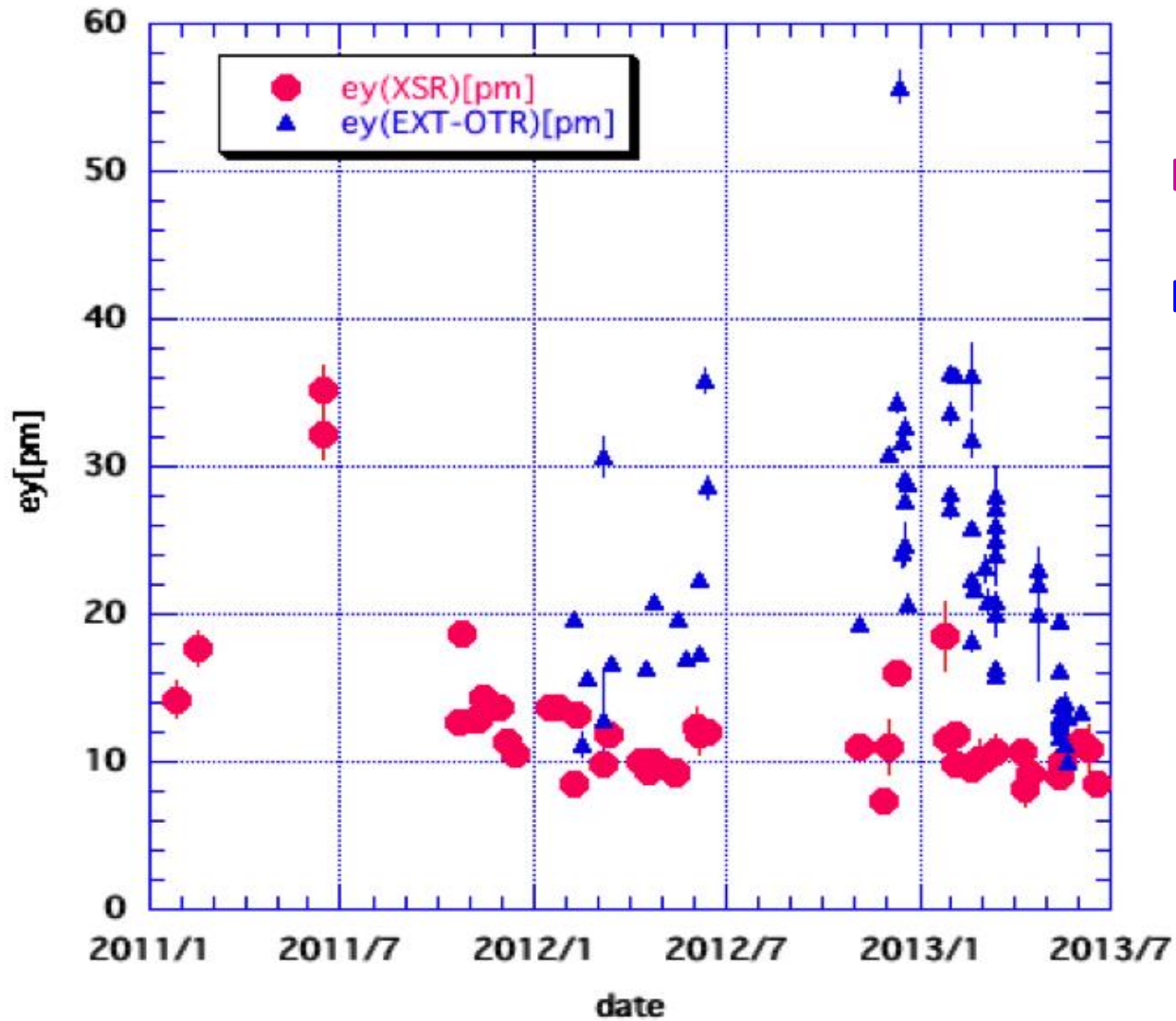
Optics/Beam Dynamics
(9 talks)

Halo Monitoring / Collimation
(1 talk)



GOAL 1 –
Demonstration of
“local” FFS

GOAL 2 – Stability



DR emittance

Extracted emittance

←ε_y≈10pm

Beam time status #1

1 2012 Feb $\sigma_y \sim 150 \text{ nm}$ @ 30° mode
 Prepare 174° commissioning

Major optics reform of 2012 summer
 By *IPBSM group@KEK*

- Suppress systematic errors
- Higher laser path stability / reliability

2 2012 Autumn ~

12/20 :
1st success in M detection at 174° deg mode

Last 2 days in Dec
Measured many times $M \sim 0.23$
 ($\leftrightarrow \sigma_y \sim 70 \text{ nm}$) * IPBSM systematic errors uncorrected
 ** low e beam intensity ($\sim 1\text{E}9 \text{ e / bunch}$)

Large step towards achieving ATF2 's goal !!

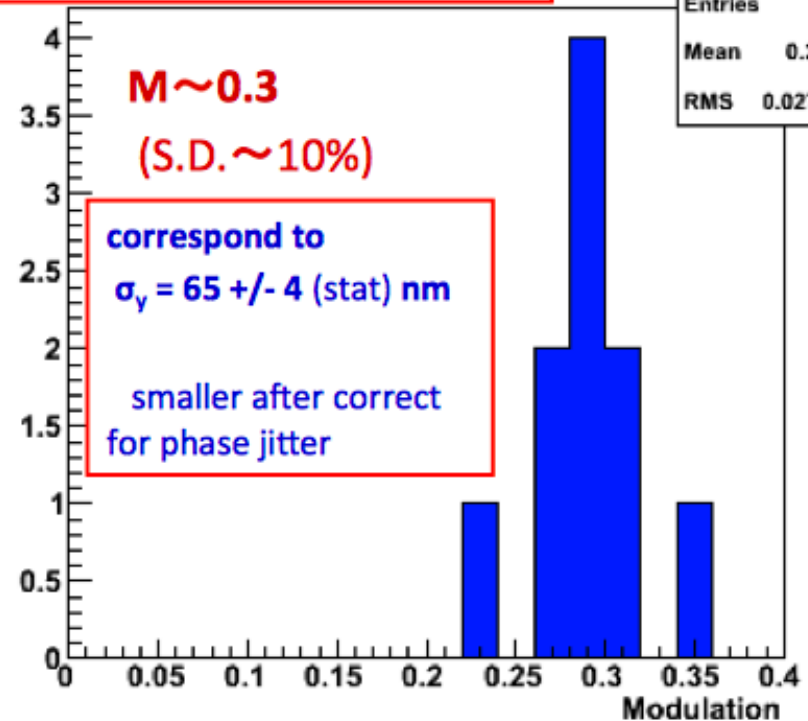
error studies ongoing

3 2013 Spring

Contribute stably to ATF2 beam focusing

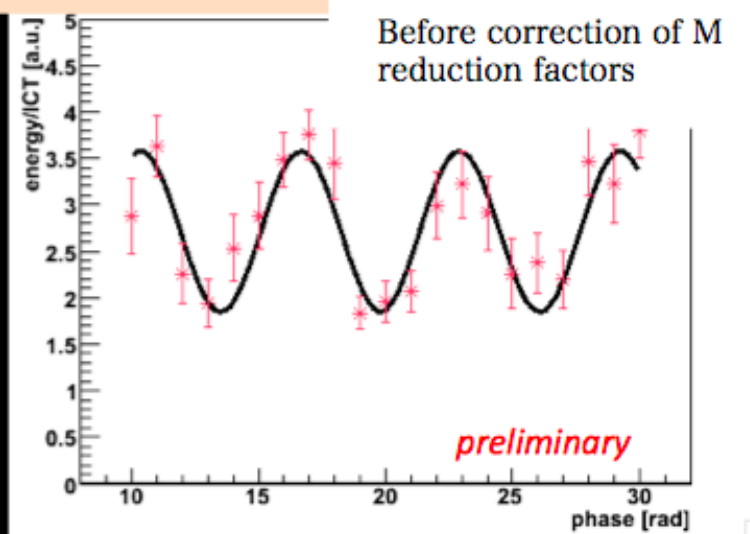
10 consecutive scans @ 174°

Entries	10
Mean	0.293
RMS	0.02768



1 example

174° (Mar 14, 2013)
 $M = 0.32 \pm 0.03$
 $\leftrightarrow \sigma_y = 64 \pm 3 \text{ nm}$



ATF2 beam stabilisation results

1. Upstream FB: beam stabilised at IP to ~ 300 nm
2. Feed-forward: beam stabilised at IP to ~ 106 nm
3. IP FB: beam stabilised at IP to ~ 93 nm

Getting interesting! (i.e. ³¹hard)

CLIC

- Can ILC tunnel accommodate CLIC in the far future?
- Difference in the tunnel shape
 - Crossing angle : 14mrad vs. 20mrad
 - Geoid-following vs. laser-straight
 - Offset due to undulator scheme
- Note:
 - Cost saving by reuse of tunnel is ~1.2B\$
 - CLIC-ILC General Issue Group Interim Report 1
 - http://ilcdoc.linearcollider.org/record/31959/files/CLIC_ILC_Interim-Report_Final-1.pdf
 - In addition, save 0.25B\$ if reuse Main linac klystron for CLIC driver (but CLIC frequency must be changed 12GHz→11.7GHz)

Overview

We had three sessions:

- Tuesday afternoon: **Key Issues** (joint with System tests)
- Wednesday: **ATF2** (joint with BDS+MDI and System Tests)
- Thursday: this summary (joint with System tests)

Topics presented: 10 talks

1. Design and performance optimization
2. Experimental verification of Beam-Based Alignment
3. Developments in Linear Collider Diagnostics
4. Experimental program
 - CTF3 outlook
 - Plans for the future

AWG6: System tests and performance studies

R. Corsini

Tuesday afternoon:	Joint session with AWG3, 4 & 5	Key Issues
Wednesday, full day:	Joint sessions with AWG4 & 5	ATF2
Thursday, full day:	Joint sessions with AWG4	FACET, main linac/RTML issues, beam diagnostics, drive beam & CTF3

Final Remarks

- Feel that system tests and test facilities should continue to operate during the project preparation phase (and even during the initial part of construction).
- In particular, ATF2 will still be extremely important after having reached goals 1 & 2.
- Synergies with other programs should be explored and maximized whenever possible e.g.:
 - Like it was done for the X-FEL regarding ILC linac, or
 - the planned use of X-band technology for FELs,
 - long term evolution of ATF2 as a low emittance beam facility beyond linear collider,
 - possible new uses/transformations of CTF3, e.g. as user facility for diagnostic tests.

AWG5: Conventional Facilities

A. Enomoto

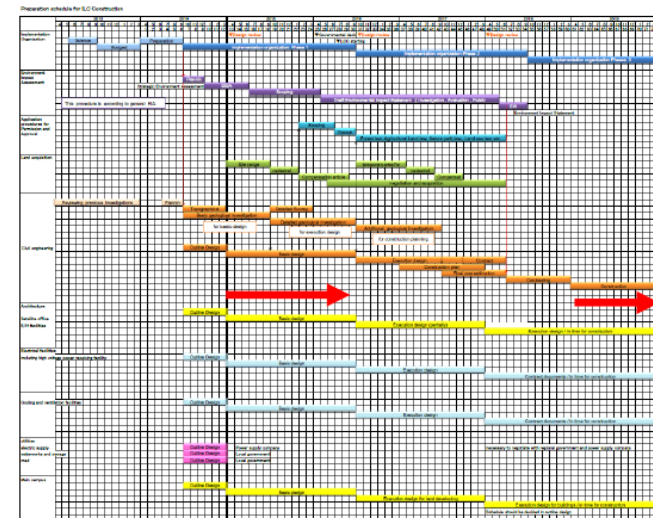
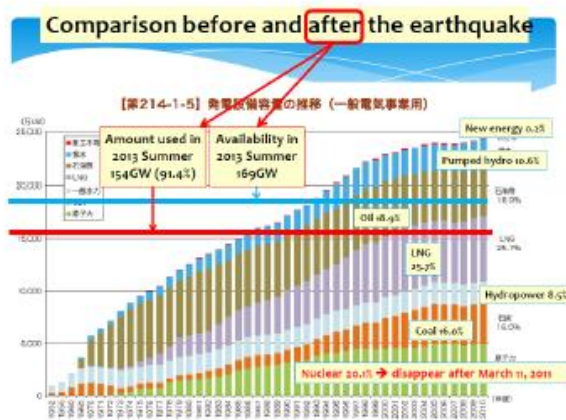
LCC Linear Collider Collaboration ILC - CFS

WG5 Talks

Tues	0900-1030	Site	T. Sanuki(Tohoku U.), M. Miyahara(KEK)
	1100-1230	Civil	A. Enomoto(KEK)
	1400-1530	Mech/Elec	A. Enomoto(KEK)
	1600-1730	Joint e+	
Wed	0900-1030	DH JPOWER/ARUP	Y. Nishimoto(JPOWER)
	1100-1230	Joint CFS/MDI	T. Sanuki(Tohoku U.), M. Oriunno (SLAC),
	1400-1530	Effort/Resources	A. Enomoto
	1600-1730	EDMS	L. Hagge
Thur	0900-1030	Summary	
	1100-1230	ECO/Green	J. Fujimoto, D. Perret-Gallix
	1400-1530	ECO/Green	T. Saeki
	1600-1730		

ECO/Green

J. Fujimoto, D. Perret-Gallix, T. Saeki



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 CO₂ 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

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

Atsuto Suzuki (KEK)



INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION
HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION

AWG7: SRRF technologies

H. Hayano

Discussion Topics

Total 11 time slots

(1) Deep Technical Review of Input Couplers

TTF3 coupler

STF2 coupler

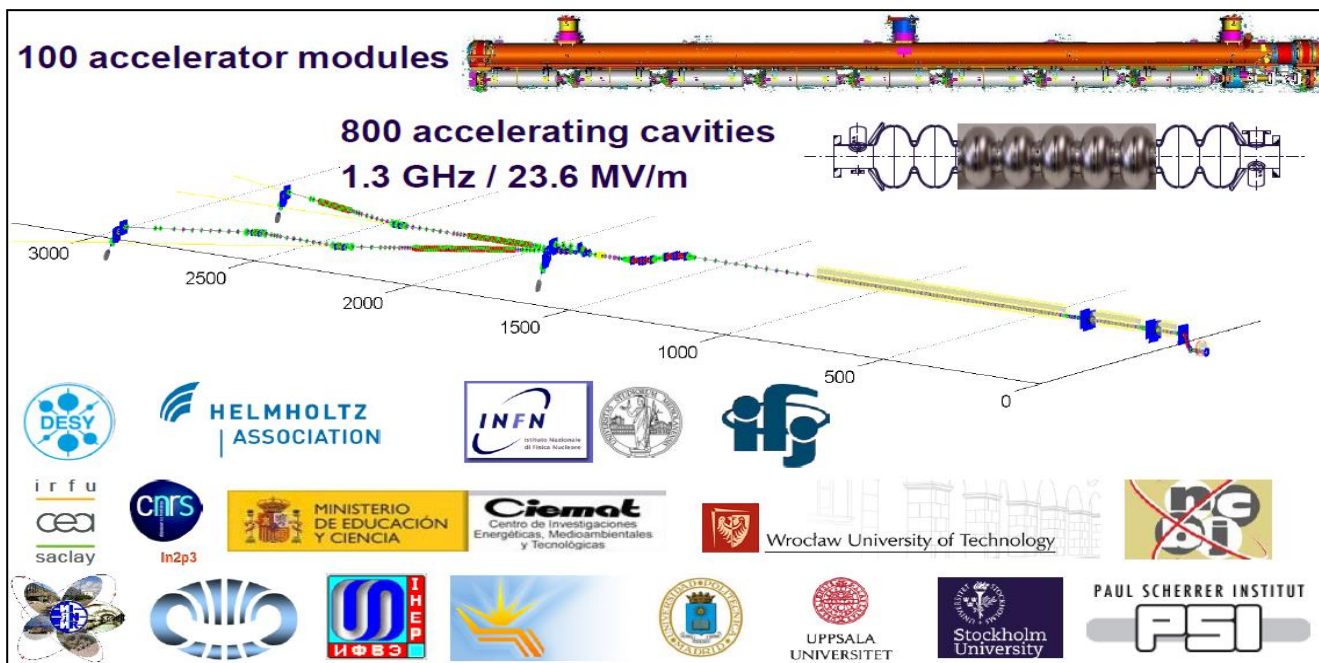
8 slots

DESY, FNAL, SLAC, CERN, Saclay, KEK and 7 industries

(2) General discussion on Cavity, Cryomodule

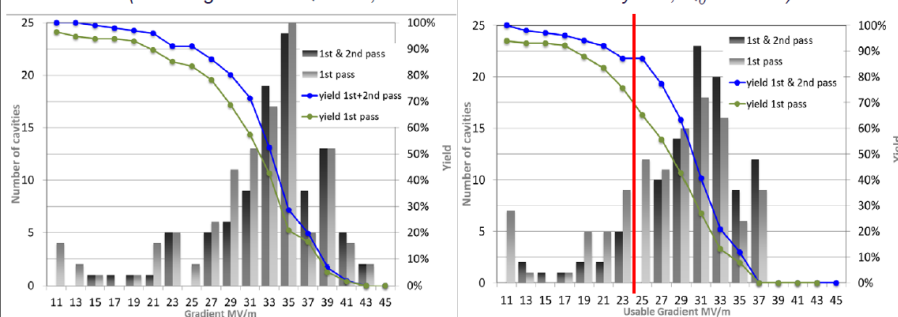
3 slots

XFEL accelerator $\sim 0.05 \times$ ILC



Large scale
multi-partner
industrialization

- 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 > 1×10^{-2} mGy/min, $Q_0 < 1 \times 10^{10}$)

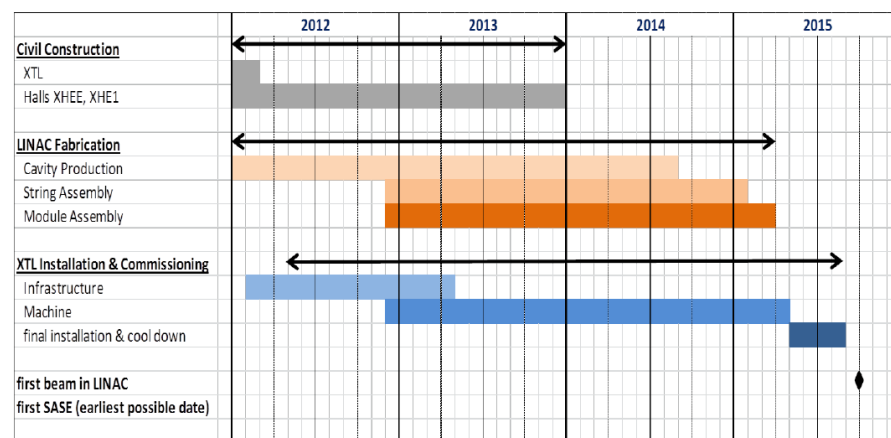


Average maximum gradient:

(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



Wolf-Dietrich Moeller (DESY), Accelerator Plenary

Challenges and Status of XFEL Module Assembly

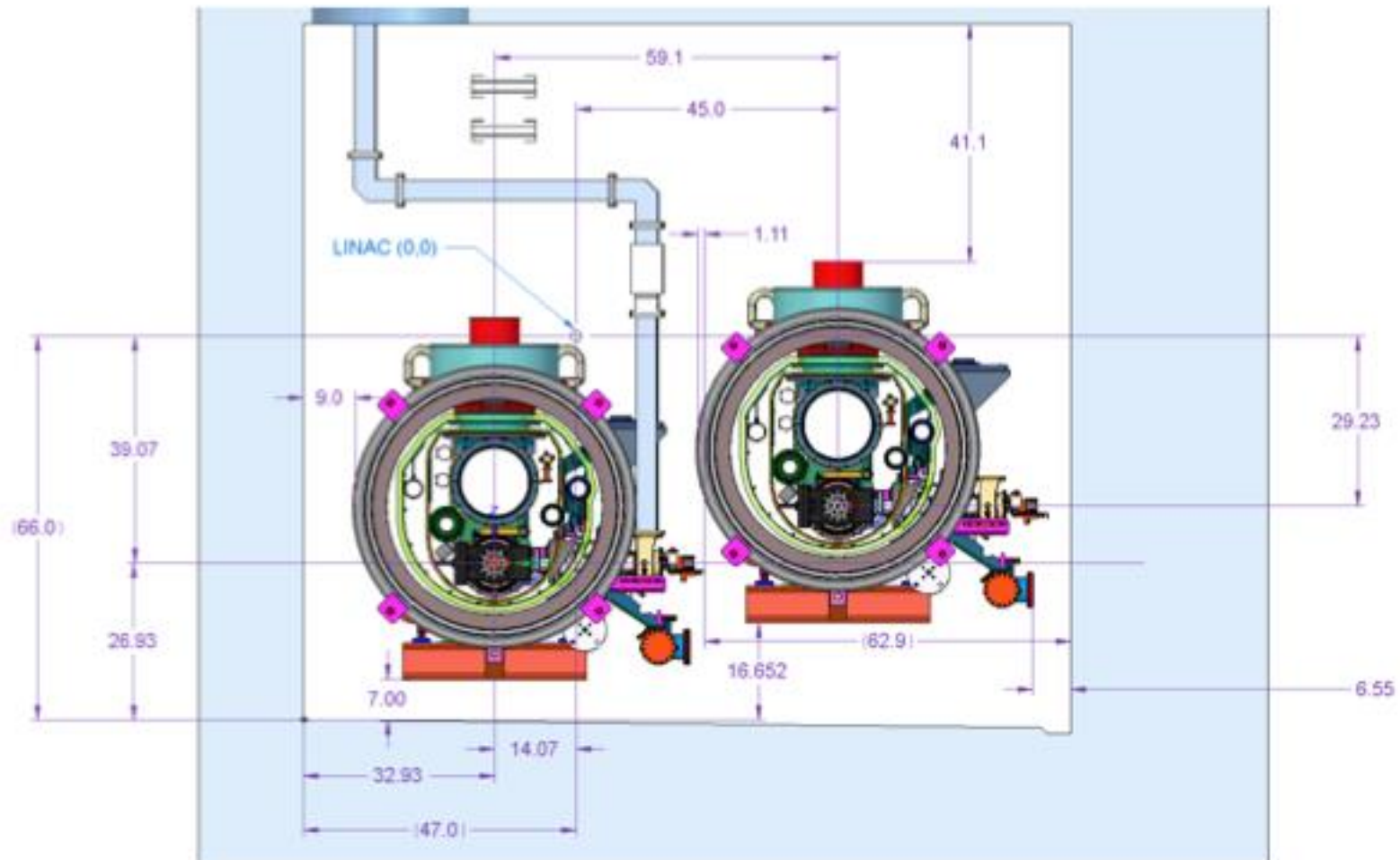


O. Napoly, CEA-Saclay, Irfu/SACM

Cryomodules in SLAC Tunnel

SLAC

SLAC Linac Tunnel (11 feet wide x 10 feet high) (3.35 m x 3.05 m)



H. Hayano: CM Earthquake simulation

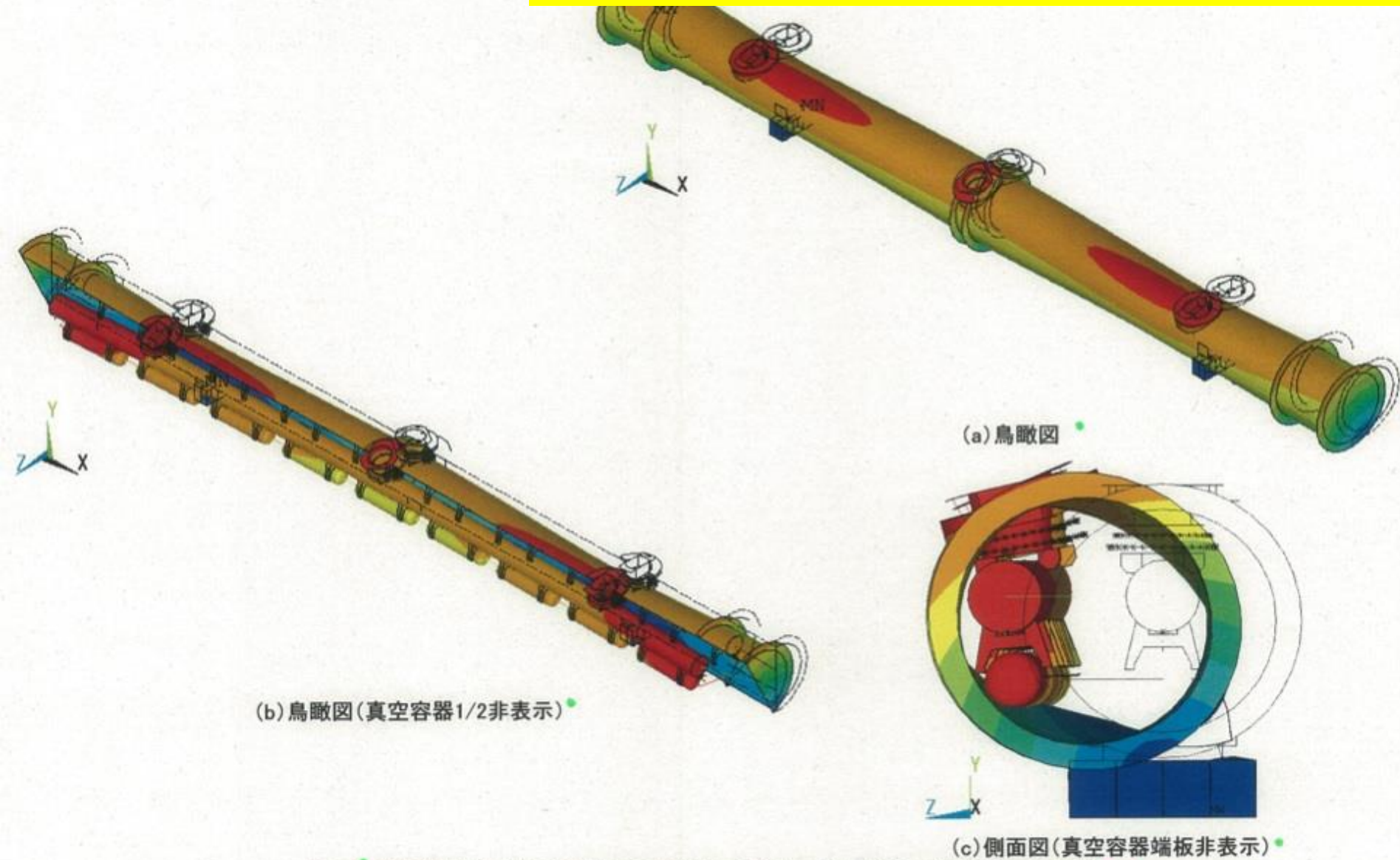


図3-3 固有値解析 水平方向(モデルZ方向)卓越モード 固有モード図(1次:6.67Hz)

Main mode of Z-direction (horizontal axis) : 6.67Hz

Our future in 202x !?

Masanobu Miyahara (KEK), Accelerator Plenary

History of the candidate site in Japan

Primary candidate site



Two candidate sites



Site unification



Scenic Spots

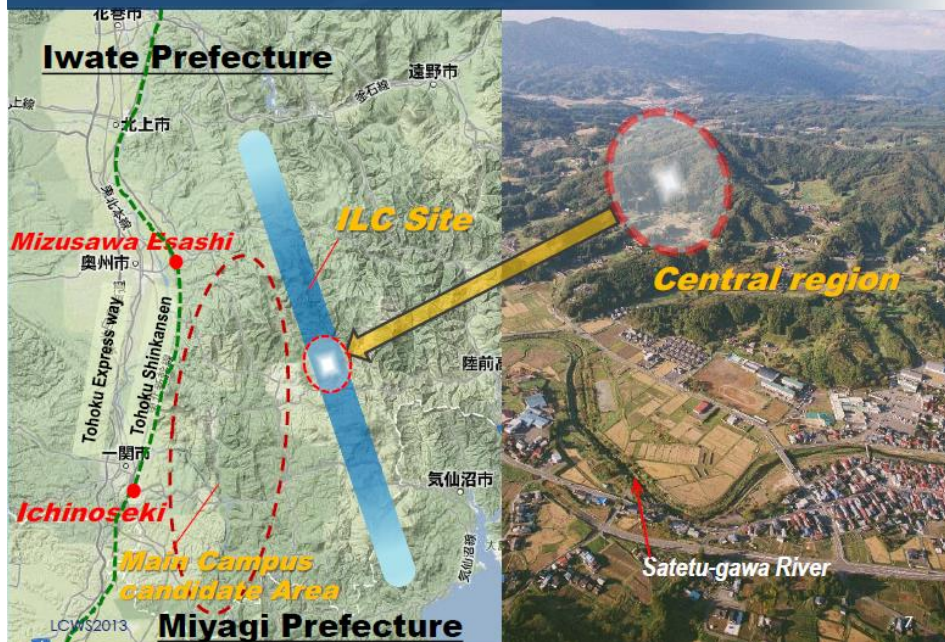
Attractions, Historic sites around the site



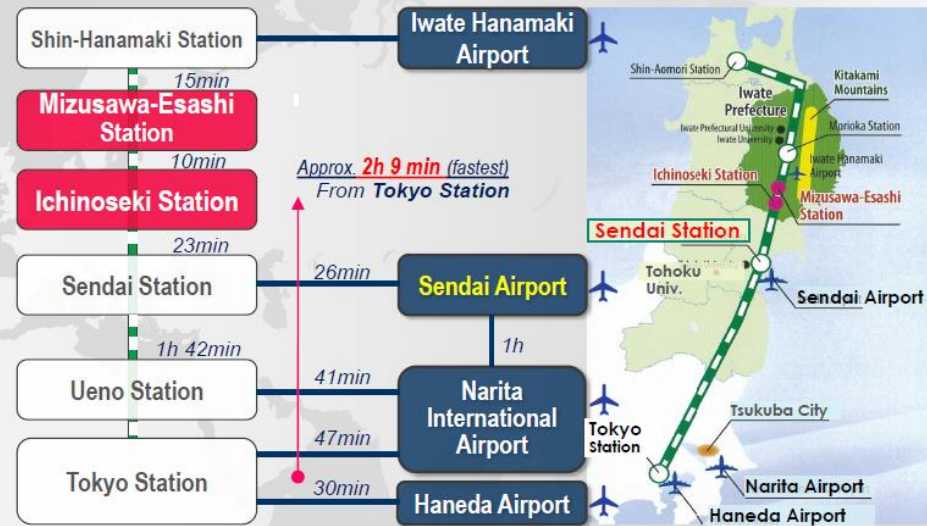
Tohoku is blessed with beautiful natural surroundings and abundant agriculture, and our people represent the spirit of hospitality. —from Iwate Prefecture Web site—

LCWS2013

Location



Access to the site from Tokyo



Mr. Kawamura's Talk

- Text (in English)

- Can be downloaded from the workshop home page
 - Please use today's version

- 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.



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)

Americas Workshop on Linear Colliders

May 12 to 16, 2014

Fermilab

