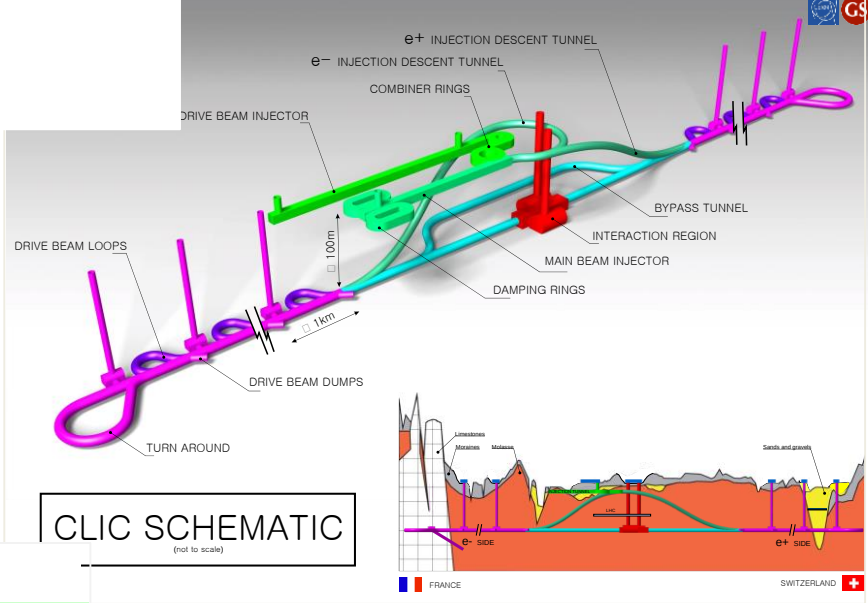
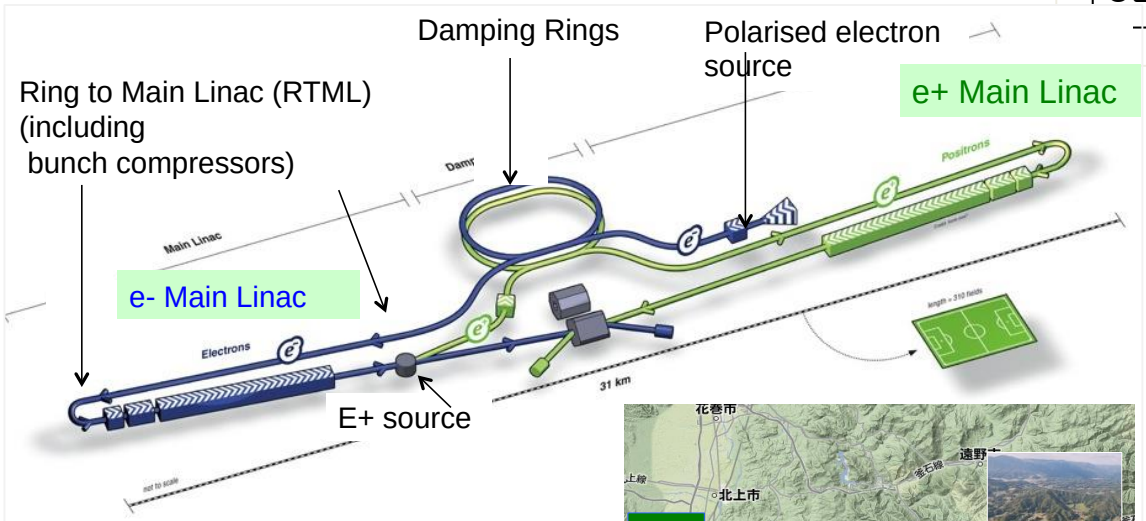
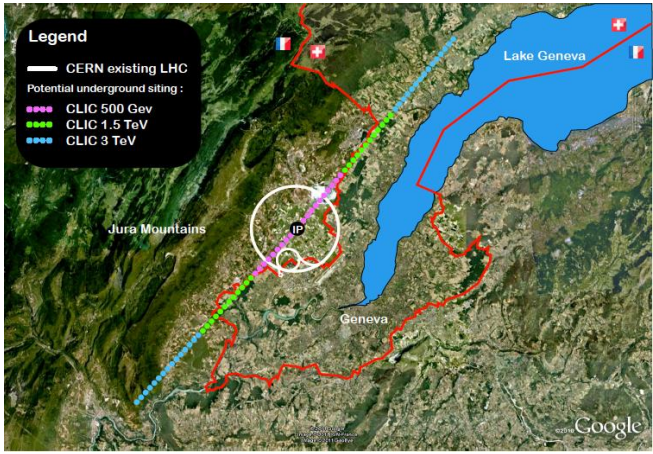
LCC report





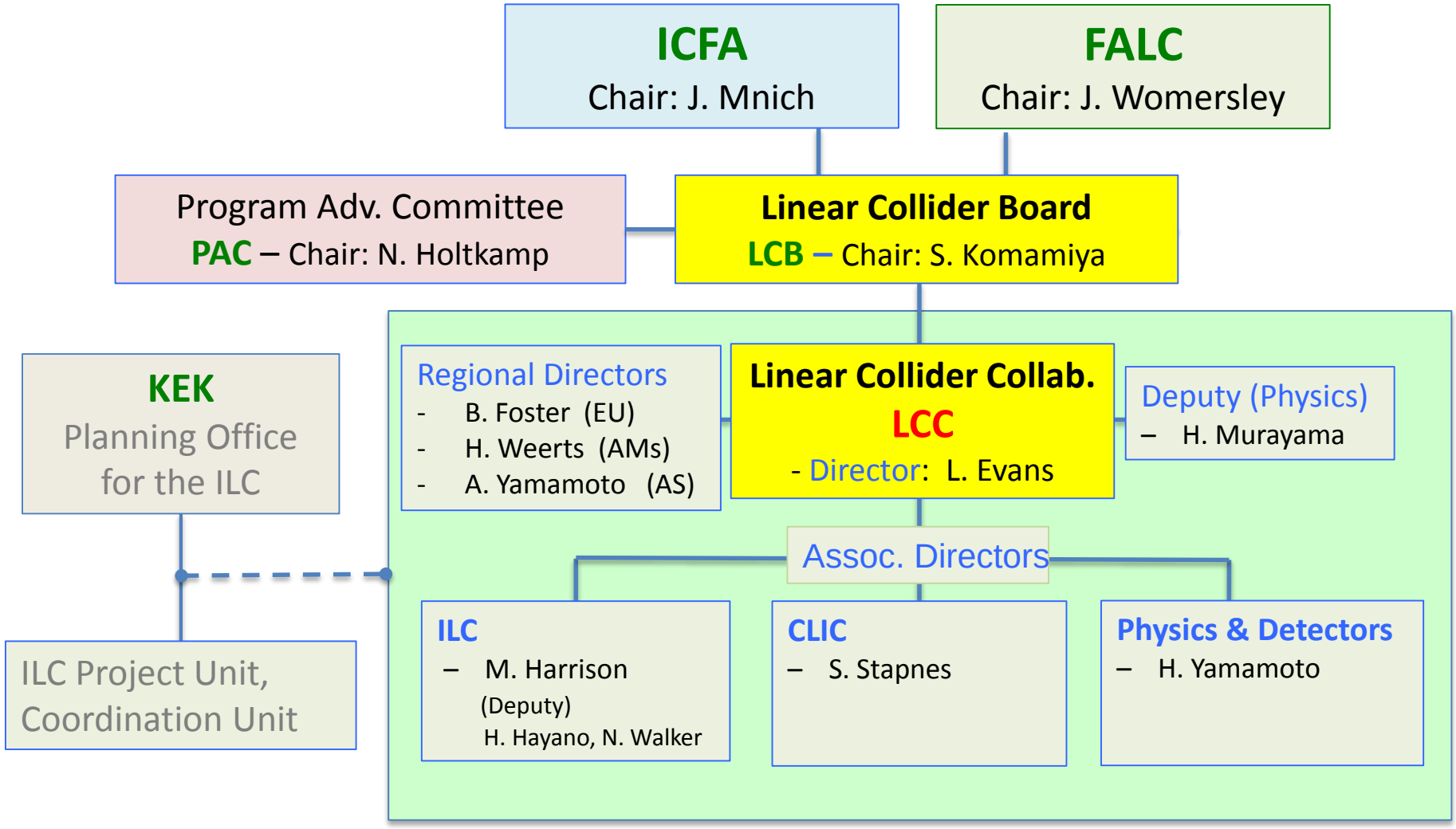
ILC SCHEMATIC



Lyn Evans
FALC. CERN 19th June 2015

ILC in Linear Collider Collaboration

As of April, 2015



Key points

The ILC and CLIC accelerator studies are organised under the leadership of the Linear Collider Collaboration with goals:

- Strongly support the Japanese initiative to construct a linear collider as a staged project in Japan
- Prepare CLIC machine and detectors as an option for a future high-energy linear collider at CERN
- Further improve collaboration between CLIC and ILC machine experts
- Beyond the significant progress on the basic RF studies, increased and successful effort on system-studies of various types (FACET, ATF, etc)
- Many common challenges with 3rd generation light sources and FELs, the latter providing very important industrial/lab production experiences

Comprehensive physics studies – and in parallel technical detector R&D and concept studies – demonstrate the realism and unique impact of LC e+e- measurements and searches at energy scales from 250 to 3 TeV

The on-going process in Japan for ILC is nevertheless (by some margin) the most central activity right now

ILC Accelerator in TDR

Damping Rings

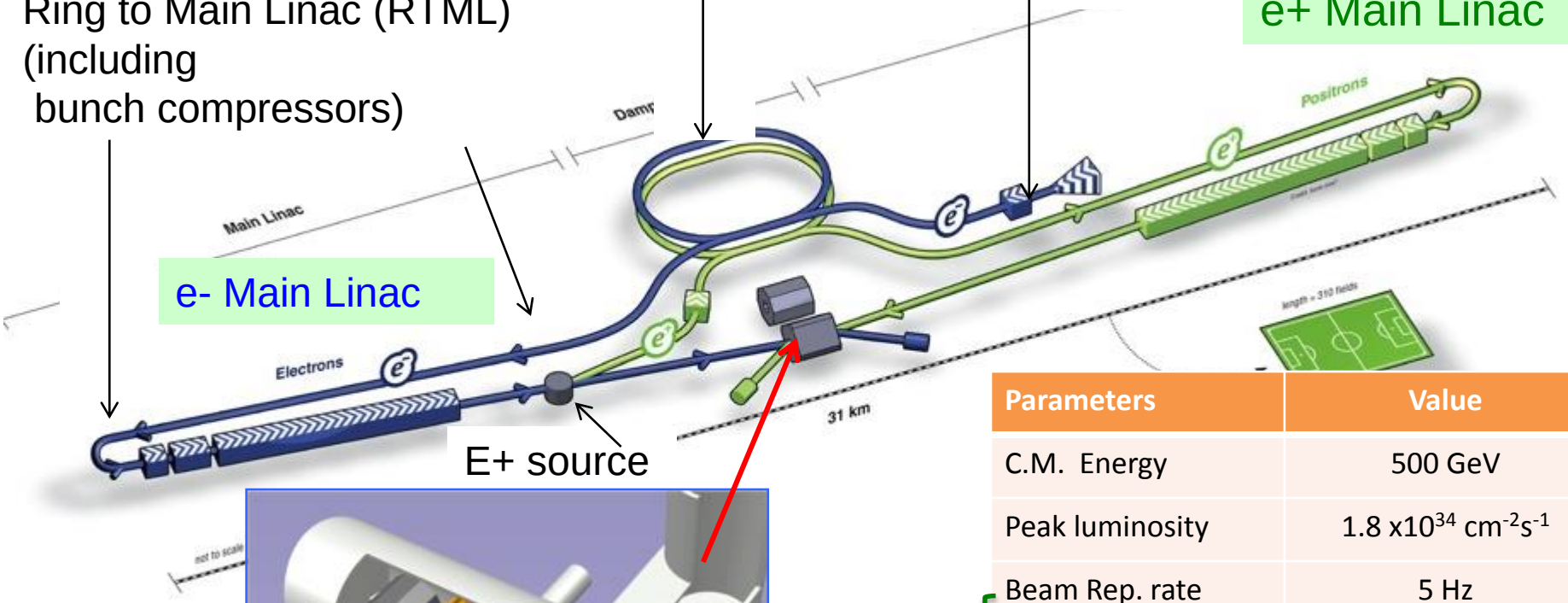
Polarised electron source

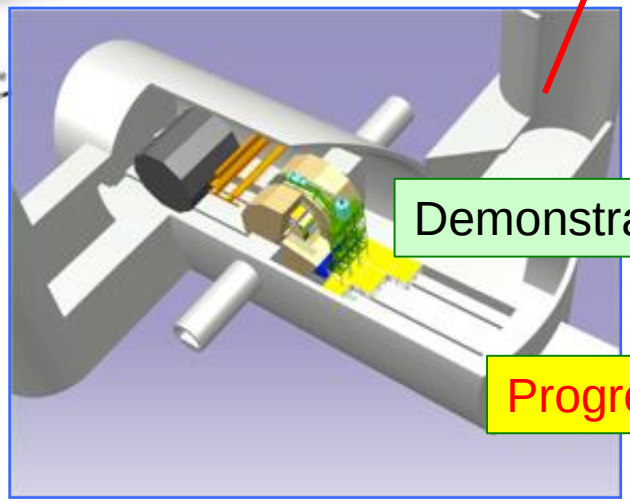
Ring to Main Linac (RTML) (including bunch compressors)

e+ Main Linac

e- Main Linac

E+ source





Demonstrated in TDR

Progress in 2014

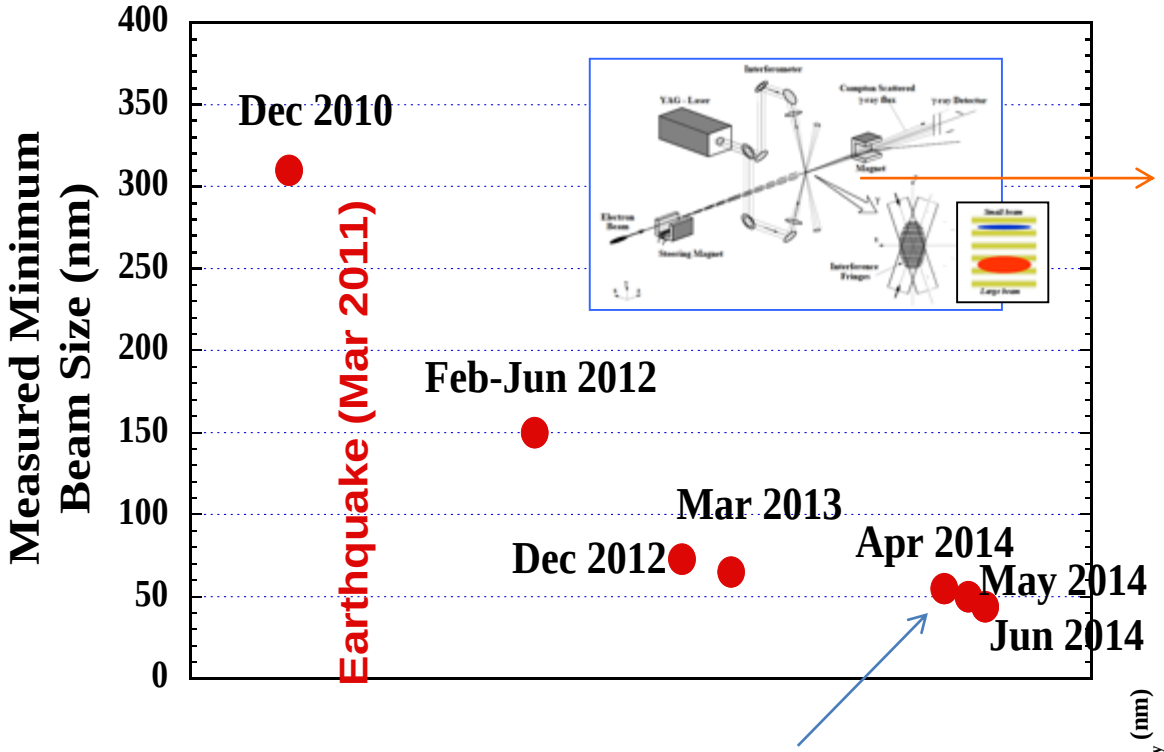
Parameters	Value
C.M. Energy	500 GeV
Peak luminosity	1.8 x10^{34} $cm^{-2}s^{-1}$
Beam Rep. rate	5 Hz
Pulse duration	0.73 ms
Average current	5.8 mA (in pulse)
FF beam size (y)	**5.9** nm
E gradient in SCRF acc. cavity	**31.5** MV/m +/-20% Q_0 = 1E10

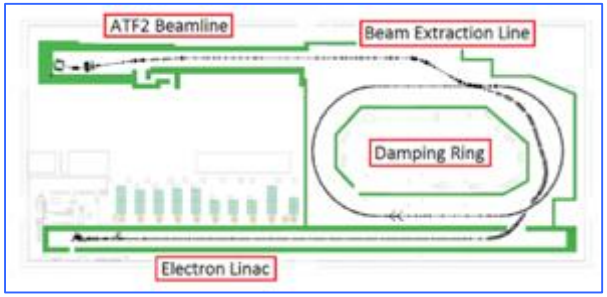
Technical Highlights in 2014

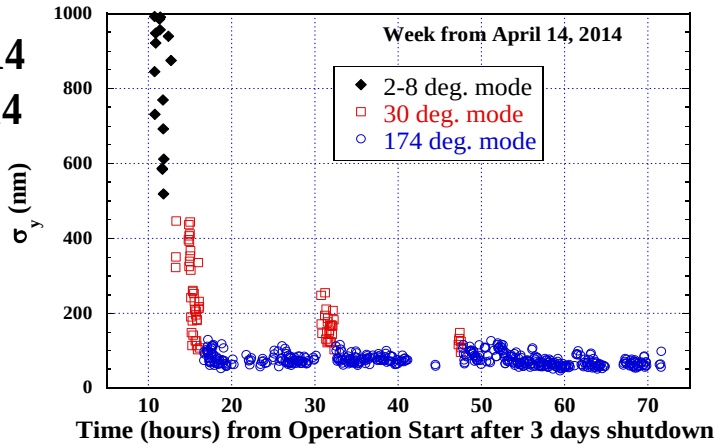
- Nano-beam
  - **ATF2**: reached 44 nm at the final focus, closing the primary goal of 37 nm
    - Corresponding to 7 nm at the ILC energy (250 GeV/beam) with the goal of 6 nm
- SRF
  - **EXFEL**: exceeded 50 % (400/800) cavity production, and 10 % (10/100) cryomodule assembly and test
  - **Fermilab**-ASTA: reached the ILC specification gradient
  - **SLAC**-LCLS: started the project in consortium with the US SRF laboratories
  - **KEK**-STF2: completed CM1+CM2a installation into the beam line
- Accelerator Design and Integration (ADI)
  - **LCC:** processed Post-TDR design update with a model-site assumption
    - Common L* for both detectors of ILD and SiD
    - Vertical access at Detector Hall at IR points
    - Extension of ML tunnel for optimizing e+e- collision timing and for redundancy of ML SRF cavity gradient integration
  - **LCC**: is continuing to seek for potential cost saving in balance to necessary increase

Progress in Beam Size at ATF2

IPAC2014, K. Kubo
ICHEp2014, S. Kuroc







Beam Size 44 nm observed,
(Goal : **37** nm
corresponding to **6** nm at ILC)

CM2 reached <31.5 MV/m > at Fermilab in 2014

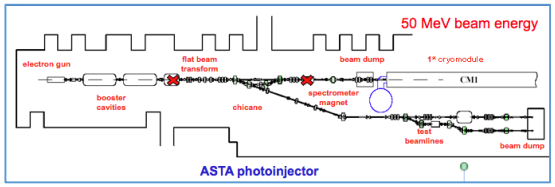
CERN Courier December 2014

ACCELERATORS

ILC-type cryomodule makes the grade

For the first time, the gradient specification of the International Linear Collider (ILC) design study of 31.5 MV/m has been achieved on average across an entire ILC-type cryomodule made of ILC-grade cavities. A team at Fermilab reached the milestone in early October. The cryomodule, called CM2, was developed to advance superconducting radio-frequency technology and infrastructure at laboratories in the Americas region, and was assembled and installed at Fermilab after initial vertical testing of the cavities at Jefferson Lab. The milestone – an achievement for scientists at Fermilab, Jefferson Lab, and their domestic and international partners in superconducting radio-frequency (SRF) technologies – has been nearly a decade in the making, from

CM2 in its home at Fermilab's NML building, as part of the future Advanced Superconducting Test Accelerator. (Image credit: Fermilab.)



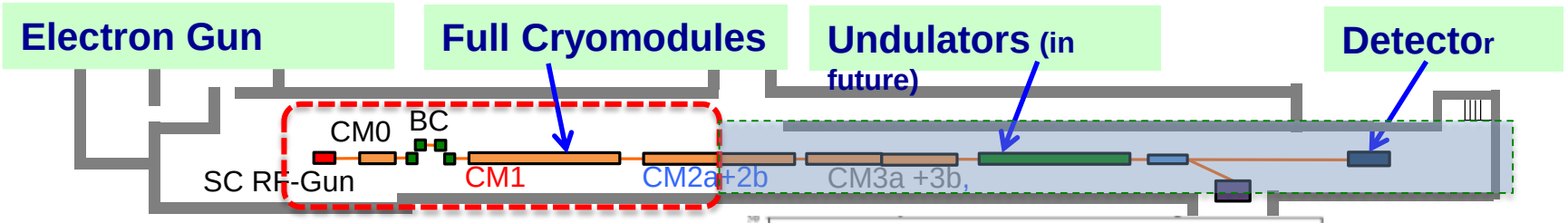
Cavity	Gradient (MV/m)
1	31.9
2	30.8
3	31.8
4	31.7
5	31.5
6	31.3
7	31.6
8	31.4

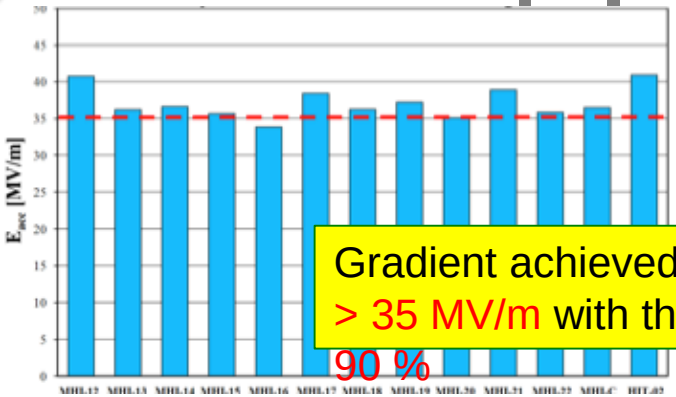
Cryomodule test at Fermilab reached < 3.15 > MV/m, exceeding ILC specification

KEK-STF2 is to be a SRF Beam Accelerator Facility

Objective
- High Gradient (31.5 MV/m)
- ＝＞Demonstration of full cryomodule
- Pulse and CW operation (for effective R&D)
- Better efficiency power sources
- SRF electron gun
- Training for next generation s

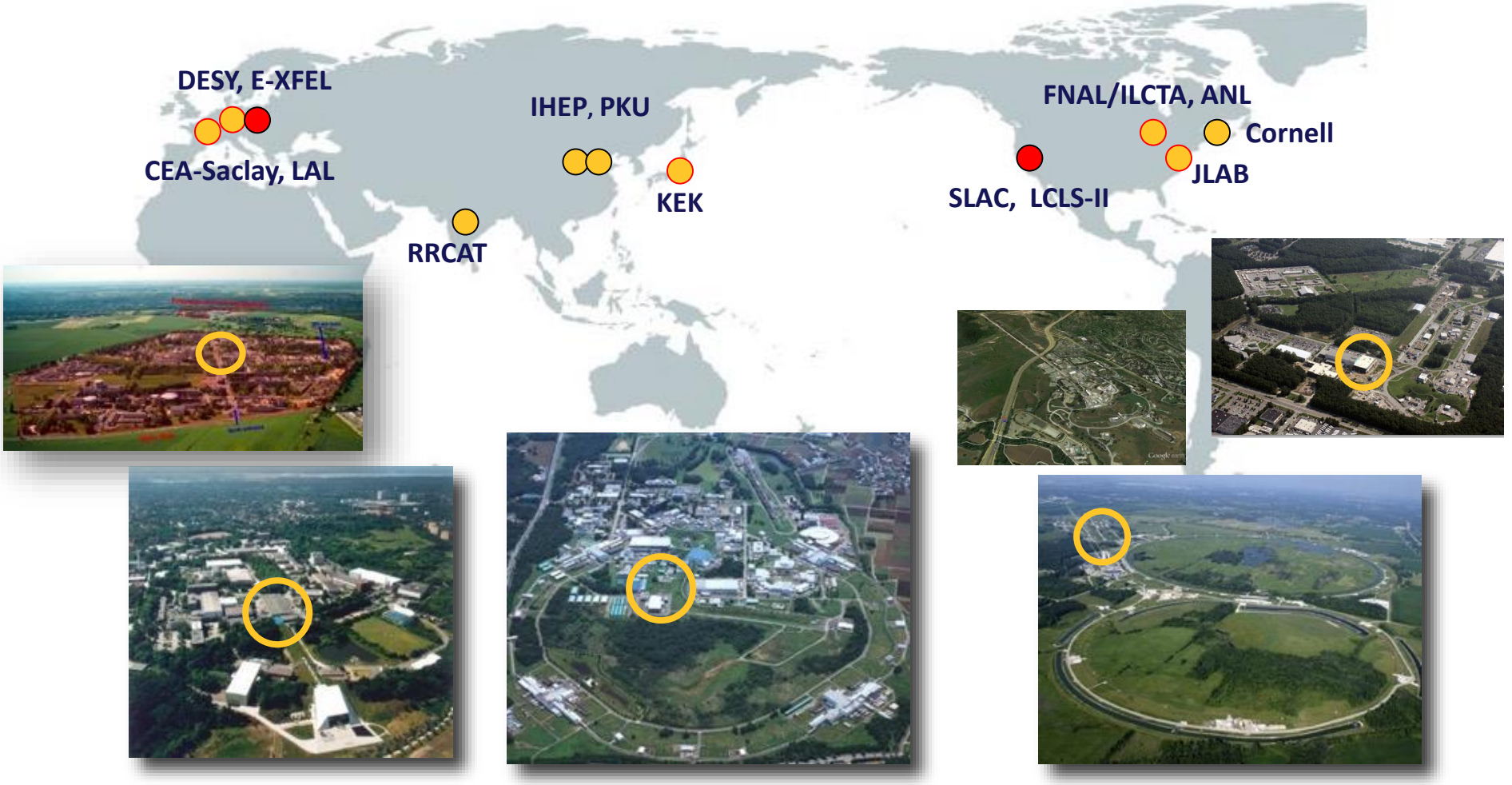
Plan:
- Multiple Cryomodule for system study
- In-house Cavity to be installed in cooperation with industry
- Wide range application including Photon Science





Gradient achieved at Cavity VT:
> 35 MV/m with the yield of > 90 %

SRF Facilities anticipated for Hub/Consortium



AMTF @DESY/E-XFEL, CM

STF-CFF @ KEK

ASTA @ FNAL, TEDF @ JLab

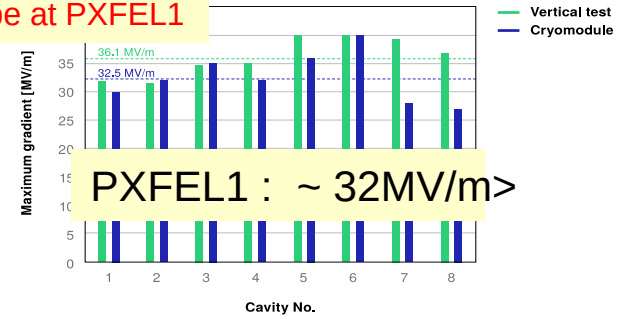
Cryomodule System Tests

DESY: FLASH

- 1.25 GeV linac (TESLA-Like tech.)
- ILC-like bunch trains:
- 600 ms, **9 mA** beam (2009);
  800 ms 4.5 mA (2012)
- RF-cryomodule string with beam → PXFEL1 operational at FLASH

← Demonstrated

XFEL Prototype at PXFEL1



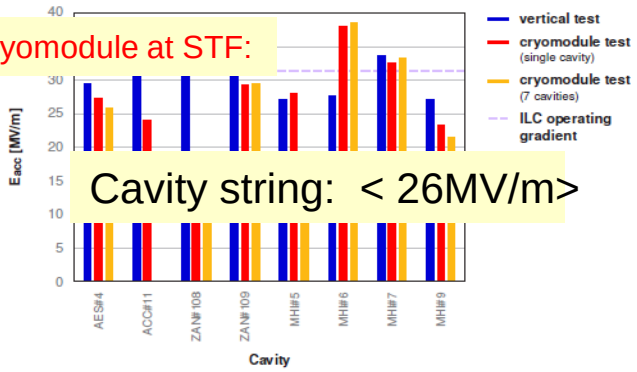
PXFEL1 : ~ 32MV/m>

KEK: STF/STF2

- S1-Global: completed (2010)
- Quantum Beam Accelerator (Inverse Llaser Compton): 6.7 mA, **1 ms**
- CM1 test with beam (2014 ~2015)
- STF-COI: Facility to demonstrate CM assembly/test in near future

← Demonstrated

S1 Global Cryomodule at STF:



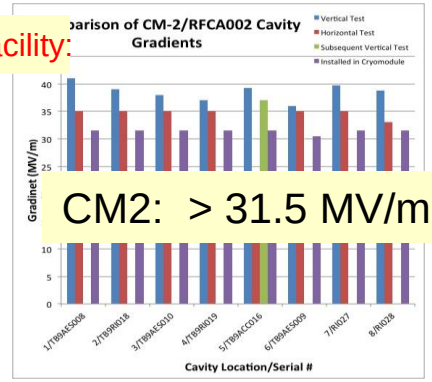
Cavity string: < 26MV/m>

FNAL: ASTA

(Advanced Superconducting Test Accelerator)

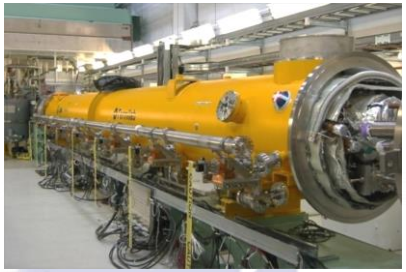
- CM1 test complete
- CM2 operation (2013)
- CM2 with beam (soon)

CM2 at NML Facility:



CM2: > 31.5 MV/m>

FEL and advanced linacs with SCRF modules



XFEL
X-Ray Free-Electron Laser

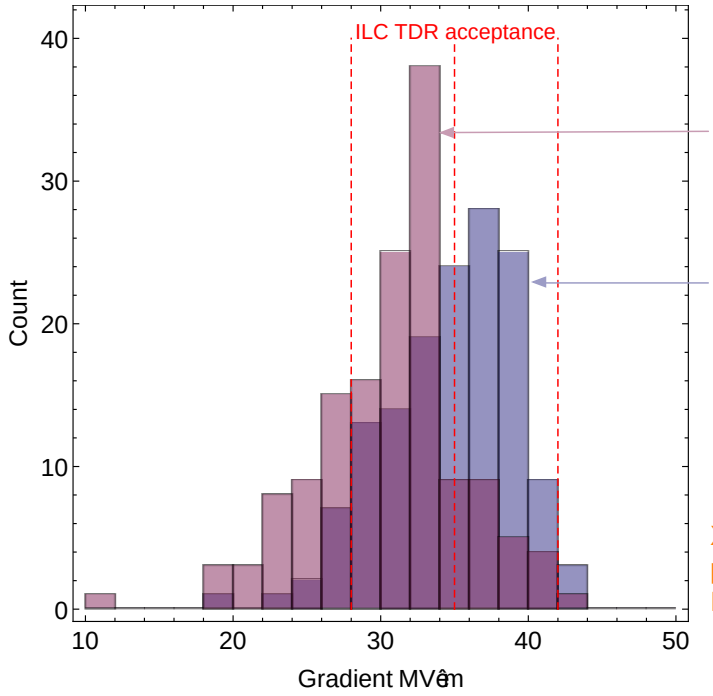
Largest deployment of this technology to date
- 100 cryomodules
- 800 cavities
- 17.5 GeV (pulsed)

TRIUMF
FNAL/ANL
SLAC
Cornell
JLab
LAL
Saclay
CERN
DESY
IHEP
PKU
KEK
Kitakami proposed site

US infrastructure for
- 35 cryomodules
- 280 cavities

Year	Capable industry
2006	2 ACCEL, ANON
2011	4 RI, ANON, AES, MHI,
2012	5 RI, ANON, AES, MHI, Hitachi

oduction a
of ILC cor



XFEL industrial production following ILC baseline process

ILC Site Candidate Location in Japan: Kitakami

Proposed by JHEP community
Endorsed by LCC
To be authorized by Government

High-way

Oshu

Express-Rail

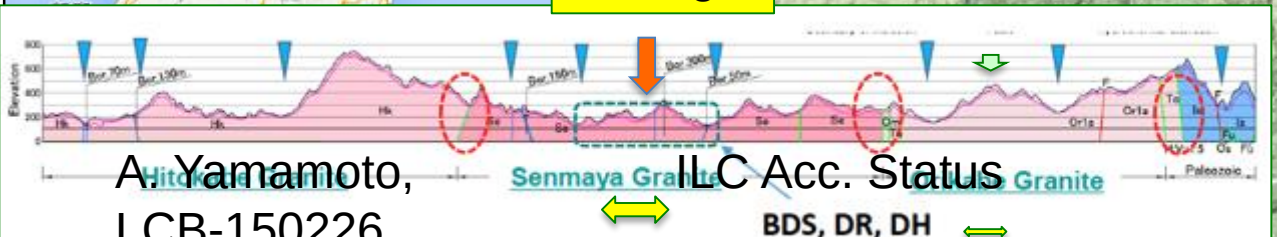
Ofunato

Kesen-numa

Sendai

Ichinoseki

IP Region



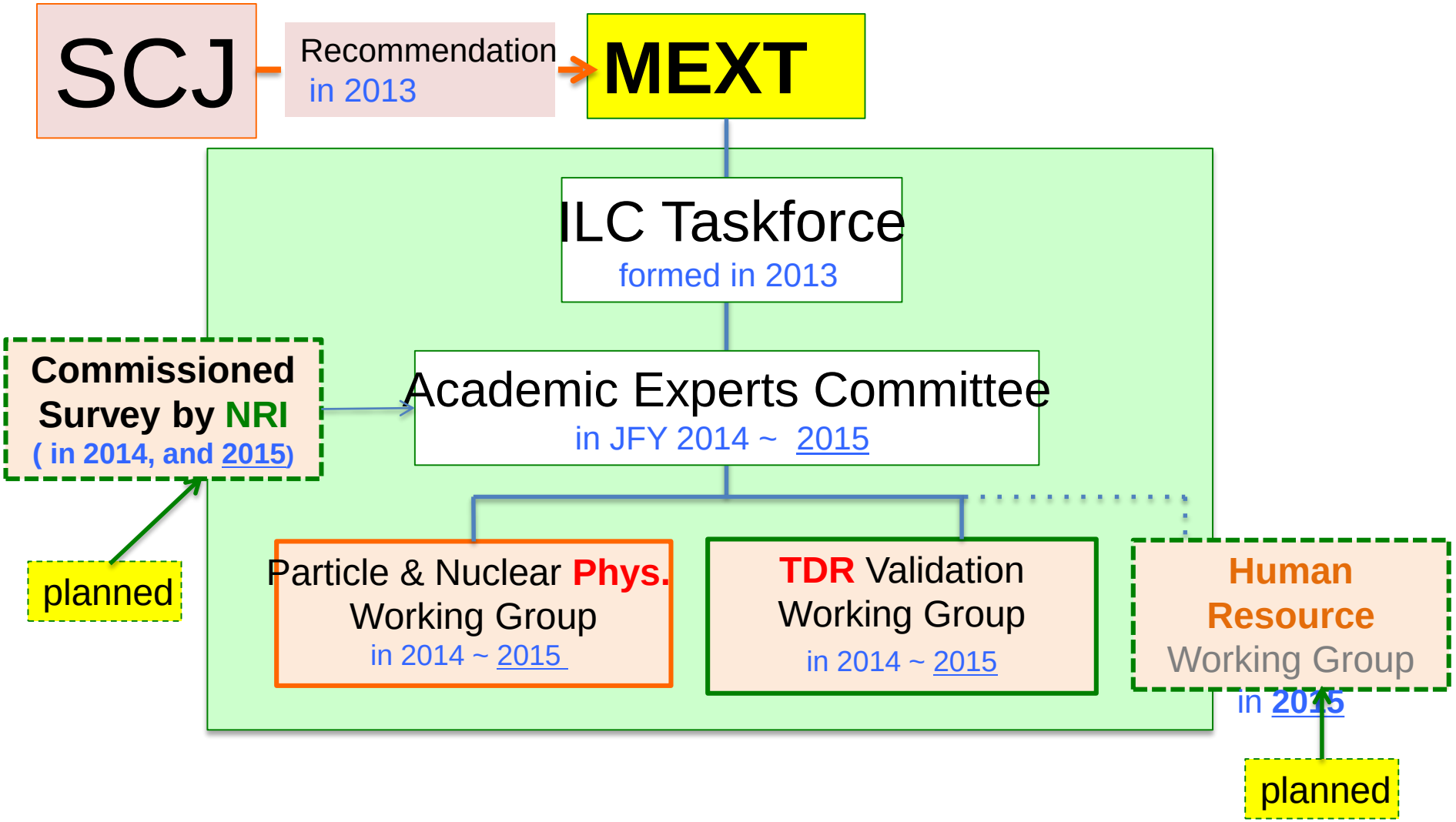
A. Yamamoto, ILC Acc. Status
LCB-150226

ILC Global Accelerator Organization

ILC Director: M. Harrison, Deputies: N. Walker and H. Hayano

Sub-Group	Global Leader Deputy/Contact p.	Sub-Group	Global Leader Deputy/Contact P.
Acc. Design Integr.	N. Walker (DESY) K. Yokoya(KEK)	**SRF**	H. Hayano (KEK) C. Ginsburg (Fermi), E. Montesinos (CERN)
Sources (e-, e+)	W. Gai (ANL) M. Kuriki (Hiroshima U.)	**RF Power & Cntl**	S. Michizono (KEK) TBD (AMs , EU)
Damping Ring	D. Rubin (Cornell) N. Terunuma(KEK)	**Cryogenics** (incl. HP gas safety)	H. Nakai: KEK T. Peterson (Fermi), D. Delikaris (CERN)
RTML	S. Kuroda (KEK) A. Latina (CERN)	**CFS**	V. Kuchler (Fermi), M. Miyahara J. Osborne (CERN),
Main Linac	N. Solyak (Fermi) K. Kubo (KEK)	**Radiation Safety**	T. Sanami (KEK) S. Roesler (CERN) TBD (Ams,)
BDS	G. White (SLAC), R. Tomas (Cern), T. Okugi(KEK)	**Electrical Support** (P. Supply etc.)	TBD
MDI	K. Buesser (DESY) T. Tauchi (KEK)	**Mechanical S.** (Vac. & others)	TBD

ILC being studied in Japan



JFY2014, Commissioned Survey

- deliverable given in a public report -

- **Technical/economical benefits from ILC**
  - ILC, General plan and technical features
  - Current, technical status and subjects for further development
  - Prospects for industrial applications and benefits
  - Analysis for economical impacts, base on direct and indirect effects to be expanded (estimated, ~ > 2)

- **Scientific prospects and future plans**
  - for particle and nuclear physics, in Europe, north America, and in China
  - Observation and suggestions for ILC, obtained through worldwide visiting and Interviews

MEXT

contracted with Nomura Research Institute (**NRI**)

- Subjects for survey and analysis:
  - **Technical feasibility** to realize the ILC
    - Regarding components, system design, management, and infrastructure
  - **Technical issues** to prepare for the ILC construction
    - Regarding industrial technology, and necessary time-scale, and prototype works.
    - Cost increase risk
  - **Cost reduction** possibility
    - with technical approaches not described in TDR

LCC-ILC Progress Report in preparation

to be useful for further surveys and studies

- It contains the LCC-ILC technical progress after TDR, respecting:
  - *Civil engineering studies*
  - *Accelerator hardware design/development updates*
  - *Accelerator system layout updates for preferred site*
  - *Integration/test facilities to be prepared for "hub-laboratory functioning*
  - *Project Implementation Plan*
  - *Further preparatory work*

- It may be useful as a reference document for any survey and/or evaluation on the ILC activities, updated.