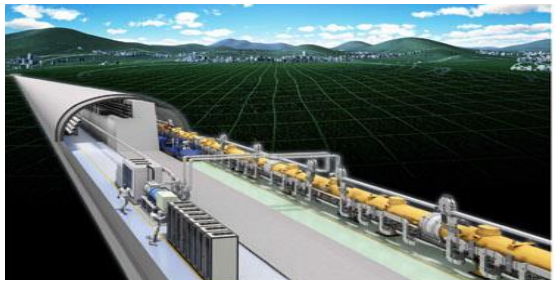
A mini-workshop on the ILC Cryogenics and He Inventory

- **Objectives**
  - Overview the ILC cryogenics design and further optimize it, to provide reliable inputs for CFS work during the ILC preparation phase.
    - Focusing on optimization of locations for major components such as main-compressors and He inventory
    - Establishing the safety guideline and design

- **Agenda (18, June)**

9:00	Opening remark:	Mike Harrison
9:10	ILC preparation in Japan:	Akira Yamamoto
9:30	ILC Cryogenics design including updates: - focusing on the main-compressor location and He-inventory, and - necessary space on surface / underground,	Hirotaka Nakai
10:10	ILC Geological Conditions and Constraints: - focusing on vertical shaft/access location for cost-effective design	Tomoyuki Sanuki
10:30	Coffee break	
10:50	CERN's experience for He inventory and advice: - focusing on He main-compressor location, and He inventory - please show us a safety training video for information, - please report the recent study.	Dimitri Delikaris
11:20	Discussion for the ILC He inventory safety and actions required	
12:00	Closing remark:	Laurent Tavian



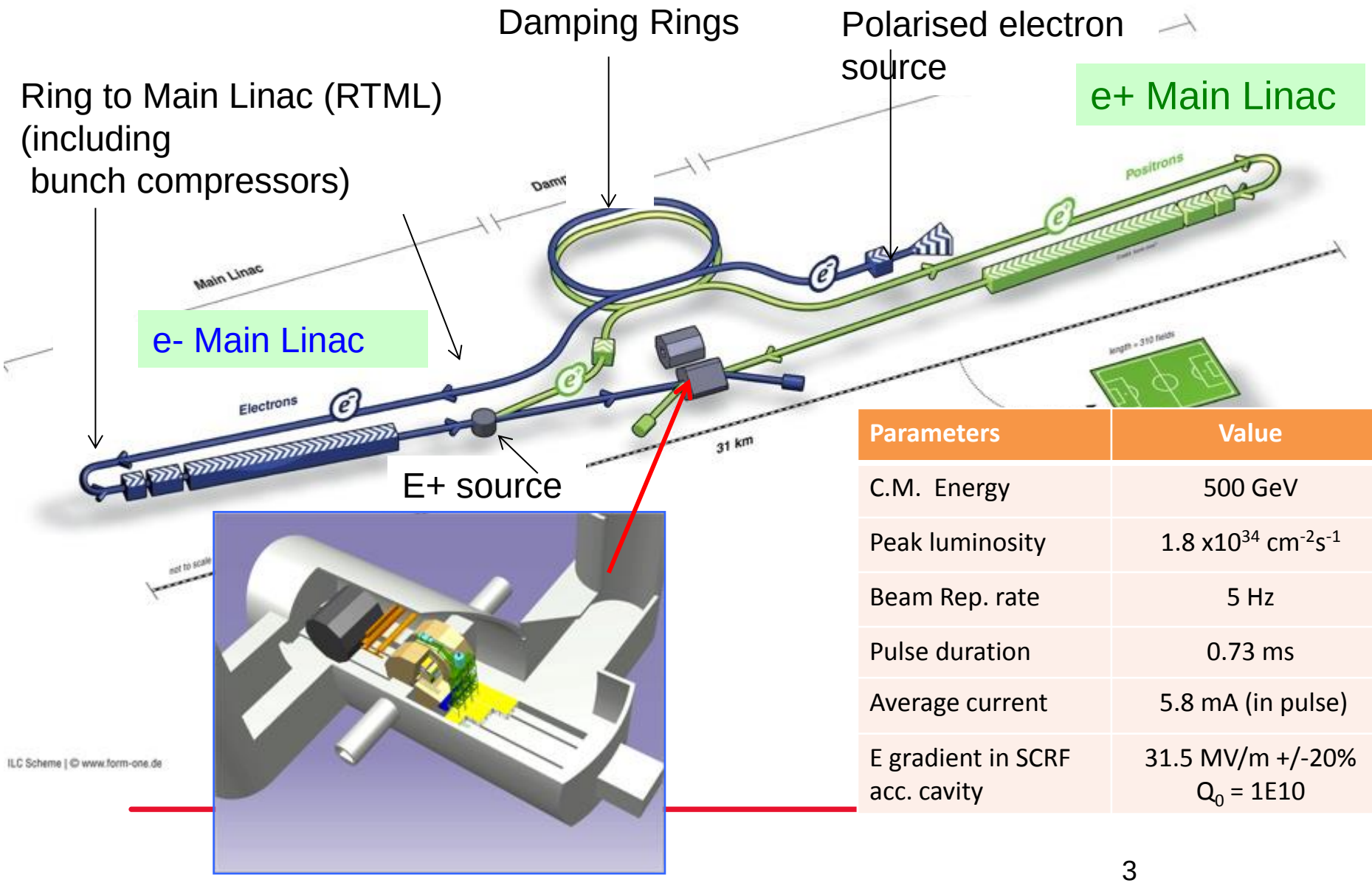
ILC Preparation in Japan

Akira Yamamoto
KEK / CERN

to be presented at A mini-workshop on ILC Cryogenics and He Inventory

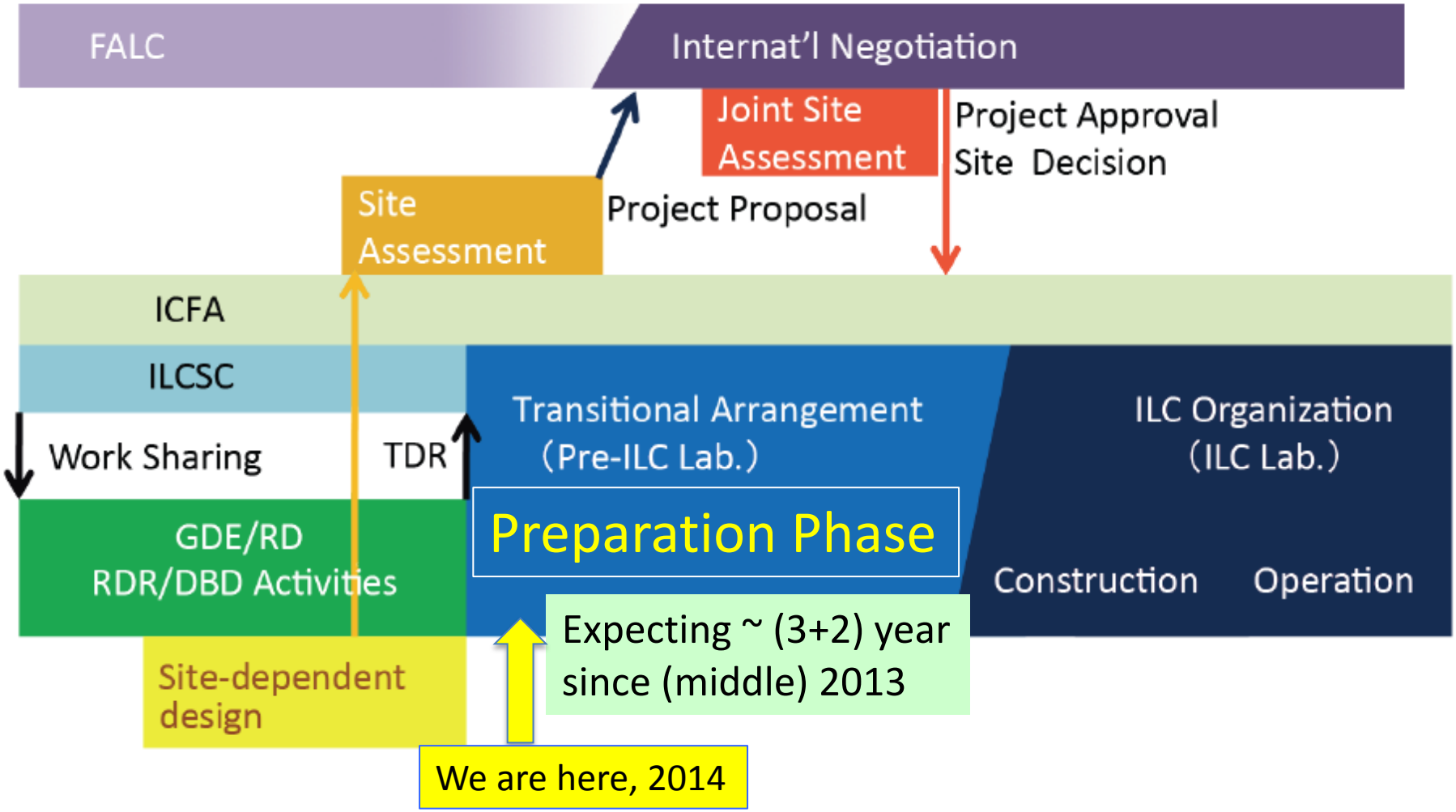
held at CERN, 18 June, 2014

ILC TDR Layout



Parameters	Value
C.M. Energy	500 GeV
Peak luminosity	1.8×10^{34} $cm^{-2}s^{-1}$
Beam Rep. rate	5 Hz
Pulse duration	0.73 ms
Average current	5.8 mA (in pulse)
E gradient in SCRF acc. cavity	31.5 MV/m +/-20% Q_0 = 1E10

ILC Time Line: Progress and Prospect



LCC-ILC Accelerator Organization

LINEAR COLLIDER COLLABORATION

LCC-ILC Director: M. Harrison, Deputies: N. Walker and H. Hayano *KEK LC Project Office Head: A. Yamamoto

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

Major Task: Fix technical design parameters to be optimized, and reflect them to CFS design optimization, within a few years.

LCC-ILC Accelerator Organization

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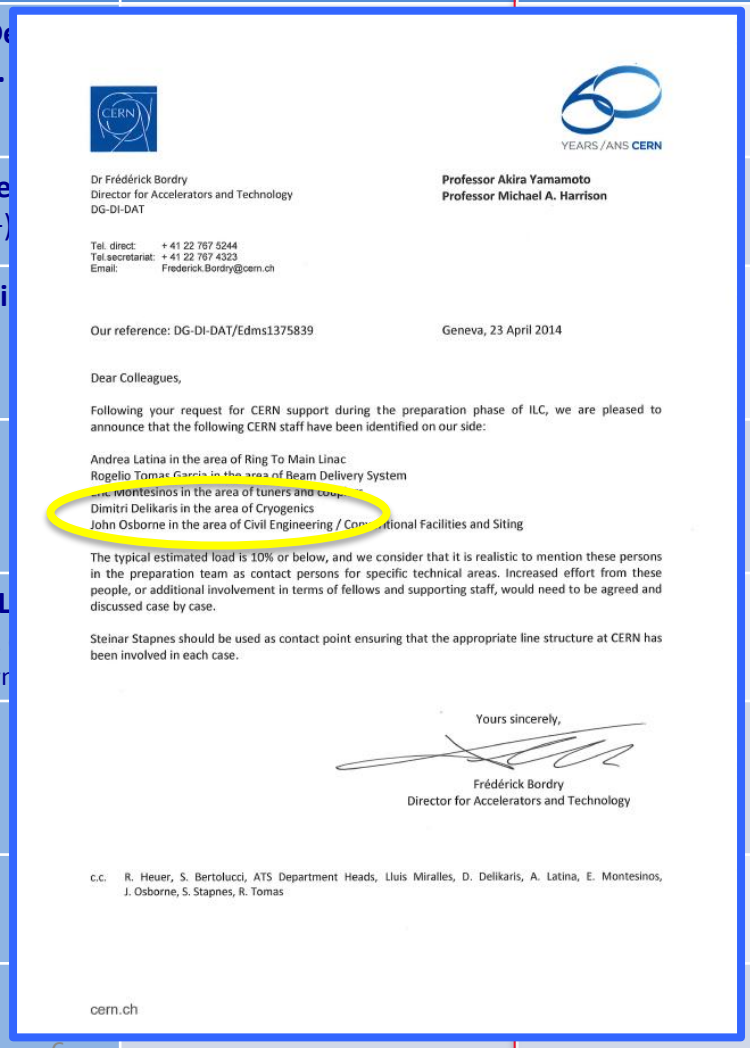
Acc. De Integr.			SRF	**H. Hayano (KEK)** C. Ginsburg (Fermi), E. Montesinos (CERN)	H. Hayano Y. Yamamoto
Source (e-, e+)			RF Power & Cntl	**S. Michizono (KEK)** TBD (AMs , EU)	Michizono T. Matsumoto
Dampi Ring			Cryogenics (incl. HP gas issues)	**H. Nakai: KEK** T. Peterson (Fermi), D. Delikaris (CERN)	H. Nakai Cryog. Center
RTML			CFS	**A. Enomoto (KEK)** V. Kuchler (Fermi), J. Osborne (CERN),	A. Enomoto M. Miyahara
Main L (incl. B. & B. Dyr			Radiation Safety	**T. Sanami (KEK)** TBD (AMs, EU)	T. Sanami T. Sanuki
BDS			Electrical Support (Power Supply etc.)	TBD	TBD
MDI			Mechanical S. (Vac. & others)	TBD	TBD
			Domestic Program, Hub Lab. Facilities	TBD	H. Hayano T. Saeki



CERN

YEARS /ANS CERN

Dr Frédérick Bordry
Director for Accelerators and Technology
DG-DI-DAT

Tel. direct: + 41 22 767 5244
Tel.secretariat: + 41 22 767 4323
Email: Frederick.Bordry@cern.ch

Professor Akira Yamamoto
Professor Michael A. Harrison

Our reference: DG-DI-DAT/Edms1375839

Geneva, 23 April 2014

Dear Colleagues,

Following your request for CERN support during the preparation phase of ILC, we are pleased to announce that the following CERN staff have been identified on our side:

Andrea Latina in the area of Ring To Main Linac
Rogelio Tomas Garcia in the area of Beam Delivery System
E. Montesinos in the area of tuners and co
Dimitri Delikaris in the area of Cryogenics
John Osborne in the area of Civil Engineering / Co tional Facilities and Siting

The typical estimated load is 10% or below, and we consider that it is realistic to mention these persons in the preparation team as contact persons for specific technical areas. Increased effort from these people, or additional involvement in terms of fellows and supporting staff, would need to be agreed and discussed case by case.

Steinar Stapnes should be used as contact point ensuring that the appropriate line structure at CERN has been involved in each case.

Yours sincerely,

Frédérick Bordry
Director for Accelerators and Technology

c.c. R. Heuer, S. Bertolucci, ATS Department Heads, Lluis Miralles, D. Delikaris, A. Latina, E. Montesinos, J. Osborne, S. Stapnes, R. Tomas

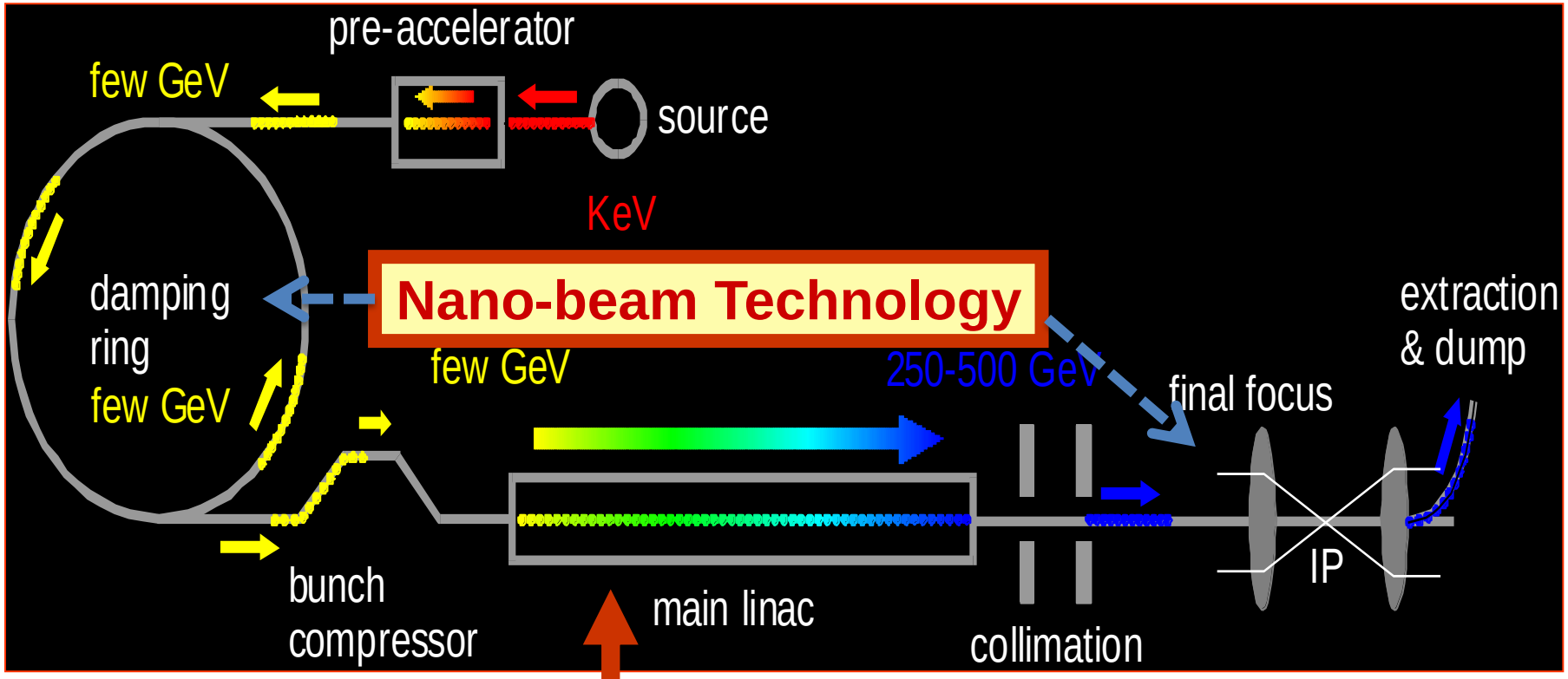
cern.ch

Major Task: Fix technical design parameters to be optimized, and reflect them to CFS design optimization, within a few years.

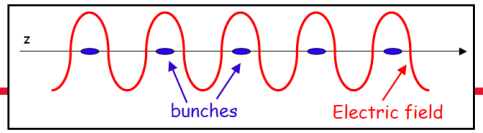
Further Global Cooperation Expected

Category	Work-base	Specific subject	Global Collaboration w/
Positron Source		Positron source	PosiPol Collaboration
Nano Beam	ATF	37 nm beam 2 nm stability	ATF collaboration
SCRF Cavity Integration	STF	Power Input Coupler Tuner He-Vessel	CERN-DESY-KEK CEA-Fermi/SLAC-KEK DESY-KEK (WS at CERN? Autumn. 2014)
CM integration	STF, ILC	Conduction-cooled SC Quadrupole	Fermilab-KEK
Cryogenics	ILC	Cryog. Underground He inventry High p. Gas Safety	CERN-Fermilab-KEK (WS at CERN, 18 June)
CFS	ILC	CFS design prep.	CERN-Fermilab-KEK
Radiation Safety	ILC	ML radiation shield	SLAC-DESY-CERN-KEK (Session during this week)

ILC Accelerator Technology



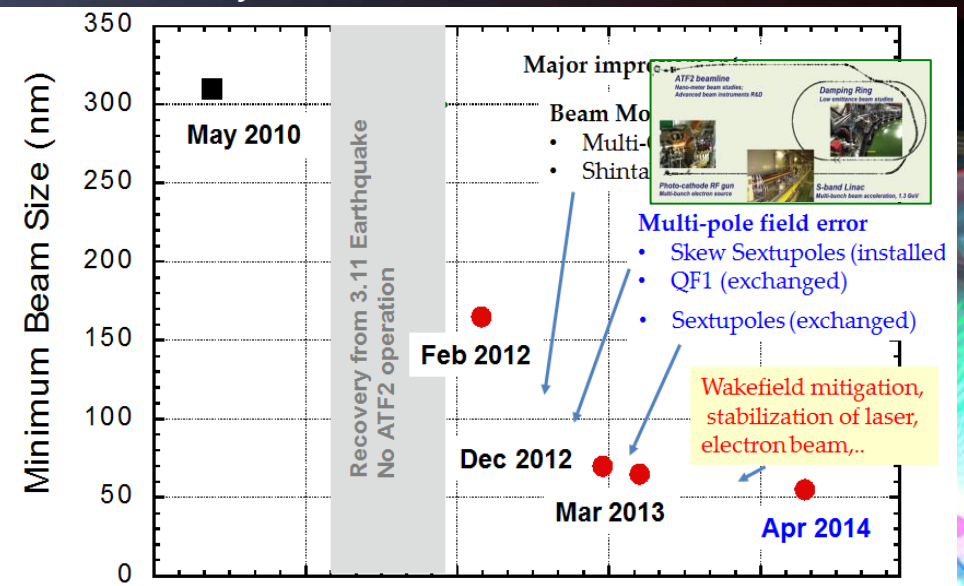
SRF Technology



8

ATF2: Final Focus Test Beamline

History of ATF2 minimum beam size:



Further improvement will be reported by the ATF2 collaboration at the IPAC14

N. Terunuma

Beam trajectory stabilization with nm precision:

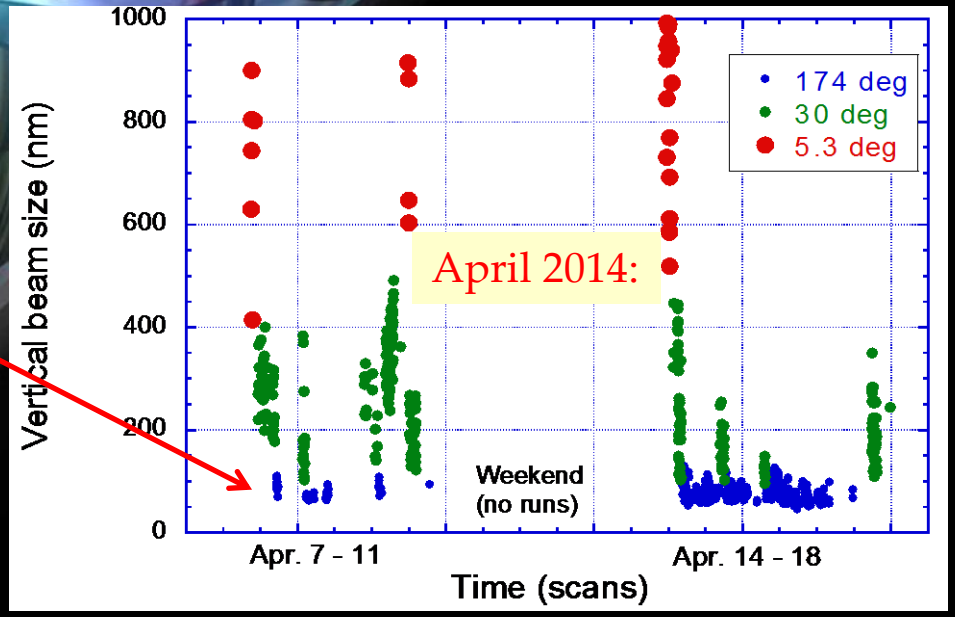
- April 2014: routinely reach < 60 nm vertical beam size (low intensity)
- Future Goals:

→achieve beam size of 37 nm
(beam-size monitor improvement required; optics for final focusing needs to be established)

→achieve beam stability of a few nm and ILC-like intra-train feedback
(instrumentation improvement to reach IPBPM resolution of 2 nm in the 2 ~ 3 years)

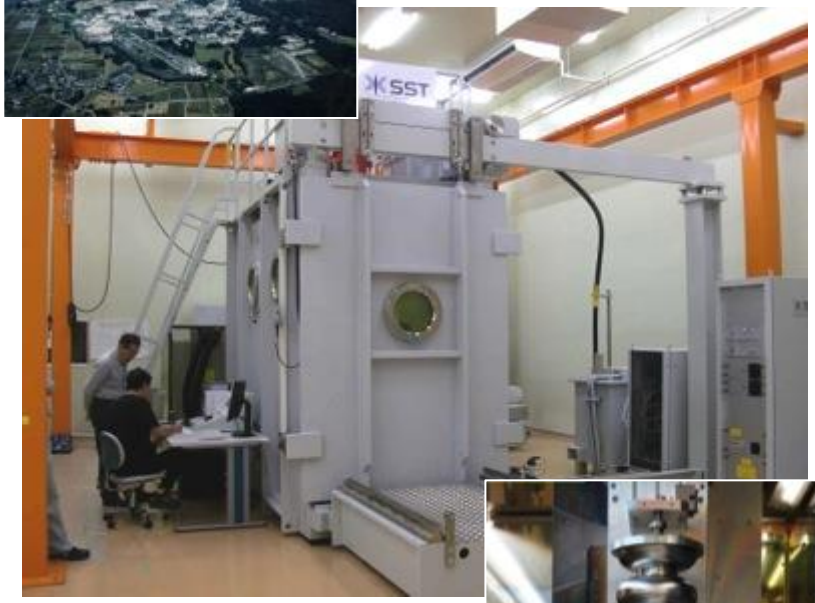
Major improvements in beam-size tuning:

- Quick recovery of beam size down to < 60 nm (in less than 1 day)
- Good reproducibility (after machine is off for an extended period of time)

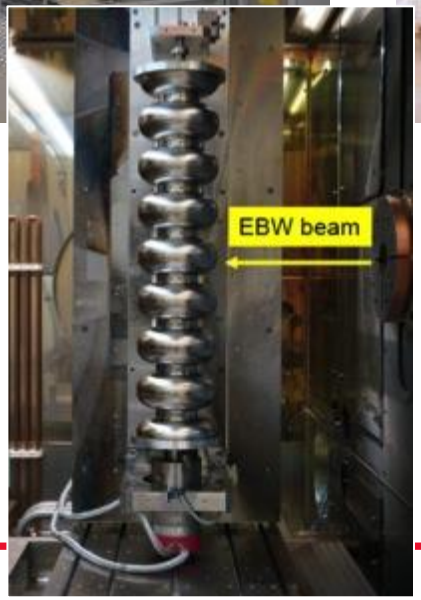


Effort to lead industrialization technology at KEK

EBW



SST EBOCAM KS-110 – G150KM
Chamber (Stainless Steel chamber)



Press

AMADA digital-servo-press SDE1522
150t, 50stroke/min, 225mmstroke

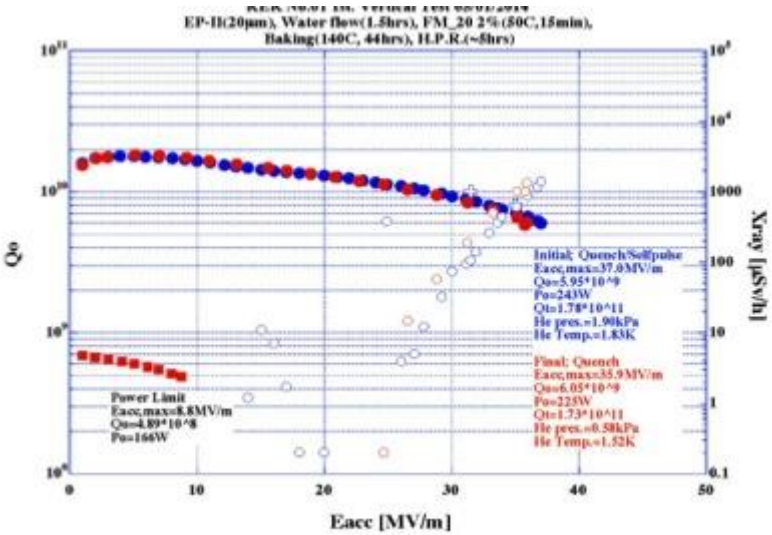
Trim

MORI VKL-253
Vertical CNC lathe

Chemical process

More discuss w/
Y. Yamamoto,
T. Saeki,
H. Hayano

KEK (in-house) 9-Cell Cavity (KEK-01) completed, and tested, April, 2014



Reached 36 MV/m at the first vertical RF Test at 1.9 K, April, 2014

Required ADI Information

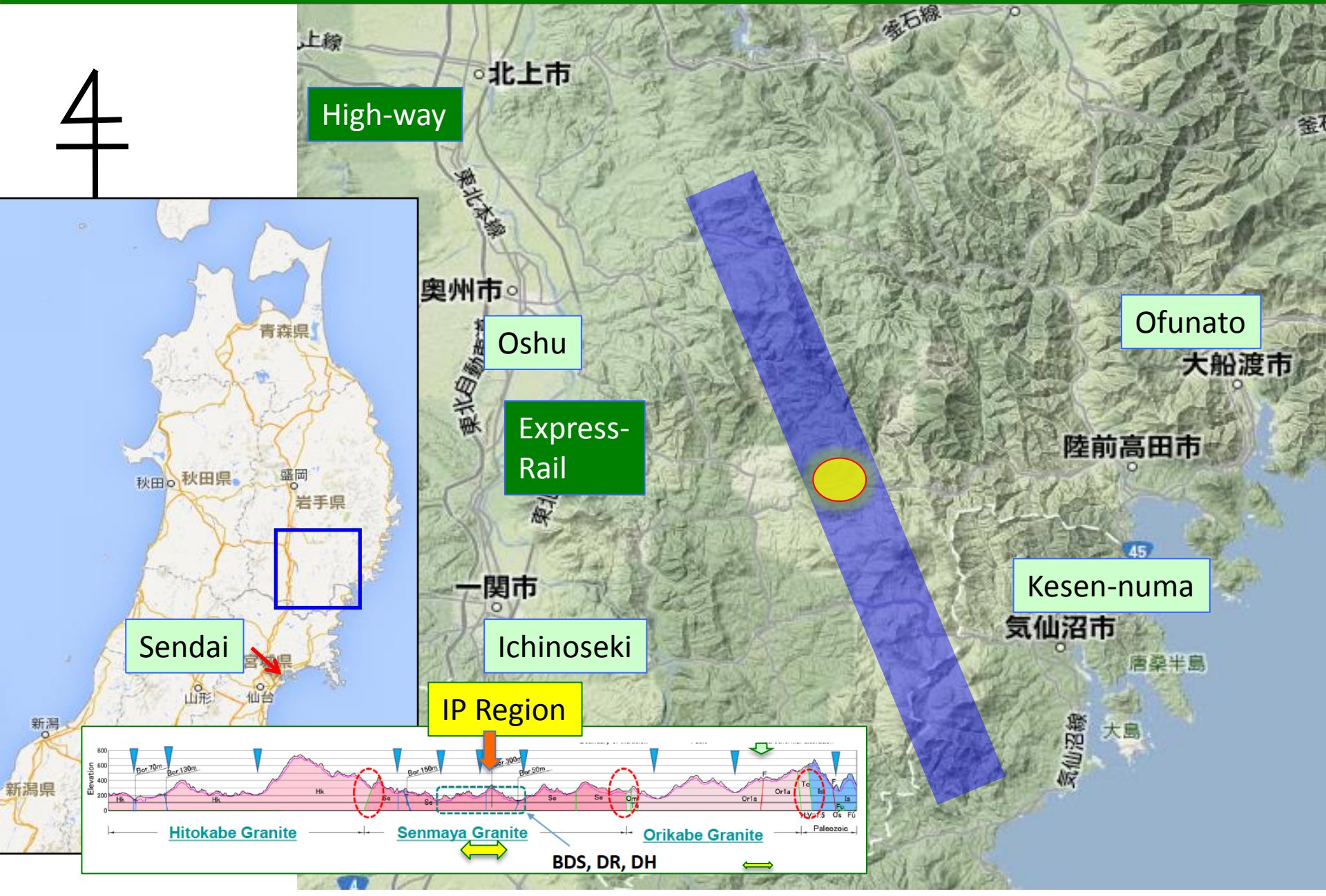
Expected Input (for facility arrangement)

- **Determination of DH (Detector Hall) Location**
  - IR point (including elevation)
  - Layout of the Beam Line route and elevation
- **Access way to DH** (Vertical or Horizontal or,)

Expected Input (for Cross section)

- **Decision of the Cross-section for the main part**
  - BDS Beam Line Layout & Cross-section
  - Shield Wall thickness in ML-tunnel (Sanami-san reported)
- **Cryogenics Equipment layout**
  - Arrangement of He-Tank & Cold box
  - Anti-vibration measure of the Compressor
- **Install Method to MLT** (include AH Cross-section)
  - Cryomodules & RF, Cold box

ILC Candidate Location: Kitakami Area



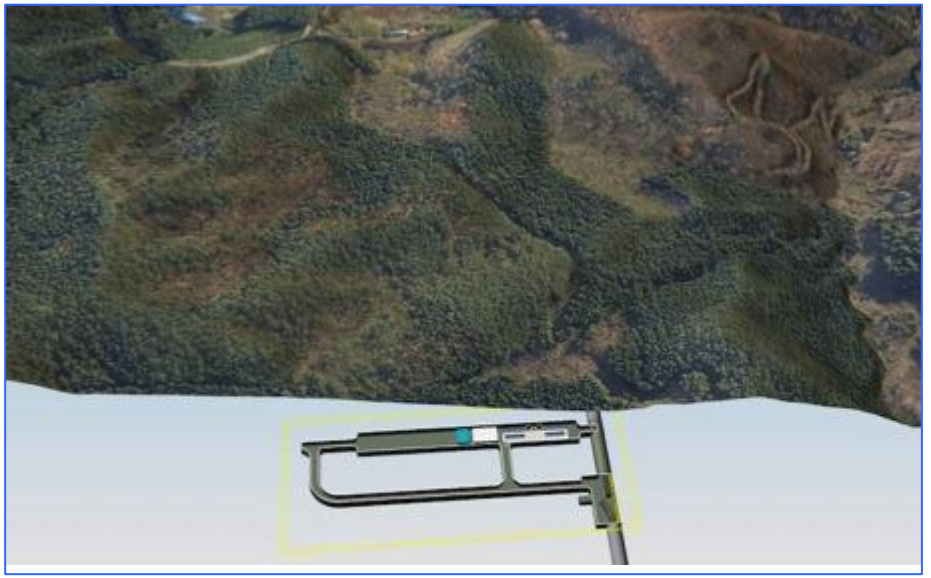
B. List and H. Lars

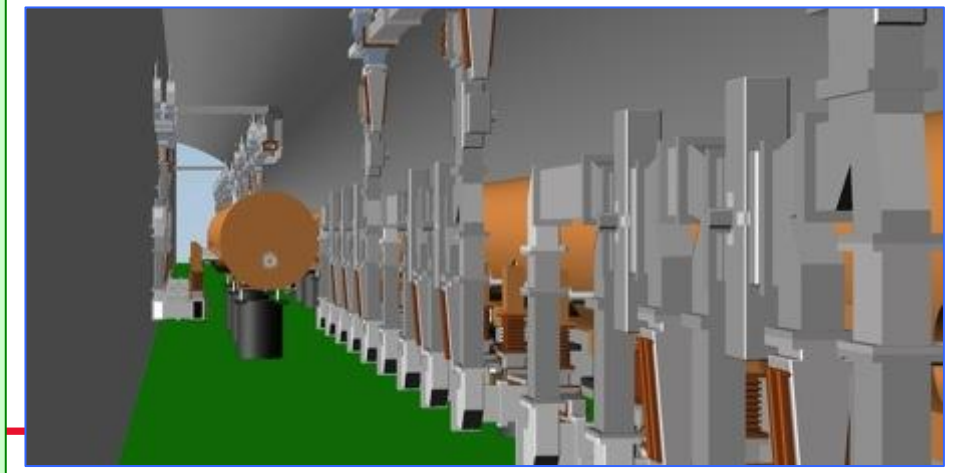
ILC Design Integration and 3D Modeling

implemented into the ILC-EDMS: in cooperation with DESY-EDMS Team

Objectives:

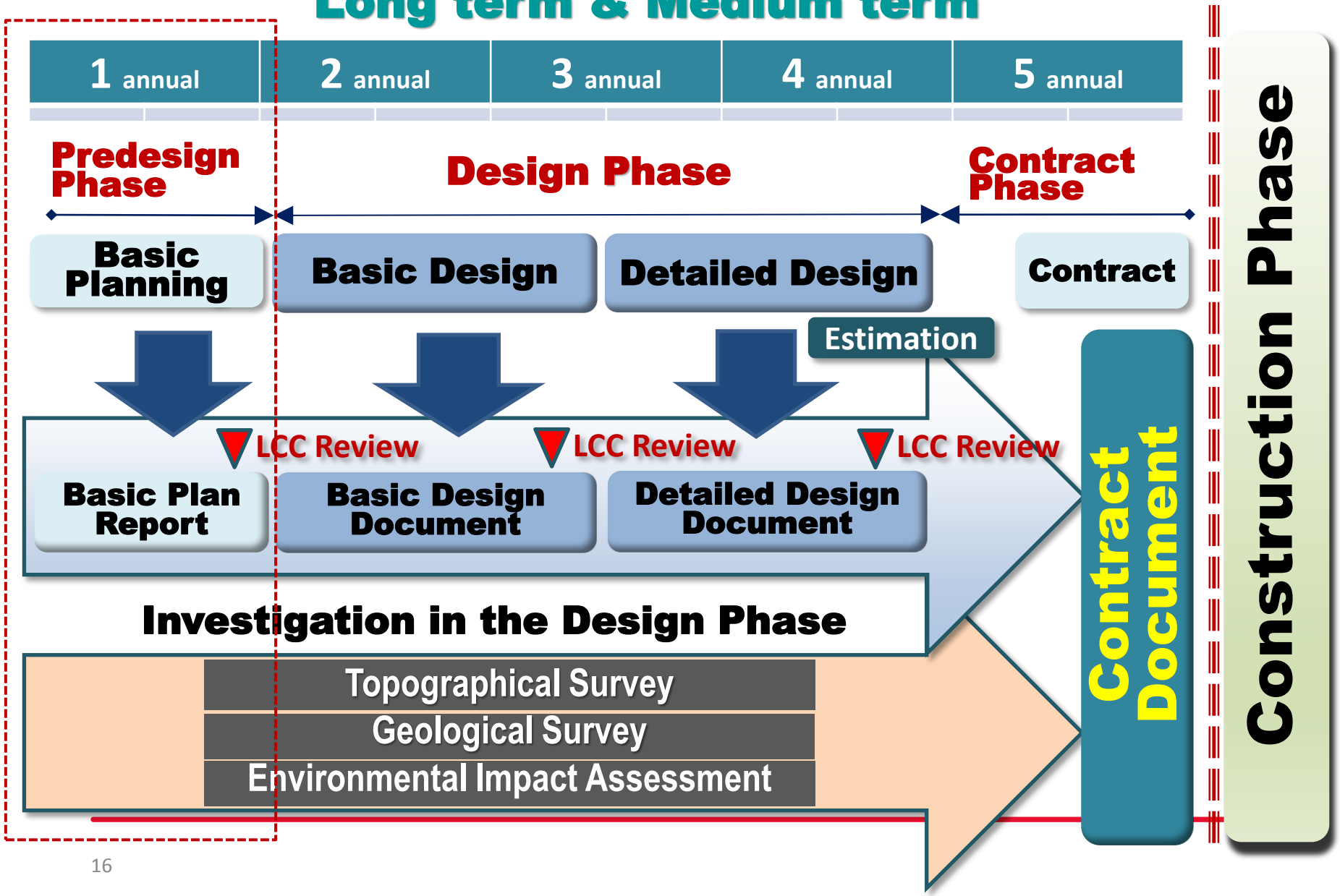
- **Study relation of underground structures and surface buildings to landscape**
- **Adjust caverns and tunnels to accelerator lattice and vice versa**
- **Allocate space in tunnel for transport, installation, survey, safety, infrastructure**
- **Reserve sufficient space for beamline components**
- **Share a common vision of the project between involved people: scientists, engineers, politicians, local population, general public**





Pre Construction Schedule

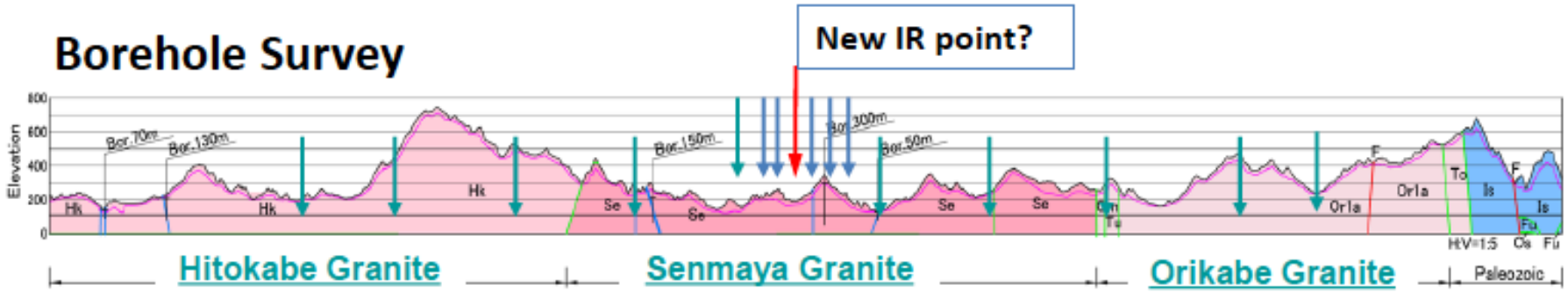
Long term & Medium term



Geological Investigation

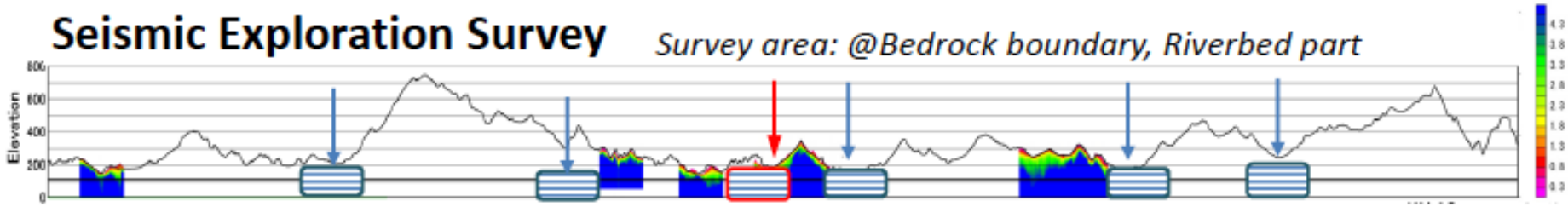
☐ Profiles of Geological Surveys along the project

Borehole Survey



Seismic Exploration Survey

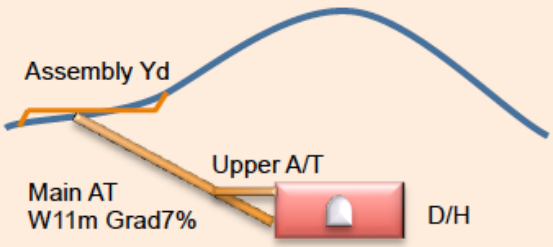
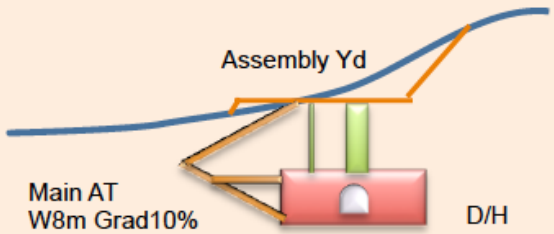
Survey area: @Bedrock boundary, Riverbed part

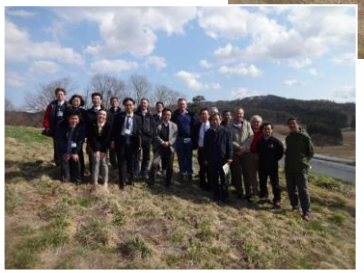


Geological Survey at pre-construction stage

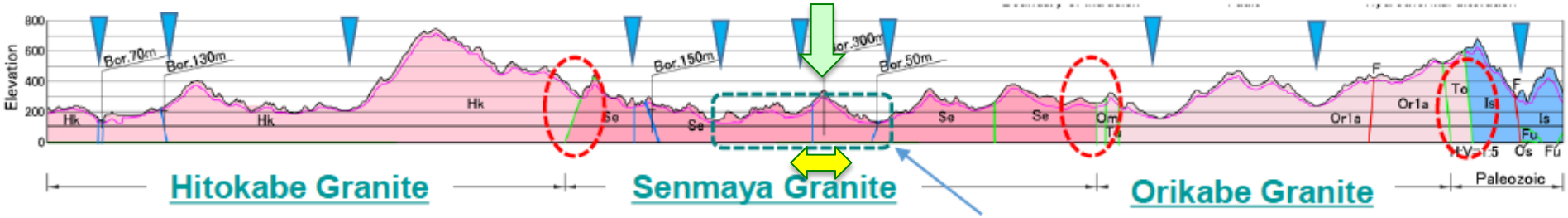
	Basic Planning	Schematic Design	Detailed Design
Borehole Survey	- 1 p DH area	- 5 p DH/DR area	- 10 p along the BL
Seismic Exploration	- 1 area /1,000m	- 5 area /5,000m	0 (Additional)

IP Access Design under Re-investigation

Baseline	Hybrid-A
	
• 1 HT (11x11m 7%grad) • Detector assembling is inside of DH	• 1 HT (8.0x7.5m 10%gradl) • 2 VS (D18m, D10m) • Detectors assembling is on-ground.



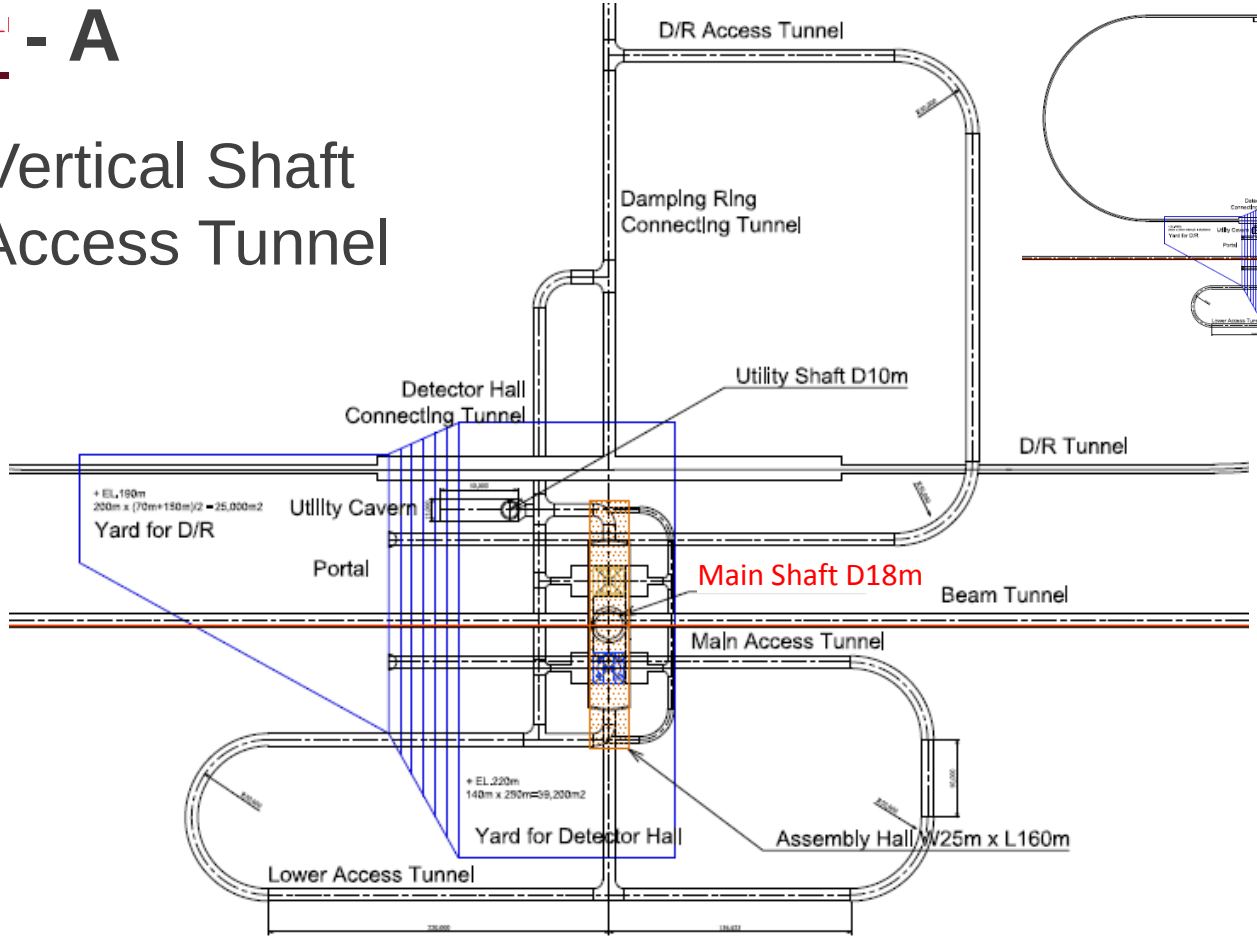
TDR IP point

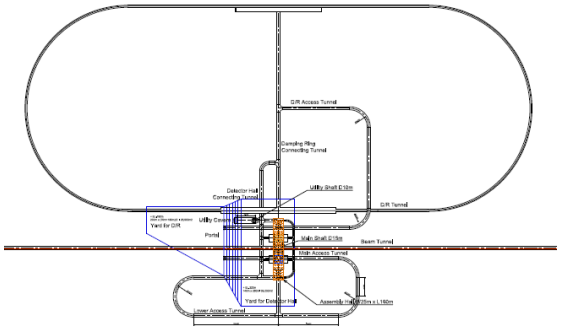


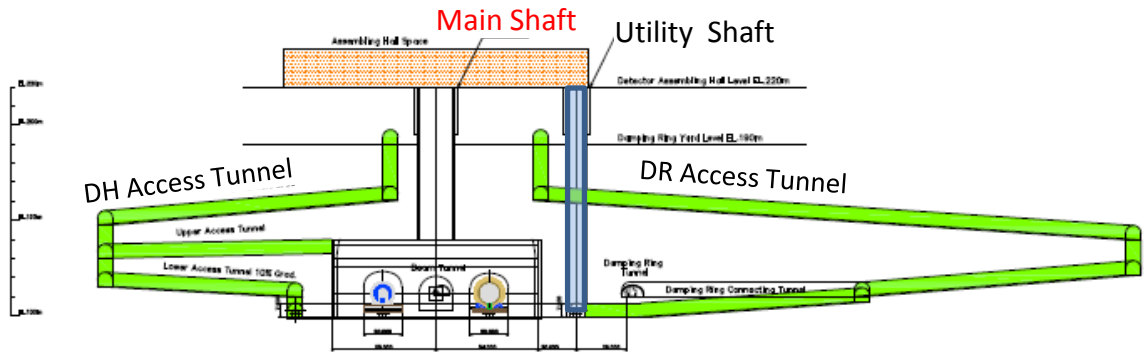
BDS, DR, DH

Hybrid - A

- One Vertical Shaft
- One Access Tunnel

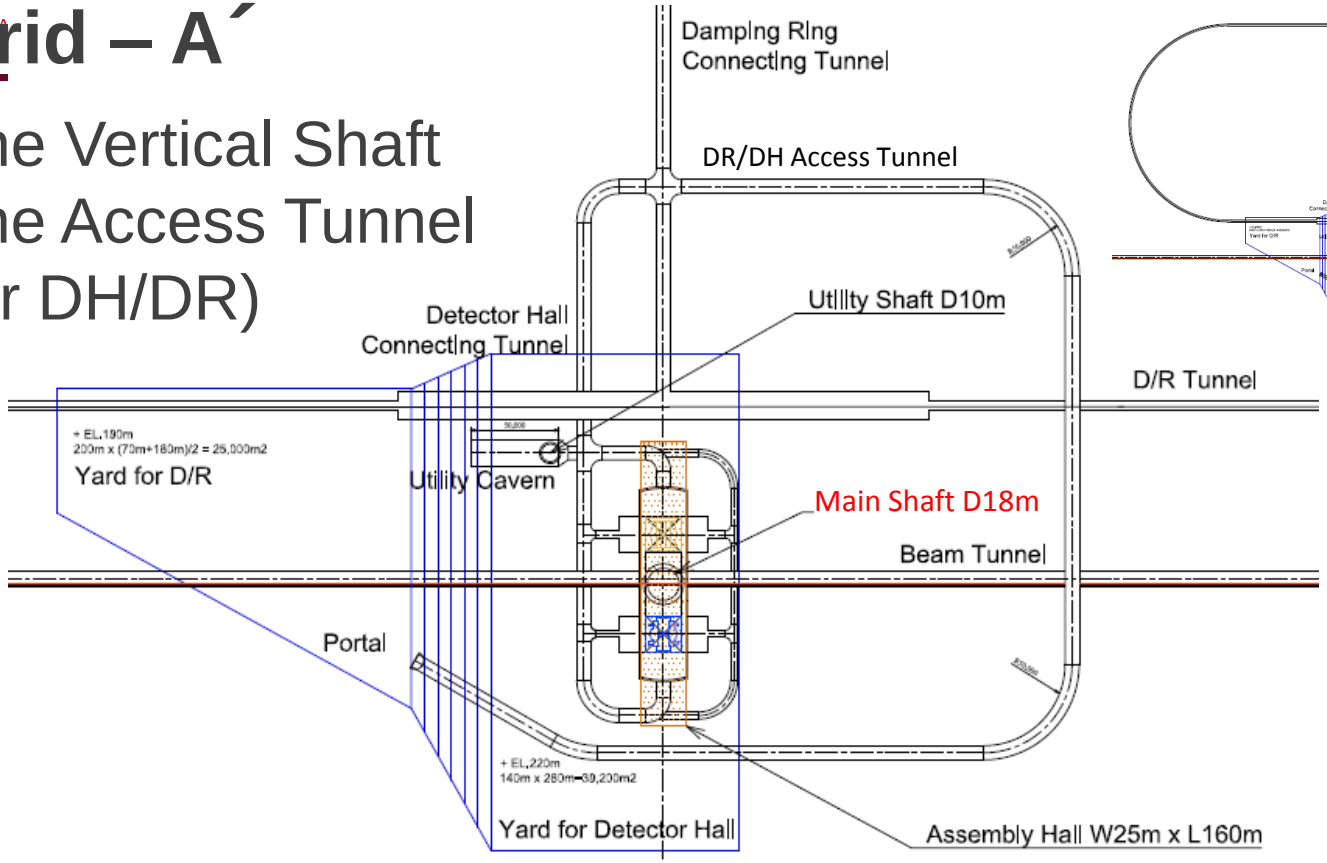


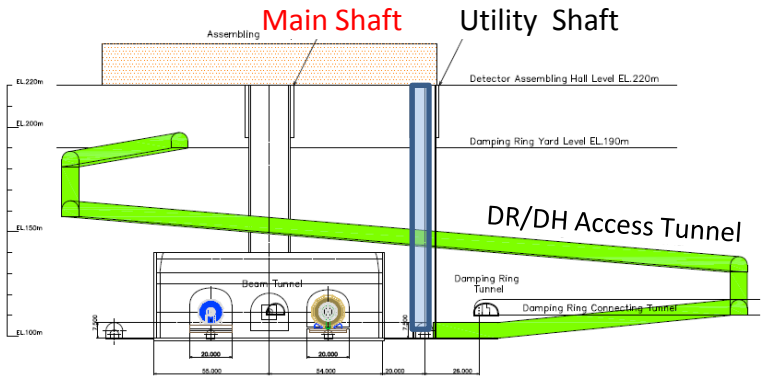




Hybrid – A´

- One Vertical Shaft
- One Access Tunnel (for DH/DR)





ILC Preparation in Japan focusing on to

- **Establish a cite-specific Civil Engineering Design (CFS), assuming "Kitakami" as a primary candidate site in Japan,**
- Optimum cryogenics design to be established
  - Location of Major components, access, and He Inventory / Safety
    - Can we consider variation/combination of vertical and horizontal access?

- **Demonstrate:**
- Nano-beam handling at ATF, hosted in Japan
- SRF beam acceleration at STF, hosted in Japan

- **Establish, in Japan, the technology with the best cost-effective approaches and industrialization,**

Main Subjects to be discussed

Optimum Cryogenics Layout

- Locations of Main compressors and He Inventory, and possible variations from view points of
  - Cost effective construction, operation, and maintenance
  - Environment
  - Vibration
  - Safety for liquid-gas handling (LHe and LN2 (if necessary))

Input to CFS design

  - Within a period of ~ one year,
  - A goal to establish a basic consensus on the cryogenics layout, by LCWS-14, October, this year