ILC Status in Japan

Progress in JFY2015

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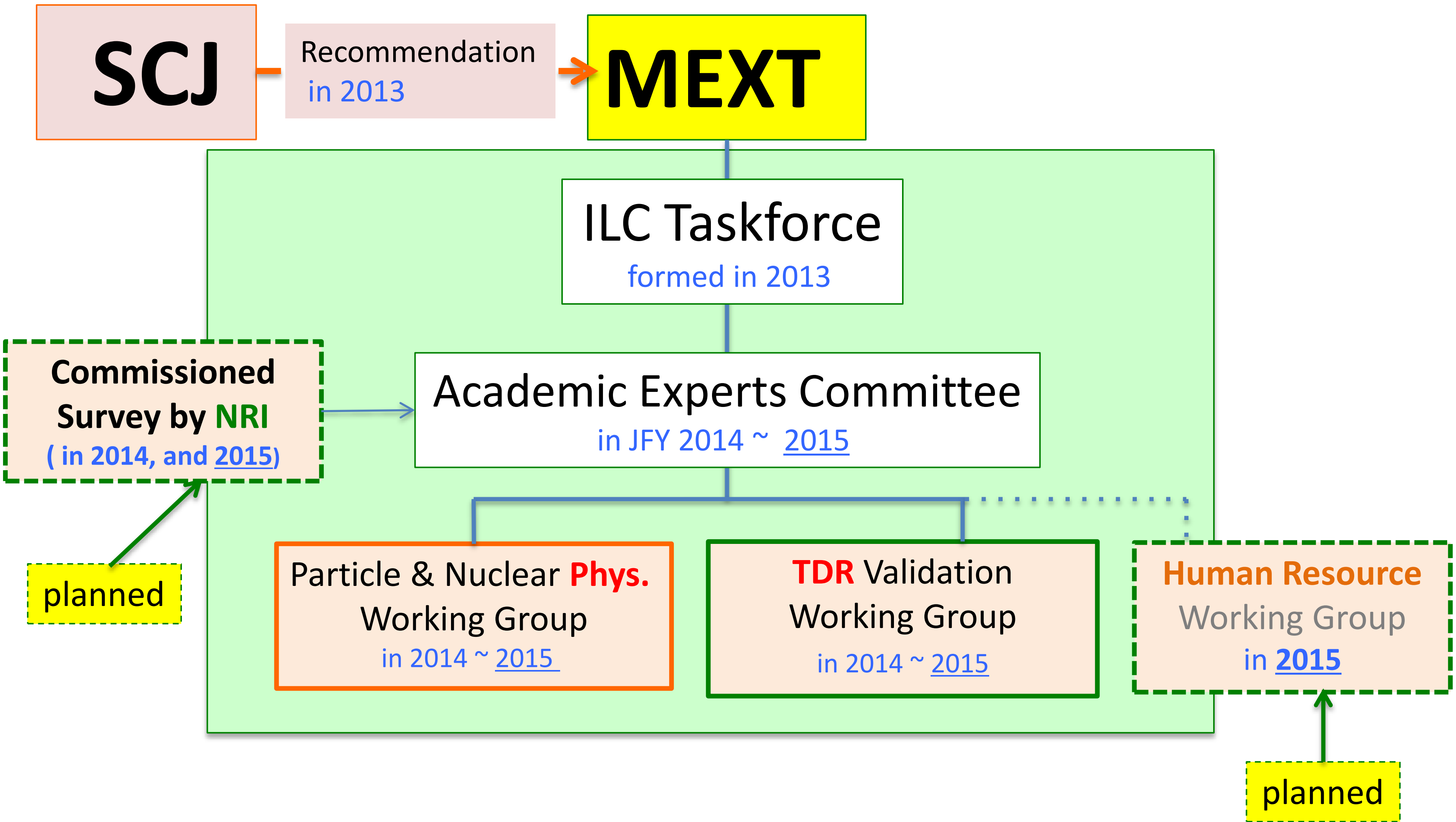
A report on 28 July, 2015

ILC being studied in Japan



Progress in MEXT Academic Expert Committee for the ILC

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	Particle and Nuclear Physics WG		TDR Verification WG (* closed mtg)
1st Academic Expert Committee (14/05/08)			
1st : 6/24	Status and Prospect for Particle Physics ILC Project and the Physics	1st: 6/30	TDR and the cost, generally reported
2nd : 7/29	Strategies at EU and Ams	2nd : 7/28*	SRF and the cost
3rd : 8/27	Cosmic-ray and astrophysics ILC Science Objectives	3rd: 9/8*	SRF and the cost (continued) CFS
4th : 9/22	Flavor and Neutrion Physics IILC Science Objectives	4th: 11/4*	ILC construction cost
5th : 10/21	Summary discussion for a report		
2nd Academic Expert Committee (14/11/14)			
6th : 1/8	Experience from SSC ILC Science Objectives	5th : 1/26*	ILC Accelerator and human resources
7th : 2/17	Science Objectives per	6th : 3/2*	Summary discussions
8th : 3/30	Summary discussion for a report		
3rd Academic Expert Committee (15/4/21)			
4th Academic Expert Committee (15/6/25)			

Interim Recommendations

from the 4th Academic Experts Committee
(Draft and informally translated by a KEK Scientist)

1. The ILC project requires huge investment, which is too big for a single country to cover, hence its **international cost sharing is indispensable.** From the viewpoint that the scientific case for the ILC should match the scale of the investment, **new particle discovery should be anticipated in addition to the precision** measurements of the Higgs particle and the top quark so as **to bring about novel development that goes beyond the standard model.**

2. Since the judgment on the adequacies of the ILC performance and anticipated outcomes should be based on the results from the on-going LHC experiments scheduled **until** the end of **2017**, it is necessary to closely **watch, analyze, and evaluate how the situation of the LHC experiment** will develop. It is also necessary to **clarify prospects for solving technological issues and risk reduction concerning the project cost**.

3. While putting in perspective the whole picture of the project including items listed in No.1 and No.2 above, it is important to **obtain understanding from the general public and communities of other fields** of science.

Human Resource WG in preparation at MEXT

- **Objectives** to: verify prospects of human resource and training to be sufficiently provided for construction of the ILC
- **Period**: July ~ December, 2015,
- **Meeting times**: 4~5 times
- **Subject** to be studied,
  - Prospects for necessary human resource in each country to be realized for construction, operation, and management
  - Issues for training of senior members for their leadership,
  - Issues for senior members for management of the international organization,
- General plan (for hearing)
  - Report of the human resource plan (which was reported to TDR-WG,
  - Hearing from some representing major projects related to ILC (such as LHC)
  - Hearing from industrial partners for preparing the ILC scale manufaturing
  - Discussions on the report to be submitted to “Academic Experts Committee”

- **Note**: MEXT is now asking us to assist the MEXT’s actions, specially to receive industrial partner’s input and contribution to the discussion.

JFY2015, 2nd Commissioned Survey by 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

Progress and Plan

7/10: ILC progress report pre-explained to NRI
7/23: The report to be presented at NRI

7/15: Appointment requests sent out by NRI to European laboratories and companies
- DESY, CEA-Saclay, LAL-Orsay, INFN-LASA, INFN-Frascati, CERN, STFC Daresbury, and Industries

7/? Requests to be sent out to US Lab/Ind.
- SLAC, Fermilab, JLab

In response to the Status in Japan LCC-ILC Progress Report prepared

to be useful for further surveys and studies in 2015

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

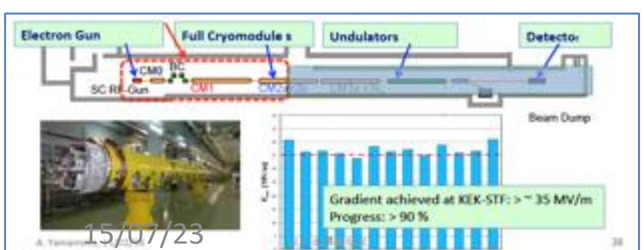
- It may be useful as a reference document for any survey and/or evaluation on the ILC activities.

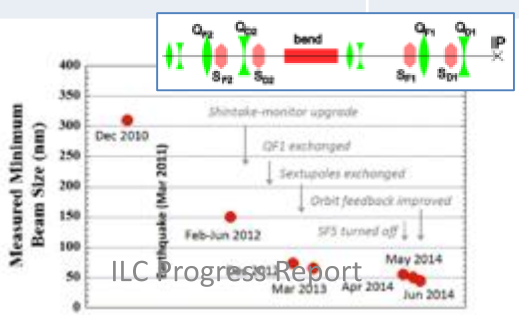
TDR 後のハイライト: Technical Highlights after TDR

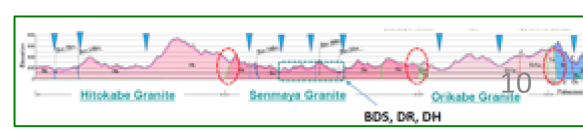
- ナノビーム : Nano-beam
  - **ATF2**: reached 44 nm at the final focus, closing the primary goal of 37 nm
    - Corresponding to 7 nm at the ILC energy (250 GeV/beam) with the goal of 6 nm
- 超伝導高周波 : SRF
  - **EXFEL**: exceeded > 75 % (> 600/800) cavity production, and > 40 % (> 40/100) cryomodule assembly 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
- 加速器設計 : 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

ILC 実現にむけた課題：Issues to prepare for ILC Realization

Themes	Issues/Subjects	Global Cooperation/work-sharing
加速器設計 ADI	Acc. Parameter optimization & eng. Design Change Management (CM)	LCC-ILC-ADI to take a central role with global cooperation
超伝導高周波 SRF	Mass-production & Testing technology → Hub-lab functioning to be balanced Stabilization of the performance	TTC Collab., as a worldwide community - KEK-STF: Hub-Lab function - EXFEL: mass production and testing - LCLS : mass production and testing
極小ビーム Nano-beam	Ultra low emittance, Nano-beam, and the stability	ATF Collab., as a worldwide community - KEK-ATF as a globalyl unique
陽電子源 E+ source	Reliable positron source, - Backup scheme under development	PosiPol collaboration
施設 CFS	Site-specific CFS design, env. assess. General plan, eng. Design, drawings	JP-CFS to serve a central role in cooperation with global experts.
運営 Management	ILC 国際研究所の実現にむけた準備 Preparation for the int'l ILC laboratory	ICFA, LCB A main Issue for the ILC to be prepared







設計改定管理(改善･アップデートの基本プロセス

Change Management: The Basic Path

提案 Propose

1. Proposing a design change
- Change Request (CR)
- Change Request Creater (CRC)
- Written document
- Submitted to Change Management Board (CMB)

評価 Review

2. Expert review
- Reviewed by CMB with additional experts as needed
- CMB defines the scope of the review
- Communication with all stakeholders
- Capture relevant documents

決定 Decide

3. Decision
- Results with recommendation from (2) presented to ILC Director
- Written summary document
- ILC Director (in consultation with the CMB) makes final decision, or
- Decision is escalated to LCC directorate.

実施・具体化 Implement

4. Updating TDD to reflect the change
- CMB identifies team (and team leader) to implement change.
- Generate scope of work
- Develope implementation plan
- Release of updated TDD

TDR 以降の設計の進展 : ILC Acc. Design Updates after TDR

- **Objectives: :**
  - Further optimize the ILC accelerator design parameters, assuming a site model in Japan, and to seek for the best cost-effective construction,
- **Process for the Change Management:**

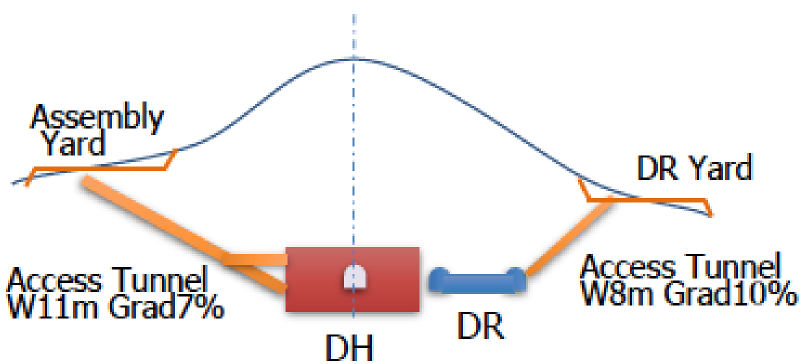
有識者会議からの
提言に応える努力

		Decision	Note
CR-001	Add return "Dogleg" to target by-pass	No approved	
CR-002	Adapt equal L* (4.1 m) for both detectors	Approved	共通設計、信頼性向上
CR-003	**Detector hall with vertical shaft access**	**Approved**	建設期間の確度向上
CR-004	**Extension of the e-e+ ML tunnels by about 1.5 km**	Approved	500 GeV 、到達確度向上
CR-005	Update top-level parameter	Approved	加速器設計値の確度
CR-006	Add BPM down stream of QD0	Approved	
CR-007	**Adoption of the Asian design as sole baseline**	Approved	TDR をアジア版に統一
CR-008	Formal release TDR 2015a lattive	Approved	
CR-TBD	**ML tunnel central call to be thinner**	To be evaluated	ビーム加速中アクセスなし
CR-TBD	**Cryogenics system mainly on surface**	To be evaluated	安全対応
CR-TBD	BDS timmel allowing e-driven e+ source in parallel	To be evaluated	陽電子源・確度向上
CR-TBD	**Cost effective SRF cavity integration**	In discussion	SRF 空洞コストの信頼性

Change Request: CR-0003
衝突点実験室への縦(竪)坑アクセス

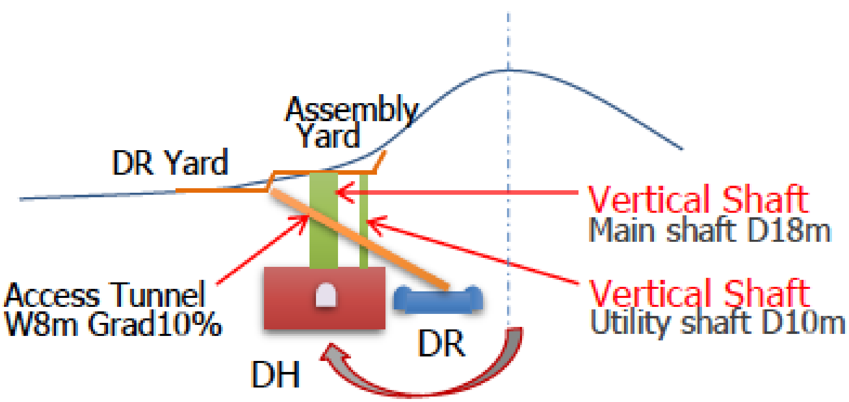
TDR Baseline

- Assembly Place: Surface Building/AH
- Access way to DHl underground
  - only Inclined Access Tunnel (AT)
  - Transport. by special long trailer



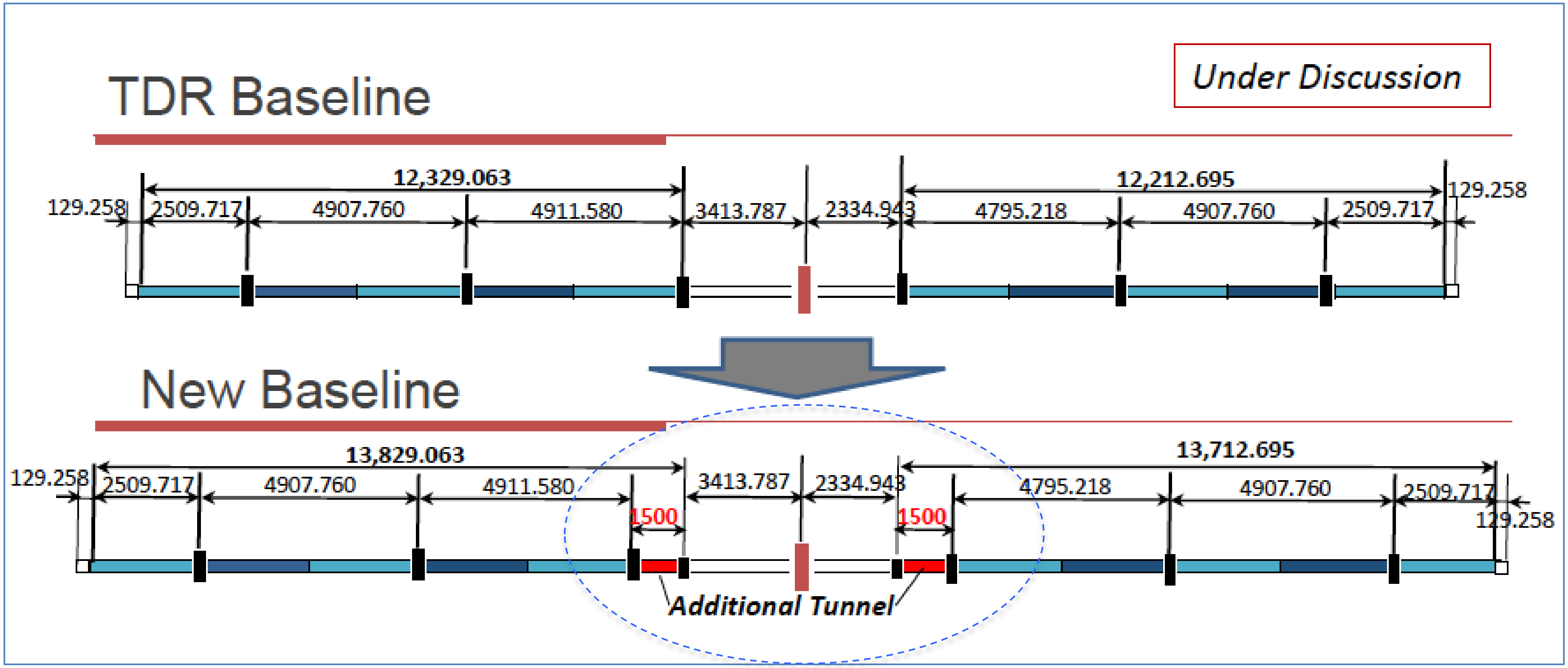
New Baseline

- Assembly Place: Underground/DH
- Access way to DH underground
  - mainly Vertical Shaft (VS)
  - Transport. by Gantry Crane



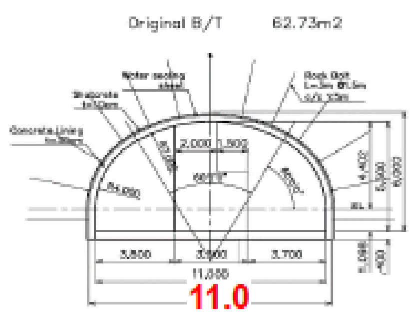
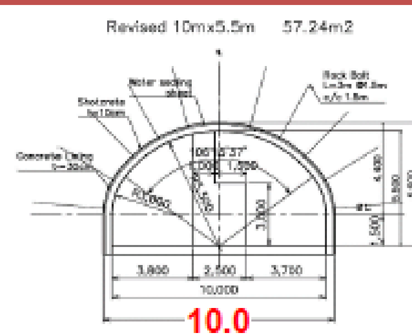
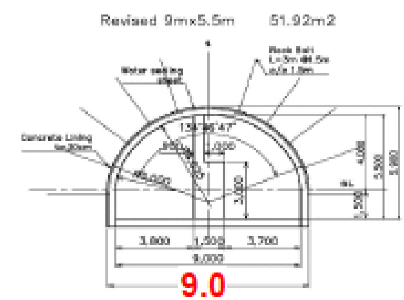
Change Request: CR-0004
メインライナック･トンネル長の延伸

e+-e-衝突タイミング調整、500 GeV達成への冗長性確保



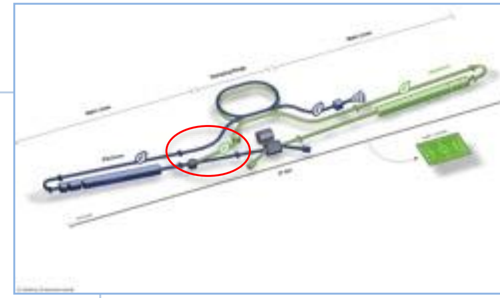
Change Request: TBD
メインライナック・中央壁厚の減少

トンネル入域をSRF Commissioning のみ、
>> トンネル延伸と合わせ、コスト制御・最適化

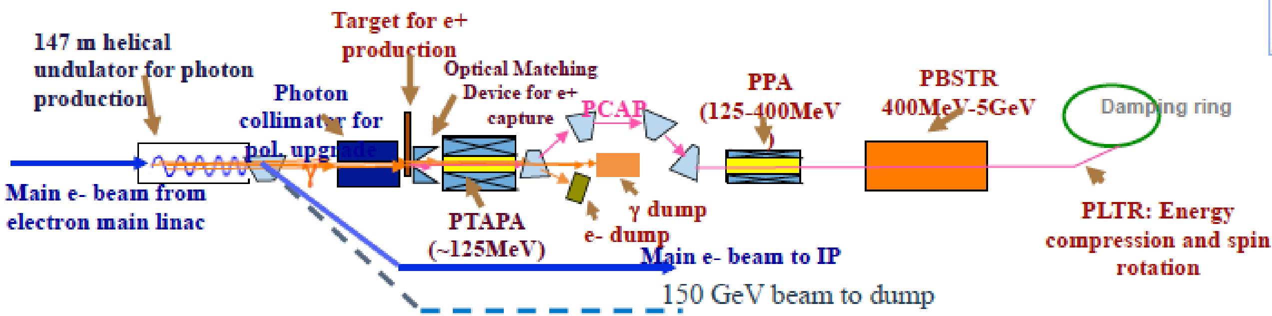
	Baseline SW3.5m	Option-1 SW2.5m	Option-2 SW1.5m
Cross Section			
Cross Section	W11m x H5.5m 62.7 m2	W10m x H5.5m 57.2 m2	W9m x H5.5m 51.9 m2

CR: TBD 陽電子源の技術実証、対応

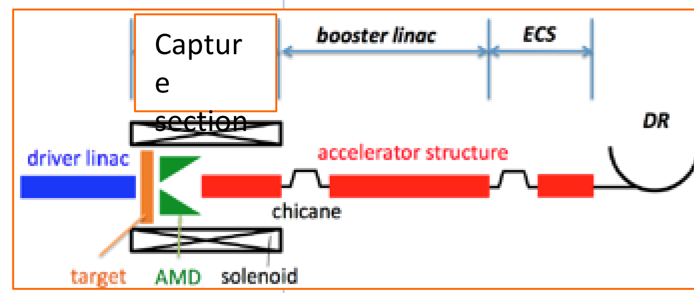
Positron Source Technology to be demonstrated



- Baseline undulator scheme
  - Use photons from high energy electrons going through undulator



- Conventional method
  - Irradiate a few GeV electron beam on W-Re target
  - Collect created positrons and accelerate them to 5GeV
- Advantage over the undulator source
  - Independence from the colliding electron beam
- Disadvantage
  - Polarized beam cannot be obtained (major reason that this scheme is not the baseline, but a backup)



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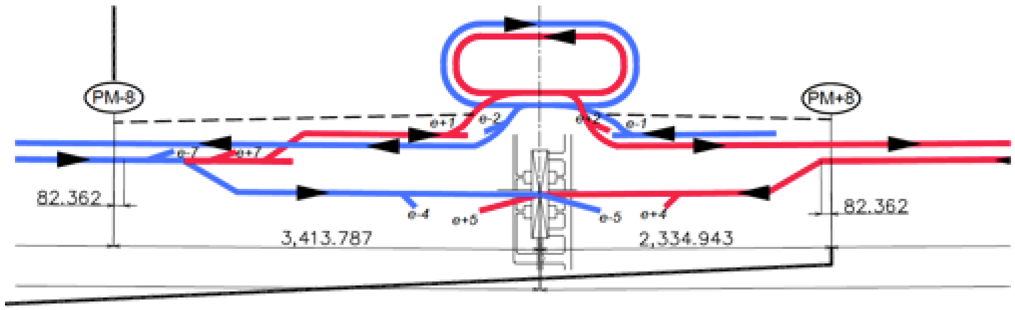
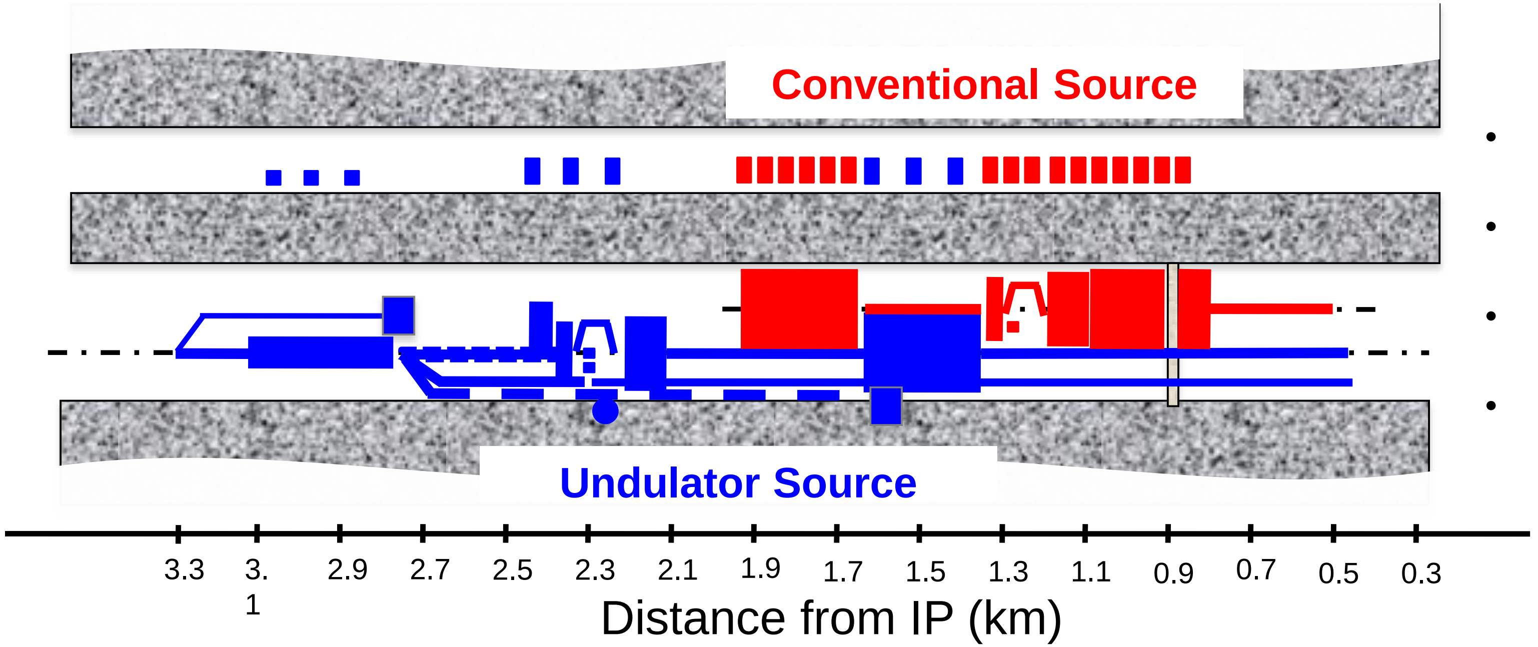
Tunnel

- It is still best to use the baseline scheme, but must prepare for the case starting with the conventional scheme

- A tunnel that can accommodate both sources being designed

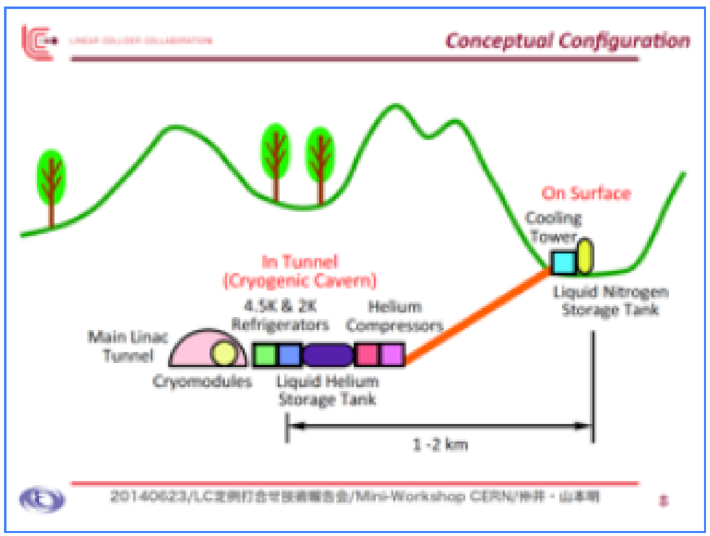




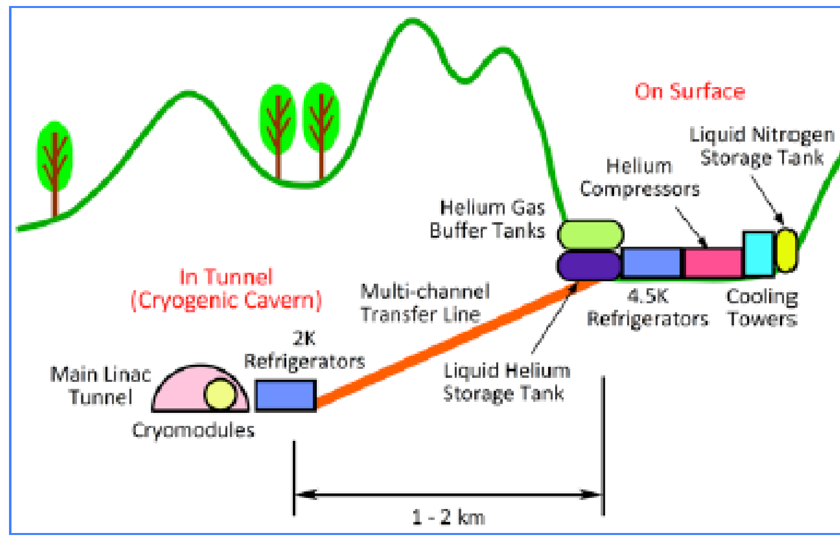
- Top: service tunnel
- Bottom: accelerator tunnel
- Blue: baseline source
- Red: conventional source

Change Request: TBD
安全･経済的な主要冷却機器の地上配置
Cryogenics Layout with more safety

ILC-TDR Baseline



New Baseline to be proposed to CMB



10. 更に推進すべき準備･技術開発 (1)
Further Preparatory Work (1)

10.1 **General**

- It is anticipated that preparation (w/ appropriate funding) will take about **4 years**

10.2 **超伝導高周波技術**: SRF technology

- Nb material, cutting sheet from Ingot w/ control grain size
- Tuner in cooperation w/ LCLS-II
- Coupler value engineering w/ simplified structure and new ceramic w. optimized process of CM assembly.
- Long term effort for further gradient to scope 1 TeV upgrade,
  - Hydro-forming w/ seamless Nb cylilnder, or Cu cylinder followed by surface coating w/ Nb.
  - High-Q realization w. new surface treatment or doping technology
- Mitigation of degradation during the process of the CM assembly

10.3 **SRF 電力供給のための電源**: Modulator industrialization for SRF

- Demonstration of the industrial manufacturing and long-term reliability

10. 更に推進すべき準備・技術開発 (2)
Further Preparatory Work (2)

10.4 試験システム技術・人材養成 Test/Qualification infrastructure at KEK

- Full prototype cryomodules under high power in which a beam can be accelerated must be completed with the highest priority.
- An assembly and cryogenic-test hall at KEK must be equipped with the entire infrastructure necessary for integrating full CMs and for testing, to demonstrate the capability of series production rate.

10.5 極小ビーム技術 : Nano-beam technology

- The effort at the accelerator test facility (ATF) at KEK must be continued to achieve the technical goals of both the beam size and the stability at the final focus, providing sufficient operational margin.

10.6 陽電子源 : Positron production

- The positron source is challenging. Further effort must be put into the undulator-based design including the convertor target. In parallel an alternative design using conventional means (which will exclude polarised positrons) must be pursued as a backup solution.

11. まとめ：Summary

- ILCの技術設計は、アジア山岳サイトをモデルとし、綿密な検討、管理のもと、設計がさらに進展。TDR 後、実施された文科省・有識者会議（およびTDR検証WG)からの提言を迅速反映しつつ設計のさらなる改善・最適化を進めている。
  - The ILC technical design is now being adapted to the preferred candidate site. Changes in layout are being managed by a rigorous change-control procedure.

- 欧州自由電子レーザ(EXFEL) 建設の進捗により、超伝導加速空洞工業技術が着実な進展、ILC の技術的実現性を実証しつつある。
  - Series production of cavities for the European XFEL has shown that cavities can be mass-produced in industry with a performance well above XFEL requirements and close to that needed for the ILC.

- ILC 建設にむけた、更なるコスト確度向上、節減への努力が重ねられている。
  - A number of technical developments are under way with a view to further reducing the ILC cost. This work must continue through the preparatory stage for ILC construction once resources become available.

Progress and Plan

7/10: ILC progress report pre-explained to NRI
7/23: The report to be presented at NRI

7/15: Appointment requests sent out by NRI to European laboratories and companies
- DESY, CEA-Saclay, LAL-Orsay, INFN-LASA, INFN-Frascati, CERN, STFC Daresbury, and Industries

7/? Requests to be sent out to US Lab/Ind.
- SLAC, Fermilab, JLab

Plan for visiting European Laboratories and Industries

9/28: BN?
9/29: INFN-LASA, E-Zanon
9/30: CERN
10/1: DESY
10/2: RI
10/5: CEA-Saclay, Alsyom, AL, APERAM
10/6: LAL-Orsay, Thales
10/7: STFC Daresbury Lab.
10/8: reserved.

Plan for visiting US Laboratories and Industries (tentative)

11/8: SLAC, CPI

11/9: Fermilab

11/10: ROARK

11/12: AES

11/13: JLab,