ML-SCRF: Monthly WebEx Meeting
August 22, 2012

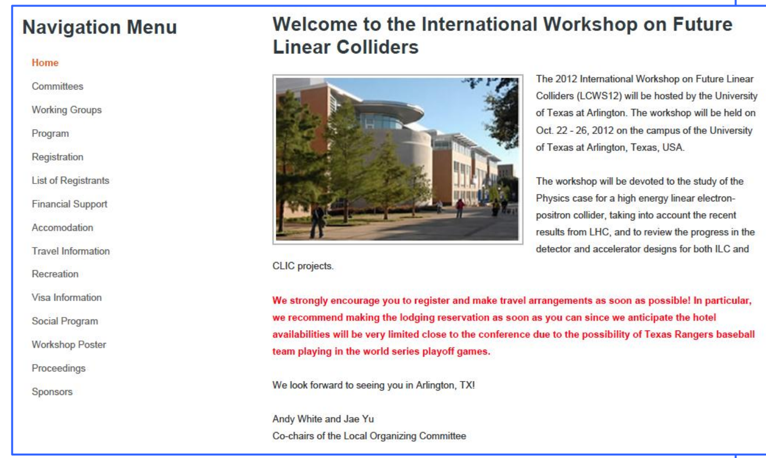
1. **Reports from PMs**
   - GDE activity and meeting plan
   - LCWS2012: Arlignton Texas
2. **Reports from TA Group Leaders** (very briefly, if any?)
   - Cavity, Cavity Integration, Cryomodule, Cryogenics, HLRF, ML
3. **Special Discussions on TDR**
   - TDR Status J. Carwardine
   - TDR1-SCRF E. Elsen and A. Yamamoto
   - TDR2-ML-SCRF N. Walker and A. Yamamoto
   - Comments K. Yokoya
4. LCWS preparation
   - TDR finalization session M. Ross, N. Walker, and A. Yamamoto
   - SCRF parallel session H. Hayano and A. Yamamoto

ML & SCRF Action/Meeting Plan (2012)

Month	Day	Place	Meeting
July	4-11 12-13 25		36th ICHEP (Melbourne) GDE-EC face-to-face Meeting (TDR draft discussed) ML-SCRF Meeting
Aug.	22		ML-SCRF Meeting
Sept.	10-14	Telaviv	Linac-2012
Oct.	3 22-26 29-30	 Texas Anaheim	ML-SCRF meeting LCWS (TDR draft to be finalized) IEEE-NS (LC event)
Nov.	5-8 13-14	JLab	TTC ILC-GDE internal cost review
Dec.	13-14	KEK	ILC-PAC (@ KEK)

LCWS 2012

- LCWS12: International Workshop on Future Linear Colliders 2012
- Dates: Oct. 22 ~ 26
- Held at: Arlington, Texas
    - http://www.uta.edu/physics/lcws12/
  - Accommodation
    - http://www.uta.edu/physics/lcws12/pages/accomodation.html



- Program
  - 22(Mon): Joint plenary, Accelerator plenary
  - 23(Tue): ILC-CLIC Common issues
    - am : Emittance preservation, Power consumption
    - Pm1 : System tests, and cost & schedule
    - Pm2 : Higgs Factory session (Joint session of accelerator and physics)
  - 24(Wed): Accelerator: CLIC & ILC separate programs
    - Finalizing TDR
  - 25(Thu): Working Groups: Parallel Sessions
    - SCRF/NCRF >> Convener H. Hayano
  - 26(Fri): Accelerator plenary, Joint plenary (~ 13:00)

IEEE -NSS Symposium:

Institute of Electrical and Electronics Engineers
2012 IEEE NSS/MIC/RTSD Anaheim, California
27 October - 3 November 2012

Nuclear Science Symposium

Conference Information

Special Linear Collider Event 29-30 October 2012

Introduction & Motivation

Agenda for the "SPECIAL LINEAR COLLIDER EVENT"

LC 6 Session:
Accelerator Technologies for Industrial Applications (Invitation to Industrial Partners)

Registration
All participants are required to register over IEEE NSS and MIC web site . Pre- registration is available online over IEEE registration

Accommodation
Hotel reservation information can be found under IEEE NSS web site

As part of the NSS Symposium, a special Linear Collider (LC) event is organized, which will include presentations on:

International Linear Collider (ILC) and the Compact Linear Collider (CLIC) accelerator

Detector concepts

Impact of LC technologies for industrial applications

Forum discussion about LC perspectives

James Brau, University of Oregon, USA
Juan Fuster, IFIC Valencia, Spain
Michael Harrison, BNL, USA
Steinar Stapnes, CERN, Switzerland
Hitoshi Yamamoto, Tohoku University, Japan
Maxim Titov, IRFU/CEA Saclay, France (ex of
Ingrid-Maria Gregor, DESY Hamburg, German

ILC Special Event: Agenda

- **Session 1: Introduction**
  - Welcome: R. Heier (CERN)
  - ILC: B. Barish (Caltech
  - CLIC : S. Steinar (CERN)
  - Physic of LC: H. Murayama (IPMU-Tokyo, LBNL)
- **Session 2: ILC/CLIC accelerator and Detector Concept**
  - SCRF acceleration and ILC: N. Walker (DESY)
  - X-band, two-beam acceleration and CLIC D. Schulte (CERN)
  - Vertec Detector LC: M. Winter (IPHC, CNRS/IN2P3)
  - Silicon Tracking for LC T. Nelson (SLAC)
- **Session 3: ILC/CLIC Detector Concept and Summary of Detector Spin-offs**
  - Gaseous tracking for LC T. Matsuda
  - EM Calorimetry for LC J-C Brient (Ecole Polytechniques, CNRS/IN2P3)
  - Hadron Alorimetery for LC J. Repond (ANL)
  - Forward calorimetry and … S. Kulis (AGH Univ. ST Cracow)
  - Spin-off Document "ILC Detector R&D" M. Demarteau (ANL)
- **Session 4: ILC/CLIC detector spin-off and ILC/CLIC Accelerator Instrumentation**
  - From ILC imaging calorimeter to a PET E. Grautti (U. Hamburg)
  - LC Spin-offs outside Medial Imaging C. de la Taille (IN2P3/CNRS)
  - LC instrumentation T. Lefevre (CERN)
  - Linear Collider module control and stabil. A Jeremie (LAPP, CNRS/IN2P3)
- **Session 5: ILC/CLIC Accelerator Technologiew for Industrial Applications I**
  - Opportunties for applications of LC technology M. Ross (SLAC)
  - Overview of industrial, medical, energy, and … N. Holtkamp (SLAC)
  - Application of SCRF LC J. Rathke (AES)
  - Application of NCRF LC W. Wuensch (CERN)
  - Aplication of LC supporting RF Technology S. Lenci (Communications & Power Industries, LLC)
- **Session 6: ILC/CLIC Accelerator Technologies for Industrial Applications II**
  - Application of LC supporting instrumentation M. Ross (SLAC)
  - The Status of AAA M. Matsuoka (AAA, Japan)
- **Session 7: Forum Discussion about LC perspetives**
  - R. Heuer (CERN), J. Mnch(DESY)i, and A. Suzuki (Suzuki), P. Oddone (FNAL), and ..

TDR Publication and Review

First-draft sections	*** 23 April ***
Complete edited draft	22 October (LCWS 12)
Final draft (for PAC)	15 November
PAC review	15-16 December

Formal publication at
Lepton Photon Conf.
(SF, June 2013)

Expect international reviews:
Both technical and cost
(Q1-22 2013)

J. Carwardine, M. Barone

ILC TDR public

https://forge.linearcollider.org/tdr

TDR – ILC TDR public – ILC Forge 12/06/26 20:09

Portal for Authors and Editors of the ILC Technical Design Report

TDR Editorial Team
Chair: *John Carwardine (Argonne)*
Editors, Part-I: *Eckhard Elsen (DESY), Hitoshi Hayano (KEK)*
Editors, Part-II: *Phil Burrows (OXON), Nan Phinney (SLAC), Kaoru Yokoya (KEK), Nobu Toge (KEK)*
Project Managers: *Marc Ross (Fermilab), Nick Walker (DESY), Akira Yamomoto (KEK)*
Technical Editors: *Maura Barone (Fermilab), Benno List (DESY)*

Reference material for the TDR Baseline Design

- Top-Level ILC Parameter Tables (EDMS)
- Technical Design Documentation Portal (linearcollider.org)

File uploader

Select the 'Upload files' button below to start uploading your content (text and/or images). Please remind that figures should be uploaded as separate files from the text, possibly in original.
A pop-up window will open, from there:

- Enter your email address and the common password (ilctdr) - note: that's a common password for all the TDR authors, valid for the file upload only, it's not your Forge password!
- Select the chapter using the drop-down menu
- Add the files to upload using the **'Add files'** button - you can add up to 20 files at a time
- Hit **'Start upload'** (IMPORTANT: files will not be uploaded to the server until you hit 'start')
- The figures will be submitted to a staging area for printing quality check. You will be contacted if the image quality is unsatisfactory for printing.

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ILC Technical Design Report status as of Oct. 1, 2012

INTERNATIONAL LINEAR COLLIDER

TECHNICAL DESIGN REPORT

ILC Global Design Effort and
World Wide Study

2012

Editor in Chief:
John Carwardine

Part I:
ILC R&D IN THE TECHNICAL DESIGN PHASE
Editors:
Hitoshi HAYANO, Eckhard ELSEN

Part II:
THE ILC BASELINE REFERENCE
Editors:
Nan PHINNEY, Nobu TOGE, Phil BURROWS

Technical Editors:
Maura BARONE, Benno LIST

TDR: Part 1 (1)

Table of Contents

iv

TDR: Part 1 (2)

TDR: Part 1 (3)

vii

Chapter 1

Introduction

Figure 1.1. A superconducting nine-cell 1.3 GHz resonator (cavity).

Although the ILC Reference Design Report published in 2007 [1] presented a relatively mature and low-risk design for a 200—500 GeV e^+e^- linear collider, it also clearly identified and prioritised several areas of risk in that design which required further R&D before such a challenging project could be proposed for construction. The highest-priority R&D items were:

1. SRF cavities capable of reproducibly achieving at least 35 MV/m.
2. A cryomodule consisting of eight or more cavities, operating at a gradient of 31.5 MV/m.
3. Linac string test (or integration test) of more than one cryomodule linac with beam.
4. Development of models and mitigation techniques for electron cloud effects in the positron damping ring.

Other R&D areas (for example in the beam delivery system and the sources) were also identified.

The first three priority R&D items all relate to the SCRF linear accelerator technology, the primary cost driver of the machine, and are discussed in Chapter 2.

1

TDR: Part 2 (1)

Table of Contents

iv

TDR: Part 2 (2)

v

vi

TDR: Part 2 (3)

TDR: Part 2 (4)

ix

x

TDR: Part 2 (5)

Chapter 1

Introduction

The technical specifications and design presented in this reference report represent a mature and relative low-risk design for a linear collider. At the heart of the accelerator remains the two approximately 11-km long SCRF main linacs, based on the technology developed by the TESLA collaboration and proposed in 2001 for the TESLA linear collider [2]. The updated cost estimate reflects the significant worldwide developments in this technology, with the establishment of R&D infrastructure as well as a significant industrial base in the Americas, Asia and Europe. The GDE driven global high-gradient SCRF R&D has succeeded in routinely establishing the required 35 MV/m average performance, with every indication that this could be exceeded in future years. Integrated systems tests at the TTF2/FLASH accelerator in DESY, Hamburg have demonstrated many of the design and performance parameters for the ILC, and this currently unique facility will soon be joined by similar test accelerators in both KEK, Japan, and Fermilab, USA. Beyond the fundamental R&D, the on-going industrialisation of the technology has enabled the GDE to provide realistic industrial studies for globally mass producing the required approximately 18,000 SCRF nine-cell cavities and assembling them into 1750 cryomodules, resulting in a relatively robust and defendable cost estimate, as well as clear concepts as to how the machine could be constructed as an international project based on in-kind contributions, complete with a realistic construction and installation schedule. The design evolution since the original RDR reflects the results of this R&D, a re-evaluation of cost-performance trade-offs, and a more detailed considerations of site-specific cost-optimum design options. The system designs and associated cost estimates reported here are considered sufficiently complete as to form a sound basis for a "Proposal to Construct" soon after an International ILC Organisation has been formalised and a specific site has been selected.

The ILC design has been developed to achieve the following physics performance goals during the first years of operation:

- A continuous centre-of-mass energy range between 200 GeV and 500 GeV
- A peak luminosity of approximately 2×10^{34} cm^{-2}s^{-1} at 500 GeV centre-of-mass
- 80 % electron polarisation at the Interaction Point (IP)

TDR Snapshot Review
SCRF in TDR1 and TDR2

K. Yokoya

2012.9.27

General

- Almost no description about X-ray (only as diagnostics in TDR1 2.2.6) TDR1 2.3.3 cavity data base does not mention at all.
- HOM coupler
- Alignment within cryomodule
- Cryogenics
  - 2 pages in TDR2 3.4.1 overview
  - half page in TDR2 3.4.3.5
- TDR2 3.5.2 Marx modulator → mostly TDR1. Leave here only the final specs.
  (3.5.2 cites TDR1 but no such section in TDR1)
- Chap4 & 5 (flat & mountain)
  - should be combined into one chapter,
  - or should be absorbed in Chap3 (3.5 RF Sources)
  - The latter seems to be more reasonable because
    - These 2 chapters concern only HLRF issues
    - The difference in the cryogenic system is described in 3.4
- TDR1 relatively in good shape.

TDR1

- 2.1 Overview. Subheadings are needed
- 2.2.4 Production and test facilities. Peking university should be mentioned at least a little somewhere if not this section.
- 2.3.1.1 cavity shape. Table 2.3. Q factor. "installed quality factor >10^{10}" & "quality factor during qualification >0.8×10^{10}". >10^{10} used to be >10^{10} at 31.5MV/m and >0.8×10^{10} at 35MV/m. Same meaning?
- 2.3.1.2 very long. Subheadings needed.
- 2.3.2 Results of cavity gradient. The present preamble fits more to the overview section.
- 2.3.3.1 Fig 2.21. Must be magnified. The legends in tiny letters are needed.
- 2.5 S1-Global. 16pages. A bit long.
- 2.6 Cryomodule etc. Deformation of cryomodule.
- 2.7 RF. Marx modulator to be included.
- 2.8.2 Fig 2.82.
  - What is vertical axis? Quantities for entire ILC?
  - Near the end. To give name "Toshiba" not appropriate.

TDR2 Chap 3 to 5

- 3.1.1 Overview. Orbit control comes as the first sentence of SCRF. Bizarre.
- 3.1.3 System description
  - Schematic diagram of 1 RF unit is needed for understanding
  - 10Hz should be mentioned
- 3.1.4 Accelerator physics.
  - 1st line. Eliminate the word “weak focusing” (This is the word against alternating grad.)
  - 7th line. “Beta about 80m in both planes” True? Phase advance in x and y are different.
  - 2nd paragraph . IP vertical emittance 40nm → 35nm
- 3.1.5 Operation and Upgrades . Is it necessary to give upgrade scenario here.?Needed only when the upgradablility imposes constraint in the baseline design.
- 3.2.1 Table 3.7 Spec for HOM Qext. This sounds like HOM Qext is measured for every cavity.

TDR2 Chap 3 to 5 (continued)

- 3.3.1 Table 3.9. Is this the plug-compatibility table mentioned in 3.3.5.1 ?
- 3.3.2 Frequency tuner. I could not find the reason why blade tuner has been adopted for TDR. (TDR1 2.2.4 describes the conclusion from S1-Global but does not say why blade tuner.) Same for couplers.
- Relation between Fig 3.12 in 3.3.6 and Fig 3.13 in 3.3.7. The latter and the right hand side of the former are the same process?
- 3.4.2 Fig 3.17 “longitudinal view” missing? Font pr oblem.
- 3.4.3.8 Quad package. Missing specs for quad, correction dipole, BPM . (TDR1 table 2.18 for quad?)

TDR2 Chap 3 to 5 (continued)

- 3.5.1 power source overview
  - 1st paragraph. 8x10^9 should be 1x10^10 ?
  - 3rd paragraph from the end. 200~300MW sounds too crude. Should give max value.
- 3.5.5. Power requirements. Hard to understand Fig 3.28 and sentences below. My problem only?
- 3.6.1 Table 3.17 field vector sum tolerance, check with Kubo table (revised)
- 3.6.4 Gradient flatness: give tolerance number and measured values at FLASH
- 4.1 end of first paragraph mentions about optics difference (`somewhat' large). True? This is not mentioned in Kubo chapter.
- Figures in 4.3 contains font problem
- Missing 4.2 & 5.2 (layout)

TDR-2, ML-SCRF: Top Level Editing and Comments given by N. Walker

Section 3.1: renamed "Overview of the ILC Main Linacs"

- This is where I have done by far the most editing. I have re-arranged the text and emphasise the technology upfront (rather than the beam dynamics). I removed section which repeatedly referenced chapter 2, to the extent of possibly repeating material from that chapter. However, once we are happy with this chapter (chapter 3), I would propose to return to chapter 2 and edit down that content. I would also move a couple of the tunnel cross-sections from chapter 2 to hear, but that must now wait.

- Section3.1.3 accelerator physics is still a little weak. In particular we should discuss what to do about the HOM issue - here is the ednote in the text:

- *Need to discuss what to include in this chapter on the HOM issue. Most of this work*
- *was done 10 years ago for TESLA. A table of the modes is given in the TESLA TDR, as well as*
- *results of multi-bunch simulations, but this never been reproduced in any document for the ILC.*
- *Effectively this field has been considered a ``solved problem'' for many years. What should we do*
- *for this TDR? Reproduce some of this? At the very least we should reference the work done for*
- *TESLA.*

- I believe this chapter does need something on this.

- Section 3.1.5 Linac Systems has been greatly simplified, and now just briefly introduces the following sections.

Section 3.2: Cavity

- Removed the introductory material and the big table of CM counts (former is integrated into 3.1). Now just starts with 3.2.1 cavity design.
- New graphic 3.4 (this gets referred to quite a lot, and I may consider to repeat sub parts of it in the later text).
- 3.2.2 cavity fabrication process
- Bullet list of the process steps unchanged but I'm still not sure this is sufficient. Need to see what's in P1. Note that alcohol rinse appears to be explicitly missing here.
- Text that follows should be read carefully as I've modified it. In particular I have integrated Hitoshi's "Cavity test procedure" figure directly into this text, and attempted to describe it in words. We have already discussed the "fractions" stated in this flow chart and the various loops. I have attempted to make references to P1 where I feel these points should be justified by the R&D and this must be checked.
- This goes to the heart of our discussion of the cost estimate and whether or not the optical inspection and mechanical repair is a justified cost-effective approach for mass production on this scale or just a belief.

Section 3.3 Cavity integration

- Quite some editing work but I think the content remains more or less the same for the various sub-assemblies. (I have a better figure of the coupler coming.)
- I have now included the coupler processing/test text/graphic directly into the coupler section, at least up to the assembly in the module. The figure should be edited to match the text accordingly, since the RHS really refers to the cryomodule testing which comes later.
- I've added many references to various places in this section (thanks to Benno); they need to be ordered a bit better and just checked they are really relevant.
- Better graphic of tuner coming also, without the side cartoon.
- I have left (as Nobu did) an empty Section 3.3.3 HOM couplers. There are plenty of references and history here, so in principle it is straightforward to add some text (much like the HOM in the accelerator physics section). The real problem is identifying somebody to write it. I could do it but I would need a couple of days to research it. What needs to be included here that's critical? This will come up again in the cryomodule section when the absorber is briefly discussed (see later).
- 3.3.5 Plug Compatibility: the first paragraph strikes me as being out of place here, and would be better suited to somewhere in Part I or even in the PIP. Only the interface specifications are really needed here, with a couple of sentences introducing them.

Section 3.4: Cryomodule

- I found the original approach here rather awkward as it first introduced the big picture (string, unit etc) and ended up with the CM. I understand Paulo's logic here but at the end of the day I don't think it worked, since we are so focused on the CM as being our most visible piece of hi-tech and our cost driver. So now this chapter deals only with the CM.
- Not much different here except English.
- Page 31: I'm still confused by the HPC issue. I have now put 3 bar for the "maximum pressure for the cavities and magnets" (although I just realise that the latter may no longer be relevant given its now conduction cooled?). You should just correct this. (AY. Design Pressure to be 2 bar)
- HOM absorber - I added a placeholder for a reference on these calculations (Martin Dohlus presumably) but I need to find one. We could add a picture of the latest XFEL absorber if you like.

- Section 3.4.2.8 on the quad. Just referencing part I is not enough here. I have copied over some of the text and the figure and parameter table. However there also needs to be something here (specs at least) for the corrector dipoles and BPM. Who could add this?
- Also there may be a (beam dynamics) technical issue with not being able to fiducialise the BPM and quadrupole together. Should check with Kubo on the tolerances.

- Section 3.4.3 is now for the module testing.
- I did my best here but there is really more work to do, especially considering it's a potential cost driver for the module. Here's the ed note:
- *This section is too weak in my opinion and needs much more detailed work. Especially when we consider the*
- *cost impact on the CM. We can certainly look*
- *to the XFEL test procedures for more details of exactly what tests are done and in what order. Also there needs*
- *to be some time-line showing how long it all takes (I think the XFEL currently takes 2 weeks total time).*
- *Also there needs to be some discussion here concerning the testing rate and the ramifications thereof. I believe our current*
- *approach is similar to the TESLA TDR, in that testing every module before installation in the tunnel is cost prohibitive,*
- *and therefore after some initial ramp up we drop to something like 1 in 3. This is more in keeping with the concept of*
- *`production quality control'. The right thing to do is to keep a buffer of 3 CM's and if one fails, the other two must also be tested*
- *(before installation in the tunnel). If all three (or even 2/3) fail then there is a problem with the production line which needs to be*
- *remedied. We have not discussed this enough and need to do so.*

Section 3.5 Cryogenic cooling scheme

- NEW! I thought this was missing in the original draft. I have simple cut and paste the RDR text and edited it to fit (including the new graphic).

- THE TABLES AND NUMBERS MUST BE UPDATED! (I guess a job for Tom P.)

Section 3.6 RF power source

- Mostly language. Removed intro stuff as repetitive. Removed (most) references to upgrade (covered in upgrade chapter).
- Despite Kaoru's EC comments, I think modulator is OK -- not overly R&D and the info is relevant. Can stay as is.
- Klystron section - only English.
- LPDS quite some re-work. Again removed superfluous intro material. Re-wrote description of power division so I could understand it. Cut out some stuff I didn't think was overly relevant.
- Still need reference to S1 global report (see ednotes).
- RF power requirements
- Major re-write. Removed the tortuous explanation of the 'few %' OH for gradient spread. Attempted to explain meaning of entires in table better (at least to me). I have an email in to Chris N. and this might get one last iteration before we're done. Need to provide a back-up report on calculation of gradient spread OH - could also be the one needed for LLRF section on PkQl

Section 3.7: LLRF

- Mostly english and style. Removed some detail concerning methods for LFD compensation (too much detail). Same for Klys linearisation.
- Punted on explanation of PkQl - can't do this simply so decided not to do it at all. Again, could review once I'm back.
- In general quite a long section for this. Perhaps somebody good at reducing word count could make it a little terser.