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DIRECTOR'S CORNER

CLIC reaches a milestone

by Steinar Stapnes

It is reporting season: the ILC community is producing the Technical Design Report that also includes the Detector Baseline Design reports, and the CLIC collaboration with associated Detector and Physics studies group have been hard at work completing the CLIC Conceptual Design Report (CDR). The documentation probably surpasses by a large amount - in scope, details and volume - what is normally called a CDR for a project, but then again, there is a lot of work to report on.

RESEARCH DIRECTOR'S REPORT

Of complete DBD drafts, reviews and the future

by Sakue Yamada

The draft of the Detailed Baseline Design report (DBD) of ILC physics and detectors is complete and has been submitted to the Project Advisory Committee (PAC) of the ILC Steering Committee (ILCSC) for review. What are the technological milestones that have been achieved?

AROUND THE WORLD

An eye on the pulse

by Barbara Warmbein

The technical prototype of the silicon-tungsten electromagnetic calorimeter, one of the calorimeter options for the ILC's ILD detector, is about to spend its first weeks in a test beam at DESY. The team will test its performance under power-pulsed operation and take detector development one step further towards a real collider detector.

IMAGE OF THE WEEK

Media advisory: International Linear Collider to take next step

The Global Design Effort and ILC Research Directorate, the international planning team for the International Linear Collider (ILC), will hand over the draft of the ILC *Technical Design Report* (TDR) to its internal oversight board ILC Steering Committee (ILCSC) in an official ceremony to be held in Akihabara, Tokyo, Japan on 15 December 2012 at 14:00 h JST. This marks the first step towards the completion of the final design for the ILC project.

IN THE NEWS

from *nature*
4 December 2012
Quiet Texan to head science committee
Innovation promoter wins key role in US Congress.

from *Scientific American*
3 December 2012
At CERN: Down in the Mouth in Paradise
You have by now heard about the discovery of the Higgs boson here at CERN – a momentous scientific, technological and human accomplishment.

from *physicsworld.com*
28 November 2012
Italy cancels €1bn SuperB collider
Physics World can confirm rumours that the Italian government is to withdraw €250m from the €1bn SuperB particle accelerator, which was set to be built at the University of Tor Vergata on the outskirts of Rome.

from *nature*
21 November 2012
Physics: Let US physics commit to collaboration
A joined-up funding system is needed to enable the United States to make long-term pledges to major international projects, says Barry Barish.

CALENDAR

UPCOMING EVENTS

SiD Workshop
SLAC
16- 18 January 2013

CLIC Workshop 2013
CERN
28 January- 01 February 2013

UPCOMING SCHOOLS

Seventh International Accelerator School for Linear Colliders
Indore, India
27 November- 08 December 2012

Joint Universities Accelerator School (JUAS 2013)
Archamps, France
07 January- 15 March 2013

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1211.7242
Prospects for Precision Higgs Physics at Linear Colliders

1211.6869
Correction of beam-beam effects in luminosity measurement at ILC

1211.6800
Triple Z^0-boson production in large extra dimensions model at ILC

1211.6330
Study of detection efficiency distribution and areal homogeneity of SiPMs

1211.6290
Commissioning of the Testbeam Prototype of the CALICE Tile Hadron Calorimeter

ANNOUNCEMENTS

German particle physics community supports ILC in Japan

German particle physicists, represented by the KET committee, has published a statement reacting to the proposal from Japanese particle physicists to host the ILC: ”The proposal of the Japanese community to host the ILC as an international project finds enthusiastic support in the German community.” They strongly advise their country to participate actively in the realisation of the project. Read the full statement.

SiD workshop at SLAC

The Silicon Detector (SiD) Design Study will hold a workshop at the SLAC National Accelerator Laboratory from 16 to 18 January 2013. This meeting will review the final DBD draft, update progress on detector R&D, plan SiD’s participation in the Snowmass 2013 process, and discuss the future of SiD.

You can register and make reservations for the SLAC Guest House through the workshop website.

Hope to see you at SLAC mid January.

Andy White, Harry Weerts, and John Jaros

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DIRECTOR'S CORNER

CLIC reaches a milestone

Steinar Stapnes | **6 December 2012**

It is reporting season. As you all know the ILC community is hard at work producing the *Technical Design Report* that also includes the Detector Baseline Design reports. Similarly, the CLIC collaboration with associated Detector and Physics studies group have been hard at work completing the CLIC *Conceptual Design Report* (CDR). The three CDR volumes covering Accelerator, Detector and Physics and Summary/Implementation plans weigh in at 800, 290 and 80 pages, respectively. The documentation probably surpasses by a large amount – in scope, details and volume – what is normally called a CDR for a project, but then again, there is a lot of work to report on.

The CLIC CDR preparation goes back several years. The CLIC concept development was given a substantially increased focus in 2004 by the CERN Council, and the importance of the R&D efforts were reaffirmed in the European Strategy report in 2006. Since 2008, the focus of the R&D has been on addressing a set of key feasibility issues which are essential for proving the fundamental validity of the CLIC concept, as well as corresponding detector and physics studies for CLIC. The CLIC CDR submission was finally scheduled for 2012 to be in time for the European Strategy update, as well as similar strategy exercises in other regions.

The comprehensive CLIC **accelerator volume of the CDR** provides detailed descriptions of the accelerator layout, its components and the expected performance of the CLIC machine. In particular, it describes technical solutions to the key feasibility issues, thus proving the validity of the CLIC concept. Prototypes of many of the technical subsystems have been successfully tested at the CLIC test facility at CERN and at other facilities around the world. Power, schedules and civil engineering issues are also covered.

Volume 1 of the Conceptual Design Report

The CLIC **physics and detector CDR volume** gives an overview of the extensive CLIC physics potential. The physics aims together with the challenging beam-induced background conditions are driving the two detector designs CLIC_ILD and CLIC_SiD. These detector concepts are based on the ILD and SiD concepts, initially designed for the International Linear Collider. Detailed detector benchmark studies, using key physics processes as examples, demonstrate that physics measurements can be performed to high precision, despite the beam-induced background.

The focus of the physics and detector CDR and the accelerator CDR has been on the maximum CLIC centre-of-mass energy of 3 TeV. This energy corresponds to the most challenging situation for both the accelerator and the detector technologies, while simultaneously providing an outlook on the ultimate physics reach. Exploring the full physics potential of an e+e− collider under optimal conditions, however, requires the availability of a broad range of centre-of-mass energies, and lower energy operation and a staged implementation have been studied more extensively in the last two years.

The **third CDR volume** focuses on a staged CLIC implementation and also recalls some of the main points described in the more detailed technical volumes. The document discusses key implementation issues as costs, power, luminosity scenarios, schedules and a physics programme implemented in stages. It also includes the proposed objectives and work plan of the post CDR phase from 2012 to 2016.

In addition, a shorter **overview document** was submitted as input to the European Strategy update, complementing **a common ILC/CLIC paper** on the Linear Collider physics potential.

Looking forward

Within the framework of the future common Linear Collider project the CLIC plans are firmly focused on providing an option for a future multi-TeV e+e- machine. The CLIC accelerator project aims to present a Project Implementation Plan by 2016, at the time when LHC results at full energy will become available. The detailed work plan for the next period focuses on technical studies, industrial collaboration and system developments, along with implementation studies for construction and operation of CLIC in a few energy stages. In particular the lower energy stages need to be re-optimised. Where possible the work will be done in common with ILC, in the areas where similar challenges exists and hence similar solutions can be pursued.

In a similar way objectives have been defined for the CLIC physics and detector study. They focus on physics studies, detector optimisation and the development of technology demonstrators. In both cases the work will be carried out in the framework of collaborative institute agreements between all the partners – and as of February also organised within the Linear Collider Collaboration.

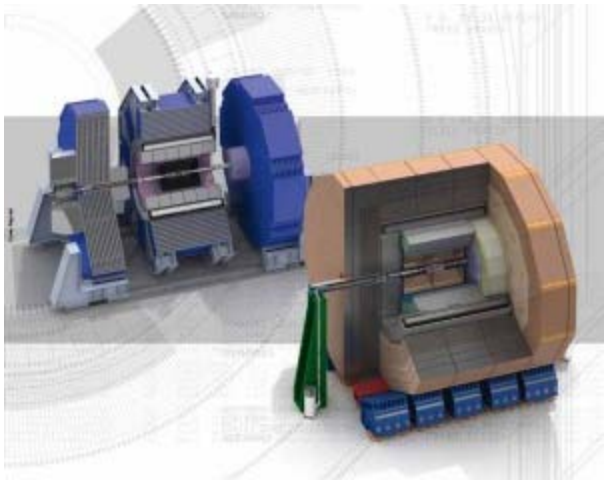
ACCELERATOR R&D | **CLIC** | **CONCEPTUAL DESIGN REPORT** | **DETECTOR R&D**

RESEARCH DIRECTOR'S REPORT

Of complete DBD drafts, reviews and the future

Sakue Yamada | **6 December 2012**

The draft of the Detailed Baseline Design report (DBD) of ILC physics and detectors is complete and has been submitted to the Project Advisory Committee (PAC) of the ILC Steering Committee (ILCSC) for review.



The two detector concepts for the ILC: SiD and ILD.

This report presents the achievements of physics and detector R&D activities during the Letter-of-Intent process (LOI) since 2007. It summarises the large amount of output from five years' work in detail in two volumes. The physics volume describes considerable physics cases for ILC for investigating the new physics landscape which we caught a glimpse of by the discovery of the Higgs-boson-like particle at the LHC, and for questing for answers to other fundamental questions of particle physics. The detector volume presents two detector designs, SiD and ILD, with feasible detector technologies and the capability to accomplish the expected physics studies. Their experimental performance is demonstrated for precision with a number of benchmark simulations. Combined with the accelerator volumes of GDE, they form a part of the entire *Technical Design Report*.

As I reported a few times in *ILC NewsLine*, we began to prepare for this report more than a year ago and passed a few milestones to complete the draft. The plans of contents were monitored by the International Detector Advisory Group (IDAG) during the KILC12 workshop last April. Through this process the input materials were rearranged and clear guidelines were given for drafting. The first set of drafts was submitted to IDAG for review at the end of September. In October, IDAG met for three days during the LCWS12 in Arlington, Texas, to examine the draft content and interview each author team to suggest a number of improvements. Every section was polished further through November.

The both volumes became larger in size than originally planned. The physics volume is about 220 pages and the detector volume is about 500 pages long. With this report we wish to convince the experts of the field of the feasibility and capability of the ILC experiments. Thus a lot of details need to be presented. Indeed a large number of frontend technologies have been developed successfully both for hardware and software and they were harmonised in two detector systems to provide physics results. We hope the rich information contained in the report shows that we have reached the intended goal of the LOI process.

We consider the review by PAC, to be held at KEK next week, very important. The PAC review is an external one for ILCSC and tells us whether the report is really convincing to the experienced reviewers. The completed draft was sent also to IDAG again, which will check the improvements after its review in October. Three IDAG members including the chair will join the PAC meeting to augment PAC's detector members. Formally the IDAG review is considered to be internal. However, as most members are experts from outside the ILC community, in practice the IDAG review was an external review. And the coming joint review will make a rigorous peer review.

When successful, this review will be a good sign for us to go forward and take the next step. In the last chapter we included our wish for the future. While much progress has been made, our effort is yet in the R&D phase. In the next phase, we need to include

more engineering studies in parallel with further detector R&D for improvement. More importantly, some parts of the design work require a definite knowledge about the site. In order to advance the detector design in view of future installation, this point becomes crucially important. We wish, as the ILC project itself advances forward, this open issue will be pinned down. I hope the completion of our draft of DBD will be effective for such progress of the project, too.

DETAILED BASELINE DESIGN | **DETECTOR R&D** | **ILD** | **SID** | **TECHNICAL DESIGN REPORT**

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AROUND THE WORLD

An eye on the pulse

Barbara Warmbein | **6 December 2012**

Engineers Stephane Callier (Omage) and Remi Cornat (LLR) setting up the SiW electromagnetic calorimeter.

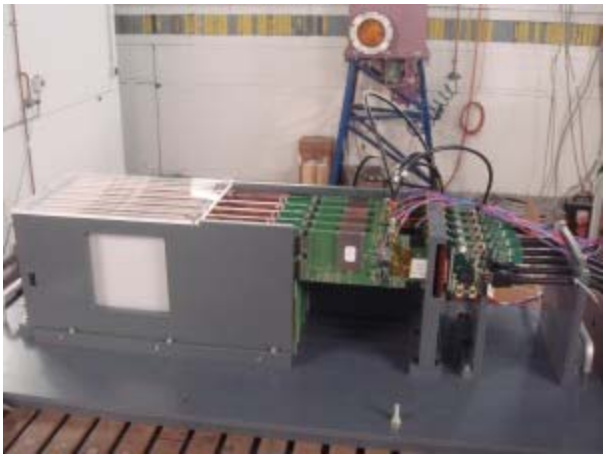
Building a state-of-the-art particle detector requires several steps. When you've decided what you want to measure, you have to decide which is the best, fastest and most reliable technology to make these measurements. When you've shown that your chosen technology can actually measure things to the specific requirements, you have to show that you can actually build it into the space earmarked for it. The collaboration that builds one option for an electromagnetic calorimeter (ecal) for the ILC's ILD detector has just passed the "technology works" step – the physics prototype – and is now starting on the next one – the technological prototype. It measures 18 by 18 by 20 centimetres and consists of a detector layer made of silicon (Si) and an absorber layer made of tungsten (W), which leads to the acronym SiW Ecal. They will take data in a test beam at DESY in Hamburg, Germany, early next year. The R&D for this detector, led by the French groups of Laboratoire Leprince-Ringuet (LLR) and LAL, is embedded into the programme of the CALICE collaboration.

Building a detector is always a complicated business, but there are some things that make ILC detectors just that bit more challenging. The calorimeters are core contributors to the particle flow algorithm, which will give the highest ever energy resolution for jets in a detector, making it possible to identify and track every single particle from a collision. These calorimeters need to fit into the magnet, so there's a space challenge – not a new one, however; also the LHC detectors, big as they are, had to be squeezed into a fixed amount of space. So much electronics – particle flow requires many channels, and each channel must not consume more than 25 microwatts of power – alongside so many sensitive materials produce a lot of heat, and there isn't really any space for an active cooling mechanism. So the detector developers have tackled the problem from the source: they want to make sure that heat isn't even generated in the first place.

With the ILC's pulsed beam cycle, when a bunch train has passed, there's a gap that's not noticeable for humans but can feel like a lifetime of inactivity (and unnecessary heat production) for the ultra-fast detector electronics. So why not take a real break before the next pulse comes through? The components aren't actually switched off, but powered down in between cycles, a system called **power pulsing**. The team working on the SiW-ecal technological prototype are about to try it in a lab workshop in France, "but it's a different story with real beam and with a magnet," says Roman Pöschl from LAL.

The team, consisting of researchers from France and Japan, tested the technical prototype's ability to acquire data in a conservative, i.e. continuous mode in summer 2012 and are now curious to see whether the signal quality is different when applying power pulsing.

The SiW ecal is very compact – because it needs to be due to its space in the overall ILC detector, but also because the materials used make it so. **Tungsten**, used as the absorber material that interacts with the particles flying through, producing a nicely narrow particle shower, is extremely dense, so very little of it is needed. Silicon supports the compactness because it allows for pixelisation. In addition it permits for building detectors that can detect small signals. This distinction of signal against everything else that is going on in a detector – aptly called 'noise' – is a fixed unit in particle physics called signal-to-noise ratio. The R&D goal for the SiW ecal was a signal-to-noise ratio of 10 to 1; in test beams they achieved between 14 and 20 to one, much better than needed. The modifications needed for power pulsing, however, can have a negative influence on the signal-to-noise ratio, and the team is after the exact rates. "We are confident that we can still reach or R&D goal," says Roman Pöschl.



Detector setup at DESY.

CALORIMETER | **CALORIMETRY R&D** | **DESY** | **DETECTOR R&D** | **ELECTROMAGNETIC CALORIMETER** | **ILD** | **LAL** | **TEST BEAM** | **TUNGSTEN CALORIMETER**

IMAGE OF THE WEEK

Media advisory: International Linear Collider to take next step

6 December 2012

The Global Design Effort and ILC Research Directorate, the international planning team for the International Linear Collider (ILC), will hand over the draft of the ILC *Technical Design Report* (TDR) to its internal oversight board ILC Steering Committee (ILCSC) in an official ceremony to be held in Akihabara, Tokyo, Japan on 15 December 2012 at 14:00 h JST. This marks the first step towards the completion of the final design for the ILC project.

Akihabara UDX Theater, the venue of the 15-December event

The Global Design Effort and ILC Research Directorate, the international planning team for the International Linear Collider (ILC), will hand over the draft of the ILC *Technical Design Report* (TDR) to its internal oversight board ILC Steering Committee (ILCSC) in an official ceremony to be held in Akihabara, Tokyo, Japan on 15 December 2012 at 14:00 h JST. This marks the first step towards the completion of the final design for the ILC project.

After several years of intensive research and development work on accelerator and detector technologies, as well as in-depth internal reviews of both the accelerator and detector reports, the TDR will be handed over to Jonathan Bagger, the chair of the International Linear Collider Steering Committee, at the official handover ceremony.

An external review of the TDR on the technical design for the accelerator and a detailed baseline design for the two detectors will have been carried out by the international committee of technical experts in the days just preceding the ceremony at High Energy Accelerator Research Organization (KEK), Tsukuba, Japan. A separate cost review on TDR will be done in January, and the results of these reviews will be presented to ILCSC in Vancouver in February 2013 at a joint meeting of ILCSC and the new Linear Collider Board, a new oversight committee for the Linear Collider Collaboration that will take up office at the same time.

The Linear Collider Collaboration will combine the two linear collider projects, ILC and CLIC, under one organisational roof. After this review, the final version of the TDR will be officially delivered to the International Committee for Future Accelerators (ICFA) in June 2013.

Following the handover ceremony on 15 December in Akihabara, Tokyo, there will be a panel discussion on the past, present and future of the ILC from various perspectives of eminent scientists and business leaders, moderated by Hitoshi Murayama, Director, Kavli Institute for the Physics and Mathematics of the Universe (IPMU).

There will be a Q&A session for press after the panel discussion, with Barry Barish, Sakue Yamada, Jonathan Bagger and Atsuto Suzuki. This will happen at around 15:00 JST. The event and press conference will be streamed live and journalists unable to attend in person have the opportunity to ask questions via ustream. Please see details below for more information.

The Global Design Effort (GDE), ILC Research Directorate (RD), the Japanese Advanced Accelerator Association promoting

Science and Technology (AAA), and Japan's High Energy Accelerator Research Organization (KEK) will jointly host this event.

Media who wish to attend or require more information on this event should contact Rika Takahashi, ILC Communicator Asia, at +81-29-879-6247 or **communicators@linearcollider.org**.

Event and Panel Details

Title: Handover Ceremony of the draft of the ILC Technical Design Report, including the Detailed Baseline Design for detectors

Date/Time: Saturday, December 15, 2012 from 14:00 to 16:00 JST

Location: Akihabara UDX Theater

Video streaming available at:

URL (Japanese) **http://www.ustream.tv/channel/ilc-jpn**

URL (English) **http://www.ustream.tv/channel/ilc-eng**

Programme:

(1) Handover ceremony (14:00 ~ 15:00)

- Presentation by Barry Barish, Director, Global Design Effort
- Presentation by Sakue Yamada, Research Director, ILC Research Directorate

(2) Panel Discussion (15:00 ~ 16:00)

Speakers:

- Barry Barish, Director, Global Design Effort
- Sakue Yamada, Research Director, ILC Research Directorate
- Jonathan Bagger, Chair, ILC Steering Committee
- Hiroya Masuda, Chair, Japan Policy Council
- Atsuto Suzuki, Director General, High Energy Accelerator Research Organization (KEK)
- Takashi Nishioka, Chair, Advanced Accelerator Association promoting science and technology (AAA)

Moderator

- Hitoshi Murayama, Director, Kavli Institute for the Physics and Mathematics of the Universe (IPMU)

(3) Q&A session (16:10 ~17:00)