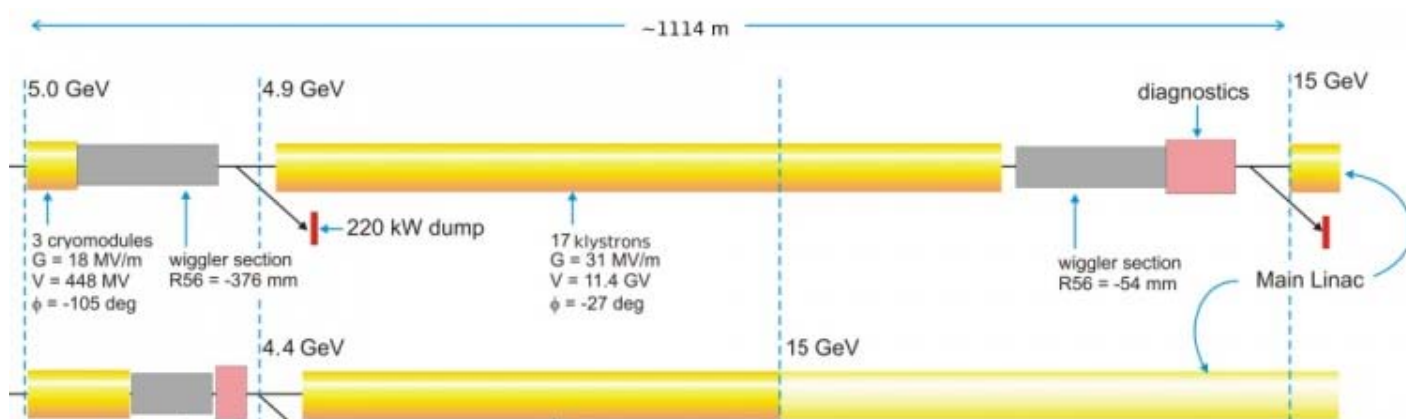


FEATURE

Setting the stages for shorter bunches

ILC's central region gets reviewed

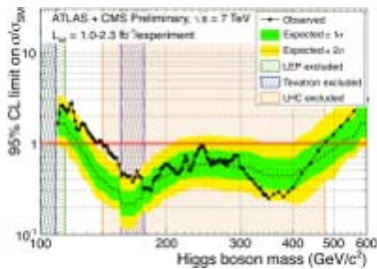
by Barbara Warmbein



One of the busiest places in the ILC design is the central region. It's where it all happens: the beams get squeezed and focused and kicked into collision and out comes physics. To make sure that everything works to perfection and to reach consensus on the design, the central region has just undergone a technical baseline review, along with areas like the connection between damping ring and main linac. One of the core decisions for the latter: a two-stage bunch compressor for shorter beams.

FEATURE

From symmetry breaking: **Favored Higgs hiding spot** **remains after most** **complete search yet**



Almost a year of work, more than 50 meetings and plenty of diplomacy went into calculating the LHC experiments' first combination of Higgs search results. The study, made public on

18 November, eliminates several hints the individual experiments saw in previous analyses but leaves in play the favored mass range for the Higgs boson, between 114 and 141 GeV. ATLAS and CMS ruled out at a 95 percent confidence level a Higgs boson with a mass between 141 and 476 GeV.

DIRECTOR'S CORNER

“The GDE must write” – The first steps to the ILC *Technical Design Report*

This week's issue features a Director's Corner from Nick Walker, Project Manager for the Global Design Effort.

by Nick Walker



ILC Project Manager Nick Walker describes the several books that will form up the ILC *Technical Design Report*. This ambitious document, planned to be released by Spring 2013, should reflect the enormous job led by the Global Design Effort over the last years.

IMAGE OF THE WEEK



Illinois Accelerator Research Center

Image: Fermilab. Conceptual rendering courtesy of Ross Barney Associates and ARUP

The **Illinois Accelerator Research Center**, or IARC, will provide a state-of-the-art facility for accelerator research, education and industrialisation. Located on the Fermilab campus, near Chicago in the US, the new building will house 42,000 square feet of offices, technical and educational space for scientists and engineers from Fermilab, Argonne, local universities and industrial partners.

Read also in *Fermilab Today*: “**CDF and DZero buildings to house new projects**”

IN THE NEWS

from ***The Guardian***

18 November 2011

[Higgs boson's moment of truth is fast approaching at the LHC](#)

Tantalising hints of the Higgs boson will be confirmed or ruled out at the LHC in the coming months, say researchers

from ***INFN***

18 November 2011

[New Tests Confirm The Results Of OPERA On The Neutrino Velocity, But It Is Not Yet The Final Confirmation](#)

The new tests seem to exclude part of potential systematic effects that could have affected the original measurement.

from ***Reuters***

16 November 2011

["Big Bang" machine to get huge upgrade in 2020](#)

Physicists from around the globe launched a major program on Wednesday aimed at converting the LHC "Big Bang" particle collider at CERN near Geneva into a vastly more powerful cosmic research machine by the year 2020.

from ***Wired Science***

17 November 2011

[LHC May Have Found Crack in Modern Physics](#)

To understand why physicists are excited, look around: We're surrounded by stuff. That might seem obvious, but scientists have long wondered why there's anything at all.

from ***Physics World***

16 November 2011

[Has 'new physics' been found at CERN?](#)

...the LHCb experiment at the CERN particle-physics lab have released the best evidence yet for direct charge-parity (CP) violation in charm mesons.

ANNOUNCEMENTS

Early edition of ***ILC NewsLine*** this week

Because of the Thanksgiving holiday in the United States this Thursday, we are publishing an early edition of ***ILC NewsLine*** this week. The publication will return to its normal schedule next week.

CALENDAR

UPCOMING EVENTS

[WHIZARD - Event Generation for LHC, ILC, CLIC](#)

DESY, Hamburg

21- 23 November 2011

[TESLA Technology Collaboration \(TTC\) Meeting](#)

IHEP, Beijing, China

05- 08 December 2011

[5th Annual Workshop of the Helmholtz Alliance "Physics at the Terascale"](#)

Bonn, Germany

07- 09 December 2011

[2nd International Workshop on Accelerator-Driven Sub-Critical Systems & Thorium Utilization](#)

Bhabha Atomic Research Centre, Mumbai, India

11- 14 December 2011

[SiD Workshop](#)

SLAC

14- 16 December 2011

[View complete calendar](#)

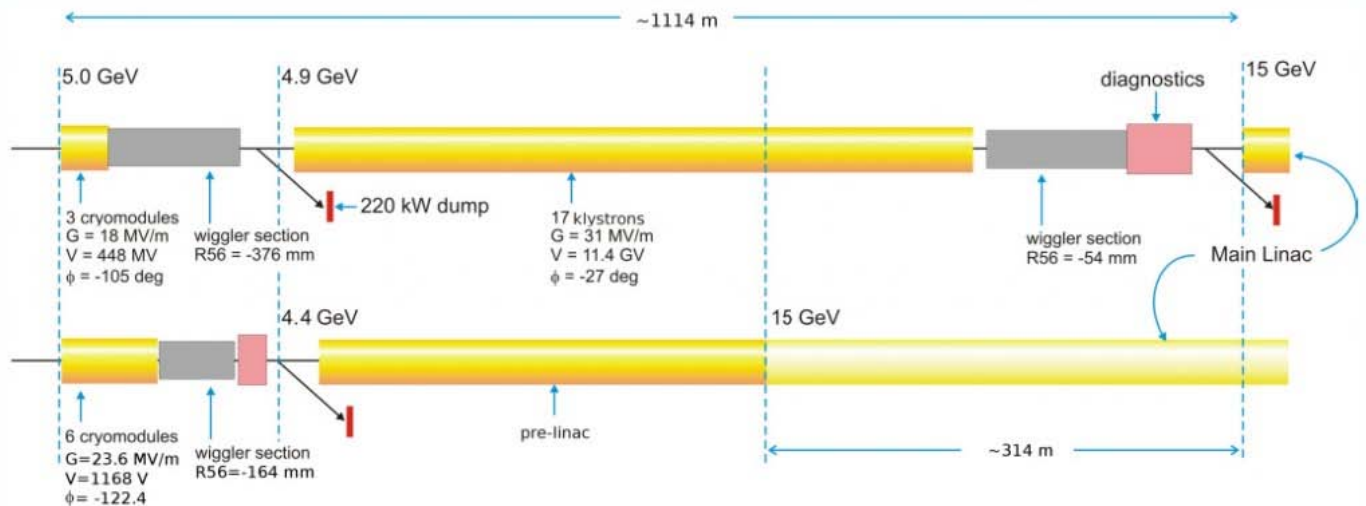
FEATURE

Setting the stages for shorter bunches

ILC's central region gets reviewed

Barbara Warmbein | 23 November 2011

Beam lines, extraction lines, supply lines, final focus, sources, dumps, tunnels, shafts and not to forget the detector hall – the ILC's central region is a busy place. In a recent [technical review held at DESY](#) in Hamburg, Germany, systems like the electron source, the positron source, the connection from damping ring to main linac, the beam delivery system and the machine-detector interface were under scrutiny. The main aim of these technical reviews is to find the best baseline design and a realistic idea of the cost for next year's *Technical Design Report* (TDR). This one achieved even more than participants had set out to do: "We basically came out with a complete integrated design of the accelerator geometry, and how it fits in the tunnel," says organiser Nick Walker, ILC project manager. "We hammered out the details and now we can work with a really realistic design much sooner than we expected."



Two possible options for compressing ILC bunches.

Another outcome is the decision to opt for a two-stage bunch compressor rather than a single-stage one. Bunch compressors sit between the damping rings and the particles' racetrack, the main linac. They do what they say on the cover: they compress bunches, making them much shorter than they are when they leave the damping ring (nice and flat) and thus guaranteeing higher collision rates and more physics. When exiting the damping ring, the bunches are 6 millimetres long, and they have to be compressed down to the baseline 0.3 millimetres. The baseline design features a rather large compressor of almost a kilometre in length, consisting of an accelerator section followed by a section with wigglers. There have been efforts to compress the compressor, putting it all into one rather than two stages, partly because some of the parameters had changed from the *Reference Design Report* design, making a single stage possible, and partly because a shorter bunch compressor section would save a little money. However, participants decided that the two-stage bunch compressor with its larger possible compression ratio offers much more flexibility in the handling of the beam and a safety margin for the target luminosity, which couldn't be outweighed by the cost savings.

Another big topic at the review meeting were the civil facility requirements for all systems that were reviewed, especially the interaction region. While the RDR offered only a very rough sketch of the hall where the two ILC detectors will sit in the famous push-pull configuration (one detector is pushed into the interaction point while the other is pulled out, letting only one detector take data at any time), it has now been decided that the hall must be roughly Z-shaped. The ends of the Z are the detectors' "garages" while the central column is the interaction point. The next step is to decide how many shafts are needed and what their diameter should be – and what it would all cost, of course.

The central region review is the second ILC-wide review after one in Frascati, Italy in summer about damping rings. It had originally been supposed to be more than one, covering the sources and beam delivery system separately, for example, but the decision to pull these together into one review has turned out to be very productive. Next up are the two major ones: the superconducting main linac, under review at KEK, Japan, in January 2012, and civil facilities and siting, under review at CERN the following March.



Group photo of the central-region reviewers. Image: DESY

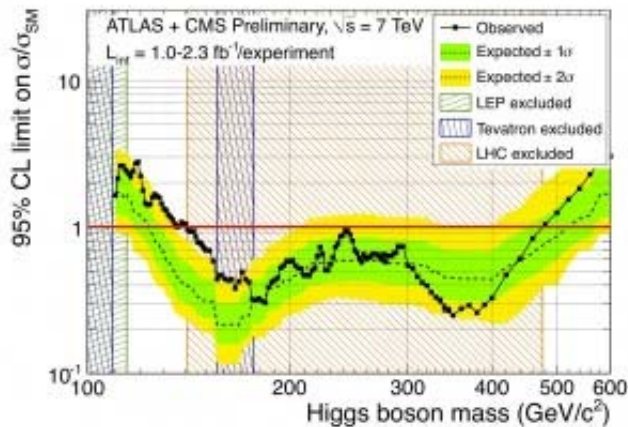
[BUNCH COMPRESSOR](#) | [COST SAVINGS](#) | [TDR](#) | [TECHNICAL DESIGN REPORT](#) | [TECHNICAL REVIEW](#)

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Favored Higgs hiding spot remains after most complete search yet

November 18, 2011 | 5:30 am



The Standard Model Higgs boson is excluded at a 95 percent confidence level everywhere the thick black line drops below the red line. Image: ATLAS and CMS experiments

The CMS and ATLAS experiments at the Large Hadron Collider have backed the Standard Model Higgs boson, if it exists, into a corner with their first combined Higgs search result.

The study, made public today, eliminates several hints the individual experiments saw in previous analyses but leaves in play the favored mass range for the Higgs boson, between 114 and 141 GeV. ATLAS and CMS ruled out at a 95 percent confidence level a Higgs boson with a mass between 141 and 476 GeV.

The new result combines eight studies of predicted decays of the Higgs boson using data the experiments collected up to July. Physicists expected to be able to rule out an even wider mass range, between 125 and 500 GeV, based on the amount of data used and the sensitivities of the different search modes. But small excesses that could be the result of statistical fluctuations or could indicate the presence of a hidden particle reduced the range of masses that could be excluded.

“I think it could be an interesting message the data is telling us,” said physicist Eilam Gross of the Weizmann Institute of Science, who shares leadership of the ATLAS experiment’s Higgs group. “Any discovery starts with the inability to exclude.”

Several related measurements indirectly suggest a Standard Model Higgs boson exists at the lower end of the mass range.

Almost a year of work, more than 50 meetings and plenty of diplomacy went into calculating the LHC experiments’ first combination of Higgs search results. Experts from both collaborations worked together for more than seven months to devise the combination procedure and for about one month to come up with the combined result. Then the two collaborations, each a few thousand members strong took about a month to review and approve it.

“This is really a landmark achievement,” said CMS physicist Vivek Sharma of the University of California, San Diego, co-leader of the Higgs combination group. “Combining LHC Higgs search results is not a straightforward process. There’s a lot going on under the hood.”

Since July, the two experiments have accumulated two to four times as much data. By the end of 2012, they hope to at least double that.

The end of the Standard Model Higgs search is in sight, said ATLAS physicist Bill Murray of the U.K. Science and Technology Facilities Council, co-leader of the Higgs combination group. “This year’s data will probably give us the answer, but next year we will be able to announce it firmly,” he said.

So far, the ATLAS and CMS experiments have not yet decided to produce a second Higgs combination based on results from the full 2011 dataset. The two experiments are still in competition; they might wait to see what they can accomplish on their own before working together again.

“This was a chance to go through the process when the results were uncontroversial,” Sharma said. “Now we’re in discovery mode. The next

time won't be so calm."

Kathryn Grim

DIRECTOR'S CORNER

“The GDE must write” – The first steps to the ILC *Technical Design Report*

This week's issue features a Director's Corner from Nick Walker, Project Manager for the Global Design Effort.

Nick Walker | 23 November 2011



What could be the relationship between a bowl of petunias and the ILC Technical Design Report? Image: ILC

“The time to begin writing an article is when you have finished it to your satisfaction. By that time you begin to clearly and logically perceive what it is you really want to say.” Mark Twain

“Scientists must write” was a particular mantra of one of my professors in my freshman year at university. He was of course talking about the importance of publication. As we approach the end of 2011 and begin to plan for the Global Design Effort's final year, “The GDE must write” might be something I should print out in large letters and stick on my office wall. The project managers are now turning their full attention on actually writing the GDE's primary deliverable: The ILC *Technical Design Report* (TDR).

As I sit here with the inevitable “blank page syndrome” and contemplate the production of this lofty tome, I can't help feeling something in common with the famous ‘bowl of petunias’ in Douglas Adam's [Hitchhiker's Guide to the Galaxy](#) – a sense of “Oh no not again”. The veterans of past such reports know all too well just how much work is involved in such undertakings. Nonetheless (and joking aside), it is an important undertaking, and one which we must approach professionally, and not least with a careful sense of planning.

The TDR as it is known will not be one book, but several. For the machine part, we are planning two primary volumes (Part I and Part II) and a lighter-weight executive summary. Our physics and detector counterparts are also planning two volumes. Add to this a

sixth outreach document currently being planned by our communicators, and you can quickly see there is plenty of pen-pushing for all.

Fortunately for us, we have the legacy of the original 2007 *Reference Design Report* (RDR) and the recently published interim report ([The International Linear Collider – A Technical Progress Report](#)) to build on. The TDR “Part I: Technical Design Phase R&D”, will cover all the global R&D of the last five years. The report will attempt to comprehensively capture the excellent work that the GDE has performed during its mandate. Although the primary focus will be on the R&D results that support the ILC baseline design and the development of worldwide superconducting radio-frequency (SCRF) technology

infrastructure, Part I will also include results on alternative approaches which are currently not considered mature enough to be adopted as the baseline, but may hold promise for the future. A final but important ingredient of Part I will be to scope the future R&D directions beyond the TDR, in particular on ultra-high gradient superconducting radiofrequency (SCRF) cavities.

"Part II: The ILC Baseline Design", will be a more formal description of the ILC machine, including the updated cost estimate and schedule. It will be very similar in structure to the 2007 RDR, with about the same level of detail. It will also include an important chapter on the energy and luminosity upgrades. Part II will capture the baseline design that is currently being ratified by a series of baseline technical reviews. So far, the damping rings, sources, ring-to-main-linac, and beam delivery system have been pinned down in two recent review workshops ([July in Frascati](#), Italy, for the damping rings, and more recently at a workshop in [DESY, Germany, in October](#) for the rest). The primary cost drivers – the SCRF main linacs the conventional facilities – will be dealt with respectively at workshops in January at KEK and April in CERN.

We expect both volumes to be approximately 300 pages, and first drafts will be needed in the first half of next year. While this is quite ambitious, it is necessary if we are to keep to the hard deadline of having a complete final draft by the end of 2012. Final and formal publication will likely by spring 2013, after international review.

The project managers have put together a strong team of editors to take on this challenge. The Technical Editorial Board (TEB) as we call it, consists of three primary editors for each TDR Part. For Part I we have Jim Kerby (FNAL), Hitoshi Hayano (KEK) and Eckhard Elsen (DESY). For Part II, Nan Phinney (SLAC), Nobu Toge (KEK) and Phil Burrows (Oxford University). Benno List (DESY) and Maura Barone (FNAL) will provide technical, database and graphics support. Finally, we have asked John Carwardine (ANL) to chair the TEB and organise and plan the TDR activities. On behalf of the project managers I'd like to thank these people for agreeing to help us with this difficult but extremely important task.

Finally, I also need to say a thank you in advance to the GDE team scattered across the globe who will actually produce the TDR. As usual we are asking you to go that extra mile. We look forward to working with you and the TEB in producing a TDR which truly reflects the enormous amount of good work that you and others have contributed to the "Great Adventure".



John Carwardine, chair of the ILC Technical Design Report Technical Editorial Board. Image: ILC

[ILC R&D](#) | [TDR](#) | [TECHNICAL DESIGN REPORT](#)

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