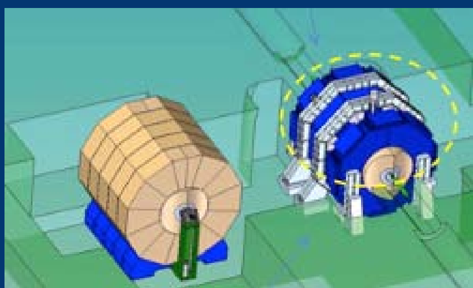
ilc newsline

ABOUT | ARCHIVE | SUBSCRIBE | CONTACT | LINEARCOLLIDER.ORG

10 MAY 2012

ILC NEWSLINE SPECIAL ISSUE



Detecting all the challenges

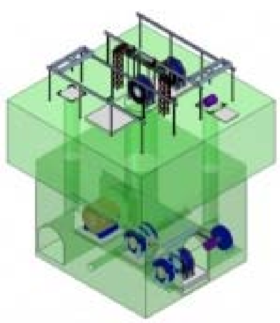
Why will the International Linear Collider have two detectors? What's the story behind this decision, and what are the challenges that the ILC planners and detector developers face? Today's issue concentrates on the big questions that (literally) surround the big future particle cameras.

FEATURE

If the particles won't come to the detector…

Experts on detector, machine-detector interface and civil engineering agree on detector hall design

by Barbara Warmbein

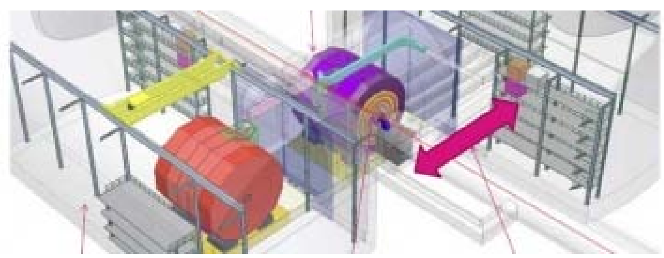


Five shafts, pacmen shields and moving platforms: the design for the hall in which the ILC detectors will sit, be pushed and pulled, record data, get upgrades and maintenance is now final, at least for an ILC that is not built underneath mountains.

DIRECTOR'S CORNER

The two detector concepts for the ILC

by Barry Barish



The ILC physics programme is based on building two complementary detectors that will share beam time. The value of having two detectors with different designs, technologies, collaborations and emphasis has proven to be a very effective way to exploit the science. For the ILC, we propose using a push-pull concept to cost-effectively share the beam between two detectors.

VIDEO OF THE WEEK

The Higgs Boson – A Tales from the Road Comic

Video: PhD Comics, images: Jorge Cham

An illustrated and animated interview about the mysterious Higgs boson and “how the LHC is going to find it (if it exists)”.

IN THE NEWS

from ***phys.org***
9 May 2012
It’s Official: Physics is Hard
… Toby Cubitt and his colleagues, Jens Eisert and Michael Wolf, of the Universities of Berlin and Munich respectively, show in this article the difficulty of obtaining the equations that govern the temporal evolution of a physical system, from observations of the system at different times, thereby showing the mathematical certainty of the difficulty of physics. …

from ***Crain’s Chicago Business***
4 May 2012
Fermilab to shed about 80 positions
… In February, the White House released a budget proposal that zeroed out money for research on Fermilab’s International Linear Collider and cut funding in half for development of the lab’s Long Baseline Neutrino Experiment. …

from ***Daily Herald***
4 May 2012
Fermilab job cuts to take effect Oct. 1, Oddone says
Up to 80 positions will be cut at the Fermi National Accelerator Laboratory in Batavia, officials announced Friday.

The workforce reductions come amid anticipated federal spending cuts to the lab.

CALENDAR

UPCOMING EVENTS

International Particle Accelerator Conference 2012 (IPAC12)
New Orleans, USA
20- 25 May 2012

ILD Workshop 2012
Kyushu University, Fukuoka, Japan
23- 25 May 2012

15th International Conference on Calorimetry in High Energy Physics (CALOR 2012)
Santa Fe, New Mexico
04- 08 June 2012

UPCOMING SCHOOLS

The 2012 European School of High-Energy Physics
Anjou, France
06- 19 June 2012

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1205.1280
Leptonic anomalous gauge couplings detection on electron positron colliders

1205.0866
Discriminating Z’ from anomalous trilinear gauge coupling signatures in e+e- \to W+W- at ILC with polarized beams

1205.0666
TeV Scale Phenomenology of $e^+e^- \toμ^+ μ^-$ Scattering in the Noncommutative Standard Model wiHybrid Gauge Transformation

1205.0362
Analyzing the anomalous dipole moment type couplings of t' quark with FCNC interactions at e^-e^+ colliders

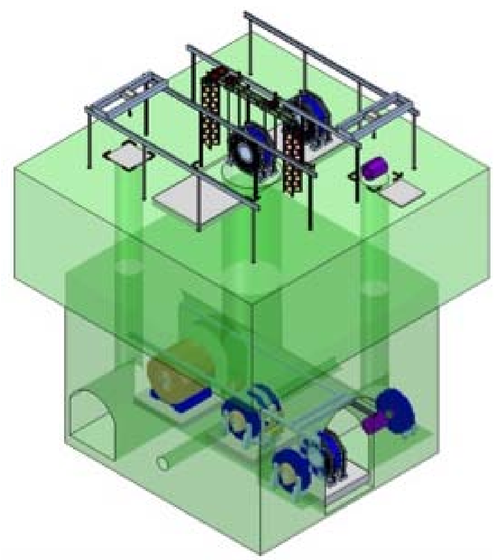
Copyright © 2012 ILC-GDE

FEATURE

If the particles won’t come to the detector…

Experts on detector, machine-detector interface and civil engineering agree on detector hall design

Barbara Warmbein | 10 May 2012



A heavy-duty crane on the surface will transport the assembled detector slices to the hall below. Graphic: Marco Oriunno

Sometimes big things have to move in the way of small things to find exciting things. The ILC detectors, for example. True to the scientific principle of reproducibility of results, two detectors, ILD and SiD, will one day record what happens when electrons and positrons collide so that one can verify (or not) what the other has observed, using different detection technologies. However, they will never be able to do this simultaneously as there will be only one interaction point. The detectors will have to move into and out of the beam in as short a time as possible for maximum data harvest, and this caused detector designers, machine experts and the guys who know all about shifting rock no end of headache. Now they have found a solution that addresses all problems (at least for an ILC that is not built in a mountainous region).

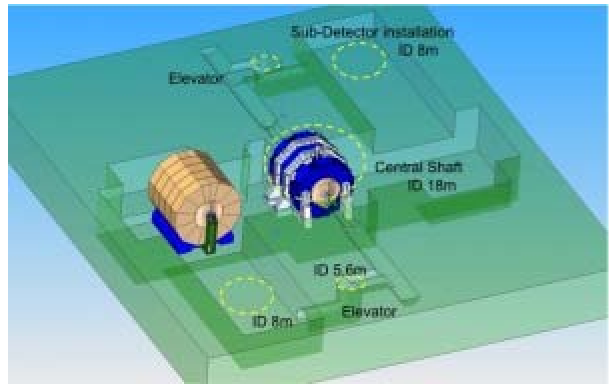
The final design for the non-mountain hall for the detectors is shaped like a Z. The downstroke, which actually is at right angles to the side bits, is where the beams come in, and the side bits are the garages for the detectors when they are not in use. Though rather compact compared to the LHC’s giant ATLAS detector, both ILD and SiD are heavyweights, and with dimensions up to 16 metres in length and up to 15,000 tonnes on the scales, they are not easily pulled around. The total surface area of the hall, therefore, also measures over 3300 square metres. This allows not only for smooth operation, but also for easier assembly and maintenance.

Assembly is the main argument for the final choice of shafts that are needed for the ILC’s collision point. There will be one big shaft, 18 metres in diameter, right above the central part of the Z for the lowering of the giant detector slices, magnet coils and endcaps. Like the CMS detector at CERN, the two ILC detectors will be assembled on the surface and then lowered underground in complete slices. Two smaller shafts – nine and ten metres in diameter – give access from above to the two garages for detector maintenance, and another two are for people only so that they can get down and up easily and also have an escape route in case of an evacuation.

Now obviously things will not be as easy as they may sound here. “We faced the problem of how to make both detectors fit the space between the two tunnels. And it’s the first time in history that two detectors share one interaction space in a push-pull-configuration,” says Marco Oriunno of SLAC, a member of the common task group on machine-detector interface and responsible for the impressive 3-D graphics of the area.

How do you move a 15,000-tonne object from a garage into the beam and back some 15 times a year? How do you make sure none of the high-tech, mega-precise parts move during the transport? How do you keep the magnets cool? The answer is: concrete slabs that serve as platforms for the detectors and will be moved by either airpads or rollers, and flexible cryogenic lines that move with the moving detector. A set of compressors on the surface makes sure that enough coolant is around while two cold boxes, one for each detector, will be installed underground. The lines extend from the garage to the interaction point. And the detectors adapted their configurations to each other so that both reach the beampipe shielding that sticks out at both sides of the central hall. Both also had to be self-shielding with respect to ionising radiation and magnetic fields for hall safety.

The shielding around the beampipe and the detectors' self-shielding material are the only protective screens needed for the hall design. Maintenance on one detector will be possible underground while the other is busy taking data. The group also thought about how to organise beam commissioning. Before you start colliding particles, the machine operators have to take a series of important steps to truly understand and control their machine. A stray beam can cause great damage in a sensitive detector, so commissioning will not happen with a detector in place. Instead, walls of shielding blocks will be erected around the beam pipe so that work can continue on both the assembly of the detectors and the commissioning of the accelerator.



Spot the Z shape – one detector in parking position, one taking data. The non-mountainous detector hall for the ILC could look like this. Graphic: Marco Oriunno

All this will be very different if the ILC is built under a mountain range. Shafts will not be vertical, for example, and the transport of the detector parts will be different. The design of the hall for these conditions is still a work in progress. Similarly, a civil engineering company is currently working on detailed studies of what can be expected of the non-mountainous geology when five shafts of different diameters are dug within relatively close distance to each other, and a detailed design of the moving platforms. Stay tuned for future info!

CAVERN | CFS | DETECTOR R&D | ILD | INTERACTION REGION | SID

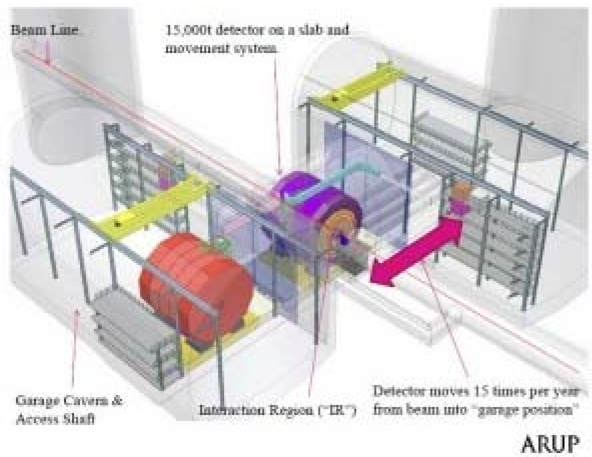
Copyright © 2012 ILC GDE
Printed from http://newsline.linearcollider.org

ilc newsline

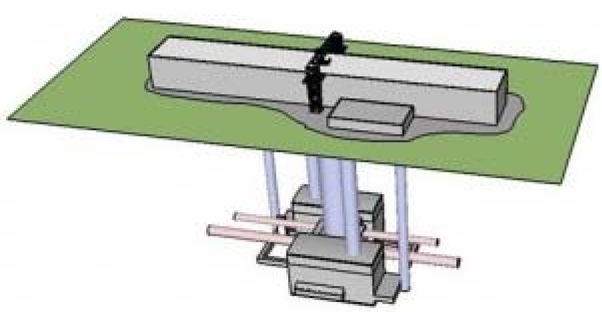
DIRECTOR'S CORNER

The two detector concepts for the ILC

Barry Barish | 10 May 2012



The push-pull concept as illustrated from the CERN ARUP report, considering the scheme for both CLIC and ILC



The push-pull interaction region layout from the US study, including surface support buildings

Since the inception of the ILC design effort, we have been developing the concepts for detectors to do the science as an integral part of our work. The interactions between the accelerator and the detectors are complex and demanding. For that reason, we have a group of accelerator and detector experts working together on machine-detector interface (MDI) issues. The ILC physics programme is based on building two complementary detectors that will share beam time. The value of having two detectors with different designs, technologies, collaborations and emphasis has proven to be a very effective way to exploit the science, as evidenced through three generations of colliders.

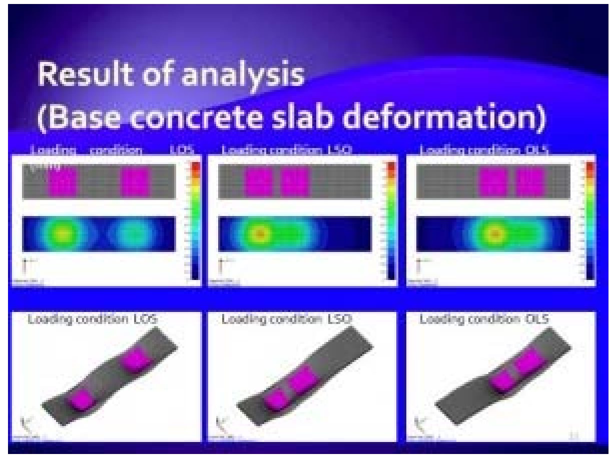
In the ILC *Reference Design Report* (RDR), chapter 8 of the detector volume very effectively outlines the arguments for having two detectors. To quote the introduction to that chapter: *"The ILC's scientific productivity will be optimised with two complementary detectors operated by independent international collaborations, time-sharing the luminosity. This will ensure the greatest yield of science, guarantee that discoveries can be confirmed and precision results can be cross-checked, provide the efficiency of operations, reliability, and insurance against mishap demanded for a project of this magnitude, and enable the broadest support and participation in the ILC's scientific programme."* The arguments for planning for two detectors are further discussed in the chapter.

However, in carrying out the early design work, it soon became apparent that designing two independent beam lines that alternately share the beam would be an expensive proposition. The problem is that the beam delivery system for the ILC is in itself a long, complex and demanding system and therefore the cost of building two such systems was forbidding. As a result, in the RDR, we proposed using a push-pull concept to cost-effectively share the beam between two detectors. Previous detectors have been built such that they can be moved on and off the beamline for servicing and upgrades, but the demands were far less than for the ILC, where we want to be able to change between the detectors on relatively short time scales and with little down time. At the time of the RDR, we were able to determine that there appeared to be no show stoppers in this scheme for the RDR, but were not able to develop a design that could accommodate the differences between detectors and meet the other ambitious requirements.

For the *Technical Design Report*, we undertook to carry out engineering designs, and for rather different sites. Now we have completed concepts to accommodate two detectors on a common platform, and have defined access and staging areas and to meet the other demanding technical requirements. It is also interesting that the Compact Linear Collider (CLIC) Study has adopted the push-pull system as well, with some specific differences to meet their more severe requirements for the stability of the final focus.

The CERN ARUP (a civil engineering consultant company) study concluded that the displacement limits of plus or minus 2 millimetres can be achieved by moving ILD on a 2.2-metre slab and SiD on a 3.8-metre slab, both with pads or rollers. They recommend future work on the movement system and an evaluation of the slab final positioning systems. Their study of the overall cavern performance under load in the CERN geology is somewhat marginal and depends on the detailed geology, *in situ* stresses and the construction sequence.

We are now reviewing the facility costs for the ILC push-pull designs, in order to ensure that we maintain the same cost consciousness for these facilities as we are for the rest of the ILC complex. Overall, however, we have established the reality of employing a push-pull system for ILC (and CLIC) and have identified the issues needing further study.



A study of the concrete slab deformation under the detectors in the Japanese interaction region study

CFS | ILC BASELINE | INTERACTION REGION | PUSH-PULL

Copyright © 2012 ILC GDE
Printed from http://newsline.linearcollider.org