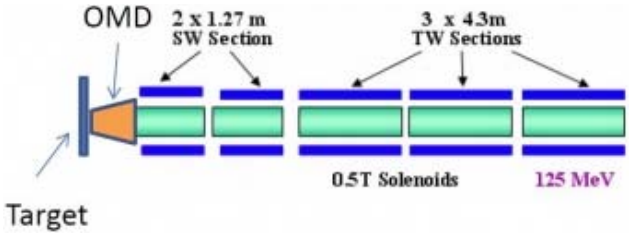
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DIRECTOR'S CORNER

Decisions, decisions, decisions

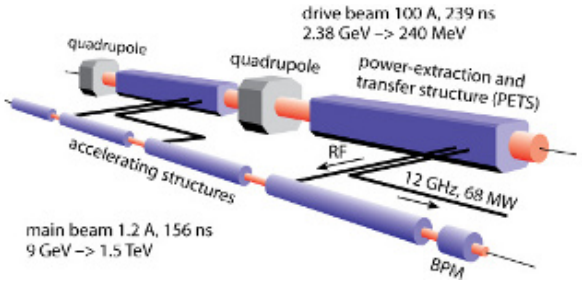
by Barry Barish



In just over one year we plan to produce the final Global Design Effort deliverable, a *Technical Design Report* for the ILC. We have made a set of important improvements in the design over the past year that will result in an ILC design that is more optimised for cost, performance and risk, and have recently hammered out a large number of smaller technical decisions at the Baseline Technical Review at DESY.

AROUND THE WORLD

From iSGTW: New accelerators, now just a CLIC away



The Compact Linear Collider (CLIC) team at CERN are investigating the potential of a new kind of particle accelerator, and to help them they are simulating their designs using grid resources, such the UK computing grid for particle physics, GridPP. They build a customised version of the DIRAC system, called ILCDirac, a grid environment for both CLIC and similar experiments which is aimed at benefitting the entire linear collider community.

Read the full article in *International Science Grid This Week*
This is an edited version of an article that first appeared on the GridPP website

FEATURE

Successful slamming with music and the ILC

Germany celebrates “Weltmaschine” LHC

by Barbara Warmbein



In a nationwide “Weltmaschine day” to celebrate the second anniversary of collisions in the Large Hadron Collider, universities and institutes all over Germany not only presented the latest results from the LHC to crowded lecture halls, but also showed the fun side of physics in slams and exhibits. A slam about the ILC came first at DESY in Hamburg.

IMAGE OF THE WEEK



“Hey Granny, what is superconductivity?”

Image: Lison Bernet

Granny superconductivity turns 100 this year! Learn more about “her” in the French LHC comics (*BD du LHC*) with Episode 1: story of a discovery and Episode 2: Gloriaaaa Conductivitaeeee, the quantum wave.

IN THE NEWS

from ***DESY***
28 November 2011
DESY engages in Belle II
On 18 November, the laying of the foundation stone for the SuperKEKB accelerator took place at the Japanese accelerator laboratory KEK in Tsukuba. This accelerator with the corresponding particle detector Belle II will become a so-called Super-B-factory.

from ***The New York Times***
28 November 2011
How Do Eminent Physicists Tackle Higgs Boson? With Chocolate
…since Dr. Wilczek had a compelling theoretical argument on his side, he was happy to give her odds of 10 to 1. If the L.H.C. finds the Higgs boson with a mass below 150 GeV, he wins 10 Nobel chocolate coins (the pinnacle of Hanukkah gelt); if not, Dr. Conrad wins 100.

from ***Reuters***
24 November 2011
Search narrowed for Higgs: does it exist?
The 21-nation CERN’s ruling Council meets from December 12 to December 16 and any concrete sign of the Higgs – whose existence was postulated four decades ago by British scientist Peter Higgs – would be reported during that session.

from ***ScienceNOW***
22 November 2011
Cosmic Antimatter Excess Confirmed
When the PAMELA team saw a spike in the ratio of positrons to the more abundant electrons over a particular slice of the energy spectrum, some physicists got excited.

CALENDAR

UPCOMING EVENTS

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

BLOGLINE

27 November 2011
Basic Space (Scientific American)
Why the Higgs Boson Matters

PREPRINTS

ARXIV PREPRINTS

1111.6155
Associated production of a photon with dark matter pair at the ILC within the Littlest Higgs model with T-parity

1111.5834
Production of gamma rays by pulsed laser beam Compton scattering off GeV-electrons using a non-planar four-mirror optical cavity

1111.5832
Testing the Higgs model with triplet fields at the ILC

1111.5630
First test of a power-pulsed electronics system on a GRPC detector in a 3-Tesla magnetic field

1111.5199
Luminometer for the future International Linear Collider – simulation and beam test results

1111.5173
Anomalous Triple Gauge Boson Couplings in $e^{-}e^{+} \rightarrow γ γ$ for Non Commutative Standard Model

1111.5132
Operational Experience and First Results with a Highly Granular Tungsten Analog Hadron Calorimeter

1111.4952
Analysis of the NMSSM Higgs Boson Masses at One-Loop Level

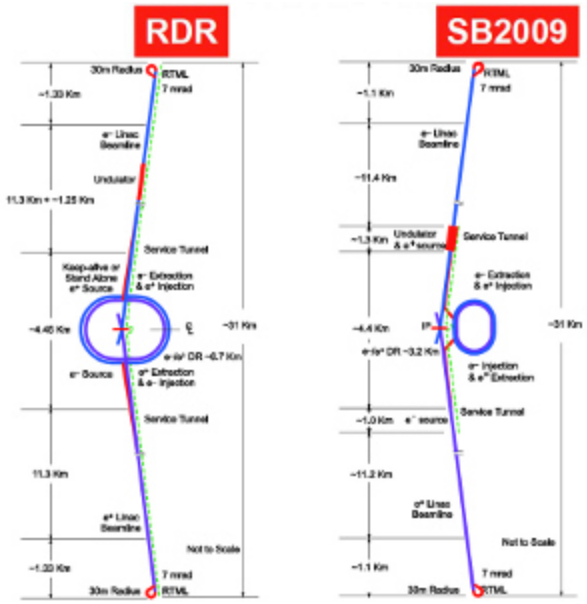
1111.4519
Spread Supersymmetry

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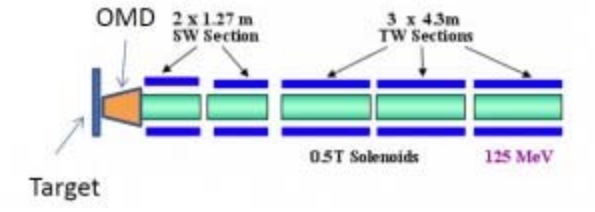
DIRECTOR'S CORNER

Decisions, decisions, decisions

Barry Barish | 1 December 2011



Evolution of the baseline design from the RDR to TDR



One important decision at the DESY BTR was to retain a flux concentrator in the baseline for the positron source

In *ILC NewsLine* last week, Nick Walker wrote a guest Director's Corner where he outlined the steps to the *Technical Design Report* (TDR) and Barbara Warmbein wrote a feature article summarising some highlights of the Baseline Technical Review (BTR) meeting at DESY. Today, I write a third article on the same basic subject of how to get from here to there, there being the TDR.

Our overall programme has had two main thrusts since we completed the ILC reference design in 2007: first, completing the key R&D technical demonstrations that are needed to prove technical viability of the ILC; and second, evolving the ILC design toward one optimised for cost, performance and risk. Today, I address the latter topic, and in particular, the multitude of remaining technical decisions that are needed to completely define the TDR baseline design.

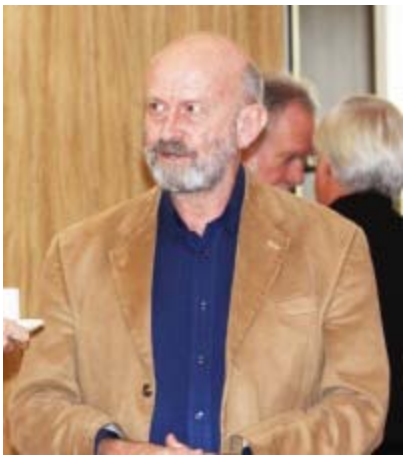
The ILC *Reference Design Report* (RDR) was completed in 2007. It presents a complete concept for a linear collider that could achieve the physics performance goals set out by the International Linear Collider Steering Committee. The next phase of our work is directed towards producing a *Technical Design Report* that can be the basis of government approvals and a final engineering design.

In late 2009, the ILC project managers (Marc Ross, Nick Walker and Akira Yamamoto) made a 'top-down' proposal for a set of changes to the RDR baseline design aimed at making significant cost savings for the TDR without markedly reducing performance. The underlying motivation was to find areas to reduce costs in order to compensate inevitable cost growth in other areas. Too many large projects have been plagued by large cost increases following initial design and costing. As a result, we have been strongly motivated to avoid that problem by being particularly diligent about containing cost growth since the RDR. One result has been the significant changes we have made to the baseline design.

Evaluating the proposed major changes to the baseline has been the focus of much of our efforts over the past two years. A process involving workshops, reviews and finally formal decisions by the Global Design Effort (GDE) director resulted in defining the average gradient and support of gradient spread; changing to a single main linac tunnel and working on associated high-level radiofrequency power solutions; reducing the beam power parameter set, including reducing the size of the damping rings; and relocating the positron source to the central campus, including provisions for low-energy running. Following completion of the process of evaluating major changes we have moved on to evaluating the multitude of other final design decisions needed to

completely define the baseline for the TDR.

One example of such a decision that was made at the BTR at DESY was to retain a flux concentrator for positrons in the TDR baseline rather than adopt a more conservative quarter-wave transformer magnet. However, the flux concentrator will have a more realistic field of 3.2 teslas (T) compared to the original proposed goal of 4 T. Simulations have indicated that the associated loss of capture efficiency will be only a few percent. In the end, the risks in this approach were deemed acceptable, given the approximate factor of two increase in capture efficiency. This decision also supports continuing the ongoing R&D programme and prototypes tests aimed at demonstrating proof of principle by the end of the Technical Design Phase.



Andy White (University of Texas at Arlington) was one of the 'stakeholder' representatives from the ILC detector community at the DESY Baseline Technical Review meeting. Image: GDE

The general process for making the remaining decisions to completely define the TDR baseline is focussed on four Baseline Technical Review meetings. The first of these, in July, dealt with the damping rings. The second of these meetings, held in October at DESY, involved the electron source, positron source, ring-to-main-linac optics, including bunch compressors, the beam delivery system and machine-detector interfaces and finally central region integration. There were many decisions and actions addressed at this meeting.

As Warmbein's article points out, one outcome of the DESY BTR meeting was a "decision to opt for a two-stage bunch compressor rather than a single-stage one." Interestingly, this particular choice represents a success of our process and went against the project managers' proposal to adopt a single-stage bunch compressor with a compression ratio of 20. Nick Walker, project manager for the European region, commented as follows regarding this decision:



A pensive project manager, Nick Walker (DESY) watches presentations at the DESY Baseline Technical Review. Image: GDE

> The primary arguments were based on an already-accepted reduction in the damping ring bunch length from 9 mm to 6 mm and an estimated cost saving of about 0.5% of the project costs. However, the participants at DESY felt that the two-stage compressor affords greater flexibility at the interaction point parameters than the single stage, allowing a higher maximum compression ratio of up to 40 (resulting in a bunch length of roughly 0.15 mm), albeit at the cost of a larger uncorrelated energy spread. The reported benefit of additional flexibility in bunch length was considered to outweigh the marginal cost saving associated with the single-stage compressor. With this change, beam parameter sets including the 'low-bunch charge' parameter set presented at BAW2 in January 2011 are in principle possible but, importantly, were neither endorsed nor adopted.

The process of evaluating the proposed changes has been a long and rigourous one, and two more Baseline Technical Reviews still remain for early 2012. However, it is clear that the GDE project managers deserve the credit for taking the lead, proposing a specific set of changes and leading the often difficult process of including all stakeholders, convincing review committees and colleagues and deciding on each change or detailed specifications. They have done a terrific job, and now we are in a good position to produce a TDR – a big step toward realising the ILC.

BASELINE DESIGN | BASELINE TECHNICAL REVIEW | BTR | TDR

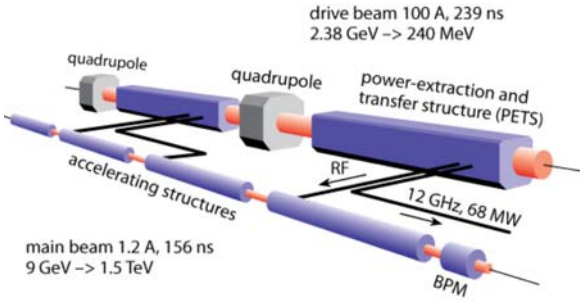
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New accelerators, now just a CLIC away

FEATURE | NOVEMBER 23, 2011 | BY NEASAN O'NEILL

In high energy physics bigger is usually better. Now a team at CERN in Geneva, Switzerland, has decided to look at different instead of big. The Compact LInear Collider (CLIC) team are investigating the potential of a new kind of particle accelerator, and to help them they are simulating their designs using grid resources, such the UK computing grid for particle physics, GridPP.

Accelerators can be split into two broad categories, linear and circular. The circular ones are known as discovery machines, the experiments where new physics/particles are seen, while the linear machines are about accuracy and really nailing down specific properties and information.



General design of CLIC. Image courtesy CLIC.

The 27 kilometer-long Large Hadron Collider at CERN is probably the best known of the discovery machines and CLIC is being designed to complement it (and others) by allowing researchers to flesh out the discoveries made and providing the detail needed for future discoveries/experiments.

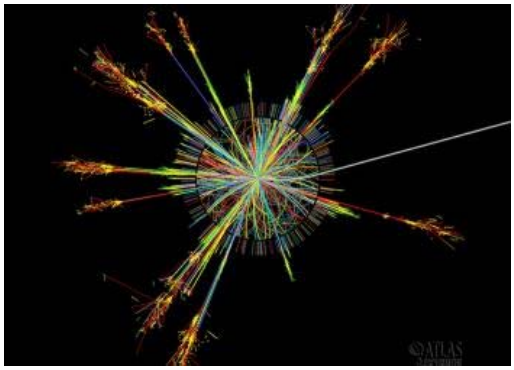
The general design of CLIC is well understood; it will use electrons and positrons (identical to the electron in all respects but with a positive charge) and operate over a range of energies. However, using current methods to accelerate particles, this would require a machine hundreds of kilometres long, but CLIC is designed to be a 'mere' 50km.

One way the researchers will achieve this reduction in length is by using two beam pipes to move the particles from low to high energies. The two beam pipes are not the only innovation; CLIC plans to have two detectors that will alternate between taking data. They will move in and out of the beam as needed, so when one detector is in the beam, the other one is in a parked position.

"The research behind these detectors intends to be as generic as possible, having these requirements in mind really helps to push the envelope of what is possible today and provides ample opportunity for further detector research and development," said Jan Strube, one of the team members working on the CLIC detectors. "However we needed computer simulations to test them. We investigated how well they carried out a set of six physics measurements that would look at different aspects of their designs. This was not a trivial task and we found that the necessary resources of CPU time and storage were only available on the grid."

It fell to Stephane Poss, at CERN, to sort out how they could get up and running on the grid. "Running our simulations was not just computationally intensive but we were also going to be shifting around a large number of files so it was the obvious solution for us. I had used the grid before and was familiar with the DIRAC system, so that was the best starting point. The developers were very helpful and its modular nature made it relatively easy to customise for us. Early on I decided that any work I did should benefit the entire Linear Collider community so after six months I had built ILCDirac, a grid environment for both CLIC and similar experiments."

By December last year the team were ready to start using the grid on a large scale. Having been accepted into the ILC virtual organisation they had access to a wide range of resources across the grid. They started relatively slowly, but by mid-July they were able to ramp up their usage and in the last 10 months they have used five million hours of CPU time, with the UK GridPP being the largest single national contributor, providing 34%.



Particle collision in one of the detectors in the LHC, ATLAS. Image courtesy ATLAS/CERN.

The grid-enabled studies were used extensively in CLIC's second design report, which was finished in September. This was presented to the community in October and the team are looking for signatures of support from them. For now though they are considering some additional physics analyses to be used in a third report but they will not be as in-depth as the work already done. The plan is to submit this third report in mid-2012, and it will contain the final technical solutions and recommendations for building a CLIC experiment.

"CLIC is not the only linear collider project on the table. The International Linear Collider is also looking in a similar area but it is important for the community to have options," said Strube.

"There is still no clear consensus in the community about which of the two machines is the one we should build, but studies such as the ones that we have done using the grid can help define the benefits and differences of each."

The 3rd CLIC report will also be used in an update to the European Strategy for Particle Physics, which will be updated in spring 2013.

This is an edited version of an article that first appeared on the GridPP website.

FEATURE

Successful slamming with music and the ILC

Germany celebrates “Weltmaschine” LHC

Barbara Warmbein | 1 December 2011



The audience is the jury at every science slam, including last week's at DESY in Hamburg. Image: DESY

If you ever take part in a science slam and really, really want to come first, here’s a tip: play music on stage. It worked when Brian Foster played the violin to slam about hidden dimensions back in March and it worked when LHC physicist Klaus Desch from Bonn University in Germany used a piano to explain particle acceleration at a physics slam last week. Exhibitions, lectures, masterclasses, competitions and of course and science slams in 15 places all over Germany celebrated the second anniversary of collisions in the Large Hadron Collider (LHC) on 23 November, the day officially declared “Weltmaschine day” (the Germans like to refer to the LHC as the world machine).



Weltmaschine slammers: Karsten Buesser, Marc Wenskat, Ingrid Gregor and Karsten Gadow. Image: DESY

At DESY in Hamburg, four scientists competed for the title of best slammer, but none of them was bold enough to get out their recorder and play a physics tune. So what was the recipe for success there? The ILC, it seems: Marc Wenskat’s show on “cool accelerators or the connection between car crashes and particle physics” had the audience shouting for an encore. Instead of live music, he used a video of a playground experiment gone wrong to explain the principle of a ring accelerator and a picture of a car crash (where an airplane is created that then decays into several VW beetles and a couple of Smart cars) to illustrate the work of a particle physicist analysing a collision.

ILC scientist Ingrid Gregor had the audience dreaming of sandy beaches before she made the link to silicon detectors, ILC machine detector interface specialist Karsten Buesser played traffic warden for speeding neutrinos and Karsten Gadow explained the wonders of pet scanning, stopping short of a live endoscopy. Earlier in the day, theorist Gudrid Moortgat-Pick had philosophised about precision in physics in DESY’s popular science café.



"Weltmaschine" day celebrated the second anniversary of collisions in the LHC with exhibitions, masterclasses, lectures and slams. Image: DESY

All evening events across Germany kicked off with a video feed from CERN where Director General Rolf Heuer presented the latest results from the LHC and wished all locations a fun evening. During the day, students had taken part in particle physics masterclasses organised by the educational network Netzwerk Teilchenwelt, which also named the winner of its video competition “(IN)VISIBLE” – watch the student videos here.

Full lecture halls and the numbers of visitors in the exhibitions in Bonn and Munich showed that particle physics is a popular topic at the moment. With the Higgs lurking around the corner, it is likely to stay that way for a while. “This is the end of my talk,” concluded Wenskat on his last-but-one slide, “but it’s the beginning of a new era!”

DESY | LHC | SCIENCE SLAM | WELTMASCHINE

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