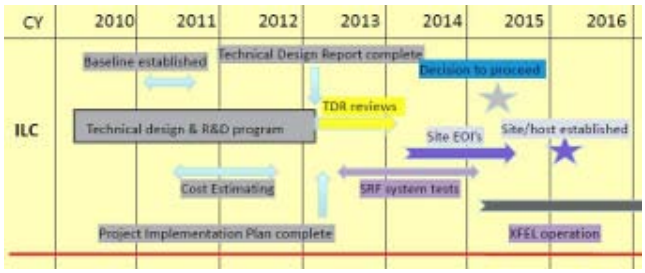
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DIRECTOR'S CORNER

GDE position paper on post-TDR

by Barry Barish



In anticipation of completing the Global Design Effort's final deliverable, the *Technical Design Report*, by the end of 2012, serious discussions are underway as to the next steps and what will follow. The International Linear Collider Steering Committee (ILCSC) is taking primary responsibility for creating a plan. As part of the process, the GDE Executive Committee submitted a position paper to ILCSC for its meeting in Mumbai, India in August. I share our input with our readers today.

AROUND THE WORLD

Globetrotters made of niobium

Accelerator modules for the European XFEL are international

by Ute Wilhelmsen (DESY)



The European XFEL X-ray laser in Hamburg will use accelerator modules of the newest generation. These high-tech devices are operated using superconducting technology at temperatures similar to those in outer space. The concept was developed and brought to practical application by the international TESLA collaboration, led by DESY.

FEATURE

CERN balances linear collider studies

At CERN, gradually formed cooperation between CLIC and the ILC is the way to go

by Leah Hesla



Steinar Stapnes has assumed the title of CERN's Linear Collider Study Leader, a newly configured position that acknowledges a call for cooperation between the ILC and the laboratory's well established Compact Linear Collider study. His new post requires him to perform a balancing act that involves two collider concepts, roughly a hundred researchers and a finite number of Swiss francs.

VIDEO OF THE WEEK



ICFA leaders discuss the ILC

CERN Director General Rolf Heuer, Fermilab Director Pier Oddone and KEK Director General Atsuto Suzuki discuss the state of high-energy physics at the Geneva Press Club's press conference of the International Committee on Future Accelerators.

The lab directors begin directly addressing the press at 6'44.

IN THE NEWS

from ***TechNewsWorld***
10 October 2011
Physicists: If There Is a God Particle, We'll Find It Soon
Some of the world's foremost particle physicists say they're closing in on proving or disproving whether the Higgs boson exists, and they think they'll have an answer within 12 months.

from ***Nature***
10 October 2011
SuperB particle-accelerator project launches
The SuperB factory, a particle accelerator to be built on the campus of the University of Rome Tor Vergata over the next six years, was officially launched on Friday. But the project faces uncertain funding and competition from a Japanese project.

from ***International Business Times***
10 October 2011
New Particle Smasher to be Built in "Science City"
A new "science city" may soon emerge with the creation of the International Linear Collider, a new multi-billion dollar particle smasher.

from ***swissinfo.ch***
6 October 2011
Scientists discuss Next Big Thing in physics
"We are moving ahead on the research and development in order to be ready when we find something at the LHC," Heuer told journalists. "The ILC has a more limited energy range than the CLIC but is more mature."

from ***Brookhaven Today***
30 September 2011
Physics Phoenix: Plotting the Journey of Muon g – 2
A haze of dust hangs in the air above Polly and a handful of other physicists and engineers who've gathered together to help resurrect the $20-million machine by transporting it hundreds of miles to Fermi National Accelerator Laboratory in Illinois.

CALENDAR

UPCOMING EVENTS

13th International Conference On Accelerator And Large Experimental Physics Control Systems (ICALEPCS 2011)
Grenoble, France
10- 14 October 2011

50th ICFA Advanced Beam Dynamics Workshop On Energy Recovery Linacs (ERL 2011)
KEK, Tsukuba, Japan
16- 21 October 2011

2011 Low-Level Radio Frequency Workshop (LLRF 2011)
DESY, Hamburg, Germany
17- 20 October 2011

2011 IEEE Nuclear Science Symposium and Medical Imaging Conference
Valencia, Spain
23- 29 October 2011

ILC Source/RTML/BDS+MDI Technical Baseline Review
DESY, Hamburg, Germany
24- 27 October 2011

UPCOMING SCHOOLS

Sixth International Accelerator School for Linear Colliders
Pacific Grove, California, USA
06- 17 November 2011

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1110.2368
The fully differential decay rate of a Higgs boson to bottom-quarks at NNLO in QCD

1110.2121
Development of Particle Flow Calorimetry

1110.1450
A conventional positron source for International Linear Collider

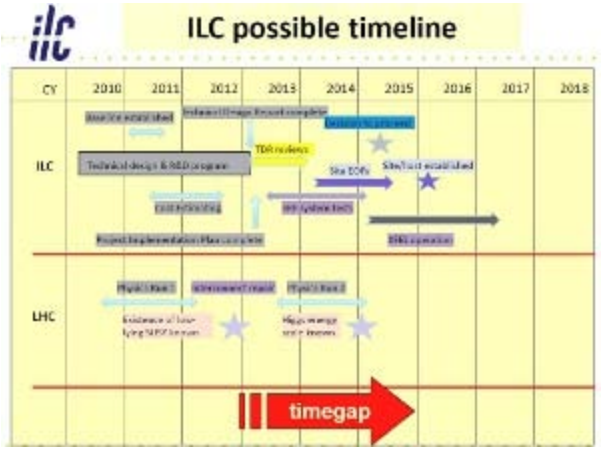
1110.1213
Hom and FP Coupler Design for the NLSF High Gradient SC Cavity

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DIRECTOR'S CORNER

GDE position paper on post-TDR

Barry Barish | 13 October 2011



Timeline projection for a linear collider programme beyond the fulfillment of the GDE mandate

The Global Design Effort (GDE) will complete the final deliverable in our mandate with the completion of the *Technical Design Report* (TDR). We intend to submit the TDR at the end of 2012, and with reviews and approval of the report, including required revisions, we expect our present task to be completed by about mid-2013. As I discussed last week regarding the Large Hadron Collider results, this is expected to be too early to seriously propose a linear collider to governments. Therefore, this raises the question of what should come after the TDR.

The International Linear Collider Steering Committee (ILCSC), chaired by Jon Bagger, is taking the lead in developing a post-TDR linear collider plan. The post-TDR plan was the central topic discussed at their last meeting at the Lepton Photon 2011 conference in Mumbai, India in August.

As input for that process, the GDE Executive Committee created a short position paper in which we discuss proposed goals of a continuing ILC R&D programme that will continue to move the ILC forward, as well as organisational issues for the successor to the GDE, addressing what primary GDE assets should be preserved and what areas could be improved. I will report on the outcomes of the ILCSC plan in this column as they emerge. In the meantime, I think it is fair to say that all agree that a GDE-like subtask (with a substantial overlap of key GDE people) will be part of the new organisational structure that will carry out the continuation of the work towards a linear collider.

I share our GDE position paper in its entirety below:

24-Aug-2011

To: Jon Bagger, ILCSC Chair

From: Barry Barish for the GDE Executive Committee

Subject: GDE position paper on replacing the GDE management in the post-2012 ILC era

With the publication of the Technical Design Report in 2012, the ILC will be ready to proceed with engineering design and project preparation tasks for the construction of a 500 GeV center-of-mass energy linear collider. In addition, the design presented will have the ability to meet the physics requirements at lower energies, and the report will address the options for increasing the energy reach of the ILC cost effectively toward 1 TeV. Finally, we will present an up to date costing and a discussion of planning for project implementation.

The next step toward ILC realization will then belong to the global high energy physics community who will need to recommend construction, informed by LHC results. Although the excellent performance of the LHC and detectors are very encouraging, time will be required to prepare the recommendations, and to await government actions. During this period, the global ILC GDE core accelerator and technology team needs to remain intact and continue development of the project in

collaboration with the physics community which will propose the linear collider. We propose this interim period be for a nominal three years, by which time much should be clarified regarding whether and in what form the ILC should go forward.

During this interim period, likely to last several years, ILC-project oriented accelerator and technology R&D will continue. The joint work with CLIC will continue and should be strengthened in areas of joint interest. As it has in the past, ILC R&D will continue to benefit projects having significant technical or design overlaps, such as the European XFEL, the super B-factories, Project X, JLab and SNS upgrades, etc. The ILC project team will continue its partnership with the development efforts of these new projects, insuring that we take advantage of their results and new knowledge, and adapt them to the ILC design as needed.

With all of this in mind, the two primary missions of the post-2012 team will be:

1) Accelerator Design and Integration (with physics and detector groups)

The AD & I team mission will be to further develop the machine design, including a) incorporating results of new R and D, b) development of options for running at other energies, and c) analyzing specific siting choices.

The team objectives include evaluating and producing cost and power consumption-optimized designs for a linear collider over a range of energy and luminosity, (including a design and plan to upgrade towards 1 TeV), and to partner with the civil engineering effort to develop specific sites and to address site-specific design issues. The work may also include studies of gamma-gamma and giga-Z options.

2) Coordination of R&D on improving the performance and reducing the cost of the SCRF systems.

The R&D coordination effort will deploy the SRF linac test facilities to carry out value engineering aimed at reducing the remaining cost risk and pursuing high-gradient development for the ~1 TeV extension of ILC. The ILC SRF team will extend industrialization studies started during the TDP. As was done for the TDR, the central team will coordinate this activity worldwide with the goal of building significant fractions of the main linac components in all three regions of the world.

To coordinate the activities described above in 1) and 2) some important features of the GDE management and team will need to be preserved. These include:

- *Maintaining the 'core competencies' that have been developed in the key areas of the ILC machine design and R&D programs. This is absolutely essential; these individuals must remain actively involved, in order to maintain and update a 'live' design for the ILC and to move the program forward.*
- *An ILC director will be essential for the next phase, in order to provide overall intellectual and project leadership for the ongoing efforts, and to represent the interests of the ILC programs worldwide. Whether there should be a single director for both the accelerator and detector programs depends on how the two activities are brought closer together.*
- *The equivalent of the GDE Regional Directors will be necessary. The role of the Regional Directors has been different in the three regions for the GDE, but in general, this coordination role needs to be strengthened as we foresee moving toward a global project. Duties will depend on the region, but include resource coordination, helping to reconcile laboratories' and ILC's priorities and programs within each participating laboratory, as well as organizing regional and regionally hosted meetings etc.*
- *The equivalent of the Project Managers or their function will be necessary, in order to coordinate the ongoing technical program described above, following global priorities and maintaining coherence in the distributed efforts.*
- *Functionally, the GDE management has been able to effectively lead the ILC design and R&D effort, make technical decisions and set priorities that have been accepted worldwide, leading to a unified global effort and design. It is essential that this ability be maintained in a global ILC project.*
- *Functionally, the GDE management has been able to organize the ILC efforts with sufficient autonomy from the laboratory and agency programs and priorities to move the effort forward, meet deadlines, etc, while at the same time understanding and working with the labs and their priorities. A reasonable level of autonomy must be preserved to insure the program can move forward.*
- *The small GDE common fund has enabled flexibility to run the program, supporting some global efforts like*

costing, electronic data bases, publications, outreach, etc, as well as to mitigate funding problems that develop locally, and to support international committees, etc. The present level for the GDE is ~ 1 M$/yr; it would be prudent to envisage maintaining this at the current level until it is clearer how future ILC effort will be organized and structured.

Experience with the GDE organization during the past five years has indicated some weaknesses which may be able to be remedied in a future organization. These include:

- *The "virtual" nature of the GDE, while essential to be able to make use of the expertise distributed around the world, results in a certain degree of inefficiency. Drawing on the experience of international corporations with world-wide distributed activities, it might be possible to design an organization specifically structured to minimize this inefficiency. In contrast, we believe that during the interim period it may be too early to create a host laboratory, as desirable as that will be as soon as the ILC nears construction. We are also concerned that the post-2012 management retain sufficient autonomy from the host laboratory priorities to carry out its global responsibility.*
- *The independent experimental and accelerator organizations for ILC design and R&D has caused continual issues, despite the many efforts to improve communications, hold joint meetings, etc. At some level, these efforts should be better integrated.*
- *The independence of ILC and CLIC programs (although improving) has caused problems and duplication of effort. For the next period, it will also make comparisons difficult. Further steps to bring these efforts closer together will benefit the worldwide efforts toward a linear collider.*
- *The general lack of access to CERN resources for the global ILC/GDE efforts has been a difficulty, especially where specialized expertise and experience are needed, and more specifically, it has hampered the European contributions toward the ILC. A further integration of CLIC and ILC efforts under a Linear Collider heading will help significantly in this respect, but CERN support will be important also in very specific ILC technology areas and implementation studies. Involving CERN more during the interim stage will be crucial to a viable European role.*
- *In managing and coordinating the technical efforts, the GDE has relied on informal agreements with HEP Laboratories, even on major R&D programs. Moving toward a more formal work package system in the next period would facilitate setting and maintaining priorities and meeting critical schedules.*

The final deliverable for the GDE will be the TDR, which we plan to complete at the end of 2012. The team will need to remain in place through a period following that for two main reasons: 1) to represent the TDR design for independent (and possibly agency) reviews of the technical design, as well as for cost reviews and to facilitate translations to local costing systems. Following these reviews, the GDE will need to finalize the TDR; and 2) a reasonable overlap period with the new interim ILC organization will be required, while the new organization becomes established and can assume control of the program. We believe a period of 6-12 months following TDR submission will be required before the transition is completed.

Overall, we believe an ongoing and viable follow-on ILC program can be achieved with reduced resources and a new organization having the above functionality; however it will continue to be very difficult to substantially update and improve the design without increasing the resources, especially engineering resources. In other words, it will require more, not less, resources to move the project closer to being construction ready. It is essential that the post-2012 organization be created and become functional as soon as possible following the submission of the TDR, in order to not lose momentum toward the ILC.

FUTURE | ***GDE*** | ***ILCSC*** | ***TDR***

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AROUND THE WORLD

Globetrotters made of niobium

Accelerator modules for the European XFEL are international

Ute Wilhelmsen (DESY) | 13 October 2011



DESY's Building 28 is the place where many superconducting ILC-style accelerator modules were born. The construction and assembly of the 101 modules for the European XFEL accelerator is an international endeavour, so DESY scientists and technicians have formed a mobile training team that educates people about the firms and institutes involved in giving birth to accelerator modules. In the picture the technicians couple the string of eight niobium cavities with the so-called cold mass, which carries the string. After the heat shields are mounted, a piece of high-tech art is mounted in the familiar yellow tanks. Image: DESY

The European XFEL X-ray laser in Hamburg, Germany, will use accelerator modules of the newest generation. These high-tech devices are operated using superconducting technology at temperatures similar to those in outer space. The concept was developed and brought to practical application by the international TESLA collaboration, led by DESY.

Meanwhile, the construction of the accelerator complex for the European XFEL is in full swing and the participating institutes and companies are preparing the series production of the 101 modules, each of which contains eight niobium cavities. The manufacture and assembly of these high-tech components are extremely complex. The highest precision and quality are required to ensure that the electron beam can later be accelerated to the targeted energy of 17.5 gigaelectronvolts.

DESY is coordinating the international consortium of institutes that participate in the construction of the European XFEL accelerator. DESY experts impart their knowledge to optimise the production of accelerator modules at the various manufacturing sites all over the world. Thus one of the already-finished modules has recently been completely taken apart to be reassembled again at CEA/Irfu in Saclay, France, as part of a training unit. All the modules for the European XFEL will later be assembled, measured and adjusted at Irfu – a highly complicated affair for which a simple blueprint is insufficient and that requires a successful technology transfer.

If the assembly is successful, the module will be transported back to DESY where it will have to pass a series of tests in the hall of the specially erected Accelerator Module Test Facility. The AMTF hall is where all the resonators and accelerator modules from the series production will later be checked under operating conditions before being installed in the European XFEL tunnel. Polish experts are responsible for these tests – their work is one of the so-called in-kind contributions by the partners participating in the European XFEL. Here too, the experience of DESY is being passed on as part of the test of the first modules.

Overall, seven institutes from different countries are involved in the production of the accelerator modules. Besides DESY, these are CEA/Irfu, CNRS/LAL in Orsay, France, INFN Milano in Italy, IPJ Swierk in Poland, CIEMAT Madrid in Spain and BINP Novosibirsk in Russia. The rest of the 16 institutions of the international Accelerator Consortium participate in the remaining accelerator sections.

Before a module is finally in place in the accelerator tunnel, it goes through a long journey. This begins with the niobium sheets, which are provided by manufacturers from Austria, China and Japan. From these sheets, the companies Research Instruments in Bergisch-Gladbach, Germany, and Zanon in Italy will form the superconducting accelerating structures, the cavities. The series delivery is to start in early summer 2012. Up to eight cavities per week will then be delivered to DESY and thoroughly tested

before travelling on to Irfu where the modules are assembled. These yellow tubes are manufactured in Italy and China and act like giant thermos bottles, shielding the cold of space inside from the outside air. In addition to the cavities, they will also contain quadrupole magnets from Spain and radiofrequency couplers from France. The finished modules will then travel back to DESY to be tested in the AMTF hall and prepared for final installation in the accelerator tunnel.

During the production phase, one module per week will find its place in the tunnel – it will thus take two years to install all 101 modules of the accelerator. What now arises between Hamburg-Bahrenfeld and Schenefeld is not only the “light of the future,” but also a real prime example of European and international cooperation.

DESY | XFEL

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FEATURE

CERN balances linear collider studies

At CERN, gradually formed cooperation between CLIC and the ILC is the way to go

Leah Hesla | 13 October 2011



Steinar Stapnes gives a talk at LCWS11. Image: Perrine Royole-Degieux

The forces behind the two most mature proposals for a next-generation collider, the International Linear Collider (ILC) and the Compact Linear Collider (CLIC) study, have been steadily coming together, with scientists from both communities sharing ideas and information across the technology divide. In at least nominal support of cooperation between the two, CERN in Switzerland, where most CLIC research takes place, recently converted the project-specific position of CLIC Study Leader to the concept-based Linear Collider Study Leader.

The scientist who now holds this position, Steinar Stapnes, is charged with making the linear collider a viable option for CERN's future, one that could include either CLIC or the ILC. The transition to more involve the ILC must be gradual, he said, and the redefinition of his post is a good start. Though not very much involved with superconducting radiofrequency (SRF) technology, where ILC researchers have made significant advances, CERN participates in many aspects of ILC-related studies through combined working groups, site studies and detector and physics activities.

"Now, over the next year, we will have a new Linear Collider organisation that provides a common discussion base, more than before," Stapnes said. At the end of this year, CLIC completes its *Conceptual Design Report*. After that comes the fulfillment of the ILC mission, the delivery of its *Technical Design Report* (TDR) at the end of 2012. The linear collider leaders are still discussing and deciding the shape of the post-2012 linear collider community.

"Short-term decisions involve what CERN can do to help with the TDR," he said.

CERN's inertia in linear collider research is firmly with CLIC, and so as Stapnes looks for solutions to help with ILC-related research at the Swiss laboratory, he also takes care not to undermine the work of the hundred or so researchers that invest their energies in CLIC and that are now moving into next phase of CLIC project development.

Initially the two projects' working groups will look for existing technological problems at CLIC where further investigation would benefit both colliders, whose primary difference is in the technology used to accelerate the beam. The ILC uses cold, superconducting cavities to propel particles to collision. CLIC uses warm, normal-conducting structures.

"In many cases there's the possibility of saying, 'Don't just look at the CLIC parameters, but work with ILC on a different set of parameters – think on both projects'," he said. Areas of potentially overlapping interests between both projects include damping rings, positron sources, beam delivery systems, machine-detector interface and detector and physics studies. "In practice one has to look case by case to identify where tighter collaboration and more combined activities could help, and also where groups can work constructively together."

Taking advantage of technological challenges common to both projects is a manageable way for CERN to participate in the ILC design in the short term, Stapnes said.



The second conference held jointly by ILC and CLIC collaborations was held this year in Granada, Spain.

Full integration of the two design teams in the run-up to the TDR, on the other hand, is unrealistic and not the aim of CERN's near-term linear collider programme. CLIC is a well established project at CERN, one that currently commands almost the full extent of resources for linear collider work. Stapnes is clear that CERN's resources on the ILC side are thin. Further, tapping into CERN's SRF technology R&D hasn't been a priority for a collider that uses normal conductivity. Developing an SRF programme now means subtracting resources from other programmes at the lab. Plus, one can't easily forget that the LHC remains the highest-priority project at the laboratory and its operation and gradual improvements require substantial resources.

"In the plan for CERN till 2016, there's no increase of personnel resources. You can only squeeze so hard," he said. "This can change. If there's really a clear discovery from the LHC indicating that a linear collider is the way to go, one could imagine a situation where more resources are available."

The situation is a bit different for detector research. The SiD (Silicon Detector) and ILD (International Large Detector) groups, who originally developed the models for the ILC, have for the past couple of years been involved in designing different detector versions to accommodate CLIC's particular beam structure and higher energies. In this area, cooperation is natural since the demands on the ILC and CLIC detectors are not fundamentally different.

"For that part, in extremely close collaboration, we're relying on a lot of the work for ILC's SiD and ILD concepts for detectors," Stapnes said.

As for the accelerating machines, over the next three to five years the combined working groups between ILC and CLIC could more actively define research directions that would aid both colliders. In addition, CERN could examine how its infrastructure could facilitate cryomodule assembly, which would boost both its own SRF programme and help the ILC.

"So there are some contributions, not big, but significant contributions where CERN has a lot of expertise, and these could be studied to see how could CERN be a part of a global linear collider project and make the most effective contributions, which also benefit the ILC option more than before," Stapnes said. "It is the ambition of CERN to be an important part of a future linear collider project."

Ideally, concrete contributions will help CERN and CLIC, as well as the ILC, as much as possible, he says. "It says clearly that CERN, or Europe through CERN, is willing and interested in participating in pulling our share of such a project – whatever this share ultimately is and whenever it becomes real."

CERN | ILC-CLIC

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