

RESEARCH DIRECTOR'S REPORT

Past and future of the Worldwide Study

by Jim Brau

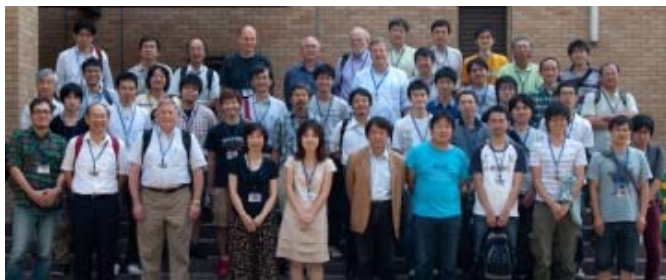


The groundwork for the Worldwide Study, a global linear collider physics and detector partnership, was laid more than ten years ago. Since then it has been a driving force for coordination and development of physics studies and detector R&D around the world.

AROUND THE WORLD

ILC detector R&D in Japan stays strong

by Rika Takahashi



During the kick-off meeting for the global R&D programme of ILC detectors in Japan, roughly 60 scientists from all over the world gathered to discuss plans towards and beyond the *Detailed Baseline Design Report* and enjoyed visiting one of the two Japanese candidate sites for the ILC in Tohoku area.

DIRECTOR'S CORNER

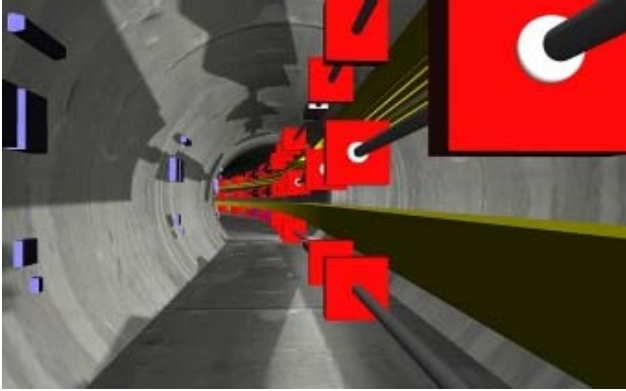
Costing the ILC *Technical Design Report*

by Barry Barish



Now that the baseline for the *Technical Design Report* has been established, the focus is on fleshing out the details of that design and optimising it for cost, risk and performance. As a result, the costing process is being initiated. The first meeting to begin the costing effort was held at Caltech in the US, immediately following the face-to-face Executive Committee meeting in July.

IMAGE OF THE WEEK



Virtual tunnel

Image: DESY

DESY's Information Management Processes Projects (IPP) group continued their design integration activities for the ILC and managed to automatically generate simple three-dimensional models from lattice files obtaining a 3-D model of the entire accelerator. Tunnel and infrastructure models can be added where available to get an early preview of the facility. More images can be seen at the [LCWS11](#) conference in Granada.

IN THE NEWS

from **The Economist**
17 September 2011

[The dark at the end of the tunnel?](#)

[The CRESST collaboration] said on September 6th that they too had data suggesting the existence of weakly interacting massive particles (WIMPs) the objects of which dark matter is hypothesised to be composed.

from **Science**
16 September 2011

[Particle Physicists' New Extreme Teams](#)

Life at the world's biggest atom smasher is an odd combination of selfless cooperation and intense competition.

from **Iwate NichiNichi**
9 September 2011

[宇宙誕生 謎に迫る ~ILCの意義学ぶ](#)

興田中学校の 年生や地域住民ら約100 人が参集、ILC の概要 や研究の意義、地域にもたらす効果などについて理解を深めた。

ANNOUNCEMENTS

François Richard gives public lecture in Granada, Spain

On Tuesday, 27 September, François Richard of LAL, Orsay will give a public lecture '[Viaje al centro de la materia](#)' (Journey to the heart of the matter) to Granada's residents. In plain language, Richard will offer fresh insight into the mysteries of the universe and the future prospects of particle physics, discussed at [LCWS11](#).

Correction

In last week's Director's Corner we stated that the LHC "shutdown will be used to fix the problems that are currently limiting the energy of the machine to 3.5 gigaelectronvolts (GeV) per beam." The correct beam energy is 3.5 teraelectronvolts per beam. *ILC NewsLine* regrets the error.

PREPRINTS

ARXIV PREPRINTS

[1109.4390](#)

Radiative decays $Z_H \rightarrow V_i Z$ ($V_i = \gamma, Z$) in little Higgs models

[1109.3387](#)

Detector Systems at CLIC

CALENDAR

UPCOMING EVENTS

[Linear Collider Workshop 2011 \(LCWS11\)](#)

Granada, Spain

26- 30 September 2011

[ICFA Beam Dynamics Mini Workshop on Low Emittance Rings 2011](#)

Heraklion, Greece

03- 05 October 2011

[13th International Conference On Accelerator And Large Experimental Physics Control Systems \(ICALEPCS 2011\)](#)

Grenoble, France

10- 14 October 2011

[ILC-HiGrade 4th Scientific Workshop](#)

LAL, Orsay, France

12 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

UPCOMING SCHOOLS

[CERN Accelerator School: Course on Accelerator Physics](#)

University of Chios, Chios, Greece

18- 30 September 2011

[View complete calendar](#)

RESEARCH DIRECTOR'S REPORT

Past and future of the Worldwide Study

Jim Brau | 22 September 2011



As we prepare for another linear collider workshop (the 13th LCWS in the [30-year series](#)) and contemplate the ILC reorganisation and next steps following the *Technical Design Report* and the *Detailed Baseline Design Report*, I have recently found myself thinking back on the history of the [Worldwide Study](#) (WWS) and the valuable role it has

played. The ILC Research Directorate assumed many of the principal roles that were carried out for so many years by the WWS and its [organising committee](#). Does the WWS still have a place? If so, what is it?

The WWS was formally launched in 1998 at the International Conference on High Energy Physics in Vancouver, Canada. The first co-chairs were Charles Baltay (Yale), Sachio Komamiya (Tokyo) and David Miller (University College London), and a regionally balanced membership with five members each from Asia, Europe, and North America joined the co-chairs on the organising committee. At that time, the LCWS series of workshops had already met in Saariselka, Finland (1991), Hawaii, US (1993) and Morioka, Japan (1995); it became the responsibility of the WWS to organise the future meetings of this series. Studies were active in three regions of the world, and the WWS became the principal mechanism to coordinate these studies. The roles for the WWS were then identified to be:

- Maintaining contact between the studies in the three regions;
- Encouraging growth of a worldwide user community, ready to participate in a linear collider programme – wherever a machine is built;
- Representing that community to the International Committee for Future Accelerators (ICFA); and
- Acting as a programme committee for the LCWS series.

The WWS organising committee would lead this effort, with interest in any future linear collider. The high-energy physics laboratory directors encouraged this new organisation.

In order to advance the detector R&D for the linear collider, in 2001 the WWS created an R&D review panel to survey efforts (projects and collaborations), assess the goals and level of support, and to identify gaps. A panel of three from each region was established and a [report](#) was written in 2002. This report helped spur the efforts and generate support. The report also took note of the difficult situation with regard to test beam facilities worldwide, and motivated increased support for facilities to meet this need in the ensuing years.

In 2002, ICFA established the International Linear Collider Steering Committee (ILCSC). The ILCSC invited the WWS to serve as the physics and detector subcommittee of the ILCSC, charging it to begin assembling a high-level parameter list to guide the efforts of the accelerator scientists and engineers. In response to the ILCSC charge, the WWS enlisted a scope and parameters panel to prepare a document. [It was delivered](#) in 2003, and guided the



early design of the linear collider. The document was updated in 2006 for the GDE and continues to define the physics requirements for the ILC.

At about this time the WWS also prepared what came to be known as the consensus document: "Understanding Matter, Energy, Space, and Time: The Case for the Linear Collider", signed by 2724 scientists and engineers, many of whom were not directly involved. The signatories had been convinced of the importance of the linear collider. The document presented the scientific case for a 500-gigaelectronvolt electron-positron linear collider, upgradeable to higher energy, with options for future investigations using alternate beam particles and enhanced beam polarisation.

The ILCSC/ICFA invited the WWS in 2004 to consider how experimental detector concepts could be developed while encouraging sub-detector R&D and promoting machine-detector interface studies. Members of the WWS organising committee held a diversity of opinions on how to proceed in responding to this invitation, creating a healthy, innovative effort to organise the path forward. This roadmap discussion became an intense topic of conversation and debate within the broader WWS as issues of detector collaborations and detector down-selection were considered.

To consider the efforts and advise on future directions, in 2005 the focus of the WWS on the detector R&D efforts was intensified with the establishment of a second R&D panel to survey the worldwide activities through a series of review meetings complete with external review panels. The reports of these review panels provided useful expert input to the various regional funding agencies decisions on R&D support.

With the formation of the Global Design Effort (GDE) in 2005, the WWS entered a new era. A vigorous worldwide accelerator R&D effort on the ILC was initiated, and the detector community felt the pressure to keep up. The GDE was planning the *Reference Design Report* (RDR), and the WWS led preparation for a companion, the *Detector Concept Report* (DCR), as well as volume 2 of the RDR, *Physics at the ILC*. The WWS community successfully produced the *Physics* volume and the DCR as companions to the RDR in 2006. At the same time, a new structure for organising the detector effort in a more formal setting was envisioned for the ILC. During this time, despite the increased focus on the ILC, the WWS organising committee maintained an interest in the Compact Linear Collider (CLIC) developments with ongoing representation of CERN on the WWS organising committee.

The WWS developed a roadmap for advancing the ILC detector effort in 2006 and 2007. The roadmap was presented to ILCSC and a discussion ensued on how to realise this plan. The concept of an ILC Research Director, advised by an International Detector Advisory Group, was invented. The ILCSC selected a search committee to recruit a Research Director. Sakue Yamada was selected, and during the period of his transition into the new role, he invited the WWS co-chairs (François Richard, Hitoshi Yamamoto, and myself) to join him as regional contacts in his ILC Research Directorate. Initially, in 2007, this was envisioned to be an interim arrangement for one year, as the co-chairs maintained separate responsibilities to the WWS. But, as the arrangement, approved by the ILCSC, has worked to Sakue's satisfaction and as he has seen no reason to revise it, it has continued and remains as initially formed. When François Richard stepped down as European WWS co-chair last year to be replaced by Juan Fuster Verdu, Sakue invited Juan to also replace François as regional contact in his ILC Research Directorate.

Through these phases and transitions, the WWS has maintained a critical role, contributing to the strength and progress toward realisation of the linear collider through efforts such as those referred to above. It has in particular provided a unifying forum for our common goals with interest in all future linear collider options.

The WWS continues to play an important, complementary role to the ILC project-oriented work of the GDE and the ILC Research Directorate, and I foresee this to be true in the reformulated, future linear collider organisation.

DETECTOR R&D | WORLDWIDE STUDY

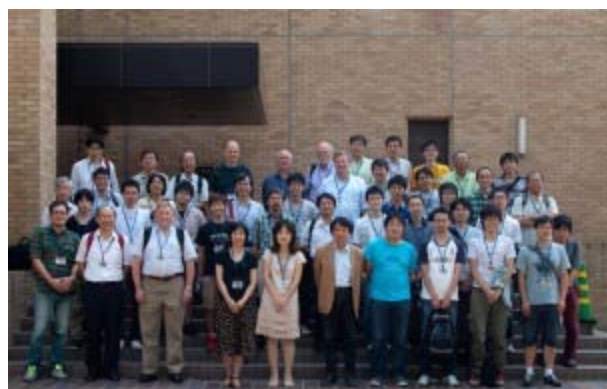
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AROUND THE WORLD

ILC detector R&D in Japan stays strong

Rika Takahashi | 22 September 2011



Attendees for the first day of the kick-off meeting for ILC detector studies. Image: Nobuko Kobayashi

From 12 to 14 September, about 60 scientists gathered at Tohoku University, Sendai, Japan, to attend the kick-off meeting for a global R&D programme of a state-of-the-art detector system for the ILC.

A large part of ILC detector R&D had been implemented with grants awarded by the Japan Society for the Promotion of Science (JSPS), an independent administrative institution that works within the framework of Japanese government policies to promote scientific advancement. JSPS also carries out its own programmes aiming for the advancement of science in all fields.

This year, Japanese scientists were awarded a new five-year JSPS grant: a grant-in-aid for a special-promoted research project entitled 'A global R&D programme of a state-of-the-art detector system for ILC',

which will cover detector activities even after the publication of the *Detailed Baseline Design Report* (DBD).

This meeting not only kicked off a Japanese research grant on ILC physics and detector studies, it was also "planned to be international and as open as possible to the world," said Hitoshi Yamamoto, chair of the meeting and Asian regional contact for the ILC research directorate. "The goal of this programme is to realise a detector system based on the particle flow algorithm, which requires detector elements with super-high granularity. We are going to accomplish this goal within international frameworks in close collaboration with our colleagues overseas."

Indeed, many scientists from overseas delivered talks during the meeting, including Jonathan Bagger, chair of the International Linear Collider Steering Committee (ILCSC), and Barry Barish, Director of the Global Design Effort (GDE). "By inviting speakers from North America and Europe to this meeting, it strengthens the position of the Japanese scientific community in general," Yamamoto said. When Bagger agreed to come to the meeting, he wrote to Yamamoto, "When travelling to Japan, I will be able to help send a signal of the importance of the Japanese ILC effort to the international community."

During two-and-a-half days of intense sessions, attendees discussed many aspects regarding ILC detector studies and heard talks from leaders of overseas ILC detector groups. "We were able to clearly see how our own efforts were positioned in the international effort. This was a good start to make our five-year plan effective towards the DBD and beyond," said Yamamoto.



Jim Brau (left), Jon Bagger (middle) and Barry Barish (right) enjoying the harvest moon with a traditional tea ceremony held at Hitoshi Yamamoto's residence near Tohoku University. Image: Nobuko Kobayashi

On the last half-day of the meeting, some of the attendees took a trip to one of the two Japanese candidate sites for the ILC, taking the opportunity of already being close to the site.

The scientists took a Shinkansen bullet train from Sendai to Ichinoseki and briefly visited Hiraizumi, the new world heritage site. After a roughly one-hour bus ride from Hiraizumi, seeing the carpet of ready-to-reap rice fields and the little apple trees, the delegation reached the green hill.

Towards the end of the excursion, Yamamoto explained to Jim Brau, regional contact for the ILC research director, where the entrance of the access tunnel to the experimental hall was expected to be. "Jim went close to the site and took a couple of pictures, and on the way back to the bus, he said to me 'OK, when do you start digging?'. I know it was just a joke, but I felt that taking a trip to one of the candidate sites enlarged our vision and made the ILC more real to us," said Yamamoto.

[DETECTOR R&D](#) | [GDE](#) | [ILCSC](#) | [JAPAN](#) | [SITING](#)

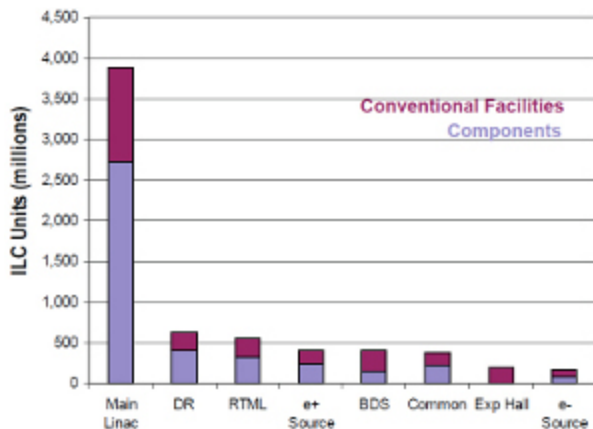
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DIRECTOR'S CORNER

Costing the ILC *Technical Design Report*

Barry Barish | 22 September 2011



The distribution of ILC subsystem value estimates for the reference design in ILC units (2007 US dollars). Note that the costs are dominated by the main linac and conventional facilities.

For a very large potential project like the ILC, costs are obviously a very big issue. Reliably costing such large projects with ambitious new technologies, in advance of having a detailed technical design and implementation plan, is a real challenge. In addition, costing is done differently in different countries, making it particularly difficult to provide costing information that can be reliably used around the world. For the ILC 2007 *Reference Design Report* (RDR), we used a so-called 'value' estimate, a scheme independent of any particular accounting system but, in principle, compatible with all of them. The VALUE methodology is becoming a standard for large international projects.

Briefly, as discussed in the ILC RDR: "*The ILC estimate consists of two important parts: VALUE (in terms of currency units) for items provided and LABOUR (in terms of person-hours or person-years), which may be provided by the collaborating laboratories and institutions, or may be purchased from industrial firms. (...)The value of a component is*

defined as the lowest reasonable estimate of the procurement cost in adequate quality, based on production costs in a major industrial nation. (...)The labour is defined as 'explicit' labour, which may be provided by the collaborating laboratories and institutions, or may be purchased from industrial firms."

The costing as produced for the RDR is a very good starting point for the new costing for the *Technical Design Report* (TDR). The first Global Design Effort (GDE) meeting to initiate the TDR costing was held at Caltech, US, immediately following a face-to-face Executive Committee meeting in July. There we discussed how to begin from the RDR value estimates and produce the most reliable updated value estimates, taking into account the changes in design, new information on component costs and some better information on how we propose to build the ILC through a global collaboration. We have built some new tools to help with the costing, which include having technical information in an electronic document management system at DESY and the development of a costing tool, called ICET.

The purpose of the Caltech costing meeting was to discuss and agree on the strategy for TDR costing. We agreed that the main focus will be on the big cost drivers, conventional facilities and superconducting radiofrequency systems in the main linac. The costing guidelines will follow those of the RDR, facilitating comparisons. The meeting covered a broad range of issues, but special emphasis was placed on conventional facilities estimating,



Wilhelm Bialowons, DESY, GDE European cost engineer, during the Caltech meeting. Image: GDE

including a case study from the recent ILC Asian siting studies, as well as a discussion by Akira Yamamoto, GDE project manager, on preparations for industrialisation of main linac components.

One interesting point of discussion involved how to compare current estimates to older RDR costs. In addition to the technical changes and new information, there has been escalation since 2007, as well as large changes in exchange rates. In addition to escalation from 2007 US dollars, at the time of the RDR in 2007, the exchange rates were 1 US dollar = 0.833 euros = 117 yen (based on average rates over 2003-2007). The exchange rates in August 2011 were 1 US dollar = 0.696 euros = 77.1 yen. These large differences have motivated us to consider how best to make the conversions from 2007. For example, the Organisation for Economic Co-operation Development produces an alternative based on a measure of relative regional purchasing power parity (PPP), which has more stability. This conversion system may be more reliable for producing technical equipment in different countries for the ILC and we are investigating whether to adopt it.



Gerry Dugan, Cornell University, GDE Americas cost engineer, during the Caltech meeting. Image: GDE

We have been very cost-conscious in evolving the ILC design and in developing our key technologies. We have tried our best to contain cost growth in the process. We use a necessary feedback system in which cost information is used to make the design more cost-effective. Over the next year as we develop the technical design and value estimate for the ILC, we will also want to make sure we have enabled the points of comparison with the Compact Linear Collider Study (CLIC) costs. I will report more on TDR costing as it develops, but we will not report any actual cost numbers until the value estimates are completed near the end of 2012.

[COST ESTIMATE](#) | [COST OPTIMISATION](#) | [RDR](#) | [TDR](#) | [TECHNICAL DESIGN REPORT](#) | [VALUE MANAGEMENT](#)

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