ilc newsline

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DIRECTOR'S CORNER

Our goals for 2012

by Barry Barish

A major accomplishment last year was the evaluation and approval of a new ILC baseline that has been more optimised for cost, performance and risk. We are now completing the design details and embarking on producing the ILC *Technical Design Report* by the end of this year.

FEATURE

Advancing superconducting accelerating technology

A report from the TESLA Technology Collaboration meeting and the ILC-GDE SCRF meeting held in China last month

by Min Zhang

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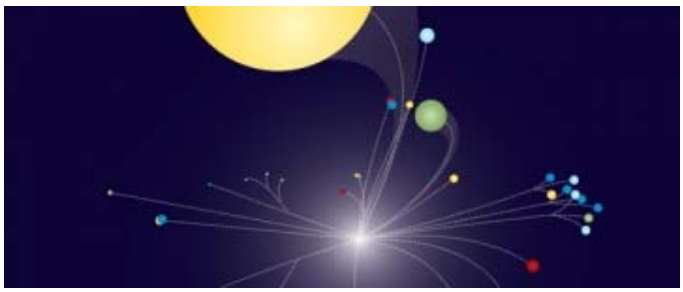
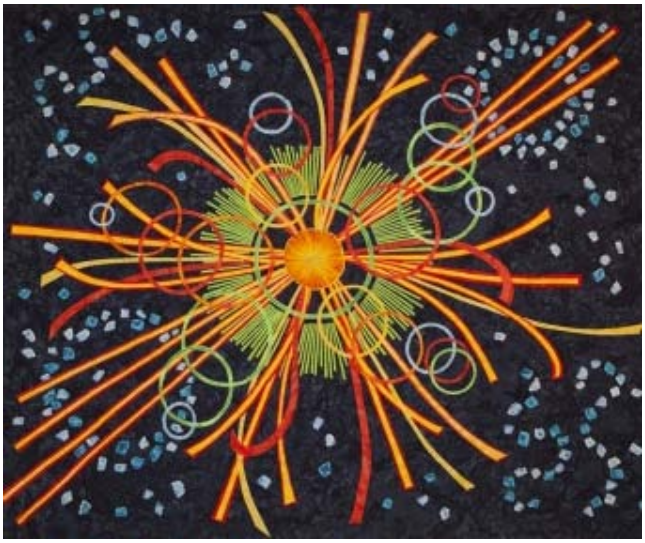
FEATURE

Most-read in 2011



What news got your attention in 2011? Revisit *ILC NewsLine*'s most-read stories from last year.

IMAGE OF THE WEEK



Quiltwork event

Quilt: Susan Jackan

Photograph: Cindy Arnold

Happy New Year! Perhaps this year will bring a discovery resembling the event being depicted on this bright, bursting-with-energy quilt.

Artist Susan Jackan fused and machine-embroidered this quilted depiction of a Higgs event, titled *The Heart of the Matter*. Stitched and fabric art works of scientific scenes, phenomena and ideas are currently on display in the exhibit *Stitched Together: Art and Science* at the Fermilab Art Gallery.

IN THE NEWS

from ***NIKKEI***
2 January 2012
宇宙誕生に迫る「加速器」、東北など誘致に熱 ヒッグス粒子発見後にらむ、地域再生にも期待
Tohoku is eager to invite the accelerator to reveal the mystery of the universe, with an expectation for the restoration of the affected area, after the Higgs is discovered.
(Subscribers only)

from ***USA TODAY***
1 January 2012
International Linear Collider race starts in physics
Just one day after physicists at Europe's CERN lab announced on Dec. 14, that they had two experiments narrowing in on that elusive elementary particle, more properly called the Higgs boson, Japan's Prime Minister, Yoshihiko Noda kicked off a Tokyo physics symposium by announcing Japan's bid to build the International Linear Collider (ILC) project, the next, big, grand thing in high-energy physics.

from ***BBC News***
22 December 2011
LHC reports discovery of its first new particle
The Large Hadron Collider (LHC) on the Franco-Swiss border has made its first clear observation of a new particle since opening in 2009.

from ***KEK***
22 December 2011
The mechanism that explains why our universe was born with 3 dimensions
A group of three researchers from KEK, Shizuoka University and Osaka University has for the first time revealed the way our universe was born with 3 spatial dimensions from 10-dimensional superstring theory in which spacetime has 9 spatial directions and 1 temporal direction.

CALENDAR

UPCOMING EVENTS

ILC ML & SCRF Baseline Technical Review
KEK, Tsukuba, Japan
19- 20 January 2012

3rd LC FORUM meeting
DESY, Hamburg
07- 09 February 2012

UPCOMING SCHOOLS

Physics and Technology of Particle Accelerators (JUAS 2012)
Geneva, Switzerland
09 January- 16 March 2012

USPAS sponsored by the University of Texas at Austin
Austin, Texas
16- 27 January 2012

Excellence in Detectors and Instrumentation Technologies (EDIT 2012)
Fermilab, Batavia, IL, USA
13- 24 February 2012

View complete calendar

PREPRINTS

ARXIV PREPRINTS

1112.6240
Radiative neutralino production in low energy supersymmetric Models. II. The case of beam polarization

1112.5993
A radiatively improved fermiophobic Higgs boson scenario

1112.5058
Collider signatures of goldstini in gauge mediation

1112.5020
Probing strongly interacting W's at the ILC with polarized beams

1112.5017
Nonlinear Energy Collimation System for Linear Colliders

1112.4825
Metastable Staus: Reconstructing Non-Prompt Tracks at the ILC with the SiD Detector

1112.4823
Generic Microstrip R&D Topics at SCIPP: Longitudinal Charge Division and Length Limitations for Long Strips

1112.4629
Exotic spectroscopy and decays: prospects for colliders

1112.3702
QCD corrections to the production of $t\bar{t}\gamma$ at the ILC

ANNOUNCEMENTS

Correction

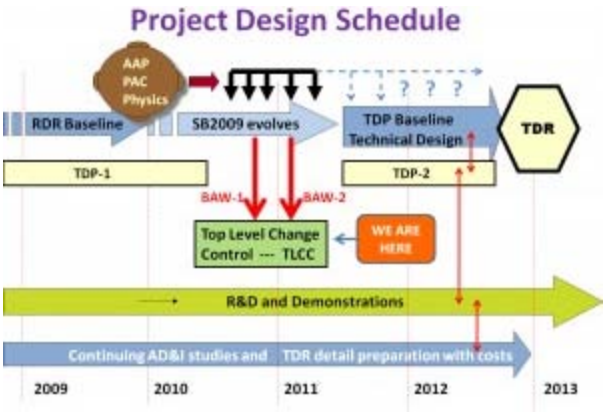
In the 15 December issue of *ILC NewsLine* we stated that all CM2 cavities were processed at Fermilab, neglecting to mention Jefferson Lab's important contribution to processing CM2 cavities. The online article has been corrected to reflect Jefferson Lab's part in CM2.

ilc newsline

DIRECTOR'S CORNER

Our goals for 2012

Barry Barish | 5 January 2012

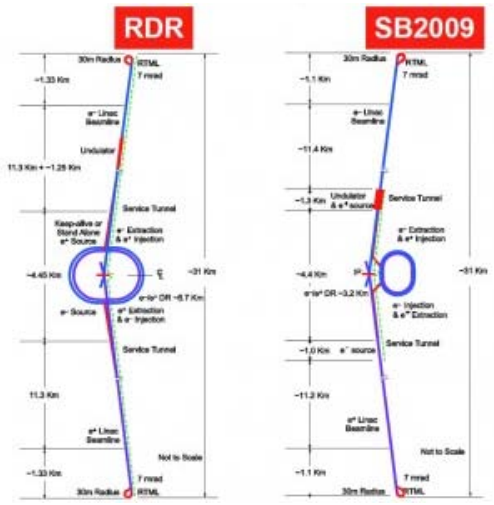


The ILC project design schedule

Happy New Year! Today is a good time to take stock of what we achieved last year and reflect on our goals for the coming year. The primary goal for 2011 was to establish a new ILC baseline that would be better optimised for cost, performance and risk, as well as to carry out the high-priority enabling R&D to demonstrate that the key technical performance goals for an ILC are achievable. We have already come a long way towards reaching those goals. For 2012, our primary goal is to produce, by the end of the year, a *Technical Design Report* that is based on this solid foundation. A fair question to pose is, Where will that leave us?

We began proposing in autumn 2009 a set of changes to the baseline that would reduce costs and/or improve some areas of the design, a process led by our GDE project managers Marc Ross, Nick Walker and Akira Yamamoto. We subjected the larger parts of that proposal to a Top Level Change Control Process that was completed last spring with the approval of four major changes, including establishing operating conditions for the superconducting radiofrequency (SCRF) system:

1. The average accelerating gradient for the installed superconducting cavities is 31.5 megavolts per metre as in the *Reference Design Report*, but the acceptable range of gradients will be +/- 20 percent.
2. The baseline civil design was changed from a double- to a single-tunnel design for the linacs by removing the support equipment tunnel. This change also involves site-dependent variations in the tunnel configuration and in the high-power radiofrequency powering.
3. A new beam parameter set has been adopted, having half the number of bunches in each bunch train, resulting in a reduction in beam power and enabling a reduction of the damping ring circumference from 6.4 to 3.2 kilometres. The idea is to use stronger focussing in the final focus to retain the design luminosity.
4. The positron source was moved to the end of the linac, bringing it to the central campus and sharing tunnels with the beam delivery system. This change shortens the tunnel and makes a more coherent design in the central region.



Changes in the ILC layout resulting from the top-level baseline changes from the RDR design

We estimate that the set of top-level changes to the baseline will save about 10 percent in the total ILC construction costs as compared to the reference design. Our philosophy has simply been to pro-actively find such cost savings, without reducing scope or performance, in order to help compensate for the inevitable cost

increases that have typically plagued very large projects as the design matures.

Following approval of the top-level baseline changes, we have been carrying out a set of system-by-system specialised workshops we call Baseline Technical Reviews, where we have dealt with the many smaller design issues and decisions for the *Technical Design Report* (TDR). So far, we have completed two of these reviews, one for the positron source and one for accelerator systems. We will conduct the final two reviews over the coming months, one on SCRF and one on conventional facilities. The rest of 2012 will involve a concerted effort to complete the TDR. Our plan is that the final report will be a self-contained document providing all the elements needed to propose the ILC to governments.

Although I did not write about our R&D achievements today, we also are on schedule to complete our major R&D demonstration goals for the TDR. These include achieving high gradient at high yield, demonstrating we can mitigate electron cloud effects in the positron damping ring and achieving and controlling small beam spots at the final focus. I will write more about each of these during the coming year.

Plan for producing the ILC TDR (slide from N. Walker, PAC review, Prague)

As I posed at the beginning of today's column, where will this leave us? We will have produced a solid design and costing for the ILC by the end of 2012 and the subsequent reviews and finalisation of the report should be completed by about mid-2013. Following our achieving this final major GDE milestone, we propose to continue to evolve the design, as well as pursue systems tests and R&D towards extending the energy reach. The project will be ready to be proposed when the physics case is established by the LHC and collaborating governments are receptive to considering a new large global initiative for the next-generation particle physics accelerator. We hope that will all fall in place not too long after we complete the TDR.

ILC BASELINE | TDR

FEATURE

Advancing superconducting accelerating technology

A report from the TESLA Technology Collaboration meeting and the ILC-GDE SCRF meeting held in China last month

Min Zhang | 5 January 2012

TTC meeting participants. Image: Jie Liu, IHEP

TESLA, which stands for TeV-Energy Superconducting Linear Accelerator, is the name of a former planned collider using an accelerating technology closely linked with the ILC. To some extent, TESLA can be said to be the predecessor of ILC technology. As time has gone by, TESLA technology has expanded its meaning to include superconducting radiofrequency (SCRF) advances and related accelerator studies across a broad diversity of scientific applications. Last month, from 5 to 8 December, the biannual TESLA Technology Collaboration (TTC) meeting, hosted by the Institute of High Energy Physics (IHEP), Chinese Academy of Sciences together with Peking University and Tsinghua University, was held at IHEP in Beijing. About 100 experts around the world in accelerator field participated.

“The mission of the TTC meeting is to keep open and provide a bridge for communication and sharing of ideas, developments, and testing across associated projects,” said Jie Gao, chair of the Asian Linear Collider Steering Committee and chair of local organising committee. IHEP Director Yifang Wang welcomed everyone to the conference and gave a brief introduction of the current projects IHEP has led, such as the China Spallation Neutron Source and the Daya Bay Neutrino Experiment. “We will actively participate in the SCRF technology fields, especially those related to ILC research,” he said.

The TTC, which originated at DESY in 2000, has met for more than 20 sessions. This meeting is the first that was held in China, providing a good platform for China’s participation in TESLA technology-related research and cooperation. Right now, TTC includes three Chinese institutes: IHEP, Peking University and Tsinghua University. As part of this cooperation, the Chinese Academy of Sciences launched design and R&D work for establishing SCRF accelerator-driven systems in China.

“This is a very important step to enrich the range of applications envisaged for SCRF technology, and it reinforces the influence of the TTC,” said Olivier Napoly, TTC chair. Peking University also launched its own TTC-related programme, the construction of an electron recovery linac prototype on its site, joining other TTC laboratories, such as Cornell University in the US, the Helmholtz Centre Berlin for Materials and Energy in Germany and the Science and Technology Facilities Council in the UK, who are developing similar projects.

More than 50 talks were given during the meeting. “Several agreements were reached during the meeting,” said Olivier. “One such agreement includes an exchange of descriptions of the cryomodule integration steps among the concerned TTC members in order to cross-scrutinise their procedures and to detect eventual mistakes that could explain the observed

degradation of cavity gradient after cryomodule assembly. We also updated information about the realisation, the cost and the benefits of magnetic shielding, as well as about the property of the different materials used at cold temperatures at various labs."

The TTC meeting may have a beneficial impact on the ILC design, cost optimisation and industrialisation plan. But the TTC and the ILC were further linked by another conference, the ILC-GDE SCRF meeting, which took place at IHEP immediately following the TTC conference.

"This time, a combination of several things, such as the venue, the TTC participants and the TTC agenda, made the ILC-GDE SCRF meeting effective and interesting," said Marc Ross, GDE project manager. "During the TTC meeting, we discussed data related to cavity performance changes following cryomodule assembly. At the following ILC-GDE SCRF meeting, with this quite fresh in everyone's mind and with the experts in the room, we were able to collect opinions on how the problem might be summarised and quantified for the ILC technical design."

GDE Project Manager Akira Yamamoto summed up the meeting's success.

"We have been very successful in discussing the technology and we were receptive to various pieces of advice. We also seriously discussed which technology variation to be adopted. Soon we will have to choose the best cost-effective choice that satisfies ILC requirements," he said.

The ILC-GDE SCRF meeting prepared scientists for the upcoming SCRF Baseline Technical Review to be held at KEK from 19 to 20 January.

Olivier Napoly (left) talks with Yifang Wang (middle) and Jie Gao (right) at the TTC meeting. Image: Jie Liu, IHEP

Jie Gao gives an opening remark at the TTC meeting. Image: Jie Liu, IHEP

SRF TECHNOLOGY | TESLA TECHNOLOGY COLLABORATION

FEATURE

Most-read in 2011

5 January 2012

What ILC news got your attention in 2011? Activity surrounding the collider was as far-reaching as it was diverse. It was discussed as a boost to an economy hard-hit by natural disaster. It brought its scientists together to entertain the residents of a vibrant college town. And it may yet earn its place as a complement to the LHC in the Great Higgs Exploration.

A countdown of the most-read stories of 2011:

10. ILC goes one step further

The ILC has reached the point where the Japanese government is starting to consider it as a possible future project in the context of Japan's national policy.

9. A recovering northeast Japan turns its sights to the ILC

As the region around Tohoku University recovers from the March earthquake, the local government highlights the ways recovery could be facilitated by bringing the ILC to Iwate prefecture.

8. Going with the particle flow

Resolved that pictures of particle jets don't have to be fuzzy or gnarled, scientists developed the particle flow algorithm, a paradigm for effectively teasing out each particle's energy from another's.

Image of the Year: Electron beam gun installed at KEK. Image: Nobu Toge

7. The multiplying effects of an accelerator economy

A company in Lansing, US is developing accelerator cavities for the ILC. In the course of improving these high-tech devices, it has enhanced its expertise in developing them for other areas of science and, as an added benefit, sustaining the technology R&D.

6. Seamless cavity performance

If you didn't know that niobium cylinders could be blown up like balloons, take a look at hydroforming. It's a method scientists are exploring to get around the nightmare welds in accelerator cavity cells.

5. Physics slam has real impact

When scientists compete, everybody wins. Eugene, Oregon plays host to the first-ever physics slam in the United States. By all accounts, it was a runaway success.

4. Onward and upward into the terascale

Until the Large Hadron Collider tells scientists where in the energy frontier to dig for new physics, ILC researchers are preparing for eventualities. Should new physics be found to reside in a range higher than the ILC's current reach, scientists have a energy-boosting plan in their back pocket.

3. The sound of accelerator cavities

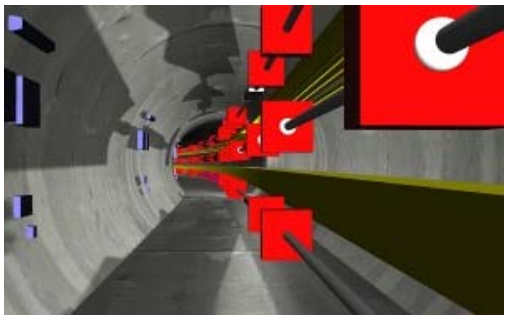
Elegant and inexpensive, the second-sound detection system developed at Cornell University helps scientists triangulate the location of hard-to-see accelerator cavity flaws. Helium helps.

2. How to become an accelerator physicist

There's a school devoted entirely to the bringing up of competent linear accelerator physicists. It's an intense hive of lectures, classes, assignments and tests – and an academic idyll away from the university.

1. Is the Higgs enough?

Few particles get as much attention today as the theorised Higgs boson, which so far has eluded detection. Whatever the outcome of the Large Hadron Collider's search for it – whether it finds a Higgs particle or not – there is still compelling physics that a future collider should explore.



Popular Image of the Week: 3-D model of the ILC accelerator. Image: DESY

Popular Image of the Week: A tabletop accelerator on display in Paris, France. Image: Sciences-ACO