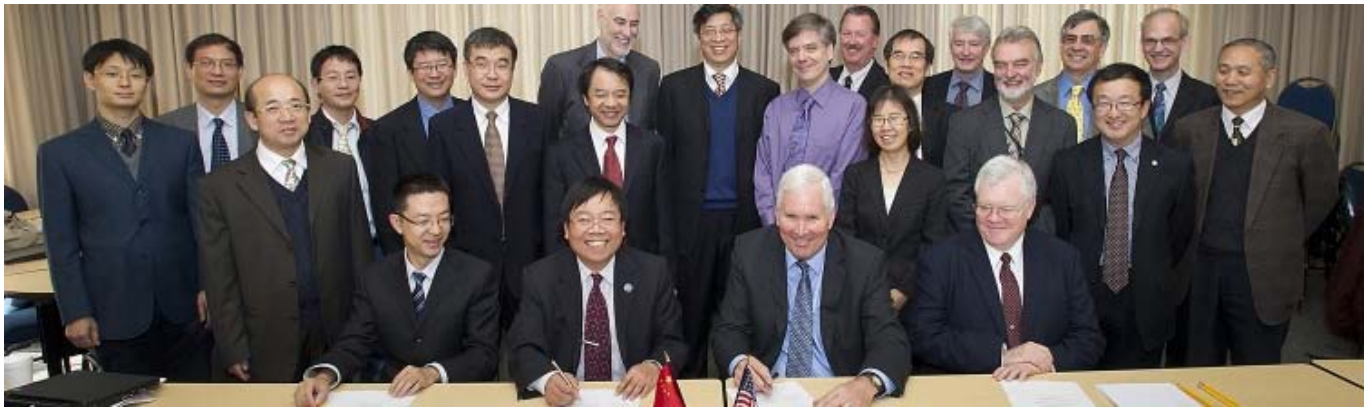
FEATURE

Jefferson Lab and IHEP renew accelerator cavity collaboration

Under the umbrella of the PRC-US Cooperation on High Energy Physics, Jefferson Lab and IHEP exchange notes on cavity R&D

by Leah Hesla



Jefferson Lab in the US and the Institute for High Energy Physics in China sign a formal agreement that will further accelerator cavity research.

RESEARCH DIRECTOR'S REPORT

Articulating the physics case for the ILC

This month's Research Director's Report was written by Michael Peskin, convener of the Physics Common Task Group and of the group preparing the physics chapter of the *Detailed Baseline Design* report.

by Michael Peskin



The ILC *Detailed Baseline Design* report will contain a chapter that describes the physics opportunities that the ILC will offer. The LHC is bringing us new information about particles in the ILC energy range. But what exactly is the Large Hadron Collider telling us, and what are the implications for the ILC programme? Michael Peskin encourages members of the ILC community to debate this question and contribute to the report.

DIRECTOR'S CORNER

FALC meets at CERN

by Barry Barish



The Funding Agencies for Large Collaborations (FALC), an informal group of agency representatives met at CERN on 6 October. FALC is constituted to improve the possibilities for international cooperation in high-energy physics by understanding the planning processes in the funding agencies, exchanging information on plans and statuses of projects in different countries or regions and preparing for cooperation on future particle physics facilities. Highlights of this FALC meeting included discussion of plans for the ILC and more generally for lepton colliders following completion of the ILC *Technical Design Report*, as well as discussions of plans for the European Strategy Update just getting underway.

IMAGE OF THE WEEK



Injector cryomodule for the Quantum Beam experiment

Image: Nobu Toge

At the Superconducting Test Facility (STF) at KEK, Japan, the construction of the injector cryomodule equipped with two ILC-type nine-cell cavities has begun for the Quantum Beam experiment. The cavity string has been brought out of the clean room, ready for tuner installation. The gas return pipe is being readied to be placed in the cold-mass assembly framework.

IN THE NEWS

from ***Physics World***
16 November 2011
Tests begin at new Middle East synchrotron
Work on the Middle East's first synchrotron light source received a major boost yesterday after scientists began commissioning parts of its accelerator system.

from ***Nature***
14 November 2011
Proof found for unifying quantum principle
If the solution holds, it is likely to guide future attempts to explain physics beyond the current standard model. It will certainly

have implications for any previously unknown particles that may be discovered at the Large Hadron Collider (LHC) at CERN, Europe's particle physics lab near Geneva, Switzerland.

from ***Discovery News***
9 November 2011
Particle Physicists Learn Cancer-Fighting Tricks
Over the last few decades, particle physicists have developed all kinds of useful simulation tools to help them predict the behavior of subatomic particles interacting with matter, with valuable applications in medical and space science to boot.

from ***The Economist***
9 November 2011
Violating old rules
PHYSICISTS are keen on symmetry. The universe does not always humour them. Take the Big Bang: if nature were ideally balanced, equal amounts of matter and antimatter would have emerged from it.

from ***The Observer***
6 November 2011
Big Bang Theory fuels physics boom
According to the Higher Education Funding Council for England (HEFCE), there was a 10% increase in the number of students accepted to read physics by the university admissons services between 2008-09, when The Big Bang Theory was first broadcast in the UK, and 2010-11.

CALENDAR

UPCOMING EVENTS

WHIZARD - Event Generation for LHC, ILC, CLIC
DESY, Hamburg
21- 23 November 2011

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

UPCOMING SCHOOLS

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

View complete calendar

PREPRINTS

ILC REPORT

2011-034
ILC Detector R&D: Its impact

ARXIV PREPRINTS

1111.3441
Fourth level MSSM inflation from new flat directions

1111.2250
Probing Light Stop Pairs at the LHC

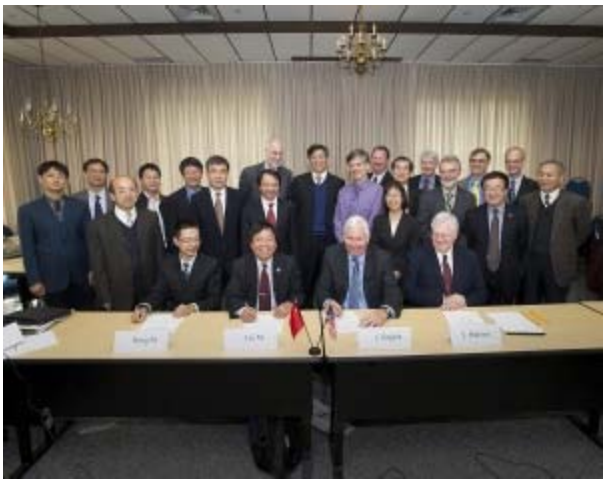
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FEATURE

Jefferson Lab and IHEP renew accelerator cavity collaboration

Under the umbrella of the PRC-US Cooperation on High Energy Physics, Jefferson Lab and IHEP exchange notes on cavity R&D

Leah Hesla | 17 November 2011



The 31st proposed programme of activities for the PRC-US Cooperation in High Energy Physics was signed earlier this month at Brookhaven National Laboratory. Image: Roger Stoutenburgh, BNL

At a recent meeting between US and Chinese high-energy and nuclear physics laboratories, Jefferson Lab in Newport News, US, and the Institute for High Energy Physics (IHEP) in Beijing, China, renewed a partnership to collaborate on the development of superconducting accelerator cavities, including an ILC-type nine-cell cavity.

It is a continuation of a collaboration that includes an R&D effort to improve an IHEP-manufactured cavity. The collaboration is signed under the umbrella of the PRC-US Cooperation in High Energy Physics.

“The collaboration is important for the IHEP-ILC group since the experimental outcome will give us the working direction for the next step,” said IHEP’s Jie Gao.

The Jefferson Lab-IHEP experiment in question is the processing and testing of IHEP-01, the Chinese lab’s 1.3-gigahertz nine-cell cavity.

The seeds of this exchange were planted in March when Gao visited Jefferson Lab to learn about methods for improving superconducting radiofrequency cavities, an area of research where Jefferson Lab is known to have made significant strides. One of the outcomes of his meeting with Andrew Hutton, associate director of the lab’s Accelerator Division, and Robert Rimmer, head of the Institute for SRF Science & Technology, involved a test of IHEP-01. It had undergone its first test in 2010 at KEK in Japan.

It was tested a second time at Jefferson Lab this July, when IHEP scientist Ji Yuan Zhai met with Jefferson Lab’s Rongli Geng, who has led several programmes for recovering and repairing cavities through surface treatments. KEK’s Eiji Kako also assisted in the test. IHEP-01 reached a gradient of 30 megavolts per metre in various modes in five cells, but was limited by field emission.

In the coming months, the cavity will get the full Jefferson Lab treatment to bring out its gradient potential, undergoing further surface treatments and vertical tests. A scientist from IHEP will visit the US lab next year to learn more about cavity surface processing and to participate in the tests.

“The collaboration is intended to strengthen Chinese and US high-energy physics laboratory collaboration through concrete research of common interest, sharing knowledge and the exchange of scientists,” said Gao.

The new collaboration isn’t limited to ILC-type cavity tests. Scientists from both labs will also cooperate on R&D involving the spoke cavity and the DC gun being developed at Jefferson Lab. They’ll also cooperate on partial wave analyses for excited baryon and meson production using data from Jefferson Lab’s electron scattering programme and from IHEP’s Beijing Electron-Positron Collider II runs. Finally, IHEP will help support both accelerator and detector aspects of Jefferson Lab’s nuclear physics programme, specifically with the future 12-GeV Upgrade project.

“We’re using our facilities to help IHEP advance their SRF research,” Hutton said. “We’ve been working very well with them – it’s what we do with our ILC partners.”

The cooperation is made official under the 31st PRC-US Cooperation in High Energy Physics meeting, hosted earlier this month at Brookhaven National Laboratory in Upton, US. It was one of several cooperative efforts between US and Chinese high-energy and nuclear physics labs that was signed into agreement.

“It’s a necessary and fruitful partnership,” said Gao. “I hope it will continue to enrich the future to the benefit of both labs.”



IHEP-01 cavity at a Jefferson Lab vertical test stand. Image: Jie Gao

1.3 GHZ | CAVITY TESTING | IHEP | IHEP-01 | INTERNATIONAL COLLABORATION | JLAB | NINE-CELL CAVITY

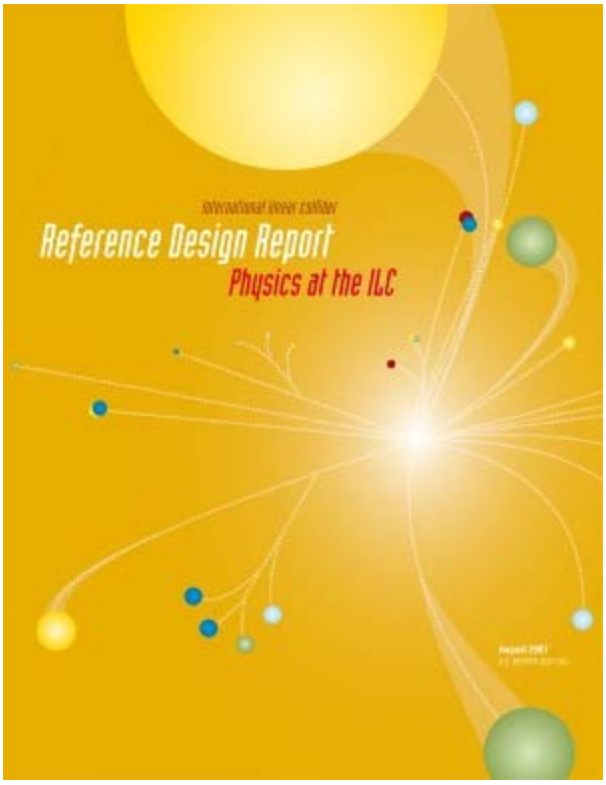
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RESEARCH DIRECTOR'S REPORT

Articulating the physics case for the ILC

This month's Research Director's Report was written by Michael Peskin, convener of the Physics Common Task Group and of the group preparing the physics chapter of the *Detailed Baseline Design* report.

Michael Peskin | 17 November 2011



The Detailed Baseline Design *report will contain an update of the ILC physics case. Image: ILC*

The Global Design Effort (GDE) has promised to submit the ILC *Technical Design Report* by the end of 2012. To accompany this document, the physics and detector community is preparing the *Detailed Baseline Design* report (DBD). That report will discuss the physics measurements to be carried out at the ILC, present the detailed technical designs of the ILD (International Large Detector) and SiD (Silicon Detector) detectors, and demonstrate the capabilities of these detectors through simulation of specific reactions that will be observed at the ILC.

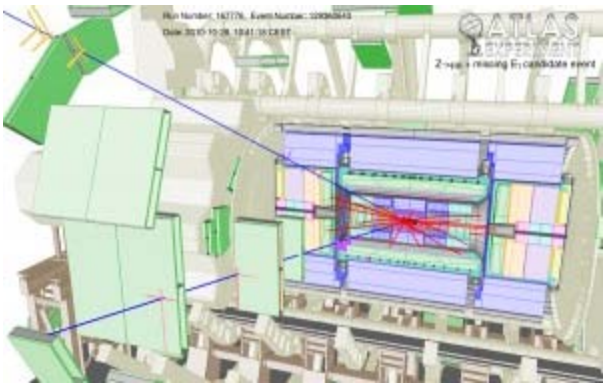
An important chapter of the DBD will be the restatement and updating of the physics motivation for the ILC. This should take into account the new information on the ILC capabilities that we have from the design studies and the new information about physics that we have from the results of the Large Hadron Collider (LHC) at CERN. I am writing to encourage members of the ILC community to become involved in the preparation of this report.

The importance of building an electron-positron linear collider that would complement high-energy hadron collider experiments has been understood for a long time. This accelerator would enable precision measurements of the electroweak couplings of the top quark, direct measurements of the couplings of the Higgs boson, and detailed studies of new particles that might be found in the energy range that will be opened by the LHC. In 2001, high-level panels in the US, Europe, and Japan declared this the highest priority for the next global project in high-energy physics. A lengthy menu of reactions that could be studied and measurements that could be made at the ILC was presented as a volume of the ILC ***Reference Design Report***, completed in 2007.

The arguments presented ten years ago still provide a strong case for building the ILC. The mysteries of particle physics that will be addressed in the ILC programme – the nature of the Higgs boson, the origin of the masses of elementary particles, and the origin of cosmic dark matter – are still the crucial questions for our field. Today, we have a more precise understanding of how the ILC will address these questions. The simulation studies done for the detector Letter of Intent reports and the additional studies that will be done for the DBD enlarge our view of what the ILC will accomplish. These studies cover, in particular, the complete suite of measurements on the couplings of the Higgs boson.

A major issue remains: What will the LHC tell us? In 2005, when the GDE was created, it was thought that the LHC would begin operation in 2007 and that by 2012 the major experiments would have accumulated hundreds of inverse femtobarns (fb^{-1}) of collision data at a centre-of-mass energy of 14 teraelectronvolts (TeV). From the results of these experiments, we would know the most important measurements that must be targeted at the ILC. Would these results call for a precision study of a light Higgs boson, or measurement of top quark couplings to a strong-interaction electroweak symmetry breaking sector, or studies of other, newly discovered particles?

At the moment, the ATLAS and CMS experiments are reporting results based on 1 to 2 fb^{-1} at 7 TeV. The implications of the results are decidedly unclear. Each experiment has collected 5 fb^{-1} in 2011; by the end of 2012, each experiment will have more than 10 times the amount of data in the samples that are analysed now.



An event collected by the ATLAS detector in 2010 which apparently contains a Z^0 boson decay and large missing energy. Image: ATLAS

Many questions that will eventually be answered by the LHC will not be resolved by the end of 2012, but we have learned much already, and we will learn more in the next year.

Much attention is now focused on the Higgs boson. The Higgs boson is a part of the minimal version of the Standard Model. In this context, all couplings of the Higgs are predicted from the value of the mass. The analysis of precision data on the weak interaction favours a low value of the Higgs boson mass. Experiments at CERN's former large electron-positron collider, LEP, exclude values of the mass in this minimal theory below 114 GeV. The LHC experiments now exclude values of the Higgs mass from 145 GeV to high values excluded by the weak interaction data. The only possibility for the Higgs boson mass is then that it lies in the narrow window between 114 and 145 GeV. This result, strictly, applies only in the Standard Model, but many models of new physics also contain a light Higgs boson with properties very similar to the Standard Model Higgs boson. The mass range still allowed for the Standard Model Higgs boson will be explored by the LHC experiments in 2012. In the next year, then, either the LHC will discover the Higgs boson at a mass that will allow precision experiments at the ILC, or the Standard Model will be ruled out and the catalogue of possibilities for new physics will need extensive revision.

Whatever surprises come from the next year of LHC data, there will be a story to be told about the implications of the results for the ILC programme. The Research Director's Physics Common Task Group is organising a study that will lead to a report that will appear as a chapter of the DBD. A preliminary outline of the report and a list of conveners of the various study groups can be found here. The conveners are:

- W and Z Physics: Tim Barklow (SLAC), Juergen Reuter (DESY)
- 2-fermion processes, including resonances, compositeness, and extra dimensions: Yuanning Gao (Tsinghua) and Maxim Perelstein (Cornell)
- Top quark: Andrei Nomerotski (Oxford) and Andre Hoang (Vienna)
- Higgs boson: Keisuke Fujii (KEK) and Heather Logan (Carleton)
- Extended Higgs sectors: Aurore Savoy-Navarro (Paris) and Shinya Kanemura (Toyama)
- Supersymmetry: Jenny List (DESY) and Howard Baer (Oklahoma)
- Cosmological connections: Geraldine Servant (CERN) and Tim Tait (Irvine)

If you would like to contribute, please contact the relevant convener. More detailed contact information is given on the web page linked above.

It will hardly be possible to attend a physics meeting in the next year without hearing debates about the LHC results. At the linear collider workshops in 2012, there will be sessions dedicated specifically to the implications of LHC results for physics at the ILC. We have already held the first discussions on this topic at the Granada LCWS meeting; see the report by Sakue Yamada in the 20 October issue of ***ILC NewsLine***. The workshops for 2012 include the 3rd LCFORUM at DESY, coming up soon on 7 to 9 February 2012; the 2012 ACFA LC meeting in Daegu from 23 to 26 April; and the 2012 LCWS in Arlington, Texas, from 22 to 26 October. Please plan to participate.

The coming year will be full of uncertainty and surprises. It will be exciting to follow the news as it comes. But also, we hope, we will obtain sharp guidance for future experiments on new particles and forces.

DETAILED BASELINE DESIGN | HIGGS BOSON | LHC | PHYSICS CASE

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DIRECTOR'S CORNER

FALC meets at CERN

Barry Barish | 17 November 2011



Anne-Marie Brugger (FALC secretary) and Walter Davidson (FALC chair) from the National Research Council of Canada.

The Funding Agencies for Large Collaborations (FALC), an informal group of agency representatives, held its 19th meeting at CERN on 6 October. Since its inception, a central role of FALC has been to provide oversight for our efforts towards a linear collider, especially regarding resources. Over the years, FALC has expanded its scope to include a much broader view of future colliders and other international projects in particle physics. For the Global Design Effort (GDE), in addition to providing a general oversight role, it has been responsible for reviewing and approving our common fund. The common fund has been crucial in providing for our central administration, communication efforts including *ILC NewsLine*, the website and its support, our document and engineering design management system, travel funds and other central support that enables us to coordinate the global effort towards the ILC.

Of particular importance to the ILC was the presentation by the chair of the ILC Steering Committee (ILCSC), Jon Bagger, and a discussion of the ILCSC planning for the evolution of the linear collider efforts following the GDE submission of the *Technical Design Report* (TDR) at the end of 2012. The planning details will be finalised at the next ILCSC meeting in February, but some features are already emerging. There will be a GDE-like organisation to continue our technical programme beyond the TDR, focused on further development of superconducting radiofrequency systems to higher gradients, including systems tests, as well as selected continuing development in other areas. The design must continue to evolve, keeping a close eye on LHC physics results and the work towards selecting a site.

It is foreseen that the GDE-like organisation will be embedded in a larger linear collider organisation that will also include CLIC and the detector and physics efforts. The ILCSC is working towards implementing the new sub-organisation to replace the GDE, and on a timescale that is supposed to make a smooth transition possible. The completion of the larger organisation, including fully integrating CLIC, will almost certainly take somewhat longer.

Beyond the FALC discussions of the future of the ILC R&D and design efforts, Michel Spiro, President of the CERN Council, reviewed plans for carrying out the update of the European Strategy for Particle Physics. The original strategy began with a preparatory group collecting input from the community that culminated in a symposium at Orsay in France in January 2006. This was then followed by a one-week meeting in May 2006 at Zeuthen in Germany to draft the strategy document. Finally it was approved by the CERN Council on 14 July 2006 in Lisbon, Portugal.



Michel Spiro, President of the CERN Council. Image: CERN

The ILC is included as the fifth item in this European plan for particle physics: regarding the ILC, it says, “It is fundamental to

complement the results of the LHC with measurements at a linear collider. In the energy range of 0.5 to 1 TeV, the ILC, based on superconducting technology, will provide a unique scientific opportunity at the precision frontier; there should be a strong well-coordinated European activity, including CERN, through the Global Design Effort, for the design and technical preparation towards the construction decision, to be ready for a new assessment by Council around 2010."



Yasuhiro Okada, KEK, incoming chair of FALC.

Our programme has been consistent with this strategy regarding the development of the ILC technologies and design, except that the timing has slipped by two years. As for the European Strategy update, we have been strongly advised (for example, by CERN Director General Rolf Heuer) that we need to bring forward unified ILC and CLIC input. As presented by Michel Spiro, there will again be an open "Orsay-type" symposium, well prepared in advance by a preparatory group (this time the group will include one representative of the Americas and one representing Asia). The group will collect input from the European particle physics community in September 2012, allowing the results of the summer conferences to be taken into account. This means that over the coming six months, we need to continue to work closely with CLIC to develop common inputs.

The final steps of updating the European Strategy will be another "Zeuthen-type" meeting of the European Strategy Group in January 2013 to prepare the Draft Strategy Document for submission to the CERN Council. This will be brought to the Council meeting for approval in March 2013. Finally, there will be a special European Strategy Session of the CERN Council in Brussels in May or June 2013 to adopt the updated European Strategy for Particle Physics.

The other important development at FALC was the naming of the next chair, Yasuhiro Okada of KEK, Japan, and secretary, Nobu Toge, also of KEK (the chairmanship now rotates to Asia). I would like to personally welcome Yasuhiro. We look forward to working with him and to continuing to work constructively with FALC as we complete our TDR and make the transition to a new ILC organisation. The ILC has no home laboratory, so FALC is especially important for us to provide guidance, oversight and support for the ILC before it becomes a real project.

The next meeting of FALC will be from 16 to 17 April 2012 in Tokyo.

CERN COUNCIL | CLIC | EUROPEAN STRATEGY FOR PARTICLE PHYSICS | FALC | ILCSC

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