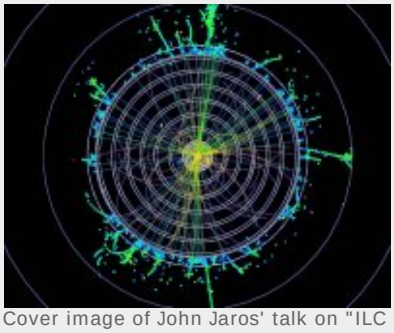
Research Director's Report

New US Strategic plan for particle physics recommends restored participation in ILC R&D

This month's Research Director's Report was written by Jim Brau, co-chair of the Worldwide Study, regional detector contact for the Americas and member of the P5 panel



Cover image of John Jaros' talk on "ILC Physics and Detectors" presented at one of the P5 meetings at Fermilab, last February. (Image : Norman Graf)

This past year, our global collaboration was derailed by funding cuts for the ILC in the UK and in the US. Anyone who has seen through a large project knows there are ups and downs, obstacles and difficulties to overcome, and only through continued dedication and perseverance will the final goals be achieved. Our dedication and perseverance have been challenged, but the science has not changed: particle physics will need a high-energy linear collider. In the US, a new strategic plan for the funding agencies restates the importance of a lepton collider to advances in particle physics.
Read more...

-- Jim Brau

Research Director's Report Archive

Calendar

Around the World

Cryo crash test

A module-shaped crash test dummy in the test bench.

Particle physicists have the reputation that they need to smash things up in order to find out what they are about. Sometimes accelerator physicists get to smash stuff up, too: a group of engineers and technicians recently crash-tested a full cryomodule. They wanted to find out what the 12-metre piece of kit would look like if somebody happened to use the beam pipe as a stepladder, drive a tunnel vehicle into a flange or decide to rip out a vacuum pump.
Read more...

-- Barbara Warmbein

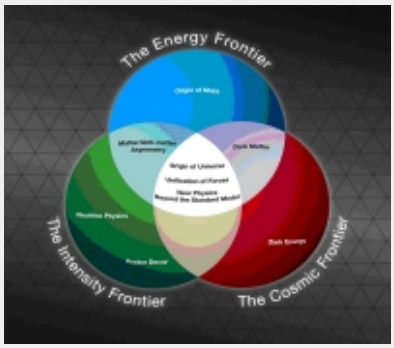
Image of the Week

From Russia and Poland with ... photos

The ILC community broke with its unwritten rule of having both the 'machine side' and the 'detector side' together in one place for their big meetings. The machinists went to Dubna in Russia last week while the detectorists are gathering in Warsaw in Poland this week. Here are some impressions of both. Read more in future issues of NewsLine. The next big meeting will take place in Chicago in November and bring the communities together again. Click here to see the photo album.

Director's Corner

The P5 Report and its implications for the ILC



The three frontiers of particle physics as portrayed in the P5 report.

On Thursday, 29 May, the High Energy Physics Advisory Panel (HEPAP) held its spring meeting in Washington, DC. The entire meeting was devoted to the presentation and discussion of the anxiously awaited report, *"US Particle Physics: Scientific Opportunities: A Strategic Plan for the Next Ten Years,"* by the Particle Physics Project Prioritization Panel, or P5. The charge to this panel was to develop a ten-year plan for US particle physics for the DOE and NSF under four different funding scenarios. Jim Brau, who served on the panel, discusses the main conclusions of the report in this issue's Research Director's Report, while I reflect here specifically on what I believe will be the impacts on the US efforts towards the ILC.
Read more...

-- Barry Barish

Director's Corner Archive

Announcements

Upcoming meetings, conferences, workshops

Polarized Positron for Linear Colliders Workshop (Posipol 2008)
Hiroshima University, Japan
16-18 June 2008

European Particle Accelerator Conference (EPAC'08)
Genoa, Italy
23-27 June 2008

Joint CesrTA Kickoff Meeting and ILC Damping Rings R&D Workshop (ILCDR08)
Cornell University, USA
8-11 July 2008

34th International Conference on High Energy Physics (ICHEP'08)
Philadelphia, USA
29 July - 5 August 2008

Upcoming schools

The second Trans-European School for High Energy Physics (TES-HEP)
Buymerhovka, Sumy region, Ukraine
3-9 July 2008

Third International Accelerator School for Linear Colliders (2008 LC School)
Oak Brook, Illinois, USA
19-29 October 2008

= Collaboration-wide Meetings

GDE Meetings calendar

View complete ILC calendar

(Photos: Nobu Toge, Perrine Royole-Degieux, Barbara Warmbein)

In the News

From *Time*
8 June 2008
The Large Hadron Particle Collider Photo Essay
This summer, after 25 years of preparation, scientists at CERN, the world's largest particle physics laboratory, will try to re-create the conditions produced by the Big Bang. Read more...

Registration to LCWS08 and ILC08 now open
The 2008 Linear Collider Workshop (LCWS) and the International Linear Collider (ILC) will be held on the UIC campus in Chicago, Illinois on 16-20 November 2008. Organisers encourage you to register and make your travel plans early. Registration is open here.

ILC Notes
2008-044
Characterization measurements of Ti-SS Bimetallic transition joint samples

2008-045
Machine-Detector Interface Issues for the ILC Polarimeters

arXiv preprints
0806.0915
High-energy photon collisions at the LHC - dream or reality?

0806.0529
Simulation study of fast ion instability in the ILC damping ring and PETRA III

Research Director's Report

12 June 2008

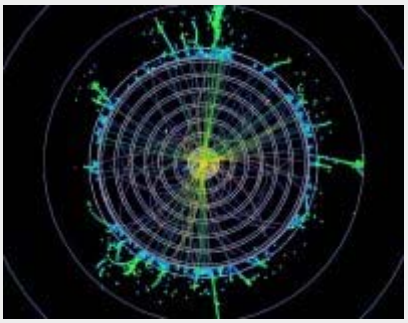
Jim Brau, author of this week's Research Director Report, is a member of the P5 panel.

New US Strategic plan for particle physics recommends restored participation in ILC R&D

This month's Research Director's Report was written by Jim Brau, co-chair of the Worldwide Study, regional detector contact for the Americas and member of the P5 panel

This past year, our global collaboration was derailed by funding cuts for the ILC in the UK and in the US. Anyone who has seen through a large project knows there are ups and downs, obstacles and difficulties to overcome, and only through continued dedication and perseverance will the final goals be achieved. Our dedication and perseverance have been challenged, but the science has not changed: particle physics will need a high-energy linear collider. In the US, a new strategic plan for the funding agencies restates the importance of a lepton collider to advances in particle physics.

The US High Energy Physics Advisory Panel (HEPAP) approved a new ten-year US strategic plan on 29 May. Among its recommendations is support for accelerator and detector R&D for the ILC in any of the studied federal funding scenarios. The report is available here.



Cover image of John Jaros' talk on "ILC Physics and Detectors" presented at one of the P5 meetings at Fermilab, last February.
(Image : Norman Graf)

About one year ago, Dr. Ray Orbach, Director of the US DOE Office of Science, asked the US High Energy Physics Advisory Panel to re-engage in a discussion of the future of particle physics in the US. While recognising the great promise of the ILC, the publication of the ILC *Reference Design Report* led Dr. Orbach to consider the hurdles which must be overcome to realise the ILC. He concluded that it could take until the mid-2020s for first ILC collisions, and asked HEPAP to open a new discussion of the near-term future of the field of particle physics in the US.

Last autumn, Dr. Dennis Kovar, acting Associate Director of the Office of High Energy Physics, charged the HEPAP Subpanel P5 (Particle Physics Project Prioritization Panel) to develop a plan for the US High Energy Physics programme.

Following several months of discussion on all aspects of the US high-energy physics programme, and its role in the international high-energy physics enterprise, P5 reaffirmed the importance of the energy frontier as one of three central areas of the field (together with the intensity and cosmic frontiers), re-expressed its opinion that the LHC is currently the highest priority of the field, and reiterated and supported the global consensus that a lepton collider will be essential to follow up on LHC discoveries. It notes that the ILC energy range is expected to be what is needed based on Tevatron, LEP, and SLC evidence. Furthermore, the report states that "*the host will be assured of scientific leadership at the Energy Frontier*," reminding the reader why three regions of the world are interested in serving as the host for this global project. The panel also recommends an R&D programme for detector technologies to support a major US role in preparing for physics at a lepton collider.

The strategic plan outlines a broad programme for the US, designed at four different funding scenarios, and coordinated with the international programme. More is possible at the higher-level scenario, of course. The ILC effort is advanced in the plan for all scenarios. The US role within the GDE will be restored to a level comparable to what it was a year ago, and continued development of detectors for the ILC is also recommended. In addition, the panel recommends support for accelerator R&D on warm options for a lepton collider.

Fermilab's future was a significant concern in the panel's charge; R&D on a high-intensity proton source based on superconducting RF is recommended by the panel. Such a source would enable a staged and evolving neutrino physics programme at Fermilab. If the proposed DUSEL (Deep Underground Science and Engineering Laboratory) in South Dakota gets approved and built, the source could provide in excess of 2 MW of power to produce a world leading neutrino beam to the new lab. In addition, new fixed target experiments are foreseen for Fermilab. Half of the US particle physics community is now working on the LHC at CERN, and Fermilab would support this energy frontier effort, while conducting a local physics programme at the intensity frontier.

We will soon be back on the rails in the US, with determination to realise our international vision of a linear collider. About two hundred years ago, John Adams, an early leader of a new nation in North America, is reputed to have said: “Patience and perseverance have a magical effect before which difficulties disappear and obstacles vanish.” We understand this concept, and we intend to reach our goal of the Terascale electron-positron linear collider.

-- Jim Brau

Cryo crash test

Particle physicists have the reputation that they need to smash things up in order to find out what they are about. Sometimes accelerator physicists get to smash stuff up, too: a group of engineers and technicians recently crash-tested a full cryomodule. They wanted to find out what the 12-metre piece of kit would look like if somebody happened to use the beam pipe as a stepladder, drive a tunnel vehicle into a flange or decide to rip out a vacuum pump.

For those readers who don't have much patience: sorry, the module would not look much different from the outside — the test showed that they are rather robust. For all those who want to know more: here's more. The worst thing that can happen to a cooled cryomodule under vacuum is for the different vacuum systems to break down. Engineers and technicians from DESY experienced this in their cryomodule test bench CMTB by running five cycles of letting room air into the insulation layers and the beam vacuum. Their goal, apart from getting to know their module in a crisis, was to pass European pressure vessel regulations for later cryomodule mass production for the European XFEL (European X-Ray Free-Electron Laser). In addition, they were looking for valuable input for the final design of the XFEL cryogenic system.

A module-shaped crash test dummy in the test bench.

Helium escapes through a safety flap of the cash test cryomodule's safety valve which protects the 2K cavity helium volume inside the cryomodule against too much pressure. Click here to download the video (3.5 MB).

“Well, there was a rather loud noise and a massive cloud of helium at the safety valves,” says Bernd Petersen, crash test initiator and head of the DESY group that runs superconductivity and cryogenics. The group had simply let normal room-temperature air stream through a large vacuum pumping port and the beam tube flange. They flooded two kinds of spaces: the insulation vacuum in the body of the cryomodule and the vacuum at the very heart of the beam, inside the cavities. A FLASH / XFEL /ILC cryomodule (their design is remarkably similar) has two thermal shields, one at temperatures between 40 to 80 K , the second at temperatures between 4.5 K to 8 K. Inside the thermal shields the superconducting accelerating cavities are sitting in a liquid helium bath at 2 K within a helium vessel. If air at room temperature — that's about 300 K warmer than the temperature of the cavities — flows into the container, it freezes out immediately by condensing on the cold surfaces. The condensation energy is transferred to the helium, which vaporises and expands immediately. Under these test conditions, the air enters the insulation or beam vacuum almost at the speed of sound — that's where the noise comes from.

Crash-testing the insulation vacuum caused only minor damages at the outer shells of the multi-layer insulation and the outer thermal shield. The cryomodule could be cooled down again immediately after the test, and the testers noticed no decrease in the cavities' operating performance.

So much for the insulating vacuum crash test. What about the core of the accelerator: the beam pipe and the cavities? The group was keen to find out what would happen to the cavities and especially how long it would take for the warm air to travel from one side of the module to the other. The surprising find: it would take as long as five seconds. “That means that, if the beam tube would be broken close to warm/cold transitions in the XFEL linac, in principle you have a few seconds to close beam tube valves to save as many cavities as possible,” explains Petersen, clearly surprised, and pleased, by the result. “The impact on the cryogenic system is also much smaller than estimated before in worst-case scenarios.”

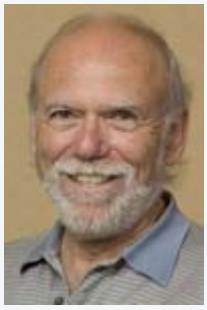
The air that flows into the pure vacuum of the cavities freezes out on the cold surfaces, shrouding the inside of the cavities in a layer of snow. The feared shock wave did not come, neither did the cavities' delicate niobium crack or crumble; instead, every single cavity froze neatly after the other. As the experts expected, attempts to bring the cavities back to operation showed a severe decrease of the RF performance. But they concluded that nevertheless an event like like this would not stop a linac run completely as long as only a few cryomodules are affected.

The data from the crash tests and a few other related experiments are analysed now and will be published soon. The module will now be taken apart and checked for damage in the alignment. Four of its cavities, those that had performed well during its life in FLASH before becoming a crash test dummy, will be taken out, cleaned and reused. Petersen hopes that the team can run a similar test with another module of the latest XFEL design that has built-in alignment monitors. “All these test make us a lot more secure and relaxed about the XFEL cryogenic design and the later operation of the linac. We know now that even after an accident of this scale, we could simply pump the air back out and switch the machine back on.”

-- Barbara Warmbein

Director's Corner

12 June 2008


Barry Barish

The P5 Report and its implications for the ILC

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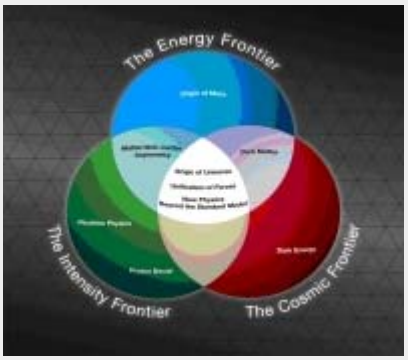

The three frontiers of particle physics as portrayed in the P5 report.

There are several reasons to want a new strategic plan for high-energy physics in the US. Last year, Fermilab responded to a request from Ray Orbach and took the lead in conducting a study to evaluate potential US-based accelerator projects that could be constructed on an earlier timescale than the DOE is assuming for the ILC. The study resulted in a proposed facility for Fermilab, Project X, a high-intensity proton source with experiments, primarily for neutrino physics. A related consideration is the proposal to NSF to build DUSEL, which would be a new deep underground facility that could house a major long baseline neutrino experiment. In addition, the DOE needed a prioritised plan at different budget levels over the next few years. As described by Jim Brau, the P5 report presents what the panel describes as a "balanced" approach to the US programme for each of four budget scenarios. The energy frontier features the LHC programme, and for the longer term reaffirms the physics priority given to a "lepton collider" in previous reports worldwide. The committee explicitly addresses the question of what energy is required for such a machine by including support for R&D on technologies for a higher-energy linear collider or possibly a muon collider. The report goes on to say that the ILC is the right machine to build if the energy range is validated by LHC physics results. I would like to stress that many physics studies give strong credence to the planned energy range of the ILC, and our R&D and design work is planned on the timescale of obtaining LHC results.


Charlie Baltay from Yale University, the chair of the P5 panel.

Another conclusion of the panel is that the ILC R&D programme should be supported at all four funding levels to insure that whenever and wherever an ILC is built, a significant US involvement will be possible. This recommended level is ~ $35M/year, which is the same as the proposal for FY09 that is presently being considered in Congress. This recommendation should give us what we need to have a viable and stable US R&D programme over the next few years, if not prepare us for possible siting in the US.

As for actually building the ILC, the report disappointedly does little to encourage ambitions to eventually host the machine in the US. Maybe more importantly, the proposed funding level does not allow the broad R&D programme that we were pursuing. Instead, the programme in the US will need to be more selective and prioritised than we might desire to ensure expertise in all major areas.

So when are we likely to see our budget restored? As I said above, $35M are proposed for FY09. However, it is very unclear if any budget will be passed by this Congress by the new fiscal year. Being an election year, Congress may well decide to leave it to the new Congress and administration to pass the budget. This would mean an extra six months at reduced budget, unless we get some special relief, either as a result of funds from the supplemental budget request now being considered in Congress or in other ways from DOE. Of course this is not desirable - but I am sure that we could also manage those six months.

-- Barry Barish