ilc newsline

ABOUT | ARCHIVE | SUBSCRIBE | CONTACT | LINEARCOLLIDER.ORG

3 FEBRUARY 2011

AROUND THE WORLD

Clustering klystrons to pool power

An elegant powering scheme accommodates the ILC's new one-tunnel design.

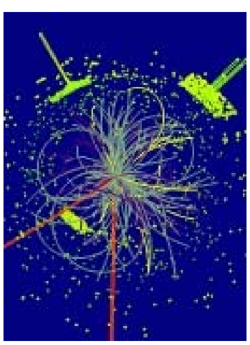
by Leah Hesla

Though it doesn't sound like a way to tidy up, the alliteratively named klystron cluster could be the mechanism that helps streamline the large-scale design of the ILC.

Scientists at the Stanford Linear Accelerator Center (SLAC) in the US are currently developing the klystron cluster scheme, a new kind power-delivery system for radio frequency cavities that distributes power from a common conduit.

AROUND THE WORLD

From CERN: CERN announces LHC to run in 2012



Geneva, 31 January 2011. CERN today announced that the LHC will run through to the end of 2012 with a short technical stop at the end of 2011. The beam energy for this

DIRECTOR'S CORNER

Taking heed of good advice

by Barry Barish

The most obvious benefit of the seemingly endless series of reviews we undergo comes from the rigours of doing our preparations. But the reviews also serve to validate our work, and perhaps most importantly, the review committees give us good advice in their reports. Last autumn, we had a two-day period will be 3.5 TeV. This decision, taken by CERN management following the annual planning workshop held in Chamonix last week and a report delivered today by the laboratory's machine advisory committee, gives the LHC's experiments a good chance of finding new physics in the next two years, before the LHC goes into a long shutdown to prepare for higher energy running starting 2014.

technical review of the Global Design Effort by the Project Advisory Committee (PAC), a subcommittee of the International Linear Collider Steering Committee (ILCSC). Several recommendations came out of that PAC review that have been quite helpful to us as we prepare to make final decisions on the proposed new baseline configuration for the ILC *Technical Design Report* (TDR).

IMAGE OF THE WEEK

Chinese new year

Image: Nobu Toge

Today, China celebrates the first day of the year of the rabbit.
春节快乐!(Happy spring festival!)

IN THE NEWS

From APS News
February 2011
Kovar Reflects on State of High Energy Physics, and the Road Ahead
…globally other countries have interests (…) in developing the next generation of accelerator facilities for particle physics. There's going to be cooperation in trying to leverage the funds globally in order to spend the most wisely in terms of R&D that will position the countries interested in doing this in the future.

From CERN Bulletin
31 January 2011
Fermilab Future
Project X would use superconducting radio-frequency cavities, a technology Fermilab scientists and their international partners hope to use in future accelerators to succeed the LHC and the Tevatron.

From CERN Bulletin
31 January 2011
LHC to run in 2012 – an interview with Rolf Heuer and Steve Myers
If nature is kind to us and the Higgs particle has a mass within the current range of the LHC, we could have enough data in 2011 to see hints (…) Running through 2012 will give us the data needed to turn such hints into discovery.

From The Economist
31 January 2011
Collide-o-scope
In effect, this makes ATLAS and CMS mutually indispensable. Still, neither Dr Lankford nor Dr Tonelli makes any attempt to hide the fact that the race is on and both teams are in it to win.

From IHEP
25 January 2011
Key technologies for EXFEL developed
EXFEL U48 is the first undulator prototype dedicated to EXFEL and the first super long high-precision undulator developed in China.

From Washington Bangla Radio
25 January 2011
Science & Technology in Pursuit of Excellence & Social Development In India
Mega Facilities For Basic Research are supported for internationally important high value projects, at the moment including continued participation in the (...) International Linear Collider Project.

ANNOUNCEMENTS

The End Station Test Beam (ESTB) 2011 Workshop takes place on 17 March 2011 at SLAC National Accelerator Laboratory in Palo Alto, California. The programme includes the status of ESTB preparations for the new 13.6-GeV electron test beam line, useful for detector R&D and machine developments and planned for first operation in summer 2011. The agenda also includes a review of who is interested in the test beam, beam property and infrastructure support and a tour of the End Station A facility.

The workshop meets conveniently before the ALCPG11 workshop in Eugene, Oregon, so we hope many of you can include ESTB in your travel plans.

Please register here

We hope to see you at SLAC!
The ESTB Program Committee

CALENDAR

UPCOMING EVENTS

End Station Test Beam (ESTB) Workshop 2011
SLAC
17 March 2011

2011 Linear Collider Workshop of the Americas (ALCPG11)
University of Oregon, Eugene, Oregon, USA
19- 23 March 2011

2011 Particle Accelerator Conference (PAC'11)
New York Marriott Marquis Hotel, New York, NY, USA
28 March- 01 April 2011

UPCOMING SCHOOLS

Excellence in Detectors and Instrumentation Technologies (EDIT 2011)
CERN, Geneva, Switzerland
31 January- 10 February 2011

View complete calendar

BLOGLINE

31 January
CERN
Soccer teams and science fairs

28 January
Frank Simon
Incoherent Thoughts on the Early Train to Frankfurt

26 January
Frank Simon
A Belle-II Toy Model

Follow all Quantum Diaries

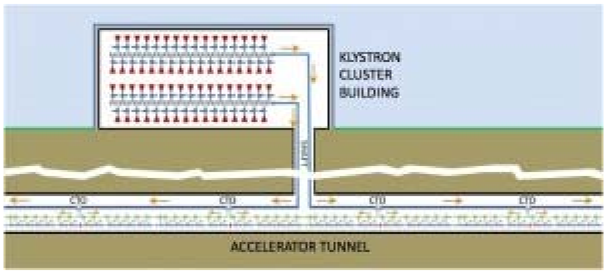
ilc newsline

AROUND THE WORLD

Clustering klystrons to pool power

An elegant powering scheme accommodates the ILC's new one-tunnel design.

Leah Hesla | 3 February 2011



Schematic of SLAC's proposed klystron cluster system. Two clusters of 33 klystrons each feed high-level radio frequency power below ground to the beamline tunnel. Image provided courtesy of Chris Adolphsen and Chris Nantista

Though it doesn't sound like a way to tidy up, the alliteratively named klystron cluster could be the mechanism that helps streamline the large-scale design of the ILC.

Scientists at the SLAC National Accelerator Laboratory in the US are currently developing the klystron cluster scheme, a new kind of power-delivery system for radiofrequency cavities that distributes power from a common conduit.

One substantial component, a ten-metre test section of pipe, has held up well under pressure and power.

"It's fairly exciting," said SLAC's Chris Adolphsen, who conceived of the scheme after a pivotal moment in the Global Design Effort's (GDE) evaluation process that radically changed the collider blueprint.

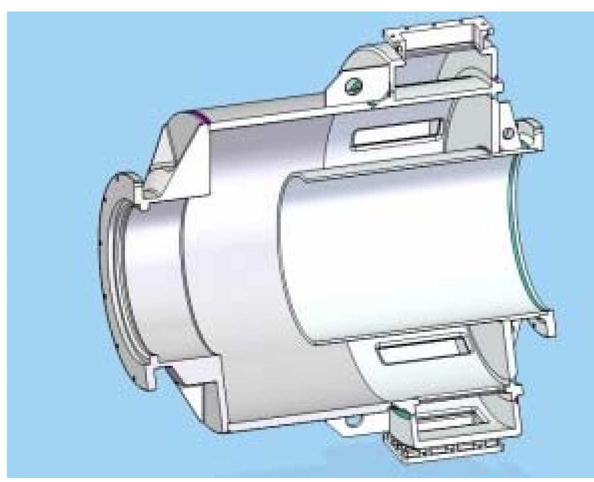
In an early incarnation of the ILC plan, scientists devised a design with two large underground tunnels: one for the beamline and one for the machinery that would power it, called the service tunnel.

Then they started thinking outside the tunnel. To help reduce construction costs, they decided to eliminate the service tunnel. One way to do this would be to promote any device responsible for generating power from beneath the soil to the surface. An alternative technique, which distributes power sources beside the main accelerator, is under development at KEK and elsewhere.

These powering devices include klystrons, which generate the radiofrequency power needed to run the accelerating cavities. One klystron provides enough power for 26 cavities. The ILC calls for thousands of cavities and therefore hundreds of klystrons. If each above-ground klystron were stationed directly above its assigned underground cavity group, the ILC would require hundreds of 100-metre-deep holes to deliver power below ground. What's more, the klystrons would take over the land, requiring long stretches of buildings along the ILC's 31-kilometre length, like a tunnel relocated to the open air.

"You want to minimise the surface presence of the linear collider," said Chris Nantista, the GDE's deputy group leader for high-level radiofrequency and member of SLAC's Accelerator Research Division. "There are roads and fields. You can't have these klystrons running all along it."

So Adolphsen, who is in charge of main linac integration for the GDE, proposed that the klystrons be clustered – physically grouped together in tightly knit bundles of 33 klystrons each. Clusters can be paired up to share a building, with one cluster feeding cavities upstream and one feeding downstream. In this scheme, the klystrons are far less disruptive. Rather than being housed in a long, nearly continuous building, klystrons would be contained in a mere 22 compact structures spaced a vast two kilometres apart.



A cut-away design of the coaxial tap-off. When power coming down the pipeline encounters the coaxial tap-off, the amount that's needed for its designated cavity set travels out through

Clustering klystrons means pooling power. Each of the 33 klystrons contributes ten megawatts of power through waveguides, hollow metal conduits of radiofrequency power. These rivulets of power feed into a much larger waveguide, or 'the big pipe' as it's known around SLAC.

the outer ring. The rest flows down the inner pipe until it encounters the next tap-off. Image provided courtesy of Chris Adolphsen and Chris Nantista

That big pipe, now channeling about 300 megawatts of power, burrows its way beneath the ground until it reaches the beamline tunnel. Once there, the power is tapped off every 38 metres, travelling along smaller waveguides to reach the cavities.

"It's like you poured all your measuring cups into one big barrel, and as you go along, you put your measuring cup in and take that much off again locally," said Nantista.

The measuring cup for radio frequency power is called a coaxial tap-off, designed by Nantista. This aluminum joint, which connects larger waveguides with smaller ones, is essentially a pipe within a pipe, forming a cross-section with an inner circle and an outer ring.

The tap-off skims off a portion of the power coming from the big waveguide. That skimmed off power passes through the outer ring of the tap-off to a group of 26 cavities. The remaining power travels down the inner region of the tap-off until it meets the next one, which then also channels power to its designated cavities. As power is fed to each cavity group, the pool of power from the klystron cluster diminishes until it is all used up. Then the next klystron cluster takes over.

The main waveguide, or 'big pipe', has a diameter of 0.48 metres. It performed well at recent tests at SLAC, handling 300 megawatts of power for many hours at a time. Image provided courtesy of Chris Adolphsen and Chris Nantista

Computer simulations and initial tests for the coaxial tap-off look promising.

"It turns out to be useful," said Nantista of his design.

The dimensions of the coaxial tap-off have to be precise to ensure that the right amount of power travels down the tap-off and that no other undesired wave patterns are propagated down the tube. For the same reason, the diameter of the big pipe, as wide as a nice-sized computer monitor, has to be accurate to within about a millimetre.

That's not the only challenge of the big pipe. It has to handle power equivalent to that in some solar or wind energy plants. Tests held at SLAC over the past two months have given the team cause for optimism.

"We've run power through the pipe for over 100 hours with only a few breakdowns," said Adolphsen. That result not only allows scientists to characterise the pipe, but assures them that this large waveguide is a viable option for the above-ground cluster scheme.

"The klystron cluster leaves you with a streamlined tunnel," said Adolphsen. "When you go down there into the ILC tunnel, there's not a whole lot to see." And that's the whole idea.

KCS | KLYSTRON | KLYSTRON CLUSTER | SINGLE TUNNEL | SLAC

ilc newsline

DIRECTOR'S CORNER

Taking heed of good advice

Barry Barish | 3 February 2011

Lyn Evans, PAC chair, during the review closeout.

The most obvious benefit of the seemingly endless series of reviews we undergo comes from the rigours of doing our preparations. But the reviews also serve to validate our work, and perhaps most importantly, the review committees give us good advice in their reports. Last autumn, we had a two-day technical review of the Global Design Effort by the Project Advisory Committee (PAC), a subcommittee of the International Linear Collider Steering Committee (ILCSC). Several recommendations came out of that PAC review that have been quite helpful to us as we prepare to make final decisions on the proposed new baseline configuration for the ILC *Technical Design Report* (TDR).

The PAC review was held on 11 and 12 Nov 2010 at the University of Oregon in Eugene with Jim Brau serving as the local host. The committee report is generally quite supportive of the GDE programme and made some specific recommendations. The committee consists of accelerator and detector experts from around the world: Jean-Eudes Augustin, CNRS/IN2P3; Jon Bagger, Johns Hopkins University (ILCSC Chair, ex officio); Lyn Evans, CERN (Chair); Stuart Henderson, Fermilab; Steve Holmes, Fermilab; Akira Masaike, Kyoto; Robert Orr, Toronto; Roy Rubinstein, Fermilab (Secretary); and Masakazu Yoshioka, KEK, who were all in attendance. Katsunobu Oide, KEK and Raj Pillay, TIFR, also PAC members, were unable to attend.

Last spring at their prior review, the PAC recommended that we take steps to improve communication and collaboration between the accelerator and detector communities, specifically with regard to the process of deciding on proposed changes to the ILC baseline. Some of the changes have implications on ILC physics performance, making it particularly important to include the physics community in evaluating them.

We followed that good advice and took active steps to include experimentalists in both the working meetings and the dialogue, which was aimed at answering questions and developing consensus on the changes. I also included detector representation on the Change Assessment Panel that advised me on the final decisions. To emphasise their point at the November meeting, the PAC decided to set a good example by integrating the agendas for both the ILC accelerator and the detector presentations.

That meeting provided validation for the process we are employing towards making decisions on the technical baseline design. But perhaps the most interesting PAC recommendation concerned another topic: how to approach fabrication of the very large number of cavities that will be needed for the ILC. So far both the European XFEL project at DESY and the GDE R&D programme have focused on developing 'expert' companies, that is, companies capable of mastering the detailed processes required to produce high-gradient cavities. However, looking towards the process for large-scale mass production, the PAC suggested we work towards the approach that was used at CERN for the LHC magnets. In that case, CERN basically assumed responsibility for integrating individual components and for achieving the required performance, significantly relieving risks from industry.

The PAC meeting at the University of Oregon.

In general, this philosophy uses industry for what they are best able to do and should thereby lower costs. The pilot plant that we are in the process of developing at KEK is a step in this direction, as it both reduces infrastructure requirements for industry and puts more central responsibility on the laboratory for technology transfer and performance. Our approach to this whole issue will evolve in the future, informed next by a second series of visits by the project managers to key vendors, who will get their inputs on how best to develop superconducting radio frequency technology toward mass production.

The PAC meets twice per year and the next scheduled meeting will be held at Academia Sinica in Taiwan this coming May. By that time, we will have finalised the TDR baseline and will have begun work towards the technical design. Once again, we will work hard and benefit from our preparations for that review, but I am also confident that the PAC's insights and recommendations will provide valuable guidance and improve our prospects for producing a solid TDR that can then serve as the basis of a global construction project.

PAC | PROJECT ADVISORY COMMITTEE | REVIEW