Around the World

ILC physics subgroup meeting at KEK

Today's issue features a story from Keisuku Fujii, a particle physicist, who is a member of the ILC group in KEK.

The two main pillars of the standard model.

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Read more...

-- *Keisuke Fujii*

Calendar

Upcoming meetings, conferences, workshops

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

Feature Story

Second sound sounds promising

Cornell proposes new cavity temperature mapping technique

Is it a microphone? Is it a thermometer? It's an oscillating superleak transducer!

"Our superconducting technology group here at Cornell is doing some very fundamental R&D," says Hasan Padamsee, physics professor at Cornell university and expert in superconducting rf technology. "Note that the stress is on the fun in fundamentals." Students are even allowed to drill holes into cavity prototypes in order to find out what makes certain areas in the material behave differently from others. A new mapping technique, invented by Cornell's Don Hartill, Zach Conway and Eric Smith, could make it possible to locate quenches during cavity tests with just eight (instead of up to 180) thermometers.
Read more...

-- *Barbara Warmbein*

In the News

From *Physics World*
18 June 2008
No extra cash for UK physics
Any remaining hopes that the UK government might plug an £80m hole in the nation's physics-research budget were dashed yesterday.
Read more...

From *France Inter*
17 June 2008
La "tête au carré", a France Inter radio programme devoted to science, set up its sound booth at CERN for a special broadcast on the LHC. Guest are 3 physicists, a theorist and an

Director's Corner

Integrating ideas at Dubna

Marc Ross preparing his summary talk in Russian early on Friday

At the recent Conventional Facilities and Siting Workshop in Dubna, there were four focus groups: *Shallow Site, Infrastructure, Siting and Accelerator Systems*. However before the meetings formally began, the conveners of the latter two had integrated them into one. These conveners, Nikolai Solyak, Andrei Seryi, Masao Kuriki and myself, felt that the subjects had so much overlap and were so strongly coupled that it would be more productive for the parties involved to discuss them together.
Read more...

-- *Ewan Paterson*

Director's Corner Archive

Announcements

EUROTeV Reports
02008-020
Collimator R&D

02007-046
Precision Beam Position Monitor for EUROTeV

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

[Conference on the Design/ Optimization of the Silicon Detector at the International Linear Collider]
University of Colorado at Boulder, Colorado, USA
17-19 September 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

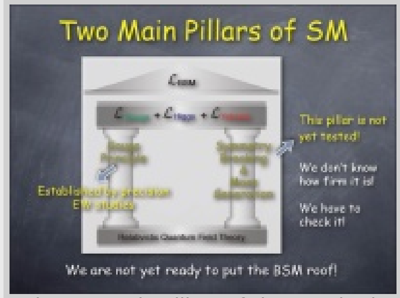
experimentalist from CNRS-IN2P3, France and an accelerator experimentalist from CERN.
Listen to the broadcast here (in French)
Read more...

ILC physics subgroup meeting at KEK

Today's issue features a story from Keisuku Fujii, a particle physicist, who is a member of the ILC group in KEK.

On May 31 we had a meeting of our ILC physics subgroup, which is a mixture of experimentalists and theorists working in Japan. The meeting was the fifth in a series that started about a year ago, and each time 20 to 30 people got together to monitor and discuss the direction of the subgroup's activities. The primary task of the subgroup is to reexamine the ILC physics in the context of the expected LHC results and to further strengthen the physics case for the ILC project.

We know that the standard model of elementary particle physics is based on relativistic quantum field theory with two main pillars, the gauge symmetry and its spontaneous breaking. The first pillar has been firmly established by the numerous experiments in the past decades. The second pillar, the electroweak symmetry breaking mechanism, is, however, left untested. At the centre of this symmetry breaking lies the Higgs boson as predicted in the standard model. We believe it fills our space-time and gives mass to every fundamental particle.



The two main pillars of the standard model.

The current data indicate the existence of a Higgs particle below 160 GeV and we hope that the LHC is going to find it. Once a Higgs-like particle is found, it is extremely important to study it in detail and check if it really is the Higgs field (and particle) that is responsible for symmetry breaking and mass generation. We need to study the force that makes the Higgs boson condense in the vacuum and the force that acts as the resistance to matter particles moving in the sea of the Higgs field, thereby giving each of them a mass proportional to the strength of the force. The first most important mission of the ILC is to study these forces so as to establish the second pillar of the standard model.

The ILC physics subgroup focuses its attention on this very important issue since it is a central motivation for the ILC and is crucial whatever new physics is going to be found at the LHC. New physics beyond the standard model is the roof we can put only after we establish both of the two main pillars of standard model. We need the ILC to carry out this mission.

-- Keisuke Fujii

Second sound sounds promising

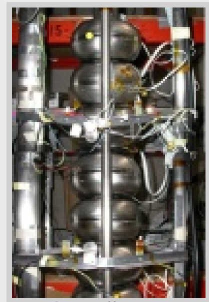
Cornell proposes new cavity temperature mapping technique

“Our superconducting technology group here at Cornell is doing some very fundamental R&D,” says Hasan Padamsee, physics professor at Cornell university and expert in superconducting rf technology. “Note that the stress is on the fun in fundamentals.” Students are even allowed to drill holes into cavity prototypes in order to find out what makes certain areas in the material behave differently from others. A new mapping technique, invented by Cornell's Don Hartill, Zach Conway and Eric Smith, could make it possible to locate quenches during cavity tests with just eight (instead of up to 180) thermometers.

Is it a microphone? Is it a thermometer? It's an oscillating superleak transducer!

Superconducting cavities for the ILC won't have an easy life. They will be pushed to their limits constantly, forced to sweep the beams along towards the interaction point at high power to ensure the best possible physics results. Scientists must make sure now that they can take the power that will be pumped into them, and to do so they have to test the cavities — and test them again and again. They are looking for the perfect recipe to treat the material itself and the cavity surfaces because spots, blemishes or inclusions could cause a quench in the cavity.

A quench is a sudden warming of the supercold superconducting cavity surface in a certain area where the current flowing through the cavity meets resistance and generates heat. The cavity field collapses and the acceleration gradient goes down, which means that the particles don't get up to the required energies. The cavities sit in a bath of superfluid liquid helium, and a special property of helium in the superfluid state is the key factor in the new technique proposed by Cornell. The heat generated by the quench does not propagate by diffusion, as one would expect; instead, in superfluid helium, the temperature propagates by a wave.



Cornell's re-entrant nine-cell cavity was tested with the second-sound method. The yellow dot shows where a quench occurred.

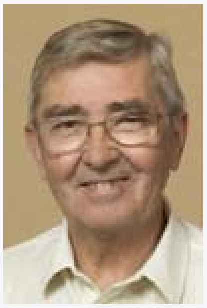
This temperature wave is called "second sound" because it behaves just like a sound wave in air. That means that special 'temperature microphones' (they are actually called oscillating superleak transducers) can measure the heat burst and the scientists can triangulate the exact quench location from the response of a few sensors. “We know the time of flight and can locate the quench spot down to 5-millimetre precision,” explains Zach Conway. “We should be able to do it within one millimetre in the future.” Temperature mapping is a standard technique in cavity testing, but at the moment it requires between 10 and 20 thermometers per cell, which means up to 180 thermometers for a nine-cell cavity — not only a lot of work but also a lot of money and time. The team thinks that eight sensors, placed strategically around the cavity, will be enough for a full cavity quench test. The technique also allows the detection of quench spots in more than one cell in the same test by powering the nine pass-band modes of a 9-cell cavity. The new microphones are custom-made at Cornell, but the principle isn't new — it's been used in low-temperature physics for a while.

“We have also used several standard thermometers on our nine-cell re-entrant cavity and proved that the predicted quench location from second sound detection was right. Now we're looking inside the cavity with a Questar telescope to find the fault,” adds Padamsee. Cornell will test all future cavities with these microphones and hopes other will do the same.

-- *Barbara Warmbein*

Director's Corner

26 June 2008



Ewan Paterson

Integrating ideas at Dubna

Today's issue features a Director's Corner by Ewan Paterson, Integration Specialist and Member of the GDE Executive Committee.

At the recent Conventional Facilities and Siting Workshop in Dubna, there were four focus groups: *Shallow Site, Infrastructure, Siting and Accelerator Systems*. However before the meetings formally began, the conveners of the latter two had integrated them into one. These conveners, Nikolai Solyak, Andrei Seryi, Masao Kuriki and myself, felt that the subjects had so much overlap and were so strongly coupled that it would be more productive for the parties involved to discuss them together. A charge to this joint focus group might be written as follows:

Examine possible sites and evaluate machine design differences that accommodate or make best use of these sites and begin a process that

a) rethinks the accelerator layout for lower costs
b) identifies new and innovative ideas for lower cost designs
c) begins defining a 'minimal' machine that could be staged to higher energy.

This process began with a review and update on the characteristics of the sample sites described in the *Reference Design Report* (RDR), including the requirements of a CLIC (Compact Linear Collider Study) technology design versus the ILC design at the CERN site. Most of the discussion revolved around the possible shallow site near Dubna where, because of the local geology and geomorphology, many conventional facilities and siting (CF&S) options are available which are quite different from the "deep" sites. Although cost studies have only begun for ILC layouts which make best use of the Dubna site, there was an unspoken consensus that the civil costs, especially in the interaction region, would be lower than those in the RDR.

We discussed several technical designs or layouts for the machine that had some common themes. The RDR is a conservative design. If one can make systems more compact and thus reduce the total tunnel length, then the CF&S costs go down faster than technical system costs (risks) increase! What are the tradeoffs in system performance, cost or operability? Examples included a shorter beam delivery system, alternative machine-detector interfaces, moving all sources and injectors to the central region, putting them in the same plane where they would share tunnel space with beam delivery systems, more compact bunch compressor systems in the 'ring to main linac' section, three-kilometre circumference damping rings with four rings in one tunnel (this may sound pretty wild but it would not be a first; CERN's PS booster uses the same system), a compact and less expensive positron keep alive source, and a few more.

Marc Ross preparing his summary talk in Russian early on Friday.

Not all these ideas are can be applied simultaneously or will survive more detail study and evaluation. However, we feel that we can probably reduce the beam tunnel by several kilometres, ignoring the question of whether there is also a second support or service tunnel, and some corresponding reduction in technical system costs. These translate into very worthwhile cost reductions and justify further study. However, as usual 'the devil is in the details', and following each idea with a more complete technical design including accelerator lattices that incorporate the changes would be a very large longtime effort. We began the process of planning to review the proposals and we believe that the area system and conventional facility leaders together can come up with a single integrated proposal by the end of 2008 that would be studied in 2009. With the Global Design Effort's finite resources, these reviews would rely heavily on past design work, the RDR and best judgment. I believe an even better combination of ideas is likely to be an outcome of this process.

Everyone including Marc thanking the local organisers.

One of the outcomes of these changes in system layouts is that one can consider the ILC in two parts, a central region which is roughly five by three kilometres and two narrow extendable arms which are each ten kilometres long. The central region contains all accelerator and detector systems and their support functions and the arms contain linac systems with their support. The requirements for access points and frequency of access are likely to be different in these different regions and might be optimised differently. The linacs have a natural redundancy, whereas the injector and beam delivery systems have many one-off and critical components or instrumentation. The central region might be part of an existing campus or form a new campus which would include all the facilities necessary for a functioning international laboratory. If we include the end of the linacs in the central region (they belong there physically) along with the cryoplants etc, then additional access to the linacs from the surface and therefore impact on the surface in the form of more buildings would occur at the five- and ten-kilometre points and would be localised. This type of geometry would fit almost any site but would benefit from having the central region at a shallow depth, especially the interaction region. In addition to a level shallow site one could envision a central campus in a broad valley with the linac arms extending into the mountains.

From the view of the focus groups on siting and accelerator systems, this was a stimulating and productive workshop. As can be seen in the accompanying photos we are grateful to the local organisers for all their efforts.

-- Ewan Paterson