ilc newsline

ABOUT | ARCHIVE | SUBSCRIBE | CONTACT | LINEARCOLLIDER.ORG 27 OCTOBER 2011

AROUND THE WORLD

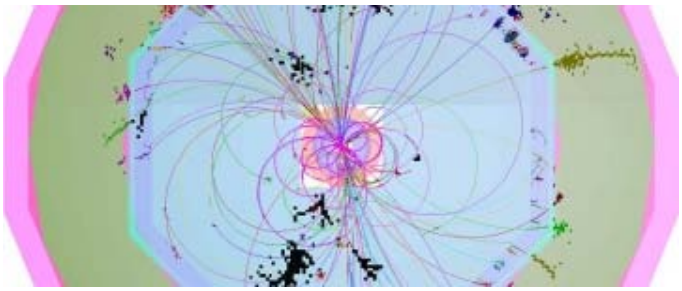
Proposing a fishcake shape

by Rika Takahashi

Kamaboko is a type of Japanese fishcake with a distinctive loaf shape, usually served sliced thin with dipping sauce such as soy sauce and wasabi or as a topping for noodles. It is also the shape of the newly proposed ILC tunnel design for an Asian mountain site.

FEATURE

from CERN Bulletin: Detectors on the drawing board



Linear collider detector developers inside and outside CERN are tackling the next generation of detector technology. While their focus has centred on high-energy linear collider detectors, their innovative concepts and designs will be applicable to any future detector.

DIRECTOR'S CORNER

Thoughts from Granada – a view from the back of the room

This week's issue features a Director's Corner from Mike Harrison, Americas Regional Director for the Global Design Effort

by Mike Harrison

Superconducting radiofrequency technology is advancing, the ILC design is coming together, and the LHC programme is running exceptionally well, although the evidence for new physics remains tantalizing. The linear collider community is well on its way to bringing the next big particle collider to the world's stage.

SLIDESHOW

Jean-Pierre Delahaye retires

Images: Erk Jensen and Perrine Royole-Degieux

Earlier this month Jean-Pierre Delahaye retired as CERN's CLIC Study Leader. A reception was held in his honour at CERN.

IN THE NEWS

from ***Science 2.0***
23 October 2011
How SUSY Gets Excluded: A New ATLAS Search
They selected events which contained six energetic hadronic jets plus a large amount of missing transverse energy: a signature which should be contributed by the decay of supersymmetric particles, if those existed and had a mass small enough to be copiously produced.

from ***Wired***
21 October 2011
Hints of New Physics Crop Up at LHC
Data from the CMS experiment is showing significant excesses of particles known as leptons being created in triplets, a result that could be interpreted as evidence for a theory called supersymmetry.

from ***APS Physics***
20 October 2011
Focus: Testing a Piece of the Next Generation Collider
Researchers have demonstrated the key piece of equipment needed to produce the intense positron beams required for the next generation of particle accelerators.

from ***DESY***
20 October 2011
Start of European project CRISP – Joint venture for tomorrow's research
Within the framework of the European project CRISP, 16 European physics research centres interlink for the first time to collaborate on central technical issues for their future research infrastructures to profit from each other.

CALENDAR

UPCOMING EVENTS

2011 IEEE Nuclear Science Symposium and Medical Imaging Conference
Valencia, Spain
23- 29 October 2011

ILC Source/RTML/BDS+MDI Technical Baseline Review
DESY, Hamburg, Germany

BLOGLINE

24 October 2011
Frank Simon
Breathe

22 October 2011
Frank Simon
The CLIC Physics and Detectors CDR

24- 27 October 2011

TESLA Technology Collaboration (TTC) Meeting
IHEP, Beijing, China
05- 08 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

ARXIV PREPRINTS

1110.5231
Pulse-to-pulse Orbit Jitter Propagation in Multi-bunch Operation at the KEK Accelerator Test Facility 2 (ATF2)

1110.5141
Studies and application of bent crystals for beam steering at 70-GeV IHEP accelerator

Copyright © 2011 ILC-GDE

ilc newsline

AROUND THE WORLD

Proposing a fishcake shape

Rika Takahashi | 27 October 2011

Cross-section of a kamaboko tunnel

Kamaboko is a type of Japanese fishcake with a distinctive loaf shape, usually served sliced thin with dipping sauce such as soy sauce and wasabi or as a topping for noodles. So what does kamaboko have to do with the ILC? It is the shape of the newly proposed ILC tunnel design for an Asian mountain site.

On 12 and 13 October, a meeting was held at KEK to discuss conventional facilities and siting (CFS) issues for the ILC.

When the Global Design Effort (GDE) released the strawman baseline 2009 (SB2009) with an effort to optimise cost and design, the single-tunnel design was adopted over the double-tunnel design proposed in the *Reference Design Report* (RDR) in 2007, where a service tunnel lay along the accelerator tunnel. At the time of SB2009, scientists at KEK proposed a so-called SB2009-J single-tunnel design, which looked as though it had two tunnels.

The Japanese ILC CFS team has been working on detailed site analysis in cooperation with specialists from industries on eight different variations for the ILC tunnel design, ranging from the RDR-type double tunnel to a proposed new shape. “As a result of hard work done by the Japanese CFS team, we would like to introduce this kamaboko shape as a new ILC tunnel design for mountain regions,” said GDE Project Manager Akira Yamamoto of KEK.

“We have examined the single-tunnel design that fits Japanese candidate sites for SB2009 based on an excavation method using the tunnel boring machine (TBM),” said Masanobu Miyahara, a technical administrative specialist at KEK. However, the SB2009 tunnel design for the Asian site was not really a single tunnel. “You will see two tunnels on the blueprint of our single-tunnel design for SB2009 because it is a rather common practice in Japan to excavate a pilot tunnel along with the actual tunnel in the case of large-scale construction,” said Miyahara.

TBM is one major tunnel excavation method. Another is called the new Austrian tunnelling method, or NATM. Because every particle accelerator needs stable ground for construction, TBM, which is generally better for providing stability, was the choice for ILC tunnel construction in all three regions of the Americas, Asia and Europe.

A TBM is a cylinder-shaped boring machine that grinds through different types of soil, from hard rock to soft ground. This method is especially well suited for use in solid rock, having the advantages of limiting the disturbance to the surrounding ground and helping to produce a very smooth tunnel wall. TBM is also effective in construction projects that need to be done quickly.

“During TBM construction, the giant machine will stay frontline and constantly grind the soil through days and nights. If the TBM hits a big groundwater flow or fracturing rock, it can be very troublesome,” said Miyahara. “Since about 70 percent of Japanese land is covered by hills and mountains, it is often the case for tunnel construction in Japan to excavate a smaller pilot tunnel to collect necessary geological information in advance.”

Without geological information, miners can face dangerous situations such as sudden flooding or cave-ins. And even if they avoid fatalities, nonfatal accidents would require a long recovery time, which would result in construction delays.

Could NATM do any better than the tunnel boring machine?

Kamaboko, a type of Japanese fishcake, artfully served and ready to eat. Image: Kinori

“For the RDR and SB2009, we excluded NATM as a construction method option because of its slow excavation speed, which averages 120 metres per month. It would need a few times longer construction period compared to TBM,” said Miyahara. “But we found out that if we optimise the construction schedule by NATM, we can reduce the construction period much more, to an even shorter time than that using TBM. If we schedule the tunnelling well, constructing many parts of the tunnel in parallel, construction can be done much faster and relatively cheaply.”

With NATM, the tunnel is excavated by a blast-and-drill method. Usually, shotcrete is applied onto the tunnel walls shortly after excavation, constituting a shell. Unlike TBM, where the tunnel cross-section shape is always circular and the diameter of the tunnel depends on the size of the machine, the shape of the NATM tunnel can be very flexible, making it possible to make a kamaboko shape.

The kamaboko tunnel is about 11 metres in width and 5.5 metres in height, divided into two rooms by a thick concrete wall. At the CFS meeting, Toshiya Sanami, radiation specialist at KEK, reported the new design’s radiation safety analysis. According to the study, the kamaboko tunnel with a 3.5-metre-thick wall in between two rooms can ensure same level of safety as that of the RDR two-tunnel design.

Also, NATM can help realise significant cost savings. “The biggest drawback of TBM construction is the cost of the machine. The excavation equipment used for NATM is much cheaper. We can deploy many machines at the same time, excavating different parts of the tunnel at the same time,” said Miyahara.

“We can also omit pilot tunnel construction,” he said, stressing the benefits of construction by NATM. “By NATM, excavation equipment is positioned posterior to the front of construction, so if any incident such as flooding occurs, workers can take a flexible approach with various auxiliary construction methods. This is a big advantage for construction with the tight schedule of a project such as the ILC.”

The design presented at this meeting was for the main linac tunnel, but the flexibility of NATM construction will be beneficial for other tunnels with much more complicated shapes, such as the beam delivery system, the electron and positron source, the damping ring or the central region of the tunnel including the detector hall.

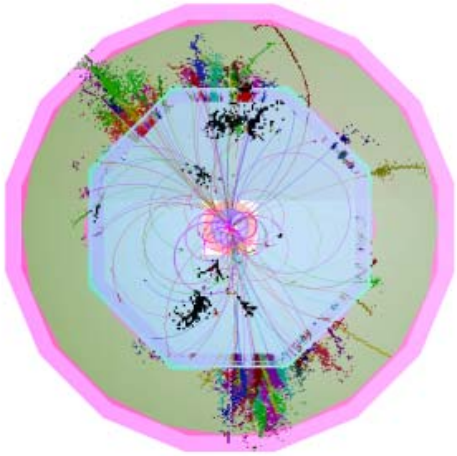
“I am very pleased to report a possible cost reduction of more than 10 percent compared to that of the RDR design,” said Yamamoto. This is the first detailed analysis done for the tunnel design together with industrial partners. The same kind of study is under way in the Americas and Europe.

CFS | CONVENTIONAL FACILITIES AND SITING | JAPAN | TUNNEL

Copyright © 2011 ILC GDE
Printed from http://newsline.linearcollider.org

Detectors on the drawing board

Linear collider detector developers inside and outside CERN are tackling the next generation of detector technology. While their focus has centred on high-energy linear collider detectors, their innovative concepts and designs will be applicable to any future detector.



A simulated event display in one of the new generation detectors.

"While the LHC experiments remain the pinnacle of detector technology, you may be surprised to realise that the design and expertise behind them is well over 10 years old," says Lucie Linssen, CERN's Linear Collider Detector (LCD) project manager whose group is pushing the envelope of detector design. "The next generation of detectors will have to surpass the achievements of the LHC experiments. It's not an easy task but, by observing detectors currently in operation and exploiting a decade's worth of technological advancements, we've made meaningful progress."

The LCD team is currently working on detectors for the CLIC experiment. "Electron-positron colliders like CLIC demand detectors with significantly more precision than those at the LHC," explains Lucie. "We've studied a variety of techniques to cope with this precision and other CLIC-specific issues. Many of these were pioneered for earlier linear colliders, but have since been adapted to fit CLIC's unique parameters." The team's work has culminated in two detector designs, published in the CLIC Conceptual Design Report.

At a glance, one could easily mistake the Linear Collider experiments for CMS. But while very similar, they incorporate a number of new elements to improve the efficiency and precision of the detectors. These include:

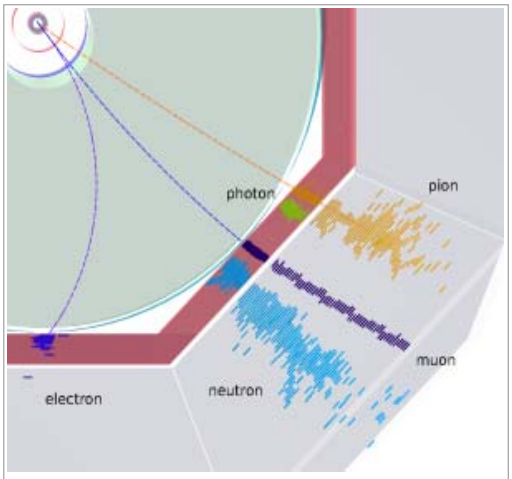
- *More Precise Vertex Detectors*: The pixel detector at the heart of the linear collider detector designs will have up to 40 times more readout channels and a much smaller pixel size (approximately 20 x 20 μm^2, compared to CMS's 100 x 150 μm^2).

- *Particle Flow Analysis*: This technique combines information from different parts of the detector in order to extract the maximum knowledge from individual particles – including particles inside jets. To fully exploit this technique, the linear collider experiments are developing calorimeters with ultra-fine granularity.

- *Tungsten Calorimeters*: The sizeable CLIC collision energy (up to 3 TeV) means that the calorimeters designed by the LCD team need to be both deep and dense in order to avoid energy leaks. To accomplish this, they have designed the hadronic calorimeter to use tungsten absorbers instead of the traditional steel. As tungsten is extremely dense, it can

instead of the traditional steel. As tungsten is extremely dense, it can provide the required depth without dramatically increasing the size of the detector. Read more about CLIC's tungsten calorimeters here.

The LCD team performed 6 physics analyses to study the potential for discoveries and precision physics of their detector designs at CLIC. These analyses took simulated physics events and simulated background events, and overlaid them to create a "real" electron-positron collision environment. These data were then sent through a computer model of the detector to create a realistic readout. Finally, using highly specialised software, the physics signals were extracted from the detector readout.



Calorimeters with ultra-fine granularity allow particle recognition inside jets.

By comparing the input physics event with the extracted physics signals, the LCD team was able, for example, to calculate Higgs boson properties and study whether it is an elementary particle or a composite particle. The LCD analyses have found the sensitivity to the Higgs compositeness scale to be significantly superior to what is possible at the LHC.

"While we need to continue to develop the detector technology, the analyses have shown that our detector concepts are feasible," concludes Lucie. "In fact, they are not just feasible – they can provide an unprecedented level of precision measurements for interactions that have only ever been theorised."

No matter what new detector makes it off the drawing board and into production, its design is likely to incorporate these linear collider concepts.

by Katarina Anthony

Copyright CERN 2011 - CERN Publications, DG-CO

ilc newsline

DIRECTOR'S CORNER

Thoughts from Granada – a view from the back of the room

This week's issue features a Director's Corner from Mike Harrison, Americas Regional Director for the Global Design Effort

Mike Harrison | 27 October 2011

Mike Harrison addresses the Global Design Effort Executive Committee at LCWS11. Image: GDE

One of the most evident aspects of the recent LCWS11 meeting in Granada, Spain, was the fact that the linear collider community has developed a meaningful collective consciousness over the past several years as closer integration has taken hold. Granada was the second major joint workshop between the CLIC and ILC programmes following from CERN, Switzerland, last year. We have had joint technical working groups for more than two years at this point and the degree of mutual awareness of the capabilities and problems we both face was on show at both the plenary and parallel sessions. Both programmes were covered in detail to an audience keen to hear about all aspects of the technical programmes. During the opening plenary, in additional to the latest LHC news, Rolf Heuer delivered a strong message for integration in the total high-energy physics community and offered support for further consolidation of the global linear collider programme. This call for enhanced cooperation was echoed by Atsuto Suzuki on behalf of the International Committee for Future Accelerators. While describing the way forward to the realisation of a linear collider project, Suzuki had an implicit strand of global action running throughout his presentation.

On a more parochial front, one of the most impressive aspects in the technical sessions was the recent progress of the superconducting radiofrequency (SRF) cavity programme. The cavity high-gradient yield has improved dramatically within the past year with much better understanding of the reasons for performance limitations. With the knowledge and techniques to diagnose cavity problems and control processing to correct flaws, potentially *post facto*, it appears to me that a yield of 100% is plausible, especially when taking into account that the high-level radiofrequency system is now capable of handling a spread of gradients. At the start of the R&D programme in 2007, it was considered a somewhat speculative call to adopt a gradient specification of 35 megavolts per metre. Now it is starting to appear possibly conservative. The ILC SRF programme has been one of the highest priorities of the global R&D effort and it is especially gratifying to see this level of achievement. It doesn't hurt that SRF is increasingly viewed as one of the fundamental accelerator technologies throughout the world and thus support is forthcoming, but the ILC programme has been in the forefront of these efforts and has continued to demonstrate the power of a well-conceived global approach. To quote Jim Kerby from one of the parallel sessions, "the past two years have been remarkable".

In preparation for the *Technical Design Report* (TDR), the process of design integration was in full flow during the workshop. The Conventional Facilities and Siting (CFS) group has the not unreasonable desire to know where to put the tunnels and infrastructure and had joint meetings with most of the systems groups to firm up the baseline. I think this step more than anything demonstrates that we will present a mature project design for the TDR. This represents a crucial step towards determining the scope (and cost) of an ILC: a firm basis on which to proceed.

Throughout the workshop, the elephant in the corner of the room remained the CERN's Large Hadron Collider (LHC) results. Both the machine and detectors are running well. In excess of 3 inverse femtobarns of luminosity has been delivered and most of it has been analysed. If either the Higgs boson or physics beyond the Standard Model are seen then the case for a linear collider will be strong and the energy and luminosity scales apparent. To date however, the underlying physics remains uncertain and thus so do the appropriate linear collider machine parameters. This situation may resolve itself by the end of the present LHC run in 2012, which will take proton beams to a centre-of-mass energy of 7 or 8 teraelectronvolts (TeV), but it may require the subsequent run at 14 TeV starting in 2015 to clarify the situation. Until the correct design energy is apparent, an ILC R&D programme post-TDR that considers various energies while maintaining SRF technology development, especially with regard to cost effectiveness, looks to be the appropriate way to proceed.

An enjoyable banquet with a vibrant atmosphere reflects the spirit of optimism of this year's linear collider workshop in Granda, Spain. Image: Perrine Royole-Degieux

Back in the political arena: An important upcoming event will be the release of the European Strategy in early 2013. This is a five-year plan for the European Union high-energy physics programme and as such will have a major influence on the whole field. A plenary session with Brian Foster and Steinar Stapnes described how this process will unfold. A position paper from the complete linear collider community will be submitted for consideration by the study group. These deliberations will be concurrent with the ILC Global Design Effort reorganisation at the end of the TDR phase. The way forward is still uncertain. The future remains interesting.

One of the high points of the workshop was undoubtedly the visit to the Alhambra (thanks to Juan Fuster and the local organising committee). Such antiquities remind us of the unquenchable nature of the human spirit to provide a sign for posterity that "we were here and our values were such that we did this". While the technology may have changed I like to think that to some degree we share these same principles in our chosen field. After the visit I noticed Vic Kuchler and John Osborne from the CFS group sharing notes. I can only assume that ILC experimental cavern will be a memorable artifact in its own right too.

LCWS11 | LHC | SUPERCONDUCTING RF

Copyright © 2011 ILC GDE
Printed from http://newsline.linearcollider.org