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RESEARCH DIRECTOR'S REPORT

New regional contact from Europe

by Sakue Yamada

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AROUND THE WORLD

Linear collider technology in your body

New FP-7-health programme brings together hospitals and particle physics

by Barbara Warmbein

A device used the linear collider's hadronic calorimeter could soon help detect cancer. It would also be the central part of what is likely going to be the world's smallest calorimeter – so tiny that it can fit on the tip of an endoscope to be inserted into a person's stomach. Since January 2011, a consortium of some 60 scientists from 13

DIRECTOR'S CORNER

What did we accomplish last year?

by Barry Barish

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institutes all across Europe is officially building the world's first in-body calorimeter, funded by the European commission in its 7th Framework Programme with about 6 million Euros over a period of four years.

highest priority goals. Hopefully, the world political and economic climate will improve before too long and there will once again be receptiveness to major investments in large-scale basic science projects. It is hard to imagine that we have seen the last of such projects; therefore our strategy is to be as prepared as possible to make a strong proposal for a linear collider when the time is right. Keeping that ultimate goal in mind, how are we doing and what did we accomplish in 2010? In fact, in my opinion, last year was a banner year for the Global Design Effort!

IMAGE OF THE WEEK

SLAC's new associate lab director

Image: Maxine Hronek

SLAC's new Director of the Accelerator Directorate Norbert Holtkamp (2nd from left) meets with GDE Project Managers Nick Walker, Marc Ross and Akira Yamamoto on a sunny afternoon in Palo Alto, California. Holtkamp welcomed GDE members to SLAC at their second Baseline Assessment Workshop on Tuesday.

IN THE NEWS

From physicstoday.org
18 January 2011
Does the world need the US to lead particle physics?
… As if to acknowledge the new reality, one possible next-generation machine, the International Linear Collider, even has "international" in its name.

From Cern Bulletin
17 January 2011
The end of a remarkable era
An important era in particle physics is coming to an end: the US Department of Energy announced on Monday that it will not fund an extension to Tevatron running beyond 2011.

From New York Times
17 January 2011
Recalling a Fallen Star's Legacy in High-Energy Particle Physics
… Some day alien archaeologists could excavate the tunnel in which giant machines replayed the Big Bang and wonder what happened to the people who built it, and what they thought about their place in the universe.

From Público
12 January 2011
La carrera por el mayor de los aceleradores
Uno de los candidatos es el International Linear Collider (ILC), un acelerador que abandona la forma circular por una lineal que funciona a menos potencia que el LHC (un teraelectronvoltio) pero aprovecha mejor cada colisión. (in Spanish)

CALENDAR

UPCOMING EVENTS

Second Baseline Assessment Workshop (BAW-2)
SLAC
18- 21 January 2011

UPCOMING SCHOOLS

US Particle Accelerator School (USPAS)
Old Dominion University, Hampton VA
17- 28 January 2011

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

View complete calendar

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New regional contact from Europe

Sakue Yamada | 20 January 2011

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We have now come over the middle point of the Letters-of-Intent (LOIs) process to produce a detailed baseline design (DBD) of the ILC detectors. The first half was very productive. Starting from the call for LOIs and establishing the advisory scheme, the International Detector Advisory Group (IDAG), we came through the validation, which included both hard work for preparation by many people and elaborated examination by IDAG. Much work on detector R&D and physics simulation is now being continued to be integrated into two detector systems by the two validated groups. While further efforts are needed towards the completion of DBD, it is timely to make an interim report now, and we are already working on it. Not only it was required by International Linear Collider Steering Committee to report the progress, it will be useful for us to summarise how much we have done and to make it public. It will also clarify the amount of work lying in front of us. The contents of the report have been drafted by many members of the detector community and are being edited by the management. After the final polishing by the communicators, it will be published in a similar format as the Gobal Design Effort's interim report.

Close to the end of the last year, we were informed that European Committee for Future Accelerators (ECFA) nominated Juan Fuster of IFIC as the new European co-chair of the worldwide study (WWS) organising committee (OC) to succeed François Richard (from CNRS/IN2P3 at LAL in Orsay, France). François organised many ECFA Linear Collider workshops, of which the most recent one in Geneva and at CERN last October was organised jointly with CLIC. Juan will begin the role by hosting the coming LCWS11 in Granada, Spain, in September this year.

Juan Fuster in front of exhibited LEP components in Valencia. He is the new European regional contact for the worldwide study, taking over from Francois Richard.

It is our practice to ask the WWS-OC co-chairs to serve as the regional contacts of the detector management. Our European regional contact also will change accordingly this month.

A big thank you to François Richard!

Taking this opportunity, I wish to thank François for his contribution since the very early phase of the present Letter of Intent process. He played a big role in planning the scheme itself. His long experience in the ILC detector activity and enthusiasm for electron-positron physics constantly meant a powerful driving force as we came along. It was a pleasure to work with François. His frank opinions were valuable and often gave power to our activity. His contribution was not only in the managerial field but in actual physics consideration, as was shown when we studied the *Strawman Baseline 2009 Report* (SB2009) performance. We strongly hope and believe François will remain in the field and strive with us.

At the same time we are very pleased that Juan Fuster of the Instituto de Física Corpuscular de Valencia IFIC in Valencia, Spain takes over the important task and joins us. He has a long carrier in electron-positron physics research which goes back to the CELLO experiment at PETRA at DESY in the 1980s and then to the DELPHI experiment at LEP when he was at CERN. In those experiments he accumulated an allround experience in detector R&D and construction, in developing and running a trigger system and in physics analyses of new particle searches or quantum chromodynamics (QCD) studies, namely jets of gluons and heavy flavours. He convened the QCD studies of LEP-I analyses. When Juan went back to Spain, he started in Valencia a team which developed the first silicon detector in the country, participated in the ATLAS experiment at the LHC and produced one-seventh of its forward silicon tracker. While working on heavy-flavour physics with his students, he keeps an interest for electron-positron physics, which was lucky for us. He made a leading effort to make a Spanish group to join the ILC activity. Juan also has managing experience as the director of his home

institute IFIC. We are glad to have Juan’s fresh power and look very much forward to working with him. For smooth transition he has been joining many of our meetings since December.

DBD | DETAILED BASELINE DESIGN | EUROPE | REGIONAL CONTACT

AROUND THE WORLD

Linear collider technology in your body

New FP-7-health programme brings together hospitals and particle physics

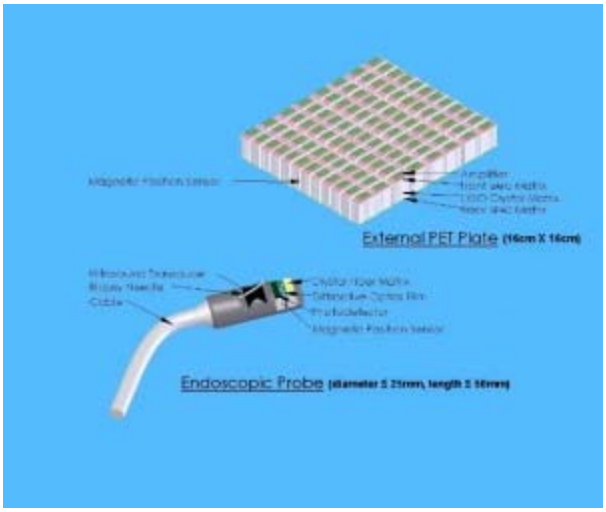
Barbara Warmbein | 20 January 2011

PET scanners like these could be a thing of the past for people suffering from pancreatic cancer. Image: CERN

A device used the linear collider's hadronic calorimeter could soon help detect cancer. It would also be the central part of what is likely going to be the world's smallest calorimeter – so tiny that it can fit on the tip of an endoscope to be inserted into a person's stomach. Since January 2011, a consortium of some 60 scientists from 13 institutes all across Europe is officially building the world's first in-body calorimeter, funded by the European commission in its 7th Framework Programme with about 6 million Euros over a period of four years. The partners have just returned from Marseilles La Timone hospital, the home of the project's coordinator, professor René Laugier, and place of its kick-off meeting. Its name is almost bigger than the device it will produce: Endo-TOFPET_ US, which stands for multi-modal endoscopic probe with Time of Flight Positron Emission Tomography and ultrasound.

The goal of the project: develop and test new biomarkers for pancreatic cancer. This extremely challenging medical task requires to build and operate a detector with unprecedented space resolution for the detection of pancreatic cancer. It is a new multi-mode tool for medicine, combining ultrasound and PET imaging techniques to significantly improve the resolution of cancerous tissues.

The keyword here is detection: medical doctors work together with detector-developers from the particle physics community to merge the expertise of both worlds. It's not the first time this happens, of course – the project draws on a long and successful cooperation expertise from PET scanning, a medical diagnostics method where detector technologies from particle physics are being routinely used in hospitals around the world.



Conceptual design of the detection part of the Endo-TOFPET_US project.

The innovative device would be as small as four cubic centimetres and could be inserted into the patient's stomach. Its partner detector (see info box for a description of how PET scanning works) is a detector plate of 15 by 15 centimetres of more conventional design that will sit on the patient's abdomen to form a direct line with the endoscope inside the body. The combination with the small detector head on the endoscopic probe placed a few centimeters away from the organ under investigation (the pancreas in this case) provides a sensitivity 100 times higher than whole-body PET scanners. This means either a reduced radiation dose for the patient or a better resolution of the parts that have to be surgically removed. An unprecedented PET timing resolution is needed because the organs surrounding the cancer tissue is active as well.

The detectors will be integrated and tested at DESY, building on the experience in large-scale detector integration and in the operation of multi-channel SiPM-based detectors. The technology frontiers in inorganic crystals, diffractive optics, single-photon detectors, time-of-flight readout electronics contributed by the partner institutes of the consortium will be assembled at DESY into it final form.

The photo-detector used in the project is a siliconphotomultiplier or SiPM, which is also used in one of the linear collider's hadronic calorimeters for its ability to measure single photons. It has been a study object for medical uses for many years (See "How a calorimeter could save your life", ILC NewsLine 19 April 2007). The SiPM group at DESY is leading one of the work packages of the project, and the existing facilities will be put to good use in the next three years. In the final year of the project the device will move from a laboratory test bench into real hospitals for testing (on animals and finally on human patients).

What does PET mean?

In a traditional positron emission tomography or PET scan, the patient receives a tracer liquid containing radionuclides that emit positrons when they decay. When these positrons encounter electrons in the patient's body, particle and antiparticle annihilate and two gamma-ray photons are emitted in virtually opposite directions. These photons are then seen by a detector, generally consisting of an inorganic crystal coupled to a photodetector, and with the help of specialised software the location of the annihilation and thus of heightened activity in the body can be identified with high precision.

More information about Endo-TOFPET_US:

endotofpet-us.web.cern.ch/endotofpet-us

More information on SiPMs:

www.linearcollider.org/newsline/readmore_20100225_atw.html

www.linearcollider.org/newsline/readmore_20090702_ftr1.html

CALORIMETER | EUROPE | FRAMEWORK PROGRAM | PET | TECHNOLOGY TRANSFER

DIRECTOR'S CORNER

What did we accomplish last year?

Barry Barish | 20 January 2011

GDE Executive Committee members Peter Garbincius, Brian Foster, Jean-Pierre Delahaye, Toshiaki Tauchi, Mike Harrison (partially hidden) and Barry Barish during a working session at ICHEP 2010 in Paris

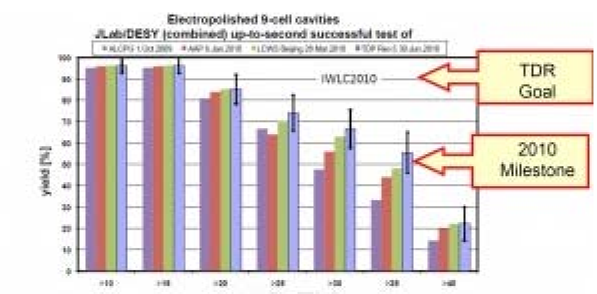
The ILC is still very much a dream and the path to a real project remains highly uncertain, even though the scientific case is as strong as ever and we continue to meet all our highest priority goals. Hopefully, the world political and economic climate will improve before too long and there will once again be receptiveness to major investments in large-scale basic science projects. It is hard to imagine that we have seen the last of such projects; therefore our strategy is to be as prepared as possible to make a strong proposal for a linear collider when the time is right. Keeping that ultimate goal in mind, how are we doing and what did we accomplish in 2010? In fact, in my opinion, last year was a banner year for the Global Design Effort!

Maxine Hronek (Fermilab), who very capably runs the GDE central administrative offices at Fermilab

We continue to appreciate the support we get from Fermilab in hosting our small central administrative offices, from which we are able to very effectively organise and support our widespread activities, whether organising meetings, hosting linearcollider.org and *ILC NewsLine*, providing web services, providing purchasing, assisting travel, etc. The scientific and technical work of the GDE is coordinated by the Executive Committee (EC), composed of senior members from around the world. It is very active and works very well, whether coordinating our scientific and technical programmes or making policy decisions. This group deserves much of the credit for our successes, which result from their dedication, hard work and good advice.

The central mission and mandate of the GDE is to coordinate the worldwide R&D programme and to produce a technical design for the ILC by the end of 2012 that has a worldwide consensus behind it. In addition, our R&D programme is focused on demonstrating the key technical features in the design. After two years, we have evolved the original reference design to one better optimised for cost, performance and risk and have succeeded in accomplishing much of the key R&D.

Perhaps our most important accomplishment last year was to achieve our ambitious intermediate goal of producing high-gradient superconducting radiofrequency (RF) cavities of 35 megavolts per metre (MV/m) with 50% yield. Now, we are concentrating on developing cost-effective production processes with industry and further improving the cavity gradient and yield.



Production yields of ILC cavities, where most recent data proves that the ILC milestone of 50% yield for cavities was achieved

The second major R&D accomplishment during 2010 was the studies of electron cloud effects in CesrTA at Cornell. This experimental programme is providing measurements that will be very important for a wide variety of future accelerator applications. Specifically for the ILC, CesrTA is giving us the crucial information to determine our electron cloud mitigation strategy.

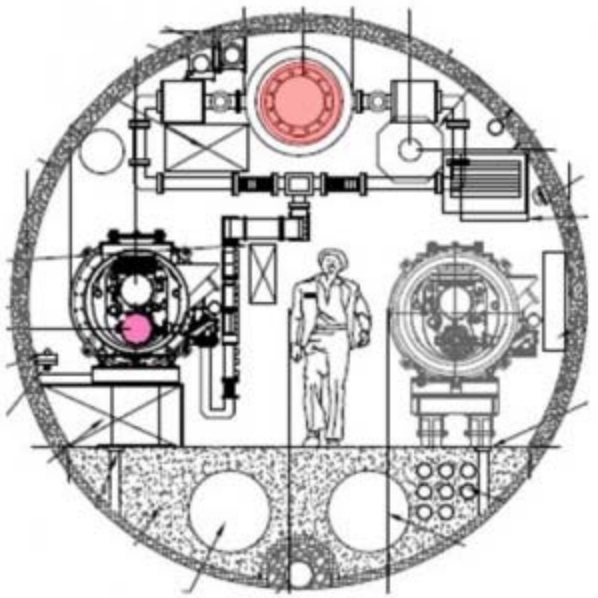
During 2010, we also turned on the ATF-2 beam at KEK and this accomplishment represents the beginning of the crucial ILC final focus performance studies. One of the unique and most crucial features of the ILC is the very small beam sizes at the interaction point. We anticipate important results from ATF-2 in 2011 and 2012.

The ILC design effort has also made big strides during 2010. The GDE project managers identified and proposed a selected set of design changes more than one year ago. After many meetings, reviews, and further work, two major changes have now been adopted for the *Technical Design Report* baseline: a change from a double to a single tunnel for the main linac and the establishment of the operating gradient (31.5 MV/m) for the main linac, which was discussed by the community at the first baseline assessment workshop (BAW-1) at KEK in September. These two changes were formally proposed to me last autumn, and with the assistance of a baseline assessment group, they were evaluated and I approved them.

Similarly, the same final steps (BAW-2, etc) for the remaining two major changes to the baseline design are taking place over the next month or so. Following those decisions, we will be ready to concentrate our efforts on the design work and costing for the TDR.

In today's *ILC Newsline's Research Director's Report*, Sakue Yamada addresses our progress on physics and detectors. He discusses the change of representative for the European World Wide Study (WWS) leader from François Richard to Juan Fuster. I would like to comment on this change, by adding my hearty thanks to Francois for his tireless advocacy of the ILC, critical approach and great energy. We will miss him in the WWS role, but I am sure his voice will continue to be heard loud and clear. Besides, Francois still owes me for a bet that he didn't mind losing to me regarding our estimates of the level of participation at IWLC 2010 and I fully intend to collect! I also welcome Juan Fuster. Juan has been instrumental in bringing the Spanish ILC effort to a reality and we look forward to using his many talents in a broader role.

In conclusion, I want to emphasise that we remain firmly on course to complete our TDR by the end of 2012, as we have promised. Let's just hope that exciting early LHC results and an improved world economic situation will combine to enable the changing of our dream to a reality.GDE



Layout of a single-tunnel ILC main linac for one of two schemes being pursued for high level RF distribution (Klystron Cluster Scheme).

2010 | GDE | GLOBAL DESIGN EFFORT | OVERVIEW