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FEATURE

Physics slam has real impact

Scientists compete for an audience's approval by giving clear, fun and to-the-point presentations on topics in particle physics.

by Leah Hesla



Eugene, Oregon played host to the first-ever physics slam in the United States. By all accounts, it was a runaway success.

FEATURE

A day in a particle physicist's shoes

by Perrine Royole-Degieux



March is particle hunting season for more than 8,000 students who participated in the International Hands on Particle Physics Masterclasses. And this year features a premiere: they analyse real high-energy proton collisions from 2010's events at the Large Hadron Collider.

DIRECTOR'S CORNER

I have a dream...

This week's issue features a Director's Corner from Jean-Pierre Delahaye, member of the GDE Executive Committee and CLIC study leader.

by Jean-Pierre Delahaye



Is it possible to build a strong, long-term and globally coordinated accelerator R&D programme? Most probably, and Jean-Pierre Delahaye wishes to. In this week's director's corner, he explains how, referring to a review of new accelerator projects he presented at ICHEP2010 conference in Paris last year.

IN THE NEWS

From symmetry breaking
29 March 2011
The Daya Bay Neutrino Experiment: On Track to Completion
The Daya Bay Reactor Neutrino Experiment brings Chinese and American scientists together with colleagues from Russia, Taiwan, and the Czech Republic to investigate perhaps the most important unanswered question relating to the phenomenon of neutrino oscillation.

From Inside SU
28 March 2011
Syracuse University physicists first to observe rare particles produced at the Large Hadron Collider at CERN
Shortly after experiments on the Large Hadron Collider (LHC) at the CERN laboratory near Geneva, Switzerland, began yielding scientific data last fall, a group of scientists led by a Syracuse University physicist became the first to observe the decays of a rare particle that was present right after the Big Bang.

From LAL
24 March 2011
Michel Davier receives 2010 André Lagarrigue Prize
This prize…is awarded to front-line researchers who have had responsibility for machine and detector construction and derived maximum scientific benefit from such projects…

From Scientific American
24 March 2011
Antimatter of Fact: Collider Generates Most Massive Antinucleus Yet
The Relativistic Heavy Ion Collider has produced several nuclei of the antimatter counterpart to helium 4

From Nature
23 March 2011
Cosmology: The hunting of the dark
The race to detect dark matter has yielded mostly confusion. But the larger, more sensitive detectors being built could change that picture soon.

ANNOUNCEMENTS

2012 IEEE Nuclear Science Symposium

As part of the 2012 IEEE Nuclear Science Symposium and Medical Imaging Conference, a special linear collider event will be organised on 29 and 30 October 2012. (The IEEE NSS/MIC will take place at the Disneyland Hotel in Anaheim, California.) The event will include presentations of the International Linear Collider and the Compact Linear Collider accelerators, as well as detector concepts, the potential impact of linear collider technologies for industrial applications and a forum discussion on future linear collider perspectives.

The event website will be released later this year. For more information, email Maxim Titov at maxim.titov@cea.fr. You may also visit http://www.nss-mic.org/.

CALENDAR

UPCOMING EVENTS

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

Linear Collider Power Distribution and Pulsing workshop
LAL, Orsay, France
09- 10 May 2011

UPCOMING SCHOOLS

Joint US-CERN-Japan-Russia School on Particle Accelerators
Course on Synchrotron Radiation and Free Electron Lasers
Ettore Majorana Foundation and Center for Scientific Culture, Erice, Sicily, Italy
06- 15 April 2011

View complete calendar

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FEATURE

Physics slam has real impact

Scientists compete for an audience's approval by giving clear, fun and to-the-point presentations on topics in particle physics.

Leah Hesla | 31 March 2011



Jim Brau emcees the particle physics slam. Brau is the ILC regional detector contact for the Americas and professor of physics at the University of Oregon. Image: Jack Liu.

Applause-o-meters don't lie. The 90-decibel-level reading of claps and cheers from the Eugene, Oregon audience indicated that the first-ever physics slam in the US was a hit.

On 22 March, five physicists carried out an assignment to explain in plain and engaging language a topic in particle physics – in only twelve minutes. After all five completed their talks, the audience voted with their applause for the favorite of the competitors, the slam champion.

"The general public is fascinated by particle physics," said Jim Brau, professor of physics at the University of Oregon and the event's master of ceremonies. "They showed it with a turnout of 800, their attentiveness and reactions during the presentations, and their unending questions afterward."

Hailing from Europe as well as the US, the slammers, as the scientist-entertainers were called, presented bite-sized talks on topics such as dark matter and neutrinos. They were in Eugene for the 2011 American Linear Collider Physics Group conference, hosted by the University of Oregon. The slam attracted local residents to learn about their work on the ILC.

In one talk intriguingly titled, "Why physics, dude?", DESY's Marc Wenskat introduced the audience to accelerating cavities. If built, he said, the International Linear Collider would require thousands of these cavities – so many that "ILC can also stand for I Love Cavities".

In another presentation, Argonne National Laboratory's Marcel Demarteau made a bet with the audience that they all had particle detectors in their homes.

"If you win, I will buy you all dinner," he told the crowd. "If I win, you owe me a beer."

Had the bet been serious, the local bar would have been tapped out.

Smoke detectors, he revealed to surprised attendees, are particle detectors. Smoke detectors and the gigantic particle detectors in high-energy experiments both rely on the same phenomenon, particle ionisation, to let us know there's something in the detector worth checking out.



University of Iowa's Garabed Halladjian, based at CERN, treats the audience to an explanation of how neutrinos act as astronomical messengers. Image: Jack Liu.

"We hope kids will go home and nag their parents to death about getting a smoke detector," said Demarteau. "Then, the next generation of particle physicists will

have been born."



SLAC's JoAnne Hewett gives her rendition of the dark matter rap, repeating the refrain: "Dark matter: what is it?". Image: Jack Liu.

The idea for Eugene's particle physics slam was borrowed from similar events in Germany, where science slams have gained popularity. Science slams are related to poetry slams, in which audience members vote on their favorite poetry reading of the competition.

The slam champion in Eugene, University of Oxford's Brian Foster, talked about hidden dimensions. Beating the clock by only one second, he used a violin, a photo of Einstein's tongue and examples of previous science revolutions to explain the idea behind string theory. And as with all the slam presentations, the audience ate it up.



An appreciative crowd applauds the slammers. Image: Jack Liu.

"I wish I could distil the enthusiasm and curiosity of the people of Eugene," Foster said. "If we could bottle it and sell it worldwide we would be able to build an International Linear Collider tomorrow."

After Brau declared Foster the night's favorite slammer, the five stuck around for an informal question-and-answer session. They also mingled with attendees who approached them personally with specific questions about the ILC and their work.

"It was so great to see hundreds of people of all ages come out for physics, and to see physicists competing over who can explain their topic in the most understandable way," said Kate Hulpke of the university's Materials Science Institute. "Let's do this again – and again."

Several audience members also suggested that the university host another physics slam next year.

"It was an impressive evening," said Wenskat. "The slammers were really entertaining and the people were fascinated. That's how science should be."

A video of the particle physics slam will be posted soon on the ILC's YouTube channel. In the meantime, see local press on the event.

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FEATURE

A day in a particle physicist's shoes

Perrine Royole-Degieux | 31 March 2011



Students and tutors during a masterclass session in 2010 at Dresden University of Technology in Germany. Image: Uta Bilow.

March is particle hunting season for more than 8,000 students who participated in the International Hands on Particle Physics Masterclasses. As the Large Hadron Collider is about to again start colliding protons, 130 universities and laboratories in 24 research institutes around the world open their doors and invite high school students to become particle physicists for one day between 4 and 26 March 2011. This year features a premiere: the young researchers are analysing real high-energy proton collisions from the LHC's 2010 run.

These masterclasses have taken place for six years, analysing electron-positron collisions from LEP, CERN's former collider. "Since proton-proton collision displays are far more difficult to decipher than electron-positron ones, one of the challenges was to find appropriate and easy-to-analyse LHC events," says Uta Bilow of Dresden University of Technology, who coordinates the masterclasses internationally.

The chosen event displays were recorded during the LHC's first run in 2010 in three of the four LHC experiments: ALICE, ATLAS and CMS. LHCb data will probably be picked up for a future edition of the masterclasses. Using the new data, the physicists from the University of Birmingham in the UK, the University of Notre Dame in the US, CERN in Switzerland, Darmstadt and Dresden in Germany, and the University of Oslo in Norway, who prepared the programme, introduced new concepts this year. Students learned for example how to distinguish background events from interesting ones.

"We wanted to give the student accurate insights into the world of particle physics and into particle physicists' everyday work, which required designing appropriate measurements," says Michael Kobel of Dresden University of Technology. Physicists even teach student how to look for new particles, like the most wanted Higgs boson or the so-called Z primes, which of course contribute to the excitement of the classroom.

After a morning session of data analysis, students share and compare their results in the afternoon with students from other countries via videoconference — just like actual particle physicists do within international collaborations. They understand at the same time the essence of healthy competition between researchers. It is also a good opportunity for them to learn that they can obtain results pretty close to and consistent with those officially measured a few months before by the LHC experiments. Students discover at the same time the importance of producing loads of collisions to improve a measurement's precision.



2011 Particle Physics Masterclass in Orsay, France. Image: CNRS/LAL.

The international particle physics masterclasses take place during the whole month of March. "Things have run

amazingly smooth so far, given that 130 institutes in 24 countries had to become accustomed to a completely new framework and completely new measurement task," said Kobel, co-chair of the International Particle Physics Outreach Group (IPPOG), where he initiated this programme seven years ago. "The excitement of the students is visible in the videoconferences and pays back the huge effort of all having contributed to the organisation." Of course, not everything runs perfectly: "We will learn and improve," he says.

Nicolas Arnaud from CNRS/LAL in Orsay, France, national organiser – and official French translator at the same time – was teaching at one of the first sessions on 4 March at LAL. He received many thankful remarks from the teachers, who were convinced they should participate again next year. "Some students were maybe a bit young to understand everything," said Arnaud, "but you could see already that some of them were very excited about every aspects of data analysis." Students were also very surprised to discover the real physicist's job is "not as difficult as we thought," as they eventually said.

Would it possible in the future to make student work on ILC events in a future edition? "Of course," answers Bilow, "as soon as we have them!"

INTERNATIONAL | LHC | MASTERCLASSES | OUTREACH

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DIRECTOR'S CORNER

I have a dream…

This week's issue features a Director's Corner from Jean-Pierre Delahaye, member of the GDE Executive Committee and CLIC study leader.

Jean-Pierre Delahaye | 31 March 2011

As a newcomer to the Global Design Effort Executive Committee nearly two years ago, I was invited to write for *ILC NewsLine*'s Director's corner, which I dedicated to one of my favorite subject: "The Beauty of Collaborations". I would like to take this new opportunity to address a complementary subject with a plea for a strong, long-term and globally coordinated accelerator R&D programme.

Indeed, I have been more than ever convinced of the absolute necessity of a strong R&D programme after I reviewed new accelerator projects in a talk at the International Conference on High Energy Physics (ICHEP2010) held in Paris in July 2010. Barry Barish wonderfully summarised the conference in the *ILC NewsLine* Director's corner of 19 August 2010.

On the occasion of this review and looking back to the past in order to better anticipate the future, I was shocked to realise the dramatic increase of time needed for the preparation of a new high-energy physics facility. The time duration between first ideas and final proposal for a new facility, including R&D, conceptual and technical designs – which remained about constant at the level of a few years, typically five – in the past, is now continuously increasing towards the scale of several decades – two to three – as outlined in Figure 1.

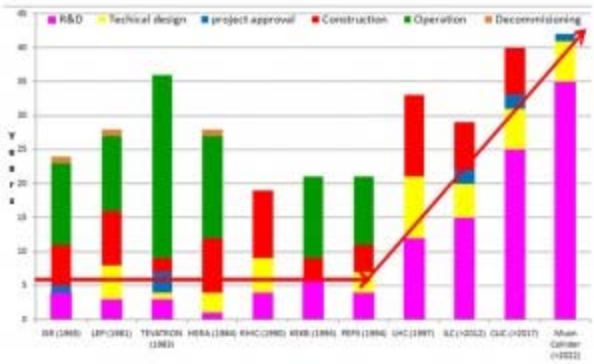


Figure 1. Evolution of the necessary time for accomplishing the various phases of past and present high-energy physics accelerator projects.

Such a long lead time, although alarming, is understandable since future facilities are more and more demanding. In order to get into new energy territories – called the "terascale" – and push further the frontiers of energy, intensity and brilliance, beam collisions with several megawatts of power focused to extremely small dimensions in the micrometre or nanometre range are mandatory to generate the extremely high luminosities (from 10^{34} to 10^{36} $cm^{-2}\times s^{-1}$) requested. In order to maximise the performance of these facilities while maintaining their cost and power consumption within reasonable limits, novel schemes and technologies have to be developed with performances well above the present state of the art. That requires imagination, inventiveness, resources… and time.

As a consequence, the necessary R&D has to be launched a long time (up to 30 years!) in advance in order to allow proposals to be available when needed. Moreover, since the future is hard to predict, all possible requirements for the future have to be anticipated early enough and the R&D launched for ALL of them. Such a long lead time also implies sociological consequences by forcing several generations of experts to push the project forward from the beginning to the end.

During the review, I also presented a tentative schedule of all foreseen high-energy projects over the next twenty years, updated after consultation with the corresponding project leaders. Putting together the schedule of the various phases of each project known at the time on a single table with one line per project (Figure 2) allows a comparative overview and triggers a few reflections:

- The large number of projects reflects the vitality of the field.
- Only a few projects have already been approved, whereas a large majority is in an R&D, conceptual or technical design phase. Obviously, all of them will not be approved. But they all have to be studied in order to provide a large range of options from which the physics community will choose the one best suited to physics.
- Some projects are clearly in competition, which is certainly very sane, by providing challenging comparisons and motivations to make the most of the opportunity with the resources available. But it also implies some duplication of efforts.
- The relative schedule of the various projects reflects the optimism or the realism of the persons in charge and is not always consistent and/or coherent.



Figure 2. Time schedule of the HEP accelerator projects envisaged in the future.

Borrowing from Martin Luther King, Jr., ***I have a dream*** that a global coordination of the various projects could define a coherent programme on a global and worldwide scale such that all options are correctly covered in a complementary and coherent way, thus avoiding unnecessary duplication and making the best use of the available expertise and limited resources. This dream will possibly come true since the International Committee for Future Accelerators, as an independent body, recently initiated a critical review of these projects, which will be extremely beneficial to the field.

Each of these projects is very ambitious and requires a large amount of R&D in order to develop the most appropriate technology, optimisation and industrialisation to reach the best balance among performance, risk and cost. Each project is usually coordinated by one single laboratory or by a collaboration of laboratories with a leading laboratory or by a global collaboration like the ILC Global Design Effort, the CLIC Collaboration for linear colliders or the Muon Accelerator Program for the US teams on muon colliders. Each project is therefore focused on its own development through the various phases from R&D to technical development to industrialisation, fabrication, installation and commissioning.

But the review also pointed out a large synergy of R&D subjects among the various projects as summarised in Figure 3, which outlines the issues related to each project.

In order to make the best use of resources and achieve the best possible performance in the global interest of the high-energy physics community, a global coordination of the R&D on a specific subject addressing all relevant projects could be extremely useful and more efficient than focused on an individual project as usually done at present.



Figure 3. Common issues and synergies of R&D among future accelerator projects.

I have a dream that teams made up of worldwide experts in the field would work together in close collaboration on specific subjects of R&D for the best benefit of all projects. Such a team dedicated to one of the R&D subjects applied to all projects could be coordinated by a national laboratory (usually too small to coordinate a global project). The laboratory would then be entitled with a global role well appreciated by the community and based on a local leading expertise on the subject in close collaboration with the corresponding worldwide experts.

As a conclusion, future high-energy projects (beyond the Large Hadron Collider) will be global, based on innovative ideas and technology breakthroughs which require extensive R&D developed by globally coordinated collaborations, or will not be! A strong, long-term and performing accelerator R&D is vital for the future of high-energy and is a high responsibility of the community. It is the critical key to future proposals of the best possible projects well adapted to physics needs with an optimised ratio of performances to needed resources (to build and operate) and a minimum of risks.

I have a dream that all accelerator experts would work together to develop the future in a close collaborative competition (or

competitive collaboration) approach where people would closely collaborate to develop together competing technologies and/or projects. The CLIC-ILC collaboration is a shining example of such a fruitful, efficient and open-minded approach in the best interest of linear colliders and high-energy physics.

ACCELERATOR R&D | GDE

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