

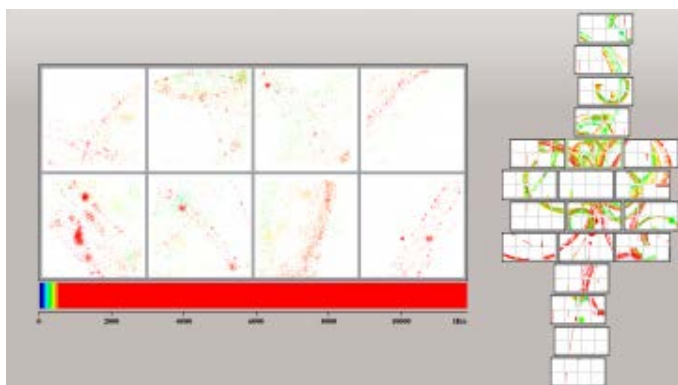
NEWSLINE

THE NEWSLETTER OF THE LINEAR COLLIDER COMMUNITY

AROUND THE WORLD

InGrids on the rise

by Barbara Warmbein



An alternative technology for the ILD detector's TPC tracker shows good results in a test beam at DESY. While the Large Hadron Collider saw its first circulating protons since many months, a detector technology for the time projection chamber of a future ILC detector saw some 1.5 million events in one week. Due to its specific technology, it probably has more channels than any other TPC so far.

DIRECTOR'S CORNER

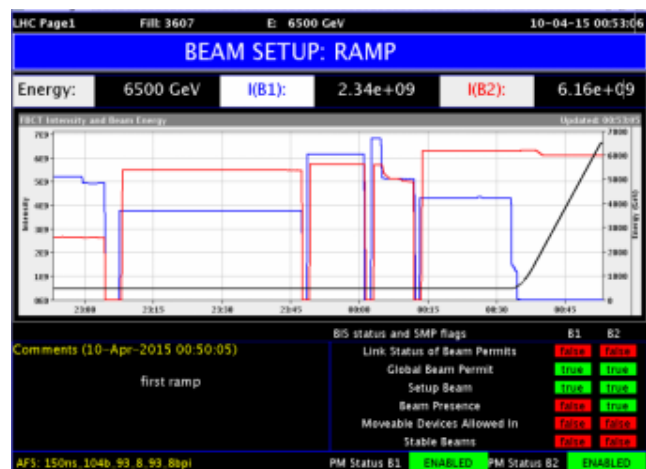
April in Paris

by Brian Foster



For the first Programme Advisory Committee meeting of the Linear Collider Collaboration, experts from all over the world gathered in France to review the status of the LCC and progress since the completion of the *Technical Design Report* in 2013. The committee was impressed by the progress both on the machine and the detectors. Brian Foster, European Director in the LCC, reports about the details.

IMAGE OF THE WEEK



LHC breaks new energy record

Image: CERN

6.5 TeV in a circulating beam! Since the LHC's restart on 5 April after its log shutdown, operations have gone smoothly in the world's most powerful particle accelerator. Since 10 April, the machine is holder of a new energy record (breaking the record it set itself), accelerating proton beams up to 6.5 TeV. According to CERN, the operators are now taking a 'softly, softly' approach, increasing little by little the number of bunches in the beams. They expect first low-energy collision in the coming weeks and the greatly-expected 13-TeV collisions sometime in June.

[Video: relive the LHC restart](#) | [Read more about the record](#)

IN THE NEWS

from *SA Visual, a Scientific American blog*

15 April 2015

[Subatomic Particles Over Time: Graphics from the Archive, 1952-2015](#)

Visualizing them in table form has become a bit of a tradition here at the magazine, as a way to introduce readers to the cast of characters in articles on the topic, and to provide context for theorized and newly described particles.

from *Iwate Nippo*

14 April 2015

[東北に国際研究ゾーン 仙台でILC推進協議会総会](#)

東北 ILC 推進協議会の 2015 年度総会で、加速器関連産業戦略ビジョンを中間報告した。ビジョンは 1 月中にまとめる。 At the annual general meeting of ILC Tohoku association, the content of the interim report on the strategic vision for the accelerator related industry was reported. The final report will be published in May)

from *Wales on line*

11 April 2015

[It's CERN Cymru as scientists from Wales work on Switzerland's big bang machine](#)

Initially at the helm of the LHC was project manager Lyn "The Atom" Evans, another Swansea University graduate who hails from Aberdare. He has now retired from the LHC and is heading the project to develop "next level collider", the International Linear Collider.

from *Hull Daily Mail*

9 April 2015

[Former Wilberforce College student Megan Wilson joins world-famous CERN research centre as intern](#)

The former Wilberforce College student will work on CERN's next big project, the internal linear collider.

from *Mainichi Shimbun*

8 April 2015

[県立大:「信頼される大学に」 鈴木新学長が抱負](#)

県立大の鈴木厚人 あつと 新学長 が、盛岡市で就任記者会見し、「技術力低下が叫ばれる中、 ILC を通した技術大国回復のため誘致実現を目指したい。国民から応援されるよう取り組みたい」と語った。(Atsuto Suzuki, new president of Iwate Prefectural University said in the press conference, "I aim to realise the ILC for Japan to regain the status of the leading country in technology through the ILC construction and operation. I will try hard to gain public support")

from *CERN*

5 April 2015

[Protons are back in the LHC](#)

The LHC is entering its second season of operation. Thanks to the work done in the last two years, it will operate at unprecedented energy – almost double that of season 1 – at 6.5 TeV per beam. With 13 TeV proton-proton collisions expected before summer, the LHC experiments will soon be exploring uncharted territory.

CALENDAR

Upcoming events

[Asian Linear Collider Workshop \(ALCW2015\)](#)

KEK and University of Tokyo, Japan

20- 24 April 2015

[6th International Particle Accelerator Conference \(IPAC'15\)](#)

Jefferson Lab, Richmond, Virginia, USA

03- 08 May 2015

[View complete calendar](#)

PREPRINTS

ARXIV PREPRINTS

[1504.03402](#)

Indirect Probe of Electroweak-Interacting Particles at Future Lepton Colliders

[1504.03273](#)

The supersymmetric Higgs boson with flavoured A-terms

[1504.03260](#)

The pMSSM10 after LHC Run 1

[1504.01726](#)

Physics at the e+ e- Linear Collider

[1504.01399](#)

Improving Higgs coupling measurements through ZZ Fusion at the ILC

[1504.00162](#)

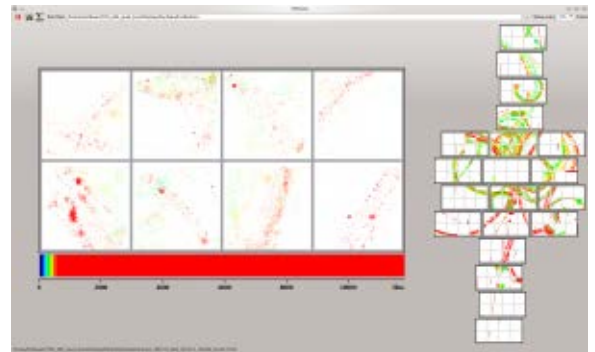
Non-interleaved FFS design

AROUND THE WORLD

InGrids on the rise

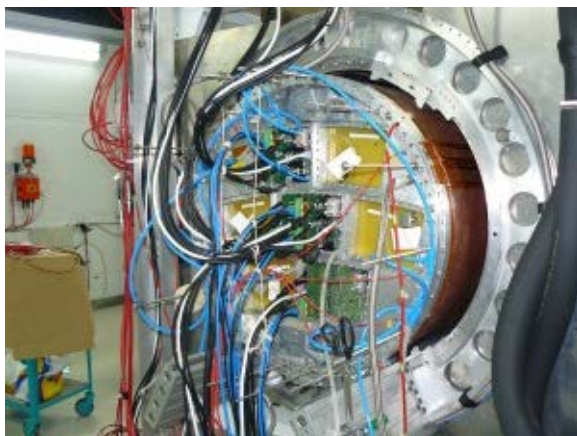
Barbara Warmbein | [16 April 2015](#)

The InGrid chip is an ingenious little thing. It is essentially a [Timepix](#) chip equipped with 256x256 pixels. On top of these sits a grid that features a hole over each pixel. Within the 50- μm gap, a strong electric field is generated. This means that electrons flying through one of those holes feel this field and are amplified in an avalanche – the pixels receive the signals from single particles. “It shows every single electron from the ionisation trail of the passing particle,” says Michael Lupberger from Bonn university in Germany, who recently spent time in a test beam at the German lab DESY to test the InGrid technology for the first time at a large scale. “It helps to better identify the track and the energy of the passing particle.”



Tracks in the TPC prototype.

InGrids are a proposed alternative to the ILD TPC’s recommended technologies of pad-based GEMs and Micromegas readout. The test beam team from Bonn and Siegen university (DE), CEA Saclay (FR) and NIKHEF (NL) used the PCMAG setup to test three modules of which one held 96, the other two 32 chips. On the central module, half of the total surface was covered by pixels. In total they ran some 160 InGrid chips, covering an area of 320 square centimetres and firing up to 10.5 million channels. The size and the density of readout channels meant that the setup with the InGrids could detect particle tracks with a length of 60 centimeters.



All cabled up: the test setup at DESY. Image: Michael Lupberger, Bonn university

The InGrid chips, made at the IZM Fraunhofer Institute in Berlin out of Timepix wafers in a photolithographic process, were assembled in a Bonn cleanroom into octoboards fitting the magnet setup at DESY. After roughly a week of data taking, the team is now busy dissecting the results. “It’s already a great step forward to know that we can equip a full module, set it up, run and and collect data,” says Jochen Kaminski, also from Bonn. “We’re three modules closer to the final 448 modules for the ILD TPC.”

InGrid are also used in other experiments, for example the CAST axion experiment at CERN, and may be interesting for medical applications like proton tomography.

NEWSLINE

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DIRECTOR'S CORNER

April in Paris

Brian Foster | [16 April 2015](#)



Group photo during the PAC meeting at LAL, Orsay, France in April 2015. Image: ©CNRS/LAL, Dominique Longérias.

*"April in Paris, chestnuts in blossom
Holiday tables under the trees
April in Paris, this is a feeling
That no one can ever reprise"*

Thus run the lyrics of the [famous song](#), composed by Vernon Duke in 1932. Indeed the first Programme Advisory Committee (PAC) meeting of the LCC era was held in idyllic weather in the French capital at the start of the week. Reviewers from all over the world, chaired by Norbert Holtkamp of SLAC National Accelerator Laboratory, gathered at LAL, Orsay to review the status of the LCC and progress since the completion of the *Technical Design Report (TDR)* in 2013.

Although the format of the review was fairly standard, the context was perhaps not. Many of the reviewers had previously taken part in similar

exercises under the Global Design Effort (GDE). However, the general feeling of "a good job, well done" that swept the world's funding agencies after the delivery of the TDR meant that almost all of the resources employed by the GDE were reassigned to other activities. The LCC, therefore, has a much reduced scope and ability to carry out R&D than had its predecessor organisation. Thus the latest PAC review was not faced with a long list of R&D activities to consider. Rather it was presented with an LCC effort that concentrates on facilitating the consideration currently going on in Japan as to whether Japan wishes to propose to host the ILC.

This isn't to say that there was no technical content to consider – far from it. Indeed it is remarkable just how much progress has been made, given the effort available, since the LCC started operation under the direction of Lyn Evans. Lyn himself set the tone of the review with his introductory talk, in which he highlighted the main mission of the LCC as facilitating the decision-making process in Japan. This was reinforced by Sachio Komamiya (University of Tokyo), the chair of the Linear Collider Board (LCB), which gives the PAC its charge, when he summarised the status of the ILC inside Japan. He concentrated on the work of the review committees set up by the Japanese funding agency MEXT which are looking at both the technical aspects and costing of the TDR and the physics case and scientific "value for money" of the project. These should give interim reports at the end of this month; so far the discussions seem to have been very positive. The committee reviewing the physics case is almost exclusively from outside particle physics; indeed Sachio is the only particle physicist member. He also presented the current status of discussions with other governments and funding authorities. A one-sentence summary is that this is gaining momentum in the US but still needs work inside Europe.

Mike Harrison, associate director for the ILC in the Linear Collider Collaboration, summarised the technical work on the ILC that has taken place in the last two years. Some highlights are the demonstration of an ILC-specification cryomodule at Fermilab and the achievement of beam sizes and reproducibility at the ATF2 facility at KEK which approach those required for ILC, albeit at small beam currents. He also showed a slide from Jim Siegrist at the recent HEPAP meeting in the US which emphasised the advances being made in the performance of superconducting niobium cavities by techniques such as nitrogen doping and baking. Mike finished by looking at

the change-control management process and the requests for modification of the baseline TDR design that are currently working their way through the system. The progress with the ILC superconducting acceleration system was further summarised by my Asian counterpart Akira Yamamoto, with emphasis on the basic science of the surface of niobium.

Undoubtedly the greatest progress on understanding the ILC has come from our sister project, the European XFEL currently under construction at DESY. The technology is virtually identical and more than 600 superconducting cavities have already been received at DESY, from where, after testing, they travel to Saclay to be assembled into cryomodules. Olivier Napoly (CEA-Saclay) showed the results from the cryomodule assembly and Nick Walker (DESY) summarised what we have learnt from the cavity tests. There is a wealth of information available as well as a great accumulation of expertise as to what are the critical areas in the production process. To summarise such an enormous amount of knowledge is difficult but basically the cavity performance is almost at that required for ILC while the basic techniques of building the cryostats are established. There is still work to be done in understanding the drop in performance between the vertical cavity tests and that once built into the cryostats but significant progress is being made.

As noted above, the LCC organisation sees its primary goal as facilitating a decision to host the ILC in Japan. One important aspect of this is the governance of an ILC Laboratory. I reported on the work of the committee I chaired, set up by the LCB, to revise and update the Project Implementation Planning (PIP) document published in advance of the TDR. Many of the chapters have been completely rewritten with new information from projects such as ITER and ESS as well as emphasising the requirements that follow if Japan does indeed become the host state. No doubt I shall write more about this in a future NewsLine when the final document is agreed by the LCB.

The final talk on Monday was by Jim Brau (University of Oregon), who summarised the discussions on running scenarios for the ILC. The day came to a close with a very pleasant buffet supper in the LAL coffee area in which the participants could enjoy the sunshine that they had missed during a long day of talks.

Steinar Stapnes, associate director for CLIC in the LCC, presented the status of CLIC and the plans leading up to the next European Strategy exercise, by when a project plan for staged implementation will be prepared, aiming at a decision on future energy-frontier projects in 2018-19. Hitoshi Yamamoto described the work of the LCC Physics and Detector Directorate, which he leads. As well as a broad summary of detector progress, details of which were left for Marcel Stanitzki (SiD) and Henri Videau (ILD) to amplify, he also discussed the physics prospects for circular electron-positron colliders which are currently being discussed both in Europe and China. The physics case for ILC was covered in a masterly summary by Christophe Grojean; gratifyingly, he concluded that the physics case for the ILC is stronger than ever. Finally Karsten Büsser summarised the work of the Infrastructure and Planning Group, chaired by Sakue Yamada. Much of this feeds into the PIP update that I referred to above.

The PAC, heroically missing their lunch, worked through the early afternoon to produce conclusions that were presented by Norbert Holtkamp. Since these are still preliminary and will be the subject of a written document it would not be appropriate, neither do I have the space, to go into detail here. In summary, the PAC recognised that in many ways the ILC was a project "on hold" waiting for a Japanese decision on hosting. As time goes on there is a clear danger that experts will leak away from the project, making a timely decision from Japan on the currently foreseen time scale of the greatest importance. The committee was extremely impressed by the progress both on the machine and particularly on the detectors given the very limited resources available.

To conclude, I return to the beginning. "April in Paris" was written for a Broadway musical entitled "Walk a Little Faster". As we progress towards the ILC, we can take our cue from this.

[CLIC](#) | [CNRS/LAL](#) | [ILC](#) | [JAPAN](#) | [PAC](#)

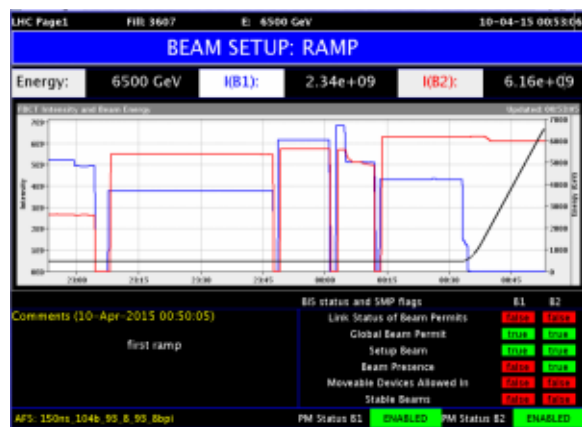
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IMAGE OF THE WEEK

LHC breaks new energy record

Image: CERN | [16 April 2015](#)



6.5 TeV in a circulating beam! Since the LHC's restart on 5 April after its long shutdown, operations have gone smoothly in the world's most powerful particle accelerator. Since 10 April, the machine is holder of a new energy record (breaking the record it set itself), accelerating proton beams up to 6.5 TeV. [According to CERN](#), the operators are now taking a 'softly, softly' approach, increasing little by little the number of bunches in the beams. They expect first low-energy collision in the coming weeks and the greatly-expected 13-TeV collisions sometime in June.

[Video: relive the LHC restart](#)

[Read more about the record](#)

"LHC Page one" is a screen showing the live status of the LHC beam. On 10 April, beams of 6.5 TeV circulated in the tunnel. Image: CERN

[LHC](#) | [PARTICLE COLLISIONS](#) | [RESTART](#)

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