

FEATURE



Press Release: International Linear Collider completes draft of its design report

Handover ceremony on 15 December in Tokyo, Japan

Tokyo, 15 December. The draft of the Technical Design Report (TDR) for the planned International Linear Collider ILC was handed over to Jonathan Bagger, the chair of the International Linear Collider Steering Committee (ILCSC), at an official ceremony in Tokyo, Japan, on 15 December. This draft is the product of many years of research and development and a series of in-depth technical reviews for the ILC, the potential next-generation particle collider to complement and advance beyond the physics of the Large Hadron Collider at CERN. The handing over of the TDR draft marks the ILC's major step towards the completion of its final design.

AROUND THE WORLD

Exciting time for the ILC technical design

by Rika Takahashi



After the official handover ceremony of the TDR draft in Tokyo last Saturday, ILC experts, policy makers and members of industry discussed the potential of building the ILC in Japan. One conclusion was that physicists from all over the world would be welcome in Japan, even though they may be considered strange by some.

DIRECTOR'S CORNER

Mitigating electron cloud effects for the ILC

by Barry Barish

One of the key objectives of the ILC R&D programme during the Technical Design Phase has been to characterise electron cloud effects in an ILC-like low-emittance positron



damping ring and to test proposed mitigation techniques. The centerpiece of our efforts has been the CesrTA programme that involved reconfiguring it as an ILC-like low emittance ring and instrumenting it to carry out these studies. CesrTA has been a highly successful experimental programme, leading to reliable mitigation strategies for the ILC positron damping rings.

IMAGE OF THE WEEK

Bye bye DORIS

Image: DESY



The German lab DESY is saying good-bye to one of its accelerator workhorses, the DORIS ring. On 2 January 2013 the final beam will go round its tunnel. It has already stopped being a light source: the last positron beam reached the HASYLAB experimental huts on 22

October. Between then and now, DORIS reverted to its original raison d'être: an accelerator for particle physics.

VIDEO OF THE WEEK

The video of the year

Video: CERN Video productions



Relive the most exciting scientific moment of the year (and possibly the decade) - watch the announcement of the discovery of a new particle at the Large Hadron Collider again. And again.

IN THE NEWS

from **nature**

19 December 2012

[Head of the line](#)

Editorial: Japanese scientists deserve support in their bid for the next big collider.

from **Heise**

18 December 2012

[International Linear Collider: Japan aussichtsreichster Standort](#)

Nun gab Barry Barrish, der Leiter des Projekts, bekannt, dass er Japan für den eindeutig aussichtsreichsten ILC-Standort hält.

from **Staple News**

18 December 2012

[Building The Next Collider](#)

Will Japan build the next generation of particle collider? The International Linear Collider could help particle physicists study the Higgs boson, the particle that helps endow all others with mass. The ILC exists only on paper and will cost billions to build. (with nature video)

from **Science**

17 December 2012

[Japan Likely to Reembrace Nuclear Power in Wake of Elections](#)

LDP campaigned heavily on reviving Japan's stagnant economy through spending on public works, including at least one big science project. The party platform specifically mentions support for the proposed International Linear Collider, a \$10 billion physics project that Japan's high-energy physicists are anxious to host.

from **Physics Today**

17 December 2012

[Japan is the likely home of the next big particle collider](#)

With extra funding available from its post-earthquake and tsunami reconstruction efforts and multiparty political support, Japan is making a concerted effort to win the project.

from **IPNL**

17 December 2012

[Physique des particules : Premiers tests réussis pour un détecteur du futur accélérateur ILC](#)

Après le grand accélérateur de particules LHC, l'accélérateur ILC est le prochain collisionneur susceptible de révolutionner nos

connaissances sur la physique et les origines de l'Univers.

from **Jiji Press**

16 December 2012

[Technical Design Completed for Next-Generation Particle Collider](#)

A technical design report for an envisioned large next-generation particle accelerator has been completed and was submitted to a committee overseeing the project at an official ceremony in Tokyo on Saturday.

from **Wales Online**

16 December 2012

[Lyn "Evans the Atom" wins a share of the world's richest science prize](#)

Lyn Evans has now come out of retirement to be early project director of the LHC's planned big brother – the cataclysmic Linear Collider.

from **Kahoku Shinpo**

16 December 2012

[技術の確立 国際研究グループが設計報告書を発表](#)

全長約 キロに及ぶ超大型の直線形加速器「国際リニアコライダー 」の実現を目指す研究者の国際グループは 日、加速器の詳細な内容をまとめた「技術設計報告書 」を発表した。世界最高の性能を持つ加速器技術の確立で、計画は大きな節目を迎えた。岩手県南部の北上山地が候補地の一つに挙げられている。

from **Iwate Nippo**

16 December 2012

[全長31キロの加速器設置 の設計発表](#)

本県の北上山地 北上高地 が候補地になっている国際リニアコライダー について、研究者による国際共同設計チームなどは 日、東京都内で技術設計報告書を発表した。

from **Yomiuri**

16 December 2012

[宇宙誕生の謎に迫る次世代加速器は直線](#)

宇宙誕生の謎に迫る次世代加速器「国際リニアコライダー 」について技術的検討を行ってきた日米欧などの国際研究チームは 日、 の設計書が完成したと発表した。

from **Nikkei.com**

15 December 2012

[ヒッグス粒子の次を狙え 新加速器は全長31キロ](#)

国際チームが設計書([google translation](#))

from **Colliding Particles**

December 2012

[Episode 11: Higgs](#)

The eleventh in a series of films following a team of physicists involved in research at the Large Hadron Collider at CERN in Switzerland.

from **Jiji**

15 December 2012

[次世代加速器、設計書が完成 東北・九州も候補、来夏一本化](#)

日米欧の物理学者が建設を計画している次世代の大型加速器・国際リニアコライダー について、国際共同設計チームは 日、技術設計報告書を 運営委員会に提出した。技術的に建設可能な段階に到達したことになり、今後候補地選びが本格化する。

from **Sankei**

15 December 2012

[次世代加速器の設計完成 国際研究チームが発表](#)

素粒子を衝突させ、宇宙創世の謎の解明を目指す次世代加速器「国際リニアコライダー 」の建設を求める国際研究チームは 日、施設で使う加速器や検出器の設計書が完成したと発表した。

from **Nature**

14 December 2012

Japan in pole position to host particle smasher

Physicists seek home for the multi-billion-dollar International Linear Collider. With video:

from **Science**

14 December 2012

Japan Stands Alone in Bid for \$10 Billion Collider

On 15 December, scientists will celebrate the completion of the technical design report for their dream machine, the International Linear Collider. But figuring out where to build it and who will pay for it will be an even bigger challenge.

CALENDAR

UPCOMING EVENTS

SiD Workshop

SLAC

16- 18 January 2013

CLIC Workshop 2013

CERN

28 January- 01 February 2013

Les Rencontres de Physique de la Vallée d'Aoste (La Thuile 2013)

La Thuile, Italy

24 February- 04 March 2013

UPCOMING SCHOOLS

Joint Universities Accelerator School (JUAS 2013)

Archamps, France

07 January- 15 March 2013

[View complete calendar](#)

ANNOUNCEMENTS

ILC NewsLine holiday schedule

ILC NewsLine is taking a break. Our next issue will be on 10 January. Happy holidays!

PREPRINTS

ARXIV PREPRINTS

1212.2655

Radiative natural supersymmetry: Reconciling electroweak fine-tuning and the Higgs boson mass

1212.2160

DEPFET active pixel detectors for a future linear e^+e^- collider

1212.1921

Determining MSSM parameters via chargino production at the LC: a one-loop analysis

FEATURE

Press Release: International Linear Collider completes draft of its design report

Handover ceremony on 15 December in Tokyo, Japan

[20 December 2012](#)



Barry Barish and Sakue Yamada handing over the TDR to ILCSC chair Jon Bagger. Image: Nobuko Kobayashi

Tokyo, 15 December. The draft of the Technical Design Report (TDR) for the planned International Linear Collider ILC was handed over to Jonathan Bagger, the chair of the International Linear Collider Steering Committee (ILCSC), at an official ceremony in Tokyo, Japan, on 15 December. This draft is the product of many years of research and development and a series of in-depth technical reviews for the ILC, the potential next-generation particle collider to complement and advance beyond the physics of the Large Hadron Collider at CERN. The handing over of the TDR draft marks the ILC's major step towards the completion of its final design.

"The ILCSC is pleased to accept the draft report. Our committee has been overseeing ILC activities since their inception, so we are sure the design is sound. We will now examine the Technical Design Report and provide our feedback," says Jonathan Bagger, chair of the International

Linear Collider Steering Committee.

At the ceremony, Barry Barish, Director of the ILC's Global Design Effort (GDE) and Sakue Yamada, ILC Research Director, representing the ILC's international planning team, introduced the results of several years of intensive research and development work on accelerator and detector technologies, as well as in-depth internal reviews of both the accelerator and detector reports. The technologies to be used for the International Linear Collider, including superconducting radiofrequency acceleration with high gradients and state-of-the-art detector technologies, have reached a stage where, should governments decide in favour, the collider could be built immediately.

"Today's handover is an exciting time for the linear collider – our mandate, the basis of the final design and the future construction for the ILC project has been completed and we're basically ready to push the green button," says Barry Barish, Director of the Global Design Effort.

"Young people from around the world have been working hard on designing and testing new detectors and making calculations and simulations for the challenging but rewarding physics possibilities of the ILC. It is great to see all this work culminating in the design report," says Sakue Yamada, ILC Research Director.

At the ceremony, three volumes of the reports were submitted: Volume 1 "Physics at the International Linear Collider", Volume 2 "Accelerator" (Part 1 and 2), and Volume 3 "Physics and Detector Detailed Baseline Design". A separate review concentrating on the cost part of the TDR will be done in January, and the results of these reviews will be presented to the ILCSC in Vancouver in February 2013, when they meet jointly with the new Linear Collider Collaboration Board. The Linear Collider Board is a new

oversight committee for the Linear Collider Collaboration that will take up office at the same time. The Linear Collider Collaboration will combine the two linear collider projects, ILC and CLIC, under one organisational roof. After this review, the final version of the TDR will be officially delivered to the International Committee for Future Accelerators (ICFA) in June 2013.



The handover was followed by a panel discussion.

The accelerator volumes of TDR are the final deliverables for the GDE that summarise both the R&D accomplishments and present a proposed design for the ILC. Combined with the accelerator design, the Research Directorate in their two volumes of the TDR demonstrated that many milestones have been accomplished in all the R&D programmes, and the chosen technologies are capable of meeting the demanding performance goals needed for an ILC.

Lyn Evans, new Linear Collider Director, who will lead the Linear Collider Collaboration from February 2013, also attended the ceremony. He is currently chairman of the Project Advisory Committee that just finished the final technical review on the TDR at the High Energy Accelerator Research Organization (KEK), Tsukuba, Japan in the days

preceding the ceremony.

"I am impressed with the accomplishments presented in the ILC TDR and look forward to leading the two linear collider groups ILC and CLIC into a new phase," says Lyn Evans, future Linear Collider Director.

[Press Release on interactions.org](http://interactions.org)

[ILCSC](#) | [JAPAN](#) | [MILESTONE](#) | [TDR](#)

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AROUND THE WORLD

Exciting time for the ILC technical design

Rika Takahashi | [20 December 2012](#)



The handover was followed by a panel discussion.

Worldwide efforts toward the realisation of the International Linear collider advanced one step further last weekend. On 15 December, the draft of the *Technical Design Report* (TDR) for ILC was handed over to Jonathan Bagger, the chair of the International Linear Collider Steering Committee (ILCSC), at an official ceremony held in Tokyo, Japan. This event was jointly hosted by the Global Design Effort (GDE), ILC Research Directorate (RD), the Advanced Accelerator Association promoting Science and Technology (AAA), and Japan's High Energy Accelerator Research Organization (KEK).

"On behalf of the ILCSC, I am pleased to accept the draft report. I am looking forward to seeing the final design," Bagger said.

This draft is the product of many years of research and development and a series of in-depth technical reviews for the ILC. The purpose of the event was to report the completion of the TDR for technical and cost review by high-level international committees of experts, which means that the technologies to be used for the ILC have reached a stage where, should governments decide in favour, the collider could be built immediately.

The TDR consists of three volumes: Volume 1 describes the physics potential of the ILC, Volume 2 the accelerator R&D achievements and accelerator design and Volume 3 the detectors for the ILC. Volumes 1 and 3 were written by the ILC's Research Directorate overseeing detector studies, and Volume 2 by GDE, the team that coordinated the R&D on accelerator technologies. The TDR is handed over by the corresponding directors Sakue Yamada (Research Director) and Barry Barish (GDE Director).

The TDR contains descriptions of the successful establishment of the key ILC technologies, the advances in the ILC detector R&D programme, and physics study. The physics study reflects the exciting discovery of a 'Higgs-like' boson at the Large Hadron Collider at CERN in July this year.

The earlier *Reference Design Report*, was released in 2007, only one and half years after the official formation of the GDE in summer in 2005. It conceptually described the design with many items waiting for technological demonstrations. Now the TDR has been completed based on five years of intensive R&D work and design improvements.

The second half of the handover ceremony was a panel discussion moderated by Hitoshi Murayama, Director of the Kavli Institute for Physics and Mathematics of the Universe (IPMU), and the future deputy director for the Linear Collider Collaboration, the international body that will combine the two linear collider projects, ILC and CLIC, under one organisational roof.

The panelists had a lively discussion on the ILC from different points of view. In addition to Bagger, Barish and Yamada, Hiroya Masuda, the chair of the Japan Policy Council (JPC), Takashi Nishioka, the chair of the AAA, and Atsuto Suzuki, director general of KEK participated in the panel discussion.

The discussion started with a comment from Murayama looking back to his graduate student days. “I had a chance to talk to Kaoru Yokoya, now the Asian regional director of the GDE, and he told me about the linear collider. What I thought back then was ‘no way, it is impossible to build such a complicated machine’. Today, Seeing the completion of the design, I would like to congratulate and express my respect to all who contributed this accomplishment.”

Barish took a look back on his eight years of the work with GDE. Barish said, “As Hitoshi said, I myself was also sceptical about the linear collider in the 90’s.” In 2003, Barish became the chair of the committee to choose the accelerating technology for the next-generation linear collider, the International Technology Review Panel, or ITRP. The choice was between warm and cold technologies, and his involvement to the linear collider started there. “It was a wonderful process with many experts to produce the best design. I am sure this collider can provide wonderful physics results,” he said.

Yamada, who led thousands of scientists spread over the world specialising in detector technologies, was asked about the challenges of his work. Yamada replied, “Of course there were many arguments and a lot of competition, but we have the common language of physics, and the common goal to unveil the mystery of the universe using the ILC, so things settled down to the best spot eventually. It is exciting to work with people who you can compete with.”

Industry has numerous experiences working in international collaborations for their business. Nishioka gave examples of the big international projects and difficulties in management. One of the examples was the Taiwan High Speed Rail project, which was a mixture of the technology of Japan’s Shinkansen system with European standards. “Within an international collaboration, working towards one single standard is a great challenge. But, if you have a concrete, agreed standard at the beginning of the project, things will go smoothly. I think the TDR is exactly this concrete standard.”

Masuda explained the Japan Policy Council’s recommendation entitled “Creation of Global Cities by hosting the International Linear Collider” published in July this year. He emphasised the importance of regional efforts to build a global city where foreigners can live comfortably and easily. He said that “work towards realising such a city is now in process.” In response to his statement, Bagger asked Masuda: “Physicists are often considered strange people. Can the regional community accept thousands of strange people?”, making the audience burst out in laughter. Masuda said, “There is no worry. It is more likely that those exciting people will help revitalise the region”.

Suzuki explained the concept of the future ILC Laboratory. “Future big projects will certainly need to have a new management system where each country shares costs and human resources. I am hoping that the ILC will be the first example of such an entity.”

At the end of the discussion, Murayama introduced Sachio Komamiya and Lyn Evans to the audience. Komamiya will lead the new Linear Collider Collaboration Board, which is a new oversight committee for the Linear Collider Collaboration. Lyn Evans was appointed to the Director of the new Linear Collider Collaboration, whose mandate is to realise the accelerator.

The handed-over TDR did not include the cost chapter. The new cost estimation will be disclosed after the official international cost review, which will take place next year.

[AAA](#) | [JPC](#) | [MILESTONE](#) | [TDR](#)

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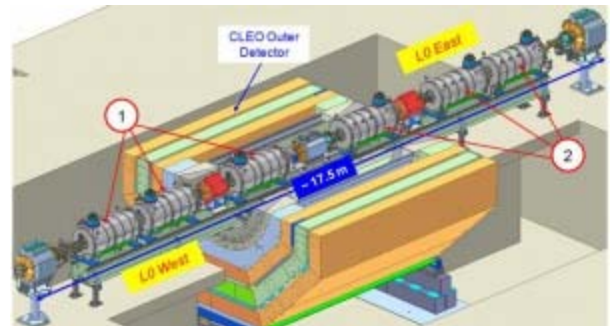
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DIRECTOR'S CORNER

Mitigating electron cloud effects for the ILC

Barry Barish | 20 December 2012

The next generation of particle accelerators will contain intense bunches of particle beams. These intense beams have the disadvantage that they create electron clouds that result from beam scattering off residual molecules in the vacuum chambers. The concern is that the presence of electron clouds can reduce performance by scattering and defocusing the incoming particle beams. Quantitative information on electron cloud effects has been rather limited. Therefore, a key goal of the ILC R&D programme has been to carry out experimental studies of electron cloud effects in an ILC-like low-emittance ring and test various mitigation schemes that could be employed in the ILC positron damping ring.



Layout of the reconfigured and instrumented CESR interaction region with ILC-like damping ring wigglers.

The CEsrTA programme began by reconfiguring the Cornell Electron-Positron Storage Ring (CESR) into a low emittance ILC-like ring and instrumenting it to perform electron cloud studies. The resulting R&D programme has been highly successful in providing detailed data that has led more generally to a better understanding of electron cloud effects. In addition, various proposed mitigation schemes have been tested and reliable mitigation strategies have been developed for the ILC positron damping rings. The CEsrTA collaboration has recently released a detailed [report](#) (60 MB) that will be very valuable to the next generation of particle accelerators, not just for the ILC.

The function of the ILC damping rings is to capture electron and positron beams that have large transverse and longitudinal emittance and “damp” them into low-emittance beams required to achieve the high luminosities. A configuration at CEsrTA similar to ILC damping rings was replicated to be able to reliably predict performance of the ILC damping rings. For example, analytical estimates of what is called the head-tail instability thresholds, an effect due to having particles with different momenta in a beam, have been made for both CEsrTA and the ILC damping rings. The observed instability thresholds for CEsrTA’s low-emittance conditions agree well with these calculations using the measured electron cloud density. The good agreement between data and experiment for CEsrTA provides confidence in extrapolated estimates for the ILC damping rings.



Mitigation techniques include using grooved chamber surfaces (left) in the dipoles and clearing electrodes (right) in the high-field wigglers.

The CEsrTA collaboration tested various mitigation techniques in order to develop a mitigation strategy for the ILC positron damping rings. Three different techniques have been studied: grooved chambers, titanium nitride coatings and clearing electrodes. Although coatings show promise, long-term performance and durability studies will need to be carried out in the future Phase II CEsrTA programme. A working group was formed to develop a mitigation strategy. Their primary recommendations are for titanium nitride (TiN) coating in the drift regions, triangular grooves with TiN coating in dipole regions, TiN coatings for quadrupole regions, and clearing electrodes in the crucial wiggler regions.

EC Working Group Baseline Mitigation Recommendation				
	Drift*	Dipole	Wiggler	Quadrupole*
Baseline Mitigation I	TiN Coating	Grooves with TiN coating	Clearing Electrodes	TiN Coating
Baseline Mitigation II	Solenoid Windings	Antechamber	Antechamber	
Alternate Mitigation	NEG Coating	TiN Coating	Grooves with TiN Coating	Clearing Electrodes or Grooves

Recommended mitigation strategies against electron clouds in the ILC damping ring.

The working group mitigation plan is very aggressive because it anticipates a possible future doubling of the number of positron bunches in a single damping ring. The group also notes that their recommendations have a large overlap with the design for the SuperKEKB vacuum chambers, so that machine will provide valuable information on electron cloud mitigation for the ILC positron

damping ring.

CesrTA has been one of our proudest achievements from the ILC R&D programme. It has established the reality of coping with a potential major issue that must be confronted for a high luminosity linear collider. CesrTA was a major achievement in collaboration of different laboratories and funding agencies in contributing equipment and personnel for an accelerator R&D project. It will have considerable and broad value for the next generation of particle accelerators.

[More on electron cloud research in ILC NewsLine.](#)

[CESRTA](#) | [CORNELL UNIVERSITY](#) | [DAMPING RING](#) | [ELECTRON CLOUD](#)

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IMAGE OF THE WEEK

Bye bye DORIS

Image: DESY | [20 December 2012](#)



The DORIS construction site in 1970. Image: DESY

The German lab DESY is saying good-bye to one of its accelerator workhorses, the DORIS ring. On 2 January 2013 the final beam will go round its tunnel. It has already stopped being a light source: the last positron beam reached the HASYLAB experimental huts on 22 October. Between then and now, DORIS reverted to its original *raison d'être*: an accelerator for particle physics.

DORIS, a child of the 70s, has had many lives. As one of the world's first storage rings, it helped to investigate the properties of quarks, shed light on CP violation with the ARGUS experiment and was turned into an X-ray source in 1991. Bronze-age axes, van Gogh paintings, corals, magnetic nanostructures all sat in its X-ray beam, giving thousands of scientists from around the world insight into a wealth of worlds and even leading to a Nobel Prize for the investigation of the structure of the ribosome. Its last few months are devoted to particle physics again: the OLYMPUS experiment looks at the scattering of electrons and positrons by protons and the photon exchange that is happening during

the scattering process.

A big shutdown celebration is planned in May 2013.

[Read more about DORIS and its lives in the CERN Courier.](#)

[DESY | PARTICLE PHYSICS](#)

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VIDEO OF THE WEEK

The video of the year

Video: CERN Video productions | [20 December 2012](#)

Relive the most exciting scientific moment of the year (and possibly the decade) – watch the announcement of the discovery of a new particle at the Large Hadron Collider again. And again.



Download from [CERN Document Server](#).

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