DIRECTOR'S CORNER

S1-Global – a plug-compatible ILC demonstration experiment

by Barry Barish

The S1-Global experiment was conceived to demonstrate the radiofrequency (RF) operation of an ILC cryomodule with an average accelerating gradient of 31.5 MV/metre. The project to build a segment of a superconducting linac system and test the string of superconducting RF cavities was carried out at KEK through a global collaboration. This experiment provided a significant and successful demonstration of the operation of eight nine-cell superconducting cavities and associated hardware components with components provided from laboratories around the world.

LCPEDIA

Klystron

by Daisy Yuhas

Superconducting cavities accelerate particles using radiofrequency (RF) power. But where does the power to accelerate a beam by millions of electronvolts come from? The ILC's power source can provide only about 100 watts, but to push that power up to the required level you need a device called a klystron. The klystron is a power amplifier. It can expand a few tens of watts into millions, or megawatts. Each ILC klystron will supply amplified power to 39 superconducting cavities for the baseline design.

VIDEO OF THE WEEK

SLAC All Access: klystrons on YouTube

SLAC's YouTube channel has more on klystrons, and of course the legendary klystron gallery. In a video about SLAC's Vacuum Microwave Device Department (VMDD), introduces itself as those people who build the devices that make SLAC's particle accelerators go: klystrons. These devices generate intense waves of microwave energy that rocket subatomic particles up to nearly the speed of light. Department head Andy Haase takes us behind the scenes where klystrons are born.

These devices are developed, designed and fabricated by teams of physicists, engineers and technicians in coordination across several departments within SLAC's Accelerator Directorate. Check out the AD website

RESEARCH DIRECTOR'S REPORT

How to make the ILC truly international

by Hitoshi Yamamoto

In order for an international project like the ILC to succeed, being able to construct the accelerator itself is not enough. To make the future ILC city an attractive and comfortable place to come and stay for a prolonged period, it is also critical that the site is geologically sound and that the living conditions of the staff and their families are agreeable.

IMAGE OF THE WEEK

Which way to the ILC, please?

Drivers stuck in a traffic jam in Ichinoseki city are more likely to wonder about the mysteries of the Universe than about the latest Hollywood movie - at least if they take in the billboards at the side of the road. Japan's Iwate prefecture in the Tohoku region in the north of the country boasts a road sign underlining the region's interest in hosting the ILC.

IN THE NEWS

from ***intermediair.nl***
17 October 2012
De vijf meest gehypte wetenschappen of technieken
Maar eigenlijk is de versneller aldaar niet optimaal geschikt voor dat soort werk, en dus wordt er druk gerekend en getekend aan een nieuwe versneller, de International Linear Collider. Daarmee moet het mogelijk zijn heel veel Higgs-deeltjes te produceren. (google translation)

from ***phys.org***
15 October 2012
Accelerators can search for signs of Planck-scale gravity
The PETRA-III accelerator at DESY and the proposed International Linear Collider (ILC) could test the energy-dependent bending of light by gravity at very small scales.

CALENDAR

UPCOMING EVENTS

2012 International Workshop on Future Linear Colliders (LCWS12)
University of Texas at Arlington, Texas, USA
22- 26 October 2012

Special Linear Collider Event at the 2012 IEEE NSS/MIC
Disney Hotel, Anaheim, California
29- 30 October 2012

2012 IEEE Nuclear Science Symposium and Medical Imaging Conference
Disney Hotel, Anaheim, California
29 October- 03 November 2012

TESLA Technology Collaboration (TTC) Meeting
Thomas Jefferson National Accelerator Facility
05- 08 November 2012

Accelerators for a Higgs Factory: Linear vs. Circular (HF2012)
Fermilab
14- 16 November 2012

ANNOUNCEMENTS

Forum on Advanced Accelerator Science & Industry: Creation of Global Project Cities

On Wednesday, 24 October, the Japan Policy Council and the AAA are organising a forum on advanced accelerator science and industry. The forum aims at clarifying the challenges for enabling Japan to realise a global project that Japan never worked for and Japan's advantages such as its internationalisation, the improvement of science and technology, and its capacity building once it will achieve hosting the Center of Excellence for Particle Physics. One of the key speakers is CERN DG Rolf Heuer. The forum takes place in Tokyo University's Ito Hall and starts at 2 pm.

PREPRINTS

ARXIV PREPRINTS

1210.3904
Flavor changing top quark decay and bottom-strange production in the littlest Higgs model with T-parity

UPCOMING SCHOOLS

The first Asia-Europe-Pacific School of High-Energy Physics (AEPSHEP2012)
Fukuoka, Japan
14- 27 October 2012

CERN Accelerator School: Introduction to Accelerator Physics

University of Granada, Granada, Spain
28 October- 09 November 2012

View complete calendar

1210.3648
HTS wiggler concept for a damping ring

ilc newsline

DIRECTOR'S CORNER

S1-Global – a plug-compatible ILC demonstration experiment

Barry Barish | 18 October 2012

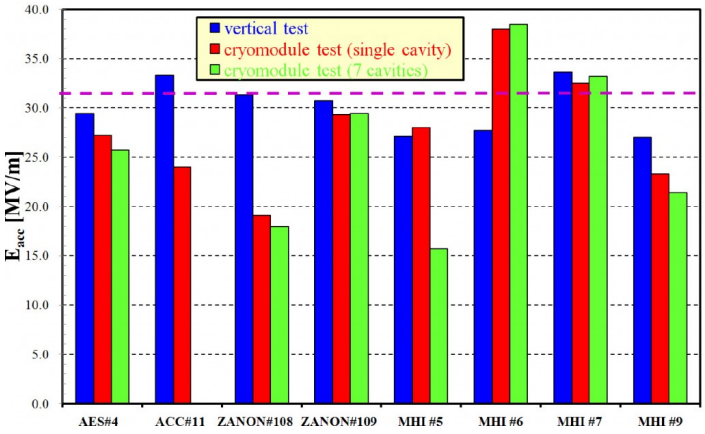
S1-Global – a successful demonstration of plug compatibility

The S1-Global experiment was conceived to demonstrate the RF operation of an ILC cryomodule with an average accelerating gradient of 31.5 megavolts/metre (MV/m). The GDE Accelerator Advisory Panel, chaired by Bill Willis, identified it as one of our ILC demonstration experiments with high priority. S1-Global has been successfully completed and a detailed technical report has recently been released. The assembly and testing of a string of superconducting RF cavities in a common cryomodule system were carried out at KEK through a global collaboration.

The main components consisted of two TESLA-type cavities with blade tuners that were provided by Fermilab, two TESLA-type cavities using Saclay-tuners from DESY, and four TESLA-type cavities with slide-jack tuners contributed by KEK. Two half-length cryomodules were provided through KEK and INFN, and components for the RF waveguides were provided by KEK and SLAC. A global collaboration integrated the various components and performed the tests of the S1-Global system.

The S1-Global project was hosted and carried out at KEK. It provided a significant demonstration of single- and multiple-cavity operation with pulsed microwave power and associated low-level RF controls. In addition, it provided a very good test of the 'plug compatibility' concept that we are proposing for the ILC by integrating components provided from collaborating laboratories around the world. The idea of the plug-compatibility is that we provide compatible, but not identical hardware components, allowing for differences in tooling and technical choices.

The S1-Global cryomodule experiment was planned to achieve the *S1-goal*, i.e. to operate at least one cryomodule with an average gradient of 31.5 MV/m. The gradient performance of the participating cavities averaged 30.0 MV/m before installation, 27.7 MV/m for single-cavity operation after installation, and 26.0 MV/m for simultaneous operation of seven cavities. One of the eight cavities was eliminated from the study due to tuner problems.



Summary of the achieved gradient values for eight cavities in vertical and cryomodule tests in the S1-Global tests. The dotted line indicates the ILC specification of 31.5 MV/m.

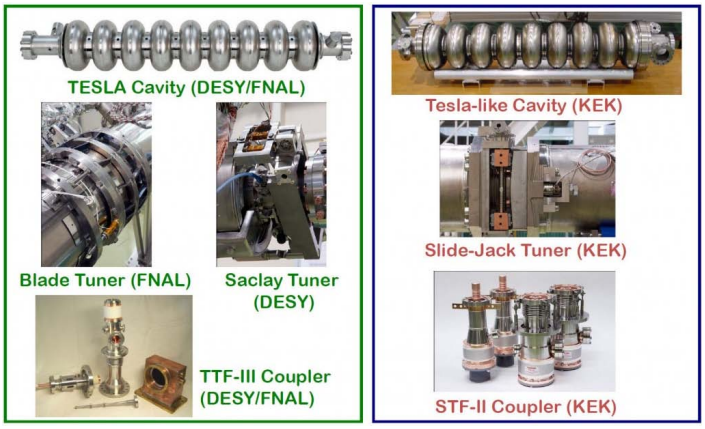
This result fell somewhat short of the gradient goal, but this was due to technical issues, not fundamental limitations. The performance of cavity number MHI-06 drastically improved from its previous result in the vertical test and achieved a gradient of 38 MV/m. However, the gradient of two of the cavities (TB9ACC011 and Z108) was significantly lower in the cryomodule than in previous tests. Issues during the assembly processes or the transportation to KEK are suspected to have been

the causes of this reduced gradient. This problem should certainly be addressed for the ILC.

The other major goal set of S1-Global was to exercise the *plug-compatibility concept* by building one set of cryomodule from brought-in cavities and couplers from different laboratories. The half-size cryomodule-C, built from INFN cryostat, DESY cavities and couplers, and FNAL cavities and couplers, provided a fine demonstration.

S1-Global provided an excellent test case for carrying out a major accelerator R&D experiment through a worldwide collaboration. The overall goals were set through the GDE R&D board, the equipment was assembled from components contributed from collaborating laboratories around the world, and the tests were performed through a joint collaboration. Valuable technical issues were learned, especially regarding couplers and tuners, despite not quite achieving all our ambitious goals.

S1-Global was successful in demonstrating the overall operation of a realistic small-scale unit of a high-gradient ILC main linac system made from ILC components. The new report is particularly valuable both as a demonstration and in identifying the future work. A condensed version of this report will be included in our *Technical Design Report*.



Plug-compatible subsystems provided from collaborating laboratories worldwide integrated into S1-Global

INTERNATIONAL COLLABORATION | PLUG COMPATIBILITY | S1-GLOBAL

LCPEDIA

Klystron

Daisy Yuhas | 18 October 2012

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The klystron is a power amplifier. It can expand a few tens of watts into millions, or megawatts. Each ILC klystron will supply amplified power to 39 superconducting cavities for the baseline design.

How does it work? Inside the klystron is a gun that sends out electrons in long pulses. These electrons will be accelerated by high voltage, which was generated by a modulator. Then this energetic particle beam crosses a cavity inside the klystron, where it's coupled with RF power that comes from the power source. When the particles interact with the RF field, their velocity changes, producing faster and slower electrons. Those particles then passes through the klystron's drift tube, where the faster electrons catch up with slower particles, causing them to bunch together. In consequence, bunch spacing corresponds to the frequency of the RF source. These bunches intensify as they travel through the klystron, until their pulses correspond to the desired frequency power.

Finally, the particles reach an empty cavity called the "output" or "catcher" cavity. In an accelerator, particles pick up energy from a RF field in the superconducting cavity— but in the klystron output cavity, the opposite occurs. The cavity is tuned so that the particles will *decelerate*, giving their energy to the cavity. It's this amplified power that is sent to an accelerator such as the ILC. These RF fields travels from the klystron output cavity to accelerator cavities along several meters of hollow rectangular metal tubing called waveguide. Meanwhile, the spent electrons plough into the aptly named 'collector.'

SLAC accelerator physicist Chris Nantista explains that it's possible to modulate how this power is distributed, "We have motorised devices that control how much power is peeled off from the main waveguide and into each cavity." This allows scientists to adjust for differences in a cavity's ability, lest they push past its limits.

ACCELERATION | KLYSTRON | RF POWER

ilc newsline

RESEARCH DIRECTOR'S REPORT

How to make the ILC truly international

Hitoshi Yamamoto | 18 October 2012

In order for an international project such as the ILC to succeed, it is not enough to be able to construct the accelerator itself. It is also critical that the site is geologically sound and that the living conditions of the staff and their families are agreeable. There are currently two candidate sites for the ILC in Japan: the Sefuri mountains in the south island of Kyushu and the Kitakami mountains located approximately 400 kilometres north-east of Tokyo. For each region, site-related studies are ongoing that include geological surveys and studies on planning of the international area created by the future ILC laboratory.

Each site has a stable granite bedrock with a length of more than 50 kilometres. An international team of experts has visited both sites and found no serious problem that would prohibit successful construction and stable operation of the ILC. Even though extensive site studies have already been conducted with local initiative in the past, the survey in each region under tha initiative of KEK is being started and to be completed by spring, next year. The new geological studies include borings at key locations, physical surveys, field explorations, airborne laser altimetry, as well as examination of past studies. After this round of geological studies is completed in about one year, sufficient geological information will have been obtained to be certain that there are no big surprises later on.

The Dazaihu shrine, close to the potential 'southern site' of the ILC.

The golden temple of Hiraizumi, close to the potential 'northern site' of the ILC in Japan.

The studies on planning the international city and necessary infrastructures for the ILC are mostly conducted by the initiative of regional organisations. These studies include laying out concrete requirements for a truly international research facility such as the ILC in terms of transportation, housing conditions, educational environments for children, employment opportunities for spouses of the ILC staff, supports by local governments, availability of cultural and physical recreations, and so forth. Another area of study are the economical and cultural effects that the ILC will create in the region close to the facility as well as in Japan as a whole. It is expected that an international town of several thousand people will be created by scientists and engineers with their families from all over the world. If the living environment is not satisfactory, however, the researchers will come only to perform minimum work and go back to their home countries immediately afterwards. Then, there will be no international village, and no community of researchers where people from different cultural backgrounds can socialise. These studies involve interviewing researchers from different countries, visiting major laboratories and projects in the world such as CERN and ITER, analysis of economical ripple effects of the ILC, ecological impact studies, and definition of functions of the central campus.

Both candidate sites in Japan have a rich cultural history and natural beauty. The Sefuri site is close to major cultural centers such as Dazaihu where civilization from China and Korea landed in Japan, and the Kitakami site is next to many historical sites including Hiraizumi – a 12th-century city and a world heritage site. The ILC has been an international programme from its design stage, and the planning of its campus and surrounding area will be conducted internationally. Together with the strong commitment of the local governments to make the ILC truly international, one can be quite sure that it will be an attractive and comfortable place to come and stay for a prolonged period.

ILC SITE | MULTINATIONAL LABORATORY | SITING

IMAGE OF THE WEEK

Which way to the ILC, please?

18 October 2012

Drivers stuck in a traffic jam in Ichinoseki city are more likely to wonder about the mysteries of the Universe than about the latest Hollywood movie – at least if they take in the billboards at the side of the road. Japan's Iwate prefecture in the Tohoku region in the north of the country boasts a road sign underlining the region's interest in hosting the ILC.

ILC HOSTING | ILC SITE | JAPAN | TOHOKU