

COLLABORATION

Going global: Japan helps LHC construction

As CERN's major project for the future, the LHC sets a new scale in world-wide scientific collaboration. As well as researchers and engineers from CERN's European Member States, preparations for the LHC now include scientists from several continents. Some 50% of the researchers involved in one way or another with preparations for the LHC experimental programme now come from countries that are not CERN Member States.

Underlining this enlarged international involvement is the recent decision by the Japanese Ministry of Education, Science and Culture to accord CERN a generous contribution of ¥5 bn (about Sfr65 m) to help finance the construction of the LHC. This money will be held in a special fund earmarked for construction of specific LHC components and related activities.

At the June Council session, Japan was unanimously elected as a CERN



Kaoru Yosano (left) and CERN's director-general Chris Llewellyn Smith paint one eye of a "daruma" talisman, marking commencement of Japanese collaboration in the LHC project.

Observer State, giving them the right to attend Council meetings. Speaking at the Council meeting in his new capacity as Observer State spokesman, Kaoru Yosano, Japan's Minister of Education, Science and

Culture, pointed to his country's wish to contribute to the LHC project at an early stage. He said that large scientific projects like the LHC "captivated the imagination of citizens".

● September 1995 p1 (extract).

CERN and Russia step up cooperation

The signing of a new protocol between CERN and Russia marks a considerable increase in joint collaboration and a further consolidation of ties dating back 30 years. As well as directly assisting construction of CERN's new LHC proton collider, the protocol, within the framework of the 1993 CERN–Russia Cooperation Agreement, and with Russia as a CERN Observer State, will provide valuable further stimulus for Russian high technology.

Covering Russian participation in LHC construction and the preparations for its research programme over a 10 year period, the protocol includes two separate in-kind

contributions, each with net value to CERN of Sfr67 m, for LHC construction and for the LHC detectors. In addition, a generous contribution from the Joint Institute for Nuclear Research at Dubna, near Moscow, will be invested in LHC preparations.

This latest two-way development in CERN/Russian collaboration will be to the mutual advantage of both parties. It will boost the LHC effort en route to completion of the machine at its full design collision energy of 14 TeV. In addition, the increased scope and scale of this challenging work, together with its inherent complexity and sophistication, will provide impetus to Russian science and industry, and provide vital transfer of front-line technology and skills.

As well as the new protocol, additional contributions to LHC experiments could come through the International Science Technology Centre programme funded by the European Union, Japan, Russia and the US to promote the integration of former Soviet Union weapons scientists into fresh projects, and where six particle physics projects have already been approved.

● September 1996 p32–33 (extract).



Loading a 6 m dipole magnet prior to the 6000 km journey from Novosibirsk to CERN in 1999.

● September 1999 p11.

After the SSC

In the wake of the demise of the US Superconducting Supercollider (SSC) project (p21), which impoverished both US and world science, some rapid scene shifting is going on. The SSC may be dead, but the underlying physics quest lives on.

To nurture the natural enthusiasm to continue this physics, contacts have been developing at several levels. In December 1993, informal exploratory talks were held at CERN between spokesmen of the LHC experiments and their counterparts from the major SDC and GEM projects which were being readied for the SSC, and with CERN management. The object was the common interest in multi-TeV physics at the LHC, and, once this is in place, to exploit valuable R&D already accomplished and the high level of expertise achieved in the SSC framework. A substantial number of US physicists involved in SDC and GEM could be interested in joining LHC experiments, together with Japanese researchers involved in SDC. Many of the SDC Canadian contingent could also turn their sights towards Geneva.

● April 1994 pp1–2 (extract).

US and CERN sign historic LHC agreement

In a significant international agreement, signed in Washington, DC, on 8 December, US scientists will contribute a total of \$531 m towards the 27 km LHC now under construction and its physics experiments. This is the first time that the US will contribute significantly for an accelerator to be built outside the US, and it is the first agreement between CERN and the US government. About 25% of the US experimental high-energy physics community are expected to do research at the LHC.

Under the agreement, the US will provide goods and services for the LHC, scheduled

to come into operation in 2005. Specifically, the Department of Energy will provide components and materials, costed at \$200 m, for use in the accelerator. Three of the department's national laboratories, Brookhaven, Berkeley and Fermilab, will use \$110 m to design and produce systems for the accelerator's interaction regions where the detectors are located. The remaining \$90 m will be used for procurements from US industrial firms, including niobium and niobium-titanium for European production of superconducting cable, and for some of the superconducting cable supply.

The US will also provide an in-kind

contribution of components, costed at \$331 m, to the massive ATLAS and CMS detectors, with \$250 m from the Department of Energy and \$81 m from the National Science Foundation. More than 550 US scientists from nearly 60 universities and six national laboratories in 25 states are collaborating on designing and fabricating these components.

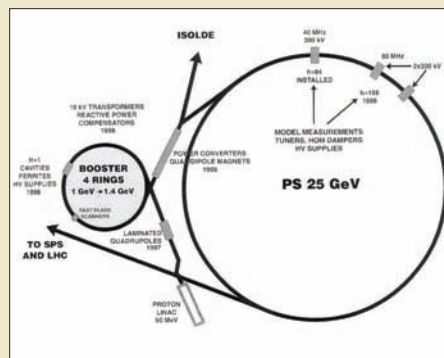
Further protocols were signed during the meetings of CERN's governing body, Council, at CERN at the end of December, when the US joined the growing ranks of CERN observer states.

● January/February 1998 p1 (extract).

Canada makes a TRIUMF contribution

Since 1995 the TRIUMF Laboratory in Vancouver has been collaborating with CERN staff to provide a five-year \$30-Canadian contribution to CERN's LHC collider complex. This is in addition to contributions to the LHC detectors, and has involved activities in a variety of areas, not only on the LHC itself, but also on the machines in the injector chain, especially in this initial phase. In particular, the Proton Synchrotron (PS) and its Booster require major modifications to deliver proton beams with much higher brightness, more strictly controlled emittance, and a different bunch spacing.

As most of the equipment required for the PS and Booster had to be installed during the 1997–1998 winter shutdown, last year was an especially challenging period for TRIUMF staff and for the many companies manufacturing the components. Happily, the commitments were all met, though not without special efforts and some use of air freight!



CERN's PS complex, showing the equipment (shaded blocks) contributed to the LHC injector train by Canada via TRIUMF.

Although the majority of the Canadian contributions have been directed to the PS complex, others have involved the SPS and LHC. For the LHC itself, Canada is contributing to the injection kickers, the cleaning-insertion quadrupoles, and the current calibration



The ALSTOM Canada assembly team beside the last of the 52 twin-aperture "warm" quadrupole magnets delivered to CERN in 2003. (Courtesy Yvon Langevin, ALSTOM Canada.)

● January/February 2004 p9.

equipment. Besides all these hardware contributions, CERN and TRIUMF staff have been collaborating on a variety of beam dynamics studies.

● April 1998 p5 (extract).

India gains observer status

With the activities surrounding the LHC, CERN's community of scientific users has grown to comprise about half of the world's experimental particle physicists, with nearly a

third coming from outside the CERN member states. India has been an active partner for many years, and in the December meeting, Council granted the country observer status.

In the past, India has contributed equipment and technical teams to LEP, the PS injector complex and fixed-target experiments. This effort was formalized in a cooperation agreement in 1991, extended

in 2001 for a further decade. Then, in the framework of the 1996 protocol signed with the Indian Department of Atomic Energy, India is one of the first nonmember states to contribute significantly to the LHC: Indian scientists work on the ALICE and CMS collaborations, and Indian IT expertise is used in Grid computing projects.

● January/February 2003 p5 (extract).

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