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Elite Canadian Computing Centre Helps Launch Worldwide Grid

(Vancouver, B.C.) — Today, three weeks after the first particle beams were injected into the Large Hadron Collider (LHC) at CERN, the Worldwide LHC Computing Grid celebrated the start of its crucial data challenge. Canadians gathered at TRIUMF in Vancouver to celebrate their role as host to one of eleven massive "Tier-1" computing centres connected to CERN in Geneva, Switzerland. The ATLAS Canada Tier-1 Data Centre at TRIUMF provides another vital link between Canada and the global science and technology community.

"Our ability to manage data at this scale is the product of several years of intense testing," said Ian Bird, leader of the Worldwide LHC Computing Grid project. "Today's result demonstrates the excellent and successful collaboration we have enjoyed with countries all over the world. Without these international partnerships, such an achievement would be impossible." The Worldwide LHC Computing Grid (WLCG) combines the power of more than 140 computer centres, the result of collaboration between 33 countries, to analyze more than 15 million Gigabytes of data every year, produced from the hundreds of millions of subatomic collisions expected inside the LHC every second.

"The Worldwide LHC Computing Grid puts in place the necessary infrastructure to allow the ATLAS Canada Tier-1 Data Centre to contribute to an international effort to understand nature at the most fundamental level," said Dr. Eliot Phillipson, President and CEO of the Canada Foundation for Innovation (CFI). "The extensive partnership on which this project rests will ensure the most effective and efficient use of resources and the greatest impact on Canada's capacity to innovate." CFI provided $10.6 million in support of the national proposal led by Simon Fraser University in 2006 to launch the Canadian Tier-1 Data Centre.

Canada's high-profile position in the global grid is largely a result of the advanced networking infrastructure provided by CANARIE and BCNET. "CANARIE is very proud to partner with others in order to provide the vital link for data to be brought to the Canadian Computing Centres from CERN," said Guy Bujold, President and CEO of CANARIE Inc. "Our advanced network also enables the sharing of this massive amount of data at various Canadian sites."

"BCNET's newly upgraded Optical Regional Advanced Network is providing TRIUMF with unprecedented bandwidth, a dedicated 10 gigabit per second fibre optic connection," said Michael Hrybyk, President and CEO of BCNET. "The province's research network is a vital link for transporting large amounts of data around the world."

"By playing a critical role in this international project, Canada is joining the computing and networking elite of the world," said Michel C. Vetterli, project leader of the Canadian Tier-1 Data Centre at TRIUMF and professor of physics at Simon Fraser University. "The launch of the WLCG not only gives Canadian researchers first-class access to the physics of the LHC, but it also puts Canada on the map as a major player in this priority area of technology."

CERN was effusive in its praise of the successful launch of the data-sharing and networking project. "The Worldwide LHC Computing Grid is a vital pillar of the LHC project," said Jos Engelen, chief scientific officer for

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the LHC project. “It is an absolute necessity for analysis of the LHC data. It is the result of a ‘silent revolution’ in large scale computing over the last five years.”

The WLCG relies on dedicated optical fibre networks to distribute data from CERN to eleven major computer centres in Europe, North America, and Asia. Together, these distributed computers provide the power to manage the LHC’s data. The innovative networking backbone provided by CANARIE has been essential for Canada’s participation in this “silent revolution.” BCNET, Cybera, HEPNET, ORION, and RISQ also play important roles in connecting the“Tier-2” centres at McGill University, Simon Fraser University, University of Alberta, the University of Toronto, and the University of Victoria to the Tier-1 centre at TRIUMF. The Tier-2 centres will use the results of the first stage of data analysis at the Tier-1 centres to extract ground-breaking physics results from LHC data.

Grid computing benefits more than just physics, however. Large-scale computing is also actively used in chemistry, biology, and environmental research. Large financial firms around the world have been taking advantage of grid computing with some purchasing clusters of more than 50,000 CPUs running grid software to process more than a 1,000 Gigabytes of data in one day.

The ATLAS Canada Tier-1 Data Centre is managed by a consortium of universities (see below) led by Simon Fraser University in Burnaby, B.C. It was funded by the Canada Foundation for Innovation (CFI) and the British Columbia Knowledge Development Fund (BCKDF) with significant in-kind contributions from TRIUMF and from the computing industry, notably IBM, in the form of discounts on hardware purchases.

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FOR EDITORS:

CERN, the European Organization for Nuclear Research, is the world's leading laboratory for particle physics. It has its headquarters in Geneva. At present, its Member States are Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. India, Israel, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and UNESCO have Observer status. Canada has made important contributions to CERN's flagship accelerator, the Large Hadron Collider and one of its associated particle physics detectors, the ATLAS experiment.

The Large Hadron Collider **or LHC** is a particle accelerator which, at 27 kilometres in circumference, is the world's largest and most complex scientific instrument. The LHC is the world's most powerful particle accelerator, producing beams seven times more energetic than any previous machine, and around 30 times more intense when it reaches design performance, probably by 2010. It relies on technologies that would not have been possible 30 years ago. The LHC is, in a sense, its own prototype.

The **ATLAS Canada Tier-1 Data Centre** is funded by the Canada Foundation for Innovation (CFI), the British Columbia Knowledge Development Fund (BCKDF), with significant in-kind contributions from TRIUMF and from the computing industry, notably IBM, in the form of discounts on hardware purchases. One of a dozen Tier-1 centres in national computing facilities around the world, the Data Centre will participate in the storage and analysis of petabytes (millions of Gigabytes) of data generated by the ATLAS detector at CERN in Switzerland. Networking resources essential for the TRIUMF facility are provided by CANARIE, BCNET and HEPNET Canada—there is a 5 Gbit/s dedicated lightpath connecting TRIUMF to CERN.

Grid computing connects computers distributed over a wide geographic area. Just as the World Wide Web enables access to information, computing grids enable access to computing resources. These resources include data storage capacity, processing power, sensors, visualisation tools and more. Grids can combine the resources of thousands of different computers to create a massively powerful computing resource, accessible from the comfort of a personal computer and useful for multiple applications, in science, business and beyond.

ATLAS is a worldwide collaboration comprising over 2,500 scientists and engineers from 178 institutions in 35 countries and regions. These are Armenia, Australia, Austria, Azerbaijan, Belarus, Brazil, Canada, China, Czech Republic, Denmark, France, Georgia, Germany, Greece, Hungary, Israel, Italy, Japan, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan, Turkey, United Kingdom and the United States of America.

ATLAS-Canada comprises about 150 faculty members, post-doctoral fellows and students from eleven Canadian institutes: the University of Alberta, University of British Columbia, Carleton University, McGill University, Université de Montréal, University of Regina, Simon Fraser University, University of Toronto, TRIUMF, University of Victoria and York University. See http://www.atlas-canada.ca

TRIUMF is Canada's National Laboratory for Particle and Nuclear Physics. Physically located on the south Campus of the University of British Columbia, TRIUMF is owned and operated as a joint venture by a consortium of the following Canadian universities, via a contribution through National Research Council Canada and supported by the Province of British Columbia: University of Alberta, University of British Columbia, Carleton University, l'Université de Montréal, Simon Fraser University, University of Toronto, University of Victoria. See http://www.triumf.ca

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Canadian involvement in ATLAS and the CERN LHC

Canadian involvement in ATLAS and the LHC has placed us in a prominent position in the forefront international science project of the decade. In total Canada has invested **$70 million of the $8 billion total** in equipment that is now a crucial part of the CERN LHC accelerator complex and the ATLAS particle physics experiment. Canadian researchers have received an additional **$30 million** to fund graduate students, postdoctoral researchers and their research on ATLAS. **TRIUMF** has provided staff and technical support to make these contributions a reality. As a result of these investments and the resulting scientific and technical expertise Canada is a respected partner at CERN and in the international science community.

No single country could afford to build the $8 billion LHC project on its own. ATLAS has been built by researchers from more than **150 universities and laboratories in 35 countries**. **150 Canadian scientists** (faculty, lab staff, postdoctoral researchers and graduate students) from **eleven institutions** across the country work at CERN, alongside 2000 other scientists from every corner of the globe, on the ATLAS experiment. Canada has made important contributions to the LHC, ATLAS and the world-wide computing grid now primed to digest the ATLAS data.

In 1995 TRIUMF was given the mandate to act as Canada's main connection with CERN. It was provided with **$42 million** of federal funding over ten years to develop and construct components for the LHC. These projects were completed on time and in budget in close collaboration with Canadian industry. Over 90% of our LHC funding has been spent in Canada. There have been a number of spin-offs from this activity. I.E. Power, Inverpower and Digital Predictive Systems in Ontario gained expertise in high current power supply design and fabrication and have competed successfully for an additional $10M in contracts from major international labs. ALSTOM-Canada, in Tracy, Quebec improved assembly tolerances for LHC magnets benefiting their main business, the fabrication of hydro generators. Canadians were instrumental in the construction of the ATLAS detector. ATLAS construction was supported by a **$12 million** grant from the Natural Sciences and Engineering Research Council of Canada (NSERC). Canadian contributions to the ATLAS detector were completed on time and on budget, are now installed in the ATLAS experiment where they have been commissioned and are ready for LHC data.

ATLAS will produce several Peta-bytes (millions of Giga-bytes) of data per year. Canada has constructed a Tier-1 computing centre at TRIUMF funded by the Canada Foundation for Innovation (CFI) and the BC Knowledge Development Fund (BCKDF) at the levels of **$11 million** and **$4 million**, respectively. The primary role of the Tier-1 centre is the processing of raw ATLAS data which will be used by physicists to understand what is going on in the high energy proton collisions. The data will be accessed at Tier-2 computing centres located at university sites, funded by the CFI National Platforms Fund. The centres are connected nationally and internationally with networks supported by CANARIE and provincial partners. The combined Canadian Tier-1 and Tier-2 centres give us “made in Canada” physics analysis ability, positioning ourselves to be leaders in extracting the first ATLAS physics over the coming years.

Particle physics studies the universe at its most fundamental level. Outstanding questions that we are on the brink of answering include:

- How do the elementary particles get masses?
- What is the nature of the cold dark matter observed by astronomers?

Excitingly, these seemly disparate questions may even be part of the same puzzle. The LHC will provide the next step to answering these questions and may provide insight into a much deeper understanding of the nature of the universe.

For further information: see http://www.atlas-canada.ca