

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 are being commissioned and will be ready for first LHC particle collisions in autumn 2008.

ATLAS will produce several Peta-bytes (millions of Giga-bytes) of data per year. Canada has constructed a Tier1 computing centre at TRIUMF funded by the Canadian Foundation for Innovation (CFI) and the BC Knowledge Development Fund (BCKDF) at the levels of **\$12 million** and **\$4 million**, respectively. The primary role of the Tier1 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 final analyses will be performed largely on the Tier 2 computing centres located at university sites, funded by the CFI National Platforms Fund. The combined Canadian Tier1 and Tier2 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 seemingly 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>