

Review of NSERC supported Major Resources Support (MRS) Centres for Subatomic Physics and of other technical expertise in Canada

TRIUMF Seminar on the HL-LHC wire-corrector system and roundtable with ATLAS Canada

September 21, 2021

Support and service Canadian efforts on: ATLAS (FCAl, HEC, ITk, LUCID, Forward Proton, NSW), Barium tagging, Belle-II, DEAP, DUNE, Hyper-K, MoEDAL-LHC, EXO & nEXO, NEWS, PICO, SBC, SNO+, SuperCDMS, TPX, T2K, TRIUMF ARIEL, TRIUMF E-LINAC; as well as electronics and infrastructure with CERN DESY, JLab, TRIUMF.

Overview today

- TRIUMF HL-LHC wire-corrector system
 - The proposal is to set the funding mechanism that would allow the LHC to reach maximum luminosity (performance) in the High-Luminosity era and for ATLAS to enhance its physics reach
- CFI IF with international contribution from CERN
 - CERN 60% & Canada/CFI 40%: how ATLAS-Canada universities can contribute envelope share
- Technical expertise in Canada at universities
 - MRS (next), but also other resource, for example, engineering at McGill (Toronto or Uvic)
- Seminar: general overview of the system
 - Concepts, physics, layout and TRIUMF 'know-how'
- Roundtable: questions, discussion, timeline, components, resource, preliminary budget, and next step...

Alberta

- **Electronics Specialist and Electronics Technician**

- Design and fabrication of fast digital and analog electronics
- Design & simulation of multi-layer boards and ASICs using MENTOR & the Canadian Microelectronics Centre
- FPGA programming, data acquisition and software prep.

- **Mechanical Engineering/Machine shops**

- Experience with main mechanical 3D CAD + mech. & thermal FEA
- Experience with cryogenic and vacuum systems
- Mechanical design for large and small detector system.

- **Detector Designer, Testing and Installation Capabilities**

- Detector design (3D modelling) development, construction & installation
- Large fabrication hall with 10T crane access
- Scintillator, gaseous detector and cryo-detector design & construction

- **Low Background Counting and Fabrication**

- Low Background Counting Facility for qualification and monitoring
- Radon free clean lab. for machining and detector fabrication

- **Special Access to External Facilities**

- Working closely with McDonald Institute's Alberta based scientists & SNOLAB engineers
- Access to National Institute of Technology Microfabrication Capability

- **Facilities and Equipment**

- Advanced Machining Facility + 15-ton crane
- Machine Shop with multiple computer-controlled lathes & mills – with 1 ton crane access
- Electronics shop with analog & digital design capability
- CAD + mech. & thermal FEA
- High energy X-ray source
- Clean assembly labs
- Low background counting facility
- Radon free laboratory
- Glass blowing and machining/polish shop
- X-ray accelerator for radiation testing. Radiation handling laboratory
- Low Background Counting Facility for qualification and monitoring

- **Personnel:** Detector technologist, electronics engineer, engineer and access to several machinists

Carleton

- **Electronics Specialist and Electronics Technician**
 - Analog and digital readout systems, power supplies, equipment certification
 - Soldering, circuit design, cabling, system modeling and control

 - **Machinist/Technician** – construction and installation, precision small parts fabrication, welding, vacuum/gas system cleaning and assembly, leak-checking

 - **Designer** - 3-D modeling, concept development, detailed design drawings for fabrication (*e.g.* CNC), as-built drawings, FEA calculations
⇒ working closely with McDonald Institute and SNOLAB engineers based at Carleton
- **Facilities and Equipment**
 - Machine shop, electronics lab, clean rooms, vacuum and gas handling equipment (Swagelok, VCR, Conflat, KF, custom)
 - Winding table
 - X-ray scanner
 - Granites tables
 - Electronics and DAQ: NIM, VME, LabView; silicon pixel telescope

 - **Carleton Science and Technology Centre (STC)**

U. de Montréal

- **Electronics lab (Groupe Technologique, GT)**
 - Wide-range expertise in DAQ, FPGA, firmware, trigger, slow control
 - 3 physicists (PhD), 1 tech, 1 newly hired electronics engineer
- **Specialized machine shop**
 - Operated by two techs with lots of experience working on subatomic physics projects
 - State-of-the-art equipments: CNC milling machine, capabilities for high vacuum quality welding on stainless steel (and other metals), sheer and bending machine for sheet metal work, hydraulic press, sand blasting chamber, 3D printing, *etc.*
- **Tandem ion-beam, cleanrooms**

