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CCE Award Competition 2014

TRIUMF Advanced Rare Isotope Laboratory (ARIEL)

Vancouver, BC

Buildings

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A. Project Information

Project Name
TRIUMF Advanced Rare Isotope Laboratory (ARIEL) - Mechanical Engineering

Location of Project
4004 Wesbrook Mall
Vancouver, BC V6T 2A3

Completed by
July 2013

Category
A. Buildings

Firm Name
Stantec Consulting Ltd.

Firm Address
1100 – 111 Dunsmuir Street, Vancouver, BC V6B 6A3

Role in the Project
Mechanical Engineering Consultant

Member of the Association of Consulting Engineering Companies of Canada (ACEC)?
Yes

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P.Eng.?
Yes

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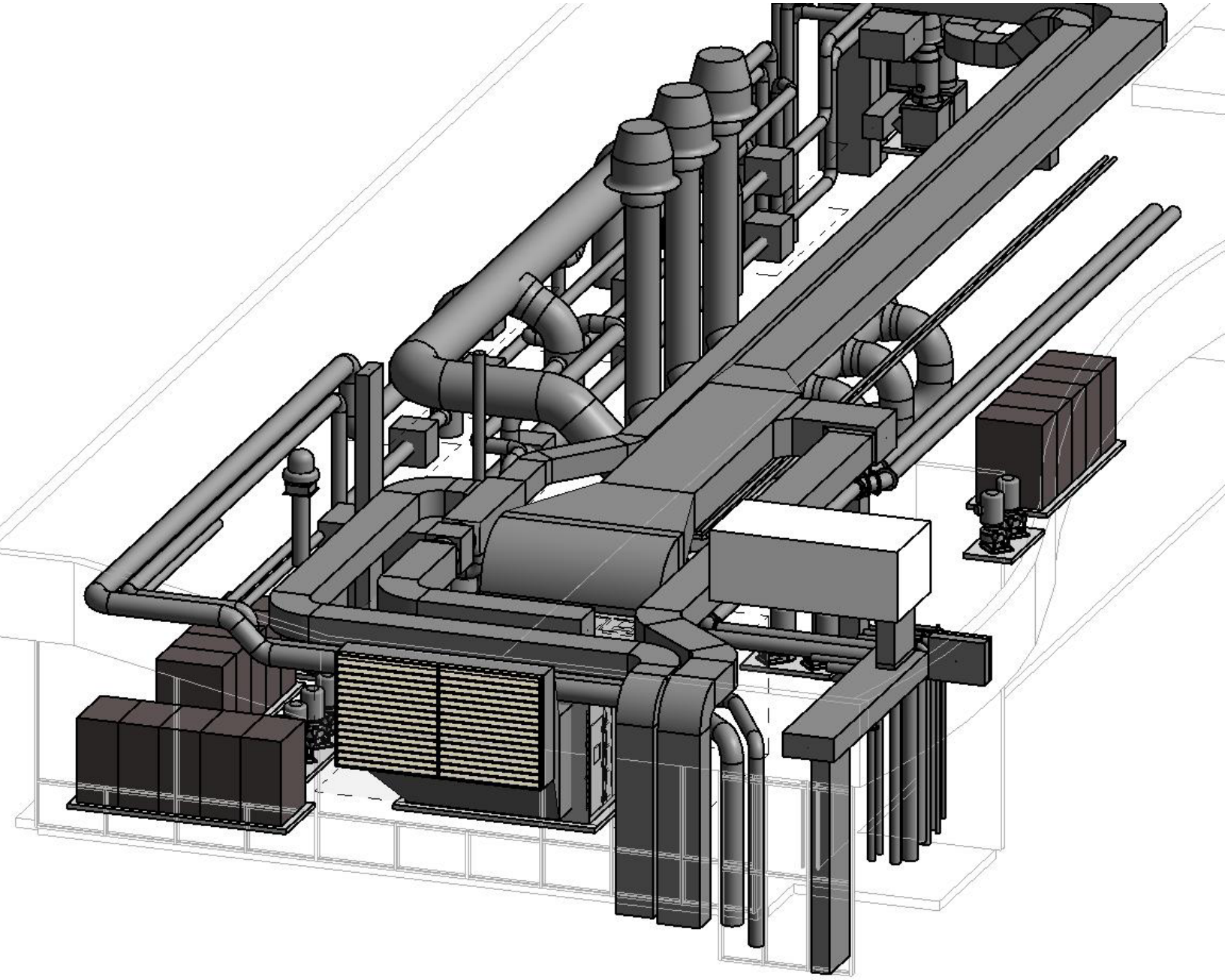
B. Project Outline

Summary

The Advanced Rare Istotope Laboratory (ARIEL) is TRIUMF's flagship facility that will expand Canada's capabilities to produce and study isotopes for physics and medicine. Utilizing next-generation technology, it showcases a made-in-Canada, high-power superconducting electron accelerator to produce isotopes for research and development. Stantec's team of engineers provided the mechanical installation to ensure that it works in tandem with the building's technically advanced structure and function.



Project Highlights

Innovation

TRIUMF was founded in 1968 by Simon Fraser University (SFU), the University of British Columbia (UBC), and the University of Victoria (UVIC), to meet research needs that no single university could provide. The University of Alberta joined the TRIUMF consortium almost immediately after. Today, there are currently more than a dozen members from across Canada in the consortium that governs TRIUMF.

Since its inception as a local university facility, TRIUMF has evolved into a national laboratory while still maintaining strong ties to the research programs of Canadian universities. The science program has expanded from nuclear physics to include particle physics, molecular and materials science, and nuclear medicine. TRIUMF provides research infrastructure and tools that are too large and complex for a single university to build, operate, or maintain.

The construction of the recently competed Advanced Rare IsotopE Laboratory (ARIEL), TRIUMF's flagship facility, expands Canada's capability to produce and study isotopes for physics and medicine. Utilizing next-generation technology, it showcases a made-in-Canada, high-power superconducting electron accelerator to produce exotic isotopes for research and development in science and medicine.

The ARIEL project houses and services the following four major scientific installations:

- Electron linear accelerator (e-LINAC)
- Specialized proton beam line
- High-power target stations
- Front end and isotope separator

The client supported adopting sustainable design principles for its ARIEL facility which is designed to a level that will achieve LEED® certification.

The Project is a Class-II accelerator under the Class-II Nuclear Facilities and Prescribed Equipment Regulations of the Canadian Nuclear Safety Commission. Proponents are advised that NFPA 801, Standard for Fire Protection for Facilities Handling Radioactive Materials will apply.

Coordination between the three branches of engineering: structural with Bush Bohlman, electrical with AES and mechanical with Stantec, was facilitated by the Prime Consultant Chernoff Thompson Architects and extensive schematic design work was carried out with the very technically savvy client to understand their needs. The depth of the construction adjacent to existing buildings along with radiation and EMI shielding requirements including two-metre thick concrete walls, provided a particular challenge for this project. Ductwork, pipe, and cable placement needed to be carefully worked into the design early due to the required thickness of the concrete walls. 3D models of the plantroom arrangement helped with this process.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Complexity

Shielding requirements including thick concrete walls, provide a particular challenge for this project. It was necessary to produce detailed ductwork and placement of pipes/mechanical systems needed to be carefully worked into the design early due to the required thickness of the concrete walls. An innovative fan wall system was integrated into the project in order to reduce noise level, provide a small plant footprint, and increase redundancy overall.

Mechanical design services include a high-active and low-active raw water cooling system, stainless steel piping, a nuclear exhaust, a liquid helium cooling pipe with PLC control, room pressurization control, a HEPA filtered supply air, pre-action (wet) system, active/non-active building sewage system, and a highly detailed fire strategy. The nuclear exhaust system is complex and features fully welded stainless steel ductwork, high plume dilution fans, and two levels of HEPA filtration. The heat recovery system is designed to provide heat for the entire University campus (with the heat rejection going back to one point).

Social and/or Economic Benefits

There are over 350 scientists, engineers, and staff performing research on the TRIUMF site. It attracts over 500 national and international researchers every year and provides advanced research facilities and opportunities to 150 students and postdoctoral fellows each year. In addition to the onsite program, TRIUMF serves as the gateway to Canada in global research in particle, nuclear, and accelerator physics.

TRIUMF scientists and university-based physicists develop and implement Natural Sciences and Engineering Research Council's (NSERC) long-range plan for subatomic physics. TRIUMF has over 50 international agreements for collaborative scientific research.

TRIUMF is positioned to put BC in the lead for the coming revolution for nuclear medicine. The construction of ARIEL expands Canada's capability to produce and study isotopes for physics and medicine. Utilizing next-generation technology, it showcases a made-in-Canada, high-power superconducting electron accelerator to produce exotic isotopes for research and development.

Environmental Benefits

A modular chiller is installed in the roof plantroom along with two large air handling units providing a duty and standby installation to ensure pressures remain at the levels they should be within the building. Cooling systems are differently zoned as high active and low active depending on which systems are being installed.

Drainage had to take account of the discharge of sprinklers in case of a nuclear event in the building and therefore an active and non-active sump was provided below the building. Cooling was centralised to existing cooling towers which were extended to take account of the new load. This also allowed all condenser water for the ARIEL site to be available at a single point where it will in the future provide a proportion of heat to a UBC-wide district heating network. And hence provide a sustainable solution for both UBC and for TRIUMF.

Meeting Client's Needs

The client supported adopting sustainable design principles for its facility which is designed to a level that will achieve LEED® certification. No mean feat for such an energy intensive building. Stantec was able to work with the client and the other consulting designers to deliver a mechanical system that supported the primary functions of the building, while achieving the overall economic and environmental benefits of the project. Stantec was able to help TRIUMF make a lasting impact on the community through the design and delivery of this building.

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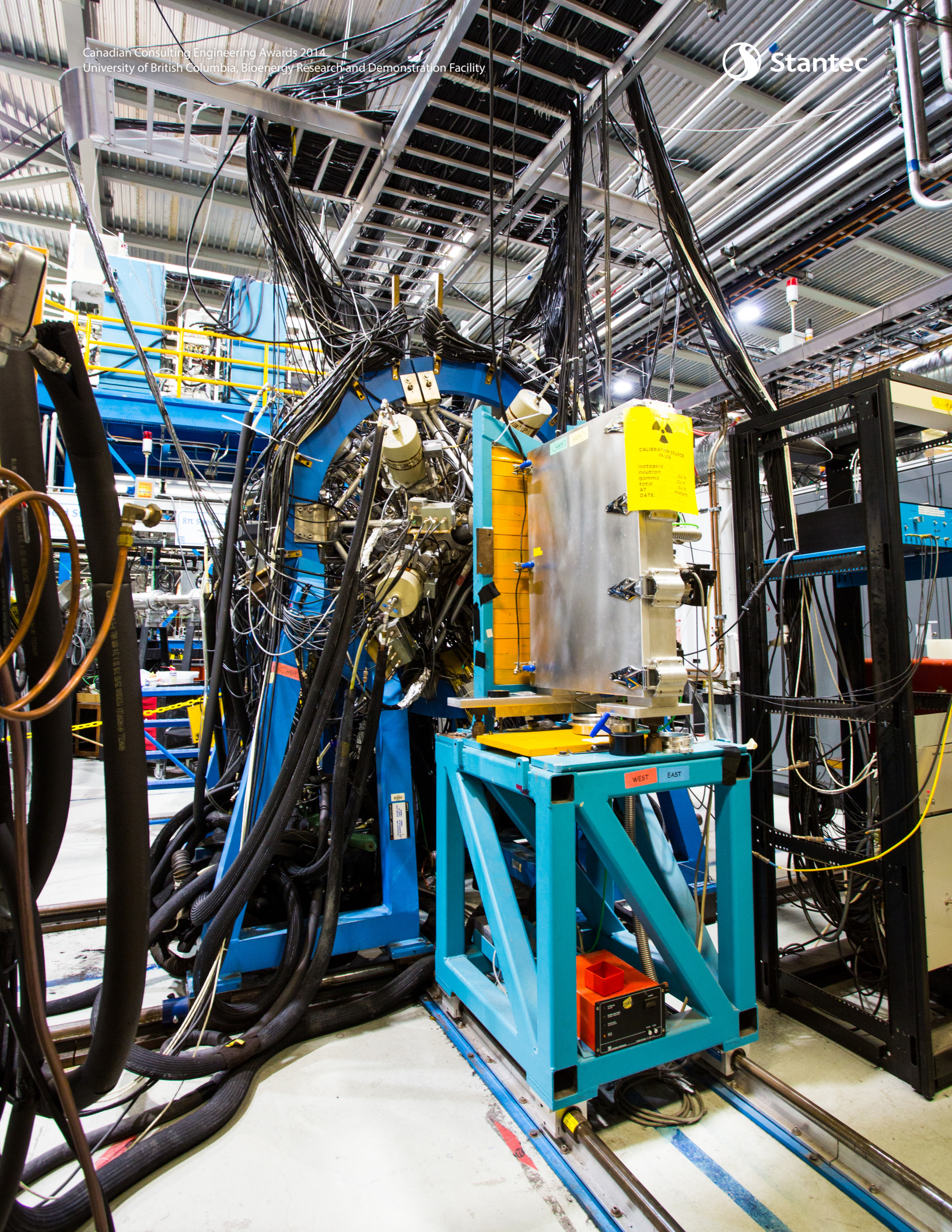

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