TRIUMF Machine and Fabrication Shop

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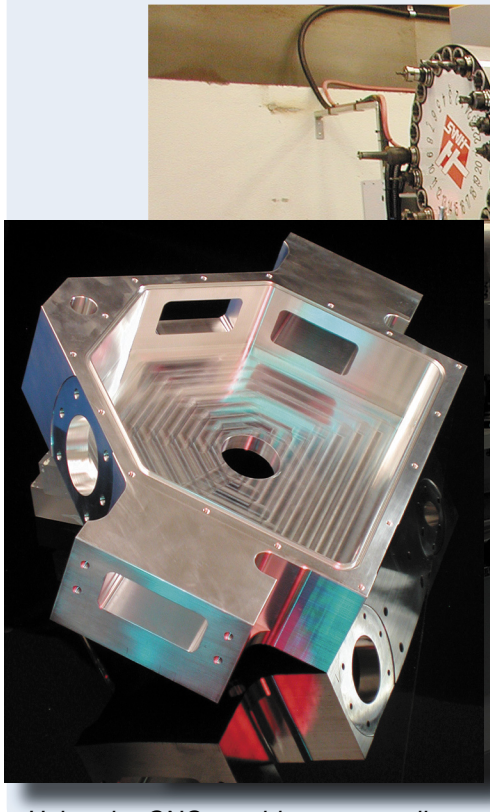
Surface treatments of metals are needed for many different applications: eletropolishing of stainless steel for high vacuum, hard anodizing of aluminum for resistance to wear, nickel plating of copper for low temperatures and powder coating for resistance to corrosion.

TRIUMF's success in developing new accelerator components, detectors and experimental equipment depends not only on its scientists and engineers but also on the skills of the machinists and welders in the TRIUMF Machine Shop. This group of skilled craftsmen is continuously faced with new challenges in fabrication, new materials to machine, and new technologies and techniques to explore and master.

At present, the shop personnel consists of a supervisor, two shift supervisors, seventeen journeyman machinists, two welders and one apprentice. Every day of the week, the staff meets the demands of operations or experiments as they arise. In addition to an array of standard lathes and milling machines, the shop has two CNC (Computer Numerical Control) vertical machining centres that can be used to produce more complex parts with improved precision and repeatability. Recruitment of experienced programmer/machinists and the conversion of the TRIUMF Design Office software to SolidWorks have enabled more efficient use of the Cam software, with the full capability of fourth and fifth axis machining. Scientists, engineers and designers now have more flexibility and can be more creative when designing components required for their projects.

Specialized welding is another important service of the TRIUMF Machine Shop. High vacuum is required for all of the accelerators and beamlines and leak-free welding of a wide array of containment vessels and vacuum boxes, in stainless steel or aluminum, is essential. TRIUMF frequently requires large structures for holding heavy magnets and similar devices for which high quality structural welding is needed. TRIUMF's electron beam welder,

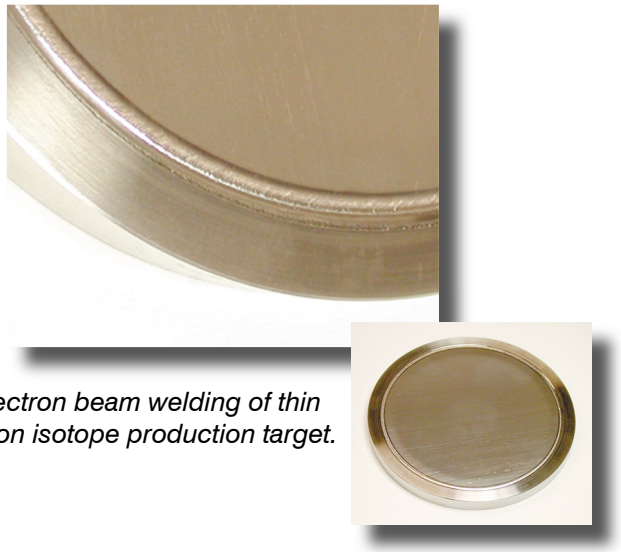


Using the CNC machine, a complicated part can be fabricated from a solid block of material.

The two CNC machines in operation.

where a powerful beam of electrons in a vacuum fuses the parts being welded, is a crucial step in fabricating the many types of targets used at TRIUMF. Targets for isotope production using MDS Nordion Inc cyclotrons, targets for meson production and the many types of target technologies required for ISAC radioactive ion beam production, are all produced using electron beam welding. Typically, these targets require either exotic materials such as tantalum or molybdenum, or very thin foils where electron beam welding is the only assembly technique possible.

With these fabrication skills, TRIUMF machinists can be part of the design team, making suggestions or providing ideas on manufacturing, suggesting preferred methods for machining a complicated device and giving practical advice on how to machine new materials. Although most parts required at TRIUMF are made from stainless steel, aluminum or copper, there are many other materials that must be machined, from assorted plastics and composites



Electron beam welding of thin foil on isotope production target.

to high-temperature materials to superconducting materials. Frequently, specially shaped ceramics are required, and fabricating them from machinable ceramics is much less expensive than having them produced by molding and firing.

The work of the TRIUMF laboratory has also placed demands and challenges on the machine and fabrication shops in the Vancouver area and across Canada. There are some components, such as the vacuum tanks for the ISAC-II cryomodules, that were too large to be fabricated in the TRIUMF Machine Shop and were contracted out to a Canadian company for fabrication. In the construction of the ISAC radio frequency quadrupole, there was a need to put a conducting copper layer on steel plate.

Positioning an ISAC target in the electron beam welder.

Superior Electro Plating of Surrey, British Columbia expressed interest in developing this technology, and TRIUMF personnel worked with them to establish the procedure for successfully accomplishing the job. Since then, copper plating on steel has been used in many of the ISAC target modules, saving money by using mild steel rather than stainless steel in certain applications where the copper layer is needed to resist corrosion. PR Manufacturing Inc. of Toronto, Ontario, fabricated some of the very large structures required by TRIUMF for assembling the Canadian-made components for the ATLAS detector at CERN. Brandt Industries, of Regina, Saskatchewan constructed some of the large vacuum tanks for the ISAC target station, as well as tanks for the pulse-forming networks used in the CERN LHC injection kickers developed at TRIUMF.

In summary, the challenges of fabricating the state-of-the-art components required for the TRIUMF scientific programme are being met by a group of skilled technologists in the TRIUMF Machine Shop. In turn, these craftsmen get the benefit of interesting and varied work to perform and the knowledge they are contributing to the success of TRIUMF.