Contribution ID: **76** Type: **Poster**

Alignment of Linear Accelerator Room Scan Data Using the Existing Reference Network

The Canadian Light Source (CLS) features a 250 MeV Linear Accelerator (LINAC) as the electron source for a Booster Ring and 2.9 GeV Storage Ring. The LINAC is found in a sub-basement under the CLS and was originally built in1962 as a dedicated particle accelerator lab on the campus of the University of Saskatchewan. Due to the age of the construction and a lack of up-to-date drawings of important features, the CLS Survey, Alignment, and Vibration team used a room scanner to capture the construction features and equipment. A Leica RTC360 was used to perform the scan of the sub-basement and the LINAC components. Initial registration of the of the scan data created a complete spatial point representation with approximately 3 mm global residual error. It is believed that this high error was due to the length of the tunnel and repetitive features of the LINAC equipment. To improve the fit of the scan data, rudimentary 3D printed spherically mounted retroreflectors with magnetics bases were installed in wall and floor nests. Using the camera views from the room scanner, locations of reference network fiducials could be manually picked and referenced to the survey network. Registering point cloud data to our existing metrology reference network decreased the global residual error to 0.388 mm. This also aligned the axes of the scan data with the existing facility reference network frame. Without conventional targets available at the time, this proved to be an inexpensive and effective method of fitting the room scan point cloud data using an existing reference network. This data will be used in upgrades and alignment of future LINAC equipment.

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Track Classification: Survey & Alignment