Contribution ID: **77** Type: **Oral**

Updating the CLS Storage Ring Reference Network

The Canadian Light Source (CLS) is a 3rd generation synchrotron with a 2.9 GeV Storage Ring. The 171 m circumference Storage Ring is equipped with a 155-point wall and floor network to allow location of laser trackers for precision alignment. The instrument locate error to this network has been high averaging in the range of 300-400 μm. There is a growing need to realign the CLS Storage Ring, so updating the reference network is the first step in that process. The CLS Survey, Alignment and Vibration team initiated a resurvey campaign in March 2021 of the Storage Ring to rebuild the network. Shots of the reference network took about 30 days was hindered by access restrictions due to the COVID-19 pandemic. To speed up the process, auto-capture features of the laser tracker were used to automate measurements using 20 spherically mounted retroreflectors. A Unified Spatial Metrology Network (USMN) was created to combine the new shots while also bringing in the original reference network points as a low-weighted boundary condition in order to blend the original network with the new shots. Two more boundary conditions in the form of straight sections related to beam lines on opposite sides of the ring were captured and included in the USMN. The average error of the resulting USMN was 0.094 mm. The average uncertainty in the horizontal axes was low, about 46 μm for each. The average vertical uncertainty was higher at 131 μm. This now allows for instrument locates with only 40-80 μm error in the Storage Ring. This resurvey campaign is planned to be extended to beamlines and the Booster Ring in the near future.

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Session Classification: Session 7 - Surveying and Alignment II

Track Classification: Survey & Alignment