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Alignment and Vibration Considerations for the CMCF-ID Beamline at the CLS

The Canadian Macromolecular Crystallography Facility insertion device beamline at the Canadian Light Source (CLS) was recently upgraded with a new 3.8 m, 5.4 mm gap in-vacuum undulator and a new optical layout. Renovation of the beamline started March 2020 and commissioning was completed June 2022. This is the first micro-focusing beamline at the CLS, therefore accurate alignment and vibration attenuation were crucial to success. To keep vibration levels less than 20% of the beam focus at the sample location, the beamline chose vibration criteria VC-D as a goal. Measurements after commissioning met this goal except for levels at one third octave band center frequencies of 12.5 Hz and 63 Hz. These frequencies are generated by nearby mechanical equipment so the CLS Survey, Alignment and Vibration team is working to attenuate these noise sources to meet the beamline's final goal. For the original insertion device to function, large storage ring beam position monitor offsets were used to allow the electron beam through the original insertion device. During renovation, radiation indication paper was placed at surveyed locations along the theoretical beam path. Burn marks acted as a feedback method for adjusting storage ring offsets to align the electron beam through the undulator to match the beamline theoretical centerline. The uncertainty of this method is high, in the range of +/- 0.5 mm, and does not provide information on the extents of the beam profile. It did provide enough accuracy such that only minor corrections were needed during commissioning to align the beam with the sample location. Ultimately the renovation and alignment were a success, producing a reduction in beam size of 12-fold from before the renovation and creating a beam focus of 8.6 um vertical x 53.6 um horizontal at 50.9 m from the undulator source.

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