

Mechanical Vibration Measurement System at the Canadian Light Source

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Introduction

At synchrotron radiation facilities, the vibration of the electron and/or photon beam, especially in the vertical direction, enlarges the size and changes its intensity. This degrades the performance of the beamline [1,2].

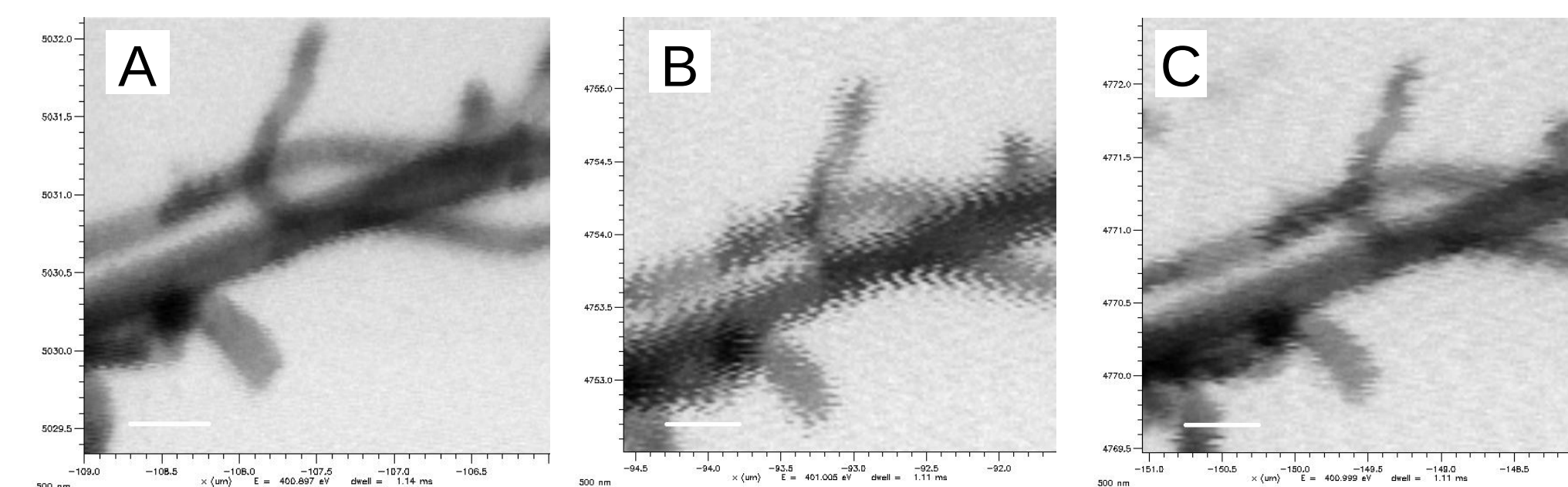


Fig. 1. Influence of mechanical vibrations on STXM images of N-CNT at 401.0 eV.

Instrumentations

The Canadian Light Source Vibration Data Acquisition system was used to measure vibration in the CLS facility [4]. It includes a Vector Signal Analyzer (VSA) (Model: Hp Agilent 89410A; Manufacturer: HP) and accelerometers (Model: 393B31; Manufacturer: PCB PIEZOTRONICS). Accelerometers produce a voltage proportional to the acceleration of their connected object.

The sensitivity of the accelerometer $a=1.02 \text{ v/(m/s}^2\text{)}$. The frequency range of the measurement is 1 Hz to 300 Hz. The frequency resolution of the accelerometer is better than 0.1 Hz.

Measurement Set Up

Accelerometers were mounted at four beamlines shown in Fig. 2.

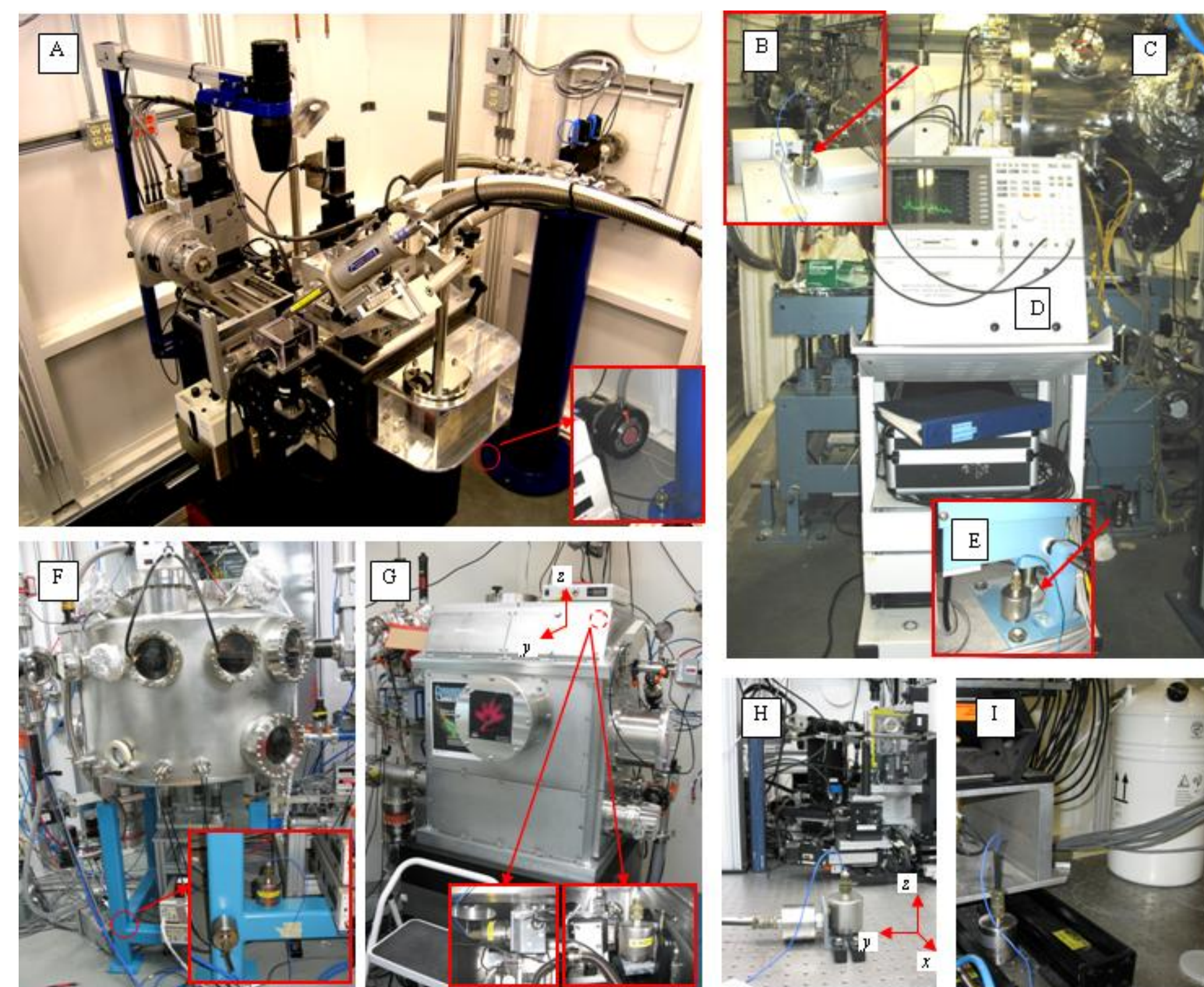
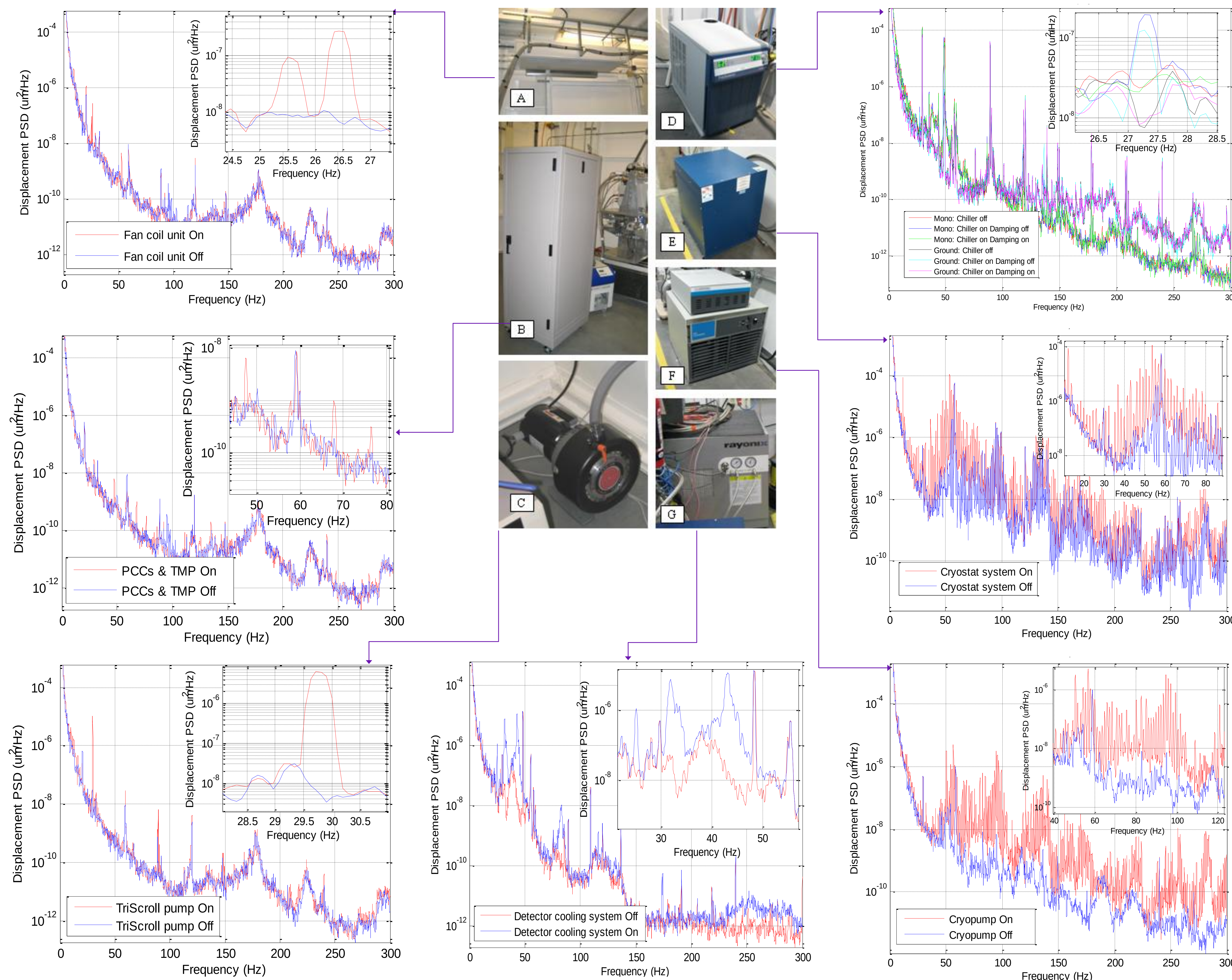


Fig. 2. Set up of accelerometers at various beamlines.

Identified Vibration Sources

Seven vibration sources were identified bellow.

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|--|-----------------------------|
| A: Fan coil unit. | C: Varian TriScroll pumps. |
| B: Polycold Compact Coolers (PCC) and Turbomolecular pump (TMP). | |
| D: Chiller. | E: Cryostat system. |
| F: Cryopump. | G: Detector cooling system. |



Conclusions

Seven vibration sources are identified at four beamlines/endstations at the CLS, i.e., the Canadian Macromolecular Crystallography Facility (CMCF) 08ID-1 beamline, the Hard X-ray MicroAnalysis (HXMA) 06ID-1 beamline, the Resonant Elastic and Inelastic Soft X-ray Scattering (REIXS) 10ID-2 beamline, and the Scanning Transmission X-ray Microscope (STXM) endstation at the Spectromicroscopy (SM) 10ID-1 beamline.

The results demonstrate that mechanical movable equipment in optics hutch and experimental hutch can cause vibrations significantly affecting the performance of these beamlines/endstations. The information provided in this paper is important to understand and control vibrations not only for beamlines at the CLS but also for other synchrotron radiation facilities worldwide.

Acknowledgement

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References

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For further information

Please contact mark.li@lightsource.ca. More information on this project can be found in [3].