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Enabling high-precision nano-positioning for beamlines: the Precision Metrology Laboratory at Diamond Light Source

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The Precision Metrology Laboratory (PML) at Diamond Light Source provides an ultra-stable environment and instrumentation to perform micro- to nano- scale dimensional metrology to support beamline operation. The lab is actively stabilised to ± 10 mK in temperature and ± 0.5 %RH in humidity. Under these conditions, sub-nm displacements have been measured using capacitive sensor and linear interferometer, and sub-nrad angles have been measured using autocollimator and angle interferometer*. Such measurement capabilities are required to characterise and enhance the performance of beamline positioning systems prior to installation. This philosophy has frequently helped to identify faults, including misalignments, parasitic motion errors, and controller issues. Solving these problems before beamline operation has saved a significant amount of X-ray commissioning time. Increasingly, the PML is involved in the prototyping of new beamline components that are beyond the production limits of commercial suppliers. Providing metrology feedback to guide design decisions following the mechatronics principle.

Footnotes

* “Generating and measuring pico-radian angles”, S.G. Alcock et al, Metrologia 59, 6, 064002 (2022) <https://doi.org/10.1088/1681-7575/ac9736>

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