Design and Characterization of a Light Frame KB Table, and Comparison with a Concrete Block Support

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Abstract

The high-resolution diffraction beamline at the European Synchrotron Radiation Facility (ESRF) is characterized by a small angular size of the X-ray source leading to a very high geometrical resolution. New experiments using a Kirkpatrick-Baez (KB) mirror setup [1] in order to demagnify the photon beam to reach the smallest possible spot size require very high dynamic stability of the supporting mechanical assemblies.

A new KB table designed with this need in mind has recently been built at the ESRF. In order to fulfil these mechanical stability requirements, low mass and high rigidity were primary targets. Particular attention was also paid to the stiffness of the "floor/table" interface. Stability was assessed using vibration as well as static measurements. A direct comparison with a heavy concrete block KB support was performed. Both of them can be moved on a marble floor, with pneumatics air pads.

The results show that the lighter KB table, mounted on more rigid feet, provides a more stable solution than the massive assembly. Indeed, the overall larger stiffness-to-mass ratio leads to higher frequency rigid body vibration modes. The first natural frequency mode occurs at 85 Hz for the lighter structure, compared to 16.5 Hz for the concrete support. This effect, combined to the spectral amplitude of the floor excitation decreasing with the square of the frequency, explains the better performances of the light frame table. This table allowed, in particular, to decrease the spot size obtained with a 20-keV X-ray beam to less than $0.2 \times 0.2\ \mu m^2$ [2].

[1] P. Kirkpatrick and A.V. Baez, J. Opt. Soc. Am. **38** (1948) 766-774.
[2] O. Hignette and P. Cloetens, private communication.

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