

Vibration Isolation Systems for The Manoharan Atom Manipulation Lab, Department of Physics, Stanford University

*The Manoharan Atom Manipulation Lab was designed for ultrahigh vacuum cryogenic STM's to assemble nanostructures one atom at a time. It used multi-stage air isolation. The first stage air isolators were replaced with ½ Hz Minus K isolators so experiments could be performed during construction of an adjacent building.*

The Manoharan Atom Manipulation Laboratory built for Dr. Hari Manoharan in the basement of the Varian Physics building has been designed to house ultrahigh vacuum cryogenic scanning tunneling microscopes (STM's) capable of sub-Angstrom spatial resolutions. A focus of the research is to use the probes to manipulate single atoms and assemble nanostructures one atom at a time.

In order to achieve this level of resolution the original systems were built with a series of pneumatic isolators and low noise feedback electronics. The apparatus are supported on dedicated concrete foundations mechanically isolated from the building and are enclosed inside acoustic shielding rooms.

A new building is being constructed in close proximity to the laboratory and preliminary vibration measurements showed that the vibration impact during the construction would be severe. Based on these measurements and performance data for the ½ Hz Minus K isolators, Stanford University concluded that replacement of the first stage 2 Hz air isolators with the ½ Minus K isolators would allow experiments to be performed during construction. There were no expectations that the experiments could be performed during extreme events such as soil compaction but they desired a vibration isolation system with sufficient performance so that experiments could be performed in the presence of general construction noise. Consequently, a contract was awarded to Minus K to provide two four-isolator systems to replace the first stage air isolators.

Each Minus K system consists of four custom passive, manually-adjustable, mildly-magnetic SM-1C isolators that support a payload weight of approximately 5000 lb. The Minus K isolators are capable of system natural frequencies of ½ Hz or less, vertical and horizontal, and they can support lateral seismic loads of ½ G in the event of an earthquake. The 5000 lb payload includes the addition of ballast weight to enable the isolators to handle a payload weight change due to cryogen boil off and maintain a vertical natural frequency close to ½ Hz with a manual adjustment no more than once a day. The isolators were installed in May 2005.