

STACIS® 2100

Active Piezoelectric Vibration Cancellation System



STACIS® is the world's most advanced active vibration cancellation system. Employing advanced inertial vibration sensors and state-of-the-art piezoelectric actuators, STACIS cancels vibration in real time by sensing floor vibration, then expanding and contracting piezoelectric actuators to filter out floor motion. Isolation starts at 0.6 Hz and the active bandwidth is 250 Hz.

Primarily designed to isolate precision microlithography, metrology, and inspection equipment in advanced semiconductor factories, STACIS is now the industry standard solution for the most sensitive instruments in noisy environments.

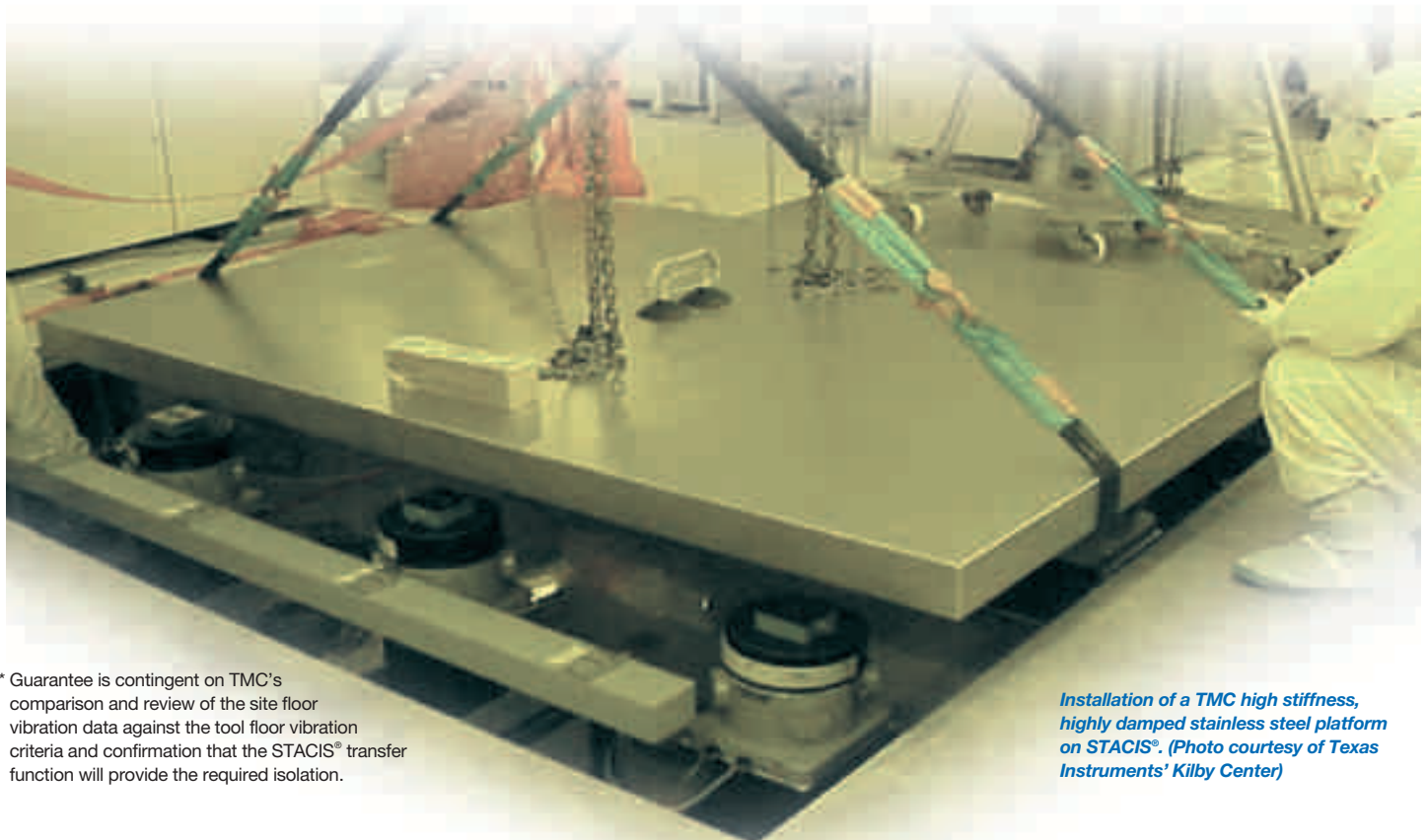


Hundreds of times stiffer than air isolators, STACIS suffers from none of the limitations of air systems. There is no “soft” suspension and, unlike active air systems, STACIS can be “stacked” (placed beneath a tool with an internal active air isolation system).

In addition to facilitating optimal tool performance and resolution in noisy fabs,

STACIS is guaranteed to meet the floor vibration specifications of wafer inspection, metrology and microlithography tools.*

With many hundreds of successful installations worldwide, STACIS is the ideal vibration isolation system for the most vibration-sensitive instruments.



* Guarantee is contingent on TMC's comparison and review of the site floor vibration data against the tool floor vibration criteria and confirmation that the STACIS® transfer function will provide the required isolation.

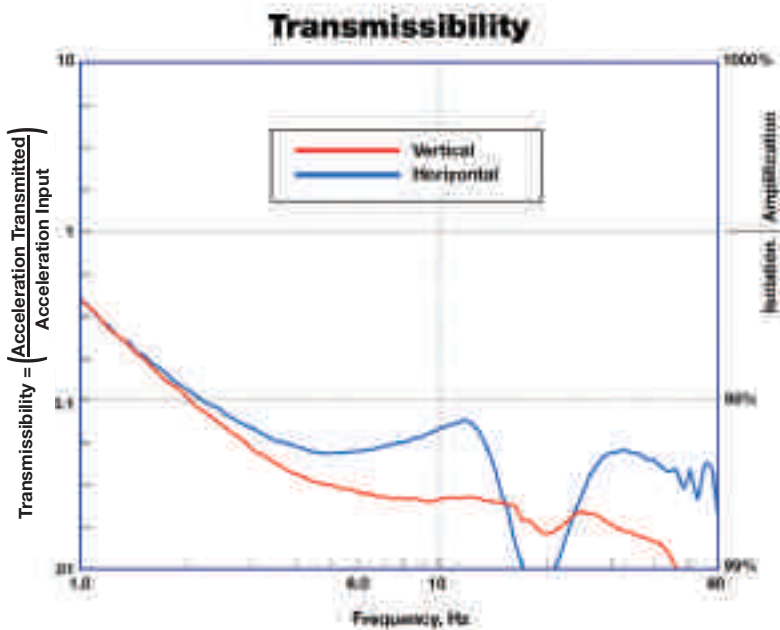
Installation of a TMC high stiffness, highly damped stainless steel platform on STACIS®. (Photo courtesy of Texas Instruments' Kilby Center)

Features & Benefits

- Provides greater than 90% isolation at frequencies greater than 2 Hz, vertical and horizontal
- Reduces fab floor construction costs, allows tools to be installed in higher vibration environments
- Active bandwidth, 0.6 Hz to 250 Hz
- Recommended by many tool manufacturers
- 6 degree-of-freedom active hard mount design, no soft air suspension
- Installs easily, robust control system requires minimal or no on-site compensation
- A point-of-use solution that is compatible with all internal tool vibration isolation systems
- Ensures tool vibration criteria will be met as fab vibration levels increase over time
- Uses TMC's patented STACIS® technology to cancel vibration using piezoelectric actuators
- Enables older and noisier floors to accommodate state-of-the-art tools
- Compatible with various floor heights and sub-floor geometries
- Increases throughput, quality and yield

STACIS® Ordering Chart

Catalog Number	Description	Pricing
21-301-01	STACIS, 3-mount, low capacity	Contact TMC
21-301-02	STACIS, 3-mount, medium capacity	
21-301-03	STACIS, 3-mount, high capacity	Contact TMC
21-401-01	STACIS, 4-mount, low capacity	
21-401-02	STACIS, 4-mount, medium capacity	



STACIS® 2100 on a "riser" installed under a TMC platform in a 36" tall raised floor

GENERAL SPECIFICATIONS (may vary depending on configuration)

DC-2000 Digital Controller

Analog inputs/outputs	16 channels (16/14 bit)
Digital inputs/outputs	16
Sampling rate	6.5 KHz nominal
Front panel	Two-line LCD with soft menu keys
	BNC input and output for signal monitoring
	Two RS-232 communication ports (second port on rear)
	Tri-color system status lamp
Physical	Single RETMA rack unit height x 15 in. deep
Power	90-240 VAC, 50-60 Hz, 600 watts max.
Other	Power connector for support of external devices

Performance Specifications

Active degrees of freedom	6
Active bandwidth	0.6 to 250 Hz
Natural frequency	Passive elastomer: 18 Hz
	Effective active resonant frequency: 0.5 Hz
Transmissibility at resonance	< 1.1
Isolation above 2.0 Hz	> 90 %
Settling time after a 10 lb (4.5 kg) step input (10:1 reduction)	0.3 sec
Internal noise	<0.1 nm RMS
Operating load range per isolator (different passive mounts required)	400 - 4,500 lb (182 - 2,045 kg)
Isolator overload safety factor	> 2:1
Number of isolators	3 or 4
Maximum displacement	590 μ in. (15 μm)
Stiffness (1,000 lb/454 kg mass) (typical middle capacity isolator)	40,000 lb/in. (73 x 10 ¹⁰ N/m)
Magnetic field emitted	< 0.02 micro-gauss broadband RMS

Dimensions, Environmental and Utility Requirements

Isolator size	11.75 in. (w) x 12.5 in. (d) x 10.8 in. (h) (300 x 320 x 275 mm)
Isolator weight	75 lb (34 kg)
Controller size	13 in. (w) x 17 in. (d) x 1.75 in. (h) (330 x 431 x 44 mm)
Temp., operating	50° to +90°F (10 to 32°C)
Temp., storage	-40° to 255°F (-40 to 125°C)
Humidity, operating	68°F dewpoint (maximum)
Power required	100, 120, 230 or 240 volts; 50/60 Hz; < 600 watts, CE compliant
Floor displacement	< 500 μ in. (13 μm) below 15 Hz
Options: TMC laminated, stainless steel platforms, frames, and "risers," leveling devices, and earthquake restraints	

Quiet Island®

Sub-Floor Platforms and Supports

Semiconductor manufacturing factories (fabs) incorporate a system of raised false floors to accommodate complex facilities requirements (plumbing, electrical cables, gas piping, etc.) and to maintain strict cleanliness standards. Such floors present a challenge to the installation of extremely vibration-sensitive production, inspection, and metrology equipment. The raised floors cannot provide the necessary quiet vibration environment for such tools.



TMC's Quiet Island® is an innovative solution that replaces a section of the raised floor area with a "Quiet Island" anchored to the sub-floor below. The Quiet Island consists of a special platform combined with a dedicated support structure, the nature of which depends upon the application.

Platform

The platform is a TMC designed and manufactured 4 inch (100 mm) thick lamination of steel plates sandwiched around a lightweight, incompressible, damped core material. The layering effect of rigid steel plates and core, epoxy bonded into a seamless, stainless steel pan provides an extremely high level of stiffness and structural damping. The large cross-section and steel content yield a very high level of overall rigidity. The top and sides are a continuous, one-piece, stainless steel shell to preserve cleanliness, appearance and integrity.

Platform Supports

Depending on the specific application requirements, the platform supports are either a rigid, non-resonant support stand or a STACIS® 2100 Active Vibration

Cancellation System. If the sub-floor meets the vibration criteria of the tool in question by a reasonable margin, simply supporting the tool with a support that does not amplify vibration is sufficient. To achieve this, TMC has designed a family of ultra-rigid support stands for a range of floor heights and sub-floor access hole requirements. Typically tripods, quad-stands or square cross-section stands, these attach directly to the sub-floor and platform.

However, if the sub-floor does not meet the tool vibration criteria, a "point-of-use" vibration isolation system must be employed. STACIS 2100 is the ideal choice. STACIS 2100 is compatible with all tool internal vibration isolation systems (ask for our "stacking active on active white paper"). In addition, it provides the most vibration isolation across the widest frequency range commercially available.

*Rigid-Damped
Tripod (no platform
required)*



And, the "hard-mount" design is extremely stiff so that there is no stability concern for tall, top-heavy tools.

The rigid stands and STACIS 2100 supports are interchangeable and field upgradable. Together, they provide the complete solution for supporting sensitive tools in a fab raised-floor environment.

Other Quiet Island Configurations

The many types of raised floors and installation challenges has led TMC to develop a number of innovative and unusual solutions. Among these are TMC's patented Rigid Damped Tripod. If you have an unusual raised-floor challenge, chances are we already have a proven solution. Please contact one of our Application Engineers to learn more.



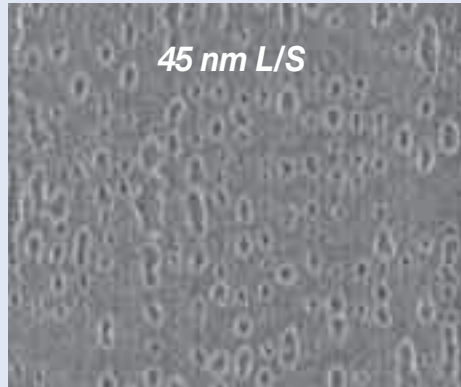
A version of our Rigid Quiet Island® meets the most stringent water scanner floor stiffness specifications.

APPLICATION NOTE

Impact of Vibration on Advanced Immersion Lithography (actual customer supplied data)

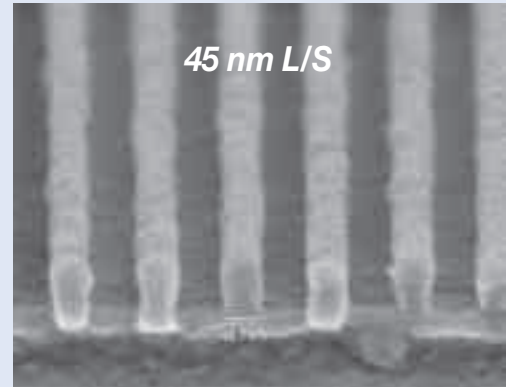


The 45 nanometer line-width test patterns shown were produced with an advanced Immersion Lithography System manufactured by Amphibian Systems and installed at SEMATECH in Austin, Texas. Variation between the images is due to the effect of seismic vibration on the photolithography process. The images shown were obtained using a scanning electron microscope.



Without STACIS® ...

Best pattern obtained on either the elastomer or rigid version of original pedestal.

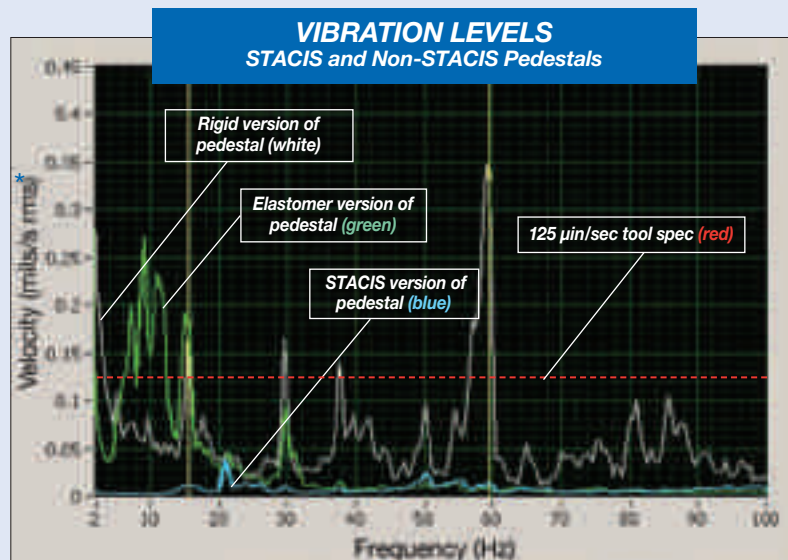


With STACIS® ...

Pattern achieved with STACIS active vibration isolation.

The tool was initially installed on a steel and concrete plinth with a steel support structure which incorporated commercial elastomer vibration isolation pads. This pedestal did not achieve the tool's specified vibration criteria and pattern quality was poor.

In an attempt to reduce vibration, the elastomer pads were effectively shorted out with metal shims leading to a more rigid, non-resonant structure but this resulted in little improvement. The vibration criteria were not met with either version of the pedestal and pattern quality remained poor.



*Vertical Axis Data shown

The plinth support structure was removed and retrofitted with a STACIS® Active Piezoelectric Vibration Cancellation System. The STACIS mounts were placed directly beneath the existing plinth. Supporting the tool on STACIS resulted in a dramatic reduction of overall seismic vibration levels and achievement of the manufacturer's floor vibration specification. More importantly, STACIS provided a dramatic improvement in pattern quality.

Photos, images, and vibration data courtesy of SEMATECH.

65 SERIES

Floor Platform with STACIS®

NEW From TMC!

1

For conventional lab floors, isolating building floor vibration from large, tall tools presents an ergonomic challenge. Placing the isolators directly beneath the tool may raise the tool to an impractical height. Furthermore, conventional air isolators are unstable when placed close together under a tall, top-heavy payload.

TMC's 65 Series Floor Platforms solve this dilemma. By combining our Stainless Steel Platforms (see page 4 discussion) with a unique "lifthood" design, our isolators "cradle" the platform allowing the tool to be lifted a minimal distance above the floor. And, because the isolators are not integrated into the platform, the platform may be custom designed to match the tool footprint or any desired shape.

TMC floor platforms are configured with our STACIS® Active Piezoelectric Isolators. The advantages of STACIS include:

- STACIS piezoelectric isolators suffer no ill effects from tall, top-heavy payloads. There's no danger of gravitational instability.



- Instruments mounted on floor platforms (TEMS) are among the most vibration-sensitive tools made. STACIS provides the best vibration isolation commercially available with no low-frequency amplification.
- Instruments requiring isolation typically incorporate an internal, built-in vibration isolation system. This system is generally a low-frequency air isolator which, in general, should not be supported by another low-frequency air isolation system. STACIS is compatible being "stacked" beneath any tool's internal isolation system (ask for our *Supporting Active Electro-Pneumatic Vibration Isolation Systems on*

Platforms Supported by STACIS® 'Hard-Mount' Piezoelectric Isolation Systems white paper).

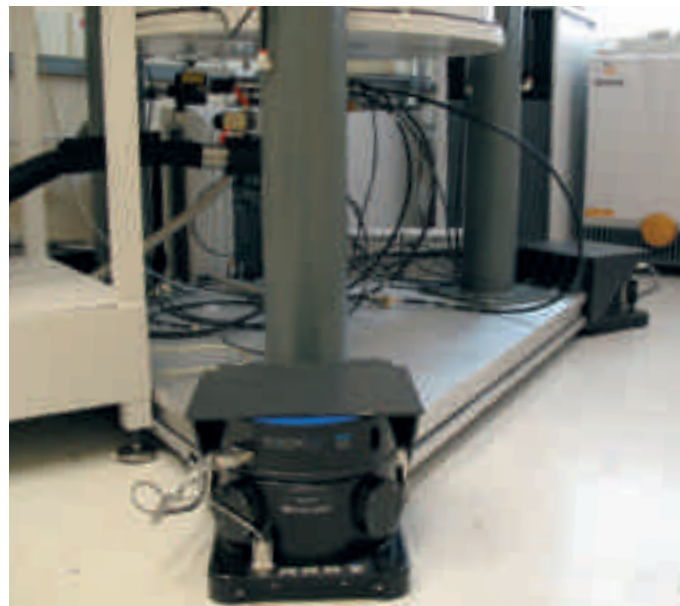
TMC works closely with instrument manufacturers to ensure that our platform design meets the instrument's footprint, structural, and utility requirements.

We have successfully isolated hundreds of different instruments and are often already familiar with the tool requirements. In most instances, you need only provide the tool manufacturer and model for us to recommend a solution.

Note: For Scanning Electron Microscopes (SEMs), TMC has developed a dedicated version of our STACIS Floor Platform. See STACIS® iX SEM-Base™ on page 12.

How to Order:

1. Identify the equipment or instrument model and configuration.
2. Confirm the type of floor you have – conventional tiled lab floor, wooden beam and planks, etc.
3. Tell us if the instrument manufacturer has made a pre-installation site survey of the vibration level. In most cases, a standard floor platform will be recommended. We may recommend taking our own site vibration measurements and look at the special conditions involved.





*A Cameca NanoSIMS 50L on a TMC 65 Series Floor Platform supported by STACIS® isolators.
This tool is a 5,000-pound secondary ion mass spectrometer with a spatial resolution of 50 nanometers.
Photo courtesy of the Planetary and Space Sciences Research Institute (PSSRI) at The Open University, Milton Keynes, U.K.*

APPLICATION NOTE

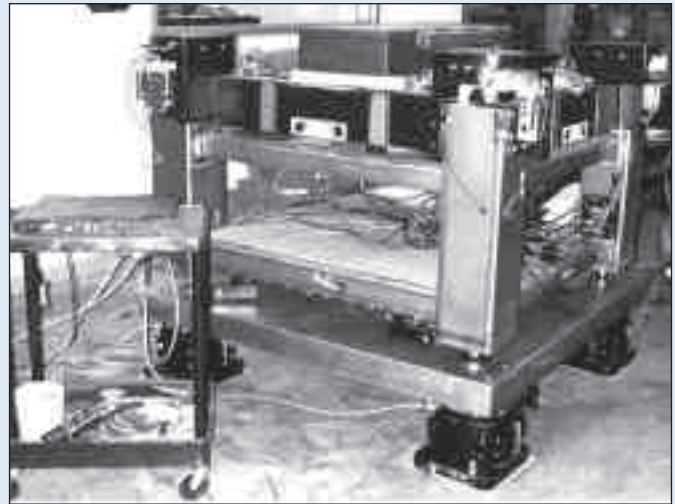
STACIS® as a Microseismic Shaker

Equipment manufacturers can use STACIS® to generate micron-level floor vibration simulating real world floor activity to develop tool vibration criteria.

Semiconductor equipment makers, electron microscope manufacturers, and other precision tool makers struggle to develop meaningful floor vibration criteria for their instruments. These criteria can be derived either theoretically or empirically. Theoretical calculations are extremely complex and are often impractical or do not reflect actual tool sensitivity because of the many variables that cannot be easily modeled. Floor vibration criteria arrived at empirically are typically based on gathering tool performance information from a wide range of installations represented by various floor vibration levels. These floor vibration levels and the corresponding tool performance are used to create an upper limit of vibration amplitudes over a frequency spectrum that represents floor vibration levels that will result in acceptable tool performance. Both of these approaches are extremely difficult, time consuming, and do not result in a precise vibration specification for the tool.

STACIS® 2100 offers a completely unique and novel way to approach the development of tool vibration criteria. STACIS, which is normally operated as a floor vibration isolation/cancellation

system, can also be operated to provide micron-level shaker input. This shaker signal can be white noise, discrete frequency, or a sine-swept wave-form. STACIS can provide independent or combined X, Y and Z axis vibration input. As a shaker, STACIS can be run to simultaneously cancel building floor vibrations providing a quiet foundation while superimposing on this the desired frequency and amplitude vibration spectrum required to test tool performance. No other shaker system can control inputs down to such small amplitudes. No other shaker system can isolate ambient floor vibration while *simultaneously* providing a controlled vibration frequency spectrum. The vibration generated at the STACIS digital controller at extremely low amplitudes is not corrupted by ambient building floor vibrations at the test site.



STACIS® 2100 is used as an isolation system/micron-level shaker within TMC's own factory to test performance of other TMC vibration isolation products.

Complete working tools can be mounted on a STACIS isolation/shaker system, and the STACIS vibration amplitudes can be adjusted as overall tool performance is evaluated. The tool can be excited at given

frequencies or given bands of frequencies to determine the exact amplitude/frequency relationship of vibration input that limits overall tool performance. The result is an overall tool vibration criteria level that corresponds to the exact vibration level at which the tool can provide optimal performance. This testing can be completed relatively quickly and easily – without shipping tools to customer sites and waiting for large amounts of field data or relying on questionable modeling information.

Contact TMC or your local sales representative to acquire a STACIS® 2100 system for use as a shaker for testing your sensitive equipment in a controlled vibration environment.



STACIS® supporting the end chambers of a prototype LIGO interferometer at the California Institute of Technology. These are the most precise instruments ever made – capable of measuring distances of less than 10^{-18} meters.

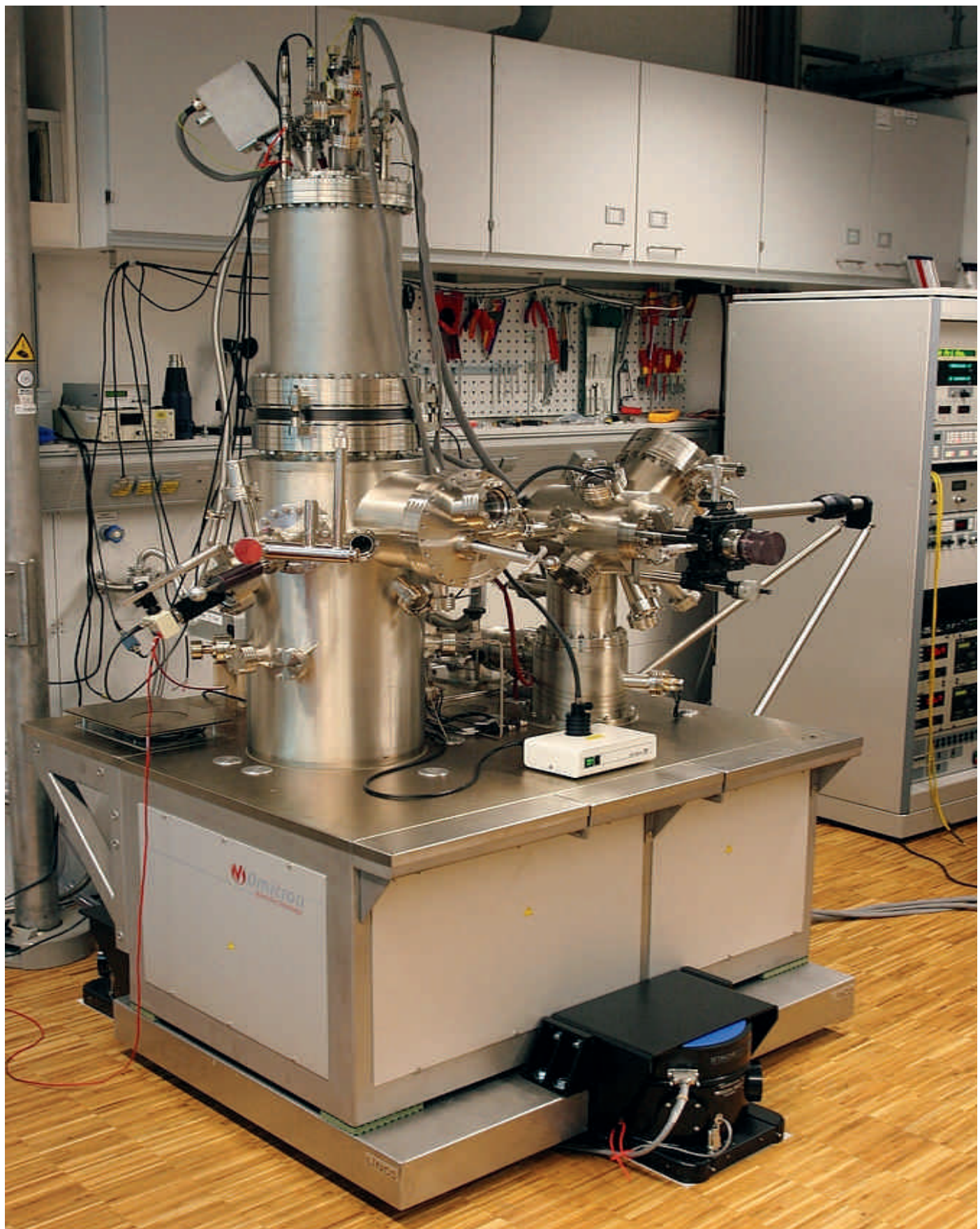


STACIS® isolating a Varian NMR Spectrometer



The Nikon FX-21S LCD Stepper incorporates an advanced version of TMC's STACIS® for the ultimate in vibration cancellation. The rigid mounts yield faster settling times in response to motion resulting in higher throughput.





65 Series STACIS® Floor Platform supporting an Omicron Multiprobe Scanning Tunneling Microscope (STM) with nanometer scale resolution at the Max Planck Institute in Dresden, Germany.