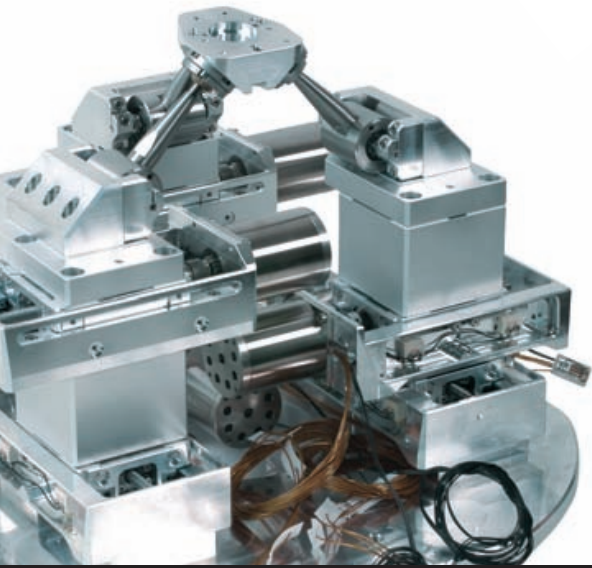
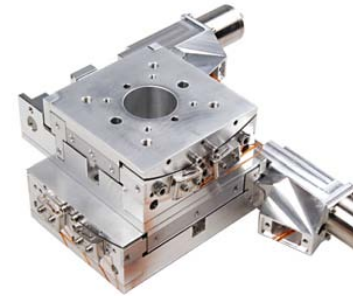
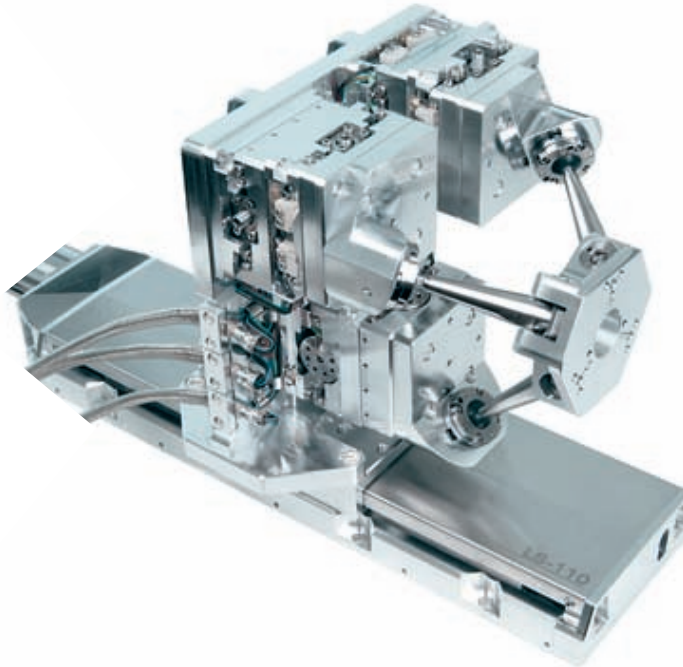
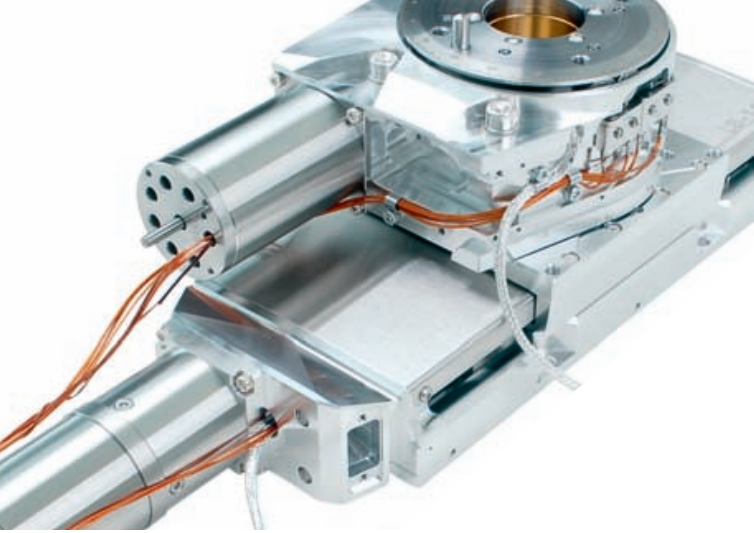


Vacuum



STAGES FOR UHV

Engineering is of major relevance for PI miCos to be competitive in the global market.

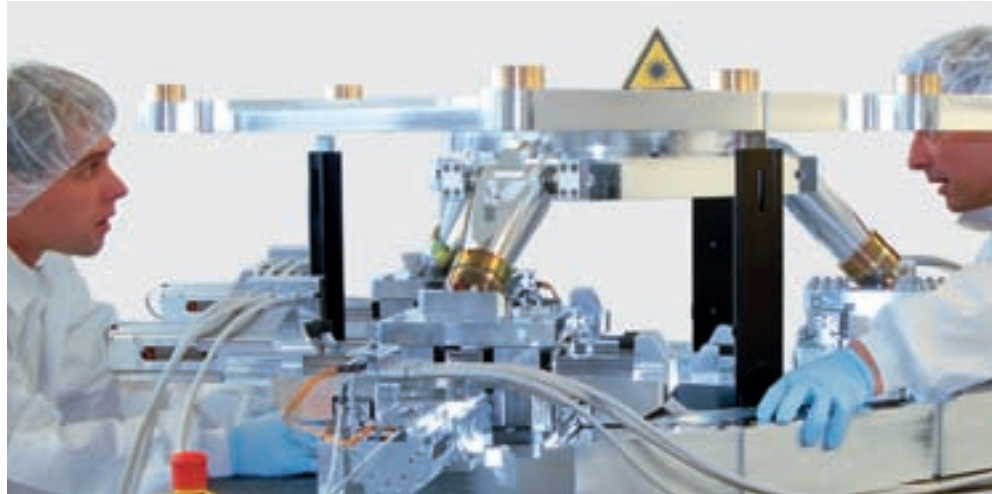
The essential qualifications are a constant advance through innovation and extensive know-how, customer and solution related product development, as well as optimum efficiency in production.

Technical solutions of tomorrow can be found in the engineering of today at PI miCos, where the understanding of structures, relations and functions of technical systems are among our strengths.

The design team develops new products, starting with the analysis, design scheme and simulation to the subsequent realisation of the finished product.

The fundamental basis of our innovative creativity is the synergy of different disciplines such as precision engineering, optics, electronics and software development.

Numerous customers from different markets and disciplines, such as



biotechnology, life science, medical, nanotechnology, photonics, telecommunications, semi conductors, astronomy, microscopy and educational laser systems, access these abilities.

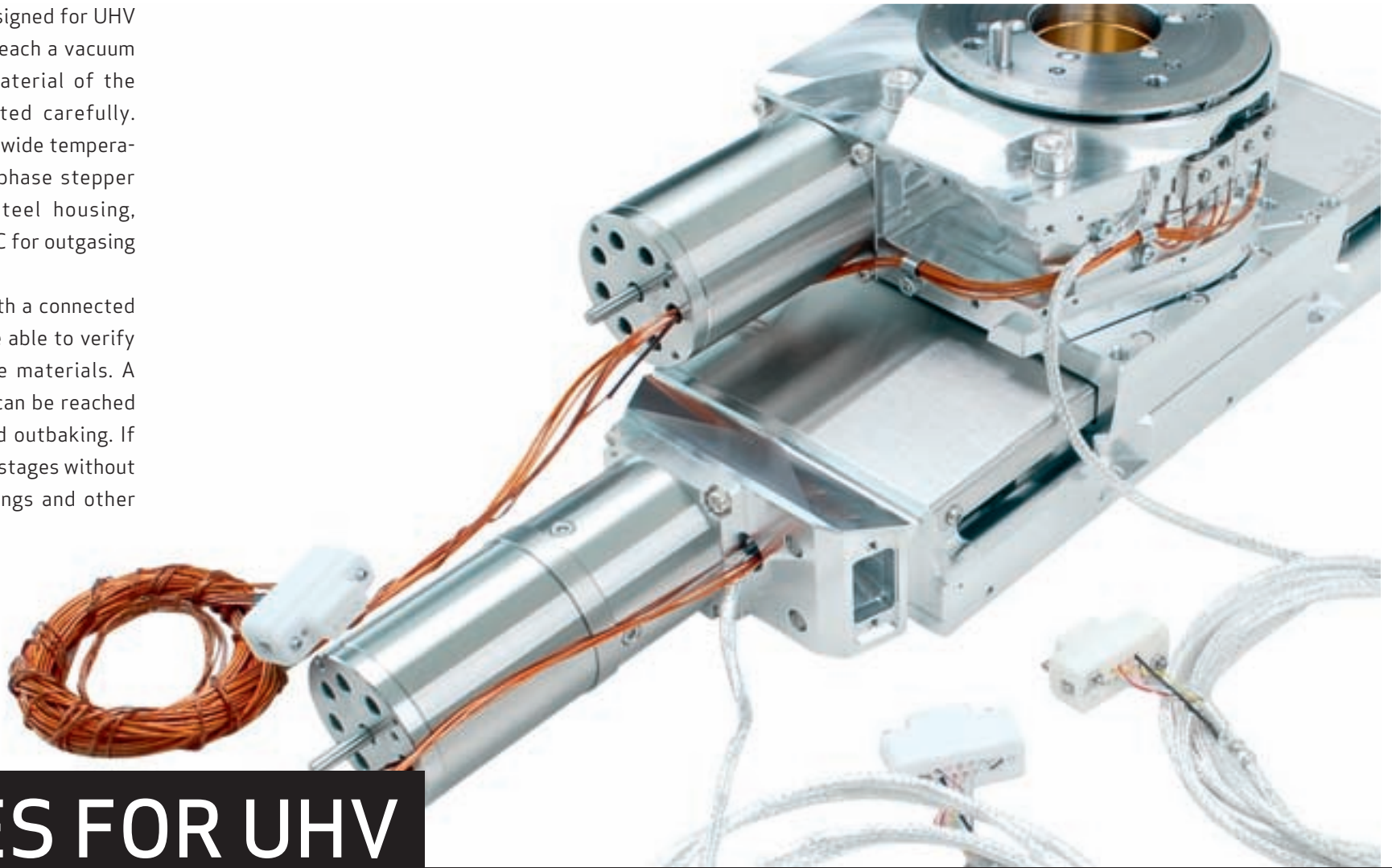
They all have a partner in PI miCos, which provides high competency in technical trouble-shooting, considers complex system solutions as a constant challenge and offers the knowledge accumulated from this experience, from the process of product development through to large project handling.

ENGINEERING

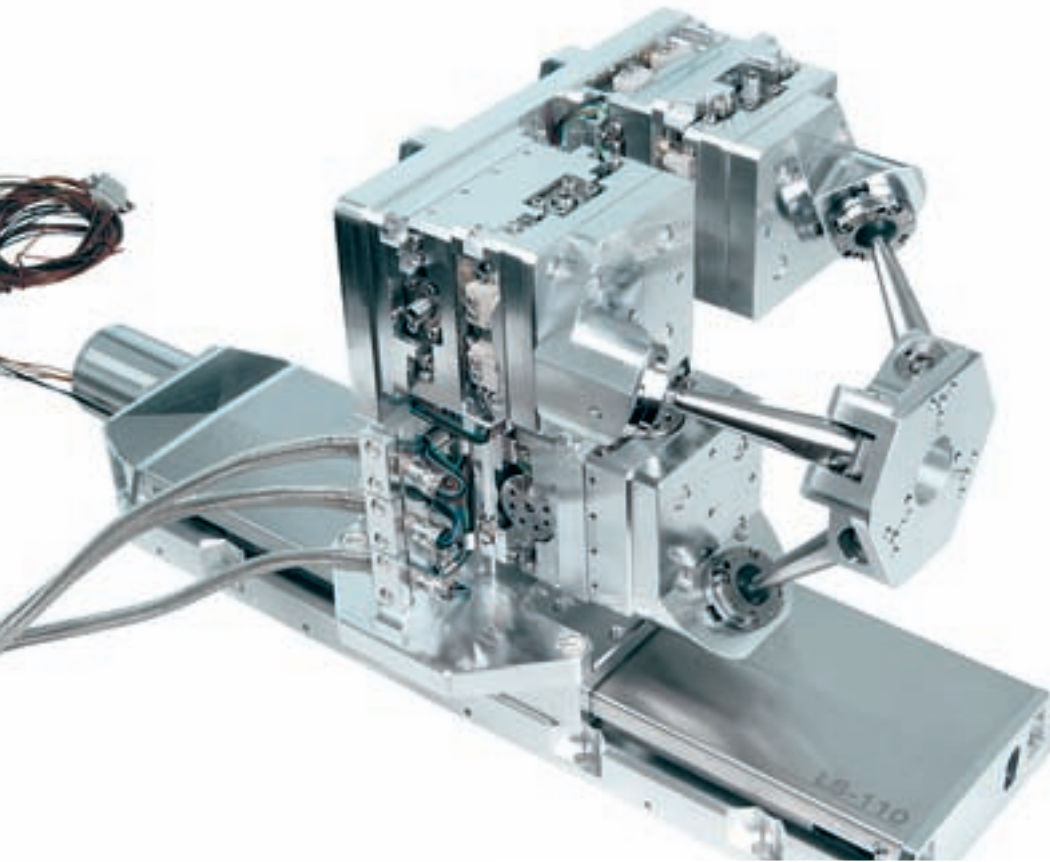
Vacuum

PI miCos stages can be designed for UHV and cryo applications. To reach a vacuum level of 10^{-9} mbar the material of the stages have to be selected carefully. Special end switches for a wide temperature range and special 2 phase stepper motors with stainless steel housing, actively heated up to 120°C for outgassing can be adapted.

Using our own chamber with a connected mass spectrometer we are able to verify the suitability of possible materials. A level of 10^{-7} mbar or less can be reached by a longer pump time and outbaking. If needed we can also design stages without any grease by using coatings and other materials.



STAGES FOR UHV



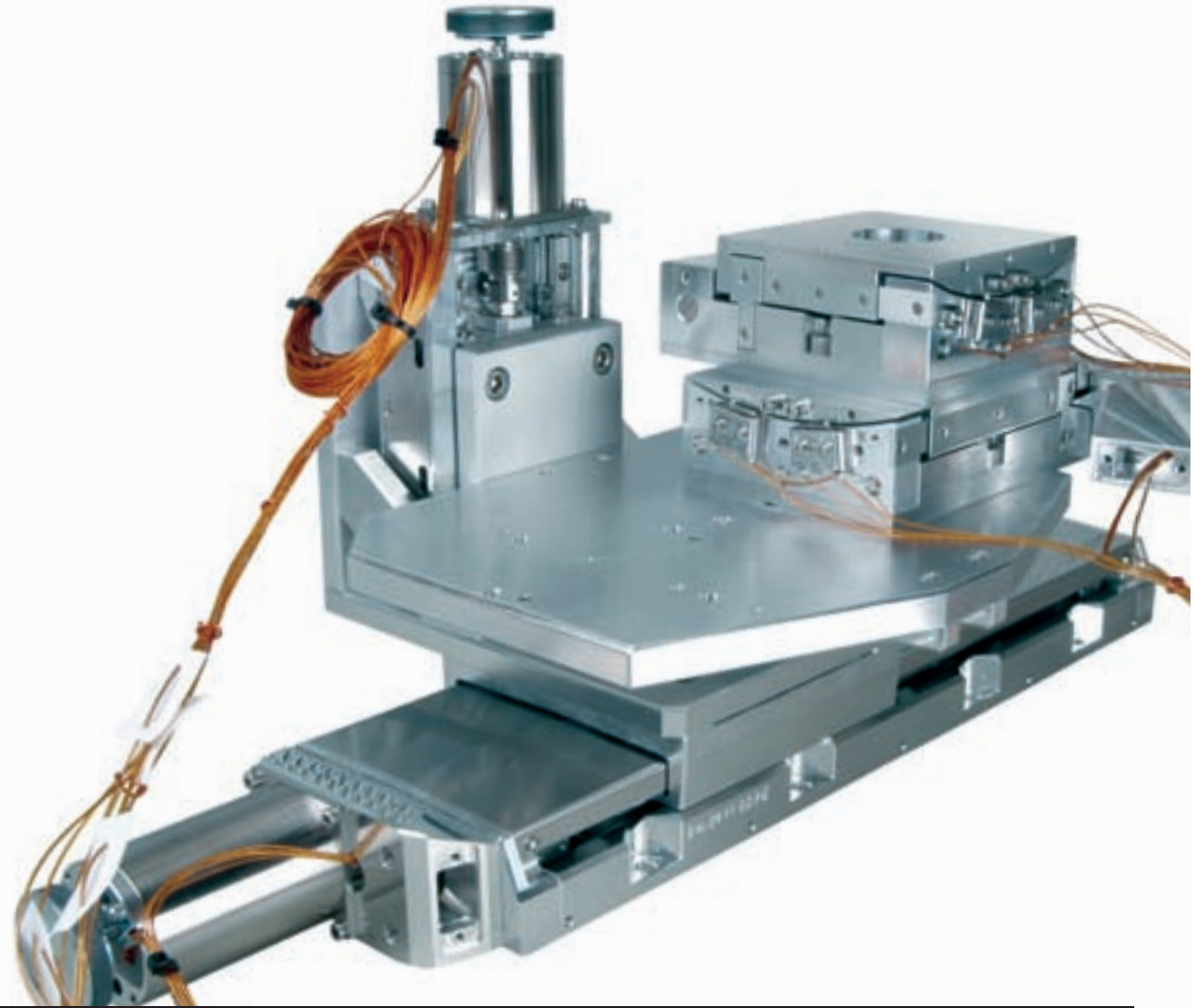
This 7 axes positioning system consists of a **LS-110** and a custom designed **SpaceFAB** which is used for dynamic measurements. To achieve the required precision, highstiffness and repeatability was required. The pivot point can be set by software in this case important for adjusting an X-Ray single reflection lens at BESSY II in Berlin.

SpaceFAB HV FOR SYNCHROTON

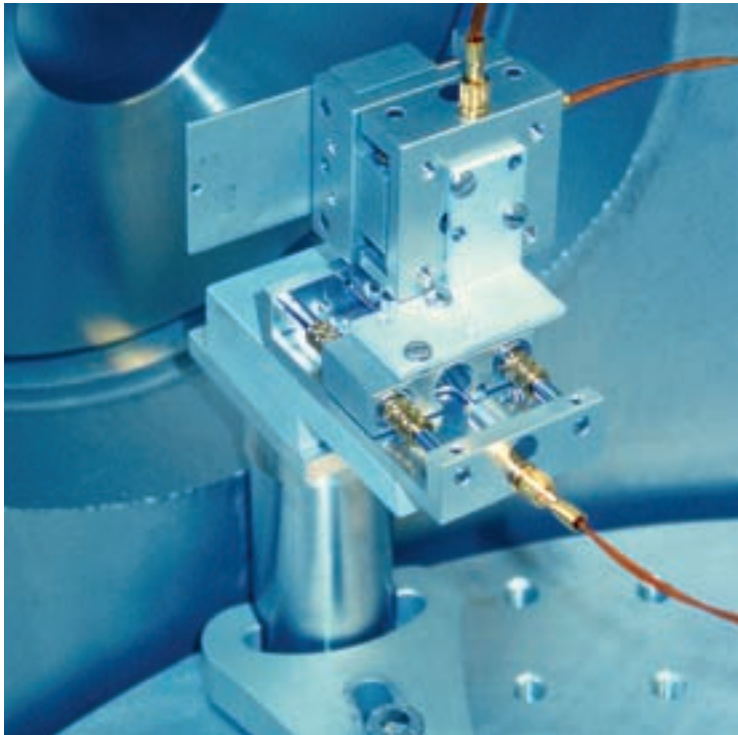
Vacuum

A 5 m long spectrometer for soft x-rays used in a synchrotron radiation beamline for resonant x-ray emission spectroscopy and resonant inelastic x-ray scattering in the 400–1600 eV energy range. 5 axes advanced x-ray emission spectrometer is mounted on a rotating platform allowing the scattering angle to be varied from 25° to 130°. The spectrometer is operational at the ADDRESS ADvanced REsonant SpectroScopy beam-line of the Swiss Light Source.

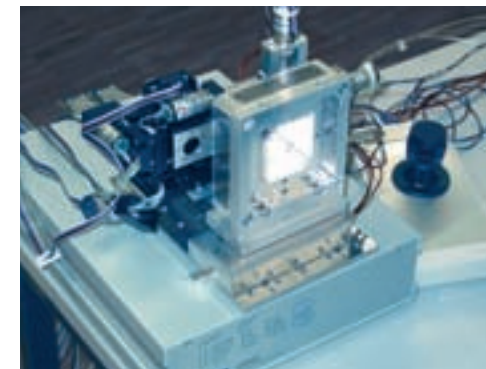
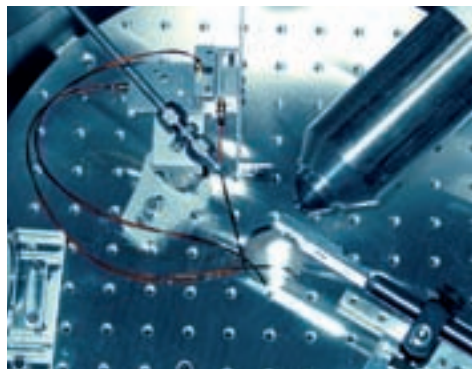
This positioning system was designed for a custom application. The system uses the linear stages [LS-110](#) and the [PLS-85](#) in addition to two goniometers ([WT-100](#) and [WT-85](#)) at a vacuum level of 10^{-7} mbar.



HIGH RESOLUTION X-RAY SPECTROMETER

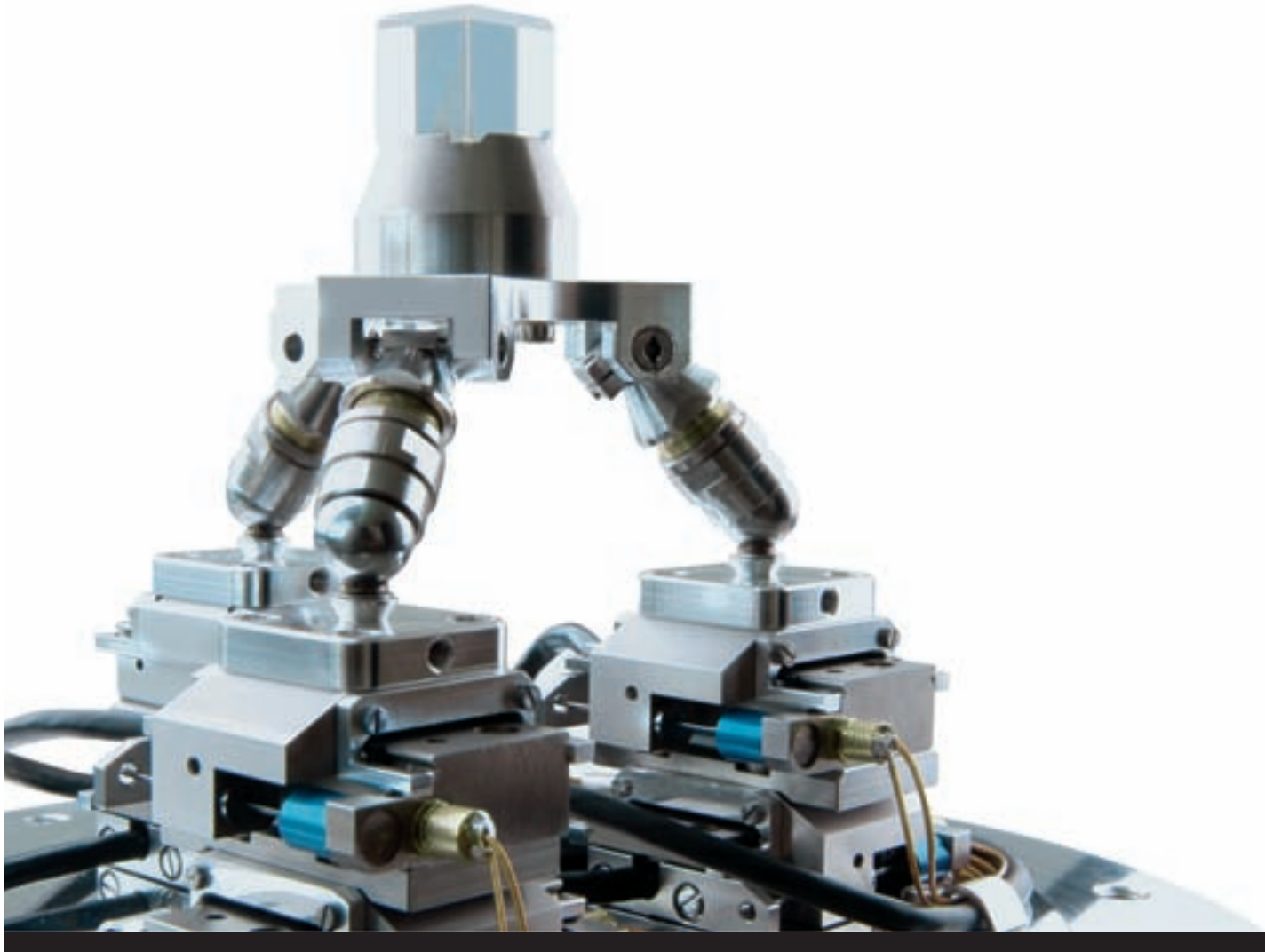


In this picture a [XYZ-PP30](#) unit is shown which carries an adapter plate for an optical system. The application has a vacuum level of 10^{-9} mbar.

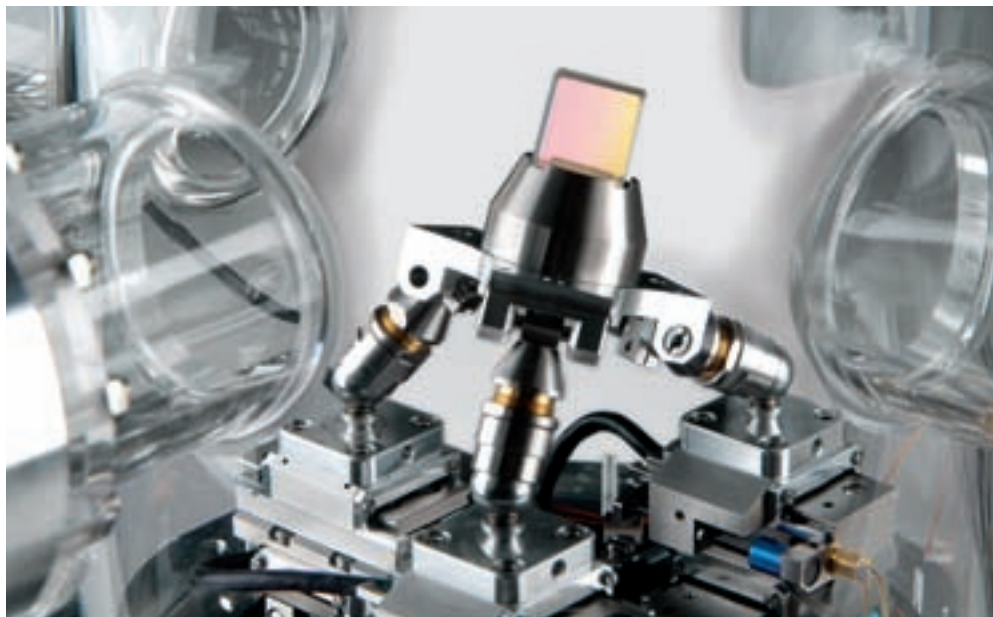


Mini-Positioner [MT-55](#) driven by [SMC corvus](#) in a vacuum level of 10^{-3} mbar.

MULTI-AXES FOR FV



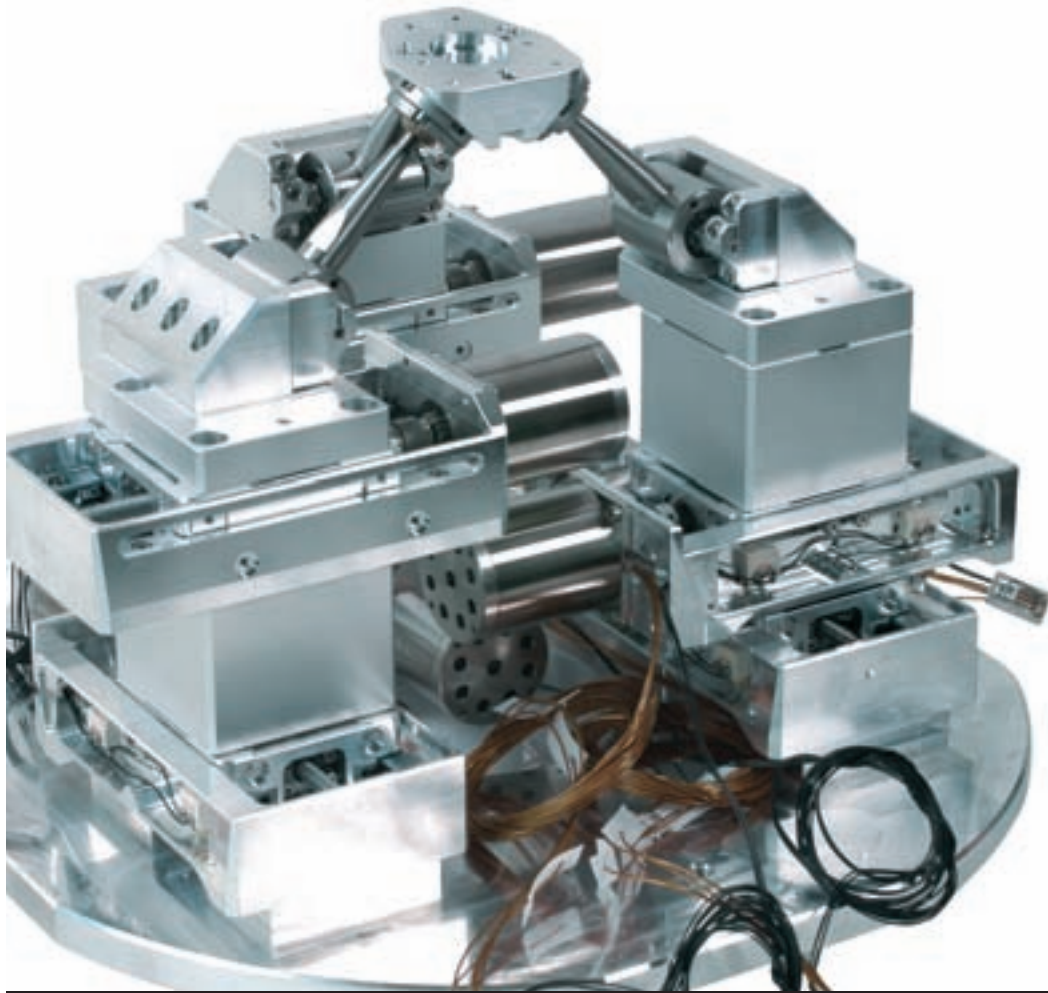
SpaceFAB SF-3000 PS is designed for applications in vacuum environments where probes have to be aligned in all six degrees of freedom. We have minimized the overall dimensions. **SpaceFAB SF-3000 PS** is based on **LPS-30** stages which allow the highest resolution with the piezo inertia drive and a closed loop scale system.



Maximum travel ranges in XY are 12.7mm with a vertical displacement of only 2mm; central load of up to 0,5kg is possible. The pivot point, i.e. the center of the probe, can be set by the customer which is very important for several applications.

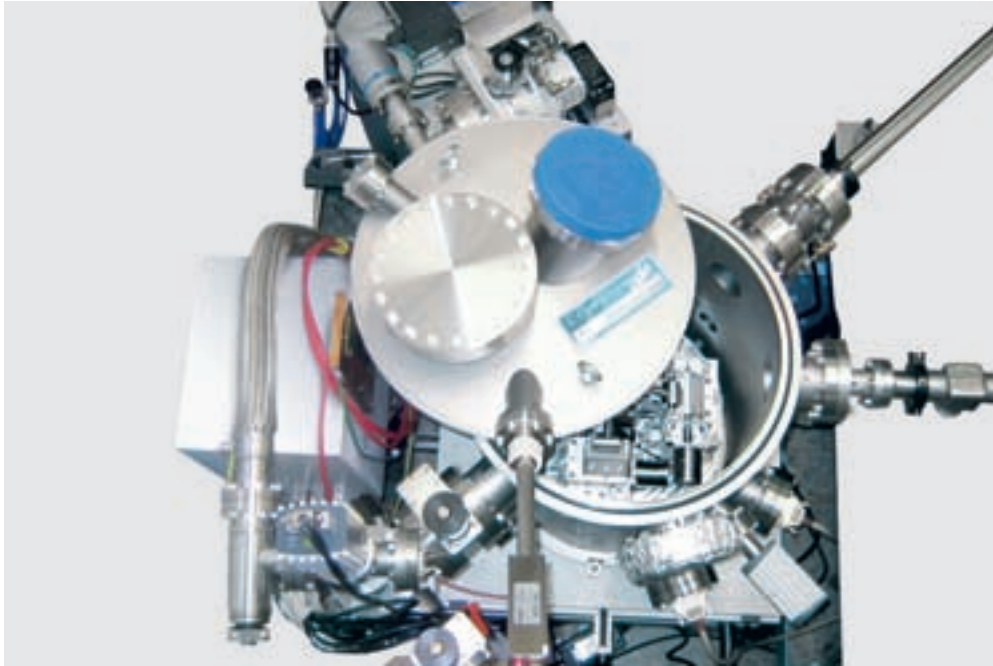
The system is based on the PI miCos Motion Server which includes all the mathematical transformations, so that the customer can start positioning directly by specifying the six coordinates X, Y, Z, Rx, Ry and Rz.

SpaceFAB SF-3000 PS (PIEZO)



Customized SpaceFAB for vacuum 10^{-7} mbar and temperature range of -40°C to $+80^{\circ}\text{C}$. 6 degrees of freedom.

With the [SpaceFAB SF-3000 BS](#) (vacuum) all six degrees of freedom can be moved without additional positioning elements. The low weight of the moving platform allows highly dynamic positioning. Using no pre-load, the design can easily carry up to 5 kg (center mounted). The pivotpoint can be set by software.



SpaceFAB HV

PI miCos SPECIFICATIONS

CALCULATED RESOLUTION

Calculated resolution is the theoretical resolution of the stage. The main factors depend on the lead screw, the motor, gear and the measuring system such as the encoder or interpolation unit.

TYPICAL RESOLUTION

The typical resolution specifies the statistical resolution based on real-world measurement data.

VACUUM

For specifying the necessary vacuum level it is important to analyze the application. Coating of optics, epitaxy or crystallography are different in the necessary vacuum level as well as mass spectroscopy or others. Not the general vacuum level of 10^{-6} or 10^{-9} mbar is often important but e.g. the partial pressure of hydrocarbons. As a result of using a wrong grease with higher vapor pressure or use of plastics these hydrocarbons can be a source of contamination of surfaces. Especially laser applications e.g. in the UV range are critical because the hydrocarbons can be split into fragments and these fragments can be deposited on optics. The choice of materials and handling processes are at the end the most important points to get the right vacuum stage.

DEFINITION VACUUM

Vacuum is defined as pressure lower than normal air pressure. A system is in vacuum if the pressure is lower than the atmospheric pressure. The PI miCos catalog uses mbar as a unit of air pressure. Other physical units commonly used are Pascal (Pa) and Torr (Torr).

DEFINITION ACCORDING TO DIN 28400

Vacuum is defined as pressure lower than the air pressure of the atmosphere.

CLASSIFICATION OF THE VACUUM CLASSES

Vacuum class	Abbrev.	Temperature range *	Pressure **
Low vacuum	FV	-20°C ... +150°C	< $1 \cdot 10^{-3}$ mbar
High vacuum	HV	-20°C ... +210°C	< $1 \cdot 10^{-3}$ - $1 \cdot 10^{-7}$ mbar
Ultra-high vacuum	UHV	-20°C ... +210°C	< $1 \cdot 10^{-7}$ - $1 \cdot 10^{-9}$ mbar
Ultra-high vacuum Grease	UHV-G	-20°C ... +210°C	< 10^{-9} mbar
Ultra-high vacuum Cryo	UHV-C	-269°C ... +40°C	up to 10^{-11} mbar
Extreme-ultra-high vacuum	EUHV	-20°C ... +300°C	$1 \cdot 10^{-9}$ - $1 \cdot 10^{-11}$ mbar

* The values refer to the vacuum motors ready to use for outbaking

** Classification of the vacuum classes general terms

Almost all PI miCos stages can be prepared for FV, HV and UHV.

For UHV vacuum class all components are made for 10^{-9} mbar. Special UHV motors, cables, controllers, greases and coatings are used.

PI MICOS STANDARD VACUUM PREPARATION CATEGORIES:

FV UP TO 10^{-3} MBAR

- Standard motor
- Standard measuring system, if measuring system required
- Standard wiring
- Standard connector for plug connection
- Standard limit switch
- All Al parts are anodized
- Stainless steel screws
- All guidance and driving elements are equipped with vacuum grease
- Outbaking temperature max. 50°C



FV UP TO 10⁻³ MBAR TO 10⁻⁷ MBAR

- Special vacuum motor
- Measuring system modified for the use in vacuum
- Motor and limit switches equipped with teflon braids 1 m length wired to a test plug
- Standard limit switches, with plastic parts
- All Al parts left un-anodized
- Stainless steel screws
- All guides and driving elements are equipped with vacuum grease
- No use of CuZn alloys
- All holes are vented

WHEN STAGES ARE USED IN VACUUM PLEASE CONSIDER THE FOLLOWING:

- Use low speed operation, max. motor speed 10 rev/s
- Shorter life time expectation
- Stages can only be run in vacuum
- Stages are delivered with test plugs, not designed for vacuum
- Outbaking temperature max. 80°C

UHV 10⁻⁷ UP TO 10⁻⁹ MBAR

- Special vacuum motor
- Measuring system modified for the use in vacuum
- Motor and limit switches equipped with kapton braids 1 m length wired to a test plug
- No limit switches, but can be offered with special UHV limit switches
- All Al parts are left un-anodized
- Stainless steel screws are Ag coated, with degass drilling (apart from M3 thread)
- Bearing and driving elements made of hardened stainless steel and equipped with vacuum grease
- No use of CuZn alloys
- No use of plastics, unless so desired after consultation with the customer
- All holes are vented (if possible)

Electronic devices such as controller, amplifier and other electronic devices supplied by PI miCos are not made for vacuum use. Therefore, they must be placed outside the vacuum chamber. PI miCos supplies vacuum-prepared stages with test plugs, which cannot be used in vacuum. The plug has to be disconnected and replaced by a vacuum plug by the customer. Vacuum feed-through and plugs can optionally be obtained from PI miCos.

For use in HV and UHV all guides and spindles are lubricated with vacuum lubricant. The specific lubricant for your application will be defined during the ordering process.

HANDLING / CLEAN ROOM

Our vacuum stages are assembled in clean room conditions. All components are cleaned in an ultrasonic bath. Afterwards they are packed in a particle free and antistatic bag. Our components and systems can be used in clean room, cryogenic applications and various other climatic environments.

PI miCos PREFERRED MATERIALS FOR STAGES ARE:

- Stainless steel
- Aluminum
- Titanium
- Brass
- Viton
- Ceramic
- Sapphire
- Teflon
- Peek
- Kapton
- Macor

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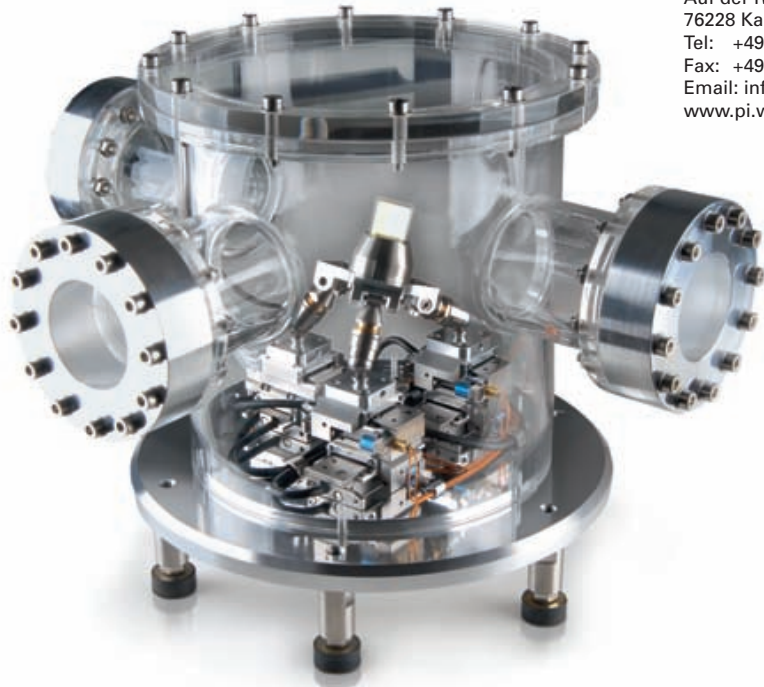
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