Vacuum Technology

PINK®

PINK – the specialist
in highly complex
vacuum applications

PINK – world market leader in vacuum technologies

Today, PINK GmbH Vakuumtechnik founded by Friedrich Pink in 1986 is one of the world market leaders in ultra-high vacuum technology (UHV) and is known for its exceptional quality and precision.

PINK GmbH Vakuumtechnik supplies customized innovative equipment and systems to highly reputed international technology companies in such sectors as the semiconductor and electronics industry, the optical industry, medical technology, aerospace as well as science and research.

The company's extensive and all-embracing product range reaches from special vacuum technology equipment via UHV systems for linear particle accelerators, ion beam therapy units, precision coating equipment and leak test systems through to vacuum soldering ovens and standard vacuum components.

The PINK Group comprises not only PINK GmbH Vakuumtechnik, but also PINK GmbH Thermosysteme. Due to continuous product improvements and a consequent customer orientation, both companies have grown steadily and successfully and now employ a workforce of over 300.

Customized products for technology leaders

Production and office buildings of PINK GmbH Vakuumtechnik.

The PINK Group comprises two companies:

PINK GmbH Vakuumtechnik

- Customized special vacuum plants and systems (accelerator technology, aerospace, helium leak test equipment, medical technology etc.)

PINK GmbH Thermosysteme

- Systems for vacuum supported soldering
- Low-pressure plasma units for surface treatment
- Plants and systems for drying and processing

PINK offers a complete service package from one source and covers everything from consulting, preparations and project planning via design and production, delivery, assembly, commissioning, training and reliable after-sales service.

PINK is used to meticulously analyze the customer's requirements and develop the matching products and system solutions. The utmost value is attached here to the reliability, performance and cost-effectiveness of the plant and the components used. The integrated quality strategy is documented by the practised quality management system acc. to DIN EN ISO 9001:2008.

PINK has a strong focus on high quality, flexibility and growth. Constant investment in the latest production technologies combined with continuous initial and further staff training enable PINK to maintain its technological lead and extend its production capability and capacity at its site.

It all started with flanges. Initially producing high-precision components for the vacuum technology sector, PINK has evolved in the course of three decades into one of the leading producers of complex UHV systems.

Ultra-high vacuum systems for treatment and diagnostics

A big step forward for medicine – during ion beam treatment, cancer cells undergo targeted irradiation. (Images: Heidelberg University Clinic)

With competence in accelerator technology, PINK manufactures UHV components for well-known installations in medicine and research.

The product spectrum extends from dipole, quadrupole and sextupole chambers and diagnosis chambers and elements through to IH structures.

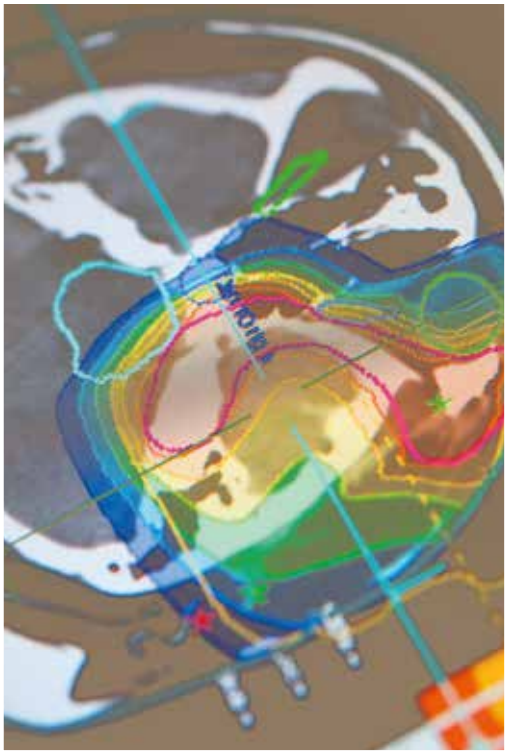
For the ion beam treatment unit of Heidelberg's University Clinic (HIT) PINK has produced substantial parts of the accelerator ring and the interdigital H-field structure.

This therapy unit is the first of its kind in Europe. This is where malignant tumours can be precision-irradiated with heavy ions or protons. Unique worldwide is the therapy centre's rotating-beam guide.

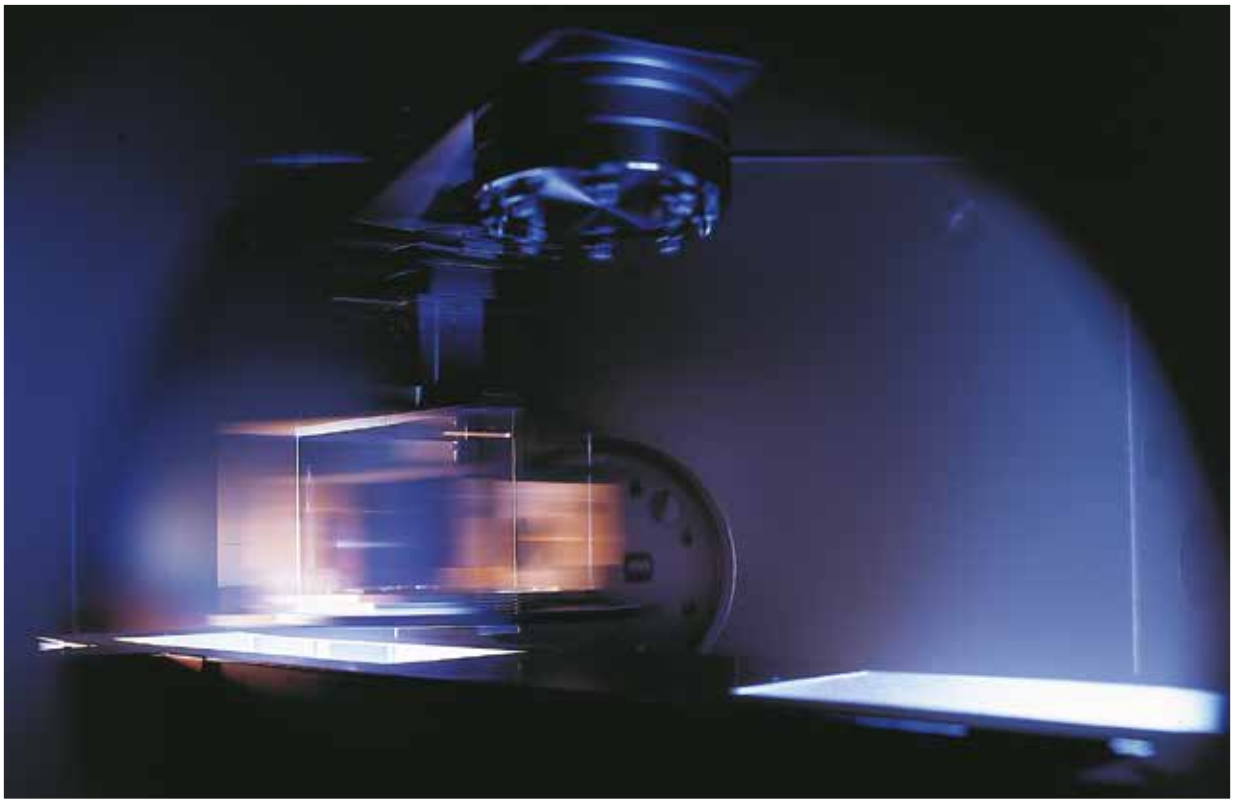
At HIT, globally unprecedented precision in the three-dimensional irradiation of tumours is achieved with a special irradiation method known as the intensity-modulated raster scan technique.

»PINK is the pioneer of ultra-high vacuum systems for ion beam treatment accelerators.«

The exact speed and accuracy of the particles are controlled by means of the interdigital H-field structure produced by PINK for high-precision accelerator tumour irradiation.



Custom-designed pencil beams accurately trace the tumour's contours – much like a glove wraps itself around the hand – and irradiate the entire tumour volume.

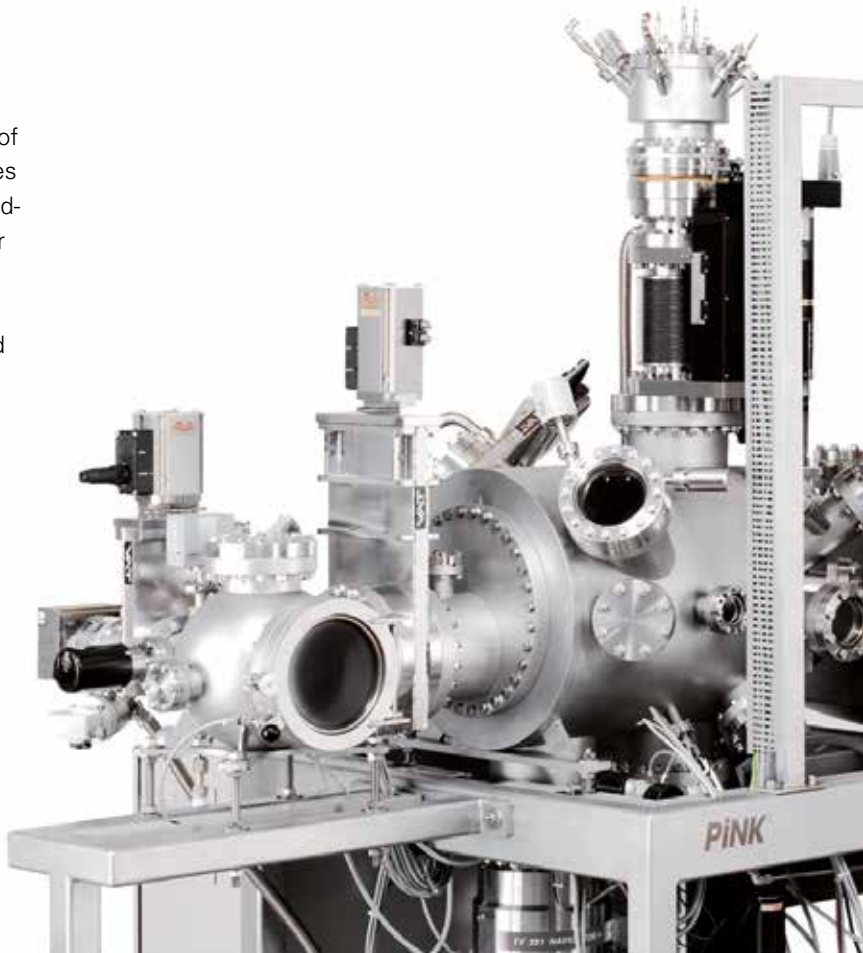


View inside the vacuum chamber of a magnetron sputtering unit in which four substrates, diameter 150 mm, can be simultaneously coated.

Special coatings meeting extreme precision requirements of accuracy can only be realized under ultra-high vacuum conditions.

Based on its experience in the UHV sector, PINK develops and produces customized coating systems – among other things for materials development in laser physics.

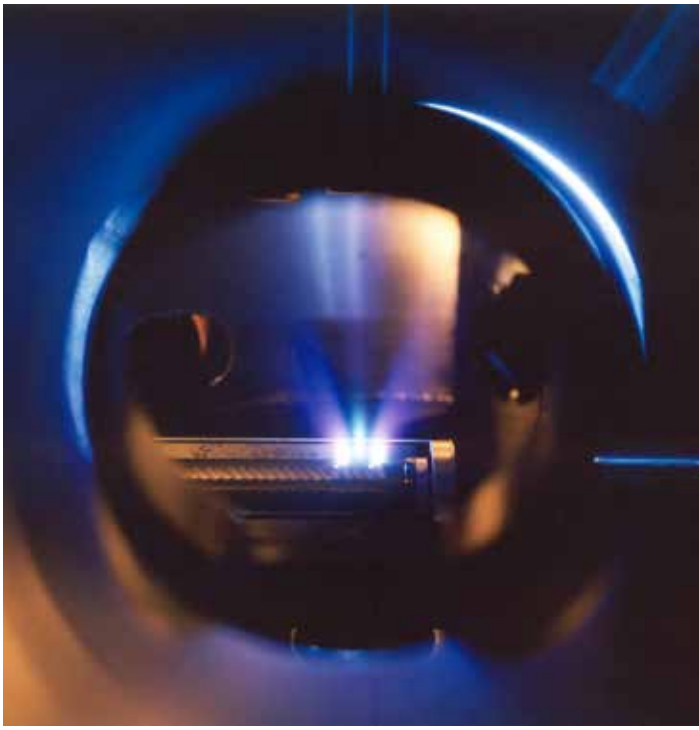
The spectrum extends from magnetron sputtering units operating on the principle of cathode atomisation with sputter electrodes to modular systems equipped with a pulsed-laser deposition (PLD) system and used for the production and analysis of super-thin layers such as cuprate supraconductors, layered manganates, heteroepitactic hybrid structures and metallic thin films.



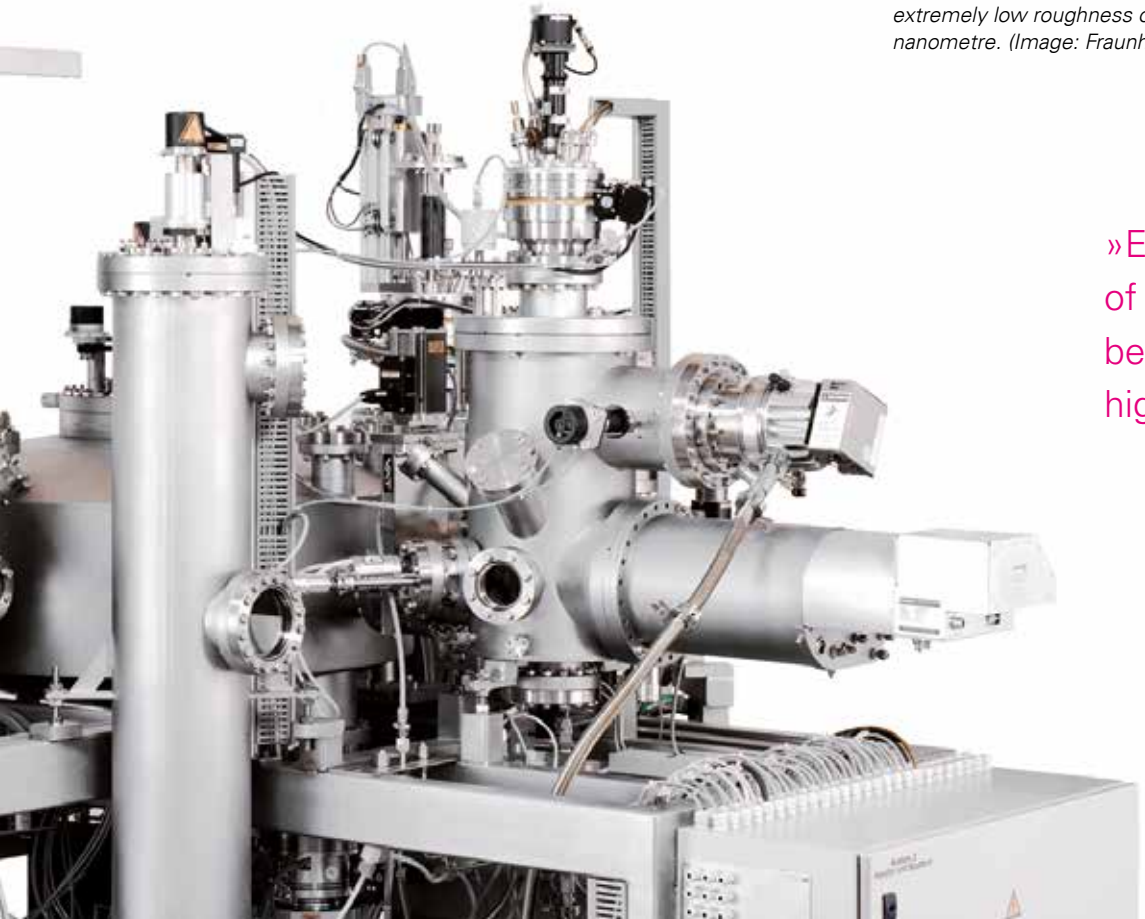
Modular ultra-high vacuum unit: pulsed-laser deposition system for the production and analysis of super-thin layers.

Systems for high-precision coatings under UHV conditions

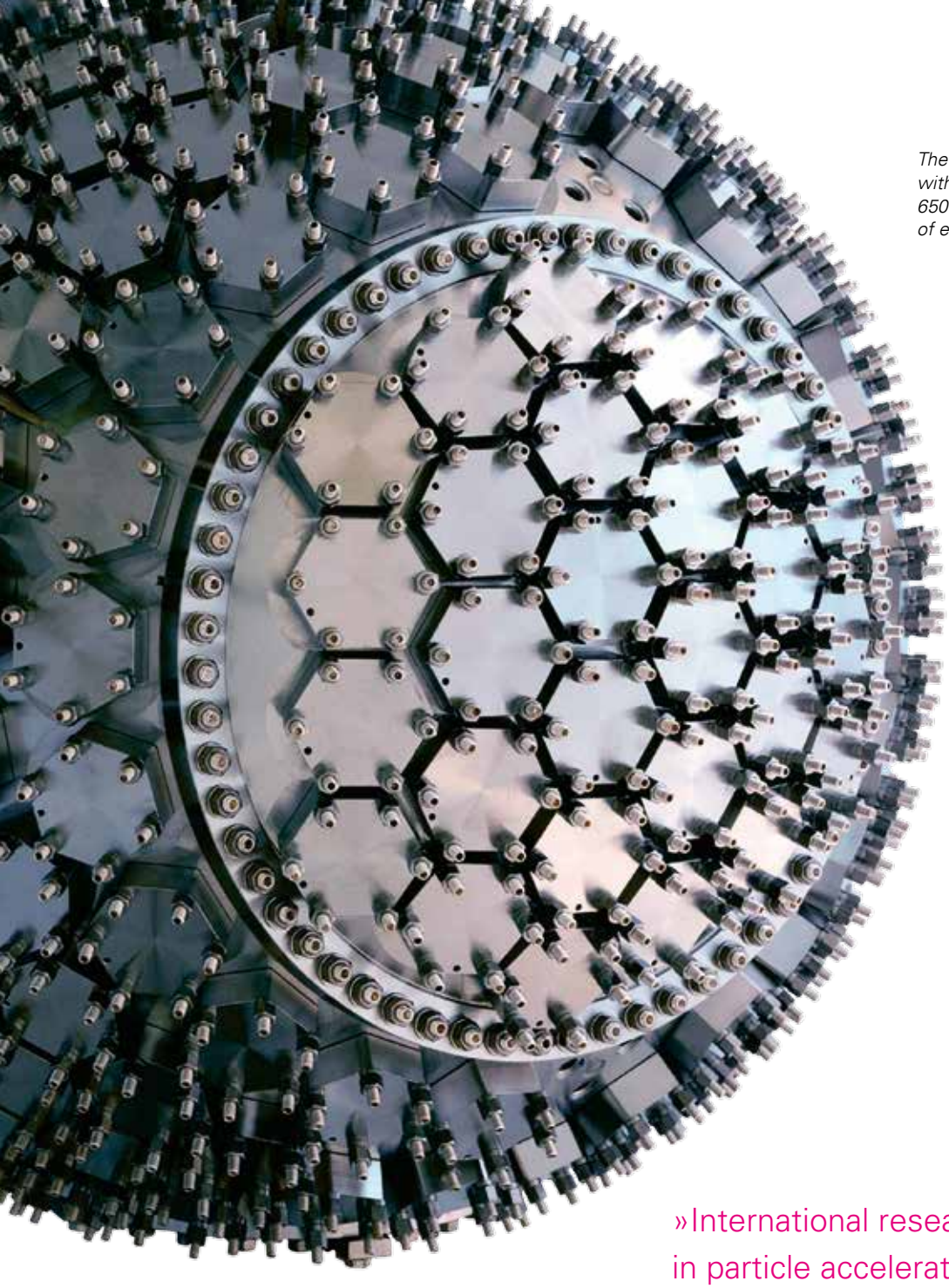
Cluster tool coating system for the production of X-ray mirrors.



Production of X-ray mirrors with extra-low scatter: process chamber of a PINK UHV cluster tool device with pulsed-laser deposition on which multi-layer films can be generated with an extremely low roughness of only approximately a tenth of a nanometre. (Image: Fraunhofer IWS)



»Extremely thin layers of high purity can only be obtained under ultra-high vacuum.«



The spherical chamber produced by PINK with 230 CF flanges DN 40 and a diameter of 650 mm is used for determining the shape of elementary particles.

»International research institutions engaging in particle acceleration trust in high-precision UHV components from PINK.«

UHV chamber intended for synchrotron radiation sources.

UHV systems for particle accelerators

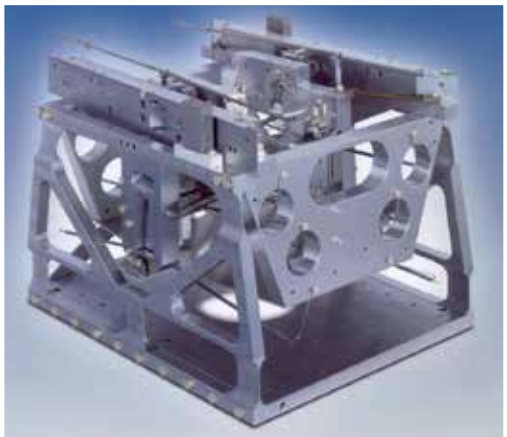
The operation of a particle accelerator requires ultra-high vacuum conditions obtainable only with components of superlative quality and precision.

PINK has special experience in this field and has already produced numerous UHV systems for particle accelerators, e.g. for the BESSY II electron storage ring of the Helmholtz-Zentrum Berlin (HZB), for the European Synchrotron Radiation Facility (ESRF), a multinational large-scale research centre, and also for DESY, GSI and PSI.

PINK builds individual components and vacuum chambers made of stainless steel, aluminium, mu-metal and numerous special materials. We also cooperate with reputed makers of ceramics and produce such items as bumper chambers, insulating pieces etc., by using special joining techniques like vacuum soldering and electron-beam welding.

To assure the quality of the produced UHV components, a bake-out pumping station equipped with a oil-free vacuum system is available. Acceptance tests for the measurement of final pressure, the leak rate, gas release rate and residual gas spectrum are therefore possible.

The ESRF building in Grenoble: the European Synchrotron Radiation Facility, a multinational research institute, operates the biggest installation in Europe for research with synchrotron radiation.



On this system for the selective deflection of synchroton radiation, PINK is responsible for the adjustability of the mirrors with solid-state elements, i.e. without moving parts.

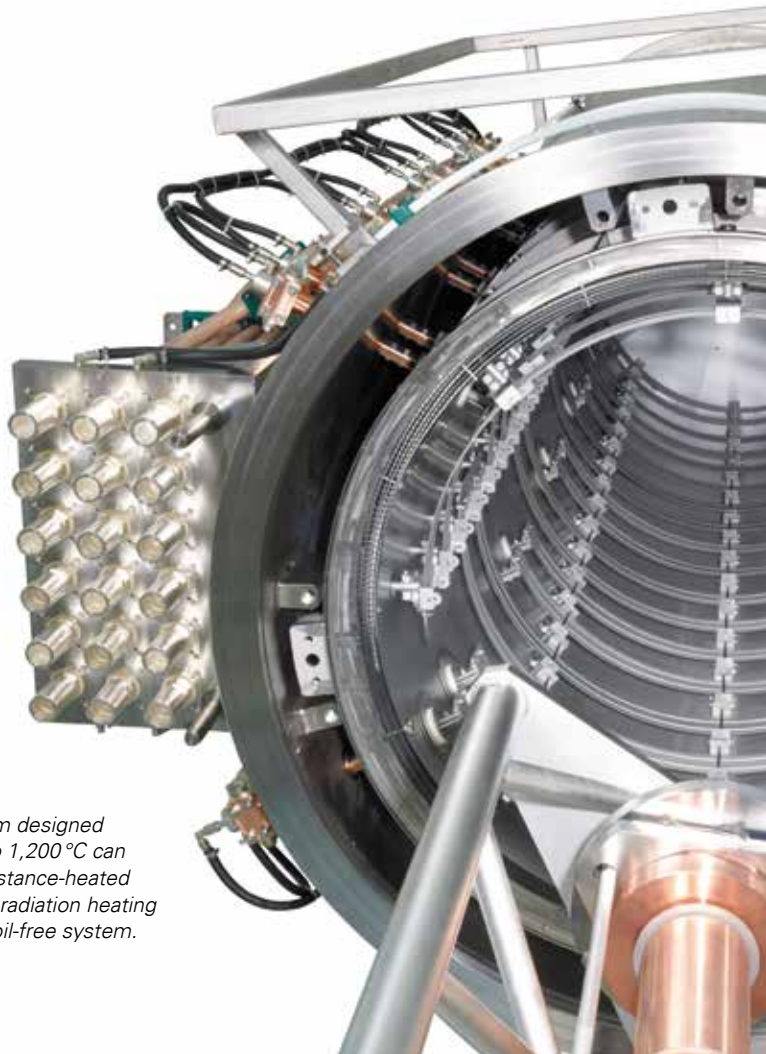
Vacuum measurement system for basic research (leak rate ≤10^{-9} mbar x l/s), among other things with 2-fold differentially pumped DN 160 CF and DN 500 COF rotary joints and a position measurement system (angle accuracy 0.001°) powered by a stepping motor (rotary speed ~0.5 rpm).

High-vacuum ovens for high-temperature soldering with maximum precision

For the SwissFEL linear accelerator of the Paul Scherrer Institut (PSI), PINK has developed, built and supplied a vacuum oven for high-temperature soldering. Using this system, cup-shaped elements of ultra-pure copper are soldered together with high precision to form 104 accelerator structures. Each of these structures consists of 113 elements, so in its final state a total of 11,752 elements will be joined together over a total length of more than 300 m and with an error tolerance of virtually zero.

Together, the copper elements form a cavity with a complex geometry into which radio waves at 6 billion oscillations per second will be fed at a later date to accelerate electron packets to close to the speed of light. The demanded precision of the soldered joints is therefore exceptional, because even the tiniest bulge of solder could cause unintended discharge.

The 6 m tall vacuum soldering oven for SwissFEL is made largely of stainless steel. The cylindrical oven chamber can be elevated and, with its hood open, achieves a height of almost 9 metres. This special design makes it possible to vacuum-solder the vertically inserted workpiece measuring 800 mm in diameter and 2,700 mm in height and weighing a maximum of 1,000 kg.



View inside the high-temperature vacuum-soldering system designed as a cold-wall oven. So that process temperatures of up to 1,200 °C can be achieved, the oven chamber is equipped with nine resistance-heated zones in the form of individually controllable molybdenum radiation heating elements. The high vacuum is generated with an entirely oil-free system.

The new international FAIR accelerator facility, one of the biggest research projects worldwide, will be built at GSI over the next few years. This project will permit an unprecedented variety of experiments, from which physicists from all over the world hope to gain new insight into the structure of matter and the evolution of the universe, from the Big Bang to the present.

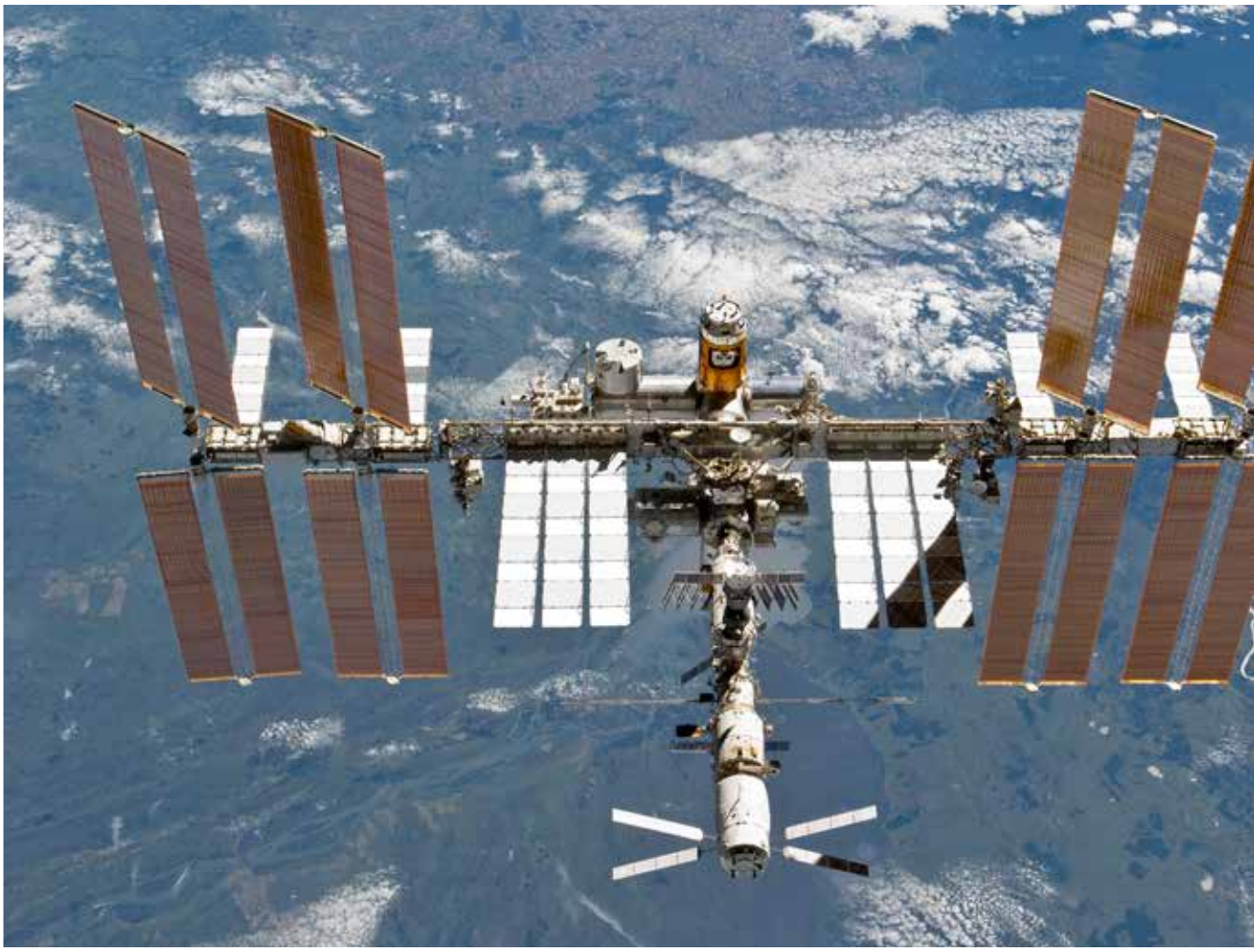
The aim is for FAIR to generate antiproton and ion beams of previously unattained intensity and quality. Fully completed, FAIR will consist of eight ring colliders with a circumference of up to 1,100 metres, two linear accelerators and roughly 3.5 kilometres of beam guide tubes.

Elementary particles are deflected on circular paths in this actively LHe-cooled rib-reinforced chamber produced by PINK.

For FAIR, PINK has built another high-vacuum oven and will also carry out the soldering work required for the project at its own production facility. The maximum workpiece dimensions are 400 mm diameter x 3,500 mm height.

In these soldering processes, ribs and flanges are connected to the extremely thin-walled but very long beam guide tube (0.3 mm sheet thickness) to structurally strengthen and mechanically fasten it. The outcome will be the demanded, extremely low-mass structure that creates the conditions necessary for new particle research experiments.

»In the PINK high-vacuum ovens, special metals will be soldered with high precision to form accelerator structures.«



View from space of the International Space Station and the earth. On the right next to the central, gold-coloured module is the European space lab COLUMBUS. PINK is producing numerous systems for this, some of which are already installed. These also include about 400 running metres of ¼" to 2" ducts and lines. Docking in the foreground is the ATV space transporter for which PINK has produced further components.

»The ACLS also creates new transport capacity, as the quantity of water that has to be brought to the space station will drop by about 1,000 kg/year.«

Systems for water, CO_2 and oxygen management in the COLUMBUS space laboratory

For the ACLS (Advanced Closed Loop System), which Airbus Defence & Space is building for the Columbus space research laboratory, PINK is fabricating several critical systems and components.

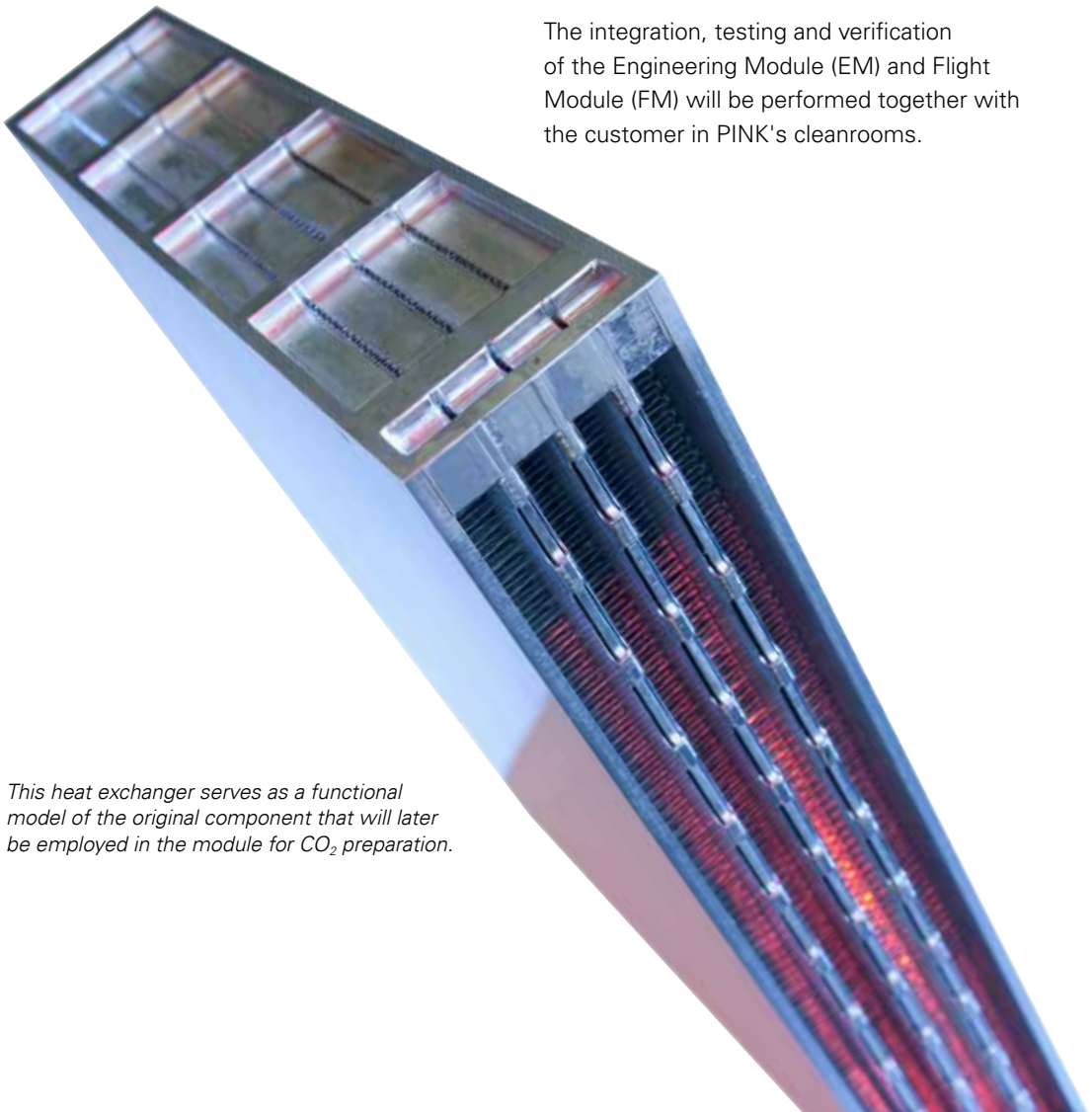
The main purposes of the ACLS system in the European research station of the ISS are to remove CO_2 from the cabin air, generate oxygen from water by electrolysis and produce water from the reaction of hydrogen with CO_2.

The system is composed of six modules, known as drawers. For Drawer 4, a module for CO_2 preparation, PINK is producing, among other things, a heat exchanger that creates the physical conditions for chemical separation and preparation processes.

View inside the Columbus lab with its modular research and supply systems known as drawers. (Graphics: ESA)

Drawer 6, the module for oxygen generation/ recovery (electrolyser), is being produced ready for installation (plug & play) complete with all the electrical and mechanical connections and pipework.

The integration, testing and verification of the Engineering Module (EM) and Flight Module (FM) will be performed together with the customer in PINK's cleanrooms.



This heat exchanger serves as a functional model of the original component that will later be employed in the module for CO_2 preparation.

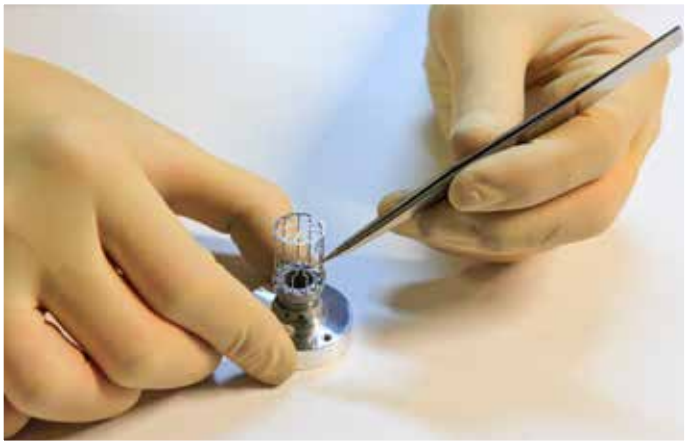
Systems for container-free melting processes in a weightless environment

For the Materials Science Laboratory (MSL) in the European space laboratory Columbus, PINK has built the Electromagnetic Levitator (EML) on behalf of Airbus Defence & Space. With this system, experiments for the development of new materials are carried out in a weightless environment.

New metal alloys and semiconductors are mainly produced by melting. The PINK module permits container-free processing by floating the material samples in their liquid state in an electromagnetic field.

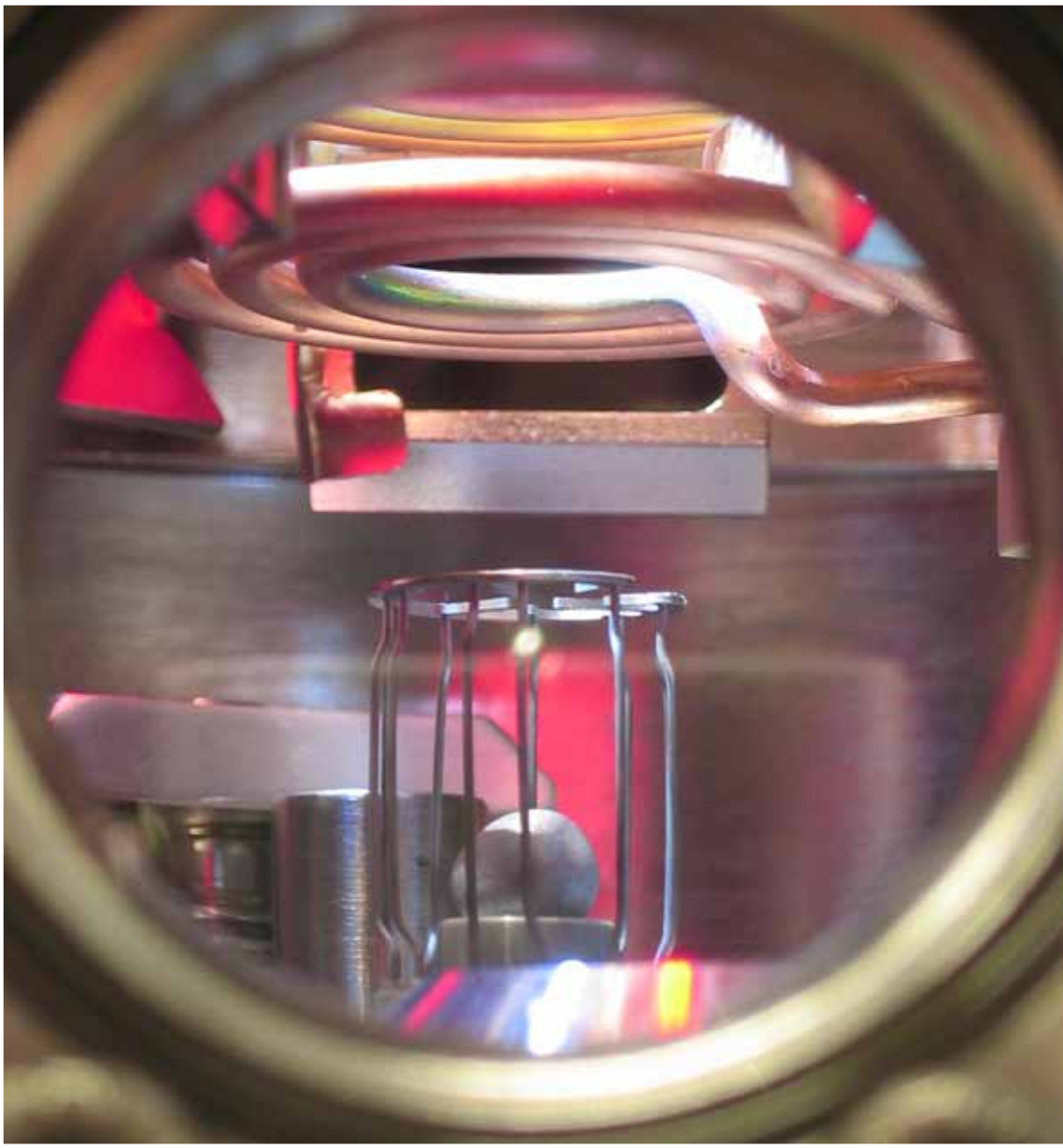
In this way it is possible to exclude problems associated with the earth's gravity and obtain new findings, e.g. on solidification conditions, material microstructure and the physical characteristics of new metal compounds on exposure to heat.

As a special technical challenge, PINK has developed high-precision drives for sample transfer and mirror changers that work under ultra-high vacuum conditions in this experimentation module. In some cases, the module's components have to withstand temperatures of up to 2,000 °C.



PINK electron-beam welds special metals to produce these intricate cages of the sample holders. This is where the material samples are fixed during weightlessness and their return trip to earth.

Cleanroom assembly work on the ultra-high vacuum chamber of the EML materials research module.



Molten experimental samples take on an ideal spherical shape in an electromagnetic field in a weightless environment. This increases the accuracy of measurement enormously.

»PINK's materials research module permits experiments that are impossible within the earth's gravitational field.«

This sample wheel fabricated by PINK will fly with the space transporter to Columbus and serves as a store for the various materials that are melted during the experiments.

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