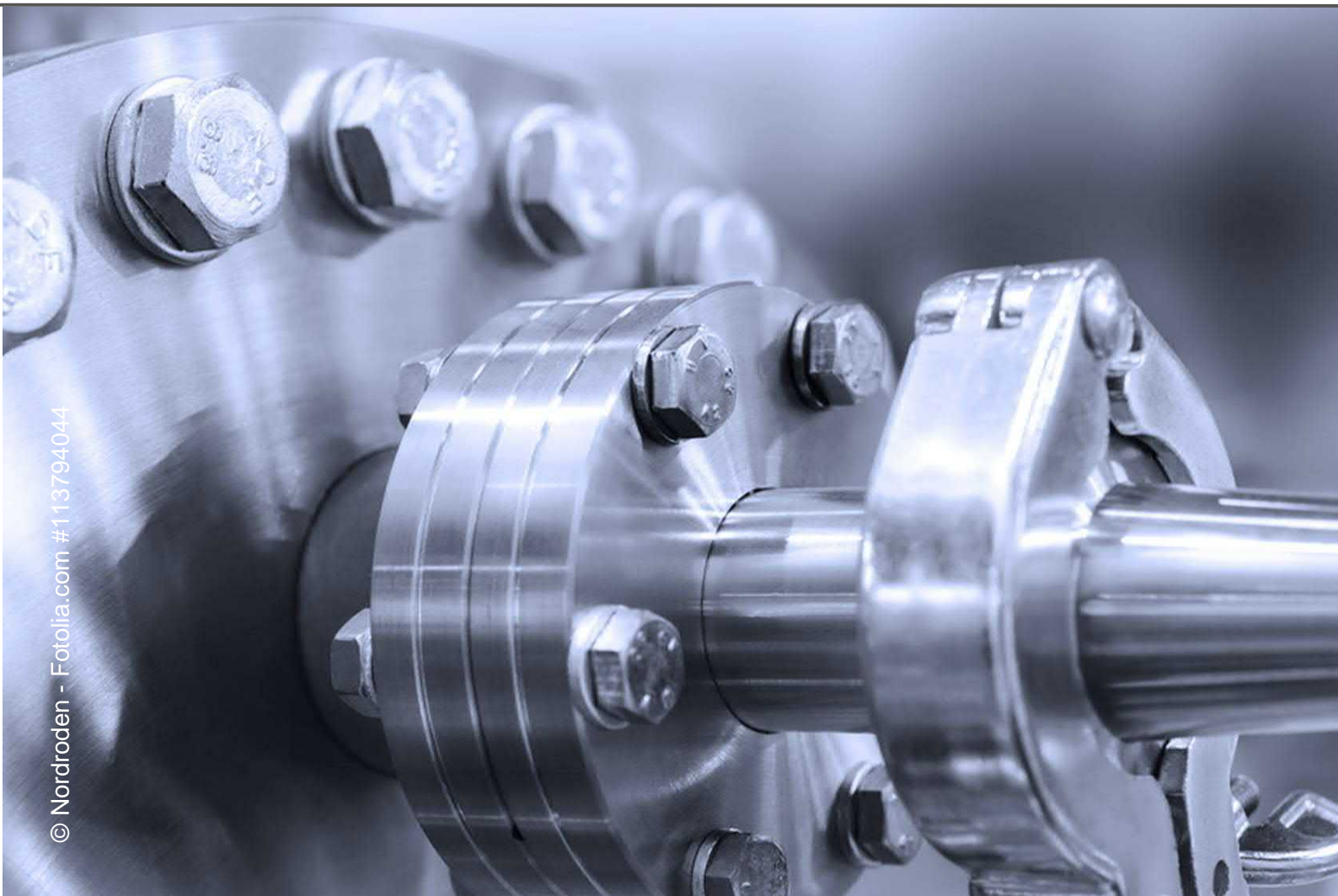


TransMIT-Business Division
PATENTS, INNOVATION AND
START-UP CONSULTING



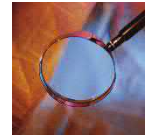
DEVICES & SYSTEMS



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IP-protected Technologies und Knowhow
from GSI Helmholtzzentrum für Schwerionenforschung GmbH

YOUR SYSTEM PARTNER FOR INNOVATION



Technical solutions for high-energy physics, industry, and medicine

- Enhancement of brilliance and flux of inverse Compton sources for X-ray and γ radiation
- Improved septum magnet
- Simulation system for tracking of tumors in motion
- Theranostic particle therapy
- Heat exchanger with vibration damping
- Tool for precise orientation of a pipe or other round material during a rechucking process

Vacuum technology

- Peltier Adsorption Trap
- Ultra-high vacuum housing for sensor and measurement technology
- Ionization manometer for position-dependent UHV/UHX pressures in cryogenic vacuum systems
- Ionization manometer for position-dependent UHV/XHV measurement in a recipient
- Production of NEG layers via electric arc

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Measuring and control technology

- Charge flow frequency converter
- Monitoring of position of recipients and of equipment located therein
- Non-destructive energy determination of ion beams

Electrical and electronic engineering

- Piezoelectric generator
- Galvanically decoupled electric energy supply for harsh environments
- Nanowire structures made to measure
- Welding process for e.g. the hermetic encapsulation of integrated circuits, sensors and detectors

Digital technology, software

- Innovative algorithm for correcting bit errors in digital storage media
- Time dynamic 3D data visualization for graphics processing units

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Enhancement of brilliance and flux of inverse Compton sources for X-ray and γ radiation

Materials science, fundamental research, medicine, public security

DESCRIPTION OF TECHNOLOGY / PRODUCT

Inverse Compton Sources (ICS) deliver high-intensity X-ray and γ radiation via backscattering of low-energy photons emitted by an UV/Vis/IR pulse laser on a beam of relativistic electrons. Despite the compact design of these ICS, their beam quality is as excellent as that of large synchrotron facilities. The beam is characterised by very short pulses in the fs range, a small source size (dependent on the size of the laser focus and the electron beam), linear polarisation, an automatic synchronisation with the laser pulses and a tunable frequency. Provided that the laser is operated with low intensity, the generated X and γ radiation has a very high brilliance and a very low bandwidth. At high laser intensities ($>10^{17}$ W/cm²) an intensity-dependent non-linear increase of the bandwidth of the X and γ radiation generated via Compton backscattering is observed. To avoid this undesired effect, the so-called ponderomotive broadening, it is up to now necessary to limit the intensity of the pulsed laser. Therefore, the intensity and brilliance of the generated radiation are as well undesirably limited.



INNOVATIVE SOLUTION

To overcome the disadvantages mentioned above, a novel method of optimal shaping the laser pulses before the backscattering process was developed. The laser pulses undergo a frequency modulation which results in a defined correlation between their instantaneous frequency $\Omega(t)$ and their instantaneous pulse shape and pulse intensity $I(t)$. Thereby, the resulting laser spectrum is shaped in a manner compensating the non-linear ponderomotive broadening.

AT A GLANCE ...

Technology field / Scope of application

- Radiotherapy
- Transmutation of nuclear waste
- Non-Proliferation of weapon-grade material

Market / Branch

- Materials research
- Medicine: Imaging, radiotherapy
- Nuclear energy
- Public Security

Unique selling points (USP)

- X and γ sources with
- tunable frequency and minimised bandwidth,
 - high intensity and brilliance,
 - ultra-short pulses, automatically synchronised with fs laser pulses,
 - compact design

Development status

- The functionality of the new X and γ -ray sources has been successfully demonstrated.

Patent status

European patent application pending, international patent application filed.

ADVANTAGES COMPARED TO THE STATE OF THE ART

Using the new method, the brilliance and/or the flux of present inverse Compton sources may be considerably increased without deteriorating the advantageously low bandwidth and compact design of the sources.

SCOPE OF APPLICATION

The X and γ radiation sources based on the new pulse shaping method will find numerous promising applications from materials science (structural analysis), medicine (imaging, radiotherapy) to particle physics (e.g. investigation of the fundamental properties of atomic nuclei). The sources may be designed as compact and portable units, which are suitable for security checks at ports and airports.

In known application fields (radiotherapy, materials science) the following benefits may be obtained: a reduction of the measurement time in X-ray fluorescence analysis, a reduction of the radiation exposure of patients in Computer Tomography (CT), a study of laser-matter interactions at highest intensity, a faster and more sensitive detection of hidden weapon-graded nuclear material using portable monochromatic γ sources.

New application fields will become potentially accessible, i.e. the transmutation of long-lived nuclear waste into short-lived nuclides, which need not to be stored in geological repositories. The application of the new method in Linac- and Laser-Wakefield-based inverse Compton sources is especially promising.

DEVELOPMENT STATUS

The functionality of the new method has been successfully demonstrated.

MARKET POTENTIAL

The new method enables improved inverse Compton sources for routine application in medicine (radiotherapy, imaging, tissue analysis), materials research, and public security, esp. the search of hidden radioactive material. The annual demand may lie in the four-digit range enabling a cost-efficient series production.

In the long run, the application for transmutation of nuclear waste may become relevant, provided the geological disposal preferred up to now will turn out to be too risky or impractical.

COOPERATION OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is searching for cooperation partners or licensees for further development and marketing of the innovative radiation sources in Germany, Europe, the USA, and Asia. As well, potential users are sought, who may contribute to open up additional application fields of the new radiation sources.

A TECHNOLOGY OF



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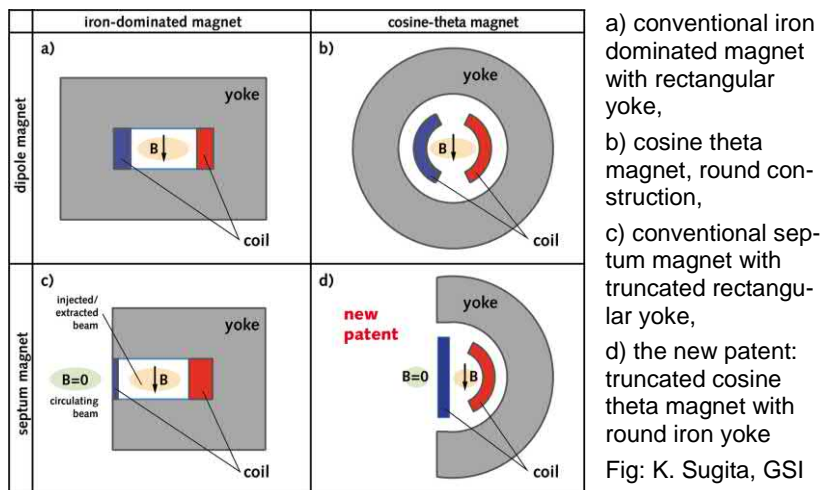


Improved septum magnet

Radiotherapy/ accelerator/ electro magnet

DESCRIPTION OF TECHNOLOGY / PRODUCT

A septum is an electromagnet, pulsed with high electricity. This sort of magnet is used at the transitions from one storage ring to the next one. With septum magnets it is of vital importance to completely shield the magnetic fields that are prevailing inside of them, to guarantee its function as a switch of particle stream.



To achieve this aim, a cosine theta magnet is used in this invention. Here, this magnet is designed as a yoke, which is cut off at one side. This causes a shielding of the electromagnetic field, so that the field strength outside of the yoke equals zero.

This makes the use of the cosine-theta magnet as septum magnet possible. With this invention, septum magnets with magnetic-field strengths of more than two Tesla, which is the limit of the conventional design, can be realized. By introducing a superconducting coil, even up to eight Tesla are achieved in electromagnetic simulations. Quadrupole or higher multipole septum magnets could also be realized with the design.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

Accelerator for radiotherapy

- Therapy with photons and electrons
- Therapy with strongly loaded particles

Accelerator in research

MARKET / BRANCH

- Medical technology companies
- Magnet producers

USP

- Realization of particularly strong and spacially limited magnet fields
- High reliability

DEVELOPMENT STATUS

- ✓ Demonstrator under development

SCOPE OF APPLICATION

Possible scopes of application of the invention might be the use for accelerators in medicine or in future large-scale facilities for research such as FAIR or the Future Circular Collider (FCC) planned at CERN.

ADVANTAGES COMPARED TO STATE OF THE ART

- Realization of magnetic fields with magnetic-field strengths > 2 Tesla
- By introducing a superconducting coil, even up to eight Tesla are achieved in electromagnetic simulations
- Possibility of a compact design of the septum magnet
- More reliable beam guidance for higher precision

DEVELOPMENT STATUS

A demonstrator is currently under development.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for further development in Europe, US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 900**

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System Partner for Innovation

Simulation system for tracking of tumors in motion

Validation of dose, tumor therapy, movable system

DESCRIPTION OF TECHNOLOGY / PRODUCT

In nuclear medicine and particle therapy, biological systems are still lacking for the validation of radiation procedures of target volumes under the influence of motion, for applications in mixed particle fields or for multiple field irradiations. Established testing methods cannot be applied in this case, since radiation procedures utilizing scanned particle beams may under certain circumstances interact with the motion, bearing the risk of local dose errors which are not detectable with currently available measuring systems, due the large bottom surface.



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The invention solves the problem by providing a spatially resolving phantom device which can be used in combination with absorber systems and under motional influence for experimental *in-vitro* validations. The biologically effective dose for the therapeutic irradiation of a moving target volume in a living body, in particular for tumor therapy, is calculated using a particle-therapy accelerator.

SCOPE OF APPLICATION

The product is a biological system for the validation of radiation procedures of target volumes under the influence of motion. Using a particle-therapy accelerator, the prevailing dose for tumor therapy can be calculated. In addition to biological systems, the product idea can also be utilized for detectors with energy-dependent efficiency.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

A spatially resolving phantom device is used with absorber systems and under motional influence for experimental *in-vitro* validations.

MARKET / BRANCH

- Medical Technology

USP

- Spatial resolution
- Differential movement
- Combination of different cell systems, levels of oxygenation and cell cycles
- Absorber systems
- Rotatable mountings for accurate positioning
- Movable systems

ADVANTAGES COMPARED TO STATE OF THE ART

- Spatial resolution for the detection of dose deviations caused by the interaction between beam and target area movement
- Differential movement of absorber and target area – by analogy with the differential movement of lung tumor and ribs
- Independent containers
 - Combination of different cell systems and corresponding culture medium, e.g. skin in the entrance channel, normal tissue in the plateau region and tumor tissue in the target area
 - Combination of different levels of oxygenation
 - Combination of different cell cycles
- Absorber systems to achieve a modulation of the particle spectrum so that bio-logical effects can also be investigated in different tissue depths – possibly manufactured individually in a patient-dependent manner
- Rotatable mountings to facilitate the accurate positioning for multiple field irradiations
- Movable system to irradiate different sections of the biological detector in direct succession – first irradiation left half, second irradiation right half, which allows for several consecutive measurements using a single biological filling.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation and distribution partners for further development in Europe and the US.

A TECHNOLOGY OF



REFERENCE NO.: **TM 717**

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System Partner for Innovation

Theranostic particle therapy

cancer theranostics, tumor therapy, (radio-)oncology, radiotherapy, therapeutic radiology

DESCRIPTION OF TECHNOLOGY / PRODUCT

The treatment of tumors with high energy radiation (radio therapy) is a generally recognized method in cancer therapy.



Source: GSI

Particle therapy as branch of radio therapy uses accelerated charged particles, such as protons or heavy ions, e.g. carbon. The interaction of the introduced particles with the tissue is highly dependent on speed.

The deeper the particles penetrate the tissue, the more they are slowed down. This al-

lows the particles to interact with the tumor using a very high dose rate without damaging the surrounding tissues. Usually the diagnosis and, in particular, the exact localization of the tumor has to be carried out separately.

The novel system for combined diagnosis and therapy, described here, allows for a radiographic examination for diagnostic purposes and therapeutic irradiation to be implemented using only a single device. This combination of therapy and diagnostics – theranostics – provides great advantages towards the current course of action, esp. time- and cost-reduction.

The novel irradiation facility for tumor therapy also works with higher particle energy rates of more than 1GeV (in the case of protons), which is several times the rate of conventional systems. Thus it allows for a more efficient radiation therapy (higher dose rate).

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- particle therapy
- medical technology

MARKET / BRANCH

- tumor therapy
- treatment of arteriovascular malformations

USP

- combination of diagnosis and therapy = theranostics
- targeted therapy of deep-seated tumors

DEVELOPMENT STATUS

- ✓ prototype-system existing

SCOPE OF APPLICATION

The main area of application of particle therapy („particle radiation therapy“) is the treatment of tumors. This kind of therapy is particularly well suited for the treatment of small tumors on risk organs via cross-firing so that damage to healthy tissue is minimized. Particle therapy is also used in the treatment of diseases other than cancer, especially neurosurgery (primarily in the case of arteriovascular malformations).

ADVANTAGES COMPARED TO STATE OF THE ART

The novel system provides the unique possibility of combined diagnosis and therapy by means of ion beams. The higher particle energy allows for a more targeted and more efficient treatment of tumors located deep in the body, because the penetration deepness of the particle beam is increased. Furthermore, the particle beam is considerably more focused and enables more precise treatment.

DEVELOPMENT STATUS

A prototype of the system exists, and the fundamental functions of the system have been demonstrated.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH the TransMIT GmbH is looking for cooperation partners or licensees for distribution or further development in Germany, Europe, the US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 791**

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System Partner for Innovation

Heat exchanger with vibration damping

Heat dissipation, cooling technology, reduction in structure-borne noise

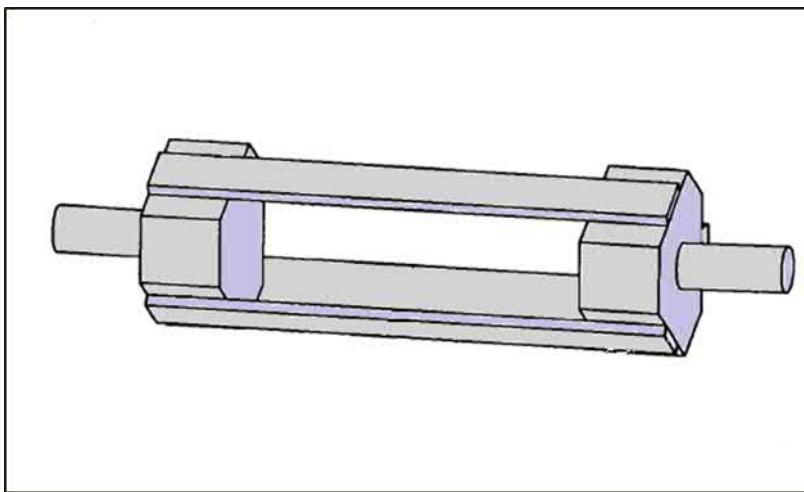


Bild: TransMIT GmbH

DESCRIPTION OF TECHNOLOGY / PRODUCT

As described in the second law of thermodynamics, heat exchangers use the principle of heat always flowing from warm to cold substance flow. For this purpose, they consist of materials such as aluminum and copper, or their alloys. For this purpose, heat pipes use further evaporation heat. Heat exchanger are applied in heat dissipation of inter alia electronics of active cooling or of passive heat sinks.

In the course of the development of this new heat exchanger, it succeeded in realizing a very good thermal coupling along with great mechanical decoupling.

The connection between the cooling device and the heat exchanger or those with the cooling can be produced through heat sealing of ultrasound.

Moreover, the heat exchanger has a flexible and elastic area at its disposal to minimize the oscillations.

There is also a heat dissipation possible for devices that are run on low temperature.

Furthermore, heat loss and process heat can be exploited through recuperation.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

Heat exchangers for (cryogenic) electronics, for which an oscillation isolation is favorable

MARKET / BRANCH

- Cooling technology
- Climate technology
- Cryogenic technology
- Energy technology
- Energy recovery technology
- Oscillation technology
- Aerospace
- Plant construction
- Machine construction
- Weld technology

USP

- Heat exchanger suitable for devices that also work under lowest temperature and that need a vibration protection with simultaneous optimal cooling

DEVELOPMENT STATUS

- ✓ Realized and in use for detectors
- Next steps: Validation with an industrial partner for specific application

REFERENCE NO.: **TM 551**

MARKET POTENTIAL

With more than 30% of the world market, Europe constitutes the largest market for heat exchangers, which develops respectably with a 5% growth. The Asian Pacific region will grow from 2014 to 2019 the fastest in the double-digit range.

In 2013 the world market already reached a volume of almost \$12 billion.

For 2020 there is a total market of little over \$18 or rather \$24 billion predicted, depending on the study. (Sources: Transparency Market Research; Global Industry Analysts, Inc.).

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for distribution/ further development in Germany, Europe, US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 551**

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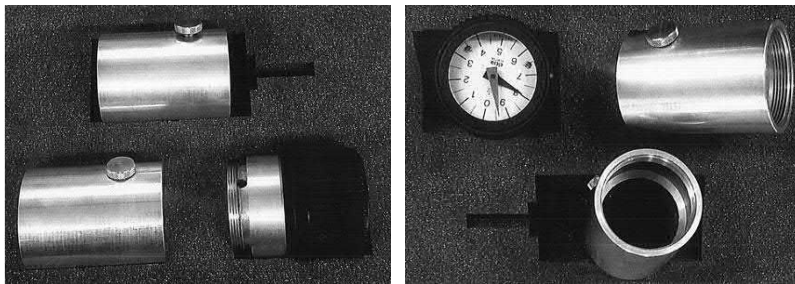
System Partner for Innovation

Tool for precise orientation of a pipe or other round material during a rechucking process

Sawing aid / mitre cutting / angle display / position setting

DESCRIPTION OF TECHNOLOGY / PRODUCT

The innovation is a device for workpiece orientation that exactly positions the tool during a re-chucking process for its machining (e.g. sawing, bending, welding, drilling, grinding, etc.)



The rechucking of a workpiece is mostly accompanied by a planned motion or displacement, typically by a transfer in a transversal direction and/or around a rotation axis. An unintentional displacement, such as a rotation around one or more rotation axes or other motions, shall be prevented using the workpiece orientation device. The new device also enables an easy method for defined repositioning of the workpiece after machining, due to the fact that it is easy to read the preassigned positions from the measurement tool.

The tool consists of two components. The first component comprises the measuring head with dial gauge, which contains a division of 18° per graduation mark (90°, 180°, 270°, 360°) and a double bubble level, as well as an external thread to screw the fixture. The second component represents a substitute workpiece fixture for mounting different sizes and forms that are attached to the workpiece.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

Workpiece orientation device for re-chucking processes of round materials - measurement and adjusting aid

MARKET / BRANCH

- Tool manufacturers
- Pipe and plant manufacturers
- Metal and woodworking industry

USP

- Well-directed control of the degrees of freedom of movement
 - translations
 - rotations
 during temporary loosening of a workpiece
- High-precision orientation of the workpiece
- Prevention of unwanted motions or changes in position of the workpiece
- Repositioning of workpiece is possible

DEVELOPMENT STATUS

- ✓ A pre-series prototype of the invention is available and was adapted successfully

SCOPE OF APPLICATION

- Sawing of mitres
- Welding of nozzles
- Bending of pipes
- Material-removing processes, like milling or cut-off grinding
- Executing two mitre cuts at a pipe during installation works (water pipelines, heating pipes, hollow pipes for placement of electric lines, etc.)

ADVANTAGES COMPARED TO STATE OF THE ART

The complicated and time-consuming orientation of workpieces with the help of levels and other aids, that are complicated to handle, is avoided with this innovation in the tool segment. The new measurement aid reduces the expenditure of work, minimizes the expenditure of time, prevents possible measurement errors and enables an easy reading of the desired preassigned positions for adjustment.

The construction of the workpiece orientation device is simple and cost-efficient.

Moreover, the fixture of the workpiece orientation device is adaptable to different sizes and forms of the workpieces.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for further development and/or distribution in Germany, Europe, US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 876**

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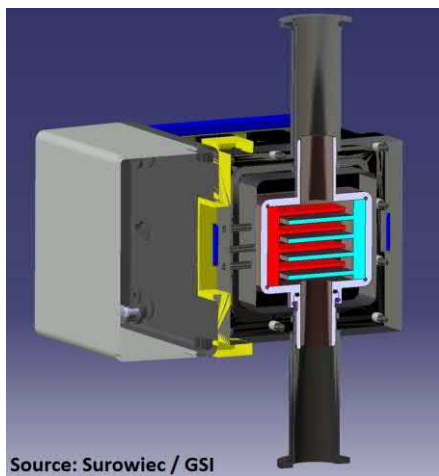
System Partner for Innovation

Peltier Adsorption Trap

Vacuum technology, separation device for impurities and pump device

DESCRIPTION OF TECHNOLOGY / PRODUCT

In technology, it is important to prevent the conversion of substances between vacuum pumps and the actual vacuum area due to possible damages. For this purpose, separation devices between two or more different sections are used. Adsorption traps and vapor barriers are used in vacuum technology to adsorb or rather condense gases on cold surfaces. So far, adsorption traps that are cooled with liquid nitrogen were used in the vacuum range. This however is disadvantageous because the adsorption trap needs to be refilled regularly. The introduced invention uses a thermoelectrical cooling (Peltier cooling) instead of conventionally used LN₂ cooling. The achieved temperatures are sufficient to adsorb and condense hydrocarbons like pump oil effectively. The efficiency is maximized by a very large cold surface, whereby it is ensured that the flow rate and the final pressure of the pump device are not affected appreciably.



Source: Surowiec / GSI

SCOPE OF APPLICATION

The new separation device for impurities can often be used as a "snap-in" solution, as an integration in existing plants. Such plants could be for example vacuum facilities and coating plants. Therefore, the innovation can be applied in oil diffusion pumps to avoid contaminations of the recipient through oils. Moreover, the innovation can be used with oil-lubricated backing pumps (rotary vane pump). It can also help to dry gases.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

Innovative device for the separation of impurities with the use of the Peltier cooling

MARKET / BRANCH

- Vacuum industry
- Coating industry
- Research

USP

- Easy and cost-effective in production
- Good conductance at maximum surface
- Stable in long term and maintenance-free
- By reversing the polarity, the trap can be regenerated in control
- Easy adaption to installation space specifications

DEVELOPMENT STATUS

- ✓ Application successfully demonstrated in prototypes

ADVANTAGES COMPARED TO STATE OF THE ART

- Easier and more cost-effective in production, because Peltier elements are a mass product.
- Very good conductance at maximum surface.
- The technique is long-term-stable and maintenance-free.
- By reversing the polarity, the trap can be regenerated in control.
- The device can easily be adapted to different installation space specifications.

DEVELOPMENT STATUS

The applicability of the innovation was successfully demonstrated in the HV, UHX and XHV for the prototypes.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners as well as licensees.

A TECHNOLOGY OF



REFERENCE NO.: **TM 455**

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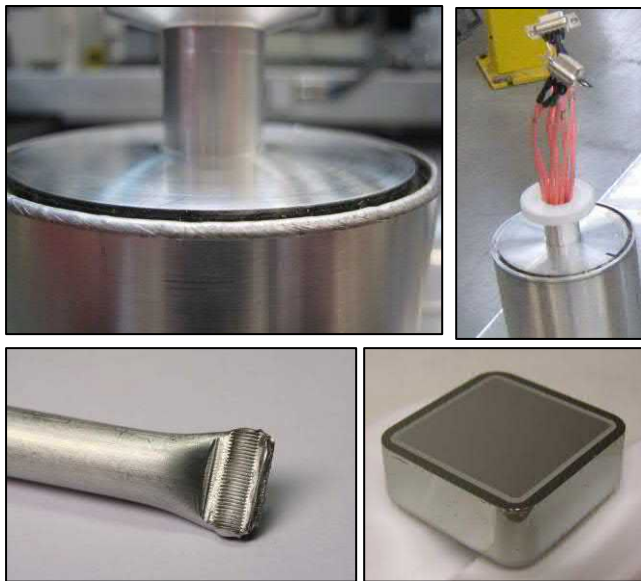
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System Partner for Innovation

Ultra-high vacuum housing for sensor and measure- ment technology

Encapsulation, getter, particle trap



DESCRIPTION OF TECHNOLOGY / PRODUCT

Sensitive sensors and other electronic and optoelectronic components require reliable encapsulations, which withstand long-lasting environmental difficulty. Such housings, with grommets for electrical connections in surroundings with low air or rather gas pressure and in the vacuum technology, require particularly high standards. The specific aluminum housing was invented for the vacuum technology.

The metal housing has two chambers, which are impermeable for particles but can be separated through a filter that is permeable to fluids, consisting out of mesh material.

One of the chambers serves as a reception area for a getter to keep a vacuum over a longer time clean without a vacuum pump. The rest of the housing inside is intended for equipment such as detectors and sensors.

Besides the sensor and measurement technology, which is operated under vacuum, the housing is also suitable for such electronics that work in a protective atmosphere.

The housing still has a fluid tight grommet for wires and hoses. Also the housing case and lid are still connected through joints. Moreover, the particle-free weld is separable and again lockable.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

Hermetic housing system for circuits

MARKET / BRANCH

- Housing technology
- Aviation and space travel
- Sensor and measurement technology
- Semiconductor industry
- Vacuum technology
- Machine and plant construction

USP

- Protection of electronic components under permanent vacuum

DEVELOPMENT STATUS

- ✓ Semiconductor detectors become encapsulated in housings to protect the surface
- Next steps: validation projects with the industry for specific use and environments

MARKET POTENTIAL

The market of housings and closets for central process industries like oil and gas, water/waste water or chemistry and petro chemistry was able to record worldwide sales of about \$2, 3 billion in 2012. Until 2019 the market research corporation Frost & Sullivan predicts a rise in sales up to \$3, 5 billion. This corresponds to an average yearly growth rate of almost 6%.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for distribution/ further development in Germany, Europe, US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 563**

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System Partner for Innovation

Ionisation manometer for the measurement of UHV/XHV pressures in cryogenic vacuum systems

Vacuum and cryogenic engineering

DESCRIPTION OF TECHNOLOGY

State of the art

Pressure measurements in cryogenic vacuum systems always represented a technical challenge. The reason for this is, that in such cryogenic vacuum systems as a rule low UHV or even XHV pressures ($p \leq 10^{-11}$ mbar) have to be generated and maintained. Except elaborate methods which may be applicable only in particle accelerators, such low pressures are measurable only by means of ionisation manometers. Ionisation manometers with heated cathode have been proven to be applicable down to liquid helium temperatures (-269°C). However, they show a decisive disadvantage: In most cases, there is a non-tolerable high heat input from the hot cathode into the cryogenic system. This thermal load has to be compensated for by an additional cooling power. Moreover, the thermal radiation emitted by the hot cathode leads to local pressure increases



Foto: Fotolia Urheber Nordroden

because of thermally induced desorption, i.e., in the immediate environment of the gauge the cryopumping effect of the cold surfaces desired in such vacuum systems is destroyed.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- Vacuum engineering
- Cryogenic engineering

MARKET / BRANCH

- Vacuum equipment
- Measurement technology

USP

- Spatial and thermal separation of the electron emitter from the recipient and from other components of the manometer
- Almost free choice of the electron emitter (hot cathode, cold cathode, cold field emitter, electron gun)

DEVELOPMENT STATUS

- ✓ Prototype

REFERENCE NO.: **TM 897**

Innovative Solution

Our novel concept of a pressure measurement using an ionisation manometer with decoupled electron source is based on the idea to maintain the classical, well-established geometry of hot cathode ionisation manometers for UHV/XHV, but to remove the heat-generating filament and to relocate the electron generation for the gauge into the room-temperature environment, where heat generation does not disturb. According to this invention, an ionisation manometer configuration for UHV/XHV measurements is installed in the cryogenic vacuum system in a manner, that the free electrons needed for the operation of the gauge are shot through a cold-warm transition in the direction of the gauge anode using an electron gun positioned outside the cryogenic environment and suitable electron-optical elements (deflector coils). From this decoupling of the gauge and the electron source three decisive advantages result: The heat transfer into the cryogenic system, which is caused by the operation of the hot cathode, is reduced to a minimum. The thermodynamic equilibrium in the cold environment of the gauge is not disturbed, which is an essential requirement for a correct pressure measurement with ionisation manometers. Using suitable electron-optical means the electron beam may be injected into any complicated or conductance-limited vacuum chamber setup.

SCOPE OF APPLICATION

This innovative solution was mainly developed for UHV/XHV pressure measurements under cryogenic conditions. However, it may be easily applied in any vacuum installations which are operated e.g. under high or medium vacuum and higher temperatures. In mass spectrometers the technology may be advantageously applied e.g. to avoid a distortion of partial pressure measurements caused by chemical reactions at the hot cathode.

ADVANTAGES COMPARED TO THE STATE OF THE ART

Thermal decoupling: The electron emitter is thermally separated from the other components of the manometer and from the vacuum chamber. Therefore, the emitter may be operated at a higher temperature than the vacuum chamber. It may be designed e.g. as a cold cathode or a hot cathode. Fast and precise pressure measurements are possible even at very low temperatures in the vacuum chamber.

DEVELOPMENT STATUS

The measurement method using an ionisation manometer and a thermally decoupled electron emitter has been tested successfully in a beam tube of a particle accelerator under cryogenic vacuum conditions.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees in Germany, Europe, USA, and Asia. They should be interested to adapt the novel concept of an ionisation manometer to large-scale industrial applications like deposition technologies in the semiconductor industry, e.g. via the development of tailor-made electron emitters, cold-warm transitions and other components.

A TECHNOLOGY OF



REFERENCE NO.: **TM 897**

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System Partner for Innovation

Ionization manometer for position-dependent UHV/XHV measurement in a recipient

Vacuum technology, cryogenics

DESCRIPTION OF TECHNOLOGY / PRODUCT

State of the art

In UHV/XHV chambers may appear a position-dependent pressure, varying over several orders of magnitudes, e.g. in the case of chambers with elongated geometry, complicated installations inside and multiple pumping systems. This pressure distribution cannot be measured using currently available ionization manometers, because their electron source and ion collector are packaged in close neighborhood. Therefore, only the pressure at the manometer position is measured.



Foto: Fotolia Urheber Nordroden

Innovative solution

In the new ionization manometer, the electron source is located in the manometer housing, whereas one or more ion collectors are placed outside. These collectors are arranged in a manner that enables to measure the pressure at defined positions and the mean pressure along a linear measuring path. The pressure distribution in a spacious recipient, e.g. a vacuum coating system or a beamline of an accelerator, becomes accessible to measurement.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- Vacuum technology
- Cryogenics

MARKET / BRANCH

- Vacuum equipment
- Measurement technology

USP

- Thermal separation of the electron source from the recipient and the ion collector
- Nearly free choice of the measuring path
- Pressure measurement at positions which are difficult to access

DEVELOPMENT STATUS

- ✓ Prototype

REFERENCE NO.: **TM 902**

SCOPE OF APPLICATION

This innovative solution was mainly developed for the measurement of the residual gas pressure in beam pipes of circular and linear accelerators. However, it is generally applicable for any vacuum equipment with medium or "better" vacuum. It allows pressure measurements in areas of a recipient that are difficult to access.

ADVANTAGES COMPARED TO THE STATE OF THE ART

Thermal separation: By means of its housing, the electron source is thermally separated from the recipient. Therefore, it may be designed as a glow cathode working at ambient temperature, whereas the recipient is under cryogenic conditions. Other electron sources, e.g. a cold cathode, may be as well applied.

Modular design: The new manometer allows a user-specific optimization. From a set of ion collectors the device with the most suitable dimensions is selected. If necessary, a new collector optimized for the actual application may be developed.

DEVELOPMENT STATUS

Prototypes of the new ionization manometer have been successfully tested under cryogenic conditions in accelerator beamlines.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for further development in Germany, Europe, USA, and Asia. Especially, companies are sought, which are interested in the adaption of the new manometer concept to industrial applications, e.g. semiconductor processing, and its further development by user-specific design of new ion collectors and other components (electron sources and collectors, evaluation electronics).

A TECHNOLOGY OF



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System Partner for Innovation

Production of NEG layers via electric arc

Non evaporative getter, high vacuum, static vacuum

DESCRIPTION OF TECHNOLOGY / PRODUCT

NEG layers (non-evaporating getter) are able to remove the majority of gases from a high vacuum device at room temperature. In doing so, they also capture the gases released from the carrier material. After being activated, the NEG film is a clean metal surface which facilitates a high pumping speed and lower level of outgassing. Up to now, its usage has been limited due to the time-consuming and complex method used for its production.

The sputtering process currently used for coating the inside of vacuum chambers with NEG layers relies on the discharge of gas in the low vacuum range ($p \sim 2 \text{ Pa}$) using an auxiliary sputtering gas. The risk that this auxiliary gas will be incorporated into this coating therefore cannot be eliminated entirely. The coating procedure is highly protracted, and only thin layers are able to be generated with a low adsorption capacity for residual gas.

The innovation comprises a novel method of production for these layers. The getter material is converted into plasma using an electric arc and subsequently coated on the interior wall of the vacuum container. This means that auxiliary gases are not required. The method allows for thick layers to be produced more quickly than would be the case for a sputter-based method.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- Non evaporative getter
- Static high vacuum

MARKET / BRANCH

- Manufacturing of
- Electron tubes
 - X-ray tubes
 - Vacuum pumps
 - Mass-spectrometers
 - Solar heating systems

USP

- Avoidance of gas inclusions
- High adsorbance capacity
- increased stability of the getter-layers at higher deposition rate
- electric arc technologically is easier and cheaper

DEVELOPMENT STATUS

- Already applied by the GSI internally

Next steps:

- Adaption to industrial application

PATENT PORTFOLIO

Patents granted

REFERENCE NO.: **TM 724**

SCOPE OF APPLICATION

The innovation is applicable in all areas where static high vacuum is needed, i. e. primarily within manufacturing of electron resp. vacuum tubes, x-ray-tubes and vacuum devices for collecting solar heat. But it may also well be applicable in areas like mass spectrometry.

ADVANTAGES COMPARED TO STATE OF THE ART

The avoidance of supporting gases (sputter gases) in creating the neg-layer results in faster creating the getter-layer, resp. in achieving layers with greater thickness which leads to a higher capacity of adsorbance. In addition, the increased stability of the getter-layers at higher deposition rates makes the procedure via electric arc technologically easier and also cheaper.

DEVELOPMENT STATUS

The method is already in use by the GSI internally in order to create and support high vacuum within apparatuses for scientific experiments.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for further development or commercialisation in Germany, Europe, US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 724**

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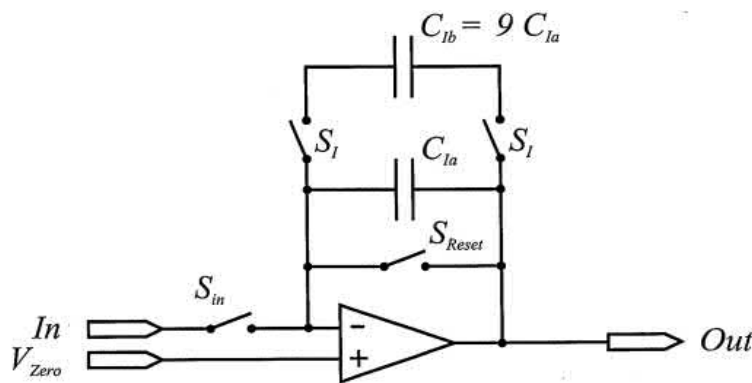


System Partner for Innovation

Charge flow frequency converter

DESCRIPTION OF TECHNOLOGY / PRODUCT

Charge flow frequency converters are used when especially small electrical currents must be measured. Here they convert a current signal into a frequency signal.



Schematic diagram of the integrator (GSI)

Usually, the integrator and the comparator are connected in series. A disadvantage of this arrangement is that the integrator during the reset process cannot work, so a dead time occurs during which no charge flow can be measured. For time-critical applications, i.e. those in which the amount of charge fed changing rapidly, and very fast to be detected, is lost by resetting the integrator in the circuit too much time. Also, always be measured by charge carriers of one polarity only charge flow.

The present innovation relates to a further development of such a device. In the novel charge-flow-frequency converter circuit two parallel branches are used. Thus, there is no dead time the re-setting of the integrator. Therefore, an apparatus and method are provided which continuously - without dead time - the charge flow can be measured.

SCOPE OF APPLICATION

The method can be used anywhere where very small currents of both polarities with high dynamics are measured. These small streams, the very be monitored and measured accurately in size must occur for example in particle accelerators (such as electron, proton or ion accelerators) and in particle detectors (e.g. in dosimeters), but also in Ion sources used as example. For ion beam etching, be on.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- particle accelerators
- ion beam etching
- ion sources

MARKET / BRANCH

- Basic Research (particle, nuclear and atomic physics)
- semiconductor industry
- device manufacturer for radiation sources of particle beams

USP

- measurement of the charge flow without dead time
- works also in the case of unexpectedly charge flows
- circuit independent from the charge carriers are independent positively or negatively charged

DEVELOPMENT STATUS

Circuits based on this innovation have been used already in operation for beam diagnostics

ADVANTAGES COMPARED TO STATE OF THE ART

- measurement of the charge flow without dead time
- works also in the case of unexpectedly large charge flows
- circuit independent whether the charge carriers are positively or negatively charged

DEVELOPMENT STATUS

Chips based on this innovation are already in operation for were used, the beam diagnostics and in the third generation made to 500 pieces each.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH TransMIT GmbH is looking for cooperation partners or licensees for [further development, ...] in Germany, Europe, US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 796**

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System Partner for Innovation

Monitoring of position of recipients and of equipment located therein

Measurement technology, cryogenics

DESCRIPTION OF TECHNOLOGY / PRODUCT

Problem to be solved

Numerous technical processes require well-defined conditions (pressure, temperature), which deviate extremely from ambient conditions. The related equipment is placed in closed recipients and is difficult to control. Under the influence of vacuum, high pressure, low and high temperatures, mechanical distortions of the recipients and the equipment inside may appear. Equipment working at cryogenic temperatures and/or high alternating thermal stress is especially prone to this undesired effect that may lead to complete malfunction. To correct a



Fotolia : Nordroden 11379444

mechanical distortion, it has to be exactly measured. Up to now, highly precise interferometric methods are used, which are very expensive.

Innovative Solution

According to the innovative solution, suitably positioned pairs of emitters and detectors are used to measure the mechanical distortion of an installation. The emitter, preferably a cost-efficient compact laser diode, delivers a beam of light, which is registered by the planar detector. The laser beam may be led fibre-coupled into the recipient. Alternatively, the emitter itself may be positioned inside the recipient, e.g. as a compact laser diode at the inner wall of a vacuum chamber. The corresponding detector, e.g. a CCD, is fixed at the inner wall or at the installation to be monitored. A mechanical distortion is measured via beam position changes on the CCD and may be immediately corrected.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

Cryogenics, vacuum technology

MARKET / BRANCH

- Measurement technology
- Monitoring technology

USP

- Contactless position monitoring for equipment of any dimensions
- Measurement during operation

DEVELOPMENT STATUS

- ✓ Demonstrator under construction

REFERENCE NO.: **TM 901**

SCOPE OF APPLICATION

The solution was developed for the monitoring of beam pipes of particle accelerators, but it is suitable for installations in many dimensions, especially for vacuum chambers and the equipment inside. Even hidden components are accessible to monitoring using suitably positioned mirror systems. Additional scattered light detectors allow the measurement of the residual gas pressure in the chamber.

A particularly advantageous application is the monitoring of tubular geometries, e.g. ring accelerators. Here, a laser signal may be coupled into a beam pipe via a window at a pipe bend and impinge on a detector at the inner tube wall.

ADVANTAGES COMPARED TO THE STATE OF THE ART

The solution enables a simple and cost-efficient monitoring of the position of recipients and the therein located installations. As a contactless procedure, it is applicable during regular operation.

DEVELOPMENT STATUS

A demonstrator is under construction.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for further development in Germany, Europe, USA, and Asia. As well, potential users of the innovative position monitoring method are sought.

A TECHNOLOGY OF



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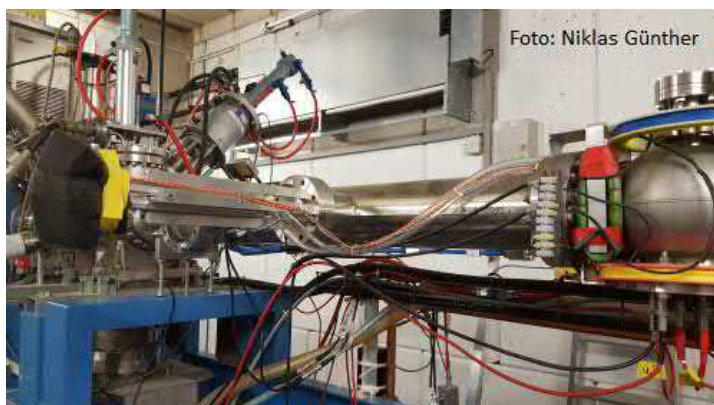
System Partner for Innovation

Non-destructive energy determination of ion beams

radiation energy, ion beams, calibration

DESCRIPTION OF TECHNOLOGY / PRODUCT

Ion beams are applied in many fields, such as medicine, semiconductor industry and basic research. In order to achieve precise results, high demands are placed on the beam quality. The non-destructive energy determination of ion beams is therefore a well needed technology.



Usually beam energies are determined by measuring the time difference a bunch needs to cover a specific distance in order to calculate the velocity and, arising from this, the amount of energy. The disadvantage of this method to determine the time term of a beam bundle over a certain distance is the disability to identify or to measure different proportions of energy in the beam bundle with precise spatial resolution.

The invention relates to a measurement device and a method to determine the energy of accelerated ions without destructing them. Beam ions push electrons (so-called cusp-electrons) out of the atoms of the penetrated medium. These electrons are accelerated into the same direction as the ion-beam is directed to and they have a velocity according to the energy of the beam ions. The innovation is based on the determination of this velocity and out of the velocity the resulting energy of the ion beam. This enables an improved controlling of the position of the beam as well as the beam energy.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- ion implantation
- ion beam etching
- analytics (SIMS)

MARKET / BRANCH

- basic research (particle-, nuclear- and high energy-physics)
- semiconductor-industry
- manufacturers for radiation sources of particle beams
- acceleration facilities

USP

- high spatial and energy resolution
- no disturbance of the ion beam
- no loss of intensity

DEVELOPMENT STATUS

- ✓ demonstrator available for calibration in research

SCOPE OF APPLICATION

The innovation can be used in numerous industrial application-fields, e.g. in semiconductor-industry (ion implantation, ion etching), and in analytics (secondary-ion-mass-spectroscopy, SIMS). Beyond that, there are also many application-possibilities in basic research and application-oriented research (particle physics, nuclear-/atomic- and high energy-physics).

ADVANTAGES COMPARED TO STATE OF THE ART

- high spatial energy resolution during the measurement
- no disturbance of the ion beam
- no loss of ions due to the measurement – preservation of the beam-intensity

DEVELOPMENT STATUS

The device for calibration is integrated in the GSI owned velocity filter SHIP, which was involved in the discovery of four atomic nuclei.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH the TransMIT GmbH is looking for cooperation partners or licensees for distribution or further development in Germany, Europe, the US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 715**

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System Partner for Innovation

Piezoelectric generator

Energy harvesting, sensor technology, regenerative energy production, wind power, hydropower

DESCRIPTION OF TECHNOLOGY / PRODUCT

The novel design principle presented here for a piezomagnetic high voltage generator facilitates the virtually wear-free construction of energy harvesting systems for various applications. A system of this kind can therefore be operated largely without the need for maintenance.

The piezomagnetic high voltage generator is made from very few components that are simple in design (i.e. with no complex wound armature coils made of steel and copper). Instead, the armature features strong permanent magnets. The stator is formed by permanent magnets arranged around the armature that are connected to the piezo elements accordingly. The rotary motion of the armature enables the oscillating compressive forces of the permanent magnets of the armature to be exerted without direct mechanical contact on the permanent magnets of the stator and therefore on the piezo elements. This leads to corresponding oscillating electric voltage/current that is suitable to be tapped without the need for a current collector.

SCOPE OF APPLICATION

The potential areas of application are extremely diverse. In the field of energy harvesting, it could be used in conjunction with conventional applications such as the supply of power to mobile end devices (consumer electronics), sensor technology, etc. The technology also offers enormous Potential for the optimization of electricity generators in high output ranges (e.g. wind power or hydropower) due to its contactless energy transfer design (mechanical→electric and when power tapping).

Furthermore, the technology is suitable for use in areas requiring protection against explosions due to the lack of spark discharge when tapping the generated electricity.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- Supply of energy
- Power generation, decentralized
- Electromobility

MARKET / BRANCH

- Supply of energy (regenerative)
- Automotive industry
- Consumer electronics
- Electronic access control systems
- Sensor technology

USP

- Direct high voltage generation
- Contactless energy transfer
- Good galvanic separation
- Virtually no mechanical wear
- Protection against explosions

DEVELOPMENT STATUS

- ✓ Functional demonstrators available on laboratory scale
- Next steps: development of functional prototypes

ADVANTAGES COMPARED TO STATE OF THE ART

The advantages of this piezoelectric generator include significantly reduced mechanical wear (contactless energy transfer, contactless power tapping) and the resulting increased service life, reduced operating noise, good galvanic separation and extremely flexible load adjustment options.

The design principle allows for the extensive adaptation thereof in order to achieve the desired power output, firstly by varying the size of the generator and the magnets used, and secondly by combining multiple individual generators in a modular layout.

DEVELOPMENT STATUS

There are demonstrators that have been able to prove their functionality. Functional prototypes are currently being developed that are set to undergo endurance tests under realistic conditions.

MARKET POTENTIAL

According to market projections, the forecast market share for piezoelectric-based generators for 2022 is estimated at 46%, which is higher, for example, than the current share of thermoelectric energy harvesters of approx. 46% (the market share for piezoelectric-based energy harvesters is now already estimated at 24%).

According to a study carried out by IDTechEx, global turnover of the market segment for energy harvesting components already amounts to approx. USD 163 million in 2014 (forecast for 2018: USD 596 million).

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH and as part of a SIGNO funding application currently being prepared, TransMIT GmbH is looking for cooperation partners or licensees for further development in Germany, Europe, USA, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 869**

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System Partner for Innovation

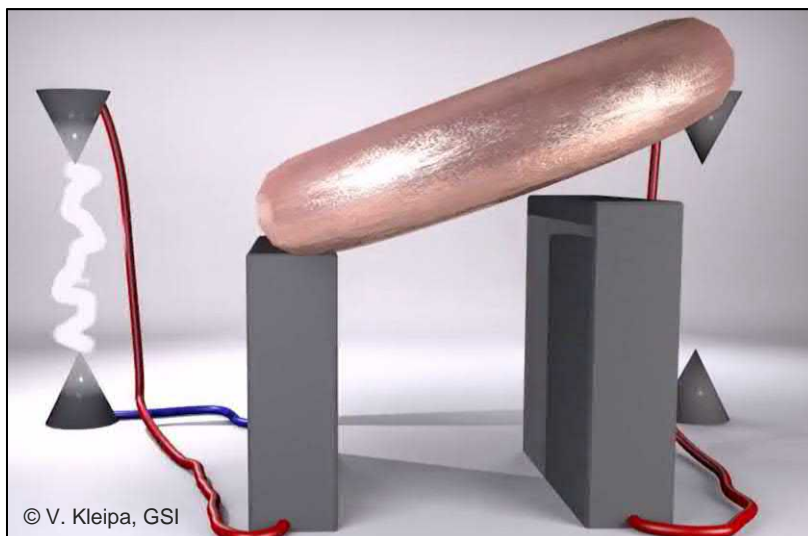
Galvanically decoupled electric energy supply for harsh environments

Nuclear power stations, strong magnetic fields, magnetic resonance tomography

DESCRIPTION OF TECHNOLOGY / PRODUCT

State of the art and its disadvantages

Electric devices in harsh environments (radioactive radiation, extreme temperatures and/or pressures, strong magnetic fields) require a galvanically decoupled voltage supply, which is free of interfering signals. Suitable sources are piezoelectric transducers, switching regulators or linear regulators. However,



these sources show different serious disadvantages. Known piezoelectric transducers operate only in narrow frequency ranges in their optimum. Switching regulators have a limited functionality in strong magnetic fields. Linear regulators show only low efficiency. Moreover, the power-converting components of switching regulators and linear regulators are based on radiation-sensitive semiconductors. Therefore, they cannot be used permanently in high-radiation environments (e.g. in close proximity to nuclear reactors).

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

Energy supply in harsh environments

MARKET / BRANCH

- Measurement technology
- Sensor technology
- Monitoring technology

USP

- Energy transmission in strong magnetic fields and/or high-radiation environments
- Easy galvanic decoupling

DEVELOPMENT STATUS

- ✓ Demonstrator under construction

REFERENCE No.: **TM 899**

Innovative Solution

The innovative piezoelectric energy transfer unit is ideally suitable for devices, which generate a strong magnetic field. This field can be used as an external supporting field for the energy transfer unit. However, the supporting field, which is indispensable for the functionality of the transfer unit, may be provided as well by means of strong permanent magnets. The primary circuit of the unit comprises a coil positioned in the supporting magnetic field, which is in mechanic contact with two stacks of piezoelectric elements in the secondary circuit. The coil is AC-fed and exerts alternating pulling and pushing Lorentz forces on the stacks of piezoelectric elements, which generate a corresponding AC power.

Compared to known piezoelectric converters, only one layered piezoelectric material is used in the secondary circuit. As the circuits of the coil and the piezoelectric elements are galvanically decoupled, an output voltage is produced, which is practically free of interfering signals.

The arrangement has high radiation hardness, because no semiconductors are used. Magnetic materials, which would lead to a low efficiency because of saturation in the supporting magnetic field, are as well not used. Depending on the design (stacking of the piezoelectric elements, amplitude and frequency of the coil current), high voltages or high currents may be generated.

SCOPE OF APPLICATION

This invention provides a universally applicable energy transfer unit, which allows to supply electric power free of interfering signals to any devices, even under extreme conditions. Depending on the application, current and voltage may be freely chosen. The energy transfer unit may be used close to nuclear reactors, magnetic resonance tomographs, but as well in the vicinity of generators and motors, where high magnetic fields prevail.

ADVANTAGES COMPARED TO THE STATE OF THE ART

The energy transfer unit has a very compact design. It is suitable for use under harsh conditions (e.g. in high-radiation environments). In a new manner, an easy galvanic decoupling of two electric circuits is realised.

DEVELOPMENT STATUS

A demonstrator is under construction.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for the further development of the innovative energy transfer unit in Germany, Europe, USA, and Asia. As well, potential users of this invention are sought.

A TECHNOLOGY OF



REFERENCE No.: **TM 899**

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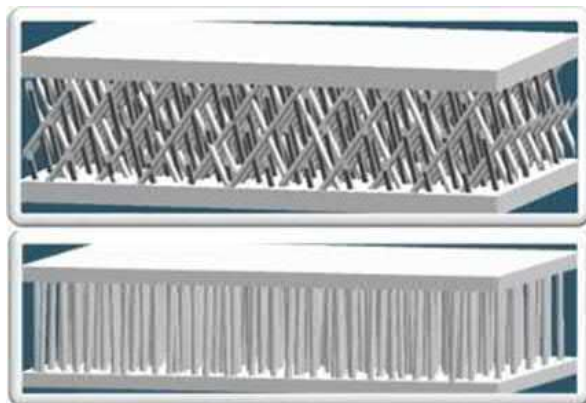
System Partner for Innovation

Nanowire structures made to measure

Micro reactor, catalyst, filter for gas sensor

DESCRIPTION OF TECHNOLOGY / PRODUCT

A method for the production of nanowires has been developed. The wires are arranged between two layers to avoid tangling of the wires. With this template-based procedure there is firstly used a dielectric foil for the breeding of nanowires, which will later be removed or rather chemically dissolved. Hereby, the fluid is guided through the chamber between the two layers. With the new production method, specific surfaces of up to 5 mm² / (cm² μm) can be realized.



The invention can also be used as a pre-filter for a gas sensor. Due to the large surface, it is possible to filter the gas flow and to absorb troublesome gases. Thus, the filtering of gases is possible by adjusting the spaces between the columns. An additional selection is possible through the use of different materials for the columns. Consequently, improvement of the cross-sensitivity of gas sensors is expected.

SCOPE OF APPLICATION

The invention can be used as a filter for gas sensors for the improvement of the cross-sensitivity and as a micro reactor or catalyst. Those have their scope of application in fire alarm systems, optical hydrogen sensors and in energy storage systems, such as in electric vehicle network.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

The invention is a new versatile nanowire structure element that is produced out of conductive material through a specifically pulsed electrochemical capture.

MARKET / BRANCH

- Electrochemistry
- Electric vehicle network
- Fire protection
- Treatment plant

USP

- Increase of security and quality
- High selectivity
- Better filtering
- Increased absorption
- Reduction of cross-sensitivity
- Prevention of poisoning

DEVELOPMENT STATUS

- ✓ GSI produces the nanowires per order

ADVANTAGES COMPARED TO STATE OF THE ART

- Production of nanowires from electrically conductive material
- Achievement of a large surface of the nanowires of up to 5 mm² / (cm² μm)
- Absorption of substances at the surface
- Fluids able to pass through, acts as catalyst
- Use as filter for gas sensors
- Increase of security and quality
- Reduction of rejects
- High selectivity, due to homogeneous and made to measure thickness of the wires
- Adjustable size of surface of the wire pillars
- Better filtering of gas energy
- Reduction of cross-sensitivity
- Prevention of poisoning

DEVELOPMENT STATUS

On the part of GSI, the innovative nanowires can be produced per order.

OFFER

On behalf of GSI Helmholtzzentrum für Schwerionenforschung GmbH, TransMIT GmbH is looking for cooperation partners or licensees for further development in Germany, Europe, US, and Asia.

A TECHNOLOGY OF



REFERENCE NO.: **TM 424**

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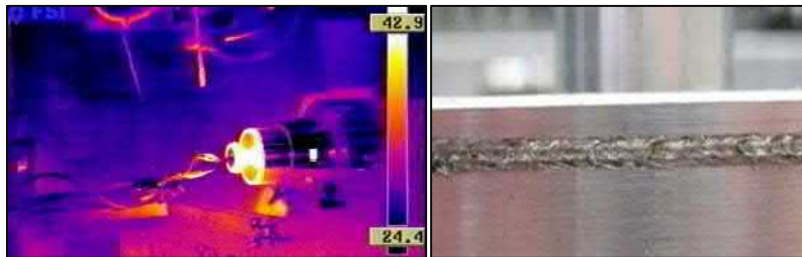
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System Partner for Innovation

Welding process for e.g. the hermetic encapsulation of integrated circuits, sensors and detectors

Welding technology, vacuum tight weld, low heat input



DESCRIPTION OF TECHNOLOGY / PRODUCT

In the modern, industrial manufacture the laser welding is already established because of the high degree of automatization, the welding speed, the narrow heat-affected zone, the low heat input as well as the low resulting warpage and the options within the context of industry 4.0.

Laser welding is preferred over arc or plasma welding because of the orders of magnitude, lower heat-affected zones and of complete warming of the component or workpiece arrangement, as well as the resulting high cooling rate. Especially the heat-affected zone and the total warming were extensively optimized.

The new developed laser welding technology serves the particle-free encapsulation of seal electronics against dust, humidity and gases. Generally, the firmly bonded connection procedure was improved in order to expand the application spectrum.

The innovative process is especially suitable for the high vacuum tight joining for ceramic-metal compounds and filigree aluminum plates or aluminum- stainless steel joint.

A thermal isolation institution made it possible to leave energy in the connecting area, through which less heat energy was removed. Therefore it succeeded in reducing the heat input.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- Manufacturing technology
- Welding technology
- Vacuum-tight housings
- High vacuum-tight electric per-forming

MARKET / BRANCH

- Sensor and measurement technology
- Medical engineering
- Microelectronics
- Semiconductor industry
- Automotive industry
- aerospace
- Machine and plant construction
- Vacuum technology

USP

- Reduced heat input
- Protection of thermal burden
- Joining of different thick assemblies
- Water-, dust- and gas-tight

DEVELOPMENT STATUS

- ✓ Under usage of a CO2 laser the surface protection of semiconductor detectors by means of this joint procedure will be realized
- Next steps: validation projects with the industry for specific use

ADVANTAGES COMPARED TO STATE OF THE ART

The reduced heat input not only enables a saving of energy, but also protects the remaining areas of the workpiece arrangement of unnecessary thermal load burden. This can also be applied to the integrated assemblies such as measurement elements, sensors, wires or detectors.

Also the joining of workpieces with divergent sizes is possible by means of the thermal isolation without preheating or multi-layer procedures. Thus the heat dissipation is stopped through the thicker connecting area, and damage of the thinner is prevented because of the increased thermal energy entry.

Also very different thick assemblies can be used for formation of a housing or rather for an encapsulation it is possible to reduce the total weight of the housing.

The production of a particularly durable, stable and thick housing is also possible with this technology.

If necessary it is furthermore possible to reopen the connection and to weld it together again.

Additionally semiconductors such as circuit boards and sensor technology for extreme environments work without the encapsulation with synthetic material.

DEVELOPMENT STATUS

Besides the optimization of the laser welding, under usage of thermal isolators a top part for laser welding head was developed.

MARKET POTENTIAL

The world market for welding products, according to BBC Research, almost reached \$18,4 billion in 2013. Until 2014, the market is estimated to grow up to \$19,3 and until 2019 up to \$25,1 billion with an average growth rate of 5,3 %.

OFFER

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A TECHNOLOGY OF



REFERENCE NO.: TM 488

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System Partner for Innovation

Innovative algorithm for correcting bit errors in digital storage media

Error correcting code (EEC),
correction program, error recognition,
redundant digital data storage, ASIC

DESCRIPTION OF TECHNOLOGY / PRODUCT

Microprocessors, logic circuits and digital memory components, are used basically everywhere in the area of digital electronics. These devices

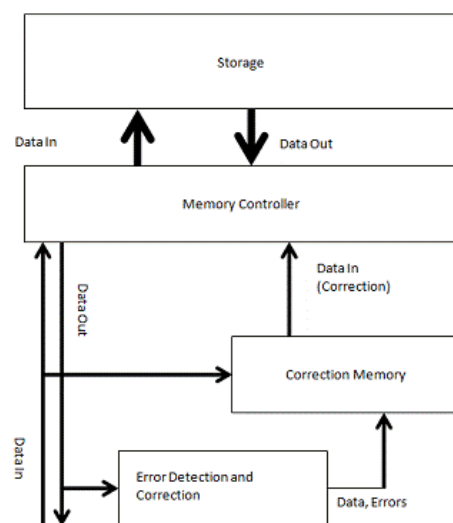


Bild: Jörg Krause TransMIT GmbH

are flexibly used for solving all types of tasks in numerous areas, e. g. telecommunication, multimedia, control engineering and measurement technology. A problem associated with the use of digital electronic components is the occurrence of soft errors due to thermal noise. The warmer a component gets or the smaller an electronic structure is, the more frequently this effect occurs.

Therefore – due to

the unbroken trend of miniaturisation of modern electronics/digital electronics – error correction is gaining increasing importance.

In an electronic component (hard wired logic circuits), one or more bits can inadvertently change the state of the circuit due to thermal fluctuations. This is called Single Event Upset (SEU). If such a negative effect affects a digital storage medium, it may alter the information stored. In this regard, measured values

can be falsified. If this involves a command in a program memory, it may cause a malfunction of the software or even a complete system crash.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- microprocessor technology
- software development
- manufacturing of electronic components (ASIC)

MARKET / BRANCH

- chip manufacturers
- semiconductor Industry

USP

- cheap and compact memory controller
- no redundant reference memory necessary
- reduced error rate / free error coding
- no interference with the data processing procedures / independent from the type of data processing

DEVELOPMENT STATUS

- ✓ implemented as ASIC.

REFERENCE NO.: **TM 727**

Appropriate measures against the occurrence of SEUs must be taken to prevent such adverse effects. Alternatively, repair mechanisms as provided by the present invention can be utilized.

The new correction system (error correction code, ECC) for bit errors solves the problem by combining error detection and error correction in memory words. Memory cells containing the incorrect content are subsequently overwritten with the correct content. The method does not depend on the type of error correction and is therefore universally applicable.

SCOPE OF APPLICATION

The innovation presented here is most preferably applied in the area of electronic production, e.g.:

- microprocessors
- memory chips
- ASICs („application specific integrated circuits“)

ADVANTAGES COMPARED TO STATE OF THE ART

- The innovation facilitates a cheaper and more compact memory controller.
- Instead of a redundant reference memory, only a small correction memory is necessary.
- The error rate is significantly minimized and the error code can be freely selected.
- The data processing procedures are unaffected by the correction.
- The invention is applicable regardless of the type of data processing.

DEVELOPMENT STATUS

The method has been implemented in an ASIC and is internally used.

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A TECHNOLOGY OF



REFERENCE NO.: **TM 727**

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System Partner for Innovation

Time dynamic 3D data visualization for GPU hardware

Graphics processor, GPU, imaging,
graphic card, GPU computing

DESCRIPTION OF TECHNOLOGY / PRODUCT

The visual representation of data, e.g. of data from mathematical calculations, is already widespread and will become increasingly important. Especially with very large amounts of data as well as with data, which have to be visually shown in real time, it is important that the graphics processor software is of highest efficiency. The invention presented here

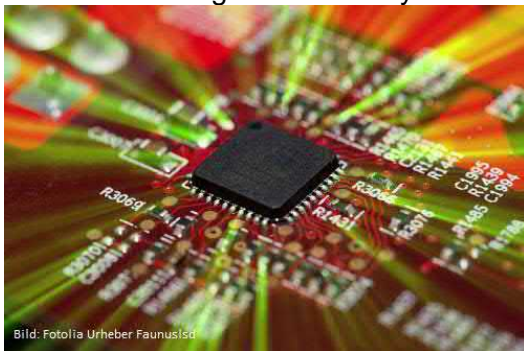


Bild: Fotolia Urheber Faunus123

is a procedure which can be profitably implemented into a graphics processor to contribute to a noticeable increase of performance. It offers a significant improvement

compared to the „Marching Cubes algorithm“ by W. E. Lorensen and H. E. Cline and consists of the following four steps:

- 1.) Identification of an intermediate hypersurface between two matrix elements, which partially matches one of the two hypersurfaces,
- 2.) Representation of this intermediate-hypersurface through neighboring points,
- 3.) Connection of these neighboring points in pairs through closed curves, and
- 4.) Combination of the thus obtained partial hypersurfaces resulting in a complete hypersurface.

AT A GLANCE ...

TECHNOLOGY FIELD / SCOPE OF APPLICATION

- 3D animation
- Visualization of the results of mathematical simulations
- Graphic card computing cluster

MARKET / BRANCH

- Entertainment industry / film industry
- Scientific research
- Material technologies

USP

- Depiction of unclosed boundary of hypersurfaces
- Depiction of data in case of unfavorable distribution of measurement values

DEVELOPMENT STATUS

- The invention is used at the GSI for performing mathematical simulations in the research area of particle physics.

SCOPE OF APPLICATION

Due to the procedure's good hardware (graphics processor) implementability, it offers a wide range of applications, both in scientific and in commercial areas. For this reason, we preferentially address graphics processor manufacturers or graphics processor programmers. Time-variant three dimensional spaces as well as 3D animations can be easily contoured:

- 3D cartoon display,
- real time presentation, e.g. in the area of medical imaging procedures (positron emission, ultrasound, magnetic resonance imaging),
- mathematical simulations,
- assembly of bigger computing clusters out of graphic cards.

ADVANTAGES COMPARED TO STATE OF THE ART

The special advantage of the invention is that also non-closed borderlines of hypersurfaces can be calculated reliably, especially if the measured values are spread unfavorably. As a result, irregular data matrices can be displayed reasonably as well.

DEVELOPMENT STATUS

Since 2003, the software STEVE (GSI in-house development) is used to determinate freeze-hypersurfaces for multi-particle production (which are caused by heavy-ion collisions) out of 4-dimensional relativistic hydrodynamic mathematical simulations. The invention is a further development of this software.

MARKET POTENTIAL

In 2015, the industry leaders in the manufacturing of graphic cards, AMD and Nvidia, together reached a sales volume of appr.8 billion USD (<http://www.finanzen.net/>). On its homepage (<http://www.nvidia.de/object/gpu-computing-de.html>), Nvidia promotes GPU computing, which very much subserves the spreading of this technology.

OFFER

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A TECHNOLOGY OF



REFERENCE NO.: **TM 898**

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System Partner for Innovation