SNAPS

Applied MedTech technologies

New X-ray technology: dark-field computed tomography

The new X-ray technology works with a considerably lower radiation dose, namely only one fiftieth of the radiation as conventional computer tomographs. This progress allows the use in significantly broader medical applications, an optimisation of the early detection as well as the course of therapy of chronic obstructive pulmonary diseases.

While conventional X-ray imaging aims to attenuate the X-ray light as it travels through the body, dark-field technology uses the parts of the X-ray light that are scattered and deflected from the straight path. These remain unnoticed and thus unused in conventional X-ray procedures. Dark-field X-ray therefore makes use of the physical phenomenon of scattering, whereby the X-ray light behaves like a wave. Scattered light has been used for a long time for examinations with visible light, namely in the procedure of dark-field microscopy. In this way, structures of almost transparent objects can be illuminated with visible light and thus made visible, so that they appear as bright structures against a dark background.

Since no suitable lenses can be produced for X-ray light and the microscope method can therefore not be transferred, X-ray dark-field imaging uses gratings as optical elements. Through the arrangement of fine grating lines, which are only a few micrometres thin due to the small wavelengths, the light waves overlap and the X-ray light passes through the various openings onto the object. This interference creates patterns of light and dark areas that can be made visible by using a detector or photographic film. The object under examination, which is exposed to the light, changes these patterns so that the structure of the object can be inferred from them.

For dark-field imaging with X-ray light, a total of three gratings are used. The X-ray light is produced by a conventional X-ray tube, passes through the three gratings and is finally detected by a detector. The detector replaces the X-ray film of a conventional X-ray image and works comparatively like the chip of a digital camera. During such an X-ray examination, the patient is located between the second and the third grid. A conventional X-ray image is then formed on the X-ray detector, which is superimposed by a thin stripe pattern. In addition, the scattering additionally weakens the resulting pattern so that individual body/image areas are imaged more strongly or weakly depending on the deflection of the scattered rays.

INNOVATIVE RESEARCH APPROACH

- **Research institute:** TU München
- **Technology:** Dark-field computed tomography
- **Field of application:** early detection of lung diseases
- **Advantages:** less radiation exposure; early detection; optimisation of the course of therapy
- **Contact person**: Prof. Dr. Franz Pfeiffer
- **Website:** https://www.bioengineering.tum.de/

Scattering can be detected particularly strongly at interfaces between materials with different densities, such as between air and tissue. Dark-field imaging with X-ray light, to analyse this scattered X-ray light and to infer the corresponding tissue structures from the measurement results. In this way, areas with functional, air-filled alveoli can be clearly differentiated in a dark-field image of the lungs from regions where there are fewer or hardly any functional alveoli. It can thus help to diagnose changes in the alveoli and thus make an important contribution to the diagnosis of lung diseases.

Are you interested in advanced medical technologies?

Feel free to visit our arcoro SNAPS library at https://arcoro.de/en/snaps/ and get excited about modern technologies!

arcoro

Your Connection to MedTech Expertise