

Optics | Medical Imaging | Medical Technology | Technology Offer

# Adaptive mini-lenses for high-resolution magnetic resonance imaging using integrated light microscopy

## Field of application

In biomedical research, the study of model organisms and their metabolism is the key to a better understanding of countless diseases. NMR technology is ideal for this due to its high soft tissue contrast. However, due to the lower resolution, it is not always easy to identify the structural features known from light microscopy.

As part of a funding program of the Baden-Württemberg Stiftung gGmbH, a technology was developed that combines two conventional methods in one device: NMR and light microscopy. This makes it possible to combine the functionalities of both systems and use them simultaneously. The combination also paves new ways for medical diagnostics.

## State of the art

Conventional magnetic resonance imaging devices (MRI) have integrated camera systems, but these are not suitable for optical microscopy. Conventional microscopes cannot be integrated into MR systems, as either their partially magnetic materials and drives would disturb the magnetic field or the strong magnetic fields would disturb or even destroy the electronic components.

## Innovation

The heart of the combined system is an adaptive lens that enables focusing by means of fluid pressure. The lens is embedded in a non-magnetic apparatus for immersion microscopy. Due to the microscope's compact design, it can be integrated into a commercially available small animal MRI. As a result, the user can examine the sample by using optical microscopy and MR technology at the same time, without interference between the two methods. This is particularly helpful as the MR image can now be compared immediately with its light microscopic counterpart, which has a significantly higher resolution. Thanks to the innovative adaptable lens, the object itself does not need to be moved for focusing. The optical observation plane is perpendicular to the axis of the magnet and the optical path is angled in a way that the RF-shielded camera can be mounted parallel to the magnet. Reflected and transmitted light (also dark field) are realized by means of light guides.

## Patent portfolio

An EP patent application (EP2824471 A1) is pending.

## Your benefits at a glance

- ✓ Use MRI and optical microscopy in one device at the same time
- ✓ Benefit from adaptable, interference-resistant mini optics
- ✓ Deploy an immersion microscope insensitive to magnetic fields
- ✓ Integrate an optical microscope into a conventional MR apparatus on a small animal scale

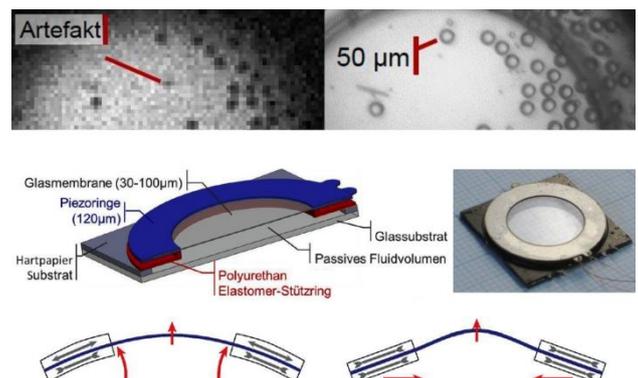


Figure: Identical section of an MR (top left) and optical image in high resolution (top right). Lens structure (center-left) and prototype (center-right) as well as mode of operation in bend mode (below).

## Technology transfer

Technologie-Lizenz-Büro GmbH is responsible for the exploitation of this technology and assists companies in obtaining licenses.

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