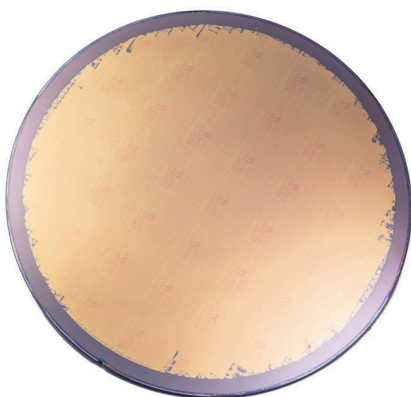


# Photoacoustic spectral imaging with unique detection capabilities

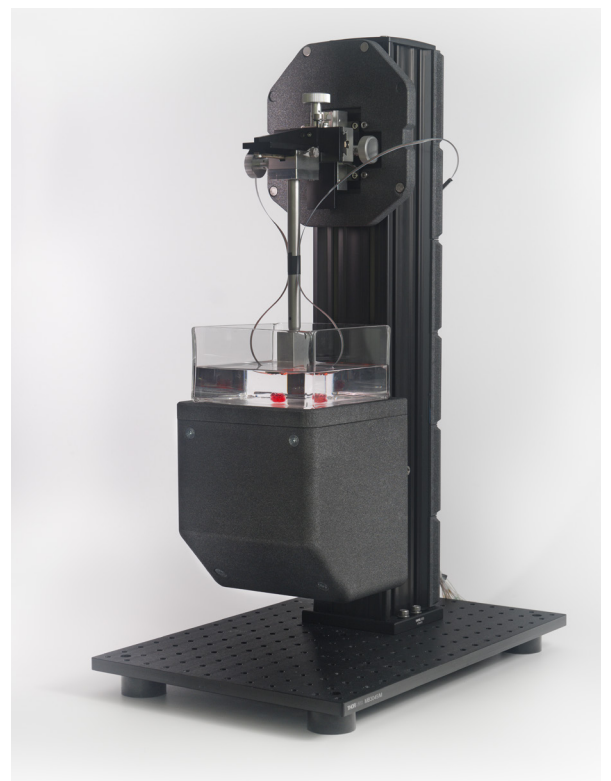
Photoacoustic spectral imaging is one of the most exciting 3D molecular imaging techniques, with applications in the medical field. Imec has developed a very compact, highly sensitive acoustic detector to revolutionize the early detection of breast cancer and non-invasive glucose monitoring.

## Photoacoustic spectral imaging

In photoacoustic spectral imaging for medical applications, human tissue is illuminated with harmless pulsed laser light, penetrating deep into the tissue. This causes local temperature fluctuations which lead to sound waves being reflected from the tissue. These sound waves can be recorded by acoustic detectors and thus be translated into a high-resolution image of the inside of the tissue. By using different wavelengths of light, different tissue components can be detected (water, blood vessels etc.). This technology combines both the high contrast of optical imaging and the deep penetration of acoustic imaging.



Wafer with ultra-sensitive, small optomechanical ultrasound sensor-in-silicon-photonics



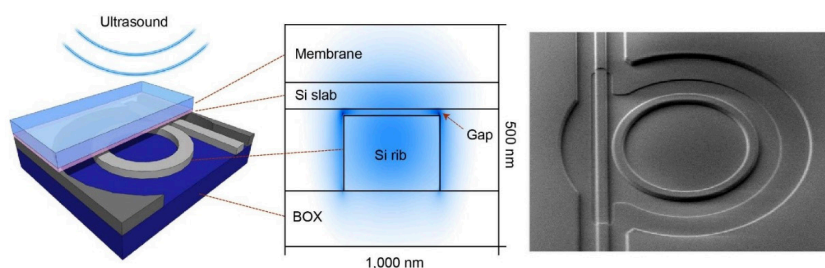
Photoacoustic demonstrator combining LED excitation and OMUS detection

## Ultra-sensitive, small optomechanical ultrasound detector

- **Unprecedented sensitivity** of two orders of magnitude larger than state-of-the-art devices. The high sensitivity is realized thanks to an innovative split-rib optomechanical waveguide.
- **Low detection limit**, improving the trade-off between imaging resolution and depth. This is crucial because pressures are up to three orders of magnitude lower than in conventional ultrasound imaging techniques.
- **CMOS-compatible manufacturing**, enabling cost-effective fabrication of detector arrays to generate 2D and 3D images. A fine-pitched (30 $\mu\text{m}$ ) matrix of these 20 $\mu\text{m}$ -sensors can be easily integrated on-chip with photonic multiplexers.
- **Deep tissue imaging** for non-transparent tissues such as skin or brain.

## Potential applications

- Breast cancer imaging
- Non-invasive glucose monitoring
- Imaging of the brain during surgery
- Rheumatoid arthritis screening and follow-up
- Skin tumor screening and diagnosis
- Intra-operative imaging using miniaturized catheters or endoscopes



Cross-section and SEM image of imec's opto-mechanical ultrasound sensor.

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