NorMIT
Norwegian Centre for Minimally Invasive Image Guided Therapy and Medical Technologies

NEWSLETTER

Photo:Gunnar Gjeldnes

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Interdisciplinary collaboration in the hybrid operating room

Ole Jacob Elle, professor The Intervension Center, Oslo University Hospital

Interdisciplinary collaboration in hybrid operating theaters is the treatment of the future. At the Intervention Centre, Rikshospitalet OUS, health personnel work interdisciplinary. Operating room nurses, radiographers and nurse anesthetists work together to treat the patients. Interdisciplinarity is not a goal in itself, but to optimize patient care.

Catheter-based image-guided treatments at the Intervention Center can replace major surgical operations such as catheter-based heart valves (TAVI) or treatment of aortic aneurysms.

It is predicted that there will be more hybrid interventional procedures in the future. We are facing a wave of elderly people, and according to the Cancer Registry, a sharp increase in cancer patients is expected up to 2030. The patients of the future will need more minimal invasive procedures.

Notification to the Norwegian Parliament, Stortingsmelding 13 (2011-2012), states: "The changes in the health services require new ways of working. More of the work will be done in interdisciplinary teams, and there will be more collaboration between the various professional groups"

Complex technological intervention procedures require higher professional competence than before. New technology requires new professional groups into the health care and hybrid classrooms, such as engineers, programmers, mathematicians and physicists. At the Intervention Centre, a CT machine can be driven into two hybrid operating theaters on rails. The X-ray images can be used to confirm treatment or for 3D navigation for precise navigation and treatment.

Photos: OUS

Current projects using NorMIT infrastructure

Sigrid Berg, Research manager
SINTEF Digital, Department of Health Research

Fatty liver disease characterization by Sonography

In the project "Fatty liver disease characterization by Sonography (2022-2023)" financed by The Liaison Committee for Education, Research and Innovation in Central Norway, researchers at SINTEF collaborate with the Regional Centre of Obesity Research and Innovation (ObeCE) at St. Olavs Hospital and engineers from SURF Technology AS to implement and test a novel ultrasound method for quantitative measurements of fat content in tissue. The technique is based on non-linear acoustics and estimation of an elastic tissue parameter called nonlinear compressibility. The research ultrasound platform Verasonics Vantage system has been used together with a custom-made ultrasound transducer that is capable of transmitting two distinct frequencies simultaneously. The goal of the project is to test and validate an ultrasound method for diagnosis of fatty liver disease. The disease is characterized by the accumulation of fat in the liver, and in patients with untreated fatty liver disease, the condition can eventually lead to inflammation, the formation of scar tissue and a significantly increased risk of chronic liver disease or liver cancer.

During 2022, the method has been tested in tissue mimicking materials (in vitro) with various amounts of added fat, and in a preclinical study (in vivo) where rats were fed a high-fat diet to develop fatty liver disease. The results from experiments show very promising result, and the next step is to test the method in patients with suspected fatty liver disease. A publication describing the in vitro experiments was submitted in 2022 (due to be published in Q1 2023) and a publication on the in vivo experiment is in preparation.

Lymph node characterization with quantitative ultrasound methods.

In a project funded by The Liaison Committee for Education, Research and Innovation in Central Norway, SINTEF is working in collaboration with ISB and pulmonologists at St. Olavs Hospital and Levanger Hospital to improve characterization of mediastinal lymph nodes in lung cancer patients. The Verasonics Vantage system is used to quantify the stiffness of the tissue by using an implementation of shear wave imaging. Both clinical linear transducers and on a custom-made dual frequency transducer have been used. The latter transducer is also used for assessing the nonlinear compressibility, similar to what is done in the characterization of liver fat. We hypothesize that both tissue stiffness and the nonlinear compressibility can be of diagnostic value when differentiating between benign and malignant lymph nodes.

Ultrasound research system, with real-time channel data transfer and processing capabilities. Features:
-256 Transmit channels/ 256 Receive channels
-Universal Transducer Adaptor with dual 260-pin connectors
-External HIFU power supply
-Extended Transmit Option (when external power supply is connected
-PCI Express cable and PCI express PC interface card
-Performance Host Controller - includes installation of PCI express adapter card; installation offirmware and drivers; custom configuration of BIOS; loading of VERASONICS software including HAL, VSX, example scripts and licenses; thorough testing of the entire configuration

Improved ultrasound-guided resection of brain tumors

In a qualification project financed by the Research Council of Norway, researchers at SINTEF have developed a method for improved ultrasound imaging of brain tumors. The method is implemented on the Verasonics Vantage platform and the clinical transducer L8-18i from GE Healthcare is used. The method has been on tissue-mimicking materials in the lab, and together with neurosurgeons at St. Olavs hospital the method will be tested on patients who are scheduled for surgical removal of brain tumors.

Few cancers have proven to be as difficult to treat as malignant brain tumors, and the prognosis remain dismal for the most common types. Maximal surgical resection of the tumor has been shown to be very important in increasing survival. However, it is often difficult for the surgeon to distinguish between tumor and healthy tissue, this is especially true towards the end of the surgery when he or she approaches the outer border of the tumor. Both before and during the surgery it is useful to use ultrasound to image the tumor and the surrounding area. As tumor tissue is removed it often becomes increasingly difficult to interpret the images and find the boundary between the tumor and healthy brain tissue. By improving the image quality of the ultrasound images, especially towards the end of the surgery, the surgeon can get a tool that makes it easier to remove the last important millimeters of the tumor.

Characterization of transducers in preclinical research

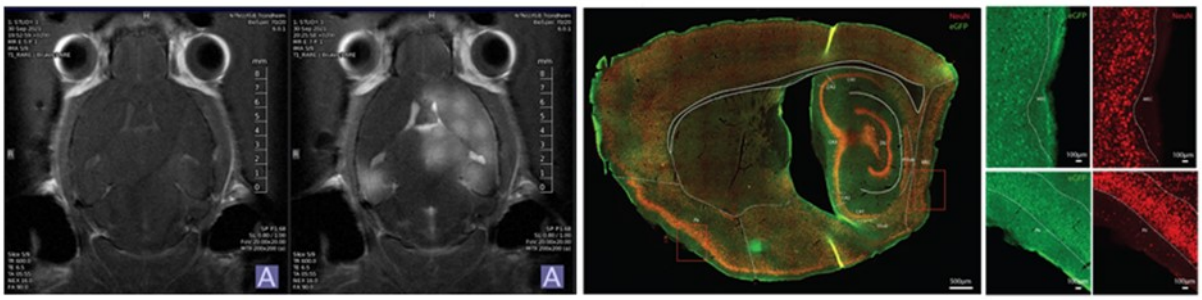
Catharina de Lange Davies, professor
Department of Physics at NTNU

Water tank-hydrophone system (Onda AIMS III Scanning Tank)

The water tank-hydrophone system is used regularly to characterize the acoustic field from various ultrasound (US) transducers. In 2022, we have particularly used the system to characterize a new 1 MHz transducer from Precision Acoustics and a custom-made dual frequency transducer at 0.5 MHz and the 5th harmonic.

Magnetic Resonance imaging (MRI) guided ultrasound (FUS Instruments RK-100)

The MRI guided ultrasound system from FUS Instruments, has been used in a pilot project to open the blood-brain barrier locally at predefined brain areas to deliver genes to brain areas affected by Alzheimer's disease.



Pre and post MRI images of mouse brain showing localized enhanced intensity in US treated areas (bright spots), and an example of a brain tissue section stained to image transgene expression by neurons (red and green) in specific brain regions.

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Go to normit.no for more information!

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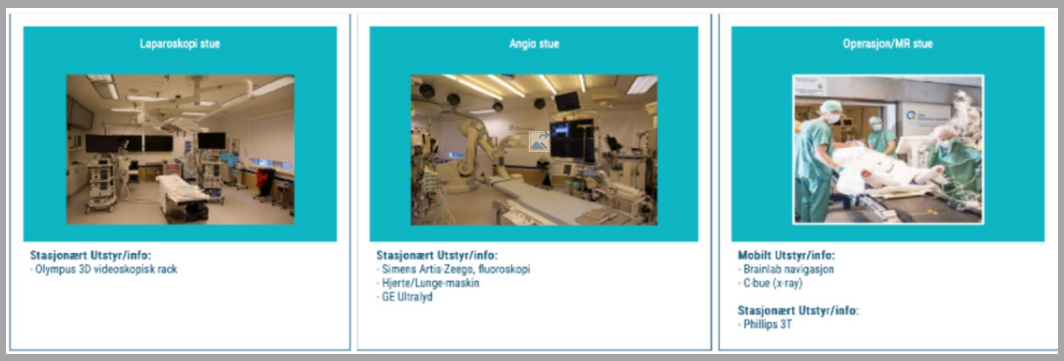

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