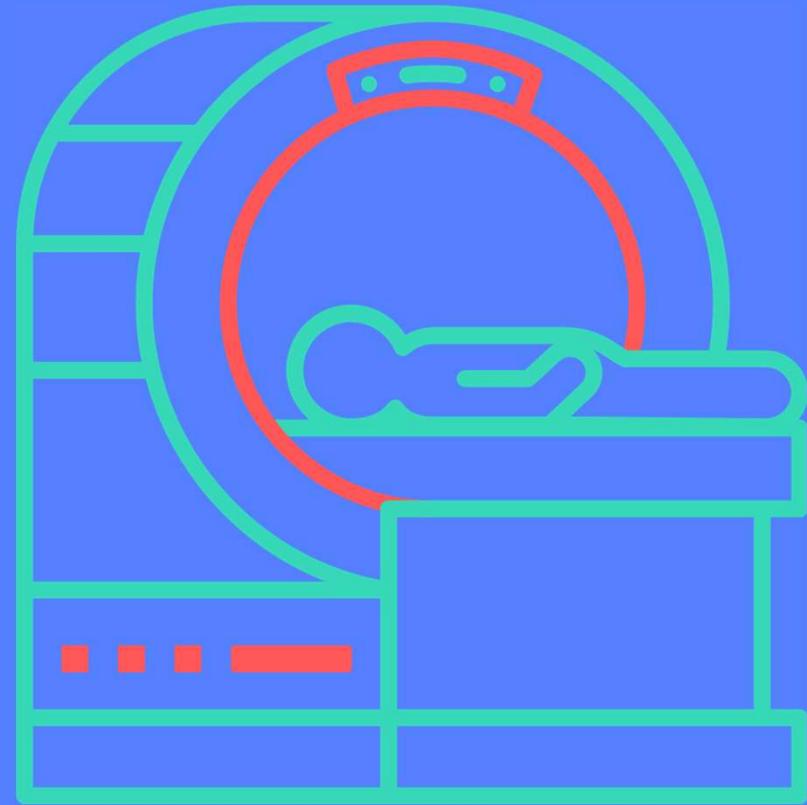


MRI PHYSICS

Presented by Jennifer Hughes

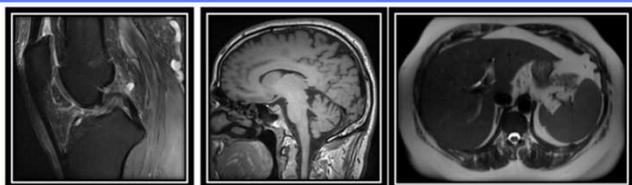


MAGNETIC RESONANCE IMAGING

- **Magnetic Resonance Imaging (MRI)** uses a combination of magnetic fields and radio waves to produce high resolution images of the human body.
- Clinical scanners have a typical field strength of 1.5 or 3 Tesla (30,000 - 60,000 times the strength of the Earth's magnetic field).
- Static field strength achieved using Superconducting magnets.



Anatomical Imaging What anatomy looks like

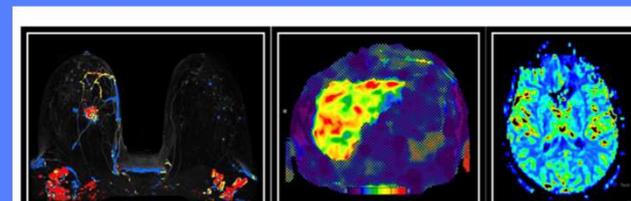


SAGITAL KNEE

SAGITAL BRAIN

AXIAL ABDOMEN

Functional Imaging How tissues behave



BREAST MRI (COLOR MAP)

ELASTOGRAPHY (LIVER)

PERFUSION (BRAIN)

MRI PHYSICS ROLE



MRI
SAFETY



CLINICAL AND
TECHNICAL
SUPPORT



EQUIPMENT
SUPPORT

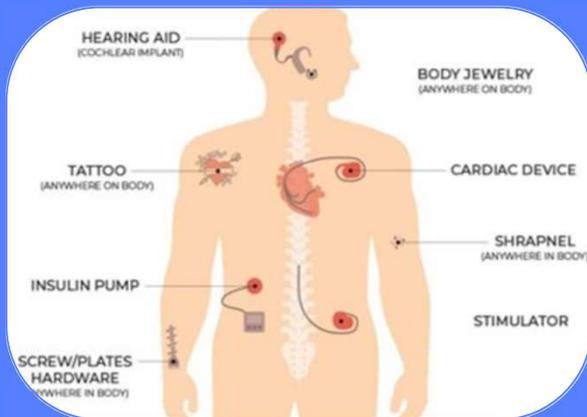


RESEARCH AND
DEVELOPMENT



TEACHING AND
TRAINING

MRI SAFETY



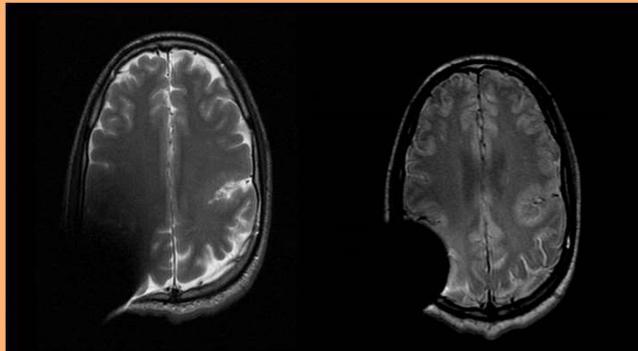
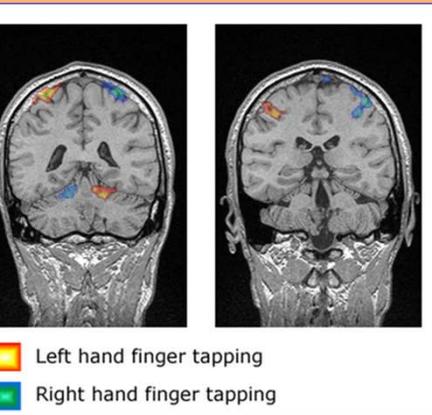
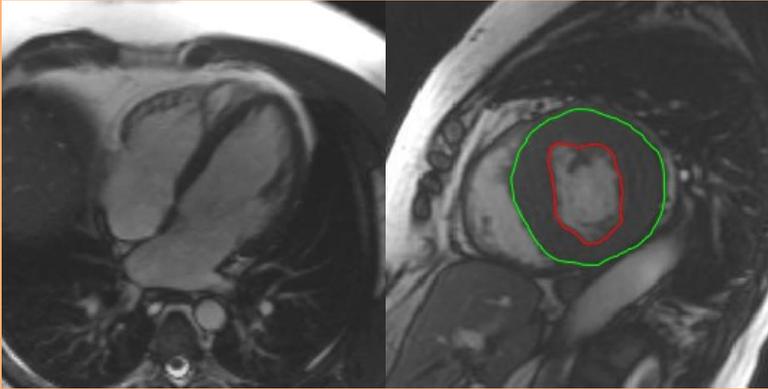
SAFETY RISKS

- Inherently safe as no ionising radiation
- Safety risks
 - Static magnetic field - projectile effect
 - Time-varying magnetic field - PNS, inappropriate triggering of active devices
 - Radiofrequency field - heating

SAFETY WORK

- MRI Safety queries/implant policies
- Local Rules
- Risk Assessments
- Incident Reporting
- Individual Site Support

CLINICAL AND TECHNICAL SUPPORT



Metallic susceptibility artefact, brain scan of a cochlear implant.

CLINICAL

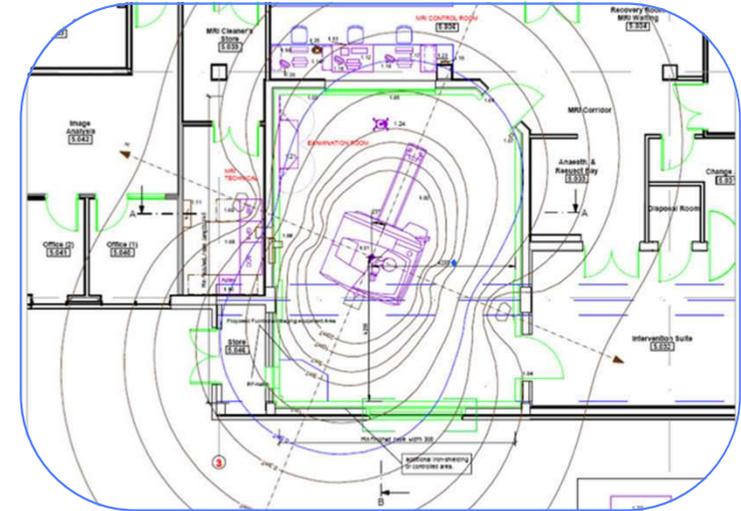
- Quantitative measurements
 - Cardiac scans
 - Breast scans
 - Liver iron quantification

TECHNICAL

- fMRI equipment setup and paradigm running.
- Scanner support
 - Artefact reduction
 - SAR minimisation

EQUIPMENT SUPPORT

- Procurement of new MRI scanners and ancillary equipment
- Acceptance testing
- Routine Quality Assurance



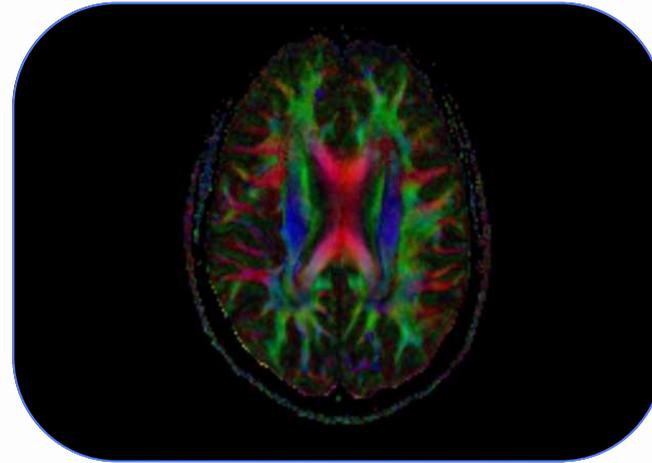
Mapping MRI field lines as part of planning scanner position



2020 installation of 1.5T scanner in Stracathro

RESEARCH AND DEVELOPMENT

- Commercial and University research projects
 - Drug trials
 - Patient cohort studies
 - fMRI studies
- Service Development
 - Investigating new technologies, sequences etc.



Diffusion Tensor Imaging (DTI) using Simultaneous Multislice (SMS)

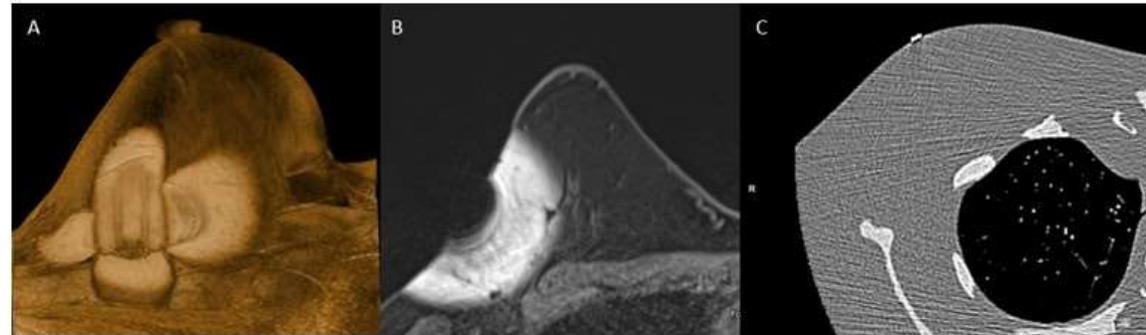
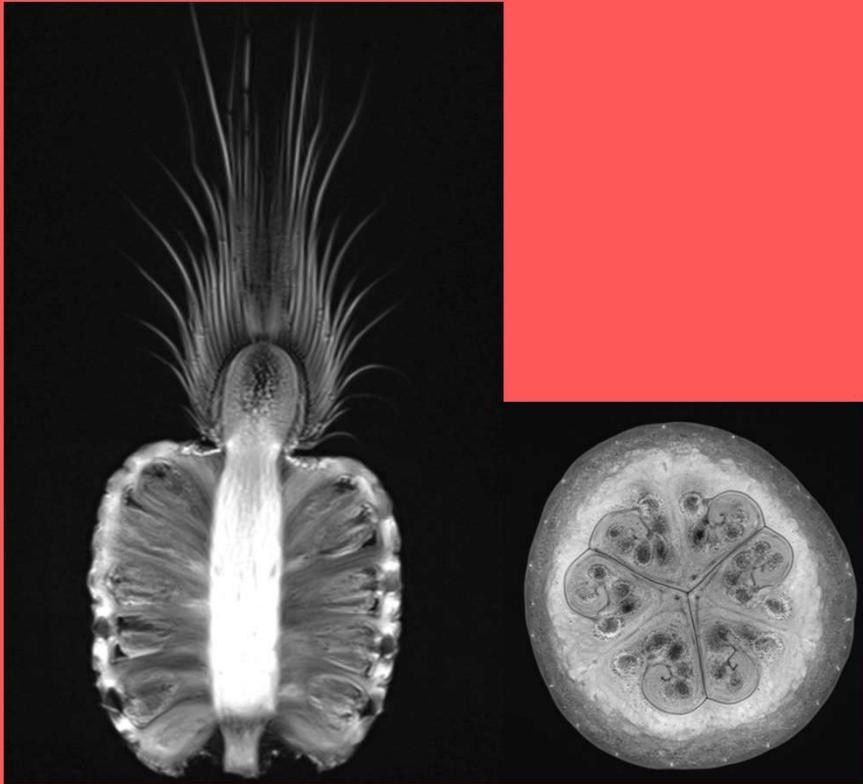
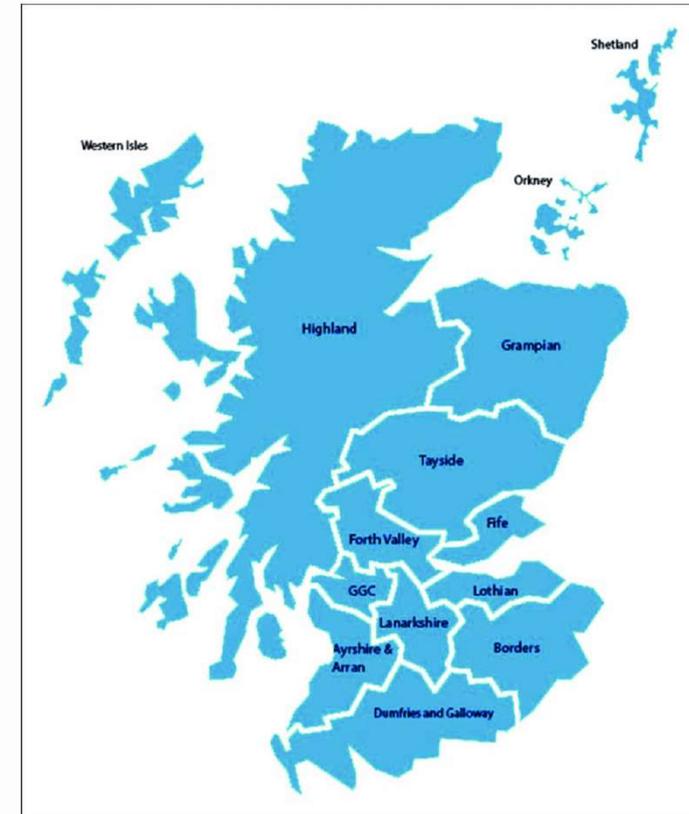


Figure 1: Three images from different scanning performed with the Magseed. A – 3D surface render of Magseed artefact on MRI imaging of a healthy volunteer on a T1 dynamic gradient echo sequence. B – Magseed artefact with area of failed fat saturation on a T1 dynamic gradient echo sequence. C – CT artefact measuring 5mm of Magseed positioned R>>L.

TEACHING AND TRAINING



- Safety training for different MRI staff groups
- MRI physics lectures for Physicists, Engineers and Radiologists
- Trainee supervision
- MSc/PhD supervision



Inverness MRI VR App

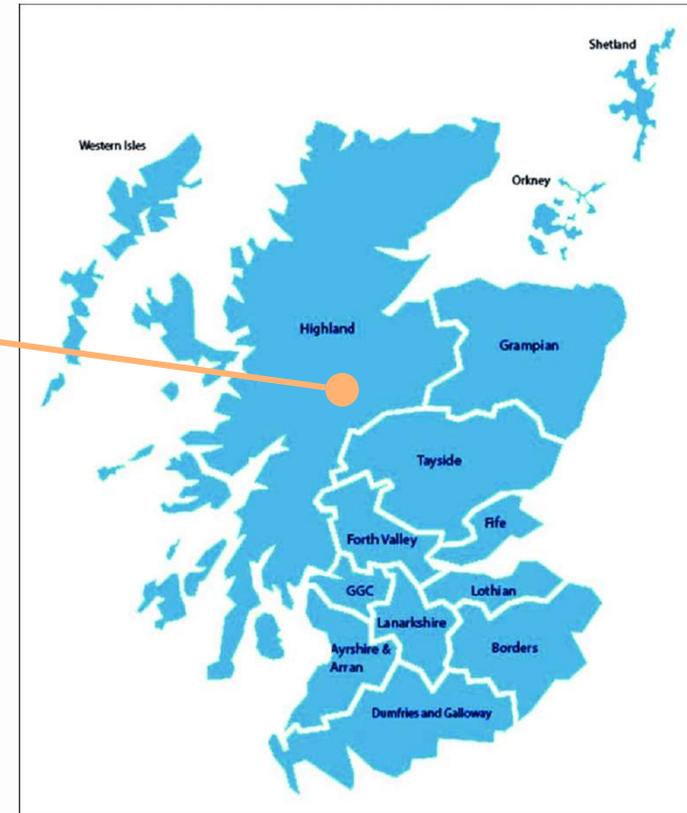
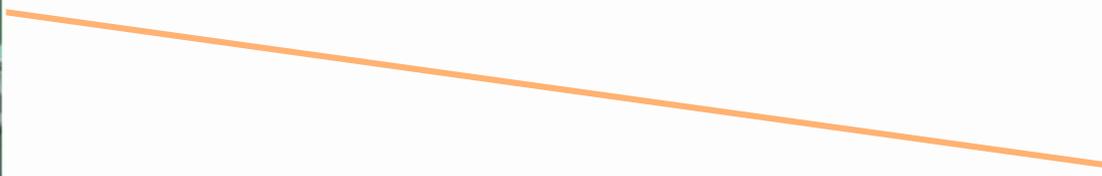
NHS Highland utilising VR headsets to aid patients preparations for MRI scans

By Chris MacLennan January 22 2019 9:02 am

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To Try:
“My MRI Buddy”
from your app store



Inverness MRI VR App

NHS Highland utilising VR headsets to aid patients preparations for MRI scans

by Chris MacLennan January 30 2019, 9:40 am

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Aberdeen Fast field cycling

Significant grant for world's first Field Cycling Imaging hospital scanner

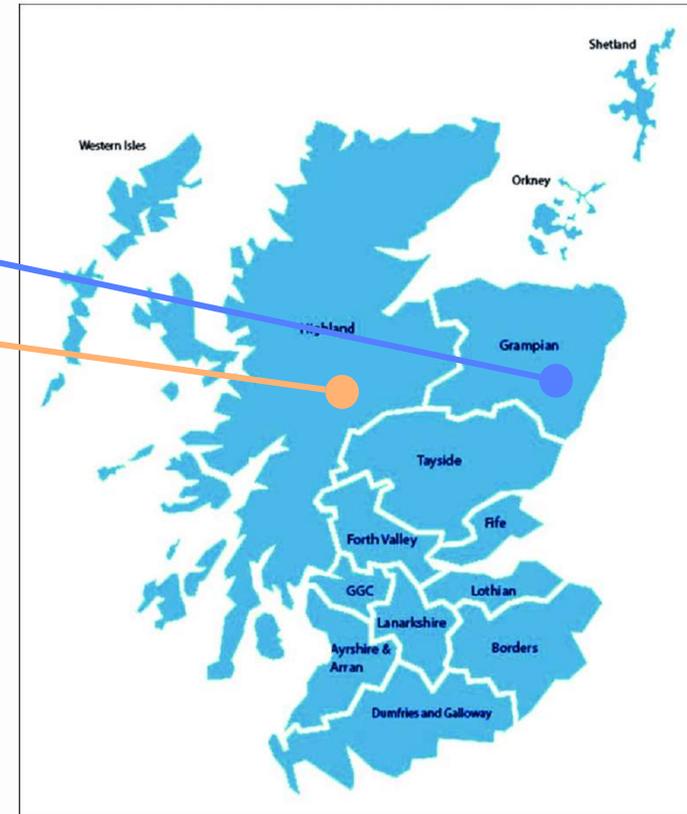
25 January 2022

The University of Aberdeen's world-first fully operational Field Cycling Imaging scanner and suite has received a generous grant from the Wolfson Foundation.

The grant of up to £723,000, generated by the University of Aberdeen Development Trust, will support the creation of a new patient focussed version of the Field-Cycling (formerly Fast Field-Cycling MRI) scanner in a newly refurbished imaging suite within Aberdeen Royal Infirmary.

Field-Cycling Imaging (FCI) is a new technology that can produce detailed images of the inside of the body. It can be used to detect effects of diseases and other issues that are otherwise invisible to the likes of MRI and may appear earlier than what is currently detectable.

The Wolfson Foundation's generous grant brings donations for the new scanner and imaging suite to almost £1.5 million.



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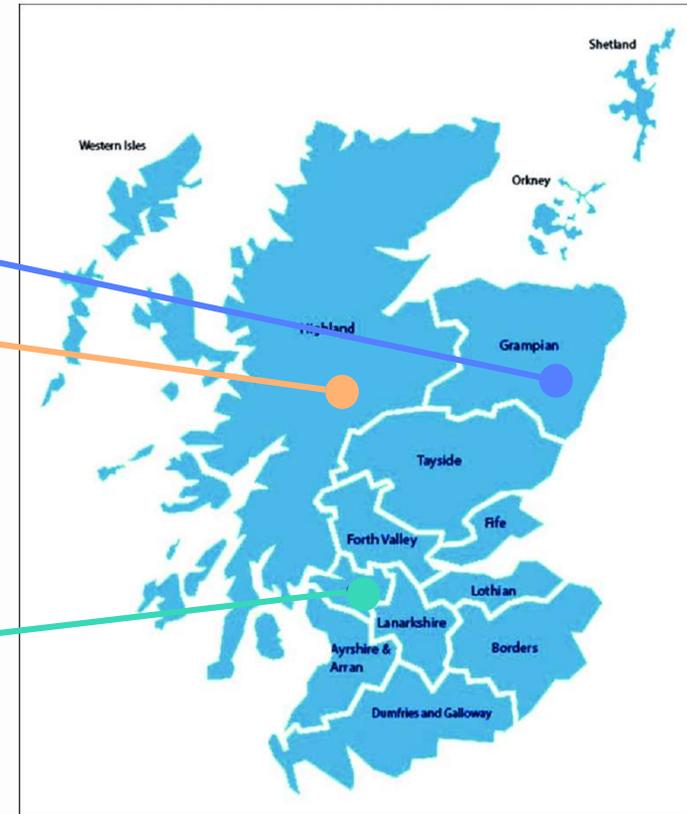
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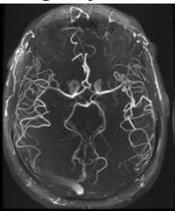
Dr Lionel Broche (2nd left) and Emeritus Prof David Lurie with the FCI imaging team



Glasgow 7T MRI, Hyperfine ultra low-field MRI (0.064T)

Powerful 7 Tesla MRI scanner arrives in Glasgow

15/27 November 2019



Glasgow University has taken delivery of Scotland's most powerful magnetic resonance imaging (MRI) scanner.

The £10m device was lifted into place at the new Imaging Centre of Excellence (ICE) at the city's Queen Elizabeth University Hospital (QEUH).

A giant crane eased the 18-tonne scanner down an alleyway with inches to spare on each side, then through a hole in the wall of the new building.

Once it is installed and calibrated it will be used to research - and help treat - a variety of conditions such as stroke, vascular dementia, Alzheimer's disease and epilepsy.

In its current condition it looks like a space capsule - a huge, up-ended metal doughnut with a hole where the patient will go.

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Edinburgh

Glasgow 7T MRI, Hyperfine low-field MRI

MRI Guided Laser Ablation System

Powerful 7 Tesla MRI scanner arrives in Glasgow

10/27 November 2018



The 7T scanner was brought into the 18-store equator

By Kenneth Macdonald

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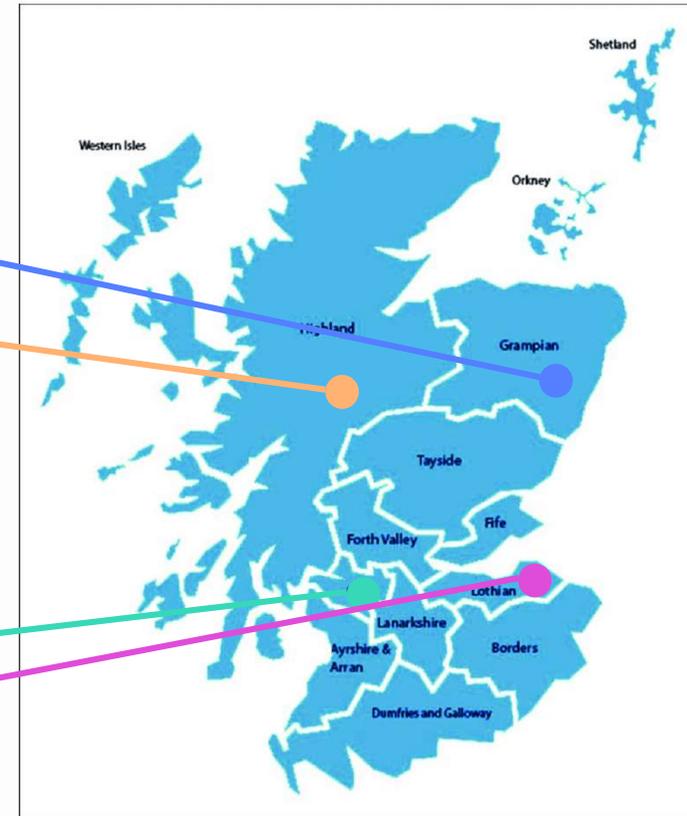
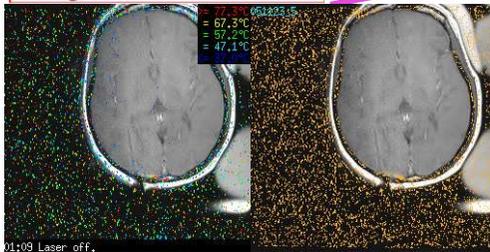
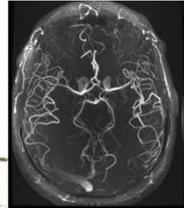
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Image by David Porter



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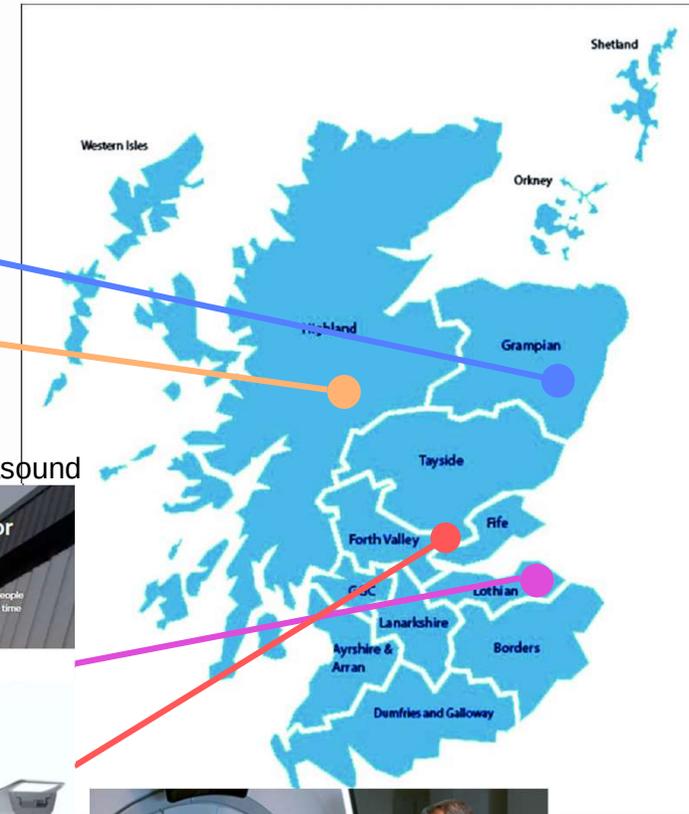
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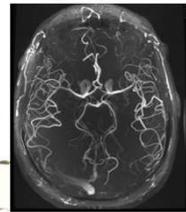
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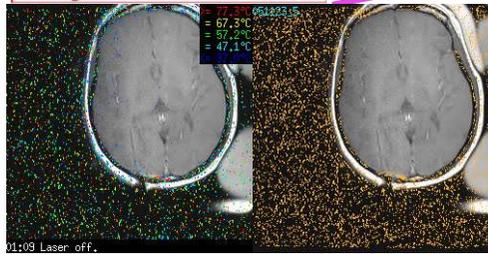
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Image by David Porter



Edinburgh MRI Guided Laser Ablation System



Dundee

MRI Guided Focused Ultrasound

University's incisionless brain surgery a first for Scottish tremor patients

published on 23 June 2021

A deep brain ultrasound treatment that can transform the quality of life for people with uncontrollable tremors has been made available in Scotland for the first time following a University of Dundee fundraising campaign.



Generous donors helped to provide more than £2 million to allow the purchase of magnetic resonance-guided focused ultrasound (MRgFUS) technology, which uses sound waves to help destroy tissue that can prompt unwanted movements in people who experience essential tremor.

The non-invasive procedure takes a matter of hours and can help restore control of movement to an individual's hands that they may not have experienced for decades. The treatment has established itself as effective in the treatment of essential tremor; initial research suggests it may also have a role in treating the symptoms of Parkinson's disease.

**THANK YOU FOR YOUR
ATTENTION**

