Conclusion
The drop in performance observed when using the validation dataset, indicate that this tool would not be suitable for public use. Higher levels of accuracy are more likely to be achieved if individual groups or clinicians use the tool with specific dermatoscopes and locally defined pre-processing steps. Group or clinician specific models could be trained if local data was made available.

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Poster Session (Xiel)

Stimulating Success: Investigation into the accuracy of ROSA robot-assisted lead placement for deep brain stimulation

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Introduction
Deep brain stimulation (DBS) is a surgical treatment conducted in Beaumont Hospital (National Centre for Neurosurgery and Neurology, Ireland) to treat patients with movement disorders such as Parkinson's disease. It involves the precise placement of intracranial electrodes, positioned with ROSA robot. Accurate placement of electrodes is a key variable affecting outcomes. An investigation was conducted into the accuracy of the lead placement, comparing the planned trajectory to the actual electrode.

Methods
A retrospective study of 25 bilaterally implanted patients, resulting in 50 lead placements, was performed. Brainlab software was used to fuse the pre-operative MRI, containing a burn-in of the planned trajectories, and intra-operative CT from which the actual trajectory can be determined. The trajectories were reconstructed for both hemispheres and DICOM coordinates were obtained for the entry and target points of the planned and actual trajectories. Vector errors (Euclidean distance) were calculated for each entry and target point. Absolute and directional errors were also analysed.

Results
Vector errors are in line with the literature and showed a significant trend towards dorsal deviation. There was a statistically significant strong positive correlation obtained between vector errors calculated and image registration accuracy obtained from ROSA. Adjustment to the workflow, involving removal of the Leksell frame from the registration process, improved the vector errors.

Conclusion
The adjustments made to the DBS workflow and the registration accuracy of the robot have a significant effect on the vector errors calculated. These results may influence workflow optimisation, future robot procurement and design input decisions.

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Poster Session

Validation of noise response method for MTF measurement

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Measuring the modulation transfer function (MTF) of a system through the edge response of the detector has been commonly employed in quality control programs for general radiography. This method utilises a high-contrast target placed at a small angle to produce an edge profile. MTF results using this method are sensitive to both the angle of the target and the sharpness of the targets edge.
A novel method for utilising only the noise response of the detector to measure the MTF has been proposed that eliminates the need for any target and can utilise uniform images already acquired for measuring the normalised noise power spectrum (NNPS) or detective quantum efficiency (DQE) of a detector. This method but has not been widely adopted despite its advantages over the edge method. Validation of this method was performed by comparing the MTF gained from both methods and the manufacturer specifications on multiple different systems. Multiple measurements on the same system over several months were also carried out to test the stability of the noise response method over time.

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Poster Session

The application of artificial intelligence algorithms for the generation of synthetic medical imaging data

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Purpose
To evaluate the performance of state-of-the-art AI algorithms, in particular Generative Adversarial Networks (GANs), and their potential use in Irish Radiology in creating synthetic cross-sectional imaging.

Material and methods
A dataset was obtained consisting of 50 patients who have been fully consented and recruited in the Mater as part of a separate study examining accuracy of an optimised lumbar spine CT protocol for patients with suspected Cauda Equina Syndrome (CES) was gathered. All patients (recruited or not) will have an MRI as part of standard care without delay. Ethics and Data Protection approval was obtained. The Pix2Pix model was modified and employed in the various tasks to create synthetic medical data. Mean Square Error (MSE), Mean Absolute Error (MAE) and the Structured Similarity Index (SSI) measurement are used to quantify the approximations of the synthesised data when compared to real data.

Results
We will present the results of our algorithms that have generated synthetic MRI data from CT studies, specifically, synthetic lumbar spine

MRI images. We will provide quantitative results assessing similarity of synthetic data to real data using above metrics. We will discuss the potential applications of GAN AI models in the Irish and International context, in particular when there are limited imaging resources, such as emergency out-of-hour imaging.

Conclusion
Artificial intelligence GAN algorithms are capable of generating high quality synthetic images. These images could be theoretically used in clinical practice as an aid in real imaging interpretation, especially when there is a lack of access to additional imaging.

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Poster Session

Hybrid 3D-IMRT breast planning and its use at UPMC whitfield cancer centre

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Volumetric Modulated Arc Therapy (VMAT) and Intensity Modulated Radiotherapy (IMRT) breast planning have grown in popularity across Europe. However, significant portions of the world do not use them routinely as they can fail to meet their organ at risk (OAR) standards. Specifically, the mean dose to the heart and the low dose volume in the lungs are of particular concern. For this reason, VMAT and IMRT breast planning are not routine at UPMC Whitfield Cancer Centre. However, while 3D conformal breast planning can more easily meet these standards, it can struggle with achieving target coverage in certain cases with complex anatomy. For this reason, we have begun using a hybrid approach for certain complex breast plans. This technique combines a 3D conformal plan, whose dose distribution is used as the basis for an IMRT plan, which finished off the plan as a whole. We have used this technique as a way of creating simultaneous integrated boost (SIB) plans. A 3D conformal plan covers the whole breast up to the target dose for the whole breast, and an IMRT plan uses the dose distribution from the 3D plan as the basis for its coverage of the tumour bed up to its target dose. The resulting sum of these two plans gives an overall plan with the OAR sparing of a 3D conformal plan, combined with the precise target coverage of and IMRT plan. This presentation will show examples of hybrid plans and compare them to IMRT and VMAT plans.

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Poster Session

Python-based data visualisation tool for dose optimisation and DRL automation with siemens Teamplay

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Diagnostic reference levels (DRLs) are dose levels which are intended to act as benchmarks for comparison of medical radiation exposures. The establishment of local DRLs by undertakings is required under the Irish legislative document S.I. 256 (2018). Siemens Teamplay is a dose management system installed in the Mater Misericordiae University Hospital (MMUH), which collates dose information from radiology procedures carried out in the hospital. The purpose of this project is to develop a Python-based tool for the visualisation of this dose data, the automated calculation of local DRLs, and the identification of higher-dose exams for follow-up.
Dose datasets were obtained from Siemens Teamplay for several modalities. The data was filtered, using DICOM header information, into bins representing each of the national DRL categories published by HIQA. An interactive HTML scatter plot was generated for each DRL category, showing individual exam doses in comparison to the local and national DRL, with mouseover capabilities to show further information. The top exam doses for each DRL category were identified and placed into a user-friendly document for follow-up by the radiography and medical physics teams in the hospital.
This Python programme automates the DRL calculation process and facilitates easy identification and follow-up of exam doses that may require further investigation. It is expected that the implementation of this tool in the MMUH Radiology Department will augment the capabilities of Siemens Teamplay, and form part of the ongoing drive towards optimisation and proactive multidisciplinary dose monitoring for patient safety.

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Poster Session

Development and use of a 3D-printed anthropomorphic head phantom for optimisation of Neuro-radiological procedures

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An anthropomorphic 3D head phantom was designed and printed using a resin-based Polyjet technology (using a J750 Digital Anatomy Printer), incorporating a novel radio-opaque resin which was used to mimic the skull and iodinated vessels.
The resin opacities were adapted following printing and imaging of small prototype phantoms and used to create an anatomically realistic high-resolution 3D model.
The phantom was imaged on various x-ray imaging modalities, including a 3D rotational angiography (3DRA) acquisition of the anterior and middle cerebral arteries (ACA and MCA), as is regularly acquired clinically for neuro-interventional procedures in Beaumont Hospital. Clinically relevant image quality parameters such as contrast to noise ratio and vessel dimensions have been measured for a range of radiographic imaging parameters and protocols. These are compared with the known phantom composition and geometry in order to assess the effect of dose modification on image quality in clinically relevant situations. These measurements showed that the radio-opacity of some phantom tissue types were not representative of those found clinically, limiting the scenarios where image quality can be evaluated, though this may be improved in a future 3D print.