along the mandible. Differences between Accuros XB results with 12 or 16 bits reconstructions are statistically significant (Student's T test, p = 0.05). Therefore, the use of extended HU ranges helps address the effect of metal objects inside a patient.

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Poster Session : P13

X-ray microscopy, investigation into tomographic soft tissue imaging at a micron scale

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When looking at the implementation of x-ray microscopy for the diagnosis of most cancers, the nucleus and surrounding structures of the cell need to be discernible. This is far beyond the capabilities of most x-ray equipment in terms of limiting spatial resolution and the necessary output to resolve soft tissue structures at that scale. Phase contrast Imaging(PCI) methods can be utilised to improve low contrast detectability. PCI is a relatively new range of techniques that measures the phase shift induced by the sample to produce an image. This results in a soft tissue image signal at certain photon energies that can be thousands of times higher than absorption, greatly reducing the required exposure. Even with this reduction a high output source is still required. Typically to achieve such high resolution and output a synchrotron source would be used. Given the excessive cost of synchrotrons it is not a practical x-ray source in a clinical environment. Recently developed alternative sources such as Plasma wakefield accelerators could be used. They utilise a petawatt laser pulse, which ionise specific gases to create a "bubble" of high gradient charge deferential to accelerate an electron bunch of sub micron diameter to high energy levels. The electron bunch can then be oscillated through undulators to generate the required x-rays. This presentation will discuss the initial work done through a collaboration between UHG, NUIG and Diamond Synchrotron on the potential of a novel PCI method and also discuss future planned work with the Central Laser Facility.

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Poster Session : 14

TomoTherapy® System repositioning accuracy according to treatment localization

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We analyzed the Image-guided radiotherapy method used by the TomoTherapy® System (Accuray Corp.) for patient repositioning in clinical routine. The TomoTherapy® System computes X, Y, Z and roll displacements to match the reference CT, on which the dosimetry has been performed, with the pre-treatment MV CT. The accuracy of the repositioning method has been studied according to the treatment localization. For this, a database of 18774 treatment sessions, performed during 2 consecutive years (2016–2017 period) has been used. The database includes the X, Y, Z and roll displacements proposed by TomoTherapy® System as well as the manual correction of these proposals applied by the radiation therapist. This manual correction aims to further improve the repositioning based on the clinical situation and depends on the structures surrounding the target tumor tissue. The statistical analysis performed on the database aims to define reference repositioning values to be used as security and guiding tool for the manual adjustment implemented by the radiation therapist. This tool will participate not only to notify potential repositioning errors but also to further improve patient positioning for optimal treatment.

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Poster Session : P15

Ultrasound elastography: A novel user-independent quasi-static method

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Quasi-static ultrasound elastography is a popular clinical ultrasound modality which can give measures of the relative stiffness of a region of interest [1]. Tumours have been well documented to have different mechanical properties than the surrounding healthy tissue [2]. Ultrasound elastography techniques take advantage of this contrast to create stiffness maps of soft tissue called elastograms, with these, the tumours can be easily distinguished from the healthy tissue [1]. Current quasi-static methods require the user to manually palpate the region of interest with the ultrasound probe, which can lead to user-user variability when imaging [3]. We propose a novel, user-independent method where external palpation is provided by means of a stepper motor via the perineum. A tissue-mimicking agar phantom of the prostate was created and imaged using a transrectal probe. An elastography algorithm was then developed using MATLAB and inclusions of varying stiffness and sizes were successfully delineated from the surrounding soft tissue. References: Bamber, J., Cosgrove, D., Dietrich, C., Fromageau, J., Bojunga, J., Calliada, F et al. (2013). EFSUMB Guidelines and Recommendations on the Clinical Use of Ultrasound Elastography. Part 1: Basic Principles and Technology. Ultraschall in der Medizin - European Journal of Ultrasound, 34(02), pp.169-184. Hoyt, K., Castaneda, B., Zhang, M., Nigwekar, P., di Sant'Agnese, P., Joseph, J et al. (2008). Tissue elasticity properties as biomarkers for prostate cancer. Cancer Biomarkers, 4(4-5), pp.213-225. Varghese T. (2009). Quasi-Static Ultrasound Elastography. Ultrasound Clinics, 4(3), 323-338.

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Poster Session : P16

The fabrication and validation of patient specific Maxillo-facial prostheses using 3D printing

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Personalised medicine aims to optimise patient outcome by tailoring treatments and interventions to the individual. While this approach can offer a number of benefits, it can be accompanied by significant overheads in terms of resources. Prostheses exist in order to restore and replicate normal functions and appearance of the body but if these are not individually tailored to the patient then a true restoration cannot be achieved. Traditionally a labour intensive pro-

cess, the fabrication of prostheses involves taking a plaster cast of the area to be treated, hand carving wax models, multiple meetings with the patient to alter this model, before making a final prosthesis in silicone. Utilising the patient's pre-existing CT images and 3D printing technology, a patient specific prostheses can be created with improved efficiency and accuracy. However a method is required to validate this process. This study demonstrates the methods used to create a patient specific eye prosthesis using CT images obtained after reconstructive surgery. These images were manipulated in a way which allowed for the intact eye to be mirrored and used to develop a 3D printed model which acted as the starting point to create silicone prosthesis. A validation method is presented which uses freely available registration software (GOM Inspect, GOM GmbH, Braunschweig) to analyse the results at various stages of the process. The benefits of using this method include reduced manufacturing time, decreased patient outpatient appointments, improved personalised outcomes and a repeatable process allowing multiple prostheses to be made.

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Poster Session : P17

Removing limiting factors for Leeds Test Object TO.10 usage

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The Leeds Test Object TO.10 is routinely used to provide a subjective estimate of Signal to Noise Ratio (SNR) as a measure of overall image quality. Currently, calibrated contrast values are provided for a limited set of discrete peak voltage (65, 70, 75, 80 kVp) and copper filtration thickness (1.0, 1.5, 2.0 mm Cu) combinations. However, it can be challenging to attain these exact settings on modern interventional imaging systems incorporating Automatic Dose Rate Controls (ADRC) and varying amounts of additional copper filtration. These limit the accuracy of results obtained thus representing significant limiting factors for the TO.10. We describe two methods of removing these limiting factors: a three-dimensional (3D) Matlab interpolation and extrapolation algorithm, and a multivariate-polynomial function, the coefficients of which can be stored in Excel. Both methods make use of the available contrast values to generate contrast curves for any kVp and mm Cu combination. Results obtained from both methods are presented as Threshold Index (H_T(A)) curves modelled by best fit log-polynomials. Their accuracies are evaluated through comparison with H_T(A) curves obtained under calibrated conditions. Both methods are found to produce more accurate estimates of detail contrasts for non-standard kVp and mm Cu combinations. Although an inherent error of approximately 15% is associated with this type of contrast detail analysis, the ability to analyse TO.10 data for non-standard kVp and mm Cu combinations offered by modern systems increases the accuracy of calculated H_T(A)'s. These methods further reduce the time required for image quality tests and room downtime.

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Poster Session : P18

A novel quantitative measure of image quality in fluoroscopy

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The aim of this work is to develop a quantitative algorithm for the assessment of image quality in fluoroscopy as an alternative to the subjective Leeds Test Object TO-10. Current possible quantitative measurements such as Detective Quantum Efficiency and Modulation Transfer Function do not assess the effects of imaging processing, such as edge-enhancement and noise reduction, on the final displayed image. A standard statistical algorithm used to calculate the contrast needed to observe an object having area size (A) against background. The algorithm was developed to produce sets of Contrast-Detail and Threshold Contrast curves. Three flat panel fluoroscopy systems in our Cardiology were examined. Sequences of uniform fluoroscopy images, obtained using 1 mm of copper as an attenuator, were acquired and then analysed remotely. For each system curves were generated for (a) different dose rates at the detector, (b) different settings of magnification, & (c) different levels of edge-enhancement. For one system different levels of noise reduction were examined. Areas under contrast-detail and threshold-contrast curves reflect changes in dose rate at the detector. The algorithm is sensitive to changes in applied edge-enhancement and noise reduction. Both sets of curves for each system exhibit characteristic spatial frequency responses. This new efficient and objective algorithm measures fluoroscopic image quality using the standard Threshold Detection Index. It tracks quality changes that depend not only on input dose rate, but also the level of image processing applied. It only requires the acquisition of a few seconds of fluoroscopy to produce images for remote analysis.

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Poster Session : P19

Hippocampal volumetrics in the diagnosis of temporal lobe epilepsy

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Most people with epilepsy control their seizures by using anti-epileptic drugs. However, one third of these patients suffer from a severe kind, resistant to medication, refractory epilepsy. These patients may be considered for surgical resection, where a portion of brain tissue involved in seizure onset is removed. In the most common form of epilepsy, temporal lobe epilepsy (TLE), structures such as the hippocampus are often found to be involved. An indicator that the hippocampus may be related to the seizure onset is the presence of mesial temporal sclerosis (mTS), which is noted by a loss of internal architecture, reduced hippocampal volume and hyperintensity on T2 weighted MRI. It has also been shown in the literature that mTS supported by hippocampal volumetry can indicate a better