focal disease is challenging. Multi-parametric magnetic resonance imaging (mp-MRI) has potential for this and because of its improved image resolution it may be combined with machine learning to assist with delineation. The aim of this work was to combine information from T2 weighted, apparent diffusion coefficient (ADC), and diffusion weighted MRI to train machine learning models to identify focal disease within the prostate. Two datasets were utilised from previously treated patients with localised prostate cancer. The first included 16 patients with diagnostic T2 MRI, the second included 12 patients with diagnostic T2 and ADC studies. The planning CT, T2 and ADC images, where available, were registered rigidly and a clinician contoured the prostate and focal lesion on each image. Using MATLAB, sub-images were extracted from each before 32 texture features were calculated and used to train four different classification algorithms. In addition, a pre-trained convolution neural network was fine-tuned to classify each sub-image as healthy or diseased tissue. The performance of each model was assessed in terms of sensitivity, specificity and AUC. Results demonstrate that mp-MRI images can be successfully combined to identify focal disease using machine learning. This novel approach achieved a high classification performance when tested on T2 images with an AUC of 0.935 compared to 0.663 found using single sequence MRI studies. These results are promising, yet a larger data set is required to further develop these approaches.

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# Poster Session : P10

### A feasibility study to investigate the introduction of HDR intraluminal brachytherapy for oesophageal cancer at university hospital galway

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Intraluminal high-dose rate (HDR) brachytherapy is considered to be one of the most valuable options for the treatment of oesophageal cancer. This radiotherapy technique involves the insertion of specific types of plastic applicators into the body through the oesophagus. The aim of this project is to assess the feasibility of establishing an HDR intraluminal brachytherapy procedure for oesophageal cancer at University Hospital Galway (UHG). Commissioning was performed for applicators with diameters of 8 mm, 12 mm, and 14 mm. Applicators were provided by Varian Medical Systems. The most distal position of each applicator was determined using a gafchromic film (EBT3). Within this context, there is a dead space for each bougie where the source cannot be loaded. Consequently, the first position available is determined from the end of the dead space. The dead space for the applicators of 8, 12 and 14 mm diameter was found to be at 10 cm, 15 cm and 17 cm from the tip of each applicator, respectively. The most distal source position of the bougies (with diameters of 8 mm, 12 mm or 14 mm) was found to be 50 mm from the end of the dead space. Successful collaboration among specialists working in enormously diverse disciplines (e.g., radiation physicists, oncologists, nurses, and therapists) is the fundamental aspect that will determine the success of establishing HDR intraluminal brachytherapy at UHG. Structures must be developed to assist everyone working in these diverse disciplines to coordinate and safely implement this procedure.

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# Poster Session : P11

### Dynamic MLC quality assurance program using EPID

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The introduction of intensity modulated radiotherapy (IMRT) allowed delivering high uniform dose distributions in the target, while sparing the surrounding healthy tissue. This technique is performed thanks to multileaf collimators (MLCs) in continuous motion. Therefore, it is crucial for patient safety to carry out a routinely quality assurance (QA) program of the MLC to ensure that leaf motion is precise, smooth and reproducible on every fraction. In this work a set of tests was gathered in order to quantitatively examine the stability of the electronic portal imaging device (EPID) signal, the accuracy of leaf positioning, the steadiness of leaf velocity and gap sizes and the influence of gravity for different gantry angles. These tests were accomplished using EPID (amorphous silicon aS1000, Varian) calibrated for dosimetric purposes for a 120-leaf Millennium MLC. The detector consists of matrix of 1024 $\times$784 pixels for 40 $\times$30 $cm^2$ area at the isocenter, providing a resolution of 0.39 mm/pixel. Hence, the EPID not only presents an adequate resolution to detect potential faults in the MLC performance but it is also agile and accessible. Additionally, it allows exporting .dxf files for each of the tests to be quantitatively assessed with help of a series of routines developed in Matlab. Corroboration of the implemented routines was performed using a detector array. Both methods showed an exceptional agreement. In conclusion, a MLCQA program using the EPID was presented to provide a reduction in time of quantitatively analysis of the tests and an early detection of errors.

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# Poster Session : P12

### Extended CT density range: Acuros XB algorithm performance

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Modern treatment planning systems (TPS) offer photon algorithms capable of enhanced performance in heterogeneous media and high density materials, such as metal implants. Acuros XB was implemented by Varian Medical Systems in their Eclipse TPS. Computed tomography (CT) reconstruction can be performed in two ways: a 16 bits depth for HU or 12 bits. A 12 bit study would have a reduced HU scale, describing normal tissues accurately, but underestimating metal objects. Whenever metal objects can be found in the images, 16 bits are needed to have a realistic estimate of their densities. This work addresses the calculation differences between Acuros XB 13.6 using these two CT configurations. A Philips Brilliant Big Bore CT scanner has been used to scan phantoms with different inserts mimicking different metal implants and both configurations. Head and Neck VMAT and conformal plans (two full arc plans, as per local protocol) were prepared and optimized in Eclipse v13.6. Coverage and dose figures of merit were assessed, and DVH curves compared. Dose to water was used throughout this study. Acuros XB results show an increase in maximum dose for distributions obtained in 16 bits image sets: for instance, from 111.0% (12 bits) to 138.2% for PTV60, in a phantom with Ti dental implants (insert)