determine the amplitude of organ/target motion,prior to each SBRT fraction, a 4D MR technique, relying on retrospective image analysis of fast cine MR data, was developed. 4D image studies were generated by sorting and binning image data as a function of anatomical structures' motion phase/amplitude. To test and validate the technique, patient and volunteer data was acquired on a 3T Siemens Verio MR scanner using a TurboFLASH sequence with an in-plane and temporal resolution of 1x1 mm^2 and 4 frames/sec,respectively. Regarding patient treatment planning, VMAT plans were generated using CT (gold standard) as well as MR-only data for comparison. To perform dose computations for the MR-based plans, bulk electron density values were assigned to organ structures (i.e. soft-tissue, lung).

Results: The 4D MR method was successfully benchmarked against 4D CT/CBCT and cine MR using liver clinical data from patients treated with abdominal compression and free breathing. The system-related (i.e. B0 inhomogeneities, gradient non-linearities) and the patient-induced (i.e. susceptibility) distortions were fully quantified using phantom measurements and numerical simulations,respectively. MR-only plans were found to be in good agreement with the corresponding CT-based plans. The comparison was performed using a TCP-based plan ranking tool.

Conclusions: An MRI-guided SBRT procedure was investigated for liver patients. The study included the development of a) an MR-based treatment planning process and b) a 4D MR method for daily patient setup verification. The MR-SBRT workflow is expected to be integrated on the linac-MR on rails platform.

PO-0891

Monte Carlo investigation into feasibility and dosimetry of Flat Flattening Filter Free (F4) beams

S. Zavgorodni[1]

[1]*BC Cancer Agency Vancouver Island Centre, Medical Physics, Victoria, Canada*

Purpose/Objective: Flattening filter free (FFF) beams became commercially available recently and generated considerable interest in radiotherapy due to their high dose rate and unique dosimetric characteristics. However, due to their non-uniformity, FFF beams are sub-optimal for larger field sizes. The purpose of this study was to consider potential modifications to the incident electron beam parameters (and linac head components) that would produce Flat FFF (F4) radiotherapy beams without the use of flattening filter.

Materials and Methods: Monte Carlo (MC) simulations with BEAMnrc/DOSXYZnrc codes have been performed to evaluate the feasibility of this approach. The dose distributions in water for open 6MV beams were simulated using our model of a Varian 21EX linac head. This model will be called Flattening Filter (FF) model further in the paper. Flattening filter has then been removed from FF model, while other components remained intact. MC simulations were performed using (1) 6 MeV electrons incident on the target with the same parameters as used in FF model, (2) 6 MeV electron beam with electron angular distribution optimized to provide flat dose profile. Configuration (1) represents FFF beam while configuration (2) produced a Flat FFF (F4) beam.

Results: Figure 1 shows diagonal profiles modeled for each of the beams at the depth of maximum dose (d_{max}) and normalized at the beam central axis. Profiles demonstrate that F4 beam greatly improved flatness of the FFF beam. For example, at 15 cm off-axis the dose increased from 62% for FFF to 96% for F4 beam. At 20 cm off-axis the dose increased from 52% to 92%. Also, importantly, compared to FF the out-of-field dose was reduced by about a factor of two for F4 beam, similar to that for FFF beam. Profiles of F4 beams did not change significantly with depth, unlike profiles of conventional FF beams. This is expected, as very little off-axis photon spectral variation exists in these beams, and was previously shown for FFF beams. Percentage depth doses (PDDs) were also calculated for these beams demonstrating that PDDs for F4 beams are similar to those of FFF beam, but slightly more penetrating. All FFF beams show less penetration compared to conventional 6MV FF beam.

Conclusions: Up to field sizes of 35x35 cm^2 profiles achieved for F4 beam at d_{max} are actually slightly flatter than profiles of conventional FF beam (though the dose off - axis is reduced rather than increased). F4 beam also demonstrated very little change of profile shape with depth. Therefore on average, through phantom depths, flatness of these beams can be considered comparable. Compared to FF, F4 beam considerably reduced out-of-field dose.

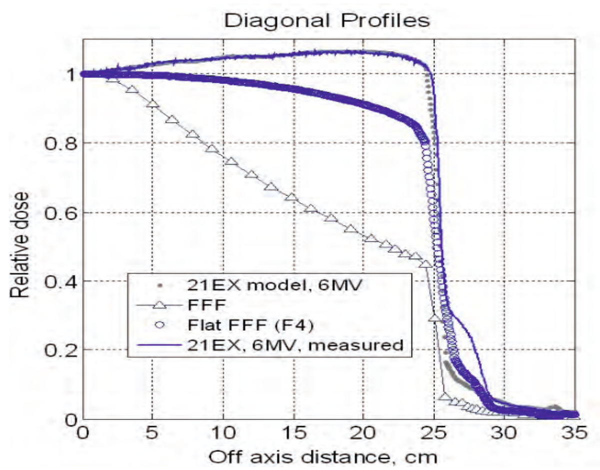


Figure 1. Diagonal dose profiles in water measured at d_{max} for Varian21EX linac and also calculated using our MC 21EX model for: open 40x40 cm^2 6MV beam, open 40x40 cm^2 6MV FFF beam, open 40x40 cm^2 6MV FFF beam with optimized angular distribution incident of electrons (F4).

PO-0892

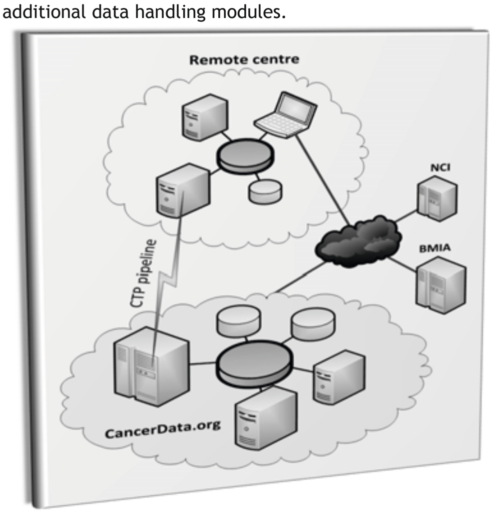
CancerData.org: open source biomedical data sharing to facilitate oncological research

E. Roelofs[1], J. Van Soest[1], R. Van Stiphout[1], M. Starmans[1], L. Dubois[1], A. Dekker[1], P. Lambin[1]

[1]*Maastricht University Medical Centre, Department of Radiation Oncology (MAASTRO) GROW - School for Oncology and Developmental Biology, Maastricht, The Netherlands*

Purpose/Objective: The human genome project has demonstrated that the concept of 'open data' tremendously stimulates research and additionally increases citation of the concerned paper. Therefore, we decided to build a platform to allow downloading and sharing of (pre-)clinical imaging and other biomedical datasets. Our immediate aim is to demonstrate the proof of concept with various (pre)clinical types of radiotherapy-related data.

Materials and Methods: Using free and open source software only, we have set up a DICOM image archive and data storage for metadata among others. The platform is built using the CaBIG software developed by the NCI, which offers a grid-enabled DICOM store. Data collections can be offered publicly or kept in a private collection if needed. To upload DICOM datasets, remote centres are using the RSNA Clinical Trial Processor (CTP) so that data is being sent over the internet in a de-identified manner. CTP configuration files have been defined to facilitate centre and collection specific de-identification, together with unique coding to guarantee that the uploaded images are stored in the proper collections. Windows and Linux based virtual machines have been created that use default web protocols to make sure the institutions firewalls do not block the transfer. Data can be collected in a shop-style basket and downloaded using an operating system independent download manager. Presentation of collection metadata and download of non-DICOM datasets is offered by integrating the site in a Drupal content management system with additional data handling modules.



Results: We have set up the CancerData.org site and integrated it into the CaBIG-enabled grid of Biomedical Imaging Archives. Private