addition, three VMAT class solutions were created for this patient group covering most of the rectal carcinoma cases, reducing the time needed to plan individual treatments. The technique has since been implemented clinically at our department.

EP-1644
Absorbed dose due to guide tube path in HDR Brachytherapy
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Purpose/Objective: Since 2010 the treatment of localized skin cancer on the nose is irradiated, in our service, with HDR (192Ir) using a custom mold. By the characteristics of the unit, guide tubes passing above the patient. The aim of this study is to determine if the source path leaves dose at the skin and if therefore require special protection.

Materials and Methods: A skin tumor on the tip of the nose is simulated in an anthropomorphic phantom on which a customized thermoplastic mold is made with 3 plastic catheters placed covering the tumor. Dosimetry was made with the BrachyVision 3D (v8.1) treatment planning. To determine the dose received we used radiochromic films (Grafichromic EBT2); they are placed one on a flat surface under a block of expanded polystyrene (8cm thickness) and other one over the block, and the three transfer tubes above it. Complete treatment, consisting of 18 sessions of 3 Gy, was administrated. All films were digitized with an Epson Expression 1000XL scanner and analyzed at 24h of irradiation using the ImageJ program. Background (fog) was determined by an unirradiated film. We measured the mean and standard deviation of dose administrated in 3 representative areas (150x150 pixels) of each film, and compared between them.

Results: The film that was in contact with the tubes, in spite of the fast speed transfer of the source, indicates that was administrated a significant dose to the patient. The film under the polystyrene block indicates that the dose was decreased considerably.

Conclusions: To reduce the dose to the patient is useful to avoid the contact of the transfer tubes with him. The polystyrene blocks, are an easy, cheap and convenient method that can reduce significantly the dose received by the patient. A study to determine optimum materials and to avoid unnecessary irradiation of healthy tissue during treatment with HDR is launched with the physics unit.

EP-1645
Improved reproducibility and reduced lung dose with breathing adapted radiotherapy for breast cancer
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Purpose/Objective: Adjuvant radiotherapy after breast-conserving surgery for breast cancer implies a risk of late cardiac and pulmonary toxicity. This pilot study evaluates cardiopulmonary dose sparing of respiratory displacement adapted radiotherapy (BART) using free breathing gating.

Materials and Methods: 30 patients were computed tomography (CT) scanned with EIG audio coaching during scan and treatment process. Respiration curves were analysed with average maximum IL and standard deviation (SD) for the EIG part of the respiratory signal. Analysis of dosimetric and respiration parameters were performed.

30 patients were CT-scanned during non-coached breathing manoeuvre including free breathing (FB), end-inspiration gating (IG), end-expiration gating (EG). The Varian Real-time Position Management system (RPM) was used to monitor respiratory movement and to gate the scanner. For each breathing phase, a population based internal margin (IM) was estimated based on average chest wall displacement, and incorporated into an individually optimized isocentric wide tangential photon field treatment plan for each scan.

Purpose/Objective: Since 2010 the treatment of localized skin cancer on the nose is irradiated, in our service, with HDR (192Ir) using a custom mold. By the characteristics of the unit, guide tubes passing above the patient. The aim of this study is to determine if the source path leaves dose at the skin and if therefore require special protection.

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Conclusions: To reduce the dose to the patient is useful to avoid the contact of the transfer tubes with him. The polystyrene blocks, are an easy, cheap and convenient method that can reduce significantly the dose received by the patient. A study to determine optimum materials and to avoid unnecessary irradiation of healthy tissue during treatment with HDR is launched with the physics unit.

EP-1646
Development of an in-house TomoTherapy transfer plan check
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Purpose/Objective: At the UHB Radiotherapy department we have two TomoTherapy HD units. The QA procedure for patients being treated on TomoTherapy (Tomo) is that a patient specific delivery QA (DQA) must be carried out prior to the patient beginning treatment, using out Delta4 phantom. For Category 1 patients, a secondary DQA must be carried out (known as a transfer plan), so there is one plan for each of the two rooms in case of a treatment delivery unit breakdown. The Tomo HD units have dynamic jaws functionality (known as TomoEDGE) which speeds up the delivery time thus enabling us to increase patient throughput. More throughput means more time required on the machines to carry out DQA. The aim of this project is to reduce the workload of patient specific QA on transfer plans. The solution should be auditable, safe, secure, maintainable, not impact on already deployed clinical software and present the required results in a presentable format to attach to patient records in our Oncology Management System (OMS), MOSAIQ.

Materials and Methods: The two DICOM Tomo RT plan files were validated and interpreted using dcm4chee library and private Tomo DICOM tags compared using standard Java libraries. A web application was created using the robust infrastructure of Enterprise Java Beans (EJB) to allow the user to load the two plans for comparison. The sinogram from the two plans were compared against each other by taking into account the latency differences between the machines. As TomoEDGE functionality is used, the jaw positions for each projection were also compared. The results of the comparison are displayed in the Graphical User Interface.
(GUI) as a table and graph. The entire program suite was developed using Netbeans.

**Results:** A robust and maintainable solution has been put in place through a web application without interfering with any software medical devices. The table of values that have been compared against tolerances can be attached as a PDF document to the patient records in the OMS. The graphical user aspects of the application have been tested with the automated testing package, Selenium. This enables future modifications in the program to have the vast majority of its user interface checked without user intervention. The developed application had its business logic tested using JUnit4 with 23 representative datasets. This program has the capability of reducing the time it takes to carry out patient specific QA by removing the need to deliver the transfer plan on the second machine, which takes 40 minutes for the first patient and 20 minutes for subsequent patients.

**Conclusions:** An application has been developed that meet the overarching requirements of such medical software. It is a reliable independent check on transfer plans. It has reduced the need to carry out transfer plan checks on the second TomoTherapy machine. It will be running in parallel with the QA procedure of checking patient transfer plans and then eventually integrated into the QA workflow.

**EP-1647**

Re-planning of field-in-field tangential treatment based on misalignment during the delivery

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**Purpose/Objective:** Field-in-field (FIF) technique ameliorates the conventional planning with tangential fields (TANG) for adjuvant treatments of breast cancers. It applies additional fields to improve different parameters. Ideally, each additional field should be delivered with perfect alignment to the main one. Treating more complex plan solutions for such patients affects the daily work of the RTT and implies more demanding practicalities. Define the stability of the dosimetric gain for the FIF plan when data errors due to the misalignment of conventional main fields to each field-in-field is incorporated, could improve the awareness of clinicians, physics and RTTs about such an issue.

**Materials and Methods:** We compared FIF technique to the corresponding TANG. Endpoints evaluated were: V95, V105, Maximum Dose within PTV, Maximum Dose. Separately, the misalignment of each specific field-in-field with the corresponding conventional main field was acquired directly during the treatment delivery (details reported in separately submitted abstract). First, the baseline FIF was compared to the TANG plan. Then, the FIF was recalculated incorporating the misalignment data and the new plan (FIFErrors) was compared to the TANG to check the stability of the dosimetric gain. A statistical analysis of the significance of differences reported on treatment plans between TANG and FIF, and between TANG and FIFErrors was separately addressed by Wilcoxon.

**Results:** We analyzed 33 patients. Mean values for FIF and TANG plans, were respectively: V95=98.92 vs 98.25%; Maximum Dose=109.0 vs 110.01%; Maximum Dose within PTV=108.32 vs 109.01; V105=4.01 vs 4.42. The FIF was significantly superior to the TANG plan for V95 (p=0.003), Maximum Dose (p=0.002), Maximum Dose within PTV (p=0.033); it was not significantly superior for V105 (p=0.201) although the mean V105 value was overall inferior for the FIF (4.01%FIF vs 4.42% TANG).

**Mean values for FIFErrors and TANG respectively were:**

V95=98.90 vs 98.25%; Maximum Dose=109.8 vs 110.01%; Maximum Dose within PTV=108.39 vs 109.01; V105=4.11 vs 4.42. The FIFErrors was significantly superior to the TANG for V95 (p=0.005), Maximum Dose (p=0.003); it was not significantly superior for V105 (p=0.326) and for the Maximum Dose within PTV (p=0.071) although the mean V105 and Maximum Dose within PTV values were overall inferior for the FIFPlan. The mean gain by the adoption of FIF over the TANG accounted for: V95=0.67%; Maximum Dose= 1.01%; Maximum Dose within PTV= 0.69%; V105=0.41%. Once recalculated considering the misalignment it was reduced by a percentage of 2.98% for V95, 10.14% for Maximum Dose; 7.93% for Maximum Dose within PTV; 24.39 % for V105, respectively.

**Conclusions:** FIF technique optimizes the planning, without major drawbacks for the RTT practice. Although it presents a good geometrical stability during the delivery, it is more demanding for the daily practice of the RTT. The risk of waist of a rate of the planned gain should be taken into account when clinicians and physics select the planning. Close inter-professional collaboration could improve the whole process of planning and daily delivery.

**EP-1648**

A robust automated approach to clinical data integrity management

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**Purpose/Objective:** As part of Treatment Planning System (TPS) QA, the Institute of Physics and Engineering in Medicine (Report 61) recommends performing frequent, independent integrity checks of all executable, configuration and data files. Checksum calculations provide a rapid, automated method to verify file integrity. They can be performed at a high frequency, to minimise delays between change and detection. Verifying program integrity via checksums requires no knowledge of program function and is operating system independent; requiring only a baseline calculation in a known working state (commissioning/post-update).

In a multi-vendor department, a single, unified approach to manage file integrity across platforms is desirable, to minimise maintenance and management overheads. Whilst various systems exist to perform this, they normally require the installation of clients, which is undesirable on certified Medical Devices.

**Materials and Methods:** The Open Source Security (OSSEC) Host Intrusion Detection System (Trend Micro, UK) has been implemented to perform File Integrity Management (FIM) on two TPS (Monaco and XiO, Elekta, Sweden). Natively, OSSEC performs integrity checks on Unix/Linux systems without components being installed onto target devices, via the Secure Shell (SSH) protocol. A parallel system, utilising the Secure Shell (SSH) protocol. A parallel system, utilising the