further improved to 0.3±0.6%, 0.2±0.4%, and 0.1±0.3% by combining 3, 4, and 5 fractions, respectively.
Conclusions: A system was developed for high accuracy assessment of actual delivered IMRT fluence profiles in treatment fractions for dose-guided radiotherapy. For prostate cancer patients, intra-fraction anatomy changes did sometimes result in reduced accuracy. Combination of measurements performed in 2 or more fractions could largely reduce uncertainties.

PD-0229
Evaluation of gated volumetric modulated arc therapy using COMPASS 3D dosimetry system
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Purpose/Objective: To evaluate the accuracy of the Gated Volumetric Modulated Arc Therapy (VMAT/RA) dose delivery using conventional 2D planar dosimetry and advanced COMPASS 3D dosimetry system
Materials and Methods: We have installed Varian Real-Time Position Management (RPM) Gated Technology in RapidArc (RA) enabled Clinac-iX .The advantage of Gated RapidArc (G-RA) technology is that it reduces the margin of Internal Target volume (ITV). G-RA was delivered using the RPM which uses external markers to generate gate-open signals of different durations. To assure the proper dynamic dose delivery and MLC position of G-RA treatments, we have planned 10RA plans for lung cases in Eclipse (V8.9TPS) which use Analytical Anisotropic Algorithm. Plan quality was verified using conventional 2D planar dosimetry and advanced Compass 3D dosimetry system. Advantage of COMPASS over 2D planar is it provides the clinical relevance of error in treatment delivery.
IBA, COMPASS system calculates and displays the delivered 3D dose distribution on a patient CT data by using beam modeling, dose map from detector measurements (Imatrix ^{Evolution}) and dose map reconstruction using Collapsed Cone Convolution Algorithm. For 2D planar dose evaluations, verification plans were generated on IBA, Imatrix^{Evolution} in a Multicube Phantom and planar dose at isocenter plane were exported for Omipro IMRT software for gamma analysis. In both cases, Imatrix is fixed while Infrared reflecting box is periodically moved to provide gating signal for RPM.To evaluate the accuracy of dose delivery, measurements were performed for different duty cycles (DC) 100% (without Gating), 80%, 50%, 30% & 20%, i.e., number of interruptions were approximately increased from 5-30 times and same were compared with Eclipse TPS dose. Area gamma was analyzed with criteria 3mm distance to agreement and 3% dose difference. Dynalog files were analyzed and expressed as root mean square(RMS)of the deviations of individual leaves during treatment delivery.
Results: In conventional 2D planar dose analysis the average area gamma less than 1 for DC 100% , 80%, 50%, 30% & 20% were 98.4±1.6%, 98±1.2%, 97.4±1.8%, 96.6±1.3%& 96.1±2.1% for TPS vs. G-RA (3mm&3%) respectively. Average deviations of error root mean square for all MLC positions were 0.11 ±0.01mm, 0.14±0.01mm,0.25±0.02mm, 0.32±0.02mm & 0.46±0.03mm for 100%, 80%, 50%, 30% & 20% DC respectively. 3D average gamma for 10 Patients PTV and organ at risk from COMPASS system for different DC were shown in table 1. Average gamma for all structure and different duty cycle is less than 0.5

Structure	Average Gamma for Ten Patients				
	100% (without Gating)	80%	50%	30%	20%
Body	0.16±0.04	0.17±0.04	0.16±0.04	0.16±0.04	0.16±0.04
PTV	0.33±0.12	0.33±0.13	0.33±0.12	0.32±0.12	0.34±0.13
Lungs	0.24±0.05	0.24±0.06	0.24±0.06	0.25±0.06	0.25±0.06
Heart	0.24±0.07	0.24±0.06	0.26±0.10	0.24±0.06	0.24±0.05

Table-1

Conclusions: Both conventional 2D planar dose analysis in phantom and advanced COMPASS 3D dosimetry analysis in patient anatomy shows that Gated VMAT dose delivery can be executed with good clinical dosimetric accuracy as non-gated VMAT delivery.

PD-0230
Dosimetric investigation of an amorphous silicon EPID for modulated electron radiotherapy applications
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Purpose/Objective: The aim of this work was to experimentally determine the response of an amorphous silicon electronic portal imaging device (EPID) to electron beams in order to use it for quality assurance (QA) of modulated electron radiotherapy (MERT) delivery.
Materials and Methods: For this work, a commercially available EPID was used to detect electron beams of energies ranging from 6 to 18 MeV and shaped by a photon multileaf collimator (MLC) at a source to surface distance of 70 cm. On the central axis, the dose response of the EPID to electron beams was studied by investigating the fundamental dosimetric properties such as reproducibility, dose linearity, field size response, energy response and saturation. For the off-axis response of the EPID, a new method to acquire the flood-field (FF) for the EPID calibration was developed. For validation purposes, the FF-corrected EPID measurements were compared to dose profiles of open fields and various square and irregular MLC fields measured with a diode in water. Finally, in order to use the EPID for QA of MERT delivery, a method was developed to reconstruct EPID two-dimensional (2D) dose distributions in a water-equivalent depth of 1.5 cm. Comparisons were performed with film measurements for static and dynamic mono-energetic fields as well as for multi-energetic fields composed by several segments of different electron beam energies.
Results: The beneficial EPID dosimetric properties already known for photons as reproducibility, linearity with dose and dose rate were found to be identical for electron beam detection. The FF calibration method was proven to be effective and it was shown that the EPID accurately reproduced the dose measured in water at 1.0 cm depth for 6 MeV, 1.3 cm for 9 MeV and 1.5 cm for 12, 15 and 18 MeV. The deviations between the output factors measured with EPID and in water at these depths were within ±1.2% for all the energies with a mean deviation of 0.1%. The average gamma pass rates (criteria: 1.25%, 1.25 mm) for profile comparison between EPID and measurements in water were better than 97% for all the energies considered in this study. When comparing the reconstructed EPID 2D dose distributions at 1.5 cm depth to film measurements, the gamma pass rates (criteria: 2%, 2 mm) were better than 97% for all tested cases considered.
Conclusions: This study demonstrates the high potential of the EPID for electron dosimetry, and in particular, confirms the possibility to use it as an efficient verification tool for MERT delivery.

PD-0231
Small field in-air output factors: miniphantom design and selection of dosimeter type
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Purpose/Objective: Specialised treatment techniques have led to the increased use of radiotherapy fields as small as 4 mm. Dose measurements of small fields in air are needed to provide parameters for radiotherapy beam modeling and the commissioning of treatment planning systems. For fields larger than 40 mm, ionisation chambers with conventional water equivalent miniphantoms have been used for the measurement of the in-air output factor, S_c. However, for small fields, dosimetry is complicated by both the beam characteristics and the dosimeter design. This study describes a reliable and convenient method to measure S_c, for small fields and explains the clinical significance of our findings.
Materials and Methods: Measurements were performed using brass miniphantoms, either caps (with sidewalls) or tops (no sidewalls) of varying heights and widths. The performance of two unshielded diodes (PTW 60012 and IBA SFD), EBT2 radiochromic film and a fibre optic dosimeter (FOD) were compared for fields defined by SRS cones (4 mm to 30 mm) on a Varian Novalis linear accelerator.