Similar results were obtained for the different OAR.
From plan difference the mean doses of OAR and targets were within ±1%.
Conclusions: This study showed the good agreement of CCC calculations from measured fluences with respect to both Acuros XB and AAA algorithms from treatment planning system.

PO-0801
Grid size based dosimetric comparison of dose calculation algorithms for brain cases using VMAT technology
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Purpose/Objective: Aim of this study is to compare dose calculation algorithms Analytical Anisotropic Algorithm (AAA) and AcurosXB(AXB) in terms of different dose calculation grid sizes for brain cases using Volumetric Modulated Arc Therapy(VMAT) where maximum dose is more concern for serial organs.
Materials and Methods: AcurosXB algorithm recently available in varian 3D treatment planning system was compared with AAA algorithm. In this study we selected 10 brain cases where optic apparatus and brainstem very close to or merged within the Planning Target Volume(PTV). All the cases 3mm CT slices were taken and full arc or semi arc VMAT plans were created using Varian Eclipse treatment planning system(TPS)(V10). Plans were optimized using Progressive Resolution Optimization(PRO) III algorithm and dose was calculated using AAA and AXB algorithms for different grid sizes 1.5mm, 2.0mm & 2.5mm. Plans were compared dosimetrically in terms of dose and volume. PTV was analyzed in terms of maximum dose (1% of PTV volume receiving dose), dose received by 95% volume of PTV V95% and conformity index(CI) whereas critical organs maximum dose was compared for optic chiasma, optic nerve and brainstem. In addition Verification plans were created and measured for all plans on multi cube phantom (with iMatrixx 2D array) and dose calculations were performed with AAA & AXB for the same gird size combinations. Measured dose was kept as reference and all other dose calculated plans were compared in terms of gamma analysis.
Results: The mean percentage of PTV maximum dose difference of AAA over AXB(taken as reference) was found to be 1.992±0.20, 1.342±0.76 & 1.599±0.21, the average PTV V95% dose percentage difference was 2.822±0.48, 2.825±0.42 & 2.944±0.42 and mean Conformity index percentage difference was 5.784±1.34, 5.639±1.73 & 5.872±1.51 for 1.5mm, 2.0mm & 2.5mm grid sizes respectively. Regarding critical organs the mean percentage difference of maximum dose for optic chiasm was 1.398±0.27, 1.326±0.23 & 0.780±0.34, left optic nerve 0.924±0.43, 1.022±0.20 & 0.498±1.18, right optic nerve 0.924±0.43, 1.022±0.20 & 0.498±1.18 and brainstem 1.582±0.23, 1.402±0.23 & 1.590±0.56 for 1.5mm, 2.0mm & 2.5mm grid sizes respectively. 2D planar gamma evaluation for 3mm/3% criteria area gamma for AAA & AXB were 98.62±0.89, 98.67±0.65, 98.86±0.47 and 98.87±0.58, 98.94±0.65, 99.14±1.02 for 1.5mm, 2.0mm & 2.5mm grid sizes respectively.

	Percentage dose difference (%)						Gamma analysis 3mm/3% (%)	
	PTV			Optic chiasma	Lt Optic nerve	Rt Optic nerve	Brainstem	
Grid	Max	V95%	CI95	Max	Max	Max	Max	Area	Area
1.5mm	1.992	2.822	5.784	1.398	0.924	0.712	1.582	98.62	98.87
2.0mm	1.342	2.825	5.639	1.326	1.022	0.514	1.402	98.67	98.94
2.5mm	1.599	2.944	5.872	0.780	0.498	0.222	1.590	98.86	99.14

Conclusions: The results showed that AAA compared with AXB overestimates dose by maximum of 3%. Delivered & measured dose analysis shows good agreement between measured and AXB than AAA. Little overestimation of AAA as compared to AXB can be attributed to better modeling of spot size,penumbra & electron contamination in AXB. 2.5mm grid size is considered acceptable for most of the VMAT brain plans but at least in the high gradient area 1.5mm grid size is required.

PO-0802
On the use of an analytical source model for dose calculations in image-guided small animal radiotherapy
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Purpose/Objective: Small animal image-guided precision radiotherapy is rapidly advancing through the use of dedicated micro-irradiation (micro-IR) devices. However, precise modeling of these devices in model-based dose-calculation algorithms such as Monte Carlo(MC) simulations continue to present challenges due to the required high mechanical tolerances placed on beam collimation, positioning and long calculation times. We believe that source generation may benefit from alternative analytical techniques since the majority of calculation time in MC algorithms is electron transport and bremsstrahlung generation that is potential unnecessary given that fast spectrum generating codes now exist. The specific intent of this investigation is to introduce and demonstrate the viability of a fast analytical source model for use in either investigating improvements in collimator design or for use in faster dose calculations.
Materials and Methods: An image-guided small animal micro-IR (P225Cx, PXInc, CT, USA) was modeled in MC (EGSnrc, NRC, Ottawa), including the electron beam distribution for several circular and square fields with sizes ranging from 1-mm to 25-mm in diameter. An analytical source model was developed in Matlab (Mathworks, MA, USA) that consists of two distinct steps. The first step is the generation of a fluence intensity distribution, and the second step consists of generating a phase-space file from the fluence intensity distribution. The analytical model uses a pinhole image of the focal spot, a pre-calculated x-ray spectrum, and collimator-specific entrance and exit aperture geometries. MC phase-space files (PSF$_{MC}$) and analytical model phase-space files (PSF$_{AM}$) were generated at the exit of the collimators for a tube potential of 225kVp. Simulations using each phase-space file were performed in a voxelized water phantom and in a realistic mouse phantom. Beam profiles and 3D dose distributions between the analytical source and full MC source model were compared.
Results: Beam profiles between the analytically generated source model and the full MC source model agreed well. There was negligible difference between the pre-calculated spectrum and the full MC generated spectrum. Relative 3D dose distributions were comparable with the analytical model showing smoother isodose contours due to the nature of the analytical phase-space. The analytical model source generation demonstrated a speed increase of 30x over efficient MC source generation for the largest beams and were up to 400 times faster for the smallest beams. The analytical source model also demonstrated that the shape and output of the beam is highly dependent on the size and shape of the electron beam distribution and collimator alignment.
Conclusions: The presented analytical source model is a useful tool for rapidly generating a source model.

PO-0803
Validation of a kV dose computation method for CBCT imaging procedures
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Purpose/Objective: To validate a simplified kV x-ray beam model and dose computation method (kVDoseCalc) for CBCT in block, round, and anthropomorphic geometries.
Materials and Methods: We characterized Varian® OBI® beam output for four imaging modalities using three different energies and two different bow tie filters. (See Table 1)

Table 1: CBCT imaging modalities

CBCT modality	Filter	Arc size	Energy
Pelvis spotlight	Full bowtie	200°	125 kVp
High quality head			100 kVp
Pelvis	Half bowtie	360°	125 kVp
Low-dose thorax			110 kVp

The spatially varying spectrum of the beam was obtained by matching the nominal kVp and the measured HVL to a spectrum computed using the freeware Spektr.[1,2] The transverse beam fluence Φ(x)was calculated from Eq. (1) using in-air dose measurements. The term U$_{(x,E)}$ represents the spectrum obtained from Spektr, while the mass-absorption coefficient ($\mu_{en}(E)/\rho$)was taken from the NIST database.[3] A similar fluence was obtained along the radial axis. The two fluences were multiplied together to create a two-dimensional array that was back-projected to the position of the x-ray tube anode to form the x-ray source.[1] This source was used as input for kVDoseCalc,our in-house x-ray dose computation software.[4]