Purpose:
Acuros XB (AXB), a novel deterministic dose calculation algorithm based on grid-based Boltzmann transport equation solver (GBBS), was recently implemented in Eclipse treatment planning system (TPS). The purposes of this study were to verify the dosimetric performance of AXB by (1) comparing measured and calculated data and (2) comparing AXB with the existing Eclipse anisotropic analytical algorithm (AAA).

Methods:
Clinically equivalent intensity modulated radiation therapy (IMRT) and volumetric modulated arc therapy (VMAT) plans were created in Eclipse for the Radiological Physics Center (RPC) head and neck IMRT phantom using the RPC phantom dose prescription specifications. Each plan was calculated with two different algorithms, AXB 11.0.91 and AAA 10.0.24. Each treatment plan was delivered to the RPC phantom three times for reproducibility using a Varian Clinac21iX. Dose distributions were measured with thermoluminescent dosimeters (TLDs) and radiochromic film (GafChromic® EBT2). Gamma analysis (7%/4mmDTA) was used to quantify the agreement between AXB and AAA calculated dose distributions and those measured using films. The computation times for AAA and AXB were also evaluated.

Results:
In this study, good agreement was observed between measured and calculated doses both from AAA and AXB (dose-to-medium in medium). Comparing the calculations with TLD measurements, agreement for both AAA and AXB were < 5% (ranges from 0.2% to 4.6% for AAA, 0.1% to 3.6% for AXB) for IMRT and VMAT plans. The gamma analysis results for both AAA and AXB met the RPC 7%/4 mm criteria (over 90% passed). The AAA and AXB computation times were comparable for IMRT but AXB was ~3 times faster than AAA for VMAT.

Conclusions:
The AXB was determined to be accurate using the RPC IMRT H&N phantom measurements and in good agreement with the AAA while having shorter calculation times for VMAT as compared to the AAA.