

## **Title: Metallic implants management in radiotherapy treatment planning process**

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### **Introduction:**

Treatment planning in the presence of metallic implants may lead to several issues from contouring to dose calculation.

The aim of this study was to control if extended CT scale technique (-10240 UH; 30710 HU) is a suitable alternative to standard CT scale technique for dose calculation in presence of high-Z-materials. Then the efficiencies of two commercially available dose prediction algorithms, Accuros XB™ (AXB) and Analytical Anisotropic Algorithm™ (AAA) (Varian Medical Systems) were compared in this condition. This work will use for implementation of spinal stereotactic body radiation therapy (SBRT) with metallic fixations.

### **Methods:**

First an extended scale Hounsfield units (HU) conversion curve to relative electron density and to mass density was created based on density phantom (CIRS model 062).

Uniformity, noise, low contrast and spatial resolution were evaluated for extended CT scale technique with manufactured CT phantom (GE Healthcare). Images were analyzed with ImageJ.

Then measurements were performed using a True Beam™ linac (Varian Medical Systems) with energies of 6 MV flattening filter and flattening filter free for static fields and VMAT. Deposited dose through a titanium implant included in a water-equivalent phantom was evaluated. Two dimensional measurements were also performed at different depths in RW3's plates with the implant placed above it.

Calculations dose were made with Eclipse TPS (Varian Medical Systems) using AXB and AAA. EBT3 radiochromic films (Gafchromic) and liquid-filled ionization chamber array SRS 1000 (PTW Freiburg) were used. Analysis were performed with FilmQPro (Ashland) et VeriSoft (PTW Freiburg)).

### **Results:**

The extended scale HU conversion curve to relative electron density and to mass density show a good agreement to standard scale with 2% maximum variance.

Image quality was steady. However low contrast detectability slightly decreased without significant clinical influence.

AXB agrees better with measurements than AAA in presence of metallic implant.

### **Conclusions:**

Using extended CT scale technique can potentially improve efficiency in presence of metallic implants in the treatment planning process.

In this condition, AXB improves dose calculation in comparison to AAA.