AbstractID: 5780 Title: Site-specific image-gain calibration for MV CBCT

Purpose: MV CBCT is an image guidance modality which yields a 3D dataset representative of the patient anatomy in treatment position. During the acquisition, a series of low-dose projection images are generated by exposing a high detection efficiency flat panel to short bursts of the linear accelerator beam. In order to avoid image artifacts, the projection images need to be “gain” corrected for variations in pixel intensity unrelated to traversed patient anatomy. These variations arise from differences in individual pixel sensitivities, as well as from the spectral and the intensity non-uniformity of the incident beam. In this work, we propose and validate two treatment site-specific gain correction (GC) strategies.

Method and Materials: The first GC approach employs an open-field in-air image of the beam. Each subsequently acquired image is then divided by this GC image (GCI) to remove the effects of differing pixel gains as well as of incident beam non-uniformity. The second approach acquires a GCI using a flattened beam. A tray with a 1/2 inch uniform lead plate is inserted in the accessory tray holder prior the gain image acquisition. The presence of the lead plate in the beam path results in spectral and spatial homogeneity of the beam incident on the flat panel imager.

Results: The clinical scope of the two correction approaches was investigated by clinical MV CBCT acquisitions. In-air gain calibration is well suited for head and neck imaging since the underlying spatial and spectral properties of the beam remain unaltered. However, for prostate cases the second calibration approach significantly reduces image artifacts related to the coupled phenomena of beam hardening and profile flattening.

Conclusion:

Site-specific acquisition protocols that employ GCIs generated under different conditions result in substantial MV CBCT image quality improvement.

Conflict of Interest:

Supported by Siemens.