AbstractID: 4756 Title: Hounsfield Units calibration with adaptive compensation of beam hardening for a dose limited breast CT system

**Purpose:** Hounsfield Units calibration with adaptive compensation of beam hardening for a dose limited breast CT system.

**Method and Materials:** Following a complete cone beam CT scan of the target object (a human breast), geometrical parameters of the object, including the mass center location and maximum radius from the mass center were calculated promptly. These parameters were used to compute X-ray projection images of a water cylinder based upon photon attenuation in the cylinder and detector response. Projection images of the target object were corrected prior to reconstruction by logarithmic subtraction of the water cylinder projection images. CT images relative to the Hounsfield Units (HU) scale were produced after cone beam reconstruction of the corrected projection images. Custom built water phantoms were tested with various inserts, including polyethylene, polystyrene, PMMA, nylon, polycarbonate and Teflon, with a density range from 0.92g/cm$^3$ to 2.2g/cm$^3$.

**Results:** A wide range of breast diameters (10cm-18cm) and compositions (0%-100% glandular) were evaluated, and reconstructed and scaled HU values demonstrated excellent uniformity, linearity and consistency. Typical HU values were within 5% of theoretical values. The proposed method was applied to clinical breast scans. The "cupping" artifact caused by beam hardening in the original image was corrected as expected.

**Conclusion:** Conventional methods of Hounsfield Units conversion are based on the scan of few fix-sized water phantoms and lack the flexibility to compensate for the beam hardening from objects with various sizes. The introduced noise from water phantom scans is also not negligible, especially for a dose limited breast CT system with much lower mAs than whole body CT systems. The proposed method can compensate for beam hardening over a wide range of breast diameters and compositions without increasing noise contents in the image.

**Conflict of Interest (only if applicable):**