AbstractID: 3937 Title: A new fan-beam data consistency condition to estimate erroneous or missing projection data

**Purpose:** During diagnostic x-ray CT imaging procedures or image guided radiotherapy, some projection data may be missing due to malfunctioning detectors or limited field of view (LFOV) which is not big enough to cover the entire object. We present and validate a novel fan-beam data consistency condition (FDCC) to estimate missed or erroneous data due to the conditions given above.

**Methods:** A local Fourier transform of fan-beam projection data is introduced and the relationship with the Fourier transform of image function is established. Using the property of causality, a new FDCC is derived. The new FDCC provides an explicit estimation of any given missing projection data by filtering all other available fan-beam projections. This algorithm can be used to reduce the severity of artifacts when there are erroneous projection values present in the measured sinogram. The reconstructed image quality is significantly improved after correction compared to the image quality achieved by directly reconstructing with corrupted projection data.

**Results:** Numerical simulations have been conducted using this FDCC in the case that some detectors are out of order and constantly report a zero value. Two images of Shepp-Logan phantom are reconstructed using the standard filtered backprojection (FBP) reconstruction algorithm. One image is reconstructed with the original corrupted projection data and the other one is reconstructed with the projection data corrected by FDCC. Details in the phantom not visible in the original reconstruction are recovered and ring artifacts are significantly reduced using this algorithm.

**Conclusions:** This new FDCC was validated and has been proven to be a very powerful tool in correcting ring artifacts caused by corrupted projection data. Although the simulation was conducted for the malfunctioning detector case, this algorithm can be similarly applied to the LFOV case.

AbstractID: 3937 Title: A new fan-beam data consistency condition to estimate erroneous or missing projection data