AbstractID: 3423 Title: Geometric Calibration of An Extended View C-Arm Platform for Cone-Beam CT

Purpose: A mobile C-arm with a versatile detector mount (providing extended field-of-view) has been developed for multi-mode fluoroscopy and cone-beam CT image-guidance of surgical procedures. Geometric calibration estimating a set of parameters that fully describe the geometry of the systems is essential for the accurate image reconstruction and precise surgical guidance. We have developed a general analytic method to calibrate this system.
Method and Materials: The platform for the extended view C-arm for Cone-beam CT is a Siemens PowerMobil. Field of view can be extended originally from 18x24 to 18x40 cm^2 with the computer controlled linear guide system attached to the arm to displace the position of the imaging detector. It allows imaging objects such as pelvis of patients on C-arm. The calibration phantom, modified to fit in the field of view, consists of 16 ball bearings precisely located in two circular trajectories in a cylindrical plastic phantom. All the geometric parameters including source position, and detector position and rotation with respect to gantry angle are found at various detector shifts. The calibration algorithm previously developed and verified at the cone-beam CT systems on optical bench and clinical linear accelerator was applied.
Results: The uncertainty of the calibration algorithm is less than 0.6^o (out of plan) and 0.01^o (in plan) in detector angles, 0.01mm (normal to the beam direction) and 1.4mm (beam direction) in x-ray source/detector position. Repeatability of the center of the detector in various gantry angle and detector shift was less than 1 pixel size. Optimal weight of the counter valance for precise motion of the extended view C-arm was also found using the calibration parameters.
Conclusion: Overall, a robust method has been developed for an accurate geometric calibration of systems demonstrating non-ideal trajectory. This will allow an accurate cone-beam CT reconstruction and manual/robot-assisted image guided surgical procedures.