

AbstractID: 5656 Title: A Tool for Off-line Review of 3D Target Verification and Localization with Cone-Beam Computed Tomography.

**Purpose:** To implement a clinical tool for off-line review of Cone-Beam Computed Tomography (CBCT) based 3D target verification and localization.

**Methods and Materials:** An in-house 3D target localization and verification tool is being developed to allow physicians and physicists to review daily treatment target off-line. The system provides quick initial target verification via user selected landmark points. An automatic gray-scale registration technique provides fine-tuning of the 3D target localization. It also allows the preference of soft-tissue weighted vs. bony landmark weighted registration.

A rigid body 3D-image registration method, using a combination of correlation coefficient and mutual information measurements, has been developed. The registration algorithm uses a downhill simplex optimization technique to search for the best match of the two image sets.

This study evaluates the efficacy and accuracy of the system. First, each CBCT and CT pair is manually registered by a human expert. Then these CBCT are input to the software to be registered with the planning CT. The comparison of the computer calculated 3D correction against the manual alignment evaluates the accuracy of the system.

**Results:** 5 CBCT sets of prostate cancer patients are tested. The registration is bone weighted to simulate actual treatment target position. For all cases, the bone structures are well superimposed on the fused images. However, part of the prostate and rectum shown certain degree of mismatch due to different rectal fillings between CBCTs and CTs. Overall registration accuracy is as accurate as 1 mm and 1 degree for bone structures.

**Conclusion:** An off-line 3D target localization review tool was implemented. For prostate cases, its accuracy is acceptable for clinical use. Further implementation of the tool to other disease sites and evaluation of soft tissue vs. bone based target localization is underway.

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