Purpose: To validate the stability and accuracy of a new image registration assistance tool UTRS (Universal Treatment Plan Review System) [Case Western Reserve University, Cleveland, OH]) for CT and PET images. UTRS was developed to review and manage the DICOM and DICOM-RT data sets, performing both manual and assisted image registration.

Methods: We tested two groups of patients with existing PET/CT fusions performed by a clinical fusion expert. The first group consisted of 17 Head and Neck cancer (HN) cases and the second of 20 Lung cancer (LC) cases. In both groups, each patient's PET image set was aligned to the patient's CT image set using the assisted registration method in UTRS. For the HN cases, Spatially Weighted Mutual Information with Gaussian Weighting (SWMI-GW) was selected as the metric. Mutual Information was used to register the LC cases. The existing MIM (MIM software Inc., Cleveland, OH) fusions are used for comparisons.

Results: Visual checks confirmed the assisted registration of UTRS was comparable to the expert manual registration using MIM. Computational comparisons showed the Mean Absolute Differences (MADs) between the two registrations were less than 3.1mm in translation and 1.2 degree in rotation for HN cases. For LC cases, the MADs between MIM and UTRS were less than 2.9mm in translation and 1.5degree in rotation.

Conclusions: Since a MIM's validation study showed the manual registration of MIM had a comparable variation; up to 2.93mm MADs from their average registration, we concluded that the assisted registration of UTRS is also valid for clinical use.

We also found that rotational corrections were necessary for many cases between the image sets from the CT simulator and the diagnostic PET(/CT), even with the same immobilizer. The assisted registration dealt with rotations better since a 3-dimensional manual rotation on 2-dimensional screen is obtuse.