# AbstractID: 8508 Title: 3D Pathology Validation for Head-and-Neck Tumor Segmentation in PET/CT/MRI Images


**Purpose:**

To describe a prospective validation study that reconstructs a 3D pathology tumor volume from the surgically excised tumor and registers it with *in vivo* PET/CT/MRI images. This will provide a gold standard for evaluating the accuracy of tumor segmentation methods.

**Method and Materials:**

We design a protocol that collects *in vivo* PET/CT/MRI images and spatially registered surgical pathology data for patients with head-and-neck cancer. A 3D pathology tumor volume is reconstructed from the fixed, sectioned and pathologically marked specimen. The challenging task of registering it with the PET/CT/MRI images is implemented by acquiring intermediate CT/MRI images of the fixed and fresh specimen and registering these images sequentially. The registration is limited to a local region and the allowed translation, rotation, and scaling (based on estimated shrinkage) is bounded. Manual adjustment can be employed. The accuracy of the registration is quantitatively evaluated by manually localizing anatomic landmarks, and then measuring the distance between the transformed landmark position and the manually determined position.

**Results:**

Clear differences were observed for tumor segmentation in PET between manual contouring, thresholding, and a novel adaptive region growing + dual front active contour method. This suggested that a gold standard for 3D tumor boundary is required to evaluate the segmentation results. Six methods were evaluated for CT-MRI and MRI-MRI registrations. Intensity-based registration showed similar accuracy (1.5 mm) as manual registration. Brain surface-based registration showed inferior accuracy (3.3 mm). Both non-rigid registration and manual registration following a rigid registration improved the accuracy by 0.1-1.1 mm.

**Conclusions:**

We proposed a study on 3D pathology validation for tumor segmentation in patient images. Cares need to be taken in collecting the data. Quantitative evaluation should accompany each registration to assure the accuracy of the process.