Purpose: To evaluate the quality of two CT/MRI image fusion algorithms used for 3D-CRT and IMRT treatment planning

Method and Materials: Computed tomography-magnetic resonance imaging (CT-MRI) fusion was performed for nine patients with brain/head & neck lesions. Some patients have undergone both three dimensional conformal therapy (3D-CRT) and intensity modulated radiation therapy (IMRT) using two commercially available treatment planning systems which we will refer to as system (1) and system (2), respectively. In order to quantify the fusion results bony landmarks, such as the ramus of the mandible or part of the skull bone, were outlined on the reformatted MRI and the position of the outline in reference to the same bony landmark on the CT image were measured.

Results: Based on what was acceptable fusion for our clinicians, this preliminary study showed registration accuracy between CT and MRI within 3 mm and 2 mm for system (1) and (2), respectively. On system 2 the quality of the fusion, the bar display, was in the range 62.5% - 100%. We also found that getting full bar (100% - 'perfect match') is possible with reasonable effort if one uses three fiducial marks. Though the bar showed 100% fusion quality the fusion results were not satisfactory. We found better fusion using five or more fiducial points with 62.5 % to 75 % fusion quality.

Conclusion: Fusion software in both systems provides sufficient CT-MRI fusion accuracy. However, one has to be careful in interpreting the semi-quantitative bar display in system (2) fusion results. We found that instead of going for a perfect matching bar using few fiducial marks one has to use more points, at least five, even if one gets lower percentage match as this is averaged over more landmarks.