AbstractID: 13224 Title: Development of a Novel Multipurpose Specimen Slicing-Imaging Platform

Purpose: To develop an automated system that slices and images surgical specimens for volume reconstruction.

Methods and materials: In order to correlate radiographic images with pathologic tumor volumes, a technique that can cut different tissue structures with minimal specimen deformation is required. Thus a high precision cutting surface with ultra-low cutting forces is needed for this application. A specially designed rotary wire saw using a closed-loop, diamond coated cutting wire rolled by a motor-driven pulley was used for this purpose. This motor was computer controlled for variable cutting speed. The sample was held in paraffin or gelatin with a Styrofoam mold and was driven by a computer-controlled linear slide that fed the sample to the wire saw. After each slice, a CCD camera was used for imaging the cut surface. The image resolution can be adjusted steplessly from 1 μm/pixel to 5 μm/pixel with the field of view varying from 3.2 x 4.4 mm to 16 x 22 mm. Raster scanning was employed when studying large samples. Different animal tissue samples including kidney, liver, heart and shank were used to evaluate the cutting device, i.e., the consistency of slice thickness and the evenness of the slice surface. The relationship between tissue loss and 3D volume reconstruction was also studied.

Results: Slice thickness was measured by both caliper measurements and pixel counting on corners. Both the single slice thickness variation and the overall slice thickness variation were within 5% agreement by both measurements. Surface roughness was similar to microtome slices. The kerf loss was consistently 0.28mm ±0.01mm and had a very small disturbance on 3D model reconstruction.

Conclusion: 3D volume reconstruction using this automated technique closely approximates the specimen volume and can be used for correlating radiologic volumes with pathologic volumes.