

**CASI DMT HARDWARE
AND SOFTWARE
DEVELOPMENT EFFORT
RESEARCH PROGRESS REPORT
THIRD QUARTER 3Q**

COMPUTER AIDED SURGERY INCORPORATED

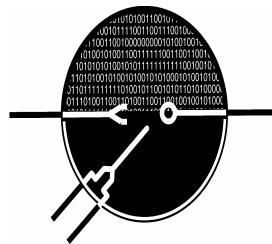
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**Research Technical Progress report 01 for
NIST ATP COOPERATIVE AGREEMENT
70NANB1H3050**

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A handwritten signature in black ink that reads "D. B. Karron, Ph.D." The signature is written in a cursive style.

D. B. Karron, Ph.D. President and C.T.O.

1 ABSTRACT

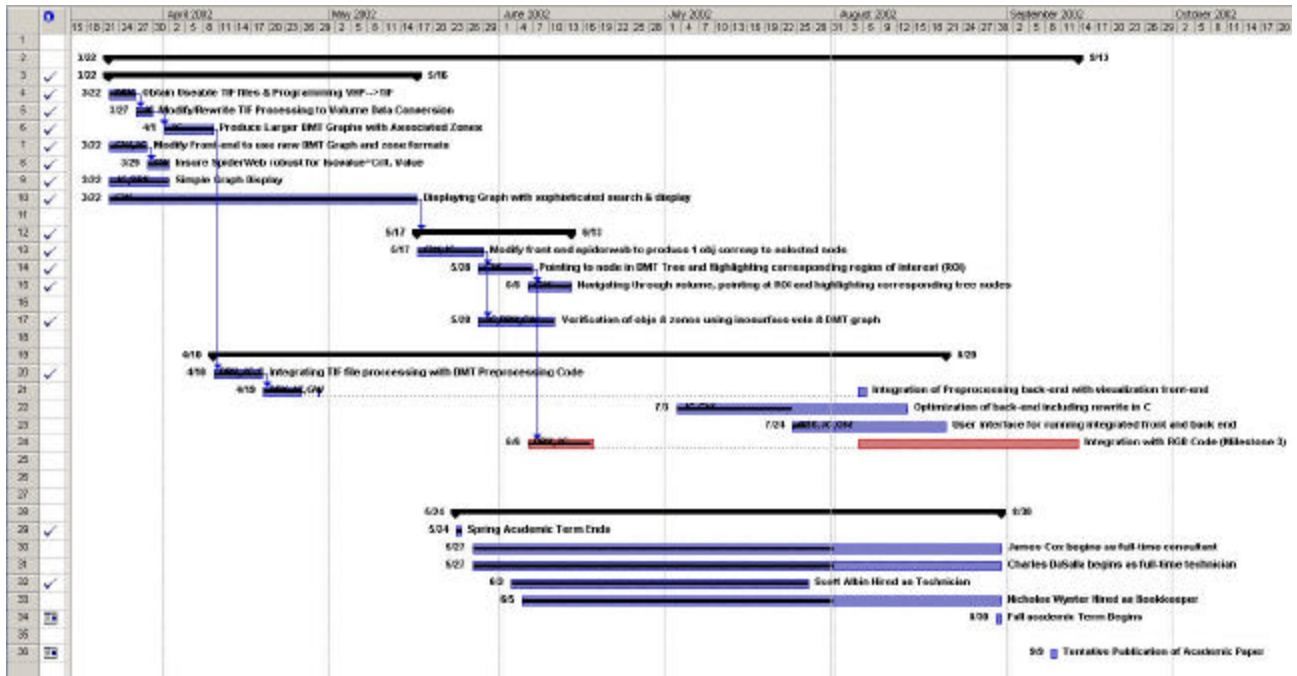
This report describes the 3q progress toward a rapid 3d DMT segmentation tree for rapid, accurate and precise segmentation of hard and soft tissue.

Significant progress has been achieved in the prototype code for calculating the DMT tree and drawing the isosurfaces. We are working toward non-iso segmentation surfaces and a rapid and intuitive user interface.

The beginning of the summer brought a new burst of effort by the academics able to work full time. Summer heat caused exceptional problem in managing a high-powered computer facility in a home taken over by high tech equipment and programmers.

2 PROGRESS METRICS

Overall Gantt Chart



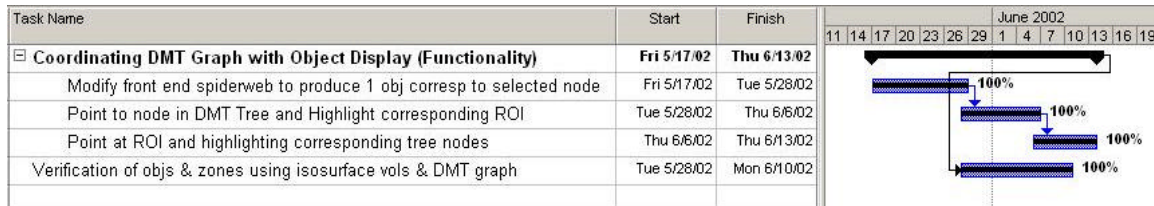
Gantt chart detail and narratives:

Graph Generation from Visual Human Project (VHP)



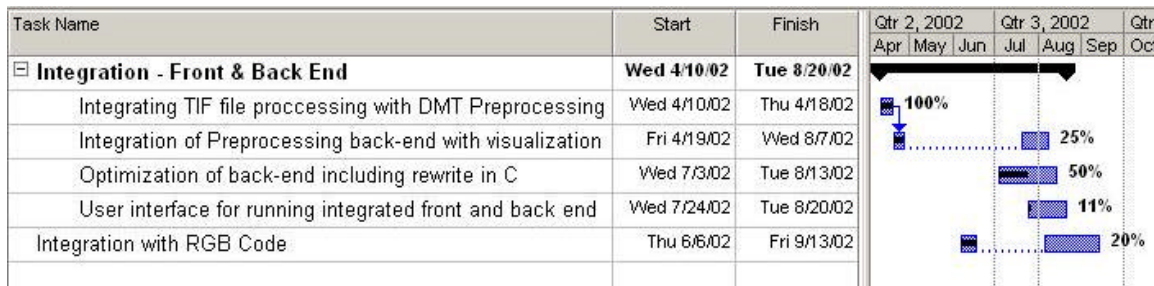
For graph generation, useable TIF files were obtained from the VHP data, TIF processing was modified for Volume Data Conversion, larger DMT Graphs with Associated Zones were produced, front-end modifications were made, robustness was checked for isovalue to critical value, and a simple graph display with search and display features was written. All tasks required in graph generation were at 100% completion by May 16, 2002.

Coordinating DMT Graph with Object Display



Following graph generation, functionality was implemented, coordinating the DMT graph with the object display. This required modifying SpiderWeb to produce 1 object corresponding to a selected node, allow the user to point to a node and return the corresponding region of interest (ROI) and vice versa, and verify objects and zones using isosurface volumes and the DMT graph. All tasks required to coordinate the DMT graph with the object display were at 100% completion by June 13, 2002.

Integration of Front & Back End



Integration of front and back end will be the focus for the next two months. Integration of TIF file processing with DMT preprocessing has been completed. Tasks pending completion include integrating preprocessing back end with visualization front end, optimizing of back end and possibly rewriting in C, developing a user interface for running integrated front and back end, and integrating with RGB code. Completion of most of these tasks is expected by late September or October.

3 DIFFICULTIES

We have had significant problems attempting to do image processing on the PC side of the shop; therefore we have decided to refocus and redouble our effort on the SGI development environment.

The initial implementation of our surface rendering used a voxel by voxel construction of the surfaces that relied on a criticality/zone representation that was not disk space and memory efficient.

We subsequently optimized and changed the zone representation employed by the back end pre-processing. The front end was modified to employ the new image DMT representation. Additionally, we rewrote the surface rendering code so that it tracks the surface from multiple active voxels and modified the SpiderWeb algorithm code to allow for NON-ISOVALUED surfaces.

This is in anticipation of the requirement for a true 'SEGMENTATION SURFACE', which is one of the revolutionary approaches, unique in surface rendering technology. We will achieve surface model segmentation by threading or navigating a segmentation surface through the DMT graph to select the objects we desire.

4 ACCOMPLISHMENTS

Our accomplishments to date are the development of highly efficient code to calculate and render both isosurface and non-isosurface SpiderWeb surfaces. This is performed quickly using our DMT zone segmentation. Our DMT criticality detection, criticality tree building, and DMT zone segmentation code has improved from a painful 3-4 hour run on data cubes of 100^3 to 30 min for a 100^3 data cube.

We hope to achieve almost real time performance by the end of the year on a full 512 x 516 x 700 volume such as the Visible Human Dataset.

A sample animation loop is given at the enclosed CD. It can be viewed with the command `netscape monster.gif` .

5 DISCUSSION

Much remains to be done, but the pace of the programming effort is improving, becoming more focused. The team is becoming more cohesive and we are better able to communicate our technical problems as the meaning of DMT becomes clear.