



Medical Imaging

Image Generator to Support the Application of a Haptic
Device for the Simulation of Arthroscopic Surgery

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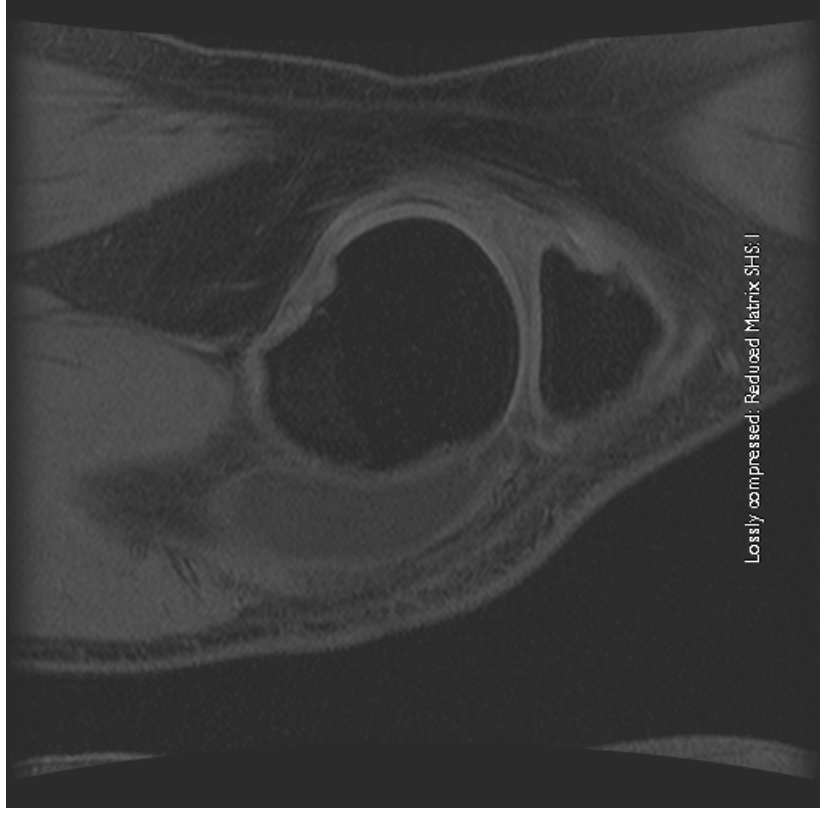


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Project Introduction

- Magnetic Resonance Imaging (MRI)
- MRI show cross section knee
- Create 3-D model of cartilage
- Simulate surgeon's view during arthroscopic surgery
- Simulate the arthroscopic surgery with a haptic feedback system



MRI Scan of Knee

Picture Provided By Dr. Stewart



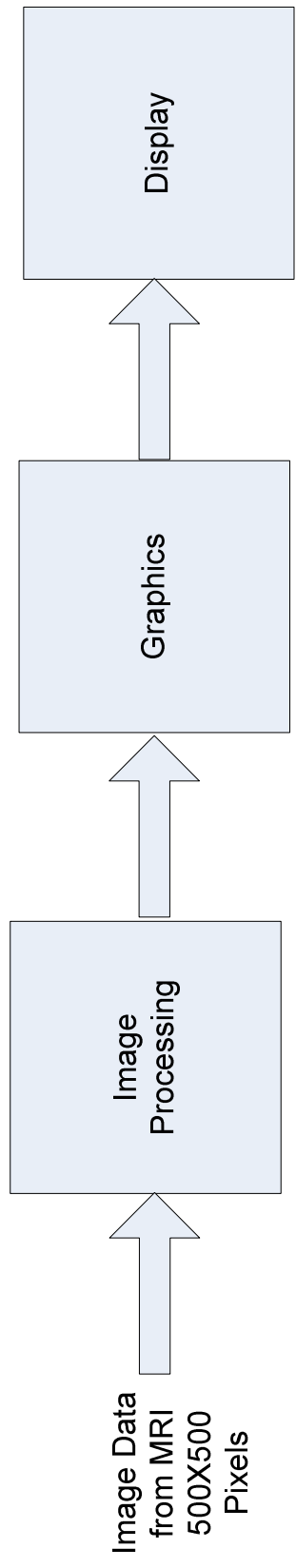
Project Introduction

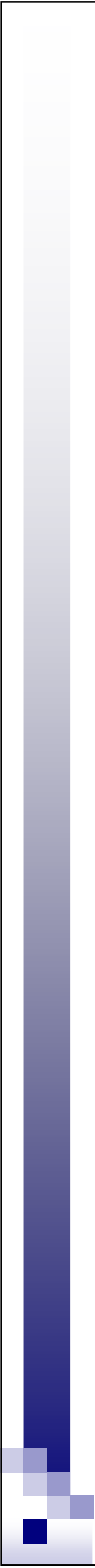
- Not Diagnosis Tool
- Medical Students
- Current medical simulator enables demonstration and trial of insertion of torqueable elongated members (guide wires or catheters) into small body passages

System Block Diagram



System Block Diagram

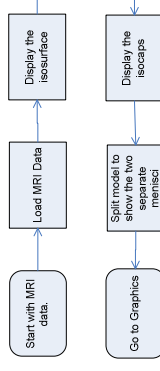




Software Block Diagrams

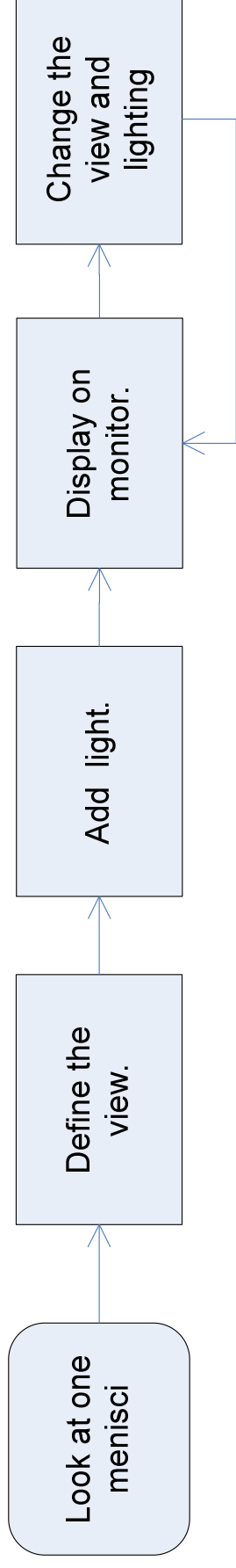
- Image Processing Block Diagram
- Graphics Block Diagram

Image Processing Block Diagram



- Creates model of cartilage
 - Isosurfaces-displays overall structure of cartilage
 - Isocaps-reveal details of interior cartilage

Graphics Block Diagram



- Takes the model of cartilage and creates the simulation of an arthroscopic meniscus surgery

Actual Views of Arthroscopic Knee Surgery

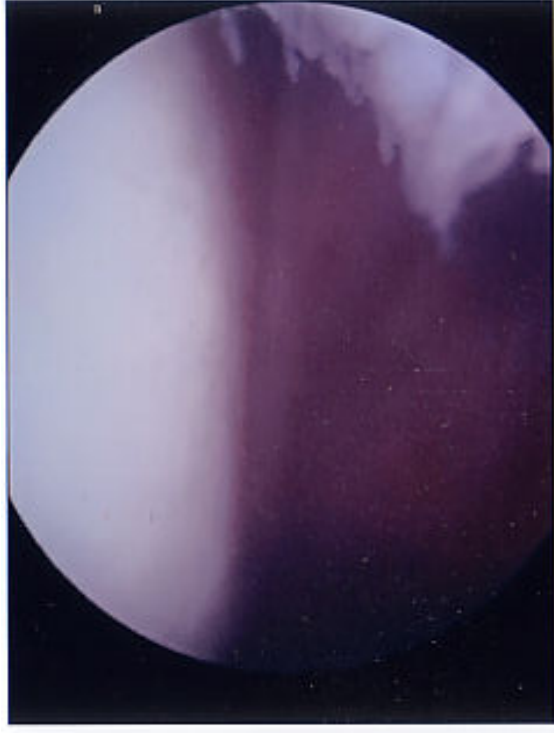


Figure 1: Arthroscopic Surgery View of Torn Cartilage



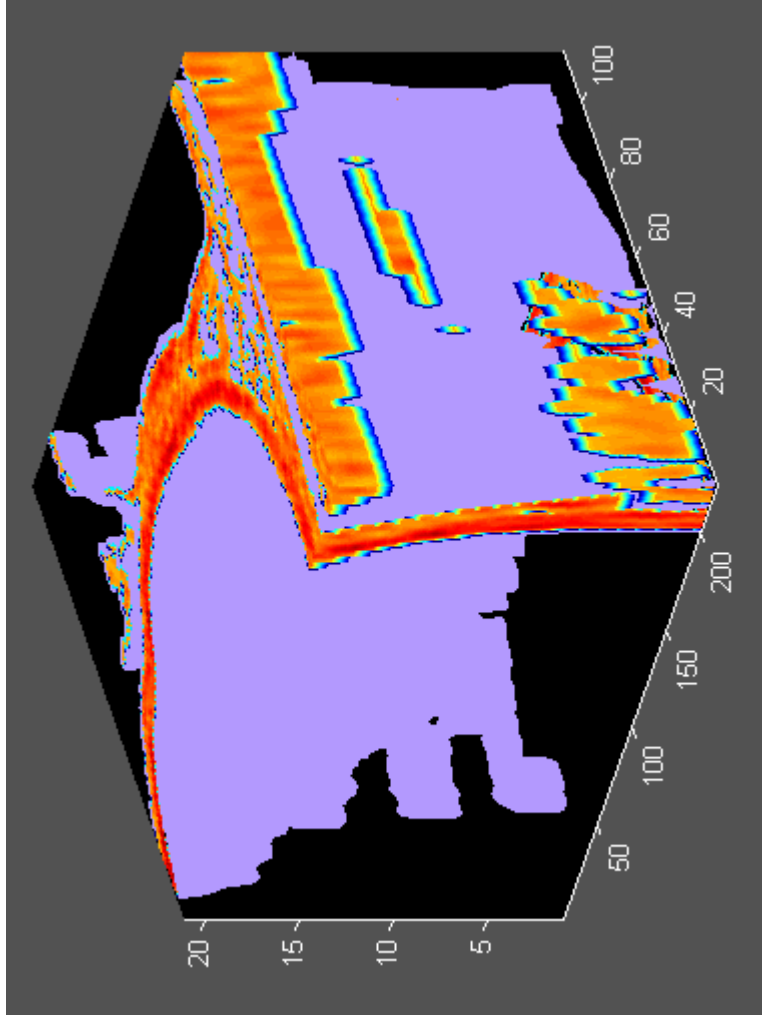
Figure 2: Arthroscopic Surgery View of Healthy Cartilage



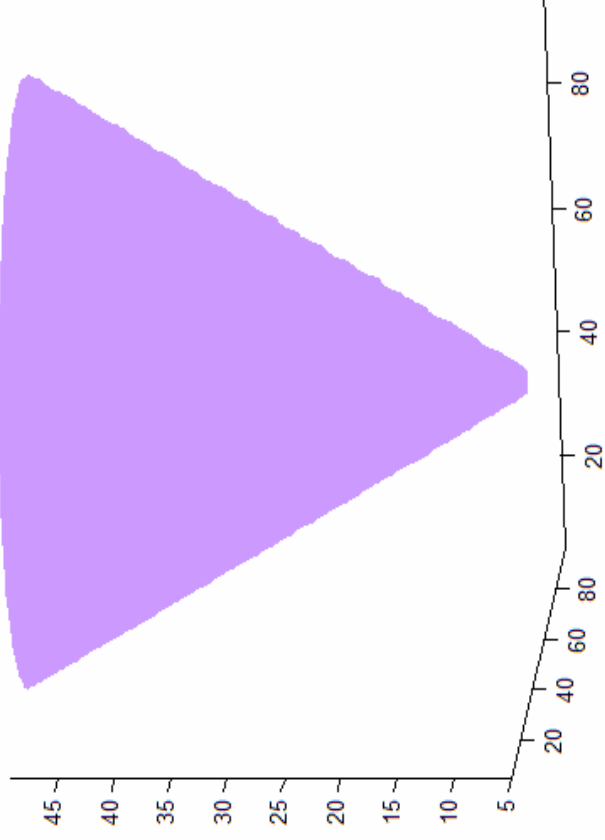
Preliminary Results / Issues

- Model of Cartilage
- Lighting
- View Control
- Making the MRI data model look like an arthroscopic surgeon's view

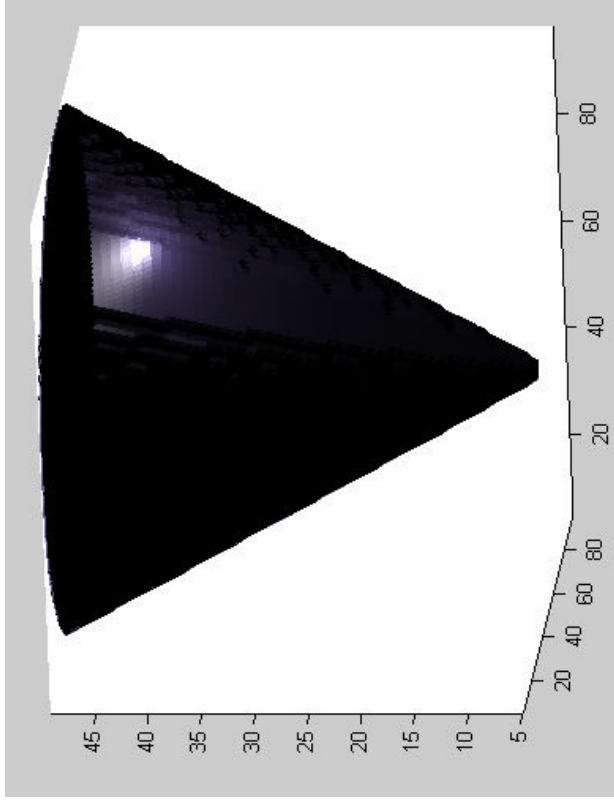
Model of Cartilage



Lighting



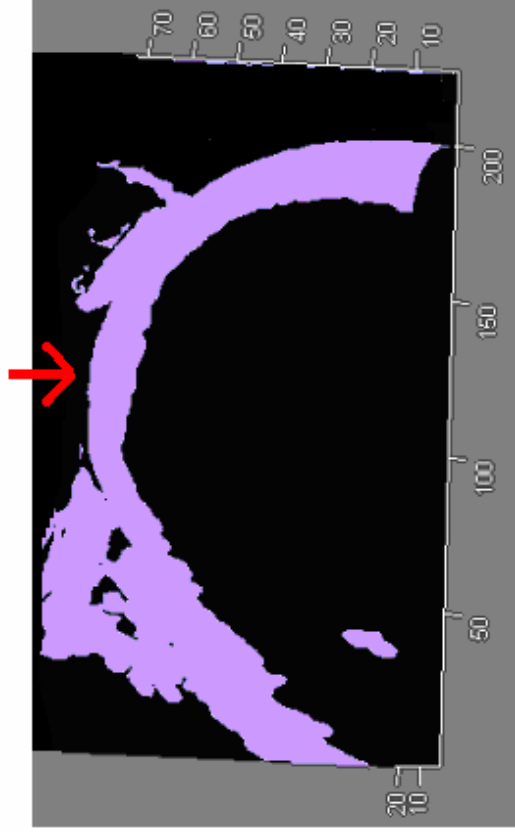
- Cone Model



- Cone with Light

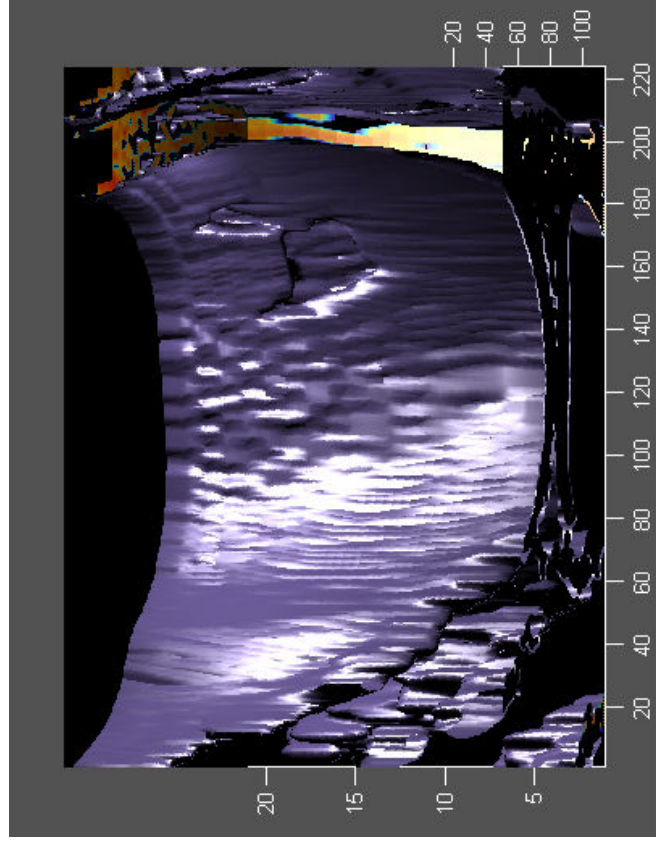
View Control

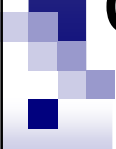
- Matlab Functions
 - Camera position
 - Camera target
- Views from different angles and at different locations
- Limited - cartilage is not yet split



Simulation of Surgeon's View

- Light added to Cartilage Model
- Problems
 - Model blows up the size of the cartilage on the screen
 - Lack of data causes distortion to show on the cartilage when light is added
- Proposed Solution
 - Render data between two points
 - Two dimensional filter over a curve





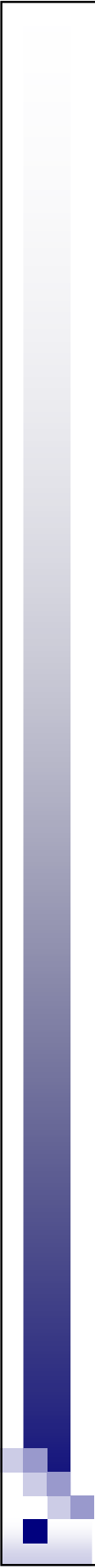
Schedule

Date	Task
12/06/05	Present Project
12/07/05	Study Day
12/16/05	Research rendering routines for cartilage model
01/19/06	
01/26/06	Address rendering issues of cartilage model
02/02/06	
02/09/06	Address light issues of cartilage model
02/16/06	
02/23/06	Research light and view control on cartilage
03/02/06	
03/09/06	Address issues for the light and view control
03/16/06	
03/23/06	Research haptic feedback system
03/30/06	
04/06/06	Implement haptic device with cartilage model
04/13/06	
04/20/06	Documentation, Presentation
04/27/06	



Equipment List

- PC with Matlab Version 7.0.1
- SensAble Phantom Omni Haptic Device



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Questions?