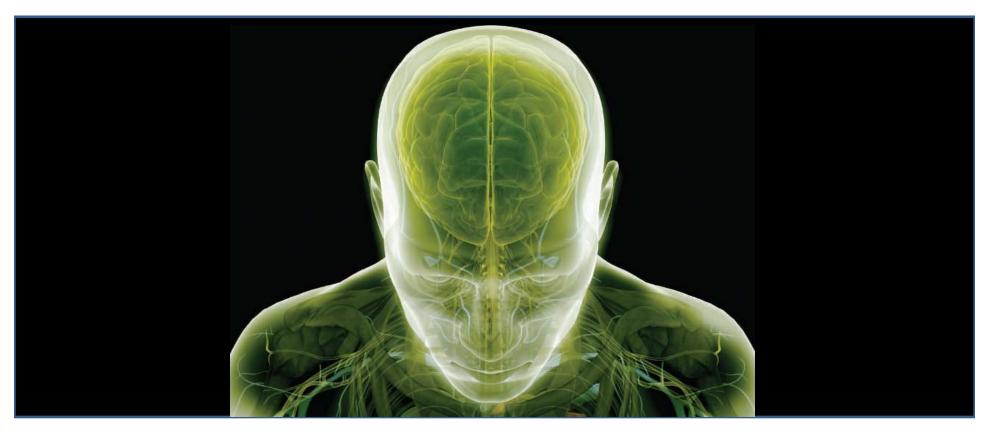


## **3D Visualization Algorithms Using VTK**



#### **Teodora SZASZ** Faculty of Electronics, Telecommunication and Information Technology

# Objective

Understand and implement the techniques used for medical image visualization (especially in neuroscience domain)



# Contents

Techniques and Tools
2D Visualization Methods
3D Visualization Methods
Conclusions

## **Techniques and Tools**

#### Common acquisition methods:

Computed Tomography (CT)

Magnetic Resonance Imaging (MRI)

#### Medical format: DICOM

Why it is not good to use DICOM in 3D visualization?

#### Implementation: \*VTK

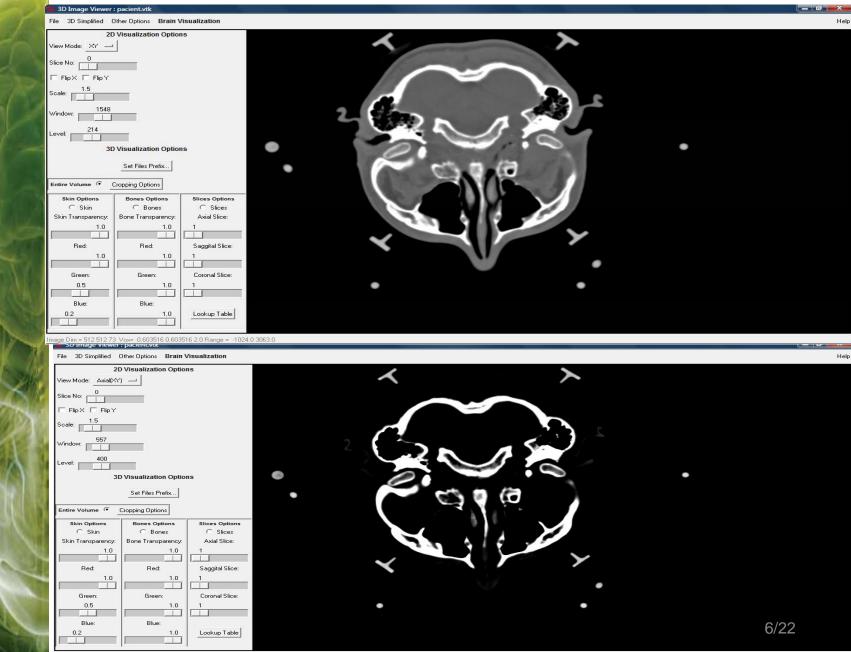
**\*Tcl /Tk scripting language** 

\*VTK – Visualization Toolkit \*Tcl/Tk – Tool Command Language

## **2D Visualization**

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## **Window and Level Adjustments**



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## **3D Medical Visualization Algorithms**

• Main methods of volume rendering in medical visualization:

## Indirect volume rendering

- Plane-based volume rendering ("the cine mode")
- Surface-based volume rendering

### Direct volume rendering

- Ray Casting Algorithm
- Shear Warp
- Texture-Mapping

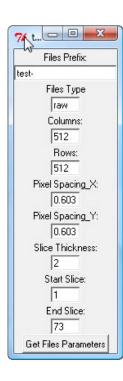


# **Converting DICOM to RAW**

Transform DICOM format into RAW format

#### Reading the files

interface:



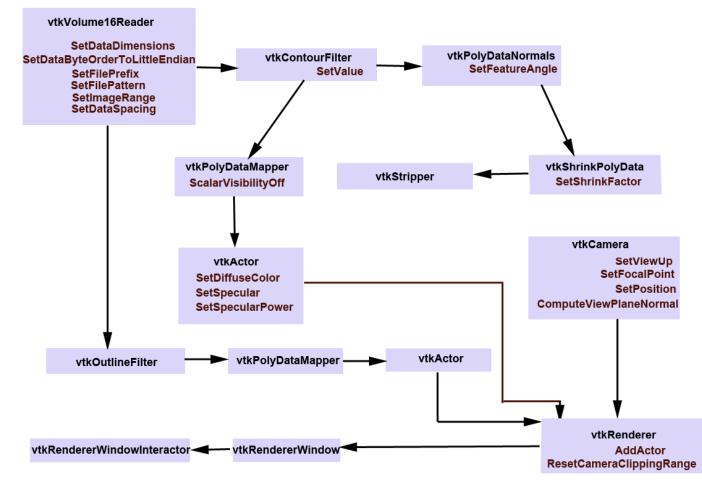
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(part of the header file)



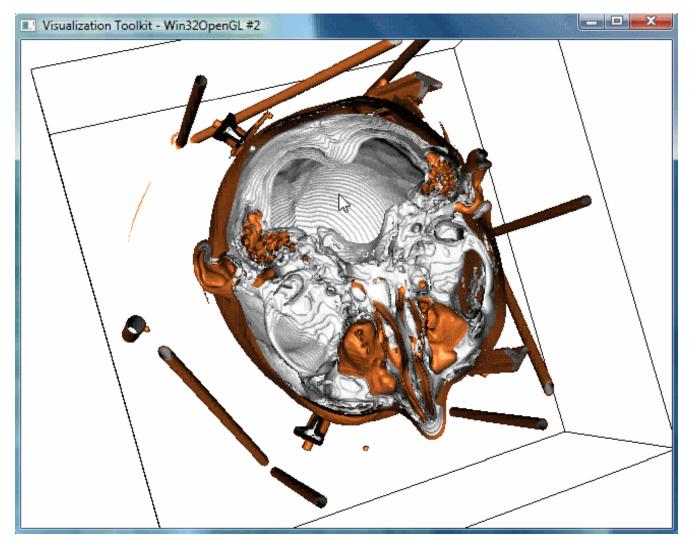
## **Isosurface Extraction**

#### • VTK Classes used for Isosurface Extraction:





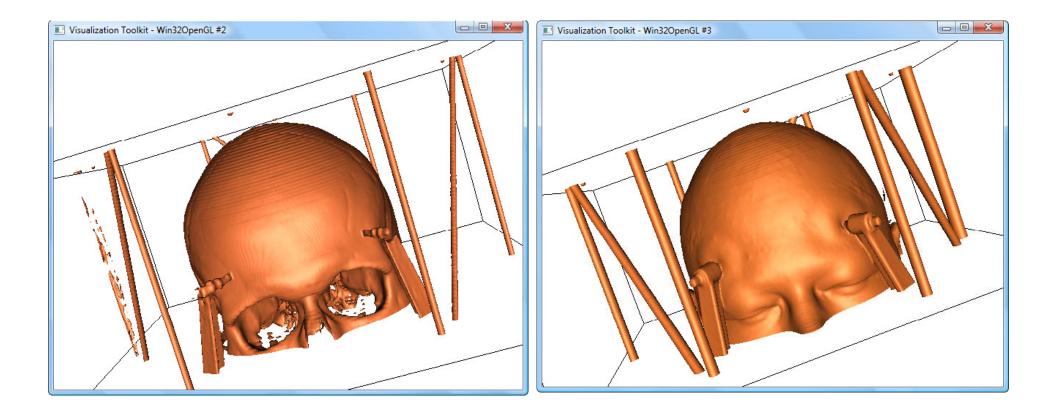
## **Bones and Skin Extraction**



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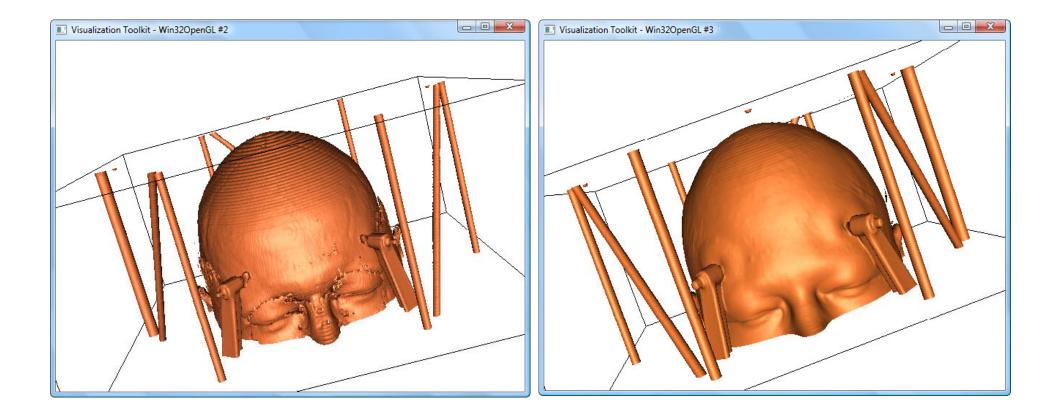


#### Isosurface Extraction: Skin Extraction DICOM (isovalue = 500) versus RAW (isovalue=500)



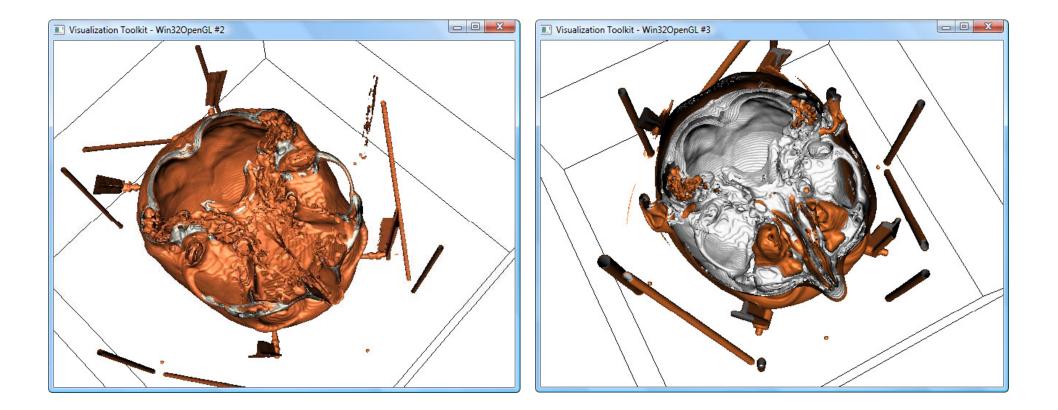


#### Isosurface Extraction: Skin Extraction DICOM (isovalue = 100) versus RAW (isovalue=500)



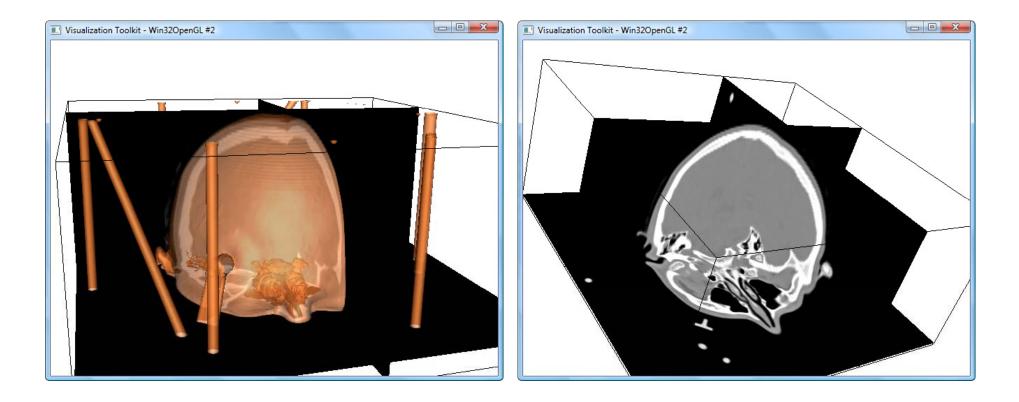


#### Isosurface Extraction: Bones Extraction DICOM (isovalue = 1250) versus RAW (isovalue=1250)





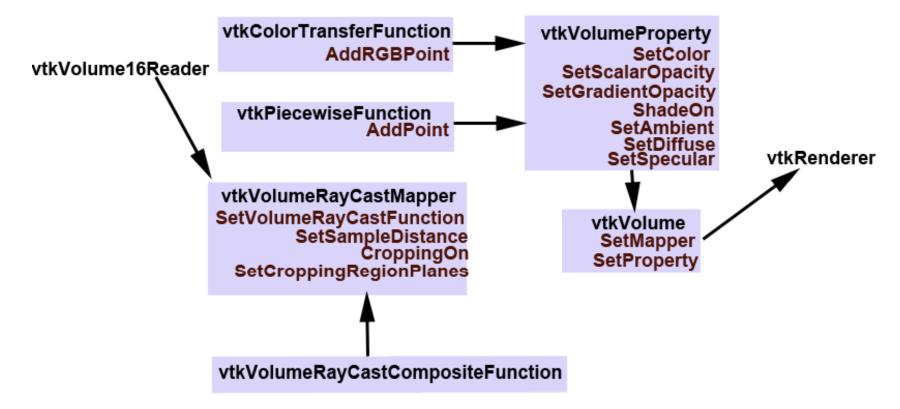
## Volume Visualization Including the Orthogonal Planes





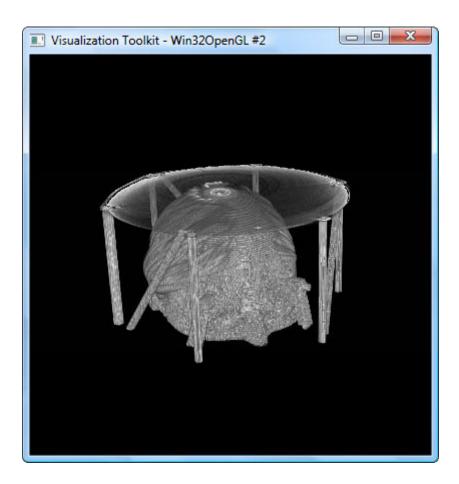
## **Direct Volume Visualization**

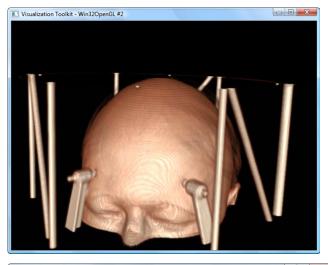
#### **>VTK Classes used for Direct Volume Visualization:**

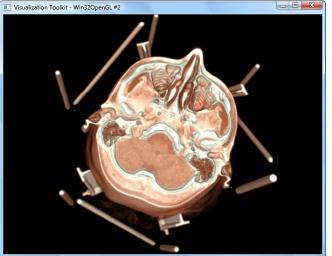




### Direct Volume Visualization DICOM versus RAW



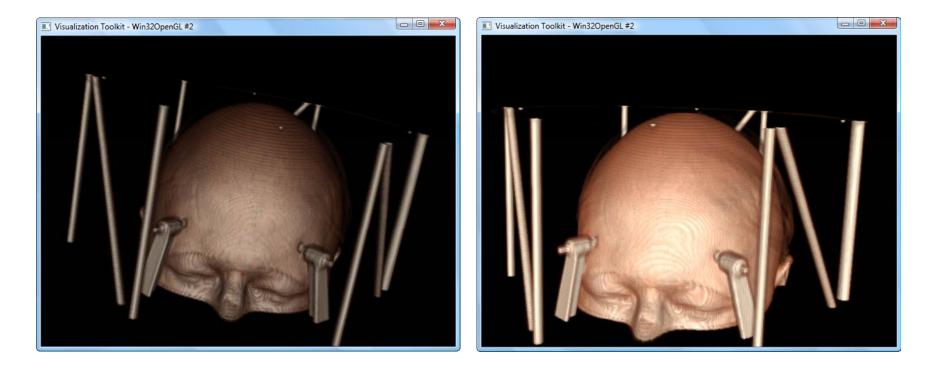




16/22

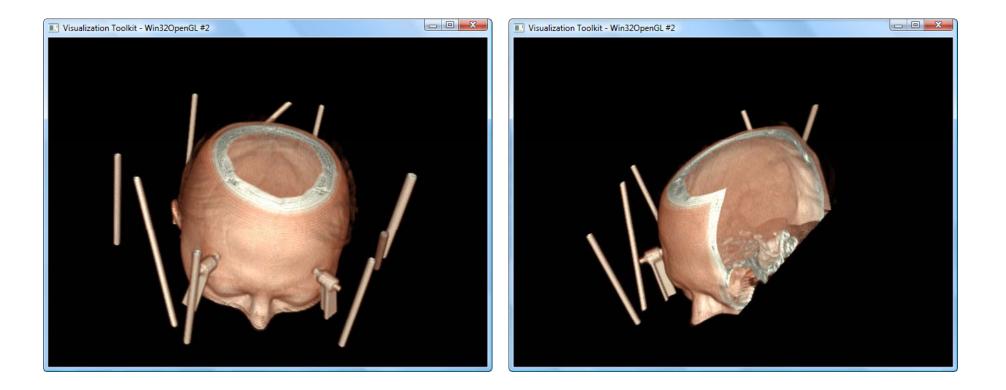


### Direct Volume Visualization VTK 5.6 versus VTK 5.4



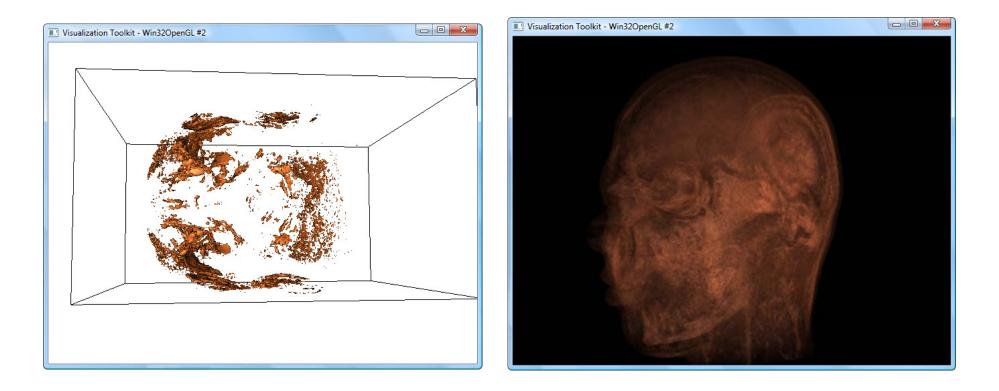


# **Cropping Options**





# Using MR dataset (skin extraction and direct volume visualization)



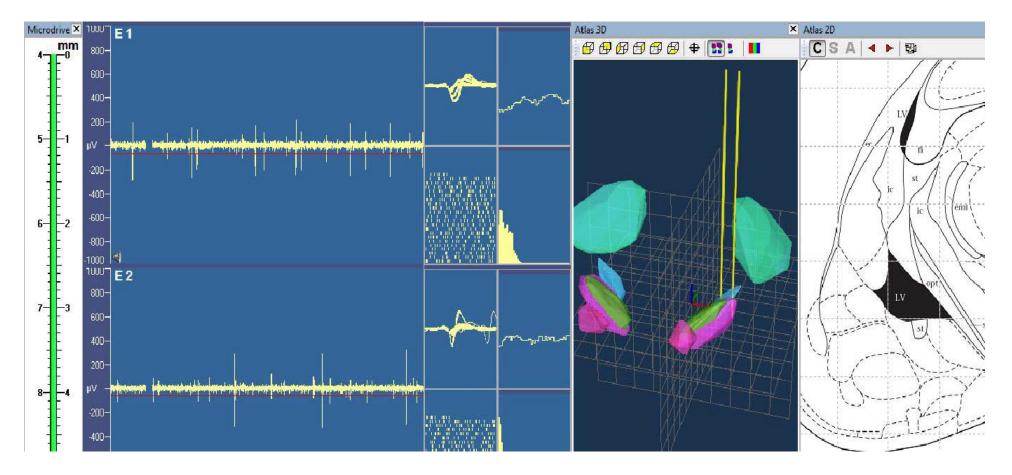
## Conclusions

> medical imaging visualization

How to improve volume rendering?
Neurosurgery planning software



#### **Neurosurgery Planning Software – Example for the future work**





# **THANK YOU!**

