The Second
Biomedical Engineering
Workshop

Introduction to Medical Visualization

Ahmed Ramadan - Yasser Daoud

360 Imaging – Symbyo Technologies

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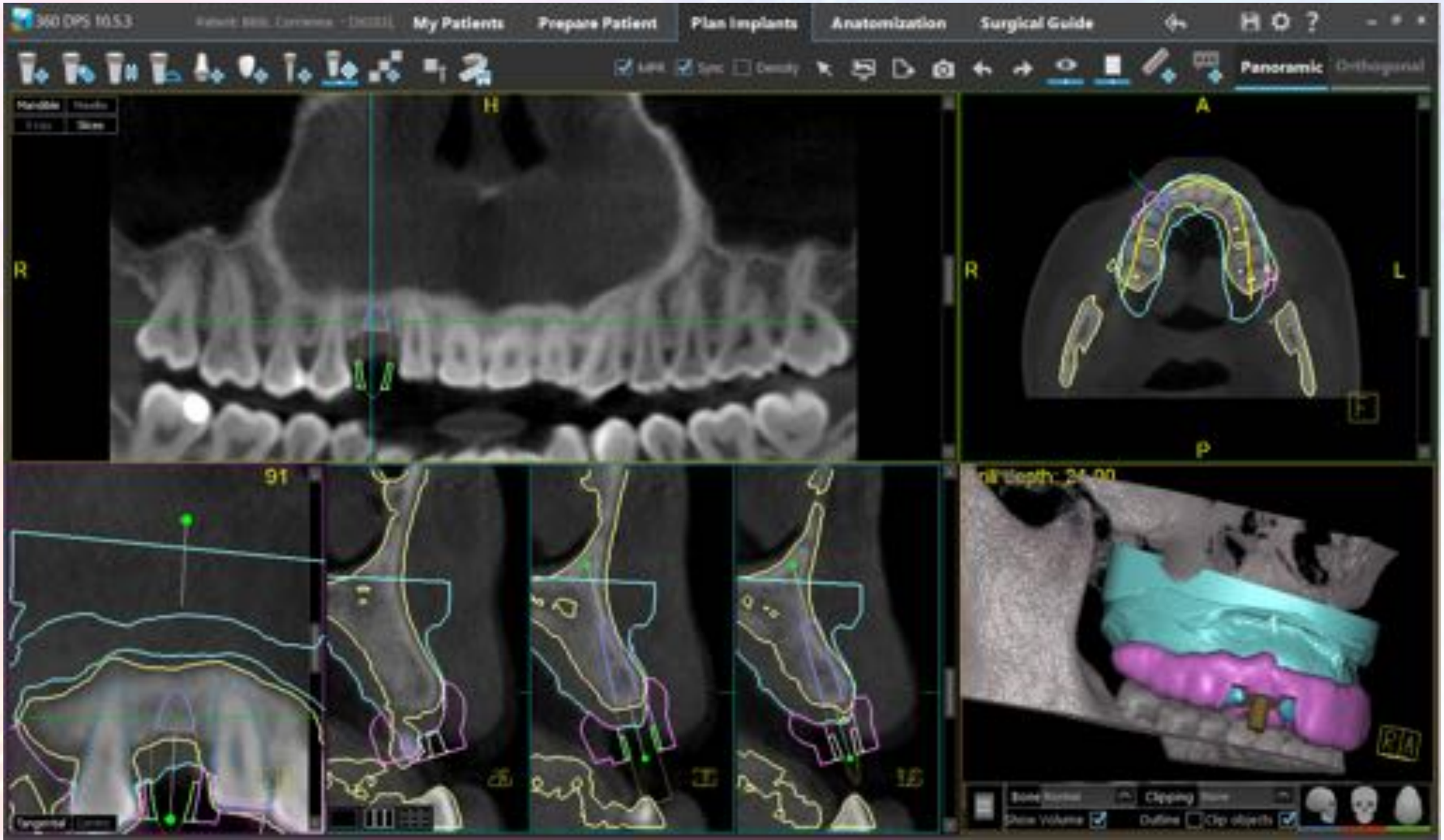
360 Dental Planning System



Visualization

Is to synthesize (generate) an image that describes numerical data.

In the medical field, advanced computer graphics techniques are used to generate realistic images of the medical data.

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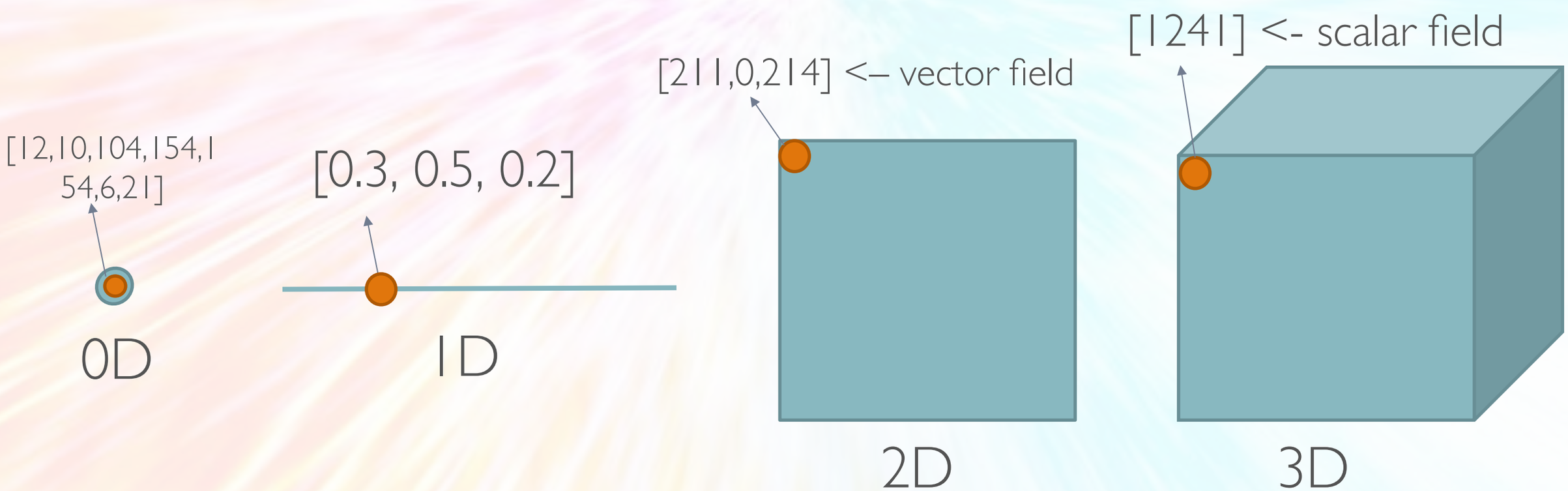
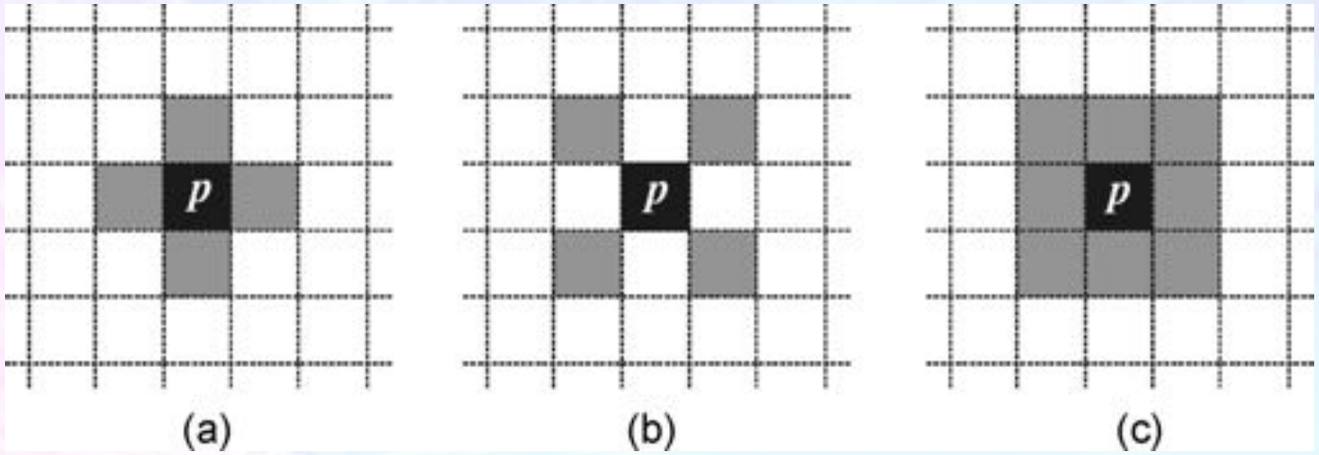
Space and Data

- Space
  - Where the data lives. (location and neighborhood)
  - Has its own dimensionality
- Data
  - A Space is always required
  - A discrete instance of the data at a specific position in space
  - Has its own dimensionality

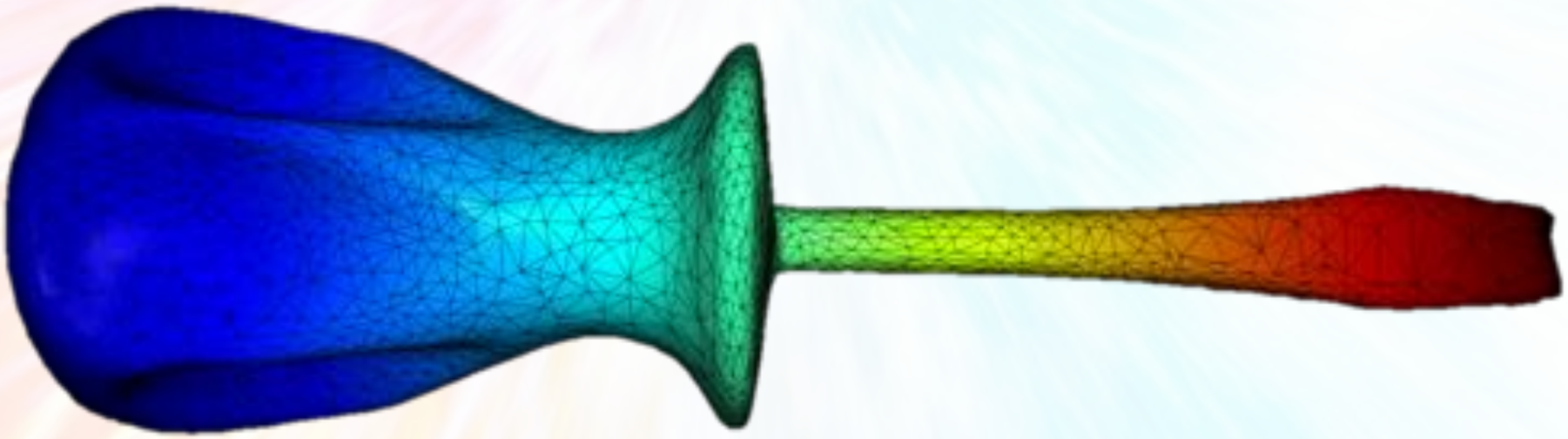


Space and Data

- Neighborhood
  - 4-neighbors
  - 8-neighbors



- Topological Space
  - Triangle Mesh



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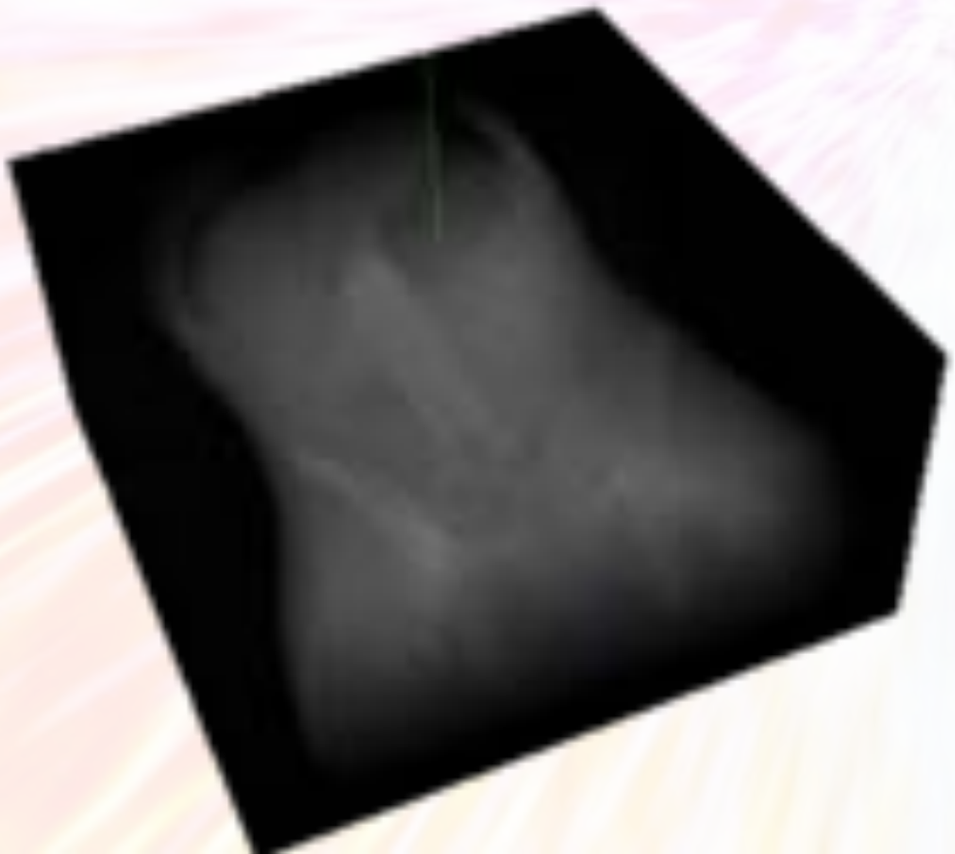
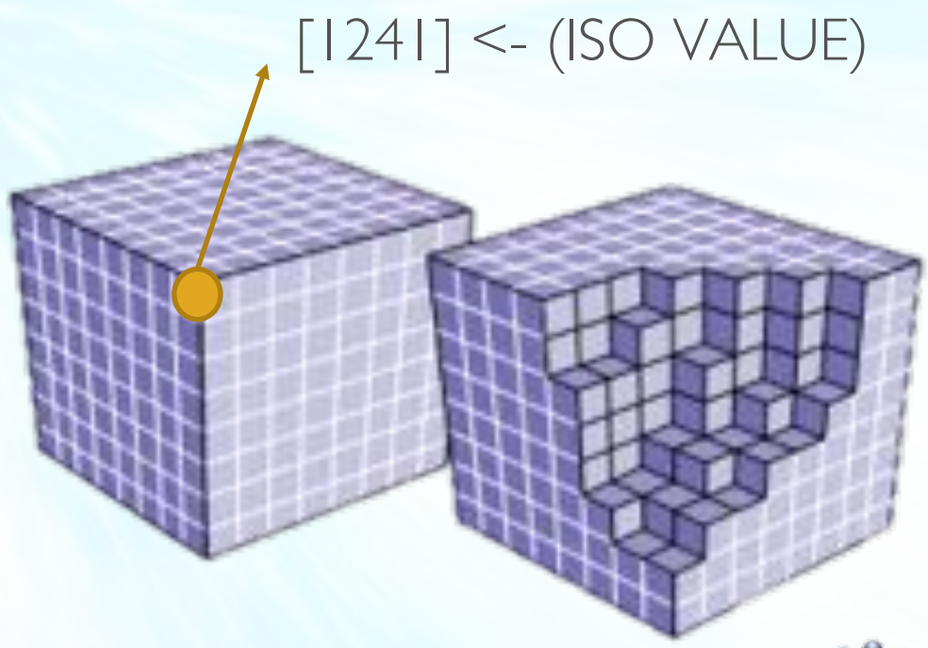
CT Volume Data

- Format: (DICOM)
- Space Dimensionality: 3D
- Data Dimensionality: 1D





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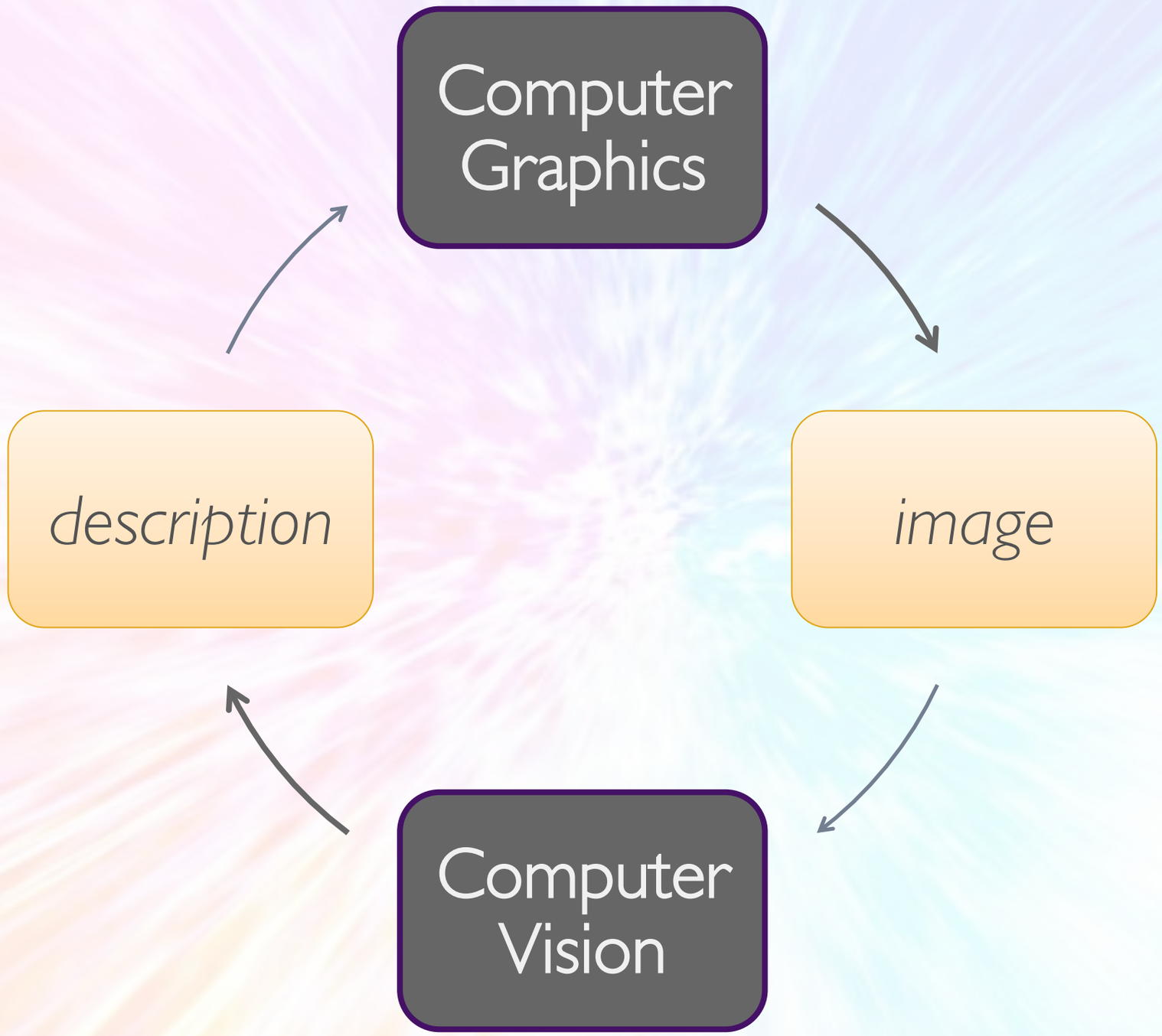

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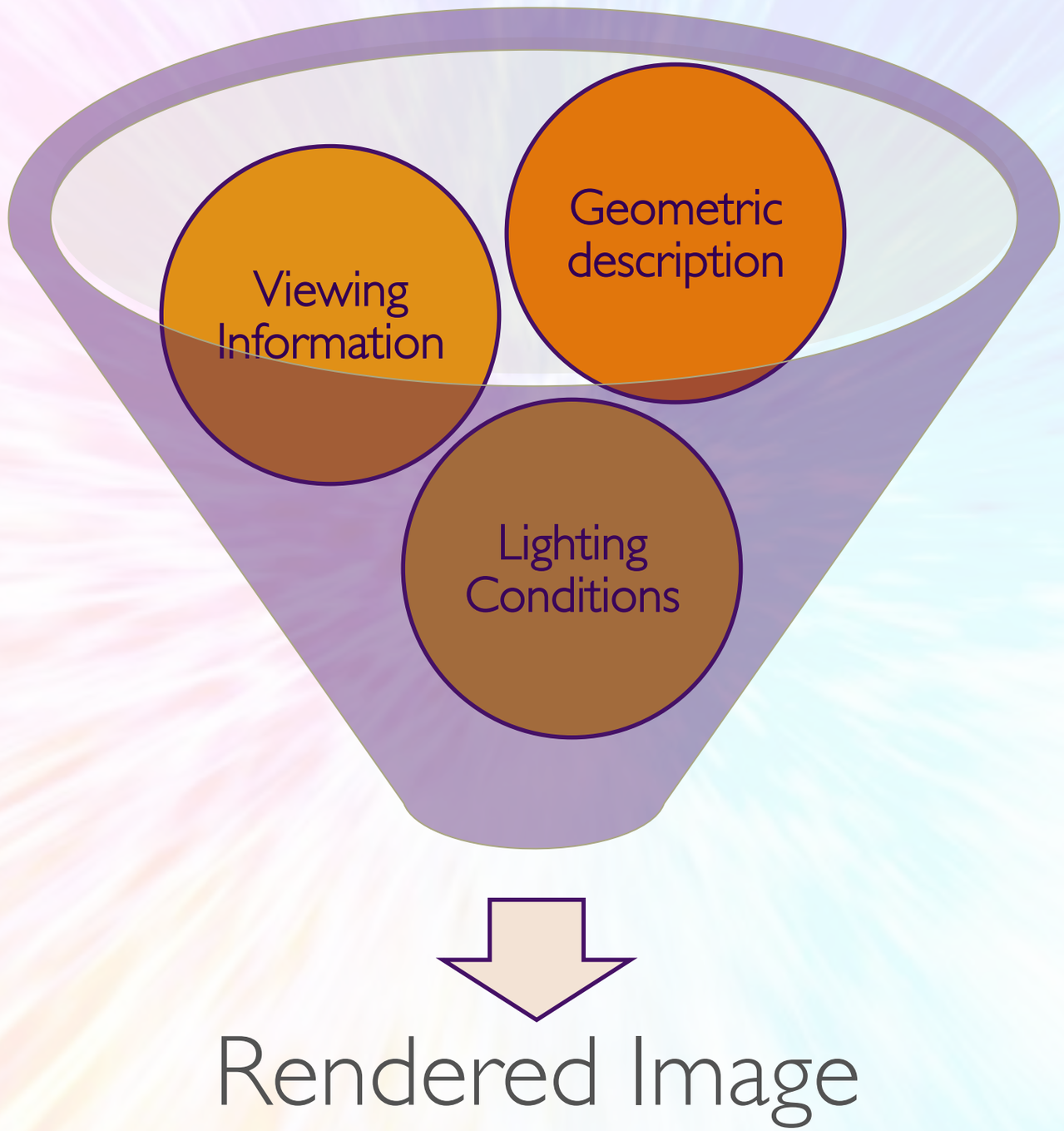
Computer Graphics



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Rendering a Cube

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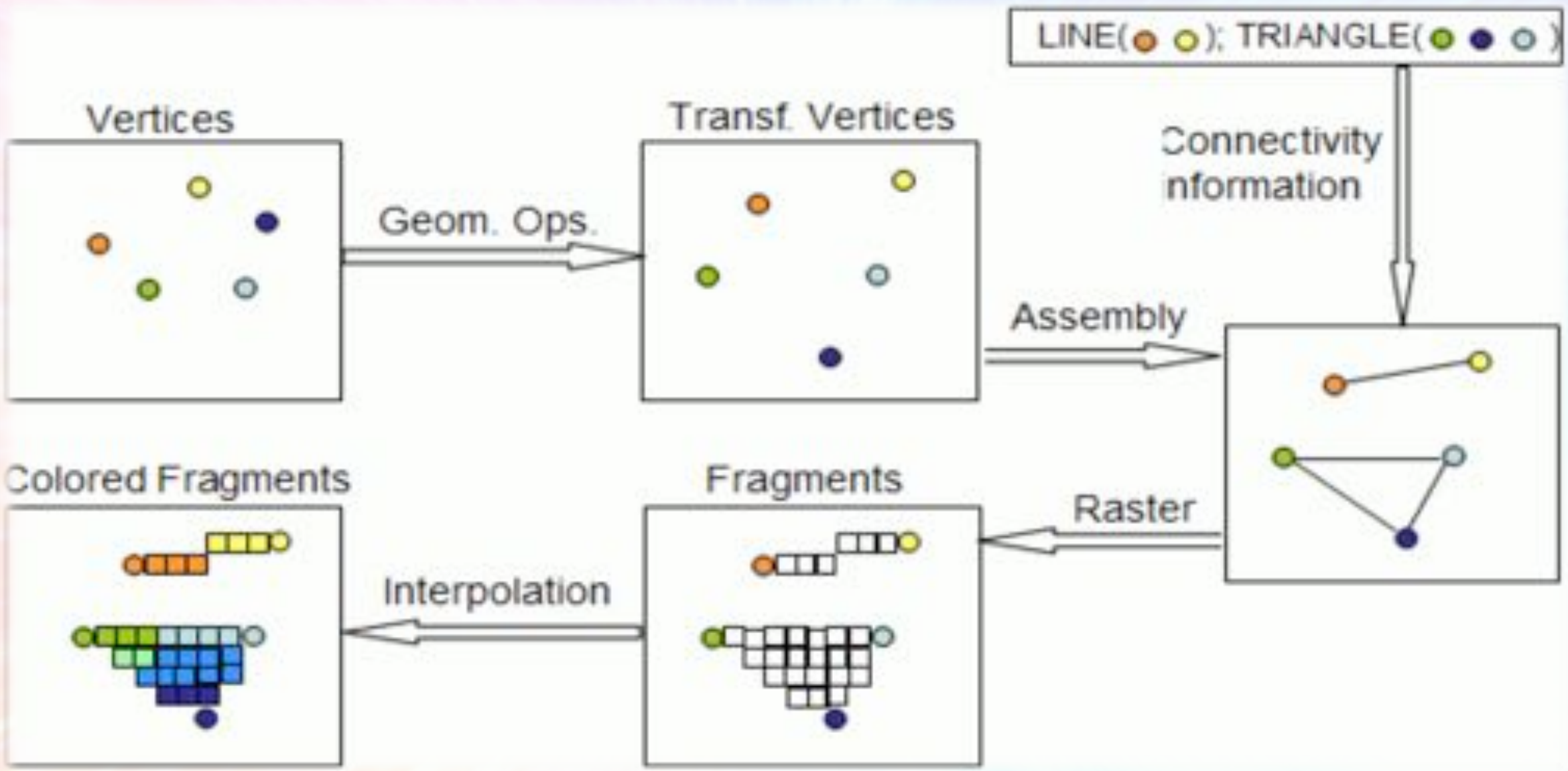
Graphics pipeline simple view



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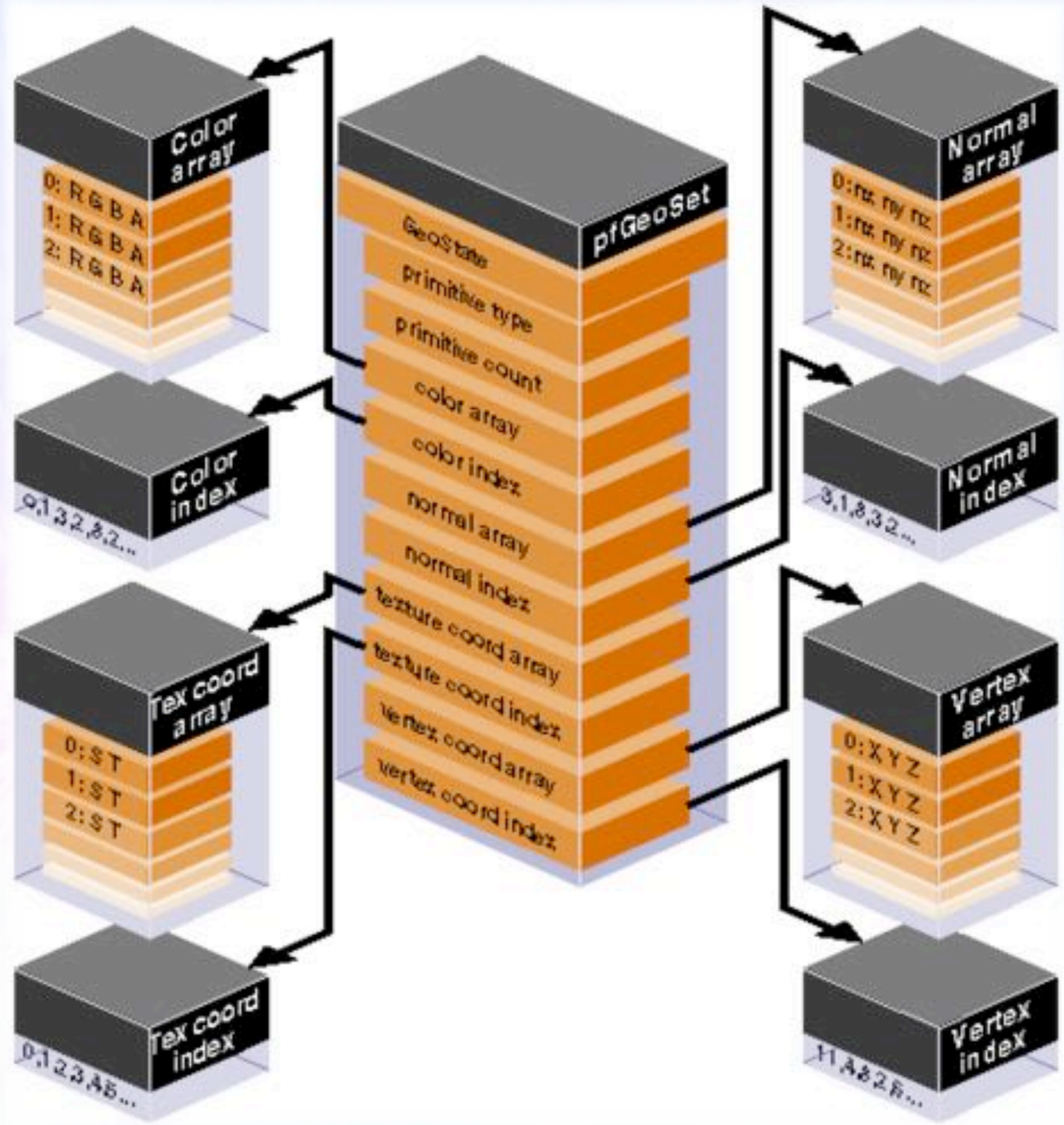
Geometric Description

Vertices are not the only thing for drawing a full fledged 3d object.

Other descriptions are there like texturing information, lighting information should be provided to draw a single 3d object.



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Nvidia GeForce GTX 980 block diagram

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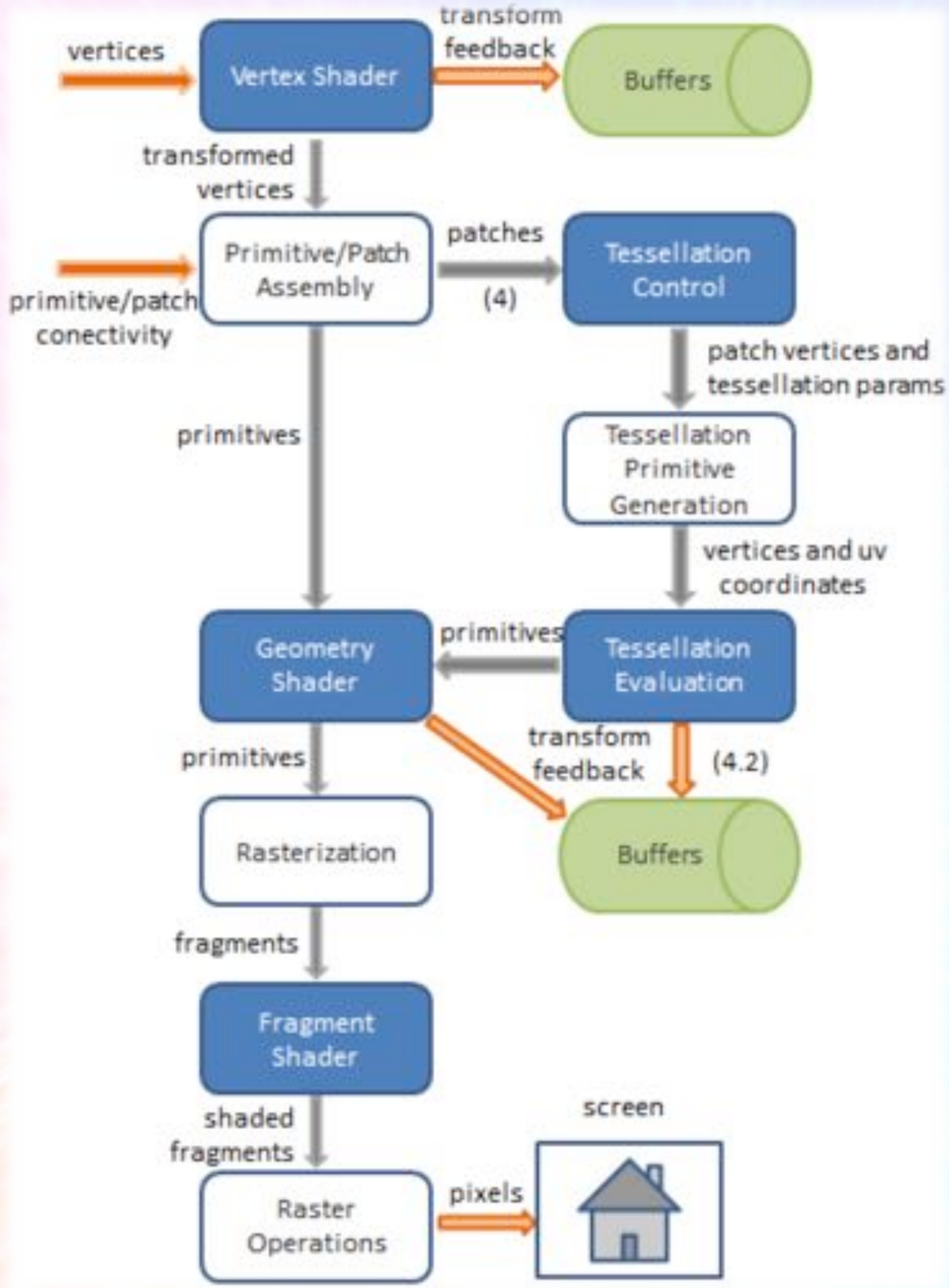

Modern Graphics Pipeline

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Crysis 3

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Visualizing our data

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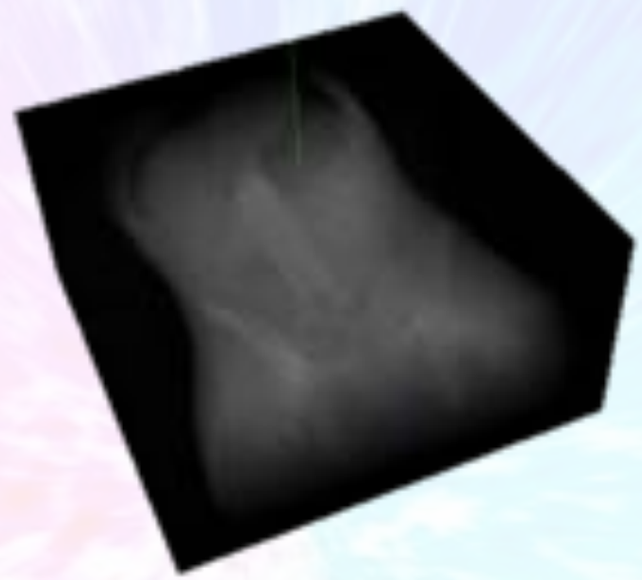
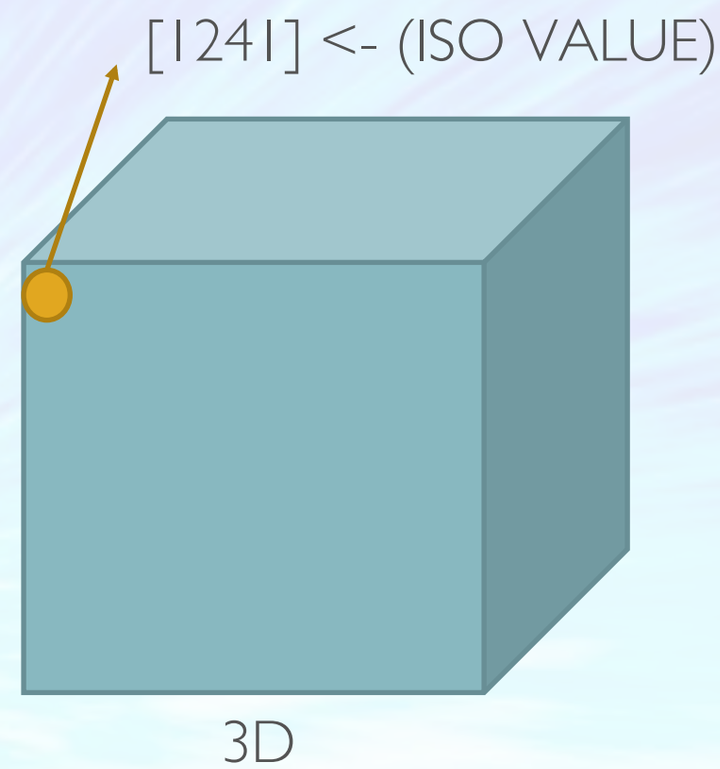
Visualizing our data

- LookUp Table
- 2D Viewing
  - MPR
  - Panorama
- 3D Viewing
  - Volume Rendering
  - ISO-Surface Rendering





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Visualizing our data

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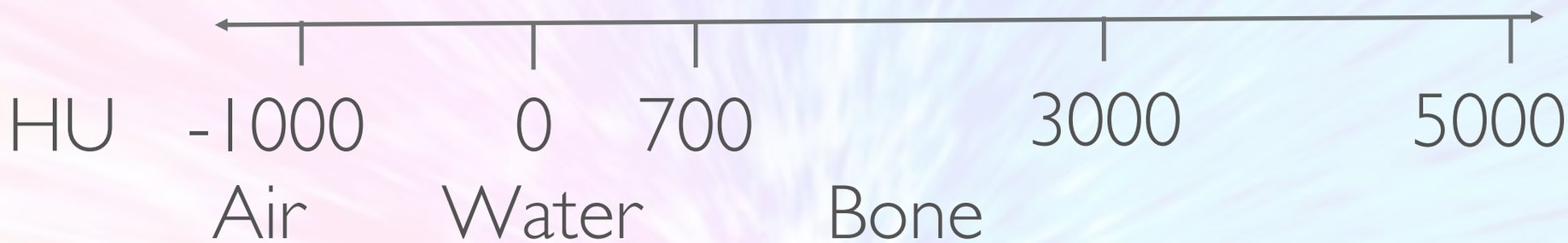
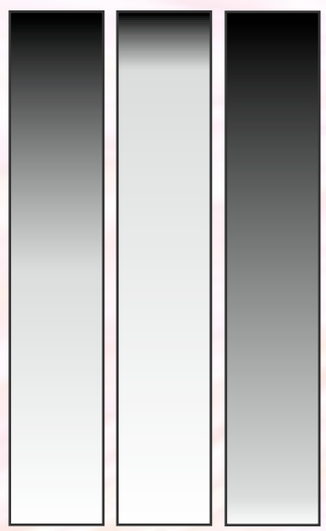
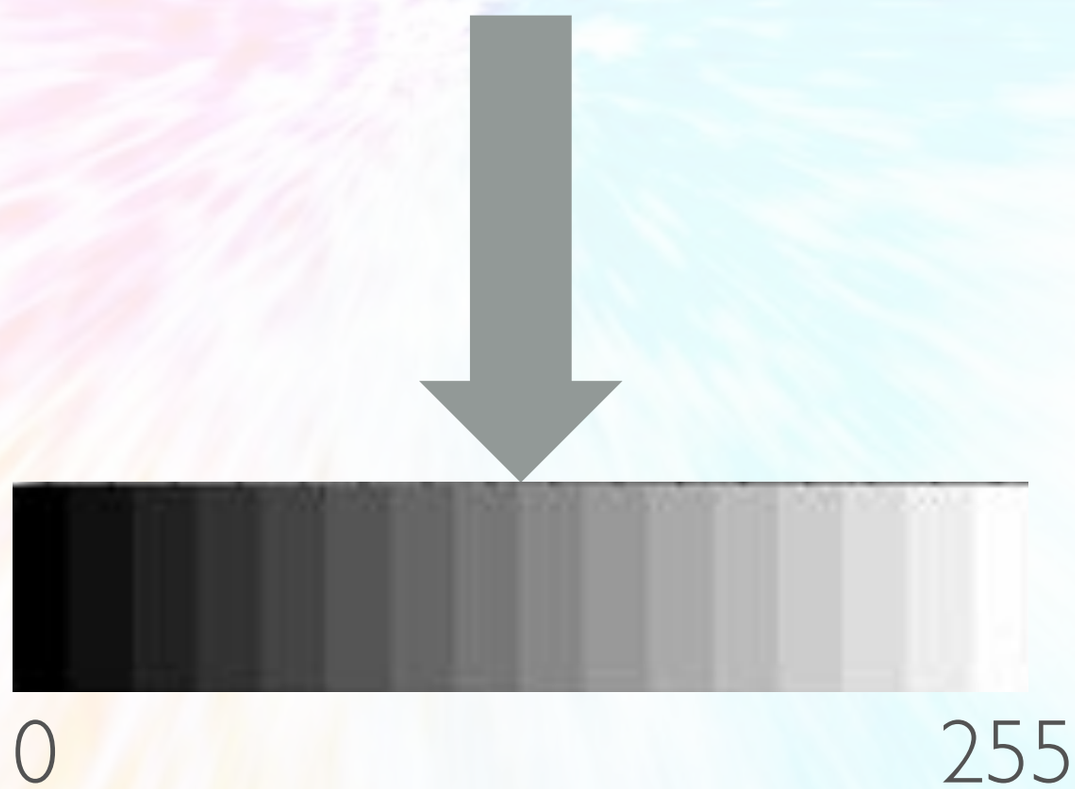
LookUp Tables (LUTs)

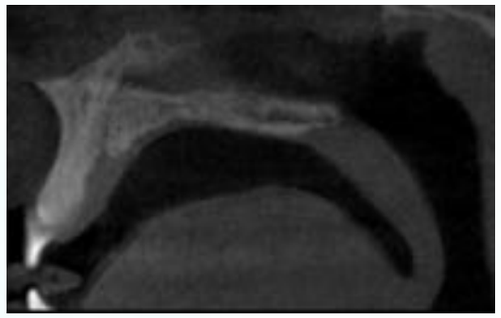


1D LUTs



8-bit Grayscale monitor





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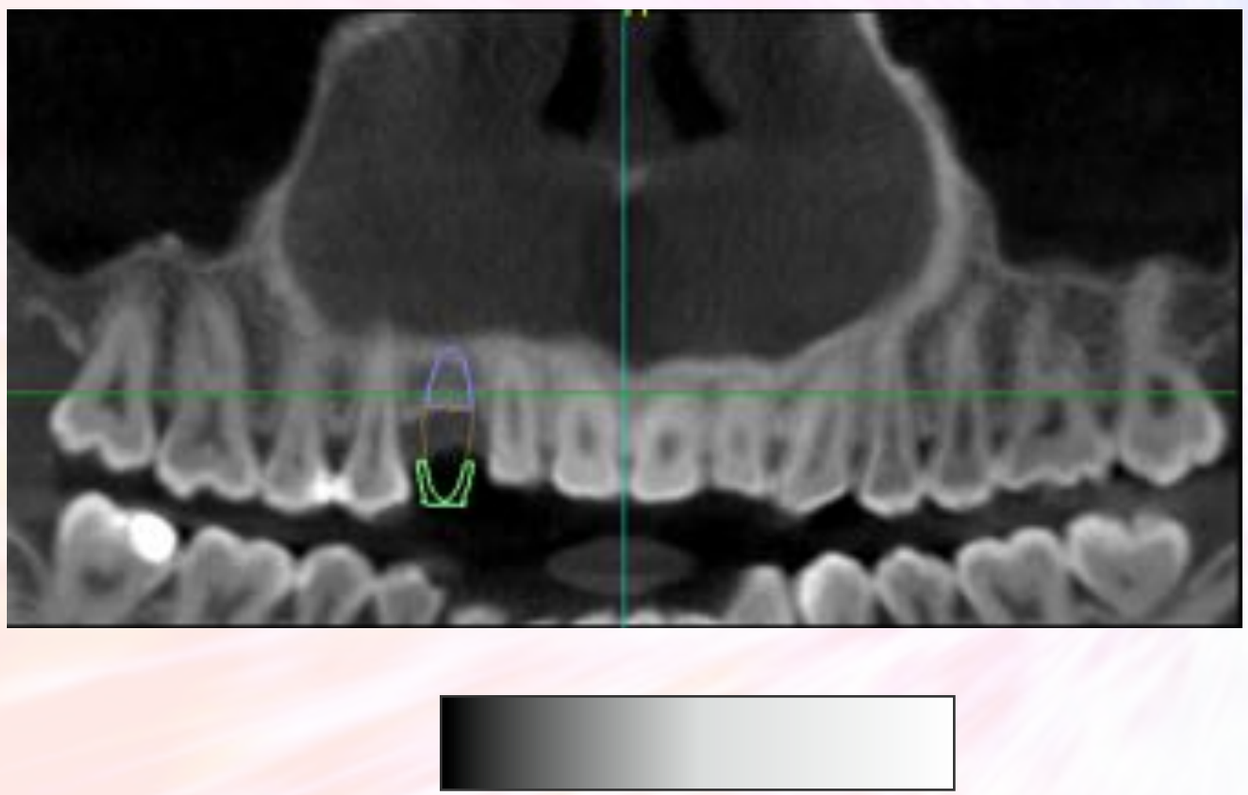
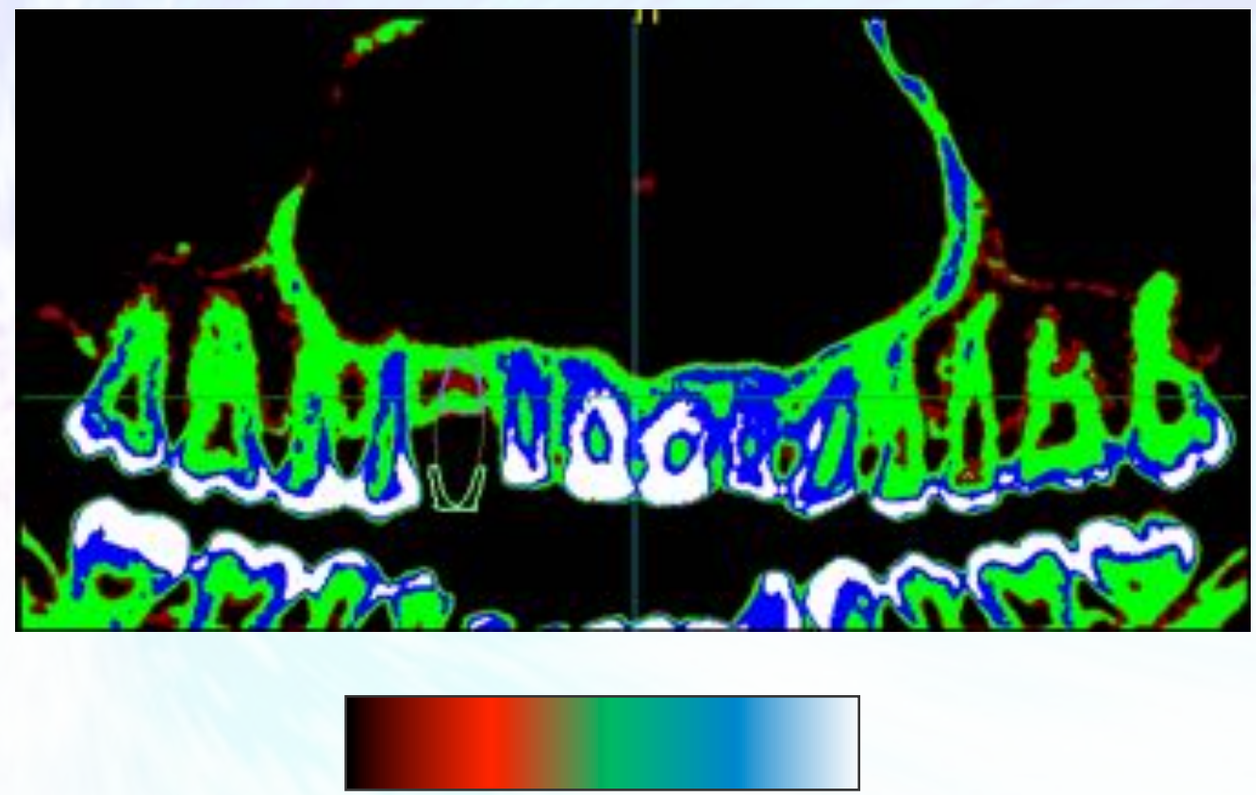
LookUp Tables (LUTs)





Different LUTs to
emphasize and visualize
areas suitable for drilling

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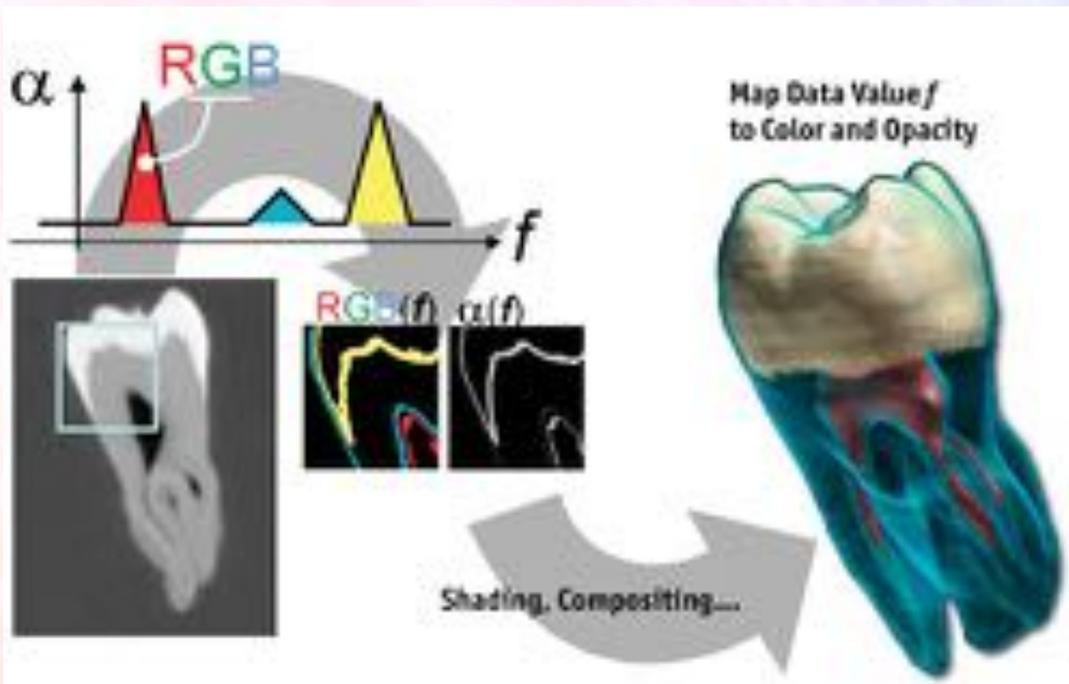
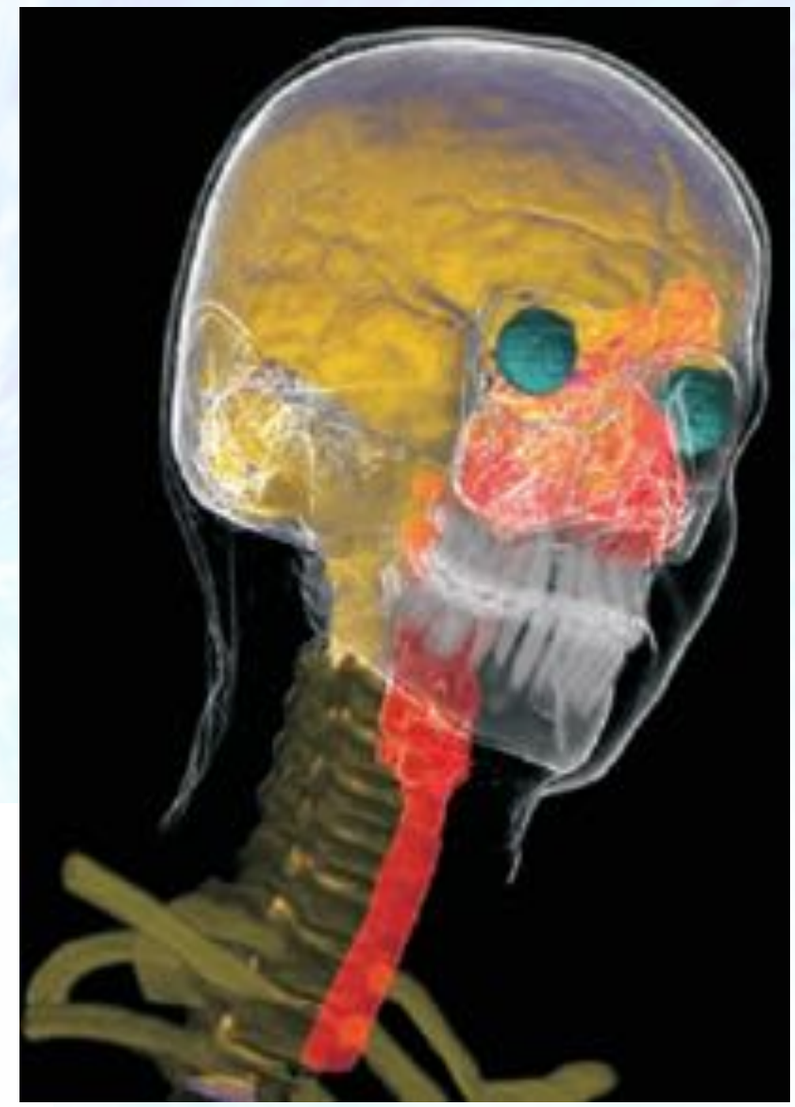
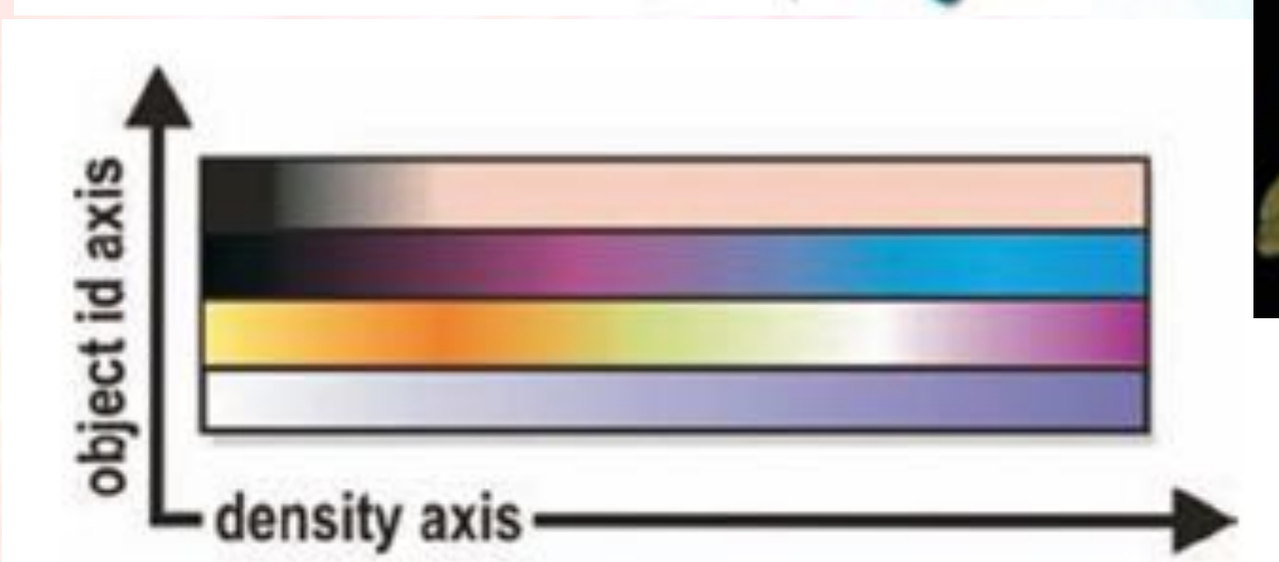
LookUp Table (LUT)

Multi-dimensional LUTs







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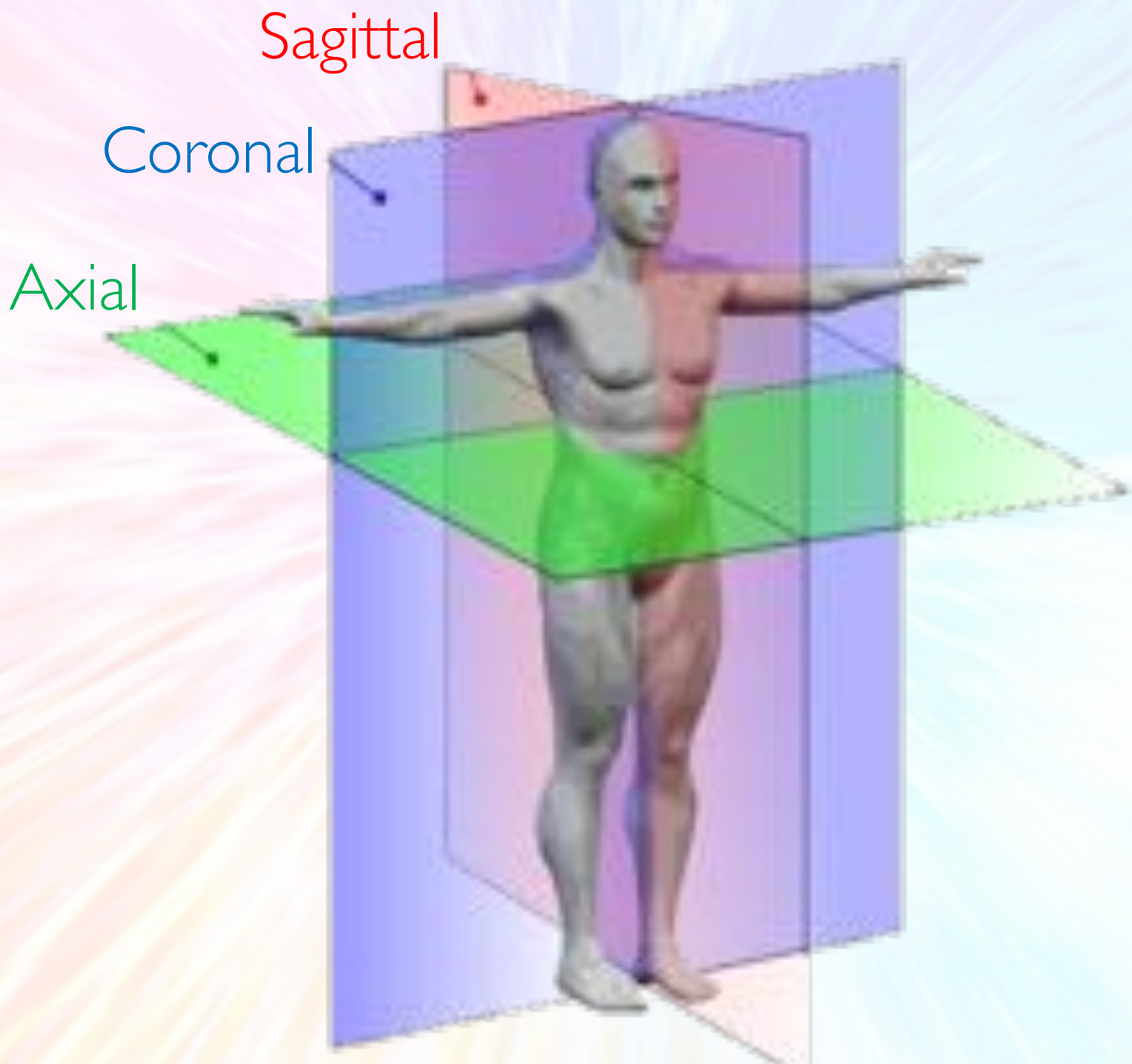
MPR
Multiplanar Reconstruction



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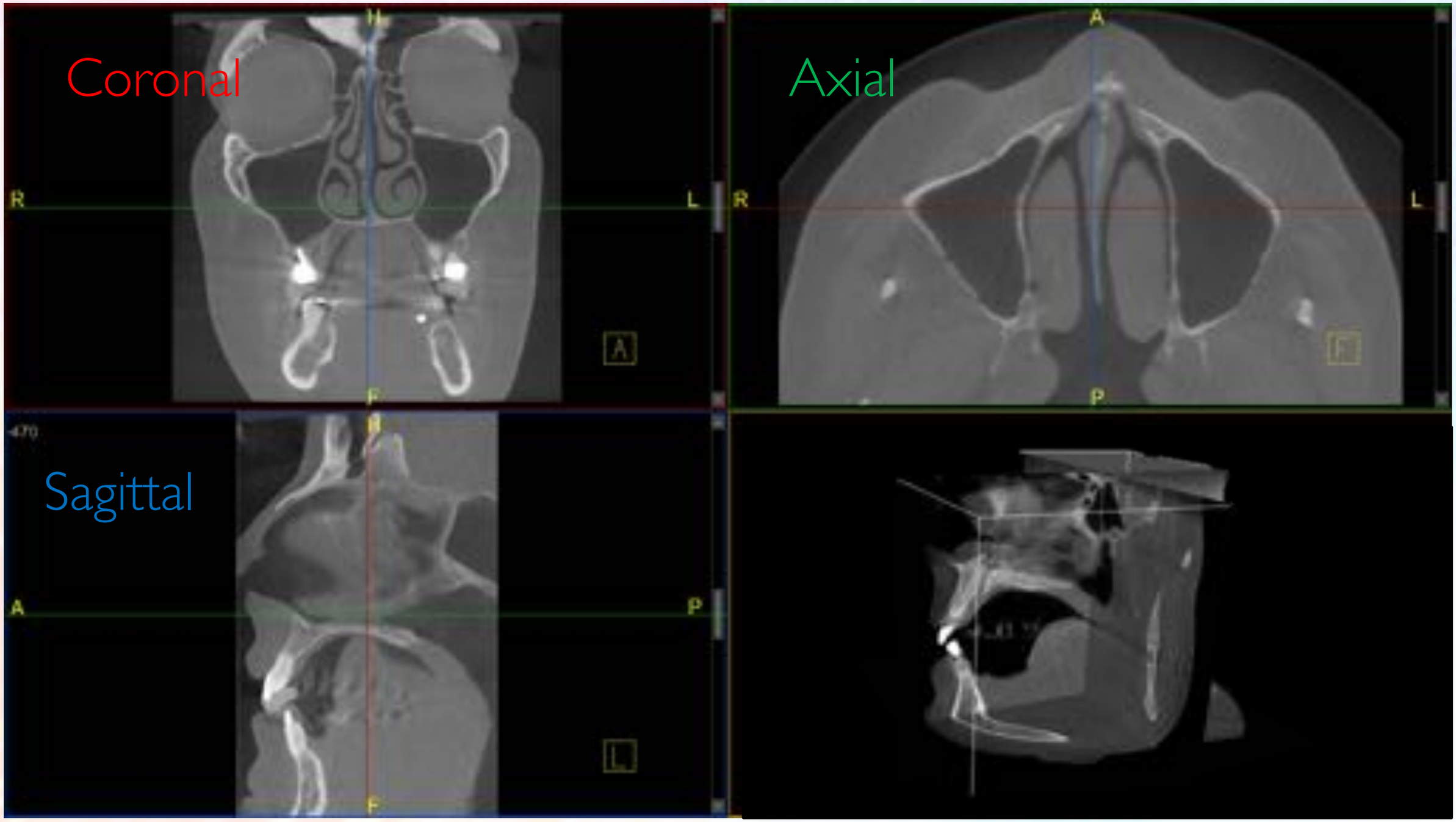
MPR
Multiplanar Reconstruction



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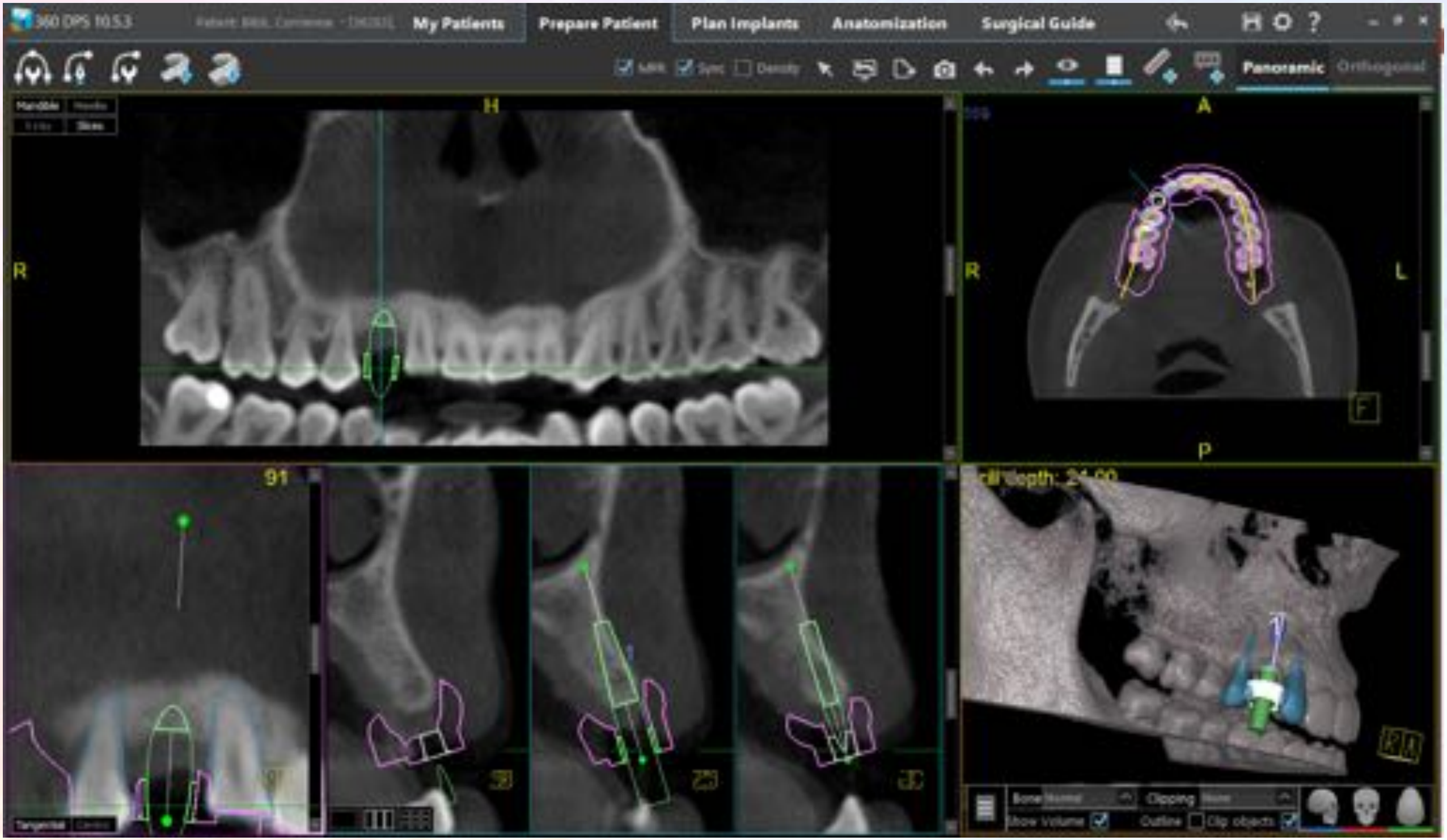
More MPRs



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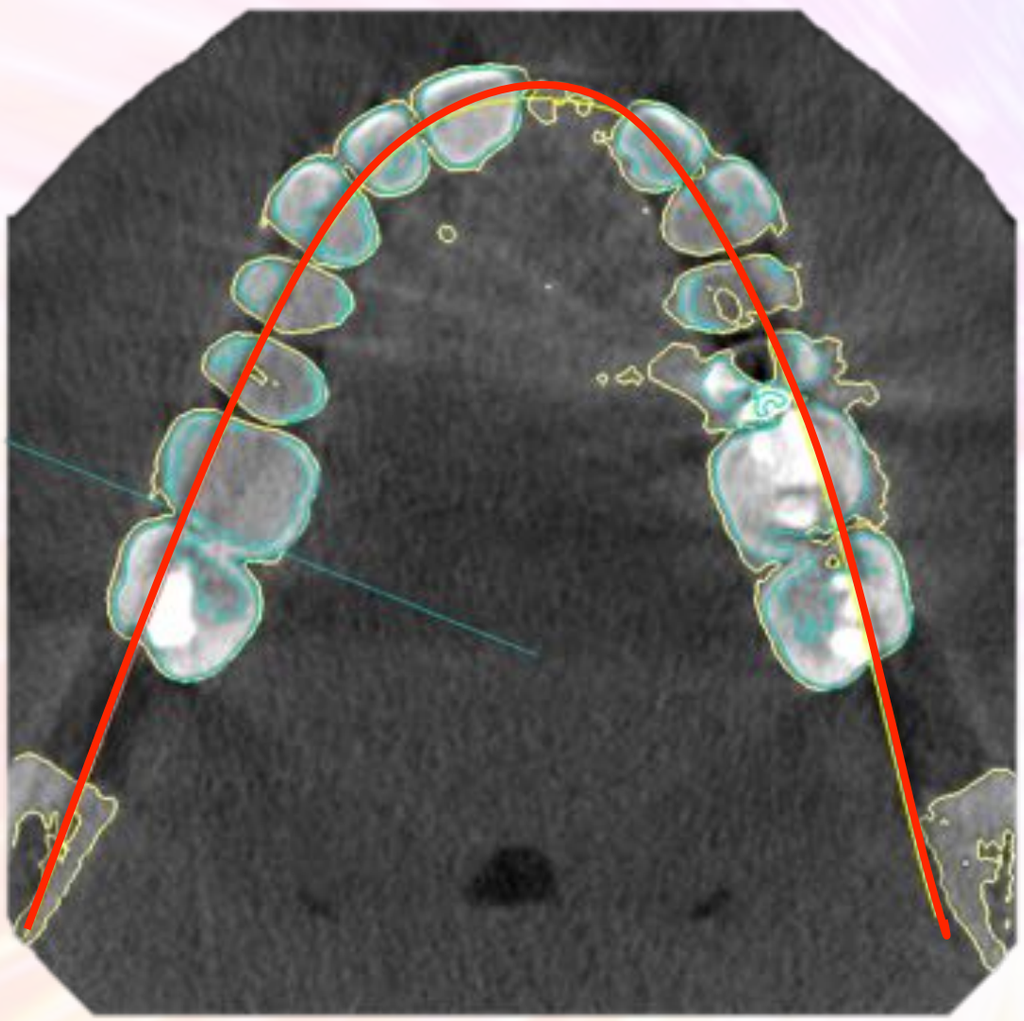
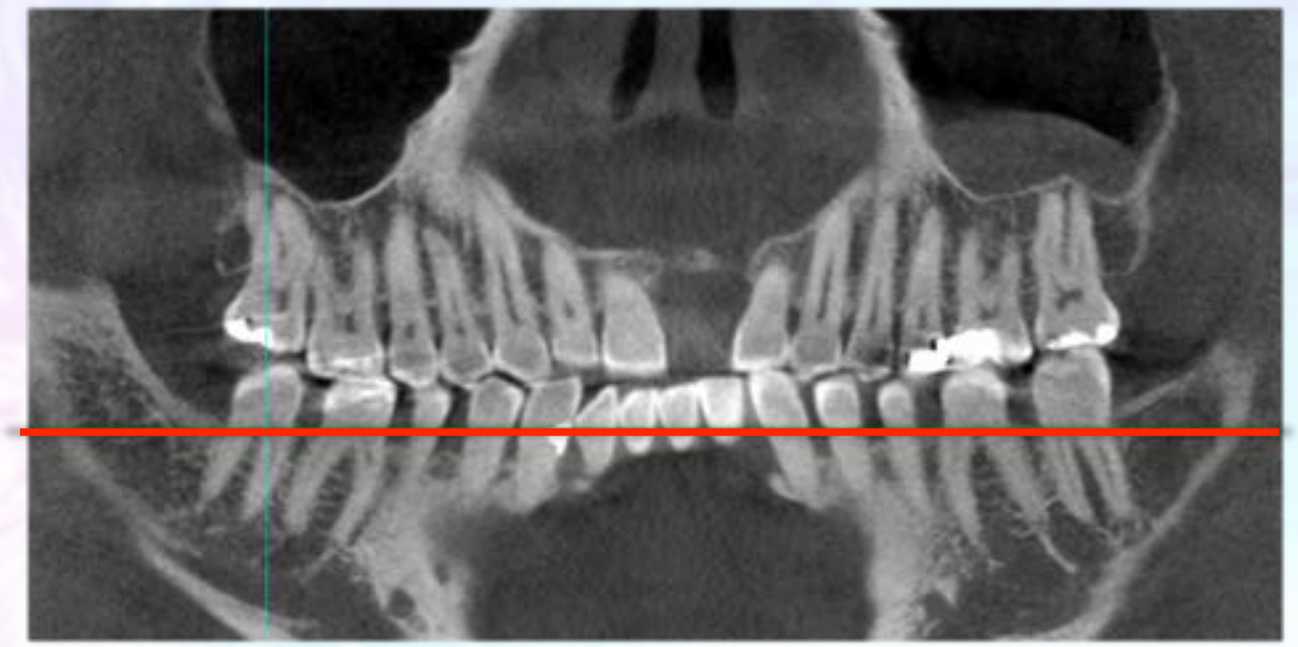
Panorama





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Volume Rendering

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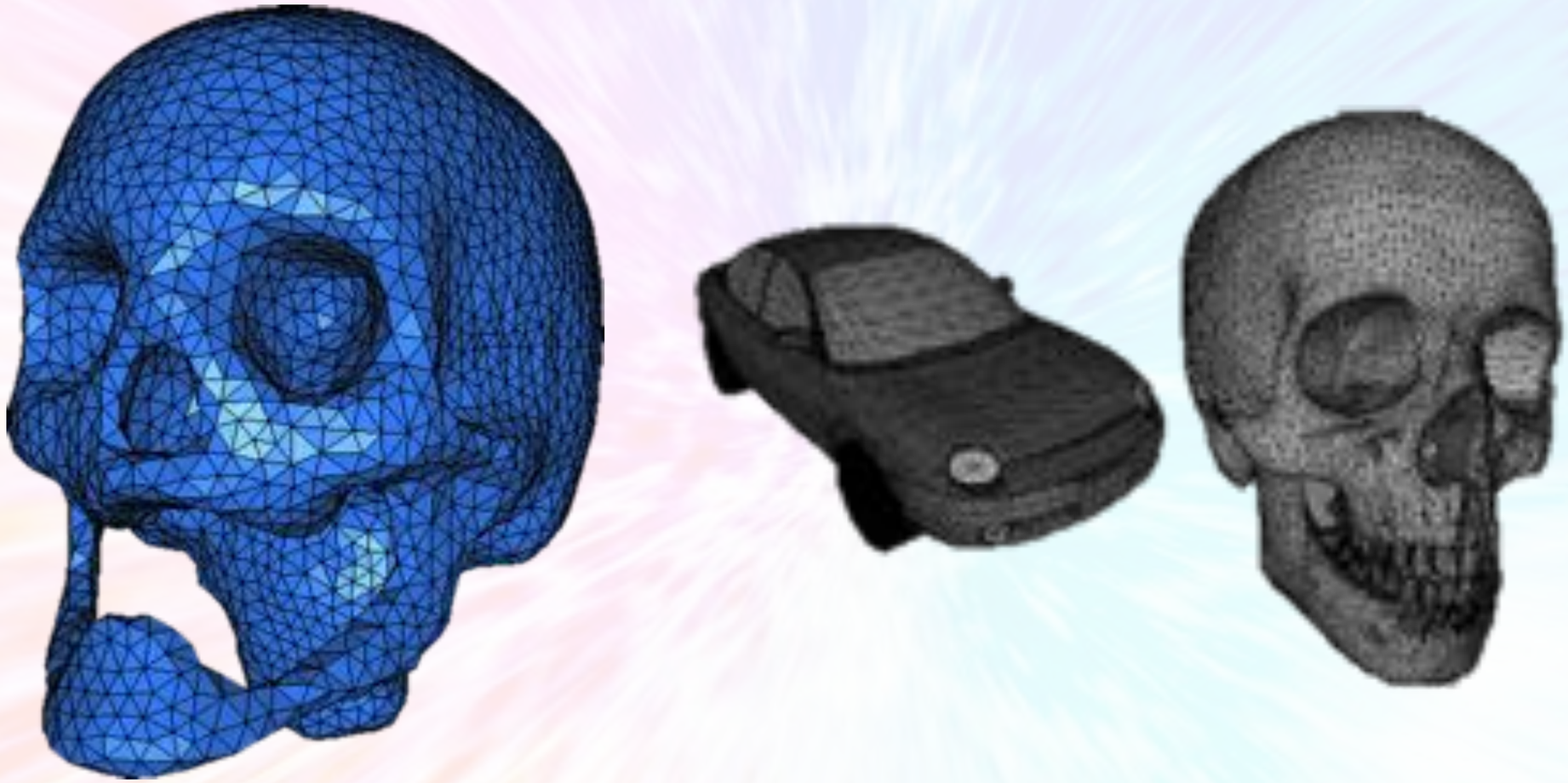
3D Rendering



GPUs are designed to render triangles

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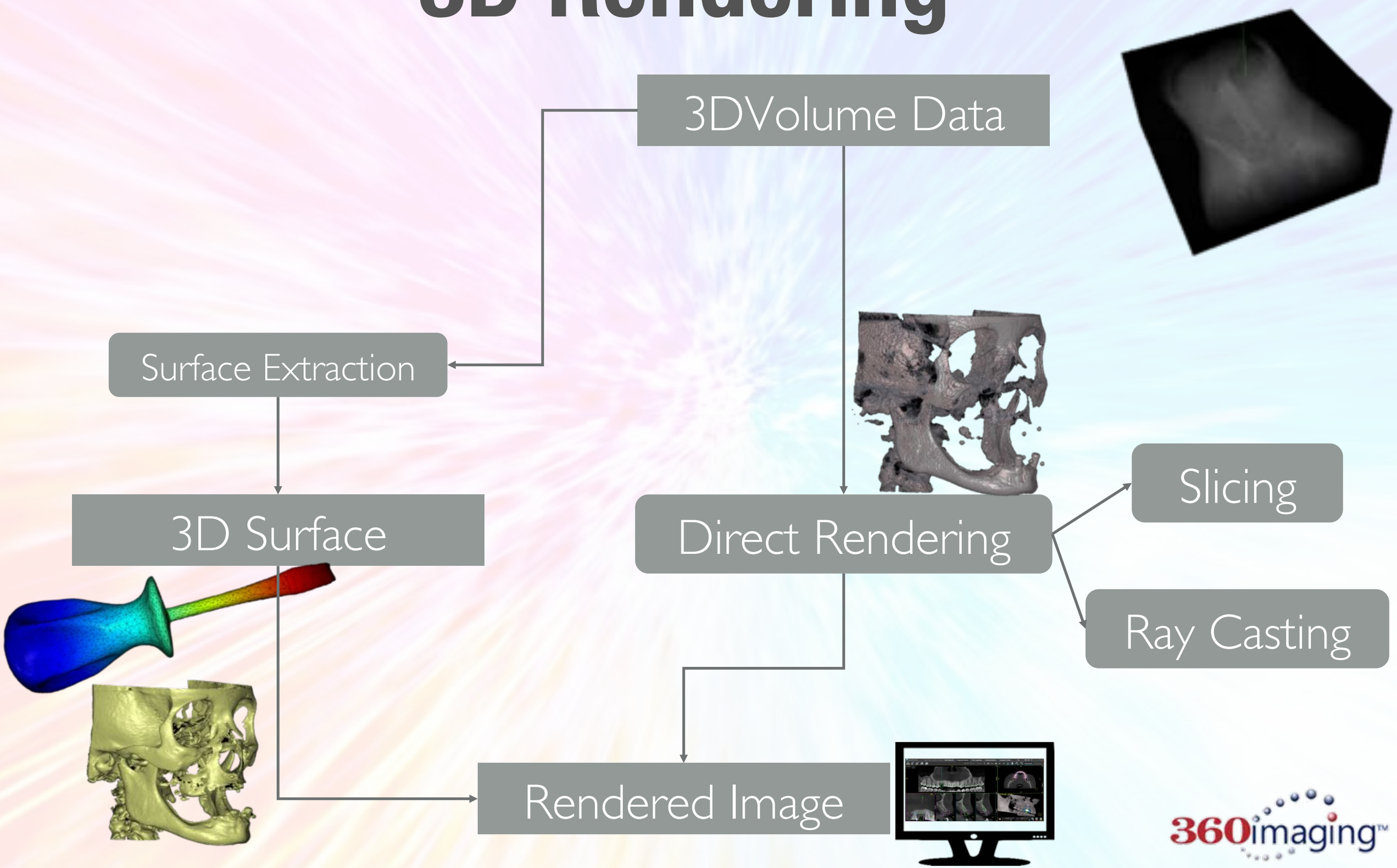
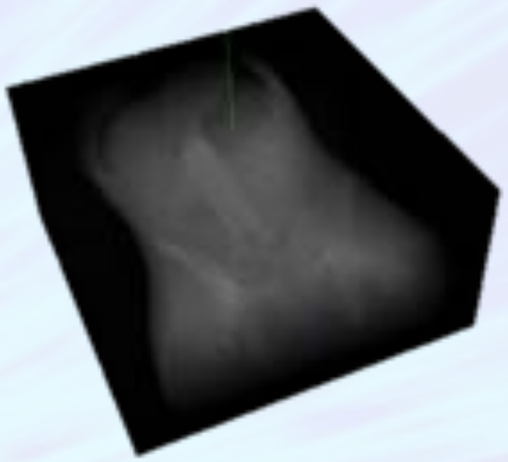
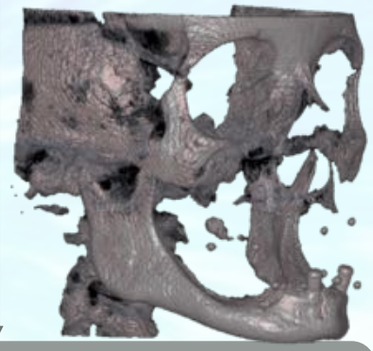
3D Rendering



3D Rendering



3DVolume Data



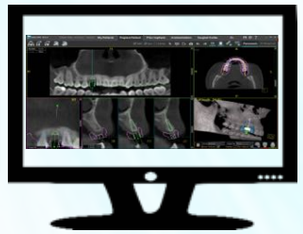
Where are my t
riangles?

Direct Rendering

Slicing

Ray Casting

Rendered Image



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