



Module 11c: **Volumetric Data**



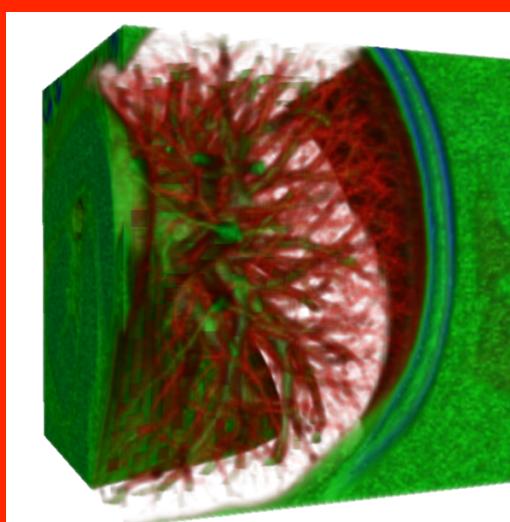
Outline



Fundamentals of Medical Imaging

- Acquisition
- CT
- MRI

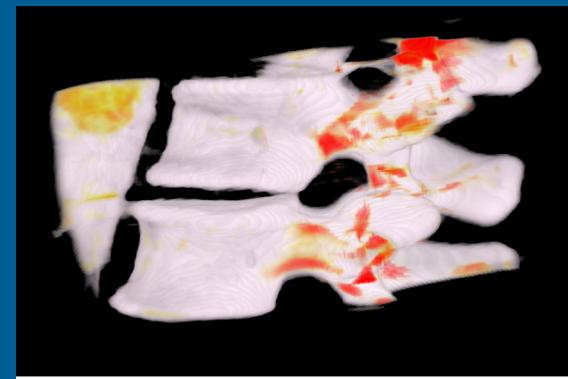
1



Fundamentals of Visualization

- Volume Rendering
- Transfer Functions
- Display Systems

2



Analyzing and Processing Volumes

- Image Processing
- Statistical Volumes

3

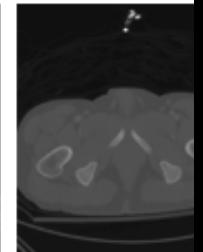
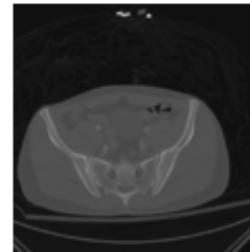
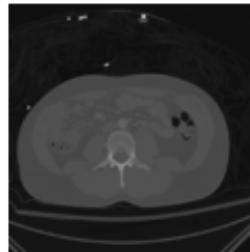
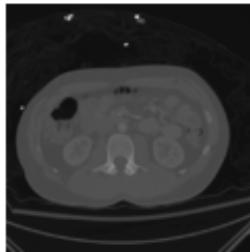
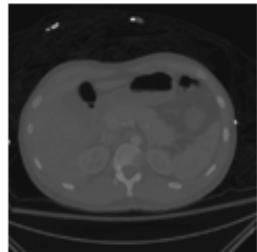
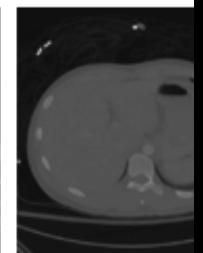
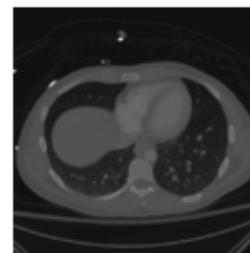
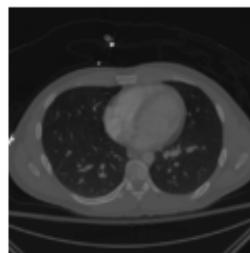
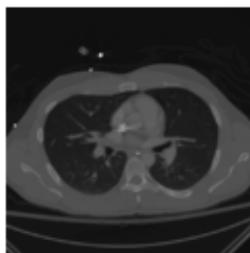
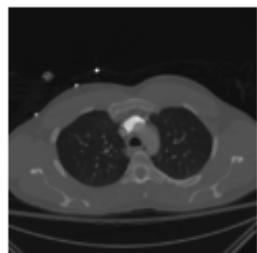


Why 3D Visualization?

- Advances in 3D acquisition devices have created
 - Challenging task of analyzing large set of images
- Can we use volume visualization as a technique to quickly explore large datasets?

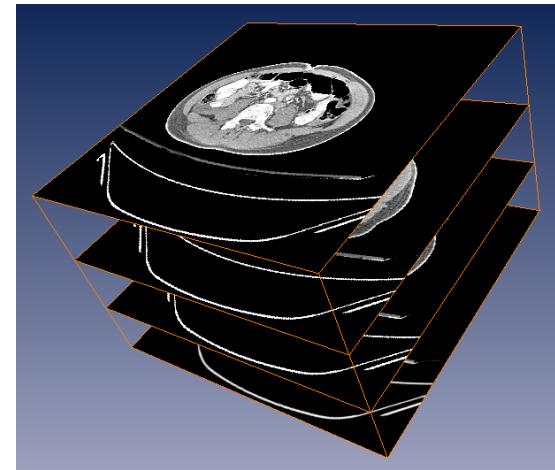
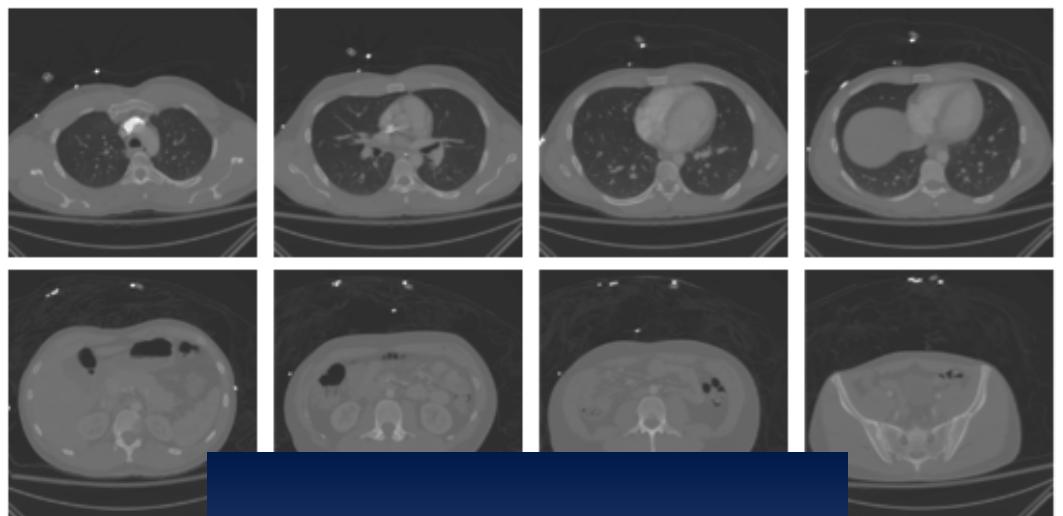


Siemens, 2007

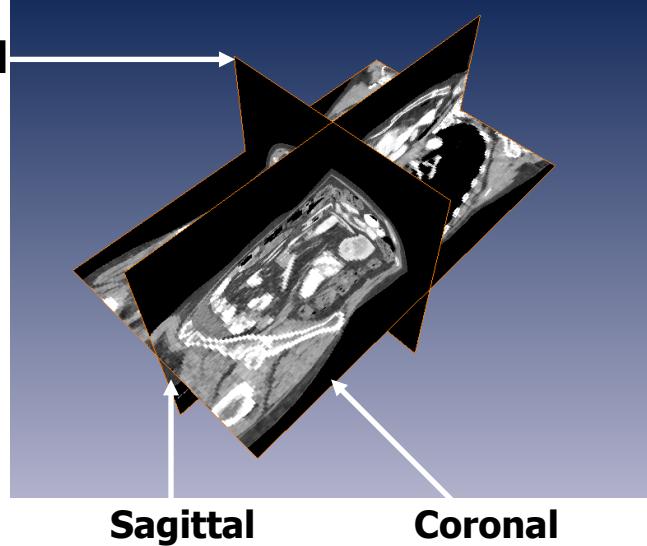




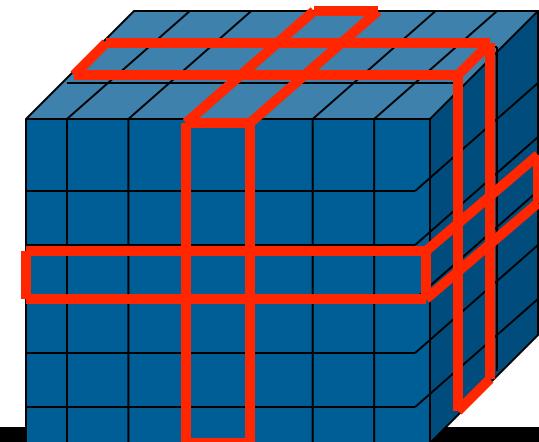
What's a volume?



Axial



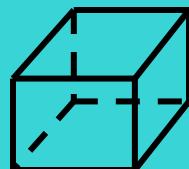
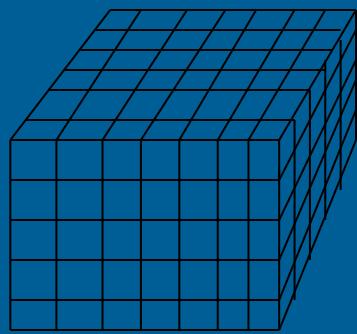
Coronal



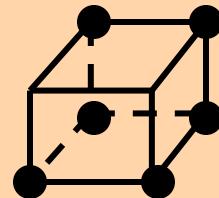


Data Representation (2)

What is a Voxel? – Two definitions



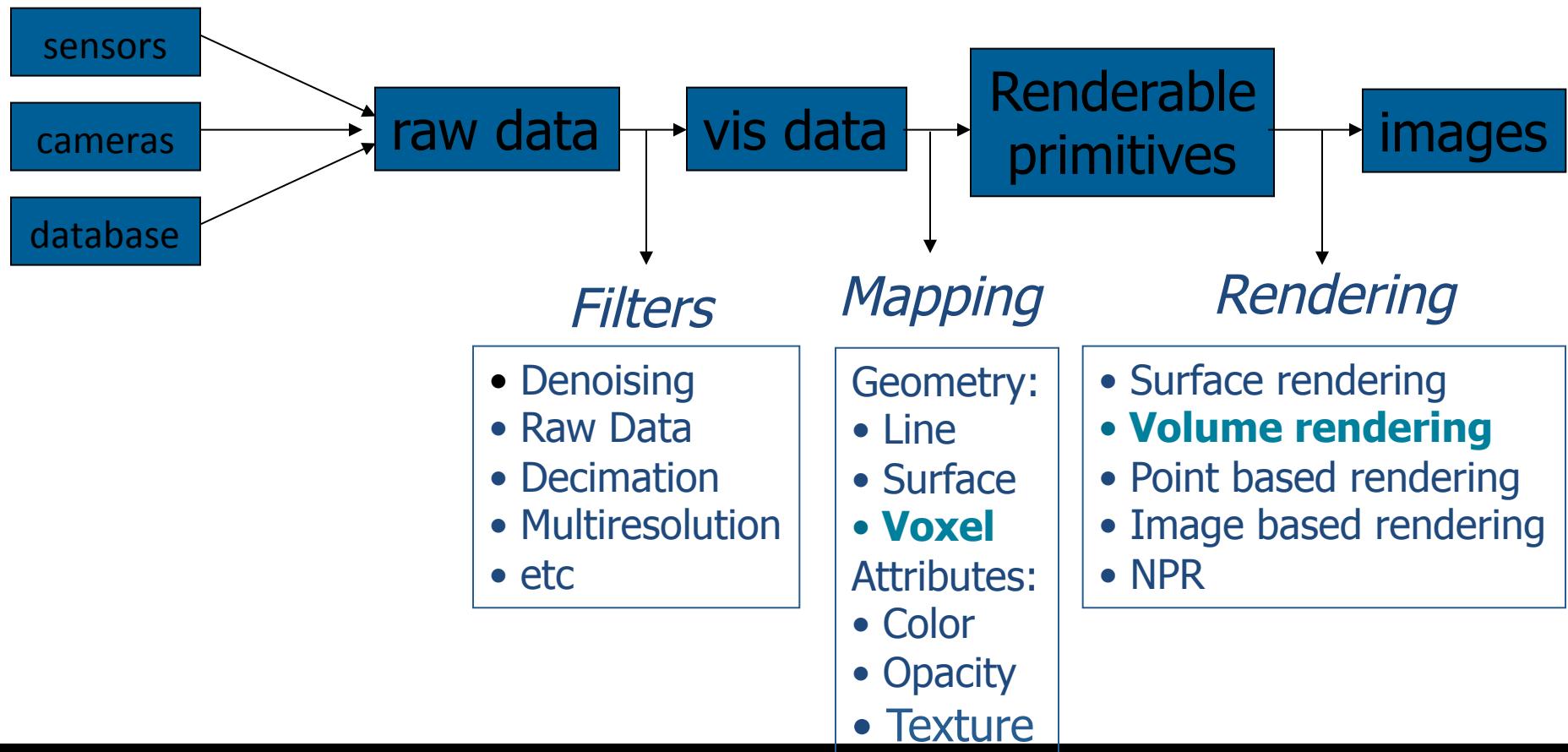
A voxel is a cubic cell, which has a single value or density



A voxel is a data point at a corner of the cubic cell
The value of a point inside the cell is determined by interpolation



Visualization Pipeline





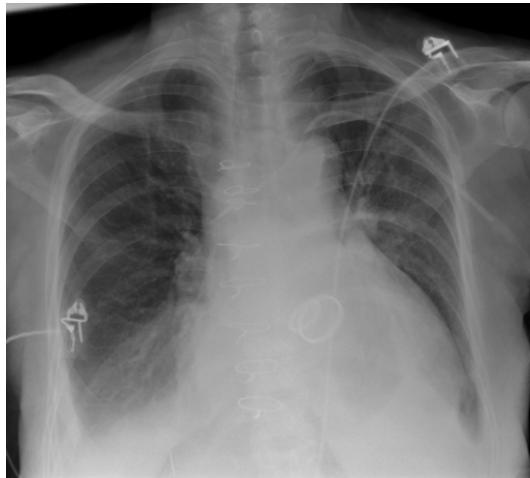
Rendering Techniques

- Primary Rendering Techniques
 1. X-Ray Rendering
 2. Maximum-Intensity Projection (MIP)
 3. Direct Volume Rendering (DVR)
 4. Iso-surfaces
 5. Non-photorealistic rendering (NPR)



1. X-ray Rendering

- X-ray rendering
 - Overview image
 - The interpolated samples are simply summed



X-ray images



Conventional processing

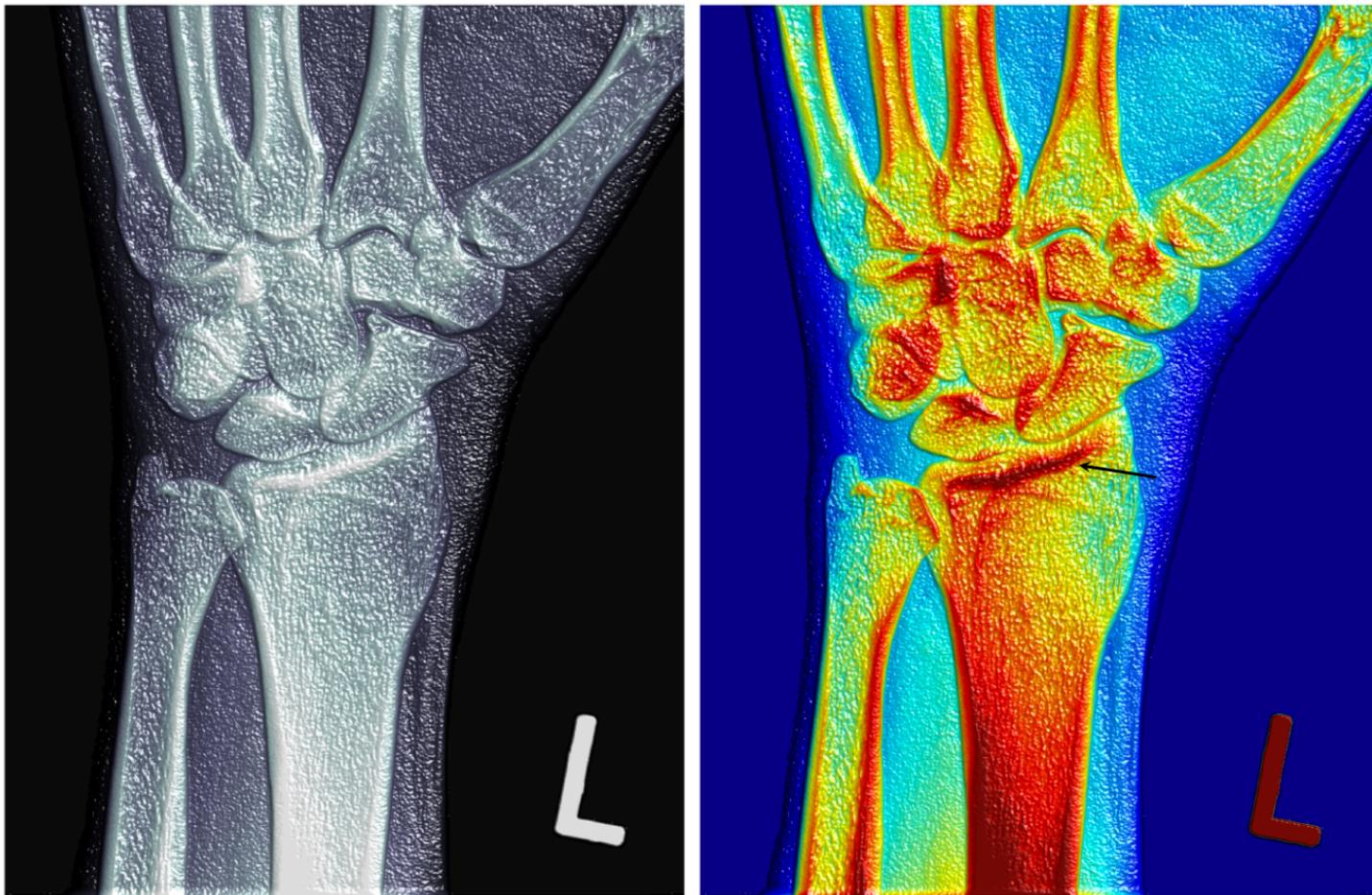


Dynamic Visualization



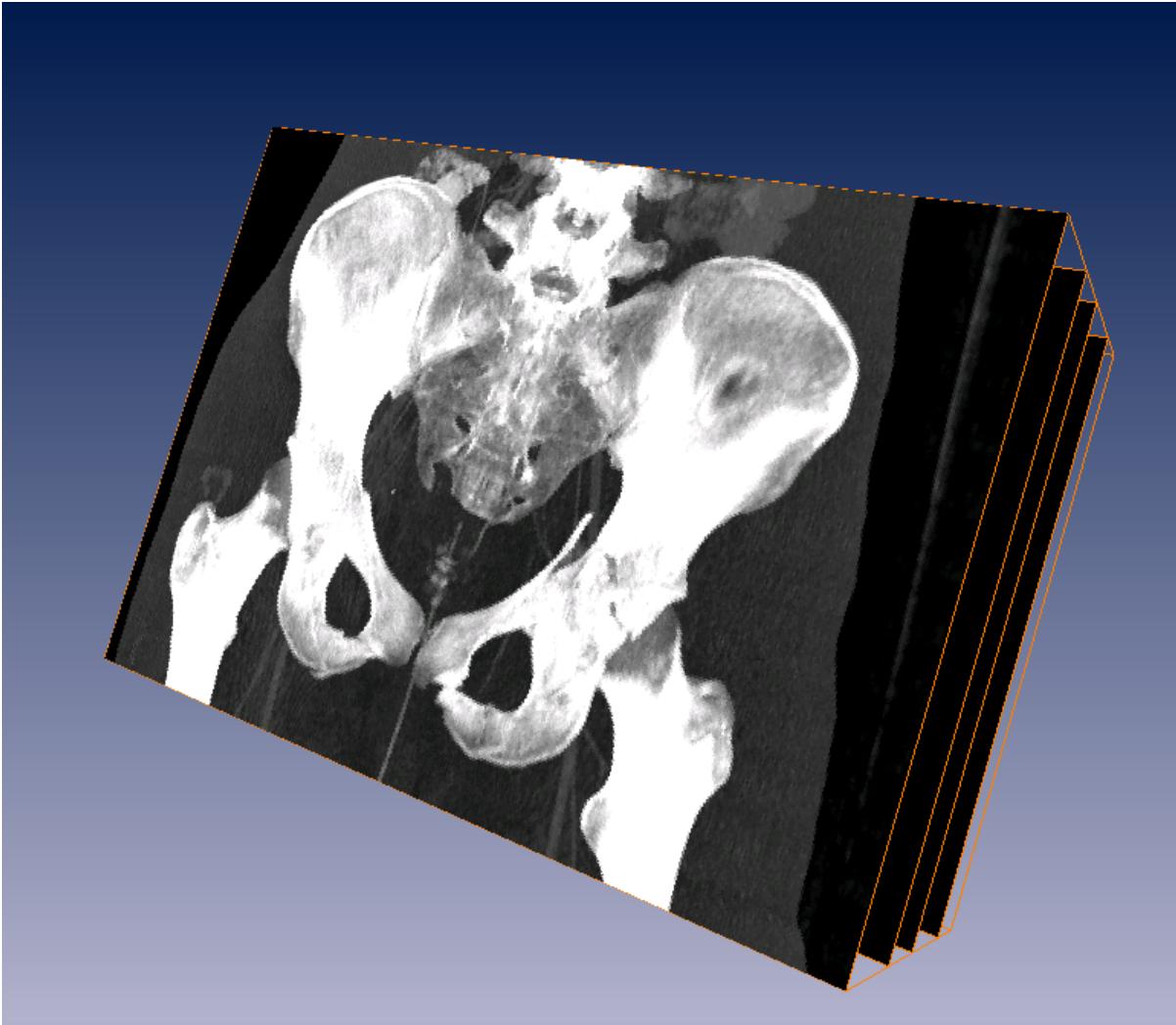


Pseudo-Color





X-Ray Rendering



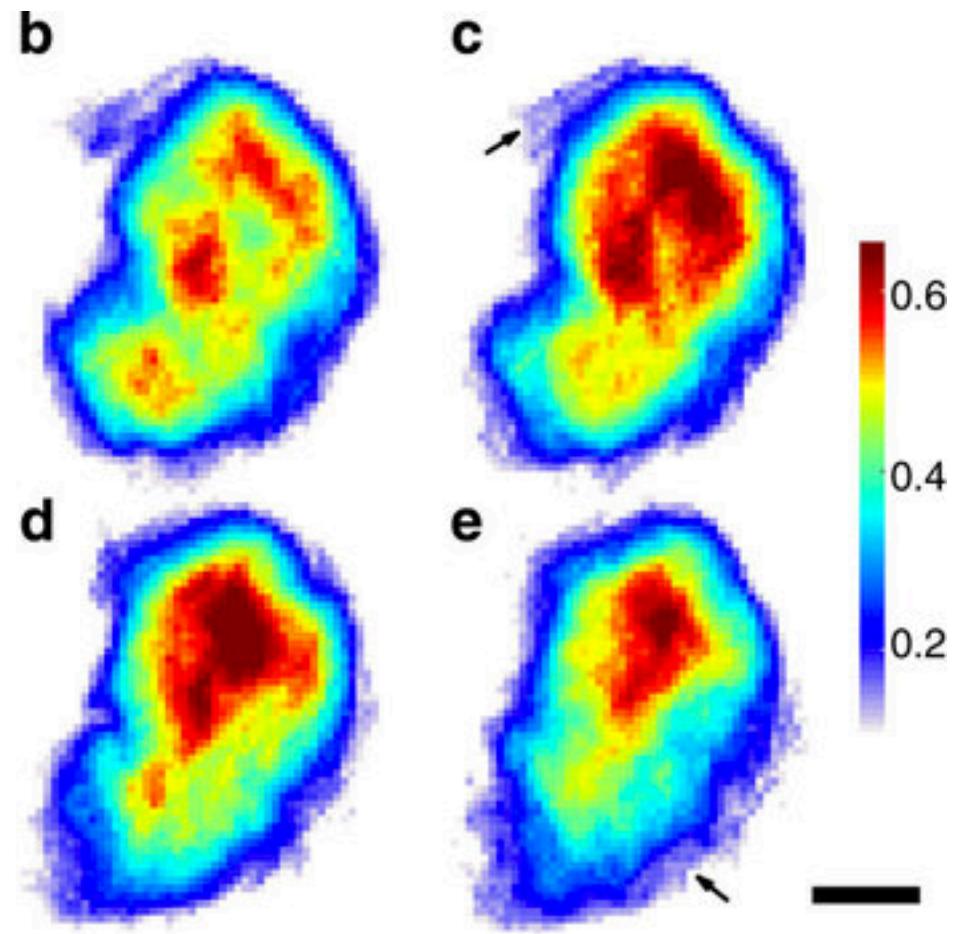
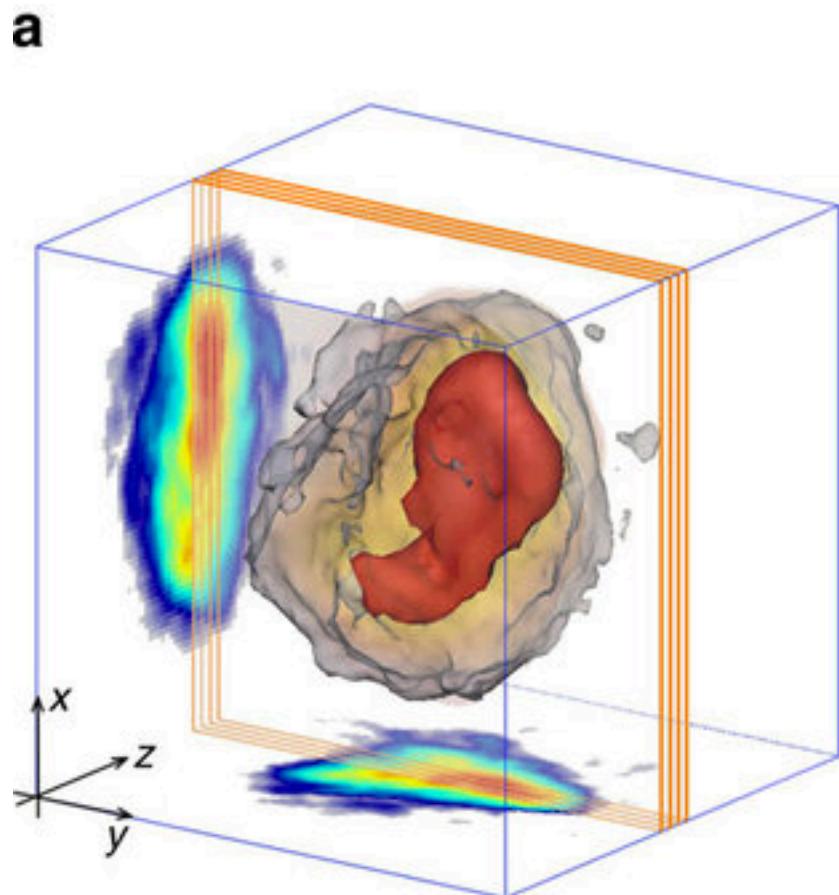


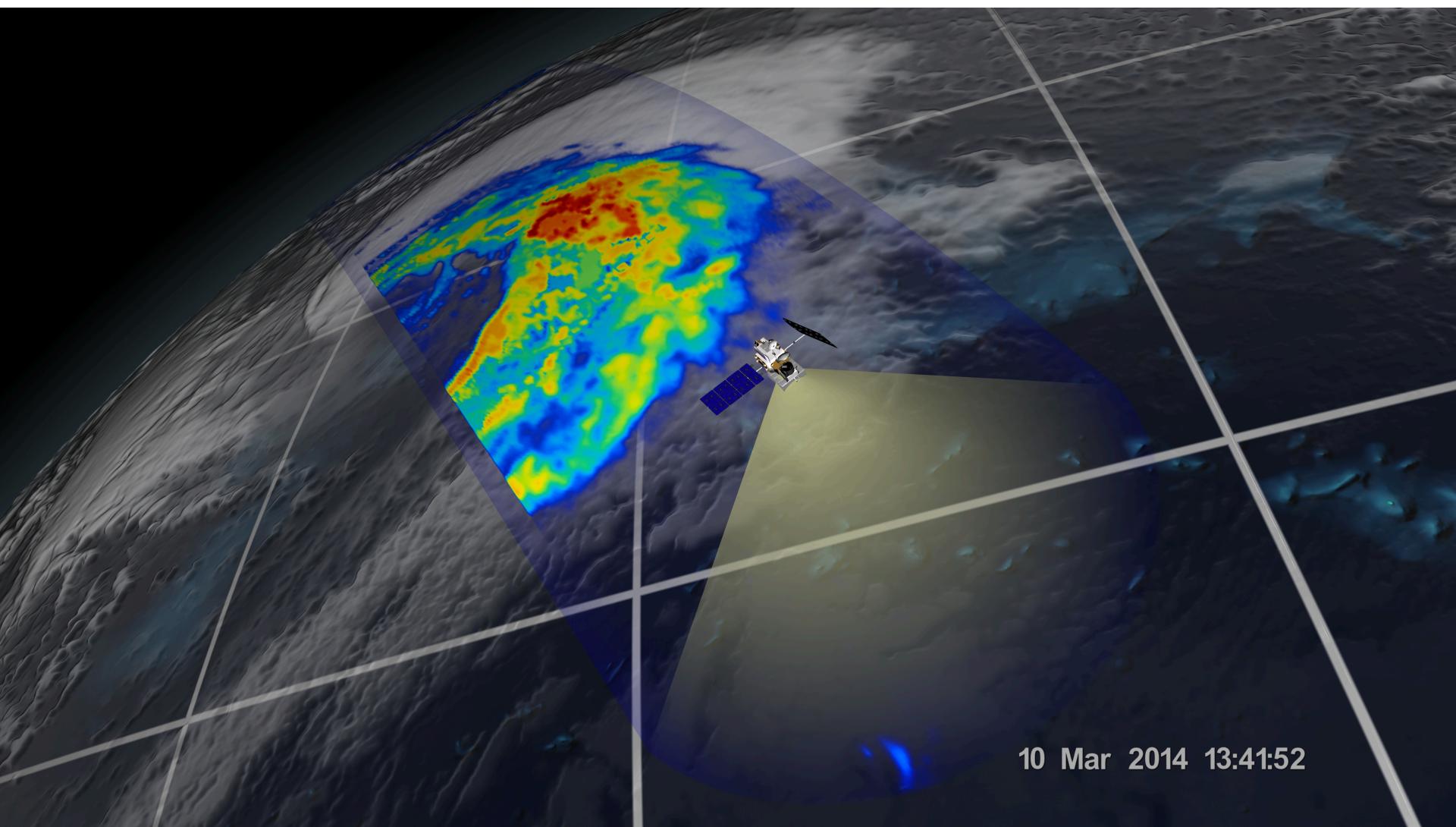
2. Maximum Intensity Projection

- Maximum Intensity Projection (MIP)
 - The interpolated sample with the largest value is written to the pixel
 - Often used to enhance vascular structures



Source: Philips, Inc





10 Mar 2014 13:41:52



Conclusion

- Discussed the fundamentals of volumetric data
- Described multiple 3D acquisition systems in medicine
- Started to review different visualization techniques to illustrate 3D data