Real-Time 3-D Visualization for Prostate ARFI Imaging
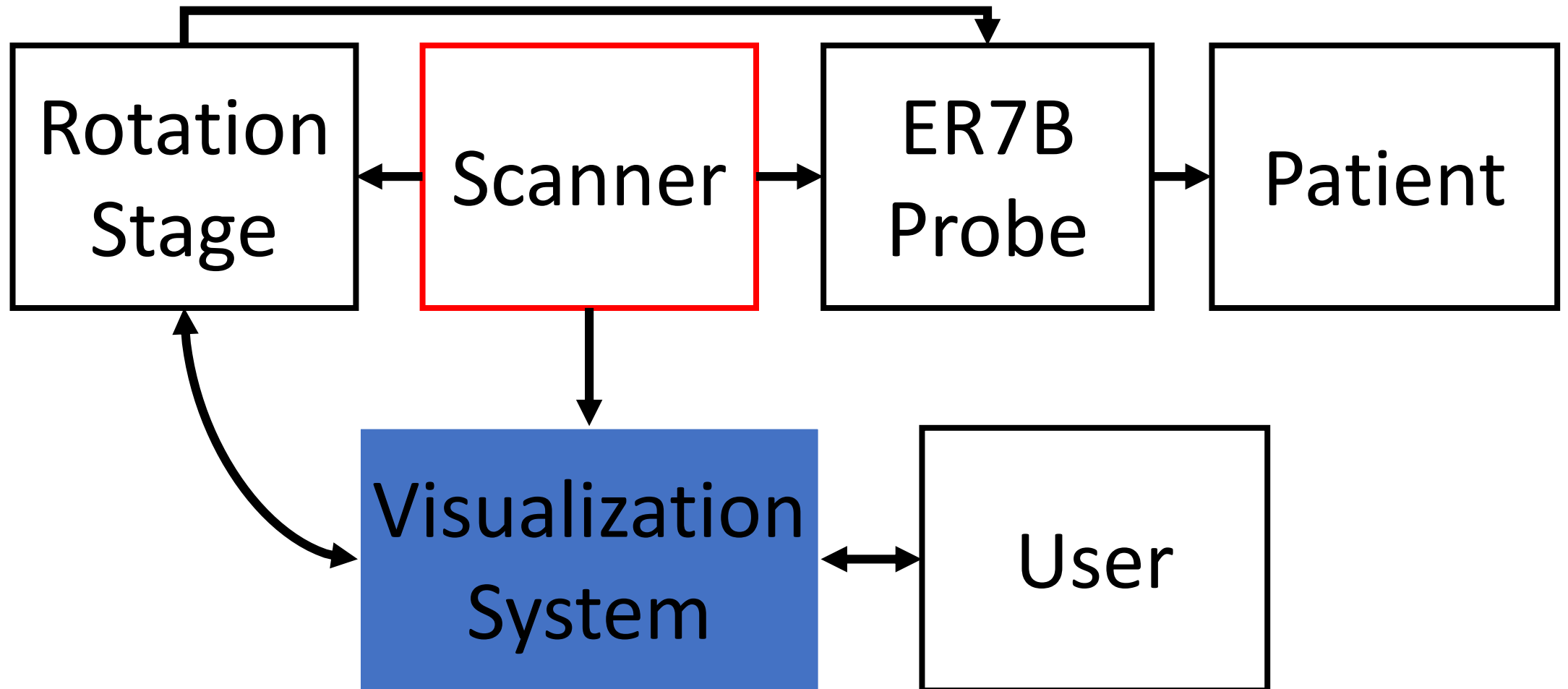
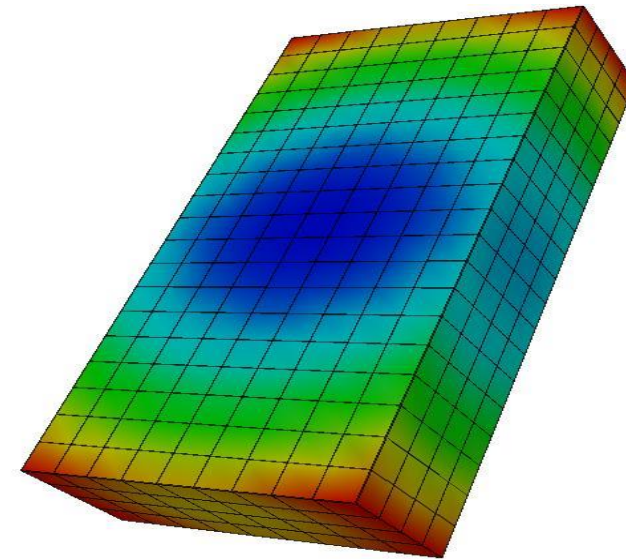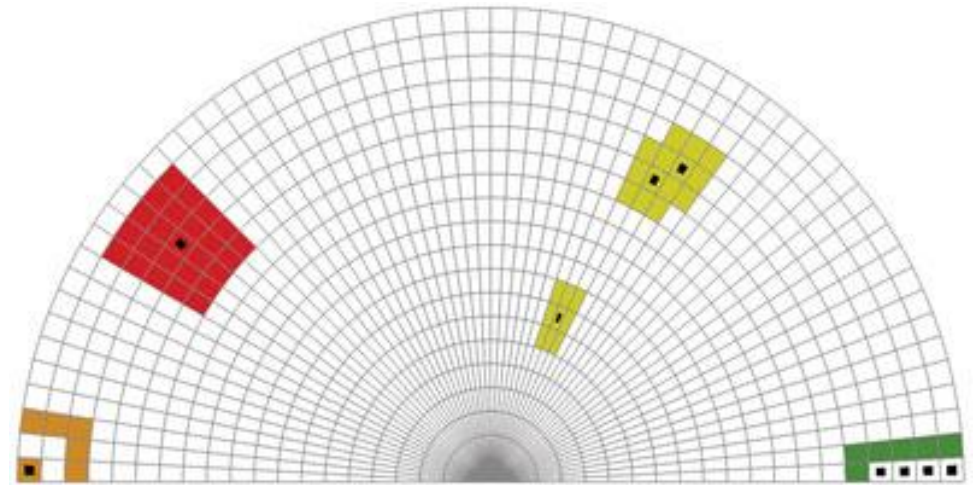Ningrui Li

Lab Meeting, 4/18/16

Objective

- Integrate real-time 3D visualization into the current prostate imaging workflow

- Feedback from clinician allows for focus on most prominent diseased regions
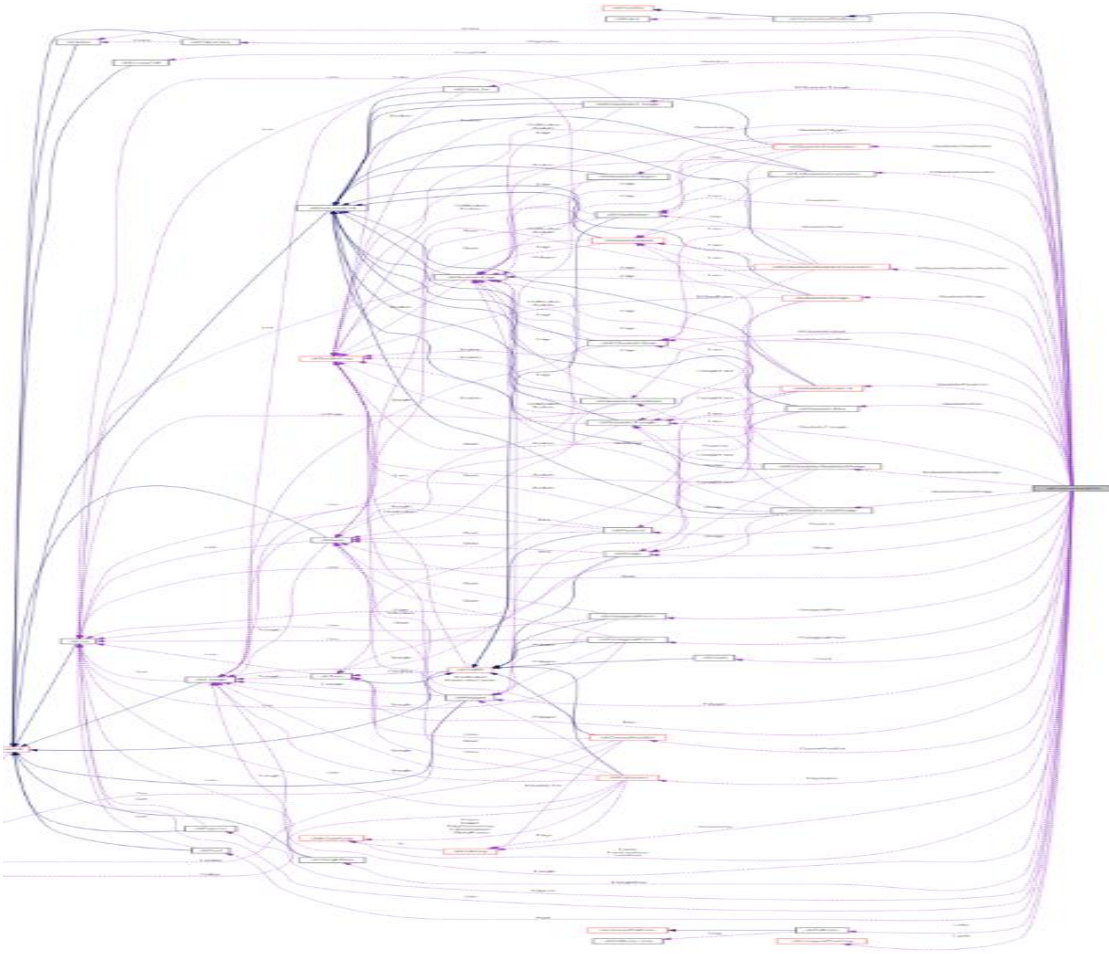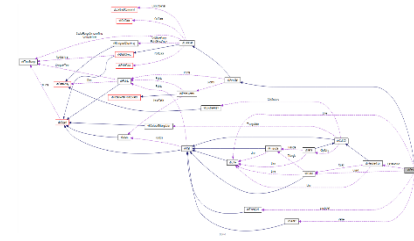
Block Diagram

VTK Dataset Types

- vtkUnstructuredGrid
  - Arbitrary combination of every possible cell type

- vtkStructuredGrid
  - Uniformly spaced set of points

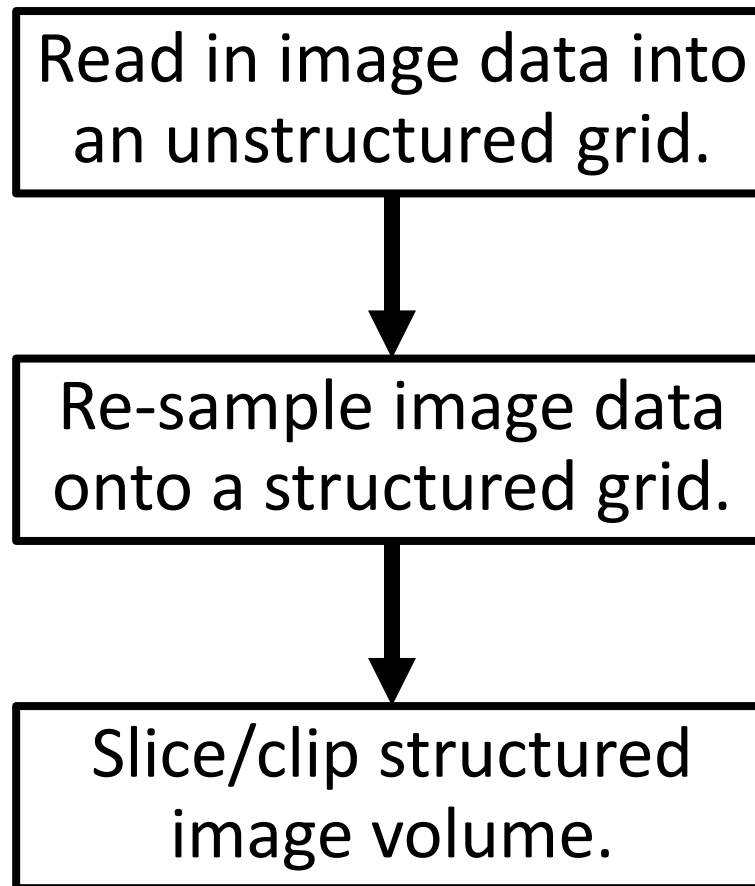# VTK Dataset Types – Collaboration Diagrams

vtkUnstructuredGrid

vtkStructuredGrid

VTK Pipeline

VTK Pipeline

Read in image data into an unstructured grid.

↓

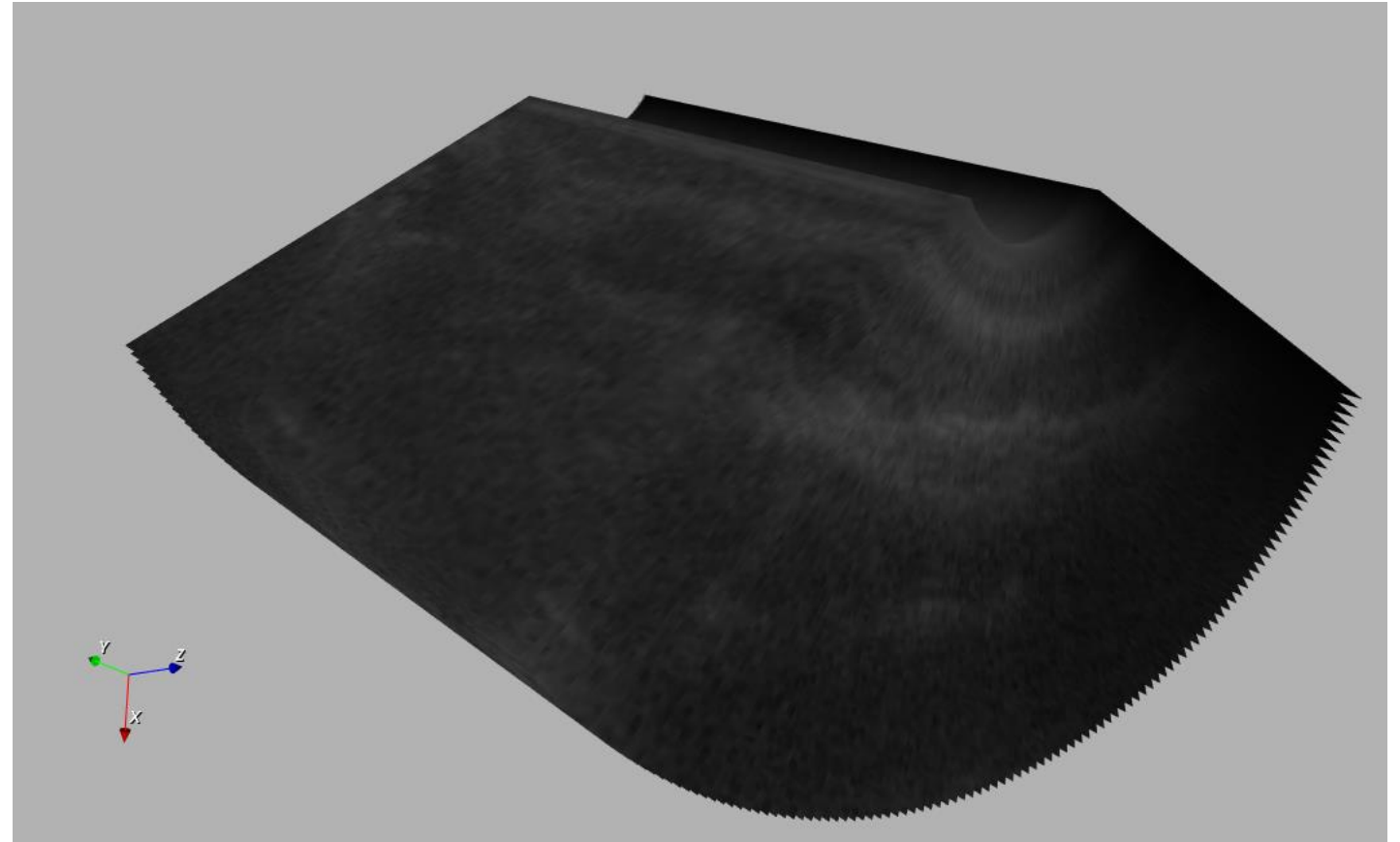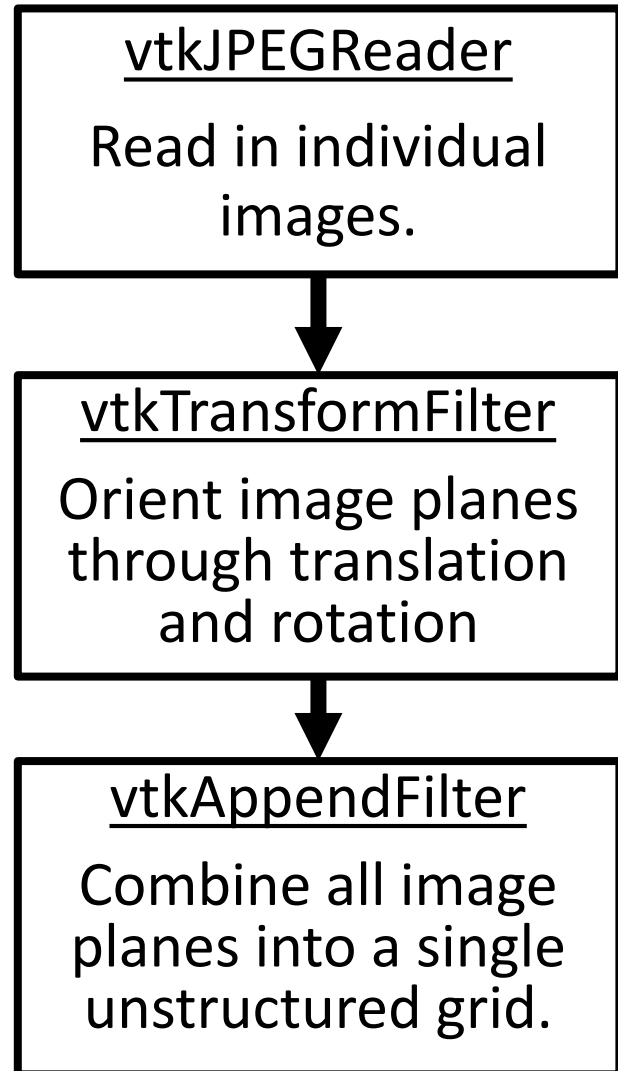Re-sample image data onto a structured grid.

↓

Slice/clip structured image volume.

Reading Image Data

vtkJPEGReader

Read in individual images.

↓

vtkTransformFilter

Orient image planes through translation and rotation

↓

vtkAppendFilter

Combine all image planes into a single unstructured grid.

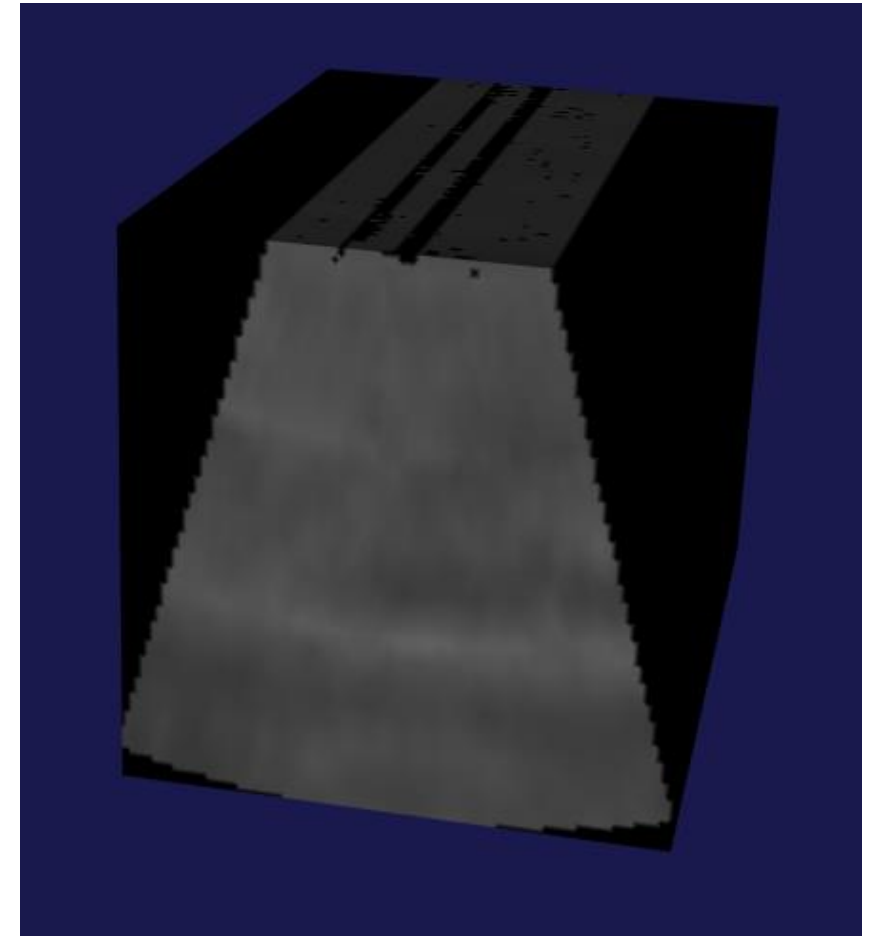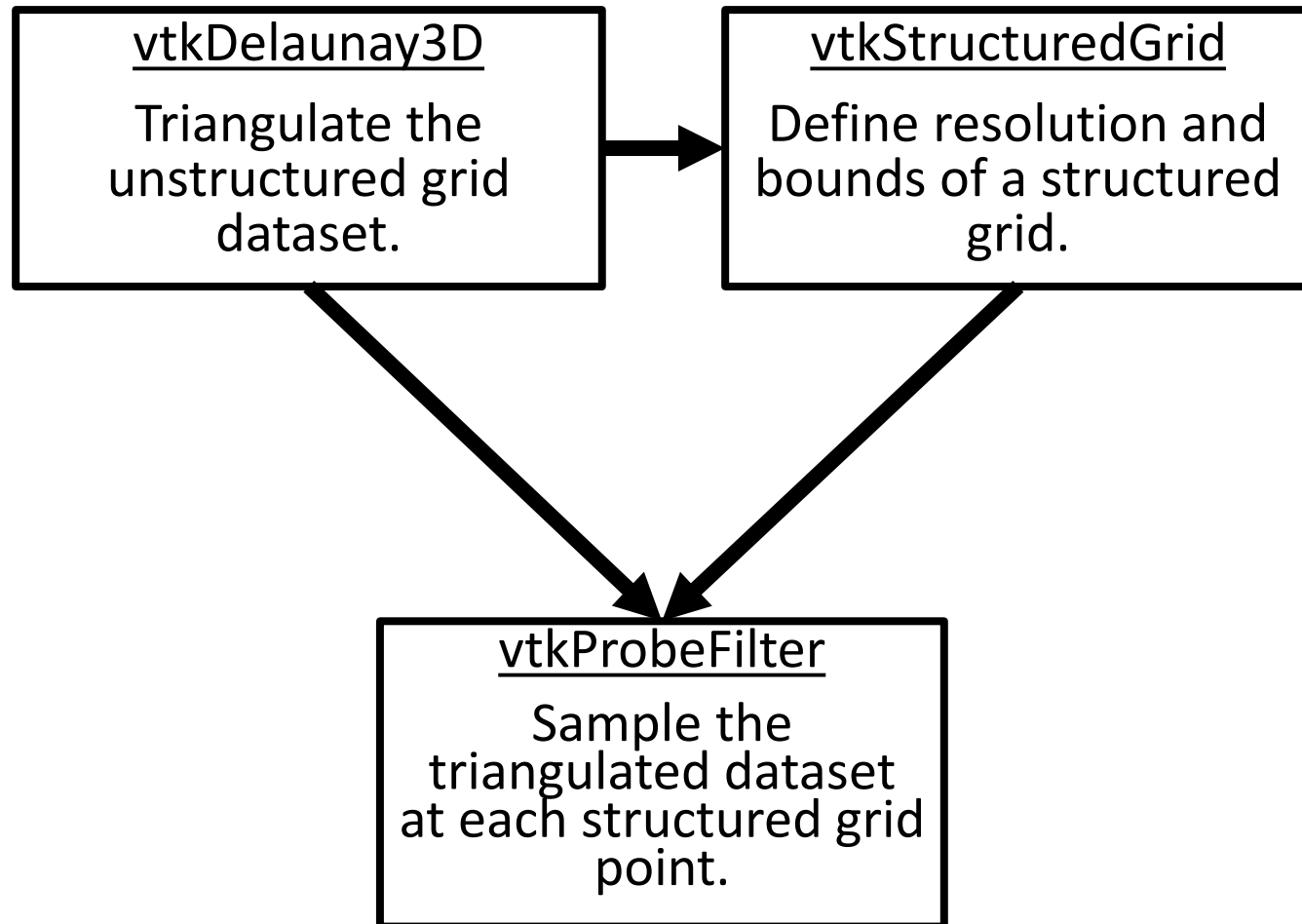

Discrete image planes combined into a single vtkUnstructuredGrid.
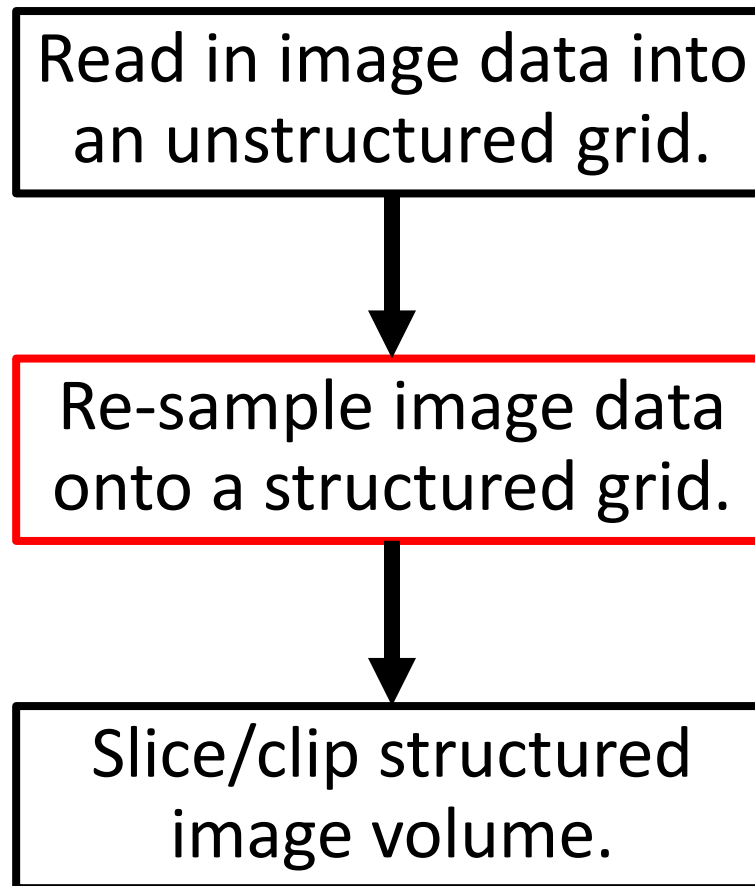
VTK Pipeline

Re-sampling onto a Structured Grid

vtkDelaunay3D

Triangulate the unstructured grid dataset.

vtkStructuredGrid

Define resolution and bounds of a structured grid.

vtkProbeFilter

Sample the triangulated dataset at each structured grid point.

Structured grid with re-sampled image volume data.

VTK Pipeline

```
┌─────────────────────────┐
│  Read in image data into │
│  an unstructured grid.   │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│   Re-sample image data   │
│  onto a structured grid. │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│   Slice/clip structured  │
│     image volume.        │
└─────────────────────────┘
```
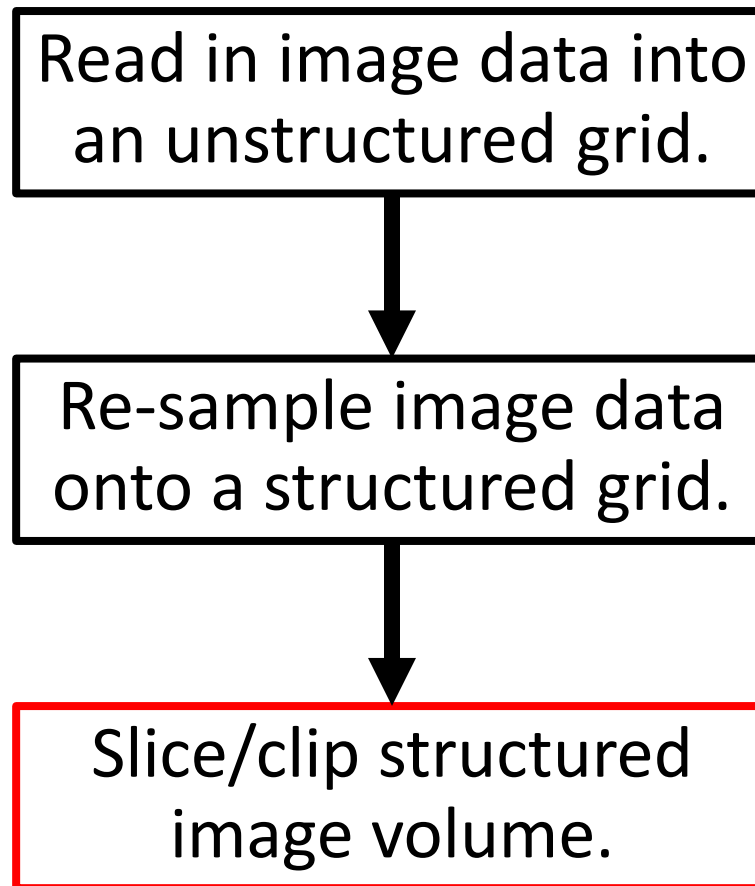
Manipulating Slice Planes

vtkPlaneWidget

Interactive planes controlled by user.

vtkProbeFilter

Triangulated dataset re-sampled at each structured grid point.

vtkPlane

Implicit function defining the slice plane.

vtkClipDataSet

Clips the image volume using the given slice plane.
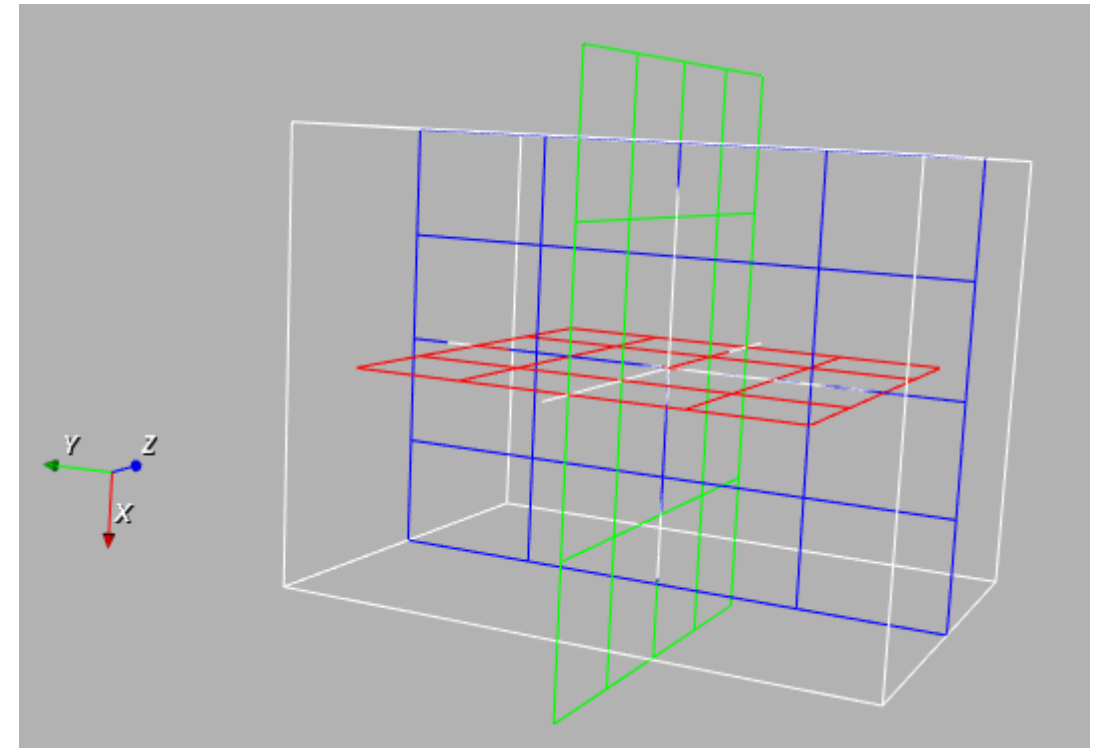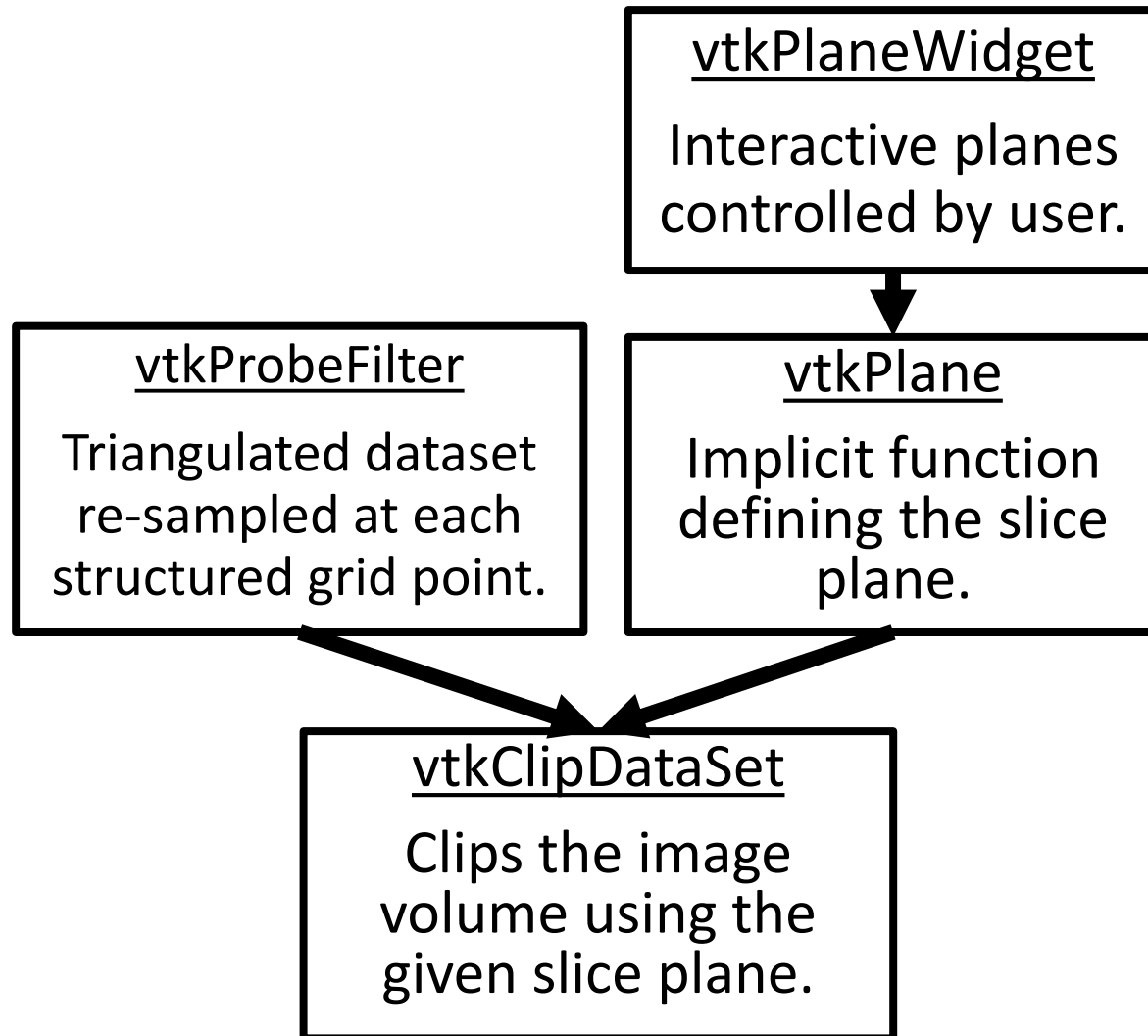
vtkPlaneWidgets oriented in the three orthogonal slice directions.