



Doosan Heavy Industries & Construction

[2019 8th OpenFOAM Korea Users' Community Conference]

VTK 라이브러리를 활용한 CAD & 데이터 후처리

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두산중공업

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Objects

Introduction to The Democratization of Computational Fluid Dynamics



VTK Library

Introduction to VTK and it's installation & configuration



Examples

From simple to complicated(?) examples

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📖 VTK Library

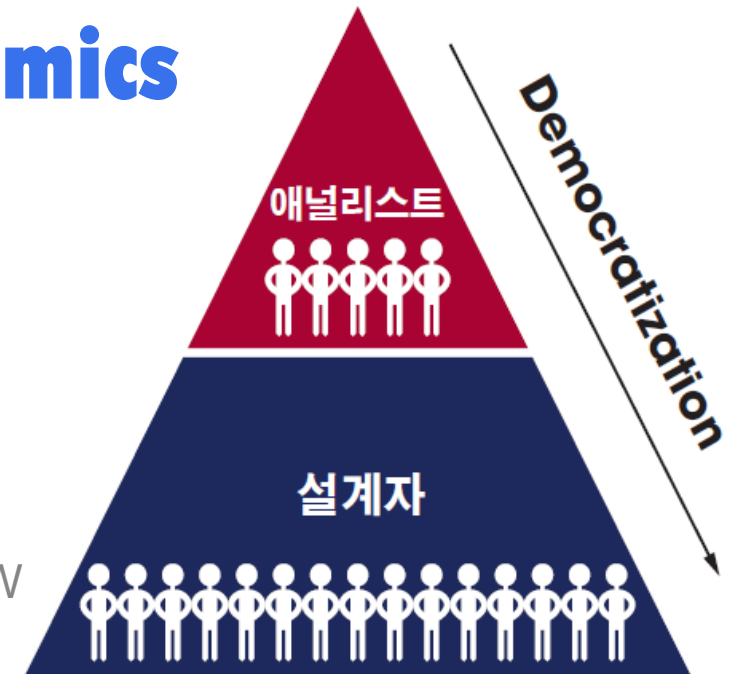
🚶 Examples

🏭 Conclusion

CFD는 소수의 전유물이여야 하는가?

The Democratization of Computational Fluid Dynamics

- Difficult to use
- Complicated pre-processing
- Needs long time to see results
- Requires huge investment in hardware & S/W
- Etc.



출처 : www.mentor.com

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📍 Objects

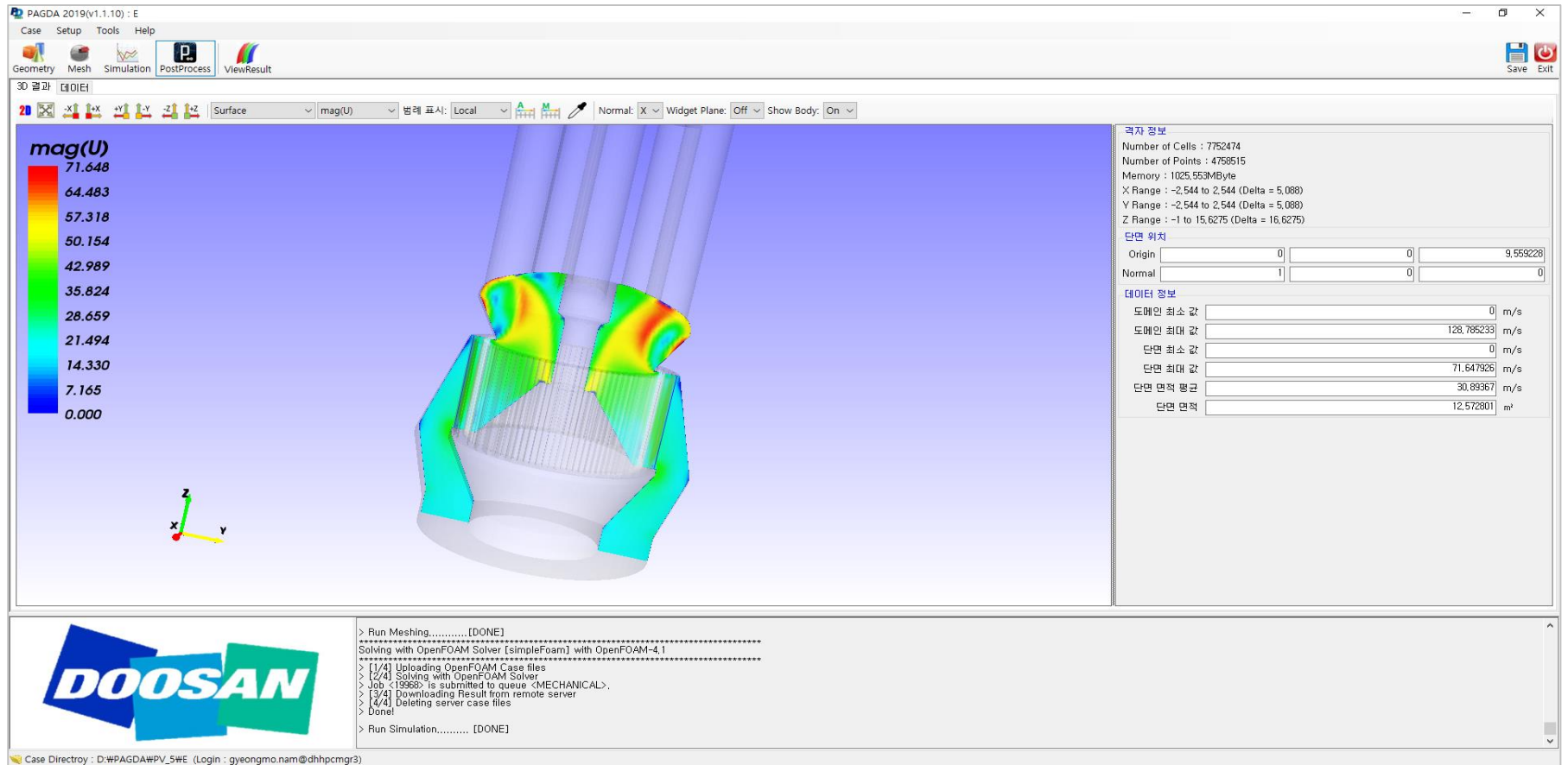
🏠 VTK Library

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On Going Project

Integrated Graphical User Interface Program



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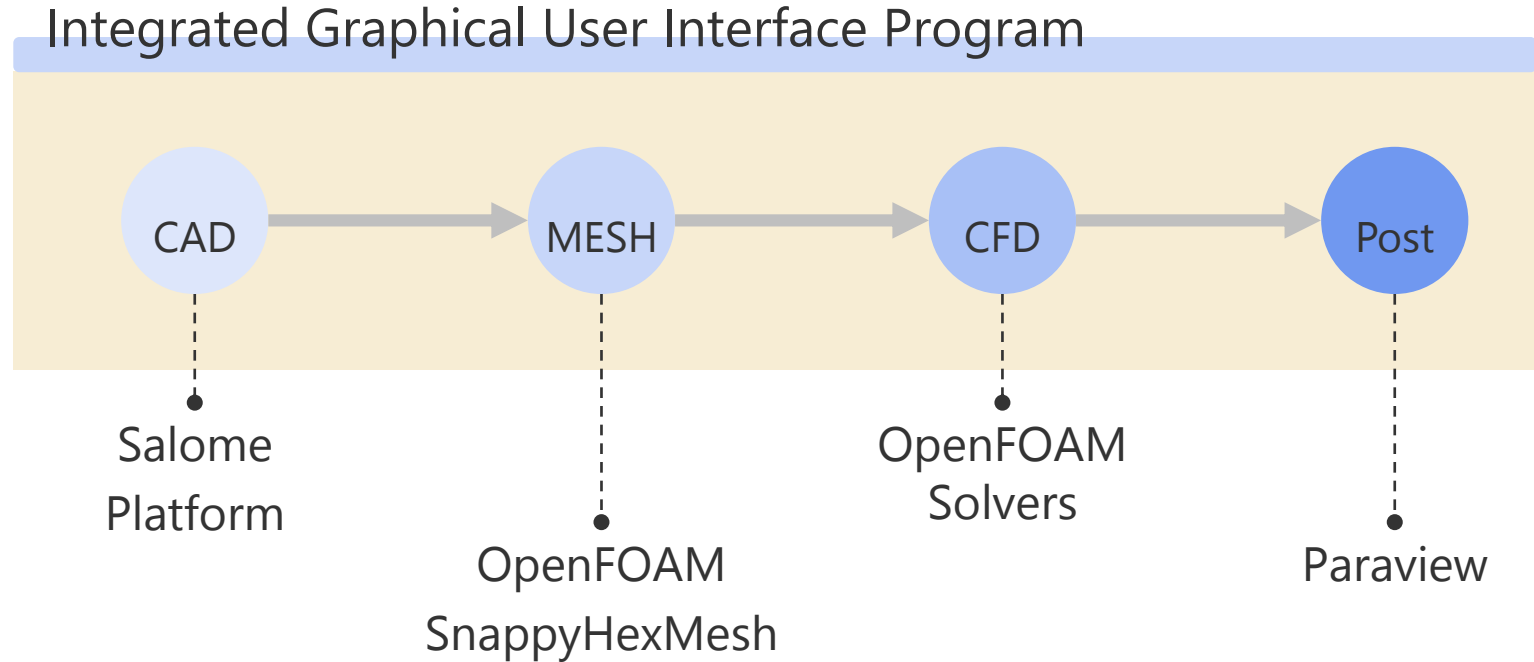
📍 Objects

🏠 VTK Library

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On Going Project



- Easy to use
 - Designer oriented GUI
- Low cost
 - Open source s/w

- Heavy Program
 - Individual program installation
- Time delay occur when execute third-party program with script

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📍 Objects

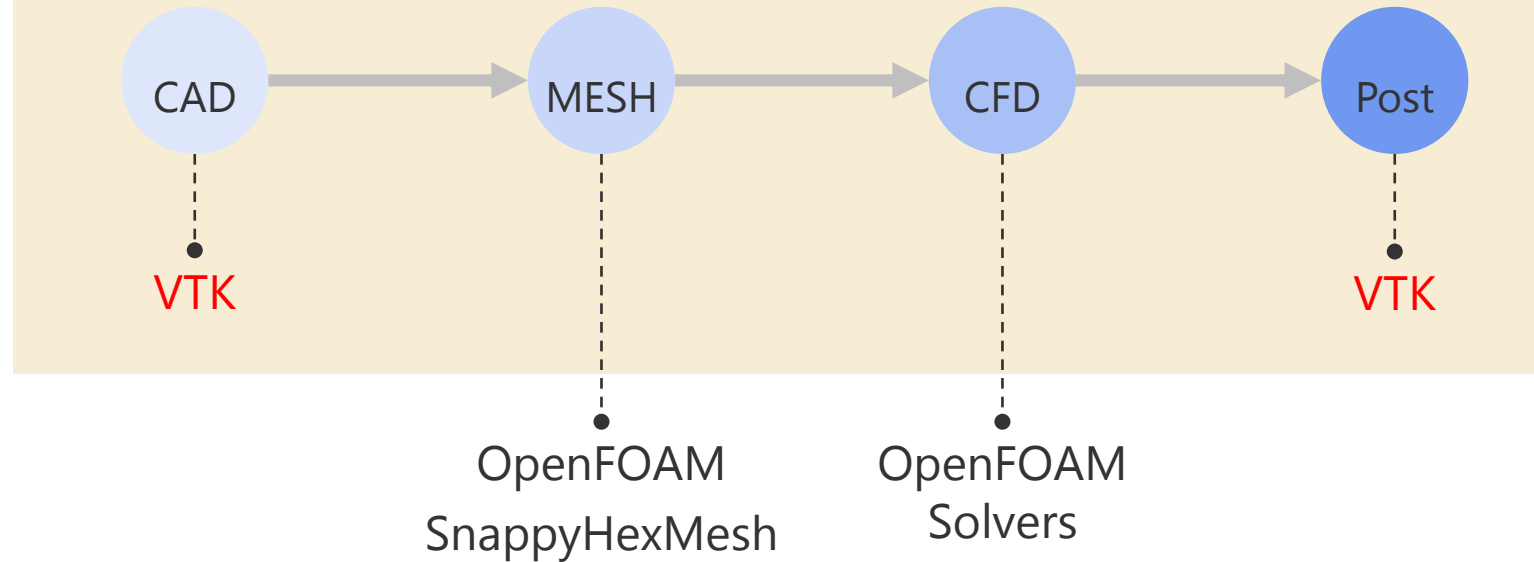
🏠 VTK Library

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🏭 Conclusion

On Going Project

Integrated Graphical User Interface Program



- Time Reduction : a geometry made in 1~3 seconds
- No need to install Salome & Paraview

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 **VTK Library**

 **Examples**

 **Conclusion**

- Definition
- Features
- Applications
- Installation
- Configuration

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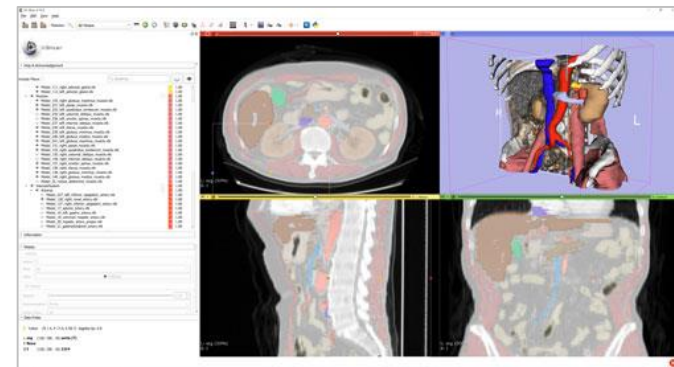
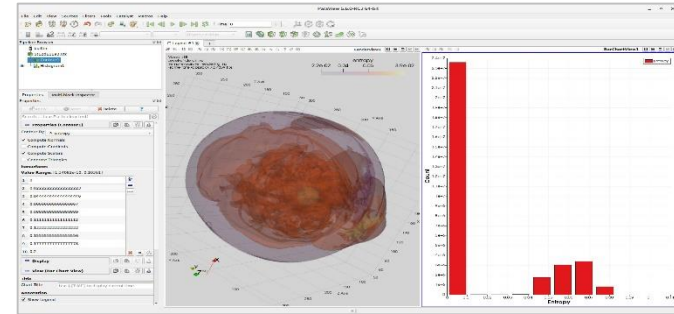
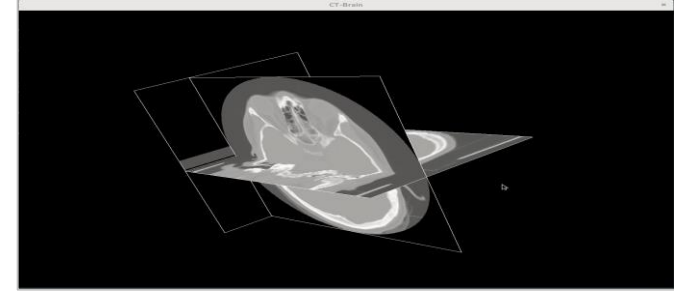
📖 VTK Library

🚶 Examples

🏠 Conclusion

Definition

- Visualization Tool Kit 
 - Open Source (BSD license)
 - 3D Computer Graphics
 - Scientific Visualization
 - Mesh and Image Processing
- Managed by Kitware Inc.
- Solutions
 - Paraview, 3D Slicer



출처 : vtk.org

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📍 Objects

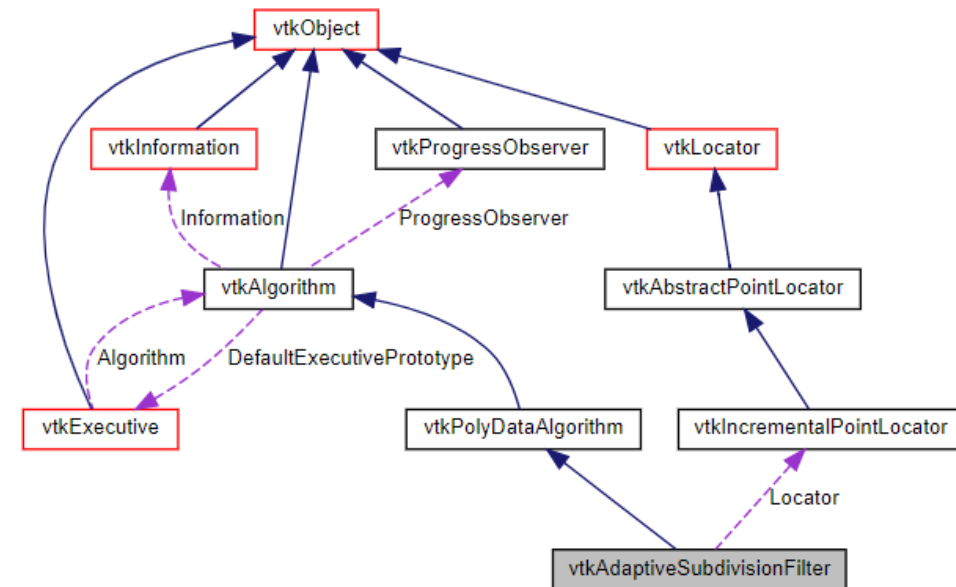
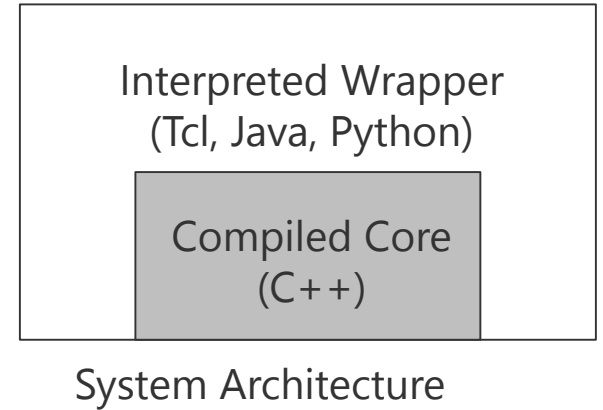
📖 VTK Library

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Features

- Provides binding to another code languages
 - Tcl/TK
 - Python
 - Java
- Object-oriented



[legend]

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📍 Objects

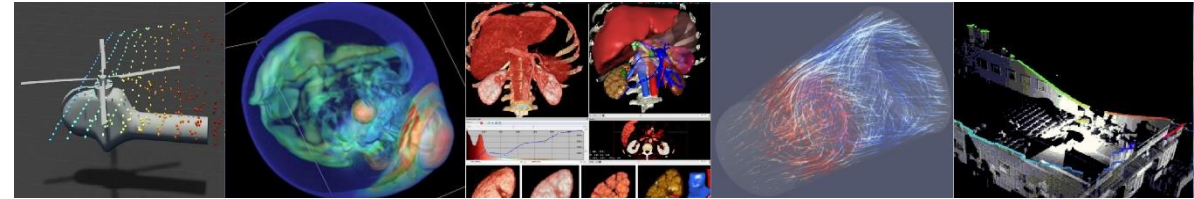
📖 VTK Library

🚶 Examples

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Applications

- Visualization
 - 3D Image
 - Information visualization
 - Etc.
- Image Processing
 - Medical Image
 - Registration
 - Etc.
- Computer Vision
 - 3D reconstruction
 - Video Analysis
 - Etc.



출처: www.kitware.eu

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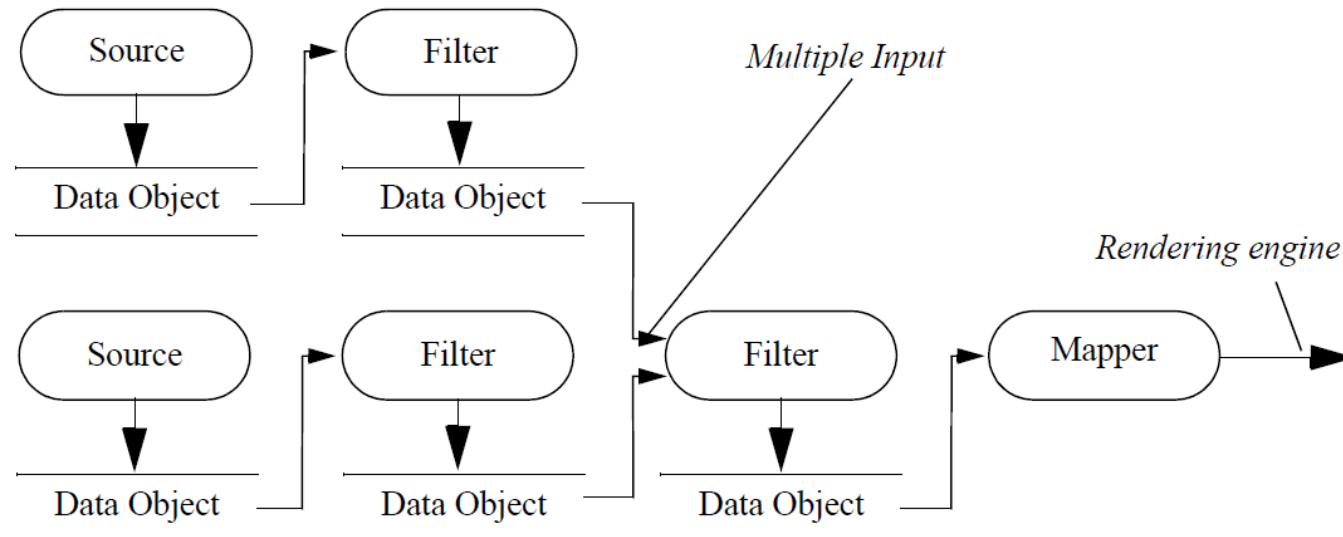
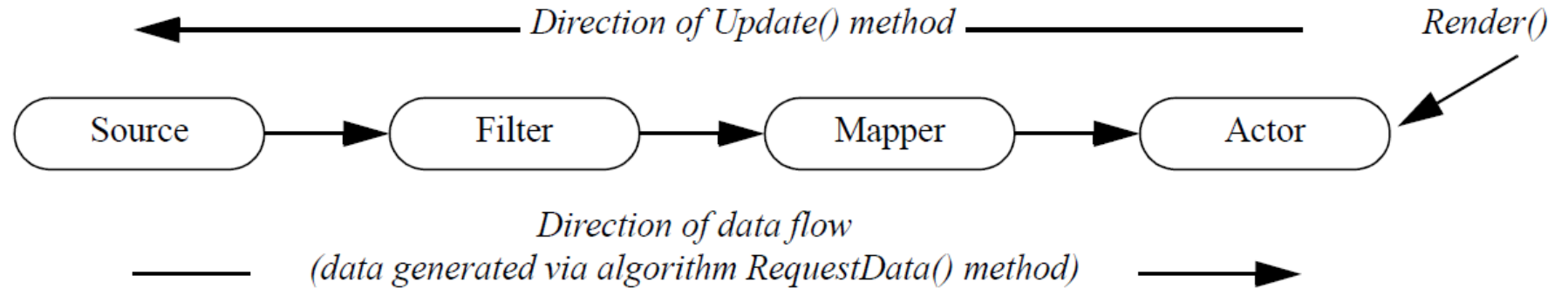
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Visualization Pipeline



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ActiViz



- 3D Visualization ToolKit for .NET/C#
- Open-source software system for 3D Visualization wrapped in C#
- Built around the Visualization ToolKit
- Supports a wide variety of visualization algorithms including scalar, vector, tensor, texture, and volumetric methods
- Includes advanced modeling techniques
 - implicit modeling, polygon reduction, mesh smoothing, cutting, contouring, and Delauny triangulation

Installation



1. Go to "<https://www.kitware.eu/product/activiz>"

2. Download

Download ActiViz

Item	Platform	File	Size
ActiViz OpenSource Edition 8.0	64-bit Windows XP or later	Contact us for details	
ActiViz OpenSource Edition 8.0	Windows XP or later	Contact us for details	
ActiViz OpenSource Edition 5.8.0	64-bit Windows XP or later	ActiViz.NET-5.8.0.607-win64-OpenSource.exe	20.16M
ActiViz OpenSource Edition 5.8.0	Windows XP or later	ActiViz.NET-5.8.0.607-win32-OpenSource.exe	17.95M
ActiViz OpenSource Edition 5.2.1 User Guide	All	ActiViz .NET 5.2 Users Guide.pdf	3.56M

3. Install

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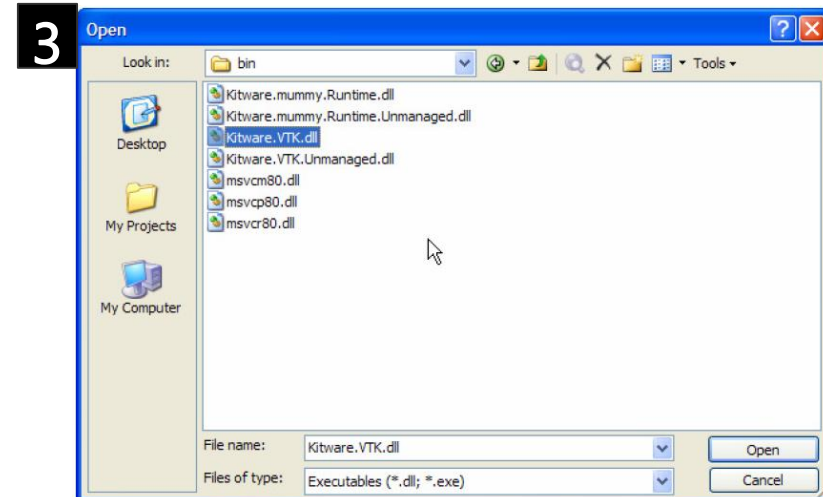
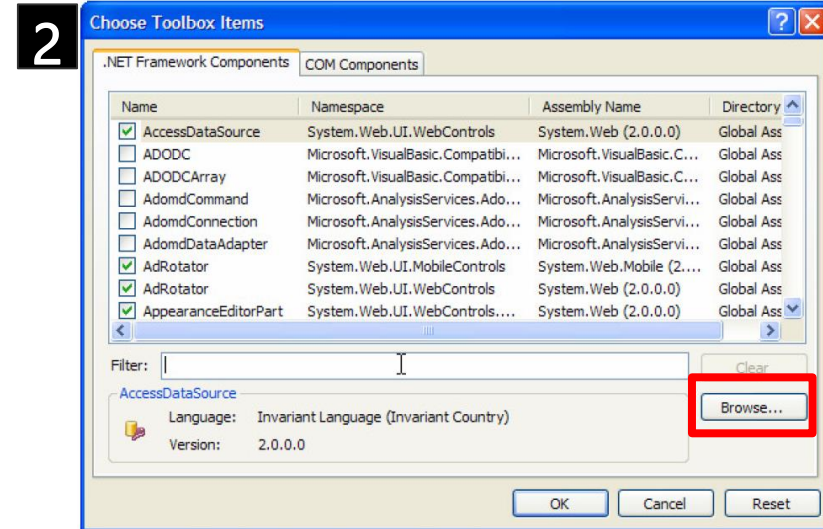
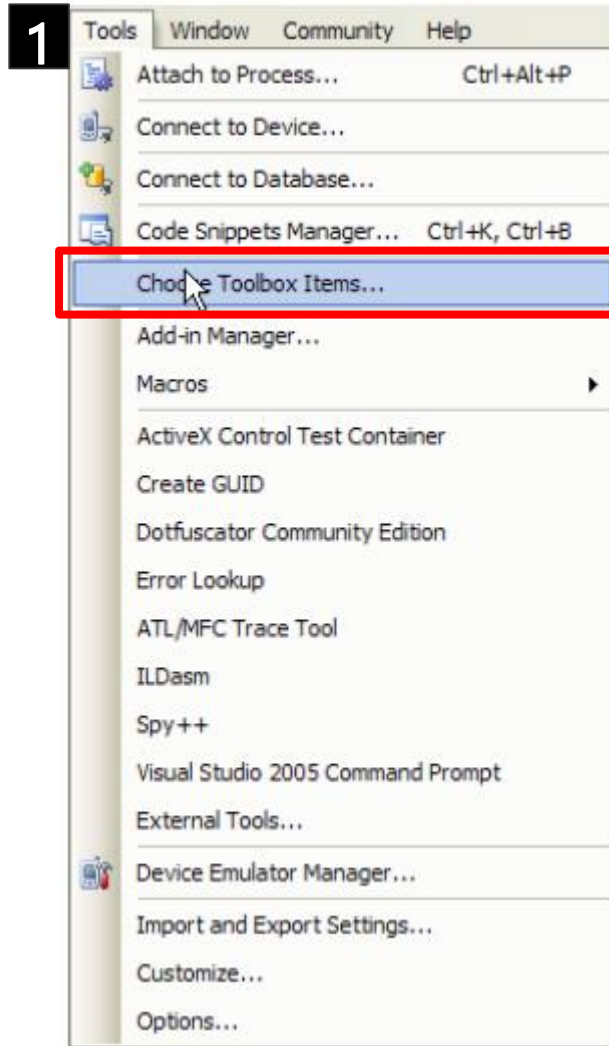
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Configuring



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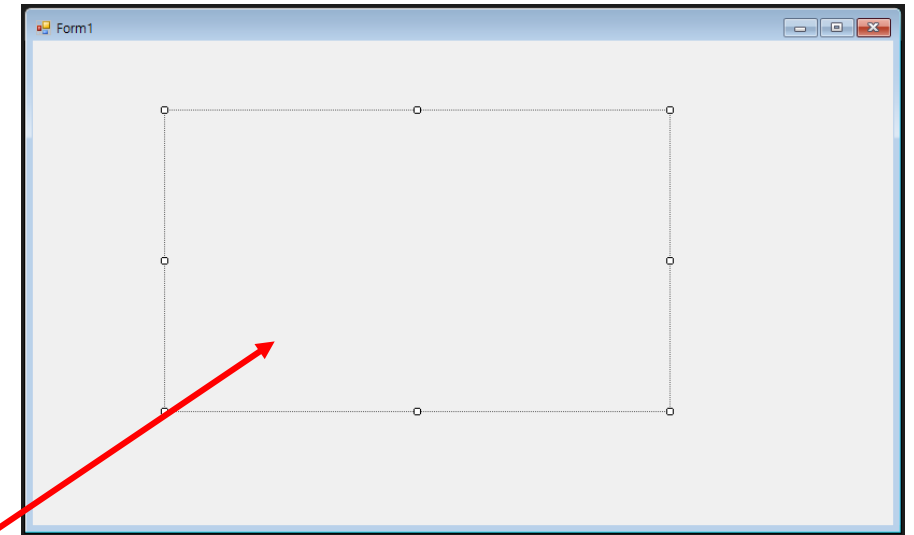
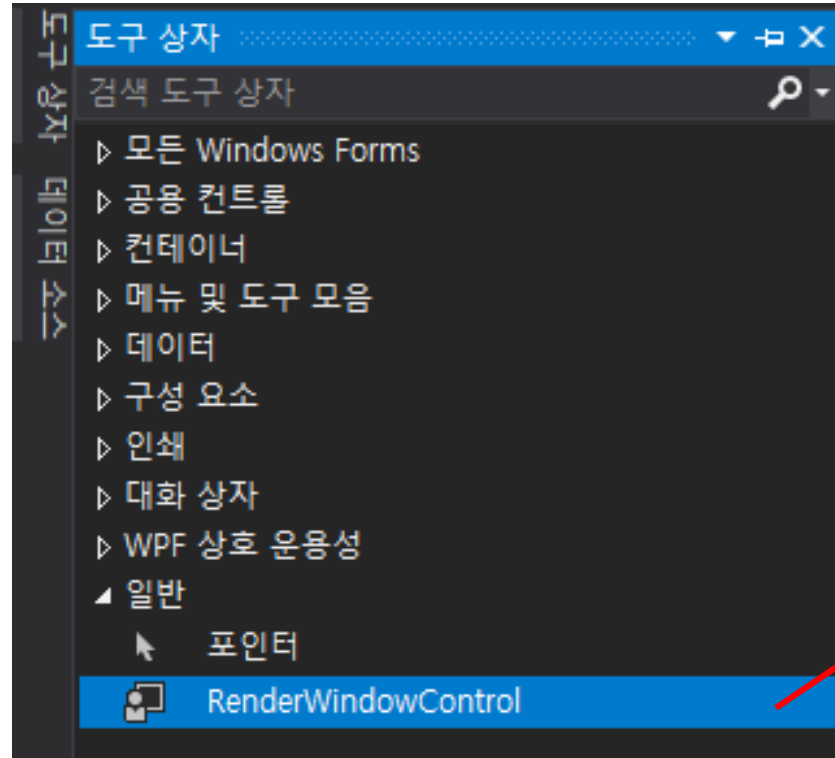
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Configuring



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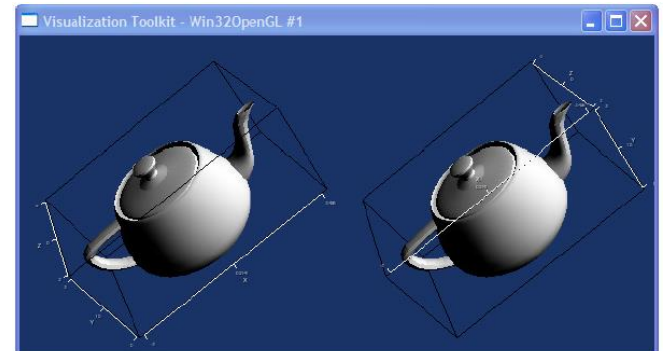
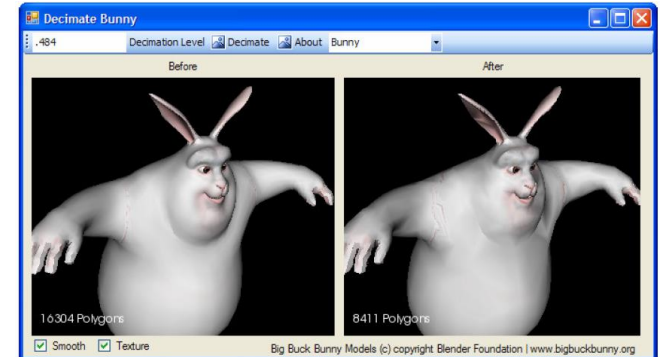
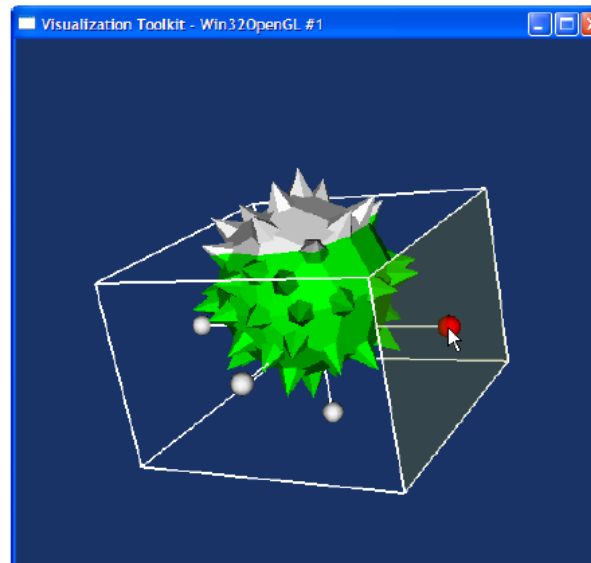
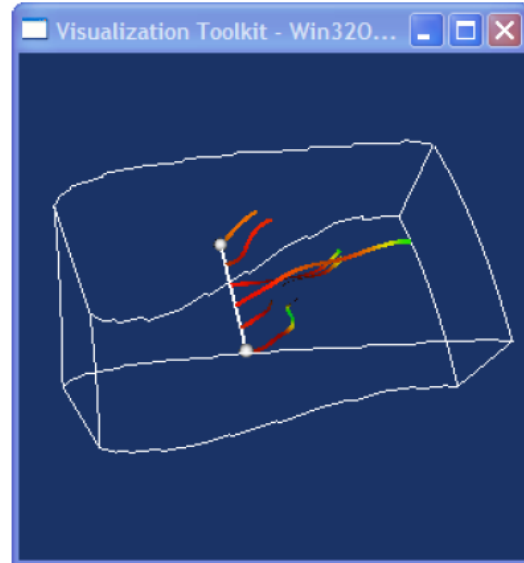
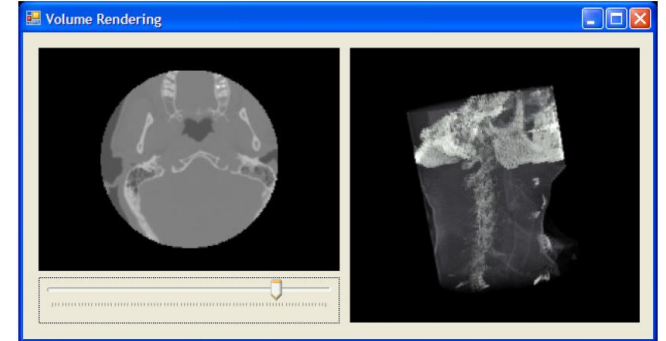
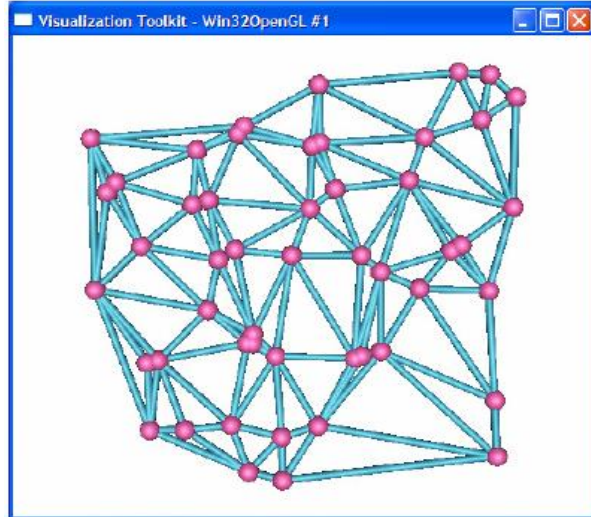
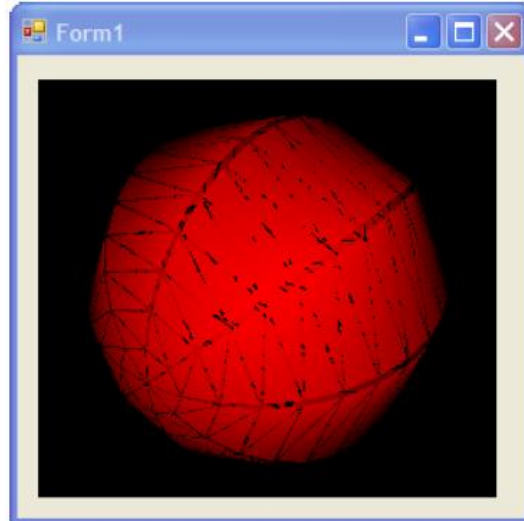
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VTK Tutorials



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Sphere Rendering

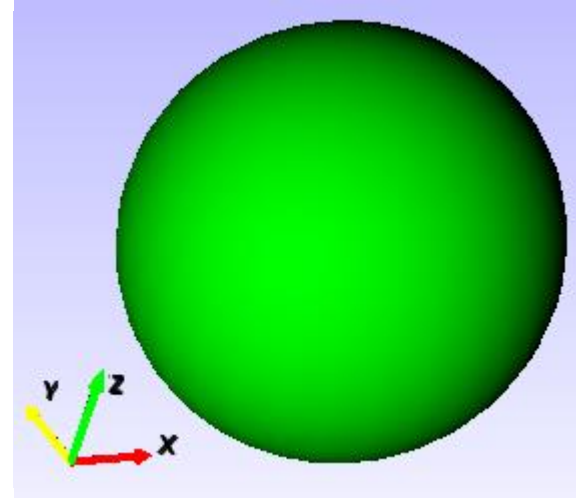
using Kitware.VTK;

```
vtkSphereSource sphere = vtkSphereSource.New();  
sphere.SetThetaResolution(32);  
sphere.SetPhiResolution(32);  
sphere.SetRadius(0.5);  
sphere.SetCenter(0,0,0);
```

```
vtkPolyDataMapper mapper = vtkPolyDataMapper.New();  
mapper.SetInputConnection(sphere.GetOutputPort());  
Mapper.Update();
```

```
vtkActor point = vtkActor.New();  
point.SetMapper(mapper);  
point.GetProperty().SetColor(0, 1, 0);  
point.SetPosition(0,0,0);
```

```
vtkRenderer render = vtkRenderer.New();  
render = this.renWin.RenderWindow.GetRenderers().GetFirstRenderer();  
render.AddActor(point);  
this.renWin.refresh();
```



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- Import STL
- Export STL
- User Defined Geometries
- Sliced Contour
- Post-Examples

Import STL

```
string filePath = "D:\Examples\test.stl";
```

```
vtkSTLReader STL_Reader = new vtkSTLReader();  
STL_Reader.SetFileName(filePath);  
STL_Reader.Update();
```

```
vtkDataSetMapper STL_Mapper = new vtkDataSetMapper();  
STL_Mapper.SetInputConnection(STL_Reader.GetOutputPort());  
STL_Mapper.Update();
```

```
vtkActor STL_Actor= new vtkActor();  
STL_Actor.SetMapper(STL_Mapper);  
STL_Actor.GetProperty().SetEdgeColor(0, 0, 0);  
STL_Actor.GetProperty().SetColor(0.75, 0.75, 0.75);  
STL_Actor.GetProperty().SetOpacity(0.3);
```

```
vtkRenderer render = vtkRenderer.New();  
render = this.renWin.RenderWindow.GetRenderers().GetFirstRenderer();
```

```
render.AddActor(point)
```

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Export STL

```
vtkTransform Transform = new vtkTransform();  
Transform.PostMultiply();  
Transform.Translate(1.0, -2.2, 4.5);
```

```
vtkTransformFilter transformFilter = vtkTransformFilter.New();  
transformFilter.SetTransform(Transform);  
transformFilter.SetInputConnection(previewMapper.GetInputConnection(0, 0));  
transformFilter.Update();
```

```
vtkDataSetSurfaceFilter surface_filter = vtkDataSetSurfaceFilter.New();  
surface_filter.SetInputConnection(transformFilter.GetOutputPort());
```

```
vtkTriangleFilter triangle_filter = vtkTriangleFilter.New();  
triangle_filter.SetInputConnection(surface_filter.GetOutputPort());
```

```
string filePath = "D:\Examples\test.stl";  
vtkSTLWriter writer = vtkSTLWriter.New();  
writer.SetInputConnection(triangle_filter.GetOutputPort());  
writer.SetFileName(filePath);  
writer.Write();
```

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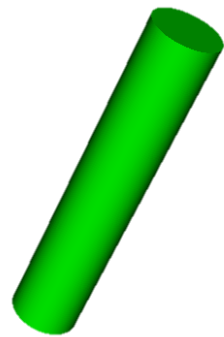
📍 Objects

📖 VTK Library

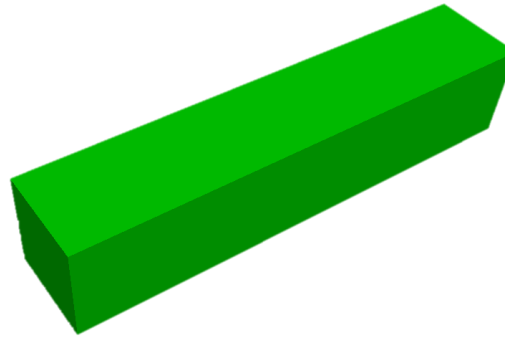
🏃 Examples

🏭 Conclusion

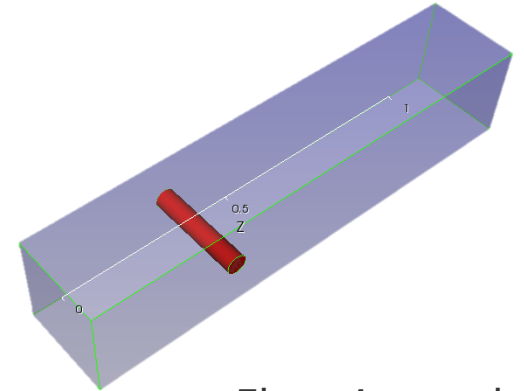
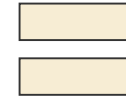
User Defined Geometries



Cylinder



Box



Flow Around
Cylinder

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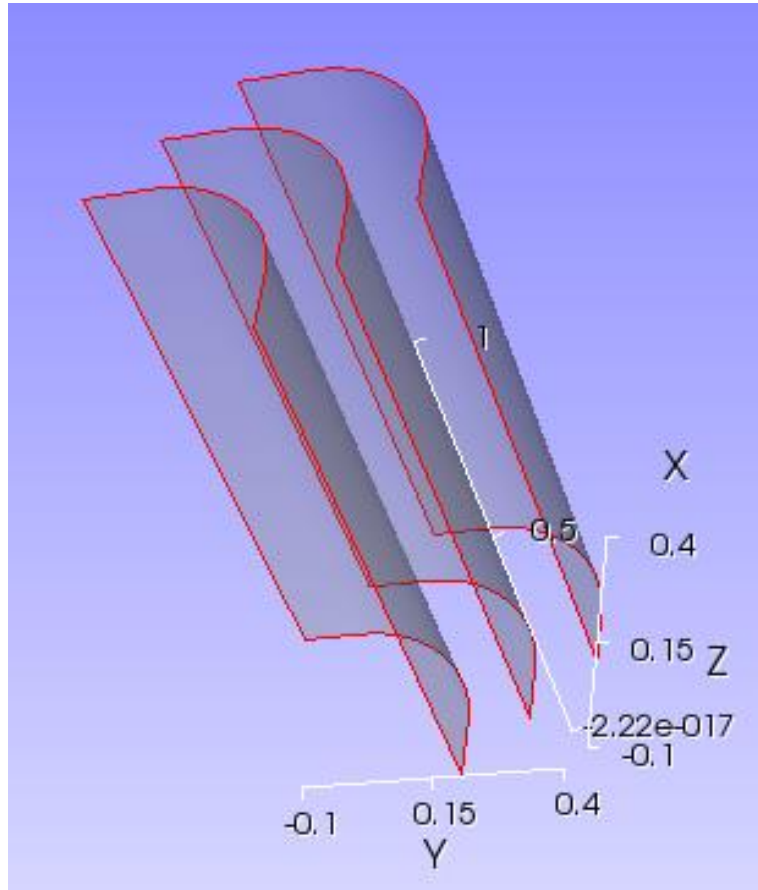
📍 Objects

📖 VTK Library

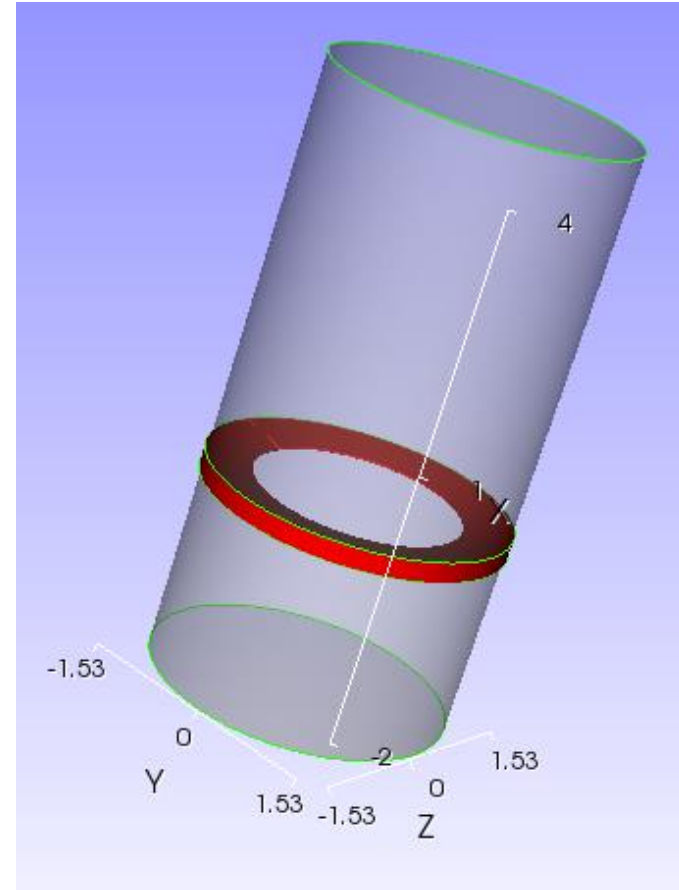
🏃 Examples

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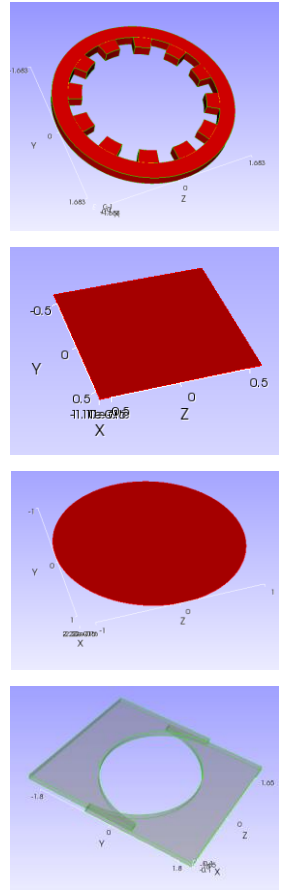
User Defined Geometries



Guide Vane



Orifice



ETC

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🚶 Examples

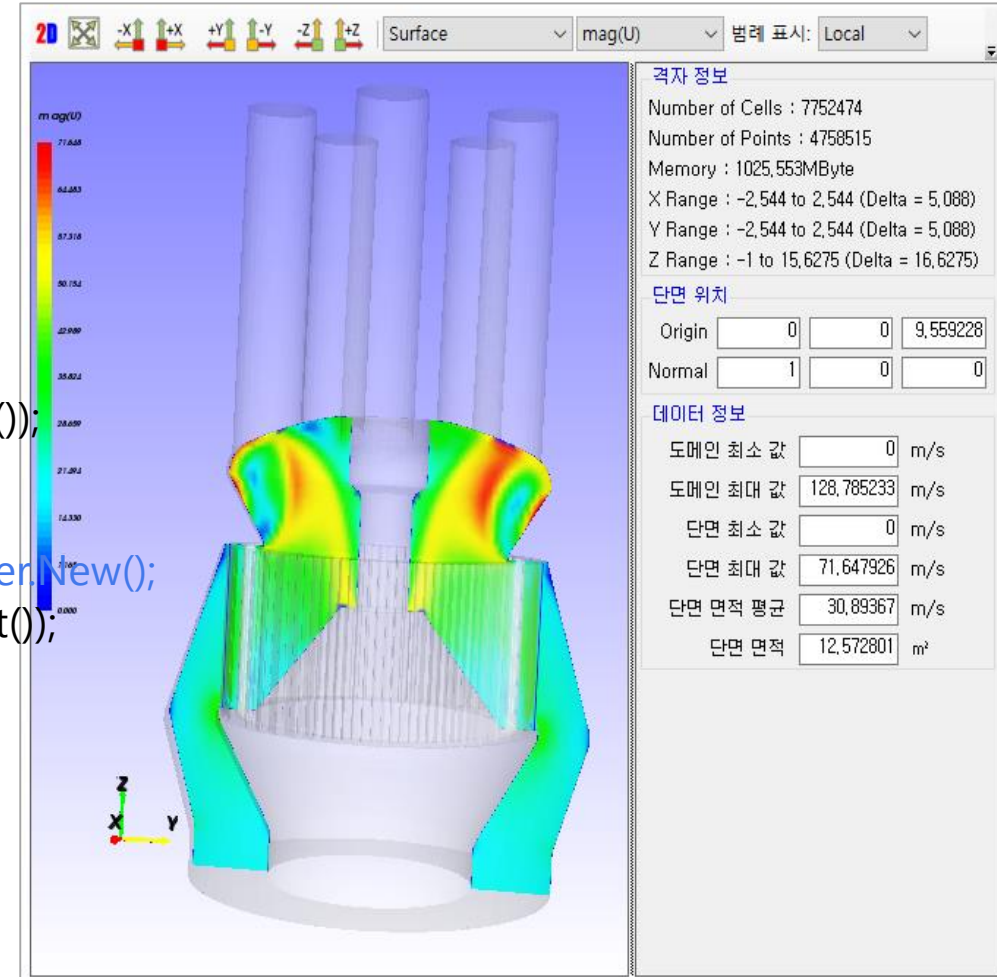
🏠 Conclusion

Slice Contour

```
vtkPlane Plane = vtkPlane.New();  
Plane.SetOrigin(0,0,0);  
Plane.SetNormal(0,1,0);
```

```
vtkCutter Cut = vtkCutter.New();  
Cut.SetCutFunction(Plane);  
Cut.SetInputConnection(Reader.GetOutputPort());  
Cut.Update();
```

```
vtkDataSetMapper Mapper = vtkDataSetMapper.New();  
Mapper.SetInputConnection(Cut.GetOutputPort());
```



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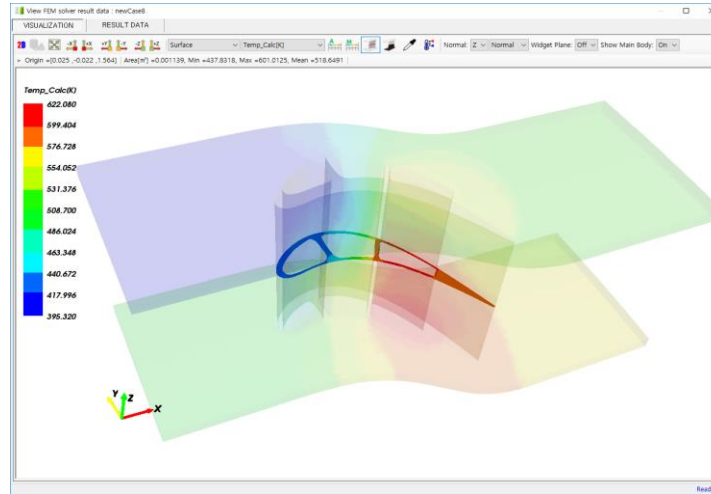
📍 Objects

🏠 VTK Library

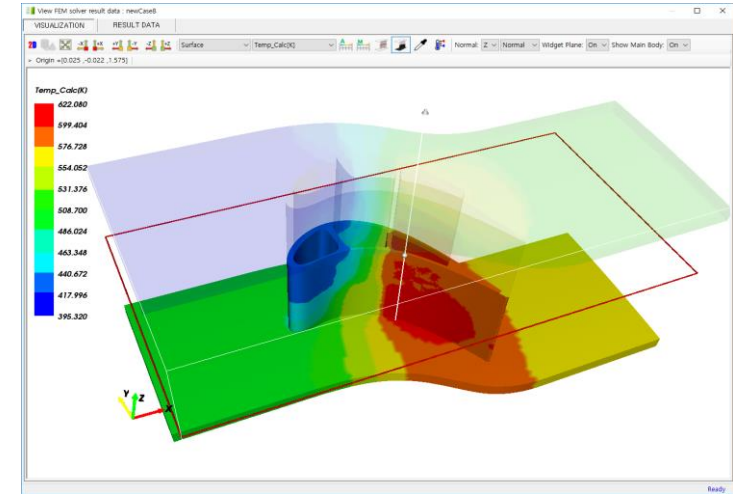
🏃 Examples

🏢 Conclusion

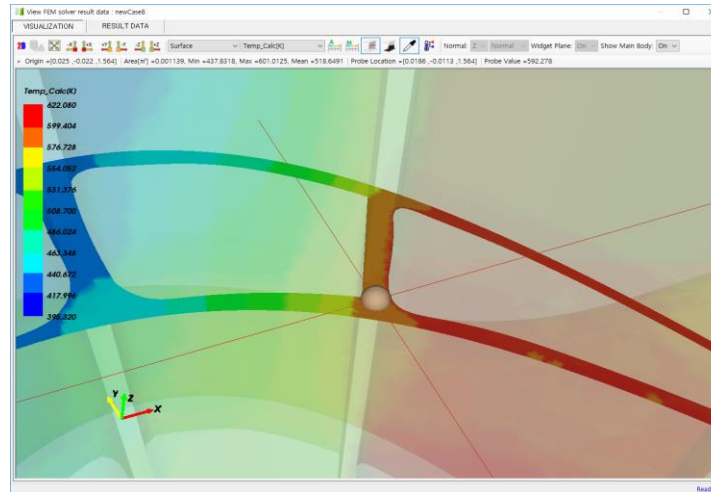
Post-Examples



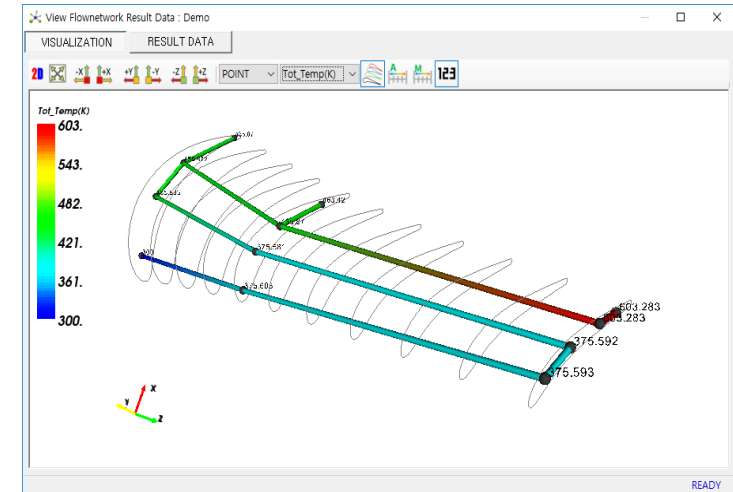
Slice Contour



Data Clip



Probe



Flow Network

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 **Objects**

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**IS
THIS
USERFUL
?**

Thank You!

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