Laboratory for Percutaneous Surgery

# Enhance medical software applications with immersive virtual reality experience

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# Virtual Reality – Key Features

- **Immersive display**: large field of view, stereoscopic visualization
- **Natural 3D interaction**: position-tracked headset and handheld controllers, with buttons, touchpad, joystick, etc.

# Virtual Reality – Now Accessible

- "VR-ready" computers (with discrete graphics card) from $1000 +
  - HTC Vive $650
  - Oculus Rift $550
  - Windows MR $400
- Standalone VR systems
  - Oculus Quest $550

$400

https://www.bestbuy.ca

$400k

https://www.displaydaily.com/article/display-daily/what-you-call-vr-i-call-a-cave

# How to develop VR software?

## Use a game engine?



- Fully immersive standalone applications, mobile devices
- Real-time photorealistic rendering, physics engine
- Huge community, lots of resources

*"made by game developers, for game developers"*

https://www.unrealengine.com/en-US/faq

How to integrate it into existing workflow and software?

How to upload patient-specific data?

Should we redevelop common *medical* imaging software features?

How to get support?

# How to develop VR software?

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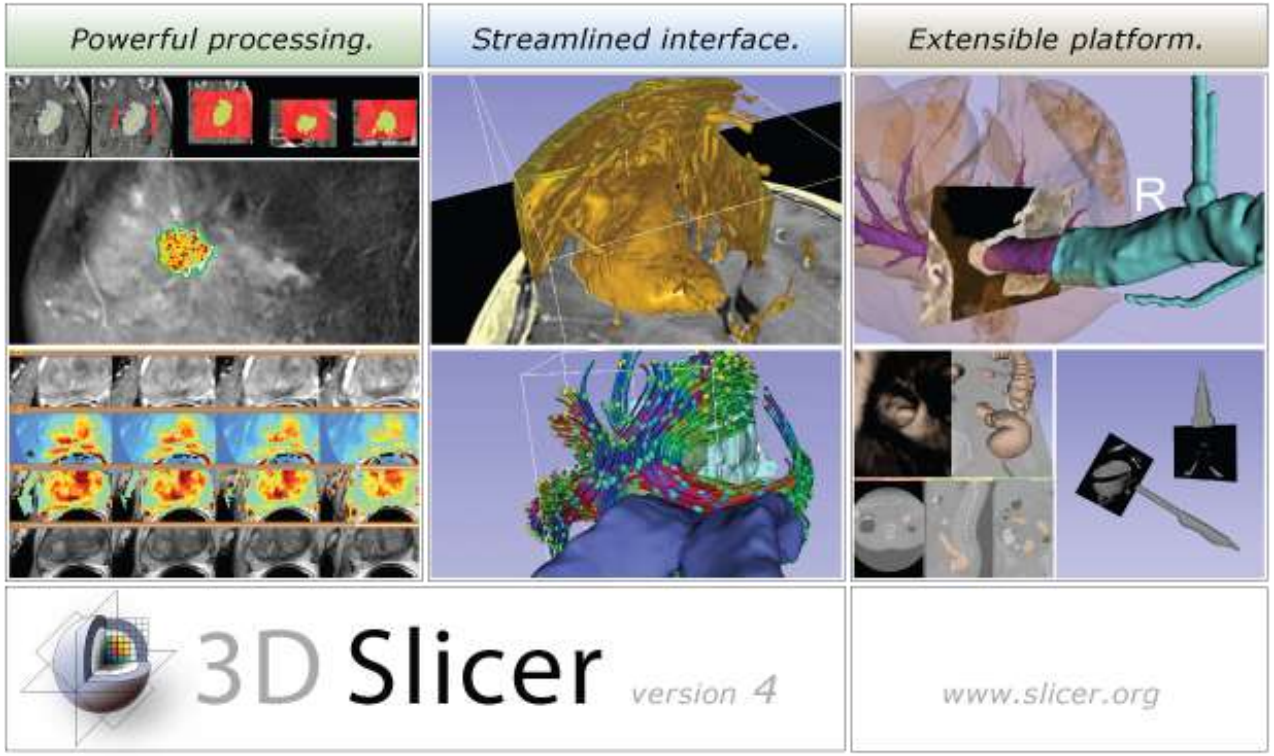
## Use medical application platform



- Hybrid desktop/immersive workflows, hospital information system integration
- Medical image processing, analysis, and visualization tools
- Community focused on medical applications

# 3D Slicer

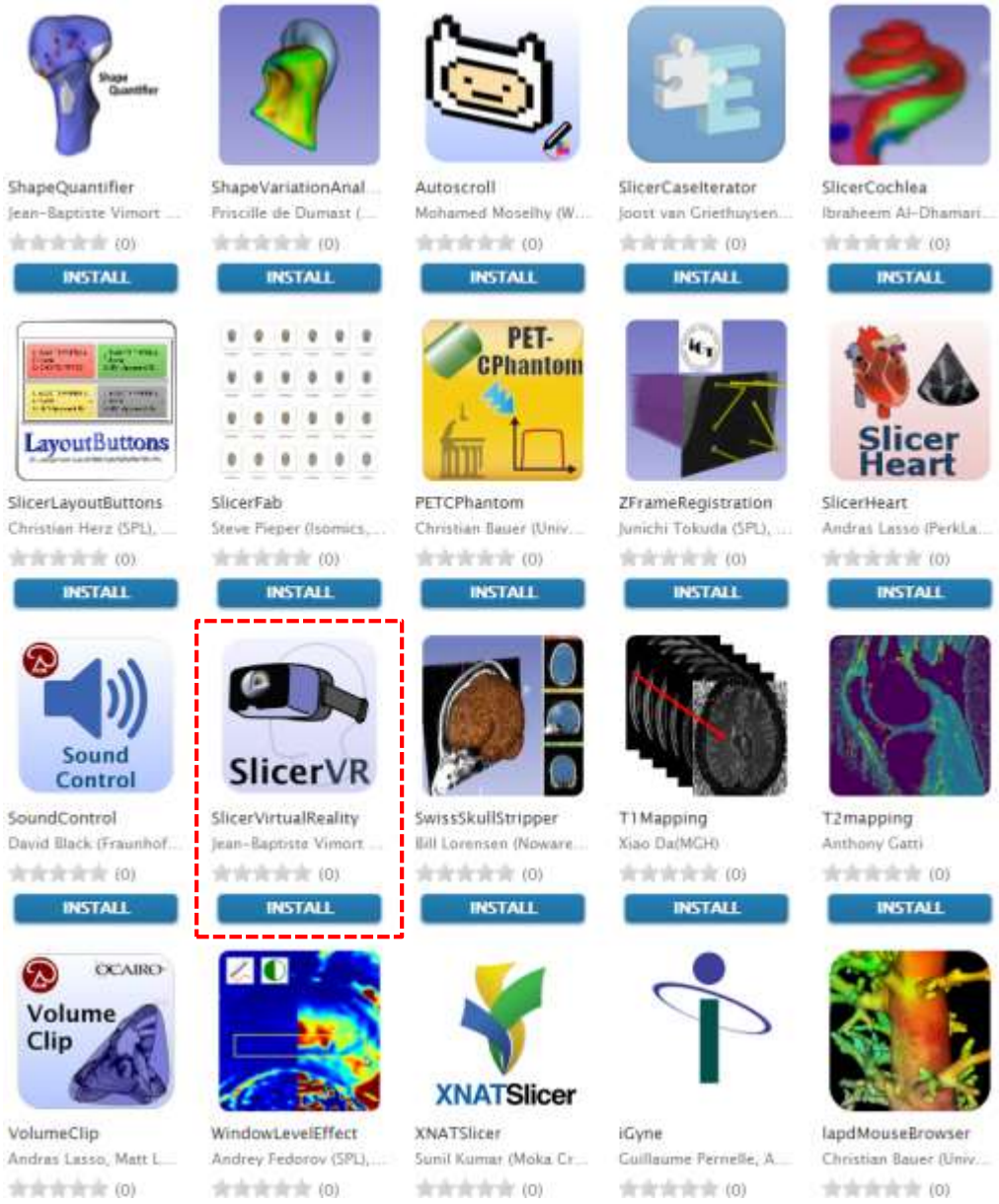



Open-source software platform for medical image visualization, analysis, treatment planning, and real-time guidance.

Completely free, no restrictions (BSD-type license).

# 3D Slicer – Existing Tools

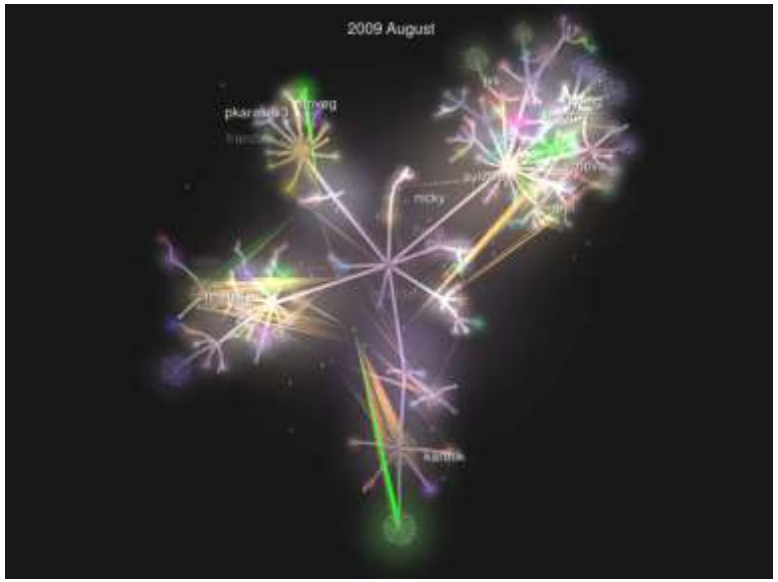
- Core features: multi-modality 2D/3D/4D visualization, DICOM, segmentation, registration, etc.
- Extensible using Python scripting, Jupyter notebooks, any Python packages (tensorflow, opencv, …)
- 150+ extensions available in the app store: radiation therapy, deep learning, radiomics, medical training, image guided surgery…



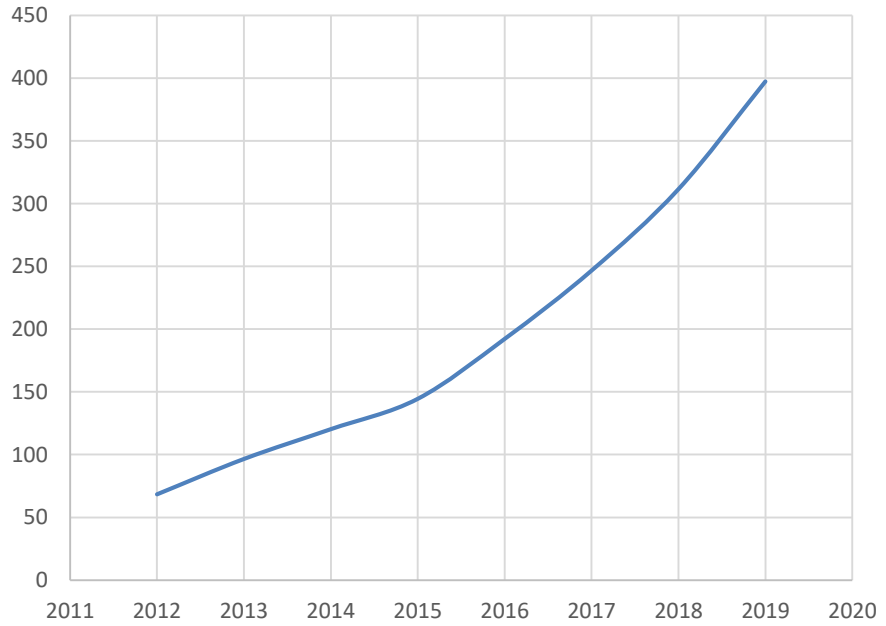
# 3D Slicer - Statistics

- $50+ million of funding, 5 generations since 1997
- 570k+ downloads to date, 25-30% growth per year
- 248 contributors to core + many more to extensions

Source code tree changes



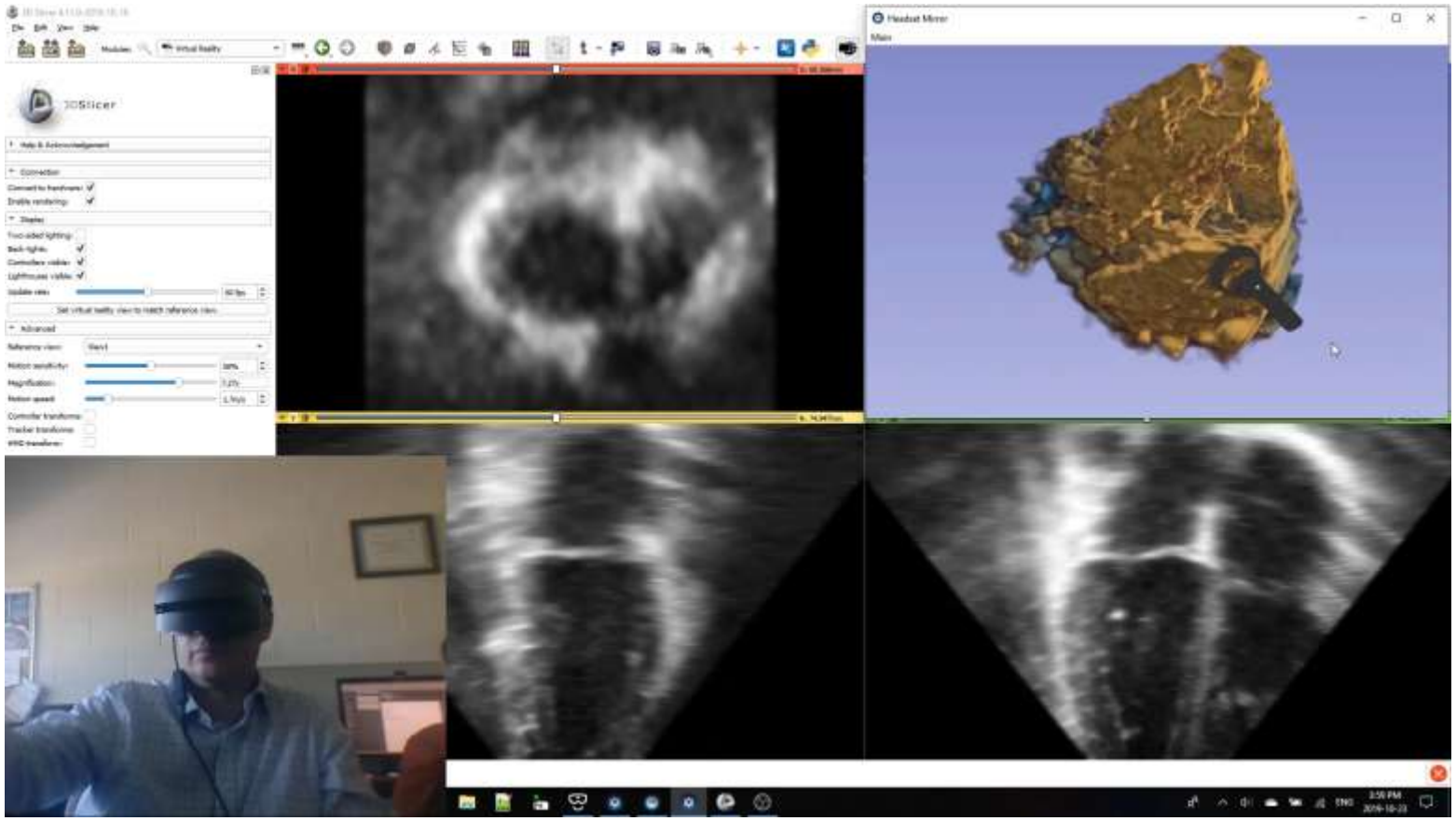

Daily download count




Downloads by country

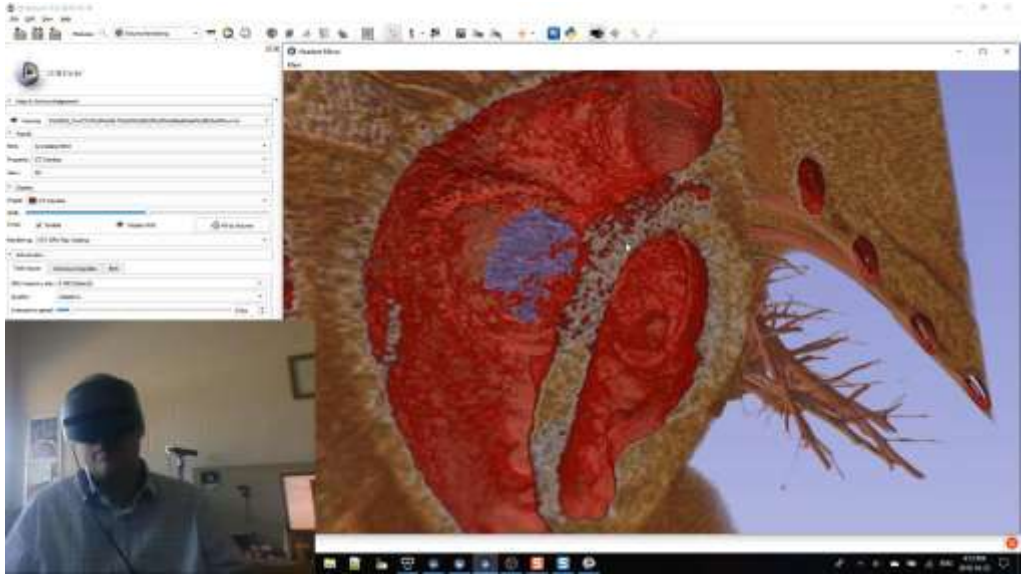
# Goals of SlicerVR

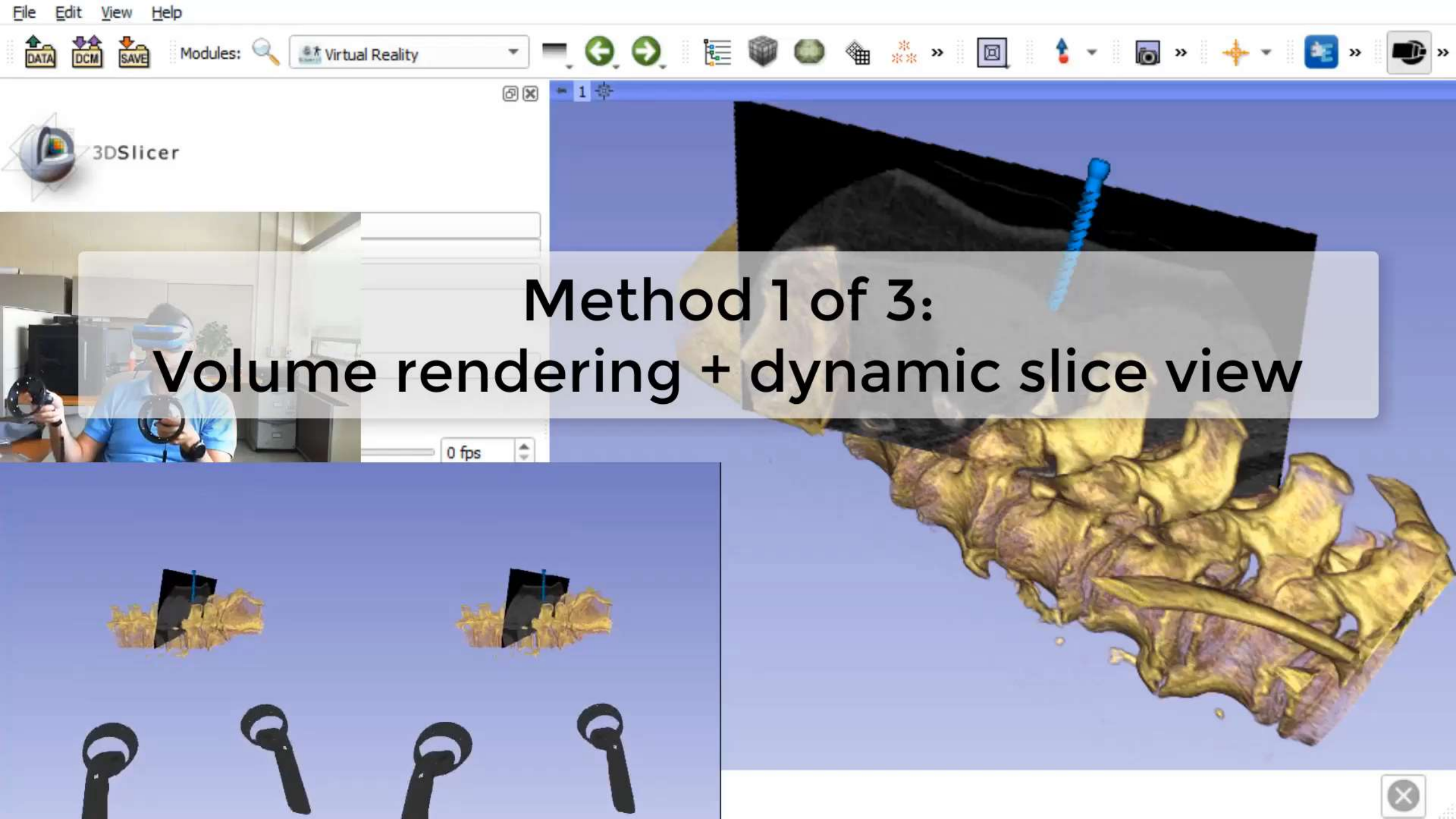
1. Quick prototyping of medical VR applications for research and product development
2. Use existing software modules
3. Simultaneous desktop + virtual reality experience
4. Open, customizable, extensible



# SlicerVR - Features

- Support all OpenVR compatible systems (HTC Vive, Oculus Rift, Windows MR headsets)
- Dynamic rendering quality: maximum quality without motion sickness
- Controller interactions
  - Fly
  - World manipulation: “pinch 3D” to pan, rotate, zoom
  - Object manipulation: grab and position objects, lock or link transforms




File Edit View Help
DATA DCM SAVE
Modules:
Virtual Reality
3DSlicer
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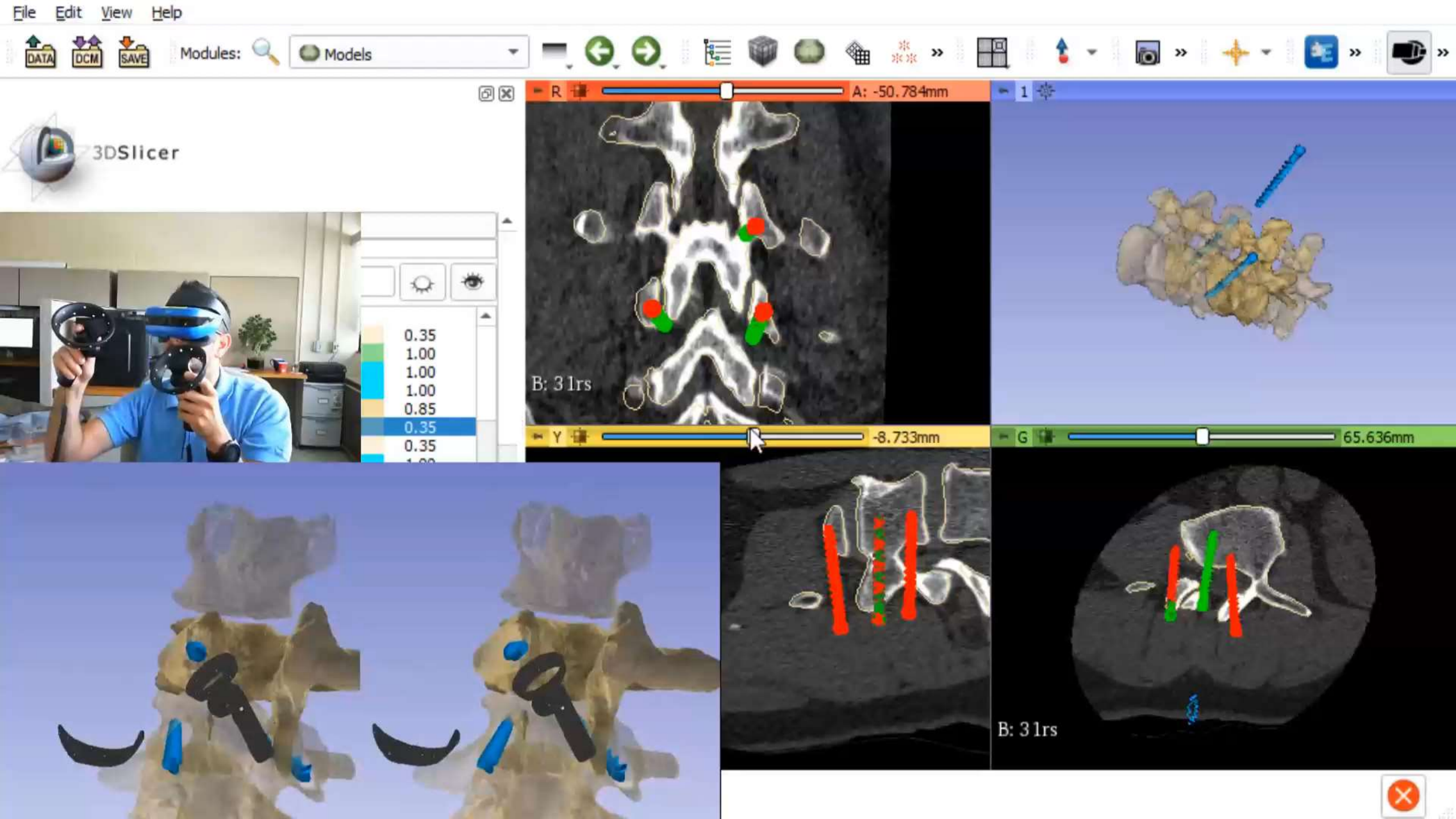
Method 1 of 3:
Volume rendering + dynamic slice view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Modules:
Models
3DSlicer
0.35
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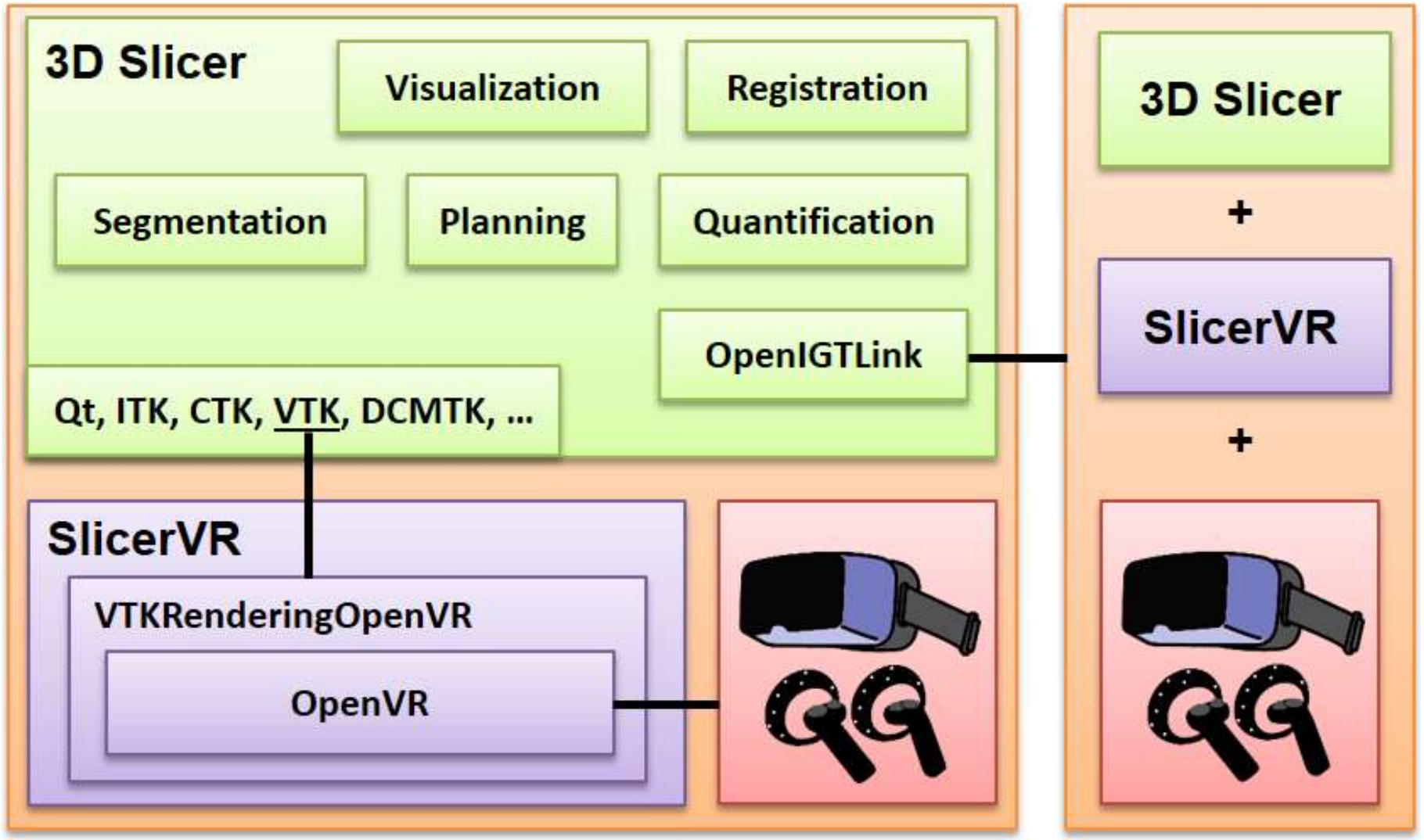
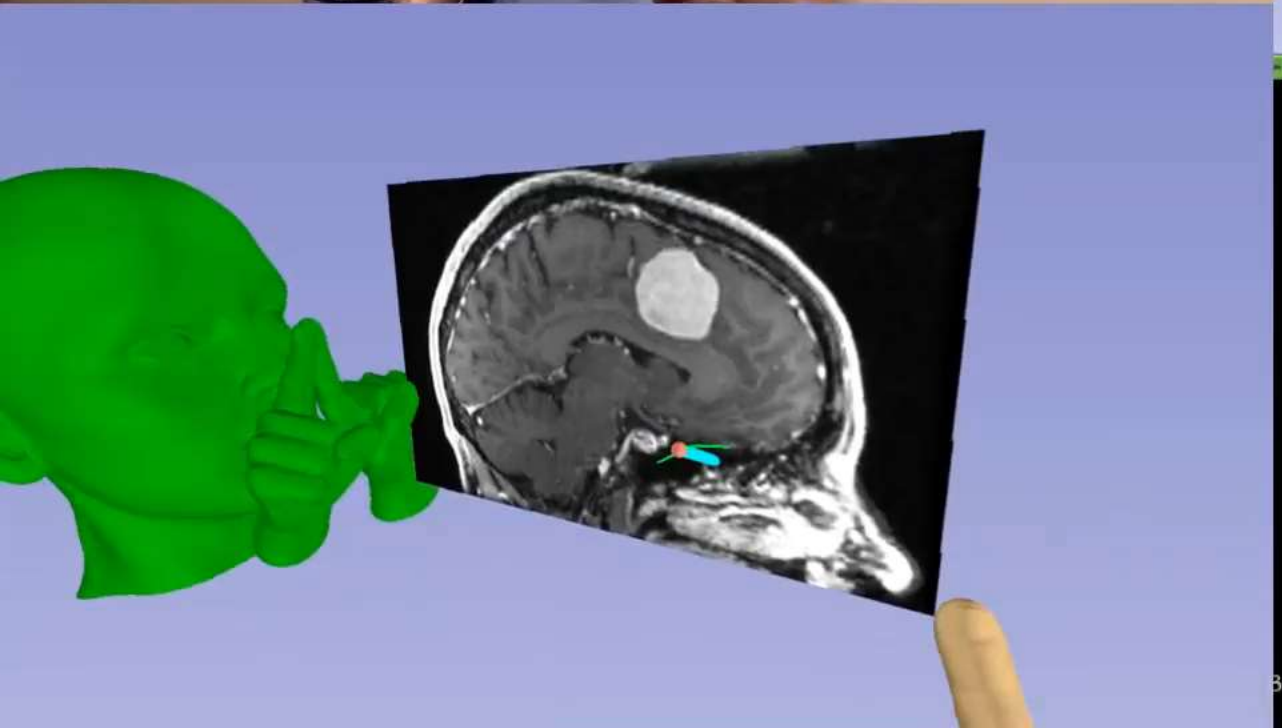
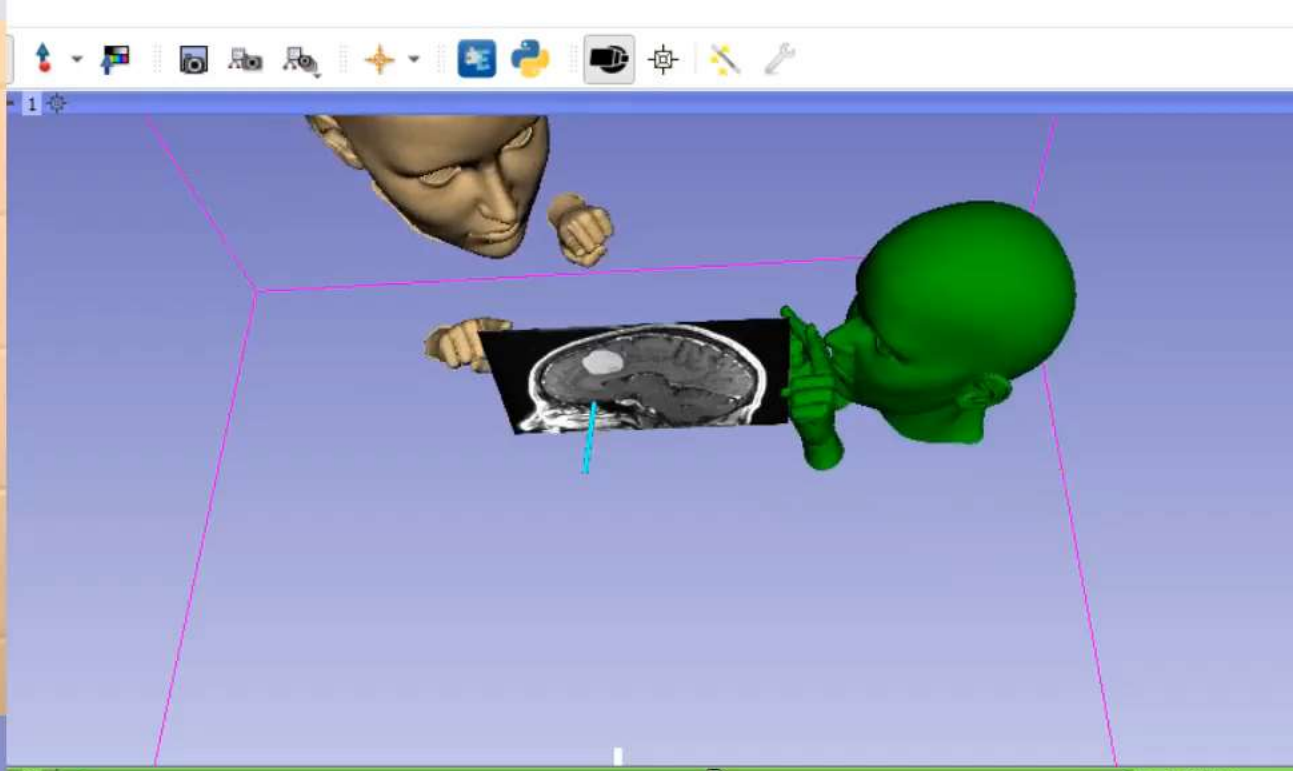
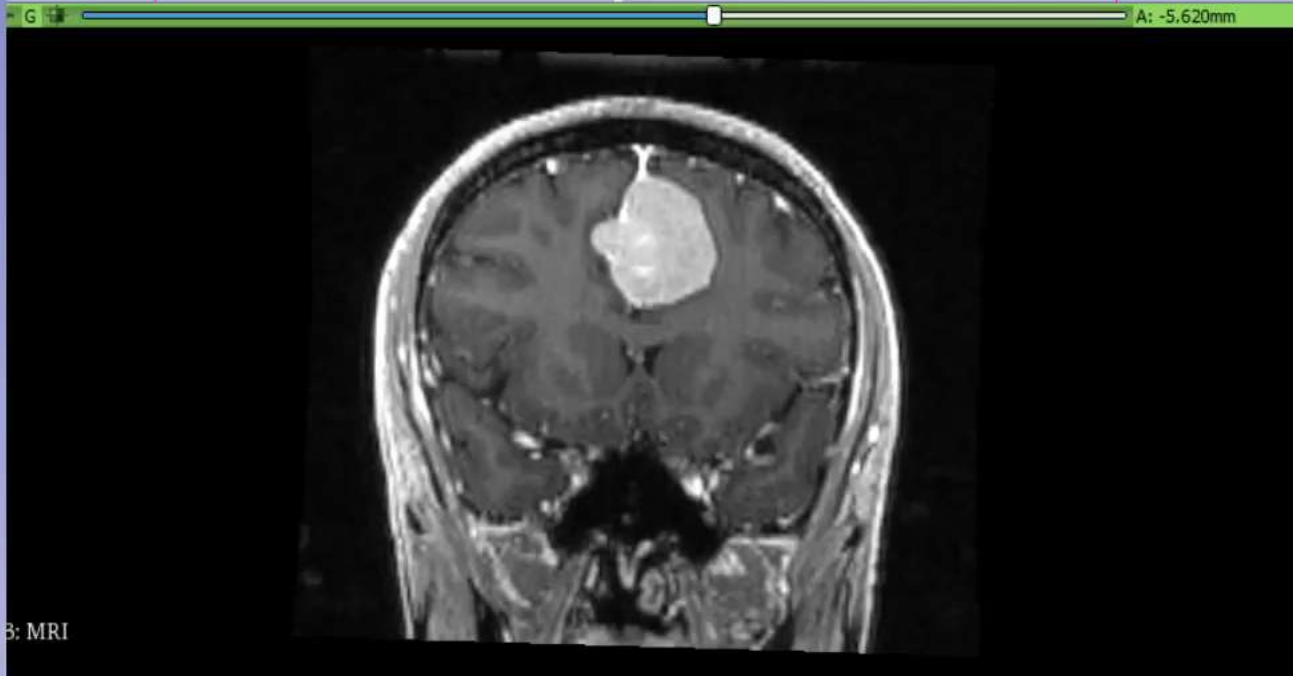
R
A: -50.784mm
B: 31rs
1
Y
-8.733mm
G
65.636mm
B: 31rs

# SlicerVR – Collaborative VR








A: -5.620mm
B: MRI

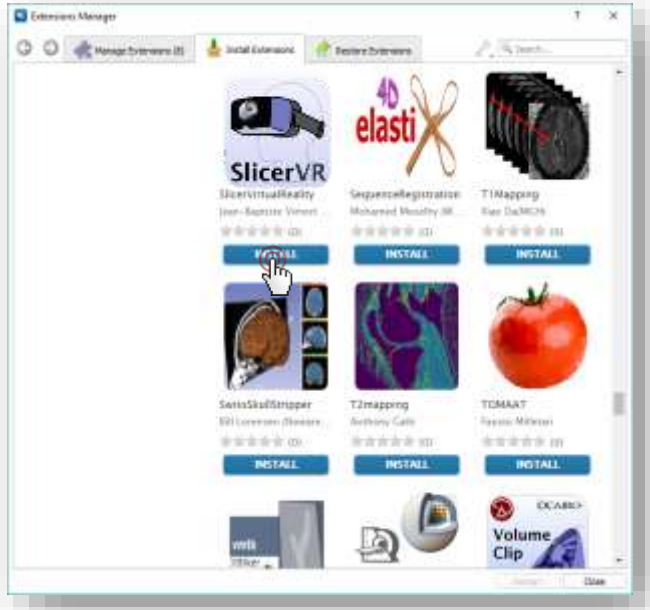
# How to try

Hardware requirements:

VR-ready PC + OpenVR-compatible headset

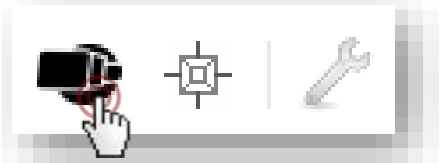
Setup:

1. Install 3D Slicer from www.slicer.org
2. Install SlicerVirtualReality extension from built-in app store (Extension Manager)




Usage:

1. Load any data (import DICOM, STL files, …)
2. Press the Start VR button



# Thank You!


http://smapse.com/queen-39-s-university-qu-university-of-queens/

**3D Slicer:** http://www.slicer.org

**SlicerVR:** http://www.slicervr.org

**Perk Lab:** http://perk.cs.queensu.ca