8th Advanced School on SCIENTIFIC VISUALIZATION

VTK use in Aneurist project showcase

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CINECA

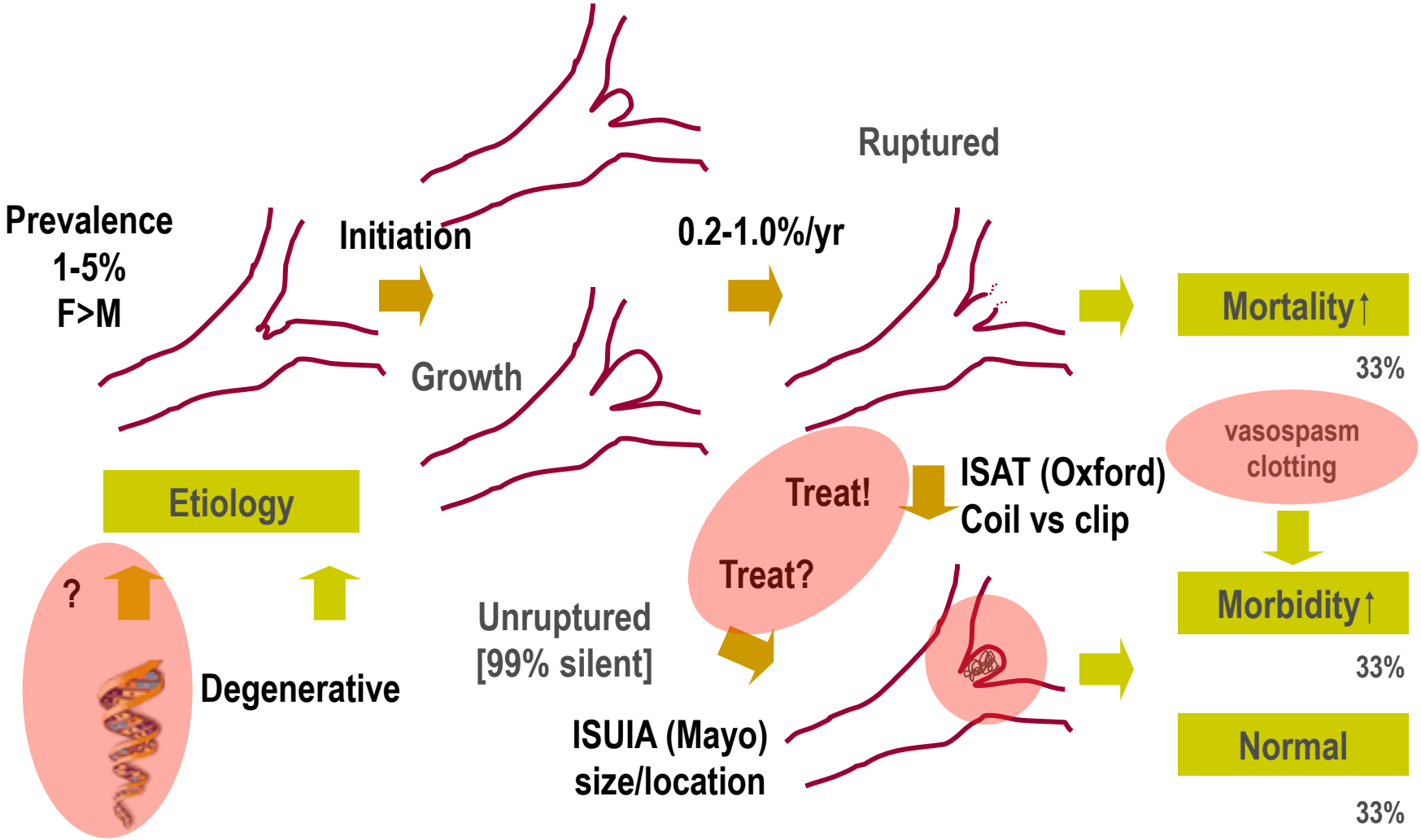
SCS SUPERCOMPUTINGSOLUTIONS a cineca company

Information Society Technologies

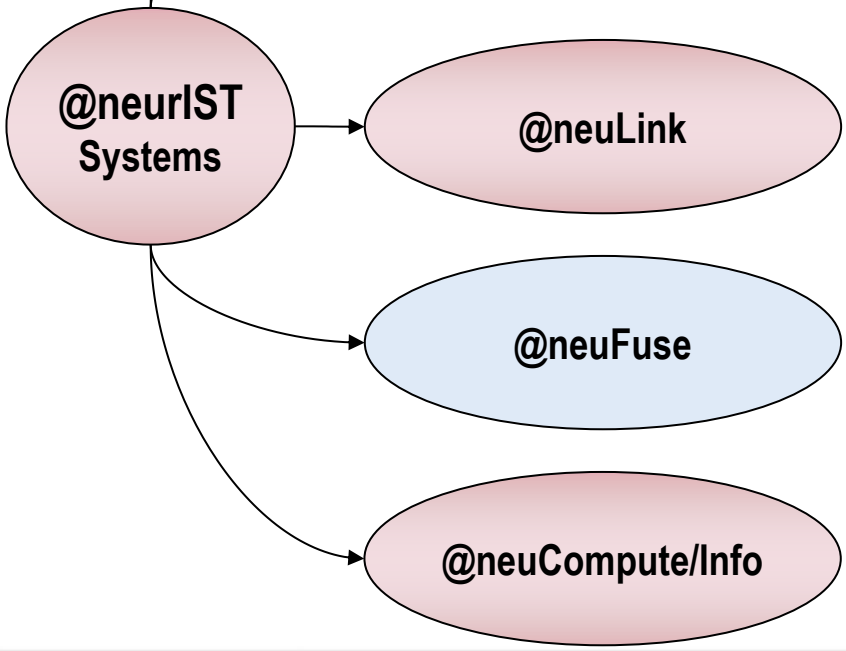
aneurIST

Integrated biomedical informatics for the management of cerebral aneurysms

Natural history of ICA



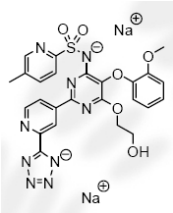
@neurIST



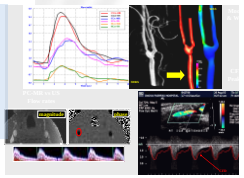
Improve **decision making processes** in the management of **unruptured aneurysms** by providing a score that integrates all the available information for **identifying at-risk patients** and reducing current over treatment

Support **computational design processes** towards a **next generation of smart flow-correcting implants** to treat **ruptured aneurysms** and reduce current treatment costs, side effects and recurrence.

Support the **knowledge discovery for linking genetics to disease,** vasospasm and blood clotting after cerebral hemorrhage



Support the **integration of modeling, simulation and visualization of multimodal data**



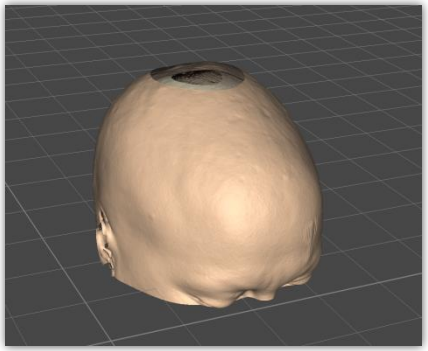
Support **integration of data and computing resources**.

IT Support Suites

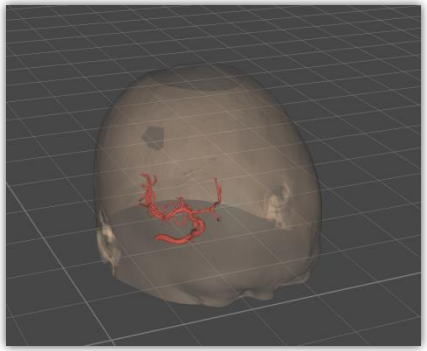
Enabling IT

medical image

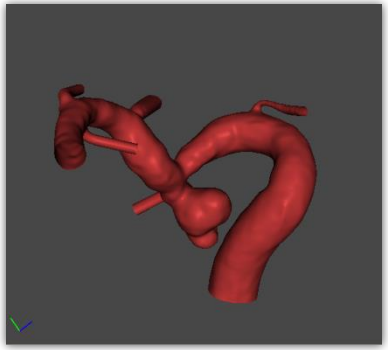
surface reconstruction 1



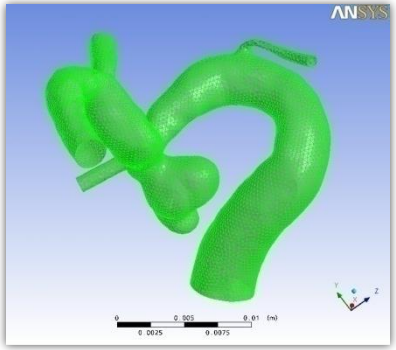
surface reconstruction 2



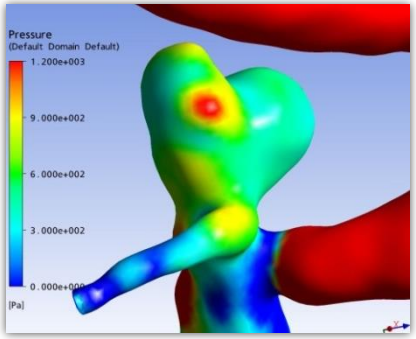
surface reconstruction 3



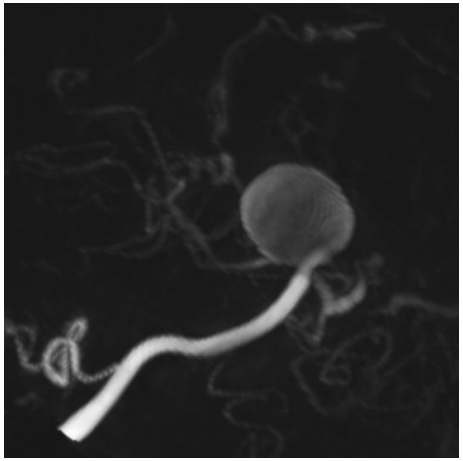
numerical model

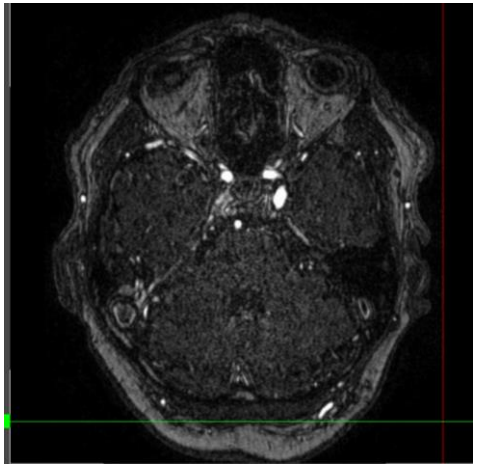


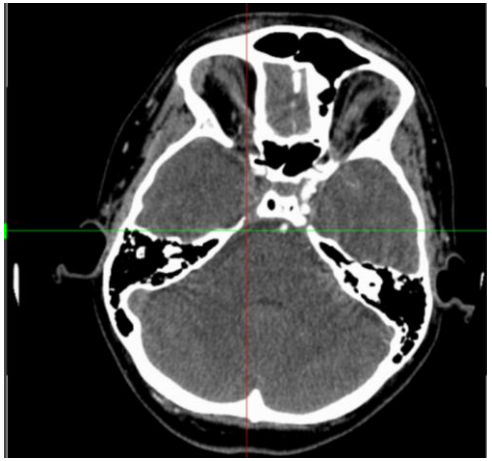
haemodynamic data



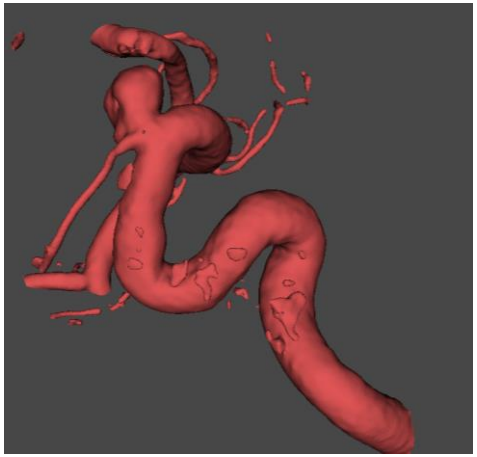
Segmentation







- Multimodal implementation
- No threshold
- Semi-automatic tool => reduced inter-operator variability
- Time consuming: 20’

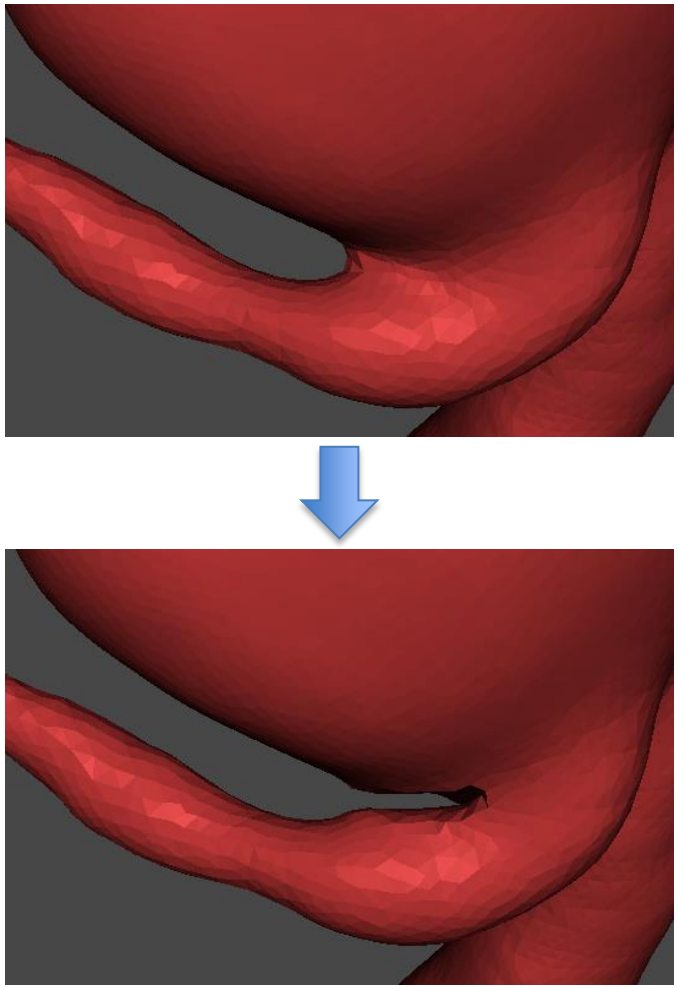


Hernandez M., Frangi A. F.: **Non-parametric geodesic active regions: method and evaluation for cerebral aneurysms segmentation in 3DRA and CTA.** *Med Image Anal.*11, 3 (2007), 224-241.

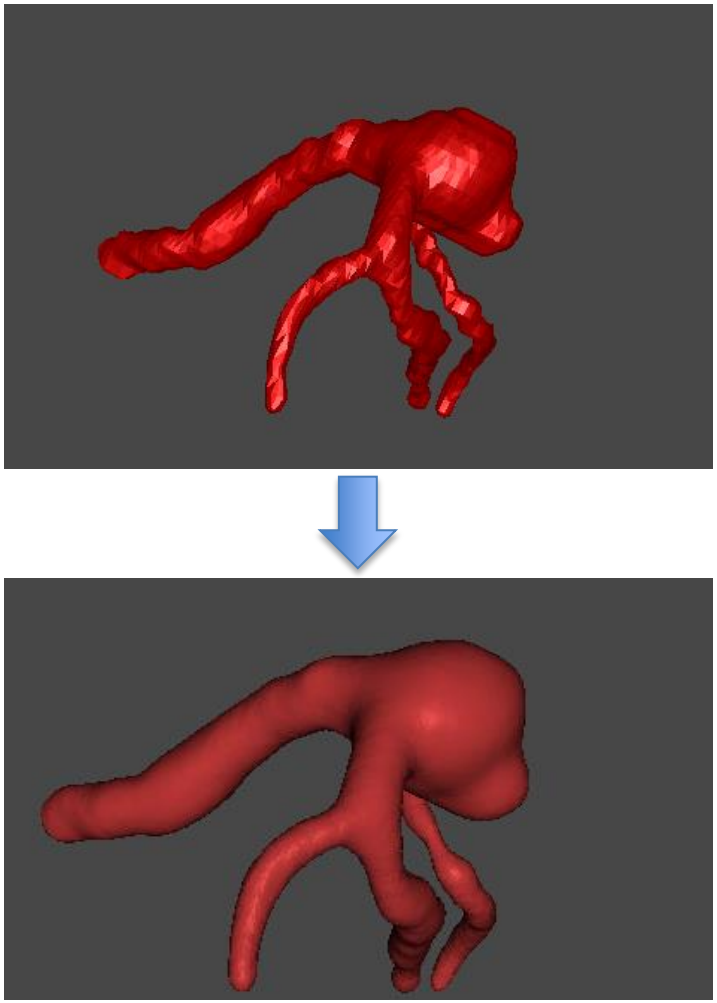
Mesh *Sculpting*

Modification of a mesh by manual removal/insertion of elements.

- Holes filling incl. smoothing
- Manual deletion of mesh's cells
- *Bridging* technique to eliminate *oversegmentation* problems
- Clip/Split of mesh along vessels' axes or by another user defined plane
- Vessel extrusion -with "circle-ification" of the opening
- Local smoothing



Mesh *Filtering*

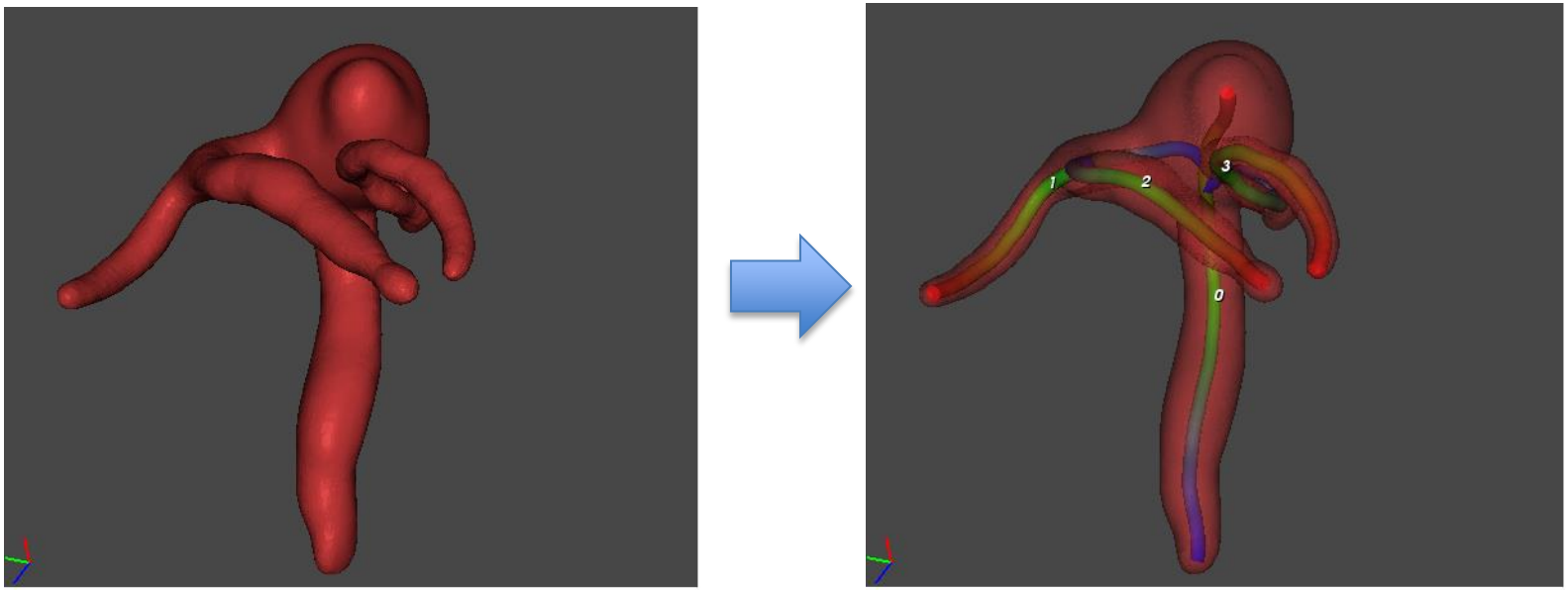


Modification of a mesh by involving the mesh as a whole.

- Connectivity
- Triangolation/Mesh cleaning
- *Decimation/Subdivision*
- Laplacian Smoothing
- Taubin Smoothing
- Optimized Laplacian – no shrinking effect
- Remeshing – Poisson reconstruction filter

Nealen A., Igarashi T., Sorkine O., Alexa M.: **Laplacian mesh optimization**. *Computer graphics and interactive techniques in Australasia and South East Asia,* 2006.

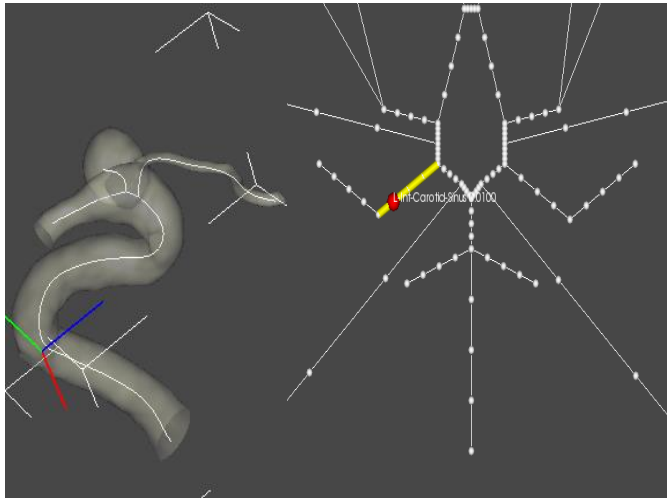
Mesh Centerline

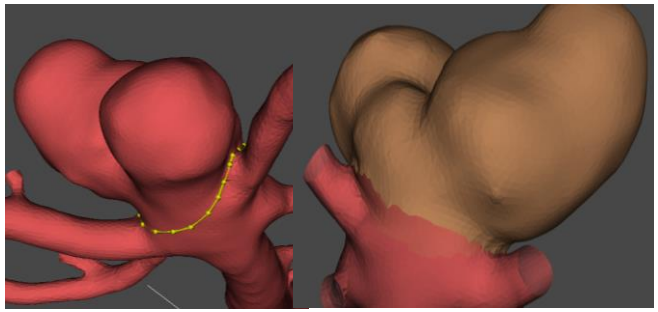


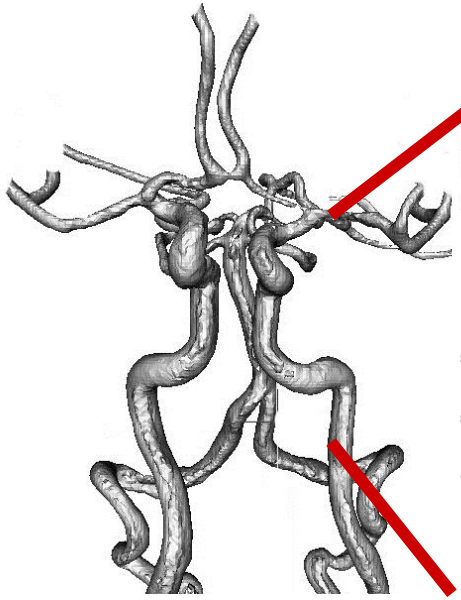
Antiga L, Ene-Iordache B, Remuzzi G, Remuzzi A: **Automatic generation of glomerular capillary topological organization**, *Microvascular Research 62, 346–354 (2001)*

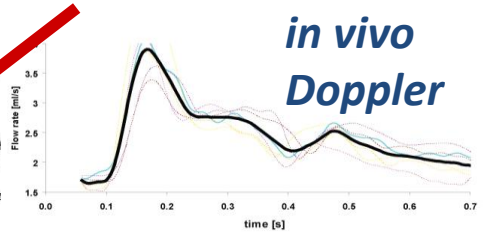
Mellado X., Larrabide I., Hernandez M., Frangi A. F.: **Flux driven medial curve extraction**, *The Insight Journal*, (2007), http://hdl.handle.net/1926/560.

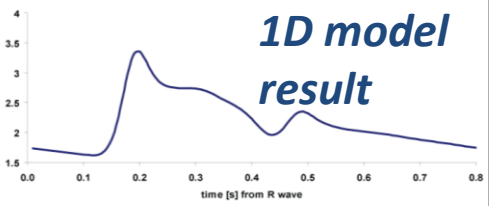
Surface Labelling

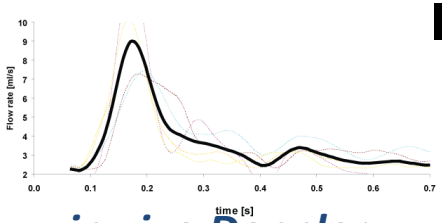


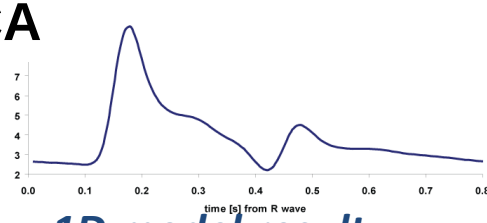












MCA

in vivo Doppler

1D model result

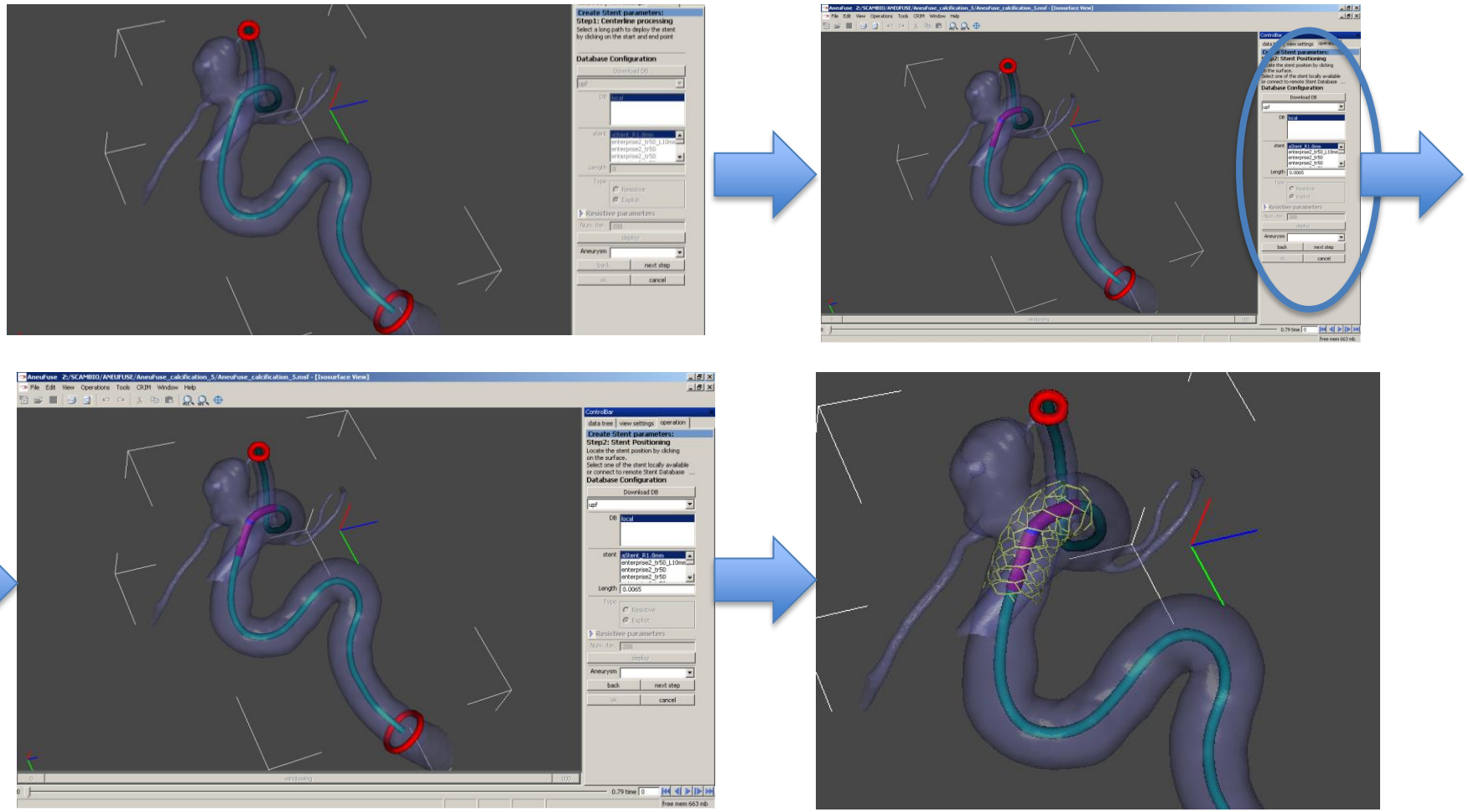
ICA

in vivo Doppler

1D model result

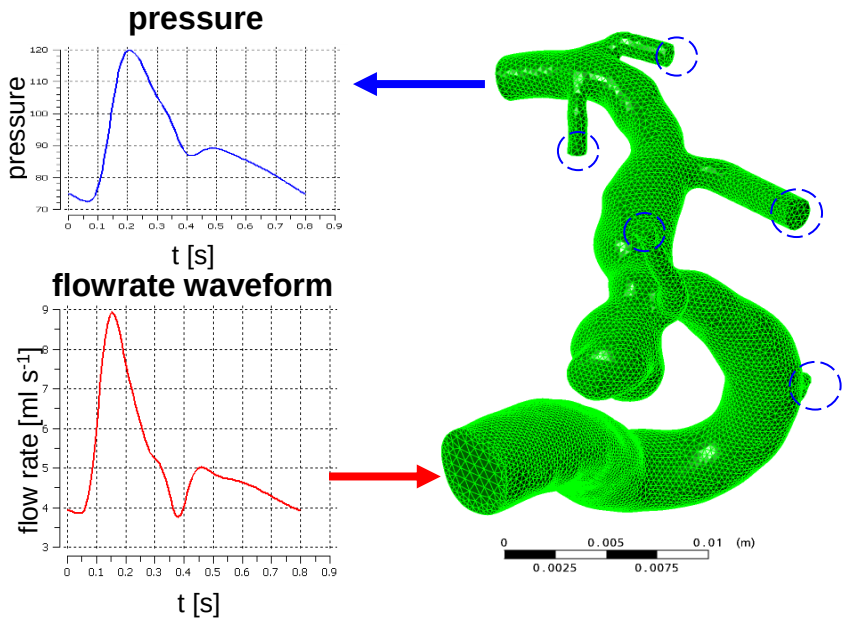
J. Kohout[1], A. Chiarini, G. J. Clapworthy, G. Klajnšek
Identification of the Aneurysm by Analysis of the Skeleton of Blood Vessels, submitted to Computer Methods and Programs in Biomedicine

Virtual Stenting



[1] I. Larrabide, A. Radaelli, and A. F. Frangi. Fast virtual stenting with deformable meshes: application to intracranial aneurysms. Medical Image Computing and Computer Assisted Intervention 2008 (MICCAI08) - Part II - LNCS 5242 – 790-797, 6th-10th September 2008, New York, NY, USA.

Solving flow equations

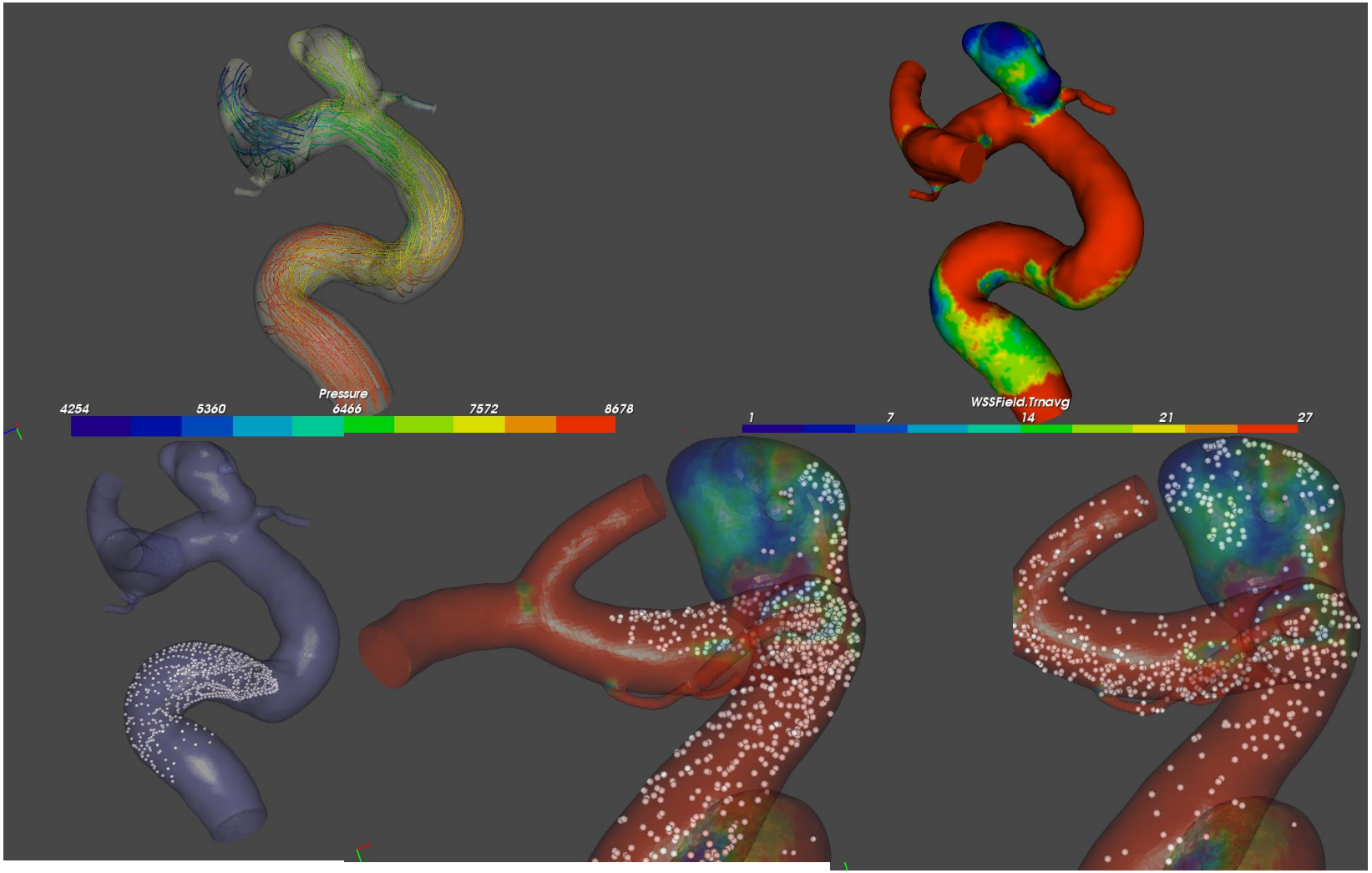


Ansys™ CFX™
or Abstract Problem Definition (APD) File
Computation times can range from minutes (steady flow) to hours (transient flow).

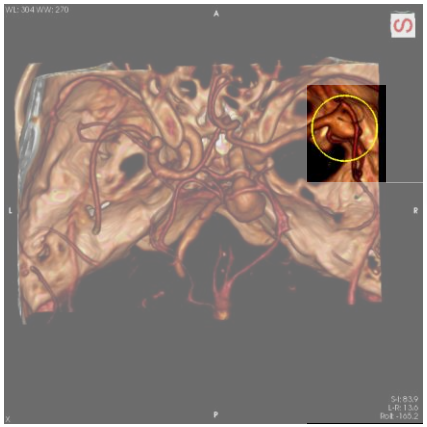
A solution! not "The solution"

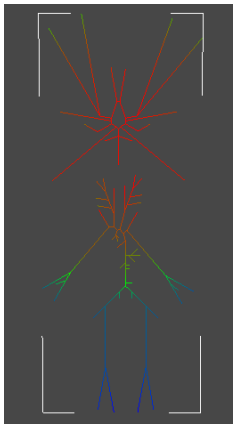
- **Converged**
- **Stable across mesh sizes**
- **May show very slight differences between runs**

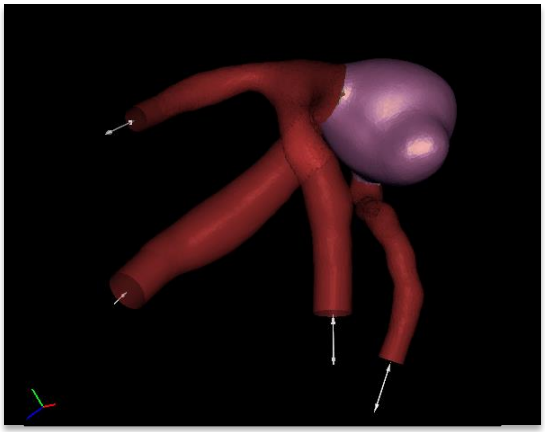
Results

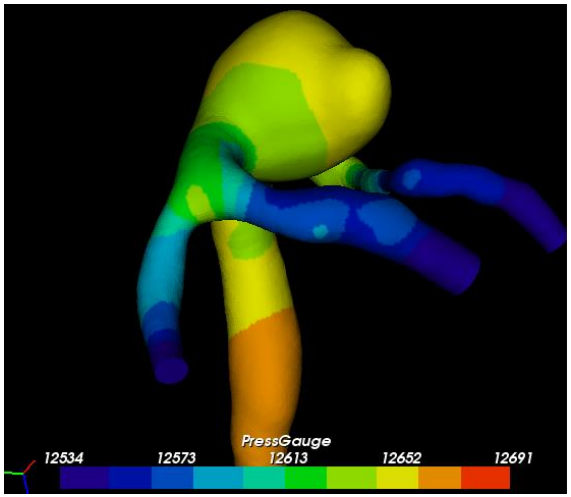

Pressure
4254
5360
6466
7572
8678
WSSField.Trnavg
1
7
14
21
27

Results

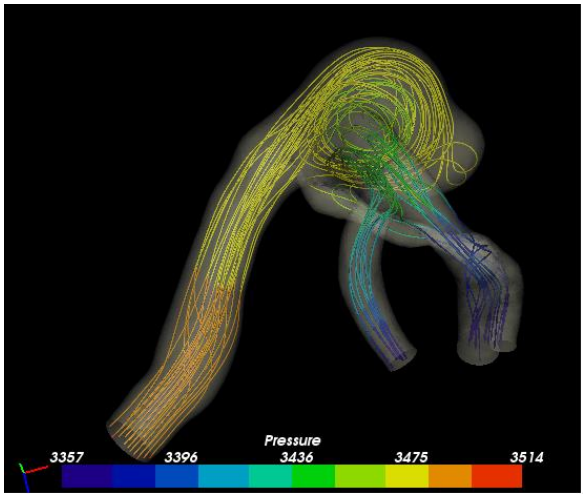




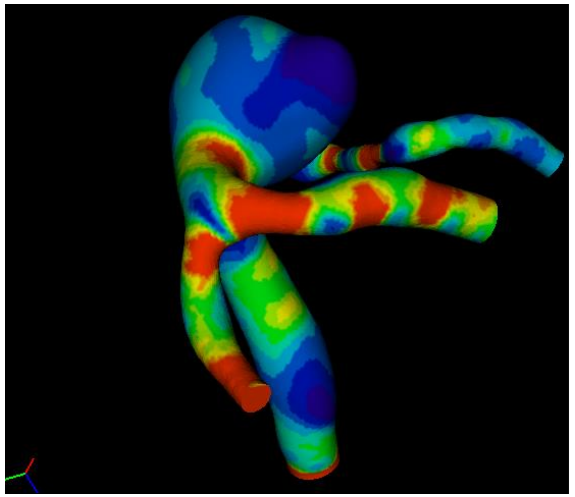




Pressure

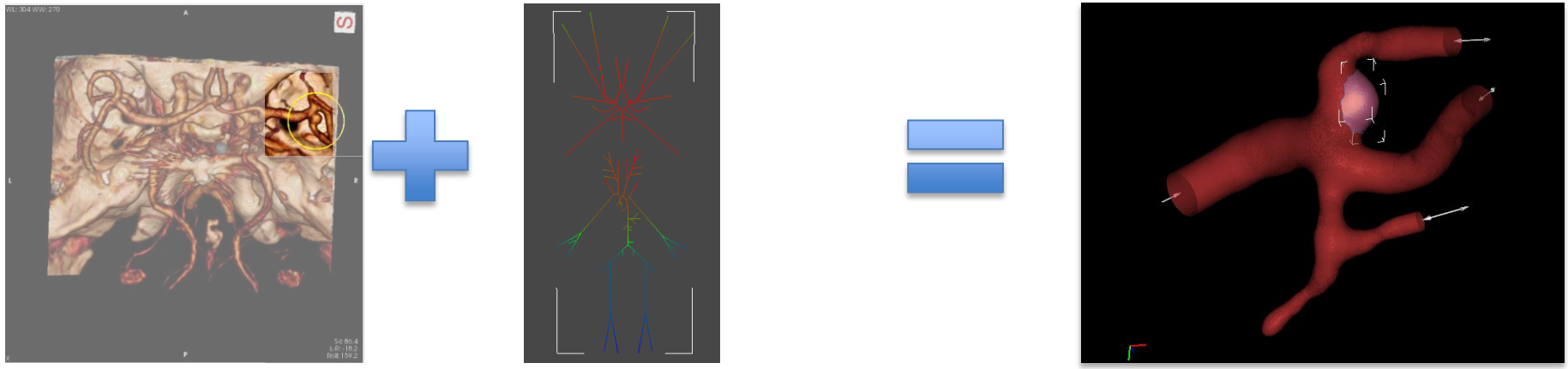


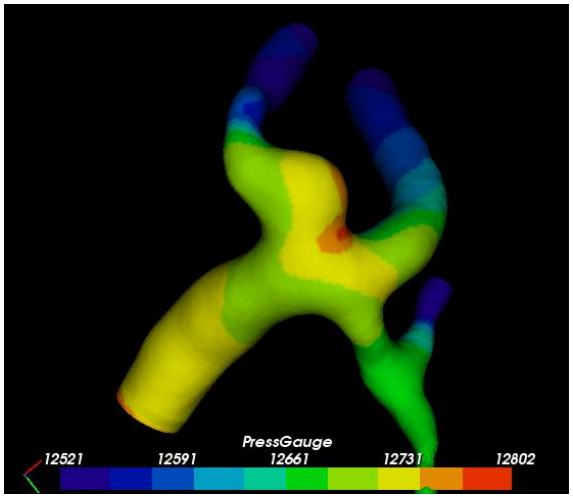
Streamlines



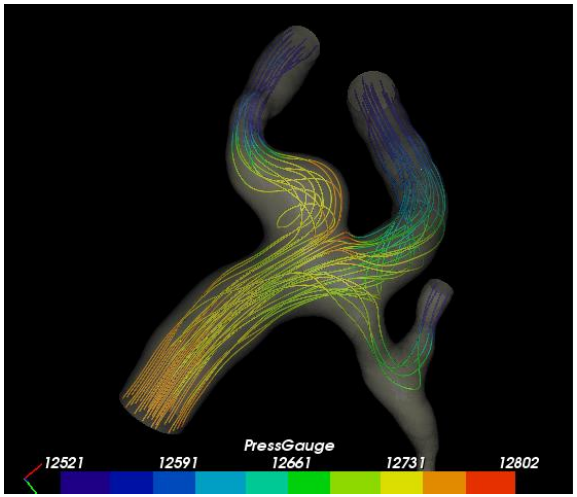
WSS

Results

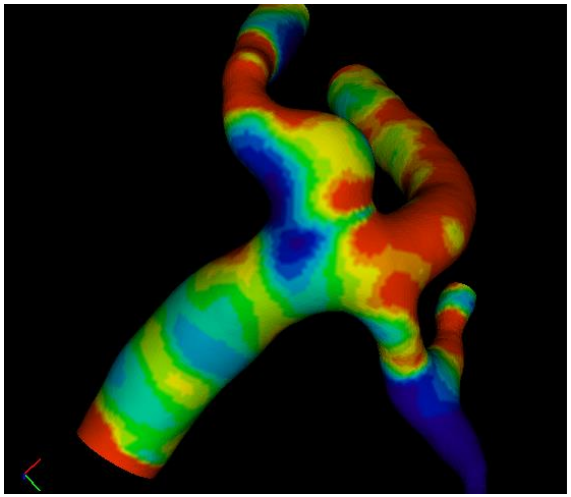




Pressure



Streamlines



WSS