COMSOL CONFERENCE ROTTERDAM2013

Hemodynamic Simulations of Implanted Multilayer Flow Modulator

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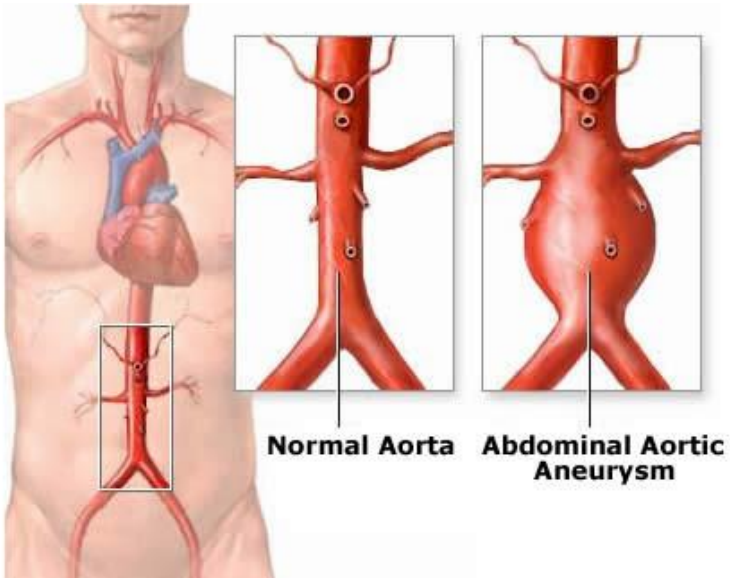
24-10-2013

COMSOL 2013, Rotterdam

Cardiatis
Virtual simulation unit
Isnes, Belgium

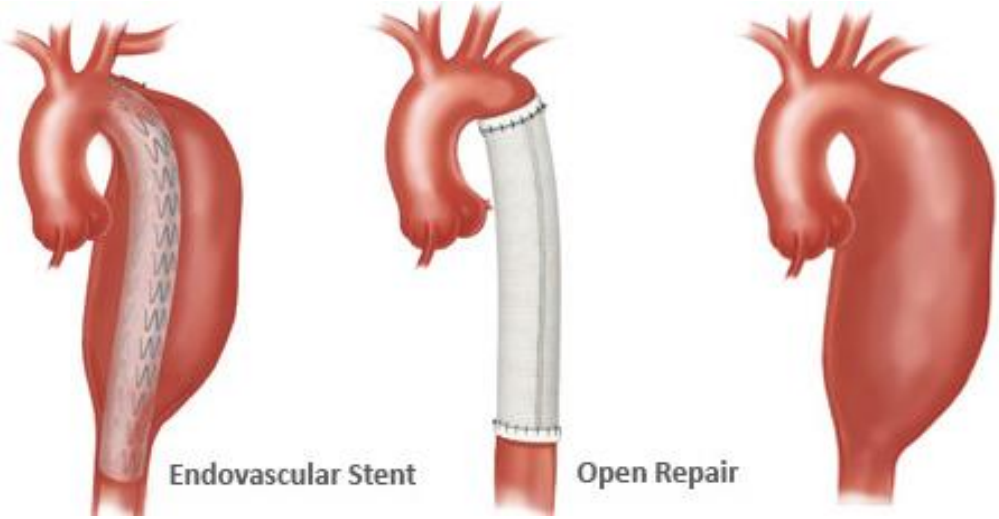
- AORTIC ANEURYSM
- VIRTUAL SIMULATION METHOD WITH REALISTIC AORTA
- MULTILAYER FLOW MODULATOR (MFM) DESIGN
- VIRTUAL SIMULATION WITH REALISTIC MFM



CT-scan 3D reconstruction

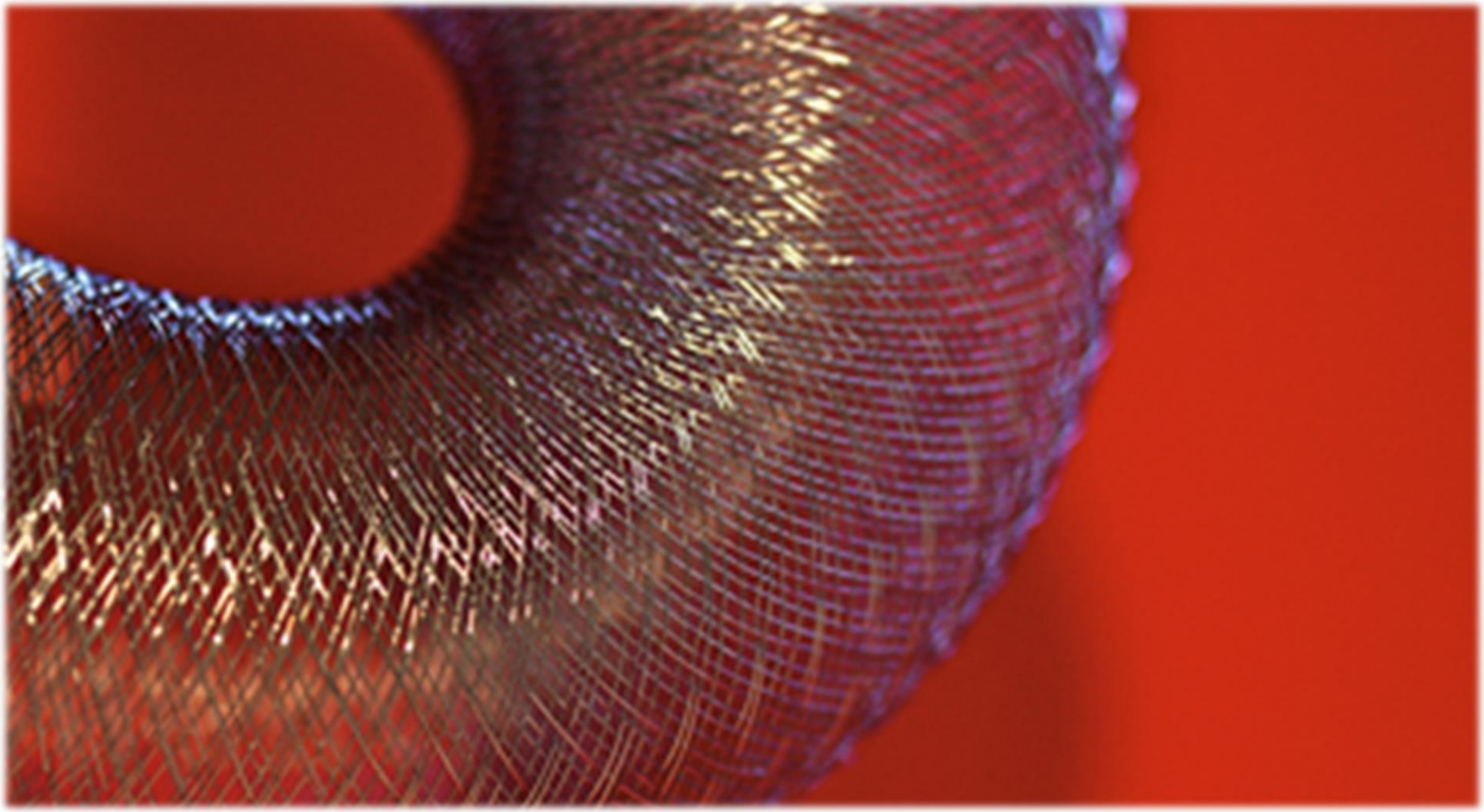
PRE

FOLLOW-UP
at 11M



Commonly performed treatment

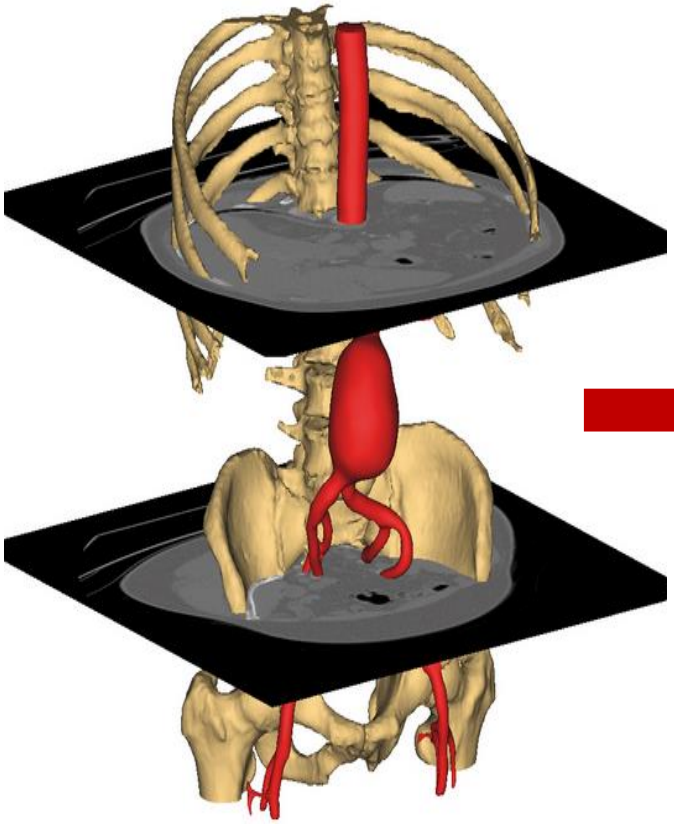
➢ NEXT GENERATION OF ANEURYSM REPAIR SYSTEM



CT-Scan

Mimics (3D)

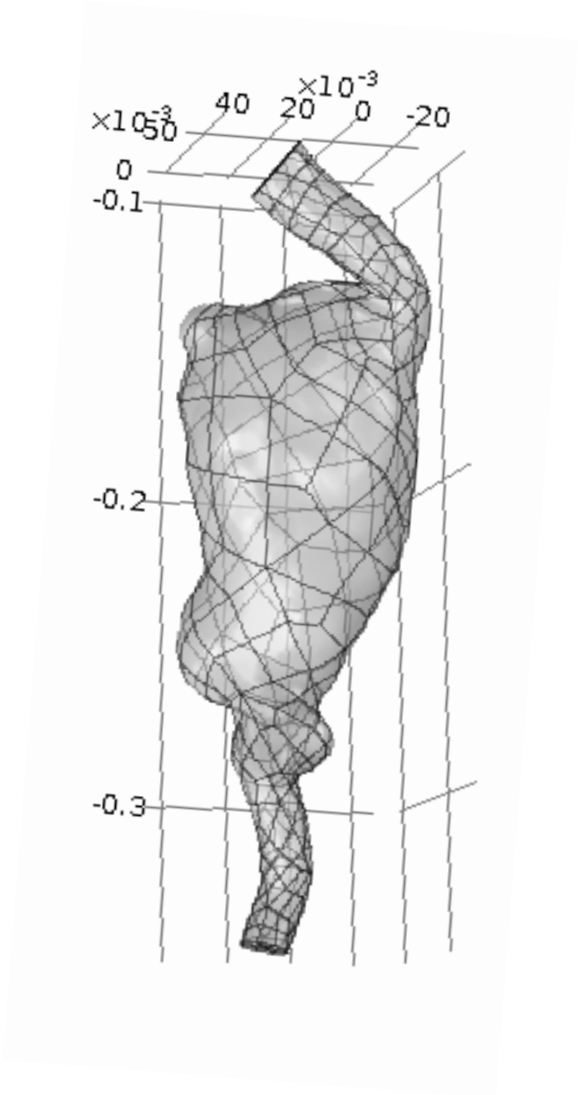
Comsol (FEA)



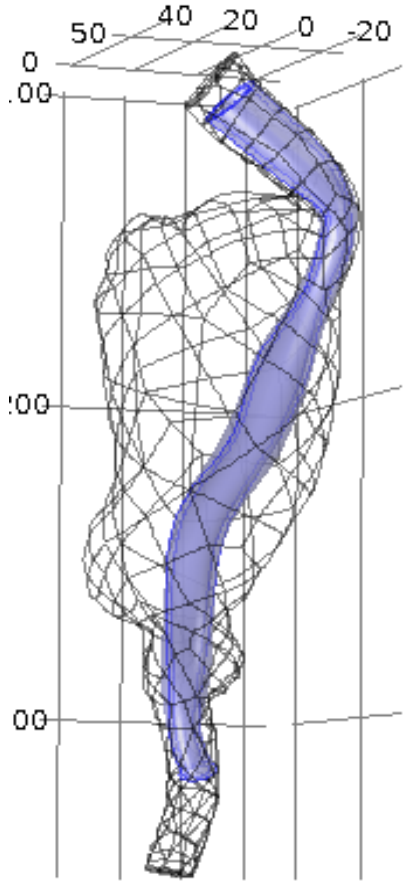
Clinical Data (Dicom)

Reconstruction 3D
Geometric Mesh

Fluid & Mechanics Analysis

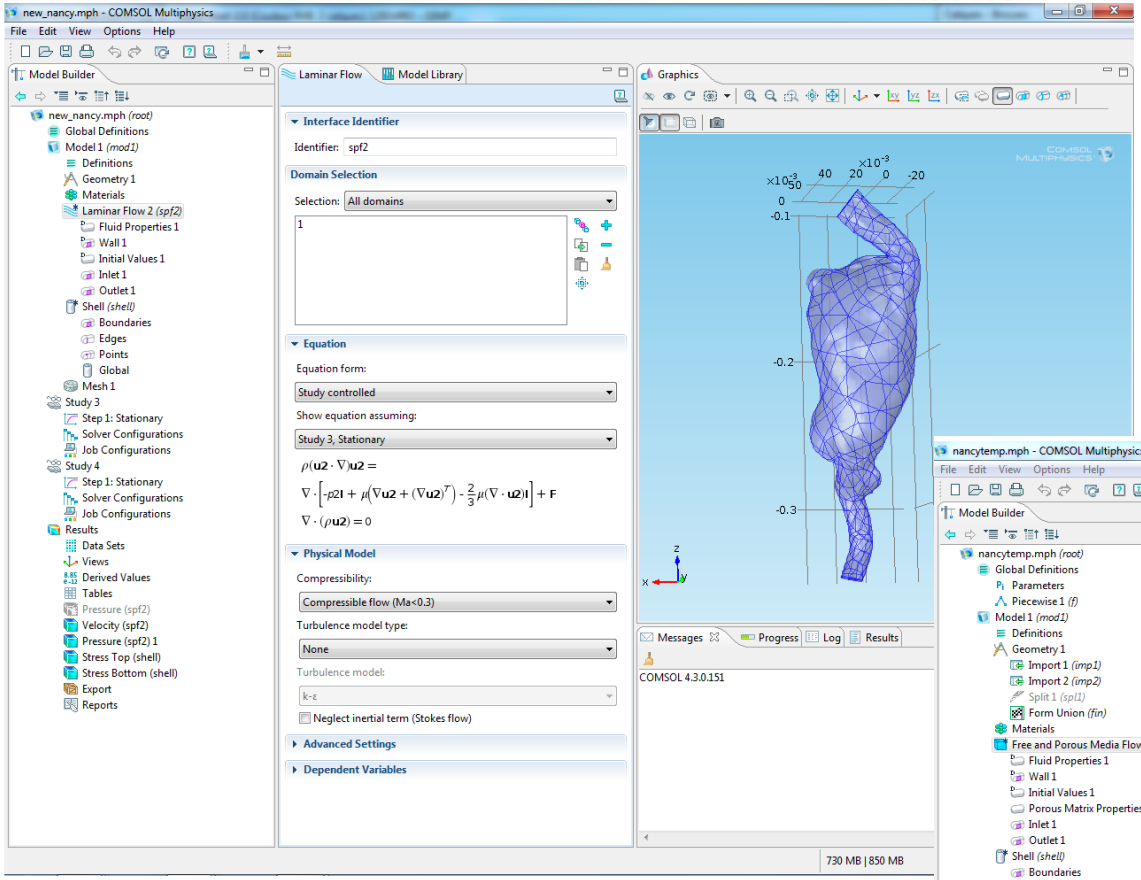


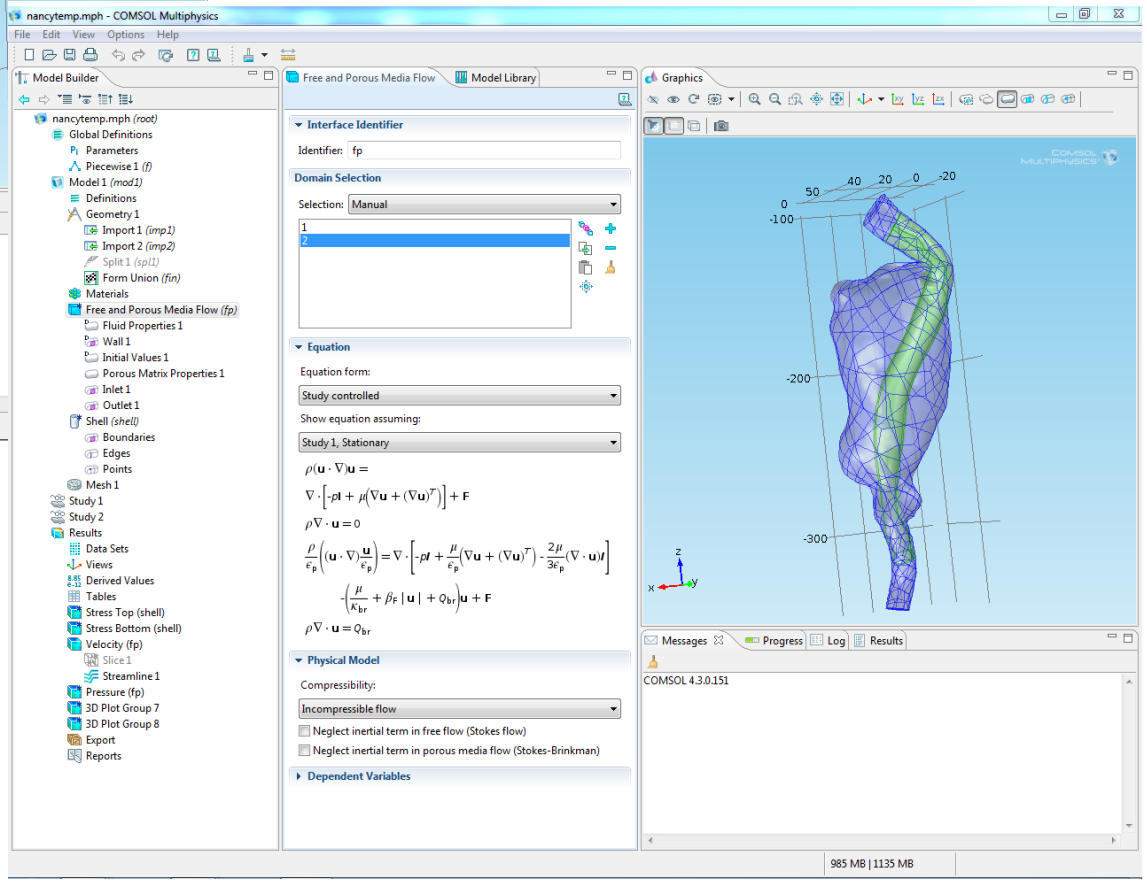
Without MFM



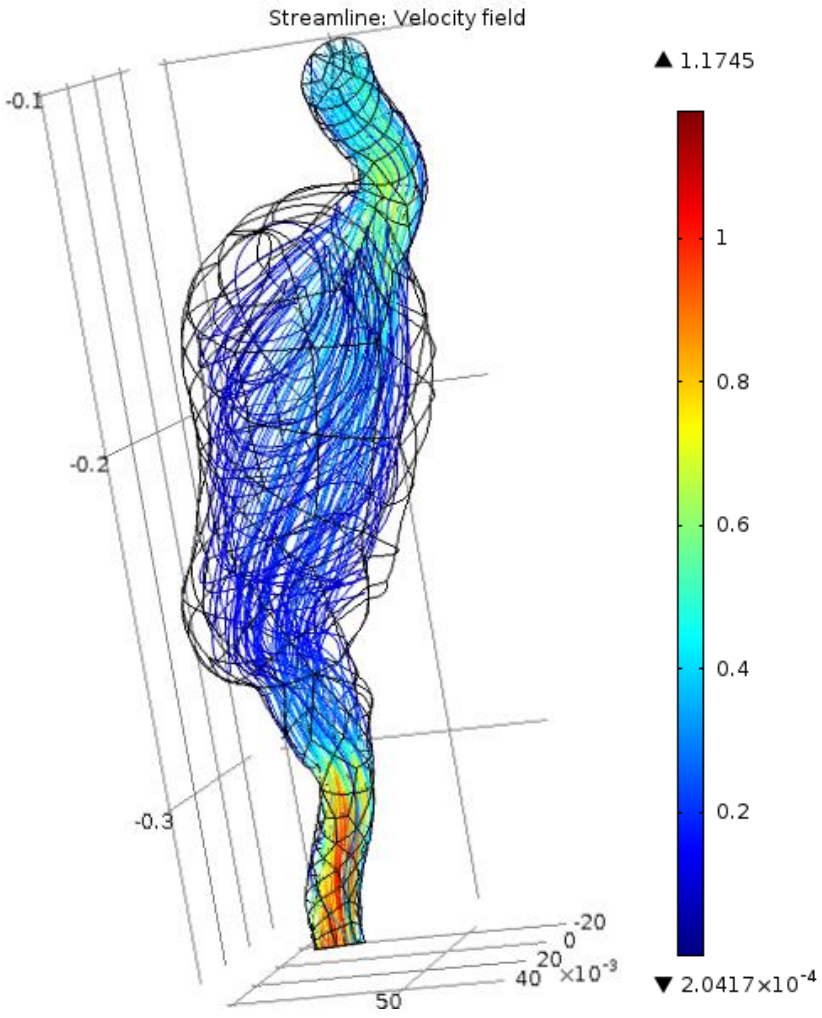
With MFM
(equivalent element)

Solved physics (1)

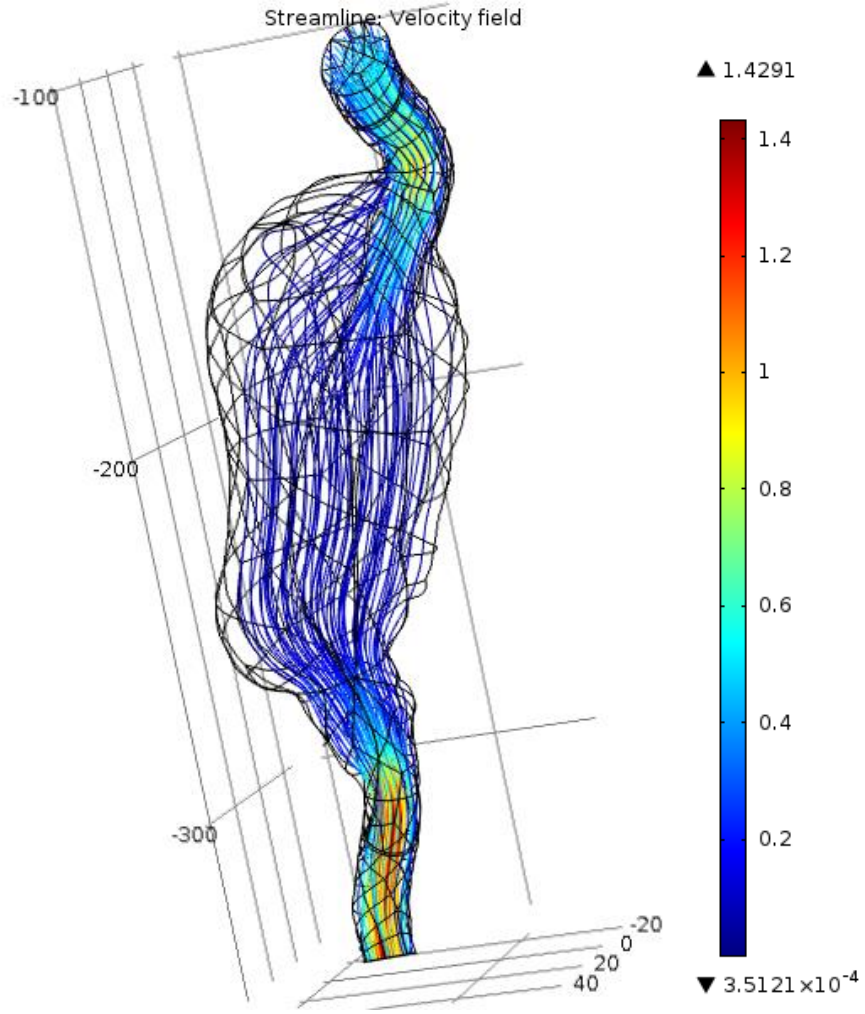




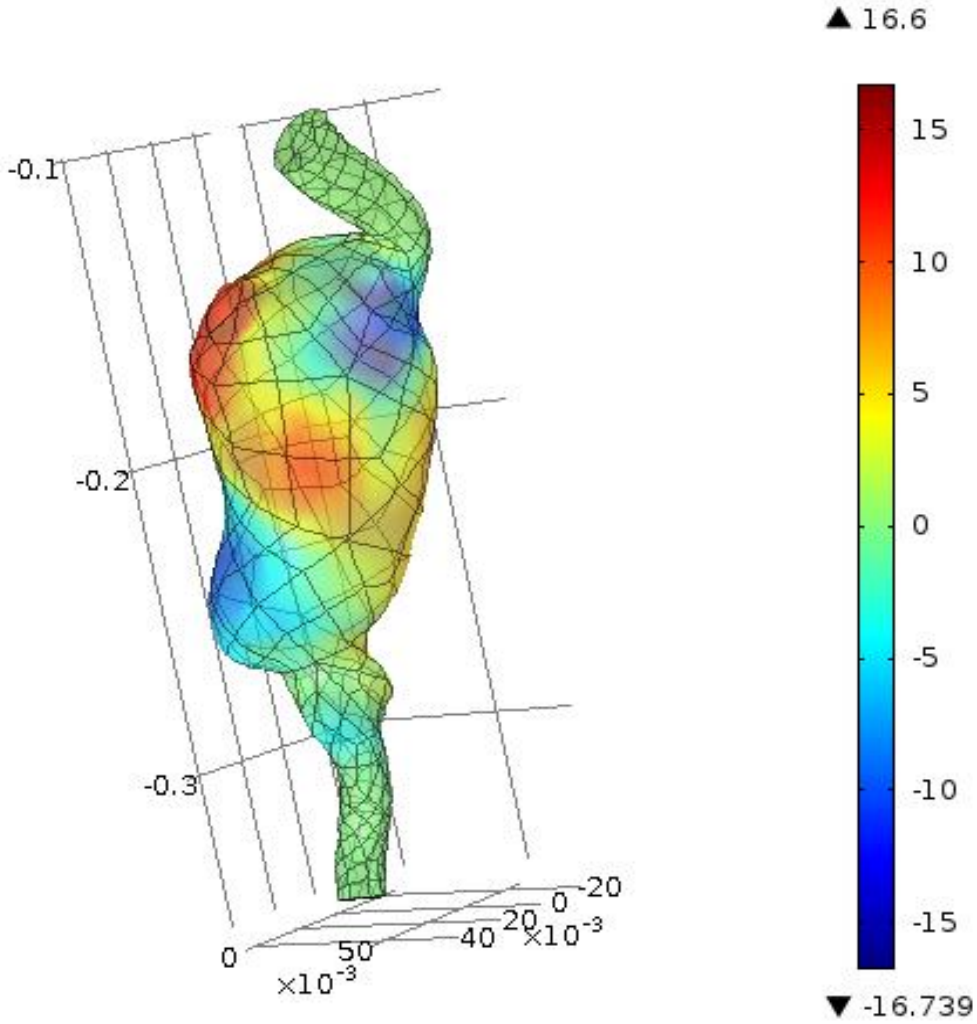
Velocity field streamline (1)



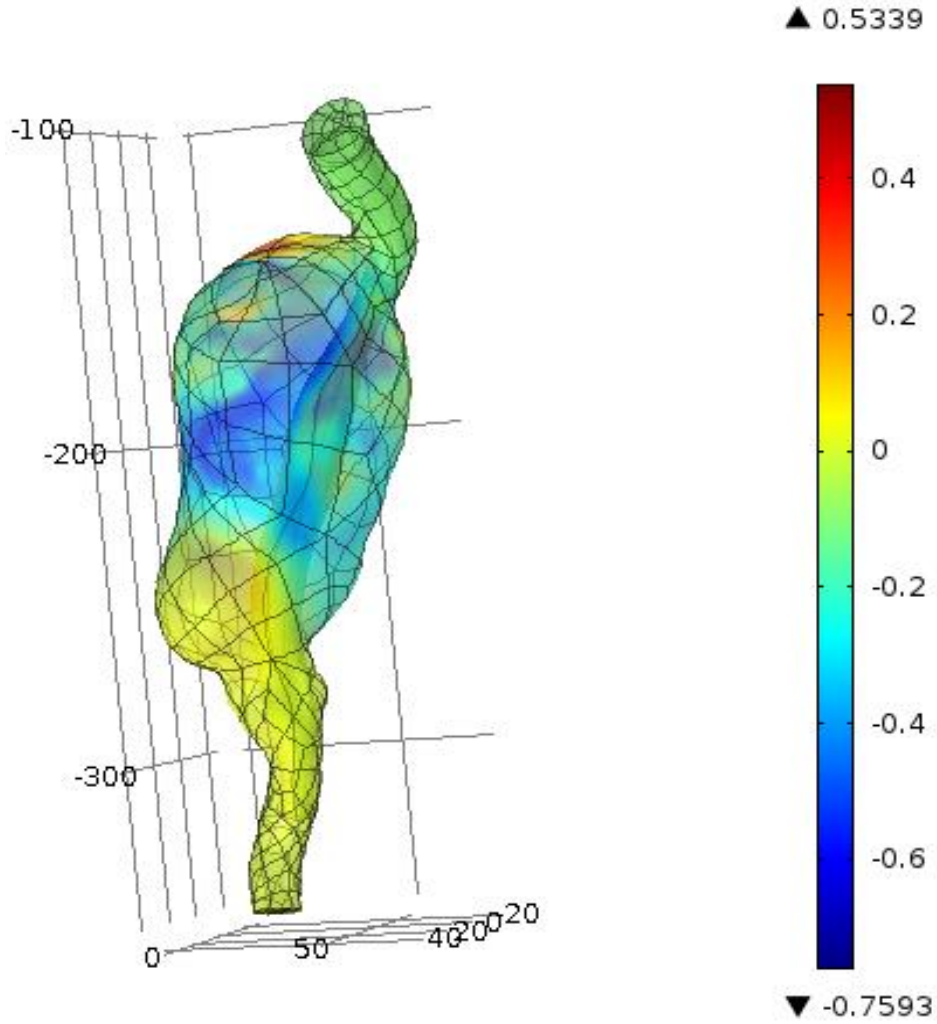
Without MFM



With MFM

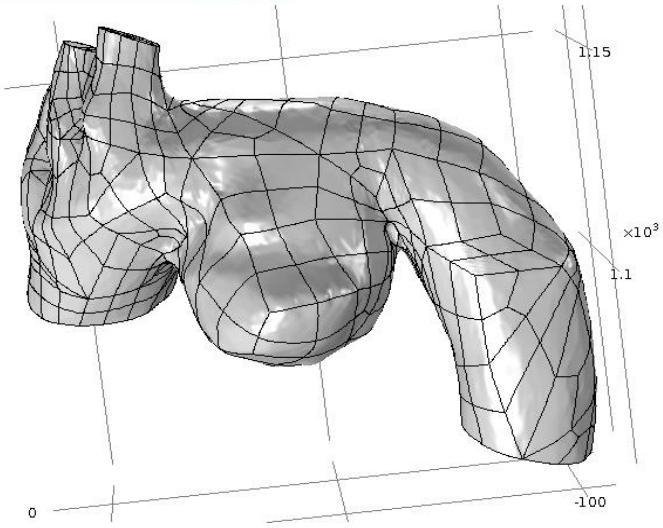


Without MFM

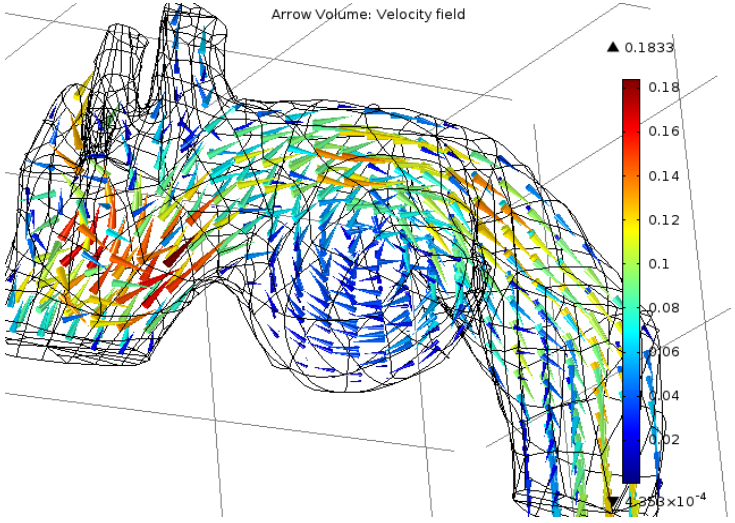


With MFM

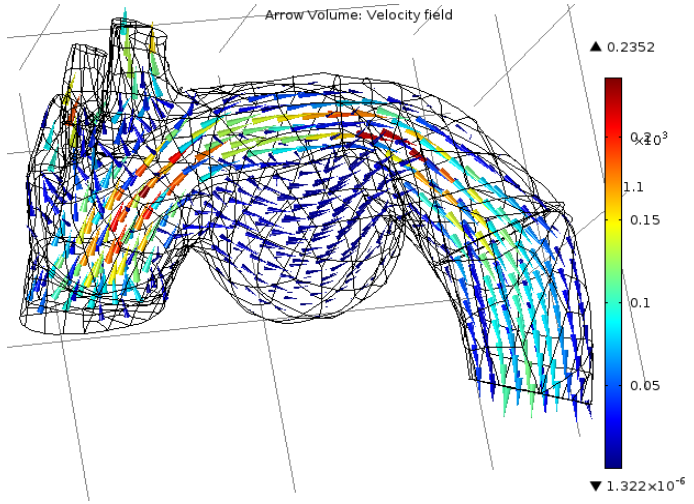
Velocity field (2)



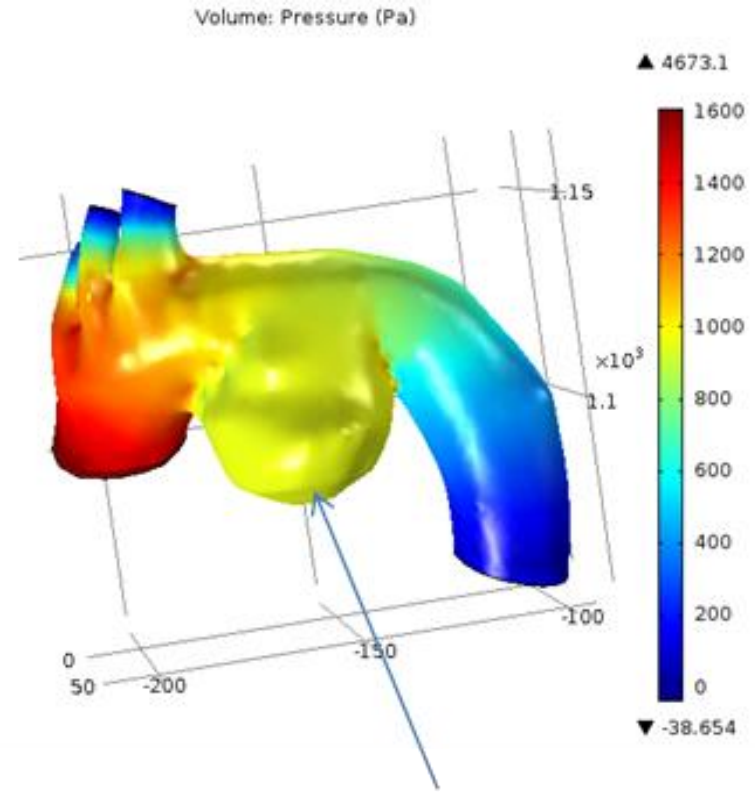
Virtual Model



Without MFM

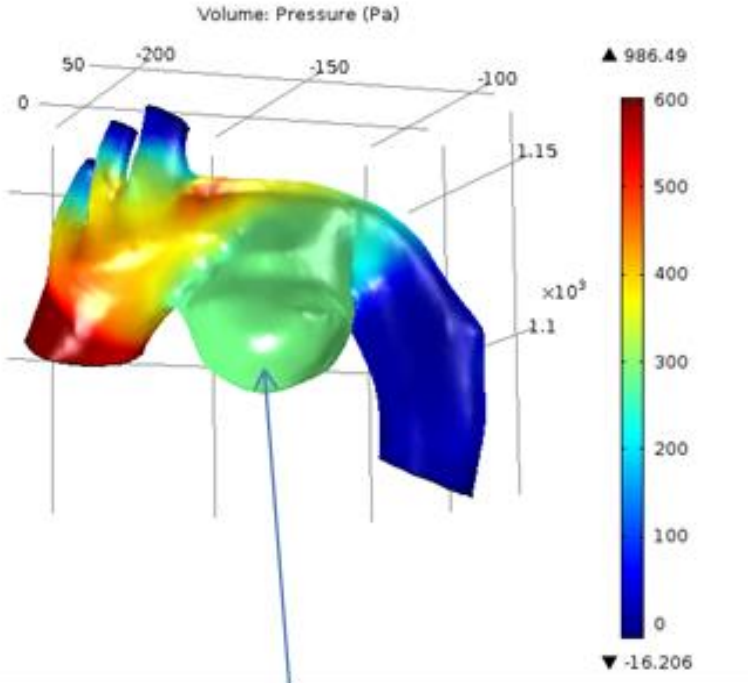


With MFM



950Pa

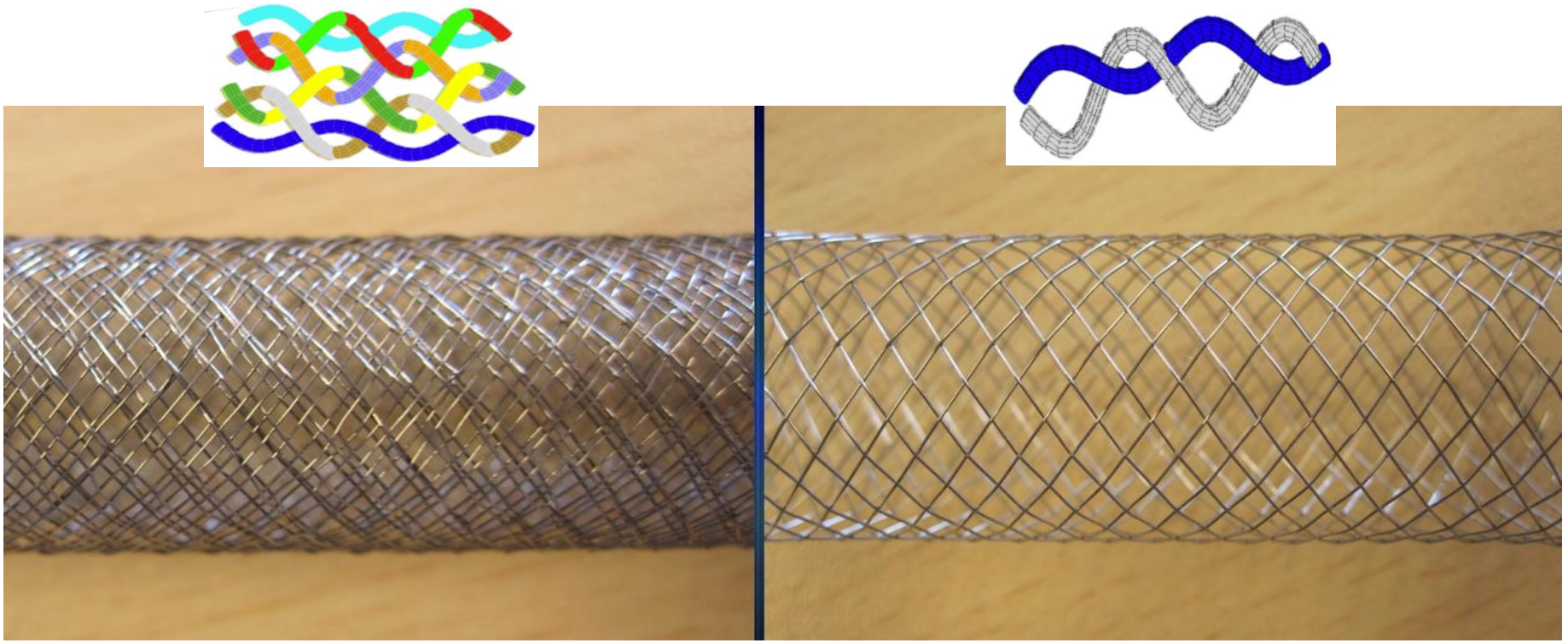
Without MFM



286Pa

With MFM

MULTILAYER FLOW MODULATOR (MFM™) VS MONOLAYER FLOW DIVERSION

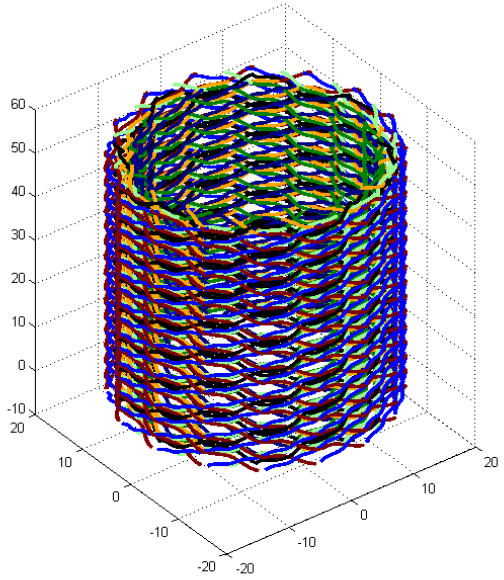


MULTILAYER – 3D

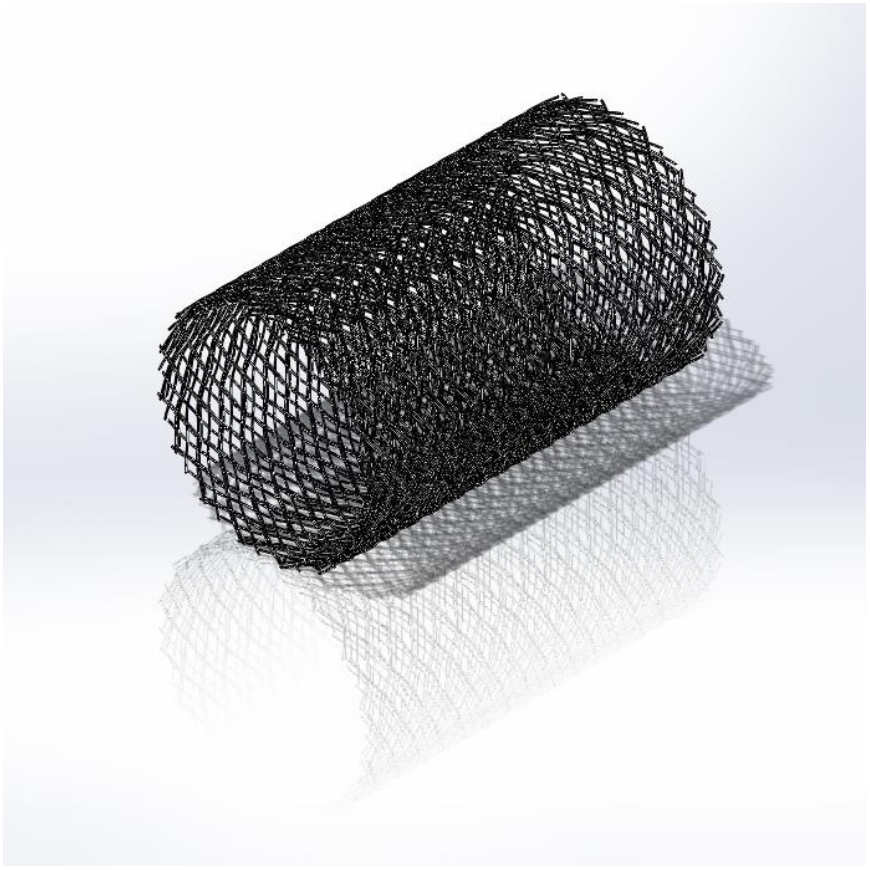
MONOLAYER– 2D

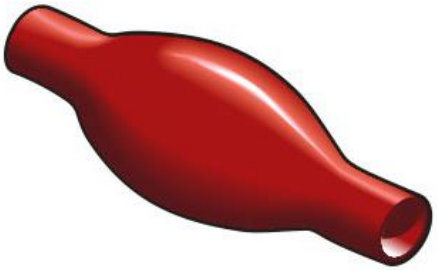
1. MULTILAYER – 3D

2. ANALYTICAL RECONSTRUCTION

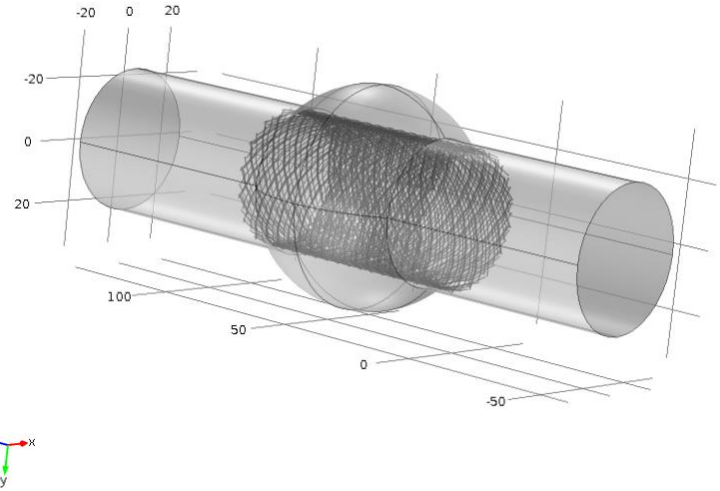


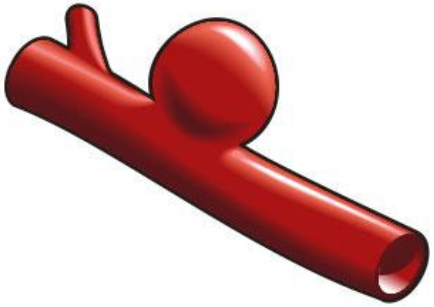
3. VIRTUAL RECONSTRUCTION



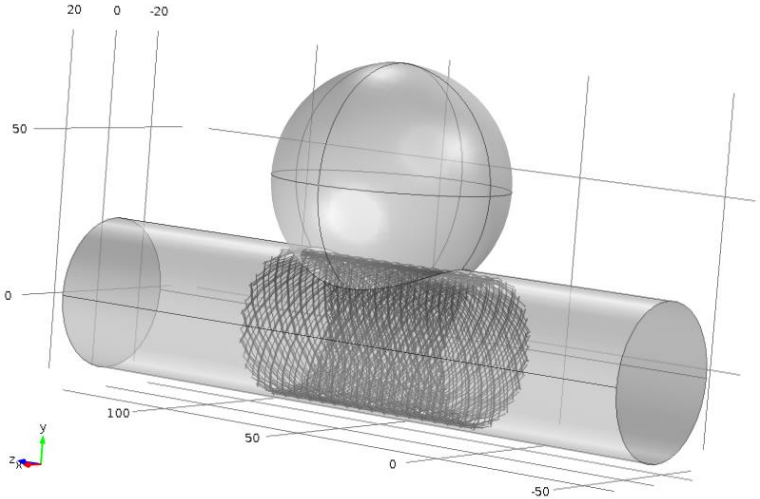


Fusiform aneurysm

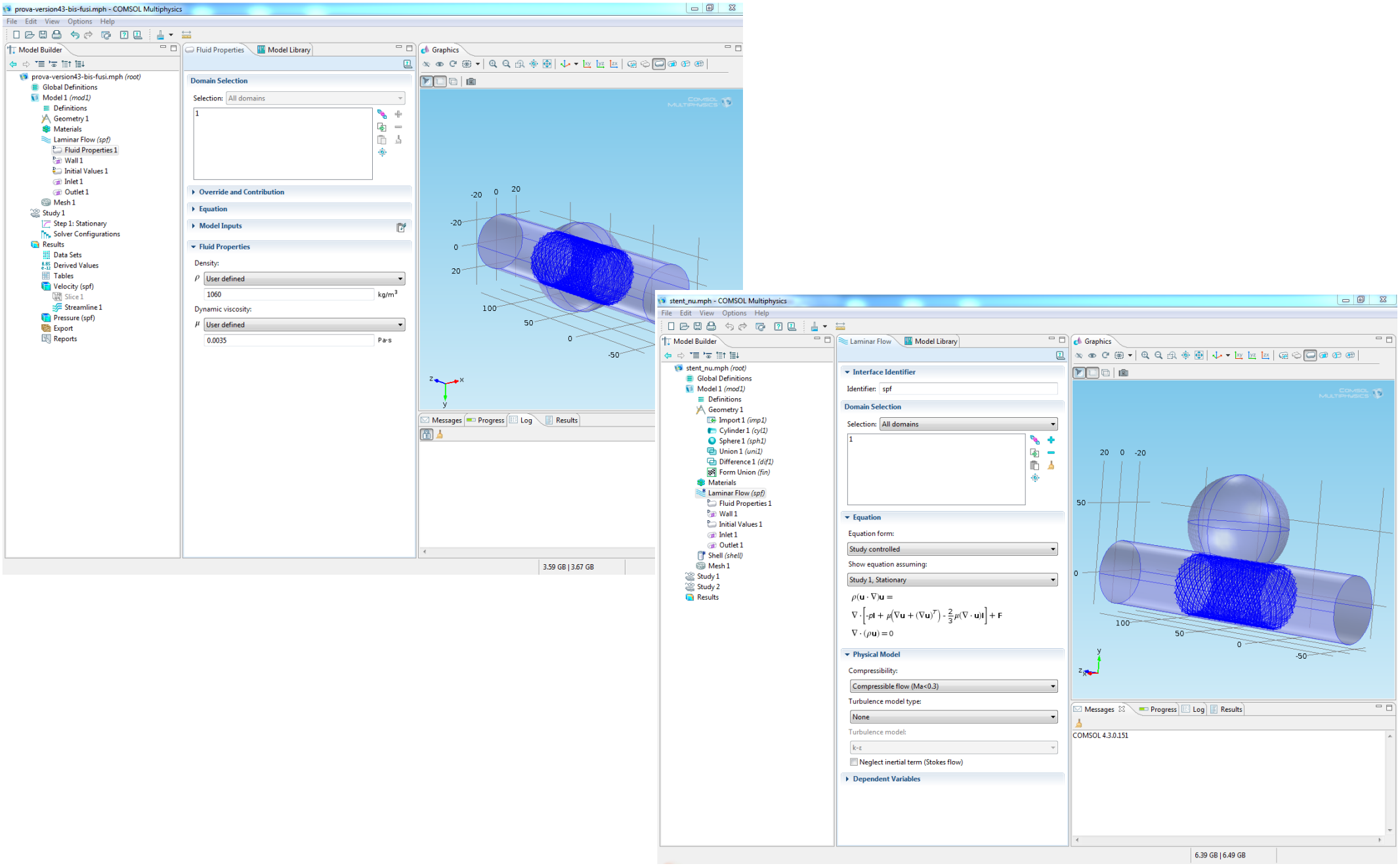




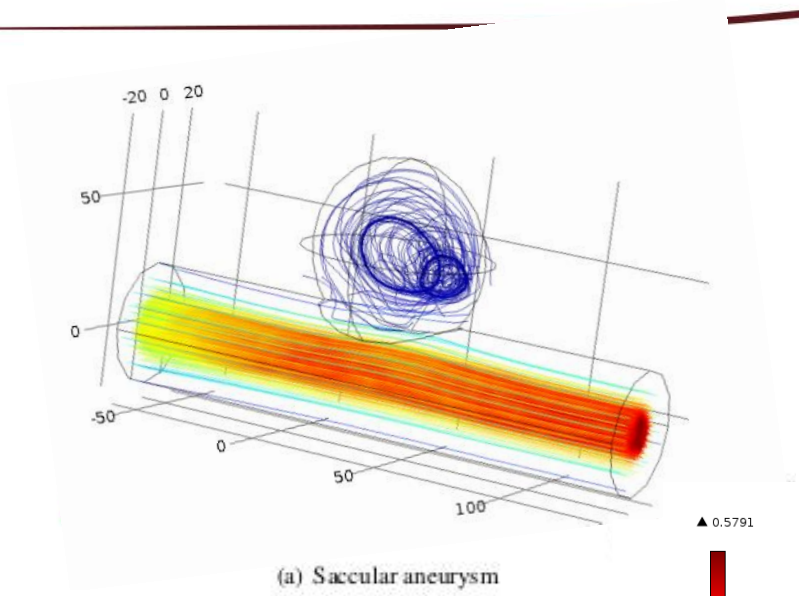
Saccular aneurysm



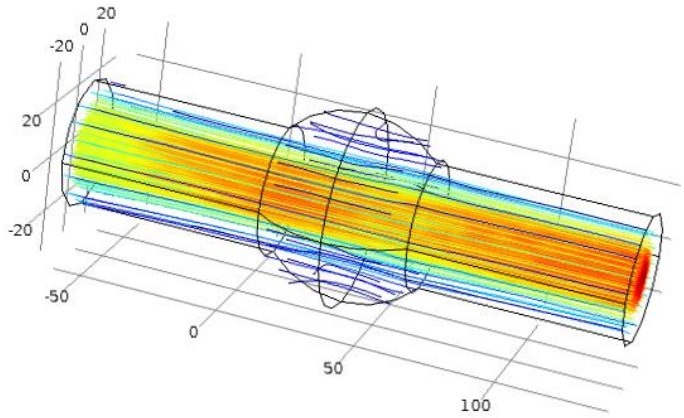
Solved physics (2)



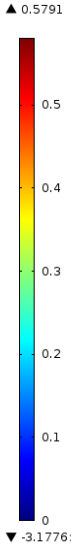
Velocity field streamline

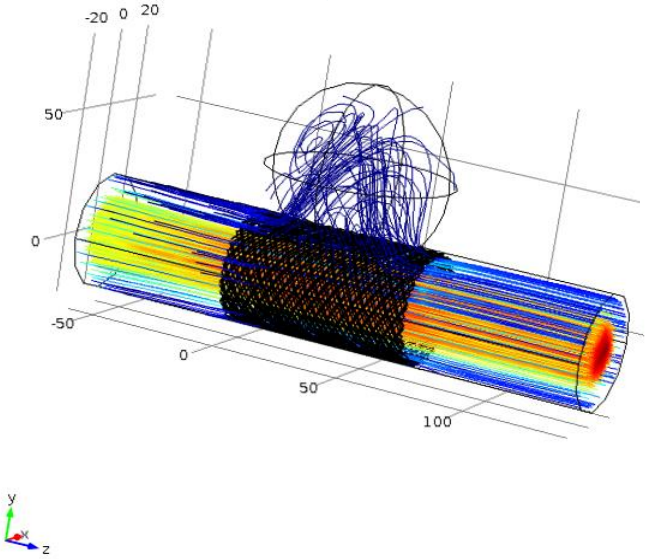


(a) Saccular aneurysm

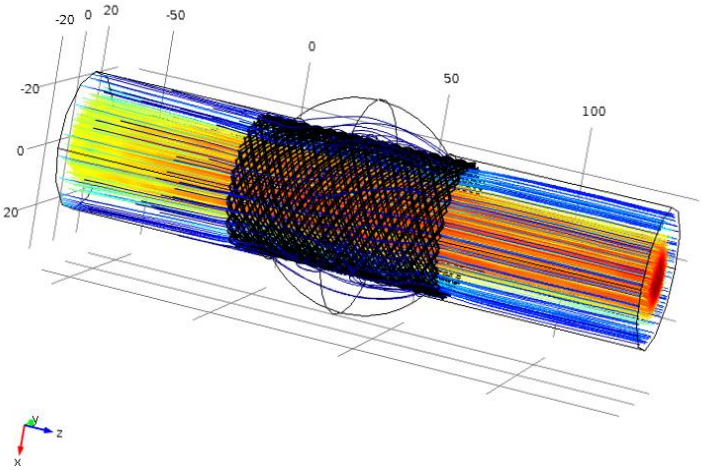


(b) Fusiform aneurysm





(c) Saccular aneurysm with MFM implanted



(d) Fusiform aneurysm with MFM implanted

WE HAVE INTRODUCED TWO DIFFERENT APPROACHES

- VIRTUAL SIMULATION WITH REALISTIC AORTA,
  ALTHOUGH EQUIVALENT ELEMENT IS USED FOR THE MFM
- VIRTUAL SIMULATION WITH REALISTIC MFM,
  ALTHOUGH IN A SIMPLIFIED AORTA GEOMETRY

NEXT STEP:

- VIRTUAL SIMULATION WITH REALISTIC AORTA & REALISTIC MFM