# Fab@Hospital Project
Kick off meeting

UniPV Unit Work Plan

CompMech Group

Computational Mechanics & Advanced Materials Group

Main Research Areas

- Constitutive modelling of advanced materials (SMA, biological tissues..)

- Numerical methods (isogeometric analysis, fluid-structure interaction..)

- Biomechanics

  ➢ Aortic valve modeling

  ➢ Vascular biomechanics

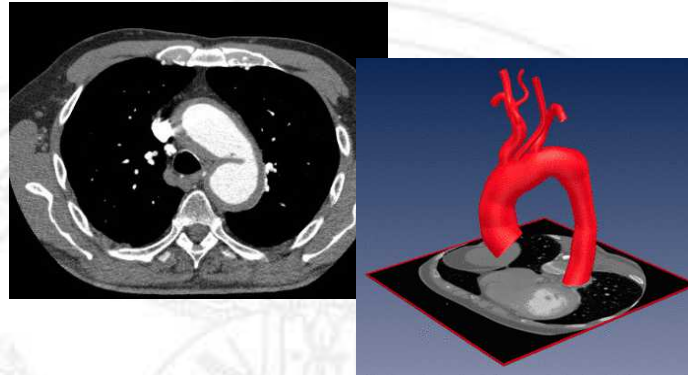- Medical image processing

  ➢ Image segmentation from CT/MRI
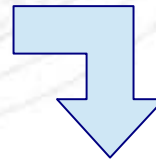
Great attention to the vascular field

Planned Activities	WP	Deliverables
• Medical image analysis and patient specific 3D virtual model development • Mould CAD design	WP2	October 2014 (M10)
• Correlation between silicone mixture and mechanical properties of the artery	WP3	November 2014 (M11)
• Demonstrator	WP4	December 2014 (M12)

WP2 - Image analysis and CAD design

From medical images...
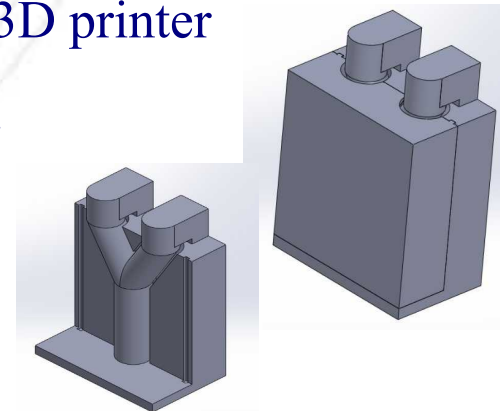

..to the 3D virtual model

CAD design for RIGID rapid prototyping

- Add proper connections

- Prototype with 3D printer

Mould CAD design for COMPLIANT rapid prototyping

- Create the negative geometry

- Prototype with 3D printer

- Silicone casting

Materials

- **Image analysis and 3D reconstruction -** ITK-Snap (open source)

- **CAD Design -** SolidWorks (3DSystem)

    Software for CAD design on .stl files (TO BUY)

- **3D Printer -** Objet 30Pro (Objet-Stratasys)

In vitro simulation - Hydraulic circuit @ Beta-Lab

Methods

Mould CAD Design

- From idealized to patient specific mould design

- Identify a correct cut plane to open the mould using the vessel centerline [FUTURE THESIS WORK]

WP2 UniPV

Deliverable: **Design process for rigid and compliant prototyping**

Date :   **October 2014**

Goal

Endow the compliant model of patient specific fisiopathologic mechanical properties, through a tabel of corresponding silicone mixtures

Materials

- **Silicone -** Sylgard 184 (Dow Corning), base + curing agent, low temperature curing

- **3D Printer -** Objet 30 Pro with Durus-White (high-temperature printing material)

- **Testing Machine -** MTS Insight® 10 Electromechanic System

Methods

- Identify different ratio of base and curing agent (starting from 10:1)

- Bone shape specimen of different silicone mixtures

- Mechanical traction test to identify elastic modulus of the different mixtures [FUTURE THESIS WORK]

WP3 UniPV

Deliverable: **Table listing mechanical properties and corresponding silicone mixtures**

                                3D printing prototyping guidlines

Date :   **Novemeber 2014**

Goal

Test the effectiveness of the developed productive methodologies

Methods

- Real scenario – clinical cases coming from:

  ➢ Vascular Surgery II Unit of IRCCS Policlinico San Donato (San Donato Milanese, Milan)

  ➢ General Surgery II Unit of IRCCS Policlinico San Matteo (Pavia)

- Cost and time estimation

WP4 UniPV

Deliverable: **First validation of the manufacturing process**

Date :   **December 2014**

3D Printing @ ProtoLab

Objet 30 Pro – 7 different printing materials at high resolution (up to 16 μm)

Web:
http://www.unipv.it/compmech/proto-lab.html

Medical prototyping

From image analysis to 3D printing

To test devices on patient specific geometries

Thanks for your attention