

# CARDIS



## Early stage **CAR**dio Vascular Disease Detection with **I**ntegrated **S**ilicon Photonics

<Presenter name>

<Event, date>

This project has received funding from the European Union's H2020 Programme for research, technological development and demonstration under grant agreement No 644798

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# Project ID card

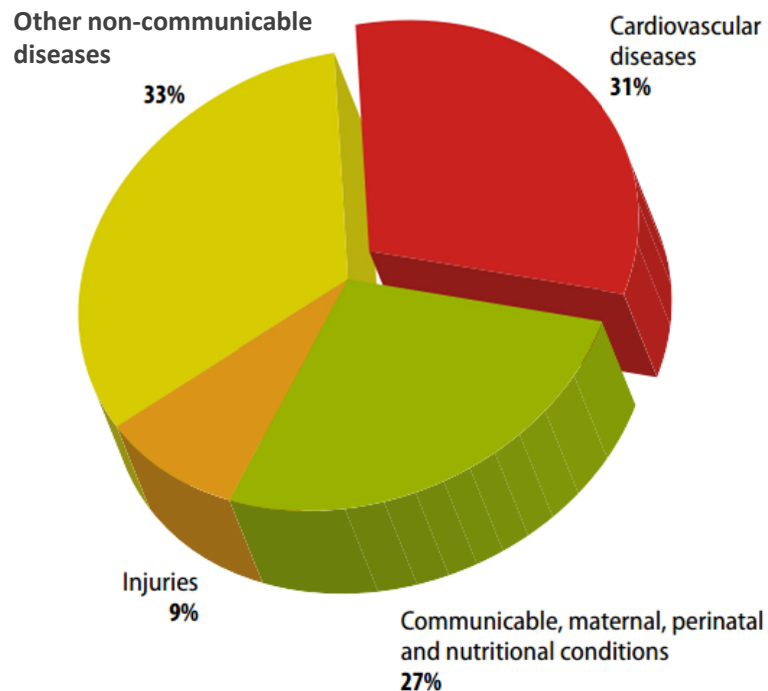


- Funded under: H2020 (Horizon 2020)
- Rate: 14.5/15
- Research and Innovation Action (RIA)
- Area: Application driven core photonic technology biophotonics for screening diseases
- Project reference: 644798
- Start date: 01/02/2015
- Duration: 42 months
- Total EC funding: 3,629.207 €
- Consortium participants:

IMEC (BE) (Project Coordinator)	Medtronic (NL) (Scientific Coordinator)	SIOS (DE)
Tyndall-UCC (IE)	Universiteit Gent (BE)	INSERM (FR)
QML (UK)	Univ Maastricht (NL)	Fundico (BE)

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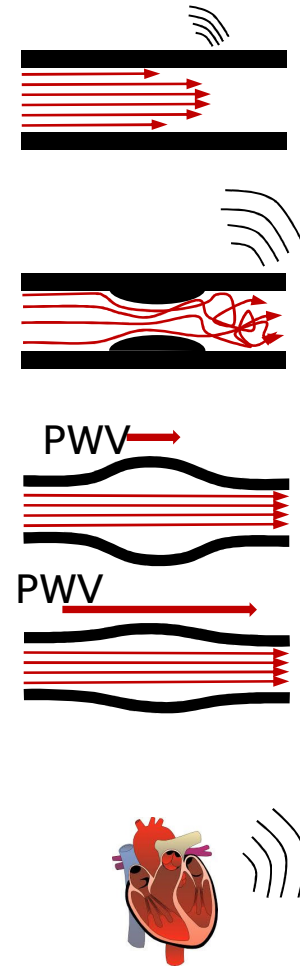
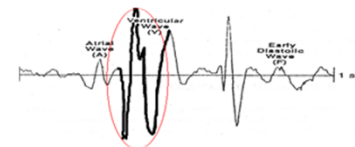
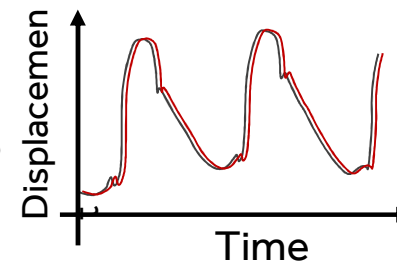
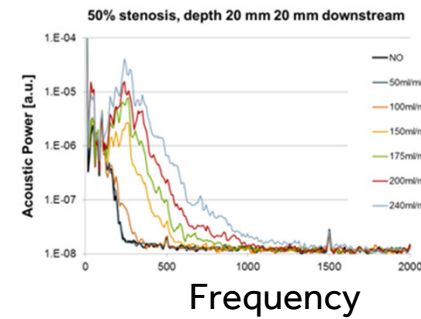
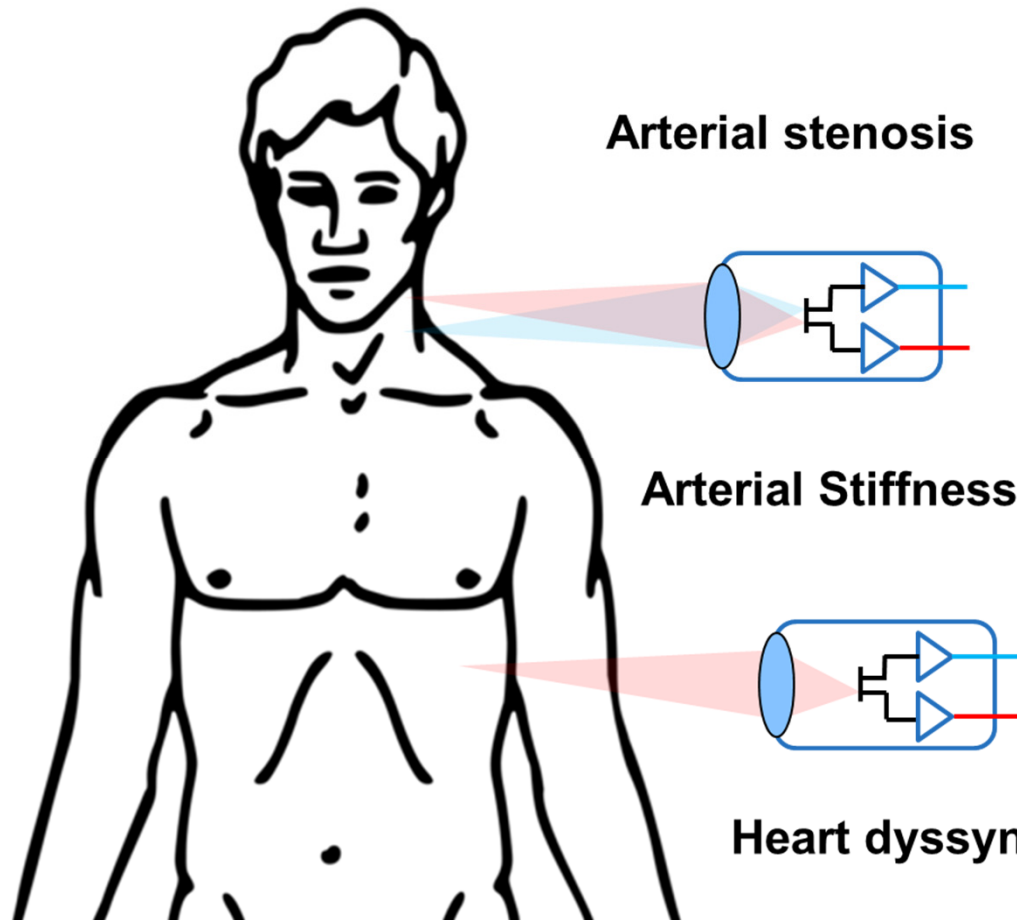




- Early diagnosis of cardiovascular diseases (CVD) to halt or reverse pathological process
- CVD markers
  - Arterial stiffness
  - Arterial stenosis
  - Heart dyssynchrony
- CARDIS: Mobile, low-cost, point-of-care CVD screening and diagnostic device

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# Project key features



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- Demonstrate concept of a mobile, low-cost silicon photonics integrated laser vibrometer:
  - Develop Demonstrator device with
    - Photonic Integrated Chip with a multi-branch laser interferometer
    - A micro-optical laser assembly
    - A micro-optical lens system
  - Develop the appropriate signal processing and filtering techniques
  - Develop a biomechanical model to simulate optical parameters as first basis for the diagnostics decision making
  - Human feasibility assessment

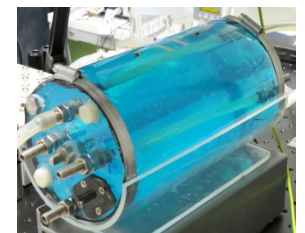
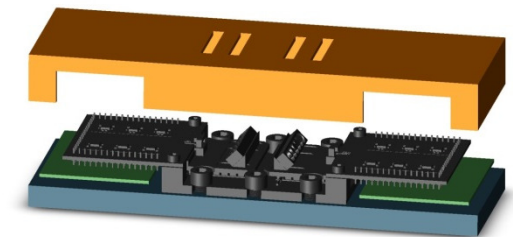
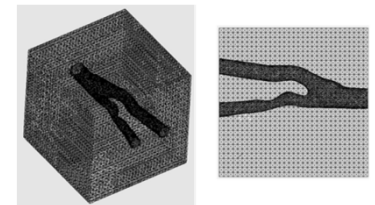
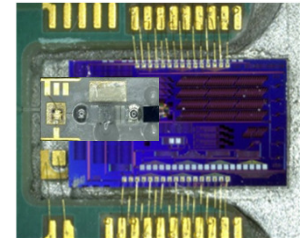
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## Achievements

- 6 beam Mach-Zehnder interferometer on Silicon Photonics Integrated Chip successfully designed and manufactured
- First iteration Demonstrator manufactured
- Biomechanical model developed
- Neck phantom developed
- Pilot studies conducted using commercial dual beam vibrometer

## Current activities

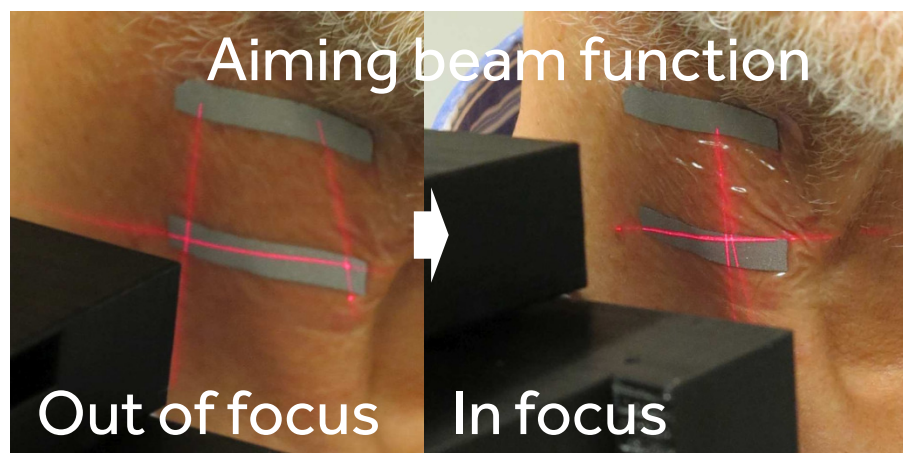
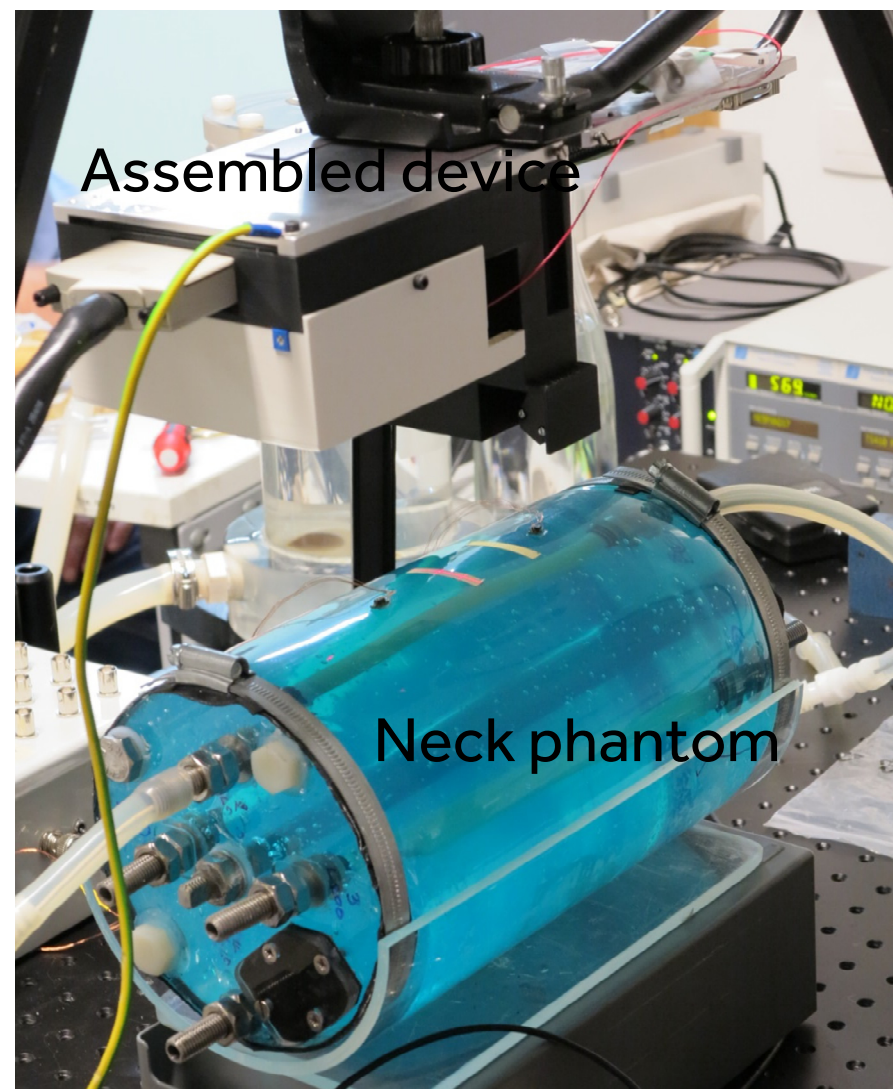
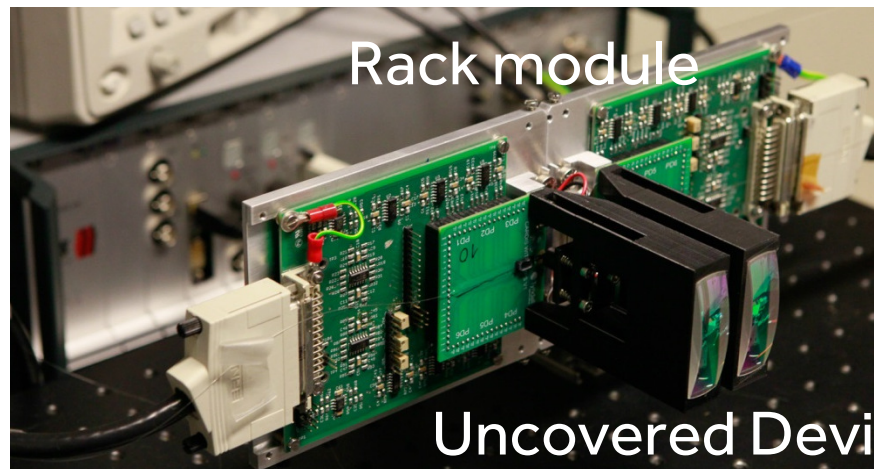
- Lab validation of first version Demonstrator (June 2017)
- Manufacturing of Demonstrator device for clinical feasibility studies



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# First Iteration CARDIS Demonstrator Device

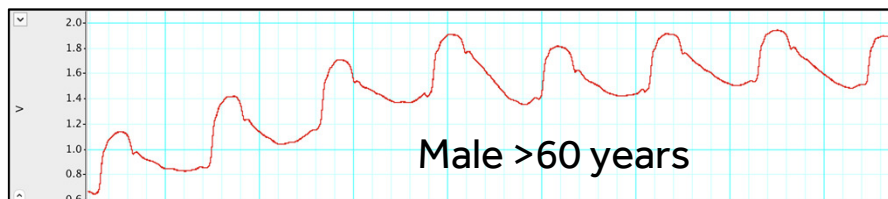
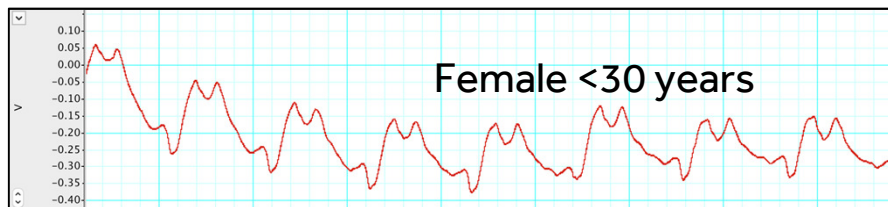


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# Pilot Study Results



(1) K Hirata; T Yaginuma; MF. O'Rourke; M Kawakami. Age-Related Changes in Carotid Artery Flow and Pressure Pulses: Possible Implications for Cerebral Microvascular Disease, [stroke.ahajournals.org/content/37/10/2552](http://stroke.ahajournals.org/content/37/10/2552)

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# Consortium partners



Imec is a world-leading independent research center for nano electronics and nano technology. Imec's research bridges the gap between fundamental research at universities and technology development in industry



Medtronic is the world's largest medical technology company, offering a wide range of innovative therapies within the fields of cardiac and vascular diseases, diabetes, neurological and musculoskeletal conditions.



SIOS Meßtechnik GmbH manufactures laser-interferometric and other types of precision instrumentation for measuring lengths, angles, vibratory motions and derived quantities such as weights, forces, and pressure.



The Tyndall National Institute is Ireland's largest research centre. Tyndall's key areas of research include; photonics, microsystems, nanotechnology, advanced theory and modelling. It has a strong track record in coordinating and partnering in European projects, and very strong links with industry partners.



Ghent University (UGent) is the 2nd largest university in Belgium. The IBiTech-bioMMeda group focuses on the advanced modeling of cardiovascular interaction, normative values of arterial function and structure.



Institut National de la Recherche Médicale (INSERM) is dedicated to clinical research concerning large arteries INSERM is associated with Université Paris Descartes, which has a strong dominance in biology, medicine and biotech.



Barts & The London School of Medicine & Dentistry at QMUL is ranked 5th in the country and 1st in London. Its translational research strength has attracted the award of a NIHR Biomedical Research Unit in Cardiovascular Disease



Universiteit Maastricht has 5 faculties including Health, Medicine and Life Sciences (FHML). This latter faculty is linked to the Academic Hospital Maastricht (AZM). FHML and AZM is dedicated to cardiovascular diseases.



Fundico is a consultancy company with the objective to assist industrial companies and research organisations with submission of financing proposals for research and development and management and coordination of research and development projects

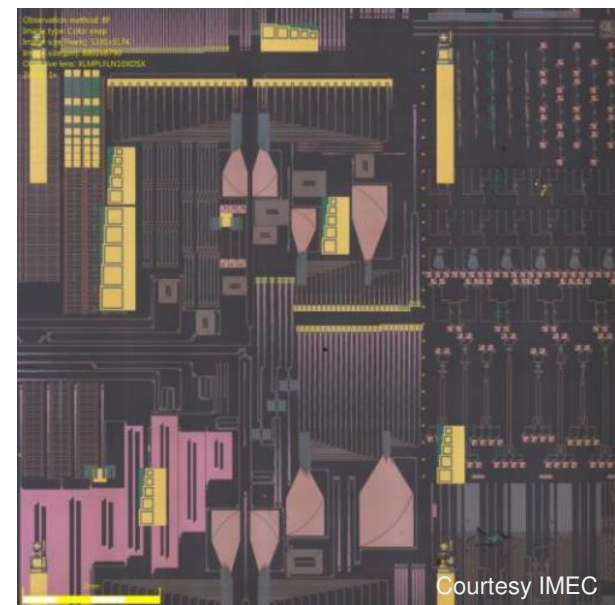
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# What is Silicon Photonics



**The implementation of high density photonic integrated circuits by means of CMOS process technology in a CMOS fab**



**Enabling complex optical functionality on a compact chip at low cost**

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# Questions?



<http://www.cardis-h2020.eu>

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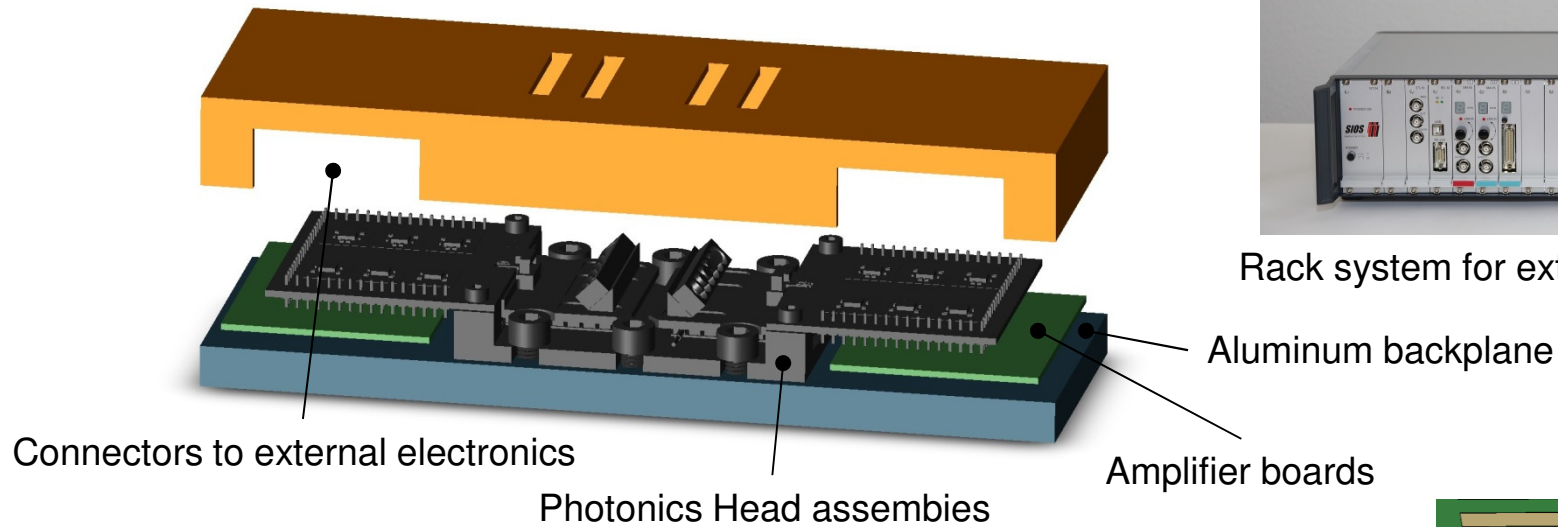


## Back-up slides

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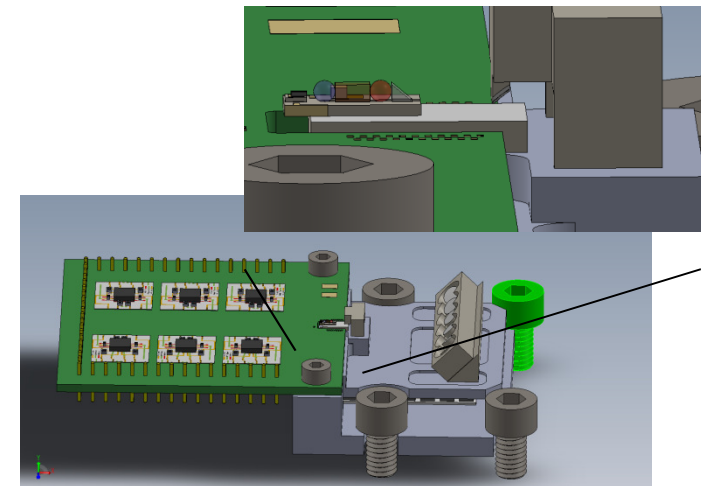


# First demonstrator device for lab use



Rack system for external electronics

- Lab use instrument
- Hand-piece LxBxH 320 x 110 x 35mm
- Signal processing and decoding in external rack system

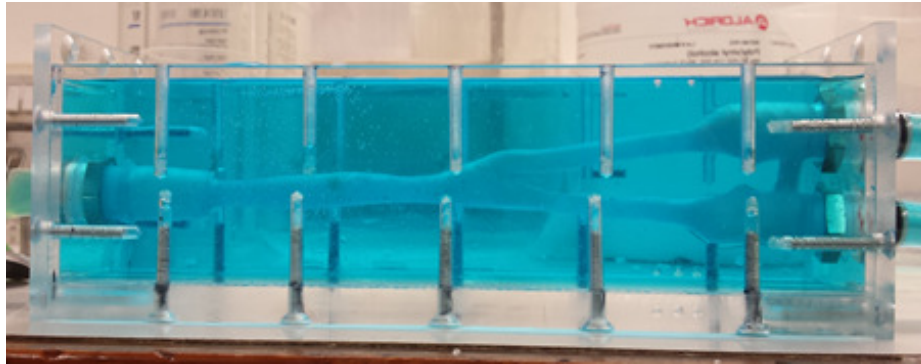


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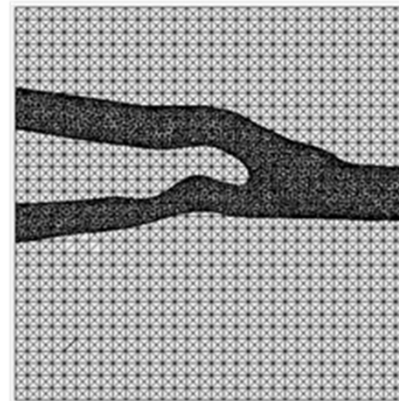
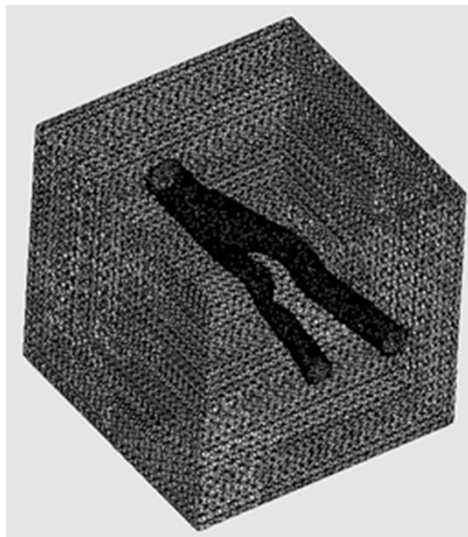




# Biomechanical model and computer model of carotid artery



*Carotid phantom surrounded by PVA liquid*



*Computational mesh of a model with a carotid artery embedded in a gel.*

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