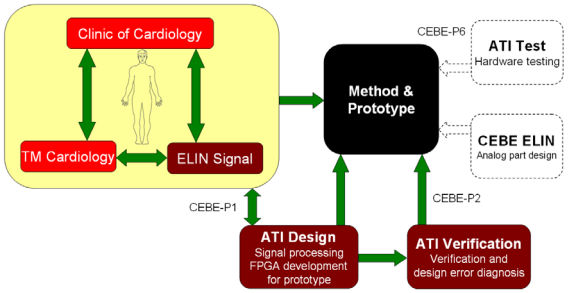
Total Peripheral Resistance

CEBE Project P3

- "Total perhipheral resistance"



Concept of peripheral resistance

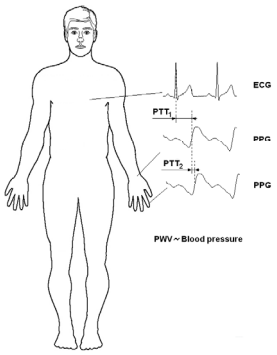
Total Peripheral Resistance:

- The monitoring device of the total resistance of peripheral arteries is aimed to be applied in medicine for non-invasive diagnostics of heart-vascular diseases.
- Peripheral resistance is dependent on blood pressure and cardiac output.
- The peripheral resistance gives important complex information about the condition of the heart and arteries.
- It is important parameter for monitoring and leading treatment process on cardiac patients.
- It enables selection of medication in the beginning of treatment process.

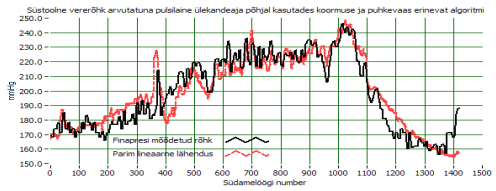
$$\text{Total Peripheral Resistance} = \frac{\text{Mean blood pressure}}{\text{Cardiac output}}$$

Mean Blood pressure

- The increase of blood pressure is achieved mainly by increasing the contractility of the heart and peripheral vasculature resistance. As a result of this the pressure wave speed in vascular system increases. Pulse wave velocity has high correlation with blood pressure.
- Pulse wave velocity depends on time delay:
  - between ECG R-peak and PPG signal raising front **PTT_1**
  - between two arterial points **PTT_2**

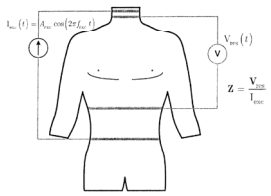


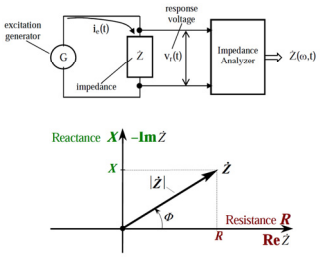
Mean Blood pressure



Registration of impedance signal

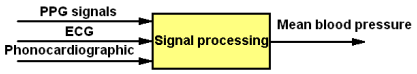
- Electrical impedance (or simply impedance) is a measure of opposition to a sinusoudal electric current.





Signal processing

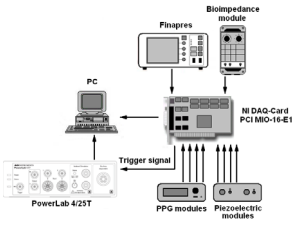
- Different signal processing algorithms are needed to estimate peripheral resistance.



$$\text{Total Peripheral Resistance} = \frac{\text{Mean blood pressure}}{\text{Cardiac output}}$$

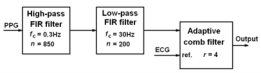
Reached aims (1)

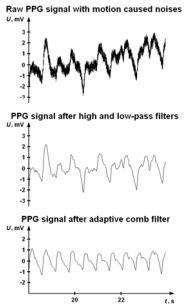
- Measurement complex for physiological signals has been designed and built.
- patients with CHD had increased aortic PWV compared with healthy subjects. in the CHD group.
- Aortic PWV had a positive correlation with arterial PWV.



Reached aims (2)

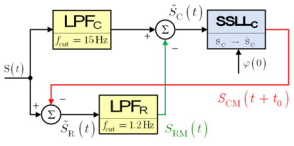
- The signal processing algorithm for the motion caused noise reduction from PPG signal.
- Adaptive sum comb filter for PPG signals by using ECG signal as reference:

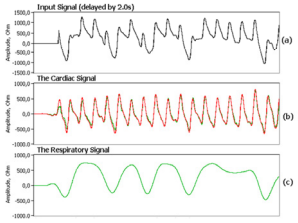




Reached aims (3)

- The model based method for adaptive decomposition of the thoracic bio-impedance variations into cardiac and respiratory components.





Future activities

- To carry out patient studies in Clinic of Cardiology of North Estonian Regional Hospital. ***(TM, Clinic)***
- Development of the signal processing algorithms for the DC component and low frequency noises elimination from PPG signal. ***(TM, ELIN)***
- Development of the algorithms and optimization. ***(TM, ELIN)***
- Development of the specific signal processor methodology, optimizations for algorithms implementation and verification methodology. ***(TM, ELIN, ATI)***
- Practical application of the prototype. Next iterations of the calculation algorithm and development of related optical and electrical methods. Decision on the further project development steps. ***(TM, Clinic, ELIN, ATI)***