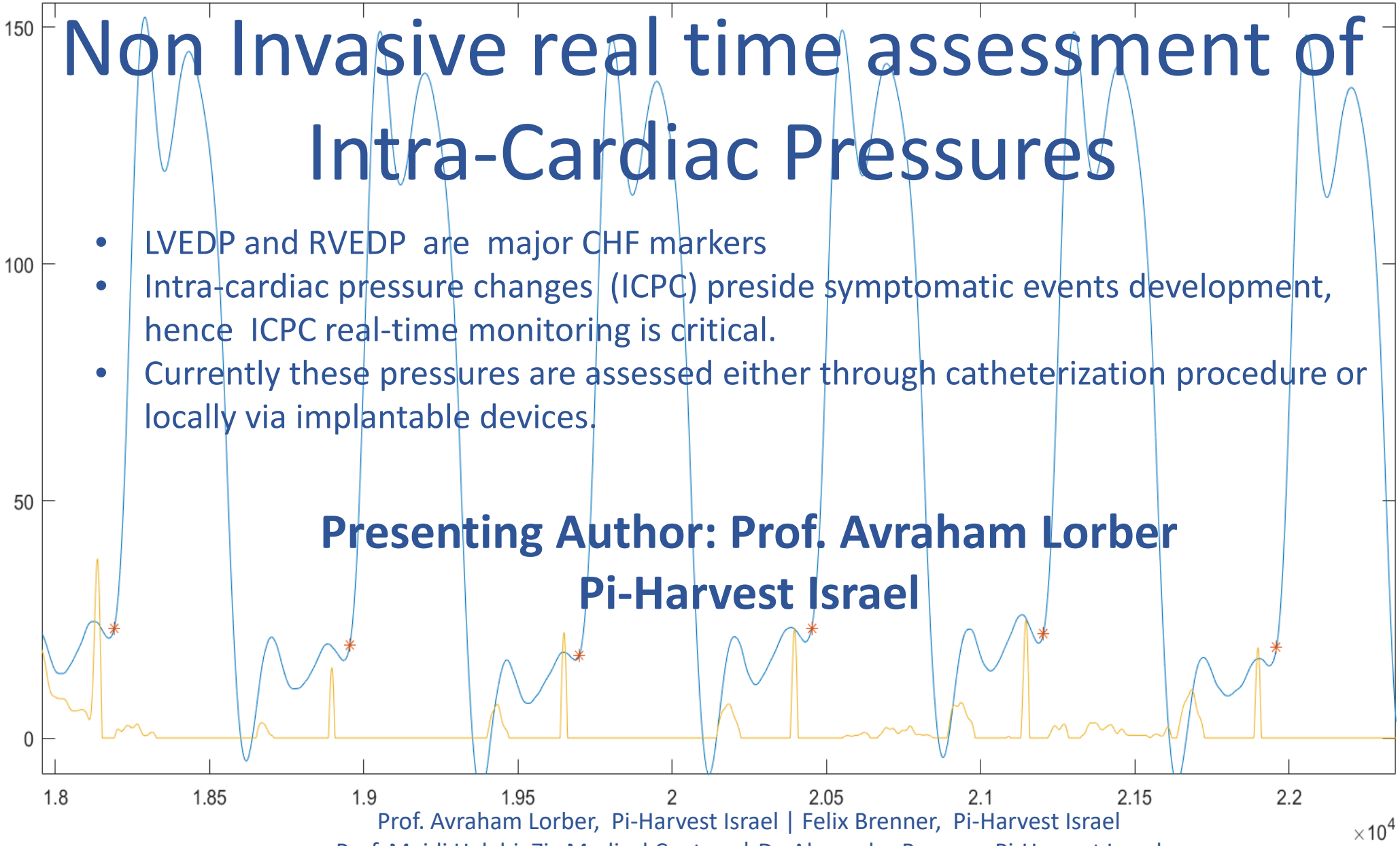
Non Invasive real time assessment of Intra-Cardiac Pressures

E-POSTER



- LVEDP and RVEDP are major CHF markers
- Intra-cardiac pressure changes (ICPC) preside symptomatic events development, hence ICPC real-time monitoring is critical.
- Currently these pressures are assessed either through catheterization procedure or locally via implantable devices.

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HARVEST

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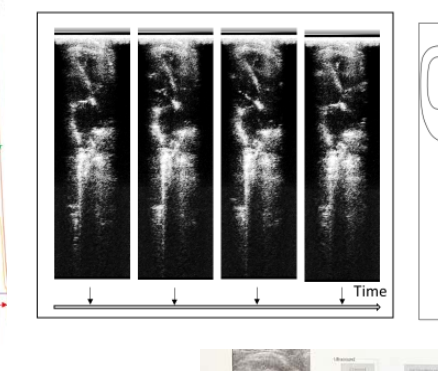
OBJECTIVE

To develop a real-time system

- providing a non-invasive measurement, calculation and prediction of pressures
  - in pulmonary artery and cardiac chambers,
  - assessing left and right ventricular
    - end diastolic pressures (LVEDP and RVEDP),
    - systolic/end systolic (LV/E/SP and RV/E/SP),
  - Left/Right ventricular pressure $dP/dt_{max.L/R}$ $dP/dt_{min.L/R}$
    - rise
    - descend
  - and their derivatives forming a self-contained set of markers for CHF
  - describing the major cardiac cycle points connected with
    - ventricular preload, filling, ejection and afterload.

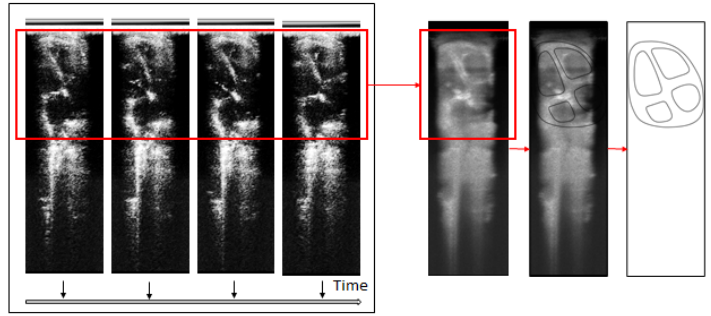


Methods: Eigen-Image

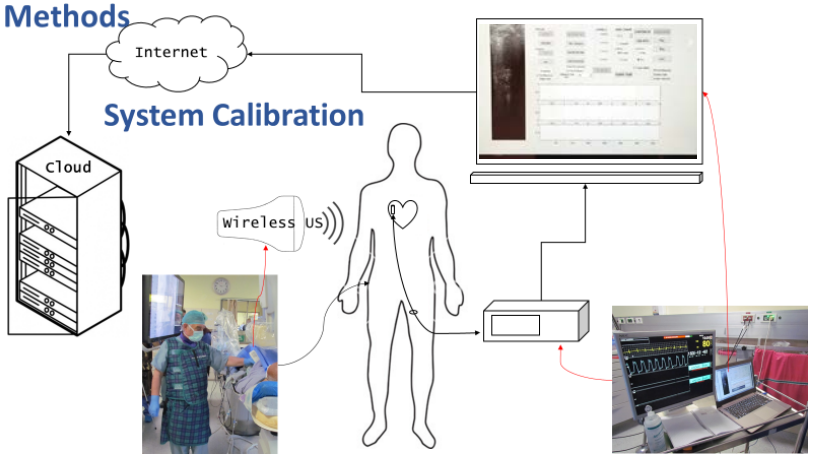
- **T-image** $\{T_i\}_{i=1,\dots,N}$ is defined as a chronological union of images with corresponding time stamps.
- **Characteristic (or Eigen-) Image** $\{I_i\}_{i=1,\dots,N}$ of T-image is as a chronological union of it's row averages

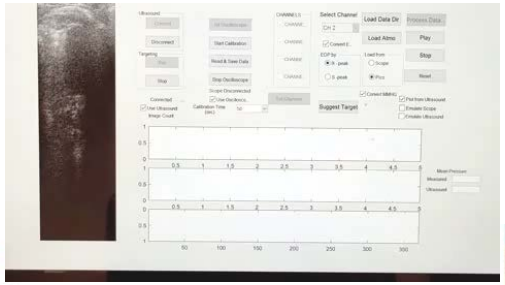
Methods: T-Image Time Derivatives

- **T-Image** $\{T_i\}_{i=1,\dots,N}$ **time derivatives** $\{T_i\}'_{i=1,\dots,N}$, $\{T_i\}''_{i=1,\dots,N}$, ... are the pixel-wise finite differences of greyscale brightness: $T_i - T_{i-1}$ with subsequent averaging.
- This allows to differentiate the oscillating parts from the environment and determine the heart shape and position.

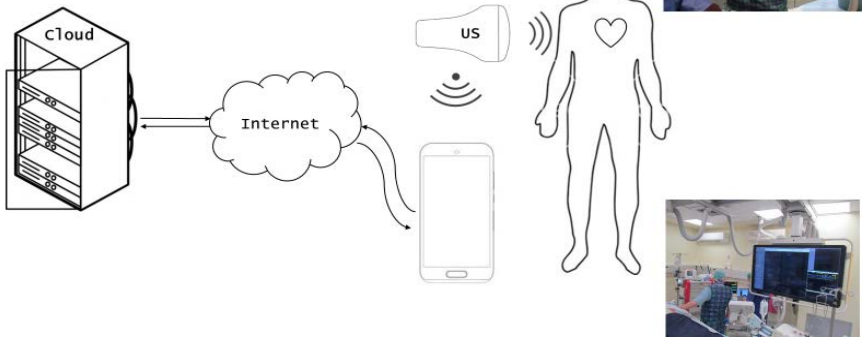


Methods





Methods Follow Up



Results LVEDP

- The results were confirmed during ongoing human study of 40 patients conducted under the approval of an ethical committee.
- The ultrasound elaborated pressure data functions are of high precision and accuracy corresponding to the catheter derived pressures and are valid for most of cardiac dysfunctions
- The further markers capable to differentiate NSTEMI Myocardial infarction with preserved and reduced ejection fraction are discovered.

Patient	8	LVEDP Comparison (mmHg)			
	Measured LVEDP	Calculated LVEDP			
Test	Pressure from LVP	Prediction by 1	Prediction by 2	Prediction by 3	Prediction by 4
1	20.60	20.60	20.72	20.67	20.36
2	21.10	21.08	21.11	21.20	20.77
3	19.09	19.18	19.57	19.08	19.15
4	17.67	17.46	18.18	17.16	17.67

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