# The Intelligent Cardiovascular Ultrasound Scanner

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*This presentation partly describes ongoing research and development efforts. These efforts are not products and may never become products*

# Cardiologist

How can I be confident in my ability to manage my patient's heart health when 10-15% of the patients have suboptimal echoes?

# Interventional Cardiologist

I need a better understanding of the anatomy and function during structural heart repairs

# Vivid™ E95

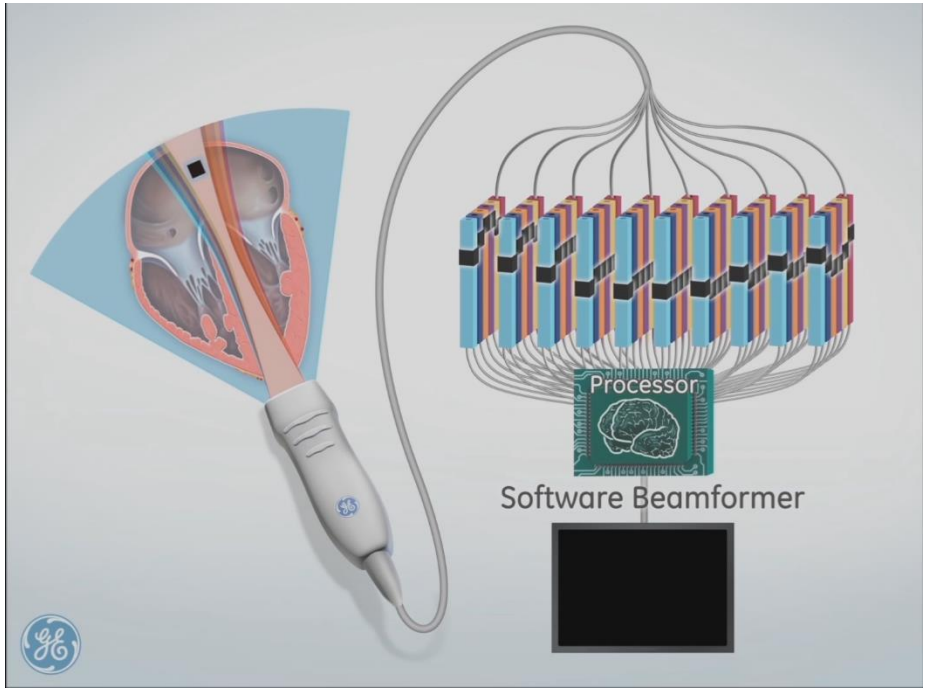
Cardiovascular Ultrasound
with

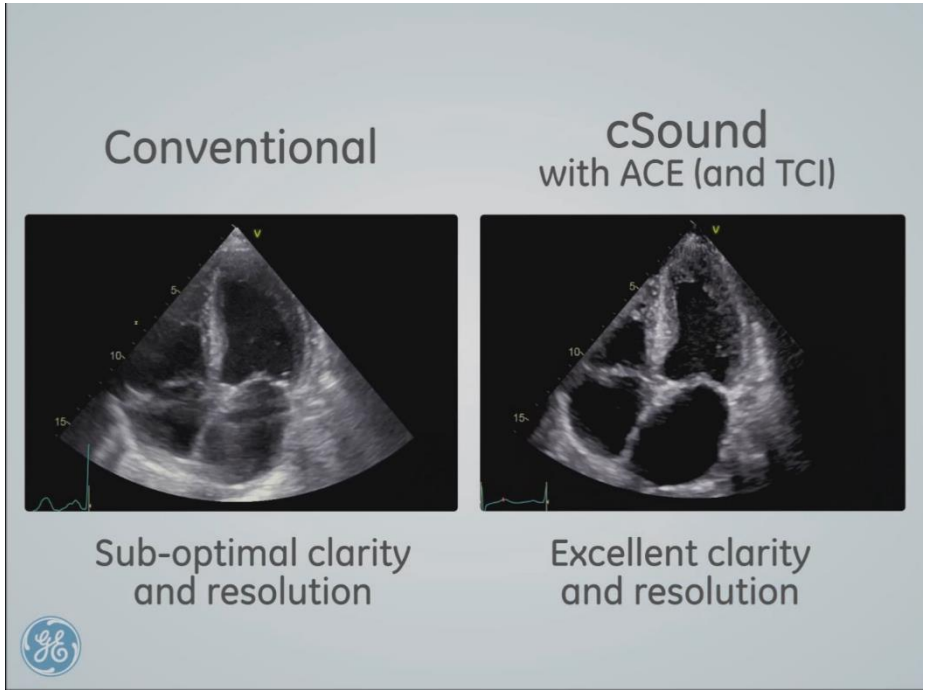
cSound™

cSound™

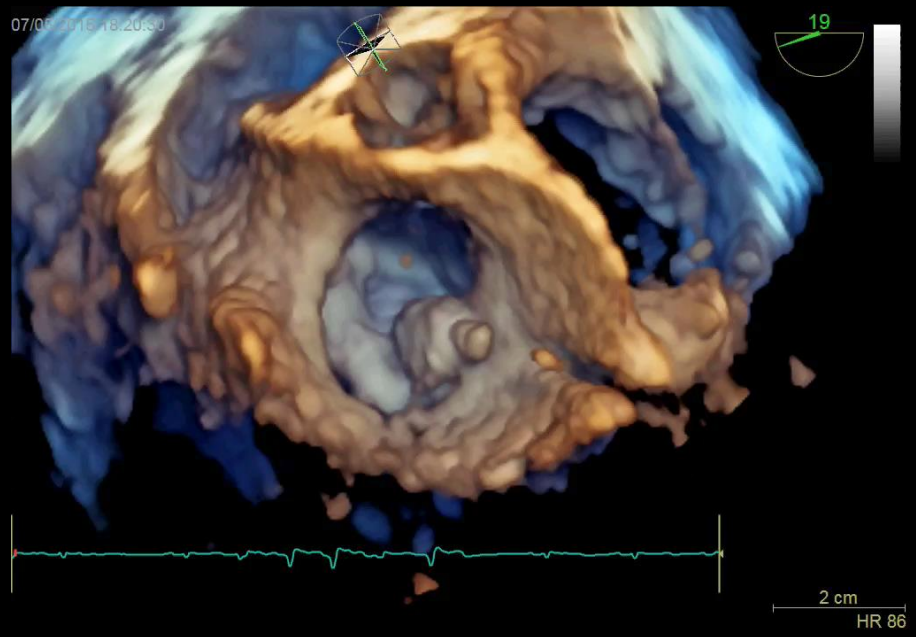
# Intelligent processing

- Channel data from many transmits collected into GPU memory in real time
- Image is computed in real time by software algorithms
- High performance
- Great flexibility to change algorithms

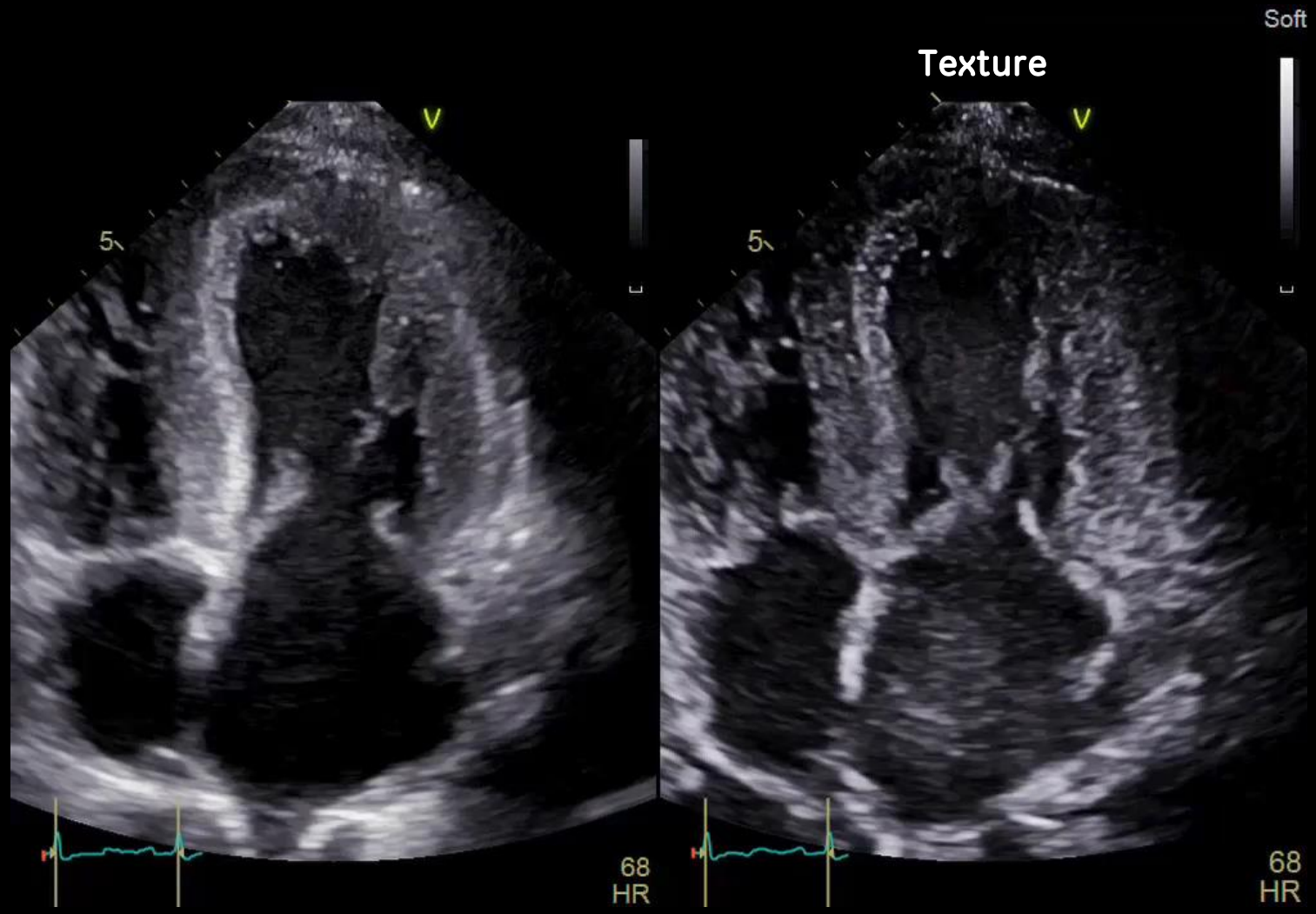


# HD*live*™
## *Examples from interventions*

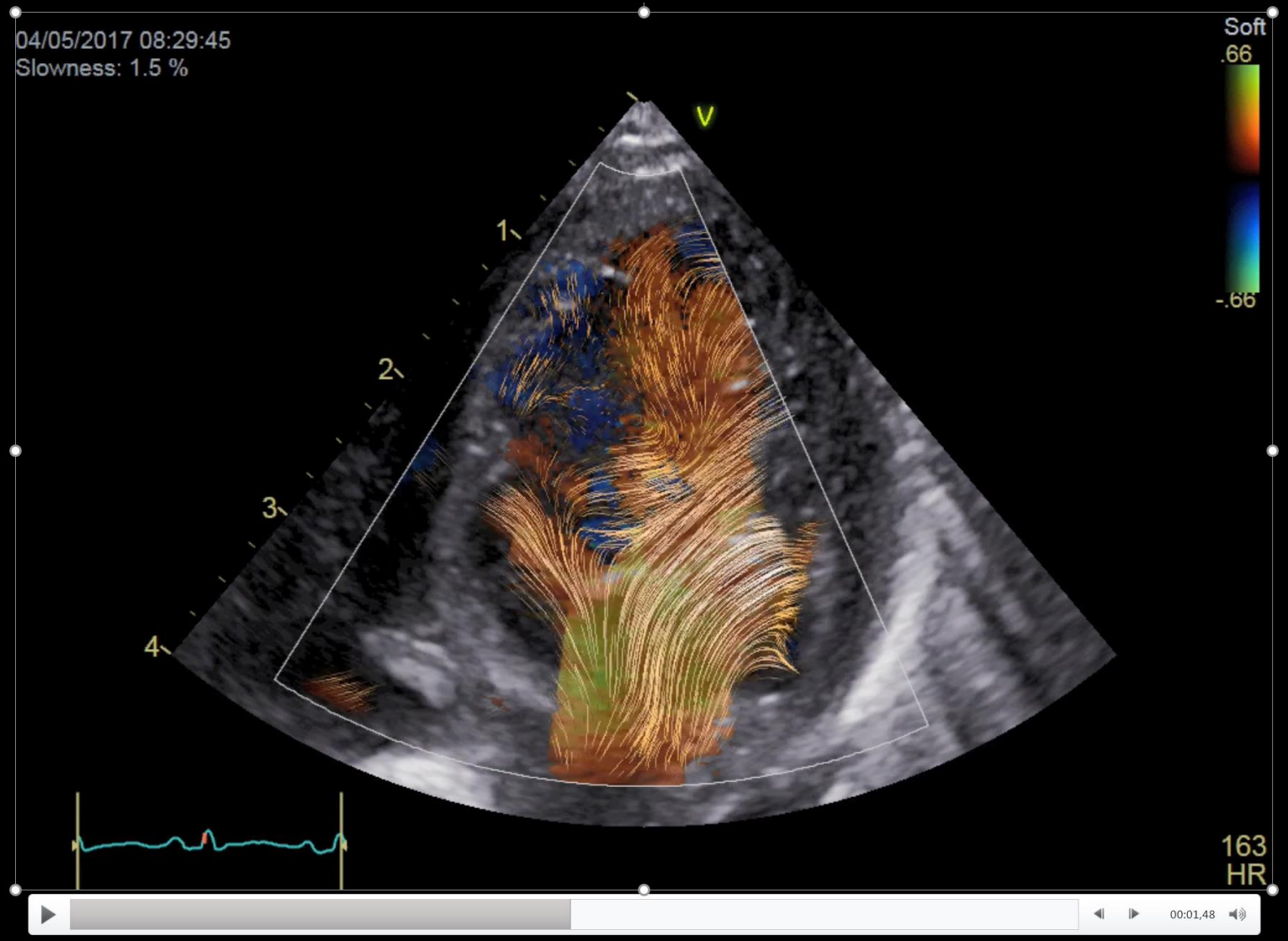



# With cSound™, image reconstruction algorithms can be changed according to clinical needs




Amyloidosis example (ACE+TCI vs Texture)

# Blood flow can be visualized in completely new ways



# Cardiologist

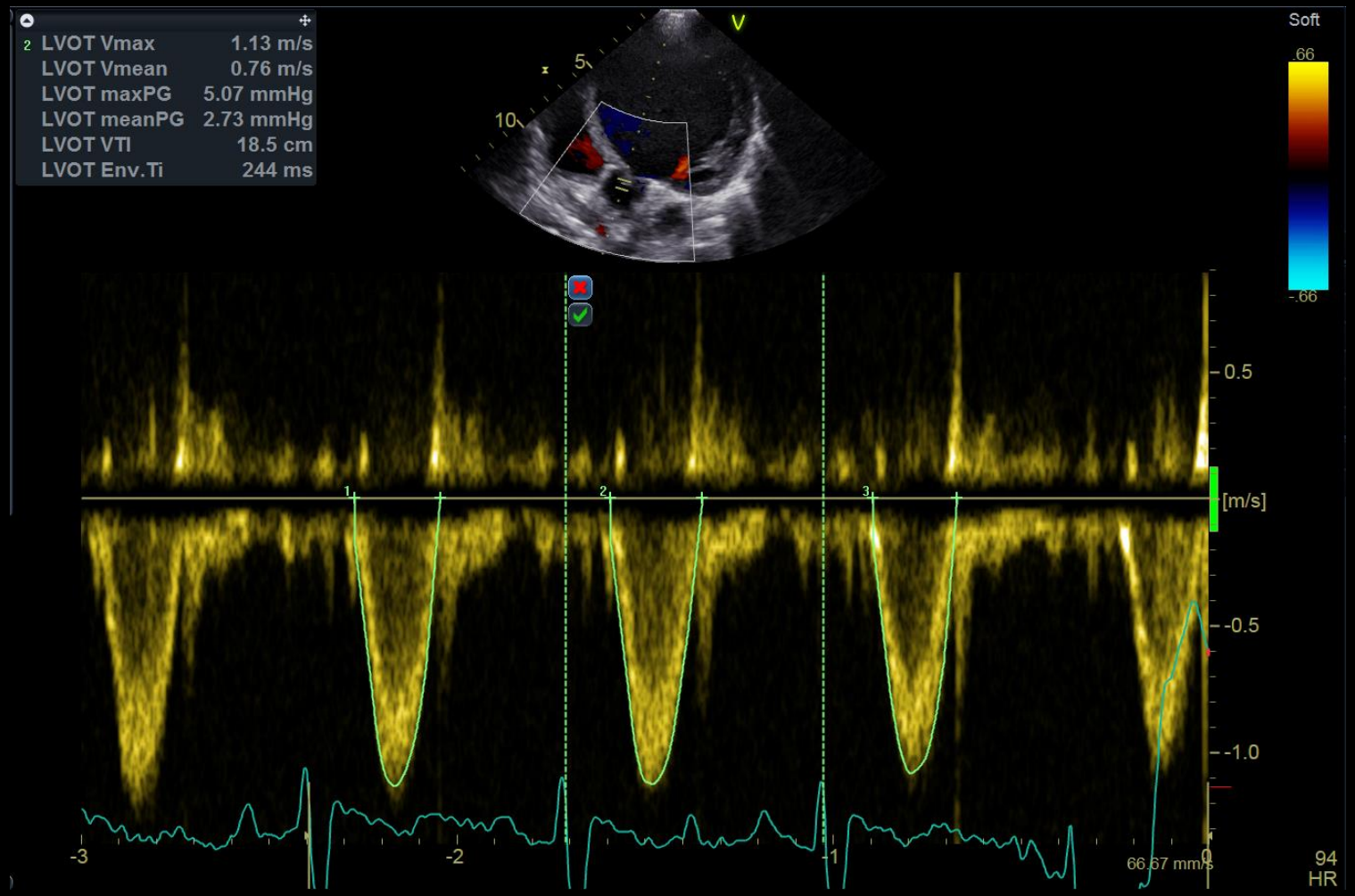
How can I be confident in my ability to manage my patient's heart health when 10-15% of the patients have suboptimal echoes?

I need a better understanding of the anatomy and function during structural heart repairs

How can I become more efficient with the increased burden of cardiovascular disease and pressure on cost ?

# Automatic Doppler Measurements

Performing manual Doppler measurements (tracings) is time consuming





Active for the most common measurements:

- LVOT Vmax
- LVOT Trace
- AV Vmax
- AV Trace
- TR Vmax
- MV E/A Velocity
- E’

Auto Doppler may **reduce scan time**, improve **consistency** (less user dependent) and eventually make the exam more **efficient**

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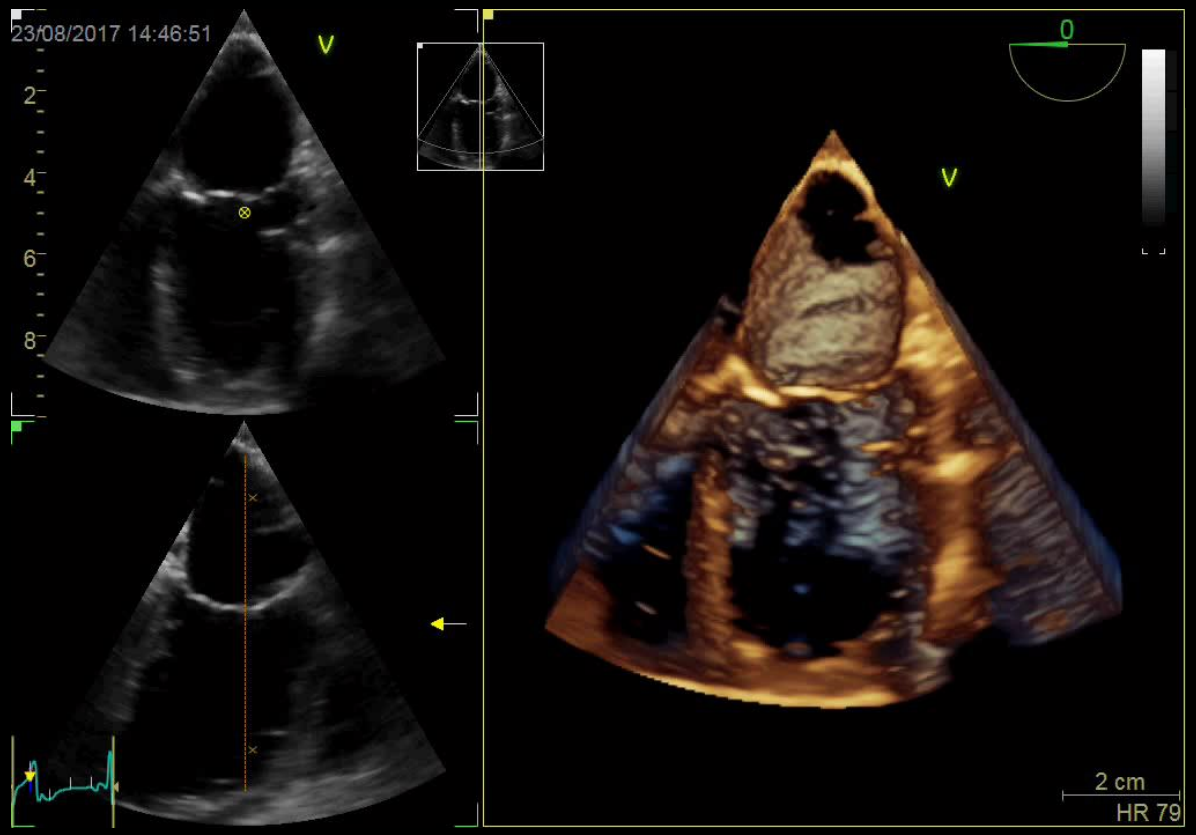
How can I become more efficient with the increased burden of cardiovascular disease and pressure on cost ?

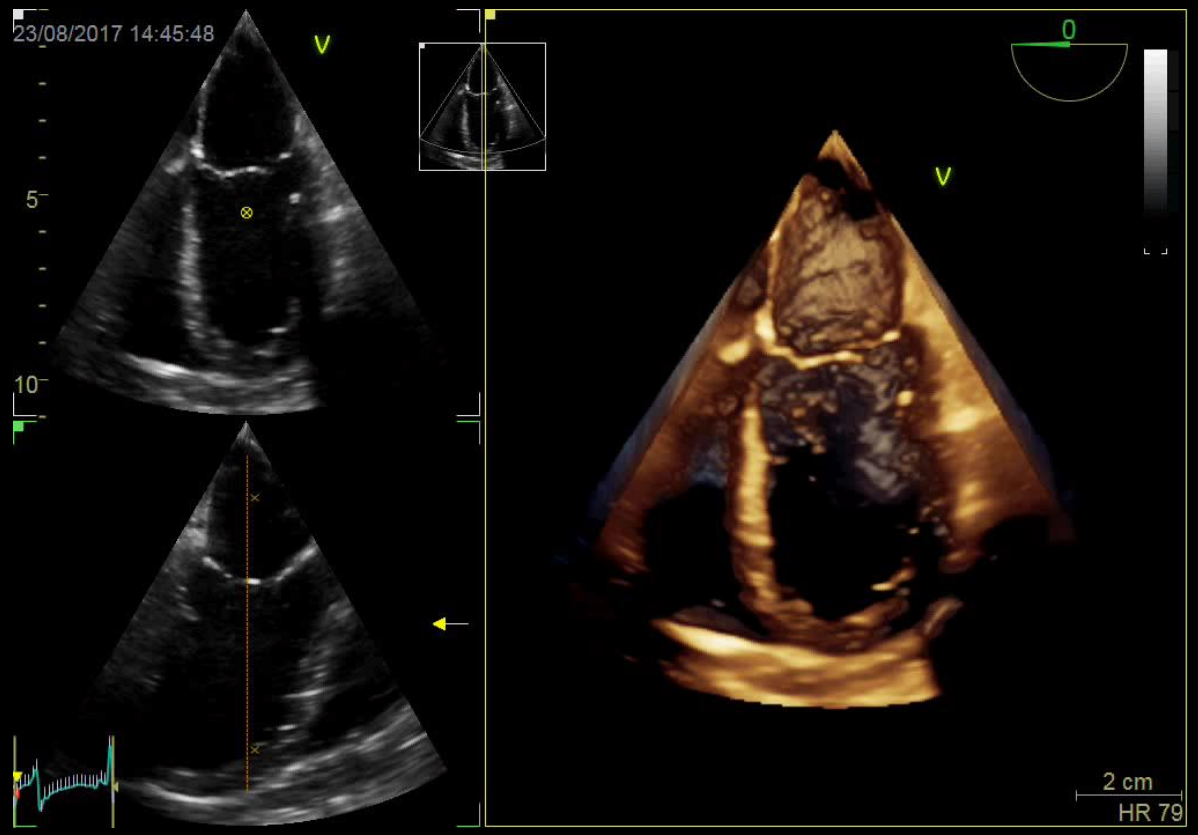
How can I make sure my cardiovascular ultrasound system is future-proof ?

# Future development(*)

**Note: Technology in development that represents ongoing research and development efforts. These technologies are not products and may never become products. Not for sale. Not cleared or approved by the U.S. FDA or any other global regulator for commercial availability*

# Faster GPUs can be combined with new algorithms for greatly improved 3D imaging (*)

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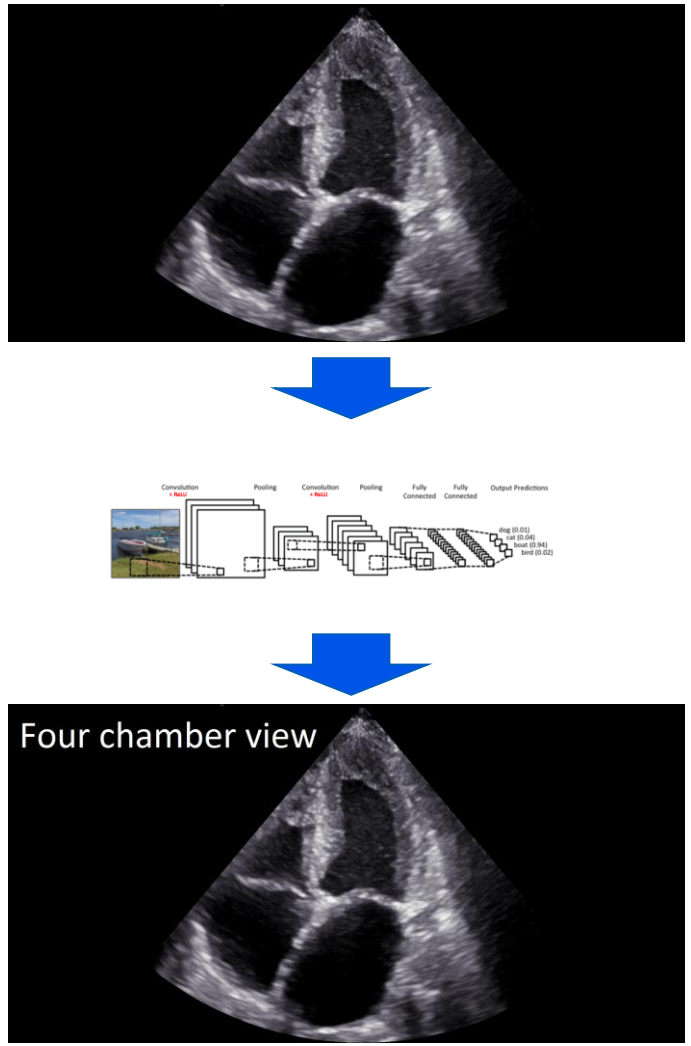
# Intelligent workflow

- **Workflow is automatically optimized according to cardiac view.**

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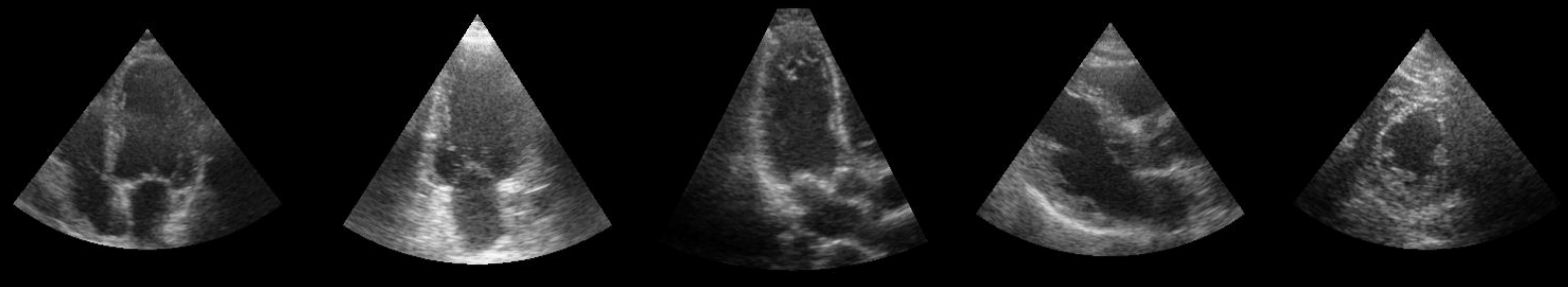
# Automatic Cardiac View Recognition (*)



Apical 4 chamber view | Apical 2 chamber view | Apical long axis view | Parasternal long axis view | Parasternal short axis view

## Preliminary results

- **Data: >100.000 images from > 5000 loops with variable image quality & patient anatomy**
- **500 loops used for validation**
- **Various network architectures investigated**
- **Accuracy (CaffeNet): 96 % accuracy on frame level, 97 % accuracy on sequence level (using majority vote)**
- **< 2 ms per frame inference time using a Quadro P4000 GPU**

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