

RealView Imaging - Holographic Augmented Reality

Company Presentation - June 2018



Deep Perception™
Live Holography

Holographic Augmented Reality - a Unique Experience



The only true 3D interactive holograms within hands reach

- Ultimate 3D visualization - see true volumes floating in the air or accurately positioned inside the patient
- Close-range precise interaction - directly explore, touch and manipulate real-time medical holograms
- Experience prolonged use without any fatigue or nausea

Company Overview

- World leader in real-time Medical Holography™
- Award-winning Digital Light Shaping™ (DLS) Technology
- Strong IP portfolio in Holographic Augmented Reality, multiple jurisdictions worldwide
- Full in-house system design - electro-optics, hardware and software
- First ever holographic clinical trials
- First product shipments to renowned medical centers in 2018
- Privately held, headquarters in Israel



Leading Team



Dr. Shimon Eckhouse
Chairman of the Board



Aviad Kaufman
CEO



Shaul Gelman
President and VP of R&D



Dr. Dalia Dickman
VP of Products



Dr. Elchanan Bruckheimer
Medical Director



Prof. Carmel Rotschild
Scientific Director

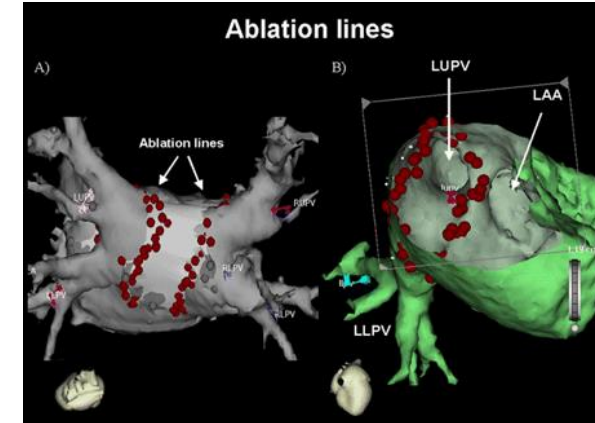


Shlomi Alon-Braitbart
CTO



3D Medical Imaging - The Need for Medical Holography™

- Advanced procedures in the modernized interventional suites rely 100% on imaging and require:
 - Real-time volumetric visualization of complex anatomy
 - Intra-procedural precise navigation and understanding of device-tissue interaction
 - Operator independence and enhanced communication within the medical team
- Current medical imaging technologies provide high quality volumetric 3D images, however:
 - Still present the data on flat 2D screens, losing critical spatial information, affecting physician interpretation
 - Limit the ability to accurately manipulate the volumetric structures



RealView's Medical Holography™ is the only solution which addresses these clinical needs

HOLOSCOPE™ - Product Line & Clinical Applications

Commercial 3D Acquisition Modalities



Real-time hologram
generation from existing
3D volumetric data

HOLOSCOPE™ *i*

Floating “in-air” holograms



Structural Cardiology

- AV Valve Interventions • LAAO
- TAVI Intervention

Electrophysiology

- Atrial Fibrillation

HOLOSCOPE™ *x*

Depth registered “in-patient” holograms



Interventional Oncology

- Volumetric Biopsy • Guided Treatments

Products under development. Not commercially available.

HOLOSCOPETM for Interventional Cardiology (Launch 2018)



Configuration subject to final changes - not commercially available.

HOLOSCOPE™ *i* - Main System Components

Holographic Optical Unit



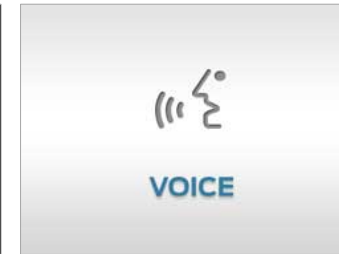
Control Station



2D Auxiliary Monitor



Human Holographic Interface (HHI)



HOLOSCOPE™ *i* - Depth Visualization

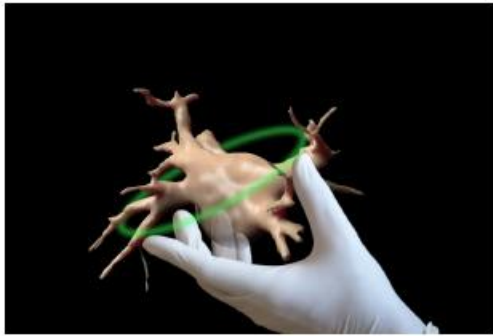
- True holography generated in real-time from 3D volumetric data (3D ultrasound, 3D/4D CT, 3D navigation, etc.)
- Provides all visual depth cues for clear and accurate understanding of the spatial information in free 3D space
- Affords enhanced confidence for intuitive navigation and exact interaction with patient's anatomy
- “Intuitive anatomy” potentially resulting in shorter learning curves, reduced procedure time, lower radiation exposure and improved outcome



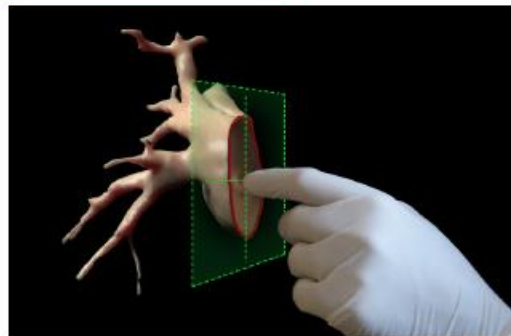
HOLOSCOPETM *i* - image intimacyTM

- Proprietary Human Holographic Interface (HHI)
- Intuitive and natural interface with the 3D images at hands-reach - all in real-time
- Unbounded interaction within the image: rotate, move, zoom, mark, slice, measure and more - all in true 3D space
- Providing the clinician independent control over the 3D images during the procedure, including voice activation

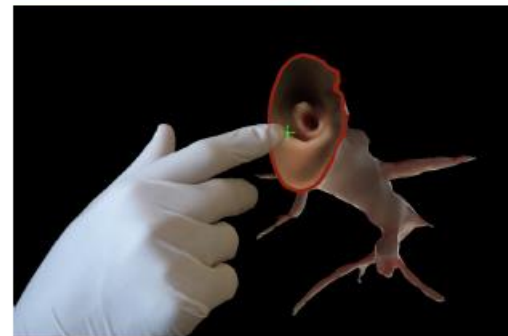
Rotate



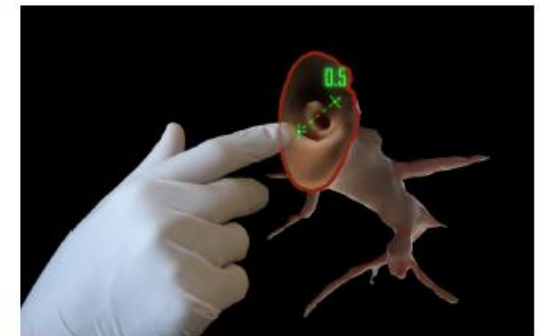
Slice



Mark



Measure



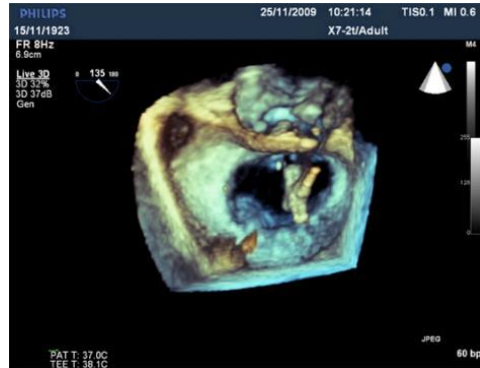
HOLOSCOPETM **i** - Addressing Unmet Needs in Interventional Cardiology

The Clinical Challenge

Real time, dynamic catheter navigation and interaction in free 3D space

Structural Cardiac Procedures

- AV Valve Interventions
- LAAO
- TAVR

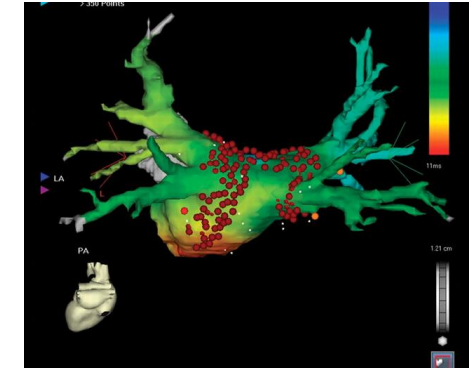
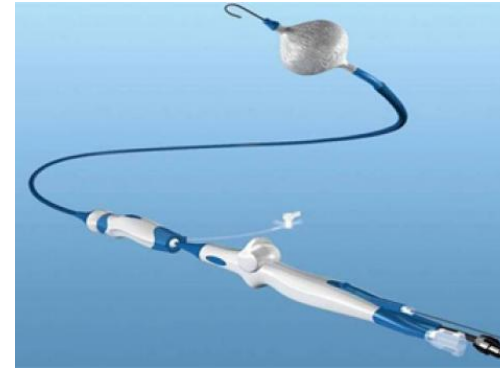


HOLOSCOPE-i Potential Clinical Impact

- Intuitive comprehension of complex 3D structures
- Precise catheter manipulation (e.g. trans-septal puncture)
- Device - tissue interaction (e.g. mitral clip orientation and optimal fixation)
- Procedure duration and success

Electrophysiology Procedures

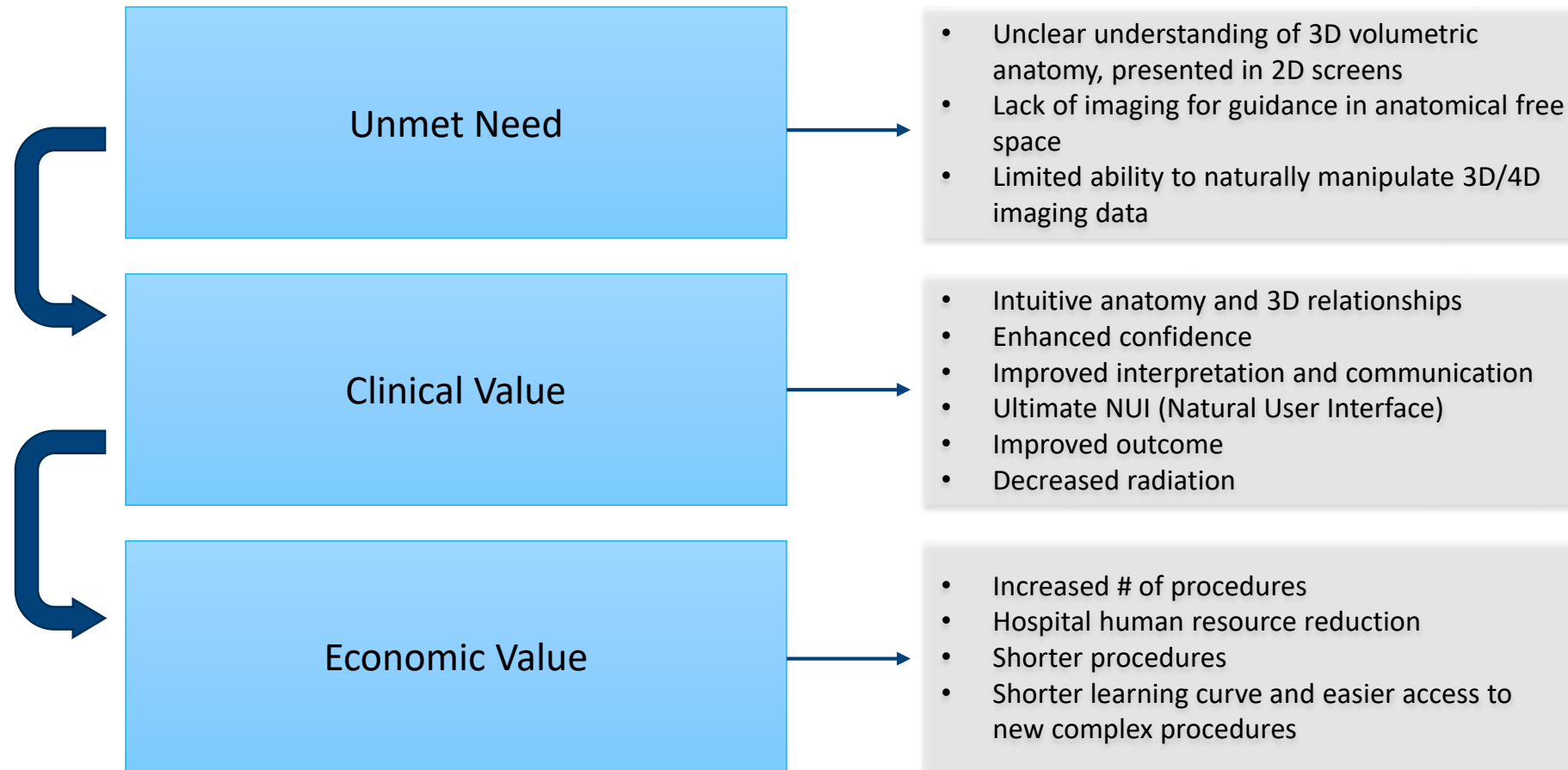
- Atrial Fibrillation
- Atrial Flutter
- Ventricular Tachycardia



HOLOSCOPE-i Potential Clinical Impact

- Intuitive comprehension of 3D electro-anatomical maps
- Precise navigation of the ablation catheter to anatomical / electro-anatomical sites
- Creation of continuous / contiguous ablation lesions
- Procedure duration and success

HOLOSCOPE™*i* - Potential Value Proposition for Interventional Cardiology



Medical Holography™ - First in the World In-Human Clinical Trials



“By teaming up with partners that share our passion for innovation, we have been able to demonstrate the feasibility and potential value of the world’s first holographic visualization technology targeted at guiding minimally invasive cardiac procedures.”

Bert van Meurs, General Manager of Integrated Clinical Solutions, Philips Healthcare

[Link](#) to RealView Imaging - Philips Healthcare Press Release

PHILIPS Global - English

For consumers | For professionals | About Philips

Search

Company Profile
Investor Relations
News Center
News
Speeches and Publications
Webcasts
Media Resources
Media Contacts

Research
Design
Sustainability
Careers
Company Contacts

Philips and RealView Imaging conclude world's first study to evaluate live 3D holographic imaging in interventional cardiology

Tweet 11 Like 101

October 28, 2013 Email Print

Amsterdam, the Netherlands and Yokneam, Israel – Royal Philips (NYSE: PHG, AEX: PHIA) and RealView Imaging Ltd. today announced that they have completed a clinical study that has demonstrated the feasibility of using an innovative live 3D holographic visualization and interaction technology to guide minimally-invasive structural heart disease procedures. In the pilot study that involved eight patients and was conducted in collaboration with the **Schneider Children's Medical Center** in Petach Tikva, Israel, RealView's innovative visualization technology was used to display interactive, real-time 3D holographic images acquired by Philips' interventional X-ray and cardiac ultrasound systems.

In addition to viewing the patient's heart on a 2D screen, doctors in the interventional team were able to view detailed dynamic 3D holographic images of the heart 'floating in free space' during a minimally-invasive structural heart disease procedure, without using special eyewear. The doctors were also able to manipulate the projected 3D heart structures by literally touching the holographic volumes in front of them. The study demonstrated the potential of the technology to enhance the context and guidance of structural heart repairs.

"The holographic projections enabled me to intuitively understand and interrogate the 3D spatial anatomy of the patient's heart, as well as to navigate and appreciate the device-tissue interaction during the procedure," said Dr. Einat Birk, pediatric cardiologist and Director of the Institute of Pediatric Cardiology at Schneider Children's Medical Center.

Follow us
Twitter Facebook LinkedIn YouTube
Global News Center

Philips and RealView Imaging conclude world's first study to evaluate live 3D holographic imaging in interventional cardiology

In the pilot study, clinicians were able to manipulate the projected 3D heart structures by literally touching the holographic volumes in front of them.

+ Download hi-res image (696.71 KB)



Medical Holography™ - Independent Expert Opinion - Roberto M. Lang, MD*



European Heart Journal – Cardiovascular Imaging (2016) 17, 850–851
doi:10.1093/ehjci/ew111

EDITORIAL

The future has arrived. Are we ready?

Karima Addetia and Roberto M. Lang*

Section of Cardiology, Department of Medicine, University of Chicago, 5758 S. Maryland Avenue, MC9067, Chicago, IL 60637, USA

Online publish-ahead-of-print 9 June 2016

There is nothing more powerful as an idea whose time has come....
Victor Hugo

Regrettably, at least according to recent history, the majority of high-impact technological advancements have been made to enable human beings to more effectively wage war against each other. The technology involving air and water travel, communications, as well as nuclear and atomic energy have all advanced during wartime. During times of peace, development of advanced technologies has centred on the entertainment industry to maximize and deepen our leisure-time experiences. But what about technology in health

medical clinical decision-making has been discussed in the literature for over two decades.⁶ In the implementation of holography, described in this paper, the object is the dataset collected with either 3D transoesophageal echocardiography or 3D rotational angiography. The advantage is real-time interaction with an anatomically accurate, volumetric dataset in the setting of a minimally invasive procedure where visualization of the patient's anatomy is otherwise limited. To have the ability of being able to project dynamic holographic cardiac anatomy in this way gives it the aura of a science fiction movie.

3D imaging is routinely used in cardiac catheterization laborator-

*“...The potential of this technology to teach and understand cardiac anatomy in 3D will undoubtedly **revolutionize the guidance of minimally invasive surgical and percutaneous procedures**, which are currently being performed using 2D/3D images displayed on flat screens.”*

*“...The advantage is **real-time interaction with an anatomically accurate, volumetric dataset** in the setting of a minimally invasive procedure....”*

“Bravo to the authors for taking this first important step.”

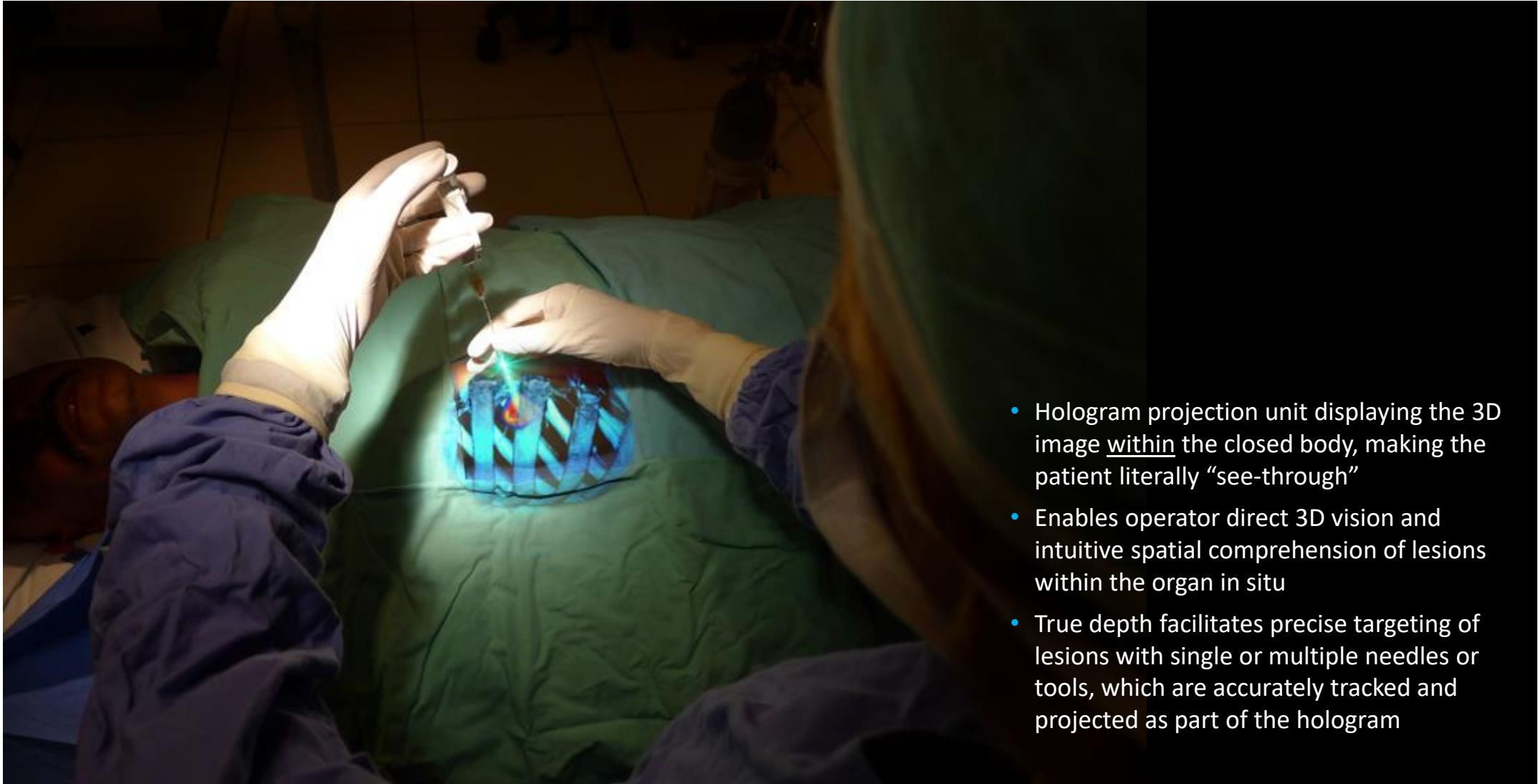
European Heart Journal, June 2016

* Professor of Medicine, Director - Noninvasive Cardiac Imaging Laboratory, University of Chicago.

Internationally renowned cardiologist and specialist in echocardiography; past president of the American Society of Echocardiography. Dr. Lang is a pioneer in the development of three-dimensional echocardiography, a state-of-the-art method to observe heart function.



HOLOSCOPETM for Interventional Oncology (under development)



- Hologram projection unit displaying the 3D image within the closed body, making the patient literally “see-through”
- Enables operator direct 3D vision and intuitive spatial comprehension of lesions within the organ in situ
- True depth facilitates precise targeting of lesions with single or multiple needles or tools, which are accurately tracked and projected as part of the hologram

Conceptual configuration, subject to changes as part of the R&D process - not commercially available

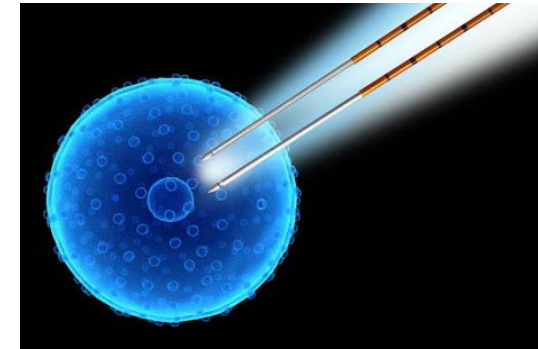
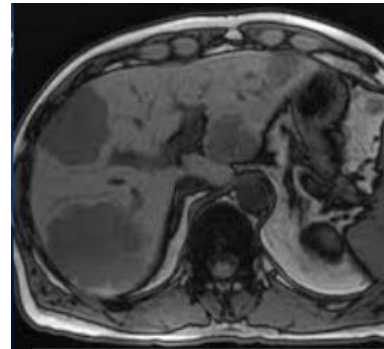
HOLOSCOPETM - Addressing Unmet Needs in Interventional Oncology

The clinical challenge

Real time precise navigation to complex 3D anatomical targets

Interventional Oncology Procedures

- Volumetric Biopsy • Guided Treatments (Radio-frequency, Cryo-therapy, Microwave, electroporation)



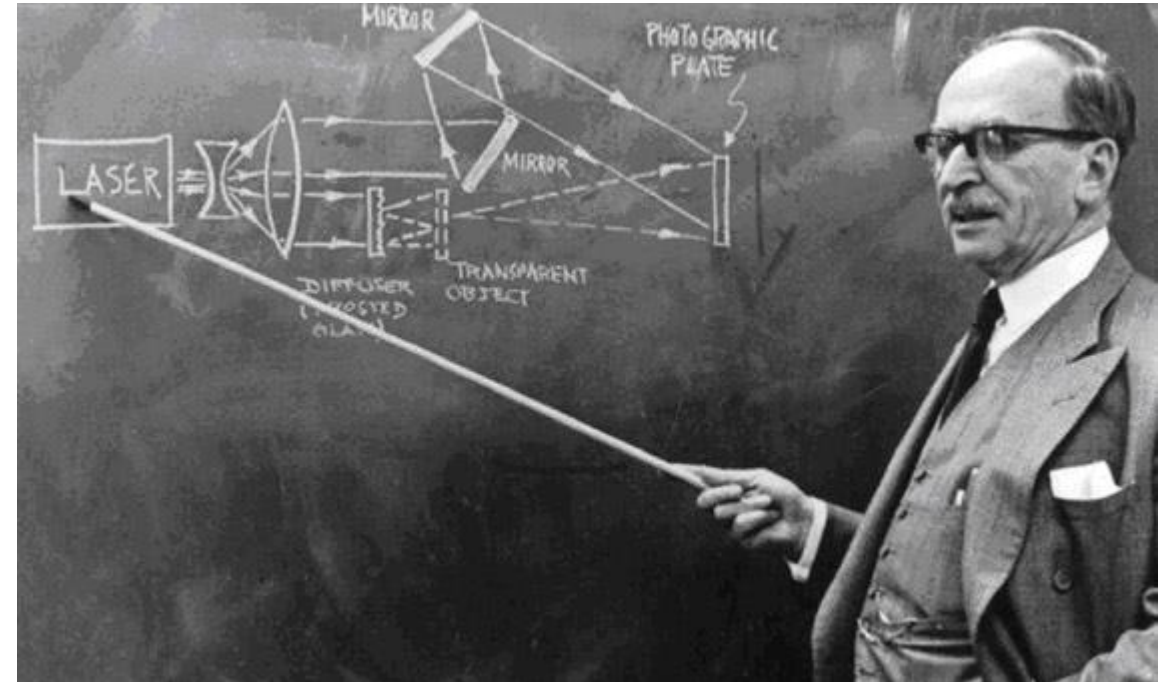
HOLOSCOPE-x Potential Clinical Impact

- Supports the major trend of moving from open surgery to minimally invasive procedures
- Enhanced spatial comprehension of target lesion within the organ in situ
- Improved target tissue ablation
- Reduced collateral damage and complications
- Reduced procedure time and radiation dose
- Improved overall patient outcome

RealView's Proprietary Technology - Digital Light Shaping™

Real-time reconstruction of interference-based 3D volumetric holograms

- The best method known to science to precisely reconstruct and display 3D objects in free space
- Contains all 3D visual depth cues at multiple focal planes
- Provides **optical reality** and not an optical illusion, not “tricking” the eye or the brain in any way



Prof. Dennis Gabor (Nobel Prize Laureate, 1971)
Inventor of Holography

Interactive holography was considered “not reachable in the near future”

Medical Imaging - 3D Visualization and Interaction Technologies

2D monitors



- No true depth perception
- Image control with a 2D mouse
- No direct in-image interaction during interventional procedures
- Long-term use with no side effects
- Standard hardware
- Mature medical grade technology

Stereoscopic screens



- Provides one 2D image per eye
- Single plane depth perception
- 2D mouse or “wand” control
- No direct in-image interaction during interventional procedures
- Long-term use typically causes headache/nausea
- Requires 3D eyewear and a 3D display
- Emerging medical grade technology

Stereoscopic AR



- Re-imaging a 2D display per eye
- Single plane depth perception
- Far-away gesture interaction
- No direct in-image interaction during interventional procedures
- Long-term use typically causes headache/nausea
- Head mounted display
- Consumer grade technology; limited medical use cases

Digital Light Shaping™



- Interference-based holography
- Multi plane depth perception
- Close proximity visualization and touch
- Direct in-image hand interaction during interventional procedures
- Long-term use with no side effects
- Adjustable over-the-head system
- Emerging medical grade technology

Traditional Visualization




3D Illusions

True 3D Visualization

Source: RealView Imaging internal analysis and respective vendor publications



Medical Imaging - 3D Visualization and Interaction: Device Segments

	2D Screen	Stereoscopic Screens 	Stereoscopic AR 	Medical Holography™ 
Core 3D technology	N/A	Stereoscopy	Stereoscopy	Interference based holography
# of concurrent depth planes & location	1 Constant	1 Constant	1 Constant; Far	Up to 50, variable location
System Configuration	2D flat screen display	3D flat screen display	Head mounted 3D Display	Mobile Overhead 3D Holographic System
Technology relevance for cardiac/oncology interventions	+++	-	-	+++
Direct, <u>precise</u> interaction within the Image	✗	✗	✗	✓
Headache-free/long duration use	✗	✗	✗	✓

Source: RealView Imaging internal analysis and respective vendor publications



The Fundamental Limitations of Existing Stereoscopic Solutions

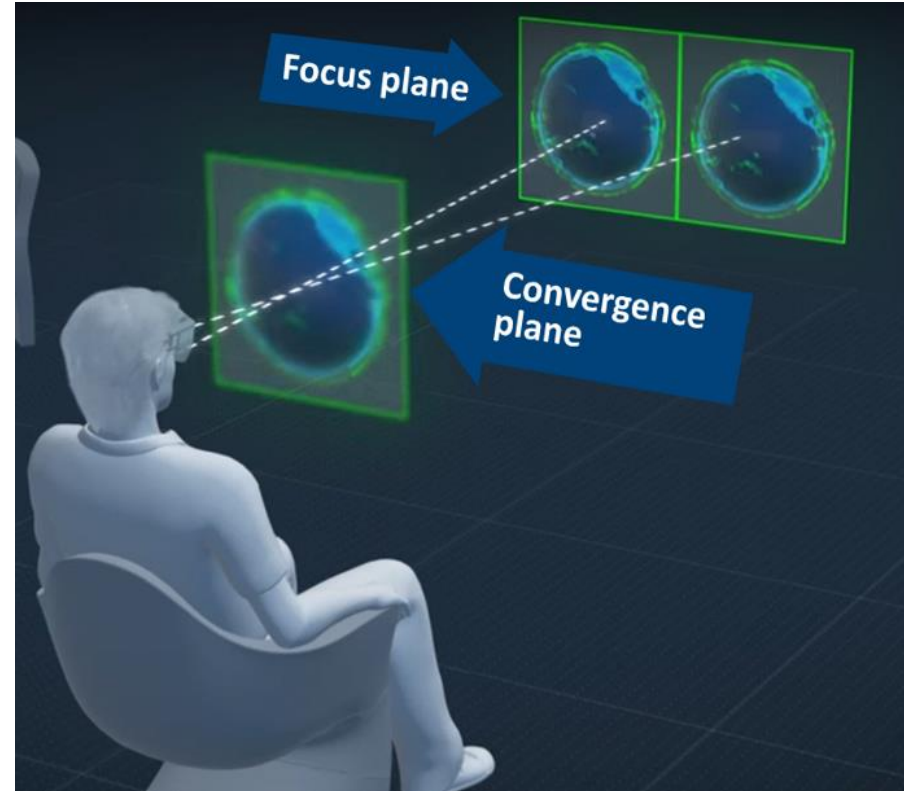
Vergence Accommodation Conflict: all current 3D stereoscopic technologies project a single far-away plane to each eye, creating a 3D illusion with a constant mismatch between the fixed image focus and the dynamic image perceived location

Current Stereoscopic Solutions:

- Provide an illusion of depth perception
- Produce an inaccurate “un-touchable” 3D image
- Support only a short user experience - may give the user a headache with prolonged use



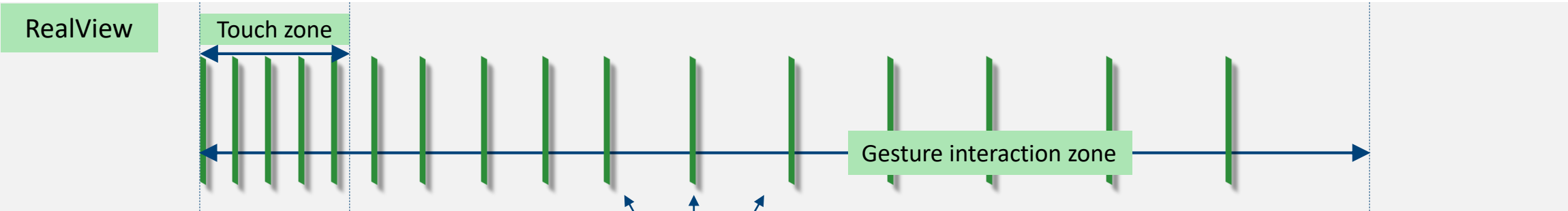
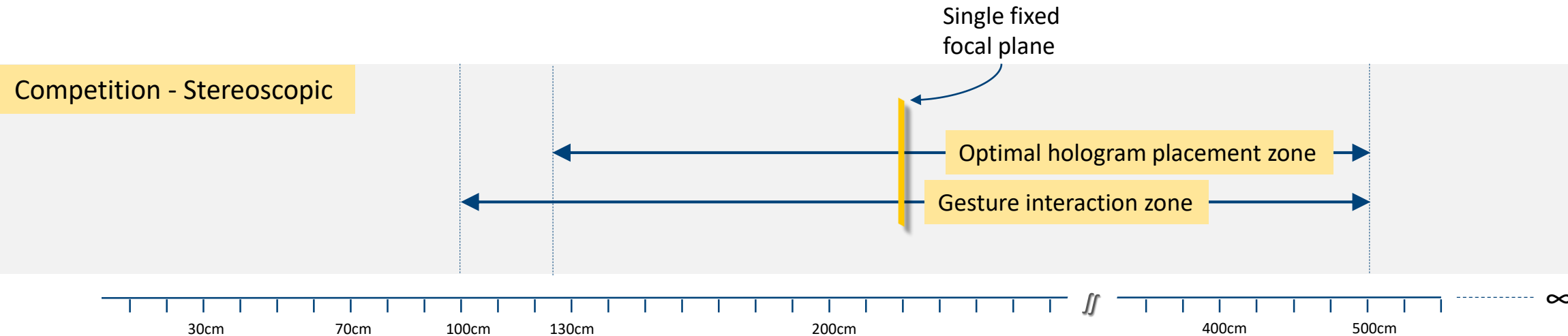
- Are not adequate for most professional applications
- None are appropriate for medical/clinical applications



RealView's Digital Light Shaping™ technology does not carry any of these limitations

Digital Light Shaping™ - a New Interaction Zone: From Gesture to Touch

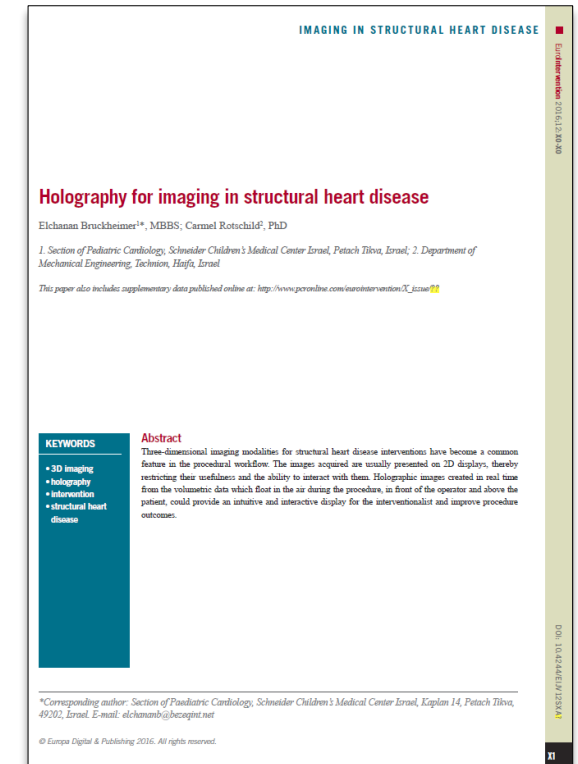
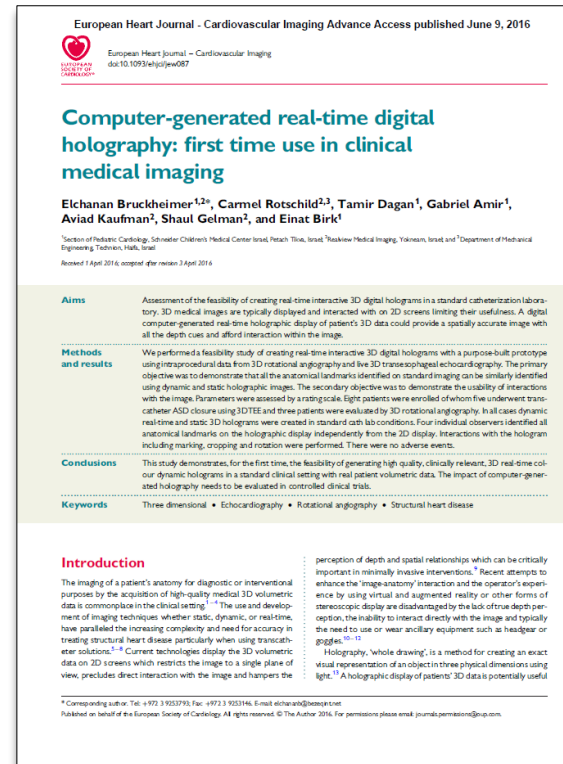
Users' eyes



Multiple dynamic focal planes projected at the same time, providing **retinal depth resolution**



RealView Imaging - Scientific Exposure & Media Coverage



THE WALL STREET JOURNAL.



REUTERS

Mirror



TheMarker

HAARETZ

CBS NEWS



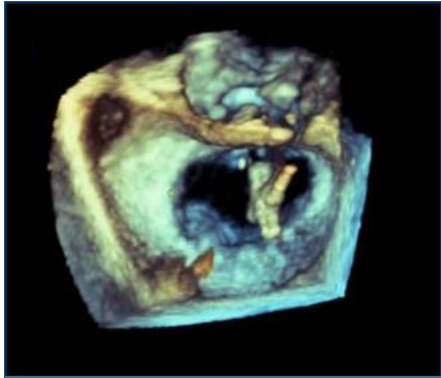
The Washington Post



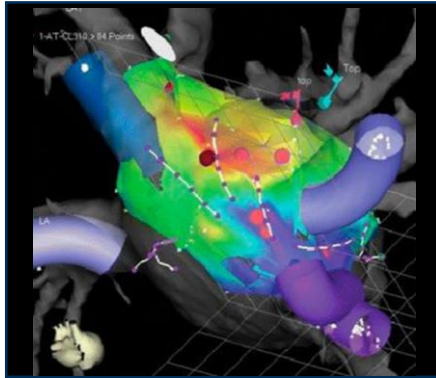
GLOBES ISRAEL'S BUSINESS ARENA



Medical Holography™ - A Continuum of Applications



Structural Cardiology



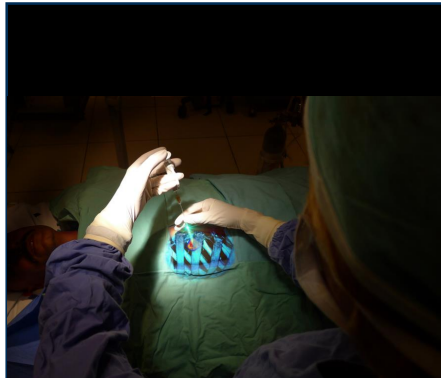
Electrophysiology



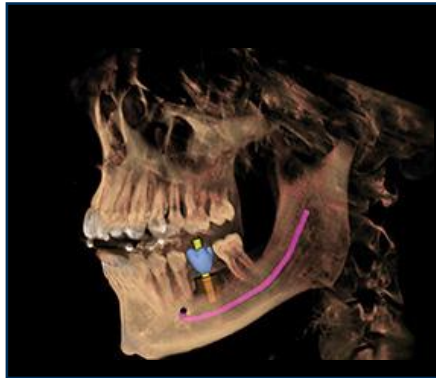
Obstetrics



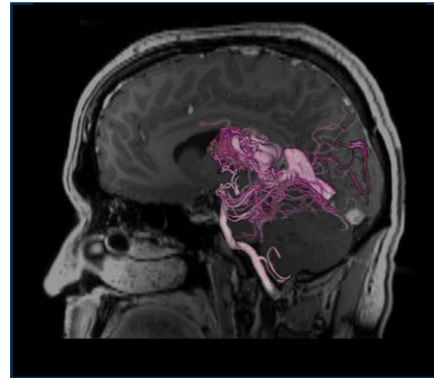
Orthopedic Surgery



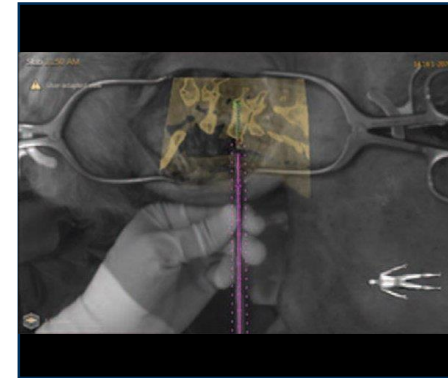
Interventional Oncology



Dental/Maxillofacial surgery



Interventional Neurology

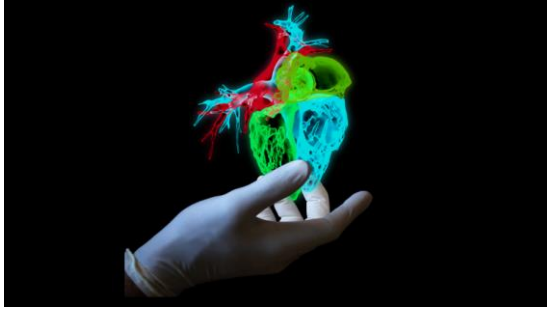


Spine Surgery

Current

Future

RealView Imaging - Links to Audio-Visual Information



First Ever Real Medical Holograms
Targeted for Clinical Settings

[YouTube](#) [youku 优酷](#)



Holographic Experience Testimonial:
Elchanan Bruckheimer, MD

[YouTube](#) [youku 优酷](#)



Holographic Experience Testimonial:
Einat Birk, MD

[YouTube](#) [youku 优酷](#)



Real Holograms Filmed at
RealView's Advanced AR Labs

[YouTube](#) [youku 优酷](#)



TEDMED Talk by Aviad Kaufman,
RealView Imaging CEO

[YouTube](#)



Presentation to Japanese and
Israeli Prime Ministers

[YouTube](#)



THANK YOU!



"The future cannot be predicted, but futures can be invented"

Prof. Dennis Gabor, Inventor of Holography

Legal Notice
© 2018 RealView Imaging Ltd.

*All rights reserved. This Presentation contains proprietary and confidential information of Real View Imaging Ltd. ("**Real View**"). No parts of this Presentation may be copied, changed or reproduced in any form or by any means. Real View grants you permission to use the materials in this Presentation solely for informational, non-commercial use. All estimates and projections contained in this document are based on information that the Company believes to be current and correct. Since these projections necessarily involve subjective judgments and analysis, their validity cannot be guaranteed. The products and configurations presented in this document are not yet commercially available and may be subject to receipt of applicable marketing regulatory approvals. The commercial products may vary. All information relating to Real View's product roadmap is provided solely as a non-binding expression of Real View's present intent and should not be deemed to constitute any form of commitment, promise, or legal obligation to develop or deliver any product, software, hardware, documentation or functionality. This document does not constitute an offer to sell or the solicitation of an offer to buy any security in any jurisdiction. Images, products and other information presented from other companies are for explanation purposes and belong to their respective owners. Real View provides this Presentation on an "as is" basis. Real View makes no warranty, representation or undertaking whether expressed or implied, nor does it assume any legal liability, whether direct or indirect, or responsibility with respect to the accuracy or completeness of any information contained in this Presentation, or for any errors or omissions, or for damages resulting from the use of information contained in this Presentation.*

