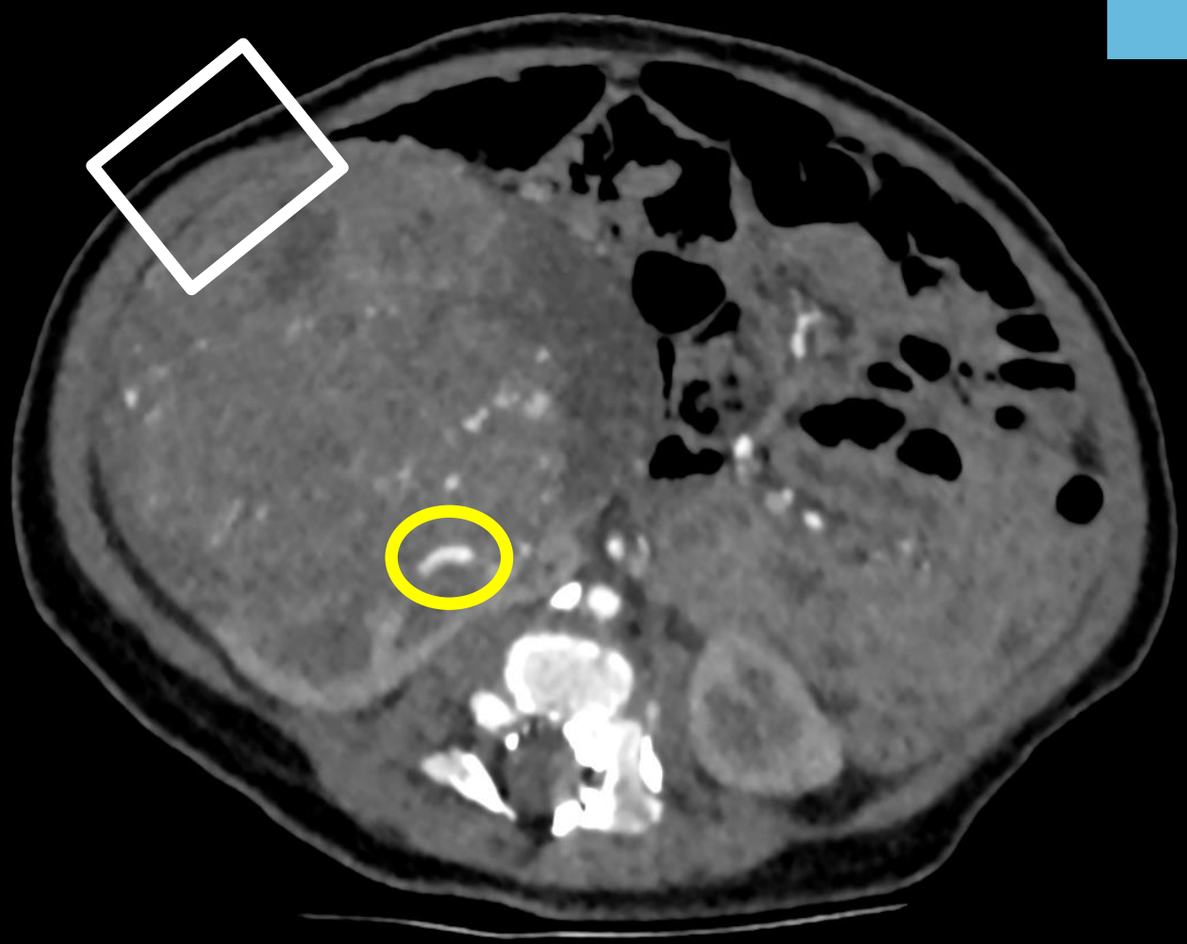
SIRA MEDICAL

Improving Surgical Planning with Augmented Reality

CT SCAN



- Critical anatomy often hidden

REALITY

Did You Know?

>50% of Technical Errors in Surgery are Related to “Unexpected” Anatomy

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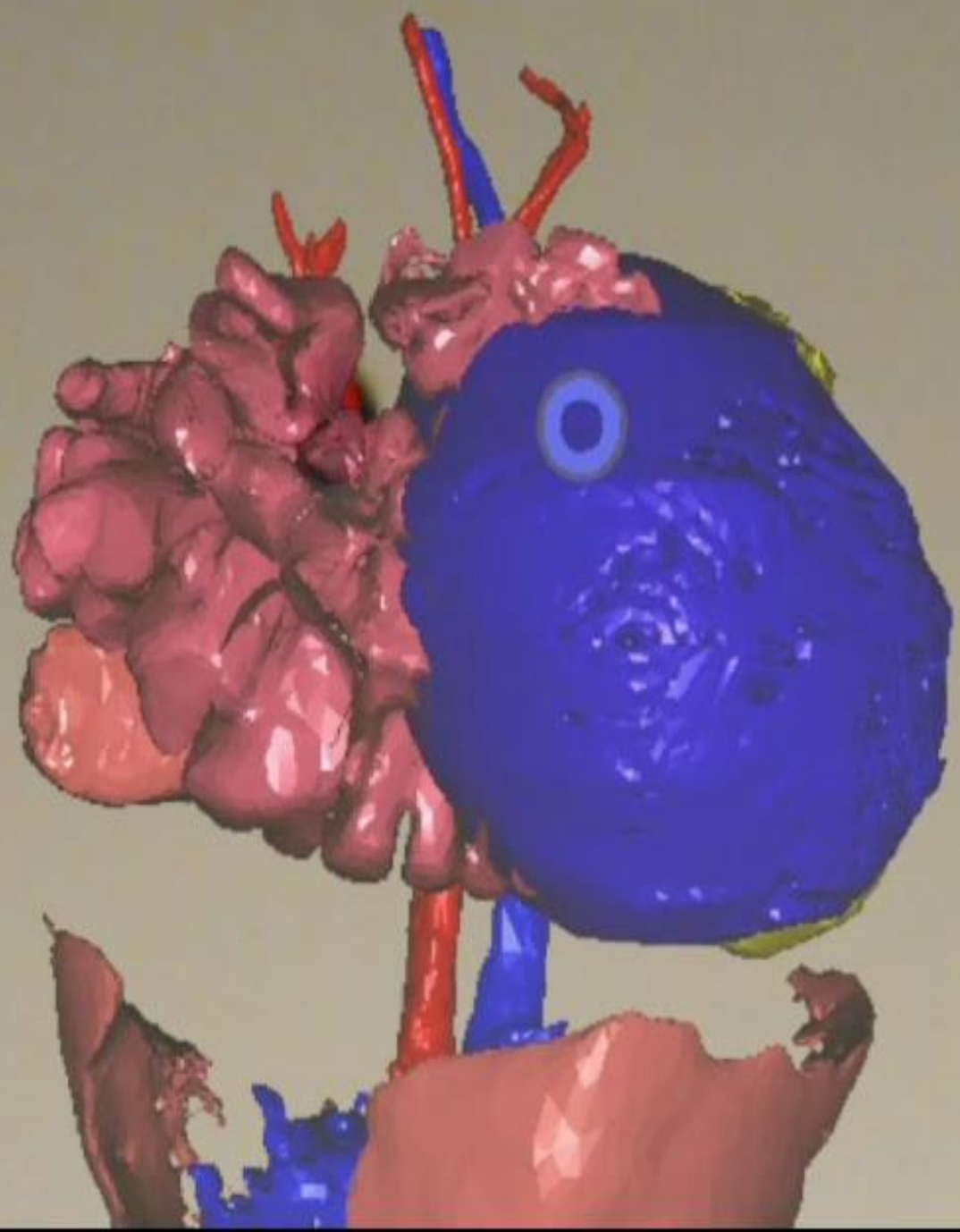
PROBLEM:
THE UNEXPECTED

Conventional imaging **does not provide robust**, **clear or realistic representations** of a patient's anatomy.

Patients	Surgeons	Healthcare Systems
↑ Morbidity/Mortality Longer OR Times Need for Re-operations	Lack of confidence in plan Inaccurate measurements Inefficient image review	Inefficiencies in Staffing/Resources $19.5B/year in Preventable Adverse Events



HOW IT **WORKS**

UPLOAD

CT/MRI: Surgeon specifies model needed, uploads to our secure server

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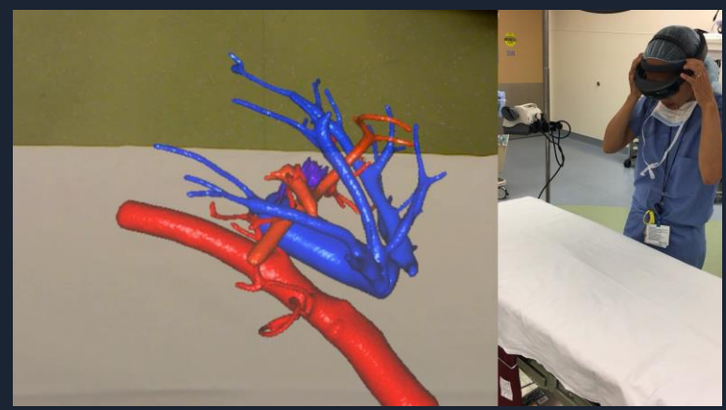
SEE BEYOND

TRANSFORM

CT/MRI images converted to custom hologram



PLAN

Clinician reviews 3D A.R. model with our software

VALUE PROPOSITION:

We help healthcare providers **achieve better patient outcomes** at a **lower cost** while also increasing revenue.

IT ALL **ADDS UP**

COST SAVINGS

- ✓ Accurate placement of implants
- ✓ Better patient-prosthesis match
- ✓ Other Efficiencies

Examples:

Pedicle screws $700MM
Valve replacements $500MM
Elbow fractures $100MM

ADDITIONAL REVENUE

- ▸ 21% time reduction
- ▸ Allows more surgeries
- ▸ O.R. time +90min
- ▸ $27,023 added revenue/OR per day

MARKET OPPORTUNITY

$15.1B

U.S. Diagnostic Imaging 2025

Total available market

$2.7B

AR in Healthcare 2025

Serviceable available market

INITIAL
TARGET MARKETS

EDUCATION

$

DEVICE MANUFACTURERS

$$

PRE-SURGICAL PLANNING

$$$

BUSINESS **MODEL**

Our Service

Tiered subscription, “basic, premium, enterprise”

For Who?

Initially focused on Orthopedics, Cardiology, Neurology, Pediatrics, Oncology and ENT

Who Buys it?

Healthcare providers, training institutions, device manufacturers

ACCURACY & **PRECISION**

Title: Assessing Accuracy and Precision of 3D Augmented Reality Holographic Models Derived From DICOM Data

CT Phantom Study:
"Holograms match Gold standard"[1]

Evaluating the Performance of Augmented Reality in Displaying MRI-Derived 3D Holographic Models

MRI Phantom Study:
"No difference between Gold Standard and Holographic Measurements"[2]

Journal of Pediatric Orthopedics
Assessing the Value of Novel Augmented Reality Application for Pre-Surgical Planning in Adolescent Elbow Fractures
--Manuscript Draft--

Elbow Fracture study (60 observations)[3]:
Models rated "highly accurate"
Major improvement in confidence in surgical plan and hardware fit

1.Uribe, et al. Oral Abstract no.1210, ARRS 2018 meeting, submitted to Journal of Medical Physics 2. Chang, et al accepted ARRS 2019 meeting, submitted to Acta Radiologica Open 3. Courtier, et al: UCSF Catalyst-funded review, Accepted, Oral Presentation European Society of Pediatric Radiology 2019

INTELLECTUAL: **PROPERTY**

- **Proprietary method of model creation.**
- Protocols specific to model optimization.
- Advanced hardware visualization.
- 4D Flow, DTI & animation.
- Radiologist-specific detail.
- Gold-standard model accuracy & precision.

- **Curated database of segmented models.**
- Data gathering future best practices.
- Radiologist approved models (Radlex ® lexicon).
- Proprietary algorithms for image processing.

RESEARCH **SITES**

UCSF

ZUCKERBERG SAN FRANCISCO GENERAL Hospital and Trauma Center

UCDAVIS

USC University of Southern California

FOOTHILL COLLEGE

CORPORATE **PARTNERS**

NTT docomo 5G

Microsoft Partner

TRANSLATIONAL **PROGRAMS**

UCSF Innovation Ventures

CTIP

Microsoft For Startups

500 startups

MEET **THE TEAM**

Jesse Courtier, MD
Founder

UCSF Associate Professor of Radiology

Rick Beberman, MBA
CEO
Co-Founder

Digital Health Expert, Venture Capitalist, Entrepreneur

Ben Laguna, MD
Chief Medical Officer
Co-Founder

AR/VR expert, UCSF Radiology Fellow, Penn Med, Princeton

Dustin Boyle
Developer

VR/AR developer, Previously at Sony

OUR **ADVISORS**

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Advisor

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Surgeon-In-Chief
UCSF Benioff Children's Hospital

Karen Ordovas, MD
Advisor

Director of Cardiac Imaging, UCSF

Past President – Society for Cardiovascular Imaging

Sean Ong
Advisor

Expert in Augmented Reality and Computer Vision

Author of "Beginning Windows Mixed Reality Programming"

AWARD WINNING
TECHNOLOGY

WINNER
Two time Catalyst Award in Digital Health

FINALIST
2018 SXSW Interactive Innovation Awards

FINALIST
2019 ACC.19 Innovation Challenge

FINALIST
Medical Capital Innovation Competition

FINALIST
Health 2.0 VentureConnect Competition

Safer, more efficient surgery with Augmented Reality

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APPENDIX

OPERATION PLANNING

SURGEON:

- Clearer and Relevant Imaging
- More Efficient Image Review
- ↑ Confidence In Plan
- Accurate Measurements
- Better Hardware Sizing
- No Change to Workflow

SCHEDULING & SETUP

HOSPITAL:

- ↑ Throughput
- ↓ Instrument Variability
- Better Use of Surgical Supplies
- Efficiencies in OR Staffing

OPERATION PERFORMANCE

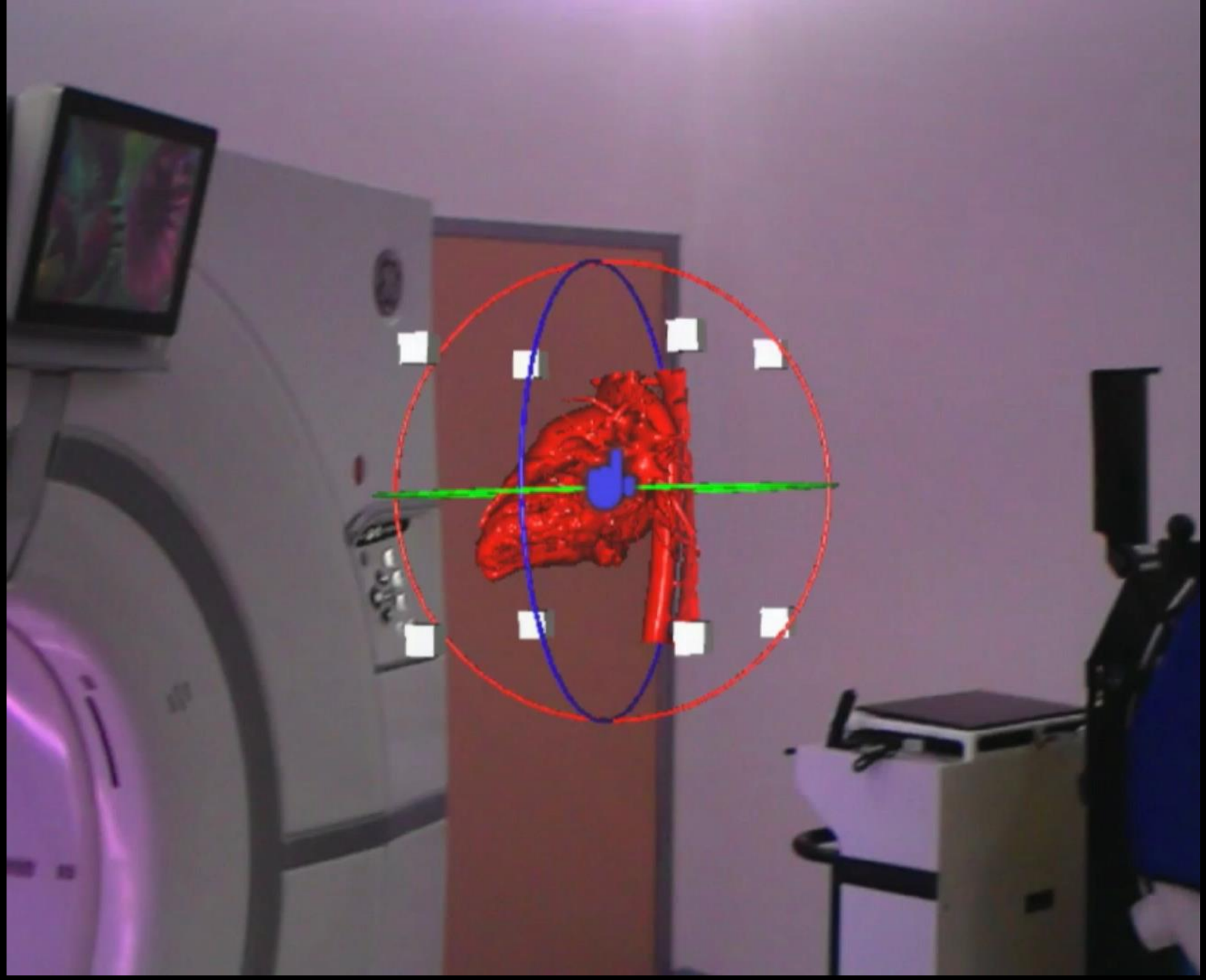
SURGEON + HOSPITAL:

- ↓ Unanticipated anatomy variants
- ↓ Complications
- Data Library For Future Cases
- Higher Quality Scores

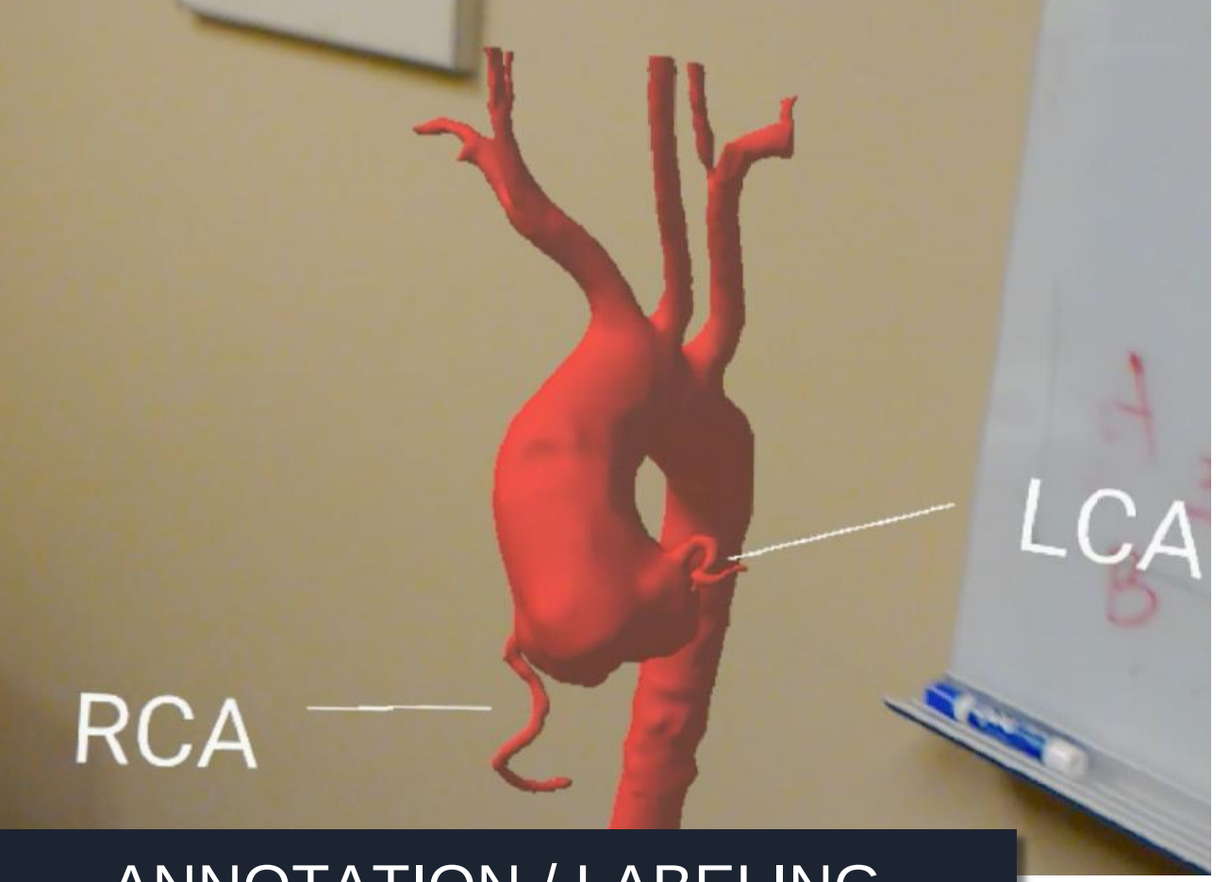
FUTURE PRODUCT

DEVELOPMENT

ML PIPELINE- DATA ANALYTICS, IMAGE PROCESSING



ANIMATION



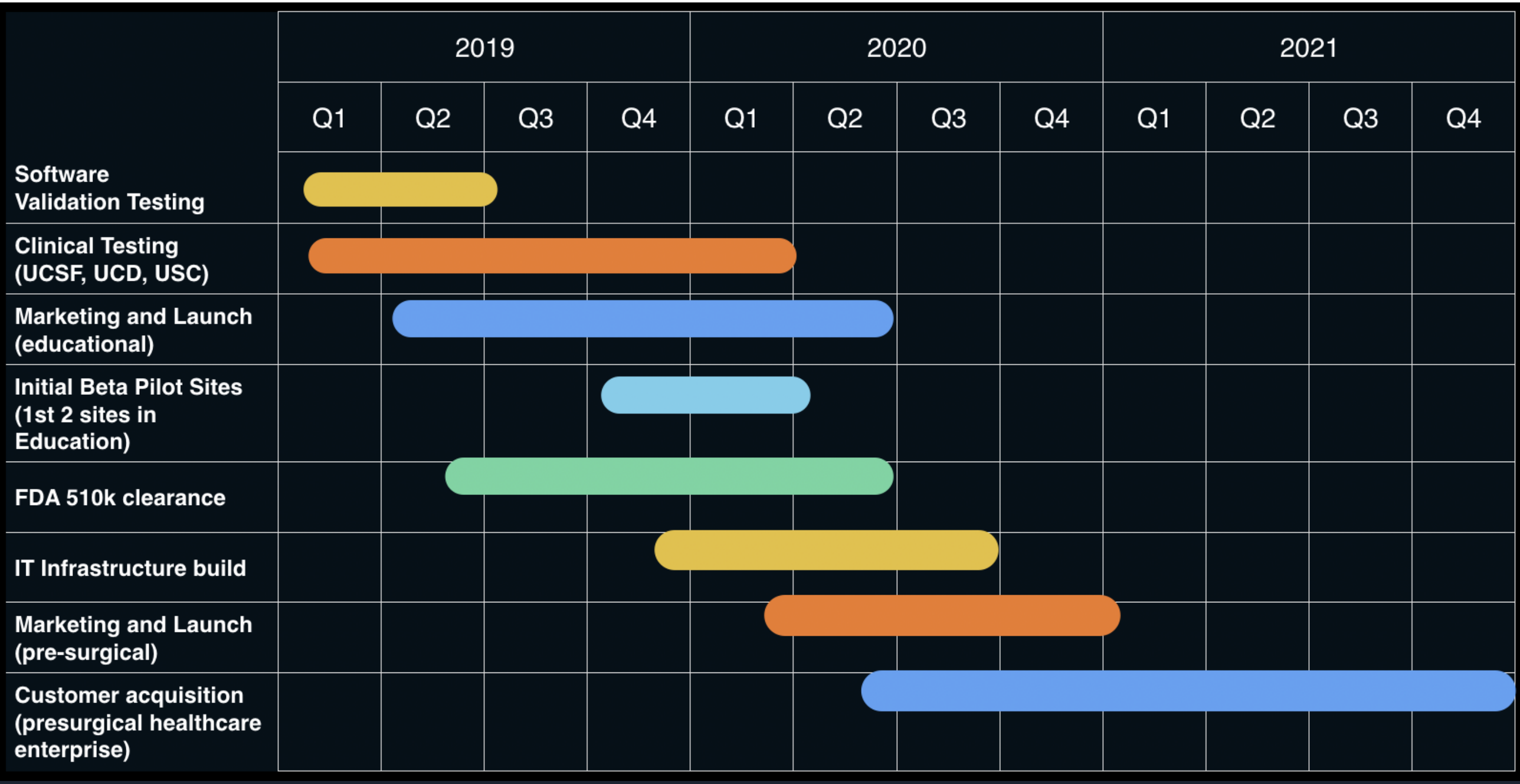
ANNOTATION / LABELING

MOBILE “SPECTATOR VIEW”

… AND **MORE**

- Object manipulation
- Measurement toolsets
- Haptic feedback elements

OUR DEVELOPMENT
TIMELINE



PILOT STUDY : **UCSF**

- Retrospective study – complex elbow fractures – 60 observations
- Impact on:
  - Confidence in surgical planning (high)
  - Hardware selection and fit (increased)
  - Intra-operative time saving (projected at 20%)
  - Quality of models (high)

“Would change how I’d approach; looking at this makes it more likely I’d have recognized need for bone grafting”

“Improves confidence in treatment plan”

“Based on CT would have done CT and gone posterior; based on model would have gone anterior and used some absorbable fixation”

“Complex intra-articular with a bad CT, [this] gives you more info on how it will fit together, relationships of fragments”

“Know what to look for for retractor positioning, incision location”

CUSTOMER VALIDATION

- What makes for a successful surgery?
  - ✓ "Having the expected outcome, having the surgery go as planned"
- How do you think imaging can be improved?
  - ✓ "Challenges with 2D image conversion to real patient; current preop imaging gives me a sense, but different when I'm in the OR"
- What are some of the factors that lead to longer surgery time?
  - ✓ "Unclear anatomy is #1" "Unexpected findings" "Surgery is different from what you expected"
- What's the biggest challenge with respect to pre-surgical planning?
  - ✓ "Time to review imaging in depth" "It is time intensive"

REGULATORY **PATHWAY**

- Standard: 510 (k) Class II medical device
- Level of concern: Minor, tool claim
- Pathway: Substantial Equivalence, predicate devices identified
- Initial assessments undertaken by USC and Battelle
- Software verification currently underway by Battelle
- Software validation to commence
- Assessments by USC Regulatory Science and Battelle available for review

PLATFORM
DEVELOPMENT

Product Development	Target Specialties	Market Development
Animation	Orthopedics	Pre-surgical planning
ML Pipeline	Cardiology	Education
Virtual cuts	Neurology	Medical device
Annotation	Pediatrics	OR decision support/analytics
Haptics	ENT	Administrative planning
Predictive outcomes	Transplant	Remote consultation
Custom toolsets	Oncology	Reference

OUR PACKAGES

BASIC

$/Month

- 5 seats
- 20 models per month

PREMIUM

$$/Month

- 7 seats
- 30 models per month

ENTERPRISE

$$$/Month

- 10 seats
- 40 models per month

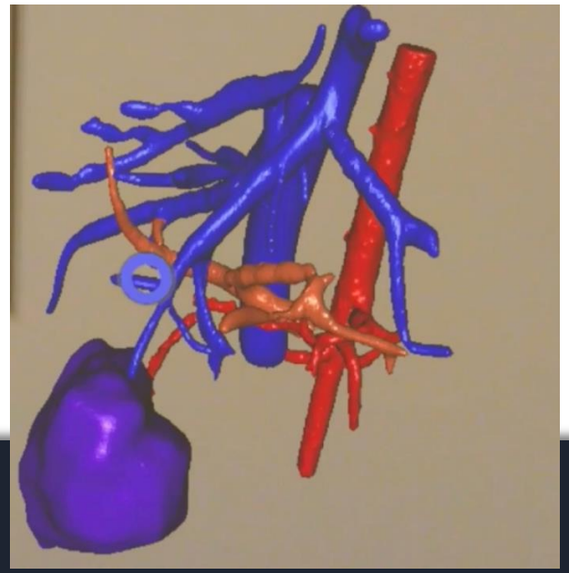
WHY
AUGMENTED REALITY?

- **Augmented Reality**
  - Collaborative
    (read each other's faces)
  - Real-world background
  - Interact with real objects

VS

- **Virtual Reality**
  - "Digital blindfold",
    limited interaction
  - Simulated background
  - Simulated objects
  - Nausea

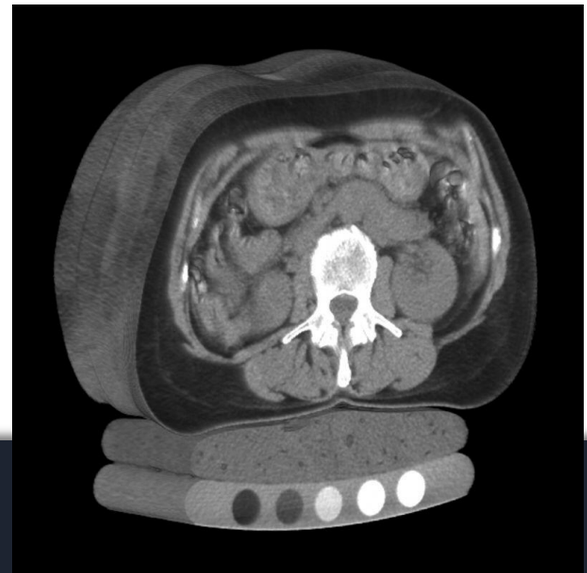
ADVANTAGES OF **SURFACE RECONSTRUCTION**



Surface Based Reconstruction

- Layers can be segmented separately and tailored to end user needs.
- Less-computationally demanding
- Easier to obtain 3D measurements, including angles, volumes, and manipulate objects in relation to each other

VS



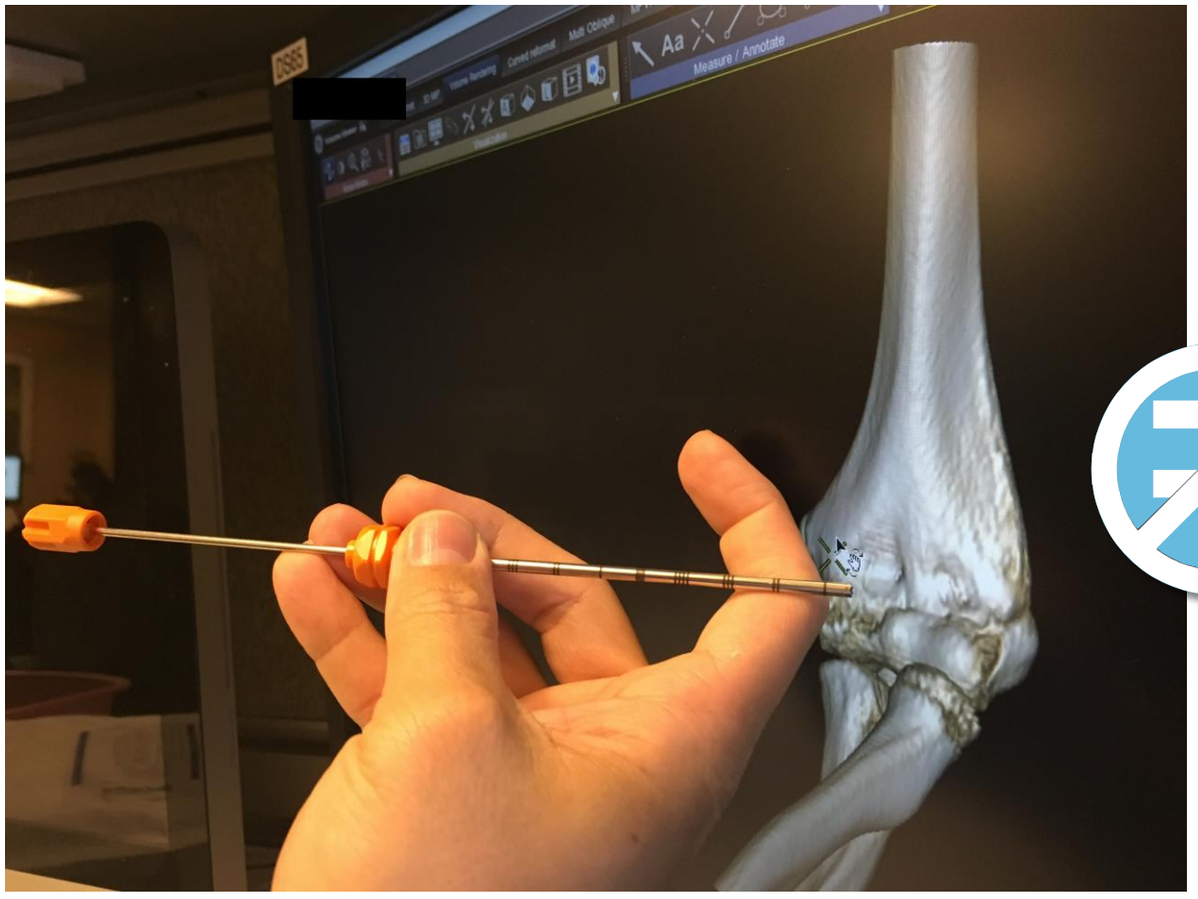
Volume Based Reconstruction

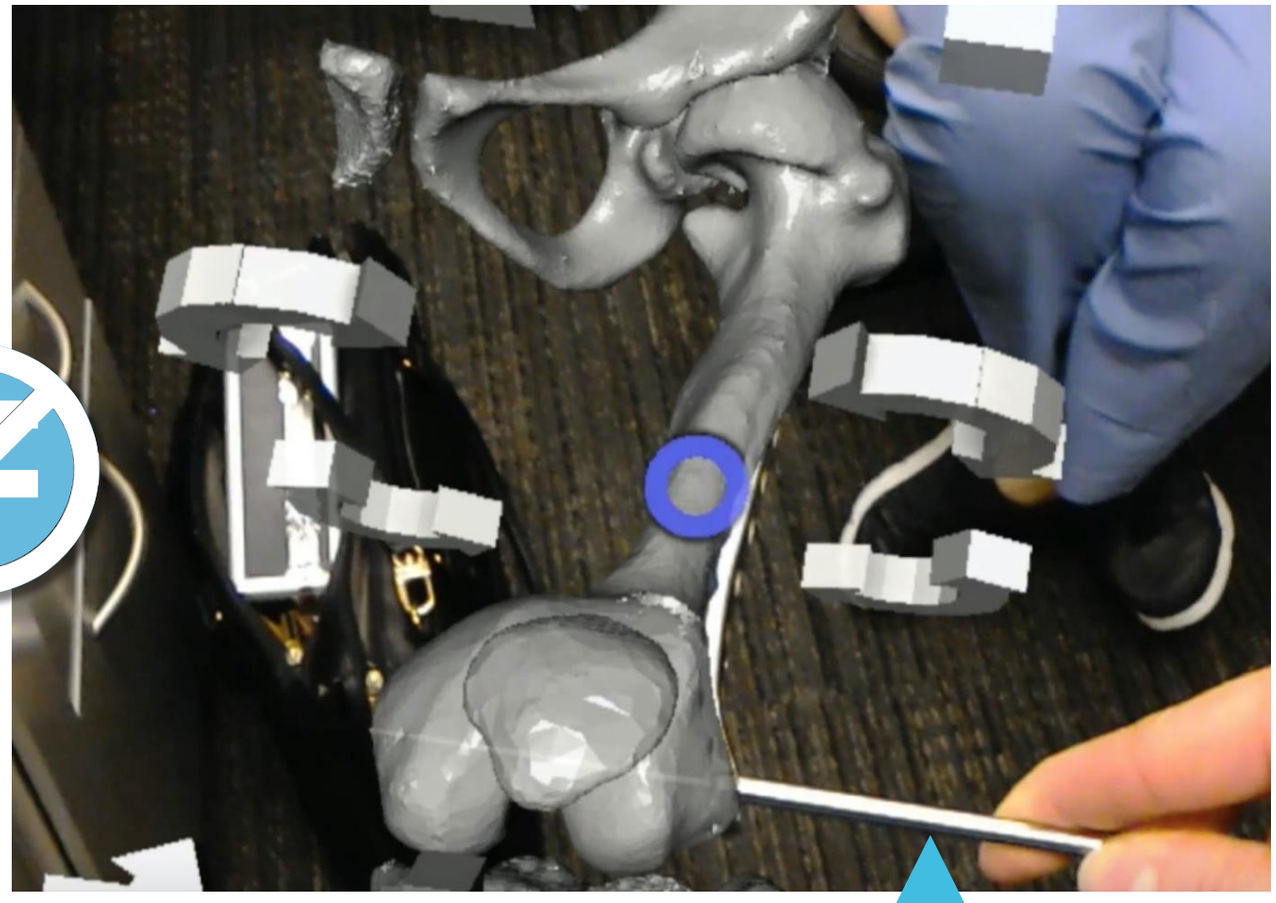
- Computationally demanding
- Only slabs of information are visualized, without segmented information, limiting utility.
- Relevant anatomy difficult to distinguish

ECONOMIC & **OTHER ADVANTAGES**

PRE-OPERATIVE	INTRA-OPERATIVE
No hidden anatomy	Hidden anatomy discovered w/patient under anesthesia
Advance plan	Plan on the fly
Optimal staffing determined in advance	Optimal staffing estimated
Optimal supply needs determined in advance	Optimal supply needs estimated
Surgery time determined in advance	Surgery time estimated
Implant size determined in advance	Implant size determined on the fly
Model segmentation in advance	Model segmentation during surgery
Much higher image resolution	Lower resolution
No change to workflow / lower barriers	Change to workflow / high barriers

“3D” ON A 2D MONITOR:
NO REAL WORLD INTERACTION





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TESTING ACTUAL HARDWARE FIT

WORKFLOW

DICOM TO CLOUD

SIRA MODEL CREATION

MODEL BACK TO CLOUD

LOCAL DOWNLOAD