# International Symposium on Advanced Technology and 3D Printing in Orthopaedics

# New Development of Surgeon Oriented 3D Surgical Planning System

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Hospital Authority

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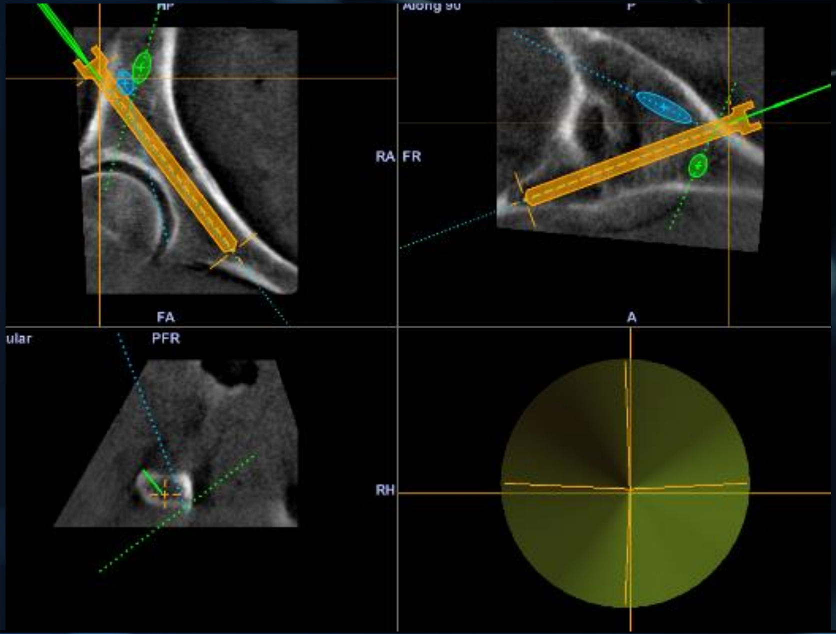
# Content

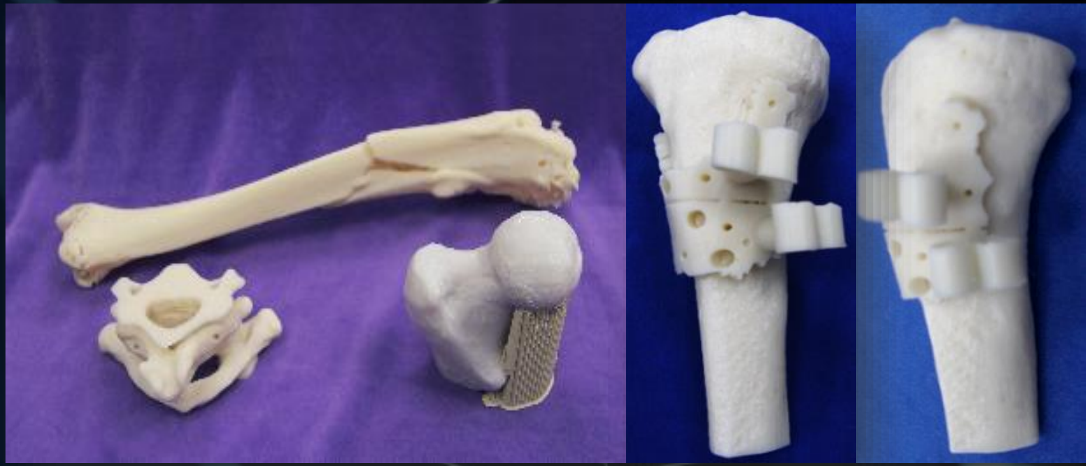
# Computer Assisted Orthopaedic Surgery (CAOS) Lab

- Established in 2001
- First Orthopaedic Navigation R&D Lab in Hong Kong
  - Stryker navigation system
  - BrainLab navigation system



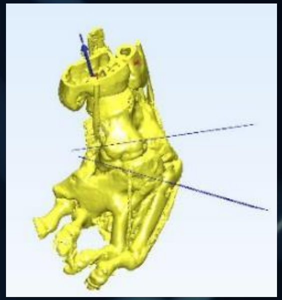
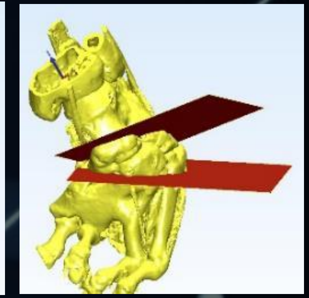
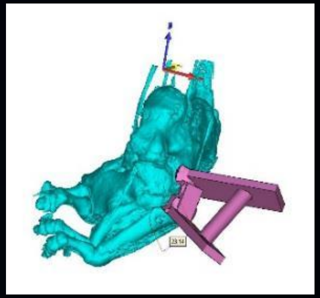
# Computer Assisted Orthopaedic Surgery (CAOS) Lab

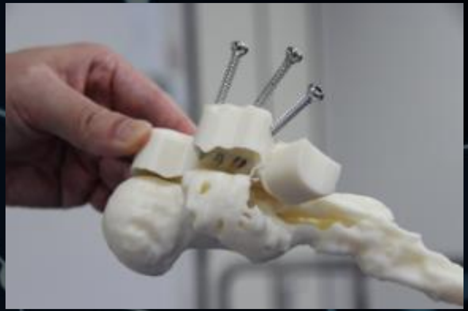
- Industrial grade 3D printer (2013)
  - Plastic
  - Biocompatible materials
  - Sterilizable
- Medical 3D printing Software
  - Mimics
  - Osirix
- 3D scanner
- → 3D printing applications

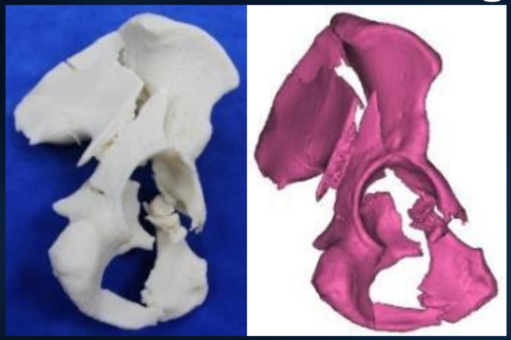


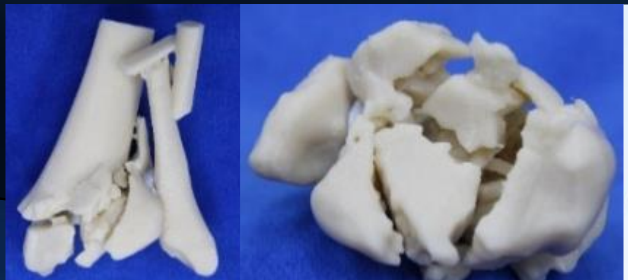
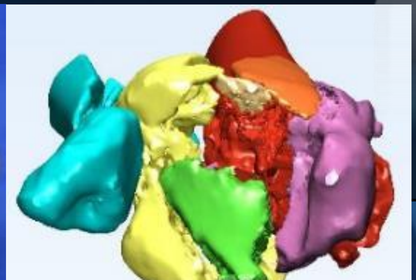
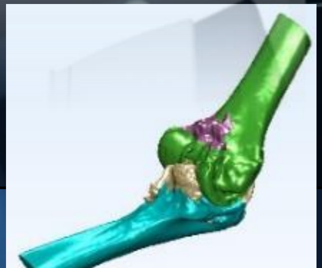
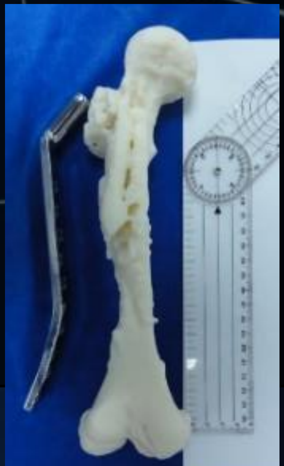
# 3D Printing Applications in CUHK-ORT

- >500 cases
- Bone model printing
- Preoperative planning
- Patient specific instrument
- Implant / Prosthesis design

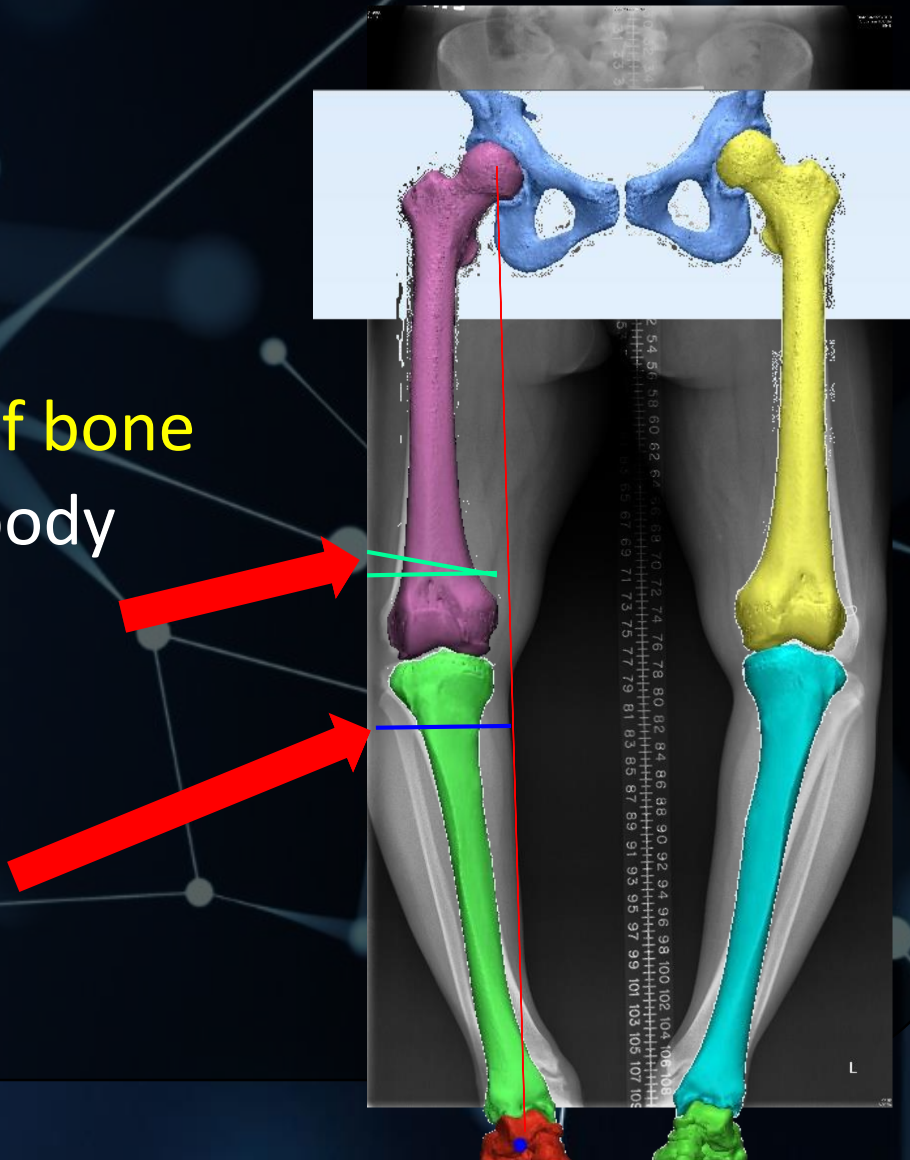




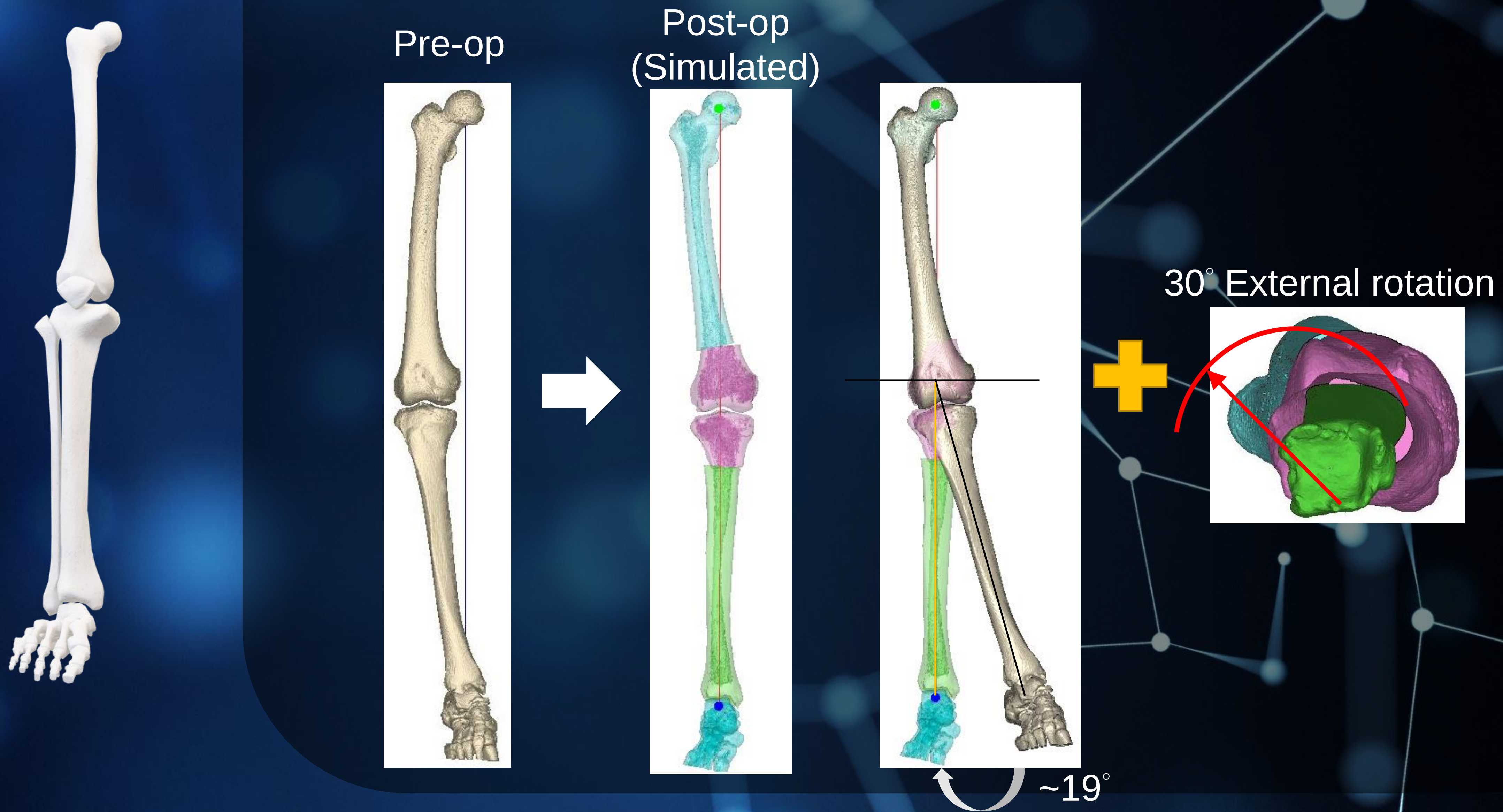





# Application of Patient Specific Instruments (PSI)

- Most helpful application
- Osteotomies
  - Complicated surgery
  - Precise bone cut + accurate reposition of bone
  - Can be done in almost all bones in our body
- Precise surgery planning
  - Multiple cuts
  - Realignments

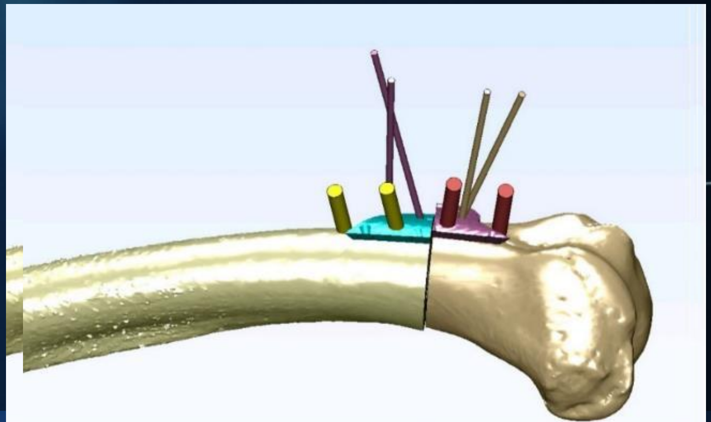


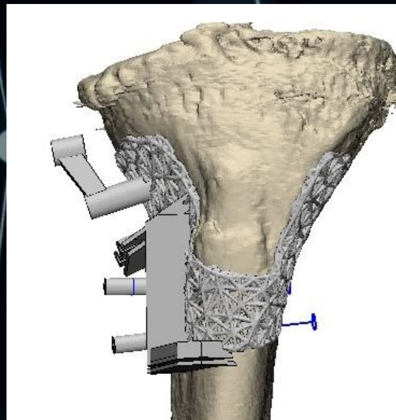
# 3D pre-operative surgical planning



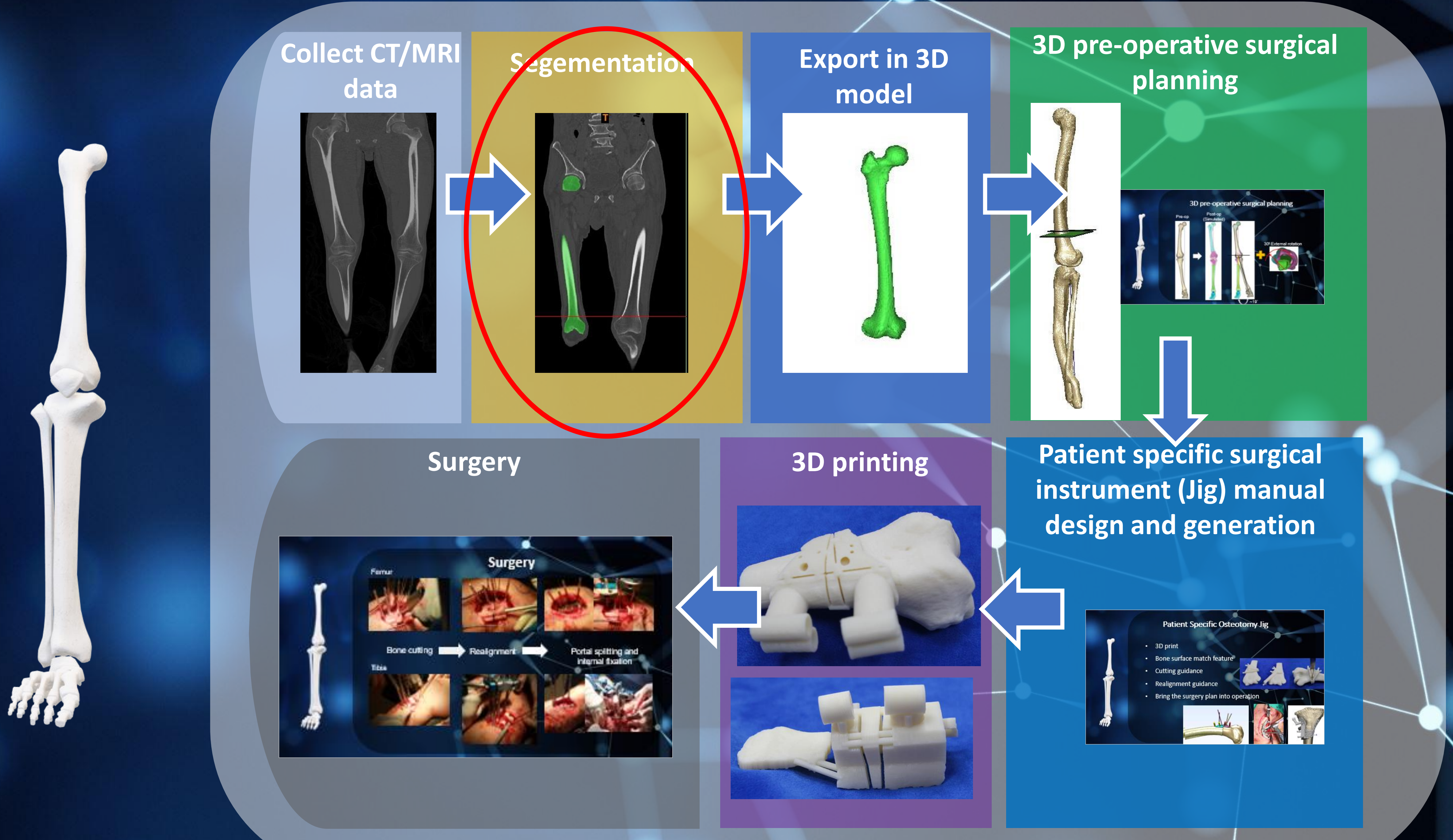
# Patient Specific Osteotomy Jig

- 3D print
- Bone surface match feature
- Cutting guidance
- Realignment guidance
- Bring the surgery plan into operation



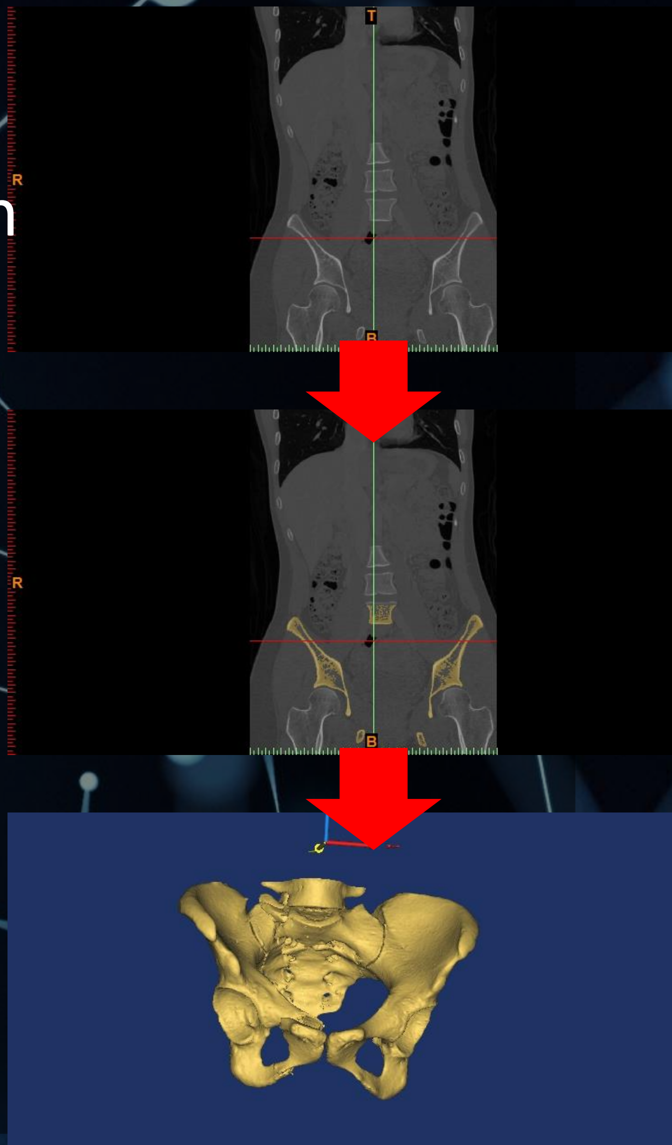


# 3D Printing Assisted Surgery Workflow



# Segmentation

1. Manual selection of anatomical region
2. Multiple slides
3. 3D reconstruction



# Content

1. Background
2. Current limitations
3. Highlights

# Application of PSI in Orthopaedic Surgery

- **Improve surgery accuracy**
- **Reduced surgery time**


**But…**

- **Long preoperative planning time**

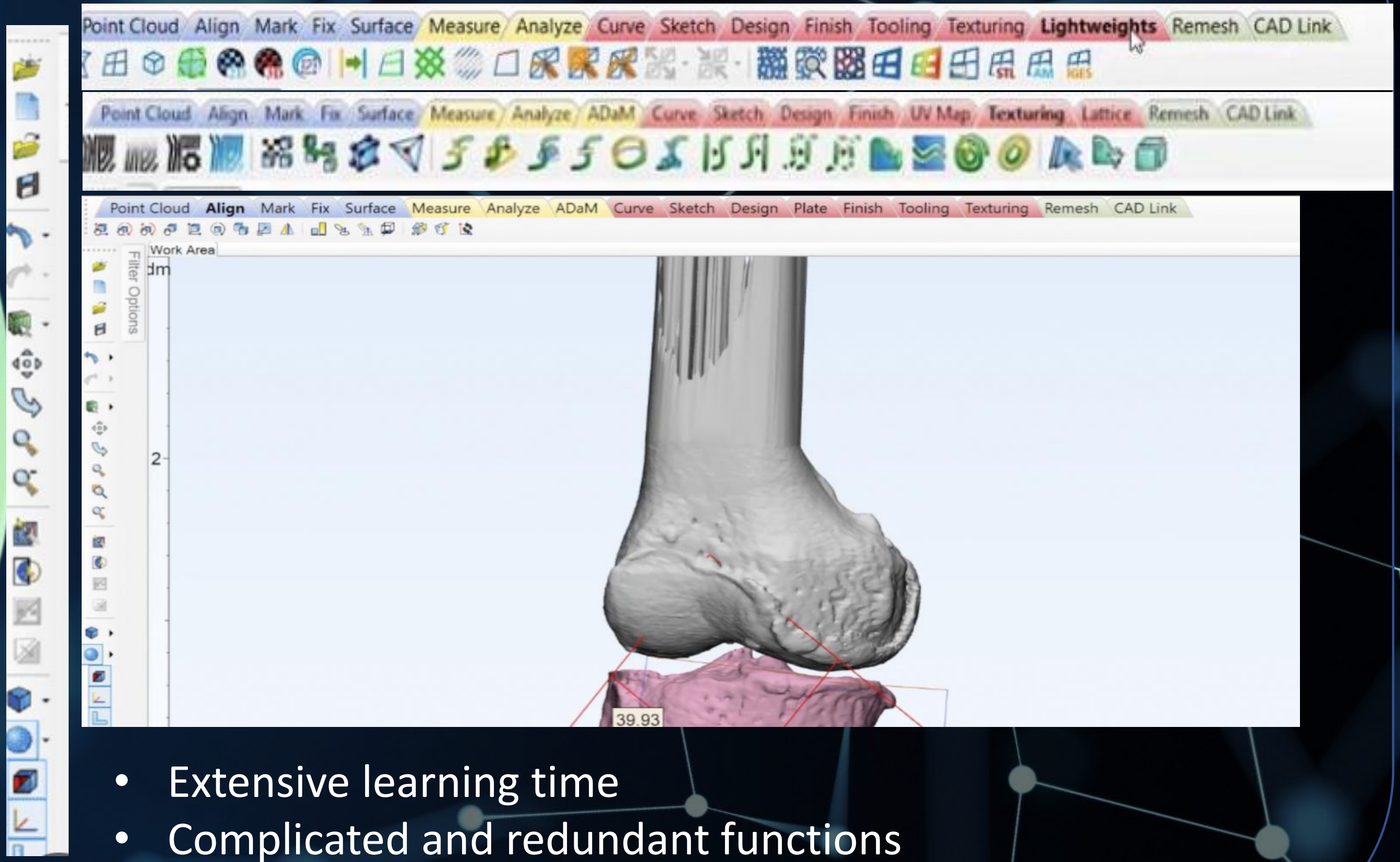
## 3D Printing Assisted Surgery (limitations)

### Time Burdens

- Software learning time
- Unnecessary Complicated design procedures
- Long Segmentation time
- Exhaustive time spend between parties

## 3D Printing Assisted Surgery (limitations)

# Software learning time




- Extensive learning time
- Complicated and redundant functions

3D Printing Assisted Surgery (limitations)

## Time Burdens

- Software learning time
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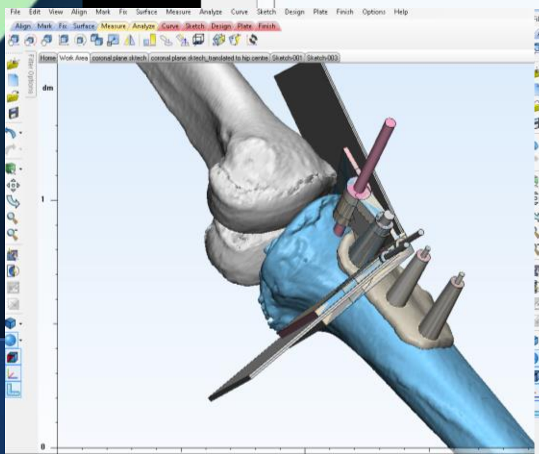
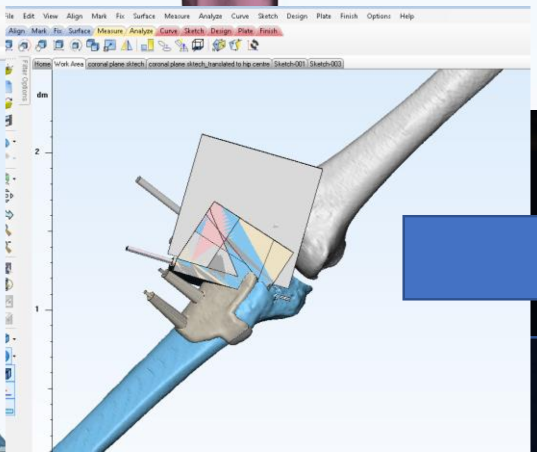
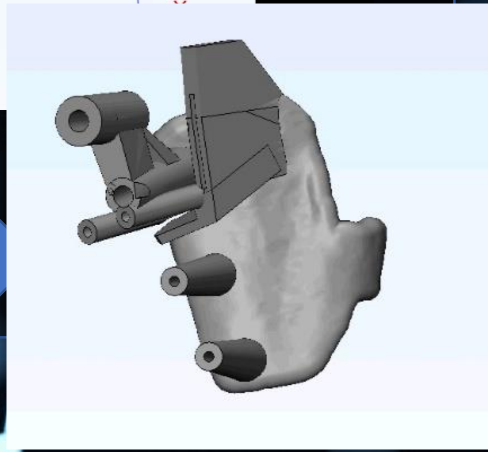
# 3D Printing Assisted Surgery (limitations)

## Unnecessary complicated design procedures





3D Printing Assisted Surgery (limitations)

## Time Burdens

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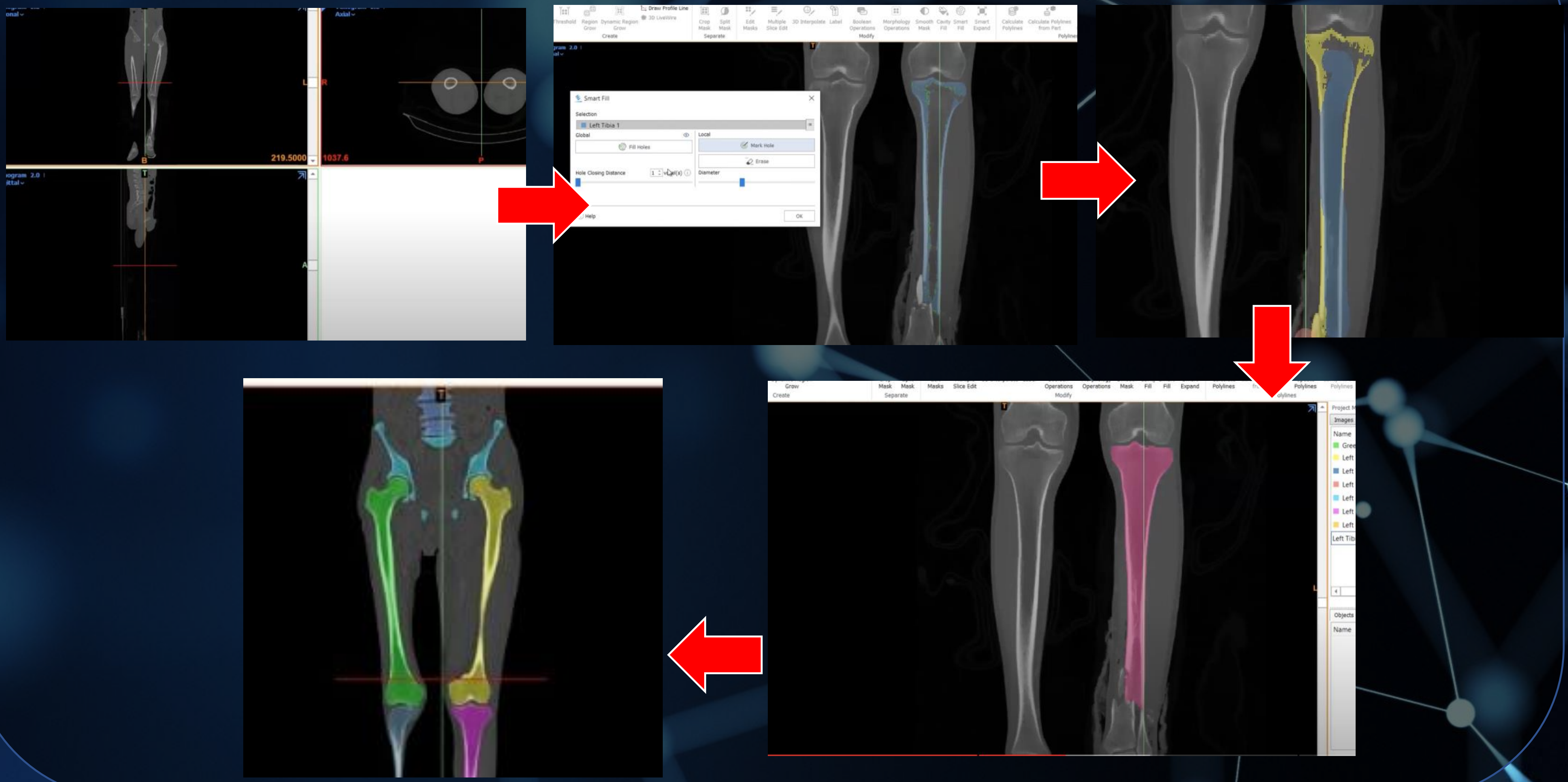
# Long segmentation time



**3D Printing Assisted Surgery (limitations)**

**Time Burdens**

- Software learning time
- Unnecessary Complicated design procedures
- Long Segmentation time
- Exhaustive time spend between parties

# 3D Printing Assisted Surgery (limitations)

## Exhaustive time spend between parties

CT-image

Discussion

Segmented

# Content

1. Project Background
2. Current limitations

## 3. Highlights

Designed by Surgeons
Used by Surgeons

# Innovation

- Revolutionise pre-operative and post-operative surgery in osteoto
- Advancement in accuracy and time using advanced algorithm
- Surgery oriented function and modules
- AI assisted segmentation and jig generation


# Cloud-base

- Compatible to tablet and mobile
- Access from any secure devices

# Commercial Planning Software

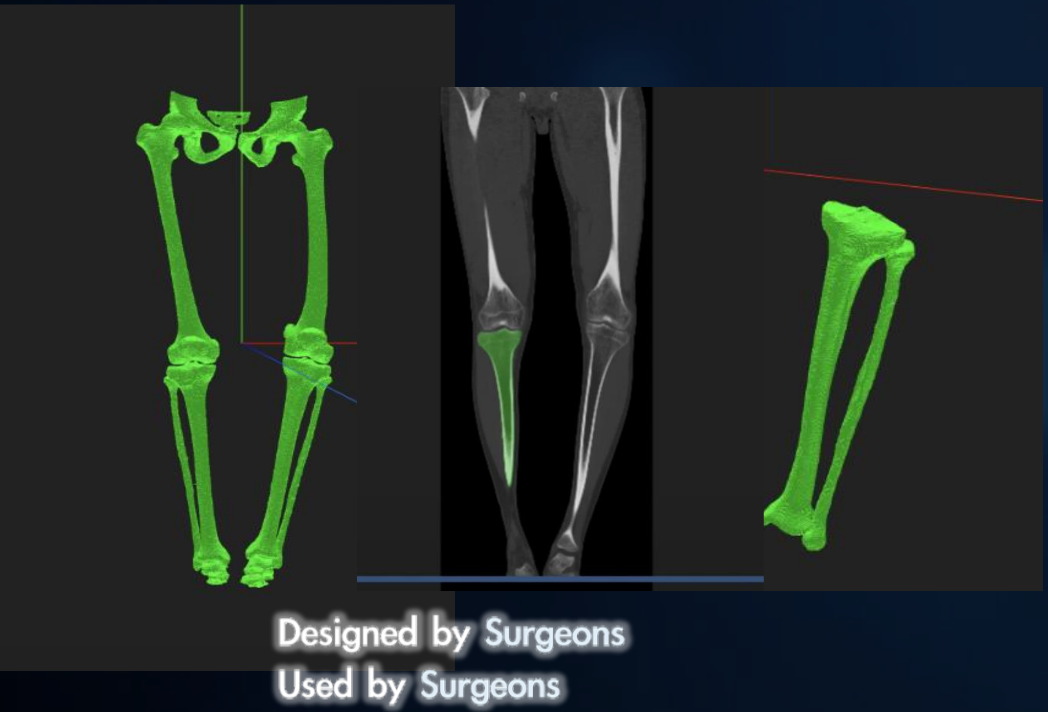
- Required powerful computer
- Access from single device only


# AI Segmentation

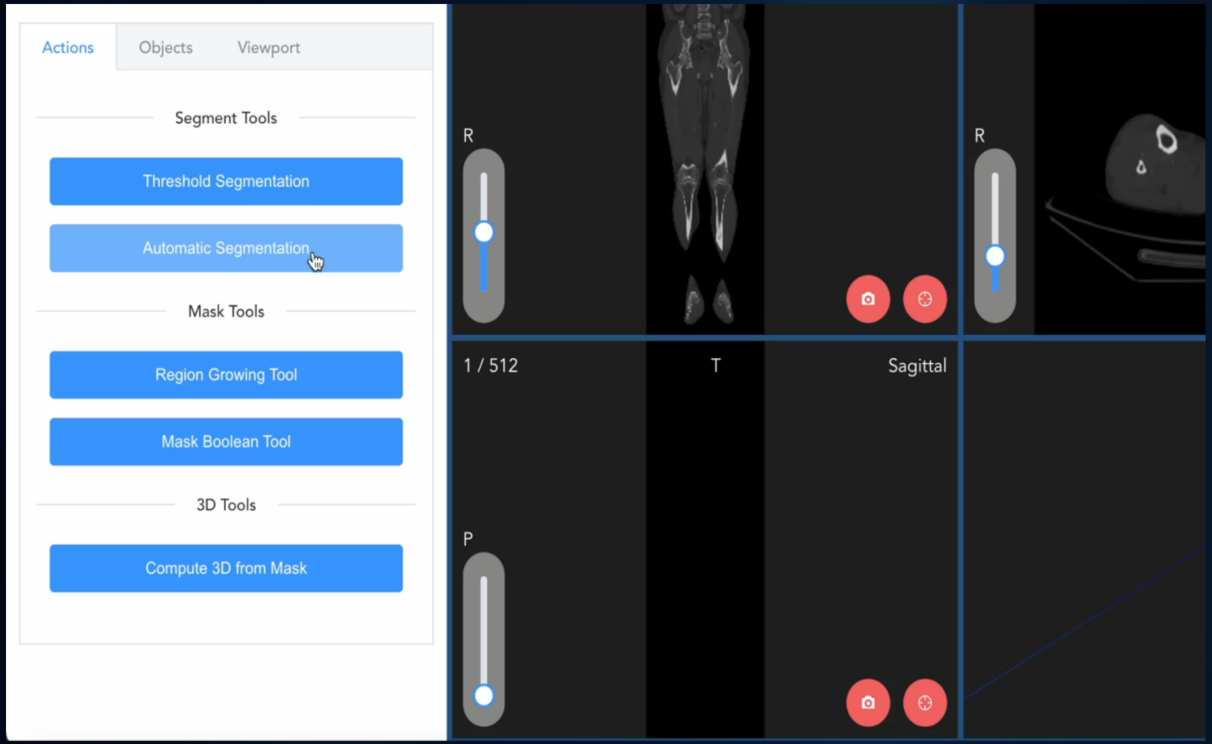
- Single bone : 2 mins
- Whole limb : 2 mins
- High accuracy (Avg 95%)

# Commercial Planning Software

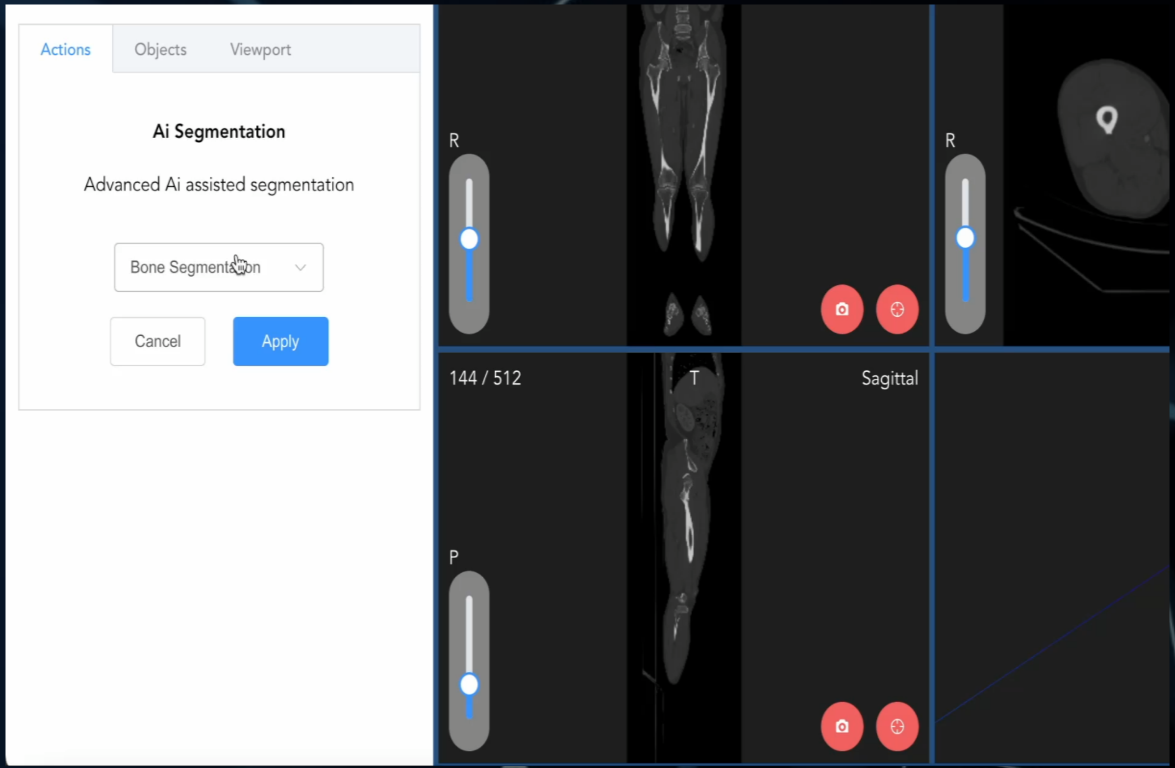
- Single bone : 15-20 mins
- Whole limb : 60-90 mins
- Human error




# AI Segmentation




Auto whole lower limb segmentation




Auto single bone segmentation

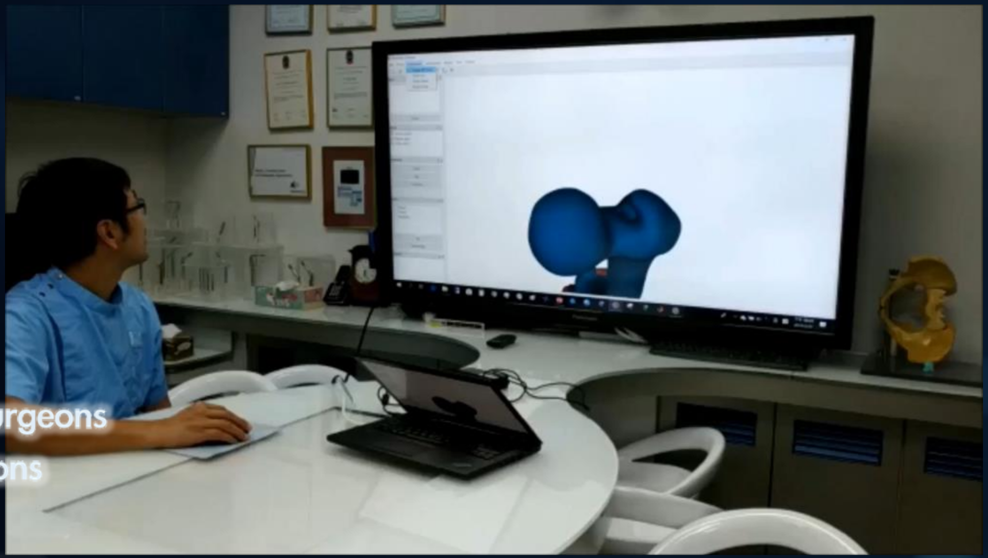
Designed by Surgeons
Used by Surgeons

## Surgery Oriented Planning Modules and Functions

- Learning time <30 mins
- Surgeon practise
- Up to 20 useful functions
- Surgeon friendly interface
- Minimal Communication error

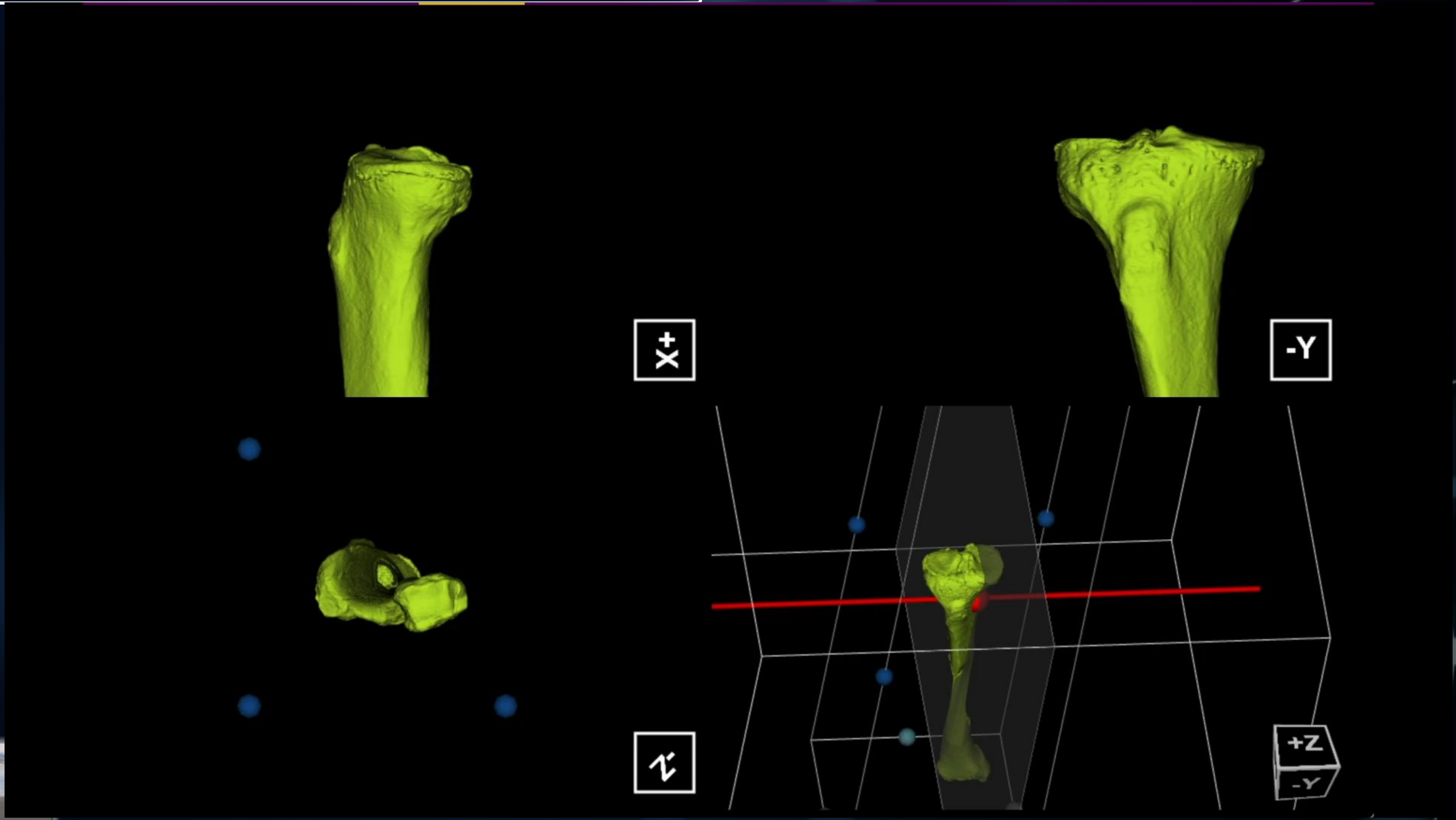
## Commercial Planning Software

- Extensive learning time required
- Complicated and redundant function
- Engineer and specialist required
- Tedious collaboration



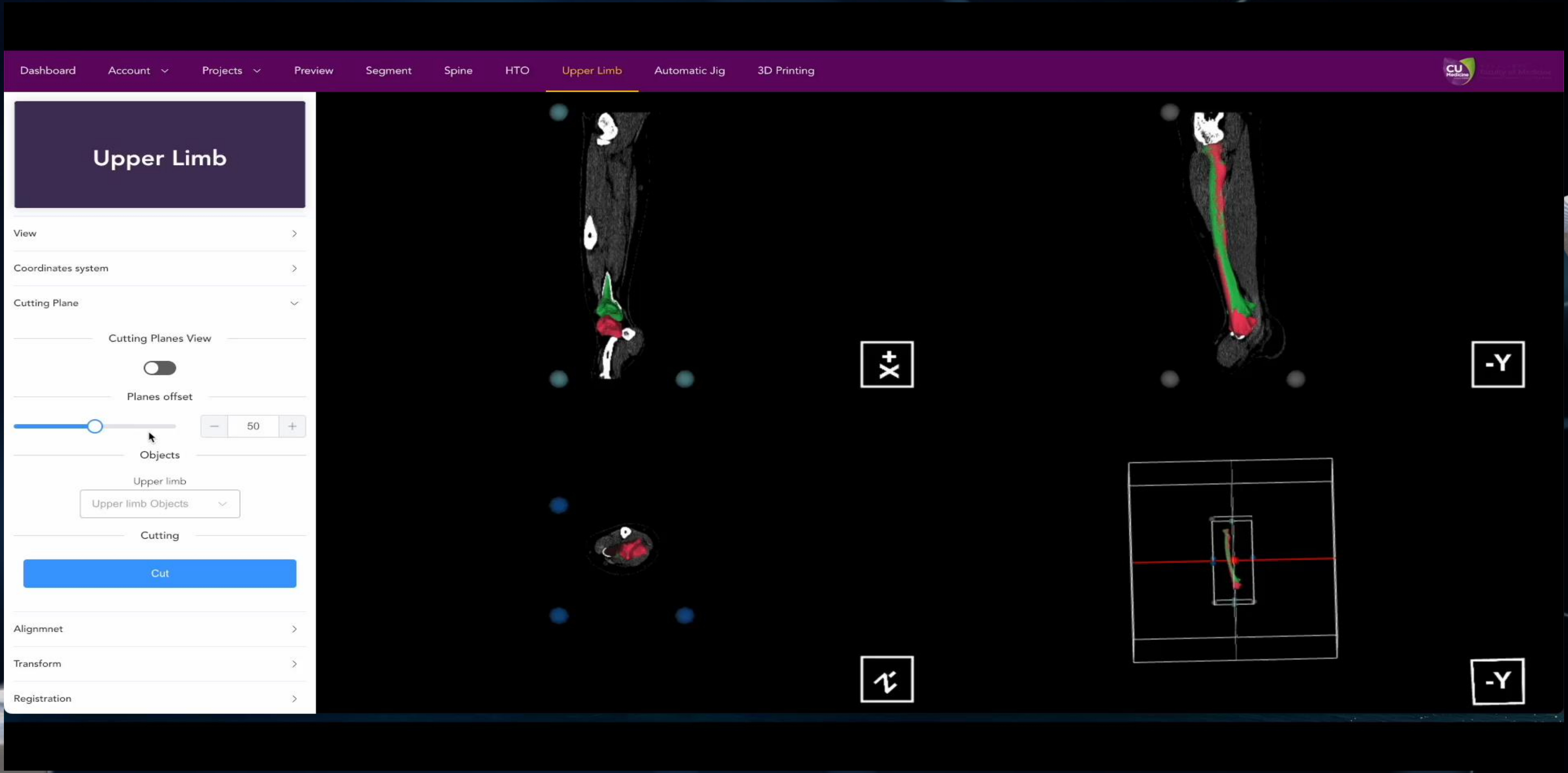
Designed by Surgeons
Used by Surgeons

# Surgery Oriented Planning Modules and Functions



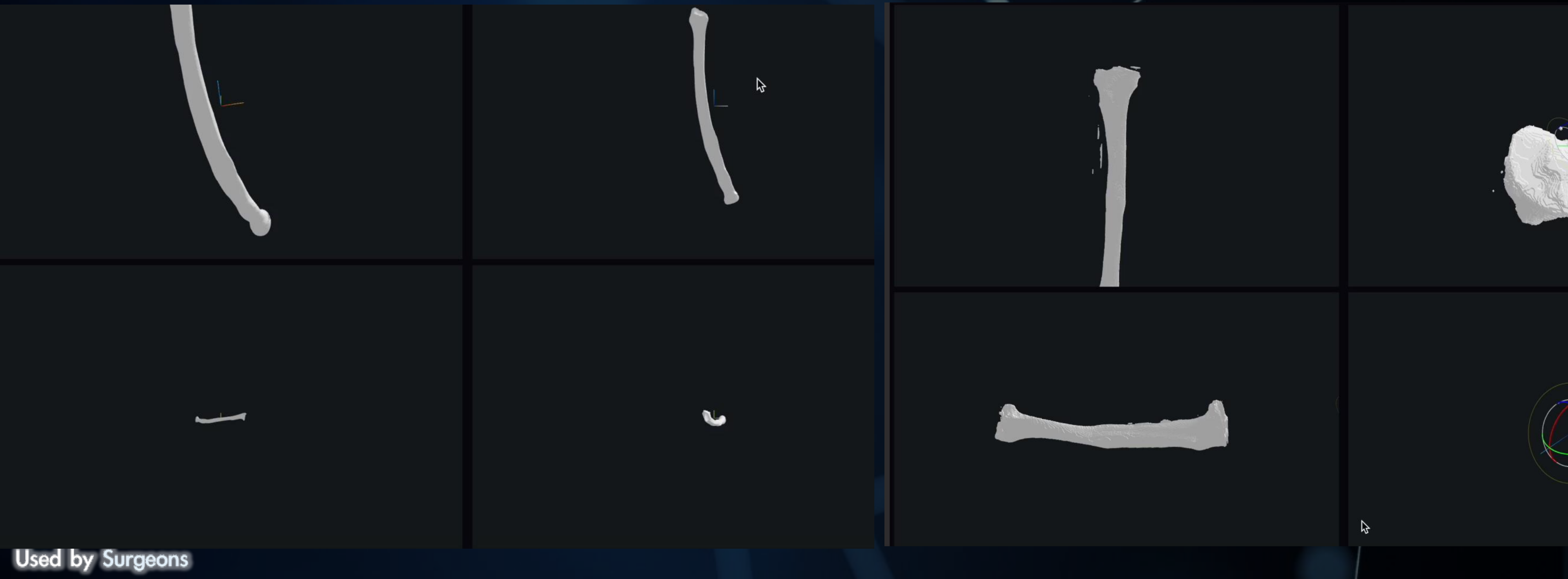

Cutting plane in customized views

# Surgery Oriented Planning Modules and Functions




Cutting plane generation

# AI Assisted PSI Design and Generation



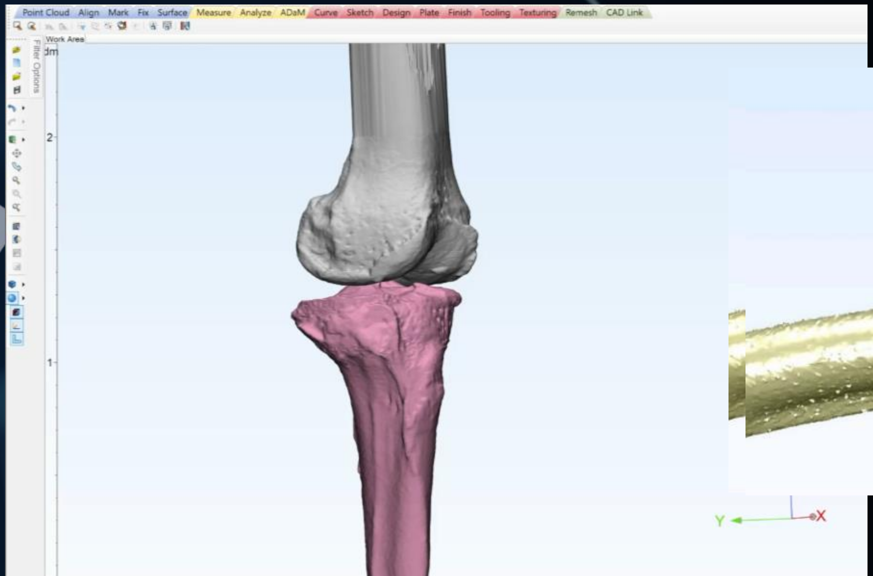

Personalized Surgical Instrument Generation

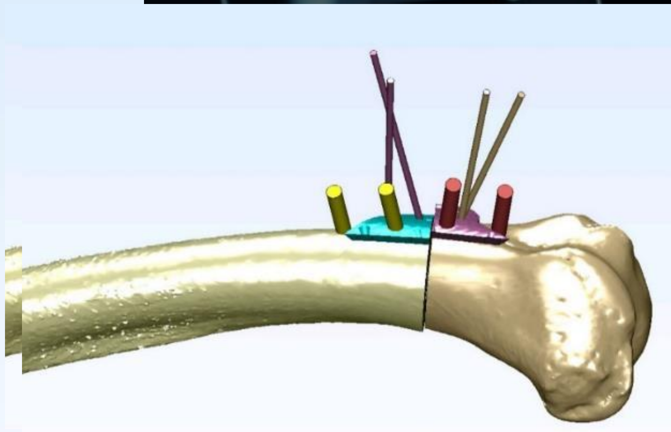
# AI Assisted Jig Design and Generation

- No communication required
- Auto jig design
- Design time less than 5mins
- Enhanced efficiency

# Commercial Planning Software

- Time consuming in communication
- Manual design required
- Design time more than 2hrs

# Impact

- **Surgery oriented function and modules**
- **AI assisted segmentation**
- **AI assisted PSI generation**

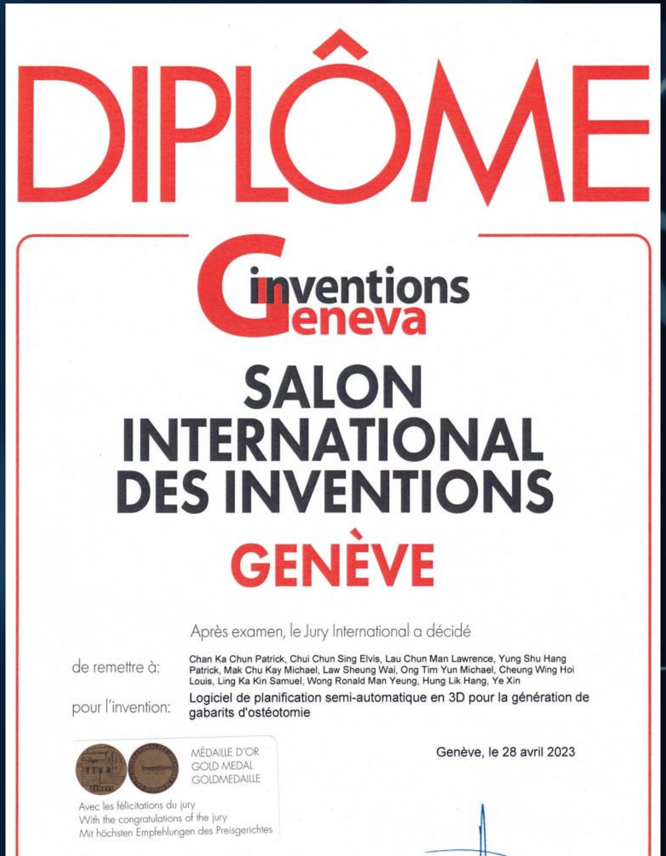
➔ **Reduce Planning Time**

- ✓ Reduced planning time
- ✓ Reduce human error
- ✓ Shorten surgery time
- ✓ Reduced patient anesthesia time
- ✓ Increased OT rooms availability
- ✓ Surgeons friendly interface
- ✓ Highly reliable AI assisted functions
- ✓ Easy to use

Design by
Used by Surgeons

# Recent Awards

- 第四十八届日内瓦国际发明展评审团嘉许金奖
  - Semi-Automatic 3D Planning Software for Osteotomy Jig Generation



# Acknowledgement

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# Thank you