



# Forum **TERATEC** **23**

**Unlock the future**

**31 MAI & 1<sup>er</sup> JUIN 2023 • Au Parc Floral, Paris**

*Un événement organisé par*

 **infoprodigital**



# DIGITAL TWINS



TERATEC 23

31st May 2023



# ANATO SCOPE



**Unlock the future**



Founded in 2015 by



**Prof. F. Faure**  
Mechanics,  
Informatics



**F. Van Meer,**  
**PhD**  
Medical Robotics



**B. Gilles, PhD**  
Imaging,  
Simulation



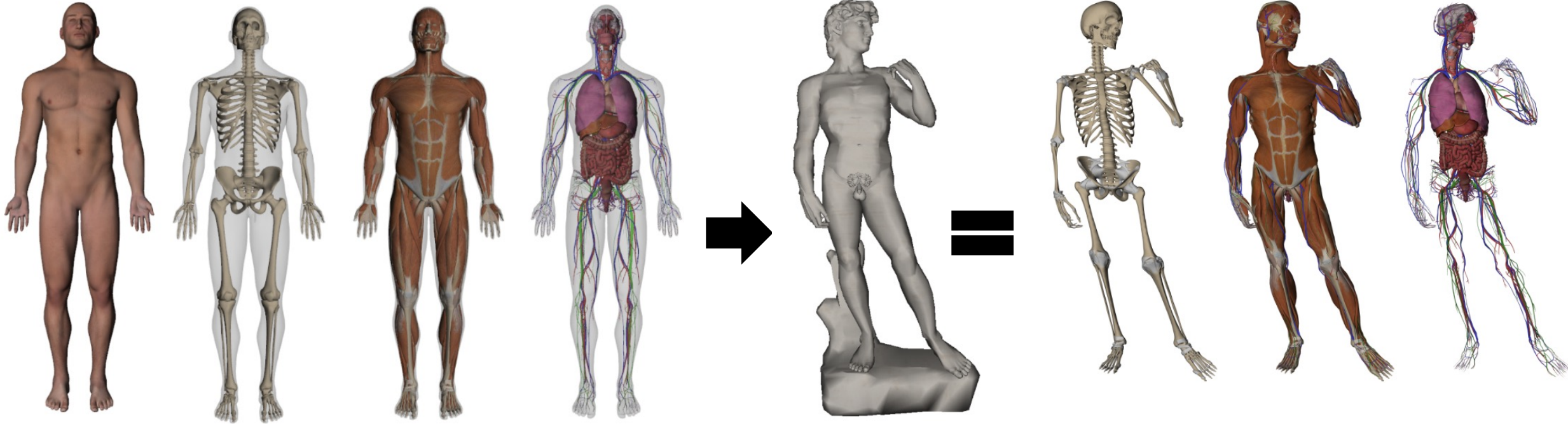
**Prof. O. Palombi**  
**MD, PhD**  
Anatomy



**M. Nesme, PhD**  
Informatics,  
Simulation



# Modèles biomécaniques personnalisés



Reference A (*surface*)

Anatomy of A

Target B (*surface*)

Anatomy of B

Input

Output

## Company

- Located in Grenoble & Montpellier
- 30 employees
- 2 majors customers in dental and orthopedics
- 2 spinoffs in dental and orthopedic

## Expertise

- Surface, volumetric and mixed registration
- From imaging to custom anatomy
- Digital workflow from imaging to personalized devices
- Personalized Biomechanics
- Statistics from multiple registrations to the standard model
- Cloud Computing



**Unlock the future**

# ORTHOPEDICS

## Problems to solve

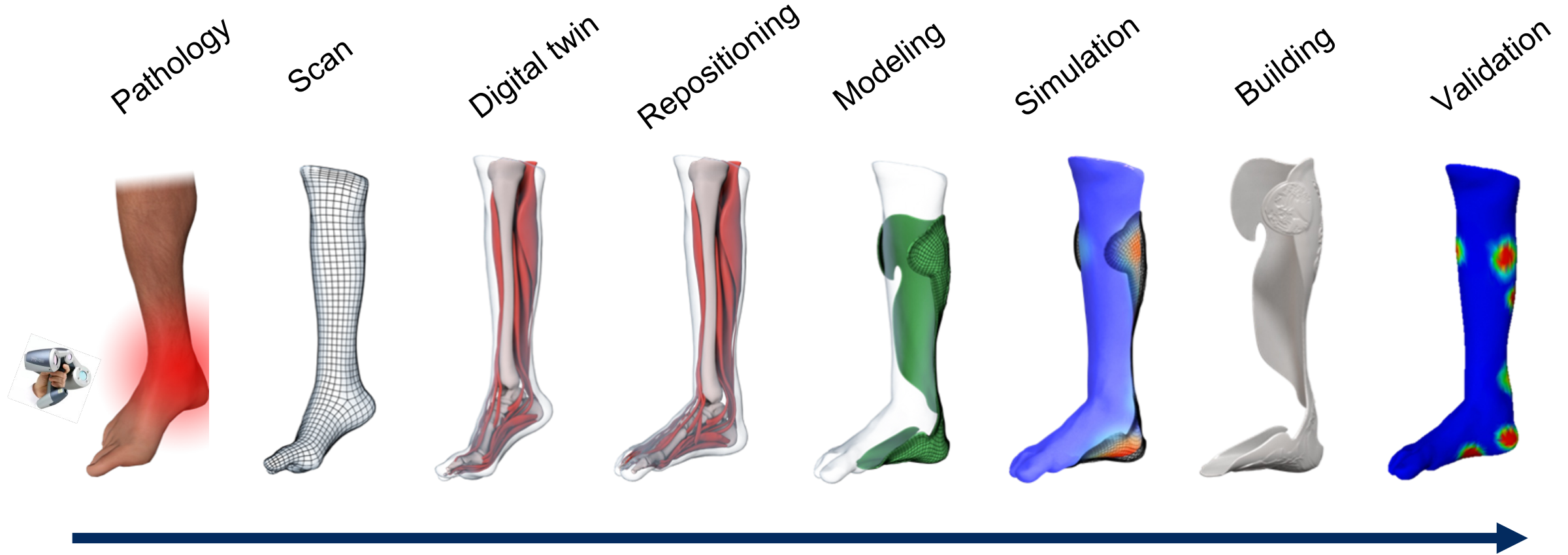
- Personalized foot orthosis conception
- Avoid plaster casting
- Foot position different from therapeutic position

## Solution

- 3D scan of the foot
- Digital twin of the foot with mobile bones
- Repositioning of digital twin for therapeutic application
- Generic orthosis registration on digital twin



## Digital Workflow Overview

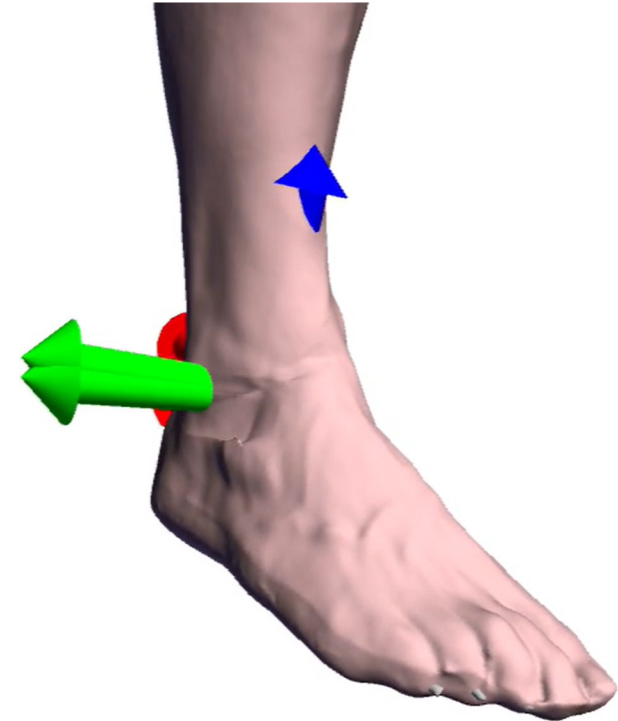
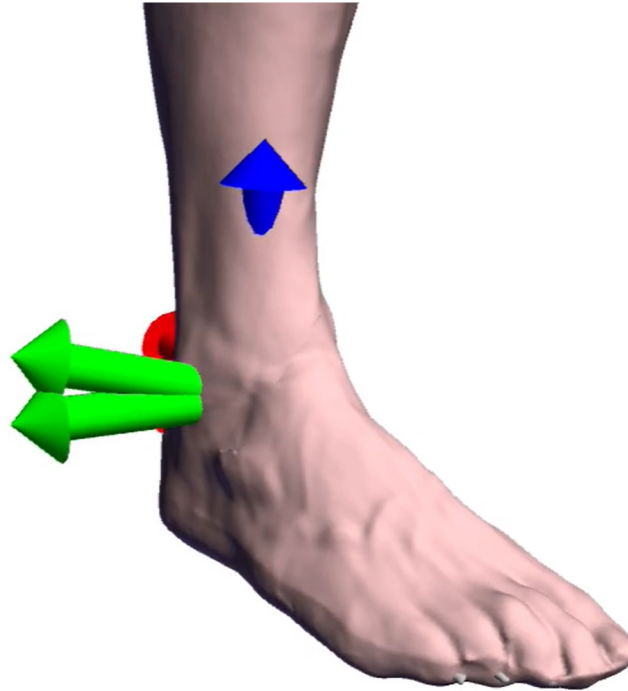
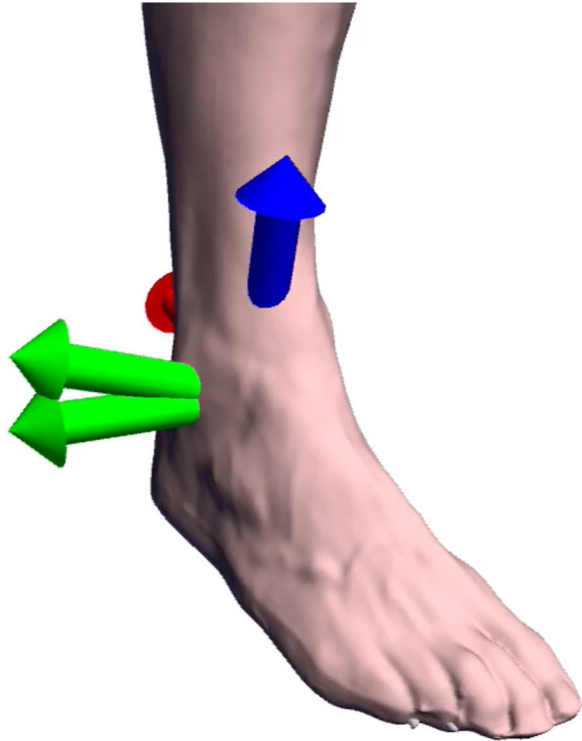




## Repositioning

Y rotation

X rotation

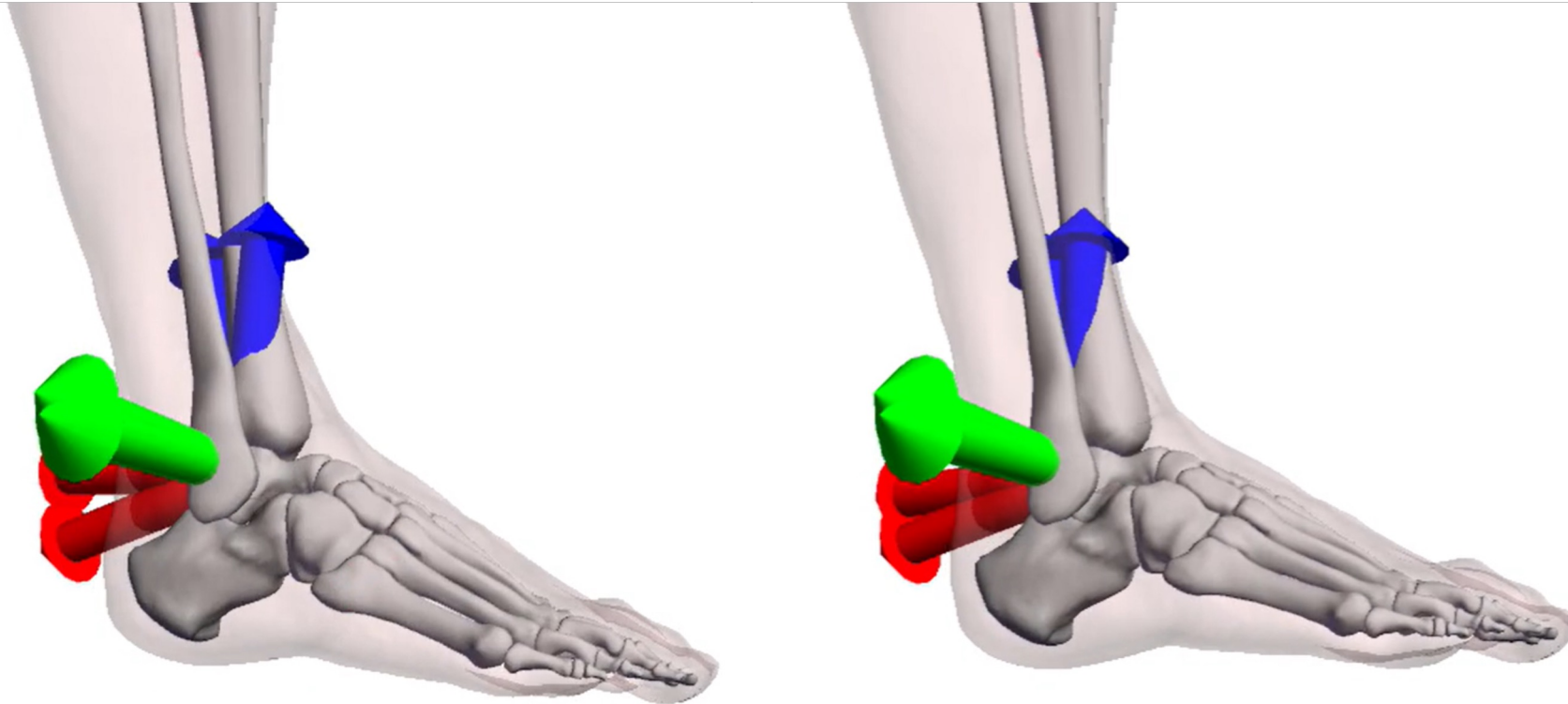


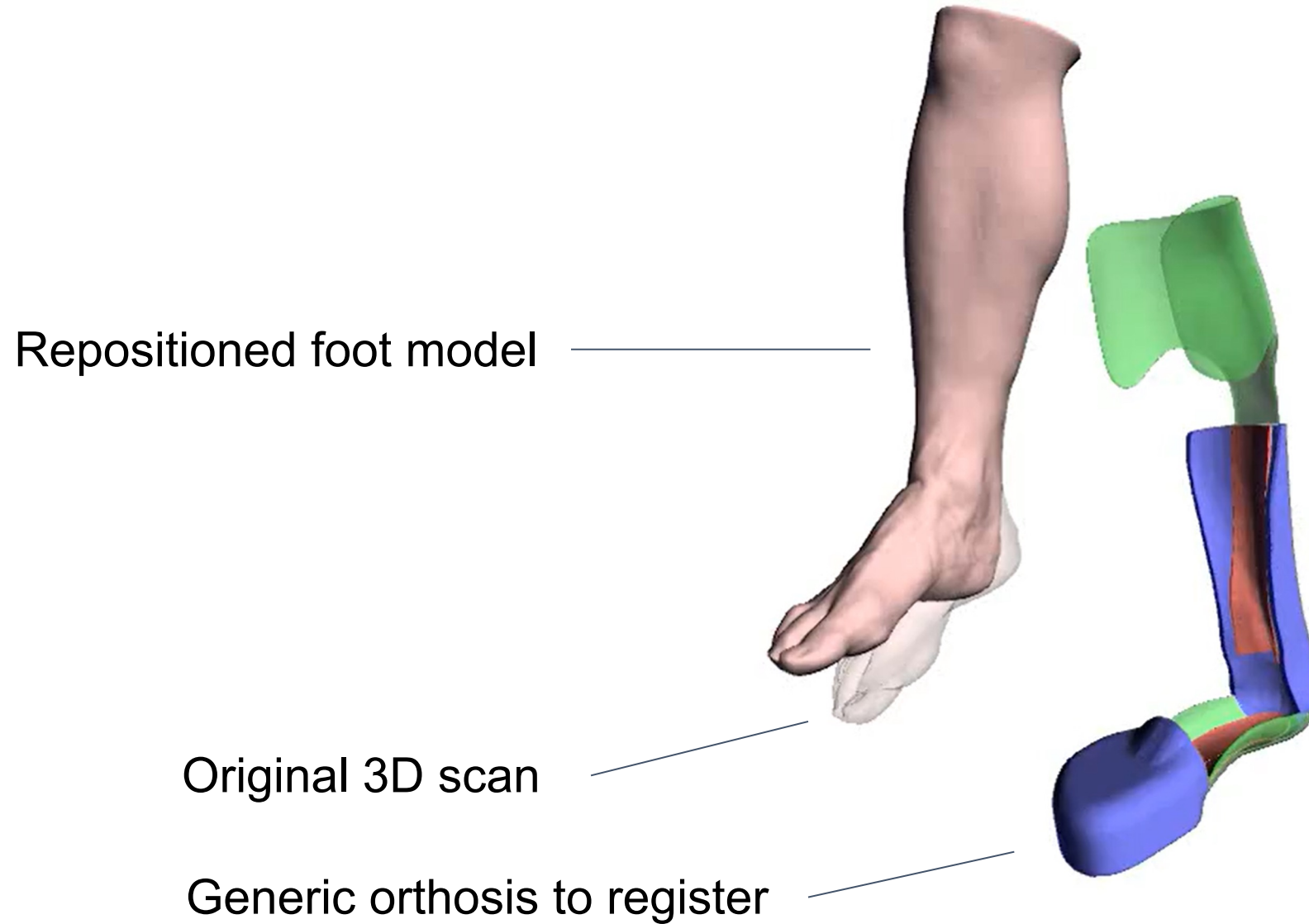




Repositioning

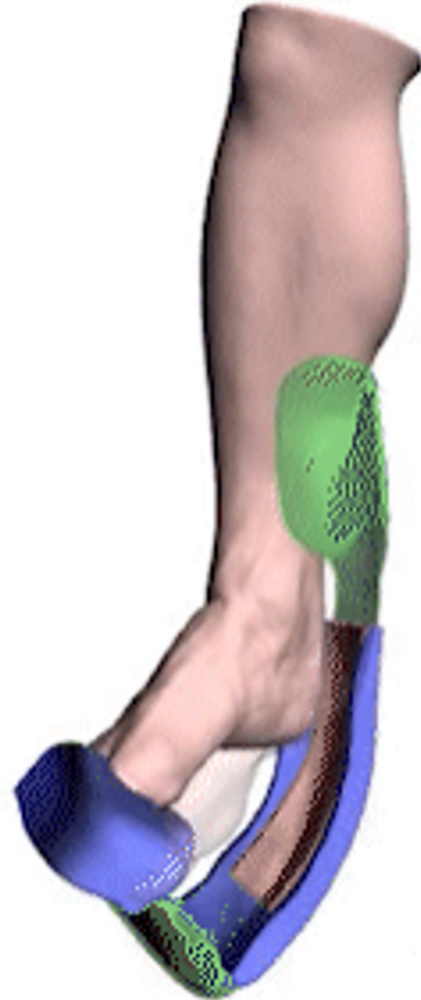
Y rotation



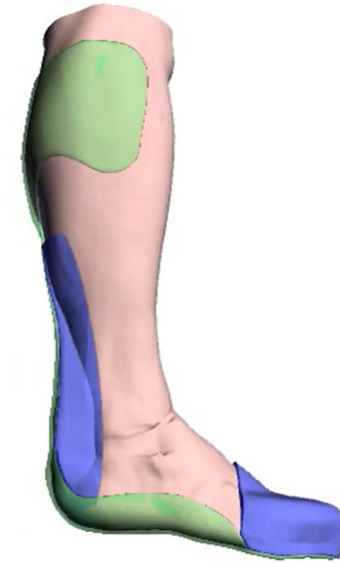




Registration

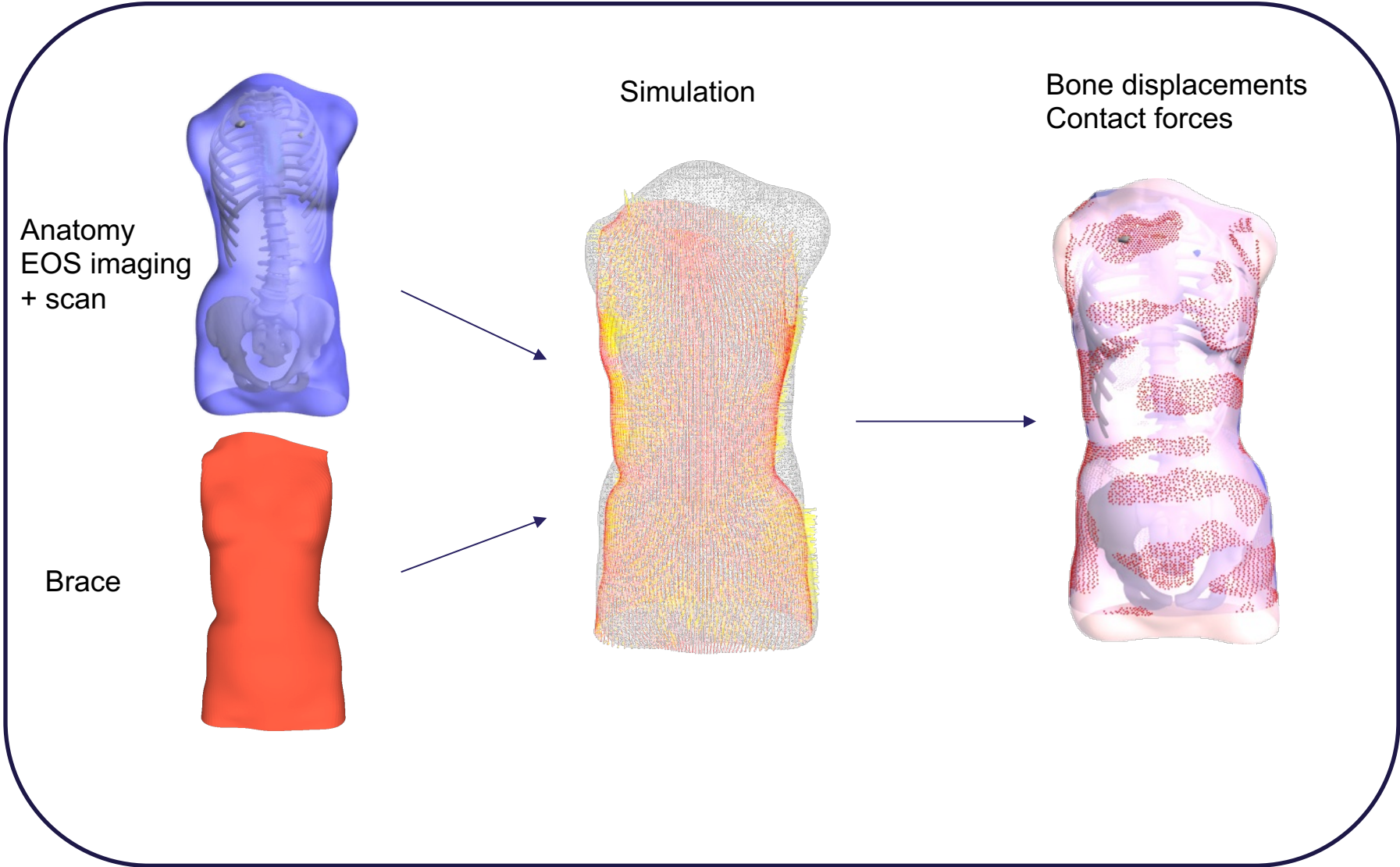


Skin view



Bones view





Clinical validation  
on 30 patients  
Grenoble Univ. Hosp.  
[ Prof. Courvoisier et al, European Spine Journal, 2019]

Legend:

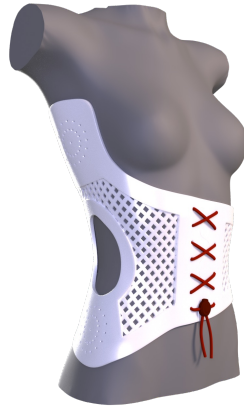
- Green box: without brace
- Yellow box: with (simulated)
- Red box: with (real)



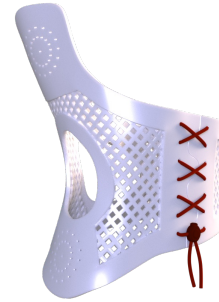
Scan



CAD



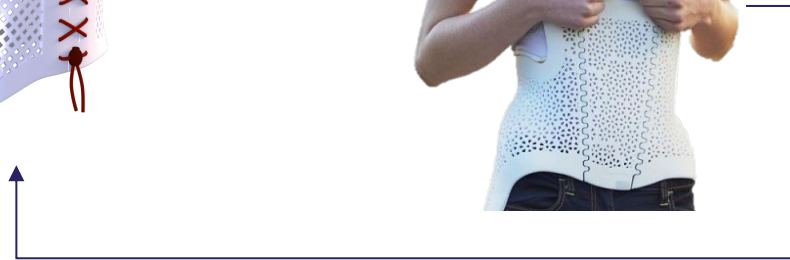
Fabrication

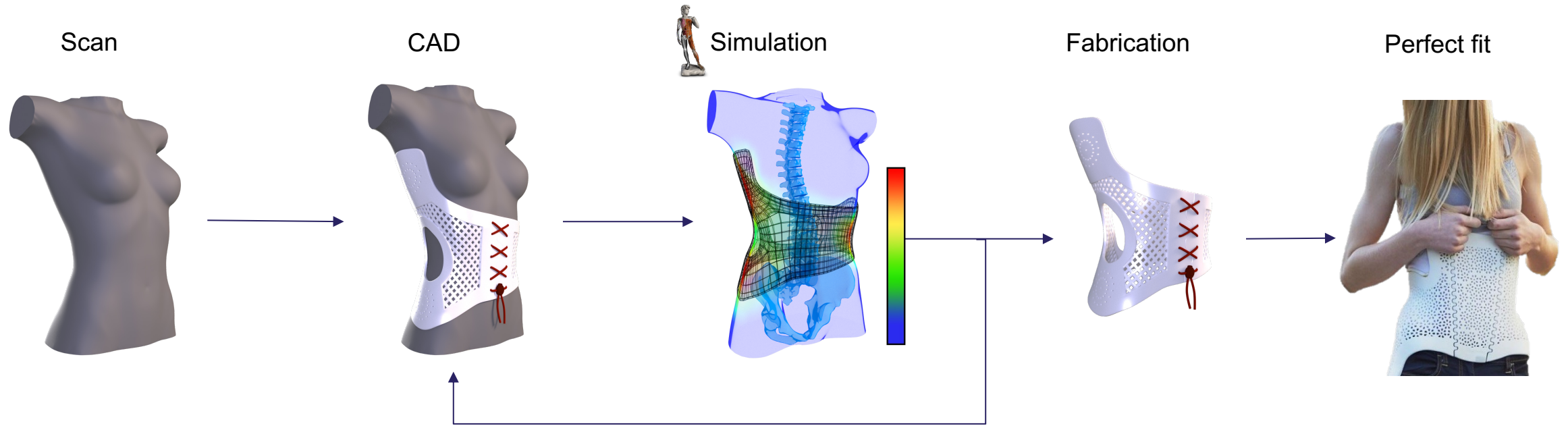


Try-on

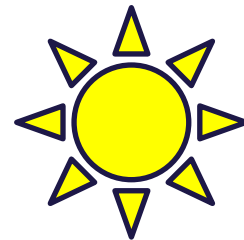


In vivo iterations





In silico iterations



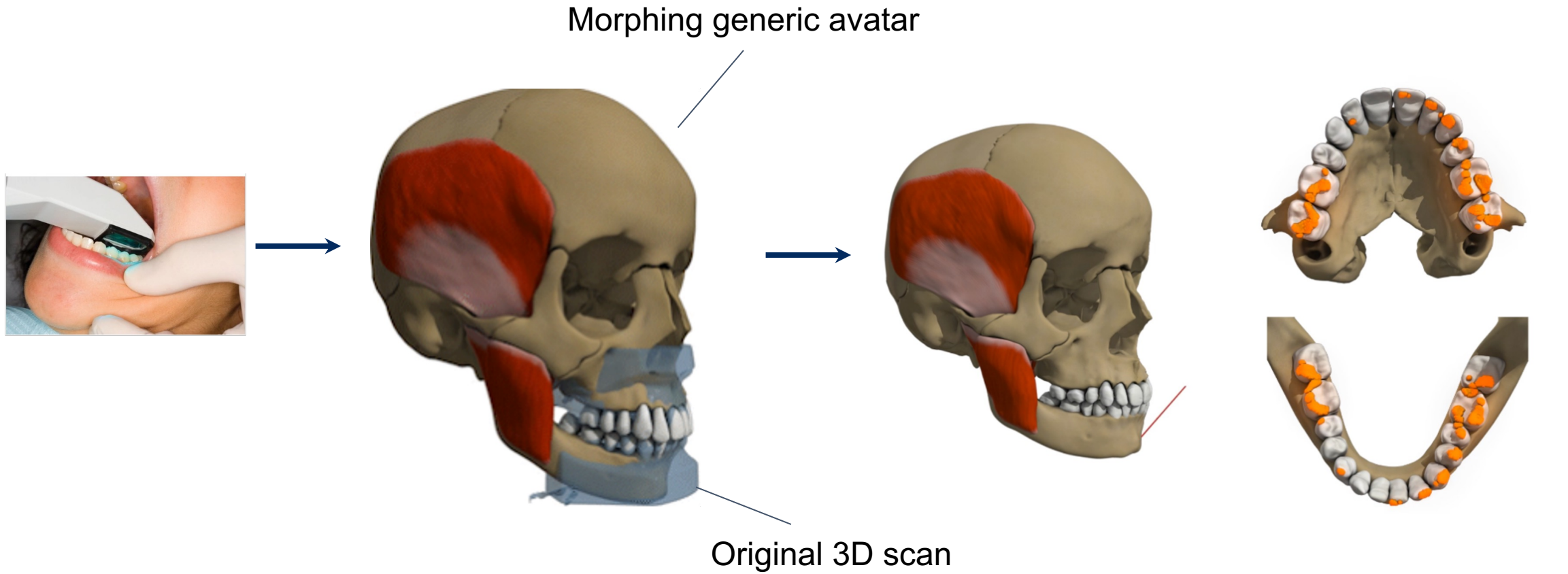
# DENTAL

## Problems to solve

- Personalized orthodontic treatment
- Dental occlusion simulation to validate treatment

## Solution

- 3D dental scan
- Digital twin using registration with skull, articulated jaw and muscles
- Muscles and external forces activation to simulate dental occlusion



3D scan of teeth  
and jaw

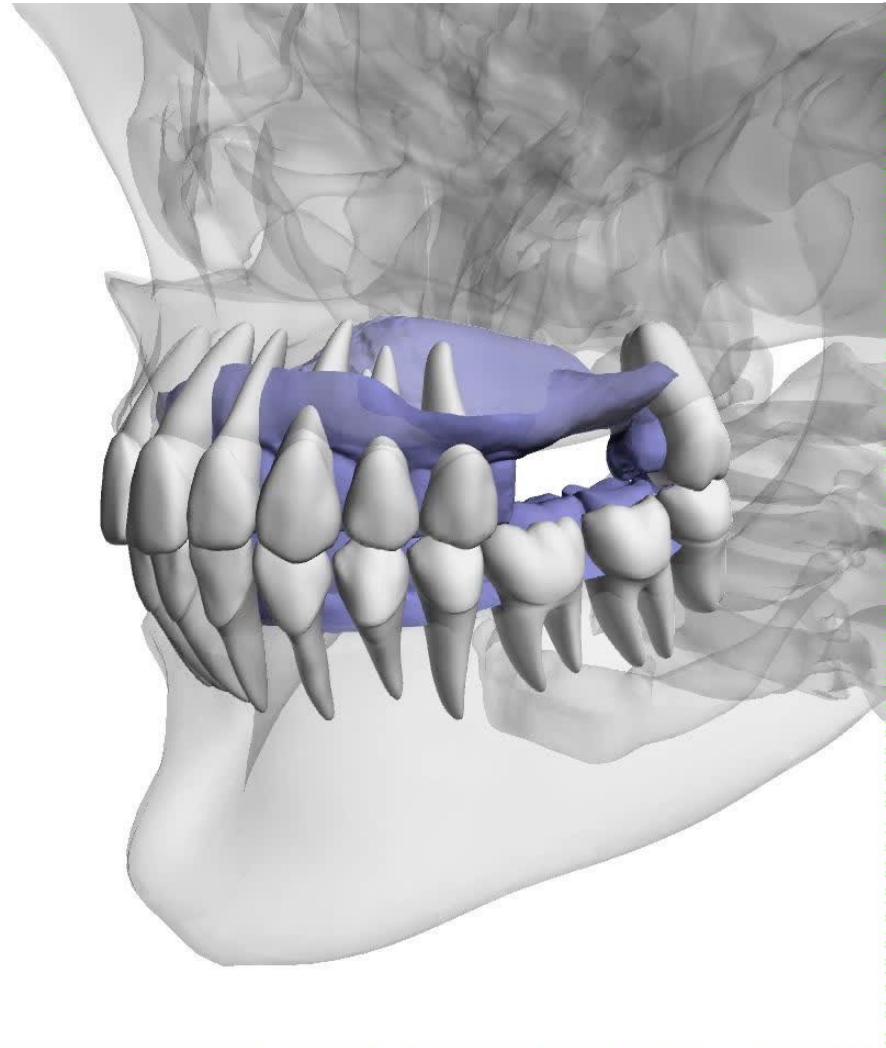
Digital twin  
with muscles and jaw

Simulation of occlusion





## Personalized Biomechanics



Muscles

- + Opening/Closing  0.0
- Retrusion/Protusion  0.0
- Left/Right  0.0

Visualization

- Maxilla
- Mandible
- Muscles
- Total force

# CONCLUSION

## Benefits

- Digital workflow enabler (modeling, validation, streaming, etc)
- Faster productivity (up to twice)
- Virtual try-on to validate the projects
- Less patient interaction (15x less 3rd medical visit in dental)
- More than 20,000 orthosis produced per year

**THANK YOU**

Any questions ?

**CONTACTS**

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