

# Individual Postoperative Treatment after Fractures of the Lower Extremities

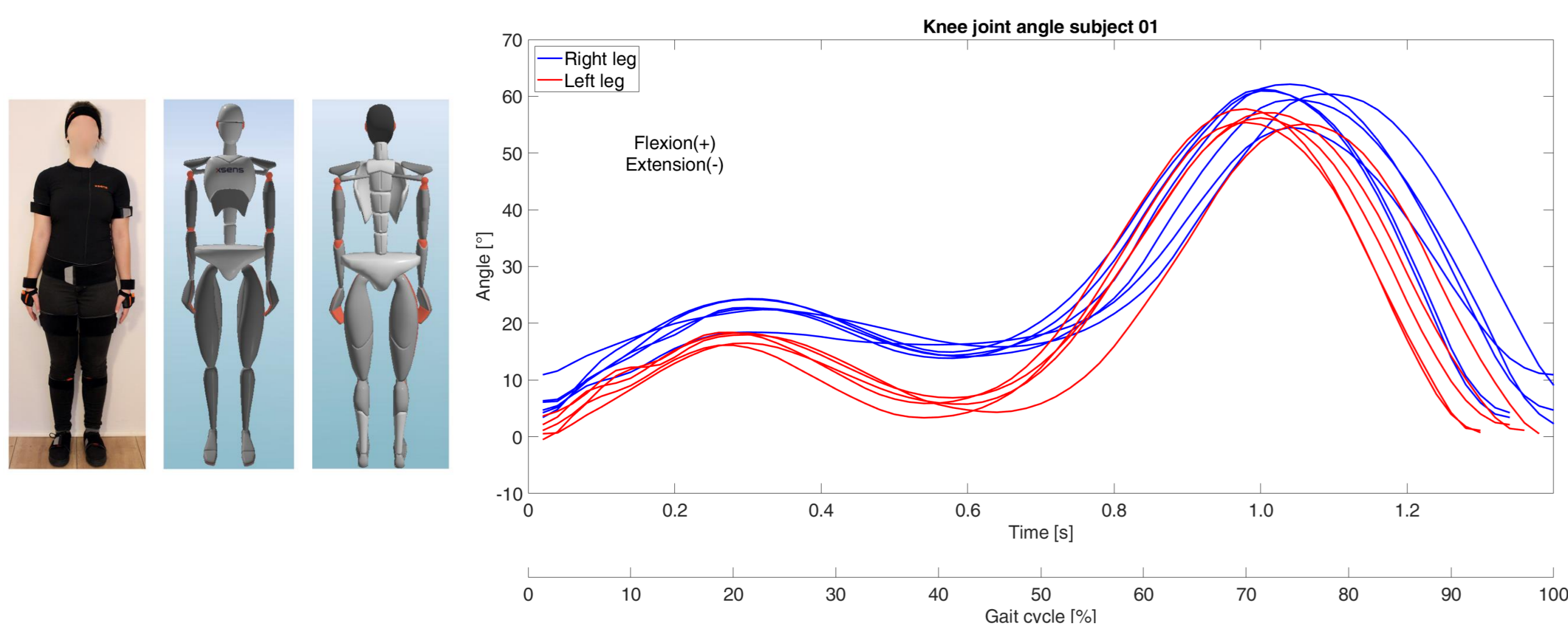
## Introduction

Limited gait-load during the healing process after fracture of the tibia can be defined by measurement and monitoring of postoperative gait analysis in patients compared to reference data of healthy subjects. For this purpose, kinematic and kinetic types of gait analysis are required. The findings of this analysis demonstrate that it is possible to collect data for individually adapted implants and to create individual loading recommendations.

## Methods

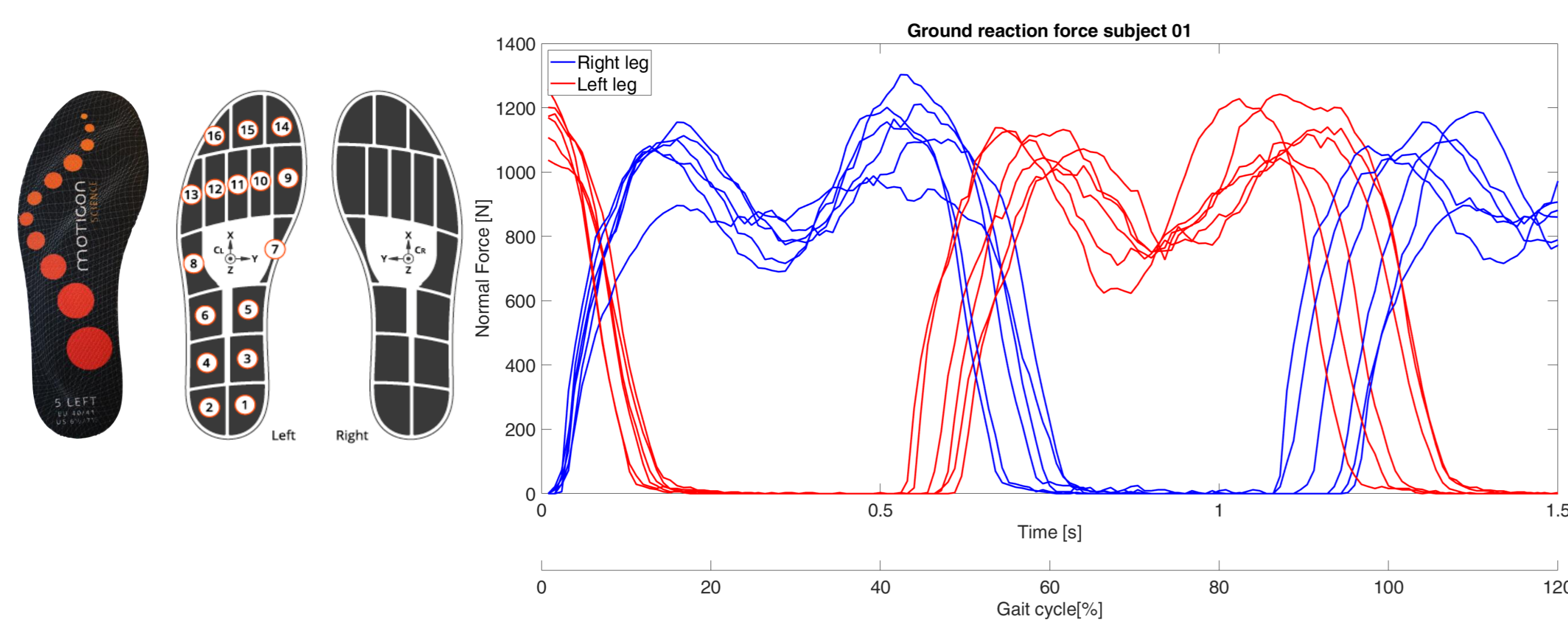
### Xsens™ Technology B.V., Enschede, Netherlands

- Kinematic analysis for joint angles and as motion data for AnyBody™
- 17 inertial measurement units placed at strategic locations on the body by straps in order to measure the motion of every segment



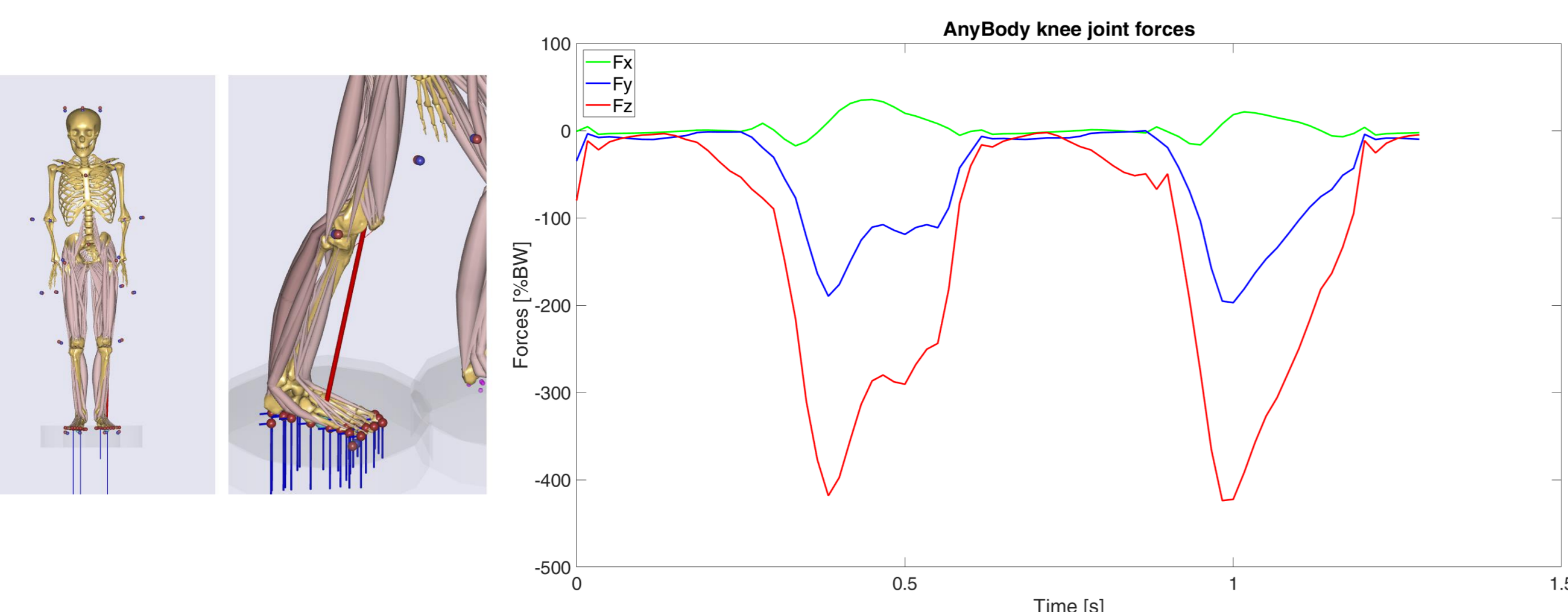
### Moticon™ ReGo AG, Munich, Germany

- Kinetic analysis for ground reaction forces and physiological gait parameters
- 16 pressure sensors and an inertial measurement unit inside the insoles



### AnyBody™ Technology A/S, Aalborg, Denmark

- Creates musculoskeletal model to analyse ground reaction, joint and muscle forces by creating a digital avatar of the patient
- Recorded motion data from Xsens™ is used to create the model



## Fundamental Questions

- What is the influence of the partial weight bearing on the fracture healing?
- What are the differences in the postoperative gait analysis in patients compared to reference data of healthy subjects?
- Is it possible to create an individual postoperative treatment for patients?

## Workflow

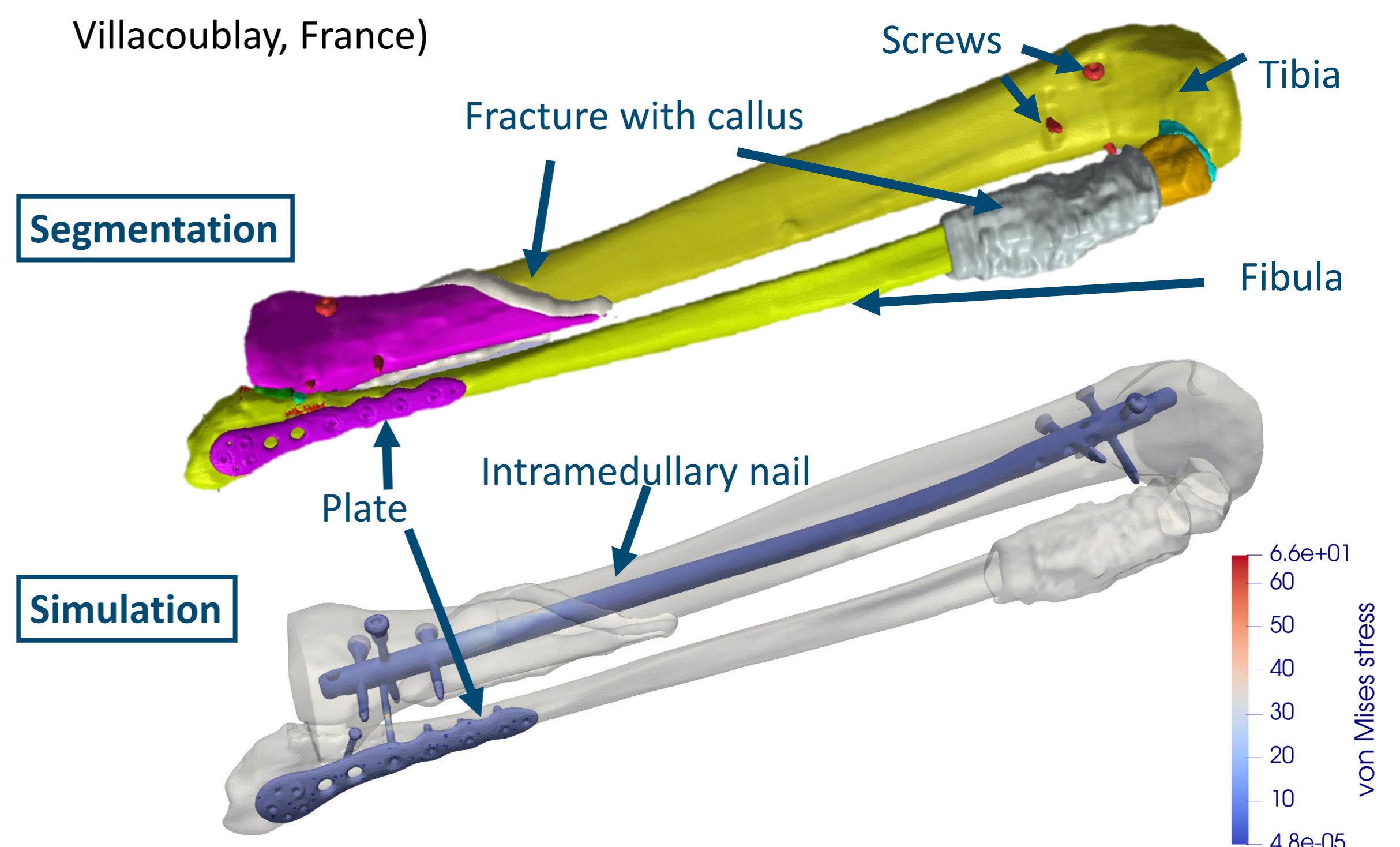
- Analysing the patient's injury using X-rays and computed tomography images
- Gait analysis after the surgical intervention with Xsens™ and Moticon™



- Recorded gait data are compared with the data of a healthy subject
- Repeated after 6 and 12 weeks

## Segmentation and Individualised Simulations

- Segmentation of CT-images with ScanIP™ (Synopsys, Mountain View, CA, United States)
- High-resolution adaptive FE (finite element) mesh from segmented bone
- Simulation with FE analysis software Abaqus™ (Dassault Systems, Velizy-Villacoublay, France)



## Conclusion and Future Work

- Development of a physiological gait pattern during the healing process
- Detecting pathological processes, which may lead to development of non-healing fractures
- Understanding of the forces that affect the fracture and its healing process permanently

References:  
[1] Werner Siemens Stiftung/Oliver Lang