

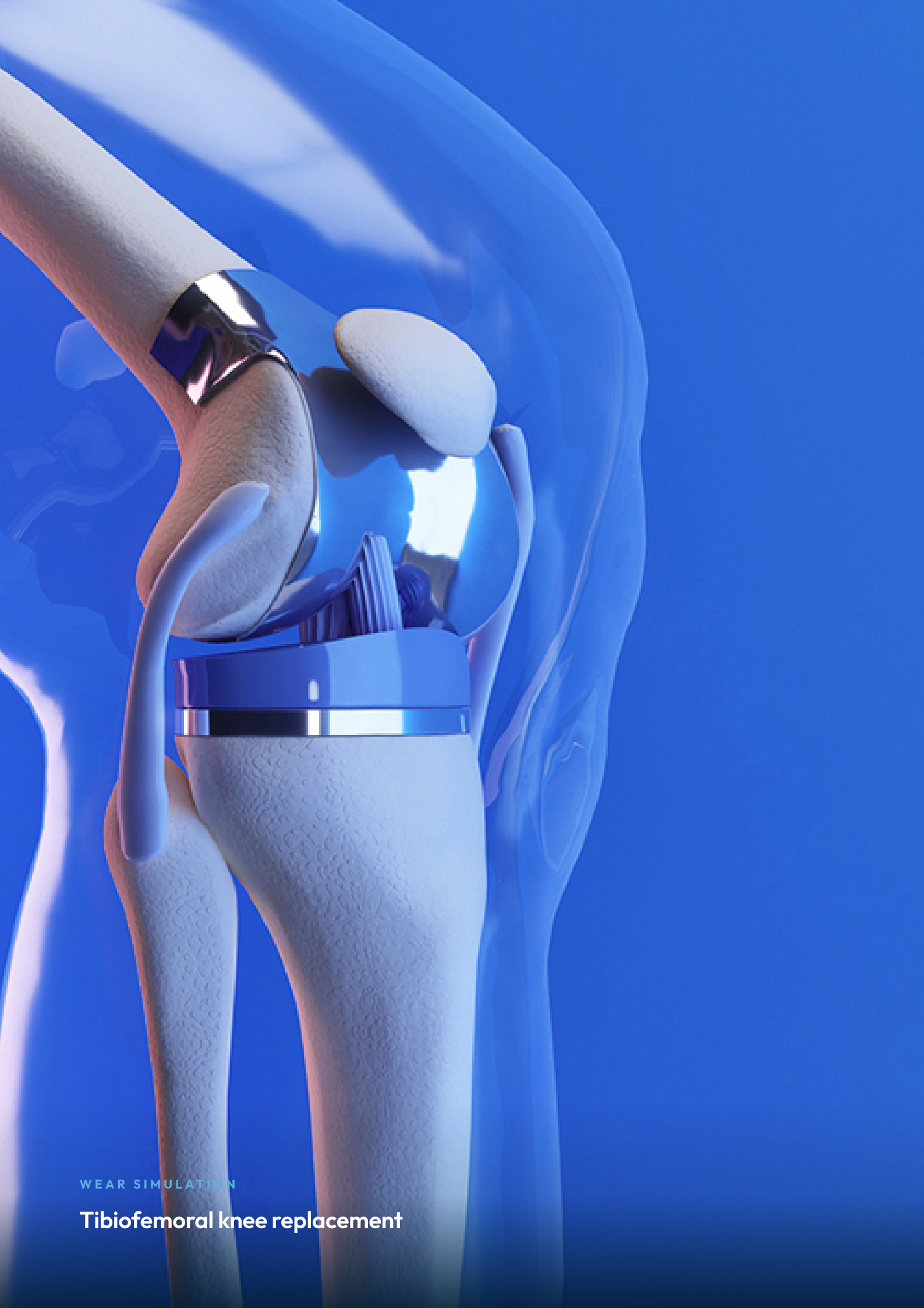
KNEE · ELECTROMECHANICAL SIMULATOR

# Knee Wear Simulator.

The ProSim Knee Wear Simulator (Independent Stations) was designed and developed with one of the leading US knee implant manufacturers to give full force and displacement control on individual stations, enabling each station to run autonomously.

ISO 14243-1 · ISO 14243-3

**6**KNEE IMPLANTS TESTED  
SIMULTANEOUSLY**5 kN**MAXIMUM AXIAL LOADING PER  
STATION**±90°**FLEXION EXTENSION RANGE OF  
MOTION



WEAR SIMULATION

**Tibiofemoral knee replacement**

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— ABOUT PROSIM

# A research partnership turned *global product range*.

ProSim, a division of Simulation Solutions Group, designs and manufactures advanced electromechanical wear and fatigue simulators for orthopaedic implant testing, in long standing partnership with the University of Leeds.

Since the 1990s, ProSim, a division of the Simulation Solutions Group, has been at the forefront of orthopaedic implant wear testing through a long standing partnership with the University of Leeds. Together, we have developed advanced wear and fatigue simulators with over 100 stations of testing capacity across leading global orthopaedic manufacturers and testing houses.

Today, ProSim offers a comprehensive suite of electromechanical simulators for both medical and industrial tribological and wear fatigue testing. Our flexible, cost effective approach has enabled

us to expand into both mature and emerging global markets.

We work closely with customers and academic partners to design simulators that exceed appropriate standards, replicating real world conditions, wider ranges of motion, and higher loads to better understand adverse wear. At the heart of ProSim is a 30 year legacy of innovation, trusted collaboration, and a relentless drive to push the boundaries of fatigue research.

Through participation in major European research initiatives like the Lifelong Joints Project, ProSim has consistently pushed the boundaries of implant wear research.

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**OVERVIEW**

# Knee Wear Simulator.

The mobility of the knee joint presents significant problems for effective and rigorous in vivo testing. Working together with one of the leading US knee implant manufacturers, the ProSim Knee Wear Simulator (Independent Stations) was designed and developed to give full force and displacement control for individual stations, enabling each one to run autonomously.

Key objectives during development: fully meet ISO 14243-1 and ISO 14243-3; go well beyond existing ISO requirements for adverse wear testing; each station fully independent and capable of running its own demand waveforms; capable of replicating deep knee bending; incorporating soft tissue virtual springs.

All axes of the ProSim Knee Wear Simulator (Independent Stations) are electromechanically driven, using a combination of motors, drives and gearboxes. This enables the simulator to closely follow any demand waveform however demanding it may be. The Peltier Heater/Cooler system maintains the test fluid media (serum) at 37°C ±2°C, only 1/3 of the serum volume is required versus pump + heater systems.

Empirical data generated by our simulators over the last ten years supports the assertion that the patterns of wear of knee implants tested in the ProSim Knee Wear Simulator accurately mirror those of implants extracted from humans after years of use.

**AT A GLANCE****STANDARDS****ISO 14243-1 / -3****KNEE IMPLANTS TESTED  
SIMULTANEOUSLY****6****MAXIMUM AXIAL LOADING PER  
STATION****5 kN****FLEXION EXTENSION RANGE OF  
MOTION****±90°****DRIVE****Electromechanical**

## — FEATURES

# Features *and benefits.*

Every capability published for the Knee Wear Simulator, sourced from the ProSim product page and product documentation.

- Up to six knee implants tested simultaneously
- Each station fully independent, capable of running its own demand waveforms
- Four independent axes of articulation per station
- Single load axis per station
- Six axis load cell per station
- Load soak incorporated into each station
- Both force and displacement control
- Can incorporate deep flexion bending
- Incorporates soft tissue virtual springs
- Auto adapting force control to meet ISO 14243-1 draft 2024
- Simple user programmability of any articulation/load cycle
- Peltier sealed temperature controlled test cells that reduce serum usage by up to 50%
- Operating frequency programmable up to 2.0 Hz
- Walk / jog / run / rest programmable sequences
- Test fluid maintained at 37°C ±2°C (Peltier)
- Axial loading up to 5 kN per station
- ±90° flexion extension
- ±30° tibial rotation; ±10° adduction abduction
- ±25 mm anterior posterior; ±10 mm medial lateral
- Real time logging of position and load
- Clinically and physiologically representative testing
- Up to 50 programmable profiles
- Backed by ProSim service & support, install, training, follow-up, PM, remote support

## — SPECIFICATION

# Technical *specification.*

Complete machine specification for the Knee Wear Simulator.

| PARAMETER                      | VALUE                                                                             |
|--------------------------------|-----------------------------------------------------------------------------------|
| Test stations                  | Up to 6, fully independent                                                        |
| Control modes                  | Force & displacement                                                              |
| Axes per station               | 3 articulation axes + load & 2 translational axes + load                          |
| Load cell                      | Six axis, per station                                                             |
| Axial load (per station)       | Up to 5 kN                                                                        |
| Flexion extension              | ±90°                                                                              |
| Tibial rotation                | ±30°                                                                              |
| Adduction abduction            | ±10°                                                                              |
| Anterior posterior translation | ±25 mm                                                                            |
| Medial lateral translation     | ±10 mm                                                                            |
| Operating frequency            | Up to 2.0 Hz                                                                      |
| Activity profiles              | Up to 50 programmable profiles                                                    |
| Deep flexion bending           | Supported                                                                         |
| Soft tissue virtual springs    | Standard                                                                          |
| Temperature control            | 37°C ±2°C Peltier heater/cooler                                                   |
| Drive                          | Electromechanical (motors, drives, gearboxes)                                     |
| Standards                      | ISO 14243-1; ISO 14243-3; ISO 14243-5; ISO 16436-1 (draft); ISO 22622; ASTM F3141 |

Specification is indicative, exact configuration is confirmed at quotation. ProSim is able to offer customisation of its simulators to meet a client's specific testing requirements.

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## APPLICATIONS

# Applications.

Common use cases for the Knee Wear Simulator.

### 01

#### **Knee implant pre clinical wear**

Reliable, repeatable wear testing of knee implants under ISO 14243-1 and -3, load and displacement control.

### 02

#### **Beyond ISO adverse wear testing**

Wider ranges of motion and higher loads than ISO baseline.

### 03

#### **Deep knee bending**

Replicates deep flexion bending for physiologically demanding test scenarios.

### 04

#### **Soft tissue interaction studies**

Soft tissue virtual spring simulation supports research into ligament balance and implant kinematics.

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## CUSTOMISATION

ProSim is able to offer customisation of its simulators to meet a client's specific testing requirements. We are always happy to look at the customisation of existing equipment or design and build projects to a customer's specifications.

— KNEE · ISO 14243-1 / -3

# Arrange a *consultation.*

If you have any specific requirements not fully addressed here, please get in touch. ProSim is always happy to discuss customisation of existing equipment or design and build projects.

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