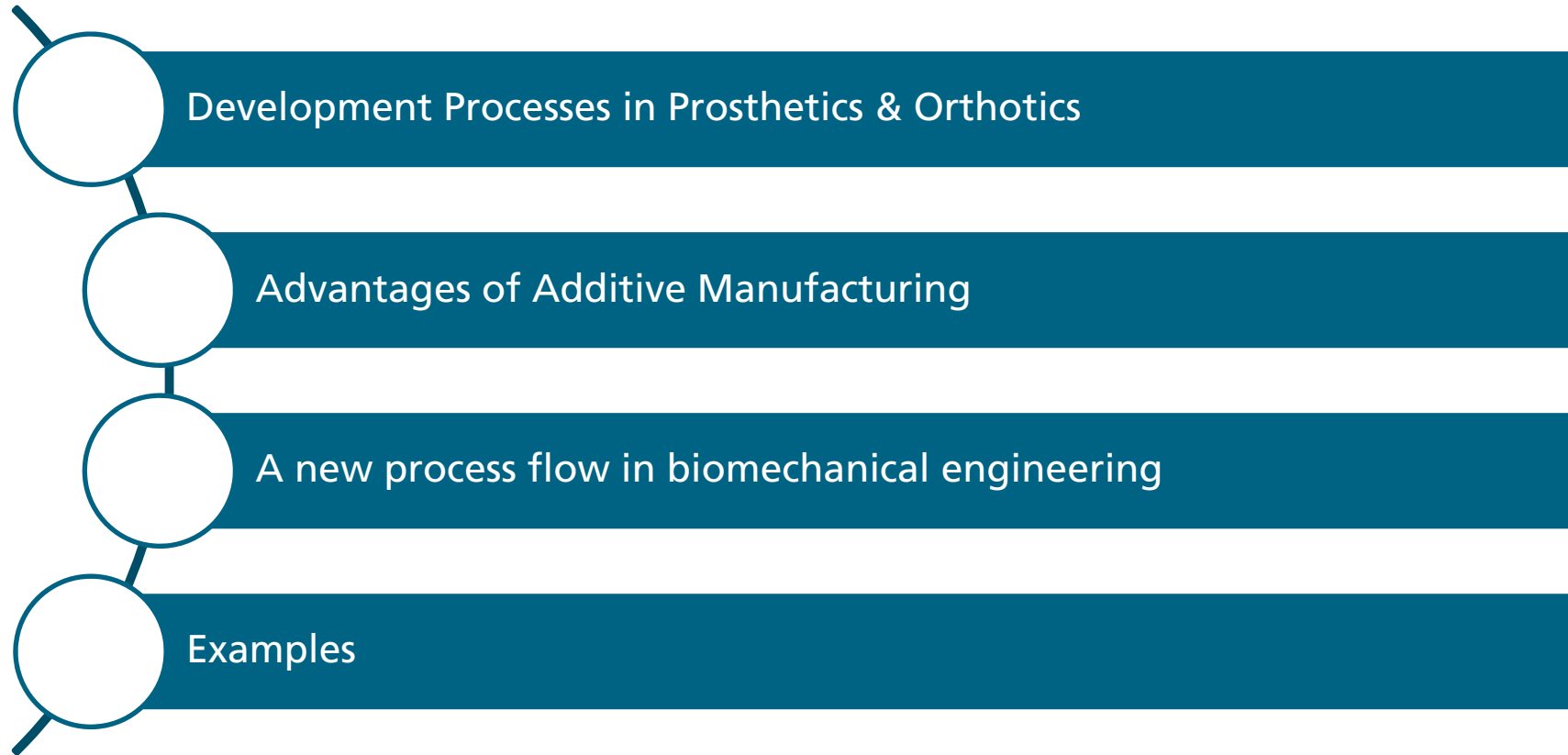

Integrating 3D printing into your existing product development

Urs Schneider, Felix Starker, Florian Dennerlein, Jannis Breuninger,
Oliver Röhrle, Ellankavi Ramasamy, Beate Dorow
Fraunhofer IPA

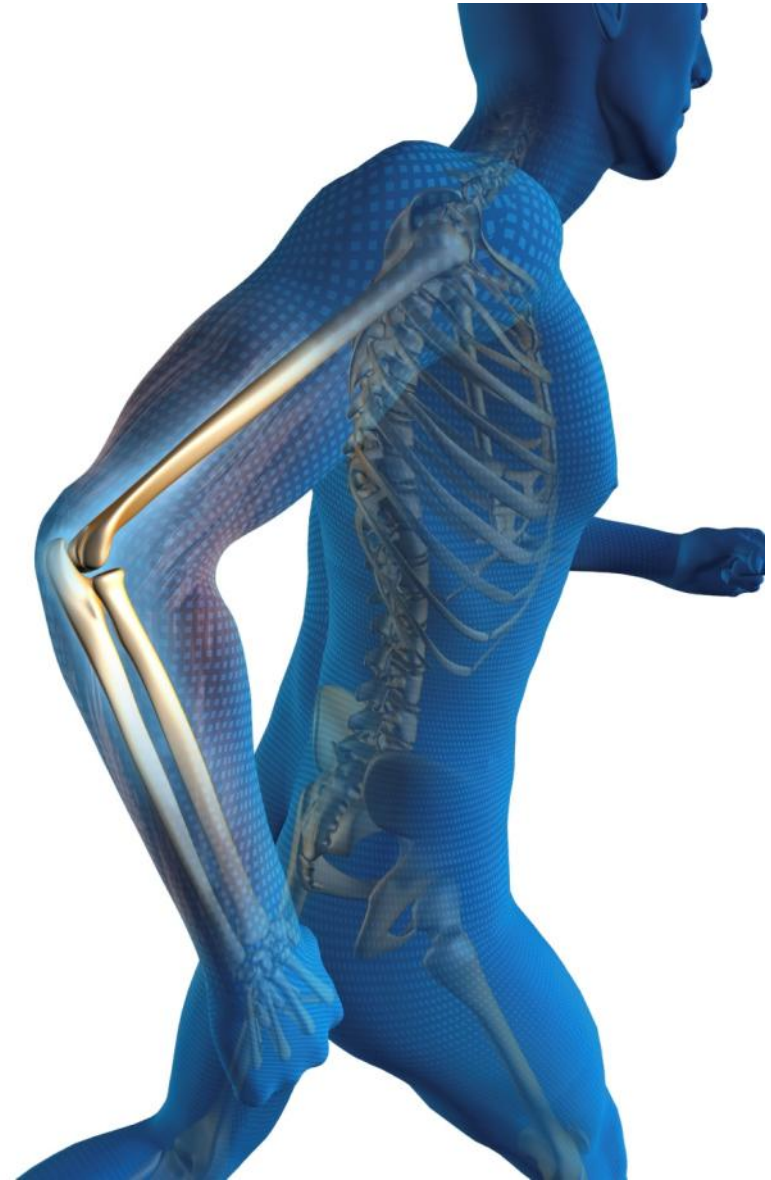
**MEDTEC Europe Conference
Stuttgart, 03.06.2014**



Outline

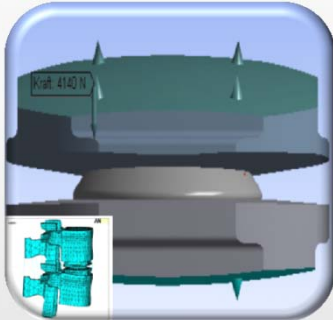


Department Biomechatronic Systems
FRAUNHOFER IPA



Department Biomechatronic Systems

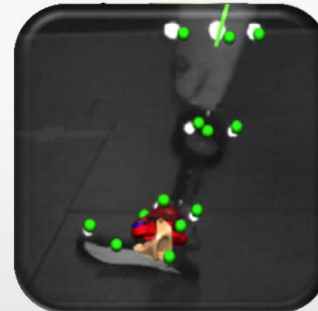
Overview



Bionics in
Medicine



Motion Control
Systems



Virtual
Orthopedic Lab



Biomechanics



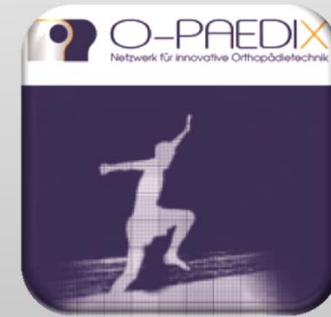
Stuttgart Minneapolis
Rehab Research



Southampton Stuttgart
Biomechanics Research

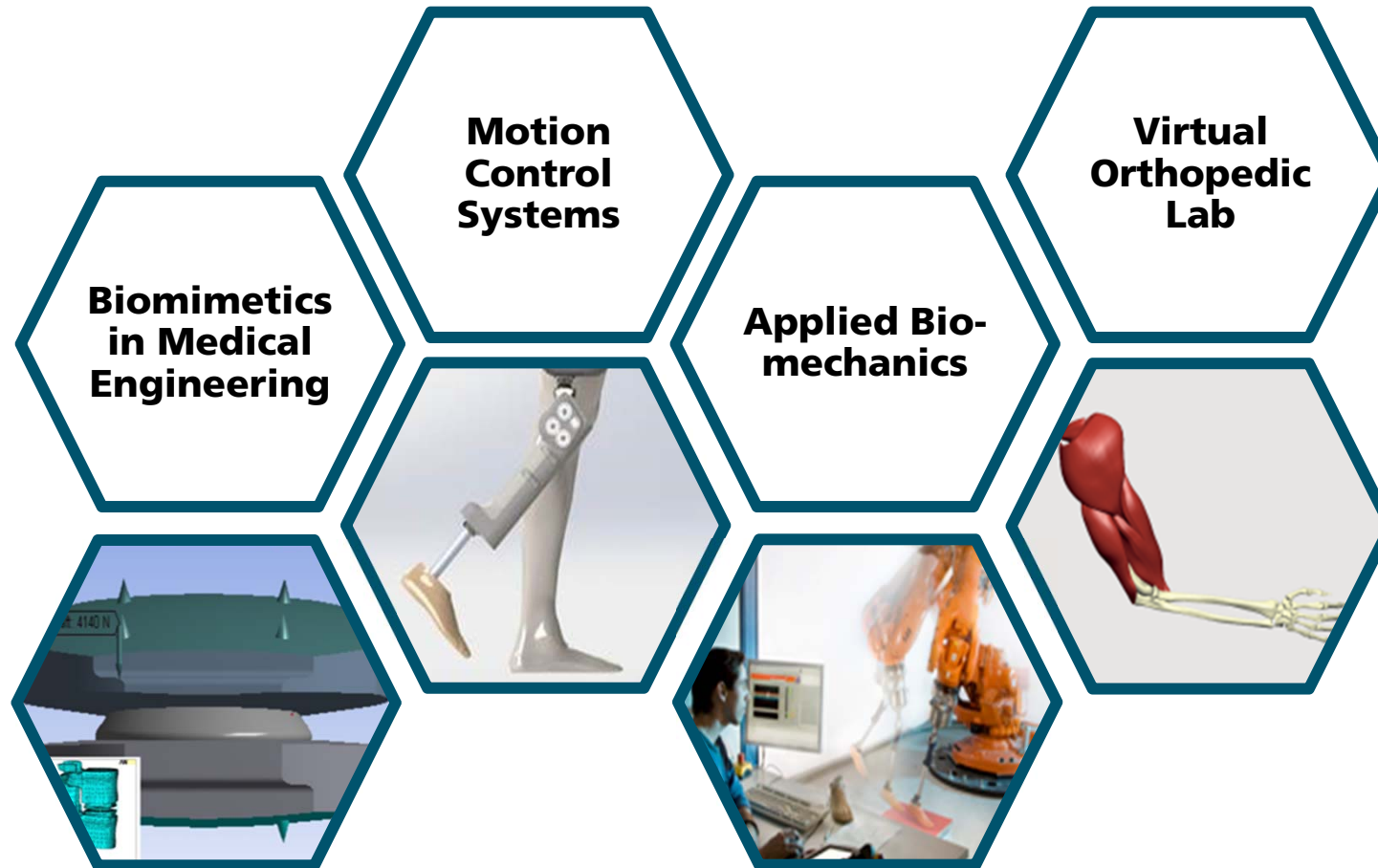


SIMTECH
Universität Stuttgart

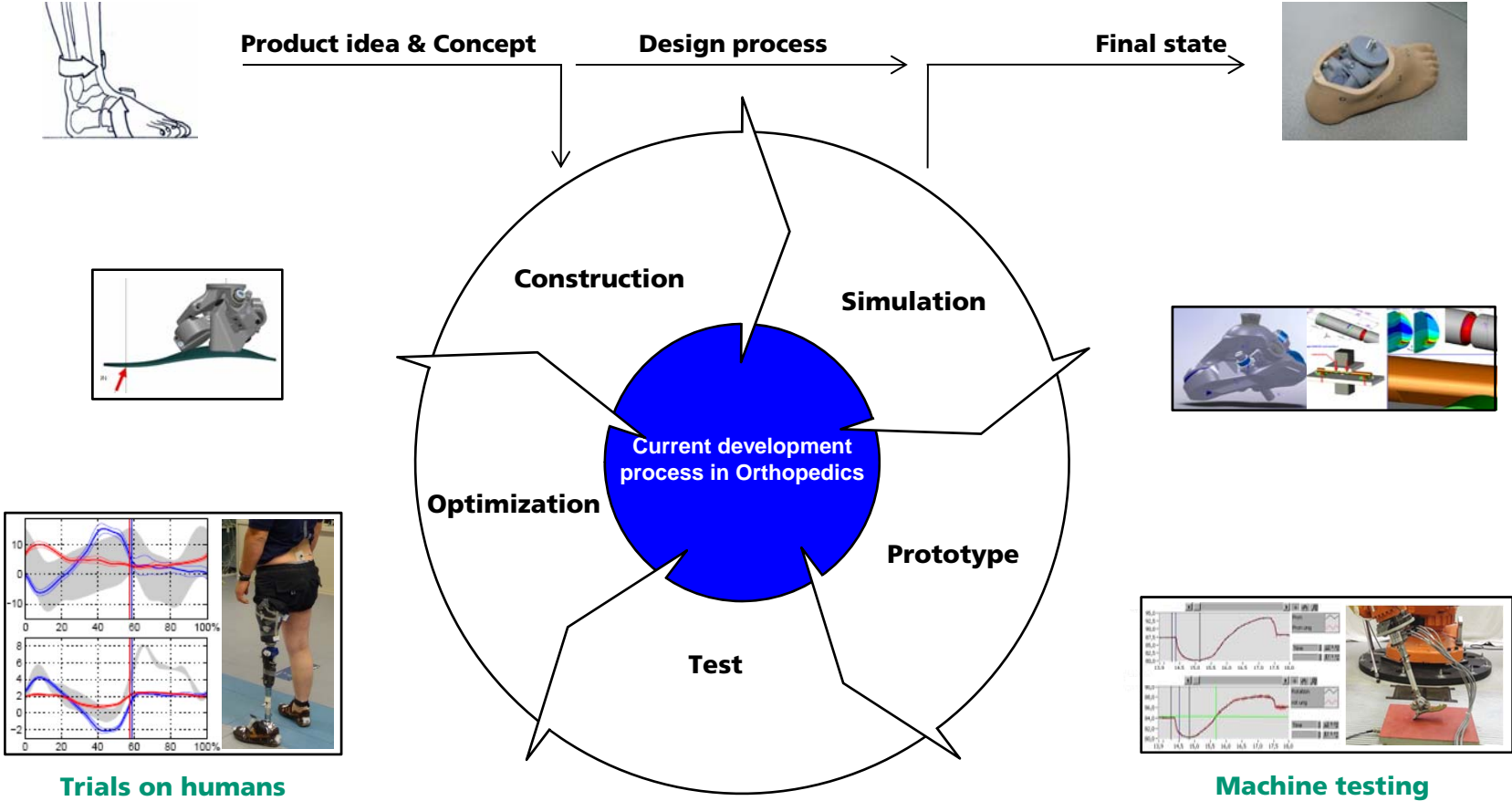


O-PAEDIX e.V.

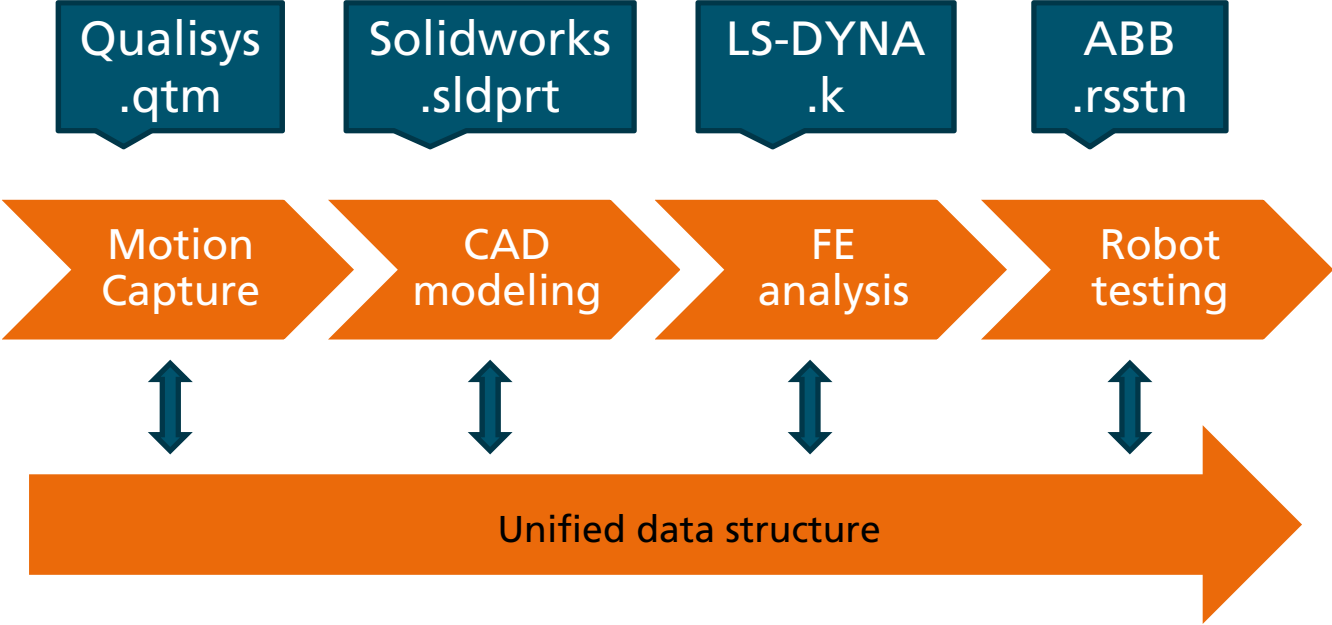
Department Biomechatronic Systems Overview



Classic Development Process in Prosthetics



Proposed solution

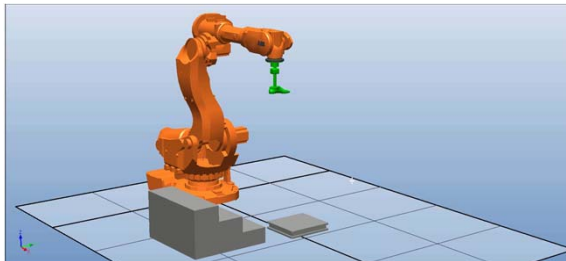


Accelerating and facilitating design-decision making in prosthetic engineering.

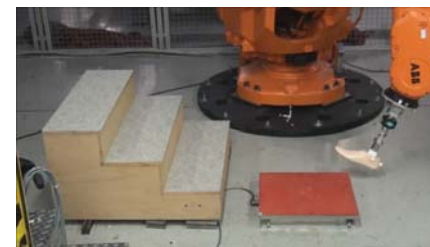
Motion analysis



Patient robot simulation



Patient robot test



Example „Below prosthesis stair gait simulation“

Produktentwicklungsphase –

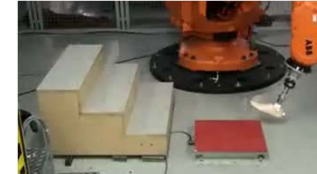
Simulationsbasierte Entscheidungsfindung im Prothesenengineering



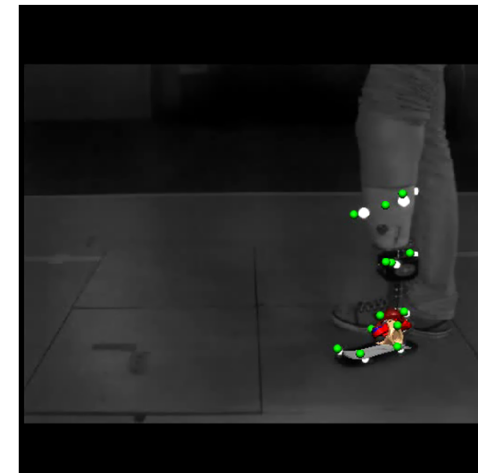
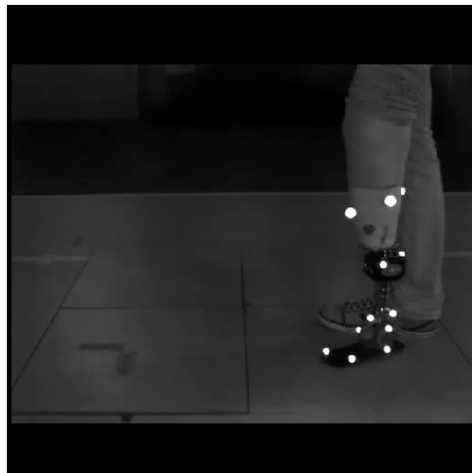
Visualisierung
der
Bewegung



FE Simulation

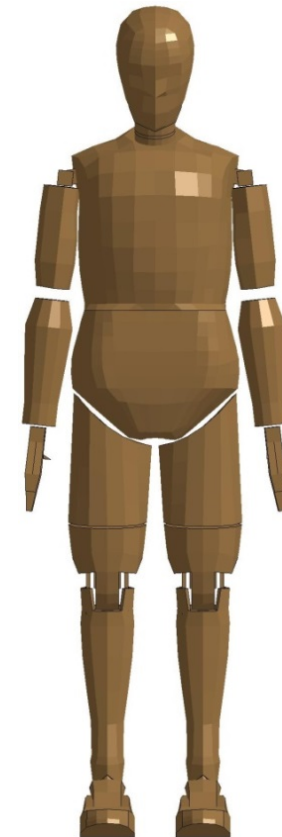


Overlay
Visualisierung



Vorteile der virtuellen Ganganalyse

- **Testen der Prothese unter realen Bedingungen**
 - Patientenspezifische Prothesenentwicklung
- **Testen von komplexen Belastungszenarien**
 - Die ISO-Norm ist eine starke Vereinfachung und bildet nicht unbedingt den Gangzyklus realistisch ab
- **Dynamische Analysis von Stumpf-Schaft-Interaktion**
 - Komfort, z.B. Druckstellen
 - Wärmebildung
 - Mechanische Effizienz
- **Klinisches Tool, um pathologischen Gang zu identifizieren**



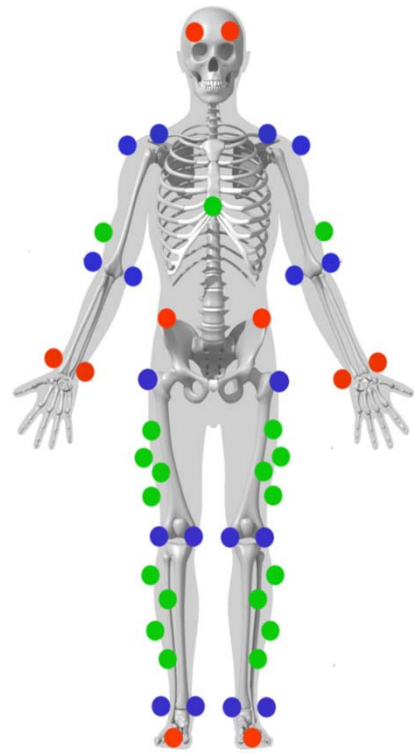
Virtuelle Ganganalyse

Datenaufnahme

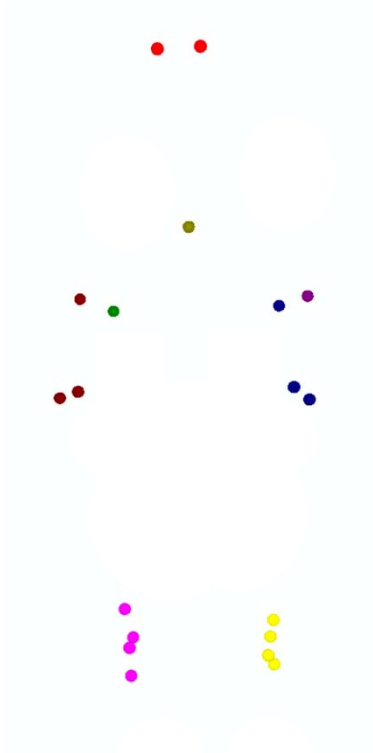


Virtuelle Ganganalyse

Modellregistrierung



Standard-Markerpositionierung



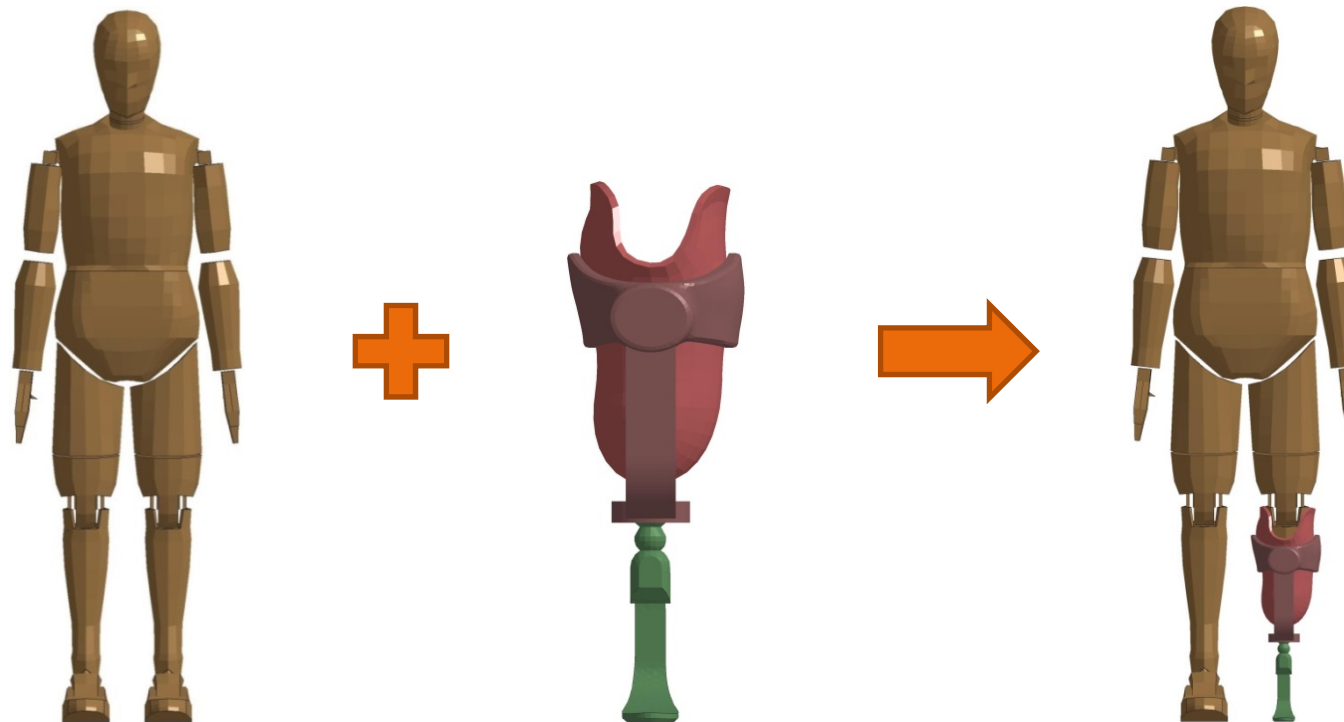
Markerreduktion



Basierend auf relevanten Segmenten

Virtuelle Ganganalyse

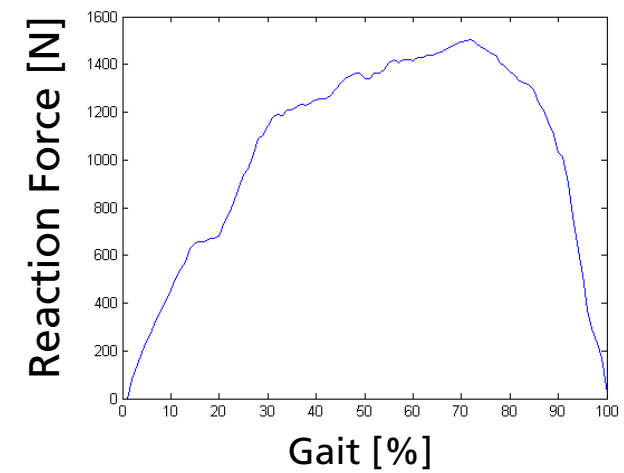
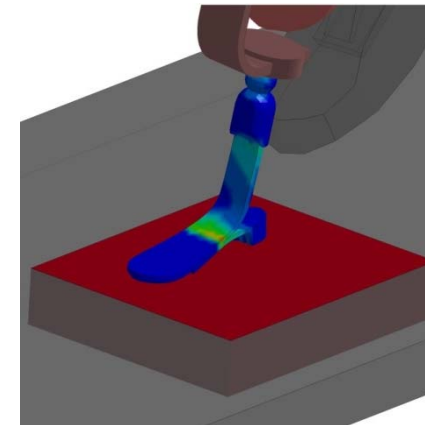
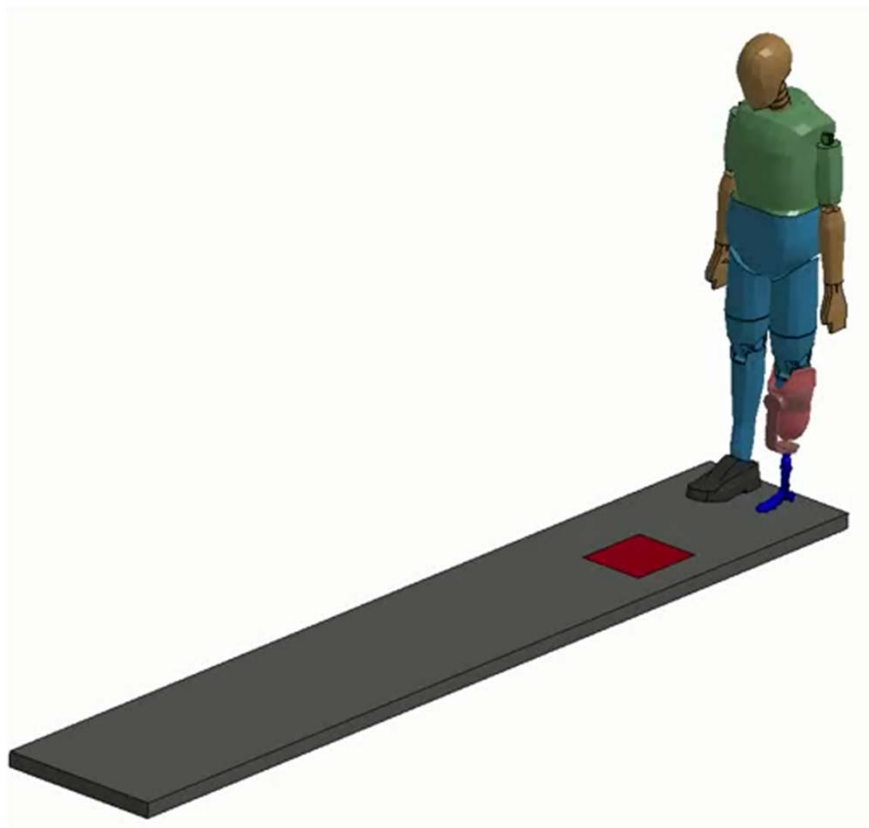
Automatische Anpassung von Prothesen



Durch statistische Methoden können verschiedene Prothesen an den virtuellen Dummy angepasst werden. Der Gang bleibt unverändert.

Virtuelle Ganganalyse

Datenaufnahme

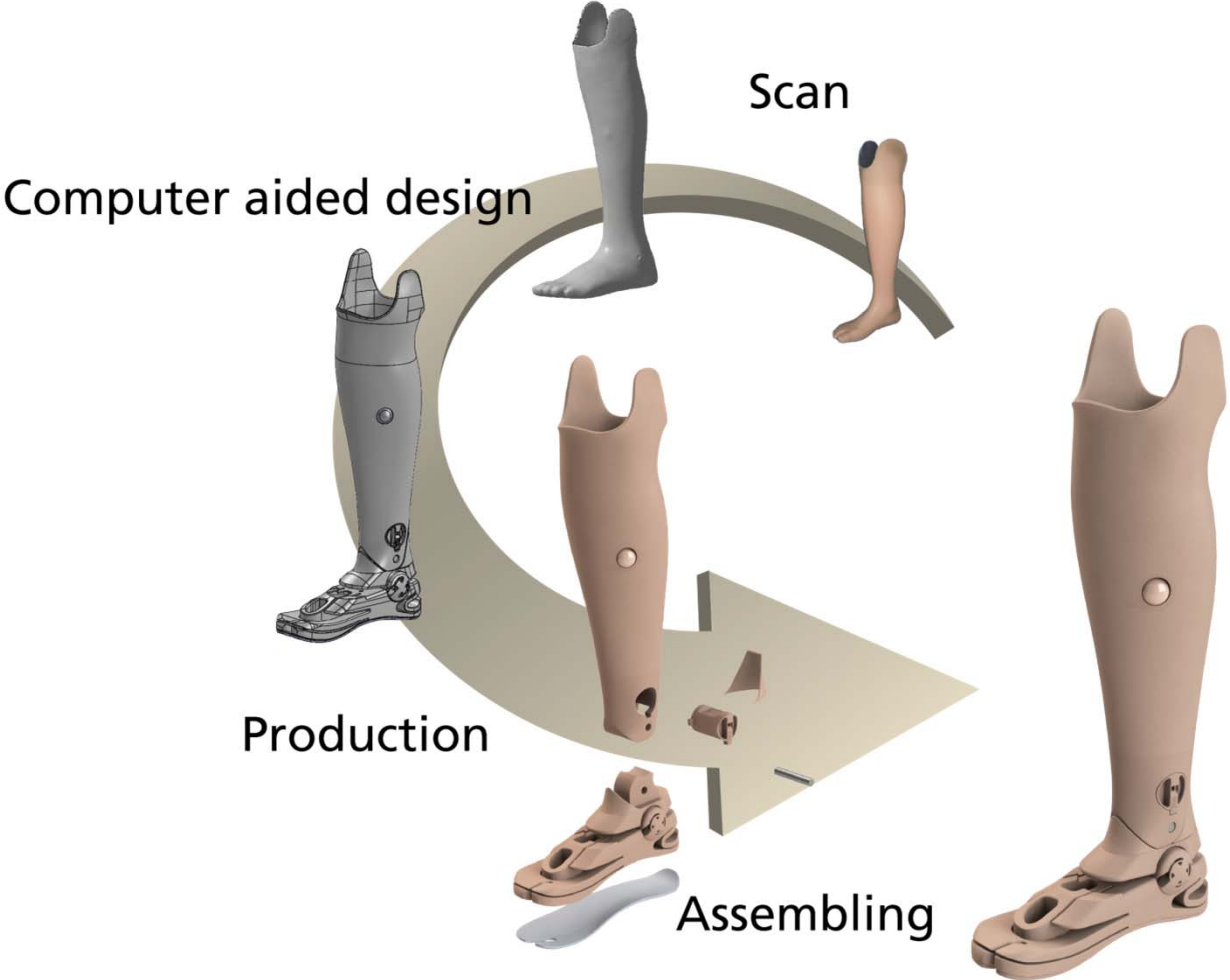




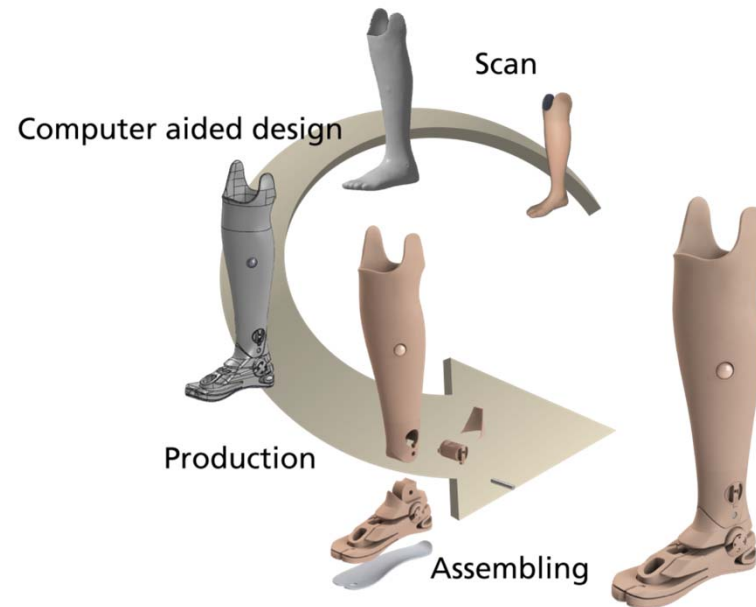
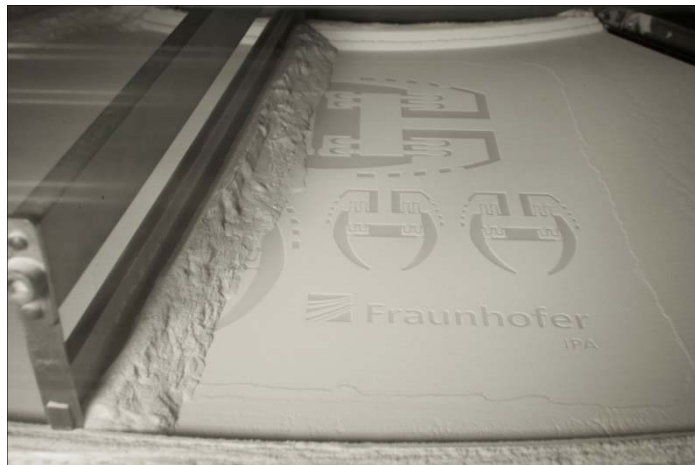
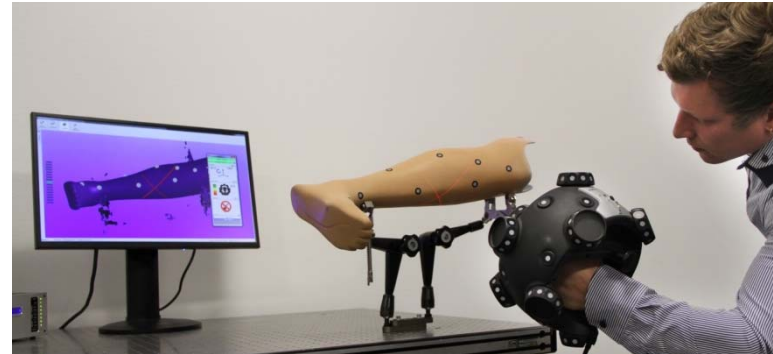
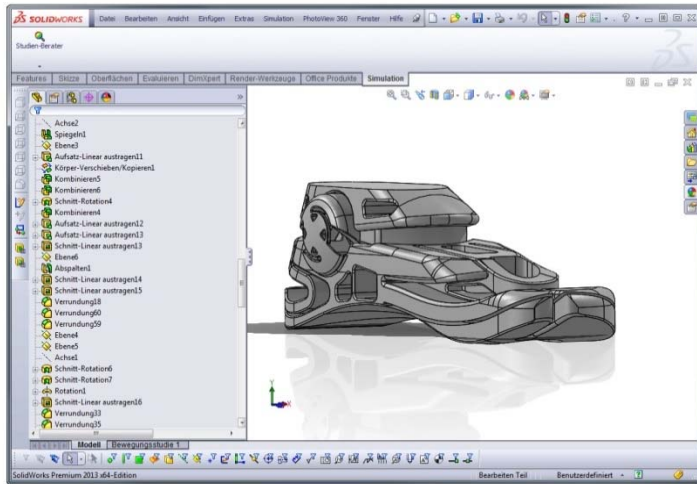
Why direct digital manufacturing?

ADVANTAGES OF ADDITIVE MANUFACTURING

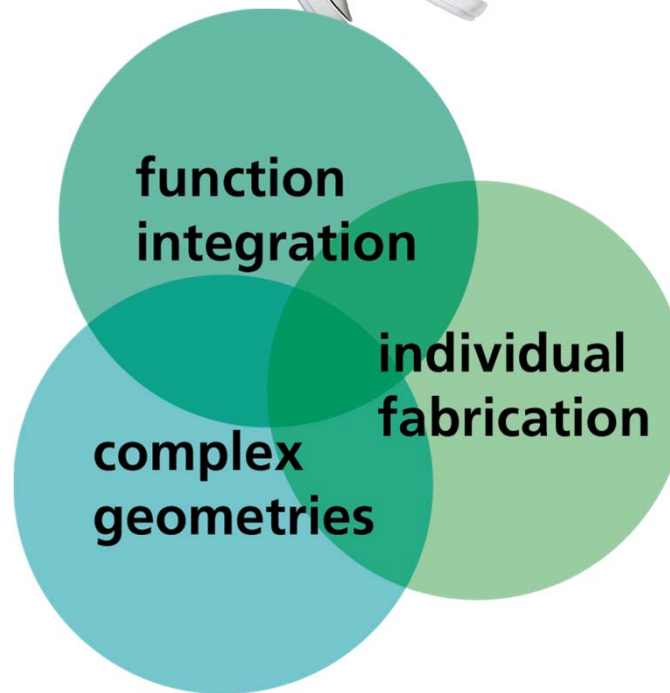
The Digital Process



The Digital Process

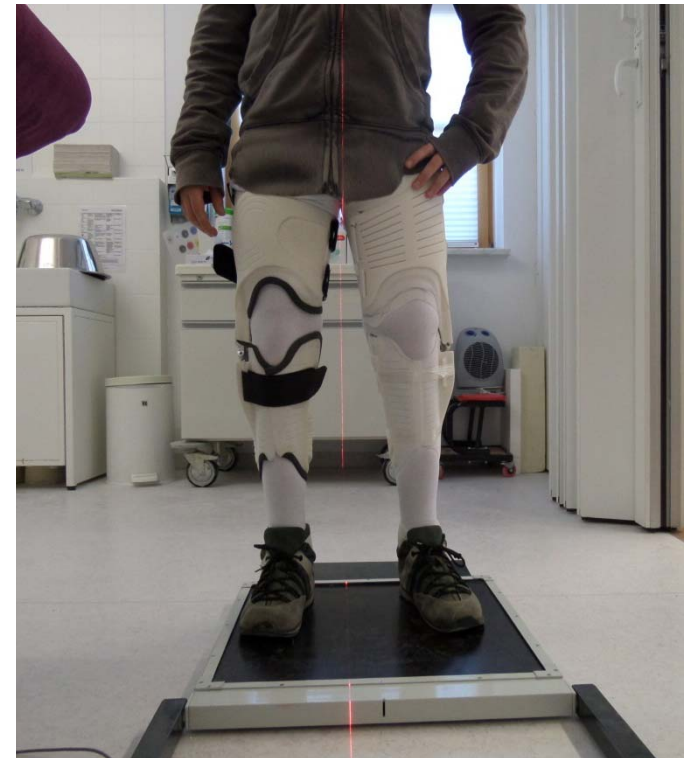


Advantages of Additive Manufacturing



Orthoses

Cooperation Gottinger and Fraunhofer IPA

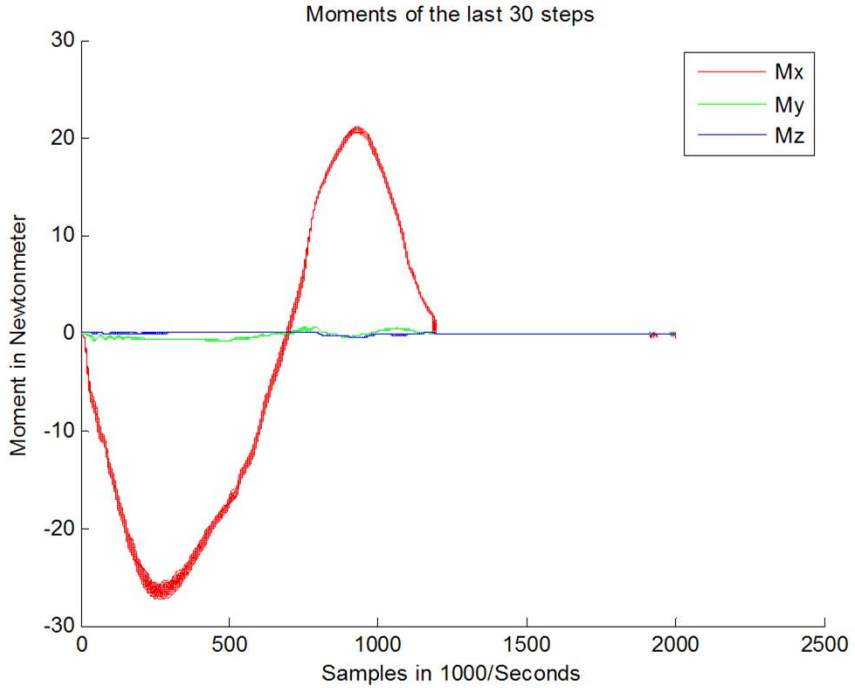
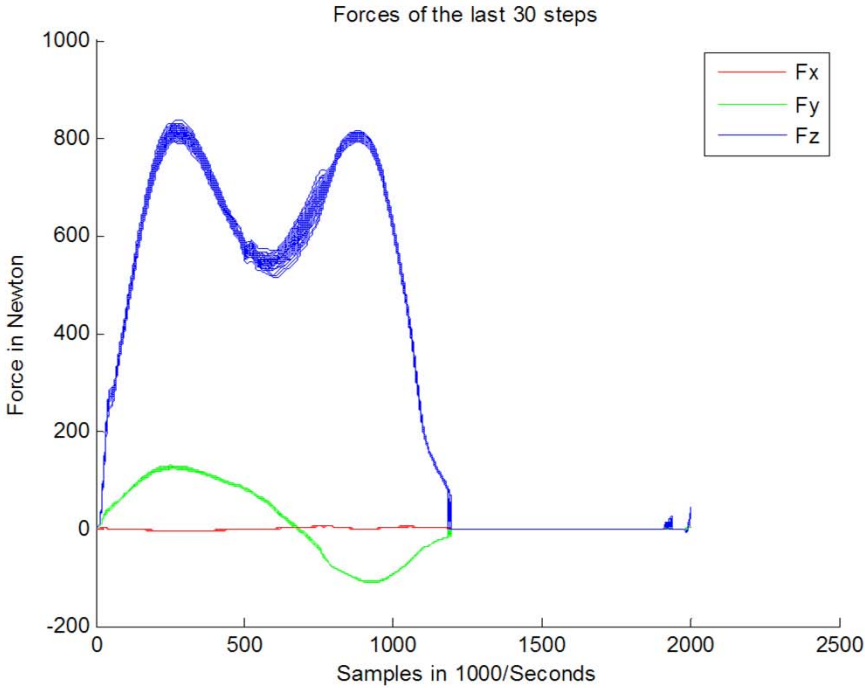


More information: Hall 3, Additive Printing Zone

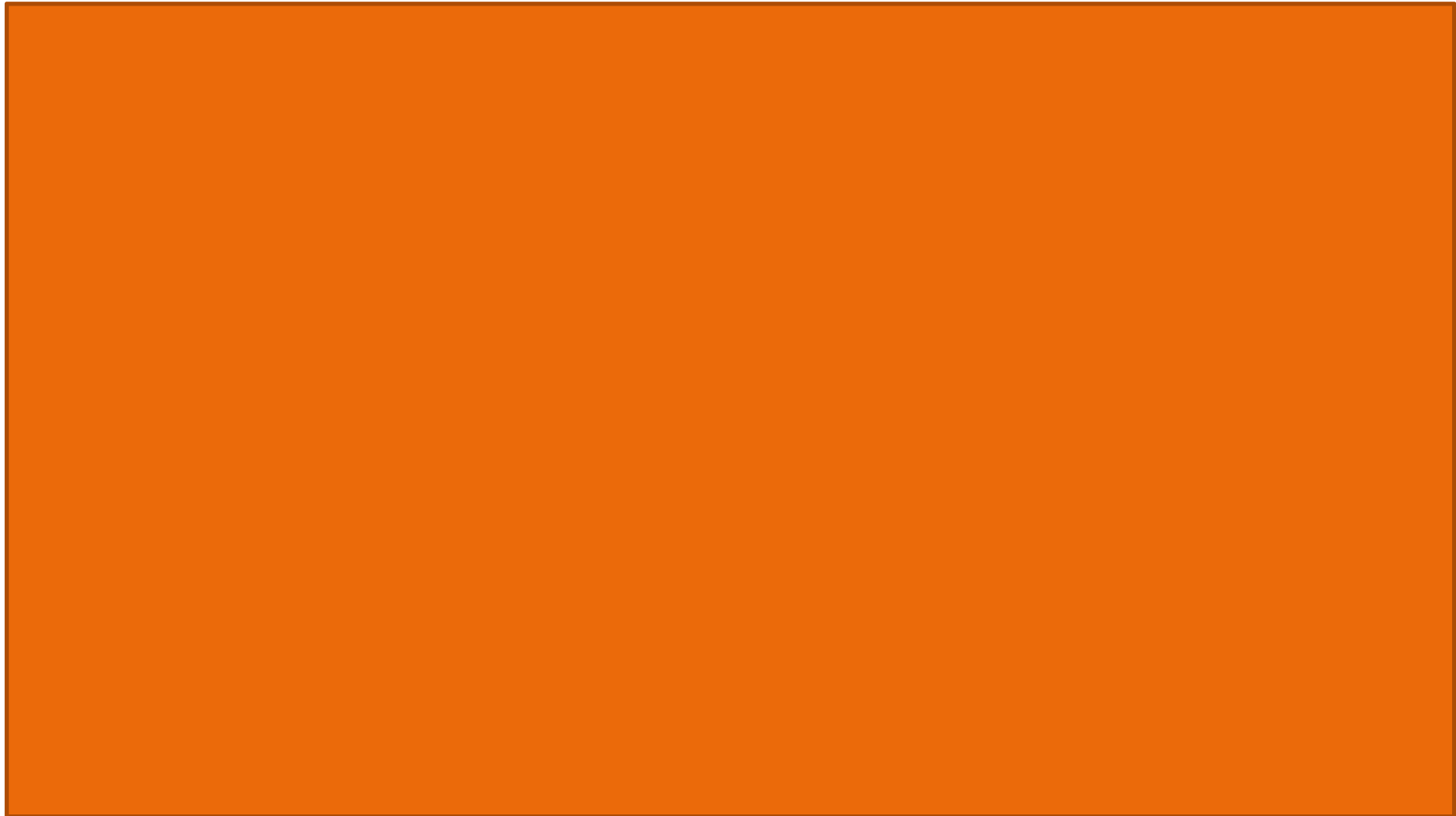
Prostheses



Prostheses



A new process flow in biomechanical engineering





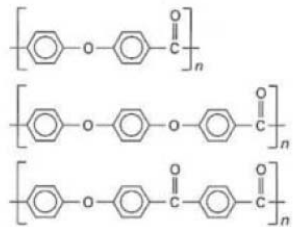
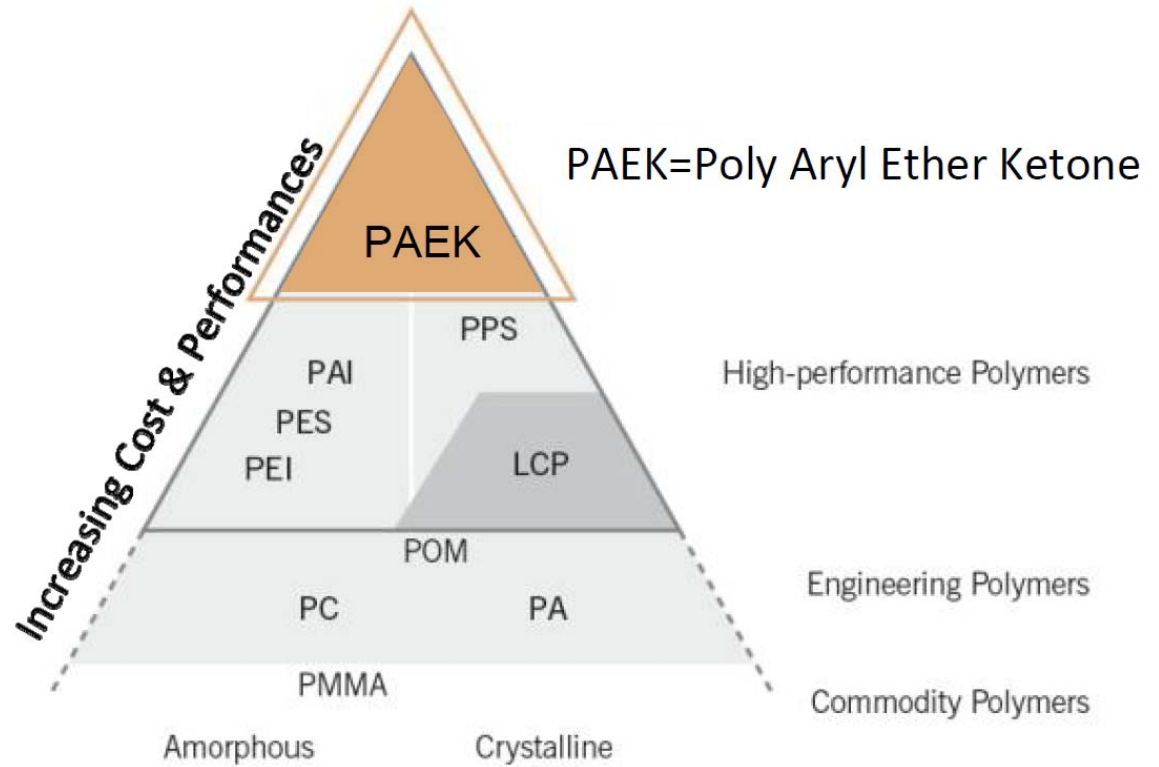
Additive manufactured prostheses and orthoses

EXAMPLES

Orthoses



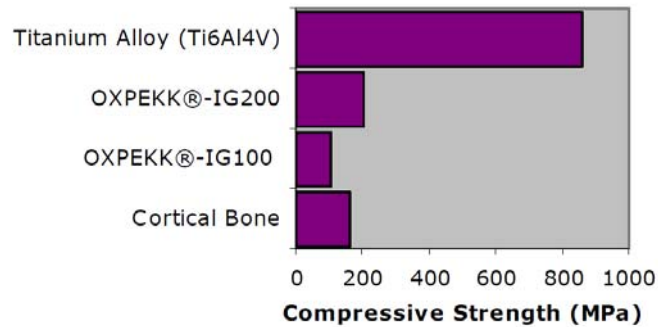
Poly Aryl Ether Ketones



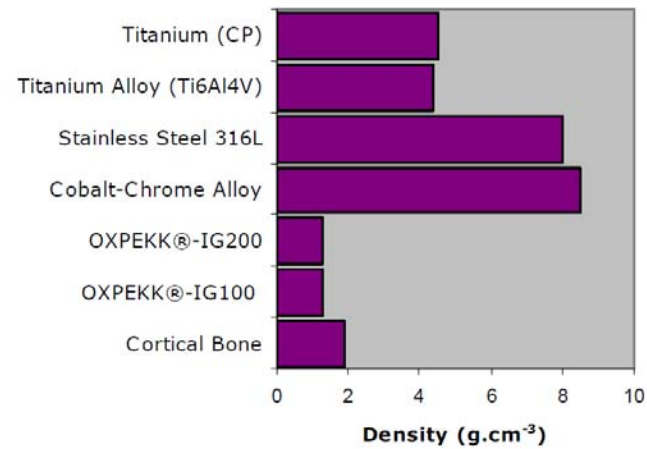
PEK	1 Ether/1 Ketone
PEEK	2 Ethers/1 Ketone
PEKK	1 Ether/2 Ketones

Implant grade PEKK: OXPEKK-IG

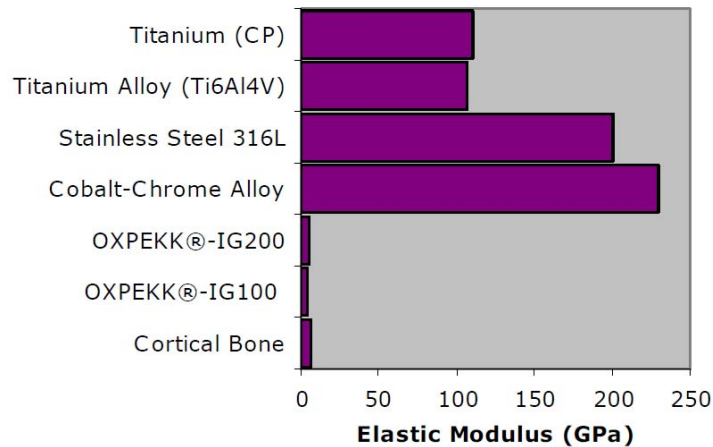
Compressive Strength



Density



Elastic Modulus



Data from OPM, South Windsor, Connecticut

New options for implant engineers

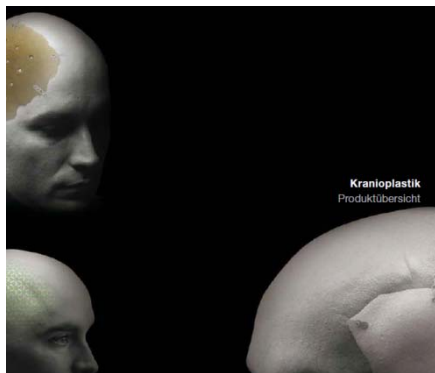


Patient specific implants
using
SLS process

- Parts are made via Selective Laser Sintering with the EOSINT P 800 using our own OXPEKK® polymer
- Final part is non-porous, unless by design
- Low risk of contamination – process has only 2 components: Powder & Light



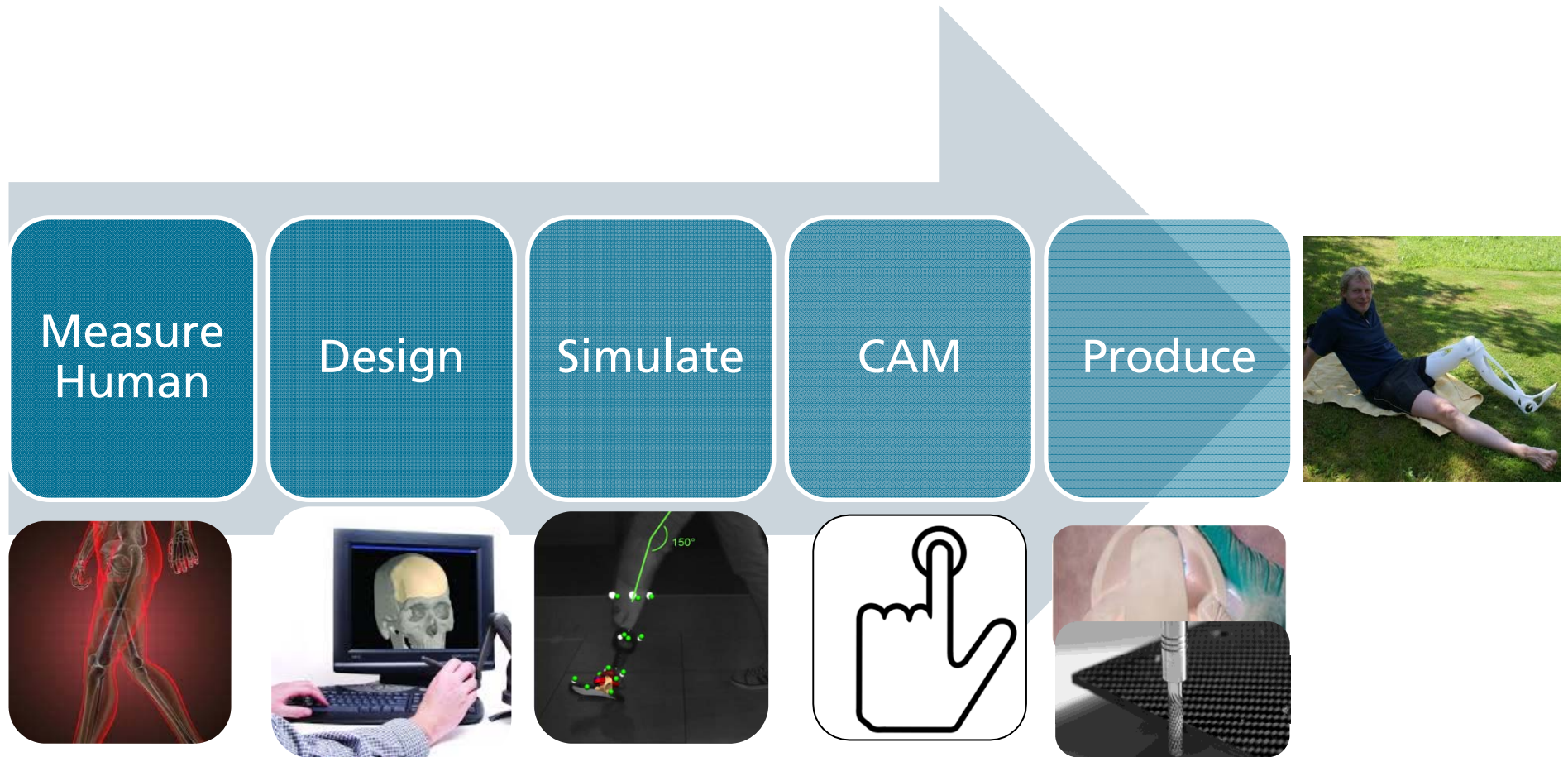
OPM process based on EOS
P800 SLS machine
technology



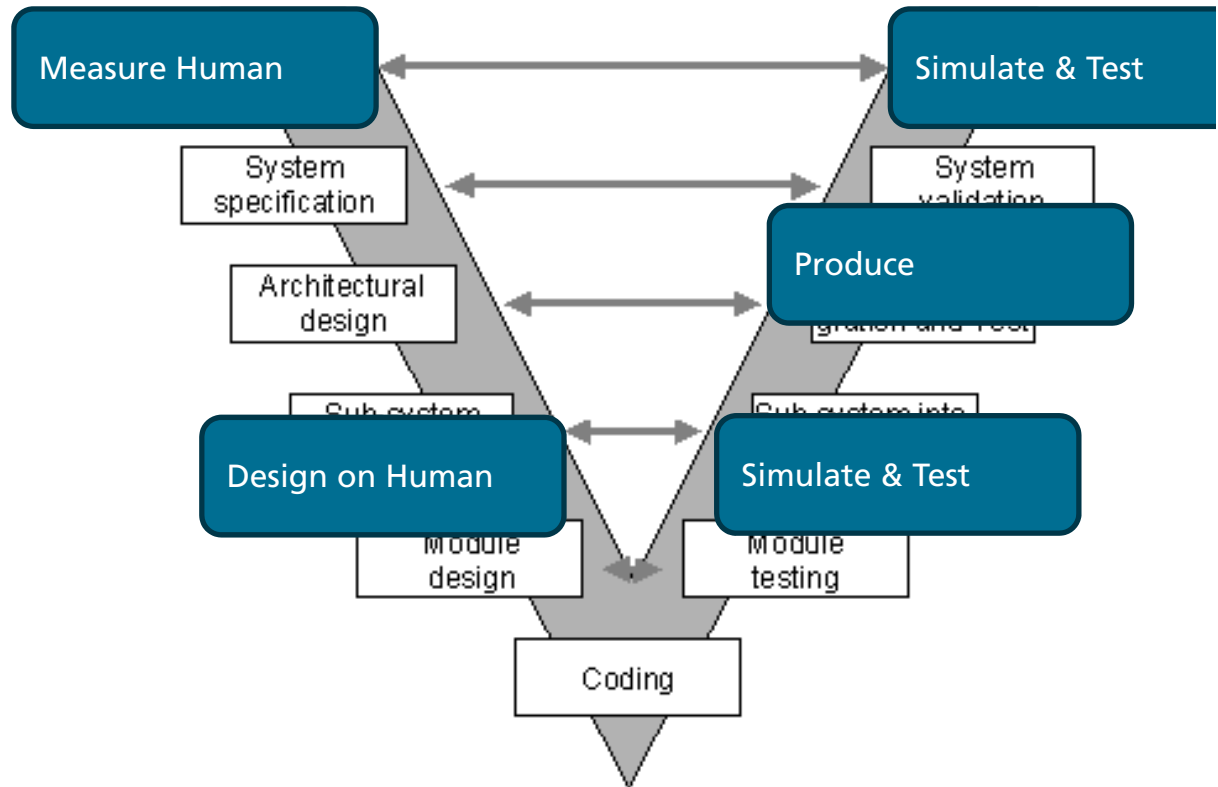
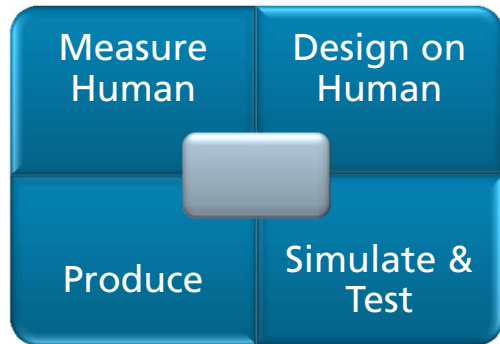
Data from OPM, South Windsor, Connecticut

Center for Human Interface Engineering

Design, Simulation, Test & Production of personalized items



Design to V-model



Thank you for your attention.

Hall 7, Stand B04/B10

and

Additive Manufacturing Zone in Hall 1

