

# Towards a predictive modelling of the normal and pathological gait

R. Van Hulle<sup>1,2</sup>, C. Schwartz<sup>1</sup>, J.-L. Croisier<sup>1,3</sup>, V. Denoël<sup>1,4</sup>, B. Forthomme<sup>1,3</sup>, O. Brüls<sup>1,2</sup>



1. Laboratory of Human Motion Analysis, University of Liège, Belgium.
2. Department of Aerospace and Mechanical Engineering, Faculty of Applied Sciences, University of Liège, Belgium.
3. Department of Motivity Sciences, Faculty of Medicine, University of Liège, Belgium.
4. Structural Engineering Division, Faculty of Applied Sciences, University of Liège, Belgium.



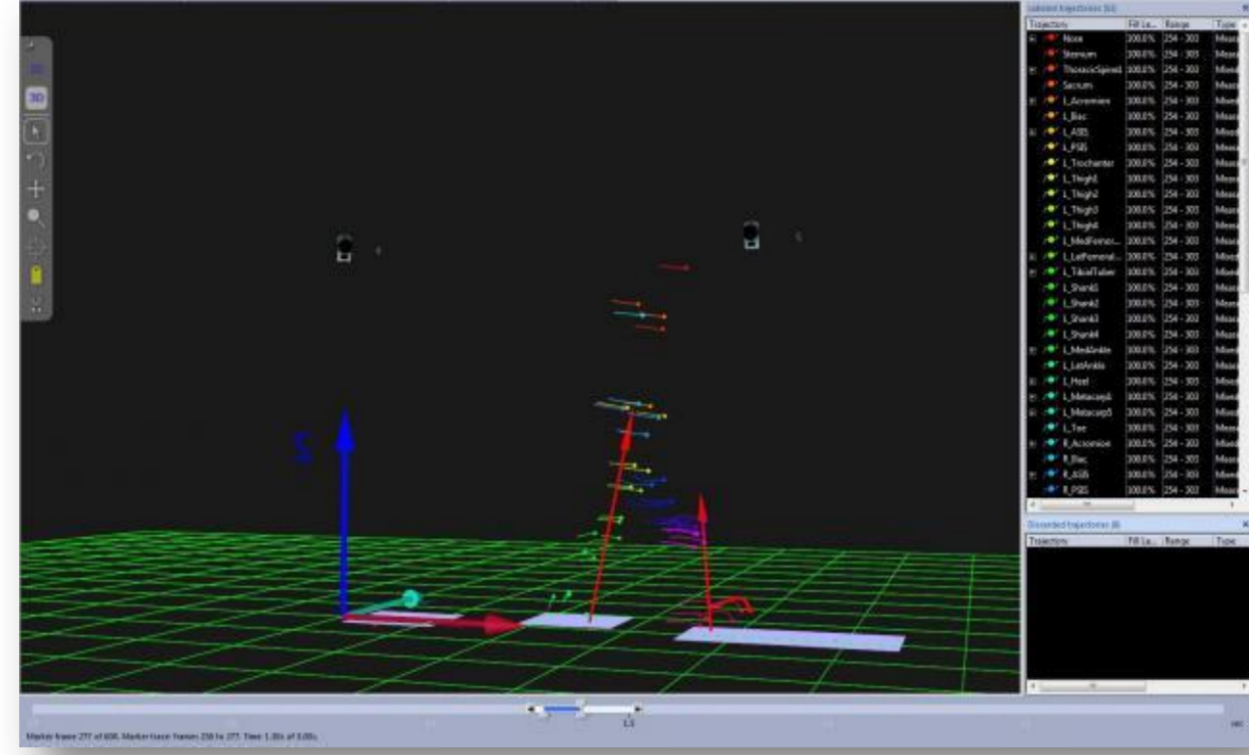
**Objective:** Creation of a predictive model of the normal and/or pathological gait of human beings

## Laboratory of Human Motion Analysis

### Description of the laboratory



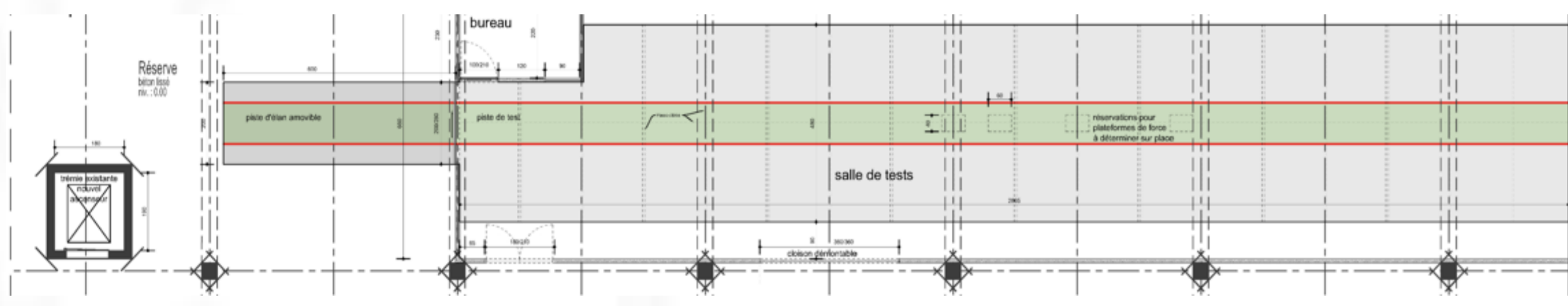
▪ 3D measurement : CodaMotion system measuring the 3D position of active markers placed on the skin of the subject .



▪ Large field of view thanks to 4 available cameras



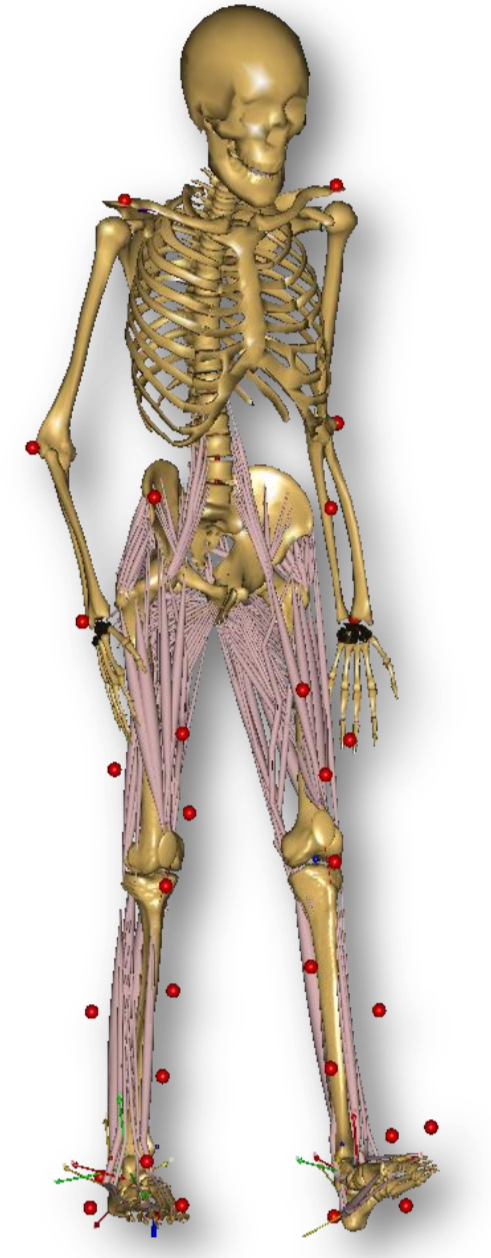
▪ Large measurement space including a 27m walking and running track



### Ongoing projects:

#### Biomechanical modelling

- Physiology of human motion,
- Evaluation of muscle forces by inverse dynamics,
- Correction of soft tissue artefacts,



#### Civil engineering applications

- Measurement of interactions between individuals and lightweight constructions such as footbridges,

#### Sport applications

- Measurement of athlete gesture for injuries prevention and performance enhancement.



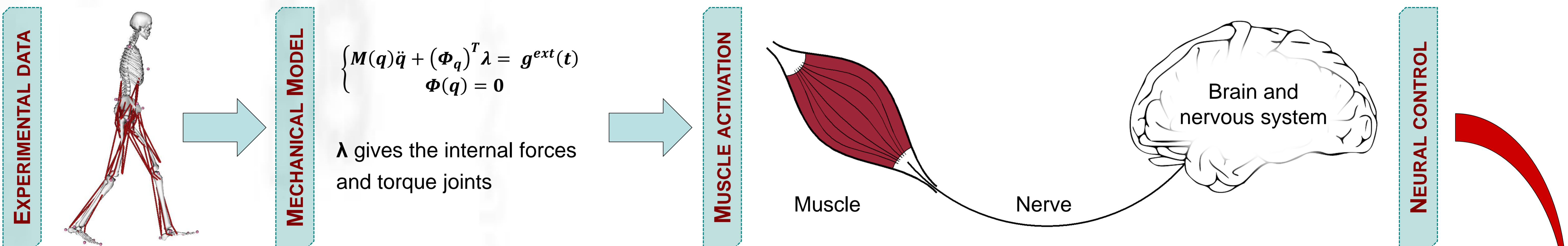
## Numerical analysis of the human gait

### Analysis of the experimental results

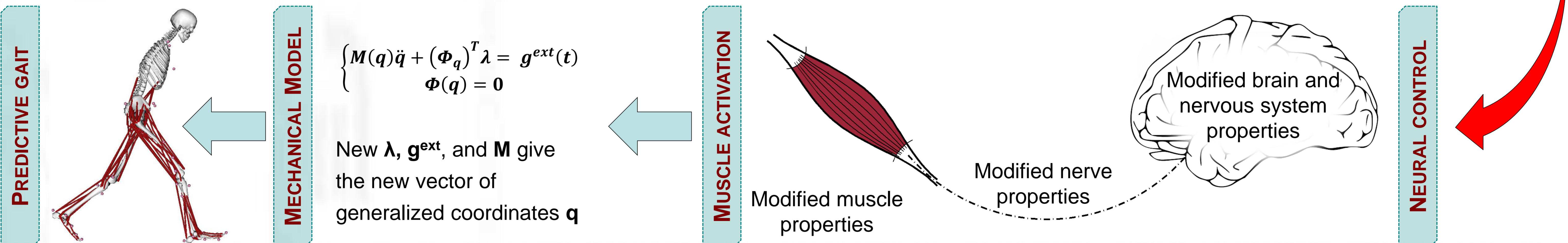
1. Determination of the mechanical model

2. Evaluation of the forces and the muscle activation

3. Estimation of the activity of the neural control center



### Development of a predictive 2D model



Neural feedback :

- Simple feedback laws
- Optimal control, dynamic optimization
- Stochastic optimal feedback control
- ...

## Contact details

Romain Van Hulle, [Romain.VanHulle@ulg.ac.be](mailto:Romain.VanHulle@ulg.ac.be), +324/366.91.13  
Quartier Polytech, Allée de la Découverte 9 (B52/3), B-4000 Liège (Belgium)