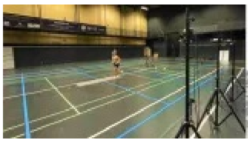
M2S Laboratory

# IT-running

## Summary

The aim of this project, conducted in collaboration with Phyling (Palaiseau, France), is to develop a methodology for quantifying the risk of running-related injuries based on in-situ measurements. This approach will allow for the assessment of injury risk in runners by quantifying the mechanical loads sustained during running. These loads will be derived from both kinematic and dynamic biomechanical parameters recorded throughout the movement. To ensure accurate and unobtrusive data collection in ecological conditions, the project will employ innovative and non-invasive devices.



Running is one of the most popular sport around the world due to its accessibility, requiring little time, no specific location, setup, or particular expertise. Numerous studies in the scientific literature have focused on training strategies to improve running performance. However, when an athlete increases training intensity too fast or fails to properly manage training load, the risk of injury rises. The incidence of injury is influenced by factors such as training frequency, intensity, and experience level. The most common injuries are related to overuse or excessive mechanical load, with nearly all occurring in the lower limbs. Quantifying training load could help improve our understanding and prevention of injury risk. While some tools exist to measure accumulated physical load, few are capable of quantifying the mechanical loads applied to musculoskeletal structures.

## Objectives

The first step of this doctoral research involved validating the measurement of ground reaction forces using a track instrumented with force sensors [1]. This size-adjustable track proved to be effective for accurate, non-invasive measurement of ground reaction forces in field conditions, as initially intended.

In the second phase, these data will be combined with markerless kinematic measurements to develop a biomechanical model capable of analyzing both joint loads and musculoskeletal parameters during running. This part of the work also aims to validate the model in a laboratory setting in order to assess its accuracy.

Finally, this model could be applied directly in the field to monitor the injury risk associated with an athlete's running technique, even under fatigue conditions.

[1] Roinson, R., Karamanoukian, A., Boucher, J.-P., Vignais, N. A size-adjustable instrumented track to measure vertical ground reaction forces: a validation study. IEEE Sensors Journal, accepted.

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