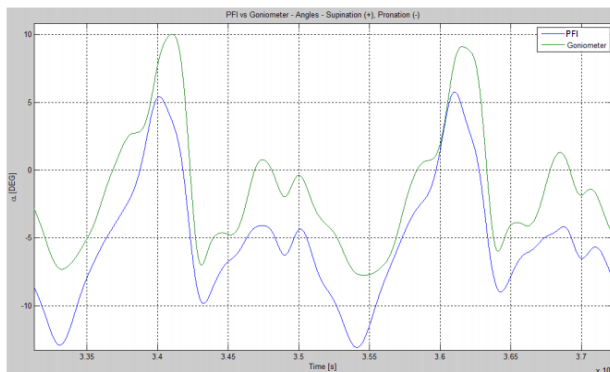


# Miniaturised Measuring System

***Development of a system that can warn an athlete of overuse in running sports and hence of risk of injury is the goal of a joint research project conducted by the Department of Sport and Exercise Science of Stuttgart University and the Test and Research Institute in Pirmasens (PFI). The project with the working title “Sensor Control Running” was the topic of an article in the PFI Newsletter back in 2013. Meanwhile the finishing post has come into sight. The first test versions of the system are currently undergoing trials.***

In the course of the project PFI has developed a measuring unit that is able to acquire no fewer than 26 sensor signals that are necessary for motion analysis of walking. Designed as a long-term data logger, the unit measures just 65 mm × 50 mm × 30 mm – and thus has the rough dimensions of a full pack of playing cards. Weighing 144 g, the measuring unit alone (without mounting strap) is extremely light compared to other commercial systems, whose weight of some 400 g precludes their integration into a shoe.

The system permits several hours' dynamic data of a runner to be saved for subsequent evaluation. The logged data include electromyograms (EMG), rotational data, foot contact, spatial orientation, and clearly also acceleration values. It also offers superior temporal resolution to many existing portable measuring systems.



**Figure 1: Typical detail of a measurement**

The system is attached to the shoe of the test person / user. The measuring probes are placed on the lower leg. The user can draw inferences about pronation or supination, stride frequency, speed, the angular position of the foot (dorsal/plantarflexion) and corresponding muscular activity.

## Future Applications

There are numerous possible applications: Such a tiny measuring unit could be a real boon for many sport and exercise scientists conducting tests in which the subjects first have to be extensively wired up and can then only be conducted on a treadmill in the laboratory but not outdoors.



**Figure 1: Different versions of the measuring unit**

Use in a standardised diagnostic system for individual rehab measures is also conceivable. For example, physicians and physiotherapists could use such a system for documentation in (long-term) monitoring during or after a course of therapy. One can also imagine an application involving detection for prevention against overloading or overuse during or after rehab measures.

Ten of these units are currently being used to perform measurements on test persons at Stuttgart University. The next step will focus on integrating the miniaturised measuring station into shoes suitable for consumers in order to warn both hobby runners and top athletes about persistent malpositions during running and the associated risk of injury.

This research project bearing the number 17615N is funded by the German Federation of Industrial Research Associations (“Otto von Guericke Arbeitsgemeinschaft industrieller Forschungsvereinigungen” – AiF). The original funding period of 24 months has meanwhile been extended to 30 months. The project will therefore be concluded on 30 June 2015. The final report will be published by 30 September 2015 at the latest.

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