

## PFI Project Description

# ASchenpuTTel

**ASchenpuTTel is an acronym for a project bearing the German title „Validierung der Aussagekraft der Schuhinnenraumprüfung mittels Terahertz-Radar-Technologie“ (“Validation of the Informative Value of Footwear Interior Examination by Terahertz Radar Technology”). The goal is to measure the interior of a shoe and to compare the results with foot scans in order to attain a better accuracy of fit.**

**Status quo:** According to current statistics, about 377 million pairs of shoes are expected to be sold in Germany in 2019. Given that 20 percent of these shoes will be sold on-line, this year about 75 million parcels containing shoes will be sent on their way just in Germany.

At least half of these on-line orders (between 50 and 80 percent) will be returned to the vendor. The main reason given (70 to 80 percent) concerns problems with the fit.

As a conservative estimate, at least 75 million parcels will be unnecessarily transported (back and forth) – unnecessarily because the customer is not satisfied, and nor is the vendor because no sale has been made and handling costs have arisen for the returns. Unnecessarily also with regard to the environmental burden: CO<sub>2</sub> emission for the first attempt to successfully deliver the parcel to its destination already lies at around 277 g on average. If the carrier has to complete the journey three times, the emission already averages 1,108 g (source: [packadoo](#)).

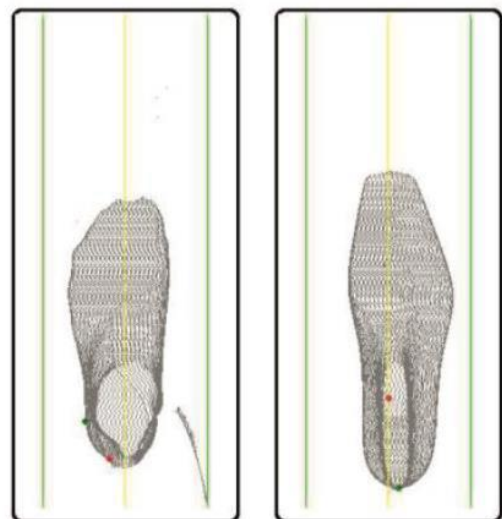
**Aim of the project:** “No blood in the shoe!” Shoes and feet have to match each other: There is an enormous variety of shoe models to cater for the different foot shapes of customers – it is just a question of finding the right match. The high rate of returns of shoes in the on-line trade should be reduced by introduction of an effective measuring system for shoe interiors.

### Approach adopted:

The project is concerned with acquisition of data about the interior of a shoe. While the exterior geometry of a foot can be acquired relatively easily using state-of-the-art technology, this is much more difficult for cavities such as the interior of a shoe.

Instead of scanning a shoe by computer tomography, which is problematic because of radiation, the interior space of a shoe is to be visualised by an external system through evaluation of signals in the terahertz range.

Terahertz technology utilises very high frequency electromagnetic waves which penetrate various materials and can provide information about the



boundary layers through transmission and reflection. In this way, the positions of the points defining the boundary layer between the shoe and the shoe interior space can be determined.

From the data of the shoe interior, which differ from the data of the shoe last, a comparison can be made between the foot scan and the scan of the shoe interior.

Although not one of the objectives of the current project, this also implies that there is a need for development of a standard for assessing customers' feet in a 3D foot scanner to provide customers with a kind of "foot ID" for use in on-line purchases, as well as for development of software for the on-line shoe trade which is able to compare the scans of feet and shoe interiors and to make appropriate recommendations (such systems do already exist but the data formats may have to be harmonised). Measurement of shoe interiors by terahertz technology could possibly become a domain of service providers and performed in conjunction with the production of product images.

**Project status:** Submitted via the German Federation of Industrial Research Associations (AiF) together with the University of Applied Sciences Kaiserslautern and the Fraunhofer Institute for Industrial Mathematics ITWM, Kaiserslautern as project partners.



**Please address inquiries to:**

Dipl.-Ing. Peter Schultheis  
Head of Technical Development and Footwear Engineering  
Tel.: +49-(0)6331-249040  
E-Mail: [peter.schultheis@pfi-germany.de](mailto:peter.schultheis@pfi-germany.de)