

Technology Opportunity, Ref. No. IS-20/342

Robotic setup for combined hearing & balance diagnostics

This novel testing environment was developed on the basis of extensive basic research and clinical expertise in Audiology and Neurotology. It combines state of the art acoustic devices with robotics and sensory assessment of vital parameters. The technology enables realistic and reproducible diagnosis and rehabilitation of patients suffering from hearing and balance disorders. The set-up is modular and allows for configurations according to a variety of diagnostic needs.

- Keywords** Sound localization, Sound field audiometry, hearing-loss, hearing aids, cochlear implants, psycho-acoustics, tinnitus, dizziness, vertigo, ENT, vestibular migraine.
- Inventors** Dr. Wilhelm Wimmer, Tim Fischer, Prof. Dr. Marco Caversaccio
- References** Fischer T. et al.: Dynamic sound field audiometry: Static and dynamic spatial hearing tests in the full horizontal plane. *Applied Acoustics* (2020); doi: 10.1016/j.apacoust.2020.107363
- Fischer T et al.: Pinna-Imitating Microphone Directionality Improves Sound Localization and Discrimination in Bilateral Cochlear Implant Users. *Ear Hearing* (2020); doi: 10.1097/AUD.0000000000000912
- Background** The system was developed to address two clinical needs associated with the fact that the inner ear houses the senses of hearing and balance. Firstly, improved diagnostic technology is needed, as multi-symptom diseases associated with the inner ear (sudden deafness, Ménière's disease, tinnitus, sound-induced vertigo,...) are - although very common - poorly understood. Secondly, modern hearing aids and implants use powerful algorithms to react to environmental sound conditions (e.g. moving noise sources). However, the diagnostic systems have hardly evolved since decades and only allow for measurements under static conditions.
- Invention** This technology enables innovative, realistic and reproducible hearing assessments, such as dynamic sound localization tests or speech understanding from moving noise sources. In addition, the robotic system enables synchronous sound and 3D motion stimulation as well as the recording of vital data of patients for completely new diagnostic approaches in Audiology and Neurotology. This leads to better understanding and more effective treatment of inner-ear associated disorders, through optimized, patient-specific programming of hearing aids and related audio-processors.



Fig. Prototype setup used for clinical testing (see references)

- Application** Diagnostics of disorders related to the inner ear, in particular hearing loss and vertigo
- Patent Status** International (PCT) patent application filed.

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