Science **made** smarter

For research use only

The Titan Research Platform from Interacoustics

Interacoustics

Audiometry | **Tympanometry** | ABR | **OAE** | Hearing Aid Fitting | Balance

A powerful platform for auditory research

The Interacoustics Titan offers the possibility to be used as a research platform, providing a combined audio interface, ear probe, and air pump for hearing research. The Titan Research Platform enables researchers to build custom measurement algorithms in MATLAB to suit their specific research needs.

Audio interface

The Titan Research Platform enables operating the Titan as a configurable audio interface that can be controlled through MATLAB–just like an ordinary sound card. The Titan Research Platform is available for researchers that would like the ability to build custom measurement algorithms beyond the Titan's clinical capabilities, and gives full control of their Titan and measurement data. Measurement algorithms can be built from scratch using a simple set of interface functions to

- send stimuli to ear-probe speaker channels 1 and 2, or a contra insert earphone/headset,
- record ear-canal responses from the ear-probe microphone, and
- control the ear-canal pressure using the air pump and the pressure sensor.

The figure below illustrates the signal flow in the Titan Research Platform. Alternatively, custom measurement algorithms can be based on the supplied sample scripts, which are designed to illustrate the basic functionality of the Titan Research Platform for

- acoustic Thévenin-equivalent calibration of the ear probe based on published methods,[1]
- ambient-pressure Wideband Absorbance (WBA) based on published methods,[2]
- pressurized Wideband Tympanometry (WBT) based on published methods,[2]
- wideband middle-ear muscle reflex (MEMR) based on published methods,[3]
- distortion-product otoacoustic emissions (DPOAE),
- transient-evoked otoacoustic emissions (TEOAE), and
- operating the air pump.

The Thévenin-equivalent-calibration script is supplied to ensure that the WBT calibration is conducted identical to the clinical Titan. We highly recommend using or basing custom WBA or WBT measurement algorithms on these scripts rather than developing absorbance measurement methods from the ground up.

Unique characteristics

The Titan Research Platform utilizes low-noise 24-bit AD/DA converters operating at user-selectable 22.05- or 44.1-kHz sample rates and offers several advantages over conventional sound-card-based research systems. Sharing measurement algorithms as scripts or custom GUIs with research colleagues is significantly simplified because it does not require accounting for differences in hardware such as levels, delays, etc.; synchronization between output and input channels is done under the hood. Using the MATLAB Compiler, it is also possible to compile a custom GUI into a stand-alone application that does not require a MATLAB license. Furthermore, the ability to control the ear-canal pressure using the air pump is a unique feature of the Titan Research Platform. Finally, measurement algorithms based on synchronous averaging of ear-canal responses–an approach conventionally used in WBA, WBT, DPOAE, and TEOAE–are significantly simplified because the playback of stimuli is looped indefinitely until instructed otherwise. Compared to the WBT Research License for the

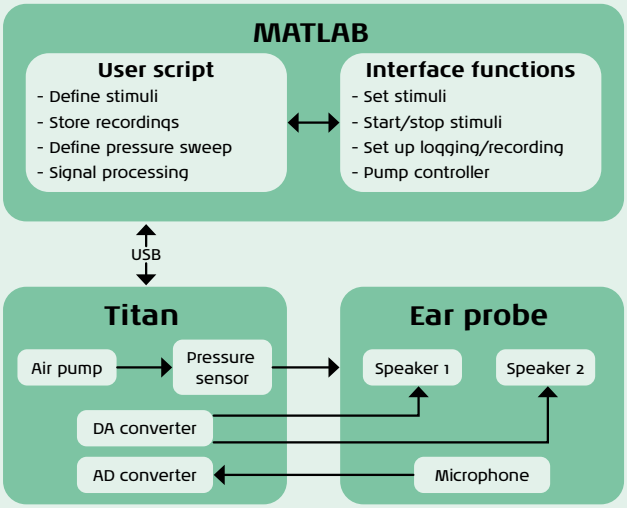
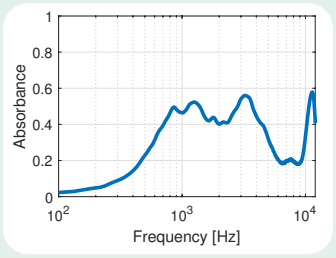
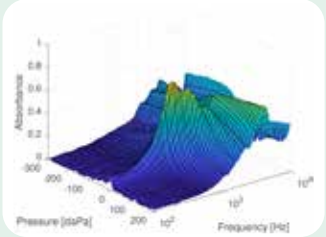


Illustration of the signal flow in the Titan Research Platform.



Ambient Wideband Absorbance measurement.



Pressurized Wideband Tympanometry measurement.

[1]Nørgaard et al. (2017), J. Acoust. Soc. Am. 142, 3013–3024 and Nørgaard et al. (2022), J. Acoust. Soc. Am. 152, 2652–2663.
[2]Nørgaard et al. (2017), J. Acoust. Soc. Am. 142, 3497–3509.
[3]Feeney and Keefe (2001), Ear Hear. 22, 316–332 and D. H. Keefe et al. (2010), Hear. Res. 264, 52–65.

Clinical Titan Suite, the Titan Research Platform offers full control of the Titan. The WBT Research License only allows exporting processed WBT measurement data taken to a MATLAB file.

Purchase configuration

Please contact your local distributor to order your Titan hardware for the Titan Research Platform. Make sure that your order includes:

- a Titan unit including the long clinical extension cable with fixed ear probe,
- the IMP440 and WBT440 diagnostic software modules,
- a WBT Research License, and
- optional WBT Calibration Kit, required for WBT acoustic Thévenin-equivalent calibration.

For access to the Titan Research Platform and MATLAB software, please contact Interacoustics at research@interacoustics.com. Note that MATLAB is not included with the Titan Research Platform which requires MATLAB R2016a or later, and the supplied sample scripts further require the Signal Processing Toolbox.

Distribution and support

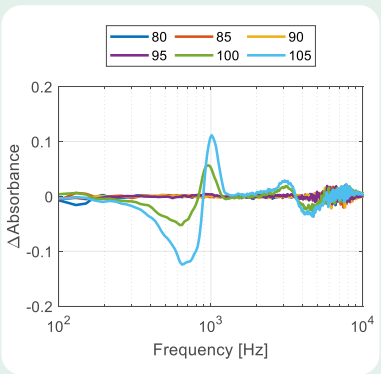
Your local distributor is responsible for supporting normal clinical use or problems related to such. However, distributors will not be able to assist with any issues related to the Titan Research Platform. The Titan Research Platform comes with the necessary documentation to start building your own measurement algorithms. Technical support for the Titan Research Platform is provided from Interacoustics' headquarters, but only within the bounds of the functionality of the physical Titan hardware. Interacoustics cannot provide any technical support for or assistance with developing custom measurement algorithms. Please direct any hardware support requests to your local distributor.

Disclaimer–investigational device

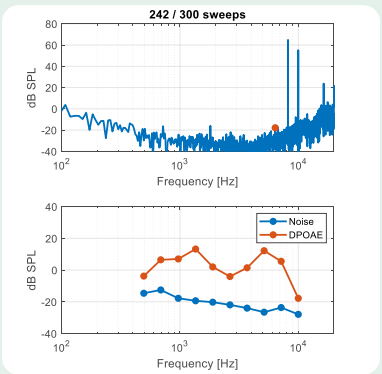
By using the Titan Research Platform, your own MATLAB software will interact with the Titan and thereby regulatory certifications like FDA, CE-markings, etc. will be invalid. The intended use of the Titan Research Platform is only for research purposes. By using the Titan Research Platform, Interacoustics cannot be held responsible for any harm caused to your research subjects, for example, in case of presenting undesirable stimuli, stimulus levels, or ear-canal air pressures. Furthermore, the supplied sample scripts are provided with the sole purpose of illustrating the functionalities of the Titan Research Platform. When using directly or building measurement algorithms based on these sample scripts, it is the sole responsibility of the researcher to ensure that the data is processed as intended. Interacoustics cannot be held responsible in any way for possible data-processing errors resulting from any use of the sample scripts or from any other use of the Titan Research Platform.

"As an audiologist and a hearing scientist who has been using wideband tympanometry (or similar) measurements for over 15 years, I have experience using the Interacoustics Titan for both clinical and research purposes. I was an early adopter of the Titan Research Platform (in 2018) and have used it in my research since. The ability to use a device in my research that is also commonly used in the clinic has been such a big advantage, as it helps facilitate the translation of my research to the clinic! The Research Platform offers a nearly limitless number of options and functionality, and most importantly for me, access to raw forms of the data. Additionally, the calibration code and sample scripts that come with the research platform gave us a huge start on developing our own customizable software, which we can easily share with colleagues and collaborators because of how the Titan Research Platform is set up. Having researchers across multiple labs and institutions using the same hardware and some of the same key foundational pieces of code will really push the field forward in a cohesive way that I believe will directly benefit innovation and development in hearing science."

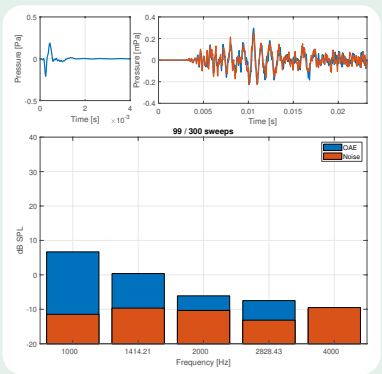
Gabielle R. Merchant, Au.D., Ph.D., CCC-A
Director, Translational Auditory Physiology and Perception Laboratory
Boys Town National Research Hospital



Wideband MEMR measurement.



DPOAE measurement.



TEOAE measurement.

Science **made** smarter

Interacoustics is more than state-of-the-art solutions

Our mission is clear. We want to lead the way in audiology and balance by translating complexity into clarity:
- Challenges made into clear solutions
- Knowledge made practical
- Invisible medical conditions made tangible and treatable

Our advanced technology and sophisticated solutions ease the lives of healthcare professionals.

We will continue to set the standard for an entire industry. Not for the sake of science. But for the sake of enabling professionals to provide excellent treatment for their millions of patients across the globe.

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