HEAD acoustics

DATA SHEET

Code 7970

VoCAS

Voice Control Analysis System

OVERVIEW

VoCAS

Code 7970

Voice Control Analysis System

Automatic Speech Recognition (ASR) systems find widespread application in telephone networks, cars, mobile appliances, multimedia and IoT devices such as smart speakers. Performance of the ASR mainly depends on the variety of talkers, languages and dialects as well as environmental conditions. Thus, testing with a lot of variations is beneficial for developing and improving ASR systems. On the other hand, variation makes testing more time-consuming and exact reproduction more difficult.

The voice control analysis system VoCAS has been developed by HEAD acoustics to organize and automate testing of ASR systems and devices. It offers easy setup and allows comprehensive, variation-rich testing under realistic and fully reproducible conditions.

ASIO COMPATIBLE
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VST COMPATIBLE
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KEY FEATURES

VoCAS Core

- Basic framework of VoCAS to built up the application with VoCOPTs according to user requirements
- Test sequence template for creating testcases to test and train ASR systems (application of customized audio sources requires VoCAS options)
- Remote control of background noise and reverberation simulation software
- Remote control of turntable HRT I

VoCAS Options

- Record and edit customized audio files
- Create databases of customized audio sources for application in VoCAS
- Distract and test ASR systems with concurrent talkers
- Automate and accelerate test sequences with Python scripting
- Control VoCAS remotely via REST API
- Batch generation of audio files with different parameters to train or test ASR systems

APPLICATIONS

Reproducible testing of speech recognition systems in realistic simulated environments (complex scenarios with multiple talkers, background noise, acoustic environments)

Meaningful benchmarking of different speech recognition systems

Recording of audio files

DETAILS

VoCAS is a test software for speech recognition evaluation. It supports the optimization and benchmarking of any device incorporating speech signal processing and speech recognition.

Speech recognition systems are an essential component of voice-controlled IoT devices such as smart speakers, smartphones, tablets, and multimedia systems in vehicles. VoCAS helps evaluating the speech recognition quality realistically and objectively of appropriate devices in complex scenarios. The software considers all factors that significantly influence the quality of speech recognition systems: the acoustic environment, background noise, different talkers, and different languages or accents. Thus, with the help of reproducible test sequences adapted to the respective applications, manufacturers receive essential information for optimizing their speech recognition systems.

VoCAS provides multiple features for various applications. The availability of all features divides into the fundamental core version (VoCAS Core) and several optional features (VoCAS options, VoCOPTs). The VoCOPTs extend and increase the scope of application.

PRODUCT STRUCTURE

VoCAS Core

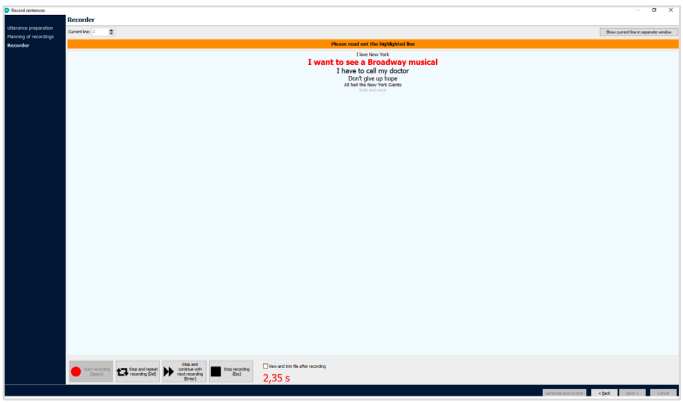
VoCAS Core is the basic framework of VoCAS. It contains necessary functions to create and run testcases, specify playback conditions and control background noise or reverberation simulation remotely. The presentation of results from the testcases may be customized according to the users preferences. VoCAS Core requires VoCAS options for recording, importing and applying customized audio sources (SQLite database) and other advanced applications.

VoCOPT – VoCAS Option

VoCAS Options – short VoCOPTs – extend VoCAS Core with additional features. These features fit to special user requirements. Using any VoCOPT requires VoCAS Core. VoCOPTs can be freely combined.

VoCOPT 1 – Signal Recorder

Record customized sentences in .dat audio file format. Additionally, the recorder has editing functions for customization of recordings with individual tags (meta data) and individual file names. The recorder interface presents highlighted text consecutively to the speaker to read it out loud. There is an extra interface to present solely the text for reading out loud. Further, each recording may be reviewed and trimmed if necessary. The recorder wizard

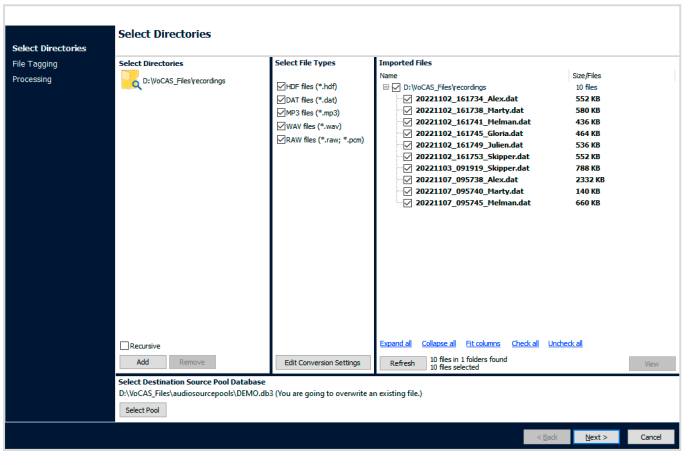


guides step by step from preparation and planning to the execution of the recordings.

VoCOPT 2 – Import / Source Pool Generator

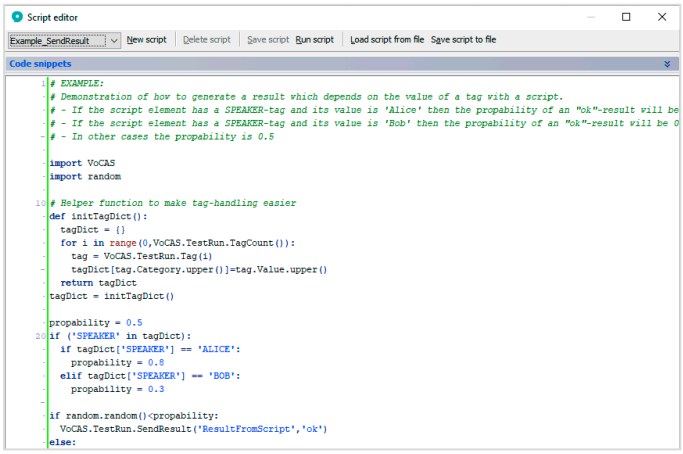
Import and generate a customized audio source pool (SQLite database) from existing audio files. The provided wizard guides through preparation steps such as tagging and file conversion pa-

rameters to the eventual import and compilation of the files into an audio source pool (database). The supported audio files range from exclusive HEAD acoustics formats (.hdf / .dat) to common



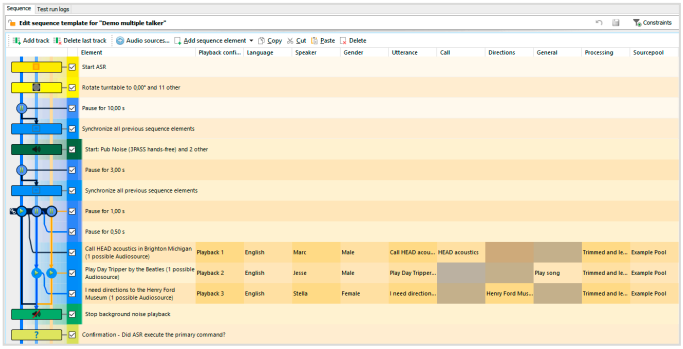
audio file formates (.mp3 / .wav /.raw). A recursive search provides the quick presentation of all appropriate files in a specific directory. The tagging editor allows both, manual and automatic tagging of the files. Before importing the files to the database, they may be altered by various available post-processing actions.

VoCOPT 3 – Python Scripting



VoCAS provides a script editor to write customized Python scripts. Apply and execute these scripts in the sequence template of a testcase. Apply Python scripts for automation of various processes in VoCAS.

VoCOPT 4 – Multitalker



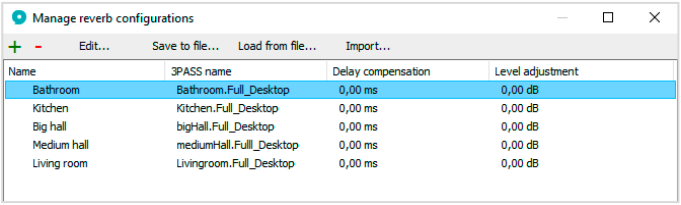
Apply up to four simultaneous talkers to the sequence template. The sequence template provides different tracks for each talker. Thus, the playback of different talkers can start and run shifted but concurrent. Specify different playback configurations e.g. gain, Lombard effect for each talker.

VoCOPT 5 – REST Remote control & Result Access

Control fundamental VoCAS functions remotely via REST API.

VoCOPT 6 – Simulation Mode

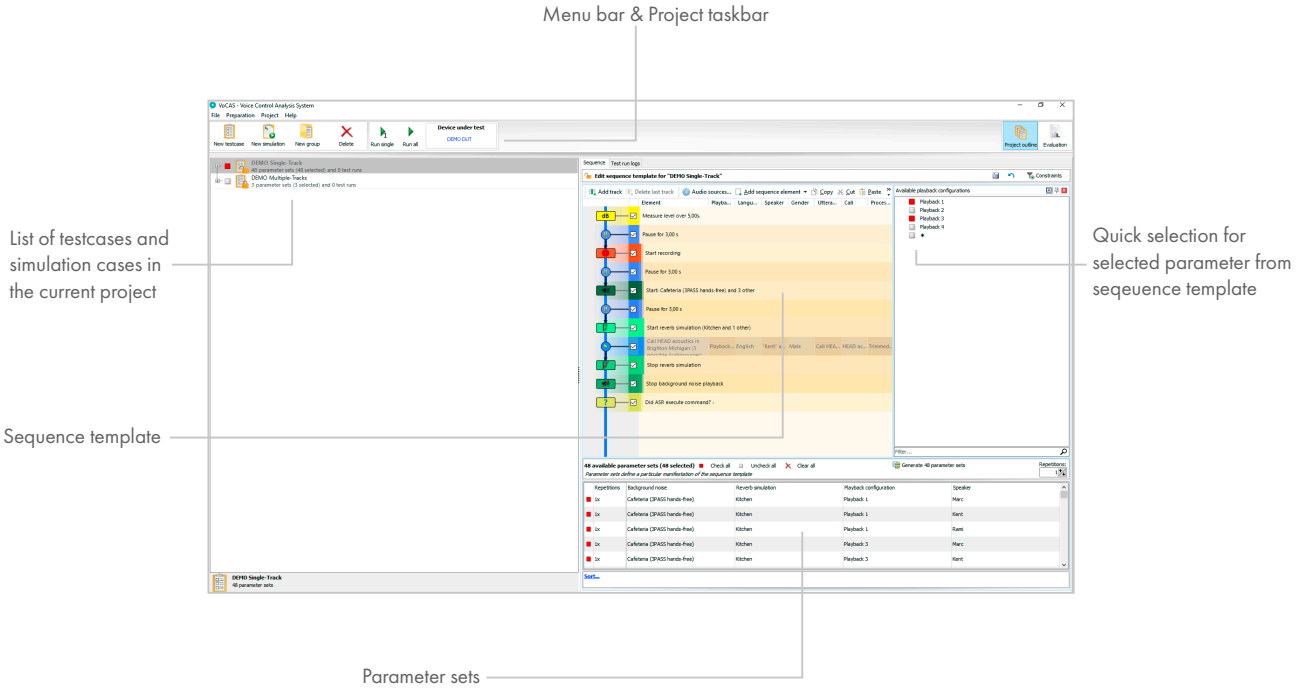
Create testcases for simulation. Simulated testcases run without actual acoustic audio output. Its use case is batching existing audio sources (speaker & background noise, reverberation simulation) into one file.



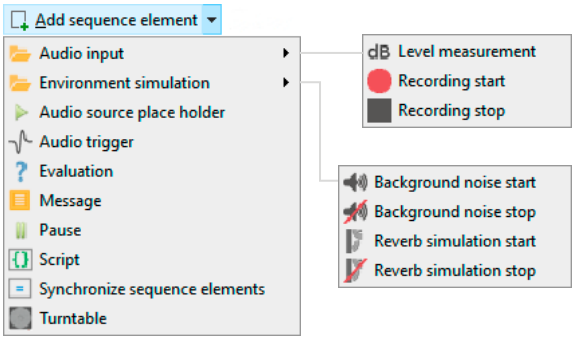
VoCAS simulates test environments. Based on an impulse response of a reverberant room, the software calculates the acoustic sum at the DUT position (talker, background noise, reverberation) and records the simulation in .dat and / or .wav file format. With the calculation of reverberant room's acoustics, these files are lifelike representations of actual acoustic testing in this room. Hence, VoCAS conveniently generates a large amount of clearly sorted audio test files in arbitrary variants.

The sequence template of the simulation mode is limited compared to normal testcases.

USER INTERFACE AND OPERATION



VoCAS presents testcases as a top-down flow diagram. The user can add and rearrange sequence elements as well as alter their respective settings to create the desired test scenario. Audio sources are the central element while the surrounding extend the test and evaluation conditions. The audio source files include meta data ("tags") for playback and are stored in databases. Around the sequence element of the audio source, there are plenty of options to extend the complexity of the testcase. VoCAS provides remote control interfaces for the background noise simulation software 3PASS *lab /flex* , a control interface for the turntable HRT I and an evaluation editor for generating significant results. Combining the available sequence elements provides various possibilities to assess and evaluate the performance of ASR systems. The range of elements within the sequence template depends on the available VoCAS Options. VoCAS automatically generates all possible variations resulting from the current sequence template in a list of parameter sets. A parameter set includes the unique combination parameters from the sequence template such as speaker, playback configuration, background noise or turntable angle.



Thus, the list of parameter sets contains all respective variations of parameters from the sequence template. Once the sequence template is saved and locked, the testcase is ready-to-run. Each active parameter set runs after starting the testcase.

RESULTS & EVALUATION

VoCAS provides a separate interface to sort and visualize the results from measurements in tabular form.

- Adjust the content of rows and columns.
- Distinguish results by allocating different colors from a broad range.
- Set constraints to view specific results isolated from others.
- Export and save the customized result table as Excel file.

OPTIONS

VoCAS Options

VoCOPT 1 (Code 7971)
- VoCAS Option Signal Recorder

VoCOPT 2 (Code 7972)
- VoCAS Option Import / Source pool Generator

VoCOPT 3 (Code 7973)
- VoCAS Option Python Scripting

VoCOPT 4 (Code 7974)
- VoCAS Option Multitalker

VoCOPT 5 (Code 7975)
- VoCAS Option REST Remote control & Result Access

VoCOPT 6 (Code 7976)
- VoCAS Option Simulation Mode

Hardware

HRT I (Code 6498)
- HEAD acoustics Remote-operated Turntable

DSB IV.I (Code 2408.1)
- Digital Sound Board (substitutes *lab*CORE in the measurement configuration)

Software

3PASS *lab* (Code 6990)
- Background noise simulation with fixed microphone position and loudspeaker arrangement

3PASS *flex* (Code 6995)
- Background noise simulation with flexible microphone position and loudspeaker arrangement

3PASS *reverb* (6996)
- Background noise simulation with reverberation simulation

HAE-BGN (Code 6970)
- Automated equalization for background noise simulation in labs

HAE-car (Code 6971)
- Automated equalization for background noise simulation in car cabins

GENERAL REQUIREMENTS

Hardware

*lab*CORE (Code 7700)
- Modular multi-channel hardware platform

*core*BUS (Code 7710)
- I/O bus mainboard

*core*OUT-Amp2 (Code 7720)
- Power amplifier board

*core*IN-Mic4 (Code 7730)
- Microphone input board

One of the following HEAD Measurement Systems:
- HMS II.3 (Code 1703)
- HMS II.5 (Code 1705)
- HMS II.6 (Code 1706)

Measurement Microphone
- For mouth equalization, measurement recordings, level measurement or audio trigger

PC with multi-core processor (1.6 GHz or faster), 4 GB RAM, 40 GB free disk space, 4 USB ports

Software

VoCAS (Code 7970)
- Voice Control Analysis System, Core Version

Microsoft Windows 10 Pro or
Microsoft Windows 8.1 Pro
- English or German version, including all current service packs

SCOPE OF DELIVERY

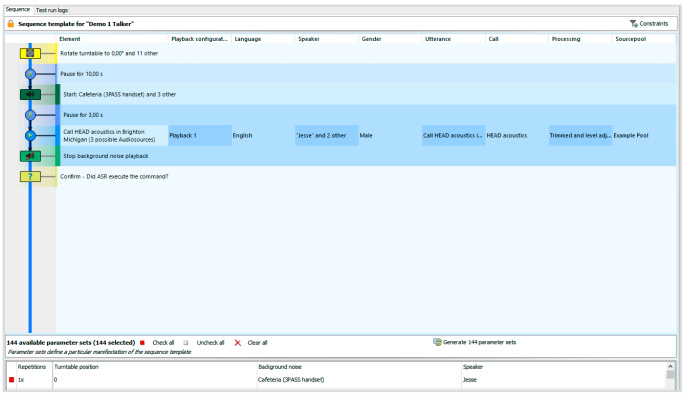
VoCAS (Code 7970) comprises the following components
- Setup DVD, including demo project and demo audio database
- USB dongle

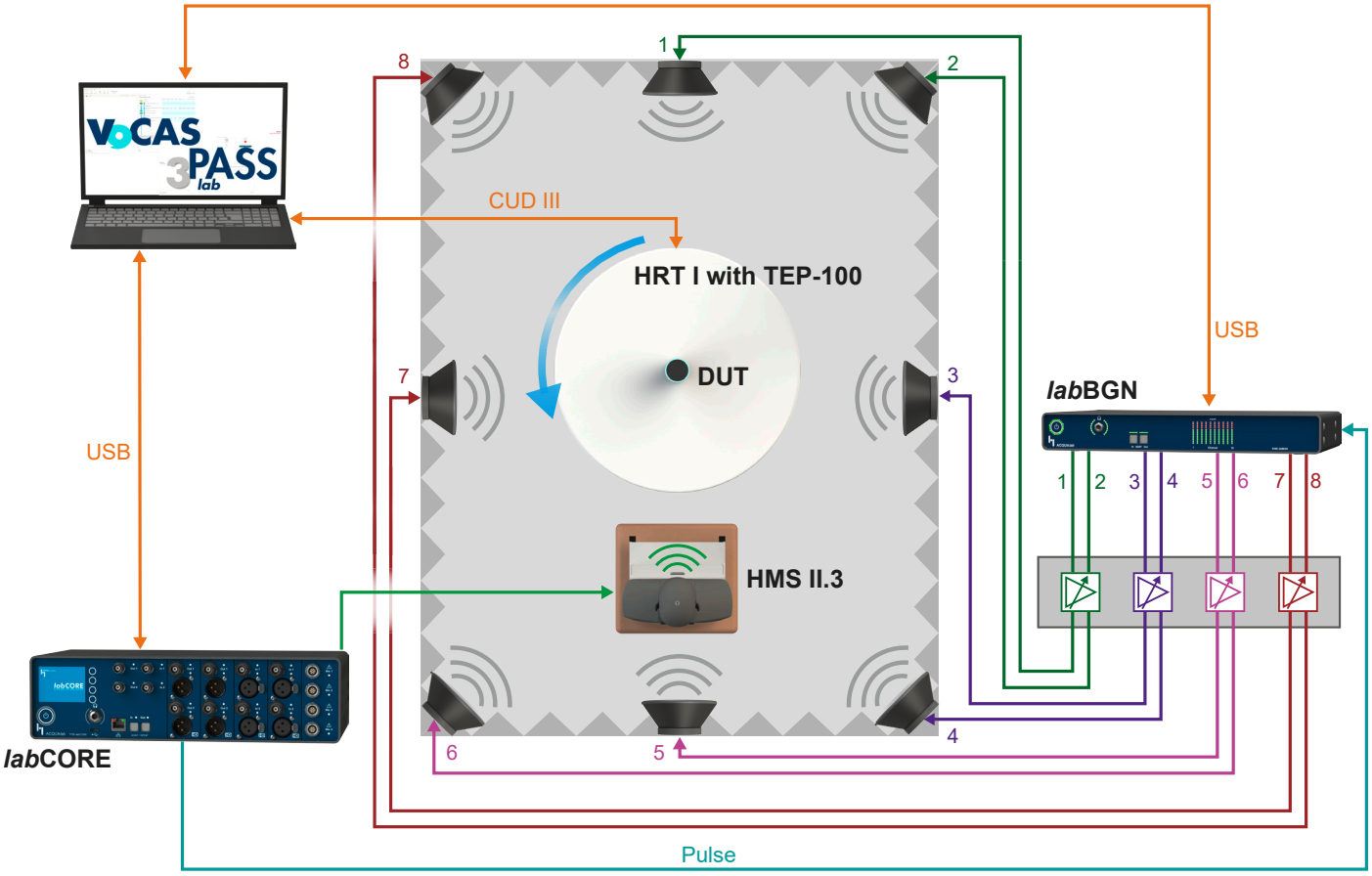
IN PRACTICE

APPLICATION EXAMPLES

Single talker in anechoic room with background noise simulation

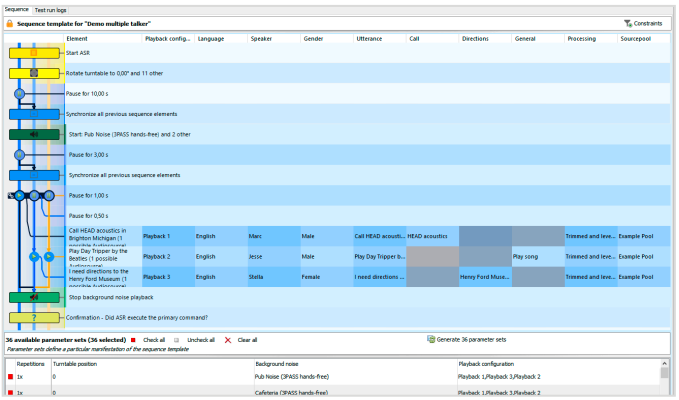
Basic measurement configuration in an anechoic room. The presented configuration has a HMS II.3 for playback of audio sources. *lab*CORE transfers the audio data from VoCAS to the HATS mouth loudspeaker. The DUT (e.g. smart speaker) is in front of the HATS. It stands on the turntable HRT I. HRT I rotates the DUT into different angles respective to the HATS. Therefore, different positions of the DUT microphone can be tested. 3PASS *lab* executes playback of realistic background noise via *lab*BGN and the loudspeaker arrangement according to ETSI TS 103 224.

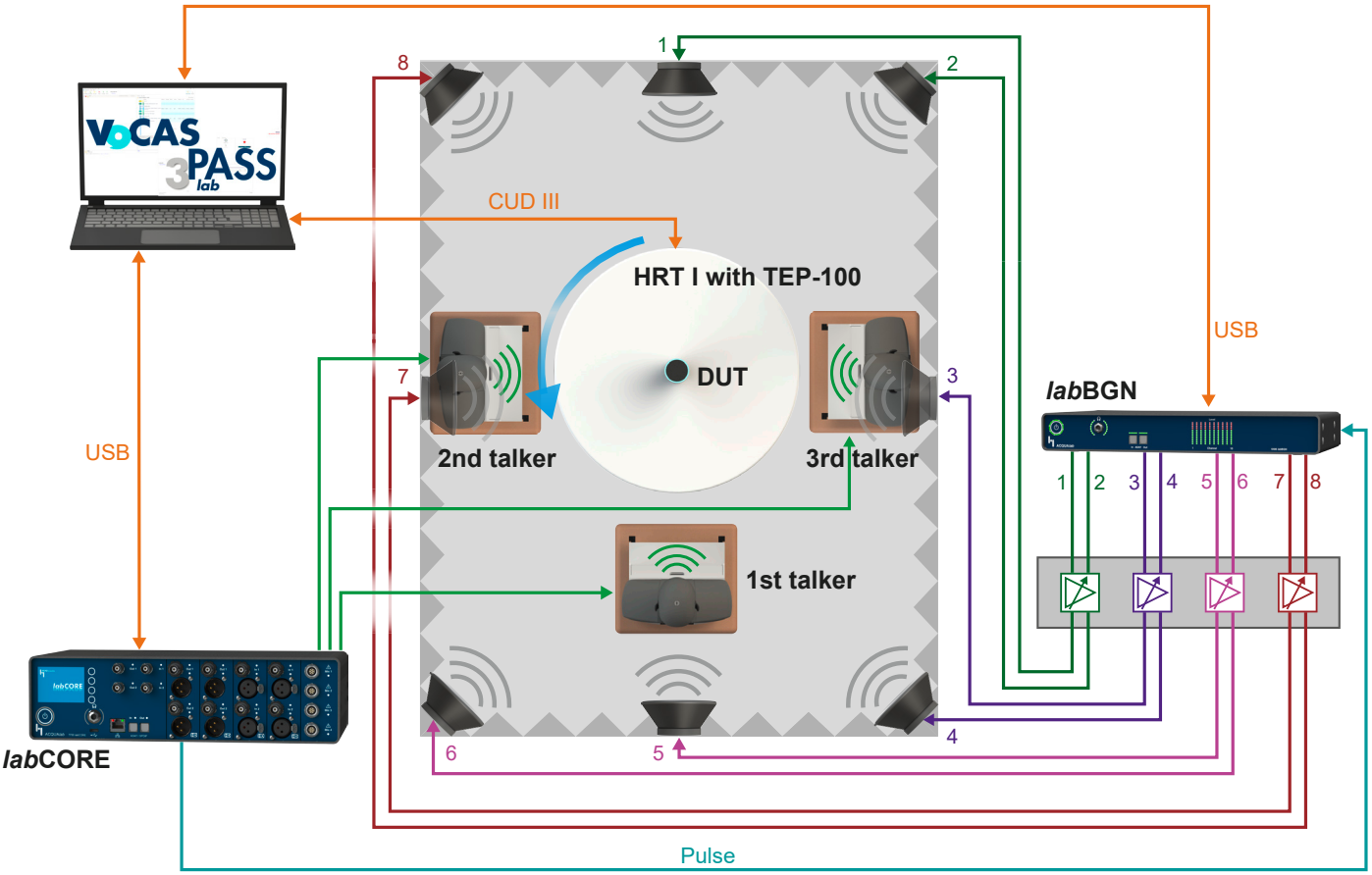




Multiple talkers in anechoic room with background noise simulation

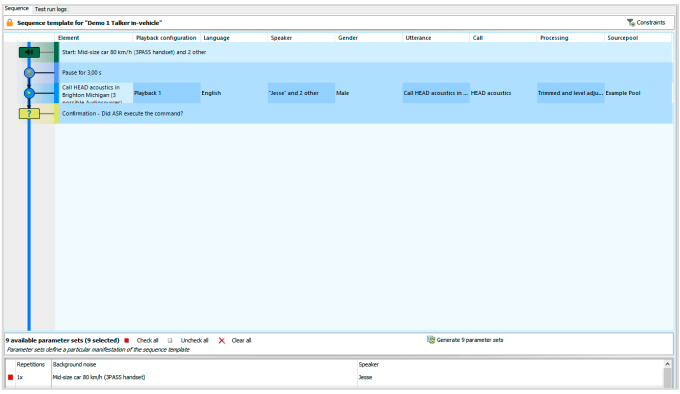
Advanced measurement configuration in an anechoic room. The presented configuration has three HMS II.3 for playback of audio sources. *lab*CORE transfers the audio data from VoCAS to the HATS mouth loudspeakers. The DUT (e.g. smart speaker) is in the center of the HATS arrangement. It stands on the turntable HRT I. HRT I rotates the DUT into different angles respective to the primary HATS. Therefore, different positions of the DUT microphone can be tested. The additional HATS simulate concurrent talkers to distract the ASR. 3PASS *lab* executes playback of realistic background noise via *lab*BGN and the loudspeaker arrangement according to ETSI TS 103 224.

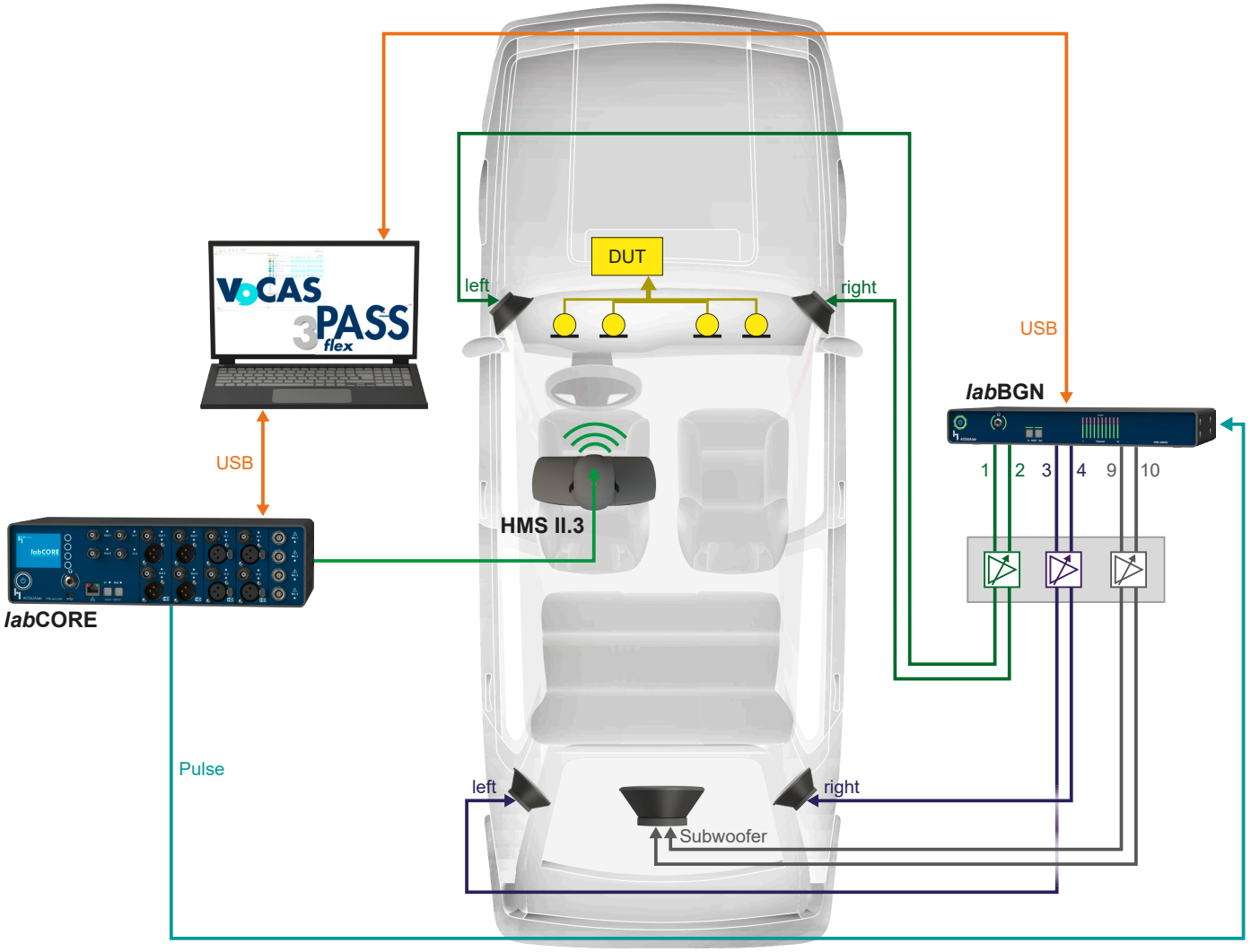




Single talker in-vehicle with background noise simulation

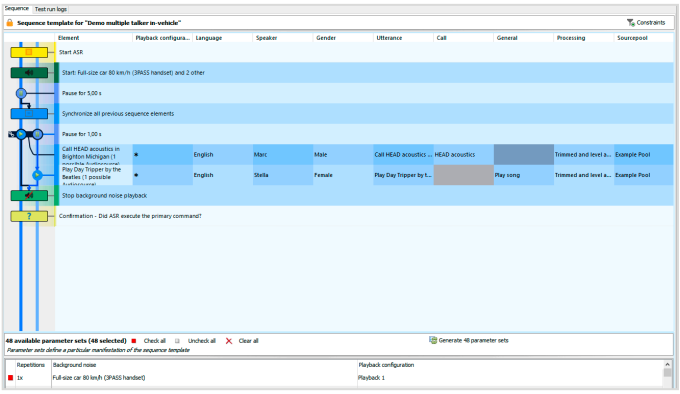
Basic measurement configuration in a vehicle. The presented configuration has a HMS II.3 for playback of audio sources. *lab*CORE transfers the audio data from VoCAS to the HATS mouth loudspeaker. The DUT microphones (e.g. Automatic speech recognition in-vehicle) are positioned at the interior mirror and the sun visors. 3PASS *flex* executes playback of realistic background noise via *lab*BGN and the loudspeaker arrangement in the car cabin.

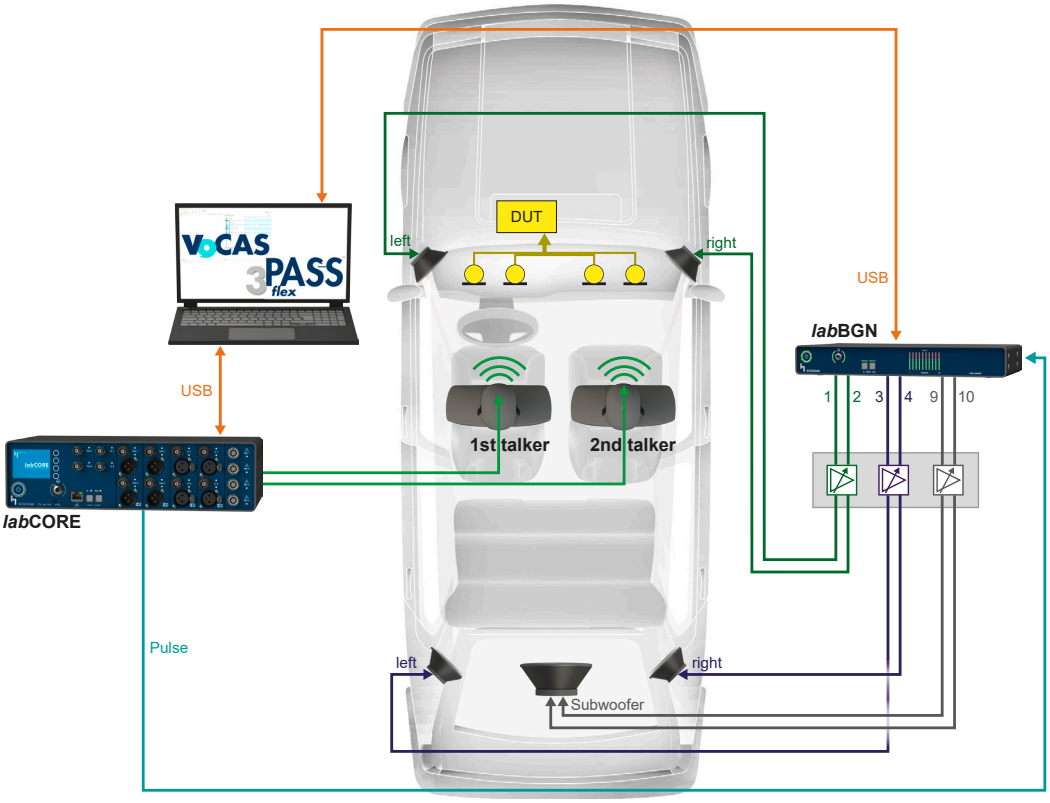




Multiple talkers in-vehicle with background noise simulation

Advanced measurement configuration in a vehicle. The presented configuration has two HMS II.3 for playback of audio sources. *lab*CORE transfers the audio data from VoCAS to the HATS mouth loudspeaker. The DUT microphones (e.g. Automatic speech recognition in-vehicle) are positioned at the interior mirror and the sun visors. The additional HATS simulates a concurrent talker to distract the ASR. 3PASS *flex* executes playback of realistic background noise via *lab*BGN and the loudspeaker arrangement in the car cabin.





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