




Les 35e lauréats des NAMM TEC Awards

Célébrer l'excellence en production audio et sonore

Présentés chaque année au NAMM Show, les TEC Awards célèbrent la production audio et sonore professionnelle en honorant les individus, les entreprises et les innovations techniques derrière le son des enregistrements, des performances en direct, des films, de la télévision, des jeux vidéo et du multimédia. Les catégories de prix couvrent 23 catégories de réalisations techniques et 8 catégories de réalisations créatives.



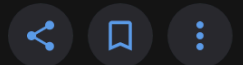
 The 2020 TEC Award Winners - Technical Achievement		
Category	Company	Product
Amplification Hardware/Studio & Sound Reinforcement	Auratone	A2-30
Audio Apps & Hardware/Peripherals for Smartphones & Tablets	Genelec	Aural ID
Audio Education Technology	iZotope	Pro Audio Essentials
Computer Audio Hardware	Universal Audio	Apollo x16
DJ Production Technology (Hardware/Software)	KORG	Minilogue xd
Headphone/Earpiece Technology	Neumann	NDH 20
Large Format Console Technology	API	2448 Console
Microphone Preamplifiers	Rupert Neve Designs	5211 Dual Mic Pre
Microphones – Recording	Townsend Labs	Sphere L22 v1.3
Microphones – Sound Reinforcement	Aston Microphones	Stealth
Musical Instrument Amplification & Effects	Line 6	HX Stomp
Musical Instrument Hardware	Moog Music	Moog One
Musical Instrument Software	Spectrasonics	Omnisphere 2.5
Production Essentials	Cable Wrangler	Cable Wrangler
Signal Processing Hardware	Solid State Logic	Fusion
Signal Processing Hardware (500 Series Modules)	API	550A 50th Anniversary Edition
Signal Processing Software (Dynamics/EQ /Utilities)	FabFilter	Pro-Q 3
Signal Processing Software (Effects)	Universal Audio	Capitol Chambers
Small Format Console Technology	Allen & Heath	SQ Digital Mixer Series V1.3
Sound Reinforcement Loudspeakers	JBL Professional	VTX A8 Line Array
Studio Monitors	Genelec	S360A SAM
Wireless Technology	Shure	Axient Digital ADX Transmitter
Workstation Technology/Recording	Devices Avid	Pro Tools 2019



January 18, 2020



Genelec



[Genelec Bags Two TEC Awards! - Genelec.com](https://www.genelec.com)

GENELEC®

VIRTUAL EARALITY

AURAL ID

Genelec Aural ID est une avancée technologique qui améliorera considérablement la livraison d'un son plus précis et fiable et permettra à un moteur audio de restituer avec précision du contenu stéréo, surround ou immersif via un casque.





Genelec Aural ID est une avancée technologique qui améliorera considérablement la livraison d'un son plus précis et fiable et permettra à un moteur audio de restituer avec précision du contenu stéréo, surround ou immersif via un casque.

Que fait Aural ID?

Aural ID calcule comment la tête, l'oreille externe et le haut du corps affectent et colorent l'audio provenant d'une direction donnée. Cet effet est appelé la fonction de transfert liée à la tête (HRTF) et est totalement unique à chaque utilisateur. Aural ID modélise vos fonctions personnelles de tête et de torse supérieur pour calculer votre propre HRTF individuel, vous fournissant un fichier qui peut ensuite être intégré à votre station de travail audio via un nombre croissant de plug-ins tiers, y compris ceux de Sparta, Noisemakers, SSA et Harpex. Vous constaterez que votre expérience d'écoute au casque devient beaucoup plus véridique et fiable, avec un sens beaucoup plus naturel de l'espace et de la direction.

Comment ça marche?

Après avoir téléchargé une vidéo à 360 degrés de la région de votre tête et de vos épaules à partir de la caméra de votre téléphone mobile, Aural ID crée un modèle 3D précis et détaillé à l'échelle exacte des dimensions correctes de votre tête et de votre torse supérieur. À partir de cela, votre HRTF personnel est formé et vous est livré sous un format de fichier SOFA reconnu internationalement, qui prend en charge des fréquences d'échantillonnage de 44,1, 48 et 96 kHz et contient des données pour les deux oreilles dans 836 orientations différentes.

C'est pour qui?

Toute personne utilisant des écouteurs pour la surveillance audio stéréo, surround et immersive. Que vous soyez actif dans l'enregistrement de musique, la post-production, la recherche universitaire, la VR ou le développement de jeux, Aural ID élèvera votre expérience d'écoute au casque à un tout nouveau niveau de réalisme.

Pour des informations plus détaillées, consultez le [manuel d'utilisation d'Aural ID](#).

Tarification

Le prix de votre Aural ID personnel est de 500 € + TVA.

Genelec Aural ID : prendre son « empreinte auriculaire » pour une écoute pro au top

Publié par Gladys Robert le 31 mars 2019. Publié dans [Actus - news audiophiles](#)



Genelec, marque finlandaise d'enceintes de monitoring de studio, pourrait se lancer dans les écouteurs sur-mesure. À l'instar de marques audiophiles et mélomanes comme [Audeara](#), [Snugs](#), [Revols](#), [Noble](#) ou [Ultimate Ears](#) qui font passer des tests d'audition - voire des séances chez des prothésistes auditifs avant de vous fabriquer des écouteurs - Genelec annonce une prise d'empreinte 3D. Elle s'effectue via une caméra d'appareil mobile pour cerner l'ensemble des critères physiques d'optimisation de l'écoute : du pavillon auditif jusqu'à l'épaule en passant par la courbe du cou, tout compte !

Conçue pour les professionnels et inspirée du système de calibration GLM de Genelec, la technologie propriétaire Aural ID prend une « empreinte digitale » des facteurs physiques qui influencent l'audition personnelle. Cette empreinte repose sur des critères dits HRTF soit « Head-Related Transfer Function » ou « anatomical transfer function ». Des mots un peu techniques qui signifient simplement que la forme du pavillon auditif, de la tête et de l'épaule sont uniques chez chacune et chacun, et produisent un résultat différent à l'écoute. Pour produire ses calculs, Genelec affirme se baser sur des centaines et des centaines de profils auditifs déjà relevés et utilisés dans sa base de données. Pour l'instant, la marque fait du teasing et ne précise pas sous quelle forme la technologie sera rendue disponible : casques, écouteurs, embouts... ou encore un fichier téléchargeable comprenant toutes les données et qui pourrait être confié à un fabricant.

Source : [genelec.com](https://www.genelec.com)





27 mars 2019

Le bureau de presse 
Éditeur du News Desk

Genelec va redéfinir la surveillance des écouteurs avec la technologie logicielle Aural ID





Genelec va redéfinir la surveillance des écouteurs avec la technologie logicielle Aural ID

Genelec, leader mondial de la surveillance active, annonce aujourd'hui une première étape importante dans l'amélioration de la fiabilité de l'écoute au casque grâce à l'introduction de sa nouvelle technologie logicielle Aural ID. Aural ID fonctionne en acquérant les attributs acoustiques exclusifs d'une personne pour créer une modélisation détaillée de leurs caractéristiques anatomiques uniques affectant l'audition, qui peuvent ensuite être compensées - permettant ainsi la livraison d'un son plus véridique et fiable lorsque des écouteurs sont utilisés pour la reproduction.

Reconnaissant que la reproduction traditionnelle du casque «taille unique» ne parvient pas à fournir une référence fiable appropriée pour les professionnels de l'audio, Aural ID calcule la fonction personnelle de transfert de la tête (HRTF) de l'utilisateur, qui décrit les propriétés acoustiques de la tête, du torse supérieur et oreille externe: éléments qui interagissent de manière complexe pour affecter les sons atteignant les tympans. Aural ID calcule ensuite tous ces éléments et crée un fichier de données personnelles caractérisant la modification du son provenant de tout azimut et élévation. Ce fichier permet par conséquent à un moteur audio de restituer précisément du contenu stéréo ou immersif via un casque.

Jusqu'à présent, la collecte d'informations personnelles HRTF a été un processus complexe et long qui nécessite une salle anéchoïque, le placement de microphones de mesure à l'entrée des canaux auditifs de l'utilisateur et une attention particulière aux détails de configuration et de procédure avec plusieurs mesures. Pourtant, même après que ces mesures ont été prises, les données recueillies sont moins complètes que celles pouvant être obtenues avec Aural ID, et peuvent encore être sujettes à des erreurs.

En revanche, le logiciel Genelec Aural ID exige simplement que l'utilisateur fournisse une vidéo à 360 degrés de sa région de la tête et des épaules - pour laquelle une caméra de téléphone portable de haute qualité est suffisante. Une fois la vidéo téléchargée sur le service de calcul Web de Genelec, le processus de calcul crée d'abord un modèle 3D précis et détaillé à l'échelle exacte des dimensions correctes de la tête et du torse supérieur, avec une attention particulière portée à la modélisation des oreilles externes. Après cela, les champs acoustiques sont analysés et calculés numériquement avec une méthode pleine onde pour capturer des phénomènes acoustiques détaillés. Les champs acoustiques sont calculés pour des centaines d'orientations audio différentes approchant la tête, après quoi les HRTF sont formées et les données sont finalement compilées dans un fichier SOFA téléchargeable - un format qui a été défini et normalisé par l'Audio Engineering Society (AES). Cela maximise la compatibilité technique du fichier de données HRTF, car le format SOFA est déjà pris en charge par de nombreux moteurs de rendu audio de réalité virtuelle (VR) et de jeu. En effet, Genelec considère que ceux qui travaillent dans la recherche universitaire, la surveillance audio immersive, la réalité virtuelle et le développement de jeux sont probablement les premiers à adopter la nouvelle technologie Aural ID.

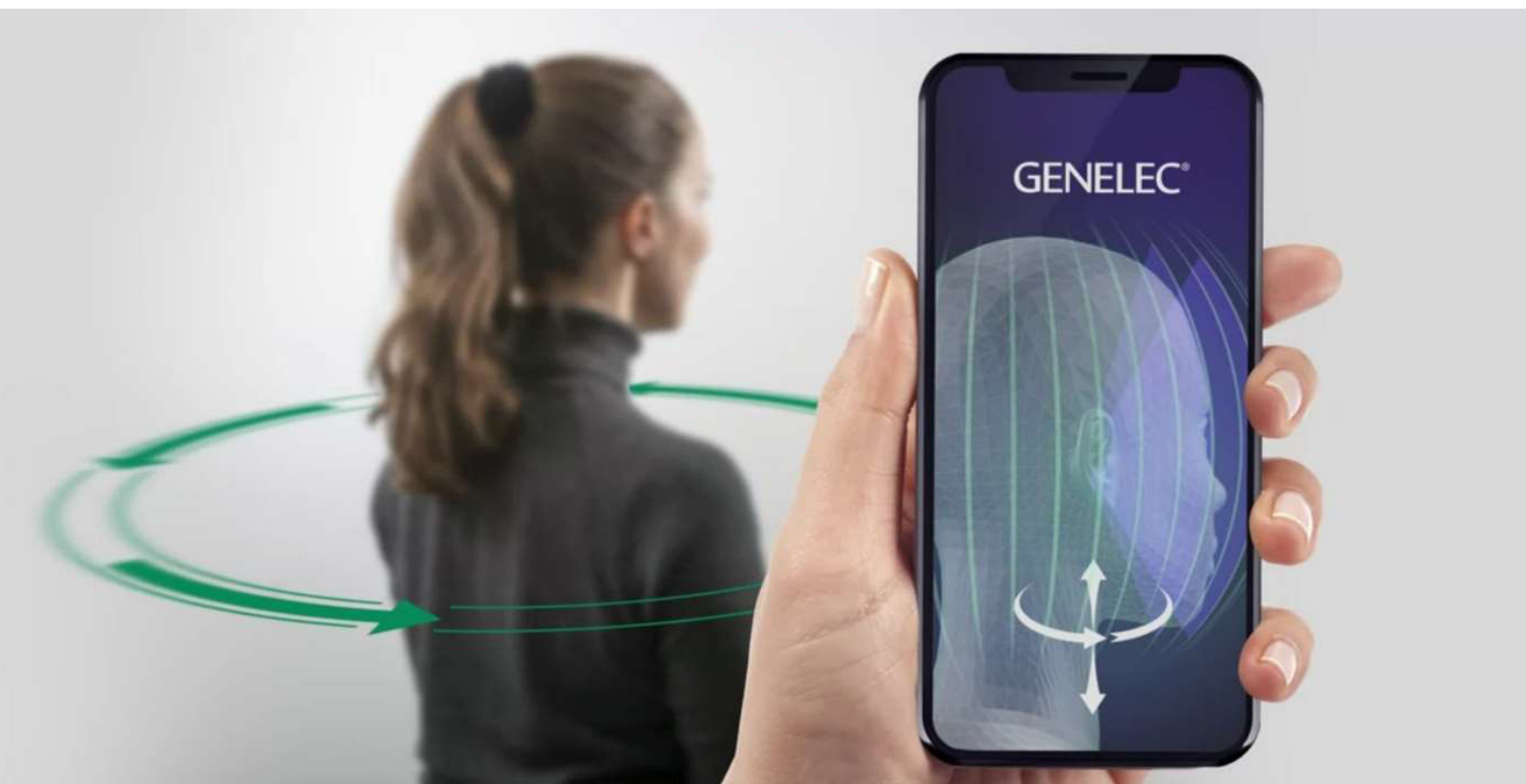
Siamak Naghian, directeur général de Genelec, commente: «De la même manière que nos haut-parleurs de contrôle ont établi la référence sonore pour la surveillance audio professionnelle, et le logiciel d'étalonnage GLM a révolutionné la façon dont les moniteurs de studio pouvaient être optimisés pour n'importe quel espace acoustique, nous sommes déterminés à apporter des normes de véracité sonore de la reproduction du casque. Avec un nombre croissant de professionnels de l'audio qui s'appuient à la fois sur des moniteurs et des écouteurs dans la chambre, Genelec Aural ID est une première étape importante vers l'utilisation des écouteurs pour la surveillance et l'écoute audio de référence. »

Le service Genelec Aural ID sera disponible à l'achat en ligne via le site Web de la communauté Genelec au deuxième trimestre de cette année.

Pour plus d'informations, visitez le [leader mondial des moniteurs de studio | Genelec.com](https://www.genelec.com).

GENELEC®

Aural ID Operating Manual



**YOUR
AURAL ID,
YOUR SOUND.**

How to obtain and use the Genelec Aural ID, what benefits it gives, how it is calculated and why it is needed.

Quick Intro

The purpose of audio monitoring is to evaluate audio presentations in a neutral way to ensure good translation to other reproduction systems. The head and outer ear shapes with head movements, the main localization mechanisms of our auditory system, provide our wonderful ability to localize sound sources and enable loudspeaker monitoring to work. Headphones break the link to these natural mechanisms we have acquired over our lifetime. Because of these reasons on-ear and in-ear headphones have not been the best choice for monitoring.

Normal headphones make it difficult to set levels, pan sound locations and equalise important sources, like the human voice or tonal instruments, because headphones do not have well-controlled frequency responses in the midrange and headphone-to-headphone sound character variation is large. This matter is complicated by individual differences between persons. What you hear on headphones can be quite different from what the other persons hear, even with the same set of headphones.

These characteristics are entirely different in good in-room monitoring loudspeaker systems. Work done using good loudspeaker monitoring systems translates precisely to other

loudspeakers and sounds the same for all listeners, and also works well on headphone reproduction.

Aural ID is a reliable path to enable stereo, surround and immersive audio monitoring using headphones. Aural ID computes how your head, external ear and upper body affect and colour audio arriving from any given direction. This effect is called the Head-Related Transfer Function (HRTF).

Aural ID delivers your unique personal HRTF in the SOFA file format. The SOFA (Spatially Oriented Format for Acoustics) file format has been standardized by the Audio Engineering Society (AES) and is widely accepted and supported by audio software. Aural ID requires a processor or audio workstation for audio rendering.

This document covers

- what is Aural ID?
- how to obtain Aural ID
- how to use Aural ID
- tutorial on Aural ID and why it is needed for accurate monitoring on headphones.

Table of Contents

Quick Intro	2
What is Aural ID?	3
Aural ID is your personal HRTF	3
What is in the Aural ID file?	3
Aural ID has the SOFA file format	3
Why Aural ID is useful	3
What Aural ID is not	3
How Aural ID is calculated	4
Who uses Aural ID	4
Video Capture for Aural ID	4
Preparing the room for video capture	4
Video settings	4
Preparing yourself for video capture	4
Shooting the video	4
Taking the dimension photos	5
Ordering Aural ID	6
Aural ID ordering site	6
Instructions	6
Video Upload	6
Payment	6
How to use Aural ID	7
Compatible plugins and software	7
Example of using Aural ID for headphone monitoring	7
Learn More about Aural ID	9
Monitoring of Audio	9
Mechanisms for Localization of Sound	9
Headphone Monitoring	9
Processing audio to recreate direction and space	10
Use Case Q and A	11

What is Aural ID?

Aural ID is your personal HRTF

The Head-Related Transfer Function (HRTF) is a filter for each ear separately, with a different value for each direction of arrival on the horizontal plane (azimuth) and vertical plane (elevation), incorporating all spectral and time-domain effects. HRTF describes all changes to the sound produced by the sound approaching an ear from a given orientation. To create complete understanding of the directional effects to sound we need measurements of a large number HRTFs, for all the directions of arrival over a sphere surrounding the listener's head.

Genelec Aural ID is your unique and personal HRTF information. It contains the HRTF information expressed in the time domain. Technically this data is called the Head-Related Impulse Response (HRIR).

What is in the Aural ID file?

The Genelec Aural ID .sofa file contains HRIR data for both ears given in 836 different directions of arrival for the audio signal. The HRIR impulse responses are 1024 samples long and use the sampling rate 48, 44.1 or 96 kHz, depending on your preference. The azimuth angular resolution in the file depends on the elevation and is given in Table 1. The highest azimuth resolution is at small elevations where the human hearing system also has the highest angular resolution.

Aural ID has the SOFA file format

Genelec Aural ID file has the standard SOFA file format. Spatially Oriented Format for Acoustics (SOFA) is an internationally standardized file format for storing multiple HRTFs. The files of this format have the extension '.sofa'.

Table 1. The angular resolutions at different azimuths in the Genelec Aural ID file.

Elevation	Azimuth resolution	Explanation
±90°	360°	direct up and direct down
±80°	30°	
±70°	15°	
±60°	10°	
±50°	8°	
±40°	6°	
±30°	6°	
±20°	5°	
±10°	5°	
0°	5°	on the ear level, in front of you

Why Aural ID is useful

The key to enabling the process of rendering audio over headphones is access to accurate HRTF information. Scientists have found that although we all share in the same broad principles of how the HRTF looks like, we are all individual with slight differences in details. These details, they have found, do not successfully translate from one person to another. Borrowing

someone else's HRTFs for listening will not be successful. You need your own, personal HRTF information.

Aural ID is calculated using numerical modelling of the acoustic field at the head. This method of acquiring your personal unique HRTFs brings significant advantages:

- Instrumentation is simple and low-cost – a standard mobile phone is used.
- Acquiring the necessary data is simple and the acquisition can be taken in any room and it does not require the listener to sit still for a long time.
- Silence is not necessary. This method does not require the use of an anechoic room although it offers anechoic HRTFs.
- Aural ID eliminates the uncertainty related to placing the microphones in the listeners ears.
- The effects of listener movements do not play a role in the quality of the final result.

What Aural ID is not

Aural ID is not a simplification of reality.

There are methods of offering HRTFs that use data not uniquely measured from the person in question. Such data may come from a mannequin or a dummy head. Typically, this would leave a lot to be desired in terms of quality.

There is also data available in databases and originally measured from totally different persons. Methods have been devised for selecting the best match in such databases, but this typically does not result in reliable rendering as there are still significant individual differences and perfect selection methods do not exist yet. Such selection is usually based on measuring a set of dimensions in the person, such as the size of the head and dimensions of the ear, commonly called anthropometrics. Aural ID is 100% based on the actual video and photo footage you provide and 100% of this data is used in creating the 3D model of your head and torso - and finally in calculating the acoustic effects. No anthropometric short-cuts are used. Aural ID is 100% personal data from you.

Efficiency of calculation is frequently increased by applying simplified physics, such as ray-tracing. Aural ID uses a full acoustic solution of the acoustic field around the head and ear, without simplifications, and therefore works accurately at all frequencies, including very low and very high frequencies.

How Aural ID is calculated

Aural ID uses photogrammetry to map the 3D shape of the head, external ears and upper torso, and has only become really feasible through modern computer technology that is now able to take a video, detect and match the features in the video and then generate the 3D shape of the object shown in the video. As you know, this technology is increasingly used in mapping terrain, charting archaeological sites, and creating renderings of apartments, statues and other objects. Using this technology for mapping the personal detailed shapes of a listener opens vastly new possibilities in using a computer to calculate the way in which an audio signal is interacting with a person's head and ears. We can calculate the exact characteristics of the audio

signal reaching the ear and hence bring all the personal features to determine what changes sound experiences when it arrives to your ears.

This method requires a simple video to be taken of the listener. This video includes the head and upper torso (shoulders) of the listener while the footage circles the listener, showing these details in all angles. After this, the Genelec calculation process analyses the video and builds a three-dimensional model of the listener using photogrammetric methods, by looking at the differences that occur between different images in the video. This model is then used in calculating the impact sound experiences when it arrives at the two ears from different orientations. Using this information, finally, the HRTF filters can be obtained in more than 800 different orientations of audio arrival.

Who uses Aural ID?

Genelec's HRTF measurement method is aimed at audio professionals, opening new possibilities to the whole audio

industry. It does this in a fully personal level, maintaining complete accuracy and full personal detail, with the robustness and convenience needed to bring the HRTF to all professional applications.

Aural ID is needed by all those who have information about the direction of arrival for sound. Examples of these potential users are Virtual Reality and Augmented Reality systems, game engines calculating the audio presentations dynamically as part of the gaming process, and researchers working with 3D audio.

Ultimately, all stereo, multichannel and immersive audio formats can benefit. The methods of presenting stereo, surround and immersive audio are developing to include the processing needed to plug in the information about the direction of sound arrival. Once in place, the Aural ID personal HRTF information can be used to obtain correct presentation of these audio formats over headphones. This will elevate headphone listening to become more reliable and accurate.

Video Capture for Aural ID

Aural ID is generated using a video of your head and upper body. First, we need you to shoot a video of yourself. After that we need photos of your ears with a ruler or a tape measure next to the ear to ensure we get the dimensions just right.

Please follow the steps and advice below. Before starting video capturing, watch the tutorial video to see the proper filming conditions and correct scanning procedure.

Preparing the room for video capture

- Study the example video before starting, paying attention to the room, lighting, arrangements and the procedure.
- The open area in the room for the scan should be at least 3x3 m.
- Ensure good lighting in the room. Lighting should be bright, monochromatic and diffuse. Fluorescent lights in the ceiling usually work well. Ensure that there are no shadow regions. Ensure you do not have bright windows appearing in the image as they tend to make everything else dark. Avoid large mirrors appearing in the video.
- Mark your intended path of movement on the floor to ensure keeping the shooting distance constant.
- Clean the background in the room as much as possible. Single colour walls work the best.

Video settings

- Use a camera that is capable of producing high quality Full HD video. Use a camera with 1080p video resolution (1920 x 1080 pixels).
- Use portrait mode in video capture. Hold the phone upright.
- Turn on the camera light.

Preparing yourself for video capture

- Study the example video before starting. The link to the demo video is on the Aural ID ordering page.

Before starting view the video here:

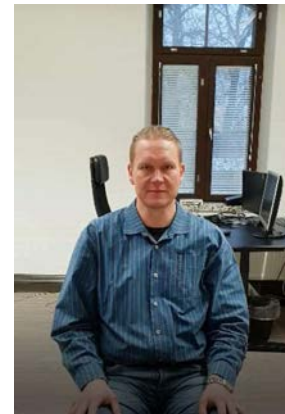
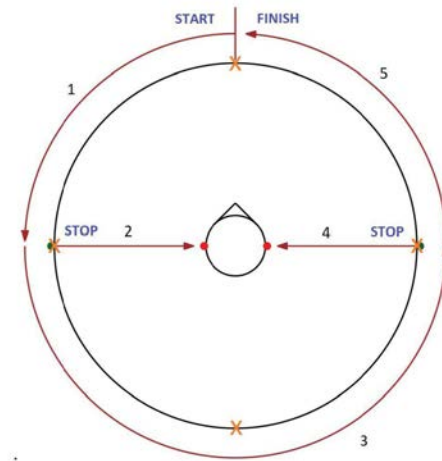
https://s3-eu-west-1.amazonaws.com/genelec-webstore-tutorial-assets/VideoCapture_Tutorial.mp4

- Remove eyeglasses and big earrings.
- Wear a T-shirt or thin long-sleeved shirt without large collars. Do not wear a hoody or other thick clothing that significantly changes the appearances of the shapes you have.
- Avoid single-color shirts, especially black. Checker or stripe pattern with good contrast works the best.
- There should be no hair covering the pinna. Push away and collect your hair if possible. Use a tight beanie hat to flatten your hair if possible.
- When the video is being shot, the person being captured must not move. Aim your eyes on the same point and keep your head still during filming.

Shooting the video

- Start at one metre (3 to 4 feet) and in front of the person you are capturing.
- Keeping your distant constant, move around the person while keeping the person's head in the middle of the image.
- At the ear, stop and approach the ear slowly.
- Come close to both ears with the camera. Carefully point the camera to all directions close to the ear to ensure that they get recorded on the video. We want to see all the 'nook and crannies' in the ear as we want to calculate their acoustic effects.
- After this, keep the ear in the middle of the image and move away, back to the same distance (1 metre) where you started your approach. After this, keeping the head in the middle, start again moving around the person.
- Repeat the approach for the other ear.
- Complete the circling until you are back in front of the person. You should finish at the same spot, at exactly the same distance, where you started from.
- The length of the video should be from 3 to 4 minutes. About 60% (about 2 minutes) should be used to shoot the close-up details of the ears.
- Rehearse the video capturing. Walk slowly and keep the camera steady. Overall movement during video scan - and especially close-up scanning part of the ears - should be fluent and pretty slow.
- Watch the Aural ID video shooting tutorials.

Video capturing process



Starting the video shoot in front of a person



Approaching the ear and shooting the details of the ear – note the use of the phone video light



Taking the dimension photos

After capturing the video take photos of each ear with a ruler placed in front of the ear. We show an example of the photos we need. The ruler is transparent and enables us to see the ear dimensions. Point the camera straight at the ear. Do not shoot high up or down. This preserves the dimensions well in the photos.

Photos needed for size scaling

Ordering Aural ID

Aural ID ordering site



Go to the Genelec Community web site at <https://www.community.genelec.com/> and go to the Aural ID ordering section. You may have to create a username and password for the Genelec Community. You will need your username later when you access the Aural ID.

Instructions

First, click on the “Create New Profile” button. You will see an ordering process indicator like this



Take time to read the instructions. In particular, pay attention to watching the example videos to understand about the correct way of creating the video and taking dimension photos.

Once on the Aural ID ordering page, you will perform the following steps

- upload your video and photos
- pay for the Aural ID (most credit cards are accepted)

Video Upload

On the upload page

- give your Aural ID profile a name you like
- click on the three upload boxes to upload your video and dimension photos
- read the end-user licence agreement and click the check box to indicate you agree with the licence terms



Profile Name

ex: John Doe

Drag and drop video or [Browse](#)

Drag and drop left ear image or [Browse](#)

Drag and drop right ear image or [Browse](#)

* The video should be at least Full HD (1920x1080) and should last at least 10 seconds.

☐ I understand that Aural ID is for my personal use only. I have read and I accept the Aural ID [End-User Licence Agreement](#).

After you have completed the upload, you will see your video and photos as shown in the example below. Once everything looks good, click the “Next” button to move to the payment stage.



Example of completed upload of the video (left) and dimension photos (middle and right)

Payment

The payment can be made using common credit cards. Please allow the system to process your payment and return to the payment page reporting that the payment has been completed.

Your Aural ID files now move to production. The uploaded video and photos will be checked for quality. If we think there are unsurmountable issues with them, we will send you a message. You can also find these messages on your Aural ID ordering page. In this case, you can chat with Aural ID support to clarify the issues and enable successful Aural ID design.

Aural ID delivery takes typically 2 to 3 working days as we also quality check your video before delivery.

You will receive an email that informs you that the Aural ID can be downloaded on your personal page. Log in with your credentials and download the file.

Your download page will be available to you always, enabling you to return to download your Aural ID at any time later. The video and photos you have uploaded can be removed by Genelec after we are convinced your Aural ID works as intended and there is no need to return to this information any longer.

How to use Aural ID

Compatible plugins and software

In case you want your software in this list below please contact Genelec at auralid-support@genelec.com.

To use Aural ID in a Digital Audio Workstation (DAW) you will need a plugin that supports .sofa files. How the plugin is used in your DAW depends on the plugin you are using, and you should check the instructions that come with your plugin.

In the list below we give some examples of software that supports SOFA files. Note that this is not a comprehensive list as more and more systems start supporting the SOFA file format. Also note that Genelec does not guarantee that all these will work perfectly as these are not Genelec products. At the end of this document we have an example of using the Aural ID.

- SPARTA/COMPASS binaural plugin collection (Aalto University, http://research.spa.aalto.fi/projects/sparta_vsts/)
- Noise Makers AMBI HEAD renderer for DAWs (<https://www.noisemakers.fr/ambi-head/>)
- SSA plugins (<https://www.ssa-plugins.com/demo-plugins/>)
- Harpex-X plugin (<https://harpex.net/>)
- SOFA for MAX (<https://github.com/APL-Huddersfield/SOFA-for-Max>)

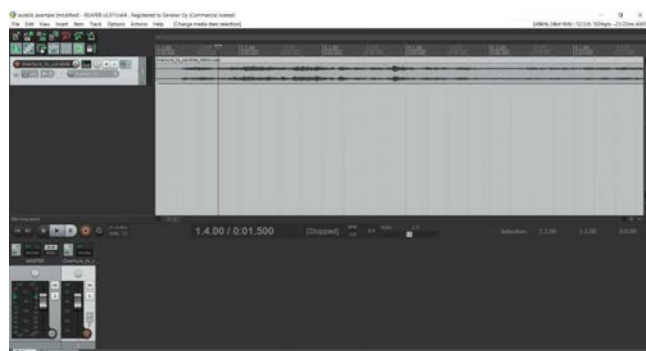
These are also available but have not been thoroughly tested by us:

- VLC Media Player (with SOFAlizer module, by Wolfgang Hraud)
- Steam Audio game engine, works e.g. in Unity, Fmod Studio, and Unreal Engine 4
- S3A Binaural Synthesis Toolkit (Franck, A., Costantini, G., Pike, C., Fazi, F. M.)
- Panoramix by IRCAM, a post-production workstation for 3D-audio content

Example of using Aural ID for headphone monitoring

This example uses Reaper as an example of a DAW installation. Aural ID can be installed in your DAW using these sample principles. The steps you must take will vary depending on the DAW you are using.

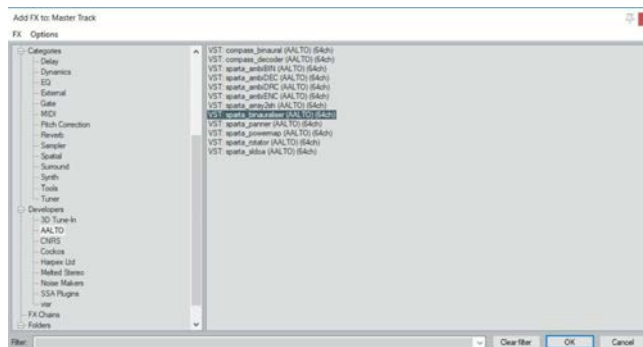
The first step is to create an audio project. In our example, we just create a stereo track that is sent directly to the master output.



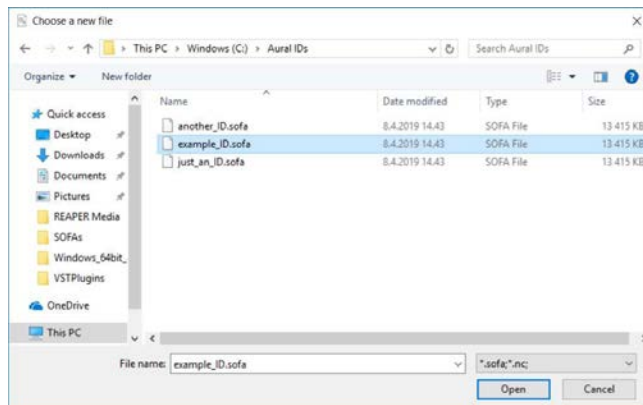
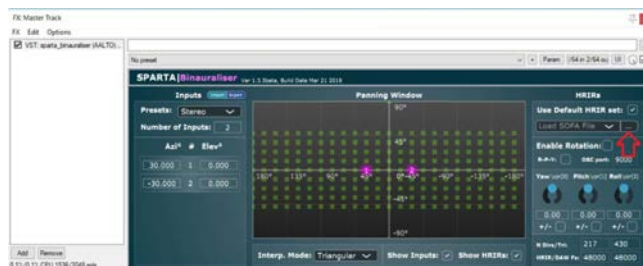
To virtualize this output, an effect is added to the master track. This effect will perform the audio processing needed to apply SOFA information.



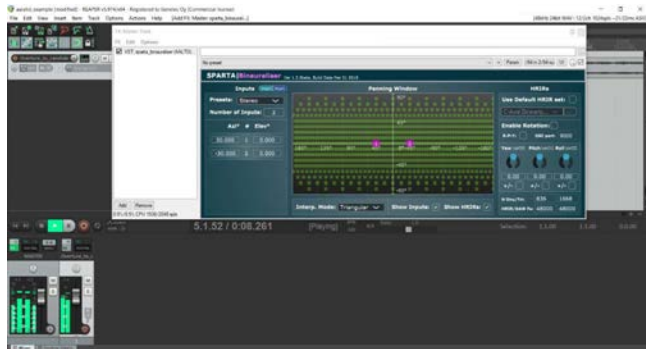
In our case, we are using the free SPARTA Binauraliser plugin. The effect selection is shown below.



Once the effect has loaded in the DAW, the personal Aural ID SOFA file is loaded in the plugin software (the red arrow points to the load button). The following step shows the selection of the 'example_ID.sofa' Aural ID file.



Once the Aural ID file has loaded, the SPARTA plugin is set to create two virtual channels at the standard stereo angles. One channel is set at -30 degrees and the other channel at +30 degrees azimuth and at 0 elevation. These represent the concept of having two loudspeakers at these orientations from the listener. In the same way, you could place any number of such virtual loudspeakers at any orientations from the listener.



When we finally play back the track, the output we hear will now be the virtualized output. The sound appears outside of the head and in front of the listener. The sensation is more natural and will cause less listening fatigue than normal headphone monitoring.

Learn More about Aural ID

Monitoring of Audio

When audio is recorded, edited and mixed, the result is monitored typically using loudspeaker and increasingly also using headphones. Recorded sound is usually monitored using loudspeakers because audio presentations are normally designed for loudspeaker reproduction. Loudspeakers work together, interacting with the room, to create the experience of acoustic space and auditory images appearing in the presentation.

Frequently mixes use virtual sound images. Virtual sound images are created on the sound stage between two or more loudspeakers. Level panning is the typical method used for placing virtual sources. This happens when the sound presentation is designed in a studio. Stereo or multichannel microphone techniques for on-site recording pick the acoustics of space. This acoustic space presentation can be delivered using loudspeakers.

Experiences of sound stage, virtual sound images, and acoustic space are created by exploiting the mechanisms of human directional hearing. When we are listening to loudspeaker, sound radiated by loudspeakers is reflected by the walls and surfaces in the room and arrives to the listener with slight delay and from different directions. This reflected sound is called 'early reflections'. Early reflections contribute to experiencing a sensation of space and they support understanding the distance to the loudspeakers.

Two ears hear the same sounds but of course slightly differently. The brain automatically combines these inputs, and this enhances the sense of direction for sound. We also spontaneously slightly turn our head while we try and locate sound. This enables us

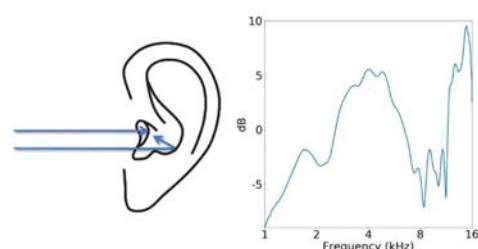
to understand how sound changes when the head turns, and this partly unconscious process greatly enhances our ability to localize sound.

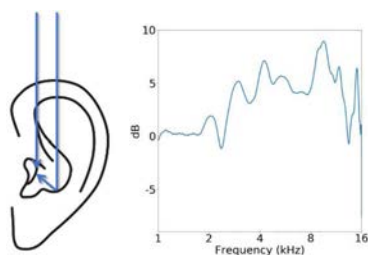
Mechanisms for Localization of Sound

We localize sound using

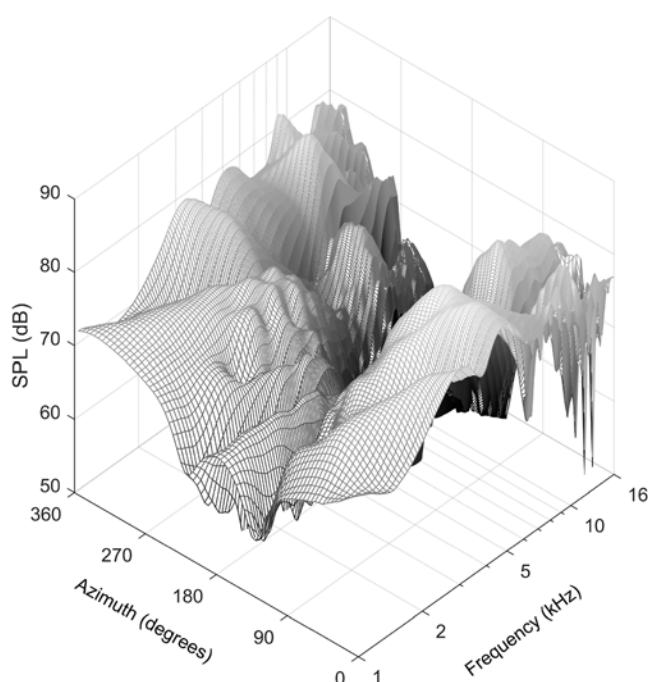
- Interaural Time Difference (ITD)
- Interaural Level Difference (ILD)
- HRTF – sound colour changes depending on the direction of arrival
- head movements

The localization of sound for humans is traditionally explained using the concepts of the Interaural Time Difference (ITD) and Interaural Level Difference (ILD). ILD is suggested to be the main localization mechanism above the frequency where the human head becomes a significant shadow for sound (above 1500 Hz) and the ITD below those frequencies. However, both of these are part of a more elaborate description of the directional hearing mechanism, that of the Head-Related Transfer Function (HRTF).





Example of the direction-dependent filtering of head-related transfer function in the external ear, sound arriving from left and sound arriving from above – our brain automatically decodes the colour given by the external ear as the direction of arrival for audio.



Examples of the direction-dependent level variations for the Left ear located at about 80 degrees, seen on the horizontal plane going around the head; straight forward direction is at zero degrees, straight back is at 180 degrees, and the rotation with increasing angle value occurs rotating to the left.

To give you some examples of what the head-related transfer function is doing to sound, let's look at the direction-dependent level variations. In the figure below, you will see the frequency-dependent level at the ear when the audio is arriving to you from different directions on the horizontal plane and going straight up and down. Specific filtering exists for all orientations on the sphere surrounding you. We only show a small subset here, for two planes, for the sake of giving an example. In real life, you will not hear changes in sound colour but instead you understand that there is a certain direction of sound.

Headphone Monitoring

Headphones are typically used to monitor smaller details in a mix because headphones can offer excellent signal-to-noise ratio and isolation for in-room background noises, so low-level audio becomes more clearly audible. Headphones are also used for checking that a loudspeaker mix also sounds good through headphones, as a lot of music these days is listened through headphones.

When headphones are placed over the ears (or inside the ears), the sound is directly delivered into your ears. Then, head-related sound colour changes cannot occur. Also, the earphones that are on your head remain at the same location always - and it is no longer possible to use head movements to help in sound source location. These are the reasons why conventional headphone sound seems to happen inside an earphone listener's head.



Loudspeakers offer a sound stage with virtual sound sources



Virtual sound sources appear inside the listener's head with standard headphone listening



Aural ID can recreate the correct sense of imaging for headphone listening

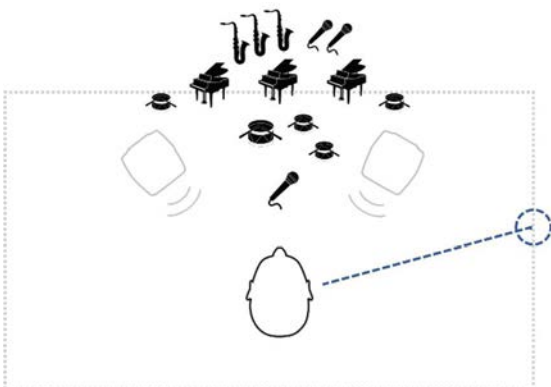
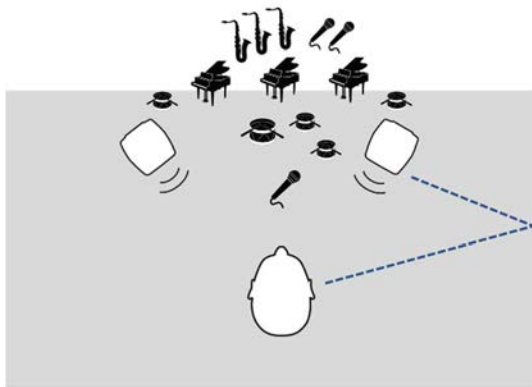
Processing audio to recreate direction and space

Once the information to localize sound, described by the HRTF, is reintroduced by signal processing, sound recovers the correct direction of arrival and no longer seems to be happening inside your head. In order to strengthen the sensation of sound source distance, some room simulation is usually also needed. All signal processing typically happens inside an audio workstation and there are software applications already available enabling you to do this. These typically come in form of either stand-alone software or as plugin software. These work by adding functionality to your audio workstation.

Using HRTF based signal processing it is possible to place one or more sound sources in your desired virtual locations. This means that HRTF processing can be applied to all audio presentation systems, from monophonic to high channel count immersive.

Processing a complete virtual immersive audio presentation means doing this to all the components of audio forming the full presentation. These components could be sound objects or sound channels, depending on the method of immersive sound presentation.

You enable the processing by importing/opening the HRTF contained in your Aural ID file in your audio processing system or plugin. Before using Aural ID you may need to install plug-ins that will enable you to do this processing. Setting the virtual loudspeaker orientations and creating early reflections to model a room requires some setting in your audio processing plug-in.



Aural ID can also create an impression of a room in which the audio is being presented by delivering early reflections associated with room acoustics in a real room (left) with virtual early reflection sources having the same directions, level and timing in headphone listening (right)

Use Case Q and A

Can the Aural ID file be moved between systems, if so how?

Aural ID is a standard format SOFA file. It can be moved to and used in any system, but it is important to understand that the content of an Aural ID file is specific to the person whose data it is.

Does Aural ID work with any type of headphone?

In principle, yes. Certain headphone frequency responses can skew localisation. It is beneficial to use headphones with neutral sound characteristics. The reason for this is that the headphone frequency response acts as another filtering effect on top of the information contained in Aural ID.

What difference is the user likely to hear when switching Aural ID in/out?

The directional cues become accurate and the audio presentation of space and direction starts making sense, as they become more natural and accurate. You get the sensation that the audio is no longer happening just inside your head and between your ears.

I'm a researcher and want to know what my HRTFs look like and analyse them. How can I read the data from the file?

There are many APIs available at <https://www.sofaconventions.org/> for accessing information in standard-compliant SOFA files. Depending on your preference on the programming language pick one and use it.

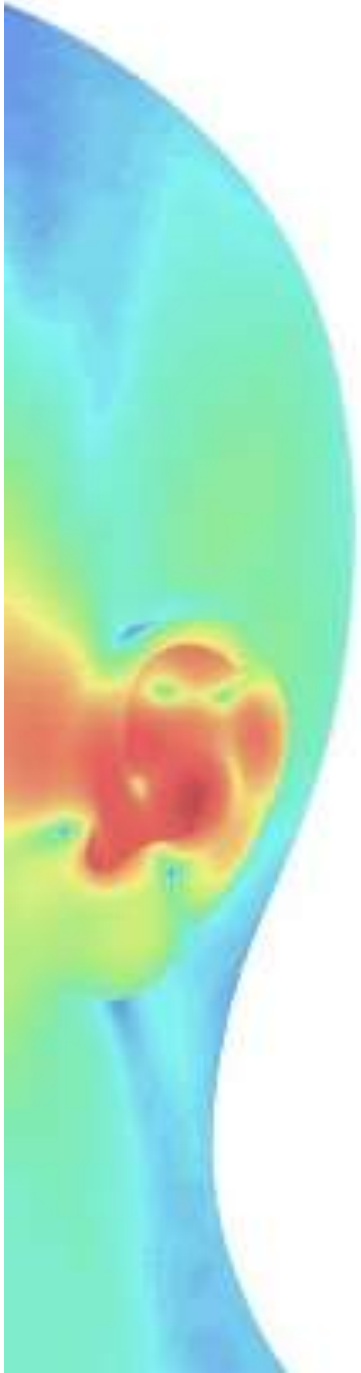
I'm a developer and want my software to support .sofa files. How can I do that?

See the previous answer. In case you also want to develop your own .sofa file content access method please refer to the SOFA-standard available at the AES web site, <http://www.aes.org/publications/standards/search.cfm?docID=99>

I want to enjoy music over headphones using my personal Aural ID. How can I do this?

At the moment the simplest way to do this is to route your music through software that can support .sofa compatible plugins. You could also use your DAW to do this following the principles given in the example earlier.

GENELEC®



3D Audio & Personal Acoustics

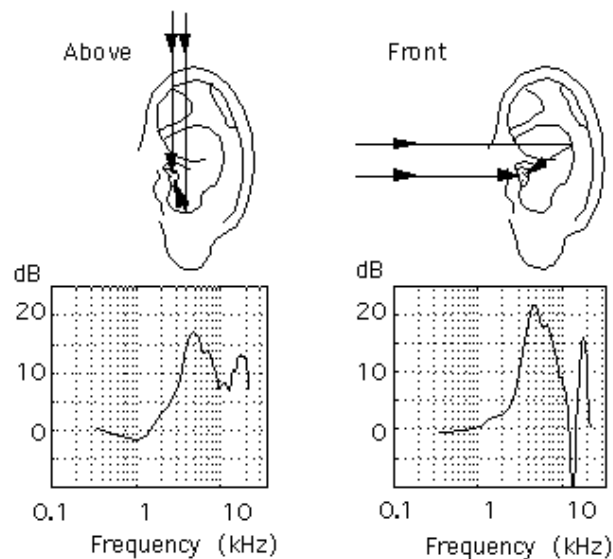
April 2018

Xavier BONJOUR
x.bonjour@3dsoundlabs.com
Tel: +33 6 84 77 66 92

Dimitri SINGER
d.singer@3dsoundlabs.com
Tel: +33 6 18 39 79 12

Ear morphology: Did you know that ...

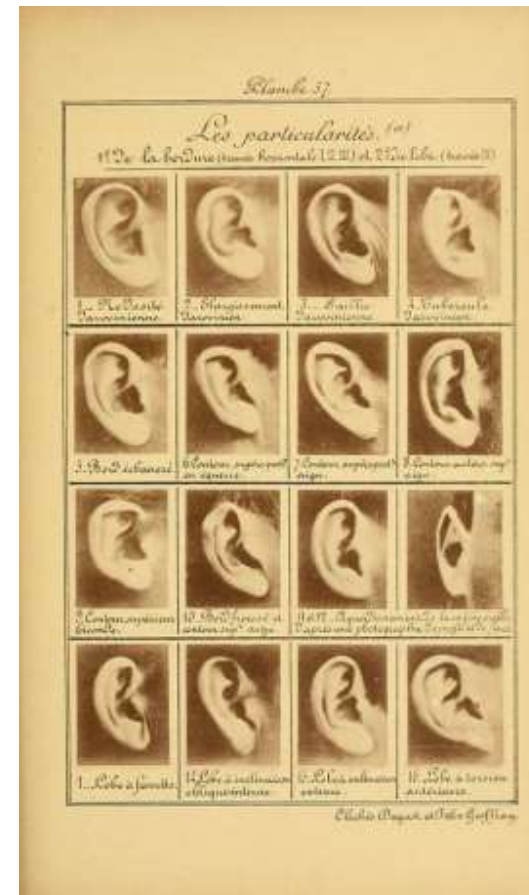
... Natural evolution has designed the human ear **to perceive sound direction?**



HRTF (Head Related Transfer Function) are directional acoustic filters created by the reflection of sound waves on the ear.

Our brain has “memorized” these directional filters and recognizes sound direction with “pattern matching”.

... everybody has different ears?



Like fingerprints, **ears are a biometric sign!**

DIGITAL EAR Applications

The DIGITAL EAR, set of specific parameters related to the 3D shape of the ear of individuals can be leveraged in several use cases.

3D Audio



Spatial Audio perception depends on the shape of the ear (HRTF). All 3D Audio engine are based on the concept of HRTF. Personalized HRTF are used to provide improved spatial audio experience to the end user.

Key feature in VR, AR and next generation of Digital TV.

Custom Fit Ear Piece



Custom made ear piece for better performance, comfort and insulation in several applications:

- Earphones
- Hearing aids
- Hearables (sensors)
- Hearing Protections
- Water protections

"In The Ear" Microphone Directivity



Leverage the shape of the ear to improve directivity of microphones located in the hearing instrument.

- "In The Ear" (ITE) Hearing Aids
- Hearables

Augmented Reality Audio



Improve the frequency response of the "Near the Ear" drivers with near field HRTF in one single direction.

Main application is in Augmented Reality (AR) headsets or glasses which use an "open ear" solution to superimpose existing and simulated 3D audio.

PROBLEM: Capturing a DIGITAL EAR is complicated

Until now, it has been **complex and expensive!**



3D scanning (Not Applicable!)



High Resolution Ear Scanner for audiologists (>10k€)



Acoustic HRTF capture in anechoic room (> 100k€)



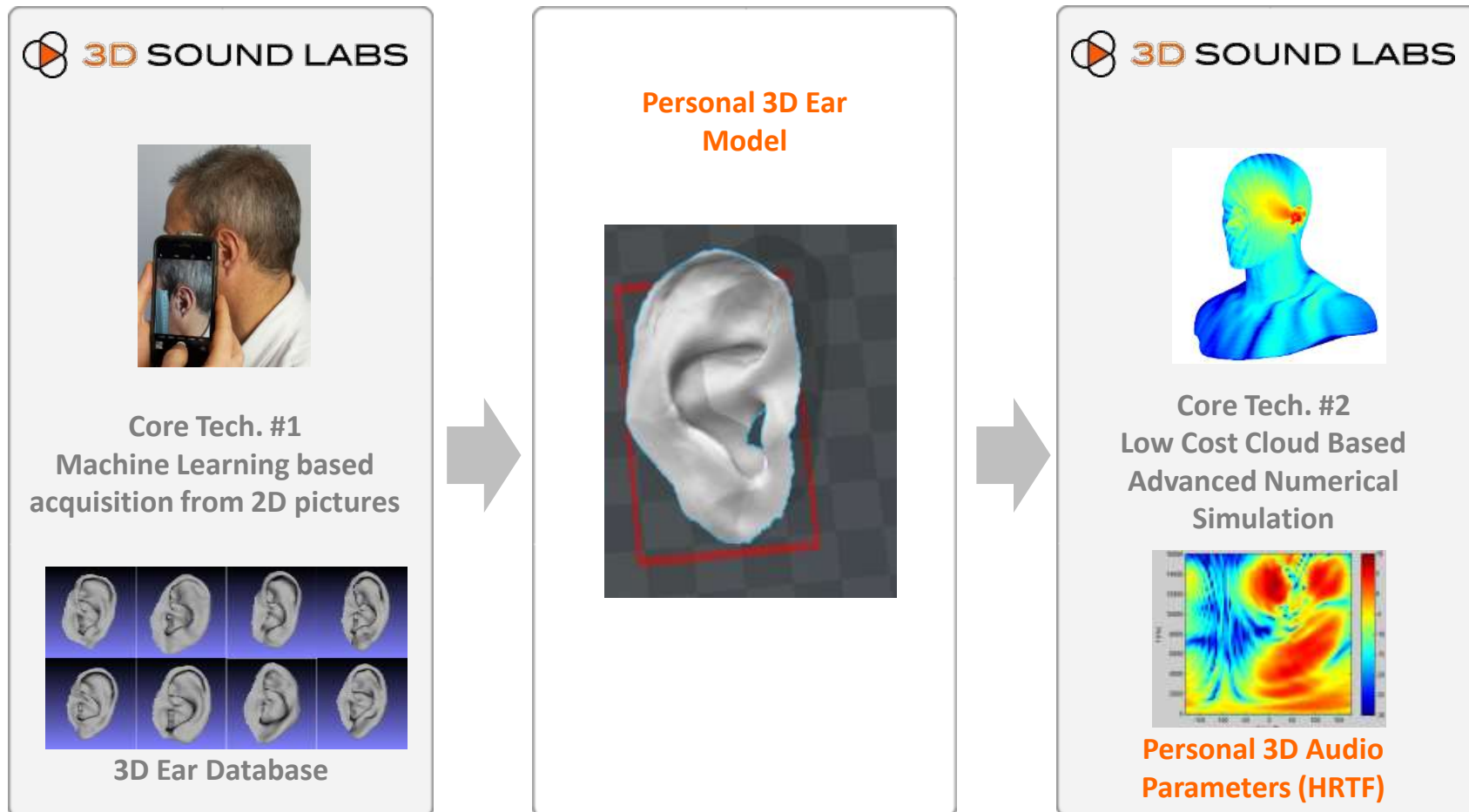
Traditional Silicon Ear Impression (<100€)



**3D Audio & Personal Acoustics
Solutions**

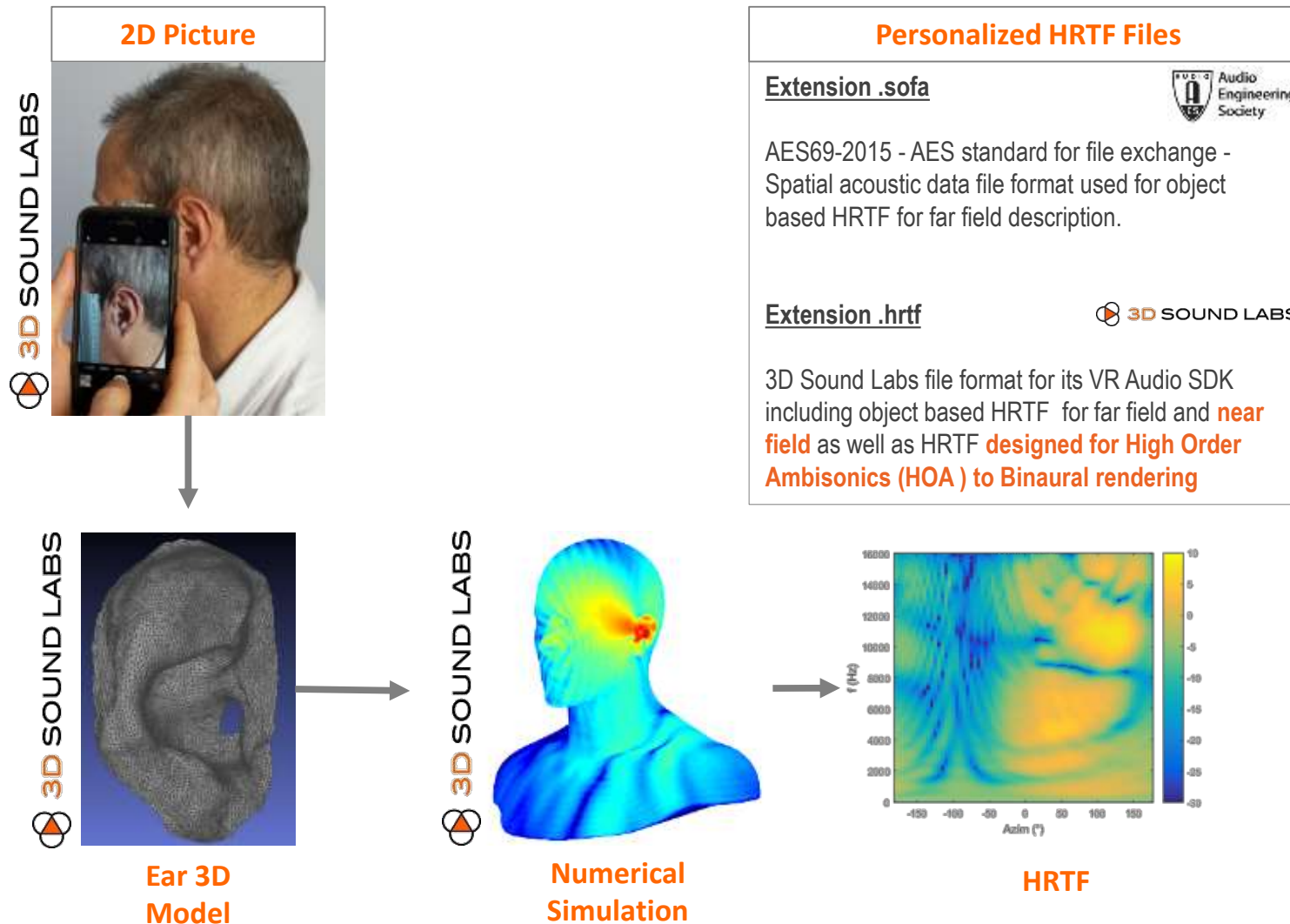
SOLUTION: 3D Sound Labs DIGITAL EAR

2D Picture provides personal 3D Ear Model and HRTF (Head Related Transfer Function)



DIGITAL EAR for 3D Audio HRTF

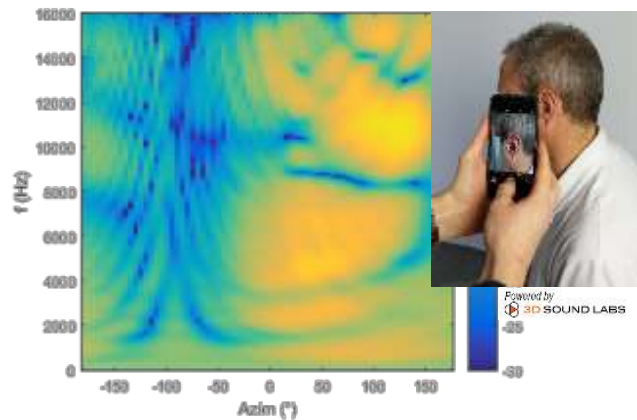
2D Picture provides **personalized HRTF** for VR/AR, Video Games and 3D Audio Music



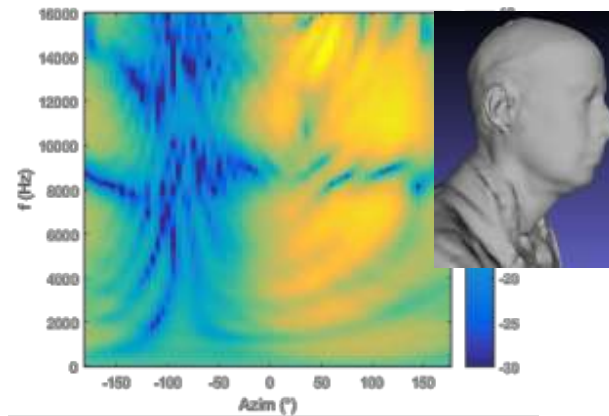
DIGITAL EAR for 3D Audio HRTF

3D Sound Labs HRTF Individualization solution based on 2D pictures provides **performances similar to HiRes Scanning and to Acoustic Capture.**

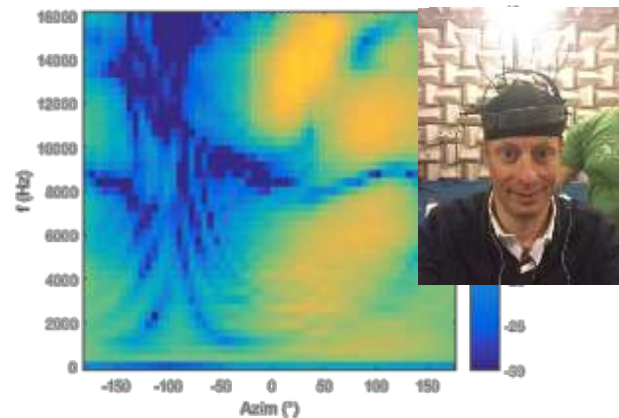
One 2D Picture +3DSL Numerical Simulation



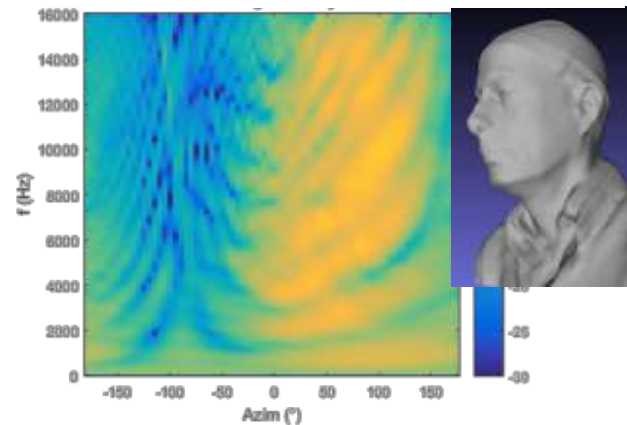
HiRes Scan + Standard Numerical Simulation



Acoustic Capture

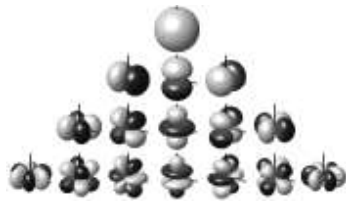


LowRes Scan + Standard Numerical Simulation



Solution: VR Audio SDK

High Order Ambisonics



VR Audio Engine core processing made in High Order Ambisonics domain yields key benefits:

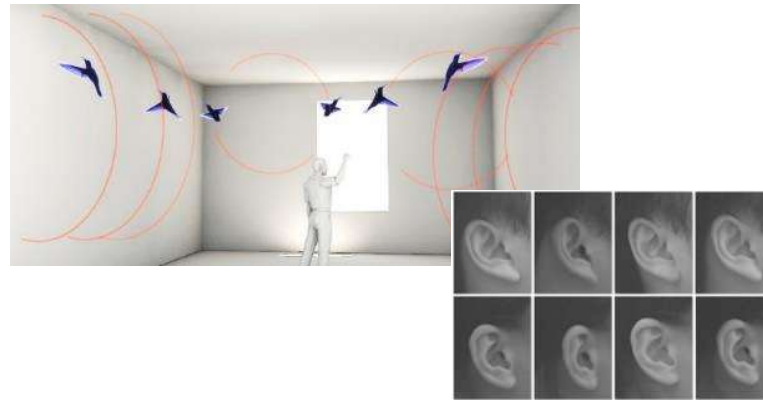
Low CPU Usage for:

- Low Latency Head Tracking
- High number of sources
- Ambisonics: B-Format (FOA) & HOA

Scalability:

- CPU Load management
- One content for both High End (PC based) and Low End (Mobile)

Realism & Immersion



3D Sound Labs has introduced two features that dramatically improve the spatial audio rendering.

HRTF Individualization

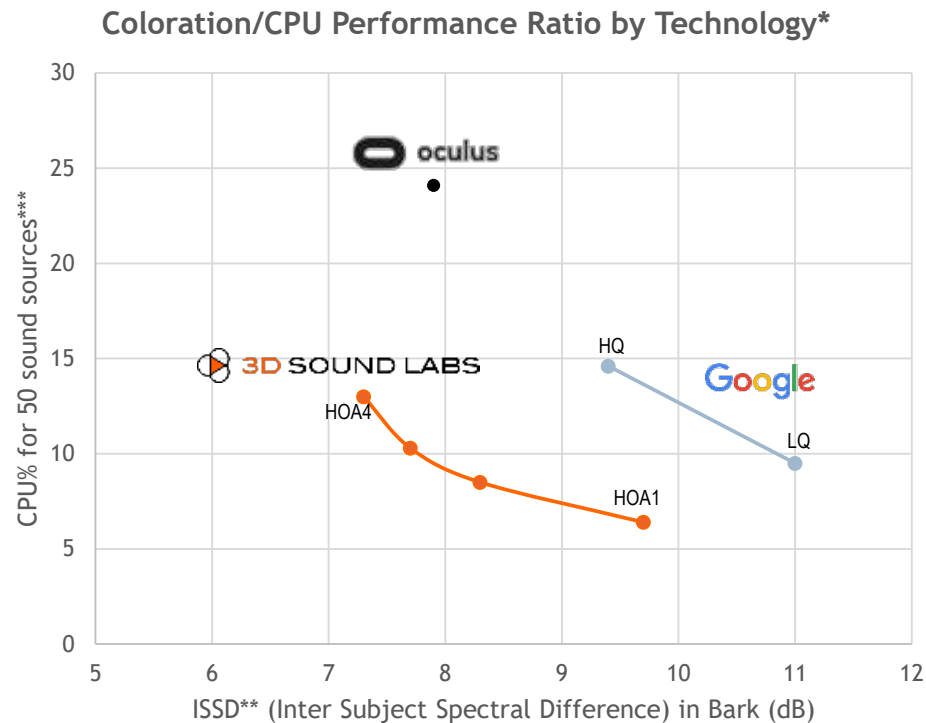
Head related transfer function personalization provide a dramatic improvement to spatial sound perception.

Low Sound Coloration in HOA Domain

Specific and proprietary processing in HOA domain brings a more realistic and natural sound quality.

VR Audio SDK Performance

3D Sound Labs HOA to Binaural rendering method provides **less sound coloration** than virtual speaker methods and object base, **with lower CPU %**



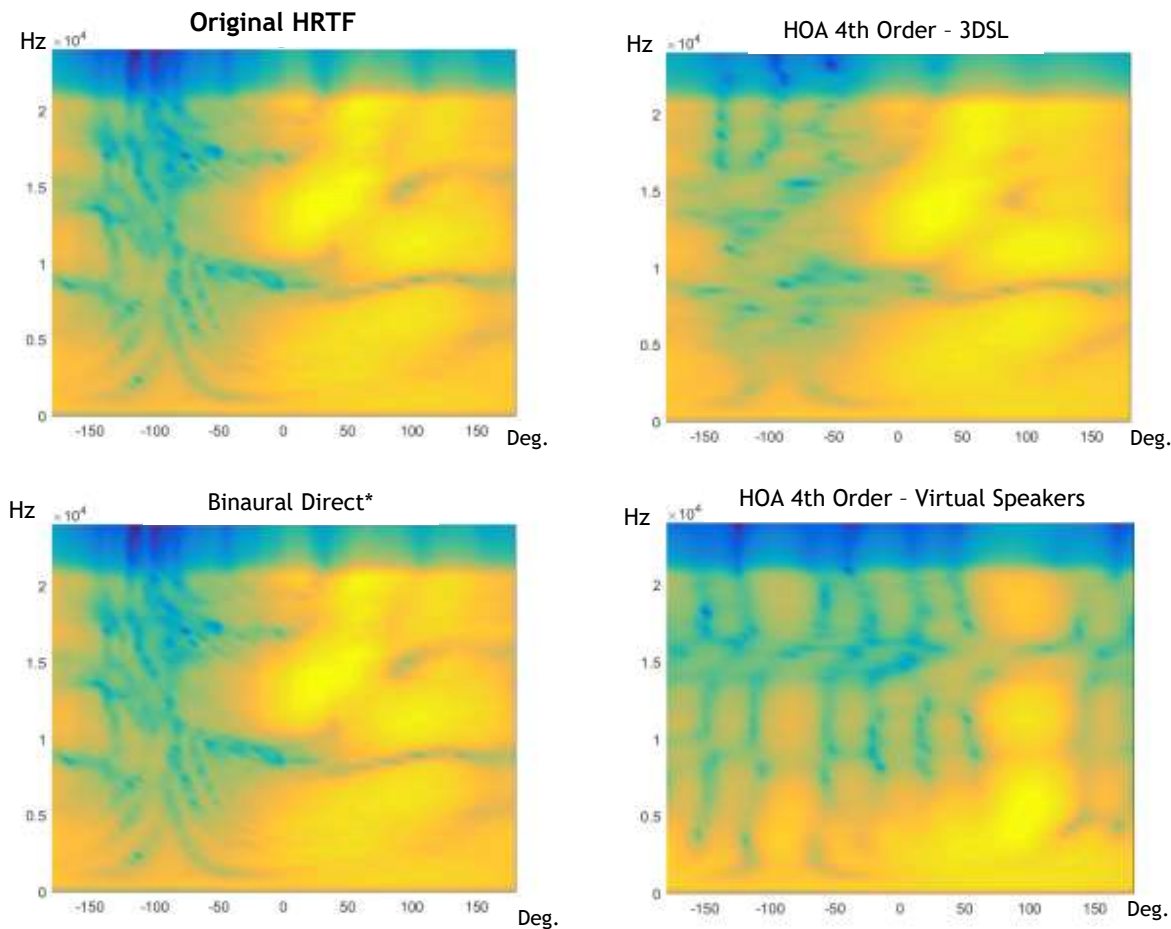
* SDK Versions: 3D Sound Labs (v 0.3.0) HOA 1st to 4th order, Google (1.0.1) LQ & HQ modes, Oculus (1.1.0)

** Average ISSD (Inter Subject Spectral Difference) in Bark applied between the frequency response and the HRTF of the 84 subjects of the ARI database . The ISSD is a metric that is based on the variance in the difference between frequency spectrum that illustrates well the difference of coloration between two HRTF.

*** Laptop Lenovo ideapad - CPU Intel i5-4210U @2,40 GHz, Windows 8.1 64bits, Single-core mode

VR Audio SDK Quality

3DSL Solution provides **less coloration artifacts and better spatialization** than Virtual Speakers Method

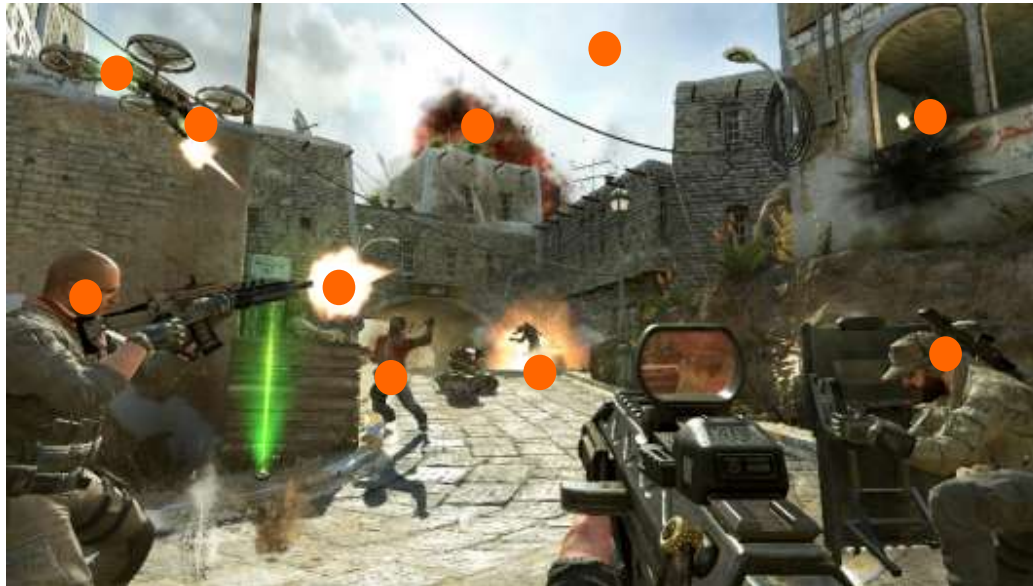


Binaural Direct result matches the original HRTF used (by definition). 3DSL HOA Filters give very comparable results, contrarily to Virtual Speaker method which introduces artifacts

VR Audio SDK: Hybrid Mode (Objects + HOA)

Unique 3D Sound Labs Hybrid mode provides different level of spatial precision to:

- Optimize CPU usage
- Manage End user attention in VR Story telling



Precise Sounds:

One enemy gun shot
Two team mates' talking

Normal Sounds:

Two explosions
Two Friendly gunshots
Drone engine

Ambiance Sounds:

Street atmosphere

Precise and Normal sounds all rendered with 6 early reflections to provide realistic audio sound scene.

Object Based Rendering

- 8 sounds with each 6 early reflections: 56 objects
- 1 ambience sound in stereo (poor realism)
- Difficult for the "player" to make a difference between important sound (enemy shot) and other sounds.

CPU
25%

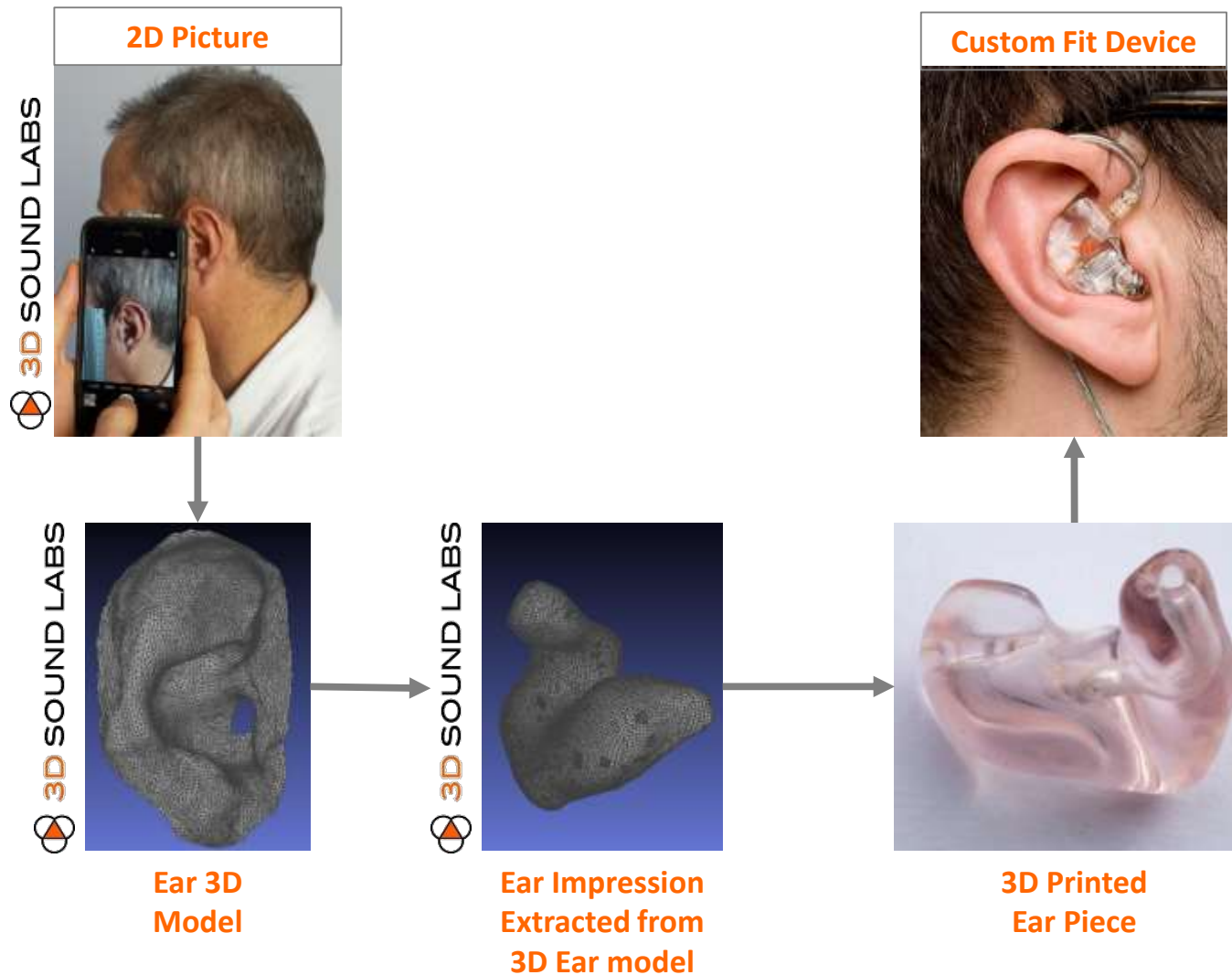
Hybrid Based Rendering

- 3 precise sounds with the first 2 early reflections object based and 4 next early reflection in HOA order 2
- 5 normal sounds with early reflections in HOA order 2
- 1 realistic ambience sound in HOA order 2

CPU
10%

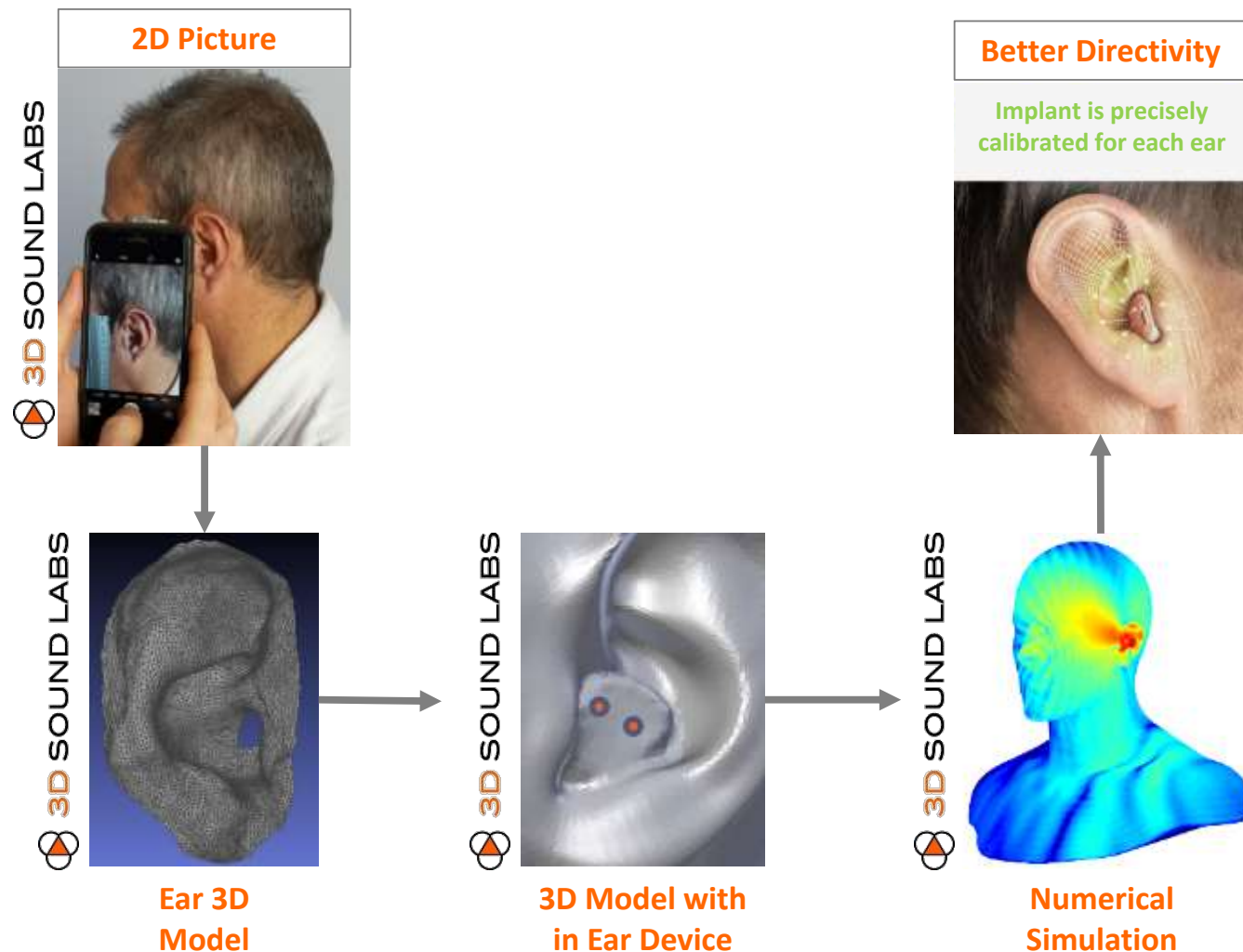
DIGITAL EAR for Custom Ear Piece

2D Picture provides personal 3D Ear Model for 3D Printing



DIGITAL EAR for Hearable Microphone Directivity

2D Picture provides personal 3D Ear Model enabling the biometric calibration microphone beamforming enabling improved frontal directivity for better speech intelligibility in noise.



3D Sound Labs, a Technology Company

Founders



Xavier Bonjour (Chairman)

- Technicolor, LG and Philips
- Startup board member: Movea
- Heriot-Watt University, ESIEE, ESCP.



Dimitri Singer (CEO)

- General/growth management: Coolsand, Wipulse, TikiLabs
- Coach, mentor, advisor for multiple startups
- Telecom Paris, INSEAD



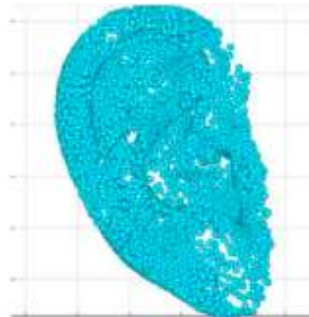
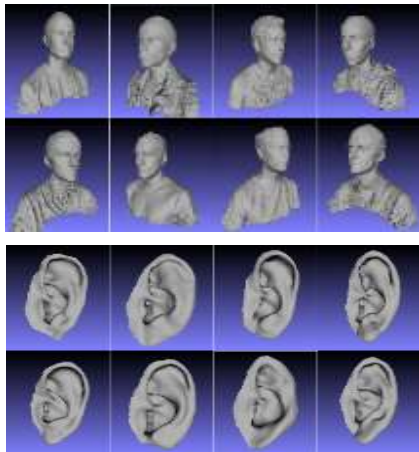
Renaud Séguier (Scientific Advisor)

- Professor at CentraleSupélec
- Co-founder of DYNAMYXZ, successful start-up company.
- PhD in Signal Processing,

Team based in France



Software, Databases and Models



4 Filed Patents



BREVET D'INVENTION CERTIFICAT D'UTILITÉ

Réception électronique de la soumission

Il est certifié par la présente qu'une demande de brevet (ou d'un certificat d'utilité) a été reçue par le biais du dépôt électronique sécurisé de l'INPI. Après réception, un numéro d'enregistrement et une date de réception ont été automatiquement attribués.

Numéro de demande	1558279
Numéro de soumission	1000309795
Date de réception	07 septembre 2015
Vos références	69927 BRU
Demandeur	3D SOUND LABS
Pays	FR
Titre de l'invention	Procédé et système d'élaboration d'une fonction de transfert relative à la tête adaptée à un individu



3D Audio & Personal Acoustics

HRTF Individualization – Benefits for 3D Audio

Localization

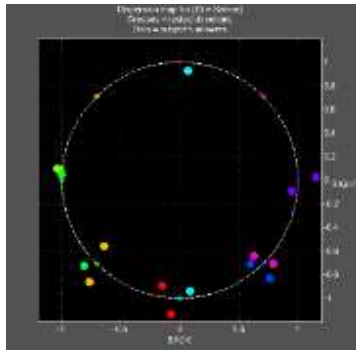
Spatial Resolution

(Image analogy)

Spectral “Coloration”

(Image analogy)

Standard
HRTF



Localization errors

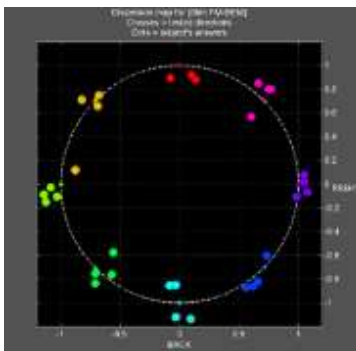


Fuzzy perception of the soundscape



Unatural Timbral Coloration

Personal
HRTF



Good Localization



Crisp and Clear perception of the soundscape



Natural Timbral “Coloration”

3D Sound Labs – Binci Project

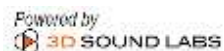
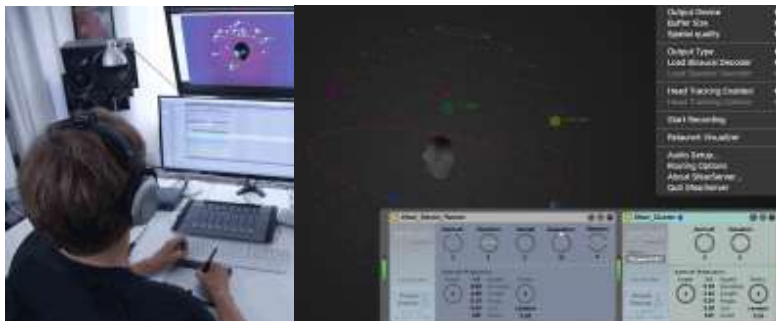


The **BINCI** project “Binaural Tools for Creative Industries” has the objective to allow the creation of immersive binaural 3D music and other binaural contents for applications in the virtual reality, augmented reality or videogames sector.



3D Audio Content Creation Tools

Advanced 3D Audio content creation plug-in allowing for **head-tracking and HRTF individualization**, including 3D Sound Labs rendering for **consistent experience between creation and play out**.

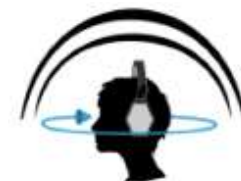


3D Audio Multiple Speakers System

Rental or purchase of inflatable domes with integrated loudspeakers for innovative experiences based on 3D sound at music festivals, promotional events, ...



3D Audio Player on Mobile Platforms (VR/AR/Headphones with Headtracking)



Use Case: Recorded content Distribution Exemple

3D Sound Labs and Viaccess-Orca are **first** to present VR video with **compressed 3rd Order Ambisonics** 3D Audio on a **mobile** platform

