

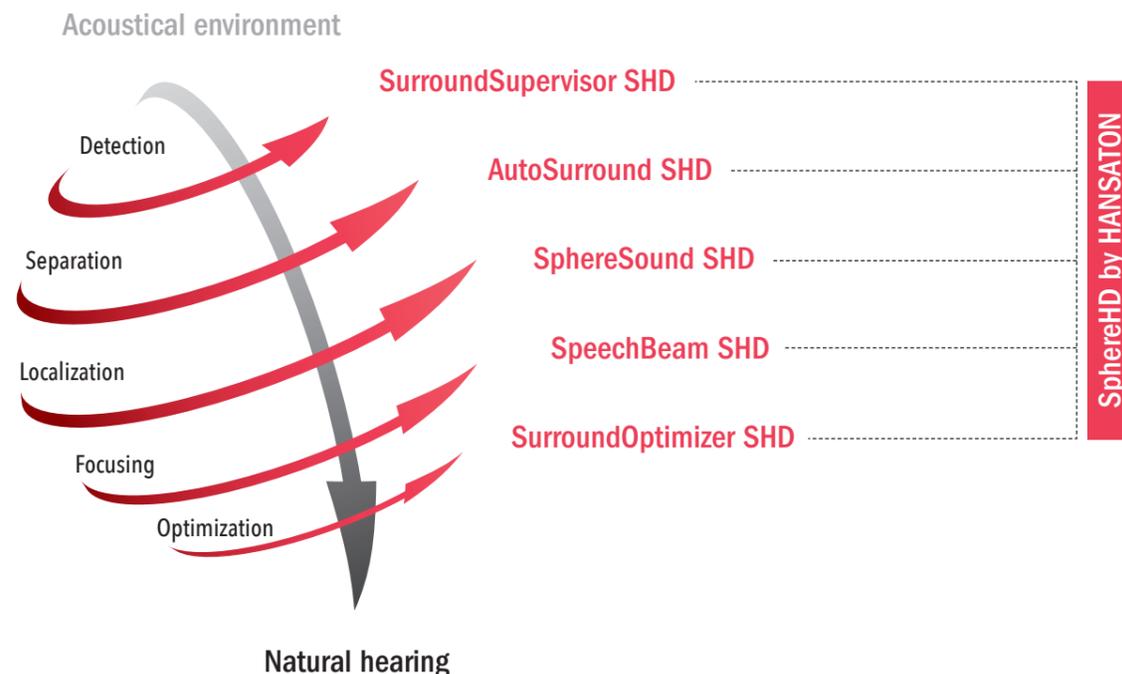
HearIntelligence by HANSATON. Intelligent hearing means natural hearing.

Acoustic environments are complex. We are surrounded by a variety of different acoustic signals, speech sounds, and noises nearly 24 hours a day, every day, week after week, for our entire lives. Our perception is heavily influenced by the shapes of our heads and ears, so each person's concept of "natural sound" is different. A number of different, complex, intelligent processes happen inside our brains automatically, all at the same time. For example, they detect acoustic signals, determine the signals' spatial locations, and evaluate their importance.

Each person has his or her own individual, natural auditory intelligence.

Hearing loss impairs these processes and changes the brain's naturally acquired auditory perception. Hearing systems can help us recover certain lost frequencies again. Here at HANSATON, we firmly believe that mere compensation isn't enough. HearIntelligence by HANSATON stands for innovative hearing system technology designed to go above and beyond hearing loss compensation – to restore the natural hearing experience. HearIntelligence is based on natural auditory intelligence, and allows the restoration of natural hearing. If the hearing system takes over the impaired natural hearing processes, it allows the wearer to perceive the acoustic environment more naturally again.

HearIntelligence powered by SphereHD.



HearIntelligence by HANSATON

Innovative features work together intelligently and efficiently to allow hearing system wearers to experience the natural functions of the ear again.

Detection of acoustic environments.

The natural hearing process involves capturing and assessing the acoustic environment precisely and quickly at each moment. Our brains do this completely automatically, without us having to think about it at all. As a result, speed and precision are crucial to hearing system technology as well. The more quickly and precisely the acoustic environment can be identified, the more effectively the hearing system technology can process this information and turn it into a natural hearing experience for the wearer.

Technical implementation by HANSATON: SurroundSupervisor SHD



Separation.

Overall acoustic environments are often made up of several different individual components: speech, music, and noise, for example. In the natural hearing process, the brain automatically uses a complex, intelligent process to identify this acoustic mix and break it down into its individual components. Tiny nuances may distinguish one acoustic situation from another. HearIntelligence by HANSATON applies a similar process, giving hearing system wearers an automatic program that identifies the acoustic mix at hand and processes its individual components intelligently, allowing it to adjust seamlessly and effectively to a wide variety of situations.

Technical implementation by HANSATON: AutoSurround SHD



Localization.

The outer ear has several different functions within the overall hearing process. For one, it helps localize sources of sound based on differences in how high and low frequencies are influenced. For another, it compresses and amplifies the sound. This sound impression is also influenced by the shapes of the pinna and the concha, and by the shape and size of a person's head. Using a hearing system means that these natural sound-influencing factors no longer come into play, because of the way the hearing system microphone is positioned above the ear. As a result, sound takes on an artificial quality, and natural directional hearing becomes more difficult. Accounting for these circumstances so that hearing system wearers can localize sound signals, and thus hear naturally, is a central aspect of the HANSATON hearing system development process... and thus a central aspect of HearIntelligence.

Technical implementation by HANSATON: SphereSound SHD



Focusing.

In the natural hearing process, listeners can automatically localize speakers and focus in on their words, while simply tuning out other speakers who are not currently relevant – regardless of which direction they are in. For a hearing system to assume the natural functions of the ear, it also needs to be capable of focusing in on conversation partners – especially in challenging situations, such as in restaurants or at loud family gatherings. At such moments, speech clarity and the ability to focus in on conversation partners are absolutely crucial aspects of a natural hearing experience.

Technical implementation by HANSATON: SpeechBeam SHD



Optimization.

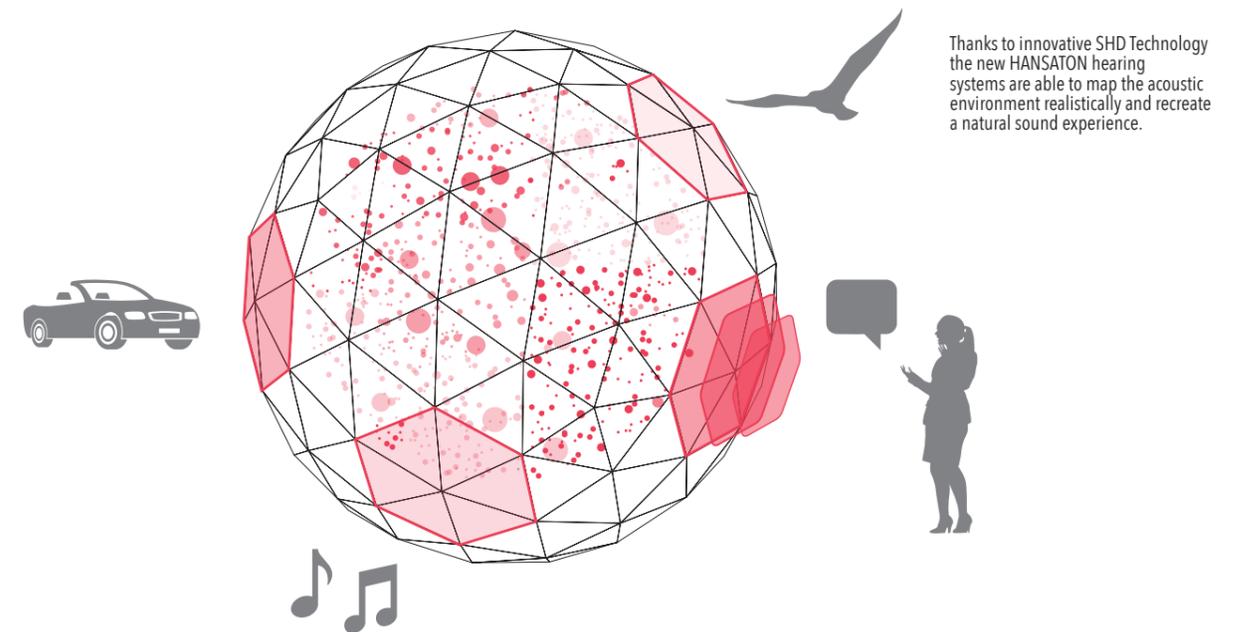
The human body is capable of ignoring disruptive noise and concentrate on speech or sounds, identifying the signals it deems relevant and then perceiving them clearly and brilliantly.

Technical implementation by HANSATON: SurroundOptimizer SHD

SurroundOptimizer SHD combines speech amplification, background noise suppression, and intelligent directional microphone characteristics in various acoustic environments to ensure that ideal, natural hearing is always the end result.

SphereHD by HANSATON. Spatial acoustics in a new dimension.

Our acoustical environment is not one-dimensional – it is complex and spherical. Spherical means that we are surrounded by different sounds, noises and conversations. SphereHD is the new HANSATON chip platform that offers hearing system wearers a new dimension of spatial hearing and the most natural hearing experience.



Thanks to innovative SHD Technology the new HANSATON hearing systems are able to map the acoustic environment realistically and recreate a natural sound experience.



SurroundSupervisor SHD

HANSATON's SurroundSupervisor SHD uses more than 30 high-resolution sensors to analyze the acoustic environment nearly 700 times per second, providing a realistic model of the surrounding area as a starting input value for signal processing.



AutoSurround SHD

AutoSurround SHD is a program that automatically adjusts hearing system settings to fit the current environment. The best part: instead of relying upon preset programs, AutoSurround SHD generates the perfect mix of parameters for the individual acoustic situation at hand.



SphereSound SHD

Hearing systems use SphereSound SHD to recreate the way the ear and head influence sound, providing a natural overall sound experience and allowing precise localization of speech and signal sources.



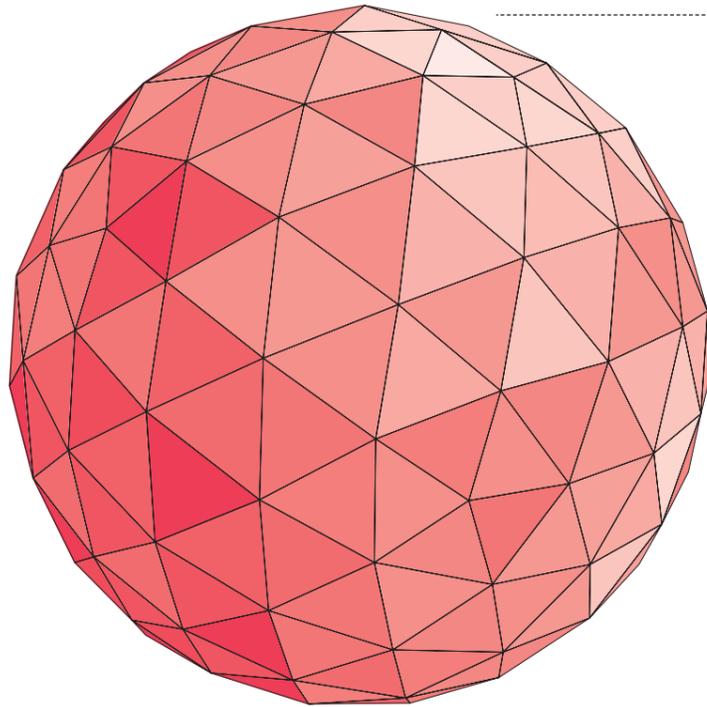
SpeechBeam SHD

Regardless of which direction speech is coming from, SpeechBeam SHD focuses in on that speaker. In combination with innovative localization algorithms, the result is crystal-clear speech and greater ease of hearing.

SurroundSupervisor SHD. High speed and precision.

SurroundSupervisor SHD acts as an interface between the hearing system and its surroundings while replicating its acoustic environment realistically. Speed and precision are the keys to its success, since the hearing system's signal processor can only fully realize its abilities to restore natural hearing if it knows the acoustic environment exactly. By optimizing our algorithms and storage capacity management, we have made our environmental detection program significantly faster, and greatly improved the precision of our speech detection module.

The powerful, highly sensitive SurroundSupervisor SHD is able to analyze the acoustic environment precisely and map it quickly. In fact, it does this about 700 times per second, with the help of more than 30 high-resolution sensors. Intelligent signal processing ensures natural hearing practically in real time.



Simplified presentation of the SurroundSupervisor SHD as a spatially, acoustically sensitive surface that receives all of the facets of sound in the surroundings and passes these on to the internal signal processor.

High-speed detection.

More than 30 high-resolution sensors analyze the acoustic environment nearly 700 times per second.

Real-life reproduction.

SurroundSupervisor SHD generates a precise map of the acoustic situation by determining the current proportional mix among seven standard situations.

Automatic results.

Based on this precise input, the automatic AutoSurround SHD program can adjust signal processing to compensate hearing loss effectively, while also restoring natural hearing.

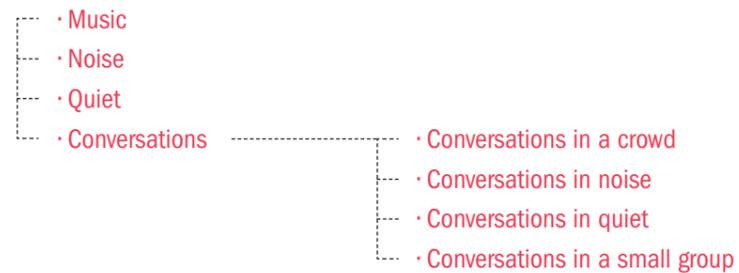
High speed and precision

More than 30 high-resolution sensors act as an interface between the hearing system and the environment, analyzing the surroundings nearly 700 times per second for maximum precision and speed.

High-tech features – coordinated perfectly.

The classifier's input is crucial in enabling HANSATON hearing systems with SHD Technology to replicate acoustic situations more naturally than ever. AutoSurround SHD automatically adjusts the hearing system to its acoustic environment, taking audiological considerations into account.

Both SurroundSupervisor SHD and AutoSurround SHD refer to seven standard situations when making their calculations.



Acoustic situations can be broken down into four standard components: speech, music, background noise, and silence. From an audiological perspective, it makes sense to differentiate among speech components more precisely.

HANSATON hearing systems are capable of replicating any acoustic environment, using these seven standard situations as a reference. SurroundSupervisor SHD analyzes the current acoustic environment and precisely measures the proportions of each standard situation – establishing the perfect basis for the automatic AutoSurround SHD program. The result: a realistic map of the acoustic environment.

AutoSurround SHD. The natural situation mix.

The precise input supplied by SurroundSupervisor SHD is the key to ideal hearing system adjustment: the AutoSurround SHD program automatically adapts hearing system settings to fit the current environment.

Here's the best part: Rather than simply using fixed programs, AutoSurround SHD can recreate a practically infinite variety of acoustic situations. AutoSurround SHD automatically generates a perfect mix of settings for any given acoustic situation, based on how SurroundSupervisor SHD has weighted the seven standard situations (see figures 1 and 2).

For the ultimate in music enjoyment: If SurroundSupervisor SHD detects that a majority of the sound input is music, AutoSurround SHD will gently shift hearing system settings to the parameters defined for music (see figure 3).

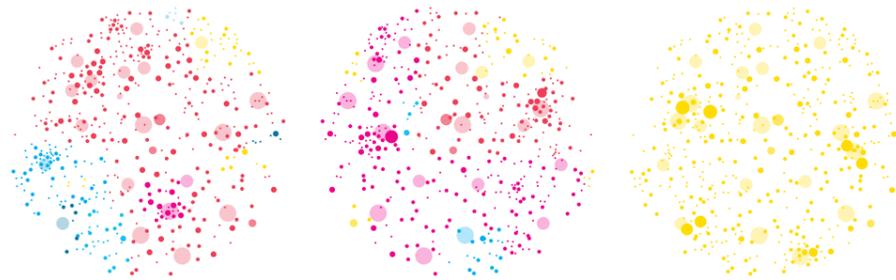


Figure 1

Figure 2

Figure 3

Functions	Ex. Noisy environment	Ex. Speech with ambient noise	Ex. Music
Music	5 %	5 %	>60 % = 100 %
Noise	65 %	15 %	0 %
Quiet	0 %	0 %	0 %
Conversations in a crowd	20 %	15 %	0 %
Conversations in noise	3 %	60 %	0 %
Conversations in quiet	0 %	5 %	0 %
Conversations in a small group	7 %	0 %	0 %

An especially natural mix

Fixed programs are a thing of the past. AutoSurround SHD automatically generates a perfect mix of settings for any given acoustic situation, based on how SurroundSupervisor SHD has weighted the seven standard situations.

Spatial and natural hearing

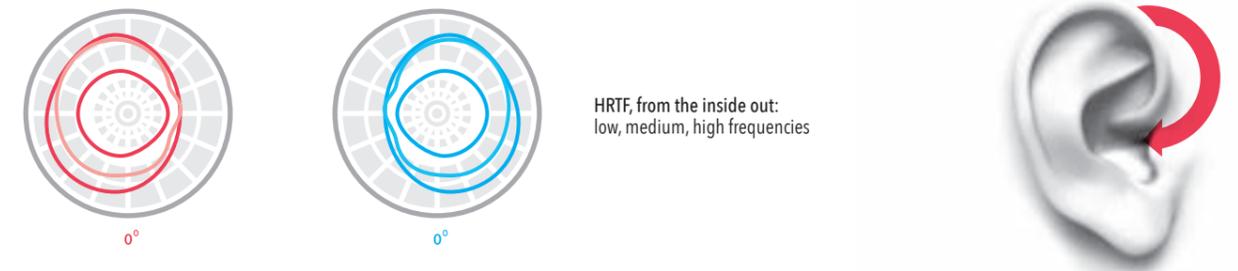
Thanks to SphereSound SHD, the way the ear and head influence sound acoustically, impaired by the hearing system, is recreated. Natural sound and the ability to easily localize the sources of sound again are the result.

SphereSound SHD. Perfectly optimized spatial acoustics.

SphereSound SHD is a core hearing system function, and one of the key components of the chip platform SphereHD. SphereSound SHD makes it possible to localize and spatially perceive sounds and speech, and also to focus in on speech. In three different levels, the hearing system uses SphereSound SHD to imitate the natural functions of the ear that influence sound to localize, bundle and amplify sound.

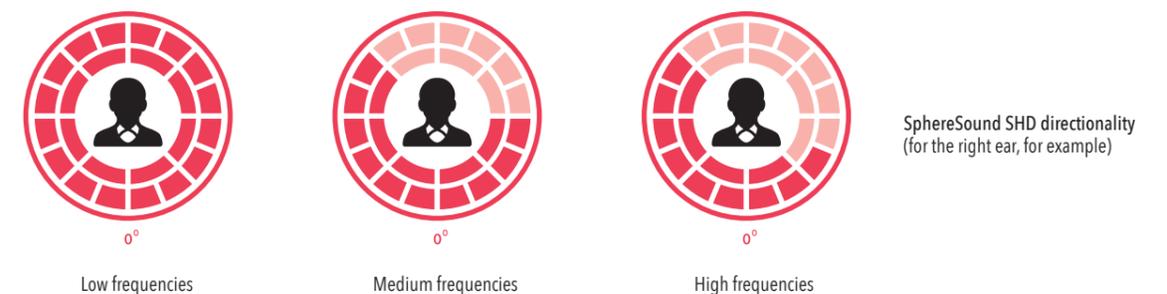
SphereSound SHD Static.

When using measurements to determine the influence that the ear and head have on sound, frequency-specific differences are easily identifiable. The characteristics of the measurements, represented by the Head Related Transfer Function (HRTF), are the basis for SphereSound Static.



HRTF, from the inside out:
low, medium, high frequencies

The high-frequency, maximum sensitivity for each ear is somewhat outside the 0° direction. With SphereSound SHD, this factor can be taken into account. Intelligent control of microphone directionality makes it possible to simulate natural sound reception, in other words to recreate how the ear and head influence sound. Influencing effects caused by the position of the hearing system are eliminated. Spatial, natural hearing is the result. This makes it possible to localize the sources of sound again.



SphereSound SHD directionality
(for the right ear, for example)

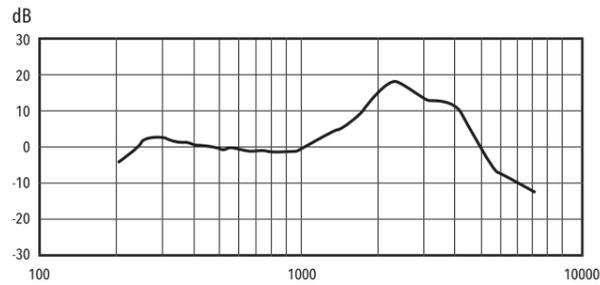
Low frequencies

Medium frequencies

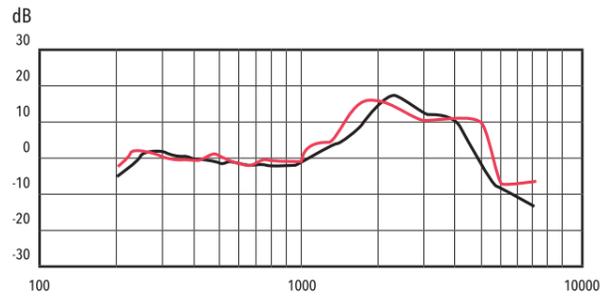
High frequencies

SphereSound SHD Personal.

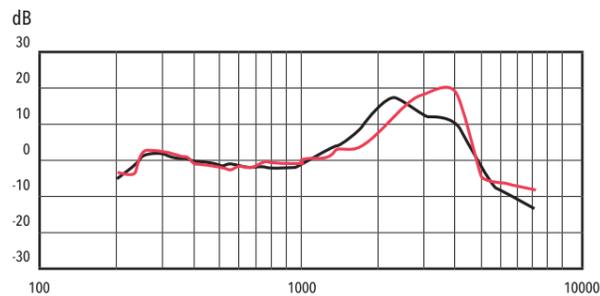
SphereSound SHD Personal takes the size of the ear canal into account, as this influences natural hearing. Depending on the size of the ear canal, the maximum amplifications, with slightly differing frequencies, appear when measuring the REUG. By selecting the canal size in scout, this frequency shift can be taken into account when creating the microphone orientation characteristics, thus optimizing the natural, personal perception further.



Medium REUG



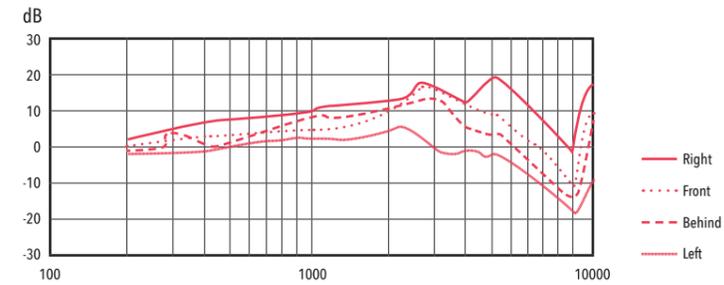
Longer auditory canal - Peak lower



Shorter auditory canal - Peak higher

SphereSound SHD Dynamic.

SphereSound SHD Dynamic works with the SpeechBeam SHD-3 algorithm and comes into action in all challenging speech situations. It is based on natural sensitivities' dependence on sounds coming from various directions.



SpeechBeam SHD-3 identifies the direction of the speech in real time and controls the orientation characteristics of the microphone for optimum speech clarity. With SphereSound SHD Dynamic, the correct, natural, frequency-dependent amplification values for signal processing are added, based on the orientation information. This means that how the ear and head influence sound can be simulated. In challenging speech situations, the hearing system user can now understand speech and at the same time localize the speaker.

SphereSound SHD is available in each performance level.

SphereSound SHD	Performance Level 9	Performance Level 7	Performance Level 5	Performance Level 3
Static (HRTF)	•	•	•	
Personal (Ear Canal Resonance)	•	•		
Dynamic	•			

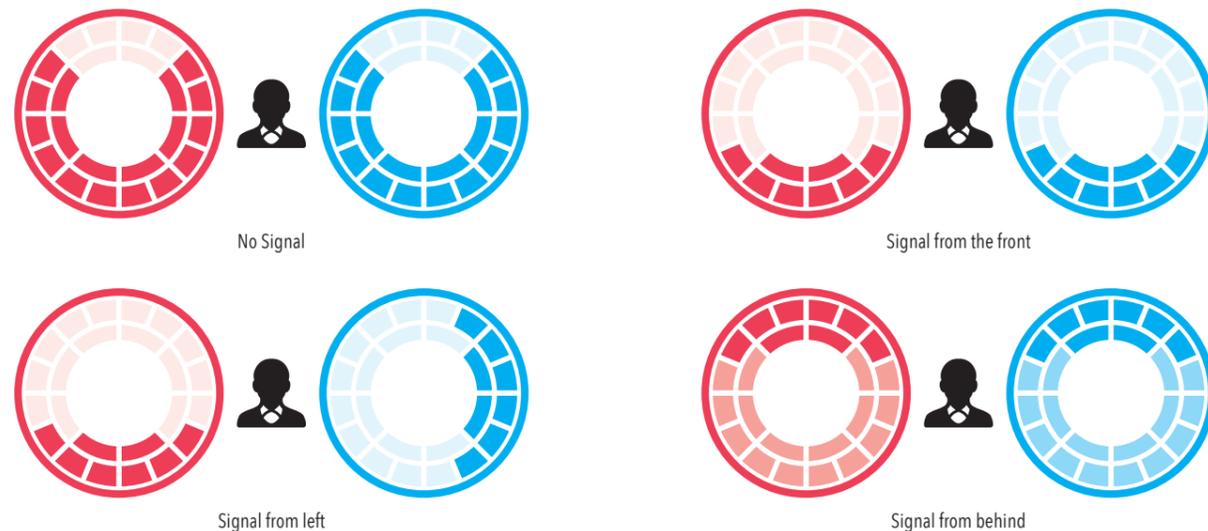
SpeechBeam SHD. Speech clarity in any situation.

In the hearing system wearer's personal acoustic environment, the direction of speech changes relative to the wearer. SphereHD hearing systems use the SpeechBeam SHD function to focus in on whoever is speaking.

SpeechBeam SHD generates a variety of microphone orientation characteristics to determine the exact direction speech is coming from, 360° around the hearing system user. This means that, thanks to cutting-edge binaural signal processing, the hearing system can focus in on speech coming from the front, from the back, or from either side (SpeechBeam SHD-1 and -2). SpeechBeam SHD-3 also generates directional characteristics oriented to the back and sides. The left and right hearing systems work together to ensure maximum precision and optimum speech clarity.

SpeechBeam SHD-3 also has the dynamic support of SphereSound SHD to ensure that, even in challenging acoustic situations, the system will not only ensure excellent speech clarity, but localize the speaker precisely as well.

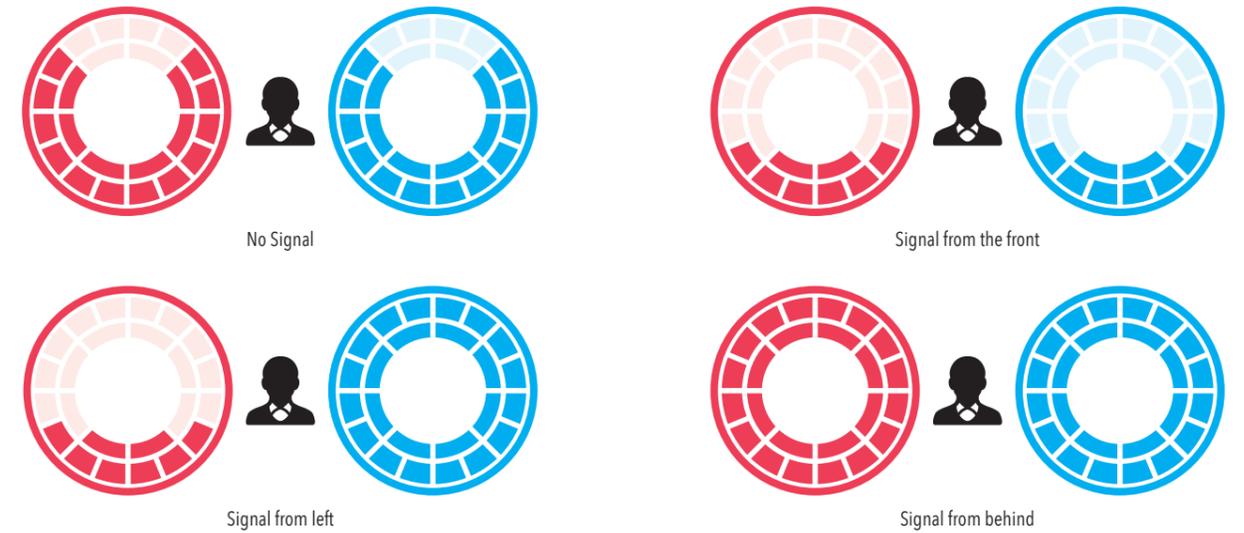
SpeechBeam SHD-3 (Performance Level 9).



Absolute speech clarity

Regardless of which direction speech is coming from, SpeechBeam SHD focuses in on that speaker. In combination with localization algorithms, the result is crystal-clear speech and greater ease of hearing.

SpeechBeam SHD-2 (Performance Level 7).



SpeechBeam SHD-1 (Performance Level 5).

