A Deeper Look at OpenSound Navigator™

Vice President, Audiology
Oticon, Inc

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D.Schum@Oticon.com

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OpenSound Navigator™

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Traditional Directionality and Noise Reduction: Slow Response

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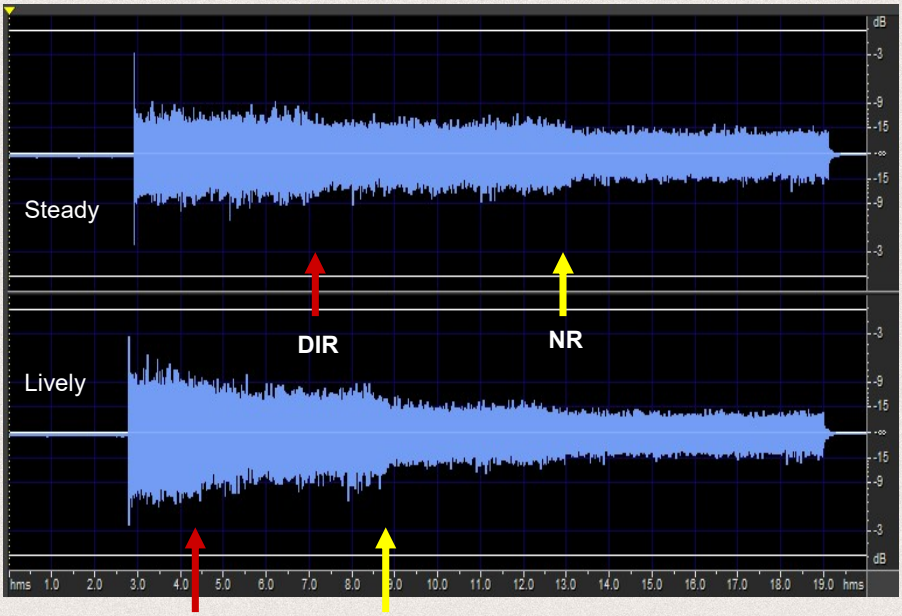

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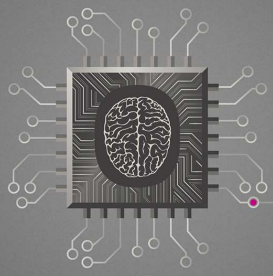
New Velox™ Platform

Power & Speed

New Oticon Opn™



50 times faster

TwinLink™

64 frequency band resolution

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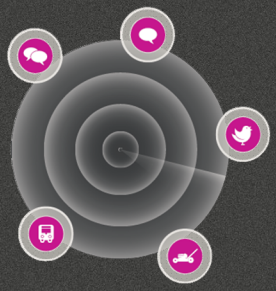
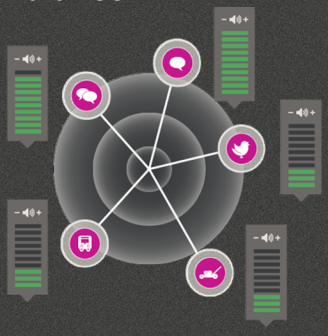
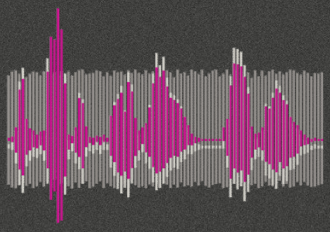
Analyzes



Balance



Noise removal



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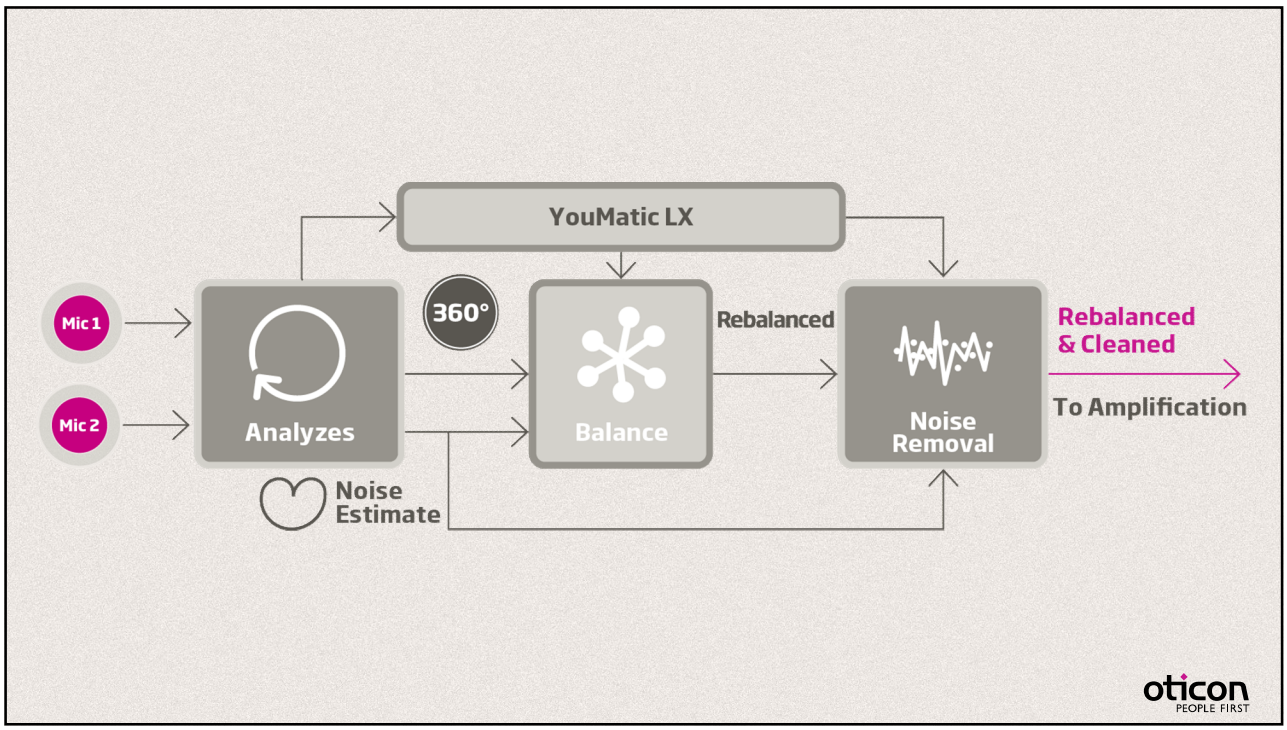
YouMatic LX
Mic 1
Mic 2
Analyzes
360°
Balance
Rebalanced
Noise Removal
Rebalanced & Cleaned
To Amplification
Noise Estimate
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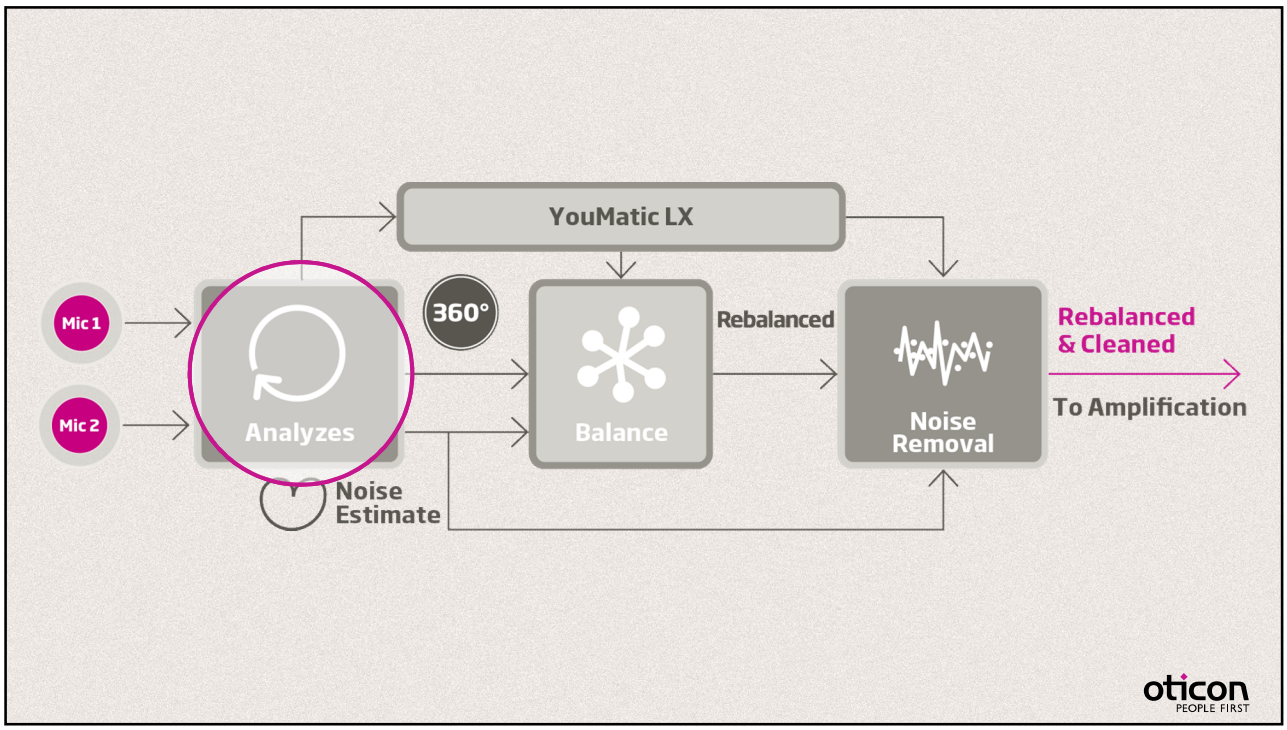
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Data Captured:

- Frequency (16 channels)
- Level
- Location
- Speech versus Non-speech

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20th European Signal Processing Conference (EUSIPCO 2012) Bucharest, Romania, August 27 - 31, 2012

MAXIMUM LIKELIHOOD BASED NOISE COVARIANCE MATRIX ESTIMATION FOR MULTI-MICROPHONE SPEECH ENHANCEMENT

Ulrik Kjems and Jesper Jensen

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Jesper Jensen[*†] *and Michael Syskind Pedersen*[*]

[*] Oticon A/S, 2765 Smørum, Denmark
[†] Aalborg University, 9220 Aalborg Ø, Denmark

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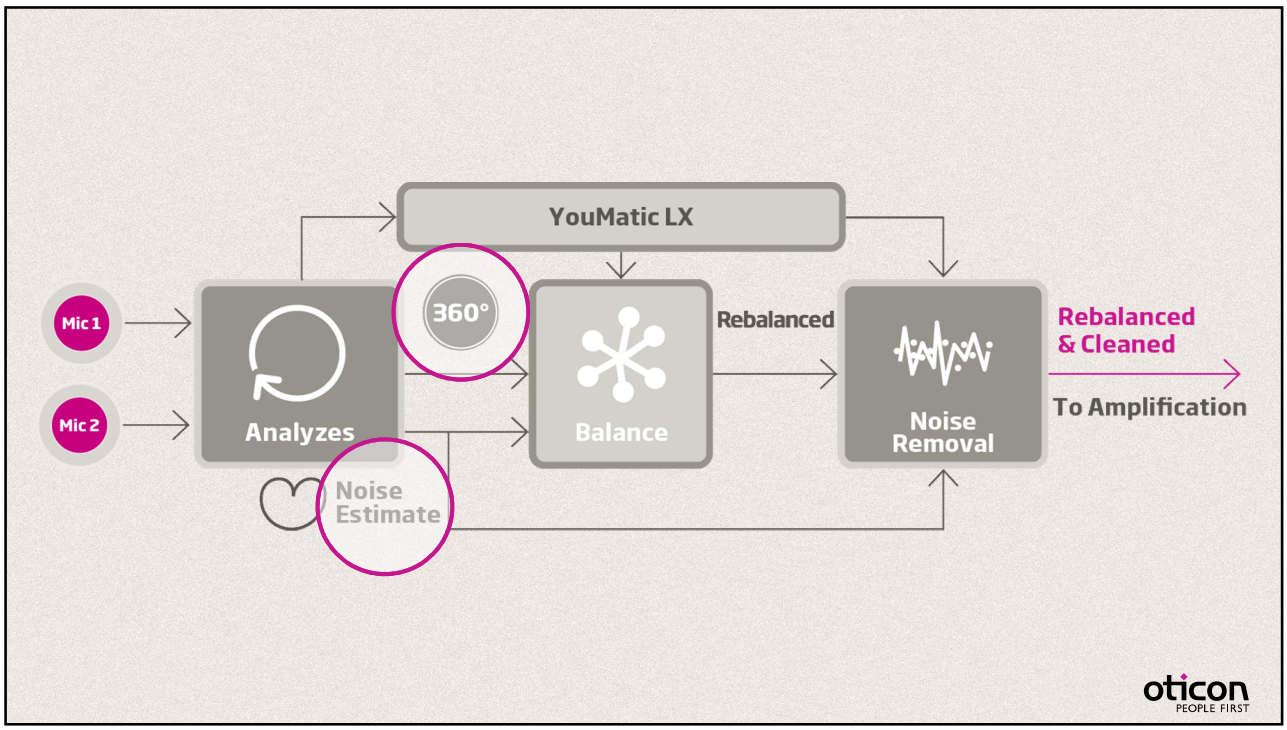
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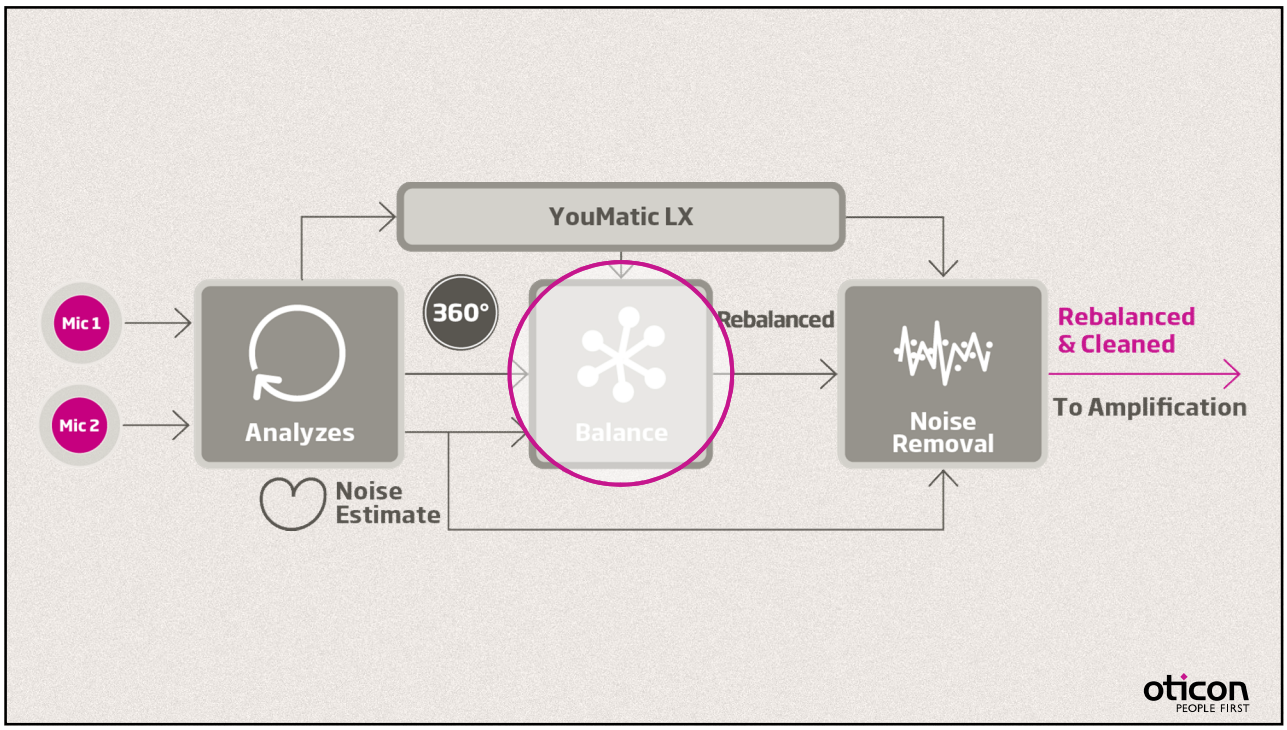
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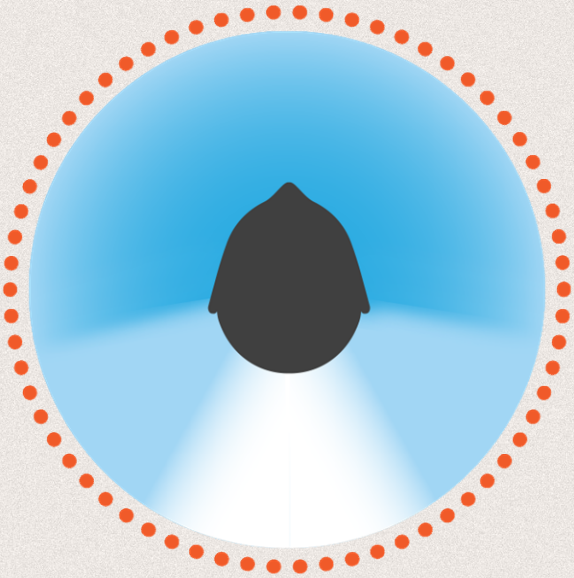

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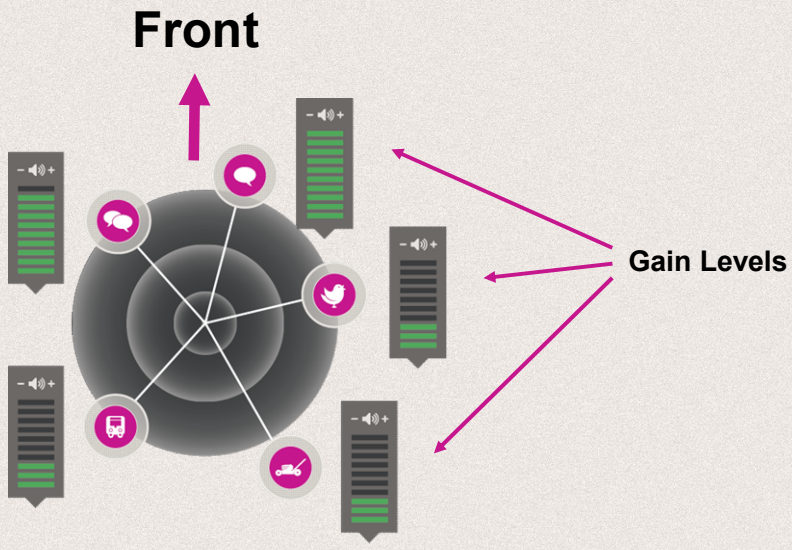

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Is this a different kind of directionality?

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Is this a different kind of directionality?

- Speed (essentially instantaneous)
- Resolution
- Criterion in setting the null

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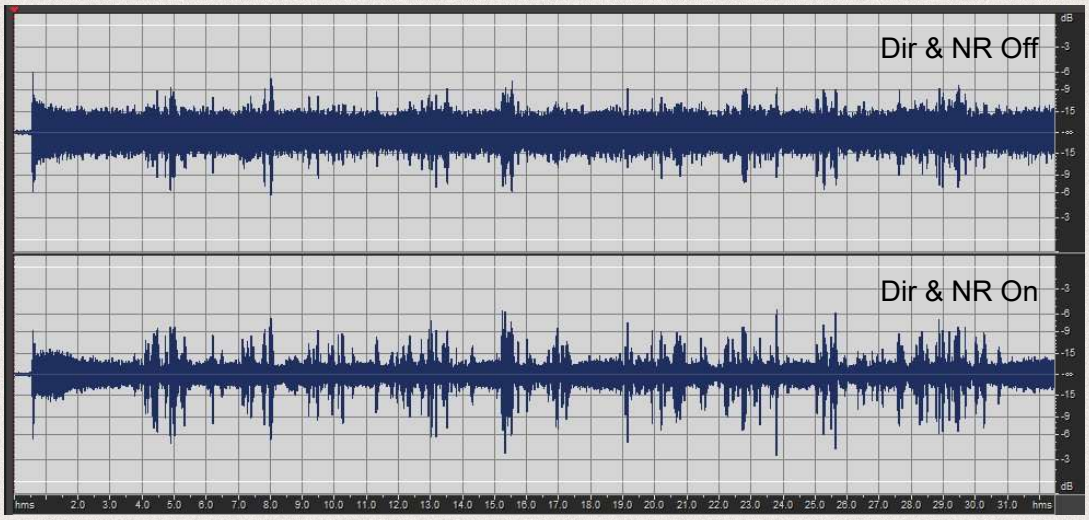
Speech 0º Pink Noise +/- 135º



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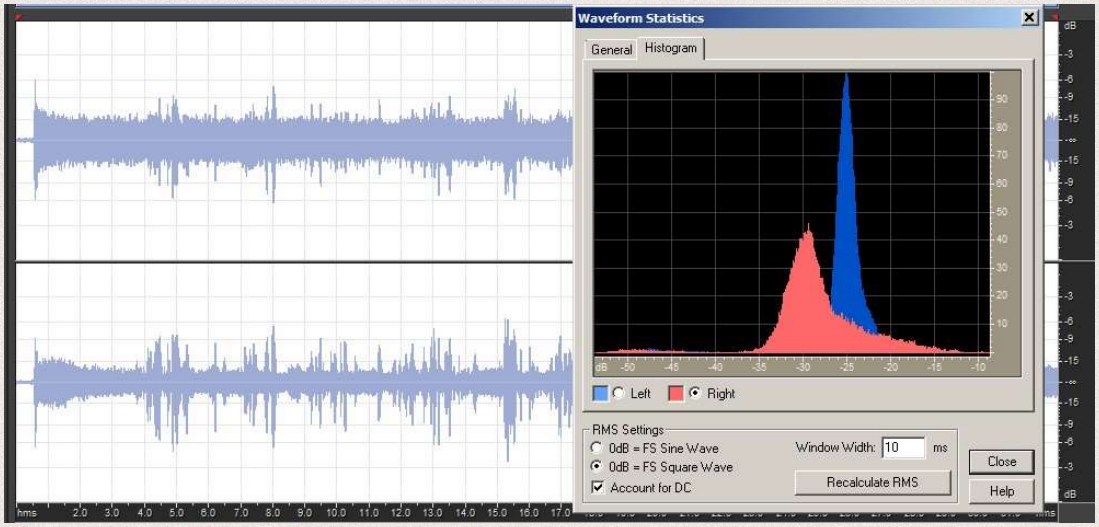
Speech 0º Pink Noise +/- 135º



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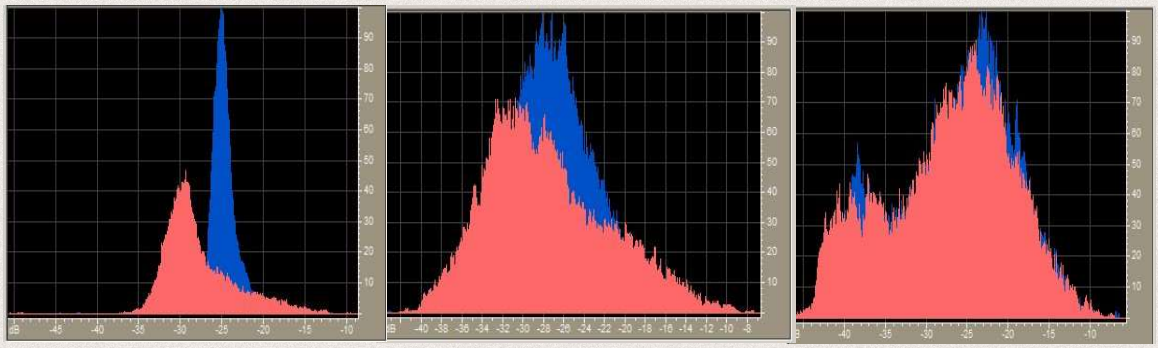
Directionality & Noise Removal On versus Off



Pink Noise | 4 Talker Babble | Single Talker

Speech 0º Competition +/- 135º

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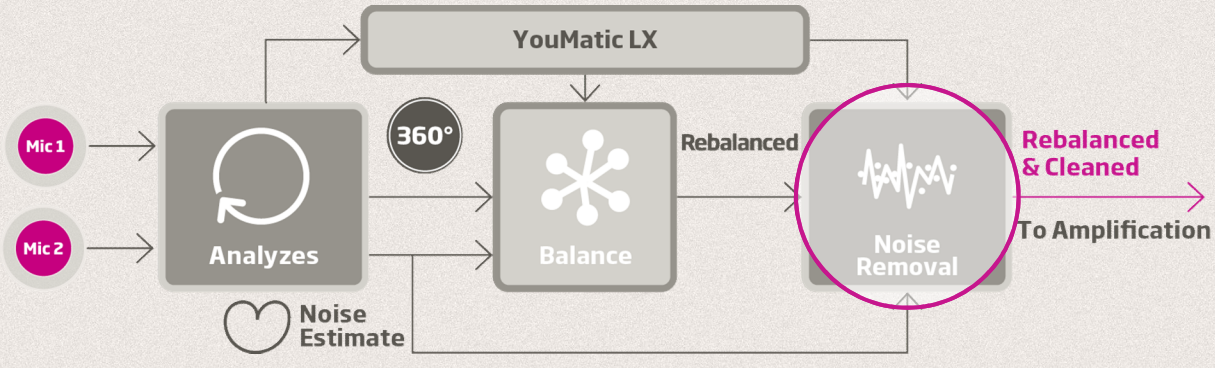

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Getting Rid of Noise

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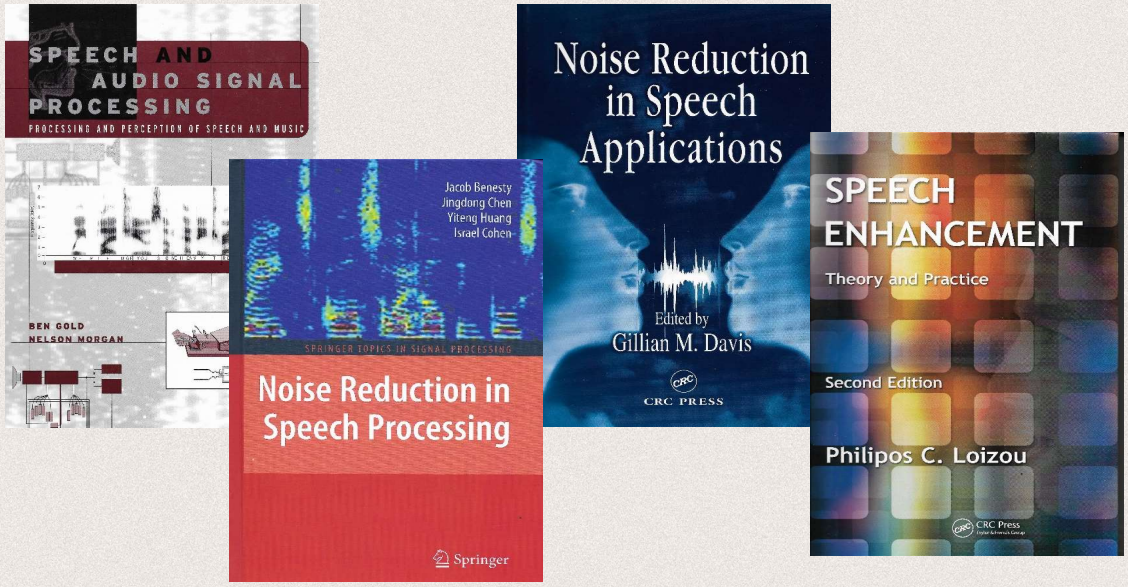

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In order to get rid of noise,
…you have to find & define noise

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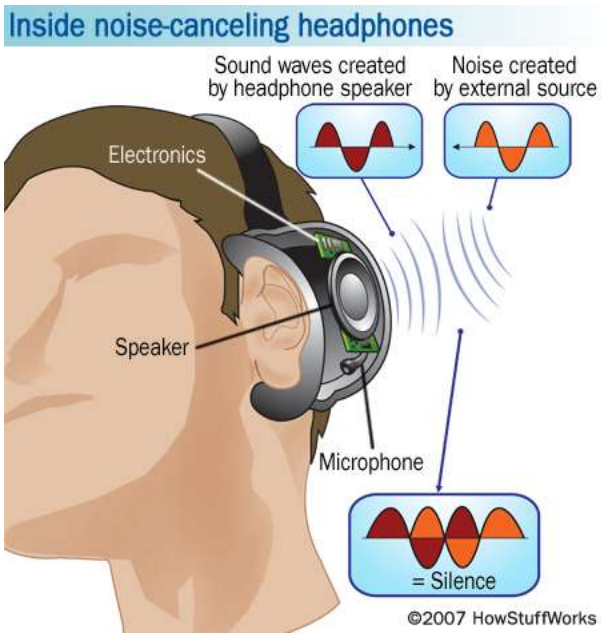
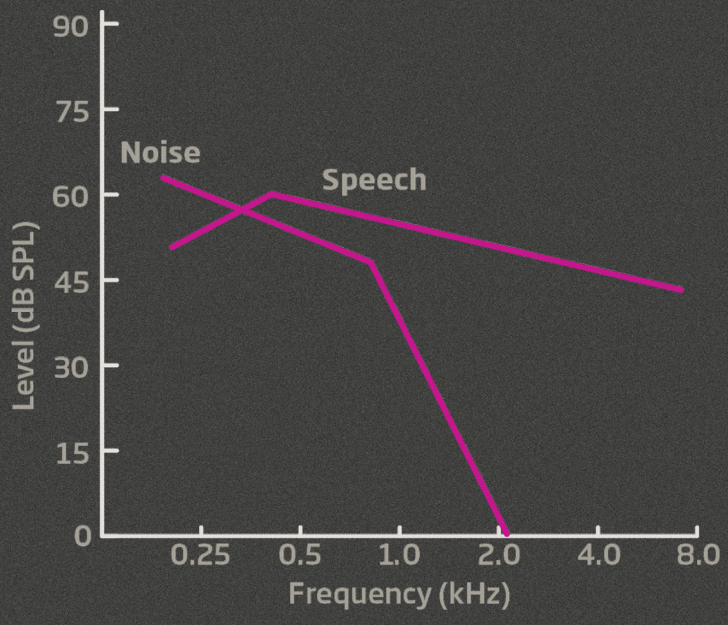

Inside noise-canceling headphones
Sound waves created by headphone speaker
Noise created by external source
Electronics
Speaker
Microphone
= Silence
©2007 HowStuffWorks


90
75
60
45
30
15
0
Level (dB SPL)
Noise
Speech
0.25
0.5
1.0
2.0
4.0
8.0
Frequency (kHz)

Filtering – Long Term

Filtering – Short Term

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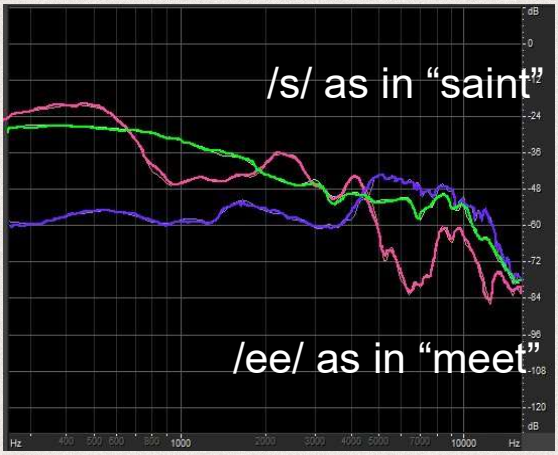

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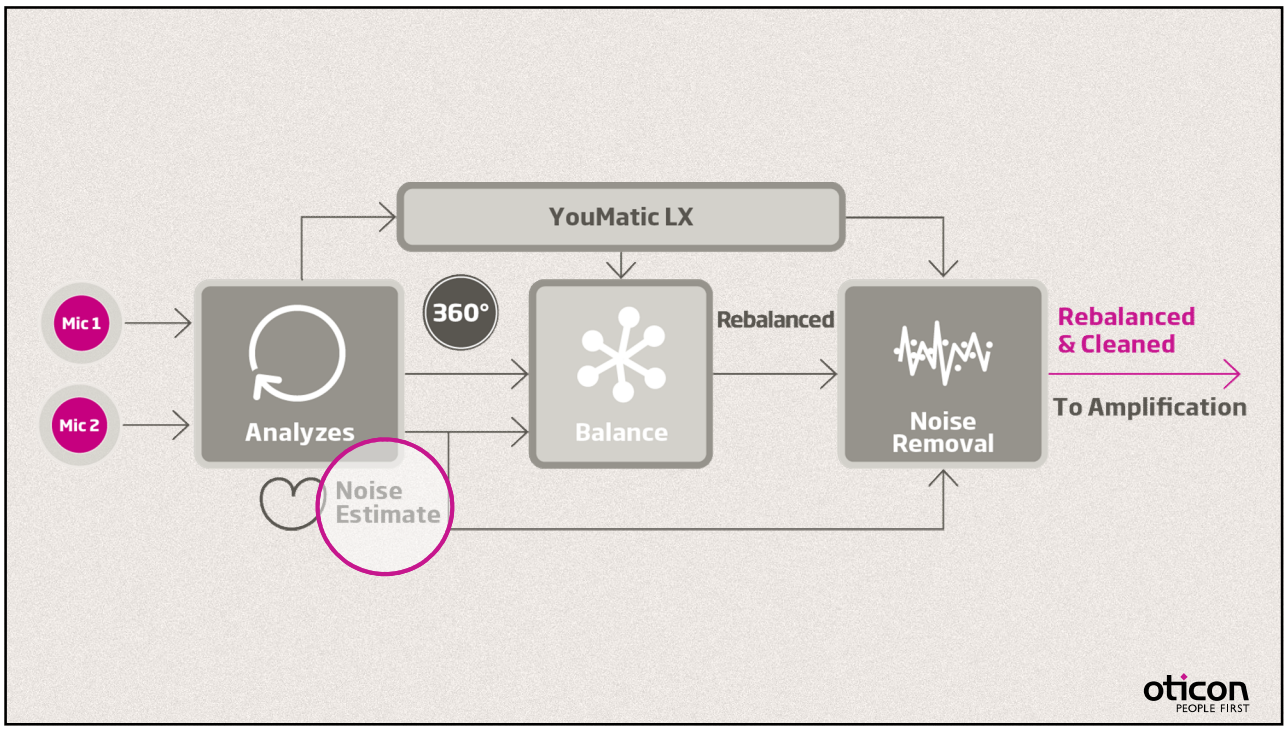

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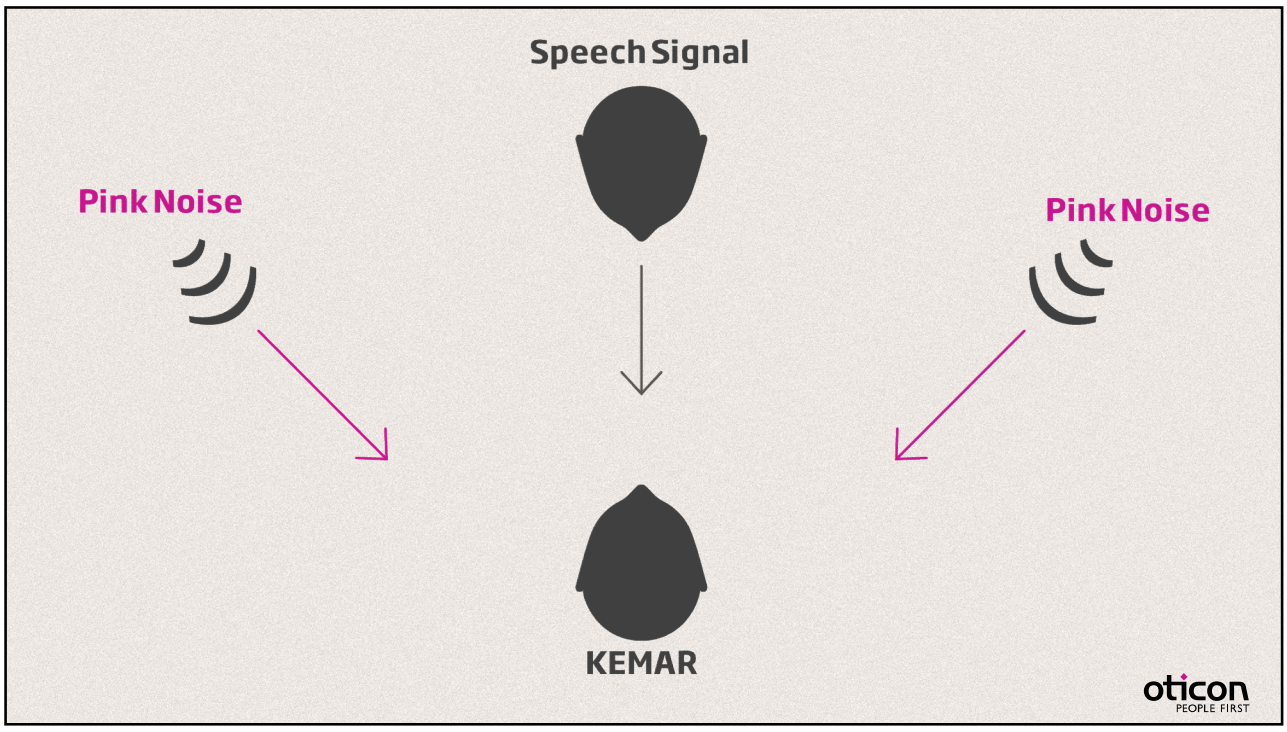
Speech Signal
Pink Noise
Pink Noise
KEMAR
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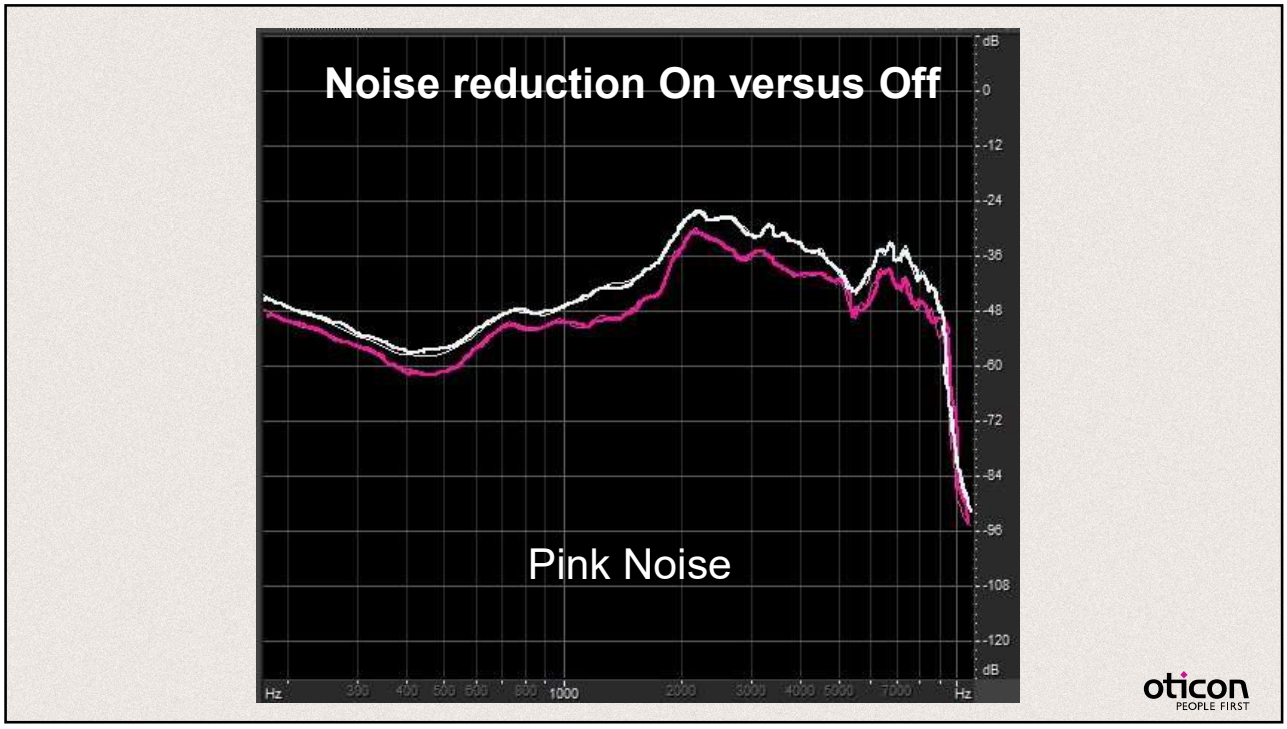
Noise reduction On versus Off
Pink Noise
dB
0
-12
-24
-36
-48
-60
-72
-84
-96
-108
-120
dB
Hz
300
400
500
600
800
1000
2000
3000
4000
6000
7000
Hz
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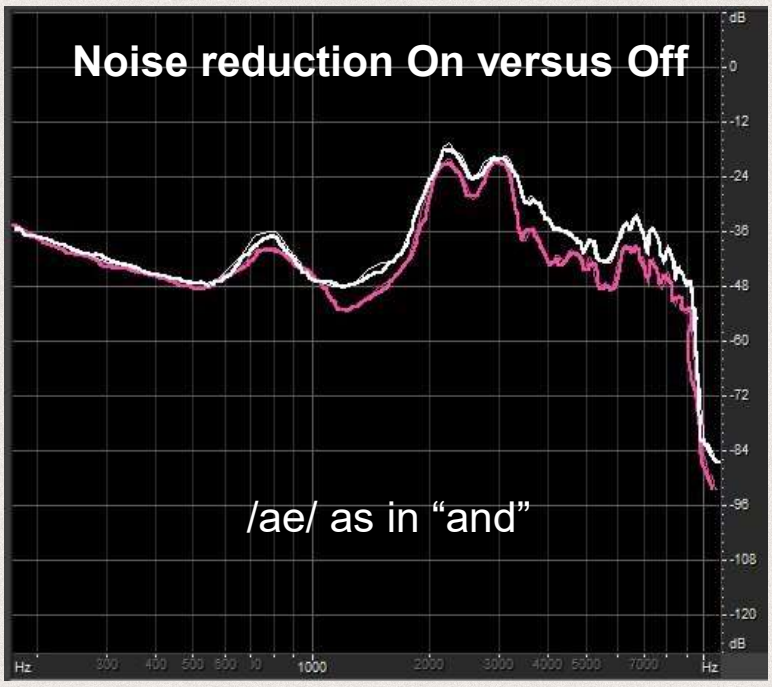
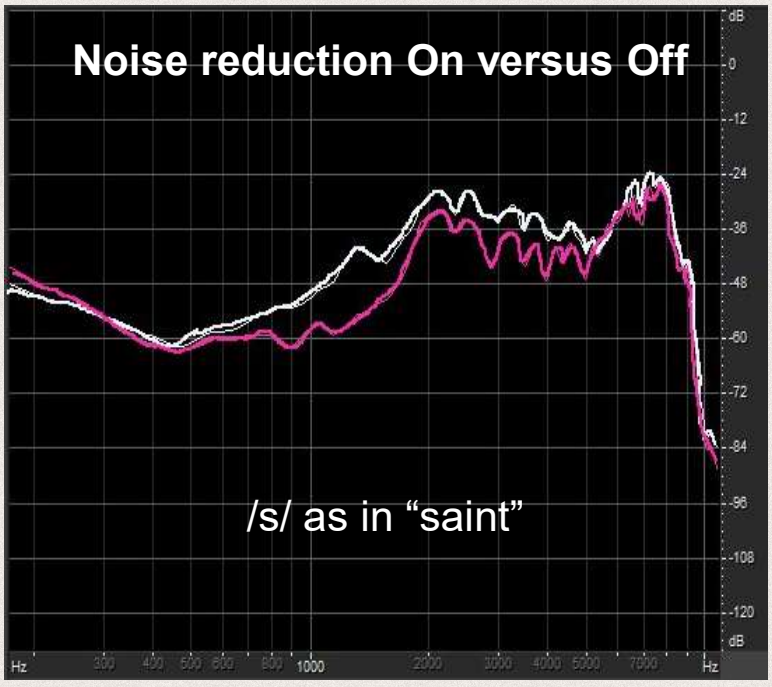
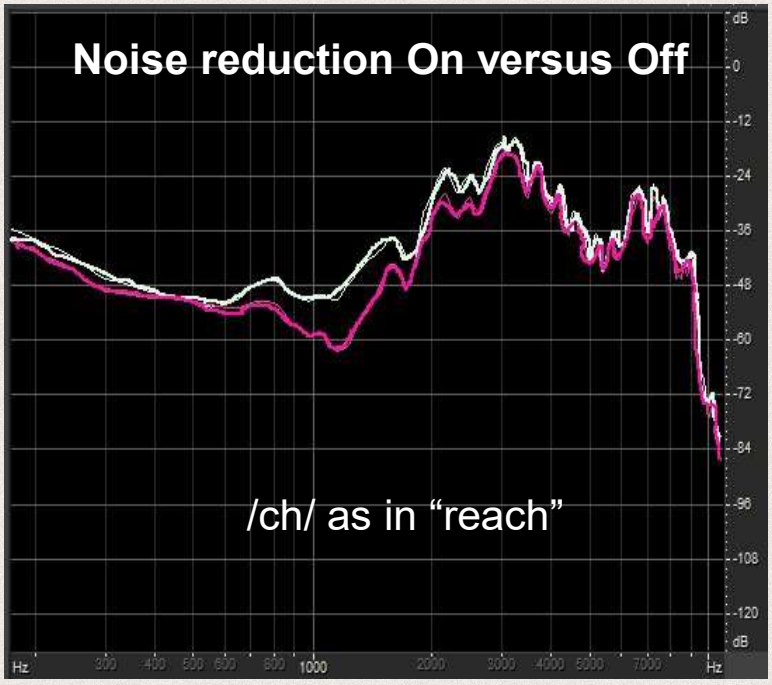

Noise reduction On versus Off
/ae/ as in “and”
dB
0
-12
-24
-36
-48
-60
-72
-84
-96
-108
-120
dB
Hz
1000
Hz


Noise reduction On versus Off
/s/ as in “saint”
dB
0
-12
-24
-36
-48
-60
-72
-84
-96
-108
-120
dB
Hz
1000
Hz



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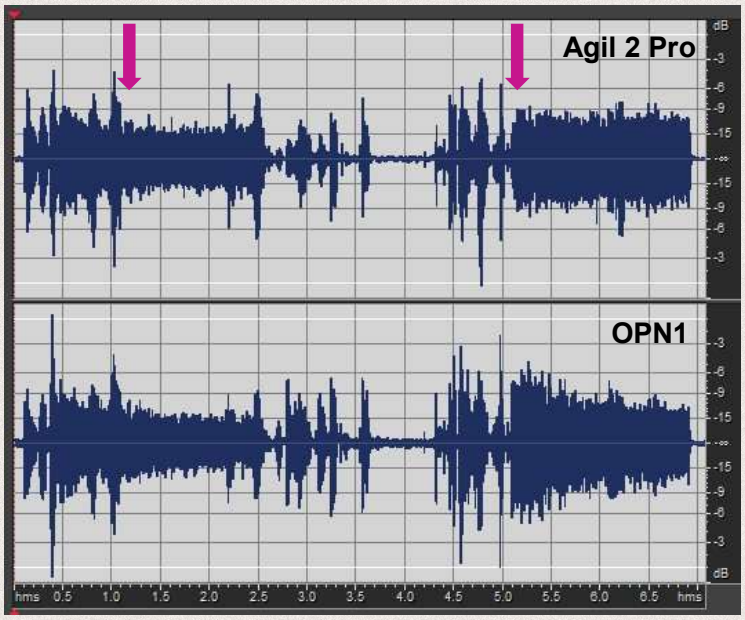
Speech 0º

Pink Noise +/- 45º



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Both Long-term and Short-term Adjustments

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When is OpenSound Navigator™ Active?

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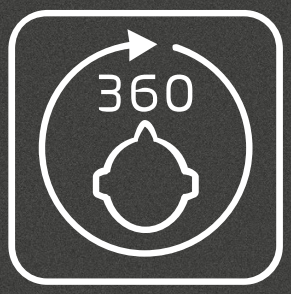

Spatial Sound™ LX

Speech Guard LX

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OpenSound Navigator™ Compared to...

- Traditional Directionality
- Beamforming
- Traditional Noise Reduction

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	Oticon Opn 1	Oticon Opn 2	Oticon Opn 3
Speech Understanding			
OpenSound Navigator™	Level 1	Level 2	Level 3
Balancing power effect	100%	50%	50%
Max. noise removal	9 dB	5 dB	3 dB
Speech Guard™ LX	Level 1	Level 2	Level 3
Spatial Sound™ LX	4 estimators	2 estimators	2 estimators
Soft Speech Booster LX	•	•	•
Sound Quality			
Clear Dynamics	•	•	-
Binaural Noise Management	•	•	-
Fitting Bandwidth (accessed in software)	10 kHz	8 kHz	8 kHz
Processing Channels	64	48	48
Bass Boost (streaming)	•	•	•
Listening Comfort			
Transient Noise Management	4 configurations	On/Off	On/Off
Feedback shield LX	•	•	•
Wind Noise Management	•	•	•
Binaural Coordination	•	•	•
Personalization & Optimizing Fitting			
YouMatic™ LX	3 configurations	2 configurations	1 configuration
Fitting Bands	16	14	12

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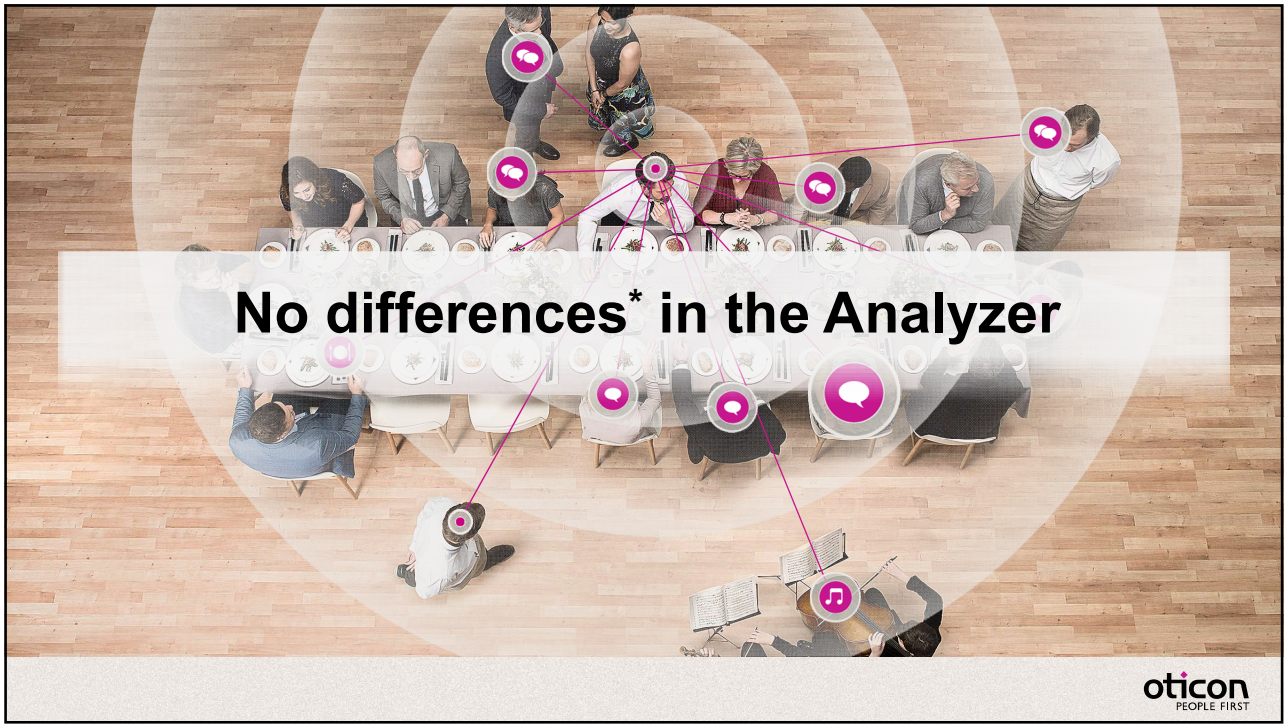

OpenSound Navigator™

Noise removal

Opn 1	Opn 2	Opn 3
		
Max. noise removal	**Max. noise removal**	**Max. noise removal**
Environments:	Environments:	Environments:
Simple: -3 dB	Simple: -1.5 dB	Simple: 0 dB
Complex: -9 dB	Complex: -5 dB	Complex: -3 dB

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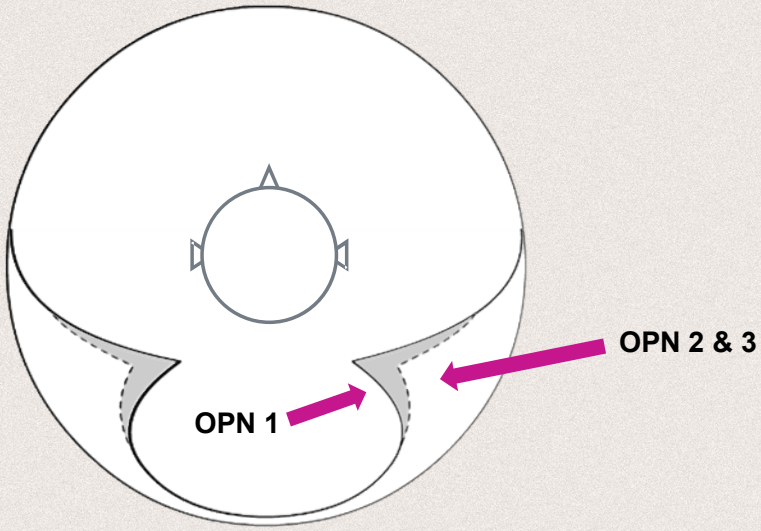
OpenSound Navigator™

Balance



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What do the differences mean to the patient?

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What do the differences mean to the patient?

- **Performance in Complex Environments**
- **Sound Quality**
- **Ability to Personalize**

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