

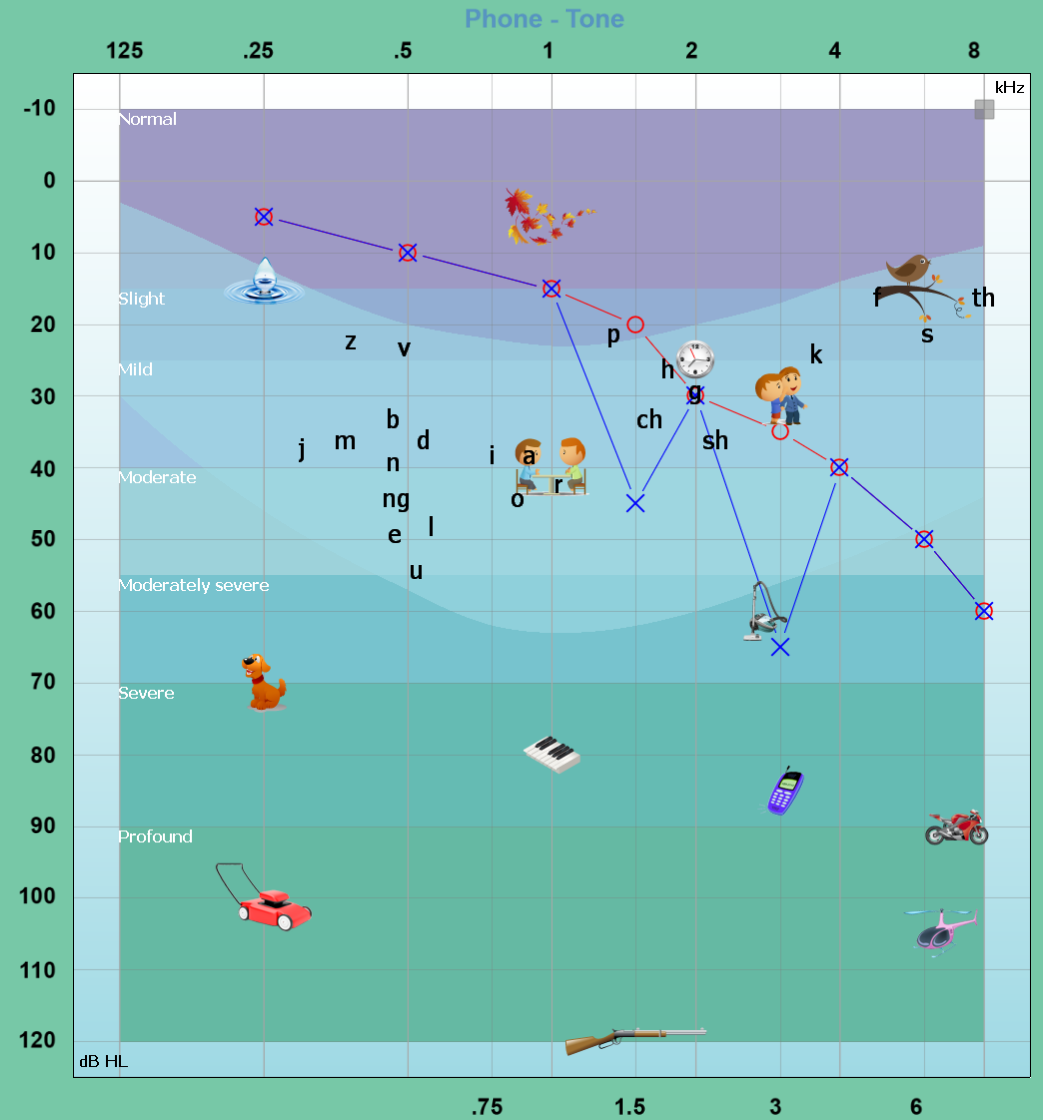


## Audible Contrast Threshold (ACT™) test

Kenneth Ervik Diatec (avd. av Oticon) – Skien sykehus 2025

# Hvilken informasjon henter vi fra et audiogram?

- Høreterskler (+gradering)
- Talelyder
- Daglige lydeksempler





# Hva mangler?

Hvordan en person fungerer i den virkelige verden



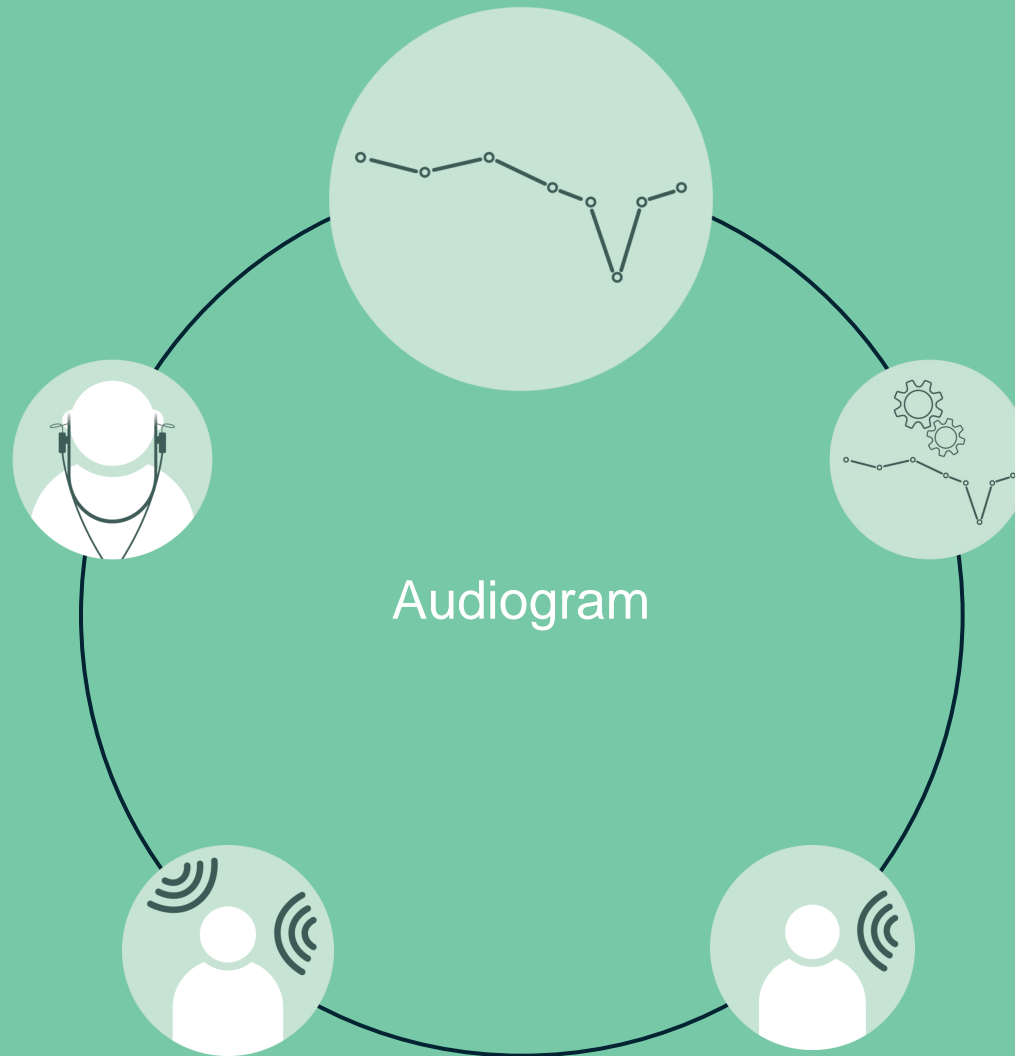
## Vi er kjent med....

- Audiogrammet gir oss en kvantitativ forståelse av hørselen, men sier ikke alt
- Taletester har god verdi, men har sine begrensninger
- Vi mangler diagnostisk informasjon utover et audiogram, og samtidig besvare en av de største utfordringene en person med hørselstap har, nemlig det å høre i støy!



**Audible Contrast Threshold**

# Dagens arbeidsflyt



# Dagens arbeidsflyt

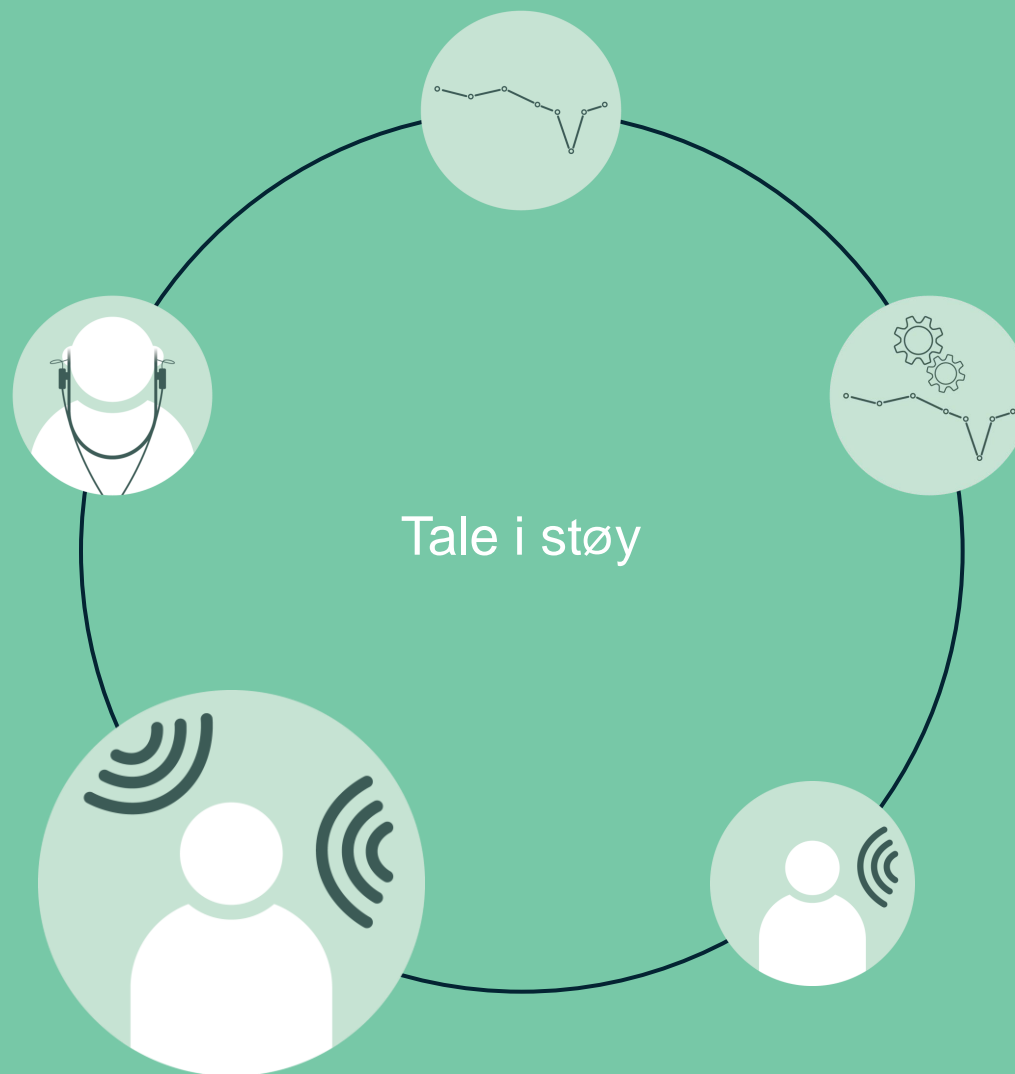


# Dagens arbeidsflyt

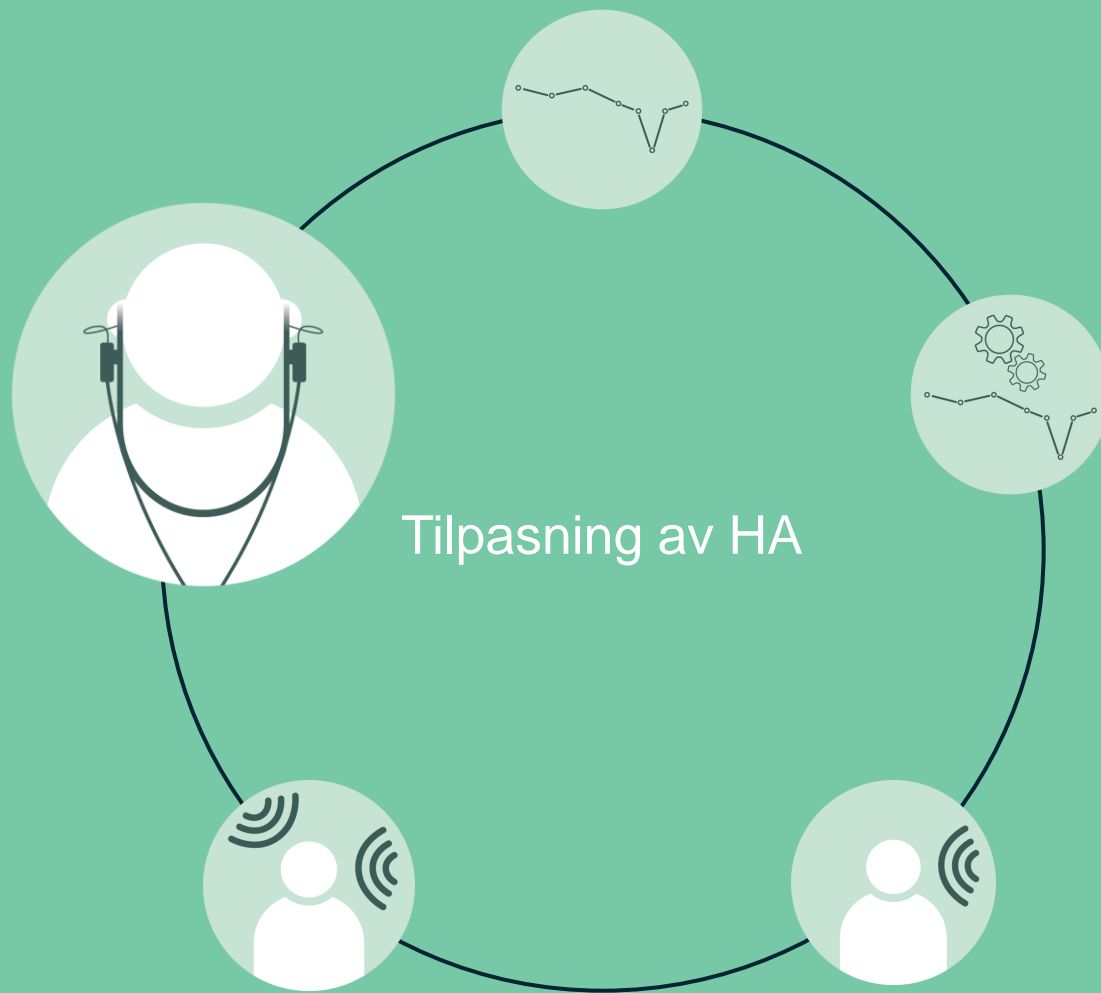




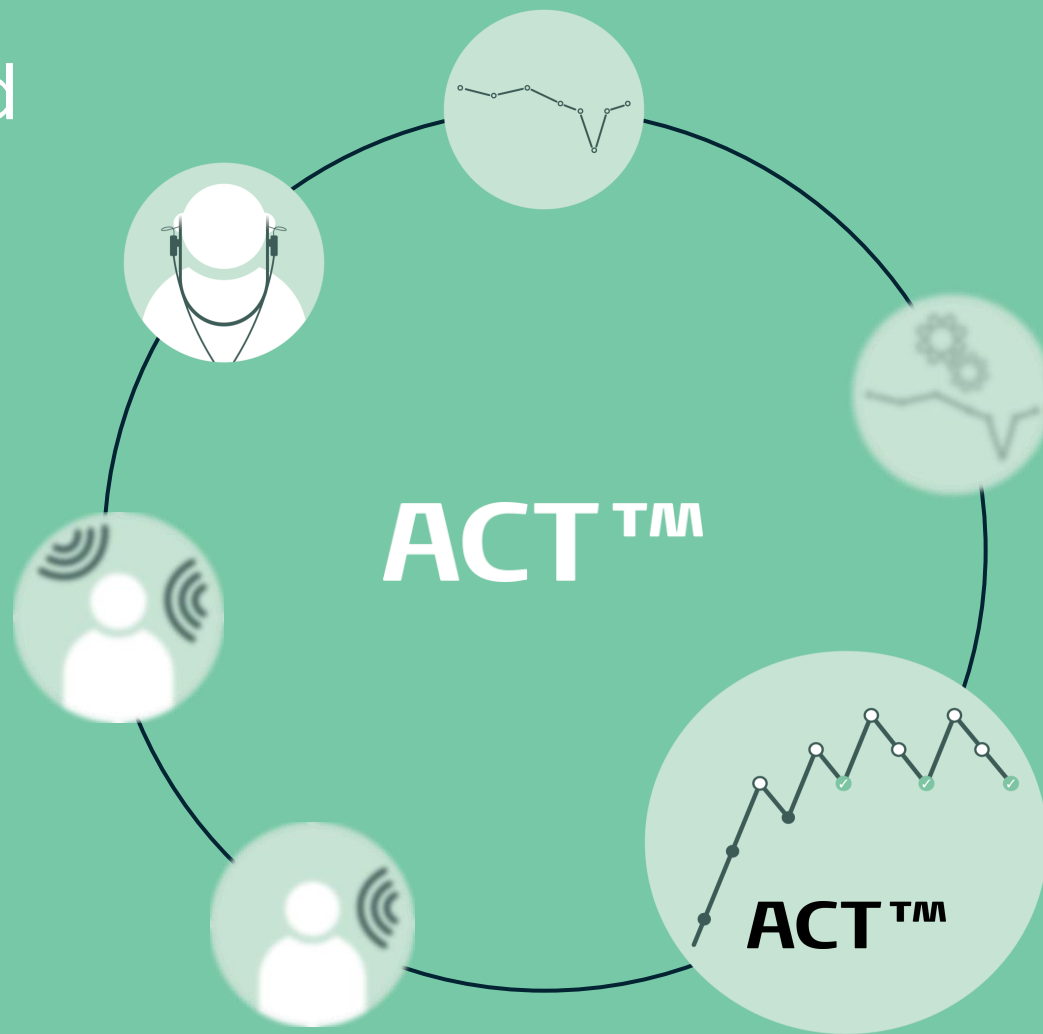
# Dagens arbeidsflyt

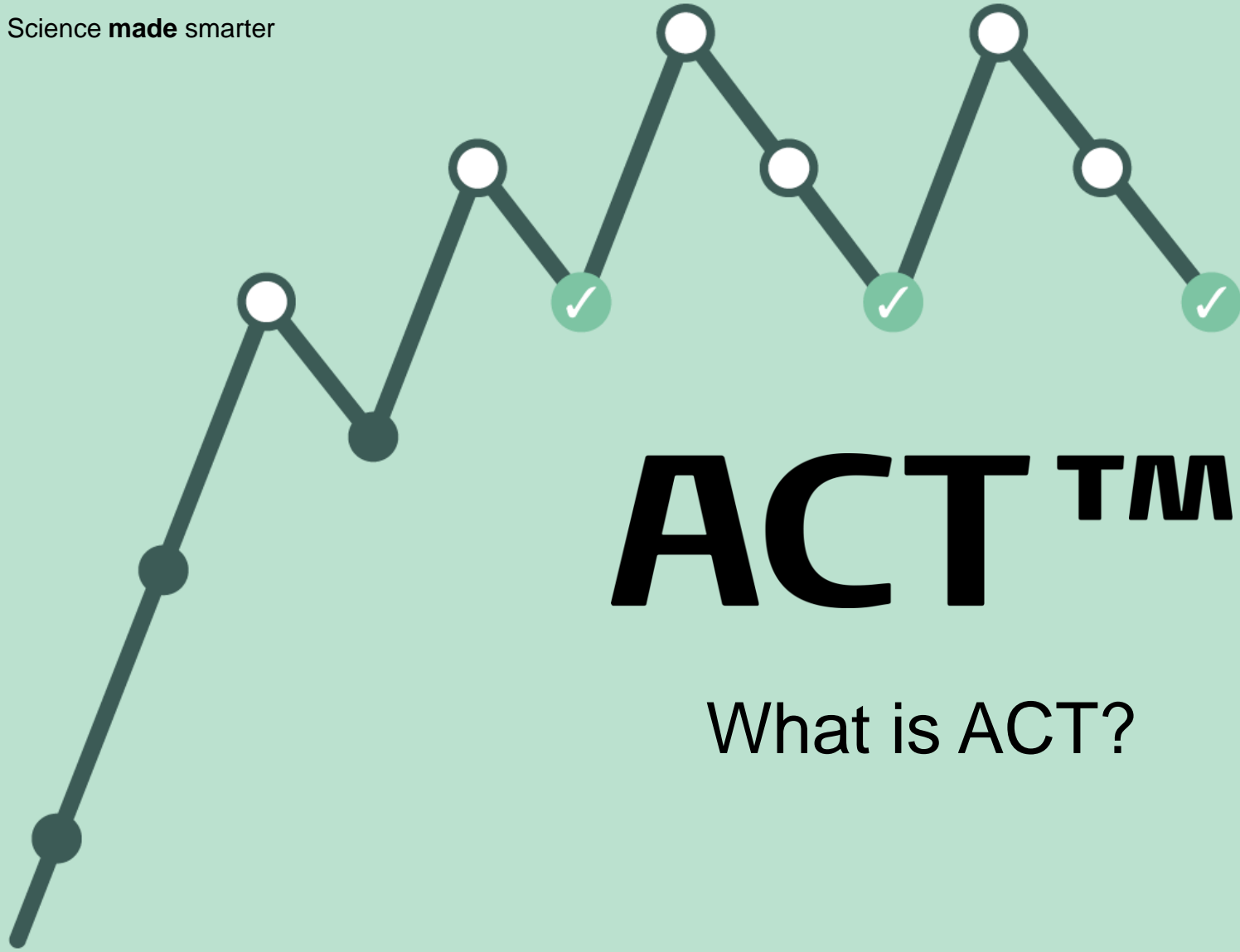


# Dagens arbeidsflyt



# Arbeidsflyt med ACT





# ACT™

What is ACT?



# ACT tilføyer det som mangler!

Quantity



Audiogram

Quality



**ACT™**

# A complete diagnosis of your client's hearing



Audiogram



ACT test

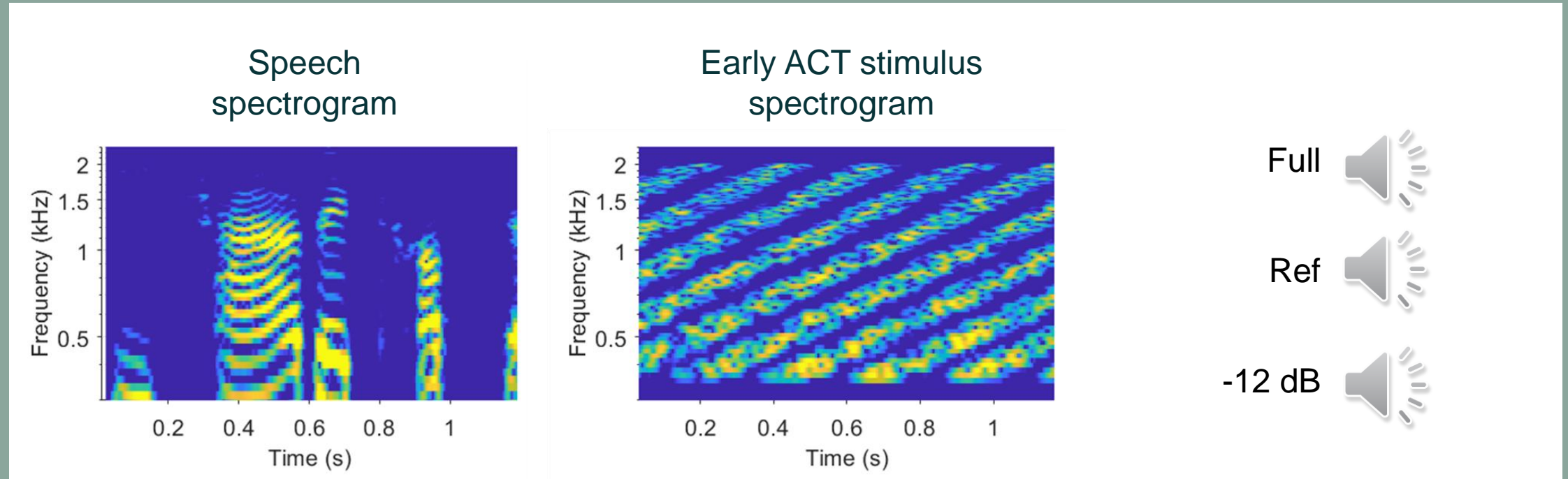


The complete hearing diagnosis



# Research from start to finish...so where did it all begin?

- Technically speaking, ACT is a test of spectro-temporal modulation (STM) ability



# Academic research background

- Spectro-temporal modulation (STM) detection versus speech-in-noise measures

*Bernstein et al. (2013)*

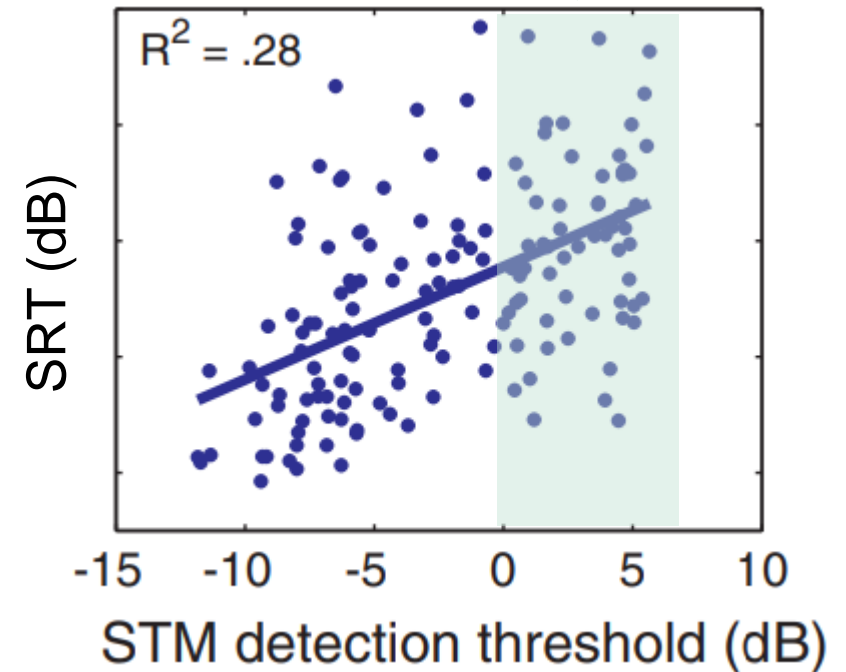
**Table 1. Squared Pearson Correlation Coefficients Describing the Relationship across HI Listeners between Speech Intelligibility and STM Sensitivity for All Tested Combinations of Rate and Density**

	Rate (Hz)		
Density (c/o)	4	12	32
0.5	0.48	0.05	0.56*
1	0.56*	0.36	0.71*
2	0.61*	0.22	0.03
4	0.38	0.21	0.15

Problem: STM test failed in 1/3 of the test subjects!



*Bernstein et al. (2016)*  
Clinical population

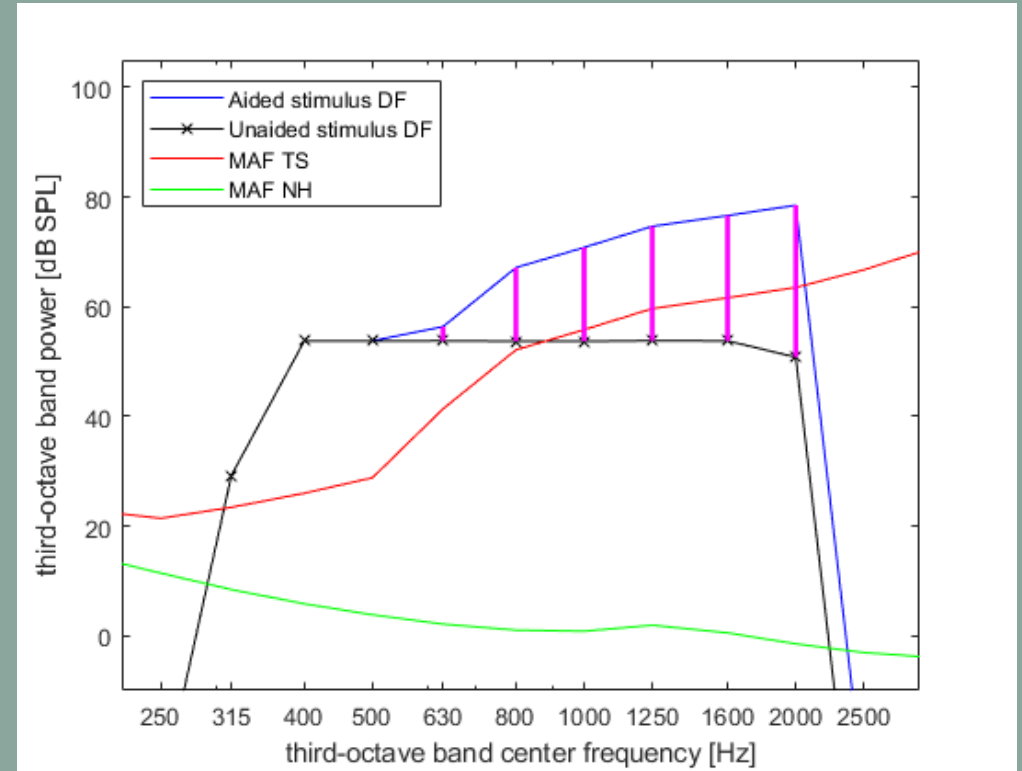






# Academic research

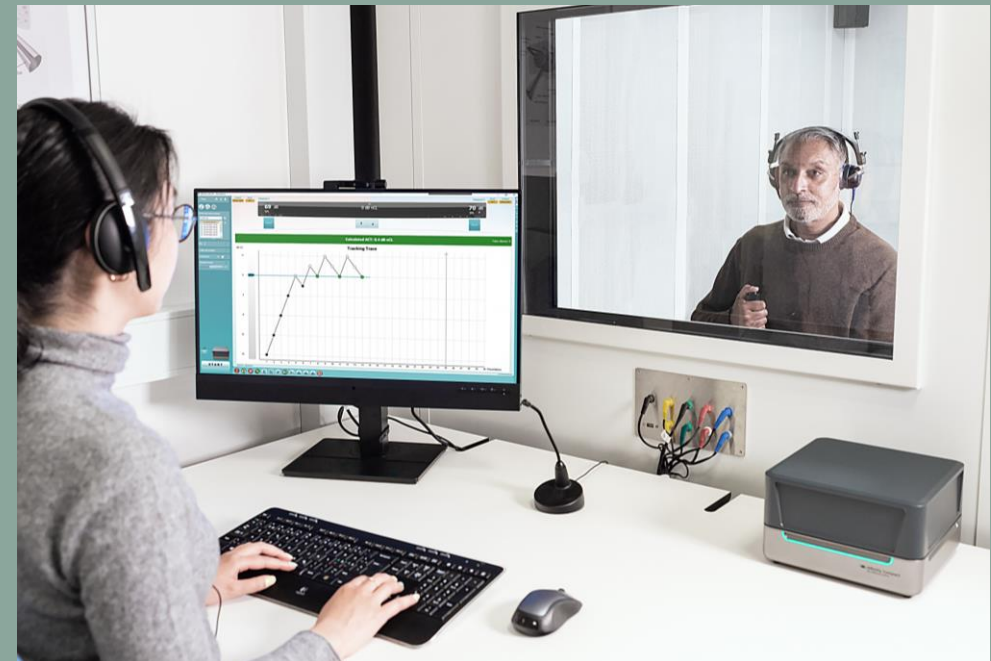
- Modify test to make it easier
  - Ear and frequency-specific compensation for hearing loss (Humes, 2007)

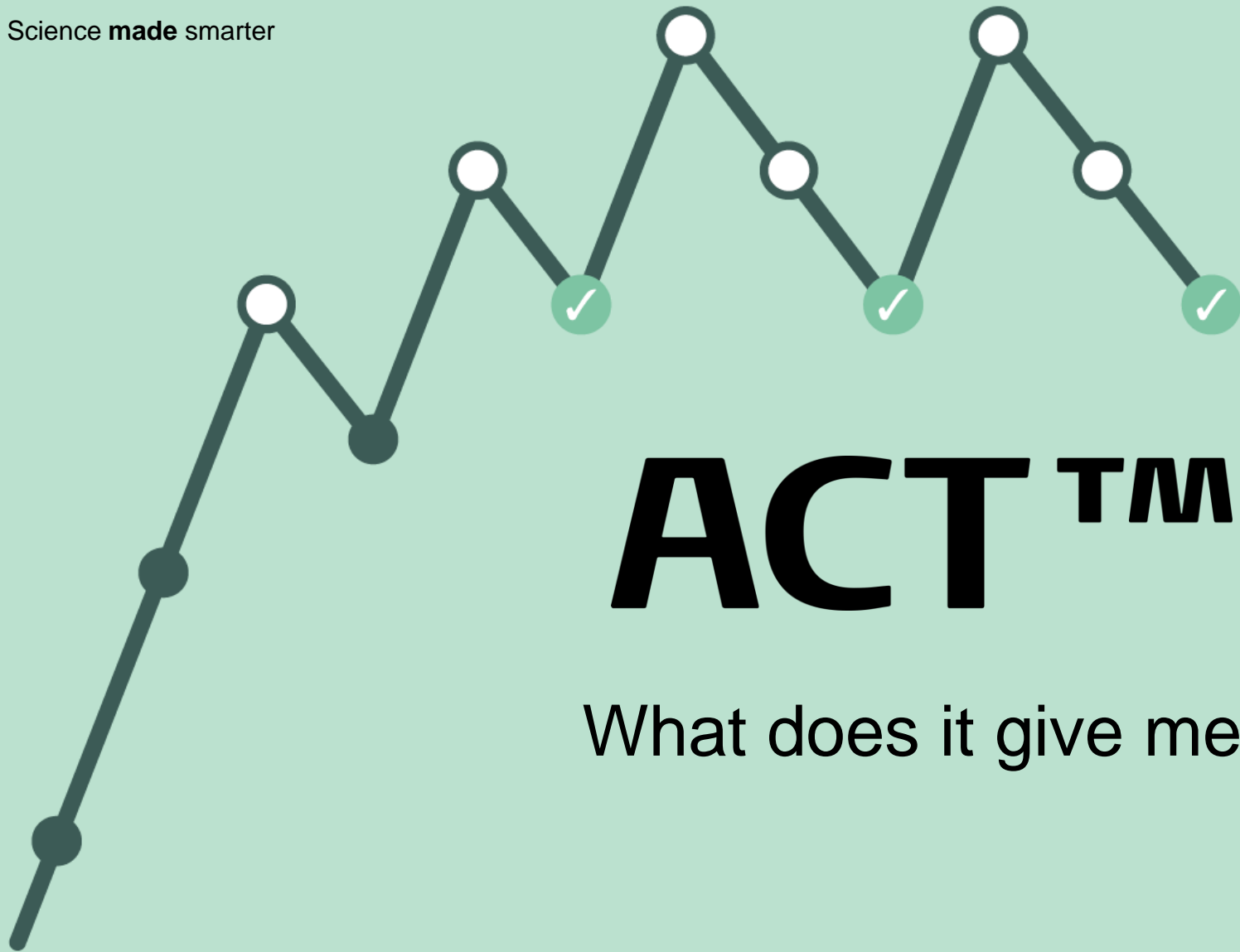




# From prototype to clinic

- **First** ever language-independent diagnostics of speech-in-noise ability
- Foundation for a better first fit
- Make ACT as similar as possible to pure-tone audiometry
- Reduce test time from 10-15 minutes to below 2 minutes + instruction
- Uses a normalized contrast level (dB nCL)

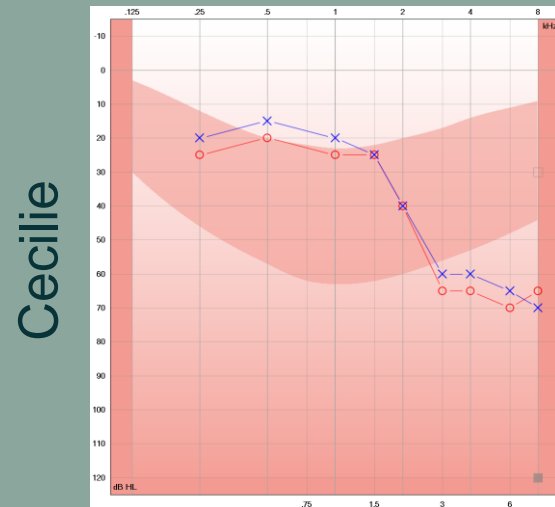




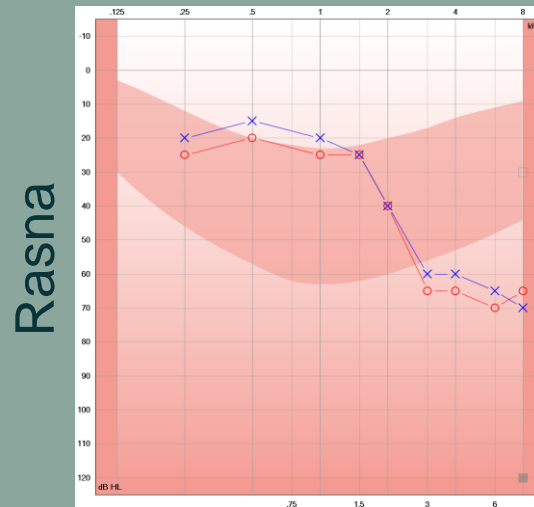
# ACT™

What does it give me?

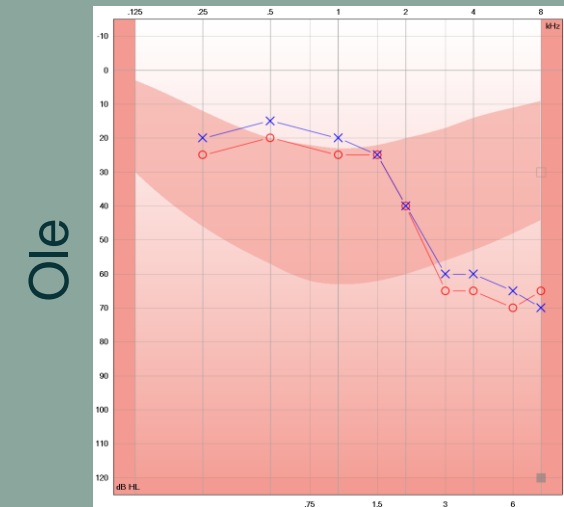
# ACT in the clinic



Excellent speech-in-noise outcome with HAs



Minor residual speech-in-noise issues with HAs



Severe speech-in-noise challenges with HAs

Tomorrow: up-front prediction available from ACT

Can help with expectation setting, counselling, rehabilitation strategy, fitting of help-in-noise features → better first fit, less follow-up needed

# ACT en del av HA-tilpasning



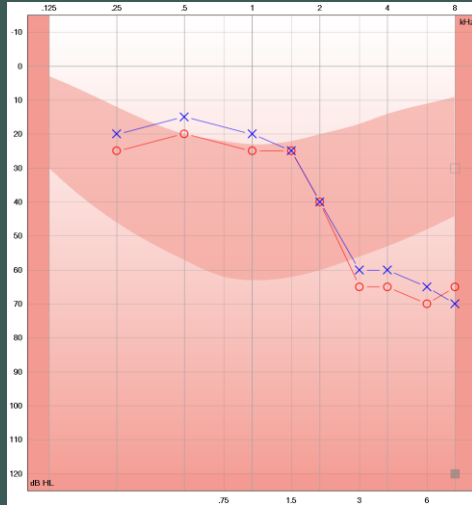
# ACT value guide

ACT value (dB nCL) <b>-4 to 4</b>	ACT value (dB nCL) <b>4 to 7</b>	ACT value (dB nCL) <b>7 to 10</b>	ACT value (dB nCL) <b>10 to 16</b>
<p><b>CONTRAST LOSS</b> <b>Normal</b></p>	<p><b>CONTRAST LOSS</b> <b>Mild</b></p>	<p><b>CONTRAST LOSS</b> <b>Moderate</b></p>	<p><b>CONTRAST LOSS</b> <b>Severe</b></p>
<p><b>PREDICTION FOR AIDED SPEECH IN NOISE PERFORMANCE</b> <b>Normal range</b></p>	<p><b>PREDICTION FOR AIDED SPEECH IN NOISE PERFORMANCE</b> <b>Mildly poorer than normal</b></p>	<p><b>PREDICTION FOR AIDED SPEECH IN NOISE PERFORMANCE</b> <b>Moderately poorer than normal</b></p>	<p><b>PREDICTION FOR AIDED SPEECH IN NOISE PERFORMANCE</b> <b>Severely poorer than normal</b></p>
<p><b>FITTING ADVICE</b> Adaptive features set to minimum level - help preserve natural sound in all environments</p>	<p><b>FITTING ADVICE</b> Adaptive features set to slightly higher than the minimum level - help preserve natural sound and improve speech understanding in the most noisy environments</p>	<p><b>FITTING ADVICE</b> Adaptive features set slightly lower than the maximum level - help balance speech understanding while maintaining natural sound in moderately noisy environments</p>	<p><b>FITTING ADVICE</b> Adaptive features set to maximum level - help (prioritize) speech understanding in even the least noisy environments. Also consider streaming devices and communication training</p>

# ACT value guide

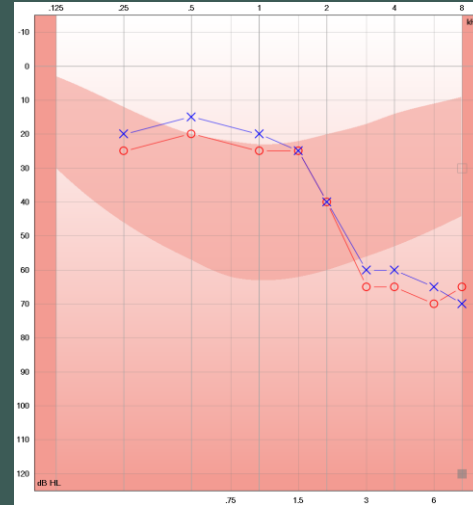
ACT value (dB nCL)	ACT value (dB nCL)	ACT value (dB nCL)	ACT value (dB nCL)
-4 to 4	4 to 7	7 to 10	10 to 16
<b>Normal</b>	<b>Mild</b>	<b>Moderate</b>	<b>Severe</b>
<b>CONTRAST LOSS</b>	<b>CONTRAST LOSS</b>	<b>CONTRAST LOSS</b>	<b>CONTRAST LOSS</b>
<b>Normal</b>	<b>Mild</b>	<b>Moderate</b>	<b>Severe</b>
<b>PREDICTION FOR AIDED SPEECH-IN-NOISE PERFORMANCE</b>	<b>PREDICTION FOR AIDED SPEECH-IN-NOISE PERFORMANCE</b>	<b>PREDICTION FOR AIDED SPEECH-IN-NOISE PERFORMANCE</b>	<b>PREDICTION FOR AIDED SPEECH-IN-NOISE PERFORMANCE</b>
<b>Normal range</b>	<b>Mildly poorer than normal</b>	<b>Moderately poorer than normal</b>	<b>Severely poorer than normal</b>
<b>FITTING ADVICE</b>	<b>FITTING ADVICE</b>	<b>FITTING ADVICE</b>	<b>FITTING ADVICE</b>
Adaptive features set to minimum level - help preserve natural sound in all environments	Adaptive features set to slightly higher than the minimum level - help preserve natural sound and improve speech understanding in the most noisy environments	Adaptive features set slightly lower than the maximum level - help balance speech understanding while maintaining natural sound in moderately noisy environments	Adaptive features set to maximum level - help (prioritize) speech understanding in even the least noisy environments. Also consider streaming devices and communication training

Cecilie



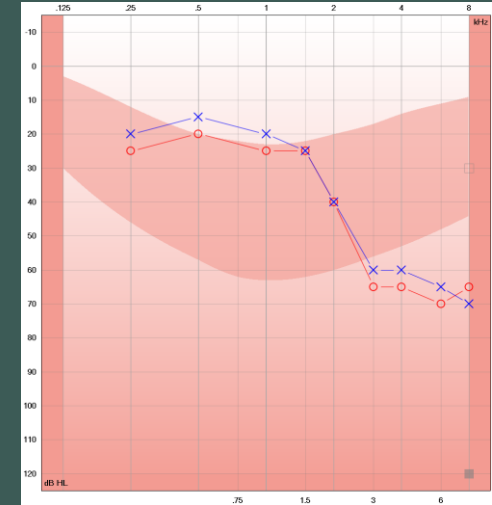
Excellent speech-in-noise outcome with HAs

Rasna

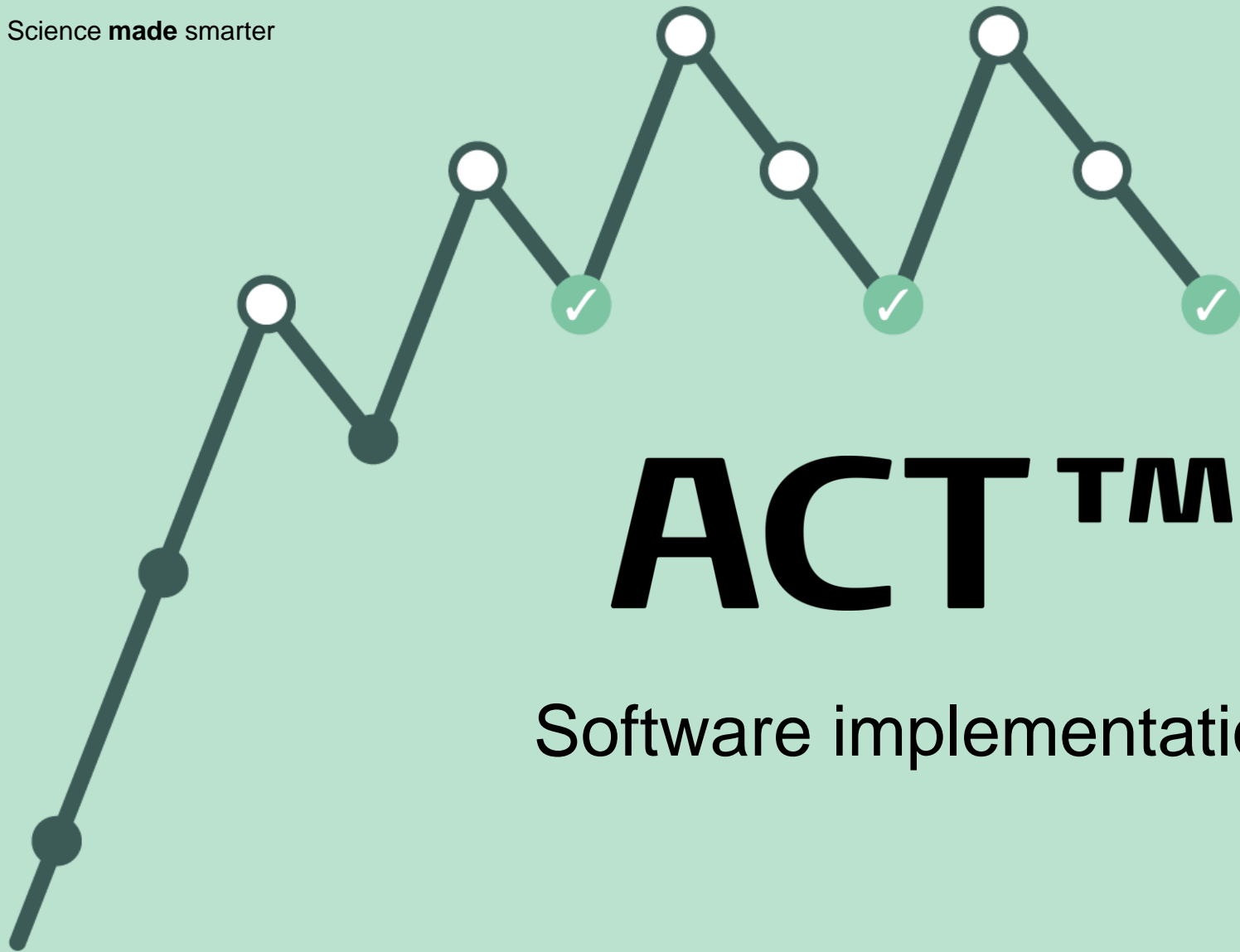


Minor residual speech-in-noise issues with HAs

Ole



Severe speech-in-noise challenges with HAs



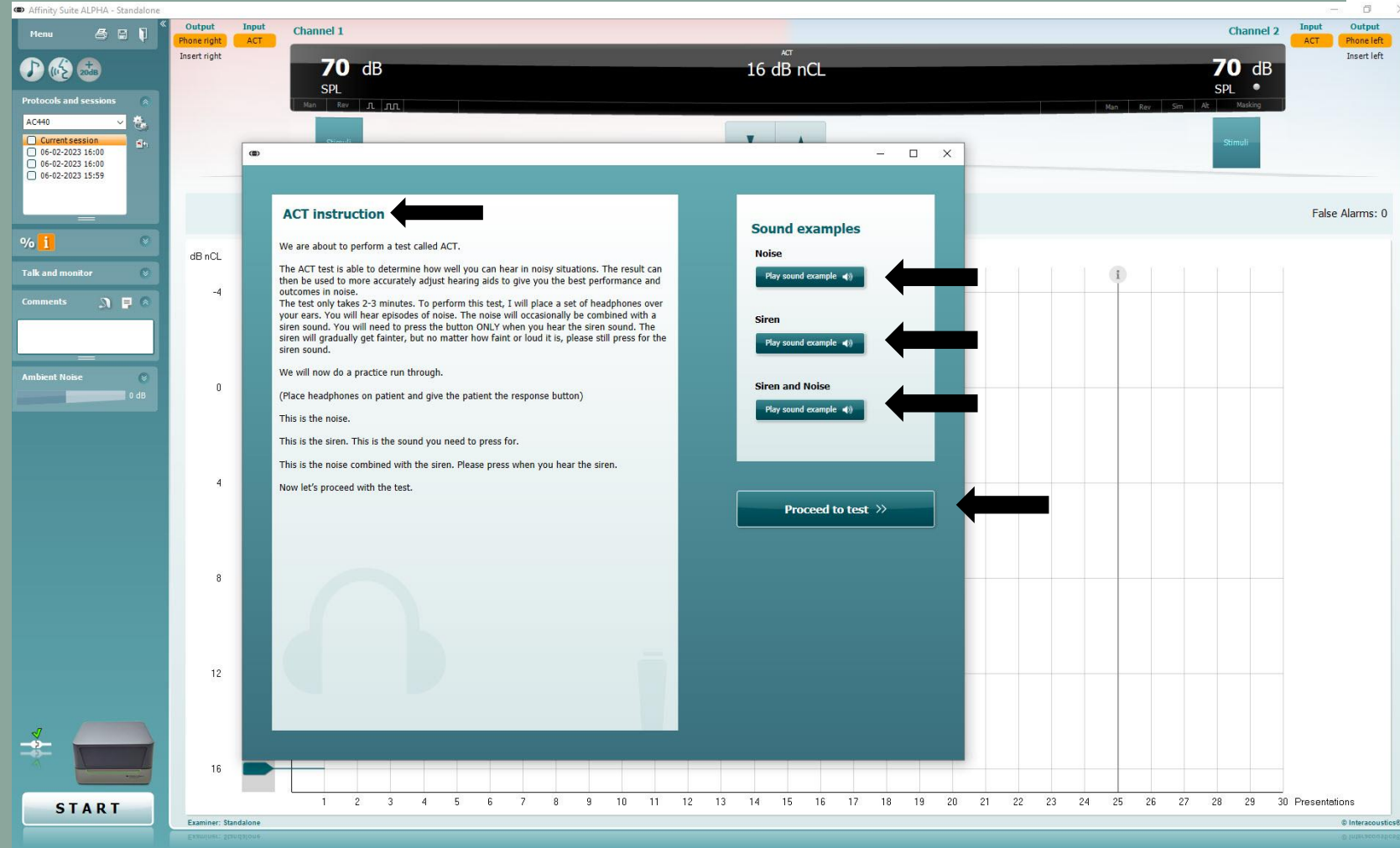
# ACT™

Software implementation

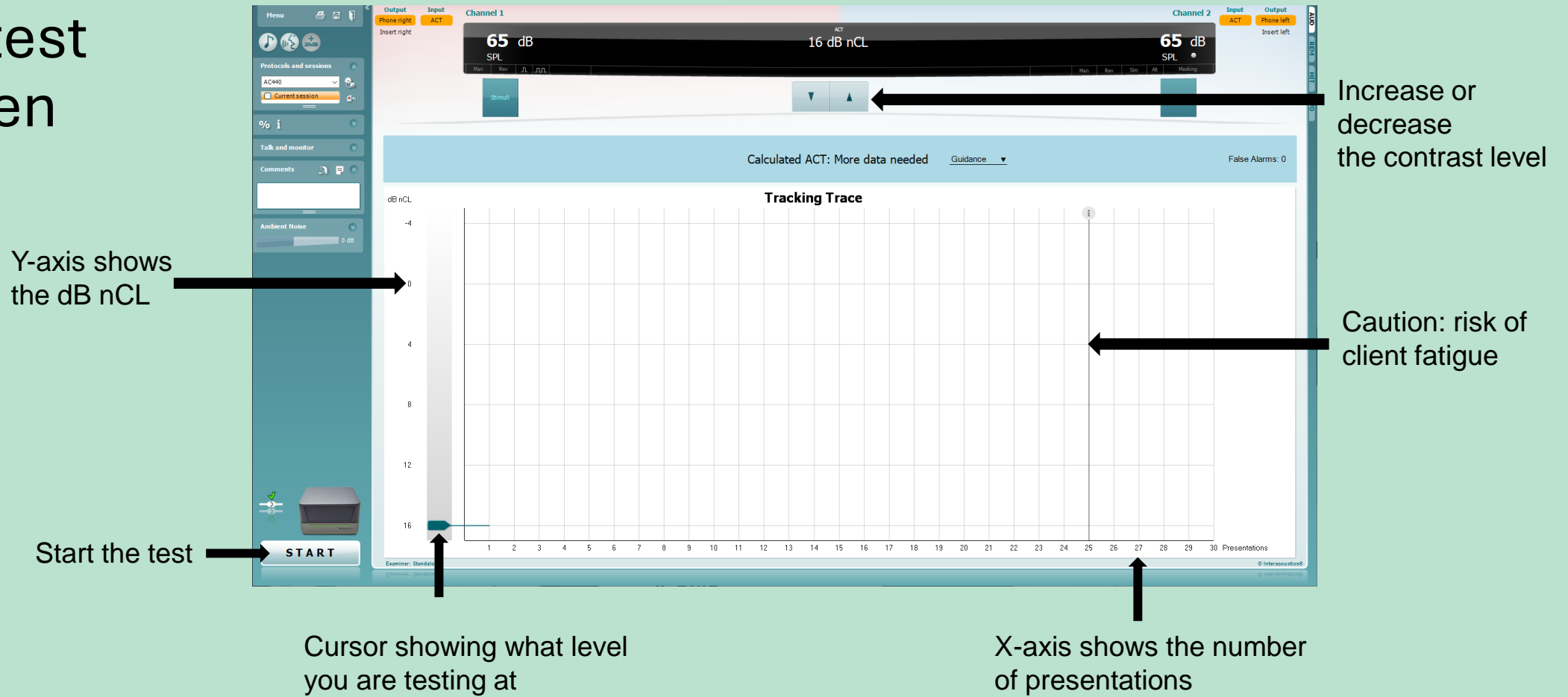


# ACT initial screen

- ACT instructions
- Sound examples for the patient
- Button "proceed to test" to begin the test



# The test screen



Sound pressure level in the ear



**65** dB  
SPL

Sound pressure level in the ear



**65** dB  
SPL

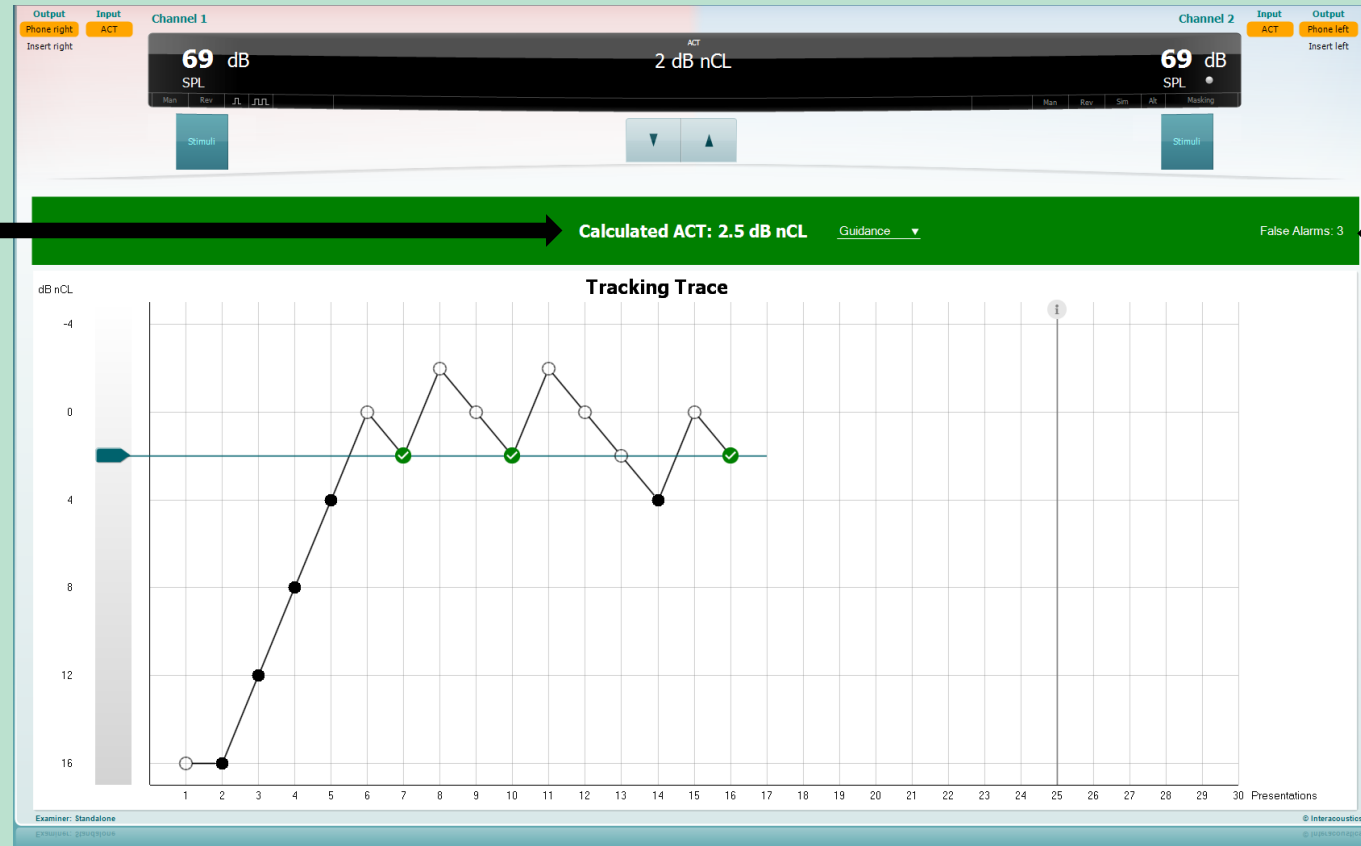
<sup>ACT</sup>  
16 dB nCL



Normative Contrast Level in dB

# The final screen

Your result – the  
calculated ACT value  
in dB nCL

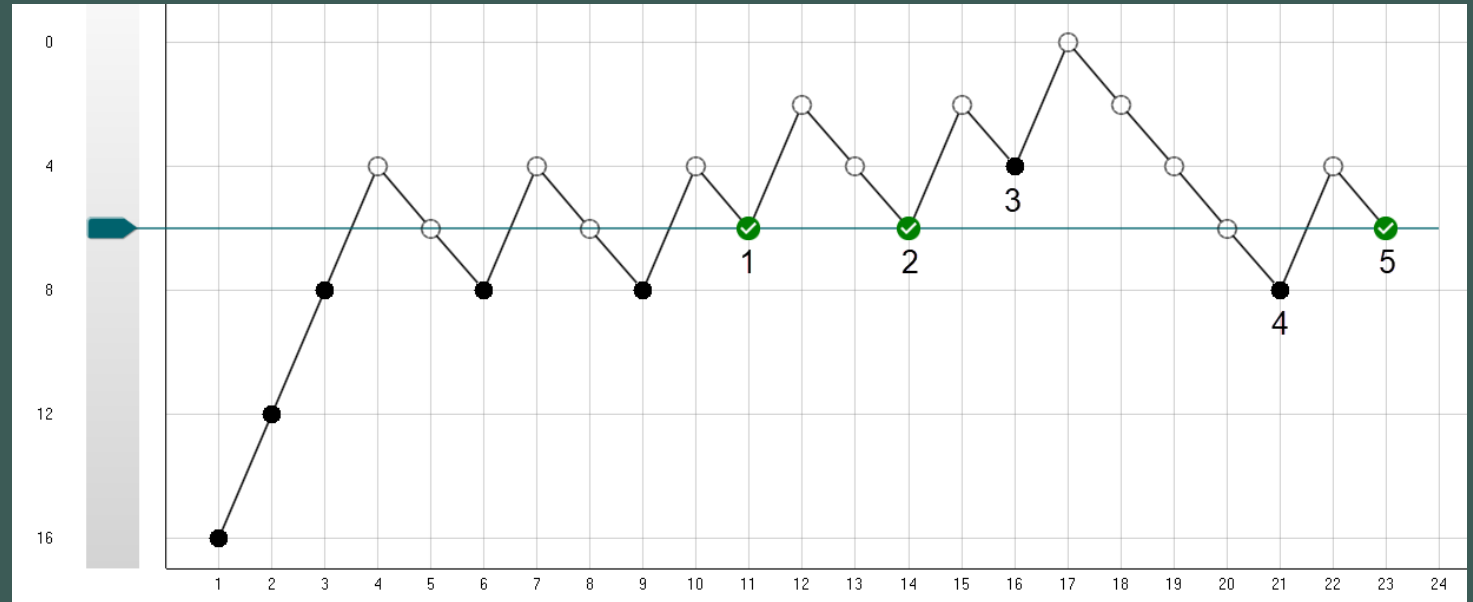


Showing the  
number of false  
alarms

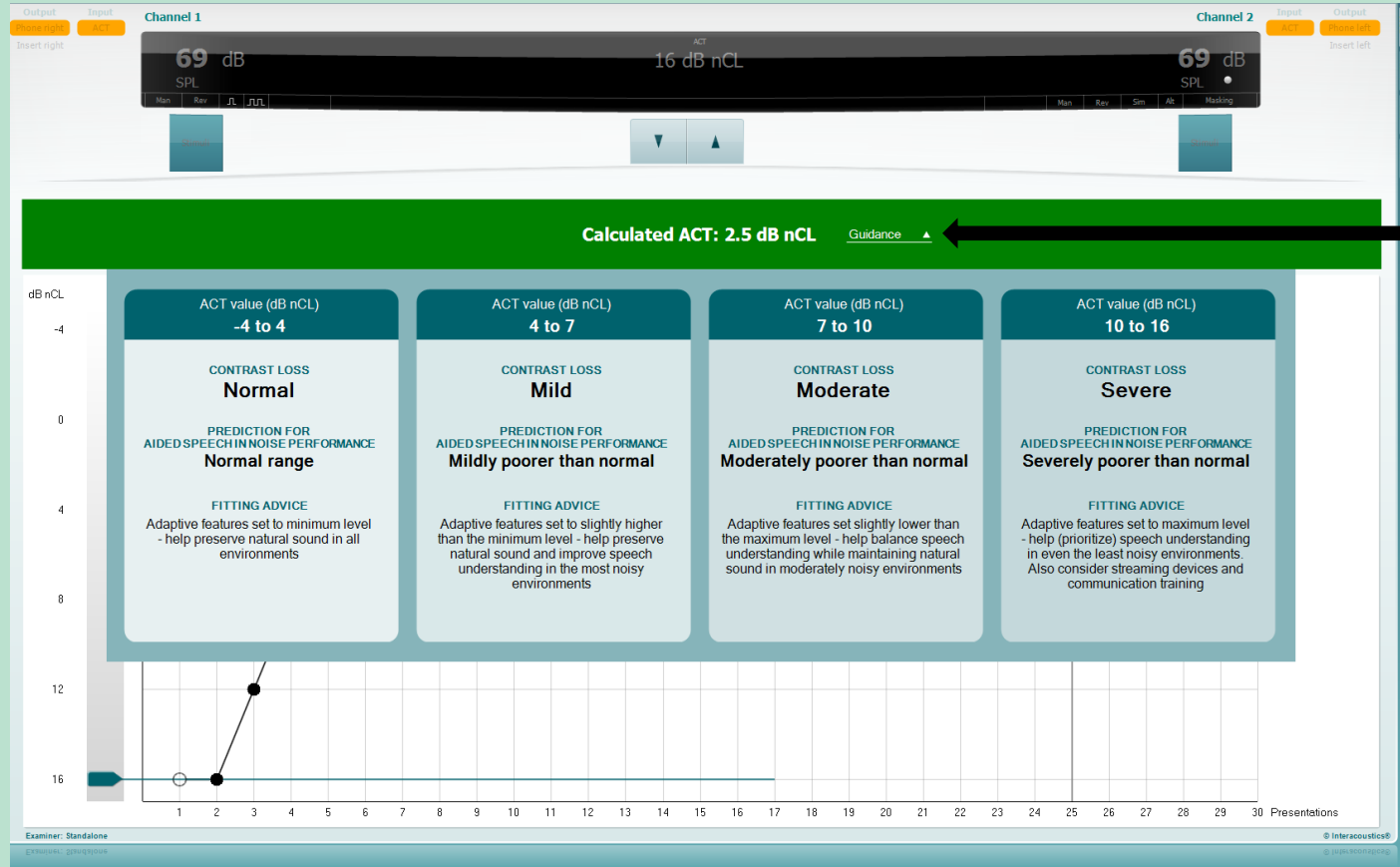
# Threshold Candidate Window

The last 5 turning points of the trace that contribute to satisfying the Hughson-Westlake 3-out-of-5 criterion

This is called the **Threshold Candidate Window**



# Guidance

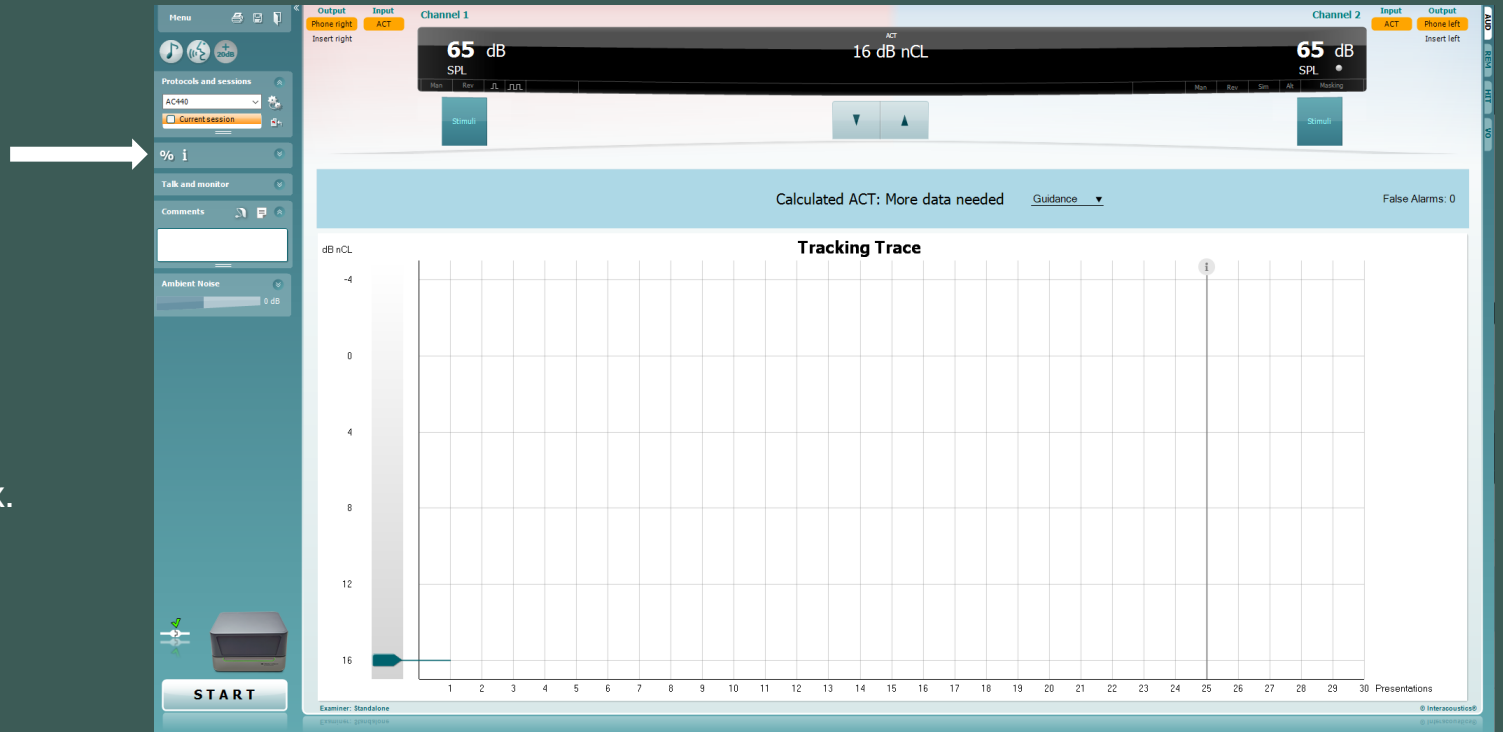


Guidance table

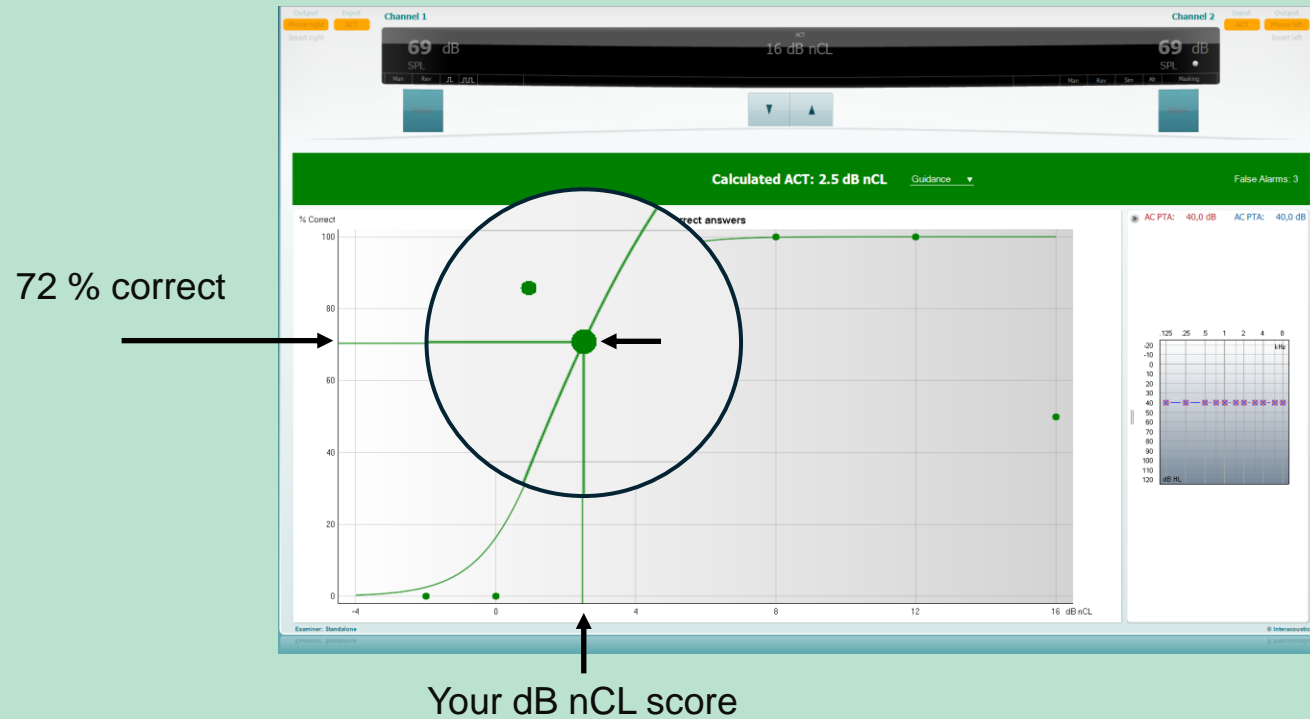
Open up the psychometric function.  
This feature is hidden, so you have to actively choose to have it on the screen.



Open up the instruction box.



# The psychometric function



Post-processing takes the last part of the trace meeting the Hughson-Westlake criterion and uses that to estimate a fixed-slope psychometric function from which the ACT is determined.

● Shows the percentage of stimulation of a given dB nCL value that has been responded to.

In other words, at 16 dB nCL, there has been stimulation two times but only one was responded to.





# Who has been involved?



**Interacoustics Research Unit**



**Interacoustics**



**Eriksholm Research Centre**  
PART OF OTICON

**CAAR, Hearing Aids, Demant**