Introduction to : Real ear Measures.

Nicole da Rocha

Speech language therapist & Audiologist

SESSION 1- AGENDA

- REUG/R- Real ear unaided response
- REOG/R- Real ear occluded response
- Open vs closed fittings why it matters

QUIZ 1- KAHOOT

- REAR- Real ear aided responses
- REAR VS REIG- Gain vs Response
- MPO – Maximum Power output measures
- LIVE AND ADVANCED - how and why

QUIZ 2- KAHOOT

RECAP of terminology

RESPONSE VS GAIN

The basics of “R” and “G”

- If it’s an “R” value that means it refers to an absolute value in the real ear, therefore in dB SPL

- If it’s a “G” value, refers to a difference value. That is, the input level used to generate the response has been subtracted from the absolute output level across frequencies.

Main components :

Ear canal resonance

(2.7kHz)

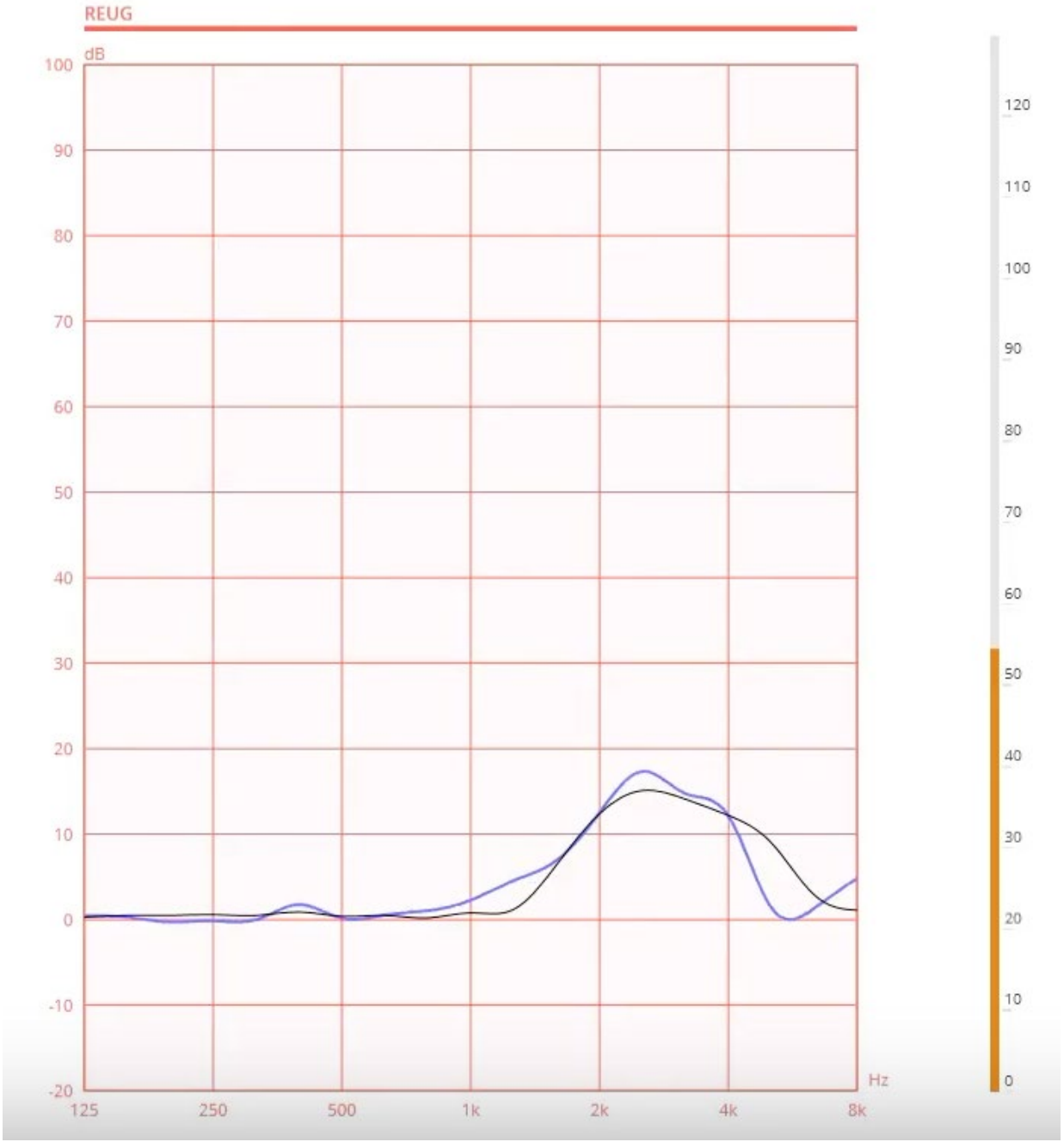
&

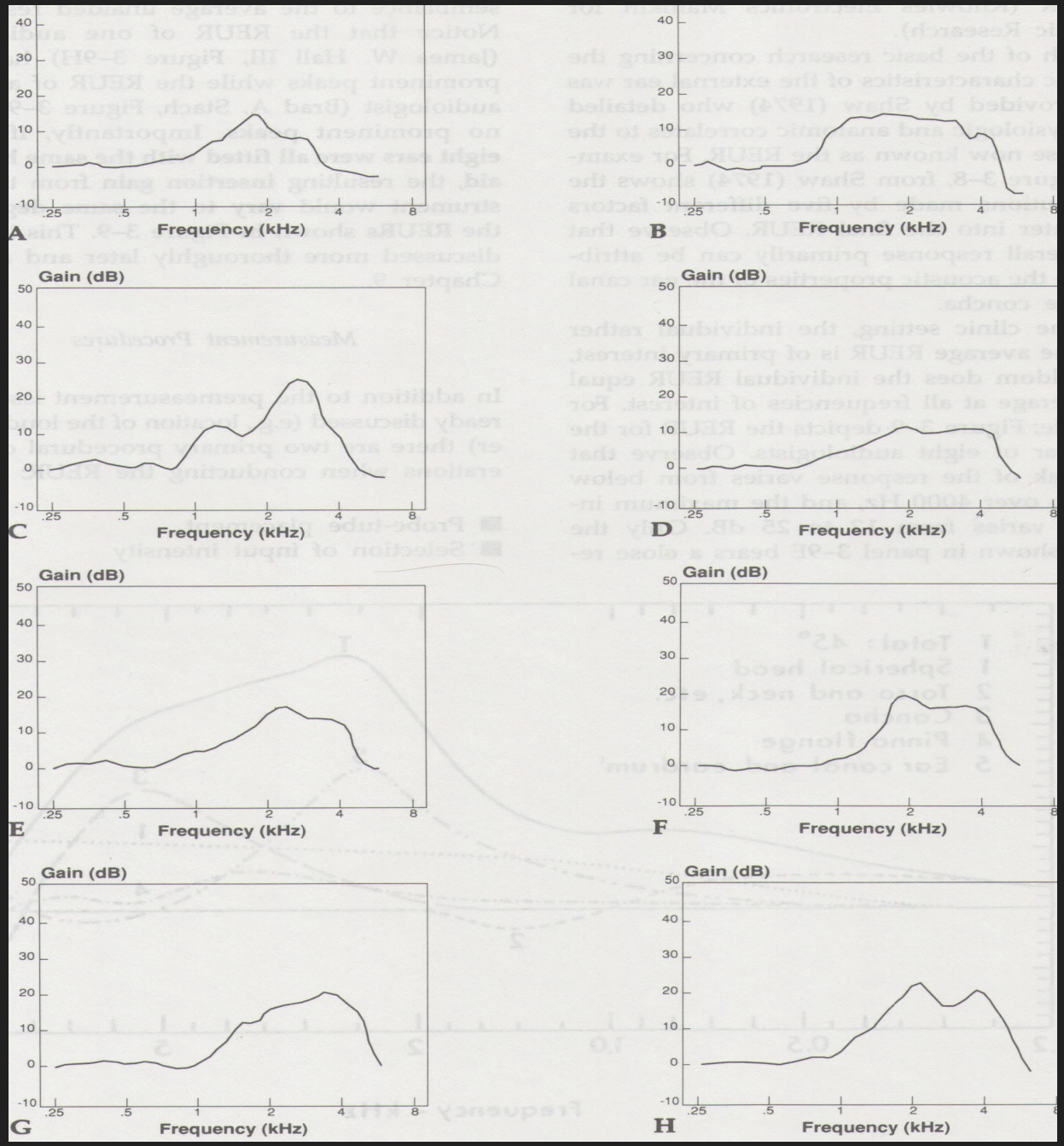
Concha effects (4-6HKz)

REUR

- Parameters= Noise – Pink - 65dB – 5sec
- TIP- Easier to measure in ‘G’
- Peak of approximately 12-22dB between 2-3 kHz

- What are the primary clinical applications?
  - –To calculate insertion gain
  - –Placement of probe tube
  - –Making sure probe tube is not occluded

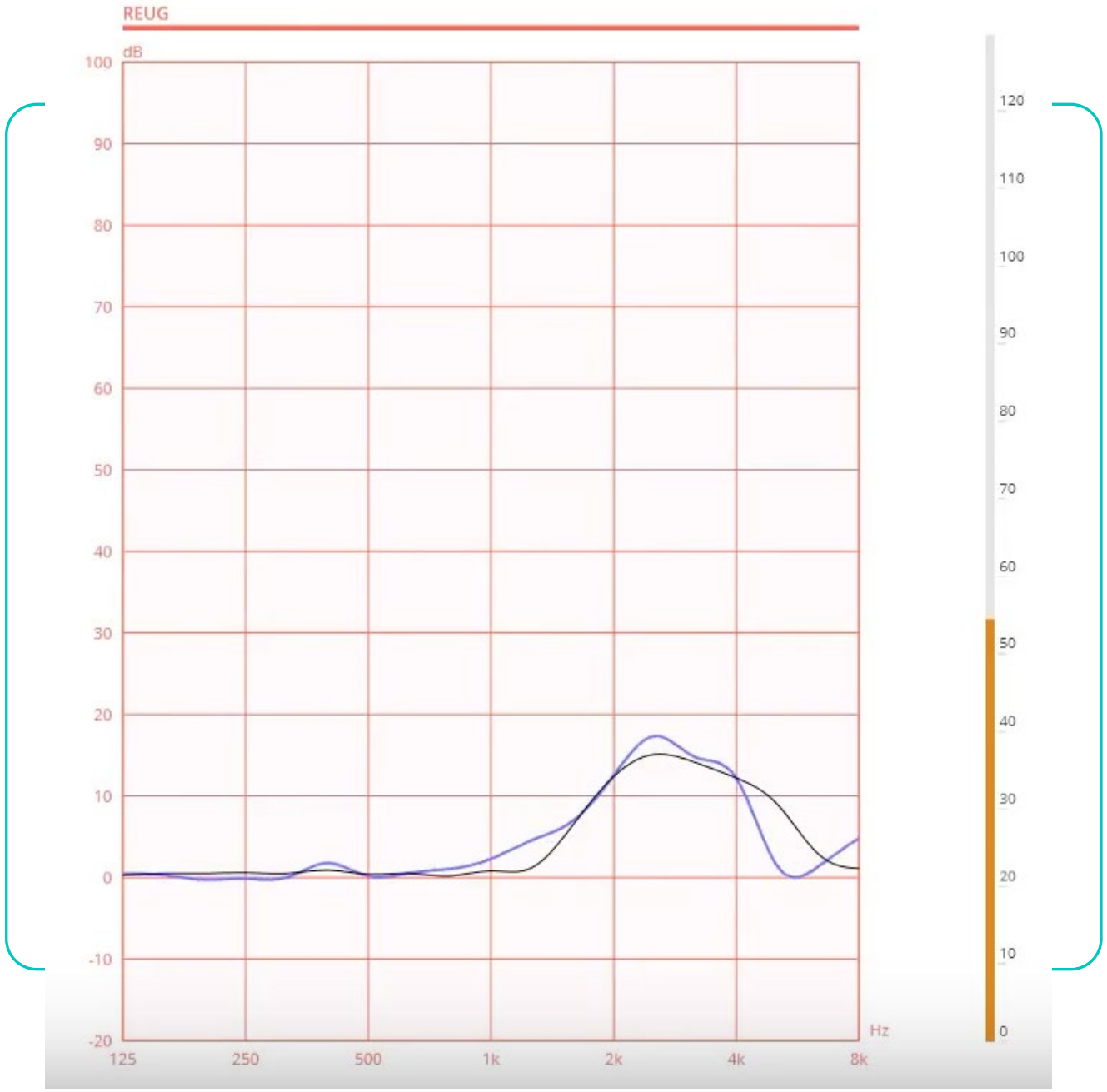




EARS ARE UNIQUE

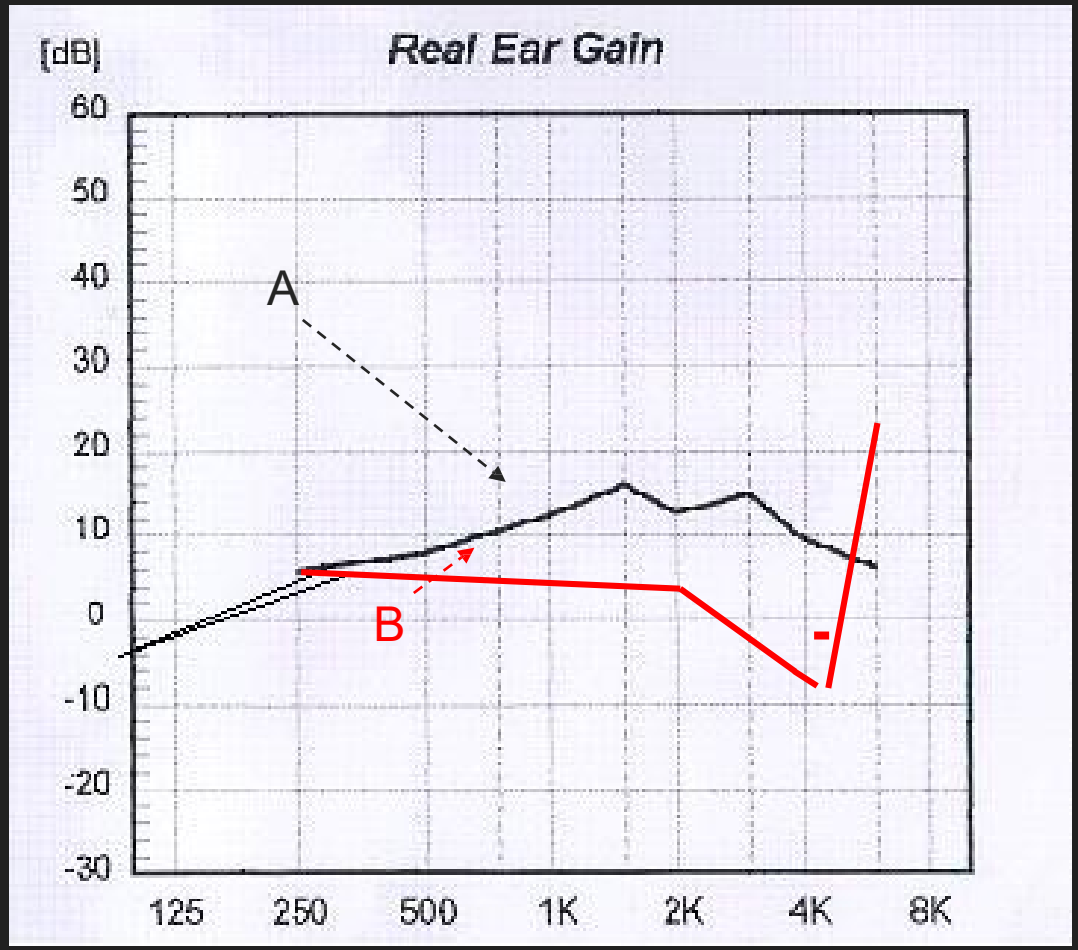
Using average REUR VS Measured

- REIG?
- Pathologies / Abnormalities?



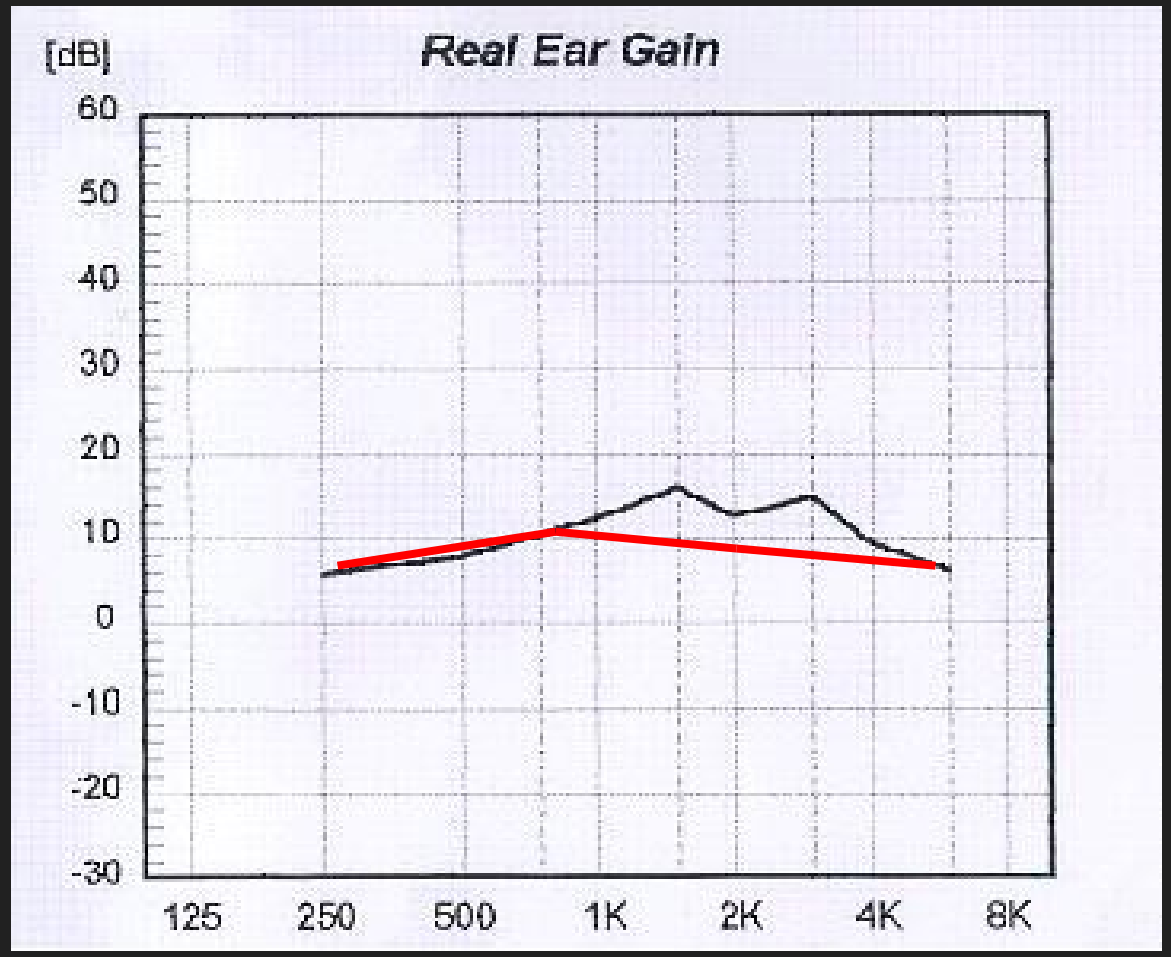
Mastoid cavities

- Large increase in ear canal volume
- Huge change in ear canal acoustics
- A- Un operated ear
- B- Mastoidectomy



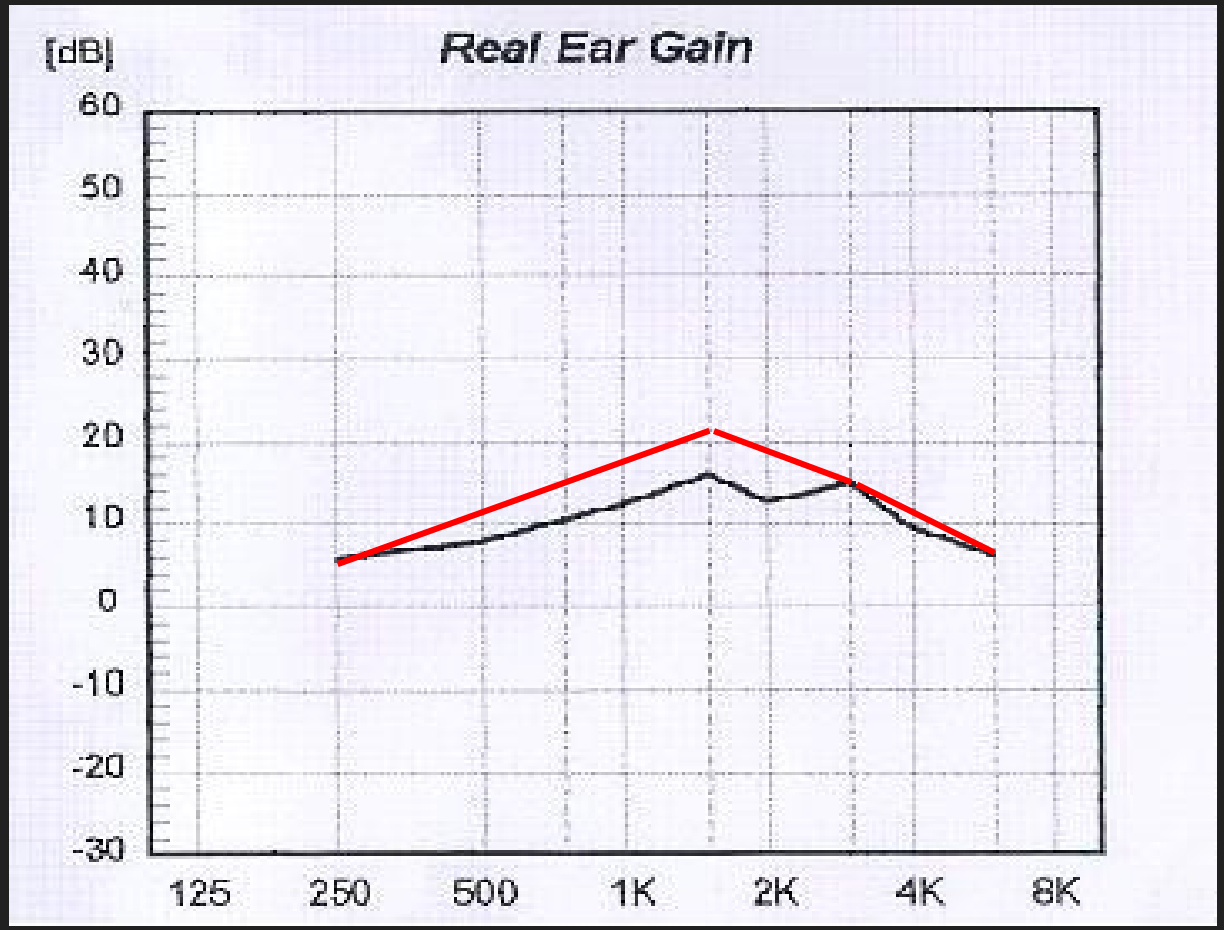
Hypermobile TM

- Reducing impedance of ear canal has similar effects as changing size of ear canal
- Resonance peak differs from norm



Otosclerosis

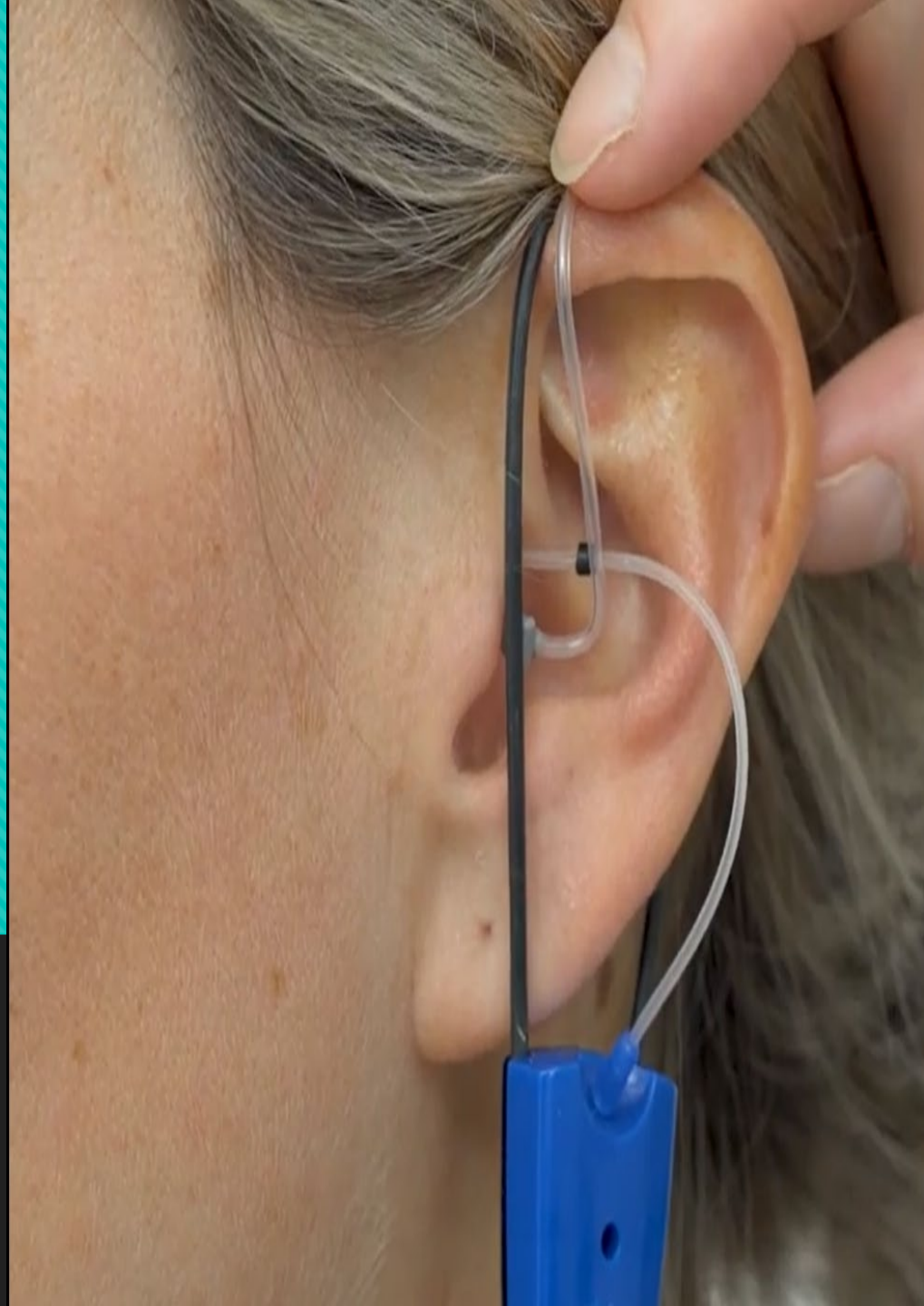
- Reducing impedance of ear canal has similar effects as changing size of ear canal
- Resonance peak differs from norm



Main components :

Effect of sound delivery system in ear canal

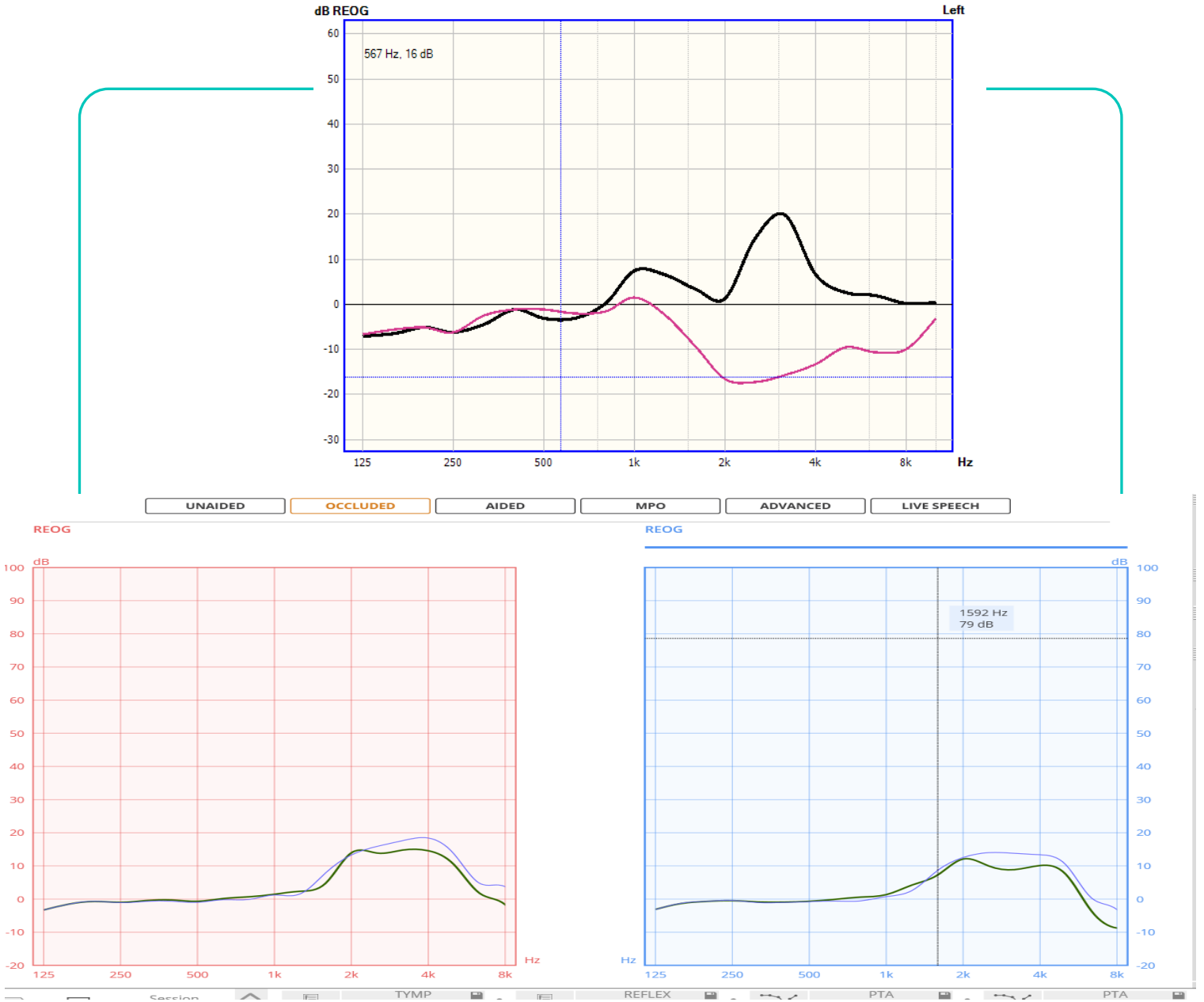
REOR/REOG



- Noise – Pink - 65dB – 5 sec
- Measured in ‘G’
- Peak of approximately 12-22dB between 2-3 kHz

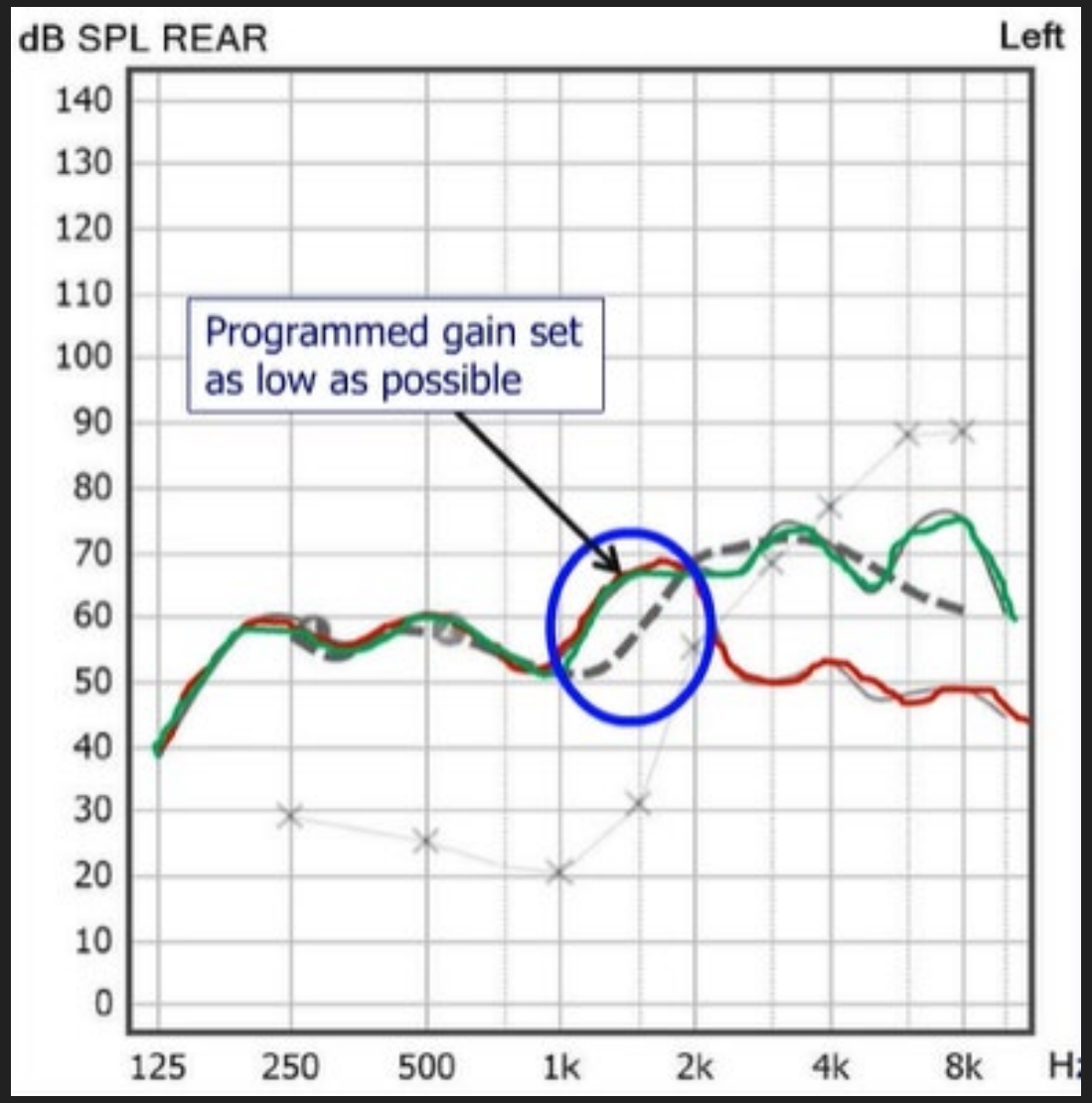
What are the primary clinical applications?

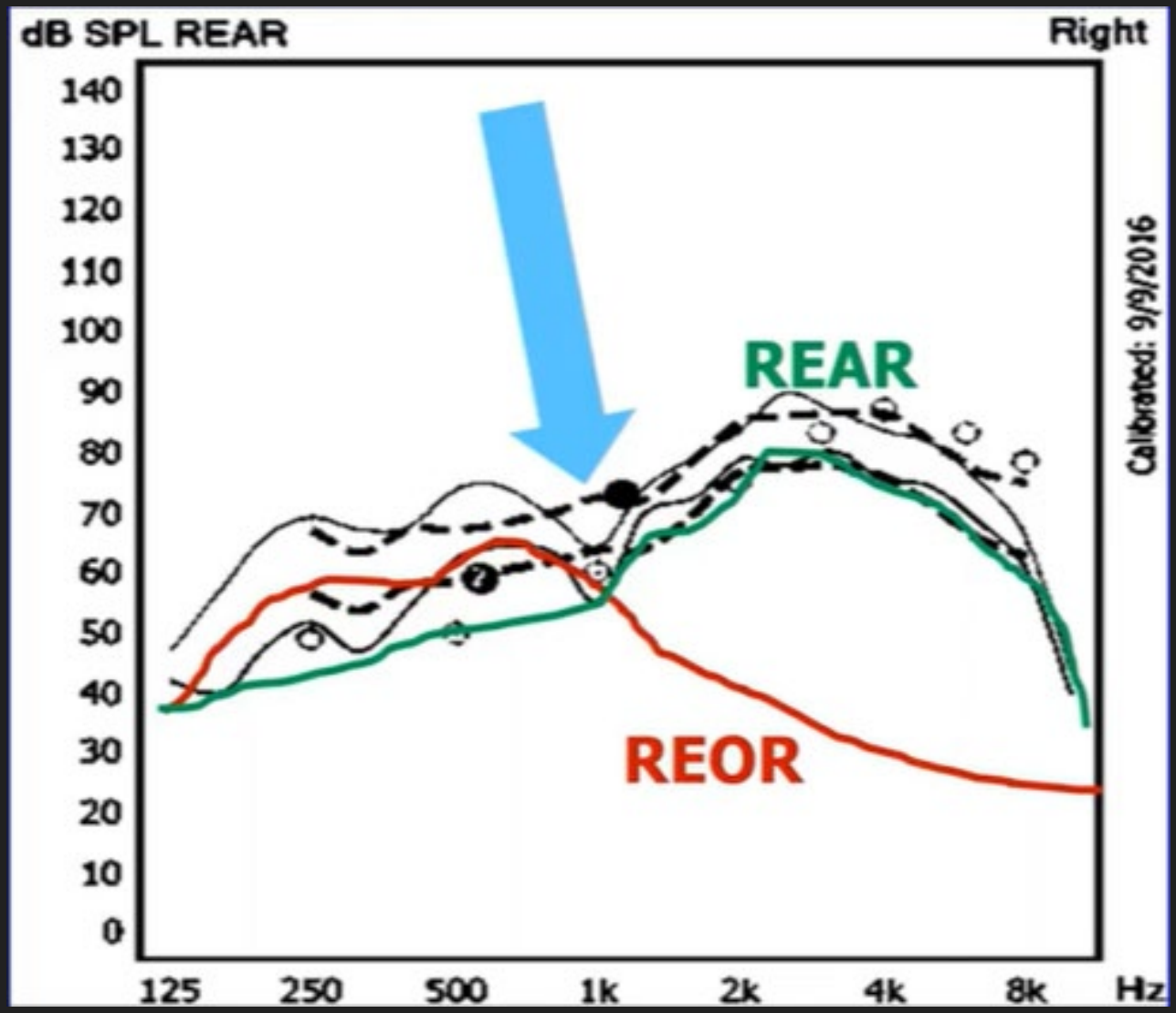
1. To know whether fit is open or closed
2. To determine venting effects



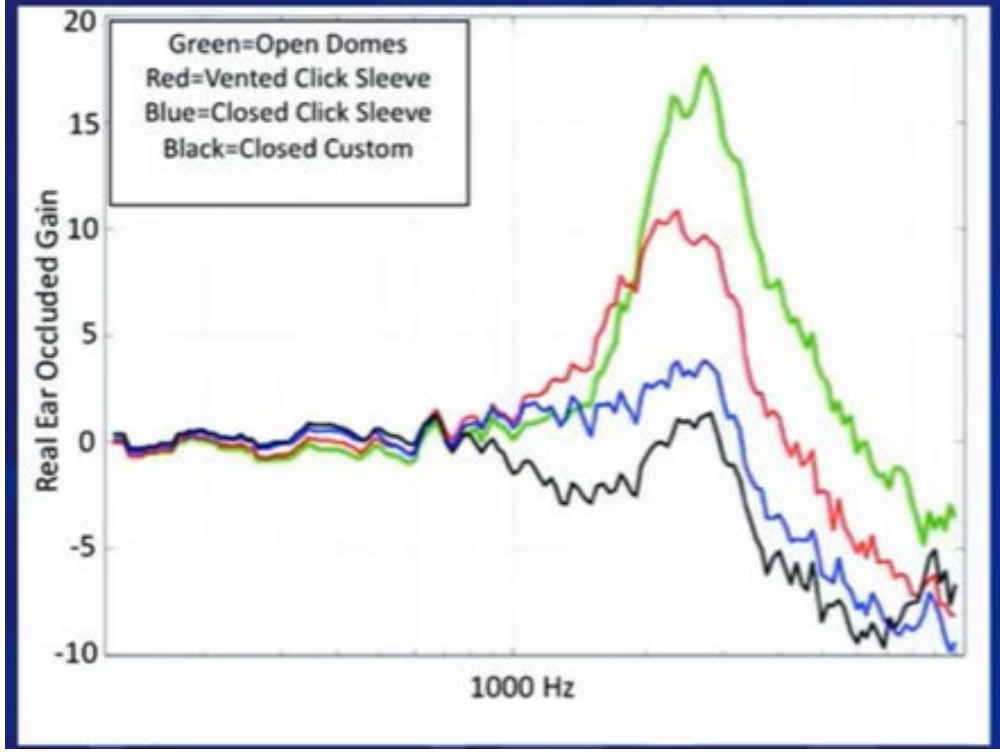
Clinical application: REOR

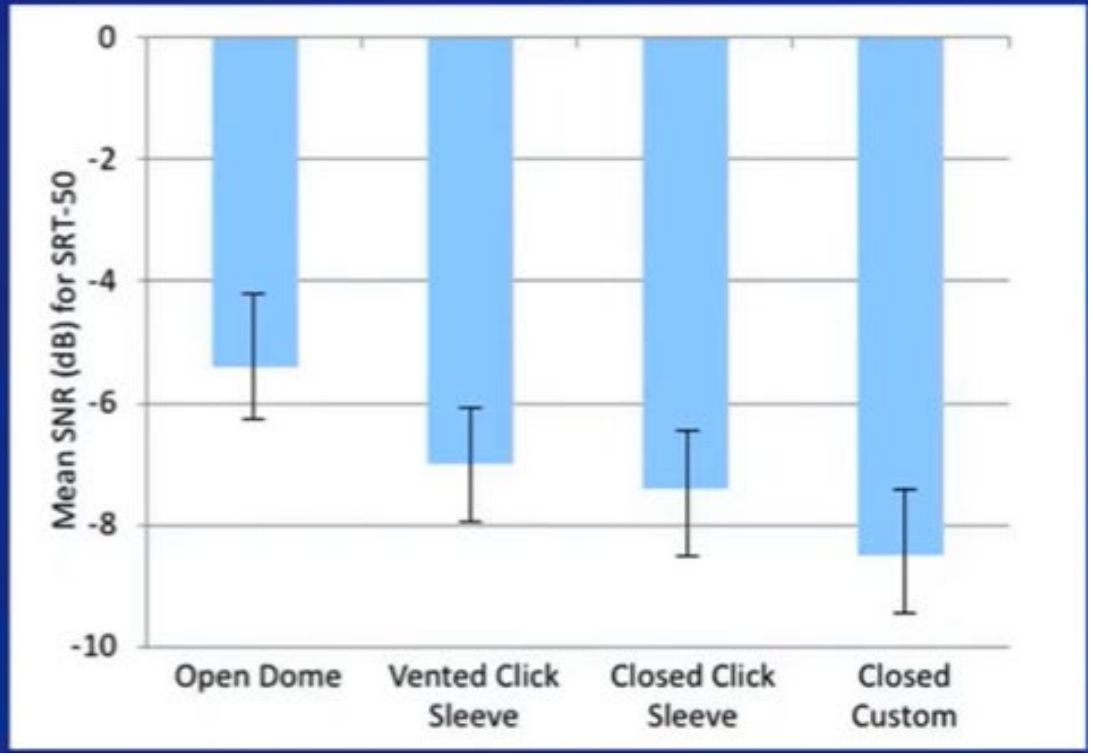
USEFUL tool in ‘odd targets/dips’



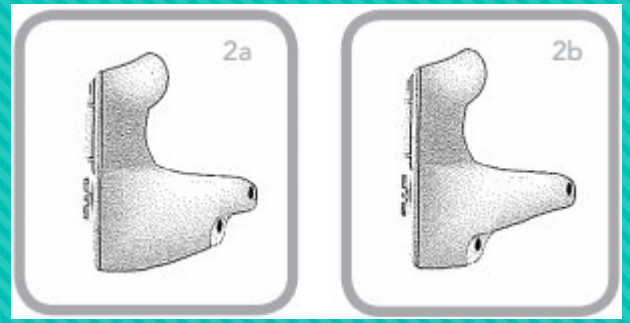


The REOR is directly related to the SNR advantage provided by directional technology





Occlusion effect vs REOR



When an individual produces a voiced sound, the vibrations within the vocal tract (larynx, nasopharyngeal column, etc.) are transmitted by bone conduction through the skull to the ear canal (Bekesy, 1960)

When talking, the movement of the articulators (i.e., the mandibular condyle) causes minute displacements of the cartilaginous portions of the ear canal (Dillon, 2001).

With open canal, this transmission of a patient's own voice is not perceived as sound is leaked into the environment outside the ear. However, when the ear canal is occluded with earmold/shell that terminates in the cartilaginous portion, the sound is unable to escape and is trapped.

The occluded ear canal becomes a resonant cavity, and the low frequencies, which have been boosted, pass into the cochlea because the impedance at the tympanic membrane has become favorable to the passage of the low frequency portion of the spectrum (Tonndorf, 1972).

IMPORTANCE OF USING KNOWING OPEN VS CLOSED ACOUSTICS

STORED VS CONCURRENT

Modified pressure method with concurrent equalisation

- When this is used, equalisation is not a separate step but occurs automatically during measurement through continuous monitoring of the signal by the reference microphone at the ear.

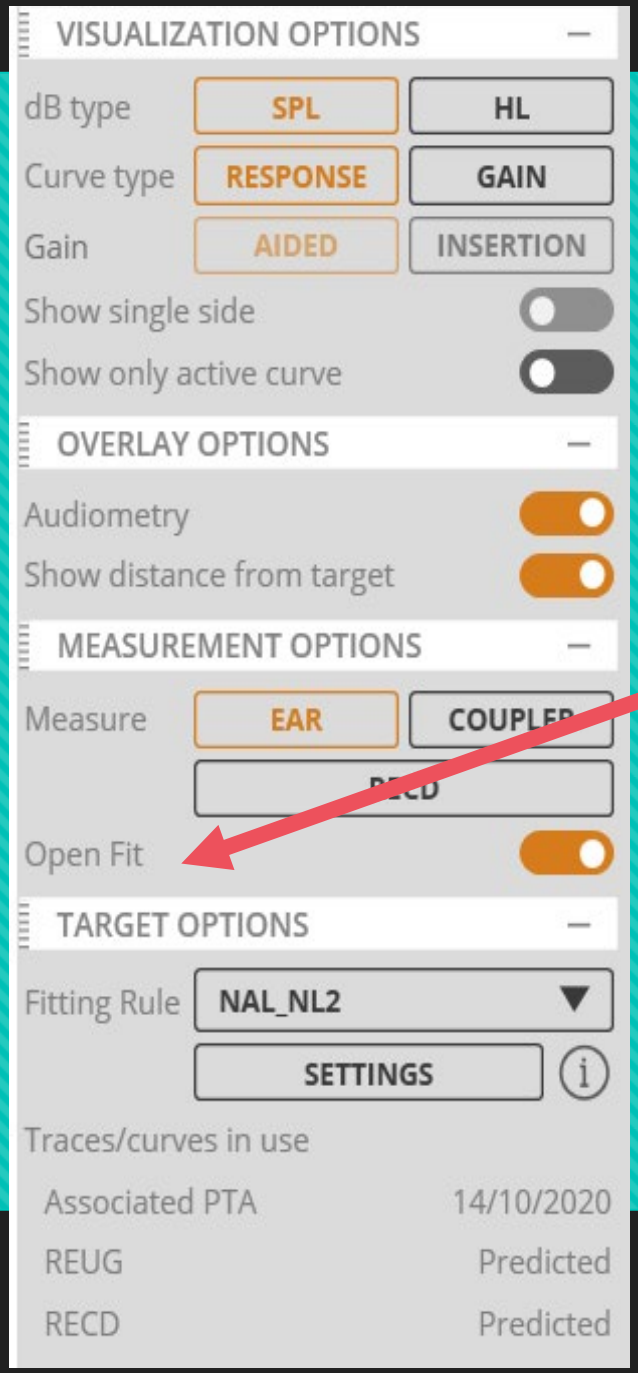
- If the patient were to turn head slightly to one direction or another, the input signal would be changed accordingly to compensate for head diffraction or shadow, so that a constant input always is present at the ear.

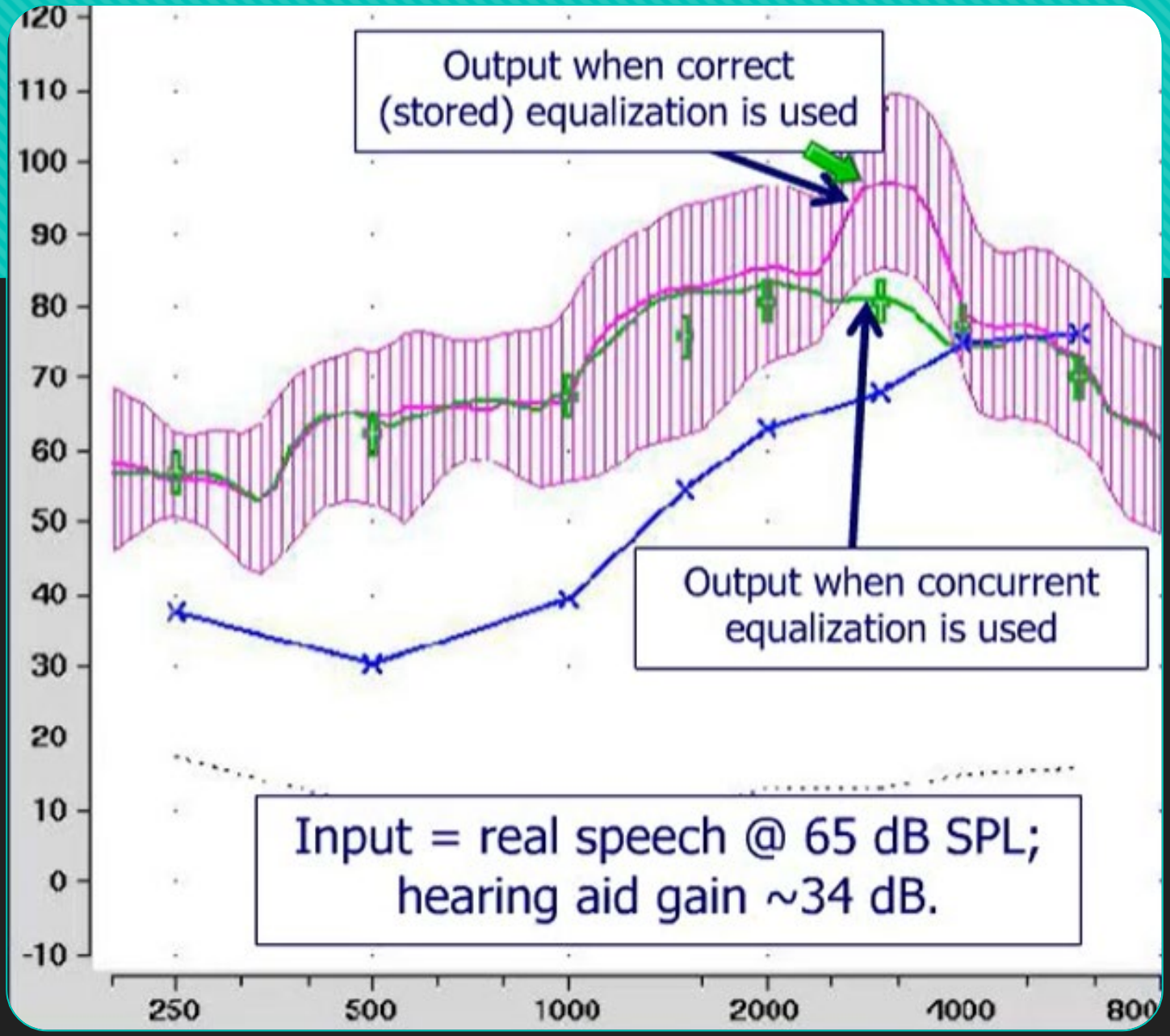
Modified pressure method with STORED equalisation

There is no automatic change in the speaker output.

Importantly: The patient must keep his head still in the calibrated position!

THIS IS NEEDED FOR OPEN FITTINGS





Clinical example

FAQ: REFERECE MICROPHONE

01

IS IT OK TO USE STORED EQUALISATION WHEN EAR CANAL CLOSED?

- Yes, but remember patient cannot move their head.

02

Is there anytime other than open fittings where stored equalisation is used?

- Yes, for CROS/ measuring head shadow effect

QUIZ TIME


Get ready to join
Join at www.kahoot.it
or with the Kahoot! app
Game PIN:
Loading Game PIN..
Kahoot!
Kahoot!
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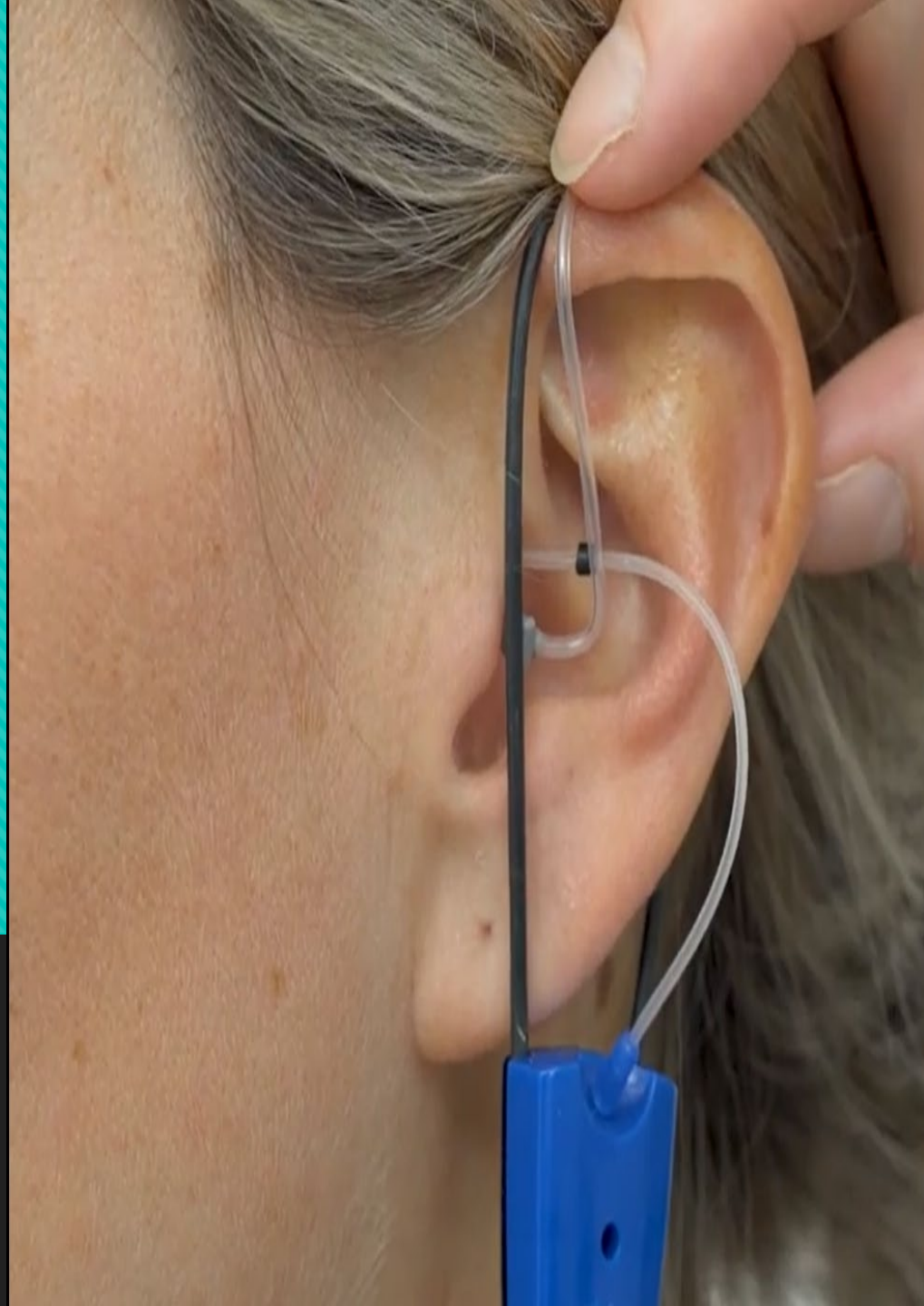
Kahoot!

Main components :

Effect of sound delivery system in ear canal

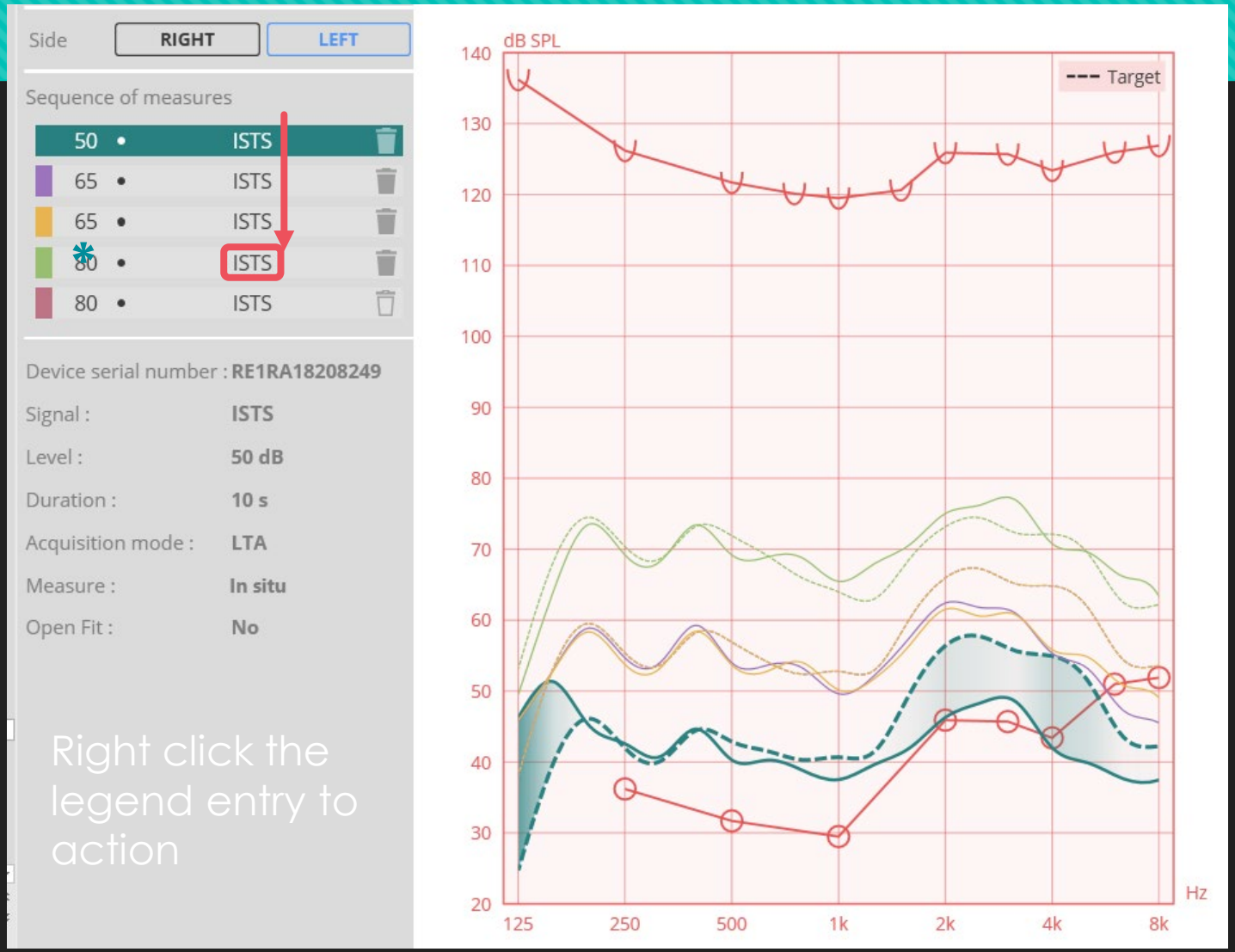
AIDED RESPONSE




File Rem Help
Jay Jindal
REAL EAR MEASUREMENT
TRUMPET
RE1RA18208249
TRUMPET
OFFLINE
QST
REM
PTA
SPEECH
MHA
STENGER
QUICKSIN
HIT
Fitting Details
AMBIENT NOISE IS OK
REFERENCE MICS CALIBRATION
LOUDSPEAKER EQUALIZATION
BOTH PROBES MIC CALIBRATION
UNAIDED
OCCLUDED
AIDED
MPO
ADVANCED
LIVE SPEECH
REAR
dB SPL
Target
Mode
SINGLE SIDE
BILATERAL
Level
65
dB SPL
Signal
ISTS
Sequence of measures
50 ISTS
65 ISTS
80 ISTS
80 ISTS
80 ISTS
DELETE CURV
REC mode
10
Change level/signal/duration
Real Ear and 2CC coupler selection
VISUALIZATION OPTIONS
dB type
SPL
HL
Curve type
RESPONSE
GAIN
Gain
AIDED
INSERTION
Show single side
Show only active curve
OVERLAY OPTIONS
Audiometry
Show distance from target
MEASUREMENT OPTIONS
Measure
EAR
COUPLER
RECD
Open Fit
TARGET OPTIONS
Fitting Rule
NAL_NL2
SETTINGS
Traces/curves in use
Associated PTA 14/10/2020
REUG Predicted
RECD Predicted
Monitor
ON TOP MODE
Test John
01/01/2013 (8)
Session
14/10/2020
PTA
21:49

Aided Responses

Aided responses are run with the aid switched on/unmuted.



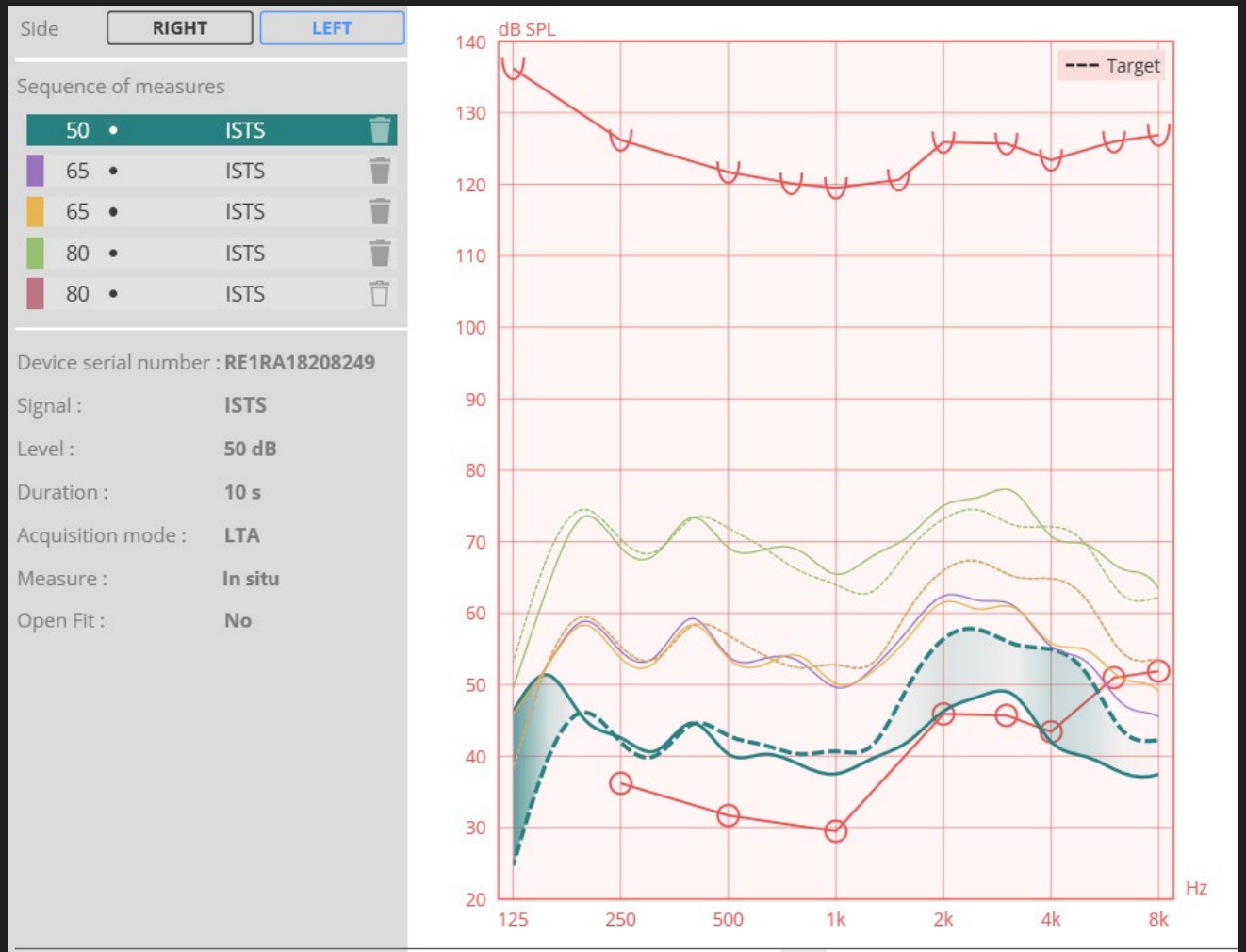
- Your target based on your fitting details entries will be the dashed line and the response will be a solid line.
- Any overlays you have active such as the patient's audiogram will also be displayed.
- The options will allow to hide/delete/copy responses you have run as well as colour coding them.

Aided Responses

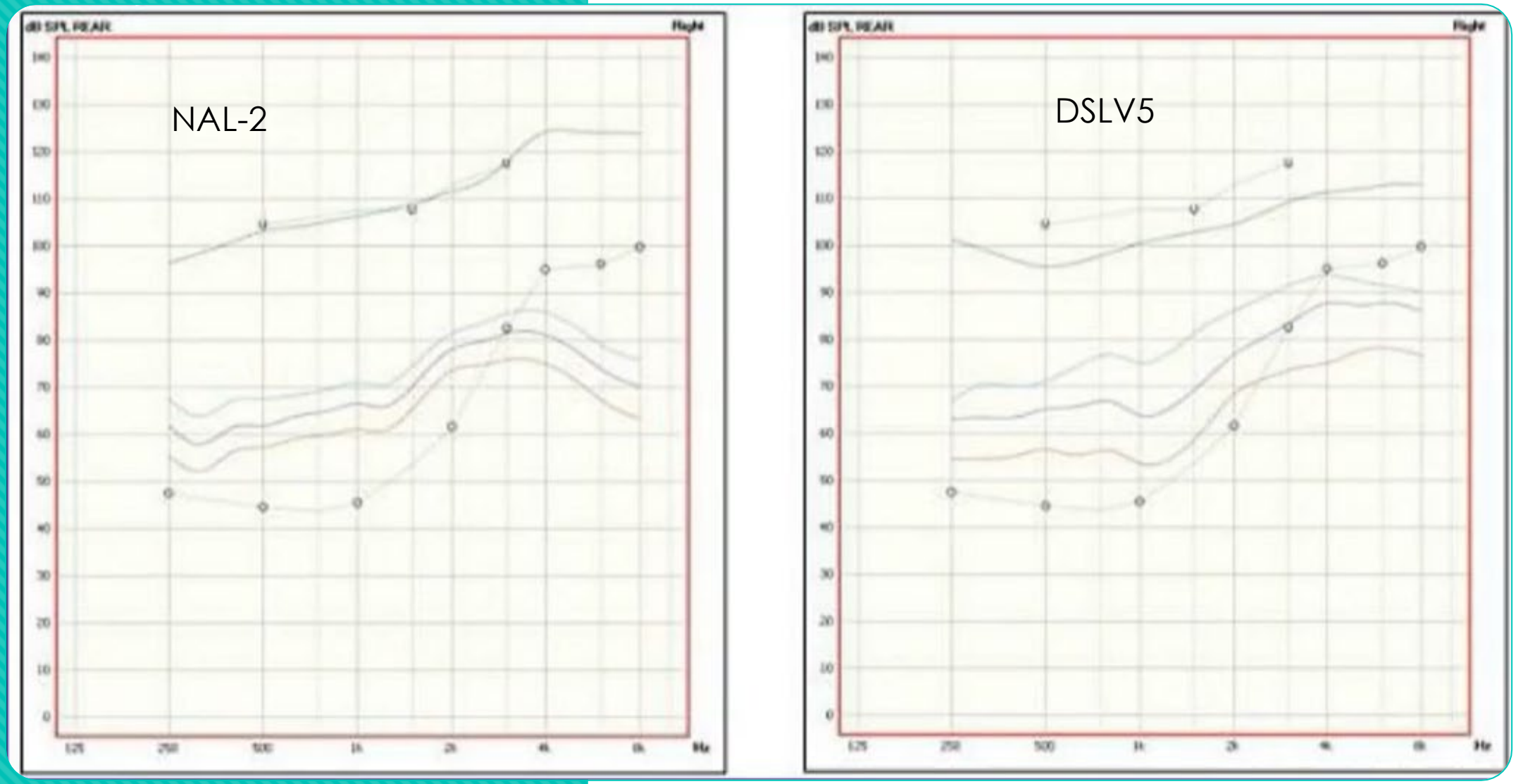
PROTOCOL:

ISTS SIGNAL
DURATION 10 SECONDS

1- 65dB (medium)
2- 55dB (soft)
3- 75dB (loud)



FAQ: WHY ARE PRESCRIPTION TARGETS BELOW THE THRESHOLDS?

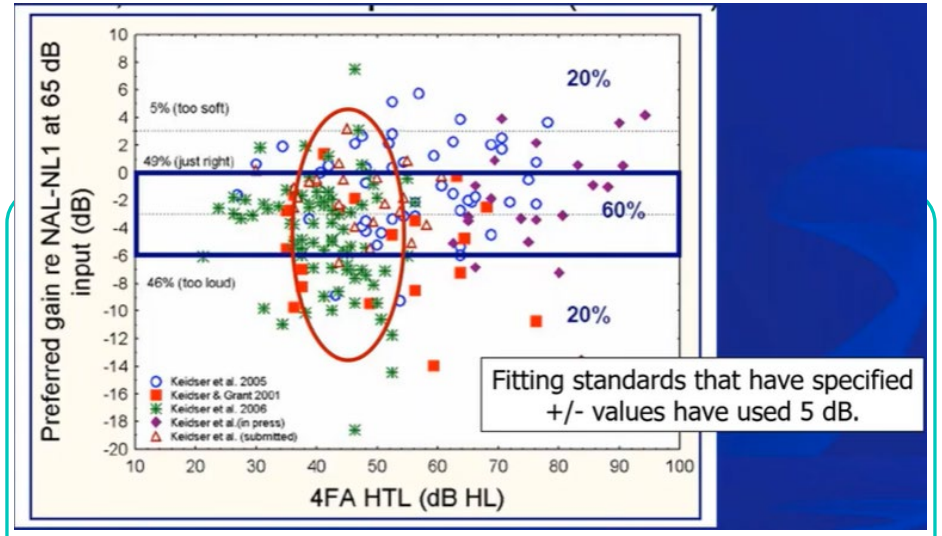


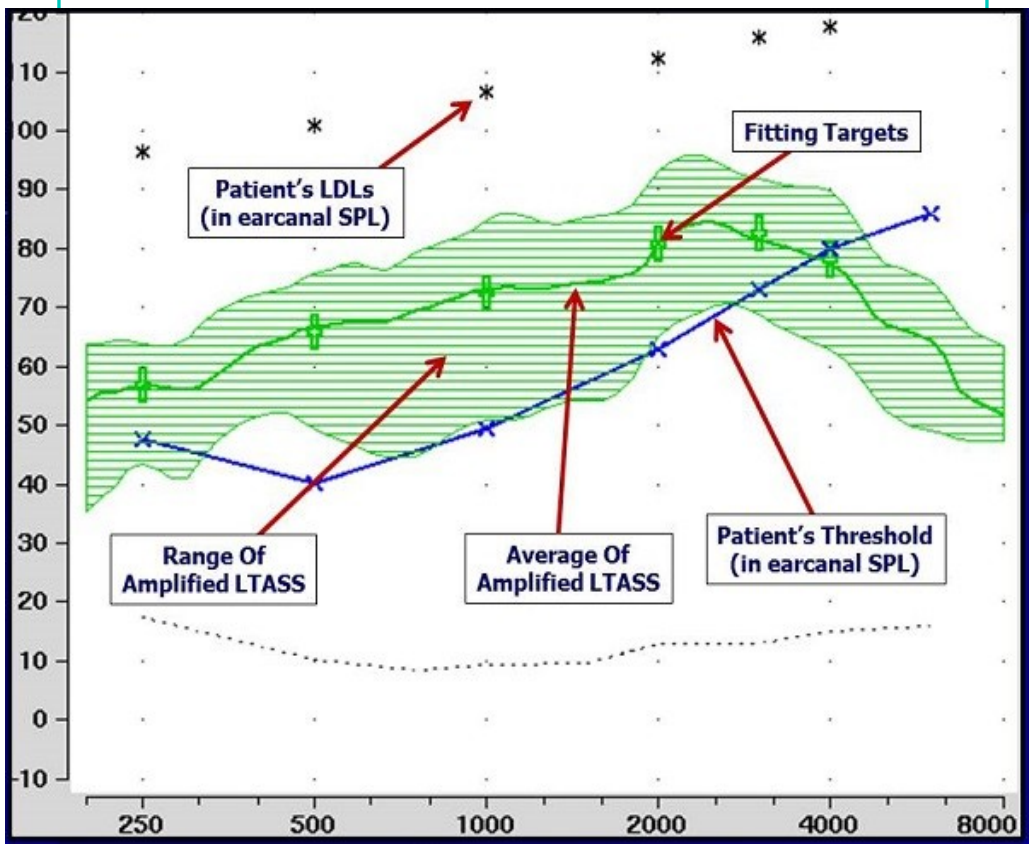
MUELLER HG Hearing aid verification: Old concepts and new considerations. In Hearing Care for Adults, Palmer C. Seewald R (Eds) Stafia: Phonak AG

- Consider the percentile (spectral peaks), not just the LTASS “ average line.”
- Remember there is an average acceptability

  174 ears- developed NAL
- You only have so much ‘gain’ don’t compromise 2kHZ for 6kHZ
- COMFORT VS AUDIBILITY-

  Lifting 6/8KHz might go beyond patients comfort for highs

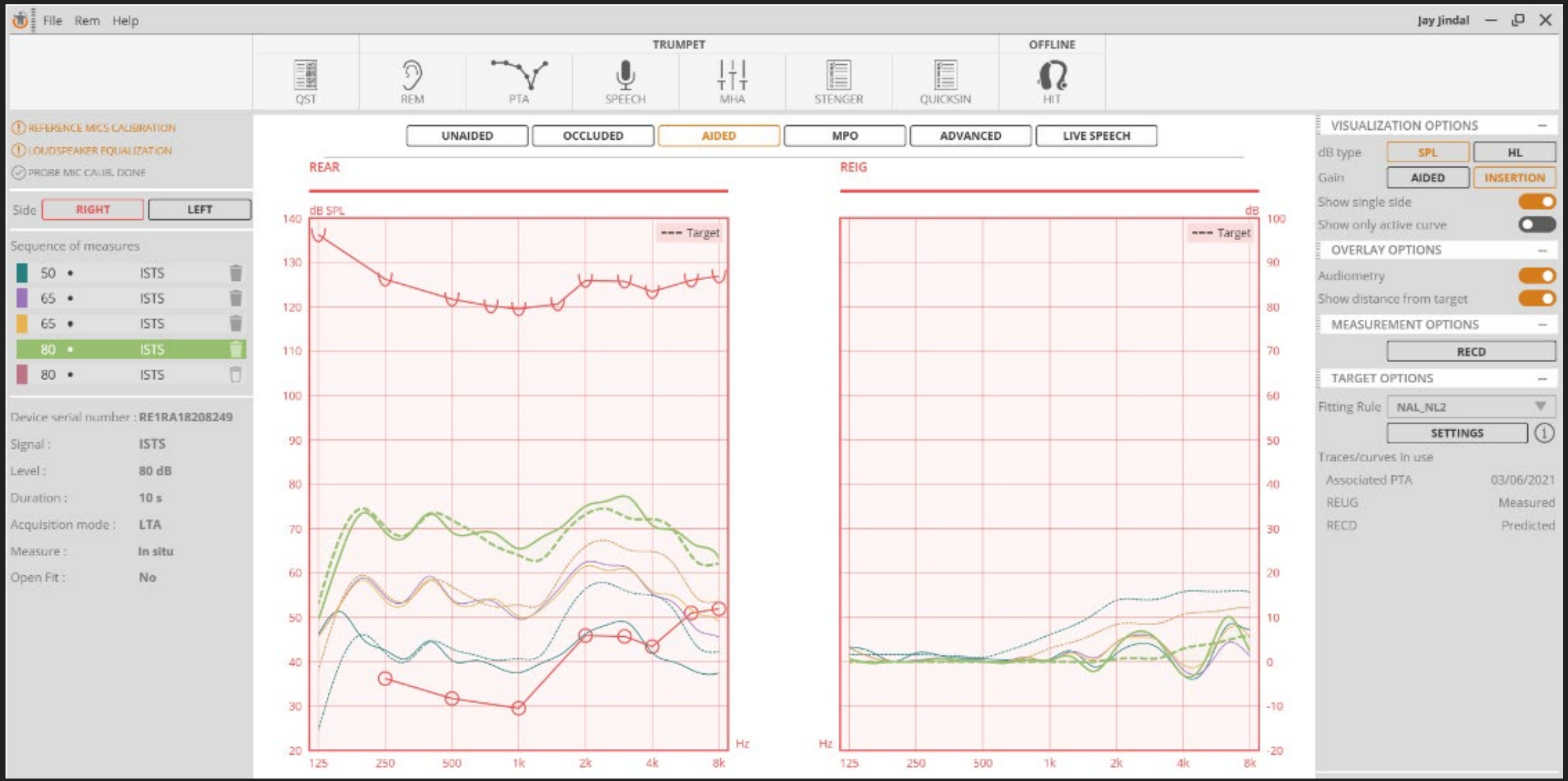




Viewing the Response: REIG vs REAR

- Real ear insertion gain view is good for asking the question: "Does the hearing aid provide the appropriate frequency-specific *gain* for speech?" REIG= REAR-REUR

- Real ear aided response is better for asking the question: "Does the hearing aid place amplified speech at the appropriate output?"


File
Rem
Help
Jay Jindal
TRUMPET
OFFLINE
QST
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PTA
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MHA
STENGER
QUICKSIN
HIT
REFERENCE MICS CALIBRATION
LOUDSPEAKER EQUALIZATION
PROBE MIC CALIB. DONE
Side
RIGHT
LEFT
Sequence of measures
50 • ISTS
65 • ISTS
65 • ISTS
80 • ISTS
80 • ISTS
Device serial number : RE1RA18208249
Signal : ISTS
Level : 80 dB
Duration : 10 s
Acquisition mode : LTA
Measure : In situ
Open Fit : No
UNAIDED
OCCLUDED
AIDED
MPO
ADVANCED
LIVE SPEECH
REAR
REIG
dB SPL
dB
Target
Hz
125
250
500
1k
2k
4k
8k
VISUALIZATION OPTIONS
dB type
SPL
HL
Gain
AIDED
INSERTION
Show single side
Show only active curve
OVERLAY OPTIONS
Audiometry
Show distance from target
MEASUREMENT OPTIONS
RECD
TARGET OPTIONS
Fitting Rule
NAL_NL2
SETTINGS
Traces/curves in use
Associated PTA 03/06/2021
REUG Measured
RECD Predicted

Why the change from REIG to REAR

REAR useful visualisation of the interrelationship between data.

You don't have to (directly) deal with the REUG

Overall display and measurement more logical (as things get louder that are higher on the scale)

Face validity of real speech

Allows testing to be conducted with DNR-On

Observation of effects of compression (including different time constants)

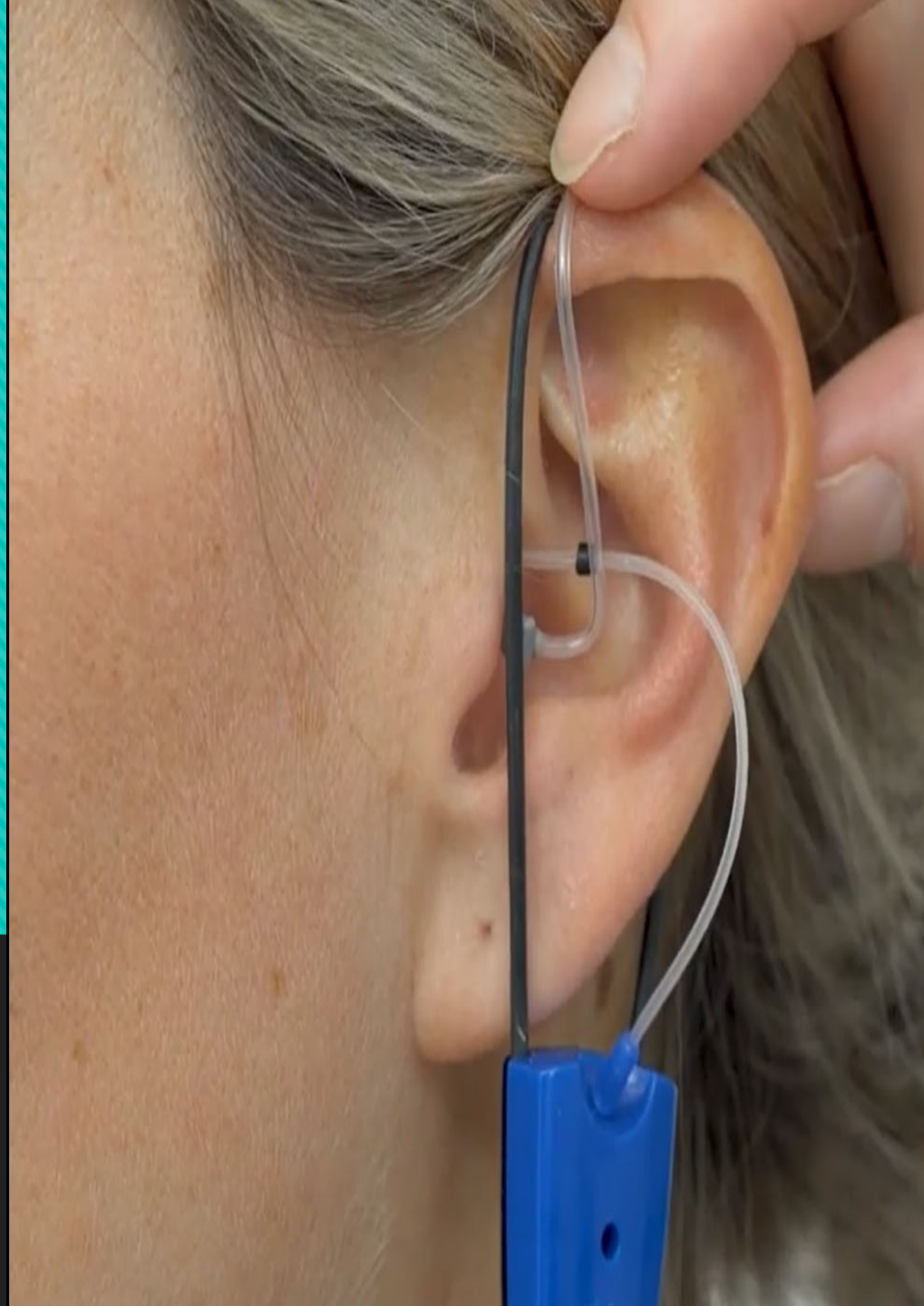
Includes effects of channel summation and other signal processing

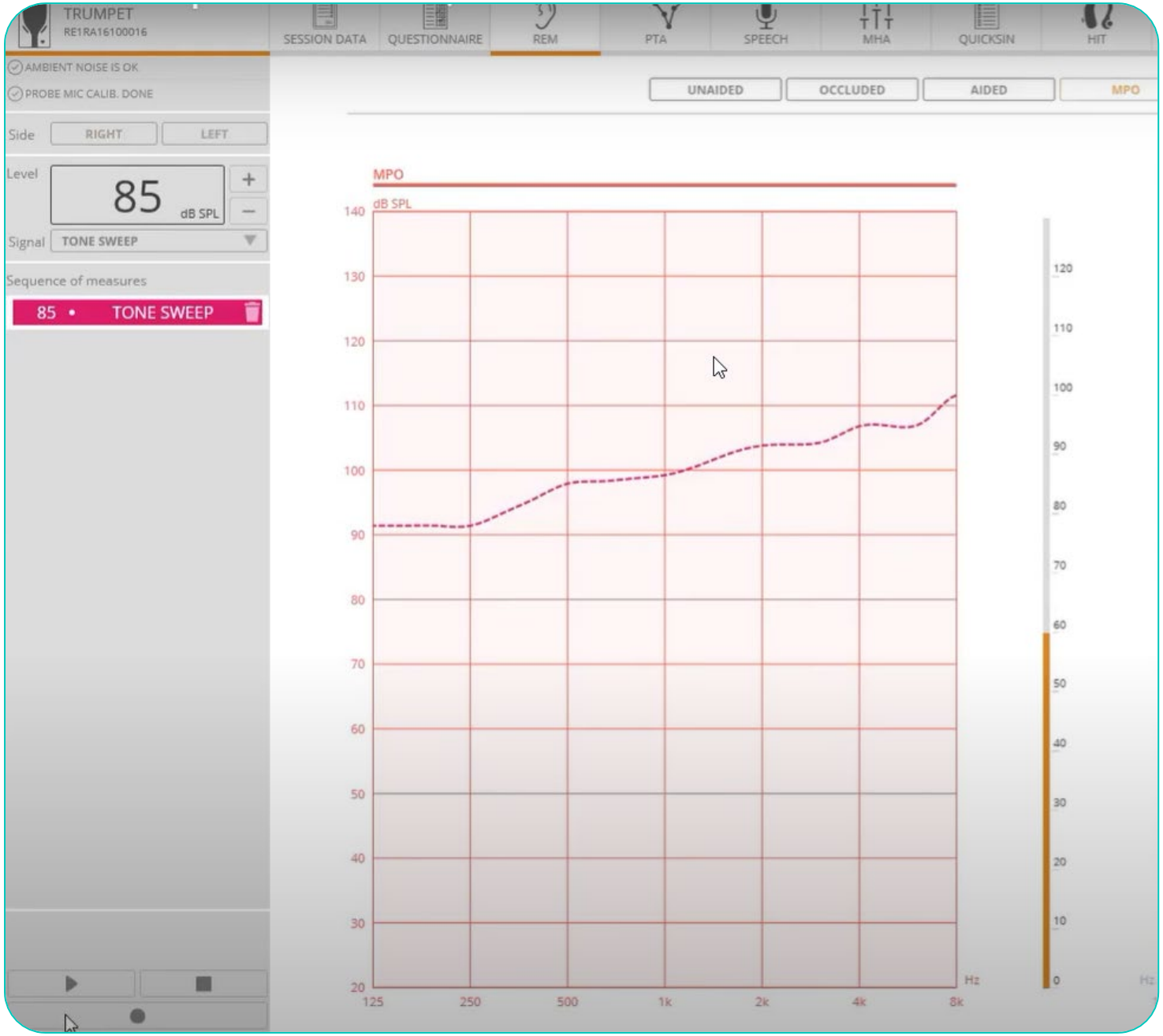
Results more meaningful for patient counseling

Main components :

MAXIMUM POWER OUTPUT

The REAR85/REAR90/MPO (formerly known as the RESR)





- The MPO of the hearing aid measured in ear canal SPL.
- Input must be great enough to place output at max.
- Usually conducted at high VC setting to predict worse case (unless fixed VC)
- SWEPT TONES -85dB IN EAR, 90dB IN TESTBOX
- Should be 3-5dB below the LDLs

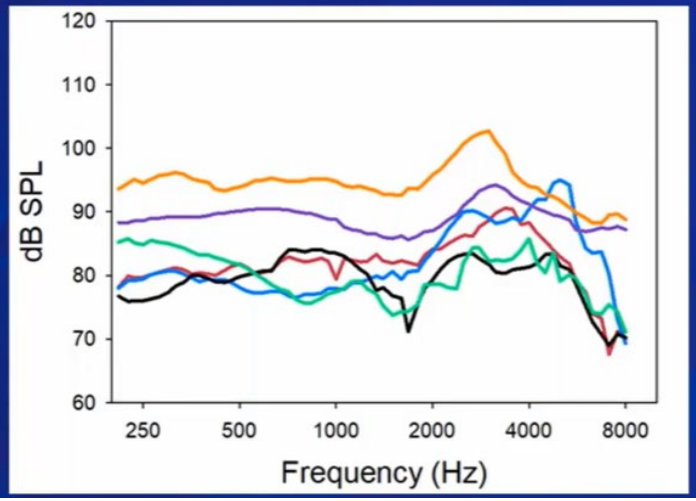
What are the primary clinical applications?

- Comfort (not too high *or* too low) and safety
- Checking the headroom of the aid

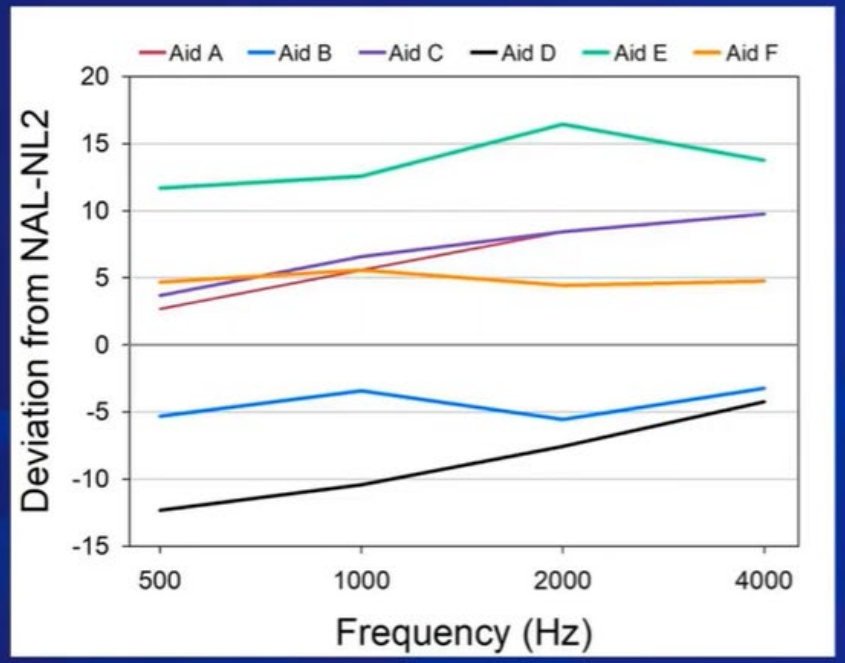
TOP TIPS

- RUN Feedback manager **before** MPO
- Run MPO First before other measures
- NOT GAIN but adjusting AGCo kneepoint
- - Measuring just 2 LDLS helps place MPO

Note that for four of the six products, the output is limited to 80-85 dB SPL, unnecessarily limiting useful headroom by ~10 to 15 dB.



NAL-NL2 prescribed MPO vs. that selected in the manufacturer's fitting software:



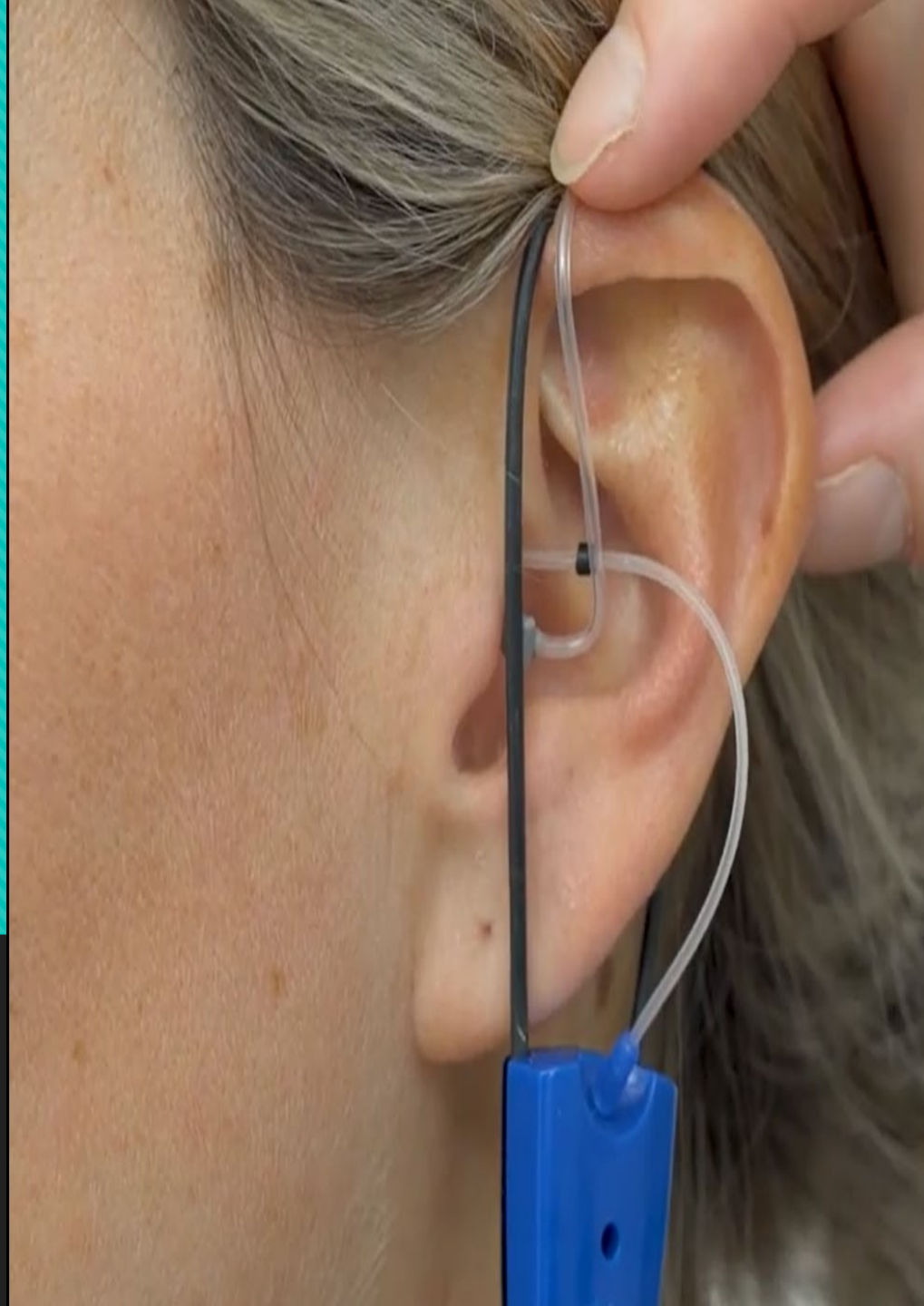
Differences of 12-15 dB from the NAL.

Differences of ~25 dB among manufacturers!

Comparison of In-Situ and Retrospective Self-Reports on Assessing Hearing Aid Outcomes.Wu YH, **Stangl E**, Chipara O, Gudjonsdottir A, Oleson J, Bentler R.J Am Acad Audiol. 2020 Nov;31(10):746-762. doi: 10.1055/s-0040-1719133. Epub 2020 Dec 15.

Live and Advanced REM

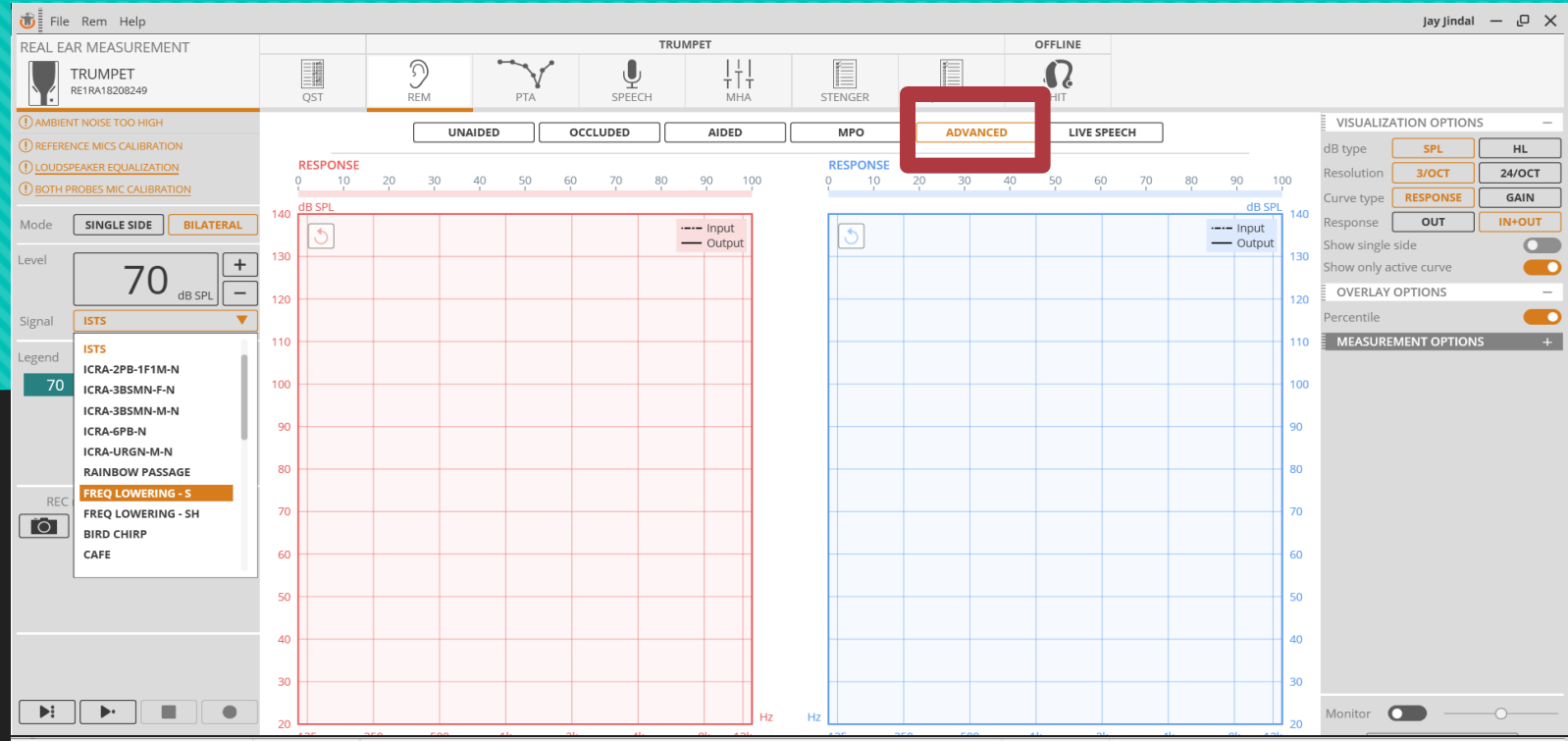
WHY AND HOW



What can Live Speech/advanced assess?

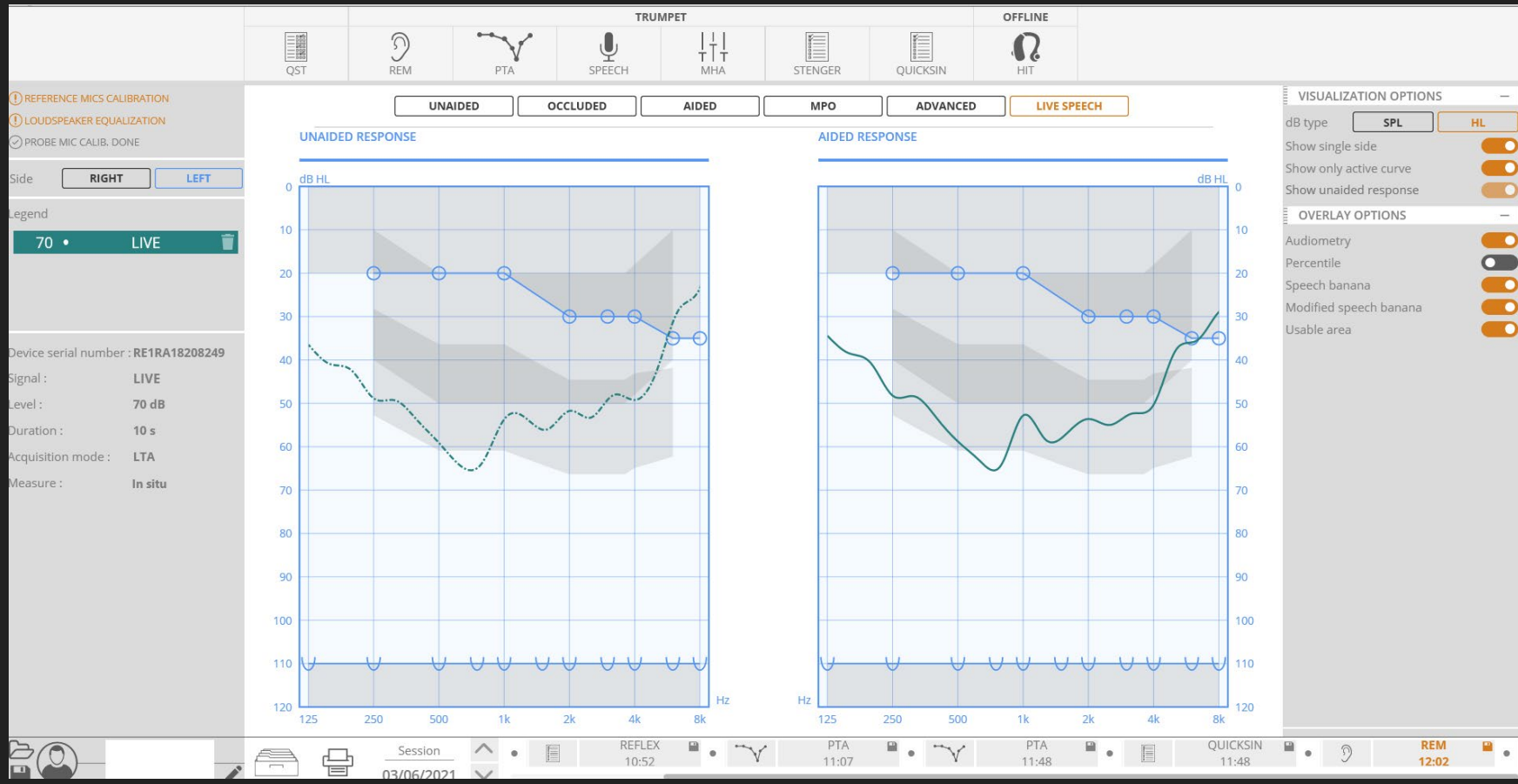
Advanced gives you the ability to set the system up in such a way as to demonstrate ANY dynamic feature of the hearing aid

- CREATE MUSIC PROGRAMS WHILE PATIENT IS PLAYING THEIR INSTRUMENT
- CREATE ‘SIGNIFICANT OTHER’ PROGRAMS
- TEST FEATURES OF HEARING AIDS
- EFFECTIVE COUNSELLING TOOL

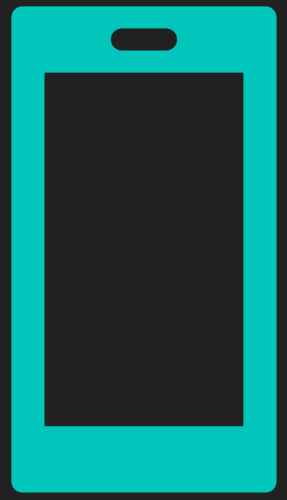


Live speech/ Advanced

- This takes us away from prescriptive verification
- Allows us to mimic real life situations as closely as possible in a clinical setting
- Advanced/Live speech allow us to get creative and great tool for counselling



QUIZ TIME



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