Life sounds brilliant.

Signia Expert Series: Is autoREMfit a Reasonable Verification Alternative?

Presented by H. Gustav Mueller, PhD

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http://www.audiologyonline.com/ce/signia-siemens

Learning Outcomes

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After this course learners will be able to…

1. Describe how the autoREMfit procedure is implemented.

2. Describe the findings of research using autoREMfit.

3. Describe the pros and cons of the routine clinical use of autoREMfit.

Introducing….

Life sounds brilliant.

Is autoREMfit a reasonable verification alternative?

H. Gustav Mueller

Faculty Appointments: Vanderbilt University, Rush University, and University of Northern Colorado. Consultant, WS Audiology

Contributing Editor, *AudiologyOnline.com*

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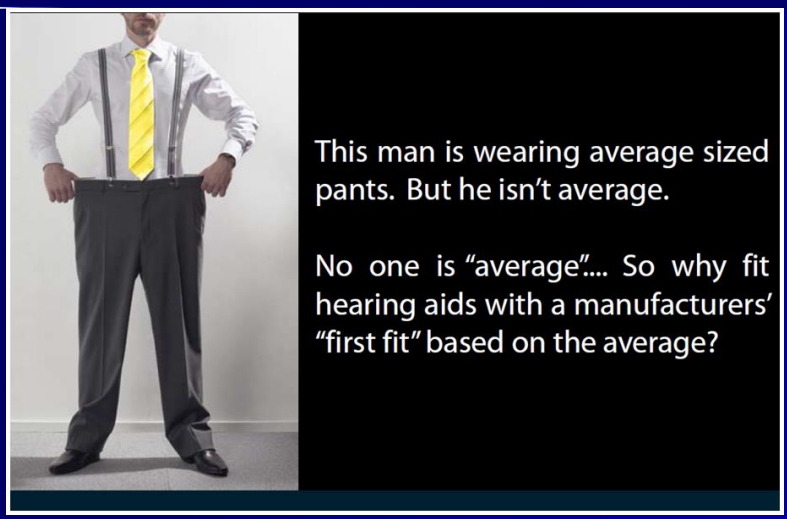
Greetings from North Dakota's largest island!

For those of you who are really into this stuff, and would like to hear more:

If you are just getting started doing probe-mic measures, and need an overview of all the techniques and procedures:
AudiologyOnline Course #27179: Back to Basics: Probe-Mic and Speech Mapping Measures (2 hours)

If you are conducting probe-mic measures routinely, but would like an explanation of why some of your findings are puzzling:
AudiologyOnline Course #29398: Hearing Aid Speech Mapping Verification - Some Explanations for Puzzling Outcomes (1 hour)

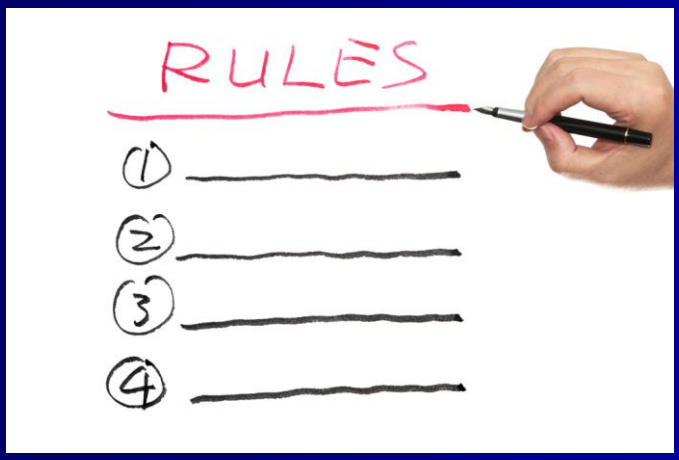
Just to get us started . . .



And another of my favorites . . .

And finally . . .

Before we talk about autoREMfit, some "ground rules" regarding verification



Let's think this through—if you are going to "verify something" you have to start with gain/output fitting goals . . .

- Something I made up.
- Something a hearing aid manufacturer made up.
- Something that has been validated with 30-40 years of research.

Next—how can you ensure that your fitting goals are being met?

- Click on the manufacturer's "Magic Button"
- Ask the Patient.
- Conduct probe-mic verification.

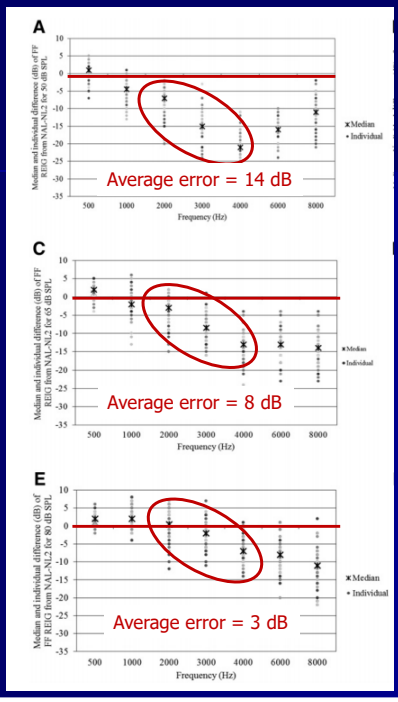
IS THERE "PROOF" THAT PLAN A WORKS?

So, for the professionals fitting hearing aids who *do not* believe in target verification . . . What is their Plan B?

By far, the majority use the proprietary default fitting of their favorite manufacturer.

There are many studies supporting the use of a validated prescriptive fitting. For example, from Valente et al (2018) . . .

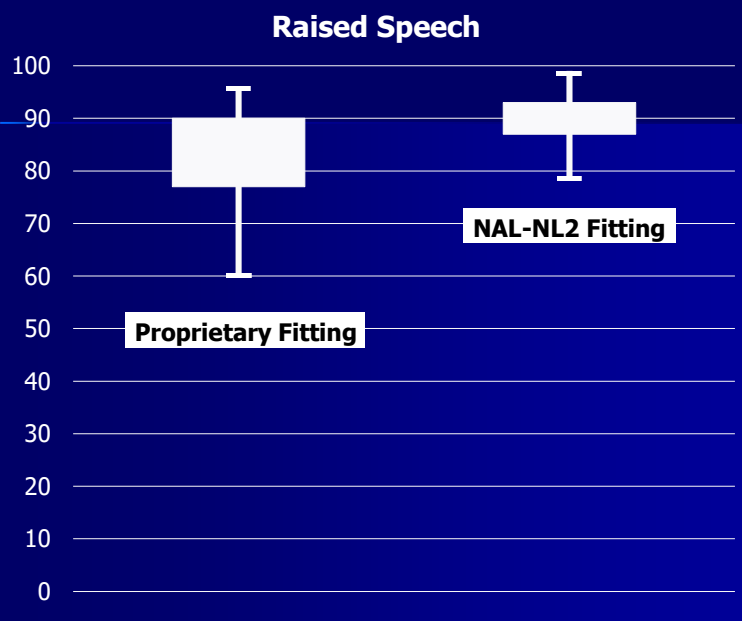
- Laboratory performance for speech recognition significantly better for NAL-NL2 fitting.
- Real world self-assessment inventories significantly better for NAL-NL2 fitting.
- After real-world trial, 19 of 24 preferred the NAL-NL2 algorithm.

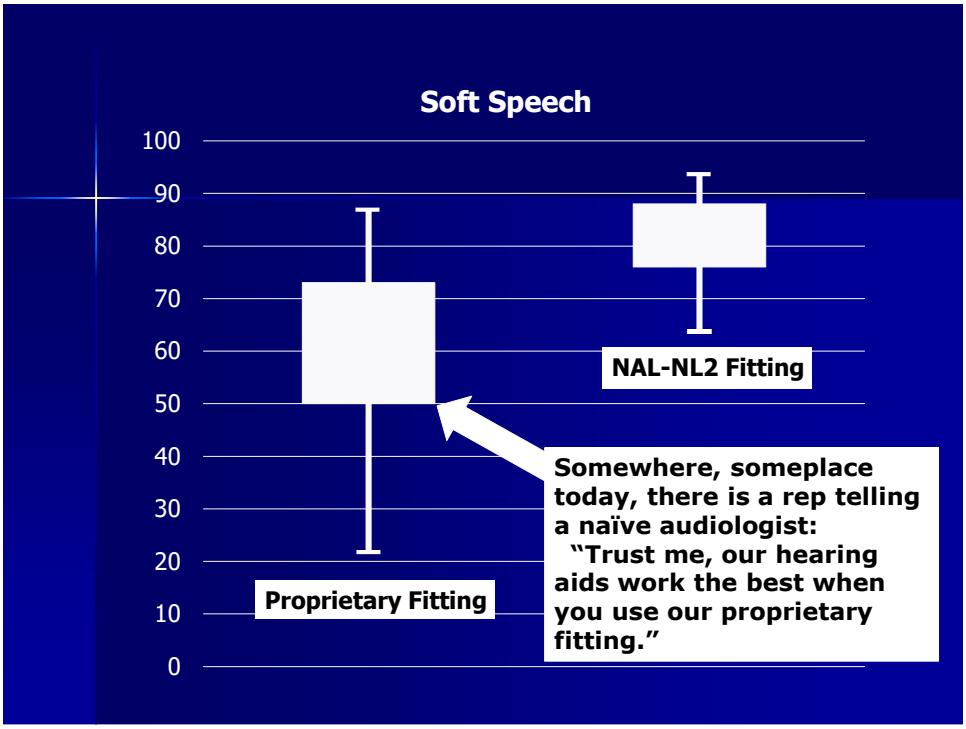


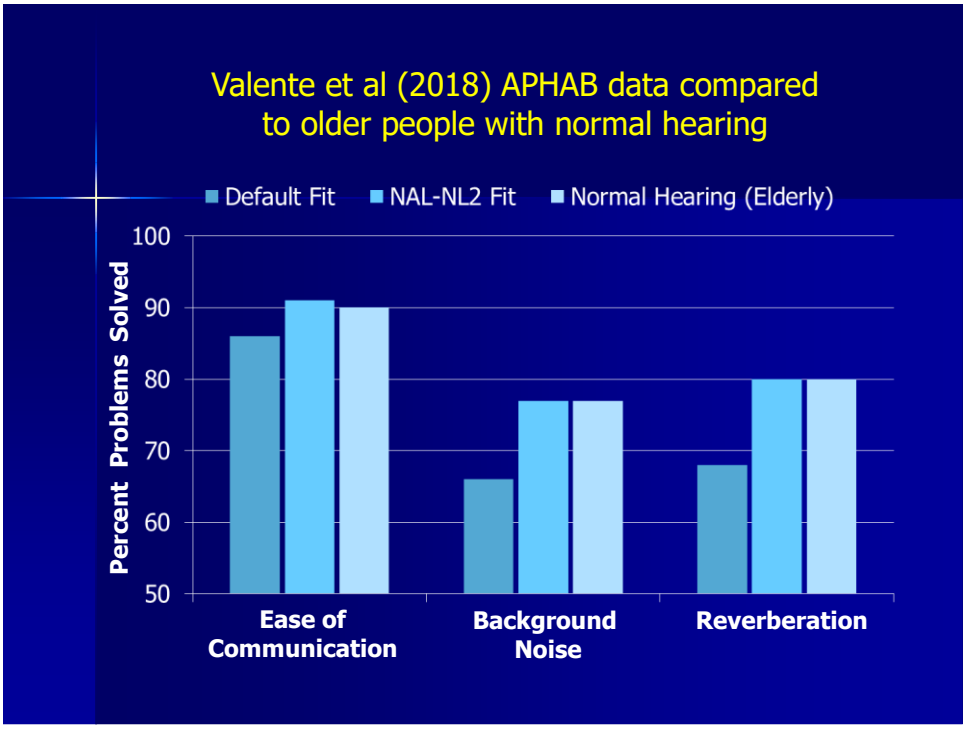
SOFT SPEECH

AVERAGE SPEECH

LOUD SPEECH




Soft Speech
100
90
80
70
60
50
40
30
20
10
0
NAL-NL2 Fitting
Proprietary Fitting
Somewhere, someplace today, there is a rep telling a naïve audiologist: "Trust me, our hearing aids work the best when you use our proprietary fitting."


Valente et al (2018) APHAB data compared to older people with normal hearing
Default Fit
NAL-NL2 Fit
Normal Hearing (Elderly)
Percent Problems Solved
100
90
80
70
60
50
Ease of Communication
Background Noise
Reverberation

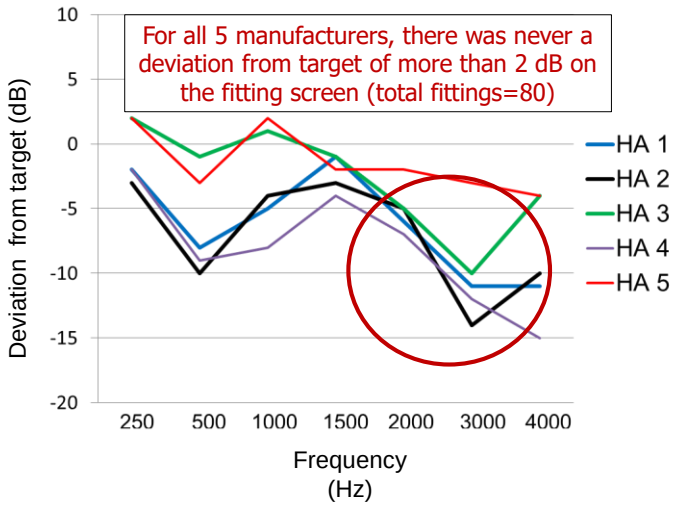
Gus's tip of the day . . .

So what if you just push the "NAL Easy Button" in the fitting software? You will likely see a perfect match to target on the fitting screen, but will you then obtain a NAL fitting in the real ear?

Probability of NAL fit when selecting "NAL" in the fitting software:

- Aazh and Moore (2007): Programmed to the manufacturer's NAL using four different types of hearing aids on 42 ears. Only 36% of fittings were within +/-10 dB of NAL targets. After re-programming, 83% were within +/-10 dB (100% for hearing aids with four or more channels).
- Aazh et al (2012): Of 51 fittings, after programming to the manufacturer's NAL, only 29% were within 10 dB of NAL targets; after re-programming, a match was obtained for 82% of the fittings.

Input=55 dB SPL: Real Speech of Verifit System
(Sanders et al, 2015)



Gus's second tip of the day . . .

USE (MANU ACT RERS' NAL ND FI TING CREEN IM ULATIO

How many people in the U.S. are suffering from being fitted incorrectly?

Results of Leavitt et al (2017) target match study (97 patients; 176 fittings)

Mismatch from target by 5 dB or more?

98%

Mismatch from target by 10 dB or more?

72%

Note: The mismatch from target was no different when the hearing aid had been fitted by an audiologist or a hearing instrument specialist.

We have a big problem!

Which takes us back to this slide from the beginning of this talk

Something I made up.

Something a hearing aid manufacturer made up.

Something that has been validated with 30-40 years of research.

How can you ensure that your fitting goals are being met?

Click on the manufacturer's "Magic Button"

Ask the Patient.

Conduct probe-mic verification.

Maybe autoREMfit can help

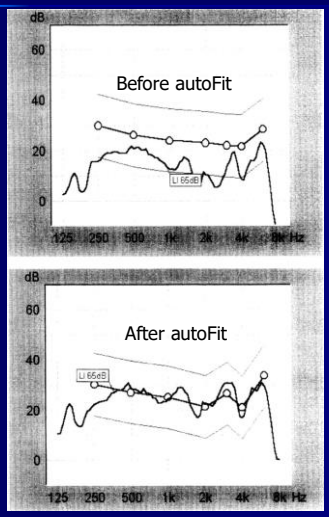
- It's a method of integrated/automated verification.
- Either the fitting software borrows information from the probe-mic equipment, or the probe-mic equipment borrows information from the fitting software. Most systems will fit to both NAL and DSL and maybe even . . . Gasp . . . Proprietary.
- The audiologist must make the background decisions in the fitting software, ensure that the patient and the probe tube are positioned correctly, and make a few mouse clicks to go through the autoREMfit software.
- The actual programming of the hearing aids, however, is conducted automatically

Some common names for autoREMfit . . .

- Oticon: REM Auto-Fit
- Phonak: TargetMatch
- ReSound: AutoREM
- Signia: AutoFit

Note 1: The probe-mic manufactures might have different names for it.
Note 2: The downstream brands of the above companies might have different names for it.

Is autoREMfit something new?



From: *Trends in Hearing*. Probe-Microphone Measurements: 20 Years of Progress?

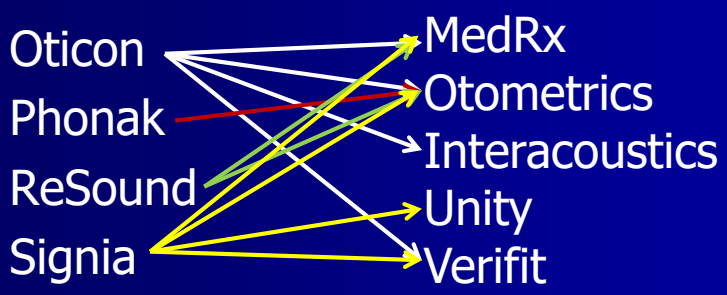
Mueller (2001)

To put that date into perspective

A cell phone with a camera was not invented until 2002

(640 x 480 pixels!)

Who is integrated with whom?



From a probe-mic equipment standpoint, the company with the most partners appears to be Otometrics

Manufacturer	Module Name
Amplifon	SmartFit
Amplifon	Genie 2
Audigy	AudigyFit 2
Audika	Genie 2
Beltone	SolusMax
Bernafon	OASIS NXT
Bernafon	OASIS NXT PL
Bernafon	OASIS NXT Costco
Interton	Interton Fitting
Oticon	Genie 2
Oticon	Prescriptives 2
Oticon	Genie 2 VA
ReSound	Audigy
ReSound	SmartFit
ReSound	Danalogic
Resound	Advance
SBO Hearing	Philips HearSuite
Sivantos	CONNEXX
Sonic Innovations	EXPRESSfit Pro

Why you might like using autoREMfit

- The fit-to-target most likely will be faster than traditional clinician programming
- Requires less thought; maybe your tech could do the fittings for you
- If you're inexperienced, the fit-to-target might be better than clinician-fit
- Good when fitting a product that is out of your wheelhouse
- Could be impressive for the patient—a sales tool

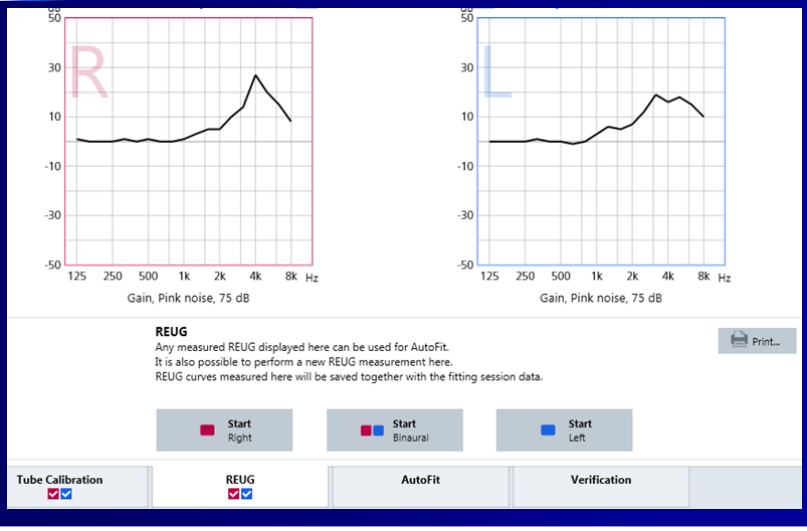
Why you might NOT like using autoREMfit

- The fit is not valid, or consistent with your verification standard
- The fit is different from your preferred method of probe-mic verification
- The fit is not for the input levels that you prefer
- You don't like the concept: Your real-ear verification skills are what make you special—now everyone can do what you do

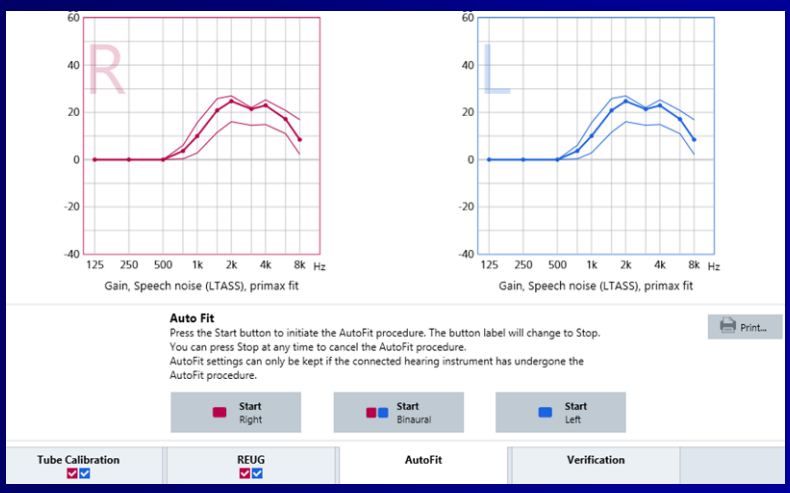
Some equipment examples:

Thanks to John Pumford and Navid Taghvaei for providing the screen shots.

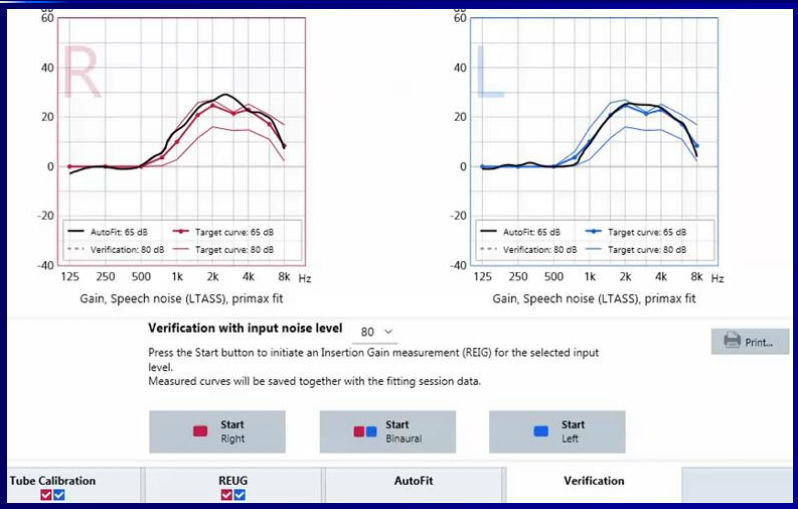
We'll start with Unity/Signia: Simultaneous bilateral measure of REUGs



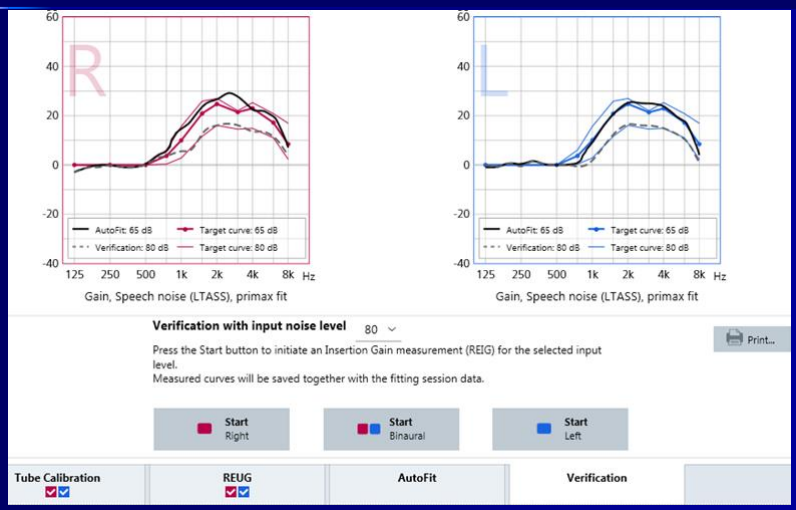
Select AutoFit: REIG targets displayed for 55, 65 and 80 dB SPL



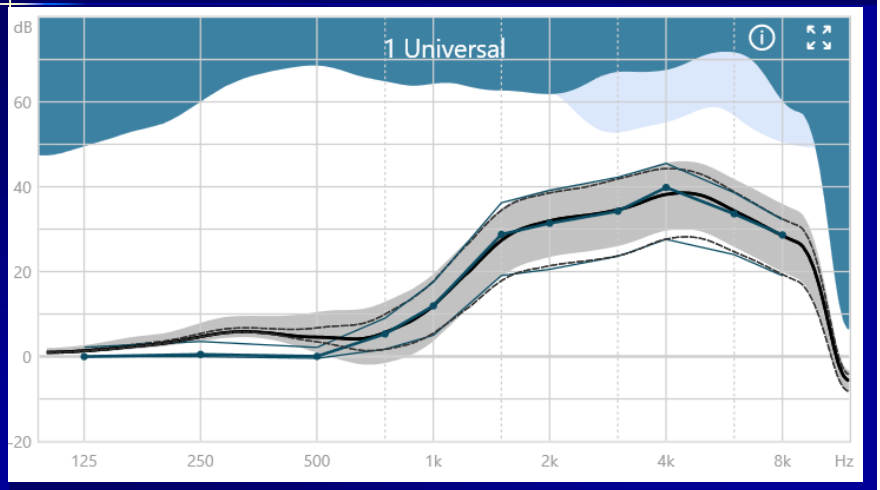
AutoFit complete for 65 dB input



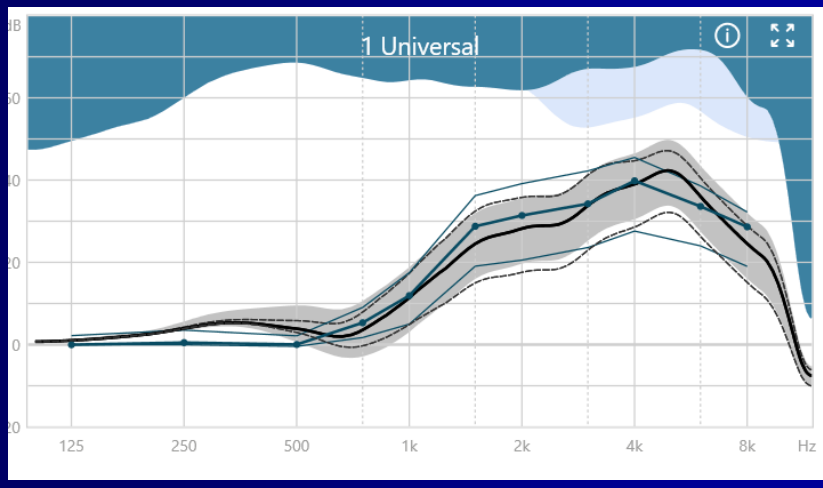
Verification using 80 dB SPL input (see bottom dashed line)



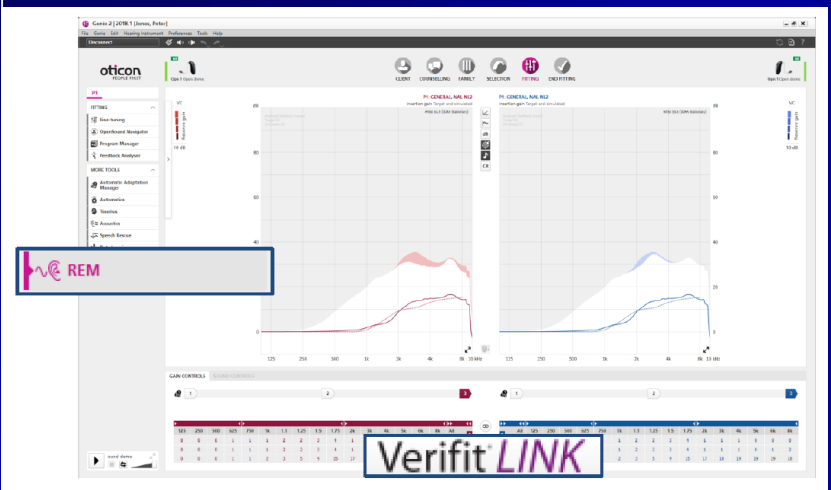
Software simulation before autoREMfit



Software simulation after autoREMfit

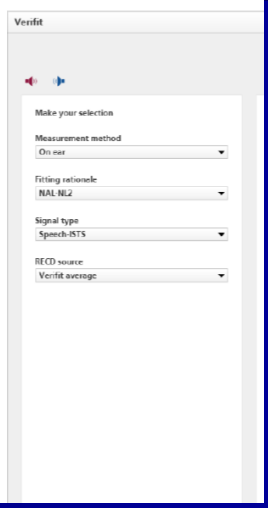


Another example from Verifit/Oticon: Configure hearing aids and go to fitting



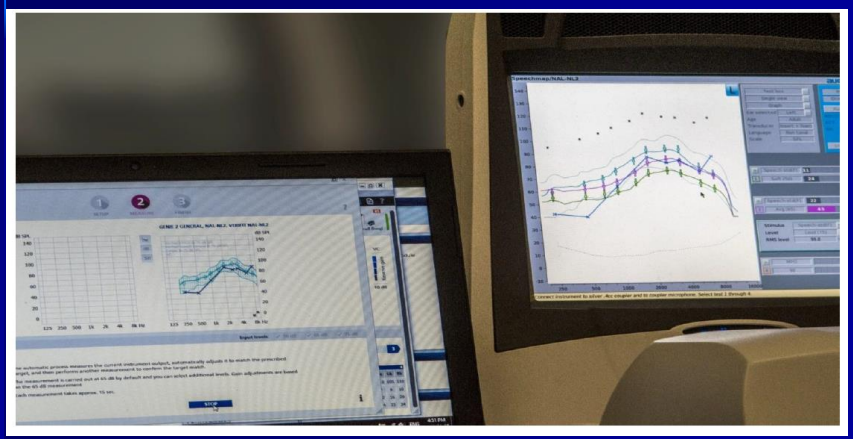
Parameters selection

- Measurement method
  - On ear
  - Test box
- Fitting rationale
- Signal type
- RECD source
  - Verifit average
  - Verifit measured
  - Genie 2

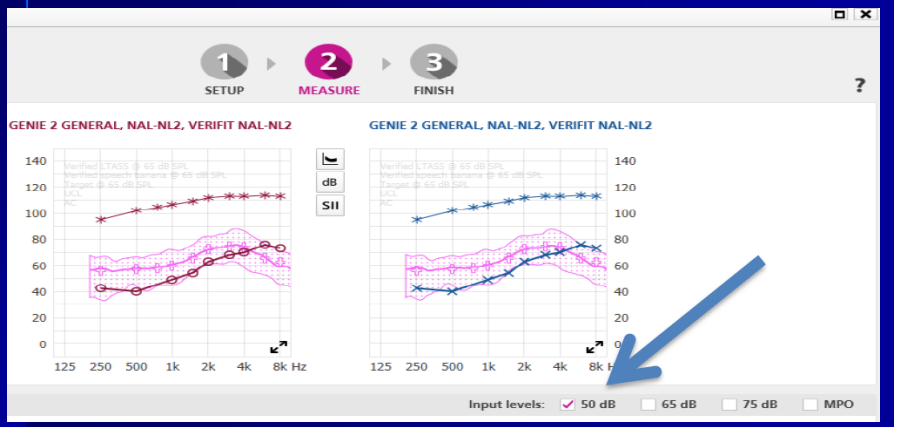


Measurement process

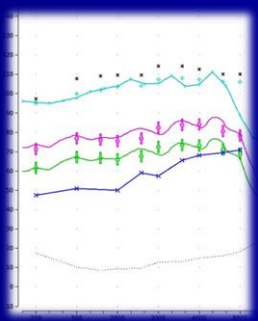
Display is visible on both software fitting screen and Verifit screen during the autoREMfit process



Following autoREMfit to 65 dB SPL input, clinician can select autoREMfit for another input if desired



Let's take a look at some of the autoREMfit research



20Q: Hearing Aid Verification - Will AutoREMfit Move the Sticks?

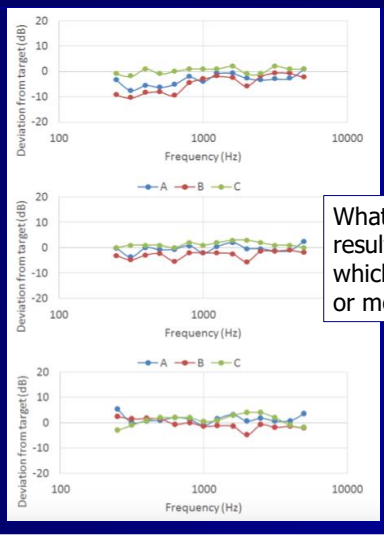
H. Gustav Mueller, PhD, Todd A. Ricketts, PhD

July 9, 2018

https://www.audiologyonline.com/articles/20q-hearing-aid-verification-226-23532

- Four models of hearing aids: Oticon, ReSound, Signia and Phonak
- An easy-to-fit audiogram was selected: 30 dB loss in the lows sloping to a 60 dB loss in the highs.
- Used the autoREMfit procedure for each company with the Otometrics probe-mic equipment. Fitted to NAL-NL2. Input signal varied among companies.
- After fitting using autoREMfit, conducted traditional speechmaping verification for 55 dB, 65 dB and 75 dB SPL inputs, again using the Otometrics equipment. Input signal was the ISTS.

What we found: Average deviation from target for three products for 55, 65, and 75 dB SPL input levels (shown top to bottom)



What is not shown are the results from Product #4, which had errors of 10 dB or more for all inputs.

Using your friendly probe-mic equipment . . .

If you are considering using autoREMfit, and your probe system is compatible with your favorite hearing aid brand . . .

- Grab a couple friends or colleagues over lunch (no need for them to have a hearing loss).
- Fit them with your favorite hearing aid brand—enter an easy-to-fit audiogram.
- Conduct autoREMfit according to software instructions.
- Without changing anything, then conduct usual speechmapping for 55, 65 and 75 inputs using a signal such as ISTS.
- How well does the output match targets?

Fast and easy fitting and verification with integrated real-ear measurement

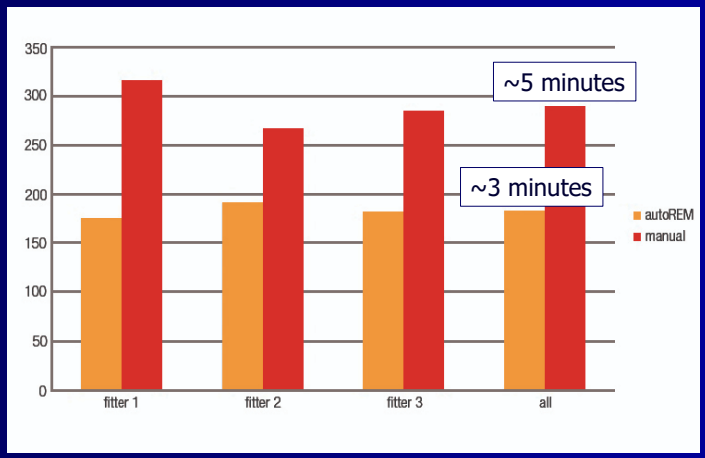
Erica Koehler Snehal Kulkarni
Hearing Review, 2014

What they did . . .

- The time required for the AutoREMfit REIG fitting was compared to the time required to fit to target by the clinician. Fitted to the NAL-NL2.
- Difference (in dB) between clinician-fit and autoREMfit was calculated.

Hearing aids/software=ReSound Probe-mic equipment=Otometrics

What they found . . .



Validity, Reliability, and Efficiency of the Signia AutoFit Procedure

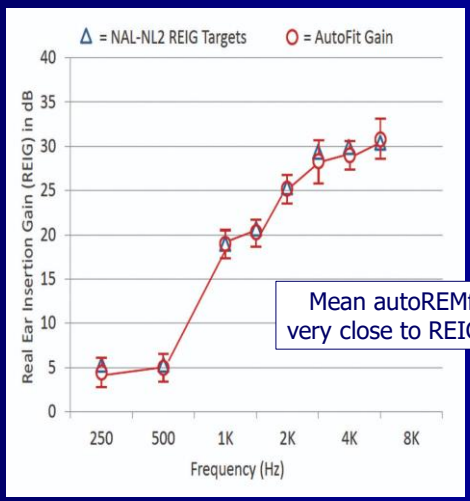
Joachim Baumann, Thomas Powers, & Eric Branda
Hearing Review 2018

What they did . . .

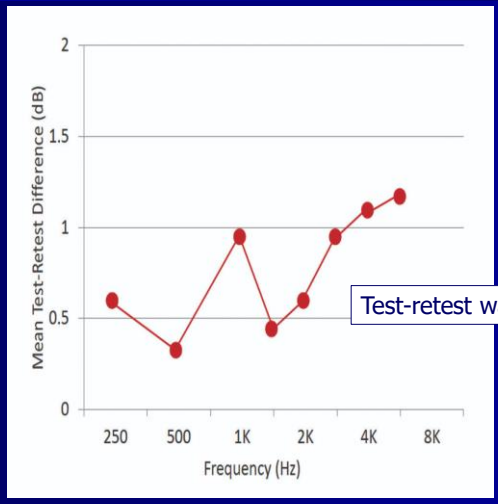
- AutoREMfit REIGs were compared to the NAL-NL2 prescriptive REIGs to assess the accuracy of the procedure
- Test-retest of AutoREMfit REIG values were assessed
- The resulting autoREMfit was compared to REAR-based NAL-NL2 prescriptive targets.

Hearing aids/software=Signia Probe-mic equipment=Unity

What they found . . .

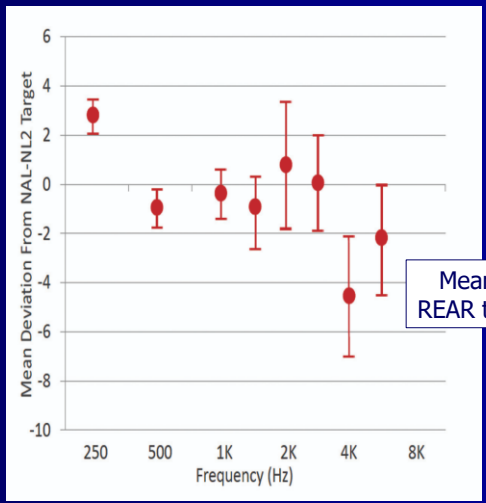


What they found . . .



Test-retest was good

What they found . . .



Mean comparison to REAR targets acceptable

A preliminary investigation into hearing aid fitting based on automated real-ear measurements integrated in the fitting software: test–retest reliability, matching accuracy and perceptual outcomes

Sam Denys, Matthias Latzel, Tom Francart & Jan Wouters
International Journal of Audiology 2018

What they did . . .

- Compared autoREMfit to manufacturer's fit for the DSLv5 and NAL-NL2
- Compared autoREMfit to "Clinician Fit" for the DSLv5 and NAL-NL2
- Examined test-retest reliability

Hearing aids/software=Phonak Probe-mic equipment=Otometrics

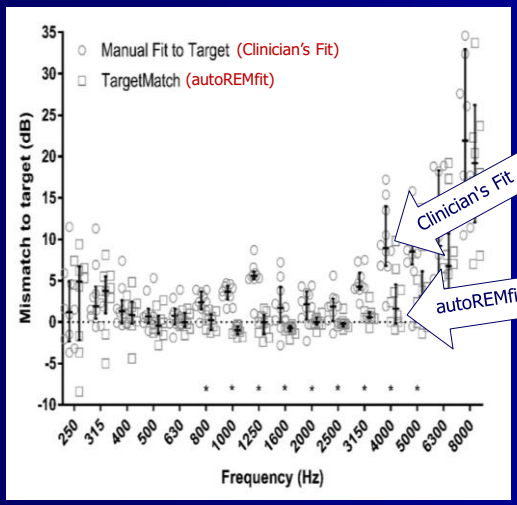
What they found . . .

	REUG (dB)		REAR (dB)	
f (Hz)	autoREMfit	Clinician's Fit	autoREMfit	Clinician's Fit
250	0.1	0.3	2.3	3.2
315	0.1	0.3	1.4	2.5
400	0.4	0.4	1.2	2.2
500	0.4	0.4	1.6	2.0
630	0.3	0.4	2.1	1.7
800	0.9	0.5	1.2	1.0
1000	0.3	0.6	1.0	1.3
1250	1.6	0.6	0.5	1.6
1600	1.1	2.1	0.2	1.4
2000	1.3	3.1	0.4	1.6
2500	0.4	1.2	0.6	2.2
3150	Test-retest good for both autoREMfit and Clinician Fit, for both REUG and REAR			2.0
4000				2.2
5000				2.9
6300	1.4	1.9	2.3	2.6
8000	2.7	2.7	2.5	4.2

What they found . . .

- First Fit mean target mismatch (across all frequencies):
  - 4.3 dB
- Clinician's Fit mean target mismatch (across all frequencies):
  - 5.4 dB
- autoREMfit mean target mismatch (across all frequencies):
  - DSLv5: 2.6 dB
  - NAL-NL2: 1.5 dB

What they found . . .



A Comparison of Automated Real-Ear and Traditional Hearing Aid Fitting Methods

Paula Folkeard, John Pumford, Parvaneh Abbasalipour, Nicole Willis, & Susan Scollie
Hearing Review

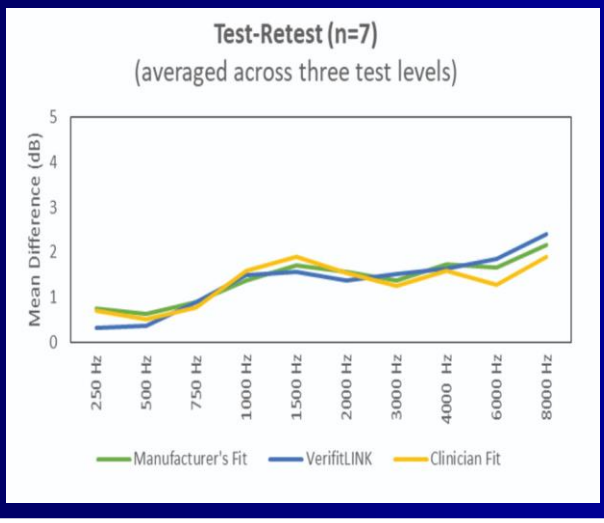
What they did . . .

- Compared deviation from target (rms error) and SIIs for DSLv5 fittings for:
  - Manufacturer's First-Fit
  - Clinician Fit
  - autoREMfit
- Assessed the test-retest accuracy of the three different methods
- Assessed the test-time for the three different methods

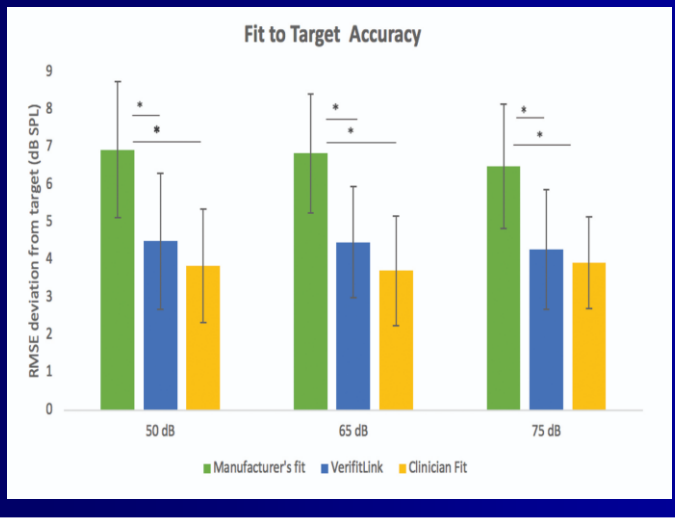
Hearing aids/software=Oticon Probe-mic equipment=Verifit

e

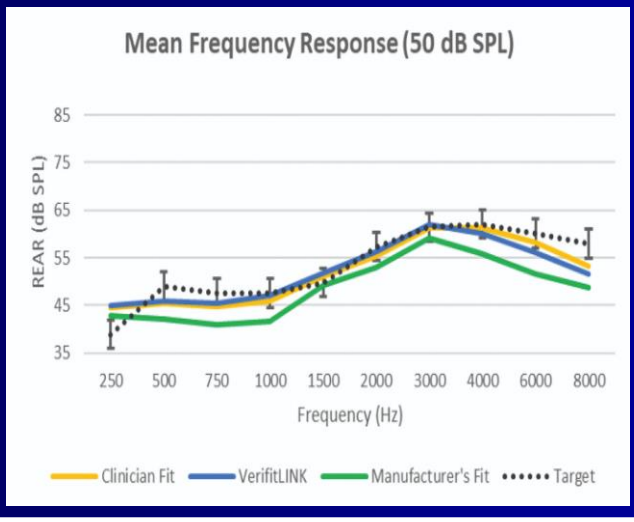
What they found . . .



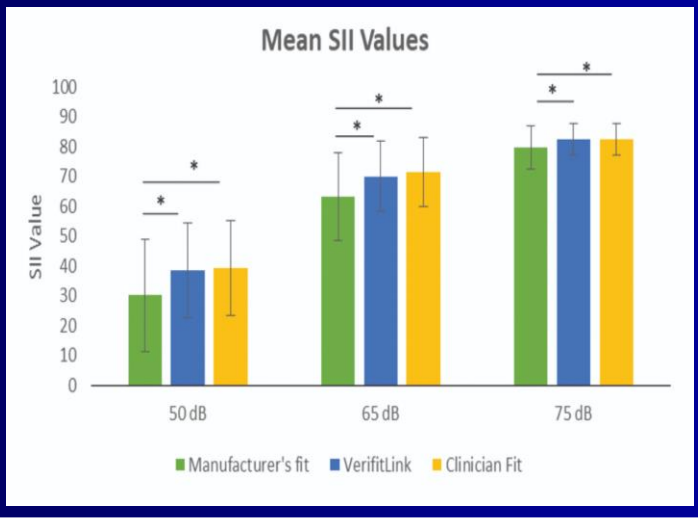
What they found . . .



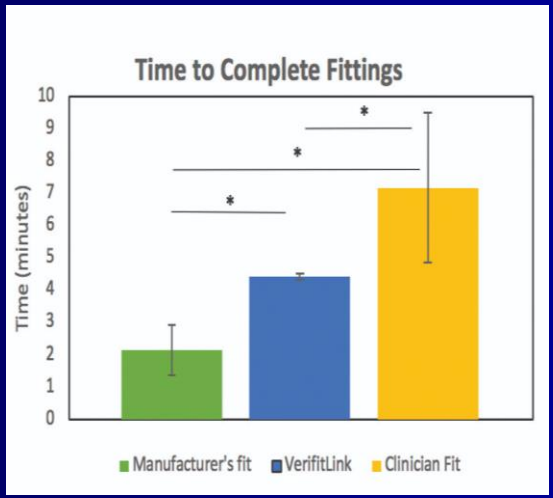
What they found . . .



What they found . . .



What they found . . .



In case you want some additional information about these studies:

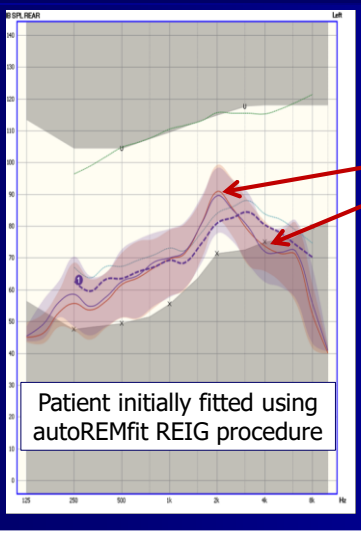
- Baumann J, Powers T, Branda E. (2018) Validity, reliability, and efficiency of the Signia AutoFit procedure. *Hearing Review*. 2018;25(9):26-30.
- Folkeard, P., Pumford, J., Kabirrah, P.A., & Scollie, S. (2018) Linking Audioscan Verifit with Oticon Genie: Comparison of manual and automatic hearing aid fittings. Paper presented at the American Academy of Audiology Conference, Nashville, TN.
- Koehler, E.E., & Kulkarni, S. (2014). Fast and easy fitting and verification with integrated real-ear measurement. *Hearing Review, 21*(10), 36-40.
- Latzel, M., Denys, S., Anderson, S., Francart, T., Wouters, J., & Appleton-Huber, J. (2017). An integrated REM system with proven accuracy and reliability. *Hearing Review, 24*(10), 36-39.

Issues to consider with autoREMfit

- Some autoREMfit procedures fit to the REIG, not the REAR. Additionally, they measure and use the individual's REUG. Typically, we would fit to REAR targets that either do not consider REUG, or are based on an average REUG.

Potential problem with REAR match when measured REUG is used for REIG calculation

Patient who had larger than average REUG at 2000 Hz, and smaller than average at 4000 Hz.



Fitting error of 10 dB

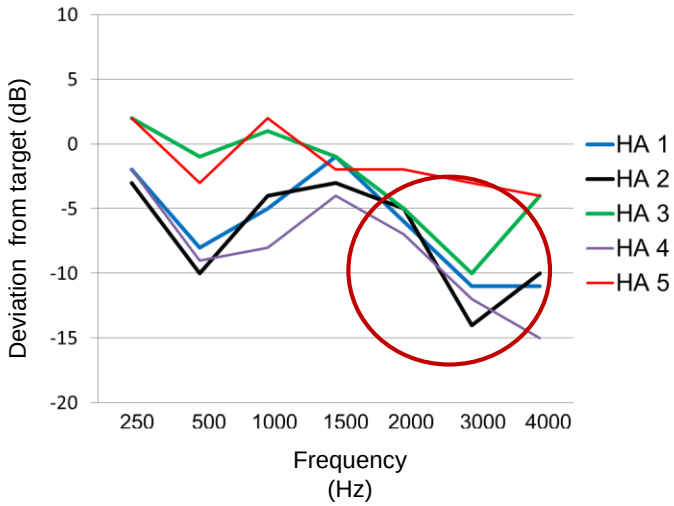
Issues to consider with autoREMfit

- Some of the autoREMfit procedures turn off all hearing aid features (e.g., digital noise reduction) during the fittings process; we normally verify with all special features "on."

Issues to consider with autoREMfit

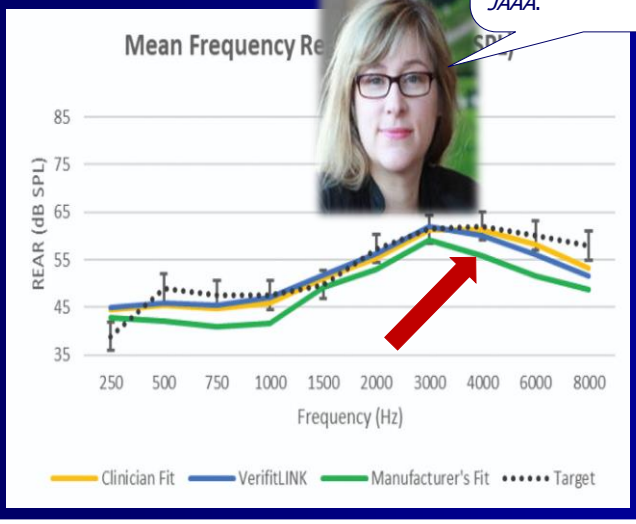
- We know that the manufacturer's presriptive targets are not the same targets generated by probe-mic equipment. Does the automatic procedure fit to the "manufacturer's NAL" or to the "probe-mic NAL," the latter of which we believe is the closest representation to the true NAL.

Input=55 dB SPL: Real Speech of Verifit System
(Sanders et al, 2015)



And the DSL?

Gus . . .Your audience might like to know that we just had a paper on this topic accepted at *JAAA*.



Look for JAAA posting . . .

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177 Issues and **57 fast track articles** and **14 supplementary data items** are available (most recent: August 16, 2019)

Issues [177] | Fast Track | Supplementary Data

57 fast track articles have been identified for this journal

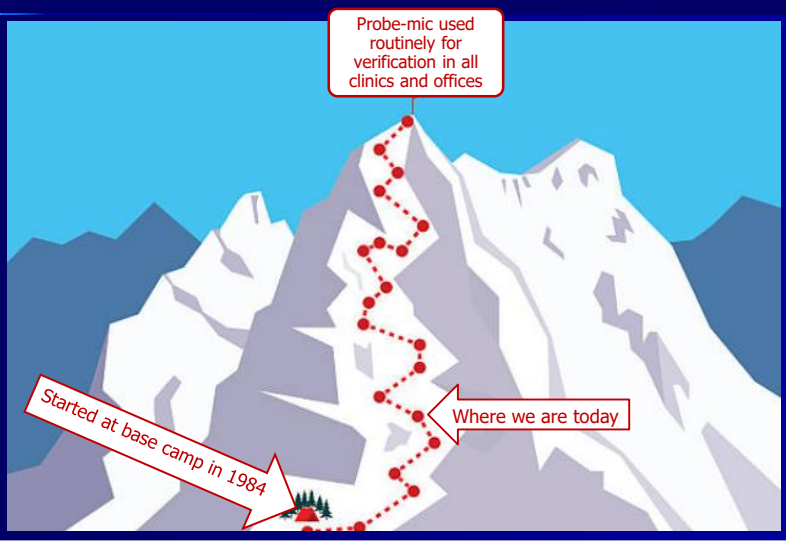
Issues to consider with autoREMfit

- Some of the autoREMfit methods only fit to a 65 dB input signal. Will there be a reasonable fit-to-target for soft and loud inputs using these methods?

What Mueller and Ricketts recommended in 2018 (and Mueller still agrees with today):

- Use the NAL-NL2/DSLv5 targets of the probe-mic equipment, not those of the hearing aid fitting software.
- Fit to REAR targets using real-speech inputs (e.g., ISTS).
- As best as possible, also fit to soft and loud speech targets, in addition to average speech inputs.
- If a fit to REIG targets is required part of the implementation, provide the option of using an average REUG.

So is autoREMfit a game-changer in the world of probe-mic measures?



signia
Life sounds brilliant.

Thank you!!!