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Verification Enhancements for BCD:

Elevating Care for Ponto Users using Verifit 2

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Verification Enhancements for BCD: Elevating Care for Ponto Users using Verifit 2

Presented by: Alicia Wooten, John Pumford, Laurie Mauro
Oticon Medical | Audioscan | CHOP

Because
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Learner Outcomes

- After this course, participants will be able to describe the verification capabilities of Audioscan Verifit2 for bone conduction devices (BCD) and its application in optimizing Ponto fittings.
- After this course, participants will be able to identify best practices for using the Verifit Skull Simulator, including proper setup and fitting verification techniques.
- After this course, participants will be able to apply Speechmap testing principles to assess and verify Ponto fittings for accurate and effective patient outcomes.

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Risks/Benefits

- The applicability and accuracy of the course content may vary by the clinical, geographical, and cultural context; you should evaluate the course accordingly.
- As healthcare is rapidly evolving, new findings may change the validity of the information presented in this course. Providers should always consult the latest research and guidelines from professional associations.
- The interventions discussed in this course may be limited in generalizability, requiring practitioners to consider specific individual and population factors.
- The course may not cover all possible risk factors, diagnostic methods, or treatment options, and complex cases may require additional considerations.
- Healthcare providers should apply cultural competence and sensitivity to ensure effective and respectful care based on their patients' diverse needs.
- Providers should always evaluate the limitations of diagnostic and screening tools, considering their potential for false results as well as any ethical implications.
- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.

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Introduction

- **Alicia Wooten (Oticon Medical)** – Lead Auditory Technical Specialist and National Training Manager
- **John Pumford (Audioscan)** – Director of Audiology, Education, and Clinical Research
- **Laurie Mauro (CHOP)** – Clinical Specialist Audiologist, experienced pediatric audiologist at the Children's Hospital of Philadelphia (CHOP) specializing in BCDs.

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Overview of Verifit2 for BCDs

- Objective hearing aid fitting system traditionally used to verify air conduction devices
- Evolved to provide objective verification capabilities with BCDs
- Supports best practice recommendations and protocols
- Recent enhancements include addition of DSL-BCD 2.0 Fitting Formula

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The challenge with BCD verification

- Lack of objective verification measures for clinical use
- Behavioral verification methods have limitations:
  - Test/retest variability
  - Limited frequency resolution
  - No estimate of maximum output
  - Stimuli are not real-world
  - Inaccurate estimates of gain at real-world levels

Hawkins (2004); Hodgetts et al. (2010)

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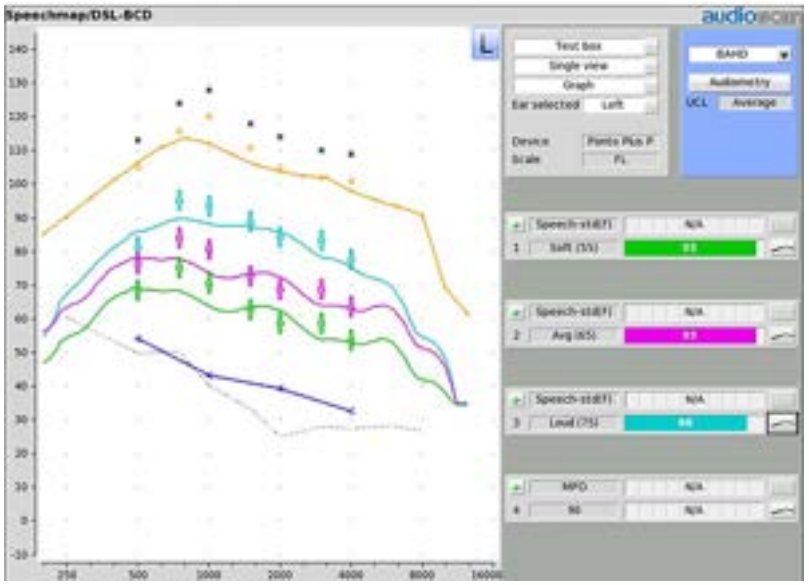
A solution for BCDs

- Measure the device

- Plot output in force level



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Verifit Skull Simulator

- "Coupler" for abutment-based BCDs
- Skull simulation via mass & spring (Equivalent to TU1000)[1]
- Measures vibrational force in µN
- Calibrated (0 dBFL = 1 µN)

1 Hakansson and Carlsson - Skull Simulator for Direct Bone Conduction Hearing Devices 1989 Scan Aud (TU-1000)

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Verifit Skull Simulator

- Replaces the Acoustic Coupler
- Couples to all Ponto and BAHA Devices

Self-powered

No adaptor required

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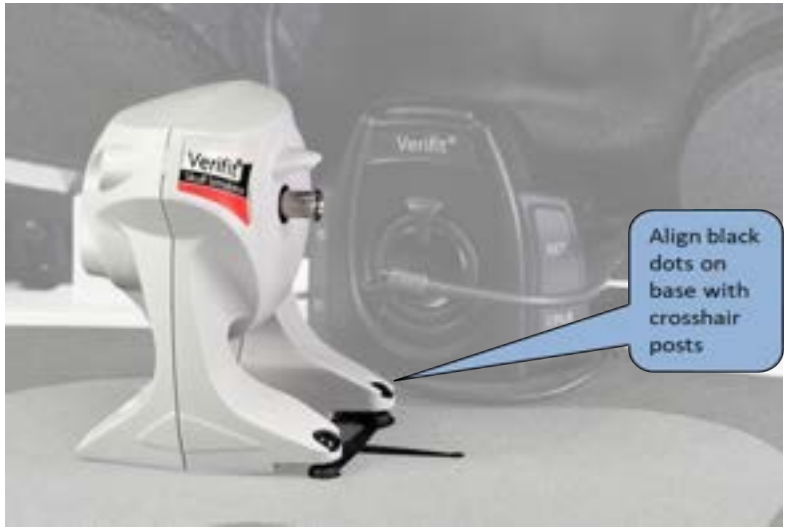
Verifit Skull Simulator

- Left/Right positioning



Verifit Skull Simulator

- Attach bone conduction device (BCD) to abutment
- Align Verifit reference mic within 1-3 mm of BCD front microphone
- Rotate device so mics are parallel with test box floor

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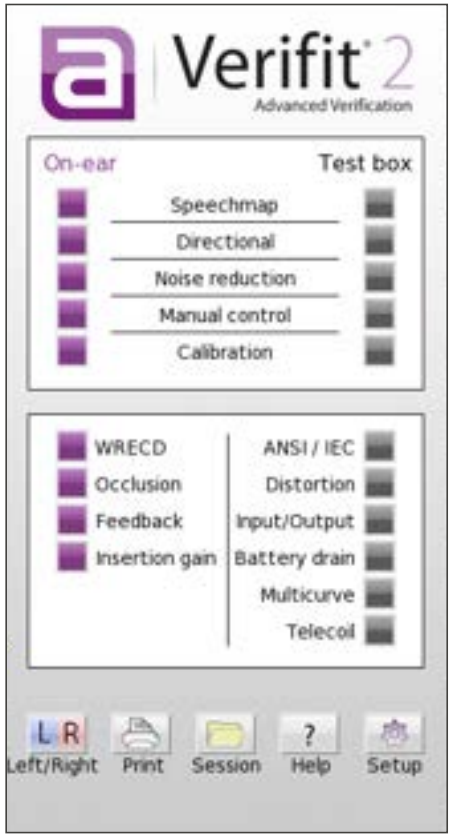
BCD Verification Possibilities



- Speechmap Verification
- Accessory Verification (Remote Mics, etc.)
- Adaptive Feature Verification
  - Directional
  - Noise Reduction
- Quality Control
  - “ANSI”
  - Distortion
  - I/O
  - Battery drain
- …

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Speechmap Testing for BCDs

FL-o-gram

- Visualizes amplification of speech sounds
- Measures force level (FL) instead of sound pressure level (SPL)
- Confirms match to prescribed targets, output relative to patient's auditory area

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DSL-BCD 1.1 Considerations

- Designed for percutaneous fittings
  - Soft band fittings were ‘descriptive’, not ‘prescriptive’

- Required insitu (dial level) thresholds gathered with BCD and fitting software
  - No support for standard BC oscillator audiometric data

Hodgetts & Scollie (2017)

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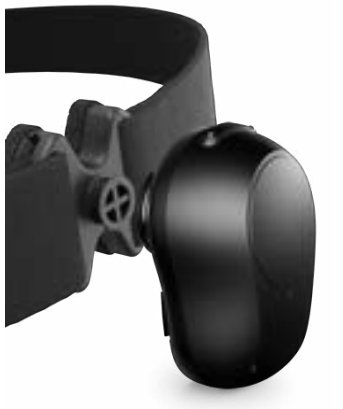
DSL-BCD 2.0 Key Enhancements

- Supports prescriptive verification of softband BCDs
  - Insitu with softband accounts for skin transmission loss (soft tissue correction), device characteristics

- Supports use of standard BC oscillator hearing thresholds when insitu cannot be measured
  - Age-based skin transmission loss transform applied to predict insitu



Beh et al. (2024)

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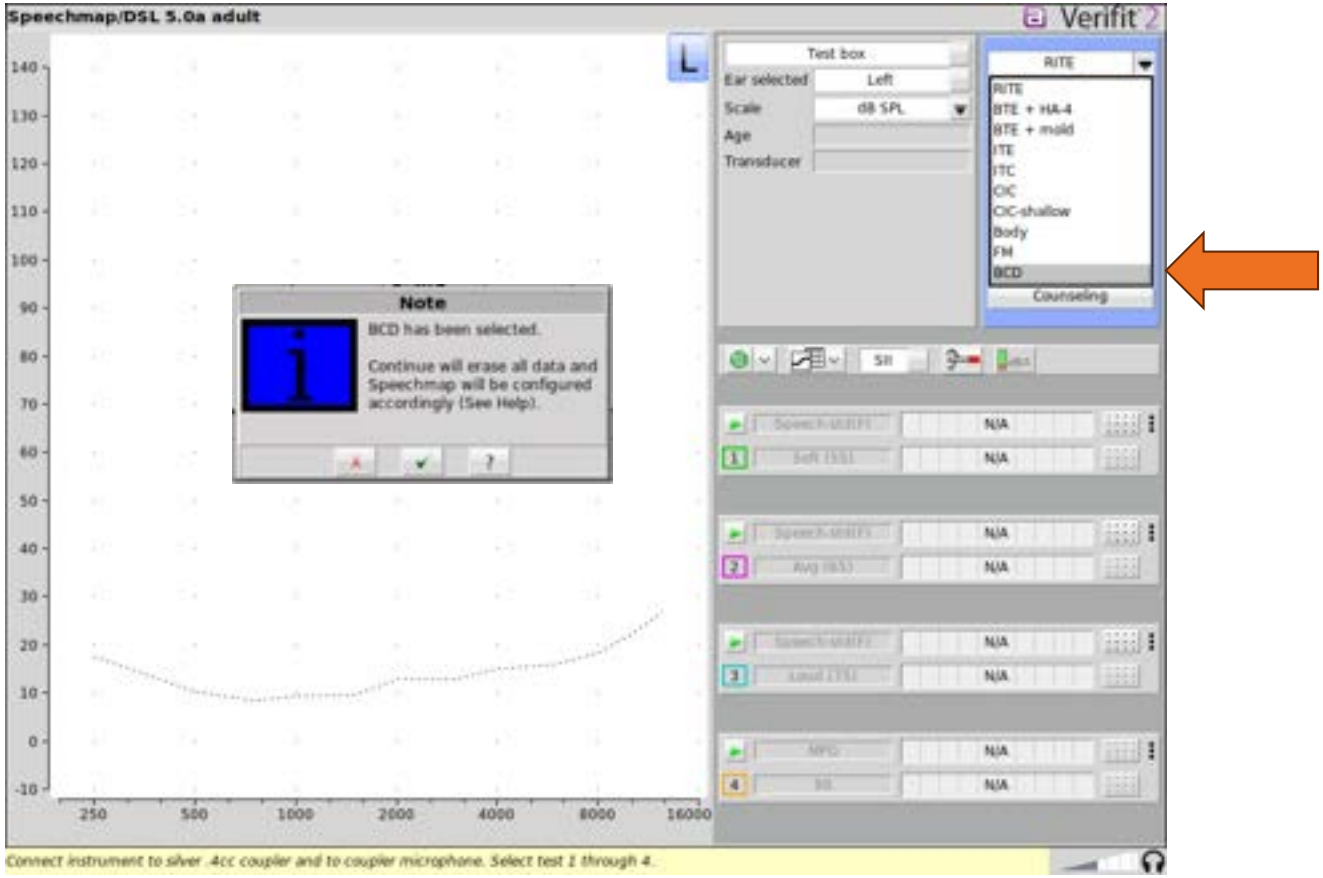
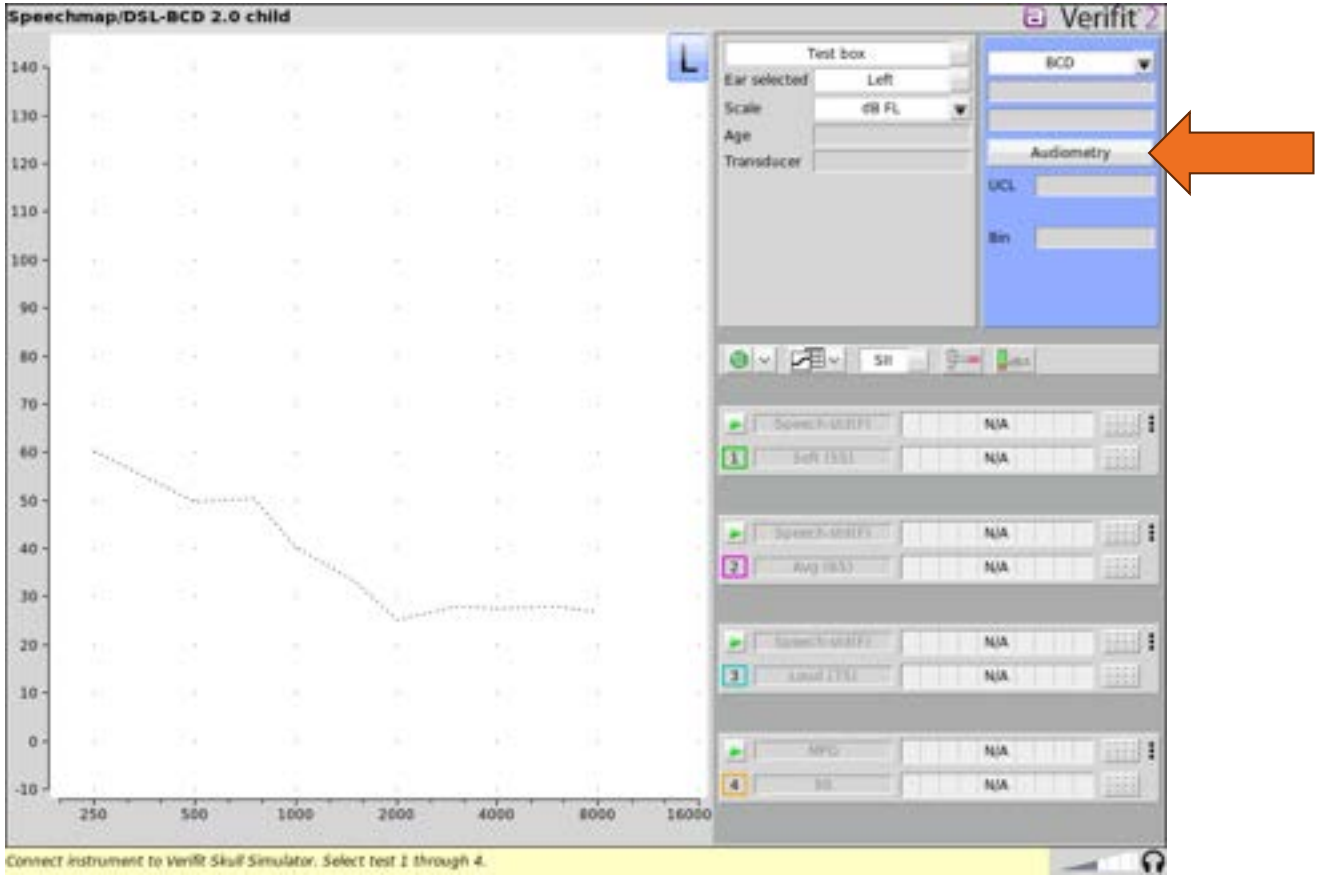
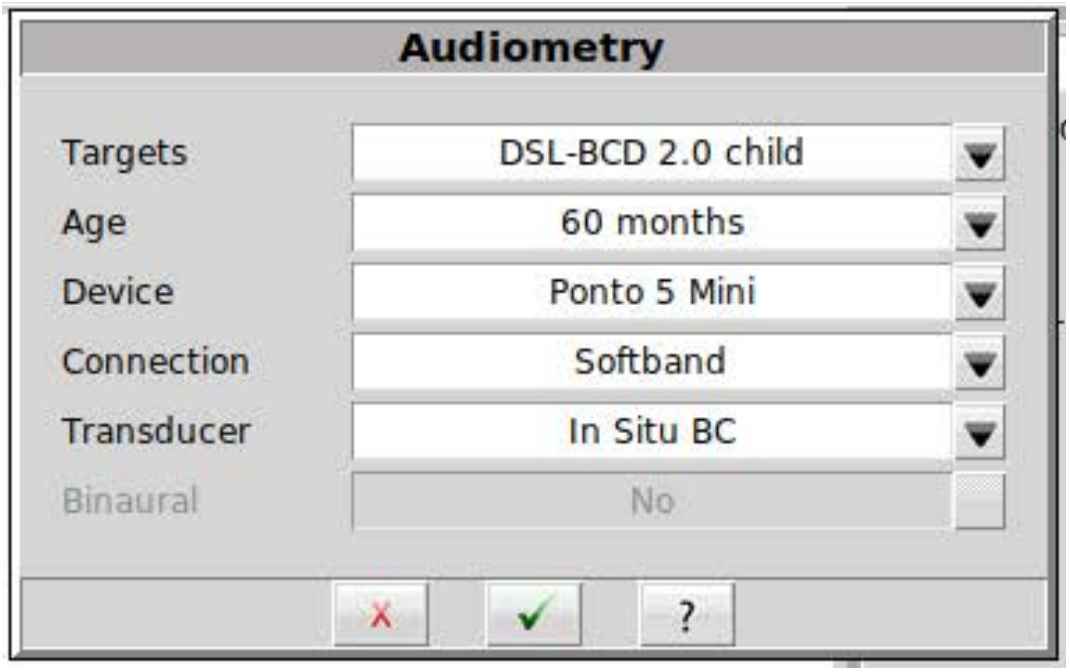
Speechmap - BCD



Select Audiometry

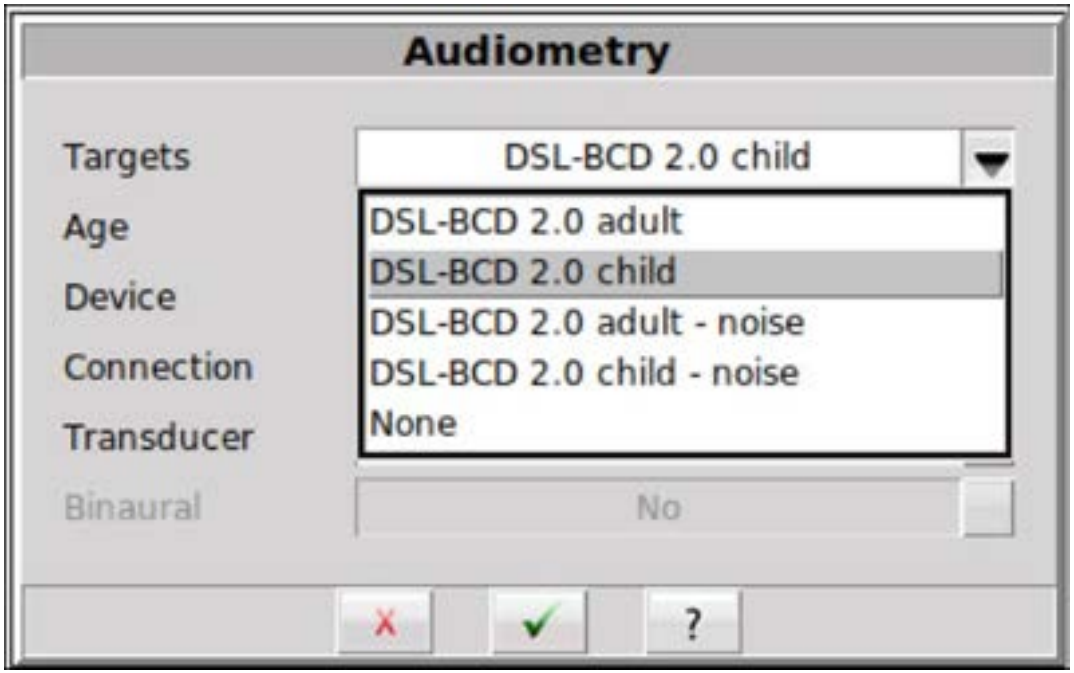


DSL BCD 2.0 Audiometry Selections



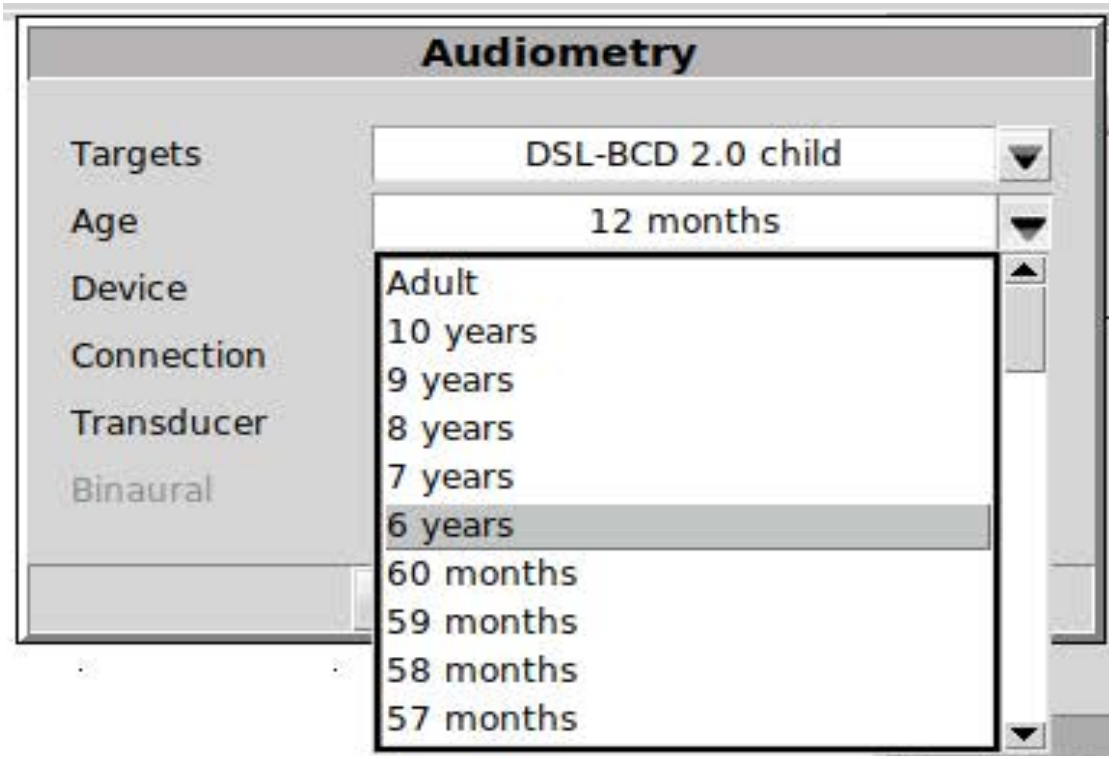
DSL BCD 2.0 Audiometry Selections

Targets



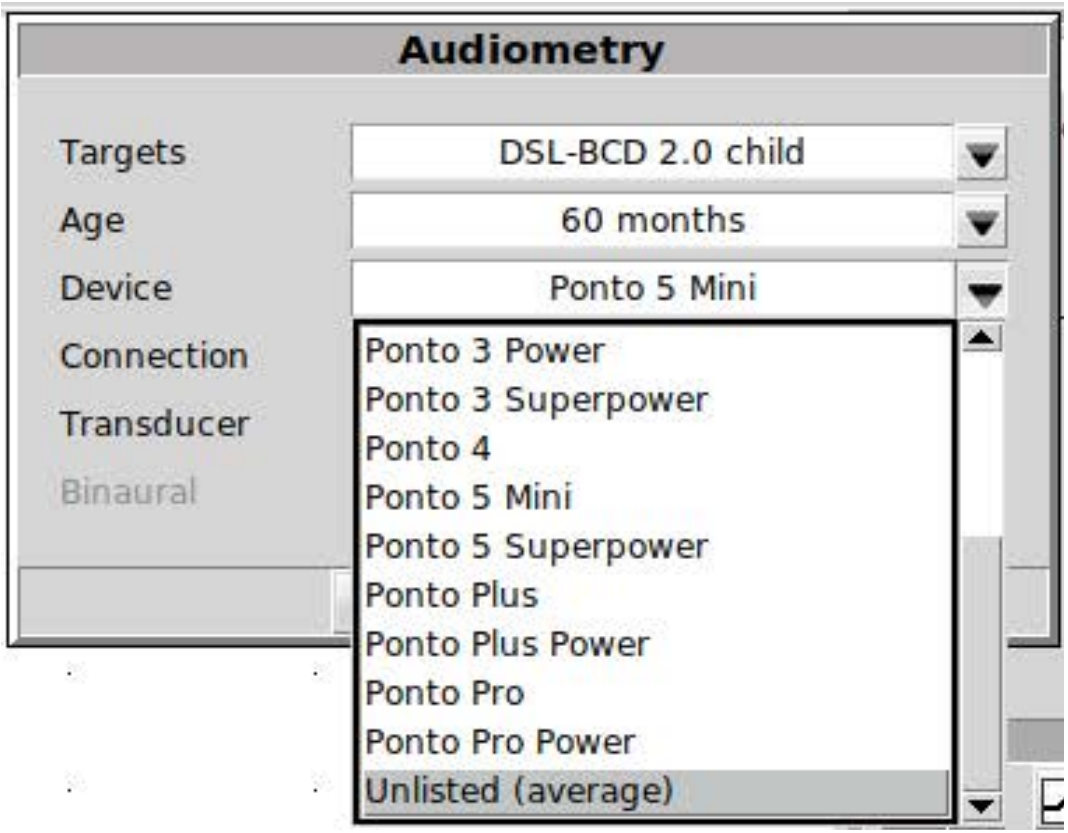
DSL BCD 2.0 Audiometry Selections

Age



DSL BCD 2.0 Audiometry Selections

Device



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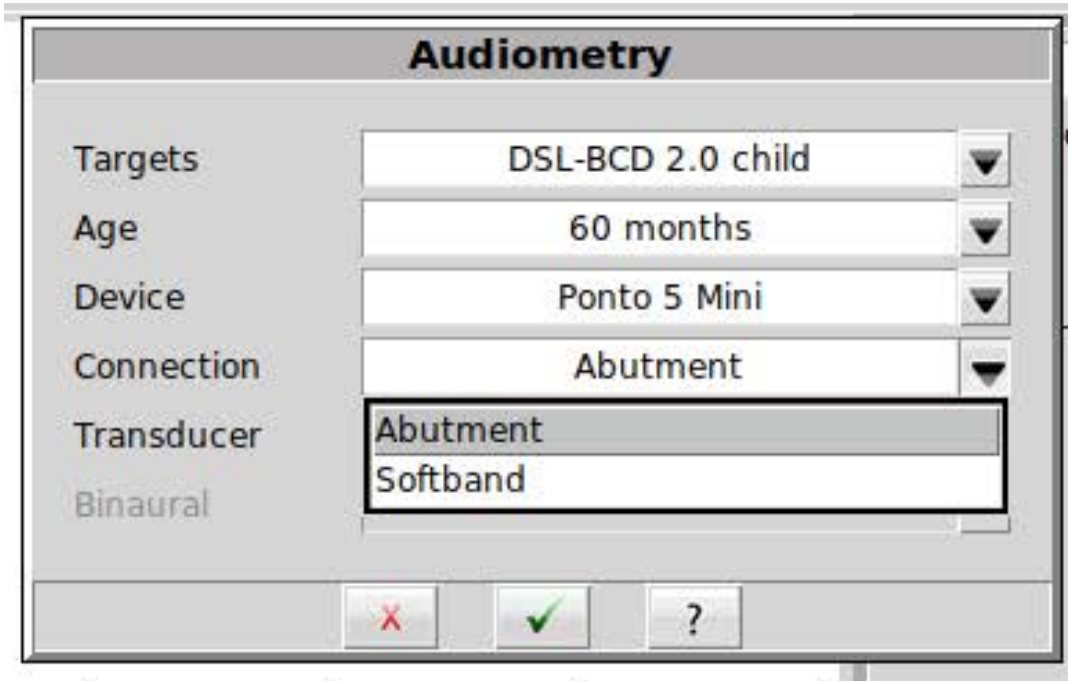
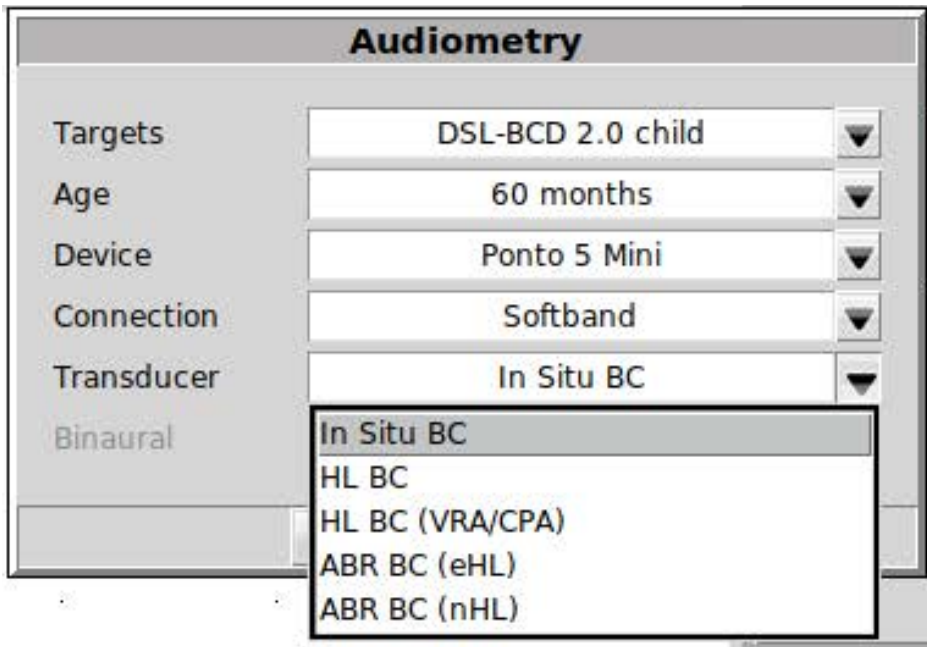
DSL BCD 2.0 Audiometry Selections

Connection



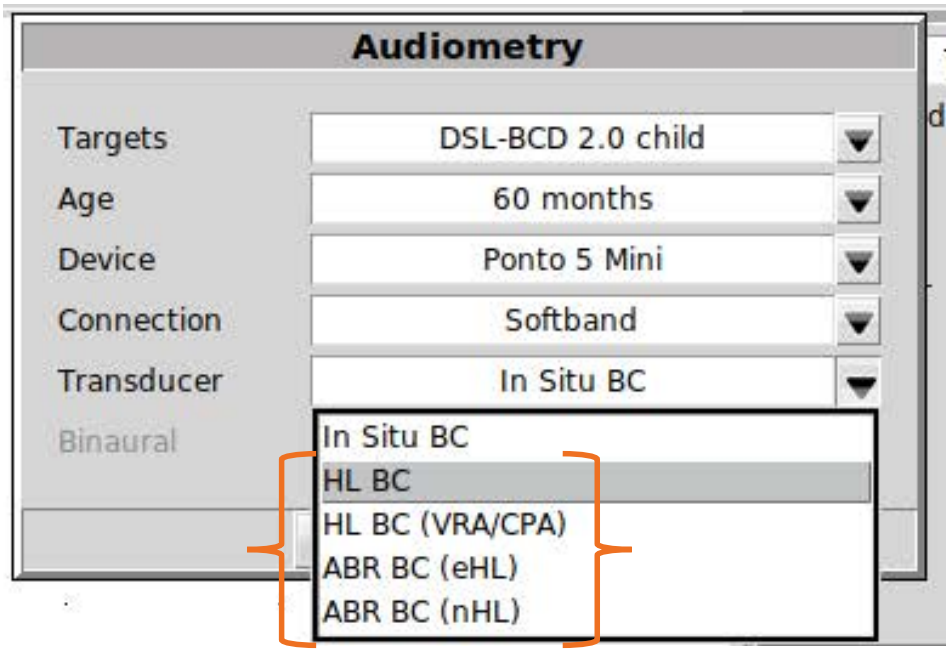
DSL BCD 2.0 Audiometry Selections

Transducer for Softband connections



DSL BCD 2.0 Audiometry Selections

Transducer for Softband connections



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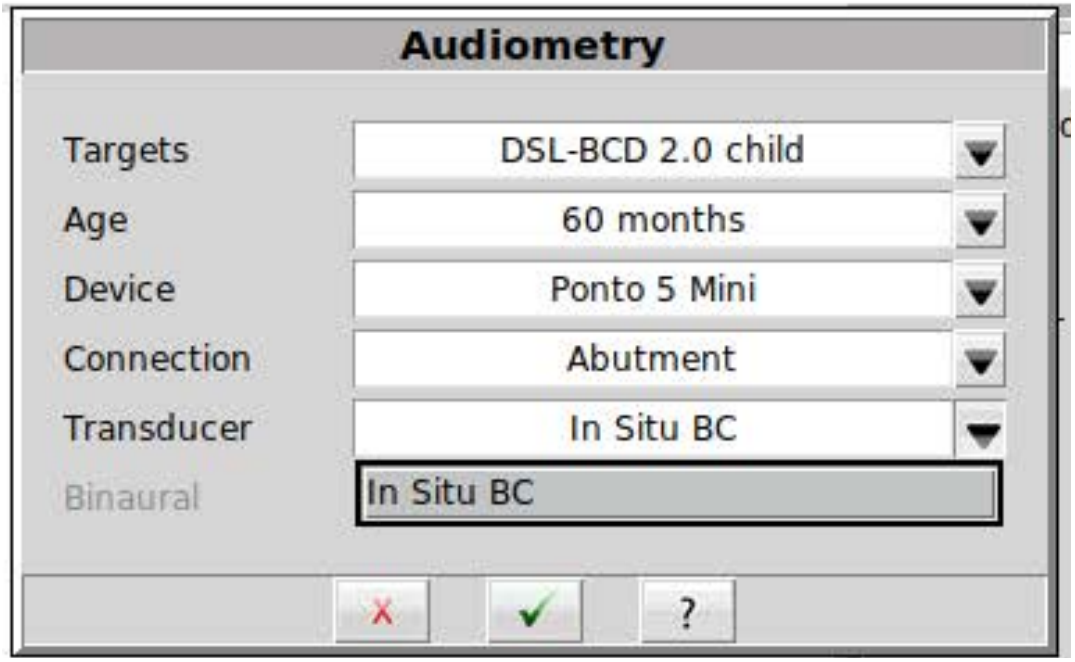
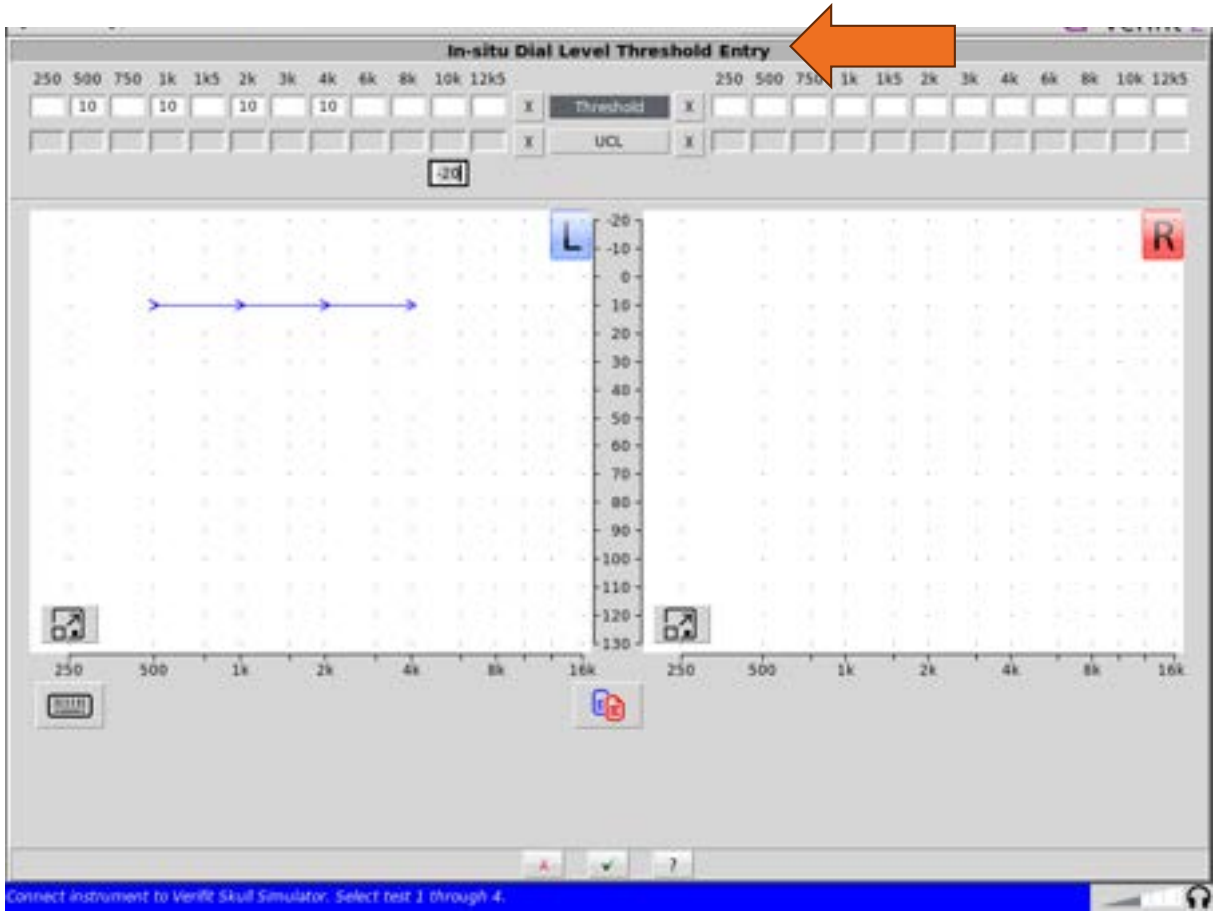
DSL BCD 2.0 Audiometry Selections

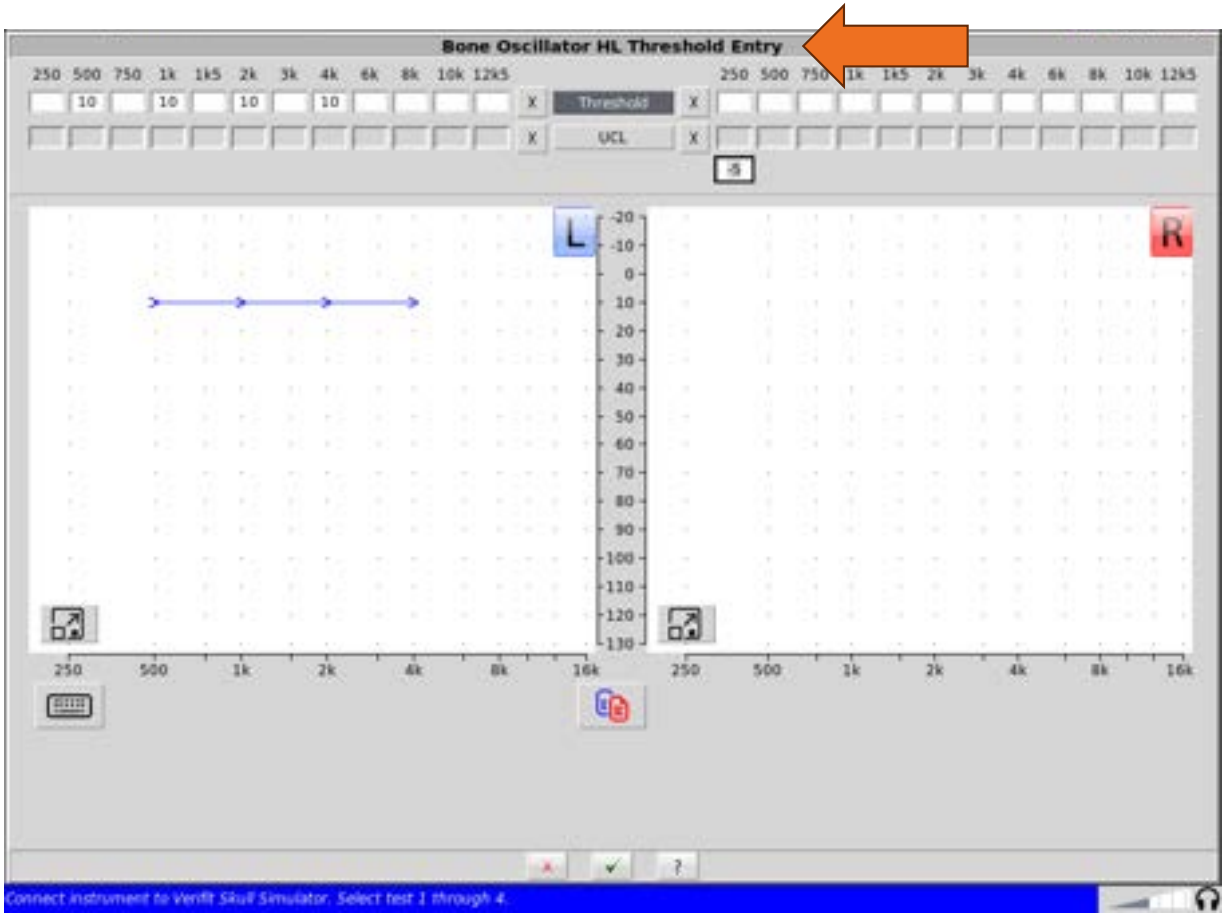
Transducer for percutaneous (abutment) connections



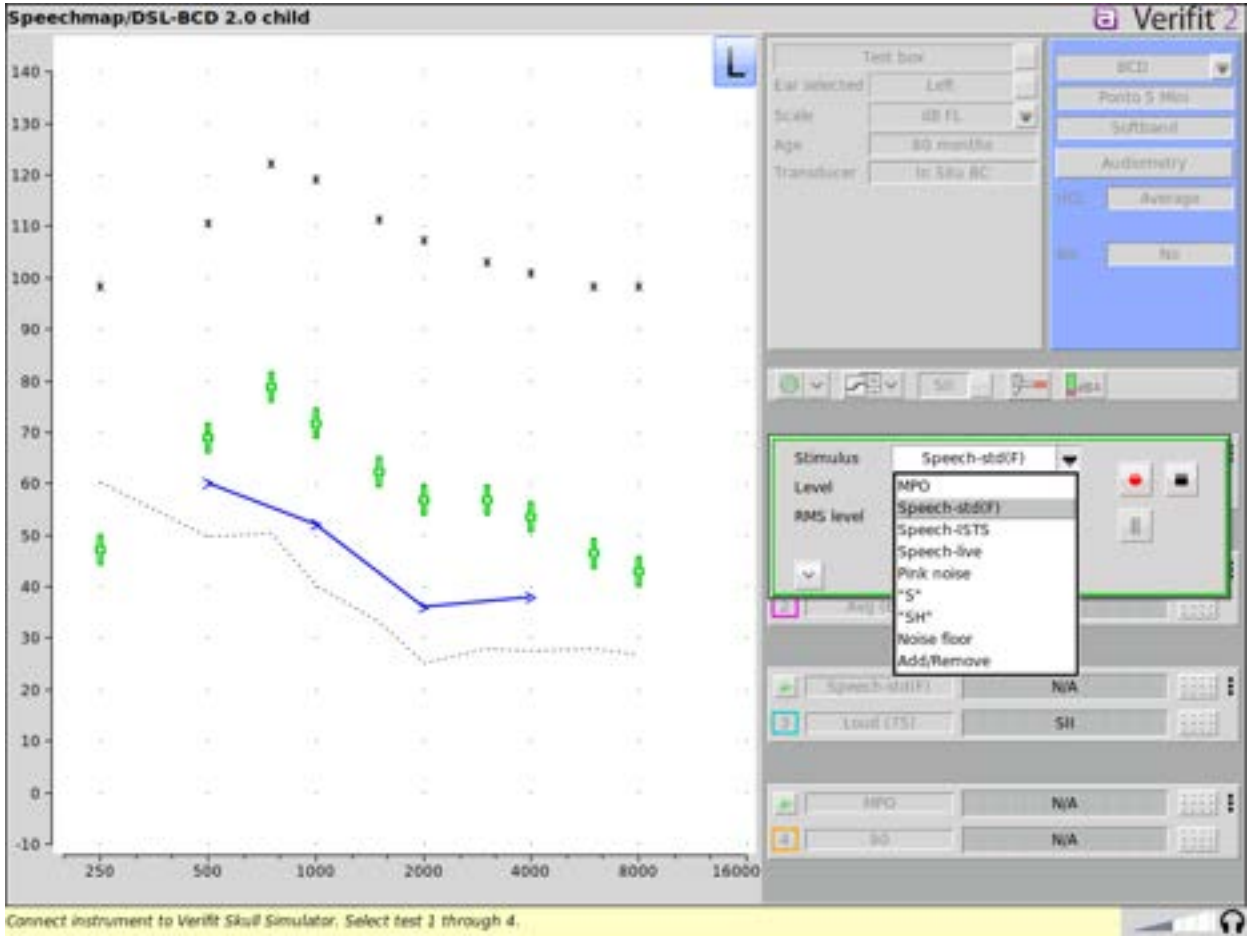
Threshold Entry – In Situ Dial Level



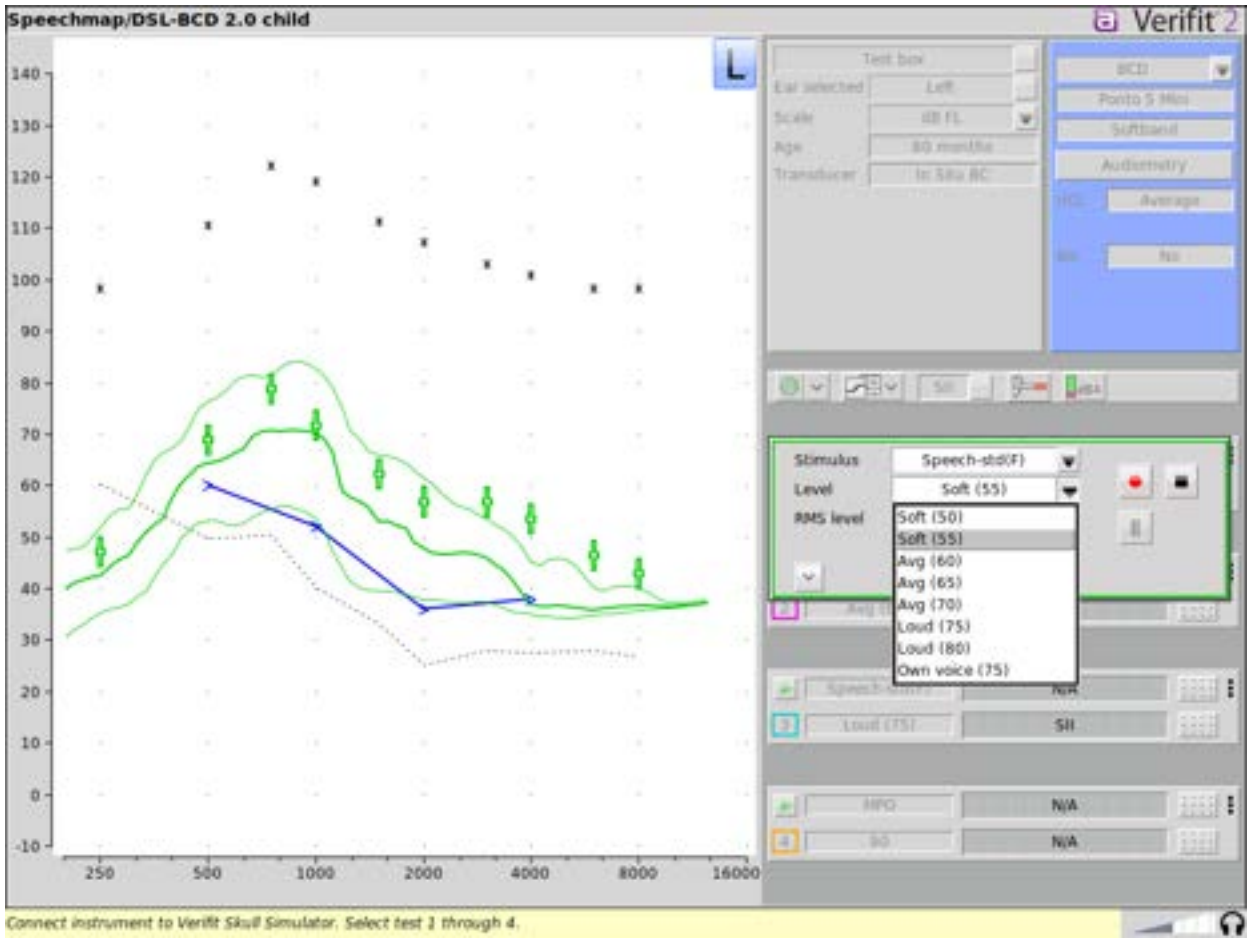
Threshold Entry – Bone Oscillator HL



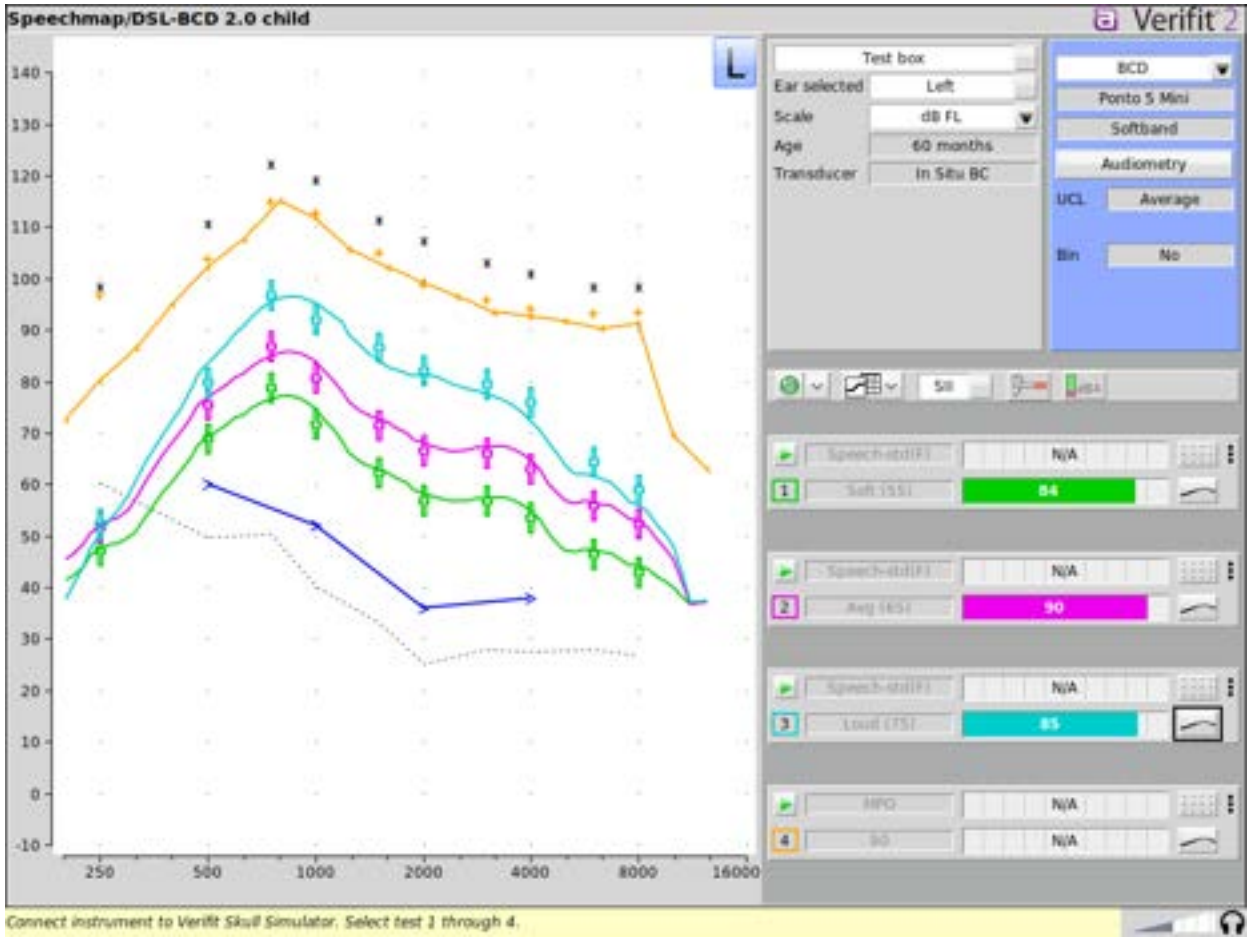
Stimulus Type Selection



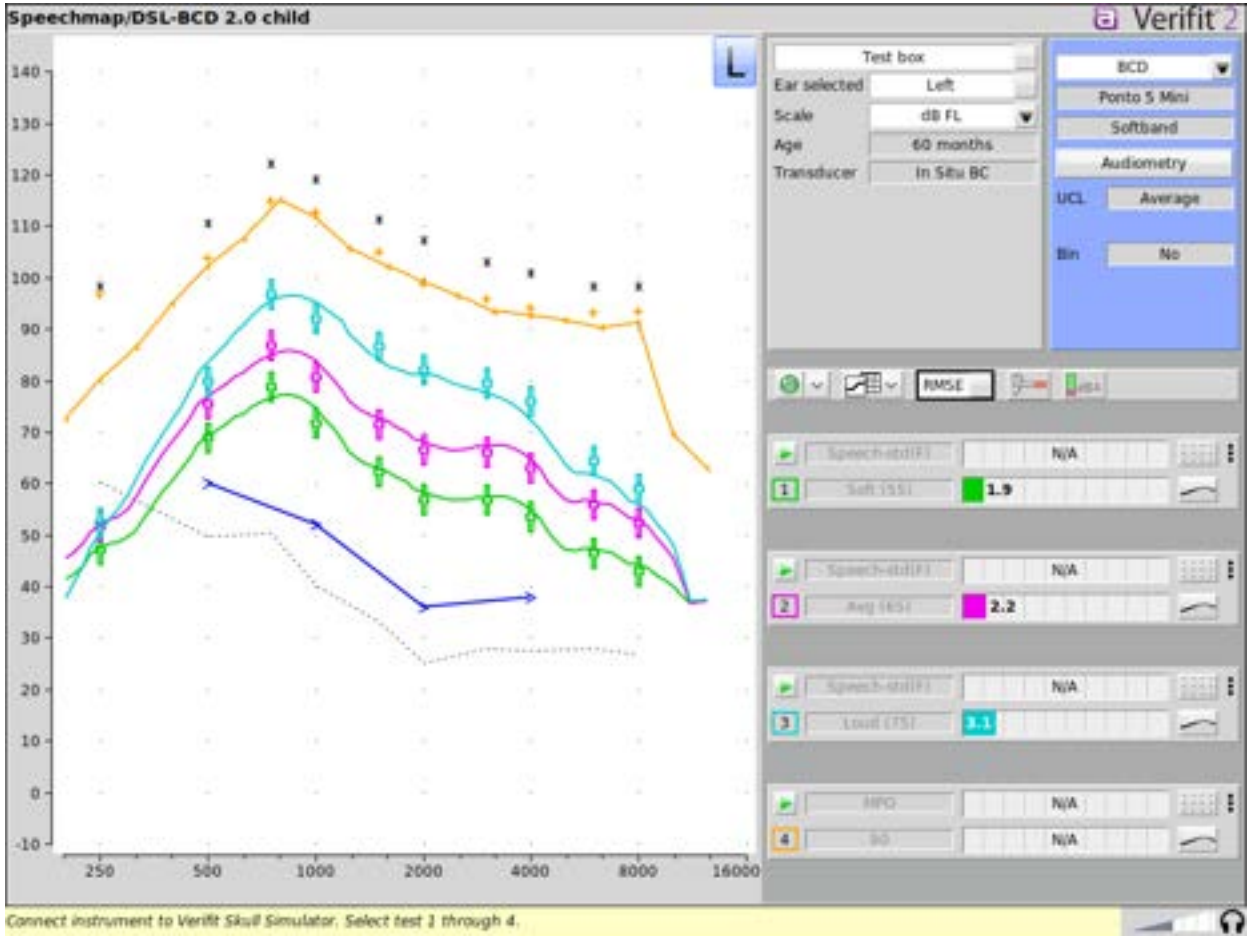
Stimulus Level Selection



Final Fitting Summary



Final Fitting Summary



BCD Verification: Clinical Perspective

Laurie Mauro

In-Situ BCD Threshold Measurements

Necessary for prescriptive formula calculations

Complete audiometry in quiet test environment (ideally sound-treated room)

Individualize fitting, as it accounts for skull resonance and device specific skin transmission differences

Measure frequency-specific thresholds using BCD as the transducer

Bagatto et al. (2022)

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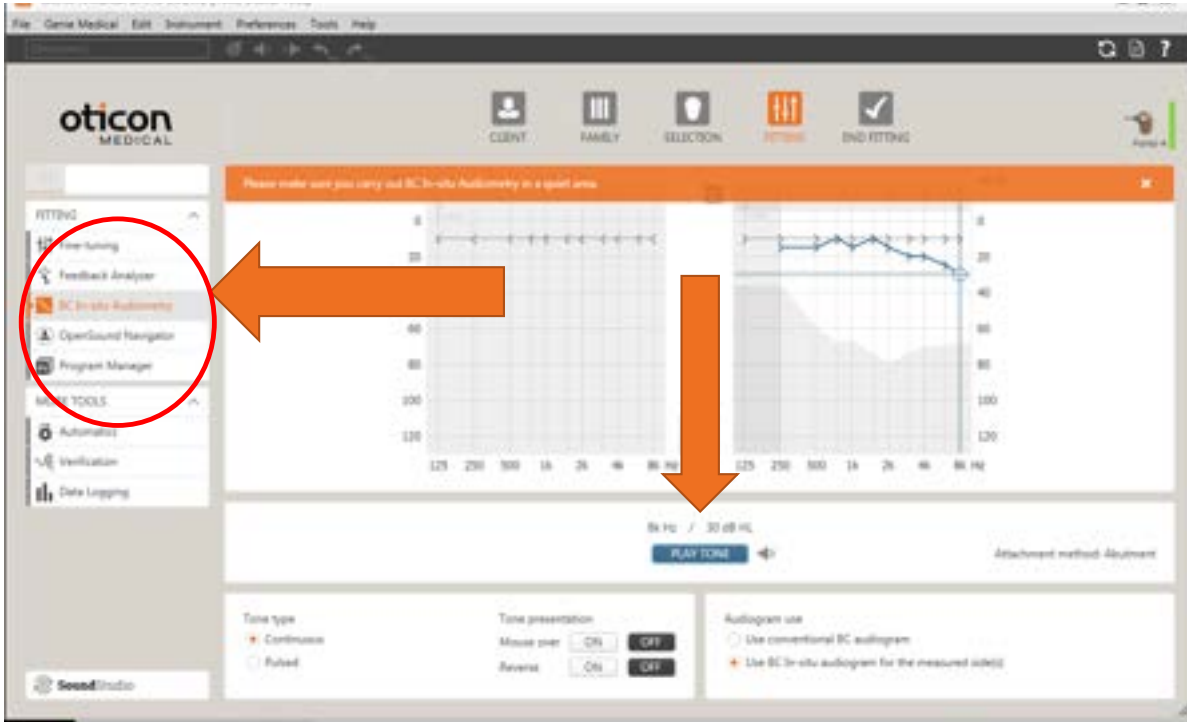
In-Situ BCD Audiometry



- Present frequency specific stimuli from the **fitting software** (not using the audiometer)
- It is recommended to obtain thresholds at 500, 2000 and 4000 Hz

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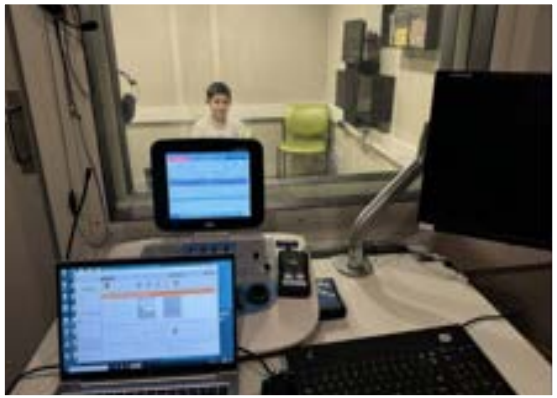
Performing In-Situ BCD Measurements

- Complete within the manufacturer software through Noah® or with stand-alone software on laptop in programming room or in a sound booth

- Perform measurements in a sound booth using Noahlink Wireless
  - Allows for VRA, CPA, and voluntary audiometry to be completed in a quiet environment



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Performing In-Situ BCD Measurements

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When In-Situ Testing is Not Available

For infants and young children assessed using ABR, new details on how to apply DSL BCD 2.0 for BCD verification will be shared by the National Centre for Audiology at Western University. This information will be available soon in their clinical protocols section: https://www.uwo.ca/nca/research/labs/pediatric-audiology.html

Bagatto et al. (2023)

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Example 1 – Normal Bone Conduction (BC) Thresholds

	500 Hz	1000 Hz	2000 Hz	4000 Hz
ABR Audiometric BC Threshold (minimum test level)	20 dB eHL	20 dB eHL	20 dB eHL	20 dB eHL
Predicted Audiometric BC Threshold for DSL BCD 2.0 Prescriptive Algorithm				

Coming soon!

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Example 2 – Elevated BC Thresholds

	500 Hz	1000 Hz	2000 Hz	4000 Hz
ABR Audiometric BC THRESOLDS	20 dB eHL	20 dB eHL	25 dB eHL	30 dB eHL
Predicted Audiometric BC Threshold for DSL BCD 2.0 Prescriptive Algorithm	**Coming soon!**			

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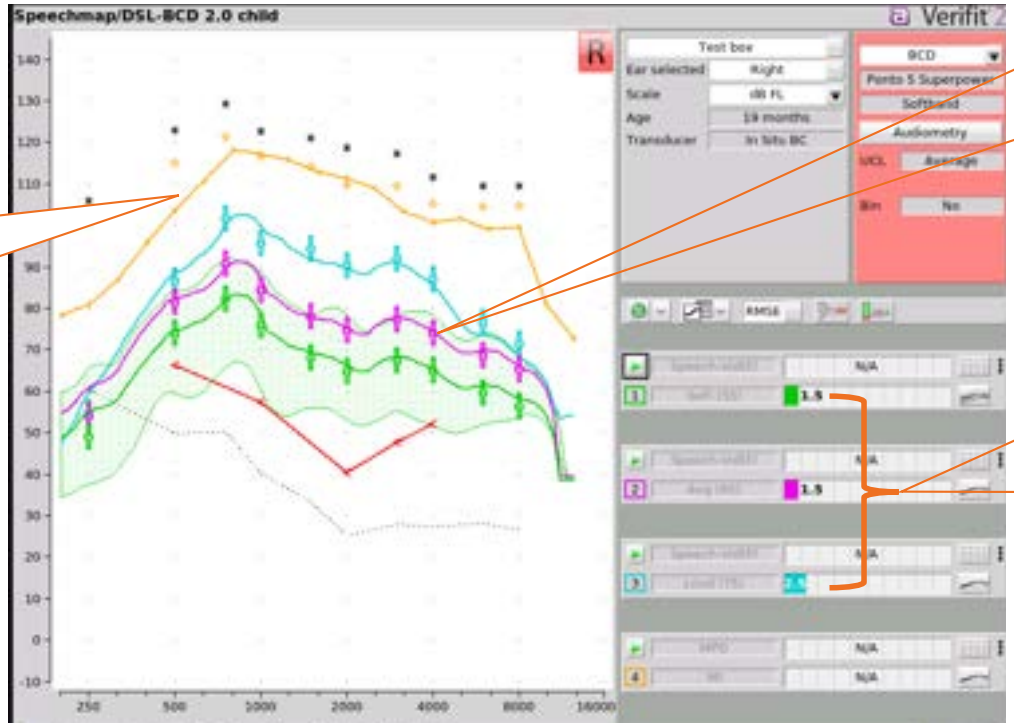
Clinical Recommendations for BC Verification

Adjust gain to match targets for soft, average and loud speech

Difficult to match MFO in lows



Focus on soft and average targets: RMSE <3-5

Weisman et al. (2023)

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Case Studies

Case 1: Meet Jacob

Determining dial levels obtained on ABR thresholds

- Failed newborn hearing screening in both ears
- Bilateral atresia/microtia
- Diagnostic ABR completed at 1 month of age revealed normal bone conduction thresholds in both ears
- Sequential binaural fitting of Ponto 5 SP recommended

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Clinical Consensus Document for Fitting Non-Surgical BCDs

COPA Working Group

Clinical consensus document for fitting non-surgical transcutaneous bone conduction hearing devices to children

Marlene Bagatto[a], Dave Gordey[b], Lynne Brewster[c], Christine Brown[d], Michael Comeau[e], Charlotte Douglas[f], Rana El-Naji[g], Sheila Fortier[e], Alex Gascon[h], Jessica Godovin[b], Colleen Ittner[i], Meredith Magathan Haluschak[g], Laurie Mauro[j], Kari Morgenstein[k], Joy Peterson[l], Susan Scollie[a], Michael Scott[i] and Annemarie Wollet[i]

[a]Faculty of Health Sciences, National Centre for Audiology, Western University, London, Canada; [b]Center for Applied Audiology Research, Oticon A/S, Toronto, Canada; [c]Department of Audiology, Royal University Hospital, Saskatoon, Canada; [d]H.A. Leeper Speech and Hearing Clinic, Western University, London, Canada; [e]Department of Audiology, IWK Hospital, Halifax, Canada; [f]Department of Audiology, Hear2Understand Audiology Services, Saskatoon, Canada; [g]Department of Audiology, Institute for Reconstructive Sciences in Medicine, Edmonton, Canada; [h]Department of Audiology, Nemours/Alfred I. DuPont Hospital for Children, Wilmington, USA; [i]Department of Audiology, Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, USA; [j]Department of Audiology, Children's Hospital of Philadelphia, Philadelphia, USA; [k]Children's Hearing Program, University of Miami, Miami, USA; [l]Department of Audiology, Cincinnati Children's Hospital, Cincinnati, USA

ABSTRACT

This clinical consensus document addresses the assessment, selection, and fitting considerations for non-surgical bone conduction hearing devices (BCHD) for children under the age of 5 years identified as having unilateral or bilateral, permanent conductive or mixed hearing losses. Children with profound unilateral sensorineural hearing losses are not addressed. The document was developed based on evidence review and consensus by The Paediatric Bone Conduction Working Group, which is composed of audiologists from North America who have experience working with BCHDs in children. The document aims to provide clinical direction for an area of paediatric audiology practice that is under development and is therefore lacking in standard protocols or guidelines. This work may serve as a basis for future research and clinical contributions to support prospective paediatric audiology practices.

Abbreviations: AAA: American Academy of Audiology; ABR: auditory brainstem response; ANR: adaptive noise reduction; ANSI: American National Standards Institute; BCHD: bone conduction hearing device; BTE: behind the ear; CPA: conditioned play audiometry; DSL: Desired Sensation Level; EHDI: Early hearing detection and intervention; FL: force level; JCIH: Joint Committee on Infant Hearing; HVAC: hearing, ventilation, and air conditioning; MFO: maximum force level output; PTA: pure tone average; SII: speech intelligibility index; VRA: visual reinforcement audiometry

ARTICLE HISTORY

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KEYWORDS

Bone conduction hearing devices; children; hearing aid fitting; conductive hearing loss; mixed hearing loss; atresia; stenosis

Bagatto, M., Gordey, D., Brewster, L., Brown, C., Comeau, M., Douglas, C., El-Naji, R., Fortier, S., Gascon, A., Godovin, J., Ittner, C., Magathan Haluschak, M., Mauro, L., Morgenstein, K., Peterson, J., Scollie, S., Scott, M., & Wollet, A. (2022). Clinical consensus document for fitting non-surgical transcutaneous bone conduction hearing devices to children. *International Journal of Audiology*, 61(7), 531–538. https://doi.org/10.1080/14992027.2021.1939449

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Assessment and Candidacy for BCD Softbands

Conductive or Mixed Hearing Loss

- Unilateral or bilateral conductive or mixed hearing loss
  - ✓ ≥30 dB HL air-bone gap
- Bone conduction PTA (500, 1000, 2000 & 4000 Hz)
  - ✓ <45 dB HL BC PTA supports fitting for most BCDs
  - Air conduction thresholds are not necessary to proceed with the fitting in cases of confirmed absence of ear canal
  - Minimum of at least one low and one high frequency bone conduction threshold is necessary to fit the indicated ear(s)

Bagatto et al. (2022)

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Jacob's Auditory Brainstem Response Results

Tone Burst Frequency	Air Conduction Threshold	Bone Conduction Threshold (minimum test level)
500 Hz	Could not test due to atresia	20 dB eHL
1000 Hz	Could not test due to atresia	20 dB eHL
2000 Hz	Could not test due to atresia	20 dB eHL
4000 Hz	Could not test due to atresia	20 dB eHL

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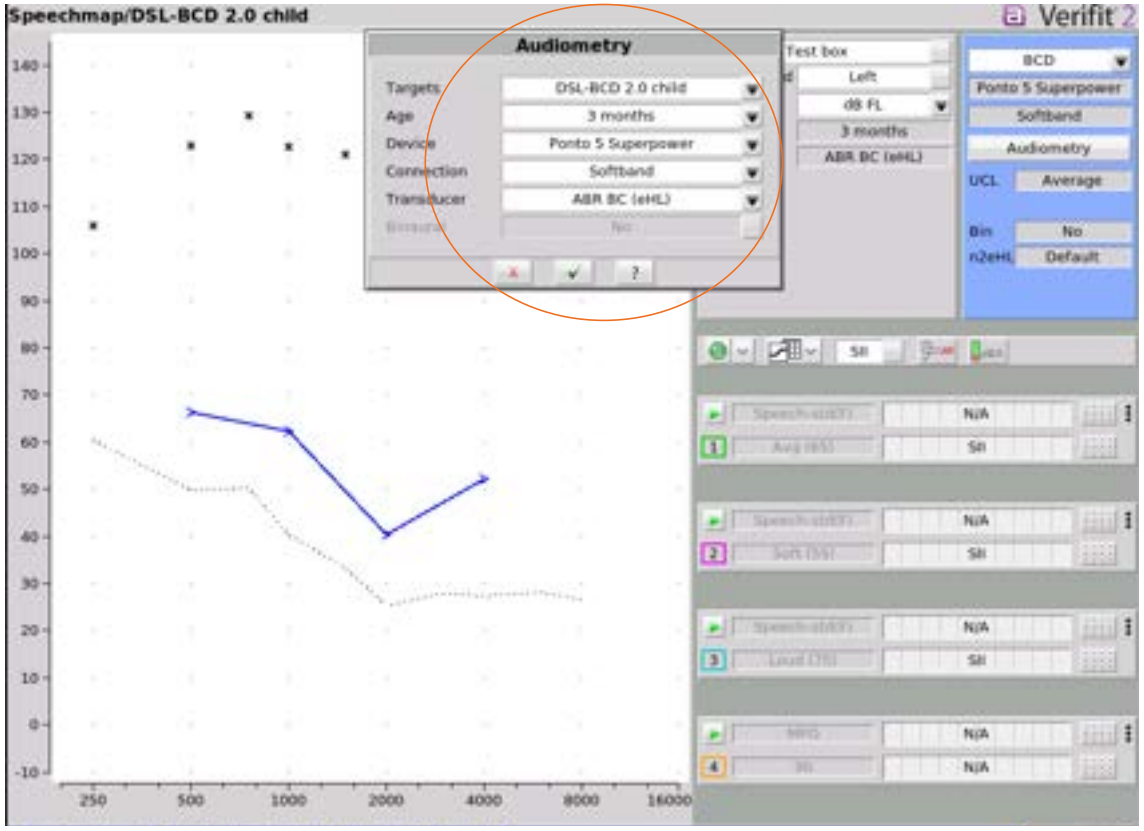
Jacob’s Speech Map Audiometry Selections



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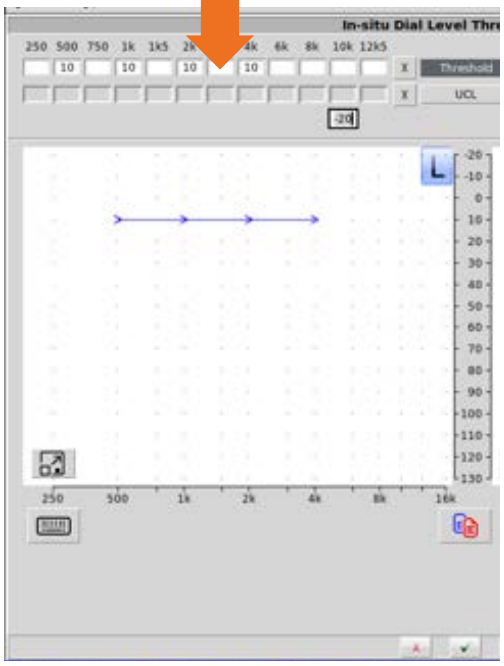

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Case 2: Meet Luke

Verifying BCD softband with custom in-situ BC measurements

- 2 years old
- Unilateral conductive hearing loss in the left ear
- Fit with Ponto 5 SP softband
- Custom in-situ BC threshold measurements obtained in the sound booth using VRA

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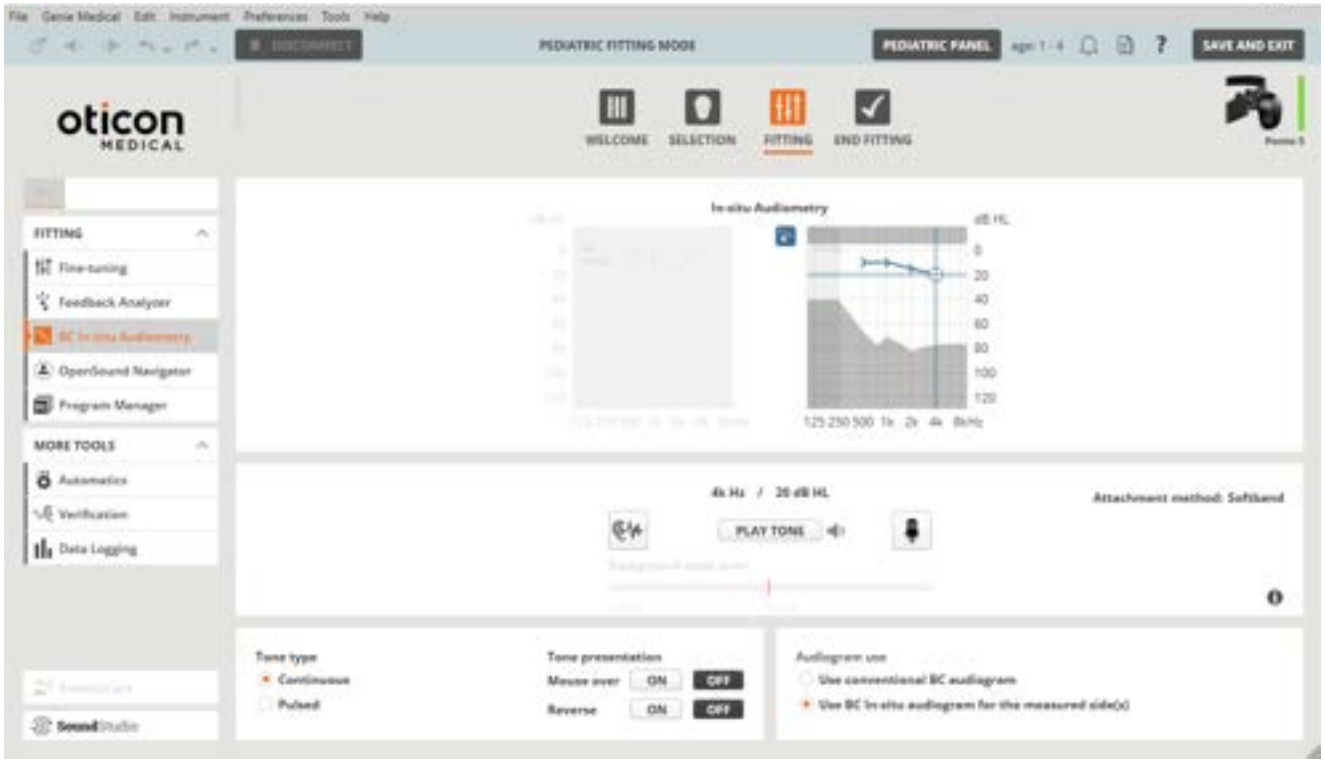
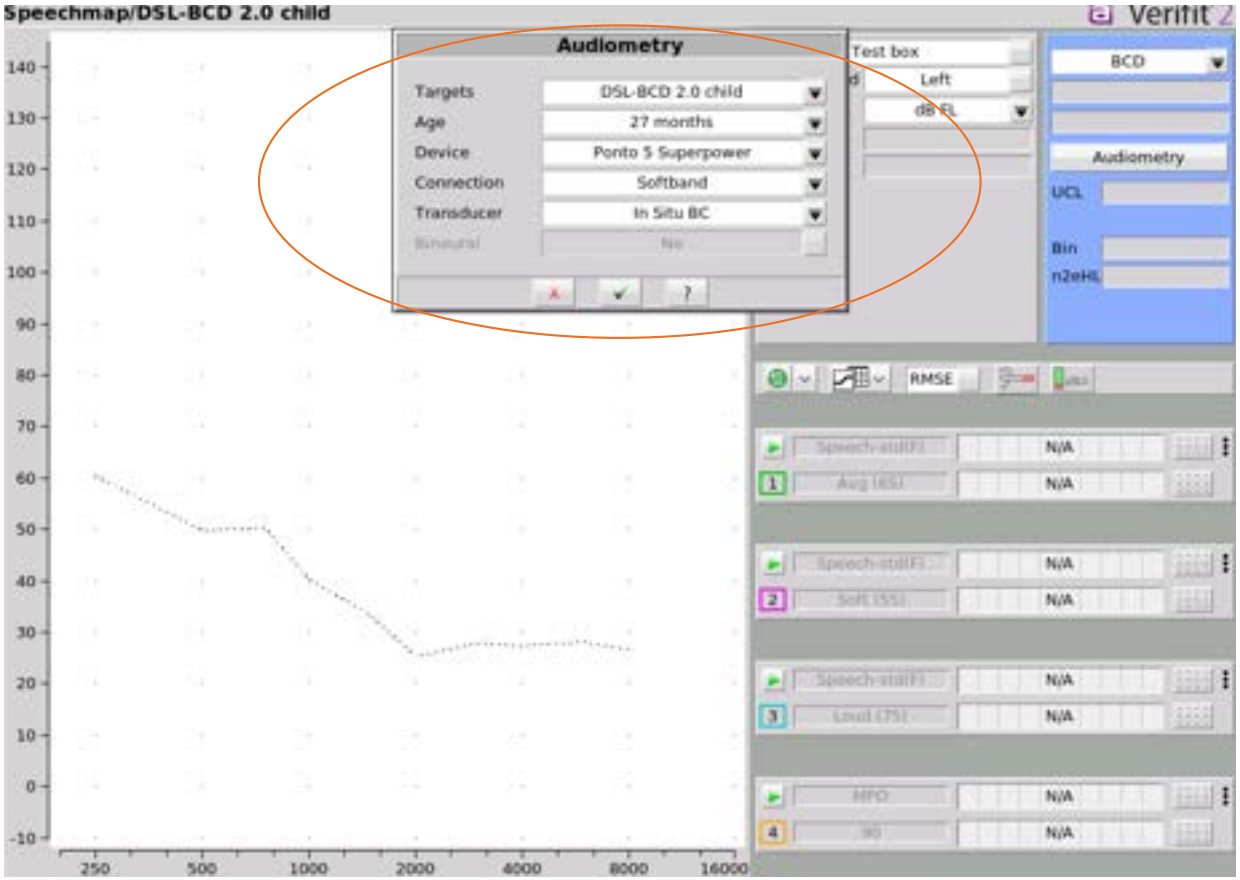
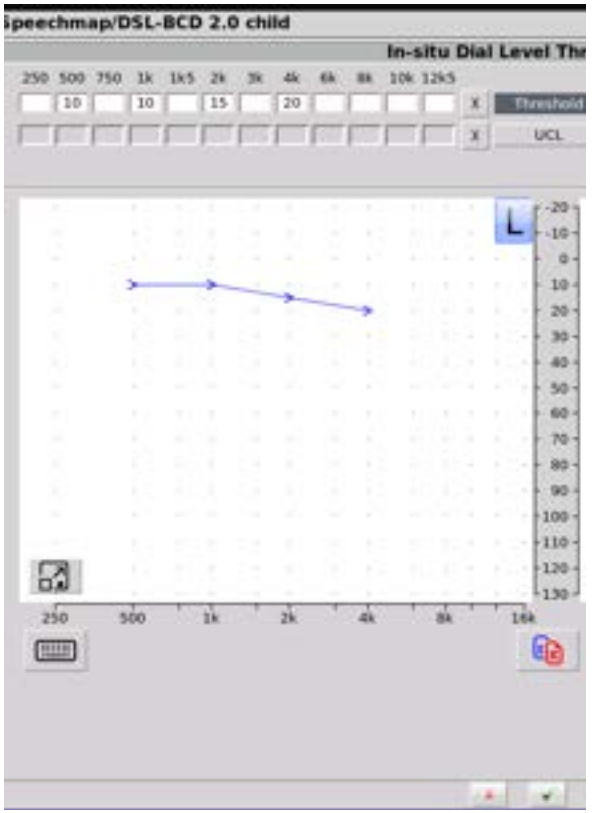
Luke’s Custom In-situ BCD Measurements

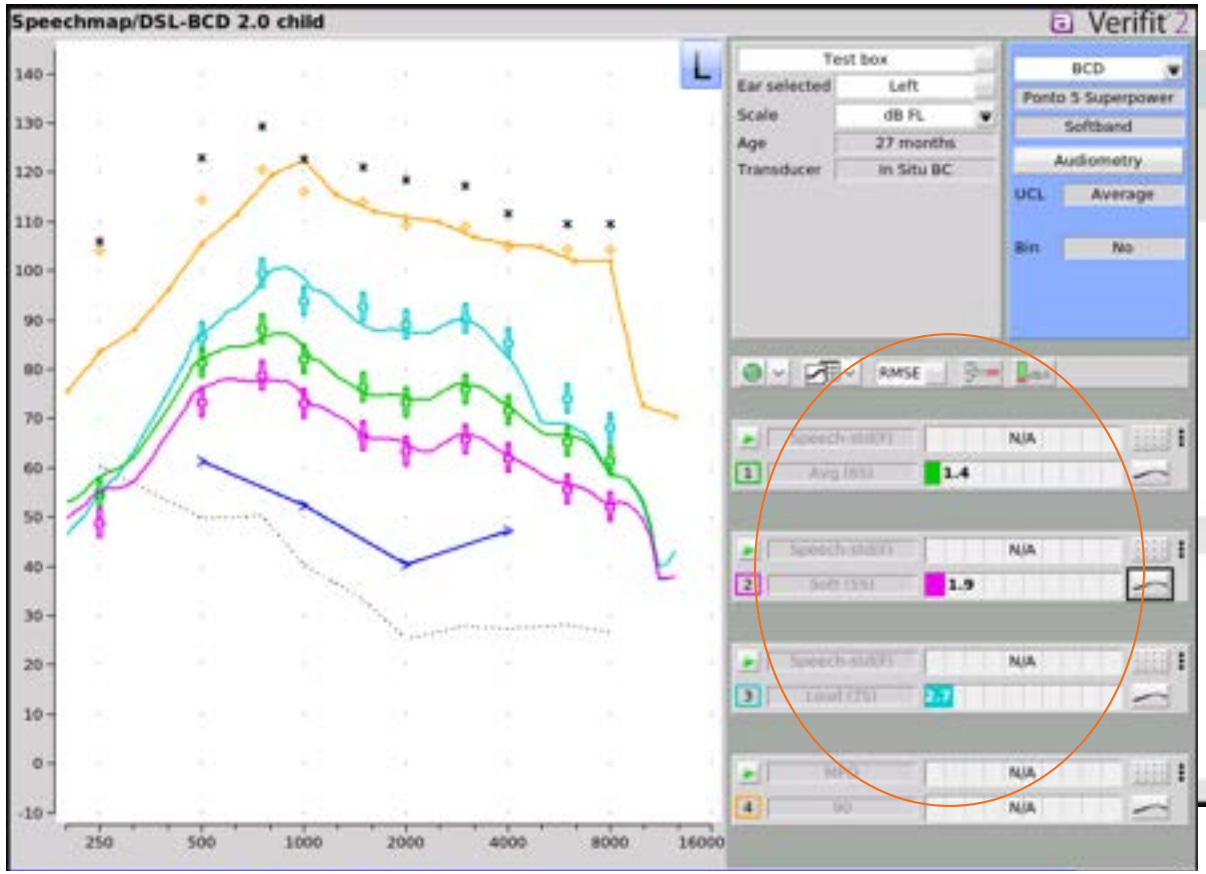


Luke’s Speech Map Audiometry Selections





Adjust Gain to Match Targets



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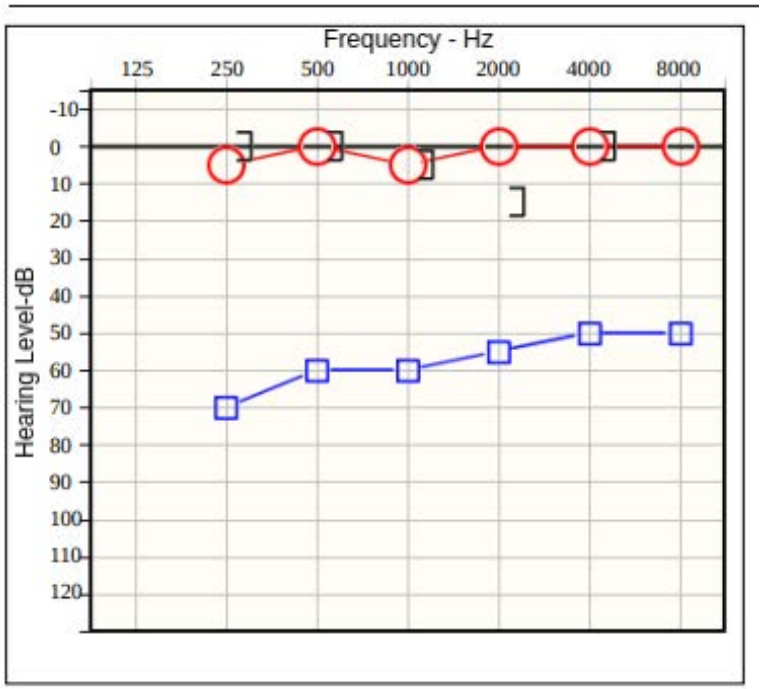
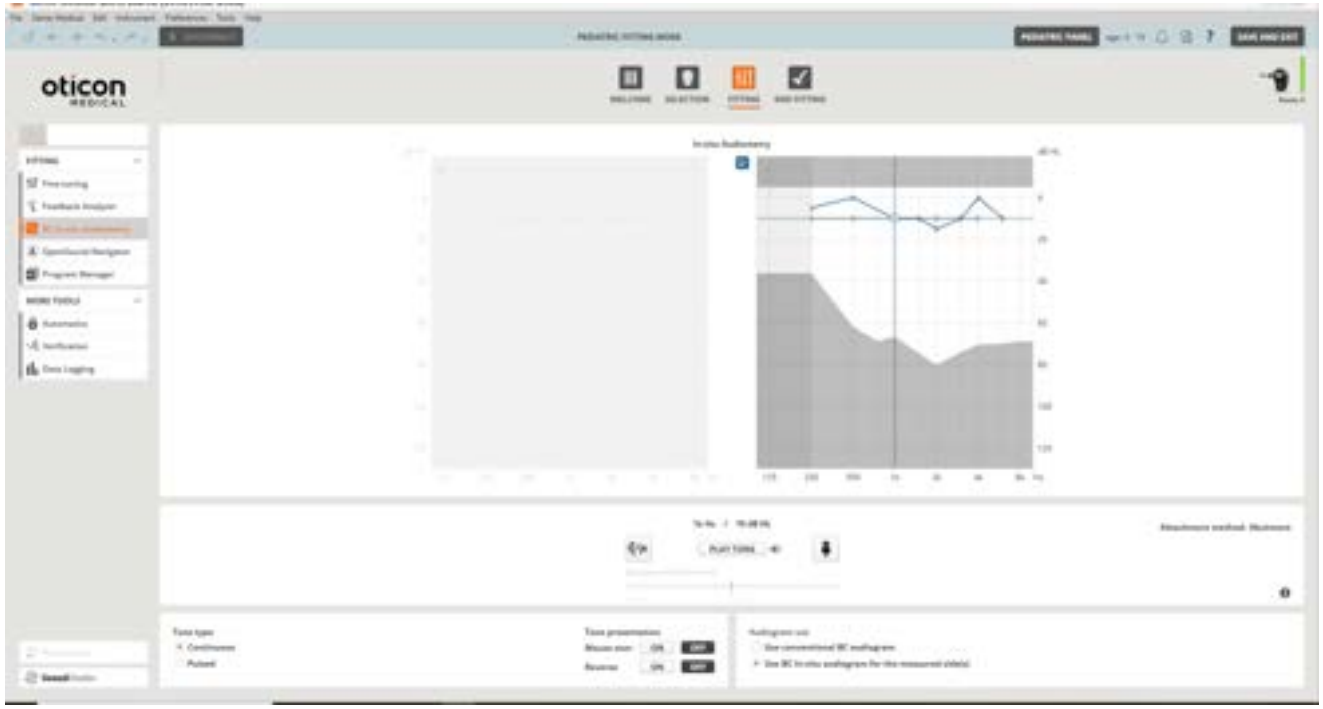
Case 3: Meet Beau

7-Year-Old percutaneous fitting of Ponto 5 Mini



Measure In-Situ BCD Thresholds



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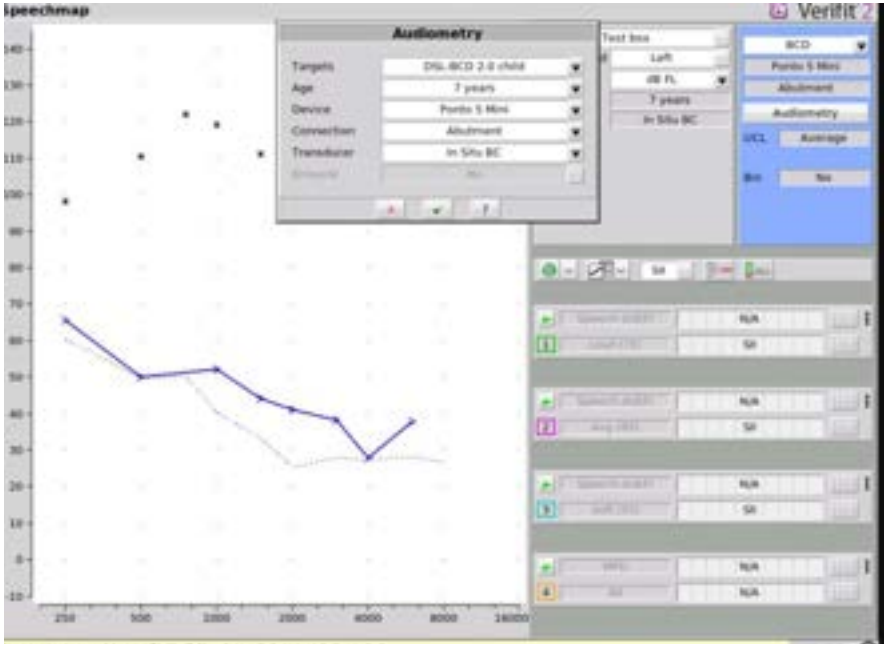
Verifit

Select targets, age, device, connection and transducer



Enter In-Situ Thresholds in Verifit as DL

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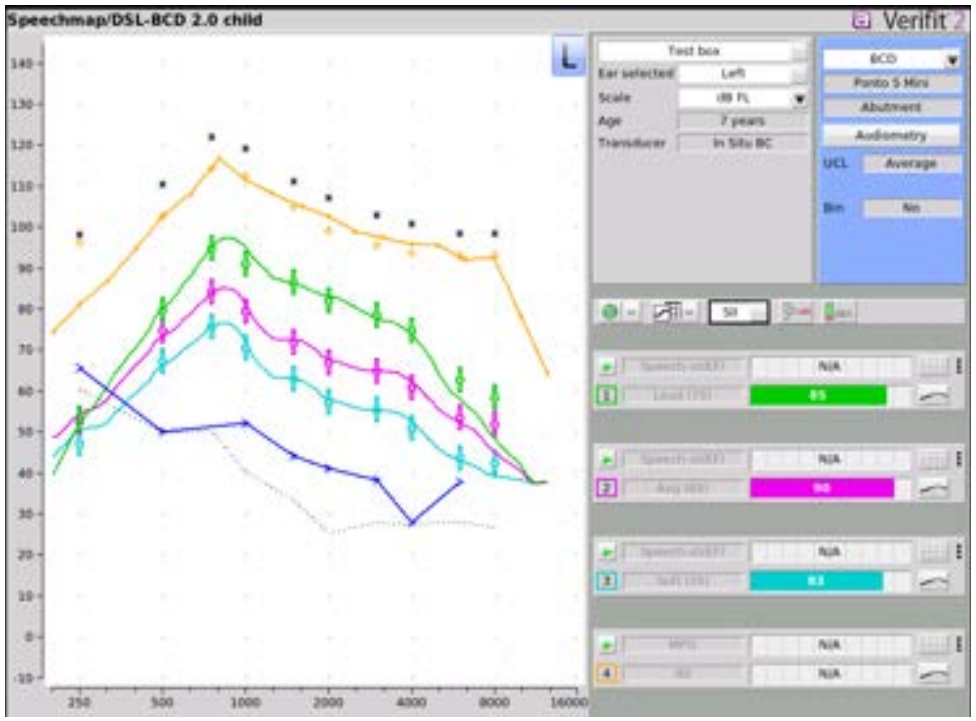
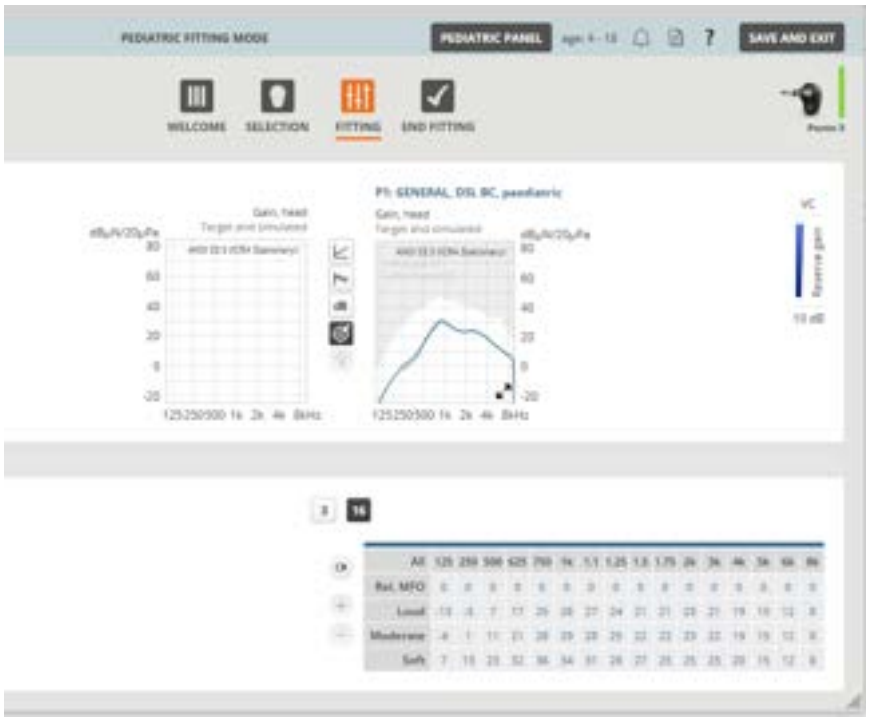
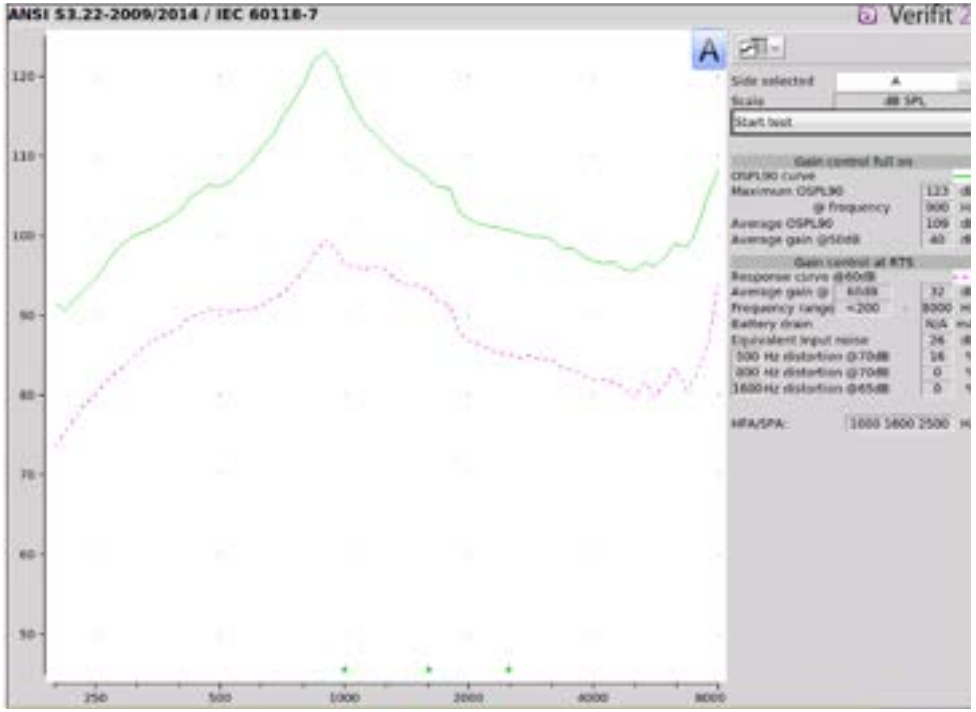
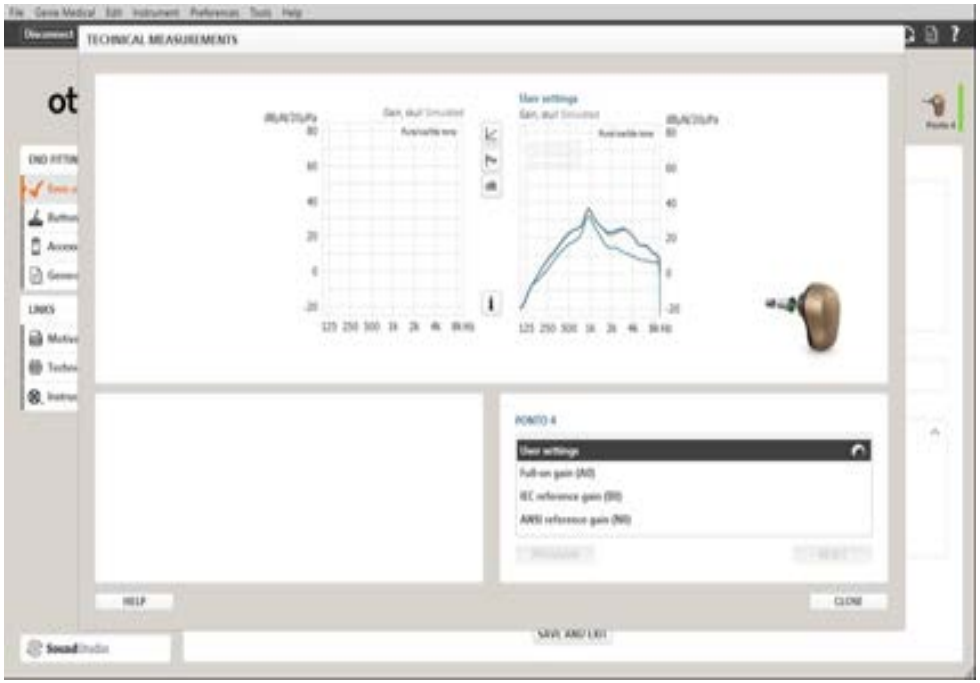
Adjust Gain to Match Targets





Electroacoustic Analysis





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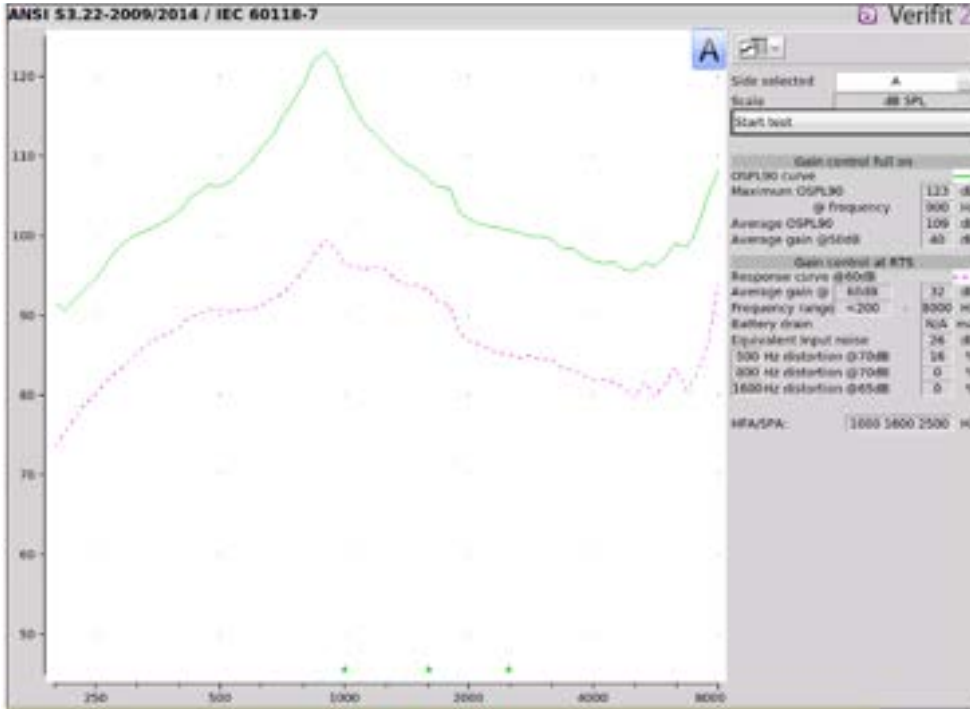
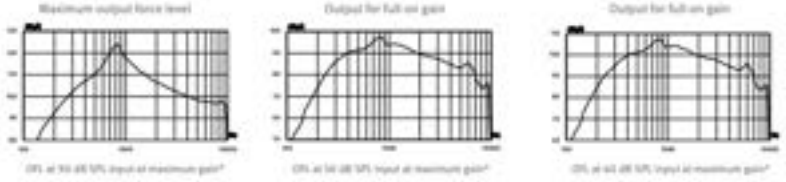
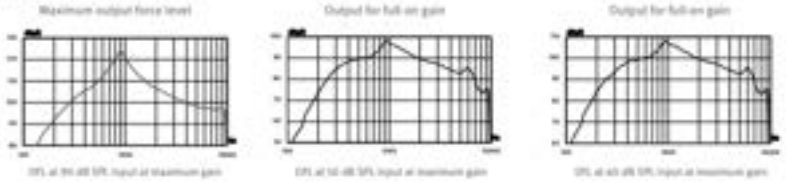
Electroacoustic Analysis



On Head



On Skull Simulator



Technical data (Measured according to IEC 60118-7:2005)	
Frequency range	200–9500 Hz
Peak OFL at 90 dB SPL input (skull sim.)	126 dB rel. 1 µN
Peak OFL at 60 dB SPL input (skull sim.)	108 dB rel. 1 µN
Peak OFL at 50 dB SPL input (skull sim.)	98 dB rel. 1 µN
Equivalent input noise level	<24 dB SPL
Processing delay	8 ms
Battery size	312
Battery consumption,** in silence	1.40 mA
Battery consumption,** typical	1.50 mA
Battery voltage	1.1–1.55
Weight, without battery	1.2 g
Physical dimensions (L*W*H)	26 x 18 x 11 mm
IRL (IEC 60118-15:2016) User compatibility	700/1400/2000 MHz: 35/25/20 dB SPL
Total harmonic distortion (typical)	
70 dB SPL input at 500 Hz	15%
70 dB SPL input at 800 Hz	0.5%
65 dB SPL input at 1600 Hz	0.7%
60 dB SPL input at 3200 Hz	0.3%

Operating conditions

- Temperature: +1°C to +40°C
- Relative humidity: 5% to 93%, non-condensing

Storage and transportation conditions

Temperature and humidity should not exceed the following limits for extended periods during transportation and storage

- Temperature: -25°C to +55°C
- Relative humidity: 5% to 93%, non-condensing

* Curve compensation made for resonance on head

** Battery current is measured according to IEC 60118-7 after a settling time of a minimum of 2 minutes

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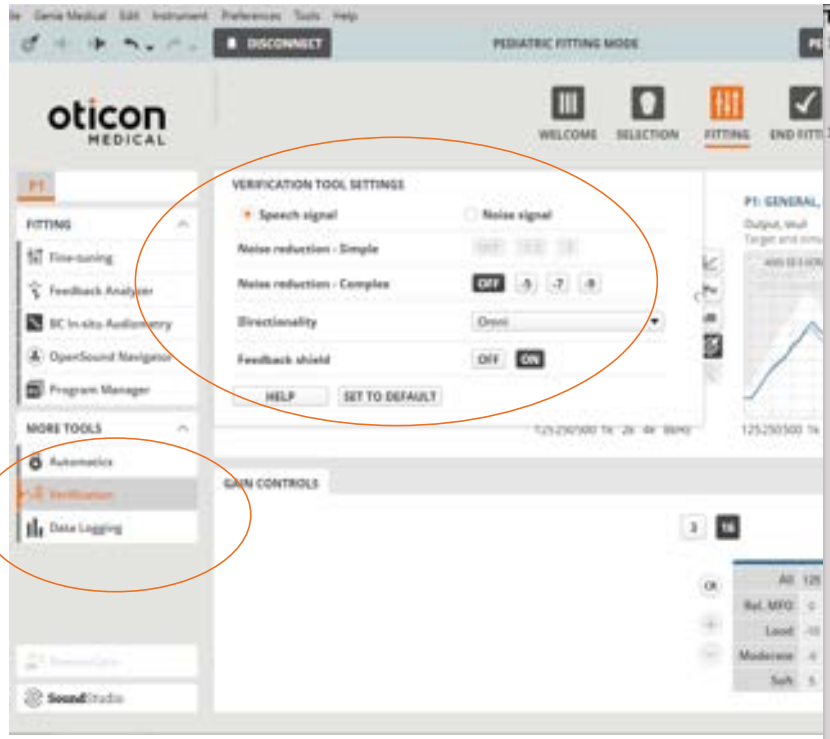
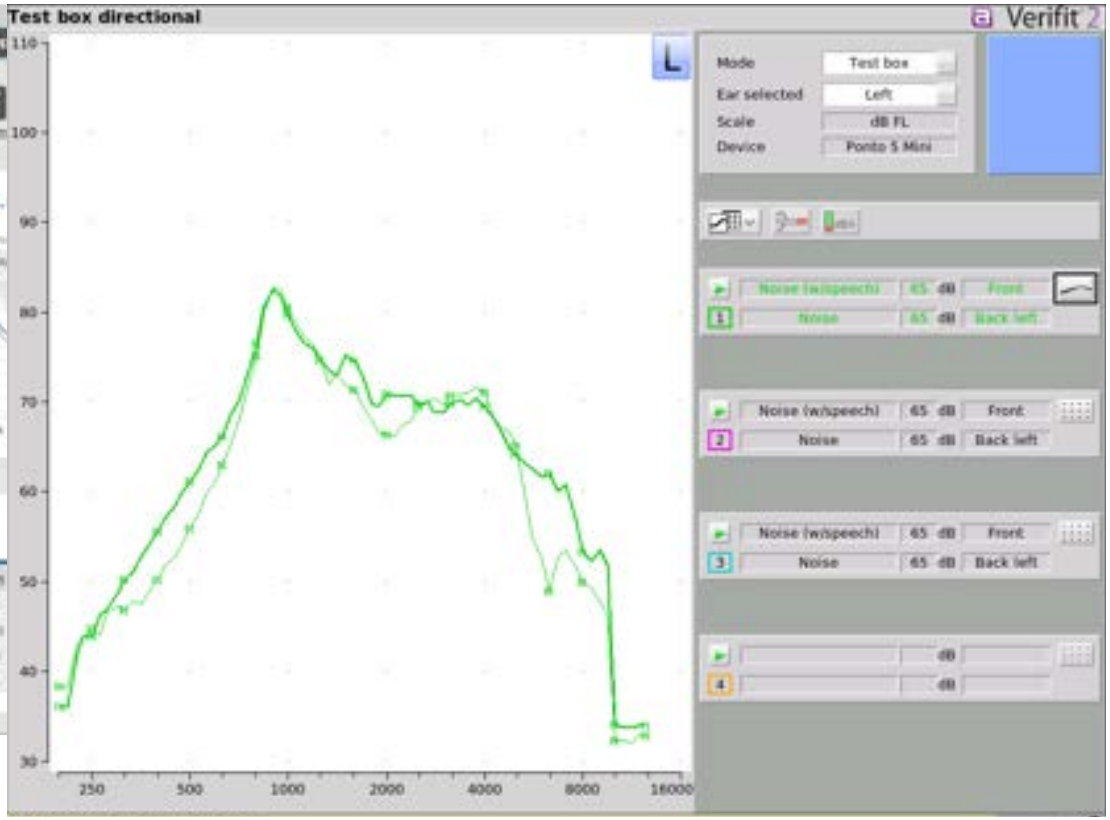
Directional Mic Verification: Omni





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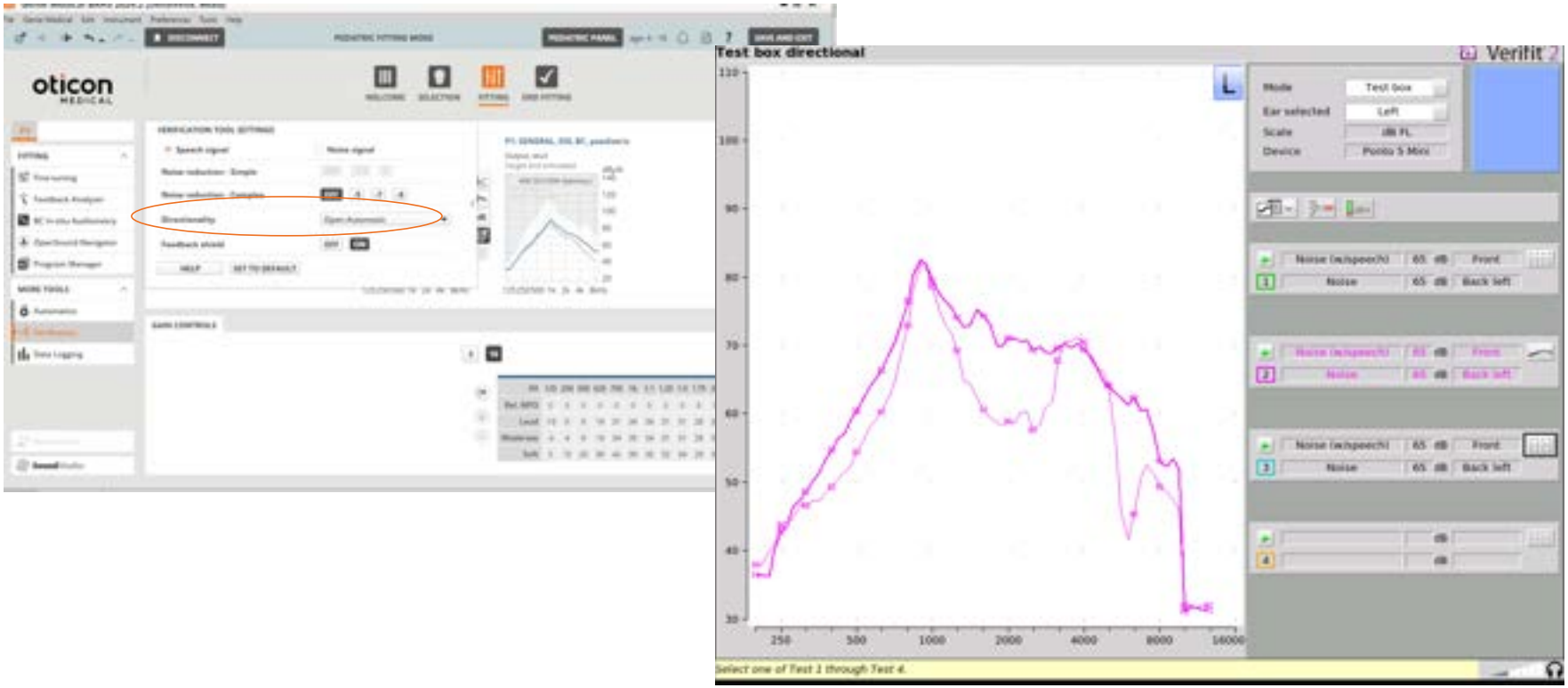
Directional Mic Verification: Directional



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BCD Remote Microphone Verification and Listening Check

- Oticon EduMic
- Oticon Medical ConnectClip
- Streaming

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Remote Microphone (RM) Verification

- Evaluate BCD response without RM
- Disconnect and pair BCD
- Place top of the RM pointed directly towards test box speaker
- Position Verifit reference microphone 1-2 mm from RM
- Place BCD (still attached to skull simulator coupler) outside the test box using the extension cable

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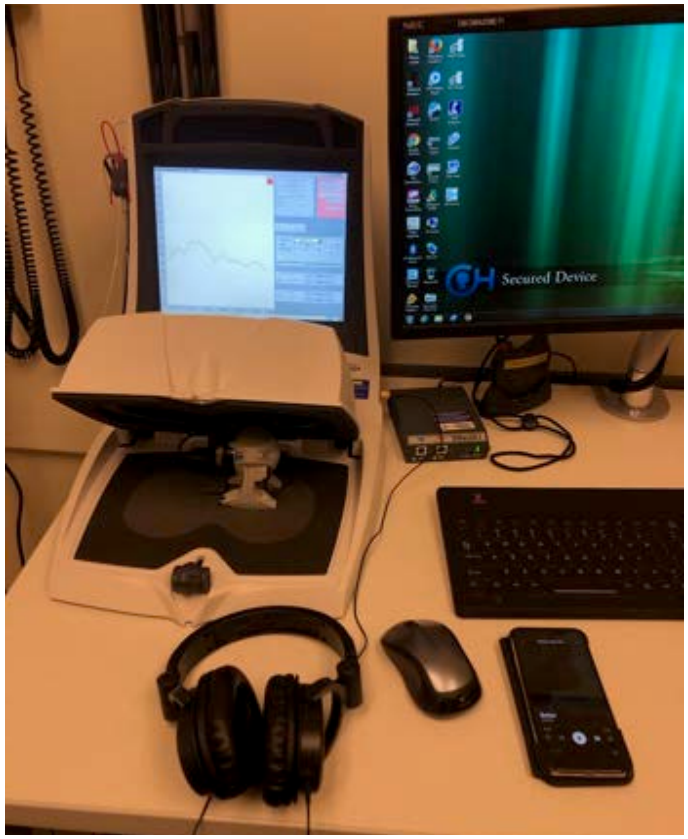
Live Speech Listening Check

- Pair smartphone to BCD
- Play music/video on the smartphone
- Verifit headphones allow listening check of streaming or phone calls



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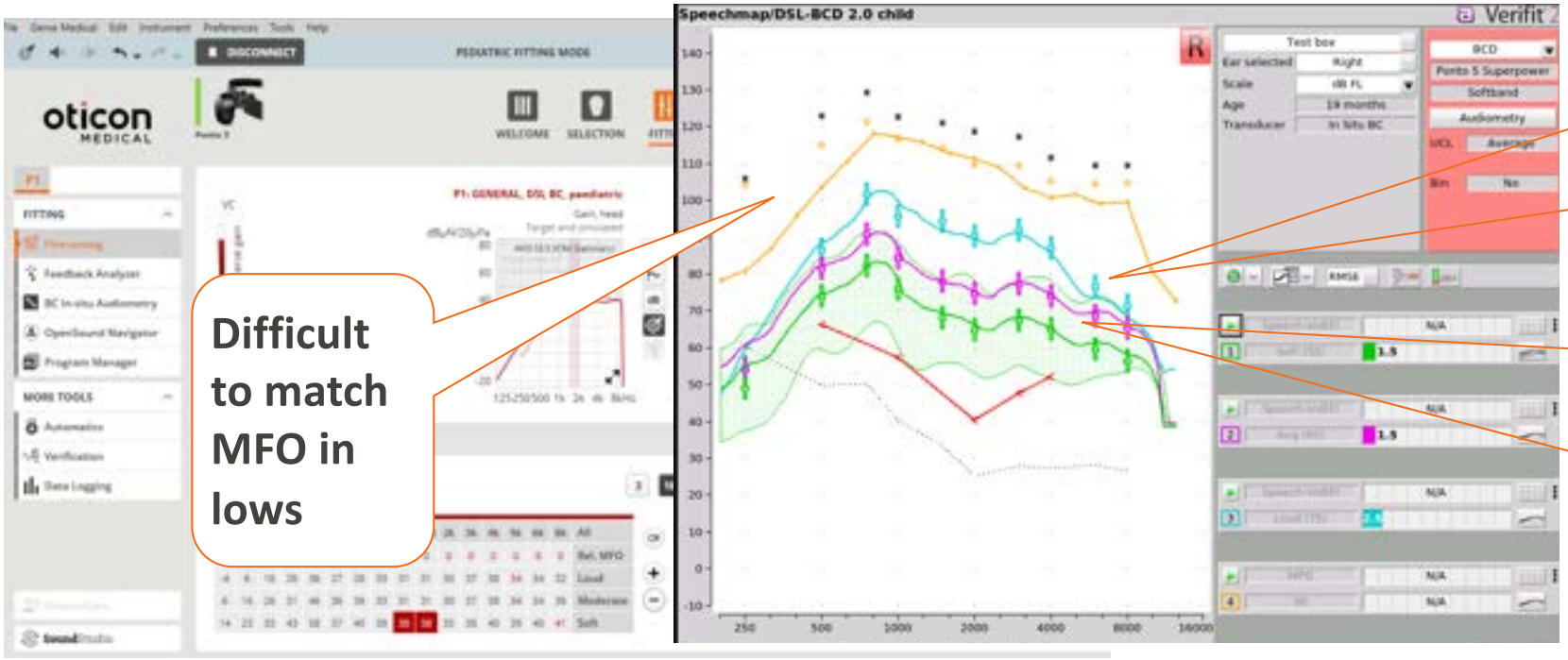
Summary: Clinical Recommendations for BC Verification



Difficult to match MFO in lows

More difficult to match loud targets

Focus on soft and average targets RMSE <3-5

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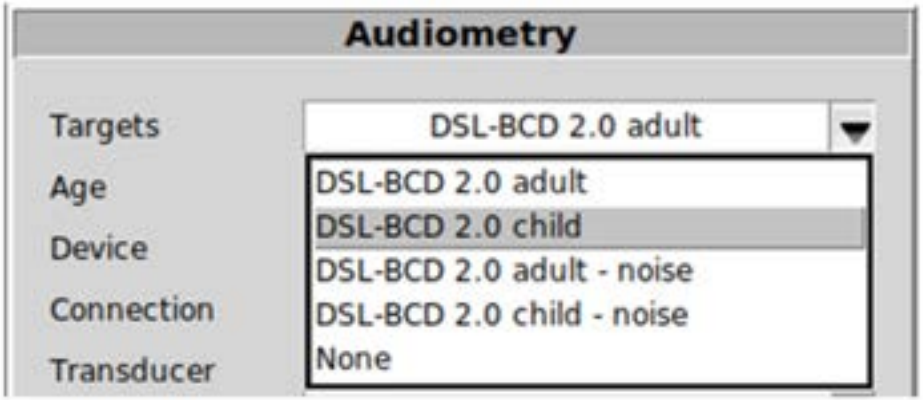
Tips: Select Correct Fitting Formula

Verifit



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- Selection of DSL-BCD child or adult determines the prescribed sensation level of targets
- Pediatric targets are higher than adult targets

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A Few More Tips

- Custom in-situ BC measurements **are** necessary
  - For infants and young children assessed using ABR, details on how to apply DSL BCD 2.0 for BCD verification will be shared by the National Centre for Audiology at Western University
- Don’t worry too much about matching the targets for MFO and 75 dB, focus instead on the targets for 55 dB and 65 dB **inputs**
- Oticon Medical’s verification mode is not necessary for speech mapping with Ponto 5; adjustments do not save in the fitting screen

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Key Takeaways

- The Verifit2 and Skull Simulator provide **objective, accurate verification** for Ponto users.
- Speechmap testing allows for **customized, patient-specific fittings** that optimize speech audibility.
- Best practices include **proper setup, choosing the right formulas, and using Speechmap for verification.**

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Additional Resources and Support

- Oticon Medical and Audioscan offer training and resources to help clinicians implement these tools effectively.
- Oticon Medical Audiology Technical Support:
  - 888-277-8014 option #4
  - audiologysupport@oticonmedical.com
- Audioscan Technical Support:
  - 800-265-2093
  - support@audioscan.com

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Thank you for attending!

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sound matters

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