The Lantos Membrane:
How it Works and How to Use It

ERIN HENRY, AUD, DIRECTOR OF TRAINING
LYDIA GREGORET, PHD, AUD, PRINCIPAL RESEARCH SCIENTIST
LANTOS TECHNOLOGIES

Erin Henry, Au.D., CCC-A

- Director of Training for Lantos Technologies
- B.S. in Communication Disorders
- Au.D. from Northeastern University, Boston, MA
- Audiologist for 10 years
- Contact information: ehenry@lantostechnologies.com

Presented in partnership with

Lydia Gregoret, PhD, AuD

- Principal Research Scientist at Lantos
- PhD in Pharmaceutical Chemistry from UCSF
- AuD from Northeastern University
- Prior careers as chemistry/biochemistry professor, and full-time at home mom
- Contact information: lgregoret@lantostechnologies.com

LANTOS TECHNOLOGIES

Agenda

- Overview of ear scanning with the Lantos 3D Scanning System
- Review pinna anatomy and relevance to earpiece form factors
- Inflating the conforming membrane in the ear: setting the stage for data capture
- Review of ear canal anatomy, compliance, and dynamics
- Capturing the compliant ear while avoiding artifacts
- Questions and Answers

LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED

Learning Outcomes

- 1) After this course, participants will be able to give a brief explanation of how the Lantos 3D Ear Scanning System works
- 2) After this course, participants will be able to name relevant anatomical landmarks of the pinna and ear canal.
- 3) After this course, participants will be able to identify the physical features of the Lantos conforming membrane and their functions.
- 4) After this course, participants will be able to describe how the Lantos conforming membrane indirectly reflects the compliance of the tissue of the pinna and ear canal.
- 5) After this course, participants will be able to explain how to optimize membrane inflation and scan path while avoiding artifacts.

LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED

The Lantos 3D Ear Scanning System

+

+

=

- Handheld scanner with cradle
- Laptop with high-end graphics card

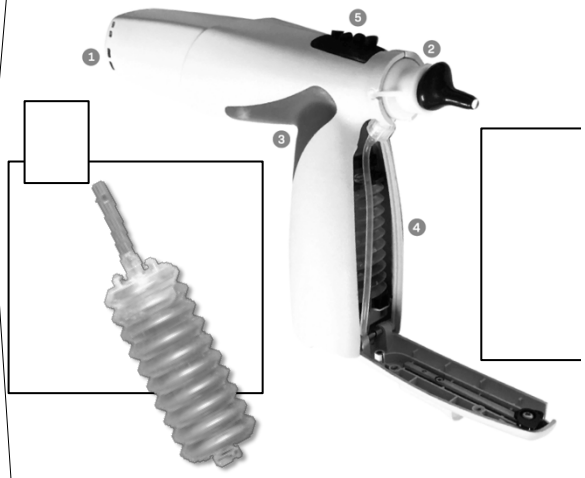
- Single-patient membrane
- Multiple-use solution cartridge

- Software that collects 1,000,000+ data points
- Algorithm that stitches data into a 3D mesh of the ear's geometry
- Cloud ordering platform

- Digital file that can be instantly transmitted to manufacturer

LANTOS TECHNOLOGIES

ANATOMY OF THE LANTOS SCANNER



SCANNER BODY

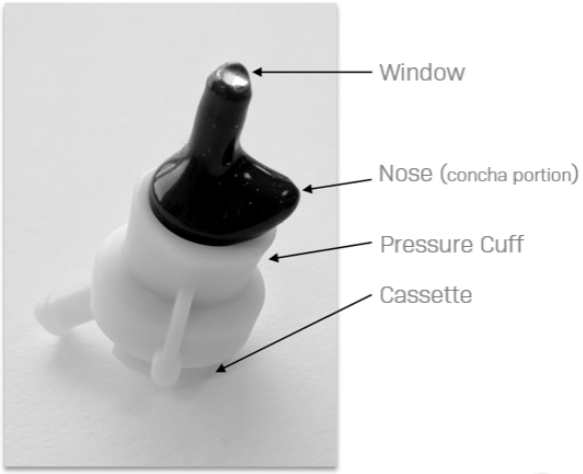
1. **End:** The back part of the scanner
2. **Tip:** The very end of the camera as it's extended into the membrane/ear
3. **Inside of handle:** Where the thumb rests within the crook of the handle while holding the scanner
4. **Elevator:** The compartment within the handle of the scanner that holds the solution cartridge and compresses the cartridge during inflation of the membrane
5. **Button Board:** The board on the top of the scanner where the control buttons are located

LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED

A closer look at the membrane

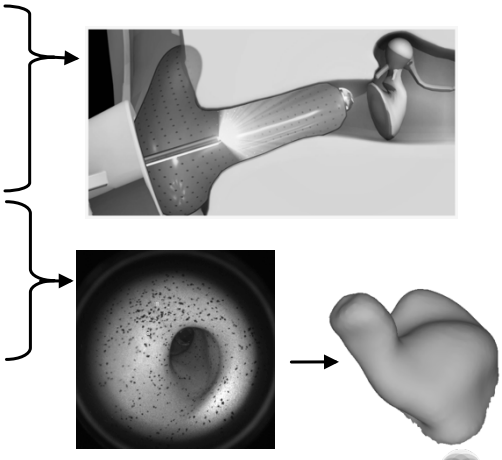


LANTOS TECHNOLOGIES

THE LANTOS EAR SCANNING PROCESS

Multi-Step Scanning Process

1. Placement under direct visualization
2. Solution fills inside of the membrane (does not touch the ear), inflating peristaltically.
3. Light fluoresces the inside of membrane.
4. Each still image is stitched into one 3D file.
   - Over 1 million data points are stitched together
   - Highly accurate, 3D topographical rendering of the ear in .STL format
5. The STL file is uploaded to the Lantos Cloud together with the hearing aid or earmold order for immediate access by the manufacturer

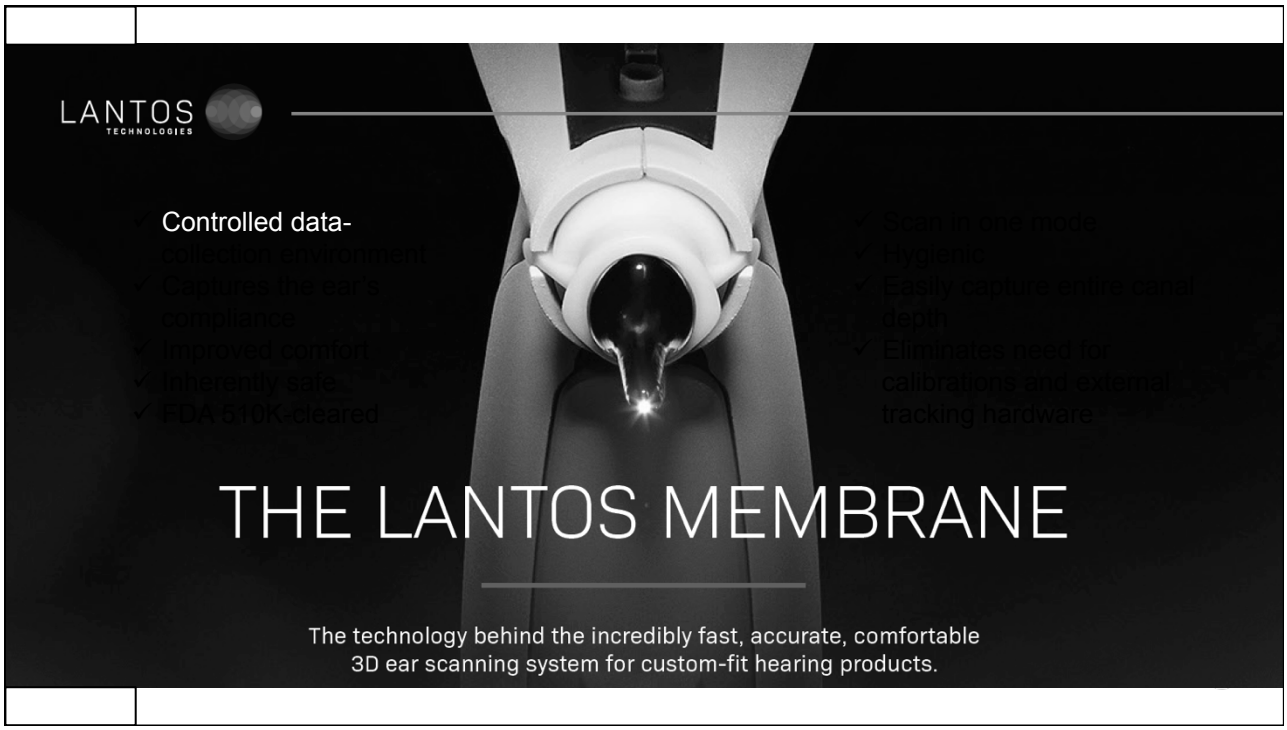


LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED

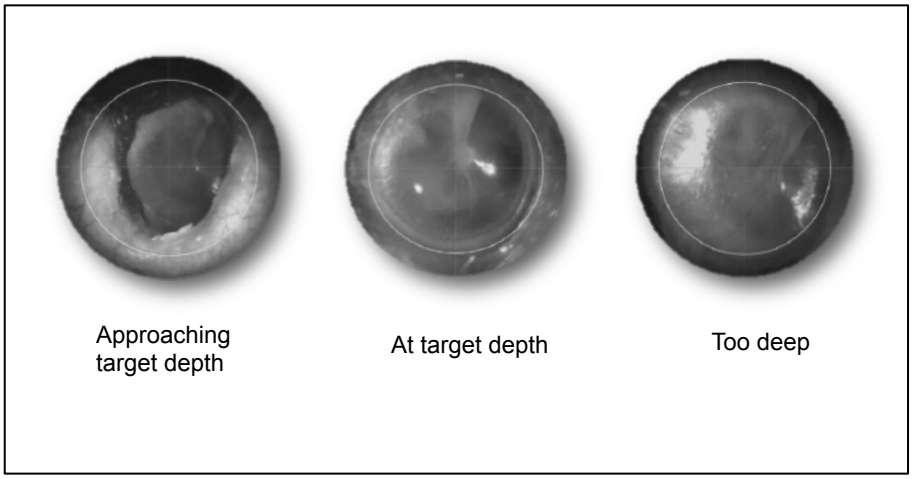
What does a Lantos Scan Session Look Like?



Presented in partnership with

CONTINUED

DIRECT VISUALIZATION



Approaching target depth

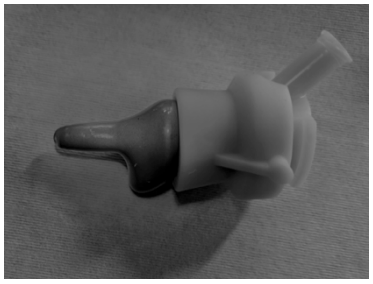
At target depth

Too deep

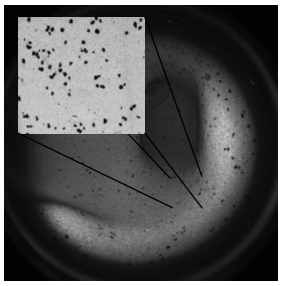
LANTOS TECHNOLOGIES

The Membrane Material's Properties

The membrane material is made of a medical-grade thermoplastic elastomer.



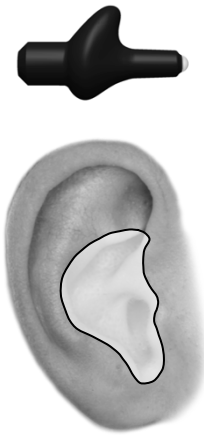
Glows yellow in violet light



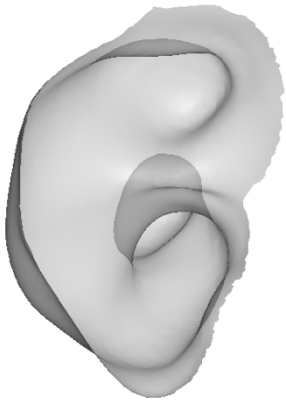
Fiducial placement markers register one image to the next

LANTOS TECHNOLOGIES

Review of Pinna Anatomy: What does the scanner membrane capture?

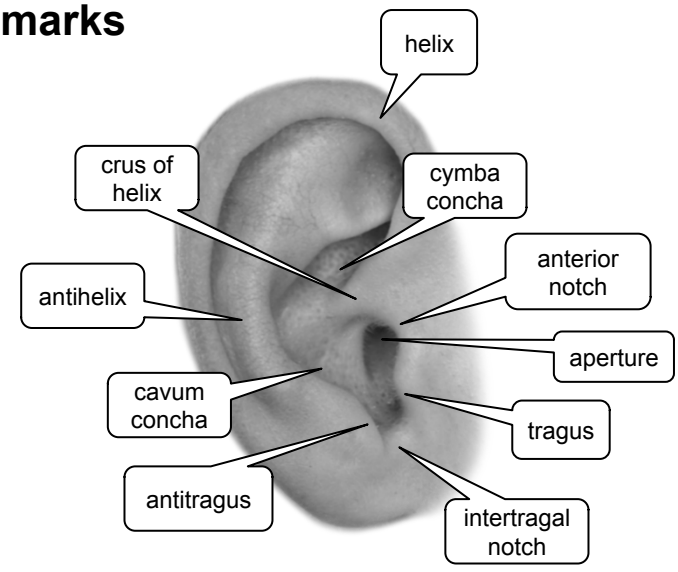


- Scans canal, lower, and upper concha
- Allows creation of full shell products



LANTOS TECHNOLOGIES

Pinna Landmarks

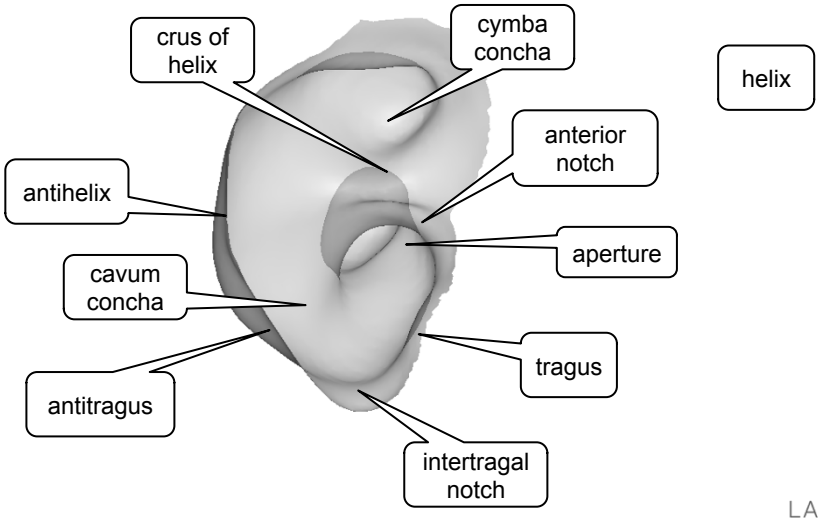


LANTOS TECHNOLOGIES

Presented in partnership with

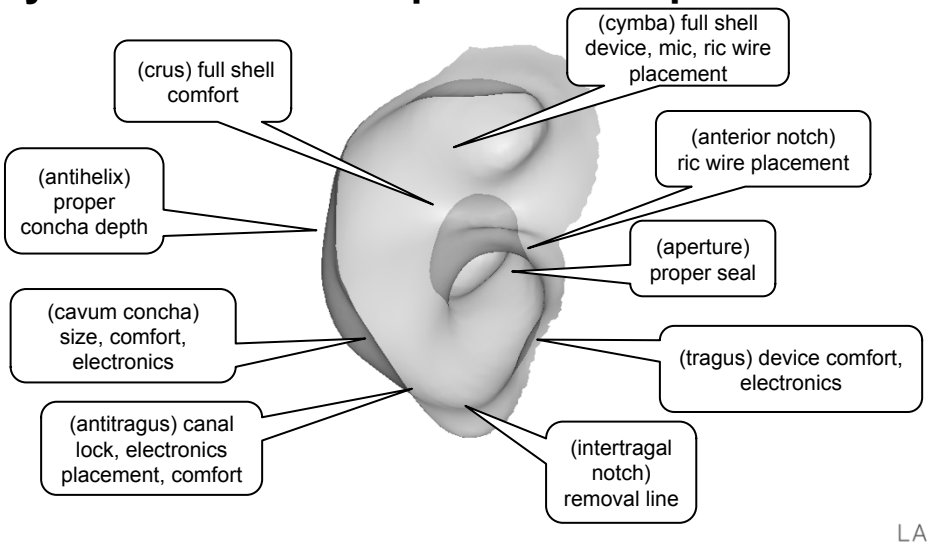
CONTINUED

Pinna landmarks on a scan



LANTOS TECHNOLOGIES

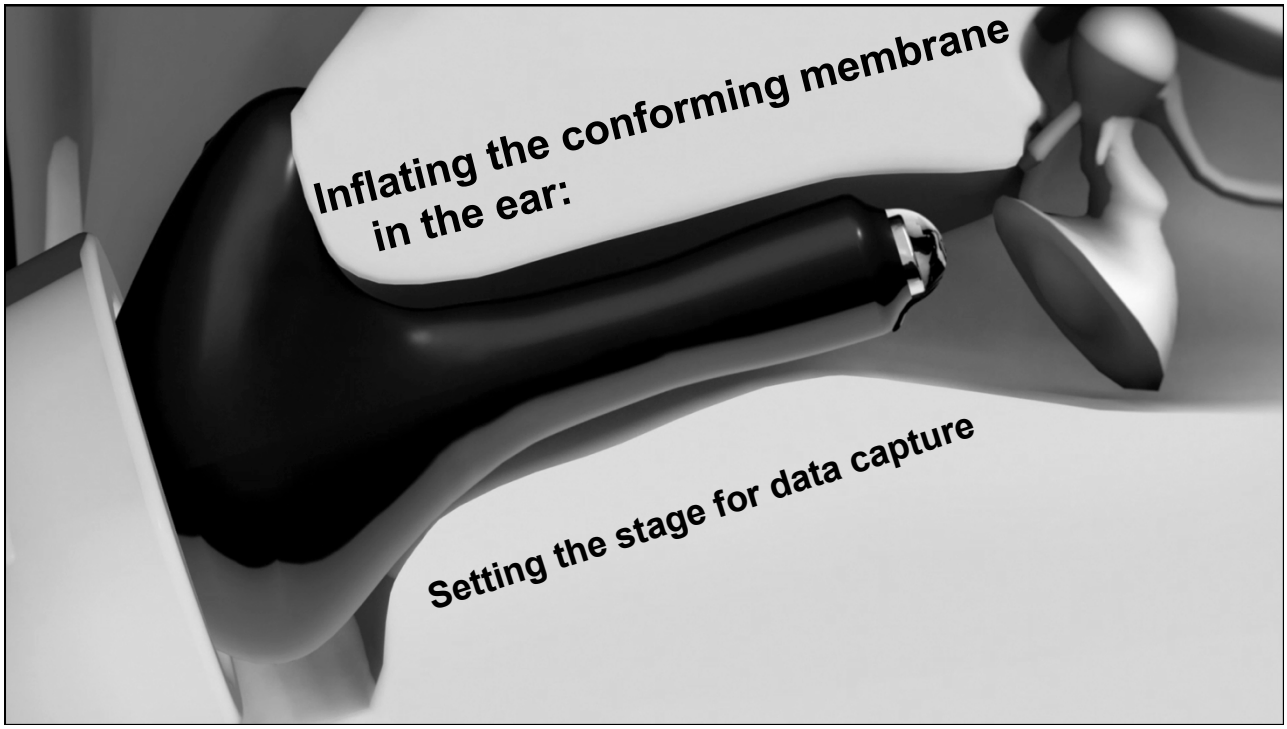
Why are landmarks important to capture?



LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED



Let's see inflation in action…

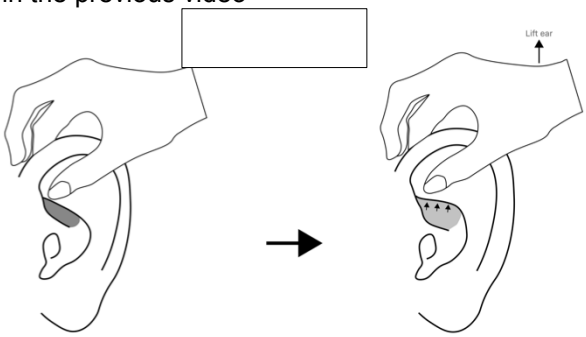
LANTOS TECHNOLOGIES

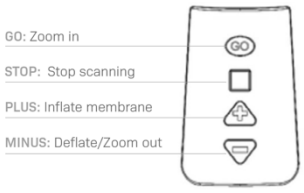
Presented in partnership with

CONTINUED

Inflation occurs in two stages

- Automatic: Initial inflation as seen in the previous video
  - Peristaltic inflation profile
  - Secure membrane depth
- Manual: Secondary inflation
  - Customize the amount of inflation
  - Perform "the lift"





LANTOS TECHNOLOGIES

"The Lift" IRL

LANTOS TECHNOLOGIES

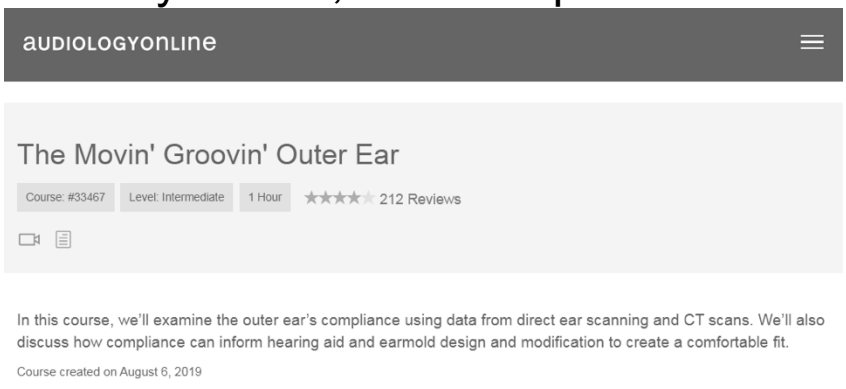
Presented in partnership with

CONTINUED

Ready to scan!

LANTOS TECHNOLOGIES

Review of Ear **Canal** Anatomy, Dynamics, and Compliance



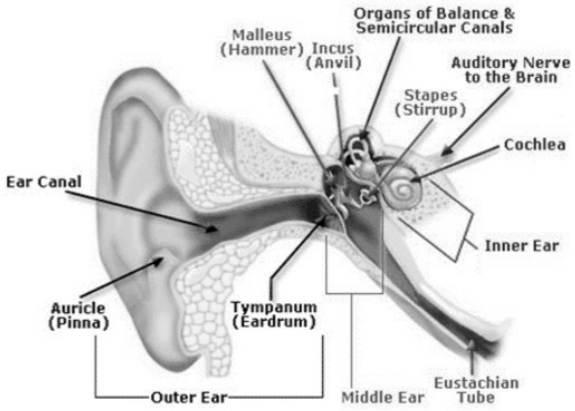
https://www.audiologyonline.com/audiology-ceus/course/the-moovin-groovin-outer-ear-33467

LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED

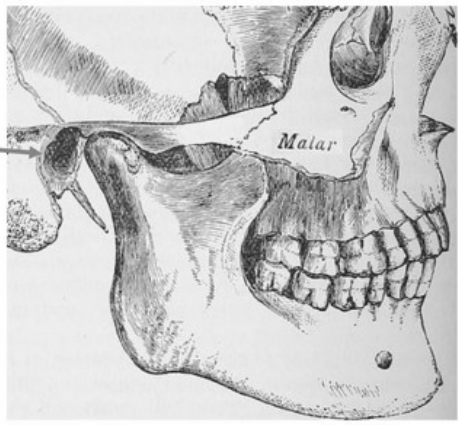
Anatomy of the Ear Canal



LANTOS TECHNOLOGIES

Ear Canal Dynamics

External Auditory Meatus (bony portion)

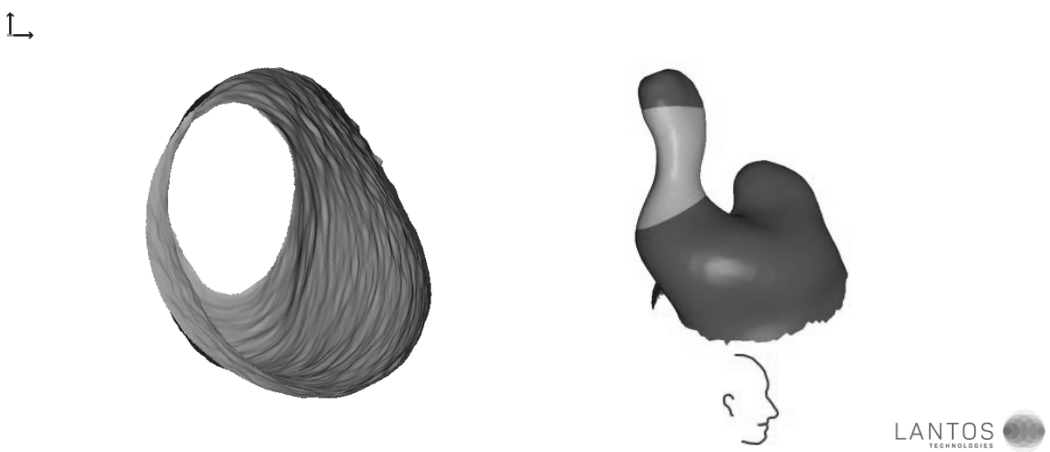


LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED

Right ear canal dynamics with jaw opening/ closing



LANTOS TECHNOLOGIES

Compliance of the Ear Canal

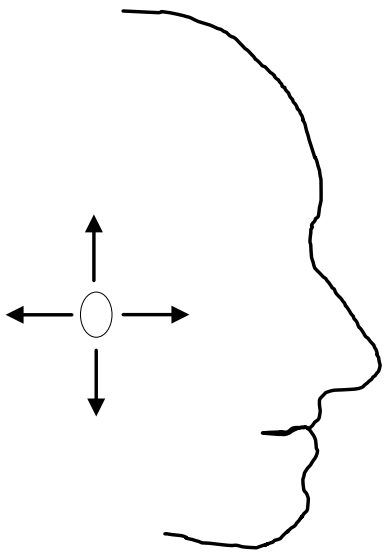
1) Compliance of the aperture to first bend region
2) Compliance of the canal when subjected to lateral pressure

LANTOS TECHNOLOGIES

Assessing compliance: scans vs impressions

Method:

- Overlay scans and impressions for 68 matched pairs
- Optimize alignment at aperture+canal
- At the aperture, measure difference in four directions

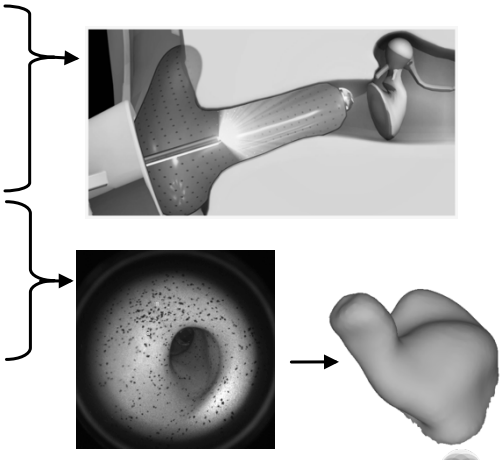


LANTOS TECHNOLOGIES

THE LANTOS EAR SCANNING PROCESS

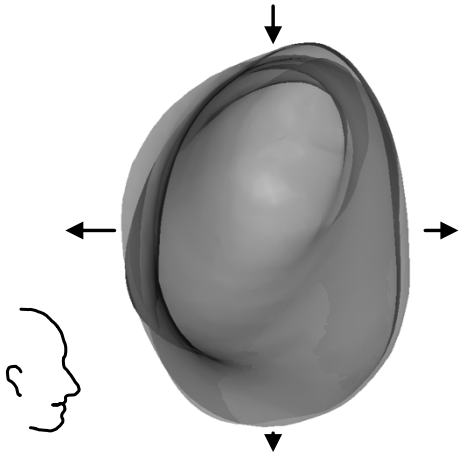
Multi-Step Scanning Process

1. Placement under direct visualization
2. Solution fills inside of the membrane (does not touch the ear), inflating peristaltically.
3. Light fluoresces the inside of membrane.
4. Each still image is stitched into one 3D file.
   - Over 1 million data points are stitched together
   - Highly accurate, 3D topographical rendering of the ear in .STL format
5. The STL file is uploaded to the Lantos Cloud together with the hearing aid or earmold order for immediate access by the manufacturer

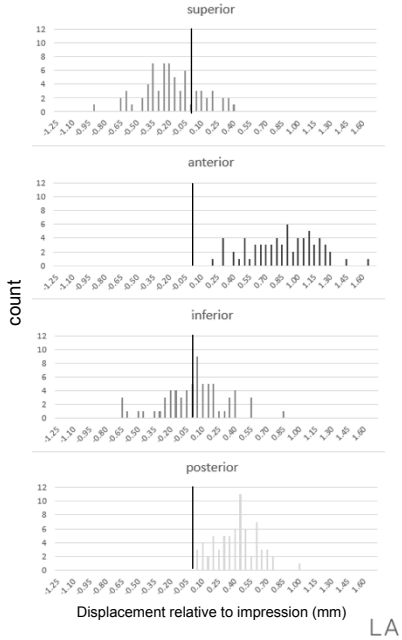


LANTOS TECHNOLOGIES

Aperture compliance with inflation



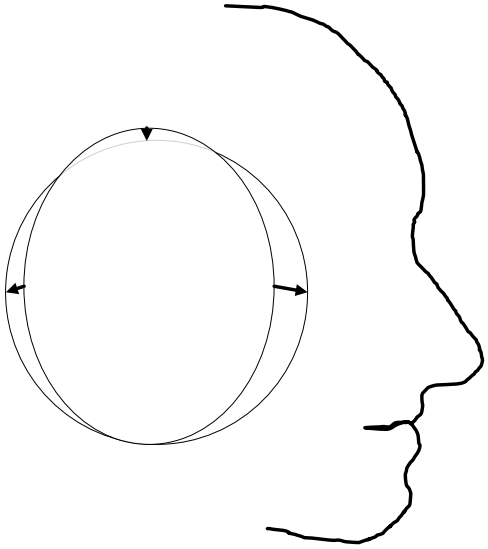
scan in pink, impression in blue



LANTOS TECHNOLOGIES

Impression vs Scan Aperture Summary

The aperture can expand most to the front of the canal and slightly to the back.



LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED

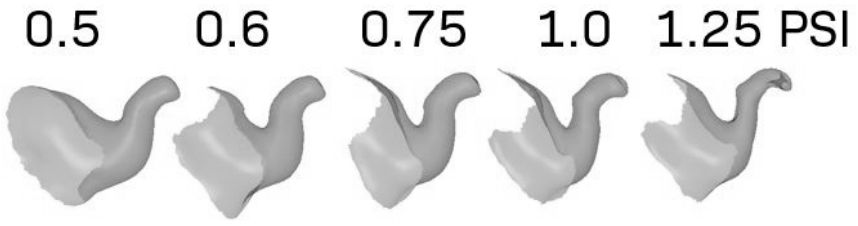
Scans as a Proxies for Comfortable Shells and Earmolds

The solution and membrane indirectly capture the *compliance* of the ear in the soft tissue/cartilaginous regions

The inflated membrane is a proxy for the custom device that will be made for the ear from the scan.

LANTOS TECHNOLOGIES

Effect of Lateral Pressure on the Ear Canal

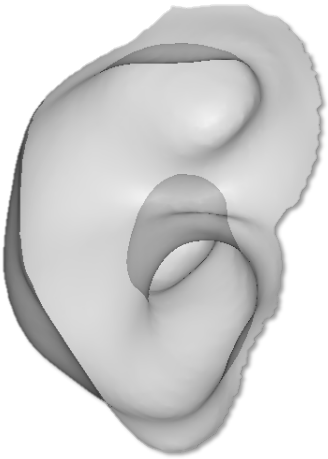


LANTOS TECHNOLOGIES

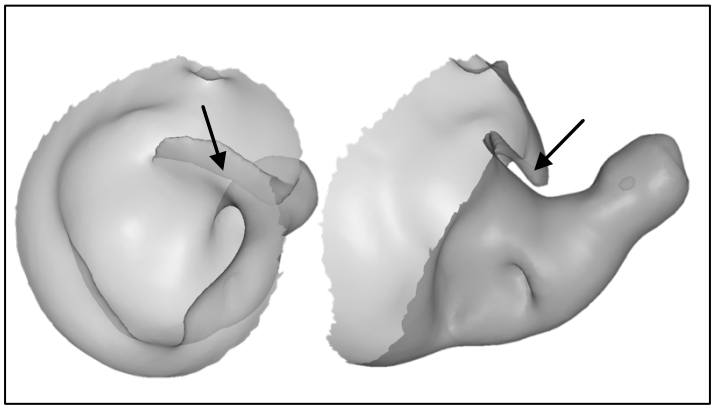
Capturing the Compliant Ear While Avoiding Artifacts

LANTOS TECHNOLOGIES

Normal Example



Artifact Example



LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED

Solution!

Simply by bracing with a pinky or ring finger against the scannee's head, we're able steady the scanner and monitor our pressure.

LANTOS TECHNOLOGIES

Presented in partnership with

CONTINUED