



Mätningar av gaser i mastoid med GASMAS

**Sven Lindberg PhD,MD1, Märta Lewander2, Tomas
Svensson PhD2, Roger Siemund PhD,MD3, Katarina
Svanberg PhD,MD4, Sune Svanberg PhD2**

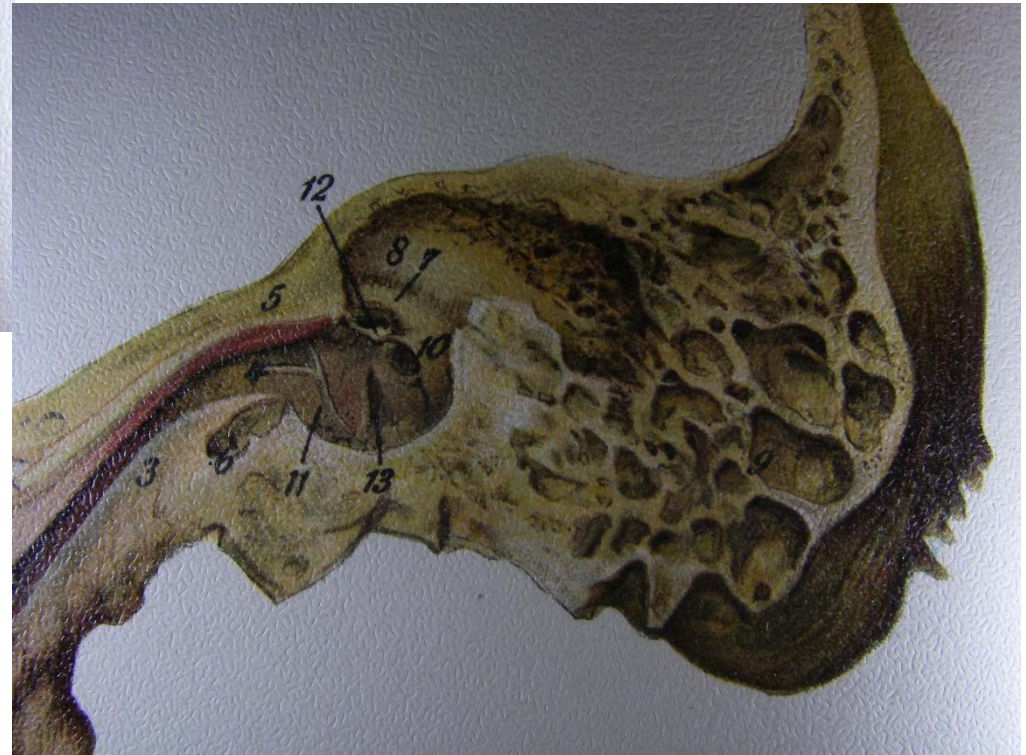
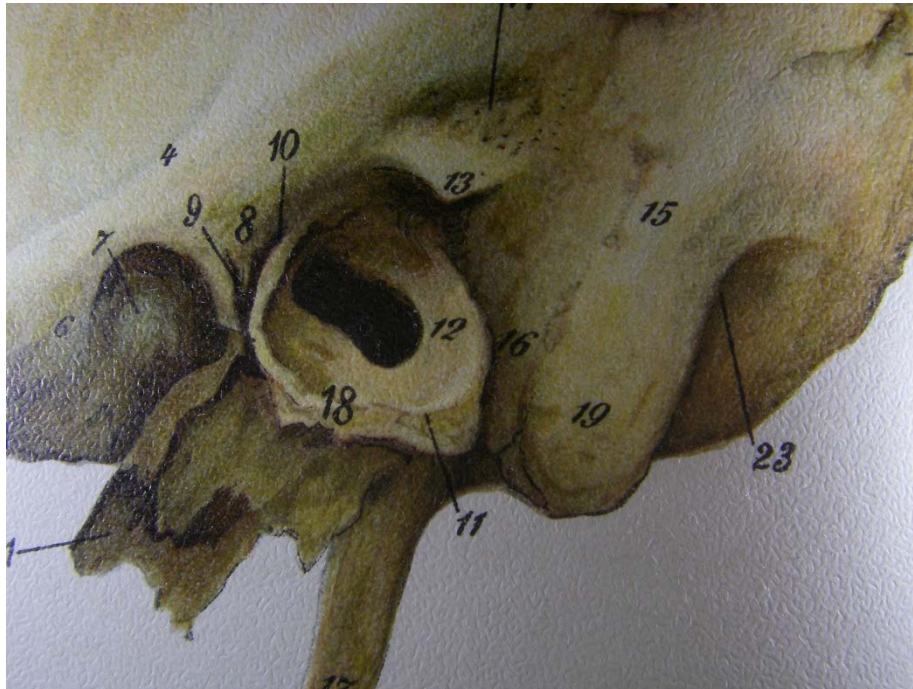
From the Departments of Oto-Rhino-Laryngology1, Diagnostic
Radiology3, Oncology4, University Hospital, Lund, and Division
of Atomic Physics2, Lund University, Lund, Sweden.

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Mastoid

- Örats "bihålor"



Bilder från Adam Politzer 1905

Mastoid size

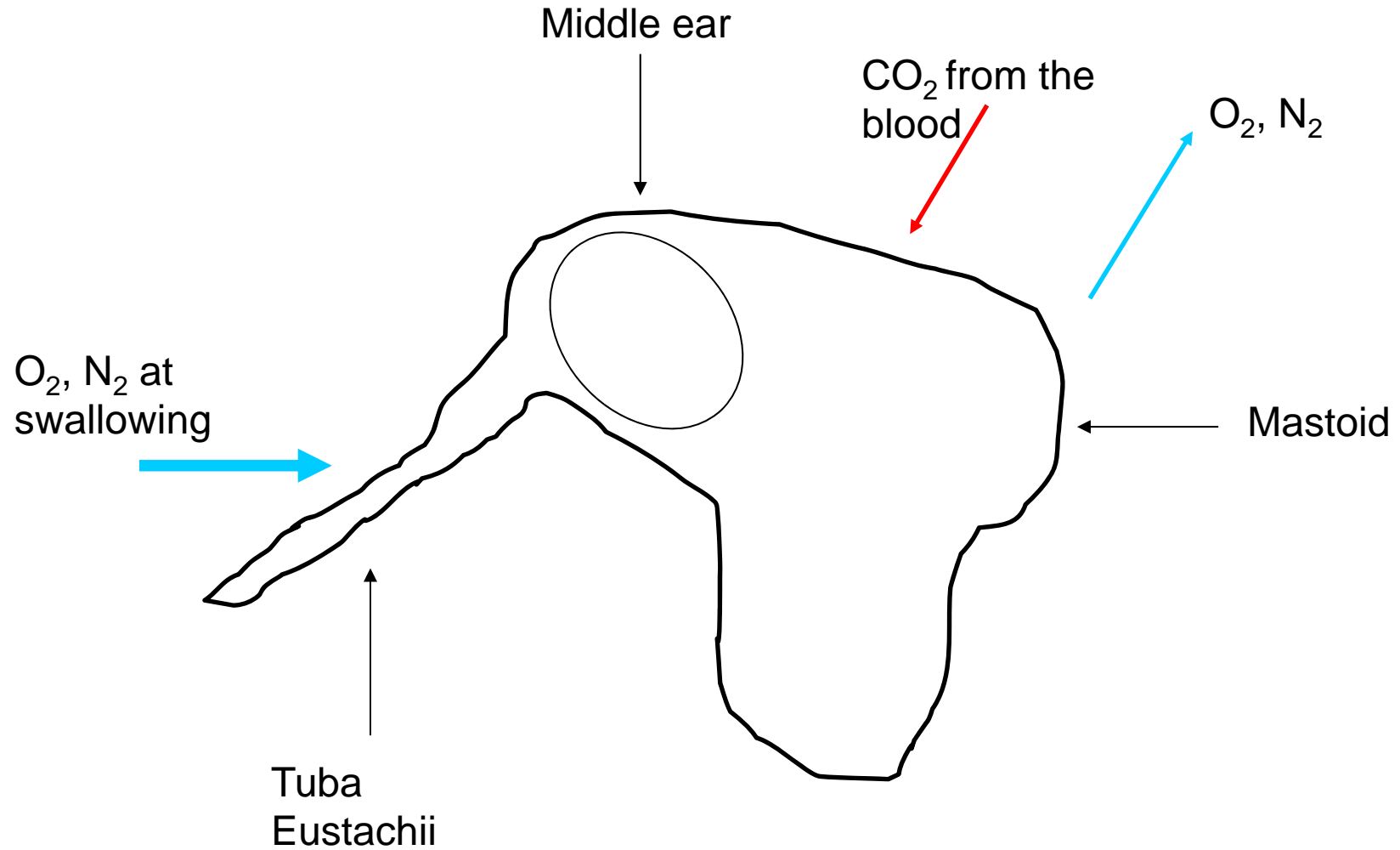
- A small mastoid volume is associated with serous otitis media
Diamant M 1958, Lindeman P 1980, Aoki K 1998
- Chronic middle ear inflammation in an animal model induced a smaller mastoid volume
Aoki K 1990
- Oxygen concentration is probably reduced during middle ear inflammation

Mastoid gas composition

- The same air as in the nose and the nasopharynx – but it is not equilibrated continuously
- Every time one swallows (or performs another equilibration maneuver) – the gas is exchanged
- Gasequilibration over the mucosa is bidirectional - O_2 and N_2 are absorbed (decreasing their concentration) while CO_2 accumulates the cavity

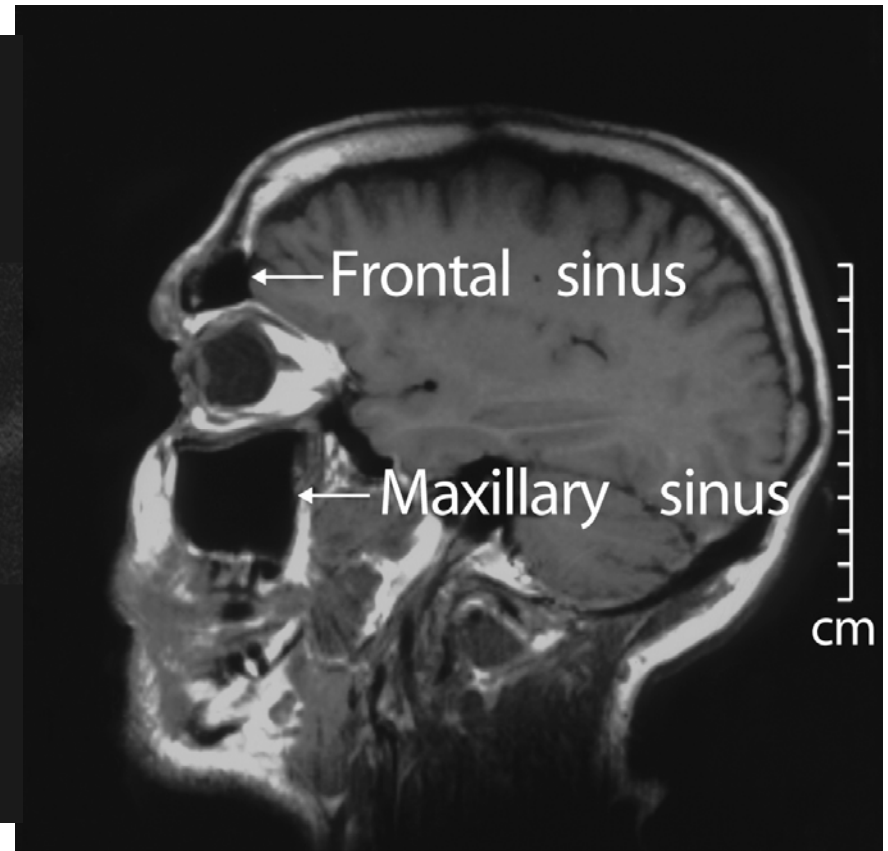
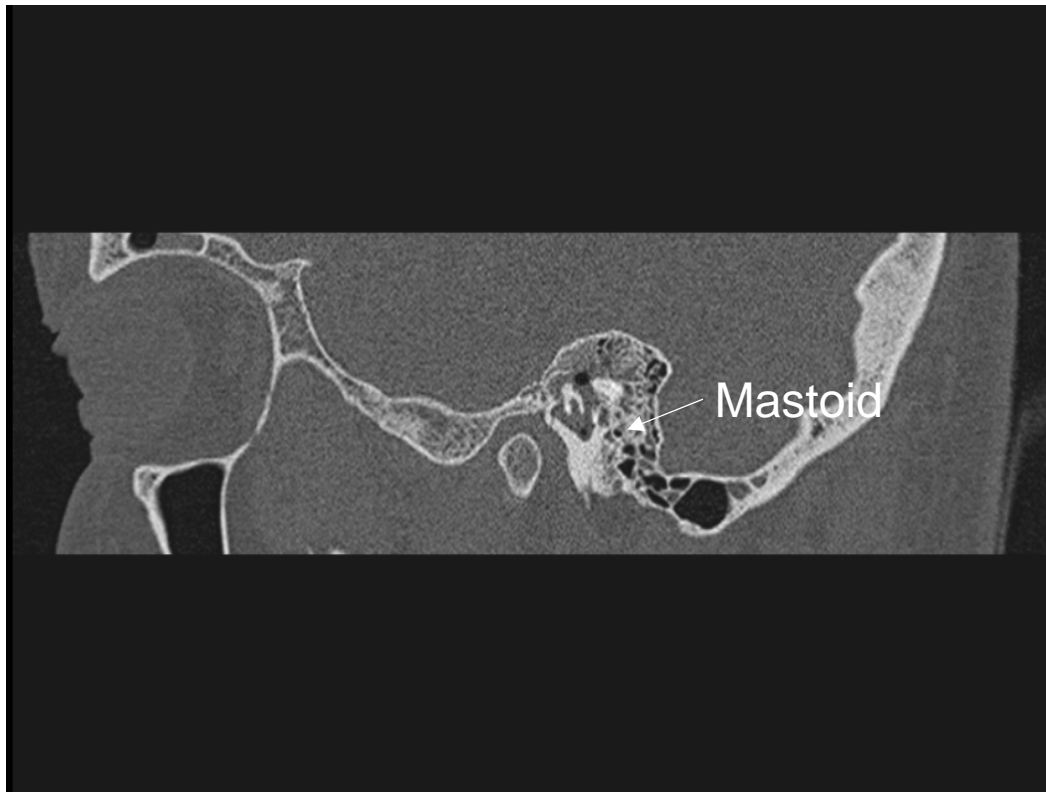
Hergils L, Magnusson B 1990, 1997, Sadé J 1995

Mastoid and gases



Measurement of gases in the cavities of the head with laser scattering spectroscopy

O₂ (760.445 nm) och H₂O (935.686 nm)



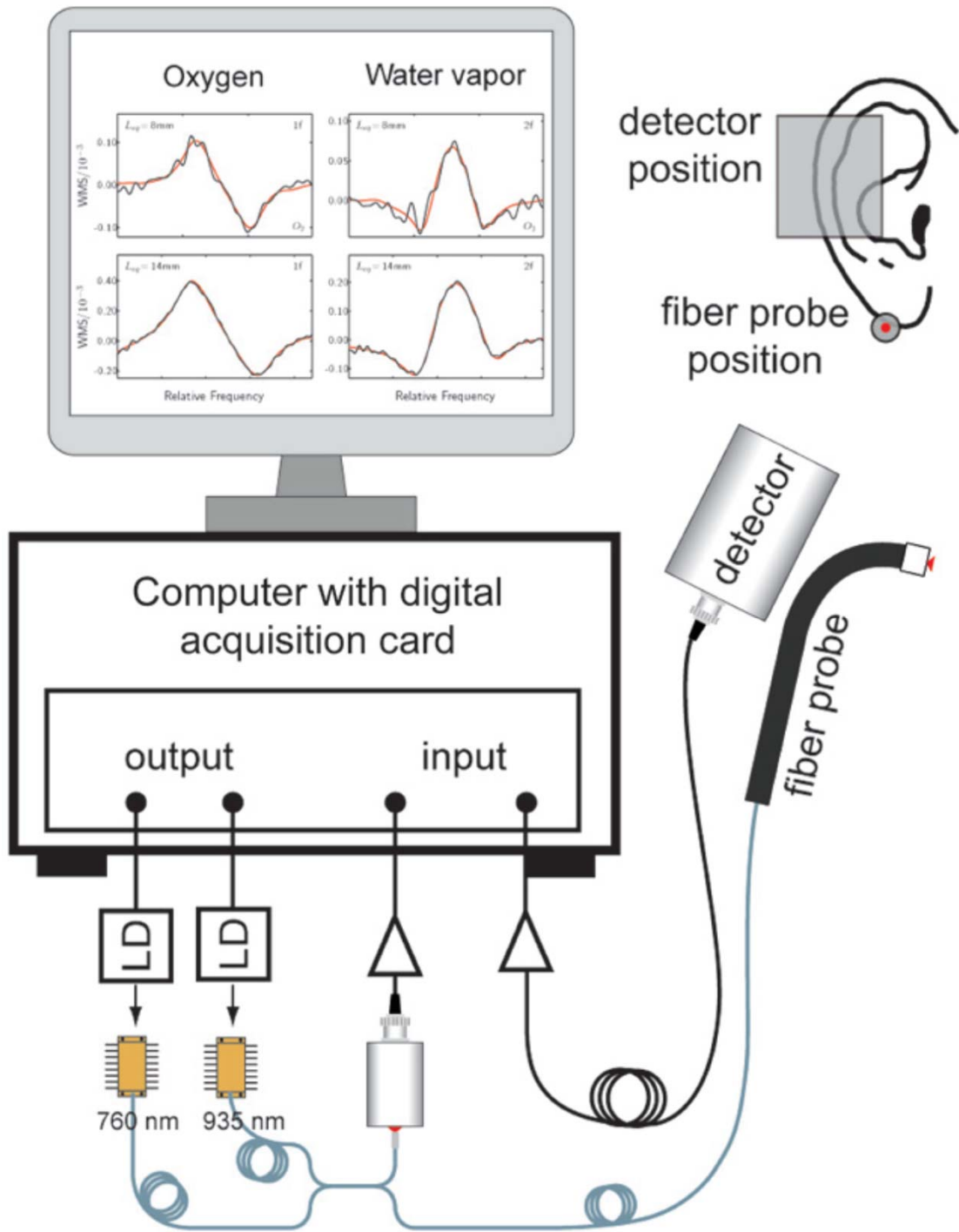
Equivalent mean path length L_{eq}

L_{eq} depends on the gas concentration

Method

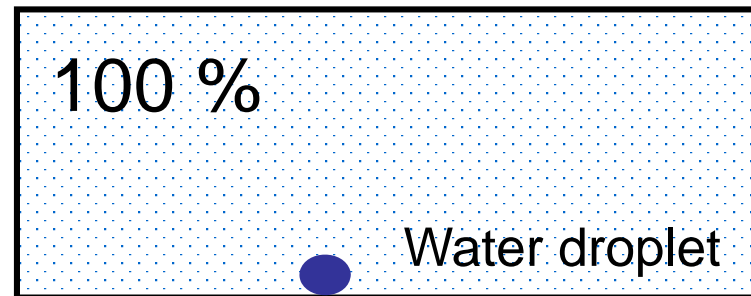
- 31 patients were investigated with CT sinus which includes the mastoid
- We performed 248 measurements with the GASMAS technology (4 from each mastoid) not knowing the results of the CT
- Mastoid volume was measured by an experienced radiologist according to the formula: width*length*depth
- The mastoids were classified as
 - 0 = normal, 1 = partial opacity and
 - 2 = total opacity

Lund & MacKay 1993



Water vapor (H₂O)

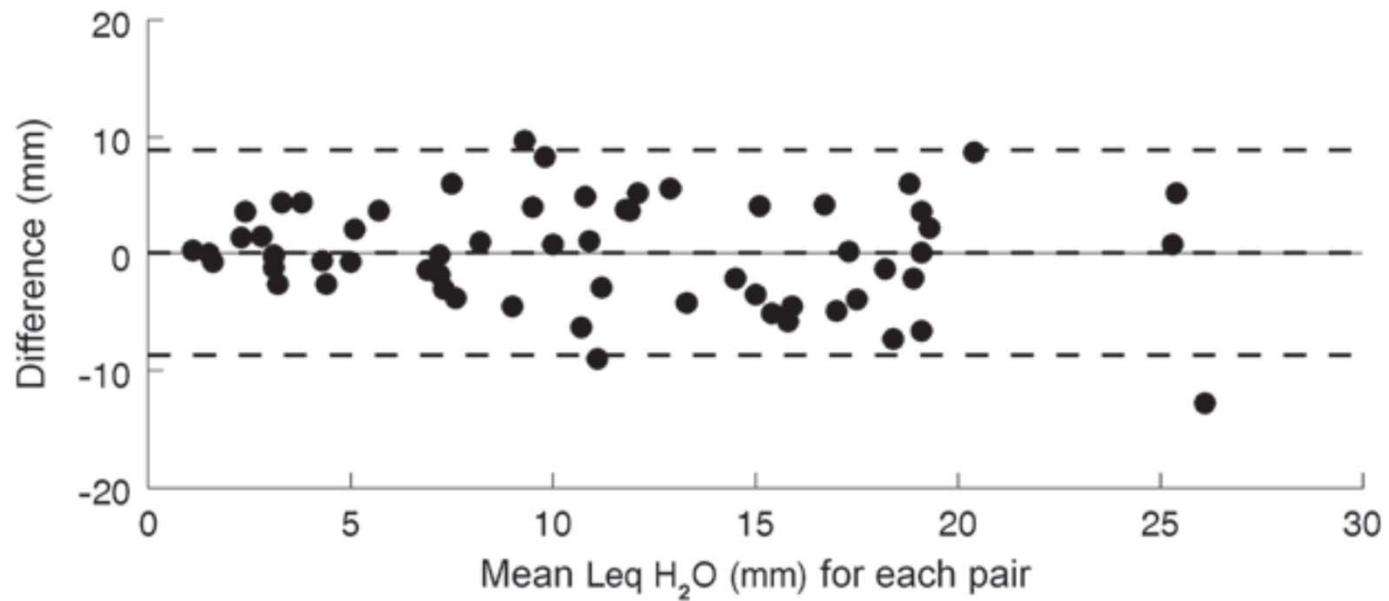
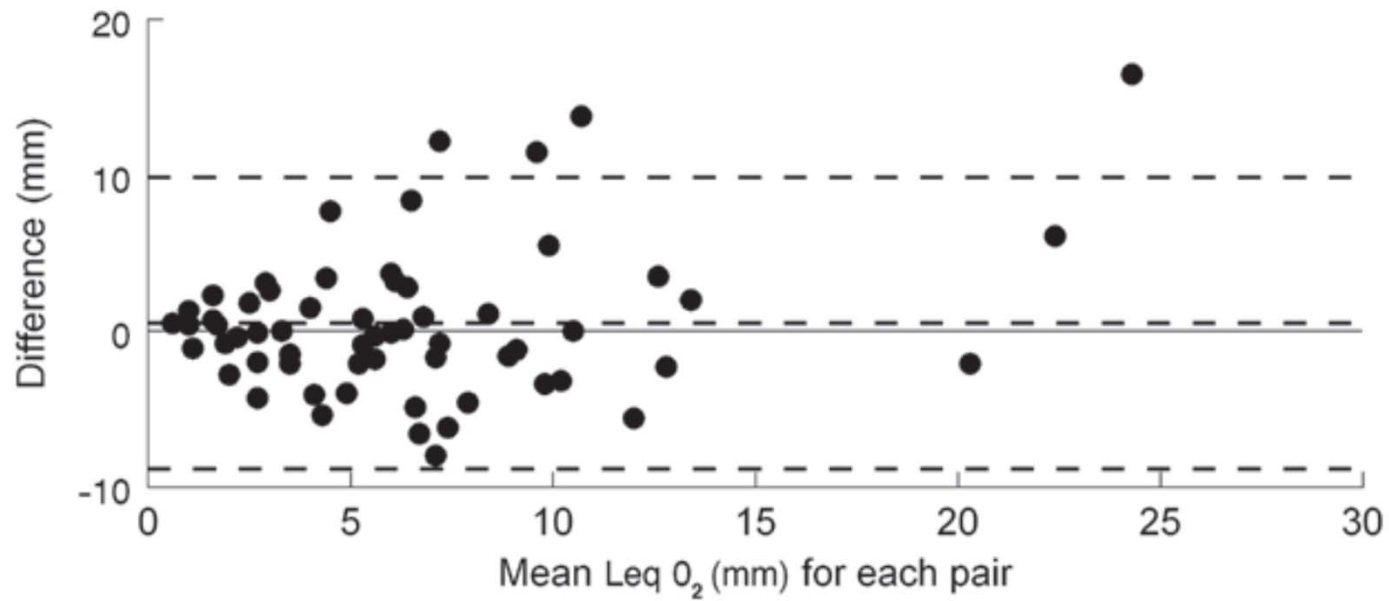
A closed volume will have a 100 % relative humidity



Bland-Altman plot

- In order to study the reproducibility
- Two measurements of the same mastoid sinus. On the X-axis the mean of the measurements, on the Y-axis their corresponding difference. The smaller the difference, the better is the reproducibility
- ± 1.96 SD of the difference is also shown in the plot

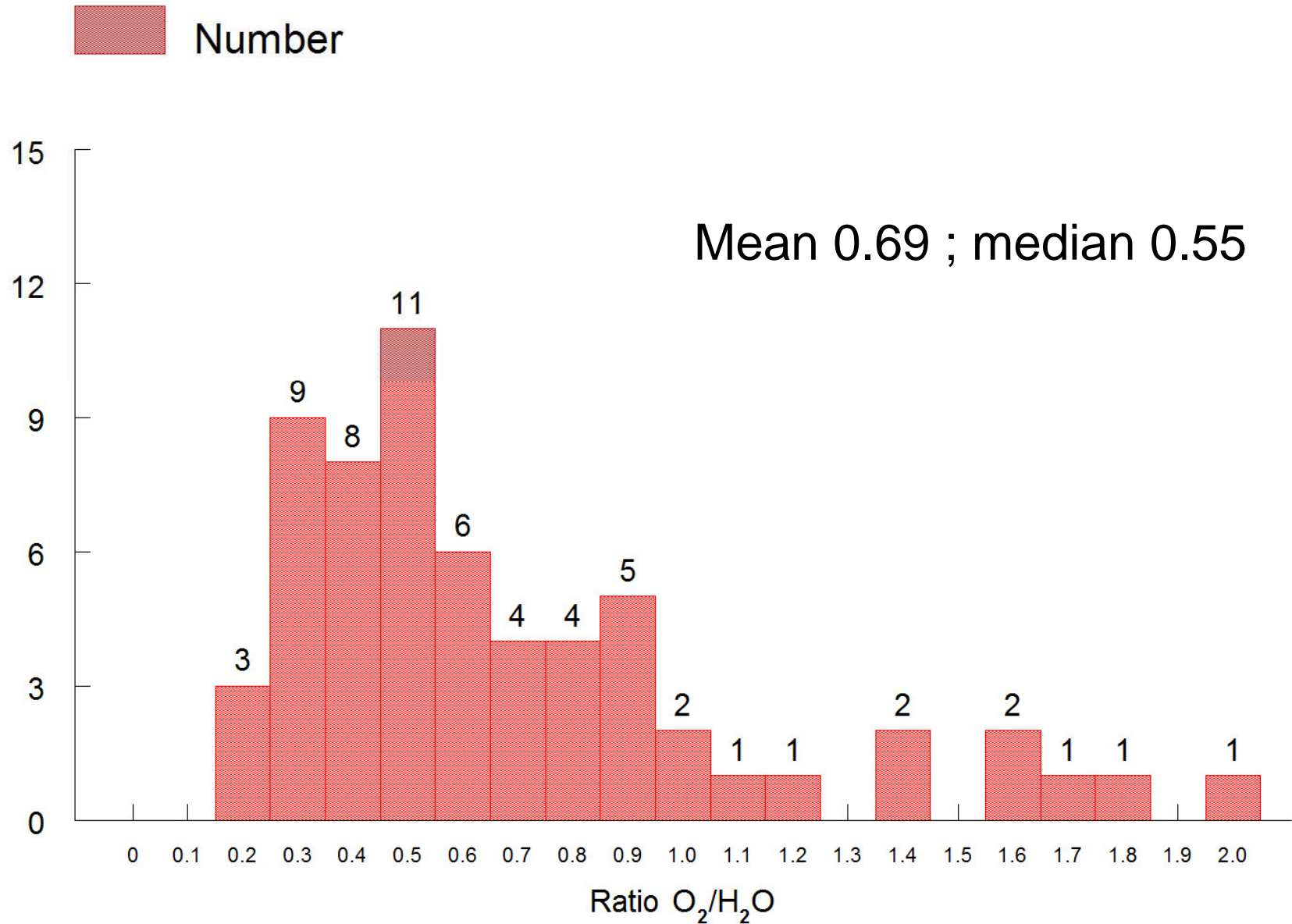
Bland-Altman plots (first vs last measurement)



Conclusion 1

- Measurements are reproducible, slightly better for H₂O than for O₂

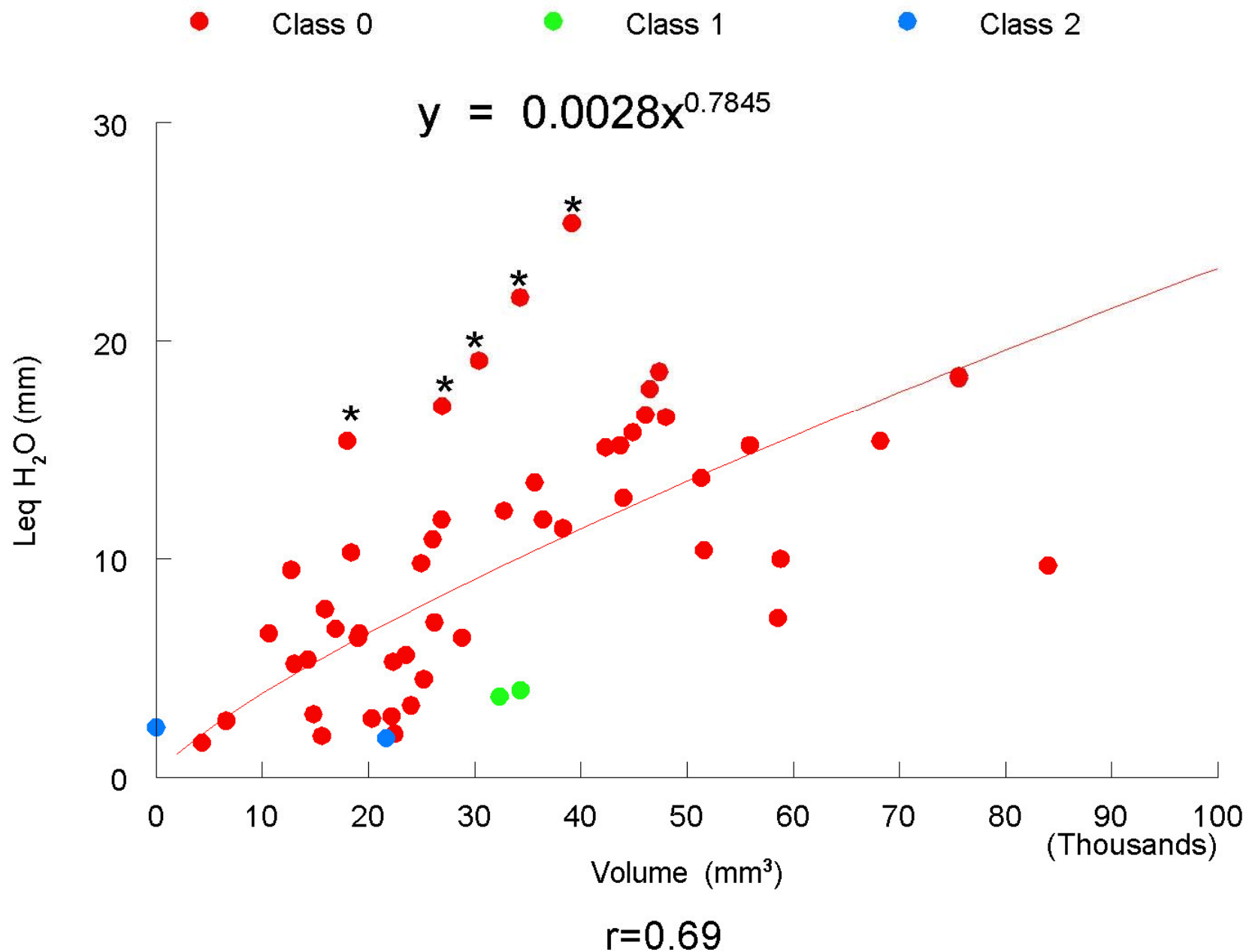
Histogram ratio Leq O₂ / Leq H₂O



Conclusion 2

- The concentration of O_2 in the mastoid is lower than in the air of the surrounding room!
- This is different to the nasal sinus where the ratio is approximately 1 instead of 0.55

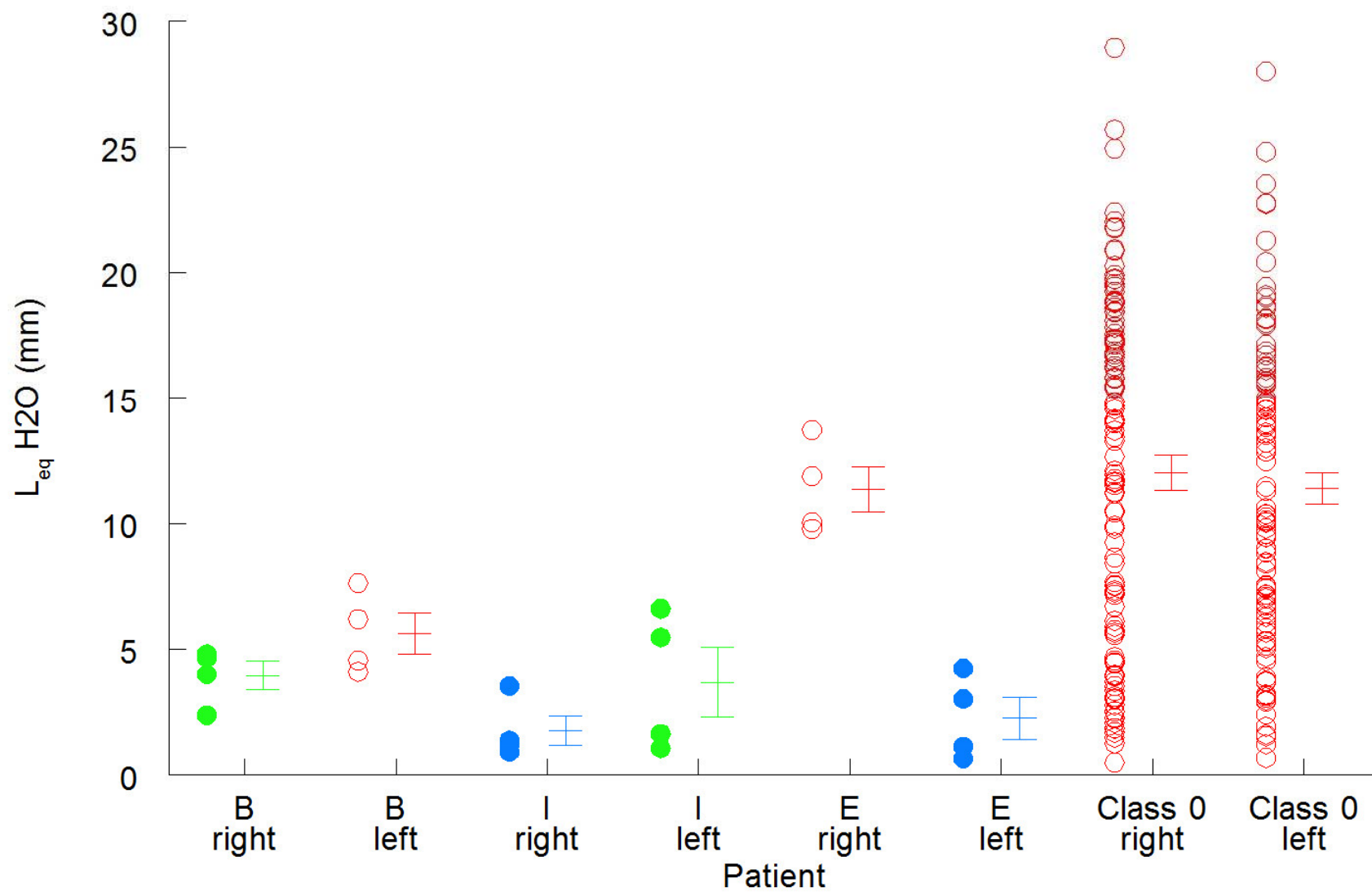
Correlation between mastoid volume and Leq H₂O on CT (power curvefit)



Conclusion 3

- $L_{eq} \text{H}_2\text{O}$ can be used for indirect measurement of the volume of the mastoid cavity!

$L_{eq} H_2O$
Class 1 and 2 mastoids



Conclusion 4

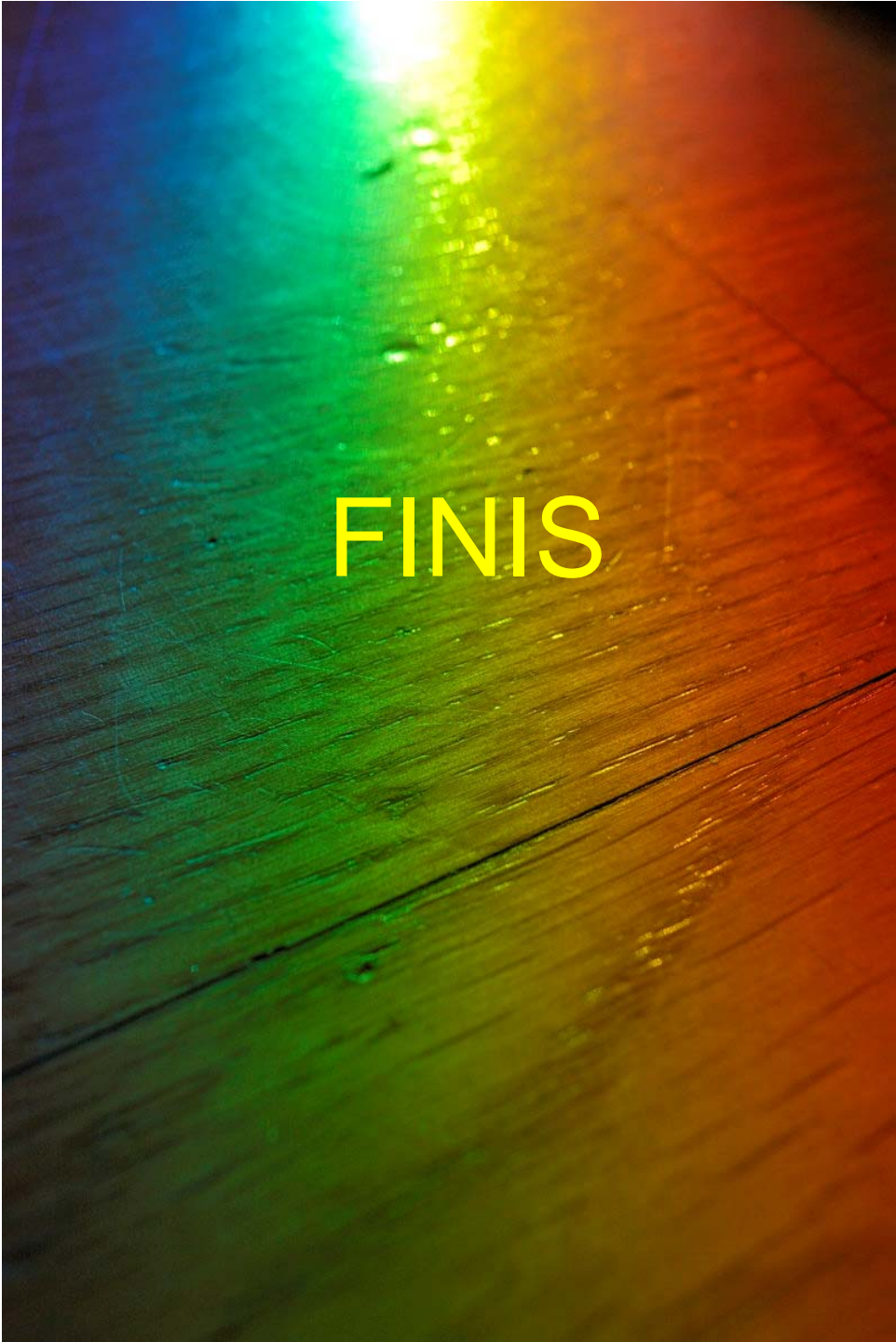
- The sensitivity of laser spectroscopy is probably high (to find mastoids with a disease), but the specificity is lower as measurements from "diseased" and "normal" mastoids overlap

Pros

- **Non-invasive**
- Repeated measurements in order to monitor progress/regress of disease

Cons

- Overlap between normal mastoids and mastoids with disease
- Leq is a non-intuitive parameter



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