

Geometry Measurements of FWEC Alveoles

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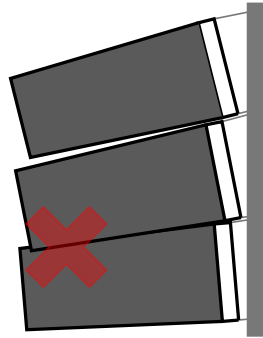


6.11.2019

Measurements of the Alveole Geometry

Why?

- Check if the alveoles will fit in the FWEC
- No adjustment after glueing possible



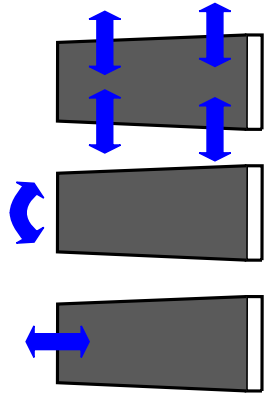
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What?

- Deviations on the side surfaces
- Deviations in the angle to the backside
- Deviations in the length



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- Deviations in the length

How?

- Leica Absolute Tracker and T-Scan
- X-Ray Imaging



Measurements of the Alveole Geometry

Leica Absolute Tracker and T-Scan

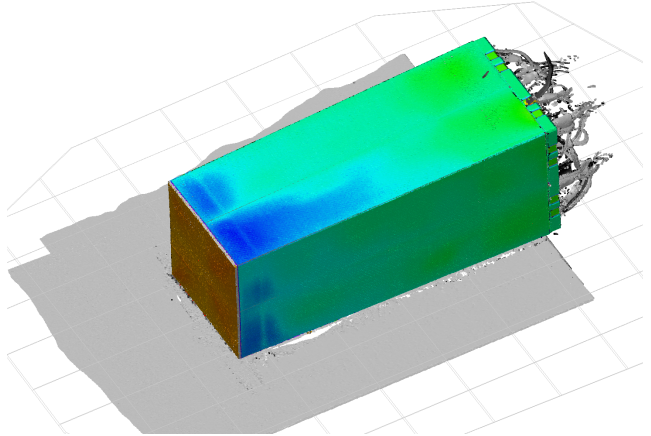
- Handheld laserscanner T-Scan measures surface of the object.
- Absolute Tracker measures position and orientation of T-Scan.
- Accuracy about $60\text{ }\mu\text{m}$, Range 40 m



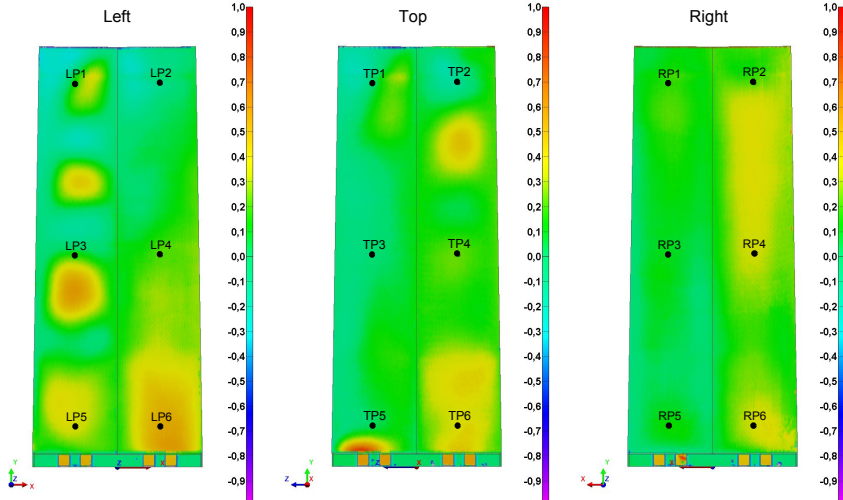
Measurements of the Alveole Geometry

Measurements

- Alveole sits on flat surface
- 40 alveole scanned
- All visible sides are scanned
- Pointcloud of 2.5 million points
- Pointcloud is compared to a CAD-model
- Deviations to the model are extracted

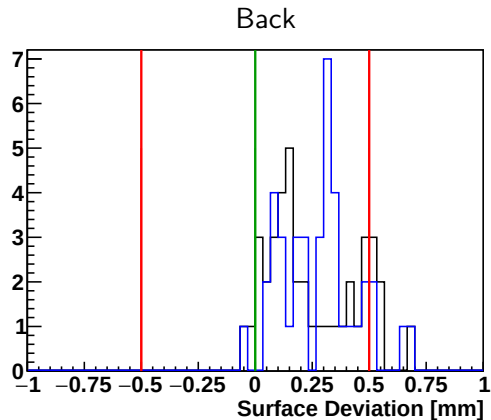
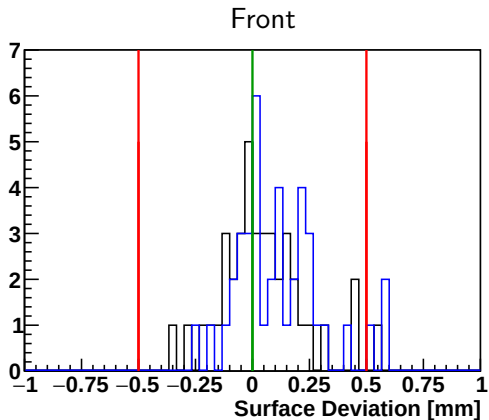


Deviations on the Side Surfaces



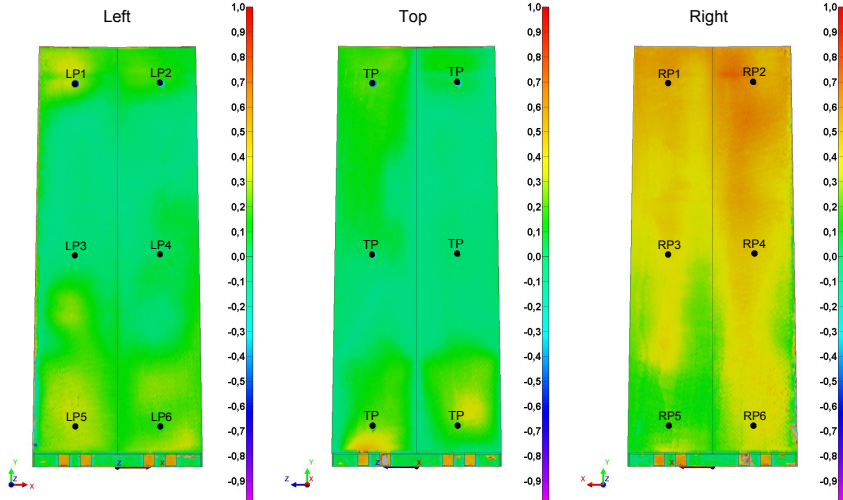
Sides of the alveoles are not flat, most alveoles bulge on the sides

Deviations on the Side Surfaces



Interesting – but not a problem, the alveoles are springy

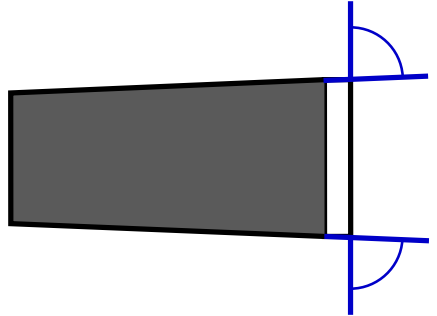
Angles to the Backside of the Alveole



The right side of alveole 1-X4Y1 is tilted, this can be a problem

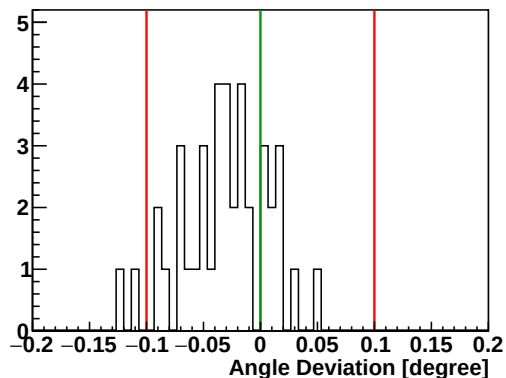
Definition of Angles

- Angle between carbon fiber alveole and back of the alveole
 - Four different angles, one for each side
 - Nominal value of 89.07°
-
- Direct measurements for top, left and right side
 - Indirect measurement for bottom side
 - Only deviations shown
 - Negative deviations move tip to the center
 - Positive deviations move tip to the outside
 - 0.1° corresponds to 0.5 mm

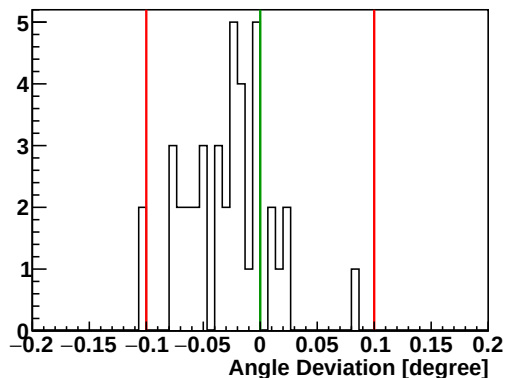


Distribution of Angles

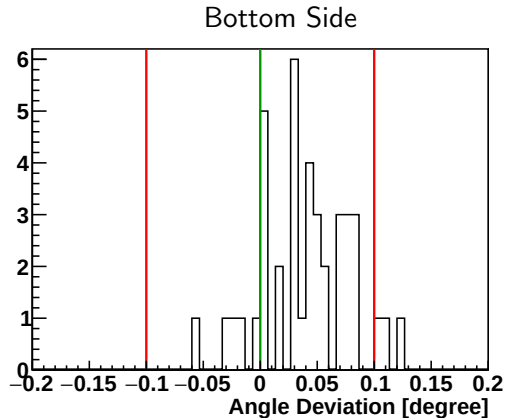
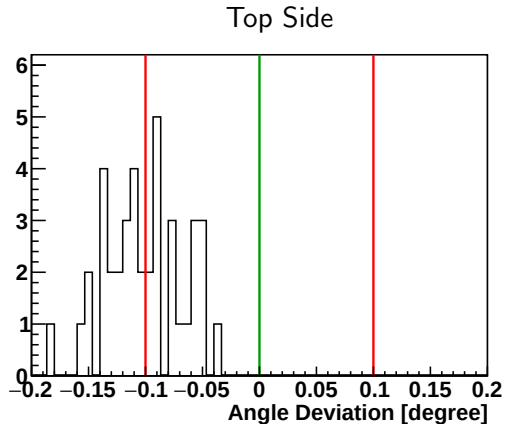
Left Side



Right Side



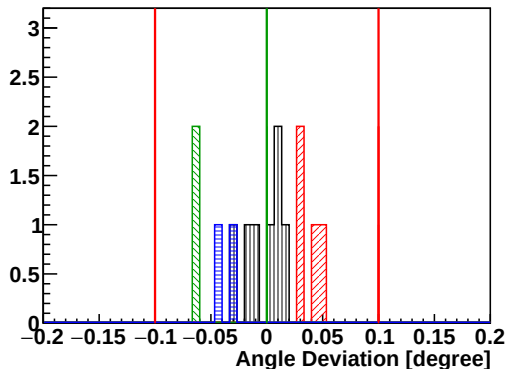
Distribution of Angles



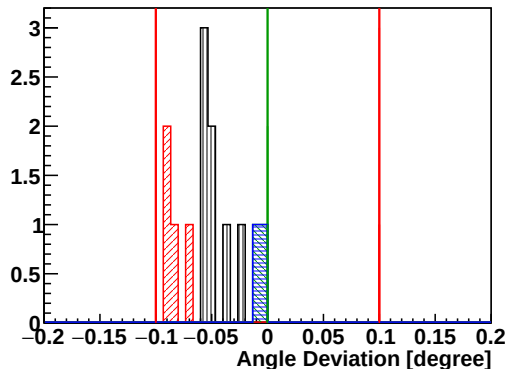
- Systematic deviations for top and bottom sides
- Might be due to assembly?

Rotation of Alveoles

Left Side



Right Side



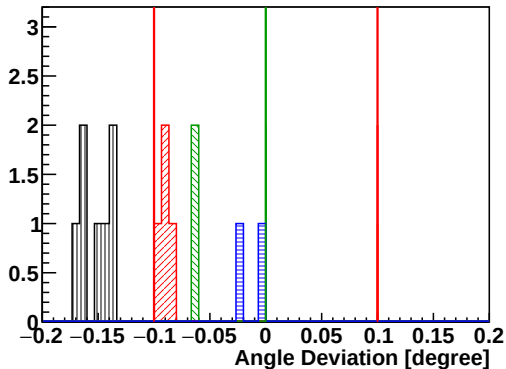
Rotation of Alveole 2-X4Y1

Black: 0° Red: 90° Blue: 180° Green: 270°

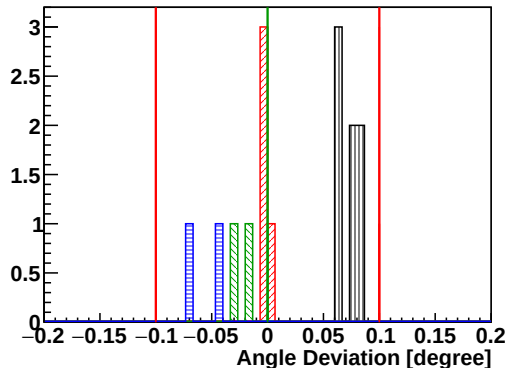
Angles on the alveole change when rotated

Rotation of Alveoles

Top Side



Bottom Side

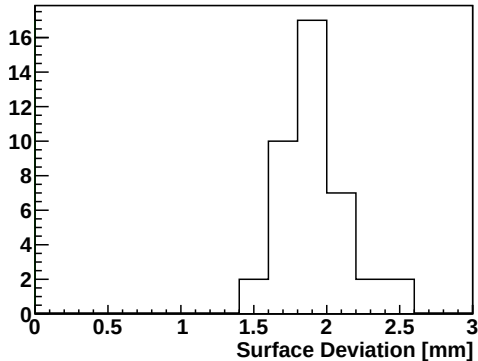


Rotation of Alveole 2-X4Y1

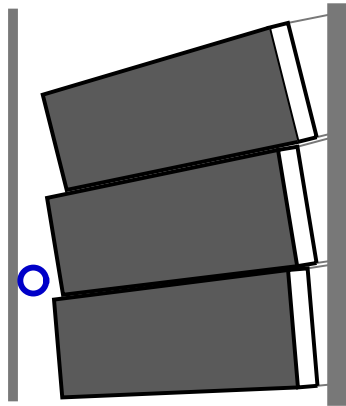
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Angles on the alveole change when rotated

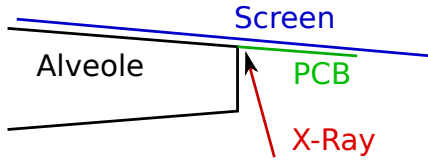
Length of the Alveoles



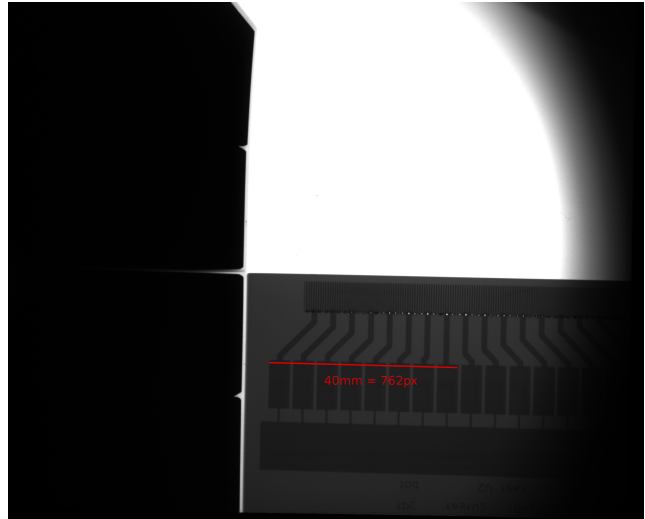
- All Alveoles are longer than expected
 - Capsule (1 mm) not included in CAD
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- Distance to front enclosure 11 mm
 - Cooling pipes?



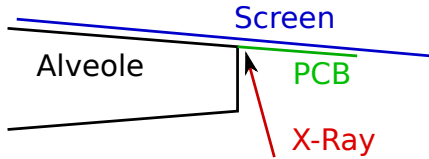
X-Ray Image Front



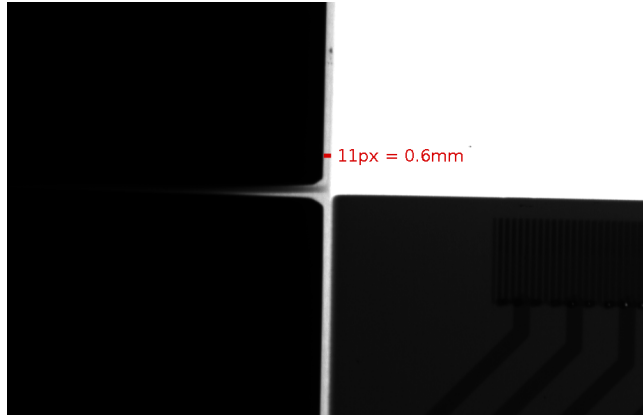
- X-Ray shadow of front of alveole



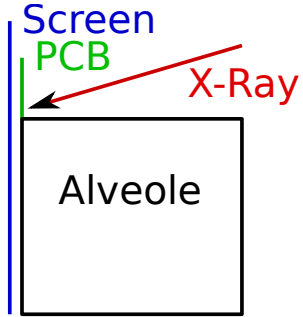
X-Ray Image Front



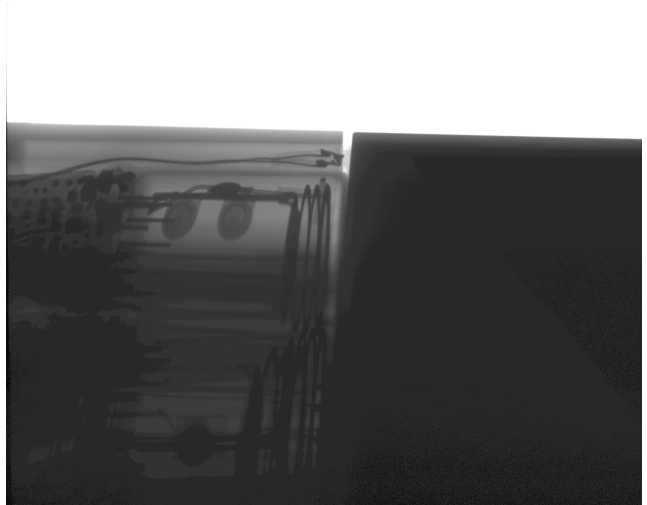
- X-Ray shadow of front of alveole
- 0.6 mm distance from crystal to front
- this includes thickness of Alveole of 0.2 mm
- edges of crystal are chamfered
- gap appears larger



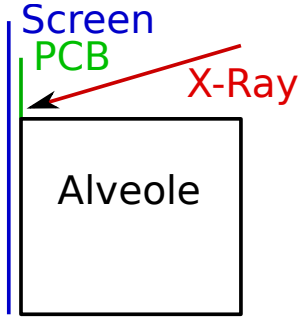
X-Ray Image Insert



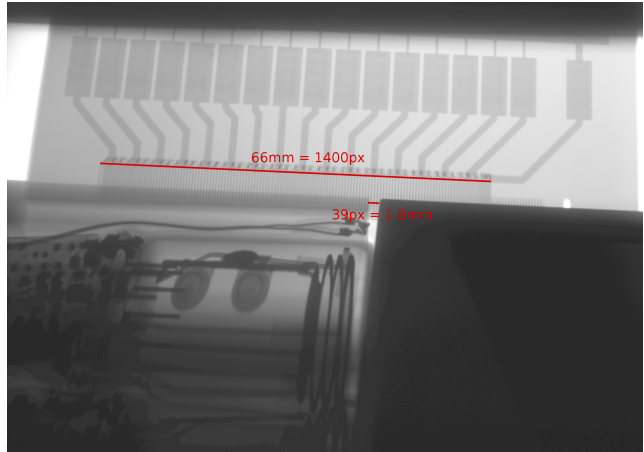
- X-Ray shadow of end of crystal



X-Ray Image Insert



- X-Ray shadow of end of crystal
- 1.8 mm distance from crystal to insert
- this includes the capsule



Open Issues

Bulging of Alveoles

No Problem

Angles to the Backside

Larger deviations, especially on the Top

Rotation of Alveoles

Alveoles move when rotated

Can this be used to straighten Alveoles?

Length

Alveoles are 2 mm to 3 mm longer than expected

Is there enough space for cooling?