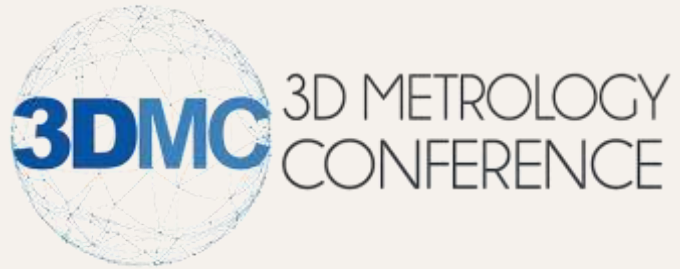


GrupoBoticário





Metrological evaluation of 3D printed fixtures for use in cosmetics industries

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Aachen, Germany

November 15 - November 17, 2022

we craft

beauty

and through
beauty we create
opportunities
to transform
people's lives
and the world
around us

/ THIS IS OUR PURPOSE /

OBOTICÁRIO

EUDORA Quem Disse,
Berenice?

vult BEAUTYBOX

O.U.I.
ORIGINAL UNIGLE POTÍVEL

Dr. JONES

beleza
NA WEB

MOOZ

CASA
MAGALHÃES

Fundação
GrupoBoticário

GGAVB

Instituto
GrupoBoticário

multi

difficulties

01

large and dynamic portfolio

02

need for fixturing during measurement

03

divergence of results on different sites

opportunities

01

print time and price of 3d printing

02

3d printing with sustainable materials

03

custom fixturing



objective

this project aimed to evaluate the metrological performance of fixtures manufactured by 3D printing and used in the dimensional evaluation process in CMM.

/ study planning /

01

equipment
validation & part
calibration

02

3D printing

03

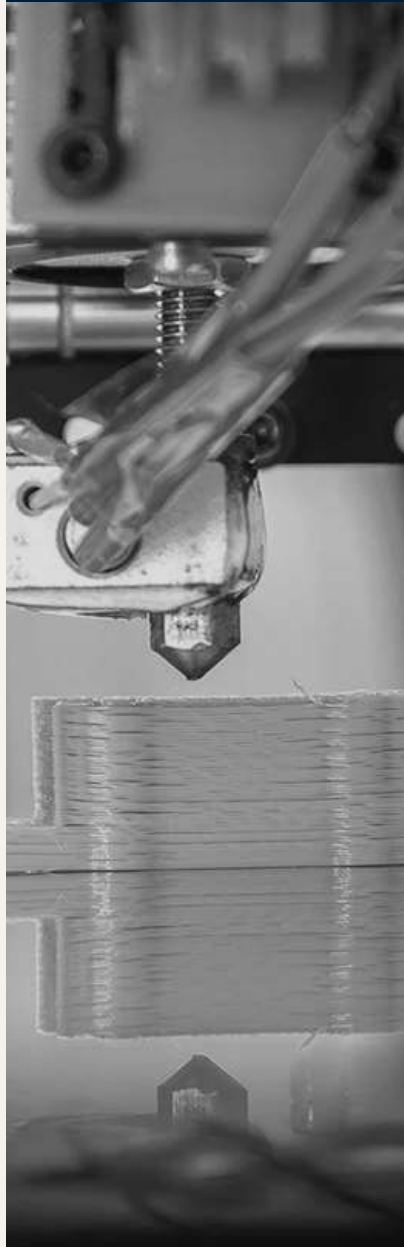
measurements

04

analysis

05

conclusions



01

equipment
validation
& part
calibration



CMM: Zeiss O-Inspect 322

measurement strategy: tactile

stylus: \varnothing 3 mm

object: same strategy of the part evaluation

repeatability : 0,0026 mm

01. cylinder

**control
diameter**

3 circular
sections
(360°)

(1270 points
each)

5 mm/min

Z200D-P*

02. plan

1 circular
section
(360°)

(1270
points)

5 mm/min

Z400L*

03. intersection point

control point

coordinates x, y
and z from the
origin



* Messstrategien Cookbook taktil [Carl Zeiss Industrielle Messtechnik GmbH](2/2014)

02 3D printing

3D printer 3Dcloner ST g3

heated bed temperature: 60 °C

nozzle temperature: 200 °C

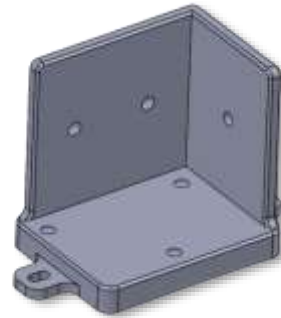
process: fused deposition modeling

filament

material: polylactic acid

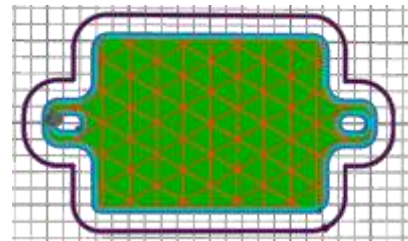
diameter: 1.75 mm

pattern: triangular



Density is the “infill fullness” of the inside of a part. In slicers, this is usually defined as a percentage between 0 and 100, with 0% making a part hollow and 100%, completely solid.

density 25%

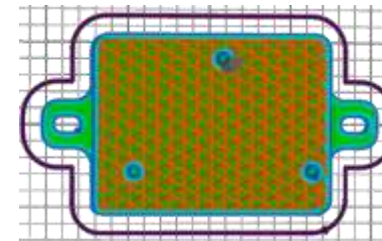


time: 5 h 33 min.

weight: 48 g

cost: 1.46 USD

density 50%

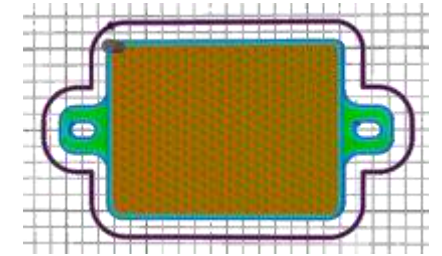


time: 5 h 45 min.

weight: 54 g

cost: 1.69 USD

density 75%



time: 5 h 52 min.

weight: 63 g

cost: 1.81 USD

03

measurements



Scanner Zeiss Comet L3D 5M

Measuring field 250

with rotatory table

360°: captures every 10°

1000

positioning cycles

with measurement every 10 cycles

03. intersection point

control point

02. plan

01. cylinder

control

diameter



CMM: Zeiss O-Inspect 322

measurement strategy: tactile

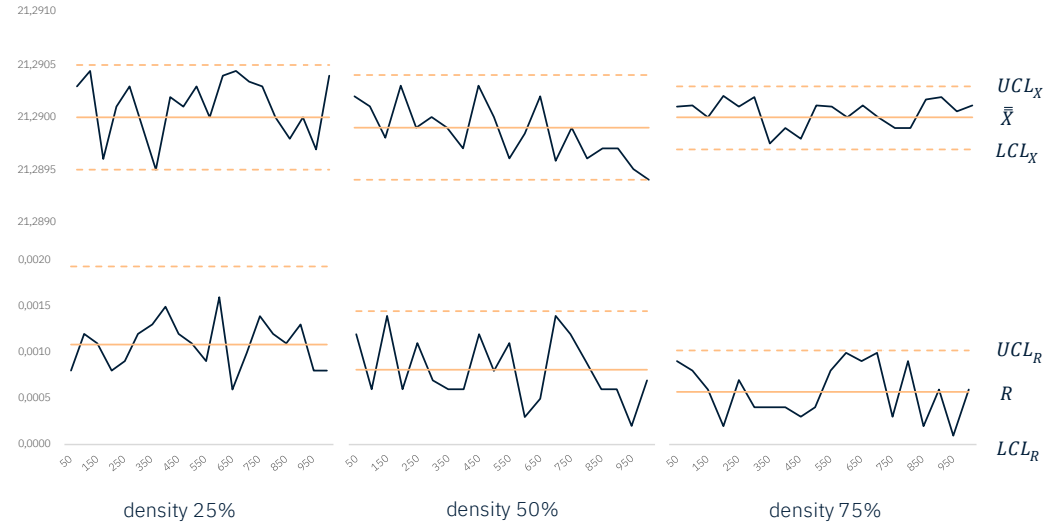
stylus: \varnothing 3 mm

04

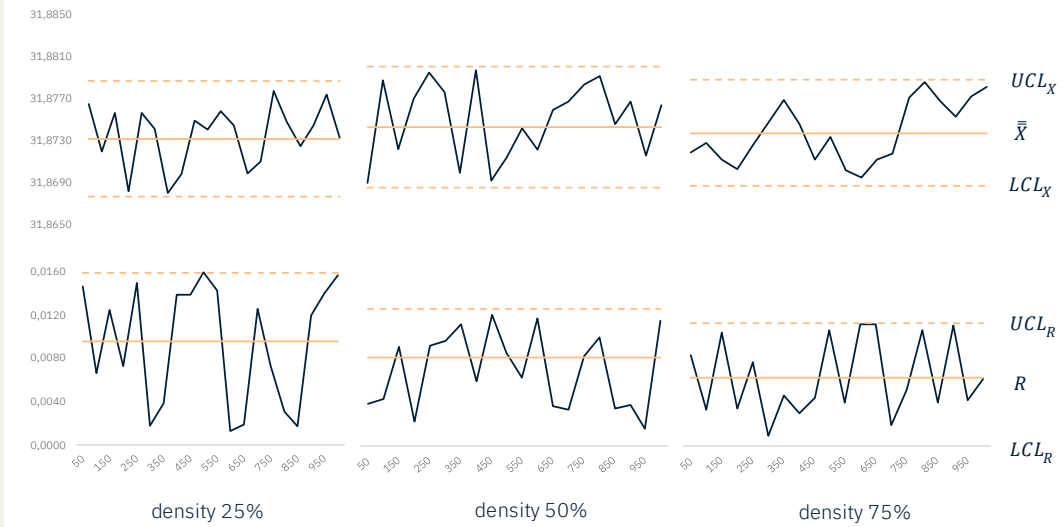
analysis

long-term
stability

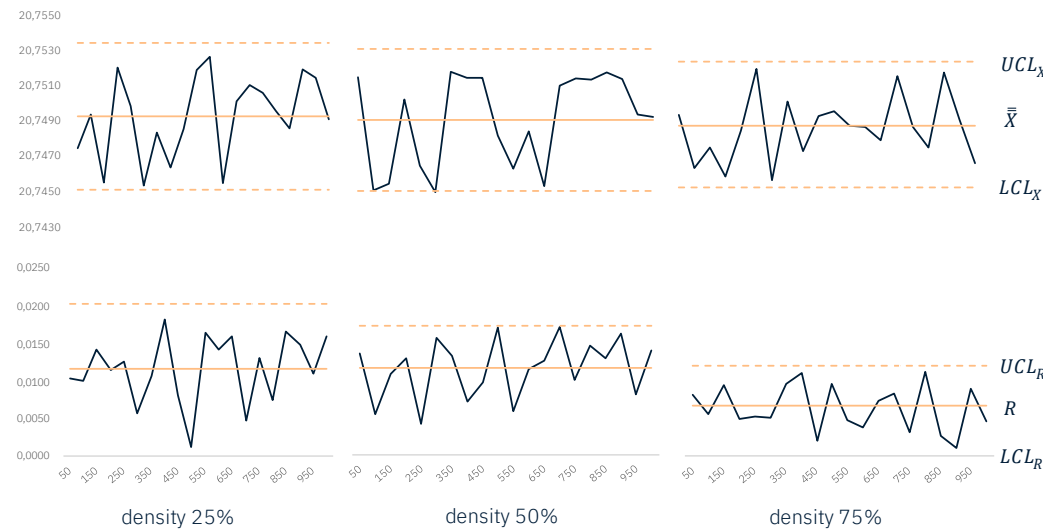
control diameter



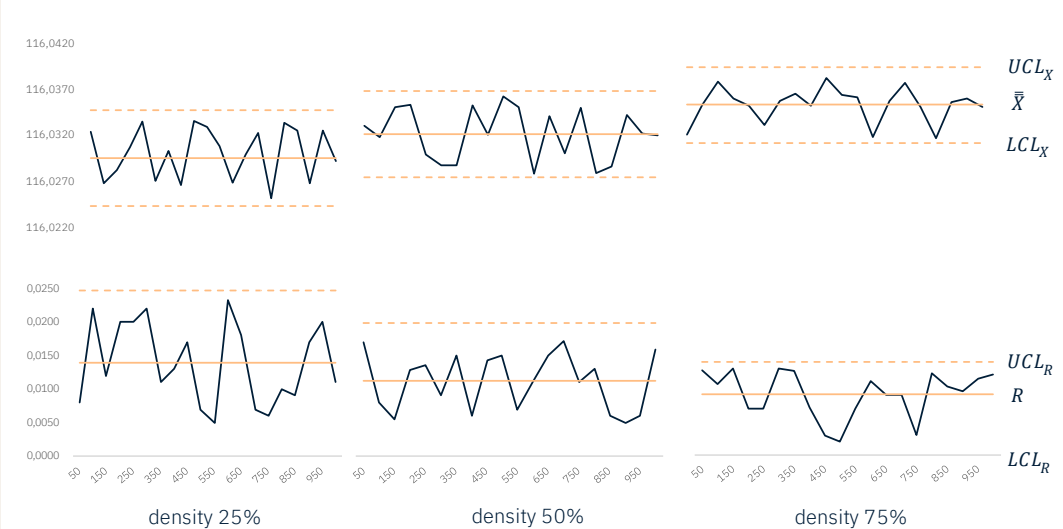
control point - coordinate X



control point - coordinate Y



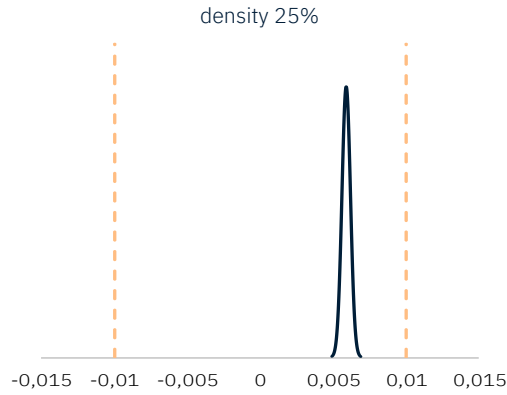
control point - coordinate Z



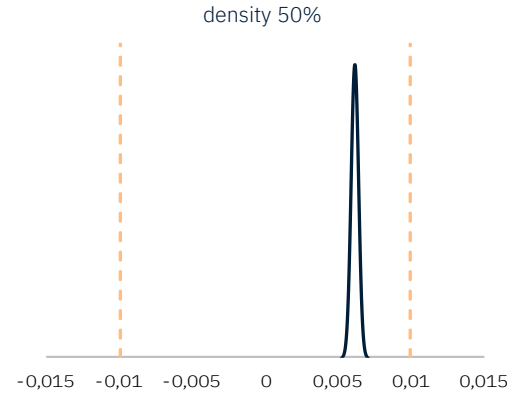
* All results in mm.

04 analysis

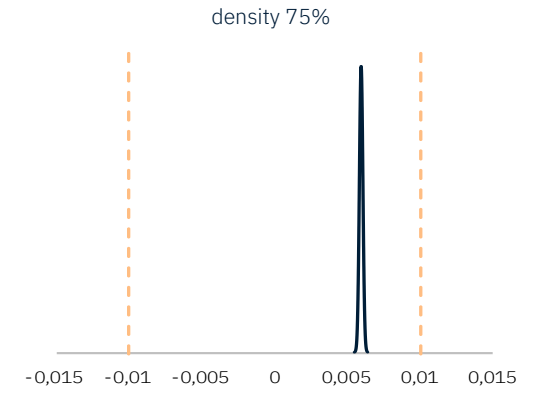
control diameter



	diameter
C_g	5,78
C_{gk}	2,36

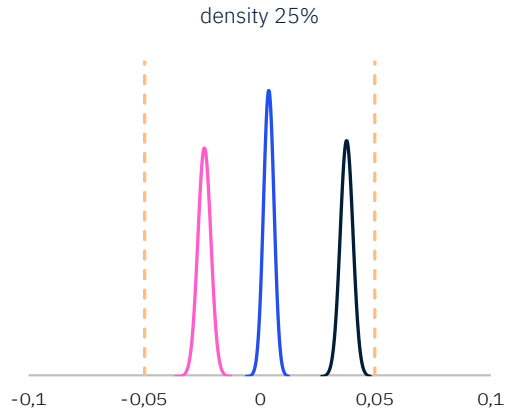


	diameter
C_g	6,24
C_{gk}	2,40

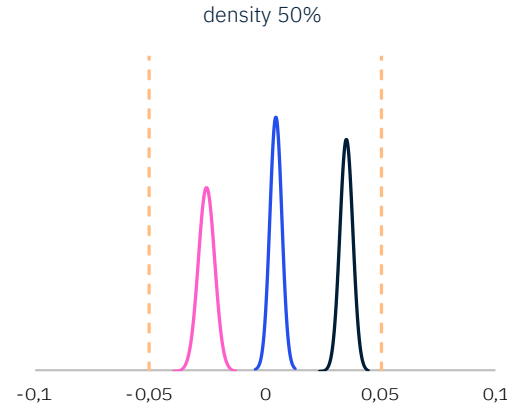


	diameter
C_g	12,44
C_{gk}	5,01

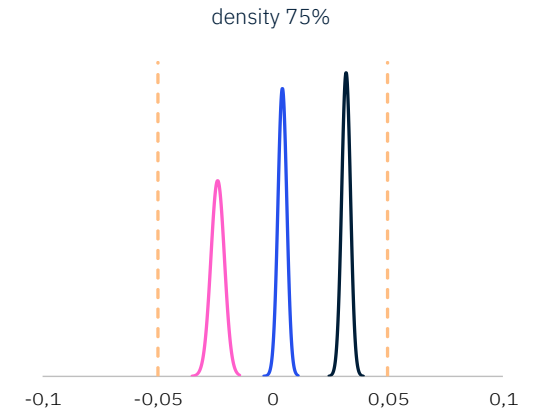
control point



	X	Y	Z
C_g	2,88	3,62	2,99
C_{gk}	1,49	3,32	0,76



	X	Y	Z
C_g	2,33	3,21	2,95
C_{gk}	1,14	2,94	0,87



	X	Y	Z
C_g	2,86	4,22	4,44
C_{gk}	1,47	3,87	1,62

* All results in mm.

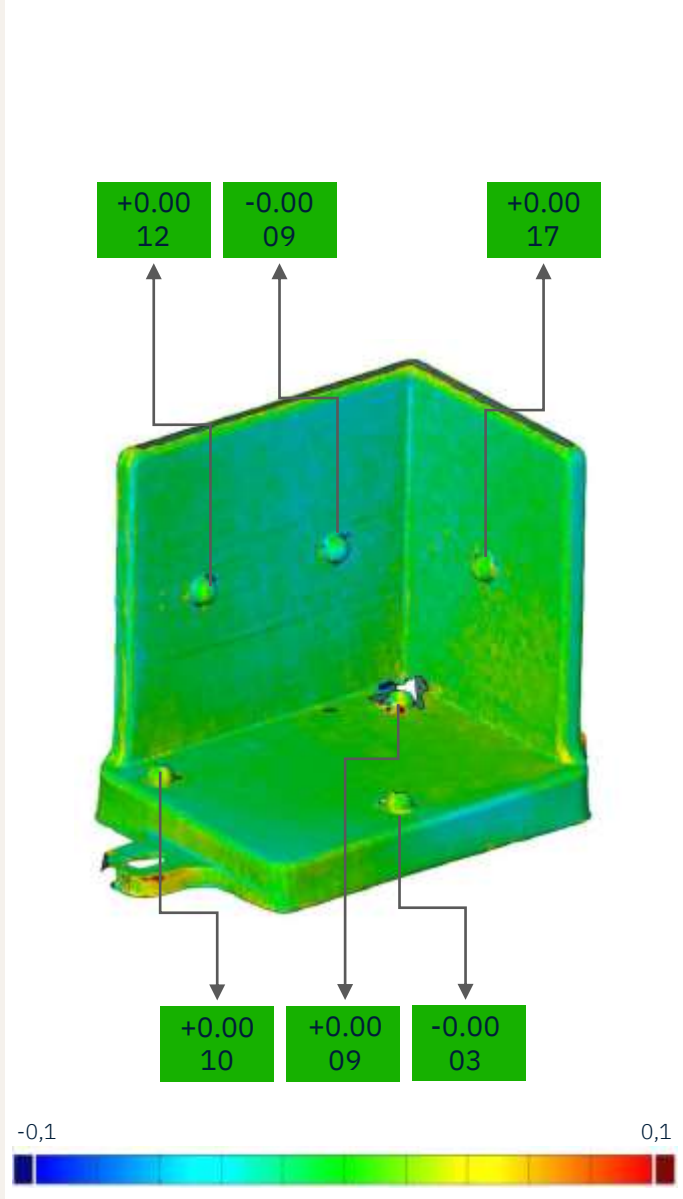
measure-
ment
process
capability

04

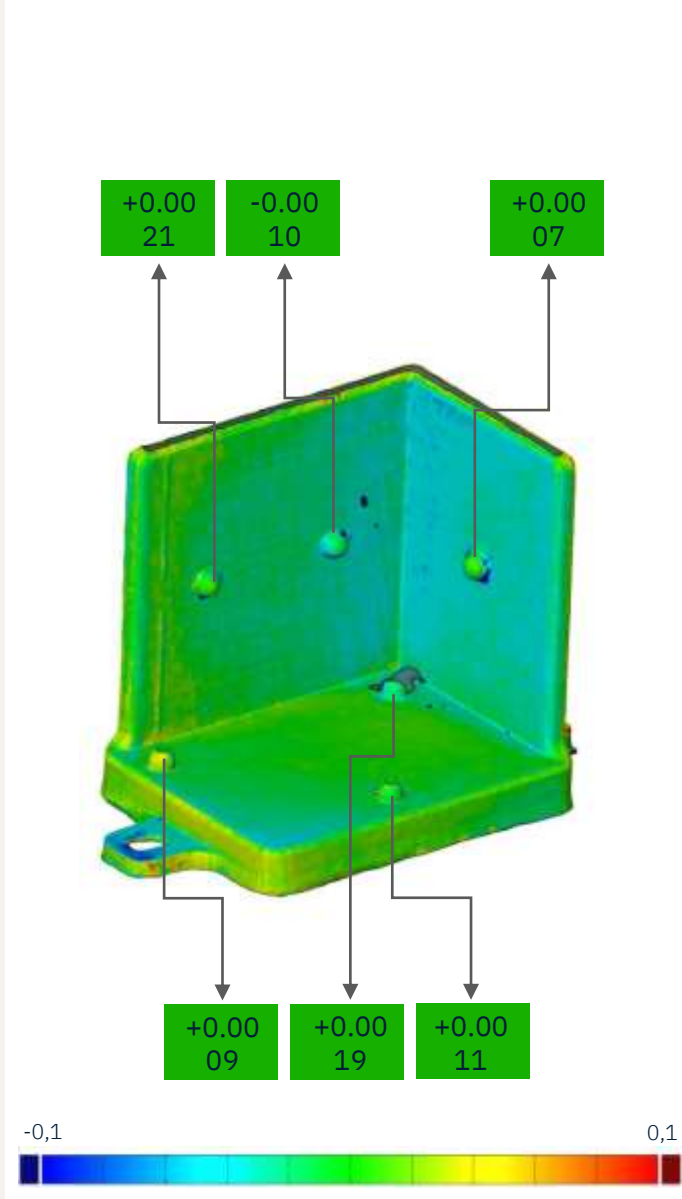
analysis

geometric
comparison

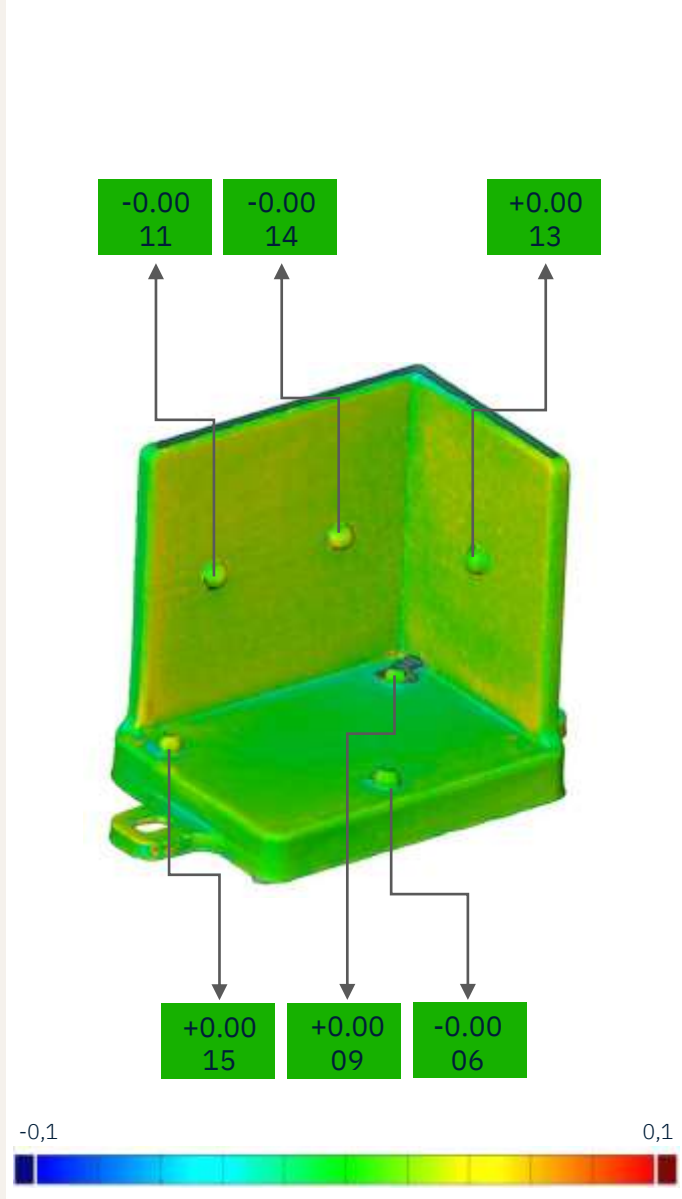
density 25%



density 50%



density 75%



* All results in mm.

conclusions

01

the three fixtures showed good long-term stability, however, the range between measurements was greater at lower density.

02

when compared to tolerance (considering the golden rule of metrology for the process - 1/10) only the fixture with 75% density showed good capability.

03

despite the shorter lifespan of printed fixtures, there is no question about comparing costs and processing time.

major references

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