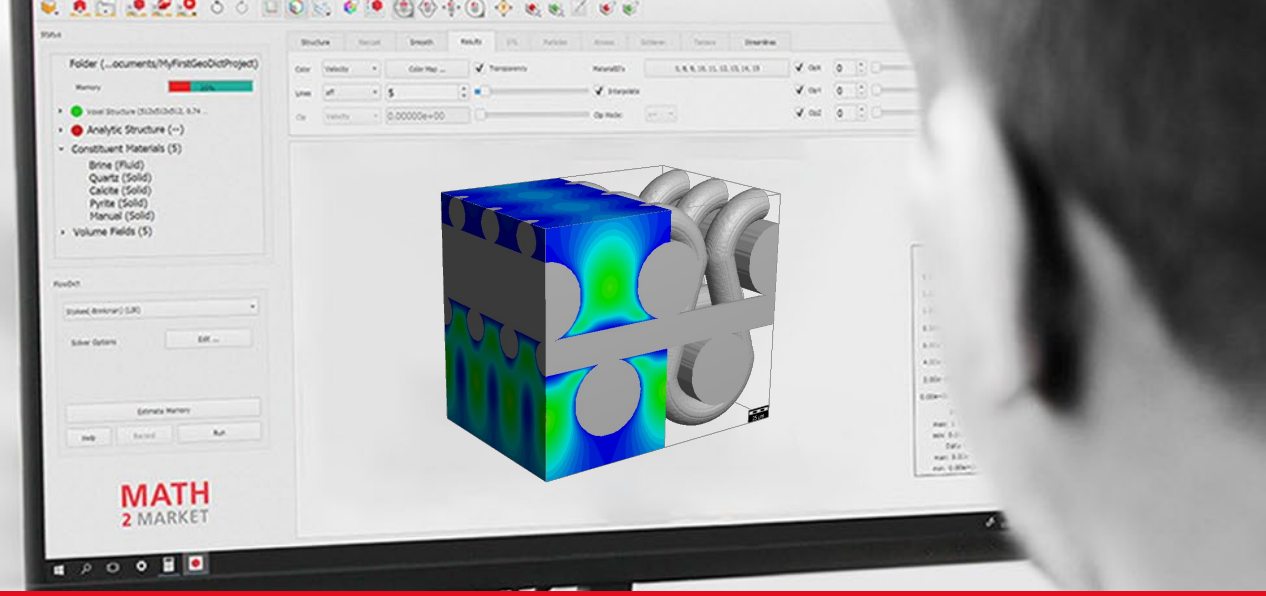
GeoDict
The Digital Material Laboratory




# Experimental and computational design, analysis and optimization of woven filter media

Alexander Mantler[1], Mehdi Azimian[2], Frank Meyer[1], Friedrich Edelmeier[1], Jürgen Becker[2], Andreas Wiegmann[2]

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[2] *Math2Market GmbH, Kaiserslautern, Germany*

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| 5 | Validation of simulation results with experimental data |




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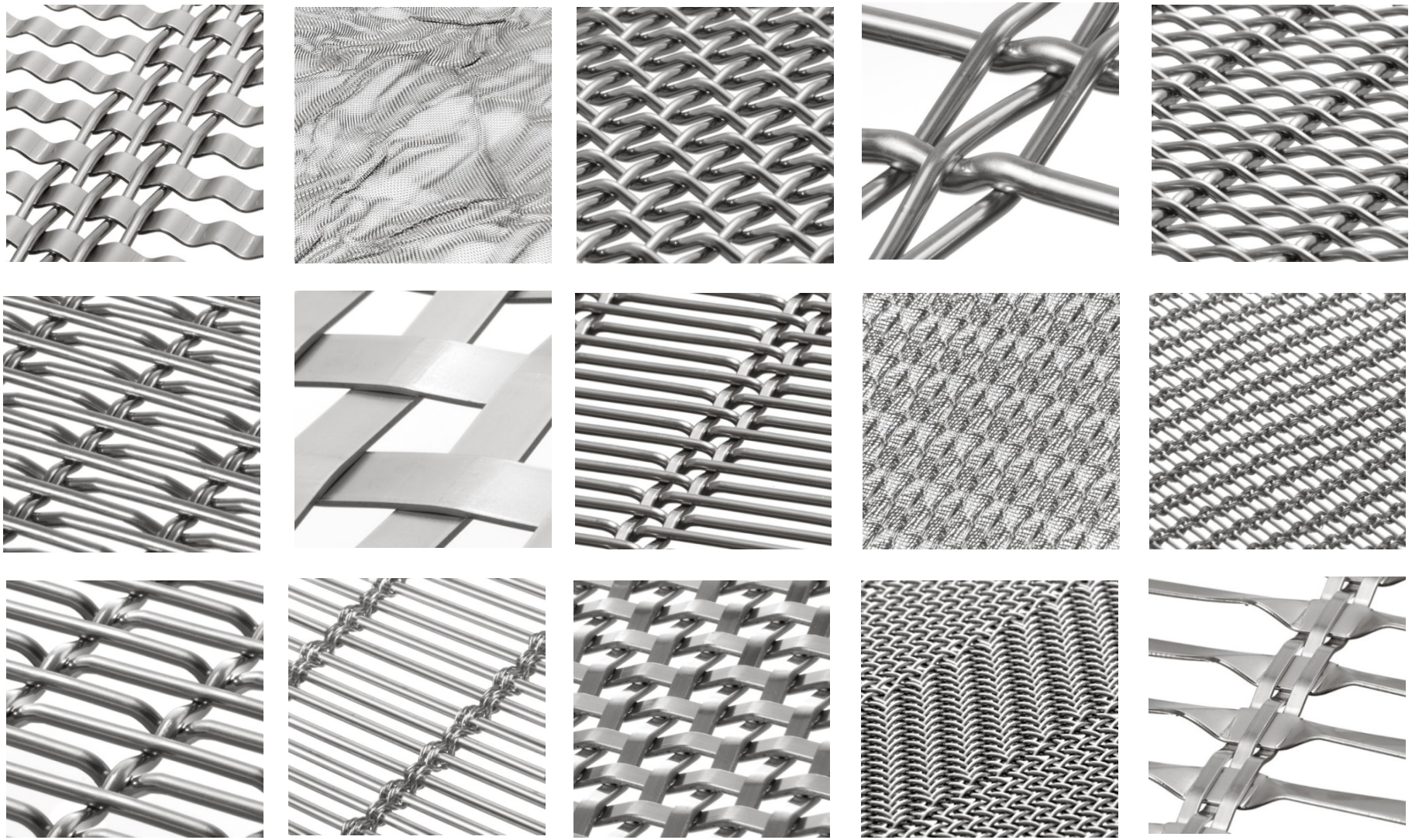
# Diverse Weave Types From Haver&Boecker

GeoDict





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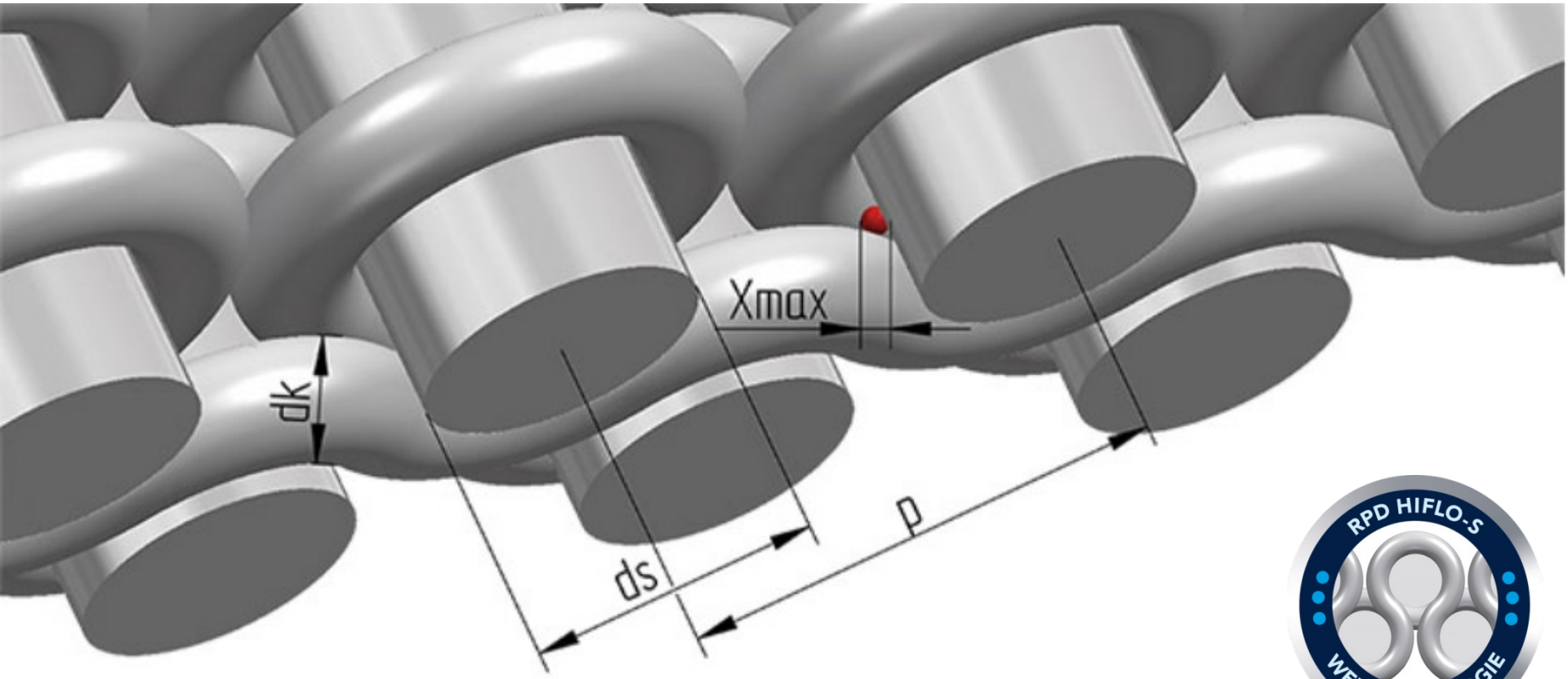
# Modeling of Woven Filter Media

GeoDict




RPD HIFLO-S WEBTECHNOLOGIE



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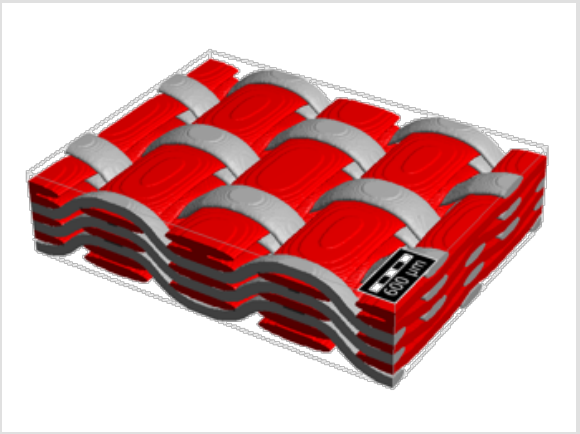
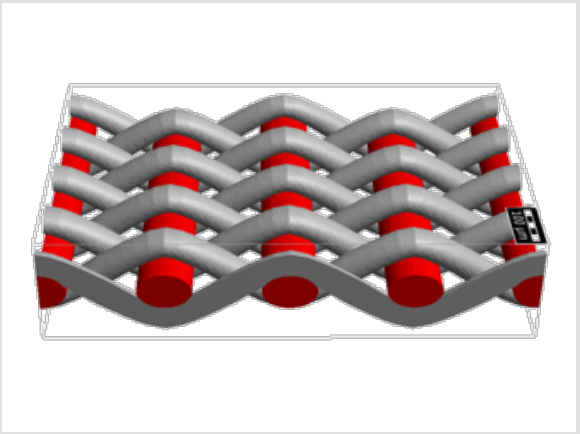
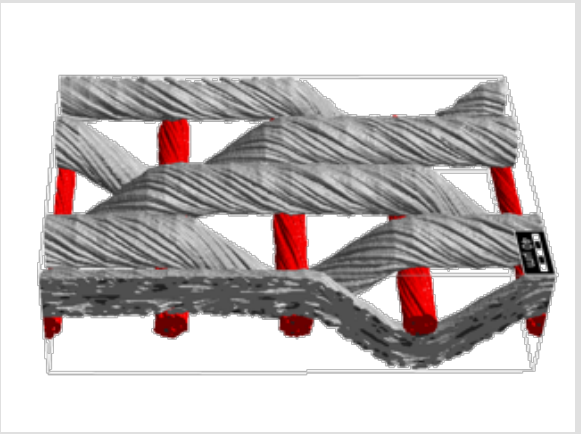
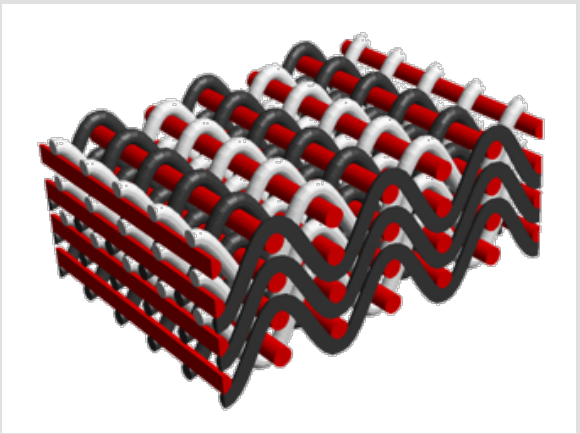
# Model Examples with WeaveGeo of GeoDict

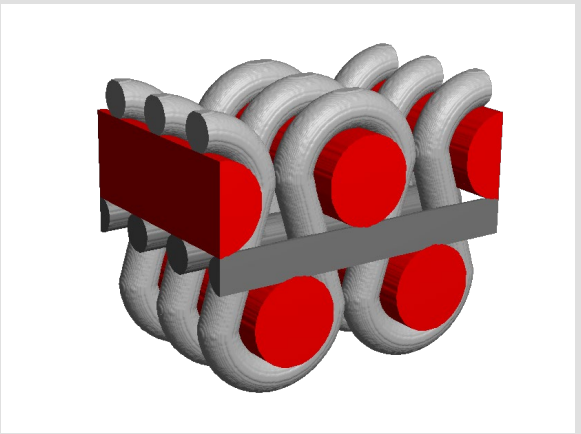










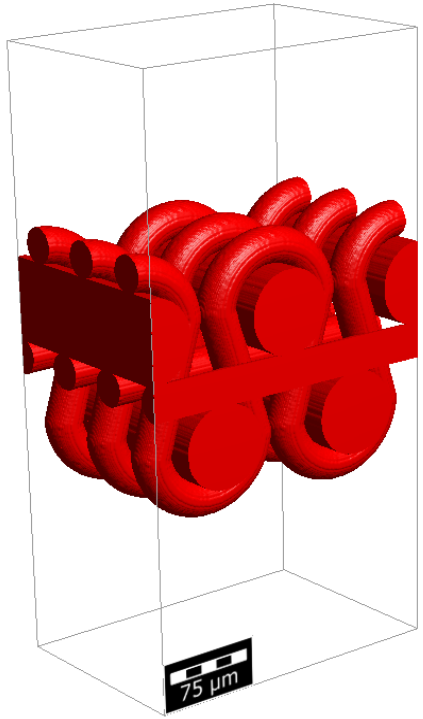


# Modeled woven filter media

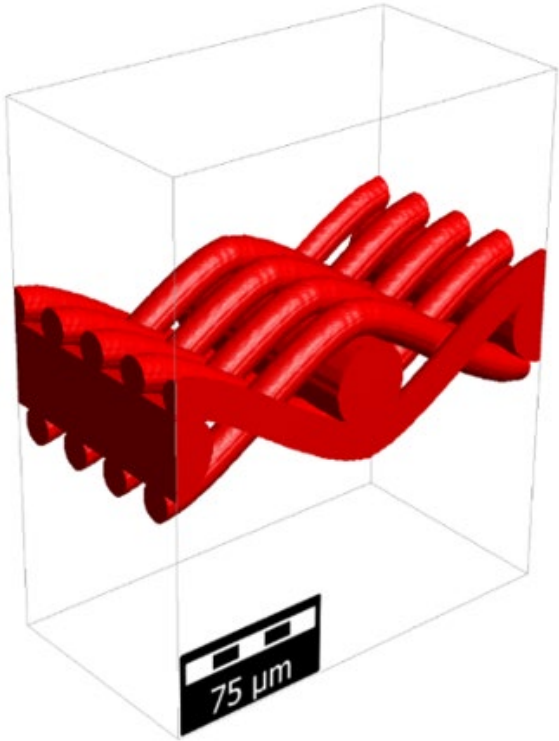
GeoDict

Three different woven filter media samples of HAVER & BOECKER modelled with GeoDict


**DTW 14 S**




**RPD HiFlo 15 S**




**HiFlo 15 S**



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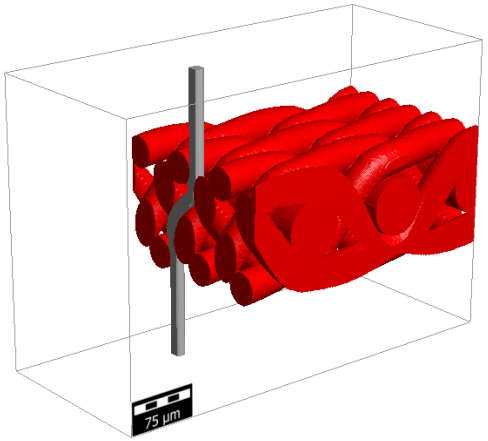
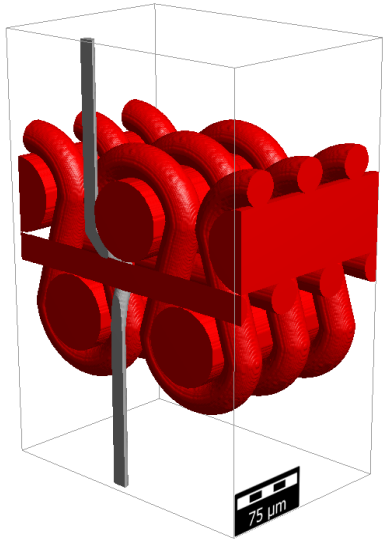
# Geometry & Percolation Path

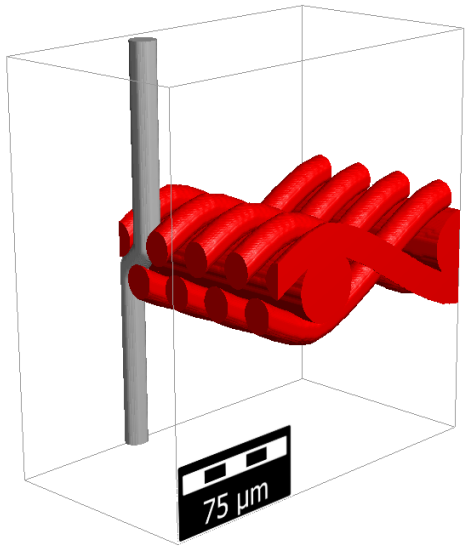
GeoDict




DTW 14 S




RPD HiFlo 15 S




HiFlo 15 S

| Weave | Max. particle diameter passable (GeoDict) | Cut Point (d97) by suspension challenge testing (Whitehouse Scientific) |
|---|---|---|
| DTW 14 S | 14.3 +/- 0.5 µm | 15.43 +/- 0.6 µm |
| RPD HiFlo 15 S | 13.0 +/- 0.5 µm | 15.03 +/- 0.6 µm |
| HiFlo 15 S | 14.0 +/- 0.5 µm | 14.50 +/- 0.6 µm |

ASTM E2814-18, Standard Specification for Industrial Woven Wire Filter Cloth, ASTM International, West Conshohocken, PA, 2018. DOI:10.1520/E2814-18

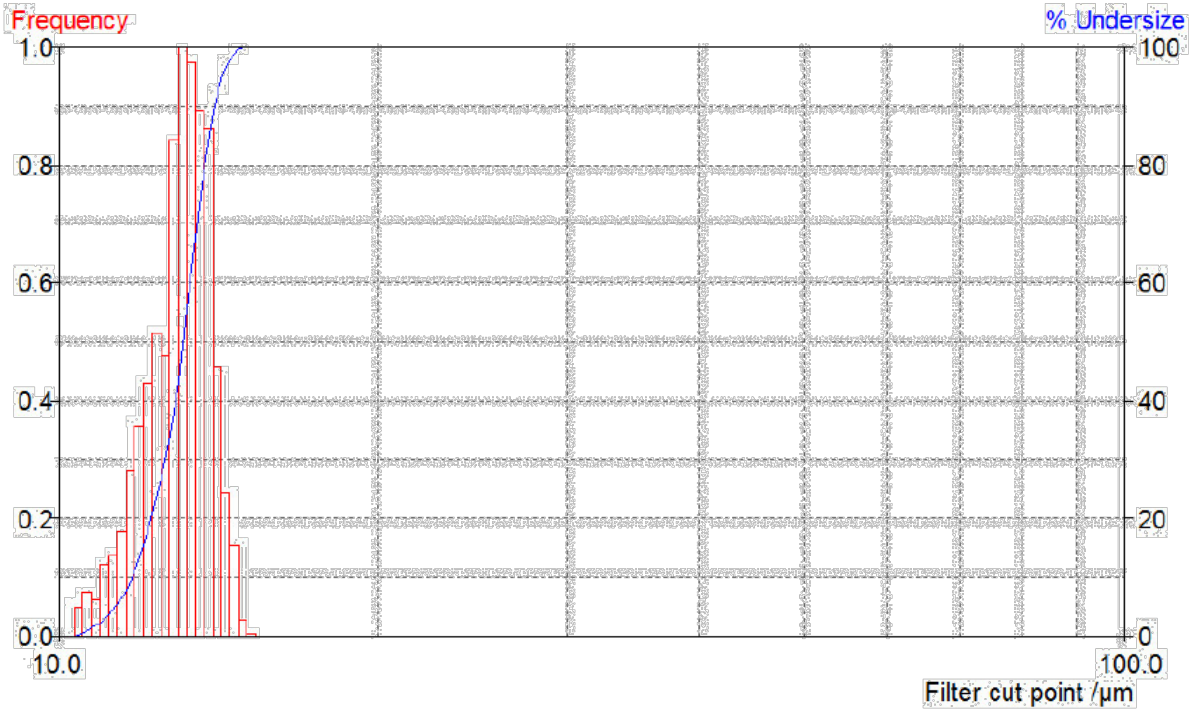
# Filter Cut Point By Suspension Challenge Testing of Whitehouse Scientific

GeoDict

Hi Flo 15S Part No. 150014 (1739)
05 Mar 2014, Num; Raw Data, 0.5658 µm/px

**Filter Cut Point (Challenge Test)**

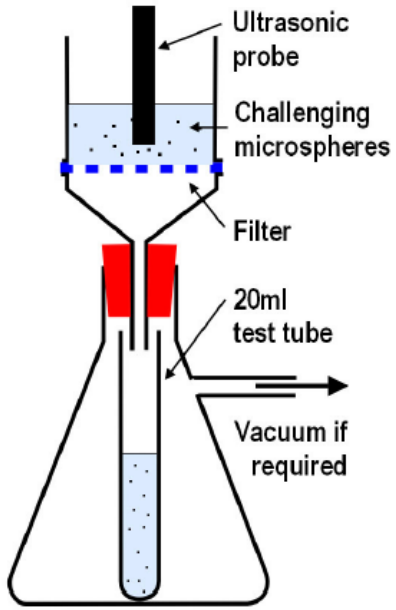
| % Undersize | 3.0 | 5.0 | 10.0 | 25.0 | 50.0 | 75.0 | 90.0 | 95.0 | 97.0 |
|---|---|---|---|---|---|---|---|---|---|
| Size /µm | 11.03 | 11.37 | 11.70 | 12.40 | 13.08 | 13.58 | 14.00 | 14.26 | 14.46 |




Reference standard passing filter - Cut Point (D97): 14.46 µm
Whitehouse Scientific - ShapeSizer Particle Characterisation

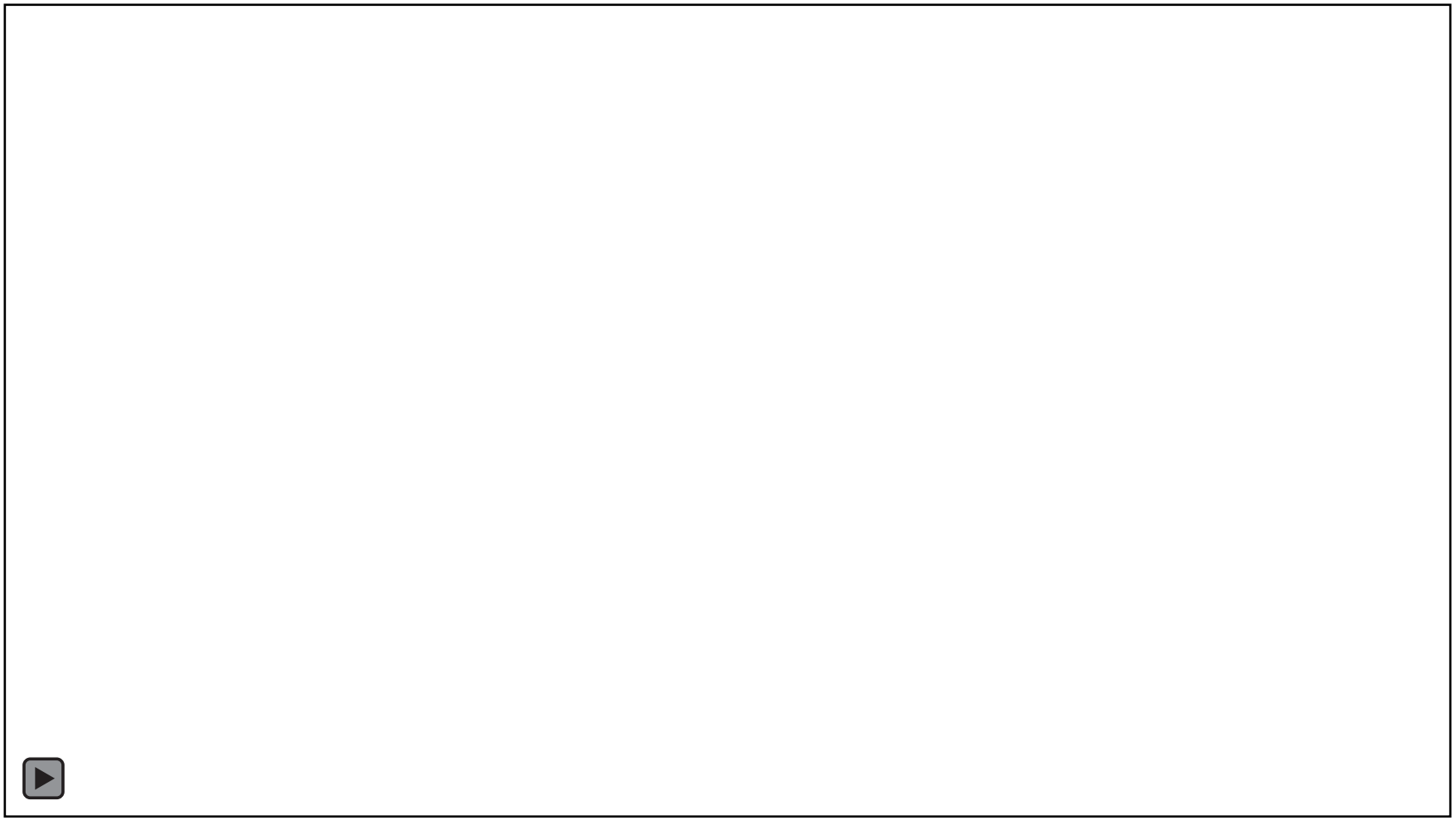
**Cut Point (d97) = 14.5 +/- 0.6 µm**

HiFlo 15 S



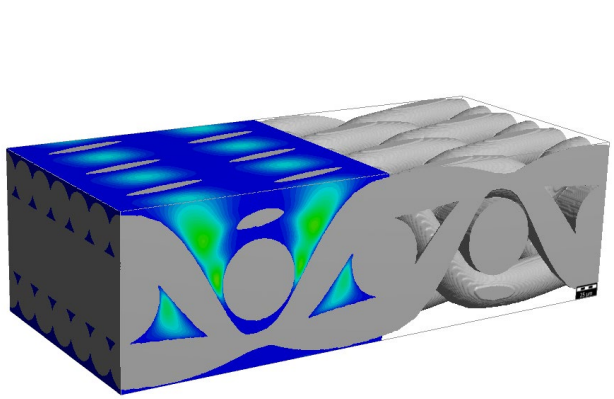
# Comparison of Flow Resistivity

GeoDict

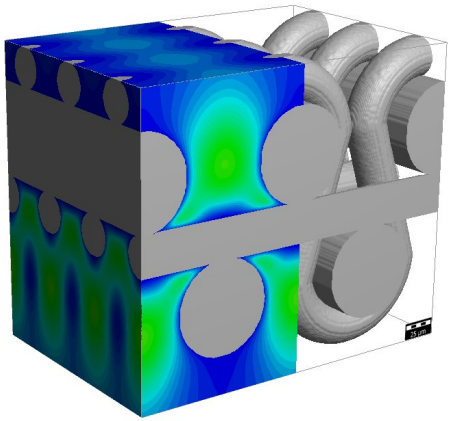


# Air Flow Simulation

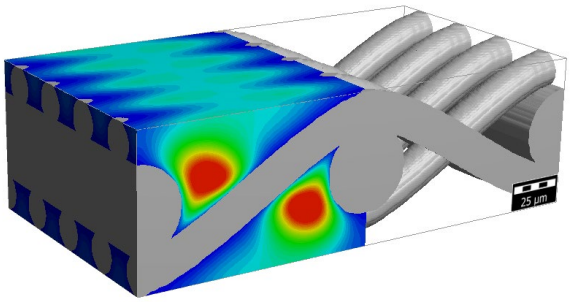
GeoDict



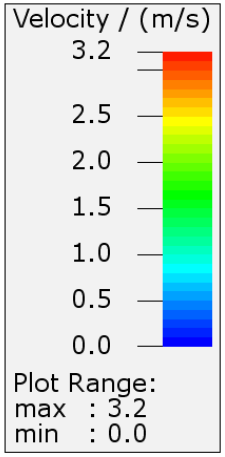
DTW 14 S



RPD HiFlo 15 S



HiFlo 15 S




| Weave | Thickness | Air permeability at 125 Pa (GeoDict) | Air permeability at 200 Pa (GeoDict) | Air permeability at 200 Pa (Measurement by H&B) |
|---|---|---|---|---|
| DTW 14 S | 153 µm | 0.151 $m^3/(m^2\ s)$ | 0.240 $m^3/(m^2\ s)$ | 0.233 $m^3/(m^2\ s)$ |
| RPD HiFlo 15 S | 230 µm | 0.259 $m^3/(m^2\ s)$ | 0.415 $m^3/(m^2\ s)$ | 0.395 $m^3/(m^2\ s)$ |
| HiFlo 15 S | 69 µm | 0.618 $m^3/(m^2\ s)$ | 0.971 $m^3/(m^2\ s)$ | 0.961 $m^3/(m^2\ s)$ |

ASTM E2814-18, Standard Specification for Industrial Woven Wire Filter Cloth, ASTM International, West Conshohocken, PA, 2018. DOI:10.1520/E2814-18



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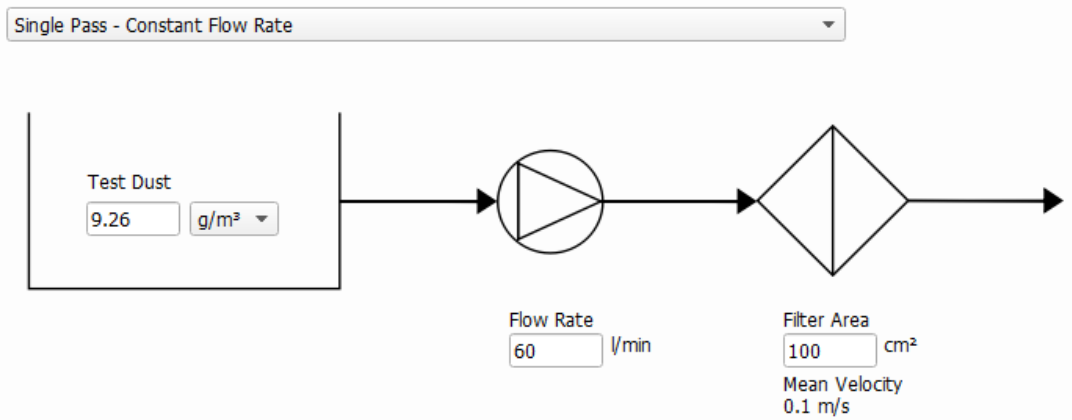
# Single-Pass Filtration Test & Simulation

GeoDict

## Single-pass filtration test rig MFP 1000 from Palas GmbH


## Single Pass Life Time filtration simulation




| | |
|---|---|
| Fluid | Air |
| Temperature | 22 °C |
| Flow velocity | 0.1 m/s (60 l/min) |
| Particles | ISO A2 fine test dust (0.255 – 16.6 µm) |
| Test dust concentration | 9.26 g/m³ |
| Particle density | 2650 kg/m³ |
| Particle shape | Spherical |



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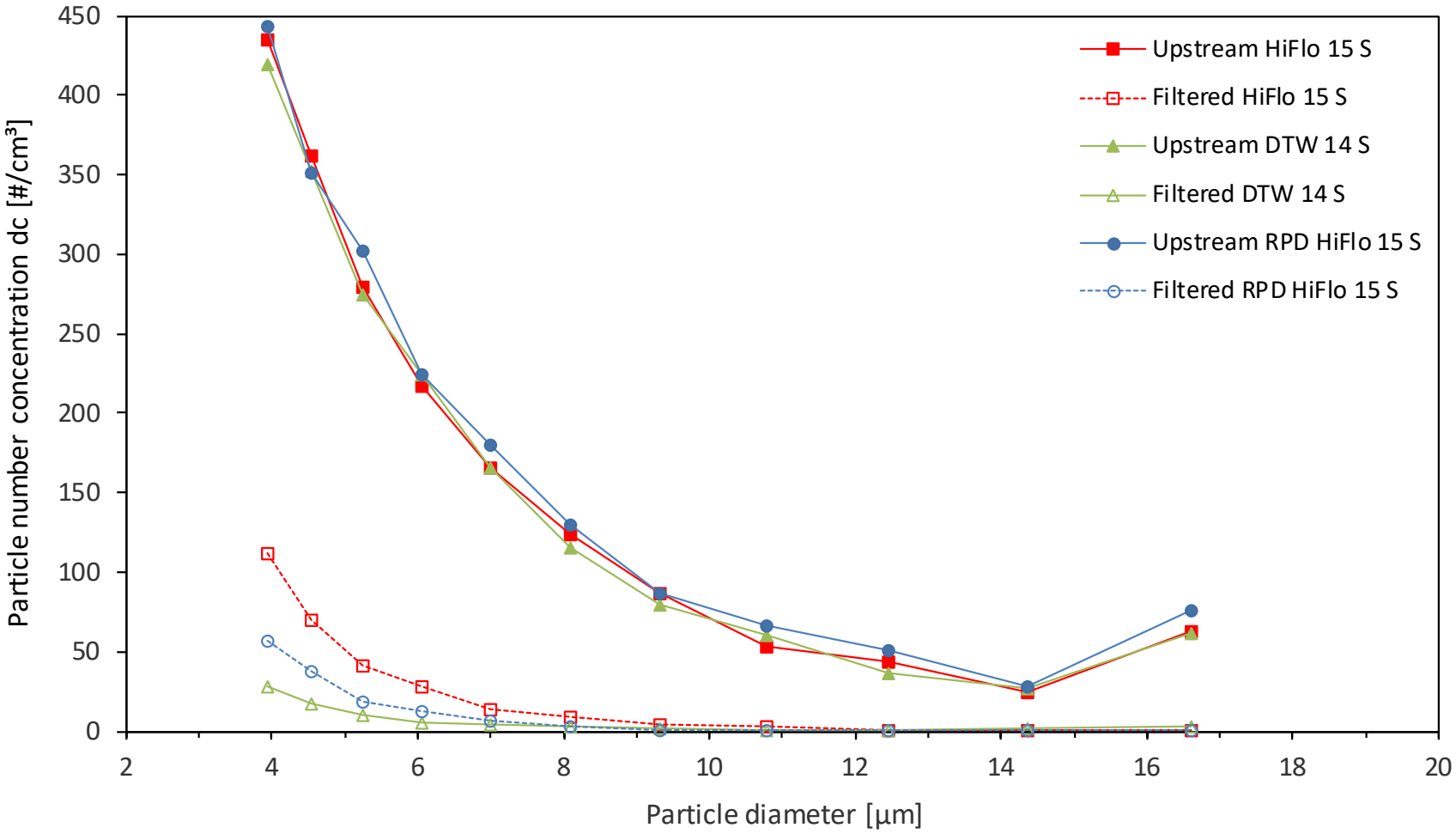
# Comparison of the Three Weaves

GeoDict




Measurements by IUTA – Das Institut für Energie- und Umwelttechnik
Three times upstream & three times downstream measurements



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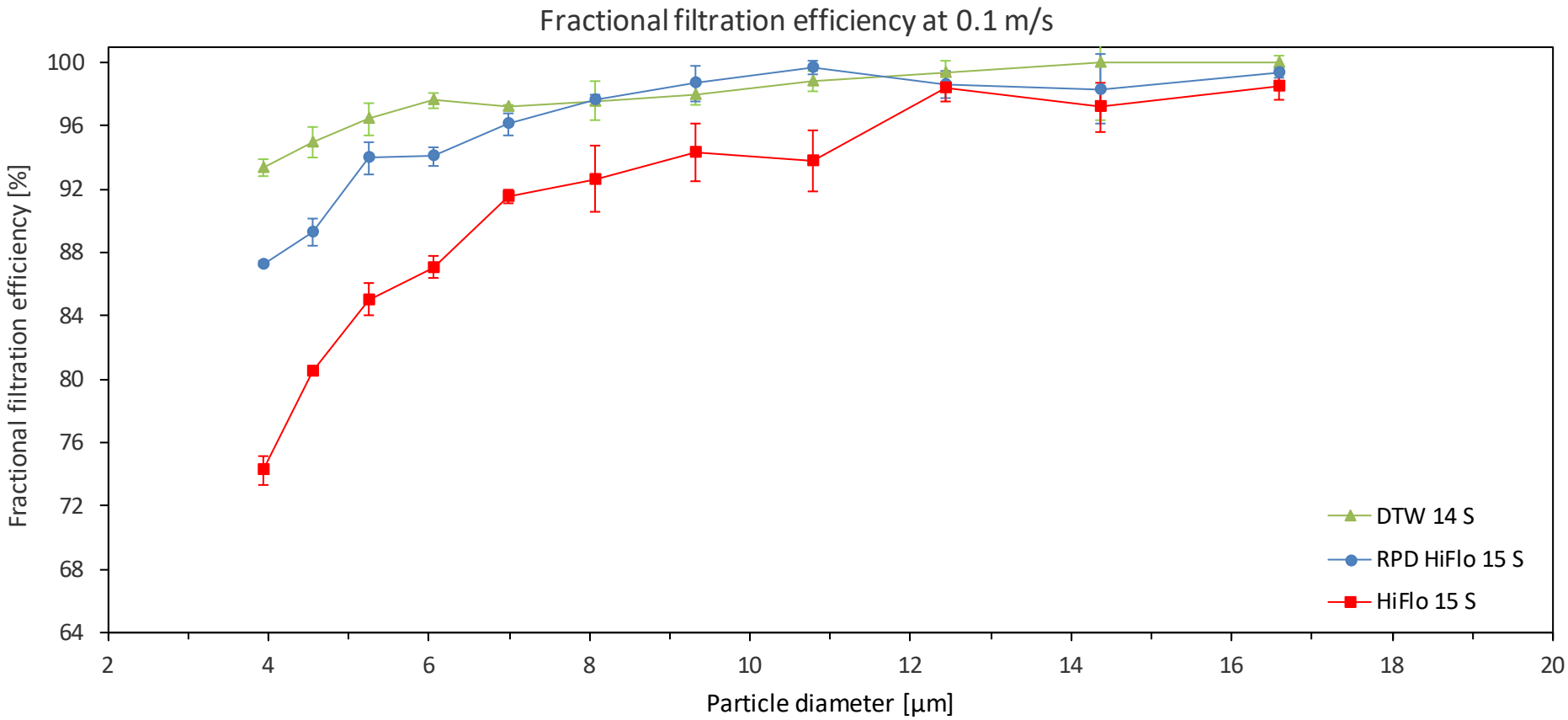
# Comparison of the Three Weaves

GeoDict




Measurements by IUTA – Das Institut für Energie- und Umwelttechnik
Three times upstream & three times downstream measurements

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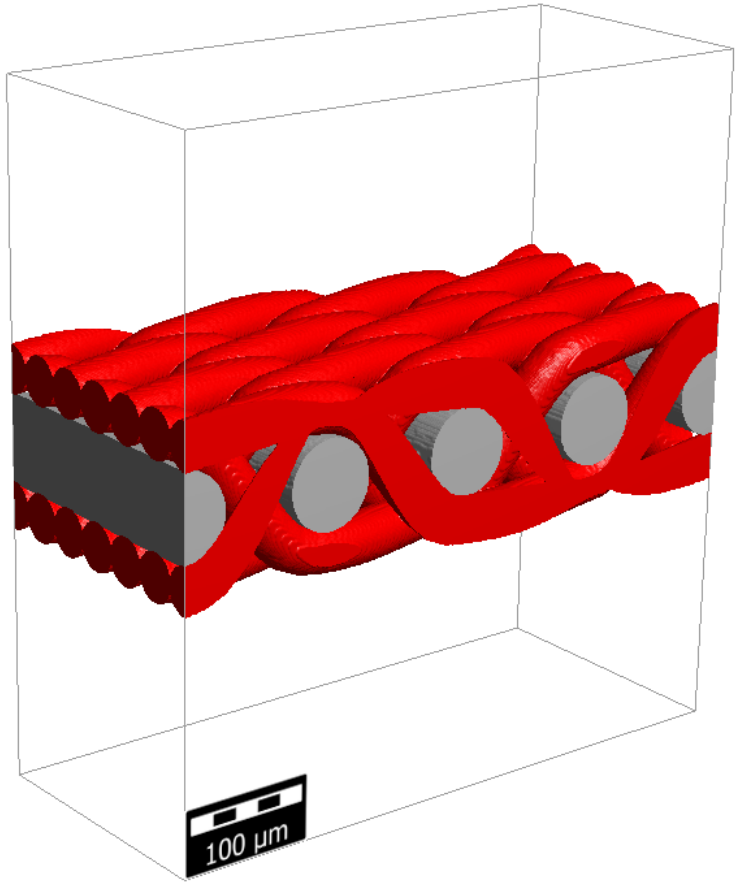
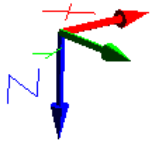
# DTW 14 S

GeoDict

Material Information:
ID 00: Air [invis.]
ID 01: Solid
ID 02: Solid



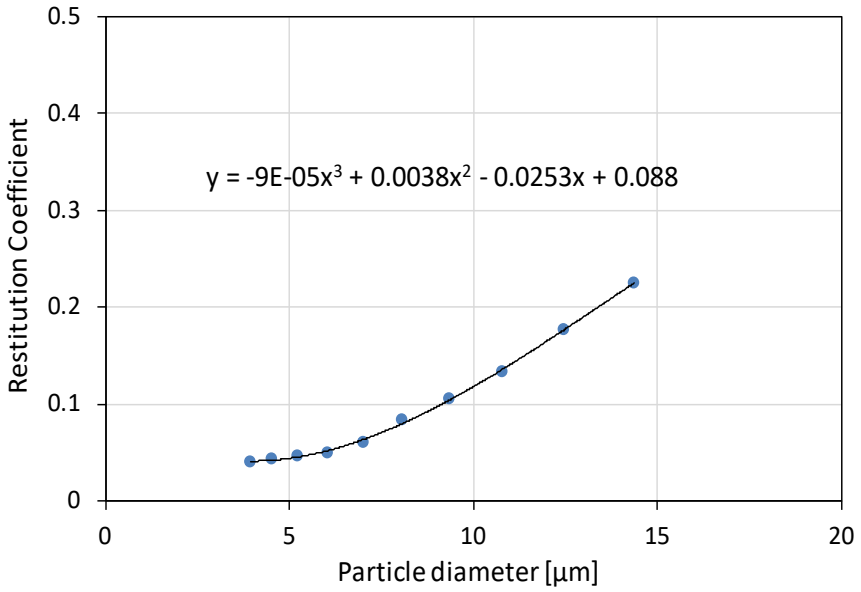



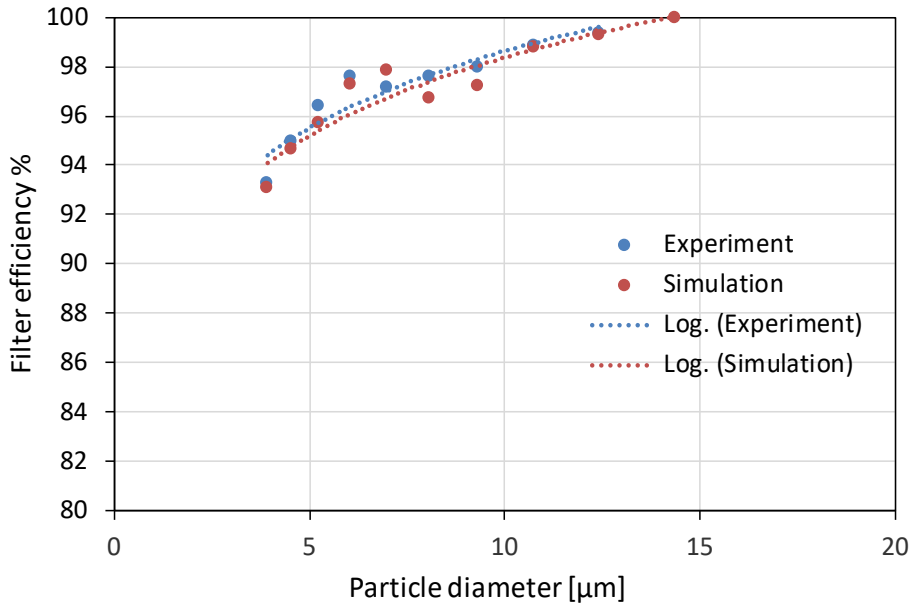
# DTW 14 S

GeoDict

Filtration test duration: **60 s**

Dust concentration: **0.771 g/m³**



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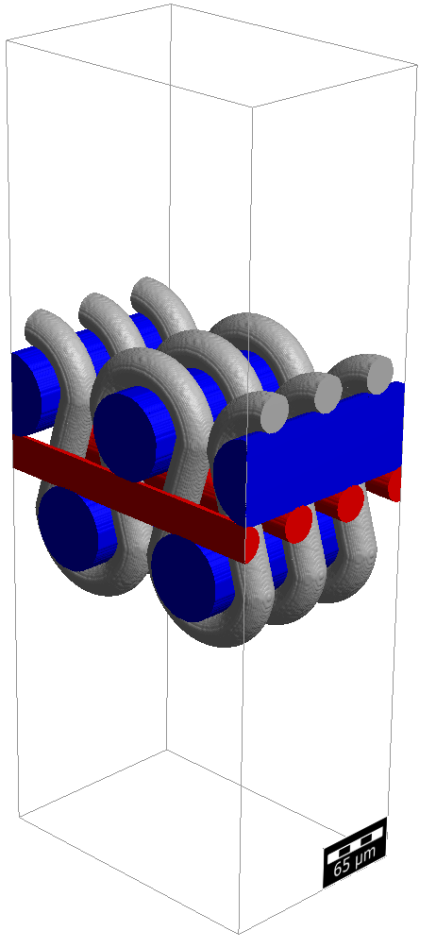
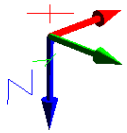
# RPD HiFlo 15 S

GeoDict

Material Information:
ID 00: Air [invis.]
ID 01: Steel (A36)
ID 02: Solid
ID 04: Solid



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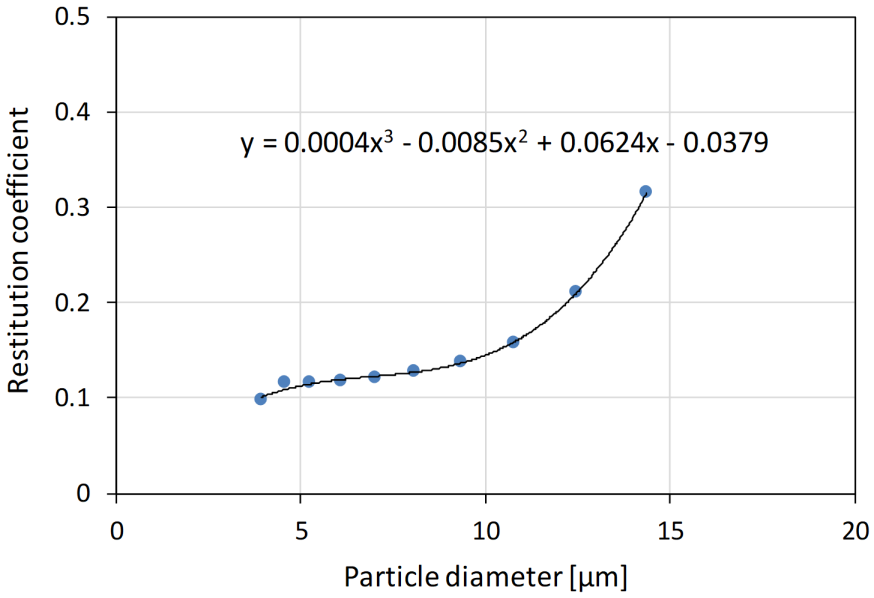
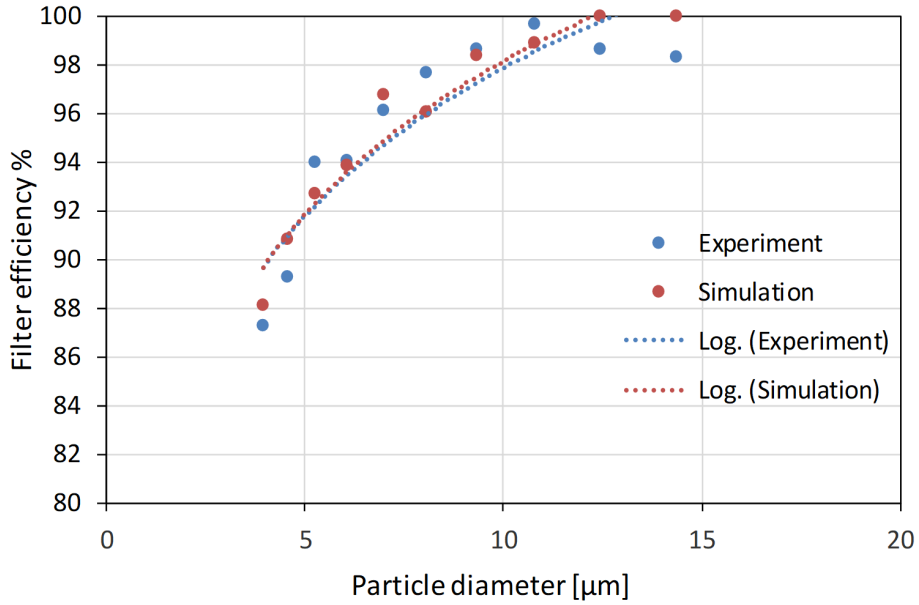
# RPD HiFlo 15 S

GeoDict

Filtration test duration: 60 s

Dust concentration: 0.859 g/m³



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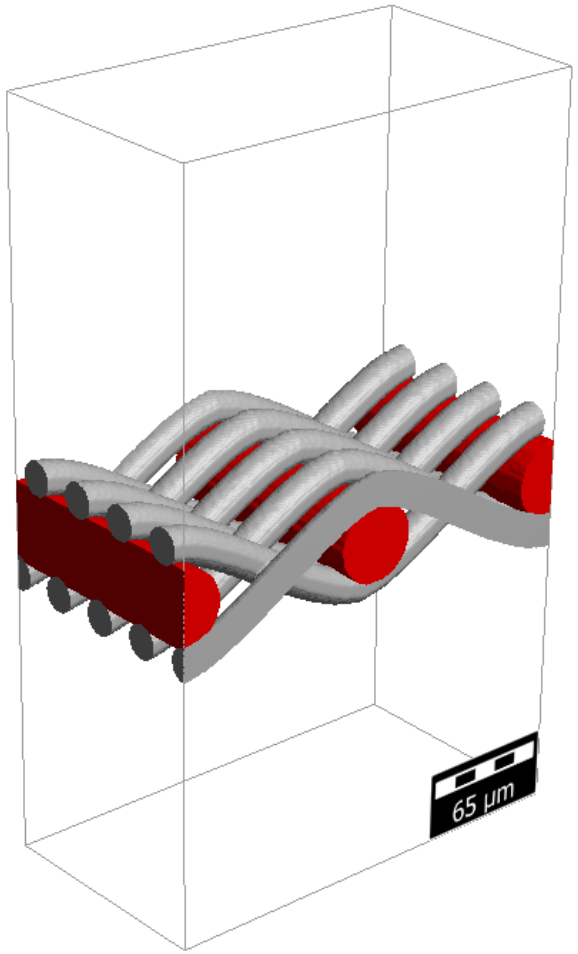
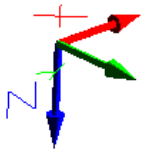
# HiFlo 15 S

GeoDict

Material Information:
ID 00: Air [invis.]
ID 01: Steel (A36)
ID 02: Solid



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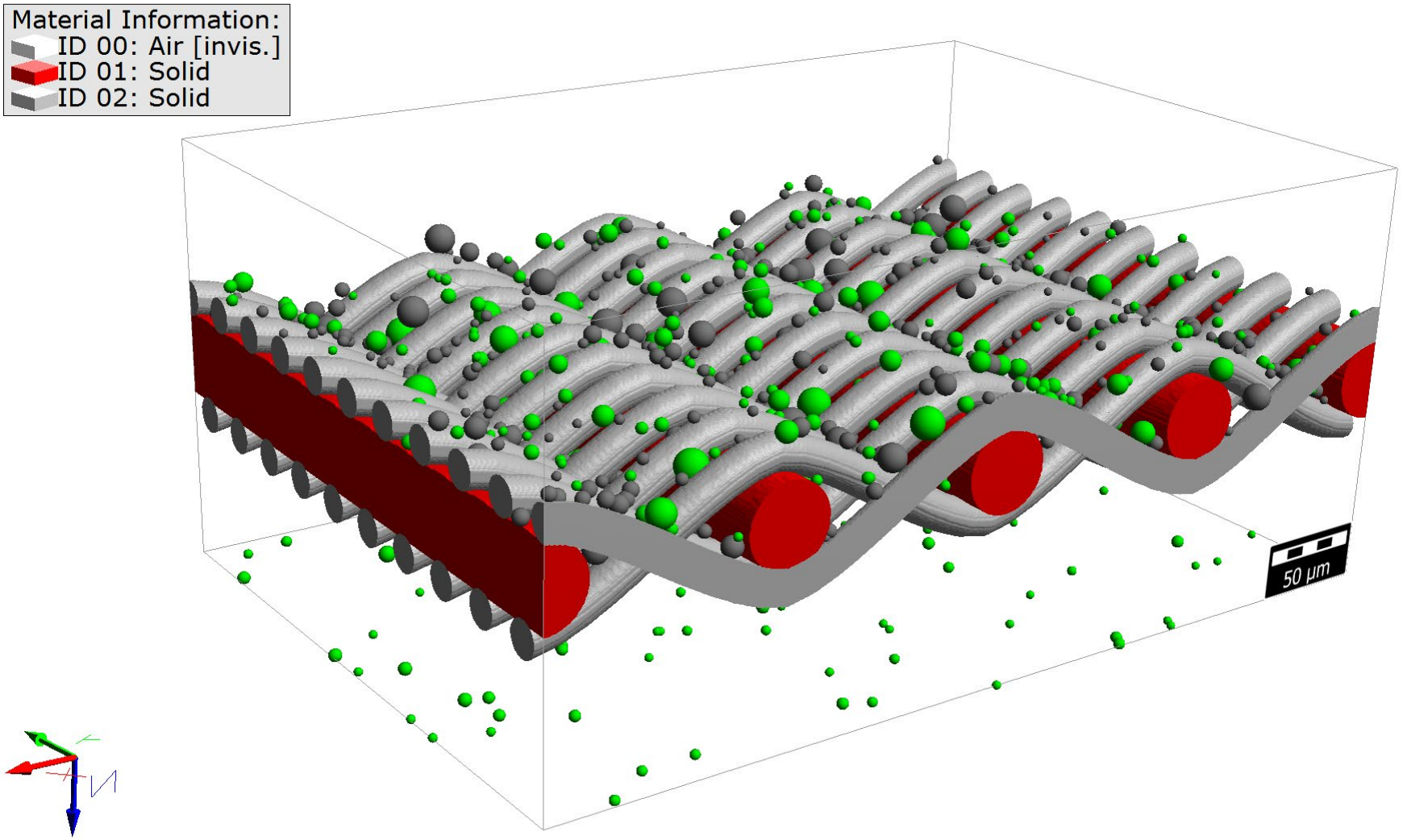
# HiFlo 15 S

GeoDict

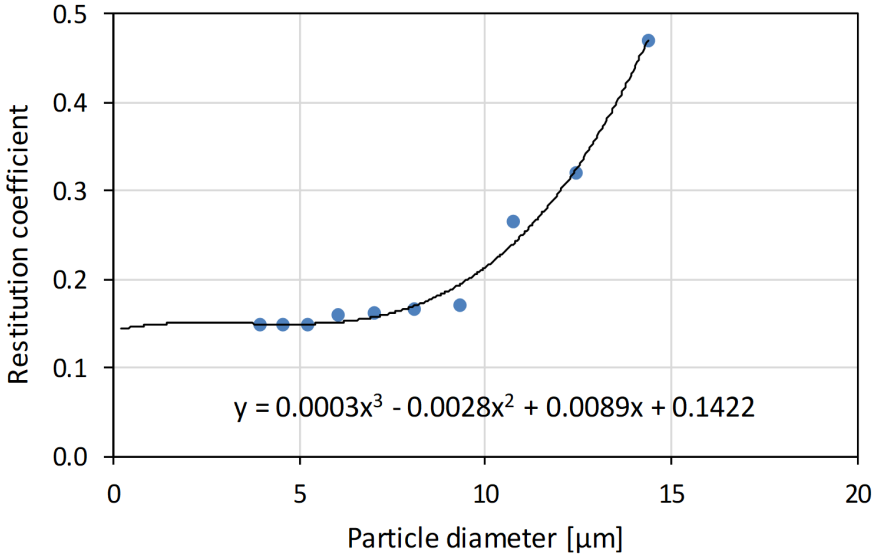


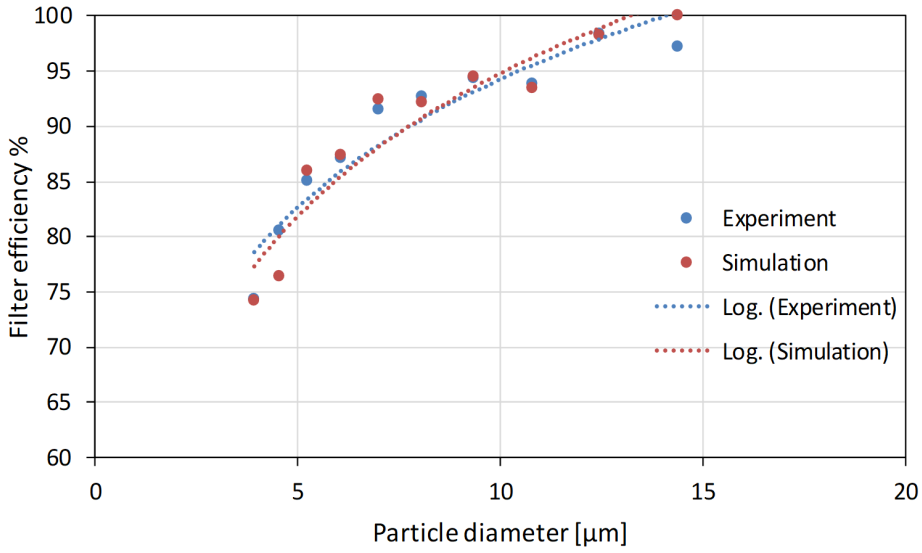
# HIFLO 15 S

GEODICT

Filtration test duration: 60 s

Dust concentration: 0.785 g/m³



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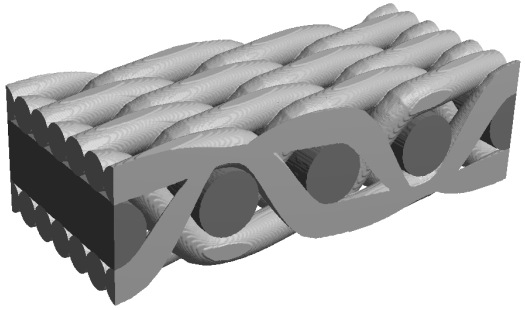
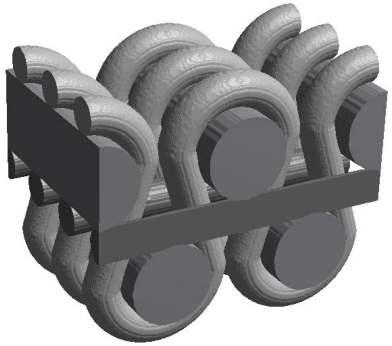
# Comparison of the Three Weaves

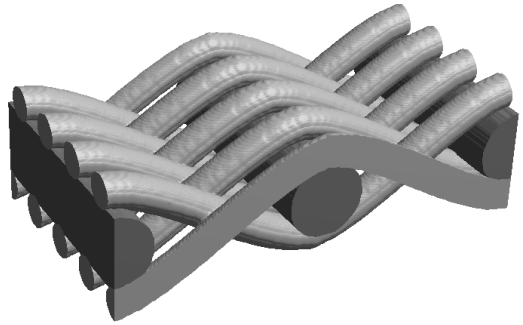
GeoDict



DTW 14 S

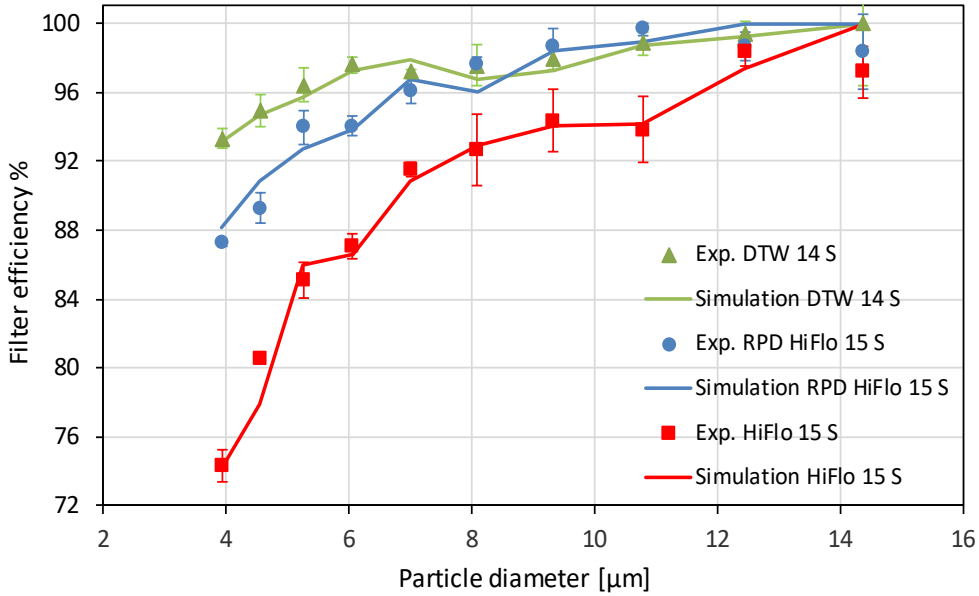


RPD HiFlo 15 S



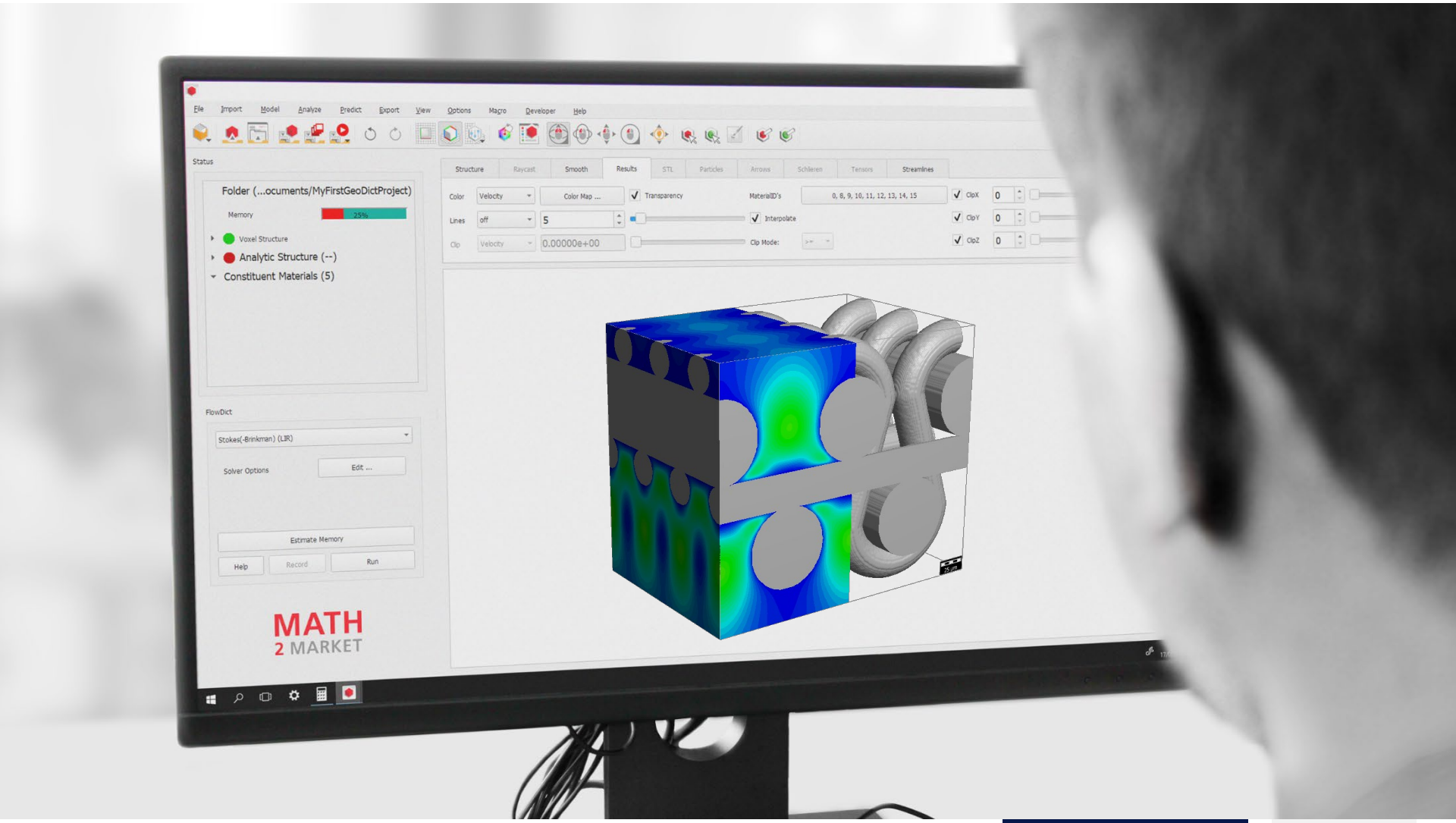
HiFlo 15 S

| Weave | Cut Point (d97) | Air Perm. at 200 Pa |
|---|---|---|
| DTW 14 S | 15.43 +/- 0.6 µm | 0.240 m/s |
| RPD HiFlo 15 S | 15.03 +/- 0.6 µm | 0.415 m/s |
| HiFlo 15 S | 14.5 +/- 0.6 µm | 0.971 m/s |



# THANK YOU FOR YOUR ATTENTION.

GEODICT



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