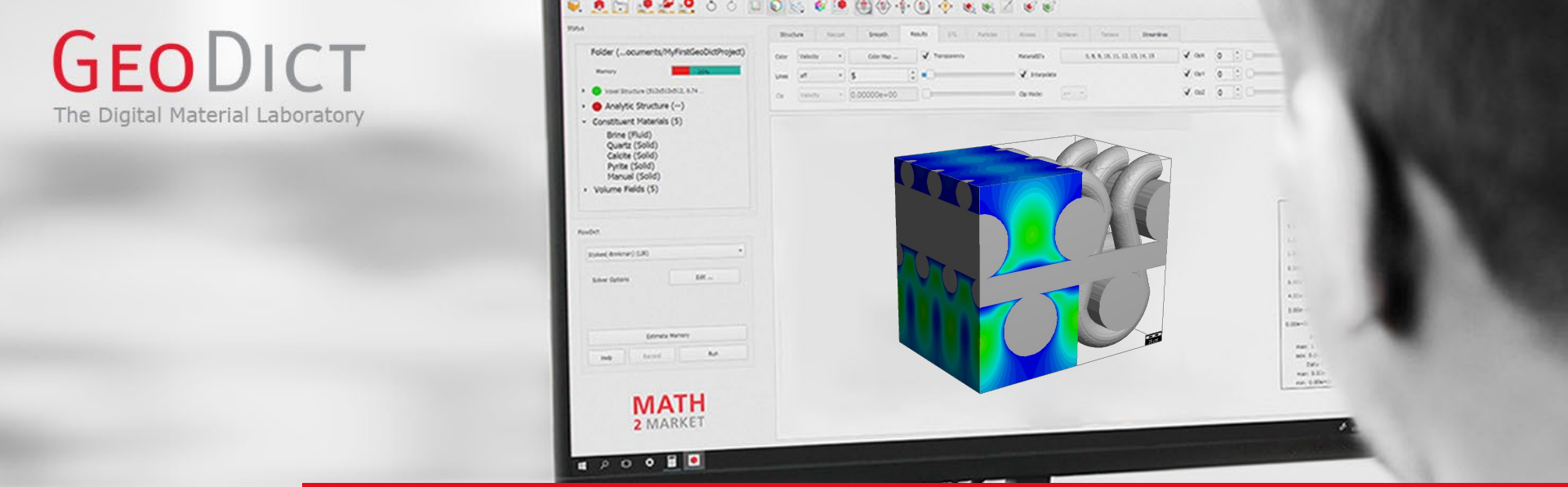
GeoDict
The Digital Material Laboratory



Innovative design, analysis and optimization of woven filter media through experimental and computational methods

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

[1] *Math2Market GmbH, Kaiserslautern, Germany*

[2] *HAVER & BOECKER OHG, Oelde, Germany*

HAVER & BOECKER

MATH
2 MARKET

Content

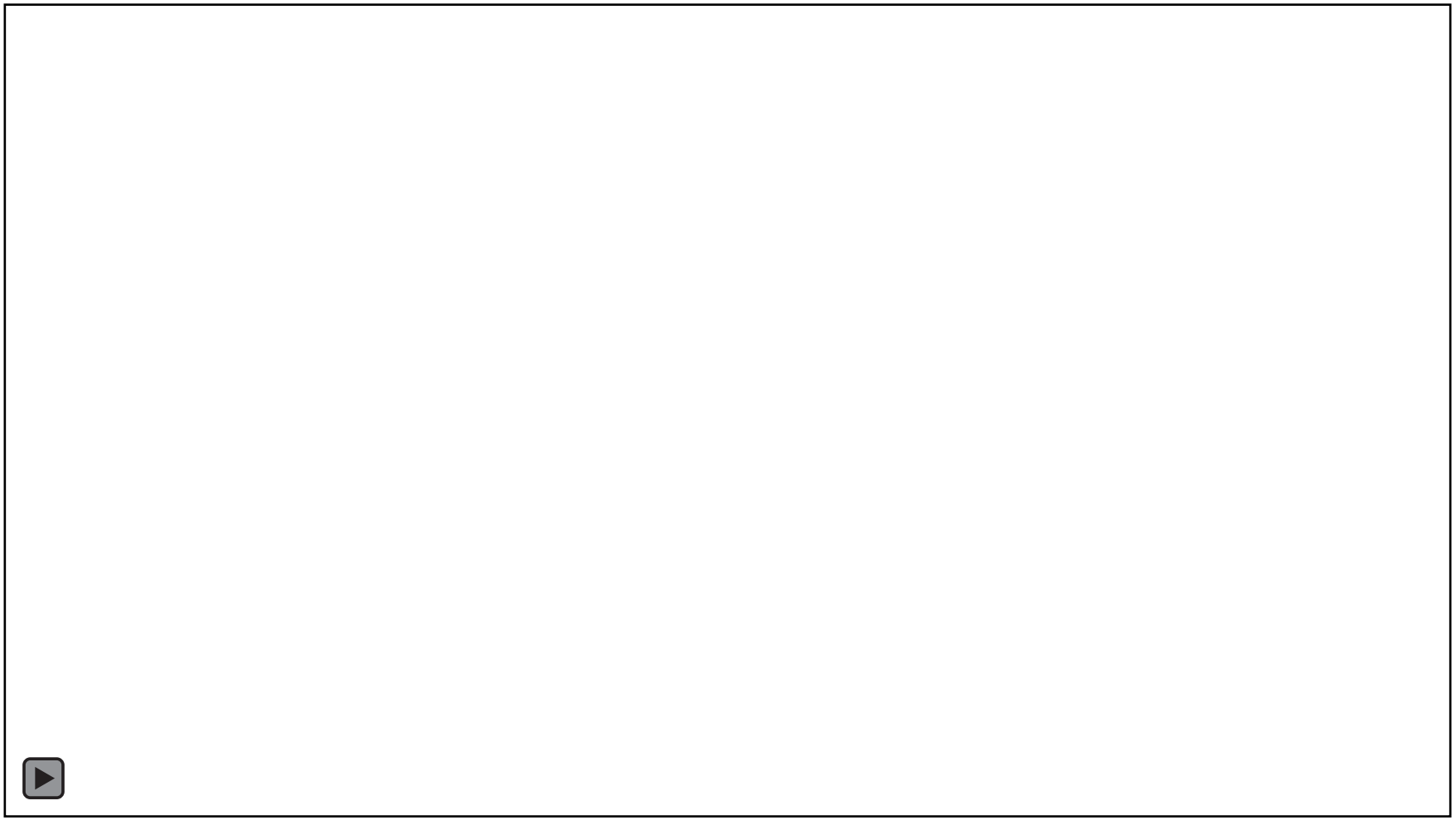
GeoDict

HAVER & BOECKER

MATH 2 MARKET

Introduction
(Innovative design, analysis & optimization of woven filter media)

GeoDict



HAVER & BOECKER

MATH 2 MARKET

Content

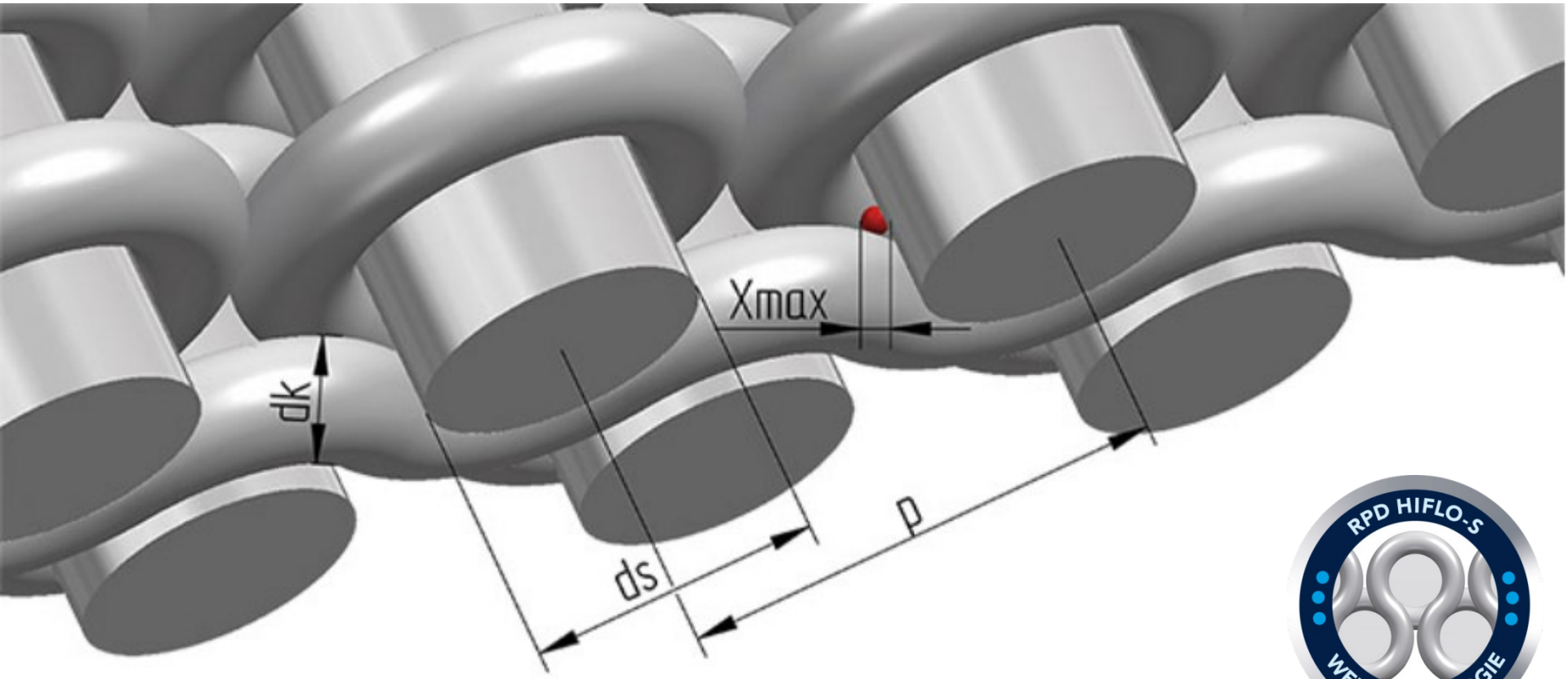
GeoDict

HAVER & BOECKER

MATH 2 MARKET

Modeling of Woven Filter Media

GeoDict

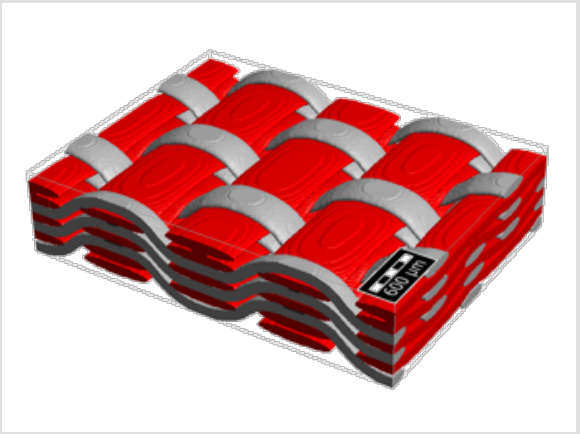


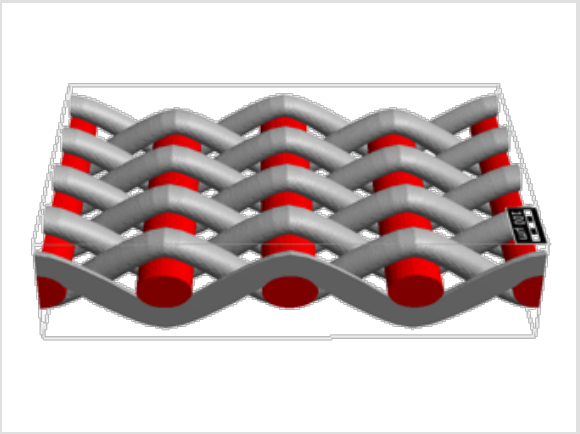
RPD HIFLO-S WEBTECHNOLOGIE

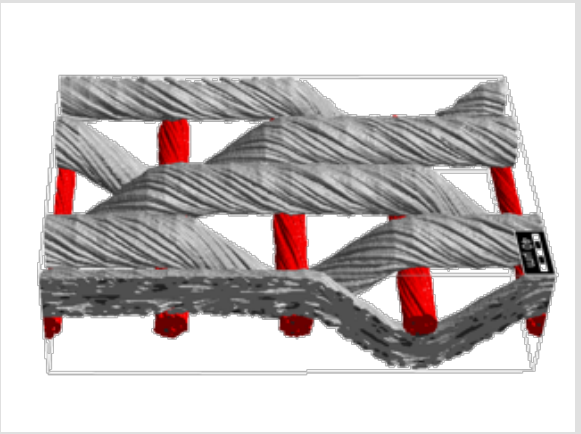
HAVER & BOECKER

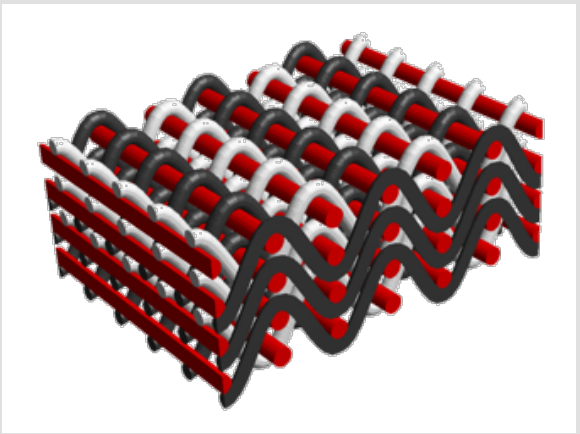
MATH 2 MARKET

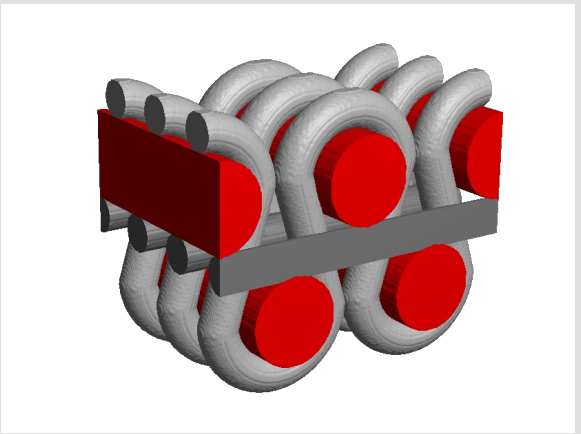
Model Examples with WeaveGeo of GeoDict











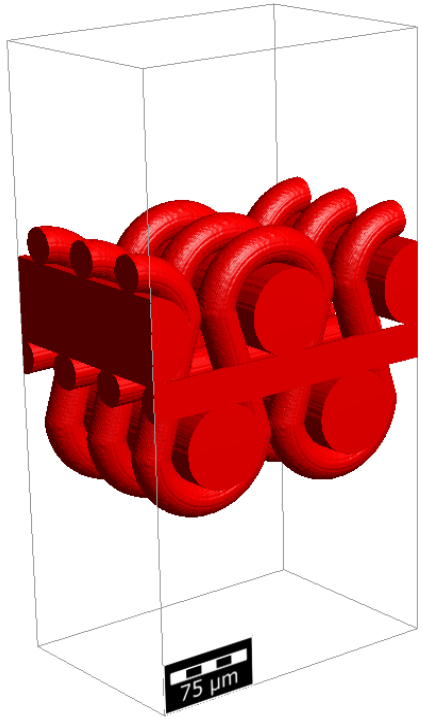
HAVER & BOECKER
MATH 2 MARKET

Modeled woven filter media

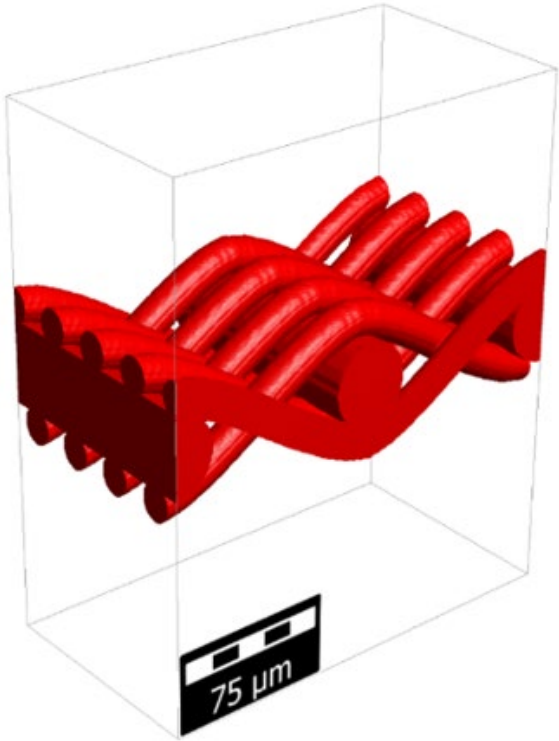
GeoDict

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

DTW 14 S



RPD HiFlo 15 S



HiFlo 15 S

HAVER & BOECKER

MATH 2 MARKET

Content

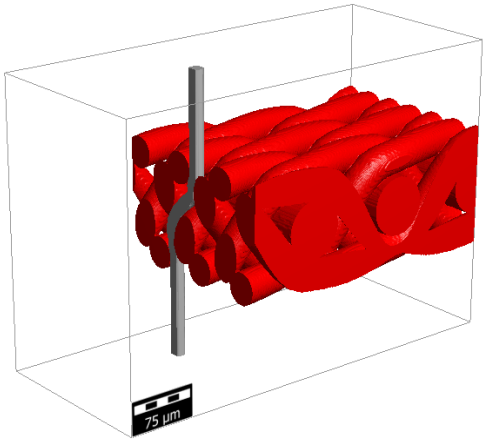
GeoDict

HAVER & BOECKER

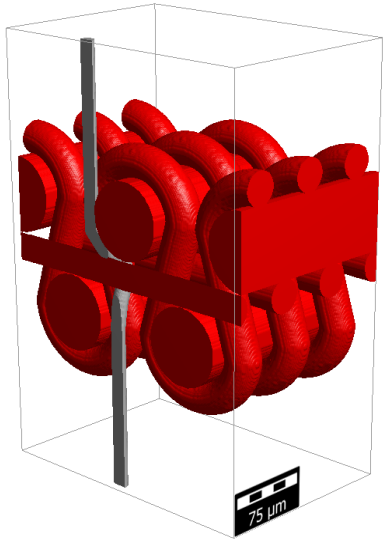
MATH 2 MARKET

Geometry & Percolation Path

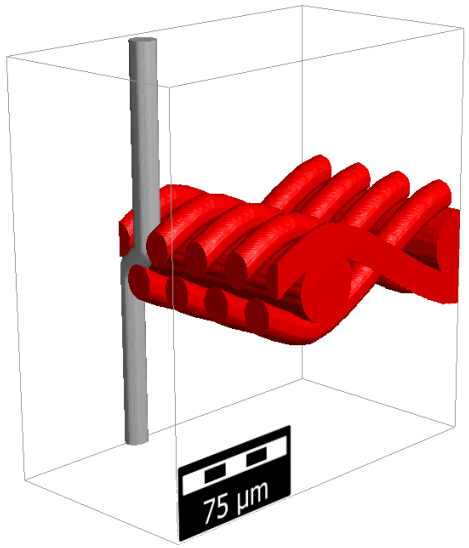
GeoDict



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

HAVER & BOECKER

MATH 2 MARKET

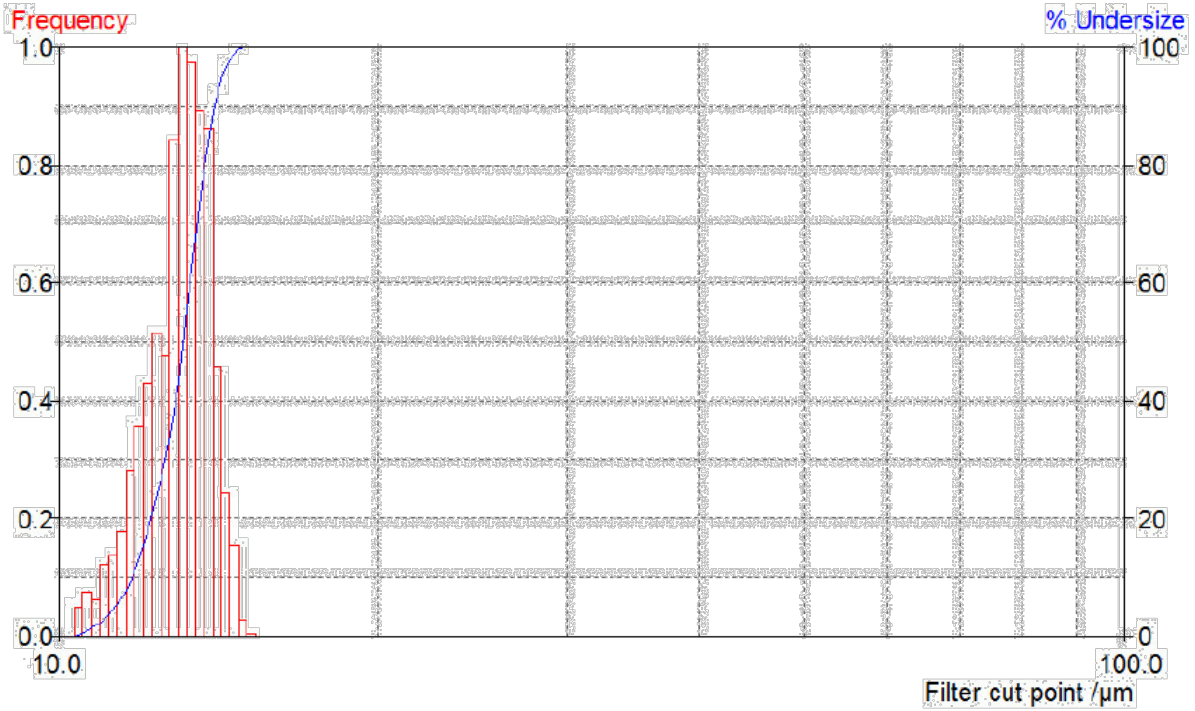
Filter Cut Point By Suspension Challenge Testing of Whitehouse Scientific

GeoDict

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

Filter Cut Point (Challenge Test)

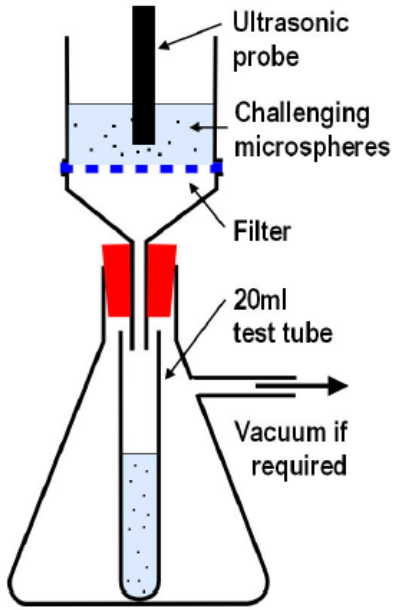
% Undersize	3.0	5.0	10.0	25.0	50.0	75.0	90.0	95.0	97.0
Size /µm	11.03	11.37	11.70	12.40	13.08	13.58	14.00	14.26	14.46



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

Cut Point (d97) = 14.5 +/- 0.6 µm

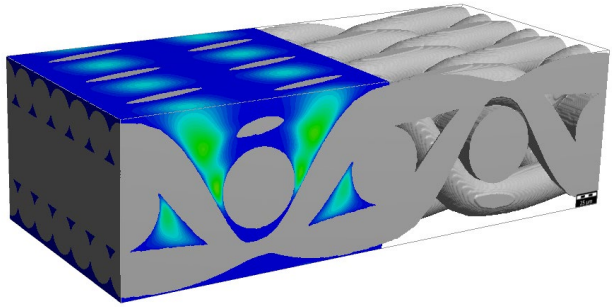
HiFlo 15 S



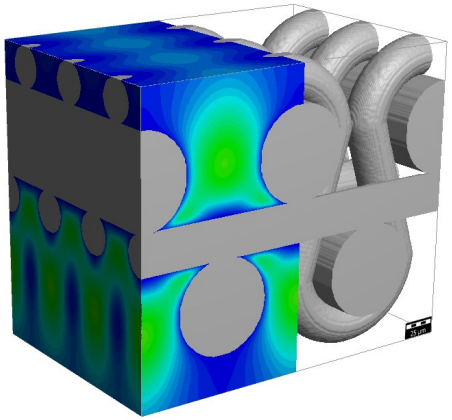
HAVER & BOECKER
MATH 2 MARKET

Air Flow Simulation

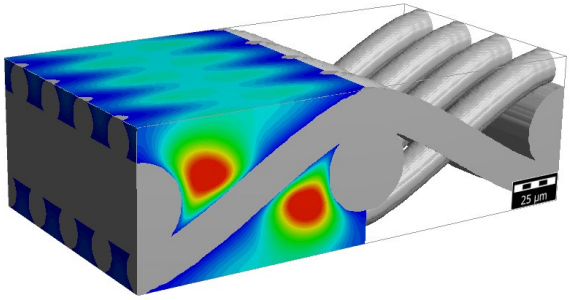
GeoDict



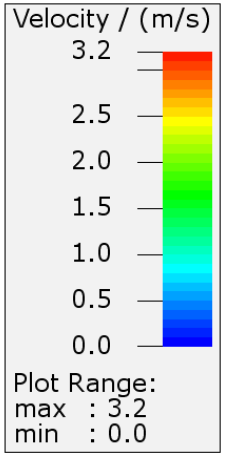
DTW 14 S



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

HAVER & BOECKER

MATH 2 MARKET

Content

GeoDict

HAVER & BOECKER

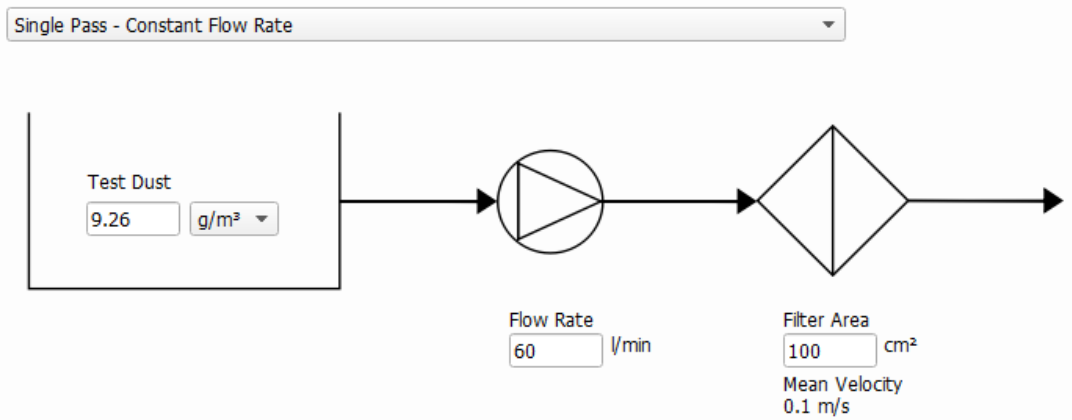
MATH 2 MARKET

Single-Pass Filtration Test & Simulation

GeoDict

Single-pass filtration test rig MFP 1000 from Palas GmbH

Single Pass Life Time filtration simulation



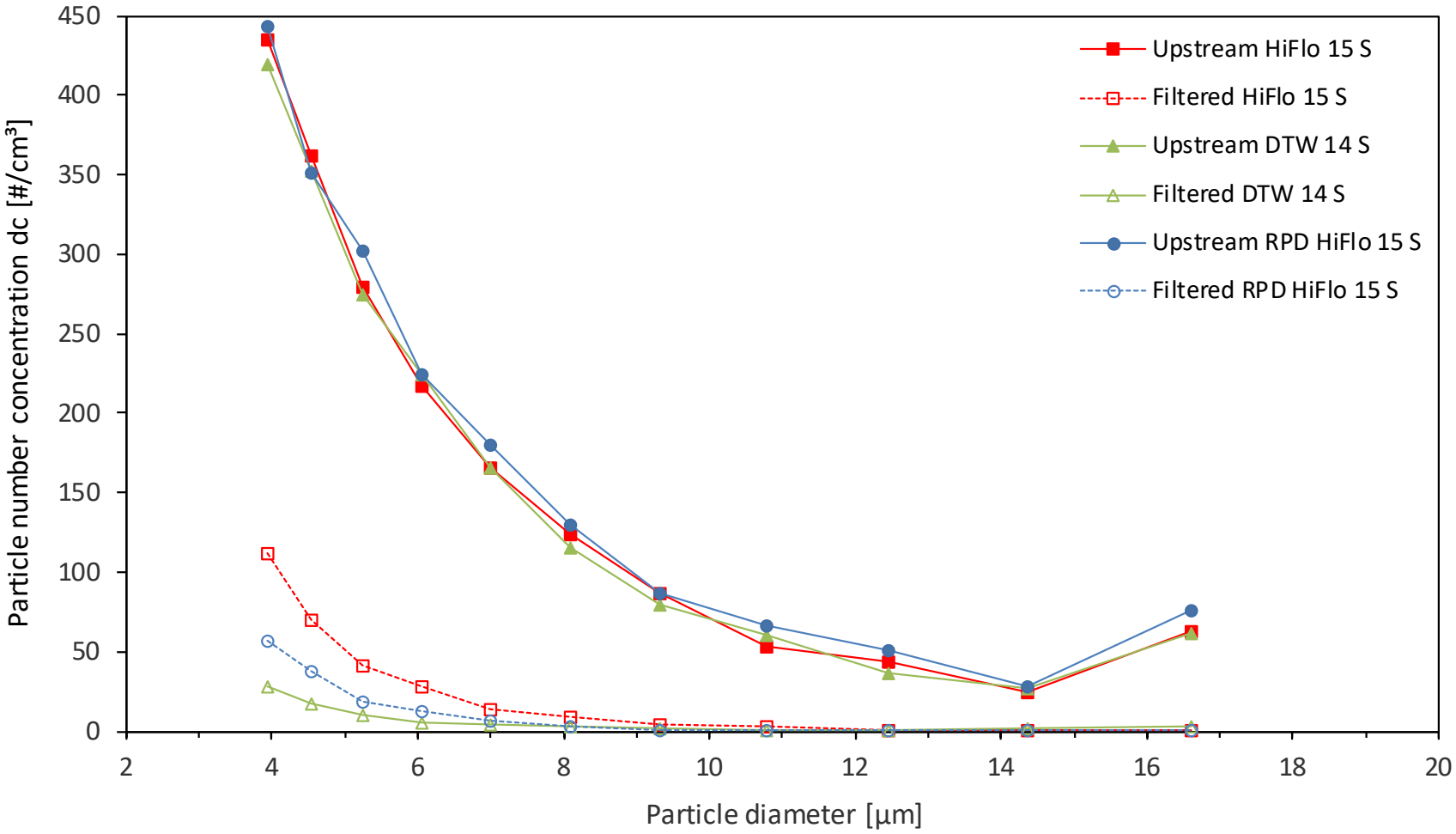
Fluid	Air
Temperature	22 °C
Flow velocity	0.1 m/s (60 l/min)
Particles	ISO A2 fine test dust (0.255 – 16.6 µm)
Test dust concentration	9.26 g/m³
Particle density	2650 kg/m³
Particle shape	Spherical

HAVER & BOECKER

MATH 2 MARKET

Comparison of the Three Weaves

GeoDict



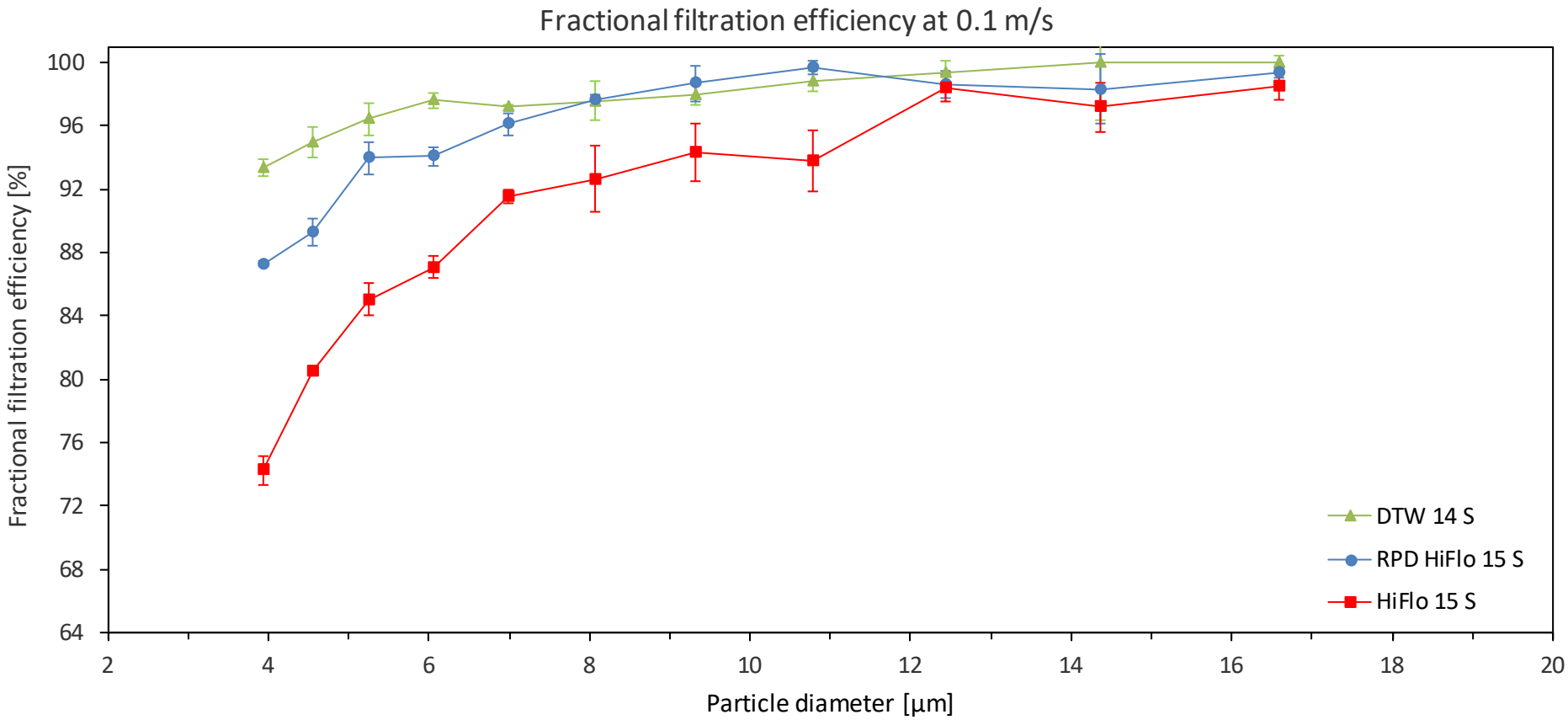
Measurements by IUTA – Das Institut für Energie- und Umwelttechnik
Three times upstream & three times downstream measurements

HAVER & BOECKER

MATH 2 MARKET

Comparison of the Three Weaves

GeoDict



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

HAVER & BOECKER
MATH 2 MARKET

Content

GeoDict

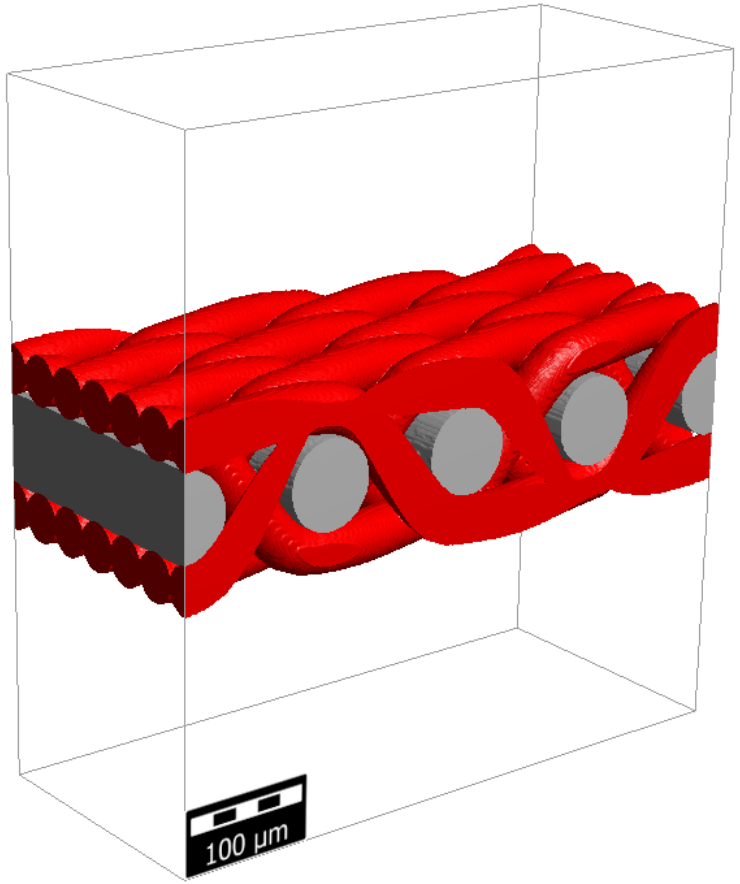
HAVER & BOECKER

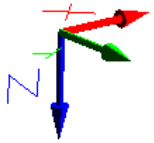
MATH 2 MARKET

DTW 14 S

GeoDict

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





HAVER & BOECKER
MATH 2 MARKET

DTW 14 S

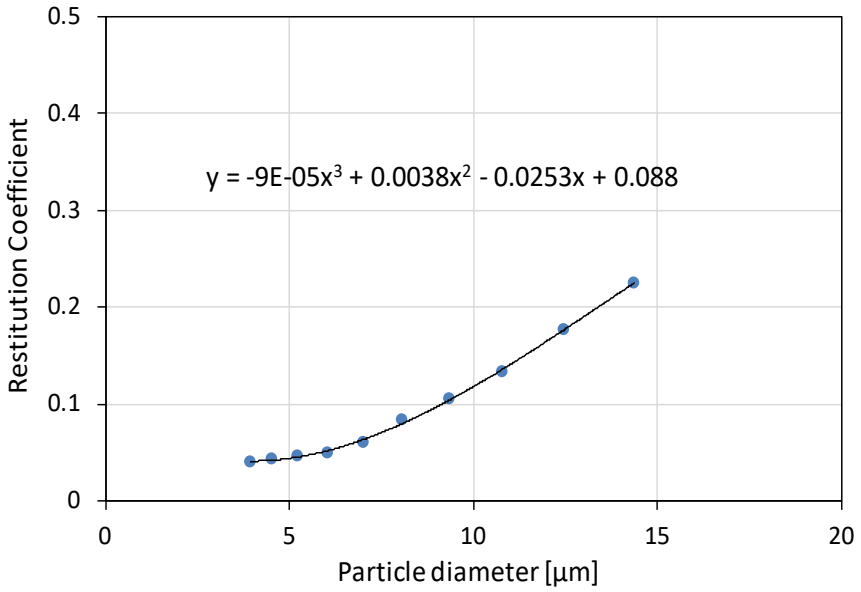
DTW 14 S

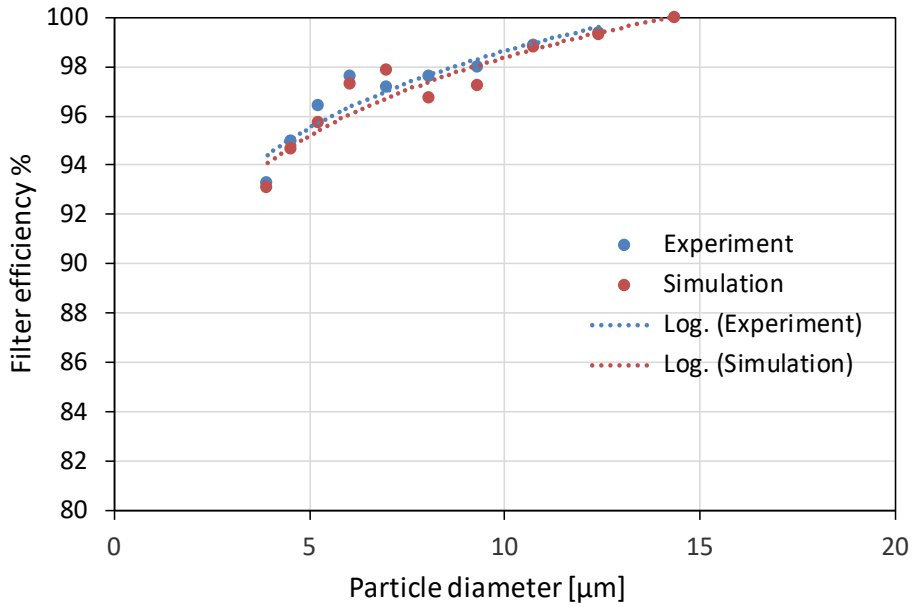
DTW 14 S

GeoDict

Filtration test duration: **60 s**

Dust concentration: **0.771 g/m³**





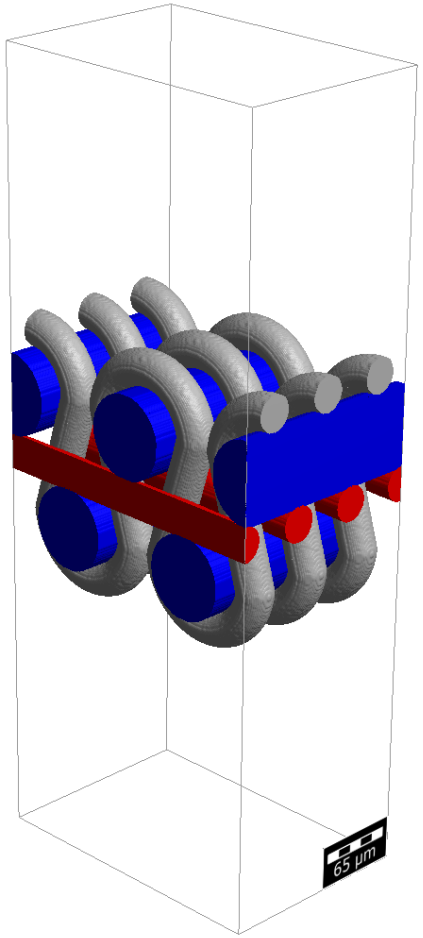
HAVER & BOECKER

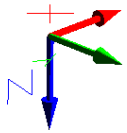
MATH 2 MARKET

RPD HiFlo 15 S

GeoDict

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





HAVER & BOECKER

MATH 2 MARKET

RPD HiFlo 15 S

RPD HiFlo 15 S

GeoDict

HAVER & BOECKER

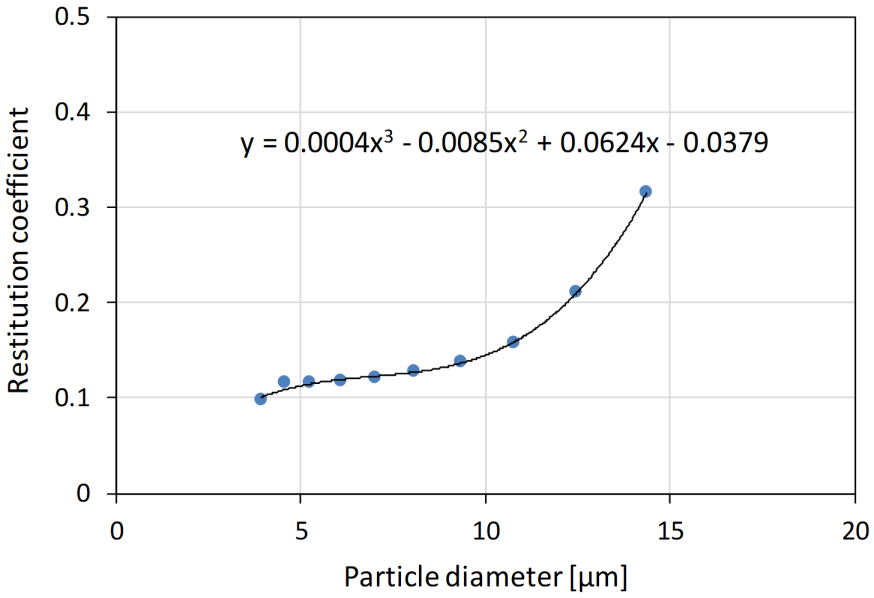
MATH 2 MARKET

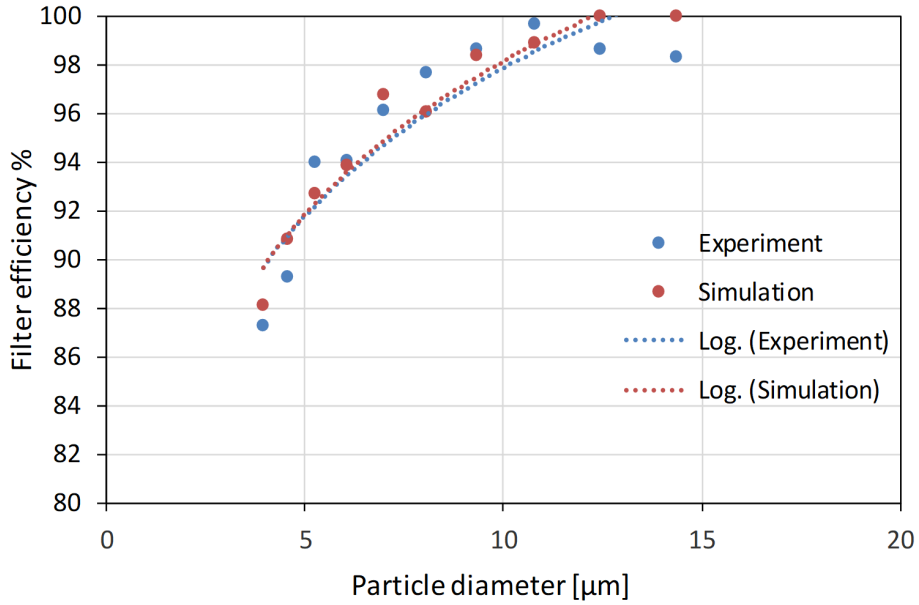
RPD HiFlo 15 S

GeoDict

Filtration test duration: 60 s

Dust concentration: 0.859 g/m³





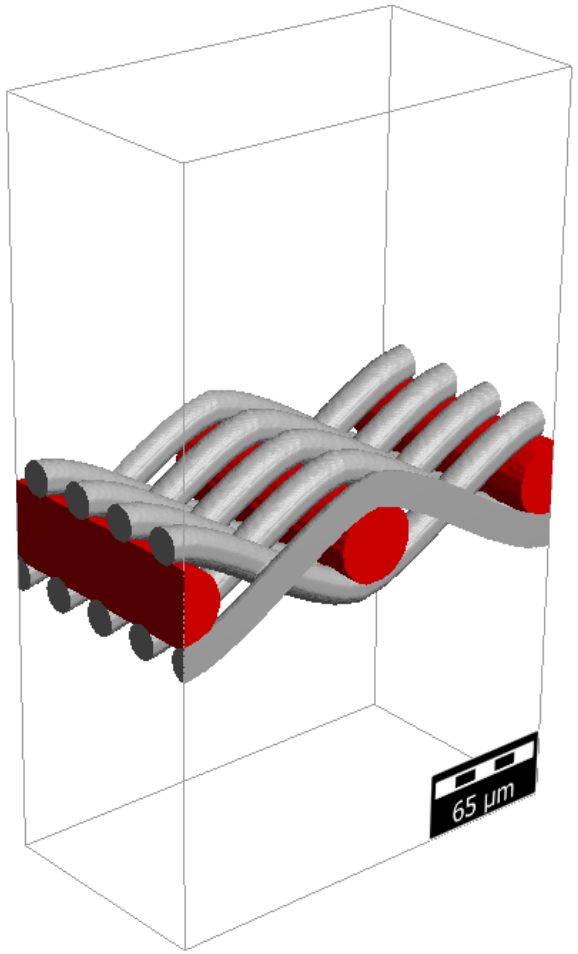
HAVER & BOECKER

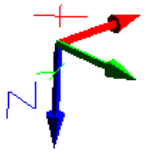
MATH 2 MARKET

HiFlo 15 S

GeoDict

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



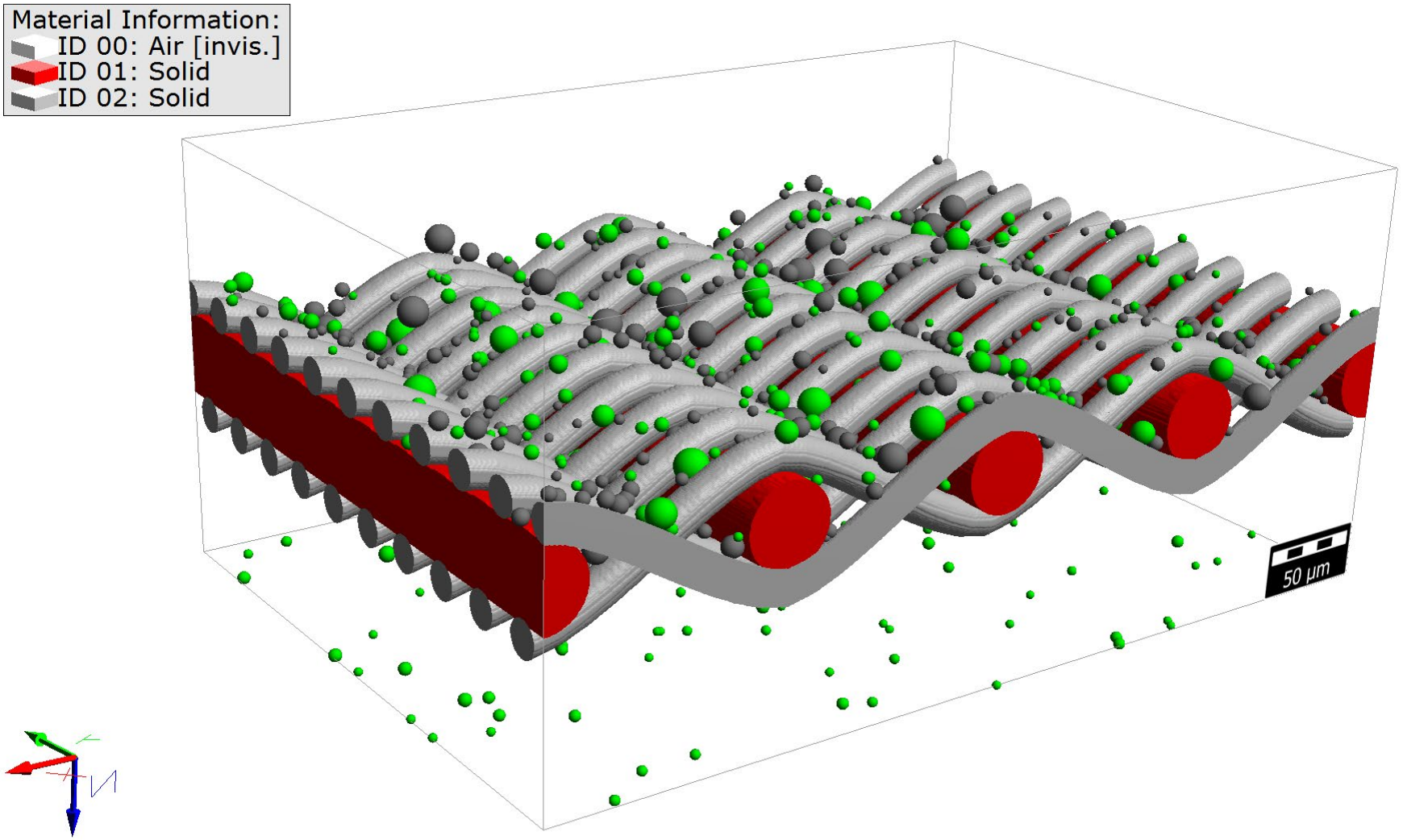


HAVER & BOECKER

MATH 2 MARKET

HiFlo 15 S

GeoDict



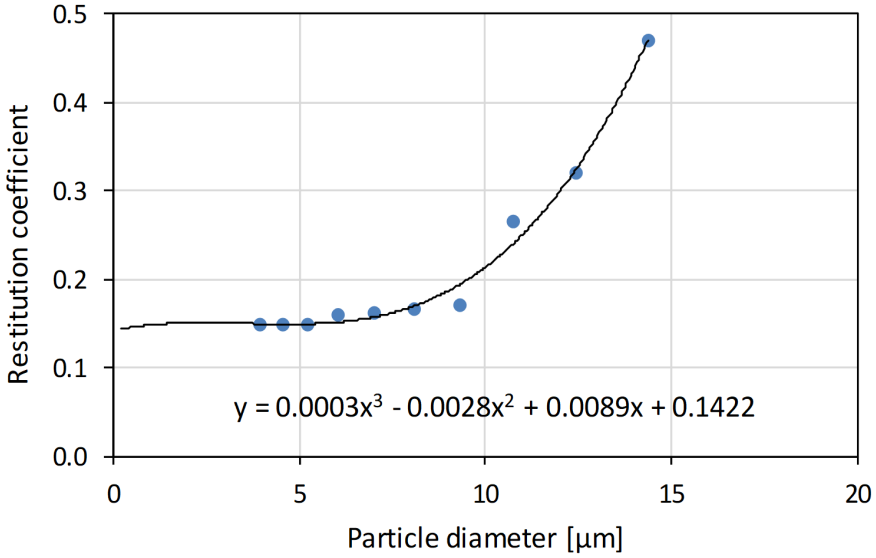
HAVER & BOECKER
MATH 2 MARKET

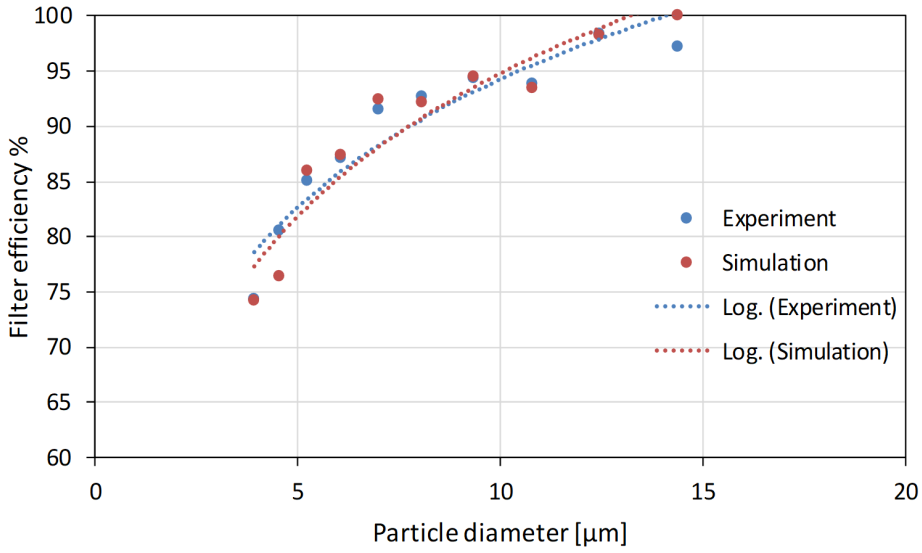
HIFLO 15 S

GEODICT

Filtration test duration: 60 s

Dust concentration: 0.785 g/m³



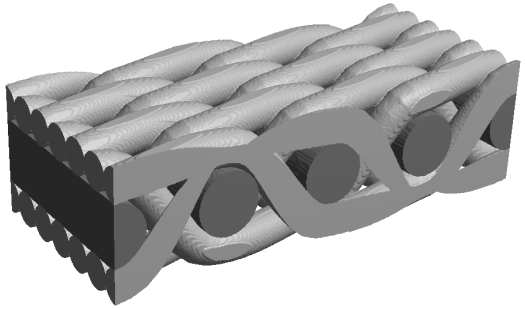


HAVER & BOECKER

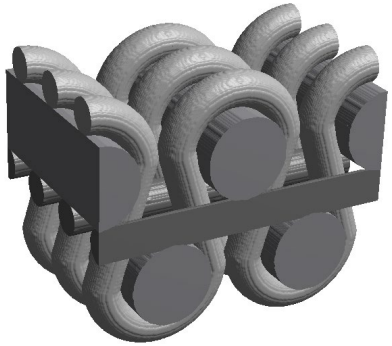
MATH 2 MARKET

Comparison of the Three Weaves

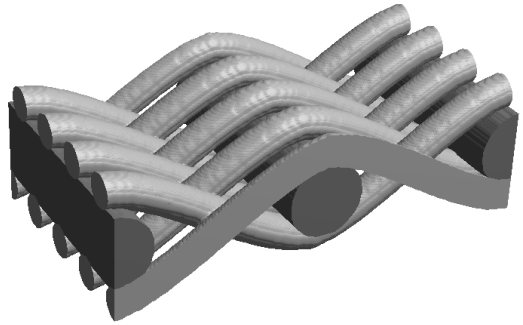
GeoDict



DTW 14 S

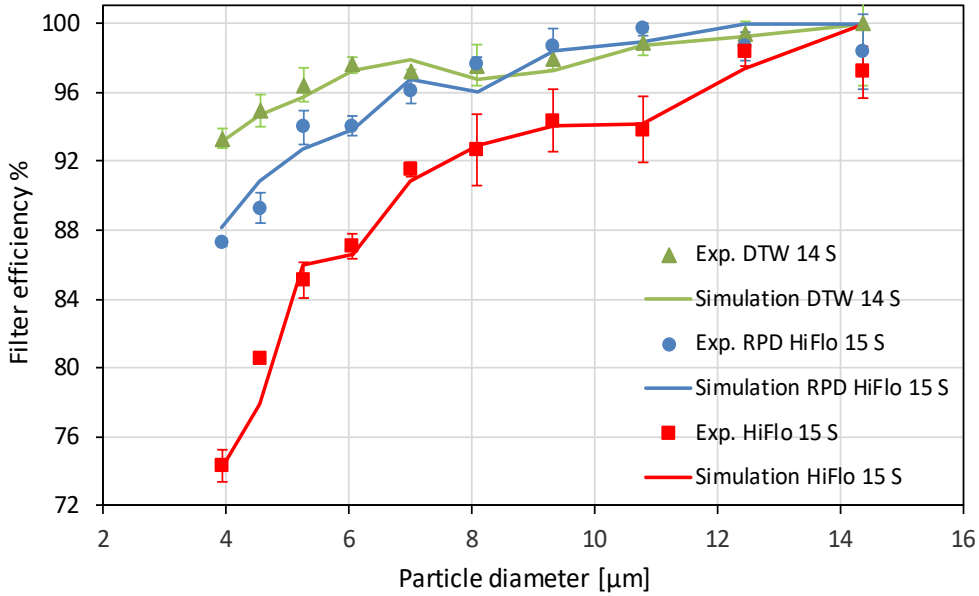


RPD HiFlo 15 S



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



HAVER & BOECKER

MATH 2 MARKET

SUMMARY

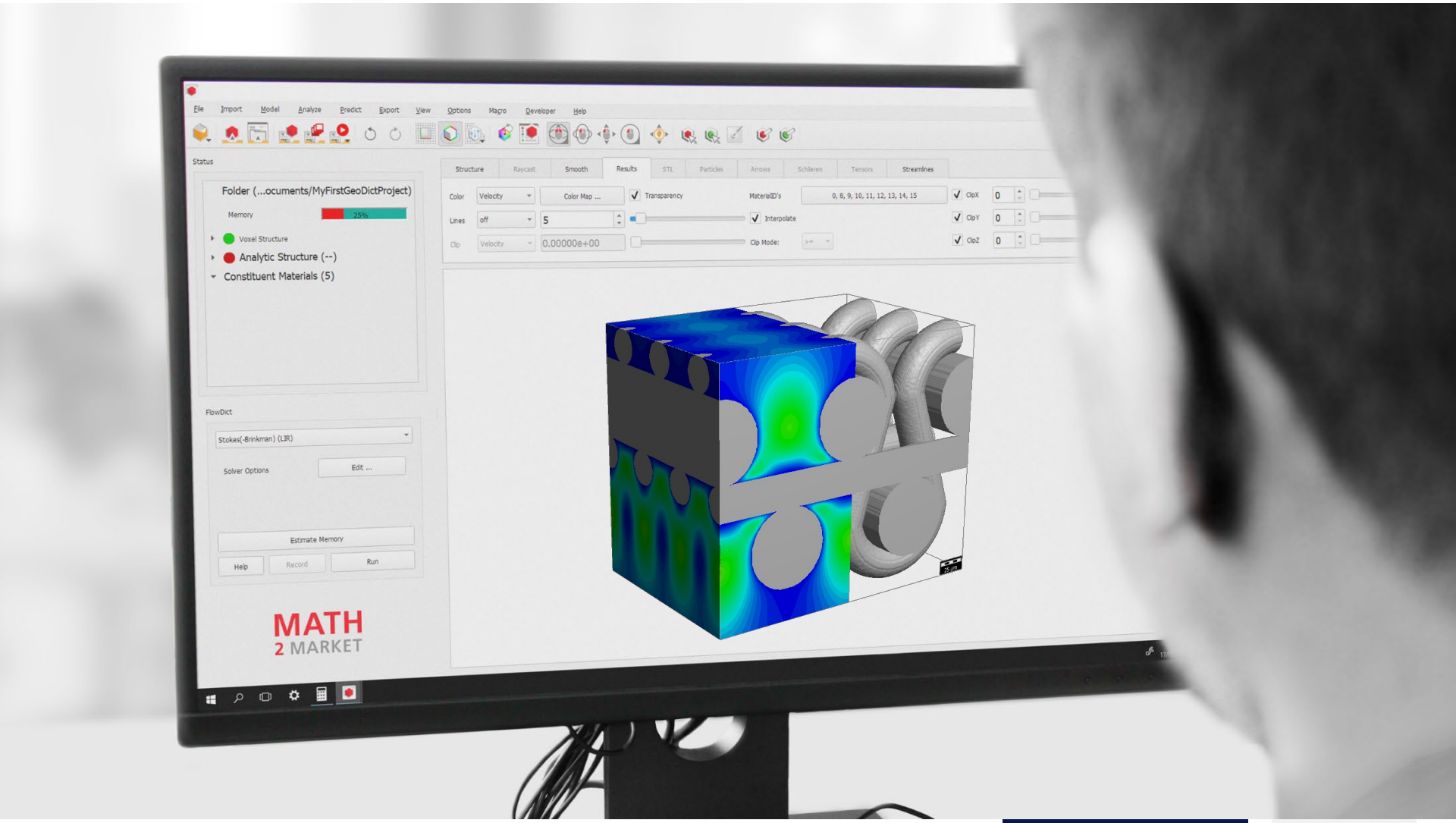
- Max. particle diameter passable simulated with GeoDict, compared & validated with Cut Point, d97, by suspension challenge testing of Whitehouse Scientific

- Air permeability simulated with GeoDict, compared & validated with the air permeability measurements by Haver&Boecker

- Particulate air flow simulation with GeoDict, compared & validated with the filtration measurements by IUTA Duisburg (Das Institut für Energie- und Umwelttechnik)

THANK YOU FOR YOUR ATTENTION.

GEODICT



HAVER & BOECKER

MATH 2 MARKET