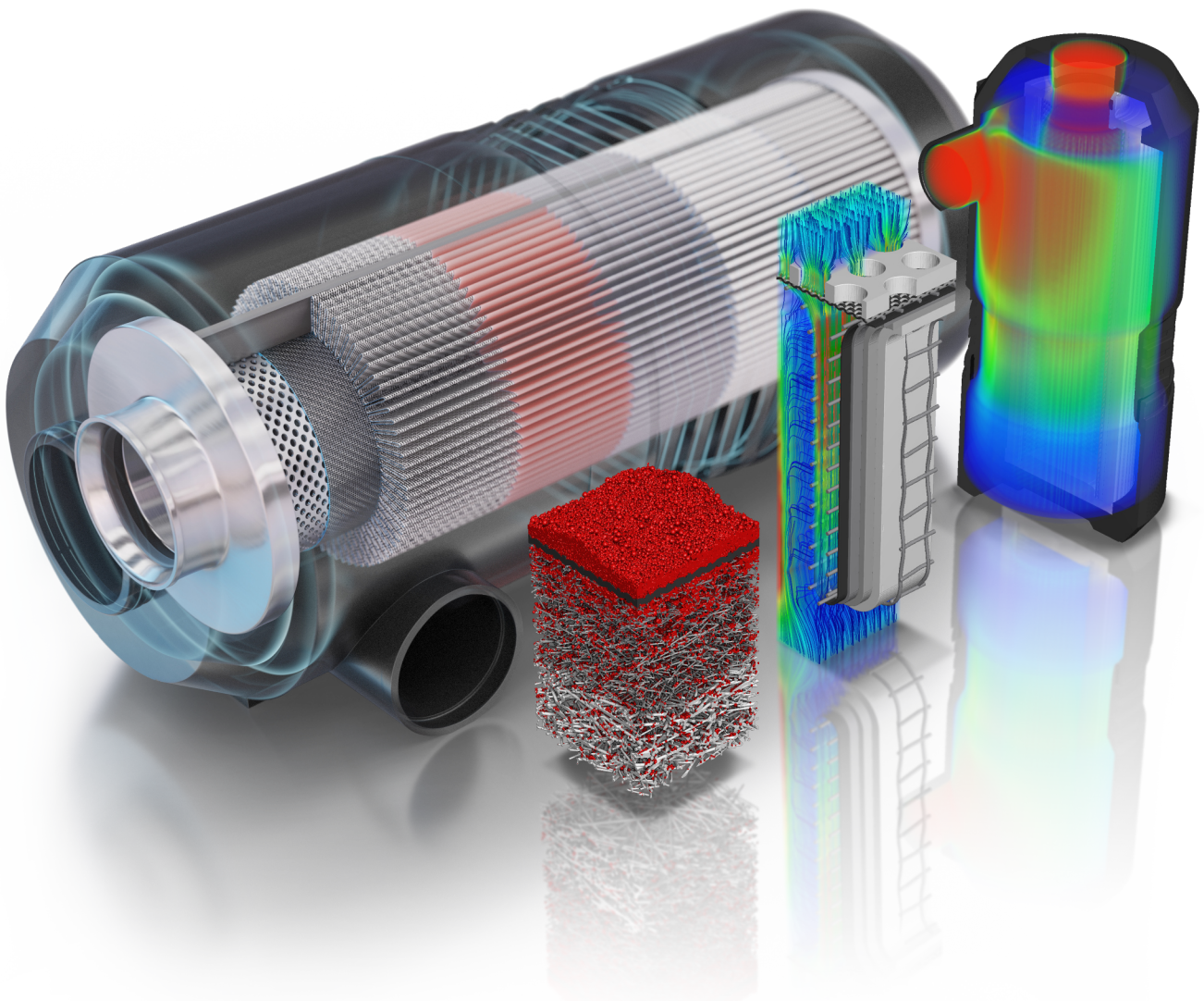


# GEO DICT

The Digital Material Laboratory

**GAS  
FILTRATION**



## **THE MOTIVATION**

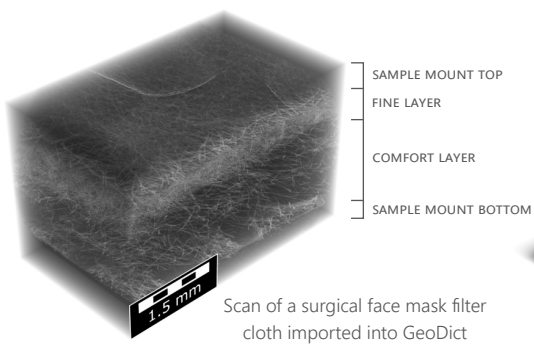
Simulations in the field of gas filtration empower users to quickly and easily test different scenarios and conditions. They offer the possibility to model and understand complex processes and interactions to identify and solve problems at an early stage. Thus, gas filtration systems can be tested for different designs and conditions to find the best solution for an application.

## **OUR SOLUTION**

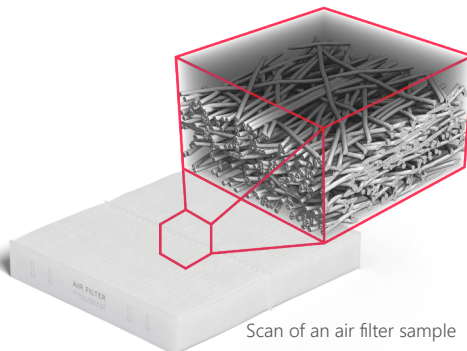
Simulations with GeoDict help manufacturers of filter media and filters to understand existing filter materials and to improve these in a targeted manner. This understanding not only leads to an efficient improvement of materials, but also to the development of completely new materials. GeoDict covers the entire development process from analysis over prediction to design performance materials.

## **YOUR BENEFIT**

Computer simulations are used to develop new filter media and filter pleats by selecting a few promising designs and reducing costly laboratory testing to these few designs. The development cycle can be significantly accelerated by parallelized parameter studies, empowering faster and better products – saving material and time to market.



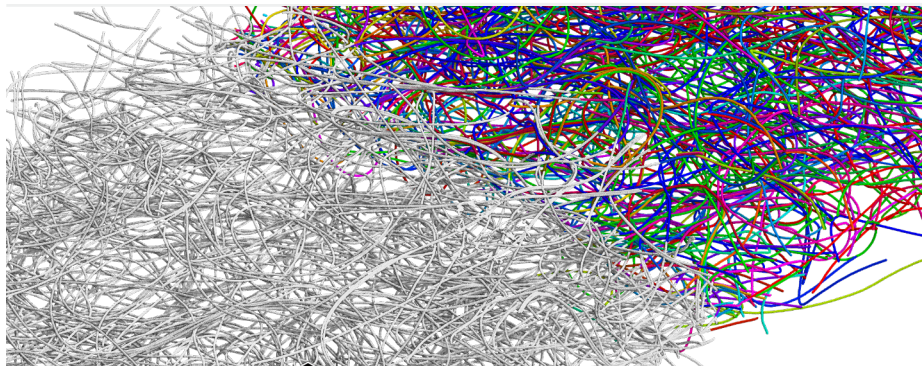
Scan of a surgical face mask filter cloth imported into GeoDict



Scan of an air filter sample

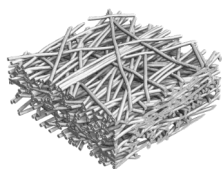
## DIGITALIZATION

Import a  $\mu$ CT scan of the filter material or a CAD model of the filter. Image filters and AI tools help segmenting and identifying useful information.



## MATERIAL ANALYSIS

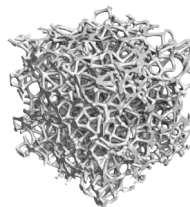
Analyze the filter media microstructure by identifying each individual fiber through AI techniques and get information on basis weight distribution and fiber diameters, orientation, curvature, etc. Analyze the pore space to obtain pore size distribution, information on pore throats, etc.



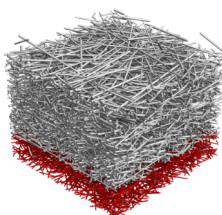
Nonwovens



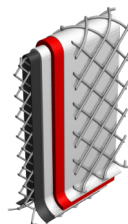
Wovens



Foams

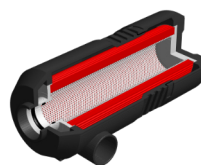


Nano-/Microscale



Multiscale approach

Mesoscale



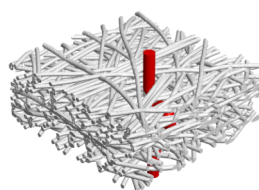
Macroscale

## MULTISCALE DESIGN

Generate three-dimensional models of filter media, filter elements, and whole filters with housing. Use data from analysis to create statistical digital twins of the original imported structure.

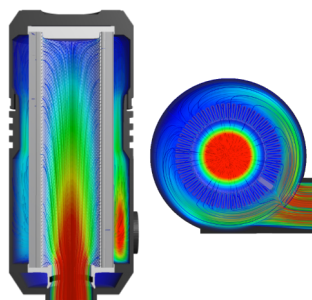
### Characterize clean filter media:

- Determine the initial pressure drop.
- Evaluate pore size distribution and bubble point.
- Find percolation paths through the medium.
- Analyze CT scans to find media thickness, fiber diameter, and fiber orientation



### Analyze filter media and filter performance:

- Simulate single-pass or multi-pass tests
- Find the most penetrating particle size
- Determine initial filter efficiency and pressure drop
- Simulate diesel soot and standard test aerosols/particles.
- Evaluate pressure drop evolution, (fractional) efficiencies, and dust holding capacity



## PROPERTY PREDICTION

Simulation of filtration-relevant properties of filter media, filter elements, and filters with housing such as initial pressure drop, initial filter efficiency, pressure drop vs. time, fractional filtration efficiency vs. time, dust holding capacity.

Using GeoDict's cloud solution, conduct extensive parameter studies to assess the effect of specific parameters on the performance of filter media and filters.