



MFP filter test rigs from Palas® have already proved themselves many times worldwide in practical applications in development and quality control. The MFP Nano plus 4000 is specially designed for the precise determination of the separation efficiency of HEPA and ULPA filter media in accordance with DIN EN 1822-3 and ISO 29463-3. In the form of the U-SMPS, a modern and powerful nanoparticle measuring device with a measurement range from 5 nm to 1  $\mu\text{m}$  is used for particle size and quantity analysis. The separation efficiency at a specific size is measured in real-time with the MFP Nano plus 4000 and a UF-CPC condensation particle counter in both the raw and clean gas.

## OPERATION PRINCIPLE

### REAL-TIME DETERMINATION OF FRACTION SEPARATION EFFICIENCY WITH TWO UF-CPC

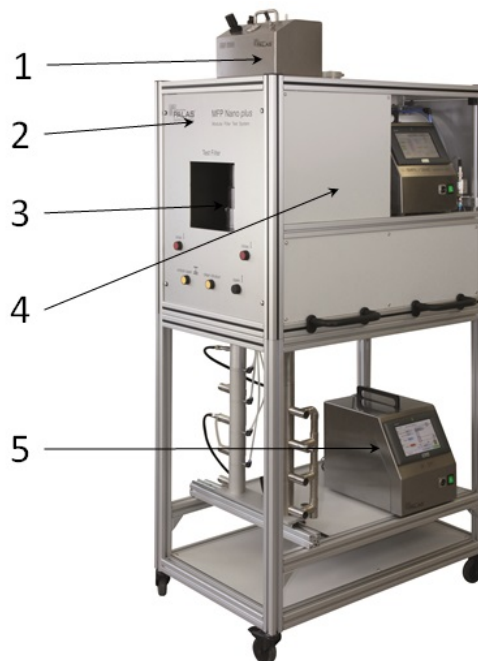
Real-time measurement of the fraction separation efficiency in the MFP Nano plus 4000 offers the following special advantages:

- By measuring the particle concentration in the raw and clean gas, the measuring time for determining the fraction separation efficiency is halved.
- Combining two UF-CPC versions, the UF-CPC for the highest concentrations up to 2,000,000 particles/cm<sup>3</sup> (single count mode) in the raw gas and the UF-CPC 50 for top counting rates at low concentrations in the clean gas corresponds to a dilution factor of 1:200. Conventional aerosol dilution is therefore for high-efficiency filter media no longer necessary.

With the aid of the universal aerosol generator UGF 2000, defined aerosol distributions matched to the MMPS range can be produced with DEHS or salt (NaCl / KCl).

The largely automated setup of the test sequence with the clearly defined individual components and the individually adjustable sequence programs of the filter test software FTControl combine to deliver the high reliability of our measurement results.

The MFP filter test rig is a modular filter testing system for flat filter media and small mini-filters. Pressure loss curves, fraction separation efficiency, or burden can be determined within a very short period – both reliably and cost-effectively.



1. Variable aerosol generation with the UGF 2000 for KCl / NaCl or DEHS. Integrated Nafion drying system. The volume flow for aerosol generation is individually regulated via mass flow controllers.

2. Aerosol neutralization: Soft x-ray Charger XRC 049 or Corona discharge (optional).

3. Mobile pneumatic filter holder for fast removal and loading of the test rig with integrated DEMC 2000 (Differential Electrical Mobility Classifier).

The DEMC 2000 (Differential Electrical Mobility Classifier) contained in the U-SMPS classifies the particle size of the polydisperse aerosol generated with the UGF 2000. Only monodisperse particles are contained downstream of the DEMC 2000. The DEMC 2000 control unit automatically regulates the relevant size.

4. Raw gas measurement for number distribution with UF-CPC 200 for high concentrations. To measure the particle number in the raw gas, the UF-CPC 200 condensation particle counter counts up to 2,000,000 particles/cm<sup>3</sup> in single count mode. No dilution system is needed for raw gas measurement in very high concentrations. Lengthy or complex cleaning of the systems is not required.

5. Clean gas measurement for number distribution with UF-CPC 50 for low concentrations. The "full flow" UF-CPC 50 is optimized for low particle concentrations (single count mode up to 10,000 particles/cm<sup>3</sup>) in the clean gas. The entire sampling volume flow is thoroughly analyzed in "full flow" particle measurement in the UF-CPC. This means very high counting rates can be achieved at low particle concentrations in the clean gas.

The Palas® filter test software FTControl controls the U-SMPS and evaluates the data.

Through a suitable selection of the solution concentration, the generated particle size distribution is matched to the relevant MPPS range in the MFP Nano plus 4000.

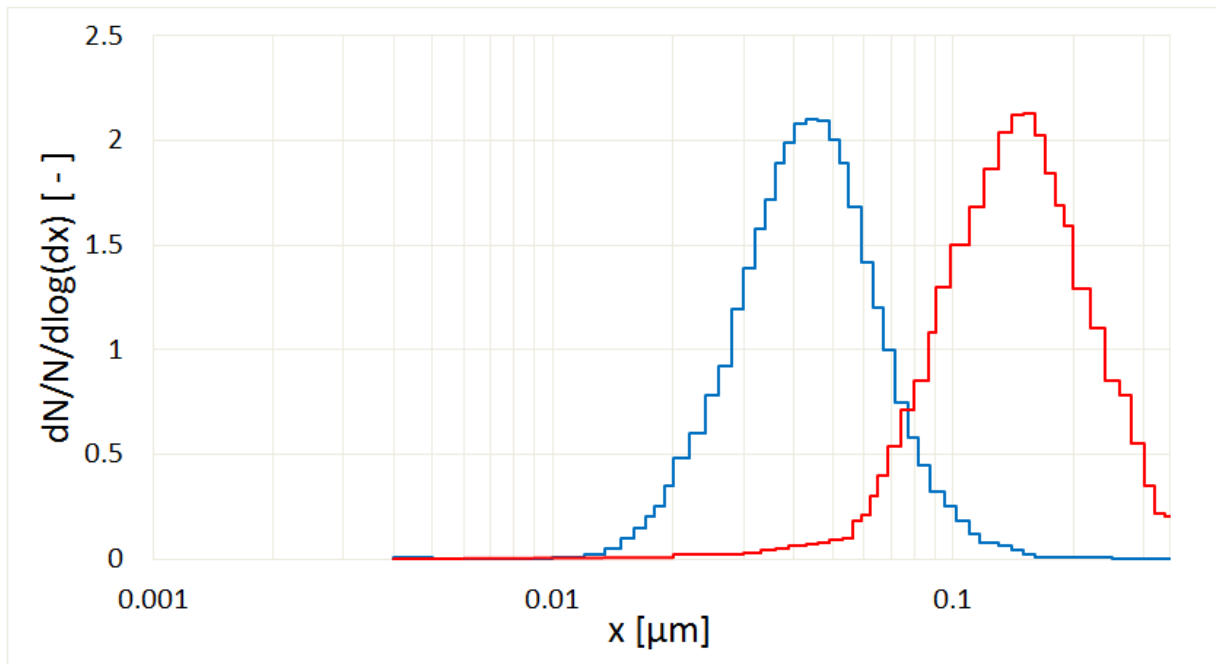


Fig. 1: Adjustment of the particle sizes for the required MPPS range with DEHS

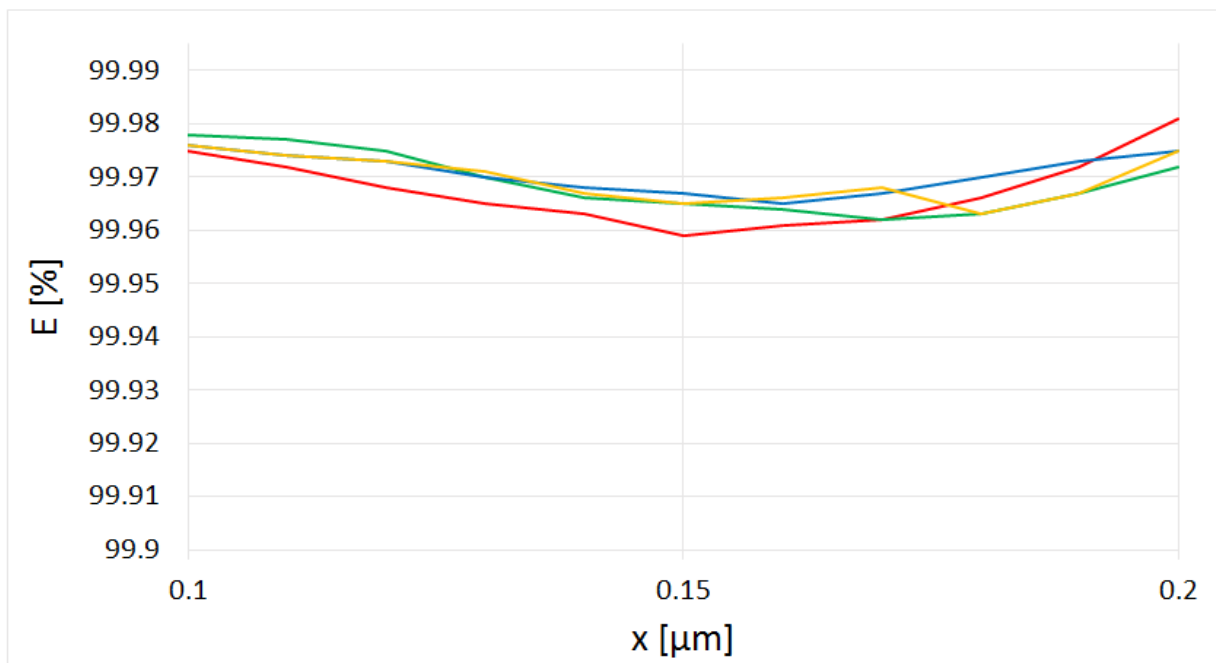


Fig. 2: Comparison of fraction separation efficiencies in the MPPS range at 140 nm

- Clear demonstration of the separation efficiency of the filter medium throughout the entire measurement range
- Clear determination of the MPPS range

- Highest measurement reproducibility and repeatability highlight even fine differences in the separation efficiency
- Short measurement times, down to two minutes per separation efficiency measurement thanks to the optimized aerosol application
- Simple comparison of separation efficiency curves, calculation of mean values also possible

#### Automation:

The MFP Nano *plus* 4000 has integrated mass flow controllers to control the volume flow; these can be automatically monitored and controlled via the FTControl filter test software.

The filter's sensor data, such as the volume flow and differential pressure, are recorded automatically during the filter test.

#### Verification of conformity of sampling in raw and clean gas:

Verification of raw and clean gas measurement conformity without filters is demonstrated during the initial training.

With the MFP Nano *plus* 4000, measurements of the fraction separation efficiency can be performed both in the MPPS range and across the entire measurement range. In addition, the relevant pressure loss of the medium is clearly determined at the relevant inflow speed.

## BENEFITS

- Real-time determination of the fraction separation efficiency above 20 nm
- The measuring time for determining the fraction separation efficiency is halved by measuring the particle concentration in the raw and clean gas.
- No dilution necessary!
- Combining two UF-CPC versions, the UF-CPC for the highest concentrations, up to 2,000,000 particles/cm<sup>3</sup> (single count mode) in the raw gas and the UF-CPC 50 for top counting rates at low concentrations in the clean gas, corresponds to a dilution factor of 1:200.
- Internationally comparable measurement results in accordance with DIN EN 1822-3 and ISO 29463-3
- Simple use of different test aerosols, such as NaCl / KCl or DEHS (others on request)
- Simple measurement of the fraction separation efficiency and determination of the MPPS range
- High reproducibility of the test method
- Flexible filter test software FTControl
- Easy to operate; even untrained personnel can be quickly trained in the use of the equipment
- Cleaning can be performed independently by the customer
- Short set-up times, fast throughput times
- Mobile set-up, easy to move on castors
- Clear verification of the function of the individual components and the system as a whole in the scope of pre-delivery acceptance testing and at delivery
- Reliable functioning
- Little maintenance required
- Reduces your operating expenses

## DATASHEET

|                                   |  |
|-----------------------------------|--|
| Aerosols                          | Dusts (e.g., SAE dusts), salts (e.g., NaCl, KCl), liquid aerosols (e.g., DEHS) |
| Test area of the medium           | 100 cm <sup>2</sup>  |
| Measurement range (size)          | U-SMPS: 10 – 800 nm  |
| Volume flow                       | 0.48 – 5.76 m <sup>3</sup> /h - pressurized operation                          |
| Power supply                      | 115 – 230 V, 50/60 Hz  |
| Differential pressure measurement | 0 – 2,500 Pa (others on request)   |
| Inflow velocity                   | 1.3 – 16 cm/s (others on request)  |
| Compressed air supply             | 6 – 8 bar  |
| Dimensions                        | Approx. 760 • 2,100 • 985 mm (H • W • D)                                       |

## APPLICATIONS

- Testing of filter media and small mini filters in product development and production monitoring
- Testing capability according to DIN EN 1822-3 (HEPA / ULPA) and ISO 29463-3
- Fractional efficiency measurement for other filter media in the range of approx. 20 nm to 1  $\mu\text{m}$



Mehr Informationen:  
<https://www.palas.de/product/mfpnanoplus4000>