## Application Examples

**Tobacco Smoke/ E-Cigarette Vapors:**
whole aerosol and gas phase

**Environmental Aerosol:**
industrial emissions, exhaust gas form combustion processes, viruses, environmental pollutants in general, allergens

HICE › Aerosols and Health
Helmholtz Virtual Institute of Complex Molecular Systems in Environmental Health

**HICE:** [1]
combustion derived aerosols from ship diesel and automative engines as well as from wood stoves

C3 carbon concrete composite

**C³:**
aerosol generated from cutting process of carbon concrete composite

ProCycle

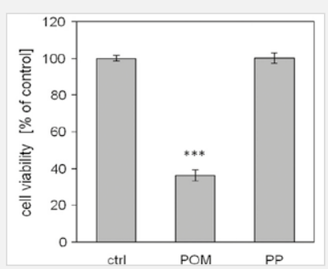
**ProCycle:**
aerosol derived from recycling processes of nanocomposites

NanoMILE

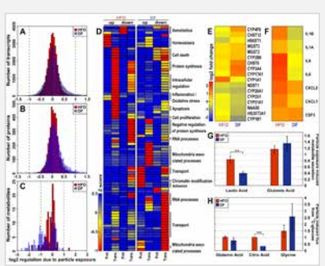
**NanoMILE:**
investigation of nanoparticles

## Aerosol Sources

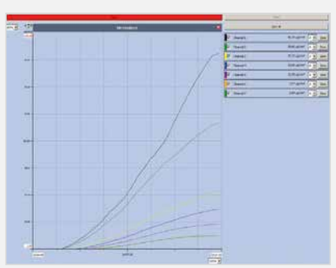
## Test Results



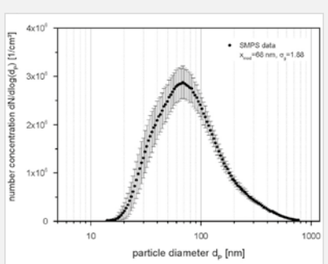

**Basic Assays:** [2]
cell viability, cytotoxicity
see also VITROCELL® Assay Guide

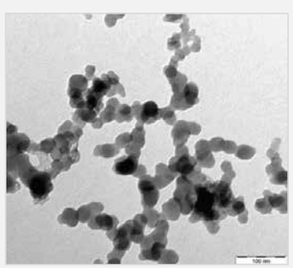


**Omics-Analysis:** [3]
metabolomics, transcriptomics, proteomics, micro-RNA

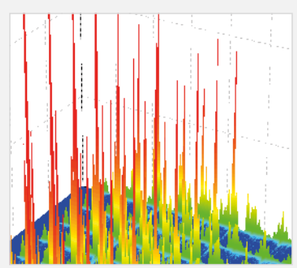


**Dose monitoring:**
online dose determination



**Physical Aerosol Characterization:** [1]
number size distribution, morphology



**Chemical Characterization:**
mass spectrometry

[1] © panalot - Fotolia_69734198

[2] S. Mülhopt et al. / Journal of Aerosol Science 96 (2016) 38–55

[3] Oeder S, Kanashova T, Sippula O, Sapcariu SC, Streibel T, Arteaga-Salas JM, et al. (2015) Particulate Matter from Both Heavy Fuel Oil and Diesel Fuel Shipping Emissions Show Strong Biological Effects on Human Lung Cells at Realistic and Comparable In Vitro Exposure Conditions. PLoS ONE 10(6): e0126536. doi:10.1371/journal. pone.0126536


### Inlet with particle separation

A size selective inlet separates different fractions of aerosol according to the installed nozzle plate. The Inlet is adjustable to $PM_1$, $PM_{2.5}$ and $PM_{10}$.

### Exposure modules

The base module accepts up to 6 cell culture inserts. Each cell culture compartment has an independent media reservoir. A transparent control window facilitates the external monitoring of media levels.
The temperature is controlled by means of a water bath; therefore an additional incubator is not required during the experiment. The temperature for each module is individually monitored. The base module is made of electropolished stainless steel. It is autoclavable at 121° C (250° F) for 20 min.

### Aerosol exposure top

The aerosol inlet stream flows through specifically shaped inlets which are optimized for electrostatic deposition. They are made of stainless steel with VITROGLIDE surface treatment.
The stainless steel / VITROGLIDE inlets are specifically designed for the work with nanoparticles. The aerosol flow rate is controlled by mass flow controllers with data recording by the central data management system.

### Isokinetic sampling system

The aerosol is guided into the central reactor of the system where it is humidified if needed. Distribution to the modules via isokinetic sampling probes enables high reproducibility and uniformity of results.

### Electrostatic deposition enhancement

A significant increase in deposition efficiency is achieved by applying an adjustable electrical field between aerosol inlet and cell culture.


### Integrated Quartz Crystal Microbalance

The microbalance sensor is capable of measuring the deposition in the module at a resolution of 10 nanogram/$cm^2$ per second. The sensors can be placed in all media compartments to validate the mass deposition in the module. After validation they can be removed so that the experiment can be carried out using the cell culture inserts. One microbalance sensor can remain in the module to monitor the dose during exposure. The data is displayed online using the VITROCELL® Monitor software.

### Touch-screen operation

All functions such as aerosol and vacuum flows, temperature, humidity automatic leak test, applied voltage for electrostatic deposition enhancement, start/end of the experiment can be edited using a large 15" touch-screen display. The central data management system provides valuable information on experiment parameters with user-friendly charts. The system can be networked and has a remote service module.

### Keyboard

The keyboard can be used alternatively to the touch screen.

VITROCELL® SYSTEMS