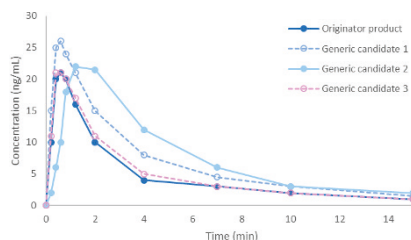




## The power of precision—early on

DissolvIt® absorption profiles of three generic candidates versus the originator product.

DissolvIt®, PreciseInhale's unique *in vitro* simulation module, is a genuine breakthrough in IVVC. It delivers highly predictive dissolution and absorption data that enables the early identification and ranking of Drug Candidates.



## Turn 3R challenge into opportunity with PreciseInhale®

### Replace

**PreciseInhale®** has two *in vitro* modules that replace animal testing entirely.

**DissolvIt®** mimics *in vitro* conditions with high precision, delivering exceptionally high-quality predictive PK data.

**XposeALL®** cell exposure module combines aerosol capability with 3D cell models cultured in an Air-Liquid Interface. It enables studies of cellular effects induced by airborne particles in lung-like conditions.

### Reduce

PreciseInhale's one-animal-at-a-time precision exposure methodology significantly reduces the Standard Deviation of the lung-deposited dose. This drastically reduces the number of animals required for inhalation research compared to conventional "tower" exposure systems.

### Refine

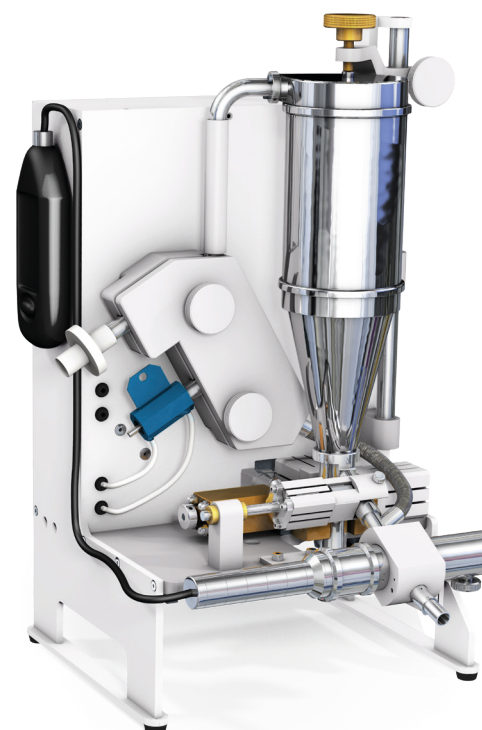
With PreciseInhale's precision dosing the aerosol generator unit separates the powerful energy released during aerosolization from the rodent's delicate lungs. This more refined, controllable dosing reduces the stress on the animal and delivers a finer, more even lung distribution.

– Contact us –

CEO Manoush.Masarrat@inhalation.se | CSO per.gerde@inhalation.se  
contact@inhalation.se | www.inhalation.se

## PreciseInhale® The power of preclinical precision

PreciseInhale® aerosol generator delivers powerful, precise, predictive data—in *vitro*, *ex vivo* and *in vivo*—early on. Its extensive range of high-precision exposure modules minimizes errors, reduces risk and accelerates drug development.



<10%

### Minimize standard deviation

Generates data with a typical standard deviation of less than 10%—compared to up to 100% using conventional methods

100 mg

### Low substance consumption

As little as 100 mg or less of test substance can run a complete PK study

IVVC

### Same aerosol across all exposure modules (*in vitro*, *in vivo* and *ex vivo*)

Minimizes translational errors and generates predictive, comparative data

3R

### Quality not quantity

Our advanced *in vitro* modules, plus one-animal-at-a-time methodology, builds control and precision into experiments, with precise doses—and exceptionally clear data

ISAB-PI-BR-0920-2

– Find out more –

P.2 Precision Dosing P.3 A complete range of exposure modules  
P.4 IVVC: The power of preclinical precision

## Precision Dosing

### – A unique, high-precision technology

PreciseInhale's unique Precision Dosing methodology generates a gentle, highly controllable stream of aerosol rather than a high-pressure jet, enabling constant control and monitoring of aerosol concentration and each individual animal's breathing pattern.

### Unique *in vivo* module

**Intratracheal:** Our intratracheal *in vivo* module delivers a lung-specific exposure that bypasses the nasal airways. It wastes little test substance and disperses aerosols evenly across the lungs.

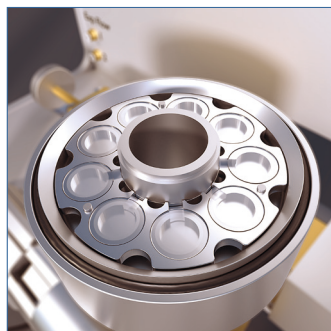
- > Individual control of inhaled dose
- > Standard deviation of typically <10%
- > PK absorption profile of test substance in the systemic blood stream



### Unique *in vitro* module

**DissolvIt®:** Our non-biological *in vitro* dissolution and absorption module uses an artificial air-blood barrier thermostatted at 37° C to generate predictive IVVC data.

- > Both dissolution and absorption data
- > Absorption profiles with  $C_{max}$  and  $T_{max}$  closely resembling clinical absorption profiles
- > Light microscope photos and/or video of real-time dissolution
- > Ranks and identifies Candidate Drugs and compares generic formulations to their originators



## PreciseInhale®

### – A complete range of exposure modules

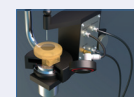
PreciseInhale® is an advanced aerosol generation system that enables precision dosing across a wide range of advanced *in vitro* and *in vivo* exposure modules—all using the same aerosol. Aerosols can be sourced from dry powders, inhalers or nebulizer.



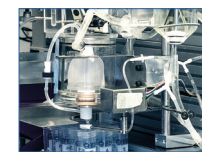
Dry powder



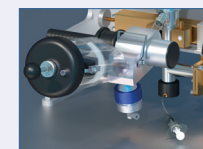
Inhalers (DPIs and pMDIs)



Nebulized "dry powder like" aerosols



Isolated Perfused Lung



Nose-Only rodent exposure



DissolvIt®: Artificial air-blood barrier for state-of-the-art dissolution and absorption studies



XposeAL® Air-Liquid Interface cell exposures

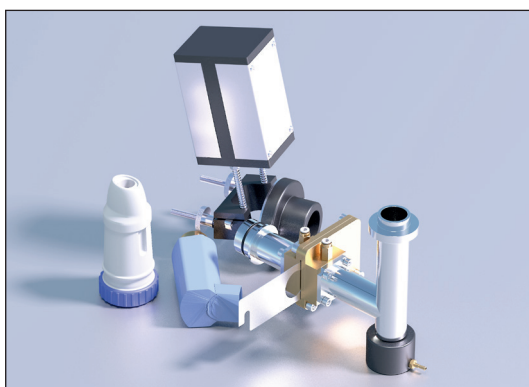


Intratracheal rodent exposure



## Applications

The inhaler actuation device is coupled to the PreciseInhale in order to produce respirable aerosols and precisely dose each exposure object from any inhaler. Suitable for DPIs as well as pMDIs.

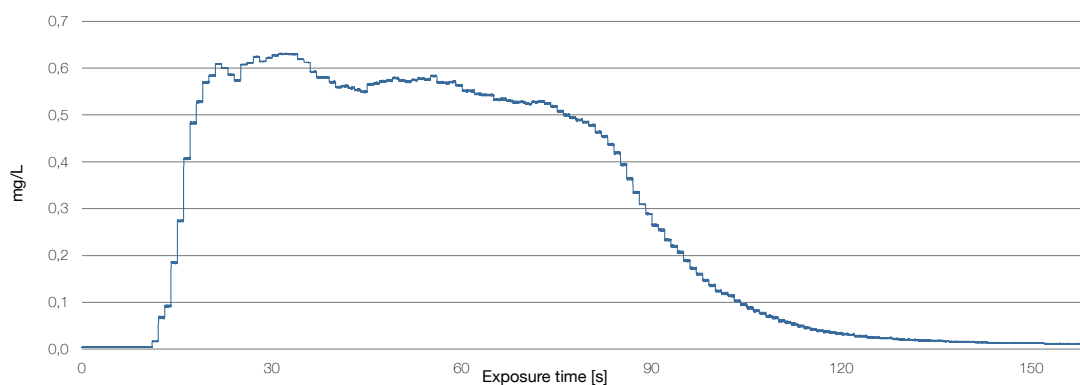


### Features

- Precise repeatable dosing of exposure object
- Allows coupling of any inhaler to the PreciseInhale (DPIs and MDIs/pMDIs)
- Automatic actuation
- Adjustable inhalation flow rate
- Registration of pressure drop (DPIs)
- USP (United States Pharmacopoeia) design

### Benefits

- Enables comparison of formulations in different inhalers vs. commercial reference inhaler
- Repetitive and controlled emitted dose
- Actuate any type of inhaler
- In line with development regulation demands



Aerosol concentration over time during a DPI exposure.





## Technical specifications

<b>Components</b>	pMDI Trigger (PIINHpt1)
	pMDI inductor adapter (PIINHpia1)
	Inhaler Inductor Tube (PIINHt1)
	Inhaler Flow Generator (PIINHfg1)
	Critical Orifice (PIINHco1)
	Inhaler Flow Pneumotach (PIINHfpne1)
	Syringe (PIINHs1)
<b>Measurements:</b>	
<b>Additional PreciseInhale width including inductor tube and pMDI trigger</b>	25 cm (left) + 15 cm (right) 1.5 kg
<b>Critical orifice</b>	26 x 15 x 19 cm (W x D x H) (3.2kg)
<b>Inhaler flow generator</b>	41 x 20 x 50 cm (W x D x H) (7.3 kg)
<b>Verified exposure modules</b>	Aerosol characterization (DPI and pMDI)
	DissolvIt (DPI and pMDI)
	Isolated perfused rat lung (IPL) (pMDI)
<b>Suitable materials</b>	Dry powder inhalers (DPIs)
	Pressurized metered dose inhalers (pMDIs/MDIs)
	> 50 different inhalers have been tested
<b>Inhaler flow range</b>	0 - 116 L/min
<b>Actuation time range</b>	50 - 1 000 ms
<b>Pre-pressurization</b>	Yes, for DPIs
<b>Pressure drop measurement</b>	Yes, for DPIs in order to verify 4 kPa pressure drop
<b>Exposure flow rate</b>	50 - 500 mL/ min
<b>Automatic trigger</b>	Yes, for pMDIs
<b>Pressure drop reproducibility</b>	<b>&lt; 10 % standard deviation</b> (n = 180 actuations) Spiriva 18 µg, inhaler flow rate 38 L/ min, pressure drop 3.9 ± 0.37 kPa, 300 mL aerosol holding chamber, actuation time 300 ms (verified through intra inhaler aerosol generator testing) (IS224)

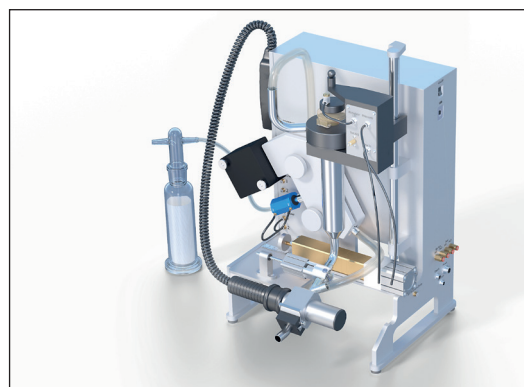




## Applications

When the Nebulizer Aerosol Generator is mounted to PreciseInhale, dry powder-like aerosols can be generated from liquid solutions, preferably from  $\geq 1\%$  water soluble starting material. This aerosol can be exposed to either Rat Intratracheal Exposure Module or Rat Nose-Only Exposure Module.

The solution is aerosolized by a modified and integrated nebulizer unit (Aeroneb Pro) and then dried "on the fly" within the holding chamber to a respirable particle size.

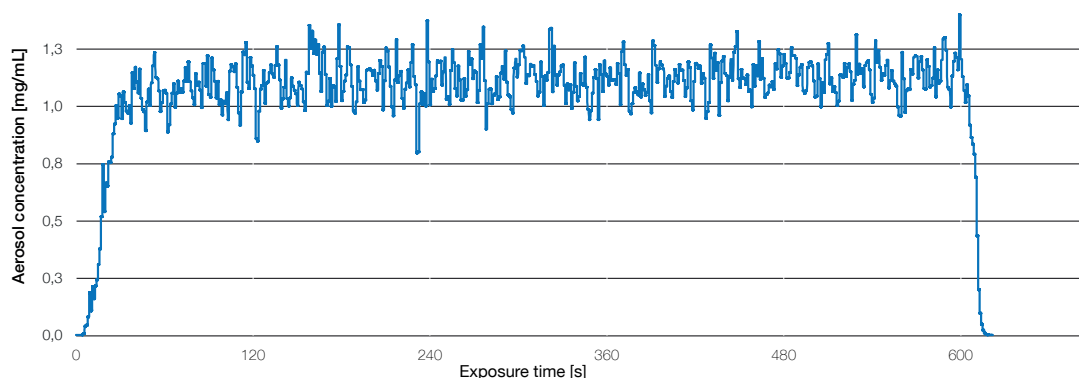


### Features

- > Liquids solutions as starting material
- > Real-time and in-line drying
- > Optional to deliver either wet or dry-powder-like aerosol from liquid solution starting material
- > Monitoring of aerosol concentration during exposure

### Benefits

- > Dry powder-like aerosol generation of hygroscopic materials or non-micronized powders
- > No need of spray drying the material before aerosolization
- > Repetitive dose delivery



Aerosol concentration curve of a "dry powder-like" aerosol generated by the nebulizer aerosol generator over 10 minutes.





## Technical specifications

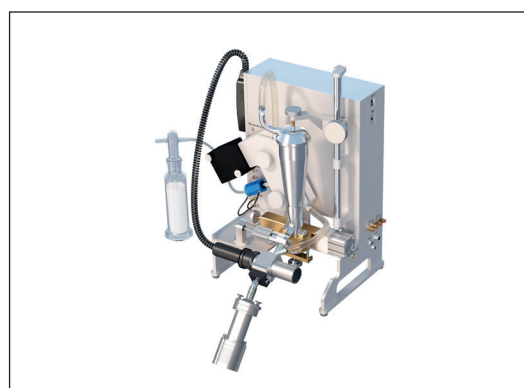
<b>Components</b>	Nebulizer Holder Assembly (PINEBha1)
	Nebulizer Aerosol Holding Chamber (PINEBhc1)
	Nebulizer Unit (PINEBu1)
	Nebulizer Unit Support (PINEBus1)
	Nebulizer Vacuum Lid (PINEBvl1)
	Nebulizer Holding Chamber Lid (PINEBhcl1)
	Nebulizer Control Module Holder (PINEBcmh1)
	Nebulizer Control Module (PINEBcm1)
	Nebulizer Power Cable (PINEBpow1)
	Nebulizer Control Module Cable (PINEBcmc1)
	Cascade Impactor Metal inserts, 8pcs (PICps1-8x8)
	Nebulizer Air Diffuser (PINEBad1)
	Air Inlet Tube (PINEBait1)
	Air Dryer (glass flask), 2 pcs (PINEBadgf1)
<b>Weight</b>	3 kg
<b>Verified exposure modules</b>	Aerosol Characterization Module
	Intratracheal Rat Module
	Nose-Only Rat Module
<b>Suitable materials</b>	Aqueous solutions
	Do not use suspensions
<b>Target molecules</b>	≥ 1% Water soluble small molecules
<b>Neb dosing range</b>	0.1-10
<b>Exposure time</b>	≤ 600 s
<b>Exposure flow rate</b>	≤ 500 mL/min
<b>Drying paper inserts</b>	Disposable, exchange before each new exposure
<b>Dose linearity (neb dosing)</b>	$R^2 > 0.98$ (0.5 - 5.0 neb dosing) (verified through intra- and inter neb unit tests) 8% (w/w) NaCl solution ( $H_2O$ ) (30-600 s)
<b>Dose linearity (exposure time)</b>	$R^2 > 0.99$ (30 - 600 s) (verified through intra- and inter neb unit tests) 8% (w/w) NaCl solution ( $H_2O$ ), neb dosing 1.0
<b>MMAD (mass median aerodynamic diameter) dependency of neb dosing</b>	Not significant, $p = 0.35$ ( $p > 0.05$ ) <b>Neb dosing 2 and 10</b> , imipramine 4% 0.1 X PBS solution, exposure time 300 s, exposure flow rate 440 mL/min
<b>MMAD (mass median aerodynamic diameter) dependency of exposure time</b>	Not significant, $p = 0.36$ ( $p > 0.05$ ) <b>Exposure time 130, 180 and 300 s</b> , imipramine 4% 0.1 X PBS solution, neb dosing 10, exposure flow rate 170 mL/min
<b>Consumables</b>	Drying Paper Inserts, 11x15 cm, packed with silica gel. 10 pcs or 100 pcs/pack (PICNdphc10 or PICNdphc100)
	Air Dryer Silica Gel, portion-packed, 10 pcs/pack (PICNsgx10)





## Applications

The particle size determination kit enables characterization of the aerosol and will present the Mass Median Aerodynamic Diameter, MMAD, as well as the Geometric Standard Deviation, GSD.

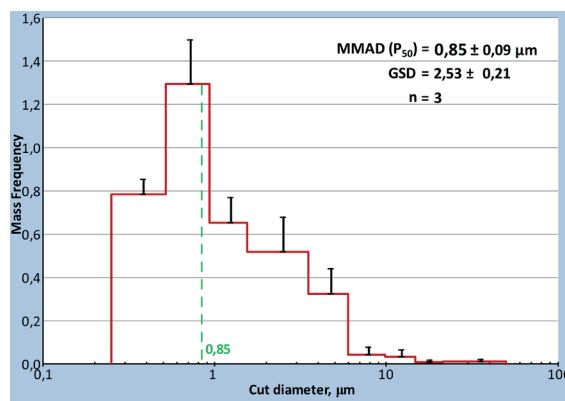


### Features

- Coupling of Marple cascade impactor to PreciseInhale
- Possibility to change aerosol exposure flow rate and aerosol generation pressure
- Flexible source of material: dry powder, inhaler and solution via nebulizer
- Flexible flowrate up to 2.0 L/min

### Benefits

- Measurement of mass median aerodynamic diameter (MMAD)
- Measurement of geometric standard deviation (GSD)
- Knowledge about the particle size distribution and dispersity of the aerosol
- Comparison of MMAD and GSD for particles generated under different settings



Particle size determination including MMAD, GSD of a typical aerosolized substance.



# Particle Size Determination Kit

Art. No.: PIAEpsd1

Inhalation  
Sciences



## Technical specifications

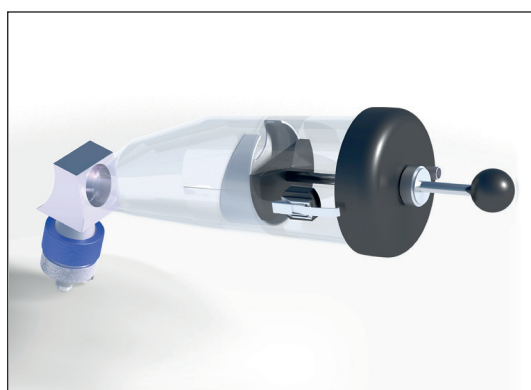
<b>Dimensions</b>	6.0 x 7.5 x 16.5 cm (W x D x H)
<b>Weight</b>	0.415 kg
<b>Aerodynamic particle cut-point</b>	21 to 0.5 µm
<b>Range, stage cut-points</b>	21.3 and above, 14.8, 9.8, 6.0, 3.5, 1.55, 0.93, 0.52 and final
<b>Verified generation modules</b>	Dry powder aerosol generator
	Inhaler aerosol generator (DPI, pMDI)
	Nebulizer aerosol generator
<b>Suitable exposure object</b>	Glass fiber filter Grade A and F, stainless steel inserts
<b>Exposure flow rate</b>	50 – 500 mL/min
<b>Inhalation flow rate</b>	0 - 102 L/min
<b>Consumables</b>	Cascade impactor stage 1-8 filter GF/A, 100 pcs (PICps1-8x100)
	Cascade impactor end filter GF/F, 100 pcs (PICps34x100)
	Cascade impactor stage 1-8 steel inserts, 8 pcs (PICps1-8x8)
<b>Components</b>	8-stage Marple cascade impactor
	Dilution tunnel
	Particle size distribution analysis tool





## Applications

With the Rat Nose-Only exposure module connected to PreciseInhale, rats can be exposed to aerosols for *in vivo* studies. Short duration inhalation exposures to respirable aerosols, a clinically relevant method for pulmonary drug delivery.

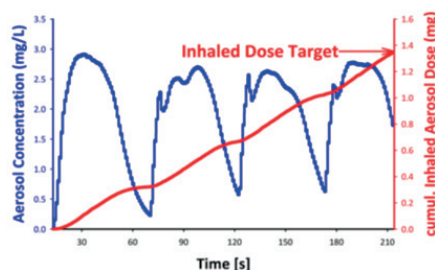


### Features

- > One animal exposed at a time
- > Monitoring breathing pattern of the rat
- > Monitoring the aerosol concentration
- > Precise dosing with the Active Dose-Control System
- > Low substance consumption

### Benefits

- > Allows practical treatment schedule
- > Exposures staggered to suit optimal post-exposure treatment schedule
- > Individual control of inhaled dose (standard deviation usually <10%)
- > High precision when repeating exposures in several animals
- > Ideal for repeated exposure series
- > < 100 mg for a typical PK study
- > Less variations, more reliable data
- > 3R – reduced number of animals required



The aerosol concentration (from repeated aerosol generation cycles) and the cumulative inhaled aerosol dose as logged during the nose only exposure of one rat.



# Rat Nose-Only Exposure Module

Art. No.: PIEMreno1

Inhalation  
Sciences



## Technical specifications

<b>Rat nose-only exposure unit</b>	10 x 42 x 9 cm (W x D x H)
<b>Weight</b>	0.6 kg
<b>Rodent exposure table</b>	22 x 25 x 36 cm (W x D x H)
<b>Weight</b>	7.7 kg
<b>Harvard pump</b>	32.5 x 20 x 25 cm (W x D x H)
<b>Weight</b>	9.5 kg
<b>Verified generation modules</b>	Dry powder aerosol generator
	Inhaler aerosol generator
	Nebulizer aerosol generator
<b>Suitable exposure object</b>	Rats
<b>Exposure flow rate</b>	50 – 500 mL/min
<b>Inhalation yield</b>	Dry powder aerosol generator typically 3-7%
	Inhaler aerosol generator (pMDI only) typically 3-7%
	Nebulizer aerosol generator typically 8-15%
<b>Consumables</b>	6 mm GF/A filters x 400 (PICf6x400)
	25 mm GF/A end-filters x 100 (PICf25x100)
<b>Components</b>	<i>Rat Nose-Only exposure unit:</i> <ul style="list-style-type: none"><li>• Nose-Only exposure block</li><li>• 2 pcs Rat restrainer tube</li><li>• 2 pcs Breathing capacitor for rat restrainer</li><li>• Nose-Only lung-phantom exposure kit</li></ul> <i>In vivo exposure base kit:</i> <ul style="list-style-type: none"><li>• <i>In vivo</i> end filter holder</li><li>• 2-way non-rebreathing valve</li><li>• Rodent exposure table</li><li>• Rodent ventilator (for phantom exposures)</li><li>• Extra-fine forceps</li></ul>

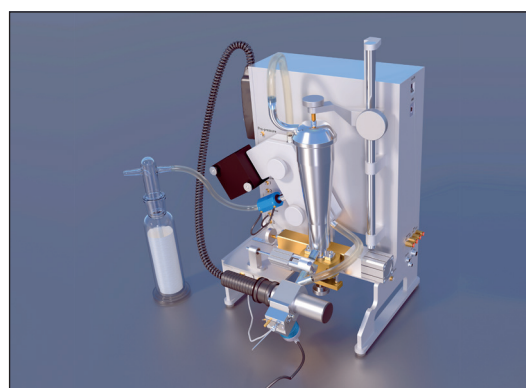
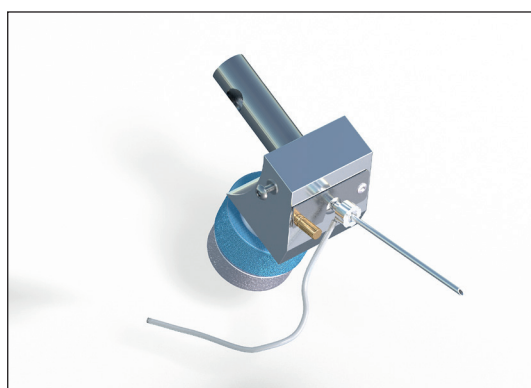
For typical nose-only inhalation exposures, the dose rate [ $\mu\text{g}$  lung deposition/min] with the PreciseInhale was 3.7  $\mu\text{g}$ /min, which is 19-37 times higher than with other methods for aerosol generation (WDF) - ref. Fioni *et al.*, 2017.





## Applications

With the Rat Intratracheal exposure module connected to PreciseInhale, intratracheally intubated rats are exposed to aerosols for *in vivo* studies. Short duration inhalation exposures to respirable aerosols is a clinically relevant method for pulmonary drug delivery.

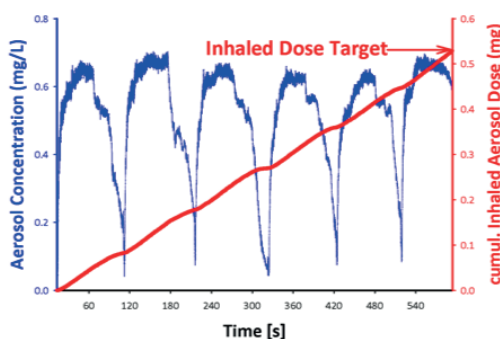


### Features

- > Lung-specific exposure (bypassing nasal airways)
- > Monitoring breathing pattern of the rat
- > Monitoring the aerosol concentration
- > Precise dosing with the Active Dose-Control System
- > One animal exposed at a time
- > Low substance consumption compared to other available methods

### Benefits

- > Individual control of inhaled dose (standard deviation of lung deposited dose typically < 10 % between animals)
- > Less variations, more reliable data
- > 3R – reduced number of animals required
- > Allows optimal treatment schedule
- > Exposures staggered to suit optimal post-exposure treatment schedule
- > < 100 mg for a typical PK study



The aerosol concentration (from repeated aerosol generation cycles) and the cumulative inhaled aerosol dose as logged during the intratracheal exposure of one rat.





## Technical specifications

<b>Rat IT exposure unit</b>	5 x 8 x 3.5 cm (W x D x H)
<b>Weight</b>	0.3 kg
<b>Rodent exposure table</b>	22 x 25 x 36 cm (W x D x H)
<b>Weight</b>	7.7 kg
<b>Harvard pump</b>	32.5 x 20 x 25 cm (W x D x H)
<b>Weight</b>	9.5 kg
<b>Verified generation modules</b>	Dry powder aerosol generator
	Inhaler aerosol generator
	Nebulizer aerosol generator
<b>Suitable exposure object</b>	Rats
<b>Inhalation yield</b>	Dry powder aerosol generator typically 3-7%
	Inhaler aerosol generator (pMDI only) typically 3-7%
	Nebulizer aerosol generator typically 8-15%
<b>Consumables</b>	6 mm GF/A filters x 400 (PICf6x400)
	25 mm GF/A end-filters x 100 (PICf25x100)
	Rat tracheal catheters x5 (PIREincx5)
	Rat phantom catheters x5 (PIREinpcx5)
<b>Components</b>	<p>Rat IT exposure unit:</p> <ul style="list-style-type: none"> <li>• Intratracheal exposure block</li> <li>• 5 pcs IT catheters</li> <li>• 2 pcs ball-joint catheter ends</li> <li>• Intratracheal lung phantom exposure kit</li> </ul> <p><i>In vivo</i> exposure base kit:</p> <ul style="list-style-type: none"> <li>• <i>In vivo</i> end filter holder</li> <li>• 2-way non-rebreathing valve</li> <li>• Rodent exposure table</li> <li>• Rodent ventilator (for phantom exposures)</li> <li>• Customized rodent Laryngoscope</li> <li>• Extra-fine forceps</li> </ul>

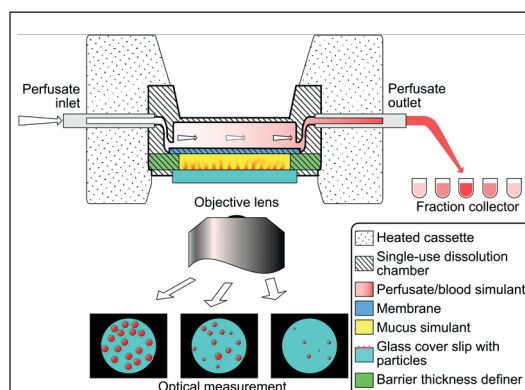
For typical intratracheal inhalation exposures, the dose rate [ $\mu\text{g}$  lung deposition/min] with the PreciseInhale was 7.2-29  $\mu\text{g}/\text{min}$  - ref. Fioni *et al.*, 2017.





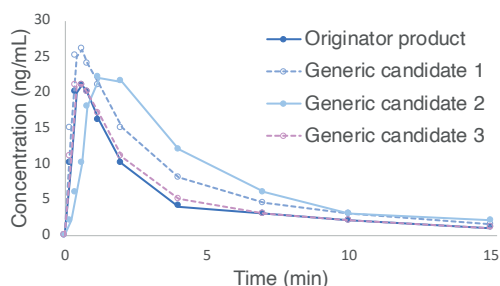
## Applications

The DissolvIt® Dissolution Module simulates *in vitro* the dissolution and absorption of aerosol particles in the lungs. DissolvIt® offers the possibility to rank test substances against each other as well as to compare pharmacokinetic profiles of drug candidates with a reference product.



### Features

- > Evenly deposited particles over test surface
- > Small amount substance/test surface (50 ng – 1 µg/cm<sup>2</sup>)
- > Dynamic system – no recirculation or stirring beaker
- > Solubility ranking tool
- > Experiments followed in a microscope



DissolvIt® dissolution profiles of three generic candidates versus the originator product.

### Benefits

- > More lung-like physiology simulated during the dissolution experiment
- > Controlled particle – particle interferences during dissolution
- > Generate pharmacokinetic profiles
  - absorption curves, including  $C_{max}$  and  $T_{max}$
  - normalized pharmacokinetic profiles
  - retention curves
- > Possibility to rank test substances against each other
- > Possibility to compare pharmacokinetic profiles of drug candidates with a reference product
- > Visualization of dissolution as disappearance of particles
- > Knowledge about particle behaviour such as hygroscopicity





## Technical specifications

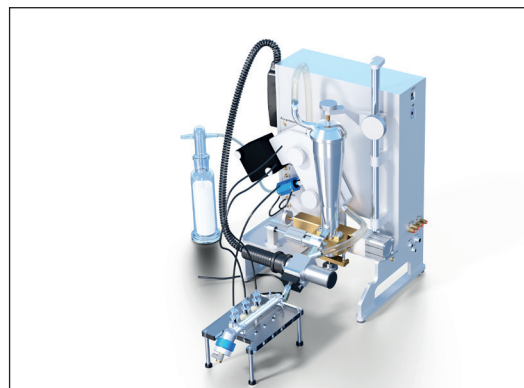
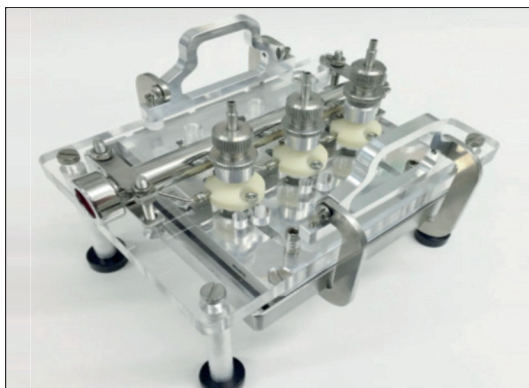
<b>Components:</b>	Glass Deposition Assembly (PIDSgda1)
	DissolvIt Assembly (PIDSass1)
	Perfusate Pump Module (PIDSpm1)
	Fraction Collector (PIFC1)
	Inverted Microscope (PIDSim1)
	Helium Degassing Kit (PIDShdk1)
	DissolvIt Control Module (PIDScm1)
	Computer (PIDSp1)
<b>Measurements:</b>	
<b>Total freight weight</b>	50 kg
<b>Total rectangular space</b>	160 x 65 cm in which to fit:
<b>Inverted Microscope and DissolvIt Assembly</b>	30 x 50 x 45 cm (W x D x H)
<b>Fraction Collector</b>	50 x 43 x 38 cm (W x D x H)
<b>Control Module</b>	42 x 19 x 21 cm (W x D x H)
<b>Computer</b>	40 x 27 x 3 cm (W x D x H)
<b>Verified Generation Modules:</b>	Dry powder aerosol generator
	Inhaler aerosol generator
<b>Suitable materials:</b>	Micronized dry powders
	Dry powder inhalers (DPIs)
	Pressurized metered dose inhalers (pMDIs/MDIs)
	Air pollution particles including nanoparticles
<b>Technical details:</b>	
<b>Number of glass cover slips</b>	9 pcs/aerosol generation
<b>Aerosol deposition flow rate</b>	100 – 2000 mL/min
<b>Recommended dose</b>	50 – 1000 ng/glass cover slip, i.e. 53 – 1053 ng/cm <sup>2</sup>
<b>Deposited dose variation</b>	RSD < 10% (n=3-9), for doses of 50-1000 ng/cover slip
<b>Temperature</b>	37 ± 1 °C
<b>Perfusate rate</b>	0.42 mL/min (RSD < 3%, n=4)
<b>Drain rate</b>	1.5 mL/min (RSD < 3%, n=4)
<b>Perfusate composition</b>	Phosphate buffer including 4% bovine serum albumin
<b>Experimental length</b>	Up to 8 h
<b>Mucus simulant volume</b>	5.7 µl
<b>Number of sampling fractions</b>	Up to 64/experiment
<b>Sampling time</b>	5 s – 4 min
<b>Sample volume</b>	35 µL – 1.68 mL
<b>Sample analysis</b>	LC-MS/MS analysis, LLOQ down to 100 pg/mL
<b>Microscope magnification</b>	10X and 20X
<b>Consumables:</b>	DissolvIt Glass Cover Slips (PIDSGcsx500)
	DissolvIt Antistatic Glass Storage Box (PIDSagsb1)
	DissolvIt Glass Deposition Filters 60 mm x 100 (PICDgdfx100)
	DissolvIt Glass Storage kit (PICDgskx100)
	Mucus Simulant (PICDms1.5)
	DissolvIt Mucus Pipette Tips x 96 (PICmptx96)
	DissolvIt Dissolution Chambers (PICDdcx12)
	DissolvIt Tubing Package (PIDTtkx5)





## Applications

With XposeALI® connected to PreciseInhale living cells can be exposed to aerosols in an air-liquid interface (ALI).

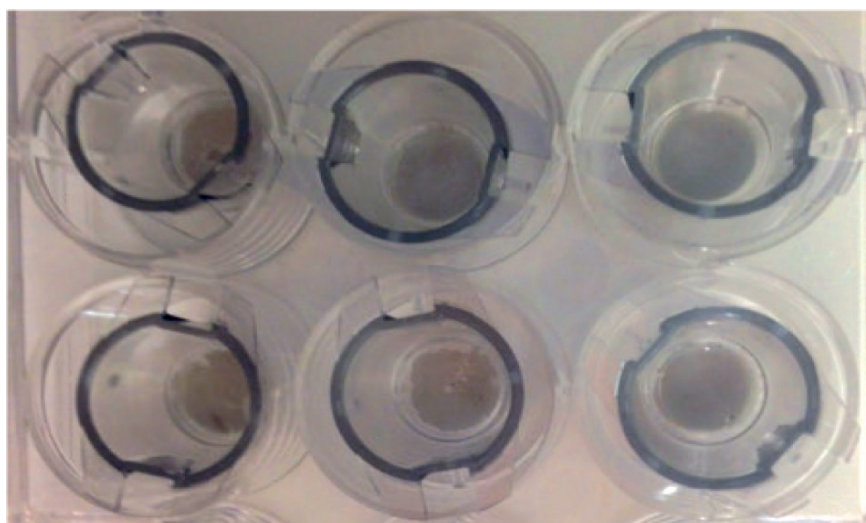


### Features

- Cell exposures with aerosol generated from dry powder, inhaler or nebulized solution
- Beneficial construction avoiding aerosol exposure of cell culture media and cell culture insert walls
- No solvent or excipients needed at exposure; pure API or other material of choice can be delivered directly to the cell culture

### Benefits

- Lung-like exposure conditions
- Evenly deposited particles over the cell surface
- Cell exposure with only the substance of interest
- Aerosol deposition on cells, not on insert walls or in the media



Even deposition of Diesel Exhaust Particles on cell culture surfaces. Jie *et al.* Plos One 2017.



## Technical specifications

XposeAL/ exposure unit	18 x 12 x 13 cm (W x D x H)
Weight	1 kg
Control box	60 x 25 x 40 cm (W x D x H)
Weight	5 kg
Verified exposure modules	Dry powder aerosol generator
Suitable exposure object	Any cells cultivated in Transwell inserts
Exposure flow rate	50 – 200 mL/min
Top flow rate	2 – 10 mL/min (the flow rate over the cells)
Consumables	6 mm GF/A filters x 400 (PICf6x400)
	25 mm GF/A end-filters x 100 (PICf25x100)
	XposeAL/ dose finding glasses x 500 (PICaligx500)
	XposeAL/ transwell inserts (Falcon) x48 (PICalitix48)
	XposeAL/ 12-well multiwell (Falcon) x50 (PICalimwx50)
	Humidifier Paper Inserts, 300 mL holding chambers x 30 (PICphpcx30)





# Inhalation Research Services

## WHAT WE OFFER:

### Precise, predictive, PK data

IRS preclinical data are powerful, predictive and precise, showing where and how Candidate Drugs (CDs) behave in all regions of the lung early on.

- > Reduce risk
- > Prevent clinical failure
- > Optimize trial protocols
- > Optimize pipeline planning
- > Eliminate weak CDs early on
- > Discover new CD modalities early on

## HOW WE DO IT:

### Precision dosing, a quality-not-quantity methodology

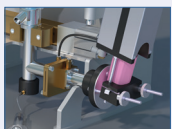
PreciseInhale® aerosol generator uses a high-precision, one-animal-at-a-time methodology called Precision Dosing. It generates a gentle, highly controllable stream of aerosol rather than a high-pressure jet.

This controllable aerosol can be exposed easily across a wide range of exposure modules, precisely dosing, with minimal standard deviation, animals *in vivo*, lungs *ex vivo*, and depositing material for *in vitro* exposure and dissolution testing.

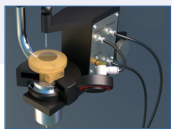
## Aerosol sources



Dry powder

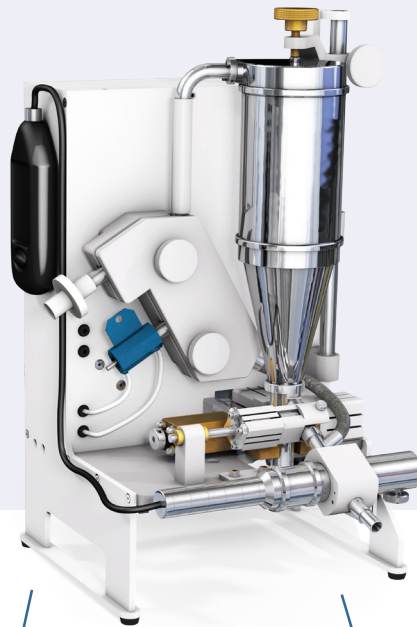


Inhalers  
(DPIs and pMDIs)

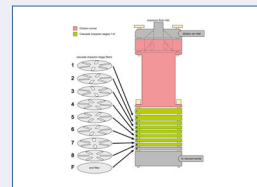


Nebulized "dry  
powder like" aerosols

## Precision dosing system



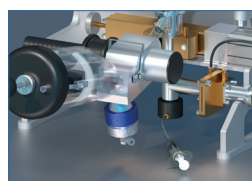
## Exposure modules



Aerosol characterization



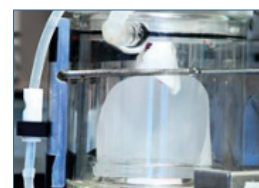
DissolvIt® *in vitro*  
dissolution testing



Nose-only *in vivo*



Tracheally intubated rats



IPL - Isolated Perfused Lung

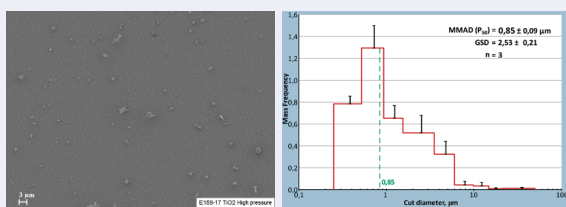


# Five preclinical services

We offer FIVE high-precision research services, all delivering the company's trademark precise, predictive, preclinical lung data from its aerosol generating platform PreciseInhale®.

## #1. Aerosol characterization

Our particle size determination tool can tailor aerosol generation and strength of air pressure for your test substance.



SEM image of dispersed aerosol.

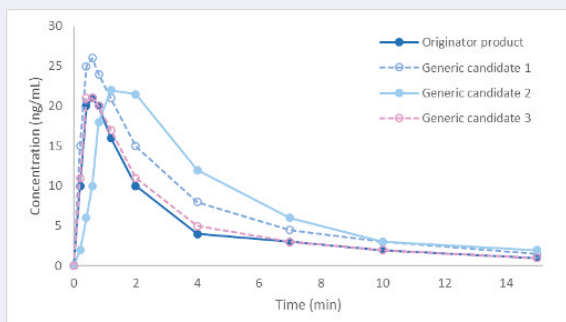
## #3. IPL (Isolated Perfused Lung) *ex vivo*

Specially tailored version of IPL delivering high-resolution data with SD of typically <10%.

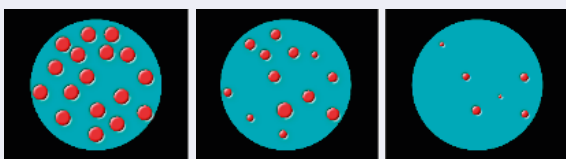


## #2. DissolvIt® *in vitro* dissolution and absorption

*In vitro* (and non-biological) simulation of particle dissolution using an artificial air-blood barrier.



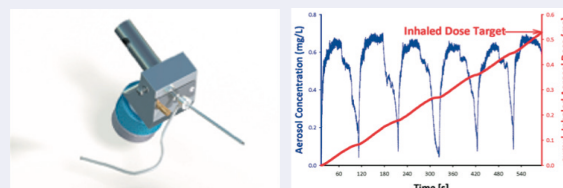
DissolvIt® absorption profiles of three generic candidates versus the originator product.



Particle dissolution - viewed as disappearance of particles in the microscope, when running DissolvIt® (snaps and real-time video can be recorded).

## #4. Intratracheal *in vivo*

Lung-specific one-animal-at-a-time intratracheal aerosol testing bypassing the nasal airways. Aerosol concentration and animal's breathing patterns monitored throughout.



## #5. Nose-only *in vivo*

With the rat Nose-Only exposure module connected to PreciseInhale®, rats can be exposed to short duration inhalation exposures to respirable aerosols for *in vivo* studies.

