

TESLA - Collaboration Meeting at DESY - March 2005

Cleanroom Technology
to manufacture under
„super“clean conditions

Contamination Control Instruments

CCI - von Kahlden GmbH

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C o n t e n t s

- What is Cleanroom Technology ?**
- Parameters and Specification of Cleanrooms**
- Filtration Technology**
- Components for Cleanrooms**
- Measurement Technology**
- Summary**



What is manufactured under Cleanroom Conditions

- Semiconductor 150 to 300 mm Wafer**
- Pharmaceutical- and Foodindustry**
Sterile areas in filling lines up to class 5 (Grade A)
Medical devices in Grade C and D (class 6 to 7)
- Biotechnology**
- Materials**
pure / clean plastics, Gases and liquids for the Semiconductor Industry
- Others**
Micromechanic; Coating Technology (Lenses); Circuit Boards;
Spacetechnology; Carindustry (Carpainting, Windshilds, Breakesystems);
Cleaning Technology

Cleanroom technology – how to explain?

The term
„Cleanroom Technology“
includes *all Technologies*
which are necessary to manufacture the
product according to the specification

„Main – Topics“ in Cleanroom Technologies

- HVAC (Heating Ventilation Air Conditioning) – Systems**
- Filtration Technology of Air – Gases and Liquids**
- Processes under „clean“ – Conditions:
- Vacuum-, Temperature- and Wetprocesses**
- Personal – Clothing – Behavior in the Cleanroom**
- Equipment which is suitable for Cleanroom use**
- Cleaning – and Service processes of the Cleanroom and the
Equipment**



Specification of Contamination

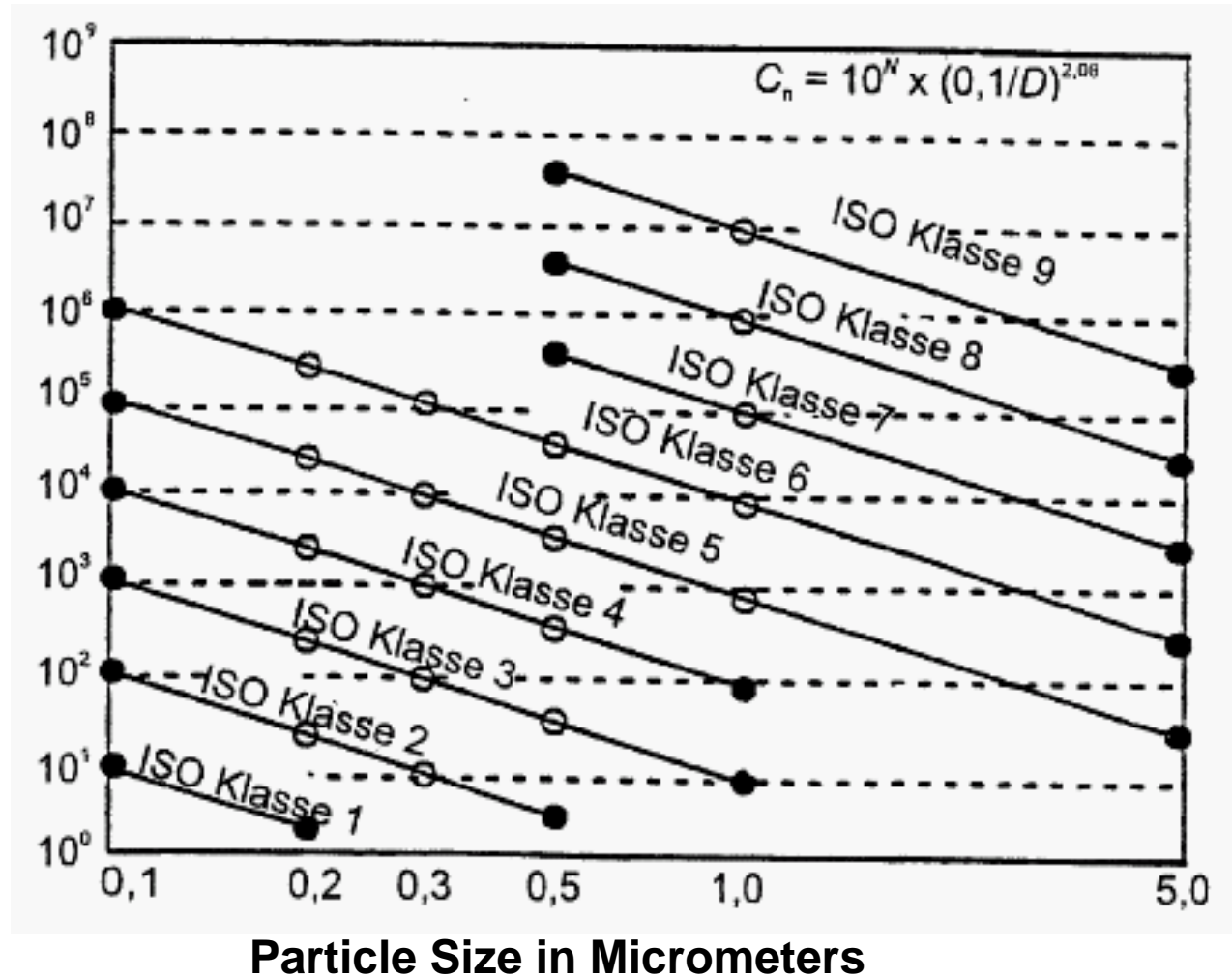
„Contamination has o be specified:

- Cleanliness class Air – Surface (ISO – 14644-1)
- Temperature – Humidity Air
- Noise Level Room
- Vibration Equipment - Building
- Molecular Contamination Air (AMC) – Surface (SMC) (14644-8)
- Electrostatic Charge Surface
- Magnetic field Air



Cleanliness Classes according ISO14644-1

Particle
Concentration
per m³

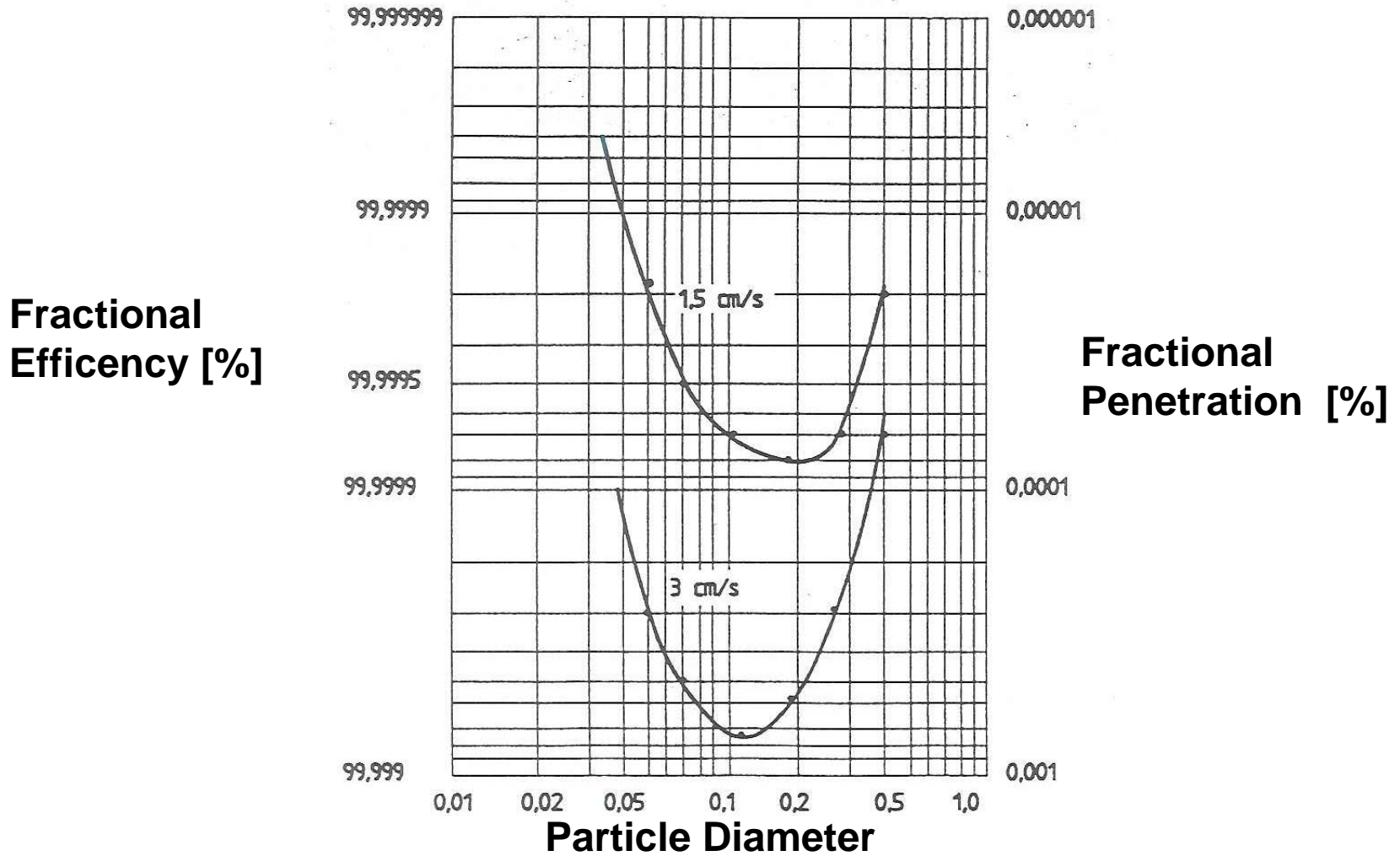


HEPA - Filter

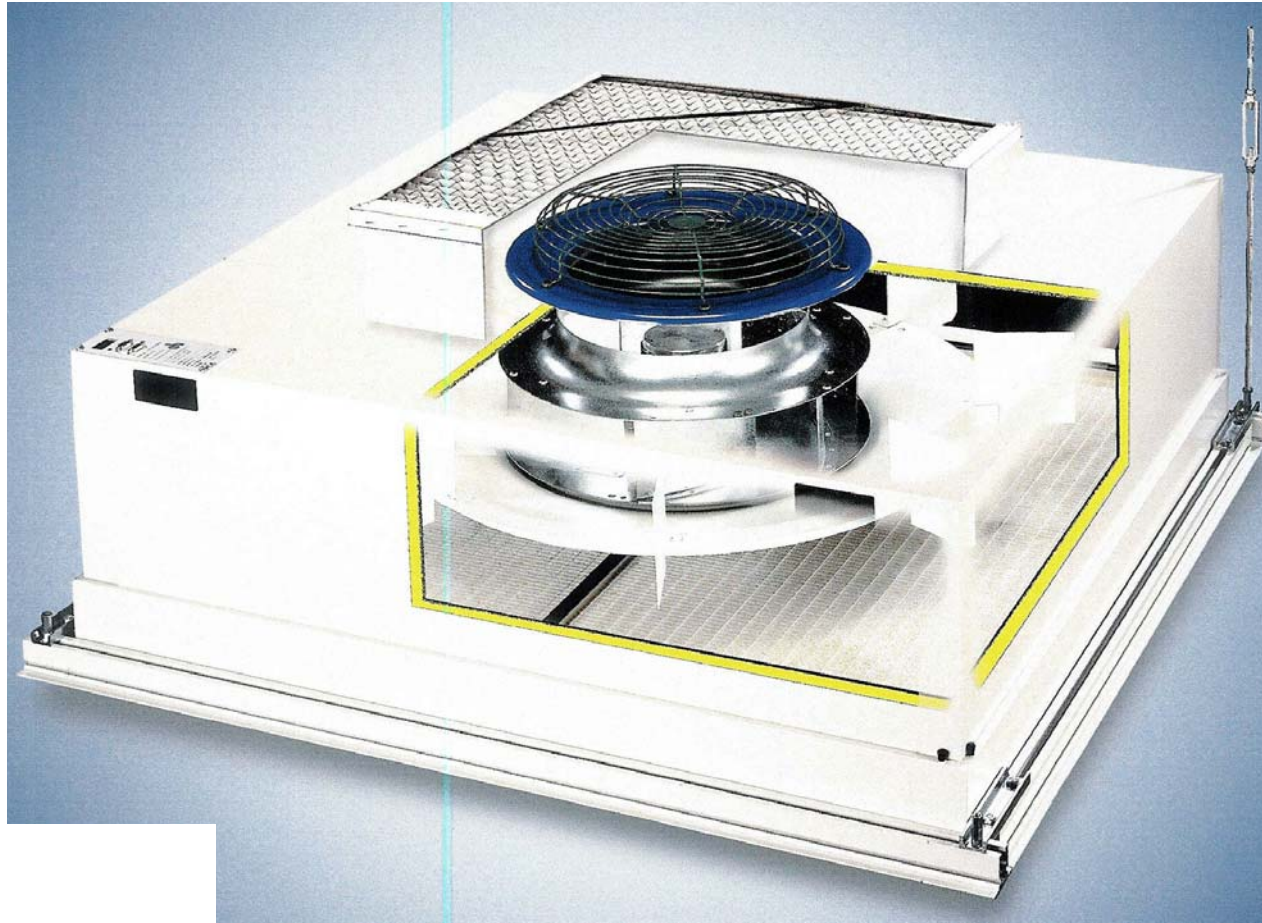
*Classification
according
EUROVENT 4/4
DIN / EN 1822*

	EUROVENT 4/4, $\approx 0,6 \mu\text{m}$	Anfangs- Penetration [%]	EN 1822 MPPS
H (HEPA-Filter)		10	H10
	EU10	5,0	H11
		3,0	
		1,0	
	EU11	0,5	H12
		0,3	
		0,10	
	EU12	0,05	H13
		0,03	
		0,01	
EU13	0,005	H14	
	0,003		
	0,001		
EU14	0,0005	U15	
	0,0003		
	0,0001		
U (ULPA-Filter)		0,00005	U16
		0,00003	
		0,00001	
		0,000005	U17
		0,000003	

Penetration / Efficiency of a ULPA-Filter at different Filter Medium Velocities



FFU - Filter Fan Unit - Technology



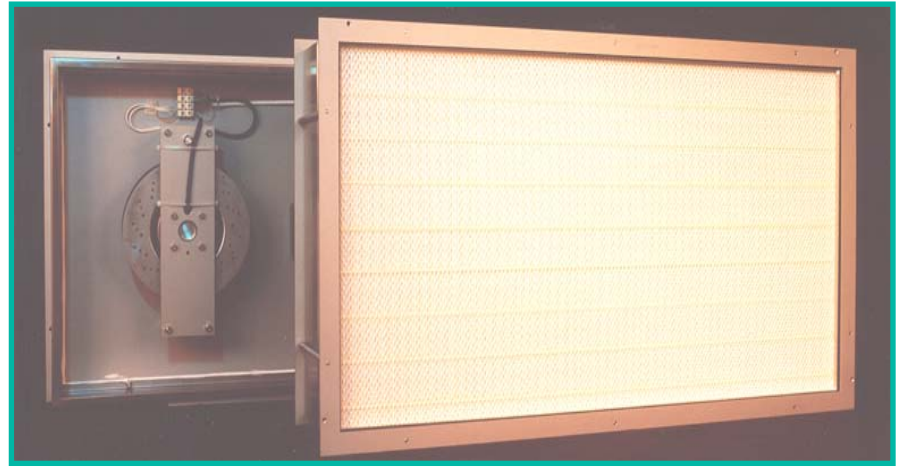
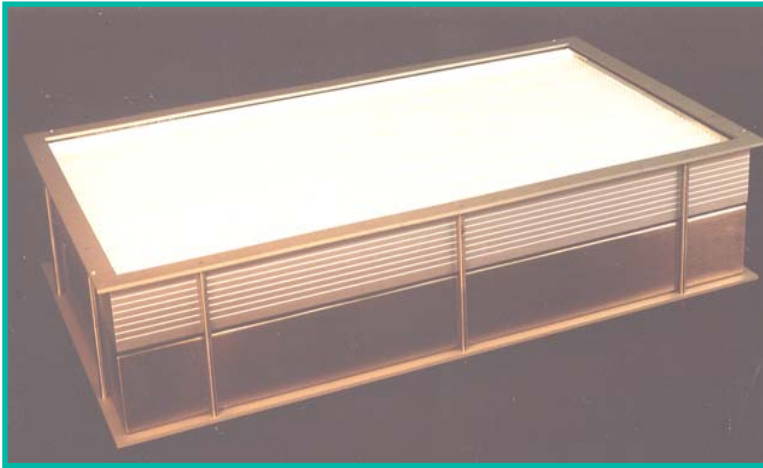
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Examples of Filter-Fan-Units



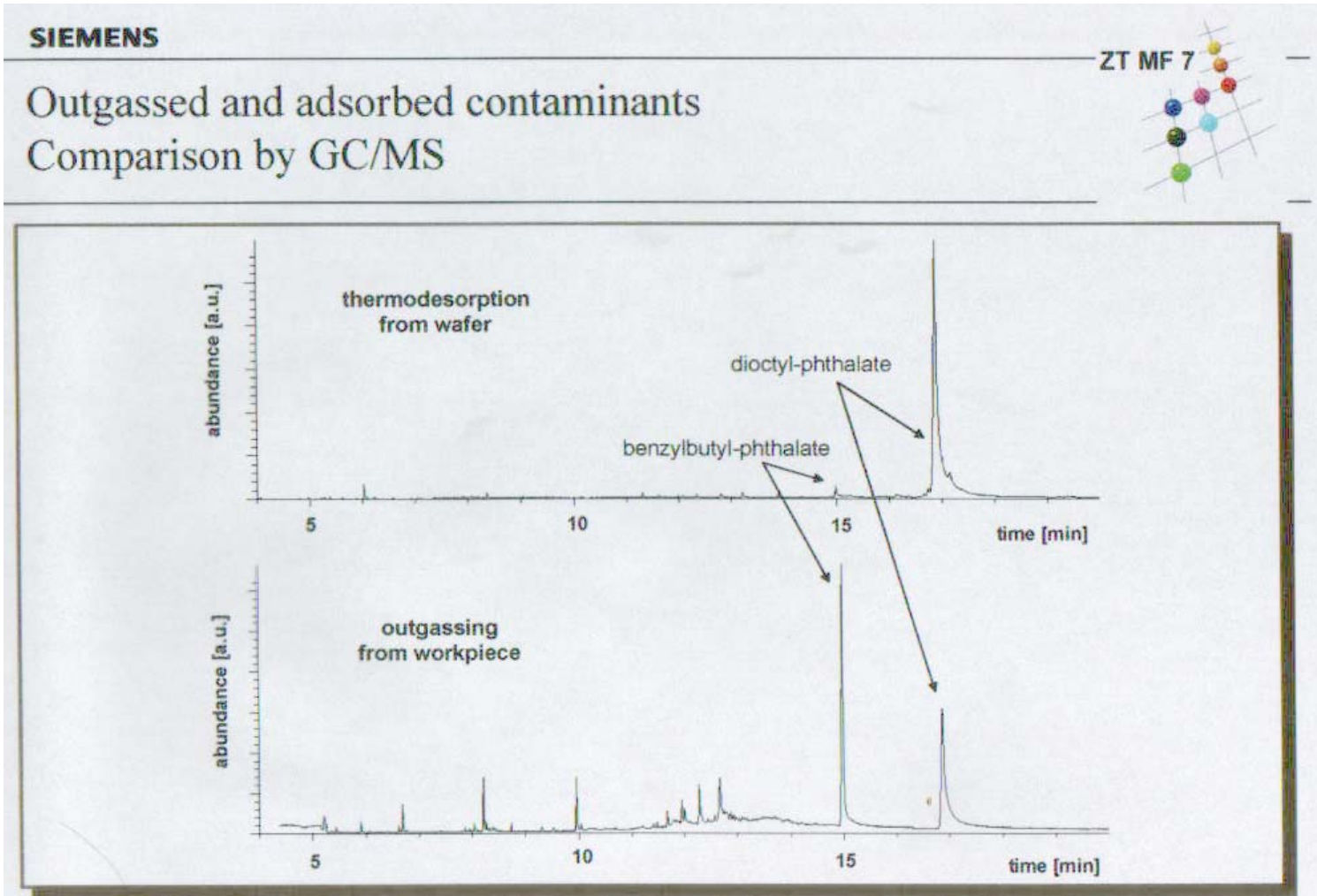
COLANDIS 

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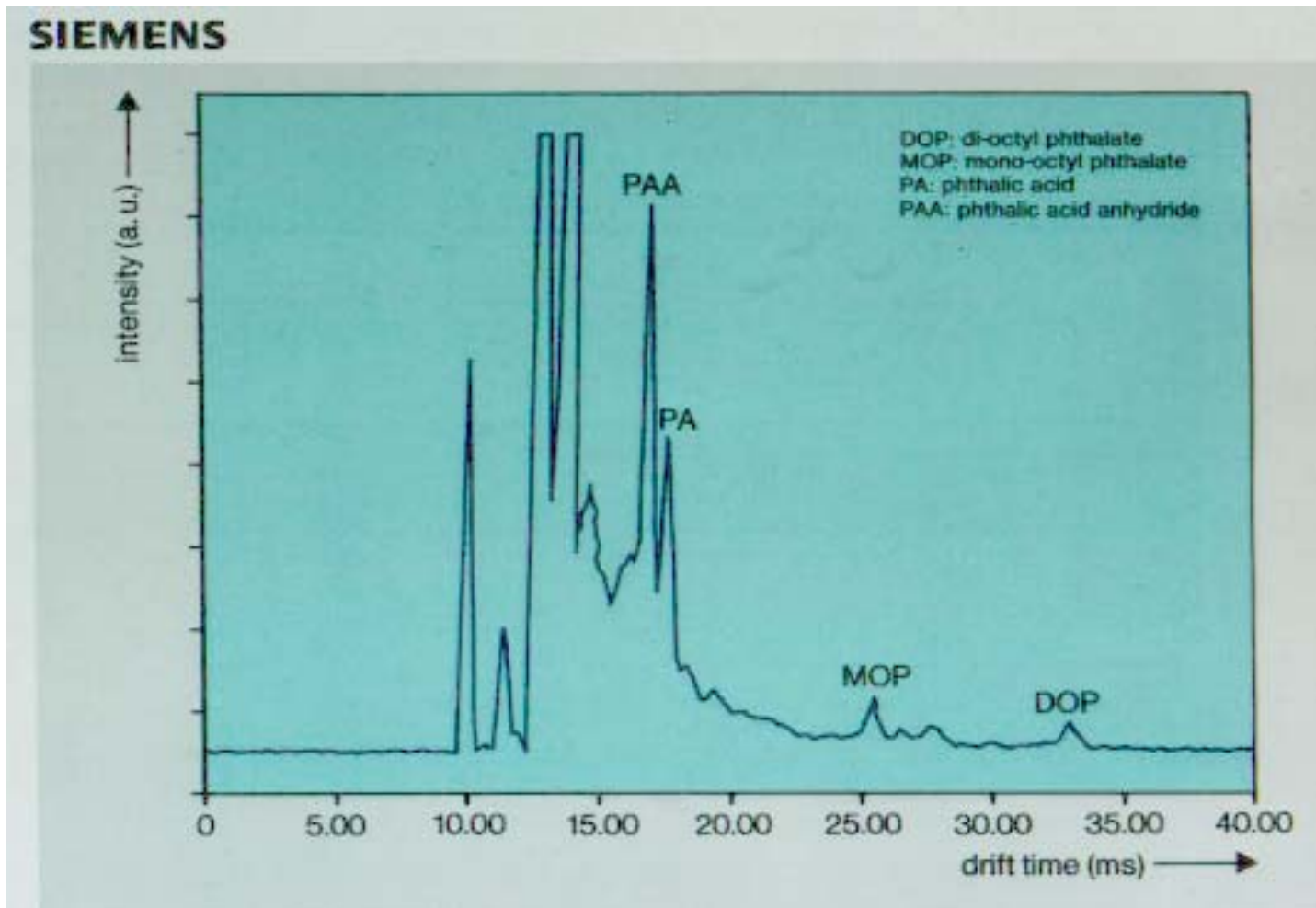


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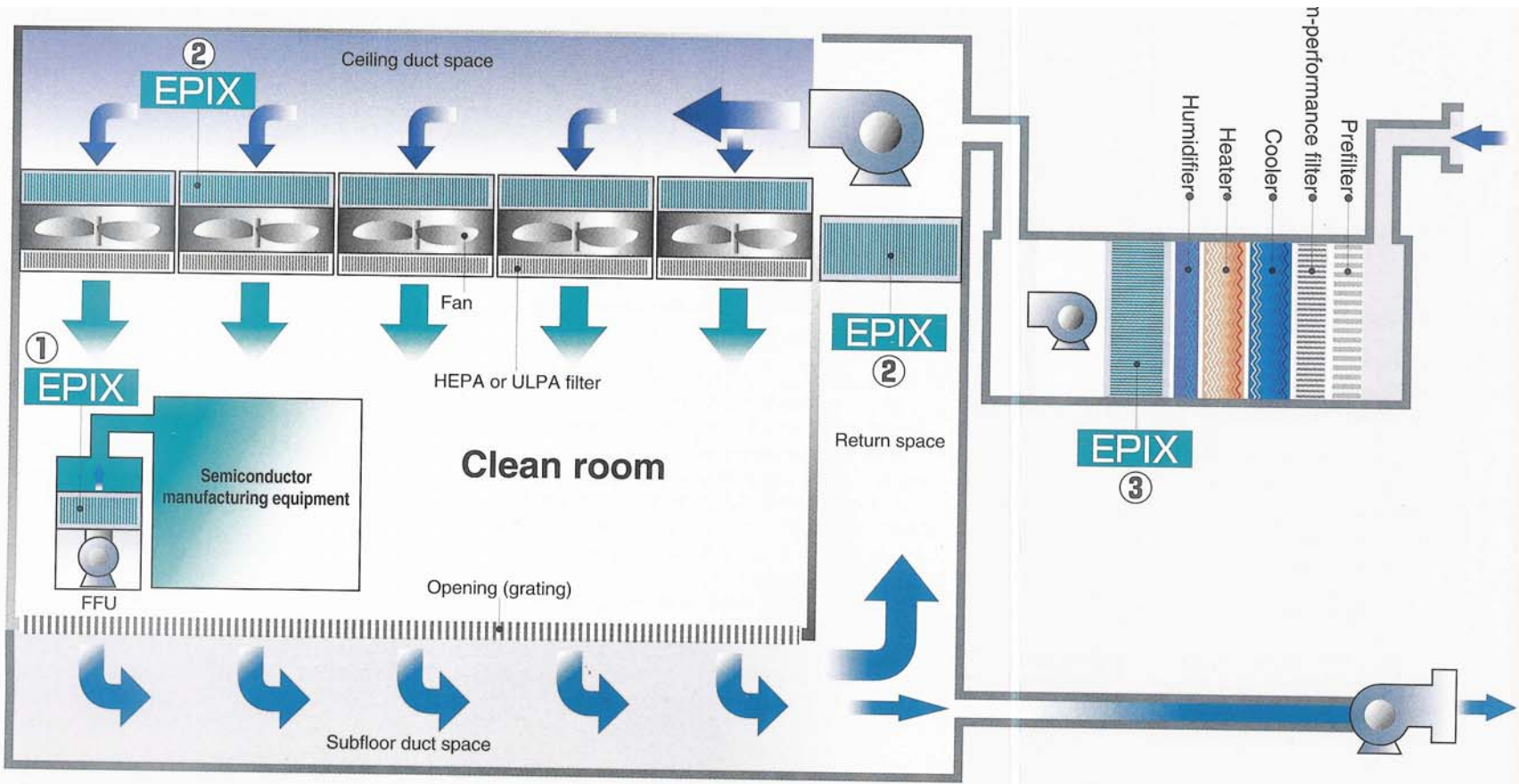
Example of Airborne Molecular Contamination (AMC)



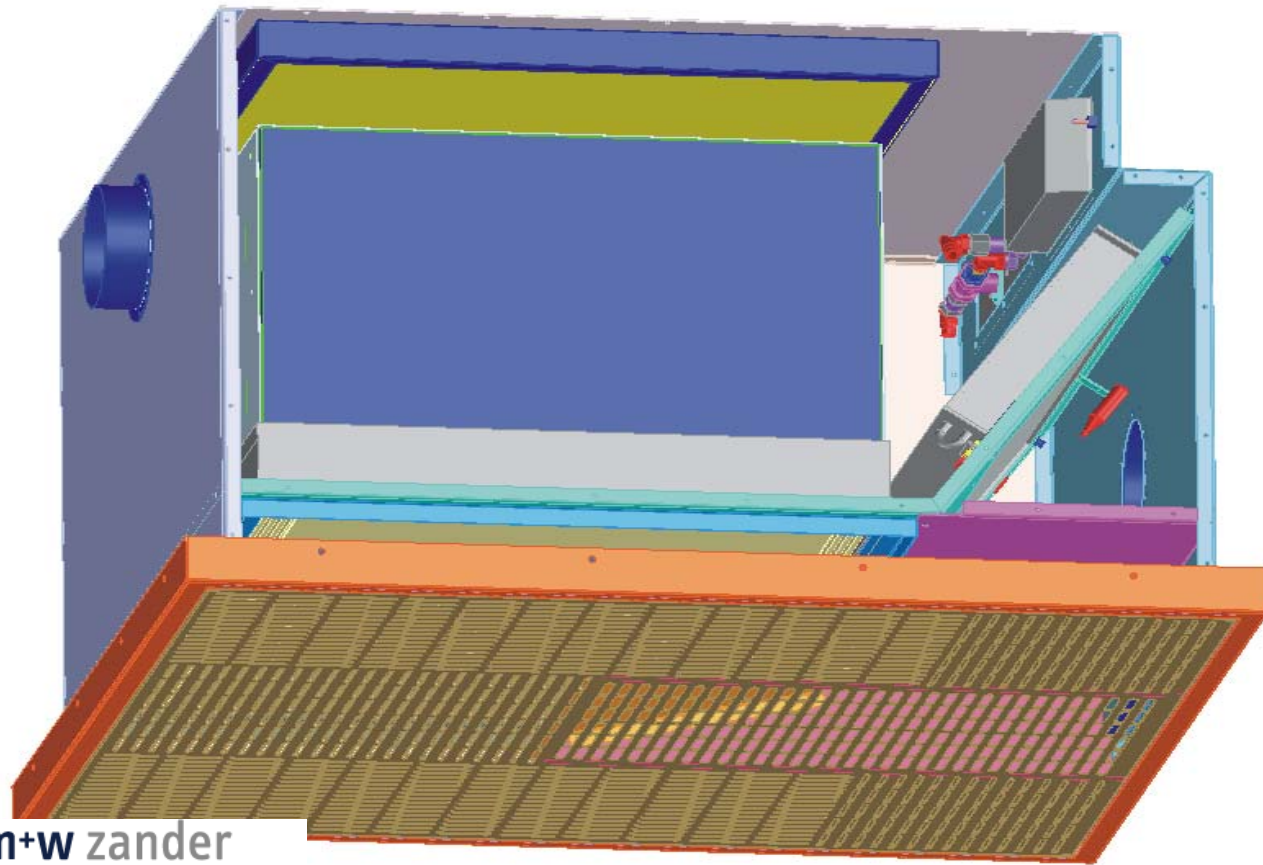
Wafer Contaminaton due to Floor Covering



Airhandling Unit with Chemical (Ion Exchange) Filters



Cross section of PIF (Plenum Integrated Filter Fan)



m+w zander



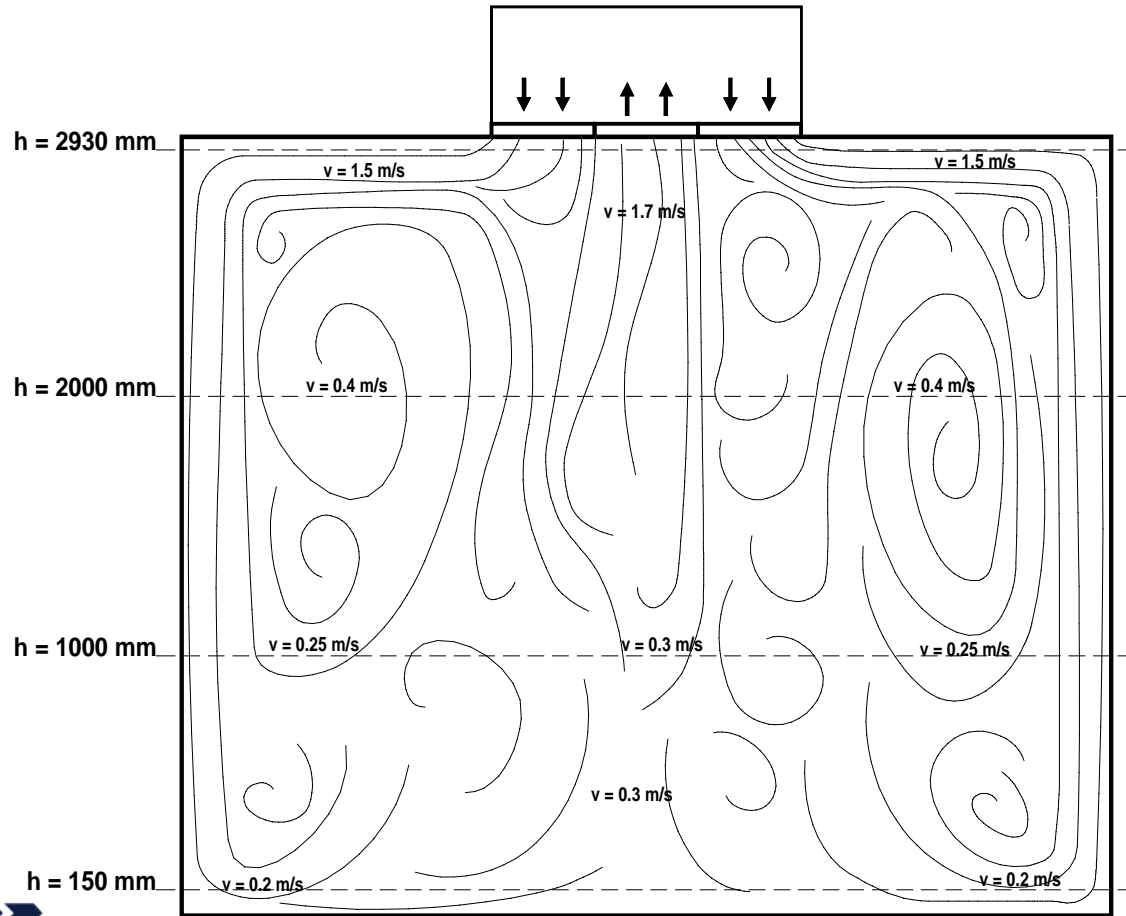
total facility solutions

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Flowpattern of PIF (Plenum Integrated Filter Fan)



m+w zander
▶▶▶▶▶

total facility solutions

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Flow Visualization around Equipment

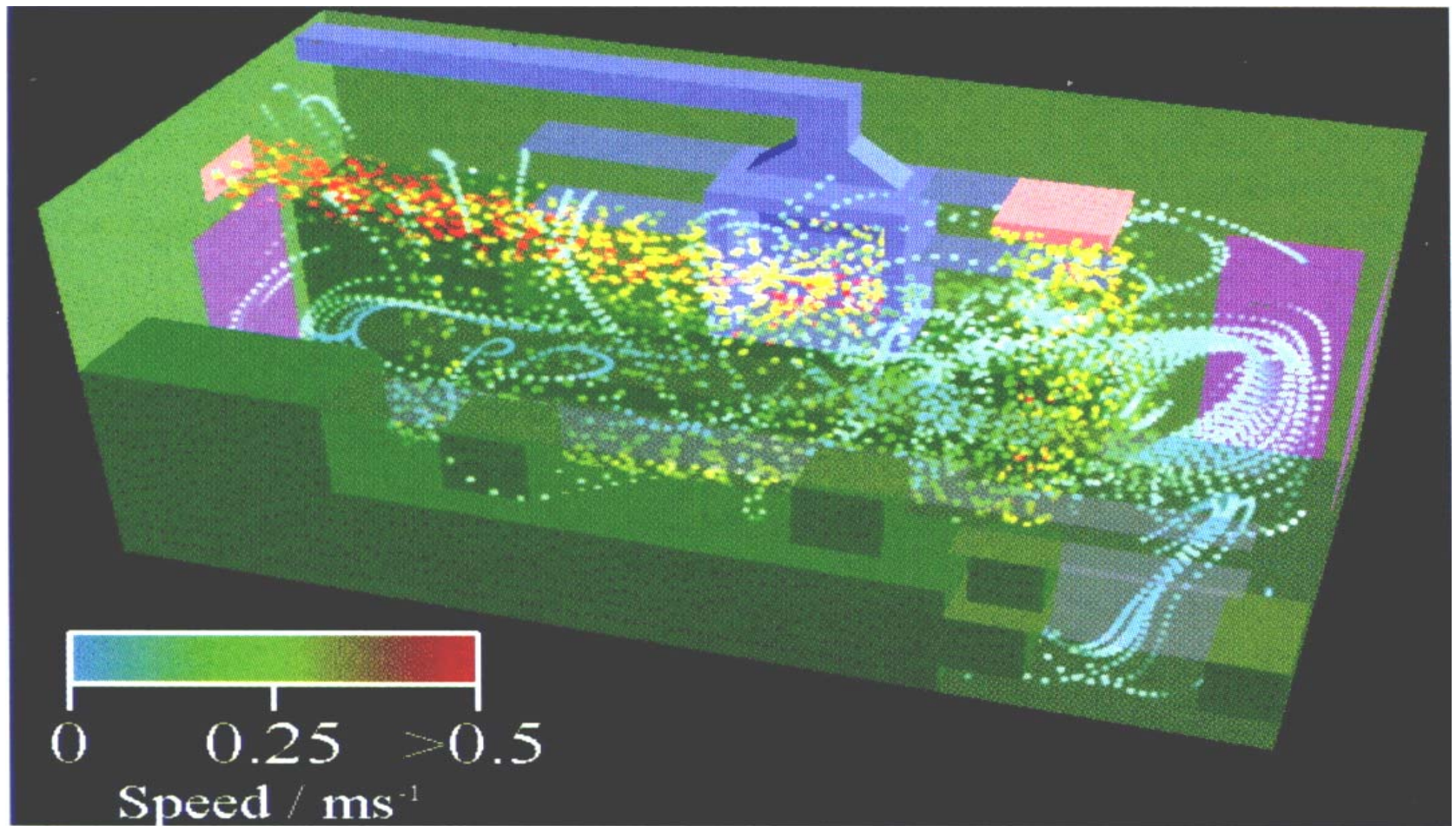


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Numerical Flow Simulation



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Cleanroom with horizontal Flow



Flowvisualization in Equipment Areas



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Flowvisualization in Working Areas



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Flow guidance in a Wet Area – Semiconductor Industry



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Equipment in a Minienvironment as Contamination Control

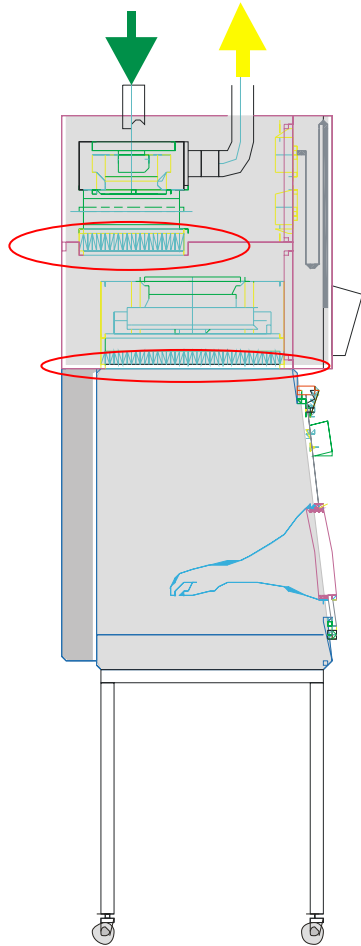


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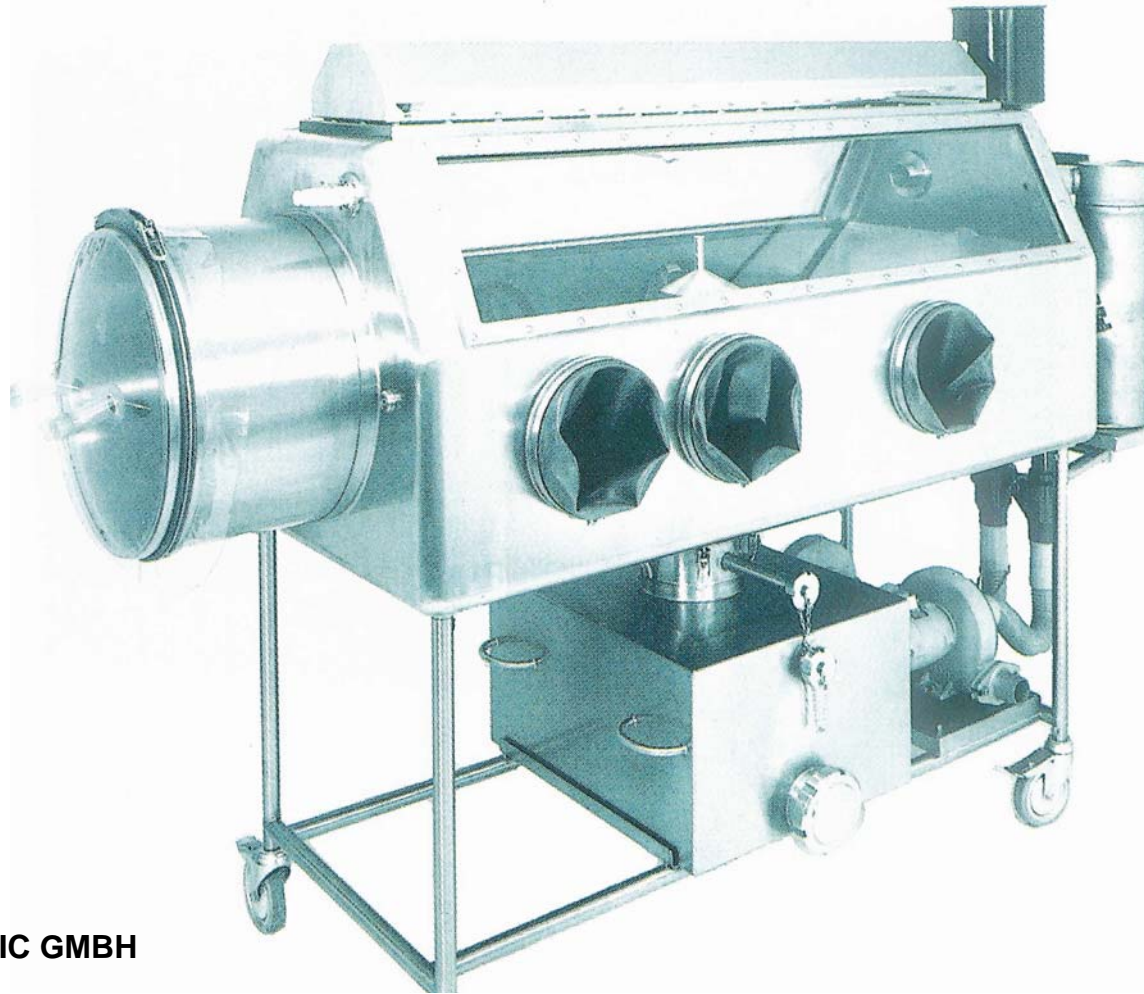


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Isolator for Safety of the Product- and the Personal



Mobile Type of a Isolator



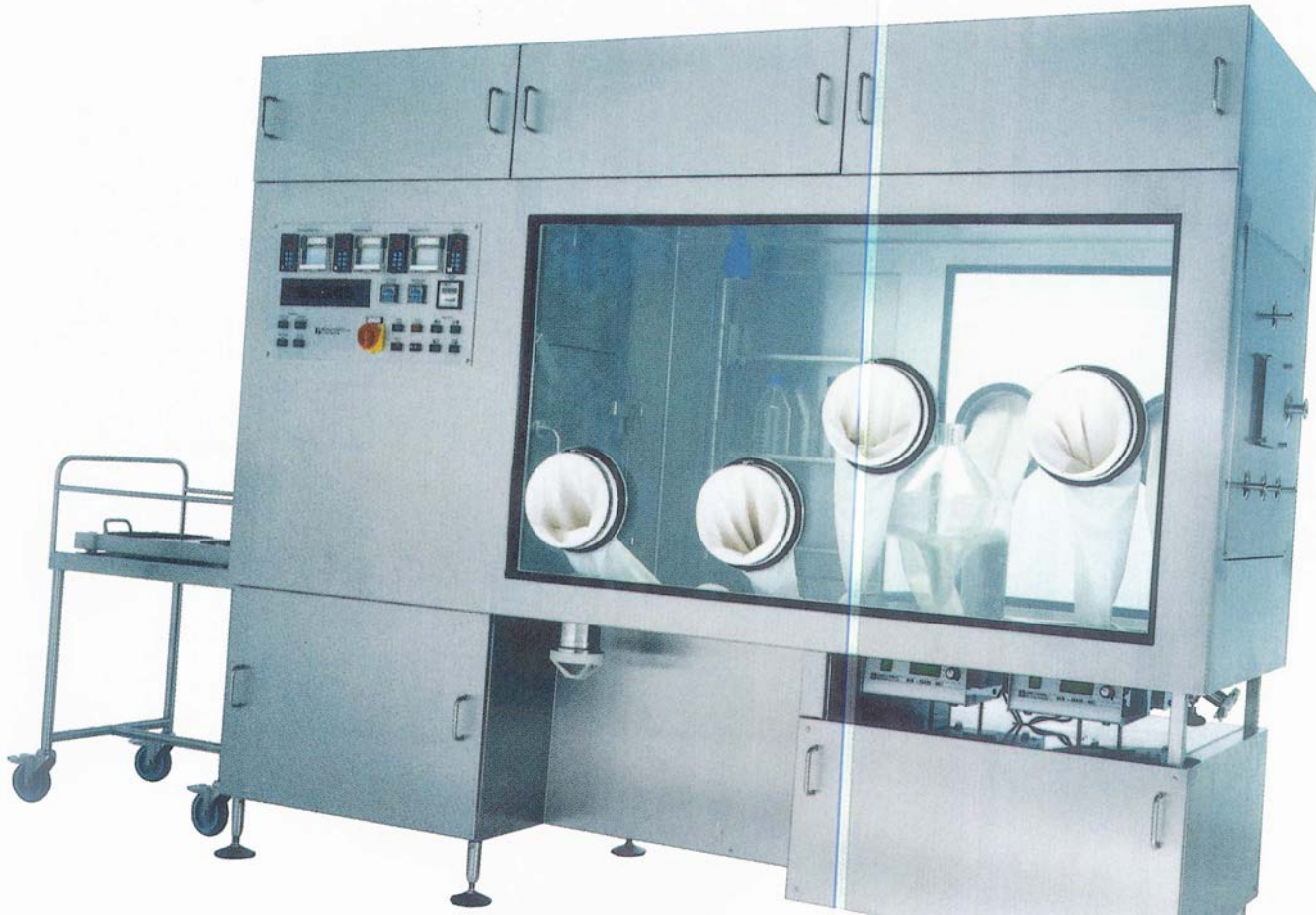
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Isolator as a stand alone unit



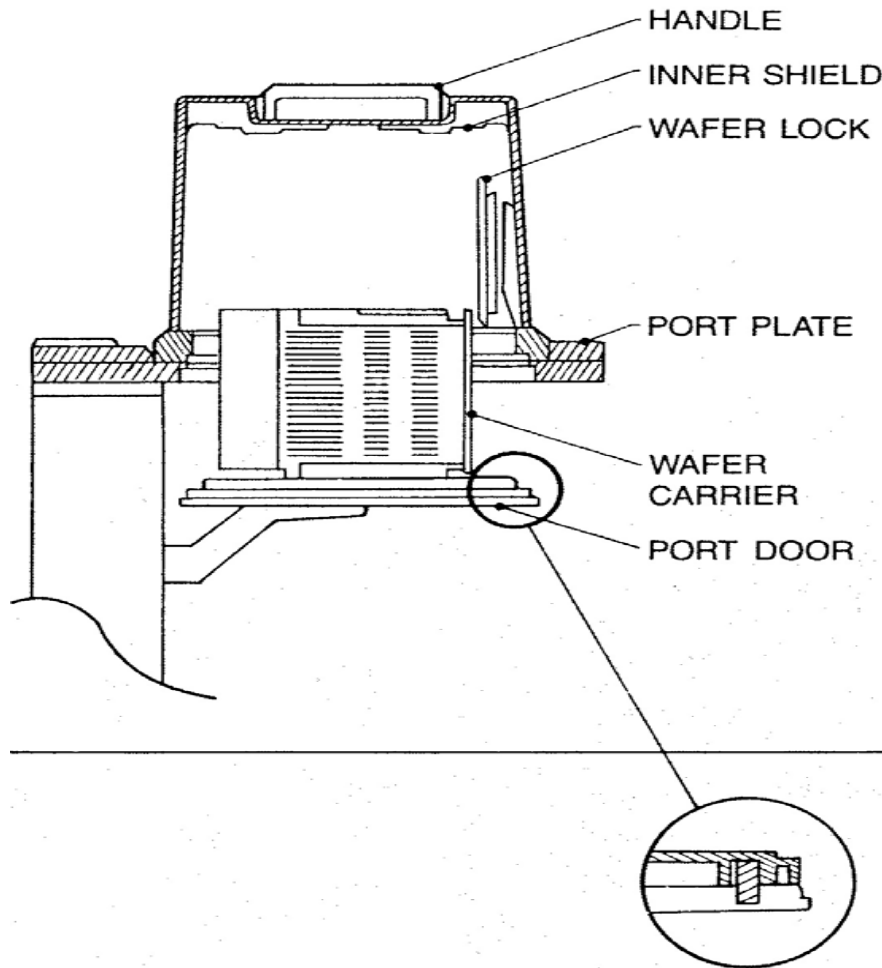
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SMIF – Standard Mechanical Interface



Example for a clean transport box with a automated system to open and close the box

Minienvironment with SMIF – Boxes and Loader



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SMIF – Box adapted to a Tool



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Components for „basic“ Cleanrooms

- Walls: coated steal, stainless steal, glass - available**
- Floorsystems: perforated, closed, - available**
- Ceilingsystems: steal coated, Aluminum - available**

Ceiling with integrated Lighting and Exhaustair



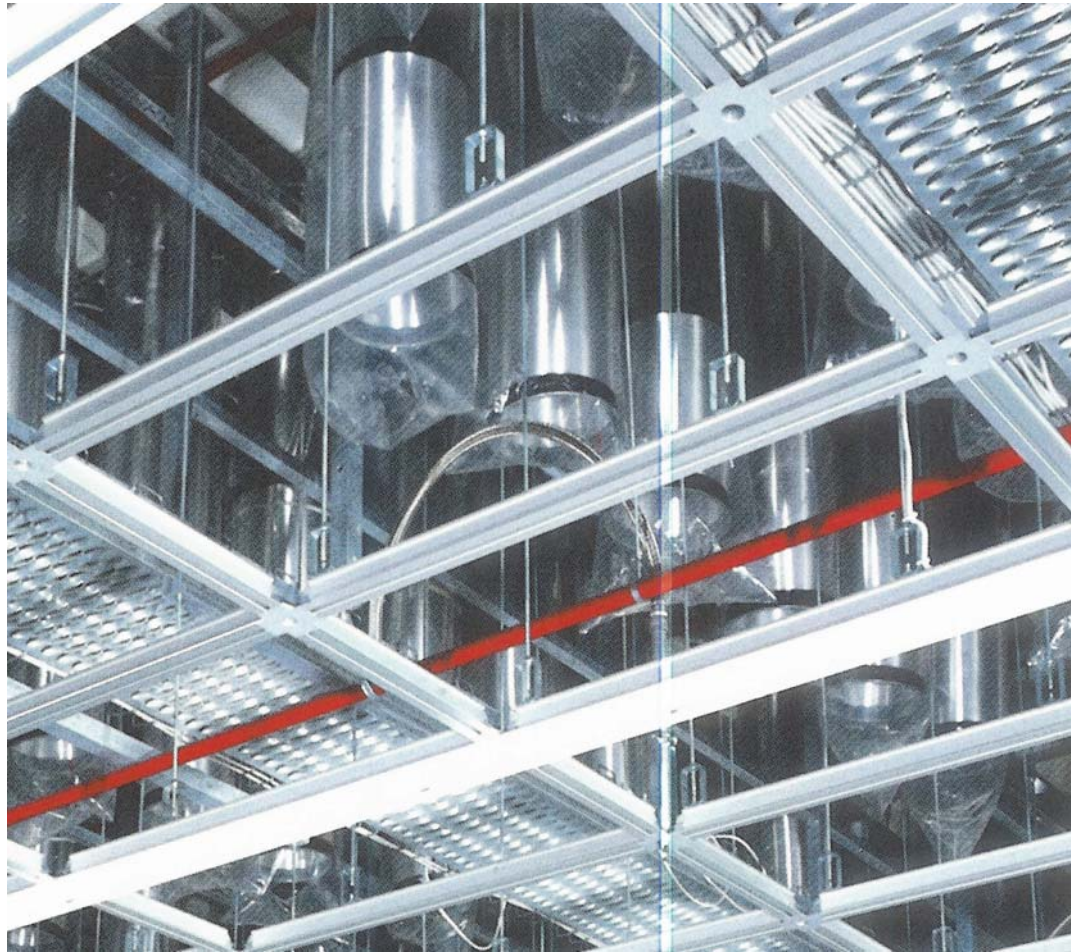
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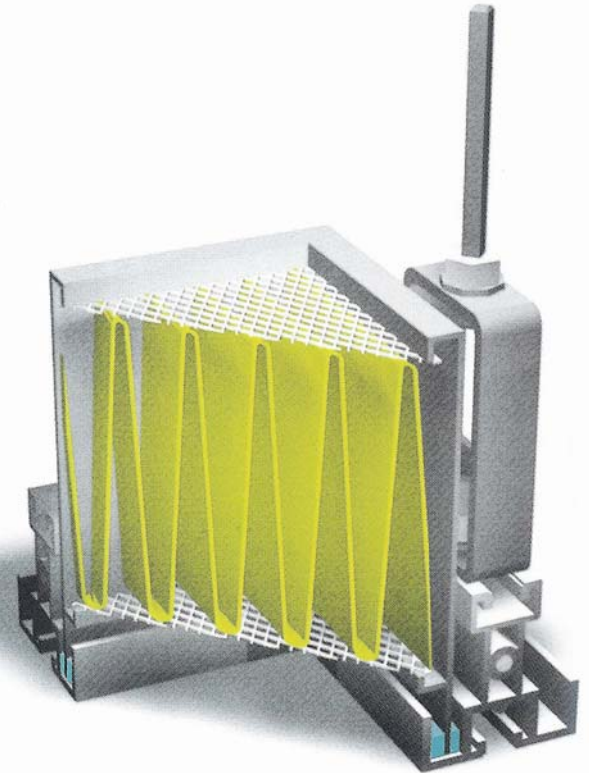


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Ceiling Grid - Filter with Fluid Sealing



m+w zander
total facility solutions



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Cleanroom suitable Sliding Door integrated in the Wall



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Cleanroom Wall in Glass and Stainless Steel



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Measurement technology for Contamination

Particles

in Air - available

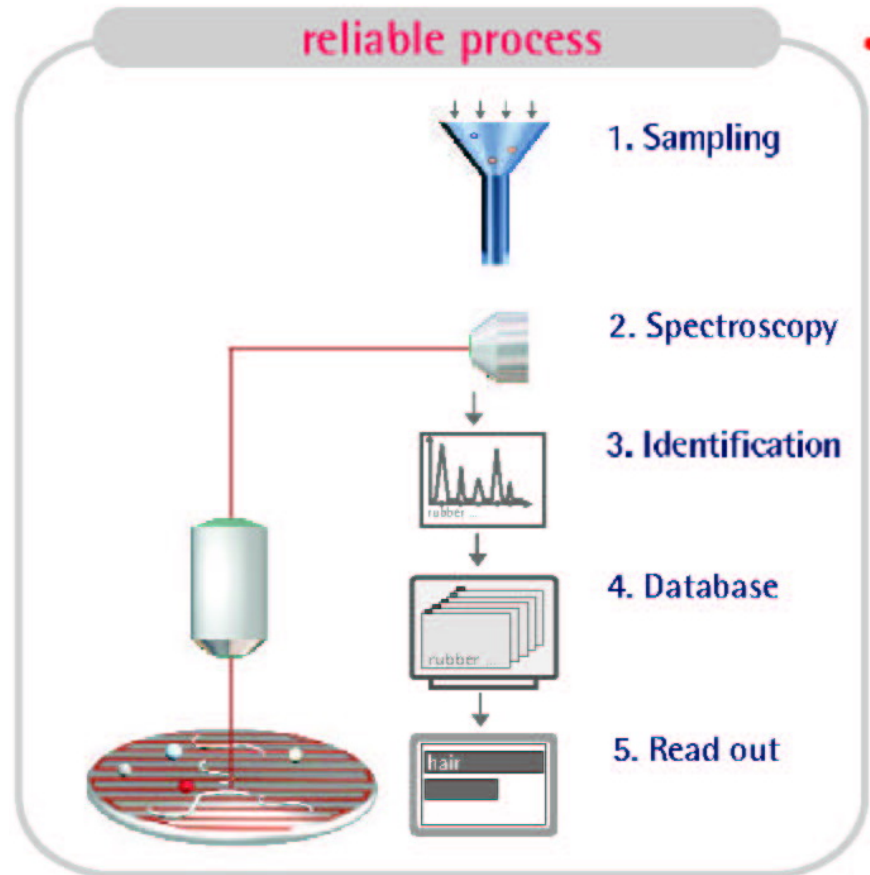
in Liquids - available

on surfaces - for big particles available

AMC / SMC - partly available

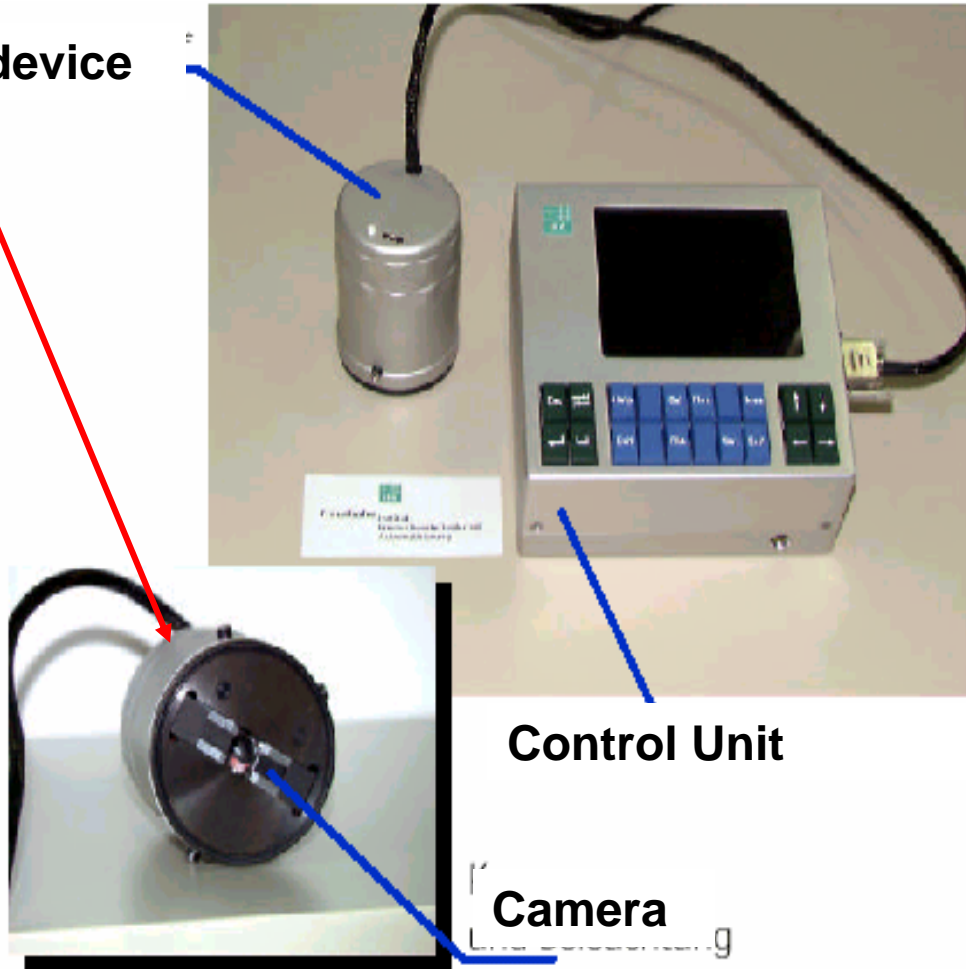
Electrostatic Charge - available

Particle – Measurement with Particle Analysis



Particle – Measurement on Surfaces

Measurement device



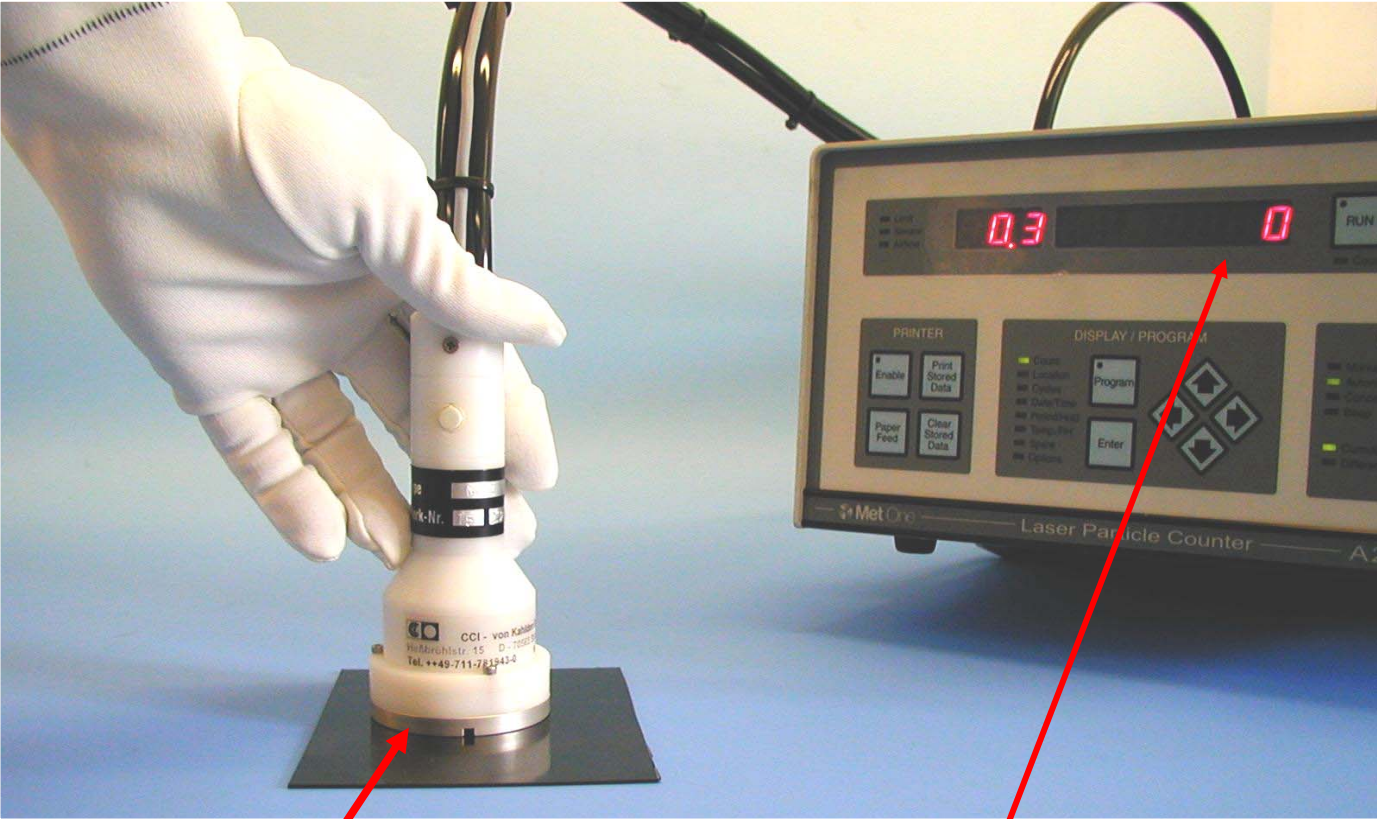
Fraunhofer Society

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Particle – collection from surfaces and counting



Samplehead

Particlecounter

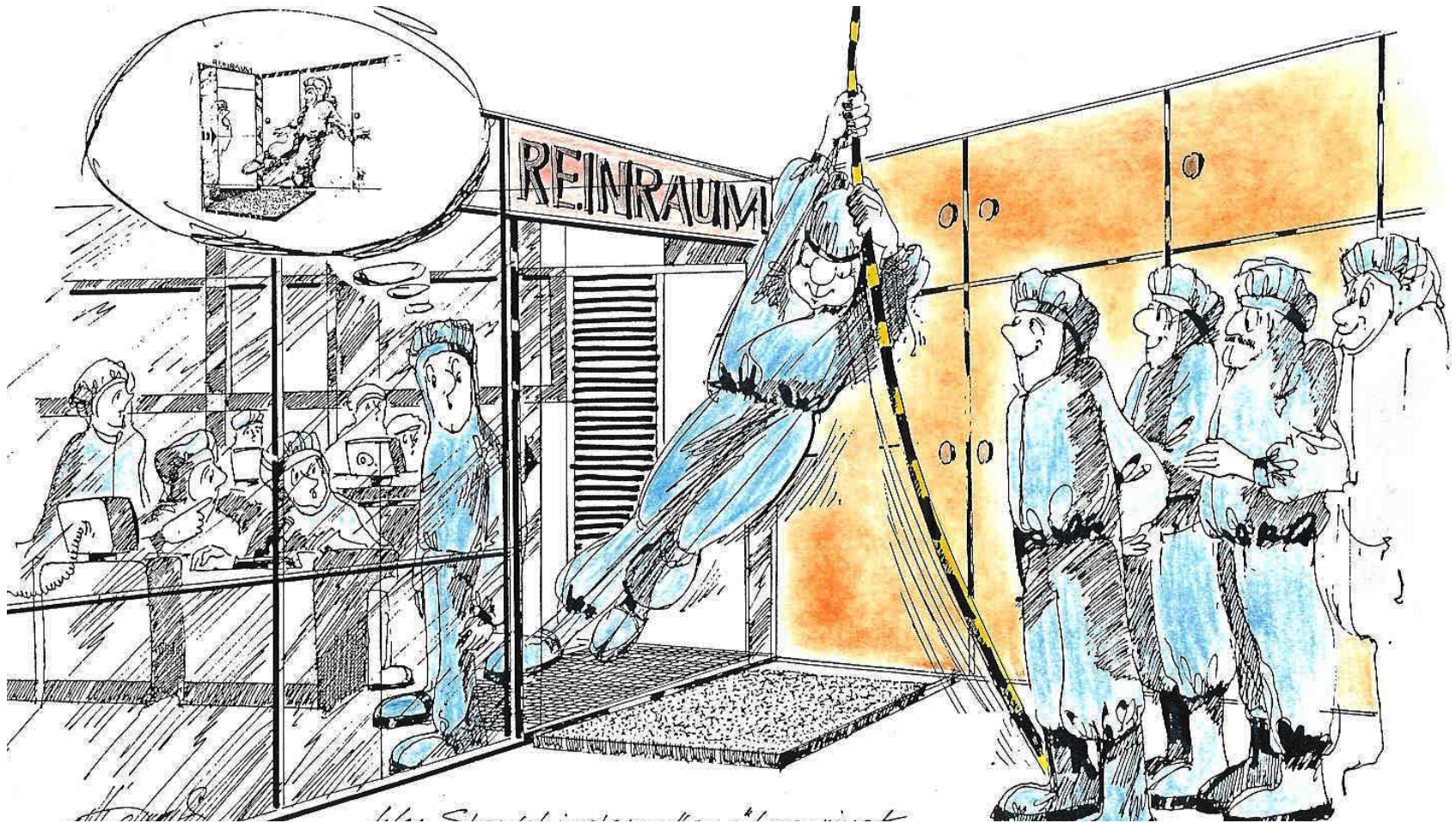


S u m m a r y

- ❑ Contamination has to be defined – may be difficult
- ❑ Components for high end Cleanroom Technology are available
- ❑ Measurement Technology of usual Contamination is available



Cleanroom Technology – Personal Behaviour



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