DESIGNING MACHINES AND EQUIPMENT FOR CLEANROOM USE
Starting point

More and more branches of industry need to manufacture their products under defined clean conditions. In doing so, they aim to increase yields and assure smooth-running production processes. In this regard, especially contamination – such as airborne or sedimmented particles, chemical contamination and electrostatic properties – plays an important role.

Industries concerned:
- Semiconductor manufacture
- Precision engineering
- Optical industry
- Microsystem manufacture
- Medical technology
- Display technology OLED

With its longstanding experience in the manufacturing world of cleanroom-suitable devices and equipment, Fraunhofer IPA develops cleanliness concepts that can be refined into precise solutions with the aid of simulation and material databases.

1 Airflow around a pre-aligner (source: Brooks Automation, Inc.).
2 Airflow around a transfer robot (source: Brooks Automation, Inc.).
Solution approaches and realization

- Developing cleanliness concepts on taking the necessary general requirements into consideration
- Loading existing CAD data files or generating device and equipment geometries
- Adapting model geometries
- Setting up networks
- Ascertaining general requirements
- Carrying out simulations
- Post processing
- Supplying documentation in the form of reports and films
- Verifying results by means of tests on prototypes

Use of Computational Fluid Dynamics (CFD)

Approximations of tool designs can be made on the basis of rough calculations. Complex or dynamic systems cannot be realized in the early stages of design without the use of CFD. Fraunhofer IPA uses the simulation software FLUENT (ANSYS), which possesses huge potentials for simulating complex physical processes.
Advantages of CFD

CFD enables cleanroom-suitable machines and equipment to be accurately designed right in the early stages of development. No hardware is required, and even highly complex models can be constructed. There is no further need to construct complex prototypes for the purpose of step-by-step optimization. Drawings made by design engineers can be read directly into the simulation software and be exported again if required for other tasks. This allows precise results to be made available quickly to design engineers. Once the calculation model has been generated, various setups can be created by modifying general requirements.

Use of material databases

30 years of experience and Fraunhofer’s very own comprehensive databases form the basis for selecting cleanroom-suitable materials. In the database, materials have been classified according to particle emission, outgassing, ESD properties, etc. from results obtained from standardized tests.
Our range of services

- Developing cleanroom-suitable concepts for machines and equipment
- Constructing informative simulation models
- Accurately designing and arranging components and machines
- Selecting suitable materials, qualities and assemblies
- Verifying and optimizing existing systems and devices by means of CFD and metrological verification (airborne particles, particle sedimentation on wafers, airflow visualization, etc.)

**TITLE**  
EFEM for 300 mm wafer tools: air flow  
(source: project for Vistec Electron Beam GmbH).

EFEM for 300 mm wafer tools: pressure distribution  
(source: Brooks Automation, Inc.).
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If you require more information about our range of services or specific advice, please get in touch with our contact partners.

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