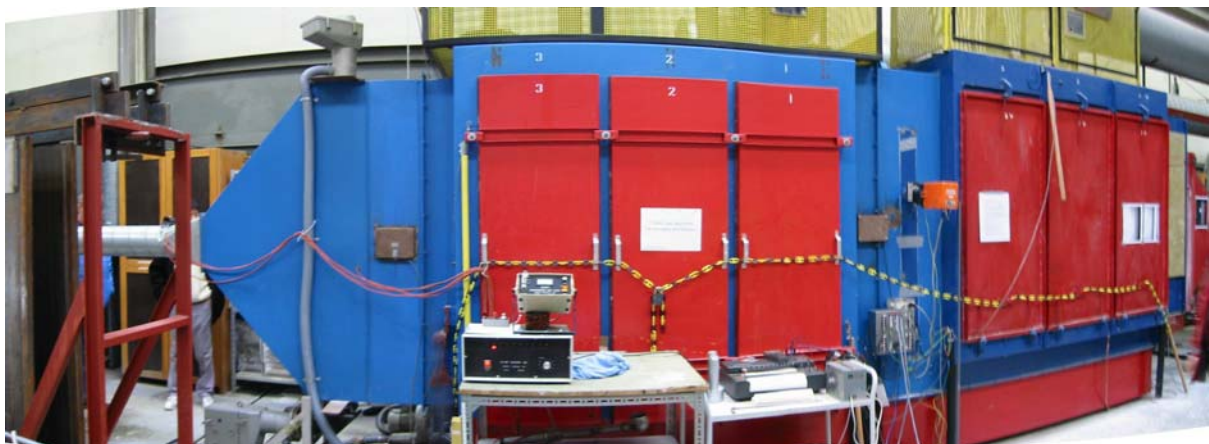


# Particle Transport in Electrostatic Precipitators



*Scale model of ElectroStatic Precipitator applied for verification of the numerical ESP model*

In cooperation with FLS miljø a/s and the Technical University of Denmark, FORCE Technology has carried out a project with the aim of developing a numerical tool for design of ElectroStatic Precipitators (ESP). Application of the design tool is part of a programme of reducing energy consumption and emissions.

## **Modelling of Physics**

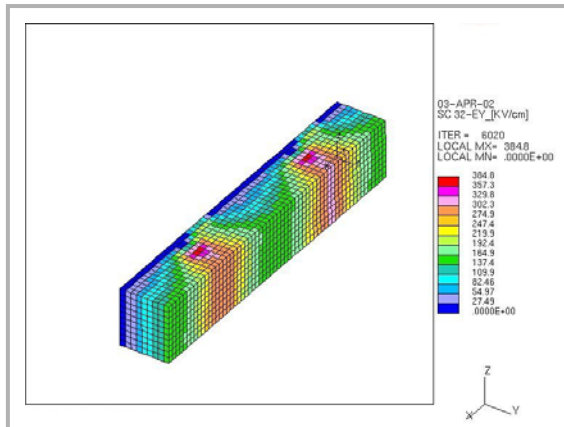
ElectroStatic Precipitators are applied for cleaning flue-gases from dust particles at power plants, cement factories, metallurgical plants and many other process industries. The electric field in the ESP causes dust particles of sizes 0.1 to 20  $\mu\text{m}$  to migrate towards the collector plates, transversal to the flow direction, to which they adhere, removing them from the flow.

The developed tool simulates all the major physical processes taking place in the ESP. This includes three-dimensional modelling of the electrostatic field, flow field and the particle concentration phase. The model is unique due to the three-dimensional modelling of the full ESP process taking into account the interaction between the different fields.

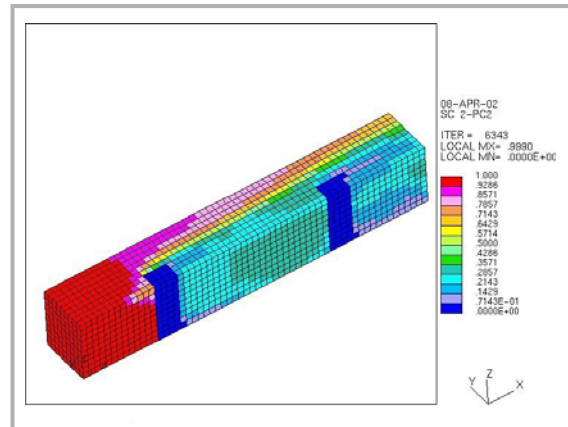
## **Flexible Model**

The developed model is implemented in a commercially available Computational Fluid Dynamics (CFD) code. A high level of flexibility and generality has been implemented in the model allowing development of new electrode geometries and implementation of additional physical models. The resulting model data is effectively visualised using an output module developed for the CFD-code.

The ESP efficiency, dust concentration at the collecting plates and distribution of the different particle classes present in the flue-gas and collected in the ESP are amongst the output data.



*Simulated electric field in a test case set-up showing high field strength at two electrodes and zero-field strength at the collector plate*



*Simulated dust concentration in a test case set-up showing high dust concentration at the inlet, zero at two electrodes, and approximately half the inlet concentration at the outlet*

### Validation

Verification of the model is carried out by comparison of measurements carried out on a two-section scale model ESP as well as comparison of full-scale measurements.

### Future Prospects

Prospects are promising and the tool is a large step forward to meet worldwide environmental emission requirements needing high efficiency of an ESP. The ESP design tool can be applied for optimization of existing precipitators as well as in the development of new designs.

### Industrial Fluid Dynamics

FORCE Technology offers consultancy services within industrial flows. Our consultancy services are based on access to state-of-the-art soft- and hardware facilities together with sophisticated flow-measuring equipment and modern laboratory facilities. This enables FORCE Technology to offer a unique combination of both physical experiments and numerical investigations.



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Subject to changes without notice

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