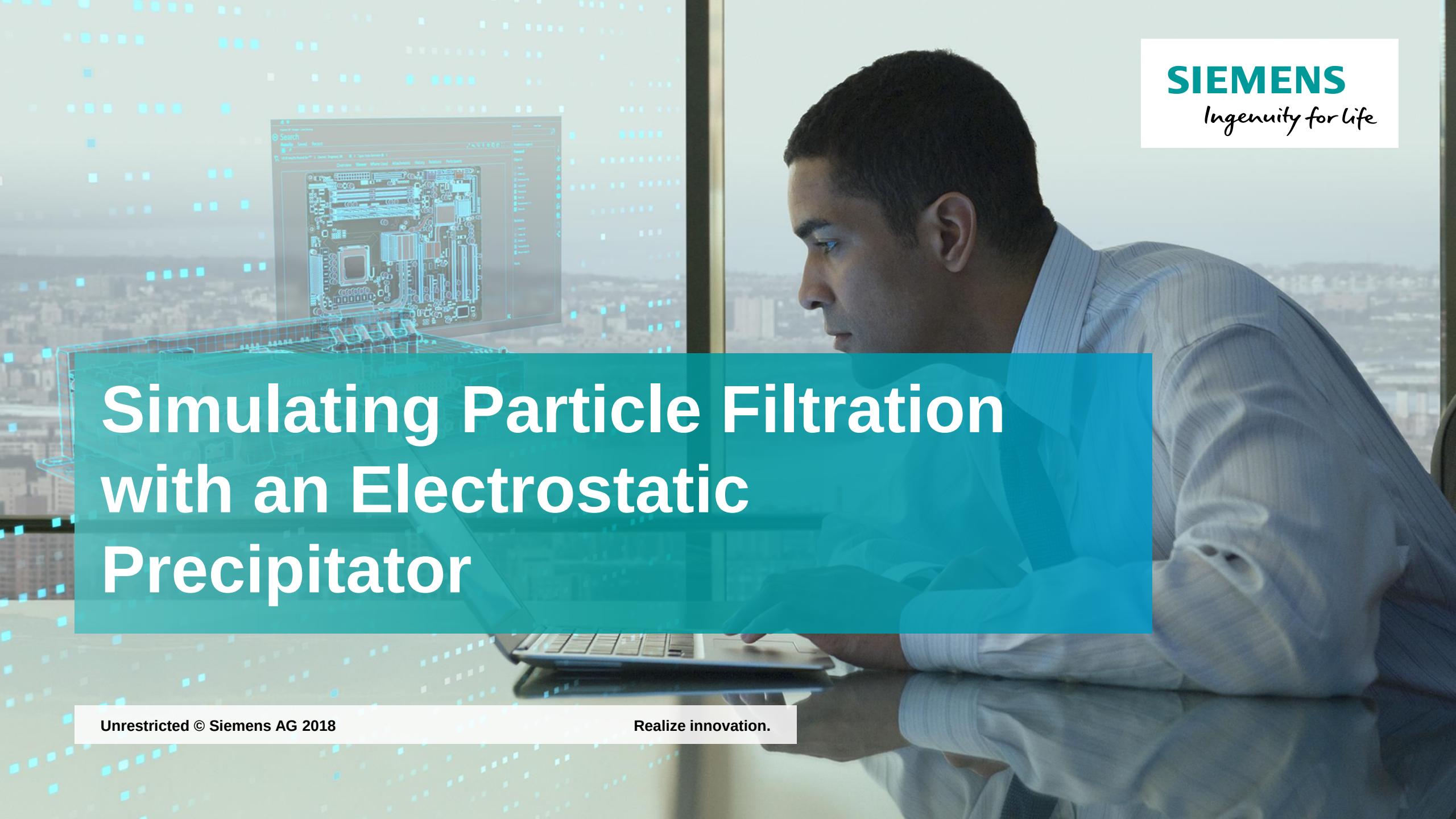

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Simulating Particle Filtration with an Electrostatic Precipitator

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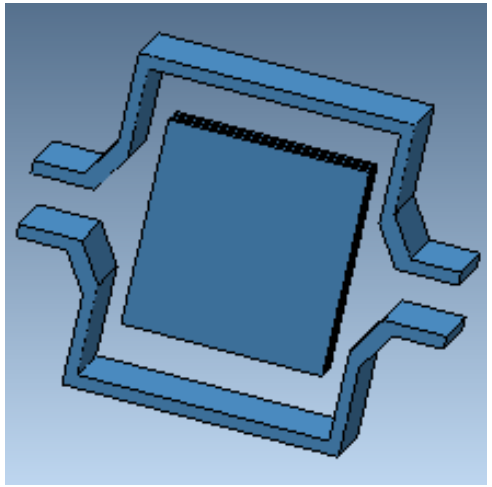
Consider the architecture of this electrostatic precipitator (ESP) or electrostatic air cleaner: it consists of an inlet-outlet casing through which particulate laden gas (such as air) flows into an area where a series of particulate collection sheets are placed.



These sheets of metal are maintained at certain voltages, after passing through which completes the filtration process so that clean air is deposited at the other end of the casing.

Given a uniform, linear voltage distribution and separation of 1mm between the collection plates, a constant force is expected to be imparted on the charge.

The model has been solved using ElecNet's 3D electrostatic solvers and the Trajectory Evaluator add-on.

The Collection Plates

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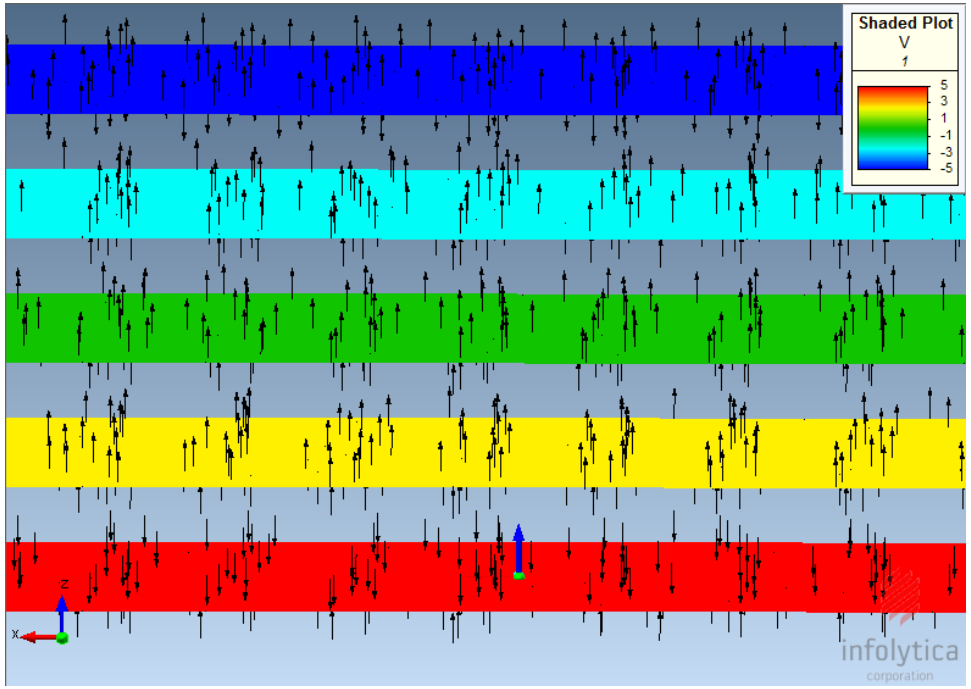
Voltage is applied to the collection plates in order to ionize the gaz around each electrode. ElecNet can simulate and then plot the electrode potentials and electric field between the two collection plates.



Using the Trajectory Evaluator tool, the path of charged particles are tracked starting from the entrance of the inlet in the model. Consider a particle with mass 5e8 amu with a net charge of -1.602e-19 C placed in the air gap between the metal sheets. The collection plates are set to be between -5 and + 5 V.

The z coordinates of the position, velocity and acceleration of this particle, evaluated using the Trajectory evaluator are shown in the figures below.

Position of the Charged Particle

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The Back-EMF waveform for this motor is very sinusoidal. BMW states that it was one of its primary specifications for this motor. The following Back-EMF waveform was created by Simcenter Motorsolve.

Velocity of the Charged Particle

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The velocity of the charged particle along the z-axis inside the precipitator versus time.

Acceleration of the Charged Particle

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The acceleration of the charged particle along the z-axis inside the precipitator versus time.

Comparing to the De-ionized Particle

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The results show that this particle is not affected by the electric field.