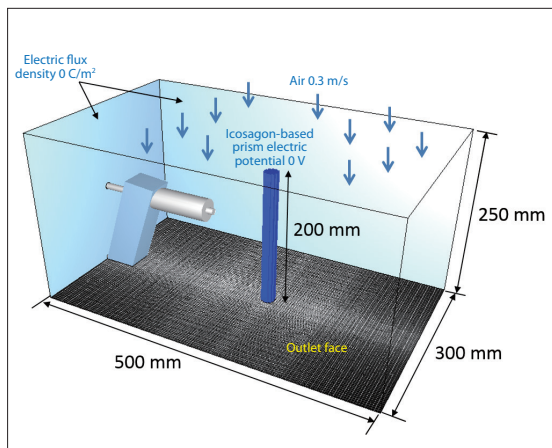# Analysis of an Electrostatic Spray Gun

An electrostatic spray gun is analyzed with Particle Tracking Method using scSTREAM

Analysis of an Electrostatic Spray Gun

Analysis Model

Figure 1: Coating booth

Coating booth	500 mm × 300 mm × 250 mm
Icosagon-based prism	• 20 [mm] wide× 200 [mm high icosagon-based prism • Located 100 [mm] away from the tip of the electrostatic spray gun • Electric potential is 0 V (Ground)
Air velocity	• Flows into the booth from the ceiling with a uniform velocity of 0.3 [m/s] • The floor of the booth is the outlet (like a grating) Removes paint particles that have not adhered to the prism
Electric flux density	0 [C/m²] (All walls of the booth including the ceiling and the floor)
Relative permittivity of air	Relative permittivity of air 1.000586

Analysis Results

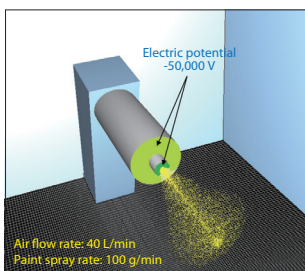

Figure 2: Electrostatic spray gun

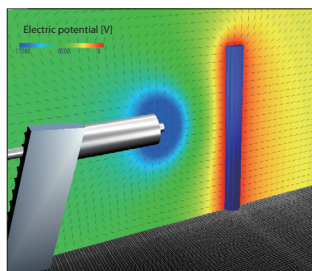Figure 3: Electric potential distribution

Air flow rate	40 [L/min] (Nozzle diameter 10 [mm])
Paint spray rate	100 [g/min] (Density of the paint is 1000 [kg/m³])
Diameter of paint particle	50 [μm]
Electric potential of nozzle tip	-50,000 V

Paint particles that adhered to the icosagon-based prism are vanished and no longer tracked

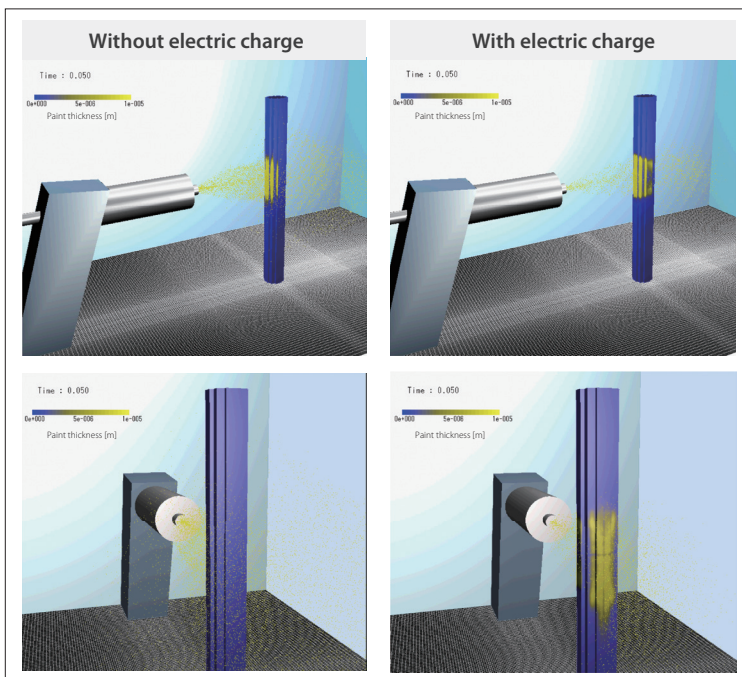**Converted to coating thickness by sedimentation**

Figure 4: Analysis result (0.05 sec.)
Paint distribution in front (top), paint distribution in back (bottom)

Notes

The coating efficiency of the paint spray process is calculated from the number of paint particles that adhere to the icosagon-based prism and the number of particles sprayed from the nozzle. The efficiency is 59.6 % without electric charge on the paint particles. It is 84.5 % with electric charge on the particles. The effect of electrostatic painting is well simulated.