The Océ Color Technology is called Direct Imaging. The print quality of the Direct Imaging technology is primarily determined by a toner flow in the region between a DI-drum and an imaging roller. The collection of toner between the DI-drum and the imaging roller is called the DI toner assembly. The toner is mono-component, magnetizable and electrically conductive. The behavior of the DI toner assembly is determined by external and internal magnetic, electric and mechanical forces. The sum of these forces results in a complex system behavior. Insight in the underlying physical processes of Direct Imaging can be obtained by experimental research. The possibilities of experimental characterization of the DI toner assembly are, however, limited. This is essentially caused by the small dimensions of the system.

Another approach to get insight in the toner flow in a DI-unit is theoretical modeling and numerical simulation. The simulation of toner deposition conducted consists of a many-body system where the motion of each particle is calculated based on the forces acting on it. This way we account for the mechanical interactions in combination with other forces driving the motion of the assembly of toner particles. This method is based on the discrete element method.

The aim of this project is a simulation tool that gives a quantitatively correct description of a toner-like granular medium under the influence of electric and magnetic forces. Although we have a specific focus on the description of the DI technology, the applied techniques are generic and can be applied in the analysis of problems of a similar complexity. An example of this is the application of the local defect correction method for solving Maxwell's electrostatic equations.