

# eXtended Particle System (XPS) - High-Performance Particle Simulation

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## Abstract

Understanding of granular flow is important in many fields. Especially in the pharmaceutical industry simulation is a crucial tool to gain process understanding. XPS uses the Discrete Element Method (DEM) to compute granular flows based on particle-particle pair interactions.

Typically, huge amounts of particles are needed to accurately model real-world problems, in conjunction with small time steps. Therefore, massively parallel algorithms designed for modern Graphics Processing Units (GPUs) were developed to make computation times acceptable.

To deal with fluidized processes, like wet coaters or fluidized bed applications, we use a coupling interface with the industrial simulation software AVL FIRE® to add support for Computational Fluid Dynamics (CFD). The biggest challenge is to keep the computation time per time step and the memory consumption as low as possible.

XPS supports complex real-world boundaries via STL input files, can handle various non-spherical particles (bi-convex tablets, glued-spheres, polyhedral shapes), and optionally includes heat flow and particle coating. Currently Smoothed Particle Hydrodynamics (SPH) is being integrated and a multi GPU implementation is planned.

## References

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