

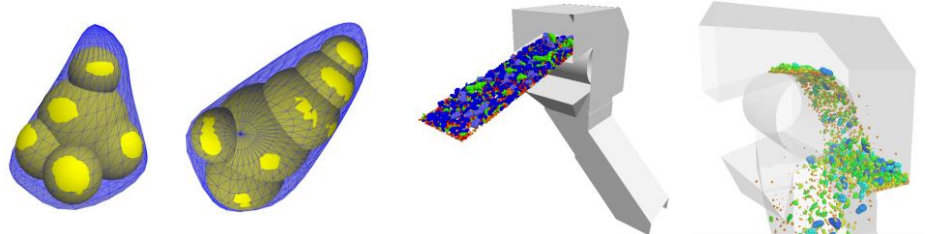
## PROJECT DESCRIPTION

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SOLVAY S.A. wanted to characterize the potential segregation of a mix of blocks (limestone + coal) charged into a cylindrical hopper. An intermediate loading structure between the conveyor and the hopper is added to limit segregation observed in a previous study.



**Block shapes in Rhino (in blue) and clumps of particles modeled using Kubrix (in yellow)**

**Visualization of the loading system and of clumps during their falling**

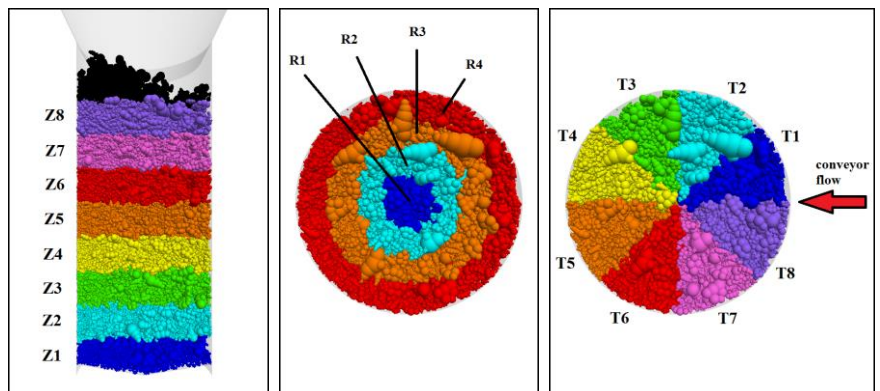
## ITASCA'S ROLE

A *PFC3D* model was developed to reproduce this complex system. Blocks were simulated through *PFC3D* clumps, whose constituent particle positions were defined by using CAD tools (Rhino and Kubrix) to reproduce the block morphologies. Six block shapes with different elongation ratios were used. Block interaction properties were calibrated using the angle of repose of the mix.

The mix is brought to the hopper by a belt conveyor and a loading system. The hopper is filled with about four tons of blocks, approximately 45,000 clumps. Optimization procedures were developed to reduce considerably the simulation time.

Parametric studies allow influence of restitution coefficient, friction coefficient and the initial homogeneity of materials on the vertical, radial and angular segregation of the blocks in the hopper to be analyzed.

**Geometrical classification of blocks by sectors, respectively along the vertical, radial and angular directions**



## PROJECT RESULTS

- Segregation analysis of the material within the silo shows that radially, the largest fractions tend to concentrate in the inner part of the silo whereas small fractions tend to localize in outer silo regions.
- In the angular silo direction, a homogeneous block distribution is observed, thanks to the geometry of the loading system which allows a uniform loading.
- Reducing the restitution coefficient (more energy dissipation during shocks) increases the above effects and increases the final porosity in the upper zone of the hopper.