
The Extended Discrete Element Method (XDEM) for Multi-Physics Applications

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- Introduction
- Features and Benefits
- Thermal Conversion of Packed Beds
- Conclusions



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Extended Discrete Element Method:

- based on the classical Discrete Element Method (DEM) to describe motion of granular materials (discrete phase)
- extended by
 - thermodynamics for particles
 - an interface to Computational Fluid Dynamics (CFD) and Finite Element Analysis (FEA)



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Benefits

- Appropriate solution strategy for discrete and continuous phase
- High resolution of both discrete and continuous phase
- No empirical correlations
- No expensive experiments, sometimes even not feasible
- Retains individual inputs
- Common post-processing preferred, although individual post-processing feasible

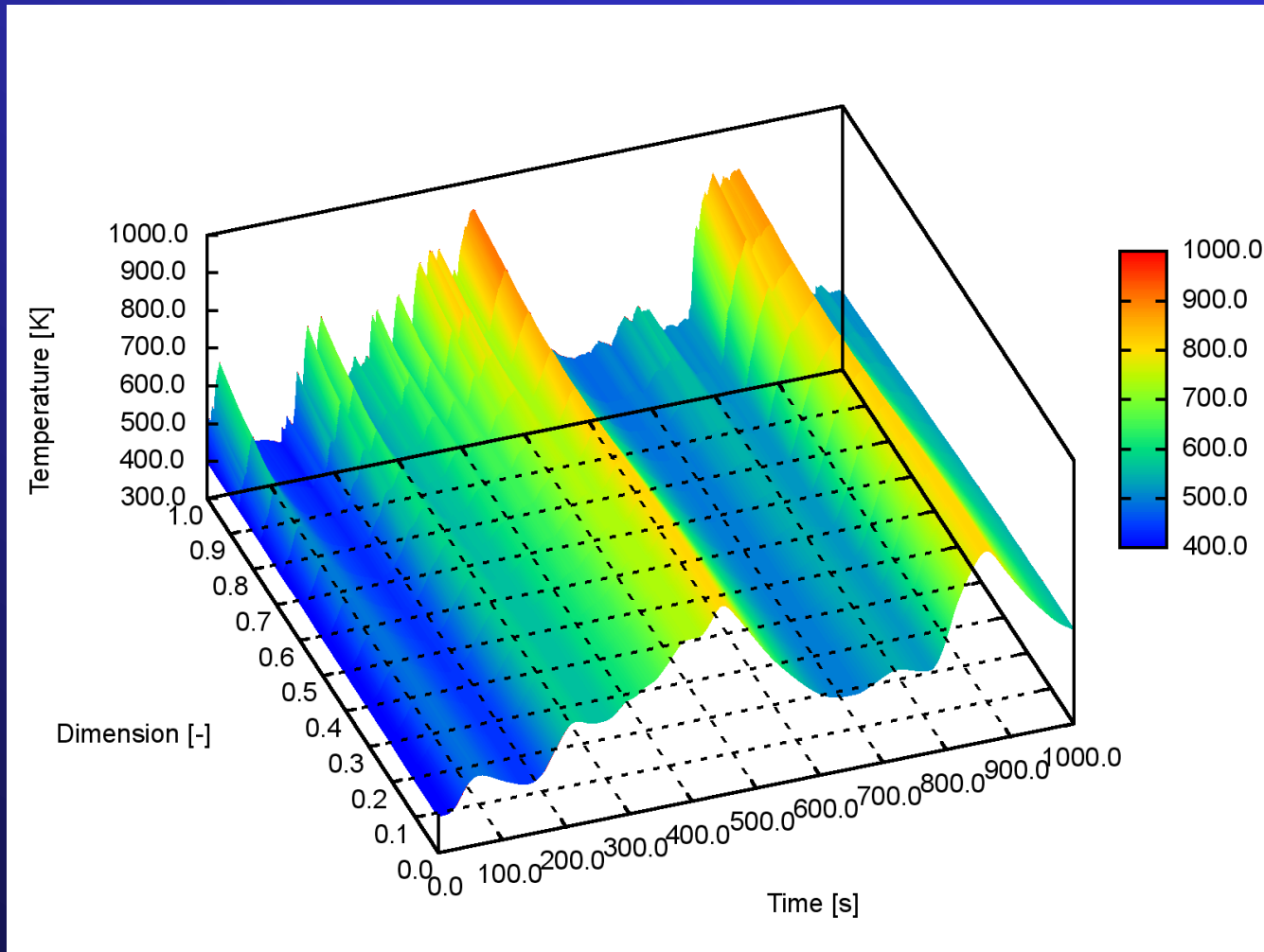
Combination of expert tools for maximum synergy

Applications

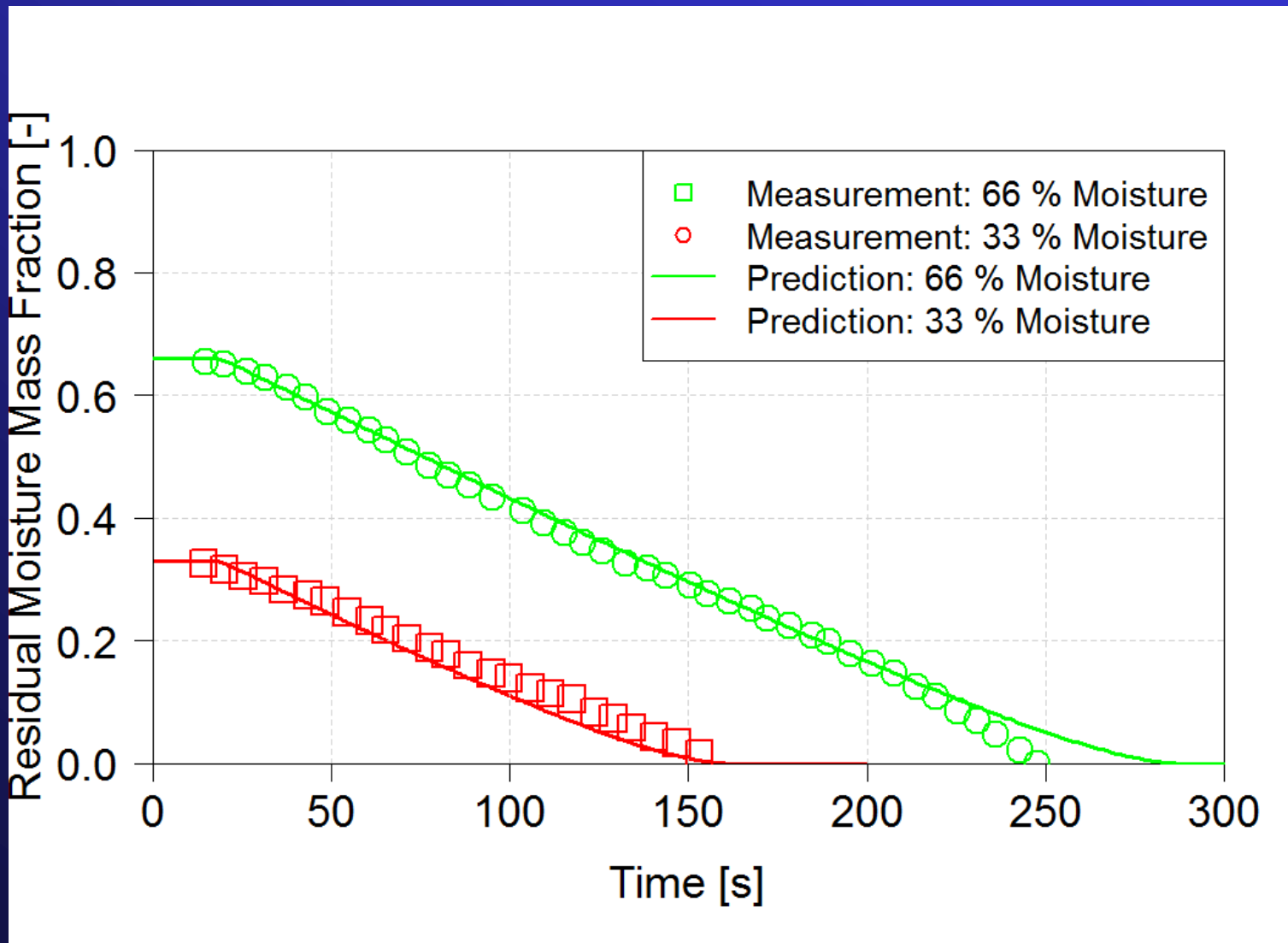
- Storage and transport of granular material
- Mining and its machinery
- Agriculture and its machinery
- Processing industry: Fluidised beds, fixed and moving bed reactors for
 - Drying
 - Thermal conversion (combustion, gasification)
 - Processing of raw materials
- Pharmaceutical industry e.g. coating, drug production
- Food industry (transport, coating, processing)



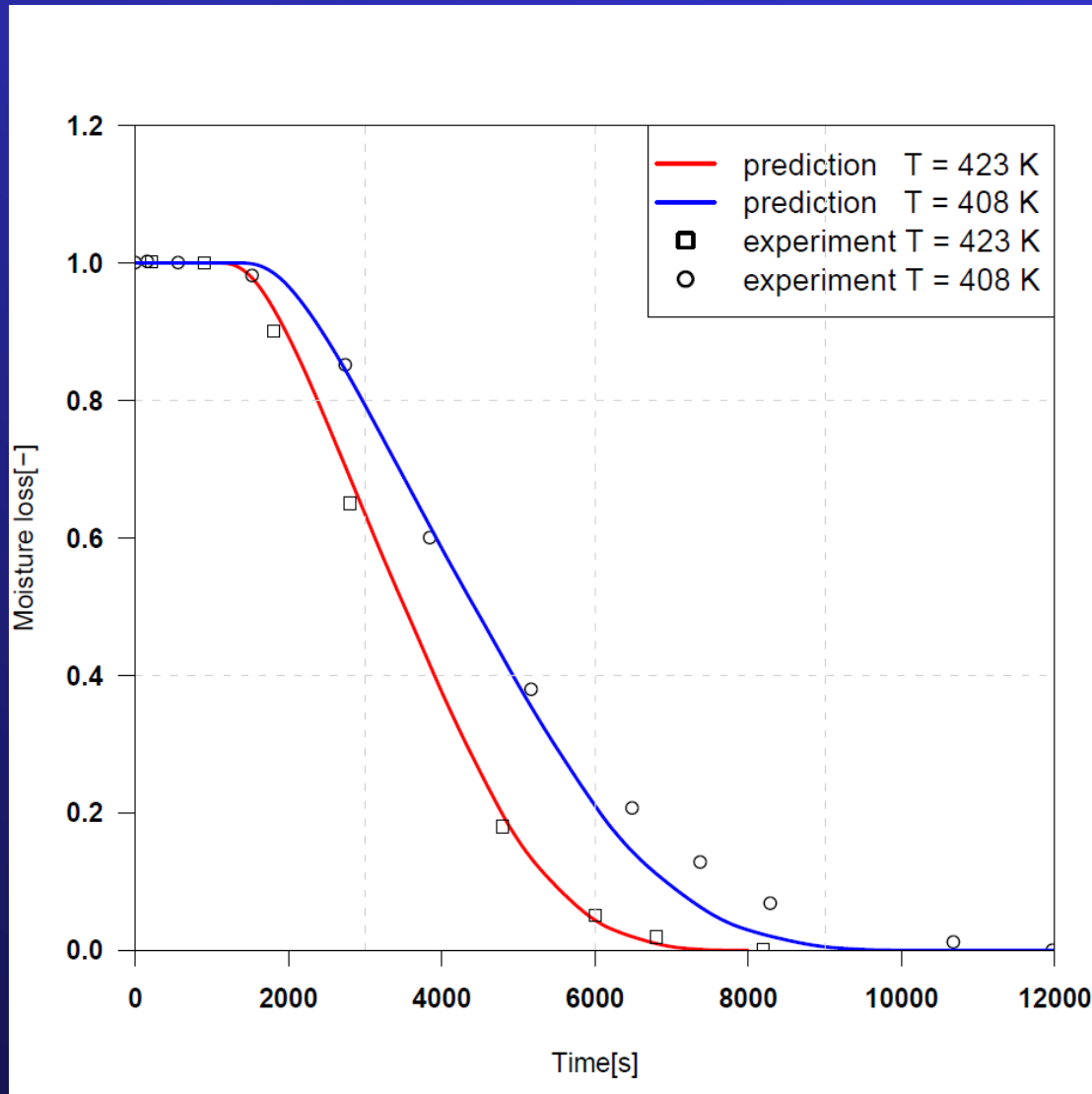
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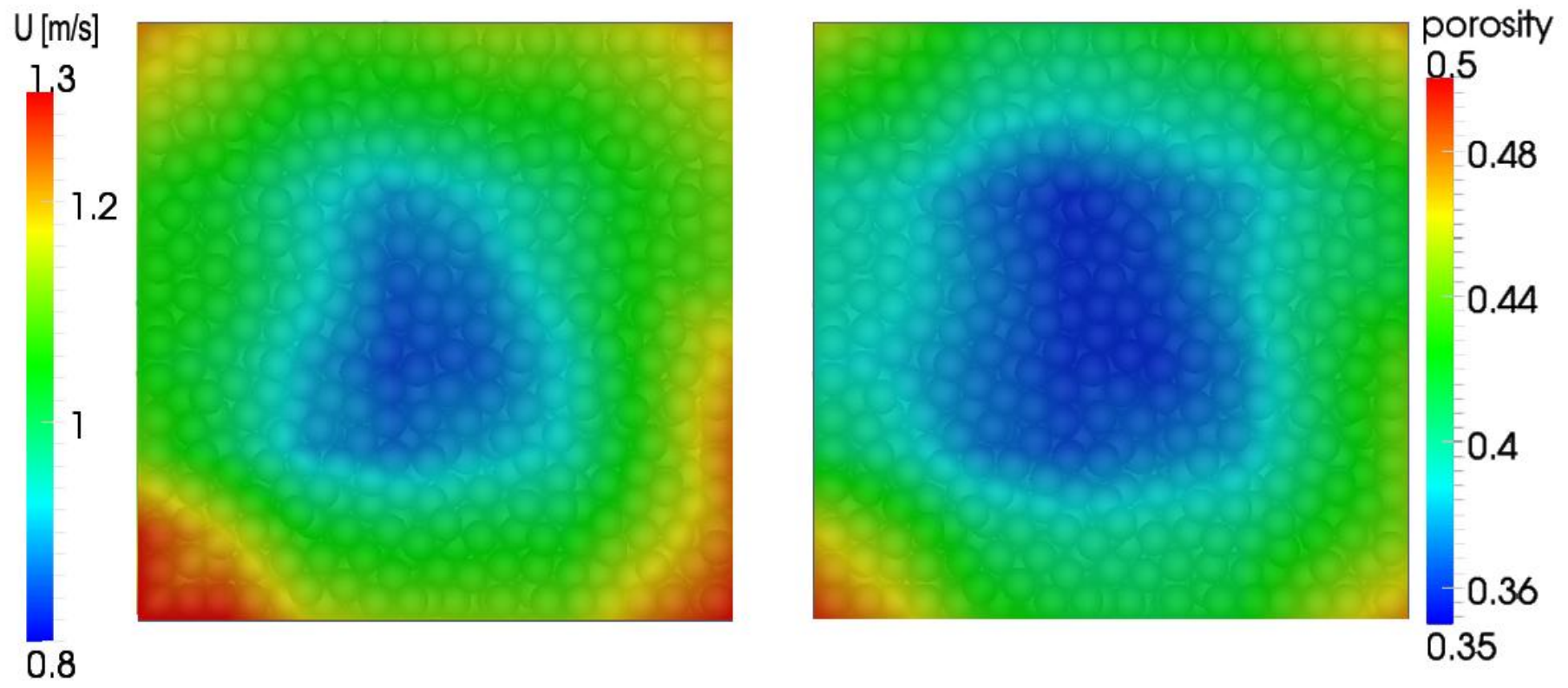
Validation for a Single Particle



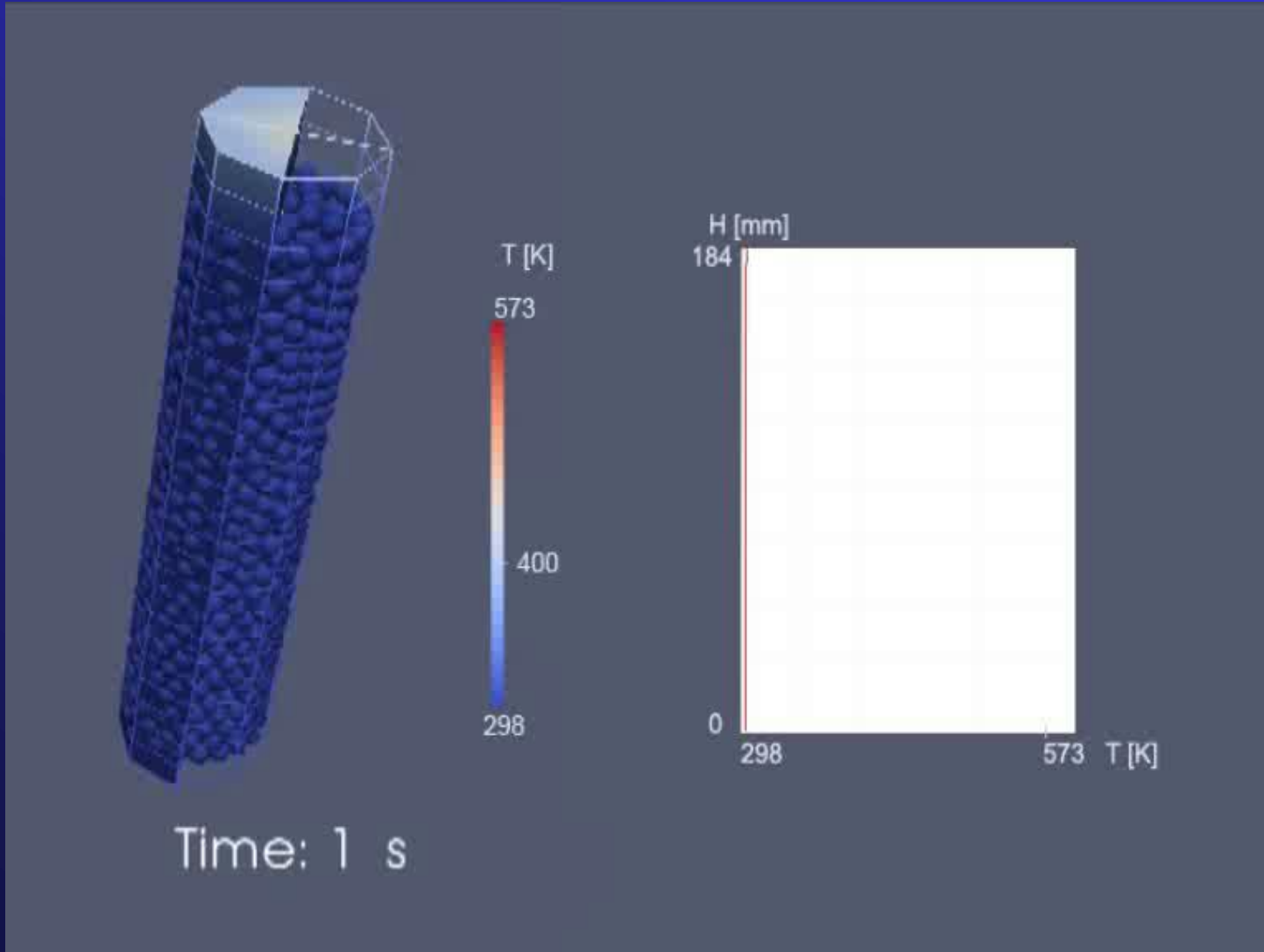
Validation for a Packed Bed



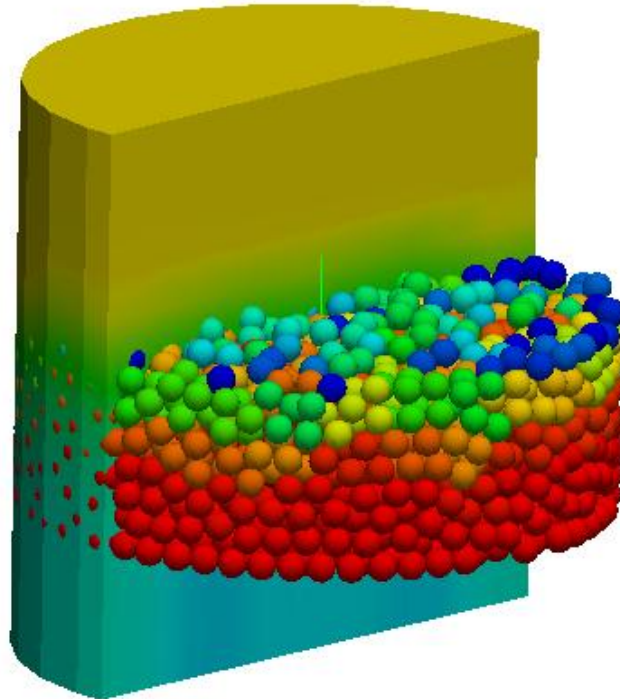
Distribution of Porosity and Velocity



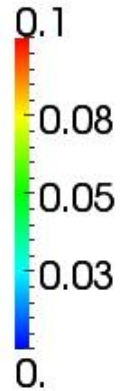
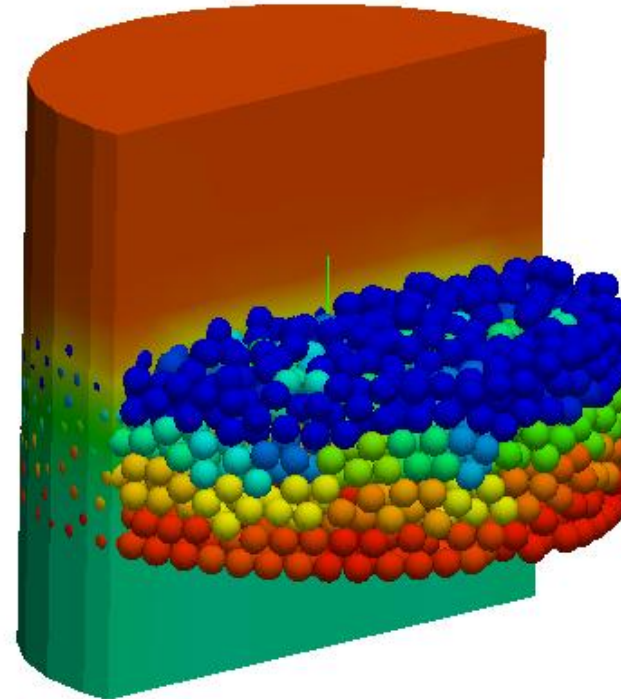
Dynamic Distribution of Temperature



2000 s



3000 s





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Conclusions

- XDEM as a novel and advanced simulation framework for multi-physics applications
- Efficient and flexible coupling to CFD/FEM solvers
 - Mechanical interaction
 - Heat/mass transfer
 - Drag forces
- High resolution of discrete and continuous phases
- No further modelling or assumptions

Thank you very much for your attention

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