

# PCOG Team Meeting 2015

Xavier Besseron

# My Resume

## PhD in Computer Science in Grenoble University

- Fault Tolerance and Dynamic Reconfiguration for large scale distributed applications

## 1-year Postdoc in Ohio State University

- Fault Tolerance in MVAPICH2 (ie MPI over InfiniBand)

## Postdoc researcher here since 4 years

HPC for eXtended Discrete Element Method (XDEM)

- Process Engineering: LuXDEM Team with Bernhard Peters
- Computer Science: PCOG with Pascal Bouvry

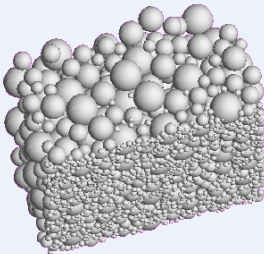
# What is XDEM?

XDEM software is multi-physics simulation toolbox modeling granular materials and processes



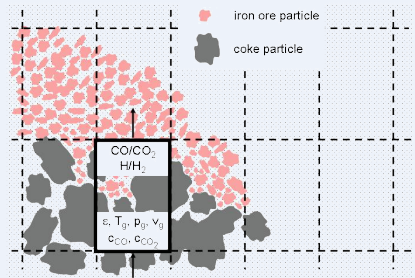
## Particle Motion

Snow, Sand, ...

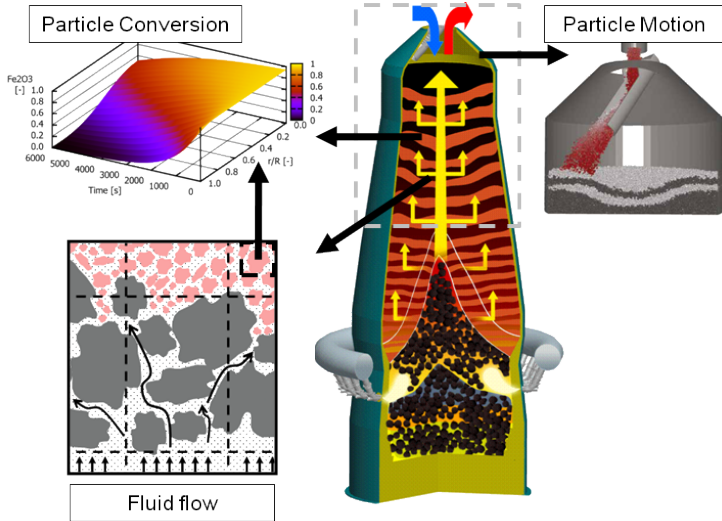


## Chemical Reactions

Coke, Iron ore, Biomass, ...



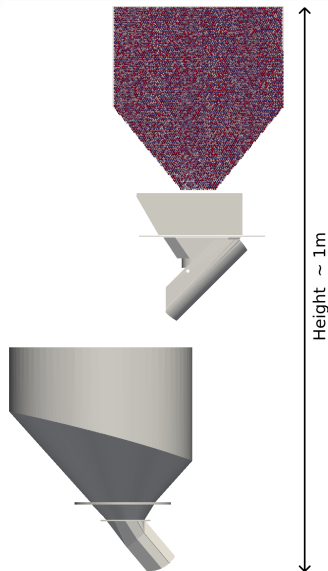
# Example: Blast Furnace



# Case study: Arcelor-Mittal benchmark 1/4

## Simulation the charge and discharge of hoppers

- 2 hoppers, total height  $\simeq 1$  m
- 427 878 spherical particles
- Particles diameter between 1.6 and 3.6 mm



# Case study: Arcelor-Mittal benchmark 1/4

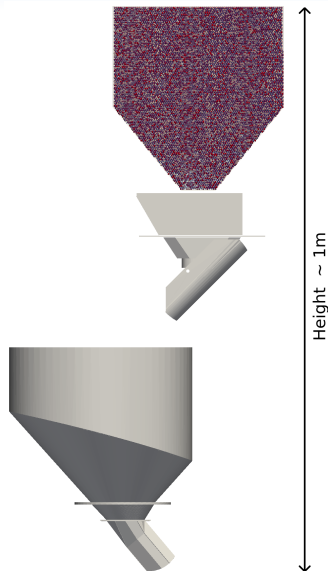
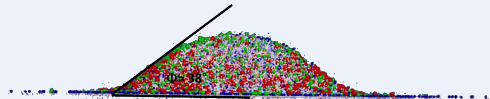
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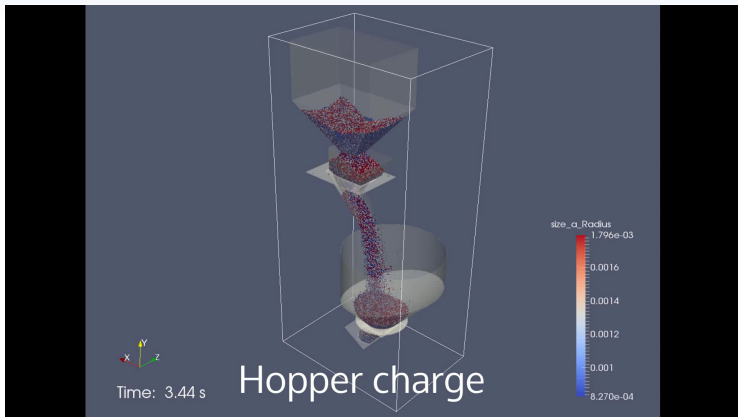
## First step: Calibration

Find the parameters matching the physical properties of the material

- Rolling resistance coefficient



## Case study: Arcelor-Mittal benchmark 2/4



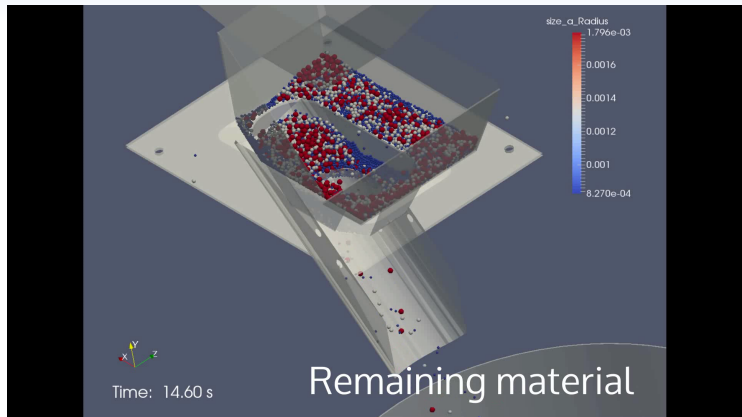
### Hopper charge

- 15 s of simulation
- 92 hours with 120 cores
- Est. seq. time > 4 months

### Hopper discharge

- 18 s of simulation
- 120 hours with 144 cores
- Est. seq. time > 6 months

## Case study: Arcelor-Mittal benchmark 2/4



### Hopper charge

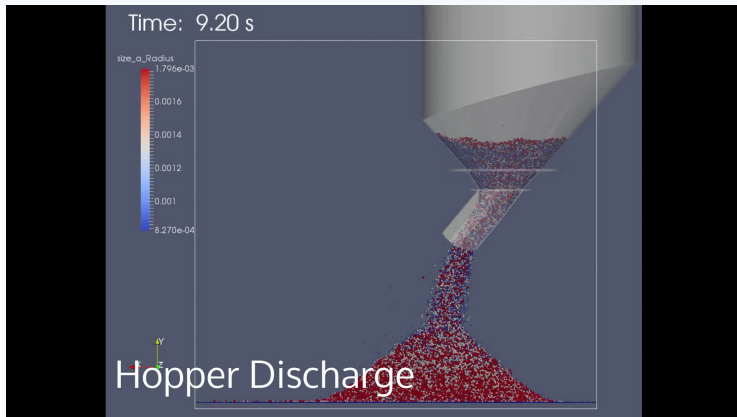
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## Case study: Arcelor-Mittal benchmark 2/4



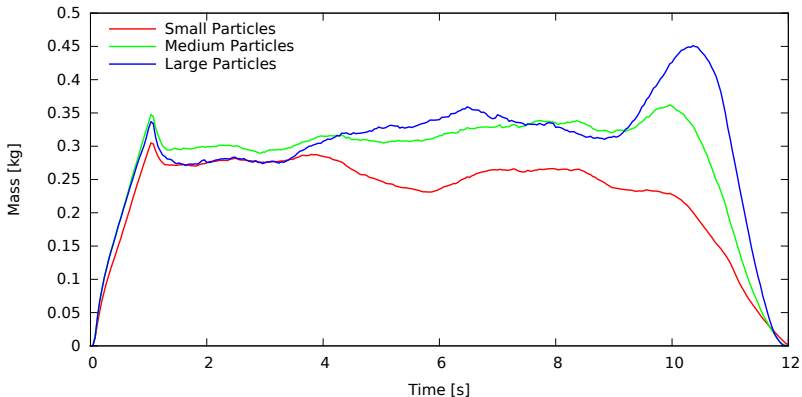
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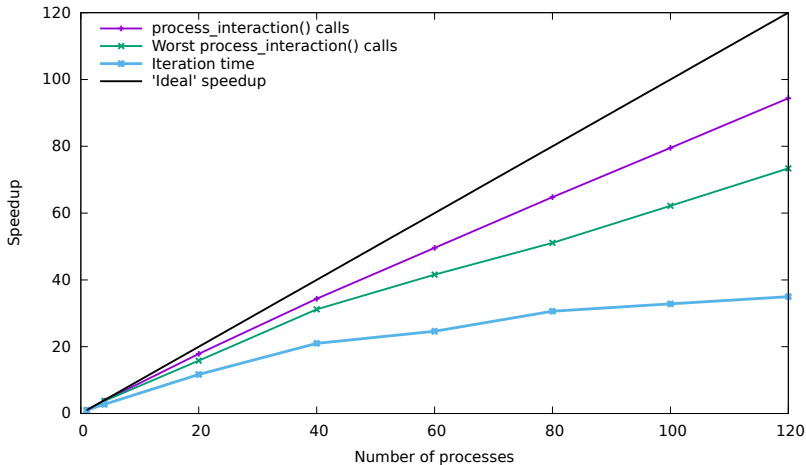
## Case study: Arcelor-Mittal benchmark 3/4



Hopper discharge: Mass of particles accumulated over the last second

# Case study: Arcelor-Mittal benchmark 4/4

## Speedup study



→ On-going work with Barcelona Supercomputing Center to improve this

# Collaborations with PCOG

## HPC for Cloud

- with Valentin, Mateusz and Seb

## HPC clusters

- Continuous testing of MPI stacks
- HPC workflows, Checkpoint/Restart, ...
- EasyBuild / Modules (with Maxime and Seb)

## Flexible Docking using Evolutionary Algorithms

- Follow-up of a student project for Optimization course
- with Greg, Angelo (student) and Émilie (INRIA Grenoble)

...

Thank you!

Any question?