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Multi-GPU implementation of finite-size particle in a pipe flow

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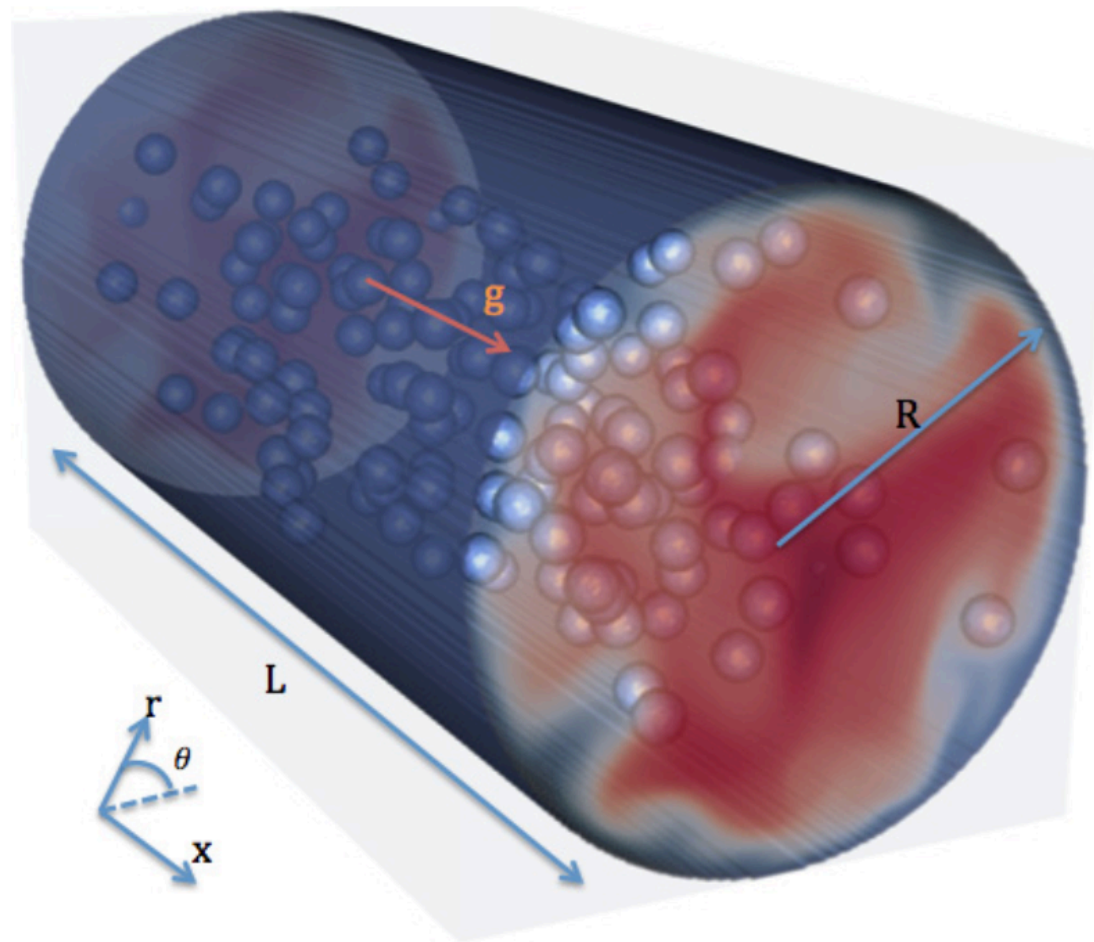
4. NVIDIA

5. University of Sheffield

Lugano, 02.10.2018



Goal: Particles in complex flows



- Multi-GPU implementation for lattice Boltzmann
- Multi-GPU implementation for particle-fluid interaction and particle-particle interaction

A Gupta, HJH Clercx, F Toschi
Communications in Computational Physics 23 (3), 665-684 2018

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The European Physical Journal E: Soft Matter 2018

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The European Physical Journal E 41 (3), 34 2018

Performance checks and optimisation

- Flow without particles (mini app)
 - single CPU speed up reference 1
 - single GPU optimization (block size, memory hierarchy, data layout): 1 GPU speed up 140
 - MPI parallelisation improved (halo exchange)
 - Multi-GPU optimization (CUDA aware MPI testing, halo exchange optimization): 4 GPUS speed up 380
- Flow with particles (separate code)
 - Embed particle method in mini app
 - Algorithm design for finite-size particle(data layout, efficiently linking between neighboring cells)
 - single GPU particle algorithm to be tested and optimised (locally & daint)
 - Multi-GPU particle code optimisation on daint