



# Algorithmes parallèles pour le suivi de particules

Soutenance de thèse – Florent Bonnier

**12/12/2018 10h00**

La Maison de la Simulation – Gif-sur-Yvette

Salle Mandelbrot

## Devant le jury composé de :

Mme Sabine Roller, Professeur à l'université de Siegen, Rapporteur

M. Osni Marques, Directeur de recherche au Lawrence Berkeley National Laboratory, Rapporteur

M. Jean-Marc Delosme, Professeur à l'université d'Évry Val d'Essonne, Examineur

M. François-Xavier Roux, Ingénieur de Recherche à l'ONERA, Examineur

Mme Nahid Emad, Professeur à l'université Paris Saclay/Versailles Saint-Quentin, Directrice de thèse

M. Xavier Juvigny, Ingénieur de Recherche à l'ONERA, Co-directeur de thèse

## Résumé :

Particle tracking is often used in the domain of fluid dynamics because it enables the reconstruction of long trajectories with high spatial and temporal accuracy. Thus, lots of applications in the industry related to gas-particles as in aeronautic engines, use the Euler-Lagrange method. The increase of the computation power of high massively parallel machines and the arrival of petaflop systems begin a new approach for simulations that were prohibited a decade ago.

The implementation of an efficient parallel code to keep high performances on a large number of processors is studied. This study particularly focuses on a good task-balancing on processes. As the targeted machine can be a set of very heterogeneous computing nodes, the final computation tool used to track particles must be as modular as possible in order to be called either in sequential and parallel modes. In this dissertation, a component-based parallel library for particle tracking is designed and the different algorithms of particle tracking are studied. We propose also special structures in the design of the library in order to make it inter-operational. The developed library is auto-tuned allowing to adapt itself for the exploitation of a large number of cores in shared and distributed memory and also accelerating the computation time while minimizing the memory occupancy.

## Mots clés

particle-tracking, distributed memory, component-based library, task distribution.