MATURATION :
Algorithmes PIC sur grilles parcimonieuses massivement parallèles pour la simulation des plasmas froids hors-équilibres
ANR-22-CE46-0012

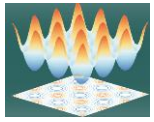
CE46 - Modèles numériques, simulation, applications

DUREE : 2023 - 2026 (4 ANS)
BUDGET : 1 341 072 €
AIDE : 355 470 €

label

Ordre du jour

- **9h30-10h15 :** point administratif (L. Garrigues)
- **10h15-10h45 :** résultats code 3D (L. Garrigues)
- **10h45-11h45 :** décomposition de domaine des méthodes sparse-PIC via composyx (P. Pace)
- **12h-13h15 :** repas – L'Esplanade
- **13h30-14h30 :** optimisations (M. Lobet)
- **14h30-17h00 :** discussion générale



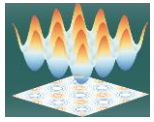
Point administratif

- **Pas de rapport intermédiaire, uniquement un rapport final**

- **Recrutement acté**
  - **Fin 2024, 1ere offre de post-doc déposée : recrutement de JUAN SILVA CUEVAS …. devenu IR CNRS/CEA à la MdS – en temps partiel sur le projet**
  - **02/2025, 2ème offre de post-doc déposée : recrutement de MARC CHUNG-TO-SANG pour deux ans (05/2025 – 05/2027)**

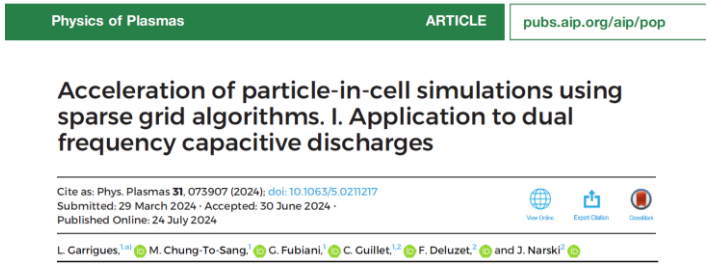
- **Demande puis obtention d'un prolongement de l'ANR jusqu'au 01/07/2027**

- **Recrutement à venir**
  - **1 an de post-doc disponible côté INRIA**



Production Scientifique au 05/06/2025

- **4 publications**

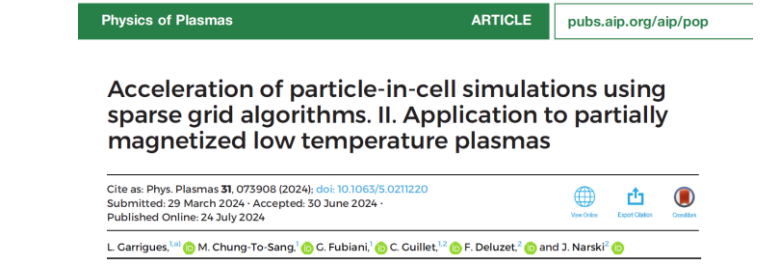


Physics of Plasmas ARTICLE pubs.aip.org/aip/pop

Acceleration of particle-in-cell simulations using sparse grid algorithms. I. Application to dual frequency capacitive discharges

Cite as: Phys. Plasmas 31, 073907 (2024); doi: 10.1063/5.0211217
Submitted: 29 March 2024 · Accepted: 30 June 2024 ·
Published Online: 24 July 2024

L. Garrigues,[1,a)] M. Chung-To-Sang,[1] G. Fubiani,[1] C. Guillet,[1,2] F. Deluzet,[2] and J. Narski[2]



Physics of Plasmas ARTICLE pubs.aip.org/aip/pop

Acceleration of particle-in-cell simulations using sparse grid algorithms. II. Application to partially magnetized low temperature plasmas

Cite as: Phys. Plasmas 31, 073908 (2024); doi: 10.1063/5.0211220
Submitted: 29 March 2024 · Accepted: 30 June 2024 ·
Published Online: 24 July 2024

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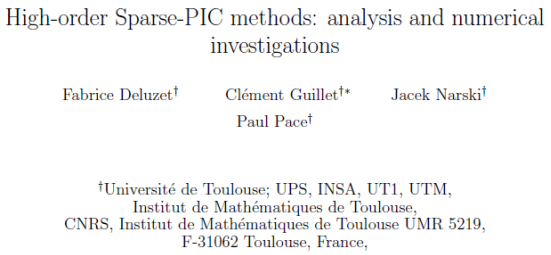
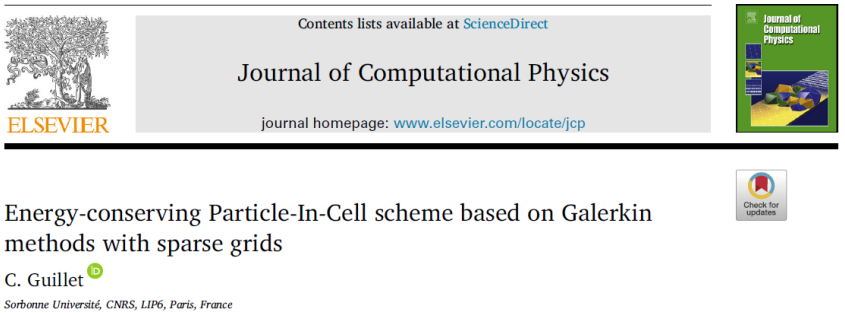


High-order Sparse-PIC methods: analysis and numerical investigations

Fabrice Deluzet† Clément Guillet†* Jacek Narski†
Paul Pace†

†Université de Toulouse; UPS, INSA, UT1, UTM,
Institut de Mathématiques de Toulouse,
CNRS, Institut de Mathématiques de Toulouse UMR 5219,
F-31062 Toulouse, France,



Journal of Computational Physics 524 (2025) 113739

Contents lists available at ScienceDirect

Journal of Computational Physics

journal homepage: www.elsevier.com/locate/jcp

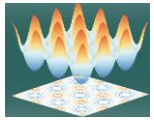
ELSEVIER

Energy-conserving Particle-In-Cell scheme based on Galerkin methods with sparse grids

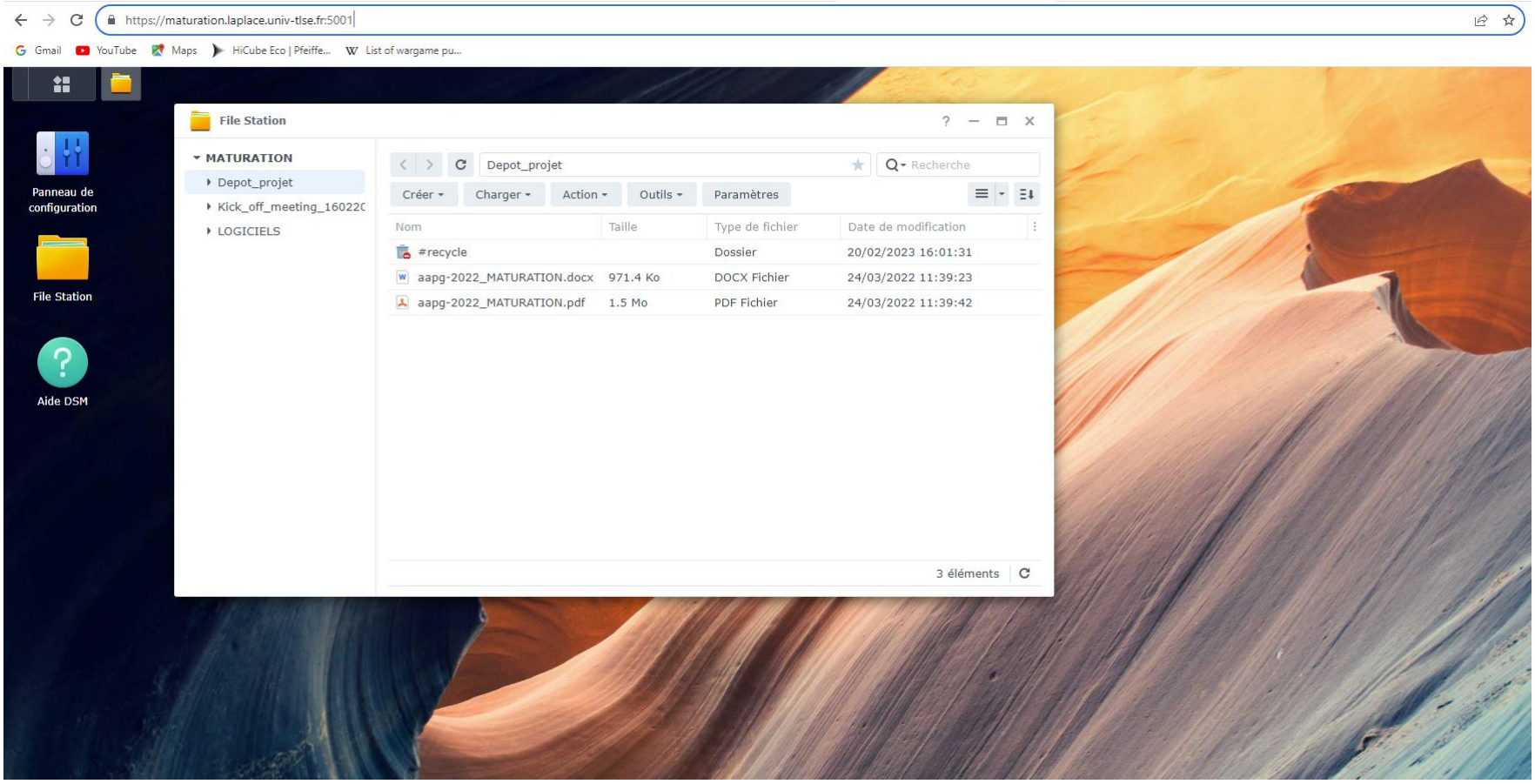
C. Guillet

Sorbonne Université, CNRS, LIP6, Paris, France

- **2 Conférences invitées**
- **1 oral**
- **1 séminaire**



Site web à diffusion interne

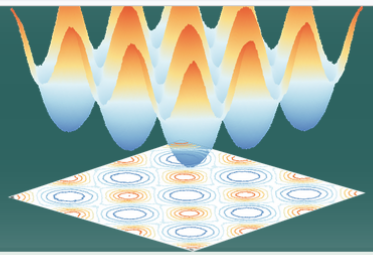


Site web à diffusion externe

https://www.math.univ-toulouse.fr/~narski/MATURATION/

MATURATION

ANR Project



MAssively parallel sparse grid PIC algorithms for low TemperatURe plAsmas simulaTIONs

CONTRACT NUMBER: ANR-22-CE46-0012-03

PARTICIPANTS

LAPLACE - Laboratoire Plasma et Conversion d'Energie, University of Toulosue

- Laurent Garrigues
- Gwénaël Fubiani
- Marc Chung-To-Sang

CONCACE - COmposabilité Numérique et parallèle pour le CAlcul haute performanCE, Inria, Talence

- Luc Giraud
- Emmanuel Agullo
- Olivier Coulaud

IMT - Institut de Mathématiques de Toulouse, University of Toulosue

- Fabrice Deluzet
- Jacek Narski
- Clément Guillet
- Paul Pace

MDS - Maison de la Simulation, CNRS, CEA, Saclay

- Mathieu Lobet

PARTICIPANTS

OBJECTIVES

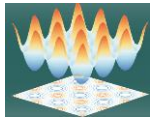
MEETING REPORTS

PUBLICATIONS

A mettre à jour

Tâches – diagramme de Gantt

Work Packages &Tasks	LAPLACE	CONCACE	IMT	MdS	Year 1				Year 2				Year 3				Year 4			
					T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
WP0 *Project management*	☒	×	×	×																
T0.1 – data management	×	×	×	×		M0.1														
T0.2 – meetings	×	×	×	×	D0.1	D0.2		D0.6		D0.3		D0.7		D0.4		D0.8		D0.5		D0.9
T0.3 – hiring of persons	×	×	×	×				M0.2				M0.3	M0.4							
T0.4 – annual reports	×	×	×	×				D0.10				D0.11				D0.12				D0.13
T0.5 – collaborative tool	×	×	×	×		M0.5														
WP1 *Opt. 3D sparse PIC model*	☒	×	×	×																
T1.1 – construction	×	×	×	×															D1.1	
T1.2 – scalability	×	×	×	×																D1.2
WP2 *Benchmarks*	☒	×	×																	
T2.1 – definition of test cases	×						M2.1													
T2.2 – implementation	×	×	×								M2.2			D2.1						
T2.3 – verification	×	×	×												M2.3			D2.2		
WP3 *Numerical analysis*	×	×	☒																	
T3.1 – Sparse grid reconstruction	×	×	×								M3.1							D3.1		
T3.2 – hierarchization strategy	×	×	×									M3.2						D3.1		
T3.2 – Vlasov-Maxwell system	×	×	×													M3.3				D3.2
WP4 *3D solvers & parallelization*	×	☒	×	×																
T4.1 – 3D parallelization	×	×	×	×								M4.1						D4.1		
T4.2 – parallel Poisson solver	×	×	×									M4.2						D4.1		
T4.3 – parallel perform. benc.	×	×	×															D4.1		
WP5 *Sparse PIC optimization*	×	×		☒																
T5.1 – cache-based optimization	×	×		×										M5.1						
T5.2 – vectorization	×	×		×														M5.2	D5.1	
WP6 *Commun. & dissemination*	×	×	☒	×																
T6.1 – communication	×	×	×	×	M6.1															
T6.2 – archive	×	×	×	×	M6.2															
T6.3 – dissemination	×	×	×	×		D6.1		D6.2		D6.3		D6.4		D6.5		D6.6		D6.7		D6.8



Budget

	Partner 1 LAPLACE	Partner 2 Concace	Partner 3 IMT	Partner 4 MdS
Staff expenses	103 196 € (2-year post-doc)	48 000 € (1-year post-doc)	57 180 € (1-year post-doc)	3 900 € (1 Master Internship)
Instruments and material costs (including the scientific consumables)	13 000 €	3 000 €	14 000 €	4 000 €
Building and ground costs	0 €	0 €	0 €	0 €
Outsourcing / subcontracting	2 000 €	2 000 €	2 000 €	2 000 €
General and administrative costs & other operating expenses	17 200 €	22 000 €	15 200 €	5 900 €
Administrative management & structure costs (13 %)	17 601 €	9 750 €	11 489 €	2 054 €
Sub-total	152 997 €	84 750 €	99 869 €	17 854 €
Requested funding	355 470 €			