

# LEMMA PRESENTATION

o By Olivier ALLAIN



04 93 90 53 90



04 93 90 53 51



[olivier.allain@lemma-ing.com](mailto:olivier.allain@lemma-ing.com)

# OUTLINES

- ✓ *SOCIETY*
- ✓ *ACTIVITIES*
- ✓ *CPU NEED*
- ✓ *LEMMA ROLE*
- ✓ *RESULTS*

*Key facts*

*LEMMA Worldwide presence*

*Skills*

*Main collaborators / Clients*

**High Performance Computing**

- Studies : 420 processors PPC 4 Ghz
- Research : 64 processors Opteron 2.2 Ghz
- Visualisation – Meshing – Partitioning  
20 processors Xeons 3 Ghz

**Mesh range :  
from 1 to 20 million nodes**



Space

Defense

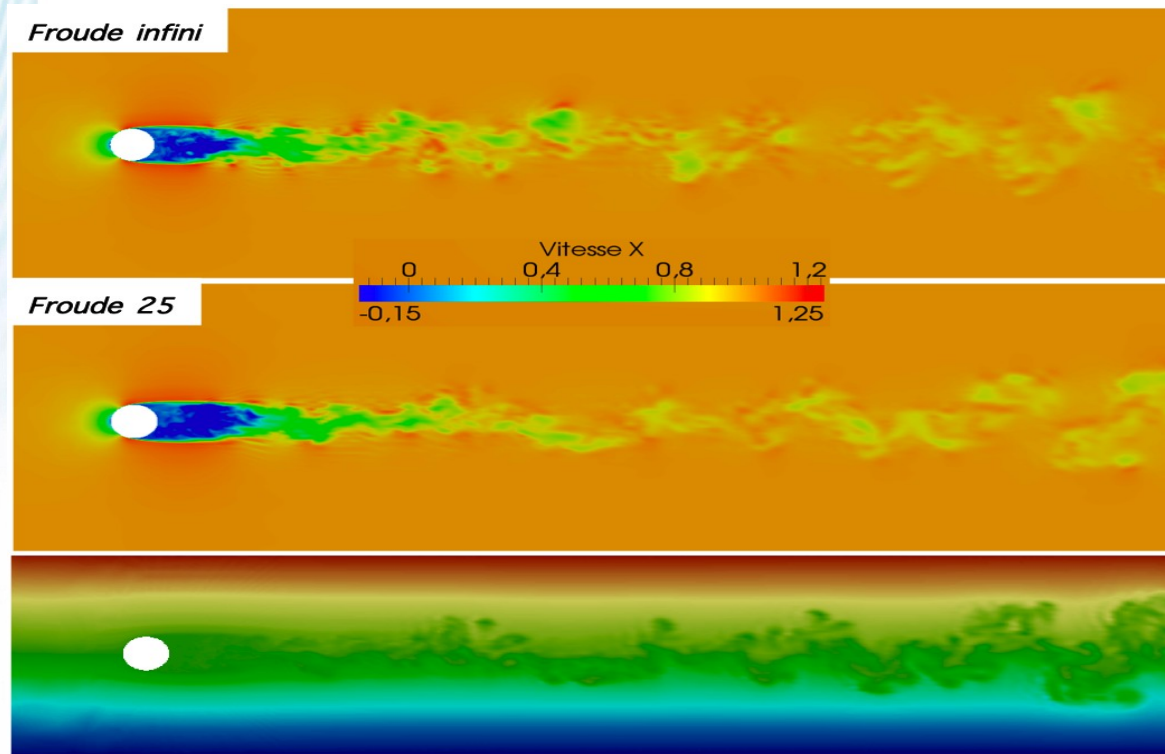
Aeronautics

Industry

Marine

Offshore

## o Wake computation.



Space

Defense

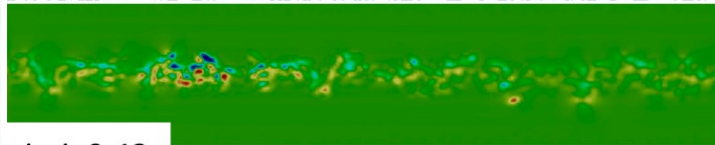
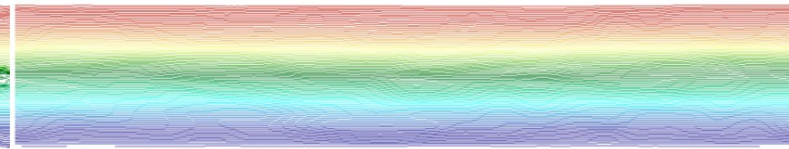
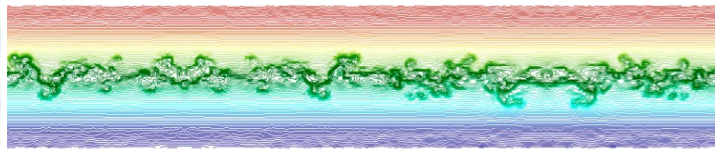
Aeronautics

Industry

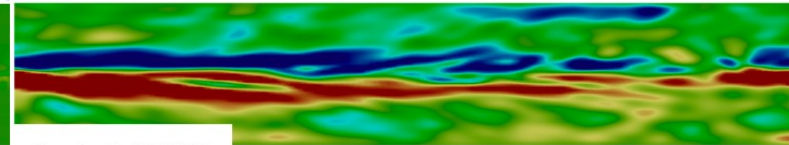
Marine

Offshore

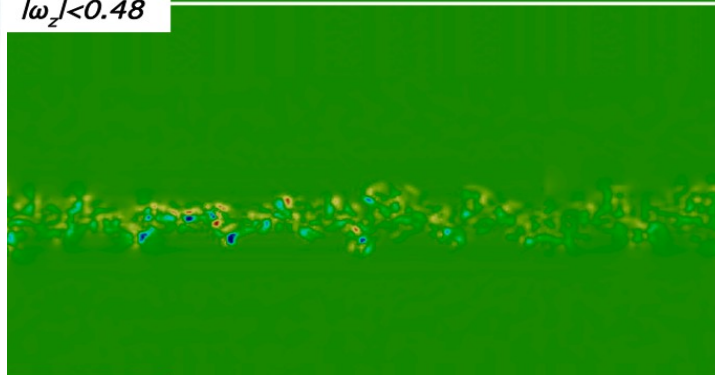
## Wake computation.



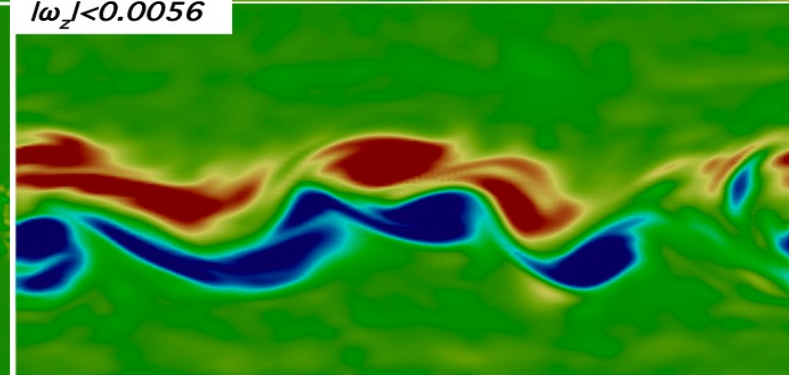
$|\omega_z| < 0.48$



$|\omega_z| < 0.0056$



$|\omega_y| < 0.62$



nt=1.24

$|\omega_y| < 0.008$

nt=49.24

# CPU NEED

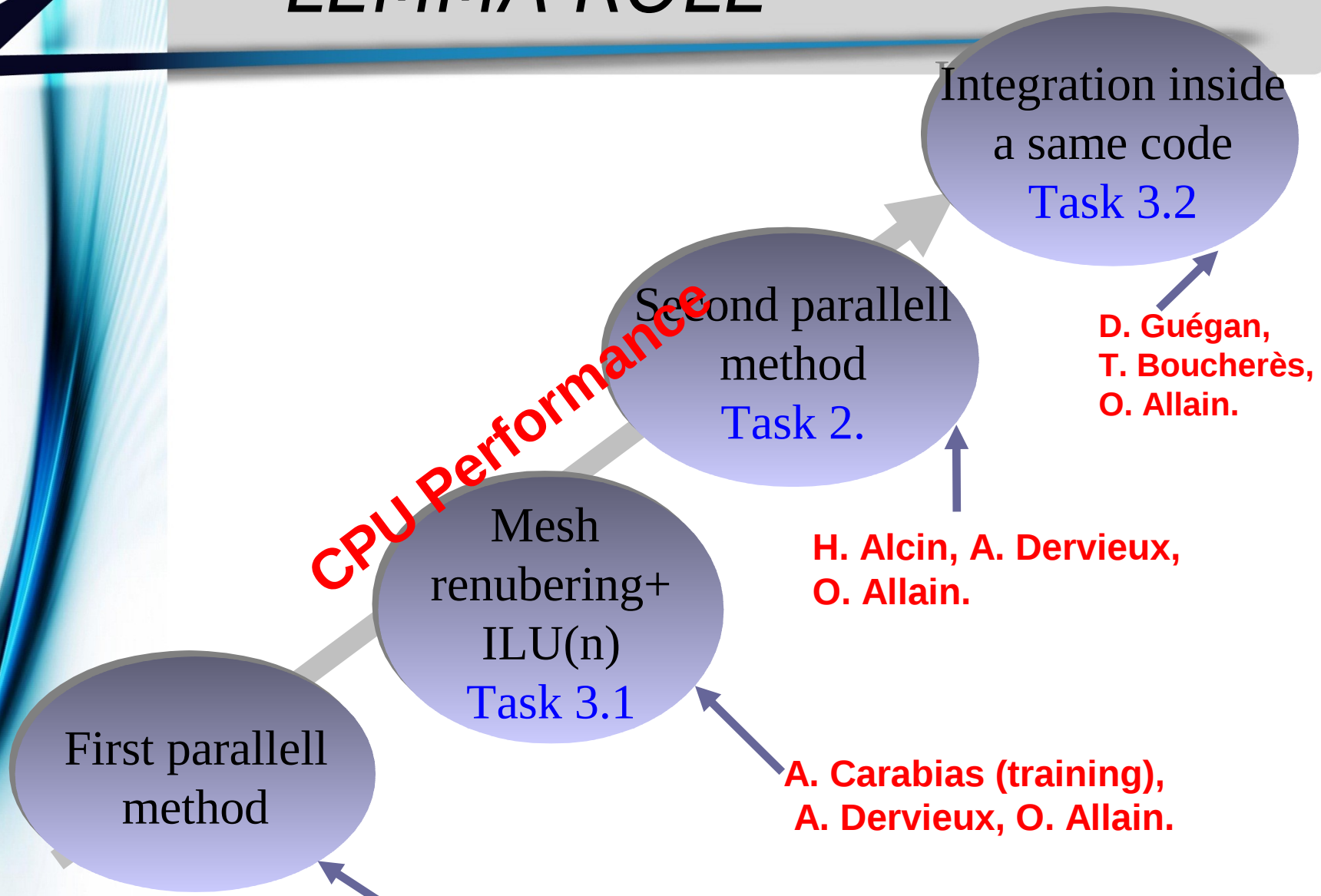
## ANANAS CPU information

	Convection solver	Matrix solver
Boundary layer problem	30,00%	70,00%
Free surface flow problem	50,00%	50,00%
Turbulent flow problem	80,00%	20,00%
Compressible flow	100,00%	0,00%



**Different problem occurs.**

# LEMMA ROLE



# LEMMA ROLE

Participation to the following tasks:

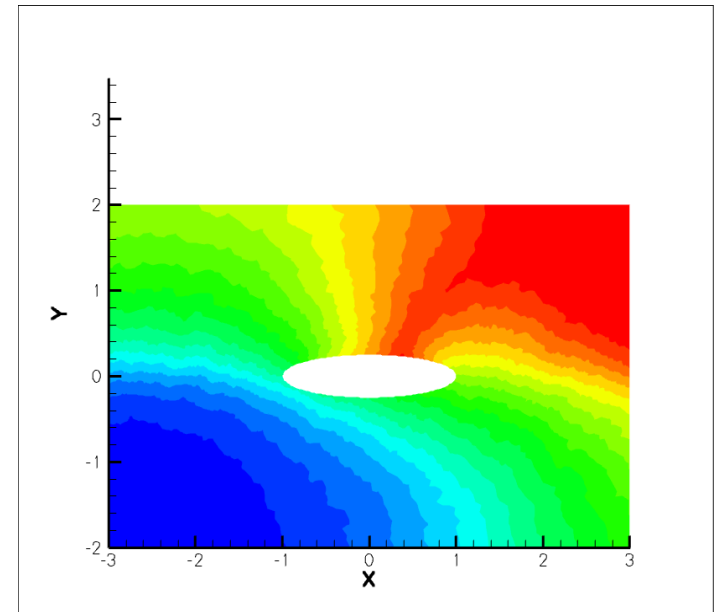
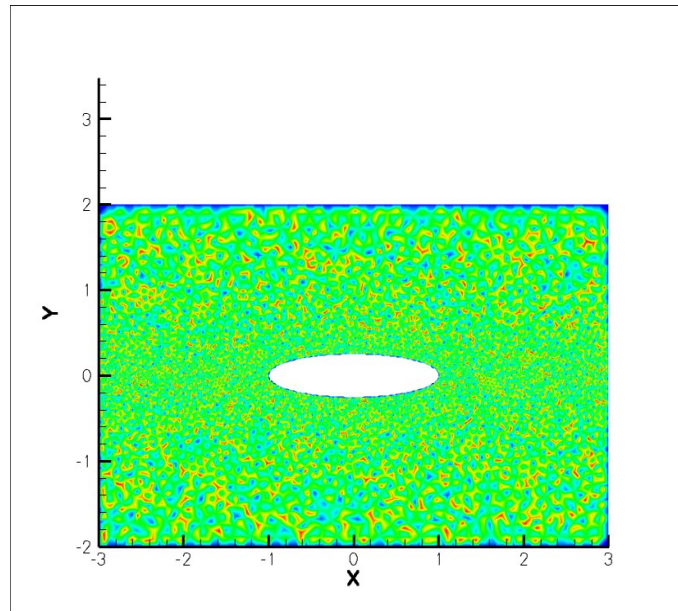
- Task 2: Global Preconditionning by coarse grid
- Task 3.1: Renumbering and ILU(n).
- Task 3.2: Integration of task 2 and 3.1 inside a same code
- Task 4: Assesment and applications.

7 men.months for O. Allain.



# RESULTS

## Renumbering mesh



Renumbering impact  
color level represents node number

# RESULTS

## Renumbering mesh

Different method have been tested:

- Cuthill-McKee
- Hilbert
- Front.

# RESULTS

## Renumbering mesh

CPU comparison for the same test case.

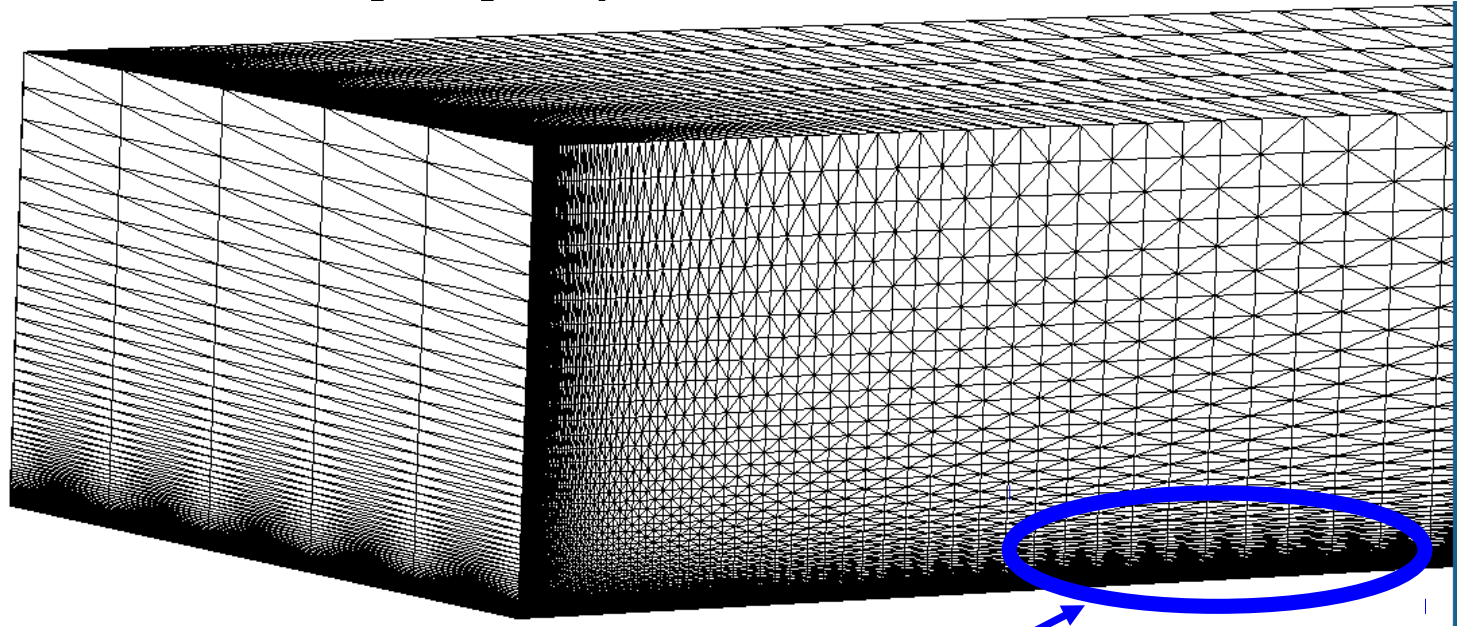
	Convection solver	Projection solver	Total cost
Without renumbering	60	67	127
Cuthill-McKee	52	49	101
Hilbert Method	48	63	111
Front method	53	44	97

➔ Front method is the fastest

# RESULTS

## Renumbering mesh

Boundary layer problem:

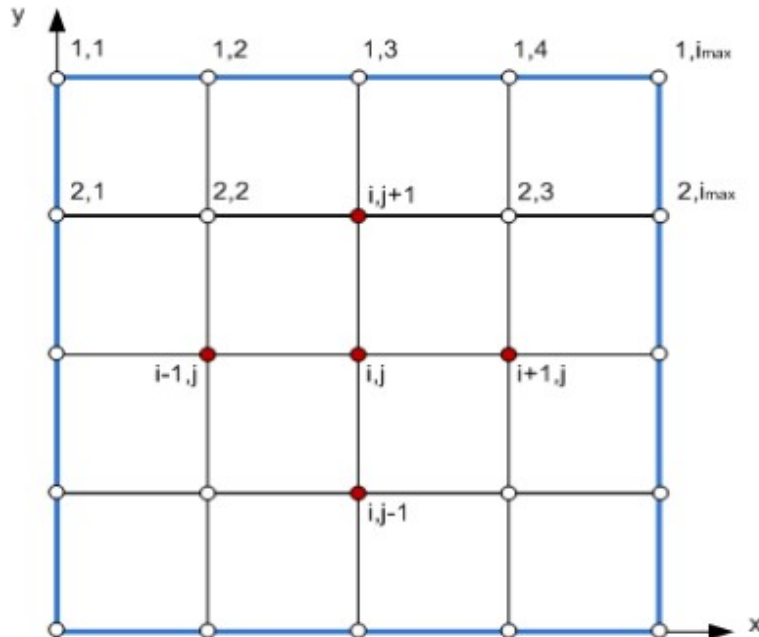


Stretch cell is about 2000

# RESULTS

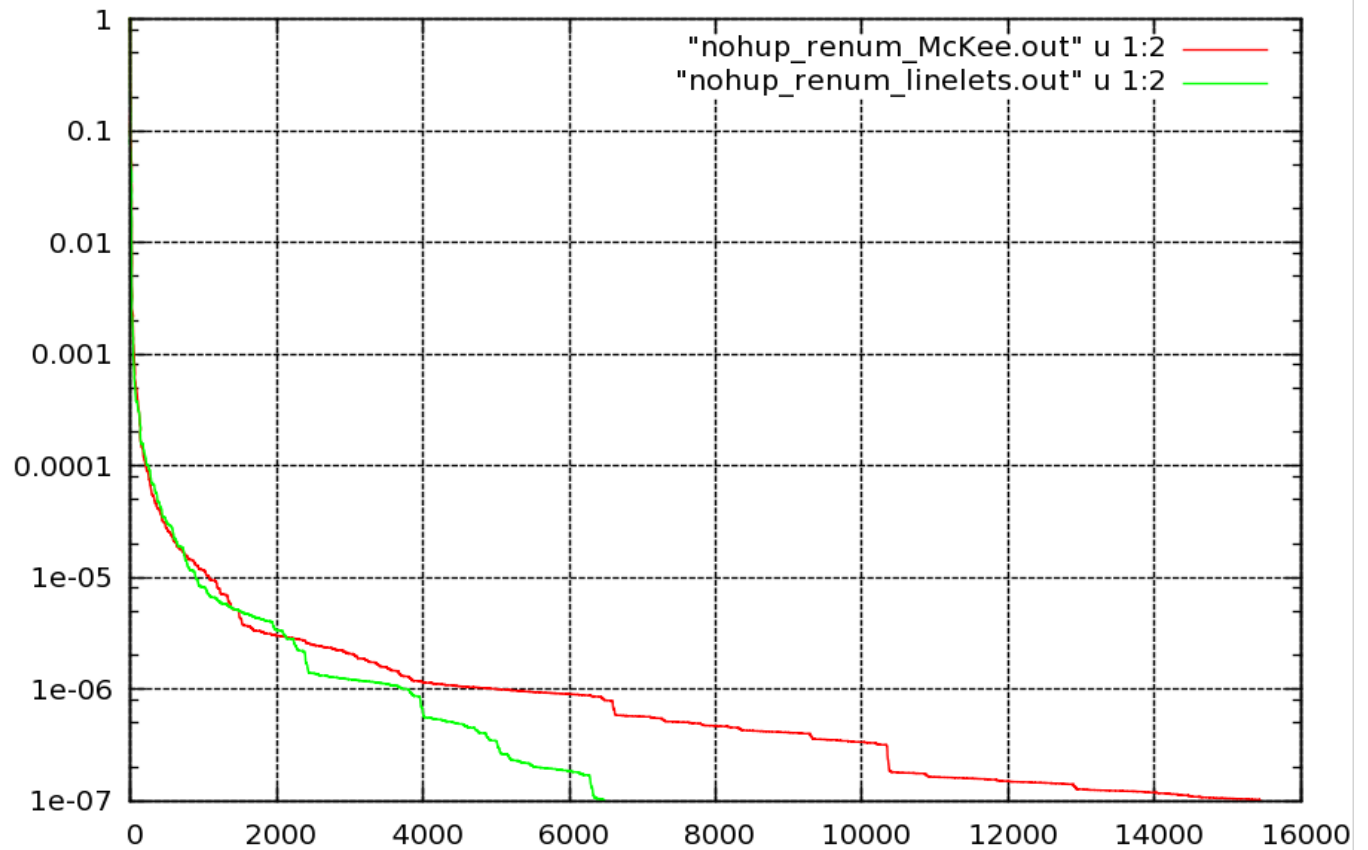
## Renumbering mesh

Boundary layer problem  
Linelet renumbering.



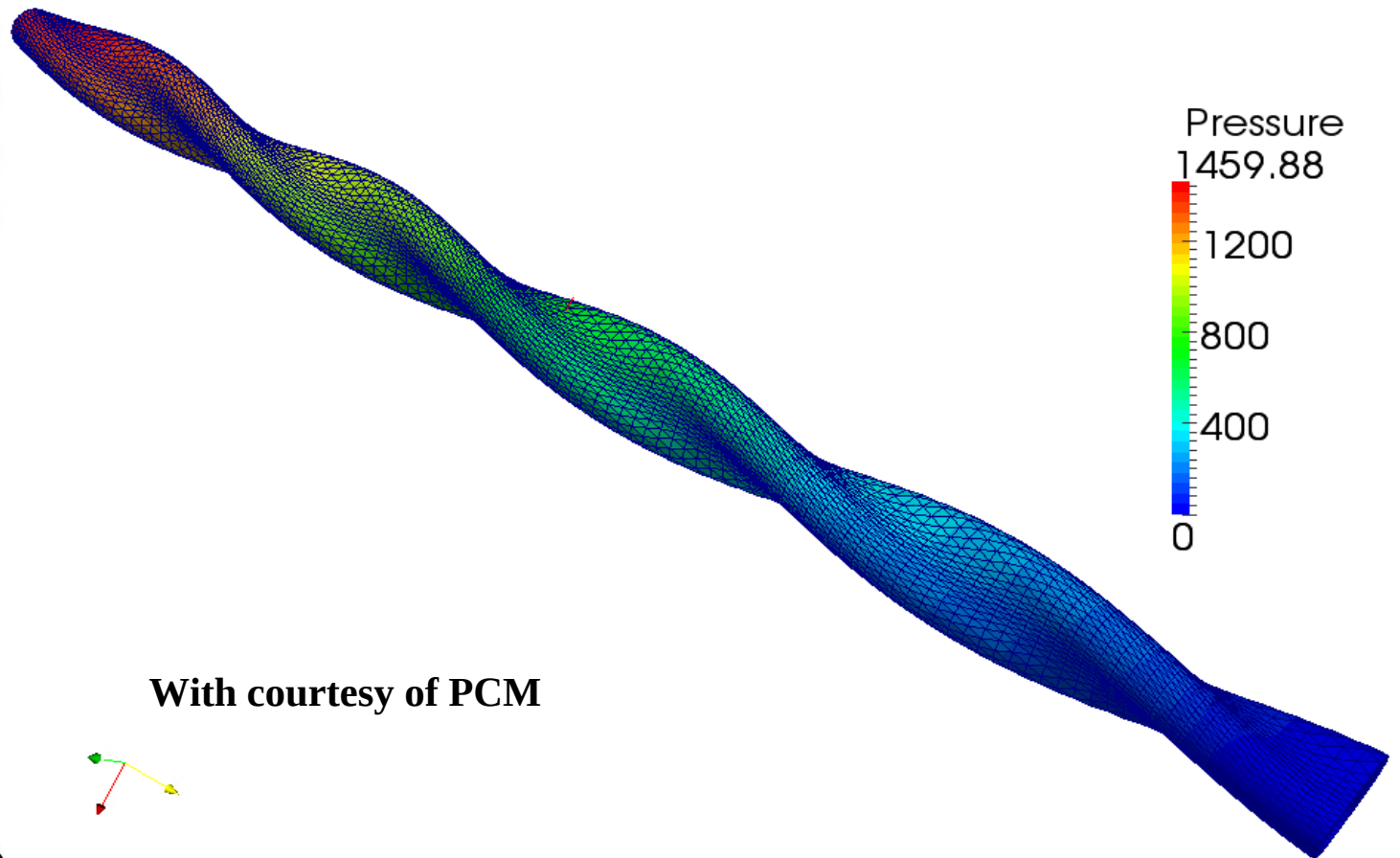
# RESULTS

## Renumbering mesh



# RESULTS

## ILU(n) Preconditionning

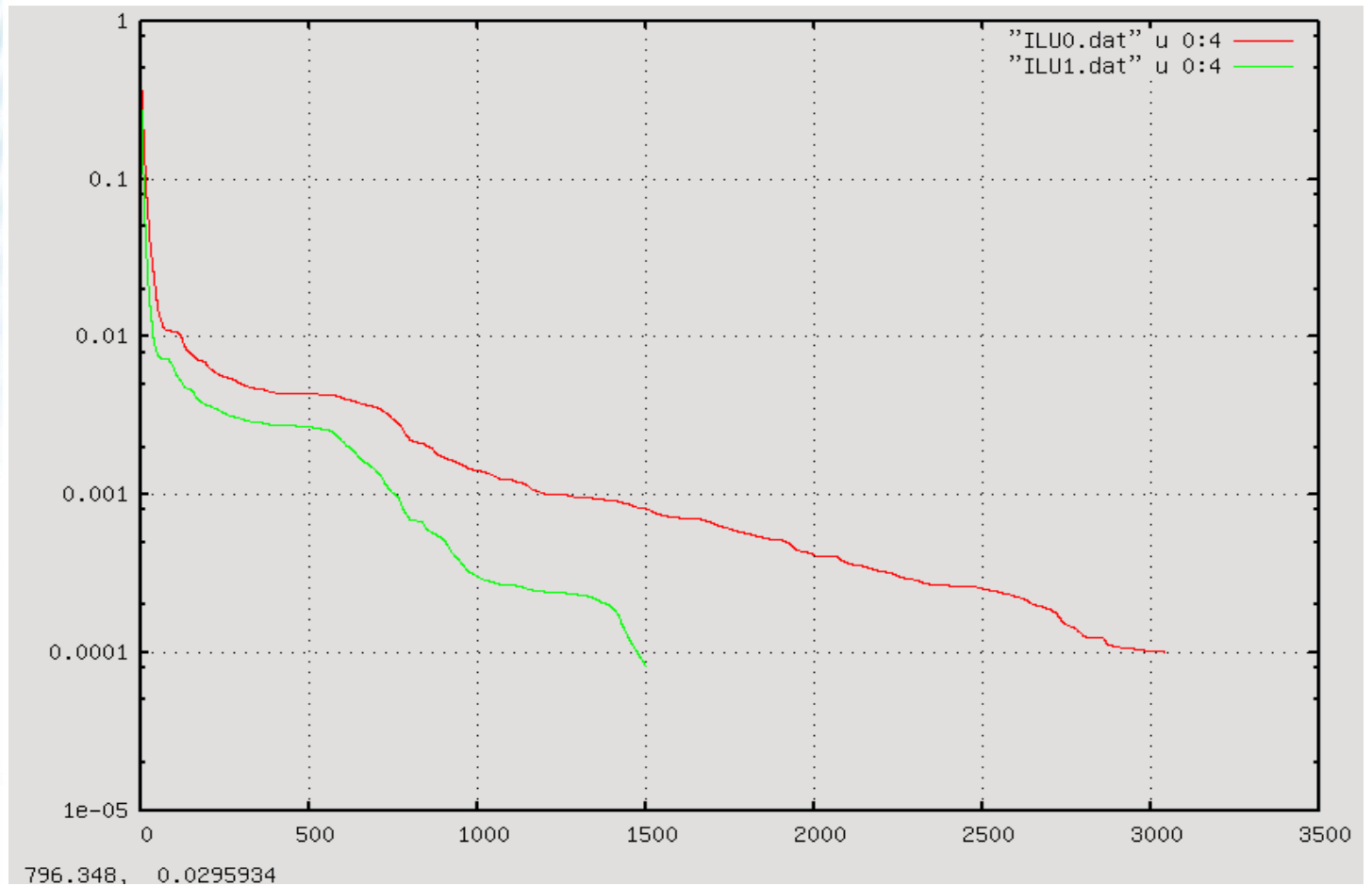


With courtesy of PCM



# RESULTS

## ILU(n) Preconditioning



796.348, 0.0295934



# RESULTS

## Deflation preconditionning

Scalability problem when the number of processors increase

The number of iteration of the linear solver increases due to exchange between each subdomain

# CONCLUSION

