immerse
IMPROVING OCEAN MODELS
FOR THE COPERNICUS PROGRAMME

IMMERSE WP6:
MS35 milestone: « Global 1/36 configuration upgrade “

Demonstrating impact on
CMEMS systems

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NEMO 4.2 release HPC tests with eORCA36 configuration

Developments tested:

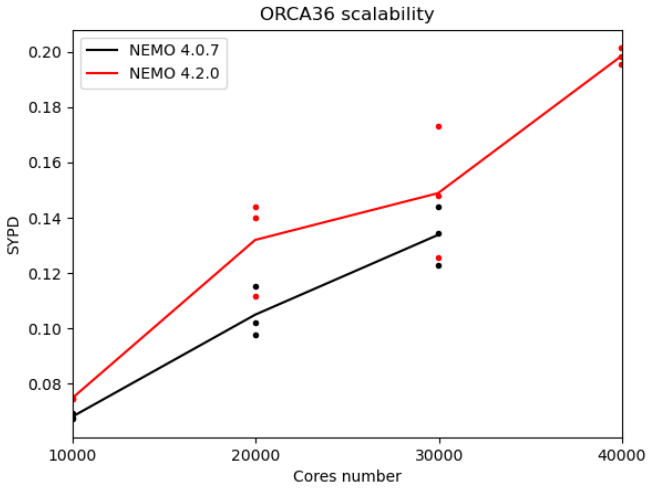
- NEMO 4.2 vs NEMO 4.0.7
- QCO vs VVL
- MPI3 vs MPI2
- Loop fusion
- Tiling
- Using XIOS for reading/writing restarts

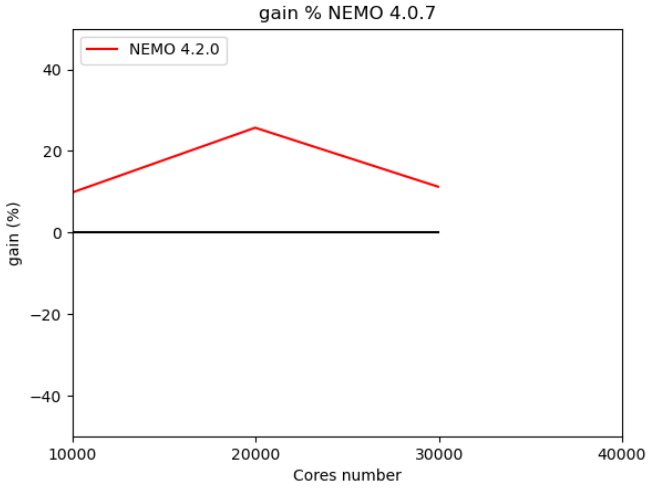
Method:

- Configuration: eORCA36
- All tests performed 3 times
- All tests performed on a 4-days run, excepted for tiling (1-day run)
- Performances obtained with NEMO timing tool

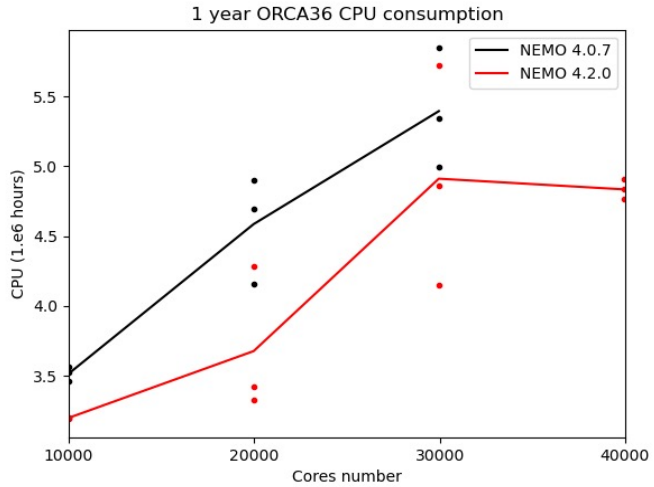
NEMO 4.0.7 vs NEMO 4.2

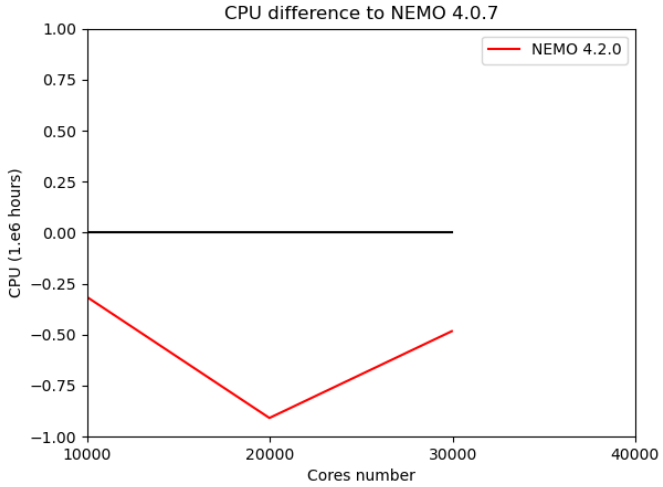
- **Simulated years per day**





- **CPU**





- VVL and MPI2 for NEMO 4.0.7 and NEMO 4.2

- Run crashed for 40 000 cores and NEMO 4.0.7
- NEMO 4.0.7 made Out of memory ;
  need to depopulate

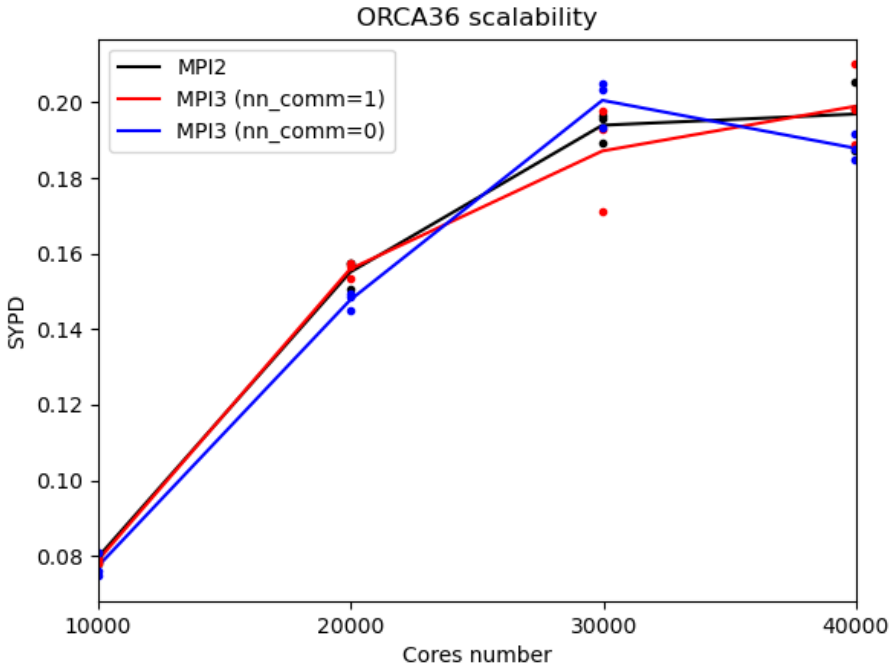
- Better performance with NEMO 4.2 ,
thanks to less MPI communication:

10 to 25 % gain for elapsed time
0.3 to 0.9 million CPU hour gain for a 1 year run

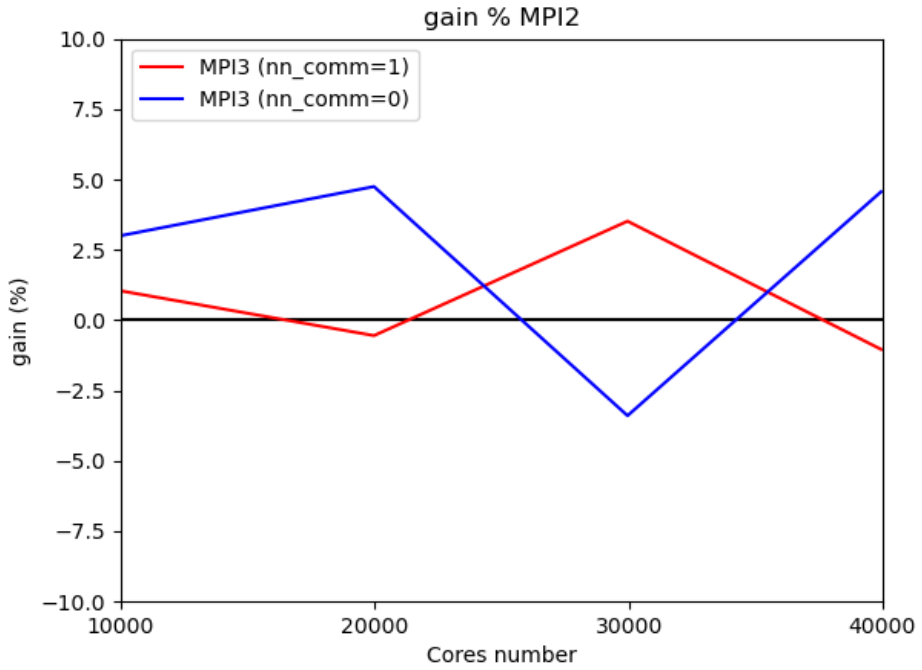
- Additional test: QCO vs VVL
  –7.5% elapsed time thanks to QCO

MPI2 vs MPI3

- **Simulated years per day**



- **Gain % MPI2**



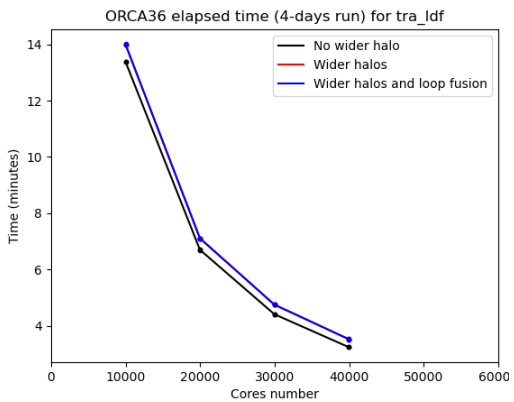
- nn_comm: 0= neighbor collective, 1= point to point
- MPI2 performed with nn_comm=0
- Performed with NEMO 4.2

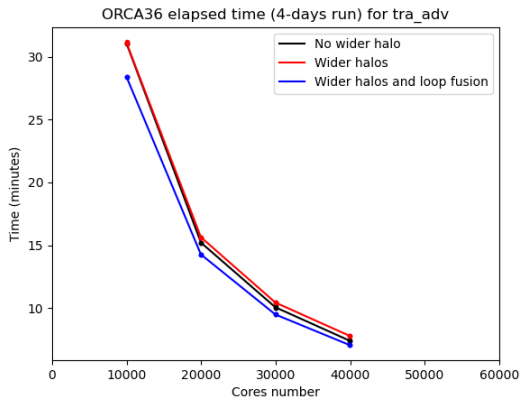
- No clear gain with MPI3

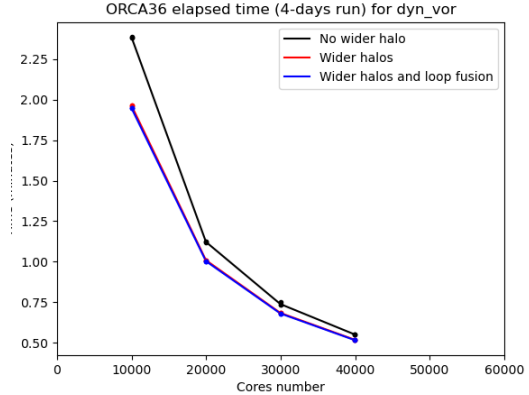
Loop fusion

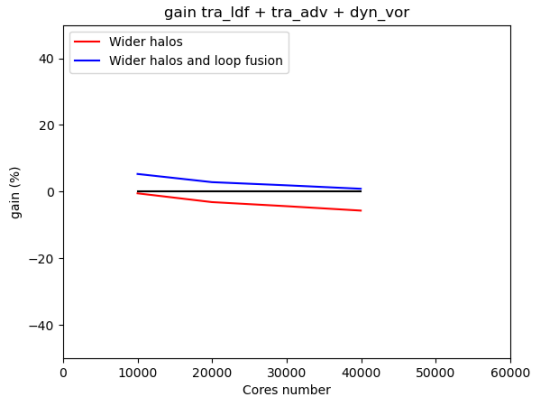
Traldf | traadv | dynvor | Total

Elapsed time

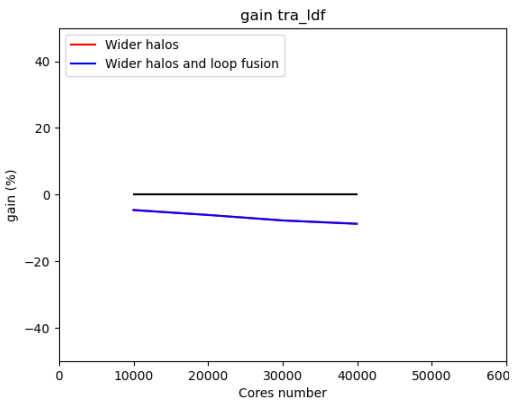


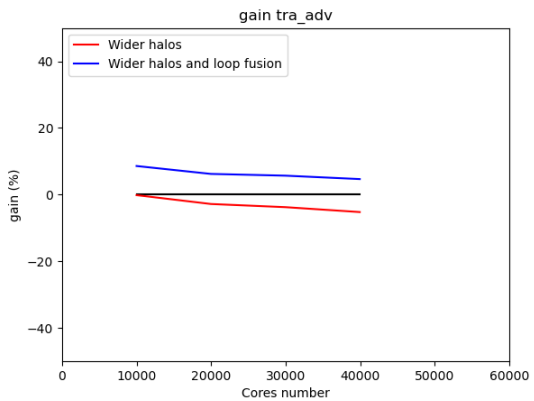


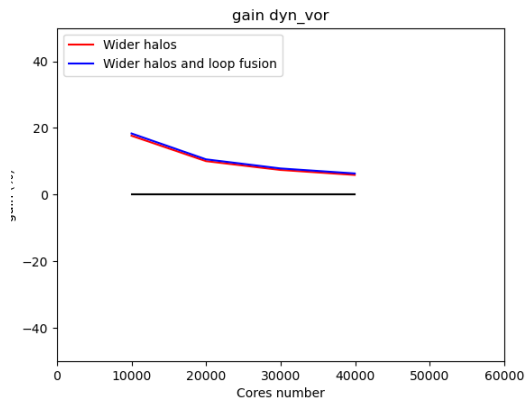


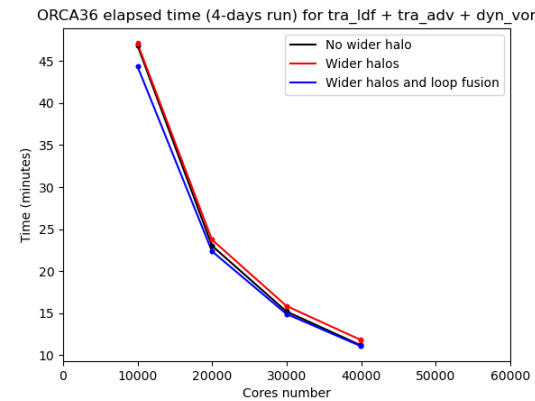


Gain % no wider halo and no loop fusion







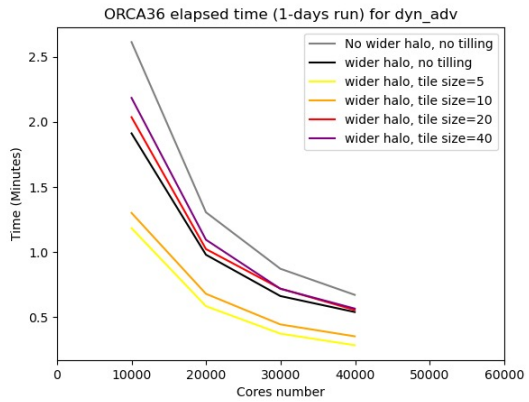


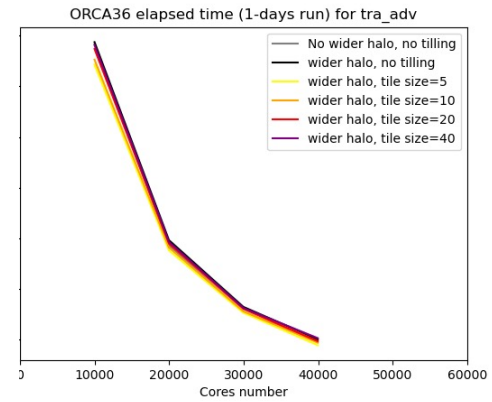
- Behaviour are diferrents for each routines
- For the total, Loop fusion improves performances only with lower cores numbers (as expected)
- Total = traldf + traadv + dynvor

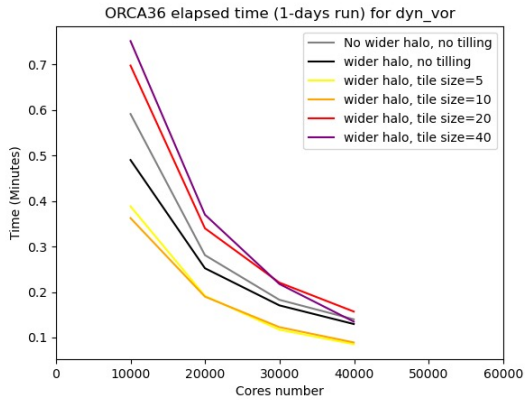
Tiling

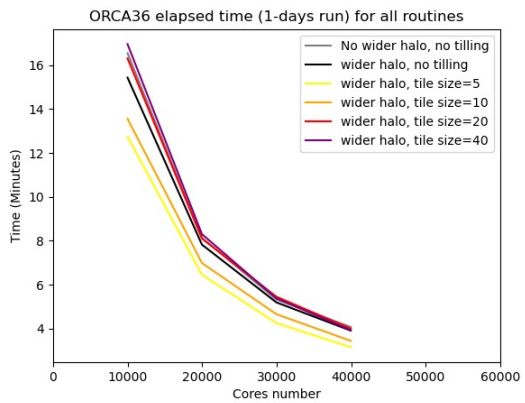
Dyn_adv | Trad_adv | Dyn_vor | Total

Elapsed time

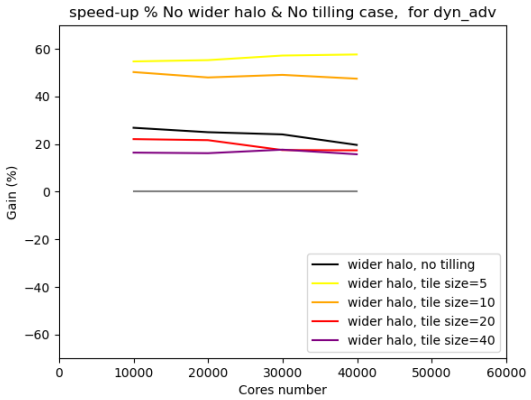


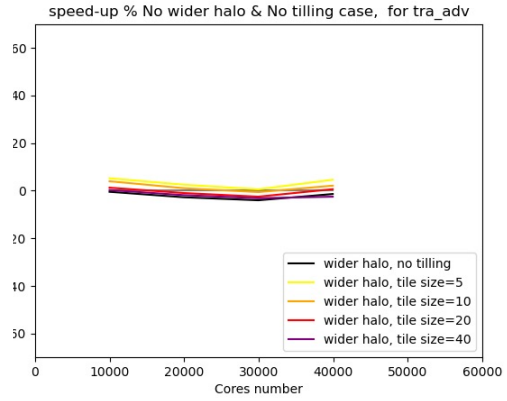


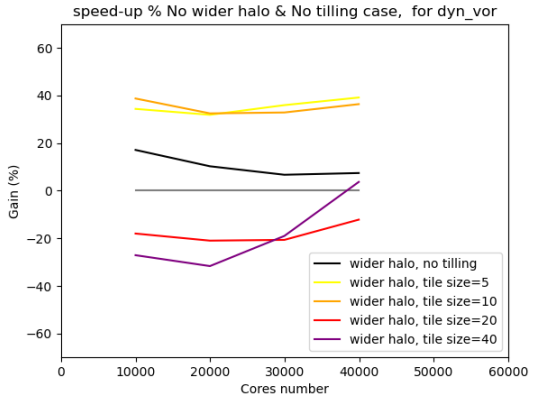


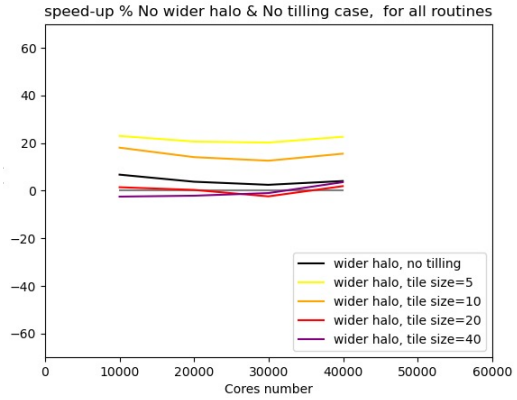


Gain % no wider halo and no tilling





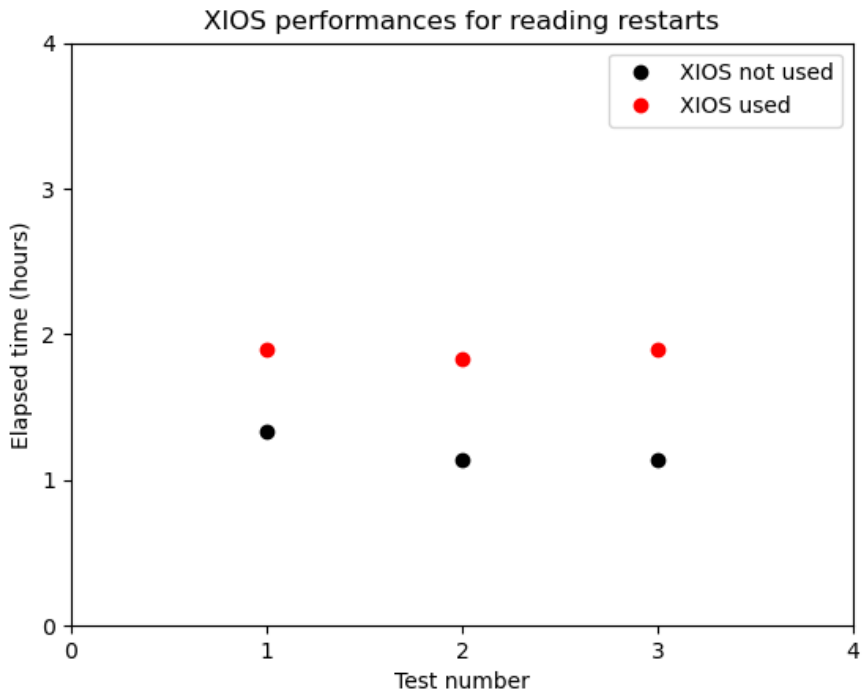




- Behaviour of tiling is not the same for all routines
- Tiling with little sizes (5,10) improves performances
- tilling improves performances with lower core numbers
- Total = "zdf_phy","dyn_adv","dyn_vor","dyn_hpg","tra_sbc","tra_qsr","tra_isf","tra_bbc","tra_adv","dom_qco_r3c

Use XIOS to read/write restart netcdf files

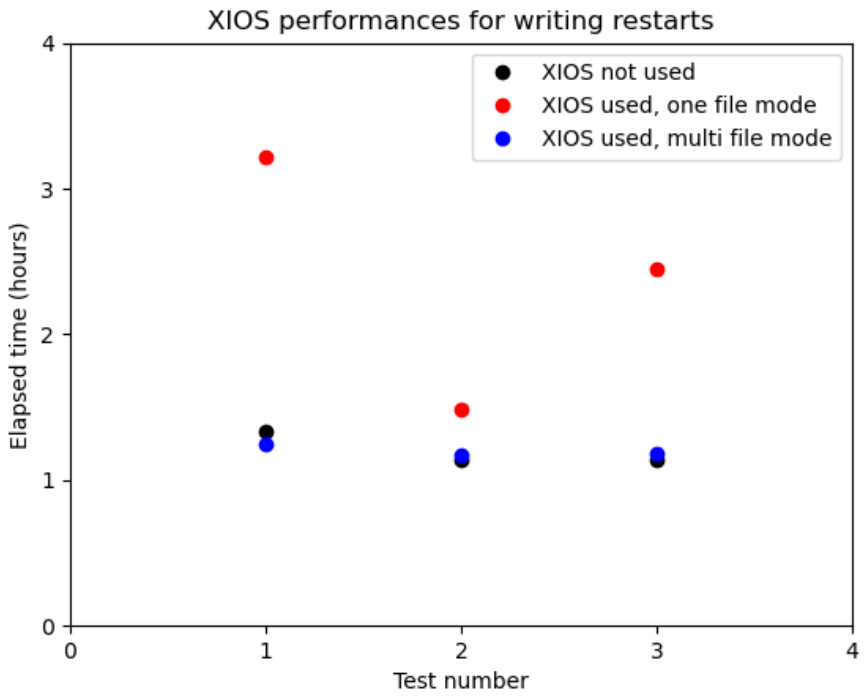
Reading restarts with XIOS



Using XIOS to read restart files degrads performances:

+ 56 % elapased time

Writing restarts with XIOS



Using XIOS to write restart files:

- No performances change in multiple file mode
- Strong degradation in one file mode : +98%