

Title:Parallel pimpleFoam calculation of channel flow with the mapped inlet condition is violated.

- Summary
 - This mesh model has two cellZones, one cellZone is used to develop the channel flow continuously with the set of cyclic boundary conditions, the other cellZone is used to calculate an arbitrary flow field with the mapped inlet flow condition connected with the above channel.
 - The single-core calculation of the mesh model mentioned above with pimpleFoam is successful, but the parallel calculation of the same model is violated.

Description(1)

- Set the pressure gradient to the cellZone of ELEMENTS1 with cyclic boundary conditions in order to develop the channel flow as follows,

system/fvOptions

```
momentumSource
{
    type      pressureGradientExplicitSource;
    active    on;
    selectionMode cellZone;
    cellZone ELEMENTS1;
```

0/p,U

```
in_cyc
{
    type      cyclic;
}
out_cyc
{
    type      cyclic;
}
```

Description(2)

- Set the mapped inlet condition of the other cellZone of ELEMENTS0 as follows, constant/polyMesh/boundary

```
MAPPED_INLET
{
    type            mappedPatch;
    inGroups        1(mappedPatch);
    sampleMode      nearestCell;
    sampleRegion     region0;
    samplePatch     none;
    offsetMode      uniform;
    offset          (-1 0 0);
```

0/U

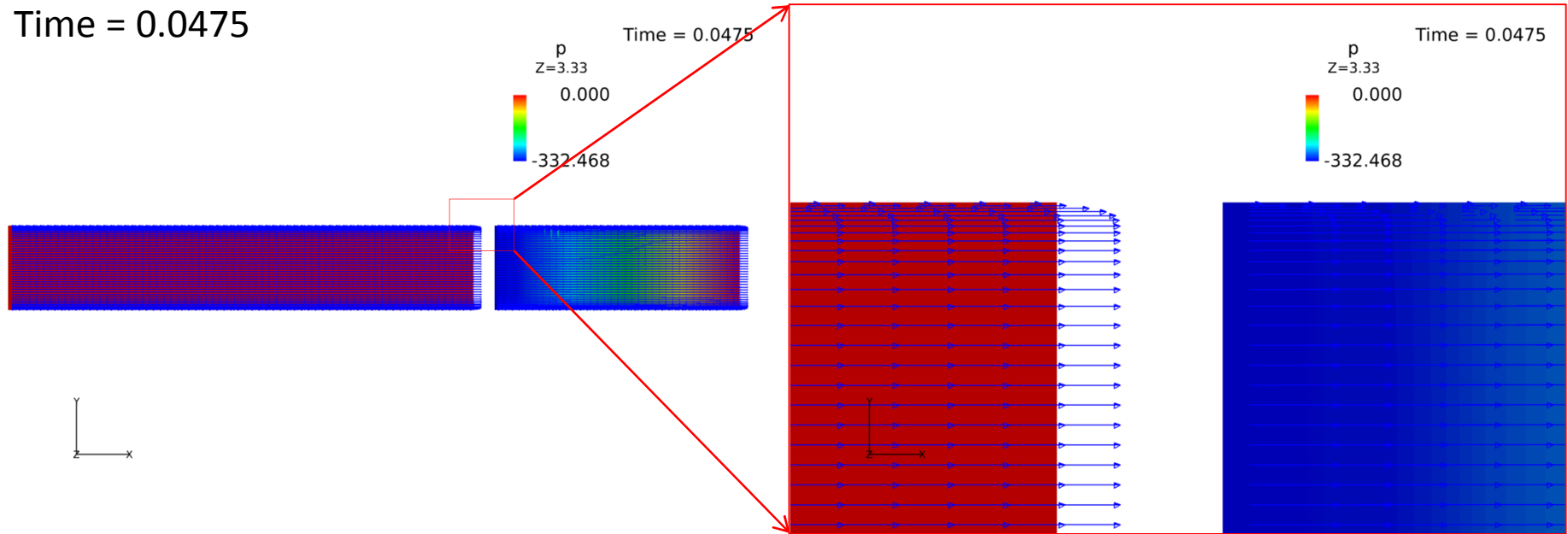
```
MAPPED_INLET
{
    type            mapped;
    interpolationScheme cell;
    setAverage      false;
    average         (0 0 0);
    value           uniform (0 0 0);
}
```

Description(3)

- The single-core pimpleFoam calculation of the mesh model with two cellZones mentioned above is success full, but the parallel pimpleFoam calculation is violated as the following figures.

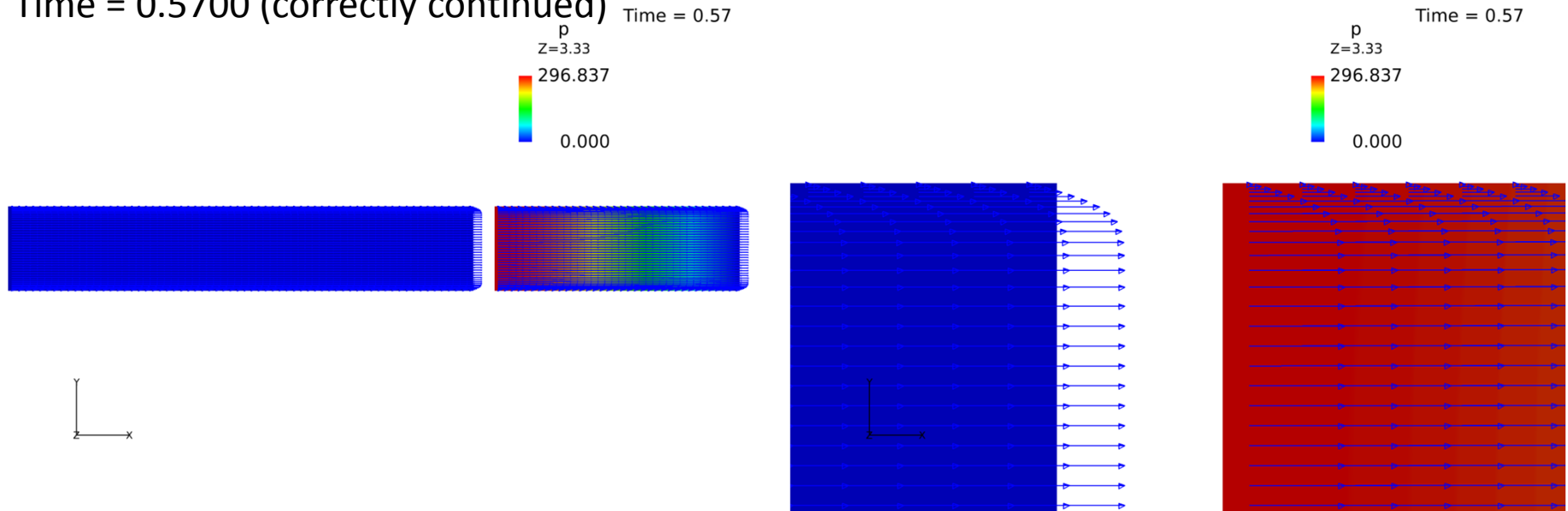
【Single calculation】

Time = 0.0475



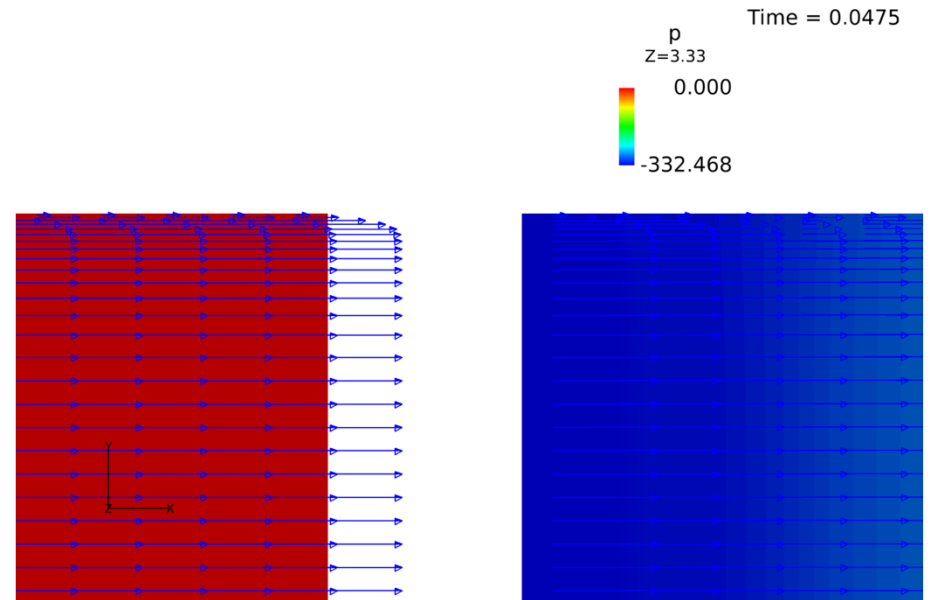
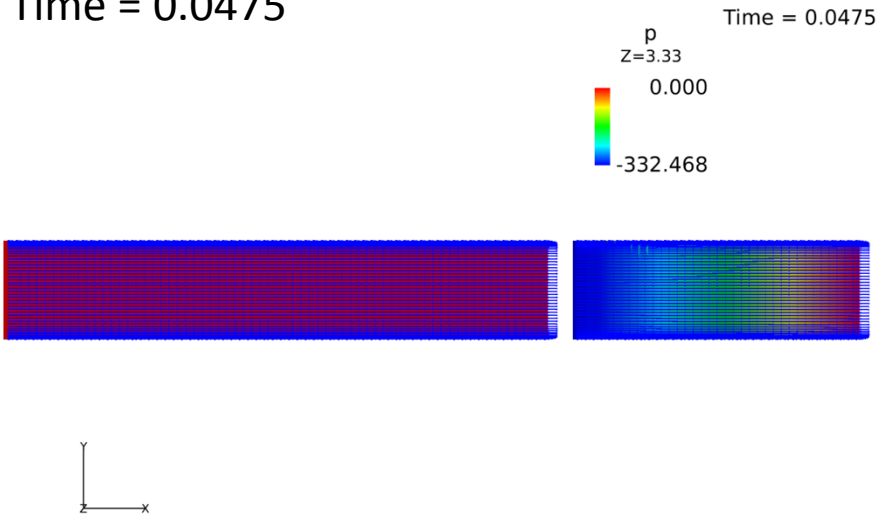
【Single calculation】-> successful

Time = 0.5700 (correctly continued)



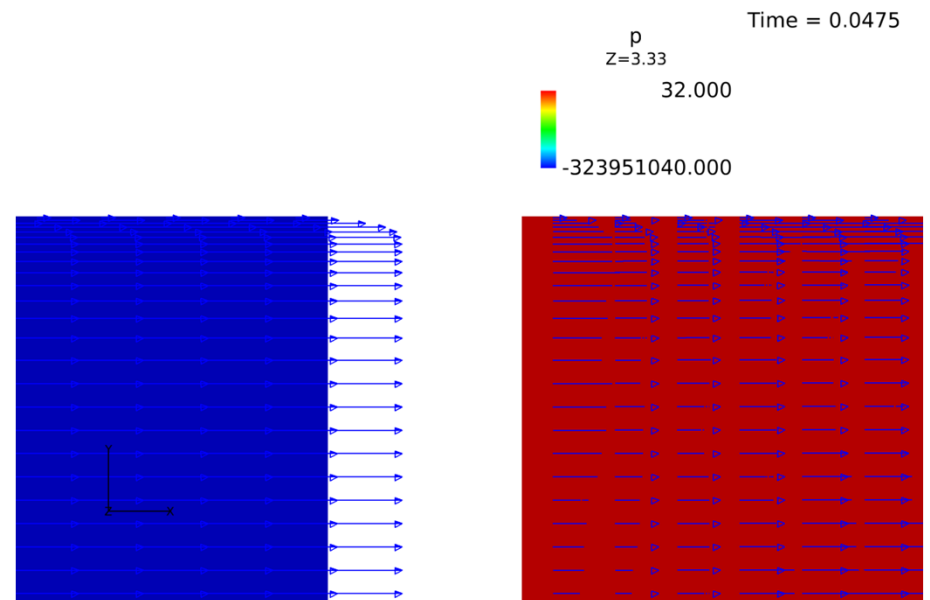
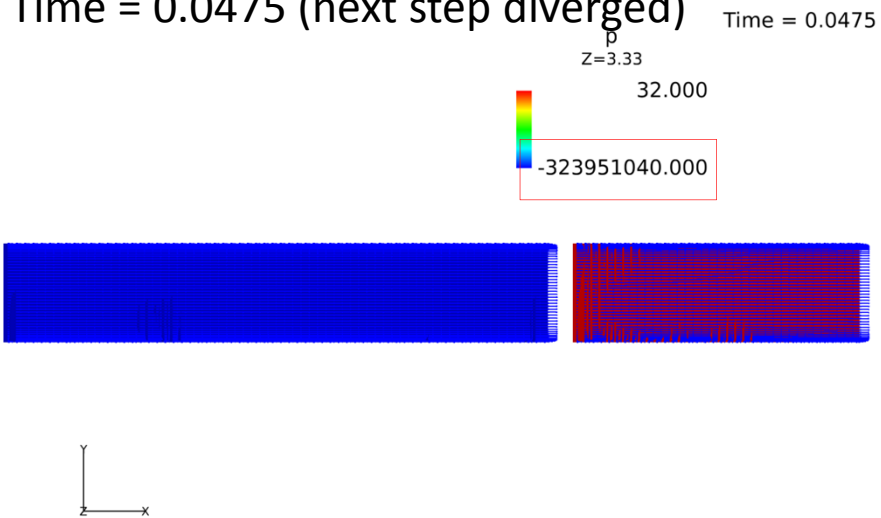
【Single calculation】

Time = 0.0475



【Parallel calculation】-> violated

Time = 0.0475 (next step diverged)



Description(4)

- The former figures are the series of the single calculation successfully continued up to Time=0.57, but the latter figures are the comparison of the single and parallel calculation at the Time=0.0475, when, in the case of parallel calculation, the next some steps will be diverged as follows.

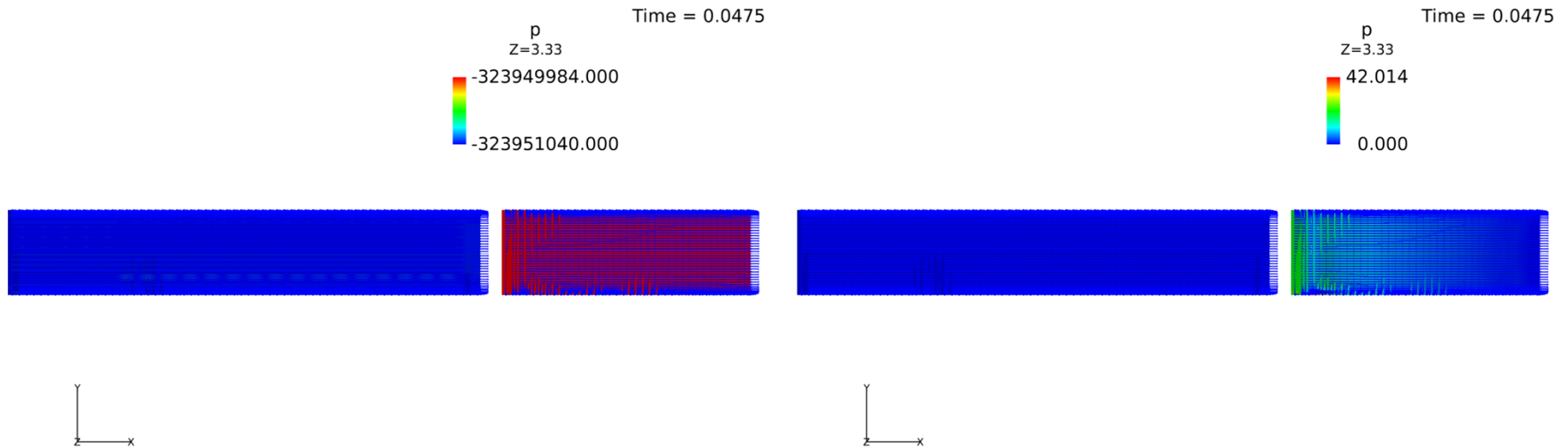
```

Courant Number mean: 0.271537 max: 1.72544↓
Time = 0.0475↓
↓
smoothSolver: Solving for Ux, Initial residual = 0.00419904, Final residual = 4.49285e-07, No Iterations 2↓
smoothSolver: Solving for Uy, Initial residual = 0.66742, Final residual = 1.11277e-06, No Iterations 3↓
smoothSolver: Solving for Uz, Initial residual = 0.569084, Final residual = 1.63568e-06, No Iterations 3↓
Pressure gradient source: uncorrected Ubar = 17.8572, pressure gradient = 3.72531↓
GAMG: Solving for p, Initial residual = 9.15237e-07, Final residual = 3.07539e-08, No Iterations 2↓
time step continuity errors : sum local = 2.75596e-05, global = 1.03371e-06, cumulative = -1.84951e-05↓
Pressure gradient source: uncorrected Ubar = 17.8572, pressure gradient = 3.72686↓
GAMG: Solving for p, Initial residual = 1.1002e-07, Final residual = 1.1002e-07, No Iterations 0↓
time step continuity errors : sum local = 9.85927e-05, global = 1.01051e-06, cumulative = -1.74846e-05↓
Pressure gradient source: uncorrected Ubar = 17.8572, pressure gradient = 3.72685↓
bounding k, min: 1.40748e-43 max: 3.02511 average: 0.226079↓
ExecutionTime = 44.72 s ClockTime = 62 s↓
↓
Courant Number mean: 0.271551 max: 4.97151↓
Time = 0.05↓
↓
smoothSolver: Solving for Ux, Initial residual = 0.00391087, Final residual = 2.17207e-06, No Iterations 2↓
smoothSolver: Solving for Uy, Initial residual = 0.688363, Final residual = 9.27912e-06, No Iterations 11↓
smoothSolver: Solving for Uz, Initial residual = 0.573055, Final residual = 9.62715e-06, No Iterations 10↓
Pressure gradient source: uncorrected Ubar = 17.8573, pressure gradient = 3.59775↓
GAMG: Solving for p, Initial residual = 1.06132e-06, Final residual = 3.56409e-08, No Iterations 2↓
time step continuity errors : sum local = 3.19379e-05, global = 4.71273e-07, cumulative = -1.70133e-05↓
Pressure gradient source: uncorrected Ubar = 17.8573, pressure gradient = 3.59993↓
GAMG: Solving for p, Initial residual = 1.38213e-07, Final residual = 1.38213e-07, No Iterations 0↓
time step continuity errors : sum local = 0.000123853, global = 4.48019e-07, cumulative = -1.65653e-05↓
Pressure gradient source: uncorrected Ubar = 17.8573, pressure gradient = 3.59995↓
bounding k, min: 7.26397e-43 max: 55.2259 average: 0.232145↓
ExecutionTime = 46.14 s ClockTime = 64 s↓
↓
Courant Number mean: 0.271564 max: 19.9281↓
Time = 0.0525↓
↓
[5] #0 Foam::error::printStack(Foam::Ostream&) in "/home/xxxxxx/OpenFOAM/OpenFOAM-2.3.x/platforms/linux64GccDI
[5] #1 Foam::sigFpe::sigHandler(int) in "/home/xxxxxx/OpenFOAM/OpenFOAM-2.3.x/platforms/linux64GccDP0pt/lib/
[5] #2 ↓
[5] at sigaction.c:0↓
[5] #3 Foam::symGaussSeidelSmoother::smooth(Foam::word const&, Foam::Field<double>&, Foam::lduMatrix const&, I
) in "/home/xxxxxx/OpenFOAM/OpenFOAM-2.3.x/platforms/linux64GccDP0pt/lib/libOpenFOAM.so"↓
[5] #4 Foam::symGaussSeidelSmoother::smooth(Foam::Field<double>&, Foam::Field<double> const&, unsigned char,
[5] #5 Foam::smoothSolver::solve(Foam::Field<double>&, Foam::Field<double> const&, unsigned char) const in "/

```

Additional Information(1)

- The following two figures show each pressure distribution of the two cellZones.



Additional Information(2)

- The parallel calculation of the only cyclic cellZone is successful as follows.

