

## 3D turbulent channel flow at $Re_{\tau} = 590$

**Author** : Y. Fraigneau CNRS-LIMSI (yann.fraigneau@limsi.fr)

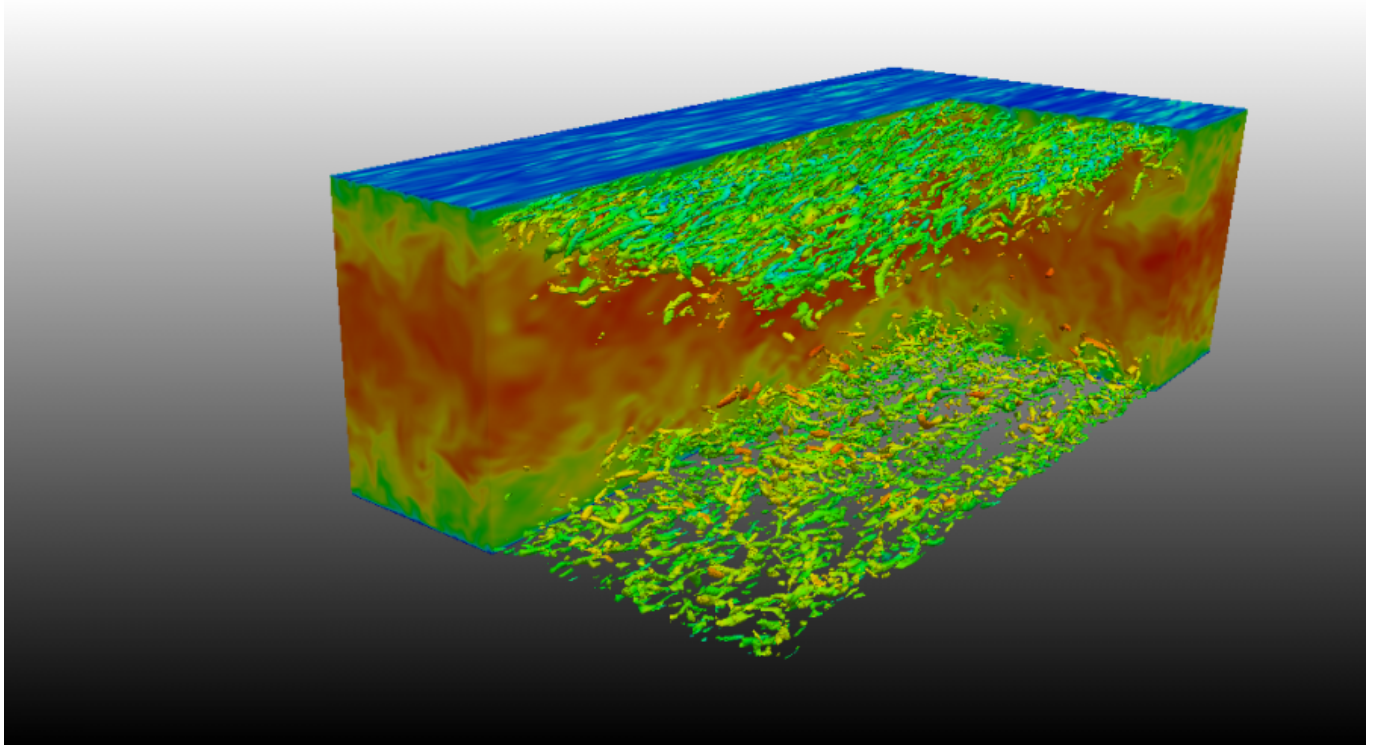
**Date** : May 2017

**Simulation type** : LES, Mansour's model ([Sunfluidh code](#))

**Location** : DATABASE\_CHANNELFLOW\_RETAU590\_LES

**Status** : Restricted access

**Data size** : ~ 5.1 To



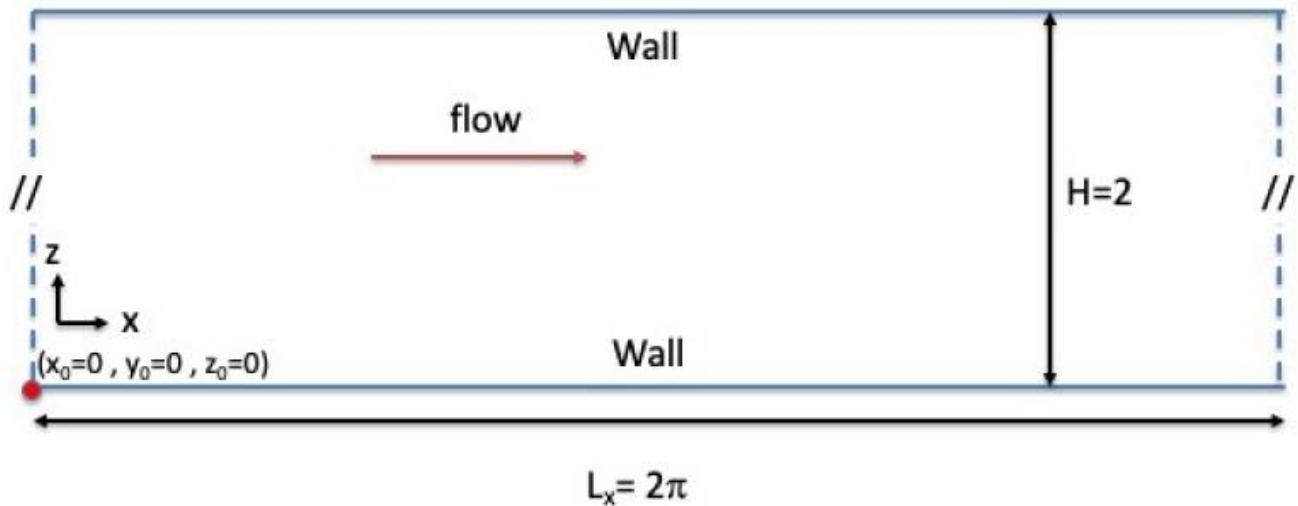
[Come back to first page](#)

---

**Simulation settings**

---

**2D sketch**



## Referential : cartesian geometry

1. axes :
  - $x(i)$  : downstream direction
  - $y(j)$  : spanwise direction
  - $z(k)$  : normal direction
2. origin :
  - $x_0 = 0$  : left down corner
  - $y_0 = 0$  : left down corner
  - $z_0 = 0$  : left down corner

## Reference scales

- Density : mass density of the fluid ( $\rho_0$ )
- Length : half height of the channel ( $h = \frac{H}{2} = 1$ )
- Velocity : wall friction velocity ( $u_*$ )
- Dynamic viscosity : dynamic viscosity of the fluid ( $\mu_0$ )
- Reynolds number :  $Re_H = \frac{\rho_0 \cdot u_* \cdot h}{\mu_0} = 590$

## Non-dimensionalised data

- velocity :  $U^* = \frac{U}{u_*}$
- density :  $\rho^* = \frac{\rho}{\rho_0} = 1$
- coordinates :  $x^* = \frac{x}{h}$ ,  $y^* = \frac{y}{h}$ ,  $z^* = \frac{z}{h}$

## Computational domain

1. **Domain scope**
  - Downstream direction ( $x$ ) :  $L_x^* = 2\pi$
  - Spanwise direction ( $y$ ) :  $l^* = \pi$
  - Normal direction ( $z$ ) :  $H^* = 2.0$
2. **Boundary conditions**

- Wall conditions : Top and low walls of the domain
- Periodicity : lateral ends of the domain in  $x$  and  $y$  directions
- 3. **Domain decomposition** (128 MPI subdomains)
  - Along the downstream direction : 8
  - Along the normal direction : 4
  - Along the spanwise direction : 4
- 4. **Spatial resolution**
  - Grid :  $32 \times 64 \times 64$  per subdomain (16.777.216 cells over the domain)
  - About cell-size
    - $\Delta x_{\min} = \Delta x_{\max} = 2.45437 \cdot 10^{-2}$  (downstream direction)
    - $\Delta y_{\min} = \Delta y_{\max} = 1.22718 \cdot 10^{-2}$  (spanwise direction)
    - $\Delta z_{\min} = 6 \cdot 10^{-4} \quad \Delta z_{\max} = 1.92765 \cdot 10^{-2}$  (normal direction)

[Come back to first page](#)

## Data Recording : information about data types

### • Time series from probes

- Physical quantities : velocity components along  $x$ ,  $y$  and  $z$  directions ( $u,v,w$ ) and pressure ( $p$ )
- 9 probes
- Time step= 0.001 time unit
- Time range : 16.64 to 199.44 time units
- Locations (In vertical plan at  $y=1.0$ )
  - $X_i = 1.00, X_j = 1.00, X_k = 0.10$  - MPI Subdomain ID : 20
  - $X_i = 1.00, X_j = 1.00, X_k = 0.25$  - MPI Subdomain ID : 21
  - $X_i = 1.00, X_j = 1.00, X_k = 0.50$  - MPI Subdomain ID : 21
  - $X_i = 1.00, X_j = 1.00, X_k = 0.75$  - MPI Subdomain ID : 21
  - $X_i = 1.00, X_j = 1.00, X_k = 1.00$  - MPI Subdomain ID : 21
  - $X_i = 1.00, X_j = 1.00, X_k = 1.25$  - MPI Subdomain ID : 22
  - $X_i = 1.00, X_j = 1.00, X_k = 1.50$  - MPI Subdomain ID : 22
  - $X_i = 1.00, X_j = 1.00, X_k = 1.75$  - MPI Subdomain ID : 22
  - $X_i = 1.00, X_j = 1.00, X_k = 1.90$  - MPI Subdomain ID : 23
- File name (per physical quantity):  $x\_ins\_yyyy.d$  with  $x = u,v,w,p$  and 'yyyy' the MPI subdomain ID

### • 3D snapshots

- Instantaneous fields : velocity components in  $x$ ,  $y$  and  $z$  directions ( $U,V,W$ ) and pressure ( $P$ )
- Recording rate : 0.01 time units
- Time range from from 16.64 to 199.44
- File name :  $res\_xxxx\_yyyyyy.d$  (xxxx : MPI subdomain ID, yyyyyy : Time ID)
  - MPI subdomain ID: from 0 to 127
  - Time ID : from 9 to 18288

### • Statistics

- fields : (i,j : indexes of direction x, y or z)
  - Mean fields of velocity components (<U<sub>i</sub>>) and pressure (<P>)
  - Mean fields of quadratic quantities (<P<sup>2</sup>>, <U<sub>i</sub>U<sub>j</sub>>)
  - Mean field of subgrid scale dynamic viscosity (mu\_sg)
  - Mean field of square mu\_sg (musg2)
- Time average computation
- Time startup = 20.0
- Time range per file = 5.0
- Total time range from 20.0 to 199.44
- file name : rst\_XXXXX\_YYYYYYY.d (XXXXX : MPI subdomain ID, YYYYYYY : Time ID)
  - MPI subdomain ID : from 0 to 127
  - Time ID : from 1 to 35

---

## Database organisation

---

**Data size** : ~ 5.1 To

**Main directory** :

/vol/DATABASE\_MECA/RESTRICTED\_ACCESS/DATABASE\_CHANNELFLOW\_RETAAU590\_LES

For more details about files, see the [the wiki doc of Sunfluidh](#)

## Directories & files

```
/GRID : contains all ASCII files about grid setup
input data file           : data_meshgen.d
report on grid features  : report_meshgen.d
grid files for sunfluidh: maillx.d, mailly.d, maillz.d
check files (ASCII)      : check_mesh_I.d, check_mesh_J.d, check_mesh_K.d
                          (3 columns : indices, cell-face coordinates,
cell size)
/DATASETUP               : ASCII files
input data file for sunfluidh : input3d.dat
/TIMESERIES : contains time series recorded over the time range [16.64 ;
199.44]
                        ASCII files : x_ins_yyyyy.d with x= u,v,w,p
                        time series files are sliced in storage directories CAS-
MPI200-n (n from 5 to 50)
/SNAPSHOTS : snapshots binary files res_XXXXX_YYYYYYY.d
            files stored in archive files : res_YYYYYYY.tar for each
time ID
/STATISTICS : statistics binary files files rst_XXXXX_YYYYYYY.d
            files stored in archive files : res_z.tar , z is an ID
number (from 1 to 35)
/RESTART_AR : backup/restart archive save.tar at time 199.44
/FROM_COMPUTATION : regroupes some directories and files related to the
simulation
```

directories : CAS-MPI128-n with n= 5 to 50 (from simulation 5 to 50)  
each directory contains files  
checkcalc\_00000.dat and checkdata\_00000.dat

[Come back to first page](#)

From:

<https://datasetmeca.lisn.upsaclay.fr/> - **CFD DATABASE**

Permanent link:

[https://datasetmeca.lisn.upsaclay.fr/doku.php?id=datasetmeca:chflow\\_1&rev=1606149761](https://datasetmeca.lisn.upsaclay.fr/doku.php?id=datasetmeca:chflow_1&rev=1606149761)

Last update: **2020/11/23 17:42**

