

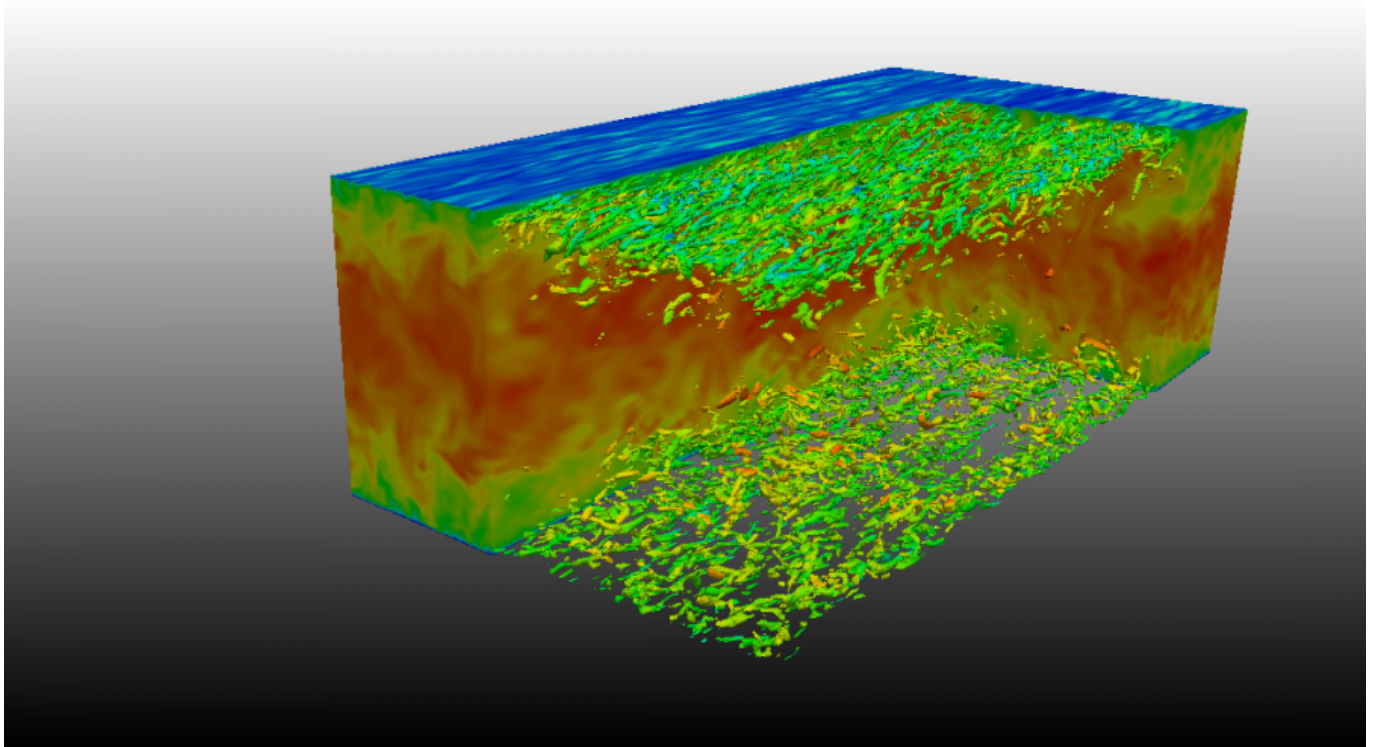
3D turbulent channel flow at $Re_{\tau} = 180$

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Location : DATABASE_CHANNELFLOW_RETAU180_DNS

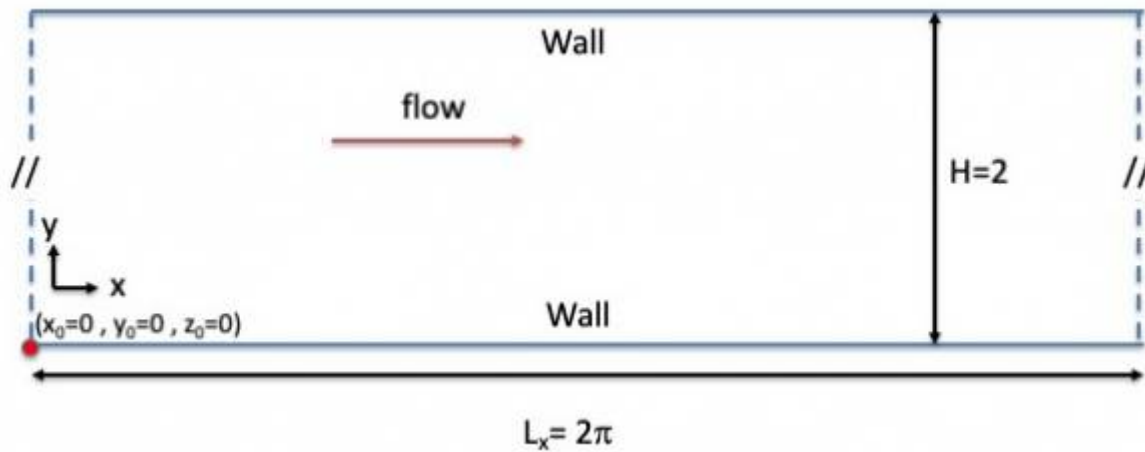
Simulation type : DNS ([Sunfluidh code](#))



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Simulation settings

2D sketch



Referential : cartesian geometry

1. axes :
 - $x(i)$: downstream direction
 - $y(j)$: normal direction
 - $z(k)$: spanwise 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 (ρ_0)
- Length : half height of the channel ($h = \frac{H}{2} = 1$)
- Velocity : wall friction velocity (u_*)
- Dynamic viscosity : dynamic viscosity of the fluid (μ_0)
- Reynolds number : $Re_H = \frac{\rho_0 \cdot u_* \cdot h}{\mu_0} = 180$

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) : $L_x^* = 2\pi$
 - Normal direction (y) : $H^* = 2.0$
 - Spanwise direction (z) : $L^* = \pi$
2. **Boundary conditions**
 - Wall conditions : Top and low walls of the domain

- Periodicity : lateral ends of the domain in x and z directions

3. Spatial resolution :

- Grid : $96 \times 128 \times 96$ per subdomain (1.179.648 cells over the domain)
- About cell-size
 - $\Delta x_{\min} = \Delta x_{\max} = 6.545 \times 10^{-2}$ (downstream direction)
 - $\Delta y_{\min} = 2.780 \times 10^{-4}$ quad $\Delta y_{\max} = 3.088 \times 10^{-2}$ (normal direction)
 - $\Delta z_{\min} = \Delta z_{\max} = 3.2725 \times 10^{-2}$ (normal direction)

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)
- 7 probes
- Time step = 0.0126 time unit
- Time range : 97.09 to 301.09 time units
- Locations (In vertical plan at $z=1.57$)
 - $X_i = 3.14, X_j = 0.25, X_k = 1.57$
 - $X_i = 3.14, X_j = 0.75, X_k = 1.57$
 - $X_i = 3.14, X_j = 1.00, X_k = 1.57$
 - $X_i = 3.14, X_j = 1.25, X_k = 1.57$
 - $X_i = 3.14, X_j = 1.50, X_k = 1.57$
 - $X_i = 3.14, X_j = 1.75, X_k = 1.57$

- File name (per physical quantity): $x_ins_00000.d$ with $x = u, v, w, p$

• 3D snapshots

- Instantaneous fields : velocity components in x , y and z directions (U, V, W) and pressure (P)
- Recording rate : 0.3 time units
- Time range from 97.39 to 301.09 time units
- File name : $res_xxxxx_yyyyyy.d$ (xxxxx : MPI subdomain ID, yyyyyy : Time ID)
 - MPI subdomain ID: 0
 - Time ID : from 11 to 690

• Statistics

- fields : (i, j : indexes of direction x , y or z)
 - Mean fields of velocity components ($\langle U_i \rangle$) and pressure ($\langle P \rangle$)
 - Mean fields of square quantities ($\langle P^2 \rangle$, $\langle U_i U_j \rangle$)
- Time average computation
- Time startup = 100.0 time units
- Time range per file = 25.0 time units
- Total time range from 100.0 to 300 time units
- file name : $rst_xxxxx_yyyyyy.d$ (xxxxx : MPI subdomain ID, yyyyyy : Time ID)
 - MPI subdomain ID : 0
 - Time ID : from 1 to 35

Database organisation

Data size : ~ 5.1 To

Main directory :

/vol/DATABASE_MECA/RESTRICTED_ACCESS/DATABASE_CHANNELFLOW_RETAU590_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 301.09
/FROM_COMPUTATION : regroups some files related to the simulation :
checkcalc_000000.dat and checkdata_000000.dat
```

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