

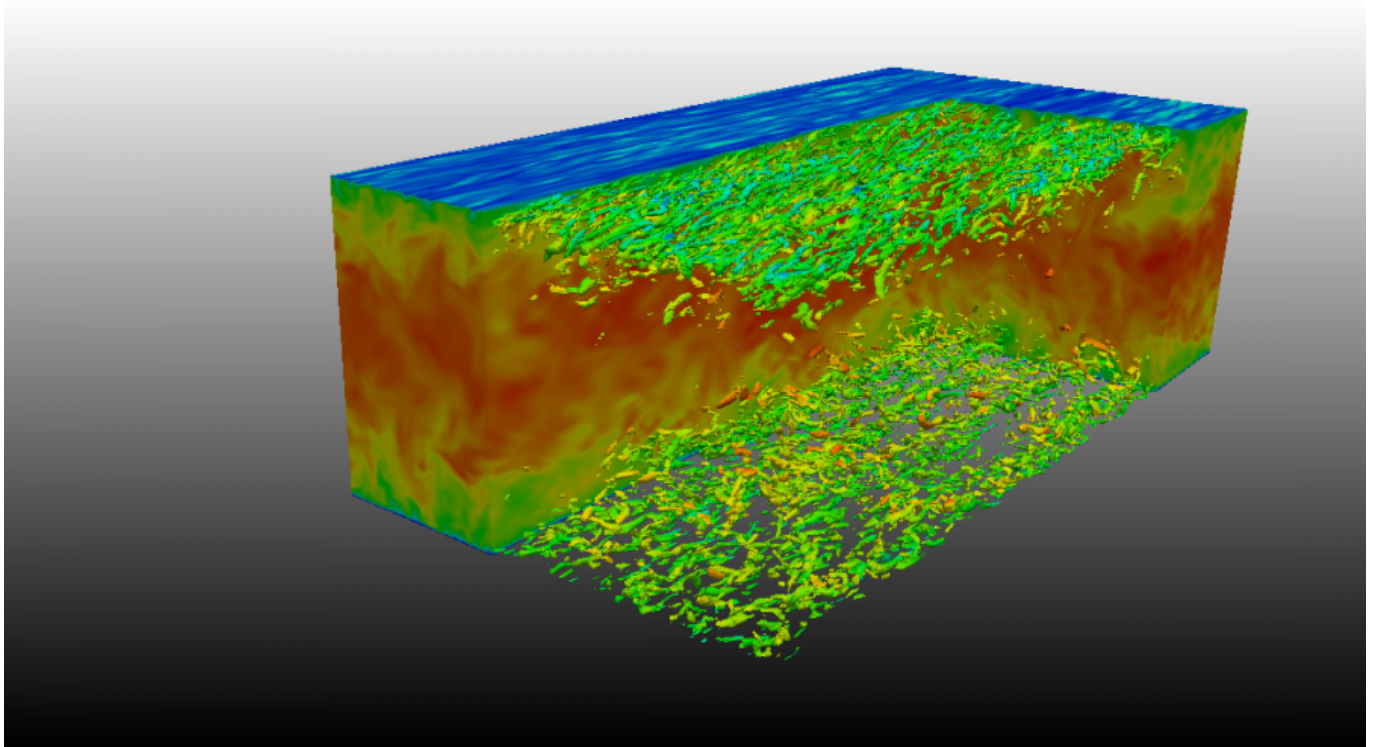
3D turbulent channel flow at $Re_{\tau} = 180$

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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 : $Re_H = \frac{\rho_0 u_* h}{\mu_0} = 180$

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
 - $\Delta x_{\min}^* = \Delta x_{\max}^* = 6.545 \cdot 10^{-2}$ (downstream direction)
 - $\Delta y_{\min}^* = 2.780 \cdot 10^{-4}$ $\Delta y_{\max}^* = 3.088 \cdot 10^{-2}$ (normal direction)
 - $\Delta z_{\min}^* = \Delta z_{\max}^* = 3.2725 \cdot 10^{-2}$ (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)
- 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 ($\langle U_i \rangle$) and pressure ($\langle P \rangle$)
 - Mean fields of square quantities ($\langle P^2 \rangle$, $\langle U_i U_j \rangle$)
 - Mean field of subgrid scale dynamic viscosity (μ_{sg})
 - Mean field of square μ_{sg} (μ_{sg}^2)
 - Time average computation
 - Time startup = 20.0
 - Time range per file = 5.0
 - Total time range from 20.0 to 199.44
 - file name : $rst_xxxx_yyyyyy.d$ (xxxx : MPI subdomain ID, yyyyyy : 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_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 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
```

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