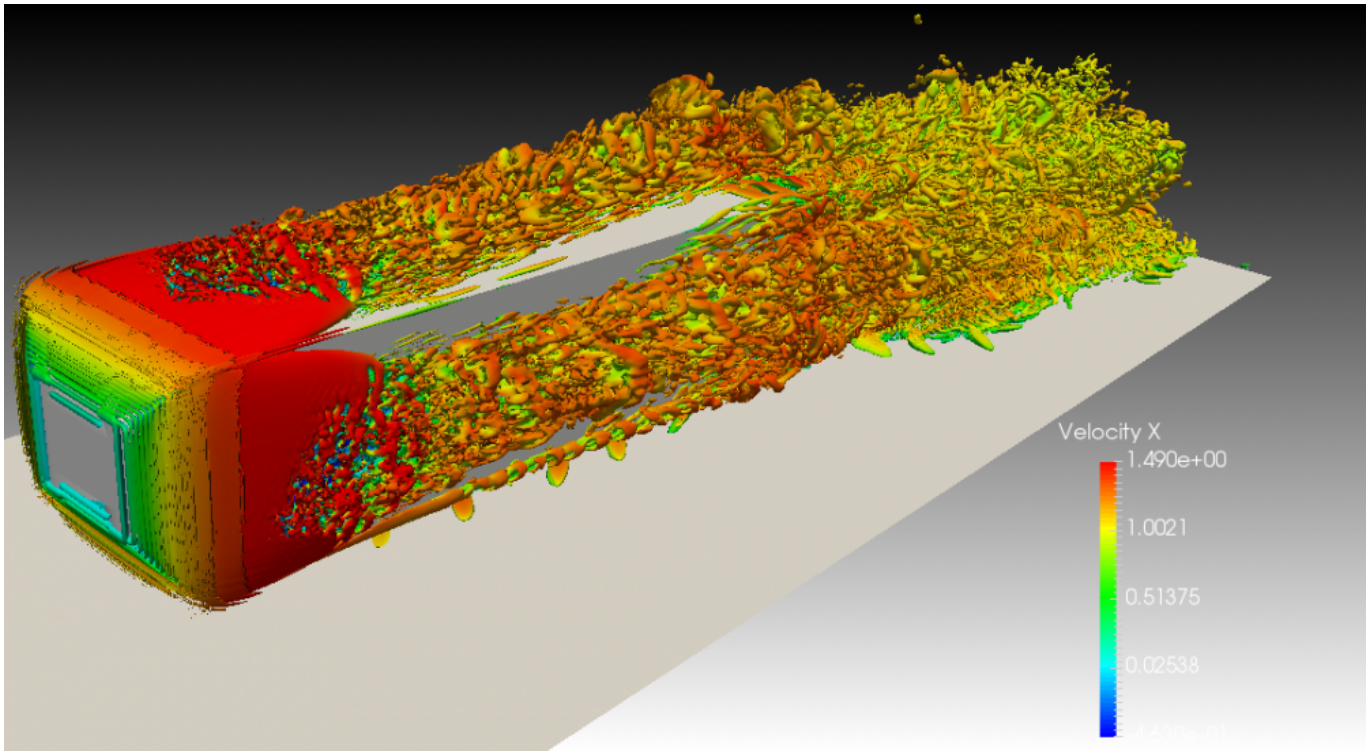
3D AHMED-BODY FLOW at $Re_H= 10000$

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Date : July 2018
Simulation type : DNS (Sunfluidh code) **Location** : DATABASE_AHMEDBODY_RE10000_DNS
Status : Restricted access

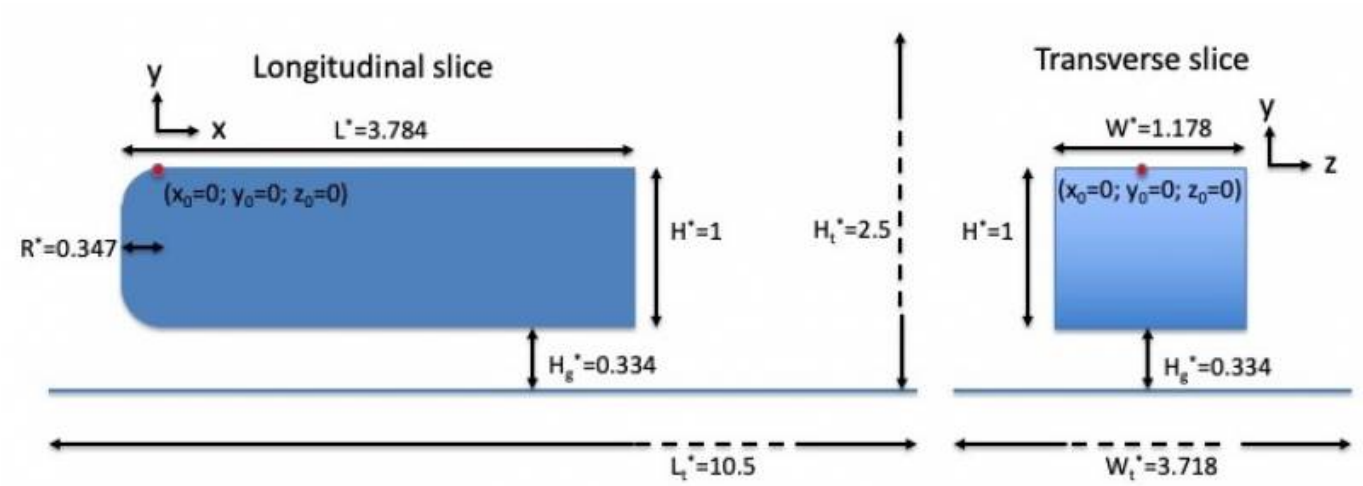


Videos are available here

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Simulation settings

2D Sketch



Referential : cartesian geometry

1. axes :
    - x : downstream direction
    - y : normal direction
    - z : spanwise direction
2. origin :
    - $x_0= 0$: upstream edge of Ahmed body top
    - $y_0= 0$: Ahmed body top
    - $z_0= 0$: mid-span of domain

Reference scales

- Density : mass density of the fluid (ρ_0)
- Length : Ahmed body height (H)
- Velocity : inlet bulk velocity (U_0)
- Dynamic viscosity : dynamic viscosity of the fluid (μ_0)
- Reynolds number : $Re_H= \frac{\rho_0.U_0.H}{\mu_0}= 10000$

Non-dimensionalised data

- velocity : $U^*=\frac{U}{U_0}$
- density : $\rho^*= \rho/\rho_0= 1$
- coordinates : $x*=\frac{x}{H}$, $y^*=\frac{y}{H}$, $z^*=\frac{z}{H}$

Computational domain

1. **Domain scope**
    - Downstream direction(x) : $L_t^*= 10.5$
    - Normal direction (y) : $H_t^*= 2.5$
    - Spanwise direction (z) : $W_t^*= 3.718$
    - Ahmed body size : $L^*\times W^*\times H^* = 3.784 \times 1.178 \times 1$
    - Quarter rounded edges radius around the front face of the body : $R^*=0.347$

- Ground clearance : $Hg^*= 0.334$

2. **Boundary conditions**
   - Inlet : Uniform profile at $X_{in}^*= -1.0$
   - Outlet : Orlansky's type at $X_{out}^*= 9.5$
   - Wall conditions : Ahmed body, top and low walls of the domain
   - Symmetry : lateral ends of the domain
3. **Spatial resolution** :
   - Grid : $512 \times 256 \times 256$ (33.554.432 cells)
   - About cell-size
     - $\Delta x_{min}^*= 1 \, 10^{-1} \quad \Delta x_{max}^*= 3.03588 \,10^{-2}$ (downstream direction)
     - $\Delta y_{min}^*= 2 \, 10^{-3} \quad \Delta y_{max}^*= 4.12564 \,10^{-2}$ (normal direction)
     - $\Delta z_{min}^*= 2 \, 10^{-3} \quad \Delta z_{max}^*= 4.59486 \,10^{-2}$ (spanwise direction)

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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)
  - 3 probes
  - Time step= $5.5 \,10^{-3}$ time unit
  - Time range : 71 to 303 and 343 to 353 time units
  - Locations (In horizontal mid-plan of the body wake)
    - Xi= 4.384 , Xj=-0.5 , Xk= 0.3
    - Xi= 4.384 , Xj=-0.5 , Xk= 0.0
    - Xi= 4.384 , Xj=-0.5 , Xk=-0.3
  - File name (per physical quantity): x_ins_00000.d with x= u,v,w,p
- **3D snapshots**
  - Instantaneous fields : velocity components along x,y and z directions (U,V,W) and pressure (P)
  - Recording rate : 0.5 time unit
  - Time range from from 185 to 638 time units
  - File name : res_xxxxx_yyyyyyy.d (xxxxx : MPI subdomain ID, yyyyyyy : Time ID)
    - MPI subdomain ID= 0 (No domain decomposition)
    - Time ID : 178 to 1084
- **Statistics**
  - fields : (i,j : indexes of direction x, y or z)
    - Mean fields of velocity components (<Ui>) and pressure (<P>)
    - Mean fields of quadratic quantities (<P2>, <UiUj>)
  - Time startup = 43 time units
  - Time range per file = 10 time units
  - Total time range from 43 to 633 time units

- file name : rst_xxxxx_yyyyyyy.d (xxxxx : MPI subdomain ID, yyyyyyy : Time ID)
  - MPI subdomain ID= 0 (No domain decomposition)
  - Time ID : 1 to 59

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Database organisation

Data size : ~ 609 Gb
Main directory :
/vol/DATABASE_MECA/RESTRICTED_ACCESS/DATABASE_AHMEDBODY_RE10000_DNS
For more details about files, see the wiki doc of Sunfluidh

Directories & files

```
  /GRID : contains all 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       : it contains input data file for sunfluidh : input3d.dat
  /TIMESERIES : contains time series recorded from probes
                /TIMESERIES_T071-305  : from time= 71 to 303 time units
                /TIMESERIES_T343-533  : from time=343 to 533 time units
                /TIMESERIES_T533-638  : from time=533 to 638 time units
                 ASCII files : x_ins_00000_full.d   with x= u,v,w,p
                also contains the space-averaged kinetic energy
                from time=326 to 561 (time step : 2.55D-02)
                ASCII file : space_averaged_ke.d
  /SNAPSHOTS  : snapshots binary files res_xxxxx_yyyyyyy.d
  /STATISTICS : statistics binary files rst_xxxxx_yyyyyyy.d
  /RESTART_AR : backup/restart archives save_t318.tar, save_t518.tar,
save_t638.tar
                contains any file to resume the simulation at time = 318,
518 and 638 time units
  /FROM_COMPUTATION : regroup some directories and files related to the
simulation
  /SLICES     : slices ... not documented  (old study)
                Binary files : plan_id_dir_xxxxx_yyyyyyy.d
               (nn : slice ID, dir : orientation, xxxxx : MPI subdomain ID,
yyyyyyy : Time ID)
```

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