

# Results from HPCMP CREATE™-AV COFFE for TGV and Tandem Spheres



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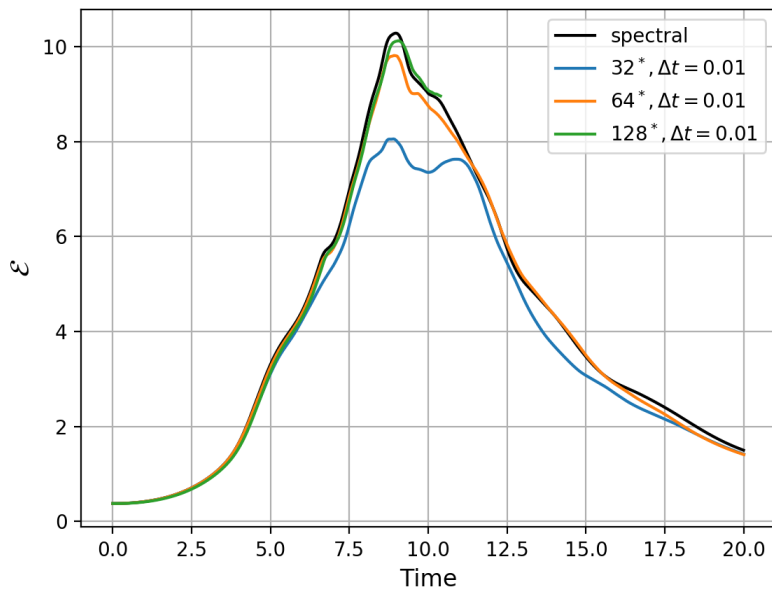
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**Pointwise, Inc.**

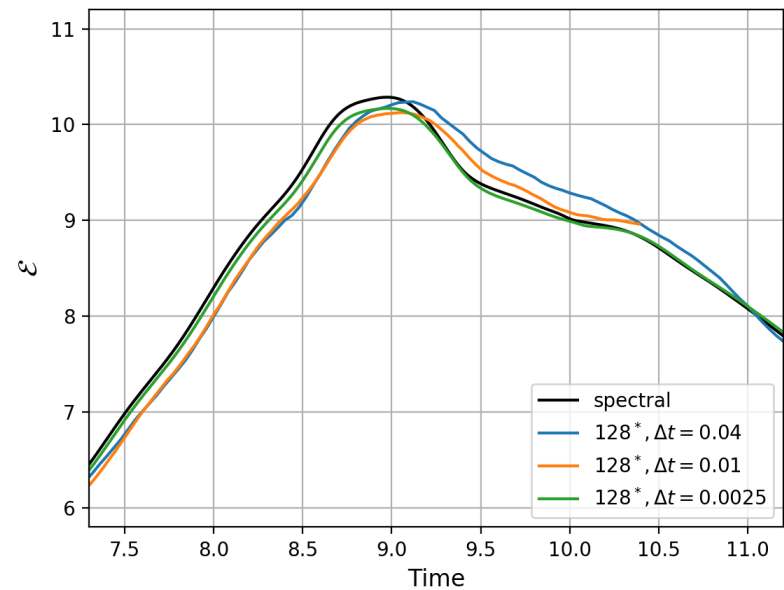
# Taylor Green Vortex

- **Conditions: Mach = 0.1, Re = 1,600**
- **Spatial Discretization: P2 SU/PG**
- **Temporal Discretization: SDIRK4**
- **$\Delta t = 0.04, 0.01, 0.0025$  (non-dimensionalized by  $L / V$ )**
- **Cartesian hexahedral meshes**
- **Cells:  $32^3, 64^3, 128^3$**
- **Symmetry plane BC's – H. Atkins (AIAA 2016)**
  - Computational domain:
  - $0 \leq x, y, z \leq \pi * L$

# TGV – Enstrophy integrated over the domain

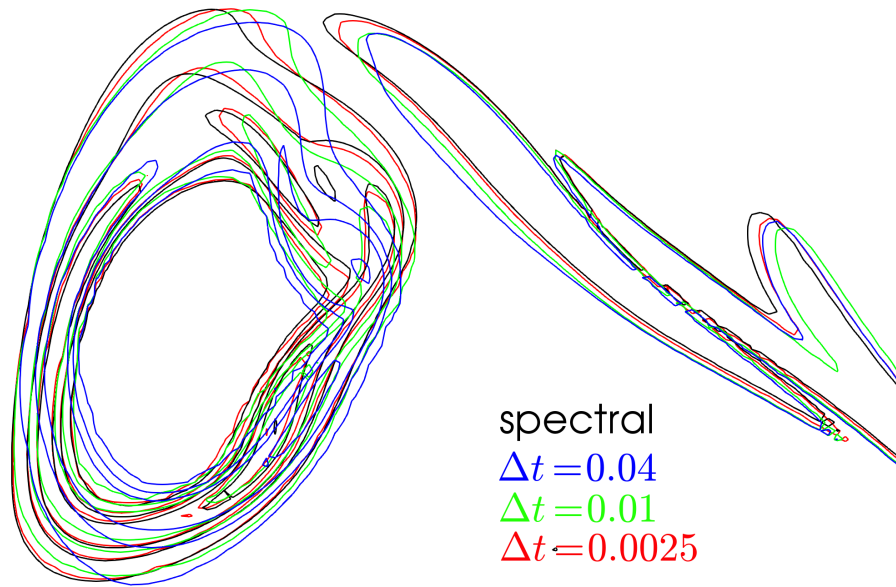


$dt = 0.01$

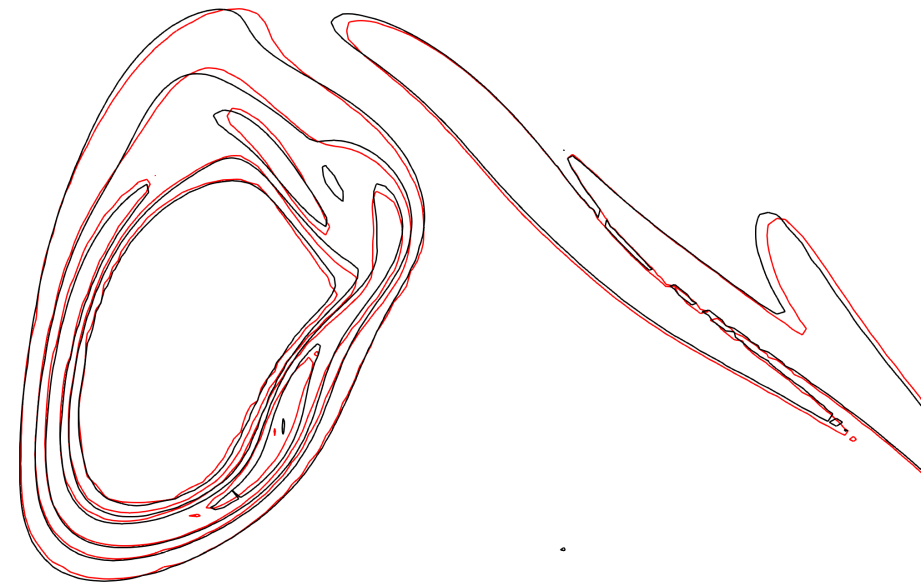


$128^3$  grid,  $dt = 0.04, 0.01, 0.0025$

# TGV – $T^* = 8$ Contour

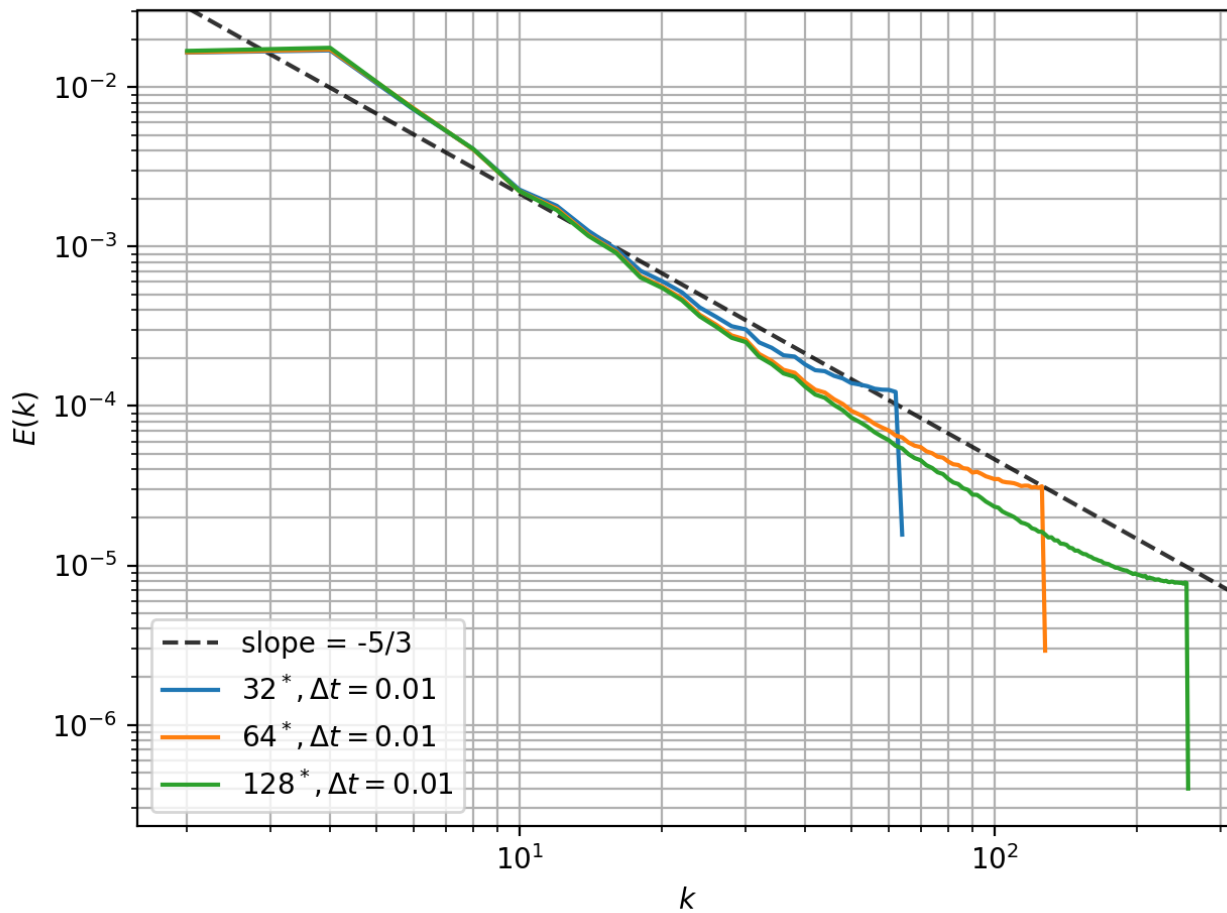


$128^3$  grid,  $dt = 0.04, 0.01, 0.0025$



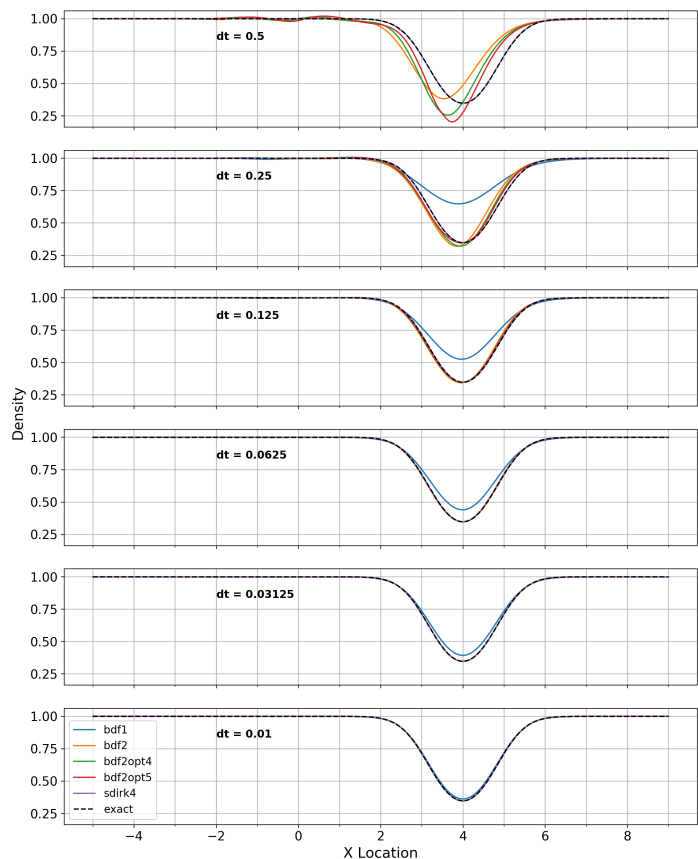
$128^3$  grid,  $dt = 0.0025$

# TGV – Energy Spectra



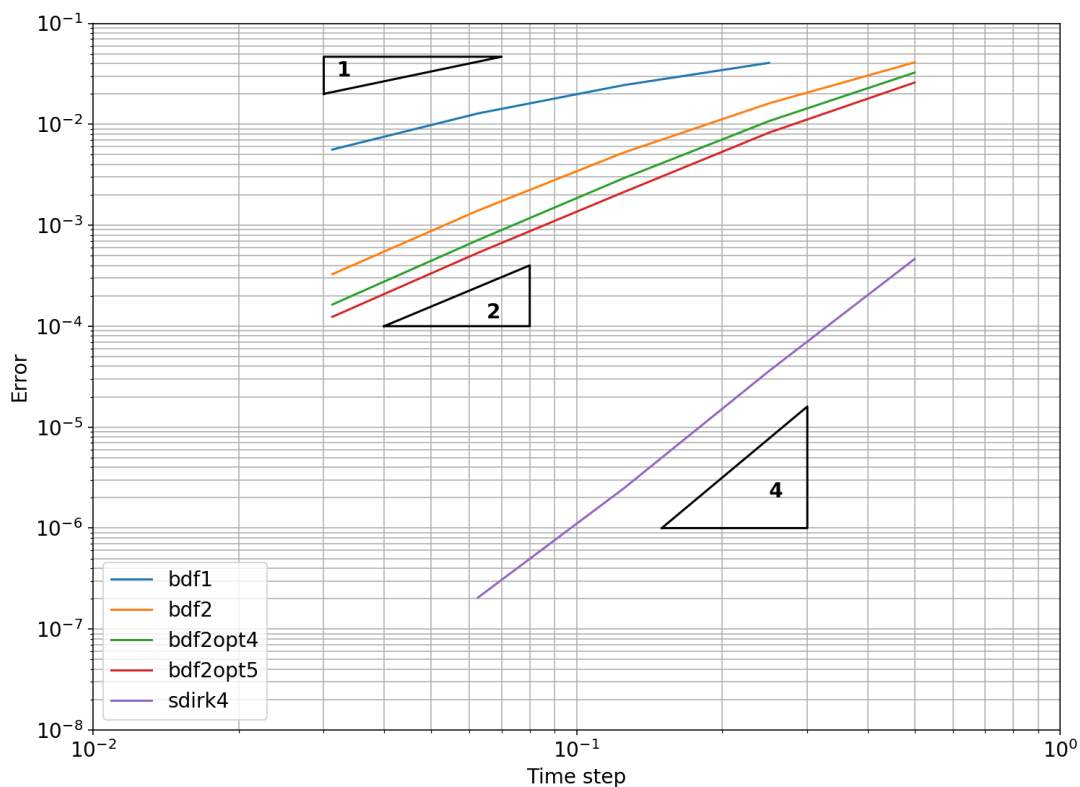
All grids,  $dt = 0.01$

# Time integration schemes – Convecting Vortex



Density at  $T = 4$  Euler Vortex

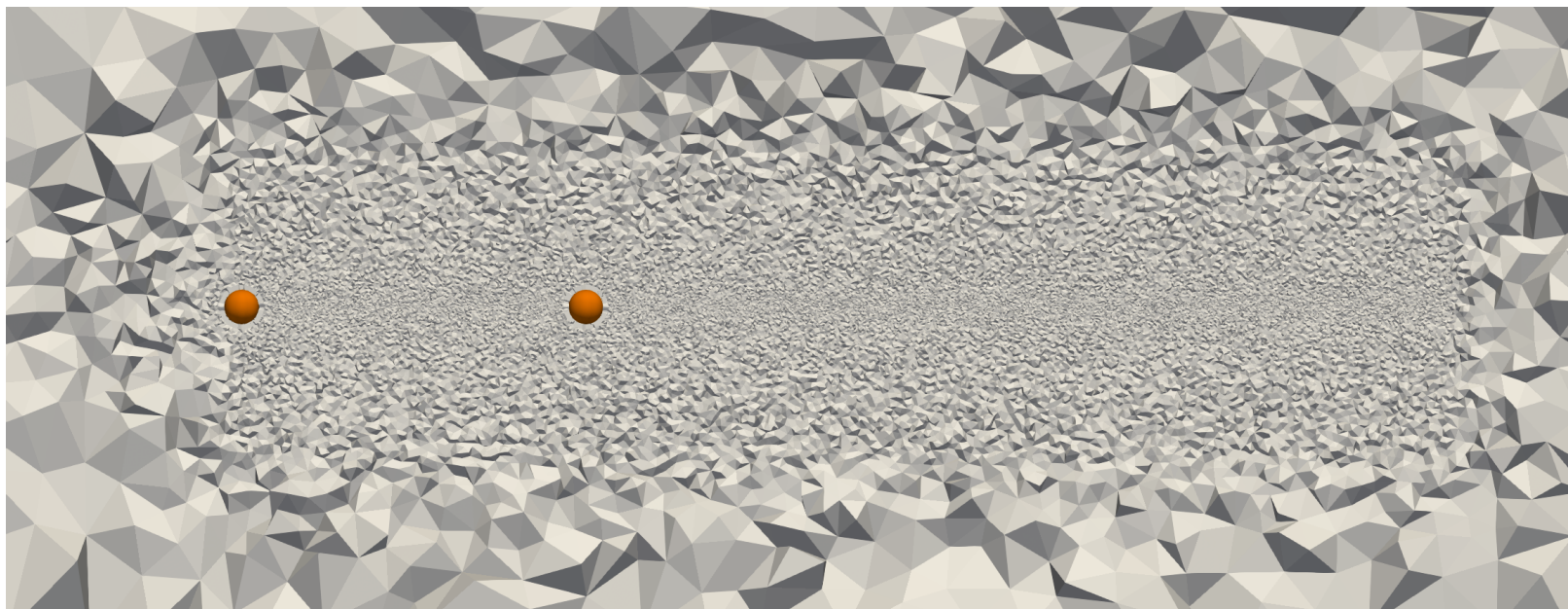
# Time integration schemes – Convecting Vortex



Temporal Order of Accuracy Euler Vortex

# Tandem Spheres

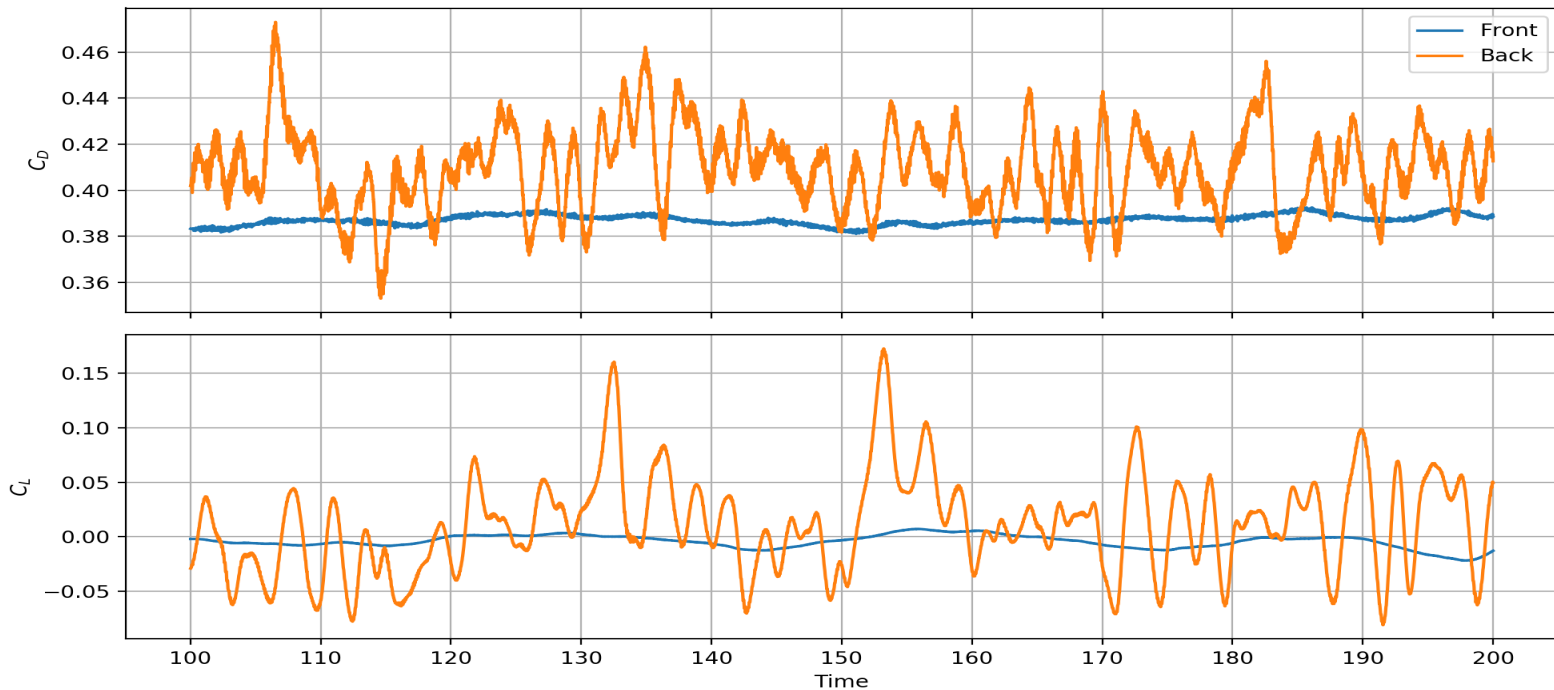
- **Conditions: Mach = 0.1, Re = 3,900**
- **Spatial Discretization: P2 SU/PG**
- **Temporal Discretization: SDIRK4**
- **$\Delta t = 0.01$  (non-dimensionalized by  $L / V$ )**
- **Tetrahedral Mesh 4, Steve Karman, 9.25 million nodes**



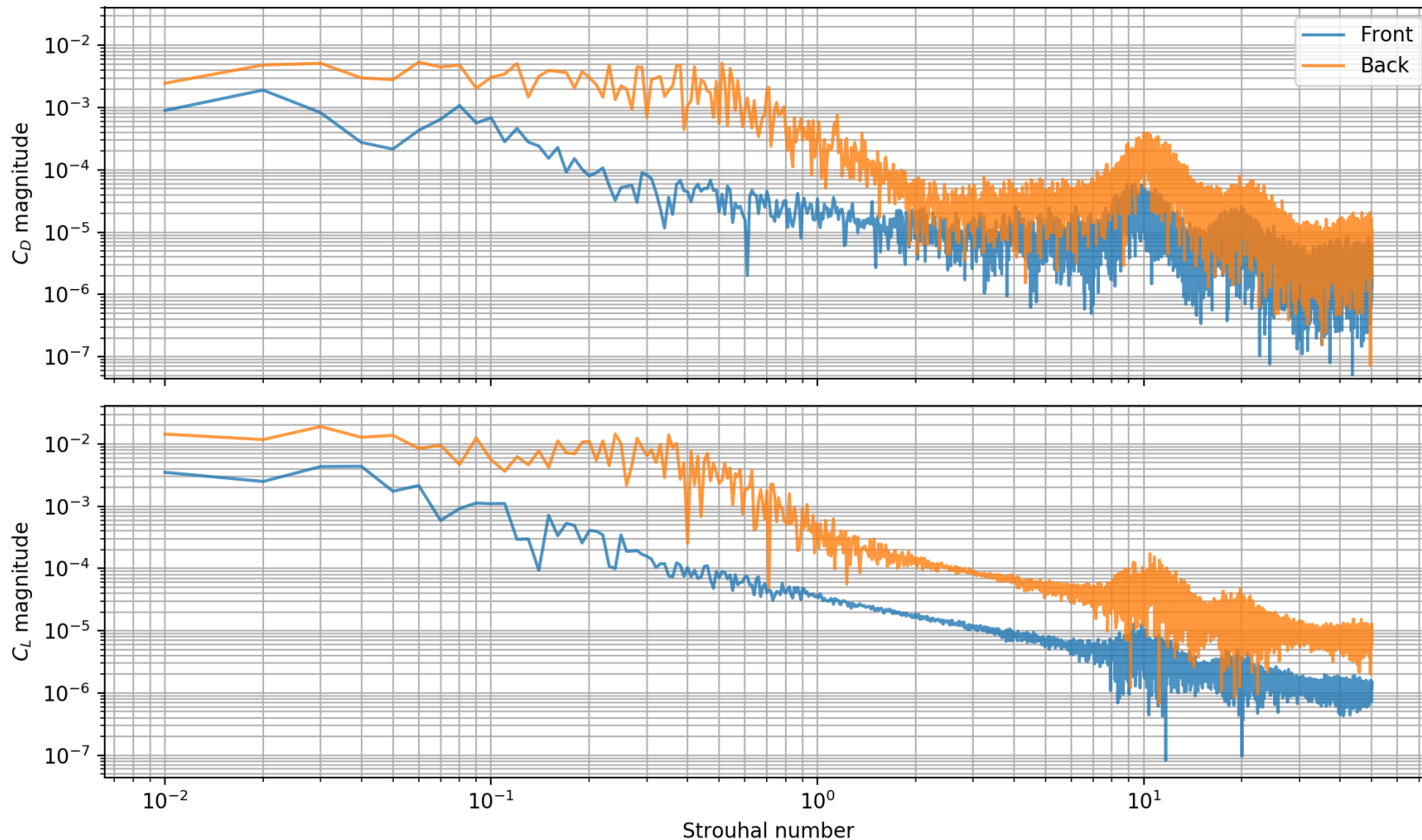


# Tandem Spheres

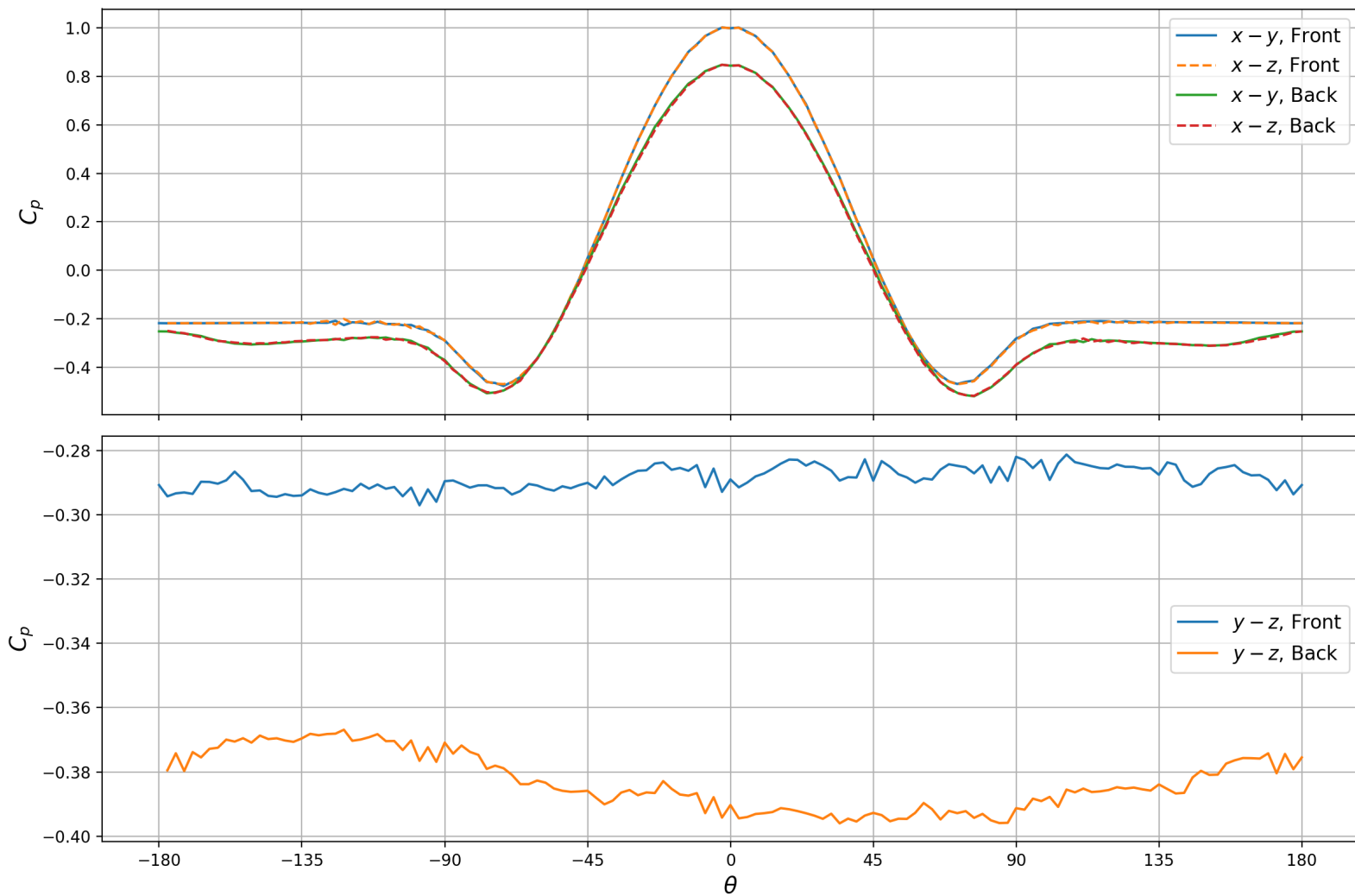
- **Mean/RMS Drag**
- **1<sup>st</sup> Sphere    0.387            0.387**
- **2<sup>nd</sup> Sphere    0.409            0.410**



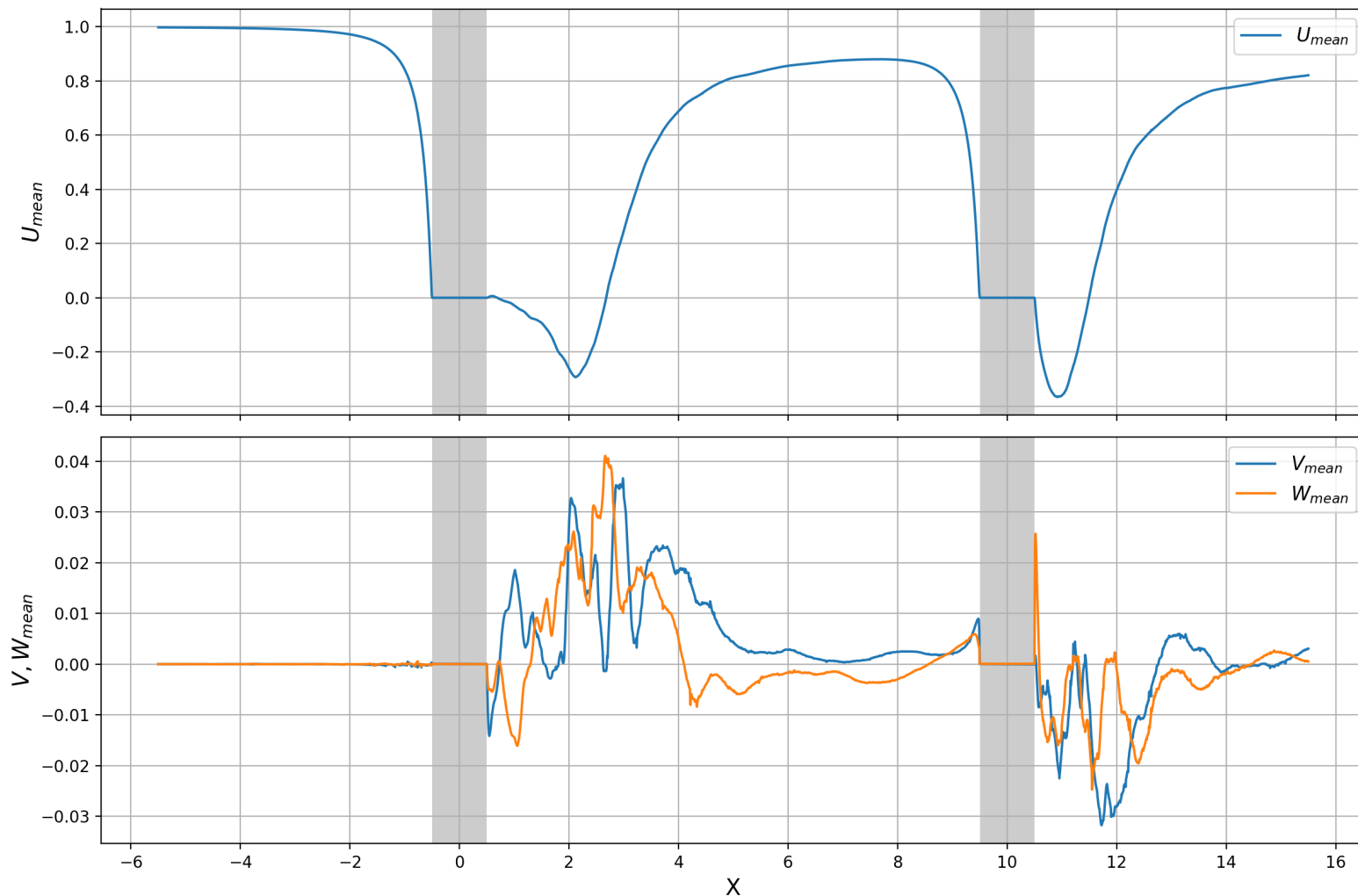
# Tandem Spheres – Frequency Spectra



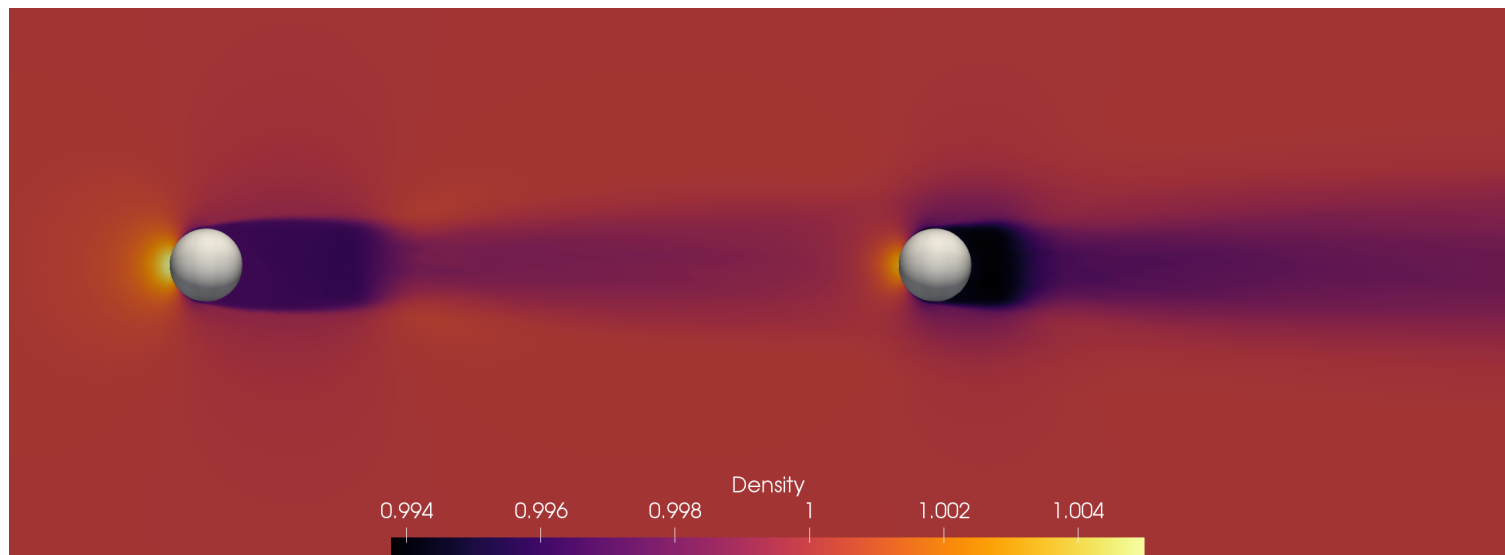
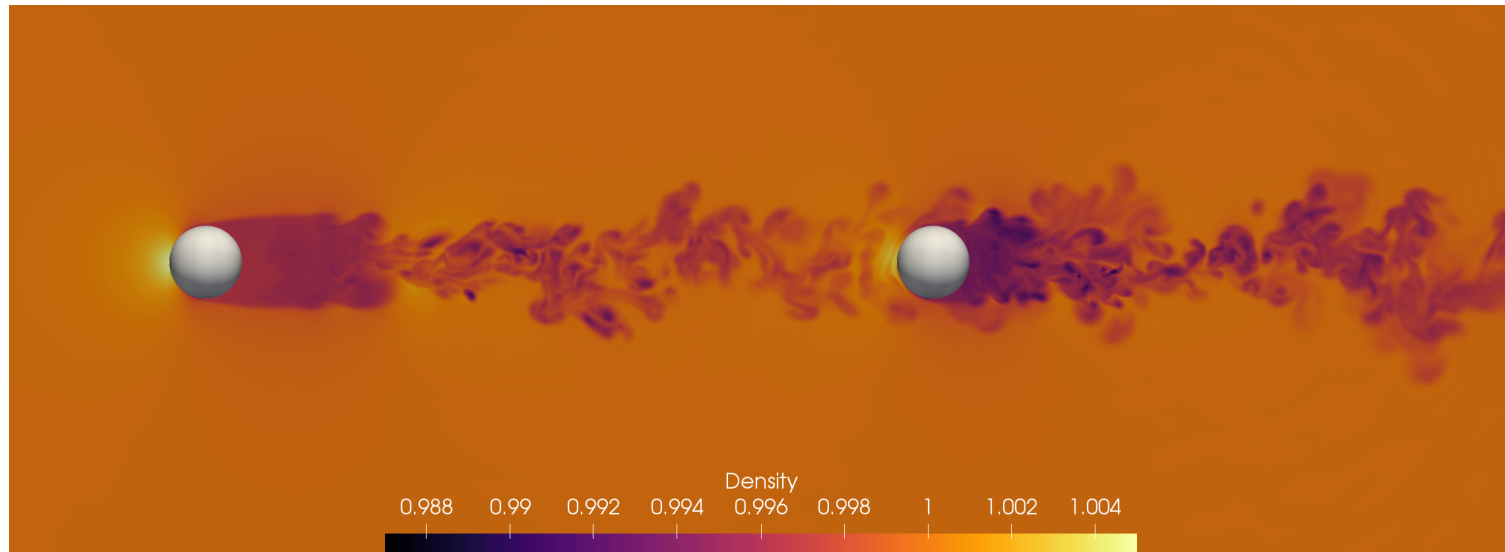
# Tandem Spheres – $C_p$



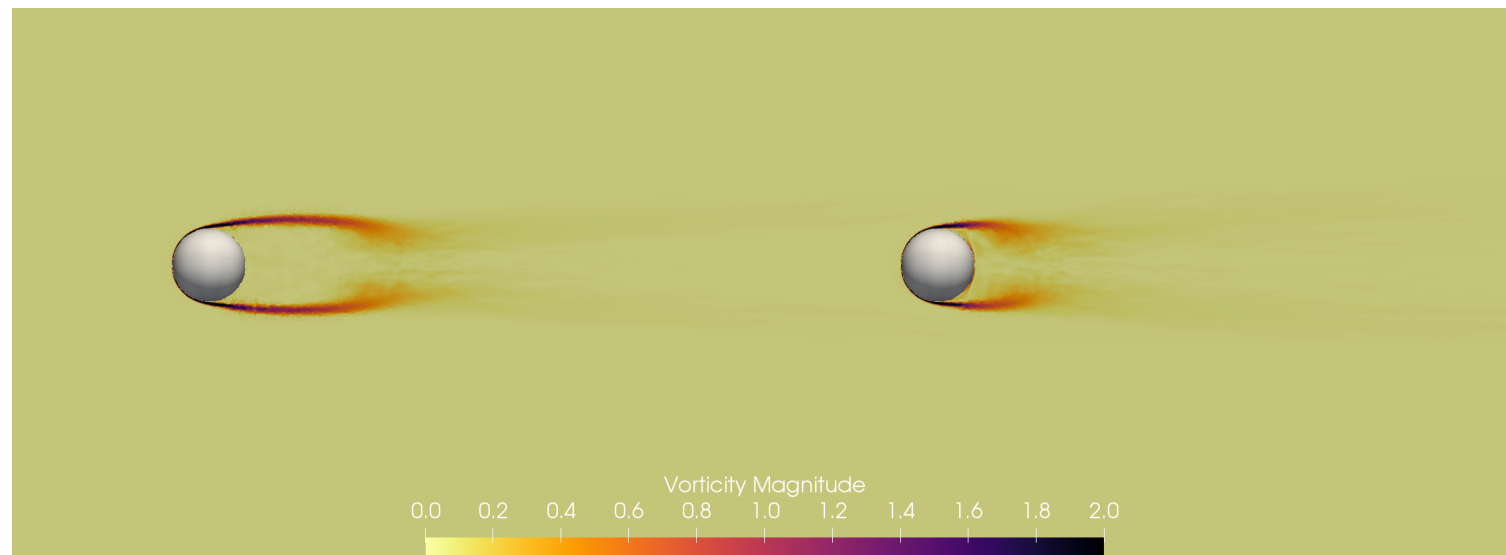
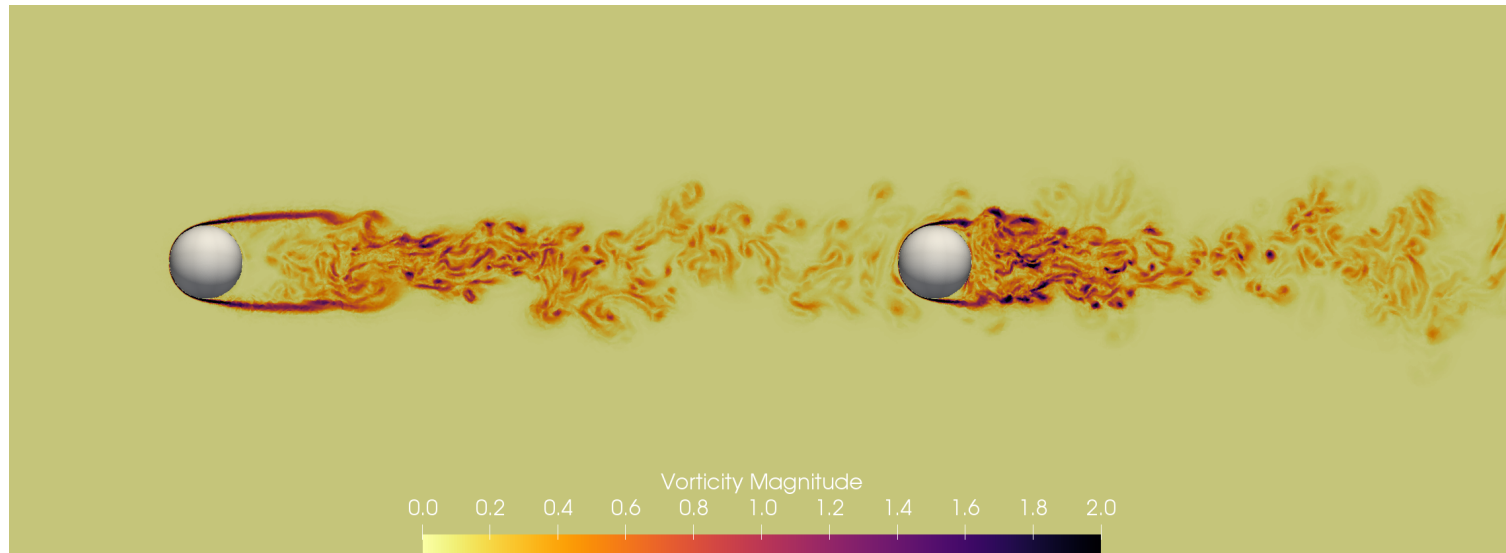
# Tandem Spheres – Mean Velocity



# Tandem Spheres – Contours



# Tandem Spheres – Contours



# Acknowledgements

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