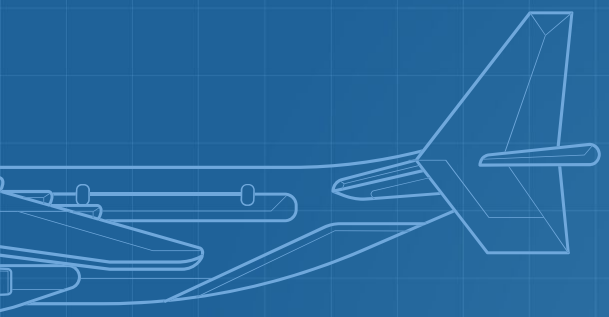
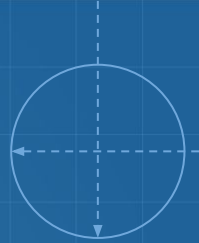
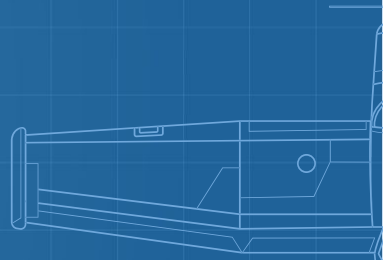




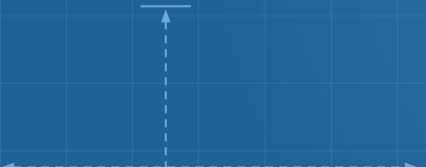
GPU-VPM

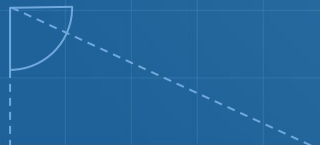
A GPU-based aerodynamics solver

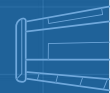


MILESTONE 3

Nadine Adnane | Dominik Kau | Shreyas Singh



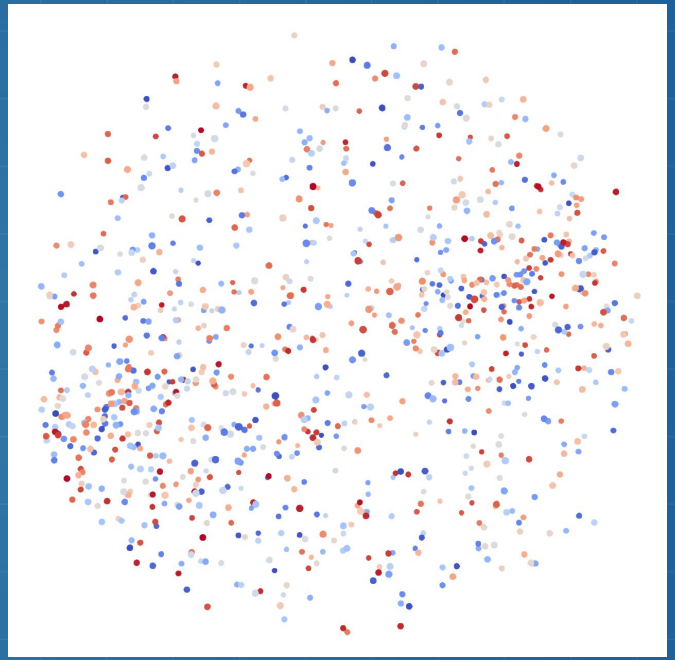




UPDATES

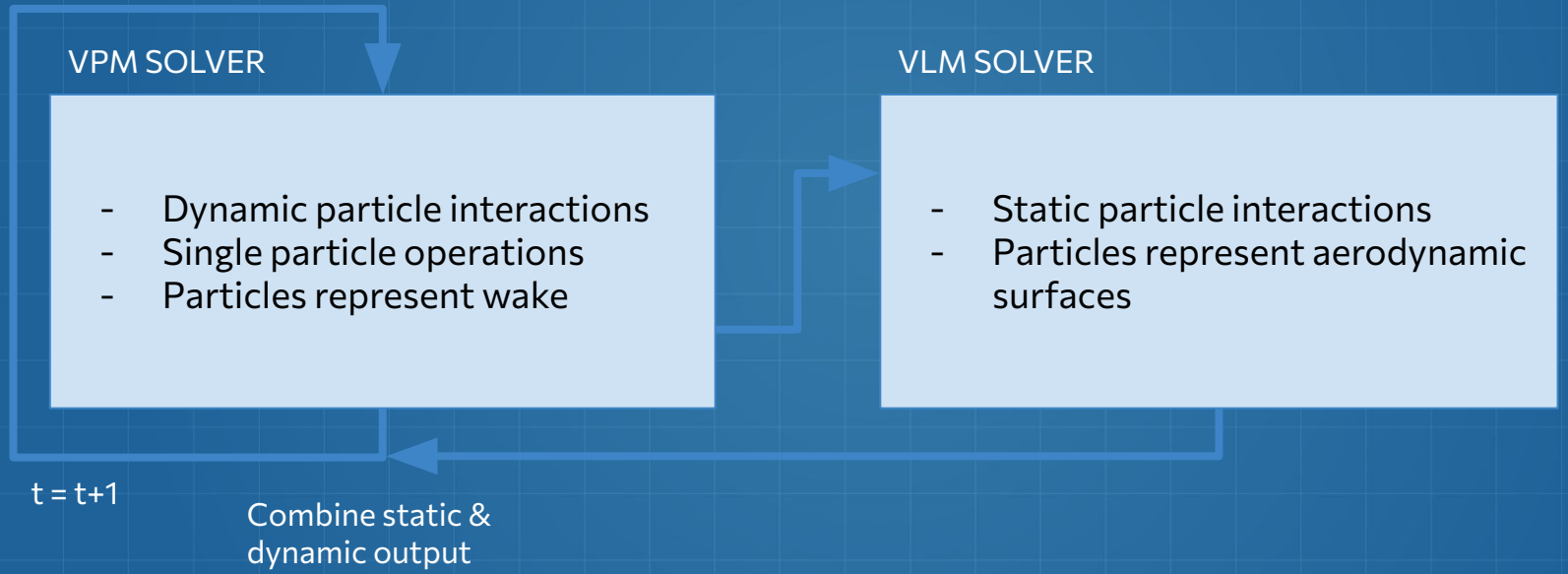
1. Completed VLM implementation
2. Completed VPM implementation
3. Completed Integration with Paraview
4. Visualized particle field
5. Had a great Thanksgiving dinner ;)

Yummy



Randomly initialized points in a sphere, visualised in Paraview

OVERVIEW


VPM SOLVER
- Dynamic particle interactions
- Single particle operations
- Particles represent wake
VLM SOLVER
- Static particle interactions
- Particles represent aerodynamic surfaces
t = t+1
Combine static & dynamic output

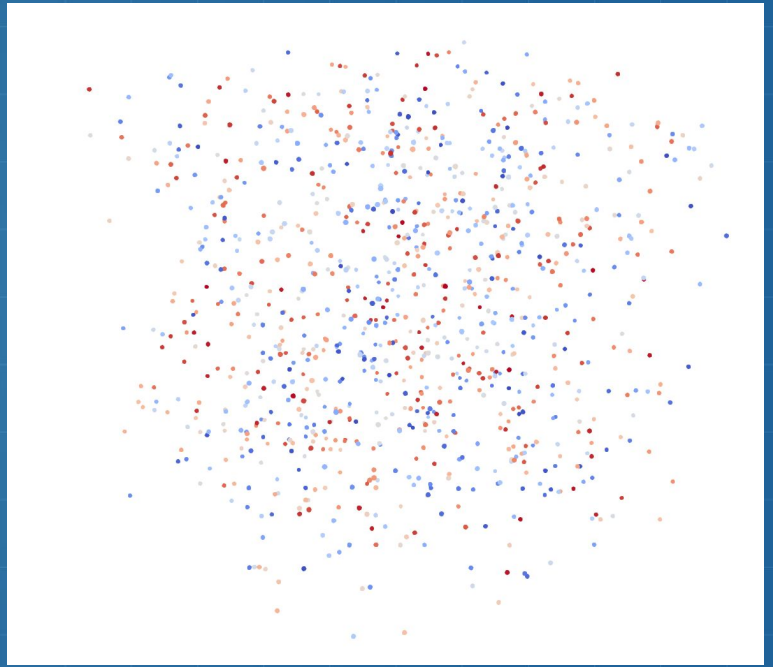
Visualization

Lean-VTK

- Lightweight library in C++ for easy export.
- Unstructured Grids as point cloud.
- Export at every n^{th} step -> easy animation

ParaView

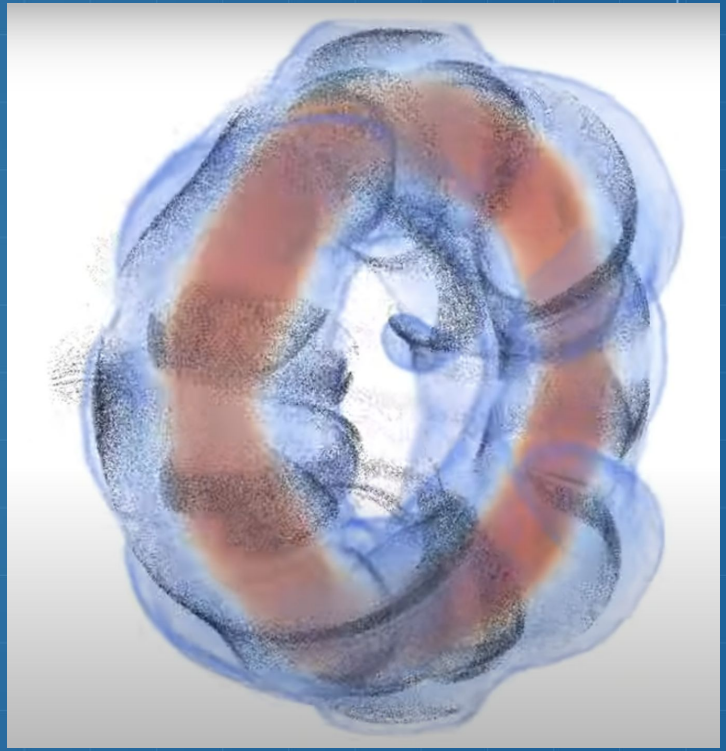
- Open-source
- Post-processing visualization engine



Randomly initialized points in a cube, visualised in Paraview

Vortex Ring Simulation

- A torus-shaped vortex in a fluid.
- Region where fluid spins around an imaginary axis, forming a closed loop.
- Approach -
  - Discretize torus -> cross sections -> layers -> cells around circumference.
- Complexity because initialization has to be physical.



Simulation output from FLOWUnsteady (https://www.youtube.com/watch?v=ke-uDLEyEjY)

NEXT STEPS - FINAL PRODUCT

1. Run simulations
    - Obtain visual output in Paraview
    - Plot graphs of physical quantities for verification
2. Integration of VLM results into VPM
3. Attempt Fast Multipole Method implementation using ExaFMM