Simulation Of 2D Hg Jet Using Implicit LES Method

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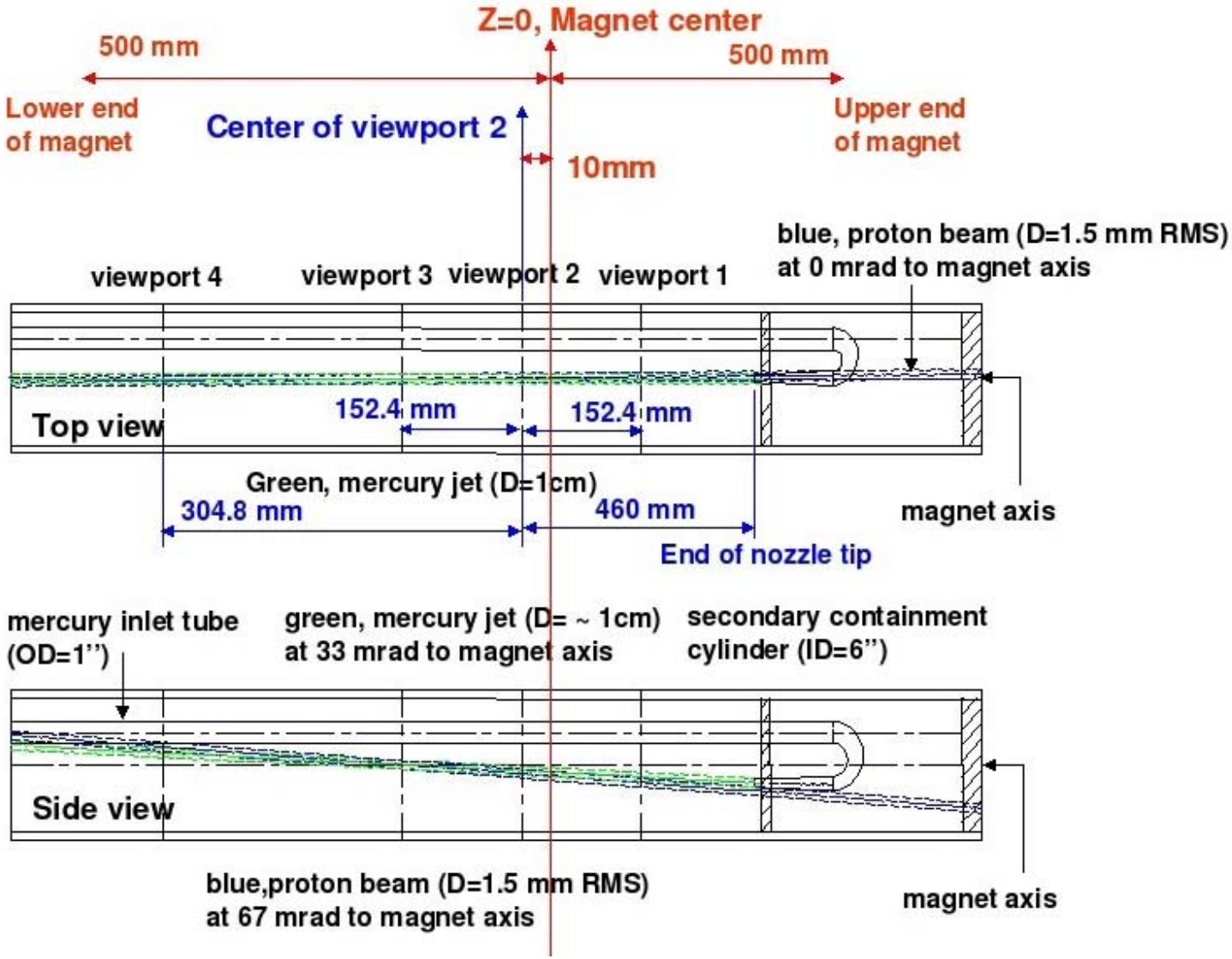
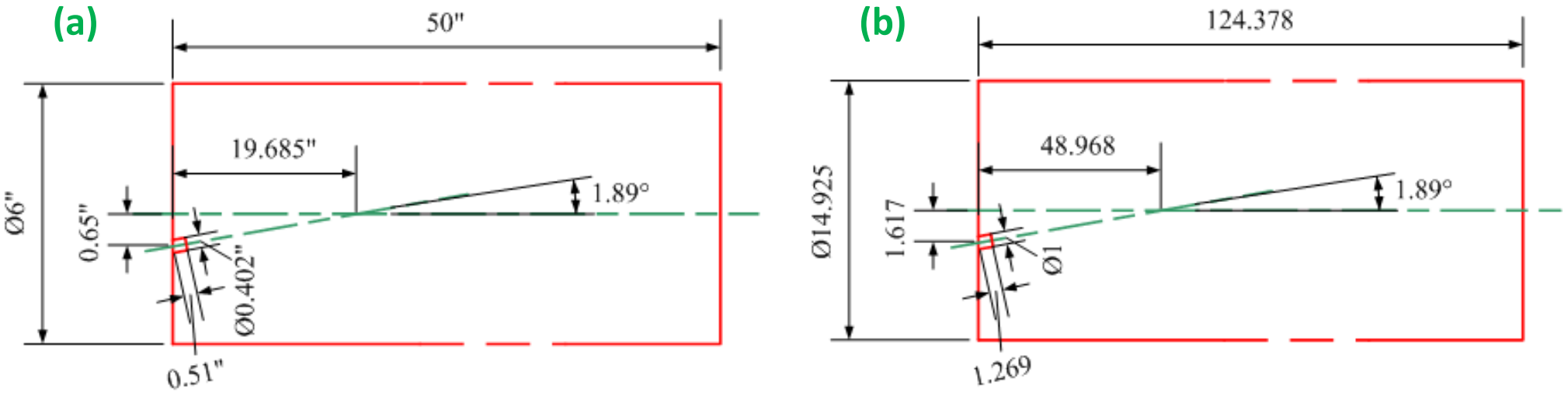
Problem Description



Sketch of the mercury free jet with MHD and energy deposition for the MERIT experiment

Numerical Calculation



The Side view of Hg Jet Flow Draft (a) In Dimension (b) Normalized By Jet Exit Diameter

Determination of the mesh size:

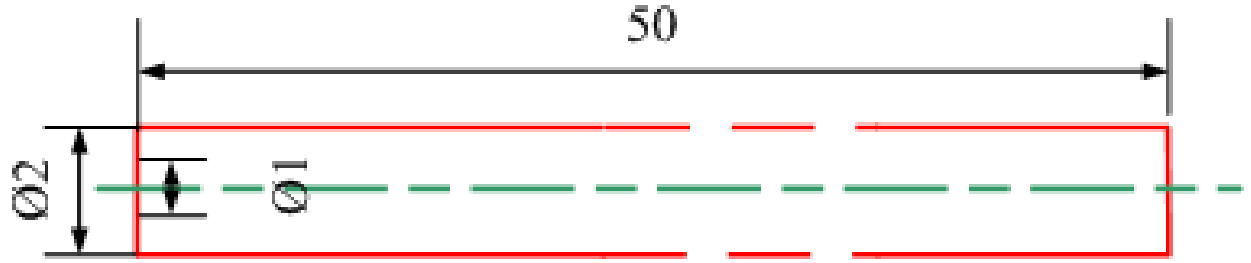
Assume only primary breakup, the critical liquid Weber number is less than 10, then $\Delta x <$ 0.89 μm. Then mesh grid number would be **2.444e+11** when mesh is uniform.

Phase	Density	Viscosity	Surface Tension
Air	1.225 kg/m^3	1.460735 m^2/s	0.4855 N/m
Mercury	13456 kg/m^3	1.1147×10^{-7} m^2/s	

Jet velocity = 20 m/s (fully developed), D_h= 0.0102108 m, Re_{Hg} = 1812785.017.

Numerical Calculation

Simplified Model For Preliminary Simulation



Grid number for halved model is 1,976,968 (width = 172, length = 11,494, $\Delta x \approx 4.437e\text{-}5$ m).
One flow-through = 0.0255 s.

Length of nozzle is 0.

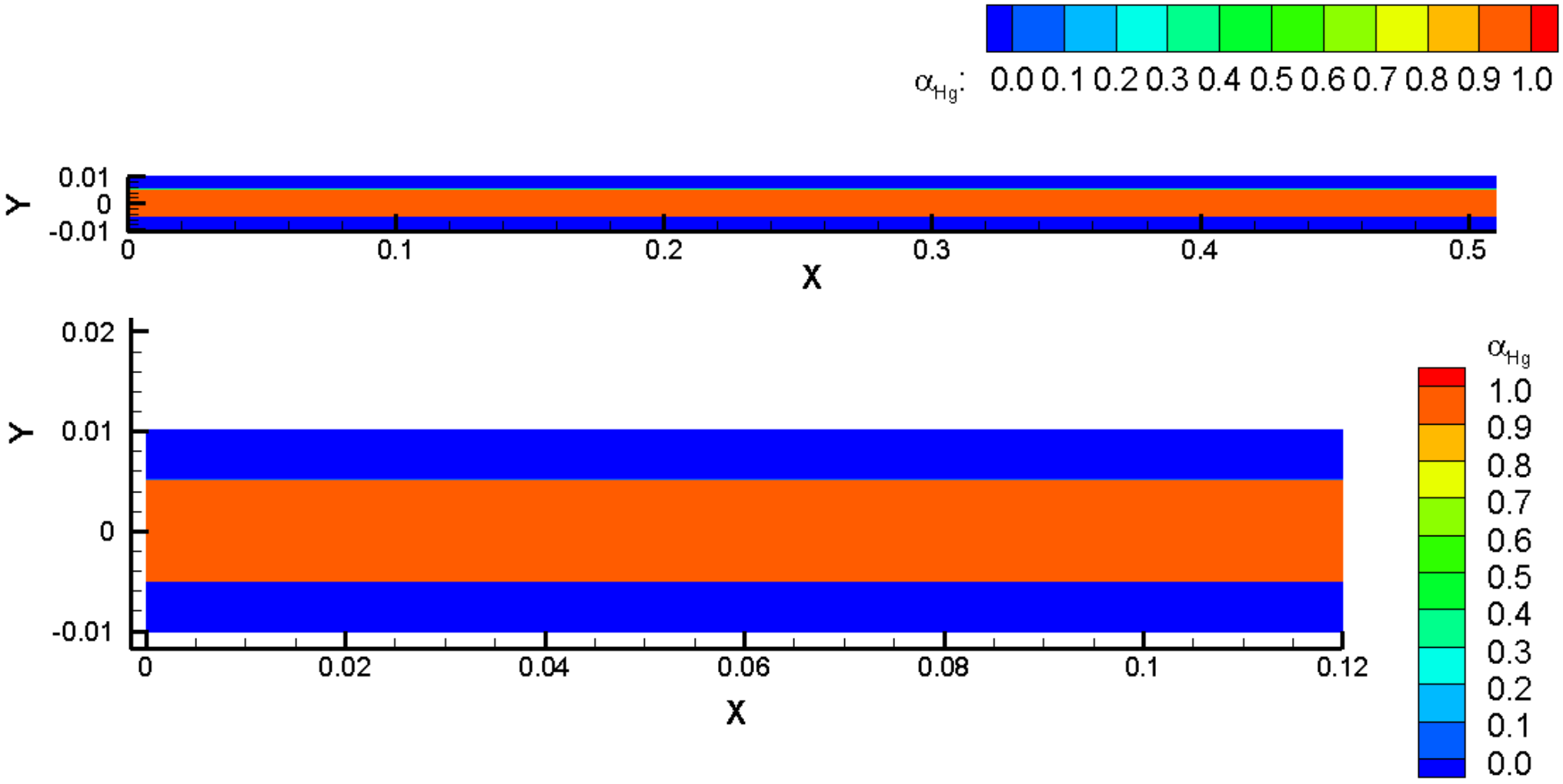
Inlet flow parameters taken from previous simulation of flow in bent delivery pipe.

Wall boundary condition used on cylindrical surface.

Results

[click to watch movie]

- 0 < t < 5.5 ms



Results

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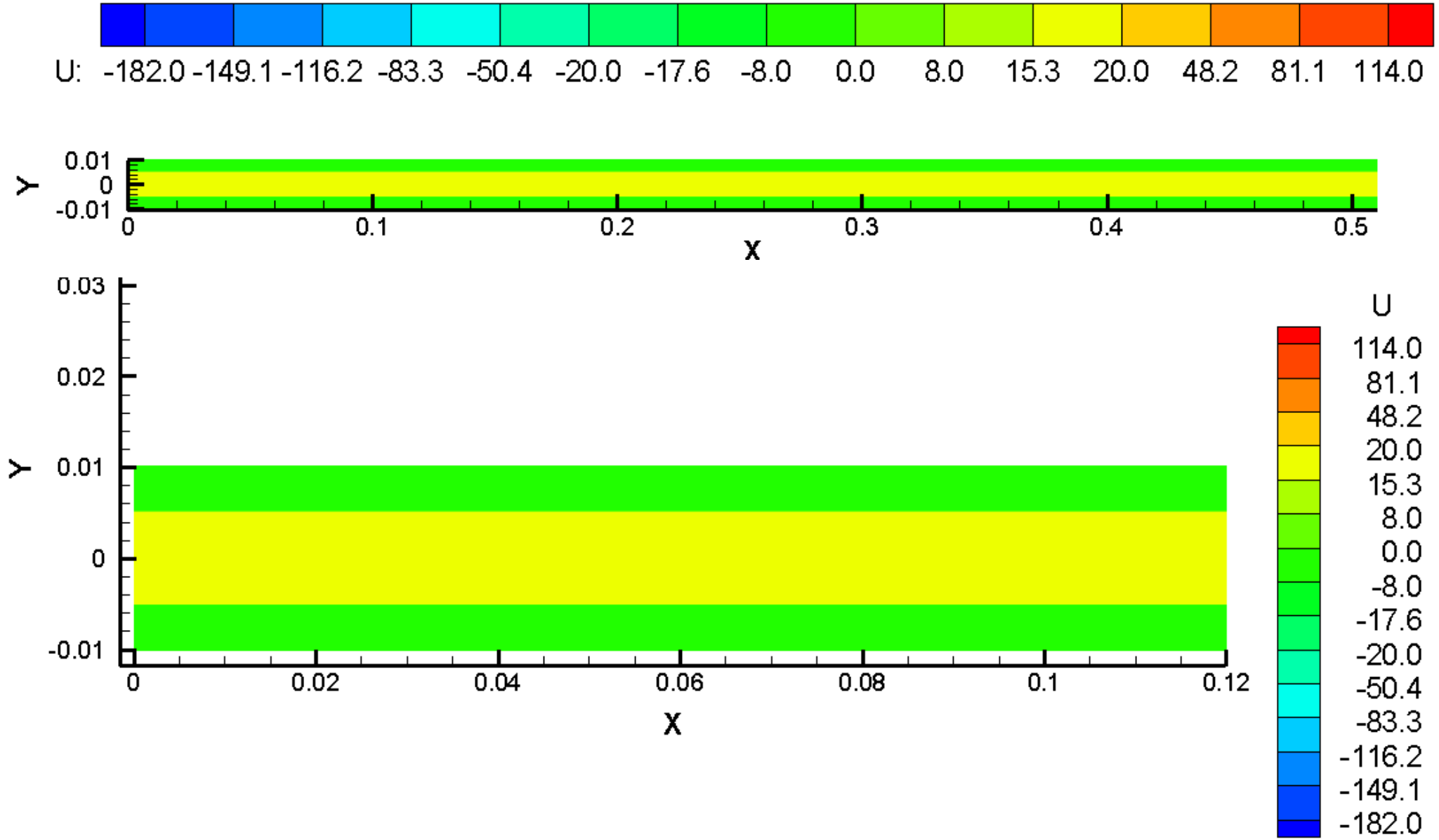
- 0 < t < 5.5 ms



Results

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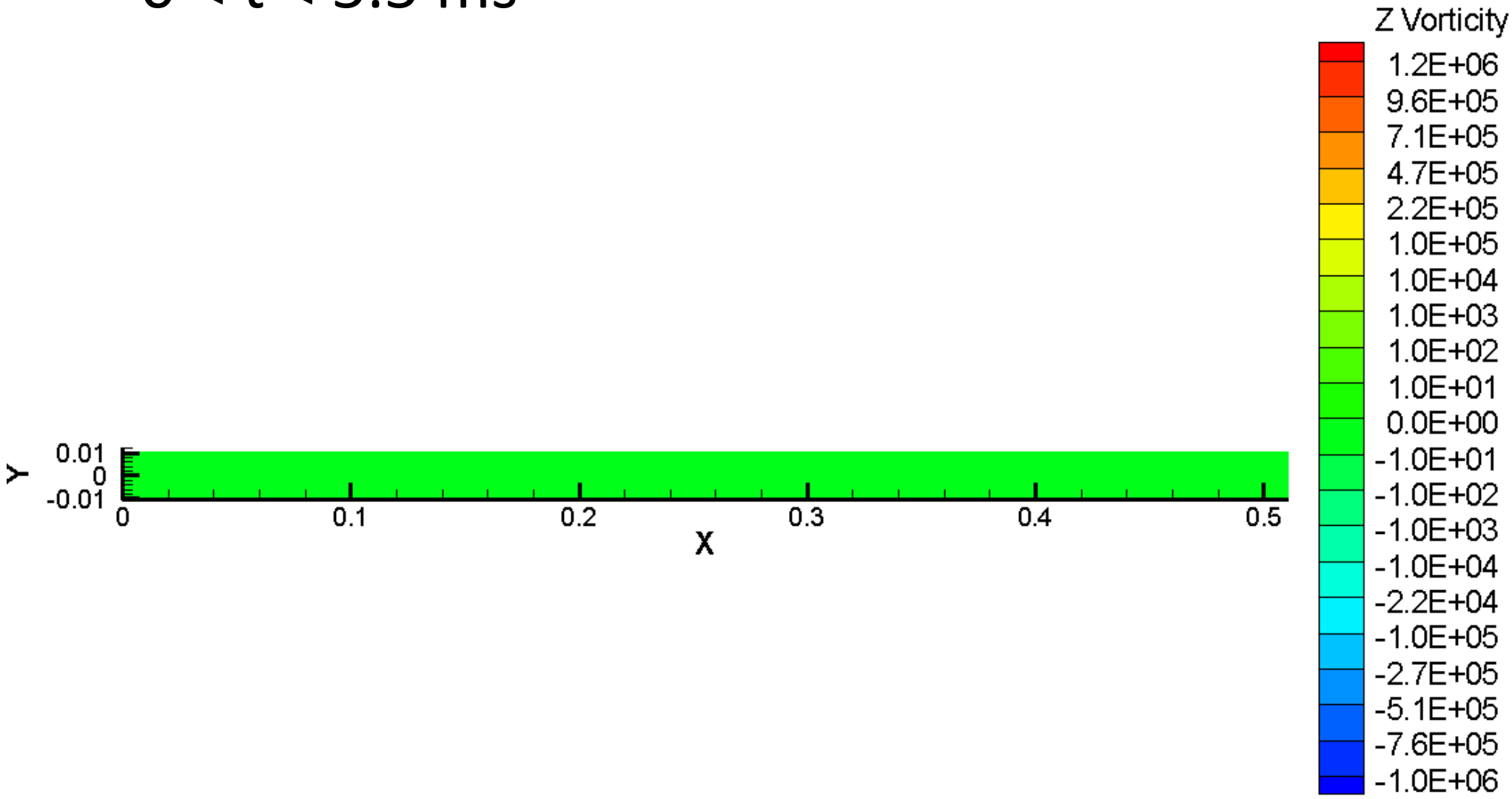
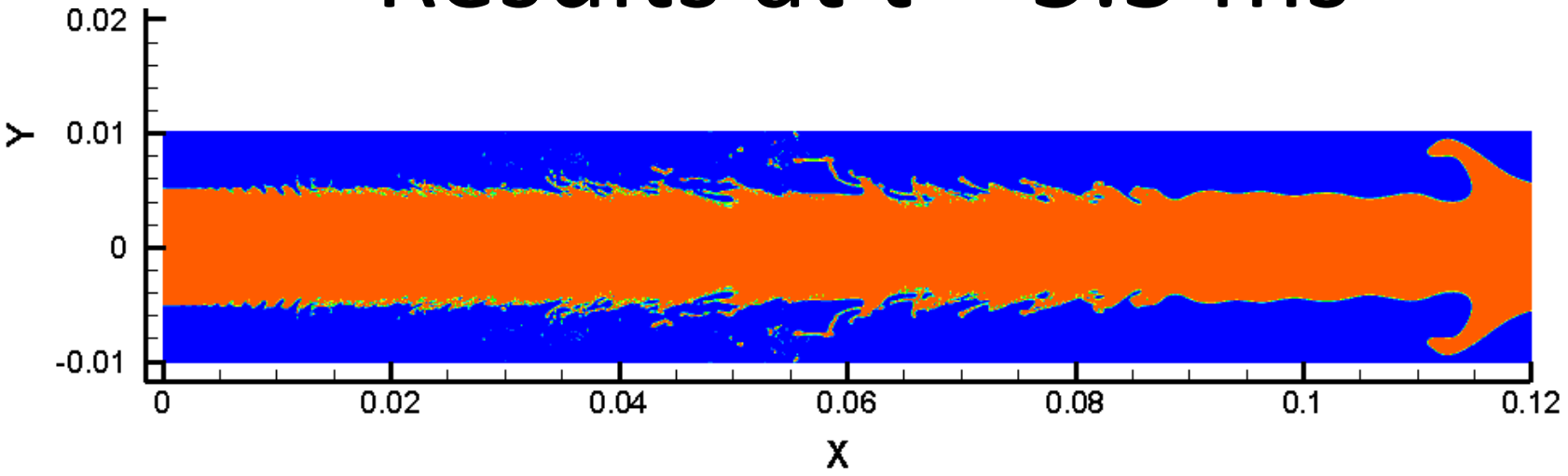
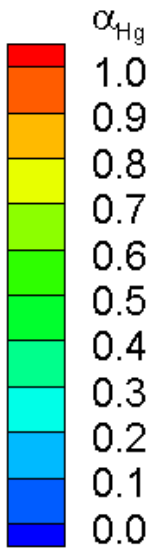
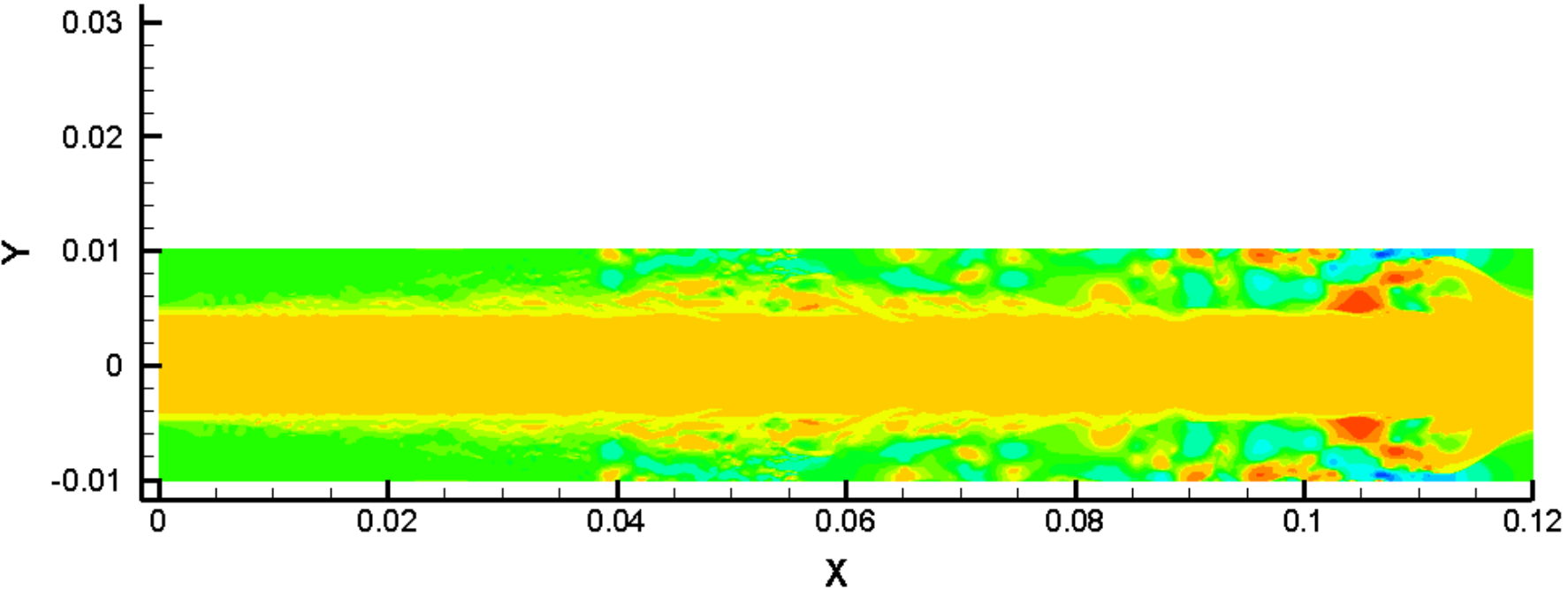
- 0 < t < 5.5 ms

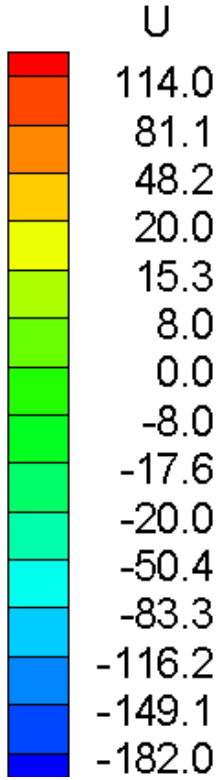


Results at t = 5.5 ms









Results at t = 5.5 ms