Interactive visualization of droplet collisions in turbulent flow

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Objective

- Large scale and small scale droplet-flow interactions lead to collisions - Need for a tool to analyze the effect of local interaction
- Challenges
  - Dense data and trajectories cannot be represented together
  - Comparison of statistics across collisions
  - Illustrate individual collisions to enable easy observability by users
Previous approaches

- Large scale visualization framework
- ParaView, VisIt, VAPOR
- Fluid dynamics visualizations
- DVR, Isosurfaces,
- Limitations
  - Little support for particle data
  - Manual selection of rendering parameters
  - Querying is text-based and often selection of data is extensively manual
Vorticity and trajectory
Flythrough
Histogram + Trajectory
Roller Coaster!
Our Contributions

- Display statistics of all collision events by abstracting away time and spatial information
- Allow users to pick the pairs they want to study and display region maps showing local flow
- GPU based Selective isosurface rendering using face walking
- Generation of time summary images to observe droplet-flow interaction
Global map of collisions based on vorticity values
Selective Isosurface rendering

Selective Isosurface of vorticity with droplet trajectories
Time summary
Conclusions

• CollisionExplorer allows users to interactively explore the various collision events that occur in a simulation.

• A global map for summary of all the collisions and region maps with the sparse and dense representations of flow near the region of collision.

• Efficient representations of dense volumetric using selective isosurface rendering
Thank you