Towards CFD Fault Detection and Scaling with Machine Learning

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Problem Statement(s)

- Attacking two problems at once
  - Similar methodologies and tools
- CFD simulations generally require HPC clusters
  - Leaves them vulnerable to computational faults.
  - Detecting faults could help save time and improve results.
- CFD simulations take lots of resources to scale up.
  - Using ML for accurate approximations could be more efficient.

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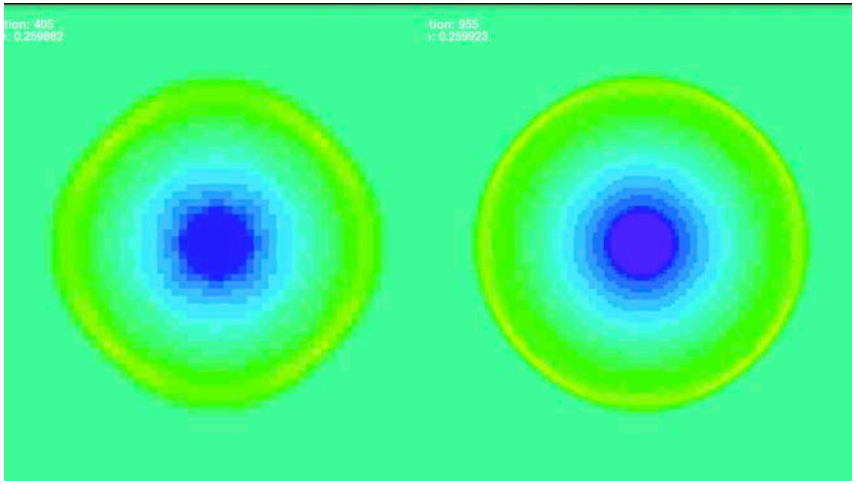
Modifying CLAMR

- Equal Timesteps for Different Resolutions
  - At a glance less than 0.0001s difference per output frame
- Separation of Mesh Resolution and Domain
  - Boundary Conditions may still need a little adjusting



Mesh resolution of 32 compared to a resolution of 64 over the same domain

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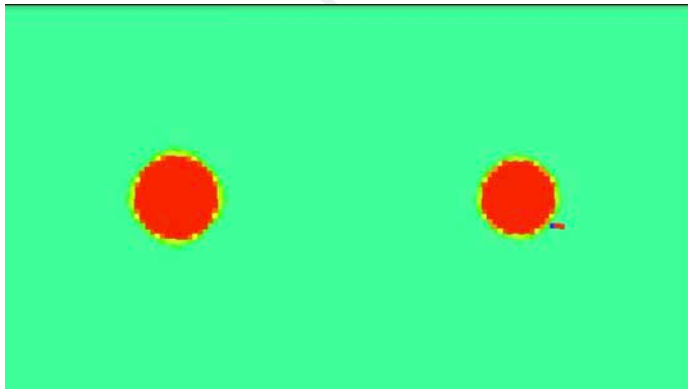
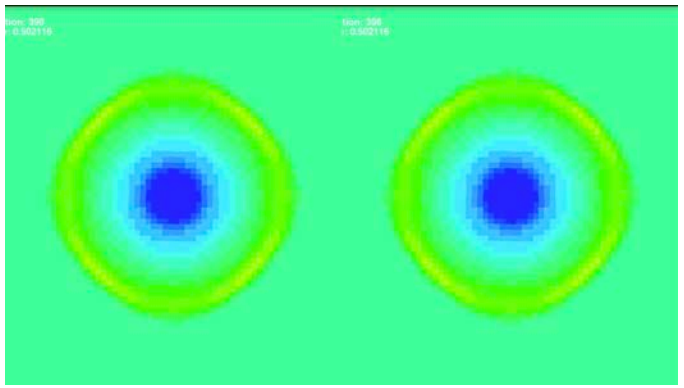
Injecting Faults

- Using PINFI for fault injection
  - Tool based on Intel PIN
  - Lightweight
- Not built specifically for the type of faults we need
  - Sometimes crashes or causes fault in control flow or output
  - Needs modification for better control



A fault that visibly modified the output



A fault that doesn't visibly modify the output

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Next Steps

- *Refine Fault Injector*
- *Generate Datasets*
- *Do Some Machine Learning*
  - Probably PetaVision
- *Expand To More General Tools*

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Thank You!

Questions?

Or Ask Me:

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In case you wanted to put a face to the voice