Performance Characteristics of Curvilinear Multi-Block Structured ALEGRA on Red Storm

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
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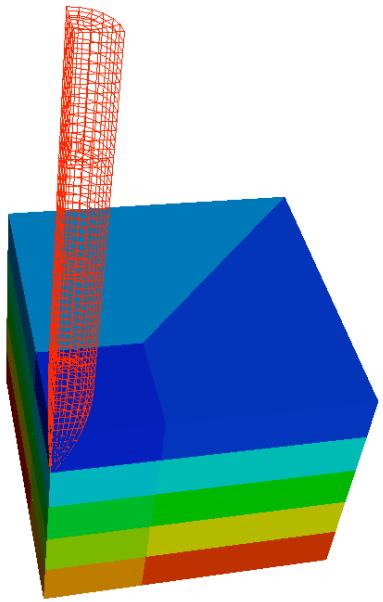
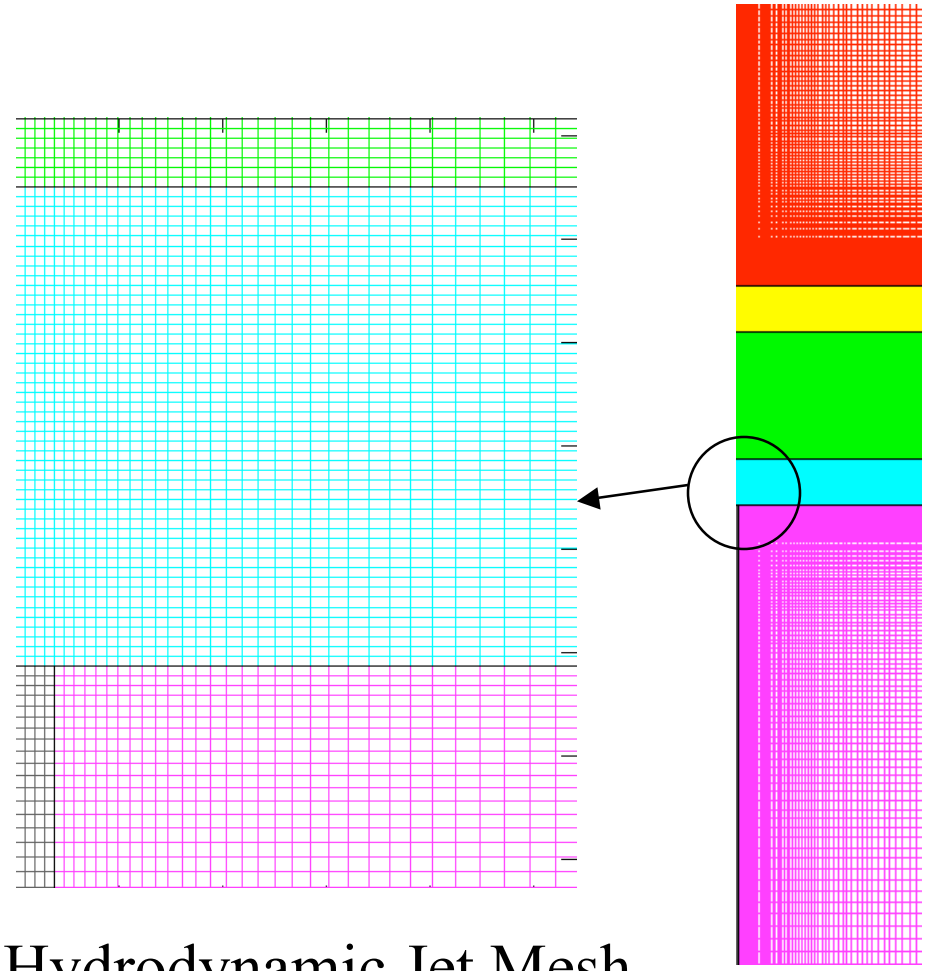
Introduction

- **ALEGRA**
  - **ALE**
  - **Unstructured**
  - **Structured**





Hydrodynamic Jet Mesh

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Communication Patterns

- Lagrangian Step
  - No Ghost Elements
  - Two Swap and Adds of Nodal Vectors
- Eulerian Step
  - Ghosts for Accumulation
  - 4 updates of element Centered Quantities
- Misc Communications

Running on the Machines

- Red Storm
  - Full Machine – one preliminary run
  - 28 Node Rack – runs assisted by Suzanne Kelly
- Janus

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The Test Problem

- Domain From 0.0 to 10.0 in x,y,z
- Uniformly Full of 1 Material
- Material Initial Velocity +x, +y, +z
- All Element Flux All Directions
- Maximum Work for Eulerian Sub-Step
- Constant Work for Lagrangian Sub-Step

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Results:
Cycle Times/ 10^{-6}s/elements/processor

Problem	Janus	Red Storm	Janus/R.S.
Serial 125,000 elements 125,000 elements/processor	500	61	8.2
25 processors 125,000 elements 5,000 elements/processor	540	57	9.5
25 processors 1000,000 elements 40,000 elements/processor	520	61	8.5
25 processors 3,125,000 elements 125,000 elements/processor	520	62	8.3

Conclusions

- Red Storm Between 8.2 and 9.5 times faster than Janus
- Scaling appeared better on Red Storm
- Small Memory on Janus limits comparison

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