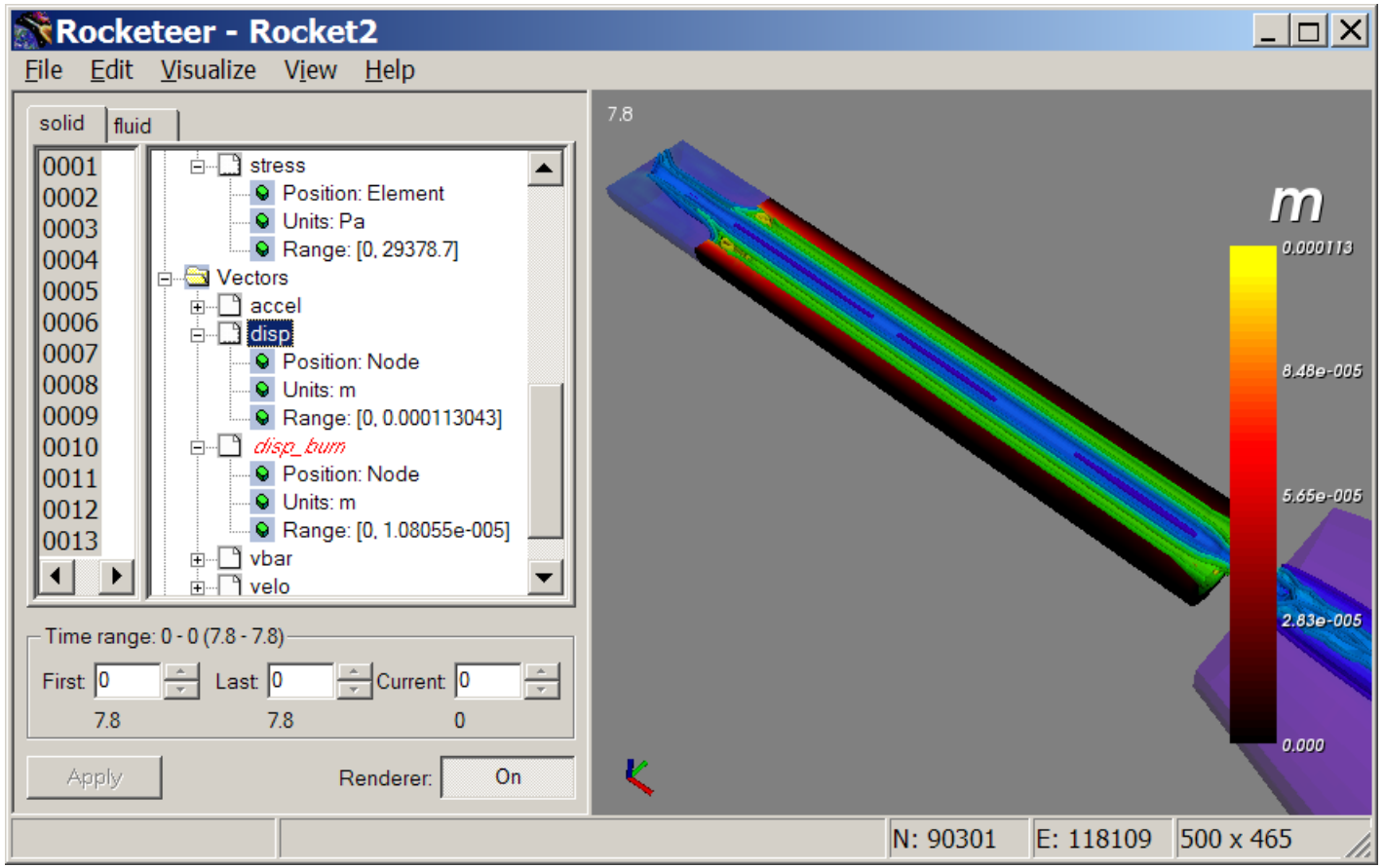
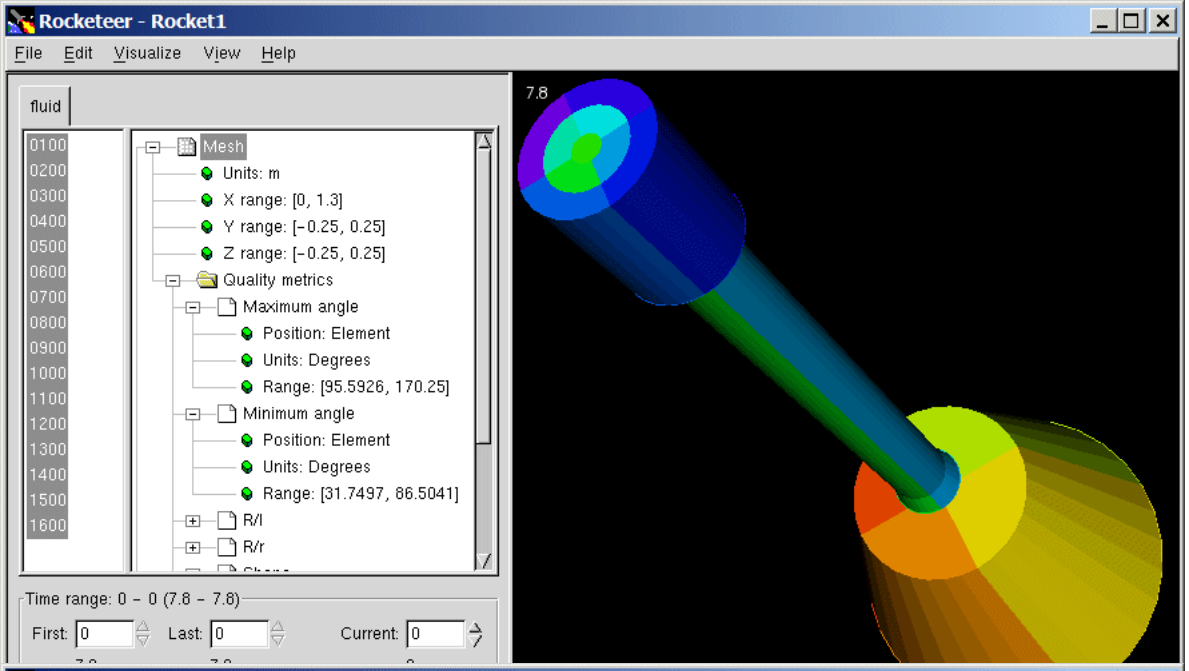
Section 12
Visualization

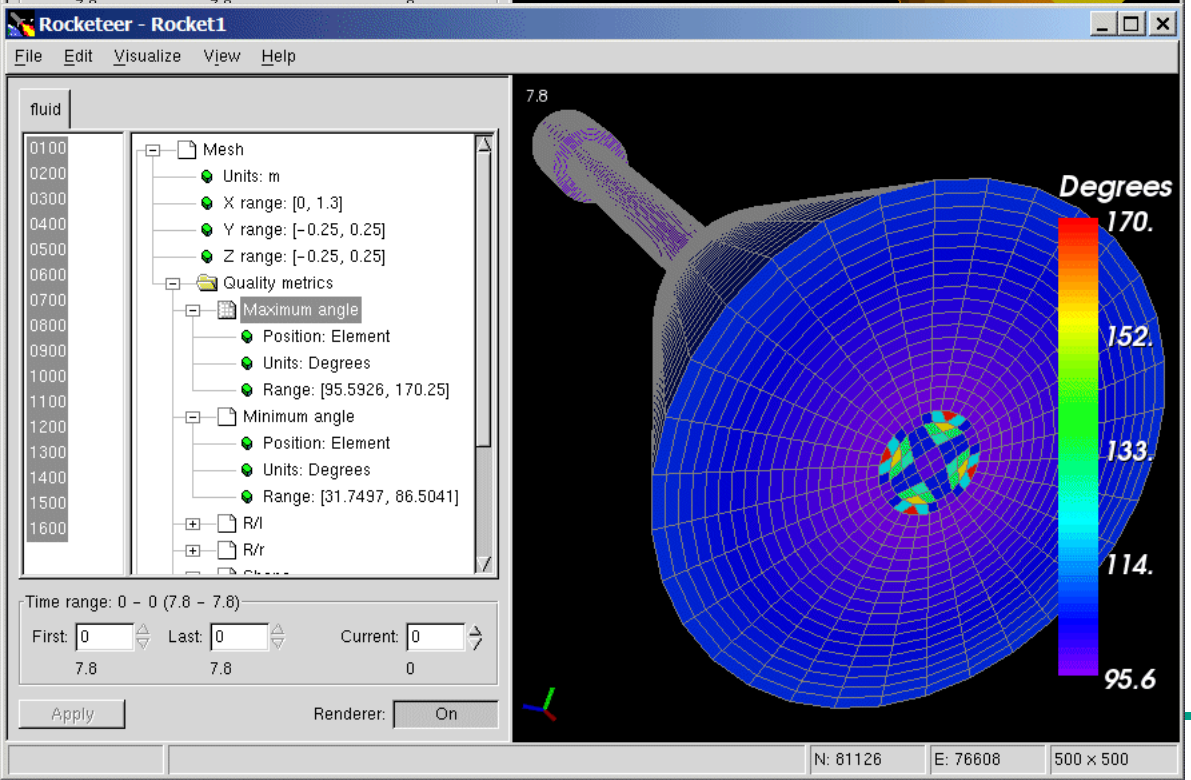
Visualization with *Rocketeer*

- Prerequsites on Linux
  - libstdc++.so.5 (compat rpm's)
  - libGLU.so.1 (rpm)



Rocketeer

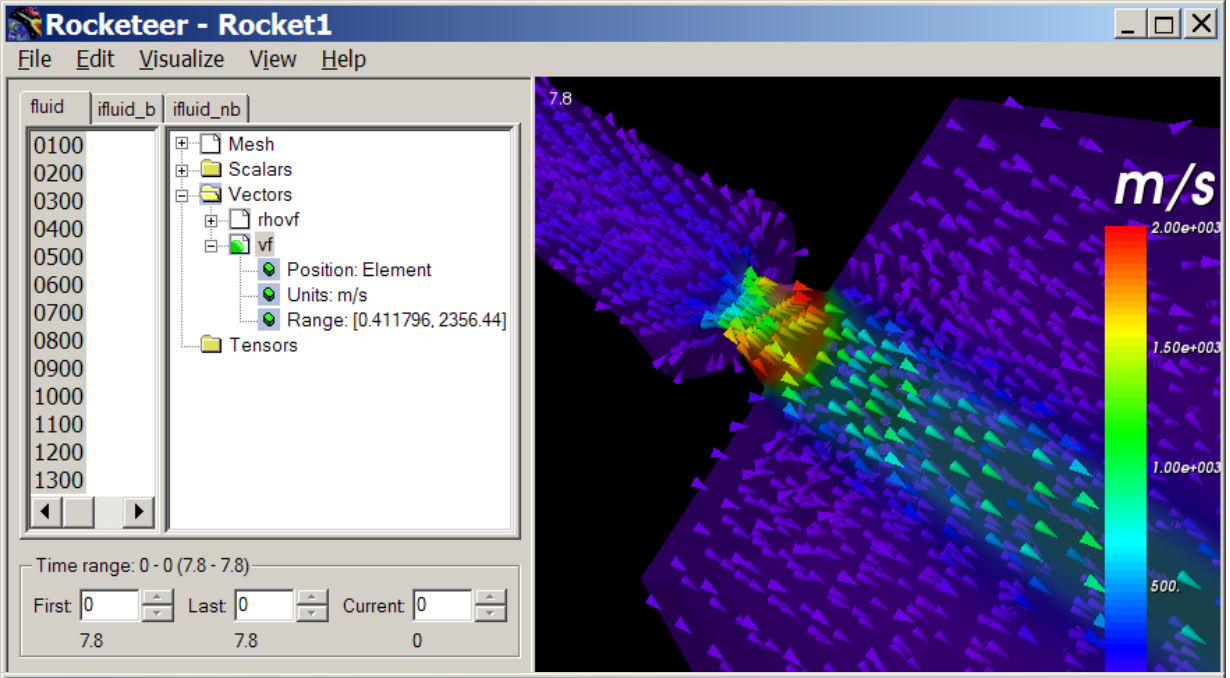


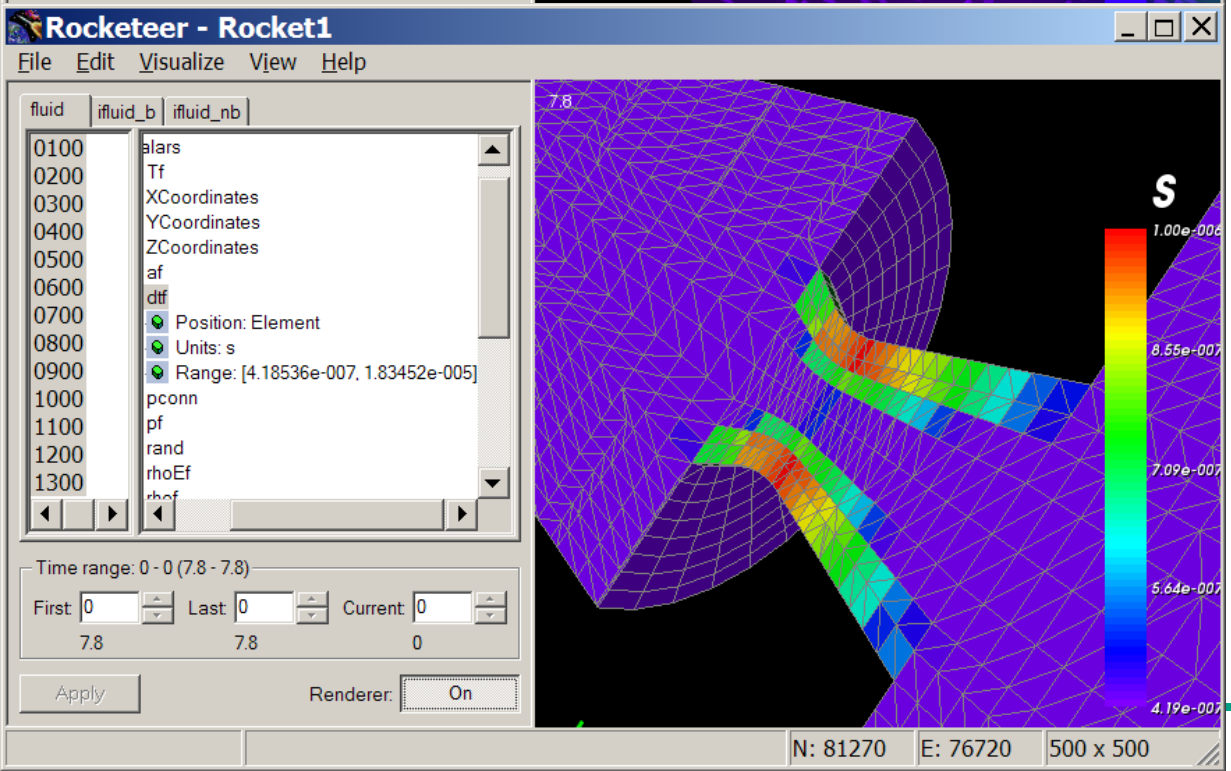


- All data sets
  - Times, Blocks
  - Coordinates/ranges
  - Nodes/elements
  - Variables/ranges
    - Scalars
    - Vectors
    - Tensors
- Mesh
  - Blocks by color
- Quality metrics
  - Min/Max angle
  - Size, Skewness, etc.
- Surface plots

Illinois Rocstar

Rocketeer

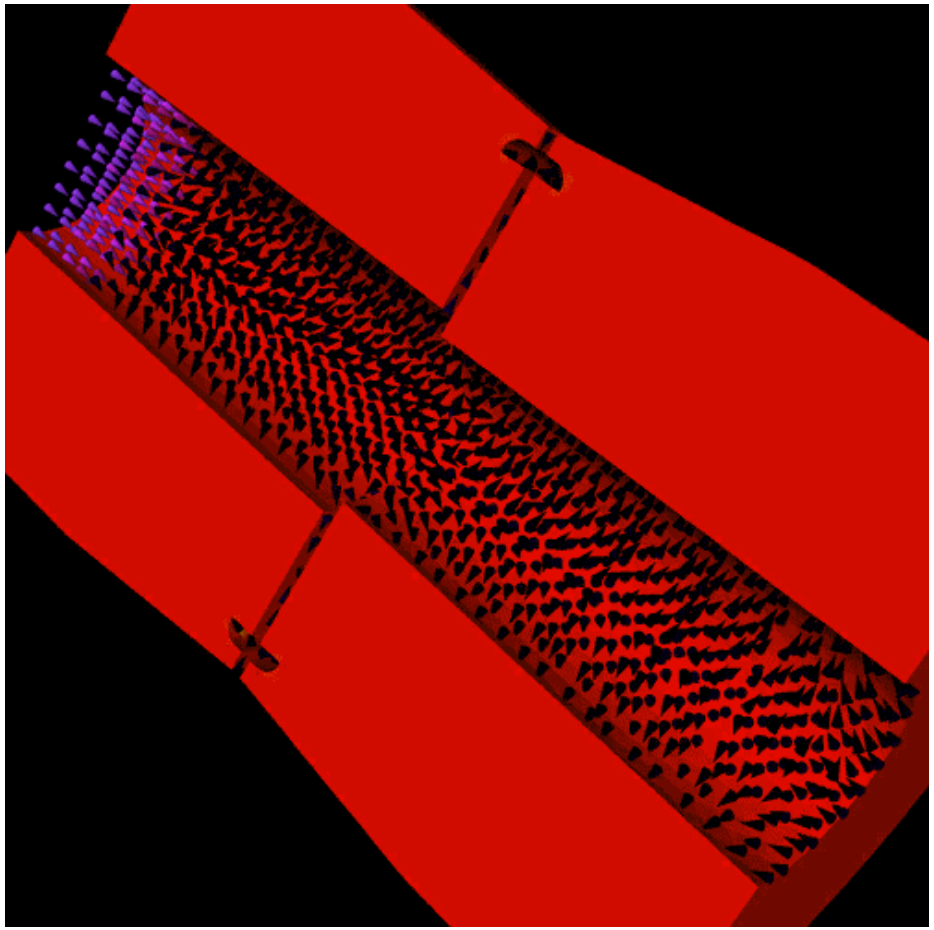




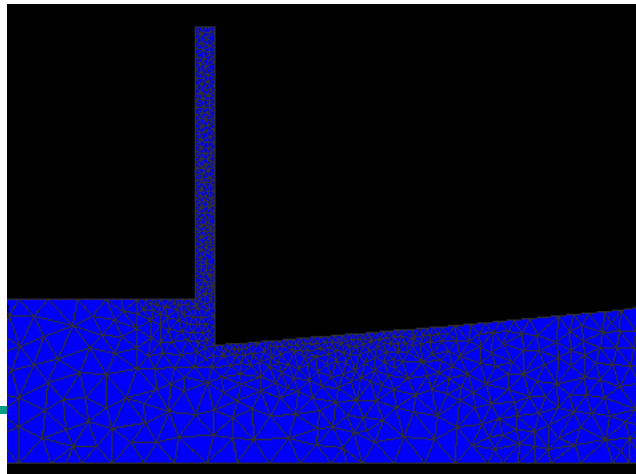
- Glyphs
  - Particles
  - Vector fields
- Isosurfaces
- 3-D mesh plots
- Opacity controls
  - Constant
  - Value-dependent
- Thresholds
- Animation
  - Output series
  - Moving camera
- Stand-alone, client/server, and batch versions

Illinois Rocstar

Titan Joint Slot Simulation



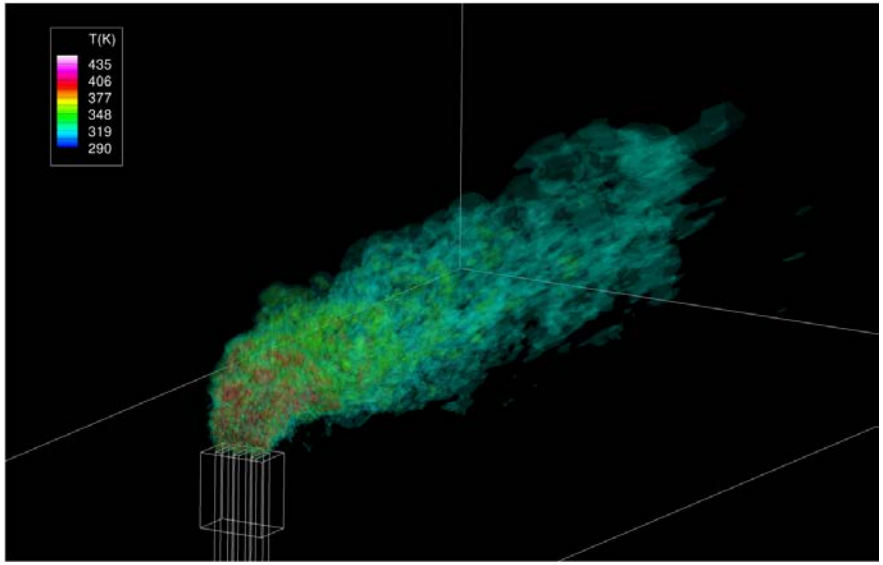
- Flow interaction over lip caused low pressure downstream
- Grain collapsed inward
- Ultimately grain separated from case and destroyed booster
- Multiphysics simulation would have demonstrated problem



Velocity (in core flow) and stress (in grain)

Loading *Rocstar* Files into Tecplot

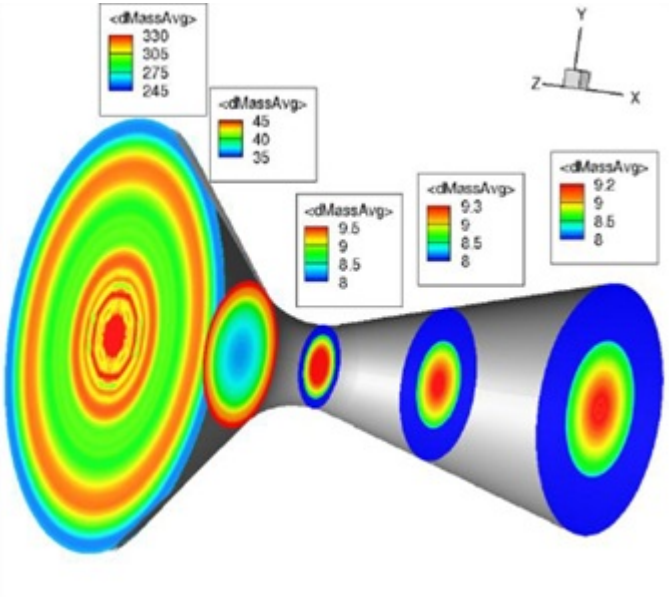
- HDF4 to Tecplot conversion utility: `<build>/bin/hdf2plt`
- Usage: `hdf2plt –regex “hdf files to convert ” –o <filename>.dat`
- Available command line flags for `hdf2plt`:
  - `--regex "{somestring}*.hdf"`: specifies a set of hdf files
  - `-g`: enables ghost node inclusion in the output file
  - `-o {outputfile}` : Specifies output file. Output is printed to STDOUT by default



Heated jet into crossflow. Three rectangular ducts. *Rocflo* simulation plotted with Tecplot

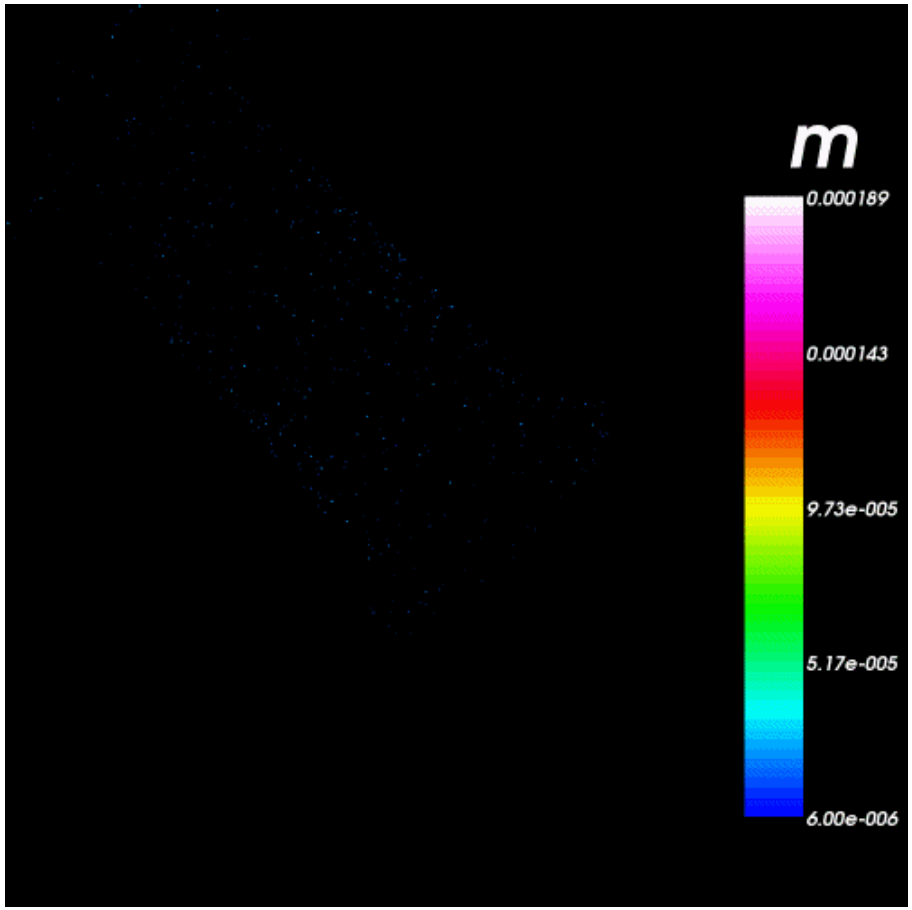
Rocstar Partitions to Tecplot

- Information on grid partitioning
  - *Rocstar* partitions grids with M original blocks into N sub-blocks for running on N processors (N >= M)
  - *Rocstar* solution files are written by partitioned block, with each block represented by a separate `.hdf` file
  - An N-processor run will produce N `.hdf` files
  - Each hdf file will be translated to separate zone of the single Tecplot file produced by `hdf2plt`
  - Note: The University of Illinois version of `hdf2plt` will produce discontinuous zone boundaries when visualized in Tecplot
    - New version under production



Particle statistics as particles traverse and breakup in nozzle throat.

BATES Efficiency



- 15 lb BATES motor
- Studied effects of different aluminum loadings on ISP (AIAA-2005-3997)
- Full 3-D fluid solution with Lagrangian particles
- Coupled fluid-combustion model
- New model for Aluminum and Al_2O_3 Phase change just added to *Rocflo*

Loading *Rocstar* Files into Tecplot

- `Preplot` (Tecplot utility)
  - `hdf2plt` writes an ascii Tecplot file that can be quite large (many Gb)
  - Converting this file into Tecplot's binary format (appended with `.plt`) saves time transferring and loading solution files
  - Preplot is a Tecplot utility for performing this conversion. It is included in a standard Tecplot installation and can be distributed freely
  - Usage: `$ preplot <filename>.dat`
  - Generates: `<filename>.plt`
- Loading fluid solution file into Tecplot
  - After conversion, the .dat or .plt solution file can be loaded by the standard Tecplot data loader:

```
File->Load Data Files -> Tecplot Data Loader
```

- Probe files
  - The probe text files are not covered by an existing utility
  - They can be loaded into Tecplot, Excel, etc. using the General Text Loader

Rocstar Data Visualization in Tecplot

- All of Tecplot's visualization and analysis tools can now be applied to the *Rocstar* simulation
- Allows deriving new variables, etc. that Rocketeer does not do