Interactive Visual Analysis Tools – SimVis –

Tutorial: Interactive Visual Analysis of Scientific Data

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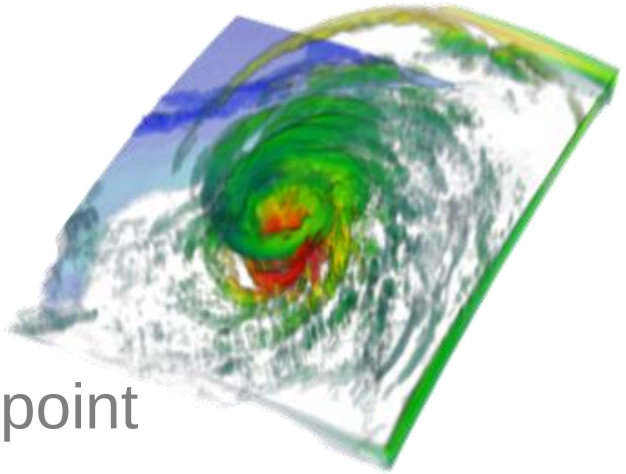
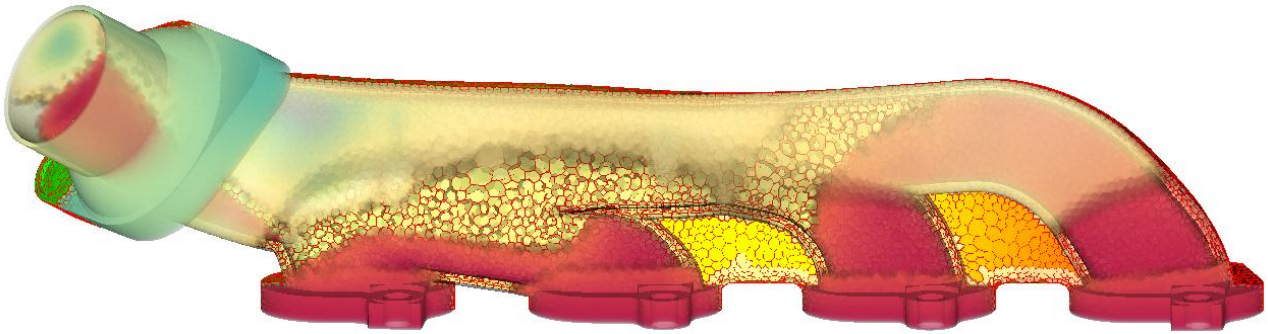
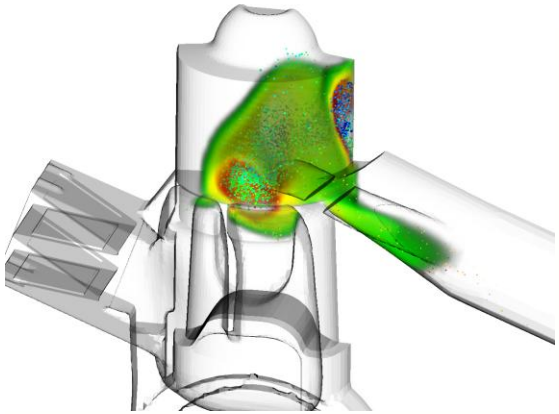
SimVis

- General purpose IVA Framework developed since 2000 in Vienna, Austria (VRVis Research Center & SimVis GmbH)
- Using multiple, linked views (2D, 3D, time-dependent)
- Allowing IVA of real-world data
  - Physial 3D (4D) grids
  - Multi-variate data per spatial/temporal point





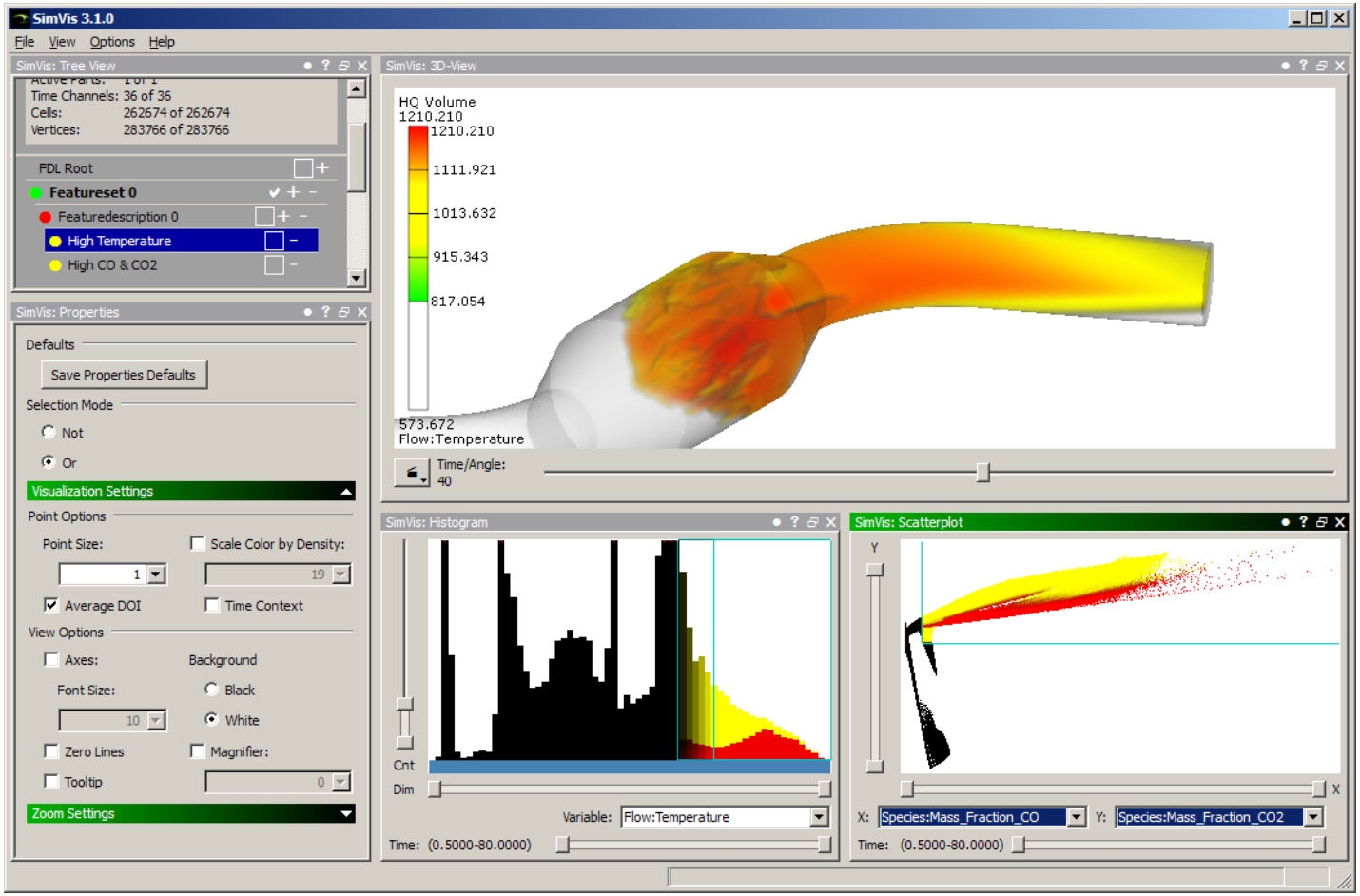


SimVis Input

- Many different data converters are available
- Data needs to be converted prior to loading into SimVis
  - CGNS, NETCDF, GRIB, Fluent, Star-CCM+, AVL Fire, OpenFOAM, Ensight Gold, many raw formats, …
- SimVis can handle completely arbitrary unstructured grids

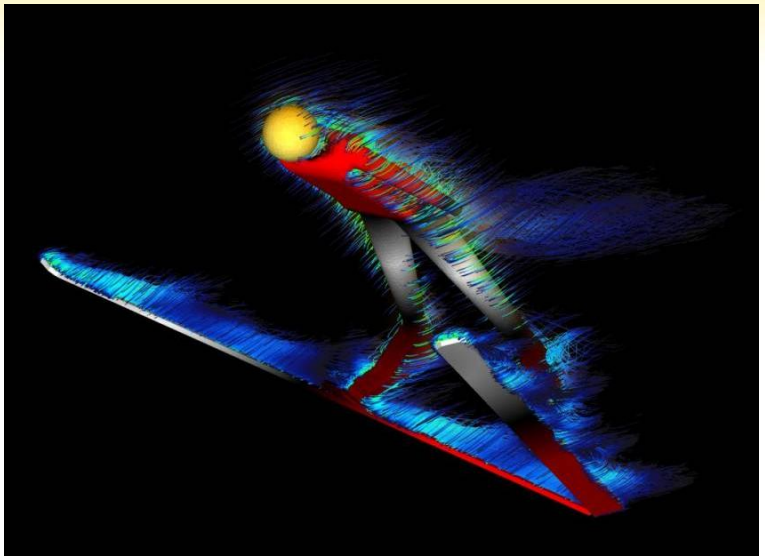
SimVis – Views

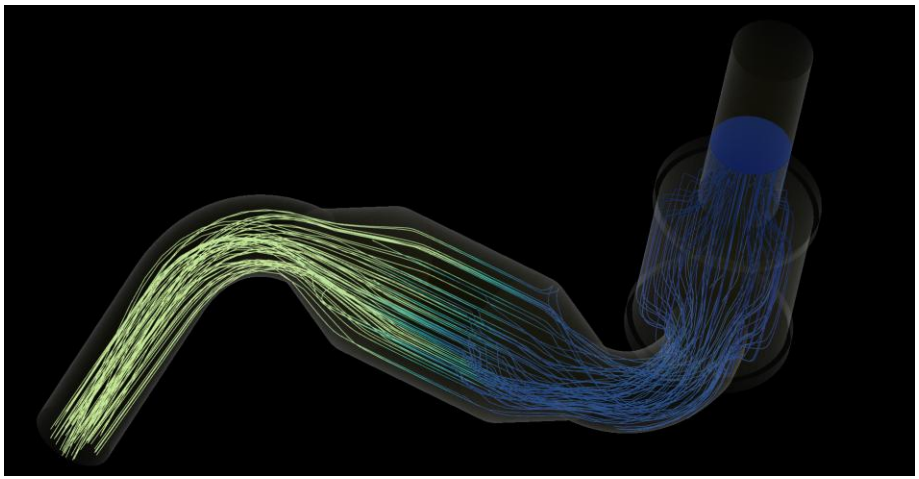
- Scatterplots, histograms, Parallel Coordinates, 3D(4D) views, etc.

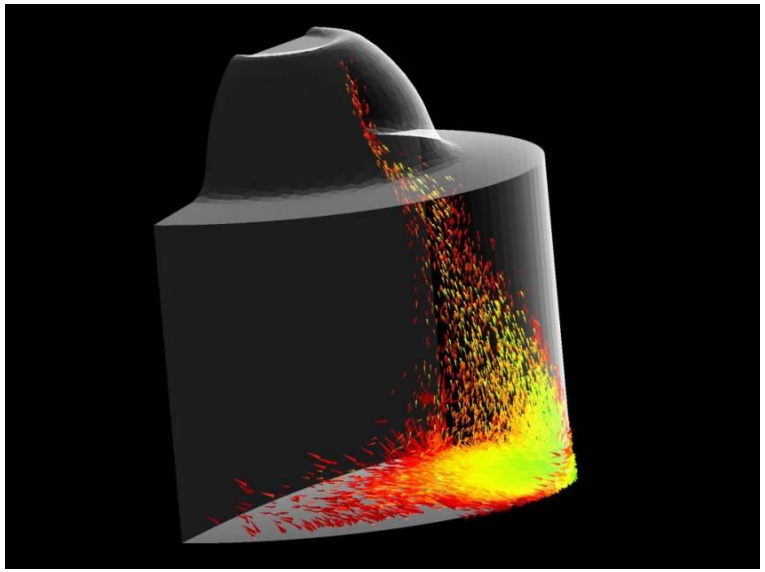


SimVis – Advanced Possibilities

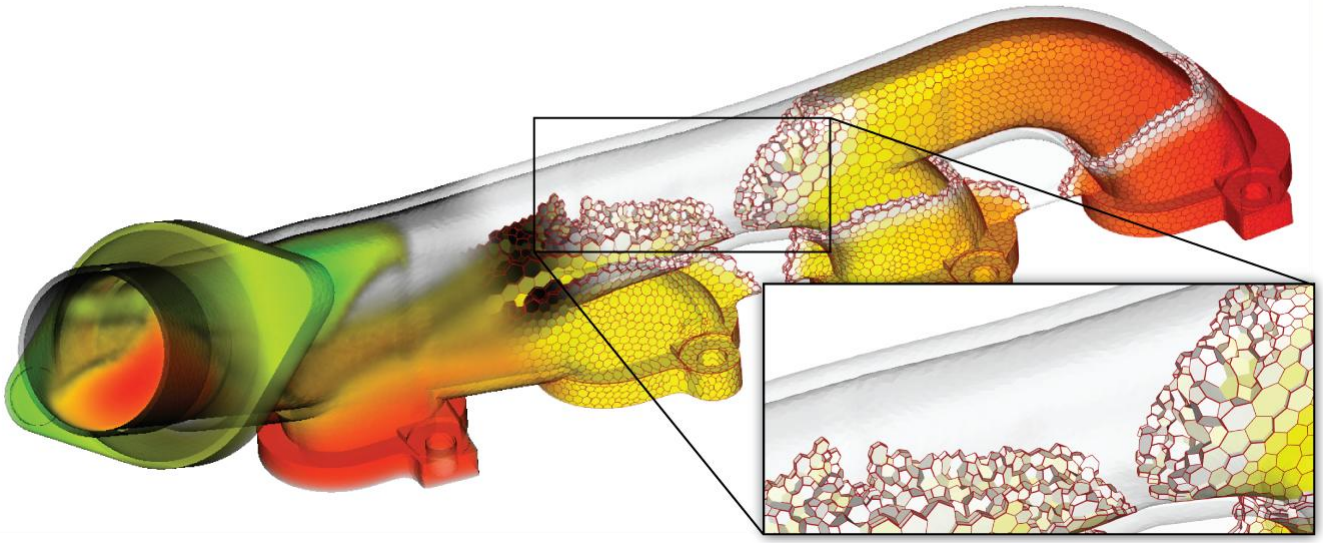
- Advanced Possibilities
  - Isosurfaces
  - Streamlines, Pathlines
  - Cut planes
  - Particles
  - Vector Display (Arrows)
- Derived Data Calculator

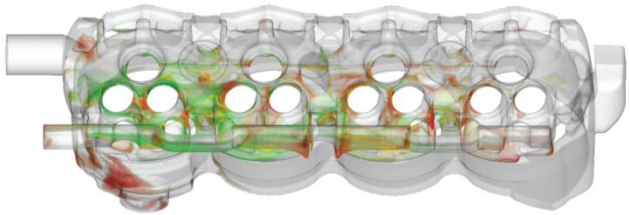






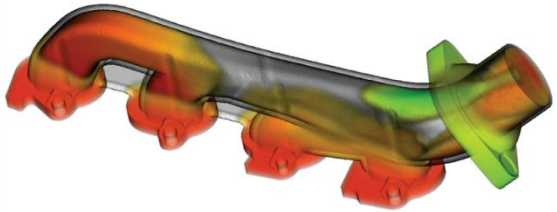
Polyhedral Grid Volume Rendering





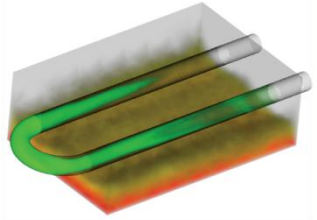
Coolingjacket

Cells: 1,537,898
Vertices: 1,630,767
Tetrahedra: 17,044,376 (~8.5 byte/tet)
HQ Rendertime: 1,245 ms
LQ Rendertime: 360 ms
Celltypes: tets/quad pyramids/tri prisms/hexahedra



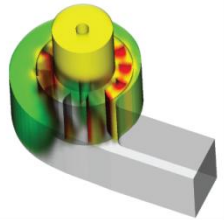
Manifold

Cells: 81,949
Vertices: 324,013
Tetrahedra: 4,094,724 (~7 byte/tet)
HQ Rendertime: 955 ms
LQ Rendertime: 323 ms
Celltypes: general (concave) polyhedra



Heater

Cells: 16,723
Vertices: 67,543
Tetrahedra: 851,089 (~7 byte/tet)
HQ Rendertime: 927 ms
LQ Rendertime: 83 ms
Celltypes: general (concave) polyhedra



Fan

Cells: 16,723
Vertices: 67,543
Tetrahedra: 281,600 (~8 byte/tet)
HQ Rendertime: 490 ms
LQ Rendertime: 27 ms
Celltypes: tri prisms/hexahedra

SimVis – Results

- Capture Images and Videos
  - With / without UI
  - Single views / full setup
- Save and reload sessions
  - Reapply analysis on similar data / cases
  - Save session state into image description
  - Save analysis step by step
- Report generation
  - Automatically produce HTML Report
  - Including data description / characteristics
  - All views, with descriptions of selections
  - Time-dependent widget
- Export selected data

SimVis – Limitations

- No data mapping for data on time-dependent geometries
  - Some techniques work only for data with steady geometry
  - Pathlines
  - Curve view
  - Some derived data
- Data needs to be converted into internal readable format
- Parallelized, but not distributed so far
- Volume rendering only on NVidia cards

SimVis – Current Status

- SimVis GmbH had to go out of business last year
- Rights are now with VRVis Research Center
- Working on solution for the future

Summary

+ General approach (works with data from different fields)
+ Very flexible (analysis adapts to user interests)
+ User in the loop (visual feedback, iterative refinement)
+ Useful for exploration & analysis
+ Smooth feature boundaries (agrees with nature of continuous data)
+ Comprehensible (analysis in the terms of the users)

Acknowledgements

- Helmut Doleisch
- Helwig Hauser
- Philipp Muigg
- Wolfgang Freiler