

VMAP WG – Visualization of VMAP Data Sets

1st VMAP User Meeting – 14.-15. February 2024

VMAP Working Group

Visualization of VMAP Data Sets

Motivation of Working Group

- VMAP as vendor-neutral storage and exchange format
- VMAP is supported by several commercial tools
- A free result visualization tool is missing and will significantly increase acceptance of VMAP

Current Members

- Fraunhofer SCAI, Hagen Engineering, Reden, KIT, Convergent
- Involved in the VMAP Project
- Open for more partners
- gitlab.scai.fraunhofer.de/vmap/paraviewplugin



Demands to visualize VMAP Data Sets

- 3D visualization engine for mesh-based and point-cloud data
 - Interactive exploration of data by applying filters, transformations, or operations to extract meaningful information (e.g., contouring, slicing, volume rendering and scripting functionality)
 - Visualization of surface plots, contour plots, scatter plots, streamlines, animations
 - Customization of the visualization tool
- Working Group decided to create a Python plug-in for ParaView (<https://www.paraview.org>), one of the world's leading open-source post-processing visualization engines

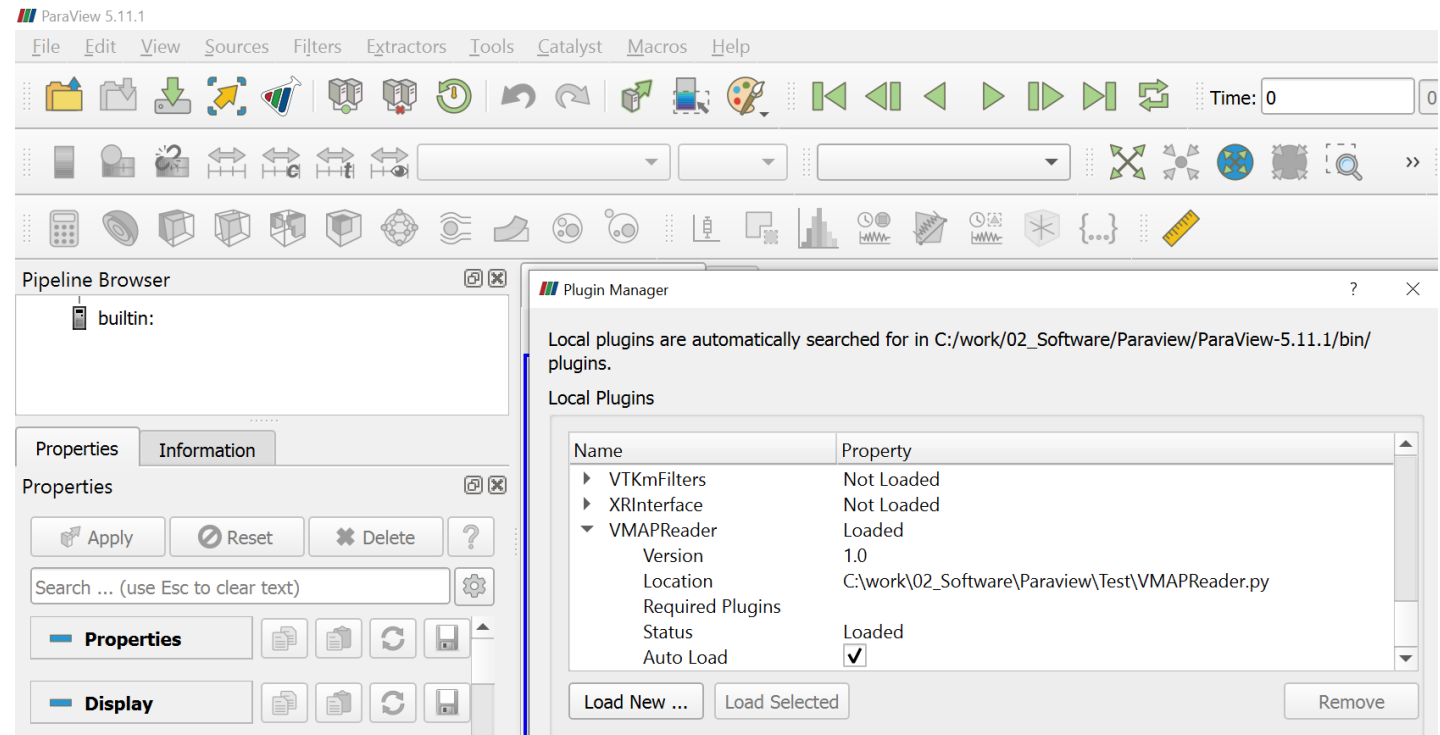
VMAP ParaView Plug-In Overview

- ParaView desktop application is build on the Visualization Toolkit (VTK)
- Allows integration of custom plug-ins (readers, writers, filters, algorithms) via ‘Plugin Manager’
- VMAP reader realized as VTKPythonAlgorithmBase

- Open ParaView
- Tools -> Manage Plugins
- Select ‘Python Plugins *.py’
- Auto Loader support

- ParaView Versions 5.10-5.12

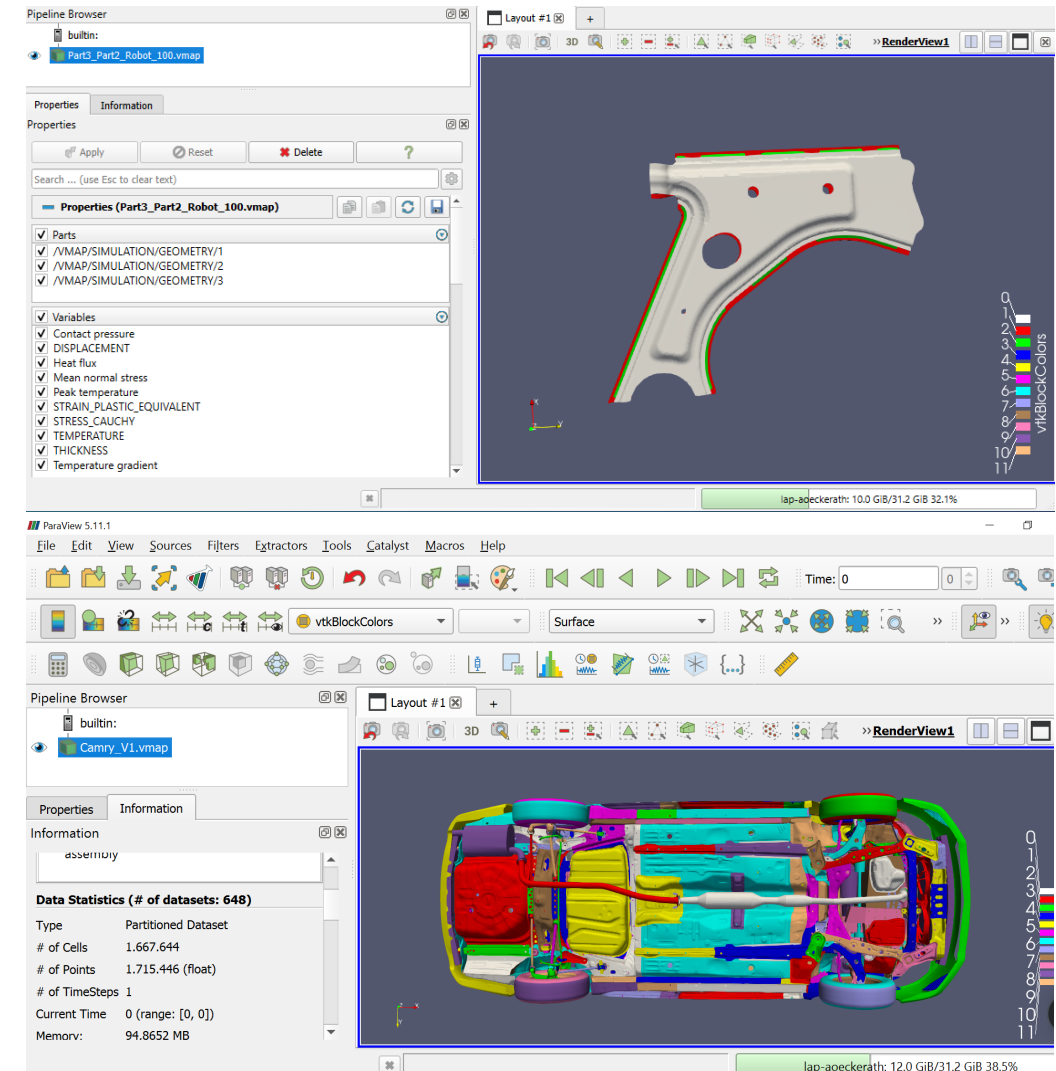
- Python 3.9-3.10 tested so far
- Linux / Windows



VMAP ParaView Plug-In Technical Status

Present functionality 'simulation data'

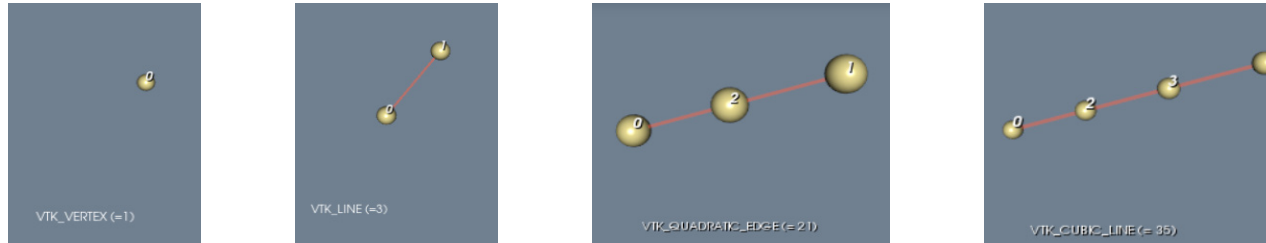
- ✓ Multiple parts
- ✓ Individual part and variables selection
- ✓ Static and transient variables
- ✓ Variables on nodes, elements or integration points (averaged to elements)
- ✓ Scalars, vectors and 2nd order symmetric tensor
- ✓ Partial results
- ✓ Deformed geometry via DISPLACEMENT variable and ParaView filter



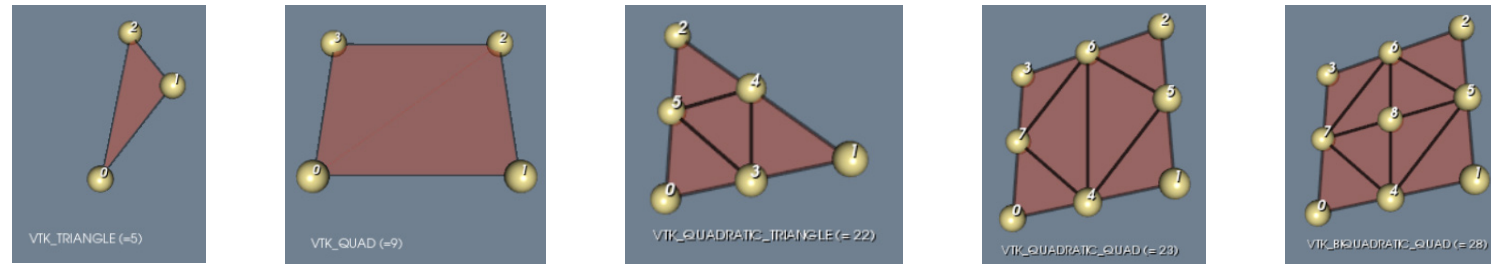
VMAP ParaView Plug-In

Supported Element shape types

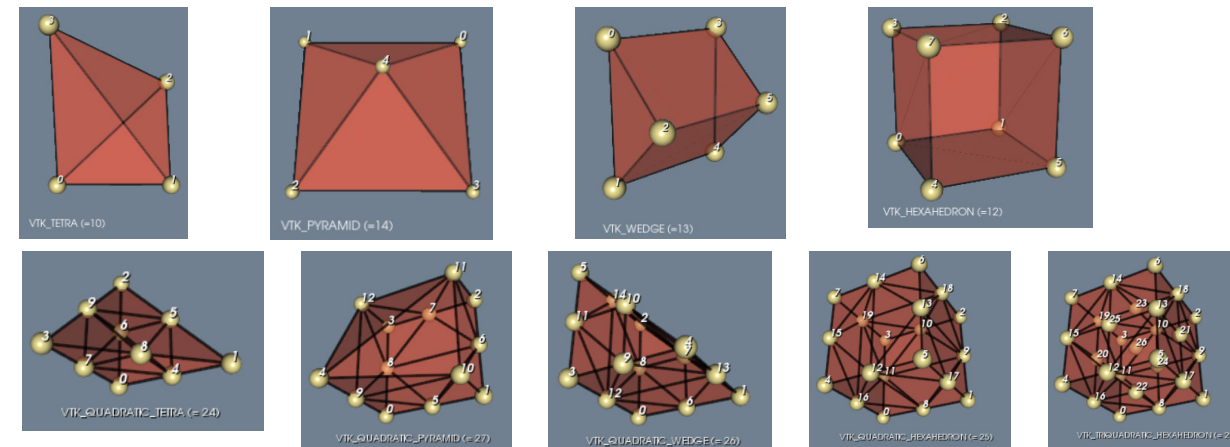
0D / 1D



2D



3D



Present functionality 'measurement data'

- ✓ Multiple parts
- ✓ Individual part and variables selection
- ✓ Static and transient variables
- ✓ Variables on nodes or elements
- ✓ Scalars, vectors and 2nd order symmetric tensor
- ✓ Deformed geometry via DISPLACEMENT variable and ParaView filter

VMAP ParaView Plug-In Performance Analysis

Toyota Camry 2012 :

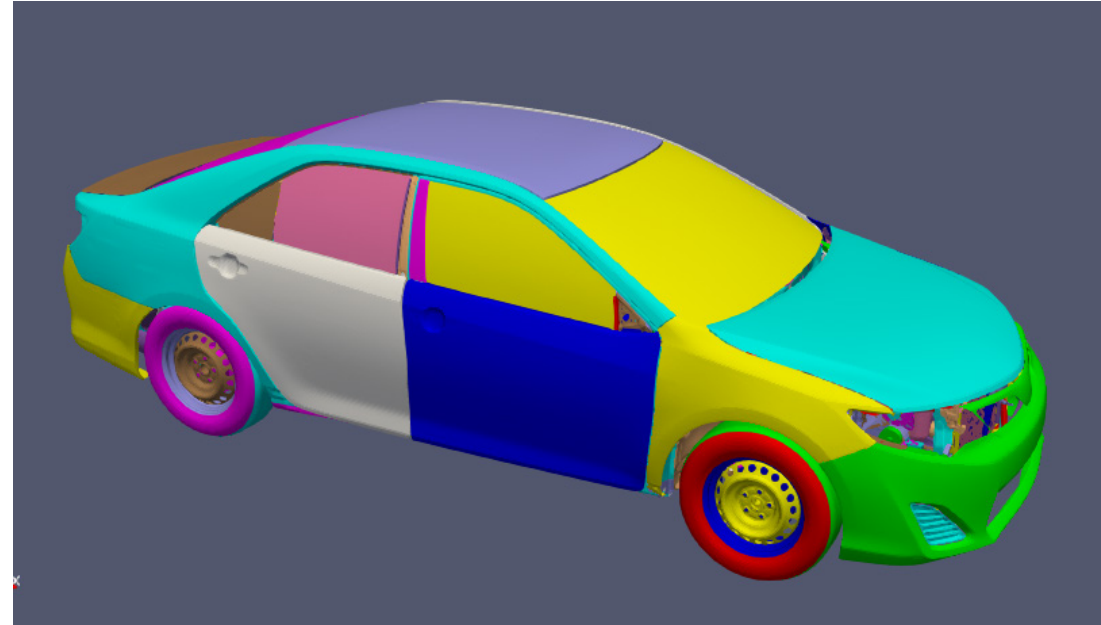
- 648 Parts
- 1.7 Mio Points
- 1.7 Mio Elements
- GZIP compressed VMAP file

Result variables:

- Thickness and equivalent plastic strain
- Stress (2nd order symmetric tensor)

Execution time:

- Geometry 8.67 seconds
- Time Step 1.17 seconds



This model is computer representation of a 2012 Toyota Camry mid-size passenger sedan for use in crash simulations. It was developed through a reverse engineering process by Center for Collision Safety and Analysis researchers under a contract with the Federal Highway Administration.

Ultrasound Measurement Data:

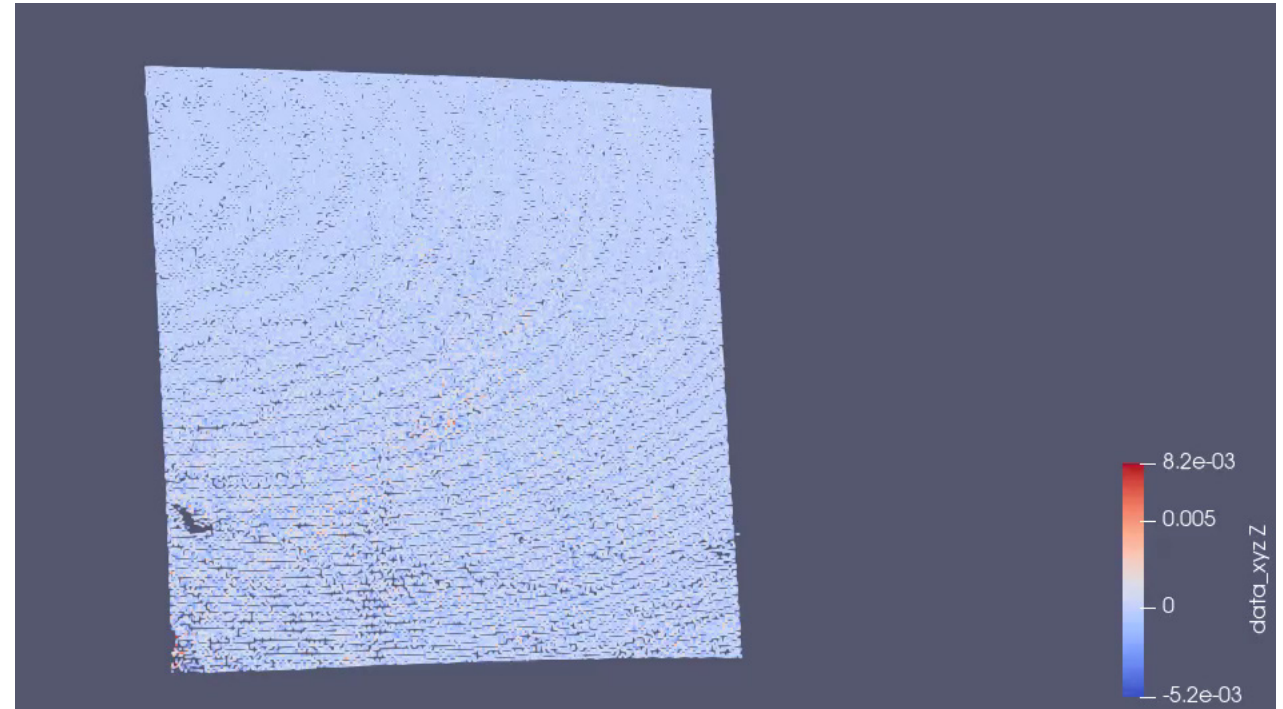
- 1 Part
- 45000 Points
- 45000 Elements

Result variable:

- Displacement Vector

Execution time:

- Geometry: 0.16 seconds
- Time Step: 0.02 seconds



- Performance optimization integration point results
- Multiplicity > 1 variables, e.g. element coordinate system stored in ORIENTATION
- Layered visualization of integration point results
- Measurement data
 - Tables
- ParaView writer VMAP Plug-In
 - Would allow wrapping other formats to VMAP

Thank you for your attention