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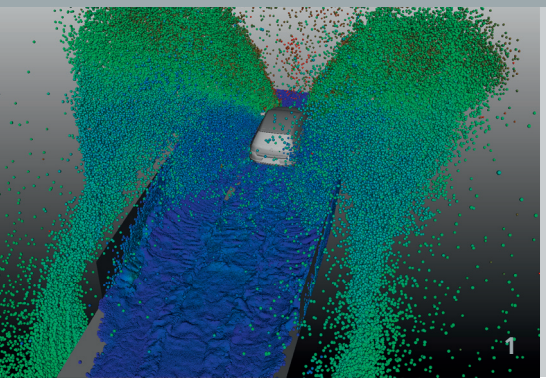
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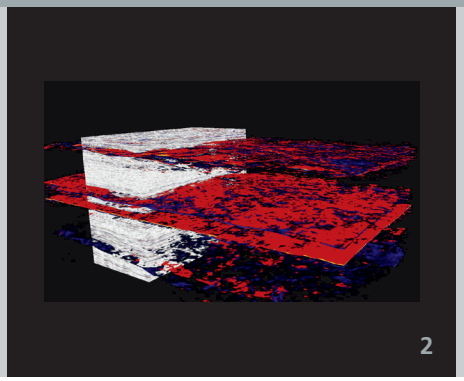
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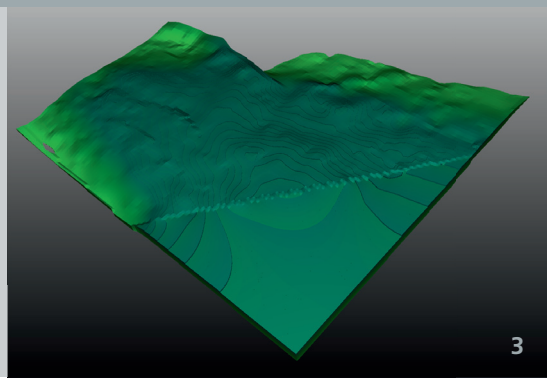
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1 *Screenshot of a real-time Visualization of a pre-calculated particle simulation*

2 *Seismic data opaque and with volume rendering*

3 *Hexahedron object with several hundreds of millions of polygons*

THE PV4D RENDER ENGINE – SPEED AND QUALITY UNITED

The PV4D render engine is a **state of the art visualization library** that is exclusively using the system's CPUs to create the final image with the fastest and most modern ray tracing algorithms. By directly working on data in the system memory, the visualization can take place on the same recourses that are used for simulations or algorithms and can access the results the moment they are produced: **in-situ visualization**.

PV4D is **fully scalable** and can be easily adapted to the problem size, making it the perfect solution for visualizing large quantities of data in full HD quality and at interactive framerates. This makes PV4D an optimal fit for seismic datasets. But it has many use cases beyond geophysics, such as automotive, medical, architecture, and many more.

Key Features

- Fully parallel and scalable
- Support for huge 3D volume data
- Support for huge surfaces with flexible texture blending
- Support for hexahedrons, up to multi-billion polygons (hexahedrons, tetrahedrons)
- Fully interactive in HD quality
- Hybrid acceleration structures and real-time primitive compiler
- Easy to integrate C/C++ library for Linux and Windows

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hpc_flyer_PV-4D_Render Engine-Speed and Quality united_EN-A4

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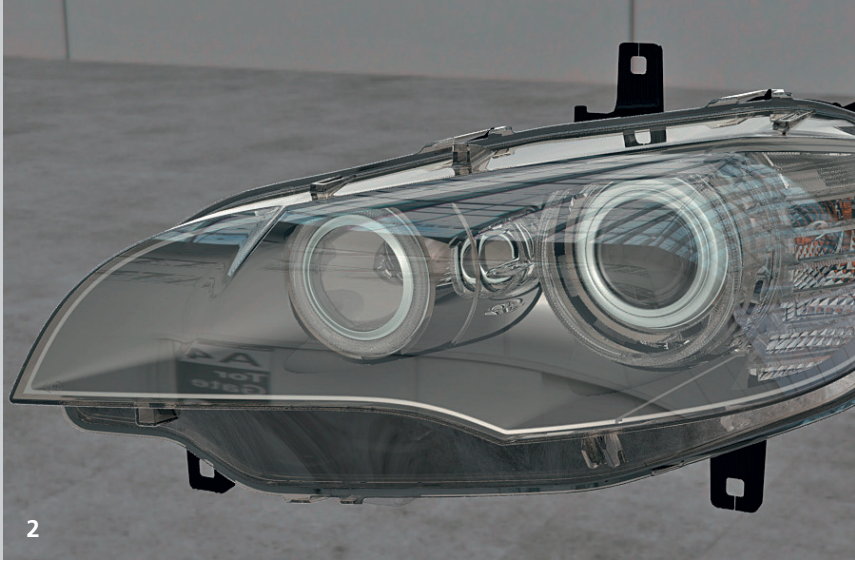

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Visualization Tools

- High quality display of full real amplitude values (32bit float) in HD quality.
- Easy and gradual overblending of seismic and attribute data.
- Real-time support for full quality zoom, pan and rotate.
- Multiple volume display with transparency or cross-section display
- Parallel and perspective projection for easy orientation and fast, distortion free browsing through large datasets.
- Easy cross-section displays and slicing of x, y and z planes.
- Advanced slicing along i, j, and k hexaplanes with range selection in real-time using a rebuilt multi bounding volume hierarchy.
- Instant read-out of cursor position and amplitude value(s) at any given position

Technology under the Hood

PV4D is exclusively using the CPUs to create the final image on a distributed system using ray tracing methods. These methods are currently the **fastest available render technology in the world** for CPU-driven ray casters, featuring novel implementations of key components.

The dataset is distributed over the nodes and held in local memory. By adding more nodes, very large datasets can easily be rendered at interactive framerates.

Each compute node calculates the part of the image that involves its local share of the dataset and in a very fast, final compositing step, using the GPI framework for RDMA, the image is generated.

To provide the absolute best render solution possible, PV4D comes with different render kernels for different data types:

- VR-Kernel for rendering large voxel based volumes (e. g. seismic data, MRI, CT, …)
- Triangle-Kernel for triangulated scenes and objects (e. g. geophysical horizons, CAD, …)
- Polygon-Kernel for hexahedron or tetrahedron based scenes (e. g. from reservoir simulations)

The different kernels work with objects in the same scene and a parallel scene graph using a multi bounding volume hierarchy as acceleration structure is ensuring the optimal processing and image generation. For the pre-processing, our kernel come with extremely fast compilers for both polygons and voxels.

1 *Our latest ray casting kernels generate an even more realistic effect by simulating the natural light distribution on mat surfaces.*

2 *Photo-realistic rendering of the light component in a BMW X5*