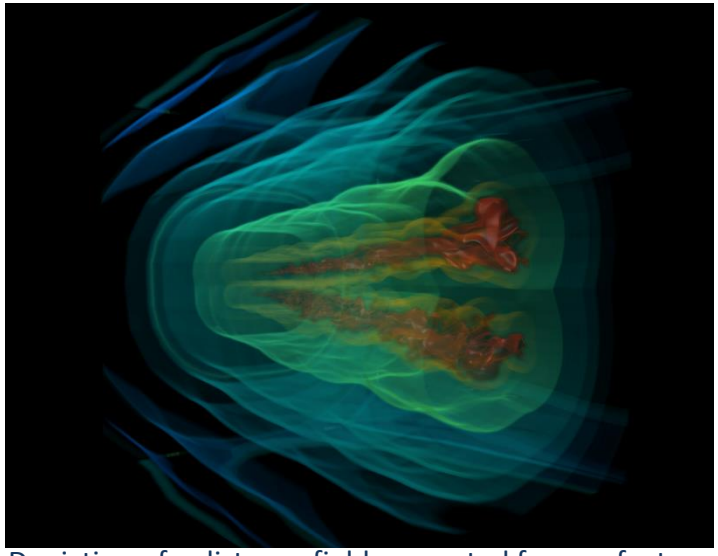
Parallel Distance Field Computing

Technology

- Distance field computing is fundamental to many data analysis and visualization applications.
- This project realizes a highly scalable parallel implementation to support in situ processing and data reduction.
- The design is general to handle a variety of data
- The product is a standalone library to be easily adopted for different settings.

Applications & Impact

- Distance fields can be used as importance fields to guide rendering, data compression, sampling, and feature-based optimizations.
- The resulting technology will benefit many SciDAC applications from combustion, fusion, to climate and astrophysics simulations.
- This work will motivate others to develop novel visualization and data reduction methods using distance fields.



Depiction of a distance field computed from a feature surface in data generated by a combustion simulation.

Results

- A use case on a turbulent combustion simulation shows over 80% data reduction while revealing previously hidden flow features.
- A parallel spatial data structure has been designed to accelerate the computation.
- Tests on the parallel implementation show the data that must be exchanged is under 0.01% of the total data, and the cost to exchange the data is under 0.2% of the overall time.

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