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Sandia National Laboratories

SDAV Progress Report

Sandia National Laboratories

Kenneth Moreland

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National Nuclear Security Administration

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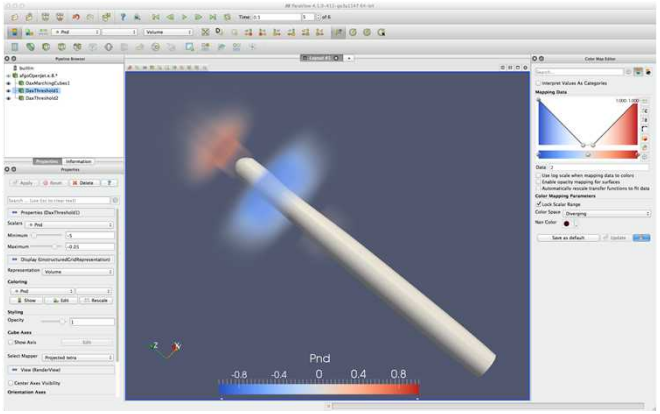
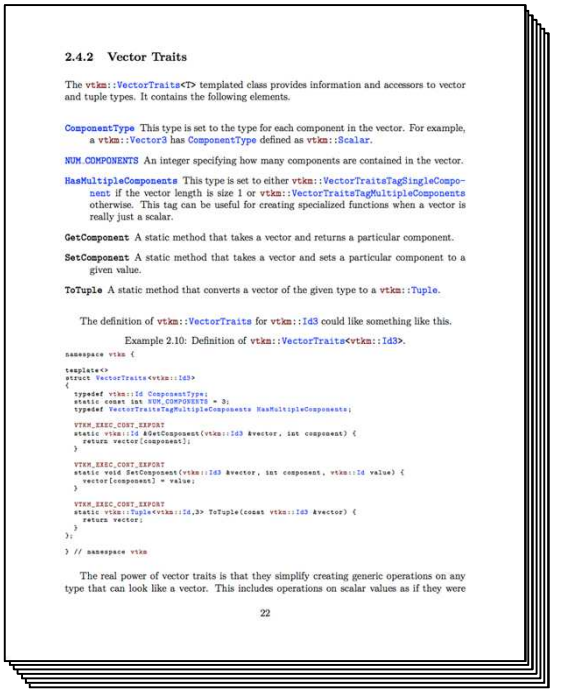
Milestone Activities

- Integration of Dax with VTK and VTK-m [3.3.2 Y3]
  - Collaboration between SNL, LANL, ORNL to combine Dax, Piston, EAVL
    - Established VTK-m repository
  - Demonstrated integration of Piston algorithms with Dax device layer
  - Planning meeting in February to interface Dax with EAVL data
    - Current major complexity combining run-time polymorphism with compile-time templating
    - Designing C++ components to bridge these
  - Building documentation as communication point
- Prototype integration ParaView - Dax [3.3.1 Y4]
  - Not hardened





2.4.2 Vector Traits

The vtkm::VectorTraits<T> templated class provides information and accessors to vector and tuple types. It contains the following elements.

ComponentType This type is set to the type for each component in the vector. For example, a vtkm::Vector3 has ComponentType defined as vtkm::Scalar.

NUM_COMPONENTS An integer specifying how many components are contained in the vector.

HasMultipleComponents This type is set to either vtkm::VectorTraitsTagSingleComponent if the vector length is size 1 or vtkm::VectorTraitsTagMultipleComponents otherwise. This tag can be useful for creating specialized functions when a vector is really just a scalar.

GetComponent A static method that takes a vector and returns a particular component.

SetComponent A static method that takes a vector and sets a particular component to a given value.

ToTuple A static method that converts a vector of the given type to a vtkm::Tuple.

The definition of vtkm::VectorTraits for vtkm::Id3 could like something like this.

Example 2.10: Definition of vtkm::VectorTraits<vtkm::Id3>.

```
namespace vtkm {

template<>
struct VectorTraits<vtkm::Id3>
{
  typedef vtkm::Id ComponentType;
  static const int NUM_COMPONENTS = 3;
  typedef VectorTraitsTagMultipleComponents HasMultipleComponents;

  VTKM_EXEC_CONT_EXPORT
  static vtkm::Id &GetComponent(vtkm::Id3 &vector, int component) {
    return vector[component];
  }

  VTKM_EXEC_CONT_EXPORT
  static void SetComponent(vtkm::Id3 &vector, int component, vtkm::Id value) {
    vector[component] = value;
  }

  VTKM_EXEC_CONT_EXPORT
  static vtkm::Tuple<vtkm::Id,3> ToTuple(const vtkm::Id3 &vector) {
    return vector;
  }
};

} // namespace vtkm
```

The real power of vector traits is that they simplify creating generic operations on any type that can look like a vector. This includes operations on scalar values as if they were

Scanning Transmission Electron Microscopes (S/TEM)

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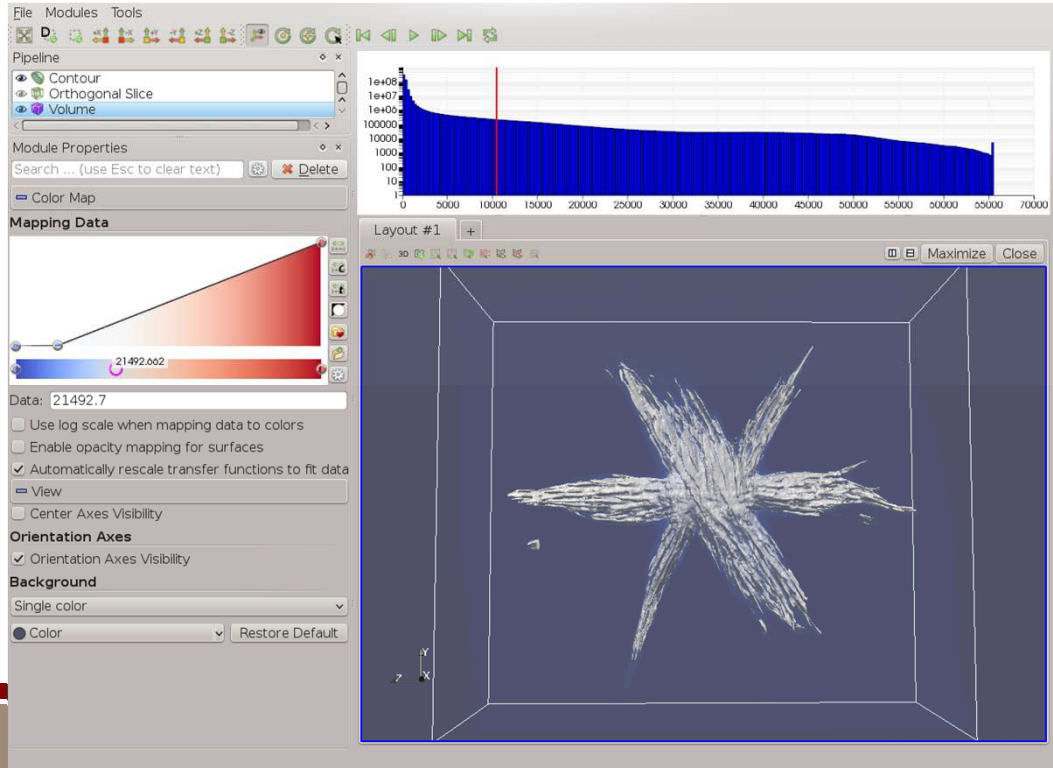
- Generates large (1024^3 and greater) volumes
  - Software limited, proprietary, or non-existent
- TomViz: an open, general S/TEM visualization tool
  - Built on top of ParaView framework
  - Uses Dax for algorithm construction
- Implements streaming, interactive, incremental contouring
  - Streams indexed sub-grids to threaded contouring algorithms
  - Significantly beats VTK's best algorithm in the majority of cases



Other Activities

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- Program Committees: EGPGV, IEEE SciVis, LDAV, VISTech
- Panel: “Current Status and Future Trends of Integrated Computational Environments,” 52nd Aerospace Sciences Meeting, AIAA SciTech 2014
- Minisymposium: 16th SIAM Confernece on Parallel Processing for Scientific Computing
- Presentation: GPU Technology Conference 2014
- Presentation: NERSC Joint Facilities User Forum on Data-Intensive Computing