VISH

Concepts and Vishions

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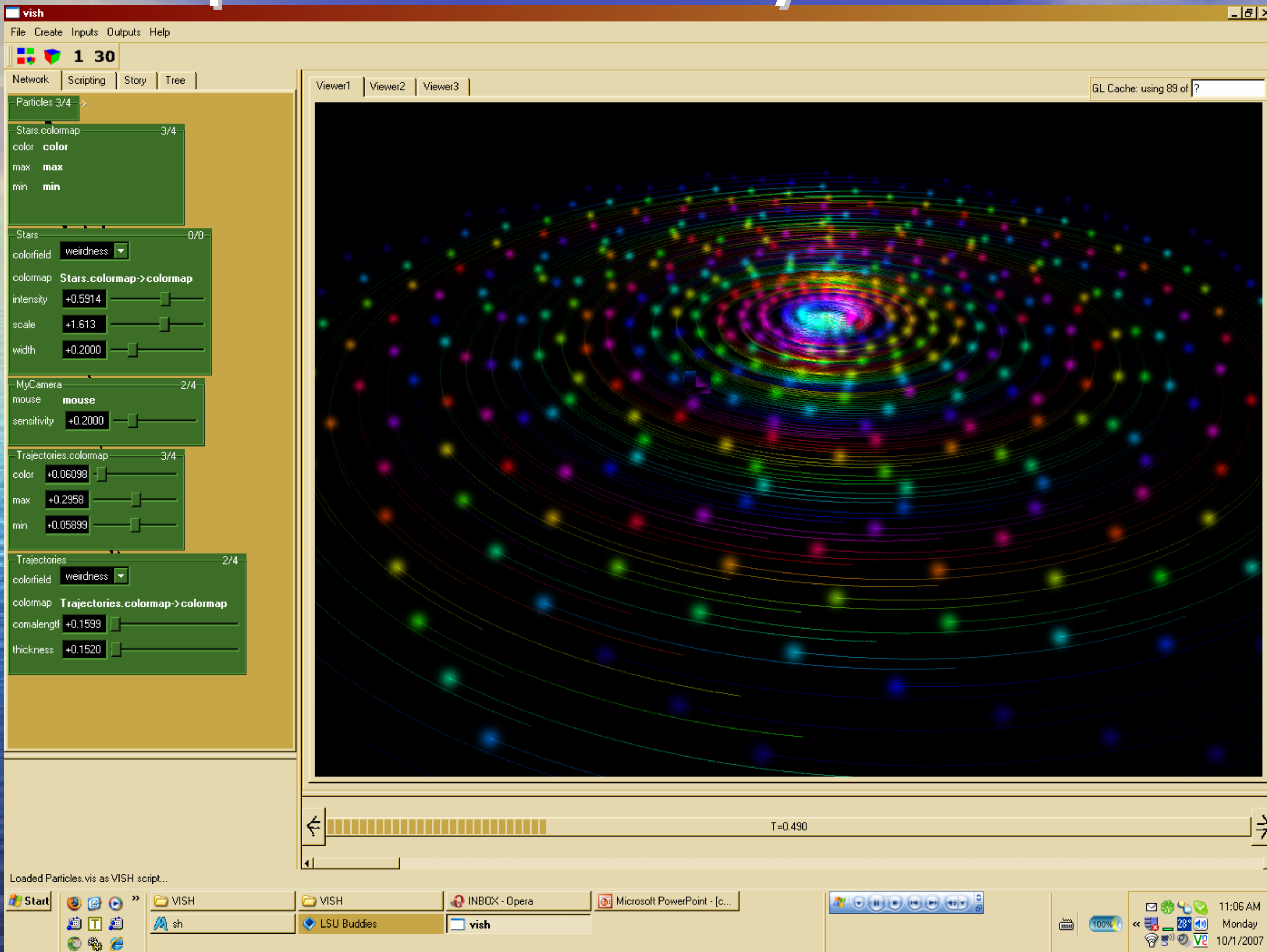
FAQ

- Can VISH visualize my data and make pretty images?
  - Simple answer: **NOT YET** ☹
- Then, what is it good for?
  - It will soon be able to do so, and do it better than anything else ☺
- Next slides: how?

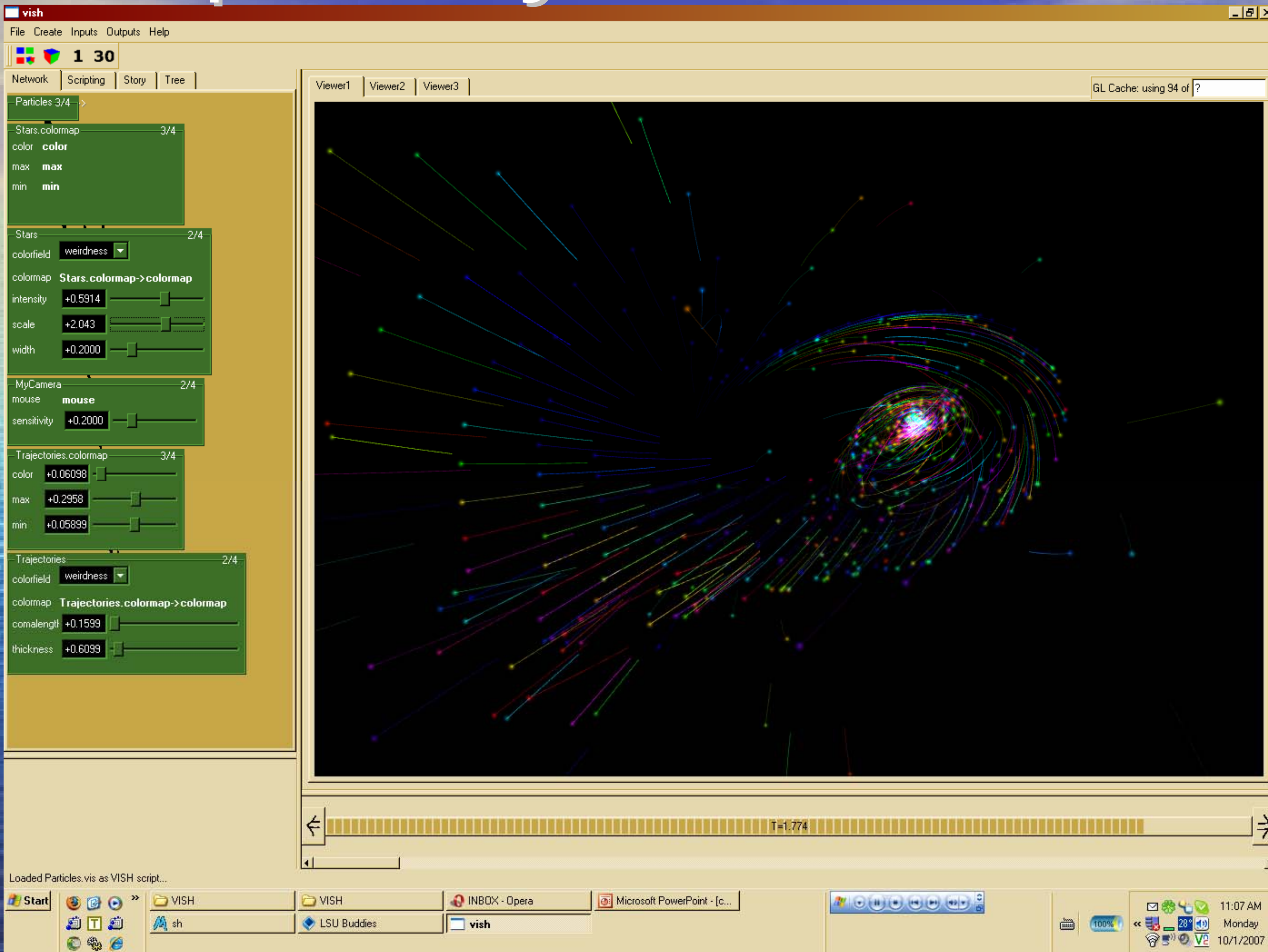
VISH Status

- VISH is currently under development
- Close to reach end-user productivity level, but not yet fully at this stage
- Development is demand-driven
- Screenshots!

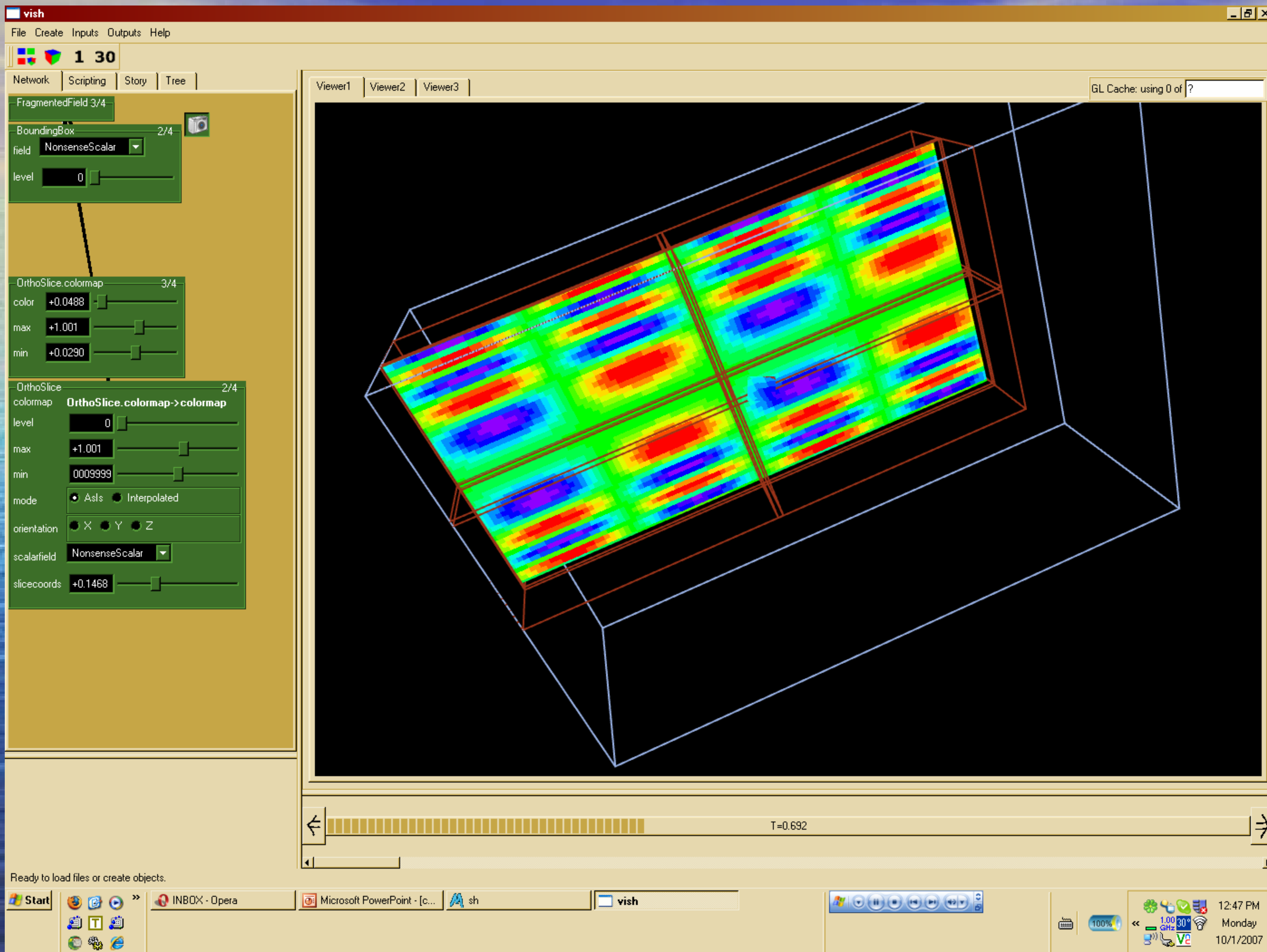
Example: Particle System



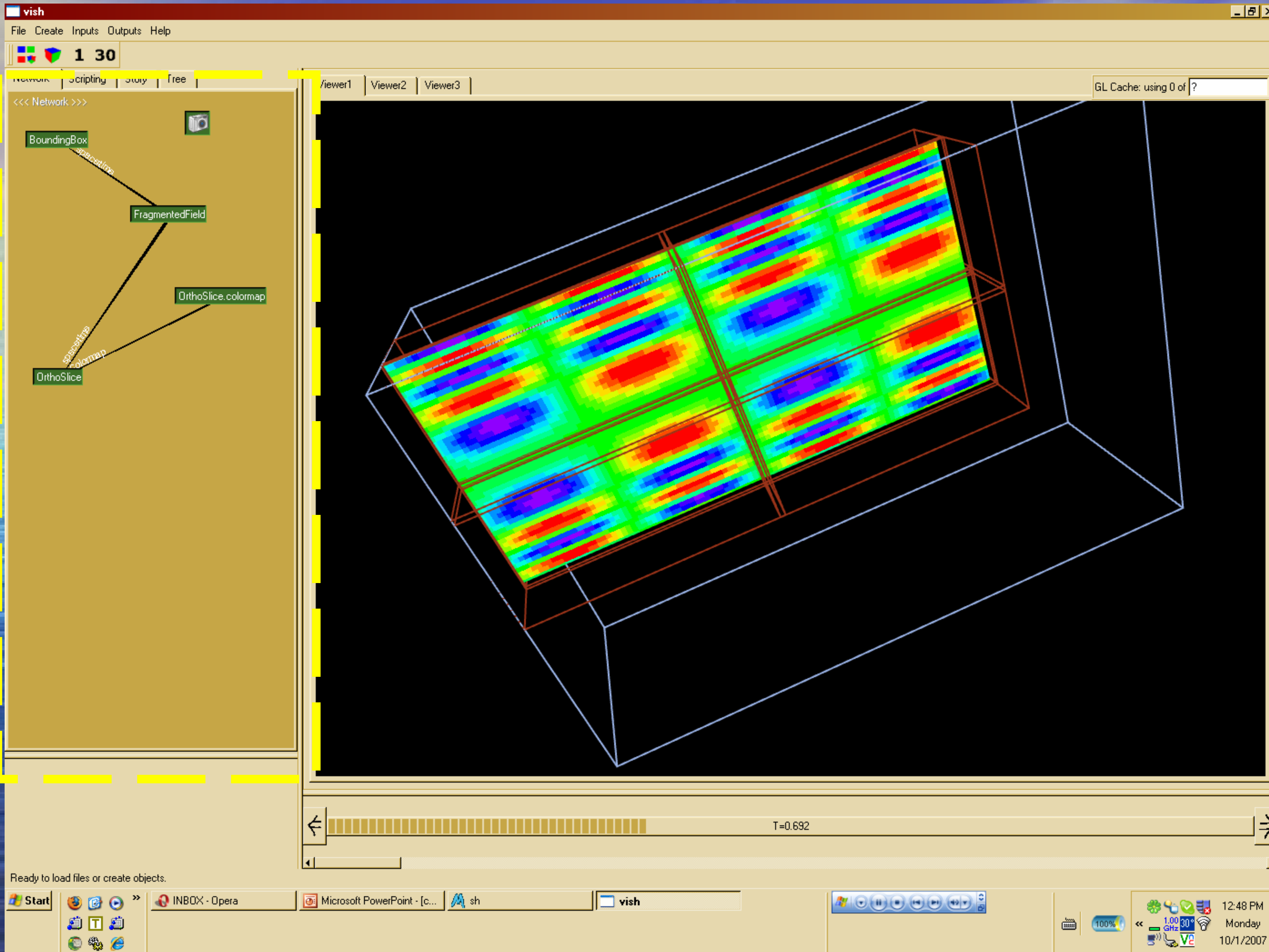
Example: Trajectories



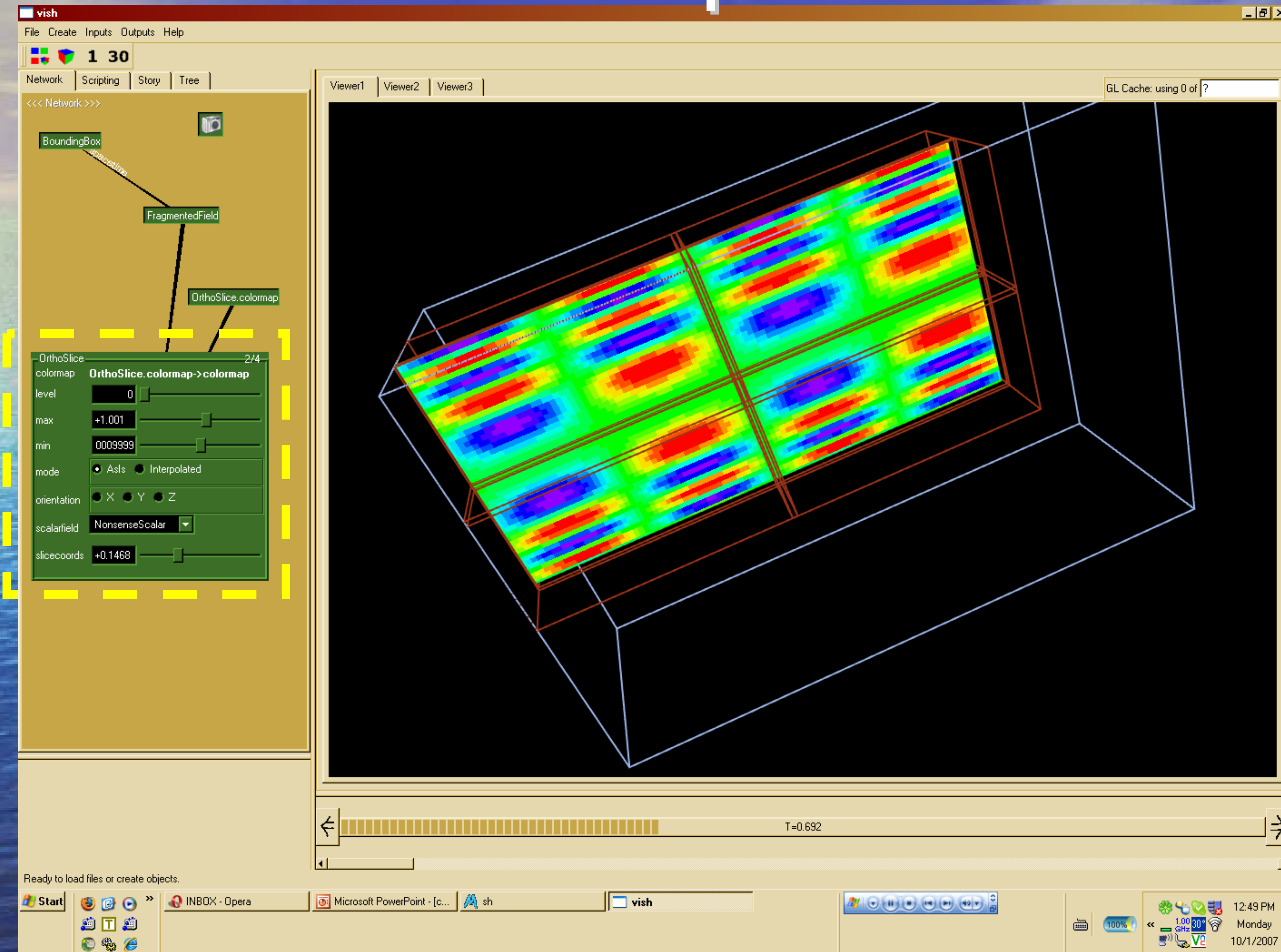
Example: Fragmented Orthoslice

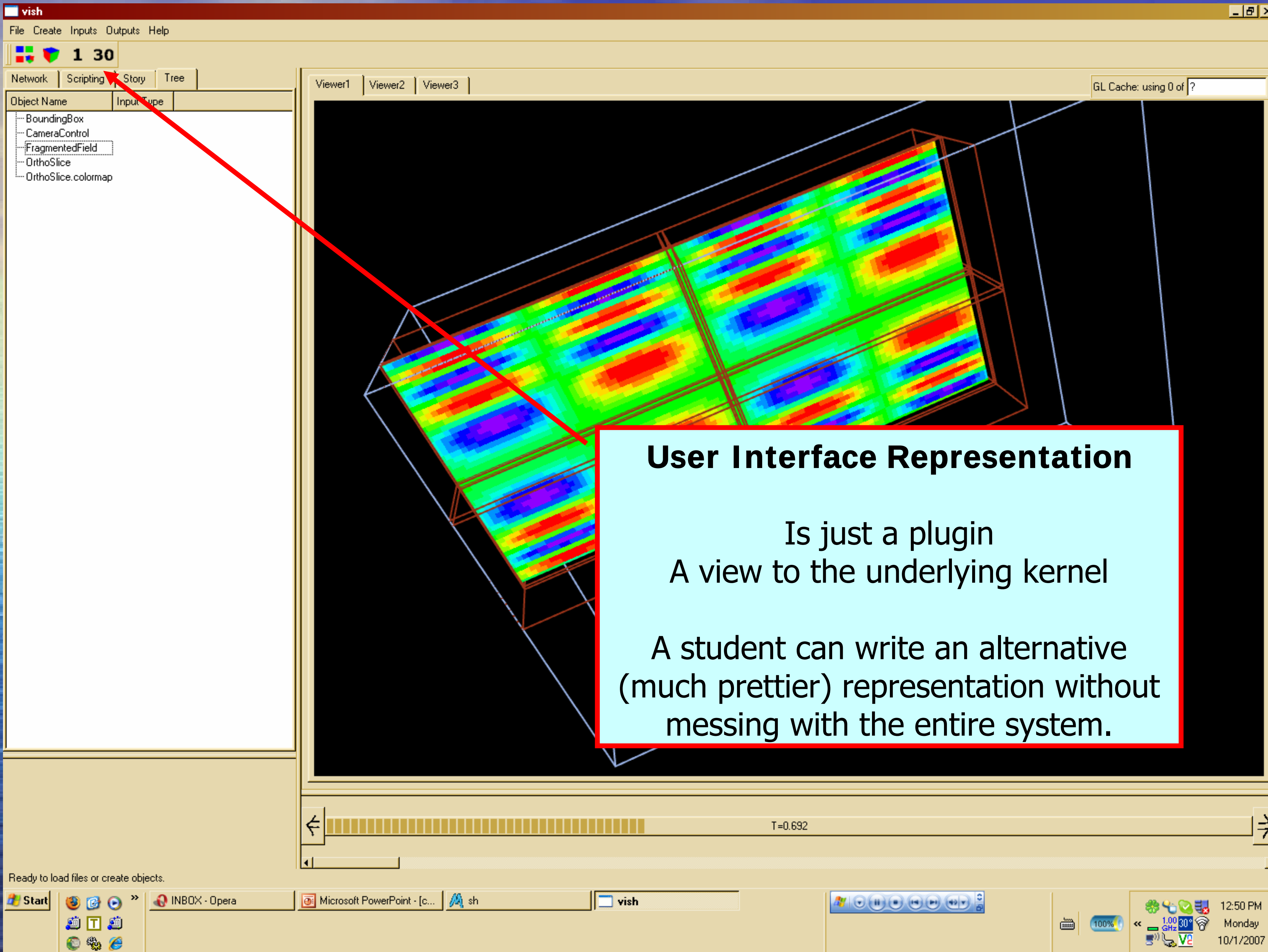


GUI: Iconized Network



Parameter GUI Expansion





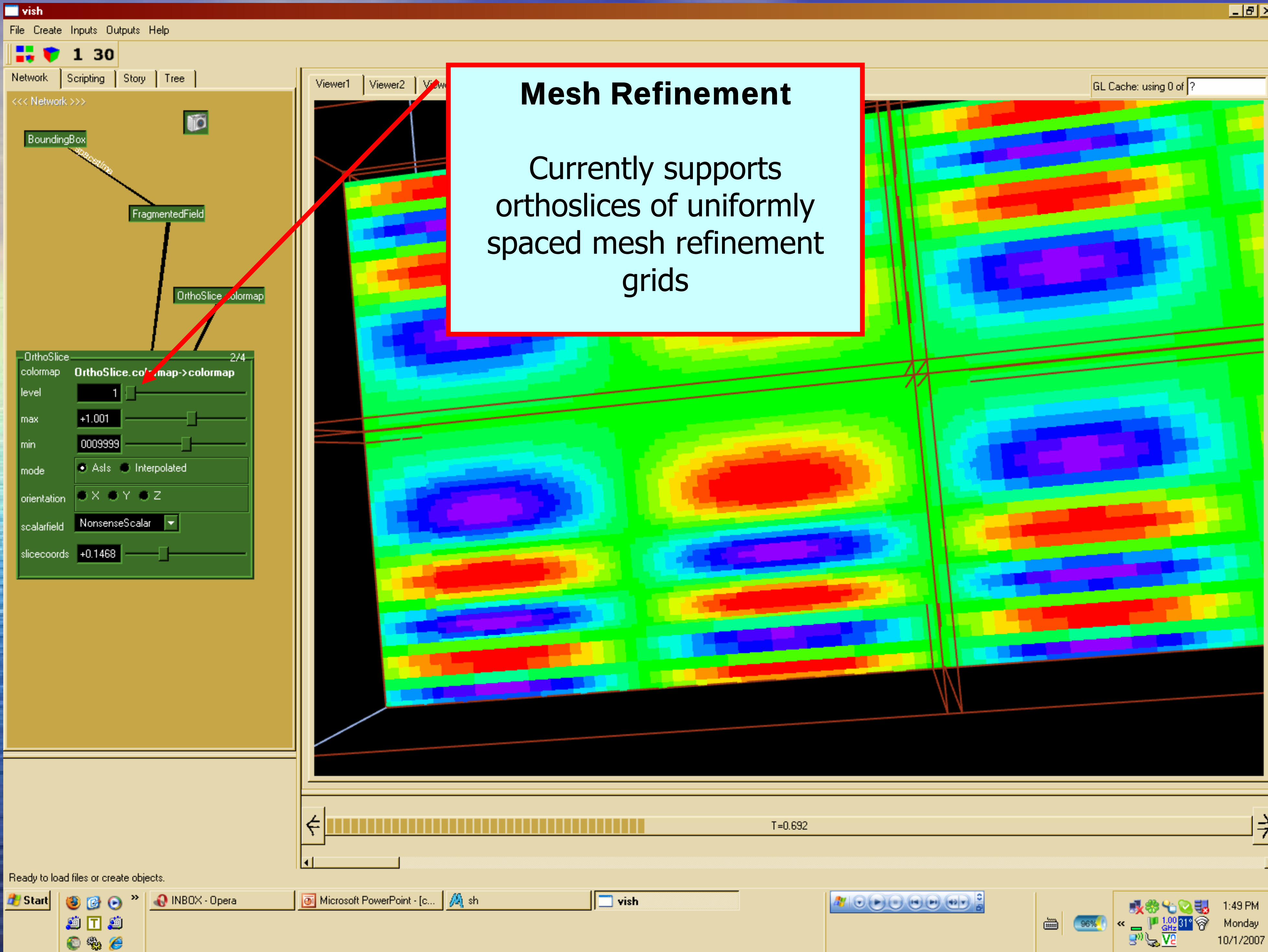
User Interface Representation

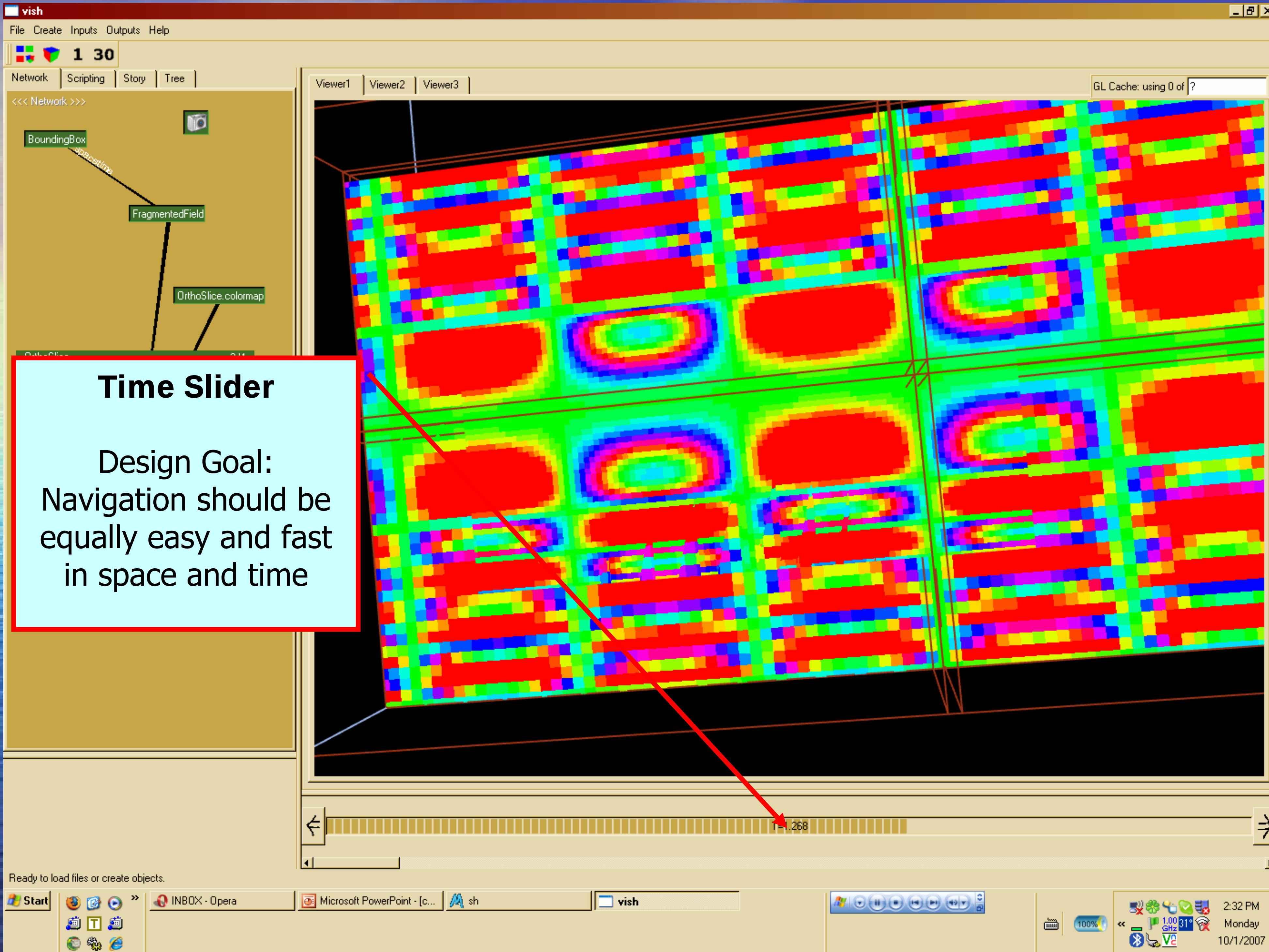
Is just a plugin
A view to the underlying kernel

A student can write an alternative (much prettier) representation without messing with the entire system.

Mesh Refinement

Currently supports orthoslices of uniformly spaced mesh refinement grids

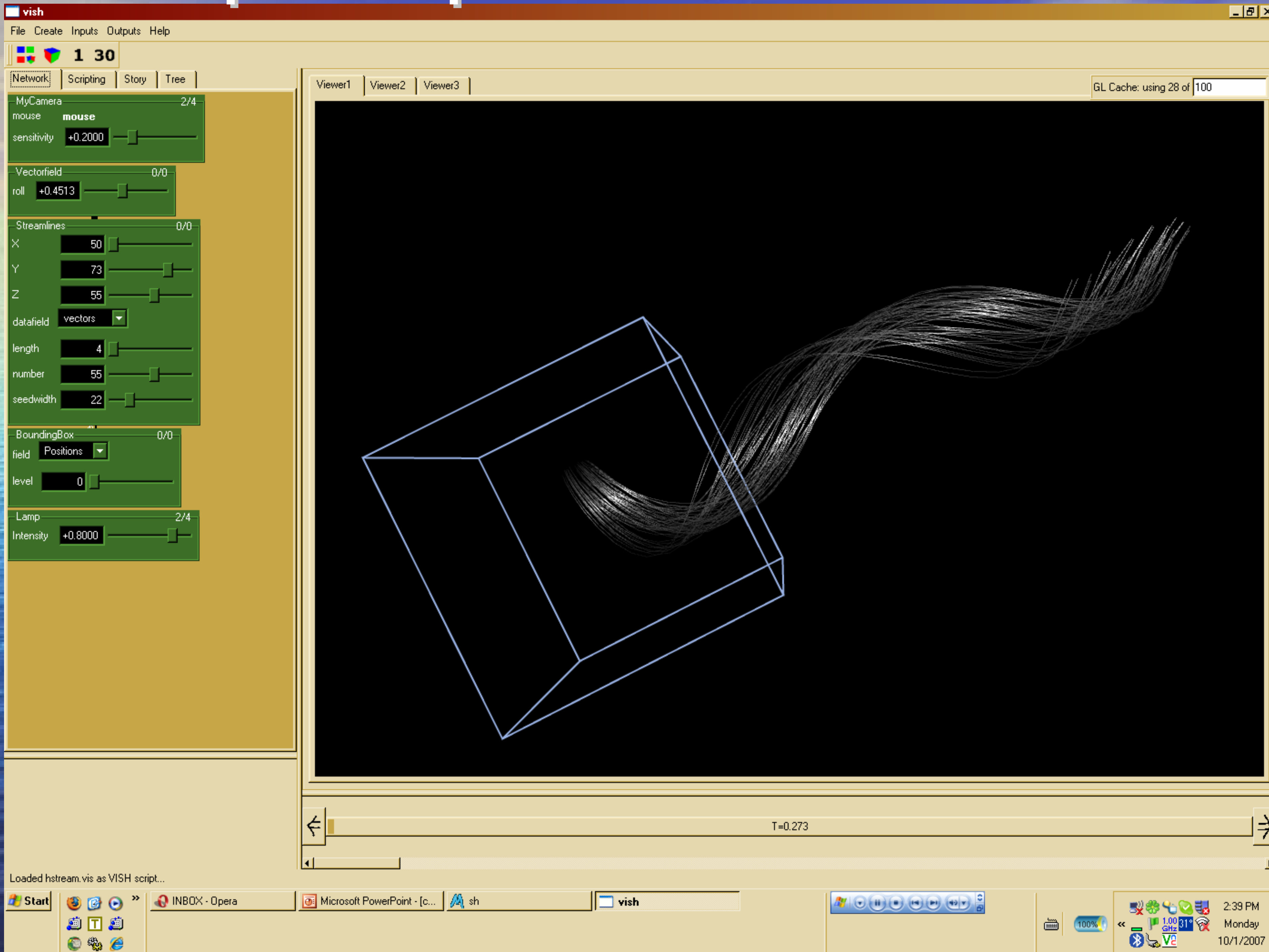




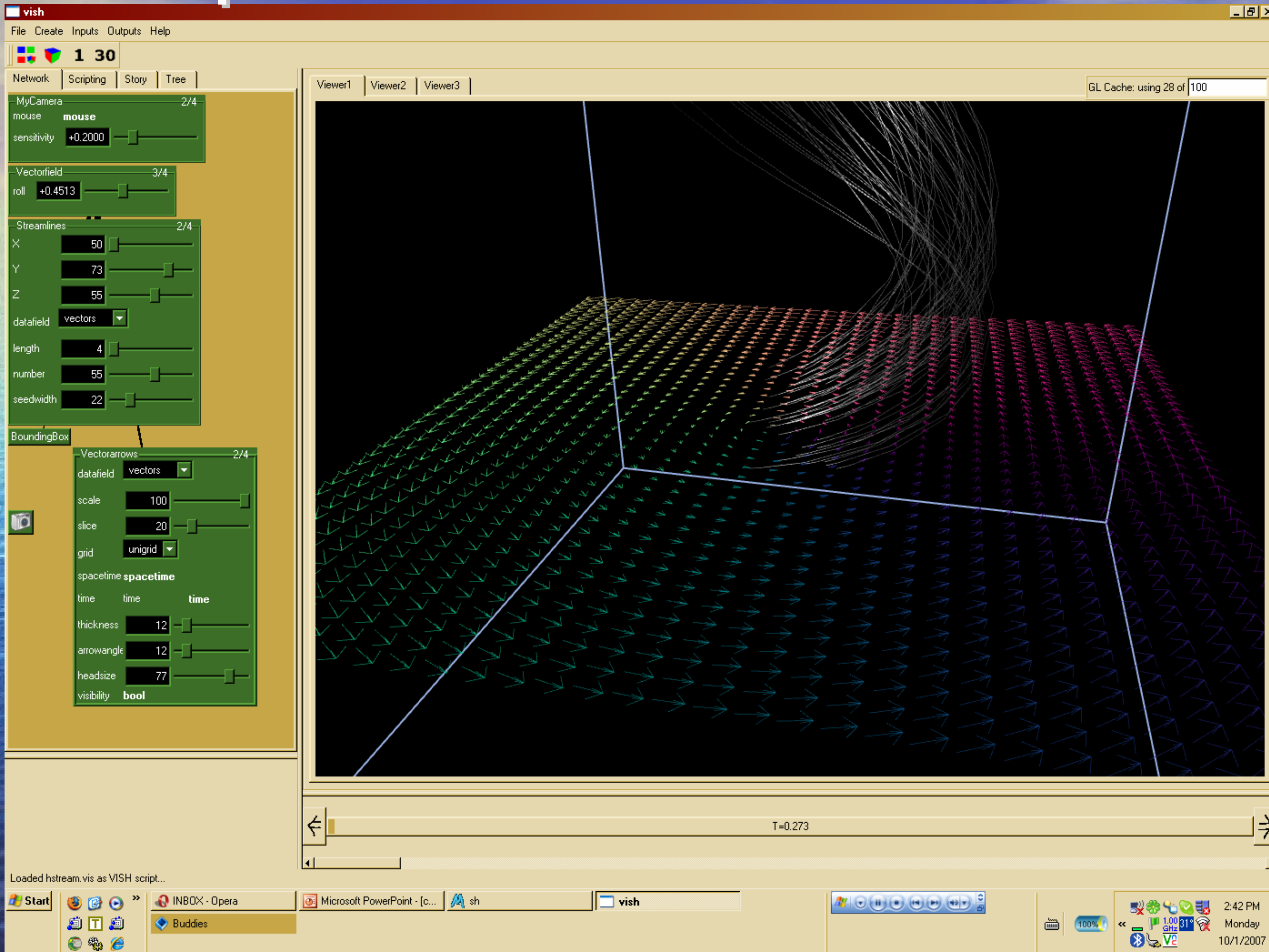
Time Slider

Design Goal:
Navigation should be equally easy and fast in space and time

Example: Specular Streamlines

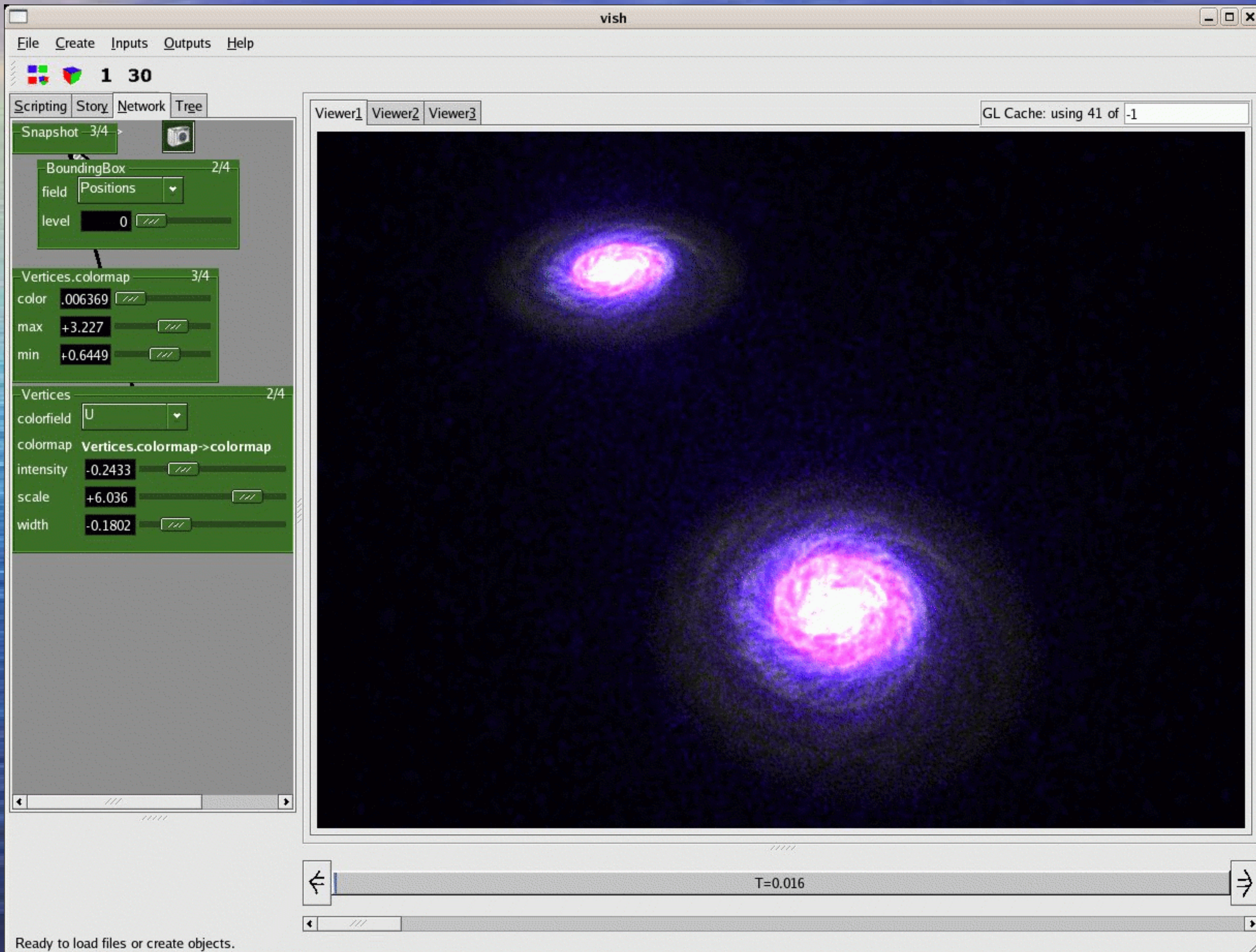


Example: Vector Arrows

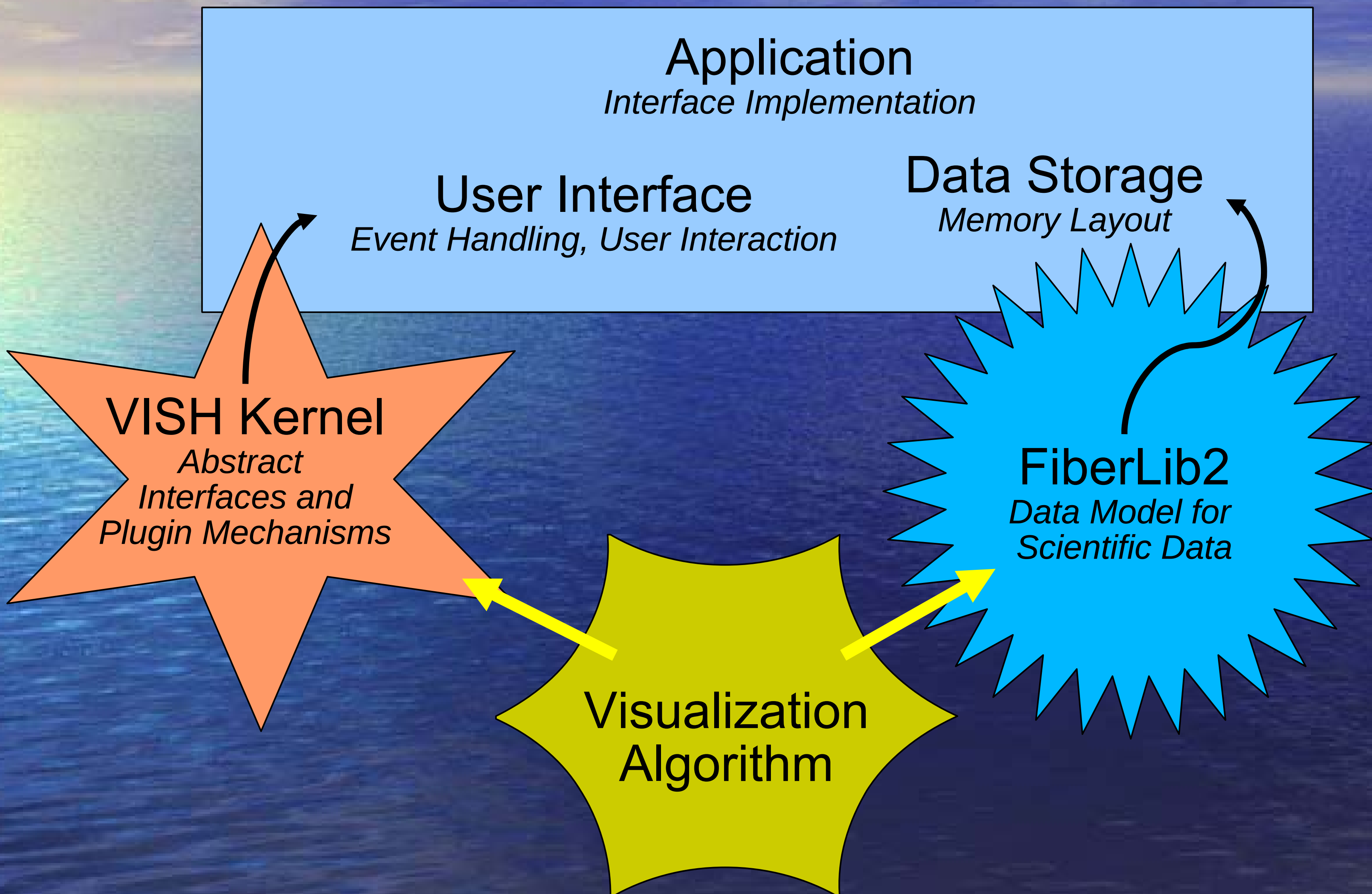


SPH Particle Data set

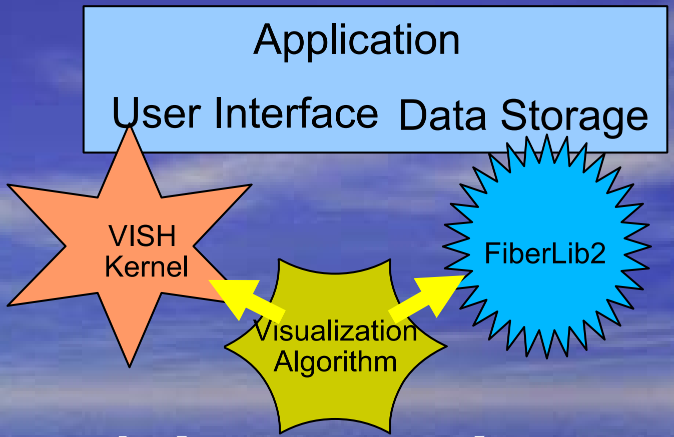
(2.6mio particles, interactive)



VISH Components



VISH Components

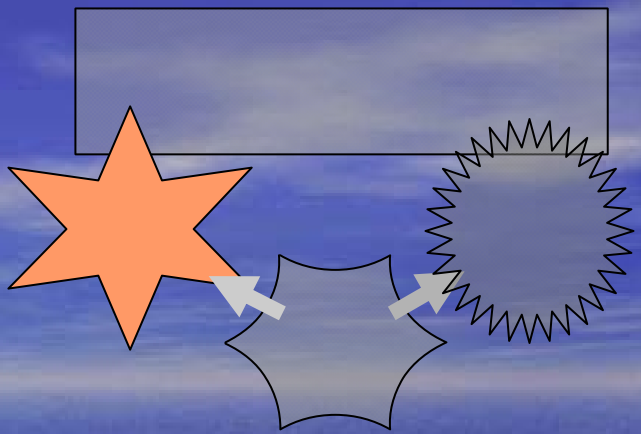


- Kernel with object management and (runtime) plugin mechanisms
- User Interface plugins (e.g., QT frontend)
- Data model (systematic treatment of scientific data via a common approach)
  - I/O layer as runtime plugins (file formats, streaming)
- Visualization infrastructure
  - OpenGL caching mechanisms

What stands “VISH” for?

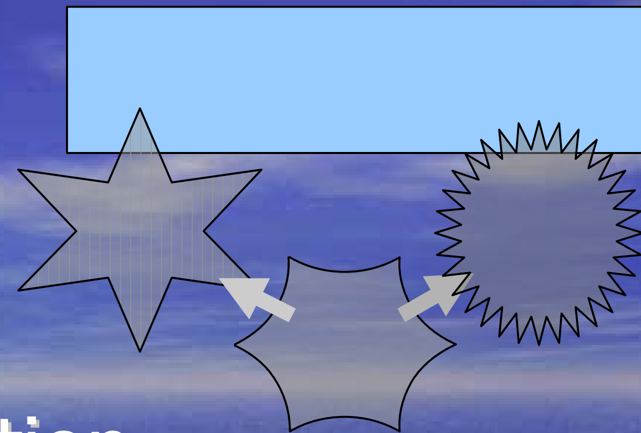
- A **V**isualization **Sh**ell
- A framework for realizing **V**isualization W**ish**es
- Something else… (free to imagination)
- Pronouncation (proposal):
  - Even times: “fish”
  - Odd times: “wish”
  - Maritime naming convention

VISH Kernel: ocean



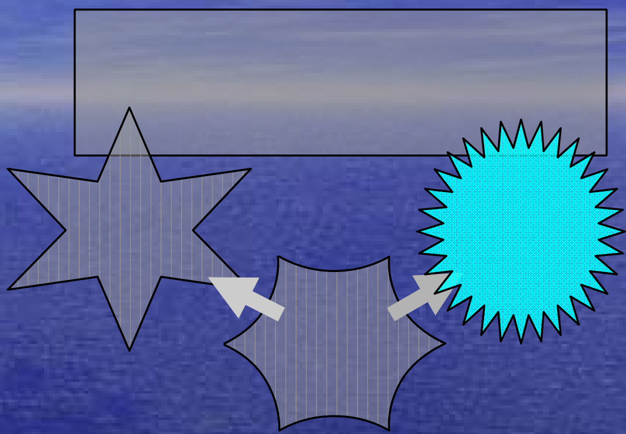
- Database-like kernel
  - Abstract objects with inputs and outputs
  - Plugin mechanisms
  - Data and control flow management
- OpenGL support library
  - Layered rendering
  - Multidimensional Cache management

VISH GUI: qVISH



- Reference prototype implementation
  - based on QT (both qt3 and qt4 possible)
  - Plugin to the kernel
  - Consists of several plugins itself, such as
    - Network, scripting, tree, story representation
- Other GUI's possible: GTK, wxWindows, FLTK, none (batch mode)
- Interfacing existing applications possible:
  - E.g. run VISH within Amira, or Scirun, or AVS or ...??

VISH data model: FiberLib2



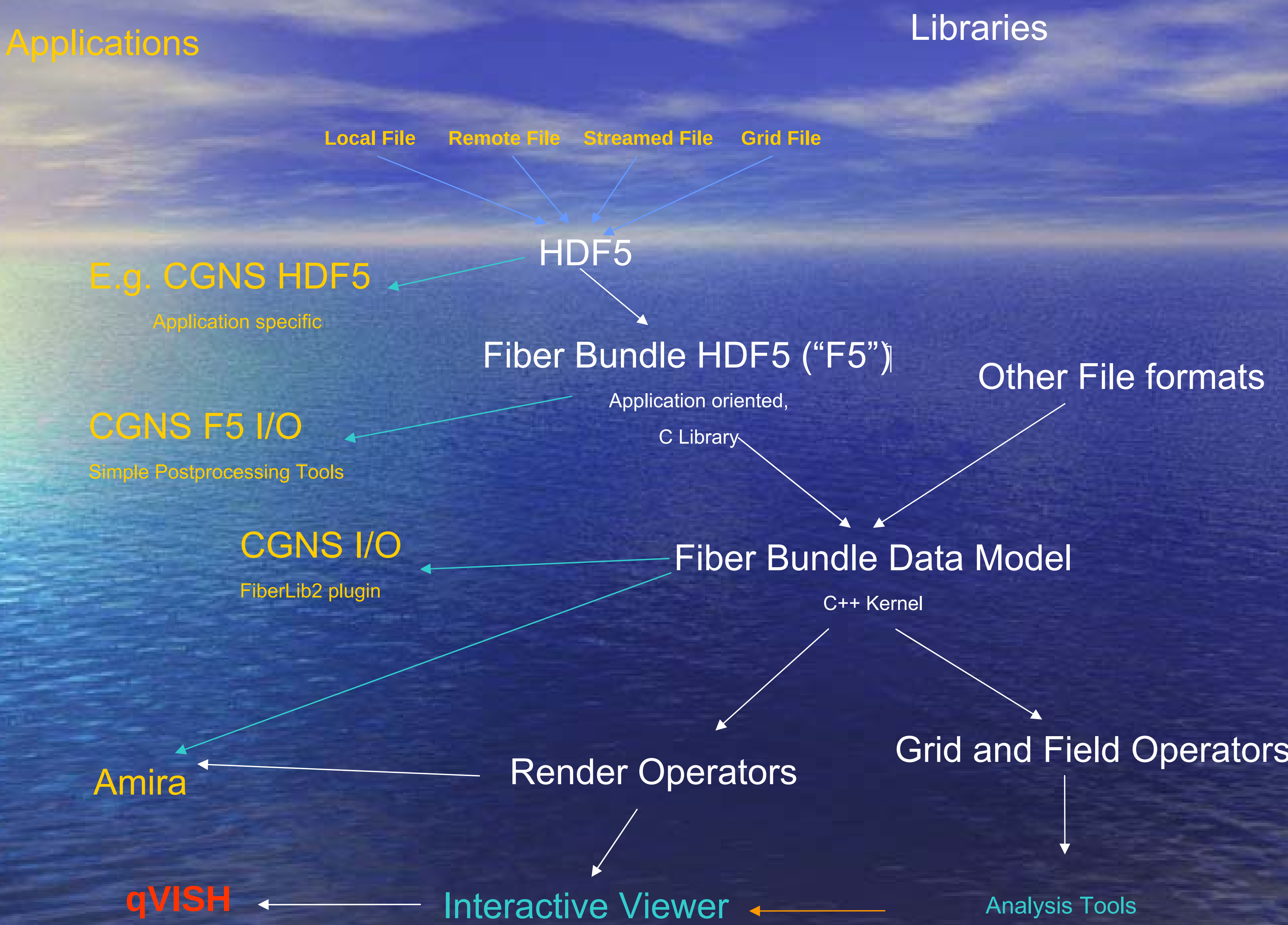
- Systematic treatment of a wide category of scientific data, based on the mathematics of fiber bundles
- Common denominator for otherwise diverse grid types
- Plugin to VISH ("fiber-VISH" or "FISH")
- No need to use it, customized data types also possible in VISH (but bypassing the FISH infrastructure then)

FiberLib2

- Systematic approach for scientific data:
  - Particle systems → unstructured grid → regular grids → uniform grids → block-structured uniform grids → curvilinear multi-block grids …
  - Incremental transition from one such category to next one
  - Can cover multiple timesteps, grids, fields…

FiberLib2 I/O features

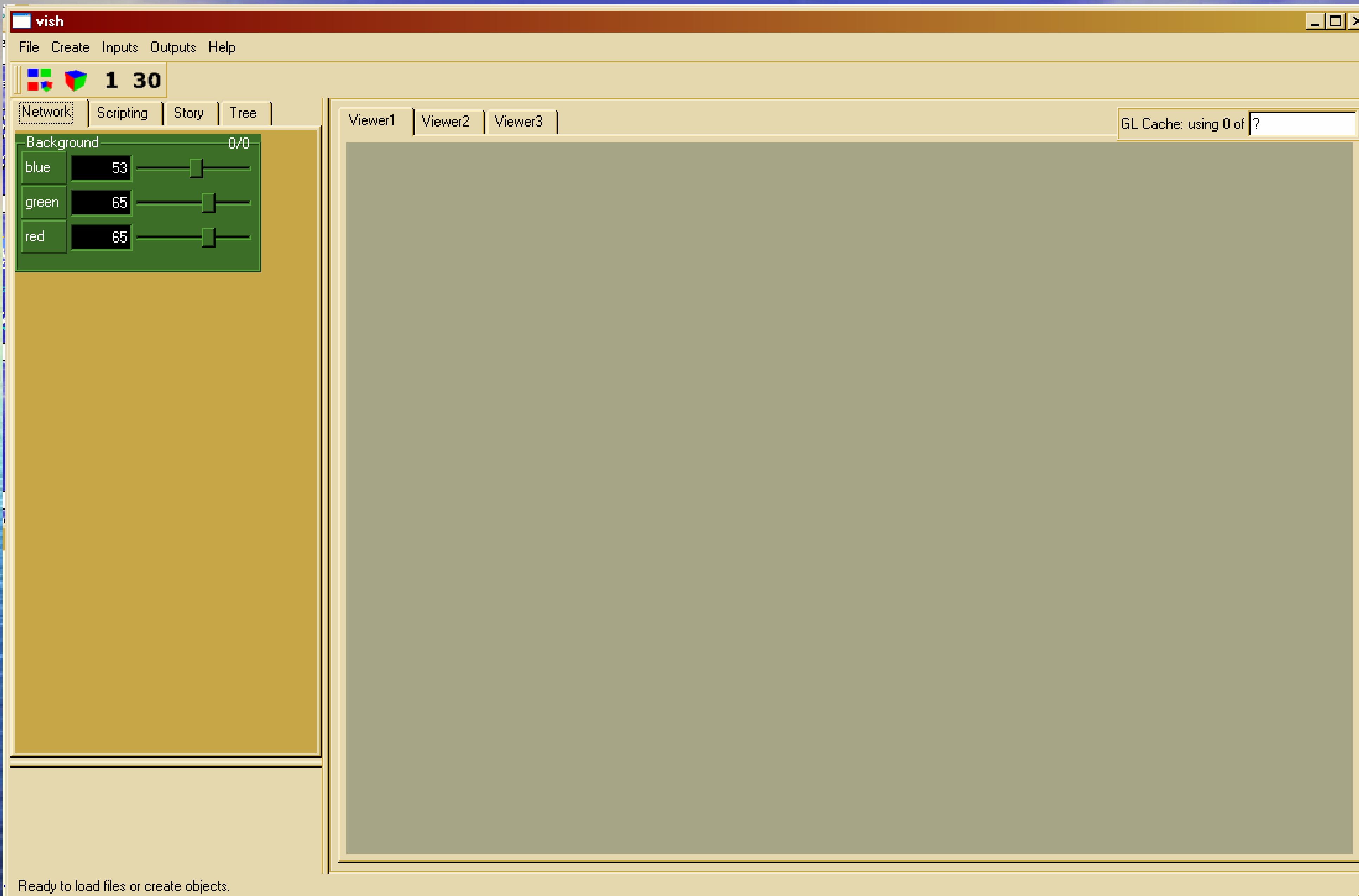
- I/O layers are plugins (shared libraries) independent of core implementation
  - Distinction among data and metadata
  - on-demand loading and creation of data
  - Cache-management
- Most powerful I/O layer is “F5”
  - 1:1 representation of the FiberLib2 into HDF5


Applications
Libraries
Local File
Remote File
Streamed File
Grid File
HDF5
E.g. CGNS HDF5
Application specific
Fiber Bundle HDF5 (“F5”)
Application oriented,
C Library
Other File formats
CGNS F5 I/O
Simple Postprocessing Tools
CGNS I/O
FiberLib2 plugin
Fiber Bundle Data Model
C++ Kernel
Amira
Render Operators
Grid and Field Operators
qVISH
Interactive Viewer
Analysis Tools

C++ Coding

Background.cpp

```cpp
#include <ocean/plankton/VCreator.hpp>
#include <ocean/GLvish/VRenderObject.hpp>


using namespace Wizt;


class   DefaultBackground : public VRenderObject
{
        TypedSlot<int>  Red, Green, Blue;

        override void render(VRenderContext&Context) const
        {
        GLclampf red=1, green=1, blue=1, alpha=1;
        int r=100, g=100, b=100;

                Red   << Context >> r;
                Green << Context >> g;
                Blue  << Context >> b;

                red   = r/100.;
                green = g/100.;
                blue  = b/100.;

                glClearColor( red,
                              green,
                              blue,
                              alpha );

                glClear(GL_COLOR_BUFFER_BIT);
        }

public:
        const std::type_info&getType() const
        {
                return typeid( DefaultBackground );
        }

        DefaultBackground(const string&name, int p, const RefPtr<VCreationPreferences>&VP)
        : VRenderObject(name, BACKGROUND_OBJECT+p, VP)
        , Red  (this, "red"  , 65, new VCreationPreferences("local") )
        , Green(this, "green", 65, new VCreationPreferences("local") )
        , Blue (this, "blue" , 53, new VCreationPreferences("local") )
        {}
};

static VCreator<DefaultBackground> myBackground("Background");
```


vish
File Create Inputs Outputs Help
1 30
Network Scripting Story Tree
Background 0/0
blue 53
green 65
red 65
Viewer1 Viewer2 Viewer3
GL Cache: using 0 of ?
Ready to load files or create objects.

FiberLib2 Usage

- Hierarchical tree of substructures, five levels:
  1. Time dependency (parameter space)
  2. Grid object (computational domain/mesh)
  3. Topological information (vertices, cells, …)
  4. Coordinate representations & relationships
  5. Fields (scalar, vector, tensor)
  6. (field fragments)

Simplest case: Equidistant static scalar field (float data[X][Y][Z])

- Hierarchical tree of substructures, five levels:
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  - Fields (scalar, vector, tensor)
  - (field fragments)

Multiple fields on same domain

- Hierarchical tree of substructures, five levels:
  - Time dependency (parameter space)
  - Grid object (computational domain/mesh)
  - Topological information (vertices, cells, …)
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Time-dependent fields on same domain

- Hierarchical tree of substructures, five levels:
  - Time dependency (parameter space)
  - Grid object (computational domain/mesh)
  - Topological information (vertices, cells, …)
  - Coordinate representations & relationships
  - Fields (scalar, vector, tensor)
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Multiple blocks (multiprozessor output)

- Hierarchical tree of substructures, five levels:
  - Time dependency (parameter space)
  - Grid object (computational domain/mesh)
  - Topological information (vertices, cells, ...)
  - Coordinate representations & relationships
  - Fields (scalar, vector, tensor)
  - (field fragments)

Mesh refinement or unstructured grids

- Hierarchical tree of substructures, five levels:
  - Time dependency (parameter space)
  - Grid object (computational domain/mesh)
  - Topological information (vertices, cells, …)
  - Coordinate representations & relationships
  - Fields (scalar, vector, tensor)
  - (field fragments)

Multiblock Curvilinear grids

- Hierarchical tree of substructures, five levels:
  - Time dependency (parameter space)
  - Grid object (computational domain/mesh)
  - Topological information (vertices, cells, …)
  - Coordinate representations & relationships
  - Fields (scalar, vector, tensor)
  - (field fragments)

Multiblock grids with refinement

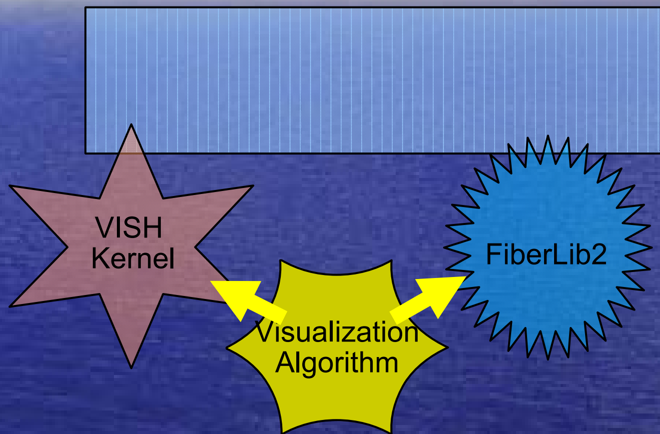
- Hierarchical tree of substructures, five levels:
  - Time dependency (parameter space)
  - Grid object (computational domain/mesh)
  - Topological information (vertices, cells, …)
  - Coordinate representations & relationships
  - Fields (scalar, vector, tensor)
  - (field fragments)

Availability

- Code development management:
  - http://vish.origo.ethz.ch/
  - Available via SVN in source code for registered users
  - No binary release yet

Develop Plans and Priorities

- Visualization Algorithms
  - Tensorfield visualization
  - This is research area



- VISH and FiberLib2:
  - Basic requirements, on-demand implementation and support (e.g. other file formats than F5)
- User interface:
  - Reduction to practice (not research)
  - Need manpower here

Isosurface Implementation

1. Do explicit Coding in FISH
2. Call external library such as VTK
3. Supercede isosurface computation by modern graphics hardware algorithms
   - Volume rendering with isolevels
   - Gpu-assisted histogram computation