Immersion Exploration of Large Datasets

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The 5-wall Immersive Cabin (IC)
- 21x21 ft. installation
- 29” automatic door on rear projection screen

Active Stereo Projection
- 5 active synchronization systems
- 2 projectors each
- Alignment platform
- IR emitter
- Users wear wireless LCD stereo glasses

Tracking system
- Wireless optical tracking from OptiTrack
- 8 near-IR cameras with wide-angle lenses
- Synchronized with the IR emitters
- User wears:
  - Reflective markers placed on shutter glasses
  - Rigid bodies with reflective spheres
  - Active LED markers

Interaction Tools
- Logitech Rumblepad 2 wireless gamepad
- 3DConnexion SpaceNavigator 3D mouse
- Wireless gesture tracking

The Visual Computing Cluster
- 71 high-end workstations
  - InfiniBand LAN, Gigabit frontend
  - Dual Intel Xeon CPUs, 2GB RAM
  - NVidia GeForce FX 5800 / NVidia Quadro FX4500 used for GPGPU cluster computations, image rendering
  - Quad-core Intel Xeon CPUs, 8GB RAM
  - Dual NVidia Quadro FX4600 used for IC visualization

Large-Scale Rendering
- NVidia SceneX scene graph management
- Asset management using the COLLADA format
- Support for high-quality antialiasing and shaders
- Support for cluster-based rendering for IC, RealityDeck, etc.

Gesture Interface
- Physically-based interactions with visual feedback
  - Police/Disaster training
  - Exploration and organization for massive datasets
  - Managing data layers across many screens
  - Two-handed 4D space exploration

Virtual Colonoscopy in the IC
- Gesture interface for navigation
  - Grabbing and dragging colon surface
- Gesture-based tools
  - Measuring polyp size, virtual pointing
- Calculation of visibility coverage
- Augmenting the missing ceiling through conformal mapping during rendering

Reference

Future Work
- Image Rendering and Interaction
  - Immersive visualization
    - Depth perception through stereo
    - Surround rendering for immersion
    - Head tracking for accurate projections
  - Large-scale rendering
    - NVidia SceneX scene graph management
    - Asset management using the COLLADA format
    - Support for high-quality antialiasing and shaders
    - Support for cluster-based rendering for IC, RealityDeck, etc.

Architectural Pre-Visualization
- The Stony Brook Advanced Energy Research & Technology Center (AERTC)
- The Stony Brook Simon’s Center for Geometry and Physics

Applications
- Urban planning and large-scale urban visualization
- Immersive visualization of large medical datasets
  - Virtual colonoscopy
  - 3D medical scans

Training and Simulations in the IC
- Real-time disaster simulation and mitigation
  - Large-scale smoke/fluid simulations on the Visual Computing Cluster
  - Real-time feedback and response training in the IC / RealityDeck
- Military/Police/Medical/Manufacturing training
  - Dynamic scenarios with feedback in the IC / RealityDeck
- Gesture-based tools with visual feedback and haptic devices for:
  - Simulation of weapon systems and vehicles
  - Simulation of medical devices