Visualization in HPC

By Randall E. Hand

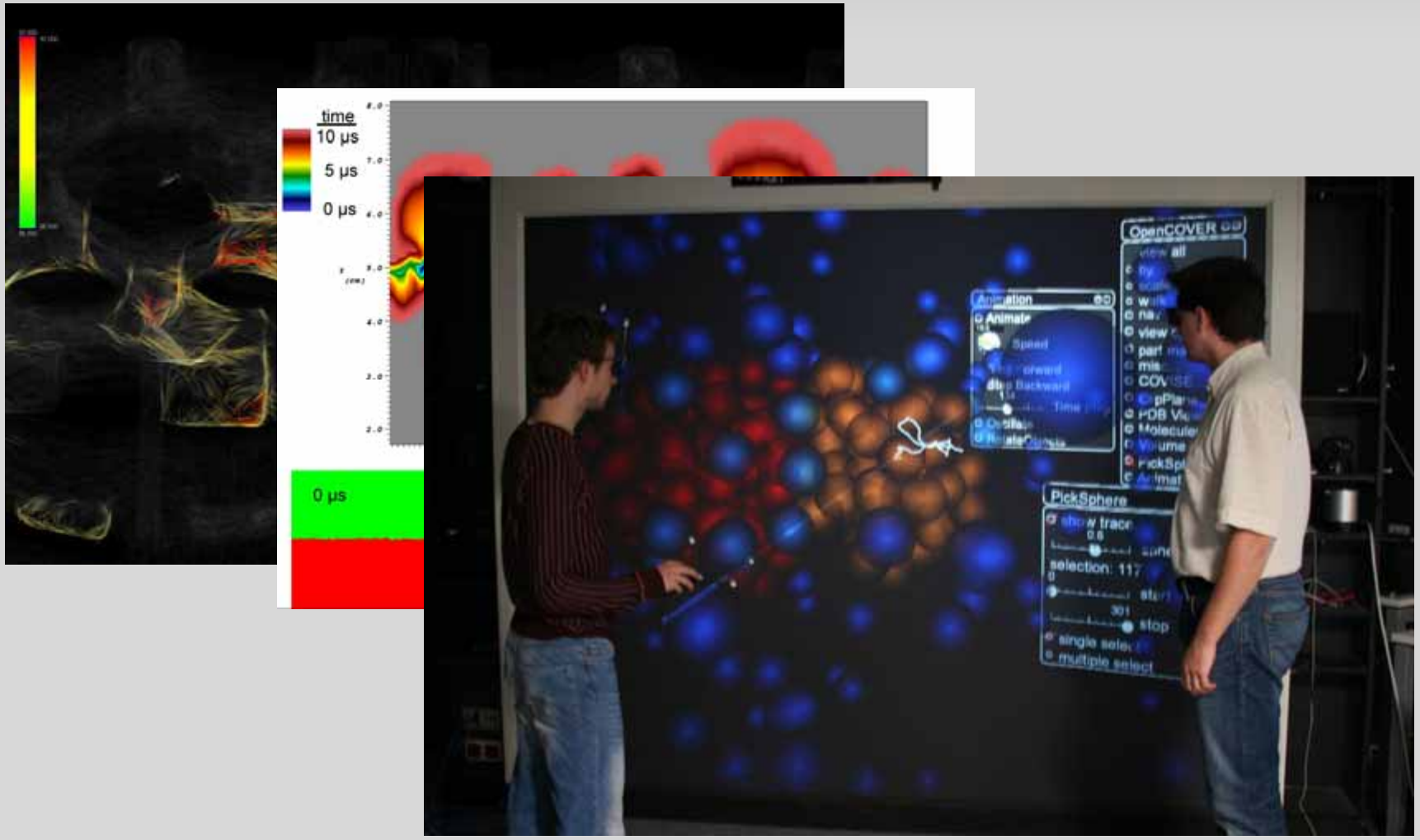
Lockheed Martin - ISGS

DoD HPCMP - DAAC

What's wrong with Visualization in HPTC

By Randall E. Hand

Visual Analysis



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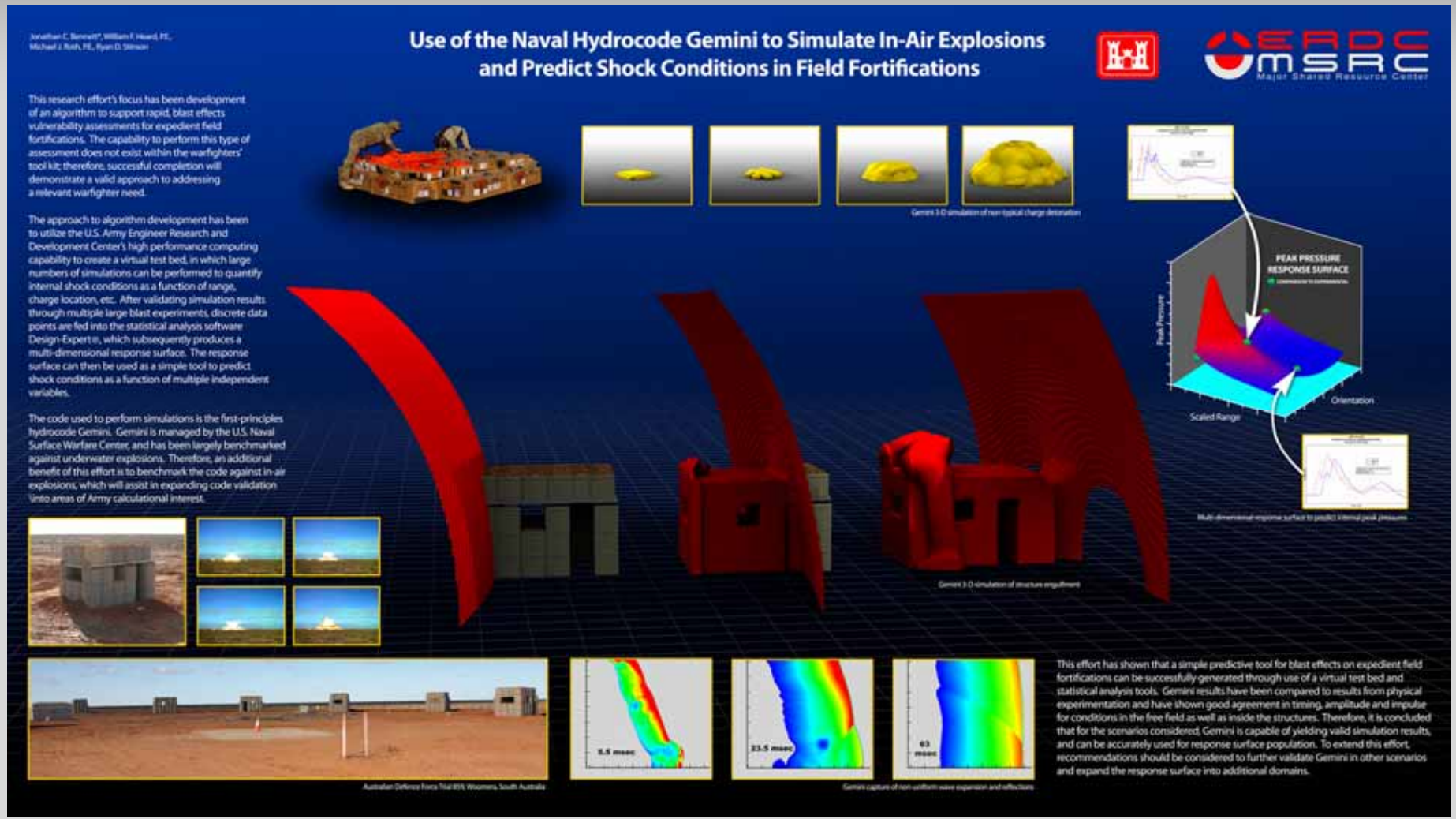

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Experiment

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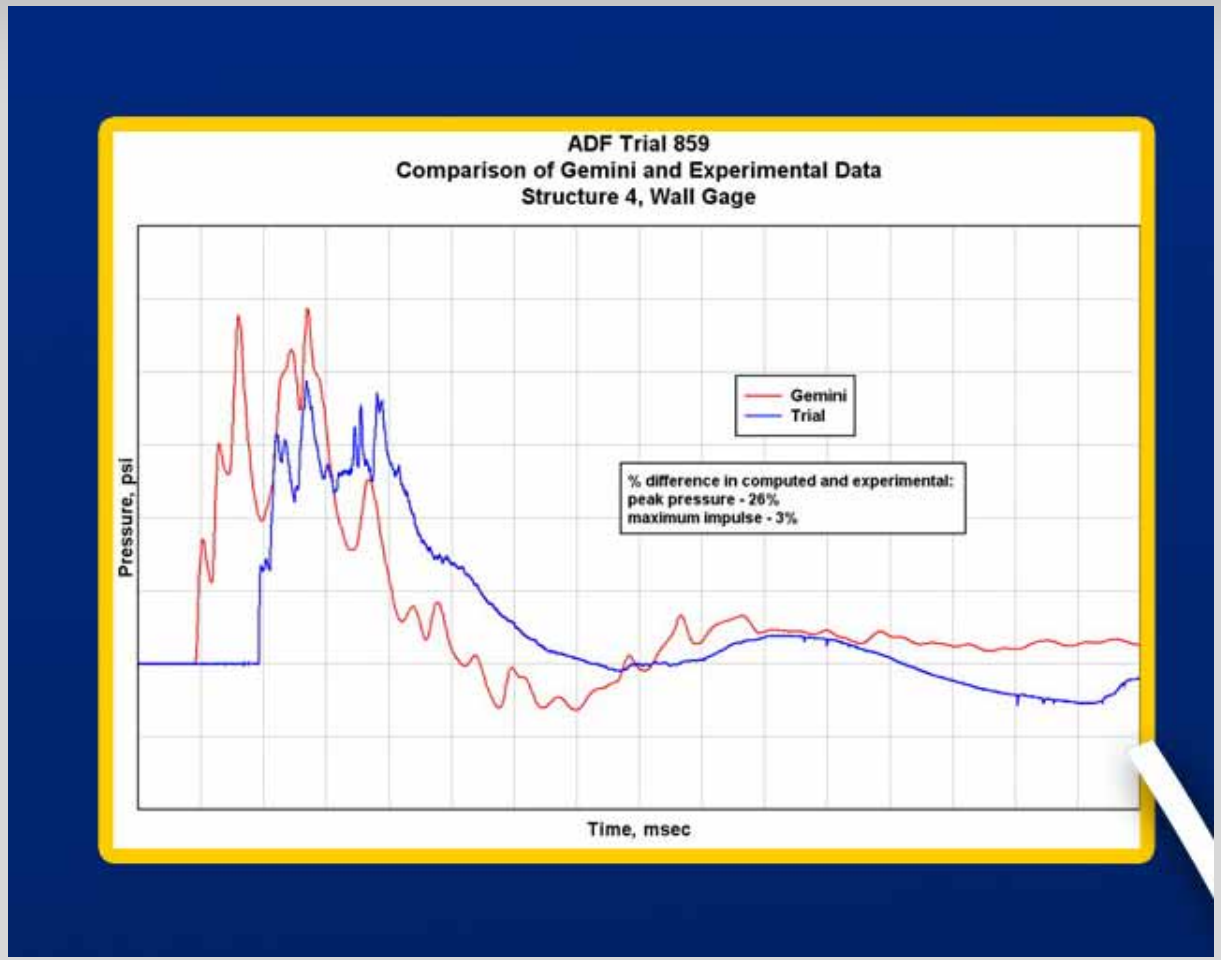

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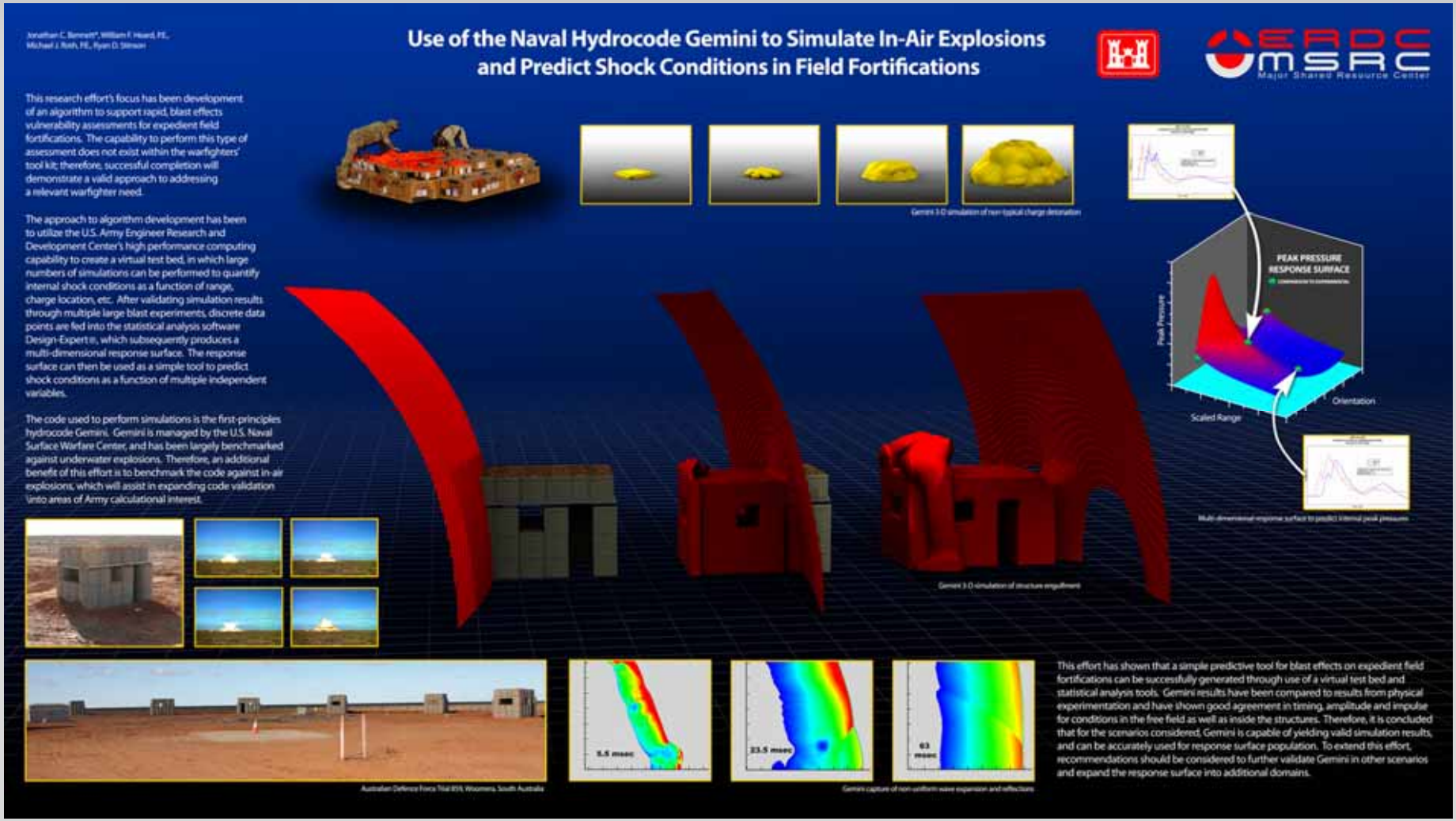

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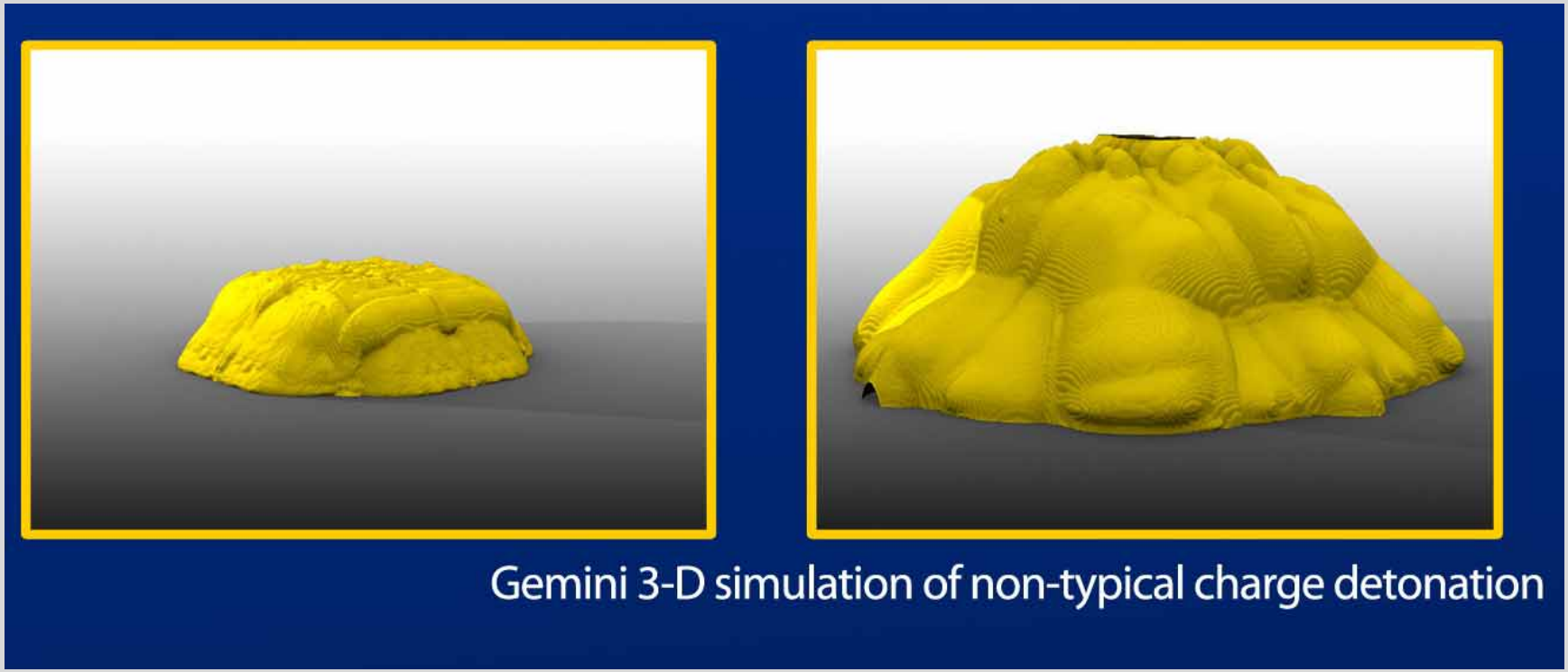

Gemini 3-D simulation of non-typical charge detonation

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In the DoD HPCMP

- Approximately 5,000 Users
- 4 Major Shared Resource Centers
- Users spread Nationwide

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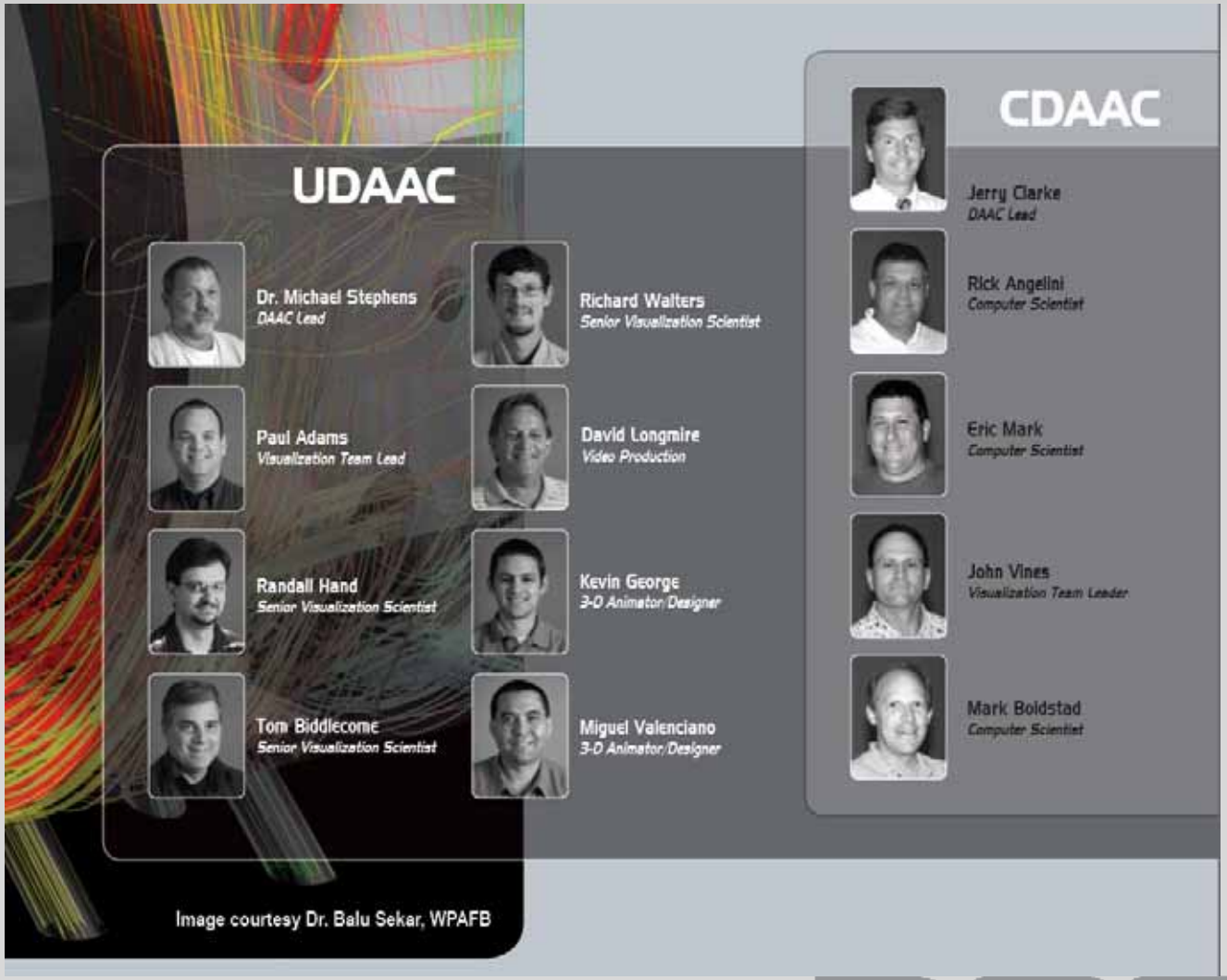
Expertise



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Hardware

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Software

ezviz

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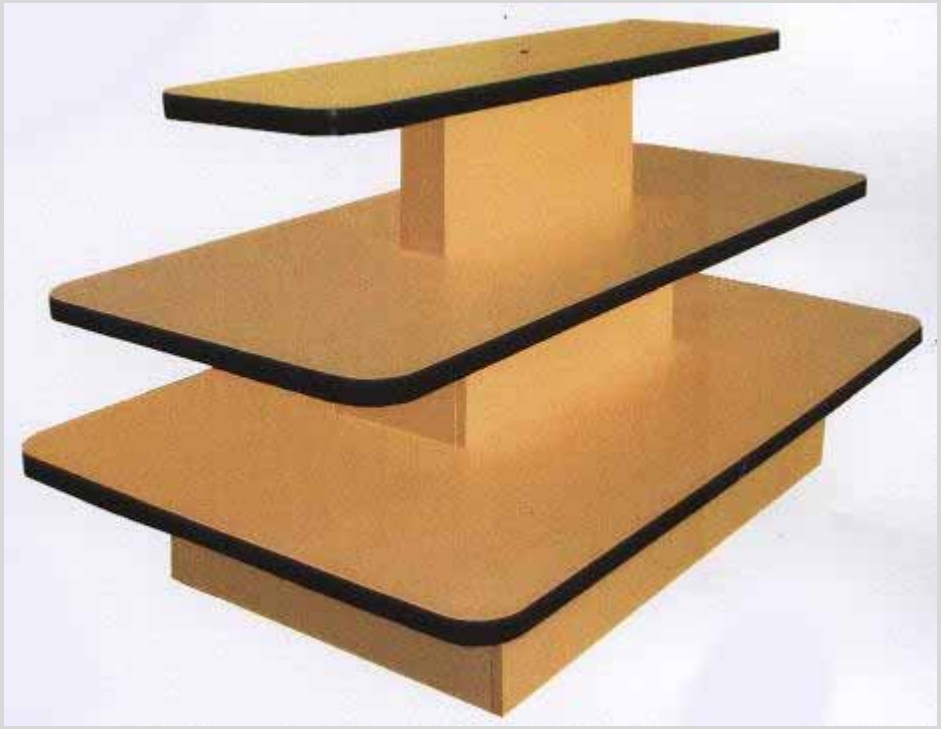
Tiers of Service

- 3 Tiers of service



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1: Custom

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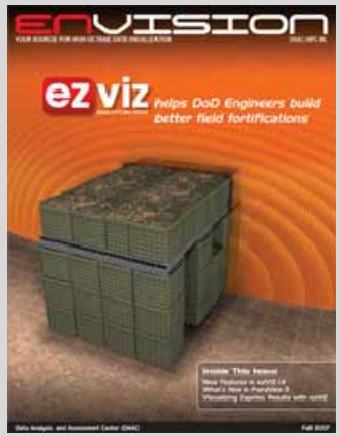
2: Collaborative

- Knowledgable Users
  - Guidance, Assistance, Training

3: Community



Helping users help themselves

http://daac.hpc.mil/

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User Response

- **Awesome** !!! Thank you Randall ! You really did this fast.
  - Jay Ratcliff, ADCIRC Visualization
- **Great**! Looks magnificient!! (sic)
  - Nayan Patel, LDI Breakup Visualization

User Response

- So far ezVizGeneric has been nice because I can **make pictures without having to transfer data** back to home. (…) There is definitely promise to get some heavy use out of ezViz.
  - David Hebert, MITgcm Visualization

User Response

- I work closely with Doug Dommermuth at SAIC and he had used it on sapphire in the past. I'm new to running it, so I just modified a script that he gave me. It worked great and really **helps to reduce the size of our data sets** so we can download them in a reasonable amount of time.
  - Thomas O'Shea, Flow around a Ship Hull

User Response

- The ability to produce quick visualizations **ensures valid integration of models** and allows for spot checking of jobs submitted through the portal. For these tasks, we have found ezViz to be an invaluable tool.
  - Tom Logan, ARSC HPC Users Newsletter 382

User Response

- My bosses are loving this right now. We'll finally have something to show the guys who are less scientifically inclined when they visit that they will remember as being "neat" and something they can understand. **It's hard to explain things sometimes without good visualization**..
  – David Wooddell

User Response

- In the past we've been operating in a 'download and visualize' mode, but I simply cannot download my simulations anymore in any reasonable time. **I must produce visualization on the MSRC's now....**
- ezViz seems like the only practical option at the moment for non-interactive visualization of certain types of data. I've been told that the scripting for ParaView is completely unwieldy.
  - Peter Mardahl

What's Broken?

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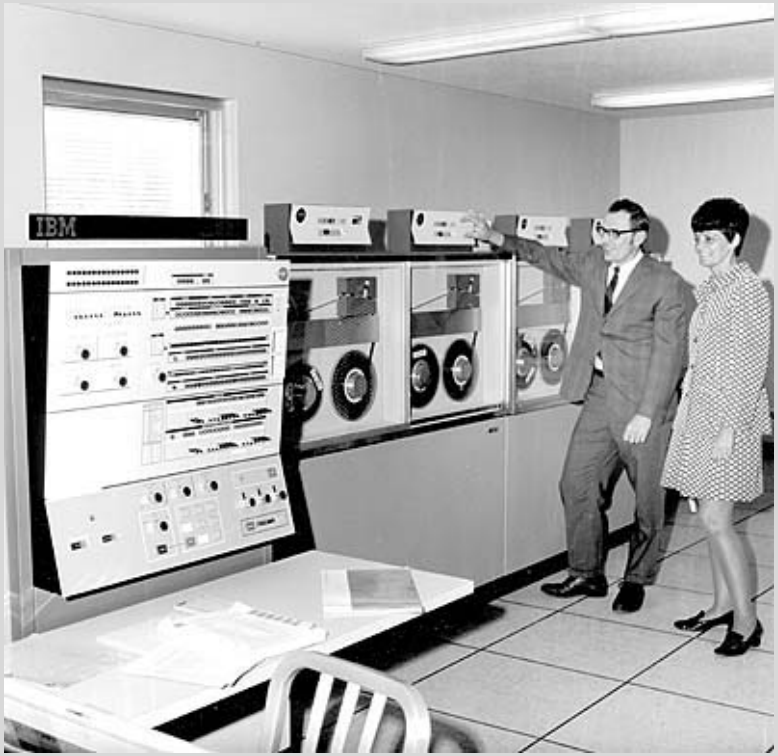
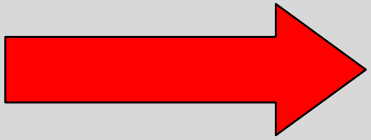
Once upon a time…





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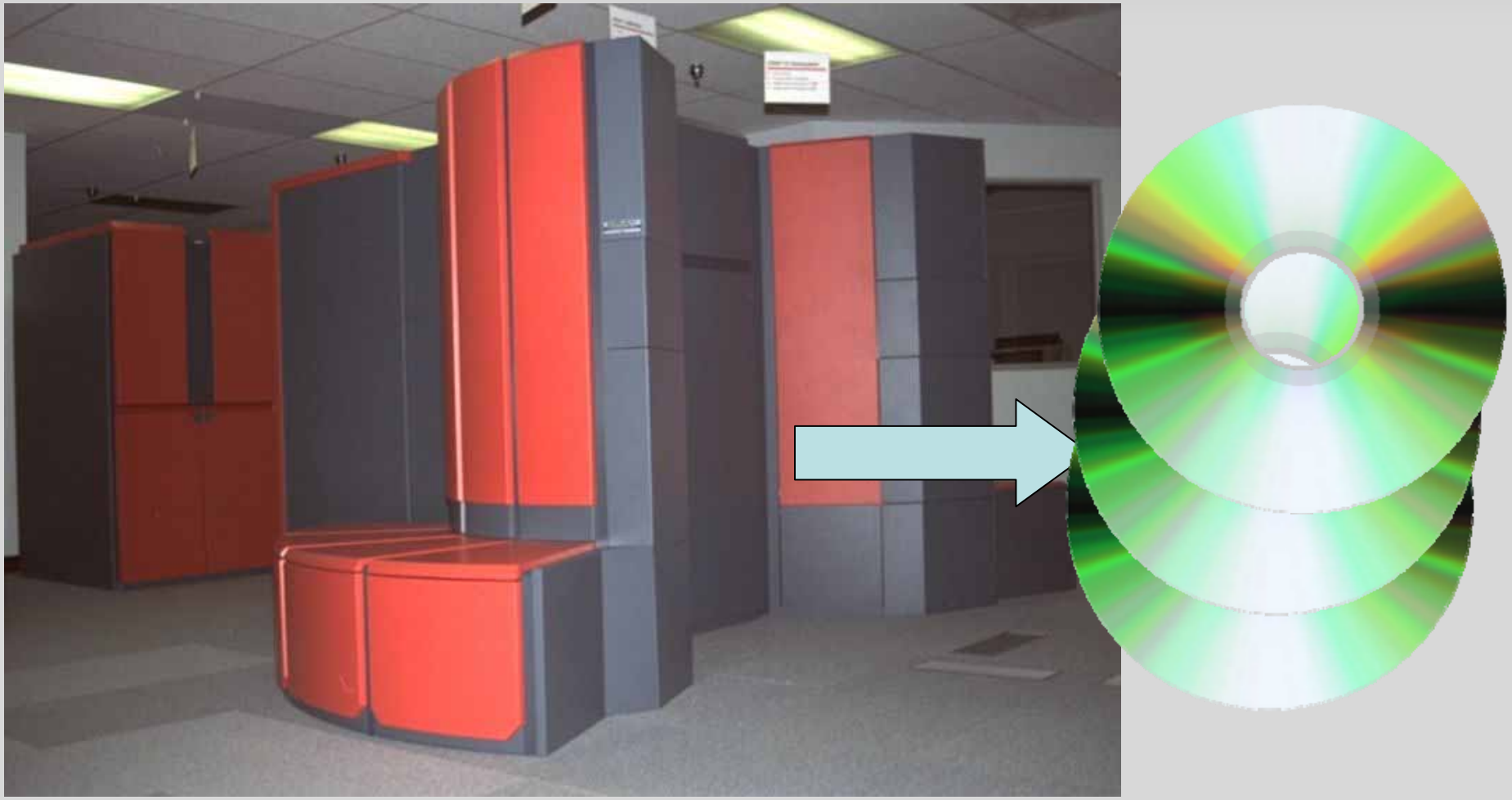
Then things got bigger..



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And Now..

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And Next

- 2.3 PetaFlops

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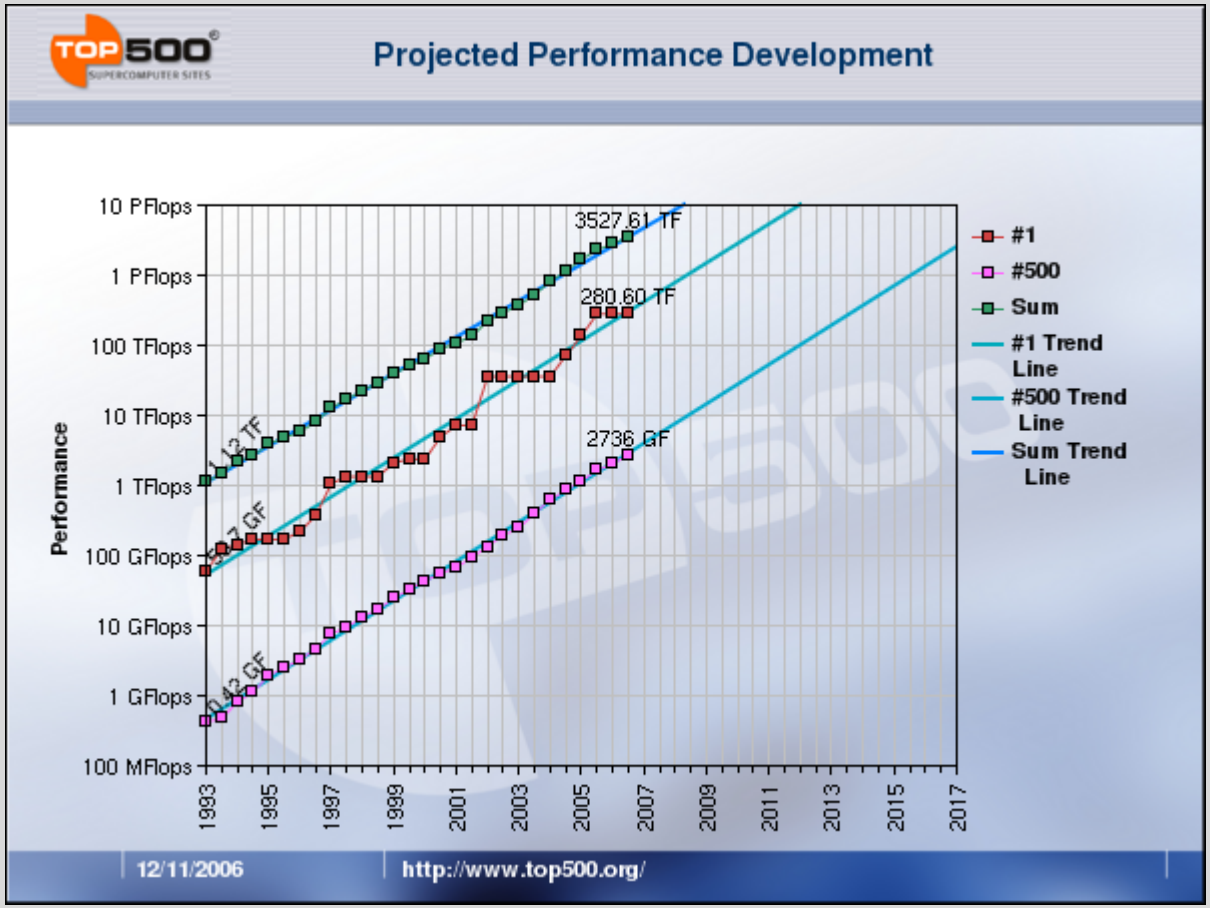
Even more…



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Too Much Data

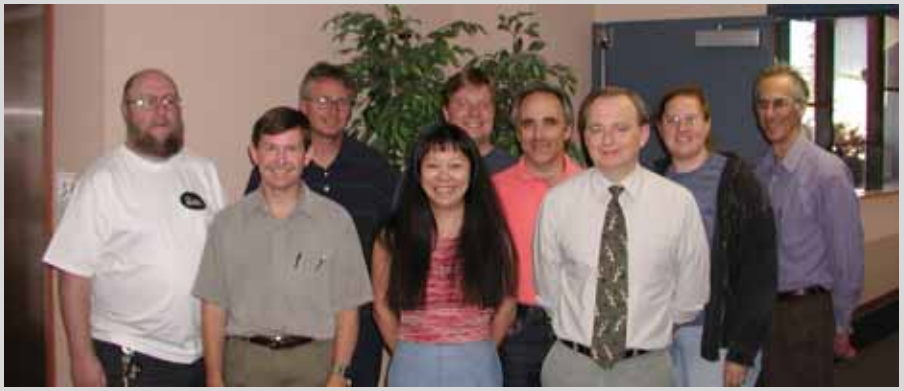
- Bigger Simulations, same old tools

Overflow = Data Loss

- Analysis becomes a limiting factor to Simulation

Who to blame?

Managers?



Users?

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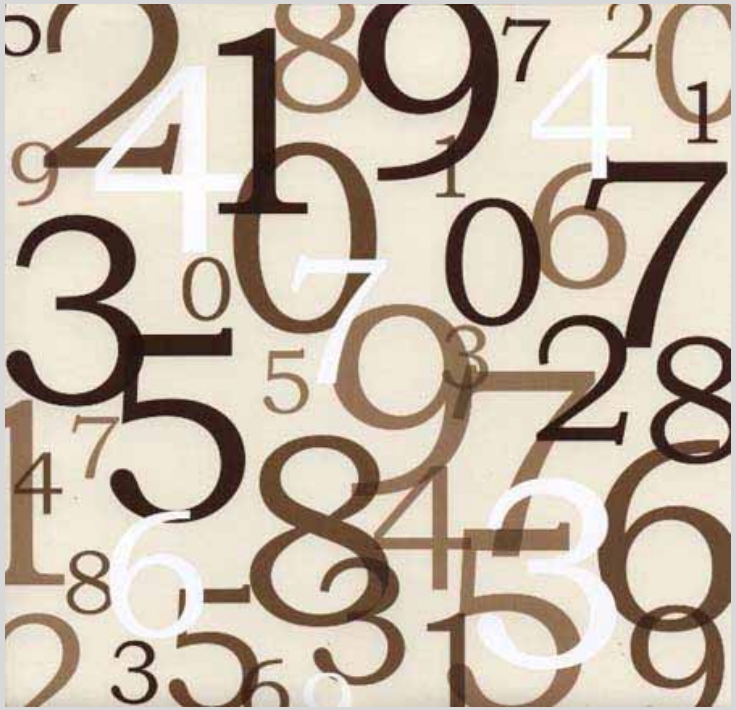
Managers

- No consideration for Analysis
- All Simulation
  - Benchmarks
  - Hour Allocations
  - Project Awards



Users

- Free analysis with every simulation!

Shift our Thinking

- Analysis & Visualization is a *primary requirement*

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What do we need **today**?

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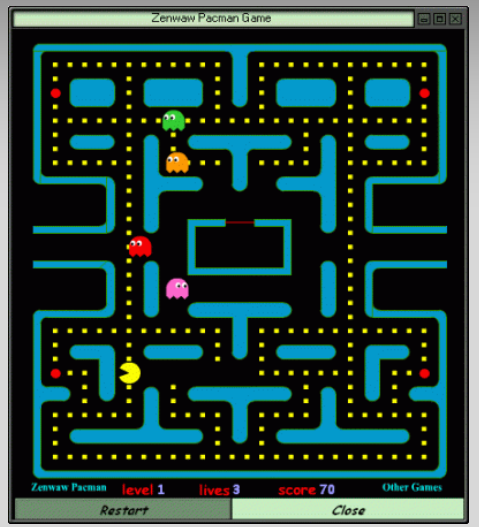

- Modern HPC's are not configured for Visualization needs

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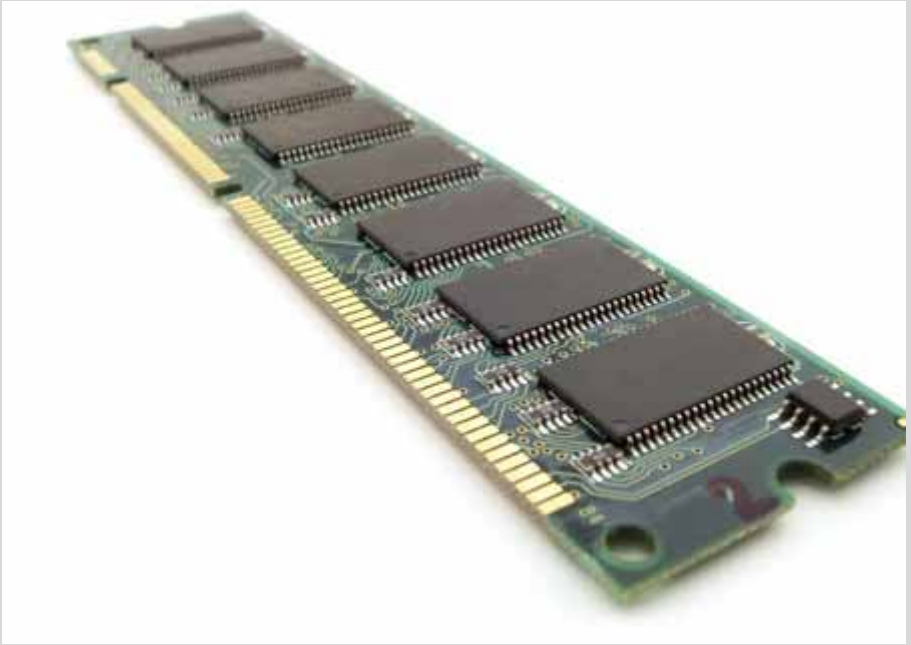
Large-Memory Nodes

- *Really large memory*
  - *64G*
  - *128G*



Graphics Cards

- Hardware Accelerated Graphics

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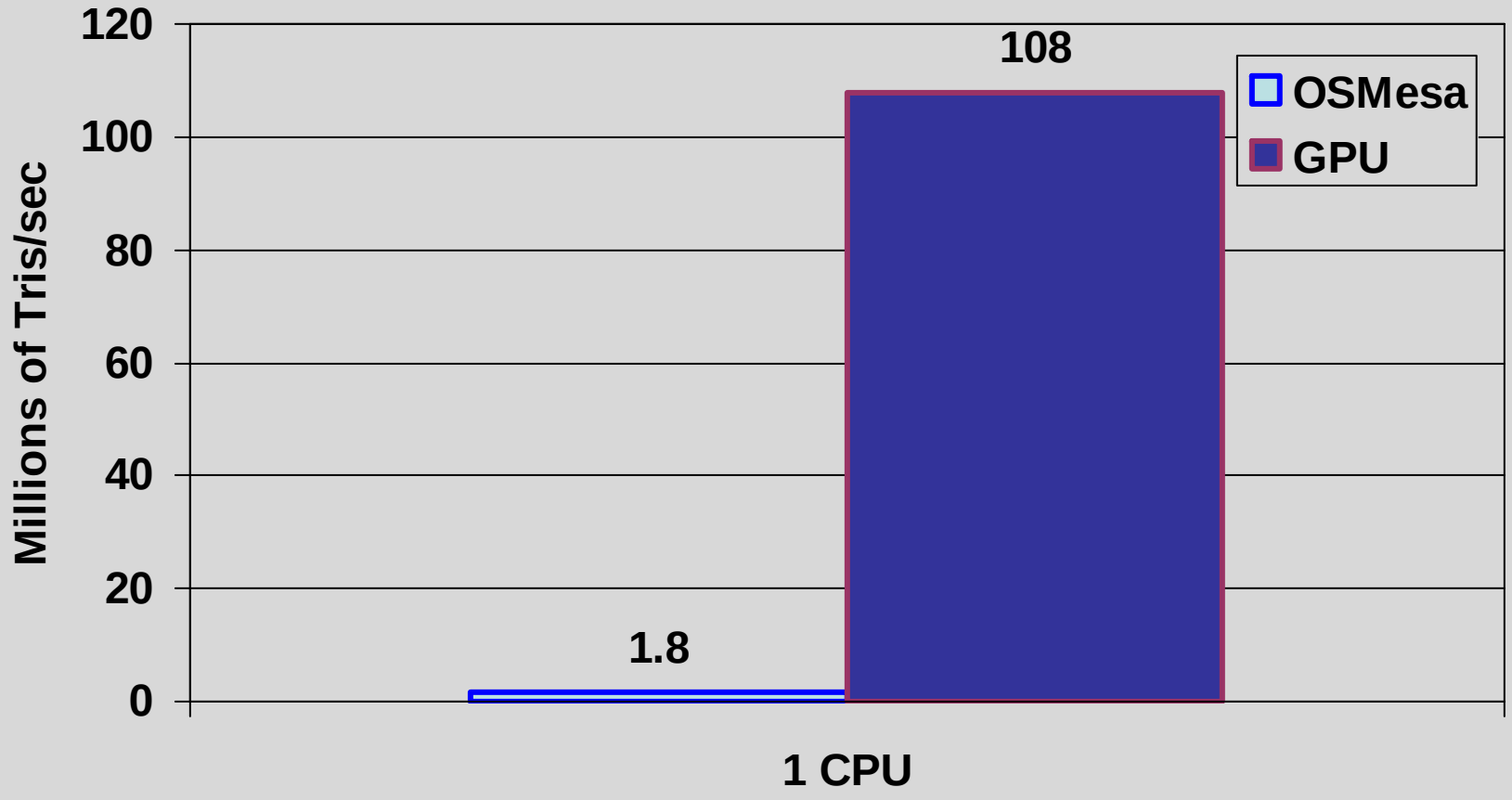
Hardware vs Software



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Remote Desktops

- Users need access to displays on HPCs

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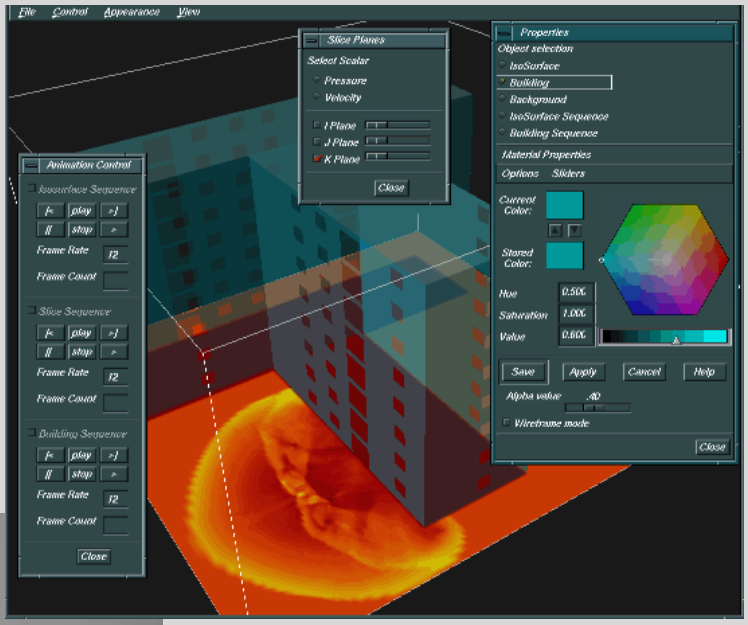
Make Viz Possible



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What do we need **tomorrow**?

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Smarter Tools

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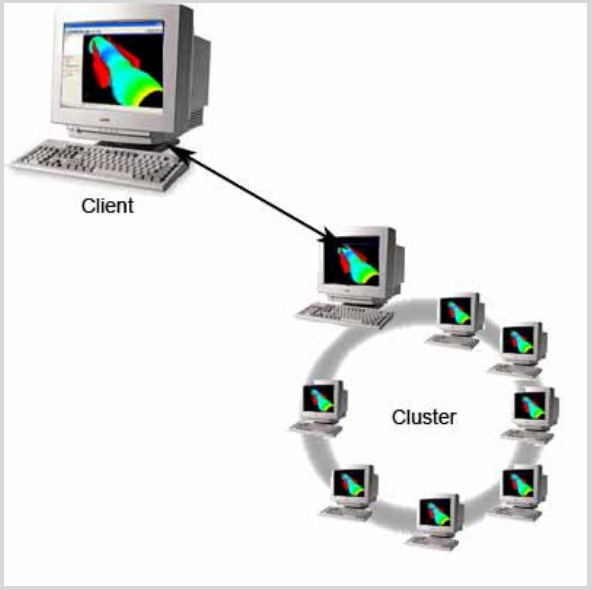
Architecture

- Multi Core
  - Low memory per CPU
- Headless Nodes
  - Client-Server



ParaView
Parallel Visualization Application

ezviz

CEI

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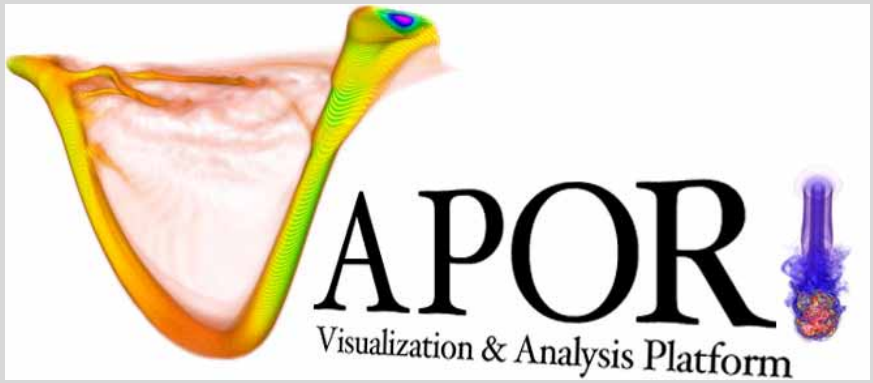
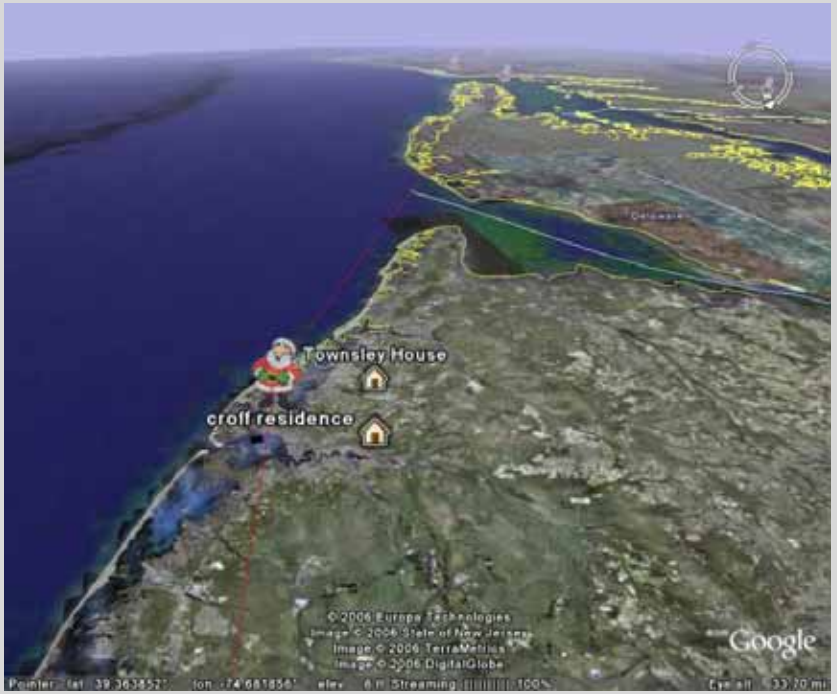
Architecture

- Queueing systems

Algorithms

- Data Decomposition
- Resolution Dependence





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Specialists

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Training

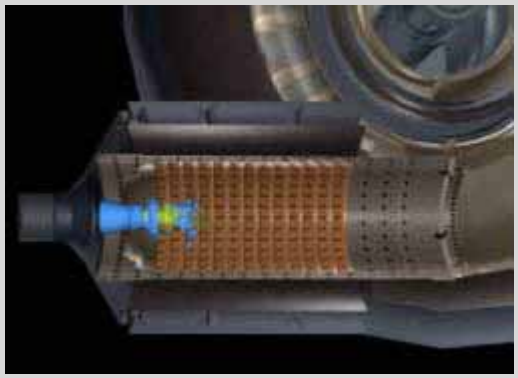
- Viz Techniques & Software change fast

Training

- Afterall, only the scientist is qualified to make conclusions about his data.

Conceptual Renderings

- Fusing conceptual renderings with simulated data can increase understanding



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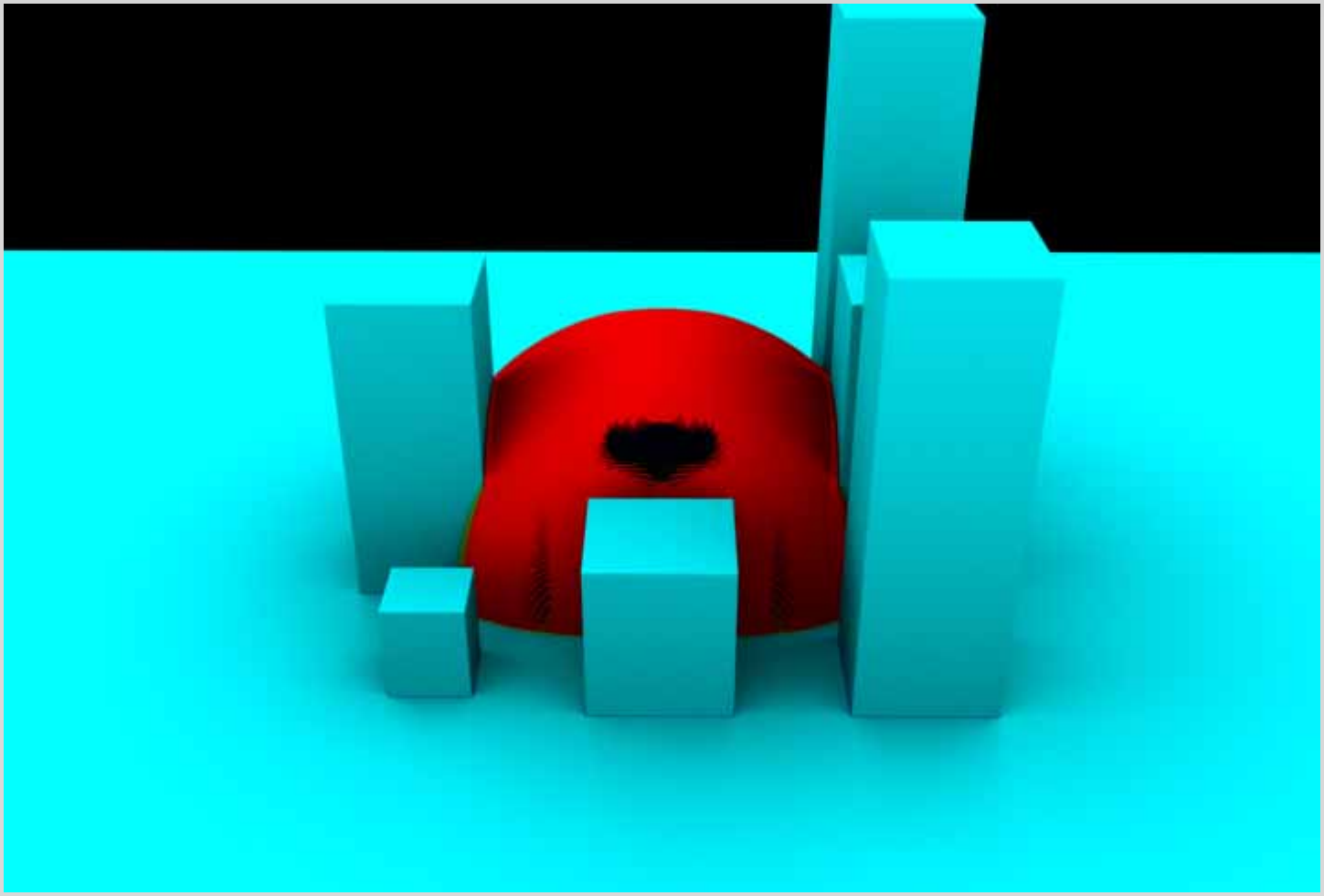

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Make Visualization Effective

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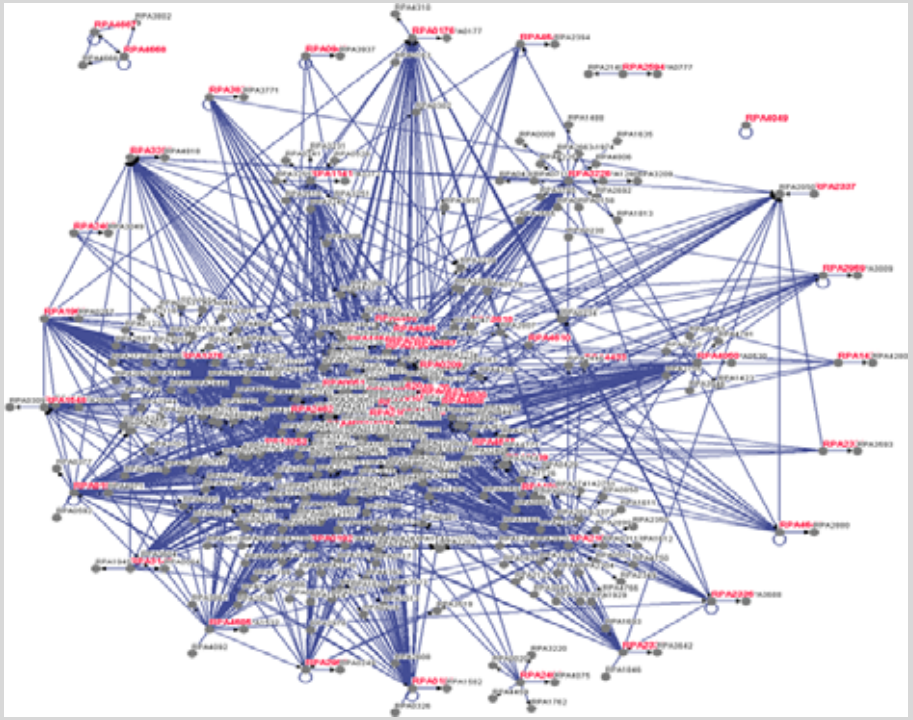
Analysis is harder than ever.



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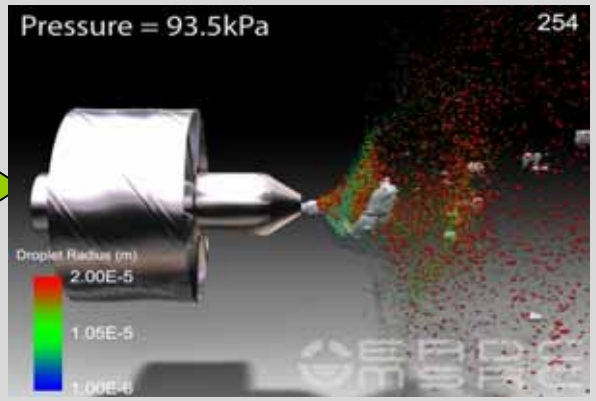
Help users unlock their data.



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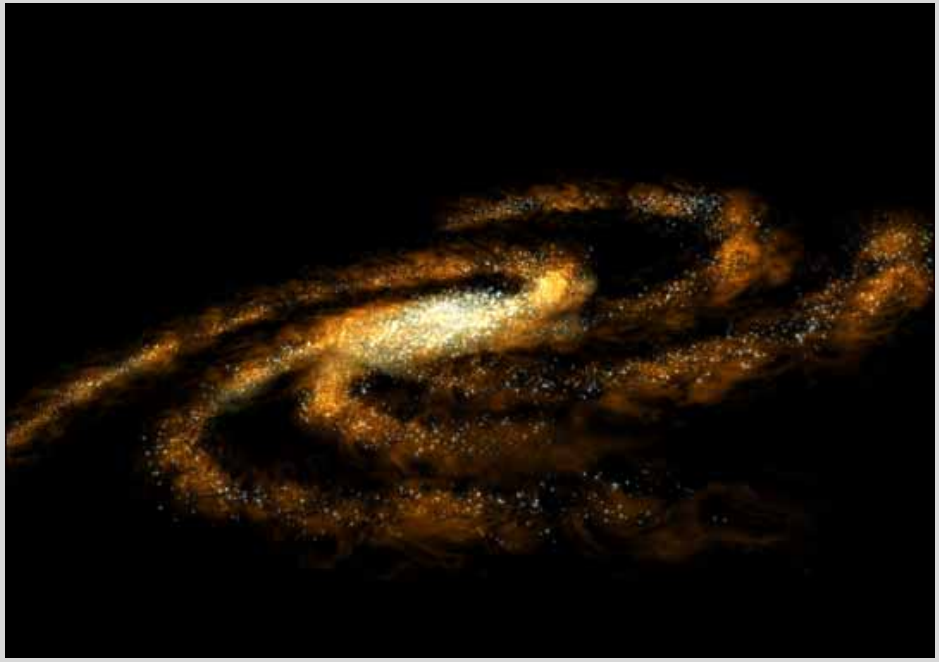
To find new information buried within the data

- Randall Hand
- http://daac.hpc.mil



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