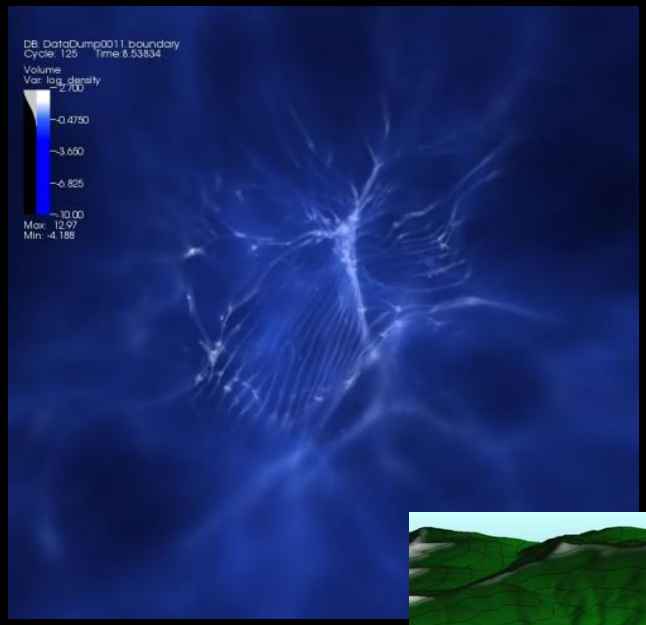
The 2011 UC-HIPACC International Summer School on AstroComputing presents:

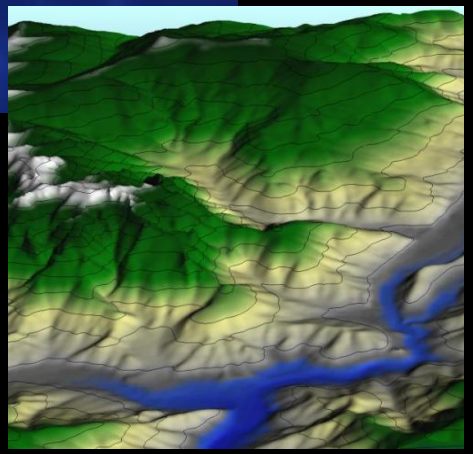
Computational Explosive Astrophysics

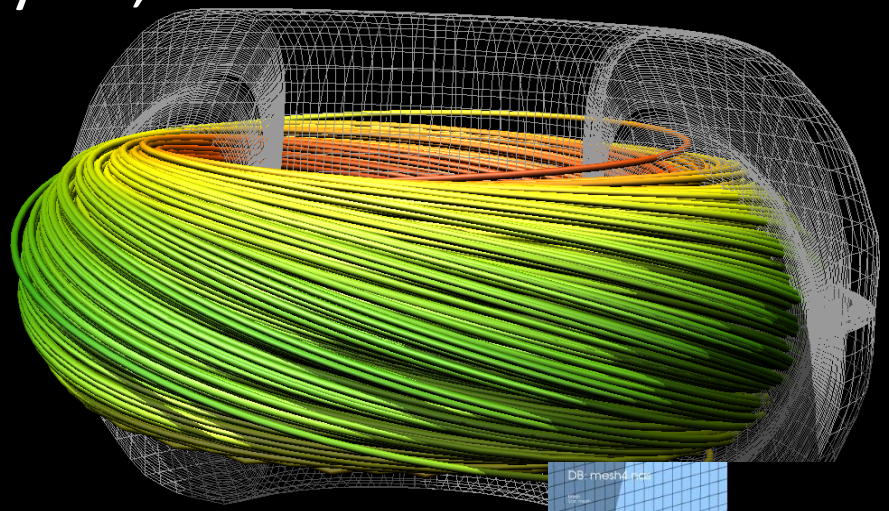
# Introduction to visualization with VisIt

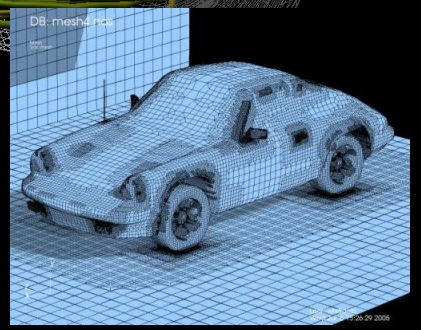
Hank Childs, LBNL

July 18, 2011



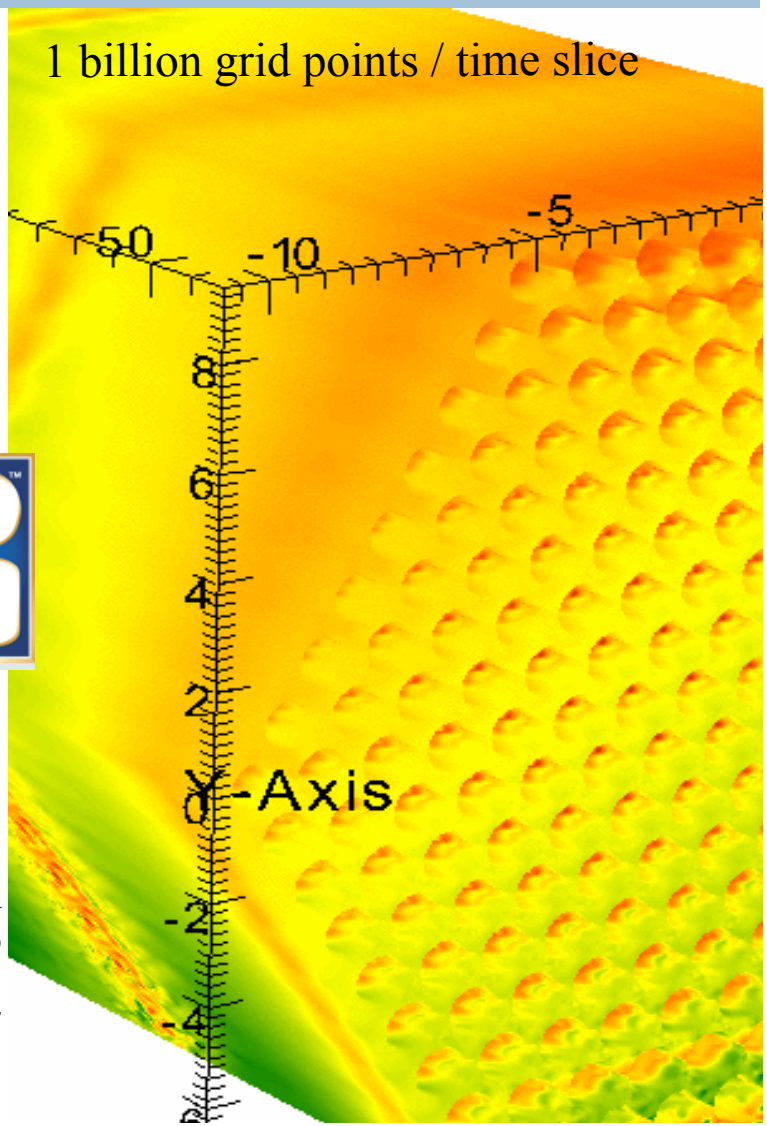




| Day 1 (7/18) | *Monday* | Speaker | Location |
|---|---|---|---|
| 8:30 – 9:00 | Morning coffee | | |
| 9:00 – 10:00 | Welcome - Intro to explosive astrophysics | Nugent/Kasen | Open Lecture: Building 66 Auditorium |
| 10:00 – 11:00 | Intro to High Perfomance Computing/NERSC | Antypas | Open Lecture: Building 66 Auditorium |
| 11:00 – 11:20 | Break | | |
| 11:20 – 12:20 | Intro to Visualization and Visit | Childs | Open Lecture: Building 66 Auditorium |
| 12:20 – 2:00 | Lunch provided (buliding 66/67 courtyard) | | |
| 2:00 – 5:00 | Workshop: Using NERSC;<br>logging in, submitting jobs, visualizing data | Childs | UCB campus: Sutardja Dai Hall, Room 250 |
| evening, 7:00 PM | Group dinner, Bistro Liasion (Shattuck and Hearst Avenue) | | |

# VisIt is an open source, richly featured, turn-key application for large data.

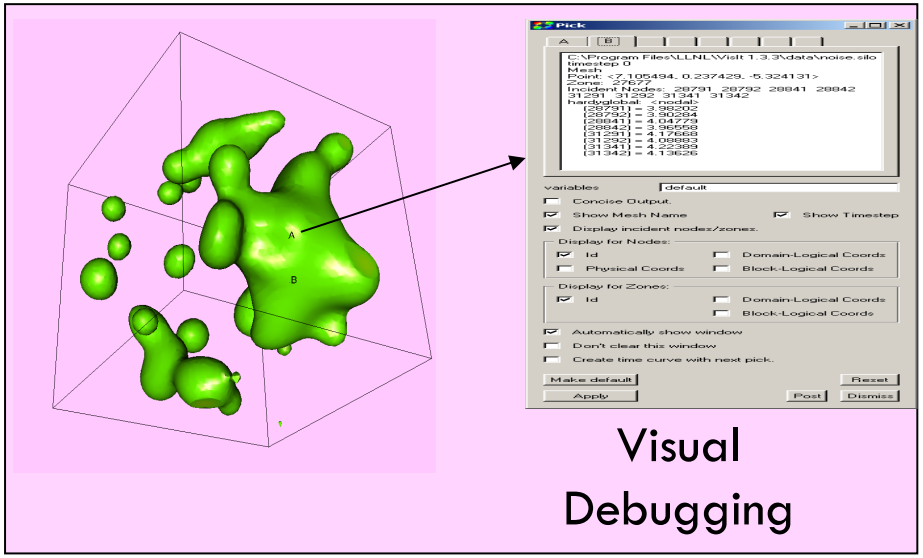
- Used by:
  - Visualization experts
  - Simulation code developers
  - Simulation code consumers
- Popular
  - R&D 100 award in 2005
  - Used on many of the Top500
  - >>>100K downloads

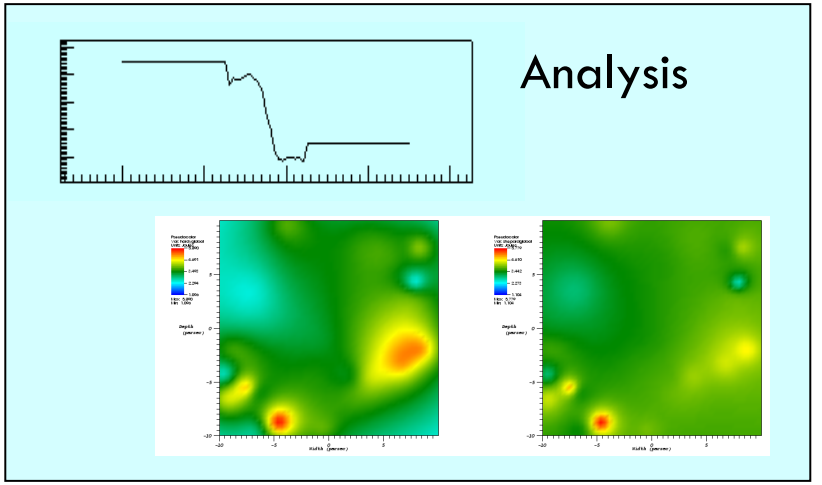


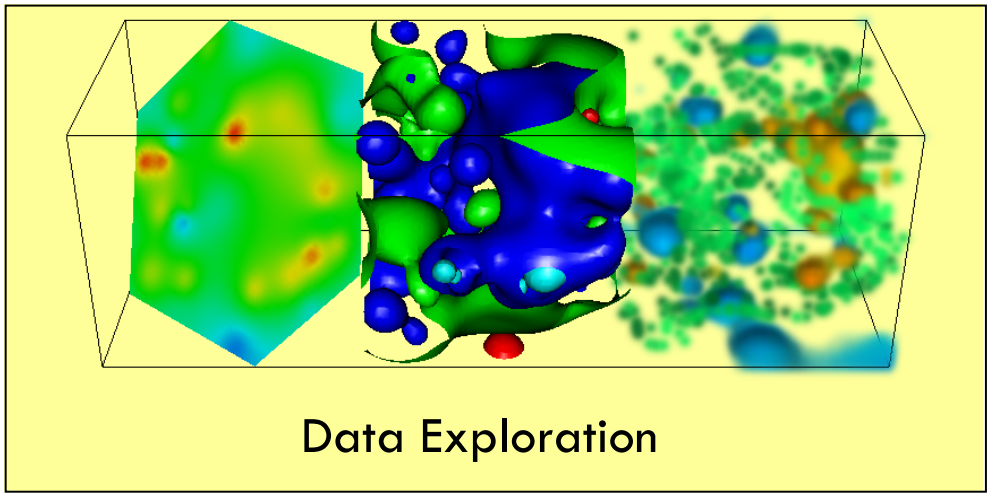

217 pin reactor cooling simulation
Run on ¼ of Argonne BG/P
Image credit: Paul Fischer, ANL

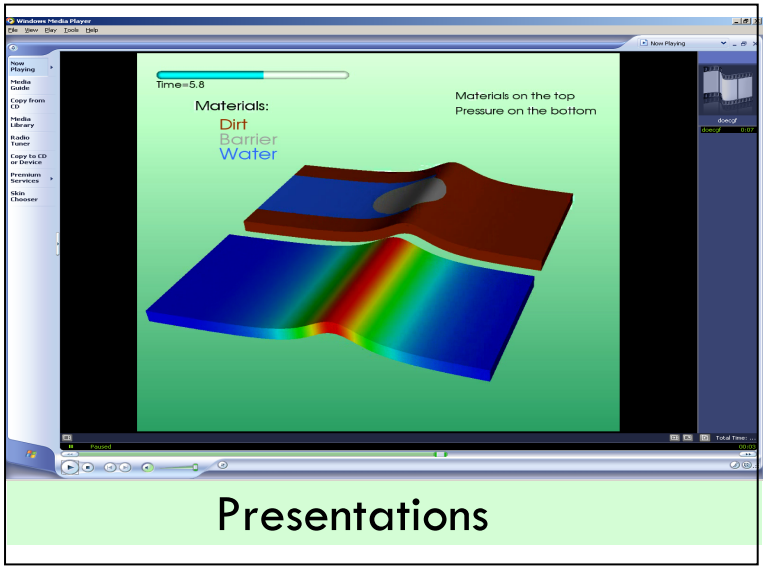
# Terribly Named!!!

## … intended for much more than just visualization



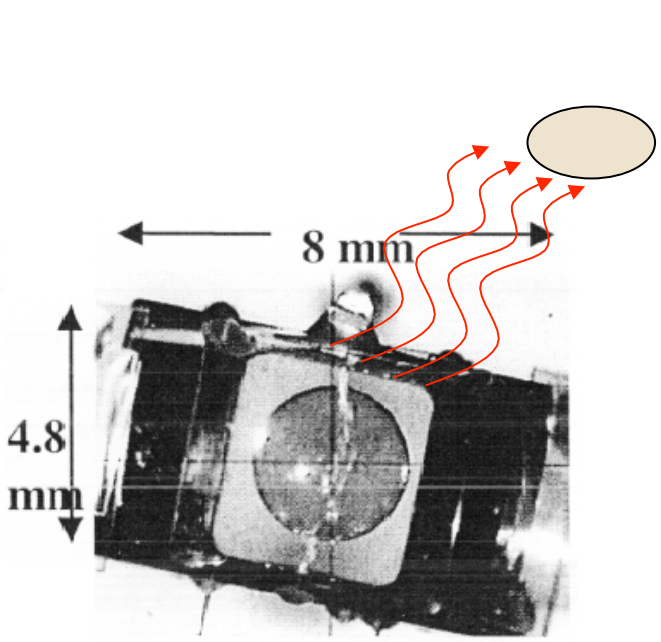



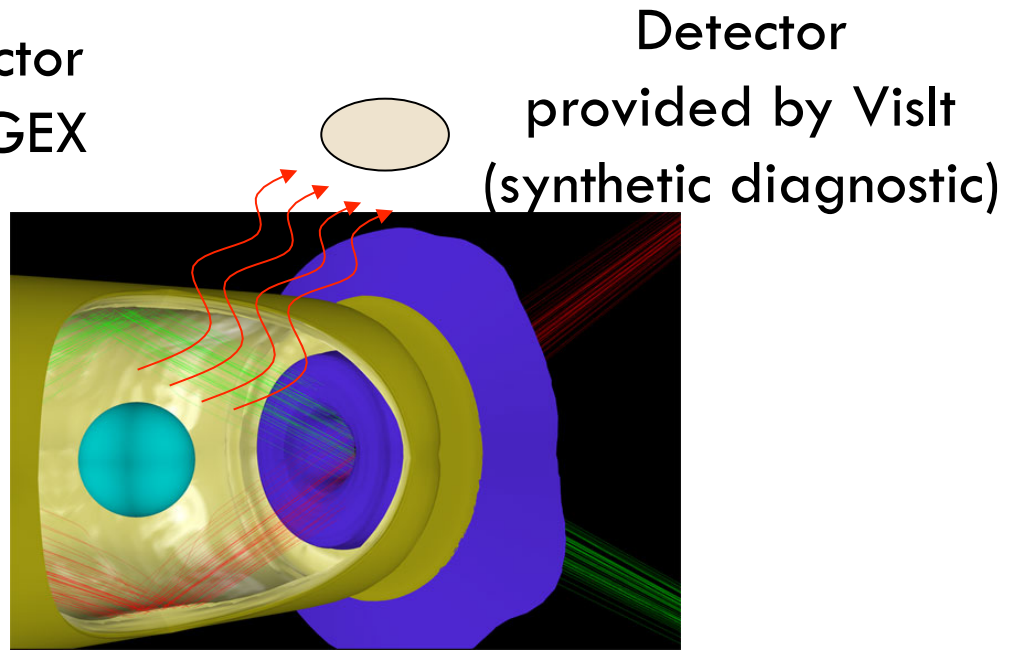



# What sort of analysis is appropriate for VisIt?

- General analysis techniques (e.g. integration, volumes, surface areas, etc.)
- Specialized analysis (e.g. hohlraum flux at AGEX)

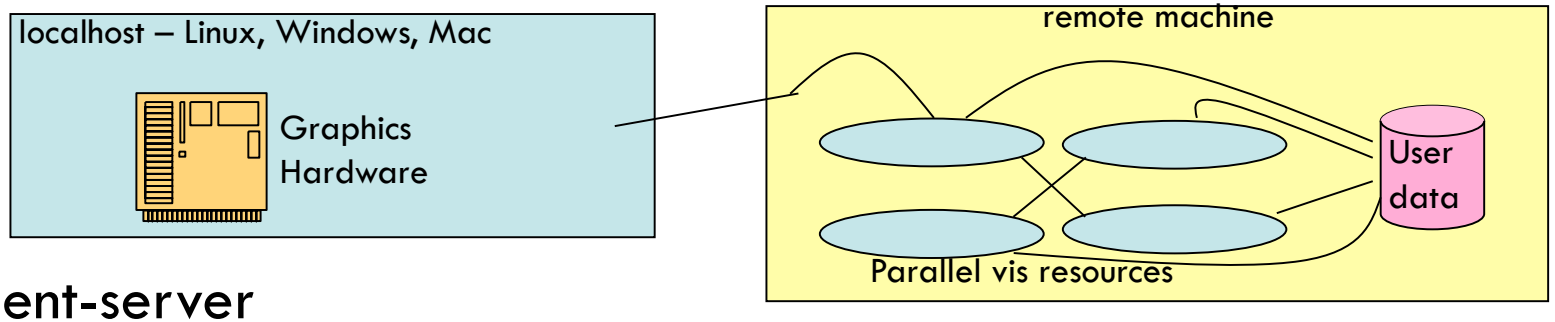


# VisIt has a rich feature set.

- Meshes: rectilinear, curvilinear, unstructured, point, AMR
- Data: scalar, vector, tensor, material, species
- Dimension: 1D, 2D, 3D, time varying
- Rendering (~15): pseudocolor, volume rendering, hedgehogs, glyphs, mesh lines, etc…
- Data manipulation (~40): slicing, contouring, clipping, thresholding, restrict to box, reflect, project, revolve, …
- File formats (~110)
- Derived quantities: >100 interoperable building blocks
  - +,-,*,/, gradient, mesh quality, if-then-else, and, or, not
- Many general features: position lights, make movie, etc
- Queries (~50): ways to pull out quantitative information, debugging, comparative analysis

# VisIt employs a parallelized client-server architecture.



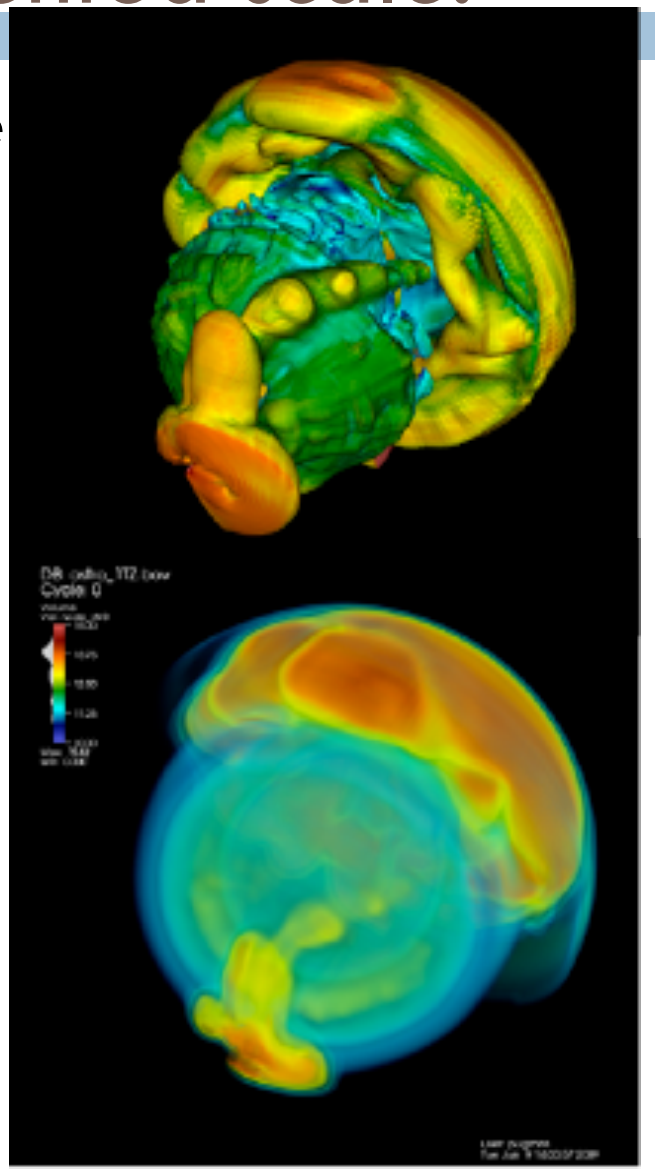

- Client-server observations:
  - Good for remote visualization
  - Leverages available resources
  - Scales well
  - No need to move data
- Additional design considerations:
  - Plugins
  - Multiple UIs: GUI (Qt), CLI (Python), more…

You don't have to run VisIt this way!
You can run all on localhost
You can tunnel through ssh and run all on the remote machine

# VisIt recently demonstrated good performance at unprecedented scale.

- Weak scaling study: ~62.5M cells/core

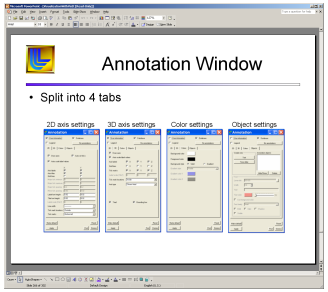
| Machine | Model | Problem Size | #cores |
|---|---|---|---|
| Franklin | Cray XT4 | 1T, 2T | 16K, 32K |
| Dawn | BG/P | 4T | 64K |
| JaguarPF | Cray XT5 | 2T | 32K |
| Juno | X86_64 | 1T | 16K |
| Purple | IBM P5 | 0.5T | 8K |
| Ranger | Sun | 1T | 16K |

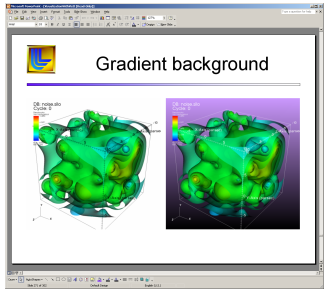


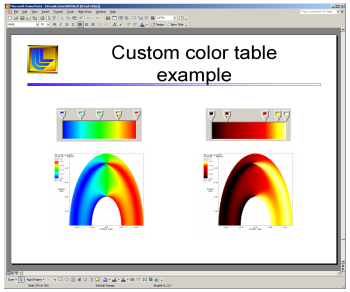
Two trillion cell data set, rendered in VisIt by David Pugmire on ORNL Jaguar machine

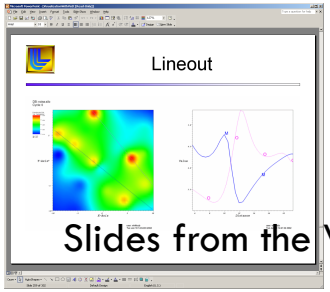
# The VisIt team focuses on making a robust, usable product for end users.

- Manuals
  - 300 page user manual
  - 200 page command line interface manual
  - "Getting your data into VisIt" manual
- Wiki for users (and developers)
- Revision control, nightly regression testing, etc
- Executables for all major platforms
- Day long class, complete with exercises



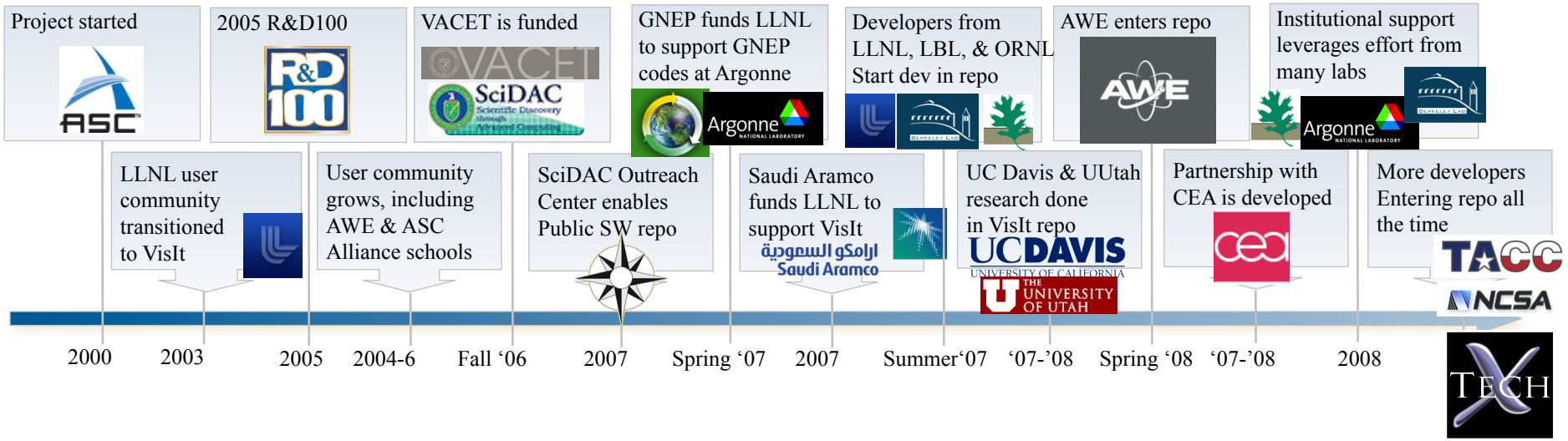




Slides from the VisIt class

# VisIt is a vibrant project with many participants.

- Over 75 person-years of effort
- Over 1.5 million lines of code
- Partnership between: Department of Energy's Office of Science, National Nuclear Security Agency, and Office of Nuclear Energy, the National Science Foundation XD centers (Longhorn XD and RDAV), and more….



# VisIt: What's the Big Deal?

- Everything works at scale
- Robust, usable tool
- Features that span the "power of visualization":
  - Data exploration
  - Confirmation
  - Communication
- Features for different kinds of users:
  - Vis experts
  - Code developers
  - Code consumers
- Healthy future: vibrant developer and user communities

# "How to make VisIt work after you get home"

- How to get VisIt running on your machine
  - Downloading and installing VisIt
  - Building VisIt from scratch
- How to get VisIt to read your data
  - Support for shapefiles, NetCDF, HDF5, and 100+ more
- How to get help when you run into trouble

- See http://www.visitusers.org/index.php?title=Short_Tutorial

# Summary

- `VisIt` is a richly featured visualization tool that is capable of visualizing data from many different application areas.
  - Truth in advertising: a general interface & it sometimes takes a lot of effort to get the visualization you want.
- `VisIt` has excellent built in support for large data sets.
- User resources:
  - Main website: http://www.llnl.gov/visit
  - Wiki: http://www.visitusers.org
  - Tutorial: http://www.visitusers.org/index.php?title=Short_Tutorial
- Contacts:
  - Hank Childs, hchilds@lbl.gov
  - General `VisIt` user email list: visitusers@ornl.gov

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- I like the power of VisIt, but I hate the interface
- How to run client-server

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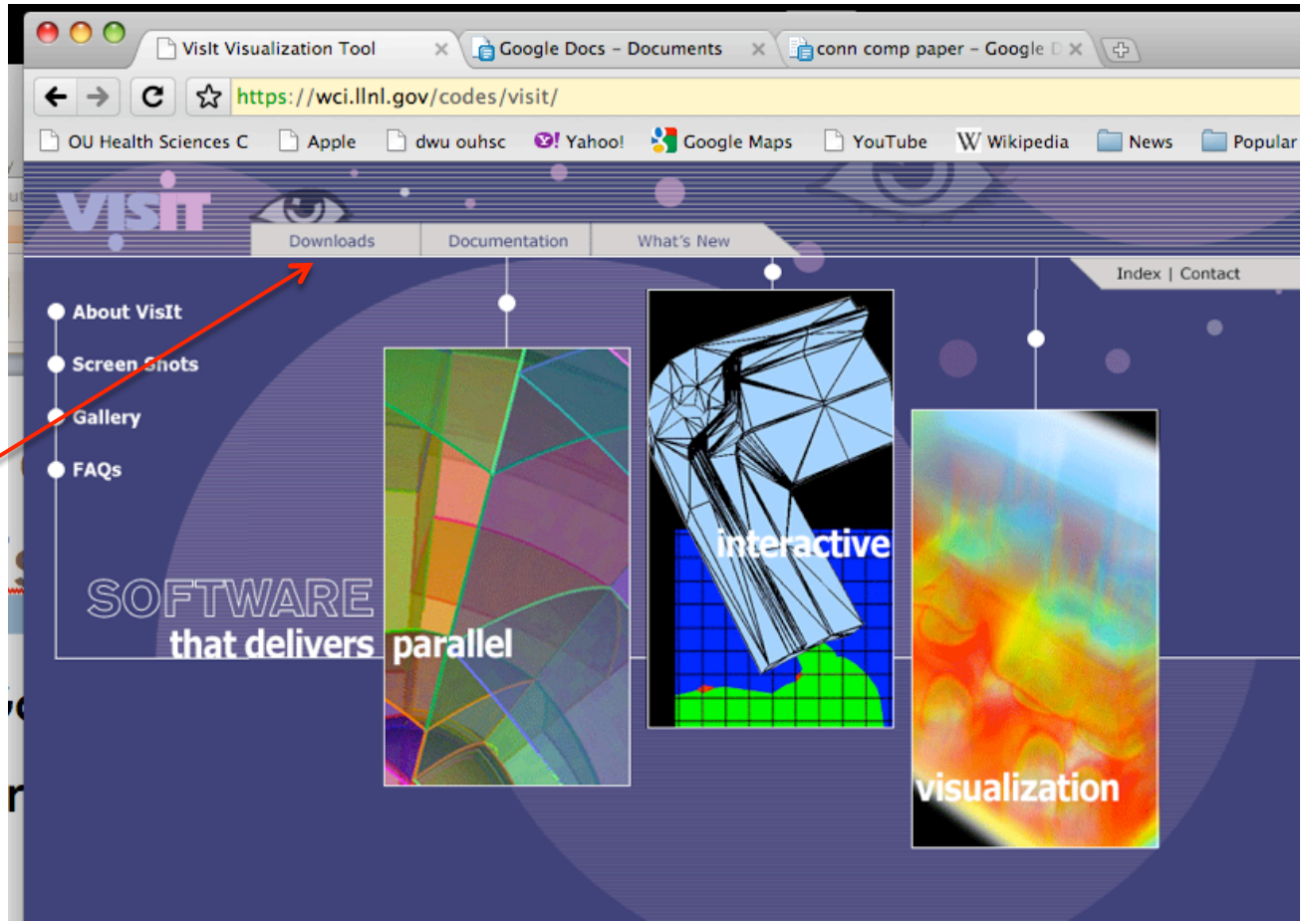
# Can I use a pre-built VisIt binary or do I need to build it myself?

- Pre-built binaries work on most modern machines.
- … but pre-built binaries are serial only.
  - Why the VisIt team can't offer parallel binaries:
    Your MPI libraries, networking libraries are unlikely to match ours
- … and it is difficult to use your own custom plugins with the pre-builts.

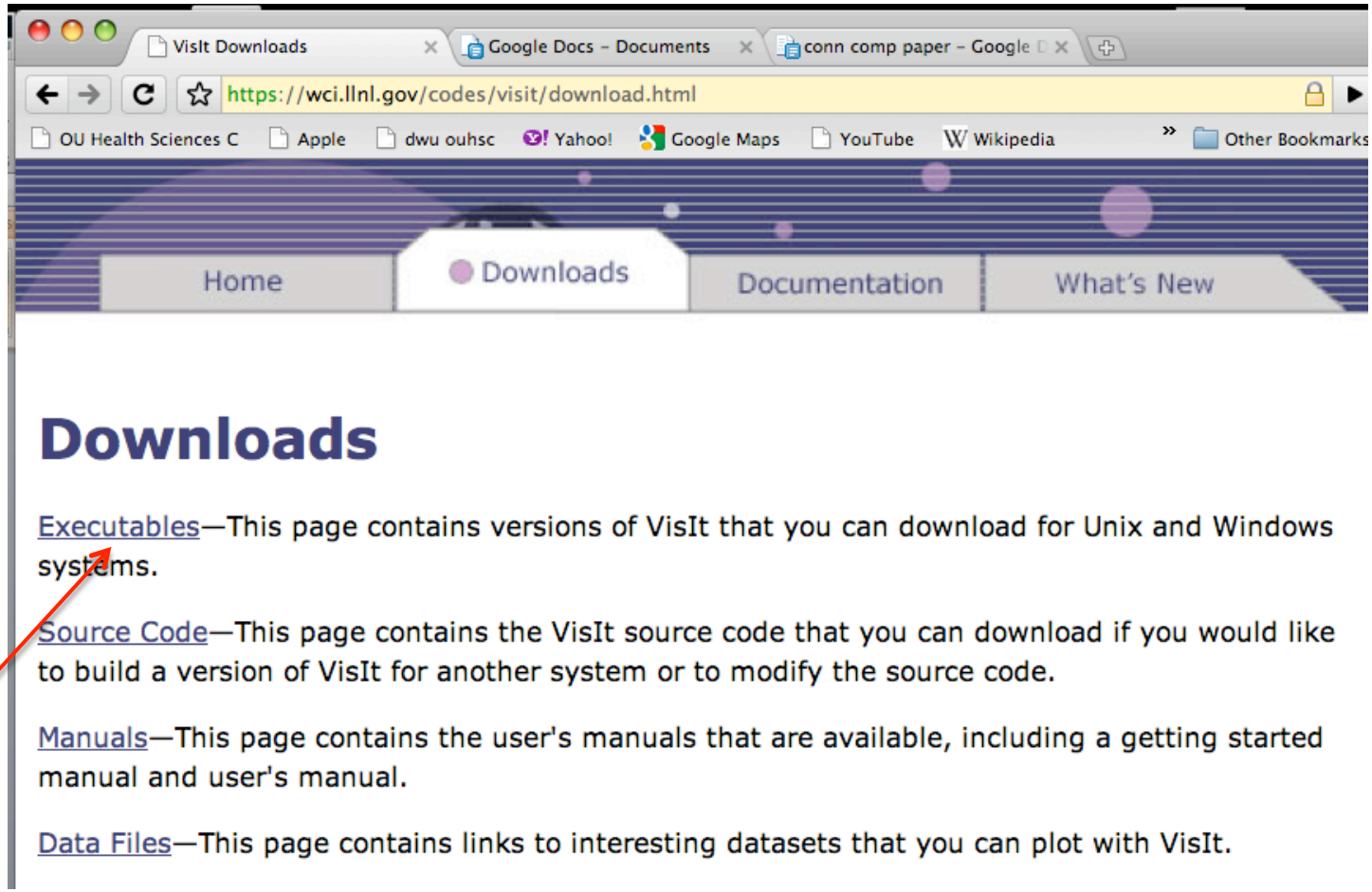
- Recommendation: try to use the pre-builts first and build VisIt yourself if they don't work.
- Also: all VisIt clients run serial-only. If you want to install VisIt on your desktop to connect to a remote parallel machine, serial is OK.

# How do I use pre-built VisIt binaries?

- A: Go to http://www.llnl.gov/visit



# How do I use pre-built VisIt binaries?



# How do I use pre-built VisIt binaries?

## VisIt Executables

This page contains links to download VisIt executables for Unix, Windows, and Mac OS X systems. The page contains several versions of VisIt, organized from the most recent to the oldest. The unix and Mac OS X executables require downloading an install script along with the file containing the executable. The Windows executables are packaged in a self contained installer. Instructions for installing VisIt can be found in the install notes. Md5 and sha1 checksums, as well as file sizes are provided for checking that the files were properly downloaded if corruption of the files is suspected during the download process.

### VisIt 2.1.0

- VisIt release notes
- VisIt install script
- VisIt install notes
- VisIt md5 checksums
- VisIt sha1 checksums
- VisIt file sizes

Important

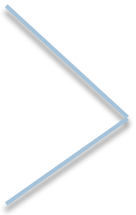
| platform | executable |
|---|---|
| Linux - x86 32 bit<br>Redhat Enterprise Linux 3, hoth.llnl.gov 2.4.21-27.0.2c.ELsmp, gcc 3.2.3<br>Will work on most Linux x86 systems. | download |
| Linux - x86_64 64 bit<br>Ubuntu 8.04, pion.ornl.gov 2.6.24-19, gcc 4.2.4 | download |
| Linux - x86_64 64 bit<br>Redhat Enterprise Linux 4, photon.ornl.gov 2.6.9-89.0.20.ELsmp, gcc 3.4.6<br>Will work on most Linux x86_64 systems. | download |

# How do I use pre-built VisIt binaries?

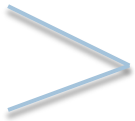
| | |
|---|---|
| Linux - x86_64 64 bit<br>Ubuntu 8.04, pion.ornl.gov 2.6.24-19, gcc 4.2.4 | download |
| Linux - x86_64 64 bit<br>Redhat Enterprise Linux 4, photon.ornl.gov 2.6.9-89.0.20.ELsmp, gcc 3.4.6<br>Will work on most Linux x86_64 systems. | download |
| Linux - x86_64 64 bit<br>Redhat Enterprise Linux 5, yana.llnl.gov 2.6.18-76chaos, gcc 4.1.2<br>Will work on most Linux x86_64 systems. | download |
| Linux - x86_64 64 bit<br>Scientific Linux SL release 5.4, euclid.nersc.gov 2.6.18-164.9.1.el5-bsdv3, gcc 4.1.2 | download |
| Windows (Xp / Vista / 7) 32 bit<br>MSVC8, Visual Studio 2005 | download |
| Mac OS X - Intel<br>Darwin 10.5, Darwin Kernel Version 9.7.0, gcc 4.0.1, OpenMPI<br>*(Includes parallel VisIt compatible with MacOS X 10.5's default MPI)* | download |
| Mac OS X - Intel 64 bit<br>Darwin 10.6.3, Darwin Kernel Version 10.3.0, gcc 4.2.1, OpenMPI<br>*(Includes parallel VisIt compatible with MacOS X 10.6's default MPI)* | download |
| Mac OS X - Intel<br>Darwin 10.4 | download |
| AIX - 32 bit<br>AIX 5.3, up.llnl.gov 00C5D6DD4C00, xlc | download |
| AIX - 64 bit<br>AIX 5.3, up.llnl.gov 00C5D6DD4C00, xlc | download |
| Java client library (jar file, compiled classes, source code, examples) | download |

# How do I use the pre-built VisIt binaries?

- Unix:
  - Download binary
  - Download install script
  - Run install script
  - --or—
  - Download binary
  - Untar



Good for host profiles, maintaining multiple versions, multiple OSs



Quick & easy

- Mac:
  - Download and open disk image.
  - Follow instructions in the README file: run included install script
- Windows:
  - Download installer program & run
- Full install notes:
  - https://wci.llnl.gov/codes/visit/2.2.1/INSTALL_NOTES

# Important step: choosing host profiles

- Many supercomputing sites have set up "host profiles".
  - These files contain all the information about how to connect to their supercomputers and how to launch parallel jobs there.
- You select which profiles to install when you install VisIt.
- Profiles that come with VisIt:
  - NERSC, LLNL Open, LLNL Closed, ORNL, Argonne, TACC, LBNL desktop network, Princeton, UMich CAC
- Other sites maintain profiles outside of VisIt repository.
  - If you know folks running VisIt in parallel at a site not listed above, ask them for their profiles.

# “How to make VisIt work after you get home”

- How to get VisIt running on your machine
  - Downloading and installing VisIt
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- How to get help when you run into trouble
- I like the power of VisIt, but I hate the interface
- How to run client-server

# Building VisIt from scratch

- Building VisIt from scratch on your own is *very* difficult.
- … but the "build_visit" script is fairly reliable.

## Automatically build VisIt with the *build_visit* script!

Download build_visit script here.

VisIt can now be built automatically using the build_visit script on many Linux, MacOS X, and AIX platforms *(more to come)*. The build_visit script takes care of downloading relevant VisIt and 3rd party source code, configuring, and building it all using your C++ compiler. We encourage users to build VisIt using the build_visit script when our binary distributions have trouble running on some systems. We also recommend using the build_visit script on your system if you plan to:

- Modify the VisIt source code.
- Run a parallel compute engine. Building a parallel version of VisIt on your system allows you to configure VisIt so it uses your MPI library, avoiding incompatibilities.
- Create your own VisIt plugins. Building VisIt on your system ensures that it is built with the same C++ compiler that you will use to develop your plugin, minimizing the chance for runtime library incompatibilities.

*(build_visit screen shot)*

# What “build_visit” does

- Downloads third party libraries
- Patches them to accommodate OS quirks
- Builds the third party libraries.
- Creates “config-site” file, which communicates information about where 3rd party libraries live to VisIt’s build system.
- Downloads VisIt source code
- Builds VisIt

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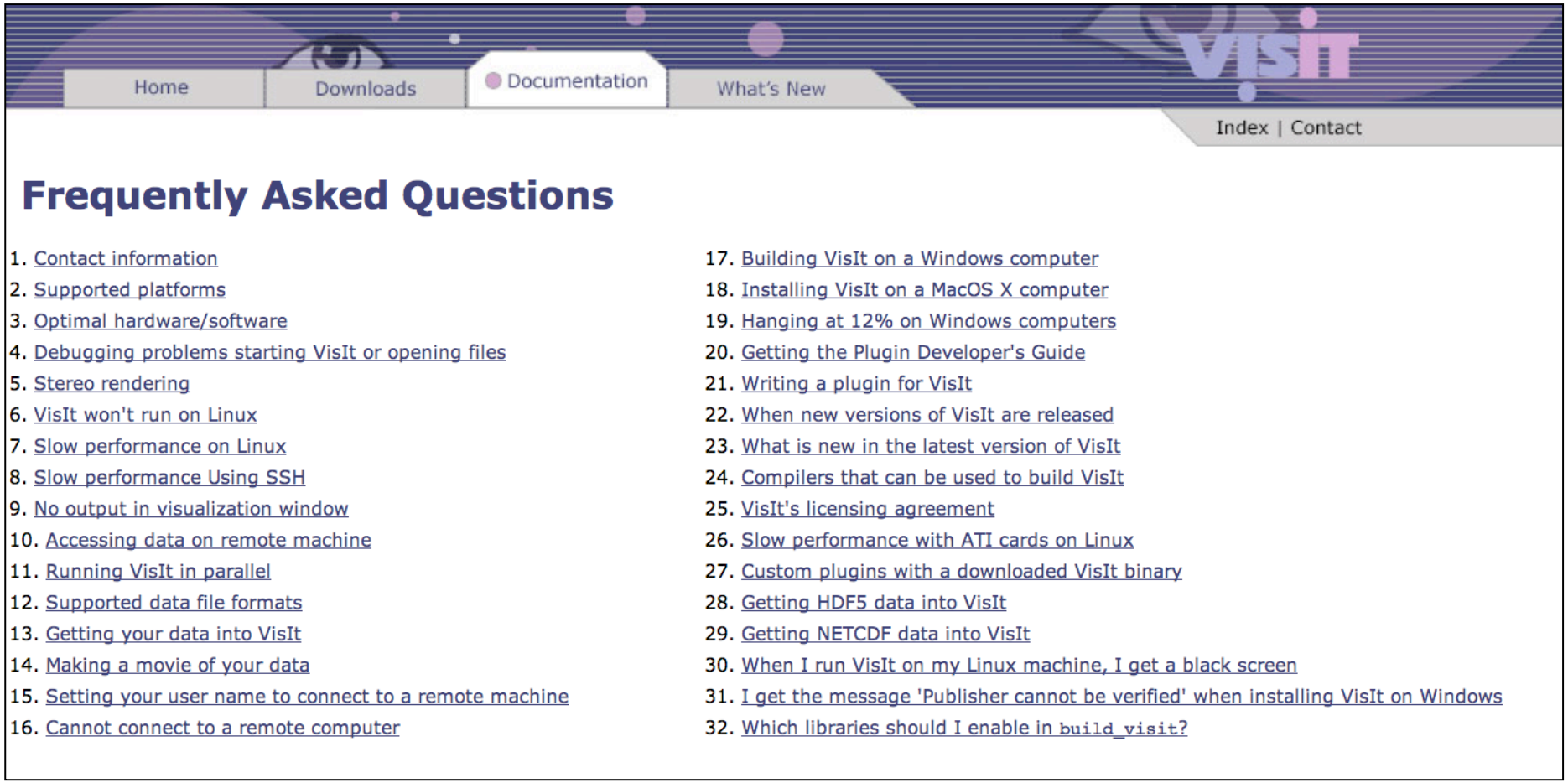
# How to get help when you run into trouble

- Six options:
  - FAQ
    - http://visit.llnl.gov/FAQ.html
  - Documentation
    - https://wci.llnl.gov/codes/visit/doc.html
    - http://www.visitusers.org
  - Vislt-users mailing list
  - Vislt-users archives
  - Vislt users forum
  - Vislt-help-XYZ mailing list

# FAQ: http://visit.llnl.gov/FAQ.html



# Manuals & other documentation

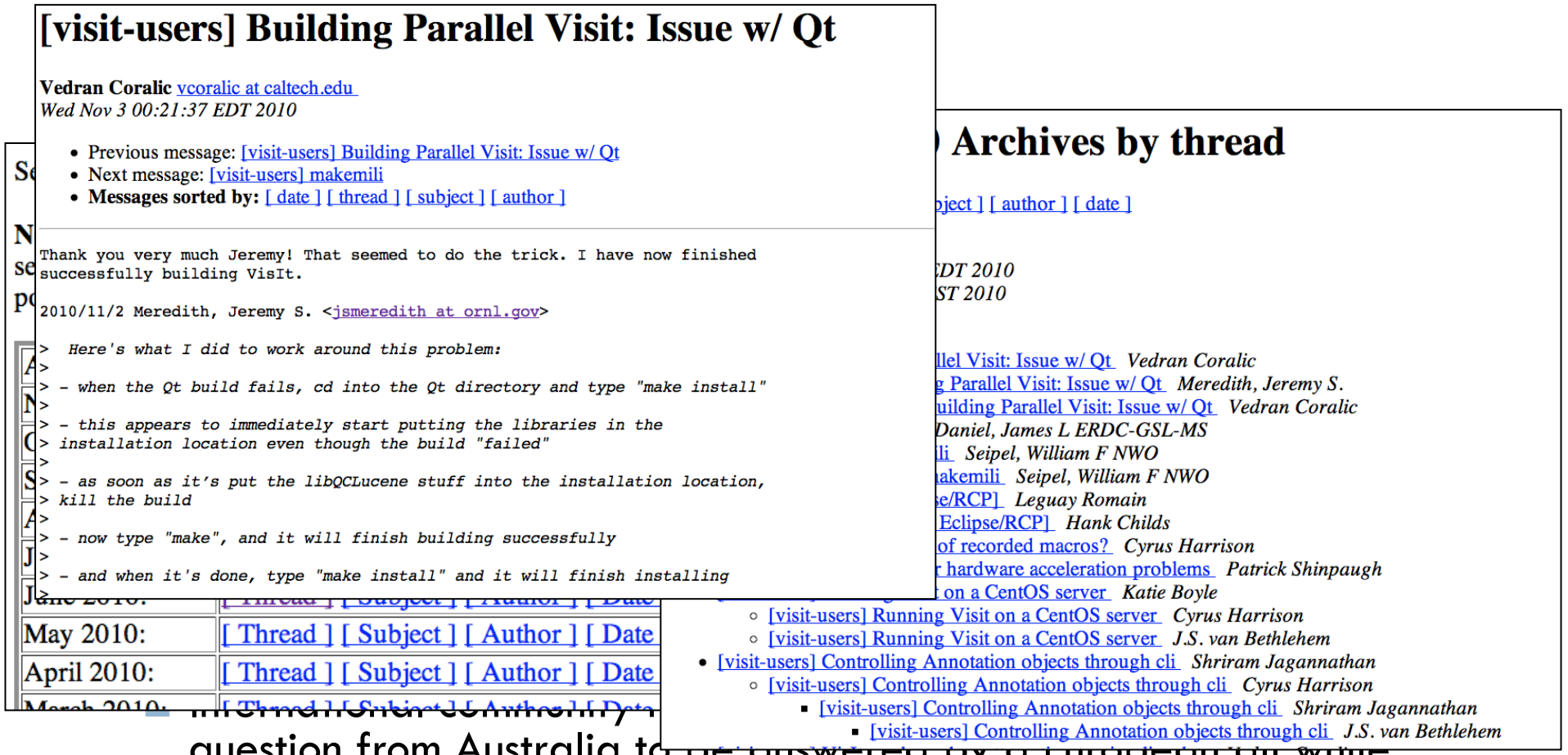
- Getting started manual
- Users manual (old, but still useful)
- Python interface (to be updated in two weeks)
- Getting Data Into VisIt
- VisIt Class Slides
- VisIt Class Exercises
- This Tutorial

# Visitusers.org

- Users section has lots of practical tips:
  - "I solved this problem with this technique"
  - "Here's my script to do this functionality"
- In practical terms, this is a staging area for formal documentation in the future.

**Misc** [edit]

- Using VisIt in an mxterm
- Using derived data functions (DDFs)
- Using the command line interface
- How volume rendering works in VisIt
- Using cross-mesh field evaluations ... how to do differences, access other time slices, etc
- Keyframing example
- Exporting databases
- Directions for specific machines
- Using the VisIt Python API with a standard Python interpreter
- Pages that contain instructions specific to certain user groups and needs
- Issues related to running VisIt on Windows under cygwin
- VisIt's Camera model
- Using VisIt's mpeg2encode
- Molecular data features
- Extracting alpha
- (Very) High resolution rendering
- Elevating shapefiles
- Raytracing your visualizations with POV-Ray and a tutorial POV-Ray exporting example



# [visit-users] Building Parallel Visit: Issue w/ Qt

**Vedran Coralic** vcoralic at caltech.edu
*Wed Nov 3 00:21:37 EDT 2010*

- Previous message: [visit-users] Building Parallel Visit: Issue w/ Qt
- Next message: [visit-users] makemili
- **Messages sorted by:** [ date ] [ thread ] [ subject ] [ author ]

Thank you very much Jeremy! That seemed to do the trick. I have now finished successfully building VisIt.

2010/11/2 Meredith, Jeremy S. <jsmeredith at ornl.gov>

> *Here's what I did to work around this problem:*
> *- when the Qt build fails, cd into the Qt directory and type "make install"*
> *- this appears to immediately start putting the libraries in the installation location even though the build "failed"*
> *- as soon as it's put the libQCLucene stuff into the installation location, kill the build*
> *- now type "make", and it will finish building successfully*
> *- and when it's done, type "make install" and it will finish installing*

# Archives by thread

[ author ] [ date ]

*EDT 2010*
*ST 2010*

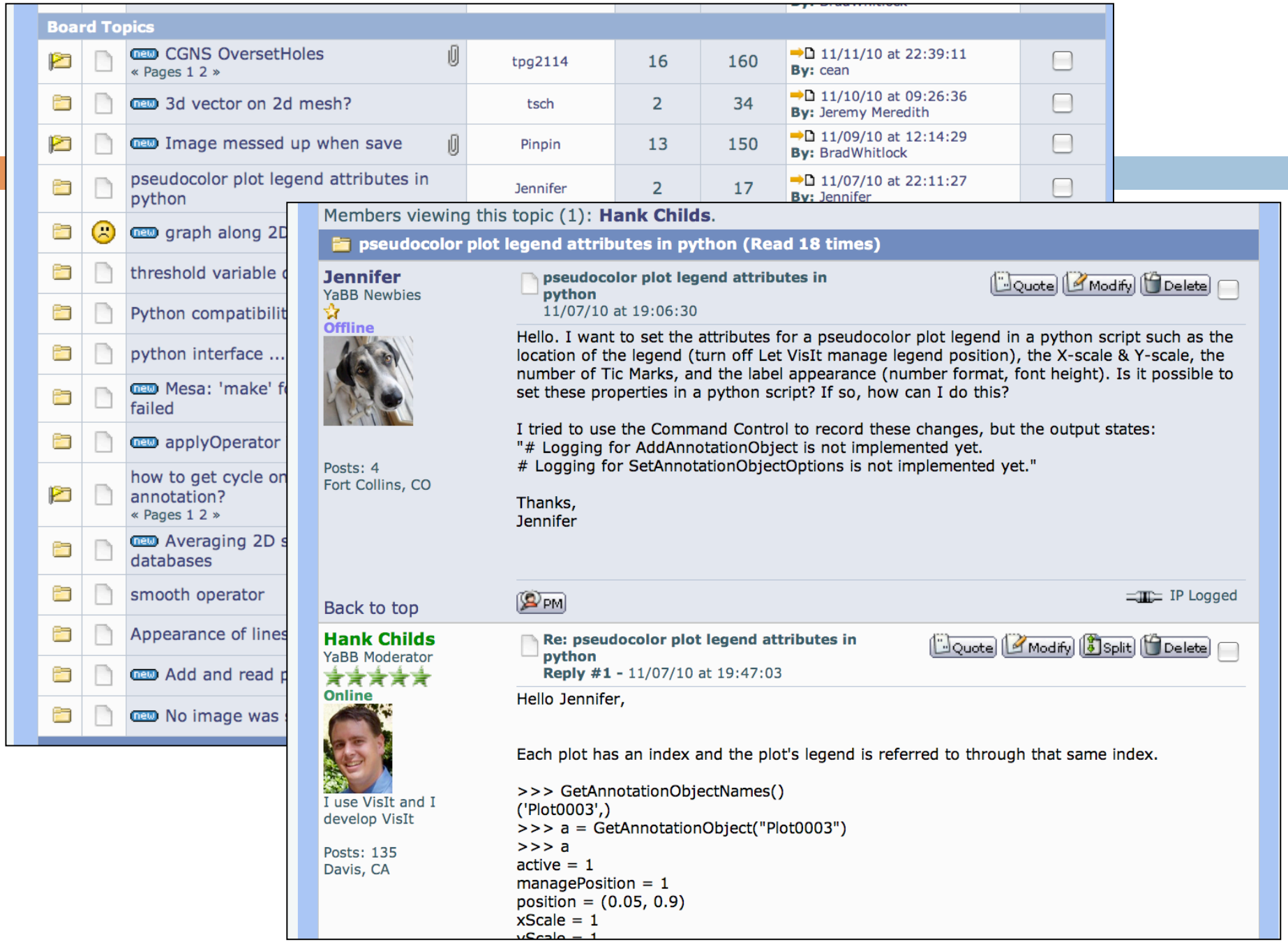
llel Visit: Issue w/ Qt *Vedran Coralic*
g Parallel Visit: Issue w/ Qt *Meredith, Jeremy S.*
uilding Parallel Visit: Issue w/ Qt *Vedran Coralic*
*Daniel, James L ERDC-GSL-MS*
li *Seipel, William F NWO*
akemili *Seipel, William F NWO*
se/RCP] *Leguay Romain*
Eclipse/RCP] *Hank Childs*
of recorded macros? *Cyrus Harrison*
r hardware acceleration problems *Patrick Shinpaugh*
on a CentOS server *Katie Boyle*
- [visit-users] Running Visit on a CentOS server *Cyrus Harrison*
- [visit-users] Running Visit on a CentOS server *J.S. van Bethlehem*

- [visit-users] Controlling Annotation objects through cli *Shriram Jagannathan*
  - [visit-users] Controlling Annotation objects through cli *Cyrus Harrison*
    - [visit-users] Controlling Annotation objects through cli *Shriram Jagannathan*
      - [visit-users] Controlling Annotation objects through cli *J.S. van Bethlehem*

| | |
|---|---|
| May 2010: | [ Thread ] [ Subject ] [ Author ] [ Date |
| April 2010: | [ Thread ] [ Subject ] [ Author ] [ Date |

question from Australia to be answered by a European dr while I'm asleep

- List: visit-users@ornl.gov
- More information: https://email.ornl.gov/mailman/listinfo/visit-users
- Archive: https://email.ornl.gov/pipermail/visit-users/


Board Topics
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11/11/10 at 22:39:11
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Fort Collins, CO
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11/07/10 at 19:06:30
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Hello. I want to set the attributes for a pseudocolor plot legend in a python script such as the location of the legend (turn off Let VisIt manage legend position), the X-scale & Y-scale, the number of Tic Marks, and the label appearance (number format, font height). Is it possible to set these properties in a python script? If so, how can I do this?
I tried to use the Command Control to record these changes, but the output states:
"# Logging for AddAnnotationObject is not implemented yet.
# Logging for SetAnnotationObjectOptions is not implemented yet."
Thanks,
Jennifer
Back to top
PM
IP Logged
Hank Childs
YaBB Moderator
Online
I use VisIt and I develop VisIt
Posts: 135
Davis, CA
Re: pseudocolor plot legend attributes in python
Reply #1 - 11/07/10 at 19:47:03
Quote
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Split
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Hello Jennifer,
Each plot has an index and the plot's legend is referred to through that same index.
>>> GetAnnotationObjectNames()
('Plot0003',)
>>> a = GetAnnotationObject("Plot0003")
>>> a
active = 1
managePosition = 1
position = (0.05, 0.9)
xScale = 1

# Visit-help-xyz

- Some customer groups pay for VisIt funding and get direct support.
  - These customers can post directly to visit-help-xyz without being a subscriber
  - The messages are received by all VisIt developers and supported collectively
- Lists:
  - Visit-help-asc, visit-help-scidac, visit-help-gnep, visit-help-ascem

The 2011 UC-HIPACC International Summer School on AstroComputing presents:

Computational Explosive Astrophysics

# Introduction to visualization with VisIt

Hank Childs, LBNL

July 18, 2011