

THE NATIONAL FUSION COLLABORATORY

Presented by

Martin Greenwald

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<http://www.fusiongrid.org>

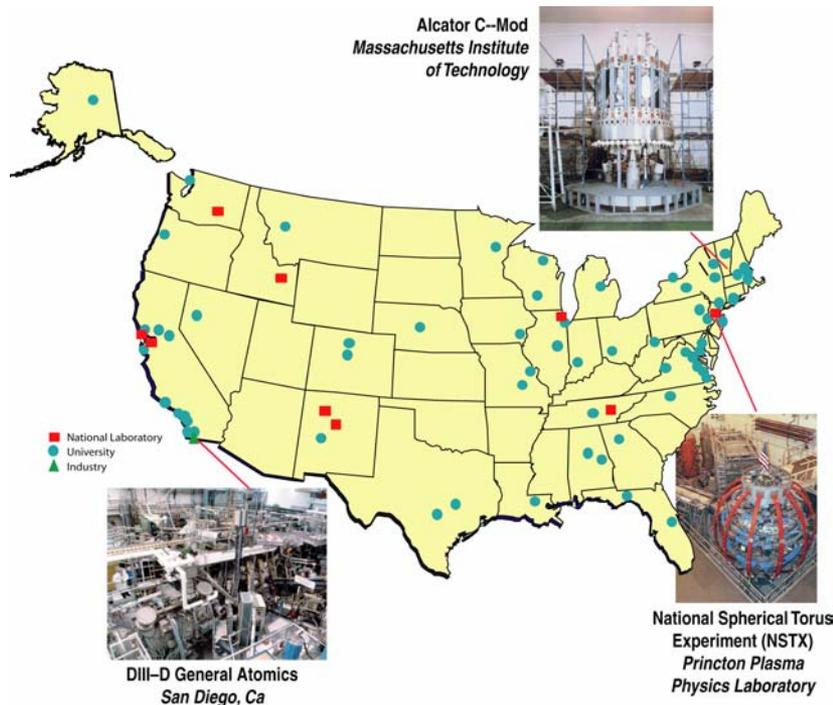


Nature of Fusion Research Drives Requirements for Computing and Networking

- Experiments
 - Characterized by near real-time interactions of large, extended teams
 - Faster between-pulse analysis translates directly to productivity
 - Barriers to use of powerful analysis tools can be significant
- Theory and Computation
 - Simulations producing very large data sets (GB \Rightarrow TB \Rightarrow PB)
 - Interactive visualization and analysis present a severe challenge for computing and networking
 - Increased code sharing and collaborative development

Collaborations in the Fusion Program

Collaboratory is required to advance fusion science: geographically diverse community



- 3 Large experimental facilities (4th under construction)
- > 40 U.S. fusion research sites in 37 states - Over 1500 scientists
- Significant International collaborations

Collaboratory's Goal is to Advance Scientific Understanding & Innovation in Fusion Research

- Enable more efficient use of experimental facilities through more powerful between pulse data analysis
- Allowing transparent access to analysis and simulation codes, data, and visualization tools, resulting in more researchers having having access to more resources
- Enable more effective integration of experiment, theory, & modeling
- Facilitate multi-institution collaborations
- Create a standard tool set for data access, security, and vis allowing researchers to build these into their own applications

Vision for the Fusion Collaboratory

- Data, Codes, Analysis Routines, Visualization Tools should be thought of as network accessible services.
- Shared security infrastructure.
- Collaborative nature of research requires shared visualization applications and widely deployed A/V technologies
- We are not focused on CPU cycle scavenging or “distributed” supercomputing (typical GRID justifications)
 - **Optimize the most expensive resource - people’s time**

Vision – Resources as Services

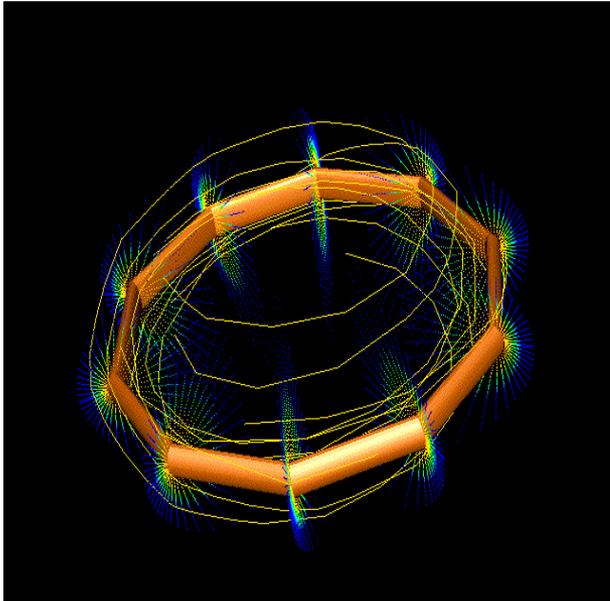
- Access is stressed rather than portability
- Users are shielded from implementation details.
- Transparency and ease-of-use are crucial elements
- Shared toolset enables collaboration between sites and across sub-disciplines.
- Knowledge of relevant physics is still required of course.

Vision – Security Infrastructure

- Strong authentication identifies users (currently based on x.509 certificates from DOE Science Grid).
- Distributed authorization allows stakeholders to control their own resources.
 - Facility owners can protect computers, data and experiments
 - Code developers can control intellectual property
 - Fair use of shared resources can be demonstrated and controlled.

Vision – Visualization and A/V Tools

- Maximum interactivity for visualization of very large data sets



- Use of extended tool sets for remote participation
 - Flexible audio and video links
 - Shared applications

Who is Working on the Collaboratory?

- **Fusion Labs**

- General Atomics
- MIT – Plasma Science & Fusion Center
- Princeton Plasma Physics Laboratory

- **Computer Science Labs**

- Argonne National Laboratory
- Lawrence Berkeley National Laboratory
- Princeton University
- University of Utah

Input from Fusion Science Programs is Actively Sought

- Presence at scientific meetings in Apr. 02 and APS-DPP in Nov. 03
 - Both the experimental and theoretical user community
 - First of their kind demonstrations at these meetings
- Demonstrations to the large experimental teams
 - Shared visualization ANL to San Diego and PCS to PPPL
- Comments and discussions with Oversight Committee
 - Represents broad cross-section of fusion community

NFC Tools and Technologies

- Secure MDSplus using Globus GSI available
 - Authentication and Authorization using DOE CA/ AKENTI
- TRANSP code - worldwide production usage on FusionGrid
 - GRAM, Beowulf cluster, client applications, complete job monitoring
- Personal Access Grid (PIG) software and specifications available - Installed at MIT and GA; PPPL has large AG node
- SCIRun for 3D visualization including MDSplus stored data
- Toolkits for sharing visualization wall to wall and on AG
 - Tiled walls at GA and PPPL

MDSplus – Data Standard for the Fusion Grid

- MDSplus is a set of software tools for data acquisition and storage and a methodology for management of complex scientific data. <http://www.mdsplus.org>
- Developed by MIT, LANL, IGI (Padua)
- **“Service”** rather than file oriented
- Hierarchical, self-descriptive, extensible, scalable, simple but powerful API
- Remote access based on client-server model - MDSIP (RPC)
- Servers at about 30 fusion sites – mostly experiments

MDSplus is Widely used in the Fusion Community

