

THE NATIONAL FUSION COLLABORATORY

Presented by

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<http://www.fusiongrid.org>



MDSplus Enhancements for Collaboratory

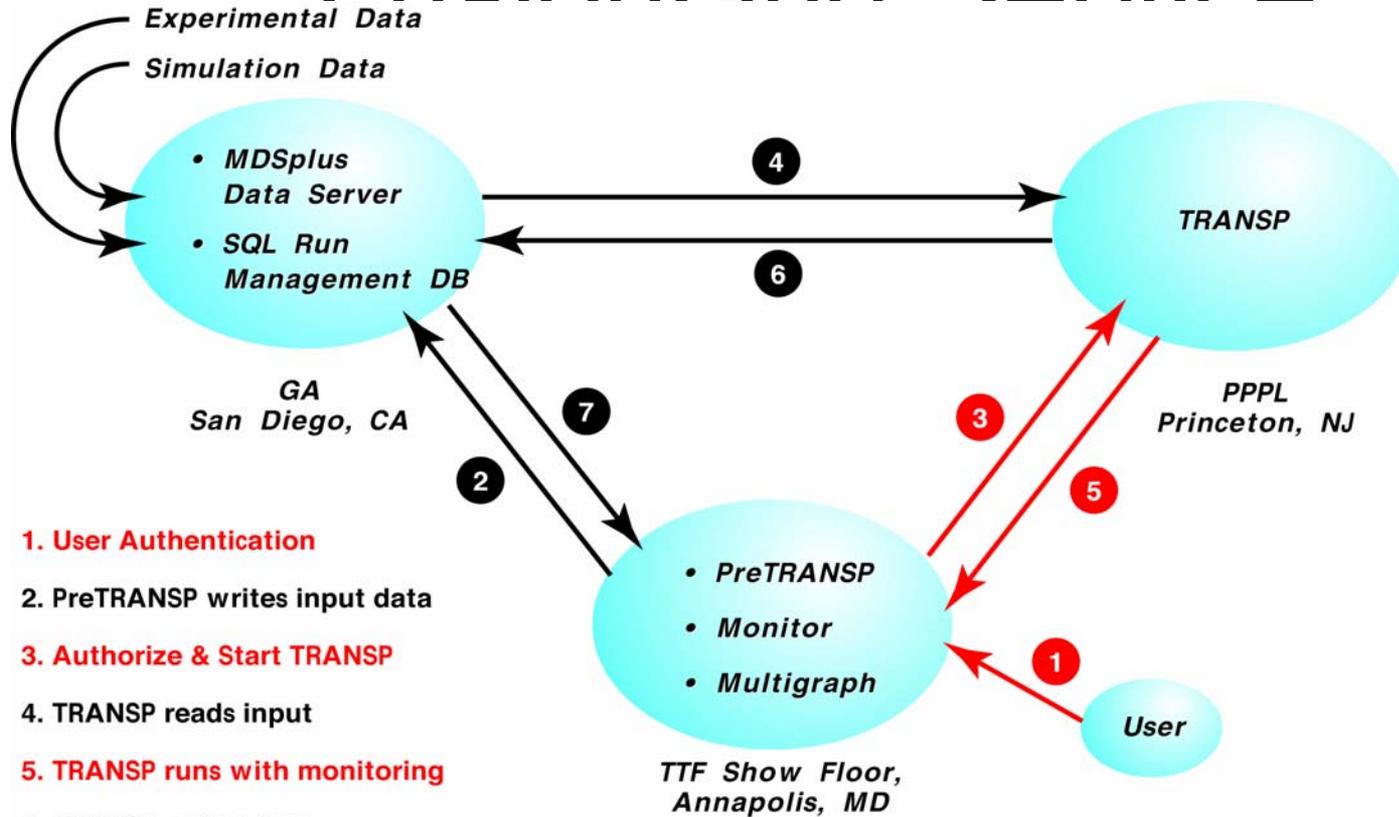
- MDSplus data system secured with Globus GSI
 - Underlying technologies are X.509 certificates/SSL
- Will use MDSplus layer to secure PC based relational database (SQL Server)
- Parallel MDSplus I/O - gridpst (grid parallel socket tunnel) ⇒ **cross country data transfer at wire speeds**

Important shared fusion codes modified to

TRANSP – A Set of Tools for Time Dependent Analysis and Simulation of Tokamak Plasmas

- Over 20 years of development by PPPL
(+ others)
 - >1,000,000 lines of Fortran, C, C++
 - >3,000 program modules
 - 10,000s lines of supporting script code:
perl, python, shell-script
 - Used internationally for most tokamak
experiments
 - Local maintenance has been **very**

TRANSP Implemented as EpsilonGrid Service



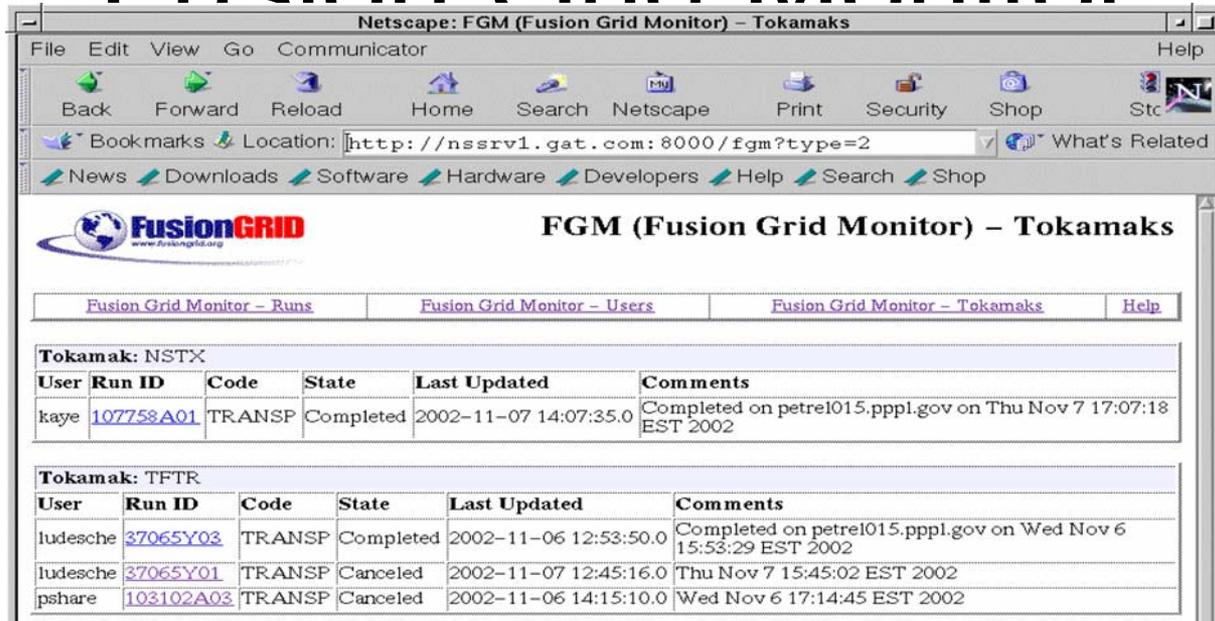
1. **User Authentication**
2. PreTRANSP writes input data
3. **Authorize & Start TRANSP**
4. TRANSP reads input
5. **TRANSP runs with monitoring**
6. TRANSP writes data
7. Visualize TRANSP data



TRANSP Service

- Advantages of grid implementation
 - Remote sites avoid costly installation and code maintenance
 - PPPL maintains and supports a **single** production version of code on well characterized platform
- Production system
 - 16 processor linux cluster
 - Dedicated PBS queue

TRANSP Jobs Tracked by Fusion Grid Monitor



The screenshot shows a Netscape browser window titled "Netscape: FGM (Fusion Grid Monitor) - Tokamaks". The address bar contains the URL "http://nssrv1.gat.com:8000/fgm?type=2". The page features the Fusion Grid logo and a navigation menu with links for "Runs", "Users", "Tokamaks", and "Help". Below the navigation menu, there are two tables of job runs.

Tokamak: NSTX

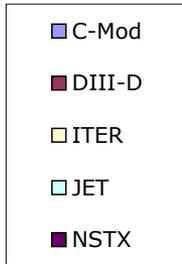
User	Run ID	Code	State	Last Updated	Comments
kaye	107758A01	TRANSP	Completed	2002-11-07 14:07:35.0	Completed on petrel015.pppl.gov on Thu Nov 7 17:07:18 EST 2002

Tokamak: TFTR

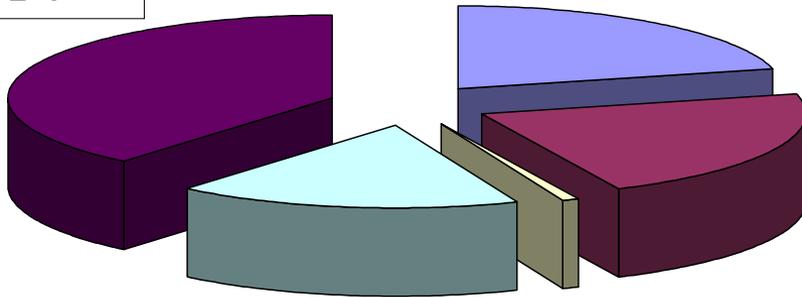
User	Run ID	Code	State	Last Updated	Comments
ludesche	37065Y03	TRANSP	Completed	2002-11-06 12:53:50.0	Completed on petrel015.pppl.gov on Wed Nov 6 15:53:29 EST 2002
ludesche	37065Y01	TRANSP	Canceled	2002-11-07 12:45:16.0	Thu Nov 7 15:45:02 EST 2002
pshare	103102A03	TRANSP	Canceled	2002-11-06 14:15:10.0	Wed Nov 6 17:14:45 EST 2002

- Java Servlet derived from GA Data Analysis Monitor
- User presented with dynamical web display
- Sits on top of relational database – can feed

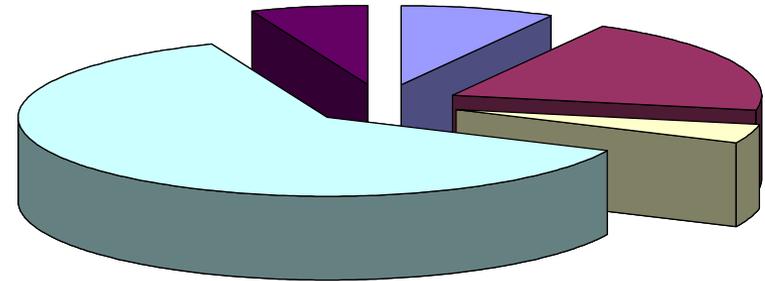
TRANSP Code - Accounting



FusionGrid TRANSP Runs



FusionGrid TRANSP CPU Time



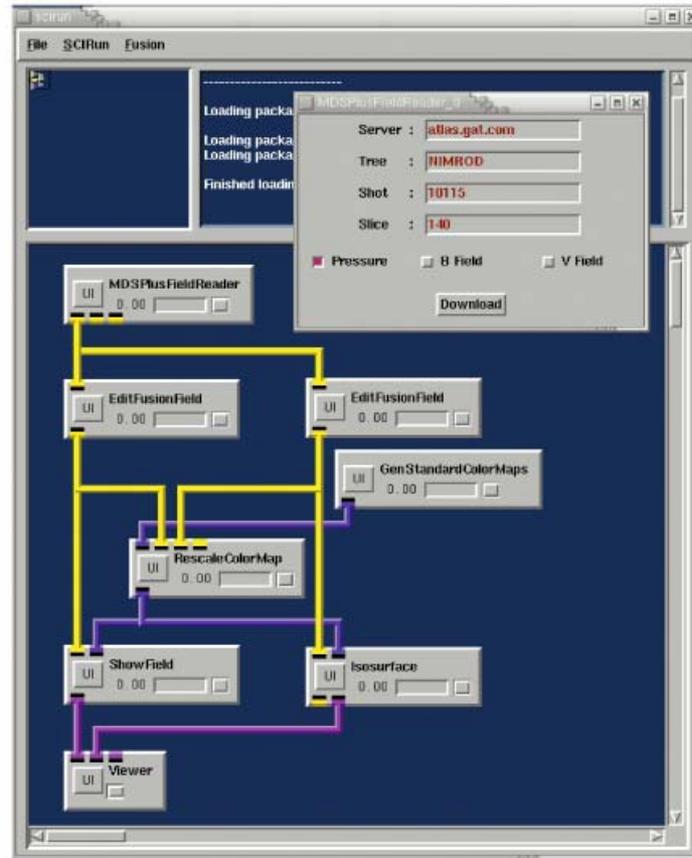
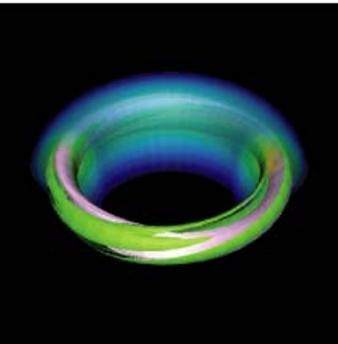
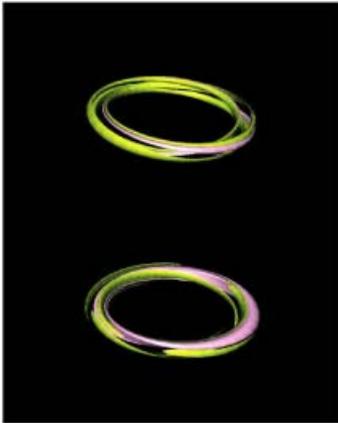
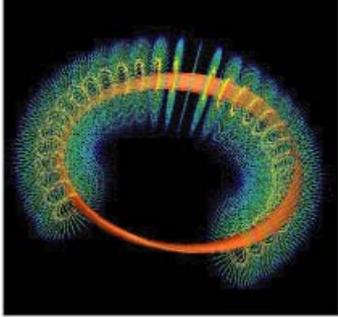
- Statistics for October, the first full month of operation
- Note US scientists supporting JET (UK based) and ITER
- Raises interesting authorization policy

Advanced Visualization in Collaborative Environment

- Strive to dramatically reduce the hurdles that presently exist for collaborative scientific visualization
- Leverage existing technology where possible
 - SCIRun for advanced scientific visualization
 - Integrate AG collaborative tools with tiled display walls

• Collaborative Control Room

Visualization Using SCIRun



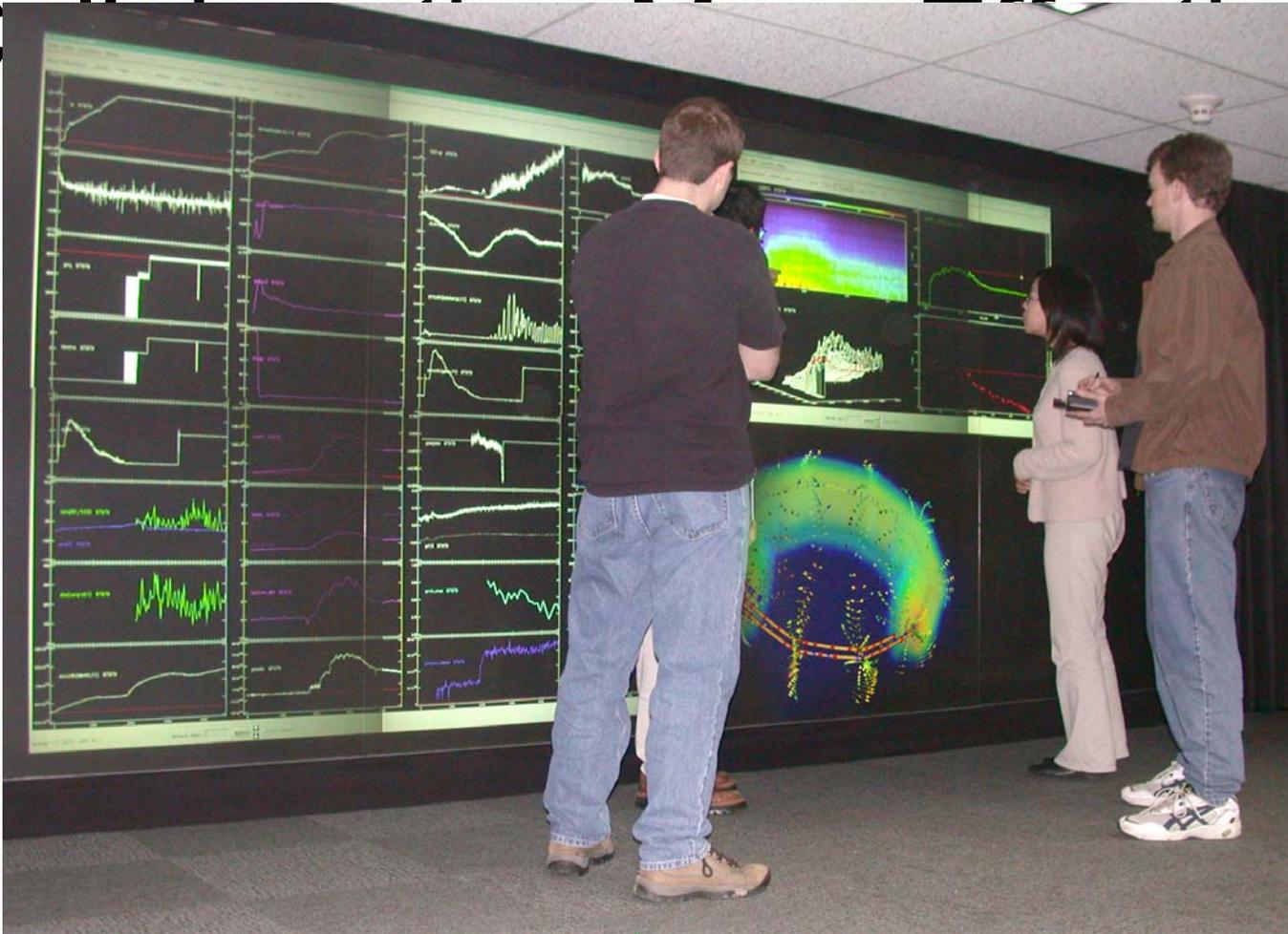
- SCIRun adapted for Fusion Simulations

- From UII
- Open source
- Runs on low-cost platforms

- NIMROD

Tiled Walls Allow a Large Group to Explore Information in

C... ..ely



General Atomics Advanced Imagery Laboratory

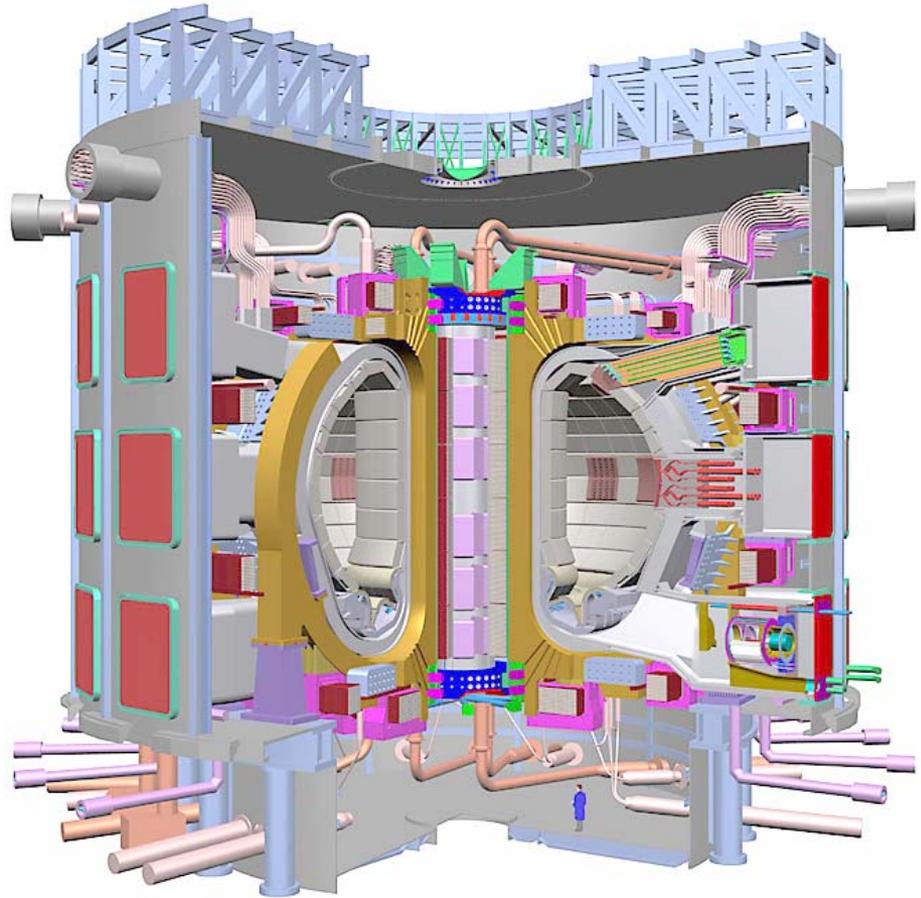
Remote Communication with



- Targeted for the small research center
 - For one to one and one to many interactions
- Usage example: communication to a tokamak control room

ITER – It's Back and It's Baad

- US rejoining negotiations
- \$5B class experiment, over 20 countries, thousands of scientists
- Planning for data systems just beginning



Relation to Other SciDAC

Projects

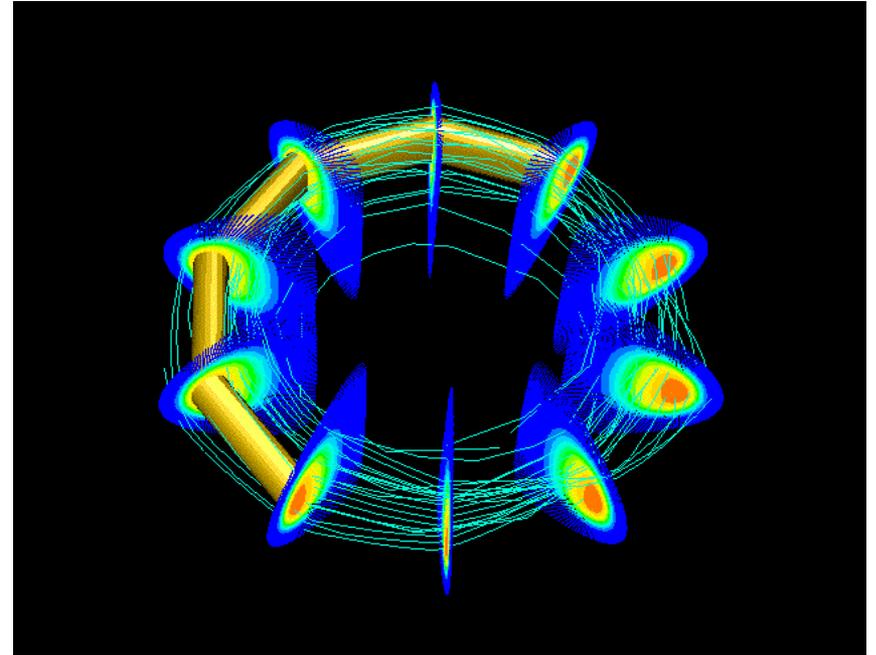
- SciDAC Center for Extended Magnetohydrodynamic Modeling
 - NIMROD data in MDSplus visualized by SCIRun presented at APS/DPP
- SciDAC Plasma Microturbulence Project
 - GS2 code being tested on FusionGrid for broader & easier usage
- Data Grid Toolkit; Security & Policy for Group Collaboration: Distributed Security Architecture
 - Secure access, authentication, authorization, Globus, CSI/Akenti

First Year Accomplishments (1)

- FusionGrid created: MDSplus data access secured with GSI
- First service in production mode: TRANSP code, authorization via GRAM
- Demonstrations to user community at large science meetings
- Prototyped: between pulse pre-emptive scheduling, parallel MDSplus I/O

First Year Accomplishments (2)

- SCIRun
visualization of
NIMROD fusion
data via MDSplus
 - New capability for
3D visualization &
animation
 - Used for real
research
- Access grid
functional on tiled



Issues for Future Work

- Ease-of-use and Ease-of-installation still need a lot of work
 - Especially on security/certificate side
- Still have conflict on site security vs application security paradigm (firewalls, NAT, SecureID...)
- Globus undergoing major transformation
- Can “lighter weight” small footprint

Concluding Comments

- The National Fusion Collaboratory Project is implementing and testing new collaborative technologies for fusion research
 - Grid computing
 - Shared visualization and communication
- Collaborative technology critical to the success of FE program