ADVANCES IN THE REAL-TIME INTERPRETATION OF FUSION EXPERIMENTS

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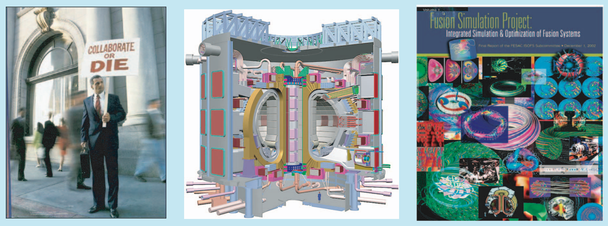
INTRODUCTION

COLLABORATION TECHNOLOGY CRITICAL TO FULLY EXPLOIT PRESENT AND FUTURE FES FACILITIES

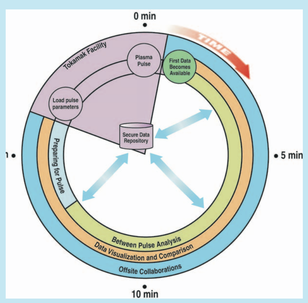


FUSION SCIENCE TODAY AND IN THE FUTURE IS VERY MUCH A TEAM SPORT

For Example Today: The DIII-D National Fusion Facility

For Example The Future: ITER

EXPERIMENTAL FUSION SCIENCE IS AND WILL CONTINUE TO BE A VERY DEMANDING REAL-TIME ACTIVITY

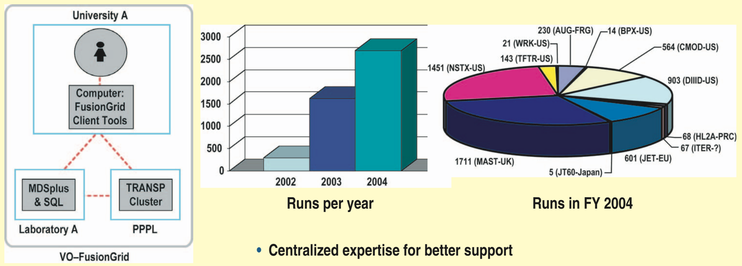


THE NATIONAL FUSION COLLABORATORY PROJECT

FUSIONGRID: SECURE ACCESS TO FES RESOURCES

- Authentication: PKI via X.509 certificates and the FusionGrid CA
- MyProxy centralized certificate management
- Authorization: customized ROAM system
- Data: MDSplus data acquisition and management system

SUCCESSFUL GRID COMPUTING FOR FES: E.G. TRANSP



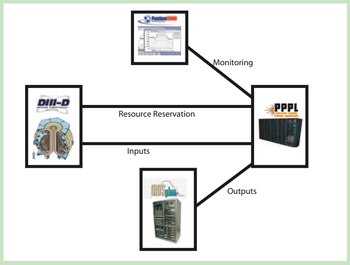
- Centralized expertise for better support
- Reduced administrative work at other labs

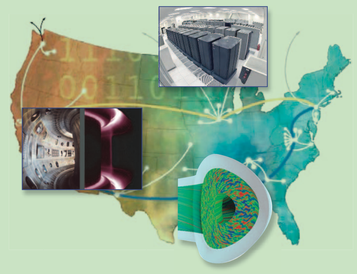
SHARED DISPLAYS INSTALLED IN FUSION CONTROL ROOMS

EXAMPLES OF SCIENTIFIC RESULTS

REAL-TIME GRID COMPUTING TO SUPPORT FES EXPERIMENTS

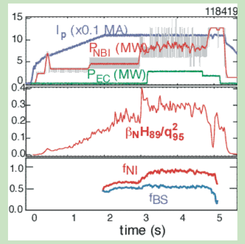
- Transport analysis to support real-time experimental science
- Eventually desire supercomputers to support real-time science



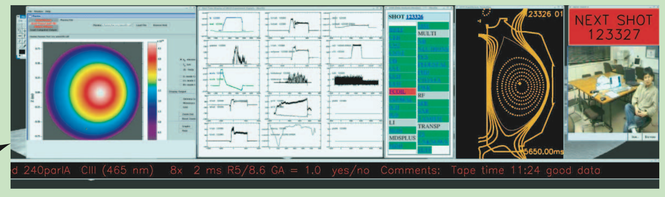


FES GRID BASED DATA ANALYSIS TO MOVE THE SCIENCE FORWARD

- Nearly full noninductive current drive
- Only limited by available hardware
- Stationary operation of a fusion plasma
- At fusion performance levels required for ITER operation

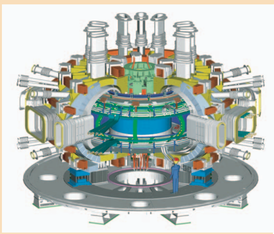


SHARED DISPLAY WALL CONTENT AT DIII-D DURING EXPERIMENTAL OPERATIONS



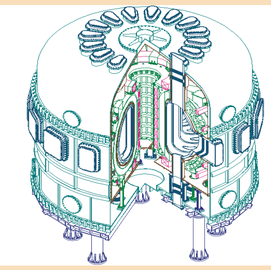
SUMMARY

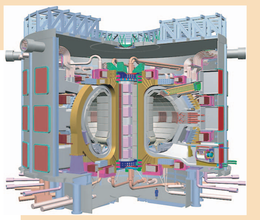
THE SUCCESS OF FUTURE MACHINES BOTH TO THE U.S. AND THE WORLD REQUIRES A ROBUST REMOTE COLLABORTORY CAPABILITY



KSTAR - South Korea

EAST - China



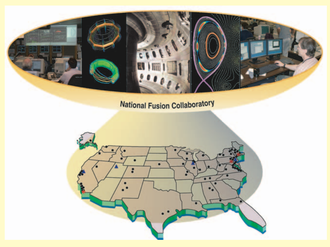


ITER - China or France

THE NATIONAL FUSION COLLABORATORY PROJECT

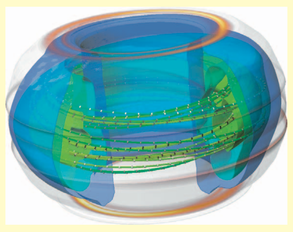
THE NATIONAL FUSION COLLABORATORY PROJECT TOOLS ARE BEING USED TO BETTER FES RESEARCH

- More efficient use of experimental facilities
- Integrate theory and experiment
- Facilitate multi-instituion collaboration
- Create a standard tool set



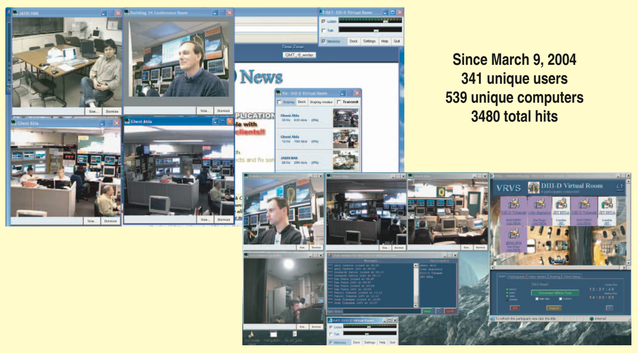
PROJECT VISION: OPTIMIZE THE MOST EXPENSIVE RESOURCE - PEOPLE'S TIME

- Network Services: data, codes, vis tools
- Access is stressed rather than portability
- Shared security infrastructure
- Shared visualization applications and widely and widely deployed collaboration technology



ACCESS GRID: REAL TIME COMPLEX COMMUNICATION FOR EXPERIMENTAL OPERATION

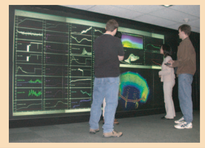
VRVS: WEB CLIENT COMMUNICATION FOR EXPERIMENTAL OPERATIONS

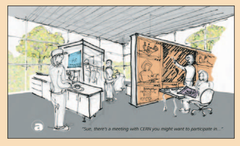


Since March 9, 2004
341 unique users
539 unique computers
3480 total hits

THESE NEEDS DEFINE THE COLLABORATIVE CONTROL ROOM

- Secure computational resources scheduled as required
  - Requires seamless interplay between grid and site security
  - Requires network QoS, CPU scheduling, data management
- Rapidly compare experimental data to simulation results
  - Requires robust and efficient unified data management
- Share individual results with the group via shared large displays
  - Requires display information sharing and concurrent control
- Fully engaged remote scientists with audio, video, shared displays
  - Requires unified and robust collaborative environment





PATH TO SUCCESS HAS BEEN DEMONSTRATED AND PARTIALLY DEPLOYED

- The NFC Project is implementing and testing new collaborative technology
- Clear vision and work scope forward to the Collaborative Control Room
- Collaborative technology critical to the success of the FES program
- Potential to apply to new sciences leading to new collaborations, particularly in China and South Korea

*The NFC Project is supported by the USDOE's SciDAC Program and composed of computer science and fusion science staff from ANL, General Atomics, LBNL, MIT, Princeton University, PPPL, and the University of Utah.