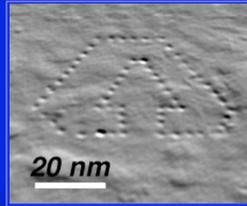


Evolving the Telepresence Collaboratory



Nestor J. Zaluzec
zaluzec@microscopy.com



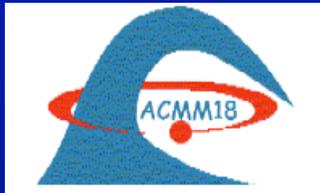
Office of Science - BES Program
US Department of Energy



Electron Microscopy Center
Argonne National Laboratory



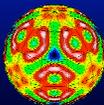
Thanks to



*Telepresence Collaboratories
are about the future...*

U.S. DoE Nanoscale Science Research Centers (NSRCs)

- **NSRCs**
 - *Research facilities for synthesis, processing, and fabrication of nanoscale materials*
 - *Co-located with existing user facilities (synchrotron radiation light sources, neutron scattering facilities, **EM Centers**, & other specialized facilities) to provide characterization and analysis capabilities*
 - *Operated as user facilities; available to all researchers; access determined by peer review of proposals*
 - *Provide specialized equipment and support staff not readily available to the research community*
 - *Conceived with broad input from university and industry user communities to define equipment scope*



NanoScience Research Centers

Phased Construction: 2001-> 2005
Begin Operation: 2006->2008

Computationally Mediated Experimental Science Facilities

- Expt. Data Generator/ On-Line Collaboratories
- Regional User Facilities to Build & Characterize at the Nano Scale
- In-house R&D in NanoScience Specialized to Local Expertise

Modeling/Theory Institutes at Each NSRC

- Simulation Data Generator
- Synergistic Understanding of Structure/Properties Relationships , Design of New Materials
- Strongly Coupled to the Local R&D and Local/Remote Computational Resources

Nanoscience Education of Next Generation of Scientists

- On-Line Collaboratory Functions
- Investment / Coordination with Local University Programs

NSRC's Expt./Collaboration Data Projections

Users: ~ 100 -200/Year/Center
 ~ 500 - 1000 External Researchers
 ~ 30 - 50 FTE's Internal Researchers

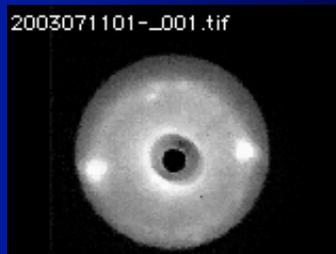
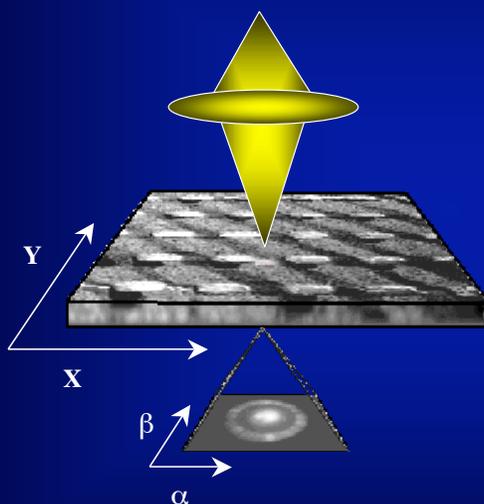
Characterization Data: ~ 0.4 - 8 Tb / User
Fabrication/Collaboration: VTC's / AG Nodes / DCS / Streaming Data

	Values(Tbits) /Yr/Usr	Year			
		2005	2006	2007	2008
# Users		100	300	500	1000
Data/User Low End	0.4	40	120	200	400
Data/User High End	8	800	2400	4000	8000
AGNode @ 2hrs	0.15	15	45	75	150
DCS/VTC @ 2hrs	0.01	1	3	5	10
Streaming Data @ 16hrs	0.05	5	15	25	50
Network Data (Min -Tbits)		56	168	280	610
Network Data (Max-Tbits)		816	2448	4080	8210
Simulations/Modeling	?	?	?	?	?

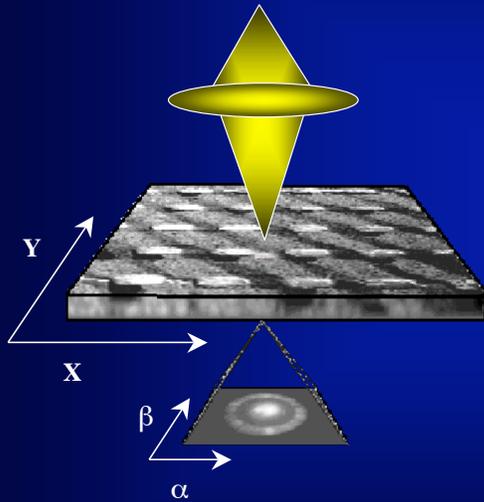
*But we don't generate that
amount of Data!*

*Everyone may not do
this now... but a
growing number of
you will start*

Position Resolved Diffraction



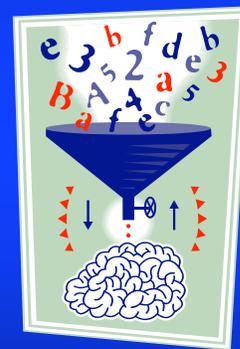
Position Resolved Diffraction



$\alpha\beta$	256^2	512^2	1024^2
XY			
64^2	262M	1G	4.2G
128^2	1G	4.2G	16.7G
256^2	4.2G	16.7G	67G
512^2	16.7G	67G	275G
1024^2	67G	275G	1T

Where does TP Collaboration Fit?

- *Innovation and the big questions*
 - *opportunities for the future*
 - *multidisciplinary opportunities*
 - *changing the “rules of the game”*
- *Status*
 - *implementation and deployment*
 - *early adopters*
 - *SOTA experiments*
- *Future*
 - *community engagement*
 - *Roadmaps*
 - *community input and assessment*



TP Collaboratory Potentials

- *New problem solving capabilities*
 - *rapid assembly of virtual teams*
 - *access to remote facilities and experiments*
 - *interfaces to distributed data archives/experiment repositories*
- *National and international cyberinfrastructure leverage*
 - *corporate and government commitments*
 - *billions of dollars in leverage*
 - *commoditization of infrastructure*
- *Distributed facility and collaboration access*
 - *Equipment sites (ES) and distributed collaborators*
 - *cooperating institutions and policies*
- *Strong security features*
 - *secure experiment control and data sharing policies*
- *Resource discovery and monitoring services*
 - *available resource identification and continuous status monitoring*

TelePresence is About Community Building

- ***Socialization and community***
 - ***multidisciplinary groups***
 - ***Physics, Chemistry, Biology, , Materials, Engineering,,...***
 - ***geographic distribution***
- ***Enablers***
 - ***distributed, unique experimental facilities***
 - ***multimodal collaboration systems***
 - ***distributed, large-scale data archives***
 - ***leading edge computing systems***
- ***Opportunities and challenges***
 - ***creating 21st century infrastructure***
 - ***nurturing a sustainable, multidisciplinary community***

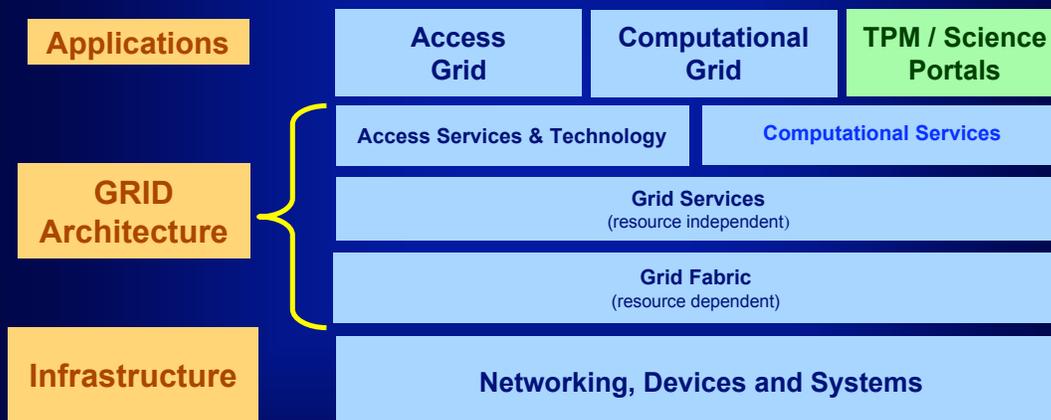


Working Together: Infrastructure

- Telepresence
 - teleobservation
 - remote observation of experiments
 - teleoperation
 - remote control of resources
- Collaboration support
 - collaborative tools to support distributed R&D teams
 - community codes to provide software tools for research
 - collaborative frameworks
 - frameworks for simulation
- Repositories of resources
 - experimental data, numeric simulation results
 - digital content (e.g., movies, video)
 - software tools



Layered Approach to Computational Mediated Science



The Grid

Infrastructure & Computing

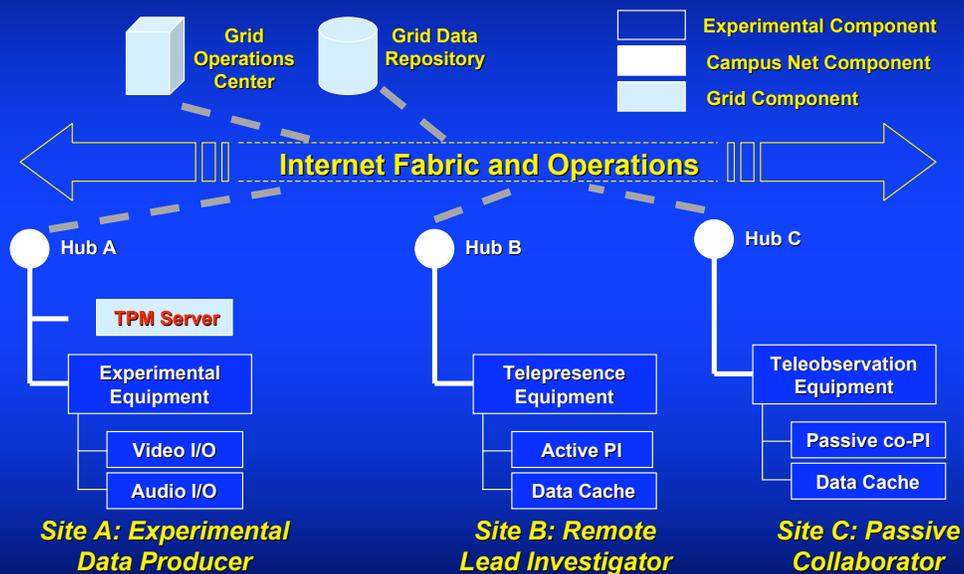
What can it do?

Exploit underutilized resources

- Virtual Organizations
 - Data Grids
 - Collaboratories
- Resource Balancing
- Parallel CPU resources
- Reliability
- Strong Security (if needed)

More Info... <http://www.globus.org>

The Grid in Collaboratories



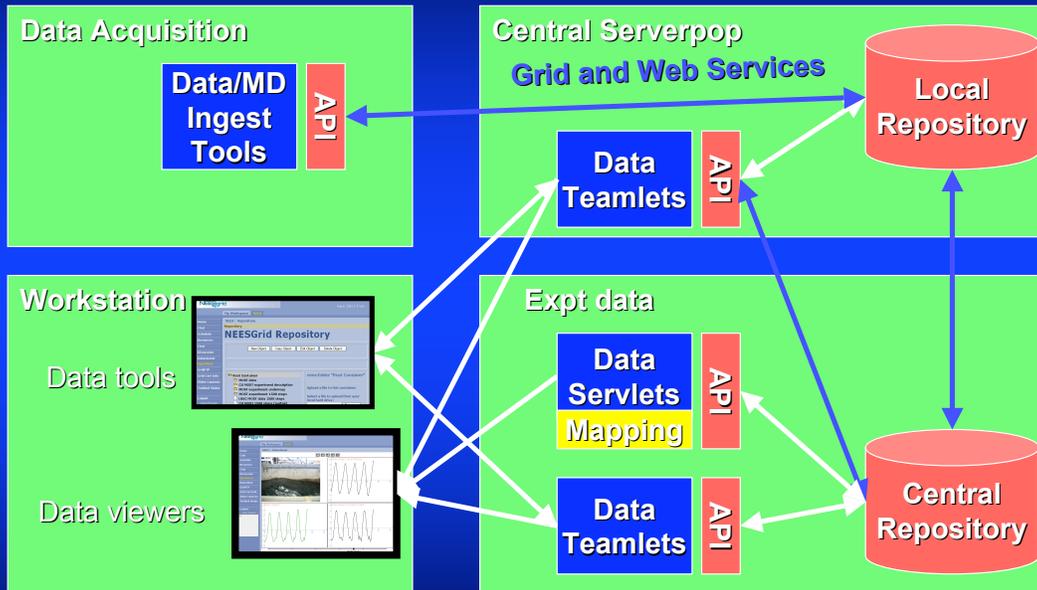
TP Architecture Approach

- *Common infrastructure that can be used across wide range of applications*
 - *Balance generic mechanisms, extensibility for future growth, efficiency for application specific tasks*
- *Validate against user requirements*
 - *Input from user requirements analysis*
 - *Build on proven technology base*

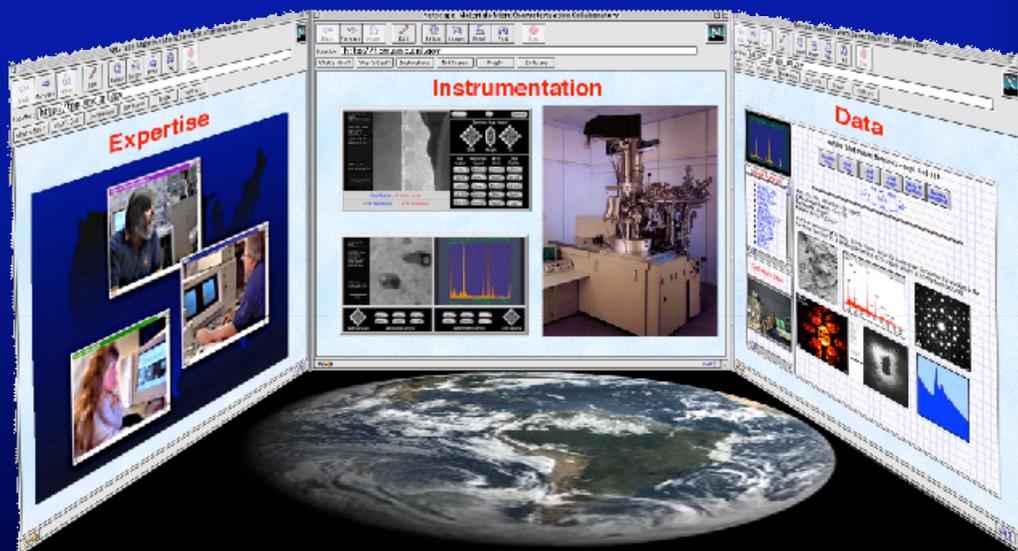
TPC Grid Data – Current Elements

- *Local Repository*
- *Central Repository*
- *APIs – Run locally on the Grid's OGSA Web Services*
 - *File Management Services*
 - *Meta Data Services*
 - *Data Mapping Services*
- *Data Viewers*
 - *Streaming (numeric, X/Y graph)*
 - *Stored (X/Y graph, 2-D structure, video)*

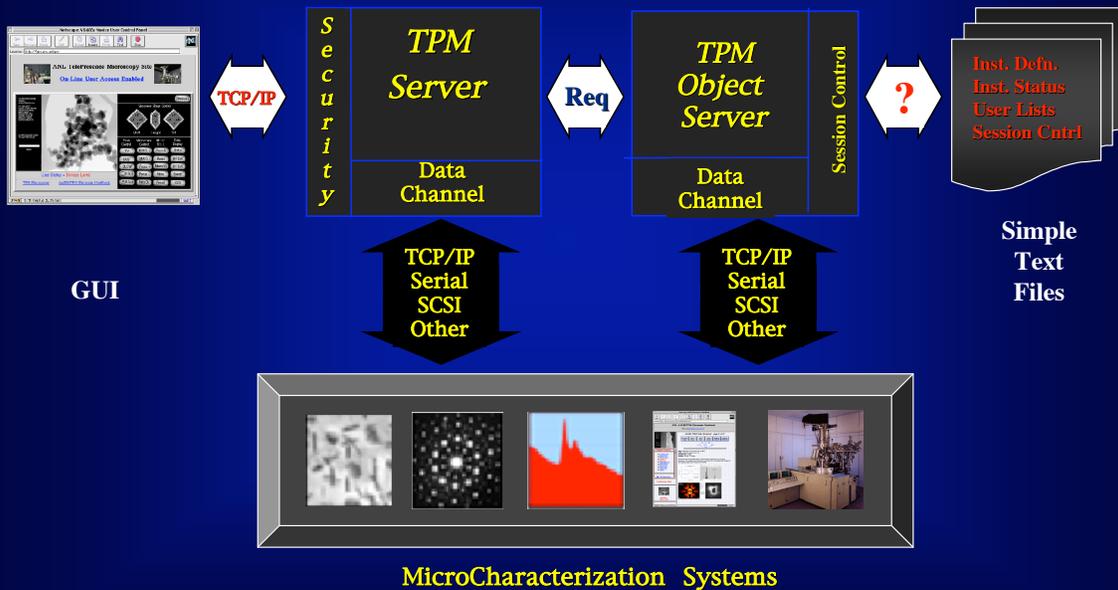
Current Data Elements



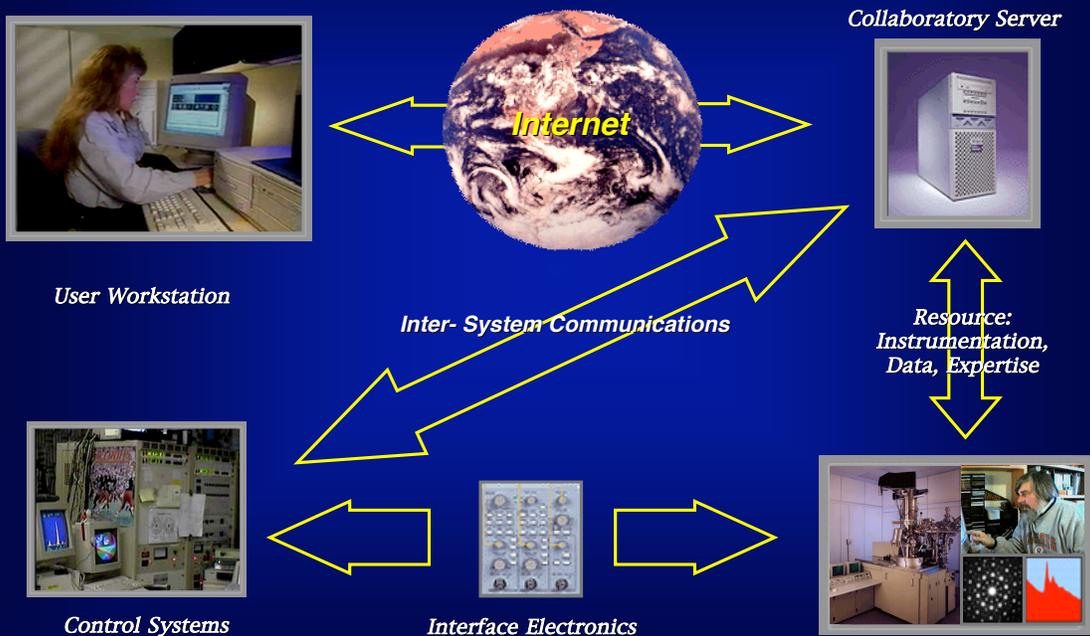
TelePresence Collaboration Enables Access to Resources via the Internet



TelePresence Operations Architecture

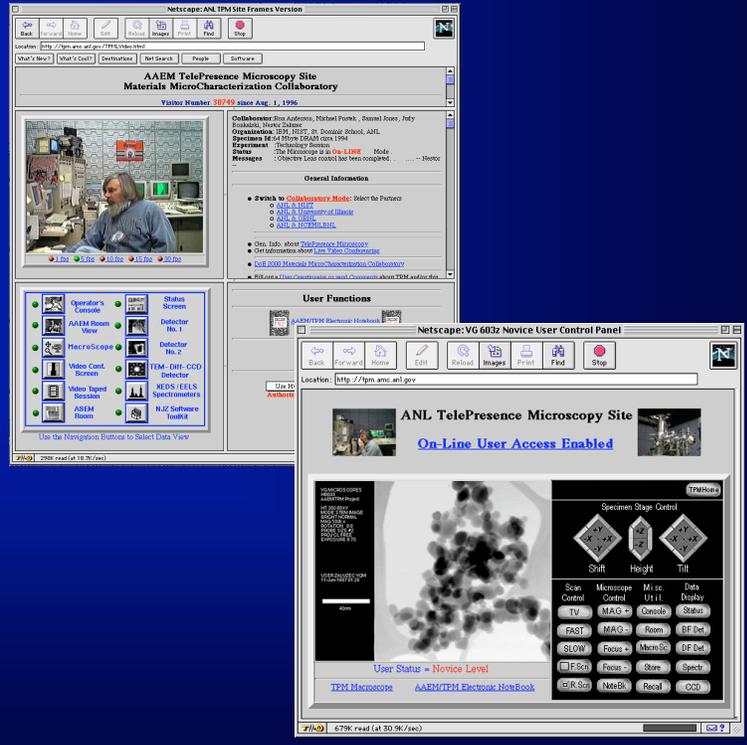


Computationally Mediated Collaboration: TelePresence Microscopy Collaboratories



**ANL - WWW
TPM Server**

*Provides Platform
Independent
Access*



**TelePresence Does Not Apply to
Microscopy / Microanalysis**



National Science Foundation - NEES Grid Collaboratory



Oregon State
Oct. 2002



Univ. of Nevada - Reno
Sept. 2002



Rensselaer Polytechnic Inst.
Mar. 2003



Univ. of Colorado
May 2003



Univ. of Texas
June. 2003



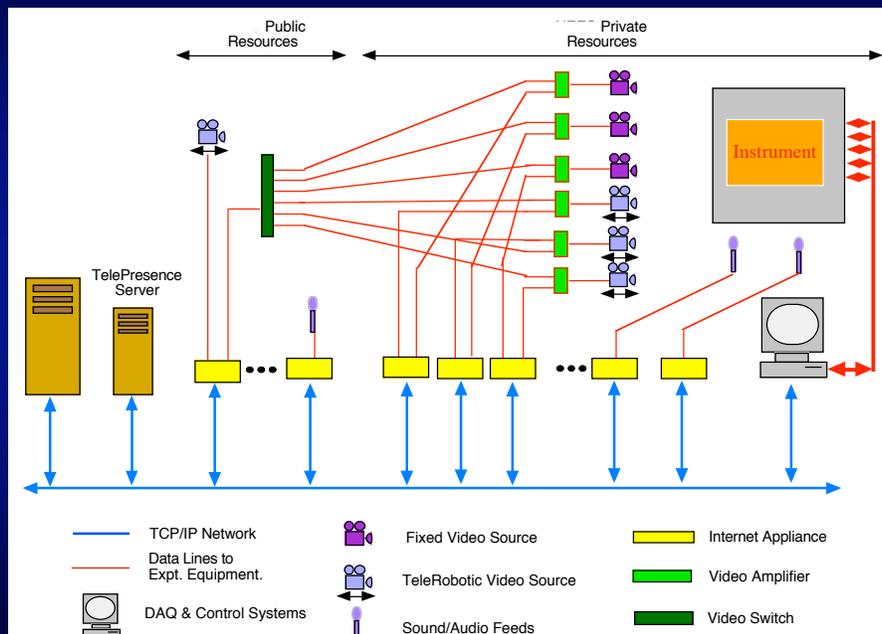
Univ. of Illinois
May 2003

NEESgrid TelePresence System

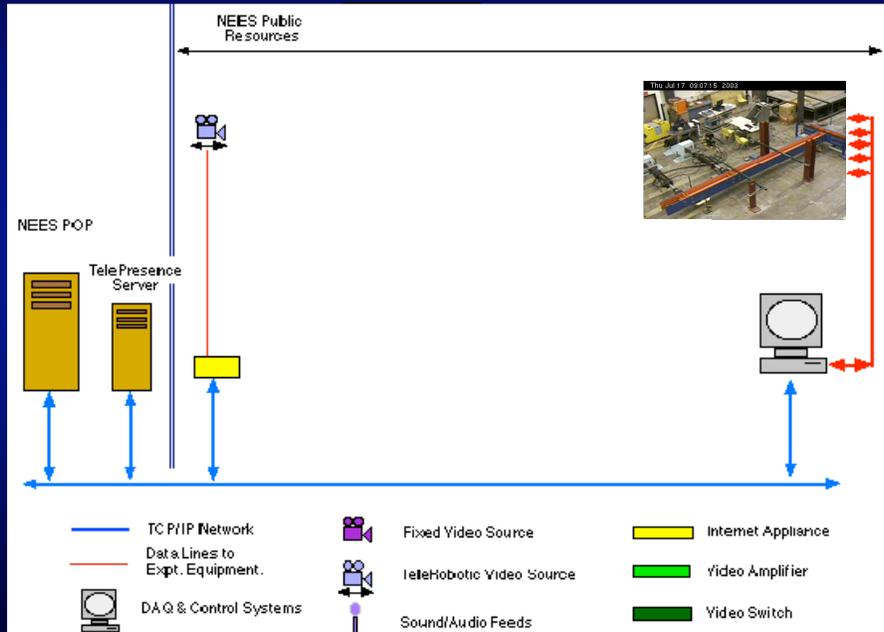
Nestor J. Zaluzec
Daniel Kuchma

SI -Team: Materials Science Division , ANL
Expt-Team: Civil Engineering Department, UIUC

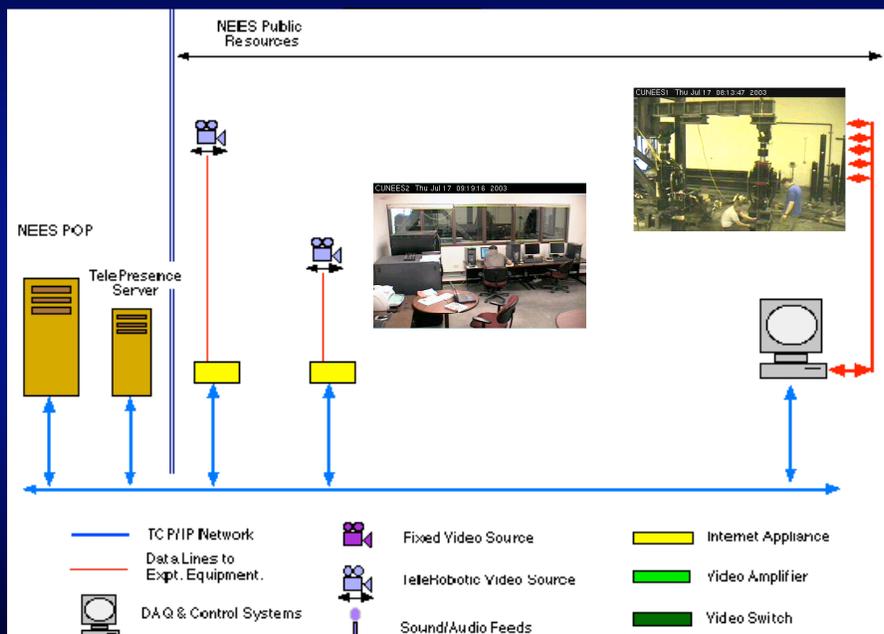
TelePresence System - Basic Hardware Components

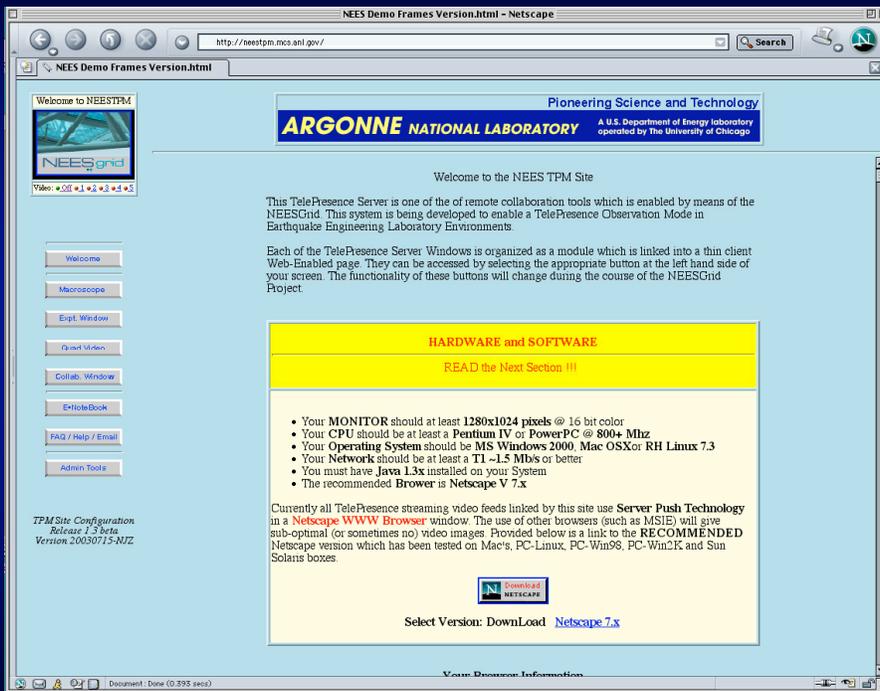


TelePresence System - UIUC



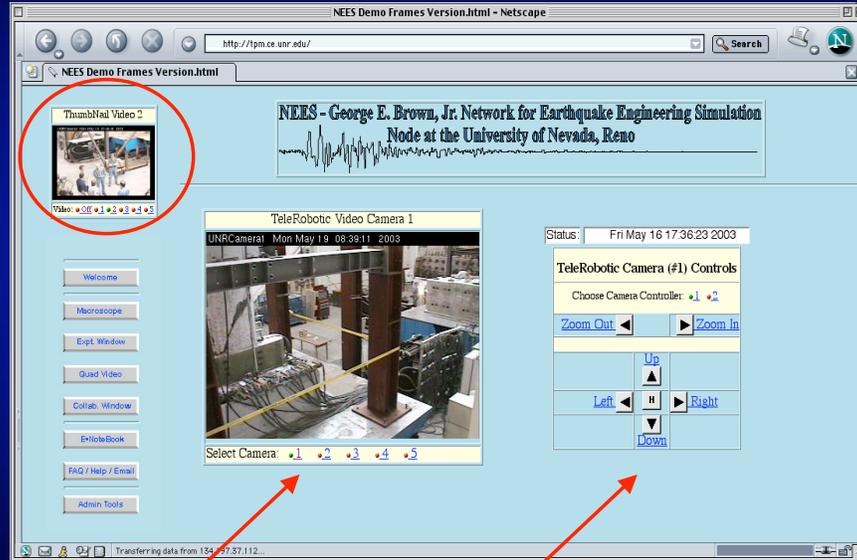
TelePresence System - Univ. of Colorado



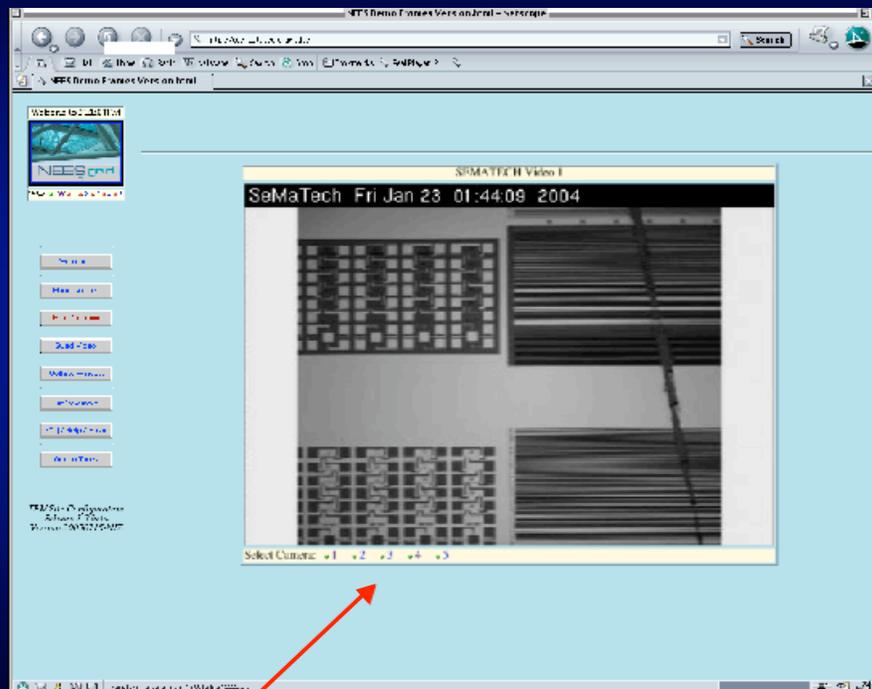


- General Information
- TeleRobotic Camera Controls
- Larger Windows
- Multiple Windows
- Multiple Sites
- Electronic Notebook
- FAQ/Help
- Administrative Functions

TeleRobotic Cameras



Experimental Window



Quad Window

- Welcome
- Macroscop
- Expt. Window
- Quad Video**
- Collab. Window
- E*NoteBook
- FAQ / Help / Email
- Admin Tools

NEES Demo Frames Version.html - Netscape

http://neestpm.nrc.anl.gov/

NEES Demo Frames Version.html

Welcome to TPM

ARGONNE NATIONAL LABORATORY
Pioneering Science and Technology
A U.S. Department of Energy Laboratory
operated by The University of Chicago

ANL-NEESTPM Video 1
ANL-NEESTPM Video 2
ANL-NEESTPM Video 3
ANL-NEESTPM Video 4

Select Camera: 1 2 3 4 5

TPM Site Configuration
Release 1.5 Beta
Version 20030715-NJZ

Transferring data from 140.221.20.144.

Multi-Site Collaboration Window

- Welcome
- Macroscop
- Expt. Window
- Quad Video
- Collab. Window**
- E*NoteBook
- FAQ / Help / Email
- Admin Tools

NEES Demo Frames Version.html - Netscape

http://neestp.colorado.edu/

NEES Demo Frames Version.html

Welcome to NEESTPM

nees@University of Colorado
The George E. Brown, Jr. Network for Earthquake Engineering Simulation

Univ. of Colorado Video 1
UIUC Video 1
UNR Video 1
ORST Video 1

Select Camera: 1 2 3 4 5

TPM Site Configuration
Release 1.5 Beta
Version 20030715-NJZ

ENotebook

- Welcome
- Macroscope
- Expt. Window
- Quad Video
- Collab. Window
- E*NoteBook**
- FAQ / Help / Email
- Admin Tools

NEES Demo Frames Version.html - Netscape

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TPM Electronic Notebook : [neestpmce]

Page 1 of 54

Welcome to NEESTPM

Video:

U. of I. ANL LBNL M*PC ORNL NIST

Previous Page Next Page New Page Grab Image Append UpLoad Table of Contents Search Notebook Home Pref

Date: Tue Apr 1 20 31 10 2003
Author: Nestor J Zaluzec
Title/Subject: Welcome to the TPM Electronic Notebook
PageID: ENotebookIntro.txt
Contents:

Welcome to the TPM Electronic Notebook.
- Nestor J Zaluzec -
- Materials Science Division -
- Argonne National Lab -

Introduction to the TPM ENotebook:

This Electronic Notebook (ENotebook) is an WWW enabled electronic system having a Browser based Graphical User Interface (GUI) which allows individuals to store, review, search and share text, images, and to a limited extent documents.

There are a number of different types of "Notebooks" (electronic or otherwise) which individuals can use for electronically recording information on computer systems today. These range from simple spread sheets, to polished commercial versions as well as a variety of open source code. Each has their own role and applicability. No single "notebook" can hope to fulfill the needs of all individuals, and this ENotebook is no exception. It has a functional design based upon a model of how some experimentalists work, but it should not be expected to fit the way everyone works.

Historically, this implementation can trace its roots back to a design developed in April of 1996 by Geist and Nachtagal of ORNL and was part of the DoE2000 project. The original ORNL implementations (Version 1.00-1.02) were useful for simple text data entry, and have been used widely. However, that design did not fit the

TPM Site Configuration
Release 1.3 Beta
Version 20030715-NJZ

ENotebook

- Welcome
- Macroscope
- Expt. Window
- Quad Video
- Collab. Window
- E*NoteBook**
- FAQ / Help / Email
- Admin Tools

NEES Demo Frames Version.html - Netscape

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TPM Electronic Notebook : [mucd]

Page 36 of 39

Welcome to NEESTPM

Video:

U. of I. ANL LBNL M*PC ORNL NIST

Previous Page Next Page New Page Grab Image Append UpLoad Table of Contents Search Notebook Home Pref

Date: Sun Jul 7 19 18 54 2002 (CST)
Author: Alessandro D'Amico
Title/Subject: SPOBB Pier W2 Test: Test Unit at Ductality 1
Keywords: pier w2 test unit at ductality 1
PageID: 1026087534.txt
Contents:

UpLoaded Information to TPM Notebook

Note: This Image was Scaled Down to Fit the Page

Data/Image file :	1026087534-scaled.jpg	
Pier W2 Displacement Ductility:	1	Click on Image to View Original File
Comments:	Ductility 1 corresponds to a displacement bigger than the displacement expected during the Functionality Evaluation Earthquake (FEE) and no spalling of the architectural concrete occurred.	

TPM Site Configuration
Release 1.3 Beta
Version 20030715-NJZ

Administrative (Local)

- Welcome
- Macroscope
- Expt. Window
- Quad Video
- Collab. Window
- E*NoteBook
- FAQ / Help / Email
- Admin Tools**

NEES Demo Frames Version.html - Netscape

http://neestpm.mcs.anl.gov/

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TPM Administrative Functions

Version 1.0 Streaming DAQ Window Display

- [DAQOnLine](#) • [DAQOffLine](#) ← 1

TeleRobotic Controls

- [TRCamera 1 Controls OnLine](#) • [TRCamera 2 Controls OnLine](#) ← 2
- [TRCamera 1 Controls OffLine](#) • [TRCamera 2 Controls OffLine](#)

MPEG Video Archive Controls

- [List Archived Videos](#) • [Start New Video Archive](#) • [Stop All Running Video Archives](#) ← 3
- [List All Running Video Archives](#)

Miscellaneous Video Proxy Functions

- [List Running Video Proxies](#) • [Stop a Video Proxy](#)
- [List Proxy Server Version](#) • [Start a Video Proxy](#)

Other Administrative Functions

- [Update Scrolling Status Text](#) • [List all ENotebooks](#)
- [Create an Additional ENotebook](#)

TPM Site Configuration
Release 1.3 Beta
Version 20030715-NJZ

Digital VCR

- Welcome
- Macroscope
- Expt. Window
- Quad Video
- Collab. Window
- E*NoteBook
- FAQ / Help / Email
- Admin Tools**

NEES Demo Frames Verstion.html - Netscape

http://neestpm.mcs.anl.gov/

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MPEG1 Software Video Recorder

Select Camera: Video #1 Video #2 Video #3 Video #4

Select Target Recording FrameRate: 15 fps 10 fps 5 fps 1 fps

Select Recording Time: 1 minute 15 minutes 30 minutes 45 minutes 60 minutes Manual

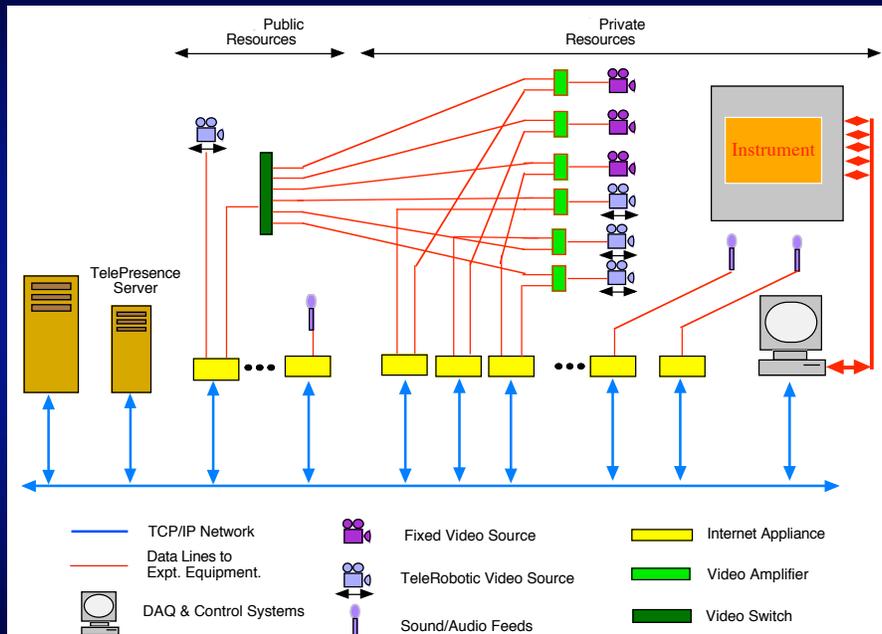
Enter description of this video to be stored as MetaData

Start Erase Everything and Start Over

Note: It is assumed that you have CALIBRATED the recording software to match both your CPU and Network Load. Variation in performance can be expected if Network conditions change from the calibration conditions. This recording should not be considered a substitute for any Hardware DVR.

TPM Site Configuration
Release 1.3 Beta
Version 20030715-NJZ

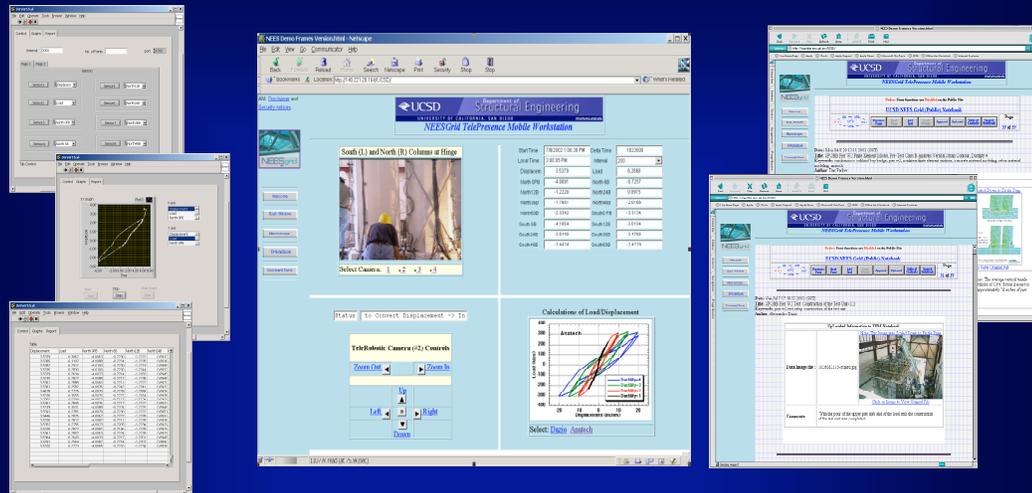
TelePresence System - Basic Hardware Components



DAQ

TPM Client

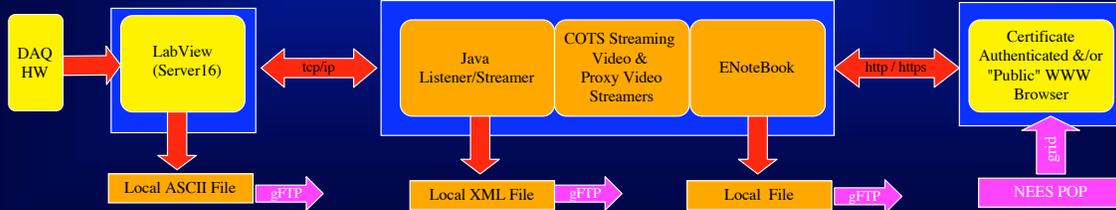
ENotebook



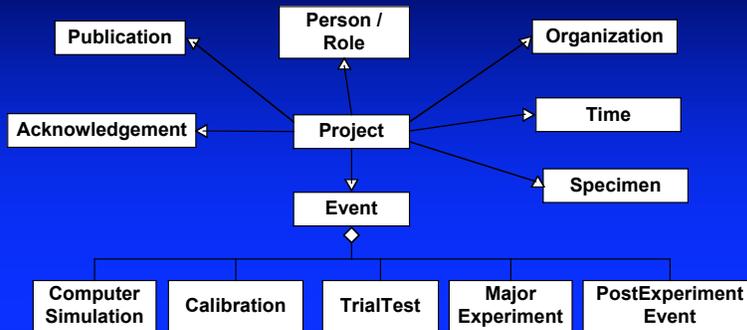
DAQ - Windows 2K/XP PC

TelePresence Server

User Interface



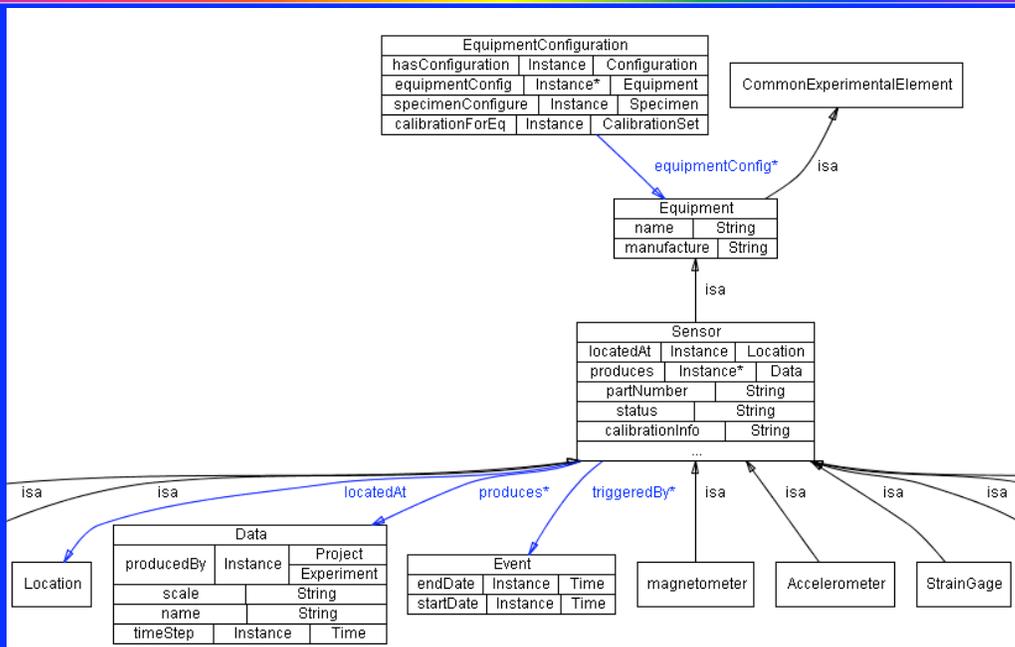
Project Model



Key Additions:

- Project has many events, which categorized in five types
- All the events have trials and versions
- Project deals with certain specimen; but specimen modeling varies widely: domain dependent, project dependent, experiment dependent

Sensor Model (generated by Ontoviz)



Middle/High School Collaboratories

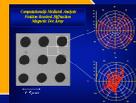


Evolution of TelePresence

Computationally Mediated
Collaboration



Resource

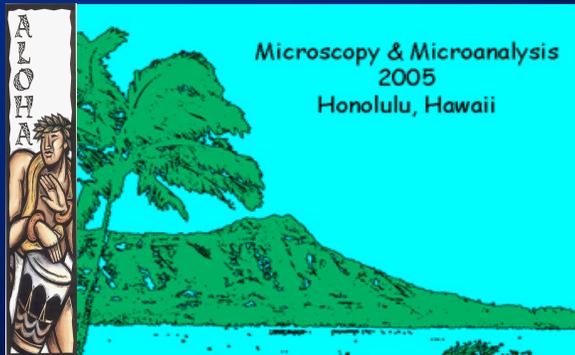


Computationally Mediated
Operation

Computationally Mediated
Analysis

Microscopy & Microanalysis 2005

Joint - MSA, MSA, AMMS, MNZ, CAPSEM, IMS



- Pre-Meeting Congress
- Sunday Short Courses
- Presidential Happenings
- Symposia
 - Tutorials
 - FIG's
 - Biological Sciences
 - Physical Sciences
 - Adv. Inst. & Tech
 - Contributed
- Posters

