



# **ENHANCED COMPUTATIONAL INFRASTRUCTURE FOR DATA ANALYSIS AT THE DIII-D NATIONAL FUSION FACILITY**

*Presented by  
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*for the DIII-D National Team*

*Presented to  
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Acquisition and Remote Participation on Fusion Research*

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# ACKNOWLEDGMENTS

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- **The Data Analysis Applications Group**
  - Qian Peng, Jeff Schachter, Dave Schissel from GA
  - Ted Terpstra from PPPL
- **DIII-D Computer Staff**
  - J. Freeman, K. Keith, B. McHarg, C. Parker, T. Warner
- **The DIII-D User Community**
- **From LLNL — Tom Casper, Bill Meyer, and Jeff Moller**
- **From MIT/C-Mod — Martin Greenwald, Tom Fredian, and Josh Stillerman**
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# COLLABORATOR SUPPORT IS FUNDAMENTAL TO EFFICIENT UTILIZATION OF THE DIII-D FACILITY

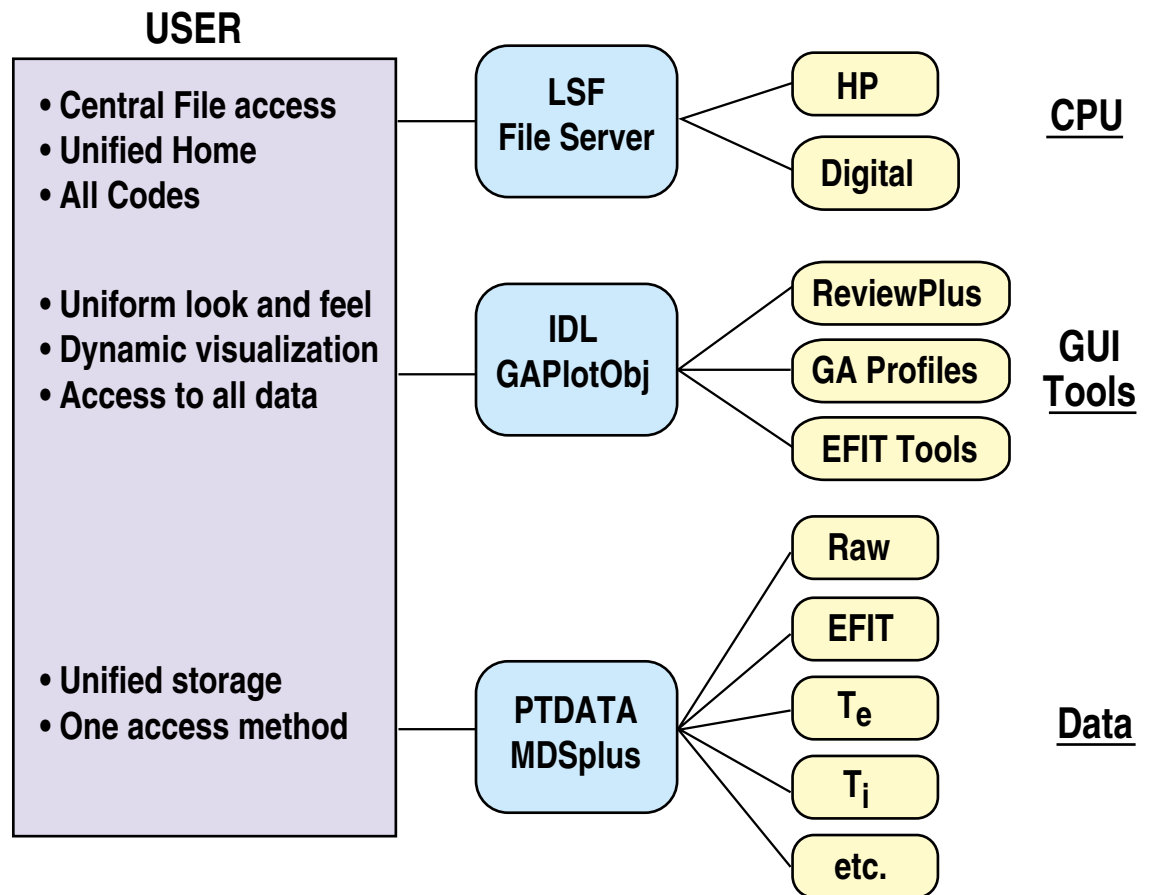
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- **DIII-D National Team consists of 54 worldwide institutions**
- **Two-thirds of onsite scientists are collaborators**
- **150 of 300 users off-site collaborators**
- **Increasing number of collaborators places more demand on computing infrastructure**

# INCREASE DIII-D DATA ANALYSIS THROUGHPUT AND DATA RETRIEVAL RATE BY EASE OF USE

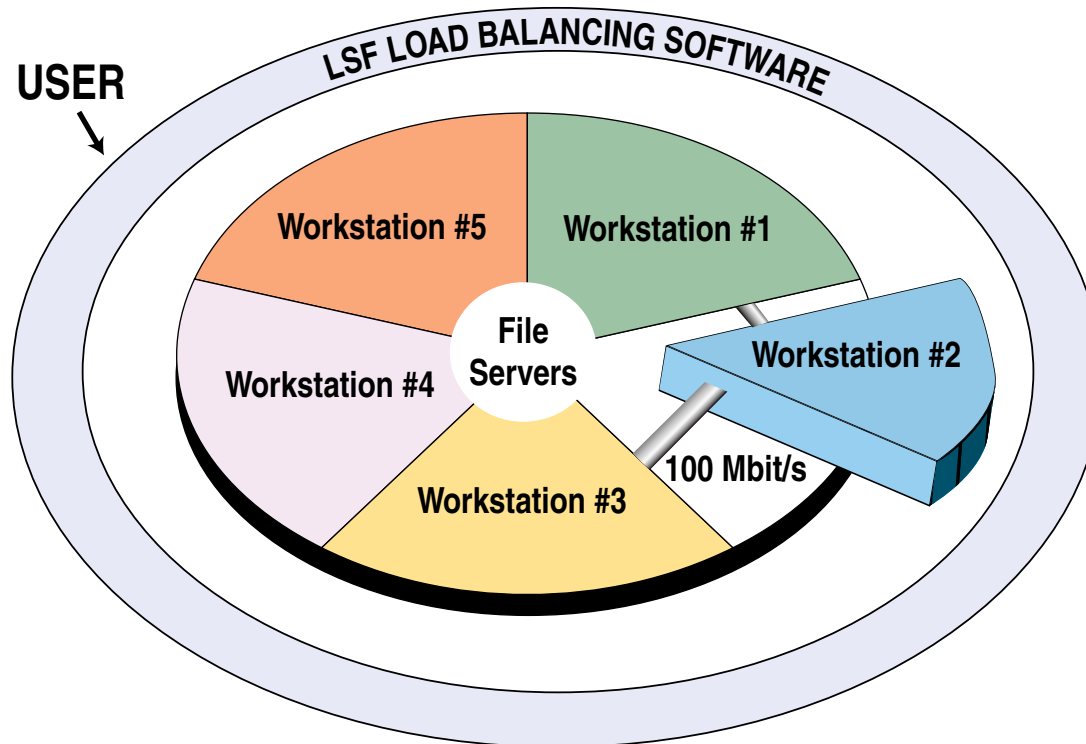
- Underlying philosophy is uniformity

- Look and feel of GUI tools
- Access methods to analyzed datasets
- Access to existing computer power

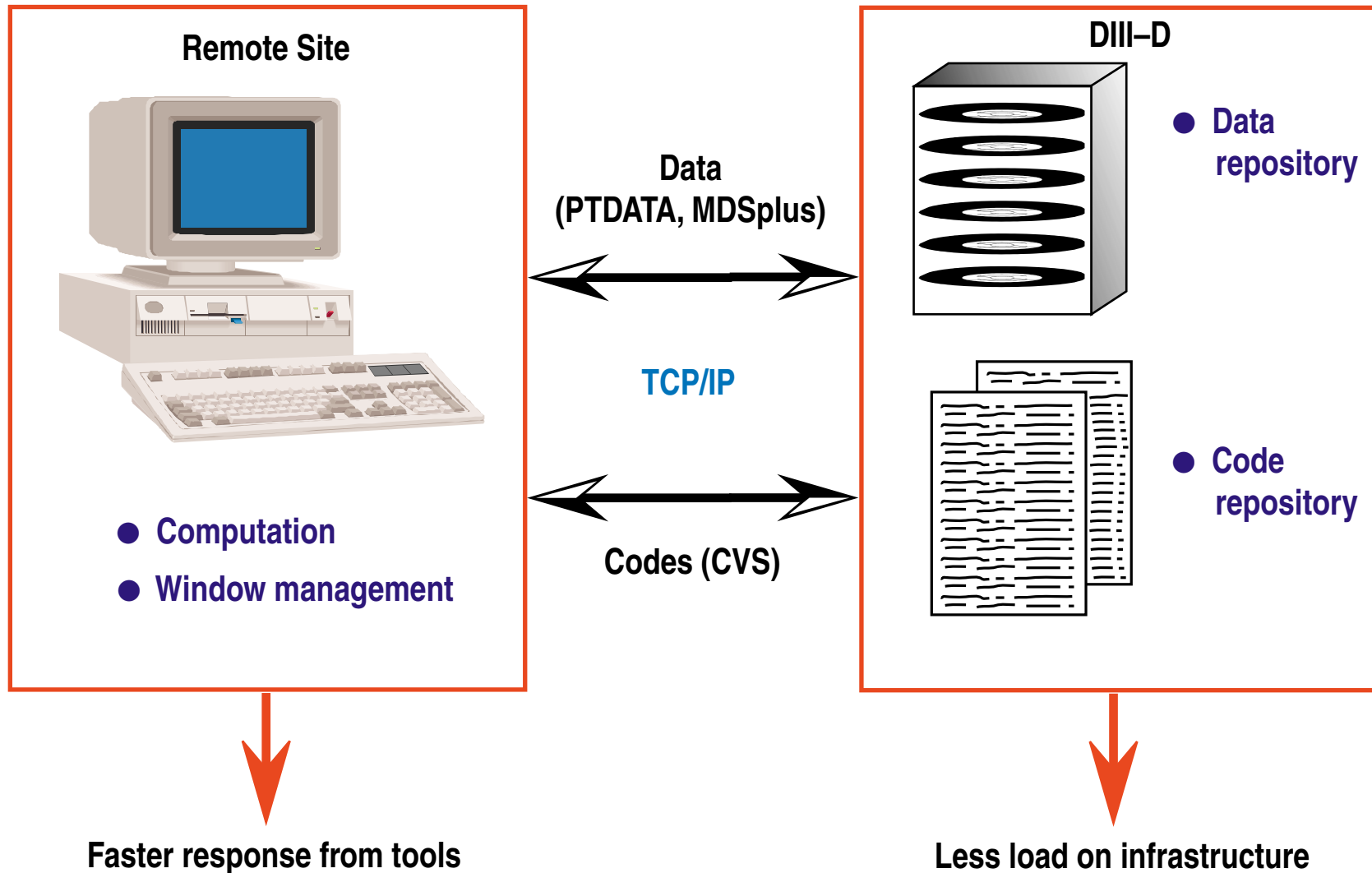


# LOAD BALANCING SOFTWARE PROVIDES SUBSTANTIAL COMPUTATIONAL POWER TO ONSITE USERS

- Heterogeneous Unix environment with a large server and numerous workstations
- Platform Computing's LSF Suite performs interactive load sharing
- Cost effective for sharing CPUs (GA, LLNL, ORNL, U. Wisc.) and commercial software
- Central file servers for data and user files with fast network access



# REMOTE COMPUTING CAN BENEFIT OFF-SITE AND ONSITE RESEARCH TEAM MEMBERS



# **UNIFIED DATA ACCESS SIMPLIFIES COLLABORATOR ANALYSIS**

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- **Raw data from PTDATA**
  - HSM system for 24x7 availability (McHarg's talk)
  - Currently 1 TB of data
- **All analyzed data from MDSplus (Schachter's talk)**
  - One interface to many data types
  - Store all relevant information
  - Currently 40 GB of data
  - PTDATA can be accessed through MDSplus
- **Data Usage and Publication Policy**
  - Talks and papers subject to DIII-D peer review

# A NEW RELATIONAL DATABASE ALLOWS THE SCIENTIFIC COMMUNITY TO MINE FUSION DATA

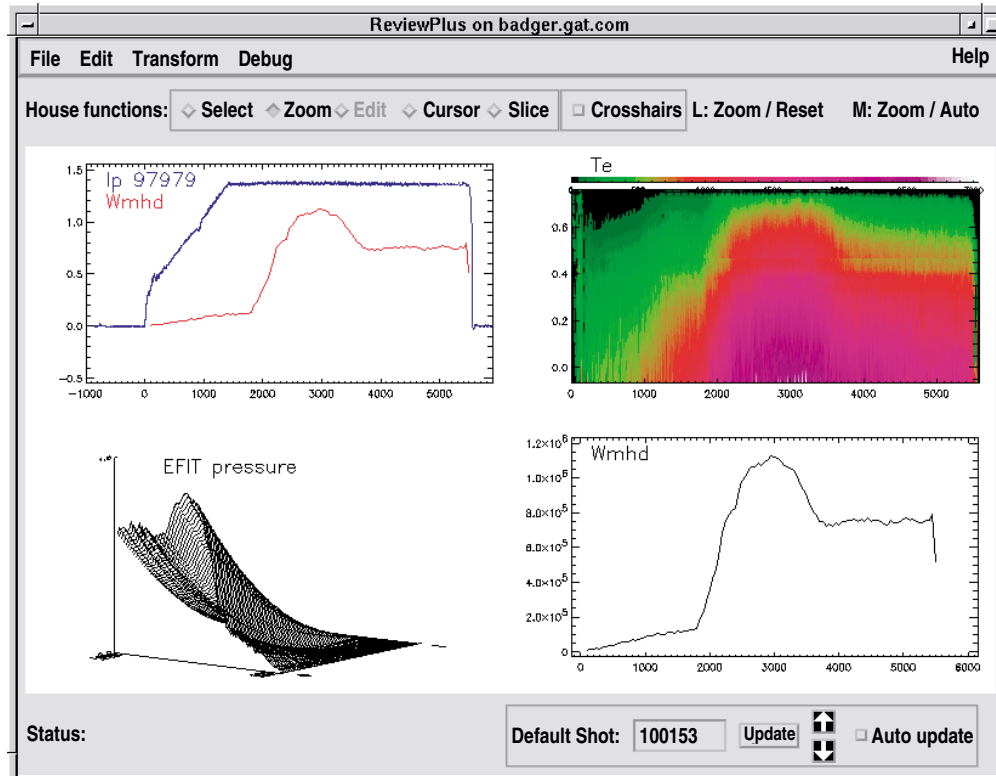
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- **Present system is 10 years old, time slice based, running on OpenVMS**
  - Must evolve like tokamak diagnostics & computer hardware (time dependence)
- **New system will work in concert with MDSplus**
  - US Fusion community favorably evaluated Microsoft SQLServer 7
  - Presently in use with C-Mod's electronic logbook
- **Multi-platform GUI tools connected to database engine**
  - Relational queries from the Web and analysis tools
- **Studying the benefits of Object-relational databases**
  - Will this allow higher performance and greater functionality?

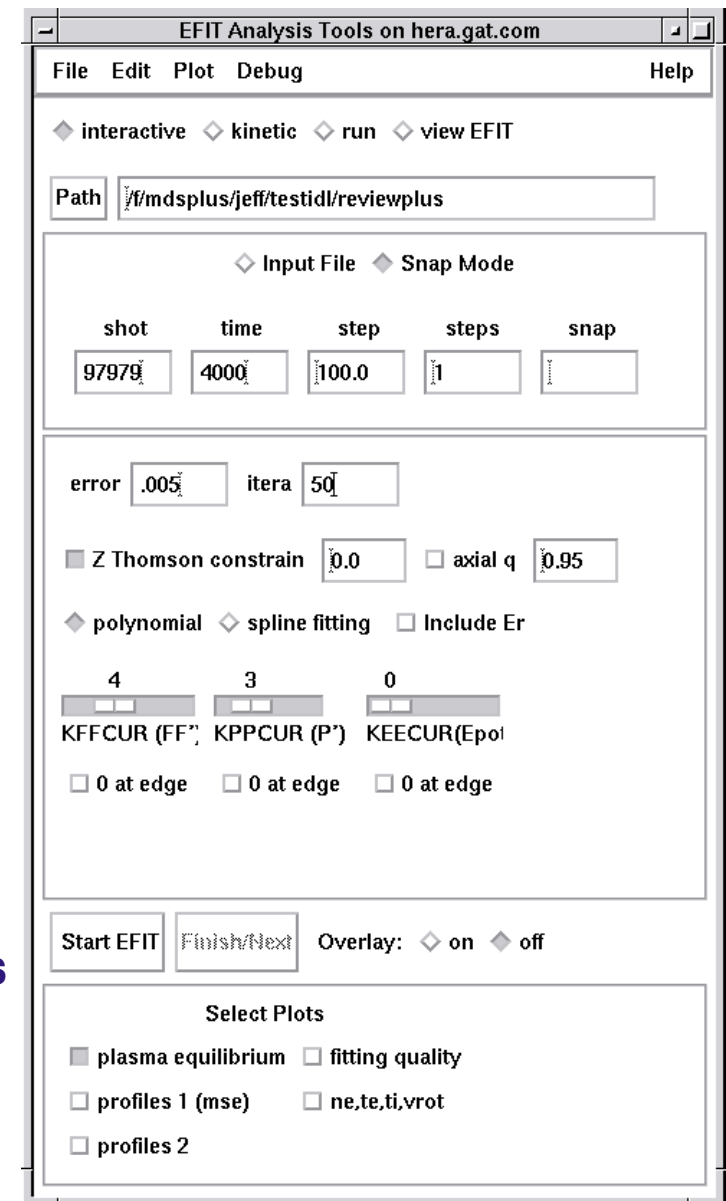


# GRAPHICAL USER INTERFACES SIMPLIFY DATA VIEWING AND ANALYSIS

## ReviewPlus



## EFITtools



- Same "look and feel" in all GUIs (IDL based GAPIotObj)
- Viewing/Analysis tools: ReviewPlus, EFITtools, Gaprofiles
- GUIs simplify use of FORTRAN analysis codes

# COLLABORATIVE ANALYSIS CODE DEVELOPMENT EFFICIENTLY UTILIZES EXISTING COMPUTER SCIENCE RESOURCES

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- **Good history of collaboration**
  - TRANSP from PPPL
  - MDSplus led by MIT
  - EFIT from GA
  - Distributed EFIT computing from LLNL
  
- **Exploring new areas of collaboration (GA, MIT, LLNL, ORNL, and PPPL)**
  - IDL-based transport analysis results display tool
  - IDL-based data preparation software
  - Name translation service
  - Run management database
  - Database analysis applications and database tool kit

# INTERACTIVE REMOTE COMMUNICATION AT DIII-D (Casper's Talk)

- **Support meetings and tokamak operations**
- **Remote meetings**
  - ShowStation IP from Polycom for viewgraphs
  - Conference calls for audio
  - Video conferencing for broad view video
- **DIII-D and C-Mod operated from LLNL – software**
  - Physics and shape control
  - Audio/video with MBone
- **Tokamak operations**
  - How does the off-site physicist communicate with the session leader?
- **Present tokamak operations**
  - C-Mod electronic logbook has been well received
  - Telephone



# SUMMARY: INCREASED DATA ANALYSIS THROUGHPUT & DATA RETRIEVAL RATE AT THE DIII-D NATIONAL FUSION FACILITY

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- **Uniform interface to a very heterogeneous environment**
  - Easy-to-use GUIs for data viewing and analysis
  - Efficiently utilize onsite and remote CPUs
  - 24x7 remote data access via MDSplus, PTDATA
  - Interactive remote communication with onsite DIII-D staff
- **Future will be built on current success**
  - Promote collaborative development of software
  - Remotely accessible relational database and tools
  - More effective remote communication