

ATF Computer Control System Upgrade

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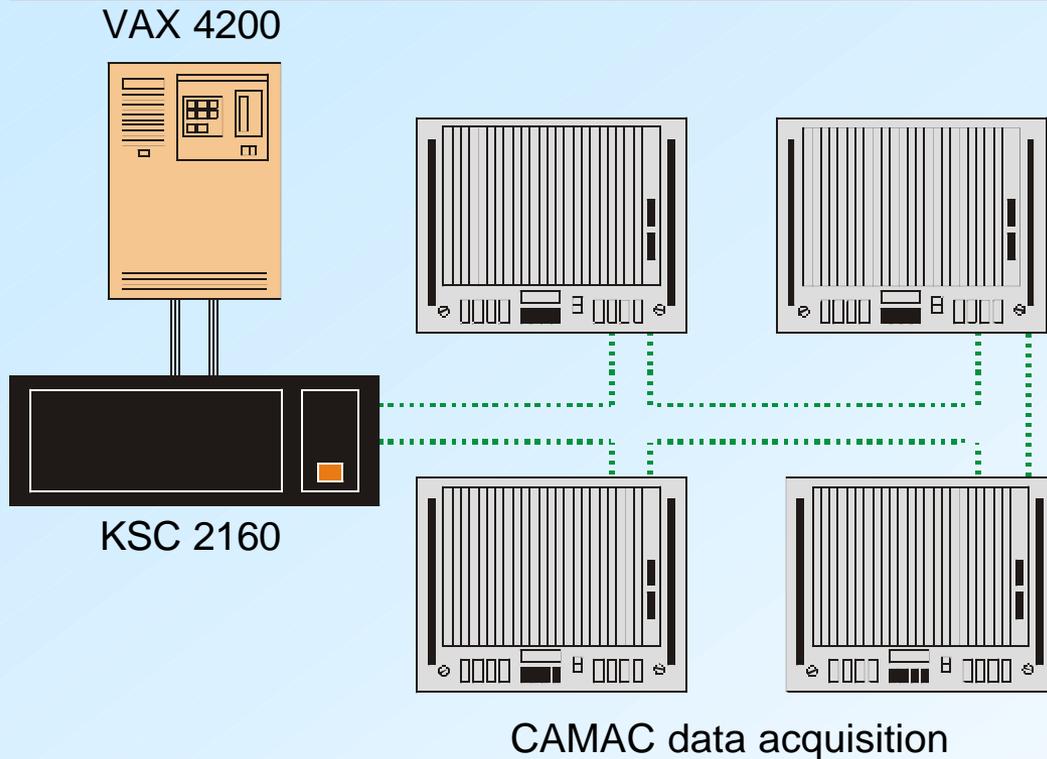
Presented at the
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Outline

- Review of Present Control System
(Soon to be Past Control System)
- What's Changing,
What's Been Accomplished, and
What Remains to be Done
- New Software Tools
- Summary & Timeline

Present ATF Control System: A Decade of Service



- Reliably serving ATF users for 10 years
- Severely resource-limited
- Legacy hardware, operating system
- Limited upgrade options
- Difficult to remain responsive to needs of ATF users

VAX 4200

- 114 MHz single CPU
- 56 MB RAM
- 1.7 GB disk
- VMS operating system

CAMAC Data Acquisition

- 6 Crates
- 5 MHz serial highway
- KSC 2160 driver

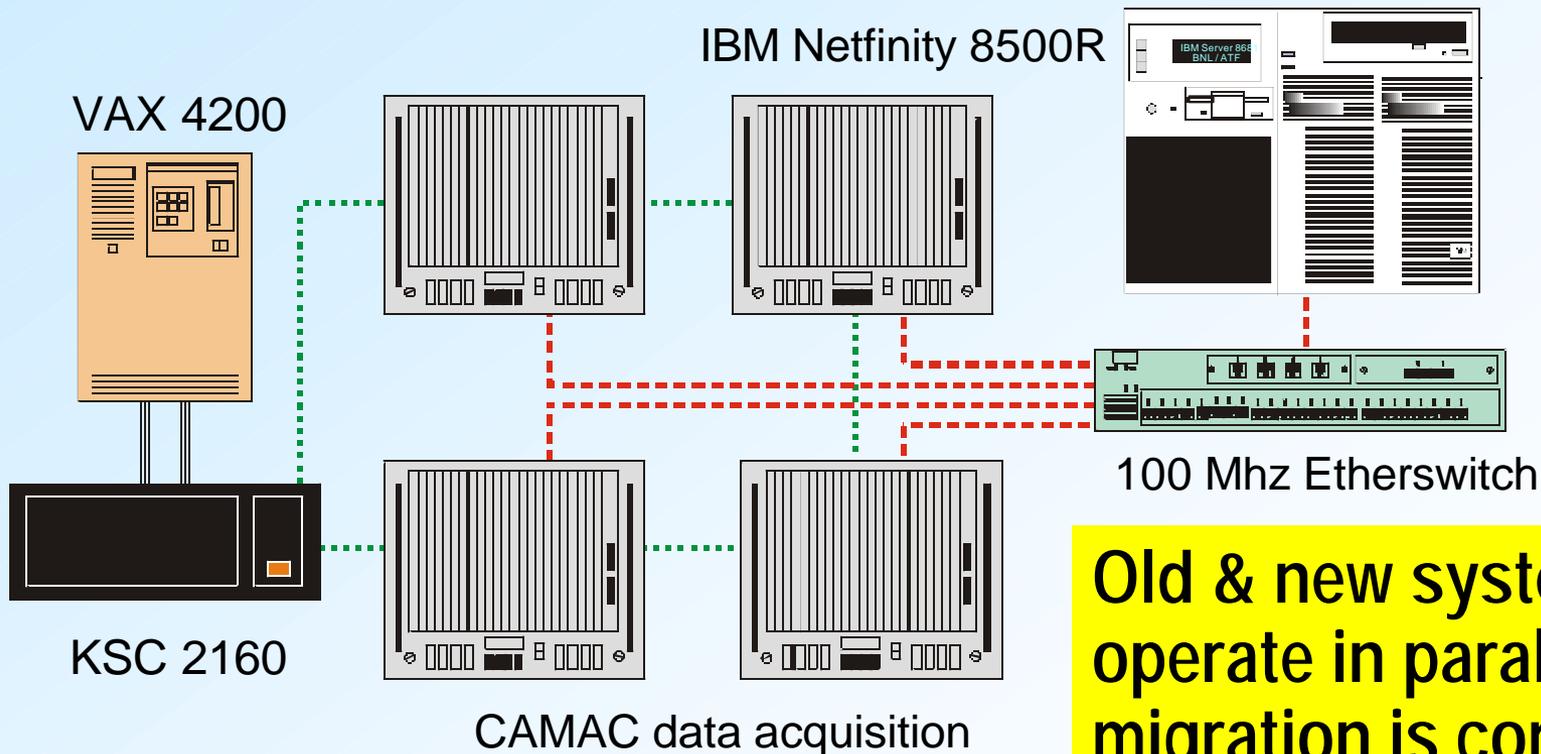
What's Changing? Preparing for the Next Decade

Hardware

- VAX → Intel Pentium
- Serial crate controllers → Ethernet controllers
- CAMAC serial highway → Fast Ethernet

Software

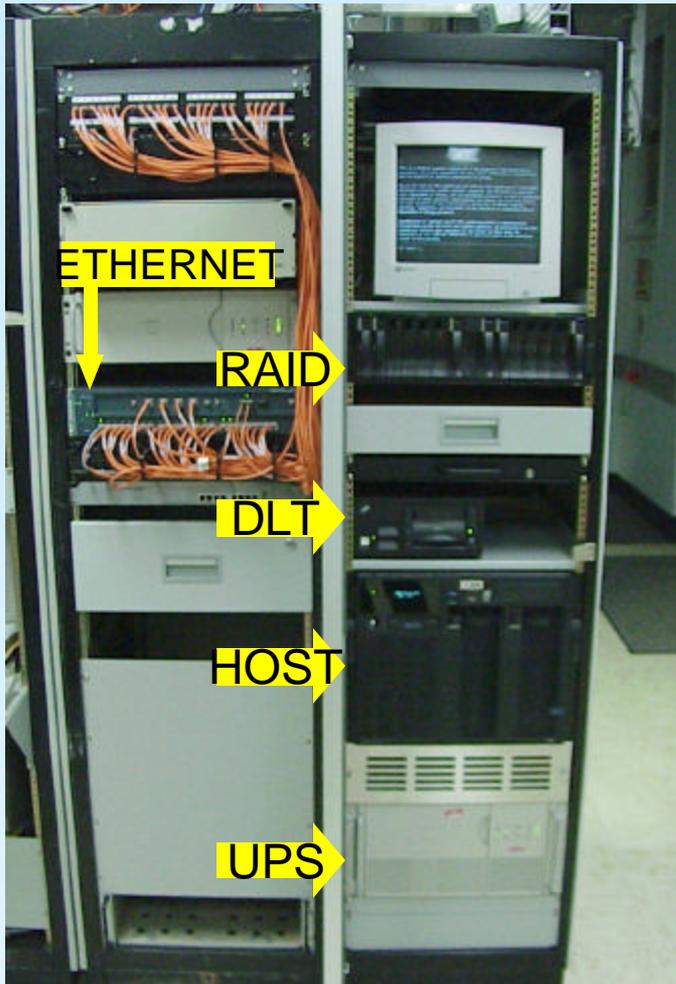
- VMS → Linux
- Fortran, C → C++
- Vsystem / VMS → Vsystem / Linux



**Old & new systems
operate in parallel until
migration is complete**

New Hardware = New Options for User Support

IBM Netfinity 8500R, Ethernet crate controllers



Now operating in parallel with existing system:

■ Host:

- 2 x 700 MHz Pentium III Xeon (Max: 8)
- 2 MB cache / processor
- 1.5 GB RAM (Max: 16 GB)
- 12 x 64-bit PCI slots
- 3 x 100 MHz Ethernet NICs
- 3 x Redundant power supplies (hot swap)

■ Storage:

- 144 GB RAID (Max.: 320 GB)
- 2 x Redundant power supplies (hot swap)
- 80 GB (compressed) SCSI tape drive

■ 6 x 100 MHz Ethernet crate controllers

■ 3 kVA Uninterruptible Power

- Condition line voltage
- 2 hours full operation with no AC mains

System Performance

- IBM Hardware + Red Hat Linux 7.2 + Vsystem = Rock-Stable System
- Uptimes > 30 days are routine
- Demonstrated 1.6×10^7 interrupts serviced continuously
 - Equivalent to 30 days of ATF operating at 6 Hz
 - Service successful at 20 Hz
- No real-time kernel needed (as of now)
- Database build time: 17 min (VAX) → 30 sec. (new system)
- No more system lock-ups due to inadequate disk space
- Increased I/O bandwidth; Future support for new hardware families (e.g., dual data streams from video frame grabbers)
- Portland Group compilers installed:
 - Fortran 77, Fortran 90, HPF, C, C++
 - Support multi-processor machines
- Recommended roadmap to upgrade other VMS, CAMAC facilities

ATF Software Migration: Displays / DBs / Applications

Major progress has been made in porting ATF software:

■ Operator Displays:

- ~ 800 displays
- ~ 24K control items

✓ Migration completed

■ Databases:

- ~10K channels

✓ Migration completed

■ ATF Common Libraries:

- ~ 15K lines of code

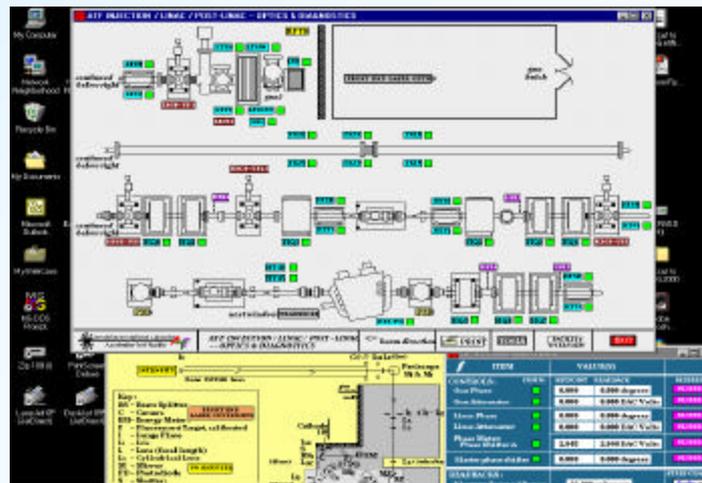
✓ Migration completed

■ ATF Application Programs:

- ~ 55K lines of code

In Progress; Est. Fall 2002 completion

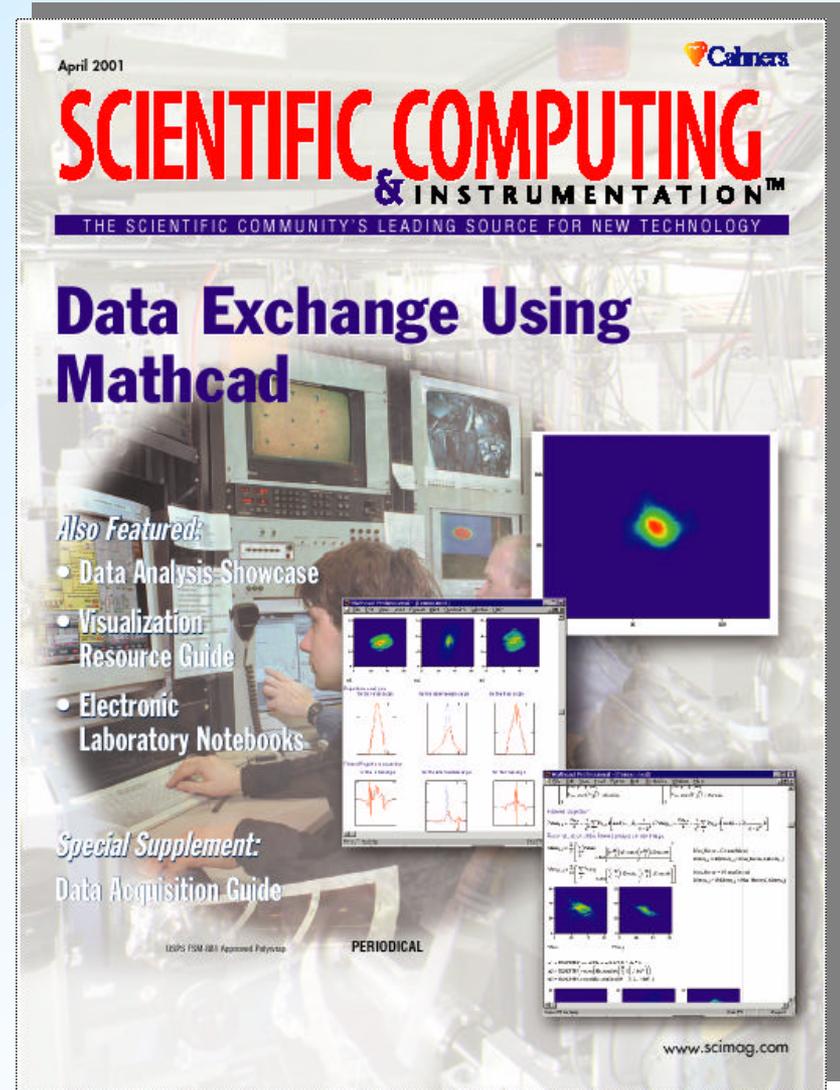
Sample operator display:



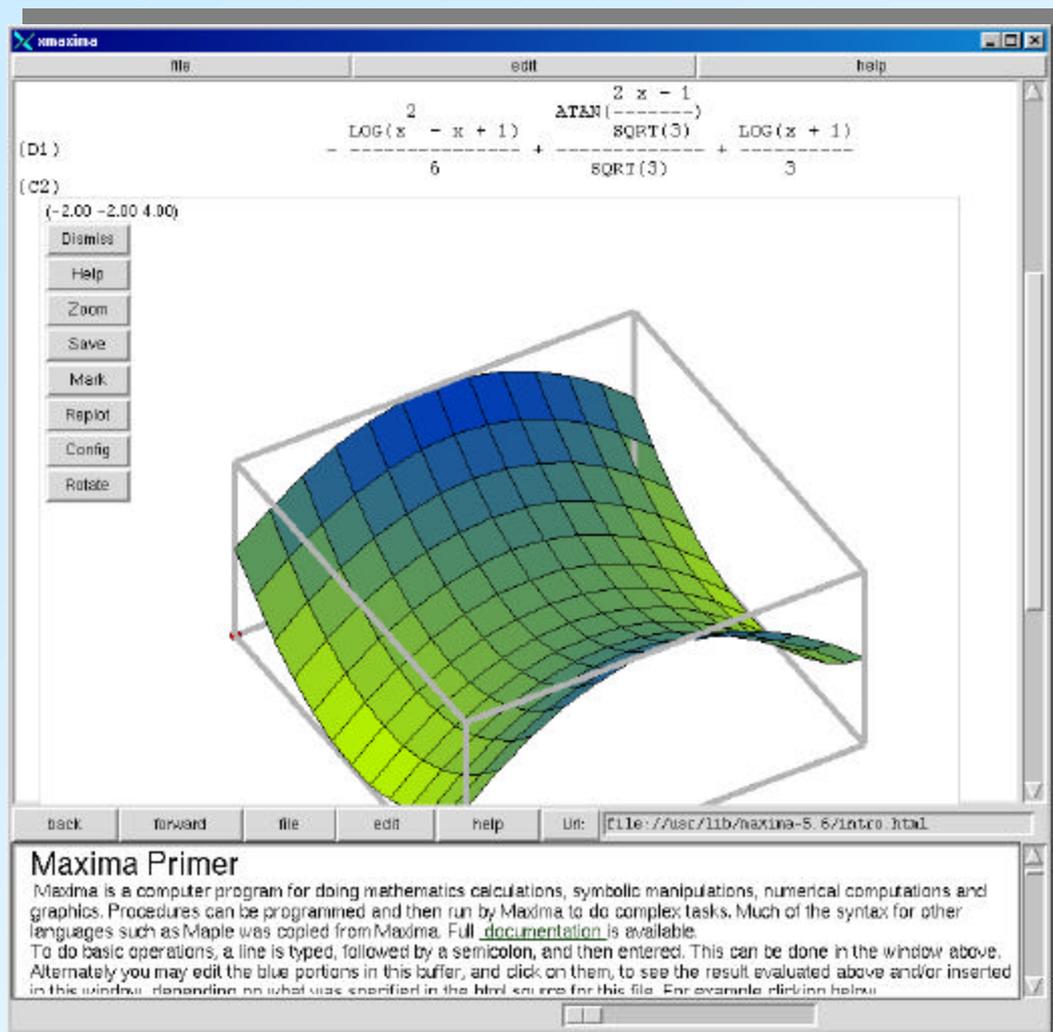
ATF Software: New Tool Development

- **Matlab:** adding access to ATF databases via network sockets
 - To study feedback and control
- Similar access already provided for:
 - MS Visual C++
 - Labview
 - Text-based (e.g., Expect script)
 - Mathcad
- ATF's innovative use of Mathcad profiled in Scientific Computing and Instrumentation magazine's April 2001 cover story.

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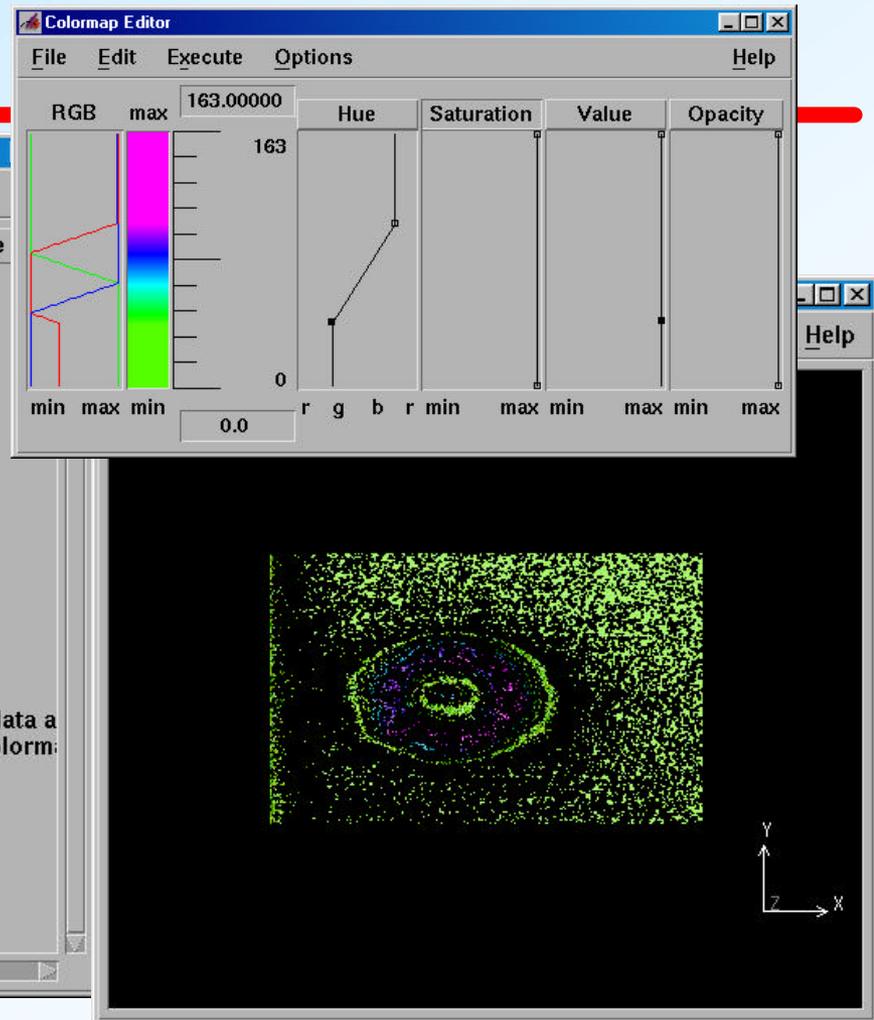
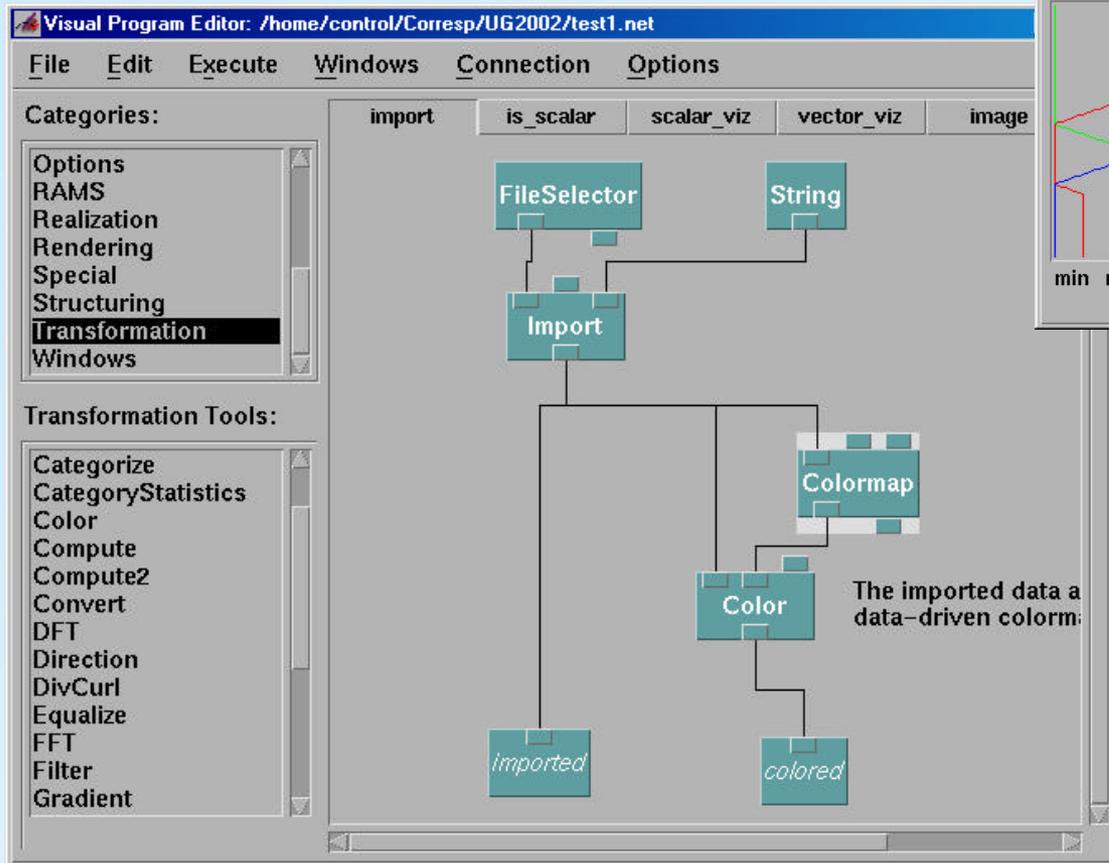
New Software: Maxima



- Symbolic mathematics / Computer algebra
- Implementation of MIT's Macsyma
- Like Maple, Mathematica
- Source code & binaries are free
- Under GPL thanks to US DOE
- Versions for Unix*, Windows

www.ma.utexas.edu/maxima.html

New Software: OpenDX



- Scientific visualization software from IBM; Free under GPL
- 200+ built-in operations
- No programming required; Excels at handling large datasets

Computer Security

- Ethernet-based data acquisition hardware now exposed to network
- Hardware firewall has been installed to buffer ATF network
- Access to the BNL network is now more tightly controlled (e.g., external access to frame grabber ftp no longer available)
- Visitors are still welcome to bring along computers, but if they need to be connected to the BNL network, check for latest requirements at [www.bnl.gov / itd / cybersecurity](http://www.bnl.gov/itd/cybersecurity).

Please be sure to do this in advance of your visit!



Sonicwall Pro200 Firewall

Summary & Timeline

- Major effort over the last year to upgrade the control system

- Hardware purchased, installed, tested:

- IBM host computer
- Ethernet crate controllers
- Private Ethernet for ATF control & data acquisition

- Software purchased, installed, tested:

- Linux OS
- Driver libraries for Ethernet crate controllers
- Vsystem for Linux
- Portland Group compilers

- Porting ATF Software:

- Operator displays: **completed**
- Supporting databases: **completed**
- ATF standard libraries: **completed**
- ATF applications programs: In progress; Est. Fall 2002 completion

**Now operating
in parallel with
existing system**

- **Users can expect:**

- Same look and feel as present system; Same services
- Significantly improved performance and reliability