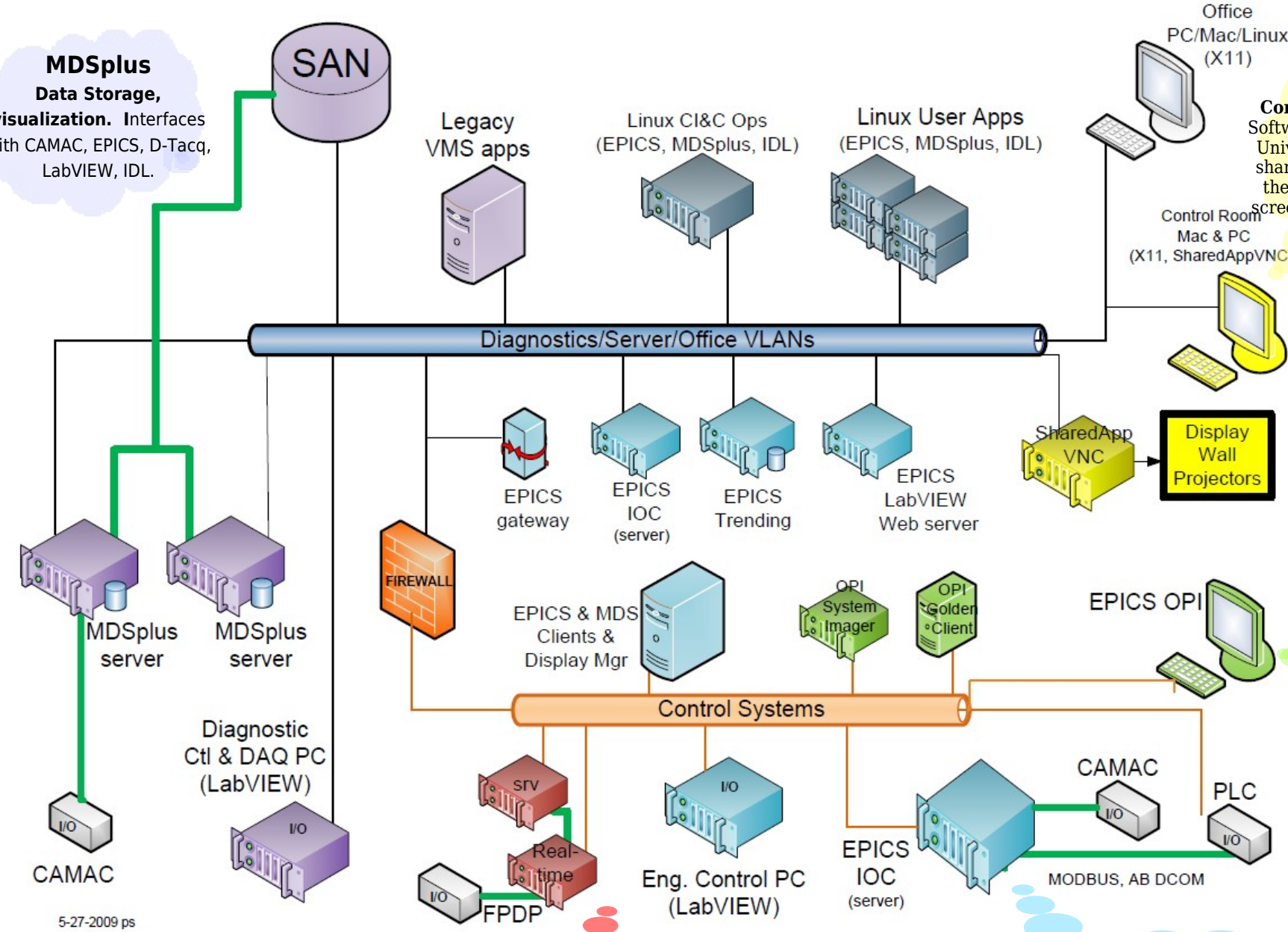
Central I&C Computing

Presented at the
Physics Operations Course
Feb. 2010
P. Sichta

Topics

- Central Computing Overview
- MDSPLUS
- EPICS
- PCS
- Timing & Synchronization
- Display Wall
- Typical Problems

NSTX Central Computing



MDSplus
Data Storage, visualization. Interfaces with CAMAC, EPICS, D-Tacq, LabVIEW, IDL.

SharedAppVnc
Control Room display wall. Software developed at Princeton University that allows users to share individual windows from their workstations on a large screen. Runs on Mac, Windows, and Linux.

System Imager
Used to manage and deploy a common Linux distribution to EPICS OPI (Operator Interface terminals).

PCS
Integrated real-time plasma control. *Commercial* and *collaborative* software from General Atomics Corp. Interfaces with FPDP, MDSplus, IDL,EPICS.

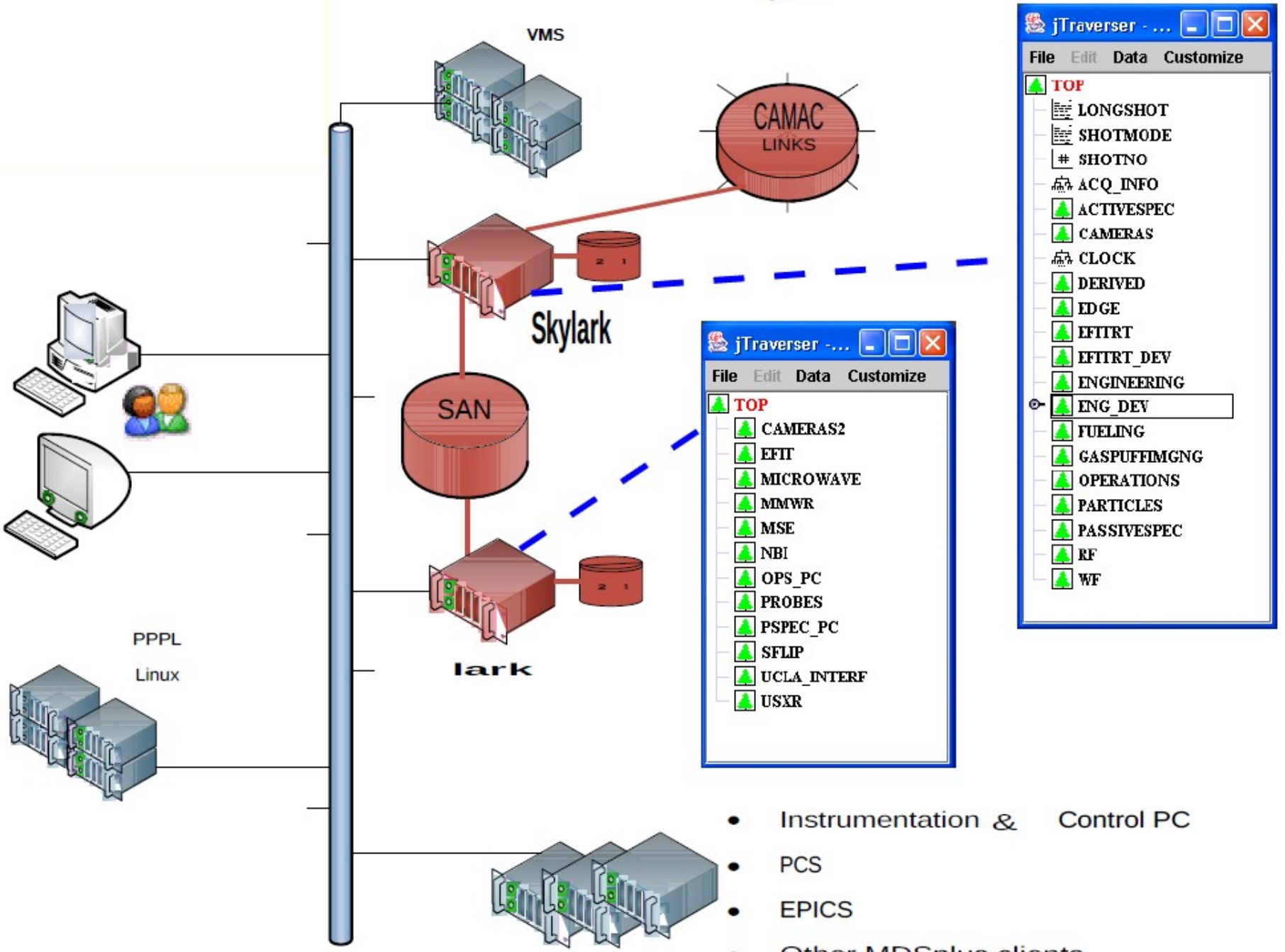
EPICS
Integrated Control and SCADA. Interfaces with CAMAC, MODBUS, OPC, MDSplus, LabVIEW, IDL.

MDSplus

- Expertise: Gretchen, Bill, Greg
- Two Servers - skylark, lark
  - MDSplus DATA and EVENTS.
  - NSTX event server is skylark.
    - An event client MEMS, waits for a set of events to produce a new event
  - Can *mdsconnect* to any host - your connection will be forwarded
  - server accounts on an as-needed basis
- Trees, branches, nodes, signals, tags, events
- tree write-permissions
  - trees generally have (unix) group write permission - groups
  - username & computer - mdsip.hosts
  - Tree edits (e.g. add node) can only be done on the server.

New MDSplus Configuration

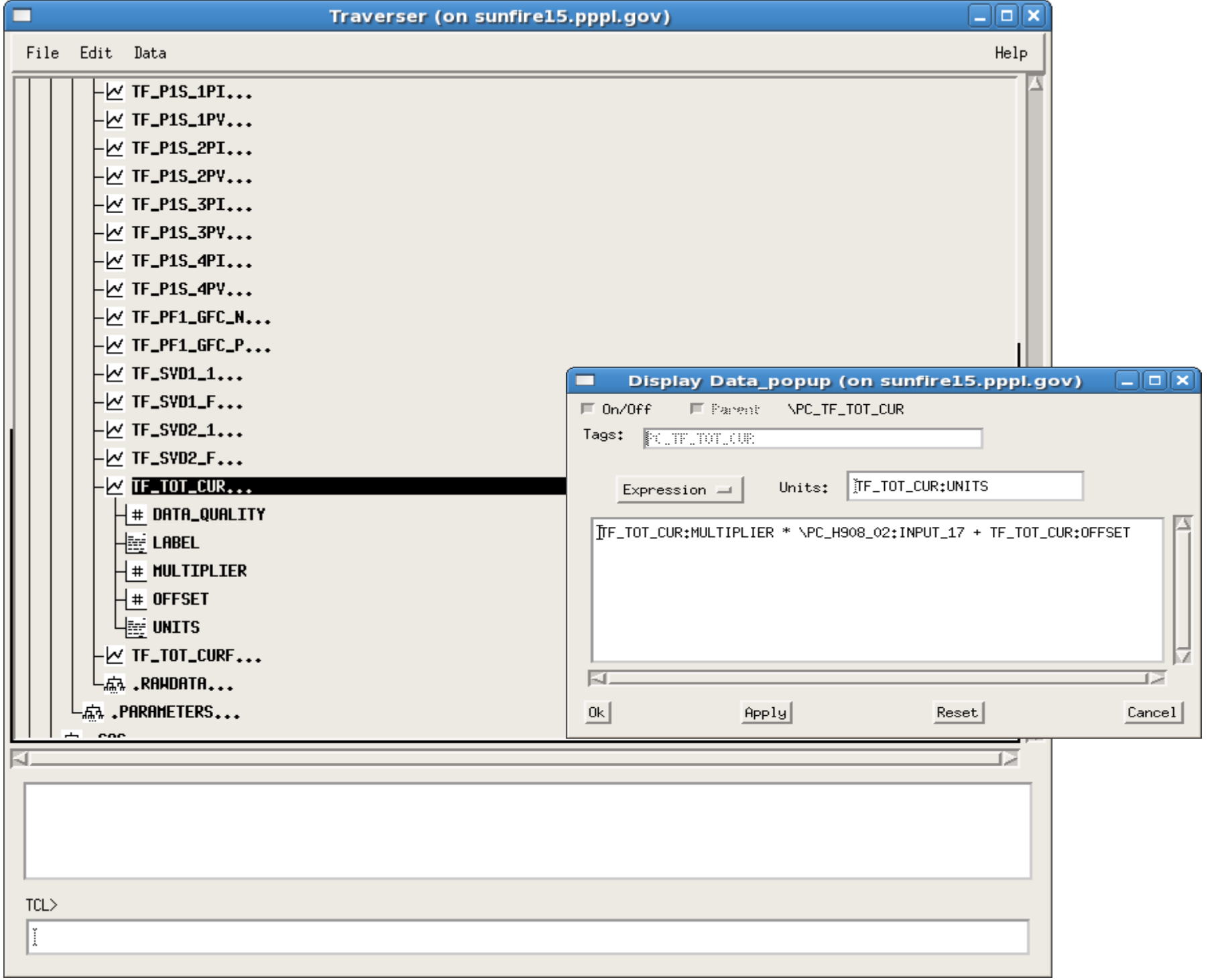
Slide revised 07OCT2008

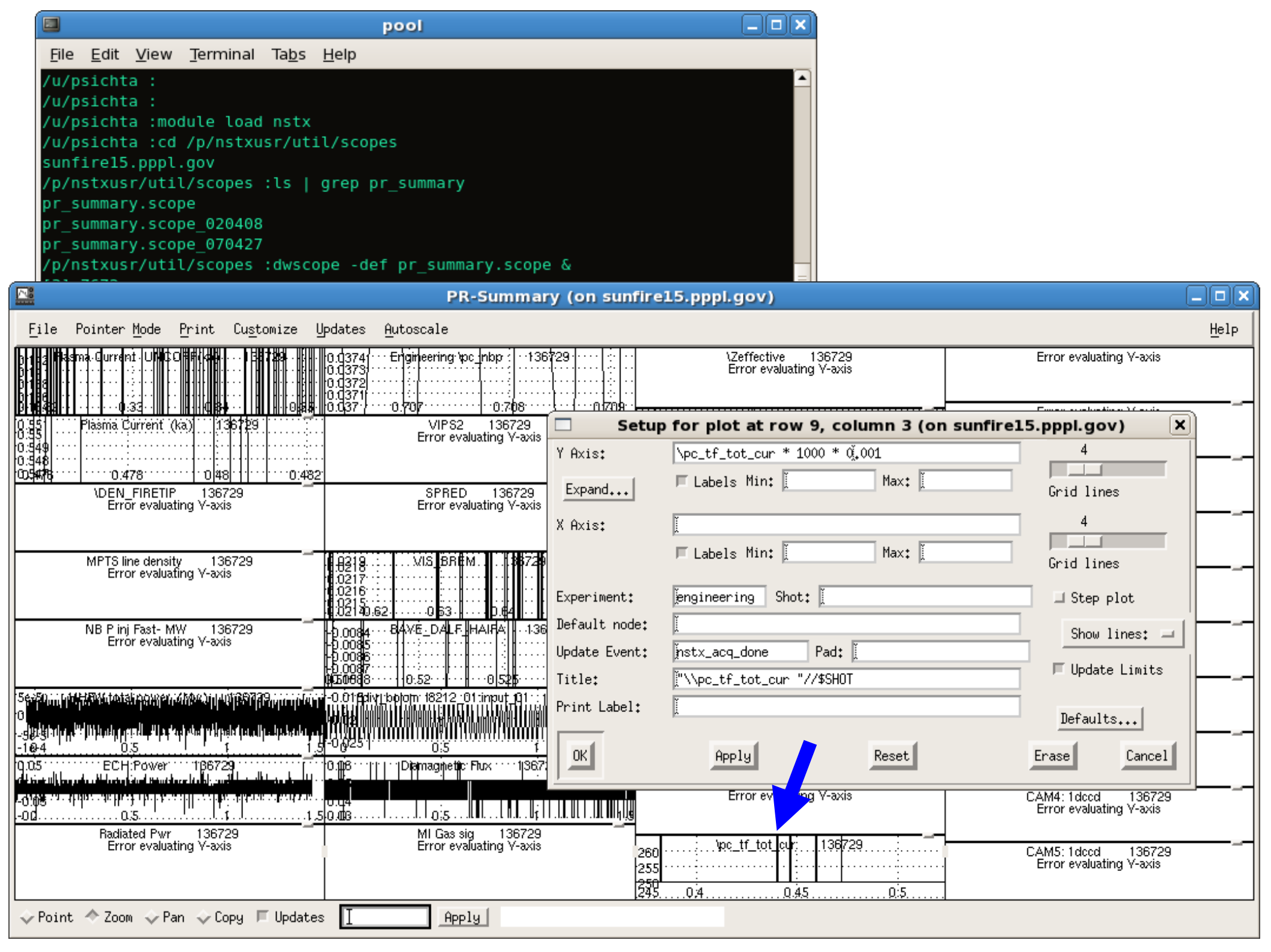


- Instrumentation & Control PC
- PCS
- EPICS
- Other MDSplus clients

MDSplus

- Programming
  - General: IDL, python, Matlab
  - Specialized languages: TCL, TDI, CTS
- GUI
  - dwscope, jScope
  - traverser, jTraverser
  - nstxpool - *module load nstx*
  - Desktop/workstation - install clients and set local environment
  - Web Tools


Traverser (on sunfire15.pppl.gov)
File
Edit
Data
Help
TF_P1S_1PI...
TF_P1S_1PV...
TF_P1S_2PI...
TF_P1S_2PV...
TF_P1S_3PI...
TF_P1S_3PV...
TF_P1S_4PI...
TF_P1S_4PV...
TF_PF1_GFC_N...
TF_PF1_GFC_P...
TF_SVD1_1...
TF_SVD1_F...
TF_SVD2_1...
TF_SVD2_F...
TF_TOT_CUR...
DATA_QUALITY
LABEL
MULTIPLIER
OFFSET
UNITS
TF_TOT_CURF...
.RAWDATA...
.PARAMETERS...
Display Data_popup (on sunfire15.pppl.gov)
On/Off
Parent
\PC_TF_TOT_CUR
Tags:
Expression
Units:
TF_TOT_CUR:UNITS
TF_TOT_CUR:MULTIPLIER * \PC_H908_02:INPUT_17 + TF_TOT_CUR:OFFSET
Ok
Apply
Reset
Cancel
TCL>


pool
File Edit View Terminal Tabs Help
/u/psichta :
/u/psichta :
/u/psichta :module load nstx
/u/psichta :cd /p/nstxusr/util/scopes
sunfire15.pppl.gov
/p/nstxusr/util/scopes :ls | grep pr_summary
pr_summary.scope
pr_summary.scope_020408
pr_summary.scope_070427
/p/nstxusr/util/scopes :dwscope -def pr_summary.scope &
PR-Summary (on sunfire15.pppl.gov)
File Pointer Mode Print Customize Updates Autoscale Help
Plasma Current (ka) 136729
VIPS2 136729
Error evaluating Y-axis
\DEN_FIRETIP 136729
SPRED 136729
MPTS line density 136729
NB P inj Fast- MW 136729
ECH Power 136729
Radiated Pwr 136729
MI Gas sig 136729
\Zeffective 136729
CAM4: 1dccd 136729
CAM5: 1dccd 136729
Setup for plot at row 9, column 3 (on sunfire15.pppl.gov)
Y Axis: \pc_tf_tot_cur * 1000 * 0.001
Expand...
Labels Min: Max:
Grid lines
X Axis:
Experiment: engineering Shot:
Step plot
Default node:
Show lines:
Update Event: nstx_acq_done Pad:
Update Limits
Title: "\\pc_tf_tot_cur "//$SHOT
Print Label:
Defaults...
OK Apply Reset Erase Cancel
\pc_tf_tot_cur 136729
Point Zoom Pan Copy Updates Apply

NSTX Web Tools - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://nstx.pppl.gov/nstx/Software/WebTools/index.html

Google NSTX Status Page PPPL PPPL Mail - Inbox Central I&C LogBook helpdeskticket

NSTX

Overview | Programming | Diagnostics | Applications

FAQ | Web Tools | UNIX & VMS | MDSplus

software

Search NSTX software pages

LOOKING AT MDSplus DATA

PLOTTING OPTIONS

SEARCHING/COMPARING /LISTING

INFORMATION ABOUT DATA

LOGBOOK searching/viewing with Plot Summaries

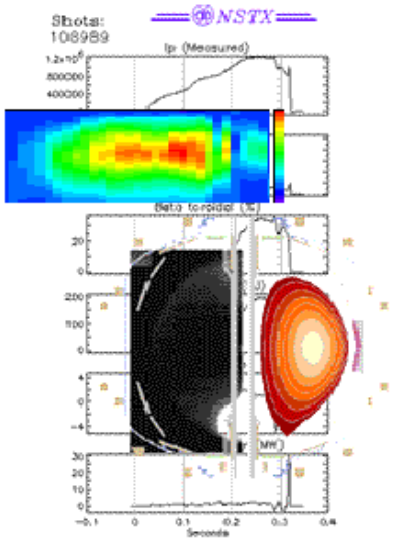
FINDING SIGNAL NAMES from Label list

SHOT LISTS
by XP
by XMP
by Date
of Calibration shots

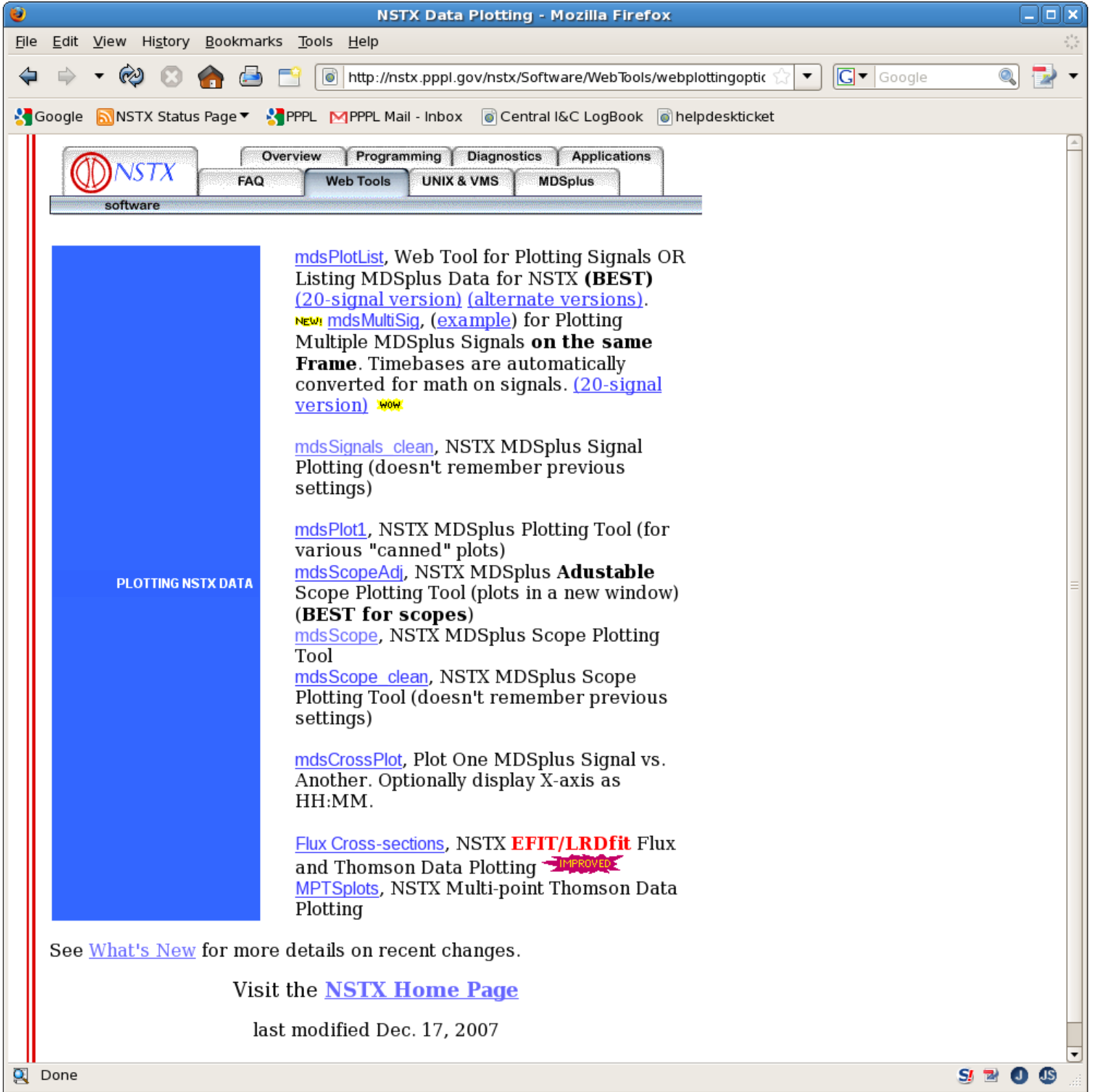
MISCELLANEOUS

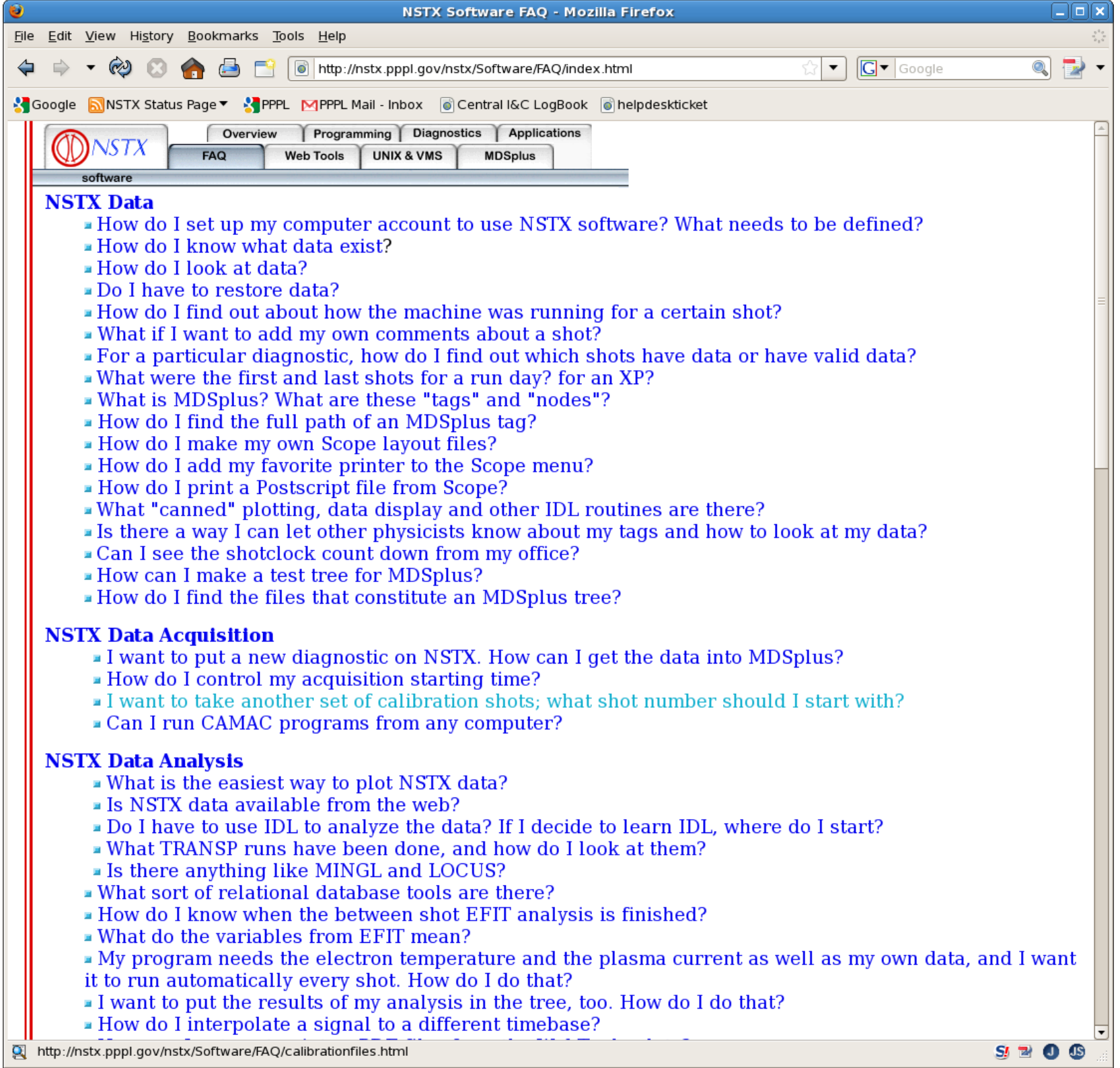
Setting up TRANSP runs

NSTX Controls Software Information



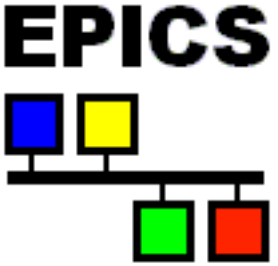
Done


NSTX Data Plotting - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://nstx.pppl.gov/nstx/Software/WebTools/webplottingoptic
Google
Google NSTX Status Page PPPL PPPL Mail - Inbox Central I&C LogBook helpdeskticket
NSTX
Overview Programming Diagnostics Applications
FAQ Web Tools UNIX & VMS MDSplus
software
PLOTTING NSTX DATA
mdsPlotList, Web Tool for Plotting Signals OR Listing MDSplus Data for NSTX (BEST) (20-signal version) (alternate versions).
NEW! mdsMultiSig, (example) for Plotting Multiple MDSplus Signals on the same Frame. Timebases are automatically converted for math on signals. (20-signal version) WOW
mdsSignals_clean, NSTX MDSplus Signal Plotting (doesn't remember previous settings)
mdsPlot1, NSTX MDSplus Plotting Tool (for various "canned" plots)
mdsScopeAdj, NSTX MDSplus Adustable Scope Plotting Tool (plots in a new window) (BEST for scopes)
mdsScope, NSTX MDSplus Scope Plotting Tool
mdsScope_clean, NSTX MDSplus Scope Plotting Tool (doesn't remember previous settings)
mdsCrossPlot, Plot One MDSplus Signal vs. Another. Optionally display X-axis as HH:MM.
Flux Cross-sections, NSTX EFIT/LRDfit Flux and Thomson Data Plotting IMPROVED
MPTSplots, NSTX Multi-point Thomson Data Plotting
See What's New for more details on recent changes.
Visit the NSTX Home Page
last modified Dec. 17, 2007
Done


NSTX Software FAQ - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://nstx.pppl.gov/nstx/Software/FAQ/index.html
Google
Google NSTX Status Page PPPL PPPL Mail - Inbox Central I&C LogBook helpdeskticket
NSTX
Overview Programming Diagnostics Applications
FAQ Web Tools UNIX & VMS MDSplus
software
NSTX Data
How do I set up my computer account to use NSTX software? What needs to be defined?
How do I know what data exist?
How do I look at data?
Do I have to restore data?
How do I find out about how the machine was running for a certain shot?
What if I want to add my own comments about a shot?
For a particular diagnostic, how do I find out which shots have data or have valid data?
What were the first and last shots for a run day? for an XP?
What is MDSplus? What are these "tags" and "nodes"?
How do I find the full path of an MDSplus tag?
How do I make my own Scope layout files?
How do I add my favorite printer to the Scope menu?
How do I print a Postscript file from Scope?
What "canned" plotting, data display and other IDL routines are there?
Is there a way I can let other physicists know about my tags and how to look at my data?
Can I see the shotclock count down from my office?
How can I make a test tree for MDSplus?
How do I find the files that constitute an MDSplus tree?
NSTX Data Acquisition
I want to put a new diagnostic on NSTX. How can I get the data into MDSplus?
How do I control my acquisition starting time?
I want to take another set of calibration shots; what shot number should I start with?
Can I run CAMAC programs from any computer?
NSTX Data Analysis
What is the easiest way to plot NSTX data?
Is NSTX data available from the web?
Do I have to use IDL to analyze the data? If I decide to learn IDL, where do I start?
What TRANSP runs have been done, and how do I look at them?
Is there anything like MINGL and LOCUS?
What sort of relational database tools are there?
How do I know when the between shot EFIT analysis is finished?
What do the variables from EFIT mean?
My program needs the electron temperature and the plasma current as well as my own data, and I want it to run automatically every shot. How do I do that?
I want to put the results of my analysis in the tree, too. How do I do that?
How do I interpolate a signal to a different timebase?
http://nstx.pppl.gov/nstx/Software/FAQ/calibrationfiles.html

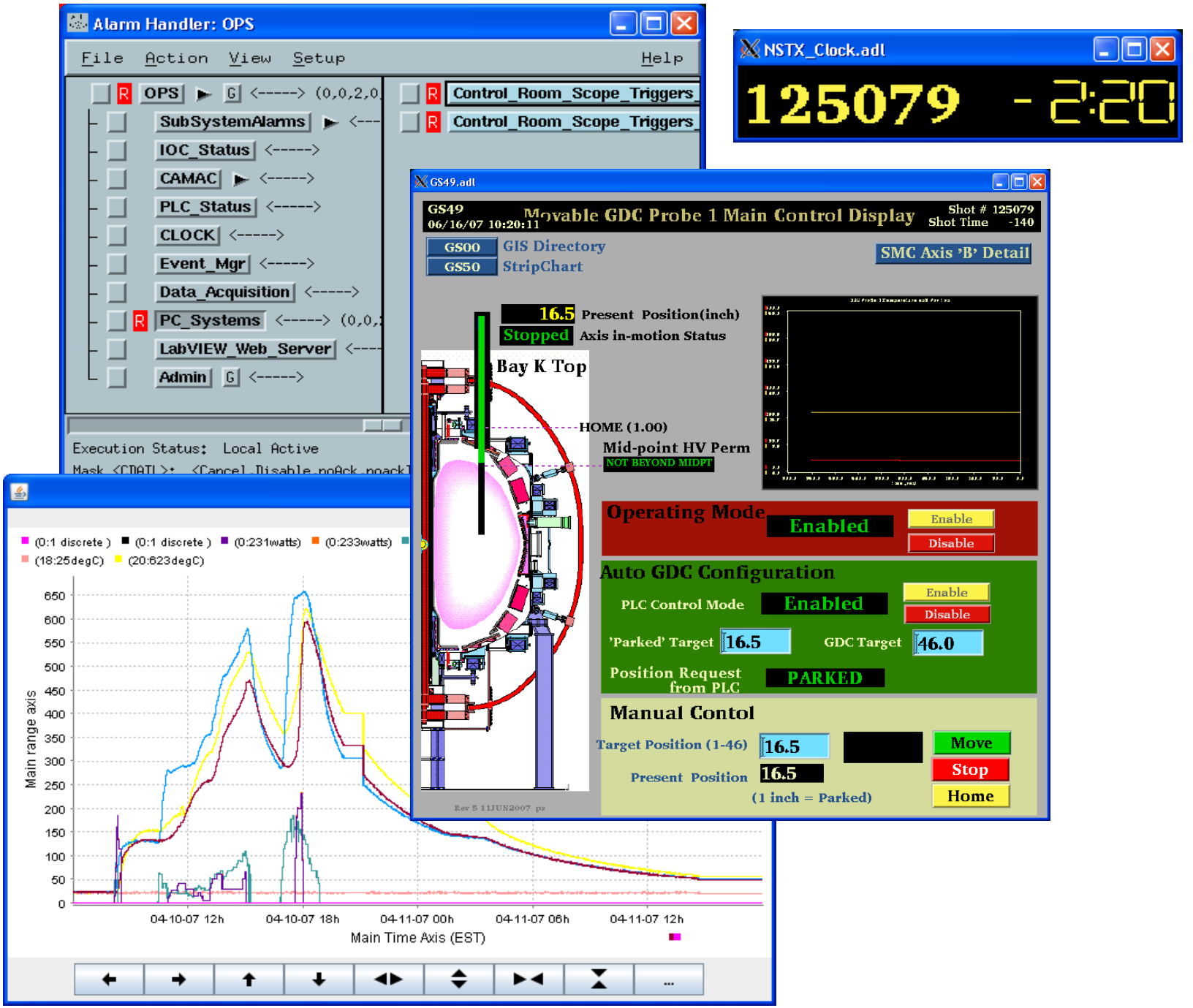
MDSplus Core Functions for the Shot Cycle

- Create/Build shot trees from the model tree @ T(-60)
- Dispatch INIT actions
  - Load timing modules
  - Arm digitizers
- Dispatch STORE actions
  - Read digitizers
  - Scope panels update from an MDSPlus event issued by the STORE action.



- Expertise: Sichta, Dong, Abe
- EPICS = Experimental Physics and Industrial Control System
  - Open source, multi-OS, multi-CPU
  - Distributed control & scalable
  - Used at 100's of experiments
- EPICS at NSTX
  - Provides: (slow) Integrated Control, operator displays, alarms, trending
  - Input/Output via VME & CAMAC & PLC & PC's
  - (6) IOC's : vxWorks, Linux, Windows
- Central Clock is an EPICS application
  - clock configuration displays, real-time database/record processing, sequence program
  - CAMAC module I/O, VME module I/O
  - 'soft' clock time and EPICS events for programs and displays
- Parameters & Data Acq to MDSplus shot trees
- Trending to Channel Archiver and MDSplus 'daily' trees

EPICS GUI at NSTX




pool
File Edit View Terminal Tabs Help
[psichta@sunfire12 ~]$ module load nstx
[psichta@sunfire12 ~]$ startmedm
[1] 32196
[psichta@sunfire12 ~]$
MEDM Version 3.1.1: Loading scalable fonts.....
[psichta@sunfire12 ~]$ nstxclock
[2] 32205
[psichta@sunfire12 ~]$
MEDM Version 3.1.1: Loading scalable fonts.....
altNSTX_Clock.adl (on sunfire12.pppl.
136729 - 2:20
CE00
09-FEB-10 11:04:58
CI&C Directory
Shot # 136729
Shot Time -140
CH00 CI&C Operations Support Directory
CK00 Clock System Directory
CM00 EPICS Data Management Directory
DI00 NSTX Diagnostics Directory
FW00 HHFW & ECH Directory
GS00 Gas Injection System Directory
MG00 Motor Generator Directory
NB00 Neutral Beam Directory
PC00 Power Conversion Directory
TC00 Vac. Vessel Thermocouples & Bakeout Sys
VM00 Torus Vacuum System Directory
WS00 Water Systems Directory
Rev 8 06DEC07 JD

EPICS Core Functions for the Shot Cycle

- Configure/run the Central Clock/shot cycle
- PreSequence Check (commit shot#)
- Initialize Digitizers
- PrePulse Check (commit SOP-T(0)-EOP)
- Parameter Acquisition
- Data Acquisition

PCS

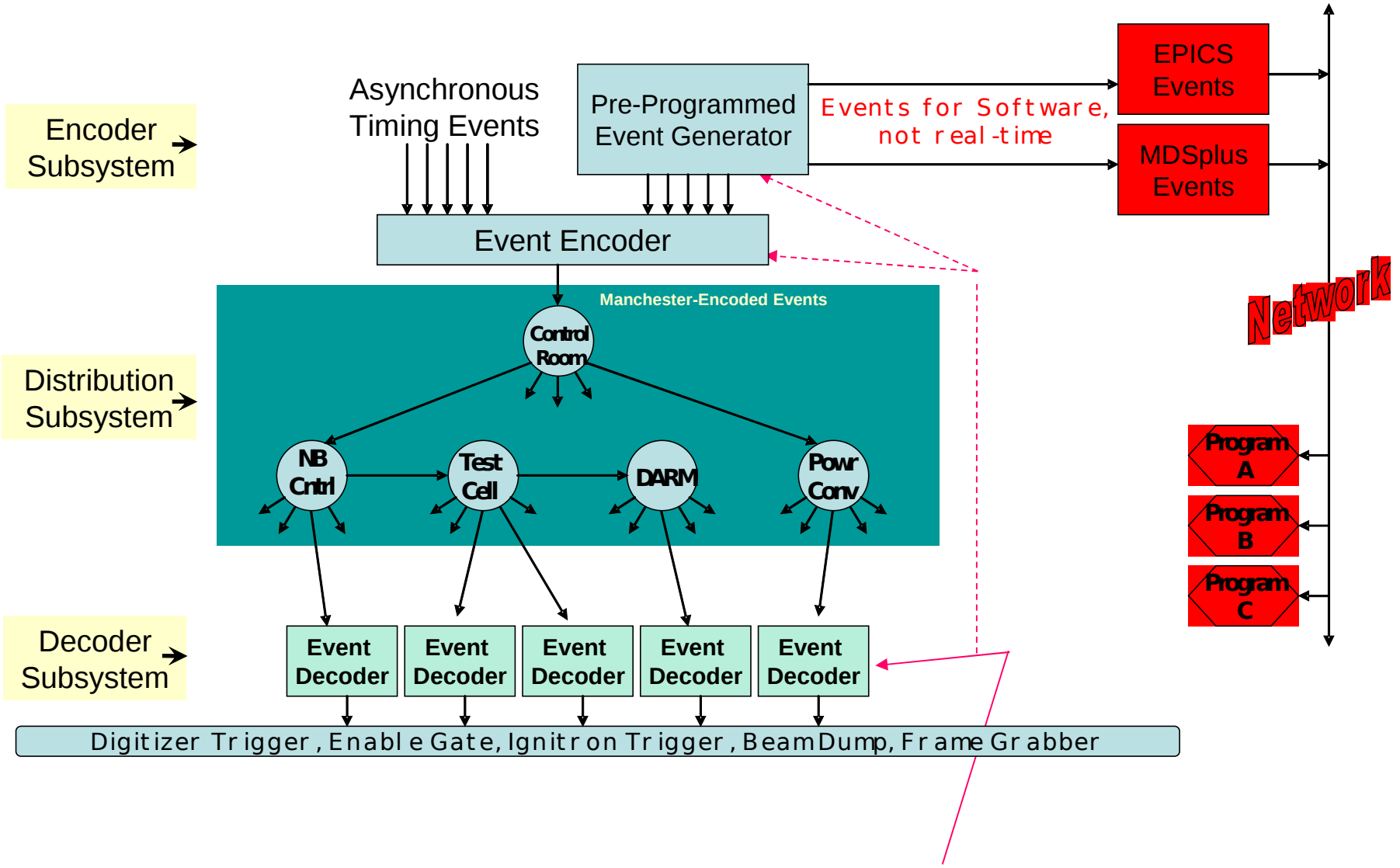
- Expertise: Dana, Lawson, Physics Operators
- Details presented in other presentations.
- The PCS computers are behind the NSTX-CS VLAN firewall, so most computers do not have access to these machines.

Timing & Synchronization

- Expertise: Wertenbaker, Sichta
- CAMAC-based Facility Clock provides microsecond timing resolution
  - 404 CAMAC Timing module in use since TFTR - early 1980's
  - 16 events distributed using fiber optics and twisted pair
- About 10 microsecond site-wide synchronization.
- Next-gen FPGA system in development.

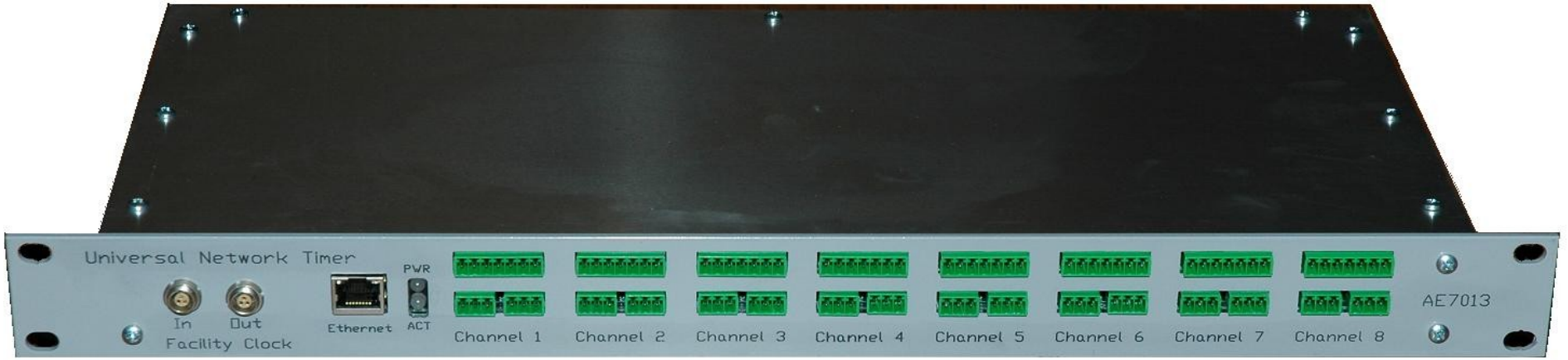

CK02.adl (on epicsrv3.pppl.gov)
CK02
Clock Control Page
Shot # 136729
09-FEB-10 09:53:28
Shot Time -140
Load CAMAC
Time since T[0]
5397 40
05-FEB-2010 15:55:26
Time to NB Sync
-17
Not_Waiting
-2:20
Seconds
SOC -140
PSC -130
SOS -120
T(-60) -60
PPC -10
SOP -3.000
T(-1) -1.0
T(0) 0.0
T(+D) 0.00100
EOD 3.0
EOP 3.5
EOC 310
-140
310
Total Cycle
(poke selection)
300
450
600
750
900
1050
Mode
HPP
SingleShot
No_NB_Sync
Single-Shot Continuation
Stop at EOC
Stop at EOC
Continue at EOC
START
STOP
CLR
Kill-Cycle Requested
PreSequence Check Failed (check CK03)
Related_Displays
Rev. 14 26JUN2009 PS

NSTX Timing and Synchronization System



The UNT is a **Decoder** and an **Encoder**

Timing & Sync in the post-CAMAC era



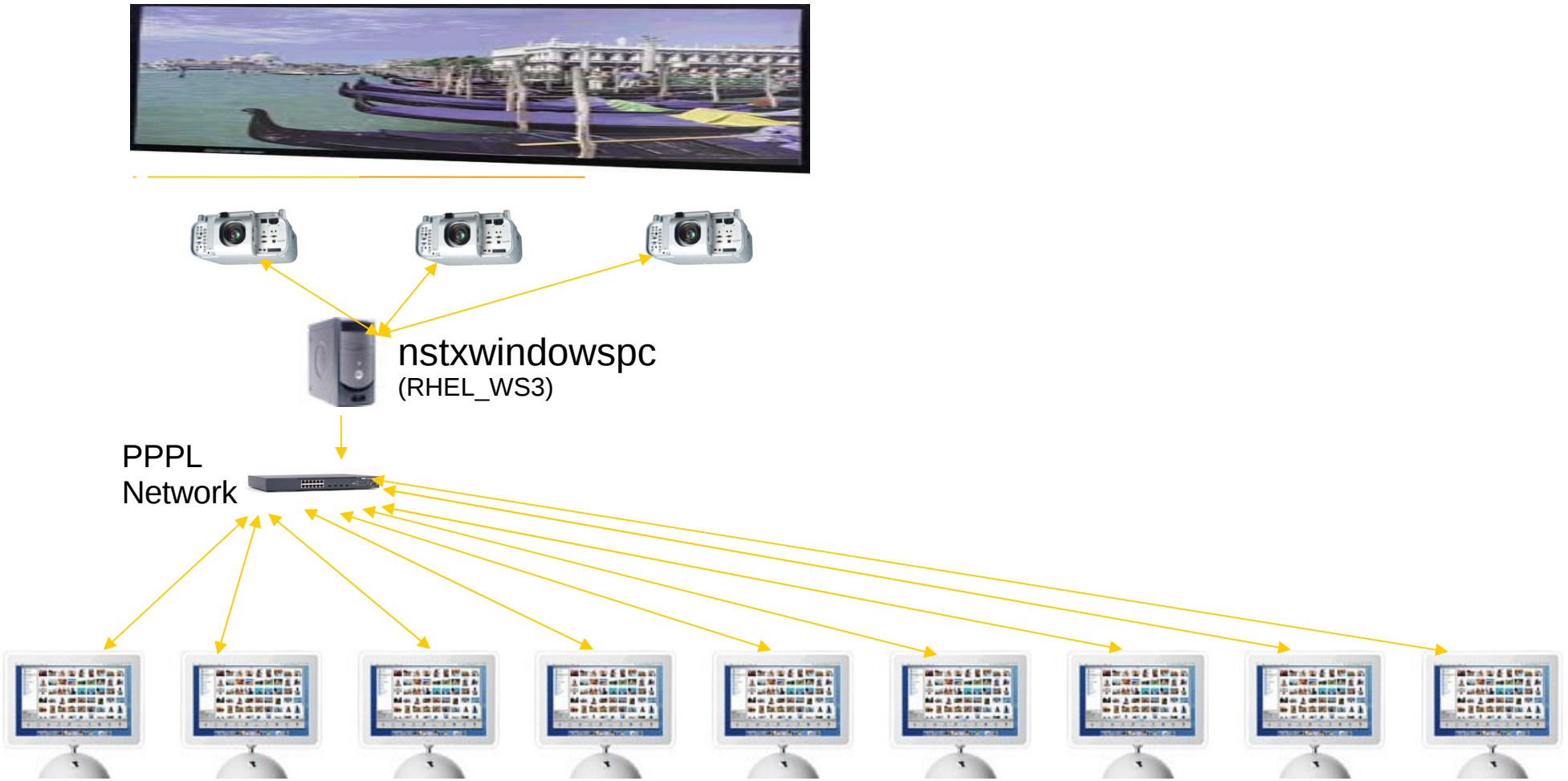
Display Wall

- Expertise: Bill, Eliot, Greg, other wall users
- *Application sharing software that allows individual windows to be replicated to other computers. Remote collaboration tool based on a modified VNC protocol.*
- Display wall can show windows from:
  - local windows (launched from nstxwindowspc)
  - remote windows (launched from your mac/win/linux)
  - Offsite collaborators can share/view windows, but this slows down the server's screen refresh rate (for all windows).
  - For remote apps to be displayed on the wall, the computer name must be in ~wall/bin/wall.enablex on nstxwindowspc (e.g. nstxmac23.pppl.gov).
- During the run day, the I&C staff usually setup/restart a 'standard' set of apps/windows on the display wall.
- Turning the projectors on/off (bulb replacement ~$800)
  - Power-on/off using remote control (2 in CR, all use same freq).
  - Can also power-off using projector's web-server.

Display Wall

- Client-Server: VNC & X-windows
  - *SharedAppVNC* downloadable from SourceForge
  - Last updated in 2006 - developer no longer active.
  - Individual mouse color using *ICE-MC* (SourceForge)
- User guides - could be outdated.
  - http://nstx.pppl.gov/nstx/Software/Applications/SharedAppVNC.html
  - Better documentation and user support is 'on the list'.
  - See experts and others who use it for individual help.

Layout of control room



Clients -- Mac/Windows/Linux

SharedAppVnc | Get SharedAppVnc at SourceForge.net - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://sourceforge.net/projects/shared-app-vnc/

Google NSTX Status Page PPPL PPPL Mail - Inbox Central I&C LogBook helpdeskticket

sourceforge FIND AND DEVELOP OPEN SOURCE SOFTWARE

Welcome, Guest! Log In | Create Account

Find Software | Develop | Create Project | Blog | Site Support | About

enter keyword Search

SourceForge.net > Find Software > SharedAppVnc

SharedAppVnc Beta by grantwallace

Share More

Summary | Files | Support | Develop

View screenshots

Application sharing software that allows individual windows to be replicated to other computers. Remote collaboration tool based on a modified VNC protocol. Its advantage is to keep some things, like email, private, while sharing other desktop apps.

Download Now!
SharedAppVnc-Windows-bin-... (1.0 MB)

OR View all files

http://shared-app-vnc.sourceforge.net

TAGS EDIT

Show project details

Ratings and Reviews

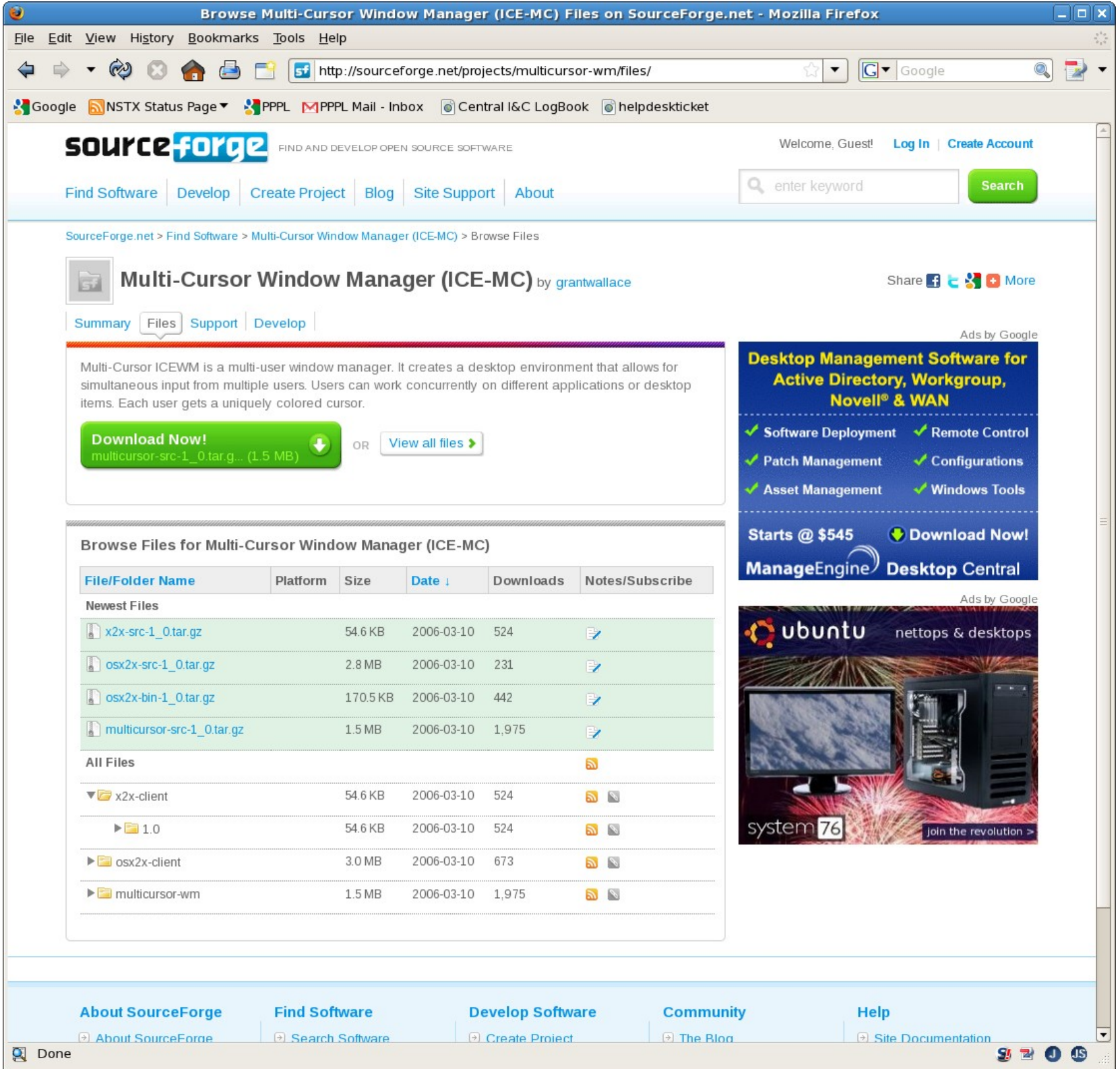
Show: Everything

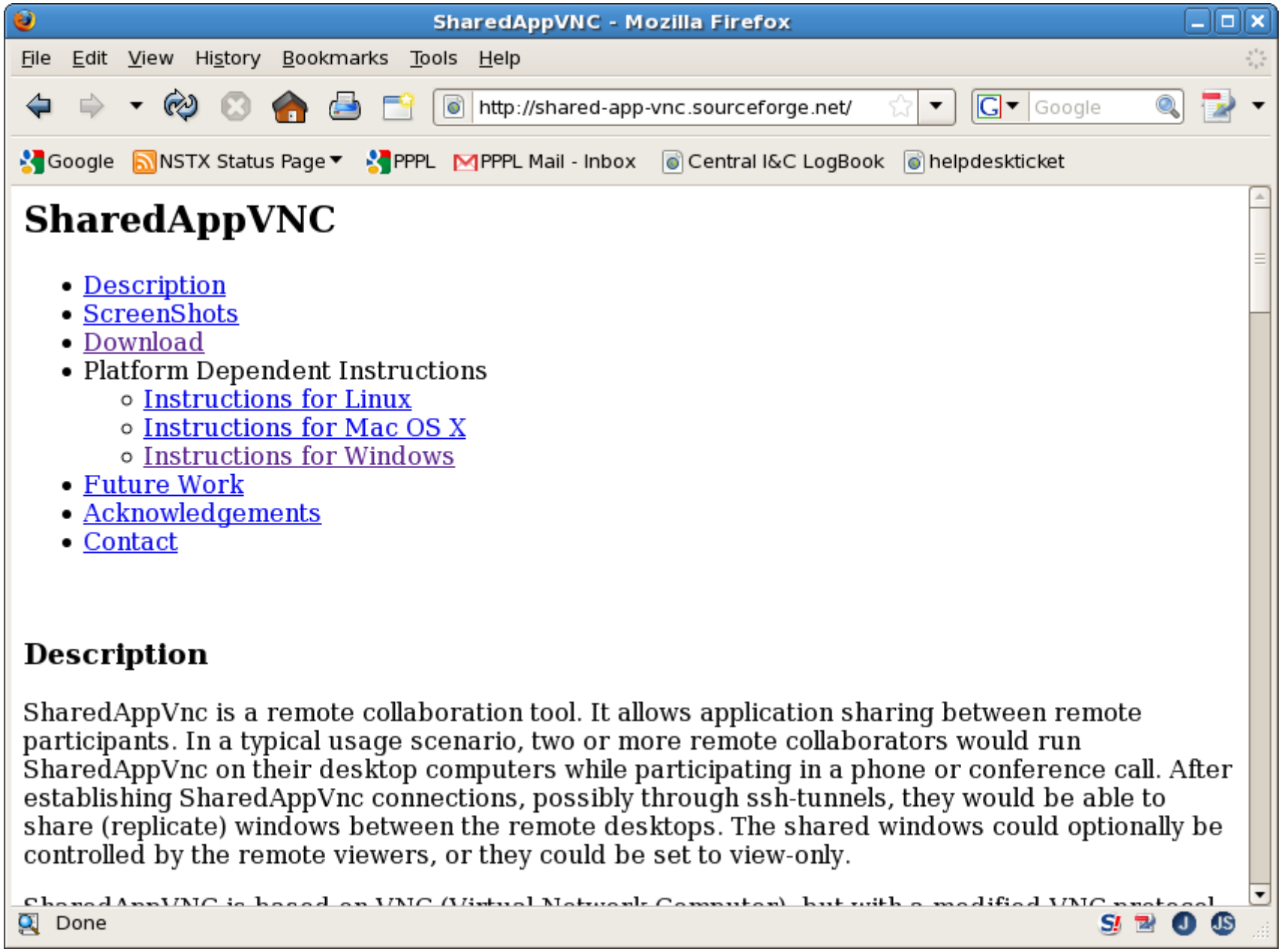
100% of 1 user recommends this project

Thumbs up: 1
Thumbs down: 0

Be the first to post a text review of SharedAppVnc. Rate and review a project by clicking thumbs up or thumbs down in the right column.

Done


Browse Multi-Cursor Window Manager (ICE-MC) Files on SourceForge.net - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://sourceforge.net/projects/multicursor-wm/files/
Google
Google NSTX Status Page PPPL PPPL Mail - Inbox Central I&C LogBook helpdeskticket
sourceforge FIND AND DEVELOP OPEN SOURCE SOFTWARE
Welcome, Guest! Log In | Create Account
Find Software Develop Create Project Blog Site Support About
enter keyword
Search
SourceForge.net > Find Software > Multi-Cursor Window Manager (ICE-MC) > Browse Files
Multi-Cursor Window Manager (ICE-MC) by grantwallace
Share More
Summary Files Support Develop
Multi-Cursor ICEWM is a multi-user window manager. It creates a desktop environment that allows for simultaneous input from multiple users. Users can work concurrently on different applications or desktop items. Each user gets a uniquely colored cursor.
Download Now!
multicursor-src-1_0.tar.g... (1.5 MB)
OR
View all files
Browse Files for Multi-Cursor Window Manager (ICE-MC)
File/Folder Name | Platform | Size | Date | Downloads | Notes/Subscribe
Newest Files
x2x-src-1_0.tar.gz 54.6 KB 2006-03-10 524
osx2x-src-1_0.tar.gz 2.8 MB 2006-03-10 231
osx2x-bin-1_0.tar.gz 170.5 KB 2006-03-10 442
multicursor-src-1_0.tar.gz 1.5 MB 2006-03-10 1,975
All Files
x2x-client 54.6 KB 2006-03-10 524
1.0 54.6 KB 2006-03-10 524
osx2x-client 3.0 MB 2006-03-10 673
multicursor-wm 1.5 MB 2006-03-10 1,975
Ads by Google
Desktop Management Software for Active Directory, Workgroup, Novell® & WAN
Software Deployment
Remote Control
Patch Management
Configurations
Asset Management
Windows Tools
Starts @ $545
Download Now!
ManageEngine Desktop Central
Ads by Google
ubuntu
nettops & desktops
system 76
join the revolution >
About SourceForge
About SourceForge
Find Software
Search Software
Develop Software
Create Project
Community
The Blog
Help
Site Documentation
Done


SharedAppVNC - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://shared-app-vnc.sourceforge.net/
Google
Google NSTX Status Page PPPL PPPL Mail - Inbox Central I&C LogBook helpdeskticket
SharedAppVNC
Description
ScreenShots
Download
Platform Dependent Instructions
Instructions for Linux
Instructions for Mac OS X
Instructions for Windows
Future Work
Acknowledgements
Contact
Description
SharedAppVnc is a remote collaboration tool. It allows application sharing between remote participants. In a typical usage scenario, two or more remote collaborators would run SharedAppVnc on their desktop computers while participating in a phone or conference call. After establishing SharedAppVnc connections, possibly through ssh-tunnels, they would be able to share (replicate) windows between the remote desktops. The shared windows could optionally be controlled by the remote viewers, or they could be set to view-only.
Done

vncviewer and SharedAppVnc for the Control Room Macs

1. To run a vncviewer of the display wall requires an ssh tunnel to nstxwindowspc:

   Click on the X11 icon to bring up an X terminal. Make sure the DISPLAY environment variable is set to your mac. Then run:

   ```
   xhost +nstxwindowspc
   ssh nstxwindowspc
   ```

   On nstxwindowspc set the DISPLAY environment variable to your mac. Then run:

   ```
   /usr/bin/vncviewer localhost
   ```

   Enter the p*ssword (lab name in lowercase, followed by a 4-number sequence).

   This will bring up the vncviewer window on your mac and give you access to the display wall.

2. SharedAppVnc runs from the command line but not from the icon shortcut. To run it from the command line:

   ```
   cd /Applications/SharedAppVnc-OSX/SharedAppVnc.app/Contents/MacOS
   ```

   Then run:

   ```
   ./SharedAppVnc -connectHost nstxwindowspc
   ```

If you have additional questions, please send email to efeibush

---

updated: 19-Jun-2008
by: Bill Davis

Sharing Applications to the NSTX Display Wall

Application programs started on a PC or a Macintosh can be shown on the Display Wall in the Control Room.
A utility program running on the PC or Mac lets you choose the applications for sharing. You can also share your entire desktop.

Run the application sharing utility

Macintosh	PC
Click the icon in the dock for SharedAppVnc	Run C:\Program Files\SharedAppVnc-win\SharedAppVnc

If you don't have these on your Mac or PC, download it from http://sourceforge.net/projects/shared-app-vnc/

This brings up the utility for sharing applications.

Go to the Clients page and connect to nstxwindowspc:0

Share Programs on the Display Wall

Macintosh	PC
Click on the Select Window to Share button and then click on the desired window.	The Windows page of SharedAppVnc lists your current programs. Click an item and then click the down arrow button to share it.
To stop sharing a program and remove it from the Display Wall, click on its listing under Shared Applications. Then click the Unshare button.	Click on the name of a program being shared. Click on the up arrow to stop sharing it. Click the rightmost up arrow-bar to stop sharing all programs.
share your entire desktop to the Display Wall by checking the box.	The Mode page has a button for sharing the entire desktop.

Use your mouse cursor on your local screen to operate your shared programs. Click on Disconnect Client to end your session.

Enable other users to interact with your shared programs

If you want other users to be able to interact with your shared programs on the Display Wall:

Macintosh	PC
Go to SharedAppVnc--->Preferences uncheck Disable Remote Keyboard/Pointer	Go to the symbol for SharedAppVnc in the toolbar showing icons for each current program. Right click to pop up a menu and select Properties. Uncheck the box for Disable Remote Keyboard and Pointer.

Mouse cursor for interacting with other people's shared programs

Macintosh	PC
Click the icon in the dock for osx2x (if you don't have it, download from Source Forge, if possible, or get this .gz file or .bz2 file).	Click the icon on the desktop for x2x-mc (if you don't have it, download it from Source Forge, if possible, or right-click here and Save Target As...)
Select an edge detection direction - the edge of your local screen that leads the cursor to an edge of the Display Wall.	Click within the x2x window to control a mouse cursor on the Display Wall.
Click on Disconnect to end your remote cursor session.	To end using the cursor on the Display Wall and go back to using the mouse cursor on your PC: Hold down mouse button 1 and simultaneously click on mouse button 2.

This brings up a utility for controlling a mouse cursor on the Display Wall.
Click on New Connection.
Hostname is nstxwindowspc:0 and connection type is X11.
Then click on Connect.

The cursor number selector sets your cursor color so you can distinguish your cursor from other users.

Bill Davis Display Wall Help File

- http://w3.pppl.gov/~bdavis/swdoc/DisplayWallSetupSteps.txt

- To display a scope display, from an existing xterm window:

  1) exec xterm -T NSTXwindowsPC -n NSTXwindowsPC -sb -sl 2000 -e ssh nstxpool &
  2) setenv DISPLAY nstxwindowspc:0.0
  3) dwscope -def $NSTXUSR/util/scopes/wall_physics.scope &

- We should try to run the computationally-intensive tasks on nstxpool that are less likely to be loaded. Wall I/O-intensive programs should be most efficient running on nstxwindowspc.

- run x2x-2wall.xs (or x2x-mc) on PC's or osx2x on Macs and click in window to rearrange windows on wall.

Typical Computing Problems

- **First shot of the day**
- Computing
  - runaway process uses all CPU
  - Windows auto-reboots - need user login and pgm startup
  - Diagnostic PC in Test Cell hang/fail
- Networking
  - x-windows disappear - especially Windows/eXceed
  - client-server connections break
- CAMAC problems
  - intermittent link transmission errors
  - digitizer/memory module breaks

Typical Computing Problems

- MDSplus
  - Trees not built before shot
  - INITs complete after T(0)
  - CAMAC digitizer data from previous shot.
- EPICS
  - data acquisition hangs - no data
  - vxWorks IOC refuses new connections
- PCS
  - operator has numerous opportunities for error
- Display Wall
  - Applications need to be restarted

Discussion of other typical failures (experienced Physics Operators)?

Are there areas where computing would further aid the Physics Operator?