Migration of NSTX MDSPlus from VMS to Linux

Aug. 28, 2008

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minor revs noted 07OCT2008 (ps)

Agenda

- Introduction
- MDSplus System Software
- Application Software
- Testing
- Cost & Schedule

Scope

The VMS computers are not being unplugged!

1. Migration of MDSplus serving from VMS to Linux.
   - Includes data and events.
2. Move NSTX ‘MDSplus’ CAMAC access from VMS to Linux.
   - Port all programs that perform CAMAC I/O.

VMS programs that access the MDSplus trees, but not CAMAC, do not need to be ported at this time.

Justification

- Continued dependence upon VMS without our ‘expert’ exposes NSTX to unnecessary risk.

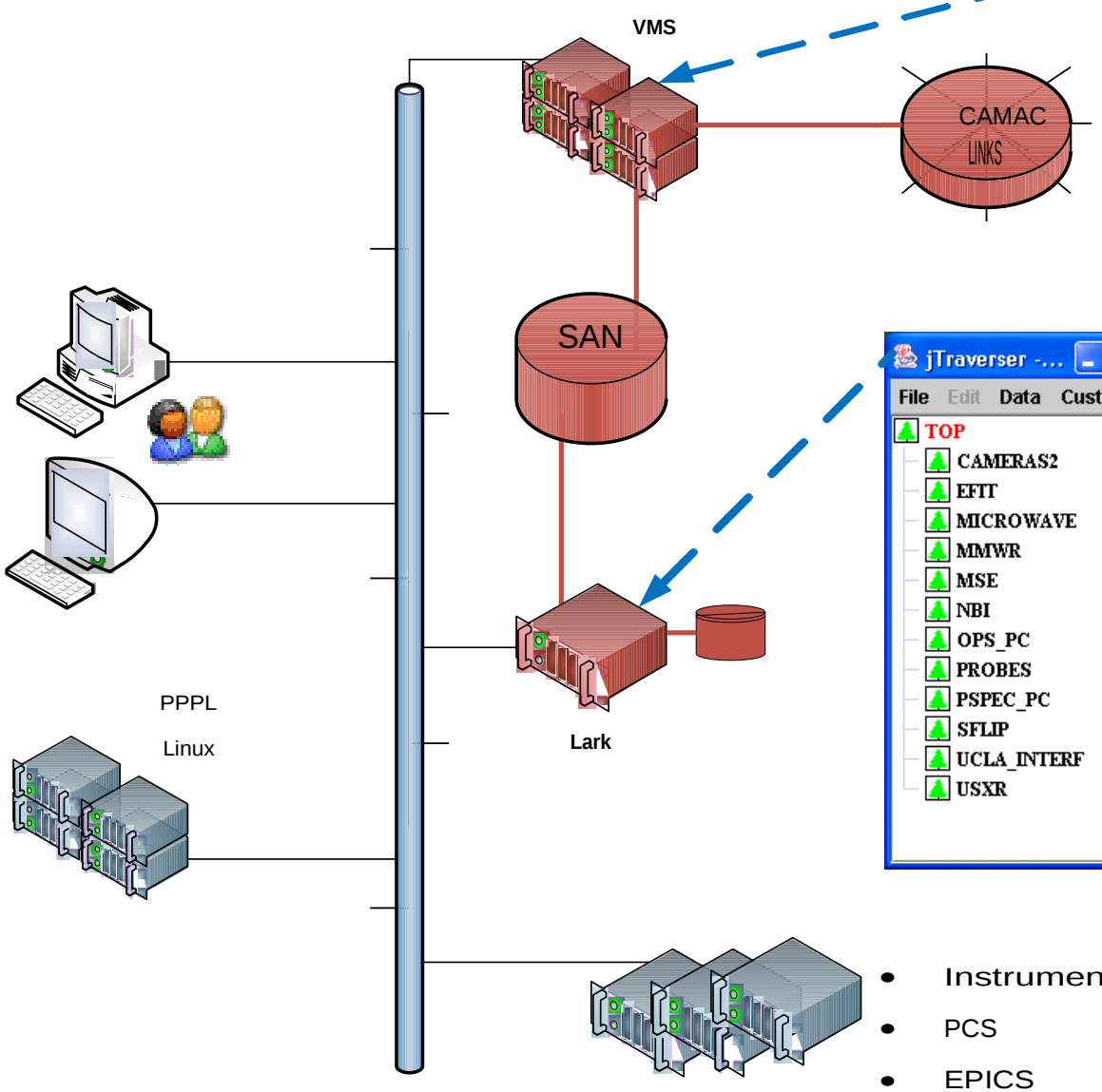
- The porting project gives the I&C team the opportunity to build our MDSplus environment from ‘bare metal’.
  - Promotes the development of documentation and understanding of the processes.
  - Brings MDSplus into an environment where the support staff and new scientists and engineers are knowledgeable.
  - Will help support other experimental programs at PPPL.

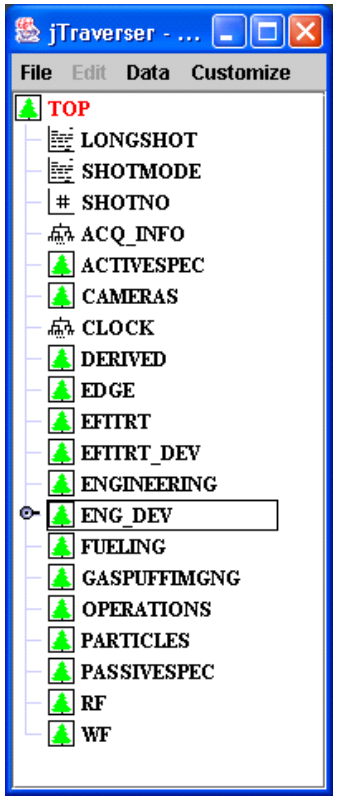
- MDSplus is a collaboration. Remaining with VMS limits our ability to contribute and grow with the community.

Major Tasks

- Computer upgrade: Replace aging *lark* with *skylark* . *THIS ON HOLD UNTIL APRIL?SUMMER 10/7/2008 ps*
- Develop MDSplus system software and tailor it to the PPPL/NSTX environment.
- Port CAMAC IDL applications (diagnostics).
- User environment, training, and support.
- Testing

Existing MDSplus Configuration



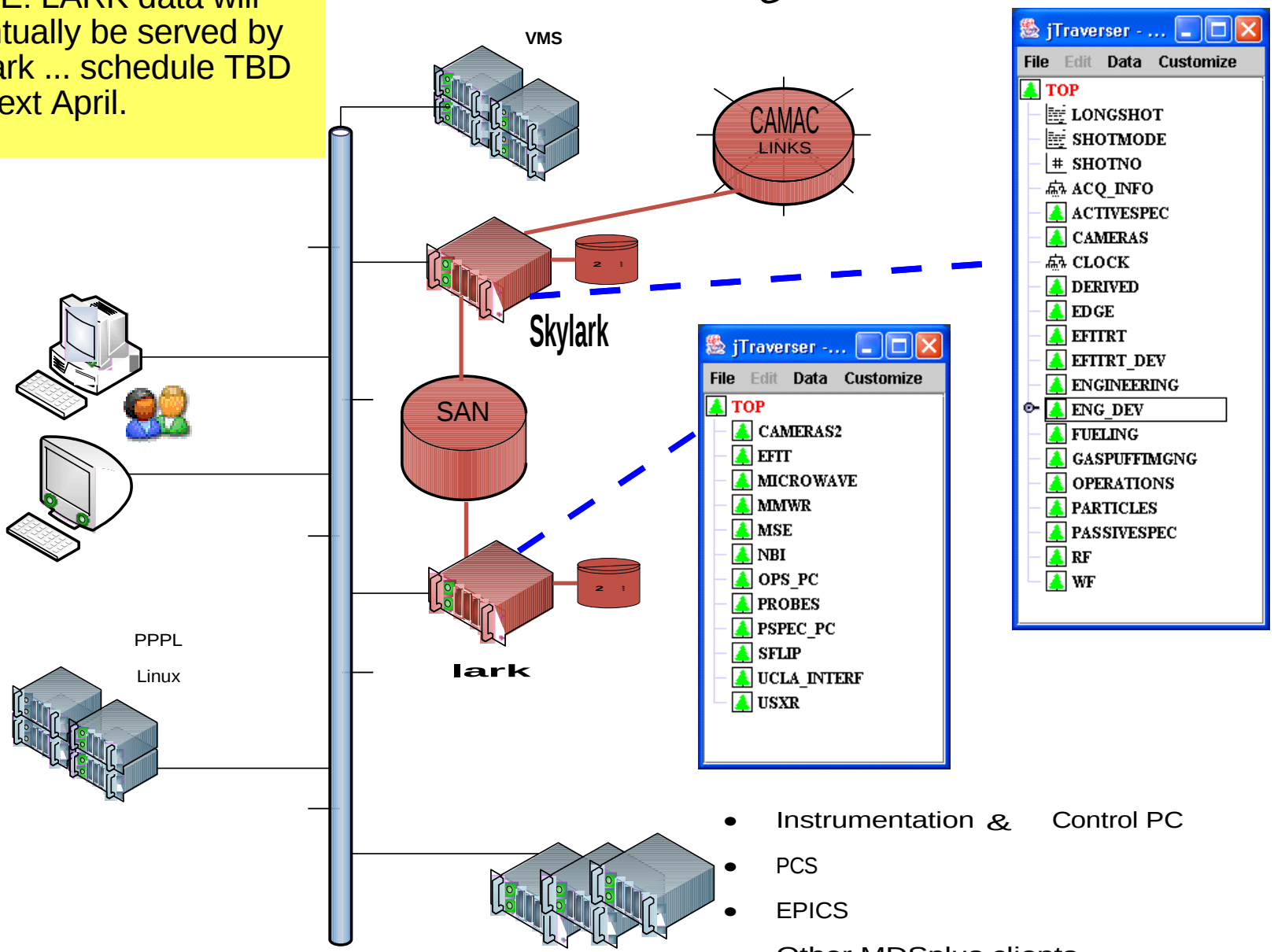


- Instrumentation & Control PC
- PCS
- EPICS
- Other MDSplus clients

New MDSplus Configuration

Slide revised 07OCT2008

NOTE: LARK data will eventually be served by skylark ... schedule TBD for next April.



- Instrumentation & Control PC
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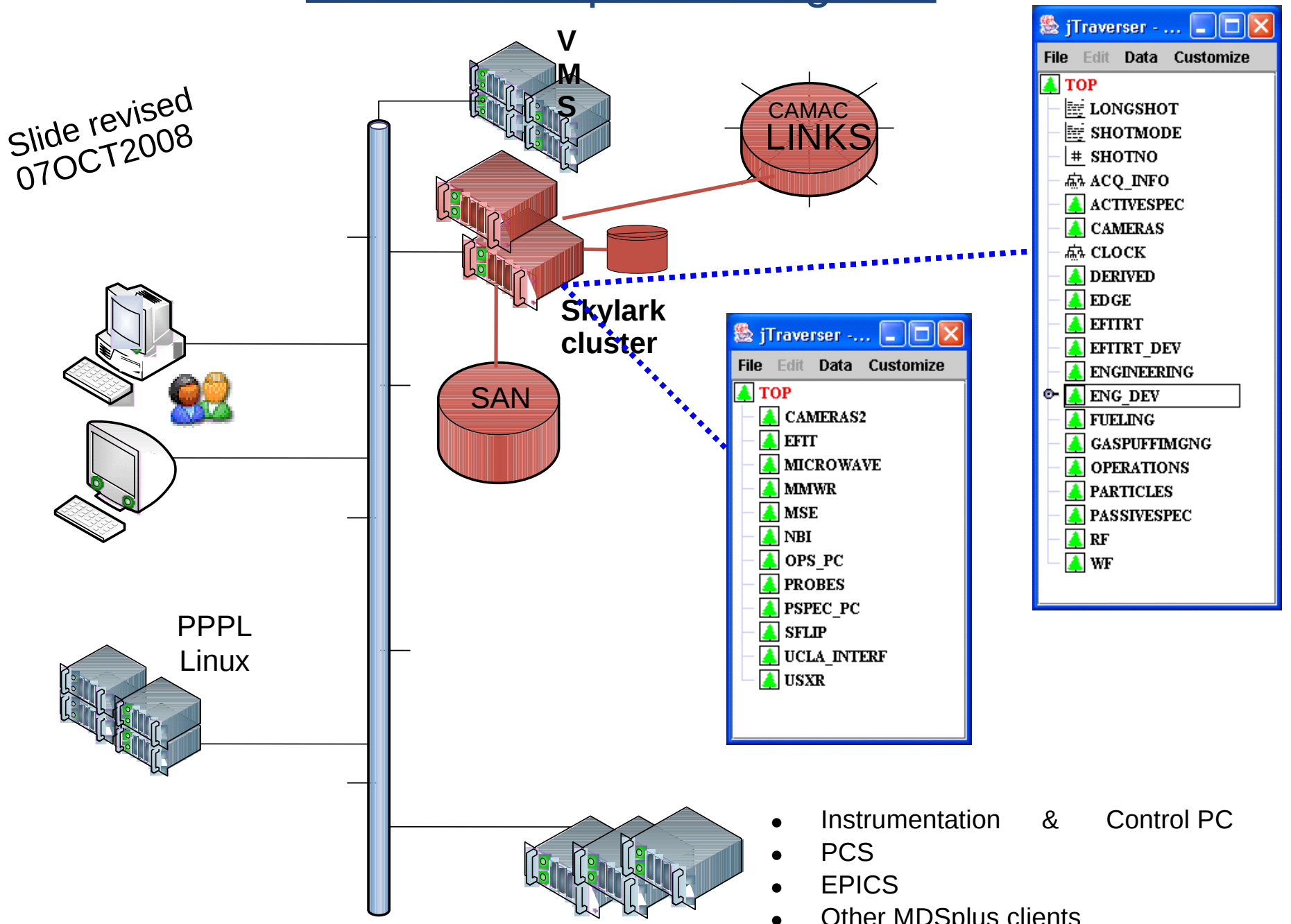
Final FY09 MDSplus Configuration



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- PCS
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VMS2Linux - CAMAC

Hardware

- Linux drivers for PCI board (SCSI i/o) and Jorway CAMAC Serial Highway Driver complete.

Software

- ~20 CAMAC module drivers written in (VMS) C have been ported to (platform-independent) TDI.
  - Will support all features currently used under VMS.
  - ‘Retries’ have been omitted for the time being (will be added before start-up).
- Device setup GUI interfaces have been ported.
- Module lab testing is ~60% complete.

VMS2Linux - ShotSync

- Shot cycle synch. code designed using Lark's configuration.
- Local CAMAC control integrated.
  - CAMAC related dispatching successfully tested.
- All logging and monitoring functionality operational.
- Our existing troubleshooting procedures continue to apply.

VMS2Linux – Data Management

Trees

- Data is currently strewn across multiple systems and architectures (VMS, Linux)
- VMS ~~& Lark Trees~~ will be moved - all future tree access via Skylark

- *THIS ON HOLD UNTIL APRIL?SUMMER 10/7/2008 ps*

Storage

- System uses a combination of local RAID array and PPPL SAN.
  - Local Disks used for data acquisition
  - Most recent data (2-3 weeks) stored locally.
  - SAN used for long term storage.

System

- Data Management model designed and operated by Phyllis, used on Lark and VMS.
- Minor changes/additions to the system:
  - Cron'ed monitoring scripts to alert operators of disk usage nearing defined thresholds.
  - Plan to add additional automation and expand ‘drive capacity safety margin’.

VMS2Linux – Data Migration

- About 9 TB's of NSTX MDSPlus Data on SAN. The VMS portion, about 3.5 TB, must be migrated.
  - Data validity will be checked using a TBD method (Bill, Greg).

- Tested various data transfer techniques with Tom Carroll.
  - SCP (Secure Copy) selected:
    - Employed by Phyllis for prior VMS-> Lark migration.
    - Can be multi-streamed on a per-disk basis to achieve better throughput.

- Data Access During Moves

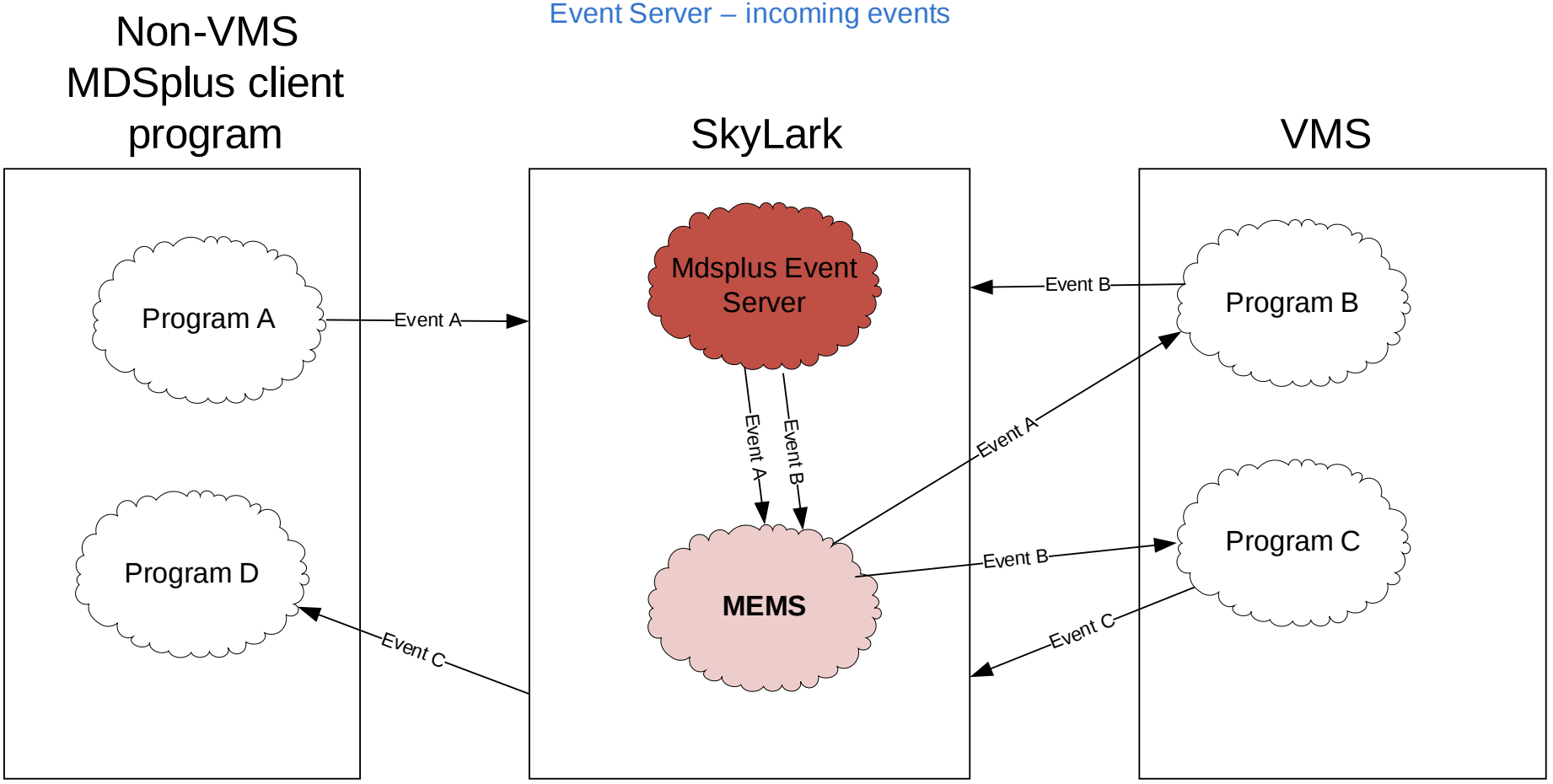
- *THIS METHOD still under development 10/7/2008 ps*
  - We will copy one tree at a time (Particles, Ops etc.)
    - “Rolling blackout” method reduces tree-unavailability time. Will do evening/weekends on a TBD schedule in late September.
    - Access restriction during move is needed to prevent data concurrency issues.

MDSplus Events

- MDSPlus Events are used for synchronizing software, e.g. automated MDSscope updates.
- The ‘main’ MDSplus Event Server will be on Skylark.
- The ‘long-frozen’ MDSplus software on VMS cannot specify Skylark as it’s event server.
  - An ‘event repeater’ will be running on Skylark to forward events to VMS.
  - User’s must ‘register’ all forwarded events.
  - THIS MAY NOT BE NECESSARY SINCE (Linux) MDSPLUS ALLOWS MULTIPLE EVENT SERVERS AND TARGETs 10/7/2008 ps

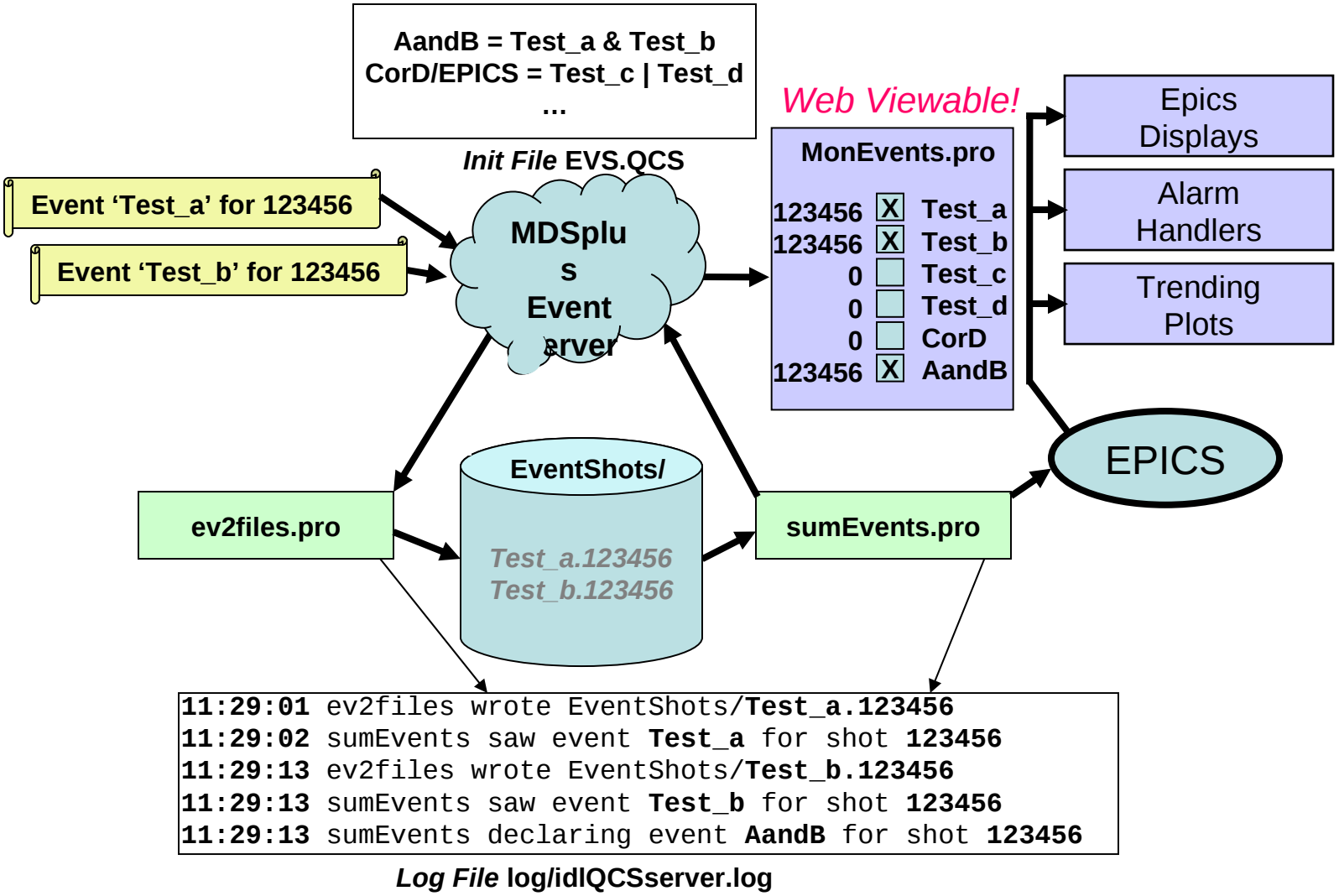
MDSPlus Events

2 environmental variables:
Event Target – outgoing events
Event Server – incoming events



MEMS is an **event repeater** for events going to VMS.
Events must be 'registered'.

MDSplus Event Management System



MEMS Event Load Test

Invoked simultaneously
From cron jobs

Sunfire12

Sunfire13

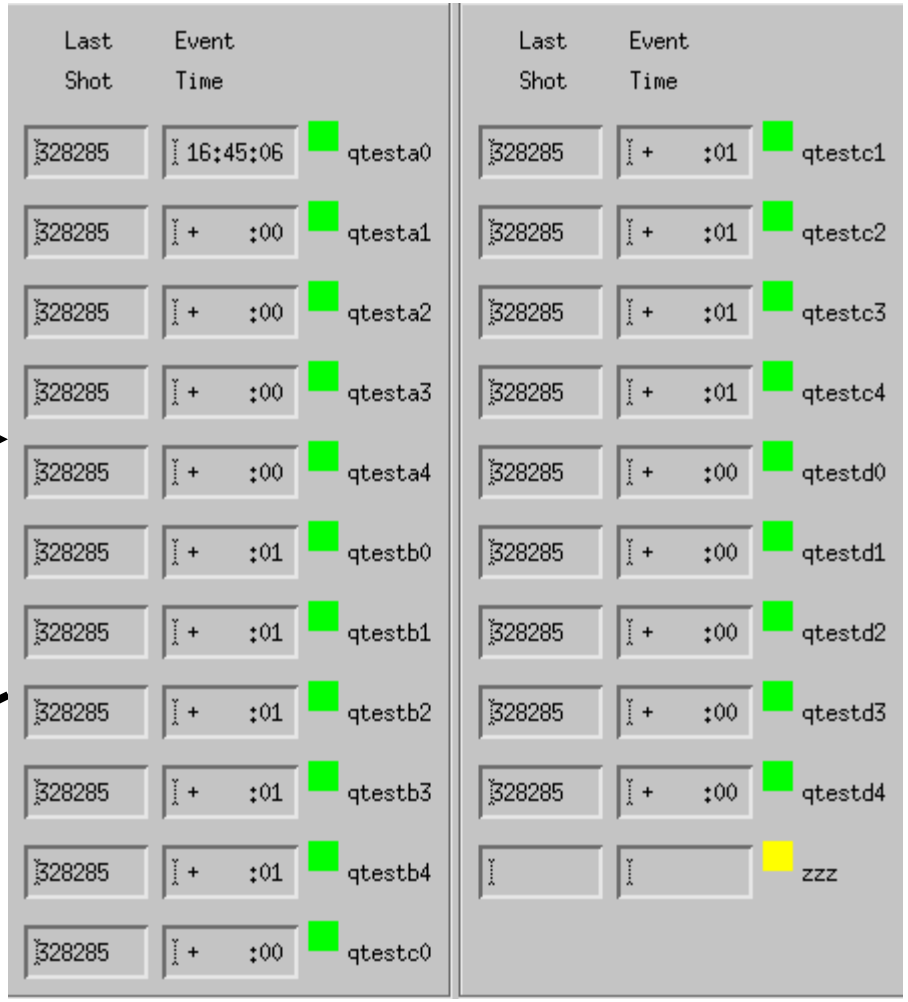
Sunfire14

Sunfire15

5 events each
1 ms delay

MDSplus Event Server

(on VMS or Linux)



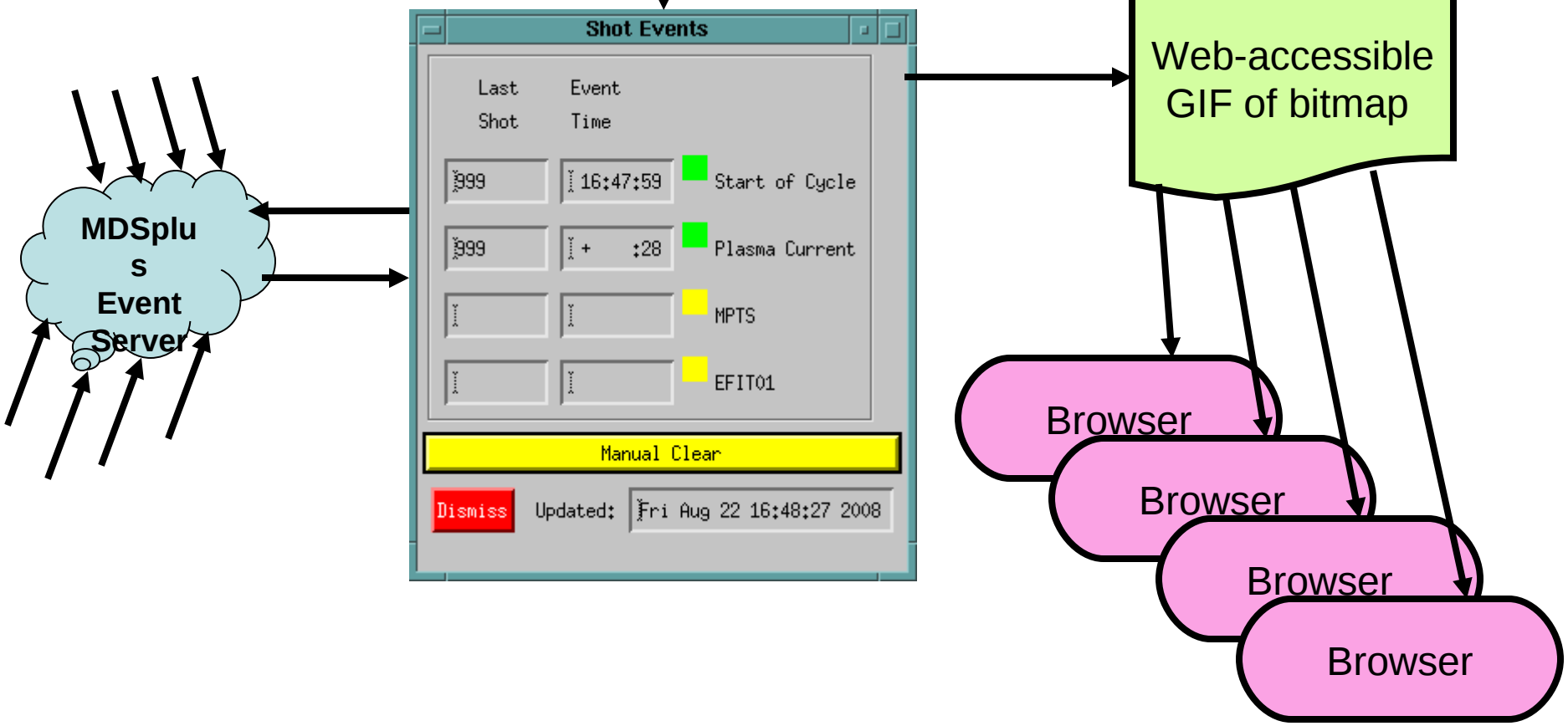
Log File

Aug 25 16:45:06 : >>>

328285 16:45:06 qtesta0
328285 + :00 qtesta1
328285 + :00 qtesta2
…

NSTX Diagnostic Status Web Monitoring

```
; events and labels for Diagnostics.
NSTX_SOC              "Start of Cycle"
PC_908C22N19_ACQ      "Plasma Current"
MPTS_FIT_DONE         "MPTS"
PHOENIXDONE_P1        "EFIT01"
```



Migration of Applications to Linux: VMS

- General rule: Porting only IDL routines that interface with CAMAC; rest will stay on VMS.

- IDL ports easily / just have to drop the dollars signs from MDSplus calls.

- Using a shared disk to move the programs:

  On VMS the directory is: NSTX$:[SHARED]

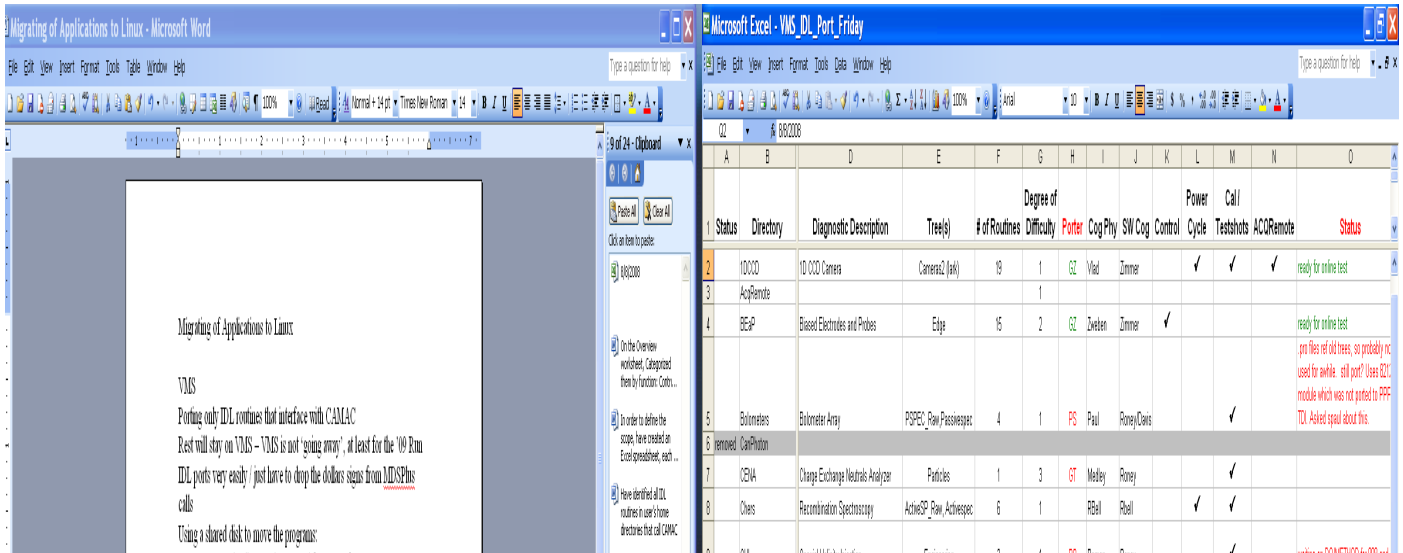
  On mdspc the directory is: /usr/nstxshr

Migration of Applications to Linux: VMS

- In order to define the scope of the project and track progress, have created an Excel spreadsheet, each diagnostic with it's own worksheet.

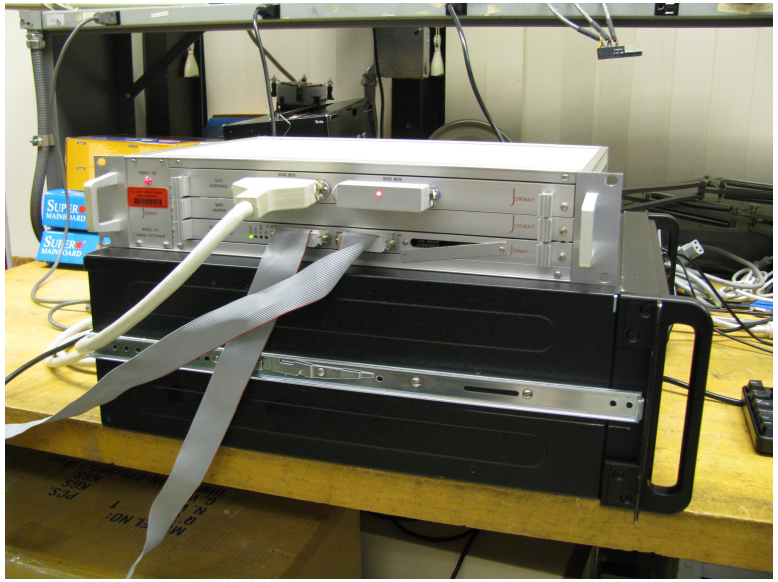
http://nstx.pppl.gov/nstx/Software/Documents/VMS_IDL_Port.xls

- Have identified all IDL routines in the VMS diagnostic directory NSTX$:[000000] (and sub directories) which interface with CAMAC.
  - 43 diagnostics, ~550 IDL routines.
  - Have yet to identify IDL routines in user's home directories which call CAMAC.



Migration of Applications to Linux: VMS

Off line Testing: *mdspc* is our test bed



mdspc and SCSI interface

Crate 1:

322

302

304

3388

408

904

404

912R

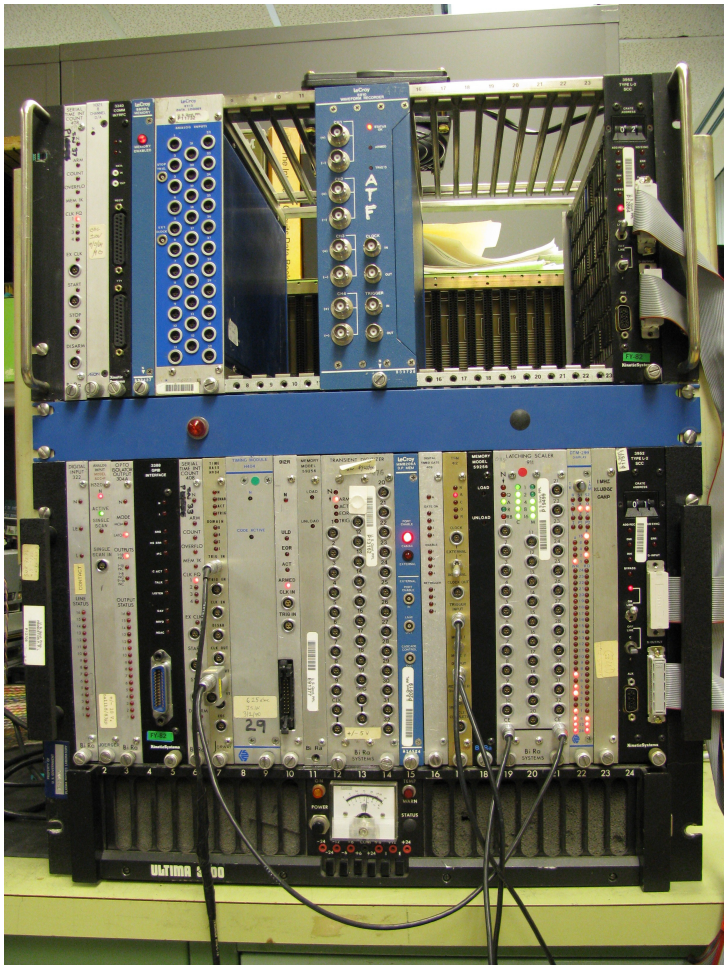
908

8206

409

412

911



Crate 2:

408

321

Migration of Applications to Linux: VMS

Current Status

- ~10 out of 43 Diagnostics have been ported & tested offline, ready for online testing.

- One of each ‘category’ has been ported & tested, ie Control, Power Cycle, Test Shot Cycle, Batch Job.
- Spred diagnostic using Labview on a PC has been ported & tested
  - writes into an MDSPlus tree from a remote PC.
  - has a ‘batch’ job that controls a 412 CAMAC module.
  - same ‘batch’ uses events to communicate with Labview VI.
- Deposition Monitor, rated high on ‘Degree of Difficulty’ has been ported & run (offline) in B101 lab.
  - acquires ‘trend’ data via a ‘batch’ job / has a tricky way of appending data / relies on several events.

Migration of Applications to Linux VMS: **Notes**

- Users that operate diagnostics with CAMAC will have accounts on *skylark*. *Skylark* is not for general user computing.
- Porting of MDS scopes is recommended. Should port with little change; will run faster, events won't require 'forwarding'.
- Results from two timing tests:

  1) display of Deposition Monitor data:

     - on *VMS*: 3+ minutes

     - on *mdspc*: 4 seconds

  2) IDL benchmark time_test2, it is 2.26 times faster on *sunfire16* than on *Europa*.

Migration of Applications to Linux: **lark**

- *THIS ON HOLD UNTIL APRIL?SUMMER 10/7/2008 ps*

Several diagnostics already on lark:

- High k Scattering
- FIReTIP
- + a few users

linux(*lark*) → linux(*skylark*), should be straightforward.

Migration of Applications to Linux

Diagnostic PC's / Labview vi's:

- *just MDSconnect to* skylark *instead of* europa/VMS.

Office & Control Room Macs & PCs:

- *will need to redirect to the new linux host*
  - Scopes
  - Traverser
  - User programs such as VisualBasic

Testing

PTP (CSD)

- Tree access and data migration validation.
- Integrated testing of core/CSD software.
- Diagnostics tests (prelim).
- Selected user-software tests.

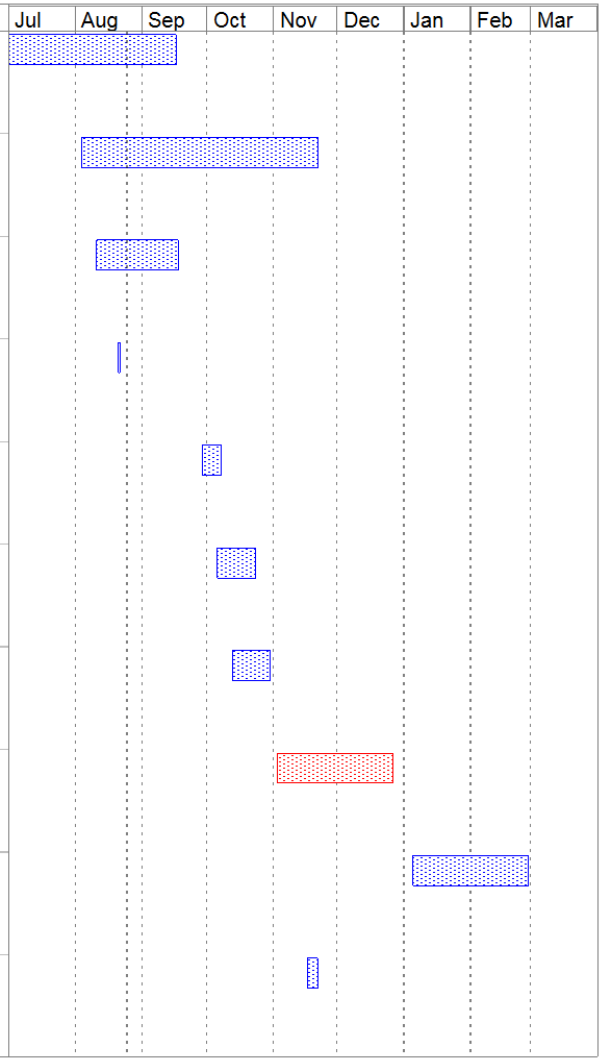
ISTP (CSD & Users)

- Diagnostic controls, data acq, analysis.
- Support ISTP-001 and initial plasma ops.

Cost & Schedule

- Work covered under WP-1465
- 200 days engineering remaining.

Task Name	Start	Finish
Diagnostics Linux port & lab test	Jul 1 '08	Sep 16 '08
online test with Physicist	Aug 4 '08	Nov 21 '08
Skylark prep	Aug 11 '08	Sep 17 '08
FDR	Aug 21 '08	Aug 21 '08
Tree Data VMS-> Skylark	Sep 29 '08	Oct 7 '08
CSD client software rev & test	Oct 6 '08	Oct 23 '08
Data Management	Oct 13 '08	Oct 30 '08
PreOps/Calib testing	Nov 3 '08	Dec 26 '08
Diagnostic/Ops Shakedown	Jan 5 '09	Feb 27 '09
APS	Nov 17 '08	Nov 21 '08



User Support

- Testing *(during the shutdown)* with the operator of a diagnostic will show areas of need, such as:
  - ‘Porting’ workshop for users to share ideas and methods for porting apps from VMS to Linux.
  - Organize ‘Linux for VMS Users’ course.
- PC and Mac users will need their ‘tree path’ environmental variables redefined.
- CSD can assist porting MDSscopes from VMS to Linux.

Conclusion

Our users hold the keys to success:

- It's *not* technology.
- A pro-active, teamwork mindset.
- Not waiting until the last minute will help the NSTX project.