

A Software Event-Summation System for MDSplus

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Abstract # 54

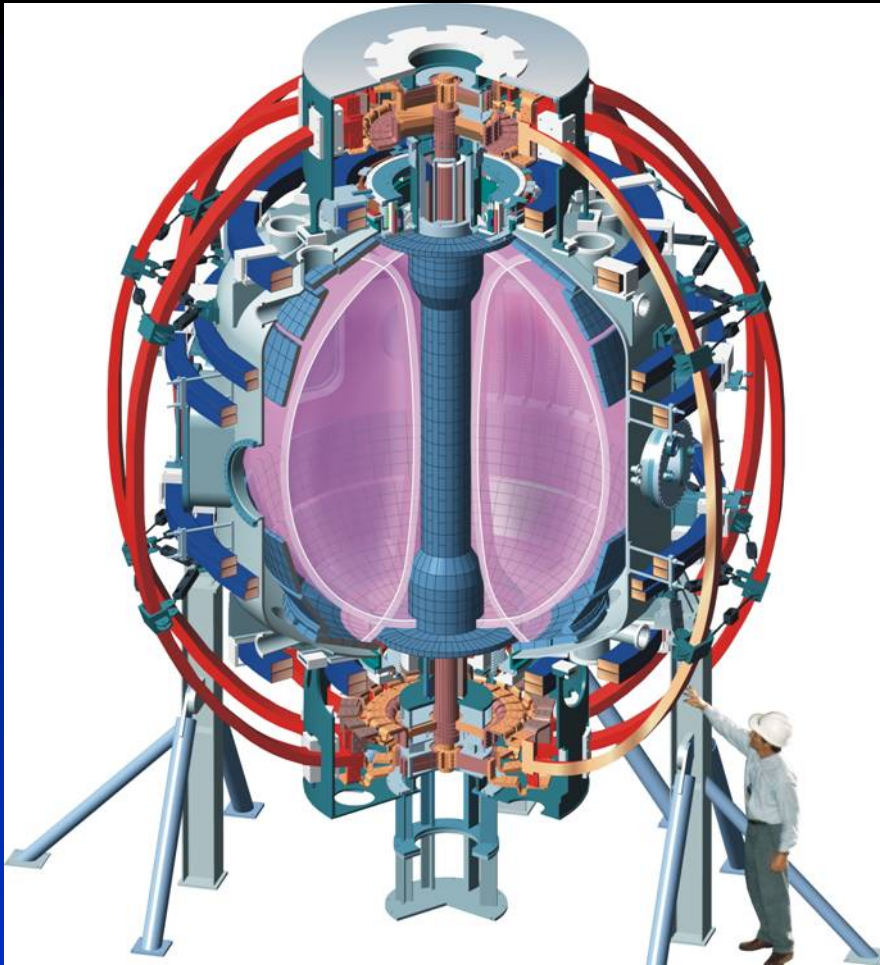
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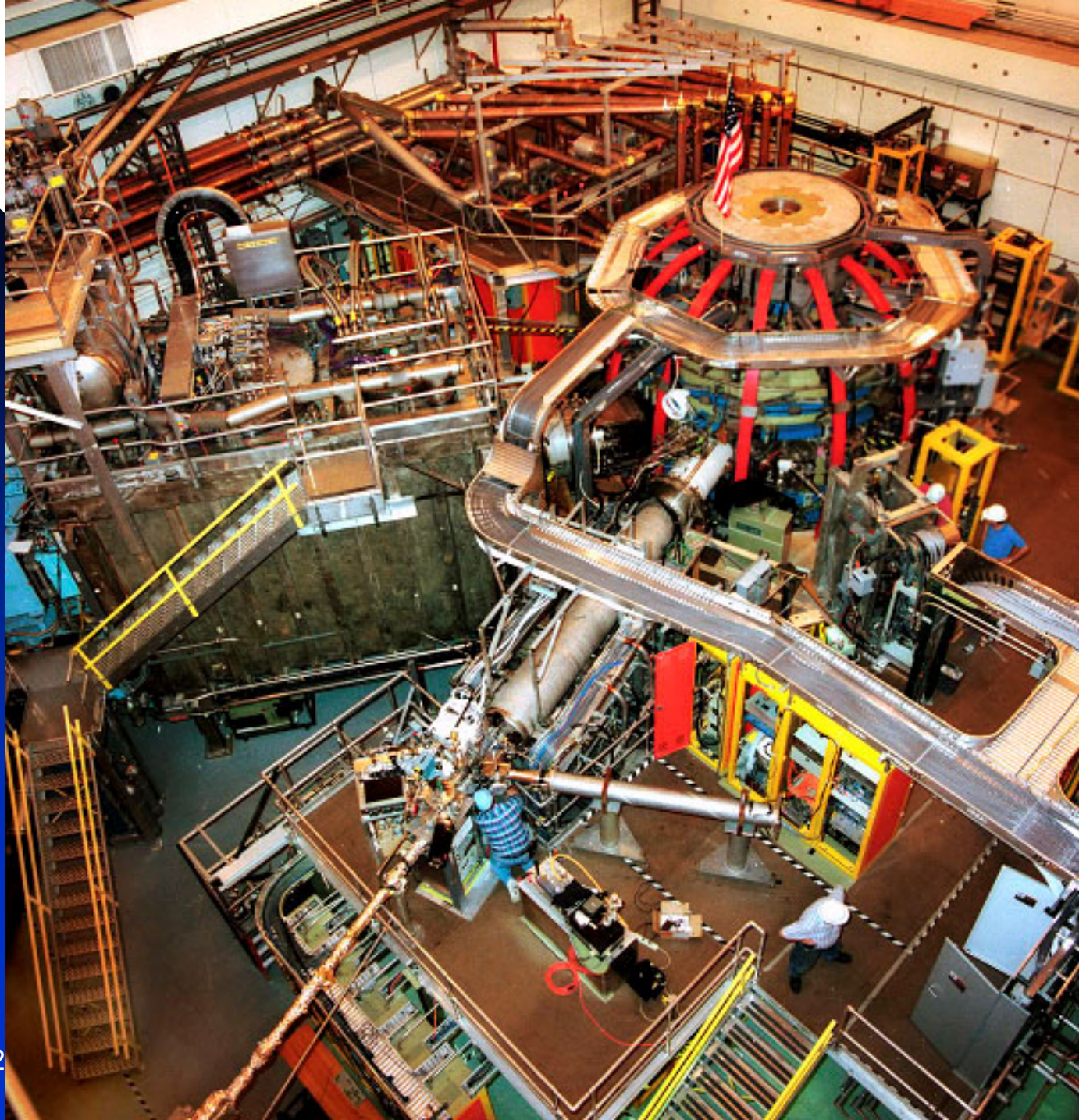
Overview

- Introduce NSTX
- Introduce EPICS & MDSplus
- The Event-Summation System
- Side Benefits (EPICS Pages)
- Future Plans

NSTX



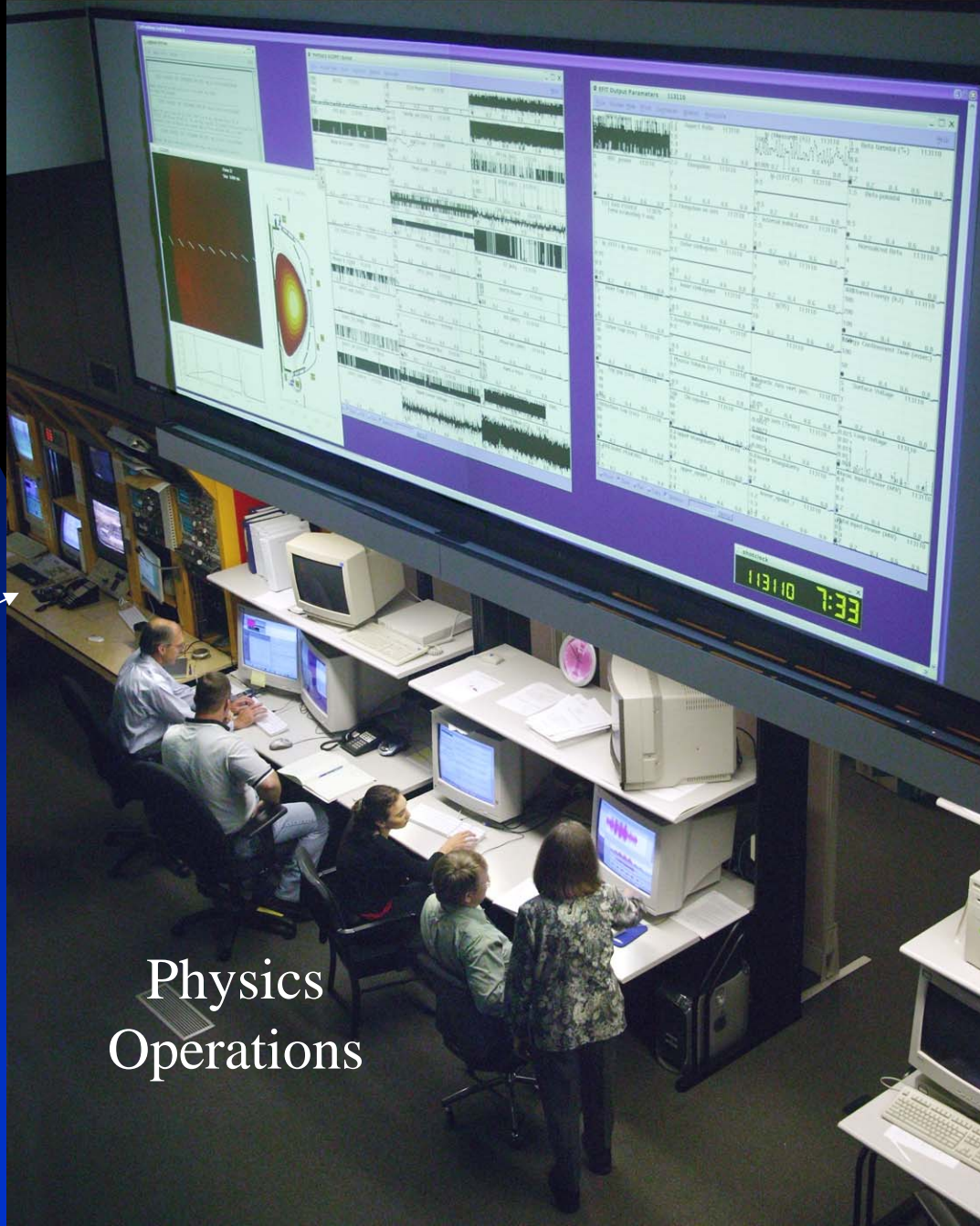
- Spherical tokamak with high β (plasma pressure/magnetic field pressure)
- Began in 1999
- \$35M/yr budget
- >200 people from 53 institutions



June 5, 2

EPICS-MDSplus Similarities

- Data acquisition and monitoring systems
- Used by >30 Experiments
World-wide
- Open Source
- Client-server model
- Quick on-line response to questions



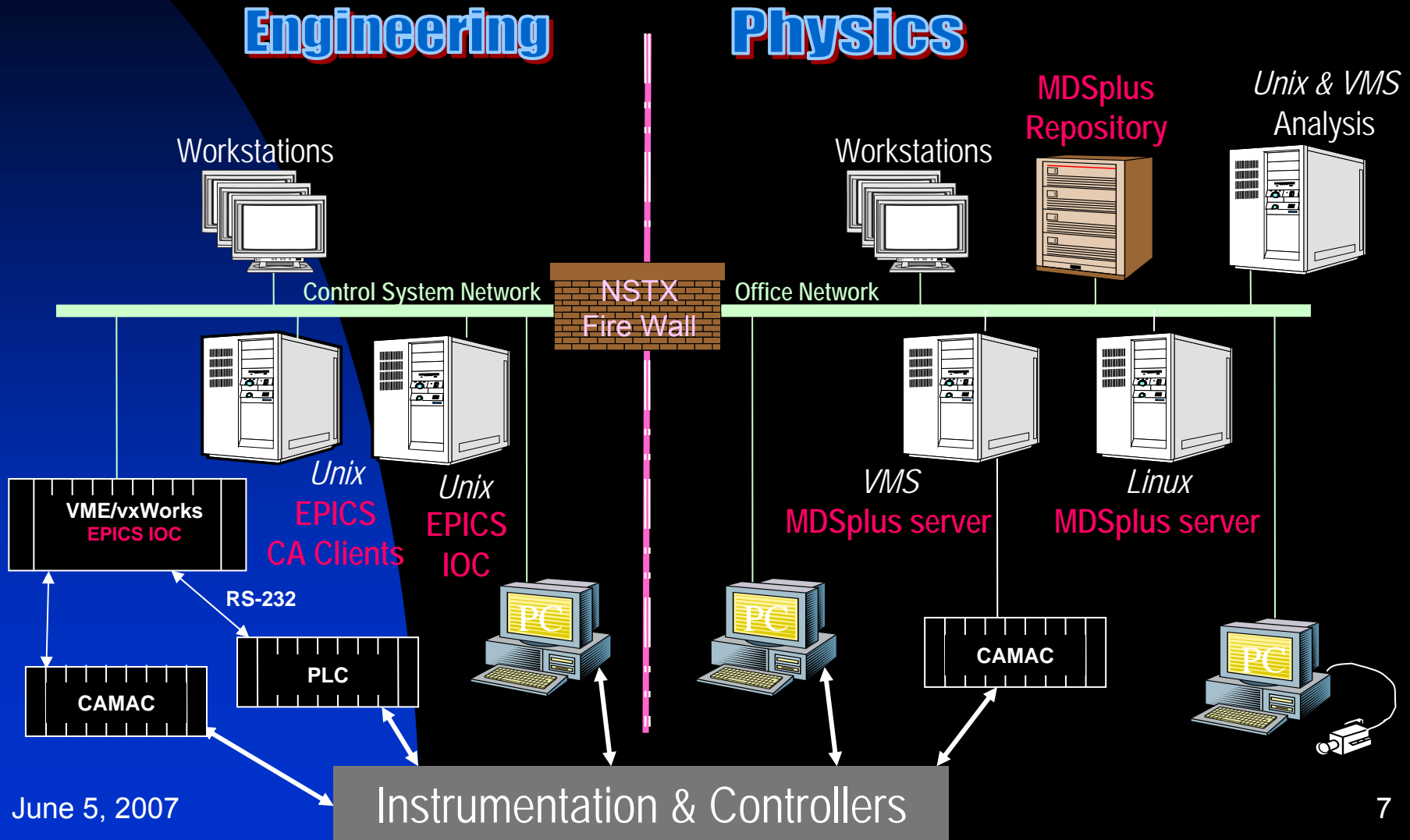
Engineering
Operations

Physics
Operations

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EPICS and MDSplus on NSTX



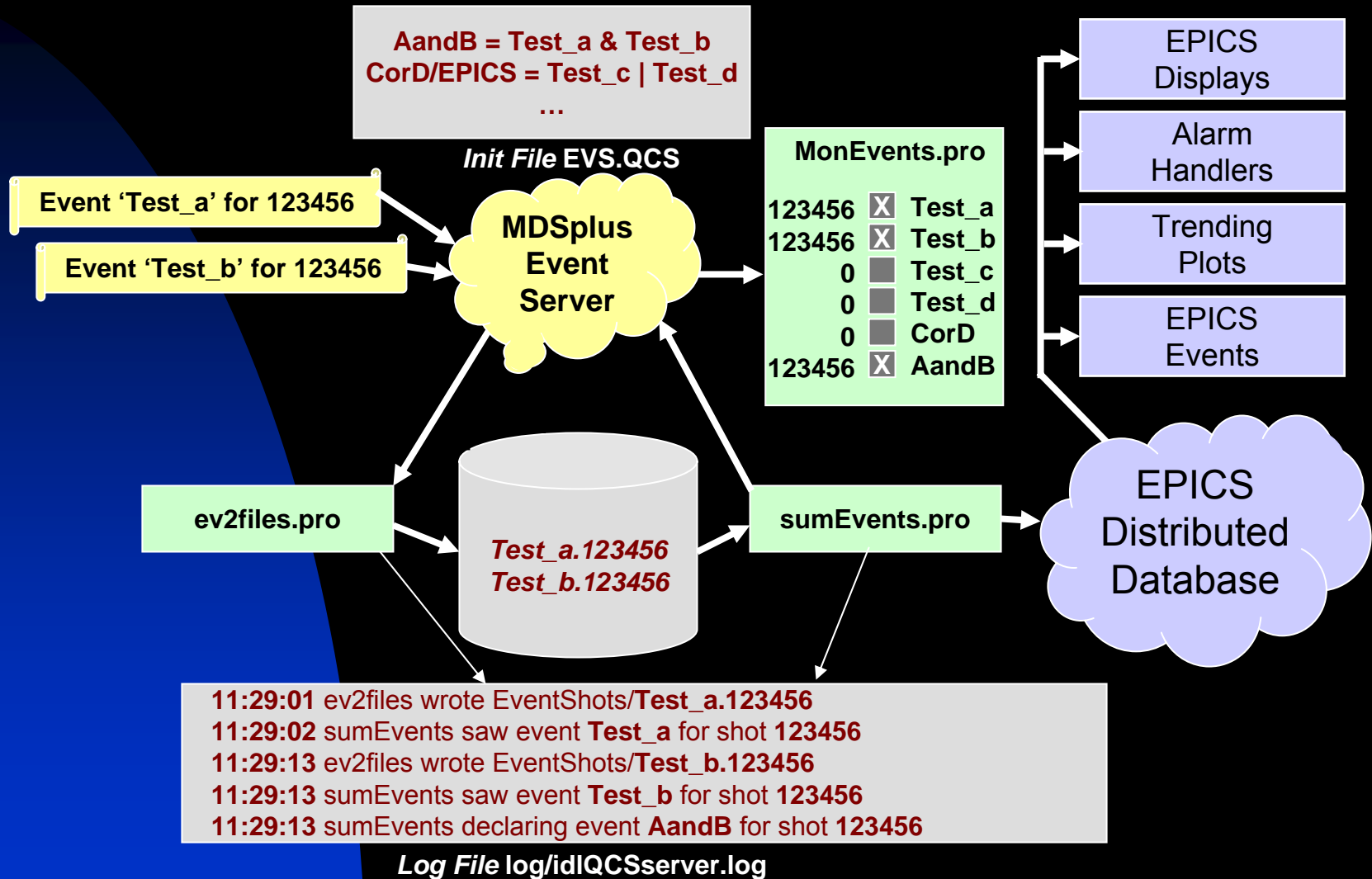
Why an Event-Summation System?

- Some software needs to wait for more than one data set.
- Some software will want to run if either of several events occur.
- We want to communicate MDSplus events to EPICS.
- We want convenient logging and alarming of MDSplus events.

Event-Summation System Features

- Declares composite MDSplus events based on logical AND and OR operations.
- Can manage thousands of events.
- Architecture supports multiple instances, so it can be distributed.
- Written in IDL, so will run on popular operating systems.
- Provides a communications interface with EPICS.

Event-Summation Data Flow



The EPICS display page for three MDSplus events from the Event Summation System.

IOCS1 EVENT: QCS Event Name	QCS Data Value	Wall Time Stamp	Shot TS
Event 100 : TFMON_ACQ_DONE	124288	05/23/07 10:38:16	212

IOCS1 EVENT: QCS Event Name	QCS Data Value	Wall Time Stamp	sec. since last
Event 101 : QCS_TEST	1035	05/23/07 10:35:01	1190
Event 102 : NSTX_EPTST	124288	05/23/07 10:38:16	70

red values indicate an alarm condition.

An EPICS alarm handler display.

The **red** indicates an alarm condition for the QCS_Test Event. A separate window provides alarm response ‘Guidance’ for the operator. e-mails are sent.

The screenshot shows the 'Alarm Handler: OPS' application window. The main interface is divided into two panes. The left pane displays a tree view of alarm categories, with 'OPS' selected and highlighted in red. The right pane shows a list of active alarms, including 'QCS_TEST event' which is also highlighted in red. A modal dialog box titled 'QCS_TEST event Guidance' is overlaid on the main window, displaying the following text: 'EPICS has not received the QCS_TEST (MDSplus) event, which normally comes every 5 minutes. Check QCS (nstxops), MDSplus event server, EPICS IOC 'nstxioc1', EPICS gateway 'epicsgate01', the network.' An 'OK' button is visible at the bottom of the dialog box.

Alarm Handler: OPS

File Action View Setup Help

OPS ▶ G <-----> (0,0,1,0,114)

- SubSystemAlarms ▶ <----->
 - Thermocouples <----->
 - IOC_Status <----->
 - CAMAC ▶ <----->
 - EPICS_1 <----->
 - EPICS_2 <----->
 - EPICS_3 <----->
 - DAS_0_A <----->
 - DAS_1_B <----->
 - DAS_2_C <----->
 - PLC_Status <----->
 - CLOCK <----->
 - Event_Mgr** <-----> (0,0,1,0,2)
 - Data_Acquisition <----->
 - PC_Systems <----->
 - LabVIEW_Web_Server <----->
 - Admin G <----->

ck_evtMon_CALC <----->

QCS_TEST event G <-----> <HIHI,MAJOR>

EPTST Echo event G <----->

QCS_TEST event Guidance

EPICS has not received the QCS_TEST (MDSplus) event, which normally comes every 5 minutes. Check QCS (nstxops), MDSplus event server, EPICS IOC 'nstxioc1', EPICS gateway 'epicsgate01', the network.

OK

Execution Status: Local Active

Mask <CDATL>: <Cancel,Disable,noAck,noackT,noLog>

Group Alarm Counts: (ERROR,INVALID,MAJOR,MINOR,NOALARM)

Channel Alarm Data: <Status,Severity>,<Unack Severity>

Filename: C:\NSTX\epics\alh_files\chAlarm,alhConfig

SilenceOneHour

SilenceCurrent

Silence Forever: Off

Beep Severity: MINOR

Future Plans

- Develop more EPICS intelligent alarm pages
- Enhance the high-event-rate reliability
- To make generally available, we will consider removing the dependency on IDL
- Incorporate into MDSplus distribution?

Summary

- The Event Summation System for MDSplus can declare composite events using logical AND and OR operations.
- It can also relay events to EPICS, so its extensive tool suite can be used.
- We now can develop more automatic responses to “alarming” conditions.

(It would be interesting to see if another site could use this system easily,
Any volunteers?)

Questions?

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References

- [1] MDSplus, <http://www.mdsplus.org/>
- [2] J.A. Stillerman, T.W. Fredian, K.A. Klare, G. Manduchi, MDSplus Data Acquisition System. *Rev. of Sci. Instrum.* 68 (1) January 1997, p. 939.
- [3] <http://nstx.pppl.gov/nstx/Software/TRAVERSER.html>
- [4] EPICS - Experimental Physics and Industrial Control System, <http://www.aps.anl.gov/epics/>
- [5] K.H. Kim, C.J. Ju, M.K. Kim, M.K. Park, J.W. Choi, M.C. Kyum, M. Kwon, the KSTAR Control Team, The KSTAR integrated control system based on EPICS, *Fusion Eng. Des.* 81 (2006), 1829-1833.
- [6] S. Kaye, M. Ono, Y.-K.M.Peng, D.B. Batchelor, M.D. Carter, W. Choe, et al., The Physics Design of the National Spherical Torus Experiment. *Fusion Technology*, 36, July 1999, p. 16, or <http://nstx.pppl.gov/>
- [7] P. Sichta, J. Dong, G. Oliaro, P. Roney, Overview of the NSTX Control System, 8th ICALEPCS – International Conference on Accelerator and Large Experimental Physics and Control Systems, San Jose, CA . (2001)
- [8] W. Davis, P. Roney, T. Carroll, T. Gibney, D. Mastrovito, The use of MDSplus on NSTX at PPPL, *Fusion Eng. Des.* 60 (2002), 247-251.
- [9] D. Mastrovito, W. Davis, J. Dong, , P. Roney, P. Sichta, Integrating EPICS and MDSplus, *Fusion Eng. Des.* 81 (2006), 1847-1851.
- [10] IDL, The Data Visualization & Analysis Platform, <http://www.itvvis.com/idl/>
- [11] http://nstx.pppl.gov/nstx/Software/Programming/pppl_idl_routines.html#CAPUT

Contrasts

EPICS	MDSplus
Interactive & Realtime Control	Control Settings in Hierarchical Data Structure
Continuous Monitoring	Shot-based data acquisition emphasis
Hierarchical Alarming	Events declared upon success
Event-triggered data acquisition	Clock-triggered data acquisition
Mainly used in High-energy physics, telescopes, etc.	Popular in fusion energy research
Rich tool set for creating display pages	Scripting language works throughout

EPICS and MDSplus Comparison on NSTX

	EPICS (Engineering)	MDSplus (Physics)
Digital Points	2500	730
Analog Channels	700	2000
GB Archived/day	0.2	40
Displays	250	2000
Users during run	15	25
Subsystems	19	57

Event System Performance

	# Events handled/sec	% Events missed
Just MDSplus	705	0.00
NSTX requirement	1	0.00
Event Summation	5	0.00
Event Summation	10	0.02
Event Summation	100	0.37
Event Summation	1000	1.50



ck_MEV.db REVISION HISTORY

REV 00 14MAY2007 P. Sichta This file will use a CALCOUT record to receive a value that is passed along with a caput, AND GENERATE A LOCAL epics event. The caput is normally sent by the QCS (an IDL-based event summation system).

REV 01 22MAY2007 PS -Changed record names, added records to alarm on periodic events.

The EPICS graphical database editor with a database for the three test alarms.

