



MICE Status and Plans for Controls and Monitoring with EPICS

Pierrick Hanlet
Illinois Institute of Technology



Outline

- Motivation – The “Need”
- Description
- The Tasks
- The Players
- Selected Tasks
- Summary



The Need

Why?

- Though it's often the last thing we think about when building and commissioning an experiment, "online monitoring" is one of the first things that we complain is insufficiently implemented when we begin commissioning and running an experiment
- MICE, as a precision experiment, requires a tight handle on systematics. In addition to monitoring conditions:
 - operating conditions
 - detector conditions
 - environmental conditions

It is important to record parameters, for documenting trends, etc.



The Need

- All user control confined to MICE control room
- All control systems have uniform interface
- All control systems have uniform start point (Über GUI)
- Two forms of Online Monitoring:
 - Data quality monitoring – plots to verify data
 - Detector/Hardware/Support monitoring:
 - * Environment (temperature, humidity, atm. pressure, etc.)
 - * Infrastructure (voltage, current, flow, pressure, vacuum, etc.)
 - * Detector operation (HV, currents, flows, pressures, etc.)
- Desire alarms to warn shifters
- Desire archiving of parameters to follow trends



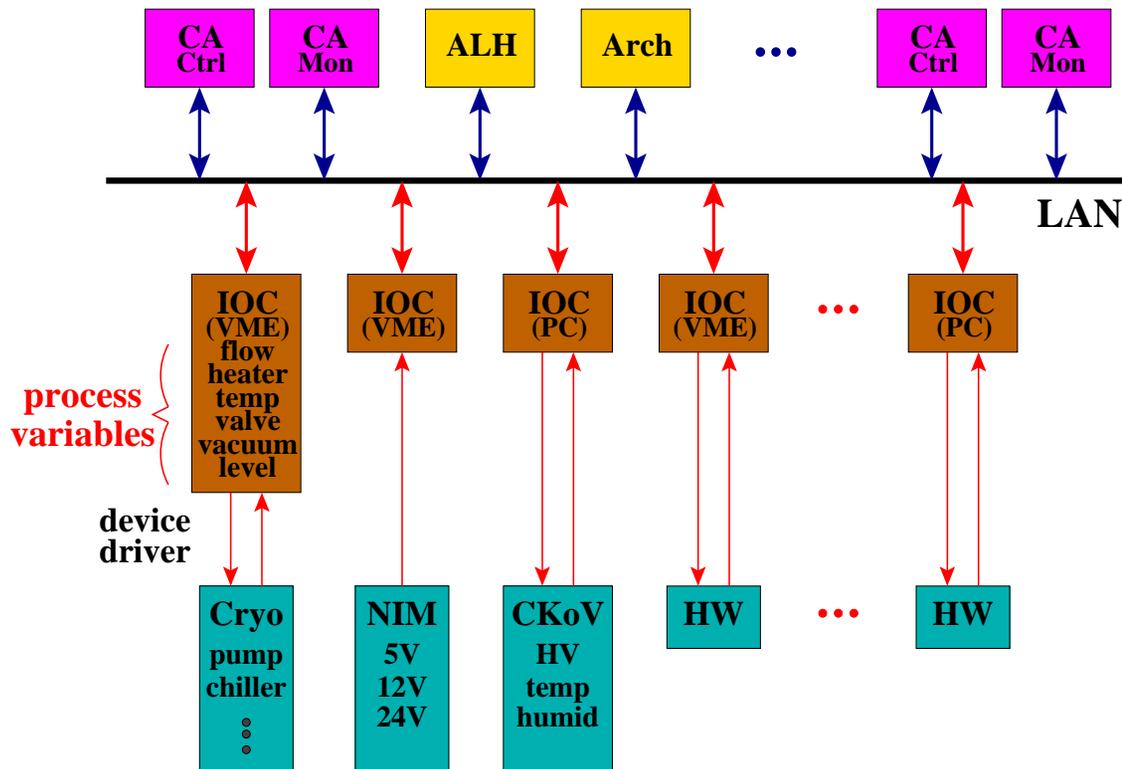
The Need

Why EPICS? (not all exclusive to EPICS)

- already in use for MICE
- allows for uniform operator interface across all subsystems
- mature package (i.e. well debugged)
- large, international community, with lots of support and expertise
- easy to use
- factorable tasks
- it's *free!!!*

How it works:

EPICS is essentially a database with tools to manipulate data. It connects IOCs (input/output controllers – PCs or VME) with CAs (channel access – PCs) via LAN.



- hardware signals are processed (ADCs, etc) and communicated to/from IOCs via device drivers
- signals of interest become process variables (PVs)
- IOCs can further process PVs (calculations, comparisons, etc)
- CAs broadcast request for PVs and a link is established between IOC and CA
- CA can control PVs or read them for displaying



Tasks

- Beamline elements
- Particle ID
- Tracker
- Spectrometer/Cooling Channel Magnets
- Absorber
- RF
- DAQ/Network

C&M Systems Overview

System	Owner	EPICS Developer	EPICS
Target: Drive	Paul Smith; Paul Hodgeson; Chris Booth (UOS)	Adrian Oates; Graham Cox (DL)	Complete for current Target upgraded system.
Target: Controller	Paul Smith (UOS); James Leaver (IC)	James Leaver (IC)	Not yet commenced.
Target: Beam Loss	Paul Smith; Paul Hodgeson (UOS); James Leaver (IC)	Pierrick Hanlet (IIT)	Functionally complete.
Beamline Magnets	Martin Hughes (RAL)	Peter Owens (DL)	Complete, with support req
Pion Decay Solenoid	Mike Courthold (RAL)	Adrian Oates; Graham Cox (DL)	Complete, with support req
FNAL BPMs	Alan Bross (FNAL)	James Leaver (IC)	Complete.
TOF	Maurizio Bonesini (INFN)	Unknown	Unallocated.
CKOV	Lucien Cremaldi; David Sanders (OLEMISS)	Pierrick Hanlet (IIT)	Not yet commenced.
Diffuser	Wing Lau (OU)	Unknown	Unallocated.
Tracker: Spectrometer Solenoids	Steve Virostek (LBNL)	Adrian Oates; Graham Cox (DL)	DL have completed most of require ~£18K of capital and finish the project. Currently
Tracker: B-Field Probes	Frank Filthaut (RUN)	Frank Filthaut (RUN)	Functionally complete.
Tracker: AFEIIts	Alan Bross (FNAL)	James Leaver (IC); Jean-Sebastien Graulich (UNIGE)	Complete, but integration w
Tracker: AFEIIt Infrastructure	Alan Bross (FNAL)	James Leaver (IC)	Thus far, only Wiener PSUs yet commenced. May have
Calorimeter: KL Calorimeter	Virgilio Chimenti (INFN)	Unknown	Unallocated.
Calorimeter: Electron Muon Ranger	A. Blondel; J-S Graulich; V. Verguilor; F. Masciocchi; L. Nicola; R. Bloch; P. Béné; F. Cadoux (UNIGE)	Unknown	Unallocated.
H2 Absorbers: Focus Coils	Wing Lau (OU)	Pierrick Hanlet (IIT)	Not yet commenced, manp
H2 Absorbers: Hydrogen System	Yury Ianyushenkov; Tom Bradshaw (RAL)	Adrian Oates; Graham Cox (DL)	DL have acquired necessary started evaluating PLC syst development, but fully budg
RF Cavities: Coupling Coils	Derun Li; Steve Virostek (LBNL)	Pierrick Hanlet (IIT)	Not yet commenced, manp
RF Cavities: RF System	Andy Moss (ASTeC)	Dimity Tettyleman (LBNL); Adrian Oates; Graham Cox (DL)	Early stages of developmen budgeted/accounted for by
DATE Status	Jean-Sebastien Graulich (UNIGE)	James Leaver (IC); Jean-Sebastien Graulich (UNIGE)	EPICS server + client GUI integration with DATE requir
Network Status	Anyone with a PC/IOC in the MLCR/Hall	James Leaver (IC)	Prototype complete, requir
Infrastructure			
EPICS Alarm Handler	Pierrick Hanlet (IIT)	Pierrick Hanlet (IIT)	Initial version complete (ong
EPICS Channel Archiver	Pierrick Hanlet (IIT)	Pierrick Hanlet (IIT)	Initial version complete (ong
Client application wrapper GUI	Pierrick Hanlet (IIT)	Pierrick Hanlet (IIT)	Not yet commenced.
Remote monitoring	Pierrick Hanlet (IIT)	Pierrick Hanlet (IIT)	Not yet commenced.
Configuration database	David Forrest (UofG)	Pierrick Hanlet (IIT); James Leaver (IC)	Not yet commenced.



The Players

- James Leaver (Imperial College) – head of C&M group
focus - channel access
- Pierrick Hanlet (IIT)
focus – IOCs
- Daresbury Lab (essentially contracted)
LOTS of expertise

Unassigned Control Systems

- Following systems have no allocated C&M effort
 - Time of Flight System
 - Diffuser
 - Calorimeter: KL Calorimeter
 - Calorimeter: Electron Muon Ranger
- Currently investigating system requirements
- Need to find additional resources within the MICE core
 - MOG operating at full capacity & no funds for DL to undertake projects
 - Expect those responsible for each system will be required to implement corresponding EPICS controls
 - Possibility of assistance from FNAL Controls Group (to be discussed)



Selected Tasks: Alarm Handler & Channel Archiver

- EPICS Alarm Handler (ALH) is a type of Channel Access
- Each PV (Process Variable) has fields for alarm limits
 - Minor Alarms – warning
 - Major Alarms – failure
 - No Connection (white)
- ALH displays PV names, color indicates alarm state
- ALH can be used to access specific monitoring GUIs
- ALH sounds audible alarm for major alarms
- EPICS Archiver is a type of Channel Access
- Select subset of monitored PVs for archiving
- Select PV monitoring/scanning rate to write to disk
- Data will be remotely retrievable via web browser (other methods also available)



Alarm Handler: Full Screen Shot

The screenshot displays the Alarm Handler interface with several windows:

- Alarm Handler: BeamLine Elements:** A tree view of beamline components including ISIS, Target, Quadrupoles (Q1-Q6), Magnets (Q7-Q9), Dipoles (D1, D2), Decay Solenoid, and Beam Stop.
- epics@micecserv:~/Software/epics/Config/opi/edl - Shell - Konsole:** A terminal window showing session logs with timestamps and session names.
- epics@micecserv:~/Software/han/let/Archiver - Shell - Konsole <2>:** A terminal window showing archiver logs with timestamps and session IDs.
- BeamLine.edl:** A control panel for magnets Q7, Q8, and Q9, showing status (On/Off), set values, read values, and interlocks. A yellow 'EXIT' button is visible.



Alarm Handler: Status & Plans

Successes:

- ALH is installed on micecserv
- Tested with selected beamline magnets
- Tested Major/Minor alarms to 0.1 A

To Do (short term):

- Fix DNS on micecserv
- Connect water flow and ΔT
- Change magnet limit calculations
- Retest all beamline magnets (with audible alarm)

To Do (long term):

- Continue to add devices as they come online



Archiver: Magnets

Group Info - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost:4812/group/BeamLine Magnets

EPICS - Experimental Physic... Google Group Info

Group Info

Group

Name BeamLine Magnets

Channels

Name	State	Mechanism	Disabling	State
MICE-PC-MQ-01:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MQ-02:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MQ-03:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MD-01:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MD-02:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MQ-04:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MQ-05:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MQ-06:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MQ-07:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MQ-08:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled
MICE-PC-MQ-09:I	connected	Monitored, max period 10.0 s, PV CONNECTED, CA Connected		enabled

[-Main- -Groups- -Config-](#)

(Status for 05/29/2009 16:57:13. Use *Reload* from the Browser's menu for updates)

Done



Archiver: Status & Plans

Successes:

- Channel Archiver is installed on micecserv
- Tested with all conventional beamline magnets
- Archiving only magnets currents
- Installed (testing in progress) java viewer

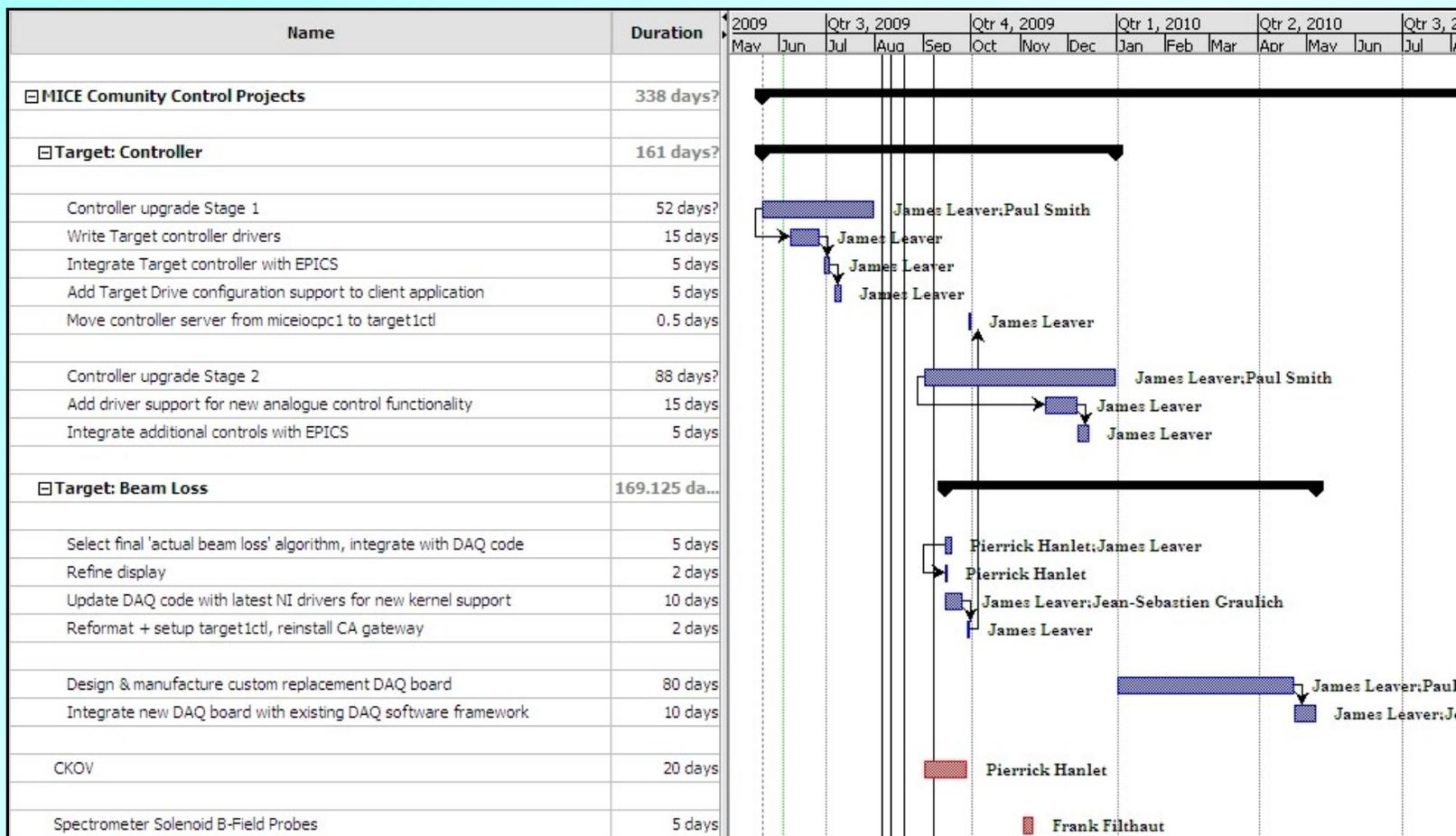
To Do (short term):

- Tune monitoring rate for beamline magnet currents
- Complete java viewer testing
- Learn/Develop web based access – raw data → graphs

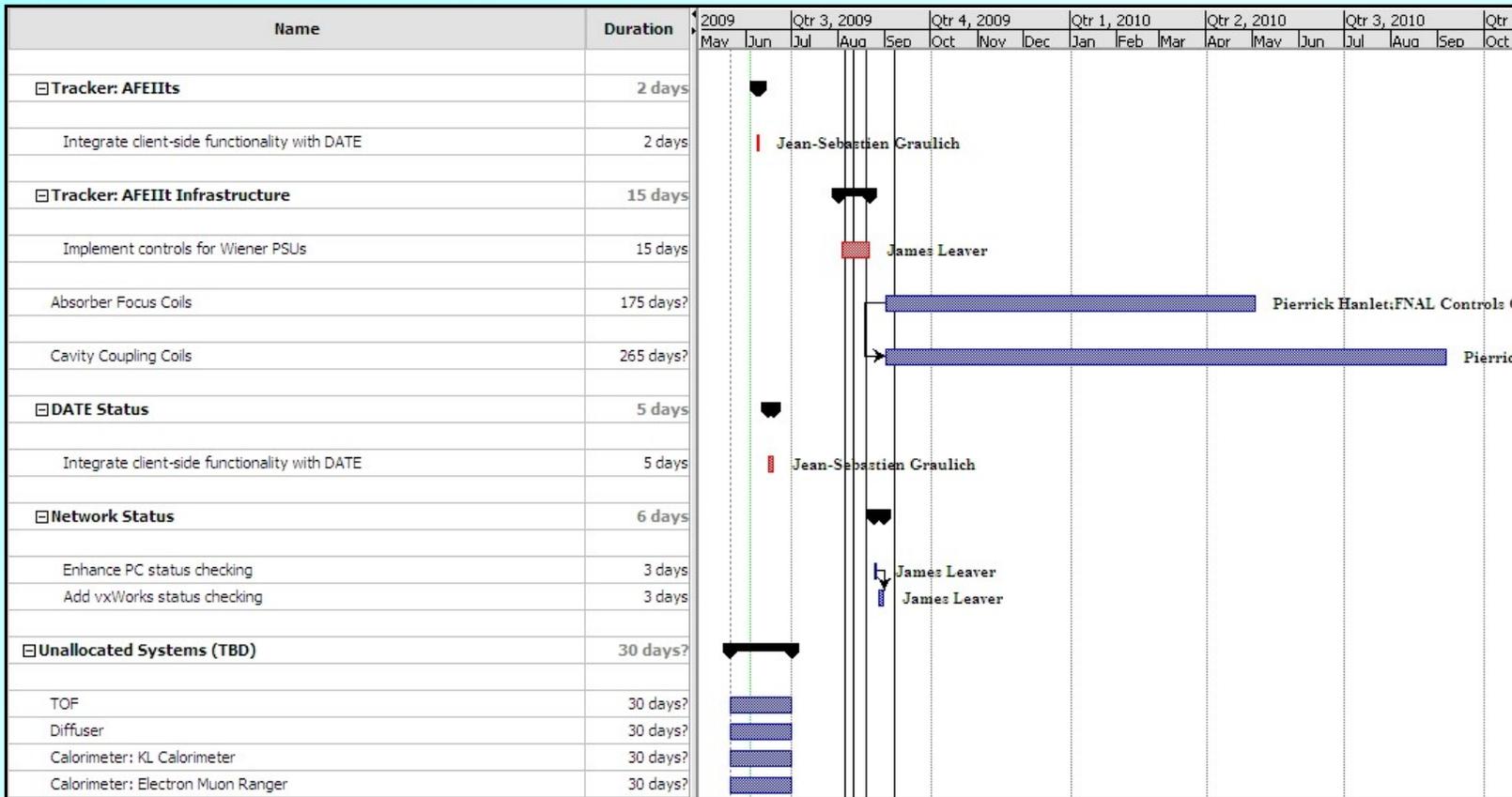
To Do (long term):

- Continue to add devices as they come online

Schedule



Schedule





Summary

- Many Controls and Monitoring systems are up and running
- EPICS is a clear choice for uniform controls and monitoring
- Small, dedicated group
- Alarm Handler and Channel Archiver working and tested
- Many Controls and Monitoring systems yet to be started
- Small group