EPICS at MIT Bates

T.Zwart, D. Cheever, X. Geng, S.Krause, B. McAllister,
D. Maher, K. Murphy
(One software Engineer!)

Machine is running well

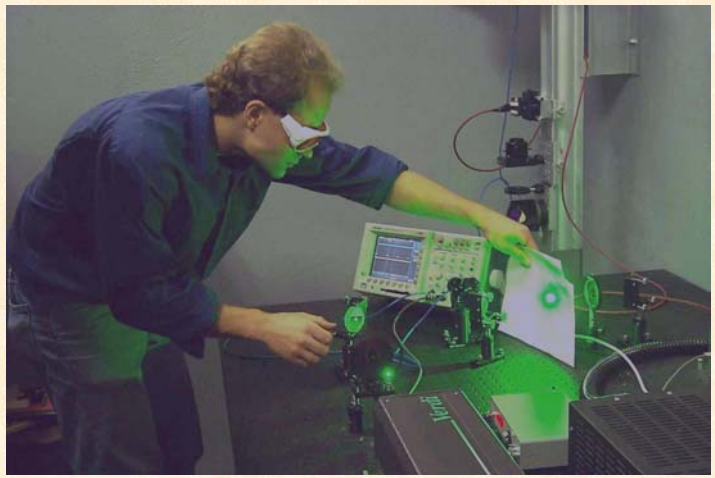
"A new controls system on an older machine can be a beautiful thing"

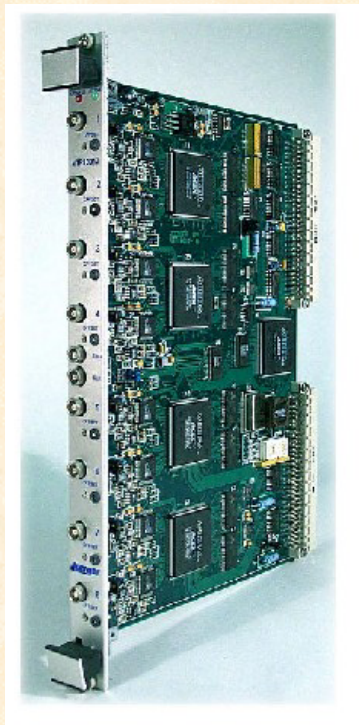
System Integration
Reproducibilty → **Thanks to EPICS**
Notification (Alarms)
High level Tools
Automation

- **9300 Records, 3600 I/O points, 500 MEDM screens**
- **20 IOC's - EPICS 3.13.4, vxWorks 5.3, Linux PC @ each IOC**
  - **Includes Three Detector Group IOC's**
  - **~6 Development IOC's**
  - **MVME 167, 177 Processors (No PowerPC yet, not mission critical)**
  - **Uninterruptible Power Sources on all IOC's, network switches and server**
- **75% of I/O on EPICS**
- **Power failure recovery in < 12 Hrs (Prior to EPICS integration → 3 days)**
- **Operations driven software**

Compton Polarimeter IOC

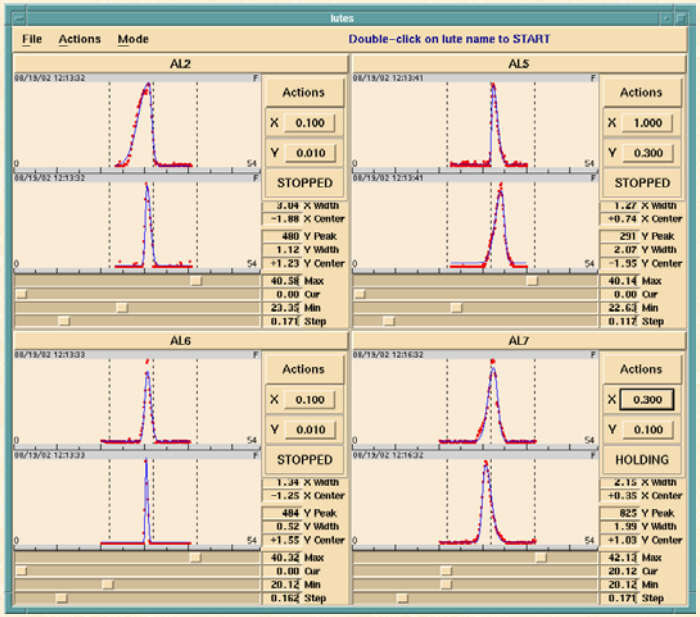
W. Franklin, T. Akdogan, D. Dutta





- **MVME 177**
- **Joerger 100 MHz ADC, 12 bits, 2MB memory**
  - **Thanks to Marty Kraimer for Device Support**
  - **CW asynchronous acquisition**
  - **Maximum ~200 kHz x 16 samples x 2 Bytes/sample = 6.4 MB/sec**
- **Block transfers to from ADC to Processor for data reduction**
- **Approaching rate limit from VME bus transfer speed!**

Functional Applications



Wire Scanners (B. McAllister)

~~Homemade Ring Control System (RCS)~~

~~SPARC Single Board~~ Proc

~~Homemade VME: Stepper Motor Control~~

~~Amplifier Gain Control~~

MVME 167 application
Xycom VME Digital IO
OMS VME Motor control
EPICS sequencer

Steerer/BPM Correlation

Recirculator 2nd Pass BPMS

Duplicated ADC Channels (x10)

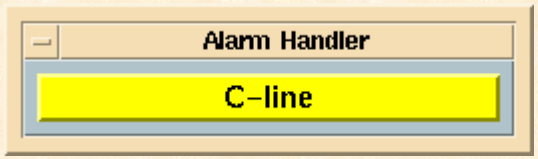
Software Identical

Alarm Handler

"Tell me about it, but don't cry wolf!"

- Must Distinguish between acceptable drift, noise, tuning changes and hardware failures

"The Krause Red vs. Yellow Convention"



DAC Tuning Alarm
Magnet Hysterisis Cycle

Hardware Failure
DAC vs. ADC

- OPS classifies a device in a binary way - working or broken
- It can be difficult to determine if a device is functional if it is off
  →Non-interfering check-out sequencer
- DAC vs. ADC alarms for Hardware failures (Windows between 1 - 0.01%)
  Requires better calibration
- Alarm Handler Classifications (Tuning, Electrical, Water...)

The Bitbus Problem

~ 250 Power Supplies on BitBus network (PEP II)

- No replacement VME cards
- Homemade Digital Interface at each PS
- Asynchronous control only
- Obsolete components
- "Slow"
- Ungraceful Power Failure Recovery

Exploring New Solution

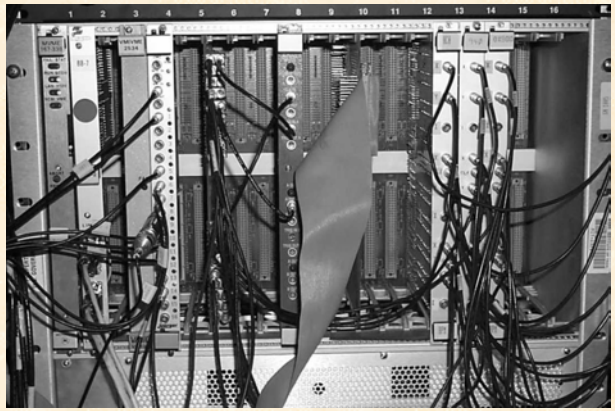
Standard Ethernet Interface on PC or VME based IOC

Industry standard microcontroller @ each power supply

- Synchro Systems (Charles Cox)
- In House Hardware frontend, DAC's, ADC's Digital I/O, CLK, etc

We are looking to cooperate with other institutions in a common design

Controls Cost Topology



Linear Facility Scaling

200 m Linac + 200 m Ring + Extra = 500 m Facility

20 IOCS → One IOC every 25 m → 100 ft Cable Runs

Cost/Channel (400 Signals in Crate.)

Processor	**6K$/400**	**15$**
Crate	**2K$/400**	**5$**
DAQ Card	**2K$/20**	**100$**
Cable	**0.5$*100**	**50$**

~170$/Channel

So we want…

More, Better, Cheaper IOC's

Linux IOC Development

D. Loughnan

Red Hat 7.3 on Pentium PC

Nat'l Instruments PCI card
COMEDI Driver

EPICS device support (Function calls)

+ **No VME**
+ **No vxWorks**
+ **Low Cost**

? **Reboot Properties**
? **Reliability**
? **What are the problems**