# E961(COUPP) Video, Trigger, & DAQ for 60 Kg

## Goal - make the world's most boring movie

Photograph a well illuminated, sensitive, bubble chamber at ~100Hz with VGA resolution (480X640) BW cameras.

Declare a trigger when an image changes (>5 pixels with $|\Delta|>15/256$ adc counts)
Combine & manage triggers from cameras, pressure controller, operator
Request a chamber compression for each trigger.

Record trigger data - 10 300kb bit map images/camera + state and other data ~10Mb/trigger. Analyze events as taken for monitoring purposes.

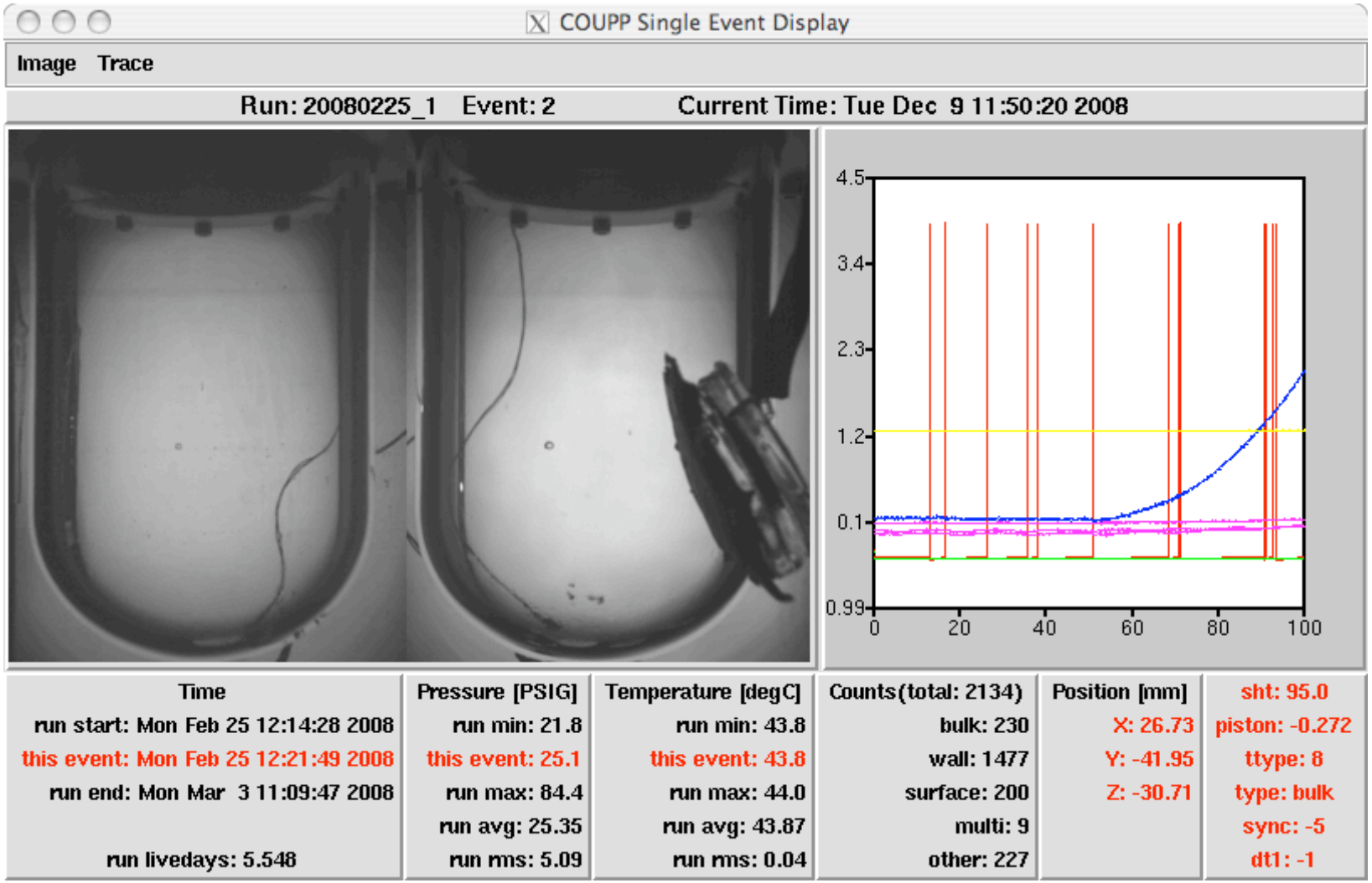
DAQ Parameters

| | | |
|---|---|---|
| Trigger rate | 100-5000/day | {high rate for source testing} |
| Trigger deadtime | 30 seconds | {chamber recompression settling time} |
| time resolution | ~10 msec | {time between images} |

Provide a user interface for monitoring, control and DAQ

Robust, stand alone, remote operations via the network. Gracefully survive power and network outages without treks to the North Woods.

# An Event




Steve Brice's Single Event Display prototype

Please ignore the UFO - the speaker to test the acoustic sensors broke free

# Parts and Players

## Components

Lighting - LED array + diffuser in compression fluid

Cameras - Basler Excite (Linux onboard) image difference video trigger

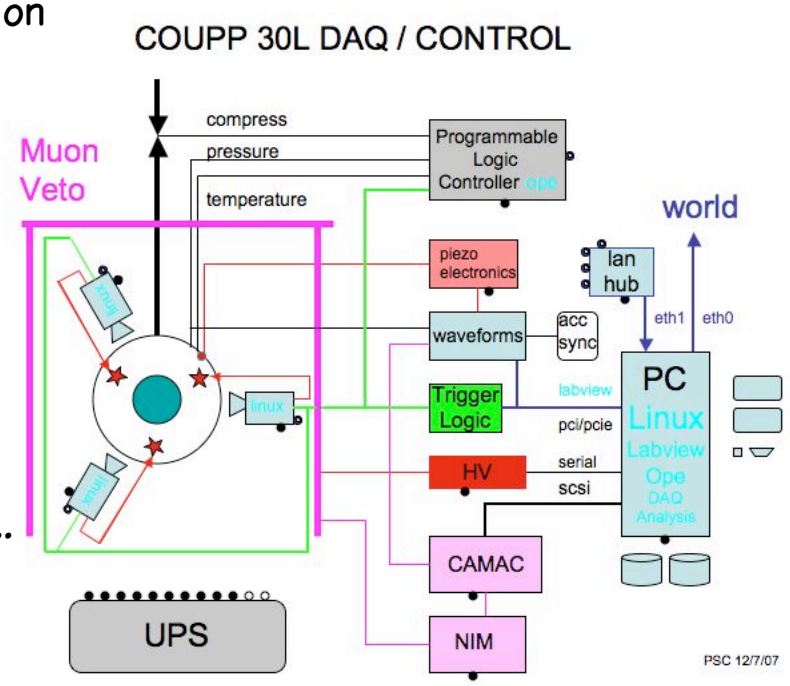
Logic - power cameras and lighting combine all trigger sources master camera clock

PLC - control pressure cycle, handle state data (P, T, etc.)

Muon Veto - 12 PMTs 5 Hz/tube, DAQ TBD

Computer - Linux servers for data, network …

Labview - waveforms and user interface




## Team

Lighting - Martin Hu (Coupp/AD)

Cameras - Dan Broemmelsiek (Coupp/AD) psc (Coupp/CD)

Logic - Rick Kwarciany (CD) , Greg Deuerling (CD)

PLC - Rich Schmitt et.al. (PPD)

Computer - psc (Coupp/CD), Jason Ormes(CD)

Coordination - psc (Coupp/CD)

# Lighting

## Milestones

Prototype built March 2008
installed and operating in pressure vessel July 2008

Construction Final lighting grid November 2008
diffuser ~now

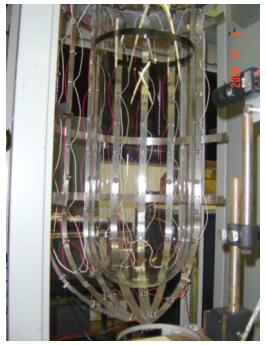
Installation major reason for present shutdown/drain

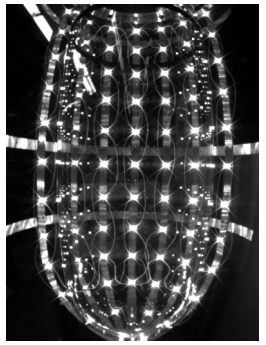
## TBD

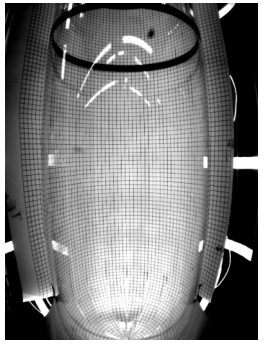
Integration with cameras and trigger/power supply …

## Manpower

~10% physicist + technician support







# Cameras

## Milestones

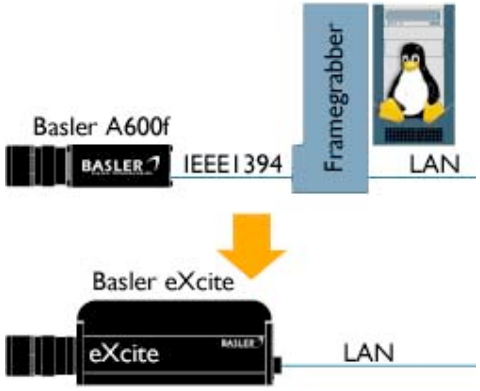
Acquisition 5 camera bought previously - need 2
Prototyping images/optics identical to old cameras
model video triggers work
trigger line software tested

Networking Basler client/server model under test
NFS has been tested and works too

Mount Design just completed
In fabrication now. Due end December


## TBD

Installation awaiting camera mount and chamber refill
Integration this winter



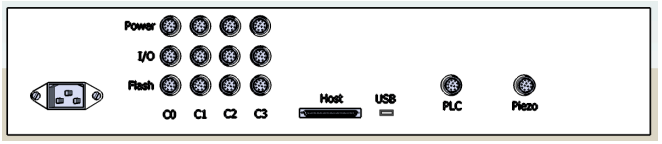

## Manpower

<10% 2 physicists - more for integration

# Logic

## Modules

| | |
|---|---|
| CTIC | Coupp Trigger Interface Controller |
| CLIM | LED Power supply |


## Milestones

| | |
|---|---|
| Design | completed and reviewed October |
| Boards | layout done, arrive Friday 12/12 |
| Assembly | before Xmas |
| Testing | January 2009 |
| V2 | May 2009 if second version required |

## TBD

Integration with cameras and trigger/power supply (winter)

## Manpower

Engineering from CD/ESE (RK & GD)

# Labview and other Programing

## Milestones

Prototype  Labview under Linux since early 2008
Running PLC pressure controller in PAB now

Hardware  Final configuration fixed November 2008
Acquire PXI crate and spare modules (now)
integrate on wh9e development system

Installation in PAB for integration (winter)

## TBD

Integration with cameras and trigger/power supply
Higher level coding  for final DAQ/control system

## Manpower

~10% physicist + technician support
More for integration this coming winter

# Computer

## Milestones

Prototype 4 large systems installed December 2007
8 2GHz CPUs, 1.5Tb disk, 4Gb memory
2 ethernets, 12 Fans, rack mount
(I ain't going to the North Woods in January!)
COUPP server, Teststand, 30l, uncommitted

Software FNAL Scientific Linux
going to v5.2 for camera development platform
PLC database (OPE)
Labview made to work

Hardware commission Labview PXI crate

## TBD

Integration with cameras and trigger/power supply

## Manpower

~10% physicist + system support, some more for Integration

# Bigger Chambers

## Design Criteria

Mainly conventional commerical technologies

Minimum number of components (CTIC instead of NIM and power bricks)

We want a 1 rack, low power (UPS-able), system for remote underground operations.

Overkill wherever possible. No stress on DAQ system parameters

The approach to bandwidth saturation of firewire for the dumb Basler cameraa lead us to the smart cameras.

## A 500 Kg Chamber?

We might need up to 8 cameras for a chamber this big.

So? Add 6 more cameras to the LAN we have now - same software
Daisy chain 2 or 3 CTICs for trigger managment,
Add more LED power if necessary
Add Labview cards for more Muon and acoustic signals

and the present system will do this job.

# Questions ?