

# Epics Video Applications



Matthew Pearson  
Diamond Light Source

26/4/07

Matthew Pearson - Epics Video  
Applications



- NSLS (USA) Status
  - Performance measurements using Flea cameras over channel access. RTEMS/VME5500. Kate Feng.
- SLS (Switzerland) Status
  - Linux system using open source driver. Miroslaw Dach.
- CLS (Canada) Status
  - Using system based on SLS driver. Elder Matias
- ASP (Australia) Status
  - Richard Farnsworth.
- DLS (UK) Status and Plans.
  - Machine/beamline status.
  - Ideas for phase II beamlines.

# NSLS

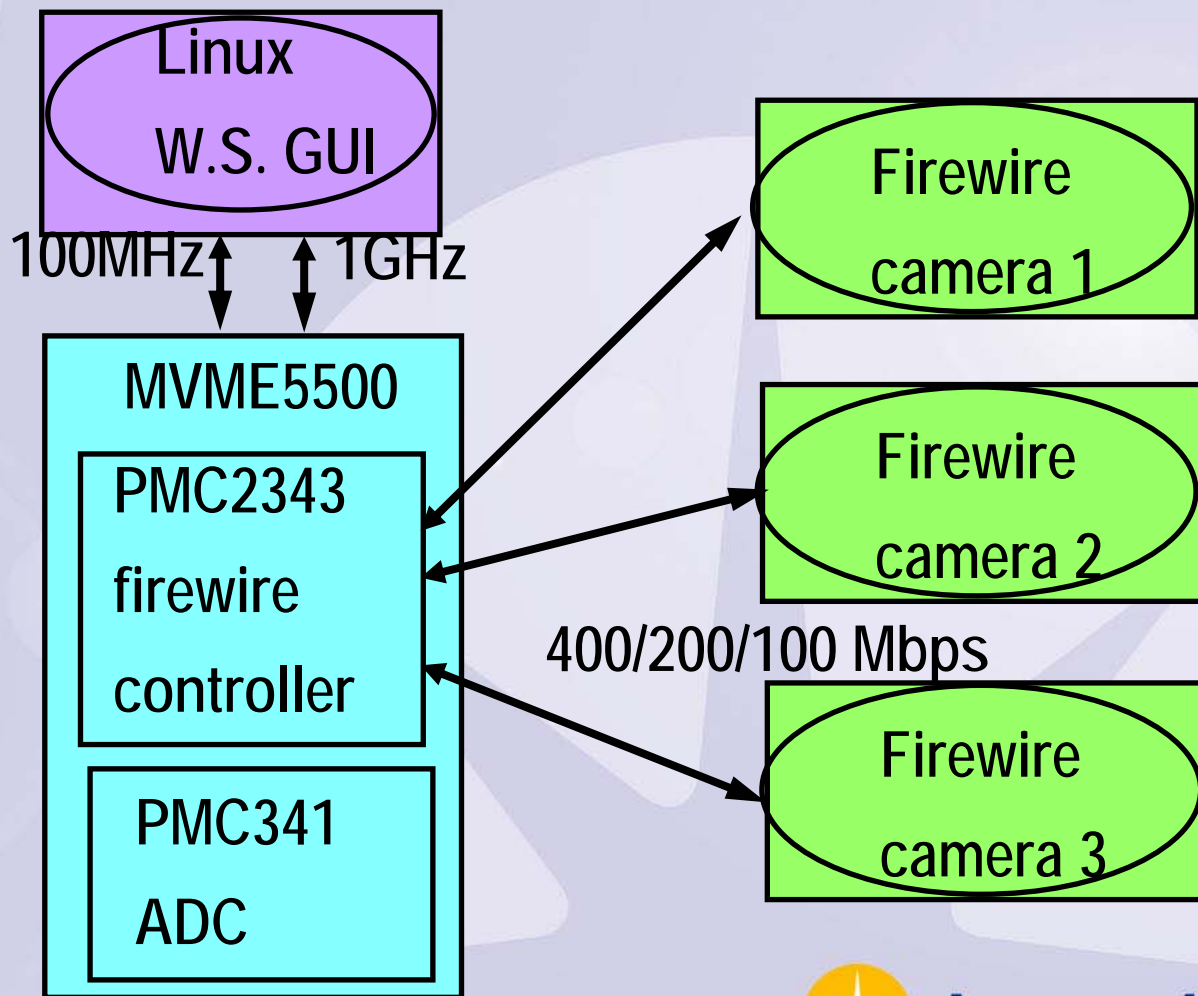
Set-up:

RTEMS-4.6.x-MVME5500

SBS 2343 Firewire A  
adapter card.

Performance achieved:

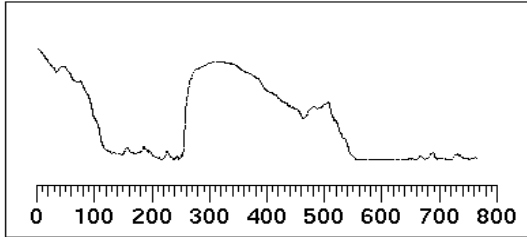
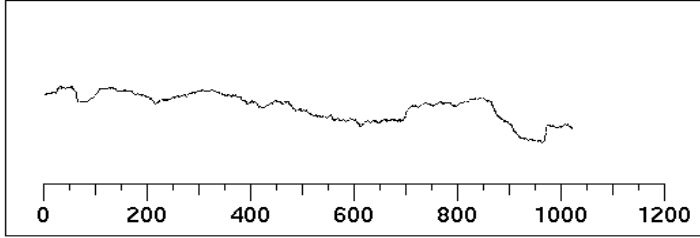

1024\*768\*8bit@30Hz



# NSLS

/home/feng/Mr1394/Rx-y/Mr1394App/opi/edl/Mr1394.edl

Number of Cameras:	1
Vendor:	Point Grey Research
Model:	Flea FLEA-HIBW
Gain:	0
Format:	1
Set Format:	0
Mode:	5
Set mode:	0
Available Format, Mode:	7,2 7,1 7,0 1,7 1,6 1,5
Formats/modes	1
Frame Width:	1024
set frame width:	0
Frame Max Width:	1024
Frame Width offset:	0
Frame set width offset:	0
Frame Height:	768
set frame height:	0
Frame Max Height:	768
Frame Height offset:	0
Frame Set Height offset:	0
Frame Size:	786432
Min Frame Rate:	1.88
Max Frame Rate:	240.00
Frame Rate:	0.00
Set Framerate	30.00
Brightness:	0.00
Set Brightness	0
X max	84270.00
X average	55807.50
X width	273.00
X Position	402.00
Y max	215692.00
Y average	74410.12
Y width	273.00
Y position	246.00



See: <http://www.nsls.bnl.gov/facility/expsys/software/EPICS/>

# SLS



1394a



Ethernet



EPICS 3.14.7 / HTTP Server

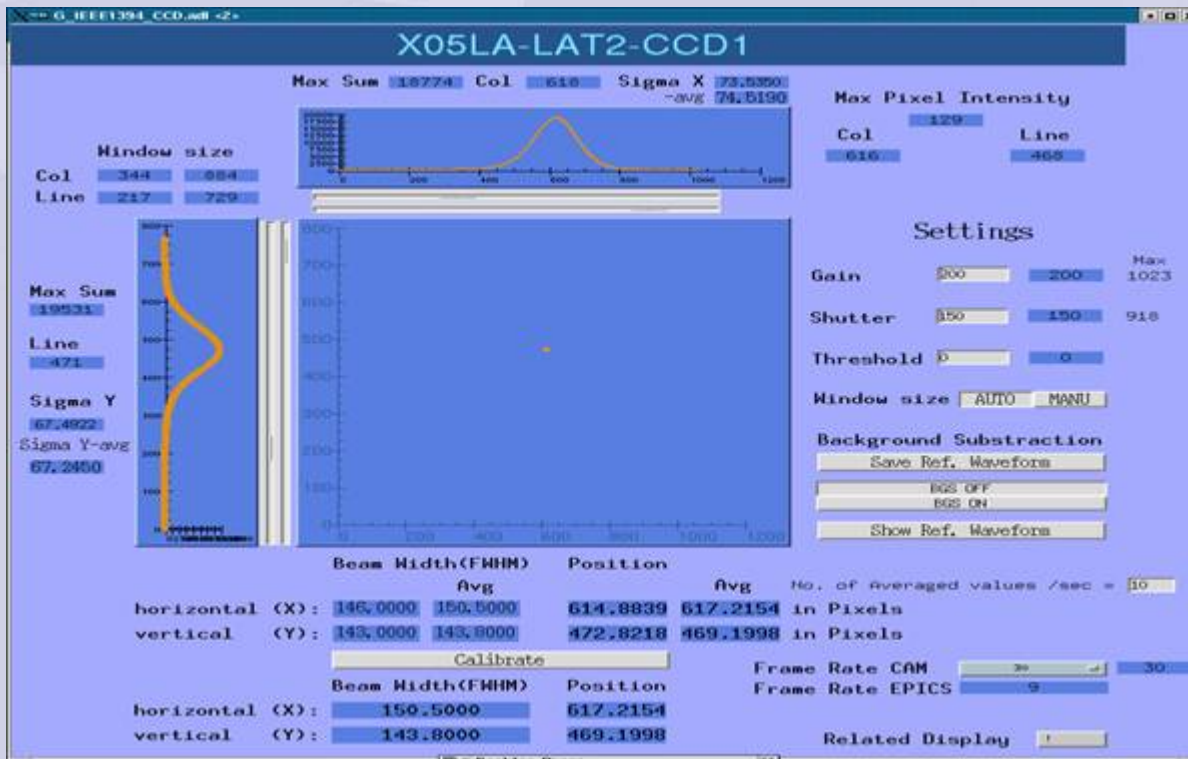
libdc1394  
libraw1394

2.6.9 (Scientific Linux 4)  
1394 built in

Interface Card

# SLS

Server performs on-line centroid finding algorithm, background subtractions, averaging (i.e. improves signal-to-noise ratio), maximum pixel intensity, standard deviation.



Driver is DCAM open source.

~10Hz image processing

Can also switch to using HTTP for visualization. Images can be jpeg compressed.

See: <http://epics.web.psi.ch/software/firewire> (can download Epics driver)

# CLS

- Using SLS Epics driver with Flea/Flea 2 and Sony DFW-SX-900 cameras.
- Exporting waveform data into Matlab for image processing.
- Used on several beamlines. Plan to use on machine.

Current set-up is similar to SLS:

Epics ver: 3.14.6

Linux (2.6.9): Scientific Linux

ccd1394-1.2.tar.gz (from SLS website)

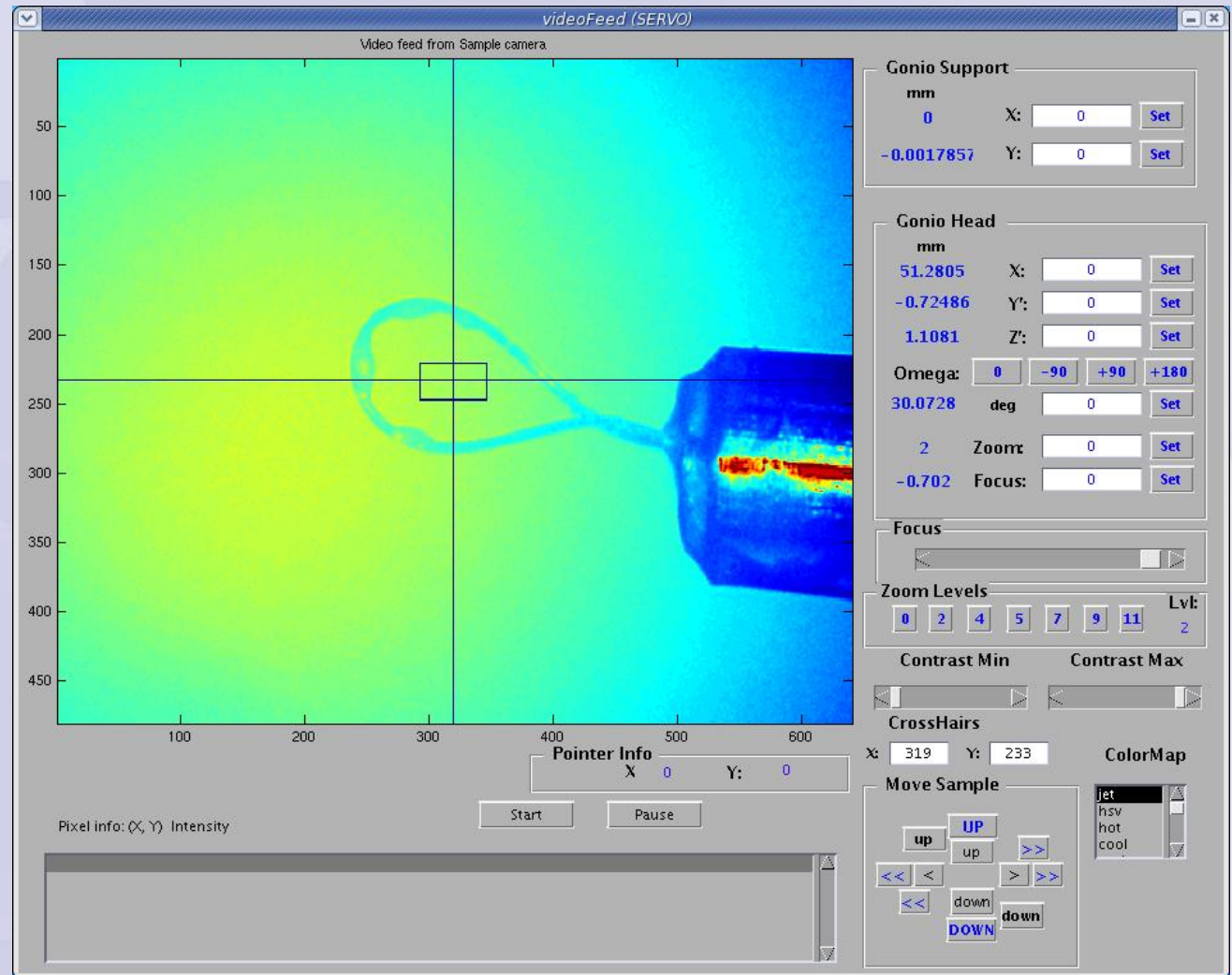
1394 card: variety OHCI compliant.

Also developed Java client (see other talk by Elder)

# CLS

Sample viewing  
& centering  
on PX  
Beamline.

Uses matlab  
CA library.





# ASP

Flea Camera  
used on  
diagnostic  
Beamline

AS Borland  
Delphi  
App



Camera Display - SR10BM02CCD01

General

Camera: SR10BM02CCD01 SR10BM02CCD01

EUID: 49712223527703902

Iso Transmission: on ON

Counter: 96025 Frames

Bytes / Pixel: 1 Bytes

Trigger

Trigger Mode: TRIGGER\_MODE\_0 TRIGGER\_MODE\_0

Trigger On/Off: on on

Trigger Delay: 1090 msec

Frame rate: 1.875 1.875

Control

Mode: 1024x768\_MON08

Shutter: 500 msec 500 A

Shutter Mode: MANUAL MANUAL

Gain: 400 dB 400 A

Gain Mode: MANUAL MANUAL

Exposure: 400 msec 400 A

Exposure Mode: MANUAL MANUAL

Brightness: 0 0 A

Brightness Mode: MANUAL MANUAL

Low Threshold: 2 2 A

Size/Offsets

Width: 1024 Pixels 1024 A

Height: 768 Pixels 768 A

Width Offset: 0 Pixels 0 A

Height Offset: 0 Pixels 0 A

Miscellaneous

Hor Beam Posn: 534.4  Detach Image

Vert Beam Posn: 250.4  Display Grid

Sigma Horizontal: 0.0000  Display Beam Position

Sigma Vertical: 116.5106

The screenshot shows the 'X-Ray Diagnostic Beamline' control window. It features a menu bar with 'Vacuum', 'Magnets & PS', 'Diagnostics', 'Timing', and 'Miscellaneous'. The main interface is divided into several sections:

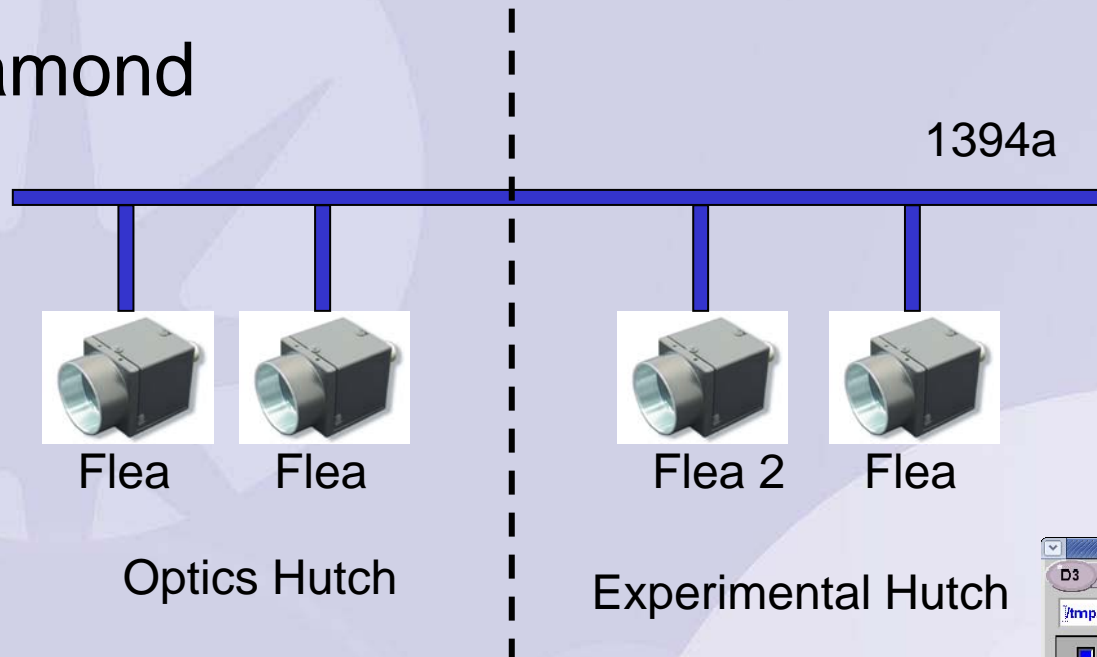
- Set Filter Position:** Includes a 'No Command' button, a dropdown menu set to 'No Command', and a 'Camera' button.
- Status:** A vertical stack of status indicators: 'Not Active', 'Not Active', 'Negative Direction', 'Done', 'No', 'Not Moving', and 'Not in Closed Loop'.
- Flow Rate:** Shows 'Ok' status and a flow rate of '6.10 l/min'.
- Sub-Image:** Displays a camera view of a blue spot on a black background. Parameters include:
  - X Offset: -4.6  $\mu\text{m}$
  - Y Offset: 12.0  $\mu\text{m}$
  - X Size: 348.6  $\mu\text{m}$
  - Y Size: 288.8  $\mu\text{m}$
  - X Origin: 64.0 pixels
  - Y Origin: 64.0 pixels
- Sub-Image : Region of Interest:** A table for defining a region of interest:

Parameter	Value	Input	Action
X Start	306 pixels	306	A
Y Start	184 pixels	184	A
X Size	256 pixels	256	A
Y Size	256 pixels	256	A

Used Gensub record to extract a region of interest to create a 16K waveform record

Also check out the Facility Status monitor at <http://www.synchrotron.com.au>

# Diamond



VME firewire Receiver  
VxWorks  
Epics 3.14.8.2

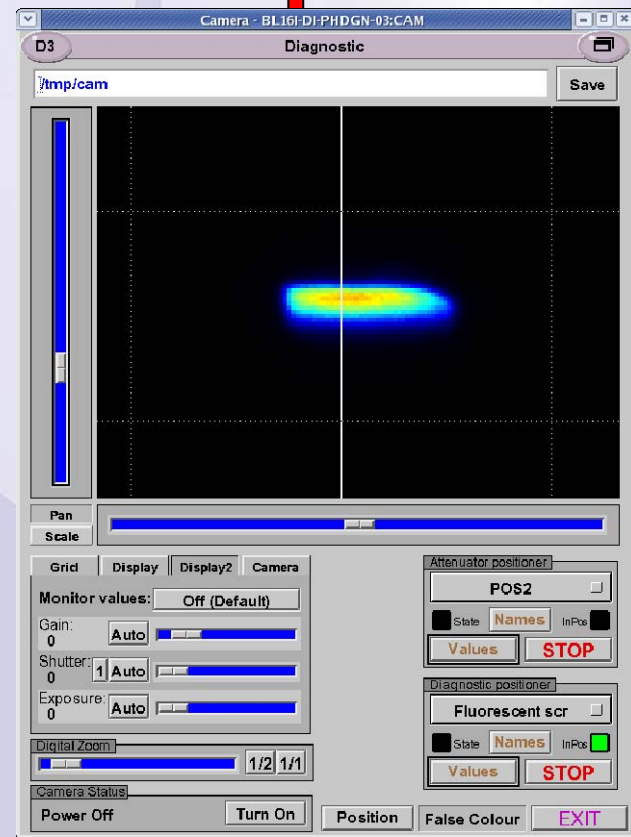
Mindready VME PMC firewire Card + driver licence (~£1200)

EPICS driver written by Steve Hunt.

Set up on 5 beamlines so far. Being deployed on phase II beamlines with some modifications.

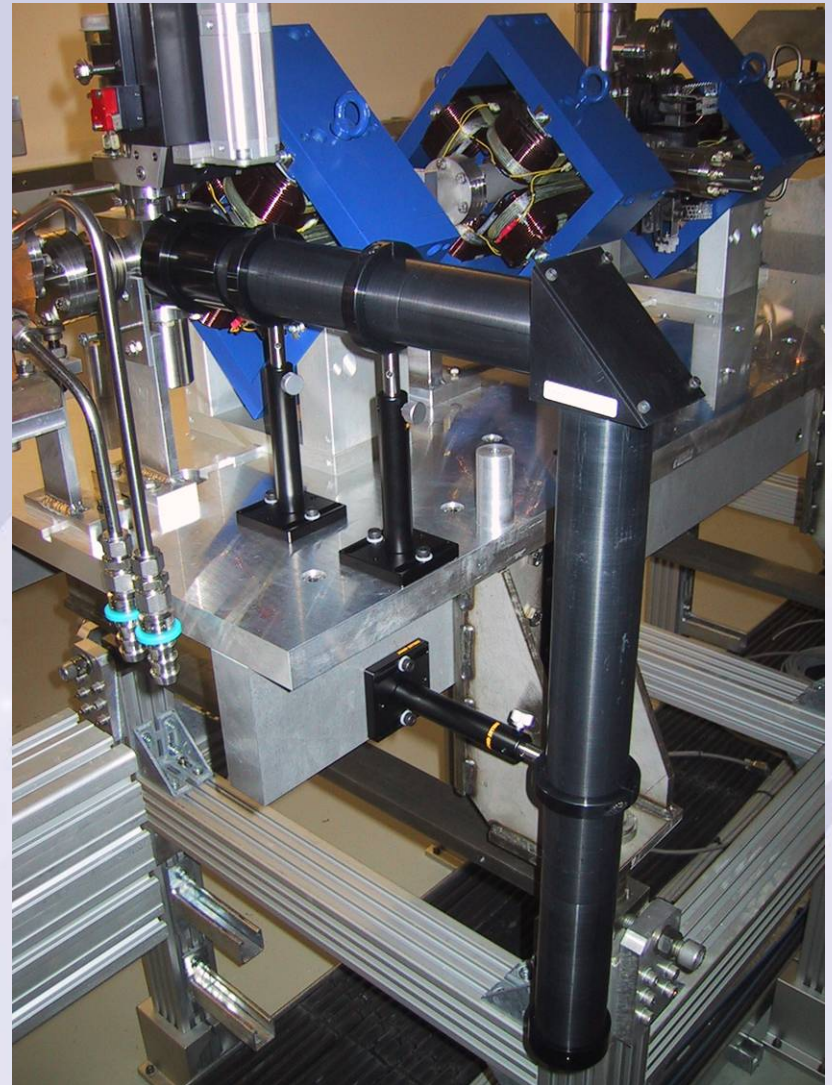
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# Diamond

## Machine diagnostics

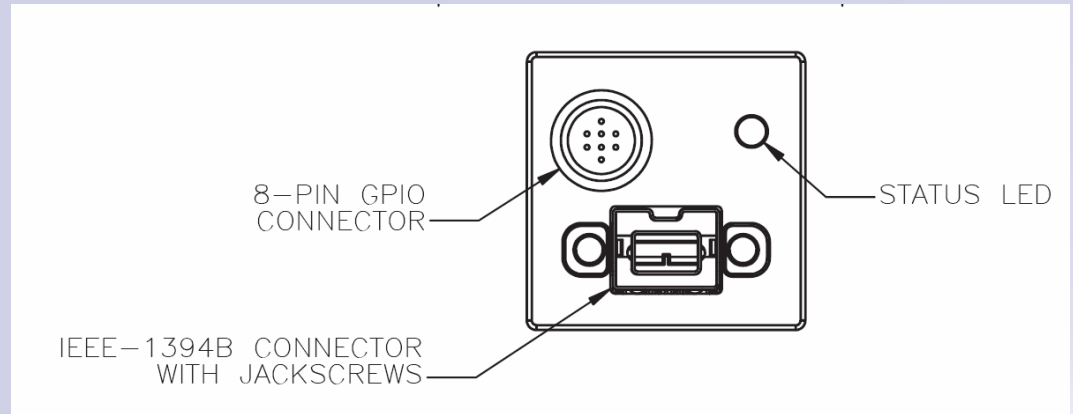


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# Diamond – Plans

- Move to Flea 2 and 1394B cables.
- Improve cabling layout on beamlines.
- Better repeaters (are testing AVT 4-port 1394B industrial repeater).
- Long term plan to move to GigE cameras. Cameras are starting to appear (have tested Pulnix TMC1405 colour). True plug&play! (?)
- No concrete software plans yet. Are investigating using RTP for video transport and using compression. Have developed an RTP server which supports any DCAM firewire camera (Flea/Flea2/AVT Oscar colour). No Epics integration as yet.



# Acknowledgements

Kate Feng - NSLS,  
Miroslaw Dach - SLS,  
Elder Matias – CLS,  
Richard Farnsworth – ASP,  
Mark Heron, Guenther Rehm - DLS

# Additional Slides

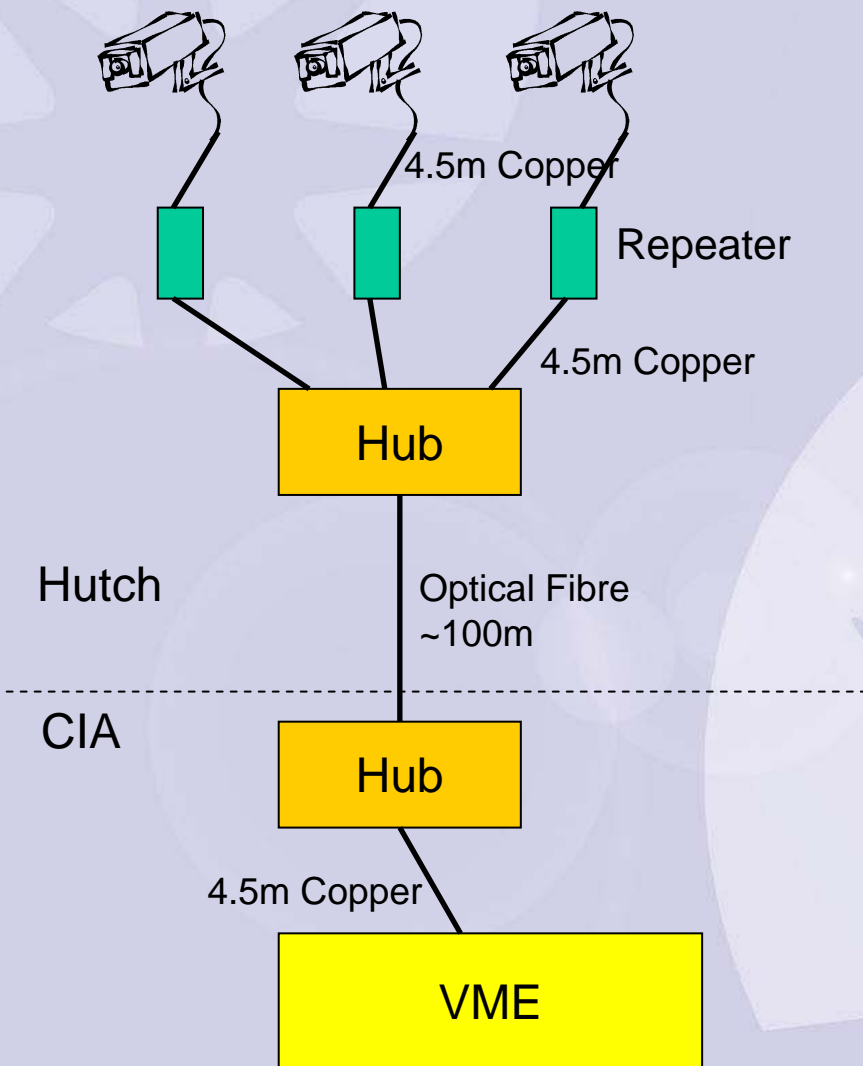
26/4/07

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## Solution 1:

### Firewire B cameras, cables and repeaters



Identical set-up for every hutch.  
VME can take two inputs.

#### Pros:

- Fully Firewire B chain
- Upgradeable at the VME end.
- Very long optical cable length.

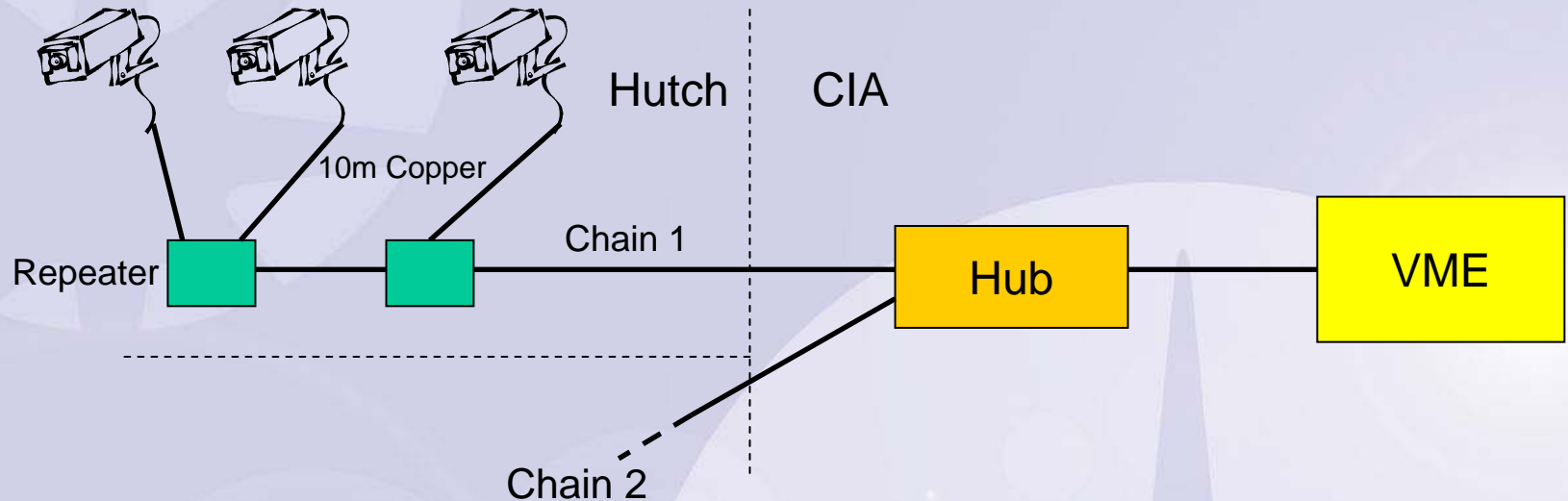
#### Cons:

- Short Firewire cables need repeaters.
- Cannot chain Firewire B all the way back to CIA, so need optical fibre.
- Hubs are ~£800 each.
- If 3 hutch (eg. I15), need another VME readout.
- Very expensive overall.



## Solution 2:

### Firewire A cameras, cables and repeaters



#### Some improvements:

- Separate chain per hutch.
- Max 4 cameras per chain (important if using PCI readout in future).
- Better 'industrial' repeaters.

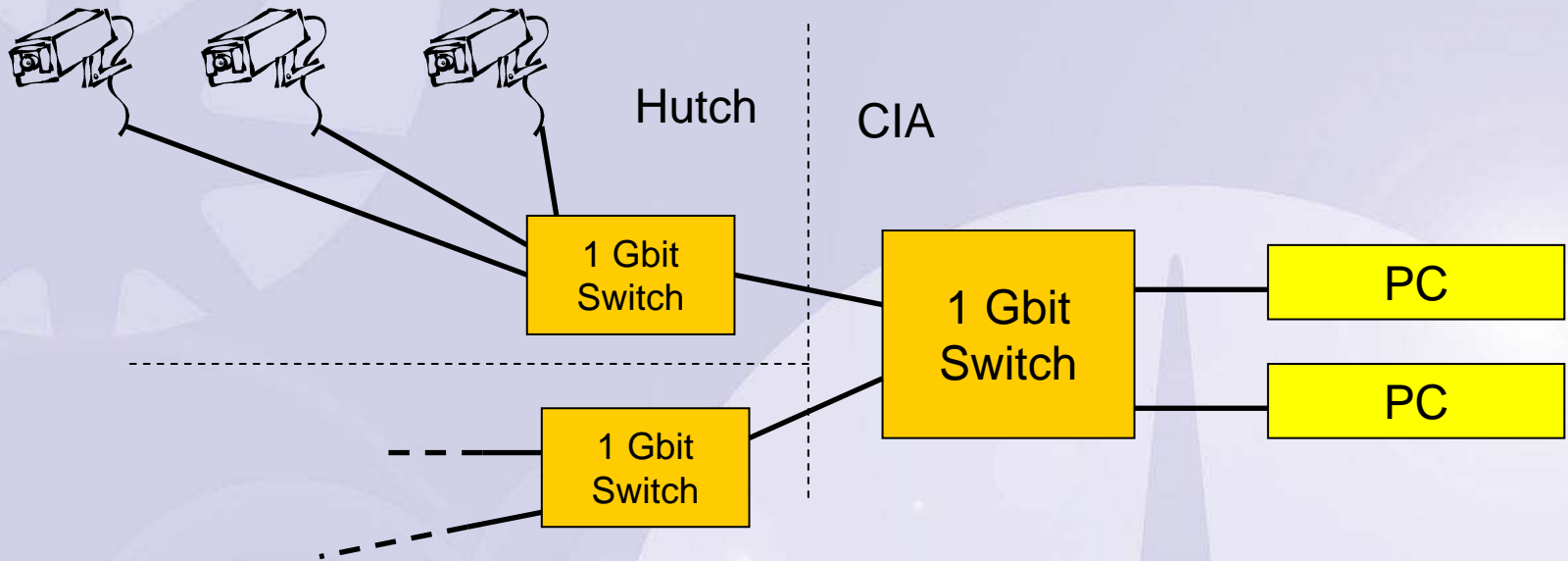
#### Pros:

- Cheap.
- Upgradeable at the VME end.
- Separate chains lessen bandwidth issues.
- Long cable lengths.
- Can still use Firewire B cameras with adapter.

#### Cons:

- Will always be Firewire A data rate.  
May be problem in future with high res or colour cameras.
- No locking cables.

## Solution 3 (for the later Phase II beamlines): Gigabit Ethernet Cameras, cables and switches.



Separate subnet for cameras.

Only visible via PC readout (which does compression, processing, etc).

### Pros:

- Machine vision industry is leaning towards GigE cameras (the GeniCam standard).
- High bandwidth.
- Cheap – fairly standard networking.
- PC readout.

### Cons:

- Need to test available cameras.
- Significant shift in architecture.
- No open source GigE driver available.