THE EPICS COLLABORATION MEETINGS
2024 SEP16-20 SNS

Digital Cameras For Beam Diagnostics @APS

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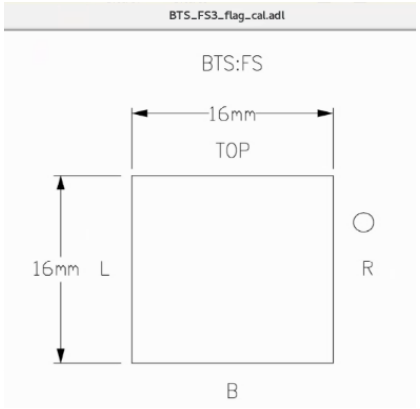
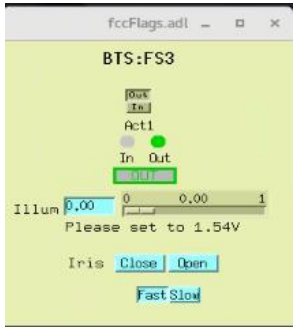
Simplify the Control System with Digital Cameras

- APS has been using framegraber with analog cameras for the Beam Dianostics
- Some flags come with a mask for beam size calibration, and a pinhole for the image orientation
- Some flags come with a motor to move the lens, with the lens moved, the real time calibration could be handy
- Upgrading happens to be a great chance to simplify the control system





Analog multiplexer

sdds

medm

ImageJ

adxv

APS Video AutoRoute

Frame grabbers

View Image

sequence program

Steve Shoaf
Rich Diviero

Digital Camera IOC Setup

- All Camera IOCs share one ioc folder and Display screens
- The USB cameras connecting to a workstation, and the ioc runs on the workstation (ioc2xxx)
- The GigE cameras connecting to a PoE network switch and runs on a VM (sioc2xxx)

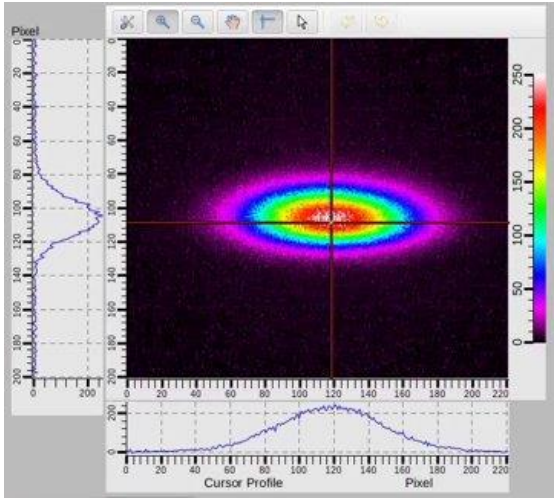
- FLIR cameras
  - USB
    - GS3_U3_23S6M
  - PoE GigE
    - BFS-PGE-13Y3M-C
    - BFS-PGE-13Y3C
    - BFS-PGE-88S6M
    - BFS-PGE-19S4M
    - BFS-PGE-70S7M-C

- MODULE
  - AREA-DETECTOR
  - $(AREA-DETECTOR)/ADCore
  - $(AREA-DETECTOR)/ADSupport
  - ADGENICAM
  - ADARAVIS
  - NDDRIVERSTDARRAYS
  - BASE
  - SEQ
  - BUSY
  - SSCAN
  - CALC
  - AUTOSAVE

```
/C2/iocs/camera
├── B1
│   ├── bin
│   │   └── linux-x86_64
│   ├── configure
│   │   ├── O.Common
│   │   └── O.linux-x86_64
│   ├── db
│   ├── dbd
│   ├── FlirApp
│   │   ├── db
│   │   ├── op
│   │   └── src
│   ├── iocBoot
│   │   ├── ioc2bslmcam1
│   │   ├── ioc2bslmcam2
│   │   ├── ioc2pslmcam1
│   │   ├── ioc2pslmcam2
│   │   ├── ioc2s38cam1
│   │   ├── ioc2s38cam2
│   │   ├── ioc2s38cam3
│   │   ├── ioc2s38cam4
│   │   ├── sioc2bslmcam3
│   │   ├── sioc2bslmcam4
│   │   ├── sioc2btsfs3cam1
│   │   ├── sioc2btsfs4cam1
│   │   ├── sioc2btsfs5cam1
│   │   ├── sioc2camtest
│   │   ├── sioc2ctlcam01
│   │   ├── sioc2leafs4cam1
│   │   └── sioc2s35cam1
│   ├── lib
│   │   └── linux-x86_64
│   └── opi
│       ├── adl
│       └── bob
└── logs
```

Extra Feature with CSS-Phoebus

- Local PV in CSS-Phoebus for color-range of image, so each user can use the color range of their choice while looking at the same image

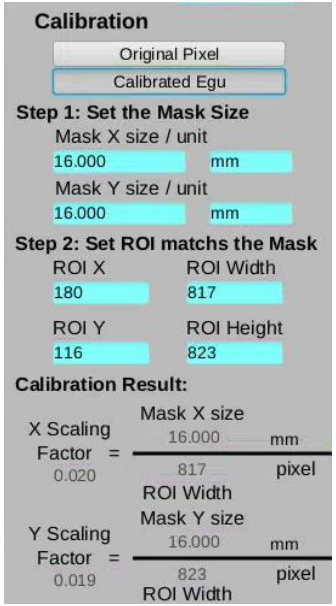


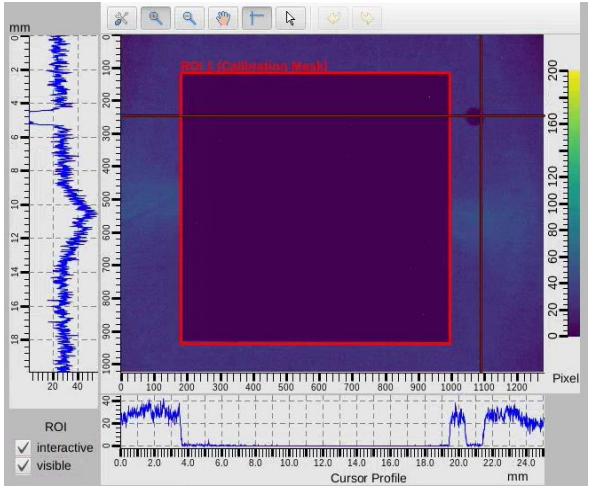
- Using rules to adopt the camera with different image size

Special Thanks to
Kaz Gofron for the great help of Script and Rules

Dianostics Camera With Calibration Mask

- Using ROI1 to match the mask size
- Utilized the CSS Phoebus feature for Real time ROI modification by hand-dragging the ROI box position and size to align the mask
- Add new database for
  - Mask size and unit
  - Calibrated value for
    - Image size
    - X-axis PV
    - Centroid, Sigma, and Cursor from NDPluginStats
    - Users can choose profile unit between pixel or calibrated unit

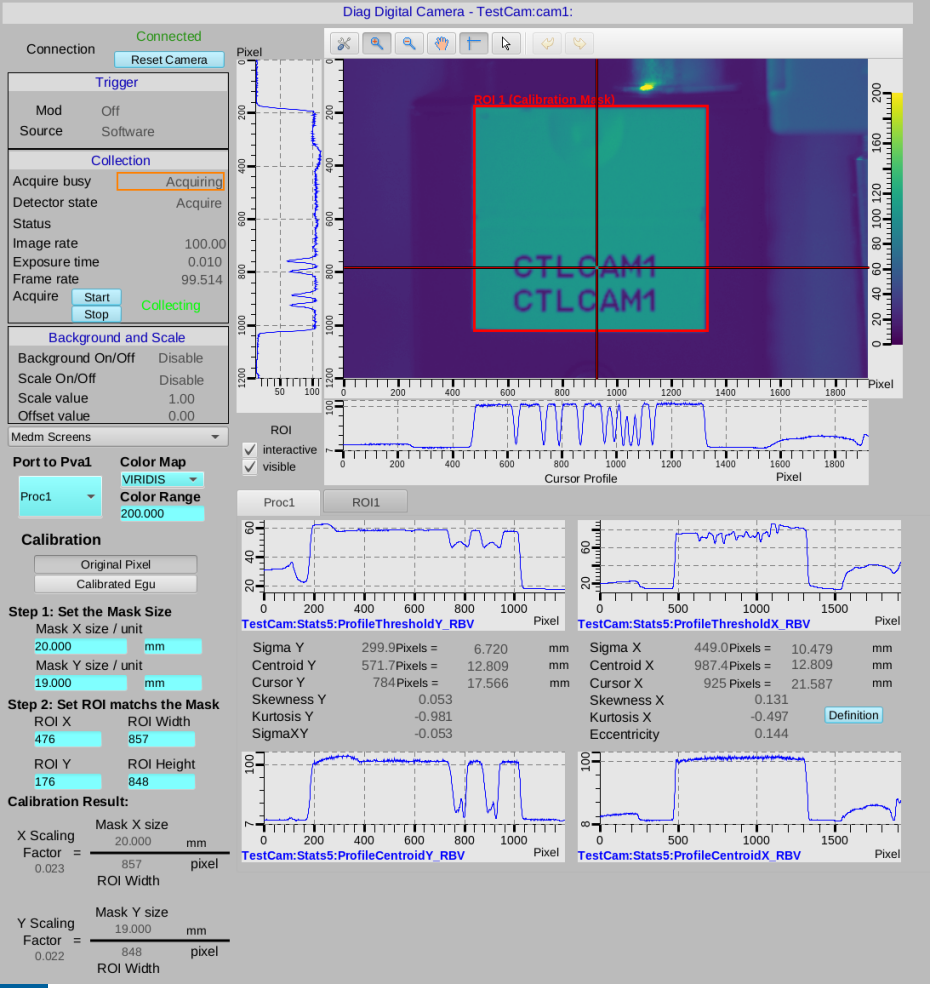


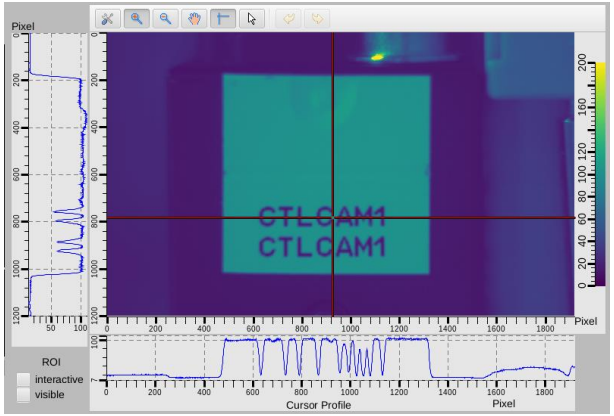


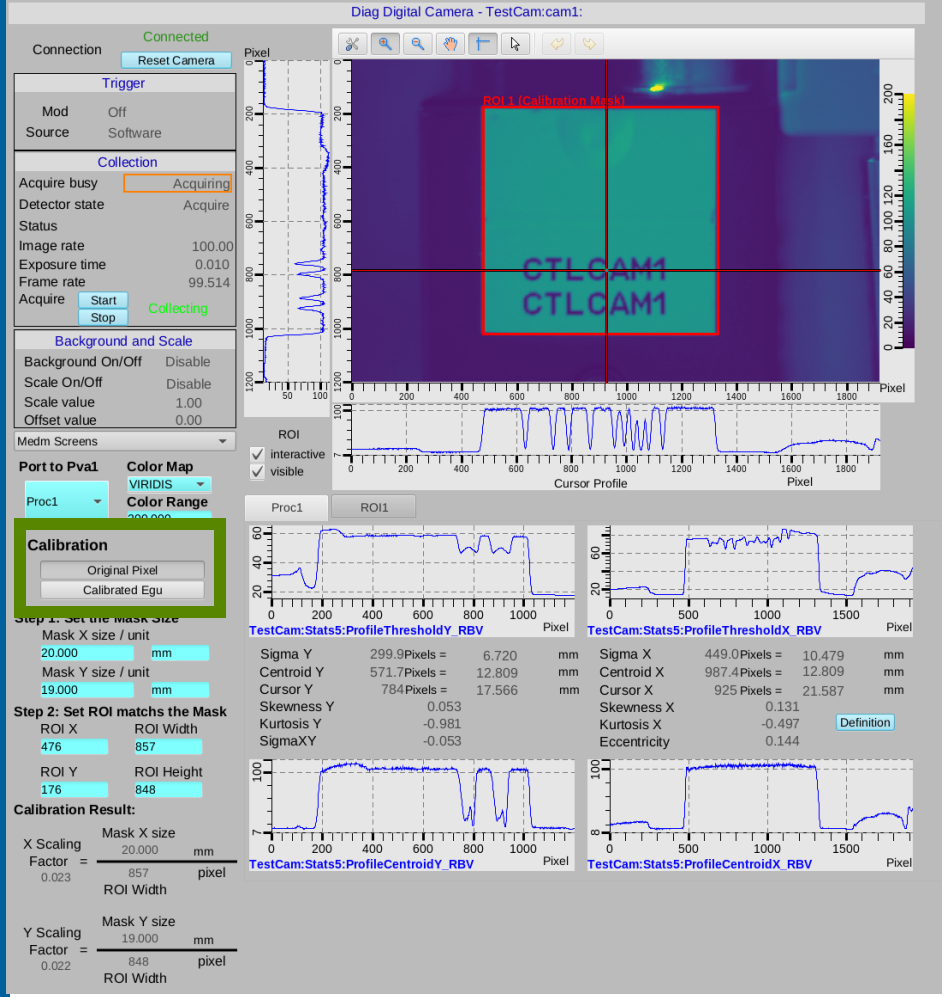
Sigma Y	295.8 Pixels =	5.453	mm
Centroid Y	512.1 Pixels =	9.439	mm
Cursor Y	84 Pixels =	1.548	mm

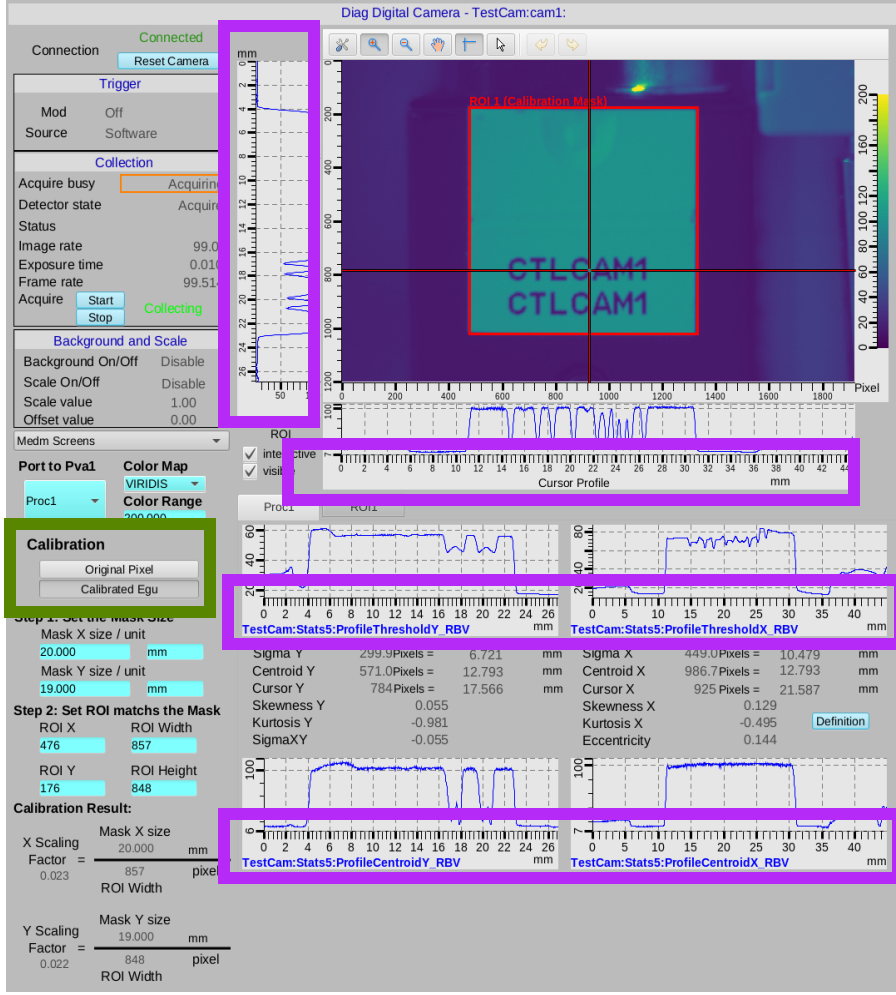
Calibration Feature

1. The example use a 20x19 mm label as a mask
   a. Set the mask size by typing the value and unit
2. We use ROI1 to set the calibration mask
   a. The ROI can be set by dragging the box in the image
   b. Or Set the number by typing the value
3. Use the check box to change ROI box on the screen, disable to interactive/visible to avoid accidentally change the ROI

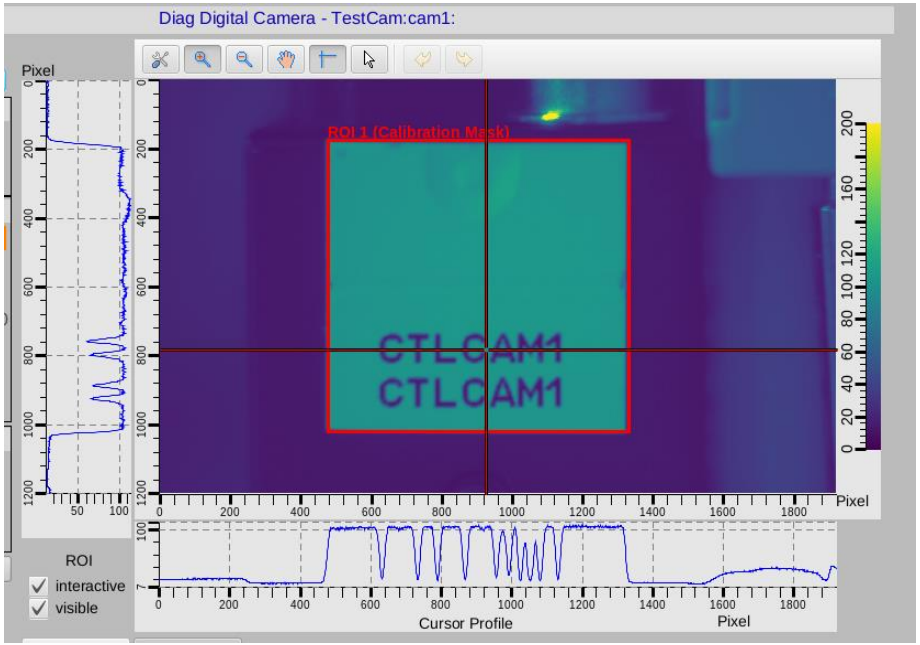


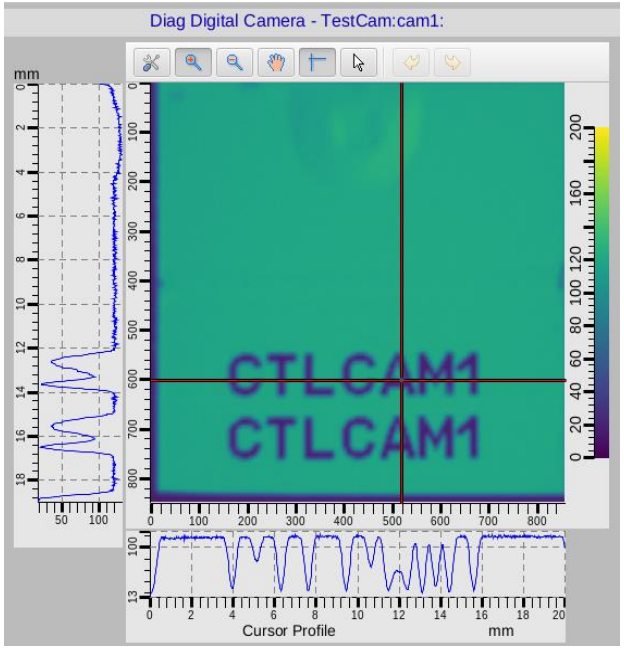


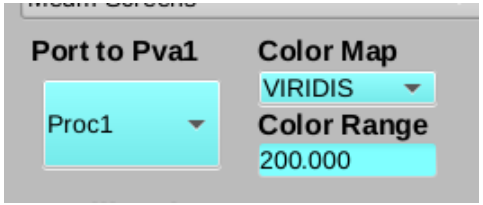




Switch the unit of axis for all waveforms by choosing Pixel or Calibrated Egu



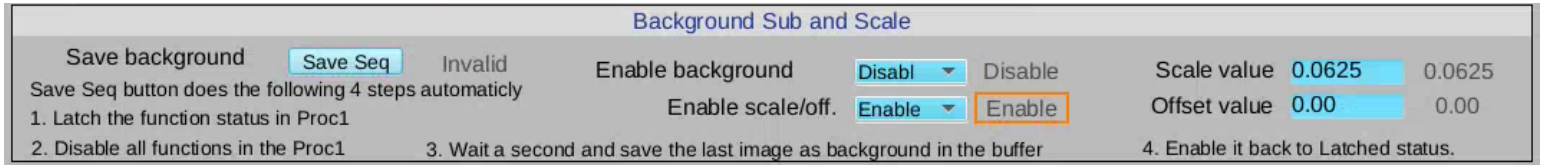




Switch Between ROI view and Proc1 view.
Note this is also what pip to port Pva1

Customized Background And Scale Sequence

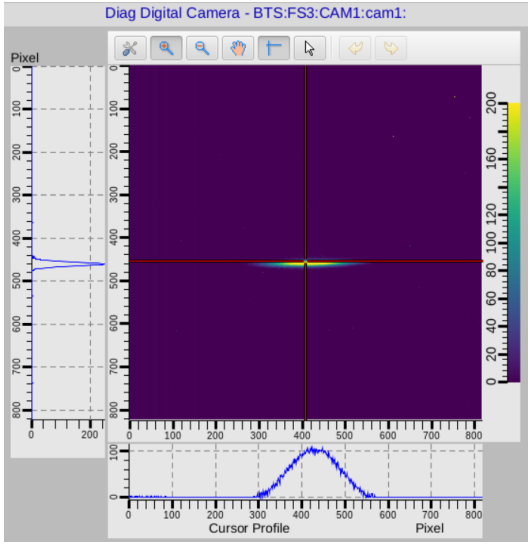
- For the area-detector the background subtraction, the background image must take when no background and scale factor applies
- A simple sequence to
  - save the scale factor, offset, and background status
  - Turn of all off it
  - Took a background image
  - Set all back to saved status



Add-on feature

- Trigger the camera with selected MRF Event
  - (See Ran Hong's talk)

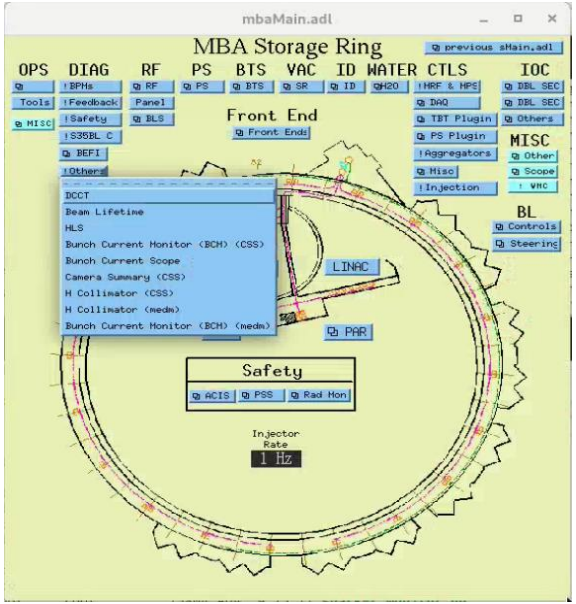
- Re-connection after a network glitch
  - The ARResetCamera PV in ADAravis module could reconnect the camera
  - The SysReset PV in iocStats module could reboot the ioc after reconnection



Hybrid Screen Structure: medm + PhoebusCSS

This allow us to phase in the software upgrade to minimize disruption

- Combination of softlink and git repository
- Individual Engineers push the update to git repository of each EPICS module or IOC
- The each element in the structure softlinks to the opi folders of each EPICS module or IOC



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Ned Arnold
Andrew Johnson
Guobao Shen

```
/C2/screens
├── adl
│   ├── iocs
│   │   ├── bcm -> /C2/iocs/bcm/B1/opi/adl
│   │   ├── befi -> /C2/iocs/befi/B1/opi/adl
│   │   ├── ....
│   │   └── xsrcpt -> /C2/iocs/xsrcpt/B1/opi/adl
│   └── systems
│       ├── oag -> /usr/local/oag/screens/adl
│       ├── site
│       └── sr
├── bob
│   ├── iocs
│   │   ├── bcm -> /C2/iocs/bcm/B1/opi/bob
│   │   ├── btsblmApp -> /home/helios/SHOAF/C2/iocs/btsdiag/main/btsblmApp/op/bob
│   │   ├── ...
│   │   └── sr-controls -> /C2/iocs/sr-controls/B1/opi/bob
│   └── systems
│       ├── bts
│       ├── site
│       └── sr
└── devices
    ├── BTS-BESOCM
    │   └── C2-1
    ├── libera-Bplus -> Libera-Bplus
    ├── Libera-Bplus
    │   ├── C2-1
    ├── Libera-LLRF
    │   ├── bob -> /home/helios/GRASS/C2/screen/libera-llrf/bob
    │   └── C2-1
    ├── Libera-SparkELHL
    │   └── C2-1
    └── Libera-SparkERXR
        └── C2-1
```

Andrew Johnson's talk on Tuesday

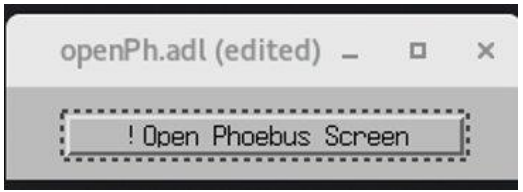
THANK YOU!!

BACKUP SLIDES

Open CSS Phoebus screen from medm

```
"shell command" {
        object {
                x=420
                y=25
                width=17
                height=14
        }
        command[0] {
                label="DLLRF L2"
                name="open-C2-screen -m N=2"
                args="/C2/screens/bob/iocs/libera-llrf/kn.bob"
        }
        command[1] {
                label="DLLRF L6"
                name="open-C2-screen -m N=6"
                args="iocs/libera-llrf/kn.bob"
        }

        clr=14
        bclr=51
}
```



There are two way to add apply macro with command line.

1. The official way to call a CSS Pheobus screen from command line is
   - **phoebus.sh -resource file:/path/to/file?MACRONAME=macrovalue**
2. One can use another line
   - MACRONAME=macrovalue phoebus.sh -resource file:/path/to/file
   - But if you use env this way, when the phoebus.sh already running, and this command just add a screen the running CSS Phoebus , the env won't kick in.

When put the command line in medm screen or any script, one should use method two to avoid the problem

- The "?" Is a special character in medm
- The work-around would be using a shell script as the medium
  - **phoebus.sh -resource file:$1?$2=$3**
- CTL group has open-C2-screen
  - **open-C2-screen -m macro=value -m macro2=value2 file.bob**