

Computer Vision and new areaDetector features

by K. Gofron, J. Wlodek, M. Rolland

- ***CSS opi deployment AD3-4***
- ***areaDetector Binaries***
- ***AD ioc structure***
- ***ImageJ clients***
- ***Codecs and Compression***
- ***Computer Vision***
- ***New AD drivers (Lambda, Spinnaker, Emergent Vision, Barcode plugin, ...)***
- ***USB cameras support***

Code:

<https://github.com/epicsNSLS2-areaDetector>

<https://github.com/epicsNSLS2-deploy>

<https://epics.nsls2.bnl.gov/bundle>

January 18, 2019

Organized by K. Gofron (kgofron@bnl.gov)

and NSLS2 Controls

BROOKHAVEN
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a passion for discovery



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ENERGY

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Science

Summary

- A. The deployment of areaDetector R3-4 for NSLS2 beamline.
 - 1. Binary package deployment.
 - 2. New ioc structure components for areaDetector.
 - 3. Updated features of CSS areaDetector screens.
 - 4. ImageJ - integrated into CSS.

- B. New EPICS areaDetector drivers and plugins for detectors.
 - 1. **Lambda** X-ray detector (10ID, 8ID, 12ID).
 - 2. **Spinnaker** support for BlackFly S USB3.1 camera (28ID).
 - 3. EPICS driver for **USB Video Class** cameras .
 - 4. **EmergentVision** (IMX 264, 5Mpel) 10Gb EPICS camera driver, and support for upcoming 25Gb camera.
 - 5. Barcode **ADPluginBar** plugin module.

- C. The deployment of areaDetector R3-4 for NSLS2 beamline.
 - 1. The ability to utilize OpenCV functionality from within AD allows for automation and for fast real time image processing by scientists. The solution integrates OpenCV into an AD plugin in such a way that generic input and output variables allow for an exhaustive implementation of the library.
 - 2. Demonstration on live beamline system will be shown.

areaDetector Binaries

- <https://epics.nsls2.bnl.gov/bundle/>

```
← → ↻ 🏠 https://epics.nsls2.bnl.gov/bundle/Deb9/envPaths

#####
# Specific to EPICS AD distribution, not camera #
# Date: 2018-08-22 #
# Author: K. Gofron #
#####

epicsEnvSet("ARCH", "linux-x86_64")
epicsEnvSet("IOC", "iocADProsilica")
#epicsEnvSet("IOC", "iocADAndor3")
epicsEnvSet("TOP", "${PWD}") # defined here not in unique.cmd
epicsEnvSet("SUPPORT", "/controls/prod/Deb9/R3-3-2")

epicsEnvSet("ASYN", "${SUPPORT}/asyn")
epicsEnvSet("AUTOSAVE", "${SUPPORT}/autosave")
epicsEnvSet("BUSY", "${SUPPORT}/busy")
epicsEnvSet("CALC", "${SUPPORT}/calc")
epicsEnvSet("SNCSEQ", "${SUPPORT}/seq")
epicsEnvSet("SSCAN", "${SUPPORT}/sscan")
epicsEnvSet("DEVIOCSTATS", "${SUPPORT}/iocStats")
epicsEnvSet("EPICS_BASE", "${SUPPORT}/base-7-0-1-1")

epicsEnvSet("AREA_DETECTOR", "${SUPPORT}/areaDetector")
epicsEnvSet("ADSUPPORT", "${AREA_DETECTOR}/ADSupport")
epicsEnvSet("ADCORE", "${AREA_DETECTOR}/ADCore")
epicsEnvSet("ADPROSILICA", "${AREA_DETECTOR}/ADProsilica")
epicsEnvSet("ADANDOR3", "${AREA_DETECTOR}/ADAndor3")
epicsEnvSet("ADLAMBDA", "${AREA_DETECTOR}/ADLambda")
epicsEnvSet("ADPILATUS", "${AREA_DETECTOR}/ADPilatus")
epicsEnvSet("ADSIMDETECTOR", "${AREA_DETECTOR}/ADSimDetector")
epicsEnvSet("ADMERLIN", "${AREA_DETECTOR}/ADMerlin")
epicsEnvSet("ADPLUGINBAR", "${AREA_DETECTOR}/ADPluginBar")
epicsEnvSet("EPICS_DB_INCLUDE_PATH", "${ADCORE}/db")

#epicsEnvSet("PVA", "${EPICS_BASE}/modules")
#epicsEnvSet("PVACCESS", "${PVA}/modules/pvAccess")
#epicsEnvSet("PVDATA", "${PVA}/modules/pvData")
#epicsEnvSet("PVDATABASE", "${PVA}/modules/pvDatabase")
#epicsEnvSet("NORMATIVETYPES", "${PVA}/modules/normativeTypes")

#epicsEnvSet("HOSTNAME", "xf19id1-ws3")
#epicsEnvSet("IOCNAME", "cam02")
```

Name	Last modified	Size	Description
Parent Directory	-	-	-
Deb7/	16-Jan-2019 16:30	-	-
Deb8/	16-Jan-2019 16:31	-	-
Deb9/	16-Jan-2019 16:32	-	-

Apache/2.2.15 (Red Hat) Server at epics.nsls2.bnl.gov Port 443

Name	Last modified	Size	Description
Parent Directory	-	-	-
NSLS2_Pack_AD_3.3_Debian_9_2018-12-17.tgz	16-Jan-2019 16:14	353M	-
envPaths	16-Jan-2019 16:32	1.8K	-

areaDetector ioc

```
1 andorNeo.txt 2 st.cmd 3 unique.cmd
kgofron@xf18id-srv2:/epics/iocs/andorNeo$ ls -l
drwxrwxrwx 2 kgofron softioc 4096 Dec 11 23:38 autosave
-rw-r--r-- 1 kgofron kgofron 74 Jan 18 2018 config
-rwxr-xr-x 1 kgofron kgofron 2416 Sep 18 21:56 st.cmd
-rw-r--r-- 1 kgofron kgofron 2298 Sep 18 21:52 unique.cmd
```

```
1 andorNeo.txt 2 st.cmd 3 unique.cmd
#!/epics/prod/Deb8/master/areaDetector/ADAndor3/iocs/andor3IOC/bin/linux-x86_64/andor3App st.cmd
errlogInit(20000)
< /epics/prod/Deb8/master/envPaths
< unique.cmd

dbLoadDatabase("${ADANDOR3}/iocs/andor3IOC/dbd/andor3App.dbd")
andor3App_registerRecordDeviceDriver(pdbbase)

# andor3Config(const char *portName, int cameraId, int maxBuffers,
#             size_t maxMemory, int priority, int stackSize,
#             int maxFrames)
andor3Config("${(PORT)", $(CAMERA), 0, 0, 0, 0, 100)
dbLoadRecords("${ADANDOR3}/db/andor3.template", "P=${(PREFIX)},R=cam1:,PORT=${(PORT)},ADDR=0,TIMEOUT=1")

asynSetTraceIOMask("${(PORT)",0,2)
#asynSetTraceMask("${(PORT)",0,255)

# Create a standard arrays plugin, set it to get data from first Andor Neo driver.
NDStdArraysConfigure("Image1", 5, 0, "${(PORT)", 0, 0)
```

areaDetector ioc

```
dorNeo.txt 2 st.cmd 3 unique.cmd
#####
# Specific to camera #
# Date: 2018-08-22 #
# Author: K. Gofron #
#####

#####:
# NELEMENTS = 3*(X x Y)=1360x1024x3=4177920, which is the number of pixels in RGB images
#
# CAMERA (X x Y) = NELMT; 3*NELMT; MAX_ARRAY_16b; MAX_ARRAY_24b
#Prosilica GC1290/GT1290: 1280 * 960 = 1228800; 3686400 2457600 Bytes 3686400
#Prosilica Mako G-125B: 1292 * 964 = 1245488; 3736464 2490976 Bytes 3736464
#Prosilica GX1920: 1936 * 1456 = 2818816; 8456448 5637632 Bytes 8456448
#Prosilica GC-1380: 1360 * 1024 = 1392640; 4177920 2785280 Bytes 4177920
#####:

#10.10.1.23: 00-0f-31-4c-9f-3b 50-0503338399 - Manta_G-125B - Unique ID = 5021499
# Andor Neo uses Camera Link with fiber extender

epicsEnvSet("ENGINEER", "K. Gofron X5283")
epicsEnvSet("LOCATION", "18IDB")
epicsEnvSet("PORT", "ANDOR")

epicsEnvSet("EPICS_CA_AUTO_ADDR_LIST", "NO")
epicsEnvSet("EPICS_CA_ADDR_LIST", "10.18.0.255")
epicsEnvSet("EPICS_CA_MAX_ARRAY_BYTES", "60000000")

#epicsEnvSet("CAM-IP", "10.18.1.41")
#epicsEnvSet("UID-NUM", "5021499")
epicsEnvSet("PREFIX", "XF:18IDB-BI{Det:Neo}")
epicsEnvSet("CTPREFIX", "XF:18IDB-BI{Det:Neo}")
epicsEnvSet("HOSTNAME", "xf18idb-ioc1")
epicsEnvSet("IOCNAME", "camb1")

epicsEnvSet("QSIZE", "21")
epicsEnvSet("NCHANS", "2048")
epicsEnvSet("HIST_SIZE", "4096")
epicsEnvSet("XSIZE", "2560")
epicsEnvSet("YSIZE", "2160")
epicsEnvSet("NELMT", "5529600")
epicsEnvSet("NDTYPE", "Int16" #Int8' (8bit B/W, Color) | 'Int16' (16bit B/W)
epicsEnvSet("NDFTVL", "SHORT" #'UCHAR' (8bit B/W, Color) | 'SHORT' (16bit B/W)
epicsEnvSet("CBUFFS", "500")

# The ANDOR camera number in the system
epicsEnvSet("CAMERA", "0")
```

1 andorNeo.txt 2 st.cmd 3 unique.cmd

```
kgofron@xf18id-srv2:/epics/iocs/andorNeo$ ls -l
drwxrwxrwx 2 kgofron softioc 4096 Dec 11 23:38 autosave
-rw-r--r-- 1 kgofron kgofron 74 Jan 18 2018 config
-rwxr-xr-x 1 kgofron kgofron 2416 Sep 18 21:56 st.cmd
-rw-r--r-- 1 kgofron kgofron 2298 Sep 18 21:52 unique.cmd
```



EPICS AD deployment and drivers

<https://github.com/epicsNSLS2-deploy>

opi_organizer

Scripts for creating a directory of CS-Studio OPIs

● Python Updated 17 days ago

ioc_deploy

Scripts for deploying an areaDetector IOC
<https://rollandmichael7.github.io/ioc-manual/>

● Shell ★ 1 🍴 1 Updated on Dec 7, 2018

ImageJmacro

A ImageJ macros for populating the PV in EPICS CA/PVA plugins

● Shell Updated on Nov 8, 2018

<https://github.com/epicsNSLS2-areaDetector>

ADCompVision

Forked from jwlodek/ADCompVision

A computer vision extension plugin for EPICS Area detector.

● C++ 🍴 1 Updated 3 days ago

ADPluginBar

Forked from jwlodek/ADPluginBar

A barcode and QR code reader for EPICS area detector

● C++ 🍴 2 Updated 13 days ago

ADUVC

Forked from jwlodek/ADUVC

An EPICS area detector driver for USB Video Class (UVC) devices

● C 🍴 1 Updated 22 days ago

EPICS AD deployment and drivers

IXS(10id) main GC1380 1wire.opi SSA-Y SmarAct 10ida-ut.opi onAxis commonPlugins GC1380 prosilica NDPva iocs2.opi

60%

The screenshot displays the EPICS AD control interface. On the left, a live camera feed shows a yellow detector unit. Below it is a plot of intensity versus pixels. The central panel contains the 'Detector Controls' section, which includes fields for Exposure Time (0.05000), Acquire Period (0.50000), Num Images (1.00000), Images Complete (0), Exp / Image (1), Image Mode (Continuous), Trigger Mode (Fixed Rate), and buttons for Start, Stop, and ImageJ. The Detector State is 'Idle'. Below this is the 'Display Controls' section with checkboxes for Autoscale Min/Max, Display ROI 1-4, and Transform / Process settings. The right panel shows an 'Intensity' plot with a linear trend and a 'Histogram' plot showing the distribution of data. A red circle highlights the 'ImageJ' button and the 'Display Controls' section.

Detector Controls

Exposure Time	0.05000	0.050
Acquire Period	0.50000	0.500
Num Images	1.00000	1
Images Complete	0	0
Exp / Image	1	1
Image Mode	Continuous	Continuous
Trigger Mode	Fixed Rate	Fixed Rate
Acquire	Start	Stop
Detector State	Idle	
Images Acquired	0	17
Image Rate	0.00 Hz	

areaDetector Plugins: Expert (AD detail)

Connect: **CONNECT** Connected

Reboot IOC: Reboot

ImageJ

Display Controls

Autoscale Min / Max Autoscale (N Sigma)

Minimum	0.0	3
Maximum	55536.0	255
N Sigma	1.0	55.3

Display ROI 1 Display ROI 3

Display ROI 2 Display ROI 4

Transform / Process

Transform Type	Rot270Mirror	↑
Process Type	Recursive	↓
Process Enabled	Disa	Disable
Process Num	1	1

Compute Histogram

Intensity

Intensity vs Time plot showing a linear trend from 0 to 3.142E8.

Histogram

Number of Events vs Bin Number plot showing a distribution peaking around bin 40.

New plugins

XF:10IDC-BI{GC1380-Cam:1} Common Plugins

Plugin name	Plugin type	Port	Enable	Blocking	Dropped	Free	Rate		
Image1	NDPluginStdArrays	CV1	Enable	Enable	No	0	5	0.00	More
PVA1	NDPluginPva	CAM	Enable	Enable	No	0	20	0.00	More
PROC1	NDPluginProcess	CAM	Disable	Disable	No	0	20	0.00	More
TRANS1	NDPluginTransform	CAM	Disable	Disable	No	0	20	0.00	More
CC1	NDPluginColorConvert	CAM	Disable	Disable	No	0	20	0.00	More
CC2	NDPluginColorConvert	CAM	Disable	Disable	No	0	20	0.00	More
OVER1	NDPluginOverlay	CAM	Enable	Enable	No	0	20	0.00	More
ROI1	NDPluginROI	CAM	Enable	Enable	No	0	20	0.00	More
ROI2	NDPluginROI	CAM	Disable	Disable	No	0	20	0.00	More
ROI3	NDPluginROI	CAM	Disable	Disable	No	0	20	0.00	More
ROI4	NDPluginROI	CAM	Disable	Disable	No	0	20	0.00	More
STATS1	NDPluginStats	CAM	Enable	Enable	No	0	20	0.00	More
STATS2	NDPluginStats	CAM	Disable	Disable	No	0	20	0.00	More
STATS3	NDPluginStats	CAM	Disable	Disable	No	0	20	0.00	More
STATS4	NDPluginStats	CAM	Disable	Disable	No	0	20	0.00	More
STATS5	NDPluginStats	CAM	Enable	Enable	No	0	20	0.00	More
SCATTER1	NDPluginScatter	CAM	Enable	Enable	No	0	20	0.00	More
GATHER1	NDPluginGather	CAM	Disable	Disable	No	0	20	0.00	More
ROISTAT1	NDPluginROIStat	CAM	Disable	Disable	No	0	20	0.00	More
CB1	NDPluginCircularBuff	CAM	Disable	Disable	No	0	20	0.00	More
ATTR1	NDPluginAttribute	CAM	Disable	Disable	No	0	20	0.00	More
FFT1	NDPluginFFT	CAM	Disable	Disable	No	0	3	0.00	More
CODEC1	NDPluginCodec	CAM	Disable	Disable	No	0	20	0.00	More
CODEC2	NDPluginCodec	CAM	Disable	Disable	No	0	20	0.00	More
FileNetCDF1	NDFileNetCDF	CAM	Disable	Disable	No	0	20	0.00	More
FileTIFF1	NDFileTIFF	CAM	Disable	Disable	No	0	20	0.00	More
FileJPEG1	NDFileJPEG	CAM	Disable	Disable	No	0	20	0.00	More
FileNexus1	NDPluginFile	CAM	Disable	Disable	No	0	20	0.00	More
FileMagick1	NDFileMagick	CAM	Disable	Disable	No	0	20	0.00	More
FileHDF1	NDFileHDF5 ver1.10.1	CAM	Disable	Disable	No	0	20	0.00	More
BAR1	NDPluginBar	CAM	Disable	Disable	No	0	20	0.00	More
CV1	NDPluginCV	CAM	Enable	Enable	No	0	20	0.00	More
EDGE1	NDPluginEdge	CAM	Disable	Disable	No	0	20	0.00	More

R3-4

NSLS2

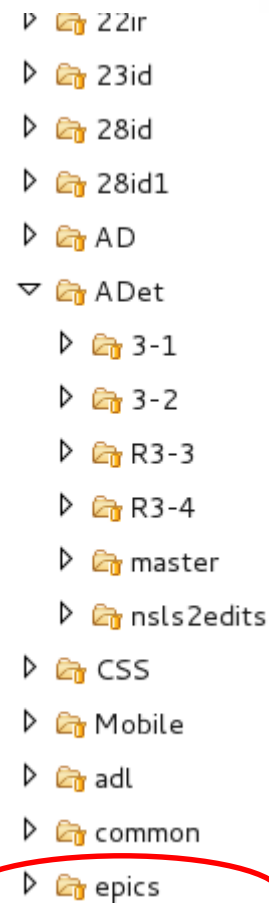
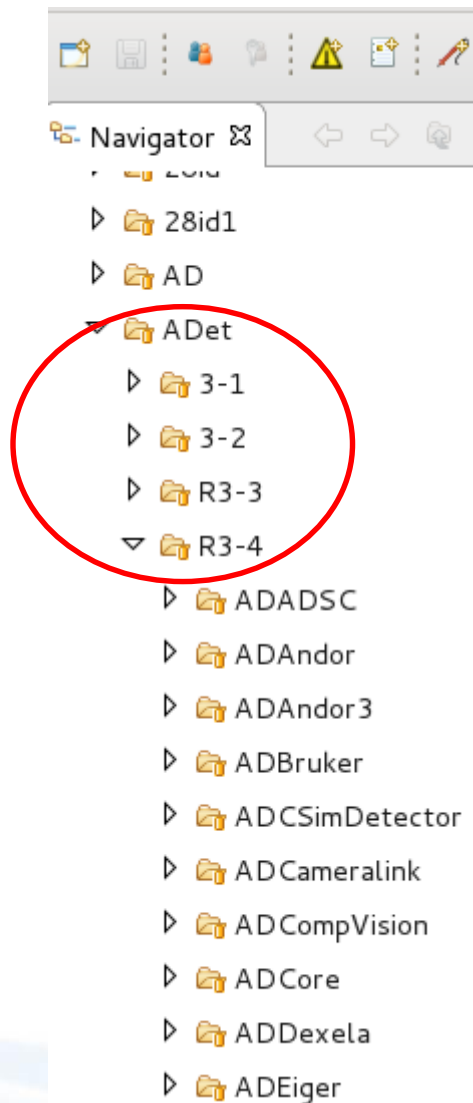
EPICS AD deployment

<https://github.com/epicsNSLS2-deploy>

A. The deployment of areaDetector R3-4 for NSLS2 beamline.

1. Binary package deployment.
2. New ioc structure components for areaDetector.
3. Updated features of CSS areaDetector screens.
4. ImageJ - integrated into CSS.

CSS opi versions



AreaDetector: Deployments

- Centralized repository of pre-compiled AreaDetector installations
- Removes need to download and compile AreaDetector for every
 - new computer, new release, new OS
 - Support for Debian 7, 8, 9
 - Deployment for 'master' version and legacy versions
- Can be downloaded from:
 - <https://gitlab.nsls2.bnl.gov/kgofron/ADbinaries>
 - <https://epics.nsls2.bnl.gov/bundle>
 - NFS mount: /controls/prod/Deb9
- Each deployment:
 - Stored as .tar file
 - Contains README with version information
 - Contains ADAndor3, ADCore, ADLambda, ADMerlin, ADPilatus, ADPluginBar, ADProsilica, ADSimDetector, ADSupport, ADViewers
 - Also contains EPICS base, 'core' EPICS modules
 - asyn, autosave, busy, calc, iocStats, seq, sscan
 - Not full copies; only required parts

ImageJ - PVA

Java-based image processing program integrated with EPICS

Access from color_camera_pva.opi

Two options: Channel Access and PVA

Click Start in ImageJ screen to display image

The screenshot displays the ImageJ EPICS viewer interface. The main window shows a live image of a sample with a vertical histogram on the left and a horizontal histogram at the bottom. The right panel contains control sections:

- Detector Controls:** Exposure Time (1.00000), Acquire Period (1.00000), Num Images (1.00000), Images Complete (0), Exp / Image (1), Image Mode (Continuous), Trigger Mode (Fixed Rate), Acquire (Start/Stop), Detector State (Acquire), Images Acquired (0), Image Rate (1.00 Hz), areaDetector Plugins (Expert (AD detail)), Connect (CONNECT/Connected), Reboot IOC (REBOOT), and ImageJ (circled in red).
- Display Controls:** Autoscale Min / Max (checked), Autoscale (N Sigma) (unchecked), Minimum (0.0), Maximum (65536.0), N Sigma (1.0), Display ROI 1-4 (unchecked).
- Transform/Process:** Transform Type (None), Process Type (Difference), Process Enabled (Disable/Disable), Process Num (1), Background (Save BG/Off), FlatField (Save FF/Off).

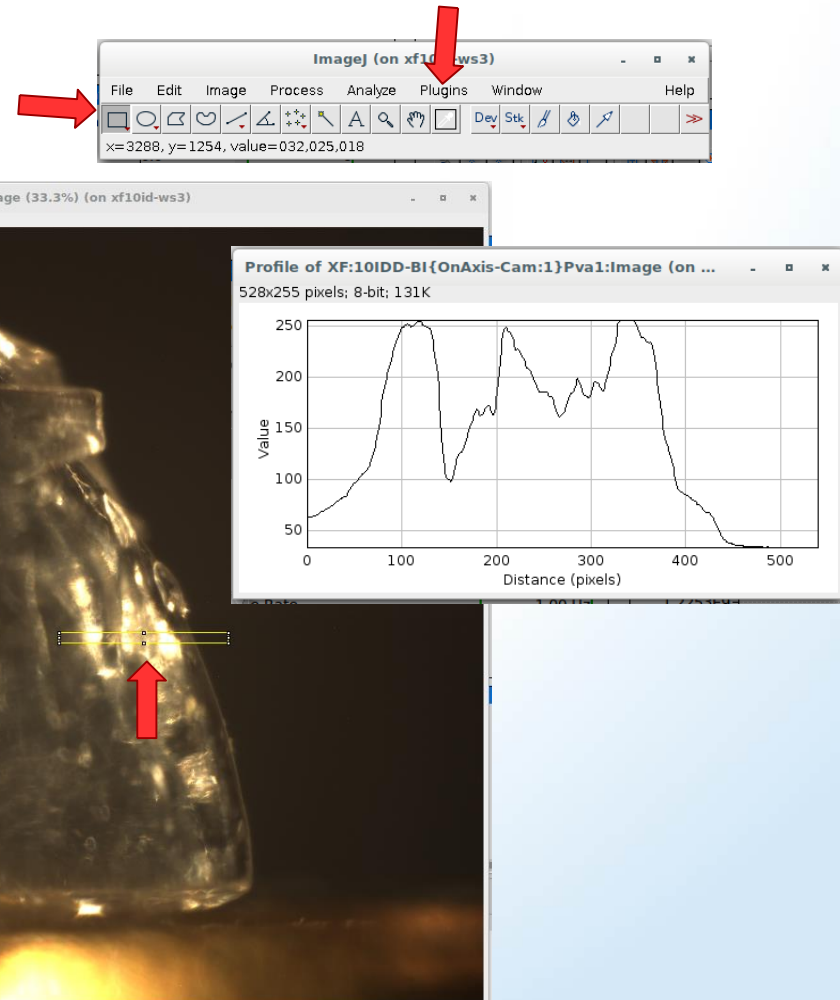
The screenshot shows the Image J EPICS_NTNDViewer Plugin window. The channelName is XF:1OIDD-BI{OnAxis-Cam:1}. The NX, NY, and NZ fields are empty. The Frames/s field is 0.0. The Capture to Stack checkbox is unchecked. The Status field shows: 16-Jan-2019 14:52:43.530: connected to XF:1OIDD-BI{OnAxis-Cam:1}Pv.

ImageJ: Dynamic Profiler

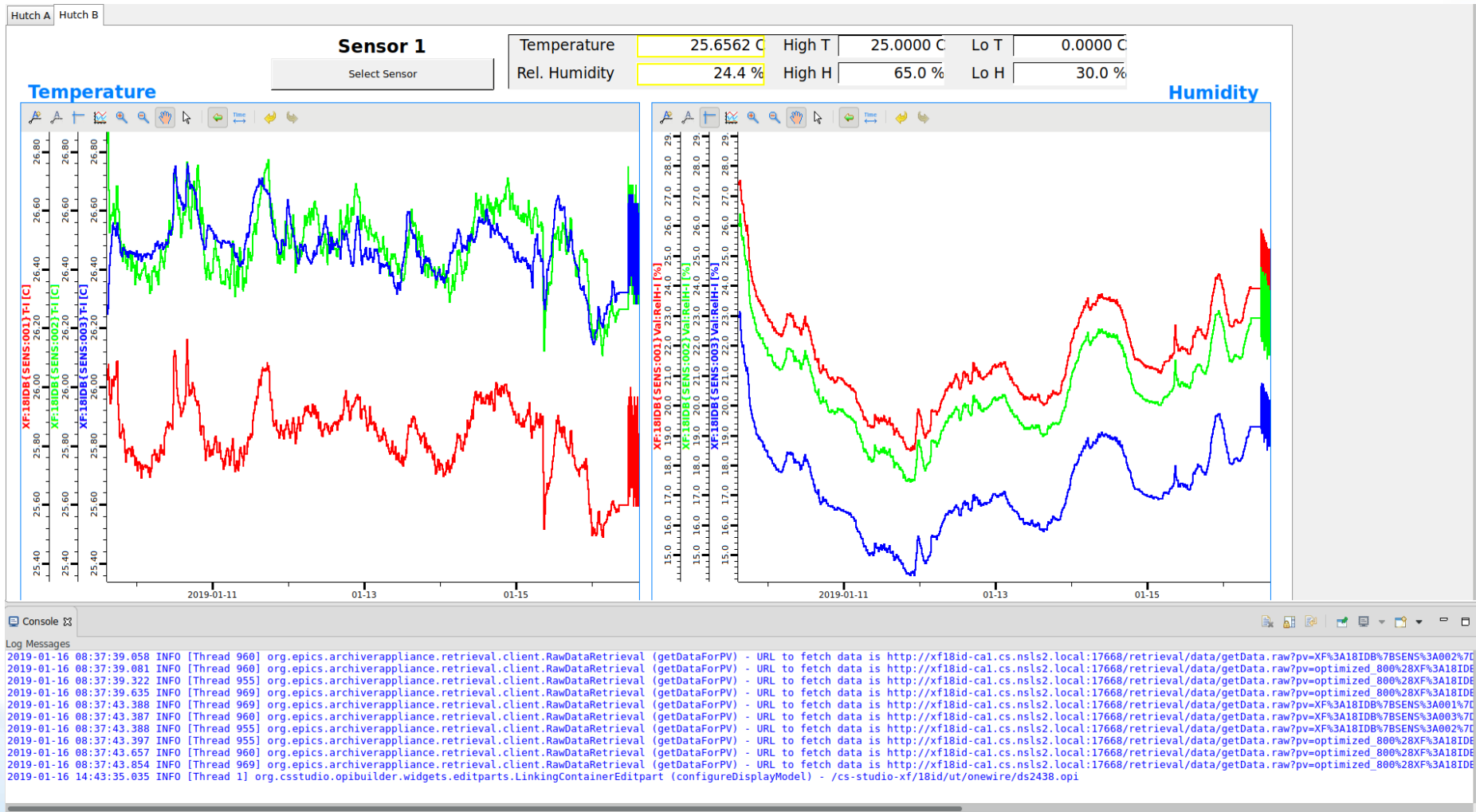
Use rectangle or line tool to select part of image

Click Plugins → Dynamic Profiler

ImageJ constructs profile of selected area in real time



OneWire screens for 18id



Machine Vision in areaDetecor

1. The ability to utilize OpenCV functionality from within AD allows for automation and for fast real time image processing by scientists. The solution integrates OpenCV into an AD plugin in such a way that generic input and output variables allow for an exhaustive implementation of the library.
2. Demonstration on live beamline system will be shown.

Introduction to CV

- What is Computer Vision?
- Why is it useful?
- What are some CV solutions?



Courtesy of 11BM - Masa



ADCompVision

1. CV has many applications - should be integrated into EPICS/CSS
2. How? - an areaDetector plugin
3. ADCompVision is intended to be a comprehensive implementation of OpenCV for use with areaDetector. Currently, it supports:

- Gaussian Blur
- Thresholding
- Laplacian edge detection
- Canny edge detection
- Centroid identification
- And user definable functions

The screenshot displays the ADCompVision control interface. The title bar shows the path: ca://XF:10IDC-BI{UVC-Cam:1}CV1:

Configuration Parameters:

- asyn port: CV1
- Plugin type: NDPluginCV
- ADCore version: 3.3.2
- Plugin version: 0.0.6
- Array port: UVC1 (UVC1)
- Array address: 0
- Enable: Enable (Enable)
- Min. time: 0.000 (0.000)
- Queue size/free: 20 (20)
- Array counter: Reset to 0 (1048)
- Array rate: 17.00
- Execution time: 1.460 (msec)
- Dropped arrays: Reset to 0 (0)
- # dimensions: 3
- Array Size: 3 640 480
- Data type: Uint8
- Color mode: RGB1
- Unique ID: 0
- Time stamp: 0.000
- Array callbacks: Enable (Enable)
- Process plugin: Process
- More: [button]

Vision Function Sets:

- Vision Function Set #1: Threshold (Threshold)
- Vision Function Set #2: None (None)
- Vision Function Set #3: None (None)

File write: [Disconnected] [Disconnect]

Input Descriptions		Output Descriptions	
Input #1	80	Output #1	0
Input #2	255	Output #2	0
Input #3	0	Output #3	0
Input #4	0	Output #4	0
Input #5	0	Output #5	0
Input #6	0	Output #6	0
Input #7	0	Output #7	0
Input #8	0	Output #8	0
Input #9	0	Output #9	0
Input #10	0	Output #10	0

Function Description: Will create binary image with cutoff at Threshold Val

ADCompVision

ADCompVision is structured in such a way that adding additional, custom functionality requires only basic understanding of C++ programming and the OpenCV Library. The entirety of the plugin's interfacing with EPICS has been contained in a separate location to make adding new functionality as painless as possible.

In addition, because of the breadth of the solution, generic input and output variables are reused between functions, but each is described when a function is selected.

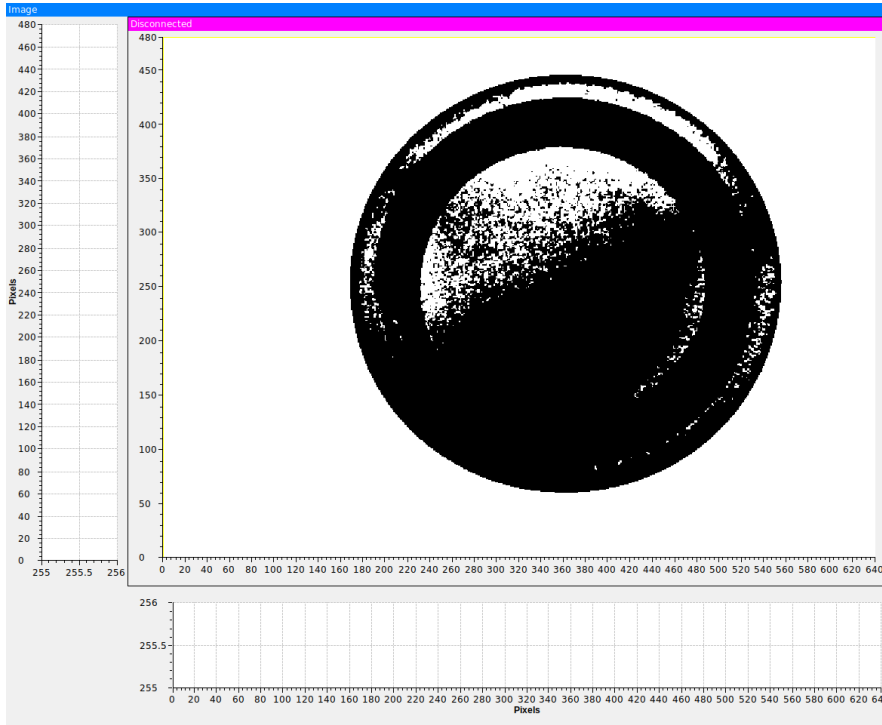
The screenshot displays the ADCompVision control interface. It features three 'Vision Function Set' options, each with a dropdown menu and a status indicator. The first set is 'None' (status: None), the second is 'Centroid Iden...' (status: Centroid Iden...), and the third is 'None' (status: None). To the right, there are two 'File write' status indicators, both showing 'Disconnected'. Below these are two columns of input and output descriptions. The input descriptions include parameters like 'Num Largest Contours', 'Blur degree', 'Threshold Value', 'Upper Size Threshold', and 'Lower Size Threshold'. The output descriptions list centroid coordinates for five different contours. A footer at the bottom provides a 'Function Description' for the selected 'Centroid computation' function.

Vision Function Set	Selected Function	Status	File write	File write Status
Vision Function Set #1	None	None	File write	Disconnected
Vision Function Set #2	Centroid Iden...	Centroid Iden...		Disconnected
Vision Function Set #3	None	None		

Input	Value	Input Description	Output	Output Description
Input #1	1	Num Largest Contours (Int 1 - 5)	Output #1	361 Centroid 1 X
Input #2	3	Blur degree (Int) Ex. 3	Output #2	227 Centroid 1 Y
Input #3	100	Threshold Value (Int) Ex. 100	Output #3	0 Centroid 2 X
Input #4	240000	Upper Size Threshold Ex. 600*400	Output #4	0 Centroid 2 Y
Input #5	200	Lower Size Threshold Ex. 400	Output #5	0 Centroid 3 X
Input #6	0	Not Used	Output #6	0 Centroid 3 Y
Input #7	0	Not Used	Output #7	0 Centroid 4 X
Input #8	0	Not Used	Output #8	0 Centroid 4 Y
Input #9	0	Not Used	Output #9	0 Centroid 5 X
Input #10	0	Not Used	Output #10	0 Centroid 5 Y

Function Description: Centroid computation. Thresholds, then finds centroid. Thresholds used to remove contours by area

ADCompVision - Threshold



Vision Function Set #1 File write

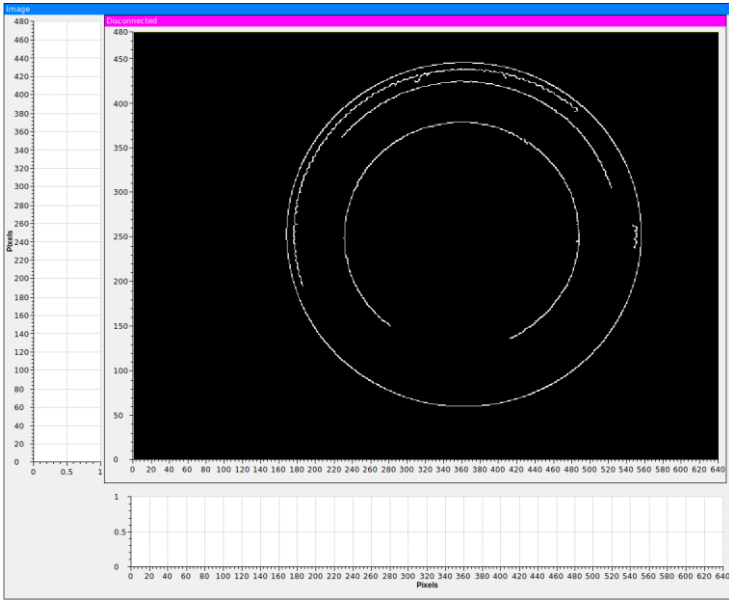
Vision Function Set #2

Vision Function Set #3

Input Descriptions			Output Descriptions	
Input #1	<input type="text" value="80"/> 80	Threshold Value (Int)	Output #1	361 Not Used
Input #2	<input type="text" value="255"/> 255	Max Pixel Value (Int)	Output #2	388 Not Used
Input #3	<input type="text" value="0"/> 0	Not Used	Output #3	227 Not Used
Input #4	<input type="text" value="0"/> 0	Not Used	Output #4	386 Not Used
Input #5	<input type="text" value="0"/> 0	Not Used	Output #5	420 Not Used
Input #6	<input type="text" value="0"/> 0	Not Used	Output #6	34 Not Used
Input #7	<input type="text" value="0"/> 0	Not Used	Output #7	167 Not Used
Input #8	<input type="text" value="0"/> 0	Not Used	Output #8	555 Not Used
Input #9	<input type="text" value="0"/> 0	Not Used	Output #9	0 Not Used
Input #10	<input type="text" value="0"/> 0	Not Used	Output #10	0 Not Used

Function Description Will create binary image with cutoff at Threshold Val

ADCompVision – Canny Edge



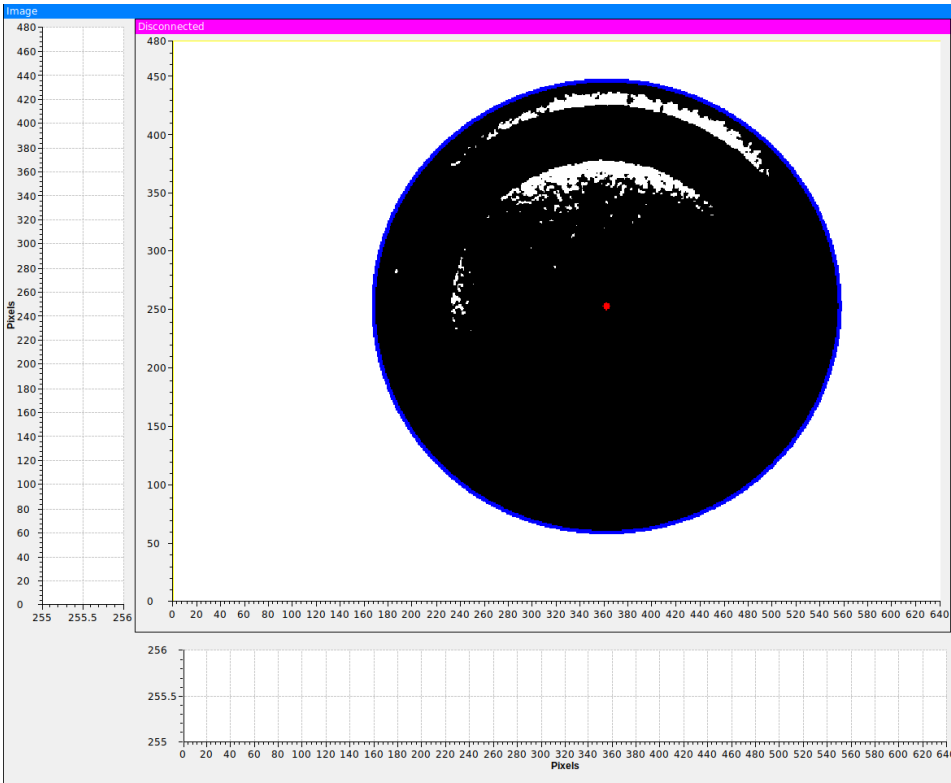
Vision Function Set #1	<input type="text" value="Canny Edge ..."/>	<input type="text" value="Canny Edge F"/>	File write	<input type="text" value="Disconnected"/>	<input type="text" value="Disconnecter"/>
Vision Function Set #2	<input type="text" value="None"/>	<input type="text" value="None"/>			
Vision Function Set #3	<input type="text" value="None"/>	<input type="text" value="None"/>			

Input Descriptions		Output Descriptions	
Input #1	<input type="text" value="100"/> 100	Output #1	361 Horizontal Center
Input #2	<input type="text" value="3"/> 3	Output #2	388 Horizontal Size
Input #3	<input type="text" value="3"/> 3	Output #3	227 Vertical Center
Input #4	<input type="text" value="3"/> 3	Output #4	387 Vertical Size
Input #5	<input type="text" value="0"/> 0	Output #5	421 Top Pixel
Input #6	<input type="text" value="0"/> 0	Output #6	34 Bottom Pixel
Input #7	<input type="text" value="0"/> 0	Output #7	167 Left Pixel
Input #8	<input type="text" value="0"/> 0	Output #8	555 Right Pixel
Input #9	<input type="text" value="0"/> 0	Output #9	0 Not Used
Input #10	<input type="text" value="0"/> 0	Output #10	0 Not Used

Function Description Edge detection using the 'Canny' function. First blurs the image, then thresholds, then runs the canny algorithm.



ADCompVision - Centroid



Vision Function Set #1 File write

Vision Function Set #2

Vision Function Set #3

Input Descriptions		Output Descriptions	
Input #1	1 Num Largest Contours (Int 1 - 5)	Output #1	361 Centroid 1 X
Input #2	3 Blur degree (Int) Ex. 3	Output #2	227 Centroid 1 Y
Input #3	100 Threshold Value (Int) Ex. 100	Output #3	0 Centroid 2 X
Input #4	240000 Upper Size Threshold Ex. 600*400	Output #4	0 Centroid 2 Y
Input #5	200 Lower Size Threshold Ex. 400	Output #5	0 Centroid 3 X
Input #6	0 Not Used	Output #6	0 Centroid 3 Y
Input #7	0 Not Used	Output #7	0 Centroid 4 X
Input #8	0 Not Used	Output #8	0 Centroid 4 Y
Input #9	0 Not Used	Output #9	0 Centroid 5 X
Input #10	0 Not Used	Output #10	0 Centroid 5 Y

Function Description Centroid computation. Thresholds, then finds centroid. Thresholds used to remove contours by area

New areaDetector EPICS Drivers

1. **Lambda** X-ray detector (10ID, 8ID, 12ID).
2. **Spinnaker** support for BlackFly S USB3.1 camera (28ID).
3. EPICS driver for **USB Video Class** cameras.
4. **EmergentVision** (IMX 264, 5Mpel) 10Gb EPICS camera driver, and support for upcoming 25Gb camera.
5. Barcode **ADPluginBar** plugin module.



New AD Drivers

Several new AD Drivers have also been developed:

- **ADSpinnaker** – has been modified and tested to run on linux (Ubuntu 18.04 and Ubuntu 16); {28ID}.
- **ADLambda** - has been modified and tested to run on Debian 7-9 (Dual Threshold not yet supported); {10ID, 8ID, 12ID}.
- **ADUVC** – Driver that adds support for UVC based USB cameras.
- **ADEmergentVision (in progress)** – Driver that adds support for Emergent Vision Technologies 10 qiqE and future 25 qiqE cameras.



ADPluginBar

Release R2-0 of ADPluginBar adds several key improvements:

- More image formats supported.
- Live barcode detection display.
- All detected barcode corners are accessible.

The screenshot displays the ADPluginBar software interface. The main window shows a live video feed of a QR code being scanned. The QR code is highlighted with a blue bounding box. The interface includes a histogram on the left side and a detailed control panel on the right. The control panel shows settings for the barcode detector, including array port, version, and detected corner coordinates.

Barcode Message: <http://ADPluginBar2-0/Test>
Barcode Type: QR-Code
Number Codes Detected: 1
Barcode Variant: Standard

Discovered Barcode Corners: Code 1

Corner #	X	Y
Corner #1	99	132
Corner #2	109	351
Corner #3	336	334
Corner #4	317	119

View codes 1-5

Plugin Name	Array Port	Enable	Disable	Process	More
OVER1	NDPluginOverlay	JVC1	Disable	Disable	No
RO1	NDPluginROI	JVC1	Disable	Disable	No
RO2	NDPluginROI	JVC1	Disable	Disable	No
RO3	NDPluginROI	JVC1	Disable	Disable	No
RO4	NDPluginROI	JVC1	Disable	Disable	No
STATS1	NDPluginStats	JVC1	Disable	Disable	No
STATS2	NDPluginStats	JVC1	Disable	Disable	No
STATS3	NDPluginStats	JVC1	Disable	Disable	No
STATS4	NDPluginStats	JVC1	Disable	Disable	No
STATS5	NDPluginStats	JVC1	Disable	Disable	No
SCATTER1	NDPluginScatter	JVC1	Disable	Disable	No
GATHER1	NDPluginGather	JVC1	Disable	Disable	No

Conclusions & Questions

- Deployment of binary areaDetector packages.
- New EPICS drivers for detectors.
- Computer Vision integration into the areaDetector.
- Demo on live beamline system.