

# PyDM

# Python Display Manager

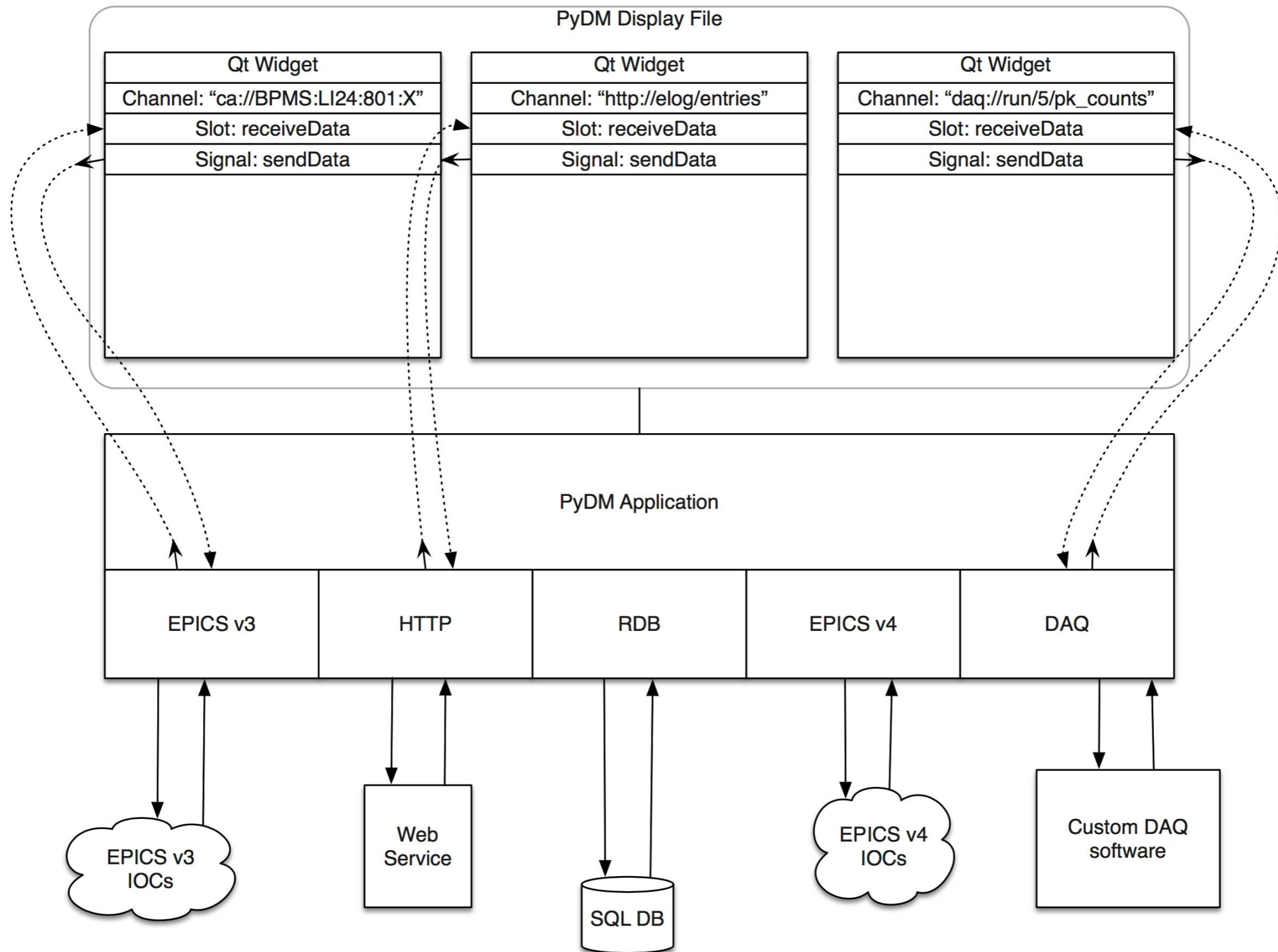
EPICS Collaboration Meeting, June 2018

Hugo Slepicka

- Open-Source Python-based Framework for Control System Graphical User Interfaces;
- It provides a system for the drag-and-drop creation of user interfaces using Qt Designer;
- Also allows for the creation of displays driven by Python code;
- Intended to span the range from simple displays without any dynamic behavior, to complex high level applications, with the same set of widgets;

- Developers can extend the framework with custom widgets for site specific tasks, and plugins for multiple control systems and data sources;
- Makes building control system UIs more efficient;
- Makes operating control systems easier and faster;
- Bridges the gap between control system displays (e.g. EDM panels) and high level applications (e.g. MATLAB or PyQt applications);

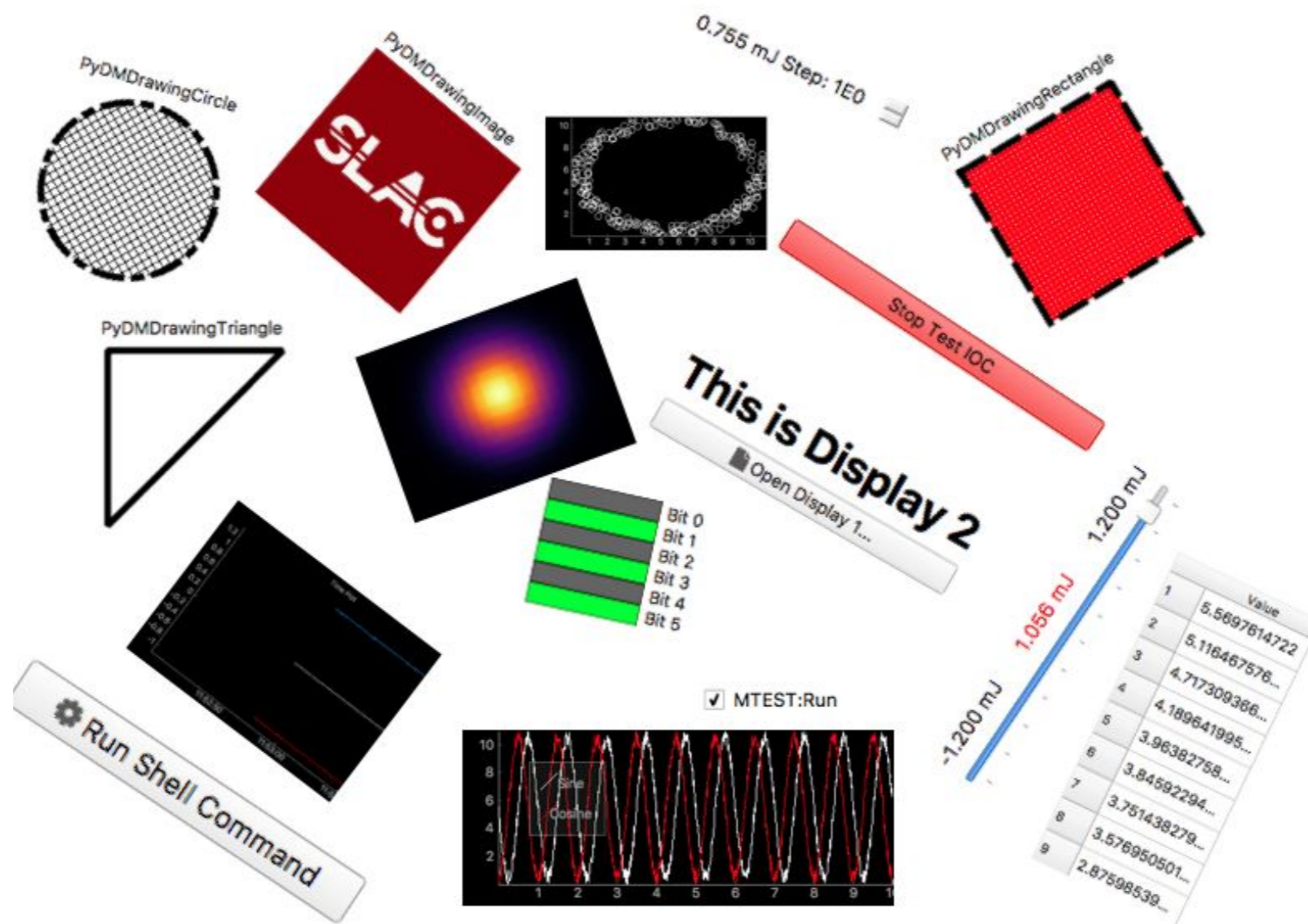
# Architecture



- PyDM ships with the following Data Plugins:
  - Channel Access (ca://)
    - PyEpics
  - Archiver Appliance (archiver://)
- It can be easily extended to support other Data Plugins and protocols such as:
  - ModBus (modbus://) - See: [https://github.com/slaclab/pydm\\_modbus](https://github.com/slaclab/pydm_modbus)

# Widget Set

Display
Byte Indicator
Image View
Label
Log Display
Related Display Button
Scale
Symbol
Waveform Table



Drawing
Line
Rectangle
Triangle
Ellipse
Circle
Arc
Pie
Chord
Image

Input
CheckBox
Enum Combo Box
Line Edit
Push Button
Shell Command
Slider
Spinbox
Waveform Table

Plot
Time plot
Scatter Plot
Waveform Plot

Container
Embedded Display
Frame
Tab Widget

- **Deployed:**

- **LSST Camera Interlock** Monitoring and Test Suite;
  - Using the ModBus Data plugin;
- UI for the **Skywalker Project** (Automatically delivery of the photon beam to a number of experimental hutches at LCLS);
- **LCLS Lightpath** (UI to Quickly Guide Beam to Experimental End Stations);

- **Under Development:**

- **Typhon** (Interface Generation for Ophyd Devices);
- Building Operator Displays for **Bunch Length (BLEN)**;
- Building Operator Displays for **Klystron Gallery** and **other subsystems**;

- **Max Planck Institute for Nuclear Physics in Heidelberg, Germany**

Using PyDM for a precision mass spectrometer named Pentatrap;

- **LNLS in Campinas, Brazil**

Using PyDM for the beamlines at current accelerator (UVX) and PyDM will be the standard display manager for the accelerator and beamlines at Sirius, a 4th-generation Synchrotron Light Source;



- Support to Widget Actions:  
Act on properties (Visibility, Position, Enable Status, etc...) based on Channel Values;
- PVAccess Data Plugin:  
Support for Normative Types and Structured Data in general;  
New Widgets for NTTTable and NTNDArray;
- PVAccess RPC Data Plugin:  
Support for Services through PVAccess;
- Expand support for Stylesheets;
- Increase Test Coverage and Documentation;

# Screenshots from LSST Camera Interlock



Form - [Preview] - Qt Designer

## MPM PLCs Monitor

### PLC Gateway

PLC Bus status

- Bit 0
- Bit 1
- Bit 2
- Bit 3
- Bit 4
- Bit 5
- Bit 6
- Bit 7

Enable Data to Pluto

- Bit 0
- Bit 1
- Bit 2
- Bit 3

Timeout

Data Area 0 addr Config Register

Data Area 1 addr Config Register

Data Area 2 addr Config Register

Data Area 3 addr Config Register

Data Area 4 addr Config Register

Data Area 5 addr Config Register

Data Area 6 addr Config Register

Data Area 7 addr Config Register

Data Area 8 addr Config Register

Data Area 9 addr Config Register

Data Area 10 addr Config Register

Data Area 11 addr Config Register

Data Area 12 addr Config Register

Data Area 13 addr Config Register

Data Area 14 addr Config Register

Data Area 15 addr Config Register

Data Area 16 addr Config Register

Data Area 17 addr Config Register

Data Area 18 addr Config Register

Data Area 19 addr Config Register

Data Area 20 addr Config Register

Data Area 21 addr Config Register

Data Area 22 addr Config Register

Data Area 23 addr Config Register

Data Area 24 addr Config Register

Data Area 25 addr Config Register

Data Area 26 addr Config Register

Data Area 27 addr Config Register

Data Area 28 addr Config Register

Data Area 29 addr Config Register

Data Area 30 addr Config Register

Data Area 31 addr Config Register

### PLC modbus

<input type="checkbox"/> <input checked="" type="checkbox"/> P1_ResetTemp	<input checked="" type="checkbox"/> P1_TempOk	<input checked="" type="checkbox"/> P1_TempHighFilter	<input checked="" type="checkbox"/> P1_Tsw0	<input checked="" type="checkbox"/> P1_Tsw1	<input checked="" type="checkbox"/> P1_Tsw2	<input checked="" type="checkbox"/> P1_Tsw3	<input checked="" type="checkbox"/> P1_NoLeak	<input checked="" type="checkbox"/> P1_Leak	<input checked="" type="checkbox"/> P1_NoLeakFault	<input checked="" type="checkbox"/> P1_NoSmoke	<input checked="" type="checkbox"/> P1_UiPowerPerm	<input checked="" type="checkbox"/> P1_RebPowerPerm	<input checked="" type="checkbox"/> P1_CoolantValve	<input checked="" type="checkbox"/> P1_LeakPower	<input checked="" type="checkbox"/> P1_APower	<input checked="" type="checkbox"/> P1_BPower	<input checked="" type="checkbox"/> P1_CPower	<input checked="" type="checkbox"/> P1_LeakFaultOkLatch	<input checked="" type="checkbox"/> P1_LeakFaultOkLatchStatus	<input checked="" type="checkbox"/> P1_LeakOkLatch	<input checked="" type="checkbox"/> P1_LeakOkLatchStatus	<input checked="" type="checkbox"/> P1_TempOkLatch	<input checked="" type="checkbox"/> P1_TempOkLatchStatus	<input checked="" type="checkbox"/> P1_SmokeFaultOkLatch	<input checked="" type="checkbox"/> P1_SmokeFaultOkLatchStatus	<input checked="" type="checkbox"/> P1_SmokeOkLatch	<input checked="" type="checkbox"/> P1_SmokeOkLatchStatus										
<input type="checkbox"/> P1_ResetLeak	<input checked="" type="checkbox"/> P1_LeakFilter	<input checked="" type="checkbox"/> P1_LeakFaultFilter	<input checked="" type="checkbox"/> P1_UiPowerPermBlockSet	<input checked="" type="checkbox"/> P1_UiPowerPermBlockReset	<input checked="" type="checkbox"/> P1_UiPowerPermBlock	<input checked="" type="checkbox"/> P1_RebPowerPermBlockSet	<input checked="" type="checkbox"/> P1_RebPowerPermBlockReset	<input checked="" type="checkbox"/> P1_RebPowerPermBlock	<input checked="" type="checkbox"/> P1_CoolantValveBlockSet	<input checked="" type="checkbox"/> P1_CoolantValveBlockReset	<input checked="" type="checkbox"/> P1_CoolantValveBlock	<input checked="" type="checkbox"/> P2_CpTemp0NoLow	<input checked="" type="checkbox"/> P2_CpTemp0NoHigh	<input checked="" type="checkbox"/> P2_CpRtd0Valid	<input type="checkbox"/> P2_CpRtd0Temp	<input type="checkbox"/> P2_CpRtd0Current	<input type="checkbox"/> P2_CpTemp1NoLow	<input checked="" type="checkbox"/> P2_CpTemp1NoHigh	<input checked="" type="checkbox"/> P2_CpRtd1Valid	<input type="checkbox"/> P2_CpRtd1Temp	<input type="checkbox"/> P2_CpRtd1Current	<input type="checkbox"/> P2_CpTemp2NoLow	<input checked="" type="checkbox"/> P2_CpTemp2NoHigh	<input checked="" type="checkbox"/> P2_CpRtd2Valid	<input type="checkbox"/> P2_CpRtd2Temp	<input type="checkbox"/> P2_CpRtd2Current	<input type="checkbox"/> P2_CpTemp3NoLow	<input checked="" type="checkbox"/> P2_CpTemp3NoHigh	<input checked="" type="checkbox"/> P2_CpRtd3Valid	<input type="checkbox"/> P2_CpRtd3Temp	<input type="checkbox"/> P2_CpRtd3Current	<input checked="" type="checkbox"/> P2_CpTempNotHigh	<input type="checkbox"/> P2_ResetCpHigh	<input checked="" type="checkbox"/> P1_SmokeFaultFilter	<input checked="" type="checkbox"/> P2_NoSmokeFault	<input checked="" type="checkbox"/> P2_NoSmokeWarning	<input checked="" type="checkbox"/> P2_MasterResetButton
<input checked="" type="checkbox"/> P2_CpTempHighFilter	<input type="checkbox"/> P2_CpHighLimit	<input type="checkbox"/> P2_CpHeatPermBlockSet	<input type="checkbox"/> P2_CpHeatPermBlockReset	<input checked="" type="checkbox"/> P2_CpHeatPermBlock	<input checked="" type="checkbox"/> P2_CpHeatLodLight	<input checked="" type="checkbox"/> P2_CpHeatPerm	<input type="checkbox"/> P2_CpRePermBlockSet	<input type="checkbox"/> P2_CpRePermBlockReset	<input checked="" type="checkbox"/> P2_CpRePermBlock	<input checked="" type="checkbox"/> P2_CpFrigLockLight	<input checked="" type="checkbox"/> P2_CpRePerm	<input checked="" type="checkbox"/> P2_CpTempNotLow	<input type="checkbox"/> P2_ResetCpLow	<input checked="" type="checkbox"/> P2_APower	<input checked="" type="checkbox"/> P2_CpTempLowFilter	<input type="checkbox"/> P2_CpLowLimit	<input checked="" type="checkbox"/> P2_CpTempLow	<input checked="" type="checkbox"/> P2_CpTempHighOkLatchStatus	<input checked="" type="checkbox"/> SM_Pluto1_Present	<input checked="" type="checkbox"/> SM_Pluto2_Present	<input checked="" type="checkbox"/> SM_Pluto3_Present	<input checked="" type="checkbox"/> P2_CpTempLowOkLatchStatus	<input checked="" type="checkbox"/> P2_CpHotLight	<input checked="" type="checkbox"/> P2_CpColdLight													
<input checked="" type="checkbox"/> P3_CryTemp0NotLow	<input checked="" type="checkbox"/> P3_CryTemp0NotHigh	<input checked="" type="checkbox"/> P3_CryRtd0Valid	<input type="checkbox"/> P3_CryRtd0Temp	<input type="checkbox"/> P3_CryRtd0Current	<input checked="" type="checkbox"/> P3_CryTemp1NotLow	<input checked="" type="checkbox"/> P3_CryTemp1NotHigh	<input checked="" type="checkbox"/> P3_CryRtd1Valid	<input type="checkbox"/> P3_CryRtd1Temp	<input type="checkbox"/> P3_CryRtd1Current	<input checked="" type="checkbox"/> P3_CryTemp2NotLow	<input checked="" type="checkbox"/> P3_CryTemp2NotHigh	<input checked="" type="checkbox"/> P3_CryRtd2Valid	<input type="checkbox"/> P3_CryRtd2Temp	<input type="checkbox"/> P3_CryRtd2Current																							

### To PLC

<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.IA0 ←	PRT-UTT-TSW-00
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.IA1 ←	PRT-UTT-TSW-01
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.IA2 ←	PRT-UTT-TSW-02
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.IA3 ←	PRT-UTT-TSW-03
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.I4 ←	PRT-UTT-LLD-00 No Leak
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.I5 ←	PRT-UTT-LLD-00 Leak
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.I7 ←	PRT-UTT-LLD-00 No Leak Fault
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.I6 ←	PRT-UTT-SMK-00 No Smoke
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> P1.IQ16	→ UT Power Status
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> P1.IQ17	→ REB Power Status
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.Q0	→ PRT-UTT-RLY-00 Power -
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.Q1	→ PRT-UTT-DCD-00 -
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.Q2	→ A_Power
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.Q3	→ B_Power
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.IQ10	→ C_Power
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.IQ11	→ UT Coolant Leak
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.IQ12	→ UT Hot
<input type="checkbox"/>	<input checked="" type="checkbox"/> P1.IQ13	→ UT Smoke
<input type="checkbox"/>	<input type="checkbox"/> P2.IA0 ←	PRT-UTT-SGC-00
<input type="checkbox"/>	<input type="checkbox"/> P2.IA1 ←	PRT-UTT-SGC-01
<input type="checkbox"/>	<input type="checkbox"/> P2.IA2 ←	PRT-UTT-SGC-02
<input type="checkbox"/>	<input type="checkbox"/> P2.IA3 ←	PRT-UTT-SGC-03
<input type="checkbox"/>	<input checked="" type="checkbox"/> P2.I4 ←	PRT-UTT-SMK-00 No Smoke Fa
<input type="checkbox"/>	<input checked="" type="checkbox"/> P2.I5 ←	PRT-UTT-SMK-00 No Smoke W
<input type="checkbox"/>	<input checked="" type="checkbox"/> P2.I7 ←	Master Reset
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> P2.IQ16	→ Cold Heat Lock
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> P2.IQ17	→ Cold Frig Lock
<input type="checkbox"/>	<input checked="" type="checkbox"/> P2.Q0	→ A_Power
<input type="checkbox"/>	<input checked="" type="checkbox"/> P2.Q1	→ MPM Active
<input type="checkbox"/>	<input checked="" type="checkbox"/> P2.IQ10	→ Cold Plate Hot
<input type="checkbox"/>	<input checked="" type="checkbox"/> P2.IQ13	→ Cold Plate Cold
<input type="checkbox"/>	<input type="checkbox"/> P2.IQ14	PRT-UTT-SGC-04
<input type="checkbox"/>	<input type="checkbox"/> P2.IQ15	PRT-UTT-SGC-05
<input type="checkbox"/>	<input type="checkbox"/> P2.IQ16	PRT-UTT-SGC-06

# Screenshots from LSST Camera Interlock



Form - PyDM

File View History Tools

Back Forward Home

## Vaccum PLC Test software

Vaccum Monitor

Test	Description	Step	Details
1 TestPlutoGatewayConfig	Check Pluto Gateway configuration registers. Expected:[	RUN	Pluto Gateway Config match expected values.C
2 TestPlutoPLCsPresent	Check Pluto Gateway sees Pluto D45 as node 0.	RUN	Pluto Gateway sees D45 PLC as node 0
3 TestChannelsBootDefault	Check if all channels are as expected when the PLC is po	RUN	Checking boot default values. Do not match. IQ20 should be 0. It is True
4 TestePlutoWriteReadback	Test write and rbv Pluto adds	RUN	
5 TestAnalogScaling	Check the analog input wiring, linearity and scaling fact	RUN	
6 TestHVDifferences	Test HV Pressure absolute difference calculation in the P	RUN	
7 TestCvValves	Test CvValves	RUN	
8 TestValveMonitors	Test TestValveMonitors	RUN	
9 TestHvStat	Test HvStat permit logic	RUN	
10 TestHvTurboOnOfflogic	Test TestHvTurboOnOfflogic permit logic	RUN	
11 TestHvTurboPermitBlock	Test TestHvTurboPermitBlock permit logic	RUN	
12 TestHvTurboPermitAuto	Test TestHvTurboPermitAuto permit logic	RUN	
13 TestCvStat	Test CvStat permit logic	RUN	
14 TestCvTurboOnOfflogic	Test TestCvTurboOnOfflogic permit logic	RUN	
15 TestCvTurboPermitBlock	Test TestCvTurboPermitBlock permit logic	RUN	
16 TestCvTurboPermitAuto	Test TestCvTurboPermitAuto permit logic	RUN	

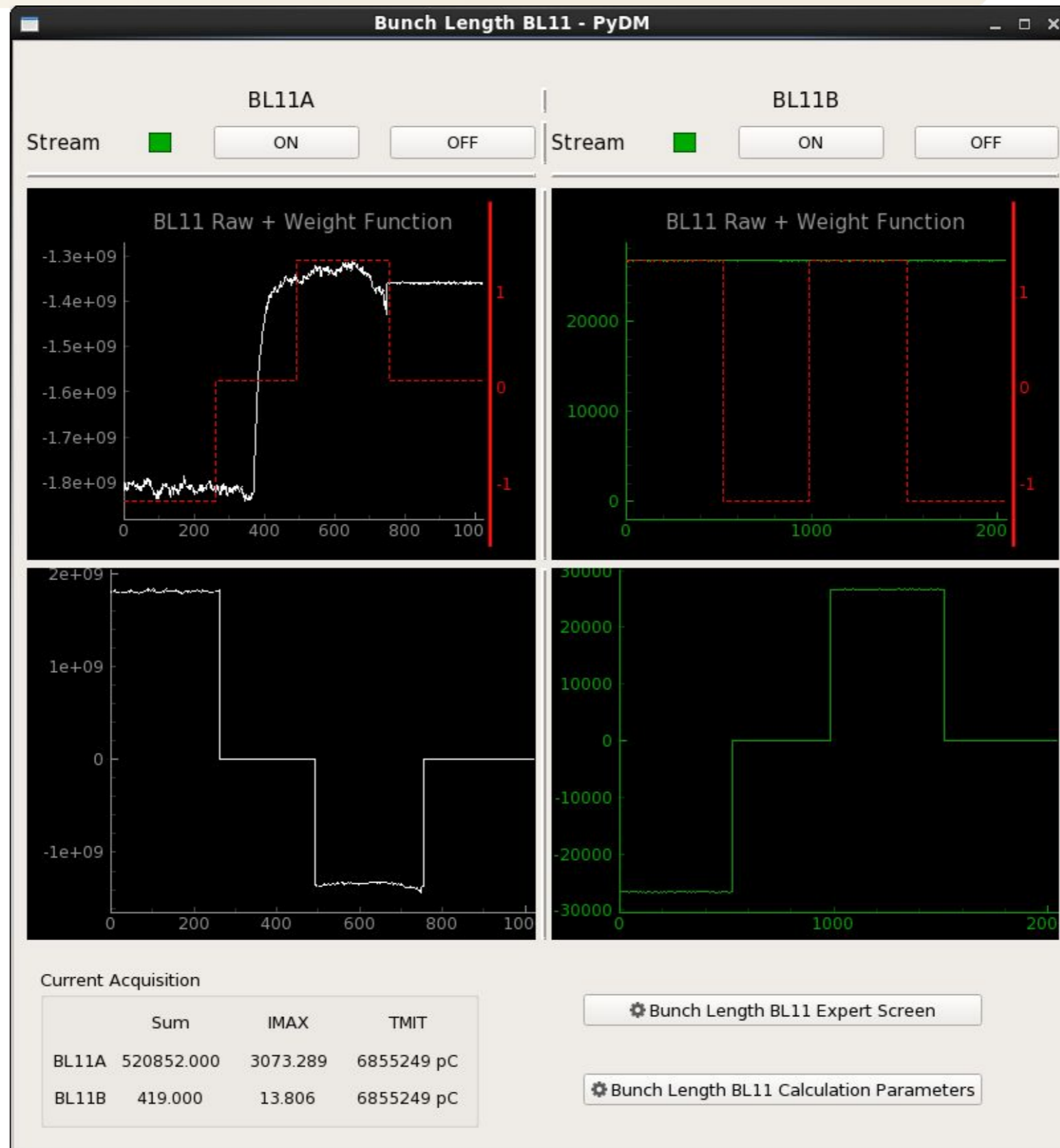
Run All

Abort

100% 1 / 1

**Failed.**

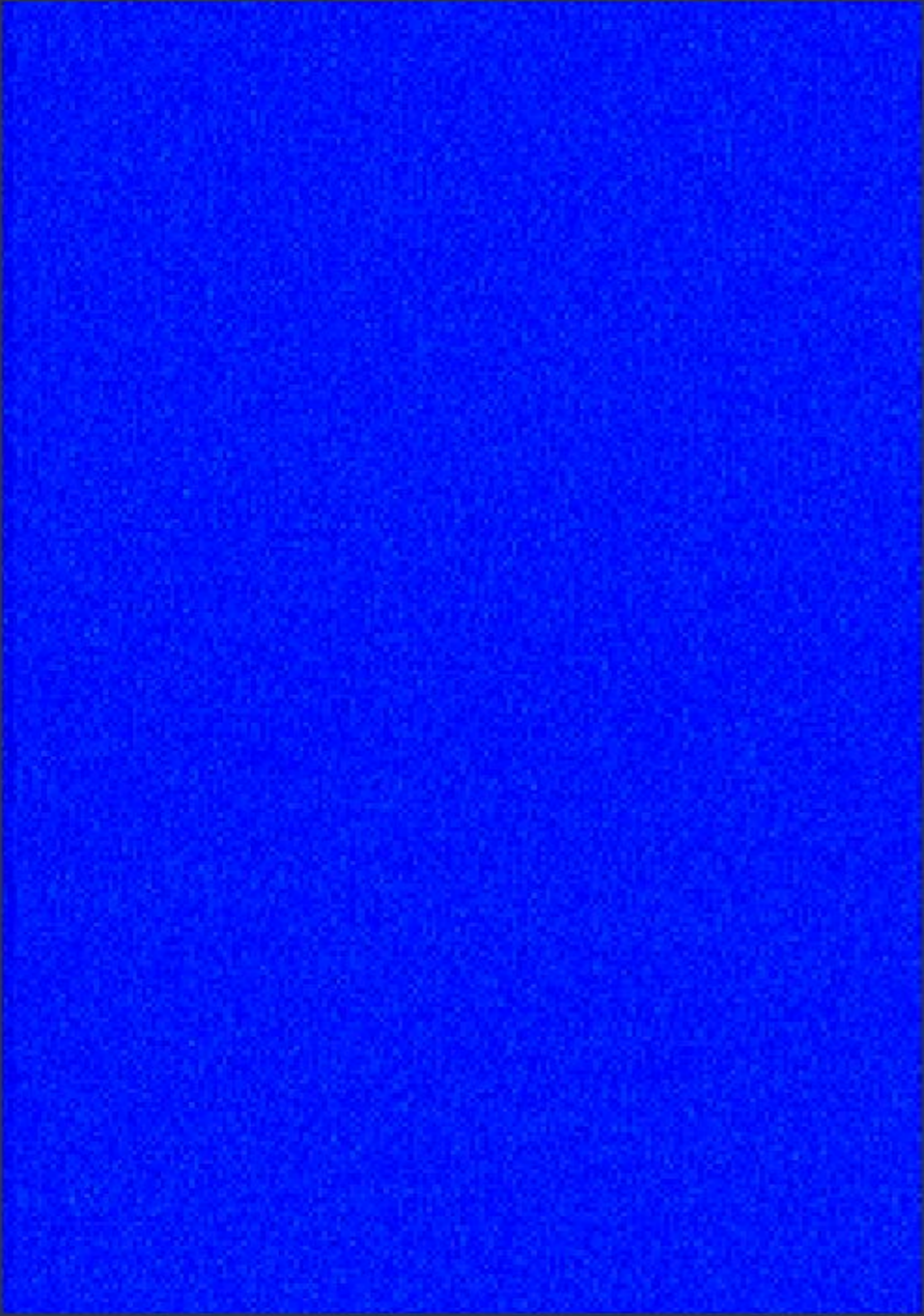
# Screenshots from Bunch Length (BLEN)





# Screenshots from Skywalker

XRT DG3M PIM YAG YAG



### Alignment Control

Procedure: HOMS Status: Idle

Start Pause Abort

#### Advanced

Lightpath Expert

### XRT DG3M PIM

Position Delta

Beam X	0.0
Beam Y	0.0

Fiducialize Align

### Goals

Save Goals

HX2 PIM	220.0
XRT DG3M PIM	264.0

### Mirrors

Save as Nominal

FEE M1H	<input type="radio"/>	225 urad	240.985	Go to Nominal
FEE M2H	<input type="radio"/>	141 urad	141.000	Go to Nominal

```
11-28 09:35:01 Selecting procedure HOMS
11-28 09:34:58 Loading necessary device information from database
11-28 09:34:58 Selecting imager XRT DG3M PIM
```

# Screenshots from Lightpath

The screenshot shows a window titled "Form" with a dark background. At the top, there is a "Beam Destinations" dropdown menu set to "MFX", a "Minimum Transmission" slider set to 1, and a checked "Show upstream devices" checkbox. Below this is a list of beam destinations, each with a colored bar on the left, a name, a path in parentheses, a status, and control buttons.

Beam Destination	Path	Status	Controls
fee_m1h	(FEE1:M1H)	Inserted	
fee_m2h	(FEE1:M2H)	Inserted	
sh1	(PPS:NEH1:1:SH1INSUM)	Inserted	Insert Remove
uvd_valve	(HX2:UVD:VGC:01)	Removed	Insert Remove
hx2_reference_laser	(HX2:REFLASER:MIRROR)	Removed	Insert Remove
hx2_slits	(HX2:SB1:JAWS)	Inserted	Remove
hx2_ipm	(HX2:SB1:IPM)	Removed	Insert Remove
hx2_plm	(HX2:SB1:PIM)	Removed	Insert Remove
hx2_valve	(HX2:DVD:VGC:01)	Removed	Insert Remove

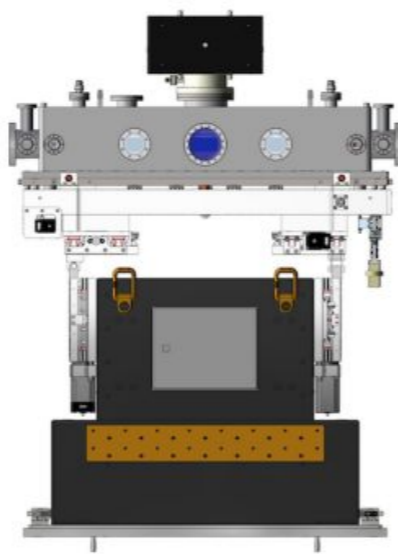
# Screenshots from Typhon

Hide All

Tools

**Device Log**

## XRT HOMS



User Readback

User Setpoint  198

Configuration **Miscellaneous**

User Offset	<input type="text" value="-974.4397"/>	-974.4397
User Offset Dir	<input type="text" value="Pos"/>	Pos
Velocity	<input type="text" value="2.0820"/>	2.0820
Acceleration	<input type="text" value="1.0000"/>	1.0000
Motor Egu	<input type="text" value="mm"/>	mm

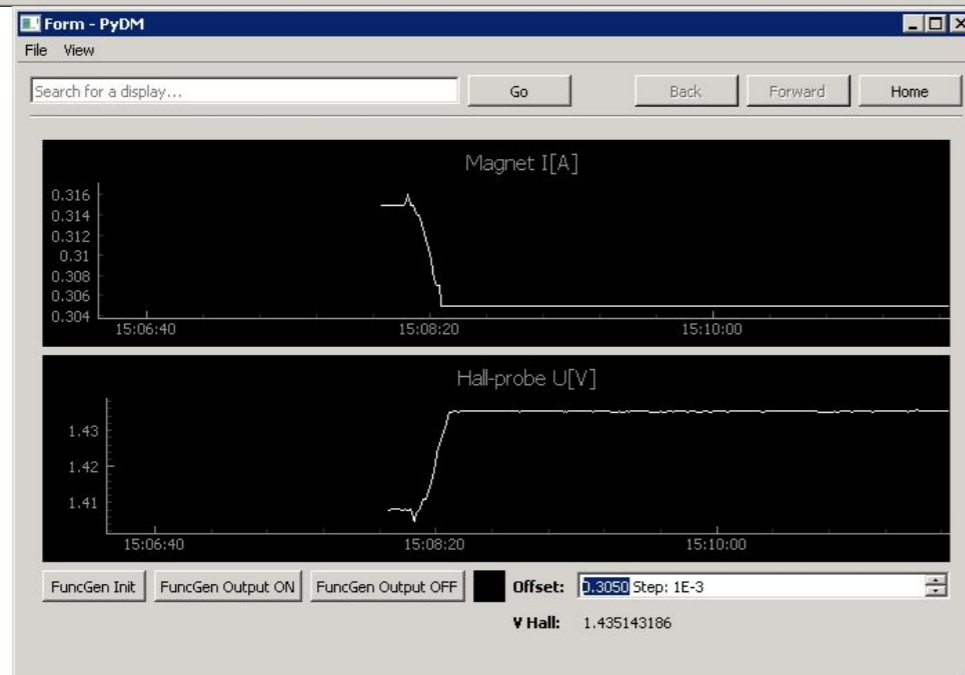
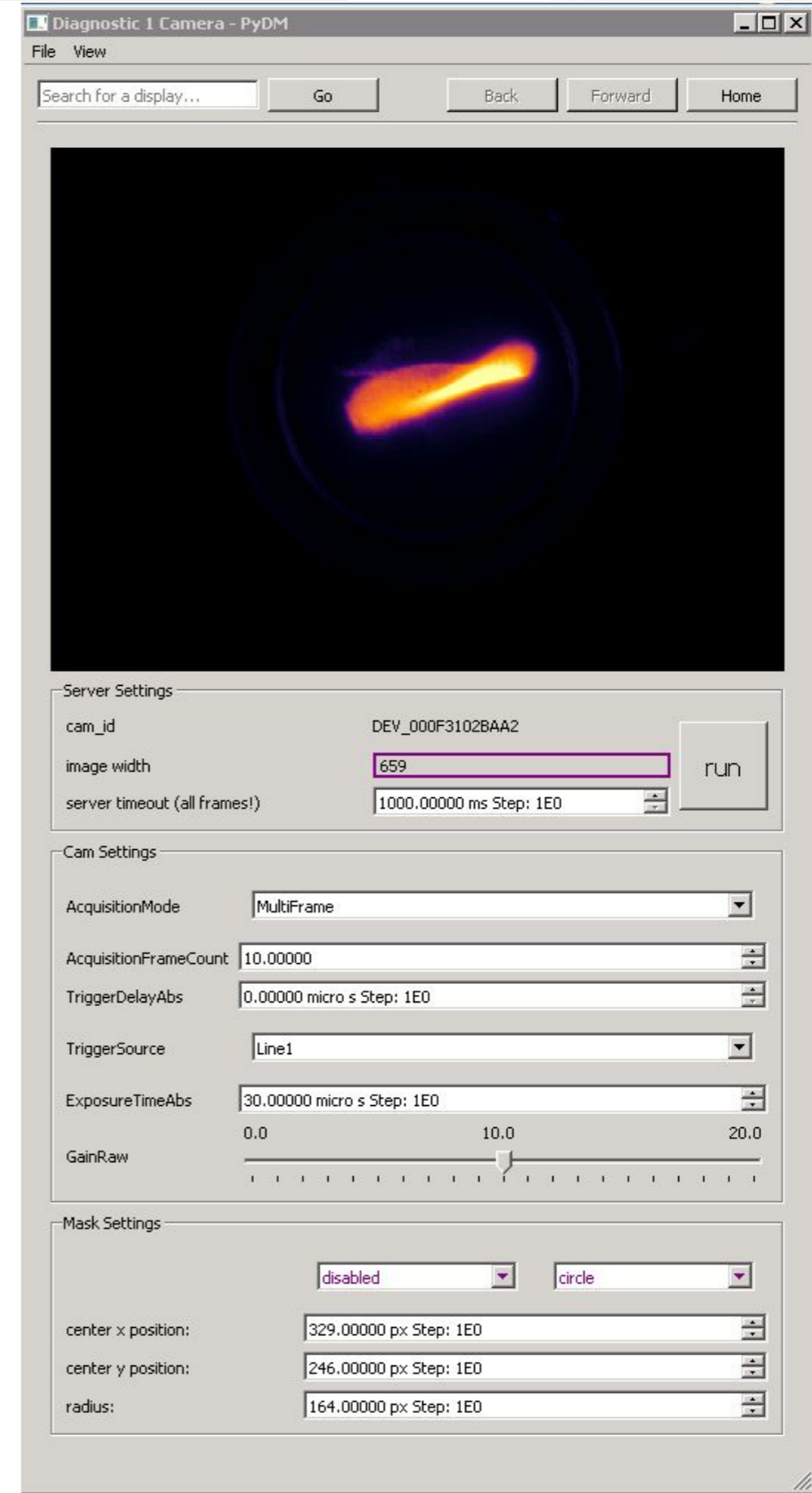
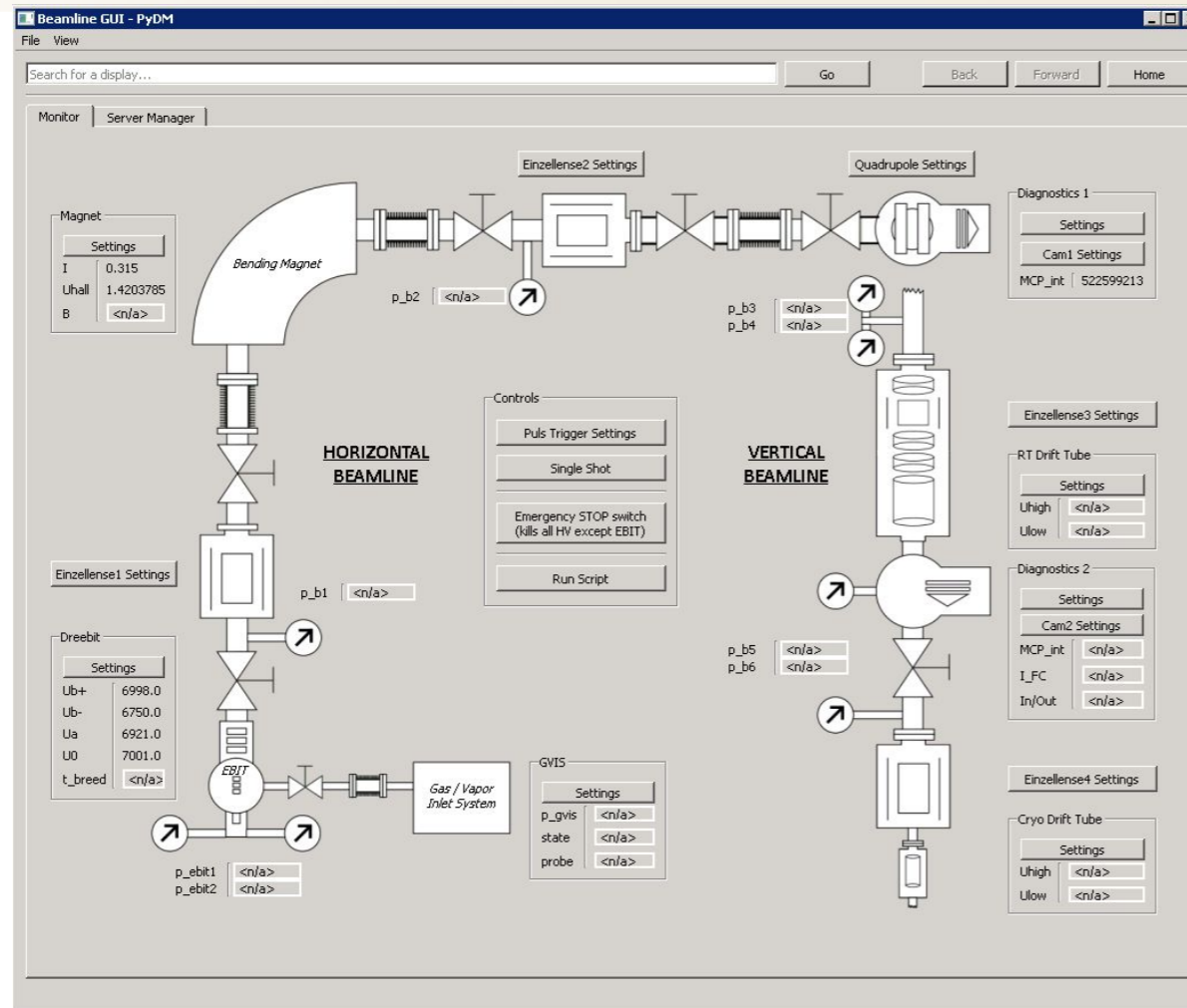
Minimum displayed log level: **WARNING**

```
2018-06-07 14:13:06.845 Subscription value callback exception
(EpicsSignalRO(read_pv='MFX:TFS:MMS:21.DMOV', name='XRT
HOMS_motor_done_move', parent='XRT HOMS', value=1,
timestamp=1528405985.837039, pv_kw={}, auto_monitor=False, string=False))
Traceback (most recent call last):
  File "/reg/neh/home/trendahl/miniconda3/envs/typhon-dev/lib/python3.6/site-
packages/ophyd/ophyobj.py", line 266, in inner
    cb(*args, **kwargs)
  File "/reg/neh/home/trendahl/miniconda3/envs/typhon-dev/lib/python3.6/site-
packages/ophyd/epics_motor.py", line 242, in _move_changed
    if self.direction_of_travel.get() == 0:
  File "/reg/neh/home/trendahl/miniconda3/envs/typhon-dev/lib/python3.6/site-
packages/ophyd/signal.py", line 553, in get
    self._read_pv.pvname)
TimeoutError: Failed to connect to MFX:TFS:MMS:21.TDIR
```

Clear



# Screenshots from Max Planck Institute





# Screenshots from LNLS



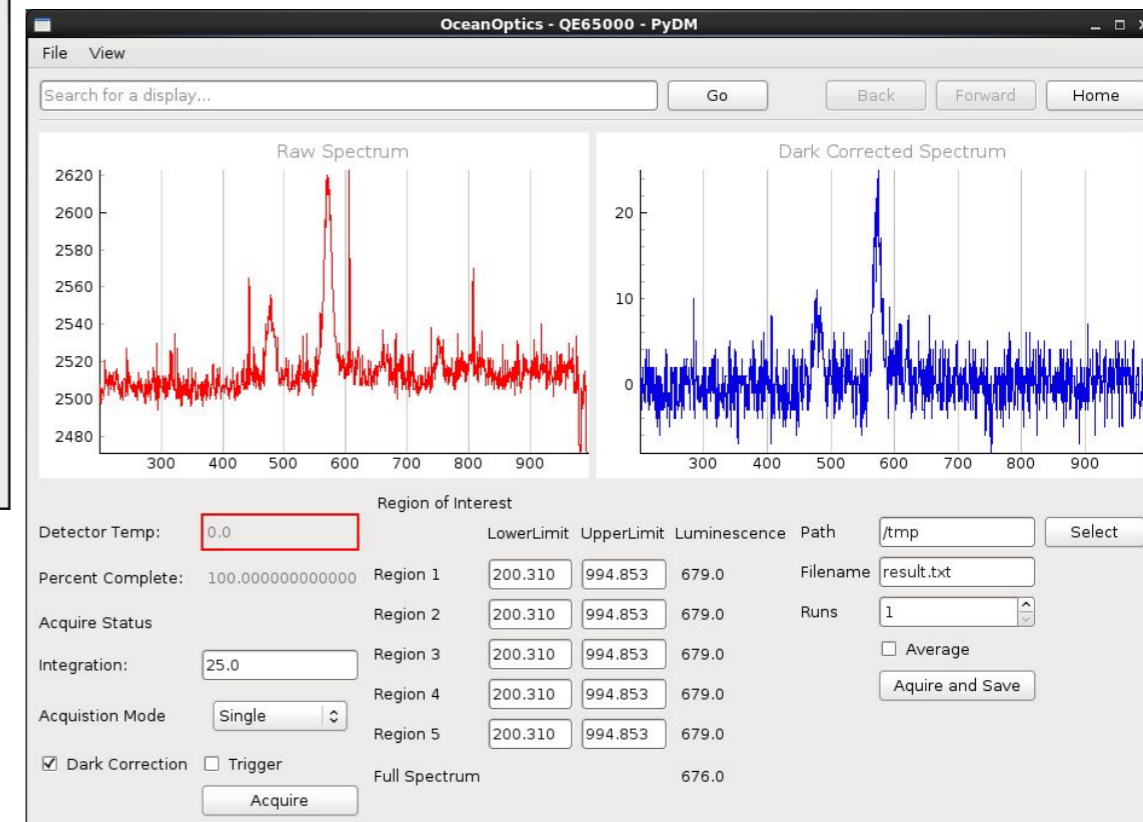
**Motor settings - [Preview] — Qt Designer**

**Slit Motor 1** SIRIUS:SLIT1:m1

**Calibration**

- User Direction: [Dropdown]
- User Offset: [Text Field]
- Set:
- Value: 0.0
- Readback: 12.0 mm

Edit



# Where is PyDM?



GitHub

Code: <https://github.com/slaclab/pydm>

Docs: <https://slaclab.github.io/pydm>

Tutorial: <https://slaclab.github.io/pydm-tutorial>



Gitter

Open Chat: <https://gitter.im/pydm/General>



ANACONDA®

Install with Anaconda: `conda install -c pydm-tag -c conda-forge pydm`

Available for:



Questions?

Suggestions?

Comments?

The ONLY valid measurement  
of code quality: WTFs/minute

