FACET-II DAQ

Live planning notes

Goal: Update DAQ to HDF5

- What has already been done?
  - We have a working version of the HDF5 DAQ, and now we are working on making it robust
  - Sharon has shown that HDF5 file writing in "Streaming" mode is very fast.
  - Now we want to extend capability for scans so that we have 1 file per camera.
- How to save scan image data into HDF5 file?
  - Use PVs:
    - extraDimSizeN = Number of shots per step
    - nExtraDims = Number of scan dimensions (0 = simple DAQ, 1 = 1D scan, 2 = 2D scan . . .)
    - extraDimSizeX = Number of steps for Dim 1
    - extraDimSizeY = Number of steps for Dim 2
    - extraDimSize3 = Number of steps for Dim 3
    - . . .
  - These PVs implicitly control the NumCapture PV
    - NumCapture_RBV = extraDimSizeN * extraDimSizeX * extraDimSizeY * . . . (depending on number of nExtraDims)
- In this scheme, we have to carefully control the triggers so that each scan step gets exactly the right number
  - We will use a new feature to do this:
    - EVNT:SYS1:1:PMAQCTRL.H = extraDimSizeN = Number of shots per step
    - EVNT:SYS1:1:PMAQCTRL.E = 0/1 to stop/start triggers to cameras
    - Need to toggle back to 0 after every step
    - Set EVNT:SYS1:1:PMAQCTRL.H back to zero at end of scan
- What happens if the camera does not receive all triggers?
  - Then scan steps are kind of messed up . . . think about how best to handle this with pulse ID
- Prefer "NDArrayUniqueId" to be "NDArrayPulseId"
- Make caput/lcaPut/lcaPutSmart consistent
- "BSA buffer" for UV spectrometer IOC?
- Find a reliable fix to shot counting issue
  - checkShots is not counting the correct number of shots at some steps. we think the DAQ is just not waiting long enough for the shot number to go up, because the shots do get saved eventually
  - for E332 shift on 5/30, we just added a while/pause loop to force DAQ to wait for shot numbers to go up
  - if we decide to keep this functionality we should at least add a break for the while loop but for now it is working again

DAQ tests E320 shift 4/30/24

Testing TIFF/HDF5 switch
- take a DAQ with TIFF and try to load it in DAN
- results look normal

Testing HDF5 DAQ
- take a DAQ with HDF5, simple DAQ, 20 shots, 1 camera (LBG_LFOV)
  - all 20 shots saved
- test with 1000 shots
  - saved 999 shots
  - took a little over 2 minutes
- add more cameras (LBG_LFOV, EOS2, GAMMA1)
  - saved 993 shots for each camera
  - ~2 min 10 seconds in total
- try streaming
  - 1000 shots
  - failed TEST 7480
- try streaming but with 10 shots
  - success with all matches
- try streaming with 200 shots
  - success with 197 matches
- try streaming with 700 shots
  - says DAQ failed on step 1 but 641 matches
- try streaming with TIFF, 700 shots
  - saved 155 matches
  - took a little more than 3 minutes
- try a 1D scan, 10 shots, 3 steps
  - did not restore to initial value
  - Spec_Quad_E
  - 28 matches
- trying a 2D scan, 10 x 2 x 2
  - saved 40 shots
- trying 2D scan with streaming
  - saved 40 shots
- try to open HDF5 images in DAN
  - error when "Plot Correlation" button pushed, expecting a TIFF image
  - Error in hlpGetImage with “imgType”

Bugs and Robustness

Issue	Person	Priority	Status	Notes
Background not being saved	Sharon	High	**DONE**	
Not saving non BSA data and getting F2_EventClass error	Sharon	High		This is caused by a PV in a list being down
Implement HDF5 file saving for images	Sharon	High	Testing	
~~Modify DAQ to write image data to "RAM disk"~~		~~High~~	N/A	
Calculate how much space on disk is required		High		
Install 10G switch and NAS in S10	Arjun	High	Planning	
Check what happens if new DAQ is started before old one is finished (failed abort)		High		
Fix binning and ROI for CMOS cameras		Medium		
Can't get magnet values on first DAQ?		Medium		
Check that the beam rate is not equal zero if rate set to "BEAM"	Spencer	Medium		
Fix "Use_PV" functionality.	Sharon	Medium	**DONE**	
Fix camera triggers if DAQ fails.	Sharon	High	**DONE**	
"Fix cameras" button disabled if DAQ hasnt run yet	Sharon	Medium	**DONE**	
"Fix cameras" button should use default values? - yes	Sharon	Medium	**DONE**	
Timestamping fails on certain ROI settings?	Spencer	High	**DONE**	
Upgrade all machines in S20 to 10G connection	Spencer	Medium	**DONE**	
Camera binning messes up pulse ID finding	Spencer	Medium	**DONE**	

Feature requests

Issue	Person	Priority	Status
Add check/remove bad PVs and notify user in an obvious way	Sharon		
Add nonBSA arrays so we can get UV spectrometer (Claudio request)	Sharon	High	**DONE**
DAQ Monitor GUI	Sharon	High	**DONE**
Find a way to globally trigger a modifier bit (e.g. "DUMP_2_9").	David		
Scan function that pauses until you click 'ok'			
Generate "camera config" file including trigger info and add a save/restore button. Monitor if this finished ok or not.	Sharon		
Load/Save Config files. Default config files.	Claire		
Robustness issues. . .	Spencer	High	In progress
DAN features	Sharon		
Documentation/commenting	Spencer	High	In progress
Fix "Use_PV" functionality.	Sharon	Medium	**DONE**

Documentation

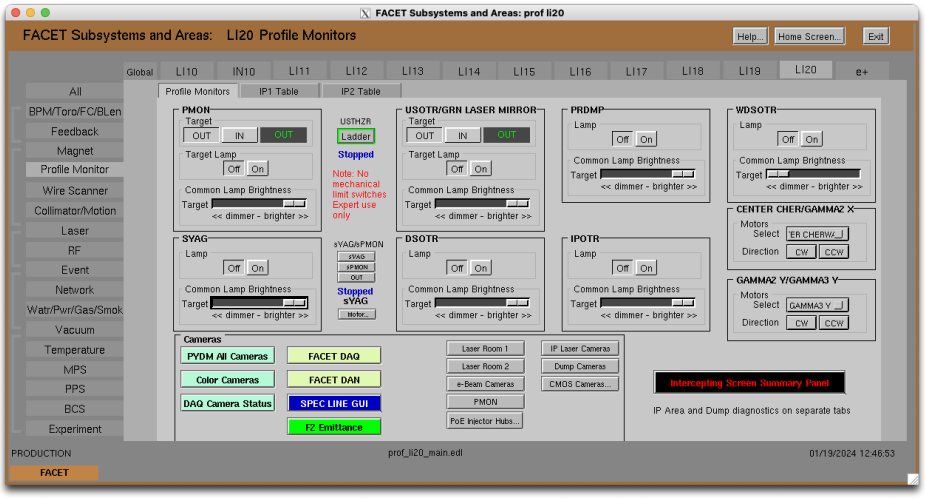
For now, the main references on the DAQ are these attached PDFs from IBIC 2021.

WEPP33_vIBIC.PDF

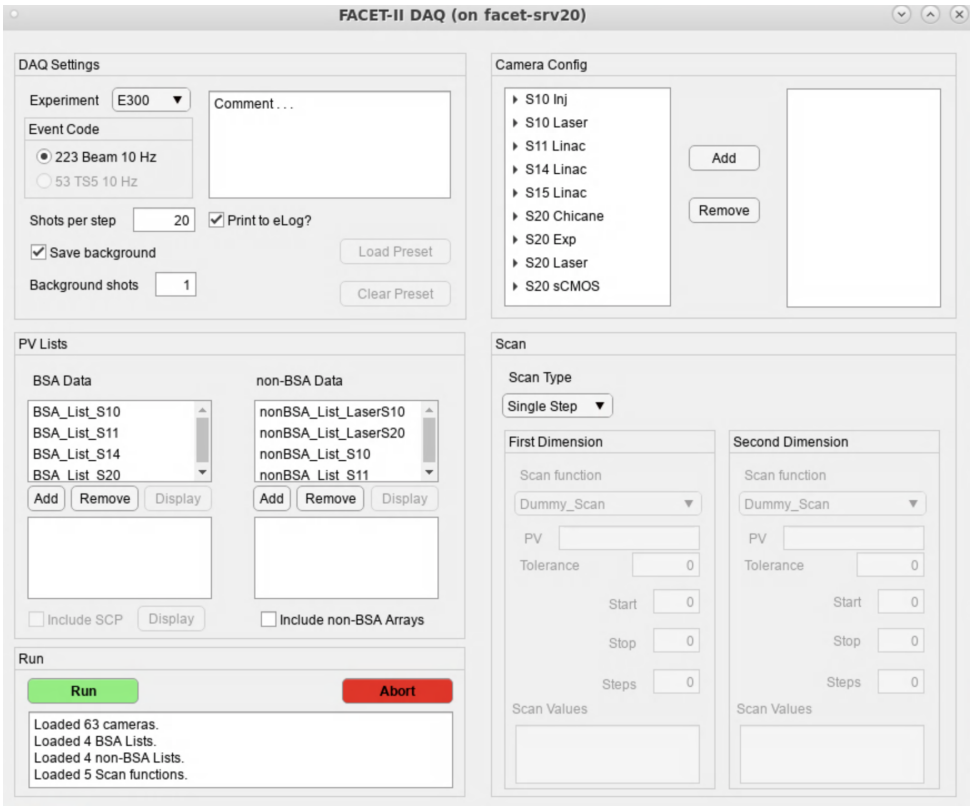
WEPP33_poster.pdf

GUI Interface

Main screen Profile Monitor LI20 FACET DAQ (green button)

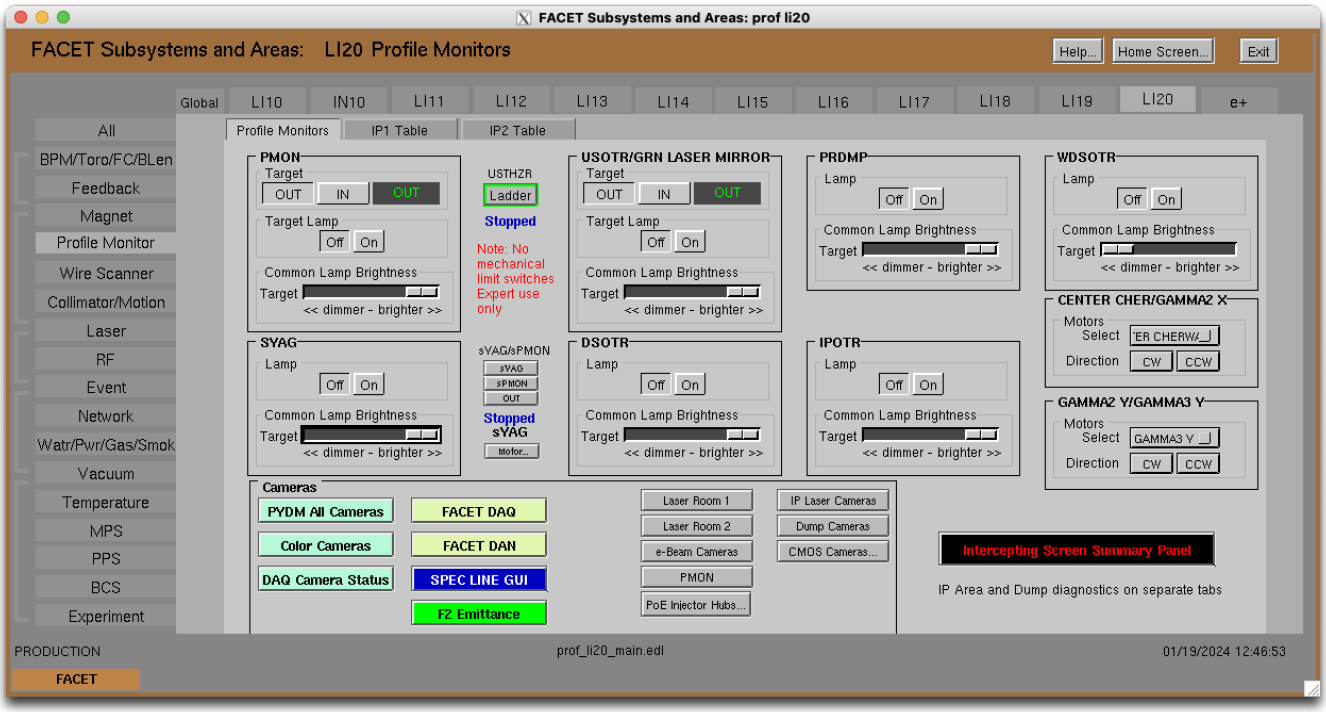


Wait for a bit after pressing the FACET DAQ button.

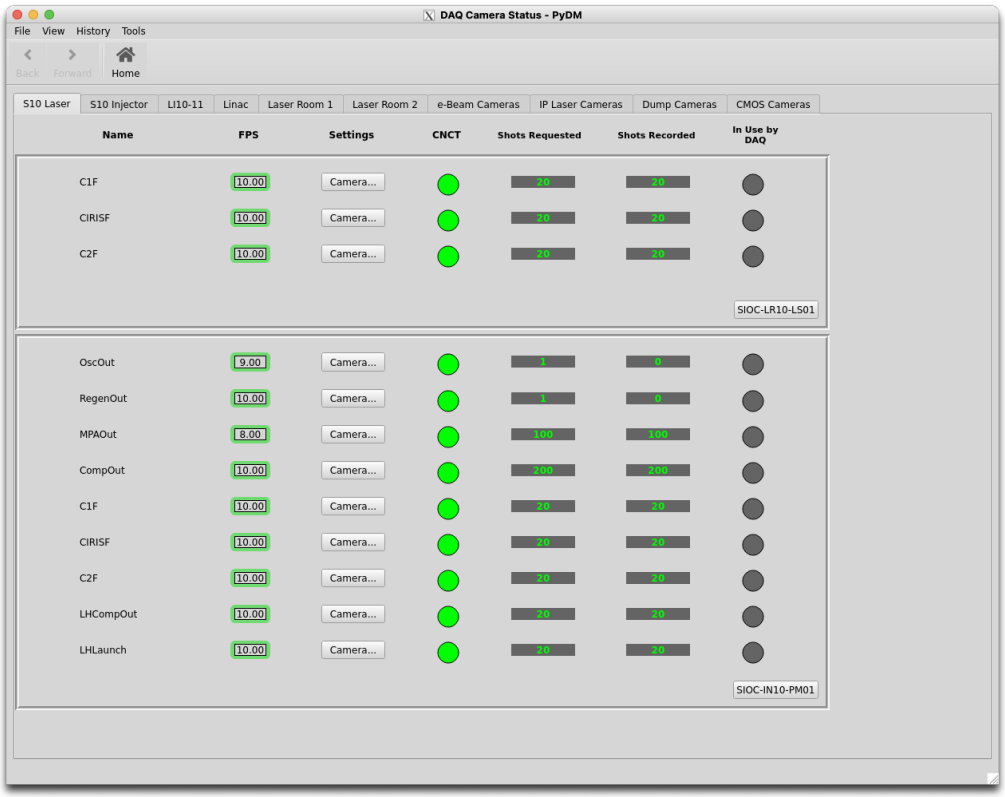


DAQ Camera Status GUI

Main screen Profile Monitor LI20 DAQ Camera Status



Indicator lamps light up when a camera is being used by the DAQ, and the "Shots Recorded" field updates as the DAQ runs


DAQ Camera Status - PyDM
File View History Tools
Back Forward Home
S10 Laser S10 Injector LI10-11 Linac Laser Room 1 Laser Room 2 e-Beam Cameras IP Laser Cameras Dump Cameras CMOS Cameras
Name FPS Settings CNCT Shots Requested Shots Recorded In Use by DAQ
C1F 10.00 Camera... 20 20
CIRISF 10.00 Camera... 20 20
C2F 10.00 Camera... 20 20
SIOC-LR10-LS01
OscOut 9.00 Camera... 1 0
RegenOut 10.00 Camera... 1 0
MPAOut 8.00 Camera... 100 100
CompOut 10.00 Camera... 200 200
C1F 10.00 Camera... 20 20
CIRISF 10.00 Camera... 20 20
C2F 10.00 Camera... 20 20
LHCompOut 10.00 Camera... 20 20
LHLaunch 10.00 Camera... 20 20
SIOC-IN10-PM01