Slew, Track and Image taking with ComCam

This notebook is used for the level 3 integration tests from test plan LVV-P81 (https://jira.lsstcorp.org/secure/Tests.jspa#/testPlan/LVV-P81) as part of test cylce LVV-C176 (https://jira.lsstcorp.org/secure/Tests.jspa#/testCycle/LVV-C176). The following tests are currently run as part of this notebook:

- LVV-T2290 (https://jira.lsstcorp.org/secure/Tests.jspa#/testCase/LVV-T2290)

Execution steps are separated by horizontal lines. Upon completion, save the notebook and its output as a pdf file to be attached to the test execution in JIRA.

Last executed by E. Dennihy 20210928

Run the setup.ipnyb notebook to bring all components up and in their enabled position. Check Chronograph.

Bring ComCom online and tranistion it to EnabledState. Check Chronograph.

In [1]:
```
%load_ext autoreload
%autoreload 2
```

In [2]:
```
import rubin_jupyter_utils.lab.notebook as nb
nb.utils.get_node()
```

```
/tmp/ipykernel_13175/1665379685.py:2: DeprecationWarning: Call to deprecated
function (or staticmethod) get_node. (Please use lsst.rsp.get_node())
  nb.utils.get_node()
```

Out[2]:
```
'yagan07'
```

In [3]:
```
import os
import sys
import asyncio
import logging

import pandas as pd
import numpy as np

from matplotlib import pyplot as plt

from lsst.ts import salobj
from lsst.ts.observatory.control.maintel import MTCS, ComCam
from lsst.ts.observatory.control import RotType
```

```
lsst.ts.utils.tai INFO: Update leap second table
lsst.ts.utils.tai INFO: current_tai uses the system TAI clock
```

In [4]:
```
logging.basicConfig(format="%(name)s:%(message)s", level=logging.DEBUG)
```

In [5]:
```
log = logging.getLogger("setup")
log.level = logging.DEBUG
```

In [6]:
```
domain = salobj.Domain()
```

In [7]:
```
mtcs = MTCS(domain=domain, log=log)
mtcs.set_rem_loglevel(40)
```

```
setup.MTCS DEBUG: mtmount: Adding all resources.
setup.MTCS DEBUG: mtptg: Adding all resources.
setup.MTCS DEBUG: mtaos: Adding all resources.
setup.MTCS DEBUG: mtm1m3: Adding all resources.
setup.MTCS DEBUG: mtm2: Adding all resources.
setup.MTCS DEBUG: mthexapod_1: Adding all resources.
setup.MTCS DEBUG: mthexapod_2: Adding all resources.
setup.MTCS DEBUG: mtrotator: Adding all resources.
setup.MTCS DEBUG: mtdome: Adding all resources.
setup.MTCS DEBUG: mtdometrajectory: Adding all resources.
```

In [8]:
```
await mtcs.start_task
```

```
MTM1M3.powerSupplyData ERROR: powerSupplyData DDS read queue is full (10
0 elements); data may be lost
MTMount.elevation ERROR: elevation DDS read queue is full (100 elements)
; data may be lost
MTPtg.mountPosition ERROR: mountPosition DDS read queue is full (100 ele
ments); data may be lost
MTM1M3.pidData ERROR: pidData DDS read queue is full (100 elements); dat
a may be lost
```

```
MTHexapod INFO: Read historical data in 0.39 sec
MTMount.azimuth ERROR: azimuth DDS read queue is full (100 elements); da
ta may be lost
MTM1M3.inclinometerData ERROR: inclinometerData DDS read queue is full (
100 elements); data may be lost
MTM1M3.imsData ERROR: imsData DDS read queue is full (100 elements); dat
a may be lost
MTM1M3.hardpointMonitorData ERROR: hardpointMonitorData DDS read queue i
s full (100 elements); data may be lost
MTM1M3.hardpointActuatorData ERROR: hardpointActuatorData DDS read queue
is full (100 elements); data may be lost
MTHexapod INFO: Read historical data in 0.42 sec
MTM1M3.gyroData ERROR: gyroData DDS read queue is full (100 elements); d
ata may be lost
MTM1M3.accelerometerData ERROR: accelerometerData DDS read queue is full
(100 elements); data may be lost
MTHexapod.electrical ERROR: electrical DDS read queue is full (100 eleme
nts); data may be lost
MTRotator.rotation ERROR: rotation DDS read queue is full (100 elements)
; data may be lost
```

Out[8]:
```
[None, None, None, None, None, None, None, None, None, None]
```

```
MTHexapod.application ERROR: application DDS read queue is full (100 ele
ments); data may be lost
MTRotator.motors ERROR: motors DDS read queue is full (100 elements); da
ta may be lost
MTHexapod.actuators ERROR: actuators DDS read queue is full (100 element
s); data may be lost
MTRotator.electrical ERROR: electrical DDS read queue is full (100 eleme
nts); data may be lost
MTRotator.ccwFollowingError ERROR: ccwFollowingError DDS read queue is f
ull (100 elements); data may be lost
MTHexapod.application WARNING: application DDS read queue is filling: 64
of 100 elements
MTHexapod.application ERROR: application DDS read queue is full (100 ele
ments); data may be lost
```

In [9]:
```
comcam = ComCam(domain=domain, log=log)
```

```
setup.ComCam DEBUG: cccamera: Adding all resources.
setup.ComCam DEBUG: ccheaderservice: Adding all resources.
setup.ComCam DEBUG: ccarchiver: Adding all resources.
```

In [10]:
```
comcam.set_rem_loglevel(40)
```

In [11]:
```
await comcam.start_task
```

Out[11]:
```
[None, None, None]
```

In [12]:
```
await comcam.enable()
```

```
setup.ComCam INFO: Enabling all components
setup.ComCam DEBUG: Gathering settings.
setup.ComCam DEBUG: Couldn't get settingVersions event. Using empty sett
ings.
setup.ComCam DEBUG: Couldn't get settingVersions event. Using empty sett
ings.
setup.ComCam DEBUG: Complete settings for cccamera.
setup.ComCam DEBUG: Complete settings for ccheaderservice.
setup.ComCam DEBUG: Complete settings for ccarchiver.
setup.ComCam DEBUG: Settings versions: {'cccamera': '', 'ccheaderservice
': '', 'ccarchiver': ''}
setup.ComCam DEBUG: [cccamera]::[<State.ENABLED: 2>]
setup.ComCam DEBUG: [ccheaderservice]::[<State.ENABLED: 2>]
setup.ComCam DEBUG: [ccarchiver]::[<State.ENABLED: 2>]
setup.ComCam INFO: All components in <State.ENABLED: 2>.
```

Find four targets separated by 5° in azimuth and elevation in a square pattern around az = 120° and el = 60° and rotator angle at PhysicalSky and 1.8°.

At this position, the rotator stays within a couple of degrees of its initial position. This is because the CCW is not running (MTmount in simulation mode).

target_1 -> az = 117.5^o, el = 57.5^o
target_2 -> az = 122.5^o, el =57.5^o
target_3 -> az = 122.5^o, el=62.5^o
target_4 -> az = 117.5^o, el = 62.5^o

In [13]:
```
target_1 = await mtcs.find_target(az=117.5, el=57.5, mag_limit=8)
target_2 = await mtcs.find_target(az=122.5, el=57.5, mag_limit=8)
target_3 = await mtcs.find_target(az=122.5, el=62.5, mag_limit=8)
target_4 = await mtcs.find_target(az=117.5, el=62.5, mag_limit=8)

print(f"Target 1: {target_1}"
      f"Target 2: {target_2}"
      f"Target 3: {target_3}"
      f"Target 4: {target_4}")
```

```
Target 1: HD  35491Target 2: HD  35739Target 3: HD  31573Target 4: HD  32425
```

Slew to target 1:

In [15]:
```
await mtcs.slew_object(target_1, rot_type=RotType.PhysicalSky, rot=1.9)
```

```
setup.MTCS INFO: Slewing to HD  35491: 05 23 10.7793 -39 50 19.035
setup.MTCS DEBUG: Setting rotator physical position to 1.9 deg. Rotator
will track sky.
setup.MTCS DEBUG: Stop tracking.
setup.MTCS DEBUG: Wait 5.0s for rotator to settle down.
setup.MTCS DEBUG: Workaround for rotator trajectory problem. Moving rota
tor to its current position: -0.00
setup.MTCS DEBUG: Wait for MTRotator in position event.
setup.MTCS DEBUG: MTRotator in position: True.
setup.MTCS DEBUG: MTRotator already in position. Handling potential race
condition.
setup.MTCS DEBUG: No new in position event in the last 5.0s. Assuming MT
Rotator in position.
setup.MTCS DEBUG: Sending slew command.
setup.MTCS DEBUG: Scheduling check coroutines
setup.MTCS DEBUG: process as completed...
setup.MTCS DEBUG: Monitor position started.
setup.MTCS DEBUG: Waiting for Target event from mtmount.
setup.MTCS DEBUG: mtmount: <State.ENABLED: 2>
setup.MTCS DEBUG: mtptg: <State.ENABLED: 2>
setup.MTCS DEBUG: mtaos: <State.ENABLED: 2>
setup.MTCS DEBUG: mtm1m3: <State.ENABLED: 2>
setup.MTCS DEBUG: mtm2: <State.ENABLED: 2>
setup.MTCS DEBUG: mthexapod_1: <State.ENABLED: 2>
setup.MTCS DEBUG: mthexapod_2: <State.ENABLED: 2>
setup.MTCS DEBUG: mtrotator: <State.ENABLED: 2>
setup.MTCS DEBUG: mtdome: <State.ENABLED: 2>
setup.MTCS DEBUG: mtdometrajectory: <State.ENABLED: 2>
setup.MTCS DEBUG: Wait for mtmount in position events.
setup.MTCS DEBUG: Wait for dome in position event.
setup.MTCS DEBUG: Wait for rotator in position event.
setup.MTCS DEBUG: Wait for MTMount elevation in position event.
setup.MTCS DEBUG: MTMount elevation in position: True.
setup.MTCS DEBUG: MTMount elevation already in position. Handling potent
ial race condition.
setup.MTCS DEBUG: Wait for MTMount azimuth in position event.
setup.MTCS DEBUG: MTMount azimuth in position: True.
setup.MTCS DEBUG: MTMount azimuth already in position. Handling potentia
l race condition.
```

```
setup.MTCS DEBUG: Mount target: private_revCode: bdcb00ba, private_sndSt
amp: 1649184332.890878, private_rcvStamp: 1649184332.8914034, private_se
qNum: 5699, private_identity: MTMount, private_origin: 263534, elevation
: 58.913161797867645, elevationVelocity: 0.003187532550003856, azimuth:
117.94660619811997, azimuthVelocity: 0.0007002641080435529, taiTime: 164
9184332.9486678, trackId: 2, tracksys: SIDEREAL, radesys: ICRS, priority
: 0
setup.MTCS INFO: MTMount elevation in position: False.
setup.MTCS INFO: MTMount azimuth in position: False.
setup.MTCS INFO: Got False
setup.MTCS DEBUG: Rotator not in position
setup.MTCS DEBUG: [Tel]: Az = +005.000[+112.9]; El = +087.499[ -28.6] [R
ot]: -000.001[  -0.0] [Dome] Az = +000.000; El = +000.000
setup.MTCS DEBUG: Dome azimuth in position.
setup.MTCS DEBUG: Dome elevation in position.
setup.MTCS INFO: Got True
setup.MTCS INFO: Rotator in position.
setup.MTCS DEBUG: [Tel]: Az = +045.336[ +72.6]; El = +067.356[  -8.4] [R
ot]: +002.045[  +0.0] [Dome] Az = +000.000; El = +000.000
setup.MTCS INFO: MTMount elevation in position: True.
setup.MTCS DEBUG: [Tel]: Az = +086.391[ +31.6]; El = +058.953[  +0.0] [R
ot]: +002.025[  -0.0] [Dome] Az = +000.000; El = +000.000
setup.MTCS INFO: MTMount azimuth in position: True.
```

Once on target_1 and tracking, take an image with ComCam

In [16]:
```
exp1 = await comcam.take_object(15)
print(f"Target 1 exposure: {exp1}")
```

```
setup.ComCam DEBUG: Generating group_id
setup.ComCam DEBUG: imagetype: OBJECT, TCS synchronization not configure
d.
setup.ComCam DEBUG: OBJECT 0001 - 0001
Target 1 exposure: [2022040500012]
```

Slew to target_2:

In [17]:
```
await mtcs.slew_object(target_2, rot_type=RotType.PhysicalSky, rot=1.9)
```

```
setup.MTCS INFO: Slewing to HD  35739: 05 24 48.5354 -42 26 23.694
setup.MTCS DEBUG: Setting rotator physical position to 1.9 deg. Rotator
will track sky.
setup.MTCS DEBUG: Stop tracking.
setup.MTCS DEBUG: Wait 5.0s for rotator to settle down.
```

```
setup.MTCS DEBUG: Workaround for rotator trajectory problem. Moving rota
tor to its current position: 1.84
setup.MTCS DEBUG: Wait for MTRotator in position event.
setup.MTCS DEBUG: MTRotator in position: False.
setup.MTCS INFO: MTRotator in position: True.
setup.MTCS DEBUG: Sending slew command.
setup.MTCS DEBUG: Scheduling check coroutines
setup.MTCS DEBUG: process as completed...
setup.MTCS DEBUG: Monitor position started.
setup.MTCS DEBUG: Waiting for Target event from mtmount.
setup.MTCS DEBUG: mtmount: <State.ENABLED: 2>
setup.MTCS DEBUG: mtptg: <State.ENABLED: 2>
setup.MTCS DEBUG: mtaos: <State.ENABLED: 2>
setup.MTCS DEBUG: mtm1m3: <State.ENABLED: 2>
setup.MTCS DEBUG: mtm2: <State.ENABLED: 2>
setup.MTCS DEBUG: mthexapod_1: <State.ENABLED: 2>
setup.MTCS DEBUG: mthexapod_2: <State.ENABLED: 2>
setup.MTCS DEBUG: mtrotator: <State.ENABLED: 2>
setup.MTCS DEBUG: mtdome: <State.ENABLED: 2>
setup.MTCS DEBUG: mtdometrajectory: <State.ENABLED: 2>
setup.MTCS DEBUG: Wait for mtmount in position events.
setup.MTCS DEBUG: Wait for dome in position event.
setup.MTCS DEBUG: Wait for rotator in position event.
setup.MTCS DEBUG: Wait for MTMount elevation in position event.
setup.MTCS DEBUG: MTMount elevation in position: True.
setup.MTCS DEBUG: MTMount elevation already in position. Handling potent
ial race condition.
setup.MTCS DEBUG: Wait for MTMount azimuth in position event.
setup.MTCS DEBUG: MTMount azimuth in position: True.
setup.MTCS DEBUG: MTMount azimuth already in position. Handling potentia
l race condition.
setup.MTCS DEBUG: Mount target: private_revCode: bdcb00ba, private_sndSt
amp: 1649184410.73948, private_rcvStamp: 1649184410.7406623, private_seq
Num: 7045, private_identity: MTMount, private_origin: 263534, elevation:
58.47196048910447, elevationVelocity: 0.0030301795104559666, azimuth: 12
2.88323215668949, azimuthVelocity: 0.0010889284349362793, taiTime: 16491
84410.797371, trackId: 3, tracksys: SIDEREAL, radesys: ICRS, priority: 0
setup.MTCS INFO: MTMount elevation in position: False.
setup.MTCS INFO: MTMount azimuth in position: False.
setup.MTCS INFO: Got False
setup.MTCS DEBUG: Rotator not in position
setup.MTCS INFO: MTMount elevation in position: True.
setup.MTCS INFO: MTMount azimuth in position: True.
```

```
setup.MTCS DEBUG: [Tel]: Az = +118.001[  +4.9]; El = +059.124[  -0.7] [R
ot]: +001.844[  +0.0] [Dome] Az = +000.000; El = +000.000
setup.MTCS DEBUG: Dome azimuth in position.
setup.MTCS DEBUG: Dome elevation in position.
setup.MTCS INFO: Got True
setup.MTCS INFO: Rotator in position.
```

Once on target_2 and tracking, take an image with ComCam

In [18]:
```
exp2 = await comcam.take_object(15)
print(f"Target 1 exposure: {exp2}")
```

```
setup.ComCam DEBUG: Generating group_id
setup.ComCam DEBUG: imagetype: OBJECT, TCS synchronization not configure
d.
setup.ComCam DEBUG: OBJECT 0001 - 0001
Target 1 exposure: [2022040500013]
```

Slew to target_3

In [19]:
```
await mtcs.slew_object(target_3, rot_type=RotType.PhysicalSky, rot=1.9)
```

```
setup.MTCS INFO: Slewing to HD  31573: 04 55 04.8513 -41 03 51.636
setup.MTCS DEBUG: Setting rotator physical position to 1.9 deg. Rotator
will track sky.
setup.MTCS DEBUG: Stop tracking.
setup.MTCS DEBUG: Wait 5.0s for rotator to settle down.
setup.MTCS DEBUG: Workaround for rotator trajectory problem. Moving rota
tor to its current position: 1.91
setup.MTCS DEBUG: Wait for MTRotator in position event.
setup.MTCS DEBUG: MTRotator in position: False.
setup.MTCS INFO: MTRotator in position: True.
setup.MTCS DEBUG: Sending slew command.
setup.MTCS DEBUG: Scheduling check coroutines
setup.MTCS DEBUG: process as completed...
setup.MTCS DEBUG: Monitor position started.
setup.MTCS DEBUG: Waiting for Target event from mtmount.
setup.MTCS DEBUG: mtmount: <State.ENABLED: 2>
setup.MTCS DEBUG: mtptg: <State.ENABLED: 2>
setup.MTCS DEBUG: mtaos: <State.ENABLED: 2>
setup.MTCS DEBUG: mtm1m3: <State.ENABLED: 2>
setup.MTCS DEBUG: mtm2: <State.ENABLED: 2>
setup.MTCS DEBUG: mthexapod_1: <State.ENABLED: 2>
```

```
setup.MTCS DEBUG: mthexapod_2: <State.ENABLED: 2>
setup.MTCS DEBUG: mtrotator: <State.ENABLED: 2>
setup.MTCS DEBUG: mtdome: <State.ENABLED: 2>
setup.MTCS DEBUG: mtdometrajectory: <State.ENABLED: 2>
setup.MTCS DEBUG: Wait for mtmount in position events.
setup.MTCS DEBUG: Wait for dome in position event.
setup.MTCS DEBUG: Wait for rotator in position event.
setup.MTCS DEBUG: Wait for MTMount elevation in position event.
setup.MTCS DEBUG: MTMount elevation in position: True.
setup.MTCS DEBUG: MTMount elevation already in position. Handling potent
ial race condition.
setup.MTCS DEBUG: Wait for MTMount azimuth in position event.
setup.MTCS DEBUG: MTMount azimuth in position: True.
setup.MTCS DEBUG: MTMount azimuth already in position. Handling potentia
l race condition.
setup.MTCS DEBUG: Mount target: private_revCode: bdcb00ba, private_sndSt
amp: 1649184463.5563369, private_rcvStamp: 1649184463.5571468, private_s
eqNum: 7891, private_identity: MTMount, private_origin: 263534, elevatio
n: 64.34047171497403, elevationVelocity: 0.003034268736422211, azimuth:
122.76616839974263, azimuthVelocity: 0.0019607731886462933, taiTime: 164
9184463.614297, trackId: 4, tracksys: SIDEREAL, radesys: ICRS, priority:
0
setup.MTCS INFO: MTMount elevation in position: False.
setup.MTCS INFO: MTMount azimuth in position: False.
setup.MTCS INFO: Got False
setup.MTCS DEBUG: Rotator not in position
setup.MTCS INFO: MTMount azimuth in position: True.
setup.MTCS DEBUG: [Tel]: Az = +122.927[  -0.2]; El = +058.601[  +5.7] [R
ot]: +001.915[  +0.0] [Dome] Az = +000.000; El = +000.000
setup.MTCS DEBUG: Dome azimuth in position.
setup.MTCS DEBUG: Dome elevation in position.
setup.MTCS INFO: Got True
setup.MTCS INFO: Rotator in position.
setup.MTCS INFO: MTMount elevation in position: True.
```

Once on target_3 and tracking, take an image with ComCam

In [20]:
```
exp3 = await comcam.take_object(15)
print(f"Target 1 exposure: {exp3}")
```

```
setup.ComCam DEBUG: Generating group_id
setup.ComCam DEBUG: imagetype: OBJECT, TCS synchronization not configure
d.
setup.ComCam DEBUG: OBJECT 0001 - 0001
```

```
Target 1 exposure: [2022040500014]
```

Slew to target 4

In [21]:
```
await mtcs.slew_object(target_4, rot_type=RotType.PhysicalSky, rot=1.9)
```

```
setup.MTCS INFO: Slewing to HD  32425: 05 01 26.8775 -38 55 13.733
setup.MTCS DEBUG: Setting rotator physical position to 1.9 deg. Rotator
will track sky.
setup.MTCS DEBUG: Stop tracking.
setup.MTCS DEBUG: Wait 5.0s for rotator to settle down.
setup.MTCS DEBUG: Workaround for rotator trajectory problem. Moving rota
tor to its current position: 1.91
setup.MTCS DEBUG: Wait for MTRotator in position event.
setup.MTCS DEBUG: MTRotator in position: False.
setup.MTCS INFO: MTRotator in position: True.
setup.MTCS DEBUG: Sending slew command.
setup.MTCS DEBUG: Scheduling check coroutines
setup.MTCS DEBUG: process as completed...
setup.MTCS DEBUG: Monitor position started.
setup.MTCS DEBUG: Waiting for Target event from mtmount.
setup.MTCS DEBUG: mtmount: <State.ENABLED: 2>
setup.MTCS DEBUG: mtptg: <State.ENABLED: 2>
setup.MTCS DEBUG: mtaos: <State.ENABLED: 2>
setup.MTCS DEBUG: mtm1m3: <State.ENABLED: 2>
setup.MTCS DEBUG: mtm2: <State.ENABLED: 2>
setup.MTCS DEBUG: mthexapod_1: <State.ENABLED: 2>
setup.MTCS DEBUG: mthexapod_2: <State.ENABLED: 2>
setup.MTCS DEBUG: mtrotator: <State.ENABLED: 2>
setup.MTCS DEBUG: mtdome: <State.ENABLED: 2>
setup.MTCS DEBUG: mtdometrajectory: <State.ENABLED: 2>
setup.MTCS DEBUG: Wait for mtmount in position events.
setup.MTCS DEBUG: Wait for dome in position event.
setup.MTCS DEBUG: Wait for rotator in position event.
setup.MTCS DEBUG: Wait for MTMount elevation in position event.
setup.MTCS DEBUG: MTMount elevation in position: True.
setup.MTCS DEBUG: MTMount elevation already in position. Handling potent
ial race condition.
setup.MTCS DEBUG: Wait for MTMount azimuth in position event.
setup.MTCS DEBUG: MTMount azimuth in position: True.
setup.MTCS DEBUG: MTMount azimuth already in position. Handling potentia
l race condition.
```

```
setup.MTCS DEBUG: Mount target: private_revCode: bdcb00ba, private_sndSt
amp: 1649184509.3633049, private_rcvStamp: 1649184509.3640428, private_s
eqNum: 8597, private_identity: MTMount, private_origin: 263534, elevatio
n: 63.76190532586195, elevationVelocity: 0.0032021618735531736, azimuth:
117.4496253173194, azimuthVelocity: 0.0012702921590644388, taiTime: 1649
184509.4214048, trackId: 5, tracksys: SIDEREAL, radesys: ICRS, priority:
0
setup.MTCS INFO: MTMount elevation in position: False.
setup.MTCS INFO: MTMount azimuth in position: False.
setup.MTCS INFO: Got False
setup.MTCS DEBUG: Rotator not in position
setup.MTCS INFO: MTMount elevation in position: True.
setup.MTCS DEBUG: [Tel]: Az = +122.824[  -5.4]; El = +064.447[  -0.7] [R
ot]: +001.905[  +0.0] [Dome] Az = +000.000; El = +000.000
setup.MTCS DEBUG: Dome azimuth in position.
setup.MTCS DEBUG: Dome elevation in position.
setup.MTCS INFO: MTMount azimuth in position: True.
setup.MTCS INFO: Got True
setup.MTCS INFO: Rotator in position.
```

Once on target_4 and tracking, take an image with ComCam

In [22]:
```
exp4 = await comcam.take_object(15)
print(f"Target 1 exposure: {exp4}")
```

```
setup.ComCam DEBUG: Generating group_id
setup.ComCam DEBUG: imagetype: OBJECT, TCS synchronization not configure
d.
setup.ComCam DEBUG: OBJECT 0001 - 0001
Target 1 exposure: [2022040500015]
```

Stop tracking to prevent hitting the Rotator soft limit.

In [23]:
```
await mtcs.stop_tracking()
```

```
setup.MTCS DEBUG: Stop tracking.
```

Use ComCam recent images CCS to ensure that the images were taken (http://ccs.lsst.org/RecentImages/comcam.html).

Query the butler to verify that the images are there and check the metadata. This step must be verified using a separate noteboook.

Wrap Up and Shut Down

This cell is not currently included as part of the test execution, but included here as needed to shutdown the systems

In [ ]:
```
await mtcs.set_state(salobj.State.STANDBY, components=["mtaos"])
```

In [ ]:
```
await mtcs.lower_m1m3()
```

In [ ]:
```
await mtcs.set_state(salobj.State.STANDBY, components=["mtm1m3"])
```

In [ ]:
```
await mtcs.set_state(salobj.State.STANDBY, components=["mtm2"])
```

In [ ]:
```
await mtcs.set_state(salobj.State.STANDBY, components=["mthexapod_1"])
```

In [ ]:
```
await mtcs.set_state(salobj.State.STANDBY, components=["mthexapod_2"])
```

In [ ]:
```
await mtcs.standby()
```

In [ ]:
```
await comcam.standby()
```