

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.jspx#/testPlan/LVV-P81>) as part of test cycle LVV-C176 (<https://jira.lsstcorp.org/secure/Tests.jspx#/testCycle/LVV-C176>). The following tests are currently run as part of this notebook:

- LVV-T2290 (<https://jira.lsstcorp.org/secure/Tests.jspx#/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.ipynb 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_18989/1665379685.py:2: DeprecationWarning: Call to deprecated f
unction (or staticmethod) get_node. (Please use lsst.rsp.get_node())
    nb.utils.get_node()
```

```
Out[2]: 'yagan03'
```

```
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: mptg: 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
```

```
|MTHexapod INFO: Read historical data in 0.04 sec
|MTHexapod INFO: Read historical data in 0.05 sec
|MTHexapod.electrical WARNING: electrical DDS read queue is filling: 11 of 1
00 elements
|MTHexapod.application WARNING: application DDS read queue is filling: 11 of
100 elements
|MTHexapod.actuators WARNING: actuators DDS read queue is filling: 11 of 100
elements
```

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

```
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 setting
s.
|setup.ComCam DEBUG: Couldn't get settingVersions event. Using empty setting
s.
```

```

| 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.STANDBY: 5>, <State.DISABLED: 1>, <
| State.ENABLED: 2>]
| setup.ComCam DEBUG: [ccheaderservice]::[<State.STANDBY: 5>, <State.DISABLE
| D: 1>, <State.ENABLED: 2>]
| setup.ComCam DEBUG: [ccarchiver]::[<State.STANDBY: 5>, <State.DISABLED: 1>,
| <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}\n"
      f"Target 2: {target_2}\n"
      f"Target 3: {target_3}\n"
      f"Target 4: {target_4}\n")

```

Target 1: HD 52415 Target 2: HD 52060 Target 3: HD 45716 Target 4: HD 46858

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 52415: 06 59 19.8617 -39 35 32.878
| setup.MTCS DEBUG: Setting rotator physical position to 1.9 deg. Rotator will
| track sky.
| setup.MTCS WARNING: Camera cable wrap following disabled in MTMount.
| setup.MTCS DEBUG: Wait 5.0s for rotator to settle down.
| setup.MTCS DEBUG: Workaround for rotator trajectory problem. Moving rotator
| to its current position: 1.87
| 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: MTRotator in position True. Waiting settle time 5.0s
| 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 MTRotator in position event.
| setup.MTCS DEBUG: MTRotator in position: True.
| setup.MTCS DEBUG: MTRotator already in position. Handling potential race co
ndition.
| 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 potential
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 potential r
ace condition.
| setup.MTCS DEBUG: Mount target: private_revCode: bdc00ba, private_sndStam
p: 1648586463.468073, private_rcvStamp: 1648586463.4672306, private_seqNum:
791, private_identity: MTMount, private_origin: 5948, elevation: 57.4116762
04007826, elevationVelocity: 0.0032064324791400453, azimuth: 117.2982788034
0429, azimuthVelocity: 0.00048431382744228336, taiTime: 1648586463.5261338,
trackId: 2, tracksys: SIDERREAL, radesys: ICRS, priority: 0
| setup.MTCS DEBUG: [Tel]: Az = +117.298[ -0.0]; El = +057.412[ -0.0] [Ro
t]: +001.873[ -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 DEBUG: No new in position event in the last 3.0s. Assuming MTRot
ator in position.
| setup.MTCS DEBUG: MTRotator in position True. Waiting settle time 3.0s
| setup.MTCS DEBUG: No new in position event in the last 3.0s. Assuming MTMou
nt elevation in position.
| setup.MTCS DEBUG: MTMount elevation in position True. Waiting settle time
3.0s
| setup.MTCS DEBUG: No new in position event in the last 3.0s. Assuming MTMou
nt azimuth in position.
| setup.MTCS DEBUG: MTMount azimuth in position True. Waiting settle time 3.0
s

```

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 configured.
| setup.ComCam DEBUG: OBJECT 0001 - 0001
Target 1 exposure: [2022032900001]
```

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 52060: 06 57 46.7074 -42 01 43.186
| setup.MTCS DEBUG: Setting rotator physical position to 1.9 deg. Rotator will track sky.
| setup.MTCS WARNING: Camera cable wrap following disabled in MTMount.
| setup.MTCS DEBUG: Wait 5.0s for rotator to settle down.
| setup.MTCS DEBUG: Workaround for rotator trajectory problem. Moving rotator to its current position: 1.77
| 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 INFO: MTRotator in position: False.
| setup.MTCS INFO: MTRotator in position: True.
| setup.MTCS DEBUG: MTRotator in position True. Waiting settle time 5.0s
| 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 MTRotator in position event.
| setup.MTCS DEBUG: MTRotator in position: True.
```

```

| setup.MTCS DEBUG: MTRotator already in position. Handling potential race co
| ndition.
| 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 potential
| 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 potential r
| ace condition.
| setup.MTCS DEBUG: Mount target: private_revCode: bdc00ba, private_sndStam
| p: 1648586500.9196882, private_rcvStamp: 1648586500.9188728, private_seqNu
| m: 1539, private_identity: MTMount, private_origin: 5948, elevation: 57.540
| 69075208095, elevationVelocity: 0.003063723355096612, azimuth: 121.88824667
| 339145, azimuthVelocity: 0.0008922671071121376, taiTime: 1648586500.977621
| 8, trackId: 3, tracksys: SIDERREAL, radesys: ICRS, priority: 0
| setup.MTCS INFO: MTMount azimuth in position: False.
| setup.MTCS INFO: MTMount elevation in position: False.
| setup.MTCS INFO: MTMount elevation in position: True.
| setup.MTCS DEBUG: MTMount elevation in position True. Waiting settle time
| 3.0s
| setup.MTCS DEBUG: [Tel]: Az = +117.347[ +4.5]; El = +057.541[ -0.0] [Ro
| t]: +001.773[ +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 DEBUG: MTMount azimuth in position True. Waiting settle time 3.0
| s
| setup.MTCS DEBUG: No new in position event in the last 3.0s. Assuming MTRot
| ator in position.
| setup.MTCS DEBUG: MTRotator in position True. Waiting settle time 3.0s

```

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 configured.
| setup.ComCam DEBUG: OBJECT 0001 - 0001
| Target 1 exposure: [2022032900002]

```

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 45716: 06 27 06.3266 -41 19 23.160
| setup.MTCS DEBUG: Setting rotator physical position to 1.9 deg. Rotator wil
| l track sky.
| setup.MTCS WARNING: Camera cable wrap following disabled in MTMount.

```

```

| setup.MTCS DEBUG: Wait 5.0s for rotator to settle down.
| setup.MTCS DEBUG: Workaround for rotator trajectory problem. Moving rotator
| to its current position: 1.67
| 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 co
| ndition.
| setup.MTCS INFO: MTRotator in position: False.
| setup.MTCS INFO: MTRotator in position: True.
| setup.MTCS DEBUG: MTRotator in position True. Waiting settle time 5.0s
| 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 MTRotator in position event.
| setup.MTCS DEBUG: MTRotator in position: True.
| setup.MTCS DEBUG: MTRotator already in position. Handling potential race co
| ndition.
| 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 potential
| 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 potential r
| ace condition.
| setup.MTCS INFO: MTMount azimuth in position: False.
| setup.MTCS INFO: MTMount elevation in position: False.
| setup.MTCS DEBUG: Mount target: private_revCode: bdc000ba, private_sndStam
| p: 1648586543.2249358, private_rcvStamp: 1648586543.224113, private_seqNum:
| 2384, private_identity: MTMount, private_origin: 5948, elevation: 63.417339
| 18476935, elevationVelocity: 0.0030291160081153358, azimuth: 122.9166684190
| 3609, azimuthVelocity: 0.0018142964514548875, taiTime: 1648586543.2829401,
| trackId: 4, tracksys: SIDEREAL, radesys: ICRS, priority: 0
| setup.MTCS INFO: MTMount azimuth in position: True.
| setup.MTCS DEBUG: MTMount azimuth in position True. Waiting settle time 3.0
| s

```



```

| setup.MTCS DEBUG: [Tel]: Az = +122.038[ +0.9]; El = +057.726[ +5.7] [Ro
| t]: +001.673[ -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 elevation in position: True.
| setup.MTCS DEBUG: MTMount elevation in position True. Waiting settle time
| 3.0s
| setup.MTCS DEBUG: No new in position event in the last 3.0s. Assuming MTRot
| ator in position.
| setup.MTCS DEBUG: MTRotator in position True. Waiting settle time 3.0s

```

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 configured.
| setup.ComCam DEBUG: OBJECT 0001 - 0001
          Target 1 exposure: [2022032900003]

```

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 46858: 06 33 50.9498 -38 50 54.907
| setup.MTCS DEBUG: Setting rotator physical position to 1.9 deg. Rotator wil
| l track sky.
| setup.MTCS WARNING: Camera cable wrap following disabled in MTMount.
| setup.MTCS DEBUG: Wait 5.0s for rotator to settle down.
| setup.MTCS DEBUG: Workaround for rotator trajectory problem. Moving rotator
| to its current position: 1.57
| 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 co
| ndition.
| setup.MTCS INFO: MTRotator in position: False.
| setup.MTCS INFO: MTRotator in position: True.
| setup.MTCS DEBUG: MTRotator in position True. Waiting settle time 5.0s
| 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 MTRotator in position event.
| setup.MTCS DEBUG: MTRotator in position: True.
| setup.MTCS DEBUG: MTRotator already in position. Handling potential race co
ndition.
| 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 potential
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 potential r
ace condition.
| setup.MTCS DEBUG: Mount target: private_revCode: bdc00ba, private_sndStam
p: 1648586579.6226926, private_rcvStamp: 1648586579.6218898, private_seqNu
m: 3111, private_identity: MTMount, private_origin: 5948, elevation: 62.770
26637137235, elevationVelocity: 0.0032140822650569925, azimuth: 117.0356285
5159926, azimuthVelocity: 0.001082921084406561, taiTime: 1648586579.680662
4, trackId: 5, tracksys: SIDEREAL, radesys: ICRS, priority: 0
| setup.MTCS INFO: MTMount azimuth in position: False.
| setup.MTCS INFO: MTMount elevation in position: False.
| setup.MTCS DEBUG: [Tel]: Az = +122.917[ -5.9]; El = +063.495[ -0.7] [Ro
t]: +001.573[ -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 elevation in position: True.
| setup.MTCS DEBUG: MTMount elevation in position True. Waiting settle time
3.0s
| setup.MTCS INFO: MTMount azimuth in position: True.
| setup.MTCS DEBUG: MTMount azimuth in position True. Waiting settle time 3.0
s
| setup.MTCS DEBUG: No new in position event in the last 3.0s. Assuming MTRot
ator in position.
| setup.MTCS DEBUG: MTRotator in position True. Waiting settle time 3.0s

```

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 configured.
| setup.ComCam DEBUG: OBJECT 0001 - 0001
Target 1 exposure: [2022032900004]

```

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 notebook.

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_mlm3()
```

```
In [ ]: await mtcs.set_state(salobj.State.STANDBY, components=["mtmlm3"])
```

```
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()
```