

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 cycle 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_19527/1665379685.py:2: DeprecationWarning: Call to deprecated
function (or staticmethod) get_node. (Please use lsst.rsp.get_node())
    nb.utils.get_node()
```

```
Out[2]: 'yagan04'
```

```
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.
MTHexapod INFO: Read historical data in 0.01 sec
MTHexapod INFO: Read historical data in 0.02 sec
```

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

```
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: cheaderservice: Adding all resources.
```

```
| setup.ComCam DEBUG: ccarchiver: Adding all resources.
| CCCamera INFO: Read historical data in 0.00 sec
```

```
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 $az = 120^\circ$ and $el = 60^\circ$ 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 28710 Target 2: HD 28666 Target 3: HD 25936 Target 4: HD 26176

Slew to target 1:

```
In [14]: await mtcs.slew_object(target_1, rot_type=RotType.PhysicalSky, rot=1.9)

| setup.MTCS INFO: Slewing to HD 28710: 04 29 48.3508 -39 24 59.715
| 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 rota
| tor to its current position: -0.10
| 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
| condition.
| 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: bdc00ba, private_sndSt
| amp: 1647974497.5279255, private_rcvStamp: 1647974497.5282147, private_s
| eqNum: 3, private_identity: MTMount, private_origin: 11345, elevation: 5
| 7.846829663985616, elevationVelocity: 0.0032182029181272833, azimuth: 11
| 6.88831646962626, azimuthVelocity: 0.0004916162725129253, taiTime: 16479
| 74497.585828, trackId: 1, tracksys: SIDEREAL, radesys: ICRS, priority: 0
| setup.MTCS INFO: MTMount azimuth in position: False.
| setup.MTCS INFO: MTMount elevation in position: False.
| setup.MTCS INFO: MTRotator in position: False.
| setup.MTCS DEBUG: [Tel]: Az = +000.005[+116.9]; El = +089.997[ -32.2] [R
| ot]: -000.100[ -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: MTRotator in position: True.
| setup.MTCS DEBUG: MTRotator in position True. Waiting settle time 3.0s
| setup.MTCS DEBUG: [Tel]: Az = +049.462[ +67.4]; El = +065.303[ -7.4] [R
| ot]: +002.034[ +0.0] [Dome] Az = +000.000; El = +000.000
| setup.MTCS INFO: MTMount elevation in position: True.
| setup.MTCS DEBUG: MTMount elevation in position True. Waiting settle tim
| e 3.0s
| setup.MTCS DEBUG: [Tel]: Az = +094.701[ +22.2]; El = +057.889[ -0.0] [R
| ot]: +002.015[ -0.0] [Dome] Az = +000.000; El = +000.000
| setup.MTCS INFO: MTMount azimuth in position: True.
| setup.MTCS DEBUG: MTMount azimuth in position True. Waiting settle time
| 3.0s

```

Once on target_1 and tracking, take an image with ComCam

```

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

```

```

| 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: [2022032200001]

```

Slew to target_2:

```

In [16]: await mtcs.slew_object(target_2, rot_type=RotType.PhysicalSky, rot=1.9)

| setup.MTCS INFO: Slewing to HD 28666: 04 29 16.3496 -42 11 53.858
| 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 rota
| tor to its current position: 1.81
| 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
| condition.
| 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: bdc00ba, private_sndSt
|amp: 1647974554.0042963, private_rcvStamp: 1647974554.0045369, private_s
|eqNum: 1131, private_identity: MTMount, private_origin: 11345, elevation
|: 57.7929875399708, elevationVelocity: 0.0030553934972533934, azimuth: 1
|22.13797756857946, azimuthVelocity: 0.0009427988803259195, taiTime: 1647
|974554.0631282, trackId: 2, tracksys: SIDEREAL, 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 tim
|e 3.0s
|setup.MTCS INFO: MTMount azimuth in position: True.
|setup.MTCS DEBUG: MTMount azimuth in position True. Waiting settle time
|3.0s
|setup.MTCS DEBUG: [Tel]: Az = +116.931[ +5.2]; El = +058.021[ -0.2] [R
|ot]: +001.814[ -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 MT
|Rotator 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 [17]: 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: [2022032200002]

```

Slew to target_3

```
In [18]: await mtcs.slew_object(target_3, rot_type=RotType.PhysicalSky, rot=1.9)

| setup.MTCS INFO: Slewing to HD 25936: 04 04 39.4672 -41 16 53.115
| 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 rota
| tor to its current position: 1.71
| 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
| condition.
| 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 potential race condition.
| setup.MTCS DEBUG: Mount target: private_revCode: bdc00ba, private_sndStamp: 1647974596.2611995, private_rcvStamp: 1647974596.2614477, private_seqNum: 1975, private_identity: MTMount, private_origin: 11345, elevation: 62.60214628409709, elevationVelocity: 0.0030534969868389918, azimuth: 122.19699790003384, azimuthVelocity: 0.0016051101244859043, taiTime: 1647974596.3201165, trackId: 3, tracksys: SIDEREAL, radesys: ICRS, priority: 0
| setup.MTCS INFO: MTMount azimuth in position: False.
| setup.MTCS INFO: MTMount elevation in position: False.
| setup.MTCS INFO: MTMount azimuth in position: True.
| setup.MTCS DEBUG: MTMount azimuth in position True. Waiting settle time 3.0s
| setup.MTCS DEBUG: [Tel]: Az = +122.179[ +0.0]; El = +057.922[ +4.7] [Rot]: +001.714[ +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 MT Rotator 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 [19]: 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: [2022032200003]

```

Slew to target 4

```

In [20]: await mtcs.slew_object(target_4, rot_type=RotType.PhysicalSky, rot=1.9)

| setup.MTCS INFO: Slewing to HD 26176: 04 06 54.9128 -39 03 17.451
| 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: 1.61
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 condition.
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 race condition.
```

```

| setup.MTCS DEBUG: Mount target: private_revCode: bdc00ba, private_sndSt
amp: 1647974641.275791, private_rcvStamp: 1647974641.2760322, private_se
qNum: 2874, private_identity: MTMount, private_origin: 11345, elevation:
62.751279588958255, elevationVelocity: 0.003205984893282002, azimuth: 11
7.31721765407273, azimuthVelocity: 0.0011109738288524306, taiTime: 16479
74641.3345015, trackId: 4, tracksys: SIDEREAL, 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 tim
e 3.0s
| setup.MTCS DEBUG: [Tel]: Az = +122.269[ -5.0]; El = +062.740[ +0.0] [R
ot]: +001.614[ +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
3.0s
| setup.MTCS DEBUG: No new in position event in the last 3.0s. Assuming MT
Rotator 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 [21]: 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: [2022032200004]

```

Stop tracking to prevent hitting the Rotator soft limit.

```

In [22]: 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()
```