LVV-T2193

November 9, 2021

1 MTAOS handling of rejected commands

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-T2193 (https://jira.lsstcorp.org/secure/Tests.jspa#/testCase/LVV-T2193)

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 updated by E. Dennihy 20211020

Load all the needed libraries. Get the remotes ready Code in the notebook including section: "Check the summary state of each CSC".

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

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

```
/tmp/ipykernel_57474/1665379685.py:2: DeprecationWarning: Call to deprecated
function (or staticmethod) get_node. (Please use lsst.rsp.get_node())
  nb.utils.get_node()
```

[2]:
```
'andes05.cp.lsst.org'
```

[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
```

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

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

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

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

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

```
<IPython.core.display.HTML object>

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```

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

```
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     <IPython.core.display.HTML object>
     <IPython.core.display.HTML object>
     <IPython.core.display.HTML object>
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[8]: [None, None, None, None, None, None, None, None, None, None]
     <IPython.core.display.HTML object>
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```

Ready M1M3: Raise mirror, turn on FB, clear forces

Need to have M1M3 LUT use its inclinometer.

Ready M2: Turn on FB, clear forces

Need to have M2 LUT use its inclinometer

Get camera hexapod ready: check config; make sure LUT is on, and has valid inputs; make sure hex is at LUT position

---

Get M2 hexapod ready: check config; make sure LUT is on, and has valid inputs; make sure hex is at LUT position

---

Slew to the next target. Choose a target such that the rotator stays within a couple of degrees of its initial position. This is because the CCW is not running (MTmount in simulation mode).

[9]:

```
target = await mtcs.find_target(el=60, az=120, mag_limit=8)
print(target)
```

```
HD 174093
```

[10]:

```
await mtcs.slew_object(target, rot_type=RotType.PhysicalSky, rot=1.9)
```

```
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```

clear all corrections using cmd_resetCorrection

```
[11]: await mtcs.rem.mtaos.cmd_resetCorrection.start()
```

```
[11]: <ddsutil.MTAOS_ackcmd_8e276e56 at 0x7ff3a3dc57f0>
```

```
[12]: await mtcs.rem.mtaos.cmd_issueCorrection.start(timeout=60.)
```

```
[12]: <ddsutil.MTAOS_ackcmd_8e276e56 at 0x7ff3fd28a490>
```

Add 1um of z7 to the system via OFC, issue the corrections.

Compare the corrections sent vs forces and position changes applied. This is currently done in a separate notebook or on Chronograf.

```
[13]: wavefront_errors = np.zeros(19)
```

```
[14]: wavefront_errors[3]=1.0
```

```
[15]: print(await mtcs.rem.mtaos.cmd_addAberration.set_start(wf=wavefront_errors,␣
       ↪timeout=10))
```

```
private_revCode: 8e276e56, private_sndStamp: 1636480740.734455,
private_rcvStamp: 1636480740.7346969, private_seqNum: 232802593,
private_identity: MTAOS, private_origin: 247075, private_host: 0, ack: 303,
error: 0, result: Done, host: 0, identity: edennihy@nb-edennihy, origin: 57474,
cmdtype: 2, timeout: 0.0
```

```
[16]: await mtcs.rem.mtaos.cmd_issueCorrection.start(timeout=60.)
```

```
[16]: <ddsutil.MTAOS_ackcmd_8e276e56 at 0x7ff3fd1db970>
```

Make plots using telemetry from each component to verify the changes in the DOFs. This step does not currently involve running any commands in this notebook. This step must be verified using a separate noteboook.

Put M2 hexapod in DISABLED state (so that we can test command rejection).

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

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

Add 1um of z7 to the system via OFC. Expect m2 hexapod corrections are rejected, and all other corrections applied, then undone.

```
[18]: print(await mtcs.rem.mtaos.cmd_addAberration.set_start(wf=wavefront_errors,␣
       ↪timeout=10))
```

```
private_revCode: 8e276e56, private_sndStamp: 1636480762.0071166,
private_rcvStamp: 1636480762.0073473, private_seqNum: 232802594,
private_identity: MTAOS, private_origin: 247075, private_host: 0, ack: 303,
error: 0, result: Done, host: 0, identity: edennihy@nb-edennihy, origin: 57474,
cmdtype: 2, timeout: 0.0
```

```
[19]: await mtcs.rem.mtaos.cmd_issueCorrection.start(timeout=60.)
```

```
---------------------------------------------------------------------------
AckError                                  Traceback (most recent call last)
/tmp/ipykernel_57474/285352443.py in <module>
----> 1 await mtcs.rem.mtaos.cmd_issueCorrection.start(timeout=60.)

/opt/lsst/software/stack/conda/miniconda3-py38_4.9.2/envs/lsst-scipipe-0.7.0/li/
 ↪python3.8/site-packages/lsst/ts/salobj/topics/remote_command.py in start(self ␣
 ↪data, timeout, wait_done)
    481         )
    482         self.salinfo._running_cmds[seq_num] = cmd_info
--> 483         return await cmd_info.next_ackcmd(timeout=timeout)

/opt/lsst/software/stack/conda/miniconda3-py38_4.9.2/envs/lsst-scipipe-0.7.0/li/
 ↪python3.8/site-packages/lsst/ts/salobj/topics/remote_command.py in␣
 ↪next_ackcmd(self, timeout)
    199             ackcmd = await self._wait_task
    200             if ackcmd.ack in self.failed_ack_codes:
--> 201                 raise base.AckError(msg="Command failed", ackcmd=ackcmd
    202             return ackcmd
    203         except asyncio.TimeoutError:

AckError: msg='Command failed', ackcmd=(ackcmd private_seqNum=730611390,␣
 ↪ack=<SalRetCode.CMD_FAILED: -302>, error=1, result="Failed: Failed to apply␣
 ↪correction to: ['m2hex']. ")
```

Re-enable M2 hexapod Make it ready for AOS

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

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

Re-issue the correction.

[21]:
```
print(await mtcs.rem.mtaos.cmd_addAberration.set_start(wf=wavefront_errors,␣
 ↪timeout=10))
```

```
private_revCode: 8e276e56, private_sndStamp: 1636480789.4373848,
private_rcvStamp: 1636480789.437568, private_seqNum: 232802595,
private_identity: MTAOS, private_origin: 247075, private_host: 0, ack: 303,
error: 0, result: Done, host: 0, identity: edennihy@nb-edennihy, origin: 57474,
cmdtype: 2, timeout: 0.0
```

[22]:
```
await mtcs.rem.mtaos.cmd_issueCorrection.start(timeout=60.)
```

[22]:
```
<ddsutil.MTAOS_ackcmd_8e276e56 at 0x7ff3b4662a60>
```

Reject the latest corrections.

[23]:
```
await mtcs.rem.mtaos.cmd_rejectCorrection.start()
```

[23]:
```
<ddsutil.MTAOS_ackcmd_8e276e56 at 0x7ff3fd0ab5e0>
```

[24]:
```
await mtcs.rem.mtaos.cmd_issueCorrection.start(timeout=60.)
```

[24]:
```
<ddsutil.MTAOS_ackcmd_8e276e56 at 0x7ff3fd2bceb0>
```

Add 2um of z7 via OFC

[25]:
```
wavefront_errors[3] = 2.0
```

[26]:
```
wavefront_errors
```

[26]:
```
array([0., 0., 0., 2., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
       0., 0.])
```

[27]:
```
print(await mtcs.rem.mtaos.cmd_addAberration.set_start(wf=wavefront_errors,␣
 ↪timeout=10))
```

```
private_revCode: 8e276e56, private_sndStamp: 1636480814.7056458,
private_rcvStamp: 1636480814.7058208, private_seqNum: 232802596,
private_identity: MTAOS, private_origin: 247075, private_host: 0, ack: 303,
error: 0, result: Done, host: 0, identity: edennihy@nb-edennihy, origin: 57474,
cmdtype: 2, timeout: 0.0
```

[28]:
```
await mtcs.rem.mtaos.cmd_issueCorrection.start(timeout=60.)
```

[28]:
```
<ddsutil.MTAOS_ackcmd_8e276e56 at 0x7ff3fcf97310>
```

Stop Tracking

```
[29]: await mtcs.stop_tracking()
```

```
<IPython.core.display.HTML object>
```

```
[30]: salobj.current_tai()
```

```
[30]: 1636480831.1752005
```

Wrap up. Put each component to the following states: mtaos –> standby m1m3 –> standby m2 –> standby camera hex –> standby m2 hex –> standby

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

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

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

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>

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<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

```
---------------------------------------------------------------------------
RuntimeError                              Traceback (most recent call last)
/tmp/ipykernel_57474/1098685940.py in <module>
----> 1 await mtcs.lower_m1m3()

~/auto-op-env-packages/ts_observatory_control/python/lsst/ts/observatory/control/
 ↪maintel/mtcs.py in lower_m1m3(self)
    666     async def lower_m1m3(self):
    667         """Lower M1M3."""
--> 668         await self._execute_m1m3_detailed_state_change(

    669             execute_command=self._handle_lower_m1m3,
    670             initial_detailed_states={

~/auto-op-env-packages/ts_observatory_control/python/lsst/ts/observatory/control/
 ↪maintel/mtcs.py in _execute_m1m3_detailed_state_change(self, execute_command,
 ↪initial_detailed_states, final_detailed_states)
    714                 f"M1M3 current detailed state {initial_detailed_states!
 ↪r}, executing command…"
    715             )
```

```
--> 716             await execute_command()
    717         elif m1m3_detailed_state.detailedState in final_detailed_states
    718             self.log.info(

~/auto-op-env-packages/ts_observatory_control/python/lsst/ts/observatory/contro/
 ↪maintel/mtcs.py in _handle_lower_m1m3(self)
    757             await self.rem.mtm1m3.cmd_lowerM1M3.set_start(timeout=self.
 ↪long_timeout)
    758
--> 759         await self._handle_m1m3_detailed_state(
    760             expected_m1m3_detailed_state=MTM1M3.DetailedState.PARKED,
    761             unexpected_m1m3_detailed_states={},

~/auto-op-env-packages/ts_observatory_control/python/lsst/ts/observatory/contro/
 ↪maintel/mtcs.py in _handle_m1m3_detailed_state(self,␣
 ↪expected_m1m3_detailed_state, unexpected_m1m3_detailed_states)
    797             ),
    798         ]
--> 799         await self.process_as_completed(m1m3_raise_check_tasks)
    800
    801     async def _wait_for_mtm1m3_detailed_state(

~/auto-op-env-packages/ts_observatory_control/python/lsst/ts/observatory/contro/
 ↪remote_group.py in process_as_completed(self, tasks)
   1134             except Exception as e:
   1135                 await self.cancel_not_done(tasks)
-> 1136                 raise e
   1137             else:
   1138                 await self.cancel_not_done(tasks)

~/auto-op-env-packages/ts_observatory_control/python/lsst/ts/observatory/contro/
 ↪remote_group.py in process_as_completed(self, tasks)
   1131         for res in asyncio.as_completed(tasks):
   1132             try:
-> 1133                 ret_val = await res
   1134             except Exception as e:
   1135                 await self.cancel_not_done(tasks)

/opt/lsst/software/stack/conda/miniconda3-py38_4.9.2/envs/lsst-scipipe-0.7.0/li/
 ↪python3.8/asyncio/tasks.py in _wait_for_one()
    617             # Dummy value from _on_timeout().
    618             raise exceptions.TimeoutError
--> 619         return f.result()  # May raise f.exception().
    620
    621     for f in todo:
```

```
~/auto-op-env-packages/ts_observatory_control/python/lsst/ts/observatory/control/
↪remote_group.py in check_component_state(self, component, desired_state)
    481             if state != desired_state:
    482                 self.log.warning(f"{component} not in {desired_state!r} ␣
↪{state!r}")
--> 483                 raise RuntimeError(
    484                     f"{component} state is {state!r}, expected␣
↪{desired_state!r}"
    485                 )

RuntimeError: mtm1m3 state is <State.FAULT: 3>, expected <State.ENABLED: 2>
```

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

[33]:

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

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

[35]:

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

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

[36]:

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

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

[37]:

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

```
<IPython.core.display.HTML object>

<IPython.core.display.HTML object>
```

[38]:

```python
await mtcs.standby()
```

```
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```

[39]:

```
await comcam.standby()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
/tmp/ipykernel_57474/4269457604.py in <module>
----> 1 await comcam.standby()

NameError: name 'comcam' is not defined
```