Report on Operations Rehearsl #2

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1 Introduction

LSST DM conducted the second operations rehearsal (milestones LDM-503-11 see LDM-503) from July 28^{th} to 30^{th} 2020. The plan for the rehearsal was outlined in LDM-643, the main principle was to simulate nominal operations with ComCam calibration data flowing from Chile, being processed (calibrated) and having some quality assurance performed. The overall emphasis was to investigate/simulate how raft-scale data can be acquired and processed in preparation for ComCam commissioning activities. LDM-643 details the procedure and personnel involved, hence in this document we give a brief summary of what happened in the rehearsal taking that as read.

2 The rehearsal #2

There was a short preliminary meeting on the Monday (July 27^{th} 2020), immediately prior to the rehearsal start to ensure hardware, software, and personnel were ready.

2.1 System Configuration During the Rehearsal

ComCam had been installed at the Base (La Serena) computer room and basic operation using the OCS/Archiver mode had been enabled. The hardware installation was a filter-less ComCam (with *r*-band hard coded in headers) and basic functionality to obtain bias, flat, and dark frames.

Data transfer from the Base to the current USDF at NCSA were accomplished but the long-haul networks were not fully operational. The raft-scale data were ingested into Butler (gen2) repos on arrival at the USDF and made available through the *projectshared/comCam* space (also visible for the RSP).

Processing was accomplished using the nascent utilities processBias.py, processFlat.py, pro-

cessDark.py and ingestCalib.py.

The calibrations frames taken were bias, dark, flat sequences of roughly 10 exposures each on each night. There exist extraneous exposures within the sets but the main calibration sequences used *groupId*'s (e.g., CALSET_20200728_1920) to facilitate their identification. Due to an upcoming quarantine in Chile (due to COVID-19) the calibration sequences were obtained the evening prior to each "night" of the rehearsal so that the rehearsal could be completed before the lock down began but also to hedge against slow transfers (because the long-haul networks were not fully functional). Processing occurred either in the evening or morning after (depending on the transfer time) and analysis and QA occurred shortly thereafter.

2.1.1 Communications

A Slack channel #ops-rehearal-2 was created to support communications.

A daily telecon was held using bluejeans at 10:00PST with the agenda:

- Observing: Recap of previous night's calibrations.
- Data transfer summary: How did data transfer and ingest go.
- Pipeline Processing Summary: How did processing go. Were there errors, incidents, caveats and reference to logs.
- Metrics/QA: What can we say about the data. Summary plots and metrics. What is missing in our view. What can we add for next night?
- Status: Current instrument status. Discuss current plans, changes, action items.

2.2 Day 1

The daily meeting took place as planned at 11:00 PST.[1]

Bias, Flat, and Dark sequences were acquired. A clear problem, L3 fogging, was noted and resulted in the replacement of the N2 bottle. It was noted that fogging was clearing and flats on subsequent nights should show a change.

[1] https://confluence.lsstcorp.org/display/DM/OPS+Rehearsal+%28Day+1%3A+2020-07-28%29+Meeting+notes

Transfers showed problems with roughly 25s per file (CCD). The ~30 exposure required O(1.5 hours) to reach the USDF. On arrival problems were detected with the ingestion of data. The culprit was that two processes were trying to ingest incoming files (one linking them with a deprecated file path). Once transfers completed, data repositories were regenerated fixing the issue.

Processing proceeded rapidly. Jobs were submitted using parallelism over 9 CCDs making up the ComCam raft. Total processing time was O(15 minutes) using 10 cores. There were problems with calibration ingestion (the CALIB area does not have permissions to allow group access). It is suspected that this has caused preliminary calibration based on early ComCam tests from a few weeks prior to be used in the reduction of the new calibration data but current provenance did not show which calibrations were used.

QA was performed with notebooks and shared. This analysis demonstrated that the proper calibrations were not used.

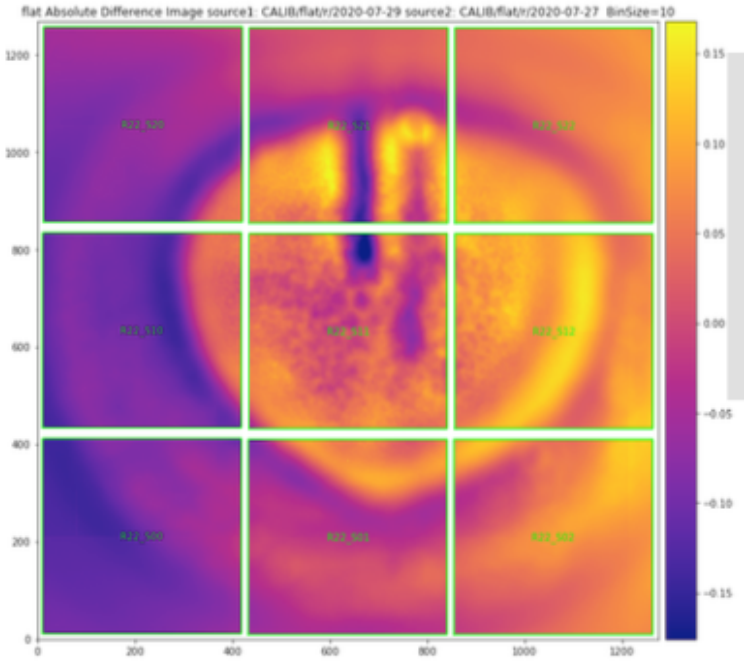

FIGURE 1: Night one flat with moisture on the lens.

2.2.1 Discussion

We discussed how to implement needed changes in infrastructure to support the current Butler Gen2 usage of calibrations (group write permissions were extended for the interim). Further discussions about Gen2 vs. Gen3 and the level of sophistication to plan for the next rehearsal.

2.3 Day 2

The daily meeting took place as planned at 11:00 PST. [2]

Initial data tests took O(2 hours). Second test provided calibrations for the second night (flats should not show condensation).

Transfers were again slow and DB access was not provided in monitoring scripts, so timing relied on file creation times (fixes were added after the meeting). LHN staff are looking at slow transfer speeds.

Processing proceeded similar to the night before. Provisional changes in CALIB area permissions worked, but is still unclear how to see the logs. One dark frame had problems with only 6 of 9 files being transferred (required a restart).

Quality analyses showed a huge change in flat frames (confirming that moisture indeed impacted previous calibrations).

2.3.1 Discussion

The plans for the next night were discussed. Initially there were supposed to be changes, with an aborted flat sequence followed by change in illumination prior to the ”real” sequence being taken. This plan was altered in favor of attempting to get some preliminary estimates about the overall stability of the instrument from one night to the next while in its temporary (not so stable) environment. So the upcoming calibration sequences were planned to have no explicit changes.

[2] https://confluence.lsstcorp.org/display/DM/OPS+Rehearsal+%28Day+2%3A+2020-07-29%29+Meeting+notes

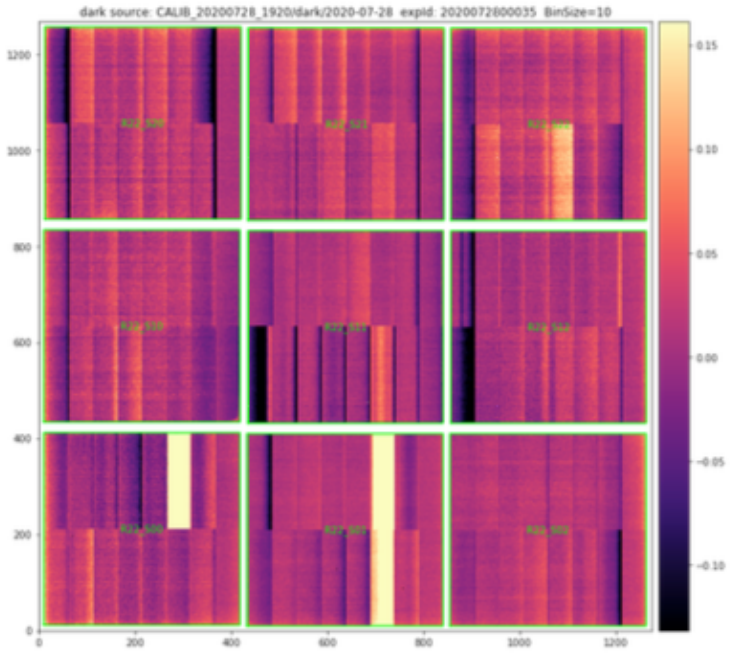

FIGURE 2: Night two flat still with incorrect bias subtraction.

2.4 Day 3

The daily meeting took place as planned at 11:00 PST.[3]

Observations were attempted to repeat images with the previous night's setup. There was a disk write timeout from the DAQ. This was mitigated, the exposure counter was incremented and a restart allowed the completion of the sequences. It was noted that this problem will likely go away once SSDs are installed for the DAQ storage hardware.

Transfers required 2 hours, 50 s for the first image and then downhill from there. Processing proceeded without incident and all calibrations went to the correct registry.

Quality analyses show huge differences in darks between nights but this has been traced to the wrong bias frames (those from 2 weeks prior) being applied.

[3] https://confluence.lsstcorp.org/display/DM/OPS+Rehearsal+%28Day+3%3A+2020-07-30%29+Meeting+notes

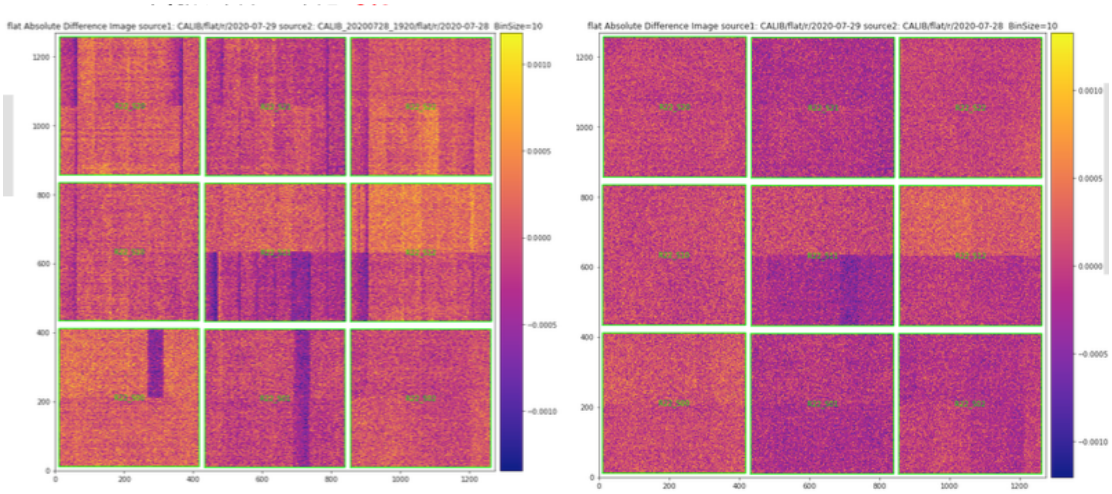

FIGURE 3: Difference between night two and night three flats with incorrect bias(left), correct bias subtraction (right).

2.4.1 Discussion

The rehearsal was deemed finished, except for some follow-on analyses and the production of this report. Most discussion revolved around the soonest that a subsequent rehearsal should be planned (even if it were to repeat this exercise) and what changes we should plan for. The current thought is that we should begin discussing this in September and should set a goal to be able to switch to using the Gen3 Butler and code-base (with high priority).

3 Conclusion and lessons learned

This rehearsal was slightly delayed to allow us to use ComCam. Even though it was in the base facility and not on the mountain it was still worth waiting for. It is a less than ideal situation born out by the first images with moisture on the lens due to the N2 running out and the poor long-haul network performance thoughout (O(25 Mb/s) compared to the current expected 10 Gb/s and the eventual planned 100 Gb/s). The team in this rehearsal, using actual hardware, had a more active role for the "observing specialist on the mountain" (in this case setting up the flat for the camera and initiating the observing sequence). We used software from Telescope and Site, Camera and DM to take the images and transfer them to NCSA. All of this activty underpinned by machines and networks supported by Rubin IT. This is a first true demonstration of multiple parts of the system working together in an operational manner. All of the hard integration efforts of SITCOM have born fruit for us here.

Among the lessons learned from this rehearsal are:

- We ran into networking problems and we were not easily able to diagnose them - we should have included key long-haul network people in the rehearsal and we shall next time.
- We encountered problems with Data Management pipeline configuration. Documentation and training need to be provided.
- We still need to have automated processing in place for images - in the plan but not yet available.

In summary, this was a very good rehearsal the teams worked well together, there remains plenty to do in future rehearsals!

A References

[LDM-643], Johnson, M., Gruendl, R., 2019, *Proposed DM OPS Rehearsals*, LDM-643, URL `https://ls.st/LDM-643`

[LDM-503], O'Mullane, W., Swinbank, J., Jurić, M., Economou, F., 2018, *Data Management Test Plan*, LDM-503, URL `https://ls.st/LDM-503`

B Acronyms

Acronym	Description
CCD	Charge-Coupled Device
COVID	COrona VIrus Disease
ComCam	The commissioning camera is a single-raft, 9-CCD camera that will be installed in LSST during commissioning, before the final camera is ready.

DAQ	Data Acquisition System
DB	DataBase
DM	Data Management
DMTN	DM Technical Note
Gb	Gigabit
IT	Information Technology
L3	Lens 3
LDM	LSST Data Management (Document Handle)
LHN	long haul network
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
Mb	Megabit (1000000 bit)
N2	Nitrogen
NCSA	National Center for Supercomputing Applications
OCS	Observatory Control System
OPS	Operations
PST	Project Science Team
QA	Quality Assurance
RSP	Rubin Science Platform
USDF	United States Data Facility