

Vera C. Rubin Observatory & LSST-Camera

Status Update & Commissioning

Remark: lots of the material presented here on Vera C. Rubin Observatory status comes from the Agency Quarterly Status from early March 2021.

T&S (=Telescope & Site) Status

Sealing Roof Cladding Panels

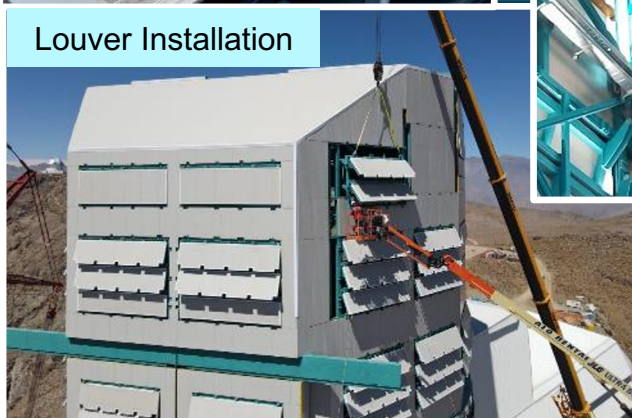


Shutter Seals (view towards AuxTel)



Light Baffle Panels

Louver Installation



Dome Electrical Work

Dome Crane FAT



Covering Base Ring Gap



Assembling/Cladding Louvers

T&S Status – Dome with TMA (Telescope Mount Assembly) Assembly Crane





Camera rotator / Camera
cable wrap integration



Top-end assembly
preparations level 3



Oil supply pump level 1



Oil piping level 5



Glycol piping level 5

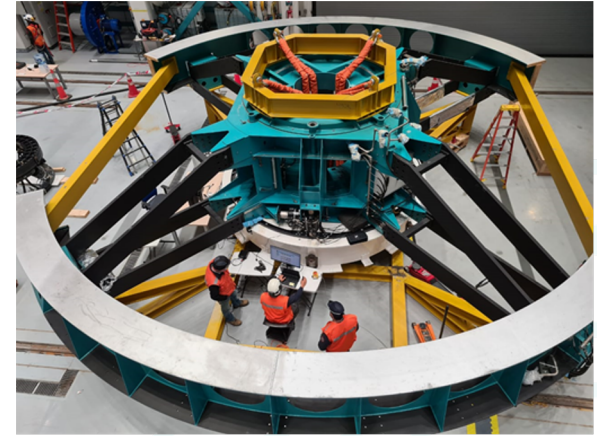


TMA assembly in progress



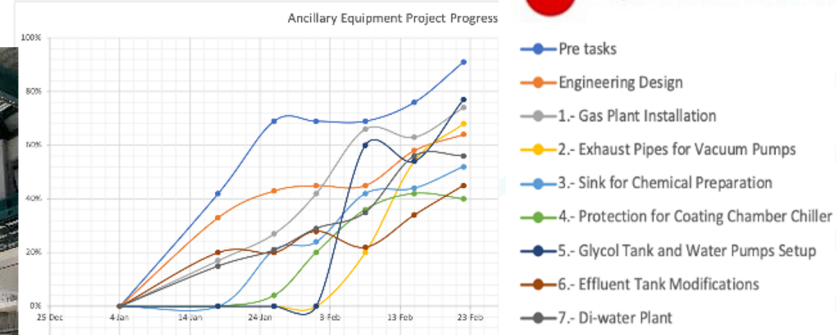
Cable trays & piping under TMA

- M2 Hexapod
 - The three water-damaged actuators were shipped to Tucson
 - It was determined that water had damaged the encoders
 - The actuators were successful repaired, tested and returned to Chile
 - The M2 Hexapod was installed on the Top End Assembly of the TMA
 - The installation as accomplished on the 3rd floor before the TEA was installed on the TMA
 - The Hexapod was tested and the actuators function properly
 - They are still trouble shooting an electrical problem that appears to be either a connector or a power supply problem
- Camera Hexapod
 - One leg of the camera hexapod was experiencing an intermittent anomaly
 - The encoder was having difficulty reading a small portion of its tape
 - This actuator was swapped with the spare so it could be sent to Tucson for diagnostics and repair



T&S Status – Coating Plant

- Ancillary Equipment contract awarded to Premium Ingenieros for \$208K
- Project in progress completion 62% complete



Task to be placed inside the 3rd level and also outside at the dedicated coating chiller area

- Rubin Operations (Phase 2) restart successfully reviewed December 11 to prepare for the arrival of the TMA team in January 2021 and to continue the progressive ramp-up of activities on summit.
- All subsystems located in the 3rd level were restarted and Camera Hexapod actuator #3 was successfully replaced with spare actuator
- Limit switches were modified to fail-safe configuration on Camera Hexapod/Rotator and M2 Hexapod
- Unloading of 9 containers with dome louvers and transport of Dome parts from local chilean company



Team lifting Camera Hexapod/Rotator with bridge crane on 3rd level

- TMA Top End Assembly (TEA) was transported inside facility building 3rd Floor
- M2 Hexapod actuators were received from Tucson and tested to verify functionality
- M2 Hexapod was integrated on TEA and tested using M2 surrogate mass
- Random fault appeared during M2 hexapod testing and investigations are in progress



TEA transport inside facility building (view from above)



TEA in summit facility during integration of M2 hexapod

Telescope & Site – Near-term Objectives

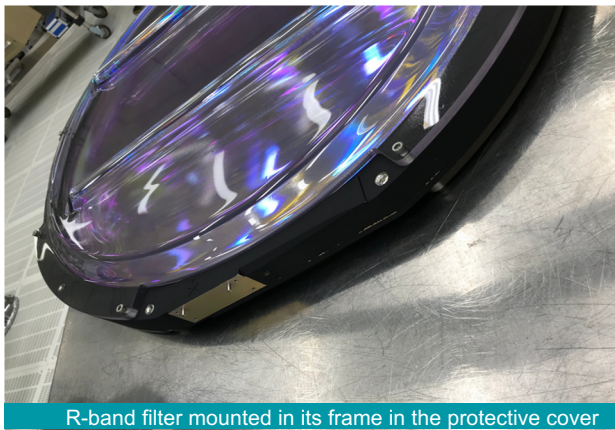
- Complete major assembly of TMA
- Complete and test oil and glycol piping
- Advance with dome closure & mechanisms
- Install permanent dome bridge crane
- Complete coating plant ancillary equip.
- Integral test of software w/ hardware
- Support ComCam Integration & AT Observing

Keep the T&S Team and Contractors working safely and efficiently in an evolving COVID landscape

Filter Recent Progress (MIE)

Filter	Coarse Grinding	Fine Grinding	Polishing	Finishing	Coating	Coating Metrology	Mounting in Frame	Delivery
r	Done	Done	Done	Done	Done	Completed	Completed	Authorized to ship
i	Done	Done	Done	Done	Done	Completed	Completed	
z	Done	Done	Done	Done	Done	Completed	Completed	
y	Done	Done	Done	Done	Done			
g	Done	Done	Done	Done	Pending			
u	Done	Done	Done	Done	Pending			

- 4 filters have now been coated
- 3 filters have been accepted from the vendors.
- r-band filter has been assembled and accepted, received at SLAC April 23rd (see next)
- Pin interface non-conformance resolved successfully
- g-band filter test run underway for first surface coating (done ?)



Filter – Exchange commissioning

The French team works remotely with a local support at SLAC since January .

It allowed to do many progresses on hardware and software commissioning...but painful 😊

SLAC started to receive the final filters, and we used the Loader to store the r filter in the storage box (made in Grenoble)

In // work in France on :

- Commissioning using the demonstrator in Paris: used to progress on key issue(s) (hard work to make it alive again with lock down and travel restriction(s) ...)
- Building spares : Loader 2 and AutoChanger 2
- Preparing upgrades for intervention at SLAC

Hope : mission at SLAC in July 🤔 😎



Example : still some gain “glitches” in ITL sensors over time

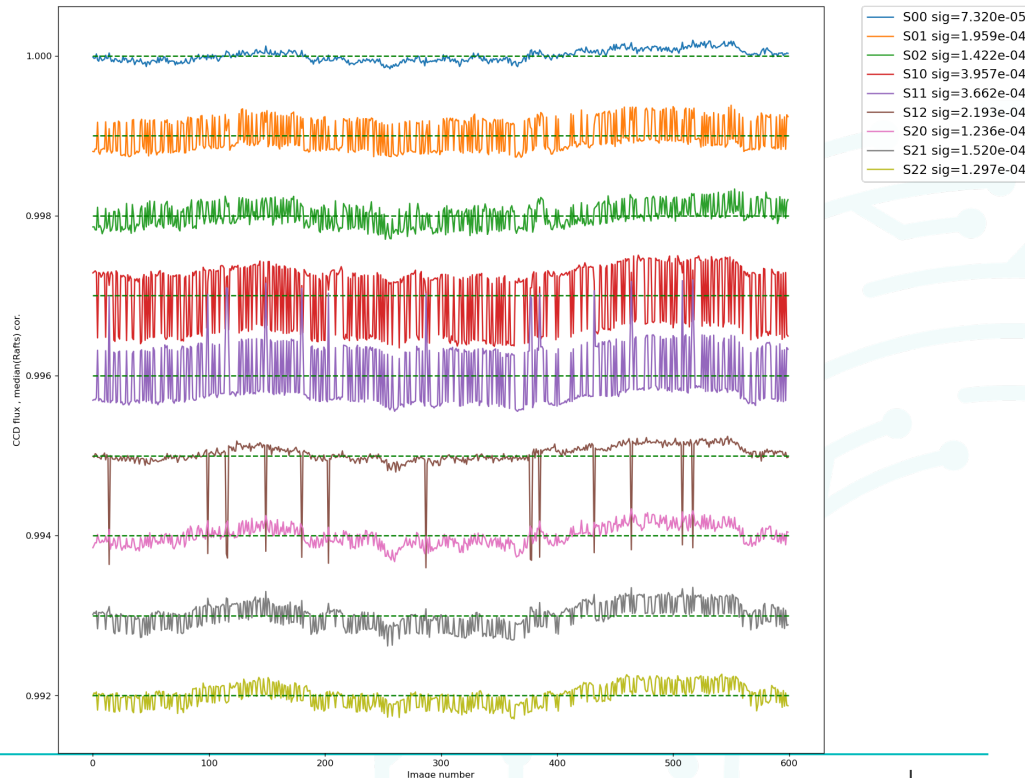
- 25 Rafts test :

French contribution on Focal plane data analysis collected this winter.

Last runs showed a clear improvement in comparison of 9 rafts test of 2019 (no tearing, more stable in response ...)

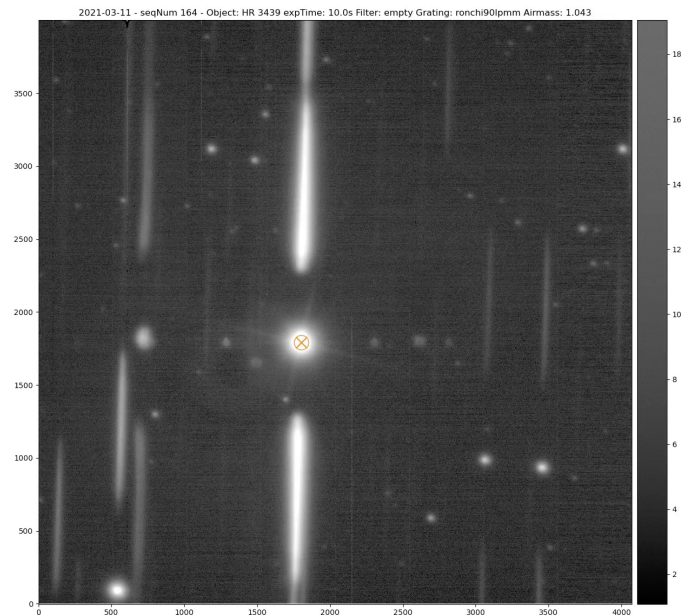
Key contribution in 2021 from our side on issues to fix related to gain stability , bias shape & stability, clear quality, long-range correlation

- CCOB calibration system delivered by Grenoble team to SLAC.

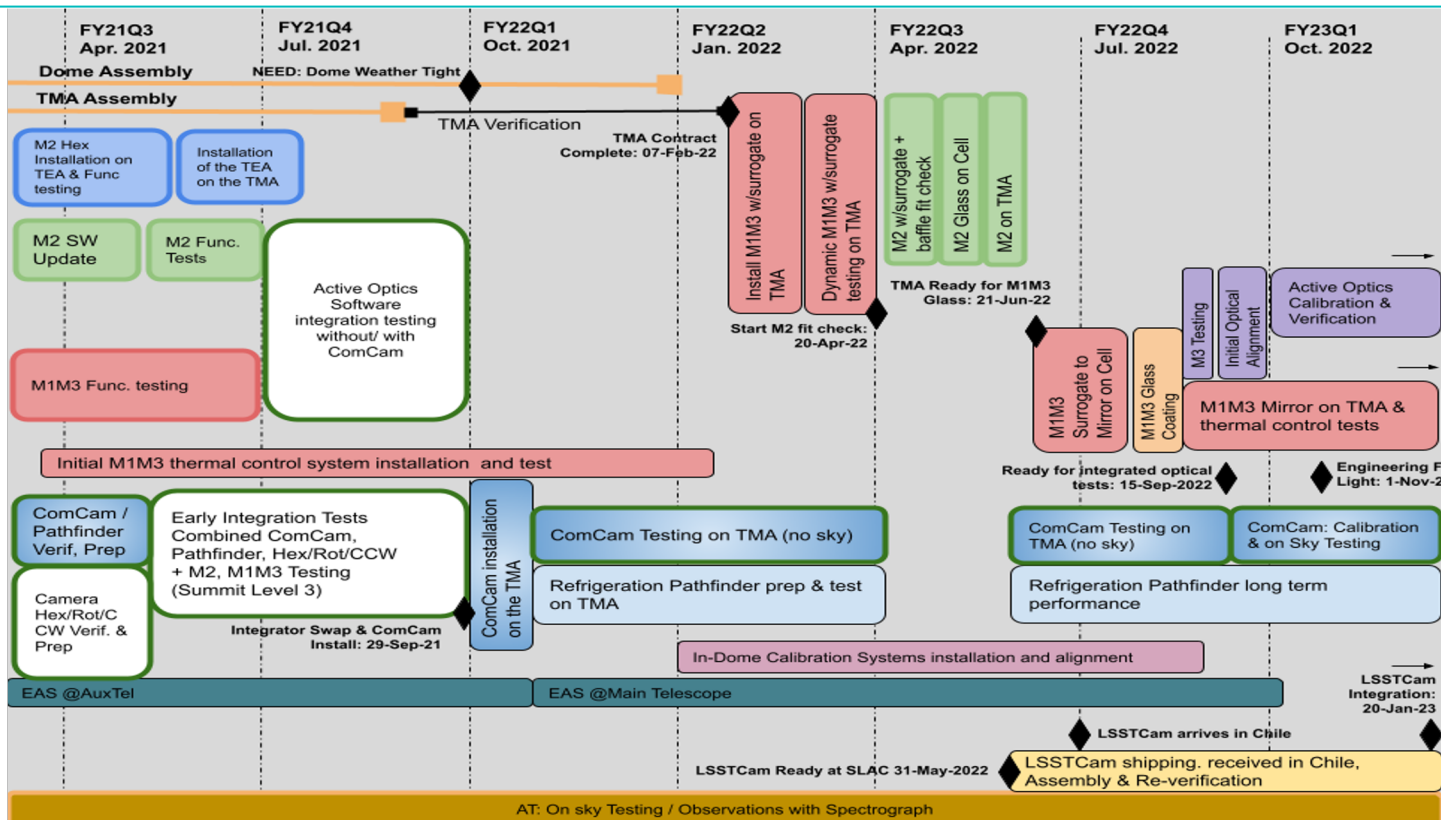


Auxiliary Telescope Technical Status

- Brought out of shutdown in late December. All hardware checked out and system came back online in the previous state relatively smoothly.
- Software development had continued rapidly during the shutdown, made a conscious decision to discontinue the regular summit deployment cycle to continue development during the ~10 month shutdown
 - Correct decision from an overall efficiency and productivity standpoint
 - Results in deployment numerous software changes for first run
- As expected, the software aspects of the restart were challenging, but the first on-sky run in January was largely successful
 - System functionality now at a higher level of readiness than before the shutdown
- Software rollouts/updates still pending but we expect to resume the regular deployment cycle towards the end of March
- With two runs completed since the shutdown, the DM pipelines team has ample data to perform end-to-end development
- [The AuxTel system continues to be a useful pathfinder in identifying issues and tasks that must be completed to optimize main telescope commissioning](#)



Current integration plan has had to adapt to evolving circumstances



- KPPs were defined to keep the Camera requirements self-contained and internally verifiable at SLAC
- The KPPs constrain the requirement trade-off within the LSST project to ensure the integrated design will meet the science requirements.
- 6 of 7 Threshold KPPs met or exceeded; ‘sensitivity range’ on track but not yet verified.
- 5 of 7 Objective KPPs met; 1 is not fully met for the combination of readout time, Readout noise and number of pixels.

Description of Scope	Threshold KPP	Objective KPP	Performance
Field of view coverage (square degrees)	> 9.3	> 9.6	9.73
Pixel size	0.2 arcsec	0.2 arcsec	0.2 arcsec
Number of pixels	> 2.6 Gigapixels	> 3.2 Gigapixels	3.2 Gigapixels (2 sec/No Defect) 3.1 Gigapixels (2 sec/13e-) 2.9 Gigapixels (2 sec/9e-)
Array readout time	< 3 seconds	< 2 seconds	1.996 sec
Sensitivity range	320-1050 nm	320-1050 nm	300-1100 nm
Shutter minimum exposure time	< 2 seconds	< 1 second	0.901 second *
Readout electronic noise, single exposure	< 13 electrons	< 9 electrons	< 9 electrons

**0.3 demonstrated if 2 blades are moving simultaneously*

Threshold KPPs have been verified and met except for the filter related sensitivity range, which has not been verified yet

- LSST cosmology will be systematic limited : understanding is the key
- ➔ We should all consider contributing to the commissioning.
- DESC side: Vera C. Rubin Observatory has publicly said at AAS that there will be a call for members of the science community to engage in commissioning, this was discussed at the Feb DESC meeting, and the call will be out soon.
- Directly through the project: we may , as individual – institution (IN2P3 is the key there), be part of the project (become builder ?)... it may end up to be more comfortable, in particular for contributions to associated commissioning publication (= not “science”). Two good/easy paths there :
 - Auxtel (+ ComCam one day) ➔ there is an IN2P3 calibration team involved, this will further ramp up, and will address many good commissioning question (from site, to ITL sensor, to ...) ➔ Contact S.Bongard and J.Neveu
 - Focal Plane commissioning (+ CCOB)... at SLAC today... at summit tomorrow, they are missing hands and brain(s)... ➔ Contact Claire, Pierre², Céline

SIT-COM: Science Verification and Validation

- Major development progress on “faro” science verification software intended to automatically generate performance metrics at survey scale
 - Fully integrated with Science Pipelines infrastructure (e.g., Gen-3 middleware, lsst verify system)
 - Metrics computed at full granularity (e.g., individual visits, patches), with flexible roll-up routines to produce summary statistics
 - Planning that most high-level science performance requirements will be implemented with faro
 - Potential for near real-time evaluation of data quality
 - Preparing to add faro to the lsst_distrib standard Science Pipelines distribution package
- DM and SIT-COM are collaborating to develop detailed specifications from science performance metrics in the DMSR, OSS, LSR
- Collected input from science community on **on-sky observing strategies during commissioning** that would facilitate science validation activities.
 - Five Science Collaborations submitted commissioning notes
 - Synthesizing this feedback as input to developing a more detailed on-sky observing strategy