



# Project Management and Status

**V. Krabbendam**

**LSST Project Manager**

**March 2017**

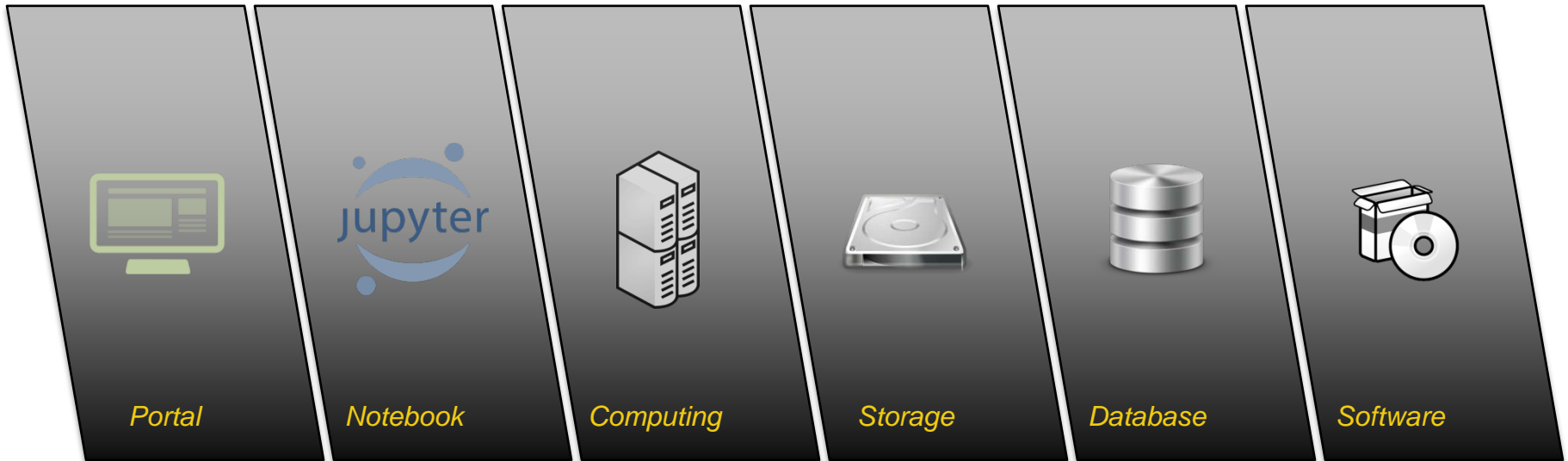
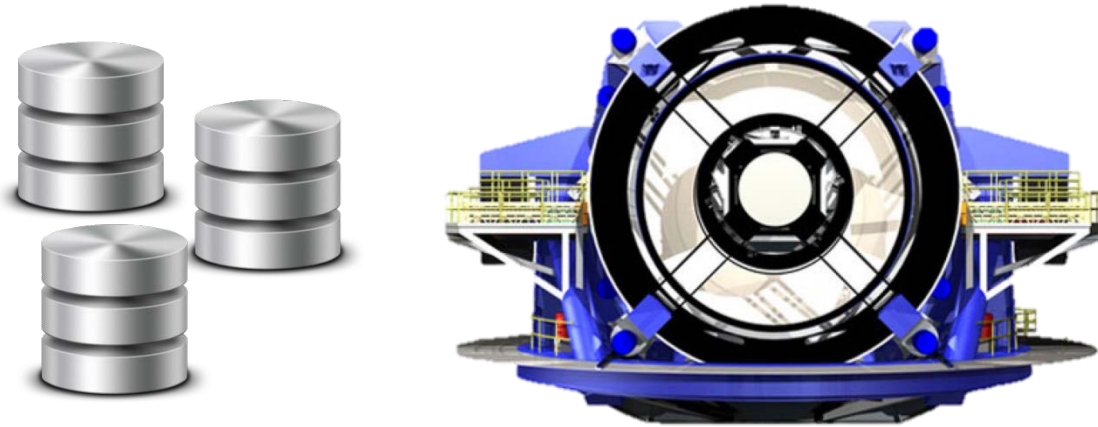




- We have completed a lot!
  - Total complete across NSF and DOE = ~\$225M
  - Camera is 57% complete and NSF is 36% complete
- There is a lot going on!
  - There are 174 participants here
  - Majority are essentially full time on LSST
- The next 6 to 12 months will be key!
  - DM has to come out of the “Replan”, Deliver a PDAC, and complete a full system review
  - Camera has to get sensor deliveries on routine basis, produce RTMs in “production” mode and start delivering subsystems to I&T
  - Telescope and Site has a building, dome, telescope, mirrors to get finished or substantially complete
  - EPO is getting staffed, launched and setting their course.

**Everything has Started but Nothing is Done!**

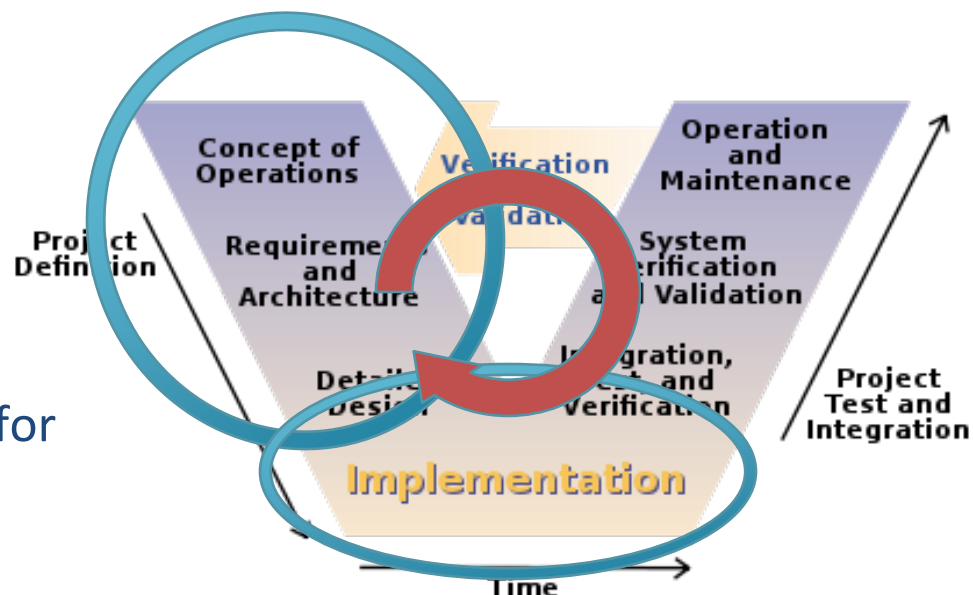
# The DM Delivery: the LSST Science Platform



# Replan has been focus for the last year



- Identify and write missing concepts of operations
- Update the requirements
- Update/define the system architecture
- Update the designs to a level need for long-term planning and estimation
- Develop implementation plans
- Update processes for agile execution of plans
- Define the verification and validation strategy
- (post-replan: continuously maintain and adjust the resulting body of work)



Challenges: the need for parallel development in many of these areas;  
desire to minimize impact on ongoing construction.





## Prototype LSST Science Pipelines Are Running on HSC Survey ...

HSC "ultra deep" gri imaging in COSMOS, with a total of 1.5 hours in g and r and 3 hours in i; (280/550 LSST visits).

The visits were processed, calibrated, registered, added, and the resulting coadds processed using the LSST stack.

These catalogues are being used to carry out first-year HSC science.

*Credit: HSC collaboration, Robert Lupton and LSST DM @ Princeton.*

**At 22% spent - LSST software already is capable**

Processing scale:

HSC Survey S16A Data Release

Exposures: 8192 images  
(note: deeper than LSST, exposure time is ~minutes)  
Areal coverage: 174 deg<sup>2</sup>  
Total data volume: ~200TB

Notes:

- Using a fork of LSST science pipelines adapted to HSC camera (will not be necessary as of Dec'16)
- Using HSC-Survey's orchestration middleware

# PDAC Features leading to minimum viable system: Example Results Return in Portal or Notebook



Add a URL for downloading the image by ID

```
In [16]: df_coadds['img_url'] = df_coadds.deepCoaddId.map(lambda x:
    'http://lsst-gserv-dax01.ncsa.illinois.edu:5000/image/v0/deepCoadd/id?id=' + str(x))
```

Verify that df\_coadds has at least five entries for the five filters

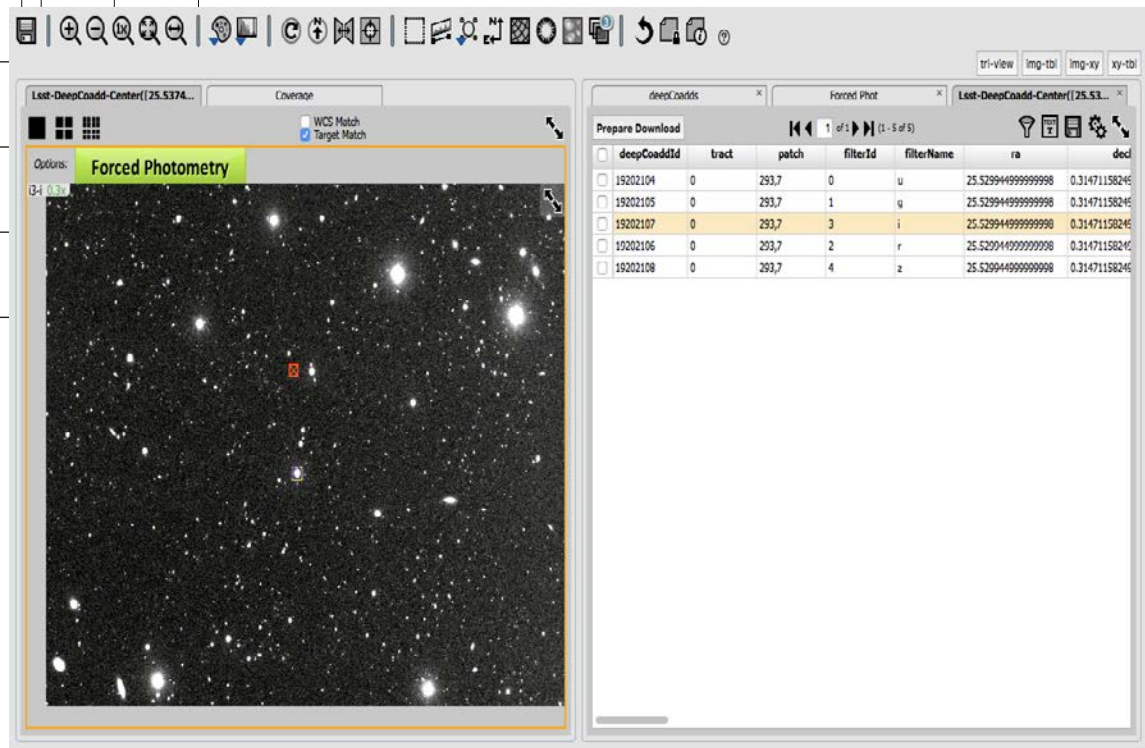
In [15]: df\_coadds

Out[15]:

	deepCoaddId	tract	patch	filterId	filterName	ra	decl	htmlId20	equinox	raDeSys	...	corner3Ra	corner3Decl	corner4Ra
0	19202104	0	293,7	0	u	25.529945	0.314712	17147177442654	2000.0	ICRS	...	25.416645	0.422899	25.416645
1	19202105	0	293,7	1	g	25.529945	0.314712	17147177442654	2000.0	ICRS				
3	19202106	0	293,7	2	r	25.529945	0.314712	17147177442654	2000.0	ICRS				
2	19202107	0	293,7	3	i	25.529945	0.314712	17147177442654	2000.0	ICRS				
4	19202108	0	293,7	4	z	25.529945	0.314712	17147177442654	2000.0	ICRS				

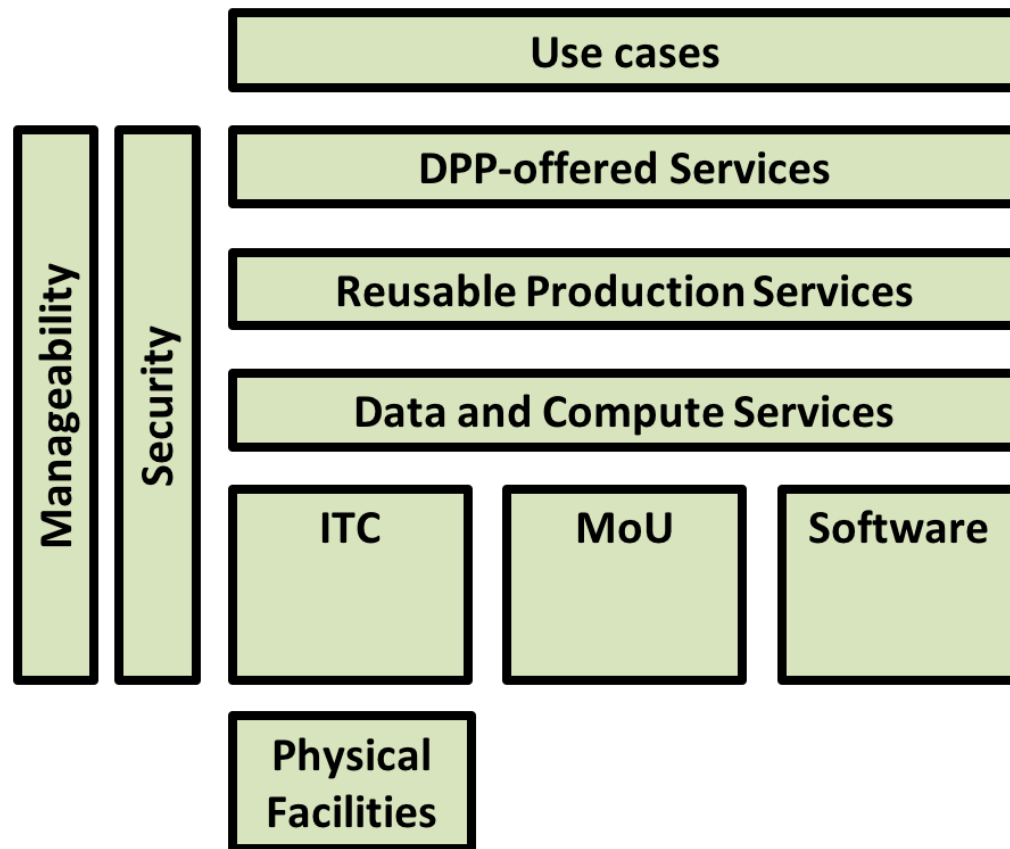
5 rows x 34 columns

- Results available in portal and notebook
- Data specific connections enabled in context of portal: images connected to table in portal
- Output driven by notebook commands
- Forced Photometry function available for images





# DM Infrastructure and Services – NCSA driving updated WBS with Standard layered structure



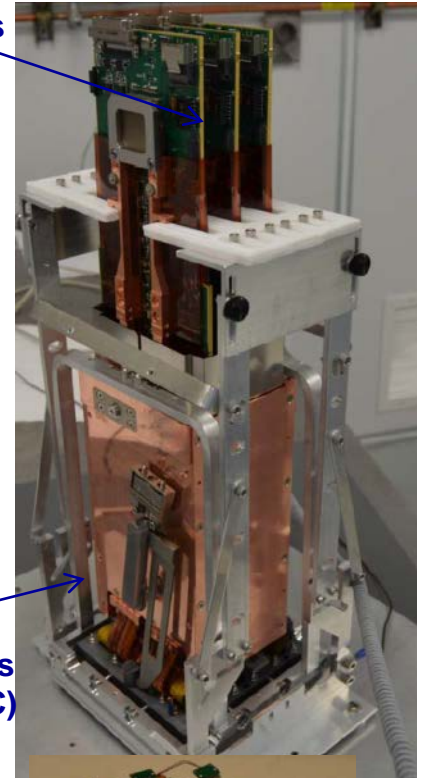
- Exclusively responsive to science use cases.
- Each use case propagated through layers.
- Vehicle for cost analysis and scope containment.

**Full DM RePlan in wrap-up / costing phase :  
There will be contingency needed but not  
outside identified Risk exposure**

- System Description:
  - Twenty-one 144 megapixel cameras.
- Recent Accomplishments:
  - Manufacturing Readiness review completed
  - Raft Sensor Assembly Baseplate awarded and first lot received
  - Electronics (REB5) design completed
  - Completion of the Engineering Test Unit
- 6 Month Major Milestones
  - Construct & commission Test Stands 5-8,
  - Conduct Test Readiness Review.
  - Mar 2017: 1st Production Raft Tower Complete
  - Sep 2018: 21st Production Raft Tower Complete

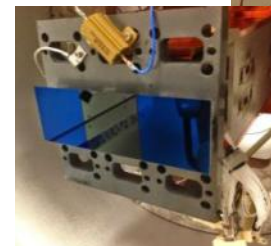
Raft Electronics Board (REB)

Science Raft Tower

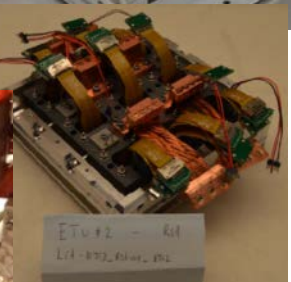


Raft Electronics Cage (REC)

Science Sensor

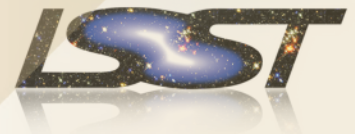


Raft Sensor Assembly



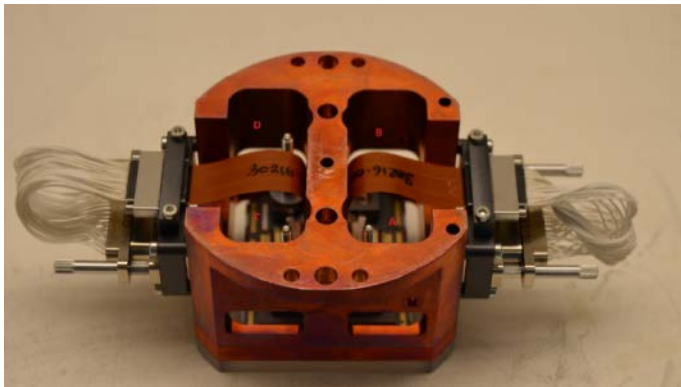


# Sensor Damage Issue

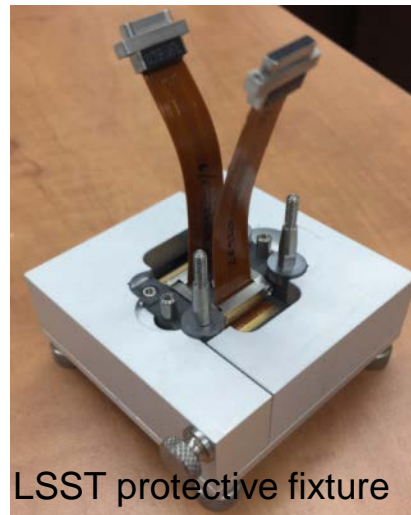


SLAC

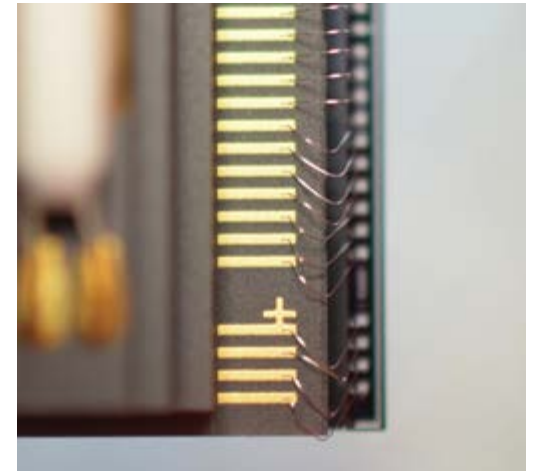
- 5 sensors had wire bond damage
- LSST QA team investigated root cause
- Determined Spacing issue with carrier – Working with Vendor to resolve



Vendor Shipping/protective fixture



LSST protective fixture



Example of wirebond damage

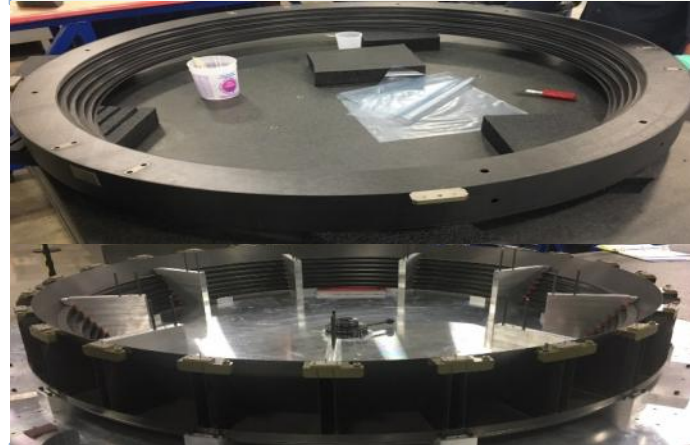
# Optics design/fabrication status (LLNL)



SLAC

- System Description:
  - Fused silica lenses.
  - Design-build contract with Ball Aerospace (With AOS and Vanguard), TESO, REOSC and Materion.
- Recent Accomplishments:
  - Award Filter Fabrication Contract: 2/2016
  - Award Filter Coating Contract: 4/2016
  - L1 shaped, received at AOS 8/2016
  - L2 shaped and polishing underway.
  - Vendors have demonstrated BBAR coating
- 6 Month Major Milestones:
  - Complete composite structure
  - Complete L3 Flat Assembly fine grind and polish,
  - Complete L3 Lens Assembly fine grind

Vanguard



L1-L2 Composite Structure



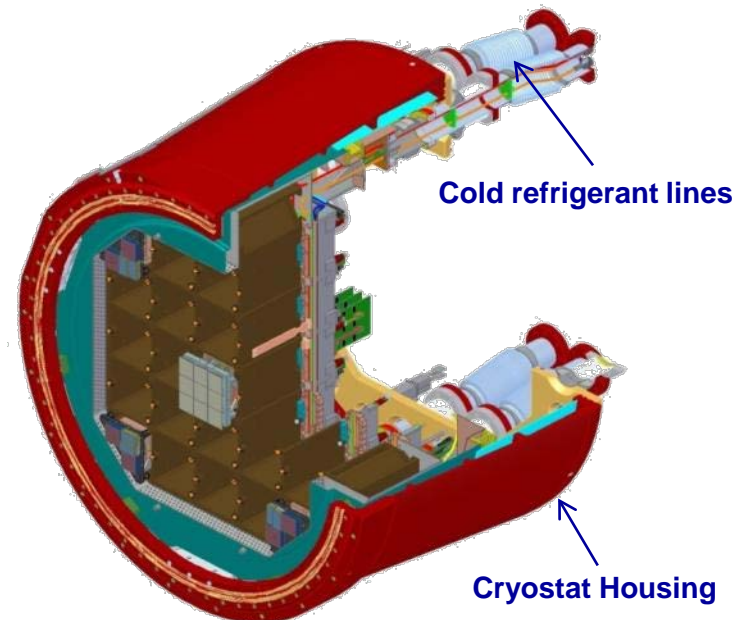
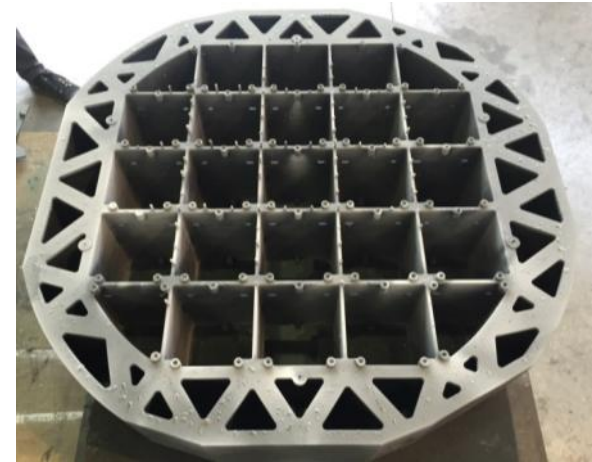
AOS L2 Optic



L3 and Test Window blanks at TESO

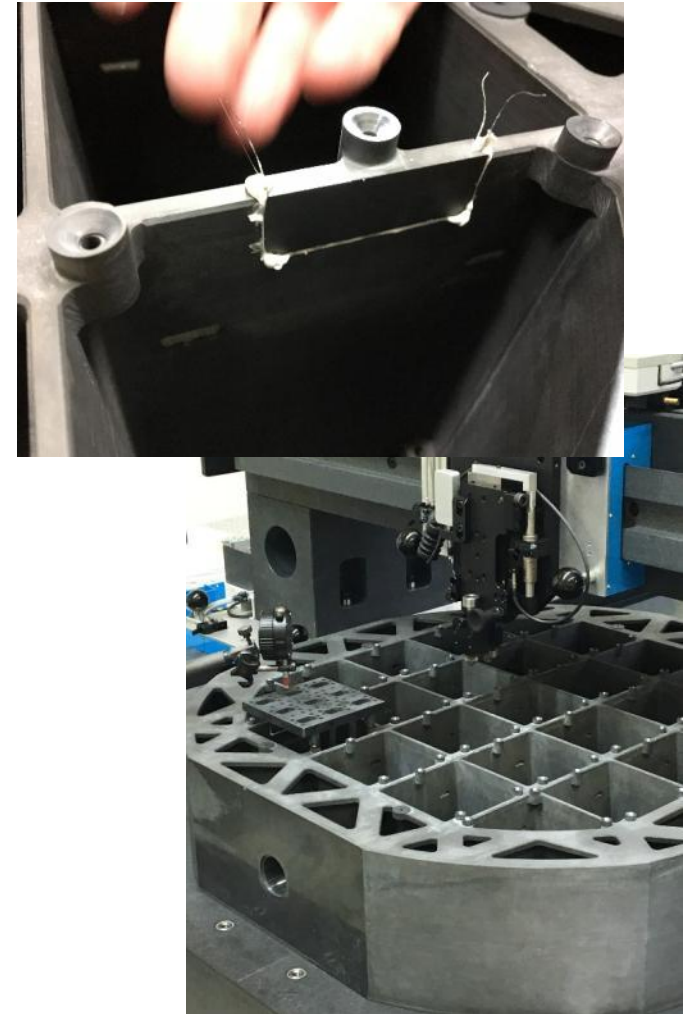
- L1-L2 strut incident
  - One strut out of the 6 struts needed between L1 and L2 failed during acceptance test prior to installation.
  - Root cause identified un-planned use of lubricant to unlock the adjustment system during a non-conformance event.
  - Replacement Strut also failed. Schedule assessment in progress . The need date at AOS is September 2017.
- L1 Fabrication Incident:
  - AOS/Ball/LLNL/SLAC team did and excellent job getting a replacement L1 after last year's grinding fabrication incident.
  - This week there was an issue with the AOS fabrication machine that damaged the L1 blank. Review in progress but impact is not expected to have significant technical impact.

- System Description:
  - Provides stable structural support for raft towers that hold the CCD detectors for the focal plane.
  - Provides stable thermal control of cold CCD's (-100C) and sensor readout electronics (0 to -40C).
  - Maintains CCD's in clean high-vacuum environment.
- Recent Accomplishments:
  - Completed Grid green machining & infiltration (high risk retired).
  - Completed grid cell mockup.
  - Fall 2016 grid incident has been mitigated and repair has been qualified and completed.
  - Awarded Housing & support cylinder fabrication.
- 6 Month Major Milestones:
  - Final Acceptance Testing at vendor in March.
  - Complete manufacturing trials and start Cryoplate fabrication.





- Grid has been repaired:
  - Grid damaged area has been removed
  - Insert has been manufactured
  - Procedures were reviewed and approved on 01/09/2016
  - Insert was epoxied into the grid on 01/16/2017
  - Fit check with baseplates
- Grid delivery dates have been updated:
  - Team going to Vendor in Mid-March for Acceptance
  - Delivery at SLAC is expected in March/ April time period.



# Summit Facility on Cerro Pachón



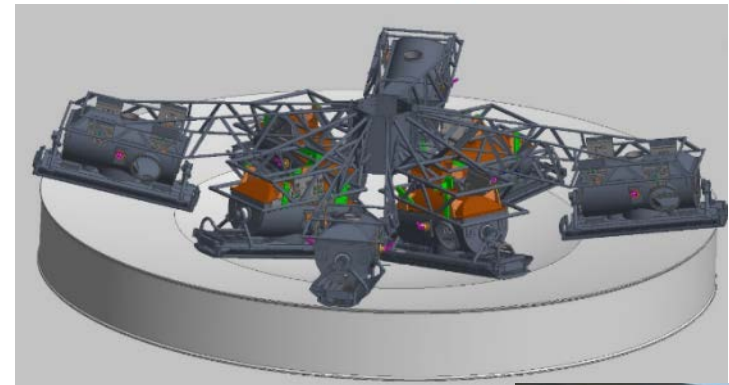
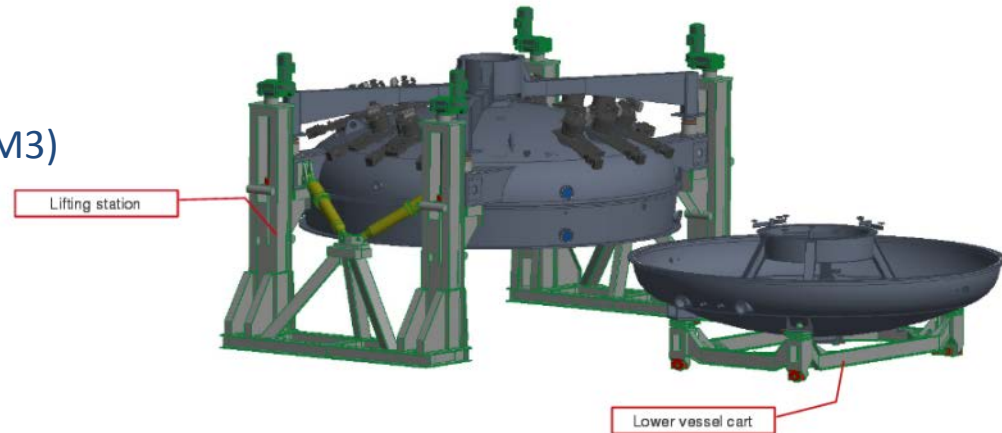
- Recent Accomplishments:
  - Dome interface and TMA topple block plates installed
  - Machinery room and control rooms interior work commenced
  - Initial installation of Pflow tower structure
- 6 Month Major Milestones:
  - Lower enclosure and TMA piers to be complete mid-Mar 2017
  - Dome vendor onsite Mar 2017
  - Sep 2017: Besalco contract end
- Construction is several months late
  - Team has ordered the work and negotiated with the vendor to allow the Dome work to start in March.
  - Building / Dome are on critical path



# Reflective Coating Plant for Summit



- System Description:
  - Upper coating/vacuum vessel (M1M3) with additional lower unit (M2)
  - Rotating magnetron system
  - Separate washing/stripping station
- Recent Accomplishments:
  - Successful PDR in Dec 2016
  - Successful demonstration of 2.4-meter LSST custom magnetron
- 6 Month Major Milestones:
  - Machining of steel vacuum components
  - FDR planned for Mar 2017
  - Initial coating plant component assembly in chamber Jun 2017
- System is too heavy – Floor loading higher than anticipated
  - Building is in place – exoskeleton defined to resolve





# M1M3 Cell Assembly



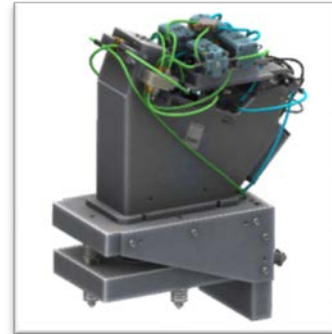
- System Description:

- 9m x 9m x 2m cell weldment
- 44 single axis and 112 dual axis pneumatic actuator assemblies
- 6 hardpoint actuators
- 97 thermal fan coil units



- Recent Accomplishments:

- Cell weldment in fine machining at CAID
- Single and dual axis actuator components procured and assembled
- First hardpoint actuator assembly complete
- M1M3 cart and M1M3 Surrogate Mirror in fabrication at CAID



- 6 Month Major Milestones:

- Actuator assembly functional testing Feb 2017
- M1M3 cell ready for actuator integration May 2017
- Commence M1M3 cell assembly testing with surrogate mirror July 2017



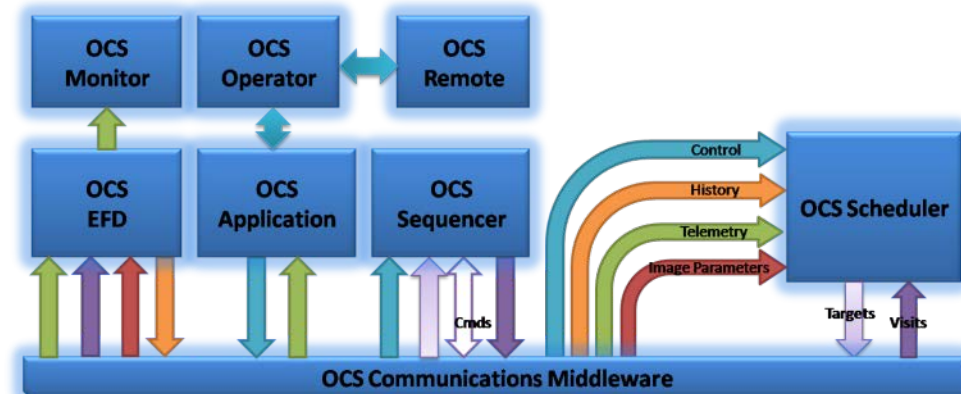
- Schedule – Schedule

- More Actuator Test stands
- Reworked integration plan several times





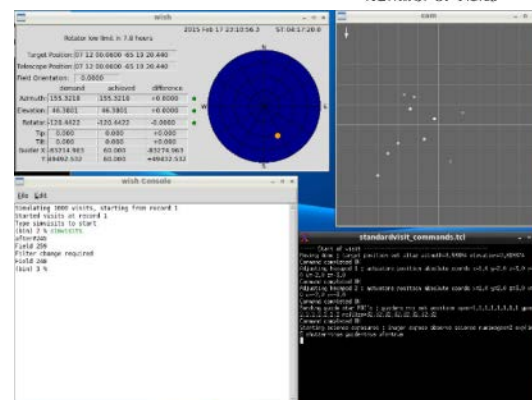
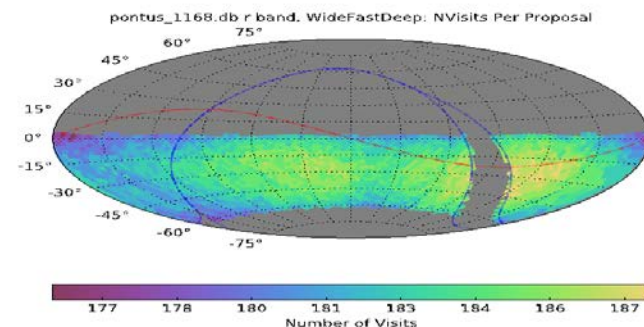
- System Description:
  - High level Control and Monitoring software
  - 420TB Telemetry Database
  - DDS based Middleware for control and telemetry
  - Adaptive Scheduler for robotic survey



- Recent Accomplishments:
  - Middleware/LabVIEW testing commenced
  - Scheduler/OpSim4 integrated package testing commenced
  - Survey average filter change rate reduced with new cost function

## 6 Month Major Milestones

- Scheduler release v1.0 Feb 2017
- Control Software pathfinder #3 Mar 2017 integration with TCS-CCS-DMCS
- Middleware release v4 Jul 2017
- Tension with schedule simulation and Project/community desire to optimize

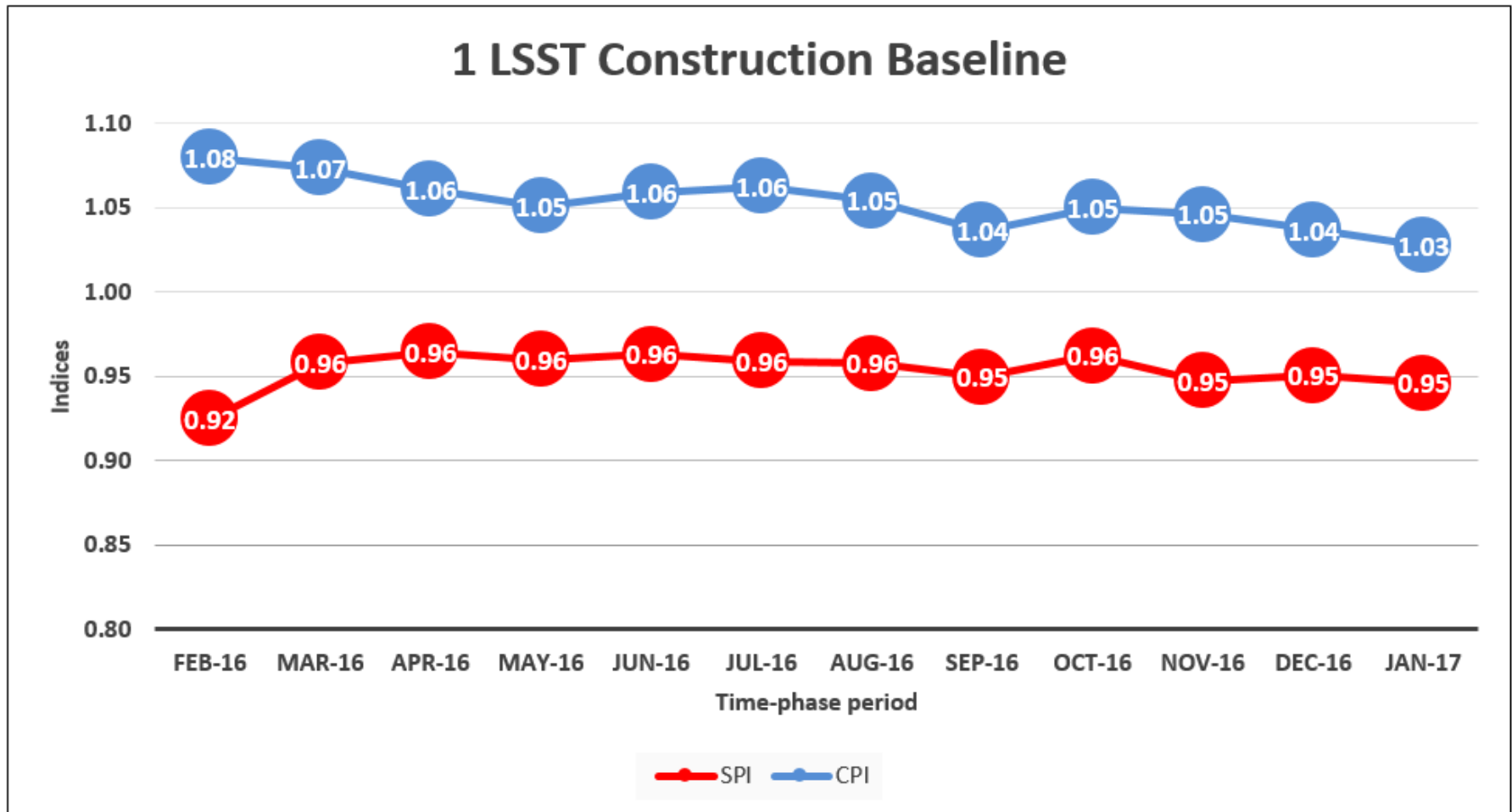




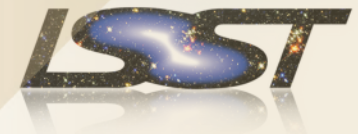
- Subsystems at various states of completion for total of 36%
- Average Value earned per month: \$7.5 M

		CUMULATIVE TO DATE (\$k) 31 Jan 2017										
		BUDGETED COST		ACTUAL	VARIANCE		PERFORMANCE		AT COMPLETION			
WBS	DESCRIPTION	WORK SCHEDULED	WORK PERFORMED	COST OF WORK PERFORMED	SCHEDULE	COST	SPI	CPI	BAC	EAC	% COMP	
1	LSST MREFC Construction	\$ 153,190	\$ 144,949	\$ 141,025	\$(8,241)	\$ 3,924	0.95	1.03	\$ 398,638	\$ 394,714	36%	
1.01C	Project Management Office Construction	\$ 15,931	\$ 15,932	\$ 15,338	\$ 1	\$ 594	1.00	1.04	\$ 44,904	\$ 44,309	35%	
1.02C	Data Management Construction	\$ 31,447	\$ 29,725	\$ 29,856	\$(1,722)	\$ (132)	0.95	1.00	\$ 132,247	\$ 132,379	22%	
1.04C	Telescope and Site Construction	\$ 100,572	\$ 94,187	\$ 91,473	\$(6,385)	\$ 2,714	0.94	1.03	\$ 181,979	\$ 179,265	52%	
1.05C	Education and Public Outreach Construction	\$ 732	\$ 680	\$ 418	\$ (52)	\$ 262	0.93	1.63	\$ 10,592	\$ 10,330	6%	
1.06C	Systems Engineering and Commissioning	\$ 4,509	\$ 4,425	\$ 3,940	\$ (84)	\$ 485	0.98	1.12	\$ 28,917	\$ 28,432	15%	

- Less than .95 is YELLOW : Heightened Agency Review



# January month-end Camera EV Summary (\$K)



SLAC

TPC - Large Synoptic Survey Telescope Camera Project Jan 2017 - Cost/Schedule Status Report

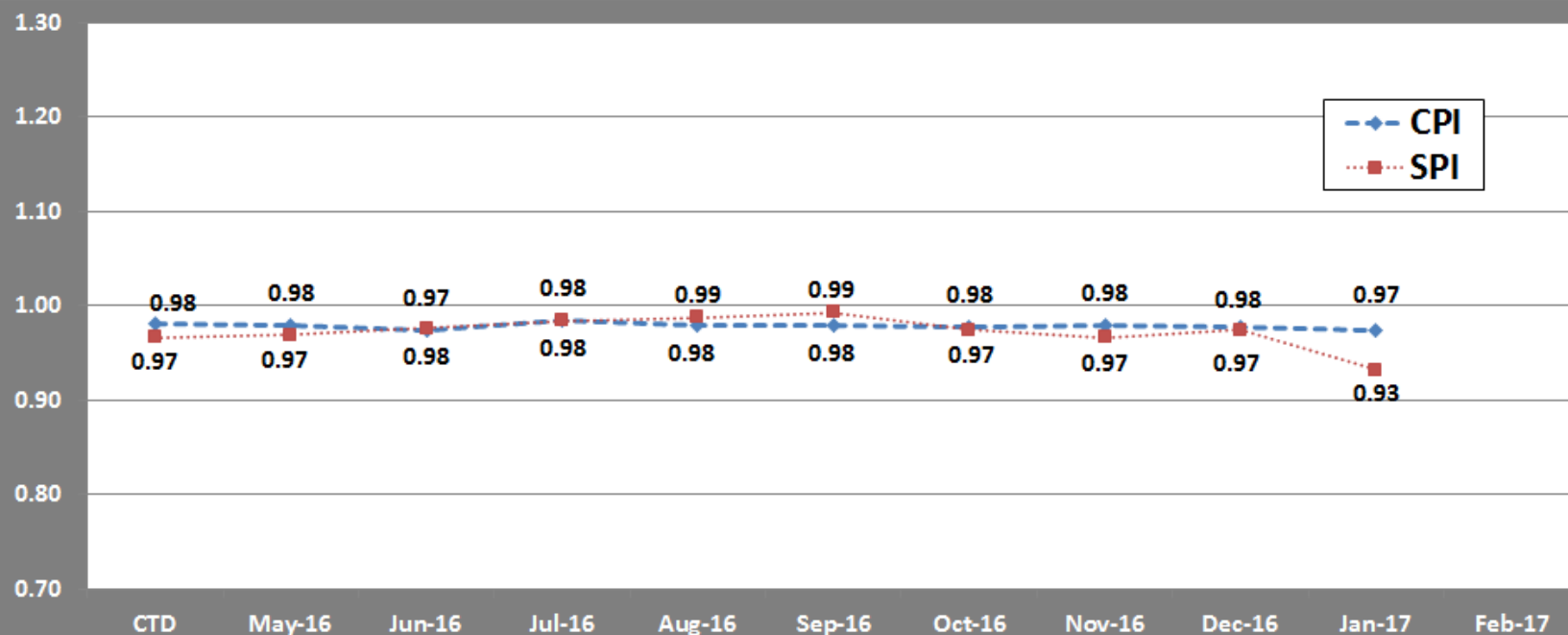
Performance Data (\$K)

WBS (L2,L3)	Cumulative to Date					At Completion		
	Budgeted Cost		Actual Cost Work Performed	Variance		Budgeted	Estimate	Variance
	Work Scheduled	Work Performed		Schedule	Cost			
3.01 Management	8,269	8,269	8,638	0 ↔	-369 ↔	13,689	14,166 ↔	-478
3.02 Systems Integration	5,781	5,765	5,723	-17 ↔	42 ↔	8,905	9,178 ↔	-273
3.03 Science Sensors	18,758	15,971	16,074	-2,786 ↓	-103 ↑	32,436	30,332 ↔	2,104
3.04.01 Science Raft Systems	10,911	10,681	11,683	-230 ↓	-1,002 ↔	16,053	16,459 ↓	-406
3.04.02 Corner Raft Systems	5,407	5,274	5,146	-133 ↔	128 ↔	7,064	6,946 ↑	118
3.05 Optics	17,913	16,522	16,577	-1,391 ↓	-55 ↓	27,511	27,895 ↔	-384
3.06.01/02 Camera Body, Shutter	2,679	2,301	2,484	-378 ↓	-182 ↓	5,115	5,640 ↓	-525
3.06.04 Cryostat	10,134	9,955	10,052	-179 ↑	-97 ↓	13,557	13,366 ↓	190
3.06.05 Utility Trunk	255	228	239	-27 ↔	-11 ↔	781	774 ↓	7
3.07.01 Control System	2,938	2,770	2,992	-168 ↔	-222 ↔	4,819	5,410 ↑	-591
3.07.02 Data Acq Sys	2,941	2,867	3,223	-74 ↔	-356 ↓	5,210	5,537 ↓	-327
3.07.03 Aux Elec	829	823	627	-6 ↑	196 ↑	1,625	1,626 ↑	-1
3.08 Integration and Test	3,735	2,929	3,087	-806 ↓	-158 ↓	11,715	11,875 ↓	-160
Sub Total	90,551	84,355	86,545	-6,195	-2,190	148,481	149,205	-725
Contingency (TPC)						19,519	18,795	725
Total	90,551	84,355	86,545	-6,195	-2,190	168,000	168,000	0

\$BCWP	\$ACWP	CV	CPI	SPI	%Cont/WR
84,355	86,545	-2,190	0.97	0.93	BAC - 30% EAC - 30%
\$BCWP	\$BCWS	SV	\$BAC	\$EAC	% Complete
84,355	90,551	-6,195	148,481	149,205	56.8%

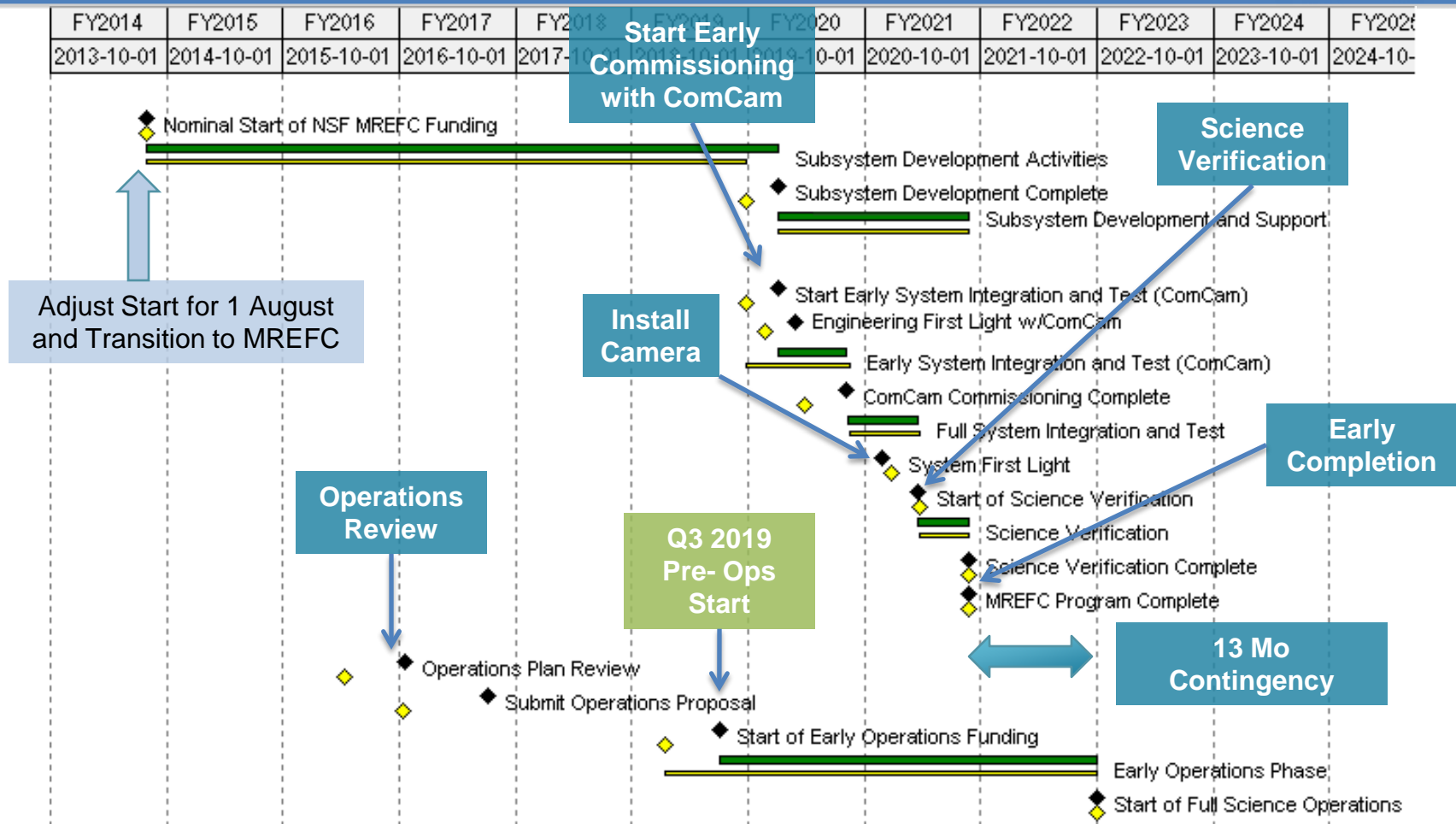


## LSST Camera Performance Chart



Total Project (\$K)	BCWS	\$	66,723	\$	68,595	\$	70,055	\$	71,853	\$	74,120	\$	75,668	\$	79,124	\$	82,543	\$	84,717	\$	90,551	\$	94,052
	BCWP	\$	64,474	\$	66,490	\$	68,415	\$	70,696	\$	73,192	\$	75,119	\$	77,120	\$	79,767	\$	82,538	\$	84,355		
	ACWP	\$	65,711	\$	67,926	\$	70,261	\$	71,834	\$	74,745	\$	76,714	\$	78,838	\$	81,494	\$	84,431	\$	86,545		
	CV	\$	(1,237)	\$	(1,435)	\$	(1,846)	\$	(1,138)	\$	(1,553)	\$	(1,596)	\$	(1,718)	\$	(1,727)	\$	(1,894)	\$	(2,190)		
	SV	\$	(2,248)	\$	(2,104)	\$	(1,640)	\$	(1,157)	\$	(928)	\$	(549)	\$	(2,004)	\$	(2,776)	\$	(2,179)	\$	(6,195)		
	CPI		0.98		0.98		0.97		0.98		0.98		0.98		0.98		0.98		0.98		0.97		
	SPI		0.97		0.97		0.98		0.98		0.99		0.99		0.97		0.97		0.97		0.93		

# Integrated Master Schedule (IMS) : Construction to Operations holding firm



- Complete MREFC / MIE Program from Construction to Operations – including 84 milestones we status with Camera System monthly
- **Detailed plans for NSF and DOE effort for Commissioning in single LSST Project Control Systems**

# Project Critical Path : Still 13 mo. Project Contingency



FY 2014				FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4



◆ Release v9.1 ◆ Final Release

2 months float on T&S and Early I&T

Pre-Commissioning Preparations

+2

Com Cam on Summit

Early Integration & Testing

MIE Transition to Ops

◆ CD-4

Full Integration & Verification

Operational Readiness Review

+13

Schedule Contingency

Pre-

Full Operations

- NSF MREFC
- DOE MIE
- Commissioning
- Operations

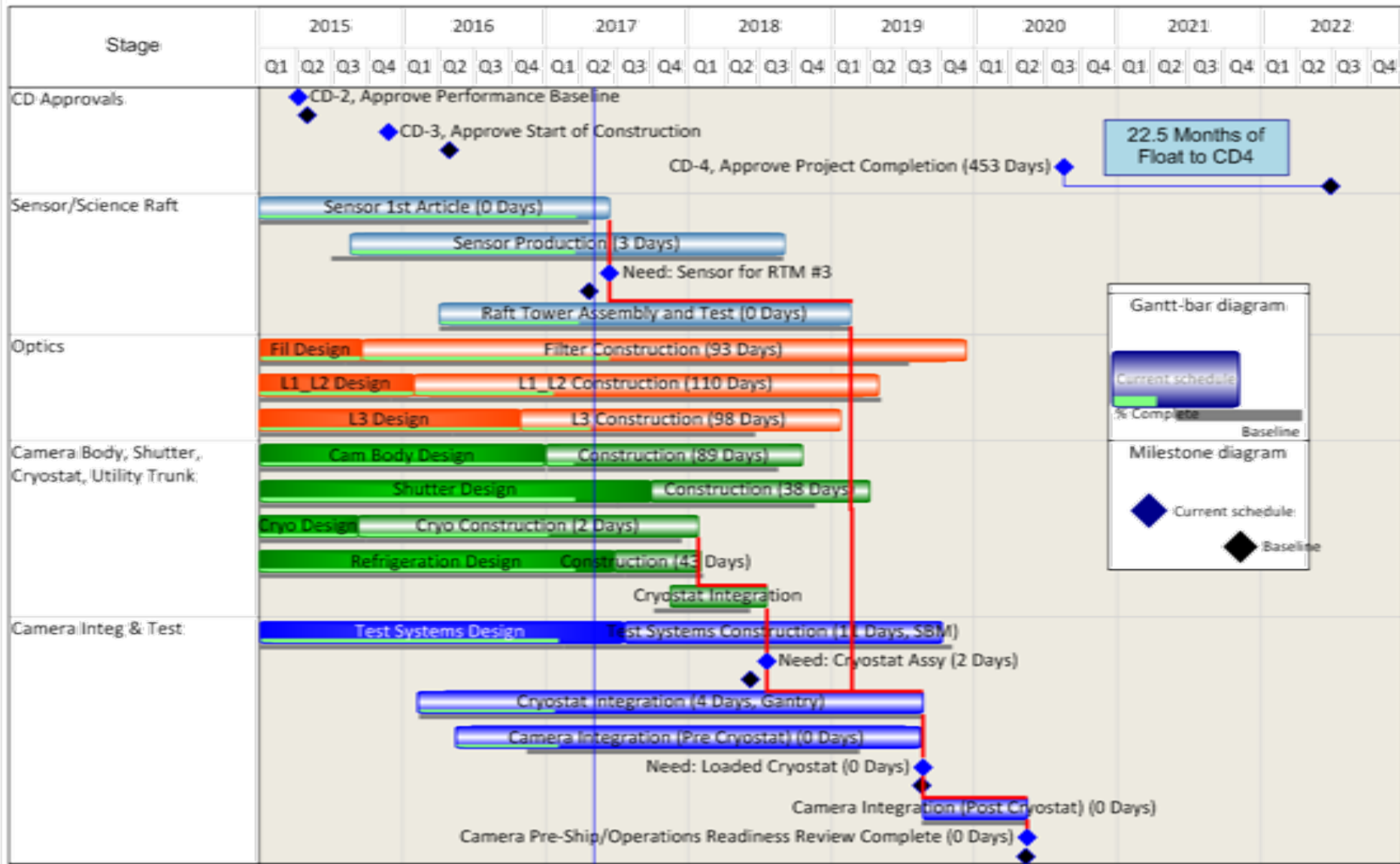
Construction Start

Now

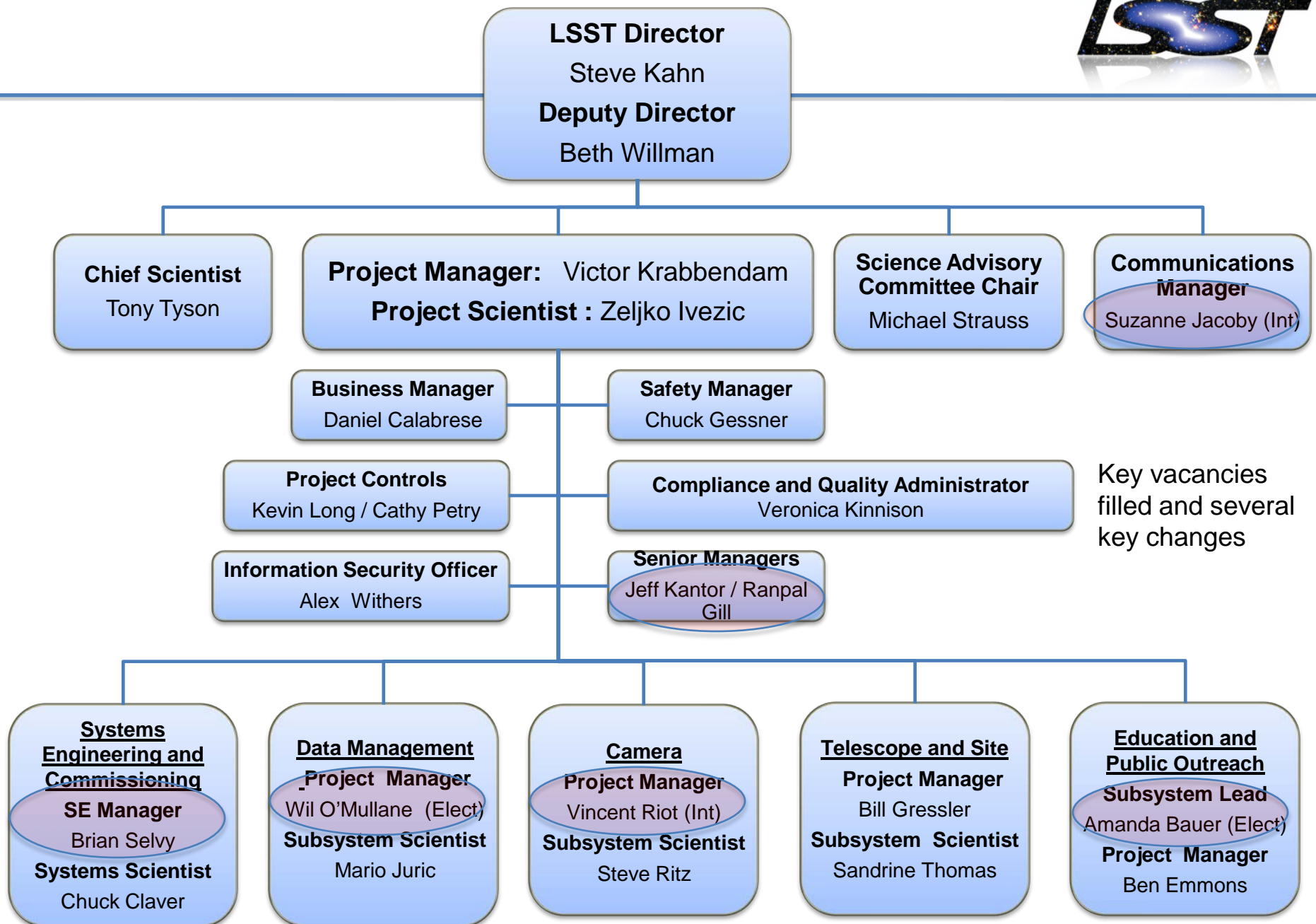
Full System Integration "Start"

Science Operations Start

# LSST Camera Summary Schedule / Critical Path



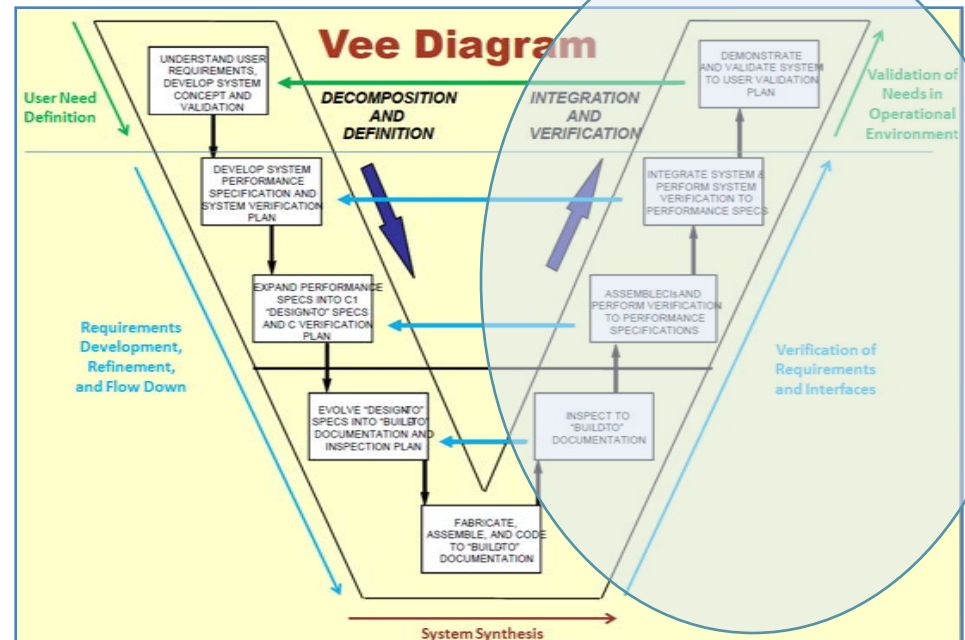




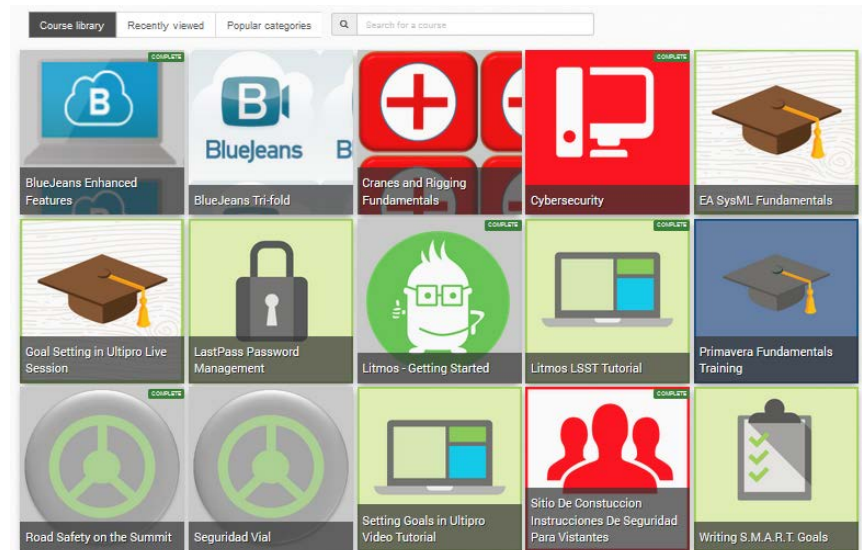
# Verification and Validation Process is SE Focus: separate but fully integrated with Commissioning



- LSE-160 *Verification and Validation Process* is the governing document for V&V on LSST
  - Establishes a consistent, project-wide process for the development of V&V plans, compliance assessments, V&V reporting, and deliverables
- Defines steps in the verification process
- Defines requirements for developing verification plans for each project-controlled requirement
- Process starts with subsystems...
- ...Concludes with Commissioning.



- Continuing Hazard Analysis Process with Contractors and Teams
- Developing detailed documentation:
  - Job Hazards
  - Detailed procedures (confined space, lockout/tag-out etc)
  - Learning Materials
- Safety Coordination
  - 2 staff on the ground in Chile
  - LSST / SLAC planning
  - Safety Council



**ALL OF THESE TASKS REQUIRE SPECIAL TRAINING**  
If you don't have the training then don't do it

- Do not stand close to or enter excavations (holes or trenches in the earth).
- Do not enter confined spaces (areas with limited, hazardous access, dark places).
- Stay clear of people working with chemicals or solvents (emanating fumes or otherwise noted as hazardous).
- Do not operate any construction machinery.
- Do not use tools that you have not been trained to use.
- Do not go to heights above 1.2 m (4ft) without guards or railings.
- Do not climb up on scaffolding unless explicitly permitted to do so by the Site Manager.

**WHEN AROUND ACTIVE EQUIPMENT**

- Keep a safe distance, at least 3m (10ft), from moving equipment and/or people working.
- Do not stand directly behind equipment. If you cannot see the operator, he/she cannot see you.
- Make eye contact and wait for a visible sign that the operator sees you before approaching or passing equipment.

**LSST SUMMIT SITE VISIT CHECKLIST**

- Do you need to be in the construction site or is there a safer vantage point?
- Did you discuss the details and purpose of your visit with LSST Site Manager?
- Did you request permission to access the site?
- Did you request a person to guide you around the site?
- Did you request explicit permission to enter the areas you plan to visit?
- Did you request personal protective equipment, if you do not have your own?
- Did you request information about ongoing construction activities and hazards?
- Do you have your authorized pass if travelling in a personal or rented vehicle?
- Did you request meals and lodging on the summit, if desired and if authorized by the Site Administrator (SiteAdmin@lsst.org).

For more information, go to: <https://project.lsst.org/Safety/chile>





**Summit Construction Site**

Visitor Safety Instructions

Welcome to the Summit Construction Site of the Large Synoptic Survey Telescope



# Safety Record Remains Good



## LSST INCIDENT/ACCIDENT CHART

31-Jan-17

	LSST	CONTRACTORS	SUMMIT SITE	OTHERS	COMMENTS
<b>INCIDENTS</b>					
PEOPLE			1		driving violation
EQUIPMENT			2		vehicle mishaps
PROCESS	1				found blasting cap
<b>ACCIDENTS</b>					
PEOPLE	3		5	1	(drone, 2 office)( minor injuries) (bus driver)
EQUIPMENT		4	4		M1M3, Grid, L1, L2 (vehicles- horse)
PROCESS					
<b>SUBTOTAL EVENTS</b>	<b>4</b>	<b>4</b>	<b>12</b>	<b>1</b>	

<b>TOTAL EVENTS</b>	<b>21</b>
---------------------	-----------

Safety is the control of accidental loss.

An accident is an undesired event that results in harm to people, damage to property or loss to process.

Accidents result from contact with a substance or source of energy above the threshold limit of the body or structure.

An incident is an undesired event which, under slightly different circumstances could cause an accident.

LSST - Directly involves AURA and SLAC personnel and equipment.





## Looking Ahead



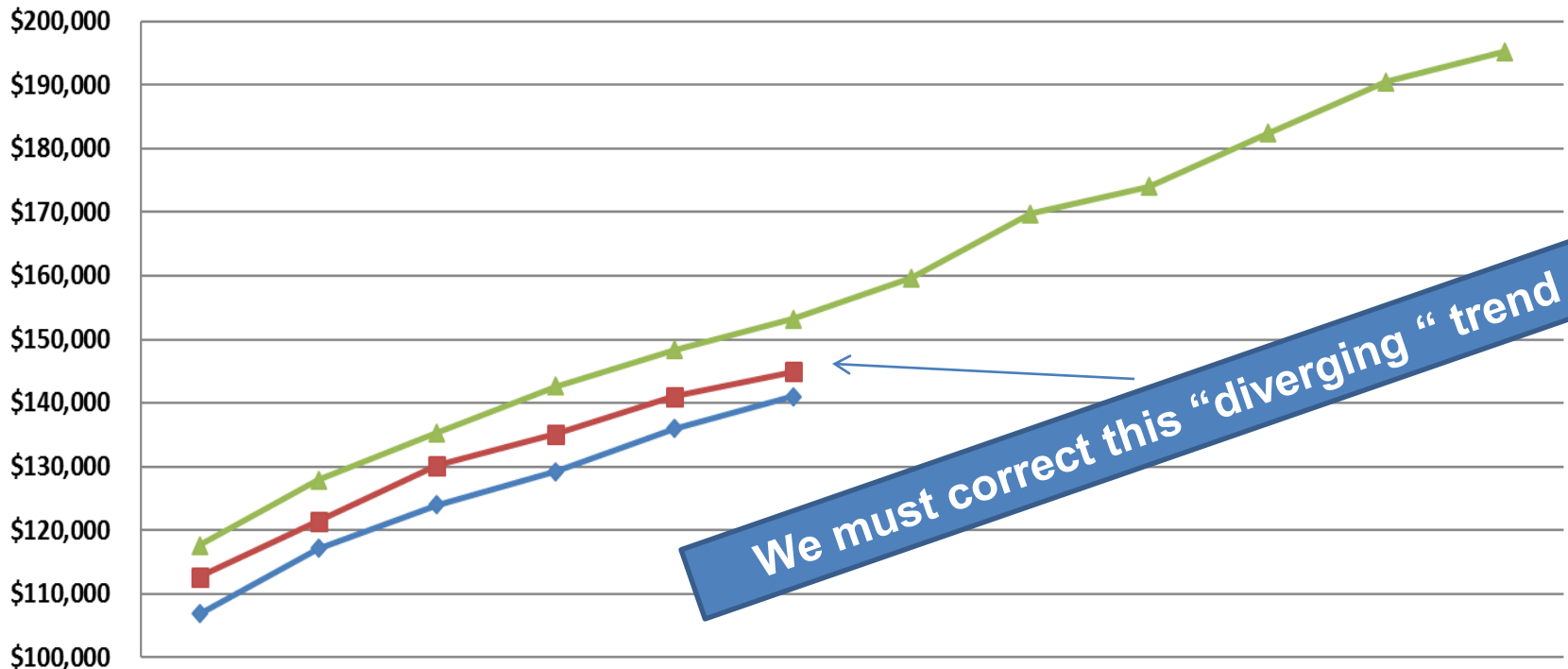


- DM Review : 25-27 July 2017 at NCSA
- LSST 2017 : 14-18 August 2017 in Tucson
- LSST Joint Status Review 2017 : 6-8 September in Tucson
- LSST Safety Review : September 2017 on Site
- EPO Design Review : September/October 2017
- Commissioning Reviews : Internal and CD-2 like next year
- and.....

# Schedule Performance (MREFC Example)



LSST Monthly Earned Value Cumulative (all Values in \$K)



	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17
◆ ACWP	\$106,877	\$117,121	\$124,005	\$129,185	\$136,002	\$141,025						
■ BCWP	\$112,687	\$121,432	\$130,209	\$135,142	\$141,042	\$144,949						
▲ BCWS	\$117,646	\$127,850	\$135,271	\$142,662	\$148,335	\$153,190	\$159,699	\$169,710	\$174,054	\$182,391	\$190,513	\$195,200



## 1. Define a “minimum viable system”

- This is not the same as satisfying minimum requirements; this is preventing “catastrophic” failure (i.e., inability to get an NCR approved)

## 2. Phase requirements accordingly

- In other words, prioritize features. We have never done this as a Project.
- Part of requirements document update work.

## 3. Deploy the minimum viable system (DAC, L1, DRP, L3)

- First prototype: the Prototype DAC (June 2017)
- Target for MVS: ~mid 2018, then continue with improvements through 2020
- Will allow us to enter “software freeze” where data collection (operations) can start even if the DM system does not meet all requirements

**PDAC in June 2017  
DM Review in July 2017  
Minimum Viable System in ~ 16 months**

## 4. Sequence development so the system being built can support commissioning

- Linking our milestones to commissioning task force milestones
- Enables verification and commissioning of services and supports commissioning

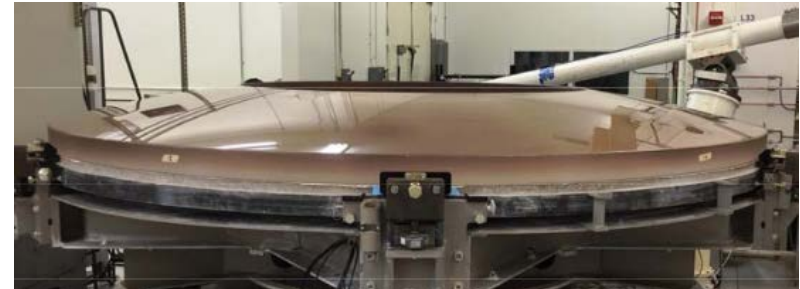


Two Major Contractors on Site  
Still Critical Path – 1 full building season

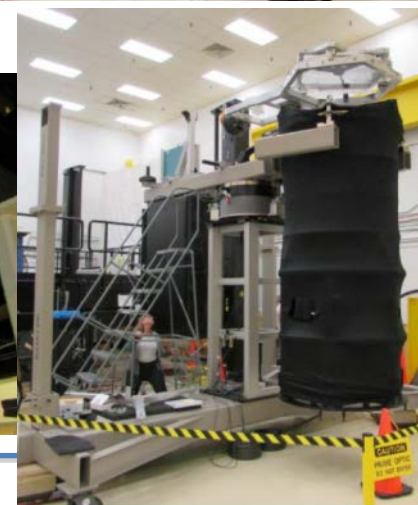
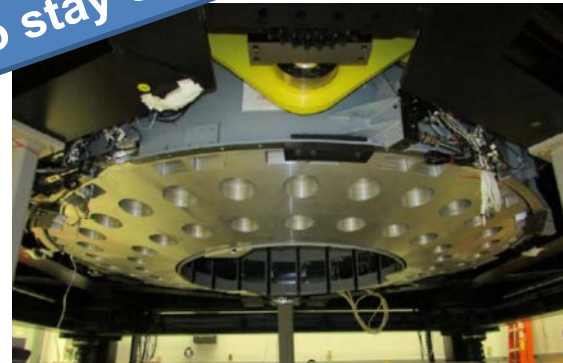
# M2 Cell Assembly



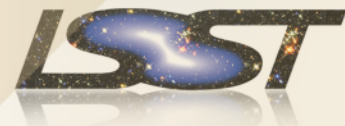
- System Description:
  - 3.4-meter diameter mirror
  - 72 axial actuators & 6 tangent links
  - Integrated optical testing
  - Includes M2 cart and lifting fixture
- Recent Accomplishments:
  - Initial ion run complete – ULE artifacts required additional full tool smoothing
  - All actuators assembled/tested and integrated to surrogate mirror
  - M2 cart completed and functional
  - Test set calibrated and being prepared for initial optical testing
- 6 Month Major Milestones
  - Mirror pad bonding commencing
  - Mirror pad pull testing March
  - Surrogate mirror cell assembly testing with M2 controller Jan-April
  - M2 first light optical test June



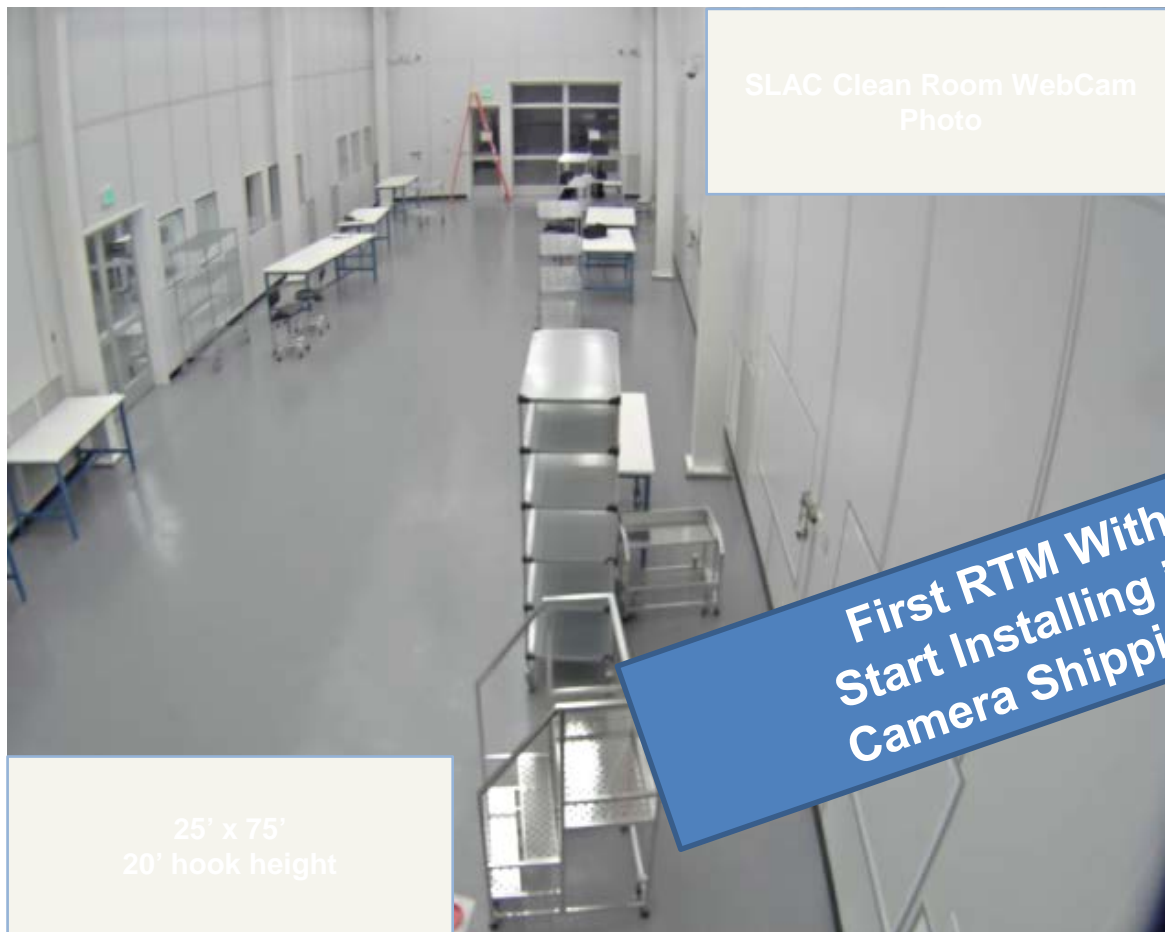
Analysis of Surface features and Inspection  
Plan to stay on Schedule



# Camera Integration and Test

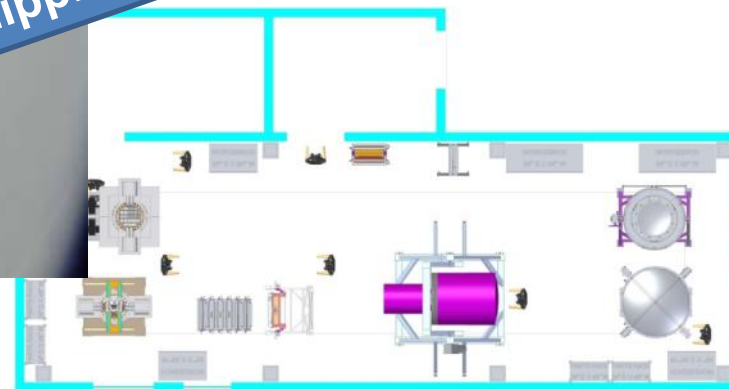


SLAC



25' x 75'  
20' hook height

First RTM Within a Month  
Start Installing in 15 months  
Camera Shipping in <3 years

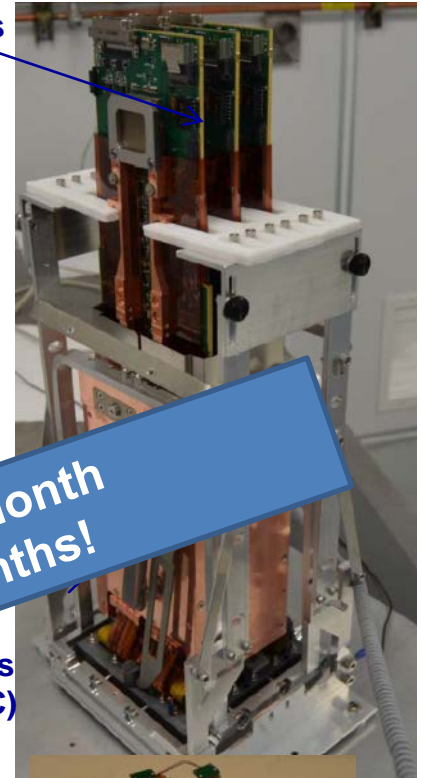




- System Description:
  - Twenty-one 144 megapixel cameras.
- Recent Accomplishments:
  - Manufacturing Readiness review completed
  - Raft Sensor Assembly Baseplate awarded and first lot received
  - Electronics (REB5) design completed
  - Completion of the Engineering Test Unit
- 6 Month Major Milestones
  - Construct & commission Test Unit
  - Conduct Test Readiness Review
  - Mar 2017: 1st Production Raft Tower Complete
  - Sep 2018: 21st Production Raft Tower Complete

Raft Electronics Board (REB)

Science Raft Tower



Electronics Cage (REC)

**First RTM Within a Month  
21<sup>st</sup> RTM in 18 Months!**

Science Sensor



Raft Sensor Assembly





- Team is working hard and making great progress
  - Look at the Day-in-the-life slide show
- ....but lots of work to keep to the plan:
  - Increased schedule pressures for Camera and T&S – lots of attention on holding 13 months schedule contingency
  - DM will need additional budget but detailed evaluation is still forthcoming

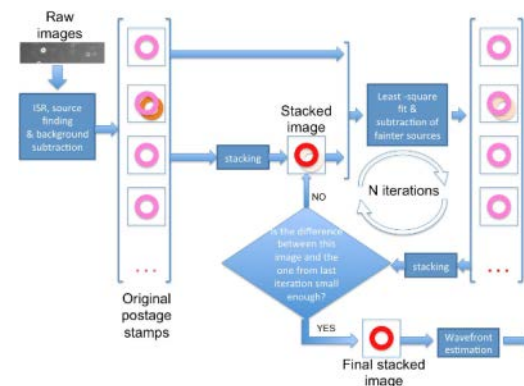
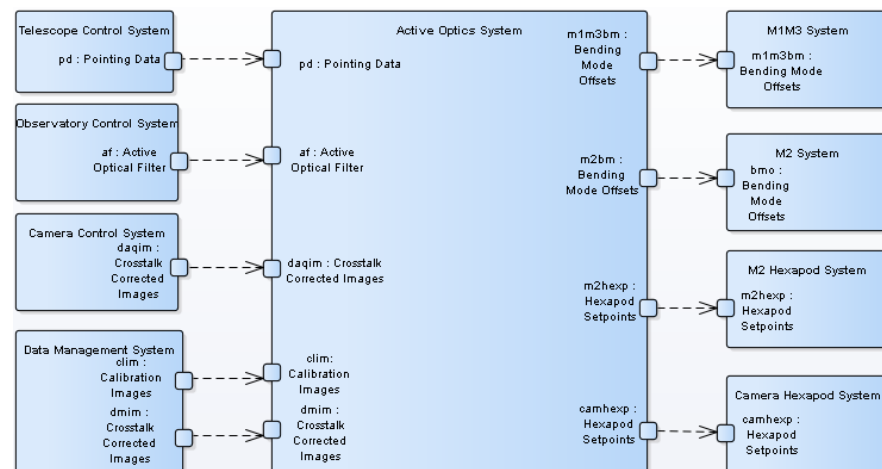
**Everything has Started (and looks great) but Nothing is Done!**



# ADDITIONAL STATUS SLIDES

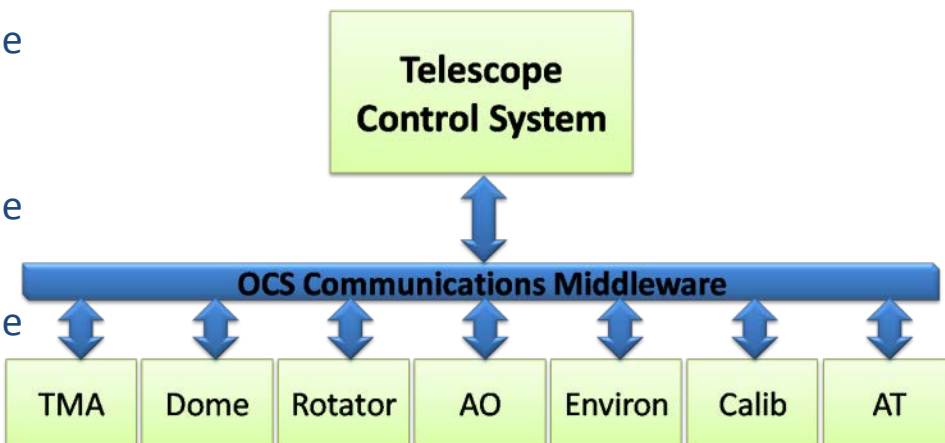


- System Description:
  - Wavefront analysis system
  - Wavefront Estimation Pipeline (WEP) driver
  - Shack-Hartman wavefront analysis system
  - Active Optics Control System (AOCS)
- Recent Accomplishments:
  - WEP model phase 1 complete
- 6 Month Major Milestones
  - AOS software review Apr 2017



- System Description:

- Control and Monitoring software for the Dome, the Telescope and the environmental equipment
- Control and Monitoring software for the Auxiliary Telescope (AT)
- Control and Monitoring software for the in- dome Calibration equipment

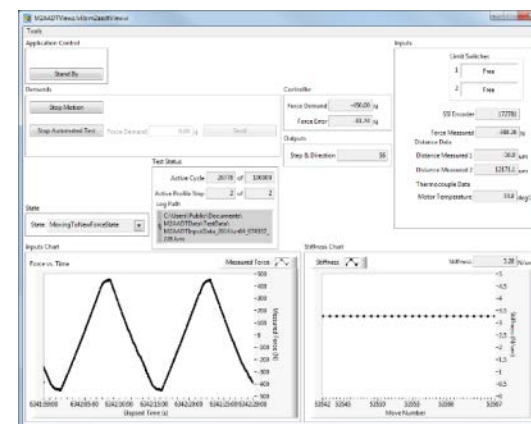


- Recent Accomplishments:

- Acquired pointing kernel and analysis software
- Force Actuator Model Tester (FAMT) software completed

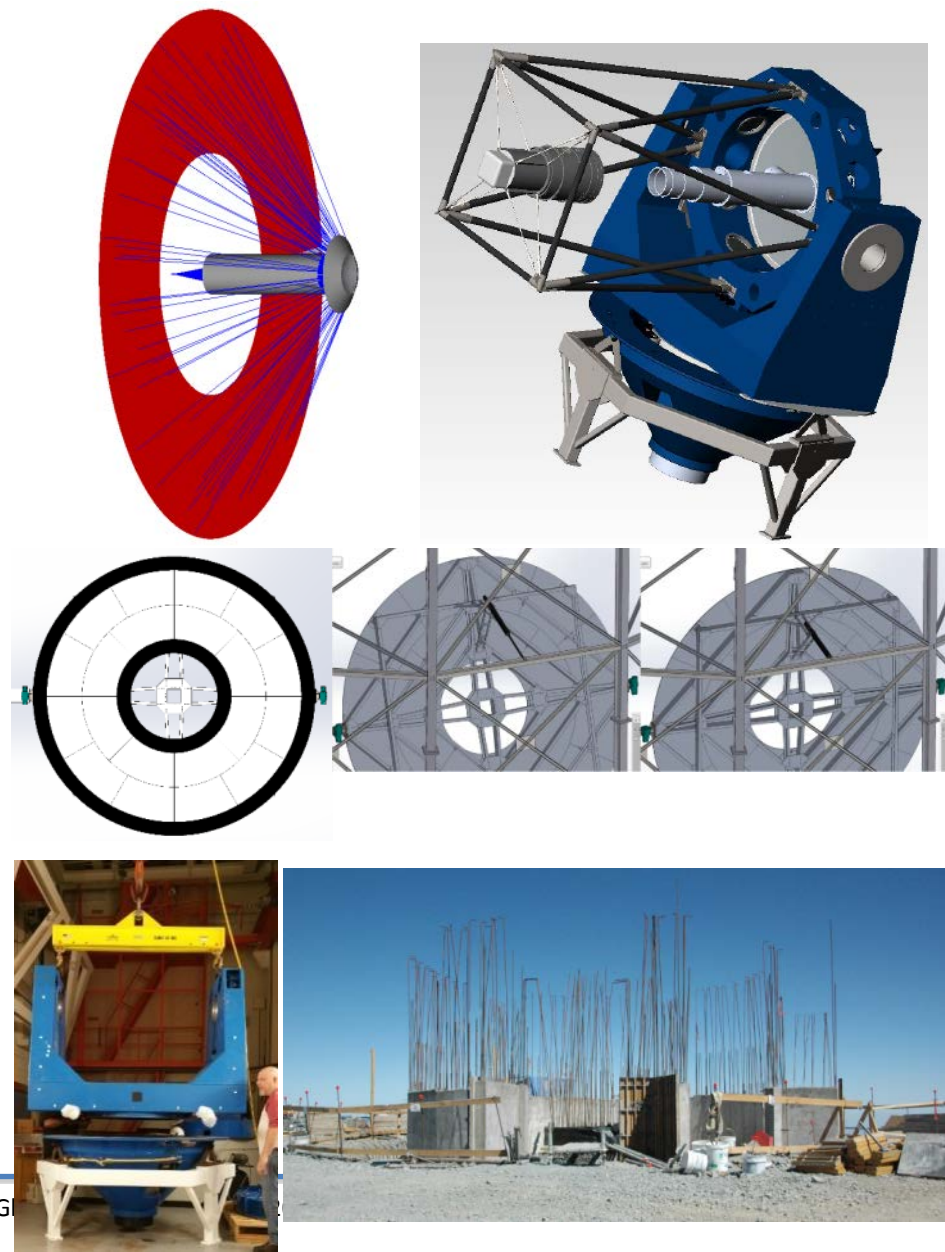
- 6 Month Major Milestones

- Rotator acceptance test Apr 2017
- AT mount test Apr 2017
- M1M3 test at contractor facility Jul 2017





- System Description:
  - In-Dome tunable laser projector and reflective dome screen
  - Collimated Beam Projector (CBP)
  - Auxiliary telescope system
- Recent Accomplishments:
  - Refurbishment of Calypso telescope in Tucson
  - Ash dome fabricated and in storage
  - CBP contract awarded
- 6 Month Major Milestones:
  - Completion of auxiliary telescope pier in Chile
  - Shipment of Ash dome to Chile
  - Advance design/fabrication approach of calibration screen (dome vendor)
  - Award auxiliary telescope spectrograph



# Telescope Mount Assembly (TMA)



- System Description:
  - 300-ton welded steel structure
  - Supports mirror systems and provides utilities to camera
  - Rapid slew and settle accomplished via linear drive motors
- Recent Accomplishments:
  - Capacitor bank system passed final acceptance testing
  - Azimuth track grouted to Spanish pier
  - Major weldment sections complete and in final machining
- 6 Month Major Milestones:
  - Major TMA structure assembled onto hydrostatic pads Mar 2017
  - M1M3 cover and camera cable wrap acceptance testing Apr 2017
  - Commence TMA factory testing June 2017

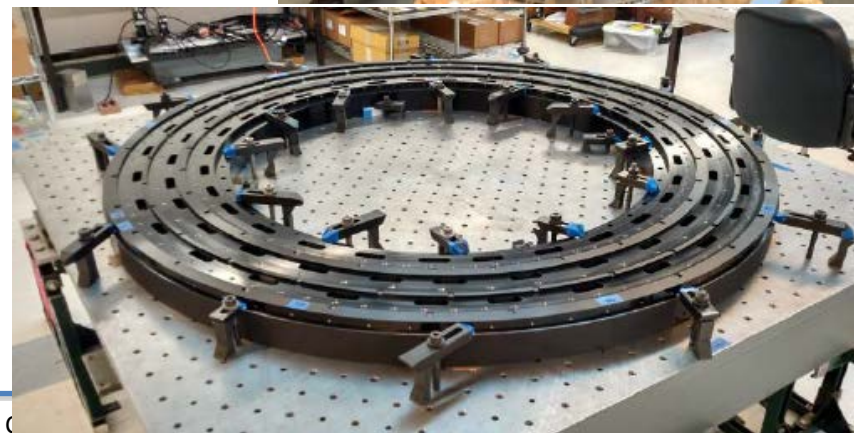
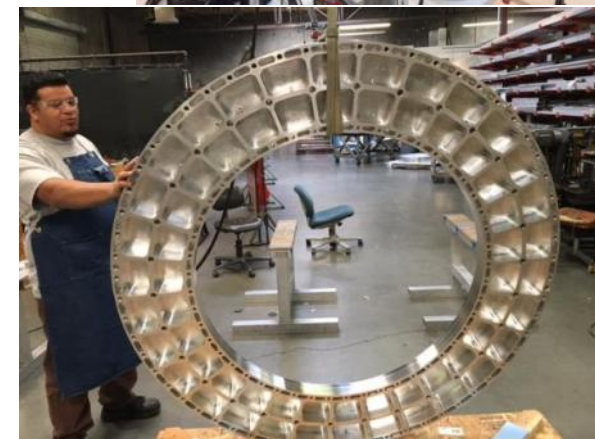




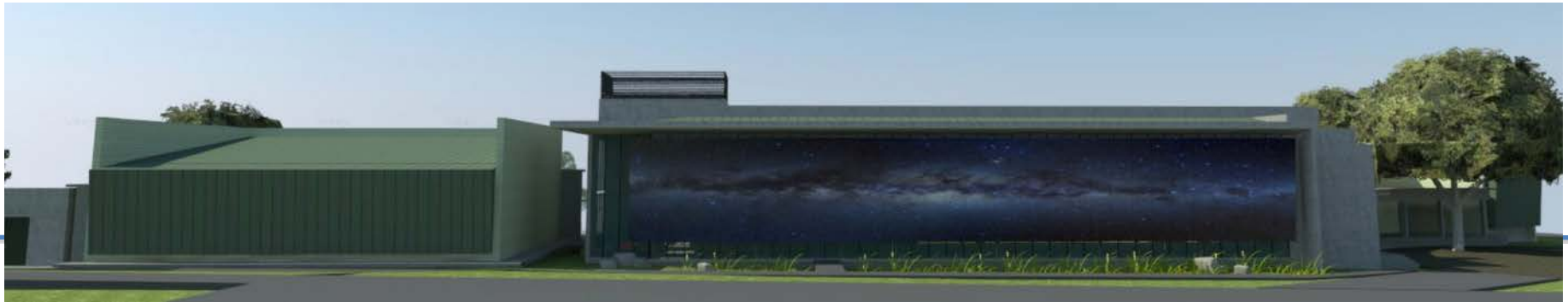
# Hexapod/Rotator System



- System Description:
  - Hexapod system for M2 and camera consisting of 13 identical struts (1 spare)
  - Two camera rotators (1 spare)
  - Curved linear bearings for rotator and strut flexure end joints
- Recent Accomplishments:
  - All actuators assembled; performance testing commenced
  - Rotator plates received and bearing surfaces mounted
  - Test facility components ready
- 6 Month Major Milestones:
  - Fabrication of payload test surrogates
  - Shipment and assembly of hexapod and rotator components to CO for testing
  - Final acceptance testing Mar-July 2017



- System Description:
  - Two-story, 34-office, 15 workstation office building
  - Data center to support full growth
  - Joint effort with AURA/CTIO
- Recent Accomplishments:
  - Phase 1 refurbishment approved
  - Website established to provide open communications, new parking area
  - Q/A with Phase 2 vendor pool
- 6 Month Major Milestones:
  - Demolition/new utilities work
  - Award Phase 2 construction



# SQuaRE Highlights Upcomming SQuaSH update



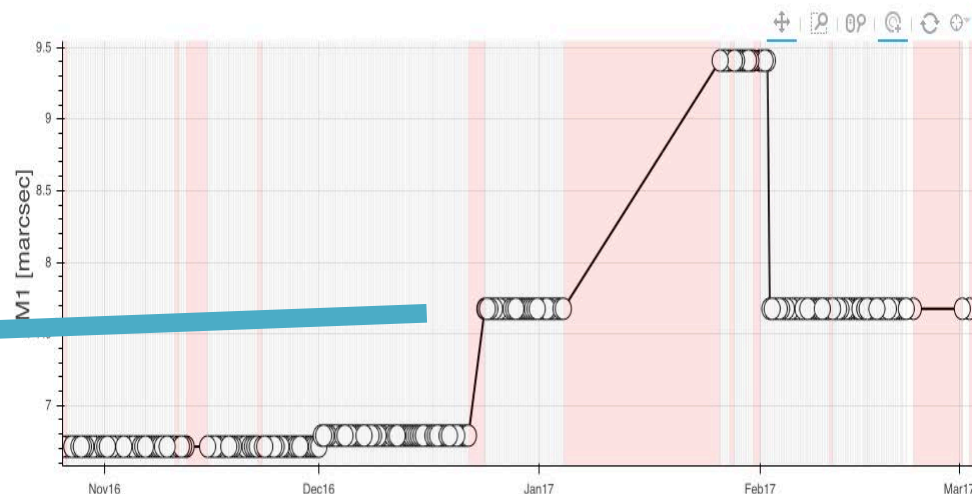
## AM1 measurements for cfht dataset

The maximum rms of the astrometric distance distribution for stellar pairs with separations of  $D=5$  arcmin (repeatability) (milliarcsec).

### Code Changes

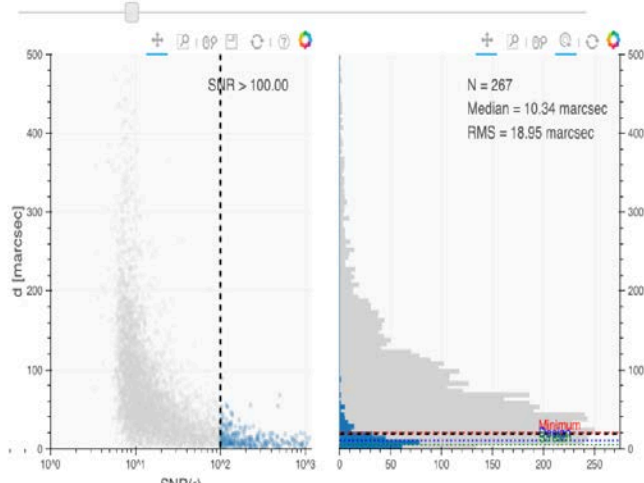
The table lists measurements values for each job and packages that have changed with respect to the previous job package names for more information.

#	Time	Job ID	Value	Packages
277	2017-02-22 05:32:35	830	7.675635...	galsim, daf_persistence, afw
278	2017-03-01 02:34:06	837	7.675635...	base, meas_modelfit, meas_
279	2017-03-02 02:30:52	838	7.675635...	daf_persistence
280	2017-03-03 23:13:20	842	7.675635...	meas_base, meas_modelfit,
281	2017-03-04 01:16:05	843	7.675635...	
282	2017-03-05 03:29:34	844	7.675635...	
283	2017-03-06 01:16:02	845	7.675635...	



### AM1 diagnostic plot for cfht dataset from job ID 841

SNR: 100



- ◆ Drill-downs
- ◆ Alerts
- ◆ Validation framework refactored
- ◆ More data

Last CI job on **March 6, 2017, 1:16 a.m.**

# of metrics being monitored: **9**

# of LSST packages being monitored: **81**

# of CI jobs: **700**

# of measurements: **2174**

Supported datasets: **cfht, decam, hsc**

Also new: Technote version dashboard, micro-service platform, status monitoring, chatbot





- Version 13.0 Release Highlights

- Kron (1980) based photometry
- More robust, better motivated, astrometric fitting
- Measurement without deblending (useful for cluster galaxies)
- (Correct) PSF matched coaddition
- Improved Deblending; reduced “galaxy shredding”
- Python 3 support
- Unified exposure metadata
- Package version tracking (provenance)
- Upgraded logging system

- Images and installation video available at:

[http://www.ncsa.illinois.edu/news/story/a\\_day\\_in\\_the\\_life\\_of\\_large\\_synoptic\\_survey\\_telescope\\_employees\\_at\\_ncsa](http://www.ncsa.illinois.edu/news/story/a_day_in_the_life_of_large_synoptic_survey_telescope_employees_at_ncsa)

