Integration and Test: Data, Metadata and Analysis

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LSST Camera Meeting
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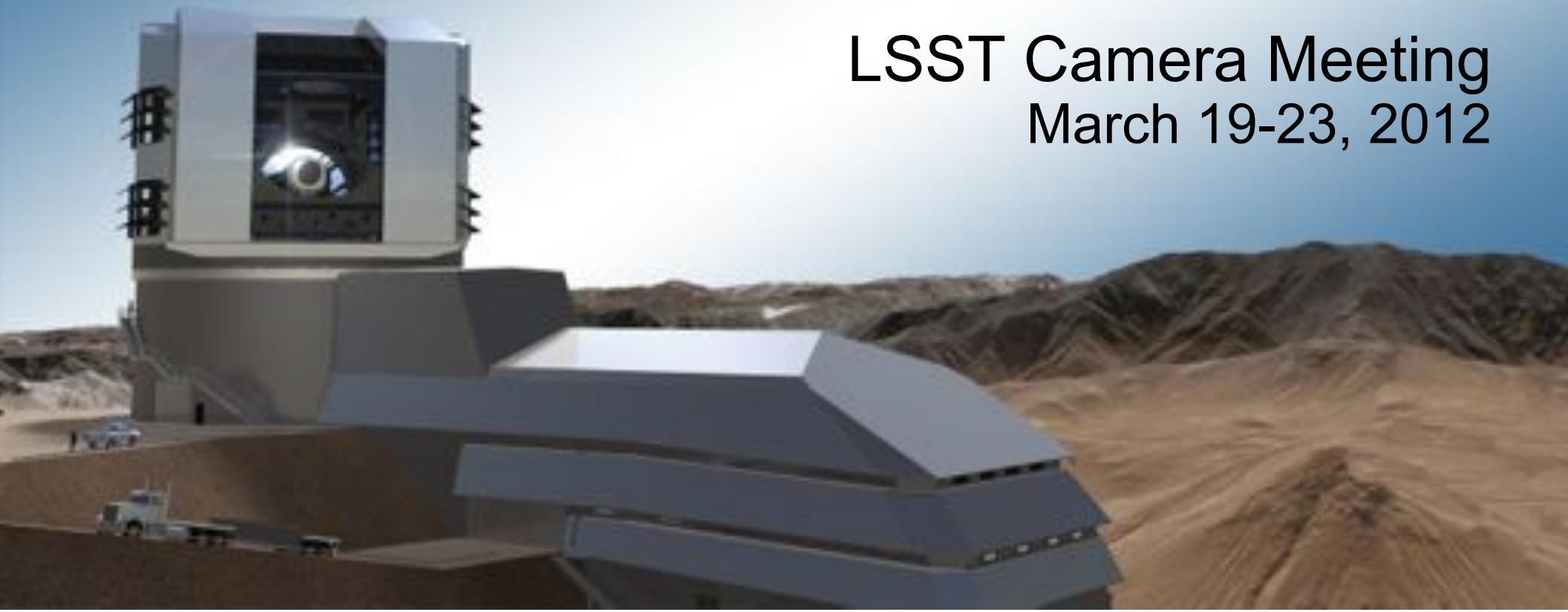
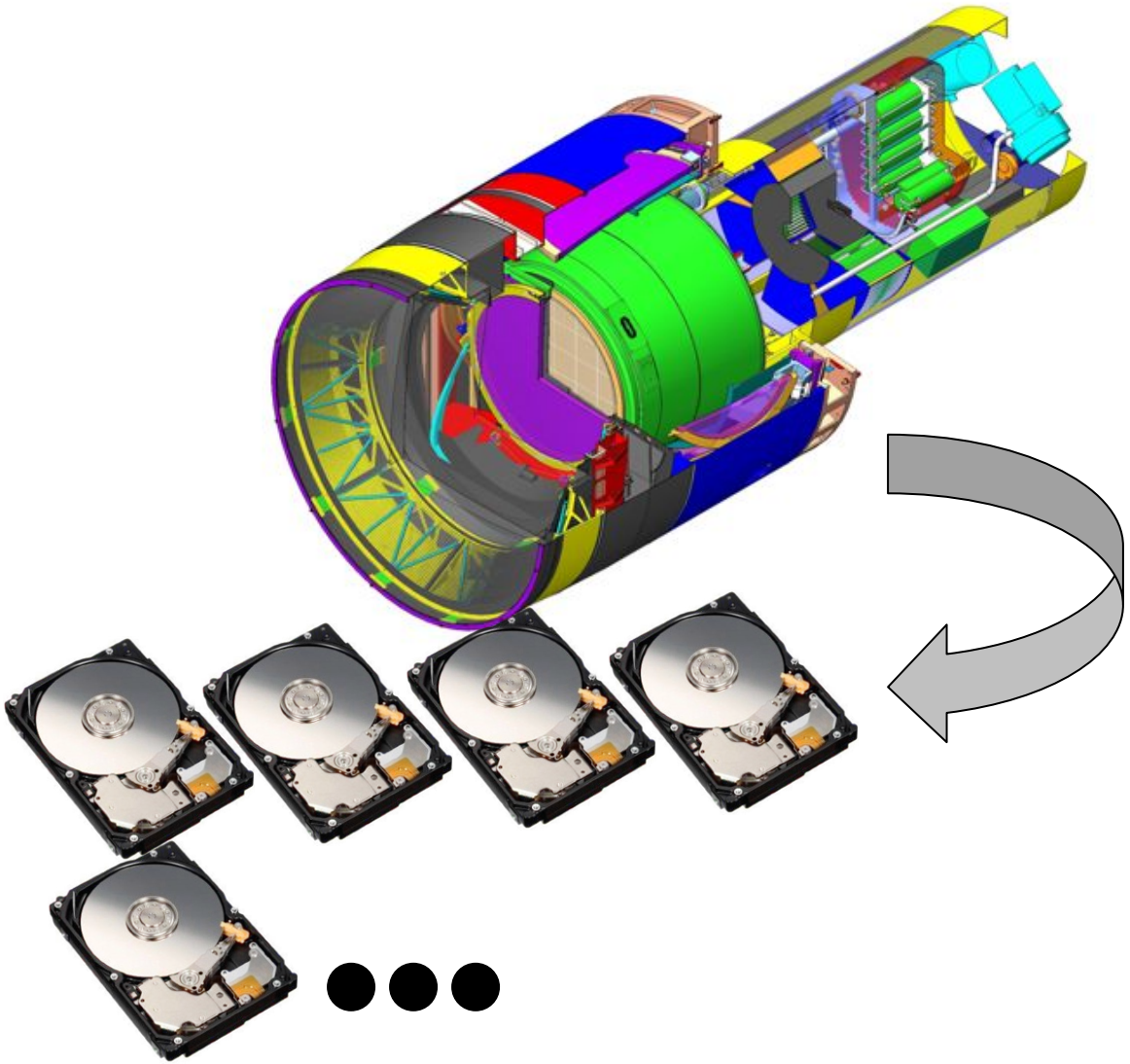


Outline: I&T Data Topics

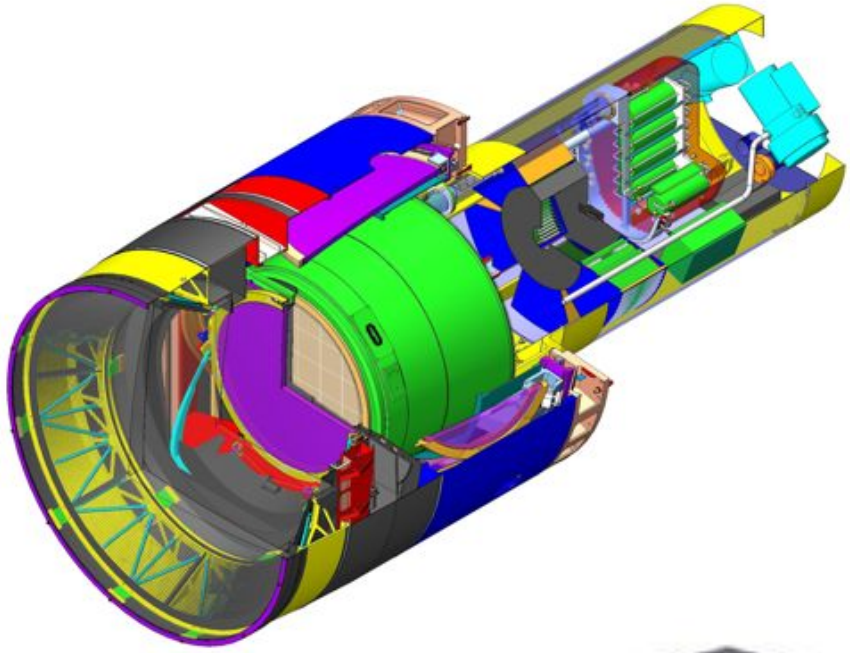
- Tests performed (interfaces)
- Meta-data
- Data Volume
- Data Handling
- Data Products
- Data Storage and Access
- Summary

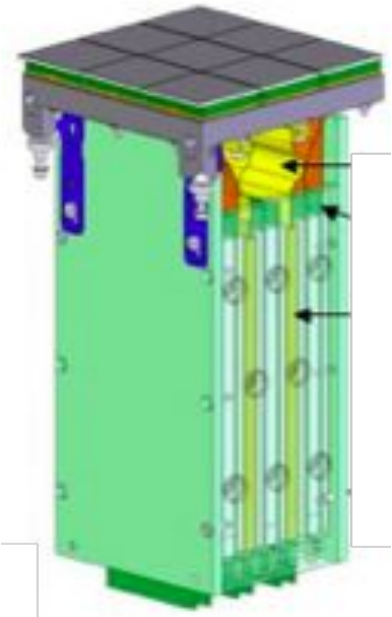


Large Synoptic Survey Telescope

Camera I&T Subsystems

- I&T brings together
  - Cryostat,
  - Camera body
  - Utility trunk
  - Control crate
  - Power supplies
  - CCS, protection modules,
  - DAQ is “the” DAQ
  - Science and corner rafts
  - L1-L2 assembly
  - L3 and L3 flange
  - Refrigeration
  - Filter exchange system



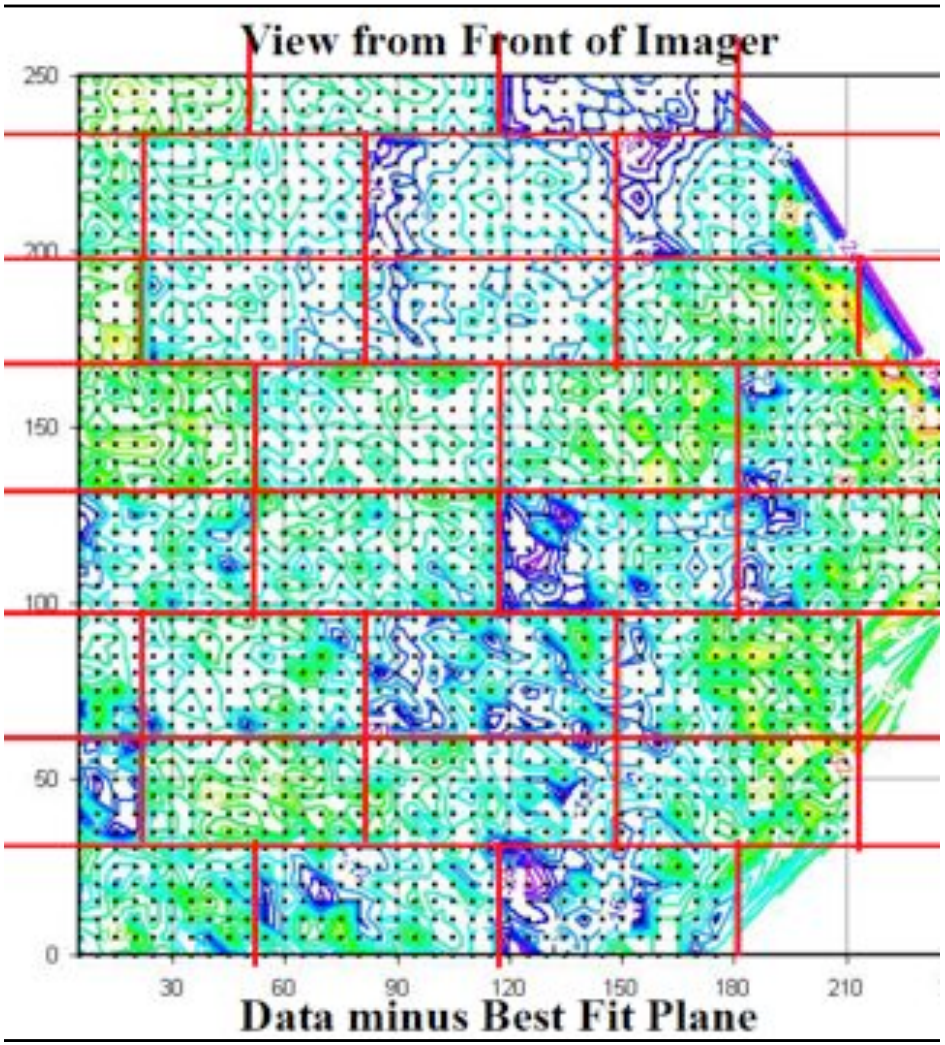


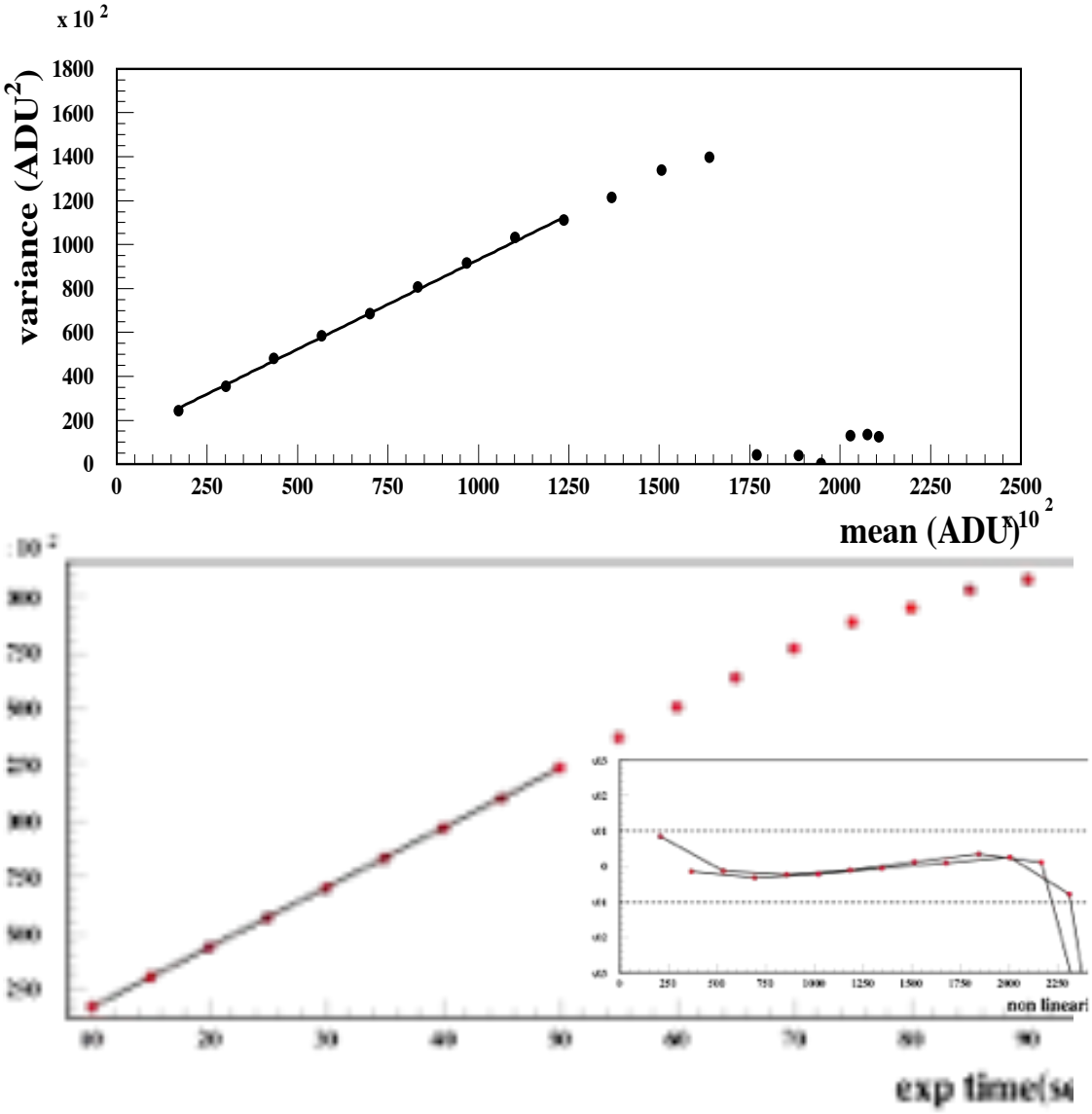
Large Synoptic Survey Telescope

Tests at I&T

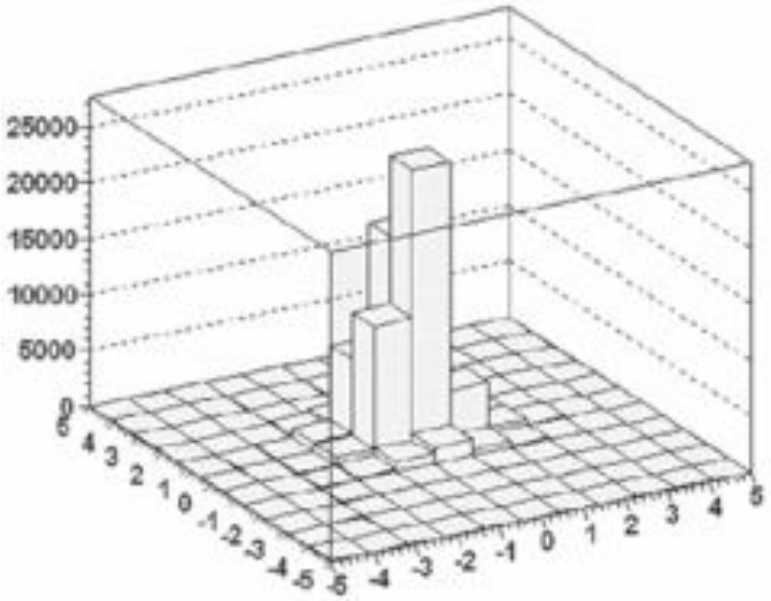
- Thermal-mechanical studies with analogs
- Receiving tests for all rafts
- Integrated camera in several steps
  - 2+ engineering rafts
  - 2 science rafts
  - 9 (+4 corner) science rafts
  - All 21+4 rafts
  - CCOB (L1+L2, L3, shutter, filter changer)
    - Image quality, alignment, throughput

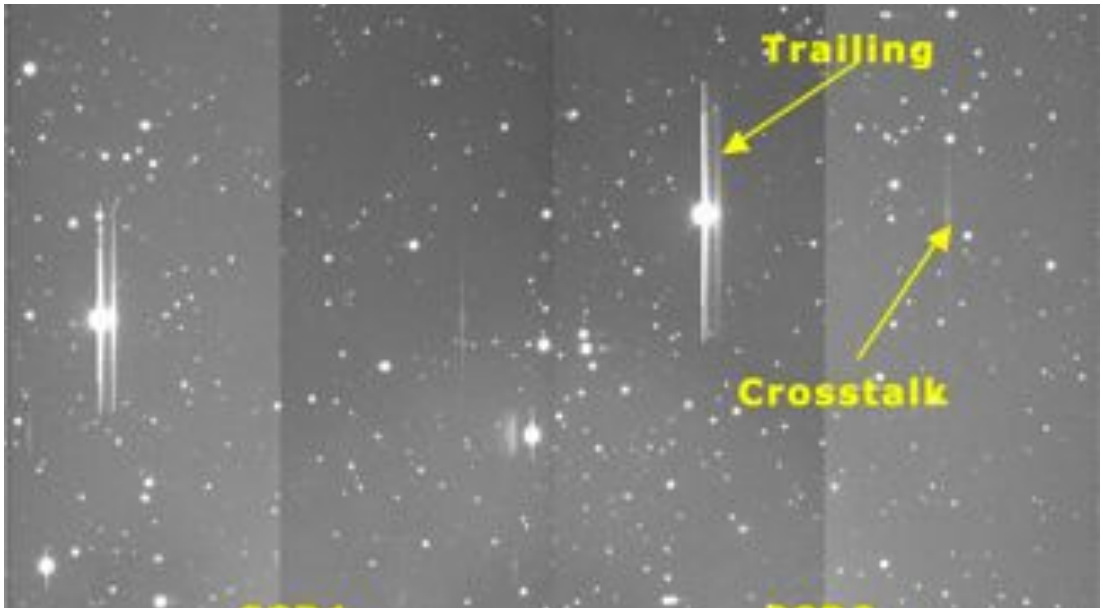
Battery of Tests

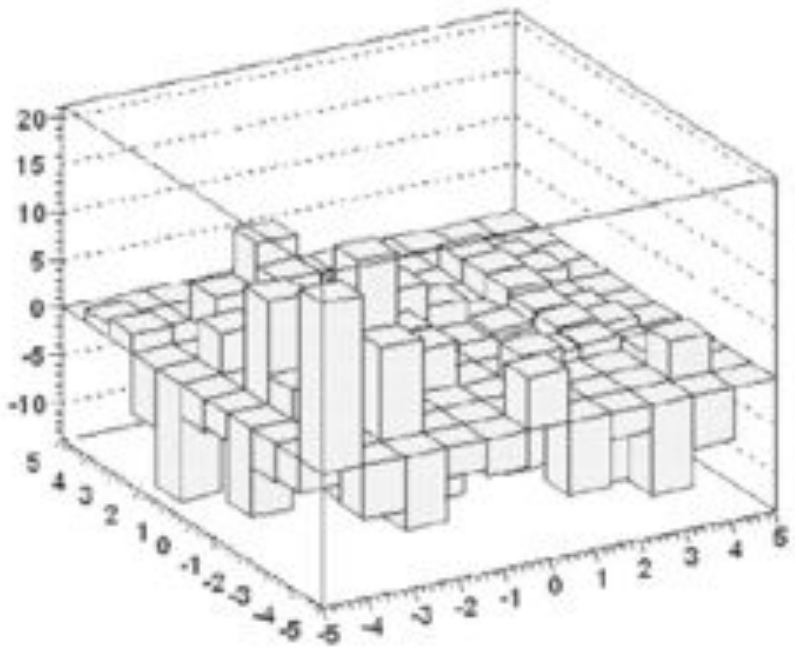


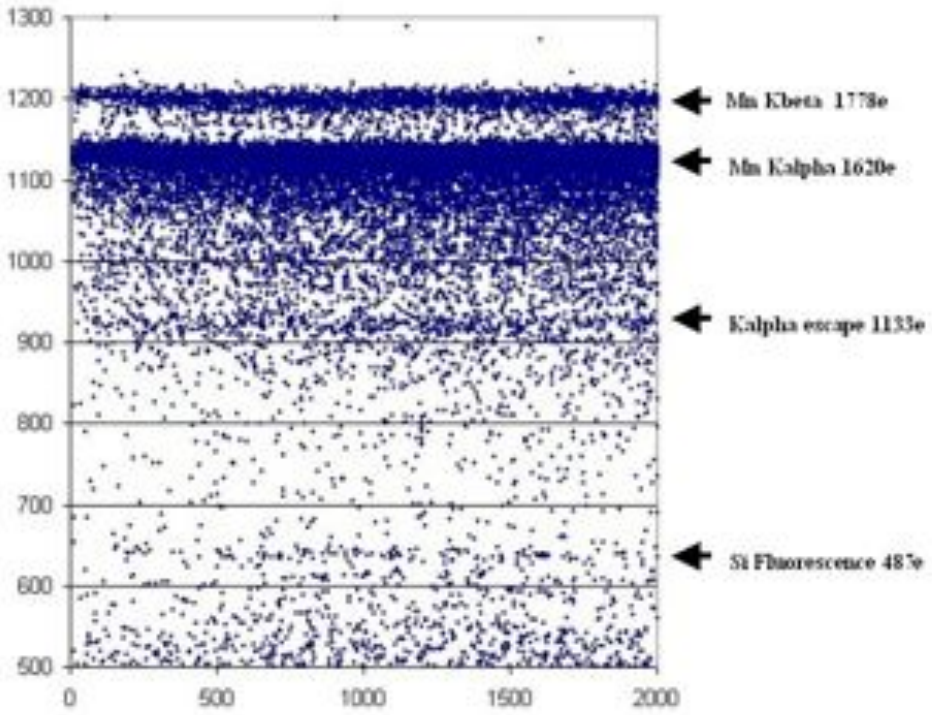


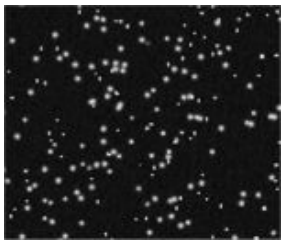
Battery of Tests











Exposure Counts

Note: In an 8 hour shift, taking 15 second exposures ~2000 exposures

Minimally: 1-4,000 exposures per “step”

	Min exposures	Max Exposures	Repeat	Min Total	Max total	Notes
Photon Transfer	20	40	2	40	80	10 exp * 2 sample
Variance	20	40	2	40	80	FullWell/Linearity/ DES
Fe55	50	100	2	100	200	1 % hit per exposure
Star Projector	500	2000	2	1000	4000	4 or 5 * Nsensors

Data Volume (TB)

Plus metrology maps and other meta data

LSST I&T Data Volume	N exposures	N rafts	N sensors	Nx	Ny	N bytes per pixel	Overhead (headers, telemetry, etc)	Repeat	Total (TB)(10^12)
Incoming Raft Tests 2	100	1	9	4096	4096	8	1.02	5	1
Engineering Rafts	100	2	9	4096	4096	8	1.02	50	12
2 Rafts	300	2	9	4096	4096	8	1.02	20	15
9 + 4 corner	700	10.33	9	4096	4096	8	1.02	10	89
21 + 4 corner	1200	22.33	9	4096	4096	8	1.02	10	330
Total								Total	447
								Data Products Factor	3
								Total	1,341

Meta Data
Data Products

- Meta Data
  - All standard camera telemetry
  - Positions and power for star projector
  - Power for flat light source, photo diode
  - CCOB light source
  - CCOB diode
  - CCOB x,y,z (*2)
- Time synchronized

- Products
  - Dark subtracted, gain balanced images
  - Image/pixel masks
  - Cross talk, CTE, gains
  - Metrology maps
  - Throughput
  - Ghosting

Algorithms

- Dark, flat subtractions
- Photon transfer
  - Full Well
  - Linearity
- Metrology
  - Stitching (single/full)
  - Maps
- Fe55
  - Charge Transfer (in)efficiency
  - Charge Diffusion
- Cross talk / correlations
- Temp analysis
  - Stability
  - Variations in ccds
- Noise studies
- CCOB
  - Ghosts (alignment)
  - throughput (roll up)

Storage and Access

- Full collaboration access
- Large data volume requires “data management”
  - Not desktop type analysis
- Automated test report generation (with access)
- Cross comparisons to prior tests at various locations.
- Importance of data products (“as built” values)
  - CTE/CTI, optical throughput, cross talk, gains, masks, noise, ghosting, alignments, etc
- Incorporation of test data into simulation and analysis (including reanalysis of prior test data)

Summary

- A very large volume of information will be generated during I&T **and** in during various subsystem development.
  - Provide “as built” descriptions, meta data, …
  - Require ability to access **data** and **data products**, rerun analysis, access and compare to prior tests across all subsystems and locations.
  - Integration of the data products into simulations and analysis.