



LARGE SYNOPTIC SURVEY TELESCOPE

Large Synoptic Survey Telescope (LSST)
Data Management

Characterization Metric Report: Science Pipelines Version 17.0

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DMTR-131

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Abstract

This brief report describes measurements of interest that were carried out for release v17.0 of the Science Pipeline. In short, the astrometric performance is excellent in comparison to both the per cycle ramps as well as the design level KPMs. The photometric performance is not as good. Though the photometric KPMs are not meeting specs, there have been no regressions from the v16.0 release. Note that TE1 and TE2 are significantly different than the values reported in the v16.0 characterization report. This is due to an intentional change in how those KPMs are measured. The report for the previous version can be found in DMTR-81.



Change Record

Version	Date	Description	Owner name
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Metrics were measured using `validation_data_hsc`, which consists of 8 HSC engineering images: 2 *r*-band, 4 *i'*-band, and 2 *y*-band. Measurements were made on individual, separately-processed, single-frame images: `Jointcal` and/or `meas_mosaic` were not run. For comparison, we provide the [SRD](#) required “design” value of each metric as defined in the Science Requirements Document [LPM-17], and, where available, the target for this release as defined in the Data Management Development Milestone Roadmap [LDM-240]. All values were computed using the `examples/runHscTest.sh` script in the `validate_drp` package. For context, the [SRD](#) does not place any constraints on *y*-band for these KPMs. For the photometric metrics, there are only specifications for *g*, *r*, and *i'*. In the case of the ellipticity correlation metrics, there are specs only for *r* and *i'*. The *y*-band measurements are for interest and historical tracking.

Some KPMs (AF1, AD1) involve thresholds that are different for “design”, “minimum”, and “stretch” specifications. Thus comparing one of these metrics against a given target number is a two-level process. Both the threshold used in the calculation is dependent on the specifications, and the requirement on the computed number is dependent on the specifications.

The metrics in this report have all been computed relative to the “design” thresholds. The values of these KPMs would be different if computed against different thresholds.

Note also that the photometric performance of the pipelines in the *y*-band is an under estimate of expected delivered performance. For these tests, the *y*-band data was calibrated with *z*-band photometry. This is due to the lack of a reference catalog containing *y*-band information at this time. We recognize that the bandpass mismatch is certainly not the only source of scatter in the *y*-band photometry. These metric measurements are still worth noting in this report as a historical benchmark to track relative performance.

The measurements of the ellipticity correlation metrics, TE1 and TE2, changed significantly relative to previous characterization reports. This is due to an intentional change in how the measurements are defined in `validate_drp`. In early July 2018, the measurement definitions were changed to agree with the definitions used in high level project documents: e.g. LPM-17.

The per cycle target numbers come from the “KPMs” sheet of LDM-240.

1 Photometric Performance

Submitted by Simon Krughoff and Michael Wood-Vasey

procCalRep corresponds to requirement OSS-REQ-0275 (defined in LSE-30). All other photometric performance metrics follow LSS-REQ-0093 (LSE-29) and LPM-17 table 14.

Metric	Unit	SRD		Value	Comments
		Requirement- Design	Release 17 Target		
procCalRep	mmag	≤ 13	—	—	Need simulations
PA1: <i>u</i>	mmag	≤ 12	—	—	No data
PA1: <i>g</i>	mmag	≤ 8	—	—	No data
PA1: <i>r</i>	mmag	≤ 5	8.0	14.30	
PA1: <i>i</i>	mmag	≤ 5	8.0	12.20	
PA1: <i>z</i>	mmag	≤ 12	—	—	No data
PA1: <i>y</i>	mmag	≤ 12	12.0	25.30	
PF1: <i>u</i>	%	≤ 20	—	—	No data
PF1: <i>g</i>	%	≤ 20	—	—	No data
PF1: <i>r</i>	%	≤ 10	10.0	30.90	
PF1: <i>i</i>	%	≤ 10	10.0	27.00	
PF1: <i>z</i>	%	≤ 20	—	—	No data
PF1: <i>y</i>	%	≤ 20	20.0	38.10	
PA2: <i>u</i>	mmag	≤ 22.5	—	—	No data
PA2: <i>g</i>	mmag	≤ 15	—	—	No data
PA2: <i>r</i>	mmag	≤ 15	20.0	27.20	
PA2: <i>i</i>	mmag	≤ 15	20.0	25.90	
PA2: <i>z</i>	mmag	≤ 22.5	—	—	No data
PA2: <i>y</i>	mmag	≤ 22.5	20.0	45.10	

2 Astrometric Performance

Submitted by Simon Krughoff and Michael Wood-Vasey

The following metrics are defined following LSR-REQ-0094 [LSE-29] and LPM-17 table 18.

Metric	Unit	SRD Requirement- Design	Release 17 Target	Value
AM1: <i>r</i>	mas	≤ 20	30.0	3.65
AM1: <i>i</i>	mas	≤ 20	30.0	7.09
AM1: <i>y</i>	mas	≤ 20	30.0	5.82
AF1: <i>r</i>	%	≤ 10	10.0	0.17
AF1: <i>i</i>	%	≤ 10	10.0	0.58
AF1: <i>y</i>	%	≤ 10	10.0	0.82
AD1: <i>r</i>	mas	≤ 20	20.0	5.77
AD1: <i>i</i>	mas	≤ 20	20.0	8.34
AD1: <i>y</i>	mas	≤ 20	20.0	8.94
AM2: <i>r</i>	mas	≤ 10	30.0	3.75
AM2: <i>i</i>	mas	≤ 10	30.0	7.37
AM2: <i>y</i>	mas	≤ 10	30.0	6.47
AF2: <i>r</i>	%	≤ 10	10.0	0.16
AF2: <i>i</i>	%	≤ 10	10.0	0.62
AF2: <i>y</i>	%	≤ 10	10.0	1.17
AD2: <i>r</i>	mas	≤ 20	20.0	5.94
AD2: <i>i</i>	mas	≤ 20	20.0	8.16
AD2: <i>y</i>	mas	≤ 20	20.0	9.79

3 Ellipticity Correlations

Submitted by Simon Krughoff and Michael Wood-Vasey

The following metrics are defined following LSR-REQ-0097 [LSE-29] and LPM-17 table 27.

Metric	Unit	SRD Requirement-Design	Release 17 Target	Value
TE1: <i>r</i>	—	$\leq 3 \times 10^{-5}$	$\leq 3 \times 10^{-5}$	1.26×10^{-5}
TE1: <i>i</i>	—	$\leq 3 \times 10^{-5}$	$\leq 3 \times 10^{-5}$	1.78×10^{-6}

Metric	Unit	SRD		
		Requirement-Design	Release 17 Target	Value
TE1: y	—	$\leq 3 \times 10^{-5}$	$\leq 3 \times 10^{-5}$	2.38×10^{-4}
TE2: r	—	$\leq 3 \times 10^{-7}$	$\leq 3 \times 10^{-7}$	3.48×10^{-7}
TE2: i	—	$\leq 3 \times 10^{-7}$	$\leq 3 \times 10^{-7}$	5.49×10^{-7}
TE2: y	—	$\leq 3 \times 10^{-7}$	$\leq 3 \times 10^{-7}$	2.36×10^{-6}

4 Computational Performance

Computational performance metrics were not re-measured for this release. We expect no significant changes relative to the report on version 12 [DMTR-15].

References

- [1] **[LSE-29]**, Claver, C.F., The LSST Systems Engineering Integrated Project Team, 2017, *LSST System Requirements (LSR)*, LSE-29, URL <https://ls.st/LSE-29>
- [2] **[LSE-30]**, Claver, C.F., The LSST Systems Engineering Integrated Project Team, 2018, *Observatory System Specifications (OSS)*, LSE-30, URL <https://ls.st/LSE-30>
- [3] **[LPM-17]**, Ivezić, Ž., The LSST Science Collaboration, 2018, *LSST Science Requirements Document*, LPM-17, URL <https://ls.st/LPM-17>
- [4] **[LDM-240]**, Kantor, J., Jurić, M., Lim, K.T., 2016, *Data Management Releases*, LDM-240, URL <https://ls.st/LDM-240>
- [5] **[DMTR-81]**, Krughoff, S., Wood-Vasey, M., 2018, *Characterization Metric Report: Science Pipelines Version 16.0*, DMTR-81, URL <https://ls.st/DMTR-81>
- [6] **[DMTR-15]**, Wood-Vasey, M., Swinbank, J., 2017, *Characterization Metric Report: Science Pipelines Version 13.0*, DMTR-15, URL <https://ls.st/DMTR-15>