LARGE SYNOPTIC SURVEY TELESCOPE

Large Synoptic Survey Telescope (LSST)

Characterization Metric Report: Science Pipelines Version 16.0

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DMTR-81

Latest Revision: 2018-06-26

Abstract

This brief report describes measurements of interest that were carried out for release v16.0 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 v15.0 release.

The report for the previous version can be found in DMTR-62.

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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.

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 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 Requirement–Design	Release 16 Target	Value	Comments
procCalRep	mmag	≤ 13	—	—	Need simulations
PA1: *u*	mmag	≤ 12	—	—	No data
PA1: *g*	mmag	≤ 8	—	—	No data
PA1: *r*	mmag	≤ 5	8.0	14.60	
PA1: *i*	mmag	≤ 5	8.0	12.00	
PA1: *z*	mmag	≤ 12	—	—	No data
PA1: *y*	mmag	≤ 12	12.0	25.10	
PF1: *u*	%	≤ 20	—	—	No data
PF1: *g*	%	≤ 20	—	—	No data
PF1: *r*	%	≤ 10	10.0	31.70	
PF1: *i*	%	≤ 10	10.0	26.10	
PF1: *z*	%	≤ 20	—	—	No data
PF1: *y*	%	≤ 20	20.0	37.20	
PA2: *u*	mmag	≤ 22.5	—	—	No data
PA2: *g*	mmag	≤ 15	—	—	No data
PA2: *r*	mmag	≤ 15	20.0	27.20	
PA2: *i*	mmag	≤ 15	20.0	25.60	
PA2: *z*	mmag	≤ 22.5	—	—	No data
PA2: *y*	mmag	≤ 22.5	20.0	44.60	

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	Release 16 Target	Value
AM1: *r*	mas	≤ 20	30.0	6.66
AM1: *i*	mas	≤ 20	30.0	9.08
AM1: *y*	mas	≤ 20	30.0	12.45

Metric	Unit	SRD Requirement	Release 16 Target	Value
AF1: *r*	%	≤ 10	10.0	2.64
AF1: *i*	%	≤ 10	10.0	2.16
AF1: *y*	%	≤ 10	10.0	10.70
AD1: *r*	mas	≤ 20	20.0	10.90
AD1: *i*	mas	≤ 20	20.0	10.90
AD1: *y*	mas	≤ 20	20.0	20.80
AM2: *r*	mas	≤ 10	40.0	6.46
AM2: *i*	mas	≤ 10	40.0	9.90
AM2: *y*	mas	≤ 10	40.0	13.20
AF2: *r*	%	≤ 10	10.0	2.24
AF2: *i*	%	≤ 10	10.0	2.26
AF2: *y*	%	≤ 10	10.0	11.10
AD2: *r*	mas	≤ 20	20.0	10.60
AD2: *i*	mas	≤ 20	20.0	11.00
AD2: *y*	mas	≤ 20	20.0	21.30

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	Release 16 Target	Value
TE1: *r*	—	$\leq 3 \times 10^{-5}$	$\leq 3 \times 10^{-5}$	3.37×10^{-6}
TE1: *i*	—	$\leq 3 \times 10^{-5}$	$\leq 3 \times 10^{-5}$	1.19×10^{-6}
TE1: *y*	—	$\leq 3 \times 10^{-5}$	$\leq 3 \times 10^{-5}$	5.92×10^{-5}
TE2: *r*	—	$\leq 3 \times 10^{-7}$	$\leq 3 \times 10^{-7}$	8.30×10^{-8}
TE2: *i*	—	$\leq 3 \times 10^{-7}$	$\leq 3 \times 10^{-7}$	1.27×10^{-7}
TE2: *y*	—	$\leq 3 \times 10^{-7}$	$\leq 3 \times 10^{-7}$	6.82×10^{-7}

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, 2011, *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-62]**, S. Krughoff, J.W.V., 2018, *Characterization Metric Report: Science Pipelines Version 15.0*, DMTR-62, URL https://ls.st/DMTR-62

[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