Overview of ZTF QA and Calibration Activities

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UW-Milwaukee

ZTF team meeting
20 March 2018

QA Metrics Provided by IPAC

- Aggregate statistics: e.g., # images received, # images processed, # difference images
- Calibration image information and statistics
- Science image statistics
  - Calibration-based: e.g., # catalog matches, global stats, fwhm
  - Difference image-based: e.g, science and reference information, background, fwhm
- Streaks information and statistics

QA Monitoring

P48 Observatory Status

UT Time	2018-03-20 06:42:02.055
LST	+10:45:36
Sun Altitude(Deg)	-52.64
Current Field	NA
Tel RA(Deg)	+11:59:60
Tel DEC(Deg)	+69:20:59.9
Last Filter State	FILTER_ZTF_R Last Changed: 2018-03-16 17:44:03.000
Dome Status	Opened
Motion Status	7
Hexapod Focus	1.361000
Hexapod Tip	0.379198
Hexapod Tilt	0.314300
Temperature(C)	6.5
Humidity (%)	16
Wind Speed (m/s)	1.3
Dew Point Depression(C)	23.7
Faults	NONE

To see historical data enter UT date of

Last Image Stats | DIQ Trend | Robot Log | Webcams

Last Image Stats

2.37	2.33	2.41	2.4	2.5	2.48	2.51	2.55
2.3	2.23	2.24	2.18	2.13	2.1	2.16	2.19
2.18	2.08	2.02	2.01	2.1	2.06	2.15	2.15
2.01	1.85	1.87	1.85	1.91	1.9	2.01	2.0
2.16	2.0	2.0	2.06	1.98	1.94	2.03	2.02
2.06	1.87	1.83	1.86	1.96	1.93	1.95	1.91
2.07	1.86	2.0	2.02	2.05	2.06	1.98	1.97
2.11	1.89	1.95	1.92	1.94	1.93	1.92	2.08

ccdid	qid	obsdatetime	expid	minmag	maxmag	fwhm	ellip	status	infobits
2	3	2018-03-20 12:13:19	44350924	-15.225	-4.485	1.937539	0.076812	0	3000320

11: RMS in PHOTCAL RESIDUALS (ZPs) is >.2 mag
14: NUMBER OF MATCHES FOR ASTROM CAL is < 100
15: MIN NUM OF IN-GRID MATCHES FOR ASTROM is < 5
16: REL-PIXEL SCALE OUT OF RANGE:-0.20percent-2.00percent
18: CHI-SQUARE FROM SECOND PASS SCAMP is > 30
19: MAX IN-GRID MEDIAN ASTROM RESID is > 0.7"
21: PCT OF DETECTED MATCHES FOR ASTROM is < 50percent

QA Task List

- Contamination
- Gain correction
- Non-linearity
- Ghosting
- Shutter-timing
- Out-of-band leakage
- Flexure map
- Photometric accuracy/reproducibility
- Astrometric accuracy
- Monochromatic flat fields

Ongoing:

- Focus dependence on temperature
- Starflats (sensitivity maps)
- Flat field optimization

Future:

- Fringing (i band)

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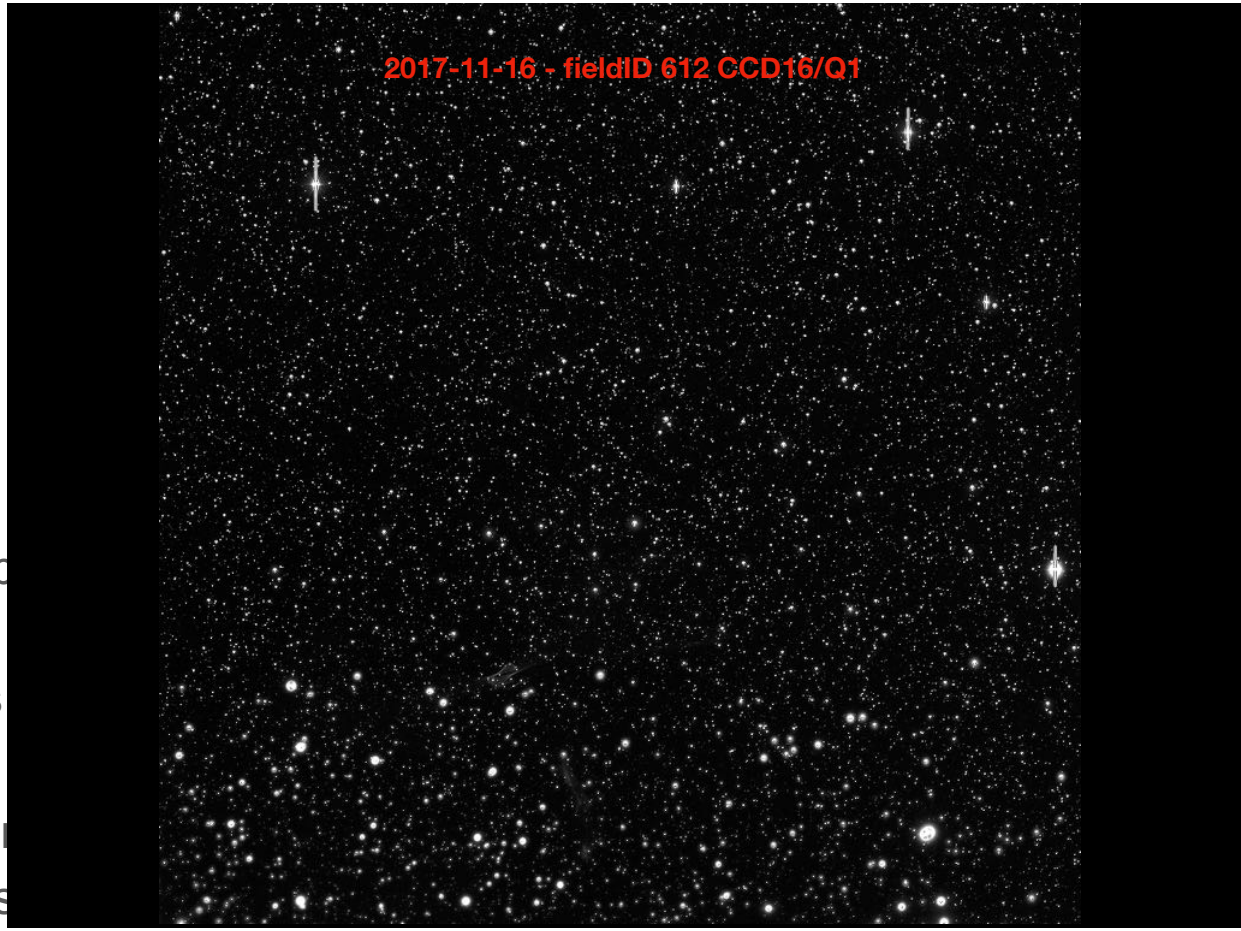

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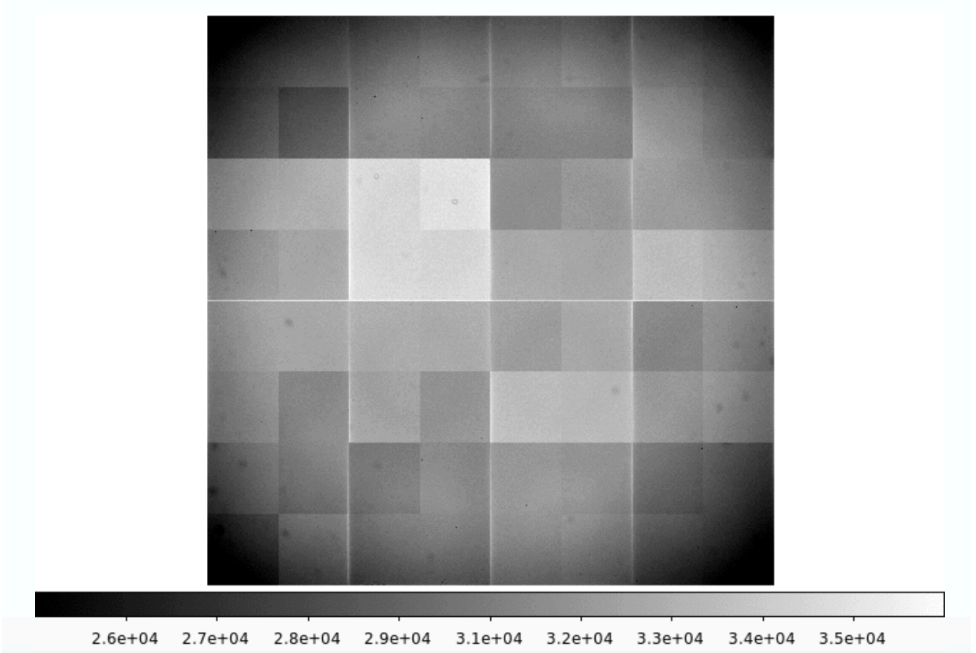

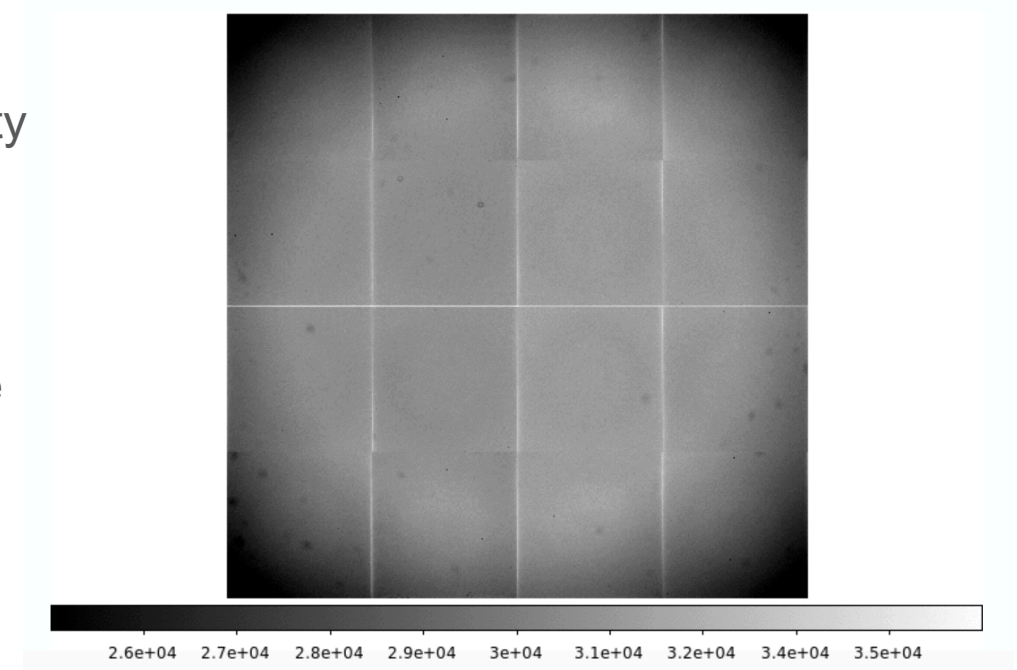

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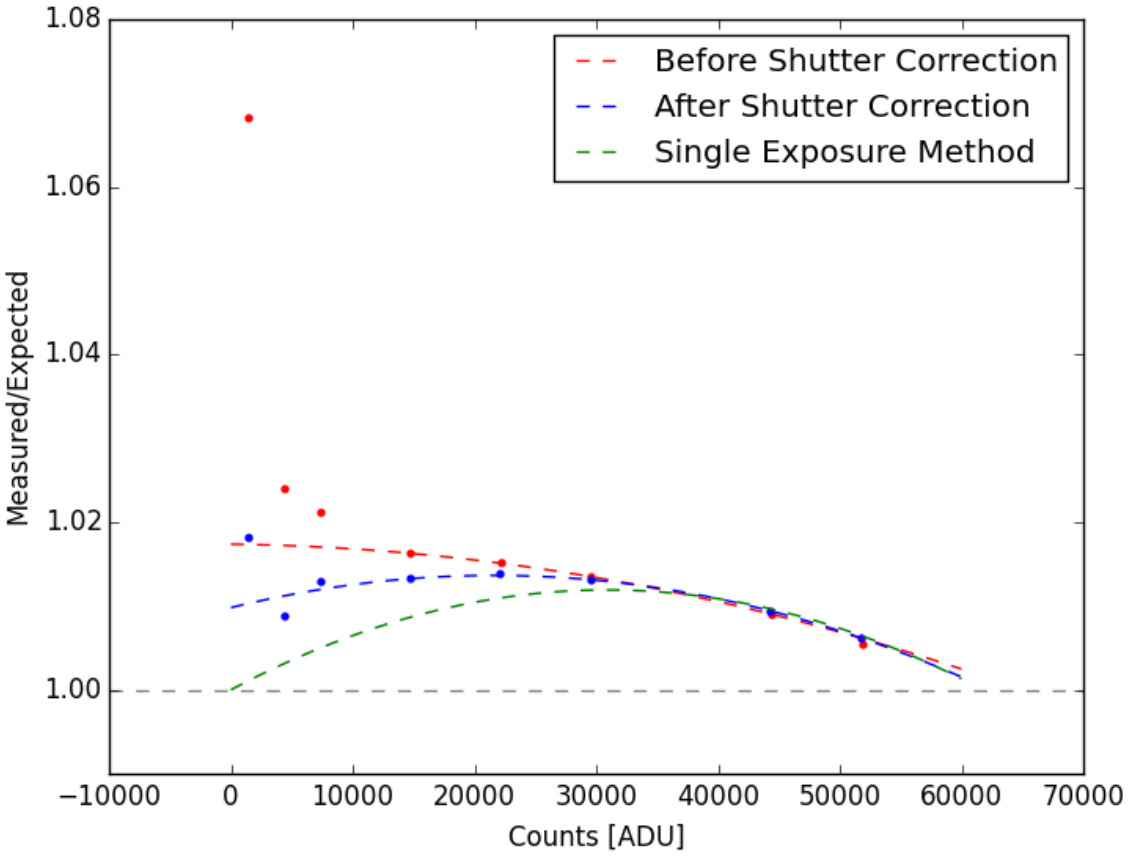

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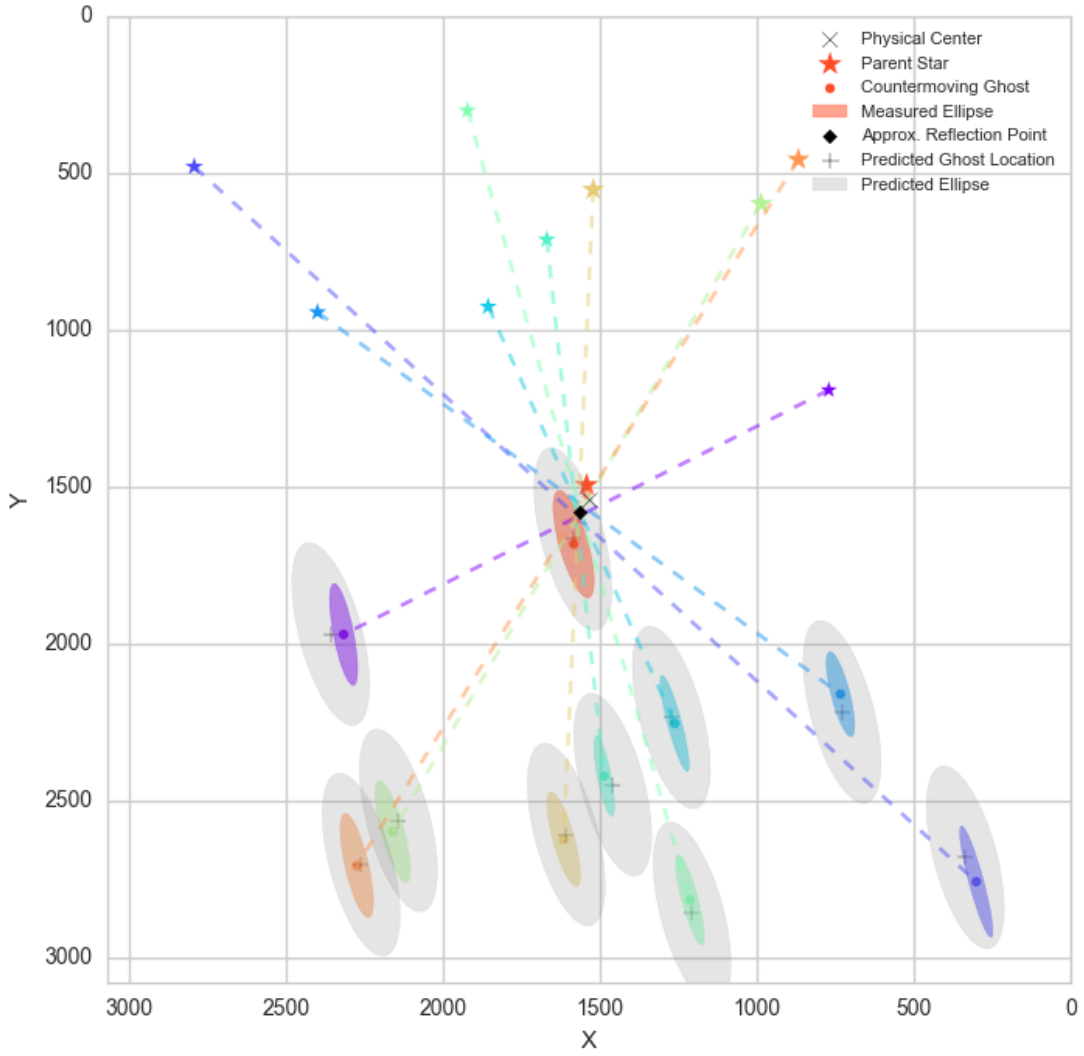

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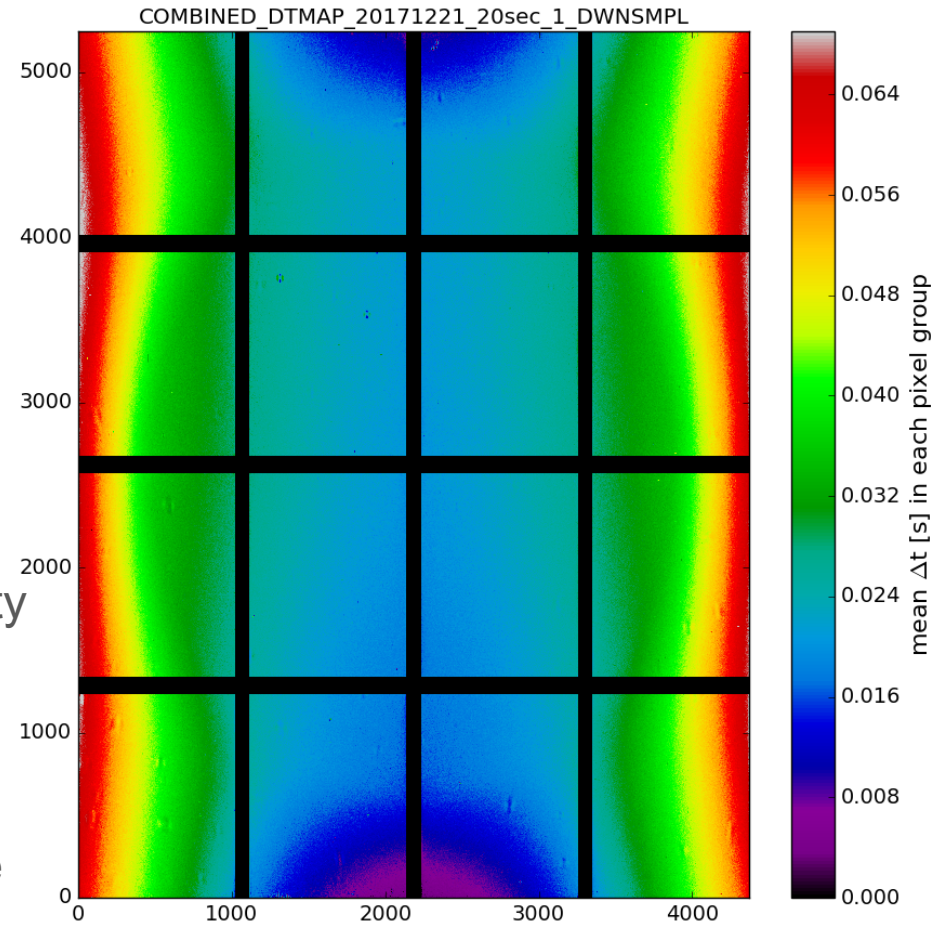

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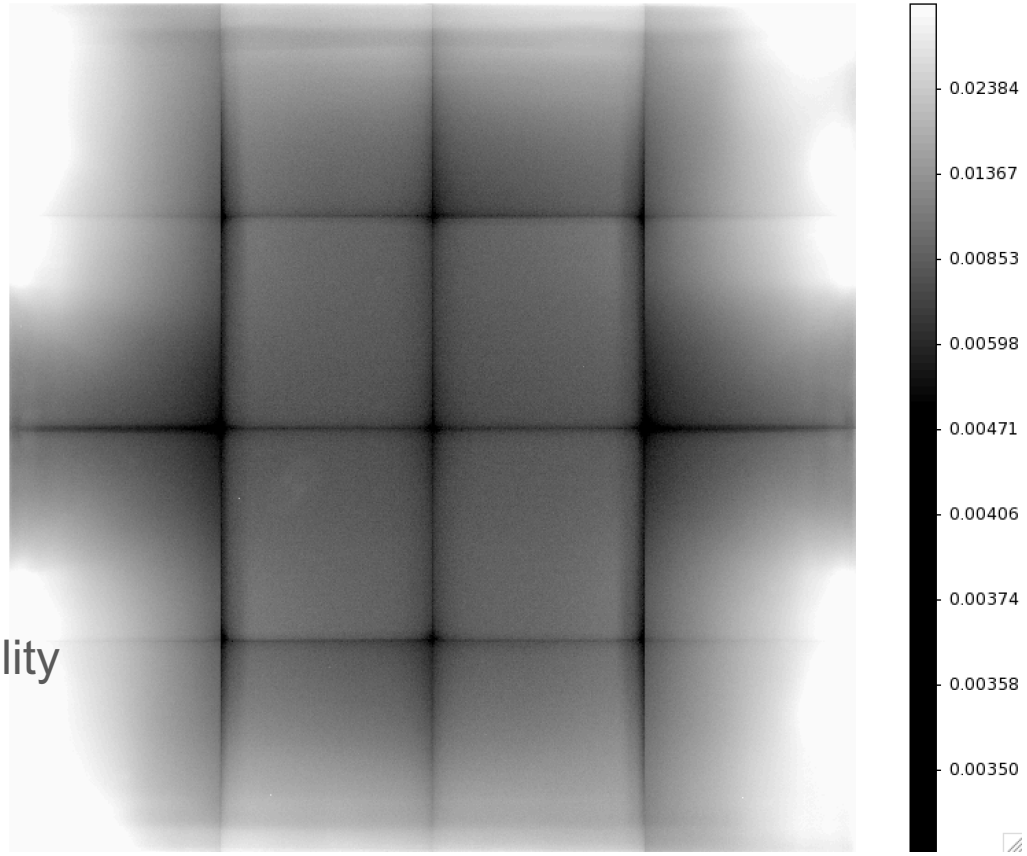

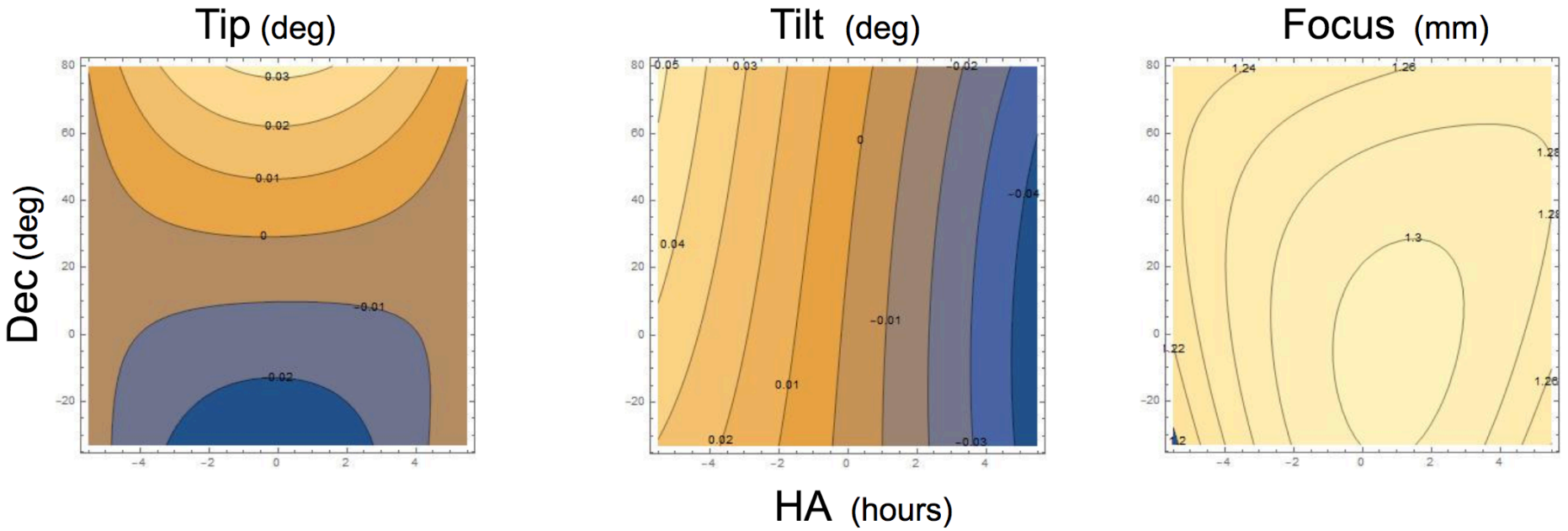

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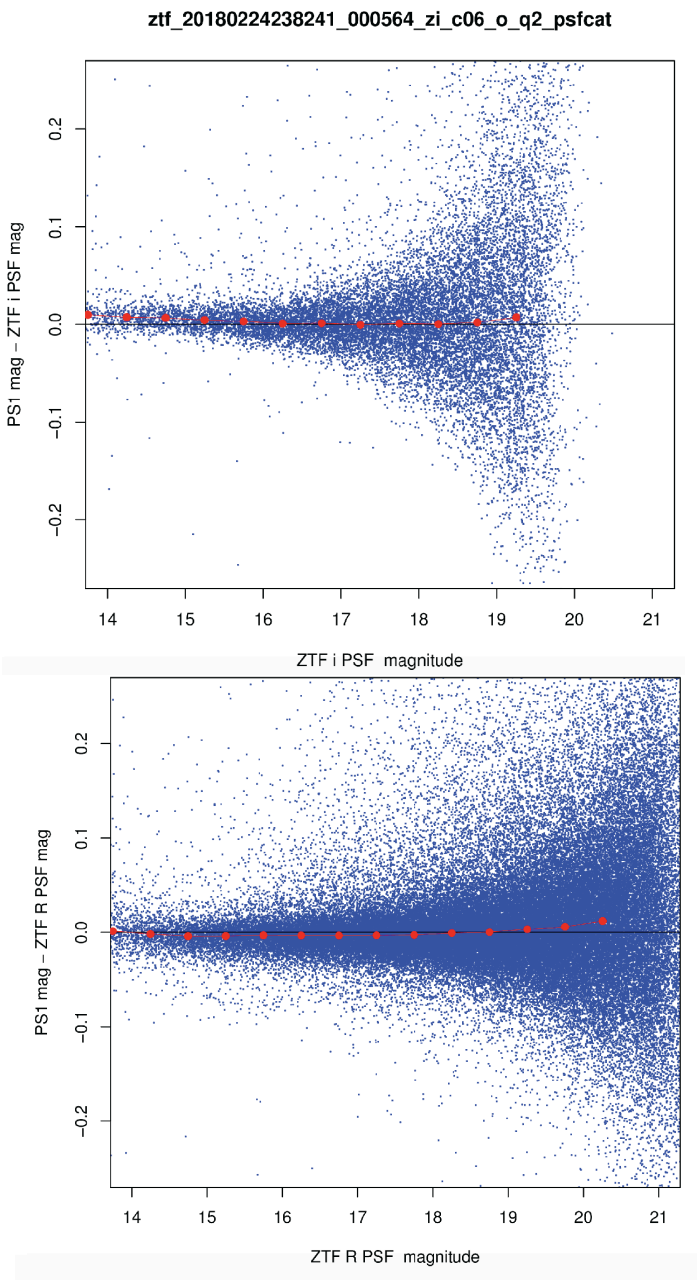

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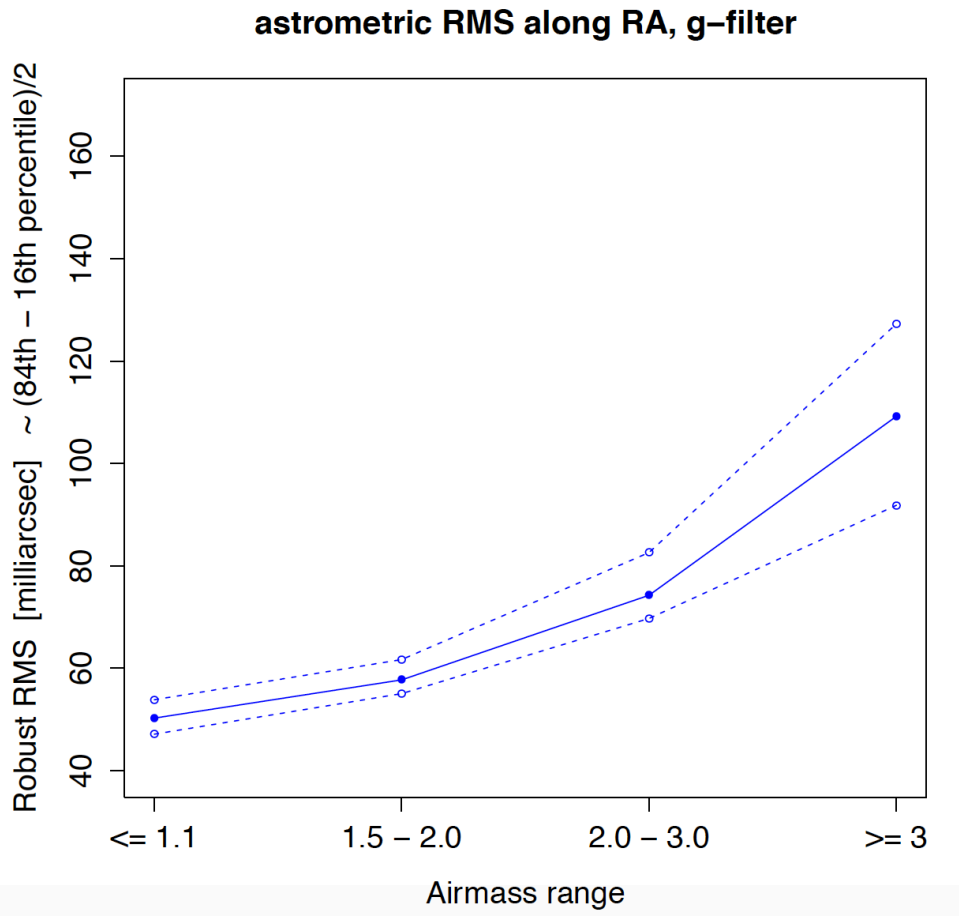

Calibration 2.0

Series of steps intended to provide improved photometry

Object dependent flatfield

Atmospheric model

Gaia star temperatures

Scene modeling

Filter sensitivity

Farther-term future ideas to improve calibration/photometry

Slides courtesy of Jakob Nordin

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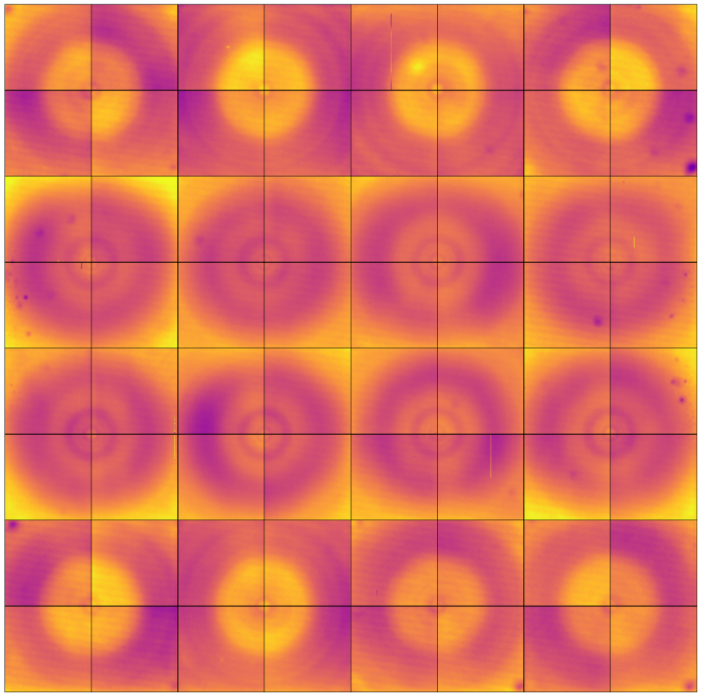

Count-weighted average wavelength for domeflat LEDs within R-filter.

A flatfield is optimized for a specific SED. With single LED domeflat data we could derive flatfields designed for a specific object.

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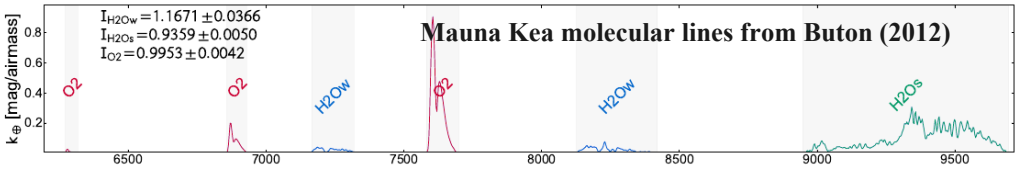
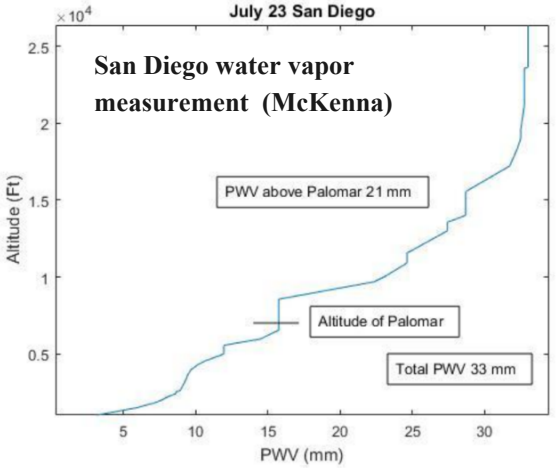
The absorbing/scattering components of the atmosphere change at varying temporal and spatial scales, but are in principle known.



ZTF data allows us to determine an atmospheric solution for each exposure/night.

Measurements from the Palomar Observatory Extinction Monitor and Lidar can be used for direct priors??



Best for cloudy nights, fields without many stars

See e.g. Buton et al. (2012) & Burke et al (2017)

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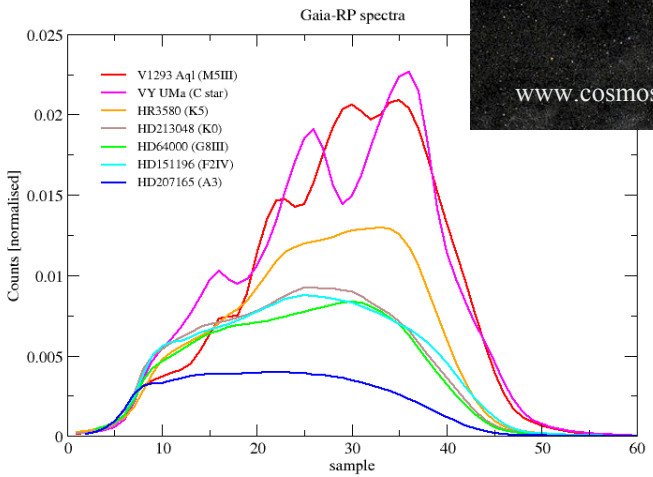

Gaia low-res spectra can distinguish star types.

Second Gaia release will contain a color/temperature measurement of ~1 billion stars. Third release contains low-res spectra. This SED information can be directly incorporated into the photometric solution (e.g., color dependent correction).

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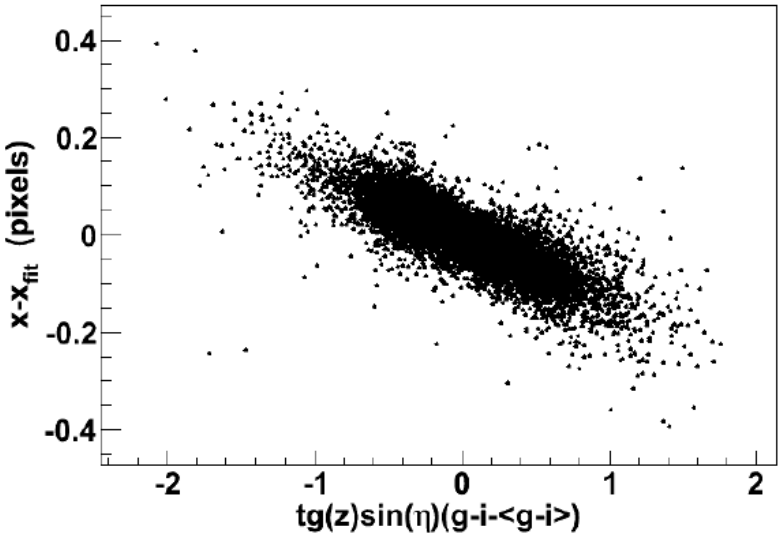

The relative position of SN + galaxy vary due to atmospheric differential refraction (Astier 2013)

A faint transient lightcurve superposed on a complex background is ideally extracted through a forward "scene" model of the full stack of images.

Ref Holtzman (2009) & Astier et al (2013)

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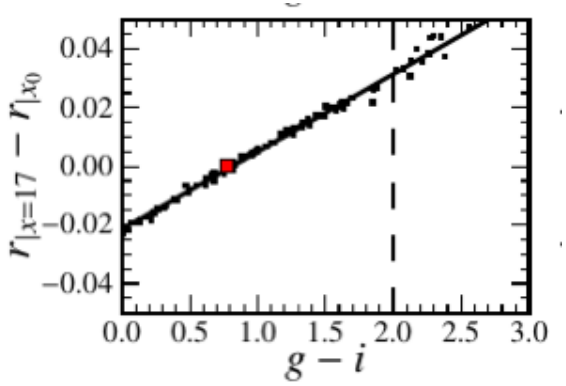
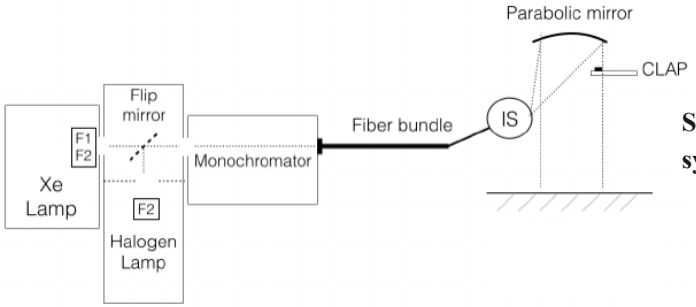


MEGACAM filter throughput variation with color across field of view. (Betoule 2012)

Uncertainties in filter throughput with position and age constitute a limiting systematic uncertainty.



Sample instrument setup to monitor system sensitivity (Lombardo 2017)

The ZTF filters could be monitored through a combination of dedicated observations, evaluation of survey observations and narrow-band light emitters.

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A chance to develop novel techniques to go with a legacy ZTF transient sample.

Long term projects which will be the focus of the Calibration WG once the intense commissioning QA activities stabilize.

Will not be part of the immediate real-time pipeline, but rather constitute a post-processing process which can be requested for interesting candidates.