

# Pachon Sky Camera

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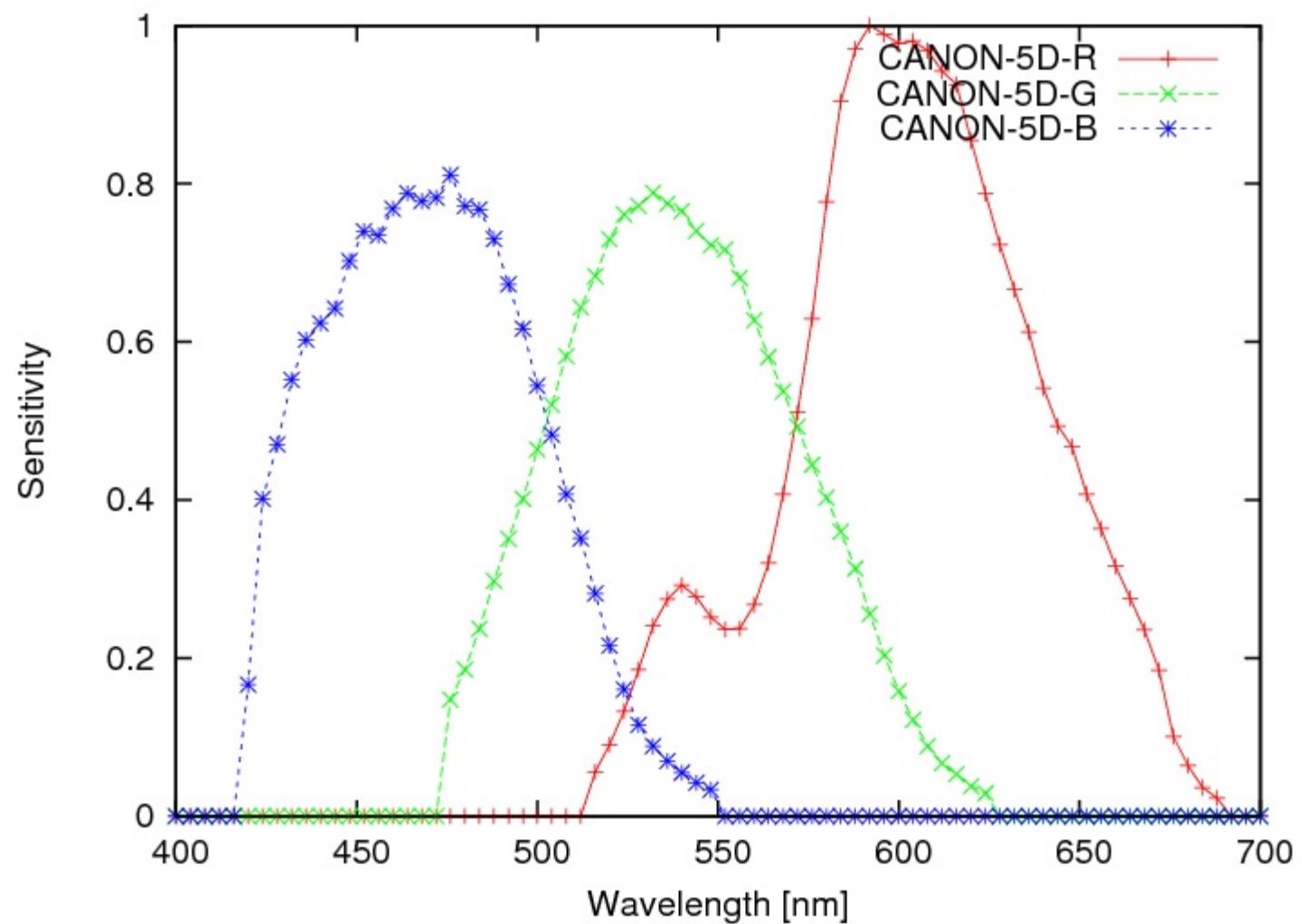
# Motivation

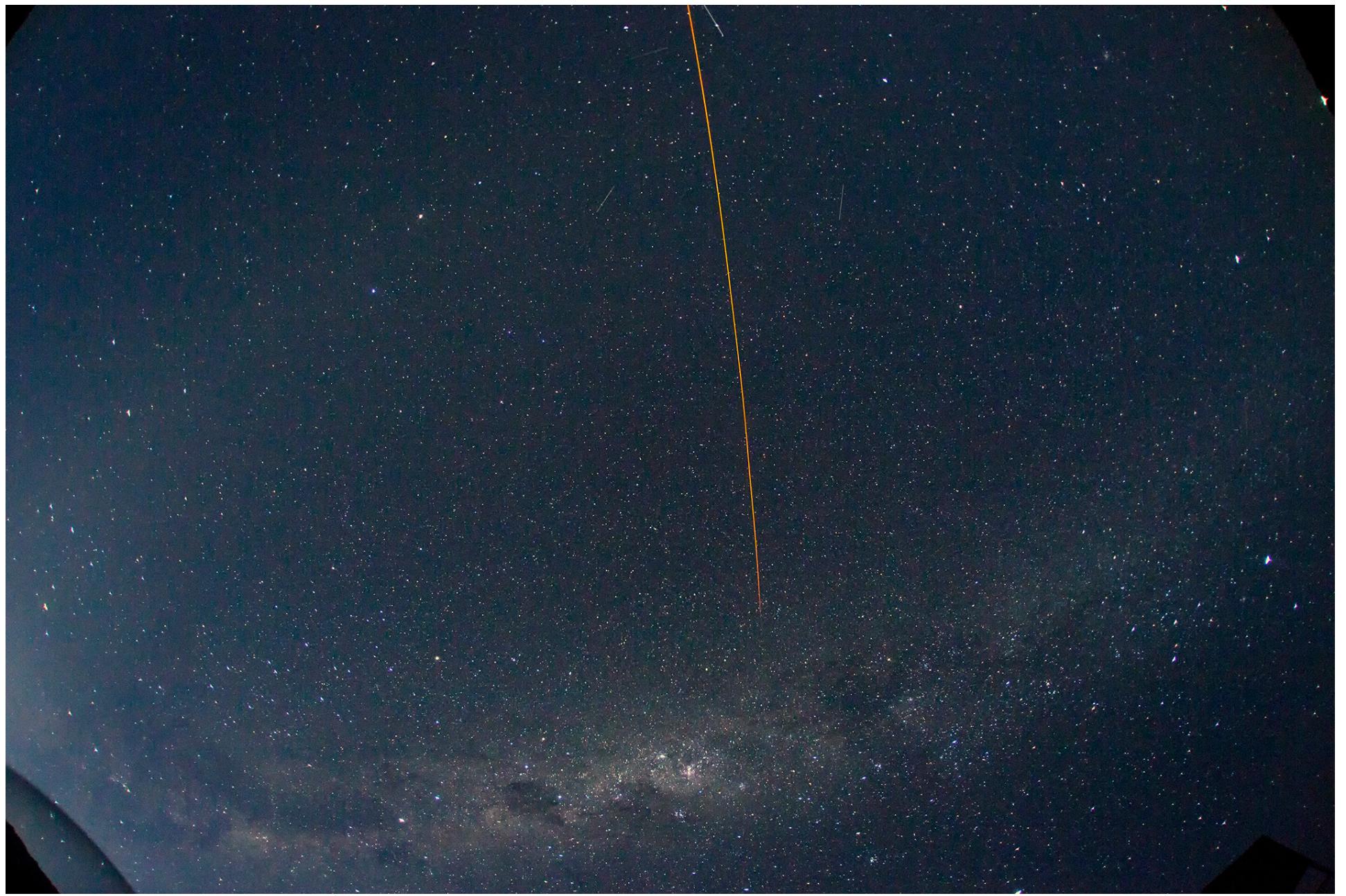
- OpSim and ImSim can both benefit from actual sky brightness and attenuation data.
- Although some instruments exist in Chile, we consider it advantageous to measure what we care about: optical sky brightness and optical transmission through clouds.
- Goal is to provide a map of m5, the 5 sigma point source magnitude, across the sky vs. time
- This should evolve into an agile scheduling system for LSST operations, that accounts for clouds in real time.

# Instrumentation

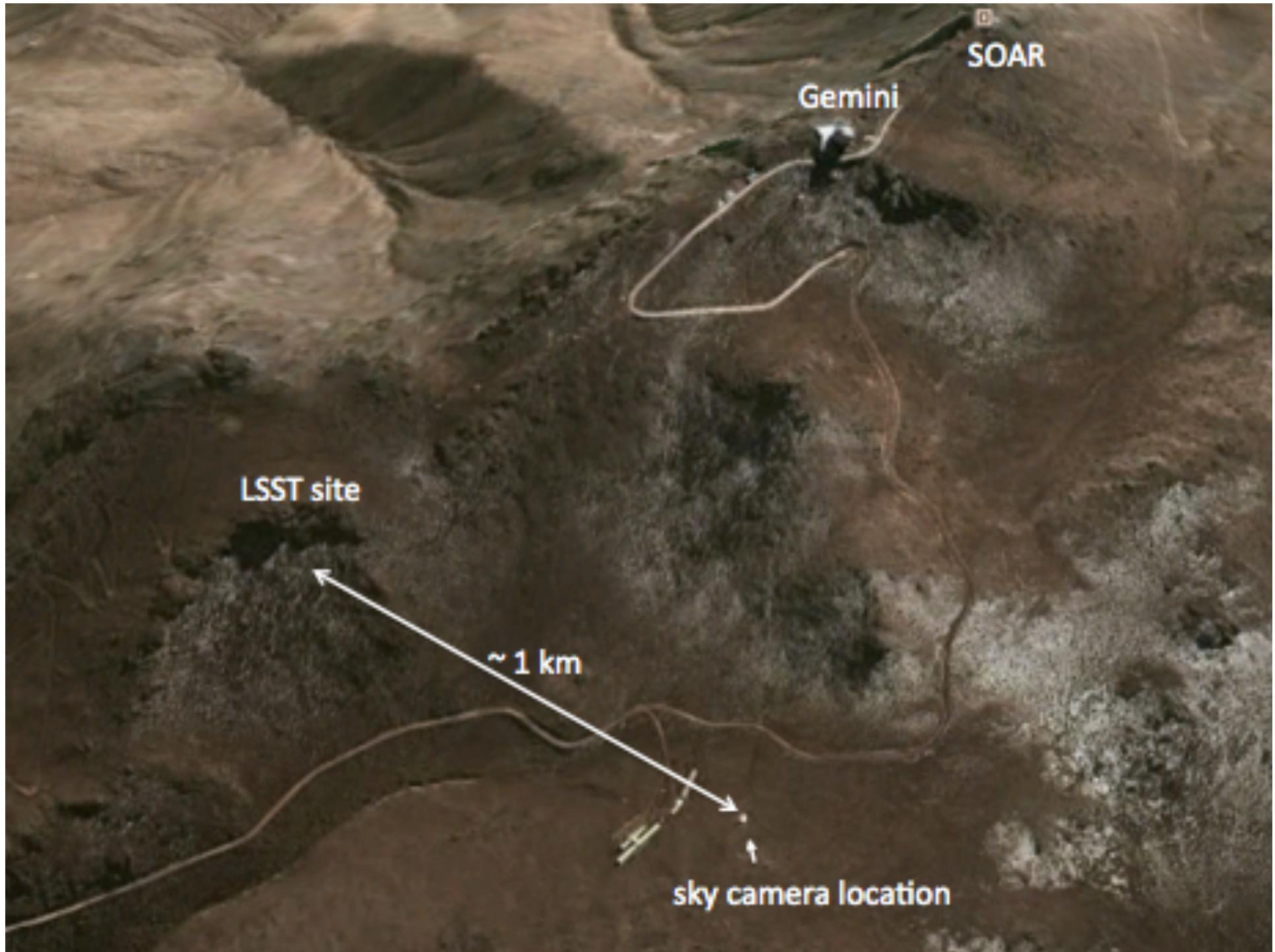
- We installed at Pachon, on Jan 13 2014, a Canon digital SLR camera with a 15mm fisheye lens.
- Instrument resides in an atmospheric sciences building, looking out through a hemispherical plexiglass dome.
- We acquire 1 sec and 10 second images each minute.
- Data is 3 band 14 bit dynamic range, lossless raw data, at 2888 x 1928 resolution.
- ~3 arcmin/pixel
- 180 degrees of sky coverage from corner to corner







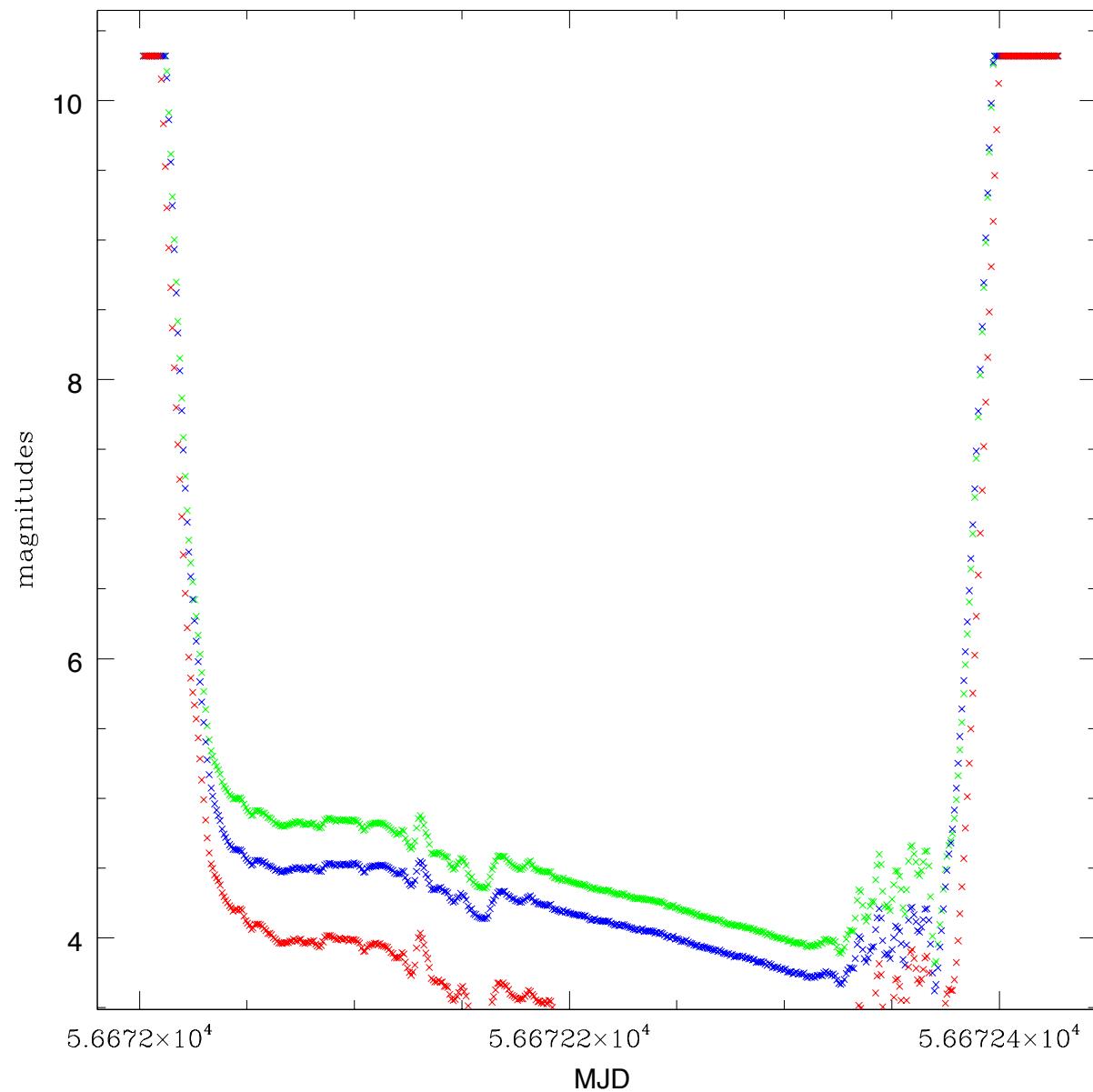




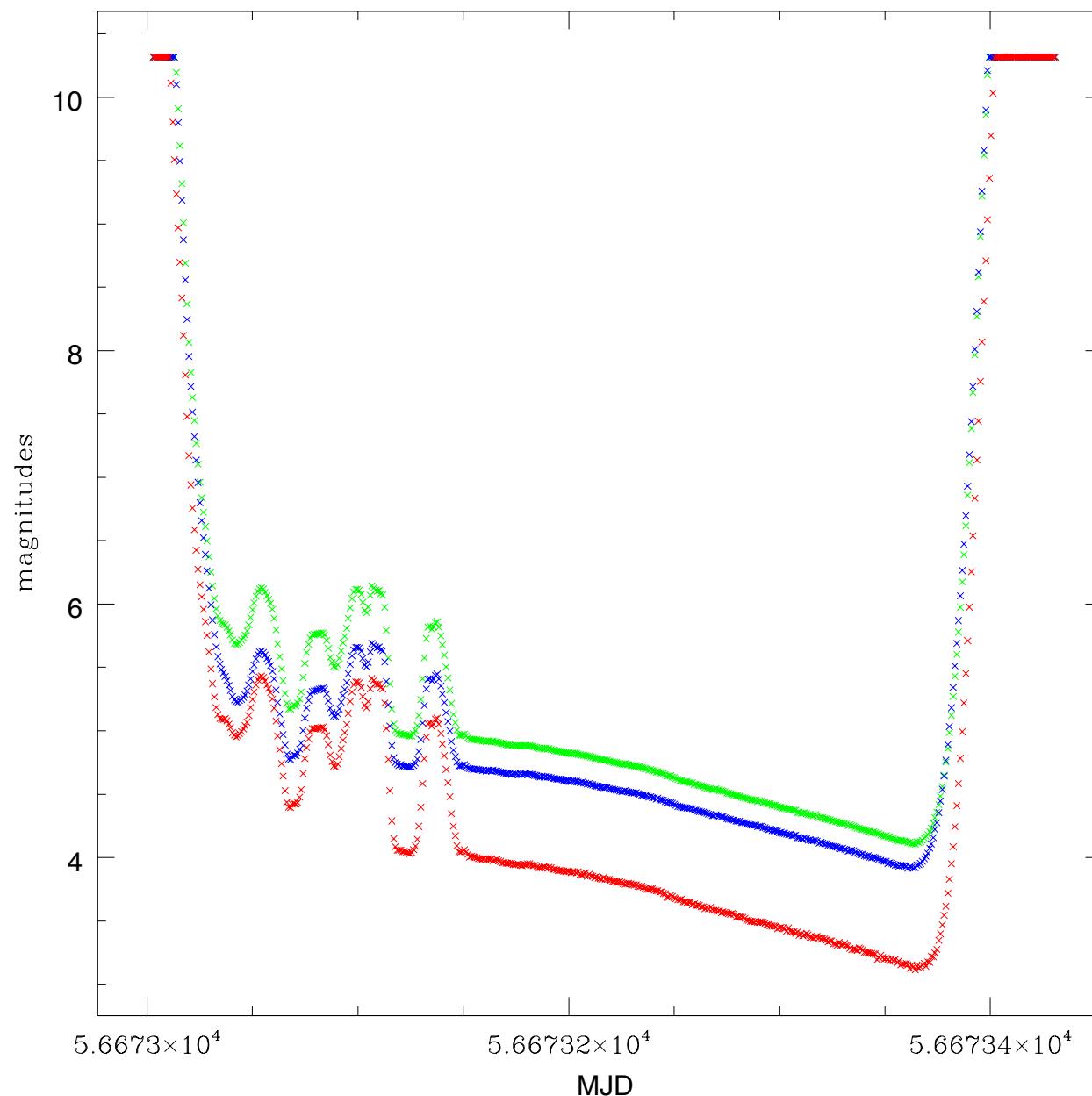
# Analysis Pipeline

- Convert .CR2 raw Canon files into FITS files:
  - monochrome (add all flux)
  - B,G,R
- Perform photometry on all of these files
- Extract sky brightness estimate at zenith, from 200 x 200 pixel box at zenith.
- We can get a 3 arcmin resolution of sky brightness by taking median filtered (point source-suppressed) image.

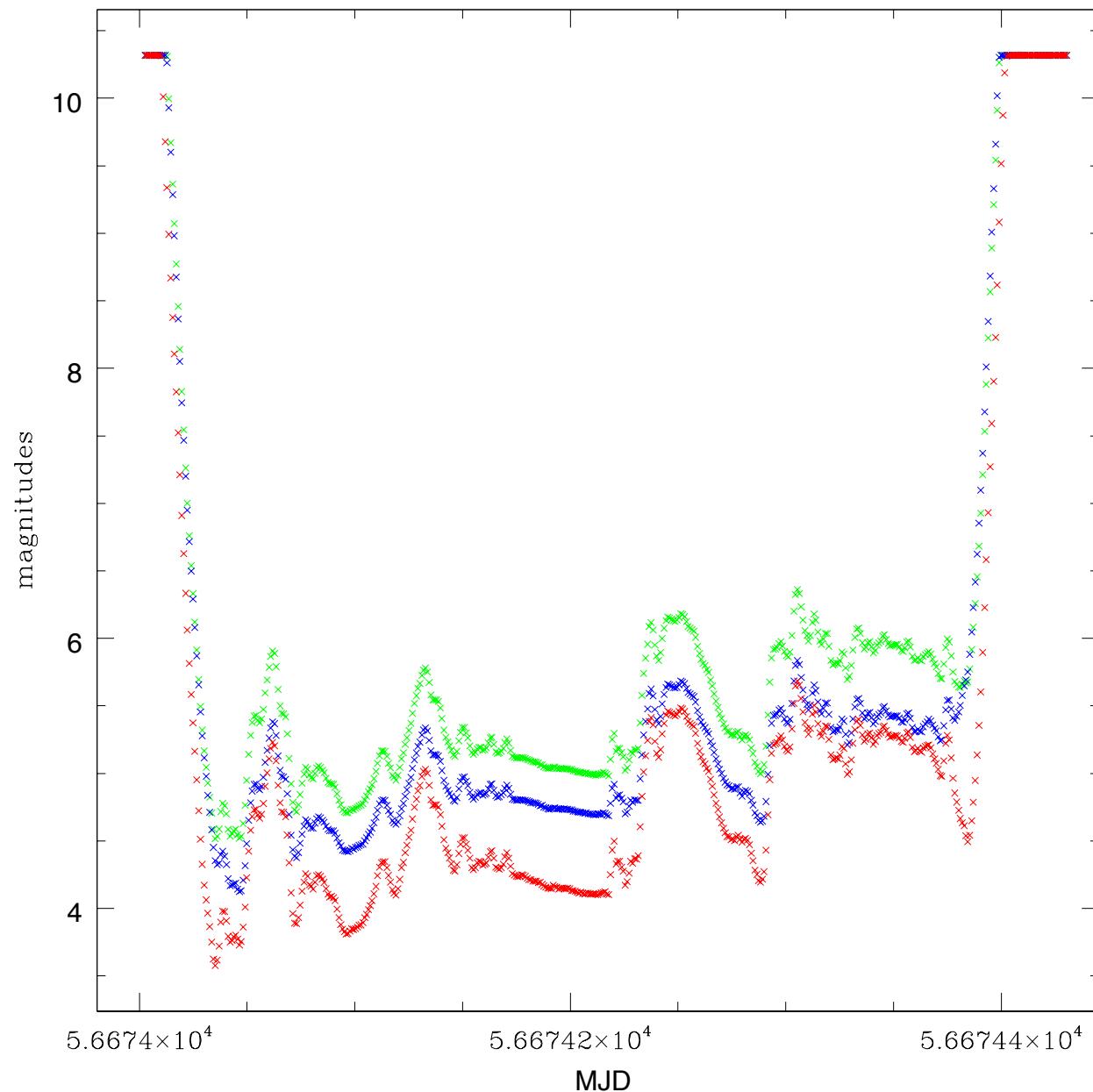
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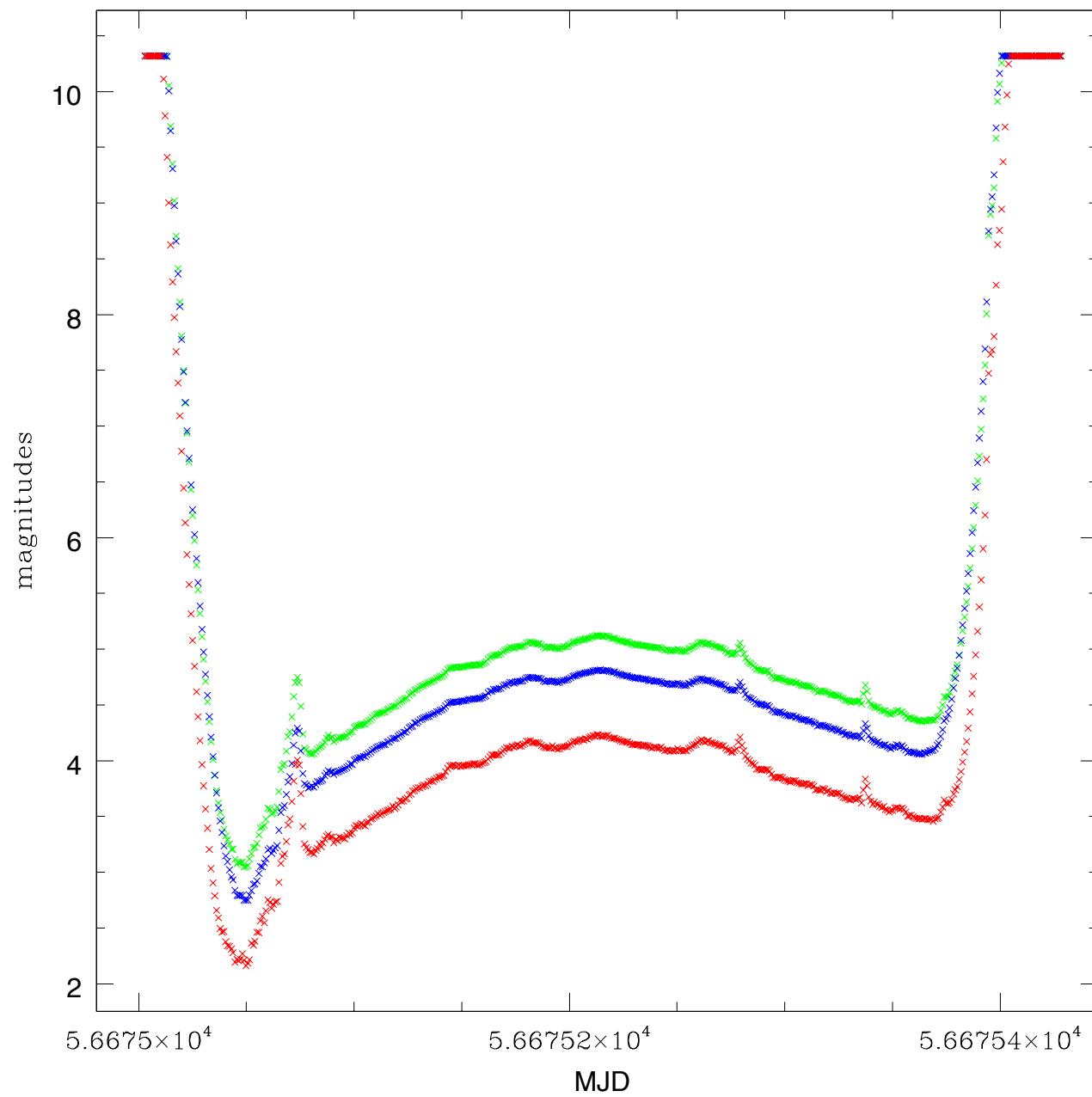
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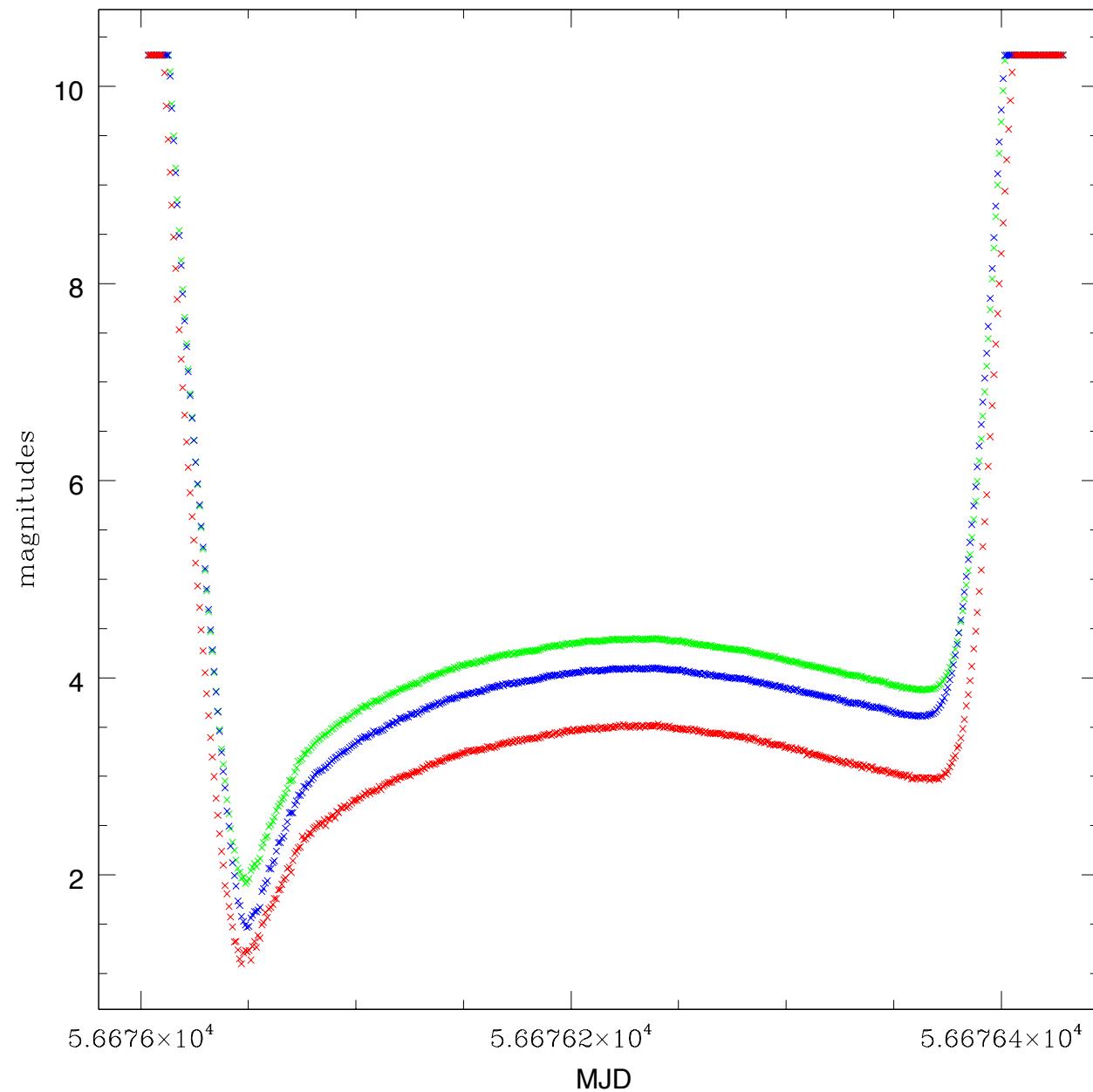
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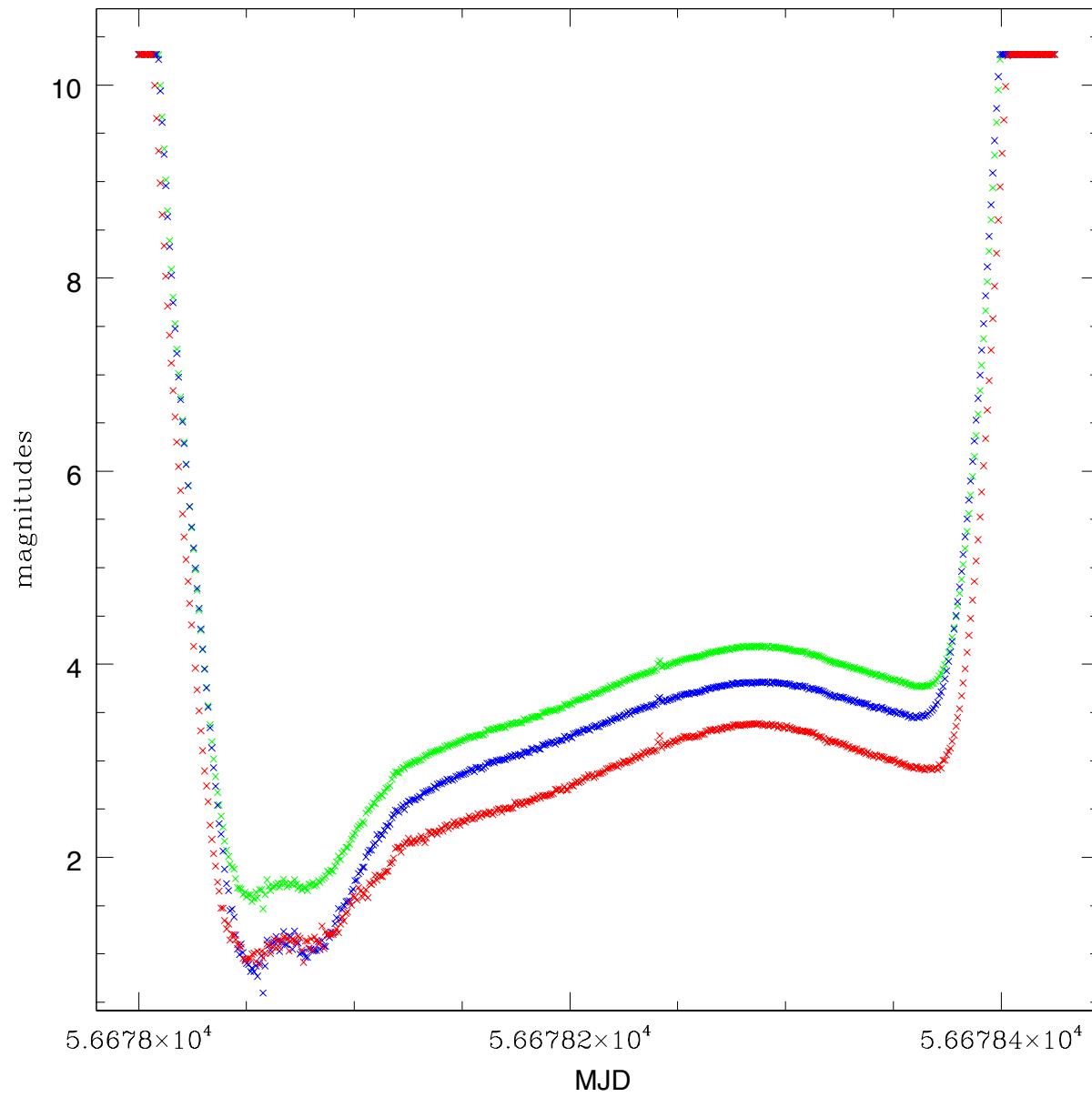
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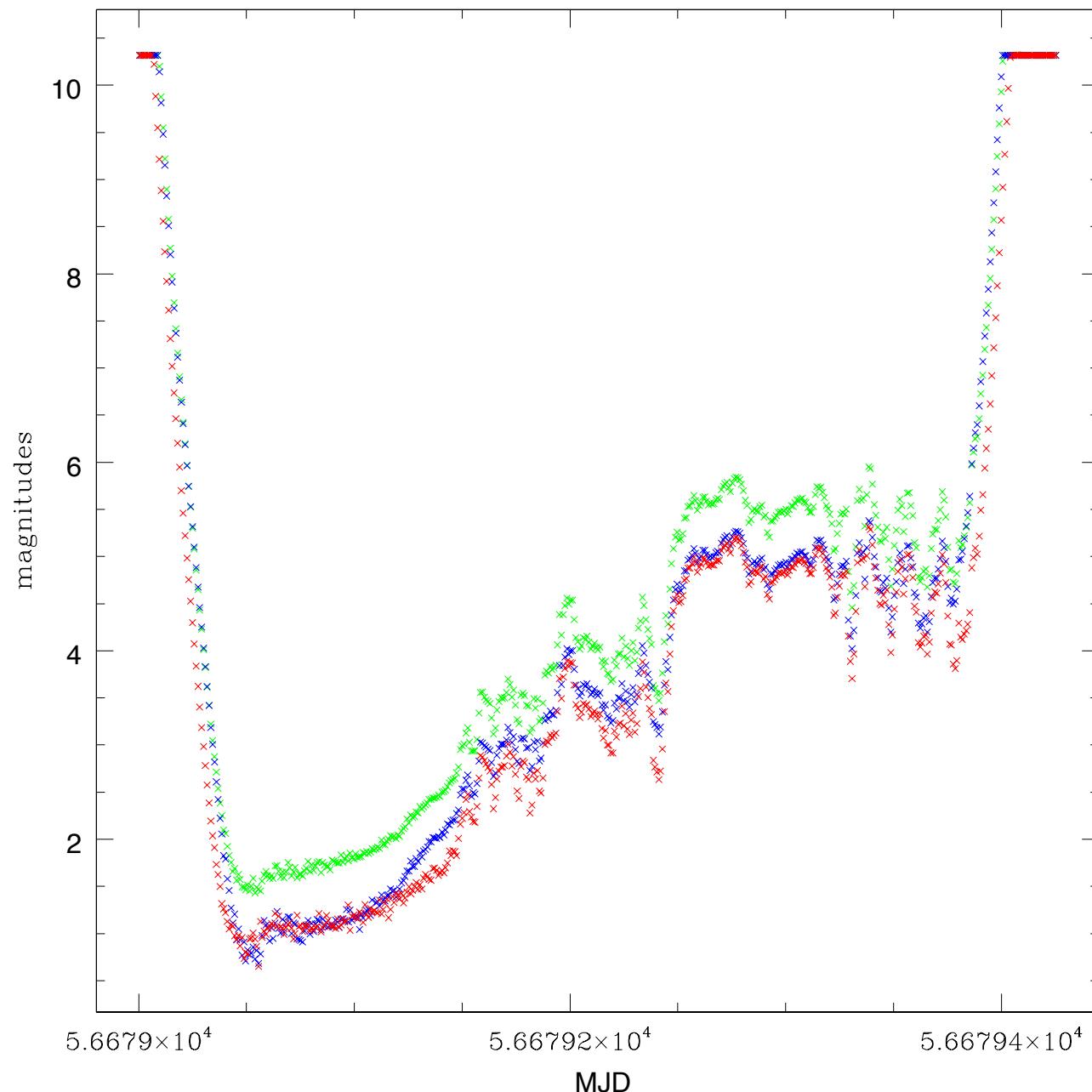
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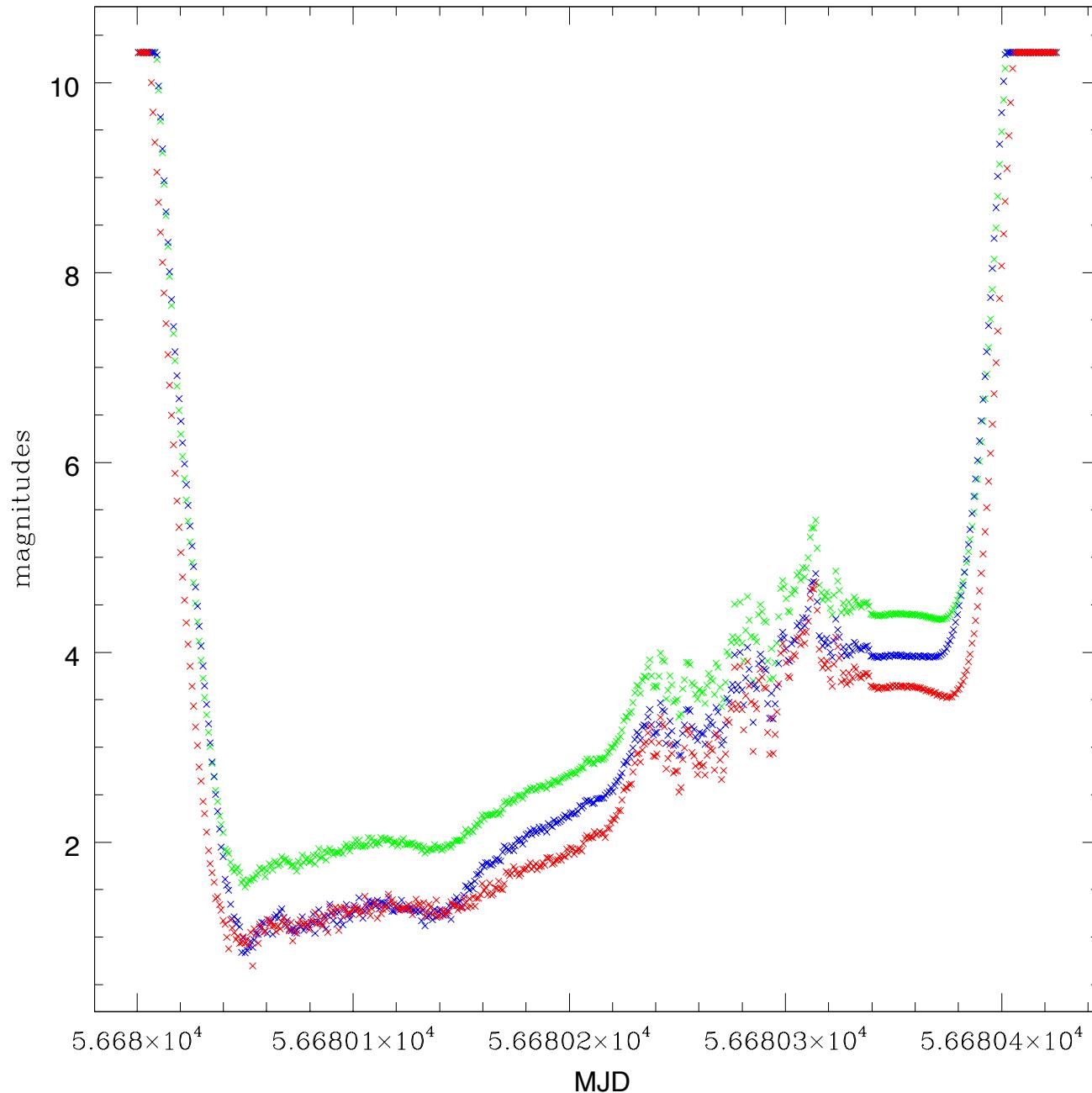
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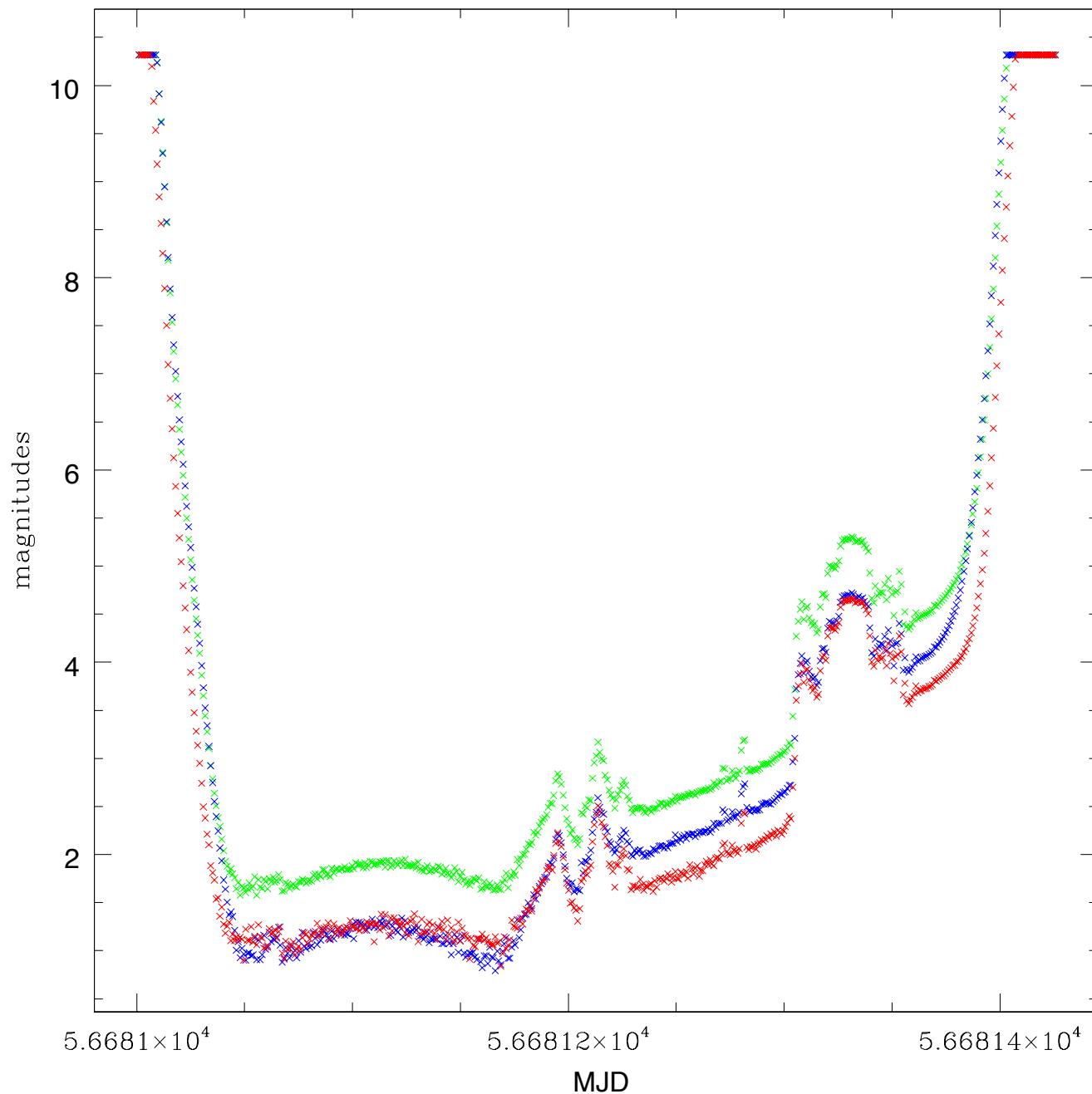
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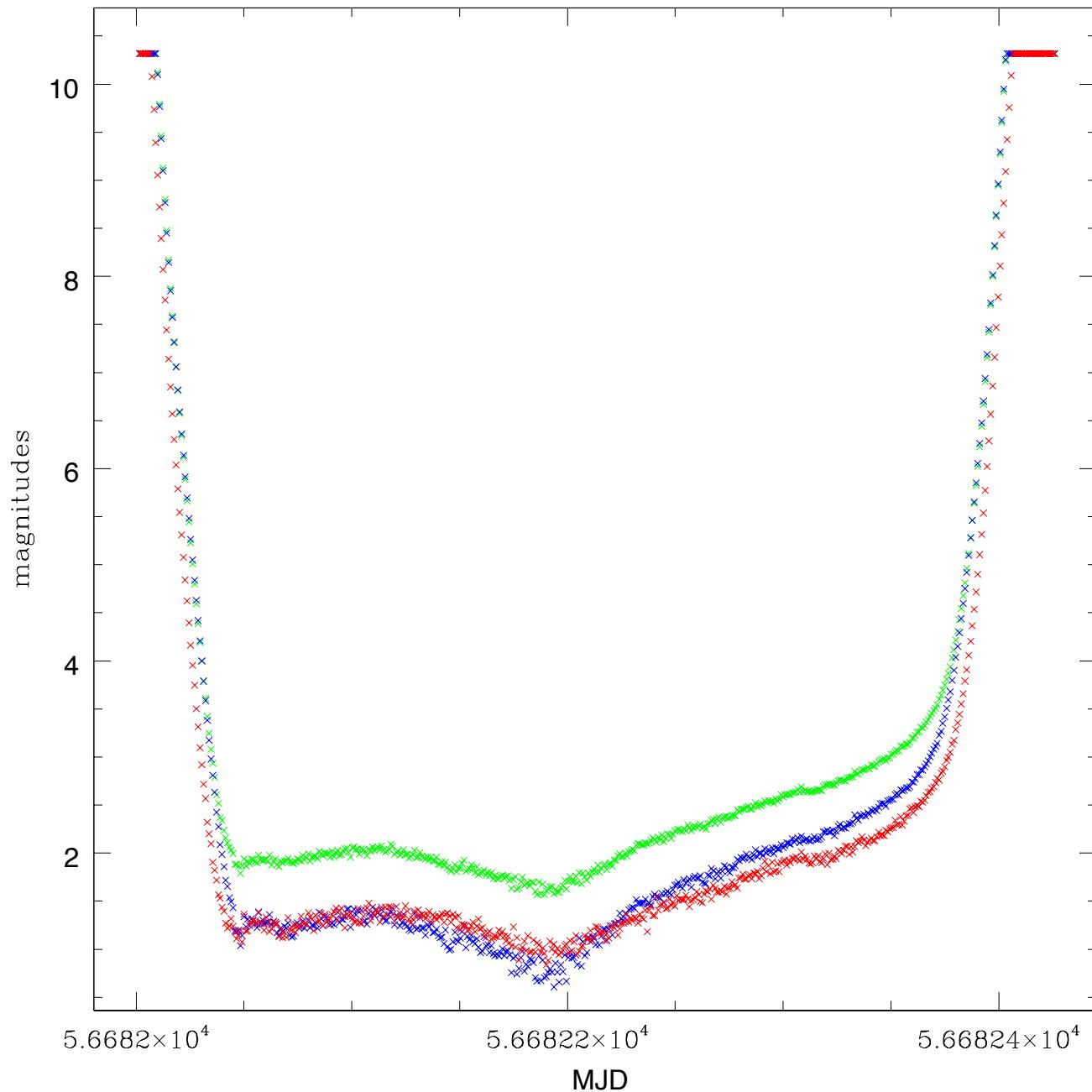
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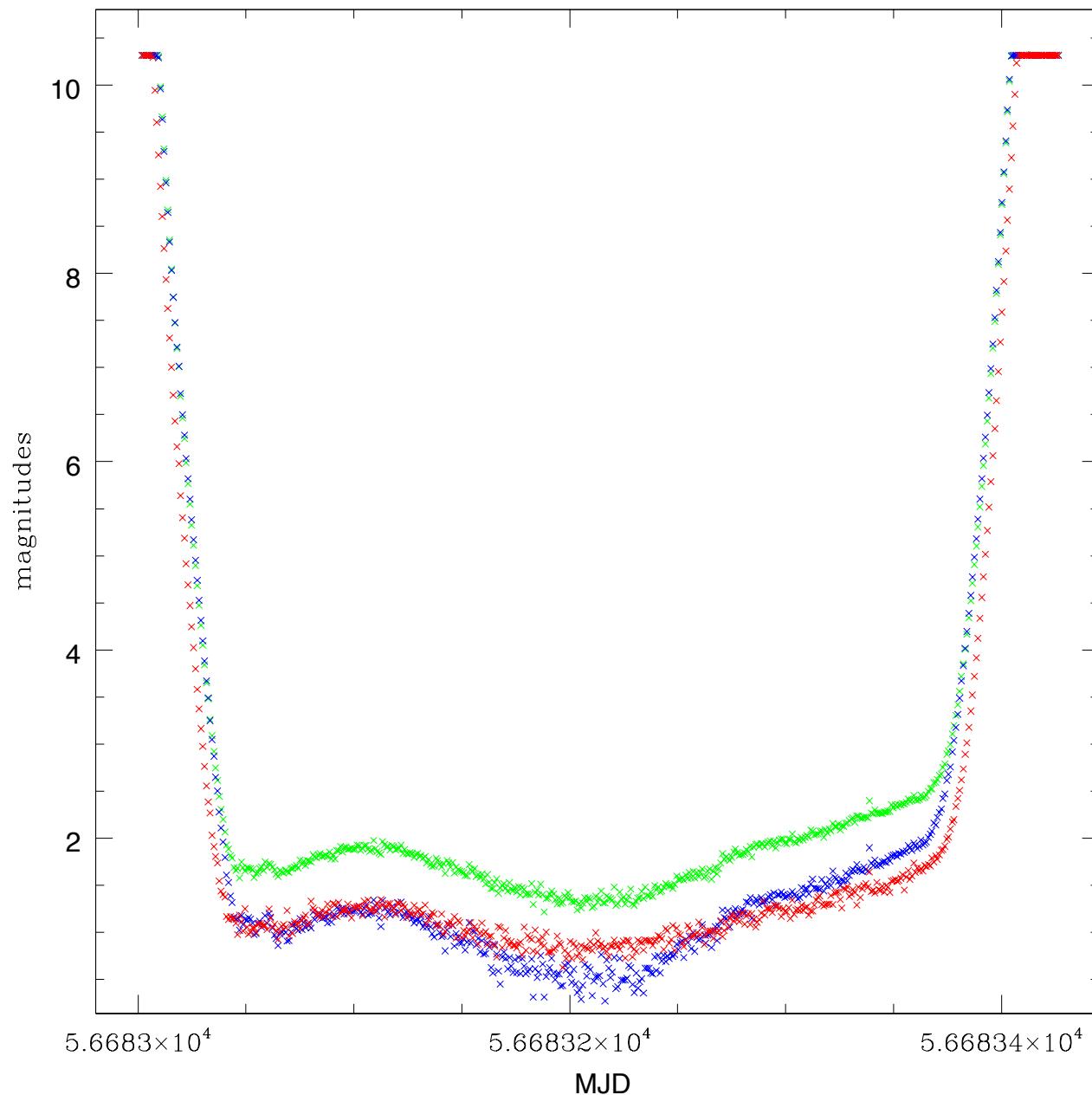
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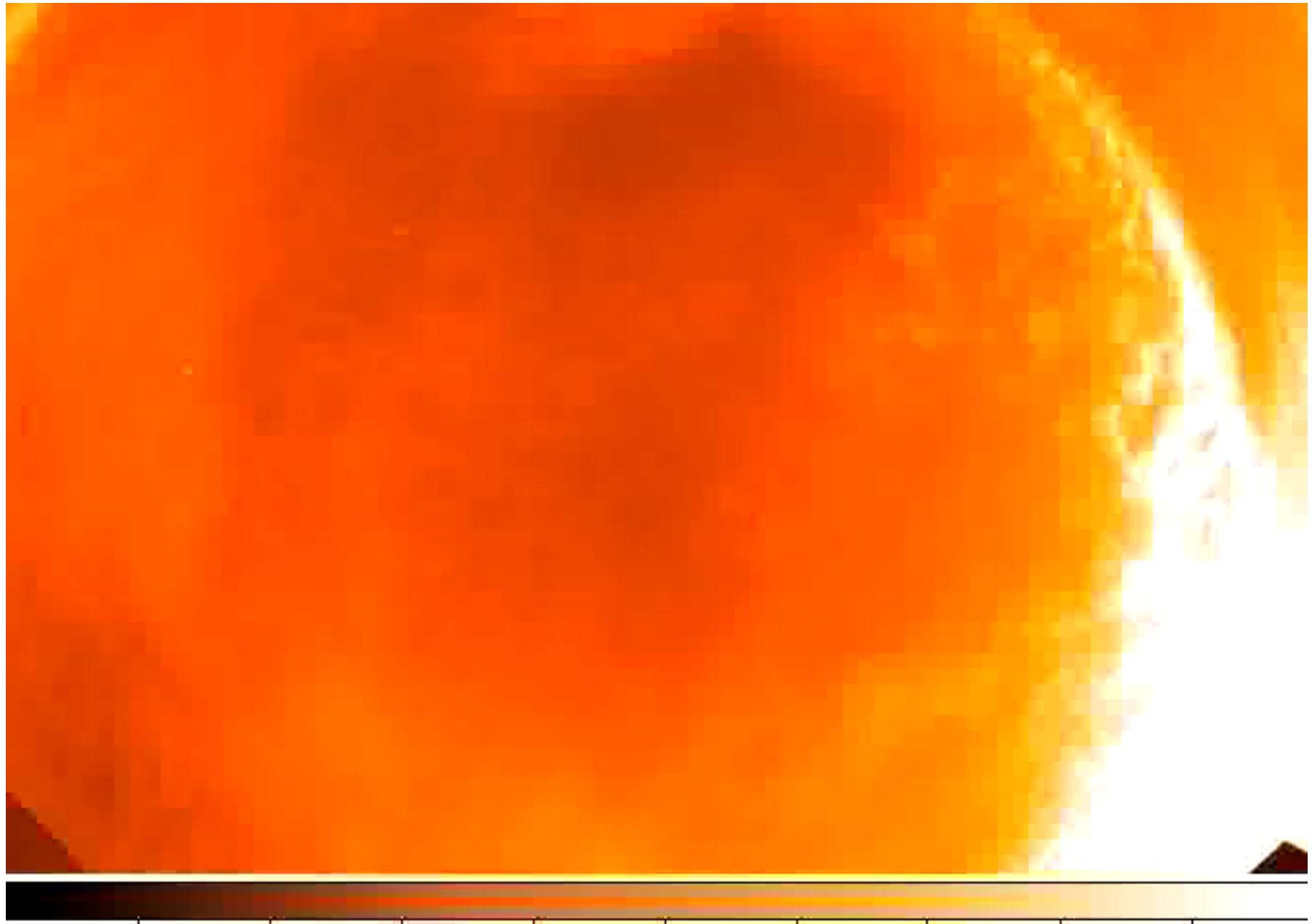


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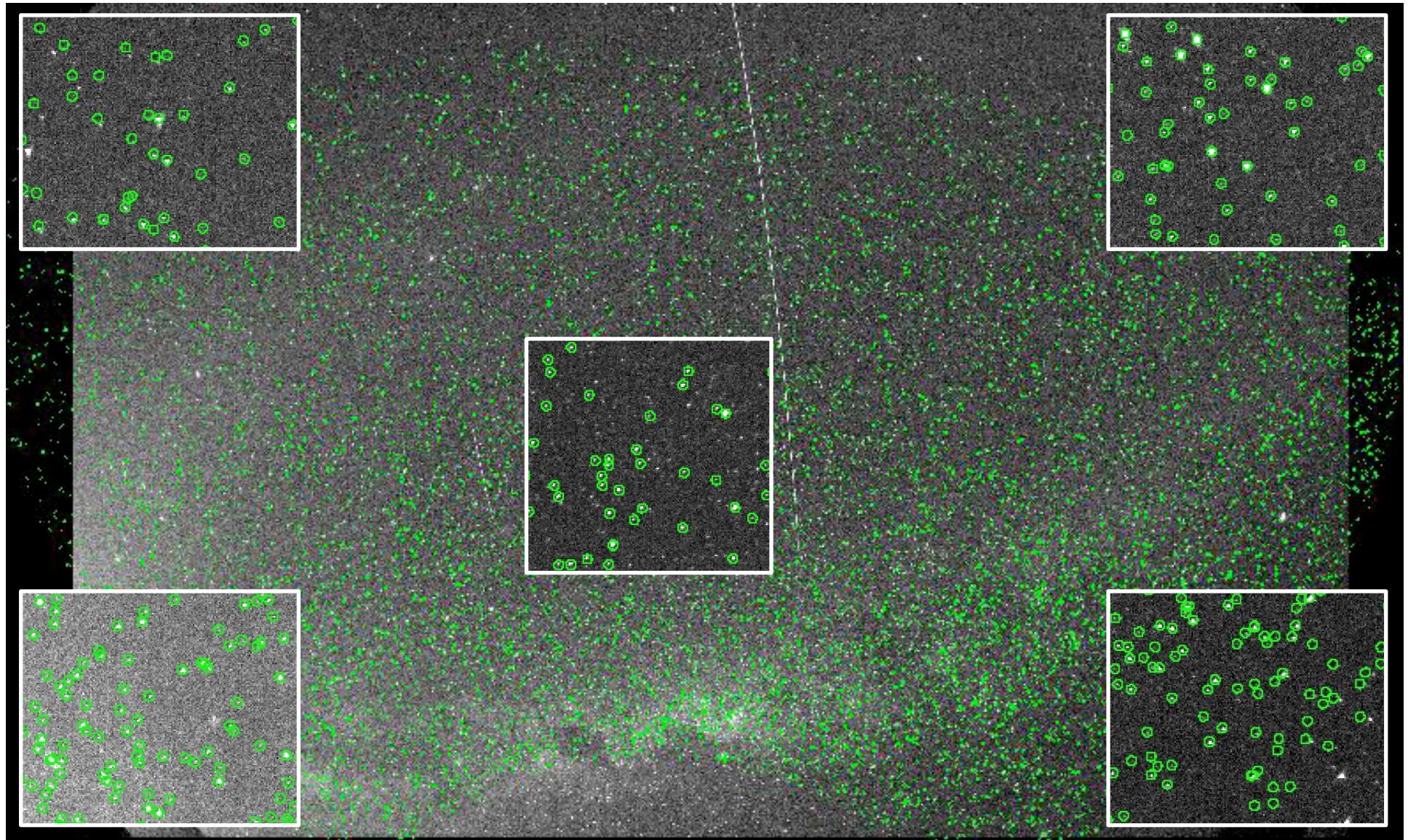


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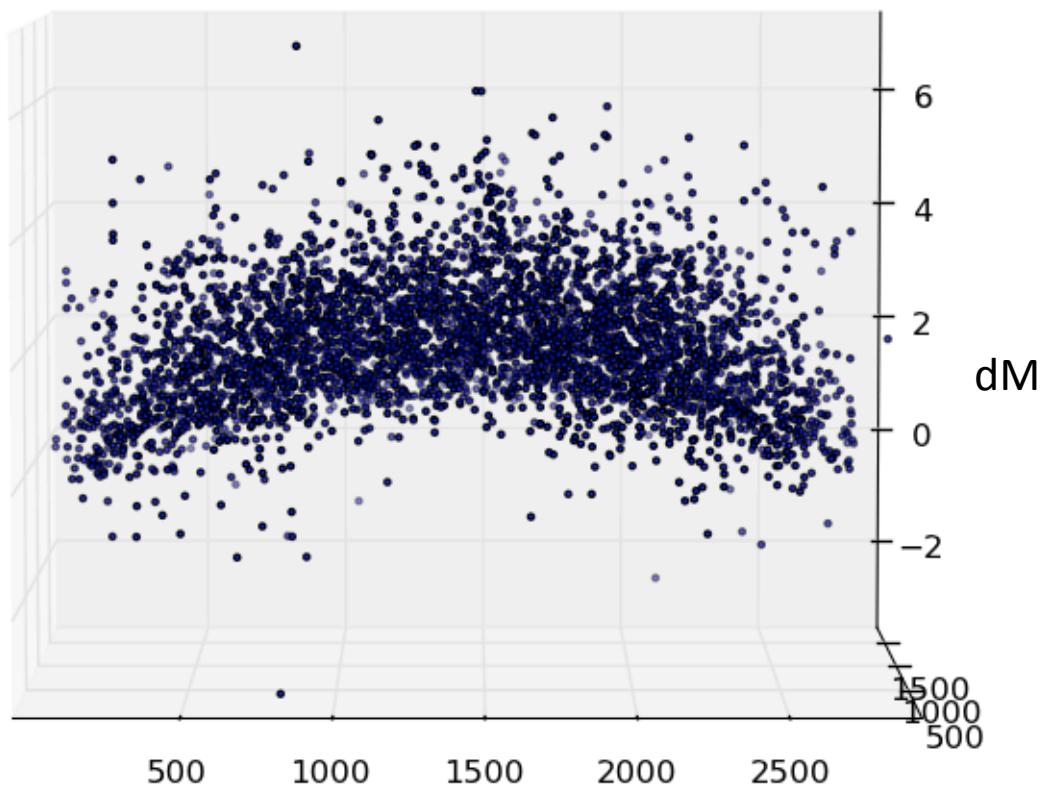


# Towards All-sky Astrometry



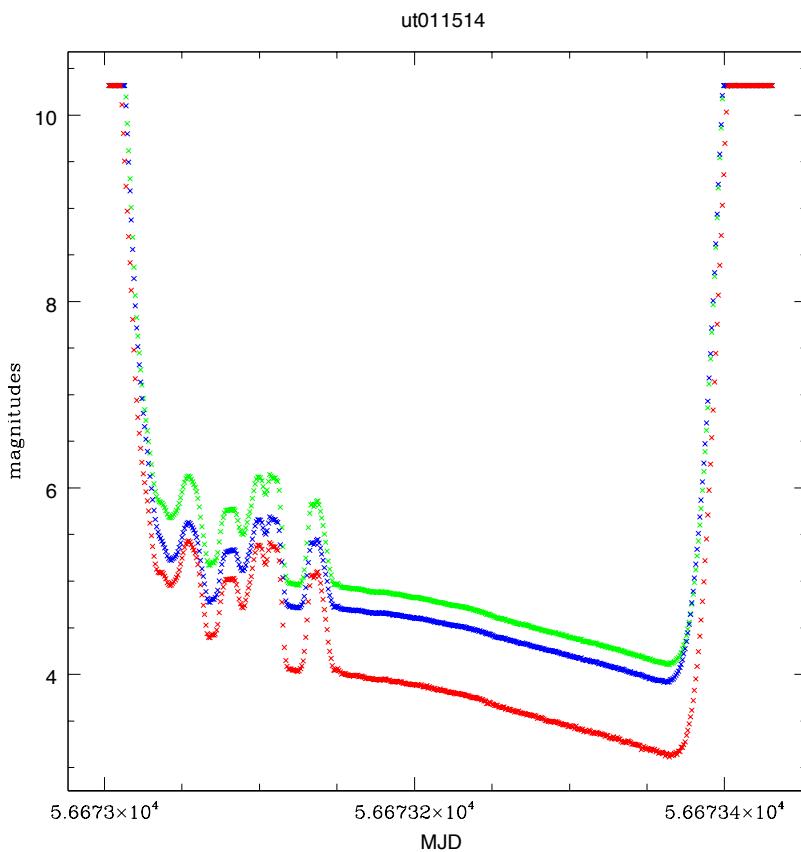
RMS fitting error  $\sim$ 60arcsec ( $\sim$ 1/3 pixel) with 7<sup>th</sup> order polynomial

# More work to do on the photometry

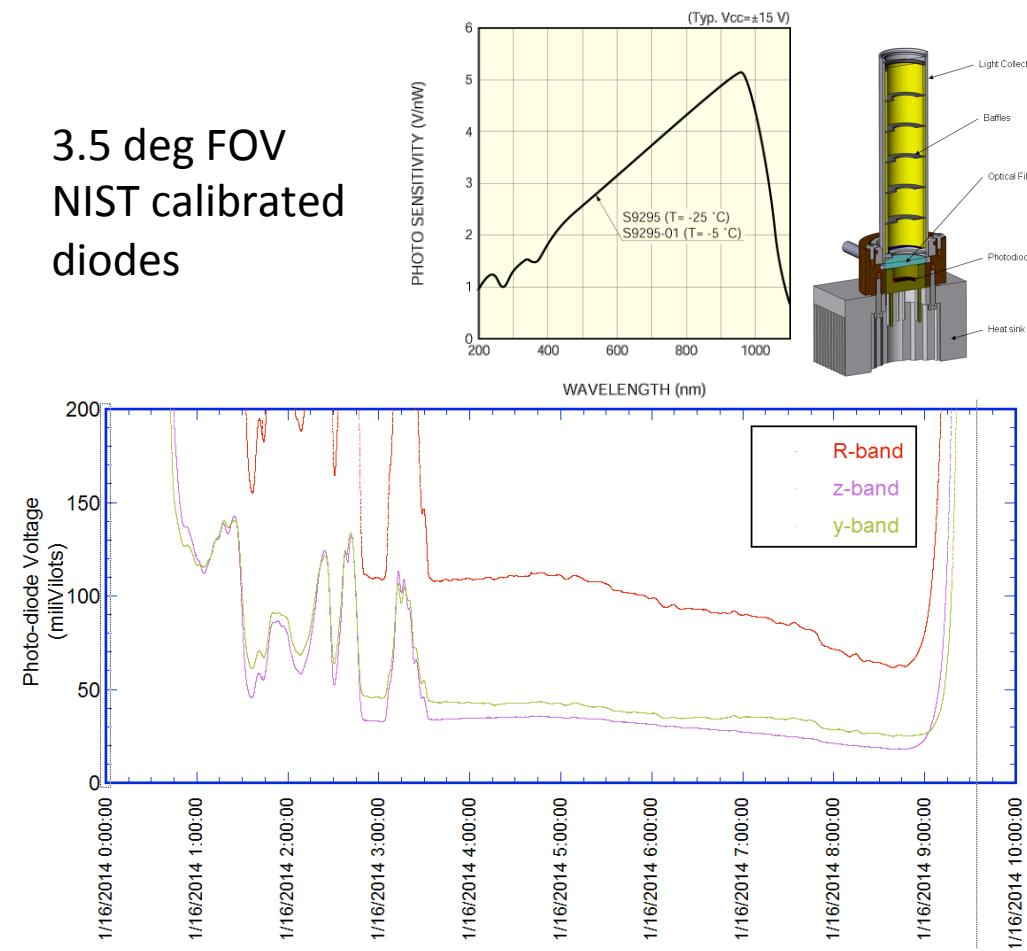


$$dM = M_{\text{SAO}} - M_{\text{tphot}} + ZP$$

# Photo-diode measurements



3.5 deg FOV  
NIST calibrated  
diodes



Extends zenith measurements to the red with LSST 'z' and 'y' band filters.

# Goals

- Finalize astrometric aspects, x,y to Ra, Dec
- Refine photometry over full sky
- Deploy photodiodes permanently
- Map out attenuation in magnitudes
- Determine 2-d profile of 5 sigma point source magnitudes
- Obtain this information for all nights
- Continue to obtain nightly m5 maps
- Transmit this information to OpSim and ImSim