Analysis of Dust Spots with TS8 Data

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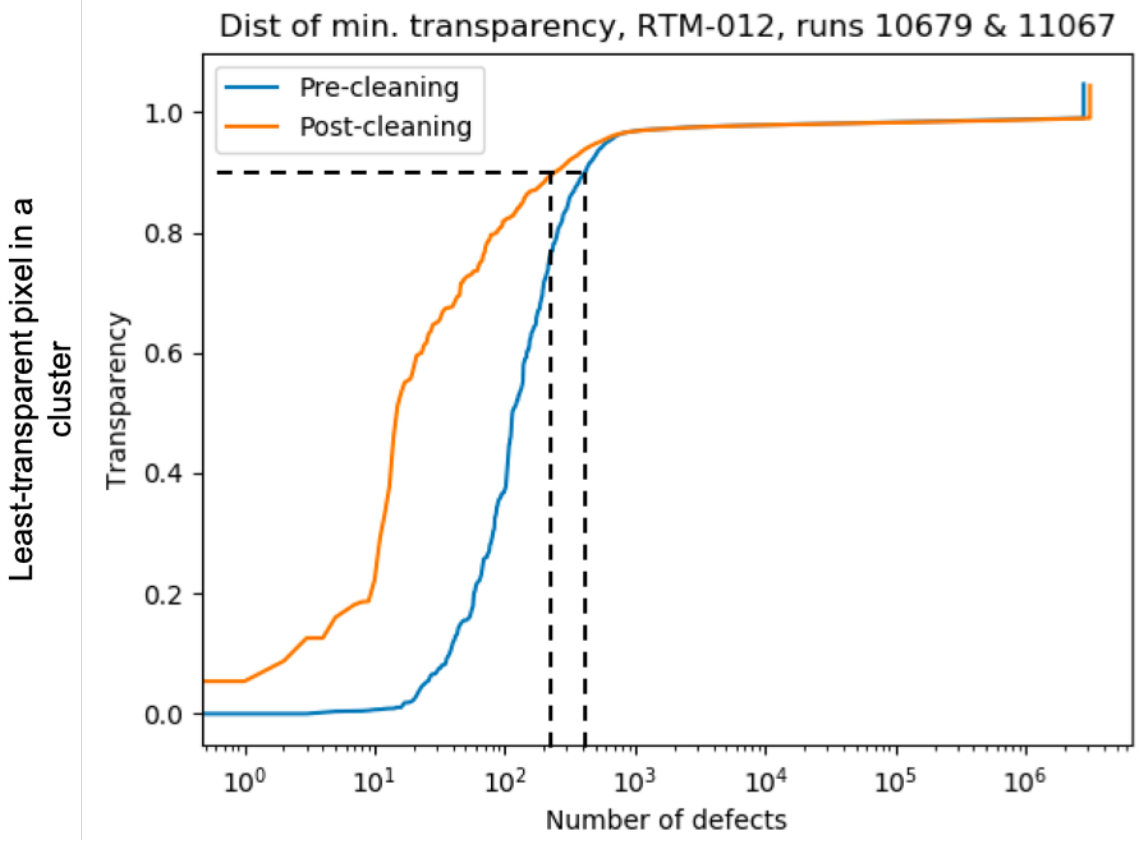
Dust on LSST camera science rafts

- Examination of electro-optical CCD test data for science rafts shows ‘dust spots’ as localized (few-10s of pixels) deficits in response.
- These are typically studied using superflat images, for best signal to noise
- The CCDs in science rafts have generally be subjected to several rounds of electro-optical testing, before and after integration into science rafts
- The general trend is a steady increase of ‘dust’ (transparency <90%).
- For this reason, a cleaning procedure was developed to remove dust spots before science rafts are installed in the focal plane.
- Here we assess the wavelength dependence of opacity for dust spots and how it changes with cleaning.

Test data: RTM-012

- This science raft was tested before and after the cleaning procedure
- The next slides shows the cumulative distributions of minimum transparency for dust spots before and after cleaning
  - The dust spots were found using the DM tools to find 'footprints' in an inverted superflat
- The `SuperflatRaft` task builds builds these footprints (subject to a threshold criteria) and stores them in an *astropy* table
  - We used transparency > 0.9 w.r.t. amplifier median as our threshold
- Other tasks can loop over these footprints.

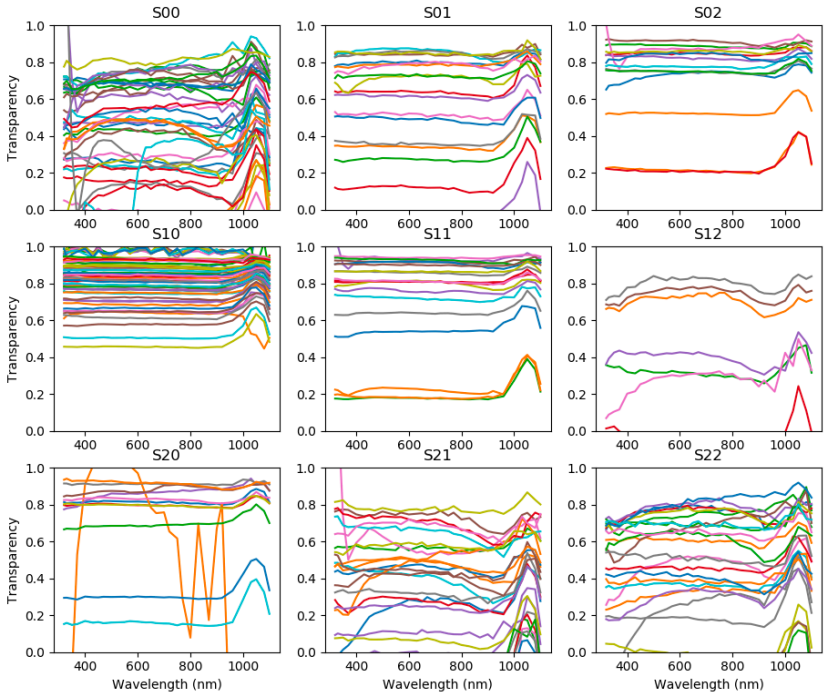
Test data: RTM-012



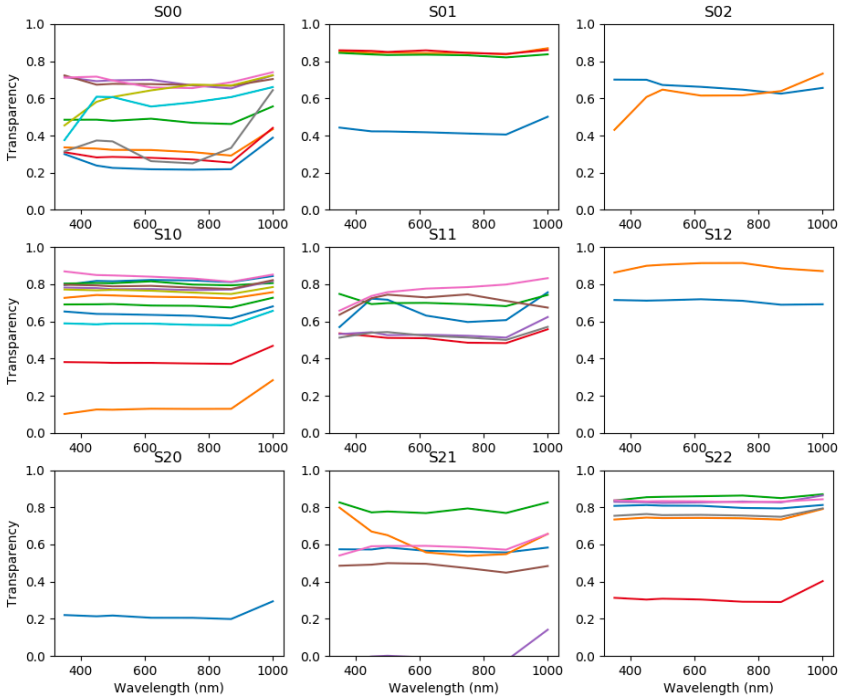
- The dashed lines correspond to a threshold of 90% transparency
- The cleaning procedure clearly reduced the number of dust spots
- Post-cleaning the number of affected pixels was a few thousand (out of 144M in the science raft)
  - Generally the larger and darker spots were removed

The color of dust in RTM-012

Before cleaning



After cleaning



- The standard electro-optical test data include flats obtained at a sequence of wavelengths
- Applying the same superflat dust footprints to these data yields the transparency curves (shown for individual CCDs below)

Notes on the color of dust in RTM-012

- The **Before** data set has many more individual wavelengths than the **After** set
- The transparency of the dust spots generally does not depend strongly on wavelength – the dust is ‘gray’
  - The **Before** data set suggests a systematic increase of transparency near 1050 nm; this may be affected by order leakage in the monochrometer

Summary & Next Steps

- The cleaning procedure clearly reduced the number of dust spots
- Post-cleaning the number of affected pixels was a few thousand (out of 144M in the science raft)
  - Generally the larger and darker spots were removed
- We have actually code run code to identify dust spots on all the good TS8 runs
- However, we are installing rafts and will not be cleaning other rafts
- I suspect we are best off just cataloging and counting the dust spots and moving on to other topics