PACCD-2016 Conference Summary

Robert Lupton

2016-12-02

New Astronomical Devices

We heard about new or rapidly developing technology:

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- CMOS

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- HgCdTe

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Should we be more scared or excited?

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Mostly the CMOS (including HgCdTe ROIC) talks were comfortingly familiar; just like a one-pixel CCD

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Talk of reciprocity failure took me back to a an era that finished just before I started my PhD. I was not happy.

But we're pushing the limits…

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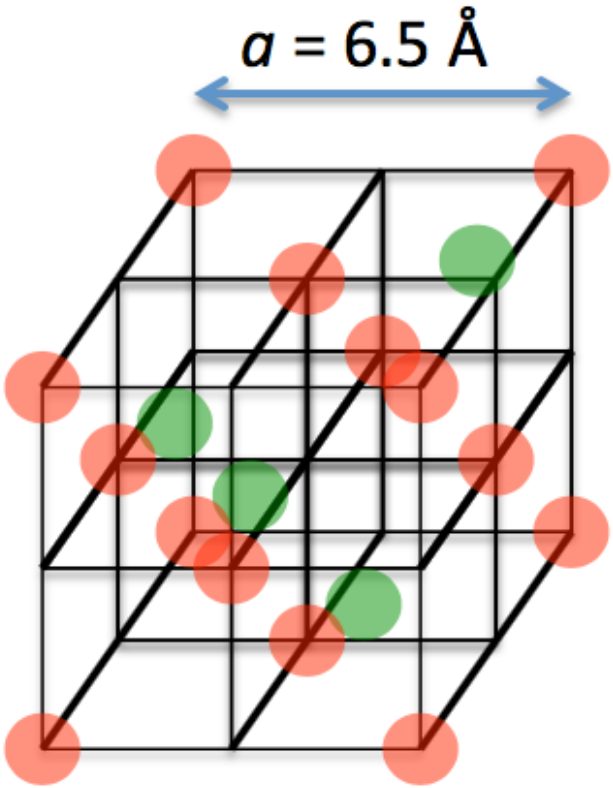
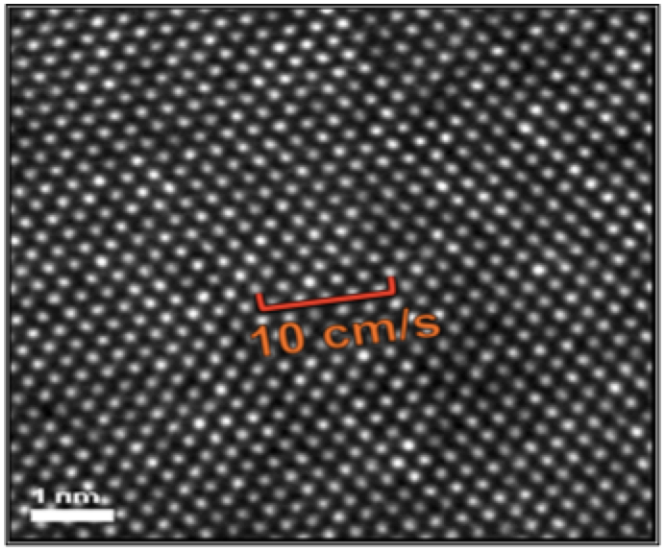




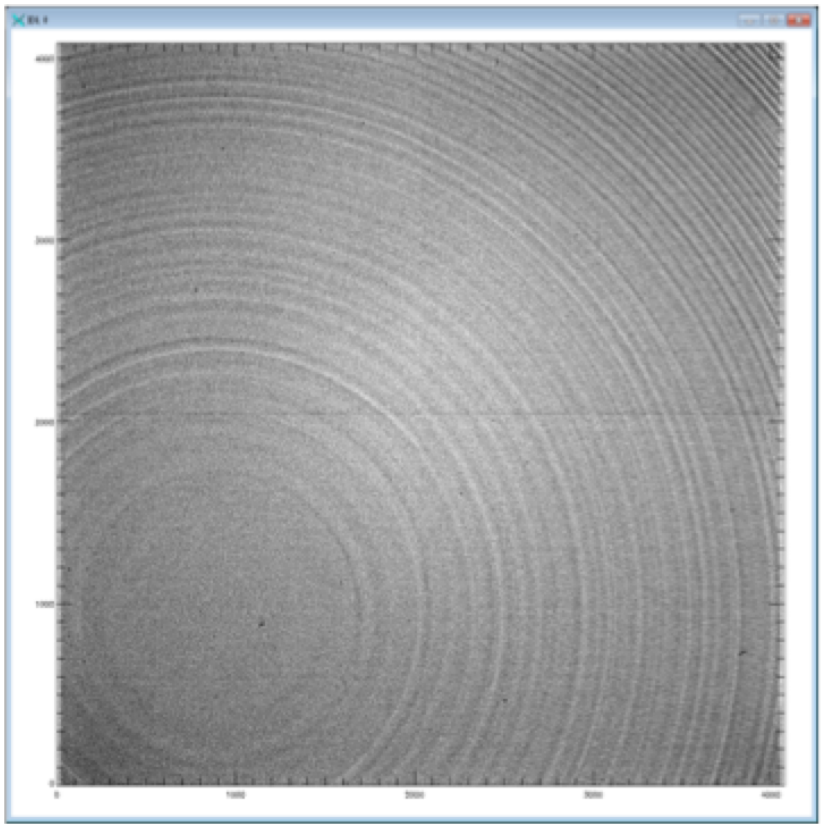
Strategy for Systematics

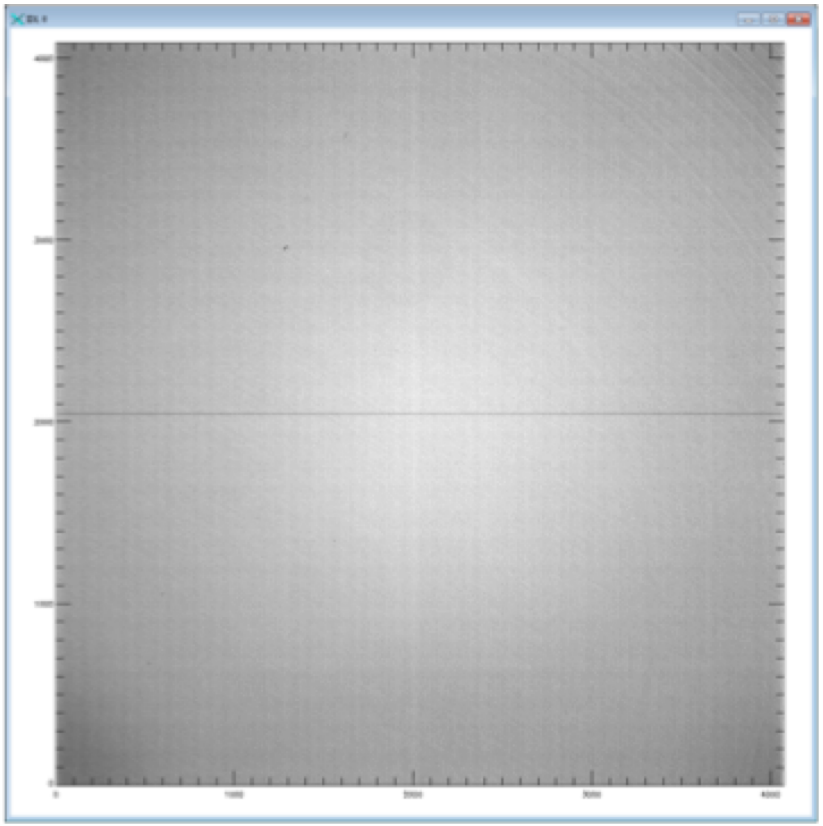
Strategy for Systematics

LAYER	PROCESS
1	*Eliminate the physics causing the effect (but not always possible).*
2	*Develop a first-principles model (but again, not always possible).*
3	*Develop an empirical model based on stars or external calibration data (may capture multiple pieces of physics simultaneously).*
4	*Mask affected data (if a small number of pixels are affected, e.g. persistence, cosmic rays …).*
5	*Statistical corrections based on science galaxies (e.g. de-trending with respect to position on focal plane).*
6	*Cross-correlations of successive passes over the sky at different roll angles (tile 2x per filter, 3 shape measurement filters).*

Chris Hirata

Fix the physics [and devices]

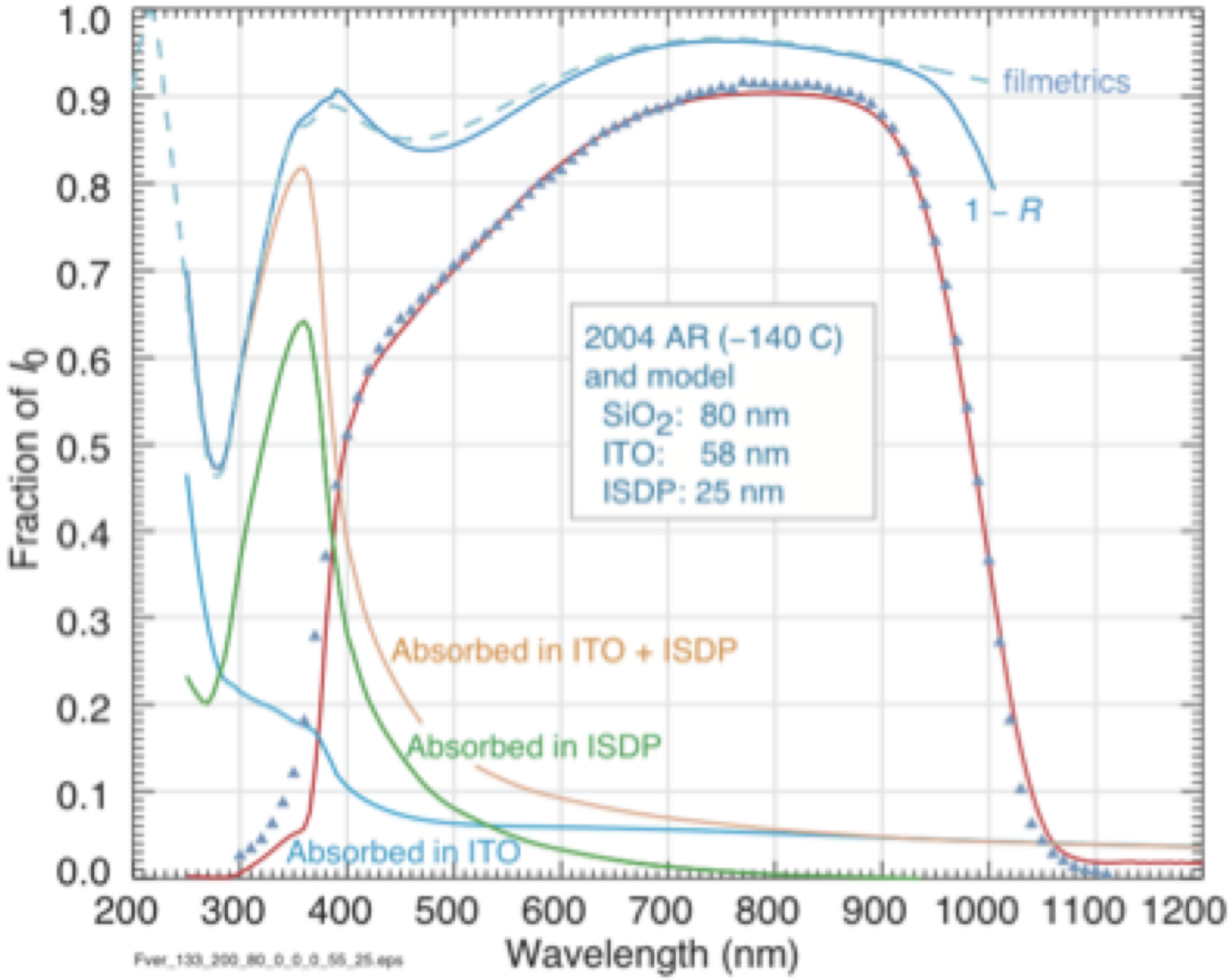




Holland

Fix the physics [and devices]

- QE results with old ITO SiO_2 AR coating



Holland

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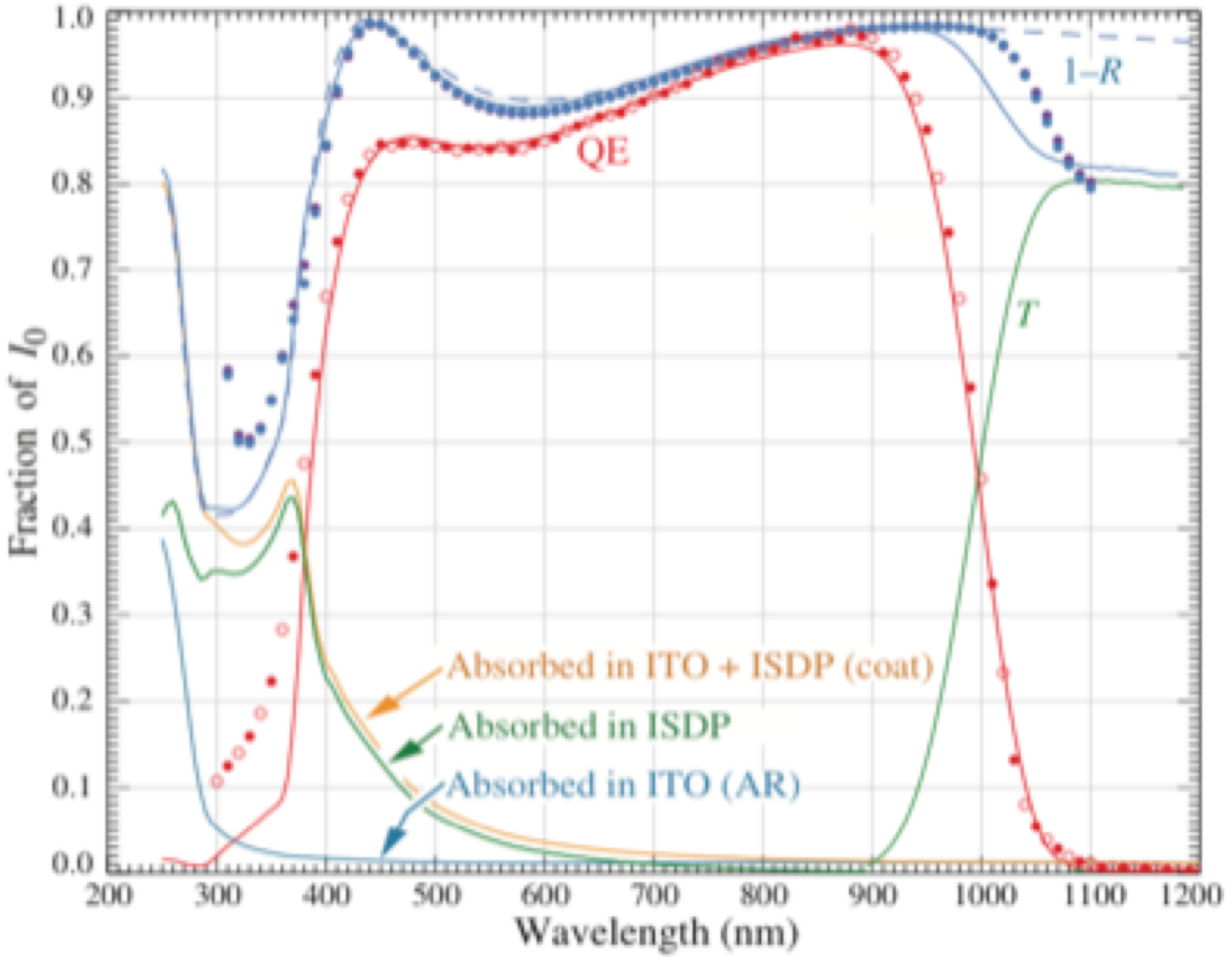
- QE results with ITO / ZrO_2 / SiO_2 AR coat



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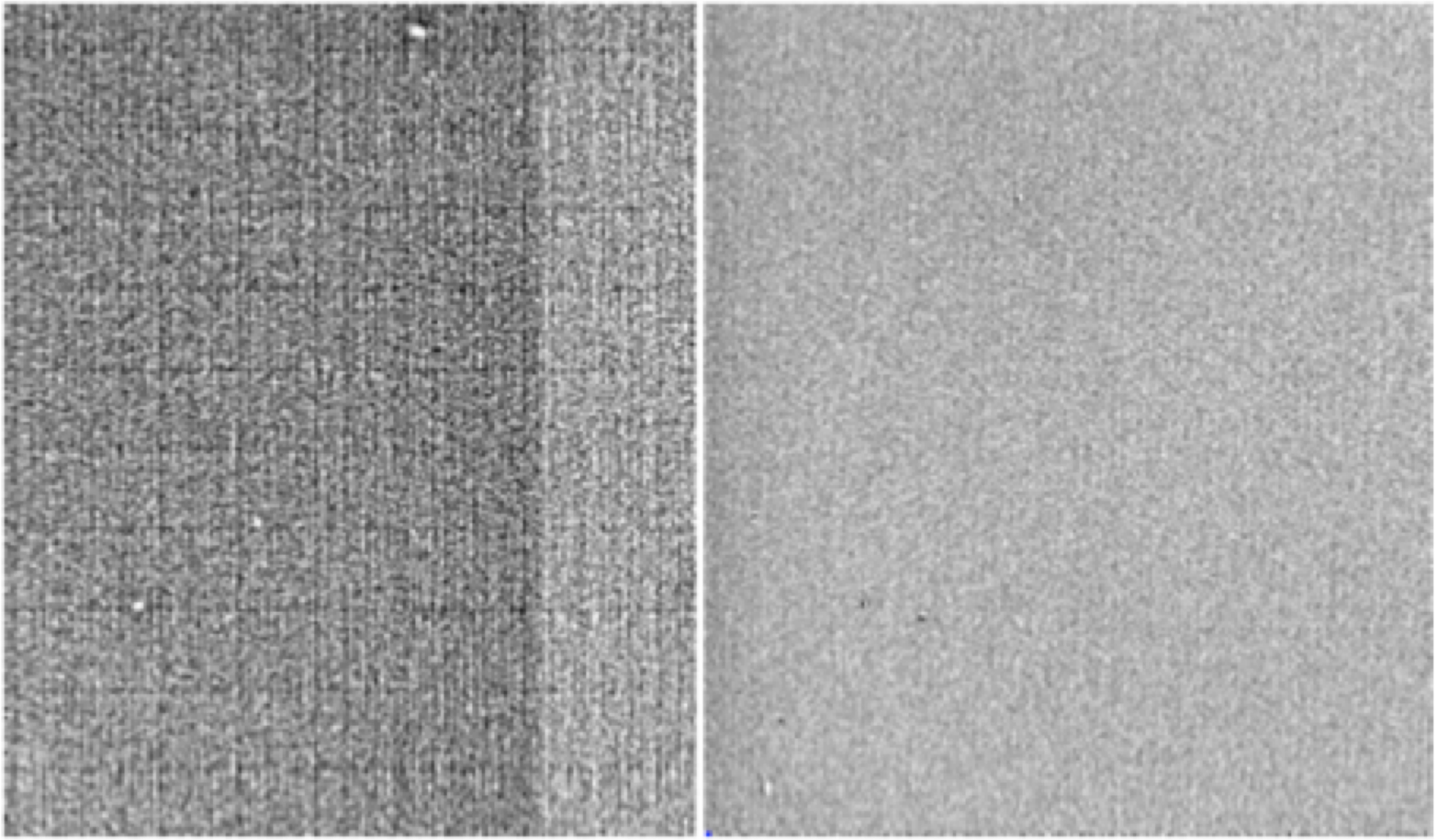
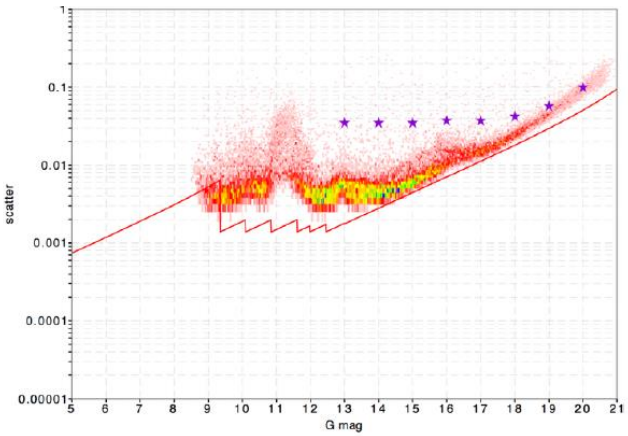
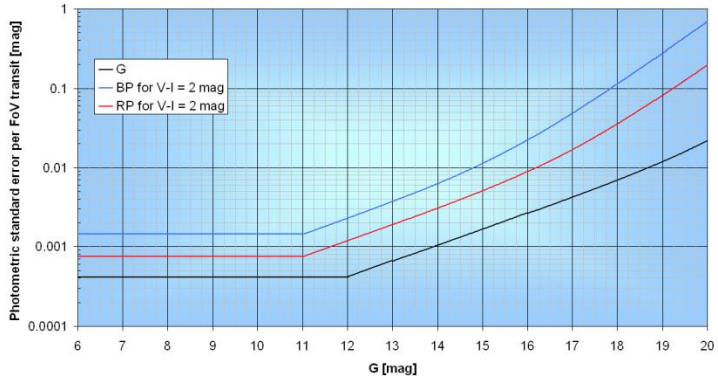


Lesser

Fix the physics [and devices]

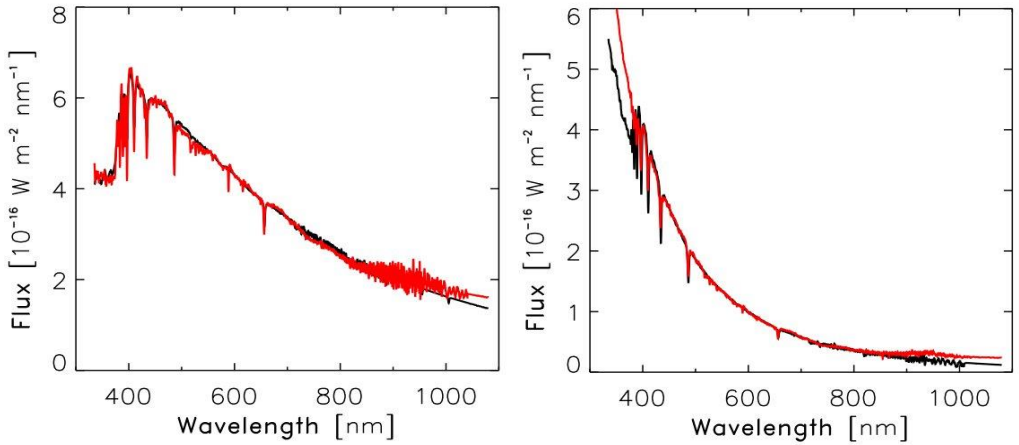


First release, 14th Sep 2016
G passband



Second release, Q4-2017
G_{XP} passbands

Third release 2018 (TBC)
XP spectra



Carrasco

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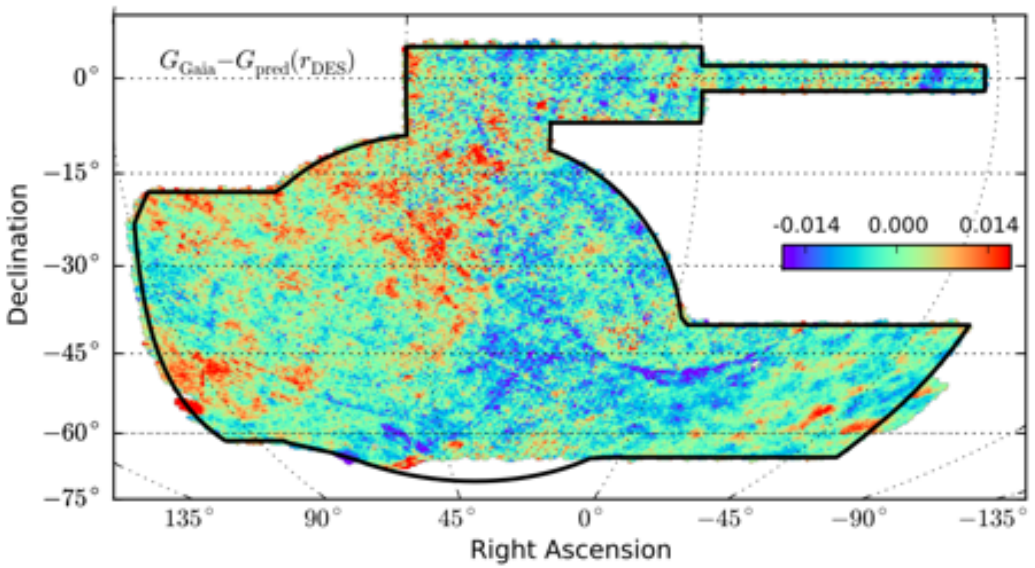
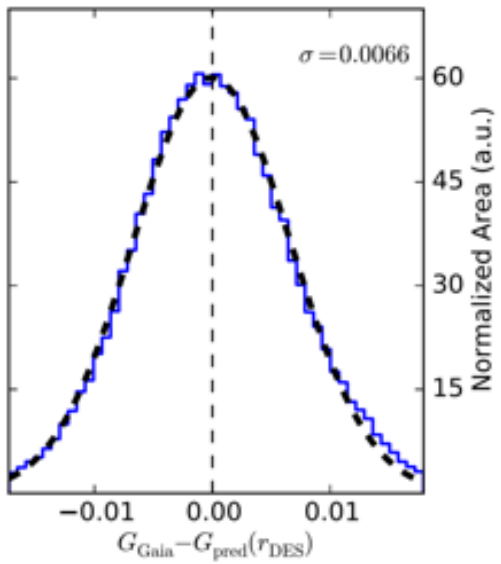
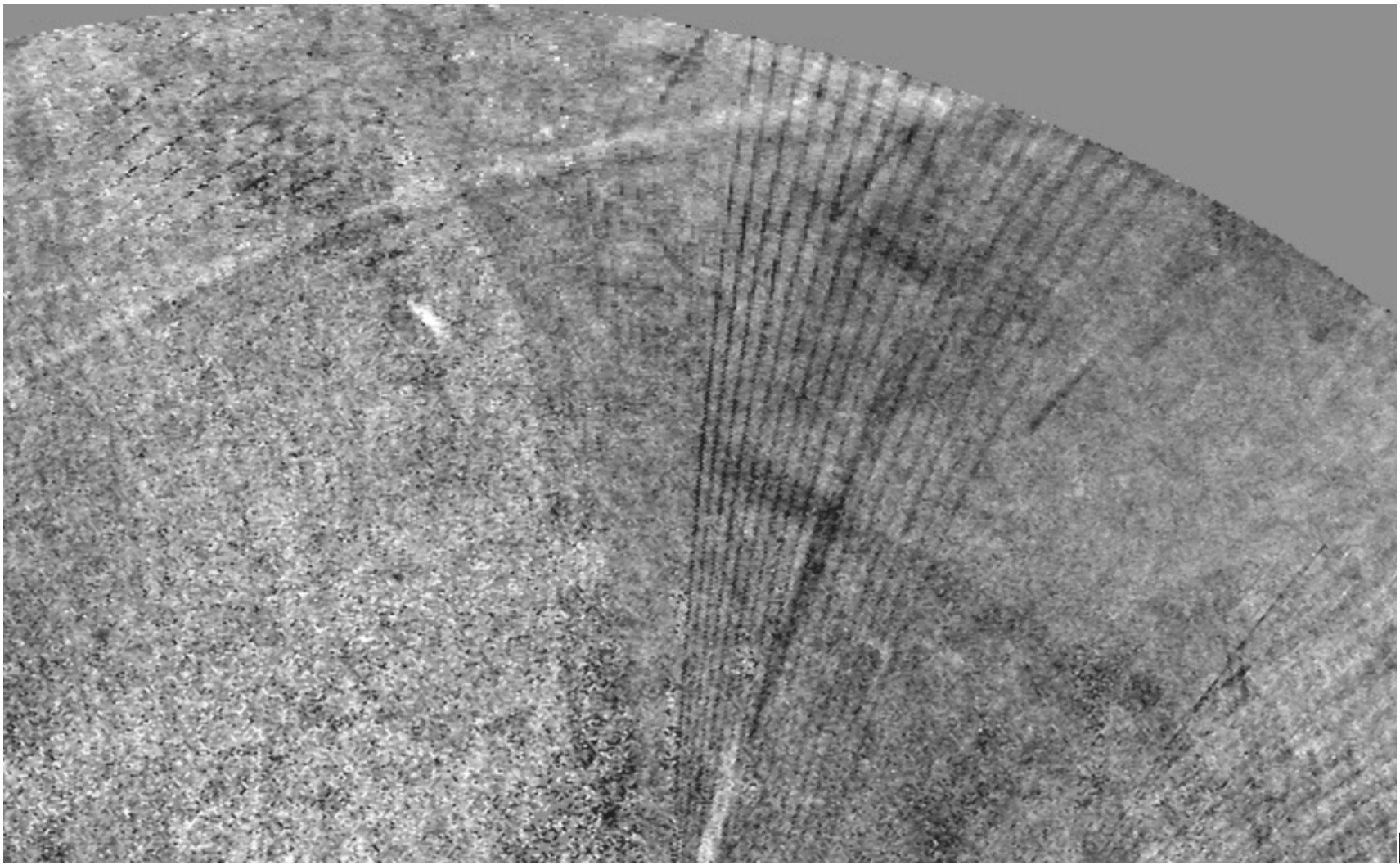




Scolnic

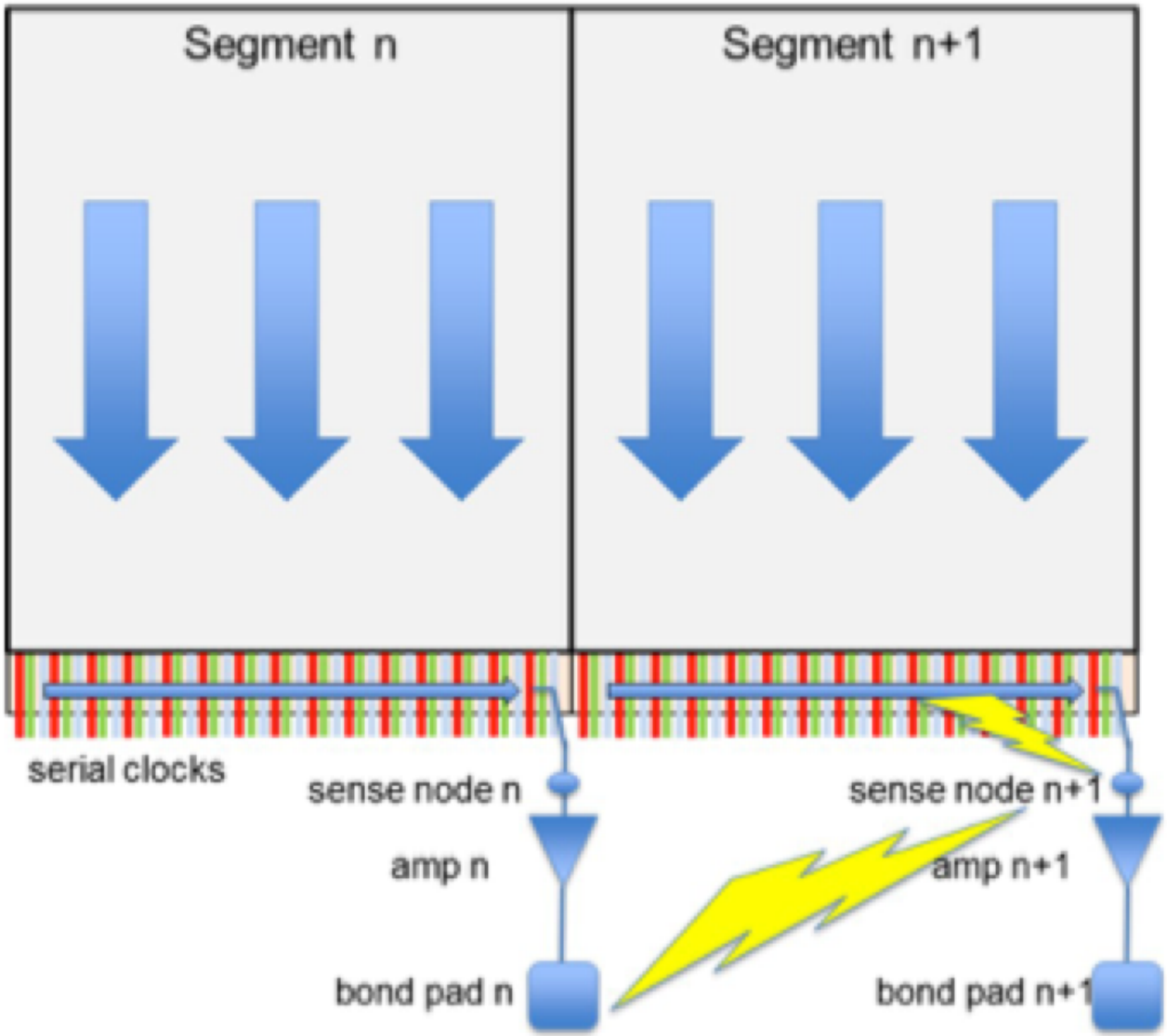
Fix the physics [and devices]

Most residuals are Gaia stripes



Finkbeiner

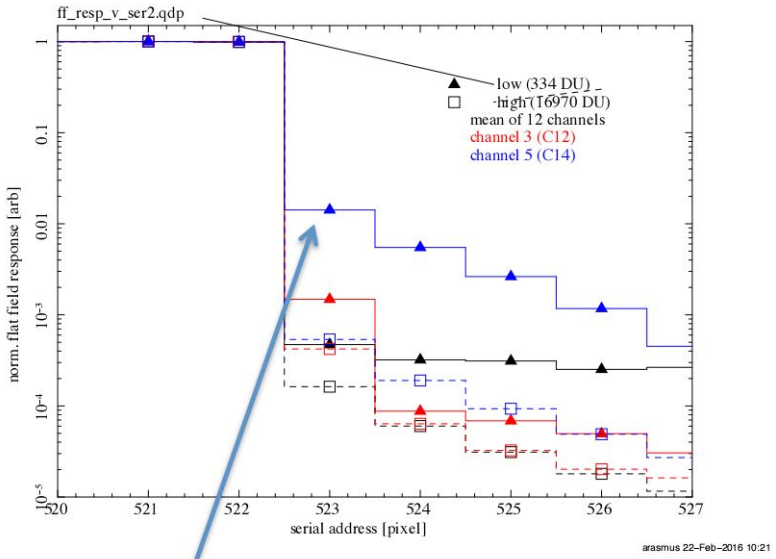
New problems we cause ourselves



O'Connor

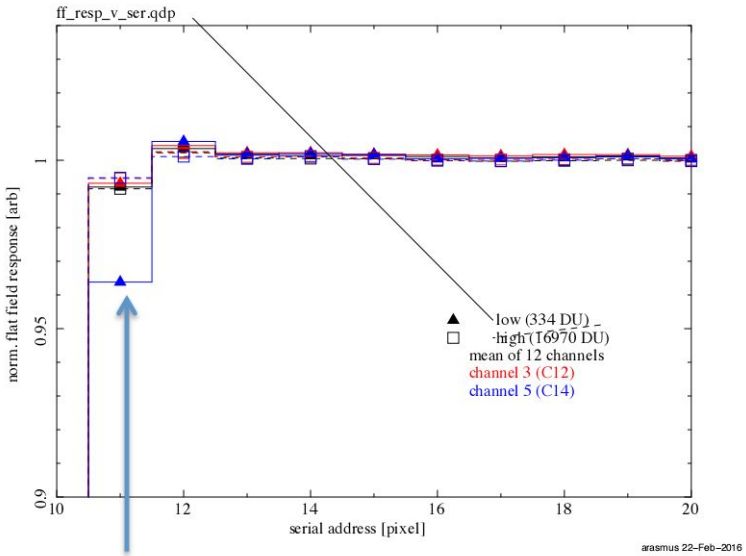
New problems we cause ourselves

Last columns & EPER deferred charge release profile (log scale)



Integrated charge release 2.4% of flat field level p/p, ~1.1 pixel release/de-trapping time constant

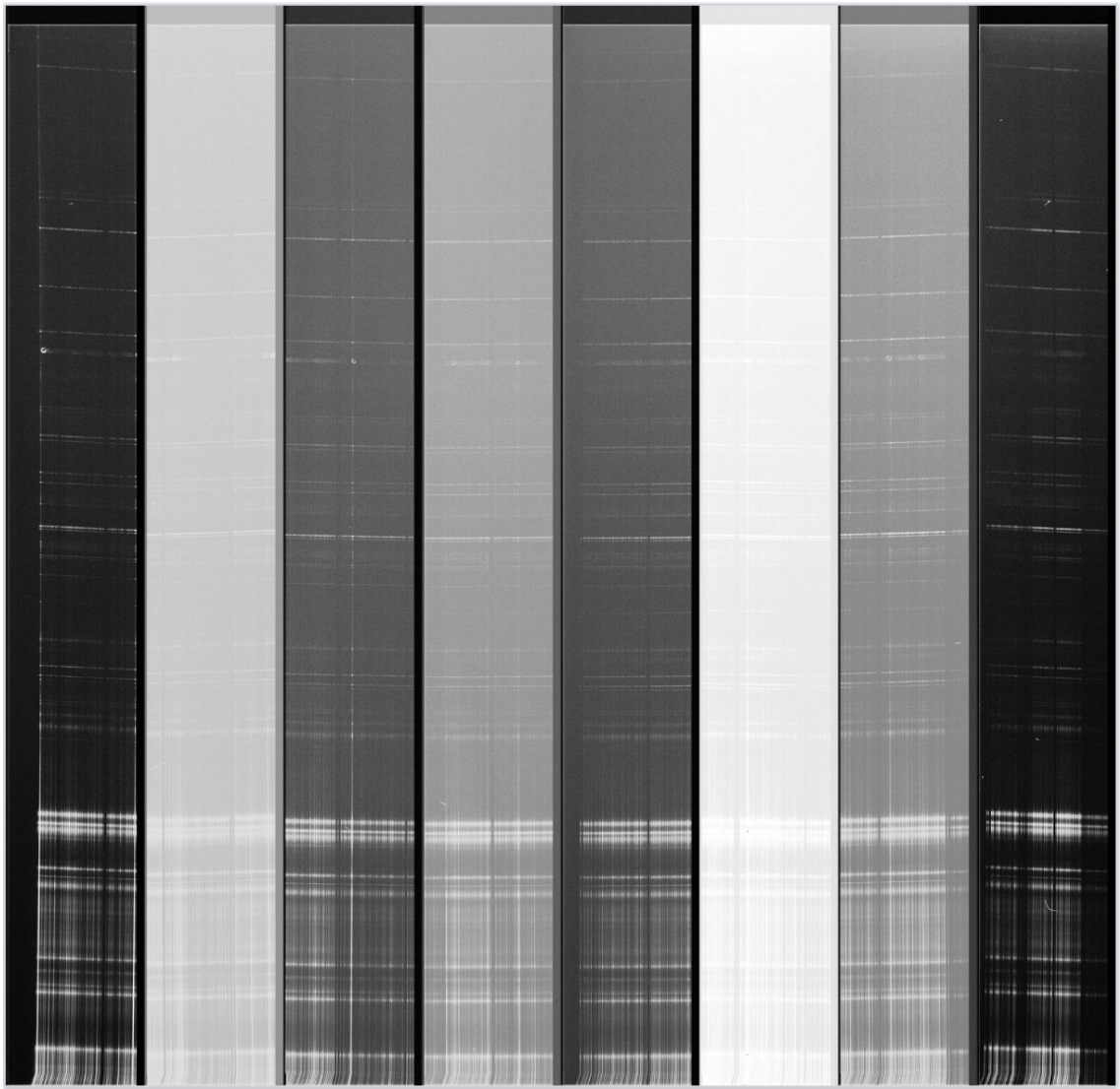
Leading columns & "leading charge loss" (linear scale)



Leading signal loss is between 2.5 and 3.0% of flat field level p/p, trapping time appears to be shorter than de-trapping time

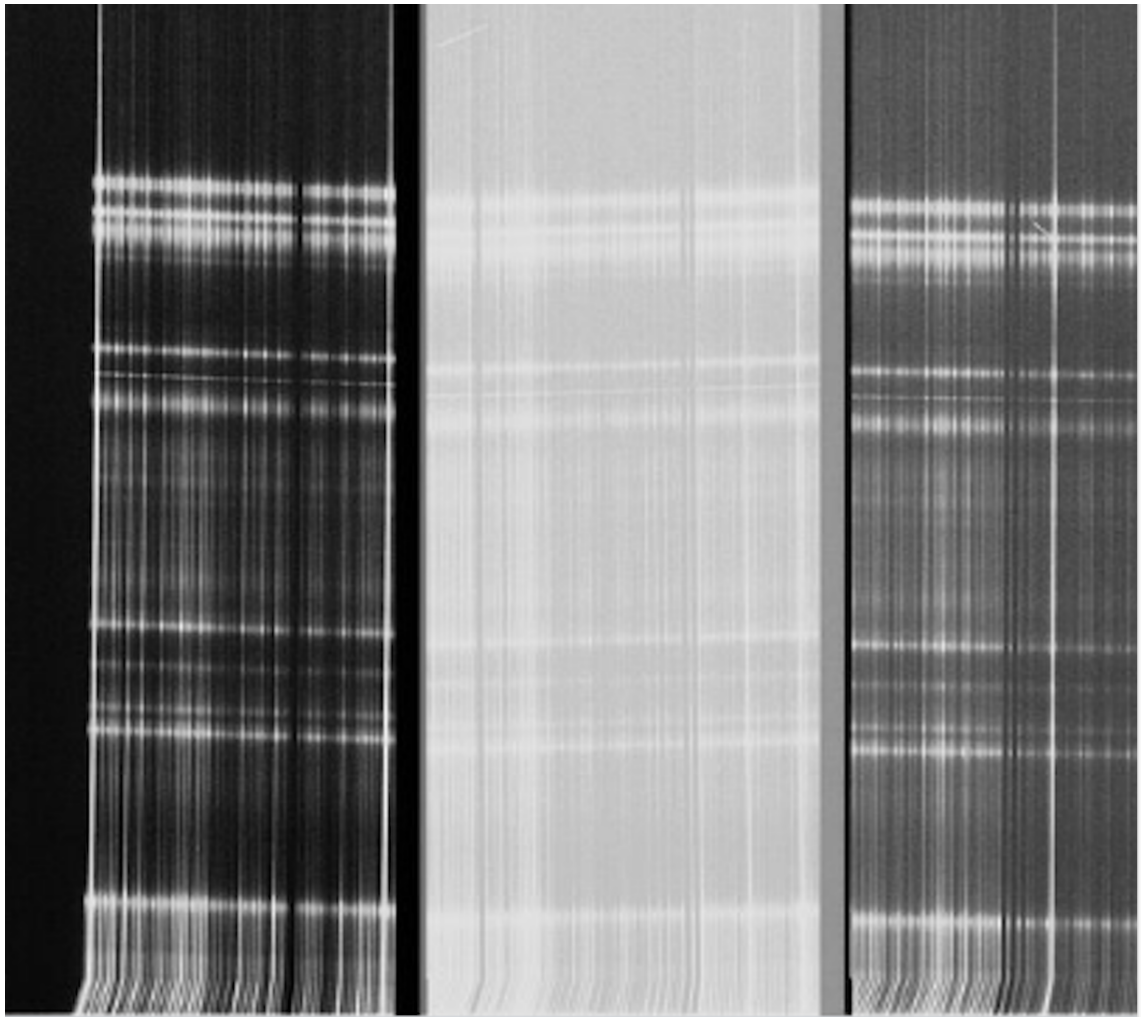
Rasmussen

New problems we cause ourselves



Loomis

New problems we cause ourselves



Loomis

Translation to CMOS/HgCdTe

We see effects familiar from CCDs in HgCdTe devices.

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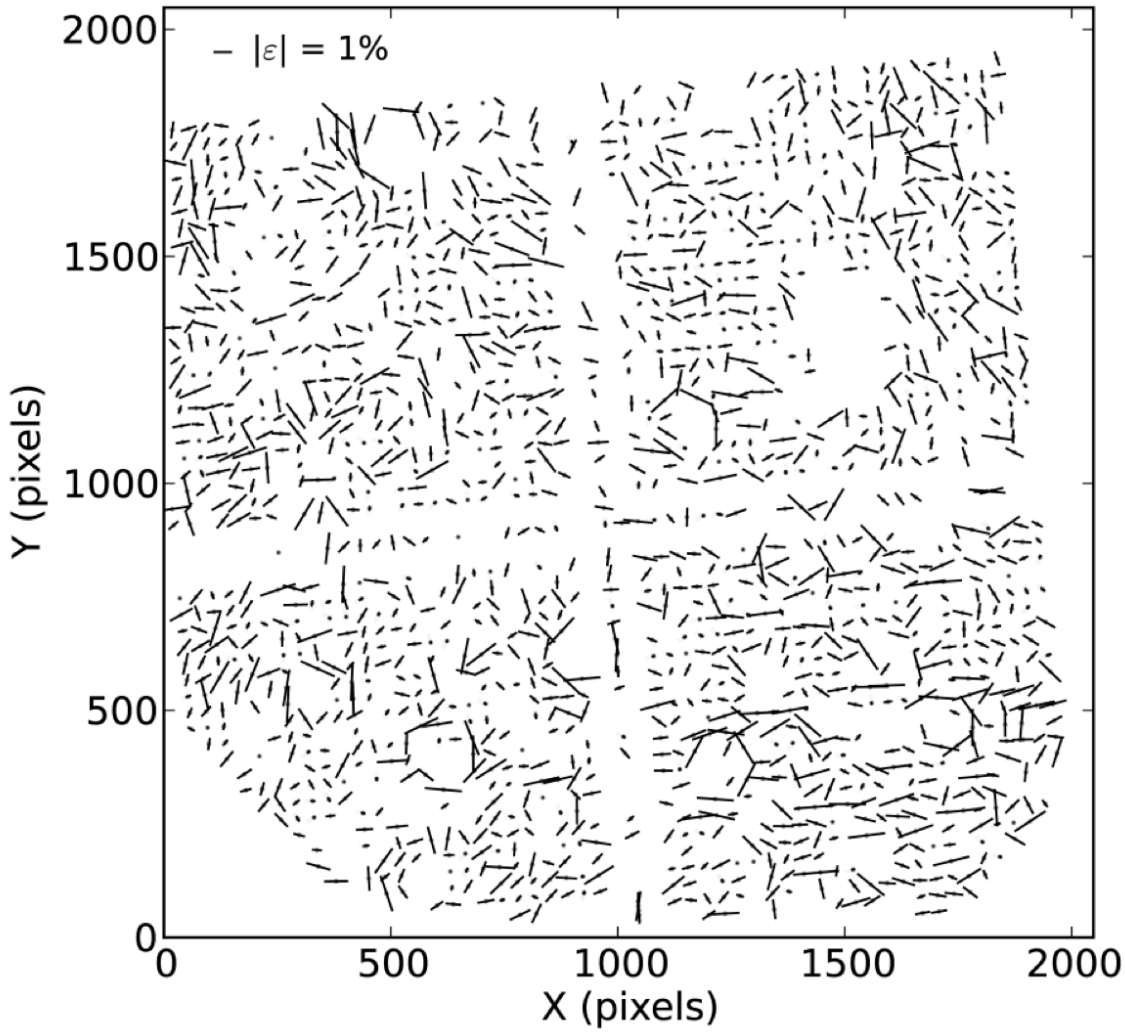
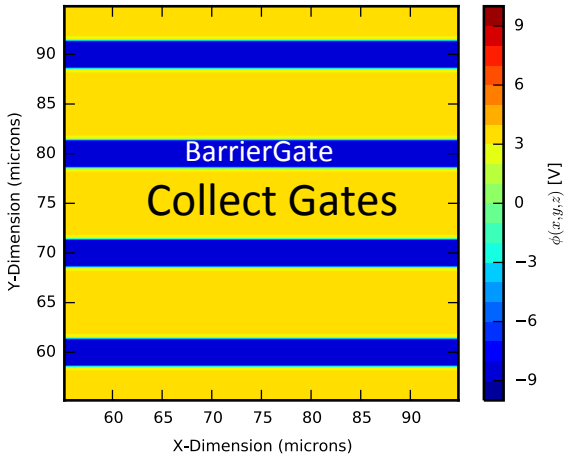


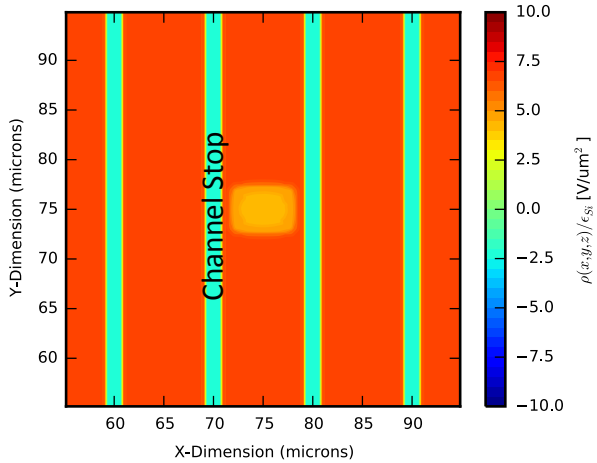
(assuming that this is some sort of pixel-size or intra-pixel sensitivity effect)

Develop a first-principles model

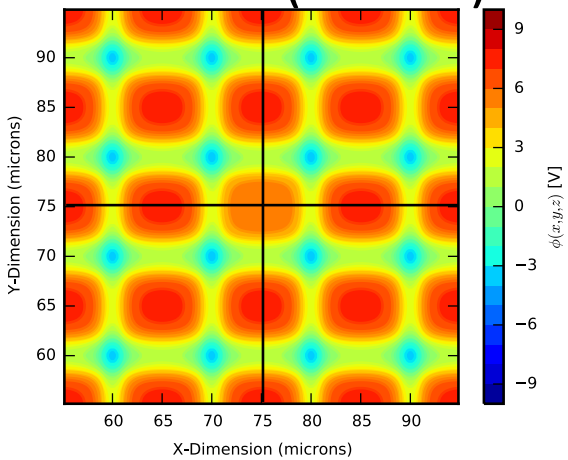
Potential(z=0)



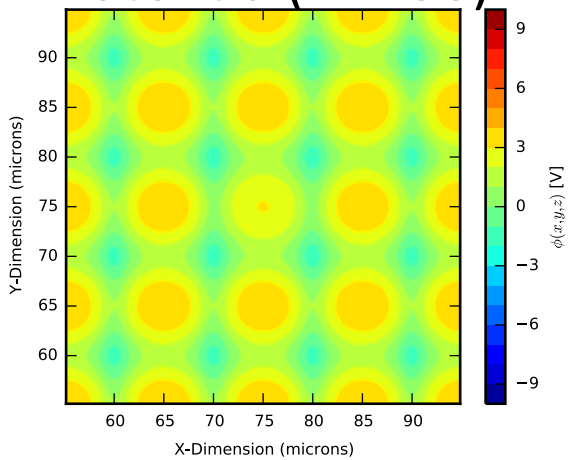
Charges



Potential(z=1.07)



Potential(z=2.56)



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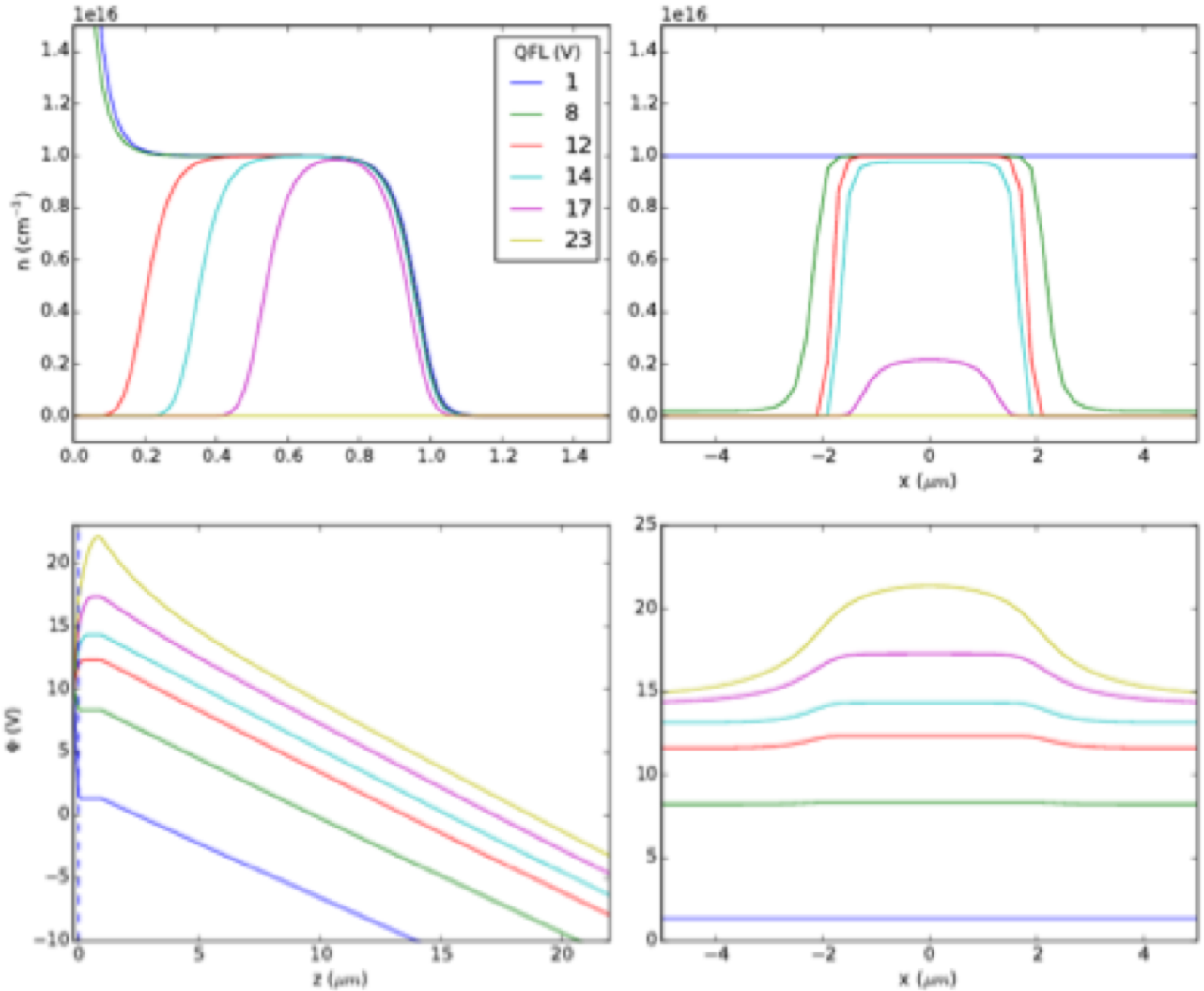

Develop an empirical model

Need measurements first…

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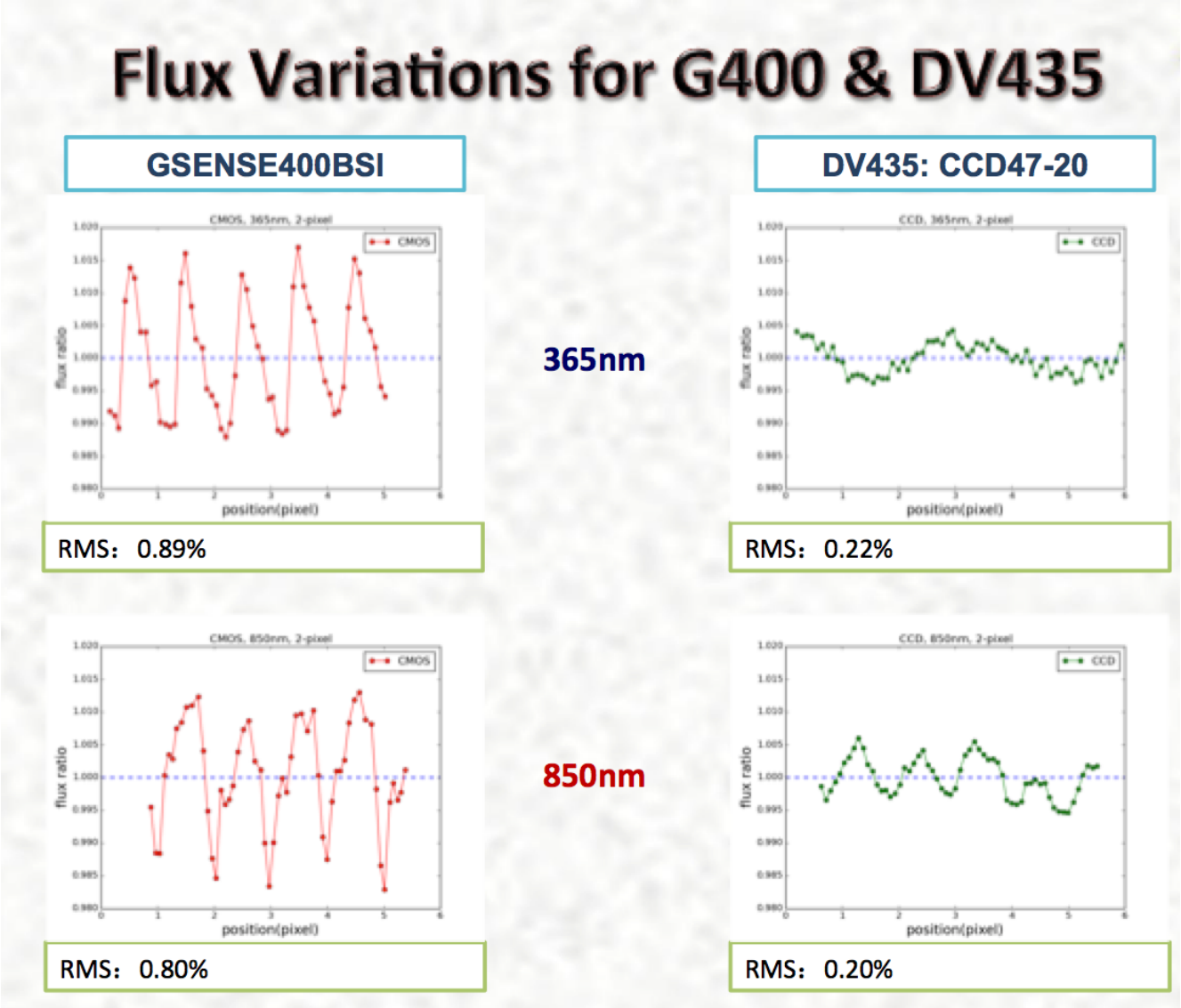

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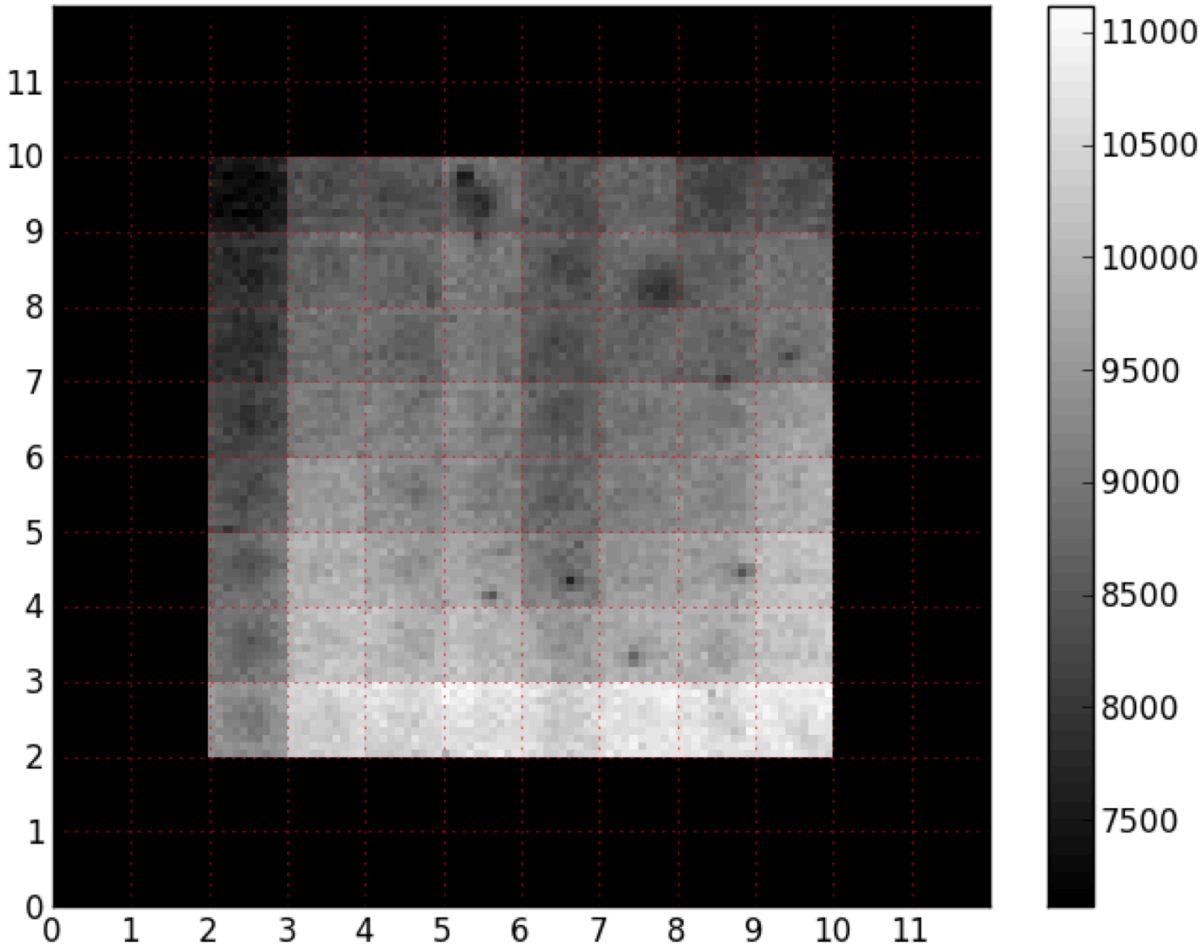

Hardy et al. (2014)
SPIE 9154, 9154D-12

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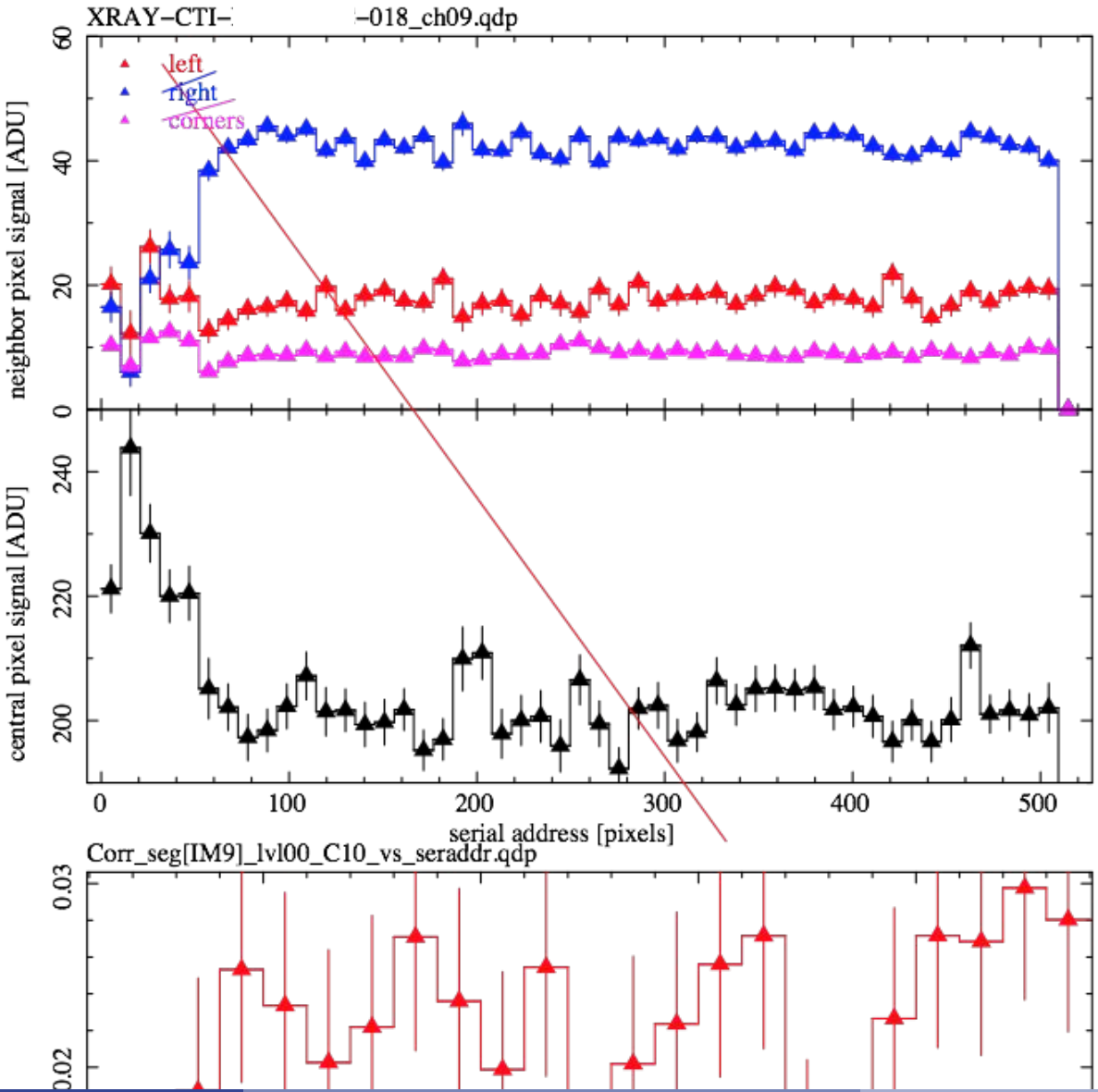

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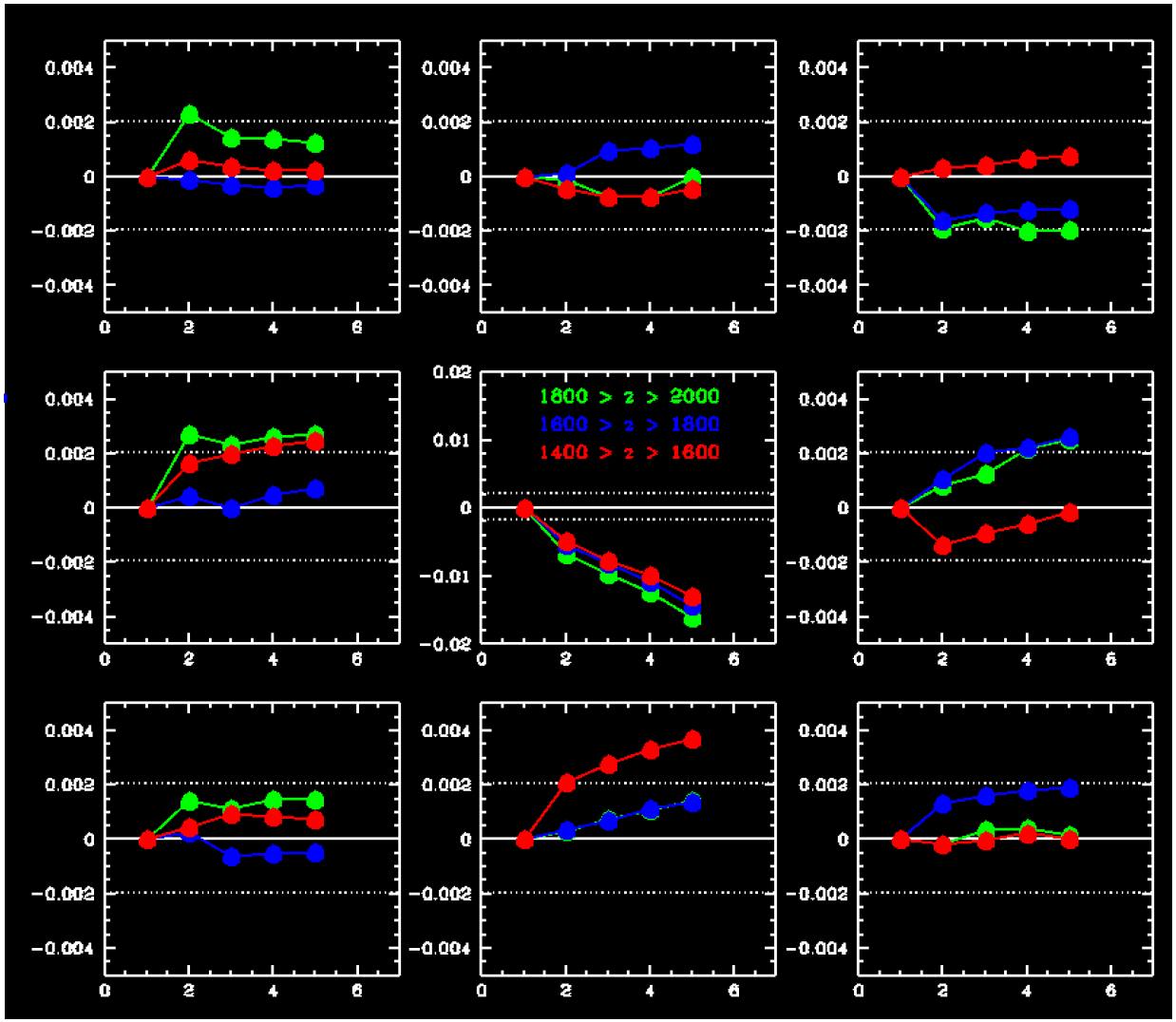

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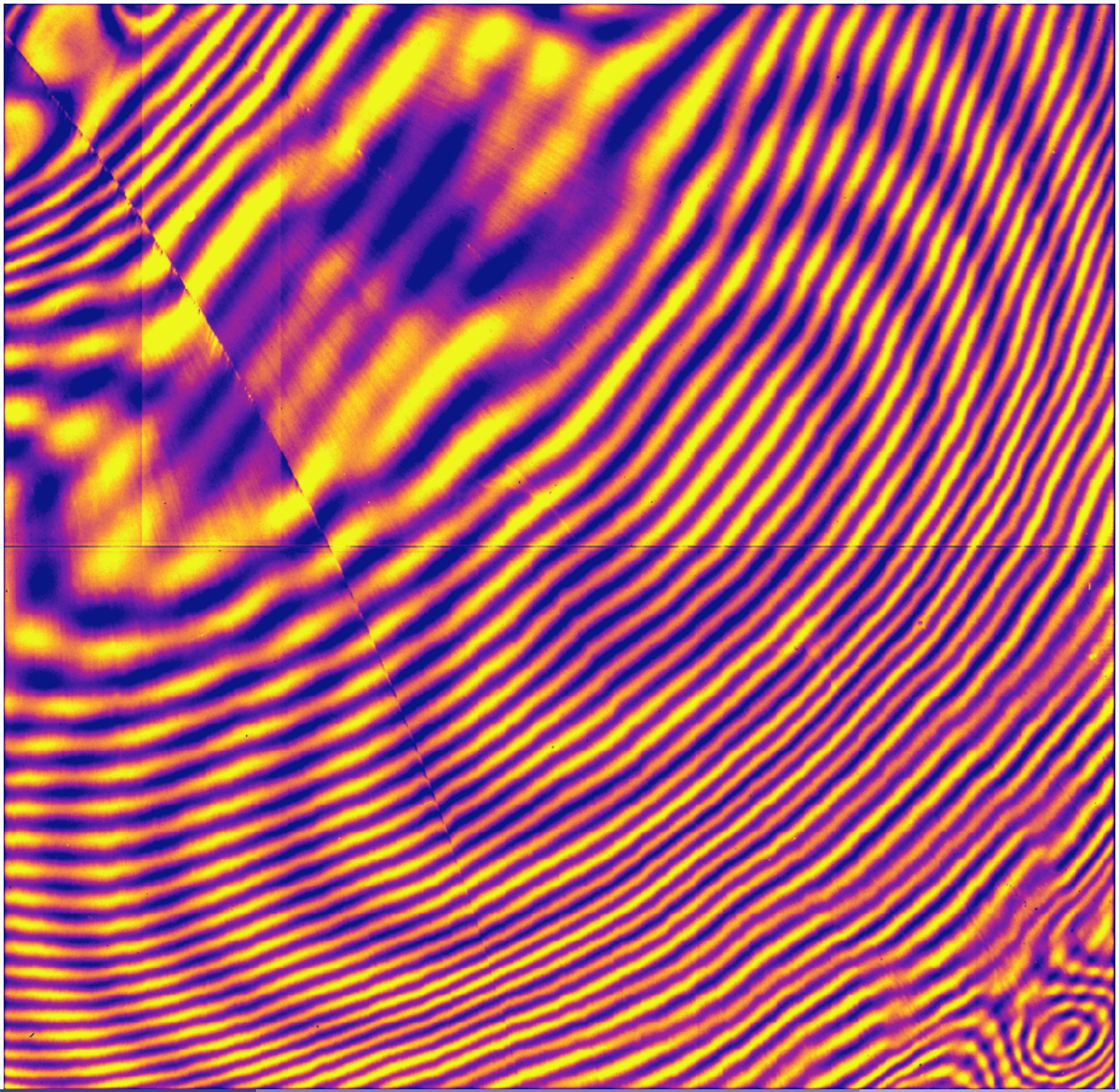

Calibration Instrumentation

I'm not sure where this fits into the Hirata Strategy.

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A CBP or DECal isn't a model, but it allows us to understand and remove pernicious effects

Develop an empirical model

How good does the model have to be?

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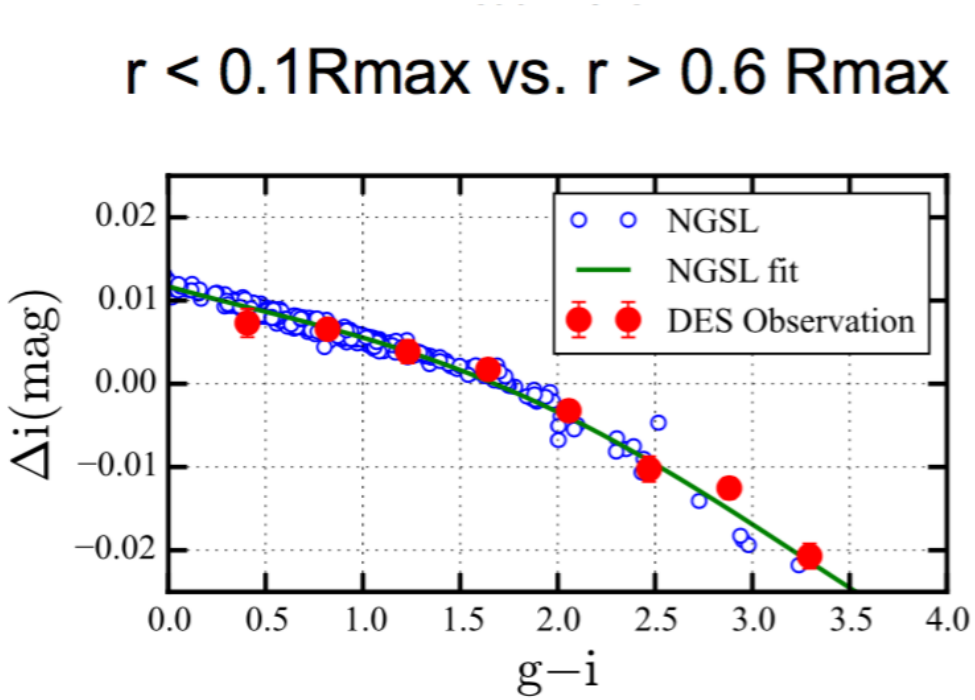
E.g. Chaz and Andrez's work on the importance of non-linearity for WFIRST

Calibration Correlations



Before correction: SCE > 20mmag
After correction: SCE < 3mmag

We can call this an empirical correlation or a model.

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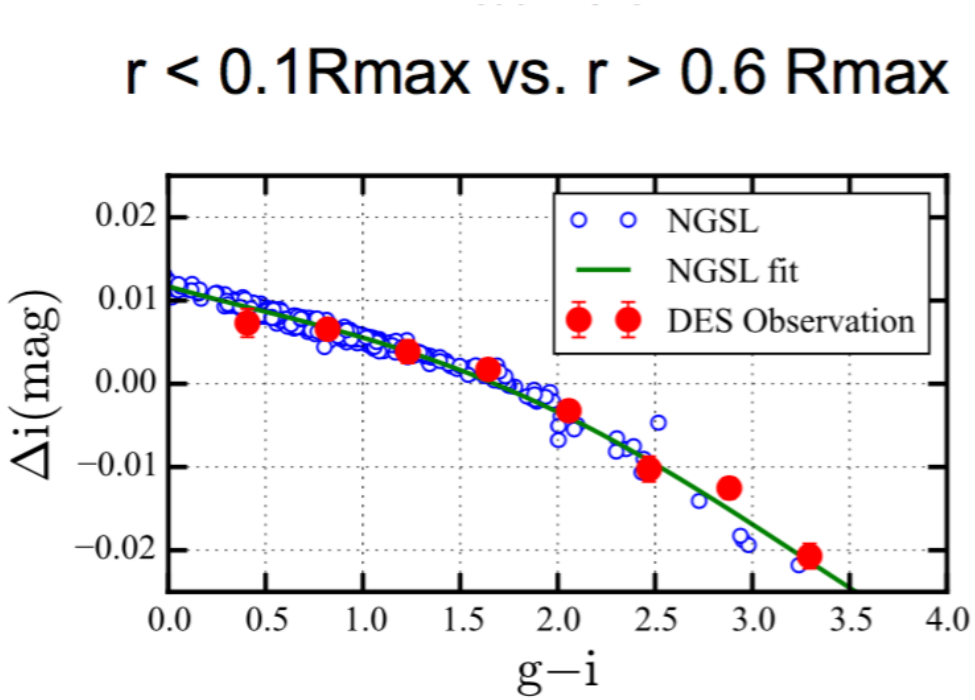
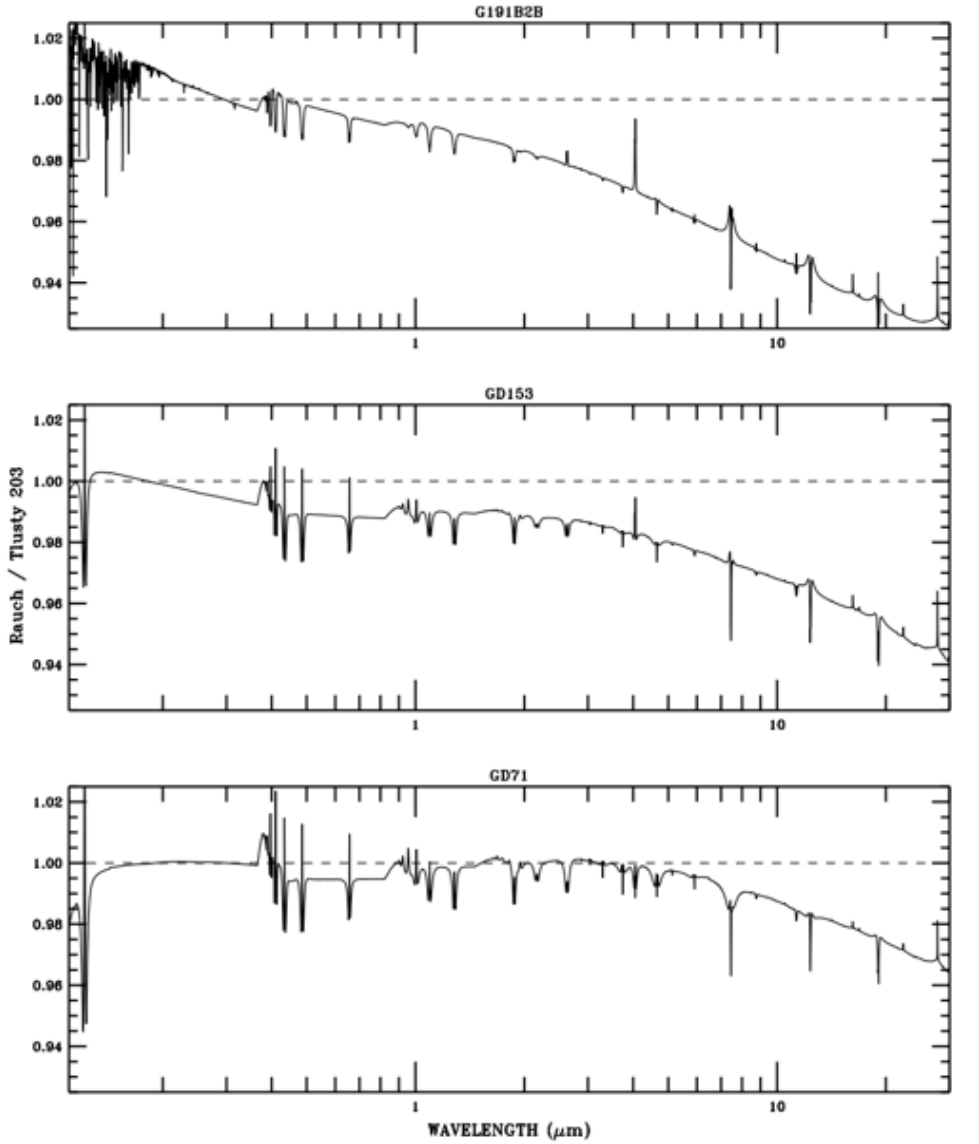


Before correction: SCE > 20mmag
After correction: SCE < 3mmag

We can call this an empirical correlation or a model. Or one of Chris's despised statistical corrections.

Absolute Calibration



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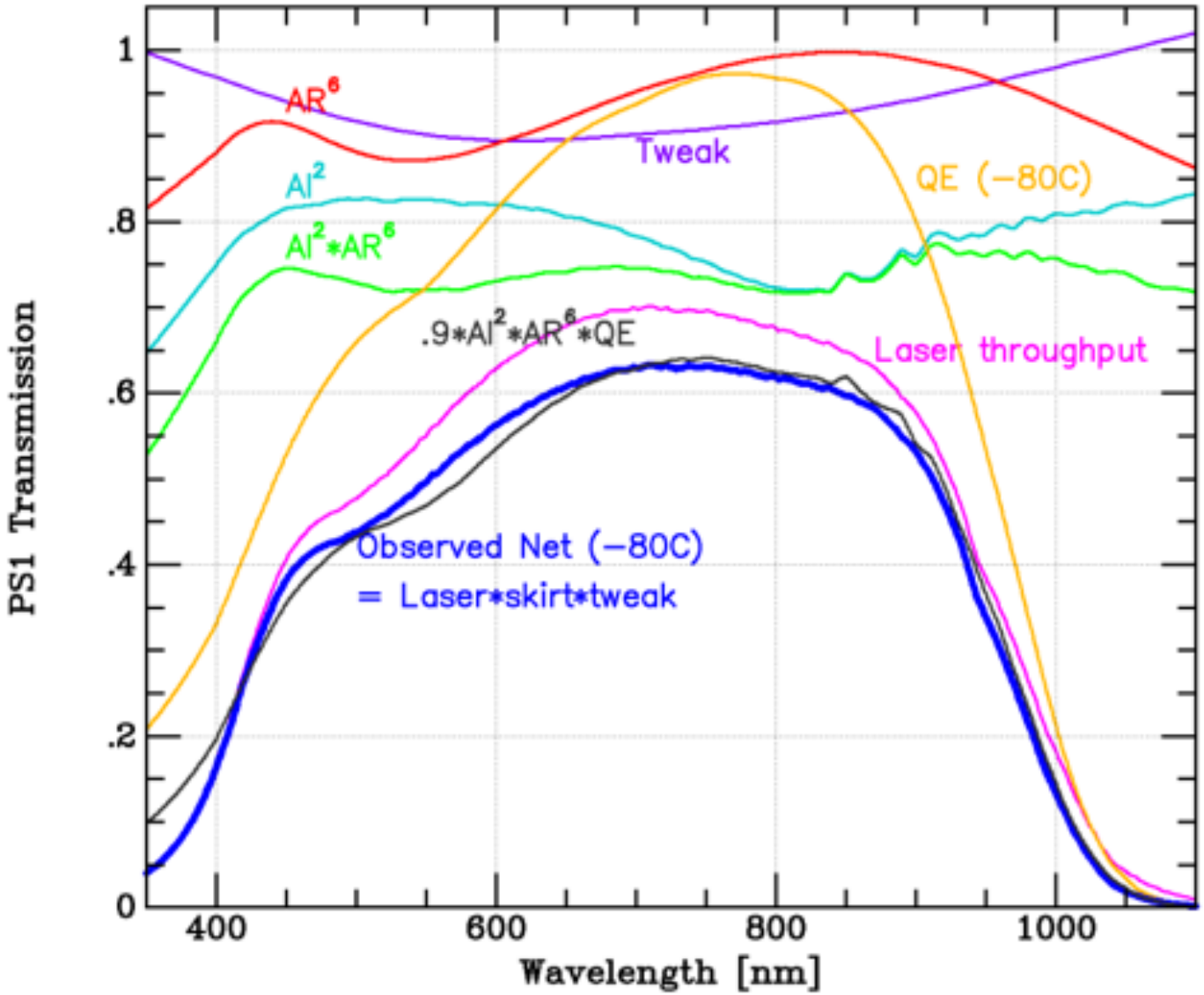

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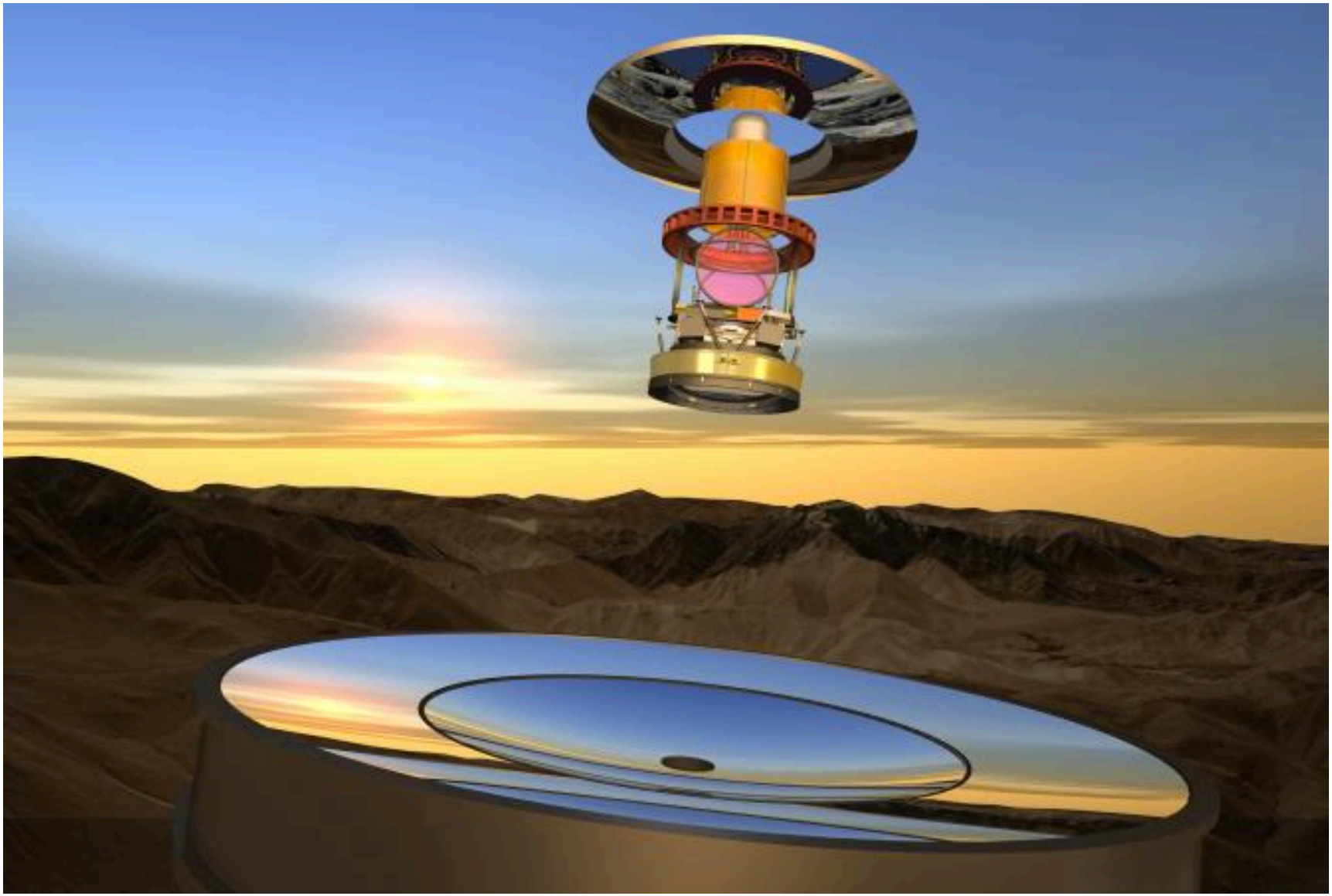

New Software

Almost all of this talk implied work for authors of pipelines.

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HST