

Overview of isr plans/status

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The Meeting Formerly Known As The All Hands Meeting

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New terminology I just made up

- Low level isr
 - The most basic sensory/video-chain things (defects, bias levels/structure, CTE etc)
- Mid-level isr
 - The fun, emergent silicony/sensory things (tree-rings, brighter-fatter etc)
- High-level isr
 - Not in the sensor itself, and requiring knowledge of the outside world and the objects being observed (flat fielding, atmospheric/SED corrections)

"Low level" isr

(NB: "low" does not mean easy/straightforward)

- Darks
 - Essentially this is for the correctable bright defects
- Other defects are to be masked: bright&dark pixels&columns, dipoles
- Biases
 - Looking to be more complex than it could otherwise be?
- Linearity
- Gain
- Crosstalk
- CTE, and probably more importantly, CTE-*like* defects
- Bleed levels (deliberately not saying "saturation level" to differentiate from the "full well" defined/measured by camera team)
- Other evils lurking in the video-chain (not sure what yet, but I'm willing to bet \$\$\$ that the above is not yet all-encompassing)
 - Could also be interplay between different mitigation strategies of the above, or other things, or both

All of these have the potential for nightmarish order-of-operation subtleties especially wrt things having had different corrections applied when measuring their characteristics. Same for crosstalk

"Mid level" isr

- Fringing corrections
 - No night-sky SED measurement, so fit a combination of narrowband flatfield components to match observed fringing pattern
- Tree rings
 - Characterise with flats, correct in wcs
- Brighter-fatter correction
 - Characterise with flat-pairs, iterative correction
- Edge distortions
 - Mask them (and correct any residual astrometric distortions in wcs)
- Spider legs
 - Ummm... I hope that the photometric part flatfields out, and that astrometric distortion can be taken out in the wcs. Will it be a problem for fringing though? I don't *think* so, but we'll have to see...

"High level" isr

- Flat fielding
 - monochromaticity (combining narrow bands to match SEDs etc)
 - photometric purity (CBP measurements)
- Filter transmission correction
 - Bandpass measurements
 - CBP measurements
- Atmospheric corrections
 - Need per-object SEDs for this (I think)

"High level" isr

- Flat fielding
 - monochromaticity (combining narrow bandpass filters etc)
 - photometric purity (CBP)
- Filter transmission
 - Bandpass
 - CBP
- Atmospheric corrections
 - Need per-object SEDs for this (I think)

This stuff is hard and hasn't been done before 😬

ISR overview & status

	Are we confident we fully understand it in <i>these</i> sensors run in production mode	Stack correction	How it's done? (simplified to 1 word)	Potential worries/complications
Bias images	Yes, assuming they're stable	Yes	Subtract	Instability, pickup, incoherence w/ read-start
Dark images	Yes, assuming stable (but this is <u>v</u> . likely)	Yes	Subtract	Temperature variation
Bright/dark pixels/columns	Yes	Yes	Mask	Temperature variation
Linearity & gain	Hopefully...	Yes	Correct w/ model	Difficulty with order of operations
Misc. video-chain badness	🤔	No	TBD...	Who knows, that's the fun
Bleeding	Yes	Yes	Mask	Weirdness at sensor edges? Subtleties?
Overscan levels	Not yet	Yes	Fit & subtract	General weird behaviour
Dipoles	Not yet	Yes	Mask?	Sign-flipping changing with clocking
Crosstalk	Probably	Yes	Subtract	Inter-raft? DECam-like? Both?!
CTE & CTE-like	Not sure, but probably	No	TBD	Lack of knowledge & understanding
Tearing	Kind of	No	Camera operation	We can't run the camera so that it doesn't happen
Fringing	Probably	Yes	~PCA + subtract	Difference between flatfield- & sky-induced
Tree-rings	Yes (in so far as DES do)	No	in wcs following DES	Is this good enough? Chromaticity?
Brighter-fatter	Yes (in so far as anyone does)	Yes	HSC/Coulton	Is it good enough?
Edge distortion	Yes	Yes	Mask / wcs	Having to mask too much area
Spider legs	Not really	No	Mask? wcs?	Will flats+wcs correct these? Fringing probs?
Flat fielding	Not yet *	No *		It needs lots of work, it hasn't been done before and the bookkeeping is hard
Filter transmission	Probably	No	Similar to flatfielding	Interplay between this, ↑ and ↓
Atmospheric correction	Not yet	No	Similar to flatfielding	It's complicated + hard bookkeeping

Per object corrections and more...

Colour coding is just Merlin's personal level of concern and that's about it

* The simple implementation obviously exists already

Things not mentioned in the table:

- Differences between surface brightness and PSF response
- Amplifier glow
- Bias shift after saturated pixels
- Temporal crosstalk correction from ASPIC and other sources.

Miscellaneous nightmares?

(if the above wasn't bad enough)

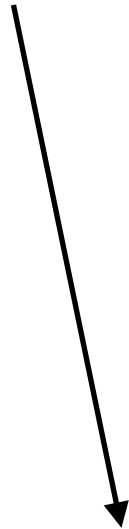
- Ghost corrections
- Temperature dependencies
- (seemingly) non-deterministic behaviour we might discover
- Rumsfeldian "unknown unknowns":
 - whatever SAWG discovers next
 - whatever else we discover once we go live on the mountain

Moving towards first light

- How are we going to stay on top of this?
- So much good work comes out of SAWG, but
 - someone has to not only track that work as it progresses, staying up to date with the state-of-the-art, and thus what we do/don't care about
 - but also implement the necessary corrections

Moving towards first light

This alone is ~a full time job in my opinion!



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DM has a new hire in this area! But will Andrés Plazas Malagón be able to save us?! Stay tuned to find out...

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