AGA0414
Data Reduction

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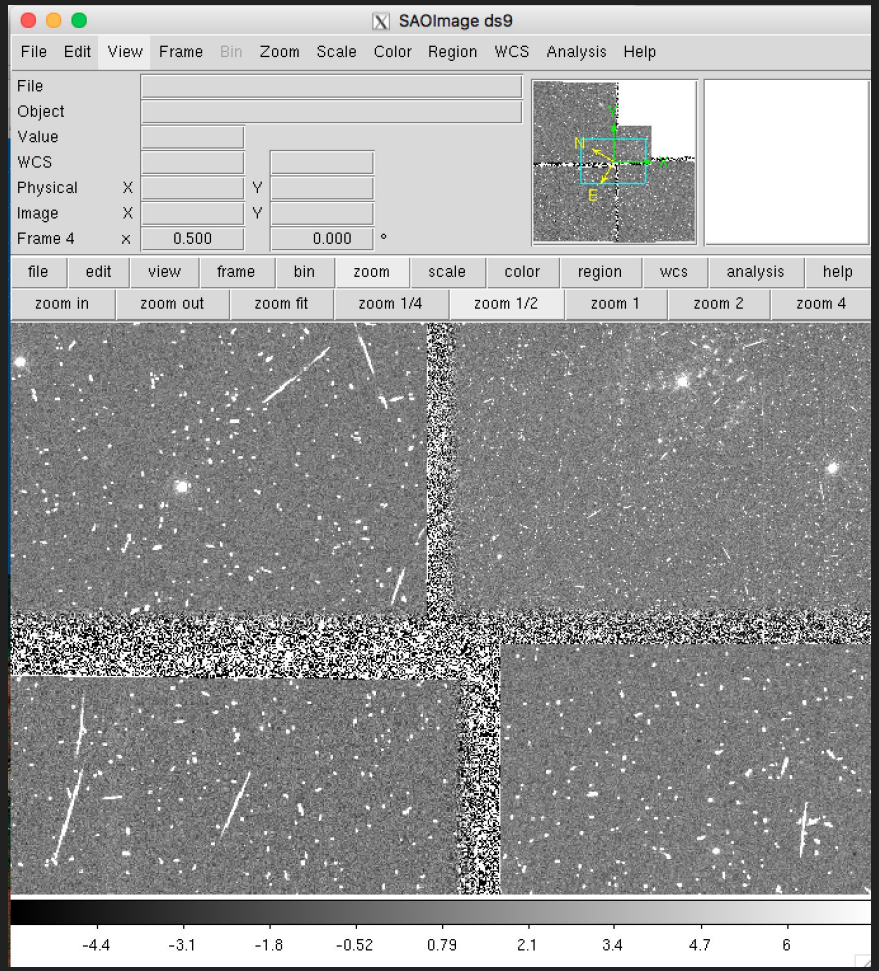
No imager is perfect

- Background noise
- Differences in illumination of the field of view
- “Sky concentration”
- Fringes
- Cosmic rays

Every time you touch data, you affect them: noise increases!

Data reduction is painful and everybody makes mistakes.

“Standard” data reduction is a myth.



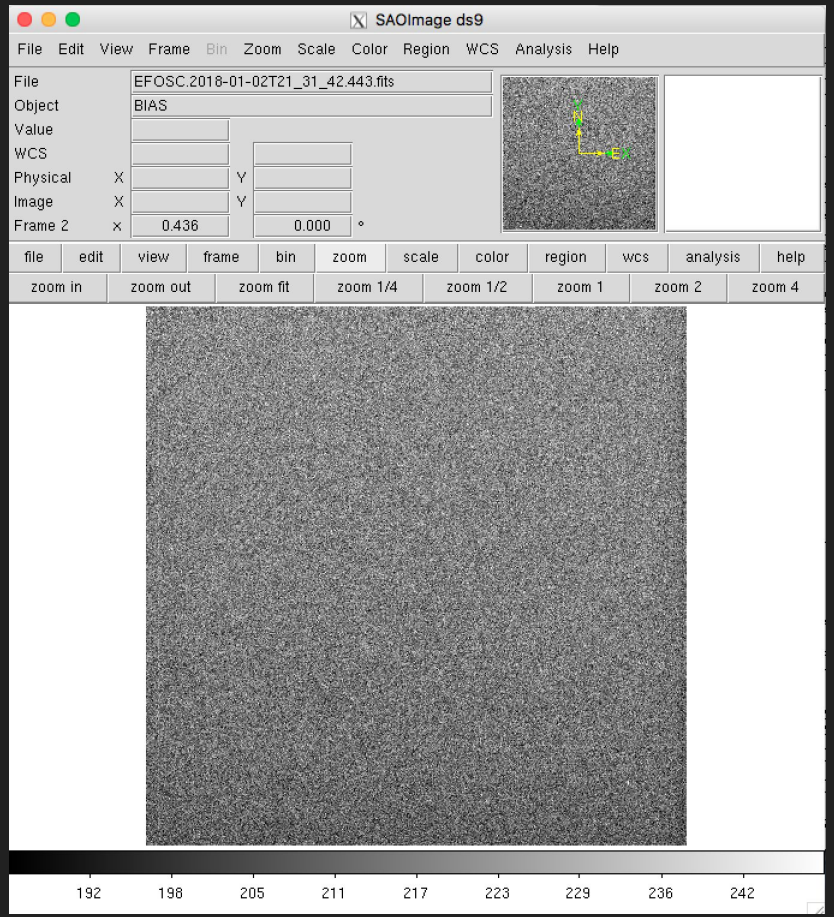
Background Noise

The “bias”

What happens if you take a “0 seconds exposure”?

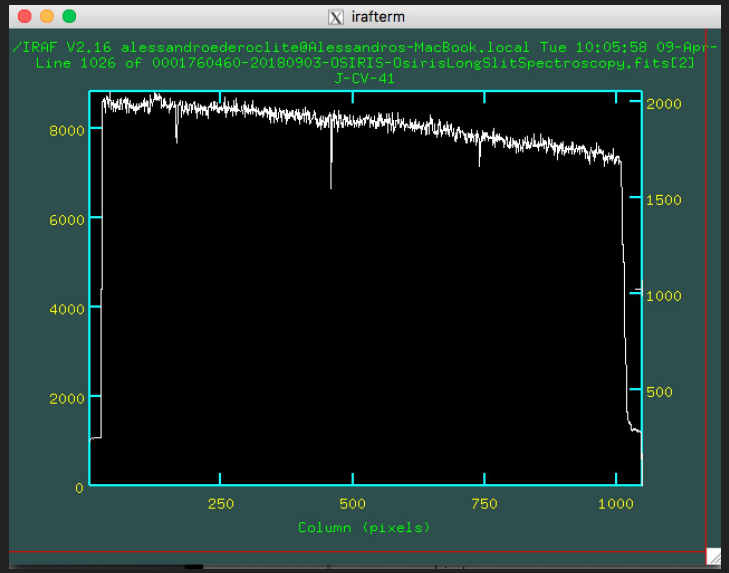
Wait a second! What do you mean by “0 seconds”?

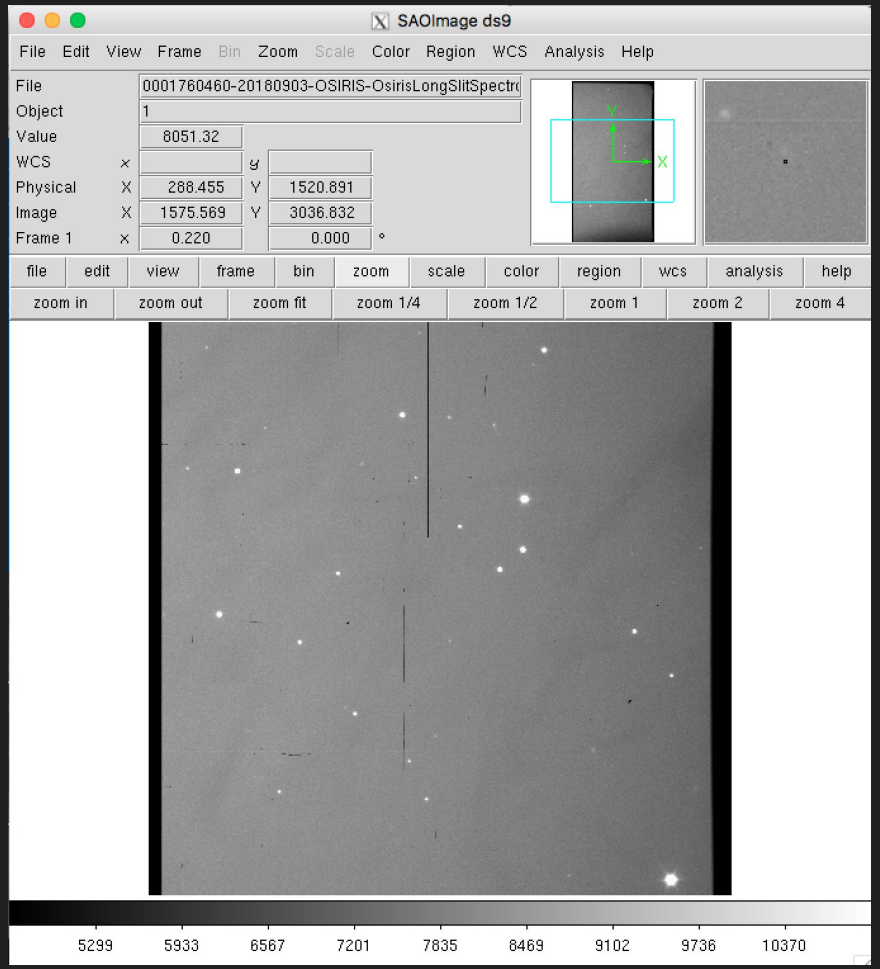
A “bias” is the readout of a CCD without collecting photons.



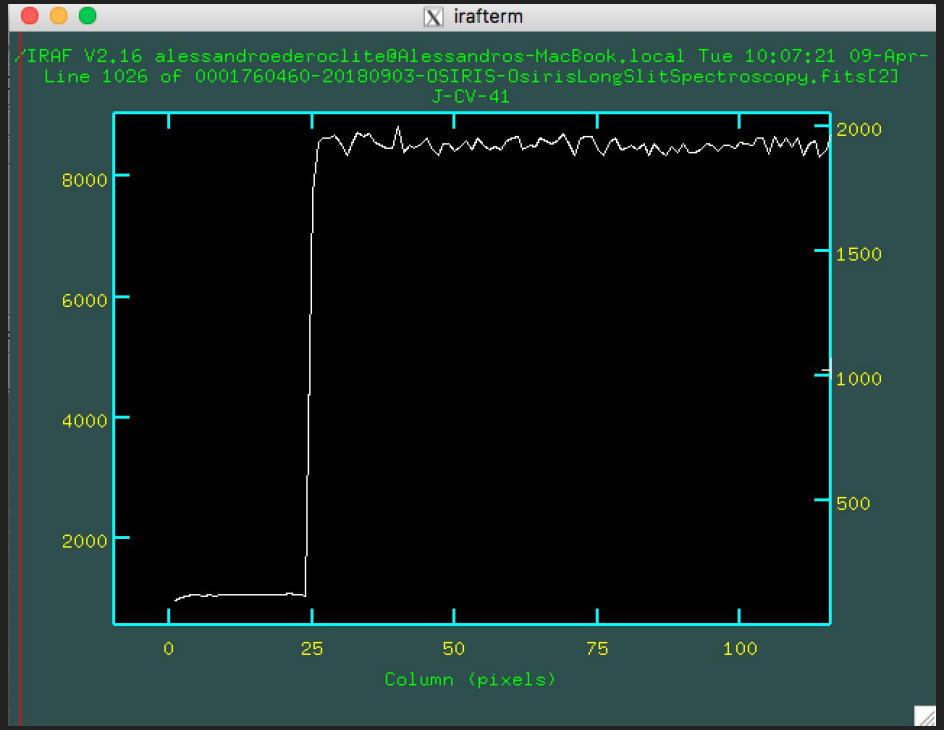
The “overscan”

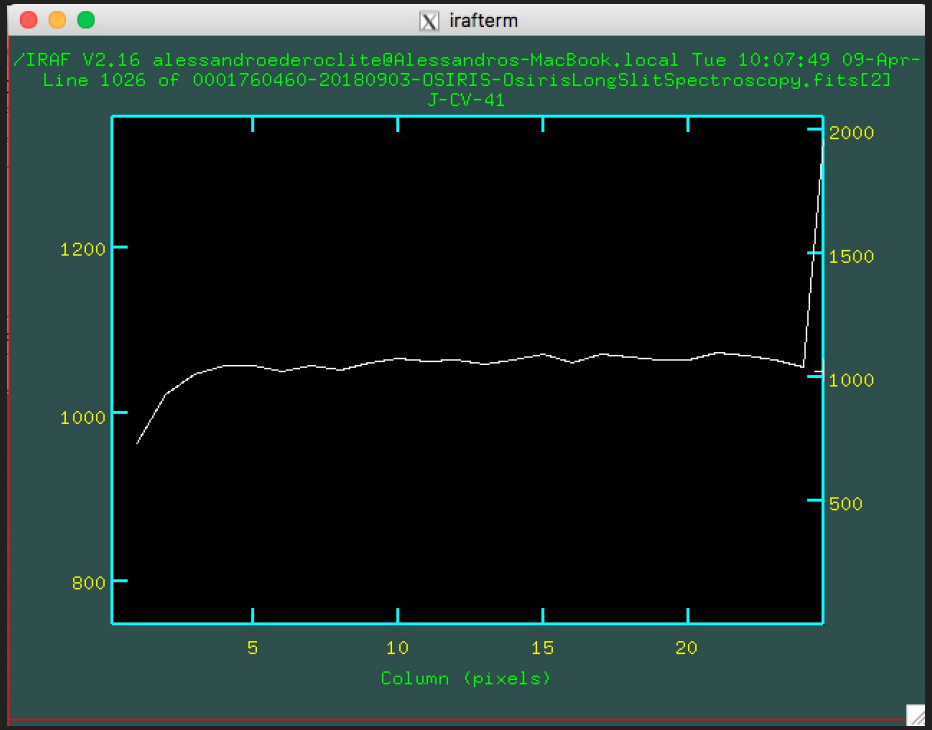
A region “on the side” of the image, where “empty” readouts of the electronics are made.





The “overscan”





Bias vs Overscan

- Bias takes into account the 2D variations of noise
- Overscan measures the noise of your image

Bias vs Overscan

	Pros	Cons
Bias	2D mapping of the noise of the CCD	Not simultaneous with observations
Overscan	Obtained together with observations	It is a 1D approximation to the noise of the CCD. Not all CCDs allow for an overscan region.

The flat field

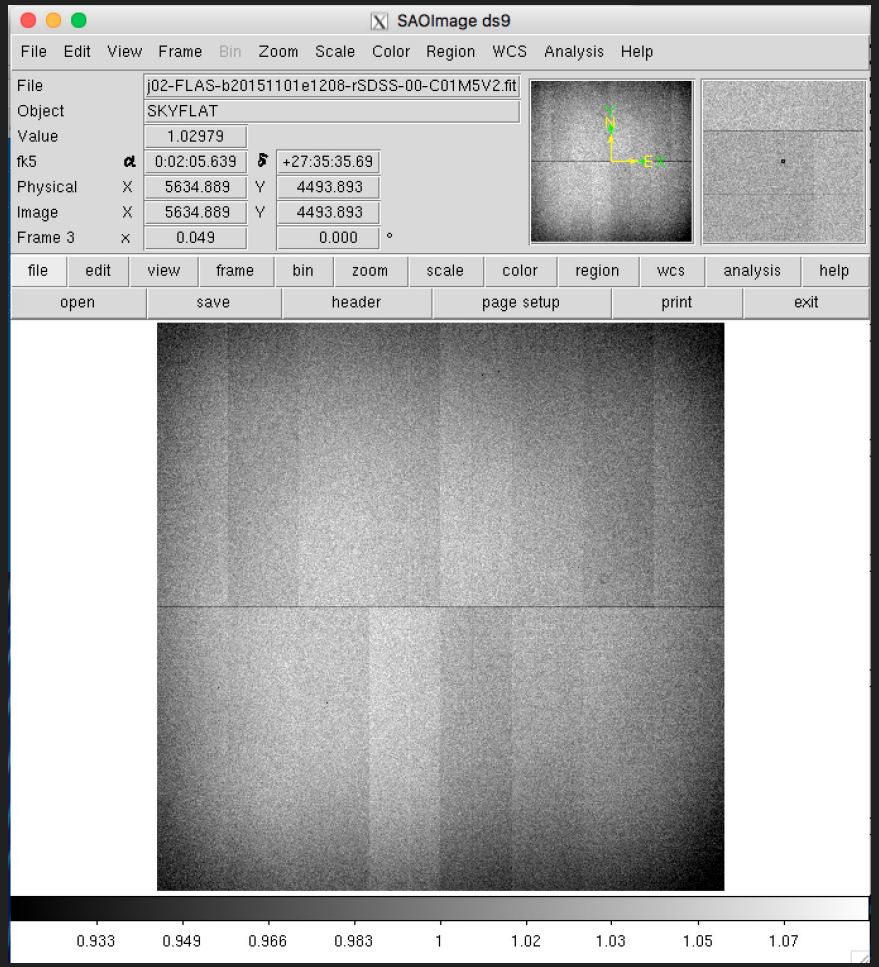
It is related with the difference of response across the field of view.

Famous example: dust particles on filters.

Corrected by observing a “flat field” (hence the name): sky vs. dome.

It is a multiplicative effect.

Mind the division by zero!



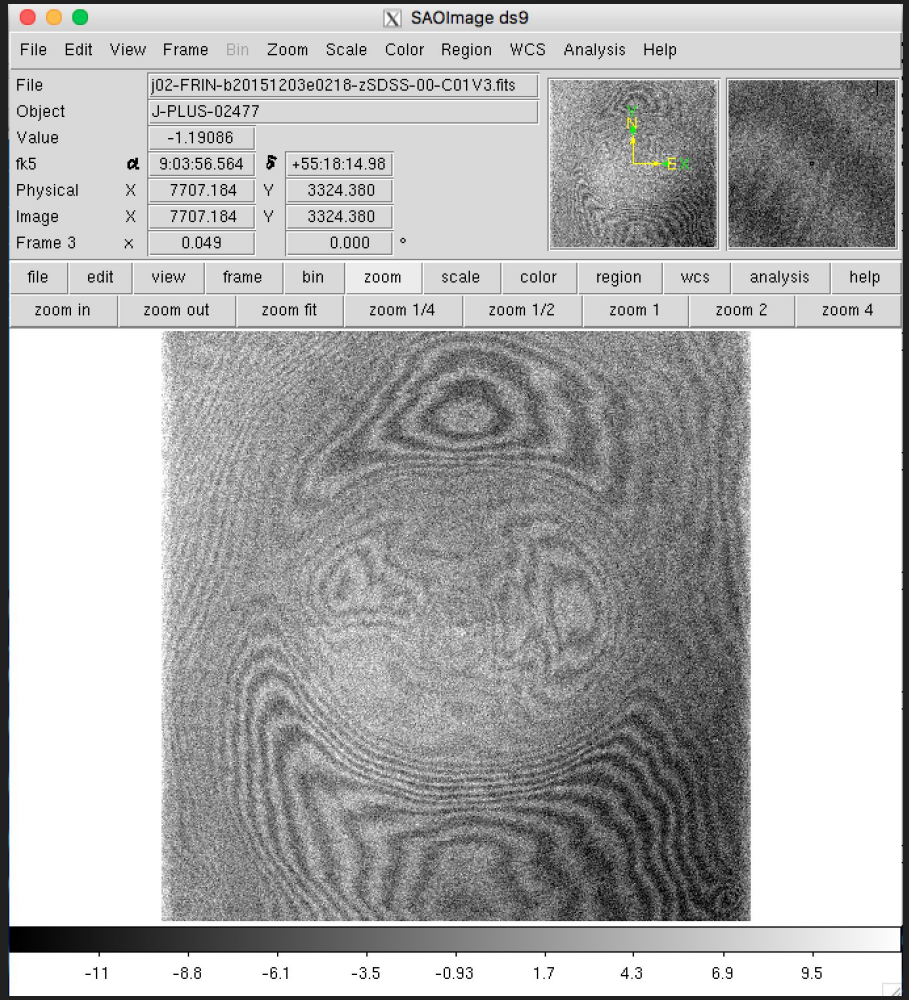
Fringing

Due to the interaction of light with the coating of the CCD.

It only affects the reddest filters (and not always).

It may vary across the night.

It is (yet) another additive effect.



Cosmic Rays

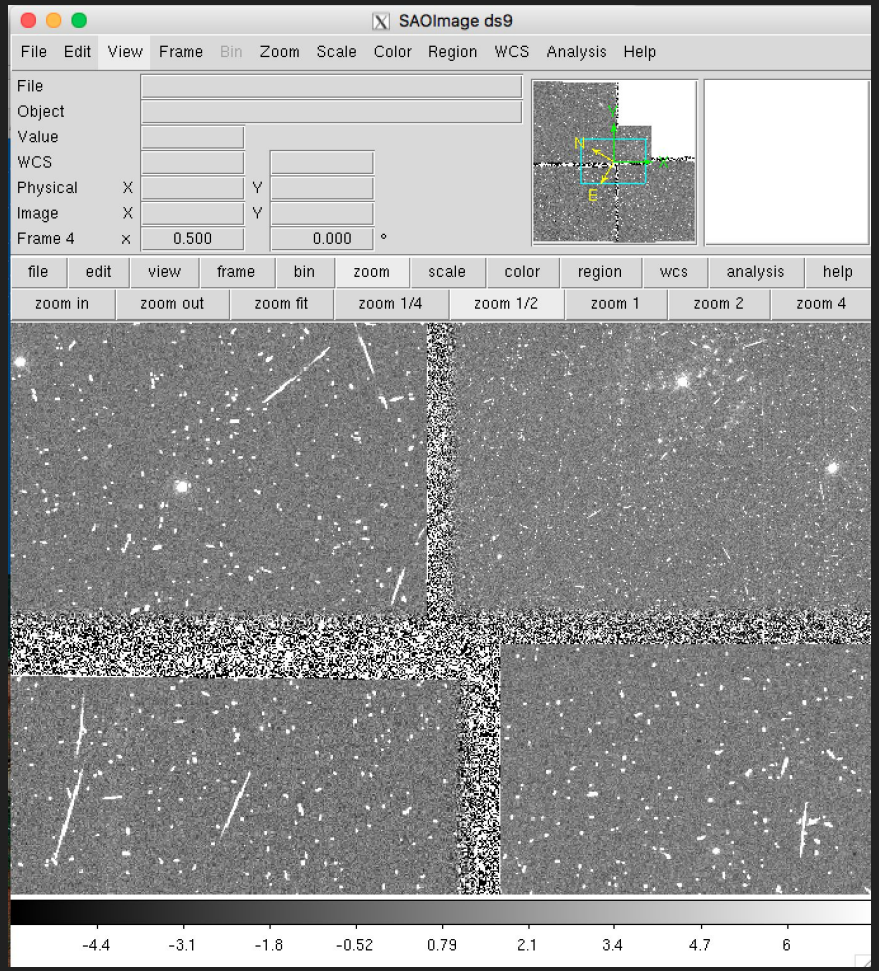
High energy particles.

Some manage to interact with the detector and leave traces.

It gets worse out of the atmosphere (e.g. HST).

Normally removed by “averaging” several images.

Another option is LACos.



Bad pixels / columns

Some pixels do not respond linearly -> hot/cold pixels.

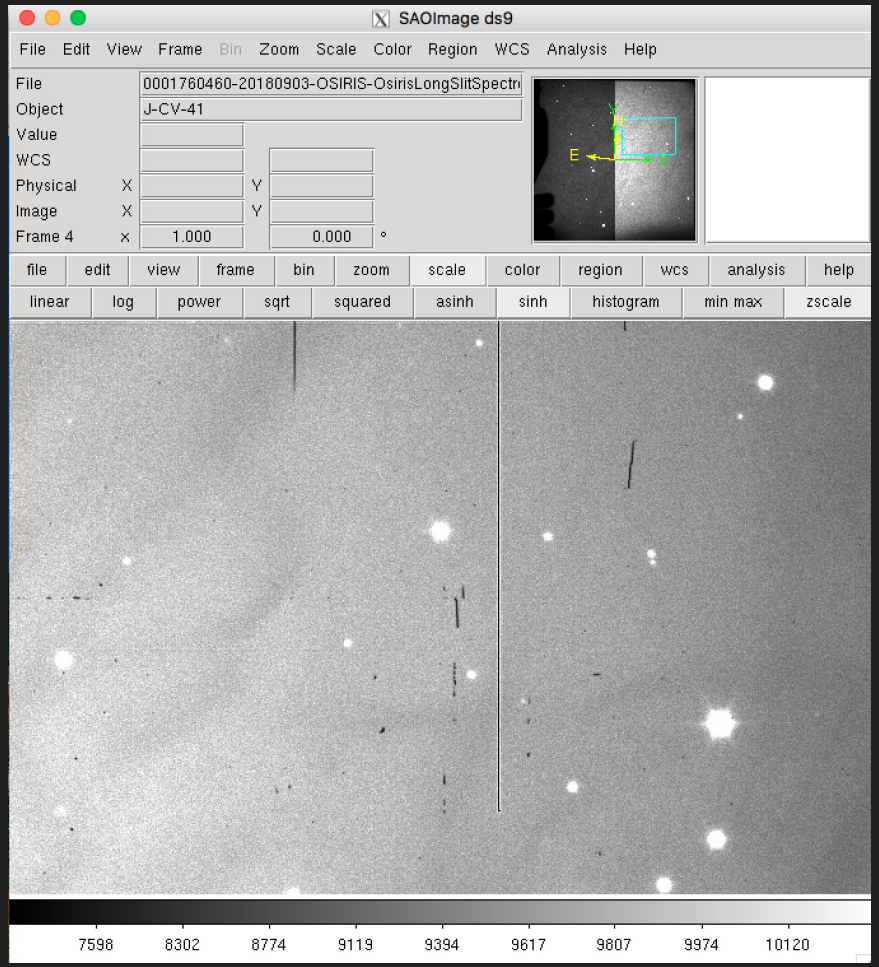
Some pixels actually block the movement of charge -> bad columns

Fix it by

-) “dithering” the telescope

-) align the images

-) combine



That’s all for today

In general, this is not all.

Depending on the instrument, you may have various effects.