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How to make a PTC

- Lab: take sequence of pairs of identical flat field images
  - Start with minimum exposure time, take two identical exposures
  - Then double exposure time, take two more identical exposures
  - Repeat step 2 until full well is reached
  - Then back off exposure time a bit and iterate linearly around full well exposure to more accurately bracket the full well exposure
- Data reduction:
  - Pick a 100 x 100 pixel selection box to use for all data reduction. Record the location of its corners for future reference
  - Measure and record the offset in each frame, subtract the offset from each frame, crop frame to selection box and save
  - For each cropped frame record standard deviation and average value
  - Then add 1000 DN to one frame and subtract the other from it. Record the standard deviation of this difference frame
  - Iterate through each exposure set repeating the data reduction above
- Dark Transfer Curve (DTC): identical to PTC except that you work with darks
- You can plot the Dark and Light data on the same plot

To make a PTC we take data in the lab and then we reduce it to analyze the PTC. Using an ordinary camera and computer, we take pairs of identical exposures starting with a minimum length exposure (seeking low signal levels here) and then we keep doubling the exposure time while continuing to take pairs of identical exposures. We continue until we reach full well.

Once we reach full well, we back off a bit on the exposure time and then iterate around full well taking our pairs of identical exposures until we can accurately determine where full well is reached.

For the data reduction we need to do several things: the first is to pick a selection box that we will use for all measurements: I use a 100 x 100 box but other sizes can be used.

The next thing we do is accurately measure and remove the offset from each frame. I use the overscan region for making the offset measurements. Not all camera vendors support overscanning for some reason, presumably to protect you from your own ignorance (they say) and perhaps to make it hard for you to do an accurate characterization if they feel there's something to hide; because if you cannot accurately measure the offset you aren't going to get accurate results in the PTC….

Then we simply crop each frame to the selection box size and record the average signal value and the standard deviation for the data in the selection boxes for all of our frames.

Finally we take our pairs of cropped and offset-removed identical exposures and difference and record the standard deviation. Before subtracting one from the other, you should add about 1000 DN to one of the images so that you avoid negative numbers and truncating the histogram when you subtract. This is very important so that you get the correct value of the standard deviation.

There's a companion plot called the Dark Transfer Curve or DTC and it is created the same way as the PTC except we use darks instead of light images. Needless to say high signal levels in darks with today's sensors can take hours or days to capture so I tend to take only the lower valued data in the DTC plots and also run the sensor with very little cooling to increase the dark current rate. You need cooling to keep the temperature constant, but you don't want to have to take a 10 hour dark so that' why you want to run it warmer.

You can then plot the DTC and PTC data on the same plot for analysis.