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EXPANDING THE FRONTIERS OF SPACE
ASTRONOMY

JWST Transiting Exoplanet WG

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Agenda Items

- Integration time tagging
- Instrument bias and saturation limits
- Nominal aperture/BG sizes for pipeline
- MIRI TSO Update



Integration Time Tagging

Problem Overview

- On-board clock drifts, not well insulated against temperature variations
- Spacecraft clock accuracy requirement is 2 sec over 40 hours (14 $\mu\text{s}/\text{sec}$)
 - Should not impact transit midpoint measurements
- Integration time is calculated based on time stamps in header
 - E.g. Header could report 100 sec integration as 100.0014 sec integration due to drift
 - When computing slope (e^-/sec), reported flux would be low by 14 ppm

- Clock is adjusted automatically, possibly during science exposure
 - Adjustments are dribbled in at up to 16 ms/sec
 - This can take \sim 2 minutes to correct a 2 sec offset
- Integration time is calculated based on time stamps in header
 - E.g. Header could report 100 sec integration as 101.6 sec integration due to clock adjustment
 - When computing slope (e^-/sec), reported flux would be low by 1.6%



Integration Time Tagging

Proposed solution #1

- Special telemetry mnemonic (called SCTA_OFFSET) records offset between spacecraft time and ground time
- Use SCTA_OFFSET to correct time reported in header to actual integration time for the purposes of flux values in pipeline
- This solution only solves problem due to clock adjustments

Proposed solution #2

- John Stansberry suggested using instrument clock to get relative integration times
- Would still use single spacecraft time as an absolute reference
- This solution may solve both problems

Proposed solution #3

- Have FITS files report data in electrons instead of electrons/sec



Integration Time Tagging

Questions

- How do HST and Spitzer maintain accurate clocks?
 - HST clock is temperature controlled in an oven
 - Spitzer likely uses instrument clock (still clarifying with Sean Carey)
 - ▶ Data are in electrons, not electrons/sec
- Do all NIR instruments use the same oscillators to keep time?
- How does MIRI keep time?
- What is the focal plane electronics (FPE) temperature variation?
 - Stability is 65 ppm over 180 degree range (0.36 ppm/K)
 - E.g. ~14 ppm deficit in flux corresponds to 40 K change in FPE temperature
- How do we access the FPE clock?



Instrument bias and saturation limits

People are planning observations without knowing what “% saturation” value to assume

Would like to make recommendations (on JDox) on nominal fluence values (or % saturation) for each instrument

Need to know bias level and uncertainty on corrected non-linearity

- I’ve asked each team for these numbers



Nominal aperture/BG sizes for pipeline

The data reduction pipeline needs to use nominal aperture and background sizes

What are these values for each instrument/mode?

- E.g. NIRCам: 64 rows total, 22 rows for aperture, 42 rows for BG