



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

Instrument Scientist Reviews of Cycle 1 Programs

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Cycle 1 Program Instrument Scientist Reviews

Review schedule

- GTO/ERS delta: 252 reviews of 141 programs (Jan– Feb 2021)
- GO1 sniff: 55 reviews of 39 medium/large programs (Feb 22 – Mar 24)
- GO1: 385 reviews of all 266 programs (May 21 – Sep 16th 2021)

GO1 Instrument Scientist reviews

- Commenced May 21st
- New APT 2021.2 (June 17th) addresses data vol. excess, MIRI reset
- Instrument Scientists will contact observers with recommendations
 - Optimization of observations to follow best practices
 - Requests for other program changes should be submitted to the TTRB



GO1 preliminary reviews

Sniff Reviews

- Medium and Large GO1 programs reviewed for completeness and technical feasibility by Instrument Scientists (1 per instrument)
- Results conveyed to SMO and STScI Director prior to program acceptance
- Proposals were found to be technically sound, with typical issues



Cycle 1 program updates

- 51 MOS (and MSA TA) programs will need updates following aperture position angle (APA) assignment
 - MOS observers will be contacted later this month to inform them of the process
 - Some programs without NIRCam pre-imaging may need to be ready soon after Commissioning (3 weeks after the MSA distortion file is ready)
 - Programs scheduled later will have 6 weeks minimum to update their observations
 - Regardless, observers can now begin to explore strategies with MPT to be prepared for the update process
 - <https://jwst-docs.stsci.edu/near-infrared-spectrograph/nirspec-operations/nirspec-mos-operations/nirspec-mos-and-msata-observing-process>
- 3 programs need to be assigned pure parallel slots (late September)
 - This process is currently being worked out



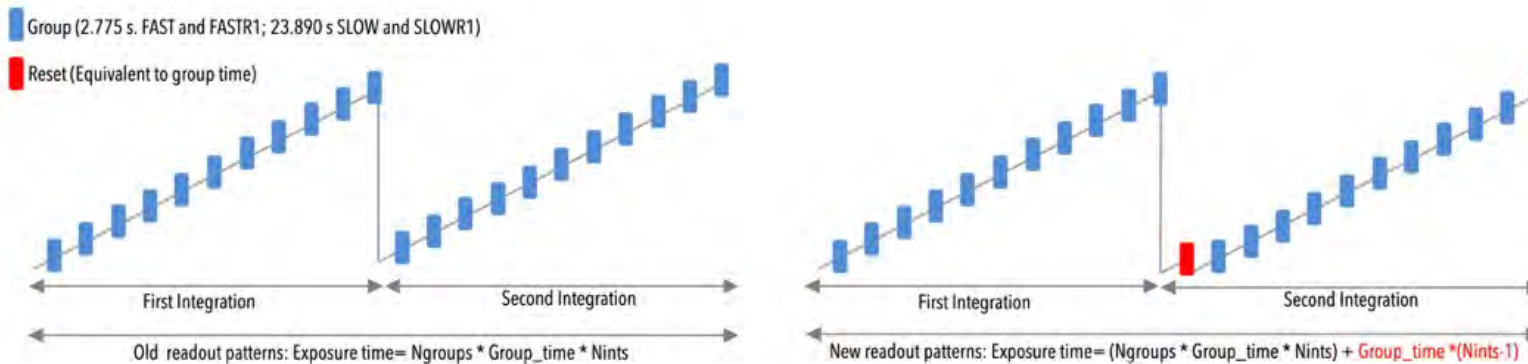
Cycle 1 major issues

Major Issues

- Data Volume Excess
 - 9 programs have **data volume excess errors**
 - 37 programs have **data volume excess severe warnings**
- New MIRI readout/reset patterns deployed (all 207 Cycle 1 programs with MIRI)
- TSO observations with too many frames—exposures must be split
- Scientifically unjustified special requirements (timing, no-interrupt, no parallels...)
- Judicious application of background-limited special requirement



New MIRI readout patterns with reset



- The FASTR1 and SLOWR1 patterns replace FAST and SLOW patterns to mitigate detector response anomalies and meet flux accuracy requirements
- Mandatory change in readout pattern for all MIRI observations
- Overhead increases by 1.7% on average
 - 15% increase in overhead for 2 GO1 programs (TSO)
 - 5-11% for 13 GTO and GO programs (non-TSO)
 - <5% for remaining programs



Unjustified special requirements and timing constraints

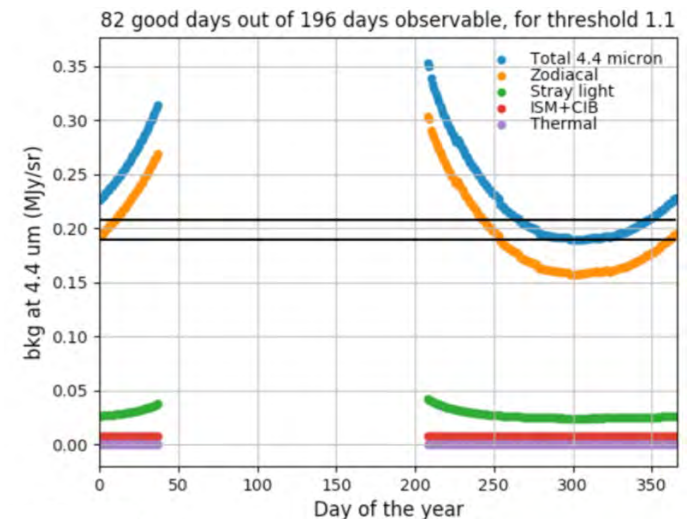
- Timing-related constraints are a limited JWST resource that impact the schedulability of observations
- It behooves the observer avoid constraints and link sets that may be unschedulable
- Examples
 - Sequential, non-interrupted observations
 - Appropriate use: Time variable or time-critical source or background observations
 - Inappropriate use: “So I can get all of my observations at the same time.”
 - PA constraints:
 - Appropriate uses: bright star avoidance, mosaics, field-of-view constraints
 - Inappropriate use: A narrow PA range that makes the observation unschedulable
 - No-parallel special requirements
 - Justifiable, e.g. for observations that have their own parallels or data volume constraints



Background-limited Observations

- Background can vary by a large amount through the year. Depends on:
 - Ecliptic latitude and longitude; source flux and wavelength of interest
- Procedure to determine if background affects SNR requirements:
 - <https://jwst-docs.stsci.edu/jwst-observatory-functionality/jwst-background-model/background-limited-observations>
 - Up to the observer to conduct the ETC investigation
- Judicious use of Background Limited SR encouraged
- Background Limited SR restricts scheduling
 - Particularly for low ecliptic latitude

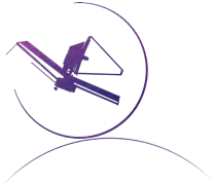
Ref: J. Rigby, JSWT-RPT-034230





Other common areas of concern

- The Cycle 1 reviews have encountered several other common issues:
 - Target acquisition strategy
 - Accurate coordinates
 - Readout pattern use
 - Groups vs. integrations
 - Subarray choice
 - Dither and nod strategy
 - When to specify backgrounds or leakcals
 - Bright object avoidance
 - Filter and grating selections
- Issues are incorporated in the instrument checklists used by reviewers
- JDox articles exist for these topics and are revised with experience



Managing SSR and Downlink Usage

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JWST Mission Scientist @ STScI



Data volume excess

- Limited resources that must be managed
 - Solid State Recorder – Buffers data until it can be downlinked
 - DSN contacts – Limits amount of data that be downlinked
- Inadequate metrics
 - Data volume alone does not track downlink usage
 - Data rate alone does not track SSR usage
- Preferred metric
 - "Data volume excess" above a nominal allocation given duration of visit(s)
- Calculation
 - $\text{duration} = \text{SUM}(\text{slew time} + \text{visit duration})$
 - $\text{allocation} = \text{duration} * 0.87 \text{ MB/s}$
 - $\text{excess} = \text{data volume} - \text{allocation}$



Non-interruptible link sets (NILS)

- Observers may [specify](#) that a set of visits execute without interruption
 - GROUP OBSERVATIONS <list> NON-INTERRUPTIBLE
 - SEQUENCE OBSERVATIONS <list> NON-INTERRUPTIBLE
- APT may implicitly create a non-interruptible link set (NILS)
- Impact of NILS on resource management
 - No additional burden on downlink capacity
 - Additional burden on SSR capacity to buffer
- Following slides consider two disjoint types of scheduling units
 - Solo visits that are not part of a NILS and hence may execute alone
 - NILS that contain multiple visits that must execute without interruption

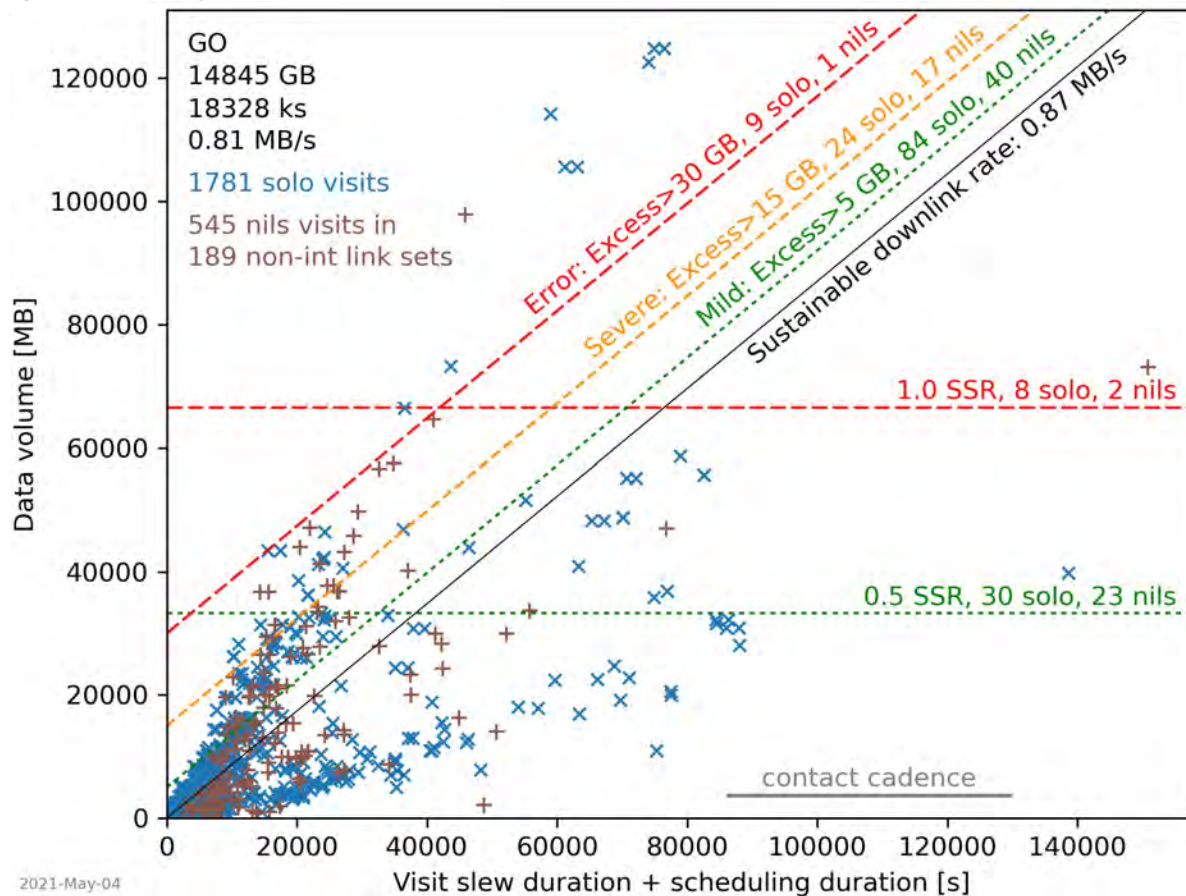


New diagnostics in APT 2021.2, scheduled for release in June

- IF excess > 30 GB:
 - *"Visit generates {data volume} MB in {duration} seconds, which exceeds downlink allocation by {excess} MB. Error threshold is 30 GB. Reduce data volume. If this makes your science infeasible, contact the Help Desk."*
- ELSE IF excess > 15 GB:
 - *"Visit generates {data volume} MB in {duration} seconds, which exceeds downlink allocation by {excess} MB. Threshold for this severe warning is 15 GB. Reduce data volume, if possible without compromising science goals. Justify exceptions scientifically. Small improvements in efficiency or S/N are not sufficient to justify excess data volume above this threshold."*
- ELSE IF excess > 5 GB:
 - *"Visit generates {data volume} MB in {duration} seconds, which exceeds downlink allocation by {excess} MB. Threshold for this warning is 5 GB. Reduce data volume, if possible without impacting science goals."*



GO prime observations with APT diagnostic thresholds



- GO prime observations, excluding pure parallels
- GO programs reviews will suggest modifications for programs with data volume excess
- Expect to mitigate all of the excess data volume errors and most of the severe warnings
- Some observers may choose to reduce data volume excess to improve schedulability



We may eventually have to do more to manage downlink usage

- Cycle 1 prime observations, coordinated parallels, and calibration parallels (ignoring science pure parallels) need an average downlink bandwidth of 0.805 MB/s
- Sustainable downlink rate is estimated to be 0.87 MB/s
- That leaves only 7.5% margin from a downlink bandwidth perspective
- New APT diagnostics will help reduce bandwidth usage (amount TBD)
- Schedulers have to juggle several other scheduling constraints
 - Visibility, timing, orient, background noise, momentum, etc.
 - Planning to add excess data volume as a resource to manage in long range plan
- Data volume excesses must be balanced by data volume deficits
 - Easy to schedule deficit visits will become more scarce as cycle proceeds
 - If pool lacks suitable deficit visits, schedulers will defer excess visit or leave gap