Alice Data Review New Horizons KEM 1 v2.0

John Noonan
February 26, 2020

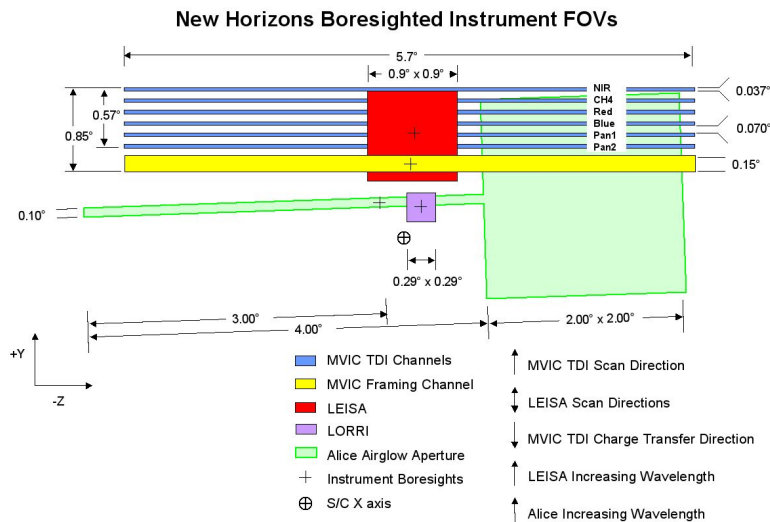# Overview

- Review of nh_a_alice_2_KEM1_v2.0 and nh_a_alice_3_KEM1_v2.0
- Previously reviewed nh_x_alice 2_KEM1_v1.0 and nh_x_alice_3_KEM1_v1.0
- New submission includes data through 01-01-2019, 07:08 UTC (S/C Time)

1. **No major issues preventing database from use and data look good**
2. **All issues identified in September review addressed**
3. **Minor typo in documentation**
    a. **Dataset.cat (Both -2- and -3- submissions)**
4. **Sequence file contains extra sequences not submitted in dataset** (Both -2- and -3- submissions)

Brief P-Alice Instrument Overview

- P-Alice is an ultraviolet spectrograph sensitive from 520 to 1870 Angstroms
- A "lollipop" shaped slit is used (wide on top, narrow on bottom)
- Detector has 1024 columns in the spectral dimension, 32 rows in the spatial dimension.

New Horizons Boresighted Instrument FOVs

Legend:
- MVIC TDI Channels
- MVIC Framing Channel
- LEISA
- LORRI
- Alice Airglow Aperture
- + Instrument Boresights
- ⊕ S/C X axis

- MVIC TDI Scan Direction
- LEISA Scan Directions
- MVIC TDI Charge Transfer Direction
- LEISA Increasing Wavelength
- Alice Increasing Wavelength

Boresight Locations

	Rot abt Y (deg)	Rot abt Z (deg)	Rot abt X (deg)
S/C	0.00	0.00	
Ralph/MVIC Frame	-0.07	-0.74	
Ralph/MVIC P2	-0.08	-0.92	
Ralph/MVIC NIR	-0.08	-1.50	
Ralph/LEISA	-0.11	-1.04	
LORRI	-0.17	-0.32	
Alice Airglow	0.21	-0.37	2.00

Axes are S/C coordinates, as projected onto sky.

-X is into page; +X is out of page.

During MVIC TDI and LEISA scans, s/c rotates about the -Z axis.

Diagram is to scale. Based on pre-flight and in-flight alignments specified in nh_v110.tf.

H. Throop/SwRI, 21-Sep-2007

Documentation Review

Alice Sequence File (seq_alice_kem1.tab, both 2 and 3)

- Includes all commands up to 1-05-2020, but dataset.cat and provided data only contain data prior to 01-01-07:08 UTC

seq_alice_kem1.tab

37	"ALI","18359:KEAL_HD42954_DPSTELLAROC1_PL_2019001 ","2019-01-01T06:40:50 ","3/0408630768:00000","Departure – Stellar Occultation Airglow Pixel List "
38	"ALI","18359:KEAL_MU69_DPROTH2_HS_2019001A ","2019-01-01T08:23:20 ","3/0408636918:00000","Departure – Airglow Histograms 2A "
39	"ALI","18359:KEAL_MU69_DPROTH1_HS_2019001 ","2019-01-01T10:45:13 ","3/0408645431:00000","Departure – Airglow Histograms 1 "
40	"ALI","18359:KEAL_MU69_DPROTH2_HS_2019001B ","2019-01-01T12:09:45 ","3/0408650503:00000","Departure – Airglow Histograms 2B "
41	"ALI","18359:KEAL_HD42954_DPSTELLAROC2_HS_2019002 ","2019-01-02T03:47:58 ","3/0408706796:00000","Departure – Stellar Unocculted "
42	"ALI","18359:KEAL_MU69_AIRGLOW-OUTBOUND_HS_2019002 ","2019-01-02T07:09:55 ","3/0408718913:00000","Outbound Airglow Observation "
43	"ALI","19003:KDAL_SUN_DPUNOCCSUN_HS_2019004 ","2019-01-04T22:53:43 ","3/0408948341:00000","Departure Solar Unocculted SOCC Histograms "
44	"ALI","19003:KDAL_SUN_DPUNOCCSUN_HS_2019004 ","2019-01-04T22:55:33 ","3/0408948451:00000","Departure Solar Unocculted SOCC Histograms "
45	"ALI","19003:KDAL_SUN_DPUNOCCSUN_HS_2019004 ","2019-01-04T22:58:50 ","3/0408948648:00000","Departure Solar Unocculted SOCC Histograms "
46	"ALI","19003:KDAL_X_703-HV-DARK-TEST_HS_2019005 ","2019-01-05T00:55:25 ","3/0408955643:00000","HV and Dark Verification "

Alice Sequence File (seq_alice_kem1.tab, both 2 and 3)

- Includes all commands up to 1-05-2020, but dataset.cat and provided data only contain data prior to 01-01-07:08 UTC

dataset.cat

```
RECORD_TYPE                     = STREAM
INSTRUMENT_HOST_NAME            = "NEW HORIZONS"
OBJECT                          = DATA_SET
  DATA_SET_ID                   = "NH-A-ALICE-3-KEM1-V2.0"

  OBJECT                        = DATA_SET_INFORMATION

    START_TIME                  = 2018-09-30T17:08:02.058
    STOP_TIME                   = 2019-01-01T07:08:02.148
```

Minor Typo - Dataset.cat (Both 2 and 3)

1. **In Notes Section 1):** Long-Range Reconaissance Imager (LORRI)
   "Reconaissance" ➜ "Reconnaissance"

```
203
204    Notes:
205    ------
206    1) CDH 1 and CDH 2 refer to the spacecraft redundant Command and Data
207       Handling systems in general, and here specifically to their
208       respective Solid State Recorders (SSRs) 1 and 2, where ALICE data
209       be stored and prepared for downlink.  ALICE can send data to SSR
210       1 or to SSR 2, or, for mission-critical data, to both redundantly.
211       ALICE shares its channel to the SSRs with the Long-Range
212       Reconaissance Imager (LORRI), so both instruments cannot store
213       data simultaneously.  ALICE has the capability to store histogram
214       data to instrument-internal storage, and to transfer it to the
215       SSR(s) later; such an operation is called a Held Histogram, and
216       it allows ALICE to take data at the same time that LORRI is taking
217       and writing data to the SSR(s).
```
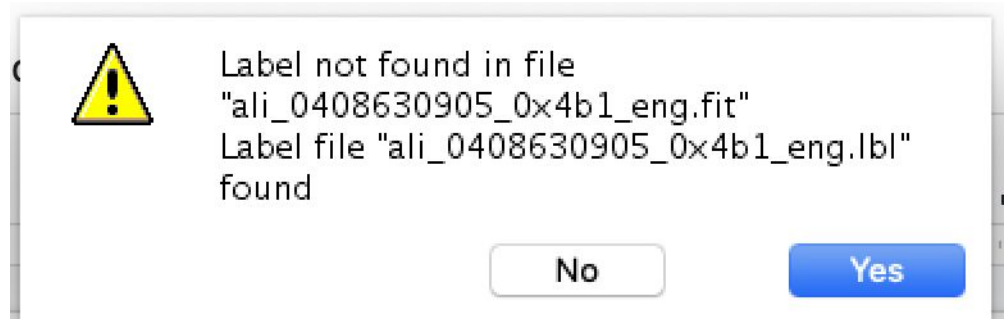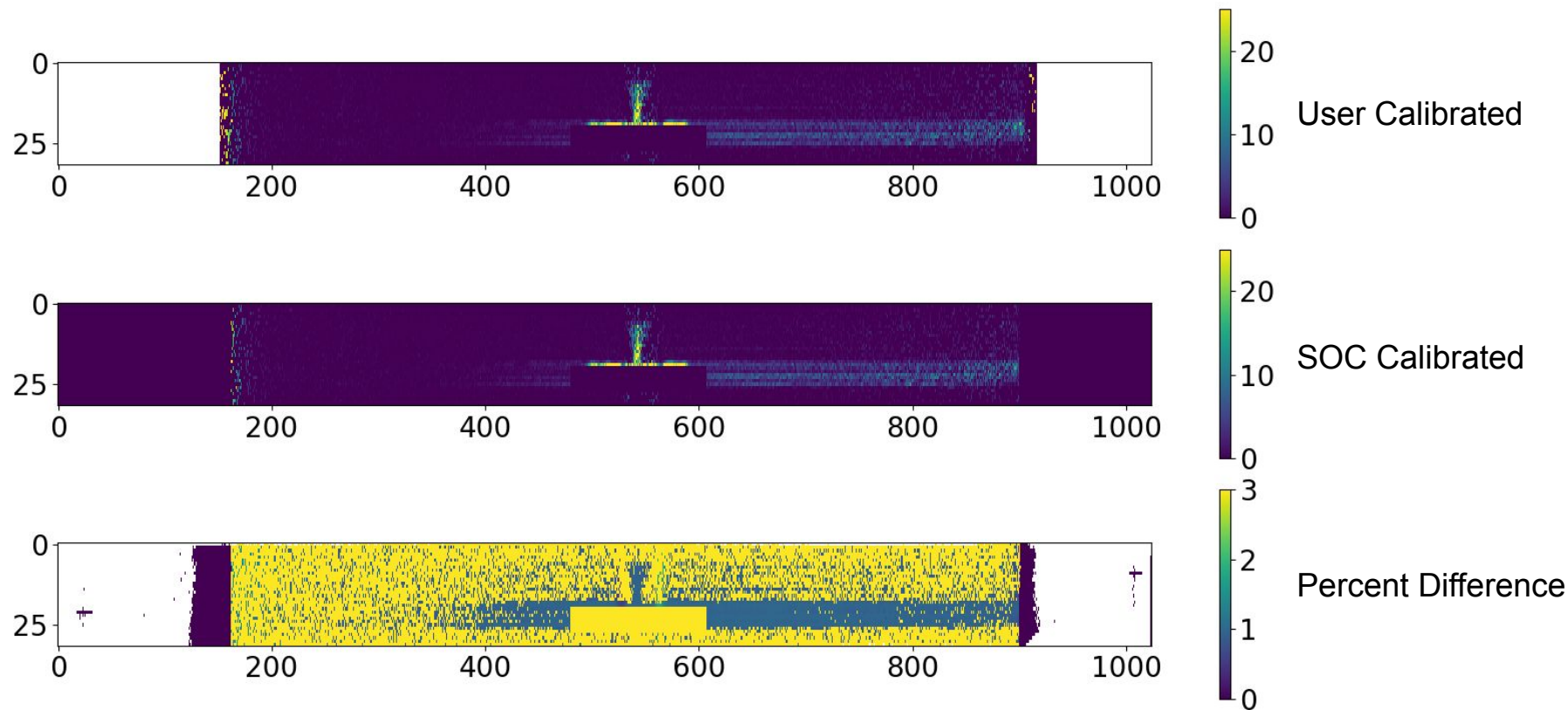
Data Review

Usability

- All .fits files accessed using Python and astropy.io.fits
    - All eng files calibrated according to ICD
    - All sci files accessed, both data and headers
    - Log file with machine readability available
    - PNGs with both user-calibrated, science files, and differences available on request
    - Python code available as well
- All .lbl files checked with Python script for machine readability
    - Log available upon request
- Select files checked in NASAView/DS9 to ensure _eng.fits files matched _sci.fits files
    - Ran into issue with NASAView opening files, but not with Python
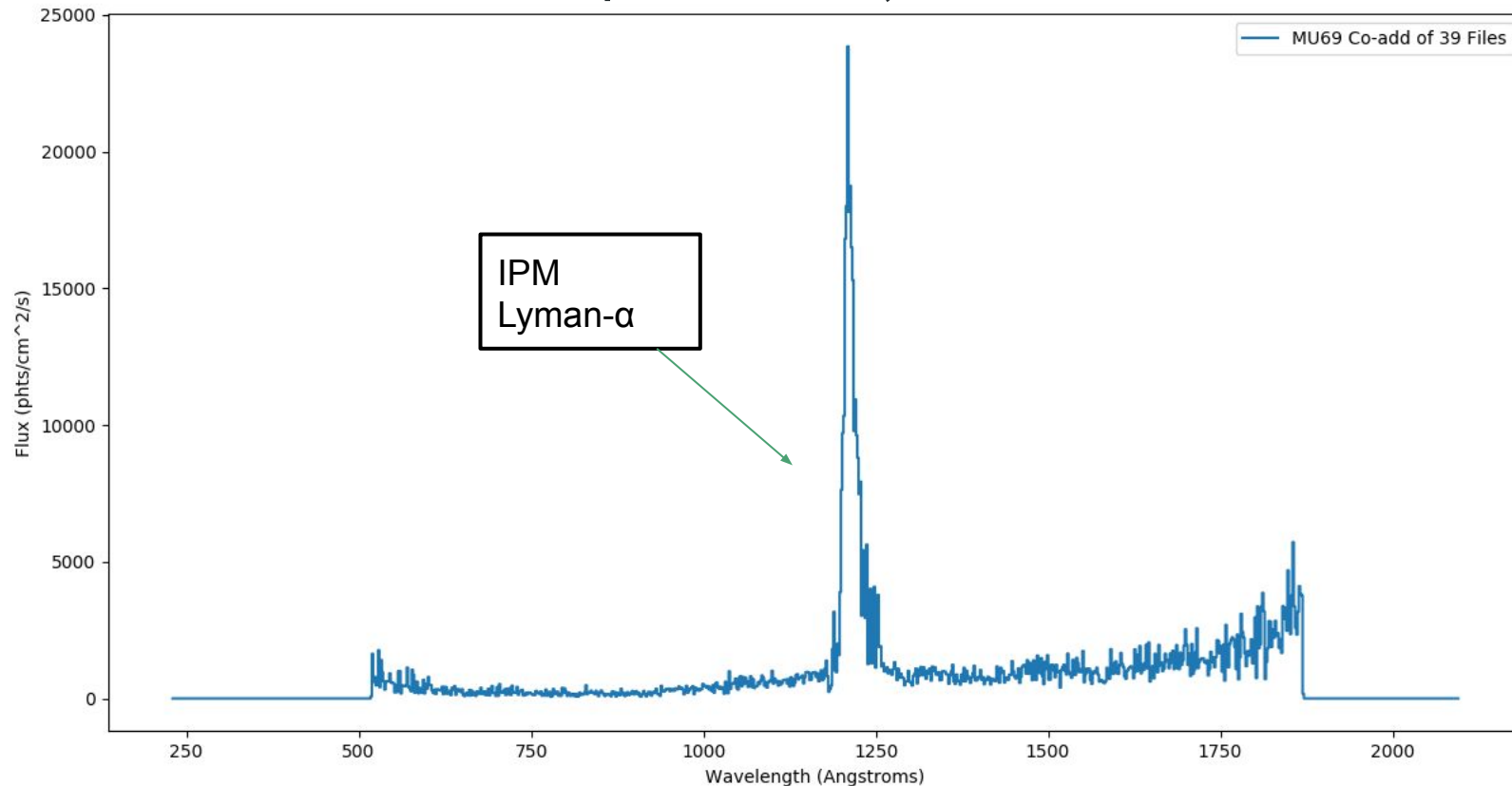
Opening Files In NASAView

- Files in opened in NASAView bring up the window below, which seems more like a notification that the header can't be read and the .lbl file is used instead.
- It doesn't seem that this is a fatal error, but it seems odd that the header cannot be read by NASAView.
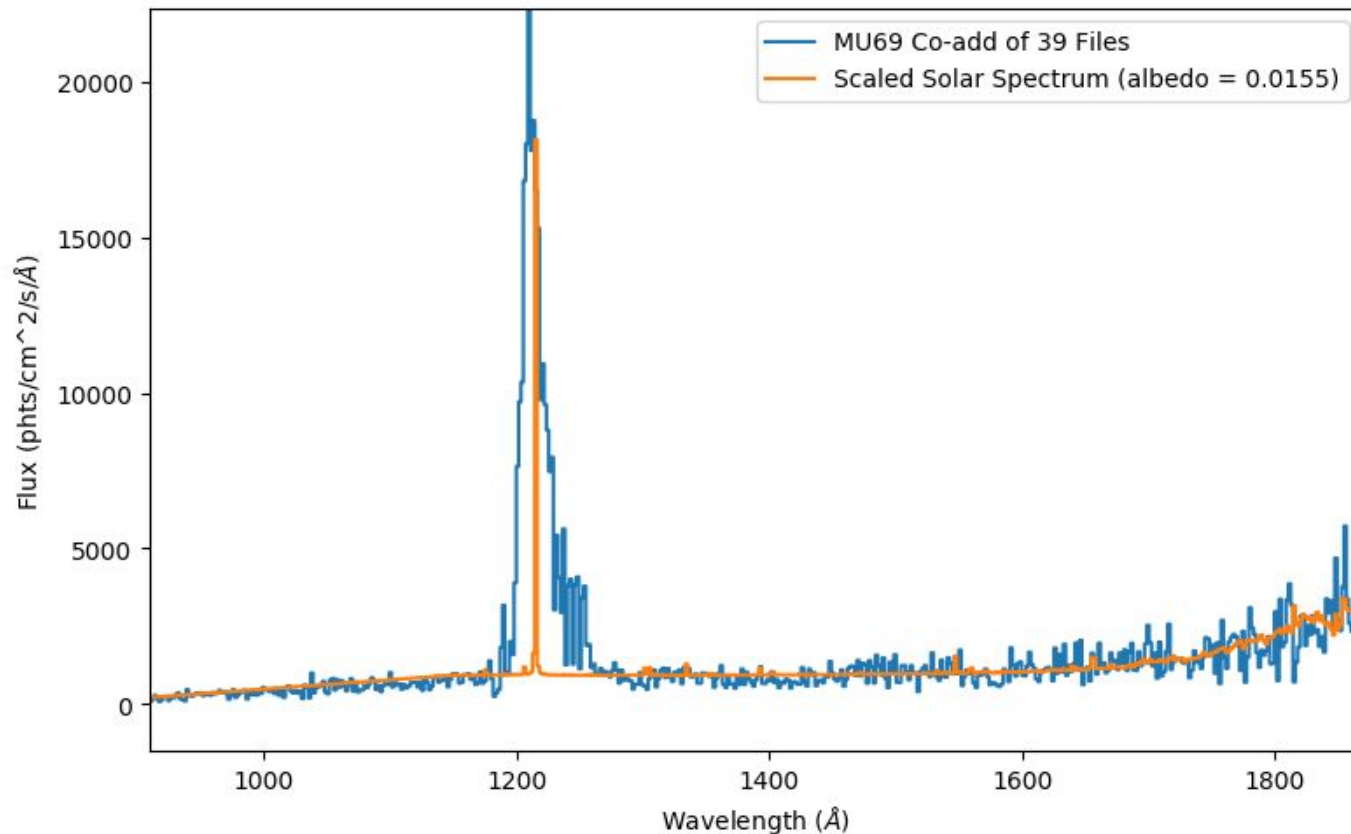- Header **is** readable with DS9 and Python.

Label not found in file
"ali_0408630905_0x4b1_eng.fit"
Label file "ali_0408630905_0x4b1_eng.lbl"
found

No   Yes

Example Difference Image: ali_0408631636_0x4b1

Arrokoth Co-Added Spectrum (Narrow Slit Rows Only)

PDS SBN Review September 5-6
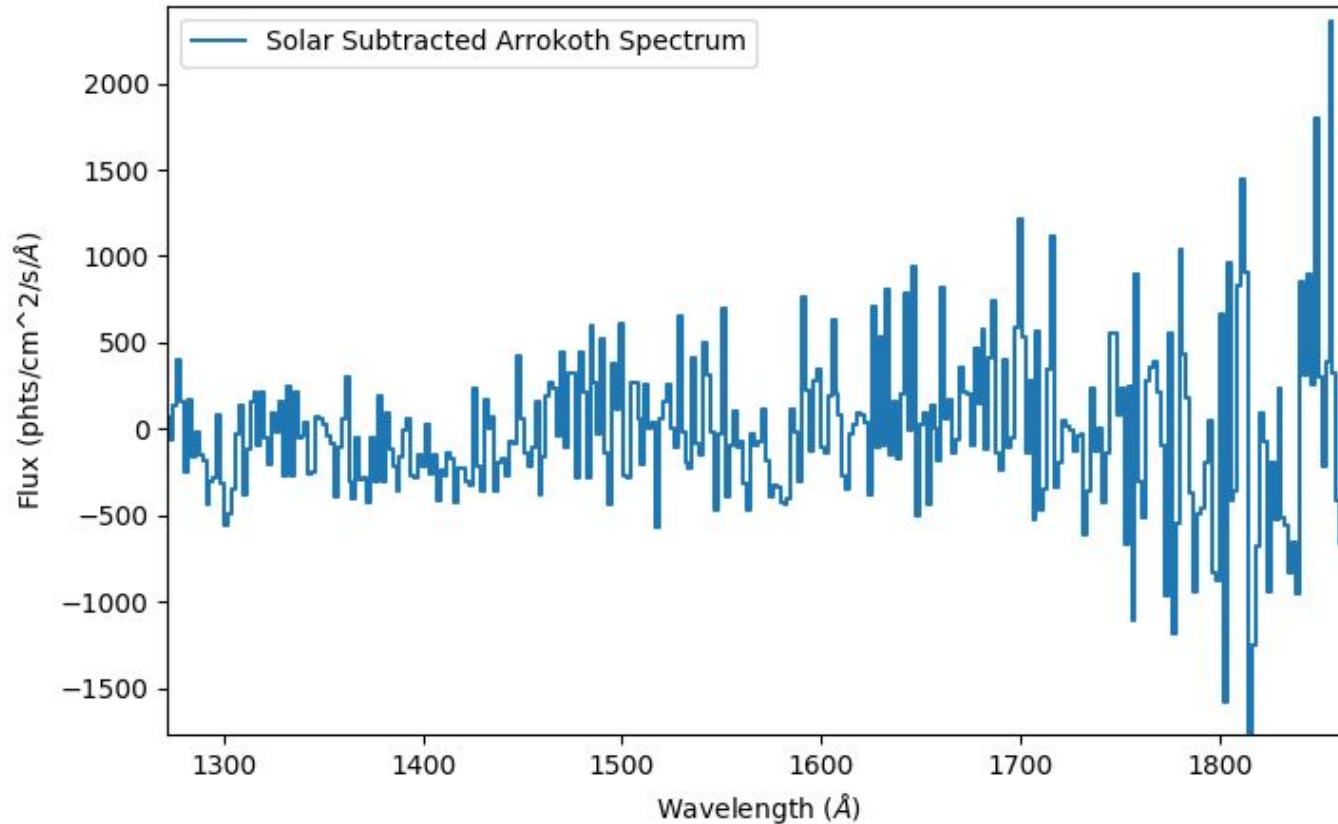
Arrokoth Solar Reflectance Fit (a_{UV}=0.0155)

Arrokoth Emissions Search

Major Issues

1. None

Minor Issues

1. Misspelling of "Reconnaissance" in *dataset.cat* (Notes, section 1)
2. Additional sequences provided in *seq_alice_kem1.tab* that are not listed in *dataset.cat* or available in data directory.
3. Files opened in NASAView open dialogue window indicating header of .fits file is not readable