

SMA Technical Memo #161

Subject: **STATUS OF SMA MIRIAD PIPELINE -**
for handling new format data taken in various SMA correlator modes
during the science operations

Date: June 9, 2015^[1]

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^[1]Updated from the versions issued on April 7, April 13, April 28, 2015

- Abstract -

Since November 15, 2014 when SMA announced that the storage of SMA data taken with all the observing modes in the SMA operation is switched to the new format system, a few updated versions for SMA Miriad have been exported to a CfA public computer in Hilo (hilodr2) at the SMA site in Hilo, Hawaii for SMA data reduction. Mac Cooper has been working on a duplication system to fetch the Miriad on hilodr2 to Cambridge. [An early report](#) on the status of handling the SMA data stored in the new format was issued in December 2014. In this SMA Technical Memo, we are reporting the status of the Miriad pipeline in transferring SMA data into Miriad. We have examined all the data taken for the science tracks in the period between December 22, 2014 and March 31, 2015 including a total of 128 data sets. The observations have covered numerous observing modes including the ASIC correlator of 4 GHz band, the hybrid correlators of the **ASIC^[2]** 4 GHz band plus 2 SWARM bands, dual receivers with 2 GHz band for polarization or non-polarization, ASIC 4 GHz polarization and ASIC 2 GHz polarization. The new Miriad pipeline successfully transfers 114 SMA data sets to Miriad formats. We note the origins of the problems caused by correlator configuring errors, initializing SWARM correlator, hardware overheating, resetting RM errors, recording errors with online software. The relevant error messages reported on screen from the Miriad pipeline for those problematic data sets are provided with further diagnosis of the data errors and information. The test was done with [Miriad SWARM3.0.0](#). The problems in six data sets that were initially failed in reading a bad data string in an ancillary data table have been fixed with special patches implemented in the updated version [Miriad SWARM3.0.1](#).

^[2]The SMA ASIC correlator was referred as Legacy correlator.

- 1. Miriad software for SMA -

Since the SMA-Miriad version ([Miriad SMA-WB2.0.0](#)) for the pipeline in handling SMA data taken in the new format, the version released on the CfA public computers has been updated and new versions of pipeline will have been exported via the duplication system on hilodr2 at the SMA Hilo site. Before the duplication system is fully function, a temporary service has been provided on rglinux12. The version [Miriad SWARM3.0.0](#) was used for the pipeline status tests described in this memo.

- 2. Observing mode -

As we have discussed in the SMA Technical Memo (December 2015) for the [Status of SMA Miriad WB for handling SMA wideband data in new format](#), one of the ASCII files under the subdirectory for each of the raw SMA data sets provides two integers to code the observing mode concerning number of receivers (1 for single and 2 for dual) and the correlator mode (4 for 4 GHz or doubleband with 48 spectral chunks, and 2 for 2 GHz usually with 24 spectral chunks) that are used in observations. So far, we have detected three general modes, i.e. (1,4), (2,2), and (2,1). However, unlike the other modes, the two integers in the (2,1) mode appear to correspond to the size of band in GHz and receiver codes, respectively, i.e. single receiver with 2 GHz band; this mode seems to be particularly used for polarization. Under each of the three general observing modes, there are specific correlator combinations to be used. For example, the mode (1,4) may contain either only the ASIC correlator of 4 GHz band data with various correlator configurations applied containing one pseudo continuum channel at the first spectral window following by number of ≤ 48 spectral windows or a hybrid configuration with the ASIC correlator plus two additional broadband windows from the SWARM correlator. Occasionally, the correlators are configured for four polarization correlations with either one or two receivers.

- 3. Data set -

Table 1 lists the results for the data sets observed in the new data format in the period between December 22, 2014 and April 1, 2015. Column 1 gives the name of all the data files from the science category under the SMA archival system in Hawaii (/sma/data/science/~) for the period of the observations applied to this report. Column 2 gives the handling status of data sets for the Miriad pipeline **SMALOD: "OK"**

means readable, and "??" marks the problematic data sets that may need further information to fix. Column 3 lists the two integer code for `modeInfo`; the observing modes of the data appear to be separated into three in general, i.e. [1,4], [2,2] and [2,1]. Additional codes are given for further information on the specific observing modes:

+2SW for two broadband SWARM spectral windows;
Pol for polarization;

in case of dual receiver modes, the relevant receiver code are given,

rx=0 for 230 band receiver;
rx=1 for 340 band receiver;
rx=2 for 400 band receiver;
rx=3 for 690 band receiver;

The byte size (GB) for each of the converted SMA visibility data sets is given in Column 4. Column 5 lists the error messages reported in the Miriad pipeline for those problematic data sets. We also add superscript numbers to table 1 to note the origins of the errors and possibility for repair. The origins of the problems were caused by correlator configuring error, initializing SWARM correlator, hardware overheating, resetting RM errors, recording errors with online software and etc..

Table 1: Observing mode

(1) File name	(2) Status	(3) modeInfo	(4) Size	(5) Report errors & test notes
2014Dec				
001- 141222_03:50:32	OK	1 4	0.84G	
002- 141227_03:52:23	OK	1 4	0.82G	
003- 141228_10:00:25	OK	1 4	0.21G	
004- 141229_05:39:16	OK	1 4	0.30G	
005- 141229_14:47:54	OK	1 4	0.29G	
006- 141230_03:49:11	OK	1 4	0.02G	
007- 141230_04:19:43	??	1 4	≤0.01G	Segmentation fault ¹
008- 141230_04:31:35	OK	1 4	0.44G	
2015Jan				
009- 150101_03:34:22	OK	1 4	0.50G	
010- 150111_03:22:27	OK	1 4	0.37G	
011- 150112_03:09:00	OK	1 4	0.82G	
012- 150113_03:26:19	OK	1 4	0.15G	
013- 150113_07:09:10	OK	1 4	0.40G	
014- 150114_09:24:35	OK	1 4+2SW	7.33G	
015- 150115_11:01:10	OK	1 4+2SW	4.58G	
016- 150116_18:54:14	OK	1 4	0.06G	Segmentation fault (sour) ⁶
017- 150117_03:23:11	OK	1 4+2SW	10.95G	
018- 150118_05:47:30	OK	1 4	1.24G	
019- 150119_03:35:52	OK	1 4+2SW	14.72G	
020- 150120_10:28:51	OK	1 4	0.47G	
021- 150122_03:48:30	OK	1 4+2SW	15.84G	
022- 150123_03:35:39	OK	1 4+2SW	5.13G	Observing Date: 1959 Jan 02 ²
023- 150123_15:01:14	OK	1 4+2SW	3.34G	
024- 150123_21:15:35	??	1 4	0.01G	Miriad needs updating ³
025- 150123_23:28:57	OK	1 4	0.08G	
026- 150126_03:51:31	OK	1 4+2SW	7.50G	
027- 150127_03:50:01	OK	1 4+2SW	11.08G	
028- 150128_05:21:11	OK	1 4	0.39G	
029- 150130_03:42:21	OK	1 4	0.02G	
030- 150130_08:46:40	OK	1 4	0.01G	
2015Feb				
031- 150201_03:36:56	OK	1 4	0.55G	
032- 150201_12:56:44	OK	1 4	0.15G	
033- 150202_03:25:12	OK	1 4	0.47G	
034- 150202_13:45:43	OK	1 4	0.02G	
035- 150203_03:40:05	OK	1 4	1.75G	
036- 150203_13:48:47	OK	1 4	0.46G	
037- 150204_03:06:38	??	2 2	0.55G	Fatal: number of antennas = 3.701562 ⁴
038- 150205_14:04:24	??	2 1 Pol	0.44G	Fatal: number of antennas = 6.844289 ⁴
039- 150206_04:59:40	OK	1 4	0.43G	
040- 150207_05:42:29	??	2 1 Pol	1.73G	Fatal: number of antennas = 8.262087 ⁵
041- 150208_04:29:54	OK	1 4+2SW	4.07G	
042- 150208_12:18:48	OK	1 4+2SW	2.16G	
043- 150209_05:18:28	OK	1 4	0.16G	Segmentation fault (Sour) ⁶
044- 150209_08:14:05	OK	1 4	0.63G	
045- 150210_04:23:33	OK	1 4	0.46G	
046- 150212_05:21:54	??	2 2	1.82G	Fatal: number of antennas = 4.274917 ⁷
047- 150212_16:29:48	OK	1 4	0.12G	

048-	150213_02:32:15	OK	1 4	0.84G	
049-	150213_11:01:12	OK	1 4	0.31G	
050-	150214_03:58:01	OK	1 4	0.49G	
051-	150216_03:34:25	OK	1 4	0.73G	Segmentation fault (Sour) ⁸
052-	150216_10:55:54	OK	1 4	0.34G	
053-	150217_04:10:12	OK	1 4	1.56G	
054-	150218_03:46:42	OK(10,950)	1 4+2SW	4.35G	
055-	150218_12:04:09	OK	1 4	0.01G	Pre-SW track ⁹
056-	150218_12:20:40	??	1 4	≤0.01G	Segmentation fault ⁹
057-	150218_12:26:18	OK	1 4	0.03G	Pre-SW track ⁹
058-	150218_12:39:13	OK	1 4	0.05G	Pre-SW track ⁹
059-	150218_12:47:38	OK	1 4+2SW	4.06G	
060-	150219_03:14:04	??	1 4	0.02G	Segmentation ⁹
061-	150219_03:33:28	??	1 4	0.01G	Segmentation ⁹
062-	150219_03:45:59	OK	1 4	0.01G	Pre-SW track ⁹
063-	150219_03:55:56	OK	1 4+2W	0.35G	Segmentation fault (Sour) ¹⁰
064-	150220_04:07:43	OK	1 4	0.20G	
065-	150220_05:47:05	OK	1 4	0.33G	
066-	150220_09:33:40	OK	1 4	0.98G	
067-	150221_02:50:36	OK	1 4	0.64G	
068-	150222_03:50:13	OK	1 4	1.11G	
069-	150223_04:06:17	OK	1 4+2SW	0.05G	
070-	150223_04:33:24	OK	1 4+2SW	4.14G	
071-	150223_11:23:32	OK	1 4+2SW	5.31G	
072-	150224_04:39:08	??	1 4+2SW	0.02G	Pre-SW track
073-	150224_04:47:03	OK	1 4+2SW	0.19G	
074-	150224_05:33:03	OK(1,695)	1 4+2SW	2.05G	
075-	150224_10:58:07	OK(1,477)	1 4+2SW	1.41G	
076-	150224_15:14:52	OK(1,535)	1 4+2SW	1.57G	
077-	150225_03:21:49	OK(1,1895)	1 4+2SW	8.34G	
078-	150225_13:48:07	OK	1 4	0.09G	
079-	150226_12:24:44	OK	1 4	0.01G	
080-	150227_03:14:20	OK(1,955)	1 4+2SW	4.23G	
081-	150227_12:00:28	OK	1 4+2SW	0.04G	
082-	150227_12:06:54	OK	1 4+2SW	5.85G	
083-	150228_05:34:15	OK	1 4	0.35G	
2015Mar					
084-	150302_17:32:24	OK	1 4	0.06G	
085-	150306_04:50:05	??	2 2	0.51G	Fatal: number of antennas = 4.274917 ¹¹
086-	150306_13:47:44	OK	1 4	0.50G	
087-	150307_02:24:55	OK	1 4	0.20G	
088-	150307_05:37:45	OK	1 4	0.04G	
089-	150307_05:45:40	OK	1 4	0.29G	
090-	150307_11:02:49	OK	1 4	0.09G	
091-	150308_04:38:50	OK	1 4	1.09G	
092-	150308_11:35:41	OK	1 4	0.09G	
093-	150317_04:23:41	OK	1 4	0.12G	
094-	150319_04:13:53	OK	1 4	0.29G	
095-	150320_04:02:29	OK	1 4	0.01G	Polarization track ¹²
096-	150320_04:16:54	OK	1 4	0.07G	Polarization track ¹²
097-	150320_05:11:15	OK	1 4	0.06G	Polarization track ¹²
098-	150320_05:38:14	OK	1 4	0.01G	Polarization track ¹²
099-	150320_05:40:07	OK	1 4	0.01G	Polarization track ¹²
100-	150320_05:42:01	OK	1 4	0.05G	Polarization track ¹²
101-	150320_05:49:27	OK	1 4	0.11G	Polarization track ¹²
102-	150320_06:38:29	??	1 4	≤0.01G	Segmentation fault ¹²
103-	150320_06:47:49	OK	1 4	0.49G	Polarization track ¹²
104-	150320_10:36:12	OK	1 4	0.01G	Polarization track ¹²
105-	150320_10:46:58	OK	1 4	0.22G	Polarization track ¹²
106-	150320_12:50:32	??	1 4	≤0.01G	Segmentation fault ¹²
107-	150320_13:03:39	OK	1 4 Pol	0.41G	Polarization track ¹²
108-	150322_06:24:51	OK	2 2 rx=0	9.25G	
109-	150322_06:24:51	OK	2 2 rx=1	9.25G	
110-	150323_05:14:40	OK	1 4	0.29G	
111-	150324_03:31:48	OK	1 4	0.13G	
112-	150324_04:12:02	OK	1 4	1.35G	
113-	150325_03:03:28	OK	1 4	0.15G	
114-	150325_11:04:08	OK	1 4	1.57G	
115-	150326_04:58:27	OK	2 2 rx=0	12.09G	
116-	150326_04:58:27	OK	2 2 rx=2	12.09G	
117-	150327_05:15:59	??	2 2	11.11G	Segmentation fault (Tsys) ¹³
118-	150328_05:20:03	OK	2 2 rx=0	10.93G	
119-	150328_05:20:03	OK	2 2 rx=2	10.93G	
120-	150329_04:51:46	OK	1 4	0.27G	

121-	150330_00:09:42	OK	2 2 rx=0	4.25G	
123-	150330_00:09:42	OK	2 2 rx=2	4.25G	
124-	150330_04:53:54	OK	2 2 rx=0	11.90G	
125-	150330_04:53:54	OK	2 2 rx=2	11.90G	
126-	150330_19:40:24	OK	1 4+2SW	1.28G	
127-	150331_02:46:49	OK	1 4	0.75G	Segmentation fault (Sour) ¹⁴
128-	150331_10:46:11	OK	1 4	0.08G	

Notes: (updated April 28, 2015)

¹Correlator overheated and needed to shut down some racks and restarted the correlator.

²The wrong observing date reported in the version of of Miriad SWARM 3.0.0 has been fixed in the updated version (3.0.1 or higher).

Data error: the cdh file of the data set provides two reference times 1) at cd_count=61 ref_time corresponds to Jan 23, 2015; 2) at cd_count=5113 ref_time corresponds to Jan 2, 1959

³Started setting RM errors so the observing program stopped shortly.

⁴Polarization tests not a source track.

⁵Daul receiver polarization, PI = Hirano.

⁶PI: Glen Petitpas; the source coordinates in inh file contains a bug which has been fixed in the version of Miriad SWARM 3.0.1 or higher.

Data error: The source coordinate string in inh at inhid=342 for 150116_18:54:14 and inhid=348 for 150209_05:18:28

⁷Daul receiver polarization, PI = Hirano, the data stored incorrectly.

⁸PI: Srinath; the source coordinates in inh file contains a bug which has been fixed in the version of Miriad SWARM 3.0.1 or higher.

Data error: The source coordinate string in inh at inhid=993

⁹Useless tracks prior to setting up SWARM correlator.

¹⁰PI: Kalfountzov, many sources in the track.

Data error: The source coordinate string in inh at inhid=1882

¹¹PI: Dunham

¹²Major correlator problems during the polarization track.

¹³VLBI track, non-standard configuration in the backend.

¹⁴PI: Dunham; the source coordinates in inh file contains a bug which has been fixed in the version of Miriad SWARM 3.0.1 or higher.

Data error: The source coordinate string in inh at inhid=1015

• 4. Pipeline status -

For the total of 128 data sets taken between December 22, 2014 and March 31, 2015, the Miriad pipeline (version [Miriad SWARM3.0.0](#)) successfully transfers 108 data sets to Miriad, covering the modes with the ASIC correlator 4 GHz or 2 GHz bands, hybrid correlators of the ASIC 4 GHz band with 2 SWARM bands (4GHz), dual receivers for polarization or non-polarization, ASIC 4 GHz polarization, and/or ASIC 2 GHz polarization. Among the readable 108 data sets, six files containing bad visibility data in the beginning or ending of the tracks can cause Segmentation fault; the problem can be resolved simply with the function [nscans](#) in [SMALOD](#); the datasets can be processed by dropping out the integrations that may contain bad data strings. The readable range of the integrations are given with two integers in the parenthesis in Column 2 of Table 1 for the easy-repairable data sets. The usage of [SMALOD](#) for 150227_03:14:20 with status = OK(1,955), for example:

```
smalod in=150227_03:14:20 out=150227tst rxif=0 \
options=circular sideband=0 nscans=1,955
```

• 5. Diagnosis of data errors -

For those data sets that are failed to read, [SMALOD](#) usually provides error reports on screen. The Column 5 contains the errors reported on the screen from the exam with [Miriad SWARM3.0.0](#). Further hints for the cause of the data problem in handling the problematic files are discussed below, and further information is needed in patching the pipeline program to read them:

[Segmentation fault -](#)

Among the problematic data sets (status=??), the screen reports from the Miriad pipeline program indicate "Segmentation fault", which usually tells one that those data contain bad strings in the visibility data files. The seven files with small byte size (≤0.02G) contains only a few integrations of visibility data, which are usually produced in the initialization process to get the SWARM correlator online.

"Segmentation fault" may also caused by ancillary bad strings or wrong information in an ancillary data table in those files. Further information is given in the parenthesis: "Sour" indicates that bad string occurs in parsing the source names; "Tsys" indicates that bad data strings contain in the system temperature data.

[Fatal: number of antennas -](#)

"Fatal: number of antennas" with a non integer number indicates that the baseline codes in the five data sets have been packed specially, not following the convention. They can be fixed if additional information on the format of baseline structure is provided.

Observing Date: 1959 Jan 02 -

For 150123_03:35:39, the Miriad pipeline interprets wrongly the observing date. This indicates that a wrong data string with incorrect observing date was placed in the entry of reference time for observation. Usually such a problem can be repairable with a special patch.

Miriad needs updating -

This usually indicates that a new version of the online code has been used in the production of the data. A special patch is needed to repair this data.

However, according to the daily operation logs (Glen Petitpas), most of problematic data sets were caused by initializing SWARM correlator (pre-SW), which contains small size of bites; a few of them were produced by special testing tracks, such as VLBI with non-standard configuration in the backend, non-source or dual-receiver polarization tests; and the rest of them were due to correlator configuring error, hardware overheating, resetting RM errors, recording errors with online software and etc,;

- 6. Patches (updated May 30, 2015) -

The data recording errors often occur in the beginning or ending of the operation for an observing track. For data errors containing in the visibility file, [SMALOD](#) provides a function to select a range of integrations with no data errors to load into Miriad. For those errors occurring in ancillary data files, special patches are needed. For the five data sets 150116_18:54:14, 150209_05:18:28, 150216_03:34:25, 150219_03:55:56 and 150331_02:46:49 with Segmentation fault (Sour) reported in [Miriad SWARM3.0.0](#), the problems have been fixed with patches implemented in [Miriad SWARM3.0.1](#). For the data set 150123_03:35:39, an error occurs in the entry `ref_time`. A patch has been implemented [Miriad SWARM3.0.1](#) for correcting the error.