RSR Data Reduction (QA)

Rotator

Room temp frontend components mount to the outside of the dewar at the waveguide feedthroughs. 2 stage amp E. and isolators

Detail of one dual polarized receiver.

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https://www.astro.umd.edu/~teuben/LMT/RSR_pipeline_2023.pdf

SLpipeline: RSR quality

Summary of all obsnum's and combinations: (click on column name to sort by that column)

#	ObservingDate 🔺	ObsNum	SourceName	RestFreq	inttime [s]	tau	RMS [mK]	RMS/RMS0 ratio	aPlot	comments
83.	"2023-02-02T12:29:42"	<u>104508</u>	NGP-78659		318.1	0.041	0.976351	0.97345 /100K		т. м. м.
82.	"2023-02-02T12:23:20"	<u>104507</u>	NGP-78659		319.3	0.041	0.962454	0.961396 /100K		м м м м
81.	"2023-02-02T12:17:03"	<u>104506_104508</u>	NGP-78659		951.1	0.041	0.58102	1.00168 /100K		
80.	"2023-02-02T12:17:03"	<u>104506</u>	NGP-78659		313.7	0.041	0.93598	0.926722 /100K		

RSR pipeline (diagram)



RSR pipeline

- 1) **Tsys** look at large channel-to-channel jitter currently 1/1, 2/4 and 3/5 appear "bad". This might give some **badcb**'s
- 2) **BadLags** plot shows ACF variations and resulting **badlags** and might give some **badcb**'s as well.
- 3) **Waterfall** plots created using rsr_driver, with all badlags and badcb applied. Are the repeats consistent? Need additional manual **badcb**'s or other tuning?
- 4) **Spectrum** created using rsr_driver and rsr_sum, compare.
- 5) **Stats**, radiometer, peak detection (even useful for linecheck=0) etc.







2) BadLags plot shows ACF variations and resulting badlags and might give some badcb's as well.













3) Waterfall plots created using rsr_driver, with all badlags and badcb applied. Are the repeats consistent? Need additional manual **badcb**'s or other tuning?















4) Spectrum created using rsr_driver and rsr_sum, compare.

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5) Stats, radiometer, peak detection etc.

rms=1.129 mK base=0.135 mK peak=50.373 mK line=110.514 GHz sigma=0.0351429 GHz rms=1.343 mK base=-1.026 mK peak=48.756 mK line=110.514 GHz sigma=0.0336182 GHz Ulines-110 F1 0 1F 100 CF 0 2 0F 2 0 4 selling a set

Project Summary

Summary of all obsnum's and combinations: (click on column name to sort by that column)

#	ObservingDate 🔺	ObsNum	SourceName	RestFreq	inttime [s]	tau	RMS [mK]	RMS/RMS0 ratio	aPlot	comments
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summary.csv contains a number of project parameters:



ObsNum

- ObsDateTime •
- Source •
- IntTime
- Tau •
- RMS •

. . .

RMS0 •





RMS/RMS0 histogram

Tau vs. RMS



ObsNum vs. Tau

2013-S1-MX-46 (152 obsnum's through Feb 8)

Let's go online?

1) TAP from LMT (usually < 5 mins after observing) http://taps.lmtgtm.org/lmtslr/2023-S1-MX-46/TAP/

2)Reduced on Unity (usually ~1 day later) http://taps.lmtgtm.org/lmtslr/2023-S1-MX-46/

3)Reduced and QA done (TBD)

4) Archive into DataVerse (TBD)

TAP = Timely Analysis Products

full SRDP

badcb= based on jitter in the Tsys value per Chassis/Board (C/B)



badlags applied

no badlags applied

obsnum=104231 badcb=



obsnum=98436 badcb=0/0,0/1,0/2,0/3,0/4,0/5,3/5,











0/2 bad freq 3/3 bad freq

1/2 wavy

2/4 should be blank (bug)



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Detections?





RMS = 0.34 mK RMS0 = 0.17 Tint = 3.24 hrs 37 obsnums

RMS = 0.25 mKRMS0 = 0.26Tint = 1.32 hrs15 obsnums



QA checklist? (M.Yun)

[0..4]

[0..24]

- Integration finished? [yes/no]
- How many chassis?
- How many C/B's?
- Weather ok? [yes/no]
- RMS noise ok? [yes/no]
- Additional flagging needed?

< 100% always fails

RMS/RMSO < 1.4

Add comments

Reducing RSR data

- 1.Use the scripts (badlags, rsr_driver etc.) for black belt users (mostly **dreampy3**)
- 2.Use the pipeline (SLpipeline) **LMTOY** needs to be installed [PI parameters can be used from here on]
- 3.Use the script generator useful to process many obsnums as well as stacking them (**Imtoy_run**)
- 4.Use the web interface [future]

PI-parameters for RSR (and their defaults)

• badcb=""

• xlines=""

e.g. "1/1,2/4,3/5"

e.g. "109.1,0.3,105.2,0.2" – or use linecheck=1

- **linecheck**=0 # 0 or 1 (1 assumes source has the xlines)
- **bandzoom**=5 # pick a band (not board) 0..5
- **speczoom**="" # e.g. "89,2" (overrides bandzoom)
- **rthr**=0.01 # threshold sigma for single obsnum repeats
- **cthr**=??? # threshold sigma for co-adding all observations
- blo=1 # baseline order
- sgf=0 # Savitzky-Golay high pass filter ; odd number > 21
- **notch**=0 # sigma cut for notch filter to eliminate large frecuency oscillations. Needs sgf > 21
- <more to come>

Questions?

Backup Slides

Future ?

- Collect Pointing and LineCheck with script generator?
- More PI parameters
 - Z= : if set, it will draw CO ladder in the spectrum
- More columns in **summary.cvs**

RSR 2023 data (jan 16 --)

Data taken in 2022 suffer from missing chassis 0 and numerous bad boards and lags. LineCheck seem ok, but no science data results yet.

Early Jan 2023 RSR was revamped and all chassis working OK now, weather has been pretty darn good!

- Projects so far:
 - 2023S1RSRCommisioning Many linechecks
 - 2023-S1-US-18 Source: HZ1, HZ4 (PI: Julia)
 - 2023-S1-MX-46
 Source: G09-44907 etc. (PI: Arturo)
 - 2023-S1-MX-47 Source: 9487-9102 (PI: Castalia)
 - 2023-S1-MX-55 Source: ??? (PI: Abigail)
 - 2023-S1-UM-10
 Source: many J*.* sources (PI: Min)

Data Flow LMT \rightarrow Umass-Archive

- R = RAW
- T = TAP
- C = CAL (not shown)
- S = SRDP (contains CAL)
- G = github script generator
- A = Archive (DataVerse)

Typical RSR workflow

- cd \$WORK_LMT/2023-S1-US-18
- SLpipeline.sh obsnum=123456

badcb="" xlines="" linecheck=0 bandzoom=3 ... <other PI parameters>

- SLpipeline.sh obsnums=123456,123457,123458
- mk_summary1.sh > README.html
- xdg-open ...

RSR: script generator

- Files:
 - mk_runs.py
 on['foo'] = [123456, 123457, 123458]
 pars1['foo'] = ""
 pars2['foo'] = ""
 - comments.txt

123456 band5 waves # badcb=3/4

Using the script generator

- Unity shell: make runs sbatch_Imtoy.sh *.run1a sbatch_Imtoy.sh *.run2a make summary
- *LMA shell*: parallel –jobs 32 < *.run1a parallel –jobs 32 < *.run2a

RSR: viewing results

- On malt ("secret", during observing)
- On unity TAP https://taps.lmtslr.org/.../2000-S0-AA-00/TAP
- On unity stage 1 SRDP
- On unity stage 2 SRDP

RSR dreampy3 based scripts

- badlags.py -
- rsr_tsys.py
- rsr_driver.py
- rsr_sum.py -
- rsr_spectra.py -

Radiometer output

- We collect:
 - RMS (mK; scales as 1/sqrt(tint))
 - RMS/RMS0 (at 100K, ideally near 1.0)
 - tau @ 220GHz (but not as function of time)

RMS/RMS0

- Individual (5 min) OBSNUM often close to 1
- Combinations often larger (1.4-1.6)
 - Adding systematics
 - Total integration time < Sum integration times ?