How to do QA2 for the SD/TP solar science data in Cycle 6

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Scope

This HOWTO describes the QA2 procedure for solar science TP data facilitated by the scripts that make **serialized processing of entire SB**.

Preparation

1. Copy all the scripts in the *./scripts* directory except of *scriptForSDImaging.py*

calScriptTemplate.py	*sb_init.py*
sb_defs.py	*sb_run.py*
sb_finalise.py	

to the QA2 dir for a given SB (e.g., *Project_298.S/Sun_10_a_03_TP/*).

2. Make sure that the all the EB tarfiles for this SB are in the same dir.

3. Edit *sb_defs.py* file (Project ID, SB name, and SB and EB uid lists)

4. Run *sb_init* (out of CASA): *./sb_init.py*. This script takes care of

   - creating EB subdirs
   - unpacking the TAR files and move the ASDMs to EB subdirs
   - backup the TAR files to *../downloads/<SB_name>* directory (created, if needed).
   - cretating the EB-customised calibration scripts in each EB subdir

Calibration

5. Start CASA.

6. in CASA: *execfile('sb_run.py')*. This script executes **all** the calibration scripts in **every** EB subdir.

7. Exit CASA and run sb_finalise: *./sb_finalise.py*. This script
   - creates the *./calibrated* subdir
   - copies all *MS.split.cal* (+flagversions) there.
   - moves CASA log files to the 1st EB subdir (for packager to find it)
   - creates the *./diag* subdir and collects all the diagnostic PNG files there for easy data inspection.

Data inspection

8. Check the PNG diagnostic files collected in the *./diag* subdir. Select
   the good antenna and spw accordingly. Remove the *./diag* subdir, if all is OK.

Imaging

9. Go to *./calibrated* subdir.

10. Copy the *scriptForSDImaging.py* there.

11. Edit *scriptForSDImaging.py*: sbName, sbID, ebIDs (all the same as in *sb_defs.py*) + antenna and spw: based on diagnostic plots see *Item 8* above.

    NB: We can **not** use *sb_defs.py* for sbID, ebIDs, etc., as this imaging script goes to the PI (and *sb_defs.py* does not).

12. Start CASA (in *./calibrated*)

13. In CASA: *applyonly=False*
    execfile('scriptForSDImaging.py')

14. The above commands process just the 1st EB. Check the FITS image – there must be no AR in the center. If it is, change the 'region' parameter accordingly to avoid AR inside the region.

15. If all is OK, continue with (in CASA):
    applyonly=True
    execfile('scriptForSDImaging.py')

    This shall process all the EBs in a series.

16. in CASA: *viewer()*
    - select the re-scaled image ('.rescl').
    - click on box-area selection button
    - draw a small box in the **dark** area outside of the Sun.
    - select '*Statistics*' tab in the right panel of the viewer.
    - copy and save the RMS value for README file and AQUA.

17. Exit CASA; check all the FITS files for QA2 criteria.

18. Remove the auxiliary Python scripts before packaging from the main SB dir:

    calScriptTemplate.py *sb_init.py*
    sb_defs.py *sb_run.py*
    sb_finalise.py

Packaging

19. Copy the *README.header.cycleX.txt* and *scriptForPI.py* (from *<QA2_DIR>/QA2/science/qa2*) to the SB directory.

20. Edit the README file.

21. Change directory (cd) **above** the Project_XXX.S dir

22. Start CASA.

23. in CASA (this is just an example – change the paths according to **your** SB!):

```
from QA2_Packaging_module import *
QA_Packager(origpath='./Project_298.S/Sun_10_a_03_TP',
    readme='./Project_298.S/Sun_10_a_03_TP/README.header.cycle6.txt',
    packpath='./QA2_final/2016.1.00298.S', PIscript='./Project_298.S/Sun_10_a_03_TP/scriptForPI.py',
    style='cycle6-nopipe', noms=True, mode='copy')
```

24. Remove the empty CASA and iPython log files (this is because of serialized processing of EBs from the above SB parent dir, just single logfile is present and that is moved to the first EB subdir; other EB subdirs have no log files).

Go to the directory (just an example!)

~/QA2_final/2017.1.01059.S/sg_ouss_id/group_ouss_id/member_ouss_id/log

and remove all 0-bytes logfiles.

25. Exit CASA, cd to the *./QA2_final* subdir, and run *tarsplit*:

cd ./QA2_final
./tarsplit.py -s 3 -o 2016.1.00298.S_Sun_10_a_03_TP_2018-08-04 2016.1.00298.S

Delivery

26. Fill in the AQUA form fields, submit for DRM review.
The RMS in AQUA **must** be filed in Jy (or mJy), not Kelvins (K). See the appended note below on how to make this conversion.

27. Copy the tarsplit()-ted TAR files to accessible but obscured URL, send the link to DRMs **by e-mail(!), never(!)** as AQUA comment.

Appendix: Notes on conversion of RMS in Kelvins to Jansky (per primary beam)

Some notes here are valid only for the setup used at EUARC - Czech node HPC cluster OASA!
Please, do not copy/paste literally, use your analogical setup.

1. Go to oasa:/home/barta/ALMA/QA2/science/DSO dir (got from DSO JAO mirror).

The Kelvin-to-Jansky conversion factors are in the 4th column of the *jy_per_k.txt* database.

Find the measurement that has closest match to your observation (antenna, Band, frequency, date).

Because this is quite cumbersome, you can use the next steps for your convenience:

2. Copy *jy_perk_k.txt* to the local FS.

3. Open it in *(Libre)Office Calc SpreadSheet* (or *MS Excell*):
Start Office -> select 'Calc' -> File: Open -> Import <Tab>-separated data

4. Apply seclection filter

* Data → More filters → Basic filter
* Select 'Column G (antenna) == 'PM0X'(where PM0X is the antenna selected in the scriptForSDImaging.py, e.g. 'PM04') AND 'Column B (Band) == 3 (or 6)'

5. Take the value Jy/K in the Column D with the closest frequency (column I) and date of measurement (column E) to your observation.

Note 1:
There are routines in the *analysisUtils* package *aU::getJyPerK()* and *aU::getJyperK2()* that search in the above databases *jy_per_k.txt* and *jy_per_k_fit.txt*. However,

it does not seem they are able to find results for the solar observations. Most likely, these methods need to be more tolerant as to frequency of SPWs in observed MS and frequencies used in calibration runs in *jy_per_k*.txt*.
As a result, we have to search the database manually, as described above.

Note 2:
There is another faster (but less accurate) alternative for determining it:

aU.janskyPerKelvin(100) for Band 3 (@100GHz)
aU.janskyPerKelvin(240) for Band 6 (@240GHz)

This does not take into account recent calibrator measurement (and,thus, they ignore the effects like aging of antennas). They are based on some average effective antenna collecting area.