An ALMA Cycle 2 QA2 Example

Project 2013.1.00020.S, SB PKS1830-211_b_07_TE

Text entered by the analyst is in red.

Important output text marked in green.
Notes marked with "###", also in green.

D. Petry, 2 February 2015

This is a "manual" analysis, i.e. we have to do the calibration ourselves
with the help of the script generator

Assignment Email from DRM
==========

Hi,
thanks for agreeing to perform QA2 on project 2013.1.00020.S
SB   PKS1830-211_b_07_TE
   http://jira.alma.cl/browse/SCOPS-1070 ### project prep ticket
   http://jira.alma.cl/browse/SCOPS-1245 ### data reduction ticket

 The EB UID(s) are

uid://A002/X86fcfa/X14a6

Please read the instructions at

   http://www.eso.org/projects/alma/arc/tw/bin/view/Offline/Cycle2DataReduction

and don't hesitate to ask in case of any problems (ideally by replying to this email
in order to stay in the same thread).

Please pay special attention to the new EB and SB checklists
(one EB checklist for each EB, one SB checklist for each SB)
which should at the end of your work be attached separately to the data
reduction ticket. See e.g. proj 195, http://jira.alma.cl/browse/SCOPS-1246 .

Best,

Dirk

==========

```
dpetry@arcp8.hq.eso.org:~>startqa2.sh
Usage:   startqa2.sh  <projectname>
       (<projectname> should not contain spaces)

dpetry@arcp8.hq.eso.org:~>startqa2.sh proj020-PKS1830-211_b_07_TE
Directory /opsw/work/dpetry/proj020-PKS1830-211_b_07_TE does not exist. Will create it.
Making a snapshot of jao-mirror/AIV/science for your project ...
Working directory /opsw/work/dpetry/proj020-PKS1830-211_b_07_TE is prepared.
(Please choose the right README and checklist template according to the Cycle of your project.)

dpetry@arcp8.hq.eso.org:~>cd /opsw/work/dpetry/proj020-PKS1830-211_b_07_TE

dpetry@arcp8.hq.eso.org:/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE>ll
total 12
drwxr-xr-x 3 dpetry arc 4096 2015-01-29 14:08 analysis
-rw-r--r-- 1 dpetry arc  397 2015-01-29 14:08 projectinit.py
drwxr-xr-x 6 dpetry arc 4096 2015-01-29 14:08 science
-rw-r--r-- 1 dpetry arc 4003 2015-01-29 14:08 templateCycle2_QA2_Checklist.txt
-rw-r--r-- 1 dpetry arc 2379 2015-01-29 14:08 templateCycle2_QA2__SB_Checklist.txt
-rw-r--r-- 1 dpetry arc 5792 2015-01-29 14:08 templateREADME-cycle2.txt




dpetry@arcp8.hq.eso.org:/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE>cd analysis/
dpetry@arcp8.hq.eso.org:/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE/analysis>mkdir X14a6
dpetry@arcp8.hq.eso.org:/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE/analysis>cd X14a6/

dpetry@arcp8.hq.eso.org:/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE/analysis/X14a6>getasdms.sh -u uid://A002/X86fcfa/X14a6

Doing uid://A002/X86fcfa/X14a6 ...
uid://A002/X86fcfa/X14a6
4:10:00  INFO - Loading properties file from URL [file:/alma/ACS-12.2/acsdata/config/archiveConfig.properties]
14:10:00  INFO - Loading properties file from URL [file:archiveConfig.properties]
14:10:00  WARN - Could not load properties from URL [file:archiveConfig.properties]: archiveConfig.properties (No such
file or directory)
14:10:00 TRACE - Resolved placeholder 'archive.db.tnsFileDirectory'
14:10:00 TRACE - Resolved placeholder 'archive.db.connection'
14:10:00 TRACE - Resolved placeholder 'archive.oracle.user'
14:10:00 TRACE - Resolved placeholder 'archive.oracle.passwd'
14:10:00 TRACE - Resolved placeholder 'db.schema'
```

```
14:10:00 TRACE - Resolved placeholder 'archive.ngast.servers'
14:10:00  INFO - using tnsnames.ora from /opsw/alma/ACS/acsdata/config
14:10:00  INFO - BulkStore servers:
arca1.hq.eso.org:7777,arca2.hq.eso.org:7777,arca3.hq.eso.org:7777,arca4.hq.eso.org:7777,arca5.hq.eso.org:7777
14:10:00  INFO - MetaData schema: ALMA
14:10:00  INFO - MetaData source: ARCDB, user: arcproc
14:10:00  INFO - Using 2 thread to fetch meta-data, 2 to fetch bulk data
14:10:00  INFO - fetching XML: asdm
14:10:01  INFO - fetching XML: MainTable
14:10:01  INFO - fetching XML: AlmaRadiometerTab

...

14:17:41  INFO - retrieved bulk data: A002/X86fcfa/X1700 in 1s
14:17:42  INFO - retrieved bulk data: A002/X86fcfa/X1701 in 0s
14:17:49  INFO - retrieved bulk data: A002/X8709c9/X1 in 8s
14:17:49  INFO - Result: uid___A002_X86fcfa_X14a6


### Start checklist
> cp ../../templateCycle2_QA2_Checklist.txt Cycle2_QA2_Checklist_uid___A002_X86fcfa_X14a6.txt
> emacs Cycle2_QA2_Checklist_uid___A002_X86fcfa_X14a6.txt &

### Enter basic information from project prep ticket and aot file

********** ALMA Cycle 2 QA2 Calibration Checklist *****************

Checklist Version: $Id: Cycle2_QA2_Checklist.txt,v 1.1 2014/07/11 12:08:18 dpetry Exp $
CASA version: 4.2.2
analysisUtils version: $Id: analysisUtils.py,v 1.2185 2015/01/27 17:32:48 tsawada Exp $

Reduction Start Date     : 2015/01/29
Reduction Completion Date:
Analyst Name(s)          : D. Petry

Project code     : 2013.1.00020.S
Contact Scientist: Ivan Marti-Vidal
PI               : S. Muller
SB Name          : PKS1830-211_b_07_TE
ASDM UID         : uid___A002_X86fcfa_X14a6

--------------------
```

```
dpetry@arcp8.hq.eso.org:/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE/analysis/X14a6>casapy-4.2.2
(casa.sh version 8 Jan 2015)

Please enter a  Session ID  containing _your_ user id, e.g. dpetry1
(ID should be different for each of your concurrent CASA sessions): dpqa2
dpqa2
Will create new directory /lustre/home/dpetry/.dpqa2.mycasa as CASA resource directory ...
Using local copy of casapy on arcp8.hq.eso.org for speed.

========================================
The start-up time of CASA may vary
depending on whether the shared libraries
are cached or not.
========================================

CASA Version 4.2.2 (r30986)
  Compiled on: Thu 2014/09/04 17:59:42 UTC

 *** Found projectinit.py in /lustre/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE ***
 *** projectinit.py for proj020-PKS1830-211_b_07_TE: QA2-relevant modules will be imported ***
$Id: analysisUtils.py,v 1.2185 2015/01/27 17:32:48 tsawada Exp $
_____________________________________________________________________
    For help use the following commands:
    tasklist               - Task list organized by category
    taskhelp               - One line summary of available tasks
    help taskname          - Full help for task
    toolhelp               - One line summary of available tools
    help par.parametername - Full help for parameter name
_____________________________________________________________________
**********************************************************************
I am going to upgrade your configuration in:
/lustre/home/dpetry/.dpqa2.mycasa/ipython
Initializing from configuration: /diska/tmp/arcproc/casa-from-tarball/casapy-42.1.29047-001-1-64b/lib64/python2.7/site-
packages/IPython/UserConfig

Successful upgrade!

All files in your directory:
/lustre/home/dpetry/.dpqa2.mycasa/ipython
which would have been overwritten by the upgrade were backed up with a .old
extension.  If you had made particular customizations in those files you may
```

```
want to merge them back into the new files.
Please press <RETURN> to start IPython.

Activating auto-logging. Current session state plus future input saved.
Filename       : ipython-20150129-132043.log
Mode           : backup
Output logging : False
Raw input log  : False
Timestamping   : False
State          : active
*** Loading ATNF ASAP Package...
*** ... ASAP (4.2.0a rev#30794) import complete ***
##################################################

Major interface changes to SINGLE DISH tasks have been
taken place in CASA 4.2.2 release

The interface of the following tasks are modified:
sdbaseline, sdcal, sdcal2, sdfit, sdflag, sdgrid,
sdimaging, sdmath, sdplot, sdreduce, sdsave, and sdstat.
Additionally, a new task called sdaverage is available. Task
sdsmooth has been incorporated in the new task and removed.

The tasks with old interfaces are available with name
{taskname}old. They will be kept until CASA 4.3 release
and removed from later releases. Users are advised to
update existing scripts.

##################################################


CASA <2>: es.generateReducScript('uid___A002_X86fcfa_X14a6')
WARNING: The asdm exists, but the ms does not exist, running importasdm.

### the following warning messages come from the bdfflags and can be ignored

2015-01-29 13:31:39     INFO    ::/diska/tmp/arcproc/casa-from-tarball/casapy-42.2.30986-1-
64b/lib64/casapy/bin/bdflags2MS.wrapped      These BDF flagging conditions have been specified :
CORRELATOR_MISSING_STATUS DELAY_CORRECTION_NOT_APPLIED DELTA_SIGMA_OVERFLOW FFT_OVERFLOW INTEGRATION_FULLY_BLANKED
MISSING_ANTENNA_EVENT SIGMA_OVERFLOW SYNCRONIZATION_ERROR TFB_SCALING_FACTOR_NOT_RETRIEVED WVR_APC ZERO_LAG_NOT_RECEIVED
2015-01-29 13:31:39     INFO    ::/diska/tmp/arcproc/casa-from-tarball/casapy-42.2.30986-1-
64b/lib64/casapy/bin/bdflags2MS.wrapped      Consequently the following flag mask will be used :
```

```
00000000000000000000011111111111
2015-01-29 13:31:39     INFO    ::/diska/tmp/arcproc/casa-from-tarball/casapy-42.2.30986-1-
64b/lib64/casapy/bin/bdflags2MS.wrapped      All scans of all exec blocks will be processed
2015-01-29 13:31:39     INFO    ::/diska/tmp/arcproc/casa-from-tarball/casapy-42.2.30986-1-
64b/lib64/casapy/bin/bdflags2MS.wrapped      The dataset has 318 main(s)...318 of them in the selected exec blocks /
scans.
2015-01-29 13:31:39     INFO    ::/diska/tmp/arcproc/casa-from-tarball/casapy-42.2.30986-1-
64b/lib64/casapy/bin/bdflags2MS.wrapped      ASDM Main row #0 , CORRELATOR data contained in
uid___A002_X86fcfa_X14a6/ASDMBinary/uid___A002_X86fcfa_X14b1 , 0 flagged rows.

...

2015-01-29 13:33:41     INFO    ::/diska/tmp/arcproc/casa-from-tarball/casapy-42.2.30986-1-
64b/lib64/casapy/bin/bdflags2MS.wrapped      ASDM Main row #316 , CORRELATOR data contained in
uid___A002_X86fcfa_X14a6/ASDMBinary/uid___A002_X86fcfa_X16ff , 0 flagged rows.
2015-01-29 13:33:41     INFO    ::/diska/tmp/arcproc/casa-from-tarball/casapy-42.2.30986-1-
64b/lib64/casapy/bin/bdflags2MS.wrapped      ASDM Main row #317 , RADIOMETER data contained in
uid___A002_X86fcfa_X14a6/ASDMBinary/uid___A002_X86fcfa_X1701(the number of integrations actually read in the BDF (numTime
= 4) is different from the value announced in the Main table (numIntegration = 8). Using 4) , 0 flagged rows.
....10....20....30....40....50....60....70....80....90....100%
INFO: Running routine fixForCSV2555 on uid___A002_X86fcfa_X14a6.ms
INFO: No issue found.
INFO: Finished running routine fixForCSV2555 on uid___A002_X86fcfa_X14a6.ms

Ignoring spectral window [0, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47,
48, 49, 50, 51, 52, 53, 54, 55, 56] because it is WVR related

*** ANALYSIS OF TSYS TABLE ***

*** SEARCH FOR NEGATIVE TSYS ***
No negatives found!

*** SEARCH FOR NEGATIVE TREC ***
No negative Trx found!
But no spws with >10% negative Trx found. So most problems are probably edge channels

*** SEARCH FOR MISSING SCANS IN SYSCAL TABLE ***
len(scans1)=6, len(scans2)=5
---------------------------------------------------------------------------
SystemExit                                Traceback (most recent call last)

/diska/tmp/arcproc/casa-from-tarball/casapy-42.2.30986-1-64b/lib/python2.7/casapy.py in <module>()
```

```
----> 1
      2
      3
      4
      5

/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE/science/analysis_scripts/analysisUtils.py in generateReducScript(self,
msNames, step, corrAntPos, timeBinForFinalData, refant, bpassCalId, chanWid, angScale, run, lowSNR, projectCode,
schedblockName, queue, state, upToTimeForState, useLocalAlmaHelper, tsysChanTol, sdQSOflux, runPhaseClosure,
skipSyscalChecks)
  26788                     if len(scans1) == 0 or len(scans2) == 0 or scans1 != scans2:
  26789                         print "len(scans1)=%d, len(scans2)=%d" % (len(scans1), len(scans2))
> 26790                         sys.exit('ERROR: THE SYSCAL TABLE IS MISSING ONE (OR MORE) SCAN(S). IT MAY BE NECESSARY
TO RE-GENERATE IT.')
  26791                     else:
  26792                         print "-> OK"

SystemExit: ERROR: THE SYSCAL TABLE IS MISSING ONE (OR MORE) SCAN(S). IT MAY BE NECESSARY TO RE-GENERATE IT.
Type %exit or %quit to exit IPython (%Exit or %Quit do so unconditionally).

CASA <2>: tb.open('uid___A002_X86fcfa_X14a6.ms.tsys.temp')
  Out[2]: True

CASA <4>: import numpy as np

CASA <5>: np.unique(tb.getcol('SCAN_NUMBER'))
  Out[5]: array([ 3,  5,  8, 11, 14], dtype=int32)
CASA <6>: tb.close
--------> tb.close()
  Out[6]: True
CASA <7>: msmd.open('uid___A002_X86fcfa_X14a6.ms')
  Out[7]: True

CASA <8>: msmd.scansforintent('CALIBRATE_ATMOSPHERE#O*')
  Out[8]: array([ 3,  5,  8, 11, 14, 17], dtype=int32)

NOTE: This shows that there is a superfluous Tsys scan in scan #17
```

```
CASA <9>: listobs 'uid___A002_X86fcfa_X14a6.ms'

### shows that there is no final scan on the phasecal and that scan 17
### seems to be the beginning of a new but aborted cycle.
### Scan 17 is superfluous. Can ignore.

### Will import ignoring the last scan.

CASA <10>: exit

> rm -rf uid*.*    ### careful not to delete the ASDM!

> casapy-4.2.2

CASA <2>: importasdm(asdm='uid___A002_X86fcfa_X14a6', vis='uid___A002_X86fcfa_X14a6.ms', scans = '0:1~16',
                     asis='Antenna Station CalAtmosphere Receiver Source')
....10....20....30....40....50....60....70....80....90....100%


### NOTE: in CASA 4.3, you should add the option lazy=True in importasdm to accelerate the processing!

### NOTE 2: for recent ALMA data (since Dec 2014), you should also add the bdfflags=True option
### (the scriptGenerator does it for you)

### Now call generateReducScript with MS instead of ASDM to make it use our manually imported MS

CASA <3>: es.generateReducScript('uid___A002_X86fcfa_X14a6.ms')
INFO: Running routine fixForCSV2555 on uid___A002_X86fcfa_X14a6.ms
INFO: No issue found.
INFO: Finished running routine fixForCSV2555 on uid___A002_X86fcfa_X14a6.ms
Ignoring spectral window [0, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47,
48, 49, 50, 51, 52, 53, 54, 55, 56] because it is WVR related

*** ANALYSIS OF TSYS TABLE ***

*** SEARCH FOR NEGATIVE TSYS ***
No negatives found!

*** SEARCH FOR NEGATIVE TREC ***
No negative Trx found!
But no spws with >10% negative Trx found. So most problems are probably edge channels
```

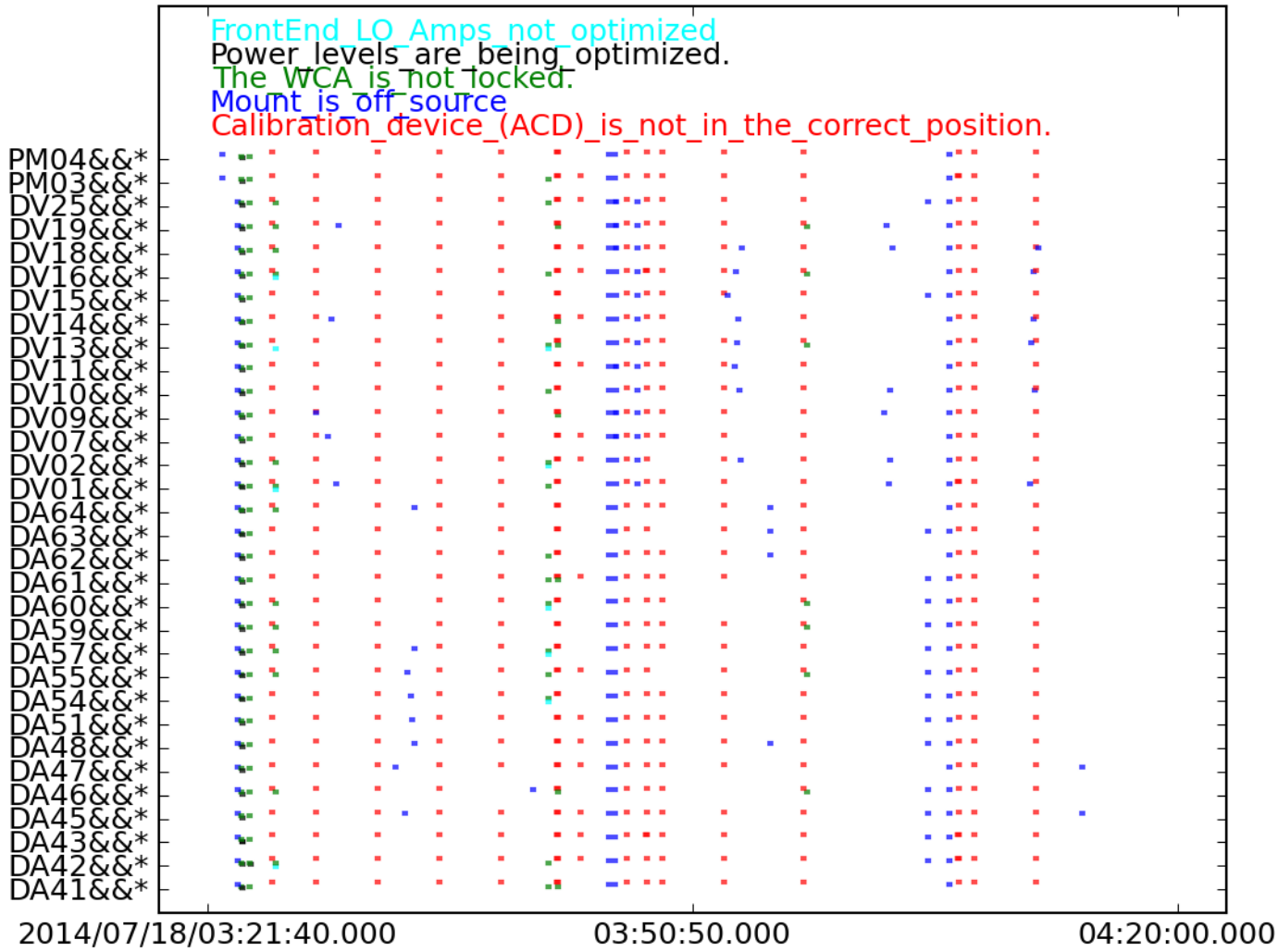
```
*** SEARCH FOR MISSING SCANS IN SYSCAL TABLE ***
-> OK
Found 496 baselines
Unprojected lengths:  min=20.125126, max=650.304653, rms=294.075233 meters
Ignoring spectral window [0, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47,
48, 49, 50, 51, 52, 53, 54, 55, 56] because it is WVR related
Running ValueMapping
Ignoring spectral window [0, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47,
48, 49, 50, 51, 52, 53, 54, 55, 56] because it is WVR related
Completed ValueMapping

Note: I could not find any offset between the antenna positions in the ASDM and in the database, so I am not including
any gencal call.

### what follows is the diagnostic output of the access to the ALMA calibration database

Working on field 1 of 3: 0 = J1924-2914
Using Band 3 measurement: 5.820 +- 0.120 (age=-1 days) 103.5 GHz
Using Band 3 measurement: 5.950 +- 0.120 (age=-1 days) 91.5 GHz
Using Band 7 measurement: 2.280 +- 0.100 (age=-1 days) 343.5 GHz
Median Monte-Carlo result for 103.490000 = 5.609870 +- 0.178202 (scaled MAD = 0.177828)
Error-weighted fit: Slope: -0.737+-0.022  Flux D. @ 103.490GHz: 5.609+-0.178 Jy
   Un-weighted fit: Slope: -0.748         Flux D. @ 103.490GHz: 5.609 Jy
Median Monte-Carlo result for 285.526574 = 2.652895 +- 0.222895 (scaled MAD = 0.225614)
Result using spectral index of -0.737 for 285.526574 GHz = 2.753880 +- 0.222895 Jy

Working on field 2 of 3: 1 = J1924-292
Using Band 3 measurement: 5.820 +- 0.120 (age=-1 days) 103.5 GHz
Using Band 3 measurement: 5.950 +- 0.120 (age=-1 days) 91.5 GHz
Using Band 7 measurement: 2.280 +- 0.100 (age=-1 days) 343.5 GHz
Median Monte-Carlo result for 103.490000 = 5.605184 +- 0.180755 (scaled MAD = 0.181351)
Error-weighted fit: Slope: -0.737+-0.022  Flux D. @ 103.490GHz: 5.609+-0.181 Jy
   Un-weighted fit: Slope: -0.748         Flux D. @ 103.490GHz: 5.609 Jy
Median Monte-Carlo result for 285.526574 = 2.653760 +- 0.227821 (scaled MAD = 0.227143)
Result using spectral index of -0.737 for 285.526574 GHz = 2.753880 +- 0.227821 Jy

Working on field 3 of 3: 2 = J1832-2039
Using Band 3 measurement: 0.470 +- 0.060 (age=200 days) 103.5 GHz
Using Band 3 measurement: 0.500 +- 0.070 (age=200 days) 91.5 GHz
Using Band 7 measurement: 0.180 +- 0.040 (age=772 days) 343.2 GHz
Median Monte-Carlo result for 103.490000 = 0.462876 +- 0.100004 (scaled MAD = 0.095869)
Error-weighted fit: Slope: -0.783+-0.094  Flux D. @ 103.490GHz: 0.462+-0.100 Jy
```

```
   Un-weighted fit: Slope: -0.784         Flux D. @ 103.490GHz: 0.461 Jy
Median Monte-Carlo result for 285.526574 = 0.211236 +- 0.104323 (scaled MAD = 0.089534)
Result using spectral index of -0.783 for 285.526574 GHz = 0.212395 +- 0.104323 Jy
WARNING: the mean time separation between the target date and the flux monitoring observations is 390 days
WARNING: the time separation between the Band 3 and 7 measurements is 572 days
  setjy('uid___A002_X86fcfa_X14a6.ms.split',
        standard='manual', field='J1924-2914', spix=-0.737332,
        reffreq='285.526574GHz', fluxdensity=[2.753880,0,0,0])
  setjy('uid___A002_X86fcfa_X14a6.ms.split',
        standard='manual', field='J1832-2039', spix=-0.782654,
        reffreq='285.526574GHz', fluxdensity=[0.212395,0,0,0])
  setjy('uid___A002_X86fcfa_X14a6.ms.split',
        standard='manual', field='J1924-292', spix=-0.737332,
        reffreq='285.526574GHz', fluxdensity=[2.753880,0,0,0])

Running ValueMapping
Ignoring spectral window [0, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47,
48, 49, 50, 51, 52, 53, 54, 55, 56] because it is WVR related
Completed ValueMapping
```

```
### now have complete calibration script

CASA <5>: !emacs uid___A002_X86fcfa_X14a6.ms.scriptForCalibration.py &

-----------------
# ALMA Data Reduction Script

# Calibration

thesteps = []
step_title = {0: 'Import of the ASDM',
              1: 'Fix of SYSCAL table times',
              2: 'listobs',
              3: 'A priori flagging',
              4: 'Generation and time averaging of the WVR cal table',
              5: 'Generation of the Tsys cal table',
              6: 'Application of the WVR and Tsys cal tables',
              7: 'Split out science SPWs and time average',
              8: 'Listobs, clear pointing table, and save original flags',
              9: 'Initial flagging',
              10: 'Putting a model for the flux calibrator(s)',
              11: 'Save flags before bandpass cal',
              12: 'Bandpass calibration',
              13: 'Save flags before gain cal',
              14: 'Gain calibration',
              15: 'Save flags before applycal',
              16: 'Application of the bandpass and gain cal tables',
              17: 'Split out corrected column',
              18: 'Save flags after applycal'}
------------------

### Paste list of intents from script into checklist

Fields by intent (paste from reduc script):
# CALIBRATE_AMPLI: J1924-292
# CALIBRATE_ATMOSPHERE: J1924-2914,J1924-292,PKS1830-211
# CALIBRATE_BANDPASS: J1924-2914
# CALIBRATE_FLUX: J1924-292
# CALIBRATE_FOCUS:
# CALIBRATE_PHASE: J1832-2039
# CALIBRATE_POINTING: J1924-2914
# OBSERVE_TARGET: PKS1830-211
```

```
### edit step 1 to perform the import correctly
-------------------
    importasdm('uid___A002_X86fcfa_X14a6',
               asis='Antenna Station Receiver Source CalAtmosphere CalWVR', scans='0:1~16')
-------------------

CASA <6>: mysteps = [2,3]

CASA <7>: execfile('uid___A002_X86fcfa_X14a6.ms.scriptForCalibration.py')

List of steps to be executed ... [2, 3]
# A priori calibration
Step  2 listobs
Writing output to file: uid___A002_X86fcfa_X14a6.ms.listobs
Step  3 A priori flagging
....10....20....30....40....50....60....70....80....90....100%
# Calibration
```

```
### inspect the online flagging plot
CASA <8>: !eog uid___A002_X86fcfa_X14a6.ms.flagcmd.png &
### nothing dramatically flagged
```



```
### inspect listobs

CASA <9>: !more uid___A002_X86fcfa_X14a6.ms.listobs
================================================================================
           MeasurementSet Name:  /lustre/opsw/work/dpetry/proj020-PKS1830-
211_b_07_TE/analysis/X14a6/uid___A002_X86fcfa_X14a6.ms      MS Version 2
================================================================================
   Observer: muller     Project: uid://A001/X106/X2f
Observation: ALMA
Data records: 3002784       Total integration time = 3192.19 seconds
   Observed from   18-Jul-2014/03:22:11.1   to   18-Jul-2014/04:15:23.3 (UTC)
   ObservationID = 0         ArrayID = 0
  Date        Timerange (UTC)          Scan  FldId FieldName             nRows     SpwIds   Average Interval(s)
ScanIntent
  18-Jul-2014/03:22:10.6 - 03:23:08.2     1      0 J1924-2914              159744  [0, 1, 2, 3, 4, 5, 6, 7, 8]  [1.15,
2.02, 1.01, 2.02, 1.01, 2.02, 1.01, 2.02, 1.01] [CALIBRATE_POINTING#ON_SOURCE, CALIBRATE_WVR#ON_SOURC
E]
              03:24:23.0 - 03:25:25.2     2      0 J1924-2914              533856  [0, 9, 10, 11, 12, 13, 14, 15, 16]
[1.15, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48] [CALIBRATE_SIDEBAND_RATIO#OFF_SOURCE, CALIBRAT
E_SIDEBAND_RATIO#ON_SOURCE, CALIBRATE_WVR#OFF_SOURCE, CALIBRATE_WVR#ON_SOURCE]
              03:25:27.6 - 03:25:43.7     3      0 J1924-2914              101696  [0, 9, 10, 11, 12, 13, 14, 15, 16]
[1.15, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48] [CALIBRATE_ATMOSPHERE#OFF_SOURCE, CALIBRATE_AT
MOSPHERE#ON_SOURCE, CALIBRATE_WVR#OFF_SOURCE, CALIBRATE_WVR#ON_SOURCE]
              03:26:05.6 - 03:41:57.8     4      0 J1924-2914              658784  [0, 17, 18, 19, 20, 21, 22, 23, 24]
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_BANDPASS#ON_SOURCE, CALIBRATE_WVR#
ON_SOURCE]
              03:42:27.1 - 03:42:43.4     5      1 J1924-292               101760  [0, 9, 10, 11, 12, 13, 14, 15, 16]
[1.15, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48] [CALIBRATE_ATMOSPHERE#OFF_SOURCE, CALIBRATE_AT
MOSPHERE#ON_SOURCE, CALIBRATE_WVR#OFF_SOURCE, CALIBRATE_WVR#ON_SOURCE]
              03:43:02.8 - 03:45:40.8     6      1 J1924-292               109824  [0, 17, 18, 19, 20, 21, 22, 23, 24]
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_AMPLI#ON_SOURCE, CALIBRATE_FLUX#ON
_SOURCE, CALIBRATE_WVR#ON_SOURCE]
              03:46:22.1 - 03:47:24.2     7      2 J1832-2039               43904  [0, 17, 18, 19, 20, 21, 22, 23, 24]
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE, CALIBRATE_WVR#ON_
SOURCE]
              03:47:54.2 - 03:48:10.5     8      3 PKS1830-211             101728  [0, 9, 10, 11, 12, 13, 14, 15, 16]
[1.15, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48] [CALIBRATE_ATMOSPHERE#OFF_SOURCE, CALIBRATE_AT
MOSPHERE#ON_SOURCE, CALIBRATE_WVR#OFF_SOURCE, CALIBRATE_WVR#ON_SOURCE]
              03:48:30.0 - 03:55:22.0     9      3 PKS1830-211             285472  [0, 17, 18, 19, 20, 21, 22, 23, 24]
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              03:55:45.4 - 03:56:47.4    10      2 J1832-2039               43904  [0, 17, 18, 19, 20, 21, 22, 23, 24]
```

```
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE, CALIBRATE_WVR#ON_
SOURCE]
              03:57:24.5 - 03:57:40.3    11      3 PKS1830-211             101664  [0, 9, 10, 11, 12, 13, 14, 15, 16]
[1.15, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48] [CALIBRATE_ATMOSPHERE#OFF_SOURCE, CALIBRATE_AT
MOSPHERE#ON_SOURCE, CALIBRATE_WVR#OFF_SOURCE, CALIBRATE_WVR#ON_SOURCE]
              03:58:00.2 - 04:04:51.9    12      3 PKS1830-211             285472  [0, 17, 18, 19, 20, 21, 22, 23, 24]
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              04:05:06.4 - 04:06:08.9    13      2 J1832-2039               43936  [0, 17, 18, 19, 20, 21, 22, 23, 24]
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE, CALIBRATE_WVR#ON_
SOURCE]
              04:06:39.7 - 04:06:55.6    14      3 PKS1830-211             101664  [0, 9, 10, 11, 12, 13, 14, 15, 16]
[1.15, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48, 0.48] [CALIBRATE_ATMOSPHERE#OFF_SOURCE, CALIBRATE_AT
MOSPHERE#ON_SOURCE, CALIBRATE_WVR#OFF_SOURCE, CALIBRATE_WVR#ON_SOURCE]
              04:07:15.5 - 04:14:07.2    15      3 PKS1830-211             285472  [0, 17, 18, 19, 20, 21, 22, 23, 24]
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              04:14:21.7 - 04:15:24.2    16      2 J1832-2039               43904  [0, 17, 18, 19, 20, 21, 22, 23, 24]
[1.15, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE, CALIBRATE_WVR#ON_
SOURCE]
           (nRows = Total number of rows per scan)

Fields: 4
  ID   Code Name                RA               Decl           Epoch   SrcId      nRows
  0    none J1924-2914          19:24:51.055960 -29.14.30.12100 J2000   0        1454080 ### bandpass
  1    none J1924-292           19:24:51.055957 -29.14.30.12103 J2000   1         211584 ### flux
  2    none J1832-2039          18:32:11.046490 -20.39.48.20320 J2000   2         175648 ### phase
  3    none PKS1830-211         18:33:39.919200 -21.03.39.88800 J2000   3        1161472 ### target

### At this point important to identify fields which appear several times under different names/intents!
### Here we find that bandpass and flux cal are the same!

Spectral Windows:  (25 unique spectral windows and 2 unique polarization setups)
  SpwID  Name                           #Chans   Frame   Ch0(MHz)  ChanWid(kHz)  TotBW(kHz) BBC Num  Corrs
  0      WVR#NOMINAL                        4   TOPO  184550.000   1500000.000   7500000.0       0  XX
  1      ALMA_RB_06#BB_1#SW-01#FULL_RES   128   TOPO  215242.188    -15625.000   2000000.0       1  XX  YY
  2      ALMA_RB_06#BB_1#SW-01#CH_AVG       1   TOPO  214234.375   1796875.000   1796875.0       1  XX  YY
  3      ALMA_RB_06#BB_2#SW-01#FULL_RES   128   TOPO  217242.188    -15625.000   2000000.0       2  XX  YY
  4      ALMA_RB_06#BB_2#SW-01#CH_AVG       1   TOPO  216234.375   1796875.000   1796875.0       2  XX  YY
  5      ALMA_RB_06#BB_3#SW-01#FULL_RES   128   TOPO  229257.813     15625.000   2000000.0       3  XX  YY
  6      ALMA_RB_06#BB_3#SW-01#CH_AVG       1   TOPO  230234.375   1796875.000   1796875.0       3  XX  YY
  7      ALMA_RB_06#BB_4#SW-01#FULL_RES   128   TOPO  231257.813     15625.000   2000000.0       4  XX  YY
  8      ALMA_RB_06#BB_4#SW-01#CH_AVG       1   TOPO  232234.375   1796875.000   1796875.0       4  XX  YY
  9      ALMA_RB_07#BB_1#SW-01#FULL_RES   128   TOPO  279583.966    -15625.000   2000000.0       1  XX  YY
```

10	ALMA_RB_07#BB_1#SW-01#CH_AVG	1	TOPO	278568.341	1781250.000	1781250.0	1	XX	YY
11	ALMA_RB_07#BB_2#SW-01#FULL_RES	128	TOPO	281383.913	-15625.000	2000000.0	2	XX	YY
12	ALMA_RB_07#BB_2#SW-01#CH_AVG	1	TOPO	280368.288	1781250.000	1781250.0	2	XX	YY
13	ALMA_RB_07#BB_3#SW-01#FULL_RES	128	TOPO	289669.235	15625.000	2000000.0	3	XX	YY
14	ALMA_RB_07#BB_3#SW-01#CH_AVG	1	TOPO	290637.985	1781250.000	1781250.0	3	XX	YY
15	ALMA_RB_07#BB_4#SW-01#FULL_RES	128	TOPO	291469.182	15625.000	2000000.0	4	XX	YY
16	ALMA_RB_07#BB_4#SW-01#CH_AVG	1	TOPO	292437.932	1781250.000	1781250.0	4	XX	YY
17	ALMA_RB_07#BB_1#SW-01#FULL_RES	1920	TOPO	279528.790	-976.562	1875000.0	1	XX	YY
18	ALMA_RB_07#BB_1#SW-01#CH_AVG	1	TOPO	278591.534	1875000.000	1875000.0	1	XX	YY
19	ALMA_RB_07#BB_2#SW-01#FULL_RES	1920	TOPO	281328.737	-976.562	1875000.0	2	XX	YY
20	ALMA_RB_07#BB_2#SW-01#CH_AVG	1	TOPO	280391.481	1875000.000	1875000.0	2	XX	YY
21	ALMA_RB_07#BB_3#SW-01#FULL_RES	1920	TOPO	289724.411	976.562	1875000.0	3	XX	YY
22	ALMA_RB_07#BB_3#SW-01#CH_AVG	1	TOPO	290661.178	1875000.000	1875000.0	3	XX	YY
23	ALMA_RB_07#BB_4#SW-01#FULL_RES	1920	TOPO	291524.357	976.562	1875000.0	4	XX	YY
24	ALMA_RB_07#BB_4#SW-01#CH_AVG	1	TOPO	292461.125	1875000.000	1875000.0	4	XX	YY

Antennas: 32:

ID	Name	Station	Diam.	Long.	Lat.	Offset from array center (m)			ITRF Geocentric coordinates (m)		
						East	North	Elevation	x	y	z
0	DA41	A079	12.0 m	-067.45.13.6	-22.53.35.0	98.2541	-219.2391	6.2318	2225122.700388	-5439951.133615	-2481886.481728
1	DA42	A081	12.0 m	-067.45.23.9	-22.53.32.5	-193.1320	-141.7870	4.6928	2224863.872927	-5440088.015655	-2481814.531382
2	DA43	A091	12.0 m	-067.45.28.7	-22.53.24.2	-331.4765	116.2789	7.3331	2224774.741665	-5440235.548197	-2481577.816231
3	DA45	A070	12.0 m	-067.45.11.9	-22.53.29.3	147.5971	-42.4425	3.4848	2225193.449218	-5439993.765306	-2481722.541226
4	DA46	A058	12.0 m	-067.45.17.3	-22.53.32.0	-5.8383	-125.9830	5.5715	2225039.860239	-5440023.554461	-2481800.313957
5	DA47	A074	12.0 m	-067.45.12.1	-22.53.32.0	143.2296	-127.5704	2.8736	2225176.656861	-5439964.248423	-2481800.726824
6	DA48	A046	12.0 m	-067.45.17.0	-22.53.29.3	2.8469	-41.7480	5.2794	2225060.201673	-5440050.345525	-2481722.599573
7	DA51	A082	12.0 m	-067.45.08.3	-22.53.29.2	250.4530	-39.9035	-0.1142	2225287.766879	-5439952.669219	-2481718.802316
8	DA54	A063	12.0 m	-067.45.16.1	-22.53.31.9	28.0012	-122.5866	5.5823	2225071.684784	-5440011.975861	-2481797.189219
9	DA55	A080	12.0 m	-067.45.14.7	-22.53.20.2	68.9012	239.8154	4.7364	2225162.611979	-5440126.242866	-2481462.997243
10	DA57	A076	12.0 m	-067.45.20.5	-22.53.33.8	-96.5653	-181.6690	8.1741	2224948.593535		

-5440040.069448 -2481852.626444

11	DA59	A021	12.0 m	-067.45.17.2	-22.53.27.0	-4.2599	28.2396	5.4476	2225063.988724

-5440078.377090 -2481658.189159

12	DA60	A090	12.0 m	-067.45.05.9	-22.53.23.1	317.9085	148.8560	-3.9108	2225376.675386

-5439991.848403 -2481543.430963

13	DA61	A075	12.0 m	-067.45.17.9	-22.53.21.4	-23.1383	201.3506	6.6350	2225072.419933

-5440148.858991 -2481499.171826

14	DA62	A016	12.0 m	-067.45.16.4	-22.53.25.1	18.8859	86.4903	5.3881	2225093.968824

-5440090.535465 -2481604.502590

15	DA63	A019	12.0 m	-067.45.17.5	-22.53.27.6	-10.8020	9.2076	5.4041	2225055.115728

-5440073.964547 -2481675.705440

16	DA64	A085	12.0 m	-067.45.10.5	-22.53.20.5	189.0989	228.8433	0.4035	2225270.737455

-5440073.091757 -2481471.420150

17	DV01	A072	12.0 m	-067.45.12.6	-22.53.24.0	128.5884	120.4639	1.7867	2225199.253359

-5440058.163652 -2481571.803430

18	DV02	A087	12.0 m	-067.45.08.3	-22.53.33.2	250.5060	-163.0193	-0.1559	2225269.669092

-5439908.287357 -2481832.205202

19	DV07	A086	12.0 m	-067.45.27.0	-22.53.29.3	-281.0688	-43.4334	10.0719	2224798.838328

-5440161.301334 -2481726.016422

20	DV09	A044	12.0 m	-067.45.18.5	-22.53.29.9	-40.5635	-59.9607	5.7220	2225017.494651

-5440060.599456 -2481739.550049

21	DV10	A071	12.0 m	-067.45.19.9	-22.53.23.5	-79.3648	137.7975	6.9845	2225011.141478

-5440147.562866 -2481557.856545

22	DV11	A031	12.0 m	-067.45.19.1	-22.53.27.1	-56.3916	25.5325	5.3322	2225015.297902

-5440097.039416 -2481660.638191

23	DV13	A067	12.0 m	-067.45.12.7	-22.53.27.2	123.8246	22.3202	3.2303	2225180.894859

-5440025.864799 -2481662.779902

24	DV14	A083	12.0 m	-067.45.22.8	-22.53.21.0	-162.1147	212.8167	8.8613	2224946.249208

-5440207.496450 -2481489.474505

25	DV15	A089	12.0 m	-067.45.19.8	-22.53.39.4	-76.1985	-355.0255	13.2147	2224943.672413

-5439974.237340 -2482014.288678

26	DV16	A069	12.0 m	-067.45.21.3	-22.53.30.2	-120.0538	-69.0535	6.9011	2224942.992781

-5440088.422751 -2481748.385401

27	DV18	A033	12.0 m	-067.45.19.4	-22.53.29.0	-65.9372	-34.5838	5.4856	2224997.663906

-5440079.140038 -2481716.079772

28	DV19	A077	12.0 m	-067.45.10.1	-22.53.25.9	199.0425	63.5182	-0.5582	2225255.259528

-5440008.989134 -2481623.352685

29	DV25	A056	12.0 m	-067.45.15.3	-22.53.30.8	51.7220	-88.2782	4.2740	2225098.236002

-5440014.232717 -2481765.074070

30	PM03	T701	12.0 m	-067.45.18.8	-22.53.22.2	-47.7029	178.2642	5.8084	2225045.995676

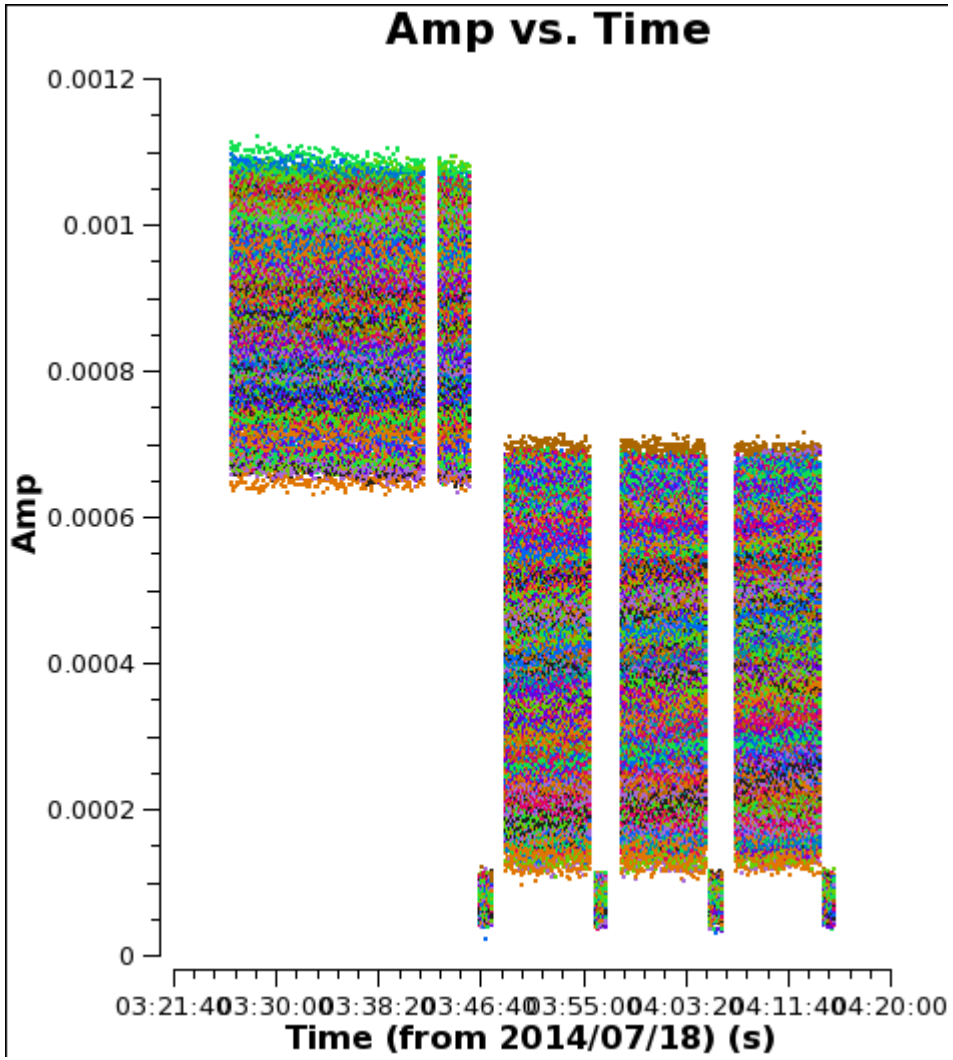
-5440149.142327 -2481520.118813

31	PM04	T703	12.0 m	-067.45.16.2	-22.53.23.9	24.3002	125.3607	5.3790	2225104.700747

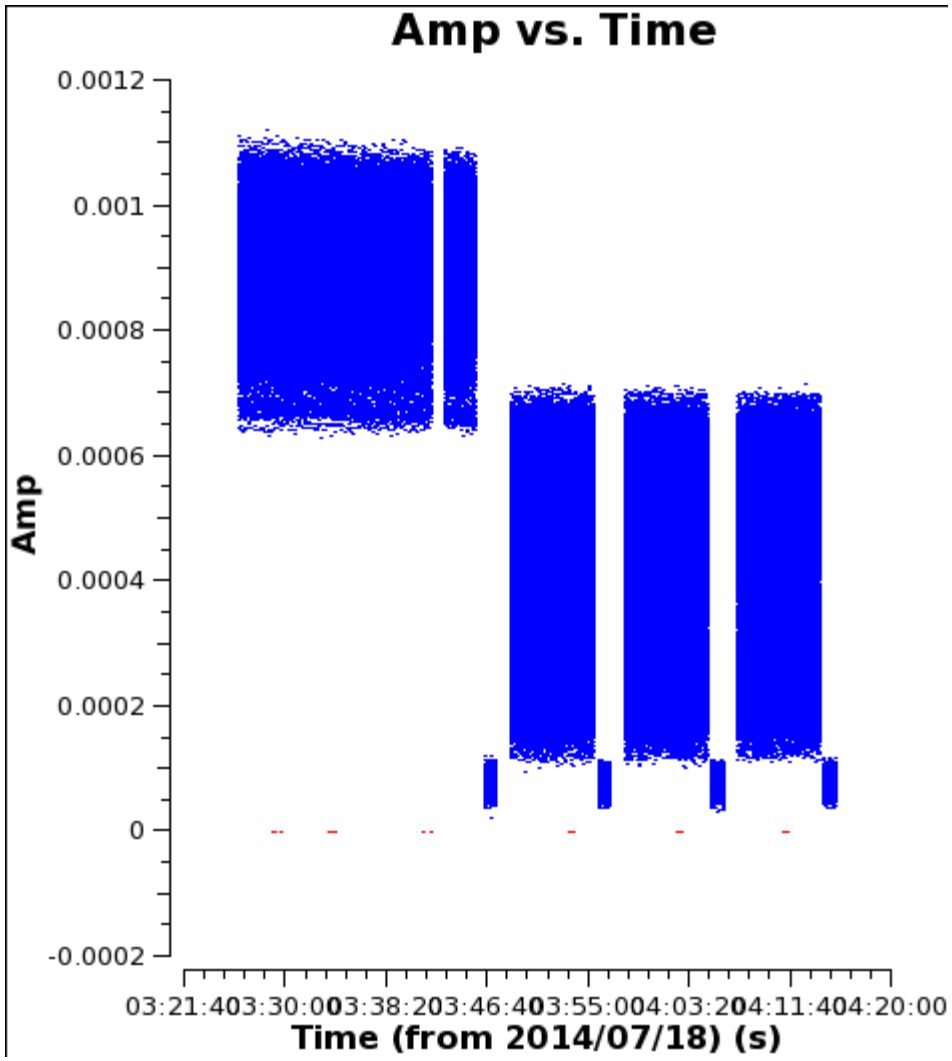
-5440102.471864 -2481568.689536

make a plot of amp vs time for one of the science SPWs (e.g. 17) averaging over all channels, colorising by baseline

CASA <10>: plotms



```
### find that we have a weak phase calibrator

### make a plot of amp vs time for one of the science SPWs (e.g. 17) averaging over all channels, not clorizing by
anything but making flagged data visible
###  and selecting only cross-correlations (antenna = *&*)
###   -> find very little is flagged
```



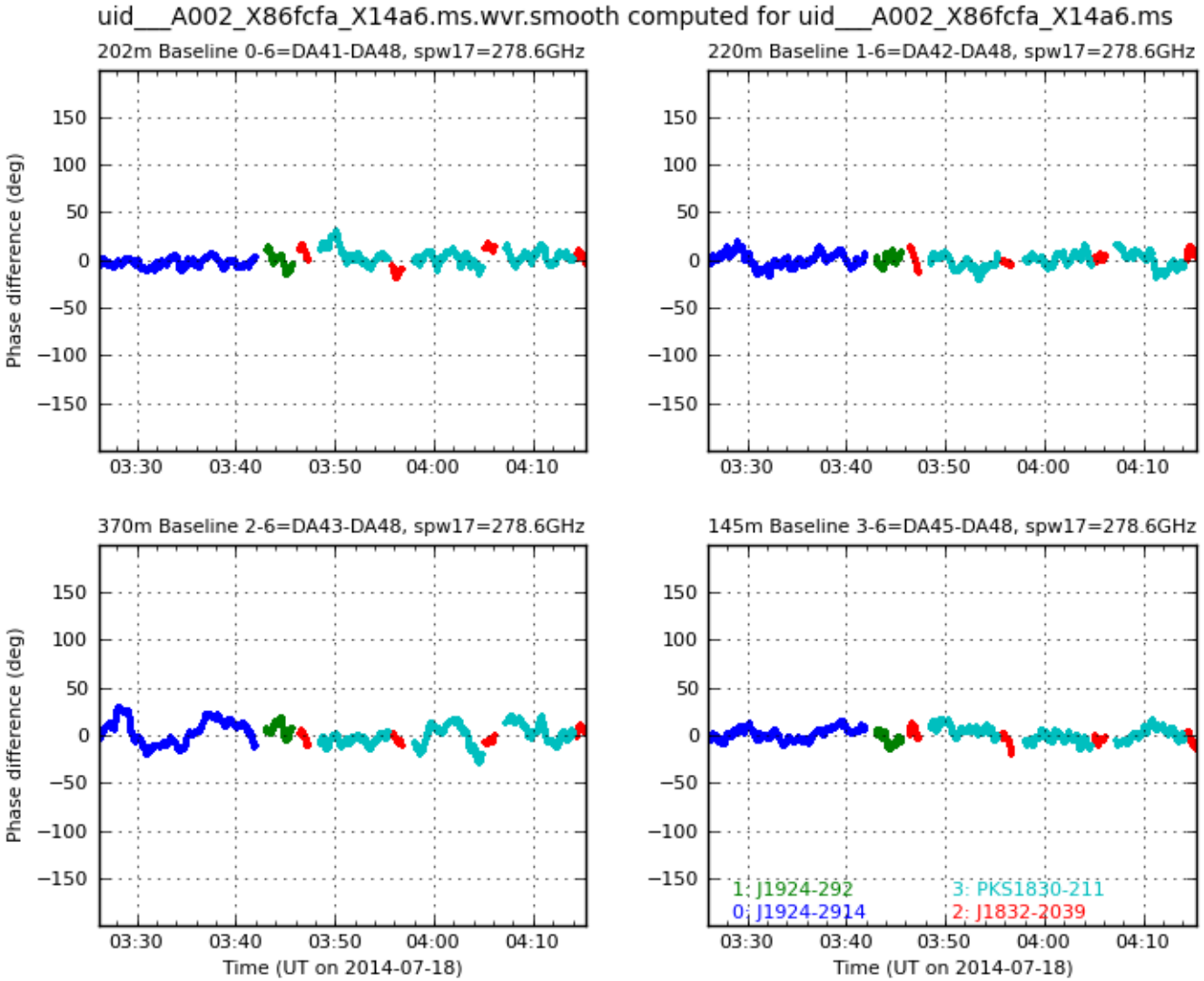
```
### WVR and Tsys caltable generation

CASA <14>: mysteps = [4,5]

CASA <15>: execfile('uid___A002_X86fcfa_X14a6.ms.scriptForCalibration.py')
List of steps to be executed ... [4, 5]
# A priori calibration
# A priori calibration
Step  4 Generation and time averaging of the WVR cal table
wvrgcal --ms uid___A002_X86fcfa_X14a6.ms --output uid___A002_X86fcfa_X14a6.ms.wvr --toffset 0 --segsource --tie "PKS1830-
211,J1832-2039" --statsource "PKS1830-211" --maxdistm 500.0 --minnumants 2 --mingoodfrac 0.8
Calculating the coefficients now...done!
Flagged 129219 of 3923424 solutions = 3.29352626685 %   ### some solutions were flagged!
Opening cal table...
Running ValueMapping on uid___A002_X86fcfa_X14a6.ms... (this may take a minute)
Ignoring spectral window [0, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47,
48, 49, 50, 51, 52, 53, 54, 55, 56] because it is WVR related
Making directory =  uid___A002_X86fcfa_X14a6.ms.wvr.smooth.plots/
antennasToPlot =  [6]
Baselines including these antennas will be plotted =  DA48
spws in the dataset =  [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]
spws to plot =  [17]
fields in the dataset =  [0, 1, 2, 3]
Fields to plot =  [0 1 2 3]
Plotting page 0
...
Plotting page 6
Step  5 Generation of the Tsys cal table
$Id: plotbandpass3.py,v 1.149 2014/12/09 15:32:16 thunter Exp $
...

Skipping DA54, xant=8, ispw=15 (spw15, bb0,  field 3: PKS1830-211,  scan14  04:06:22) all solutions flagged
Skipping DA63, xant=15, ispw=15 (spw15, bb0,  field 3: PKS1830-211,  scan14  04:06:22) all solutions flagged
Building uid___A002_X86fcfa_X14a6.ms.tsys.plots/uid___A002_X86fcfa_X14a6.ms.tsys.field3.spw13.t04.png
Restoring interactive pylab.
# This is what checkCalTable executed:
#for i in [0, 1, 3]:
#   aU.plotbandpass(caltable='uid___A002_X86fcfa_X14a6.ms.tsys', overlay='antenna', xaxis='freq', yaxis='amp',
subplot=22, buildpdf=False, interactive=False, field=str(i), showimage=False, showBasebandNumber=True,
figfile='uid___A002_X86fcfa_X14a6.ms.tsys.plots/uid___A002_X86fcfa_X14a6.ms.tsys.field'+str(i))
```

Calibration

Inspect the WVR cal table plots

CASA <16>: !eog uid___A002_X86fcfa_X14a6.ms.wvr.smooth.plots/uid___A002_X86fcfa_X14a6.ms.wvr.smooth.*

look very good except for the DA48-DV07 baseline (find later that WVR of DV07 is bad)

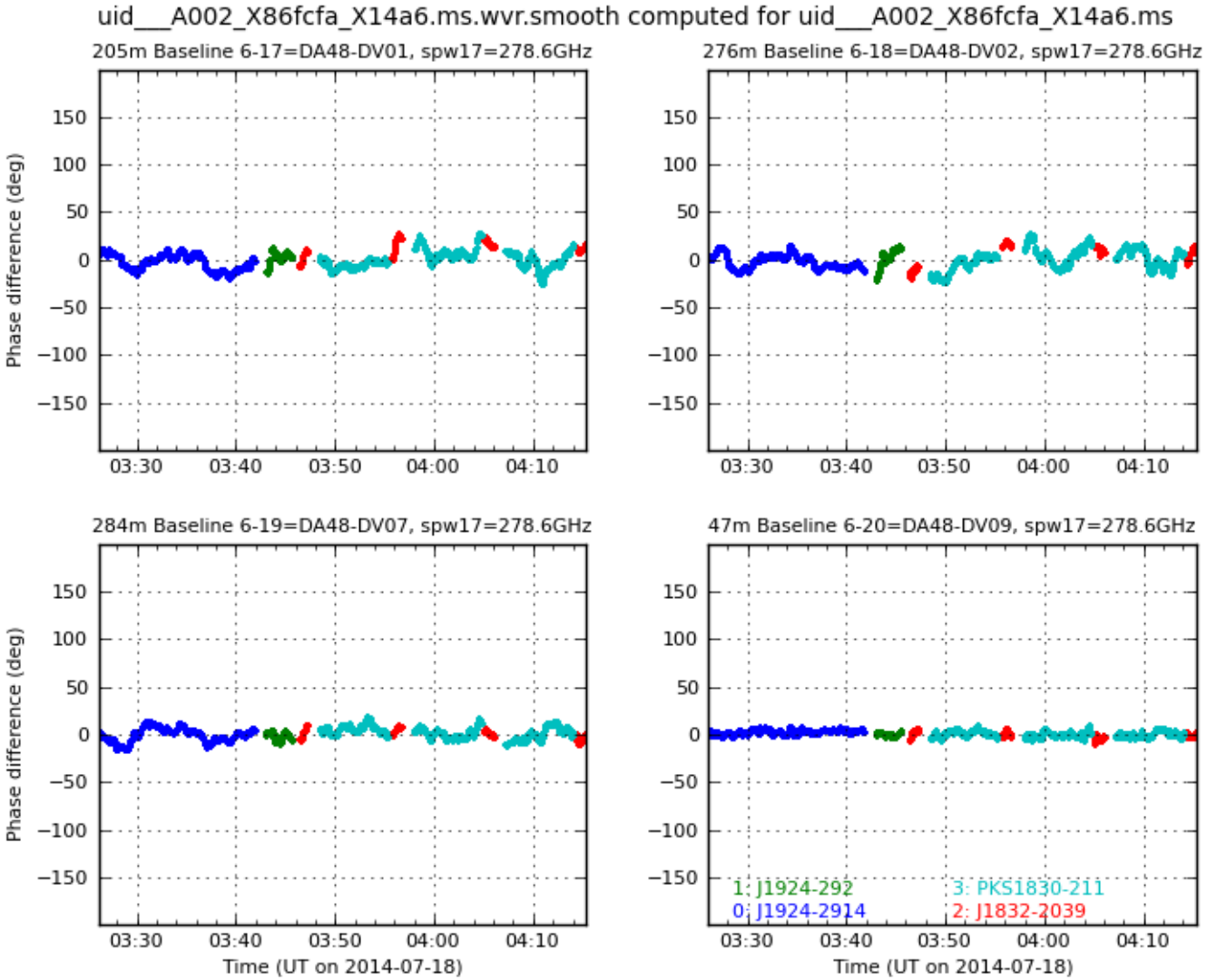


```
### inspect wvrgcal output

CASA <17>: !more uid___A002_X86fcfa_X14a6.ms.wvrgcal

2015-01-29 14:29:18 INFO  wvrgcal::::casa+        ##########################################
2015-01-29 14:29:18 INFO  wvrgcal::::casa+        ##### Begin Task: wvrgcal            #####
2015-01-29 14:29:18 INFO  wvrgcal::::casa
wvrgcal(vis="uid___A002_X86fcfa_X14a6.ms",caltable="uid___A002_X86fcfa_X14a6.ms.wvr",toffset=0,segsource=True,
2015-01-29 14:29:18 INFO  wvrgcal::::casa+                sourceflag=[''],tie=['PKS1830-211,J1832-
2039'],nsol=1,disperse=False,wvrflag=[''],
2015-01-29 14:29:18 INFO  wvrgcal::::casa+                statfield="",statsource="PKS1830-
211",smooth="",scale=1.0,reversespw="",
2015-01-29 14:29:18 INFO  wvrgcal::::casa+
cont=False,maxdistm=500.0,minnumants=2,mingoodfrac=0.8,usefieldtab=False)
2015-01-29 14:29:18 INFO  wvrgcal::::casa Running wvrgcal standalone invoked as:
2015-01-29 14:29:18 INFO  wvrgcal::::casa wvrgcal --ms uid___A002_X86fcfa_X14a6.ms --output
uid___A002_X86fcfa_X14a6.ms.wvr --toffset 0 --segsource --tie "PKS1830-2
11,J1832-2039" --statsource "PKS1830-211" --maxdistm 500.0 --minnumants 2 --mingoodfrac 0.8
2015-01-29 14:31:14 INFO  wvrgcal::::casa
2015-01-29 14:31:14 INFO  wvrgcal::::casa WVRGCAL  -- Version 1.2
2015-01-29 14:31:14 INFO  wvrgcal::::casa
2015-01-29 14:31:14 INFO  wvrgcal::::casa Developed by Bojan Nikolic at the University of Cambridge as part of EU FP6
ALMA Enhancement
2015-01-29 14:31:14 INFO  wvrgcal::::casa GPLv2 License -- you have a right to the source code (see
http://www.mrao.cam.ac.uk/~bn204/alma)
2015-01-29 14:31:14 INFO  wvrgcal::::casa
2015-01-29 14:31:14 INFO  wvrgcal::::casa Multi-MS (MMS) capable version using time sorted access and respecting flags.
2015-01-29 14:31:14 INFO  wvrgcal::::casa Tying: J1832-2039 and PKS1830-211 and
2015-01-29 14:31:14 INFO  wvrgcal::::casa Tied sets as numerical source IDs:
2015-01-29 14:31:14 INFO  wvrgcal::::casa Tying: 2 and 3 and
2015-01-29 14:31:14 INFO  wvrgcal::::casa       Retrieved parameters
2015-01-29 14:31:14 INFO  wvrgcal::::casa ---------------------------------------------------------------
2015-01-29 14:31:14 INFO  wvrgcal::::casa Evidence        PWV     PWV Error       dT1dL   dT2dL   dT3dL   dT4dL
2015-01-29 14:31:14 INFO  wvrgcal::::casa 4.14283e-19     0.463242        0.00793869      25.5737 13.1358 6.06073 3.8803
2015-01-29 14:31:14 INFO  wvrgcal::::casa 4.20226e-19     0.484444        0.00836078      25.2116 13.0354 6.02103 3.85452
2015-01-29 14:31:14 INFO  wvrgcal::::casa 8.2898e-21      0.517699        0.00875403      24.1104 12.794  5.96548 3.82768
2015-01-29 14:31:14 INFO  wvrgcal::::casa
2015-01-29 14:31:14 INFO  wvrgcal::::casa Times used for the statistics calculation (in seconds from first astro datum)
2015-01-29 14:31:14 INFO  wvrgcal::::casa ------------------------------------------------------------------------
2015-01-29 14:31:14 INFO  wvrgcal::::casa (1547.38, 1989.5)
2015-01-29 14:31:14 INFO  wvrgcal::::casa (2117.23, 2559.74)
```

```
2015-01-29 14:31:14 INFO  wvrgcal::::casa (2672.5, 3115.01)
2015-01-29 14:31:14 INFO  wvrgcal::::casa      Antenna/WVR information:
2015-01-29 14:31:14 INFO  wvrgcal::::casa ------------------------------------------------------------------------
2015-01-29 14:31:14 INFO  wvrgcal::::casa #       Name    WVR?    Flag?   RMS (um)        Disc (um)
2015-01-29 14:31:14 INFO  wvrgcal::::casa 0       DA41    Yes     No      39.4            22.6
2015-01-29 14:31:14 INFO  wvrgcal::::casa 1       DA42    Yes     No      36.4            21.9
2015-01-29 14:31:14 INFO  wvrgcal::::casa 2       DA43    Yes     No      27.3            18.4
2015-01-29 14:31:14 INFO  wvrgcal::::casa 3       DA45    Yes     No      38.8            24.4
2015-01-29 14:31:14 INFO  wvrgcal::::casa 4       DA46    Yes     No      33.5            19.3
2015-01-29 14:31:14 INFO  wvrgcal::::casa 5       DA47    Yes     No      38.9            31.2
2015-01-29 14:31:14 INFO  wvrgcal::::casa 6       DA48    Yes     No      34.3              23
2015-01-29 14:31:14 INFO  wvrgcal::::casa 7       DA51    Yes     No      42.8            25.1
2015-01-29 14:31:14 INFO  wvrgcal::::casa 8       DA54    Yes     No      35.2            17.7
2015-01-29 14:31:14 INFO  wvrgcal::::casa 9       DA55    Yes     No      31.8            18.6
2015-01-29 14:31:14 INFO  wvrgcal::::casa 10      DA57    Yes     No      39.7            20.7
2015-01-29 14:31:14 INFO  wvrgcal::::casa 11      DA59    Yes     No      42.8             155
2015-01-29 14:31:14 INFO  wvrgcal::::casa 12      DA60    Yes     No      40.6            19.8
2015-01-29 14:31:14 INFO  wvrgcal::::casa 13      DA61    Yes     No      27.8            19.3
2015-01-29 14:31:14 INFO  wvrgcal::::casa 14      DA62    Yes     No      30.5            18.6
2015-01-29 14:31:14 INFO  wvrgcal::::casa 15      DA63    Yes     No      31.5              18
2015-01-29 14:31:14 INFO  wvrgcal::::casa 16      DA64    Yes     No      36.8            25.4
2015-01-29 14:31:14 INFO  wvrgcal::::casa 17      DV01    Yes     No      36.4            22.9
2015-01-29 14:31:14 INFO  wvrgcal::::casa 18      DV02    Yes     No      49.2            25.4
2015-01-29 14:31:14 INFO  wvrgcal::::casa 19      DV07    Yes     No         0               0 # DV07 has a bad WVR
2015-01-29 14:31:14 INFO  wvrgcal::::casa 20      DV09    Yes     No      33.9            18.1
2015-01-29 14:31:14 INFO  wvrgcal::::casa 21      DV10    Yes     No      30.5            18.7
2015-01-29 14:31:14 INFO  wvrgcal::::casa 22      DV11    Yes     No      30.7            18.6
2015-01-29 14:31:14 INFO  wvrgcal::::casa 23      DV13    Yes     No      36.4            21.8
2015-01-29 14:31:14 INFO  wvrgcal::::casa 24      DV14    Yes     No      29.4              23
2015-01-29 14:31:14 INFO  wvrgcal::::casa 25      DV15    Yes     No      44.3            24.2
2015-01-29 14:31:14 INFO  wvrgcal::::casa 26      DV16    Yes     No      34.4            21.4
2015-01-29 14:31:14 INFO  wvrgcal::::casa 27      DV18    Yes     No      33.5            18.9
2015-01-29 14:31:14 INFO  wvrgcal::::casa 28      DV19    Yes     No      36.6            16.8
2015-01-29 14:31:14 INFO  wvrgcal::::casa 29      DV25    Yes     No      35.2            21.4
2015-01-29 14:31:14 INFO  wvrgcal::::casa 30      PM03    Yes     No      29.1            23.3
2015-01-29 14:31:14 INFO  wvrgcal::::casa 31      PM04    Yes     No      31.3            19.9
2015-01-29 14:31:14 INFO  wvrgcal::::casa   Expected performance
2015-01-29 14:31:14 INFO  wvrgcal::::casa ------------------------------------------------------------------------
2015-01-29 14:31:14 INFO  wvrgcal::::casa * Estimated WVR thermal contribution to path fluctuations (micron per antenna):
3.20074
2015-01-29 14:31:14 INFO  wvrgcal::::casa * Greatest Estimated path fluctuation is (micron on a baseline): 58.2749
2015-01-29 14:31:14 INFO  wvrgcal::::casa * Rough estimate path error due to coefficient error (micron on a baseline):
```

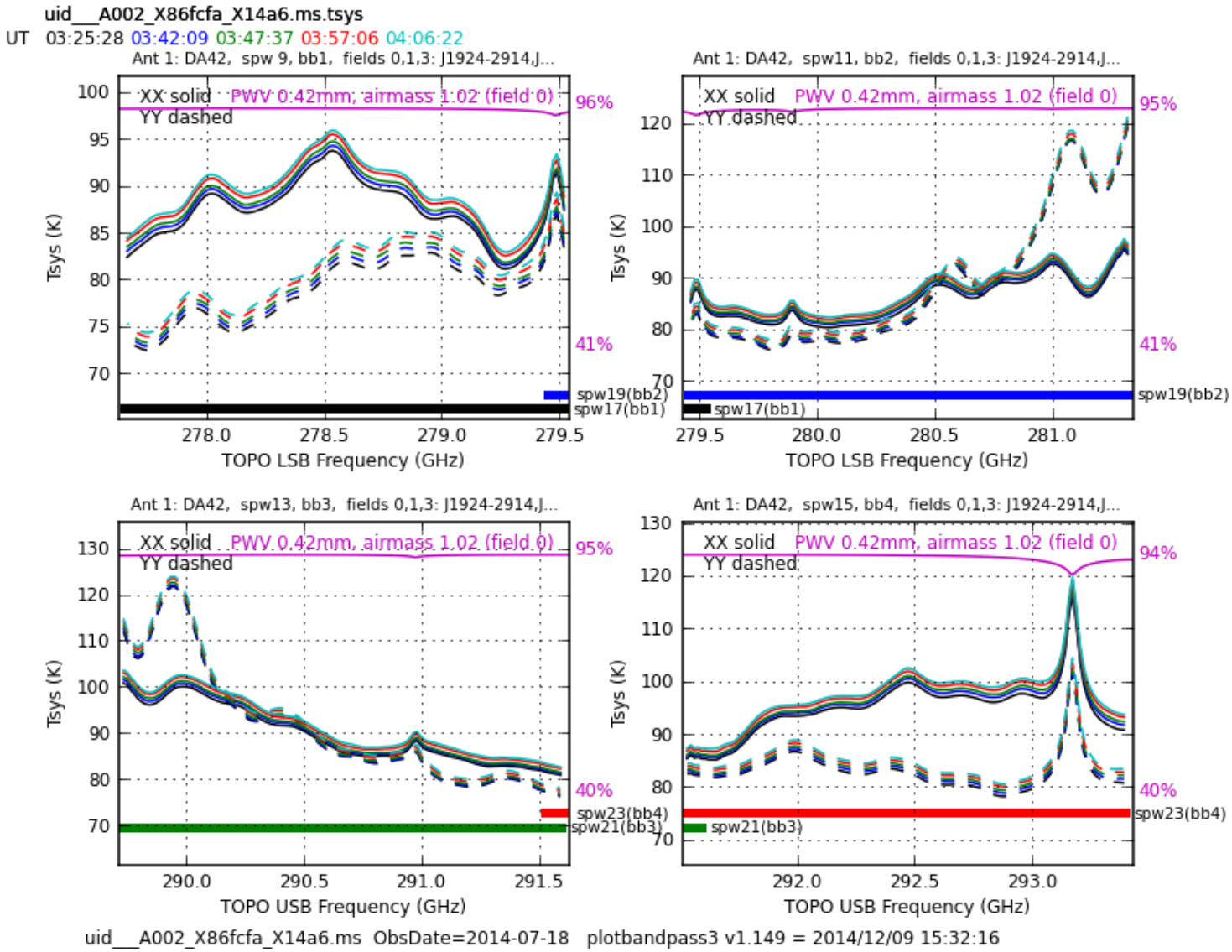
```
0.393362
2015-01-29 14:31:14 INFO  wvrgcal::::casa
2015-01-29 14:31:14 INFO  wvrgcal::::casa Writing gain table ...
2015-01-29 14:31:14 INFO  wvrgcal::::casa ##### End Task: wvrgcal               #####
2015-01-29 14:31:14 INFO  wvrgcal::::casa+       ##########################################


### Make entry in checklist

------------

A) INTERFEROMETRIC CALIBRATION ----------------------------------[x]

  1) Apriori calibration ----------------------------------------[x]
  Comments:                                  Yes  No
    - fixplanets necessary?                  [ ]  [x]
    - fix of SYSCAL table time necessary?    [ ]  [x]
    - other es.fix necessary? name:          [ ]  [x]
    - checked WVR tables?                    [x]  [ ](ACA)
        DV07 has no good WVR
-------------

### edit calibration script step 4 to flage DV07 WVR
--------------
  wvrgcal(vis = 'uid___A002_X86fcfa_X14a6.ms',
    caltable = 'uid___A002_X86fcfa_X14a6.ms.wvr',
    toffset = 0,
    tie = ['PKS1830-211,J1832-2039'],
    statsource = 'PKS1830-211',
    wvrflag = ['DV07'])
--------------

## run again

CASA <24>: mysteps = [4]

CASA <25>: execfile('uid___A002_X86fcfa_X14a6.ms.scriptForCalibration.py')
List of steps to be executed ... [4]
# A priori calibration
Step  4 Generation and time averaging of the WVR cal table
wvrgcal --ms uid___A002_X86fcfa_X14a6.ms --output uid___A002_X86fcfa_X14a6.ms.wvr --toffset 0 --segsource --tie "PKS1830-
211,J1832-2039" --wvrflag "DV07" --statsource "PKS1830-211" --maxdistm 500.0 --minnumants 2 --mingoodfrac 0.8
```

```
Calculating the coefficients now...done!
Flagged 7068 of 3923424 solutions = 0.180148768015 % % ### now only 0.18% is flagged instead of 3 %!

### inspect wvrgcal output again

    wvrgcal::::casa 19      DV07    Yes     Yes     28.8            12.2

### The RMS of the solution and the plot of the DA48-DV07 baseline look good!
```


uid___A002_X86fcfa_X14a6.ms.wvr.smooth computed for uid___A002_X86fcfa_X14a6.ms
205m Baseline 6-17=DA48-DV01, spw17=278.6GHz
276m Baseline 6-18=DA48-DV02, spw17=278.6GHz
284m Baseline 6-19=DA48-DV07, spw17=278.6GHz
47m Baseline 6-20=DA48-DV09, spw17=278.6GHz
Phase difference (deg)
150
100
50
0
−50
−100
−150
03:30
03:40
03:50
04:00
04:10
Time (UT on 2014-07-18)
1: J1924-292
0: J1924-2914
3: PKS1830-211
2: J1832-2039

Inspect the tsys plots

CASA <28>: !eog uid___A002_X86fcfa_X14a6.ms.tsys.plots.overlayTime/uid___A002_X86fcfa_X14a6.ms.tsys.* &



```
### atm line in SPW 23 (later science SPW 4), also at edge of SPWs 17 and 19 (later science SPW 0 and 1)
### but relatively low amplitude, may not need any flagging
###   make entry in checklist

### Find there is no Tsys plot for DA54, use plotms to plot amp vs time for DA54, spw= 9,11,13,15 showing flagged data
###  -> find all flagged

### make entry in checklist
-------------
PWV                     : 0.5 mm
Number of good antennas: 30 (DA54 bad Tsys, DV07 bad WVR solution)
Band(s)                 : 7
TDM/FDM/both            : FDM
-------------



### now apply, split out, listobs etc., and shadowing flagging
CASA <30>: mysteps = [6, 7, 8, 9]

CASA <31>: execfile('uid___A002_X86fcfa_X14a6.ms.scriptForCalibration.py')

List of steps to be executed ... [6, 7, 8, 9]
# A priori calibration
Step  6 Application of the WVR and Tsys cal tables
The following MS spws have no corresponding cal spws in tab15073_24927: 0 1 2 3 4 5 6 7 8 25 26 27 28 29 30 31 32 33 34
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
The following MS spws have no corresponding cal spws in tab15073_26896: 0 1 2 3 4 5 6 7 8 25 26 27 28 29 30 31 32 33 34
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
The following MS spws have no corresponding cal spws in tab15073_28865: 0 1 2 3 4 5 6 7 8 25 26 27 28 29 30 31 32 33 34
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
The following MS spws have no corresponding cal spws in tab15073_30846: 0 1 2 3 4 5 6 7 8 25 26 27 28 29 30 31 32 33 34
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
NOTICE: Exporting to images in screen resolution is currently not working.  Switching to high resolution (which is
slower, but works).
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slower, but works).
NOTICE: Exporting to images in screen resolution is currently not working.  Switching to high resolution (which is
slower, but works).
NOTICE: Exporting to images in screen resolution is currently not working.  Switching to high resolution (which is
```
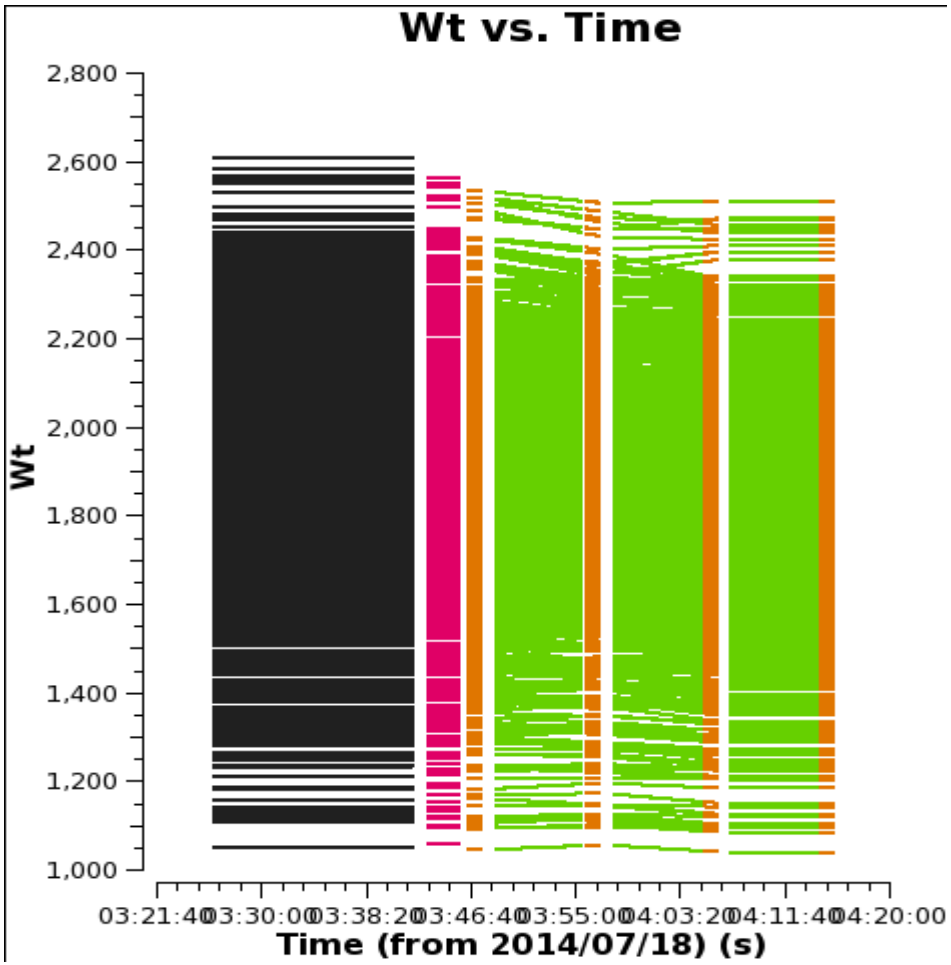

```
slower, but works).
Step  7 Split out science SPWs and time average
....10....20....30....40....50....60....70....80....90....100%
# Calibration
Step  8 Listobs, clear pointing table, and save original flags
Writing output to file: uid___A002_X86fcfa_X14a6.ms.split.listobs
Step  9 Initial flagging


### Look at the weights of the four science SPWs

CASA <23>: !eog uid___A002_X86fcfa_X14a6.ms_weights_spw*.png &
```



```
### Make entry in checklist

    - checked Weights?                        [x]


### look at listobs of split-out dataset

CASA <26>: !more uid___A002_X86fcfa_X14a6.ms.split.listobs

================================================================================
           MeasurementSet Name:  /lustre/opsw/work/dpetry/proj020-PKS1830-
211_b_07_TE/analysis/X14a6/uid___A002_X86fcfa_X14a6.ms.split      MS Version 2
================================================================================
   Observer: muller     Project: uid://A001/X106/X2f
Observation: ALMA
Data records: 865920       Total integration time = 2952.1 seconds
   Observed from   18-Jul-2014/03:26:09.1   to   18-Jul-2014/04:15:21.2 (UTC)

   ObservationID = 0         ArrayID = 0
  Date        Timerange (UTC)          Scan  FldId FieldName             nRows     SpwIds   Average Interval(s)
ScanIntent
  18-Jul-2014/03:26:06.1 - 03:41:57.8     4      0 J1924-2914              316800  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
[CALIBRATE_BANDPASS#ON_SOURCE, CALIBRATE_WVR#ON_
SOURCE]
              03:43:03.5 - 03:45:40.8     6      1 J1924-292                52800  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
[CALIBRATE_AMPLI#ON_SOURCE, CALIBRATE_FLUX#ON_SO
URCE, CALIBRATE_WVR#ON_SOURCE]
              03:46:22.2 - 03:47:24.2     7      2 J1832-2039               21120  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
[CALIBRATE_PHASE#ON_SOURCE, CALIBRATE_WVR#ON_SOU
RCE]
              03:48:30.5 - 03:55:22.0     9      3 PKS1830-211             137280  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
[OBSERVE_TARGET#ON_SOURCE]
              03:55:45.4 - 03:56:47.4    10      2 J1832-2039               21120  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
[CALIBRATE_PHASE#ON_SOURCE, CALIBRATE_WVR#ON_SOU
RCE]
              03:58:00.3 - 04:04:51.9    12      3 PKS1830-211             137280  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
[OBSERVE_TARGET#ON_SOURCE]
              04:05:06.9 - 04:06:08.9    13      2 J1832-2039               21120  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
[CALIBRATE_PHASE#ON_SOURCE, CALIBRATE_WVR#ON_SOU
RCE]
              04:07:15.6 - 04:14:07.2    15      3 PKS1830-211             137280  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
```

```
[OBSERVE_TARGET#ON_SOURCE]
             04:14:22.2 - 04:15:24.2    16      2 J1832-2039              21120  [0, 1, 2, 3]  [6.05, 6.05, 6.05, 6.05]
[CALIBRATE_PHASE#ON_SOURCE, CALIBRATE_WVR#ON_SOU
RCE]
          (nRows = Total number of rows per scan)
Fields: 4
  ID   Code Name               RA               Decl           Epoch   SrcId      nRows
  0    none J1924-2914         19:24:51.055960 -29.14.30.12100 J2000   0         316800  ### Bandpass
  1    none J1924-292          19:24:51.055957 -29.14.30.12103 J2000   1          52800  ### and Fluxcal are actually
the same source
  2    none J1832-2039         18:32:11.046490 -20.39.48.20320 J2000   2          84480
  3    none PKS1830-211        18:33:39.919200 -21.03.39.88800 J2000   3         411840
Spectral Windows:  (4 unique spectral windows and 1 unique polarization setups)
  SpwID  Name                           #Chans   Frame   Ch0(MHz)  ChanWid(kHz)  TotBW(kHz) BBC Num  Corrs
  0      ALMA_RB_07#BB_1#SW-01#FULL_RES   1920   TOPO  279528.790      -976.562   1875000.0       1  XX  YY
  1      ALMA_RB_07#BB_2#SW-01#FULL_RES   1920   TOPO  281328.737      -976.562   1875000.0       2  XX  YY
  2      ALMA_RB_07#BB_3#SW-01#FULL_RES   1920   TOPO  289724.411       976.562   1875000.0       3  XX  YY
  3      ALMA_RB_07#BB_4#SW-01#FULL_RES   1920   TOPO  291524.357       976.562   1875000.0       4  XX  YY
Sources: 16
  ID   Name               SpwId RestFreq(MHz)  SysVel(km/s)
  0    J1924-2914         0     525389.452     0
  0    J1924-2914         1     528783.928     0
  0    J1924-2914         2     548151.2994    0
  0    J1924-2914         3     551545.7754    0
  1    J1924-292          0     525389.452     0
  1    J1924-292          1     528783.928     0
  1    J1924-292          2     548151.2994    0
  1    J1924-292          3     551545.7754    0
  2    J1832-2039         0     525389.452     0
  2    J1832-2039         1     528783.928     0
  2    J1832-2039         2     548151.2994    0
  2    J1832-2039         3     551545.7754    0
  3    PKS1830-211        0     525389.452     168198.254508
  3    PKS1830-211        1     528783.928     168198.254508
  3    PKS1830-211        2     548151.2994    168198.254508
  3    PKS1830-211        3     551545.7754    168198.254508
Antennas: 32:
  ID   Name  Station   Diam.    Long.         Lat.                Offset from array center (m)                ITRF
Geocentric coordinates (m)
                                                                      East         North     Elevation               x
y             z
  0    DA41  A079      12.0 m   -067.45.13.6  -22.53.35.0        116.8368     -920.2900       22.6290  2225122.700388
```

-5439951.133615 -2481886.481728

1	DA42	A081	12.0 m	-067.45.23.9	-22.53.32.5	-174.5621	-842.8380	21.0900	2224863.872927

-5440088.015655 -2481814.531382

2	DA43	A091	12.0 m	-067.45.28.7	-22.53.24.2	-312.9126	-584.7728	23.7303	2224774.741665

-5440235.548197 -2481577.816231

3	DA45	A070	12.0 m	-067.45.11.9	-22.53.29.3	166.1820	-743.4938	19.8820	2225193.449218

-5439993.765306 -2481722.541226

4	DA46	A058	12.0 m	-067.45.17.3	-22.53.32.0	12.7399	-827.0341	21.9687	2225039.860239

-5440023.554461 -2481800.313957

5	DA47	A074	12.0 m	-067.45.12.1	-22.53.32.0	161.8143	-828.6215	19.2708	2225176.656861

-5439964.248423 -2481800.726824

6	DA48	A046	12.0 m	-067.45.17.0	-22.53.29.3	21.4254	-742.7993	21.6766	2225060.201673

-5440050.345525 -2481722.599573

7	DA51	A082	12.0 m	-067.45.08.3	-22.53.29.2	269.0424	-740.9548	16.2831	2225287.766879

-5439952.669219 -2481718.802316

8	DA54	A063	12.0 m	-067.45.16.1	-22.53.31.9	46.5808	-823.6377	21.9795	2225071.684784

-5440011.975861 -2481797.189219

9	DA55	A080	12.0 m	-067.45.14.7	-22.53.20.2	87.4827	-461.2366	21.1336	2225162.611979

-5440126.242866 -2481462.997243

10	DA57	A076	12.0 m	-067.45.20.5	-22.53.33.8	-77.9911	-882.7200	24.5713	2224948.593535

-5440040.069448 -2481852.626444

11	DA59	A021	12.0 m	-067.45.17.2	-22.53.27.0	14.3183	-672.8119	21.8449	2225063.988724

-5440078.377090 -2481658.189159

12	DA60	A090	12.0 m	-067.45.05.9	-22.53.23.1	336.5008	-552.1957	12.4864	2225376.675386

-5439991.848403 -2481543.430963

13	DA61	A075	12.0 m	-067.45.17.9	-22.53.21.4	-4.5609	-499.7013	23.0322	2225072.419933

-5440148.858991 -2481499.171826

14	DA62	A016	12.0 m	-067.45.16.4	-22.53.25.1	37.4651	-614.5614	21.7854	2225093.968824

-5440090.535465 -2481604.502590

15	DA63	A019	12.0 m	-067.45.17.5	-22.53.27.6	7.7759	-691.8439	21.8013	2225055.115728

-5440073.964547 -2481675.705440

16	DA64	A085	12.0 m	-067.45.10.5	-22.53.20.5	207.6856	-472.2087	16.8007	2225270.737455

-5440073.091757 -2481471.420150

17	DV01	A072	12.0 m	-067.45.12.6	-22.53.24.0	147.1725	-580.5878	18.1839	2225199.253359

-5440058.163652 -2481571.803430

18	DV02	A087	12.0 m	-067.45.08.3	-22.53.33.2	269.0954	-864.0703	16.2413	2225269.669092

-5439908.287357 -2481832.205202

19	DV07	A086	12.0 m	-067.45.27.0	-22.53.29.3	-262.5027	-744.4847	26.4691	2224798.838328

-5440161.301334 -2481726.016422

20	DV09	A044	12.0 m	-067.45.18.5	-22.53.29.9	-21.9869	-761.0120	22.1192	2225017.494651

-5440060.599456 -2481739.550049

21	DV10	A071	12.0 m	-067.45.19.9	-22.53.23.5	-60.7899	-563.2543	23.3817	2225011.141478

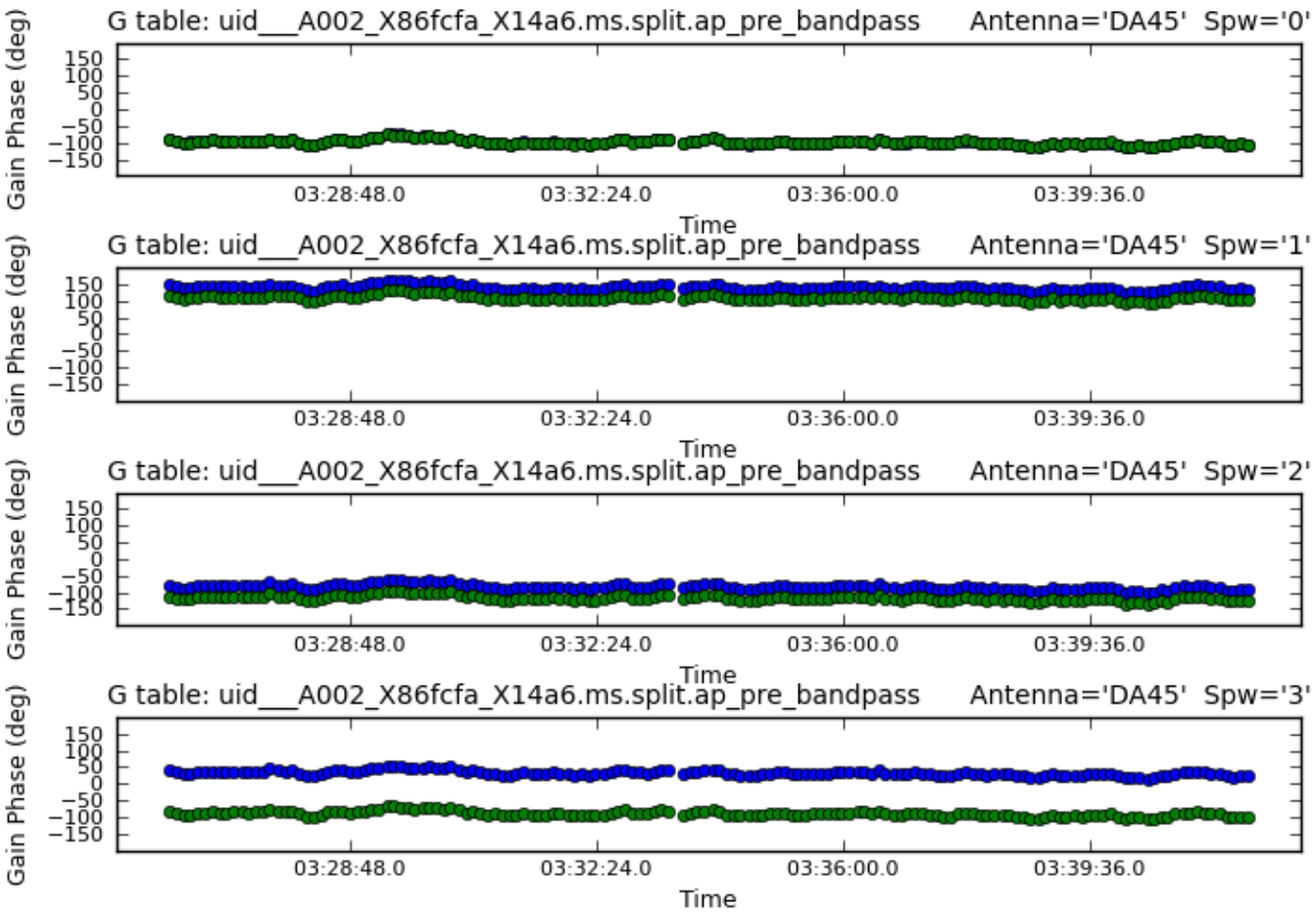
```
-5440147.562866 -2481557.856545
  22   DV11  A031      12.0 m   -067.45.19.1  -22.53.27.1       -37.8157     -675.5190       21.7294  2225015.297902
-5440097.039416 -2481660.638191
  23   DV13  A067      12.0 m   -067.45.12.7  -22.53.27.2       142.4084     -678.7313       19.6275  2225180.894859
-5440025.864799 -2481662.779902
  24   DV14  A083      12.0 m   -067.45.22.8  -22.53.21.0      -143.5434     -488.2353       25.2585  2224946.249208
-5440207.496450 -2481489.474505
  25   DV15  A089      12.0 m   -067.45.19.8  -22.53.39.4       -57.6235    -1056.0760       29.6119  2224943.672413
-5439974.237340 -2482014.288678
  26   DV16  A069      12.0 m   -067.45.21.3  -22.53.30.2      -101.4806     -770.1048       23.2983  2224942.992781
-5440088.422751 -2481748.385401
  27   DV18  A033      12.0 m   -067.45.19.4  -22.53.29.0       -47.3617     -735.6351       21.8828  2224997.663906
-5440079.140038 -2481716.079772
  28   DV19  A077      12.0 m   -067.45.10.1  -22.53.25.9       217.6296     -637.5334       15.8390  2225255.259528
-5440008.989134 -2481623.352685
  29   DV25  A056      12.0 m   -067.45.15.3  -22.53.30.8        70.3026     -789.3294       20.6712  2225098.236002
-5440014.232717 -2481765.074070
  30   PM03  T701      12.0 m   -067.45.18.8  -22.53.22.2       -29.1266     -522.7876       22.2056  2225045.995676
-5440149.142327 -2481520.118813
  31   PM04  T703      12.0 m   -067.45.16.2  -22.53.23.9        42.8797     -575.6911       21.7762  2225104.700747
-5440102.471864 -2481568.689536


### Next step is flux calibration

### Have J1924-292 as flux cal, i.e. a quasar
###  script gen has set 2.75388028353 Jy with a spectral index of -0.737332488172 for all four SPWs
### We already got the relevant output when the script was generated.
### If you want to check the flux database again, do

CASA <30>: aU.getALMAFlux (sourcename='J1924-292', frequency='278.6GHz', date='2014/07/18')
Using Band 3 measurement: 5.820 +- 0.120 (age=-1 days) 103.5 GHz
Using Band 3 measurement: 5.950 +- 0.120 (age=-1 days) 91.5 GHz
Using Band 7 measurement: 2.280 +- 0.100 (age=-1 days) 343.5 GHz
Median Monte-Carlo result for 103.490000 = 5.609890 +- 0.180069 (scaled MAD = 0.181952)
Error-weighted fit: Slope: -0.737+-0.022  Flux D. @ 103.490GHz: 5.609+-0.180 Jy
   Un-weighted fit: Slope: -0.748         Flux D. @ 103.490GHz: 5.609 Jy
Median Monte-Carlo result for 278.600000 = 2.700969 +- 0.231246 (scaled MAD = 0.228114)
Result using spectral index of -0.737 for 278.600000 GHz = 2.804200 +- 0.231246 Jy
  Out[11]:
{'ageDifference': 0.0,
 'fluxDensity': 2.8042002184340893,
```

```
 'fluxDensityUncertainty': 0.23124584066862228,
 'meanAge': 1.0,
 'spectralIndex': -0.73733248817202324,
 'spectralIndexUncertainty': 0.021878897538531936}

### consistent

### However, we saw that bandpass and fluxcal are the same source
### So better use the bandpass as the fluxcal
### edit step 10:

  setjy(vis = 'uid___A002_X86fcfa_X14a6.ms.split',
    standard = 'manual',
    field = '0', ### instead of 'J1924-292'
    fluxdensity = [2.75388028353, 0, 0, 0],
    spix = -0.737332488172,
    reffreq = '285.526573803GHz')

 ---------

### make entries in checklist

---------

  2) Other flagging and set cal models --------------------------[ ]
  Comments:
    - flagged edge channels (TDM mode)?       [ ]  [x]
    - flagged atmospheric lines?              [ ]  [x]
        SPW and channel ranges:

    - spatially resolved flux calibrator      [ ]  [x]
      - flagged channels with spectral features of the calibrator?
        (if not in Butler-JPL-Horizons 2012)
         CO lines
           115.3 GHz Band 3                   [ ]
           230.5 GHz Band 6                   [ ]
           343.7 GHz Band 7 (narrow)          [ ]
           345.8 GHz Band 7 (broad)           [ ]
           691.6 GHz Band 9                   [ ]
      - checked model amp vs uvdist?          [ ]

          uvrange (m) for later gaincal:
```

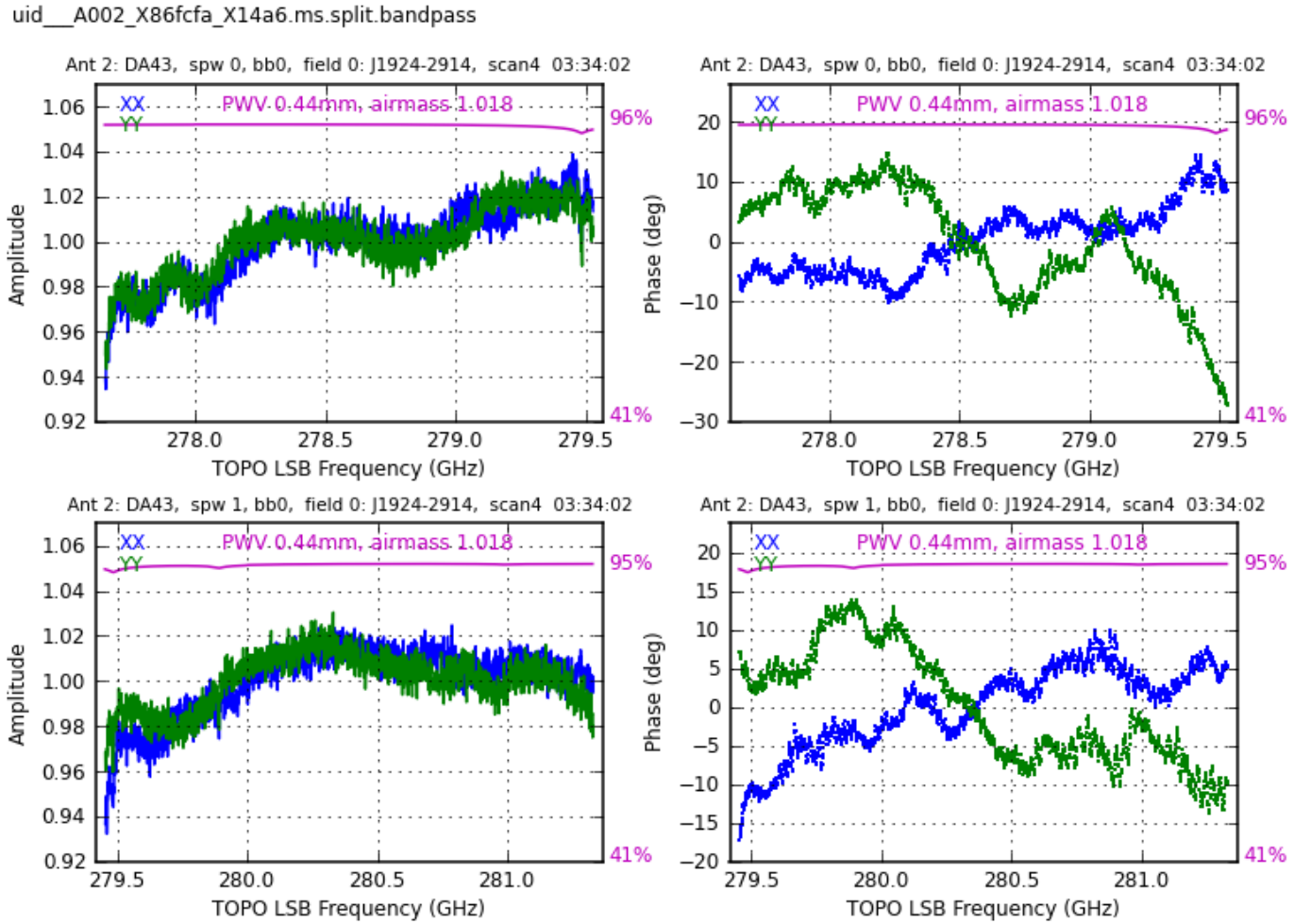
```
    - Quasar flux calibrator                  [x]  [ ]
      - reference value from ASDM Source tbl? [ ]
      - other reference:                      [x]
          used values from getALMAFlux
          NOTE: using bandpass as fluxcal

----------


### also need to make corresponding change in step 14 (gain calibration)

  fluxscaleDict = fluxscale(vis = 'uid___A002_X86fcfa_X14a6.ms.split',
    caltable = 'uid___A002_X86fcfa_X14a6.ms.split.ampli_inf',
    fluxtable = 'uid___A002_X86fcfa_X14a6.ms.split.flux_inf',
    reference = '0') ### instead of '1'

### now run the steps

CASA <35>: mysteps = [10,11]

CASA <36>: execfile('uid___A002_X86fcfa_X14a6.ms.scriptForCalibration.py')
List of steps to be executed ... [10, 11]
# A priori calibration
# Calibration
Step  10 Putting a model for the flux calibrator(s)
Step  11 Save flags before bandpass cal

### refant
### scriptgen suggests DA48

CASA <36>: plotants('uid___A002_X86fcfa_X14a6.ms.split')
INFO2 Number of points being plotted : 32

### DA48 is right in the middle of the array, seems a good choice


### can do the entire rest of the calibration in one go

CASA <37>: mysteps = [12,13,14,15]

CASA <38>: execfile('uid___A002_X86fcfa_X14a6.ms.scriptForCalibration.py')
```

```
List of steps to be executed ... [12, 13, 14, 15]
# A priori calibration
# Calibration
Step  12 Bandpass calibration
GAIN_amp_min, max =  0.999999880791 1.0
INFO2 Number of points being plotted : 300
...
Making directory =  uid___A002_X86fcfa_X14a6.ms.split.bandpass_smooth20ch.plots/
Building
uid___A002_X86fcfa_X14a6.ms.split.bandpass_smooth20ch.plots/uid___A002_X86fcfa_X14a6.ms.split.bandpass_smooth20ch.DA41.sp
w00.t00.png
...

Skipping DA54, xant=8, ispw=0 (Ant 8: DA54,  spw 0,  field 0: J1924-2914,  scan4  03:34:02) all solutions flagged
...
Skipping DV14, xant=24, ispw=0 (Ant24: DV14,  spw 0,  field 0: J1924-2914,  scan4  03:34:02) all solutions flagged
...
# This is what checkCalTable executed:
#for i in ['DA41', 'DA42', 'DA43', 'DA45', 'DA46', 'DA47', 'DA48', 'DA51', 'DA54', 'DA55', 'DA57', 'DA59', 'DA60',
'DA61', 'DA62', 'DA63', 'DA64', 'DV01', 'DV02', 'DV07', 'DV09', 'DV10', 'DV11', 'DV13', 'DV14', 'DV15', 'DV16', 'DV18',
'DV19', 'DV25', 'PM03', 'PM04']:
#   plotcal(caltable='uid___A002_X86fcfa_X14a6.ms.split.ampli_inf', xaxis='time', yaxis='amp', antenna=i,
iteration='antenna,spw', subplot=411, plotrange=[0, 0, 0.072502, 0.280849],
figfile='uid___A002_X86fcfa_X14a6.ms.split.ampli_inf.plots/uid___A002_X86fcfa_X14a6.ms.split.ampli_inf.amp.'+str(i)
+'.png', spw='', showgui=False)

...
# This is what checkCalTable executed:
#for i in ['DA41', 'DA42', 'DA43', 'DA45', 'DA46', 'DA47', 'DA48', 'DA51', 'DA54', 'DA55', 'DA57', 'DA59', 'DA60',
'DA61', 'DA62', 'DA63', 'DA64', 'DV01', 'DV02', 'DV07', 'DV09', 'DV10', 'DV11', 'DV13', 'DV14', 'DV15', 'DV16', 'DV18',
'DV19', 'DV25', 'PM03', 'PM04']:
#    plotcal(caltable='uid___A002_X86fcfa_X14a6.ms.split.phase_inf', xaxis='time', yaxis='phase', antenna=i,
iteration='antenna,spw', subplot=411, plotrange=[0, 0,-179.944926,179.362079],
figfile='uid___A002_X86fcfa_X14a6.ms.split.phase_inf.plots/uid___A002_X86fcfa_X14a6.ms.split.phase_inf.phase.'+str(i)
+'.png', spw='', showgui=False)

Step  15 Save flags before applycal


### look at bandpass phase-up plots
```

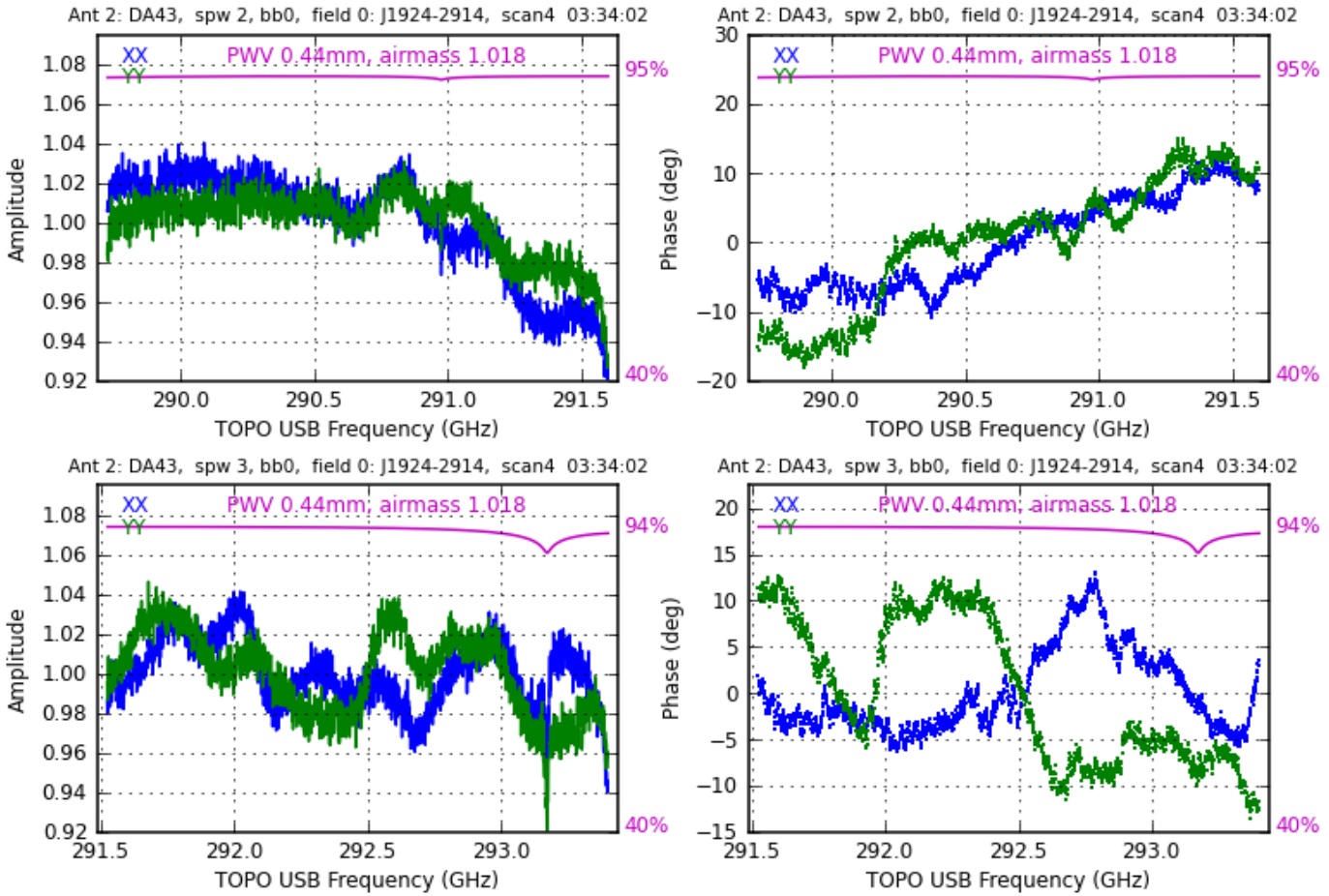
```
> eog uid___A002_X86fcfa_X14a6.ms.split.ap_pre_bandpass.plots/*.png &
### find DA54 seems to have been flagged completely
###    Dto. for DV14
```



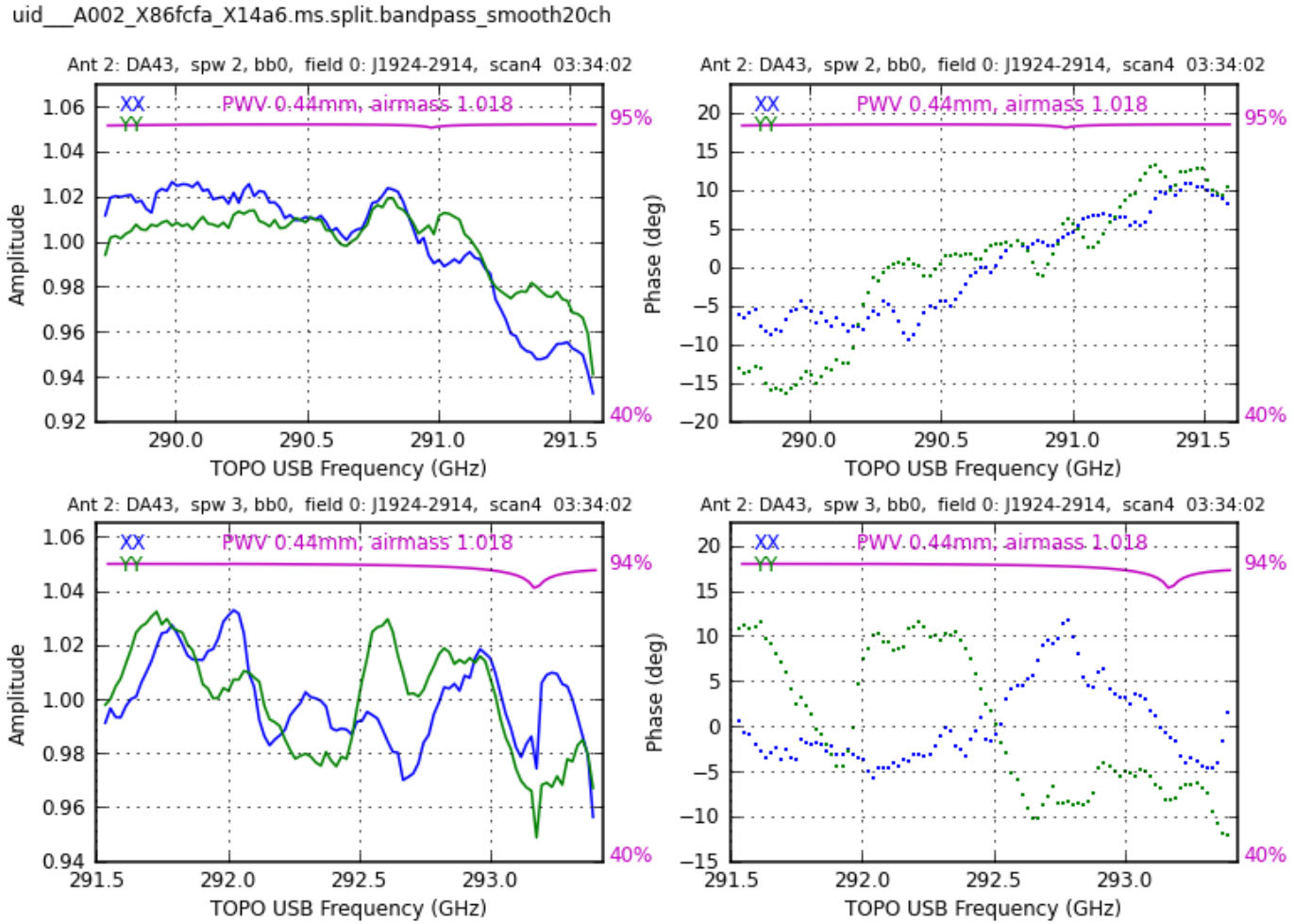
```
### look at bandpass plots

> eog uid___A002_X86fcfa_X14a6.ms.split.bandpass.plots/*.png &
### two plots for each antenna, see dips at positions of atm. lines as expected
```



uid___A002_X86fcfa_X14a6.ms.split.bandpass

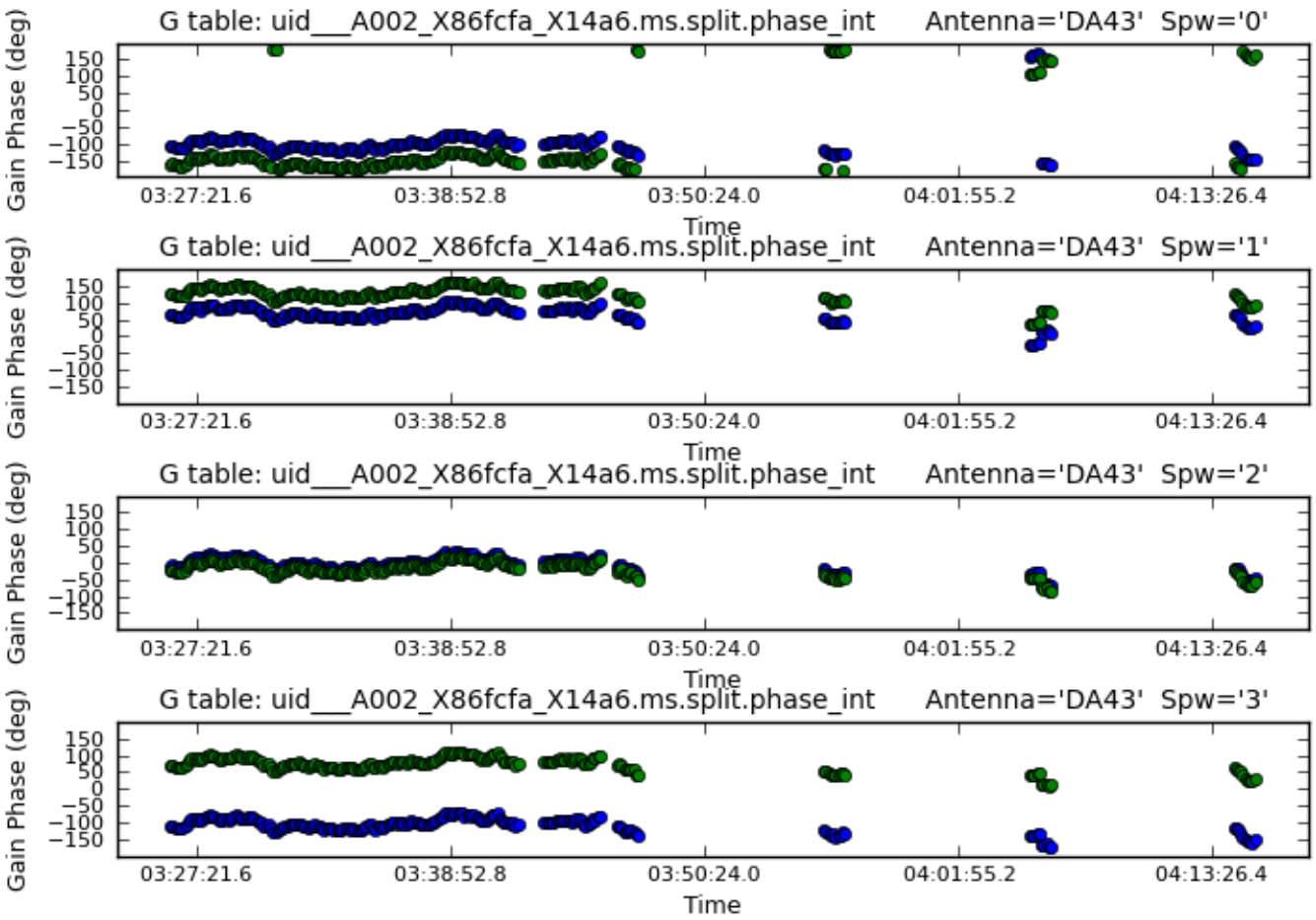


```
> eog uid___A002_X86fcfa_X14a6.ms.split.bandpass_smooth20ch.plots/*.png &
### very well behaved
```

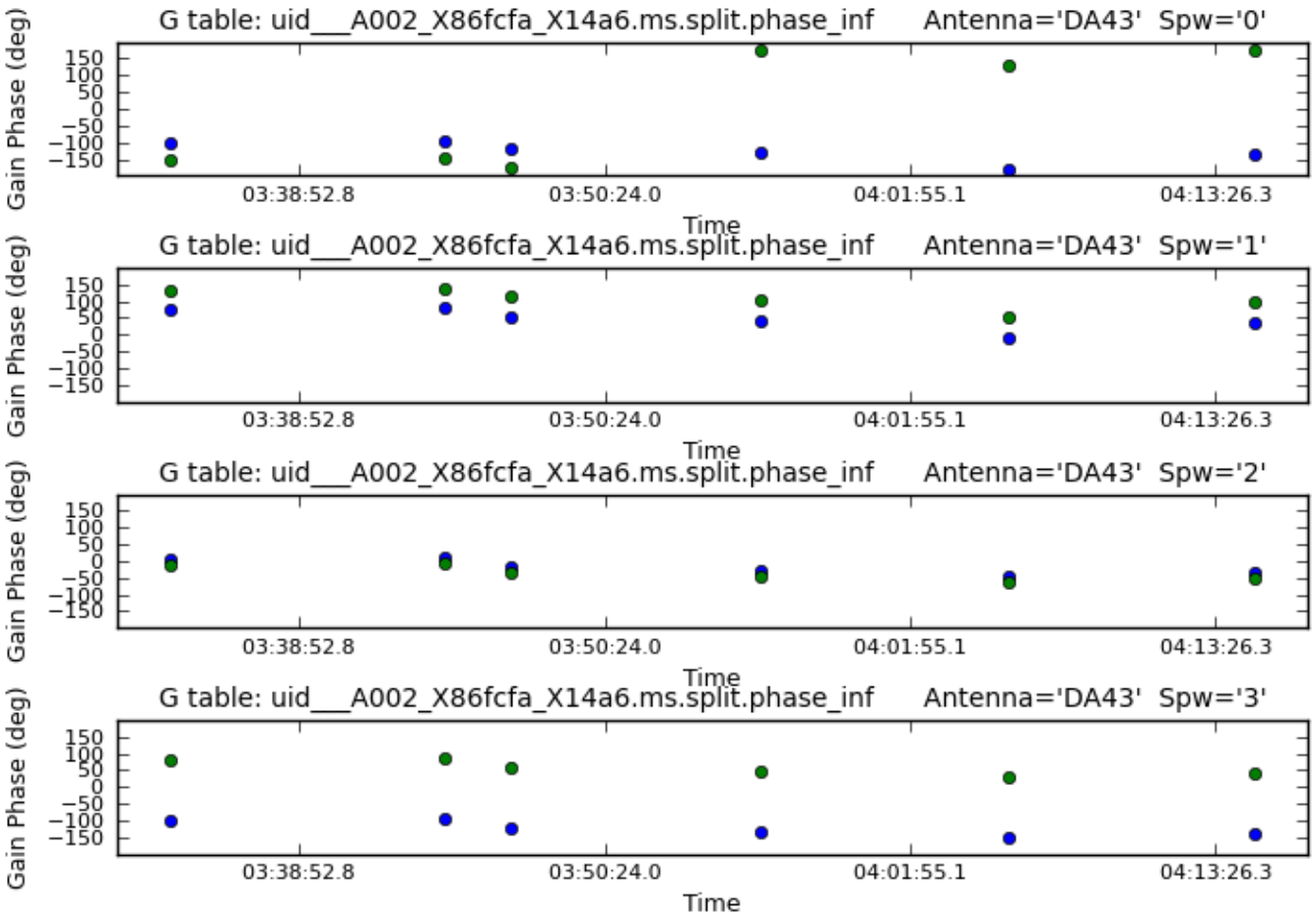



```
### look at gaincal plots
```

```
> eog uid___A002_X86fcfa_X14a6.ms.split.phase_int.plots/*.png

### well behaved but again DA54 and DV14 totally missing, DA63 has some solutions flagged
```




```
> eog uid___A002_X86fcfa_X14a6.ms.split.phase_inf.plots/*.png &
```




```
CASA <5>: mysteps = [16,17,18]

CASA <6>: execfile('uid___A002_X86fcfa_X14a6.ms.scriptForCalibration.py')
List of steps to be executed ... [16, 17, 18]
# A priori calibration
```

```
# Calibration
Step  16 Application of the bandpass and gain cal tables
Step  17 Split out corrected column
....10....20....30....40....50....60....70....80....90....100%
Step  18 Save flags after applycal

CASA <7>: exit

### (may give an IPython crash due to plotcal problems; can be ignored)


### now generate QA2 report

CASA <2>: es.generateQA2Report('uid___A002_X86fcfa_X14a6.ms')


Running ValueMapping
Ignoring spectral window [0, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47,
48, 49, 50, 51, 52, 53, 54, 55, 56] because it is WVR related
Completed ValueMapping
Found 496 baselines
Unprojected lengths:  min=20.125126, max=650.304653, rms=294.075233 meters

...

************************************************************

              MEDIAN TSYS WITH SOURCE/ELEVATION
                  (see plots for details)
Scan   Fid               Source      Elev    Median T_x  Median T_y
   3     0              J1924-2914   77.6        80          80
   5     1               J1924-292   80.7        82          81
   8     3             PKS1830-211   83.7        81          80
  11     3             PKS1830-211   81.5        82          82
  14     3             PKS1830-211   79.4        82          81



            MEDIAN TSYS versus ANTENNA/SPW and OUTLIERS

              TSYS MEDIAN               >3-sigma OUTLIERS
       XPOL              YPOL               OUTLIERS
```

```
 SPW    T   rms        T   rms      antenna  Pol  tsys  n-sigma

 0  9     79   56        77   58   No outliers
 1 11     76   49        75   52   No outliers
 2 13     84   52        82   59   No outliers
 3 15     86   62        87   65   No outliers
numspw =  4
Running the af tool, this can take a few minutes.
DA54 total=201523200  flagged=201523200  fraction=1.000000000
DV14 total=201523200  flagged=201523200  fraction=1.000000000
Will only plot the 30 unflagged of 32 antennas in the .split ms:
DA41,DA42,DA43,DA45,DA46,DA47,DA48,DA51,DA55,DA57,DA59,DA60,DA61,DA62,DA63,DA64,DV01,DV02,DV07,DV09,DV10,DV11,DV13,DV15,D
V16,DV18,DV19,DV25,PM03,PM04
...

Skip DA63, xant=15 (spw 9,  field 3: PKS1830-211) for time2=03:47:37 all solutions flagged
Skip DA63, xant=15 (spw 9,  field 3: PKS1830-211) for time4=04:06:22 all solutions flagged
Skip DA63, xant=15 (spw11,  field 3: PKS1830-211) for time2=03:47:37 all solutions flagged
Skip DA63, xant=15 (spw11,  field 3: PKS1830-211) for time4=04:06:22 all solutions flagged
Skip DA63, xant=15 (spw13,  field 3: PKS1830-211) for time2=03:47:37 all solutions flagged
Skip DA63, xant=15 (spw13,  field 3: PKS1830-211) for time4=04:06:22 all solutions flagged
Skip DA63, xant=15 (spw15,  field 3: PKS1830-211) for time2=03:47:37 all solutions flagged
Skip DA63, xant=15 (spw15,  field 3: PKS1830-211) for time4=04:06:22 all solutions flagged
### we already saw that DA63 had problems ...


* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

          SUMMARY INFORMATION FOR  uid___A002_X86fcfa_X14a6.ms.split

   Experiment Duration:  2014/07/18/03:26:09 to
                         2014/07/18/04:15:21

   Processed from ms: uid___A002_X86fcfa_X14a6.ms.split
   Written to file:   NewListobs.txt

                                  SCAN LISTING

  Scan FdId srcId FieldName         StartTime    StopTime     Int(s) Elev  ScanIntent
    4    0    0   J1924-2914        03:26:06.1 - 03:41:57.8   6.05   79.2  Cal Bandpass
    6    1    1   J1924-292         03:43:03.5 - 03:45:40.8   6.05   80.9  Cal Flux
    7    2    2   J1832-2039        03:46:22.2 - 03:47:24.2   6.05   83.5  Cal Phase
```

9	3	3	PKS1830-211	03:48:30.5 - 03:55:22.0	6.05	82.8	Obs Target
10	2	2	J1832-2039	03:55:45.4 - 03:56:47.4	6.05	81.4	Cal Phase
12	3	3	PKS1830-211	03:58:00.3 - 04:04:51.9	6.05	80.7	Obs Target
13	2	2	J1832-2039	04:05:06.9 - 04:06:08.9	6.05	79.3	Cal Phase
15	3	3	PKS1830-211	04:07:15.6 - 04:14:07.2	6.05	78.6	Obs Target
16	2	2	J1832-2039	04:14:22.2 - 04:15:24.2	6.05	77.2	Cal Phase

FIELD INFORMATION

Fid	Srd	Field	RA (J2000)	DEC	Fld Time (min)	#Scans
0	0	J1924-2914	19:24:51.05596	-29.14.30.1210	15.86	1
1	1	J1924-292	19:24:51.05596	-29.14.30.1210	2.62	1
2	2	J1832-2039	18:32:11.04649	-20.39.48.2032	4.13	4
3	3	PKS1830-211	18:33:39.91920	-21.03.39.8880	20.58	3

FREQUENCY INFORMATION

spw	nchan	-----Frequencies (GHz)------- First	Last	Bandwidth	--Channel Width-- MHz	km/s	POLN
0	1920	279.528790	277.654767	1.875	-0.977	-1.05	['XX', 'YY']
1	1920	281.328737	279.454714	1.875	-0.977	-1.04	['XX', 'YY']
2	1920	289.724411	291.598434	1.875	0.977	1.01	['XX', 'YY']
3	1920	291.524357	293.398381	1.875	0.977	1.00	['XX', 'YY']

...

****

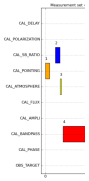
Flux Density Determinations

Reference source J1924-2914

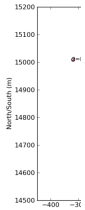
J1924-292 in SpW=0 (2.79529e+11 Hz) is: 2.8058+-0.00252432 (SNR=1111.51, N=30)
J1924-292 in SpW=1 (2.81329e+11 Hz) is: 2.79386+-0.00248271 (SNR=1125.33, N=30)
J1924-292 in SpW=2 (2.89724e+11 Hz) is: 2.7225+-0.0024183 (SNR=1125.79, N=30)
J1924-292 in SpW=3 (2.91524e+11 Hz) is: 2.7064+-0.00267441 (SNR=1011.96, N=30)
J1832-2039 in SpW=0 (2.79529e+11 Hz) is: 0.254044+-0.00326795 (SNR=77.738, N=29)
J1832-2039 in SpW=1 (2.81329e+11 Hz) is: 0.255395+-0.0033252 (SNR=76.8057, N=29)

```
J1832-2039 in SpW=2 (2.89724e+11 Hz) is: 0.250574+-0.00345336 (SNR=72.5595, N=29)
J1832-2039 in SpW=3 (2.91524e+11 Hz) is: 0.249723+-0.00356431 (SNR=70.0621, N=29)
Fit spectrum J1924-292: 2.75686+-0.000989927 (285.48 GHz) spidx=-0.864561+-0.0199967
Fit spectrum J1832-2039: 0.252425+-0.000558132 (285.48 GHz) spidx=-0.483241+-0.122127

...

************************************************************

        CHECK OF A TARGET IMAGE AND SENSITIVITY

    longest baseline       =   650.3 (meters)
    recommended cellsize   =   0.08 (arcsec)
    primary beam FWHM      =  21.46 (arcsec)
    recommended image size =   432

    target                 =  3
    resolution             =  0.42 x 0.37 in pa  -34.9
    time on target         =  20.28 (min)
    peak on image          = 1138.54 (mJy)
    rms on image           =   3.52 (mJy)
    expected sensitivity   =   0.03 (mJy) (aggregate bandwidth)


### if possible compare with reference measurements from ALMA or SMA




> cd qa2
```

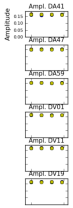
```
### look at qa2*.png and textfile.txt

> eog qa2_part?.png &
```



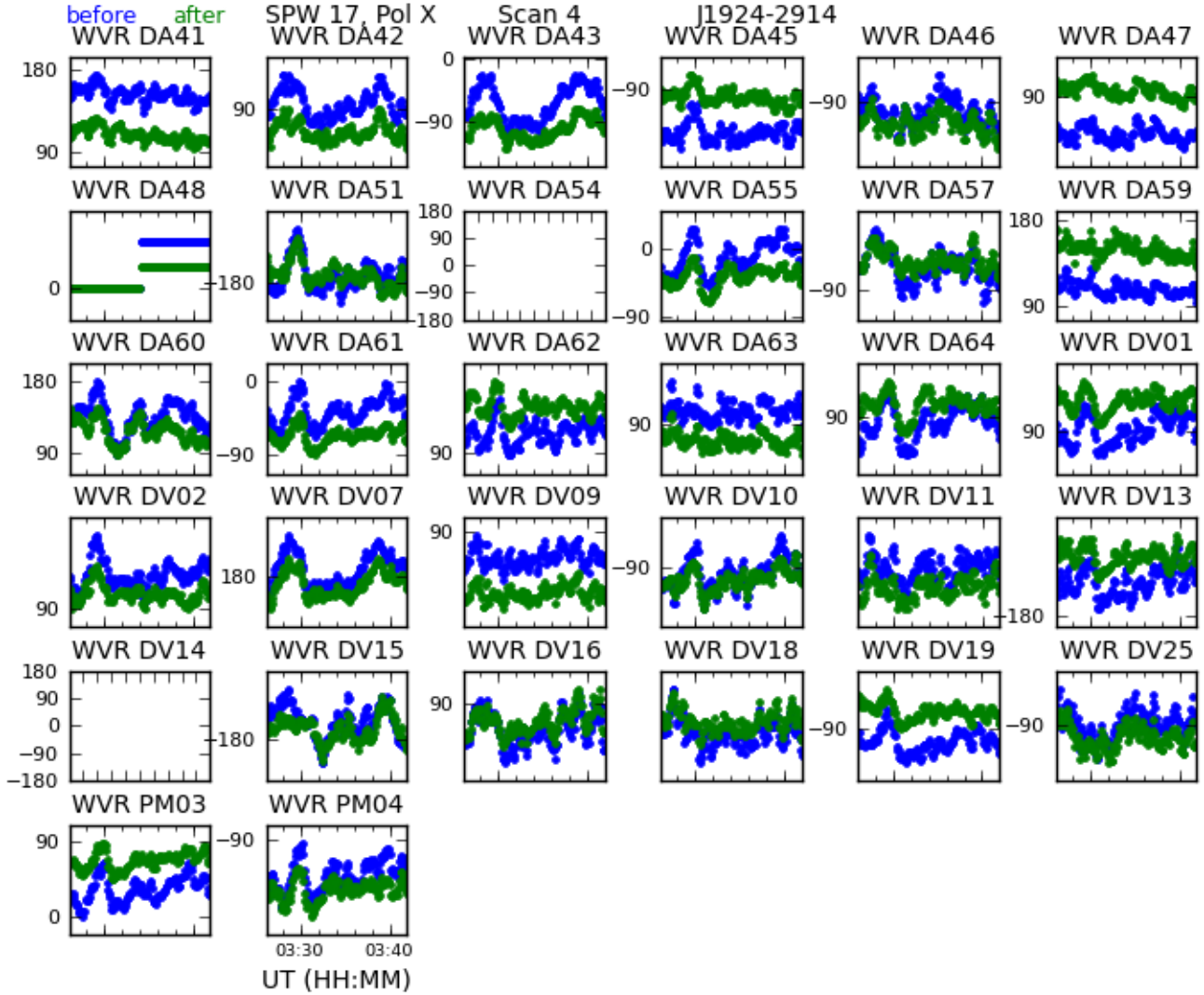
Observing Schec



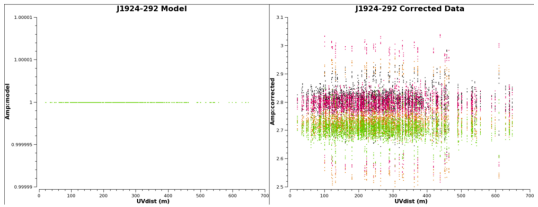
Antenna



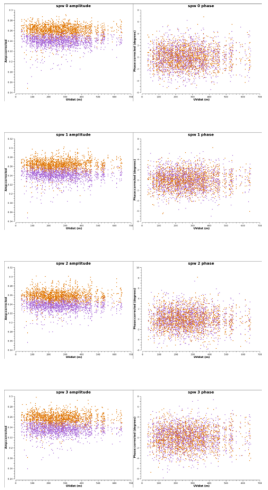
Tempora



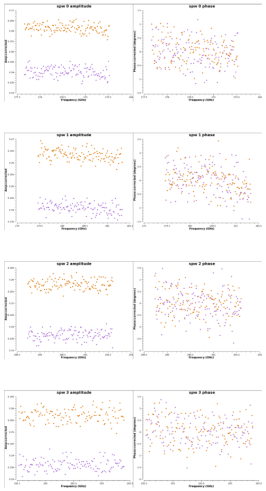
Phase: before/after WVR



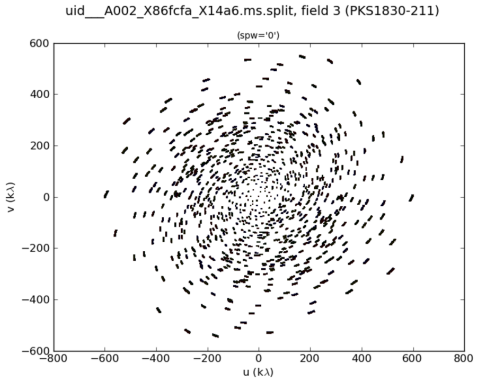
Flux calibration model and data



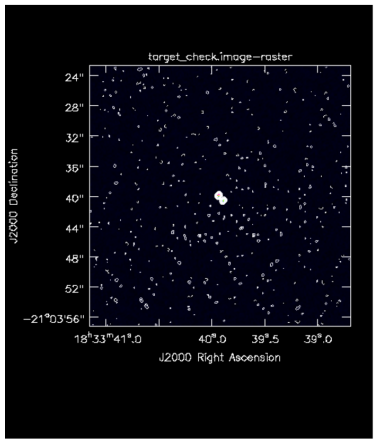
Phase Calibrator amp/phase vs uvdist



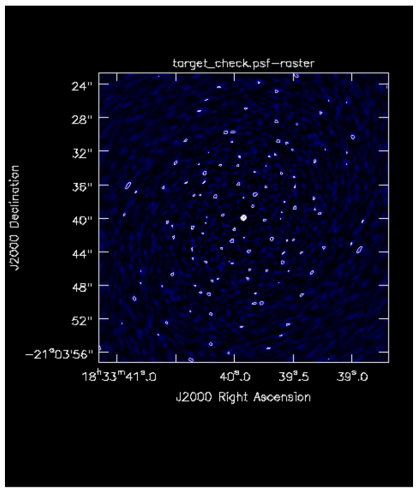
Phase Calibrator amp/phase vs freq



Target (Field_ID=3) u-v coverage



Target Image (Field_ID=3=PKS1830-211)



Target psf

```
> emacs textfile.txt &

--------------

        CHECK OF A TARGET IMAGE AND SENSITIVITY

    longest baseline       =   650.3 (meters)
    recommended cellsize   =   0.08 (arcsec)
    primary beam FWHM      =  21.46 (arcsec)
    recommended image size =   432

    target                 =  3
    resolution             =  0.42 x 0.37 in pa  -34.9
    time on target         =  20.28 (min)
    peak on image          = 1138.54 (mJy)
    rms on image           =   3.52 (mJy)
    expected sensitivity   =   0.03 (mJy) (aggregate bandwidth)


----------------

### copy *.ms.split.cal over to ../calibrated

CASA <3>: !mv uid___A002_X86fcfa_X14a6.ms.split.cal/ ../calibrated/

CASA <4>: cd ../calibrated/
/lustre/opsw/work/dpetry/proj020-PKS1830-211_b_07_TE/analysis/calibrated

### Run checkRMS to assess if it makes sense to image

### Note that you can use the optional paramter maxFlag (default=0.1) to control what fraction of channels
### of a visibility row may be flagged before it is counted as completely flagged.

CASA <5>: mycheckres = es.checkRMS(msNames='uid*ms.split.cal', numAnts=34, timeOnSource=25.9, numFieldsPerSource=1)

WARNING: THIS WAS NOT TESTED FOR SESSIONS
WARNING: OPTION groupSpwsByFreq NOT IMPLEMENTED YET
# Processing ->  uid___A002_X86fcfa_X14a6.ms.split.cal
# Found  1  source(s)
---------
Number of executions =  1
```

```
Source name =  PKS1830-211
Number of fields found =  1
Maximum rms ratio across all fields, per spw:

0 -> 1.22313723461 -> FAIL -> need 0.0877233753471 additional executions
1 -> 1.22313723461 -> FAIL -> need 0.0877233753471 additional executions
2 -> 1.22313723461 -> FAIL -> need 0.0877233753471 additional executions
3 -> 1.22313723461 -> FAIL -> need 0.0877233753471 additional executions

### OK, this is a borderline case; it may still make sense to image


CASA <2>: es.generateReducScript('uid___A002_X86fcfa_X14a6.ms.split.cal/', step='imaging')
WARNING: You are currently running CASA 4.2.1 rather than CASA 4.1.
WARNING: The scripts have been ported, but for a bit of time, please be careful with the output.
WARNING: If you observe any issue or strange behavior, please send an email to Eric V. (evillard@alma.cl)

CASA <3>: !emacs scriptForImaging.py &

### at the same time start SB checklist

-----------

********** ALMA Cycle 2 QA2 SB Analysis Checklist **********************

Checklist Version: $Id: Cycle2_QA2_SB_Checklist.txt,v 1.2 2014/08/13 08:15:13 dpetry Exp $
CASA version: 4.2.2
analysisUtils version: $Id: analysisUtils.py,v 1.2185 2015/01/27 17:32:48 tsawada Exp $

Reduction Start Date     : 2015/01/30
Reduction Completion Date:
Analyst Name(s)          : D. Petry

Project code     : 2013.1.00020.S
Project title    : Hydrides as diagnostic tools for the z=0.89 absorption toward PKS 1830-211
Contact Scientist: Ivan Marti-Vidal
PI               : S. Muller
SB Name          : PKS1830-211_b_07_TE

EBs in calibrated dataset:
uid___A002_X86fcfa_X14a6
```

```
Observation Dates and Total Integration Time
(from listobs of concatenated dataset):
Data records: 865920       Total integration time = 2952.1 seconds
 Observed from   18-Jul-2014/03:26:09.1   to   18-Jul-2014/04:15:21.2 (UTC)

Number of good antennas: 29
-------------


### imaging shows that we have a hopelessly to high RMS because the phasecal is faint
###  -> need to try selfcal

### The final scriptForImaging looks like this:


------------------------- scriptForImaging.py -----------------------
import re

if re.search('^4.2.2', casadef.casa_version) == None:
 sys.exit('ERROR: PLEASE USE THE SAME VERSION OF CASA THAT YOU USED FOR GENERATING THE SCRIPT: 4.2.2')


print "# Running clean."

clean(vis = 'uid___A002_X86fcfa_X14a6.ms.split.cal',
  imagename = 'uid___A002_X86fcfa_X14a6.ms.split.cal.image.continuum.source3',
  field = '3', # PKS1830-211
  spw = '0,1,2,3',
  mode = 'mfs',
  outframe='BARY',  ### always set outframe!
  interactive = T,
  imsize = [640, 640],
  cell = '0.08arcsec',
  phasecenter = 3,
  weighting = 'briggs',
  robust = 0.5)

# RMS 2.7 mJy/beam, beam 0.36" x 0.32", peak 1.11 Jy, dyn range 411


SOUNAME='PKS1830'
```

```
EBID='uid___A002_X86fcfa_X14a6'
VISINAME='uid___A002_X86fcfa_X14a6.ms.split.cal'
imsize=[432,432]
cell='0.08arcsec'
#mask=['circle[ [18h33m39.9s,-21d03m39.9s], 2.0arcsec ]']
imagename=SOUNAME+'_'+EBID+'.spw0_vel'
print "CLEAN the source", SOUNAME, imagename
os.system('rm -rf '+imagename+'*')

clean(vis=VISINAME,
      spw='0',
      imagename=imagename,
      field='3',
      cell=cell,
      imsize=imsize,
      outframe='BARY',
      niter=1000,
      interactive=True,
      #mask=mask,                                          ###
      mode='velocity',
      nchan=40,                                           ###
      start='-60km/s',                                    ###
      width='3km/s',  ### from "Control and Performance in the OT file
      threshold='6mJy',
      #          weighting='natural', # optimum point source sensitivit.
      weighting='briggs', # compromise with reduced sidelobe level
      robust=0.5,
      interpolation='linear',
      restfreq='278.6000GHz', # sky freq of SH+ line according to proposal
      phasecenter='3',
      usescratch=False)

# RMS 4 mJy/beam, beam 0.38 x 0.36", peak 1.135 Jy, dyn. range 283
```

```
### selfcal

# split out, spectrally average, and time bin the calibrated data
split(vis = 'uid___A002_X86fcfa_X14a6.ms.split.cal',
  outputvis = 'calibrated.cont.ms',
  datacolumn = 'data',
  timebin = '60s',
  field = '3',
  width = 10)

clean(vis = 'calibrated.cont.ms',
  imagename = 'calibrated.cont.ms.image.continuum.source3',
  field = '0', # the target
  spw = '0,1,2,3',
  mode = 'mfs',
  outframe='BARY',
  interactive = T,
  imsize = [432, 432],
  cell = '0.08arcsec',
  phasecenter = 0,
  weighting = 'briggs',
  robust = 0.5)

# RMS 2.7 mJy, peak 1.11 Jy

myimagebase = 'calibrated.cont.ms.image.continuum.source3'
impbcor(imagename=myimagebase+'.image', pbimage=myimagebase+'.flux', outfile=myimagebase+'.image.pbcor', overwrite=True)
# perform PBcorr
exportfits(imagename=myimagebase+'.image.pbcor', fitsimage=myimagebase+'.image.pbcor.fits') # export the corrected image
exportfits(imagename=myimagebase+'.flux', fitsimage=myimagebase+'.flux.fits') # export the PB image


os.system('rm -rf calibrated.cont.ms.selfcal')
gaincal(vis = 'calibrated.cont.ms',
  caltable = 'calibrated.cont.ms.selfcal',
  gaintype = 'G',
  calmode = 'p',
  solint = 'int',
  refant = 'DA48',
  minsnr = 3.0)
```

```
applycal(vis = 'calibrated.cont.ms',
  gaintable = 'calibrated.cont.ms.selfcal',
  interp = 'nearest')


os.system('rm -rf calibrated.cont.ms.image.continuum.source3.selfcal*')
clean(vis = 'calibrated.cont.ms',
  imagename = 'calibrated.cont.ms.image.continuum.source3.selfcal',
  field = '0', # the target
  spw = '0,1,2,3',
  mode = 'mfs',
  outframe='BARY',
  interactive = T,
  imsize = [432, 432],
  cell = '0.08arcsec',
  phasecenter = 0,
  weighting = 'briggs',
  robust = 0.5)

# RMS 0.5 mJy (!), peak 1.87 Jy

myimagebase = 'calibrated.cont.ms.image.continuum.source3.selfcal'
impbcor(imagename=myimagebase+'.image', pbimage=myimagebase+'.flux', outfile=myimagebase+'.image.pbcor', overwrite=True)
# perform PBcorr
exportfits(imagename=myimagebase+'.image.pbcor', fitsimage=myimagebase+'.image.pbcor.fits') # export the corrected image
exportfits(imagename=myimagebase+'.flux', fitsimage=myimagebase+'.flux.fits') # export the PB image

#apply continuum selfcal to the line data

applycal(vis = 'uid___A002_X86fcfa_X14a6.ms.split.cal',
  gaintable = 'calibrated.cont.ms.selfcal',
  field = '3',
  interp='nearest')


# split out science source and time bin

split(vis = 'uid___A002_X86fcfa_X14a6.ms.split.cal',
  outputvis = 'calibrated.timebin.ms',
  datacolumn = 'corrected', # (the default)
  field = '3',
  timebin = '60s')
```

```
SOUNAME='PKS1830'
EBID='uid___A002_X86fcfa_X14a6'
VISINAME='calibrated.timebin.ms'
imsize=[432,432]
cell='0.08arcsec'
imagename=SOUNAME+'_'+EBID+'.spw0_vel_selfcal'
print "CLEAN the source", SOUNAME, imagename
os.system('rm -rf '+imagename+'*')

clean(vis=VISINAME,
      spw='0',
      imagename=imagename,
      field='0',
      cell=cell,
      imsize=imsize,
      outframe='BARY',
      niter=1000,
      interactive=True,
      #mask=mask,                                          ###
      mode='velocity',
      nchan=40,                                          ###
      start='-60km/s',                                        ###
      width='3km/s',
      threshold='6mJy',
      #          weighting='natural', # optimum point source sens.
      weighting='briggs', # compromise with reduced sidelobe level
      robust=0.5,
      interpolation='linear',
      restfreq='278.6000GHz', # sky freq of SH+ line according to proposal
      phasecenter='0')


# RMS 1.8 mJy as requested

myimagebase = imagename
impbcor(imagename=myimagebase+'.image', pbimage=myimagebase+'.flux', outfile=myimagebase+'.image.pbcor', overwrite=True)
# perform PBcorr
exportfits(imagename=myimagebase+'.image.pbcor', fitsimage=myimagebase+'.image.pbcor.fits') # export the corrected image
exportfits(imagename=myimagebase+'.flux', fitsimage=myimagebase+'.flux.fits') # export the PB image
```

```
### image line in spw 2

SOUNAME='PKS1830'
EBID='uid___A002_X86fcfa_X14a6'
VISINAME='calibrated.timebin.ms'
imsize=[432,432]
cell='0.08arcsec'
imagename=SOUNAME+'_'+EBID+'.spw2_vel_selfcal'
print "CLEAN the source", SOUNAME, imagename
os.system('rm -rf '+imagename+'*')

clean(vis=VISINAME,
      spw='2',
      imagename=imagename,
      field='0',
      cell=cell,
      imsize=imsize,
      outframe='BARY',
      niter=1000,
      interactive=True,
      #mask=mask,                                          ###
      mode='velocity',
      nchan=40,                                          ###
      start='-60km/s',                                        ###
      width='3km/s',
      threshold='6mJy',
      #          weighting='natural', # optimum point source sens.
      weighting='briggs', # compromise with reduced sidelobe level
      robust=0.5,
      interpolation='linear',
      restfreq='290.6700GHz', # sky freq of H2180
      phasecenter='0')

# RMS 1.6 mJy

myimagebase = imagename
impbcor(imagename=myimagebase+'.image', pbimage=myimagebase+'.flux', outfile=myimagebase+'.image.pbcor', overwrite=True)
# perform PBcorr
exportfits(imagename=myimagebase+'.image.pbcor', fitsimage=myimagebase+'.image.pbcor.fits') # export the corrected image
exportfits(imagename=myimagebase+'.flux', fitsimage=myimagebase+'.flux.fits') # export the PB image
```

```
### image line in spw 3

SOUNAME='PKS1830'
EBID='uid___A002_X86fcfa_X14a6'
VISINAME='calibrated.timebin.ms'
imsize=[432,432]
cell='0.08arcsec'
imagename=SOUNAME+'_'+EBID+'.spw3_vel_selfcal'
print "CLEAN the source", SOUNAME, imagename
os.system('rm -rf '+imagename+'*')

clean(vis=VISINAME,
      spw='3',
      imagename=imagename,
      field='0',
      cell=cell,
      imsize=imsize,
      outframe='BARY',
      niter=1000,
      interactive=True,
      #mask=mask,                                          ###
      mode='velocity',
      nchan=40,                                          ###
      start='-60km/s',                                        ###
      width='3km/s',
      threshold='6mJy',
      #          weighting='natural', # optimum point source sens.
      weighting='briggs', # compromise with reduced sidelobe level
      robust=0.5,
      interpolation='linear',
      restfreq='290.6700GHz', # sky freq of H2180
      phasecenter='0')

# RMS 1.8 mJy, beam 0.36" x 0.32"

myimagebase = imagename
impbcor(imagename=myimagebase+'.image', pbimage=myimagebase+'.flux', outfile=myimagebase+'.image.pbcor', overwrite=True)
# perform PBcorr
exportfits(imagename=myimagebase+'.image.pbcor', fitsimage=myimagebase+'.image.pbcor.fits') # export the corrected image
exportfits(imagename=myimagebase+'.flux', fitsimage=myimagebase+'.flux.fits') # export the PB image

------------------------ END scriptForImaging.py ----------------------
```