IRAM 30-meter Radiotelescope
VLBI Equipment & Operation

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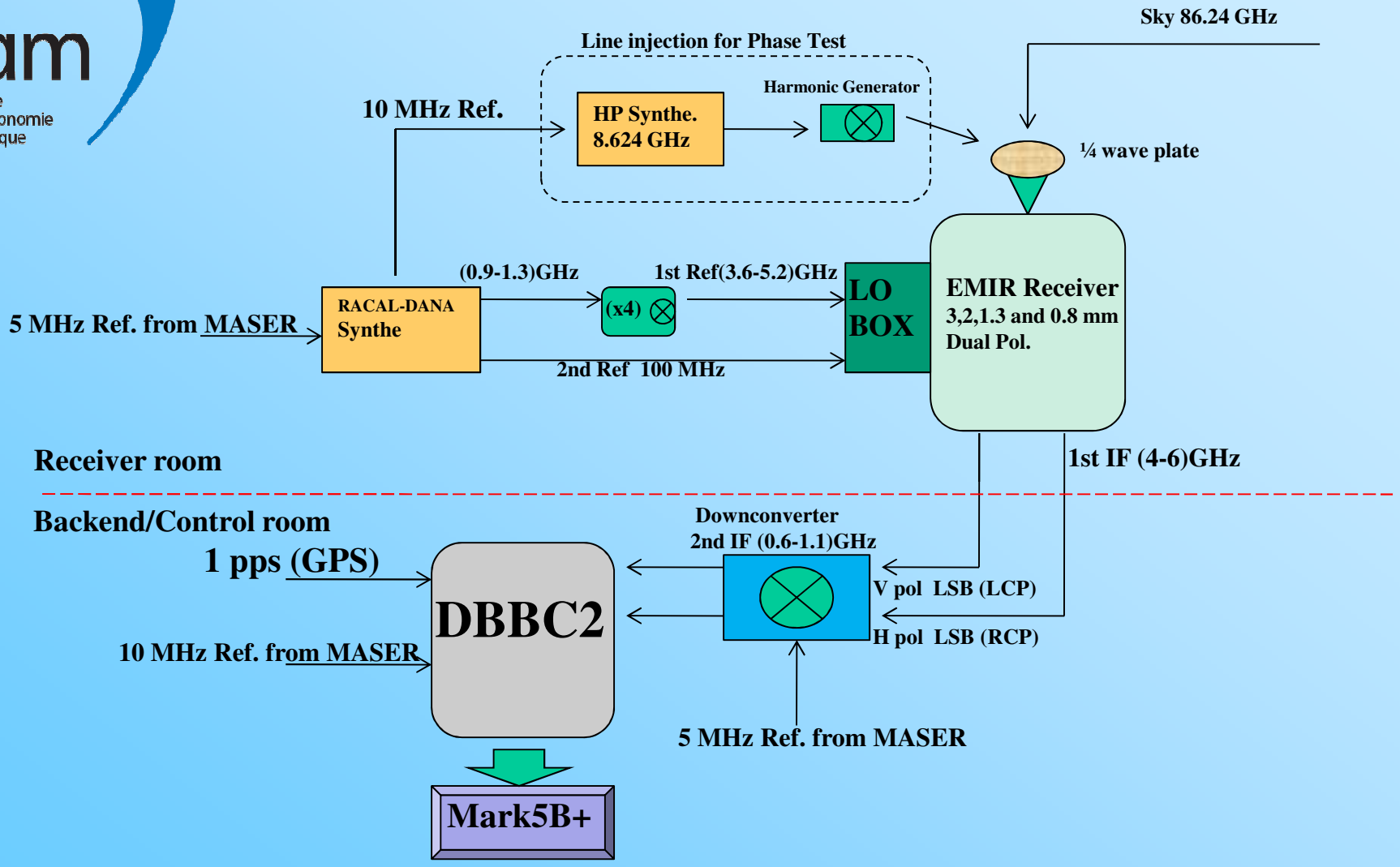
3mm VLBI system overview



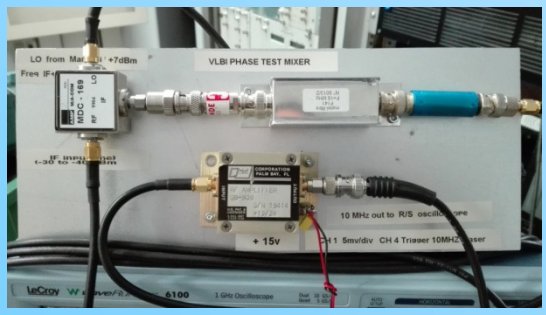
Pre-observation setup & check

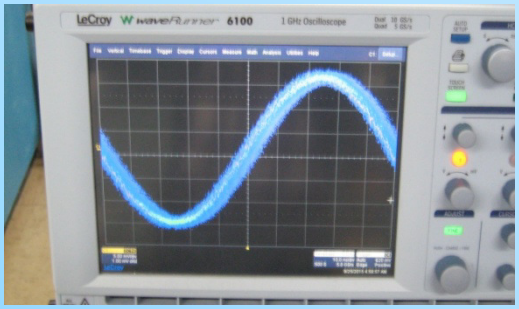
1- Receiver tunning with LO setting based on the total LO written on the schedule VEX file for PV.

2- 86.24 GHz line injection to test frequency/phase of the whole chain.

3- Load software/firmware on the DBBC2, configured with the experiment setup

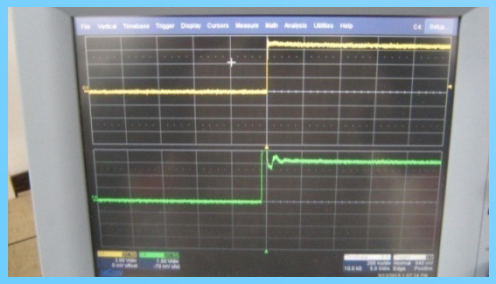
4- Take the RF mon output of the DBBC2 and meassure on the oscilloscope the phase jitter of the test line.
It is considered a good value < 36 deg pk-pk.





Phase jitter < 36 deg

5- Meassure the offset between the station 1pps and the one generated in the DBBC2 and propagated to the Mark5B.
A value better than 50 ns should be OK.



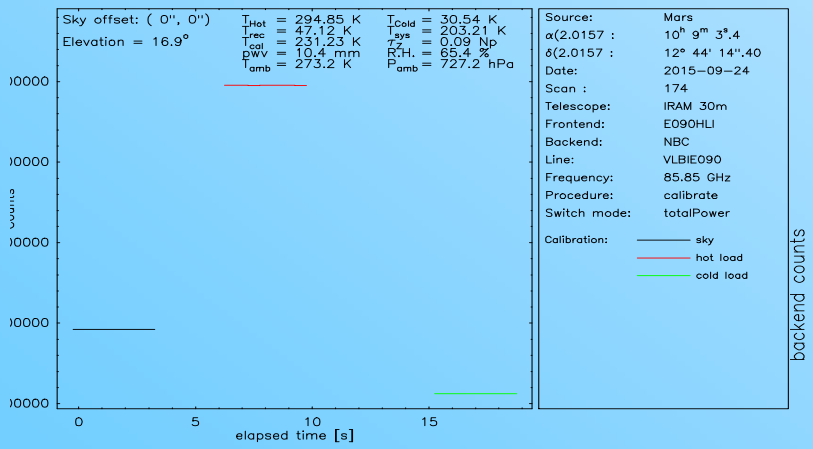
1pps offset < 50ns

Calibration and Data Reduction

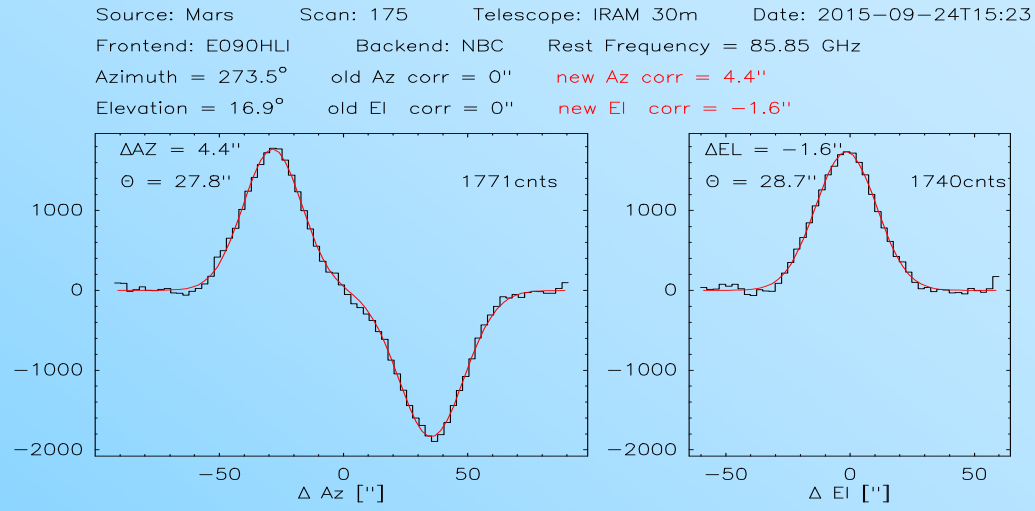
The calibration procedure at the 30M is an special " cal scan" to obtain the necessary parameters Tsys, Tcal, Trec, TAU and PWV. Input values needed are Thot (ambient in the cabin) , Tcold internally related with the receiver and the weather parameters Tamb, R.H% and Pamb.

The weather data are written in the FS log file automatically after each VLBI scan.

Calibration scan



Pointing scan (in wobbler switch mode)



CAL scans can only be done between VLBI scans and we normally do CAL + POINTING in each gap. Tsys measurement cannot be obtained in real time neither can be included in the Field System log file. The result of each CAL scan is written on the session log and used also on the pointing data reduction.

Calibration and Data Reduction

For the data reduction we use the pointing and focus scans done on calibrators , better to use primary as planets (Mars) to determine the fluxes and the necessary calibration factor ( )Jy/K.

```
vlbi@mrt-lx1:~/vlbi$ ./planets
 Local file planets_defaults.dat not found, trying to open
 planets_defaults.dat
   File PLANETS_DEFAULTS.DAT  could not be opened or read
   using internal defaults instead.

Date: 28- 1-2016 Time: 19:17:24

Use different date (y/n)? y
enter year (default:2004) : 2015
enter month (default:10) : 05
enter day in decimal number (default:11.0) : 14
 year 2015
 mes 5
 dia 1
 daep 12905
Calculations for: 2015  5  1.4
 23 h   58.6 m   (approx. sid. time)
which body (default: MARS     ) ?
enter freq. in GHz in float num. (defa=  86.24) :
enter beam width in float num. (FWHP) in arc sec (default=   27.74) :
enter geocentric distance a.u. in float number (default=   2.467) :
enter disc temp. in K, float num (default:   207.0):
enter radius vector of Mars (Almanac E12), defa.: 1.4953 :

 Body = MARS        semi dia. =    4.68   geoc.dis. =  2.47  size =  3.79
 T    =    208.96  K  (disk temp.)
 T_b  =      2.69  K  (brightness temp. in main beam)
 flux =     12.59 Jy  (per beam)

 To continue type:

 D, for new date          B, for new body
 F, frequency             A, beam size
 T, temperature           P, position (Ra,Dec) summary
 S, to STOP >
```

```
vlbi@mrt-lx1: /mrt-lx3/vis/vlbi/vlbi/may2015
vlbi@mrt-lx1: /mrt-lx3/vis/vlbi/vlbi/may2015 81x37
 Calibration 3mm VLBI observations May 2015: PICO VELETA
 Calibration 3mm VLBI observations May 2015: PICO VELETA

 RCP RCP RCP E090H E090H E090H
 RCP RCP RCP E090H E090H E090H

 Atmospheric phase cal data in mrt-lx1/vis/vlbi/vlbi/phasemmmyyyy

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============================
 Temperature of Mars: 207 K.
 Calibrated:

 gives as calibration factor:  6.39 Jy/K

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 Fluxes of observed Sources:

     Source  Nobs      Ta*      rms(Ta*)  %       S       rms(S)  Receiver
                       K          K              Jy         Jy
 ----------------------------------------------------------------------------
----------------------------
       MARS    18       1.88       0.09    4      11.99      0.56   E090H RCP
  1055+018     54       0.92       0.07    7       5.86      0.42       ,,
      OJ287    36       0.53       0.03    6       3.38      0.22       ,,
      3C279     2       1.91       0.01    0      12.24      0.10       ,,
  1156+295     14       0.29       0.01    4       1.83      0.09       ,,
   4C39.25     72       0.71       0.05    7       4.52      0.32       ,,
      BLLAC     6       0.73       0.02    2       4.63      0.12       ,,
        M87     8       0.68       0.02    2       4.36      0.13       ,,
    3C273B     54       2.05       0.08    3      13.13      0.48       ,,
 ============================================================================
:
```

Utility "planets" to compute the theoretical Mars flux @date e g. May 2015 flux=12.59 Jy ; Measured on Mars: 1.9 K

Cal factor: 12.59/1.9= 6.62 Jy/K

After the session: Files sent to correlator/Bonn

Field System computer:

The experiment log file, e g. "c151apv.log"

Telescope Observation computer:

-Calibration results for both polarizations

"cal_may2015_E090H.dat"

"cal_may2015_E090V.dat"

-Log of all pointing scans

"point_may2015_log.odt"

-Log of all observed scans for both polarizations

"may2015_E090H_all.txt"

"may2015_E090V_all.txt"

-Session log file

"vlbi_may2015_log"

(Besides hand written set of sheets is also sent.)

-Some statistic

"history_statistic"

Maser clock:

Plot of the maser behaviour against the GPS during the session with the calculated drift in ns/day.