

# 1.3cm double beam secondary focus receiver (18000-26000 MHz)

This receiver replaced the old 1.3cm secondary focus system. However, some modes, especially for broad-band observations are still under commissioning and are not yet available!

This is a two horn system for continuum, spectroscopy and VLBI observations. The system is currently tested and all values are preliminary.

**Note, that for technical reasons, no spectroscopic frequency-switch observations are possible!**

## Calibration Information

| Frequency [GHz]                                                                  | Channel | Polarisation | Tcal [K] | Tsys [K]      | Sensitivity [K/Jy] | SEFD [Jy] | Aperture Eff. [%] | TMB/S [K/Jy] | Main Beam Eff. [%] | FWHM [arcsec] | Last update |
|----------------------------------------------------------------------------------|---------|--------------|----------|---------------|--------------------|-----------|-------------------|--------------|--------------------|---------------|-------------|
| 19.0                                                                             | 1       | LCP          | 49       | 39            | 1.05               | 37        | 37                | 1.56         | 67                 | 41.9          | Jan 2014    |
| 21.0                                                                             | 1       | LCP          | 37       | 51            | 1.07               | 48        | 38                | 1.74         | 61                 | 39.5          | Jan 2014    |
| 22.35                                                                            | 1       | LCP          | 9.1      | 70            | 1.03               | 68        | 36                | 1.6          | 64                 | 39.1          | Jun 2015*   |
| 22.35                                                                            | 1       | RCP          | 9.6      | 71            | 1.06               | 67        | 37                | 1.6          | 67                 | 39.3          | Jun 2015*   |
| 23.0                                                                             | 1       | LCP          | 9.5      | 58            | 1.12               | 52        | 39                | 1.41         | 79                 | 37.6          | Jan 2014    |
| 25.0                                                                             | 1       | LCP          | 8.0      | 59            | 1.12               | 53        | 39                | 1.57         | 71                 | 35.6          | Jan 2014    |
| normalized Gain curve ( $G = A0 + A1 \cdot \text{Elv} + A2 \cdot \text{Elv}^2$ ) |         |              |          |               |                    |           | Observed in       | confirmed    |                    |               |             |
| A0 = 0.954                                                                       |         | A1 = 3.19E-3 |          | A2 = -5.42E-5 |                    |           | Jun 2015          | Jun 2015     |                    |               |             |
| A0 = 0.955                                                                       |         | A1 = 3.1E-3  |          | A2 = -5.3E-5  |                    |           | Jan 2014          | Jan 2014     |                    |               |             |

### Comments:

- Note that the system temperature at this frequency depends strongly on weather conditions!
- Zenith tau values can range from 0.05 to 0.2.
- \* tau=0.12, Temp. from 10-15C, Hum. 98% to 70% (should be summer)

## Version description for OBSINP

| RX Name                  | Wavelength [cm]                   | Frequency (center) [GHz] | Nr. of Horns |
|--------------------------|-----------------------------------|--------------------------|--------------|
| S14mm Double Beam RX     | 1.3                               | 18.0-26.0 (22.0)         | 2            |
| Version:                 | Comment                           |                          |              |
| 1. Continuum (BW: 2 GHz) | Broad Band Continuum              |                          |              |
| Horn offsets [arcsec]    | Horn 1:-95.6,734.2; 2: 95.6,734.2 |                          |              |

## Receiver Bands

The receiver delivers the data in four 2.5GHz-wide IF-subbands:

| Band | Frequency Range |
|------|-----------------|
| 4    | 18.0-20.5 GHz   |
| 3    | 19.9-22.4 GHz   |
| 2    | 21.6-24.1 GHz   |
| 1    | 23.5-26.0 GHz   |

## Channel assignment in the MBFITS data files

Note that the narrow line and VLBA IF channels are usually only available when the specific line version of the receiver was selected. In addition for most receivers with narrow line channels the cables at the patch board need to be connected by the receiver group.

To select different channel numbers in OBSINP, the online plot, or the toolbox the numbers have to be specified like c(1)+c(2) to add channel 1 and 2. E.g. channel 1 and 2 contain the LCP and RCP broadband channels, then "OnlPlot pen='c(1)+c(2)'" or "toolbox use='c(1)+c(2)'" will select these channels. In OBSINP the pen can be directly specified in the receiver selection menu.

- Abbreviations:
- SB: narrow band channel (Schmalband-Kanal), 100 MHz band width
  - BB: digital broad band channel (Breitband-Kanal), band width varies for different receivers
  - VLBA: VLBA IF, 500 MHz band width
  - BW: band width
  - TP: total power

| 1.3cm SFK single horn receiver |    |      |         |
|--------------------------------|----|------|---------|
| Channel                        | IF | Pol. | Comment |
| 1                              | BB | LCP  | TP A    |
| 2                              | BB | RCP  | TP B    |

## Spectroscopy modes and resolution

### Low-res mode (4 basebands for each of 2 feeds and 2 polarizations)

**Note, that due to technical reasons the LSR correction has to be applied via software (regridding). This will decrease the effective spectral resolution to some degree.**

| BW   | nchan | nu    | Df    | Dv    | dv    |
|------|-------|-------|-------|-------|-------|
| MHz  |       | MHz   | kHz   | km/s  | km/s  |
| 2500 | 16384 | 18000 | 152.6 | 2.541 | 2.948 |
| 2500 | 16384 | 20000 | 152.6 | 2.287 | 2.653 |
| 2500 | 16384 | 22000 | 152.6 | 2.079 | 2.412 |
| 2500 | 16384 | 24000 | 152.6 | 1.906 | 2.211 |

| <b>BW</b>  | <b>nchan</b> | <b>nu</b>  | <b>Df</b>  | <b>Dv</b>   | <b>dv</b>   |
|------------|--------------|------------|------------|-------------|-------------|
| <b>MHz</b> |              | <b>MHz</b> | <b>kHz</b> | <b>km/s</b> | <b>km/s</b> |
| 2500       | 16384        | 26000      | 152.6      | 1.759       | 2.041       |
| 2500       | 32768        | 18000      | 76.3       | 1.271       | 1.474       |
| 2500       | 32768        | 20000      | 76.3       | 1.144       | 1.327       |
| 2500       | 32768        | 22000      | 76.3       | 1.040       | 1.206       |
| 2500       | 32768        | 24000      | 76.3       | 0.953       | 1.105       |
| 2500       | 32768        | 26000      | 76.3       | 0.880       | 1.020       |
| 2500       | 65536        | 18000      | 38.1       | 0.635       | 0.737       |
| 2500       | 65536        | 20000      | 38.1       | 0.572       | 0.663       |
| 2500       | 65536        | 22000      | 38.1       | 0.520       | 0.603       |
| 2500       | 65536        | 24000      | 38.1       | 0.477       | 0.553       |
| 2500       | 65536        | 26000      | 38.1       | 0.440       | 0.510       |

BW ... band width

nchan ... number of spectral channels

nu ... center frequency

Df ... Channel separation (in frequency)

Dv ... Channel separation (in velocity)

dv ... Velocity resolution ( $dv=1.16 \cdot Dv$ )

### Hi-res mode (28 basebands for 1 feed and 1 polarization only)

| <b>BW</b>  | <b>nchan</b> | <b>nu</b>  | <b>Df</b>  | <b>Dv</b>   | <b>dv</b>   |
|------------|--------------|------------|------------|-------------|-------------|
| <b>MHz</b> |              | <b>MHz</b> | <b>kHz</b> | <b>km/s</b> | <b>km/s</b> |
| 300        | 16384        | 18000      | 18.3       | 0.305       | 0.354       |
| 300        | 16384        | 20000      | 18.3       | 0.274       | 0.318       |
| 300        | 16384        | 22000      | 18.3       | 0.250       | 0.289       |
| 300        | 16384        | 24000      | 18.3       | 0.229       | 0.265       |
| 300        | 16384        | 26000      | 18.3       | 0.211       | 0.245       |
| 300        | 32768        | 18000      | 9.2        | 0.152       | 0.177       |
| 300        | 32768        | 20000      | 9.2        | 0.137       | 0.159       |
| 300        | 32768        | 22000      | 9.2        | 0.125       | 0.145       |
| 300        | 32768        | 24000      | 9.2        | 0.114       | 0.133       |
| 300        | 32768        | 26000      | 9.2        | 0.106       | 0.122       |
| 300        | 65536        | 18000      | 4.6        | 0.076       | 0.088       |
| 300        | 65536        | 20000      | 4.6        | 0.069       | 0.080       |
| 300        | 65536        | 22000      | 4.6        | 0.062       | 0.072       |
| 300        | 65536        | 24000      | 4.6        | 0.057       | 0.066       |
| 300        | 65536        | 26000      | 4.6        | 0.053       | 0.061       |

BW ... band width

nchan ... number of spectral channels

nu ... center frequency

Df ... Channel separation (in frequency)

Dv ... Channel separation (in velocity)

dv ... Velocity resolution ( $dv=1.16 \cdot Dv$ )

## Tcal measurements

### February 2019

#### Tcal and Tsys



#### Opacity and Tebb (WVR+AATM)



#### T0



### April 2014

Note, that in April the Tcal was changed in the receiver. Gaps in the curves are entirely due to measurement uncertainties. T0 and Tsys were deduced from spectroscopic skydip measurements and are subject to fitting errors caused by the low signal-to-noise ratio in the spectral bins.

#### Tcal and Tsys



#### Opacity and T0



### Januar 2014

#### Tcal and Tsys



## Opacity and T0



## Antenna model



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