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Standard Mode (4Gbps, DDC, dual-pol)

Starting from Oct 2019 the GMVA will record at 4Gbps.

86012 - **86524 MHz** (512 MHz, dual-polarization)

For the DiFX Zoom band setup see the Correlator_Cookbook, A1: GMVA_correlation

VLBA & GBT

RDBE DDC mode with 4x128 MHz bands, dual-pol

sky start [MHz]	sky stop [MHz]	bandwidth [MHz]	Sideband
86012	86140	128	USB
86140	86268	128	USB
86268	86396	128	USB
86396	86524	128	USB

Freq / Bitstream setup:

```
 chan_def = : 86012.00 MHz : U : 128.00 MHz : &CH01 : &BBC01 : &NoCal;
*Rcp
 chan_def = : 86012.00 MHz : U : 128.00 MHz : &CH02 : &BBC02 : &NoCal;
*Lcp
 chan_def = : 86140.00 MHz : U : 128.00 MHz : &CH03 : &BBC03 : &NoCal;
*Rcp
 chan_def = : 86140.00 MHz : U : 128.00 MHz : &CH04 : &BBC04 : &NoCal;
*Lcp
 chan_def = : 86268.00 MHz : U : 128.00 MHz : &CH05 : &BBC05 : &NoCal;
*Rcp
 chan_def = : 86268.00 MHz : U : 128.00 MHz : &CH06 : &BBC06 : &NoCal;
*Lcp
 chan_def = : 86396.00 MHz : U : 128.00 MHz : &CH07 : &BBC07 : &NoCal;
*Rcp
 chan_def = : 86396.00 MHz : U : 128.00 MHz : &CH08 : &BBC08 : &NoCal;
*Lcp
```

DBBC2 Stations (Eb,On,Ys,Mh)

All DBBC2 stations should use:

- DDC mode (firmware 107 beta3)
- LO=85500
- 2nd Nyquist zone: 512 -1024 MHz
- Use 2 Core-boards

Bitstream setup:

Note: Use *astro* if IFs are connected to Boards A+B, use *astro2* if IFs are connected to boards A+C

- On,Ef: dbbcform=astro
- Ys,Mh: dbbcform=astro2

bbc freq	sideband	bandwidth	sky start [MHz]	sky stop
960	USB	64	86460	86524
	LSB	64	86460	86396
832	USB	64	86332	86396
	LSB	64	86332	86268
704	USB	64	86204	86268
	LSB	64	86204	86140
576	USB	64	86076	86140
	LSB	64	86076	86012

DBBC3 Stations (Pv)

All DBBC3 stations:

- DDC_U mode (firmware V126)

PV setup:

- 1st LO=92100 (dictated by the DBBC2 IF requirements)
- 2nd LO= 9048 (DBBC3 GComo)
  - Use E90LI IFs (4-9GHz LSB)
  - Baseband: 0-4 GHz USB => 83052 - 87052 sky freq

Bitstream order (fixed for DDC_U mode):

- BBC1-USB, BBC1-LSB, BBC2-USB, BBC2-LSB, ...

Observations can be done with 128MHz or 64 MHz subbands (see tables below)

BBC setup (DDC_U with 64MHz bands):

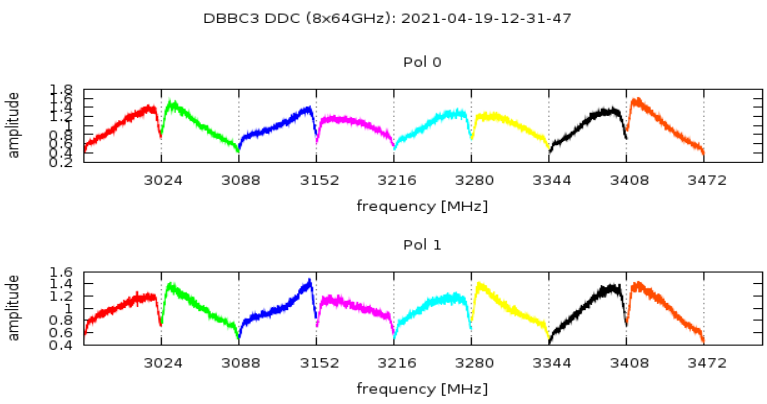
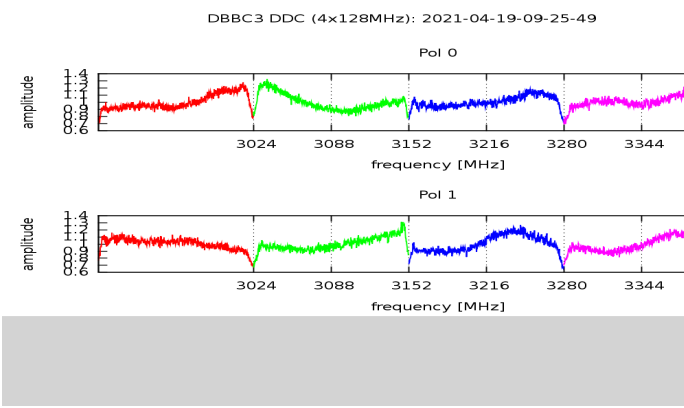
bbc freq	net sideband	bandwidth	sky start	sky stop
3024	LSB	64	86012	86076
	USB	64	86076	86140
3152	LSB	64	86140	86204
	USB	64	86204	86268
3280	LSB	64	86268	86332

bbc freq	net sideband	bandwidth	sky start	sky stop
	USB	64	86332	86396
3408	LSB	64	86396	86460
	USB	64	86460	86524

BBC setup (DDC_U with 128MHz bands):

bbc freq	net sideband	bandwidth	sky start	sky stop
3088.0	LSB	128	86012	86140
	USB	128	86140	86268
3344.0	LSB	128	86268	86396
	USB	128	86396	86524

Bandpass shapes @64and 128 MHz

64 MHz	128 MHz
	

R2DBE Stations (GLT, LMT, Haystack)

- R2DBE stations must manually setup their systems (no vex/drudg support)
- IF setup is flexible as long as the 2GHz band includes the 86012 - 86524 MHz sub-band
- **Desired tuning would yield: 85244 - 87292 USB or LSB.**

KVN

- Bistream order: ?

sideband	bandwidth	sky start [MHz]	sky stop
USB	64	86460	86524
LSB	64	86460	86396
USB	64	86332	86396

sideband	bandwidth	sky start [MHz]	sky stop
LSB	64	86332	86268
USB	64	86204	86268
LSB	64	86204	86140
USB	64	86076	86140
LSB	64	86076	86012

ALMA

ALMA will record a band of 1.875 GHz subdivided into 62.5MHz wide sub-bands. An LO offset should be avoided. During GMVA 2021, (2022), and 2023 there is a +3 MHz LO offset not accounted for by the nominal tuning given below. The ALMA center frequency is 86271.0 MHz.

From 2024 onwards, ALMA ought to have a long-planned software fix in place (per email info from 2023) that avoids the large LO offset. The ALMA center frequency for 2024 and onwards is 86268.0 MHz.

The total recorded data rate for GMVA "4 Gbps" is 62.5 MHz * 2-bit/sample * 2 * 2 pol * 32 channels = 16 Gbps.

Channel definitions *with* 3 MHz offset:

```
def FREQ_AA;
  ** datastream 1:
  ** alma-vex-defs.py -f 86271.000 -ralma -s L -n W -o  0 -b 07
  chan_def = &W : 87210.453125 MHz : L : 62.5 MHz : &CH01 : &BBC07 : &cp;
  chan_def = &W : 87151.859375 MHz : L : 62.5 MHz : &CH02 : &BBC07 : &cp;
  chan_def = &W : 87093.265625 MHz : L : 62.5 MHz : &CH03 : &BBC07 : &cp;
  chan_def = &W : 87034.671875 MHz : L : 62.5 MHz : &CH04 : &BBC07 : &cp;
  chan_def = &W : 86976.078125 MHz : L : 62.5 MHz : &CH05 : &BBC07 : &cp;
  chan_def = &W : 86917.484375 MHz : L : 62.5 MHz : &CH06 : &BBC07 : &cp;
  chan_def = &W : 86858.890625 MHz : L : 62.5 MHz : &CH07 : &BBC07 : &cp;
  chan_def = &W : 86800.296875 MHz : L : 62.5 MHz : &CH08 : &BBC07 : &cp;
  chan_def = &W : 86741.703125 MHz : L : 62.5 MHz : &CH09 : &BBC07 : &cp;
  chan_def = &W : 86683.109375 MHz : L : 62.5 MHz : &CH10 : &BBC07 : &cp;
  chan_def = &W : 86624.515625 MHz : L : 62.5 MHz : &CH11 : &BBC07 : &cp;
  chan_def = &W : 86565.921875 MHz : L : 62.5 MHz : &CH12 : &BBC07 : &cp;
  chan_def = &W : 86507.328125 MHz : L : 62.5 MHz : &CH13 : &BBC07 : &cp;
  chan_def = &W : 86448.734375 MHz : L : 62.5 MHz : &CH14 : &BBC07 : &cp;
  chan_def = &W : 86390.140625 MHz : L : 62.5 MHz : &CH15 : &BBC07 : &cp;
  chan_def = &W : 86331.546875 MHz : L : 62.5 MHz : &CH16 : &BBC07 : &cp;
  chan_def = &W : 86272.953125 MHz : L : 62.5 MHz : &CH17 : &BBC07 : &cp;
  chan_def = &W : 86214.359375 MHz : L : 62.5 MHz : &CH18 : &BBC07 : &cp;
  chan_def = &W : 86155.765625 MHz : L : 62.5 MHz : &CH19 : &BBC07 : &cp;
  chan_def = &W : 86097.171875 MHz : L : 62.5 MHz : &CH20 : &BBC07 : &cp;
  chan_def = &W : 86038.578125 MHz : L : 62.5 MHz : &CH21 : &BBC07 : &cp;
  chan_def = &W : 85979.984375 MHz : L : 62.5 MHz : &CH22 : &BBC07 : &cp;
```

```
chan_def = &W : 85921.390625 MHz : L : 62.5 MHz : &CH23 : &BBC07 : &cp;
chan_def = &W : 85862.796875 MHz : L : 62.5 MHz : &CH24 : &BBC07 : &cp;
chan_def = &W : 85804.203125 MHz : L : 62.5 MHz : &CH25 : &BBC07 : &cp;
chan_def = &W : 85745.609375 MHz : L : 62.5 MHz : &CH26 : &BBC07 : &cp;
chan_def = &W : 85687.015625 MHz : L : 62.5 MHz : &CH27 : &BBC07 : &cp;
chan_def = &W : 85628.421875 MHz : L : 62.5 MHz : &CH28 : &BBC07 : &cp;
chan_def = &W : 85569.828125 MHz : L : 62.5 MHz : &CH29 : &BBC07 : &cp;
chan_def = &W : 85511.234375 MHz : L : 62.5 MHz : &CH30 : &BBC07 : &cp;
chan_def = &W : 85452.640625 MHz : L : 62.5 MHz : &CH31 : &BBC07 : &cp;
chan_def = &W : 85394.046875 MHz : L : 62.5 MHz : &CH32 : &BBC07 : &cp;
** datastream 2:
** alma-vex-defs.py -f 86271.000 -ralma -s L -n W -o 32 -b 08
chan_def = &W : 87210.453125 MHz : L : 62.5 MHz : &CH33 : &BBC08 : &cp;
chan_def = &W : 87151.859375 MHz : L : 62.5 MHz : &CH34 : &BBC08 : &cp;
chan_def = &W : 87093.265625 MHz : L : 62.5 MHz : &CH35 : &BBC08 : &cp;
chan_def = &W : 87034.671875 MHz : L : 62.5 MHz : &CH36 : &BBC08 : &cp;
chan_def = &W : 86976.078125 MHz : L : 62.5 MHz : &CH37 : &BBC08 : &cp;
chan_def = &W : 86917.484375 MHz : L : 62.5 MHz : &CH38 : &BBC08 : &cp;
chan_def = &W : 86858.890625 MHz : L : 62.5 MHz : &CH39 : &BBC08 : &cp;
chan_def = &W : 86800.296875 MHz : L : 62.5 MHz : &CH40 : &BBC08 : &cp;
chan_def = &W : 86741.703125 MHz : L : 62.5 MHz : &CH41 : &BBC08 : &cp;
chan_def = &W : 86683.109375 MHz : L : 62.5 MHz : &CH42 : &BBC08 : &cp;
chan_def = &W : 86624.515625 MHz : L : 62.5 MHz : &CH43 : &BBC08 : &cp;
chan_def = &W : 86565.921875 MHz : L : 62.5 MHz : &CH44 : &BBC08 : &cp;
chan_def = &W : 86507.328125 MHz : L : 62.5 MHz : &CH45 : &BBC08 : &cp;
chan_def = &W : 86448.734375 MHz : L : 62.5 MHz : &CH46 : &BBC08 : &cp;
chan_def = &W : 86390.140625 MHz : L : 62.5 MHz : &CH47 : &BBC08 : &cp;
chan_def = &W : 86331.546875 MHz : L : 62.5 MHz : &CH48 : &BBC08 : &cp;
chan_def = &W : 86272.953125 MHz : L : 62.5 MHz : &CH49 : &BBC08 : &cp;
chan_def = &W : 86214.359375 MHz : L : 62.5 MHz : &CH50 : &BBC08 : &cp;
chan_def = &W : 86155.765625 MHz : L : 62.5 MHz : &CH51 : &BBC08 : &cp;
chan_def = &W : 86097.171875 MHz : L : 62.5 MHz : &CH52 : &BBC08 : &cp;
chan_def = &W : 86038.578125 MHz : L : 62.5 MHz : &CH53 : &BBC08 : &cp;
chan_def = &W : 85979.984375 MHz : L : 62.5 MHz : &CH54 : &BBC08 : &cp;
chan_def = &W : 85921.390625 MHz : L : 62.5 MHz : &CH55 : &BBC08 : &cp;
chan_def = &W : 85862.796875 MHz : L : 62.5 MHz : &CH56 : &BBC08 : &cp;
chan_def = &W : 85804.203125 MHz : L : 62.5 MHz : &CH57 : &BBC08 : &cp;
chan_def = &W : 85745.609375 MHz : L : 62.5 MHz : &CH58 : &BBC08 : &cp;
chan_def = &W : 85687.015625 MHz : L : 62.5 MHz : &CH59 : &BBC08 : &cp;
chan_def = &W : 85628.421875 MHz : L : 62.5 MHz : &CH60 : &BBC08 : &cp;
chan_def = &W : 85569.828125 MHz : L : 62.5 MHz : &CH61 : &BBC08 : &cp;
chan_def = &W : 85511.234375 MHz : L : 62.5 MHz : &CH62 : &BBC08 : &cp;
chan_def = &W : 85452.640625 MHz : L : 62.5 MHz : &CH63 : &BBC08 : &cp;
chan_def = &W : 85394.046875 MHz : L : 62.5 MHz : &CH64 : &BBC08 : &cp;
* if you are missing this line you are screwed.
sample_rate = 125.000000 Ms/sec;
```

NOEMA

The NOEMA frequency setup for 4 Gbps x 2-pol is as in their 2022 frequency spreadsheet, screenshot below.

pNOEMA VLBI backend frequency setup for the GMVA 2022 sessions

RECORDER 2 | MARK-6 4124												
RECORDER SLOT	RECORDER I/F	RX POL	RX SIDEBAND	BACKEND BASEBAND	NET SIDEBAND	POLYFIX UNIT #	POLYFIX UNIT I/F	THREAD ID	POLYFIX SUB-BAND	SUB-BAND SKY-FREQUENCY		
										f- (MHz)	fc (MHz)	f+ (MHz)
1	eth3	V / LCP	LSB	LOWER /INNER	NET USB	6	SFP+ 1	4	16	**86012**	86044	86076
									17	86076	86108	86140
									18	86140	86172	86204
									19	86204	86236	86268
								5	20	86268	86300	86332
									21	86332	86364	86396
									22	86396	86428	86460
									23	86460	86492	**86524**
								6	24	86524	86556	86588
									25	86588	86620	86652
									26	86652	86684	86716
									27	86716	86748	86780
								7	28	86780	86812	86844
									29	86844	86876	86908
									30	86908	86940	86972
									31	86972	87004	87036
2	eth4	H /RCP	LSB	LOWER /INNER	NET USB	2	SFP+ 1	4	16	**86012**	86044	86076
									17	86076	86108	86140
									18	86140	86172	86204
									19	86204	86236	86268
								5	20	86268	86300	86332
									21	86332	86364	86396
									22	86396	86428	86460
									23	86460	86492	**86524**
								6	24	86524	86556	86588
									25	86588	86620	86652
									26	86652	86684	86716
									27	86716	86748	86780
								7	28	86780	86812	86844
									29	86844	86876	86908
									30	86908	86940	86972
									31	86972	87004	87036
LO values:												RG
											Created:	4/20/2021
	f_LO1(MHz)	92764	(User entry)								Last rev:	3/31/2022
	f_LO2(MHz)	7744	(Fixed value)									

Broad band mode [experimental] (16Gbps, dual pol)

Desired tuning would yield**: 85244 - 87292 USB or LSB.**

ALMA

Same as ALMA under GMVA 4 Gbps.

GLT

KVN

LMT

MOPRA

NOEMA

The frequency setup is as in [2023-05_NOEMA_freq_setup_GMVA.pdf](), the VEX description can be generated with `noema-vex-defs.py -r 6,7 -f 91.996 --if --bbc --tracks`

Onsala (OD)

Similar to DDC_U v126 with 64 MHz USB+LSB pairs like described farther above for PV, but more recorded channels i.e. 16 BBC x 2 sideband x 2 pol = 64 channels in VEX.

```
def 85308.00MHz64x64MHz;
* mode =  1    stations =OD
     sample_rate =   128.000 Ms/sec;  * (2bits/sample)
     *
     * VDIF Thread Id #0 - RCP
     chan_def = : 85308.00 MHz : U :  64.00 MHz : &CH01 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85308.00 MHz : L :  64.00 MHz : &CH02 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85436.00 MHz : U :  64.00 MHz : &CH03 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85436.00 MHz : L :  64.00 MHz : &CH04 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85564.00 MHz : U :  64.00 MHz : &CH05 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85564.00 MHz : L :  64.00 MHz : &CH06 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85692.00 MHz : U :  64.00 MHz : &CH07 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85692.00 MHz : L :  64.00 MHz : &CH08 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85820.00 MHz : U :  64.00 MHz : &CH09 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85820.00 MHz : L :  64.00 MHz : &CH10 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85948.00 MHz : U :  64.00 MHz : &CH11 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 85948.00 MHz : L :  64.00 MHz : &CH12 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86076.00 MHz : U :  64.00 MHz : &CH13 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86076.00 MHz : L :  64.00 MHz : &CH14 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86204.00 MHz : U :  64.00 MHz : &CH15 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86204.00 MHz : L :  64.00 MHz : &CH16 : &BBC01 :
&NoCal; *Rcp
     * VDIF Thread Id #1 - RCP
     chan_def = : 86332.00 MHz : U :  64.00 MHz : &CH17 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86332.00 MHz : L :  64.00 MHz : &CH18 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86460.00 MHz : U :  64.00 MHz : &CH19 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86460.00 MHz : L :  64.00 MHz : &CH20 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86588.00 MHz : U :  64.00 MHz : &CH21 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86588.00 MHz : L :  64.00 MHz : &CH22 : &BBC01 :
&NoCal; *Rcp
```

```
     chan_def = : 86716.00 MHz : U :  64.00 MHz : &CH23 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86716.00 MHz : L :  64.00 MHz : &CH24 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86844.00 MHz : U :  64.00 MHz : &CH25 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86844.00 MHz : L :  64.00 MHz : &CH26 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86972.00 MHz : U :  64.00 MHz : &CH27 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 86972.00 MHz : L :  64.00 MHz : &CH28 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 87100.00 MHz : U :  64.00 MHz : &CH29 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 87100.00 MHz : L :  64.00 MHz : &CH30 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 87228.00 MHz : U :  64.00 MHz : &CH31 : &BBC01 :
&NoCal; *Rcp
     chan_def = : 87228.00 MHz : L :  64.00 MHz : &CH32 : &BBC01 :
&NoCal; *Rcp

*************************************************************************
     * VDIF Thread Id #2 - LCP
     chan_def = : 85308.00 MHz : U :  64.00 MHz : &CH33 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85308.00 MHz : L :  64.00 MHz : &CH34 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85436.00 MHz : U :  64.00 MHz : &CH35 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85436.00 MHz : L :  64.00 MHz : &CH36 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85564.00 MHz : U :  64.00 MHz : &CH37 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85564.00 MHz : L :  64.00 MHz : &CH38 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85692.00 MHz : U :  64.00 MHz : &CH39 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85692.00 MHz : L :  64.00 MHz : &CH40 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85820.00 MHz : U :  64.00 MHz : &CH41 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85820.00 MHz : L :  64.00 MHz : &CH42 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85948.00 MHz : U :  64.00 MHz : &CH43 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 85948.00 MHz : L :  64.00 MHz : &CH44 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86076.00 MHz : U :  64.00 MHz : &CH45 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86076.00 MHz : L :  64.00 MHz : &CH46 : &BBC02 :
```

```
&NoCal; *Lcp
     chan_def = : 86204.00 MHz : U :  64.00 MHz : &CH47 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86204.00 MHz : L :  64.00 MHz : &CH48 : &BBC02 :
&NoCal; *Lcp
     * VDIF Thread Id #3 - LCP
     chan_def = : 86332.00 MHz : U :  64.00 MHz : &CH49 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86332.00 MHz : L :  64.00 MHz : &CH50 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86460.00 MHz : U :  64.00 MHz : &CH51 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86460.00 MHz : L :  64.00 MHz : &CH52 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86588.00 MHz : U :  64.00 MHz : &CH53 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86588.00 MHz : L :  64.00 MHz : &CH54 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86716.00 MHz : U :  64.00 MHz : &CH55 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86716.00 MHz : L :  64.00 MHz : &CH56 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86844.00 MHz : U :  64.00 MHz : &CH57 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86844.00 MHz : L :  64.00 MHz : &CH58 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86972.00 MHz : U :  64.00 MHz : &CH59 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 86972.00 MHz : L :  64.00 MHz : &CH60 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 87100.00 MHz : U :  64.00 MHz : &CH61 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 87100.00 MHz : L :  64.00 MHz : &CH62 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 87228.00 MHz : U :  64.00 MHz : &CH63 : &BBC02 :
&NoCal; *Lcp
     chan_def = : 87228.00 MHz : L :  64.00 MHz : &CH64 : &BBC02 :
&NoCal; *Lcp
enddef;
```

Polarization

ALMA

Linear polarized. ALMA QA2 team provides ready calibration tables to use in PolConvert.

ATCA

Observes in linear polarization, but data get converted on-site into a circular basis. The LBA-formatted data are thus circular. Unknown ellipticity, but probably low.

LMT

Linear polarized 86 GHz. Feed rotator is active during single dish calibration scans, ought to return to a reliable origin during VLBI scans.

Mopra

Linear polarized 86 GHz receiver. Mount is Az-El. Data must be rotated after correlation. No calibration data for PolConvert.

Unfortunately, code plus observational issues for Mopra with a CASA PolSolve --> PolConvert approach.

Instead, Ivan M Vidal has a QWP_ROTATE.py module and QWP_APPLY_...py script. Rotation by a constant factor, not much calibration.

From GMVA C221 it appeas that the correct settinigs are 45 deg in a +1 sense cf. QWP_APPLY_... code.

Pico

Circular. Nasmyth Left probably, as hardcoded in difxio antenna_db.c, but can try VEX hoping that the hardcoded info does not override it:

```
def PICOVEL;
     axis_type = nasmyth : l;
     antenna_motion = el :  30.0 deg/min : 20 sec;  * 1000.000 deg/sec/sec
     antenna_motion = az :  30.0 deg/min : 20 sec;  * 1000.000 deg/sec/sec
     axis_offset =    0.00000 m;
enddef;
```

Yebes

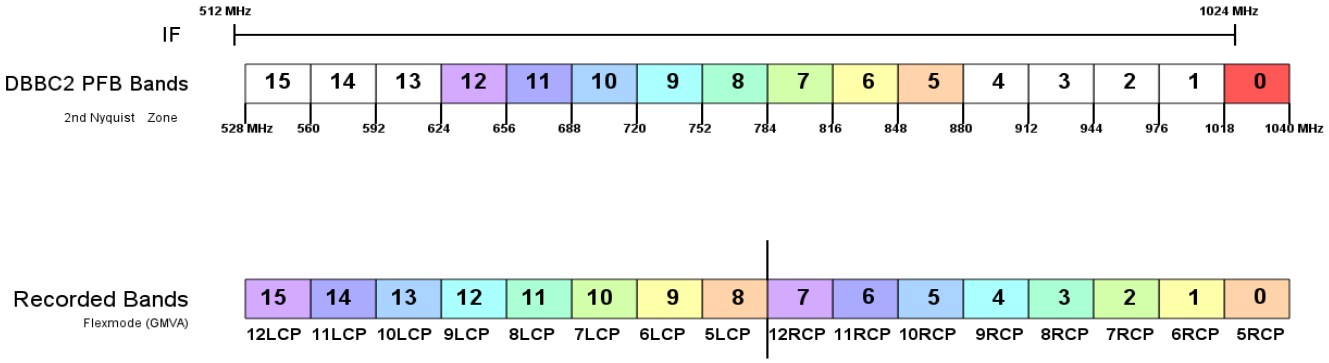
Circular. Mount info for the 86 GHz receiver is Nasmyth Right since 2018.1, previously Nasmyth Left. Can specify it in VEX under DiFX 2.6.2+ via

```
def YEBES40M;
     axis_type = nasmyth : r;
     antenna_motion = el :  60.0 deg/min : 20 sec;  * 1000.000 deg/sec/sec
     antenna_motion = az :  60.0 deg/min : 20 sec;  * 1000.000 deg/sec/sec
     axis_offset =    1.99600 m;
enddef;
```

Previous standard mode (2Gbps, PFB, dual-pol)

This mode is deprecated. New standard mode mode is DDC @ 4Gbps (see above)

The standard GMVA frequency setup is used for more than 90% of all observations. The data-rate is at present restricted to 2 Gbps due to limitations at the VLBA, which may get lifted in the near future.



Other frequency setups which are listed in the VLBA table of setups (see frequency.dat of SCHED) for the 86 GHz receiver are possible though, but not all stations may be able to tune to all the LOs given in that table.

Setup (European stations & VLBA)

```
def 86380.00MHz16x32MHz;
* mode =  1    stations =Eb:Ef:On:Mh:Ys:Pv:Gb:Nl:Pt:La:Fd:Kp:Ov:Br:Mk:Lm
     sample_rate =  64.000 Ms/sec;  * (2bits/sample)
     chan_def = : 86380.00 MHz : L :  32.00 MHz : &CH01 : &BBC01 :
&L_Cal; *Rcp
     chan_def = : 86380.00 MHz : L :  32.00 MHz : &CH02 : &BBC02 :
&L_Cal; *Lcp
     chan_def = : 86348.00 MHz : L :  32.00 MHz : &CH03 : &BBC03 :
&L_Cal; *Rcp
     chan_def = : 86348.00 MHz : L :  32.00 MHz : &CH04 : &BBC04 :
&L_Cal; *Lcp
     chan_def = : 86316.00 MHz : L :  32.00 MHz : &CH05 : &BBC05 :
&L_Cal; *Rcp
     chan_def = : 86316.00 MHz : L :  32.00 MHz : &CH06 : &BBC06 :
&L_Cal; *Lcp
     chan_def = : 86284.00 MHz : L :  32.00 MHz : &CH07 : &BBC07 :
&L_Cal; *Rcp
     chan_def = : 86284.00 MHz : L :  32.00 MHz : &CH08 : &BBC08 :
&L_Cal; *Lcp
     chan_def = : 86252.00 MHz : L :  32.00 MHz : &CH09 : &BBC09 :
&L_Cal; *Rcp
     chan_def = : 86252.00 MHz : L :  32.00 MHz : &CH10 : &BBC10 :
&L_Cal; *Lcp
     chan_def = : 86220.00 MHz : L :  32.00 MHz : &CH11 : &BBC11 :
&L_Cal; *Rcp
     chan_def = : 86220.00 MHz : L :  32.00 MHz : &CH12 : &BBC12 :
&L_Cal; *Lcp
     chan_def = : 86188.00 MHz : L :  32.00 MHz : &CH13 : &BBC13 :
&L_Cal; *Rcp
     chan_def = : 86188.00 MHz : L :  32.00 MHz : &CH14 : &BBC14 :
&L_Cal; *Lcp
     chan_def = : 86156.00 MHz : L :  32.00 MHz : &CH15 : &BBC15 :
```

```
&L_Cal; *Rcp
     chan_def = : 86156.00 MHz : L :  32.00 MHz : &CH16 : &BBC16 :
&L_Cal; *Lcp
enddef;
```

Setup (KVN stations)

```
def 86156.00MHz8x32MHz;
* mode =  1    stations =Ky:Ku:Kt
     sample_rate =  64.000 Ms/sec;  * (2bits/sample)
     chan_def = : 86156.00 MHz : L :  32.00 MHz : &CH01 : &BBC01 :
&NoCal; *Lcp
     chan_def = : 86156.00 MHz : L :  32.00 MHz : &CH02 : &BBC02 :
&NoCal; *Rcp
     chan_def = : 86156.00 MHz : U :  32.00 MHz : &CH03 : &BBC01 :
&NoCal; *Lcp
     chan_def = : 86156.00 MHz : U :  32.00 MHz : &CH04 : &BBC02 :
&NoCal; *Rcp
     chan_def = : 86220.00 MHz : L :  32.00 MHz : &CH05 : &BBC01 :
&NoCal; *Lcp
     chan_def = : 86220.00 MHz : L :  32.00 MHz : &CH06 : &BBC02 :
&NoCal; *Rcp
     chan_def = : 86220.00 MHz : U :  32.00 MHz : &CH07 : &BBC01 :
&NoCal; *Lcp
     chan_def = : 86220.00 MHz : U :  32.00 MHz : &CH08 : &BBC02 :
&NoCal; *Rcp
enddef;
```

LO=85500 MHz

DBBC2 stations have to use the flex mode with the following channel selection in the prc-file:

```
vsi1=a05,a06,a07,a08,a09,a10,a11,a12,b05,b06,b07,b08,b09,b10,b11,b12
```

Stations which can only offer a reduced bandwidth of bitrate are considered non-standard. Setups have to be negotiated with the GMVA technical team (chair: W. Alef, MPIfR)

All other setups are non-standard and require consultation with the GMVA scheduler or technical team (chair: W. Alef, MPIfR).

ALMA Mode 4 Gbps (fullband mode)

Deprecated mode. Do not use!

The description is kept for reference only.

For ALMA compatibilty the DBBC2 stations must observe in fullband PFB mode covering the full 512 MHz per polarisation in a single IF channel.

NOTE: You must use the last two core boards in the DBBC2 board stack for the fullband mode. All data from the last Core2Board (presumably IFD) will be send to VSI1 and all from last-1 (presumably IFC) to VSI2. There is no option to choose something else.

DBBC2 setup

Restart of the DBBC PFB control software is not required unless the DDC mode was used prior to the fullband mode.

The only option to be commanded is

```
dbbcform=full_auto
```

FILA10G setup

To combine the both VSI streams it is usually enough to set the Fila10G to:

```
splitmode off
inputselect vsi1-2
vsi_samplerate 64000000
reset keepsync
vdif_station PV         (<-change to your station code)
vdif_frame 2 2 5000 ct=off
reset keepsync
regwrite chan_perm 0 0x21200100
regwrite chan_perm 1 0x23220302
regwrite chan_perm 2 0x25240504
regwrite chan_perm 3 0x27260706
regwrite chan_perm 4 0x29280908
regwrite chan_perm 5 0x2B2A0B0A
regwrite chan_perm 6 0x2D2C0D0C
regwrite chan_perm 7 0x2F2E0F0E
regwrite chan_perm 8 0x31301110
regwrite chan_perm 9 0x33321312
regwrite chan_perm 10 0x35341514
regwrite chan_perm 11 0x37361716
regwrite chan_perm 12 0x39381918
regwrite chan_perm 13 0x3B3A1B1A
regwrite chan_perm 14 0x3D3C1D1C
regwrite chan_perm 15 0x3F3E1F1E
reset keepsync
timesync
```

Note: the last command "timesync" will only work if your FiLA10G is equipped with a GPS module/ antenna. If this is not the case at your station you can do the time syncronization either:

- manually: `timesync  <YYYY>-<MM>-<DD>T<hh>:<mm>:<ss>`
- use the FS `fmset` command. This must be done prior to executing the above procedure!

IMPORTANT: Do not use FMSET to sync the FILA10G after executing the above procedure as this will partially overwrite the above setting.

Note: The regwrite statements will join the two steams to a single 64 bit stream one after each other VSI1 bit 0-31 and VSI2 bit 32 to 61. The correlator expects to have alternating bits from channel 1 and 2. VSI1 bit 0+1, VSI2 bit2+3, ...

The mode has been succesfully tested at Effelsberg (details).