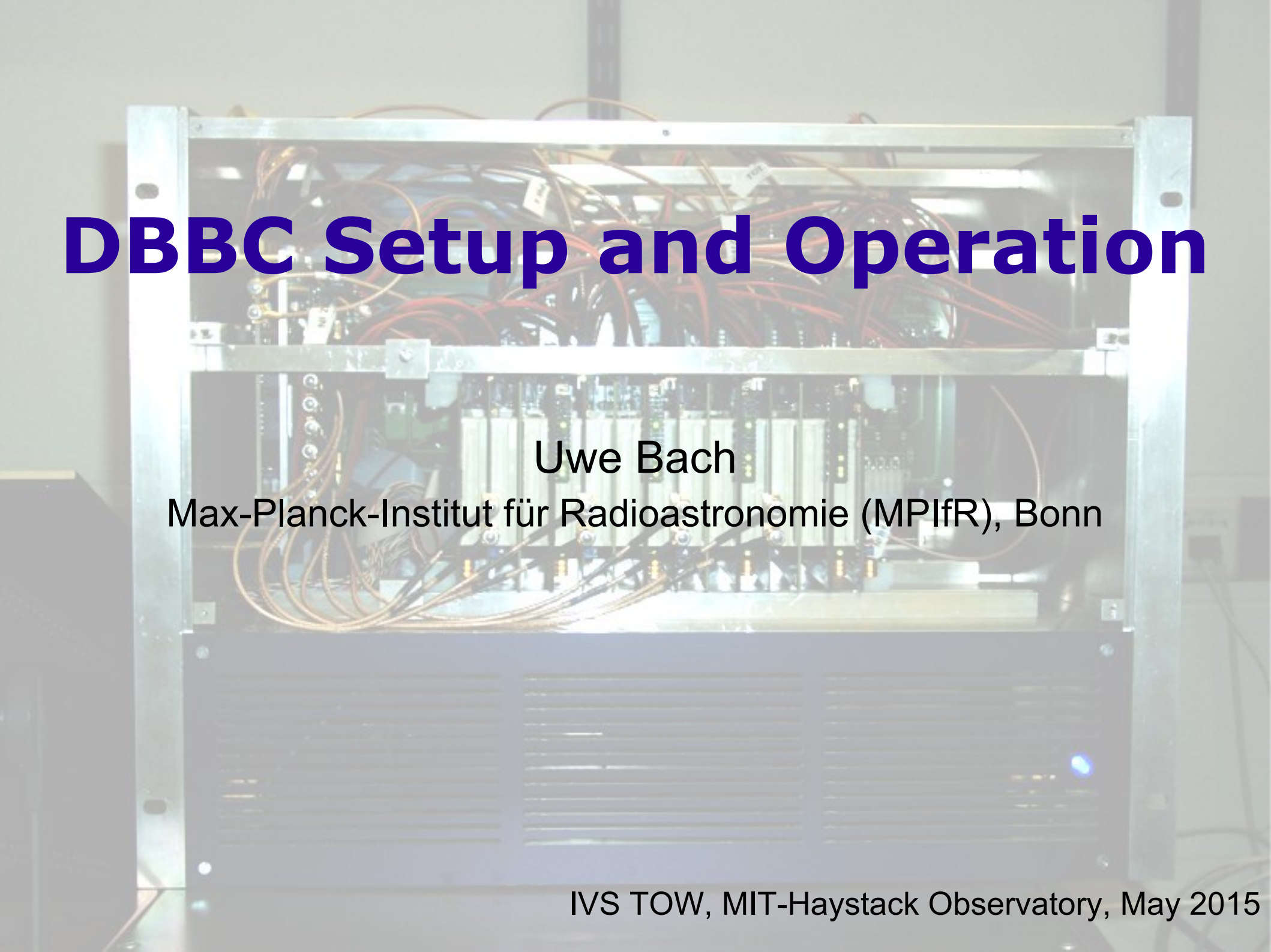


DBBC Setup and Operation

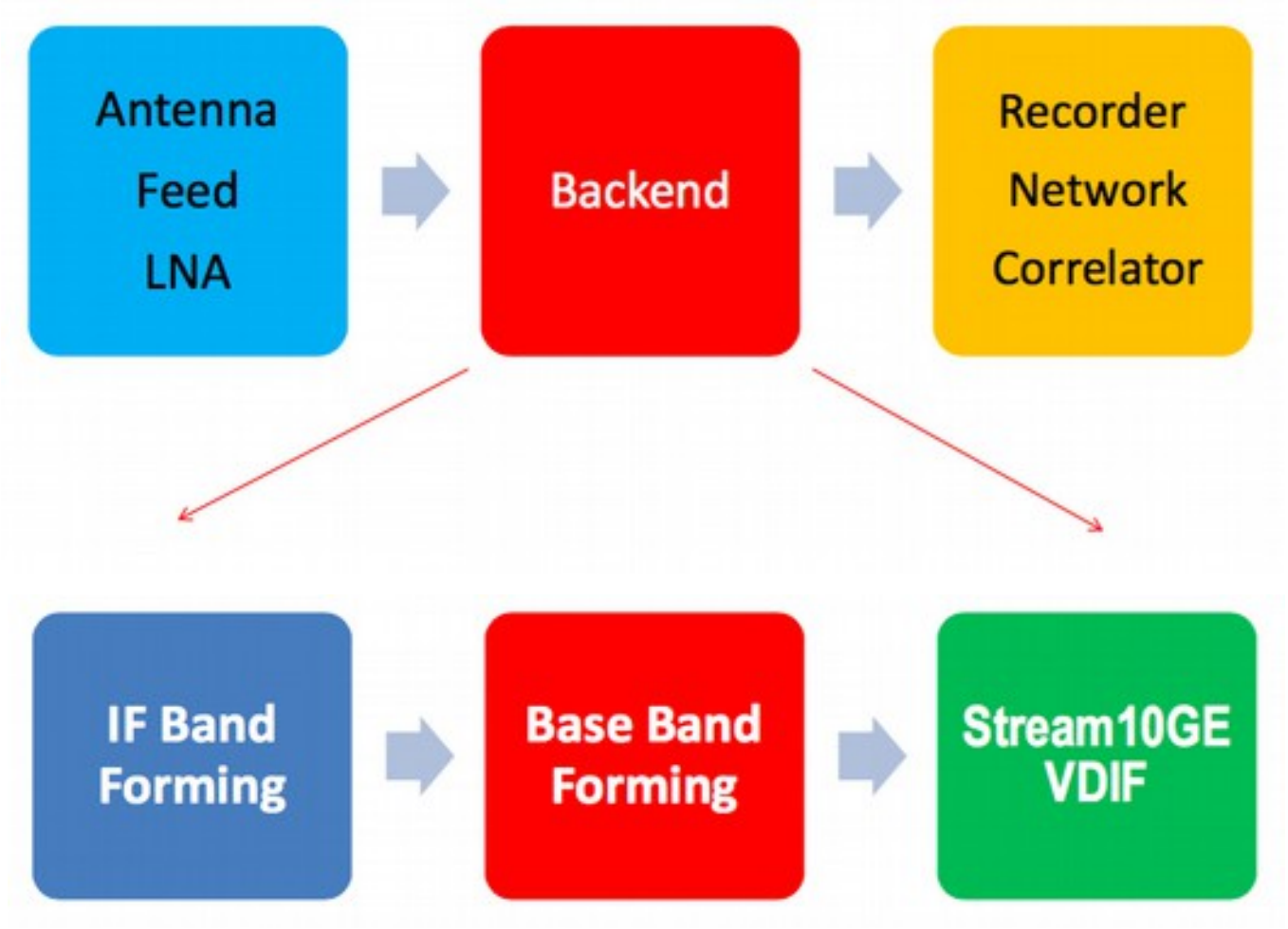
Uwe Bach
Max-Planck-Institut für Radioastronomie (MPIfR), Bonn

IVS TOW, MIT-Haystack Observatory, May 2015

Content

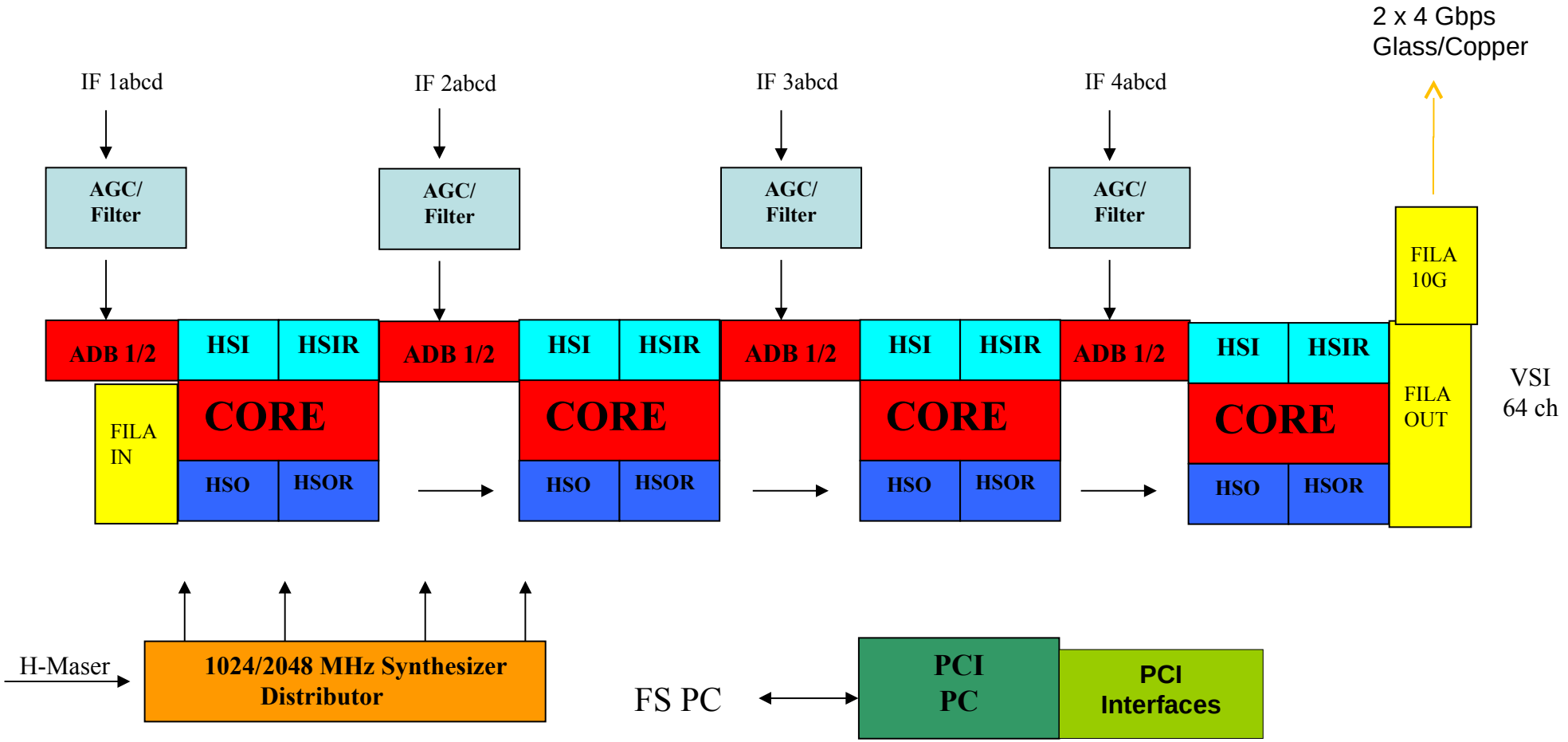
- DBBC hardware characteristics
  - What is it good for
  - A tour around the DBBC
  - Component description
- Installation of a DBBC
- DBBC software
  - Poly-phase Filter Bank (PFB)
  - Digital Down Conversion (DDC)
- Basic testing
- Field System integration
- VLBI operation

The VLBI backend



The DBBC Achitecture

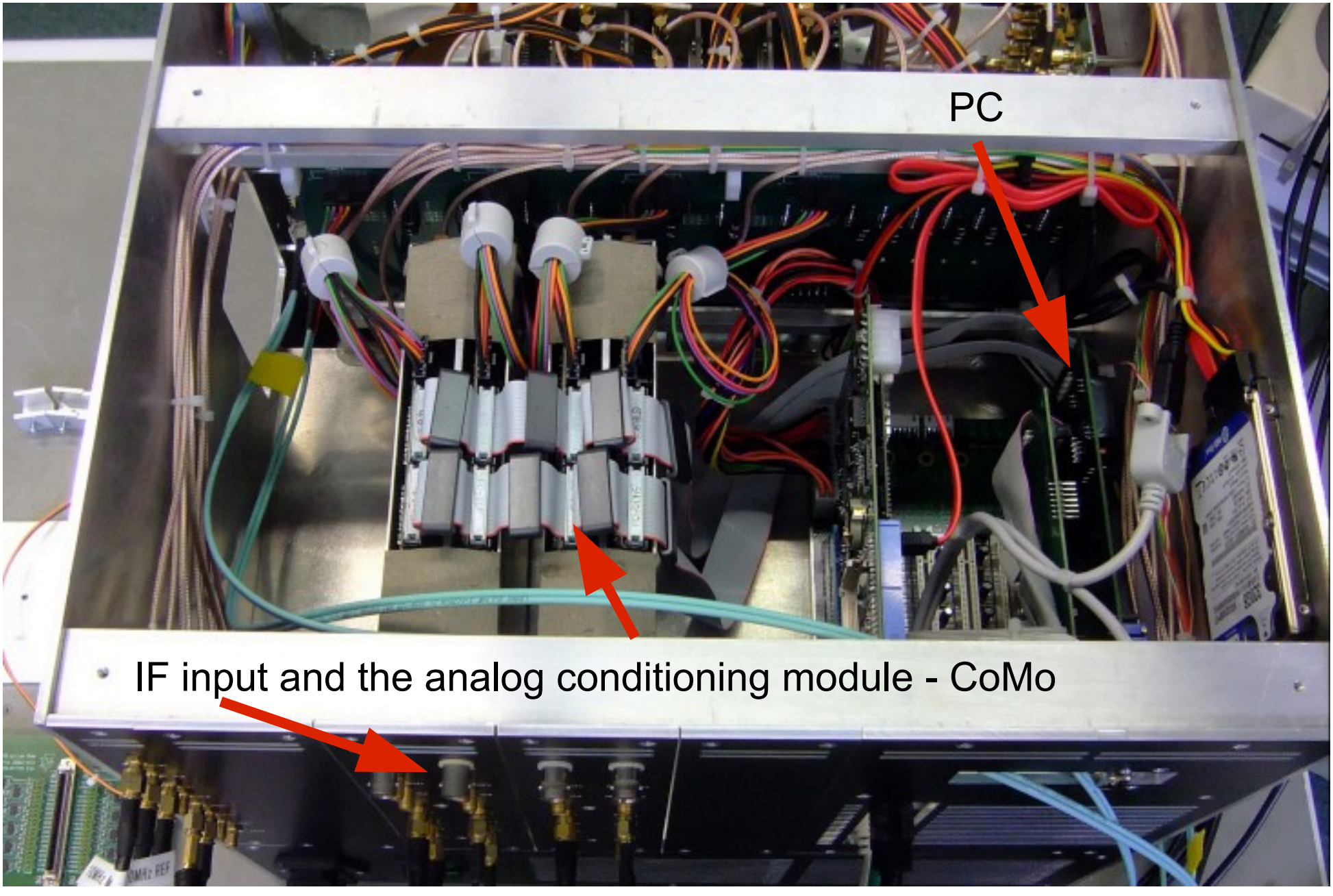
IFn (MHz)
1~512, 512~1024,1024~1536, 1536~2048
or
1~1024, 1024~2048 MHz



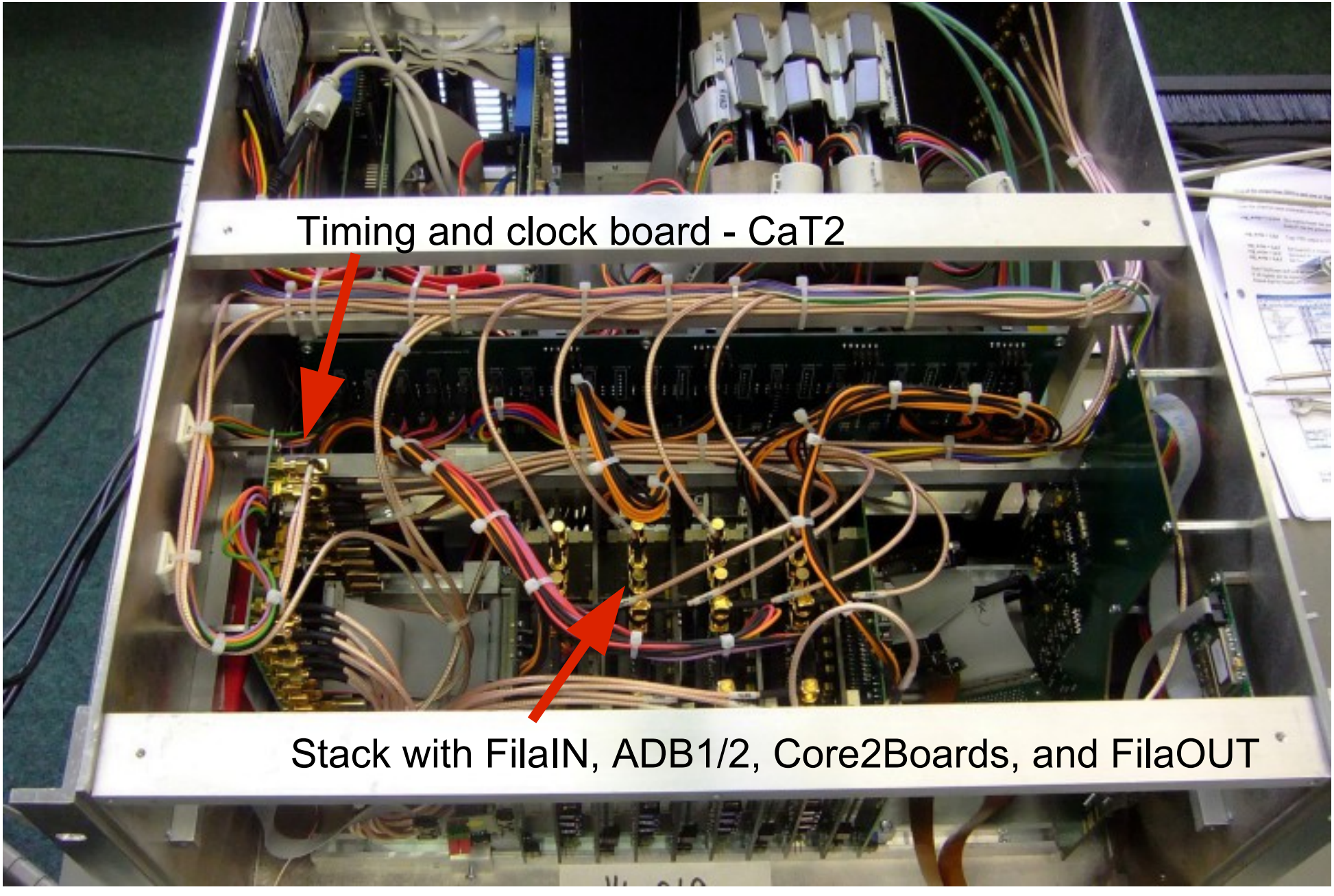
DBBC Outside (front view)

DBBC Outside (rear view)

DBBC Inside

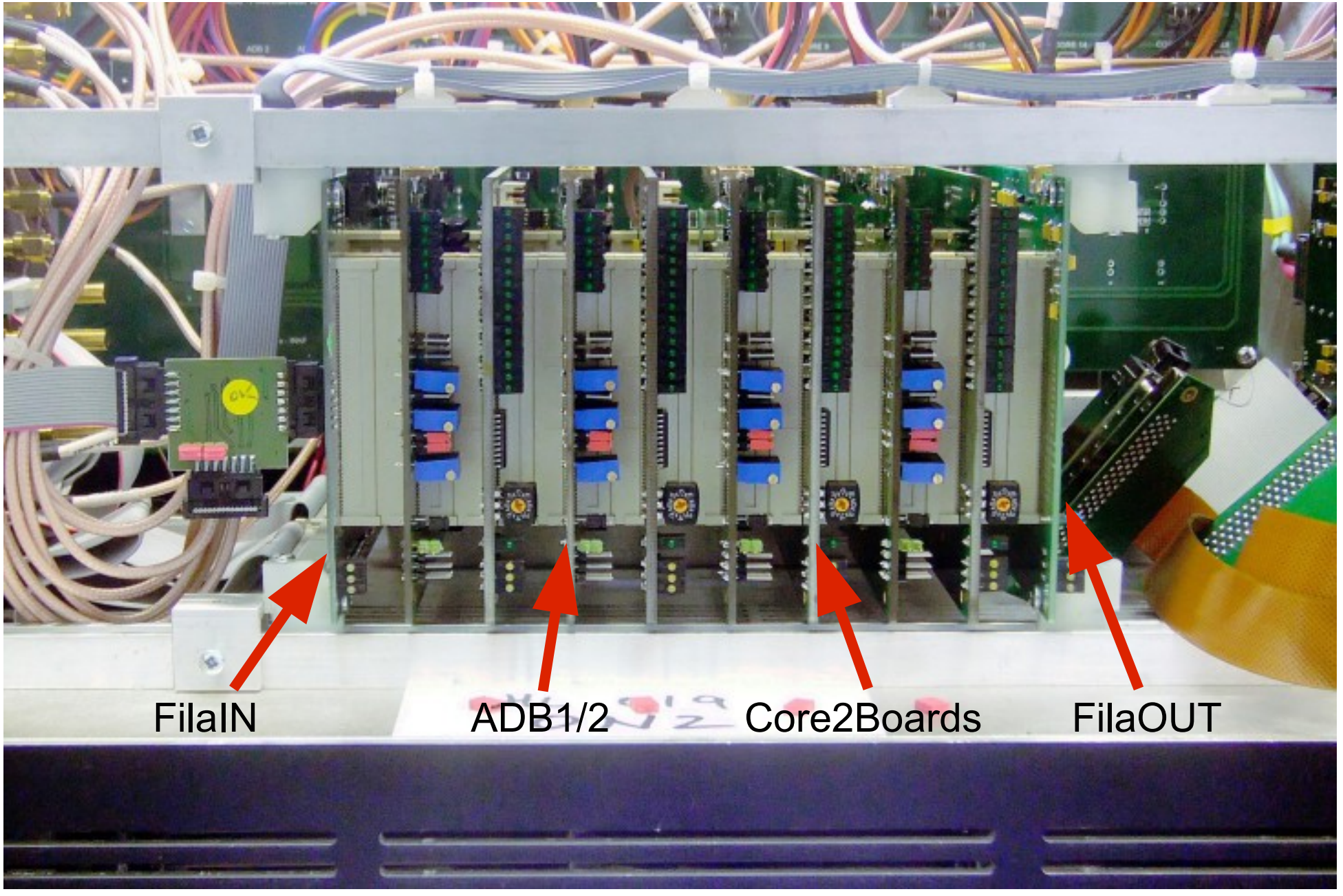


DBBC Inside


Timing and clock board - CaT2
Stack with FilaIN, ADB1/2, Core2Boards, and FilaOUT

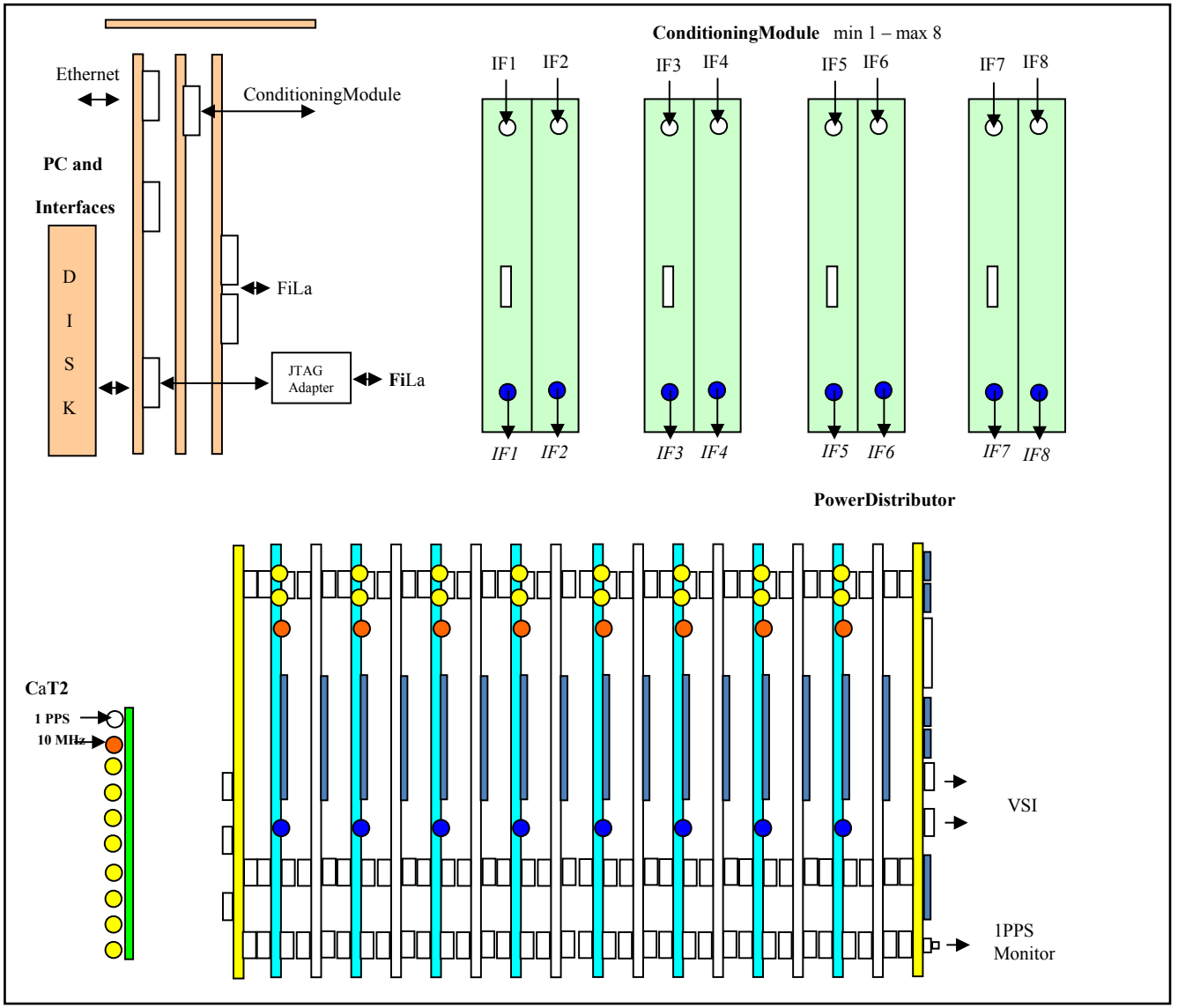
DBBC Inside

DBBC Inside

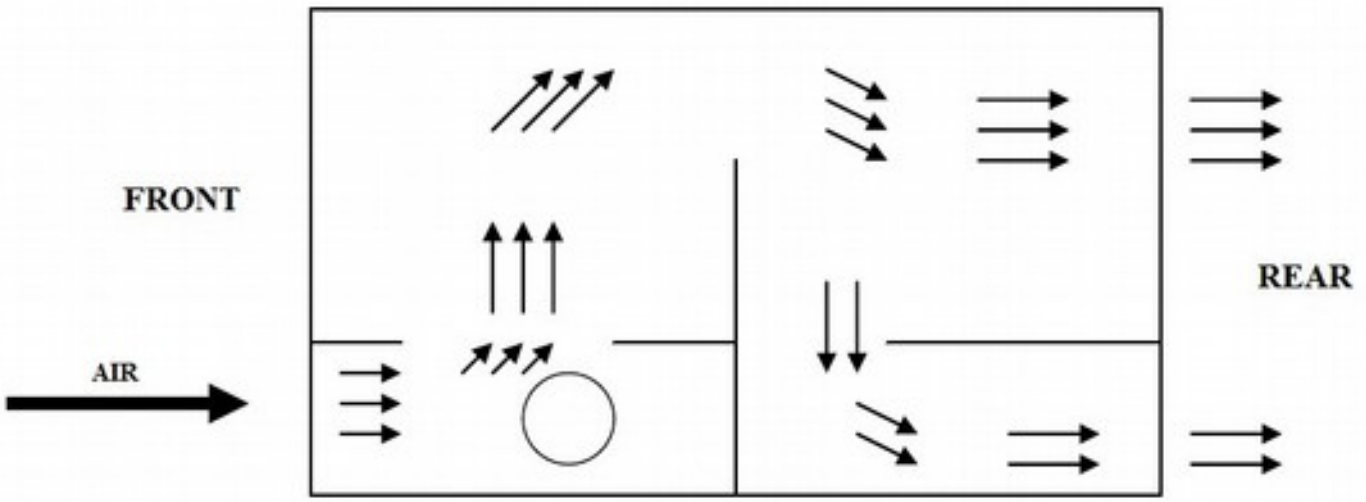


The DBBC Achitecture

DBBC2 / DCCB2010 Schematic Top View



The DBBC Achitecture



The air cooling flow from a side view

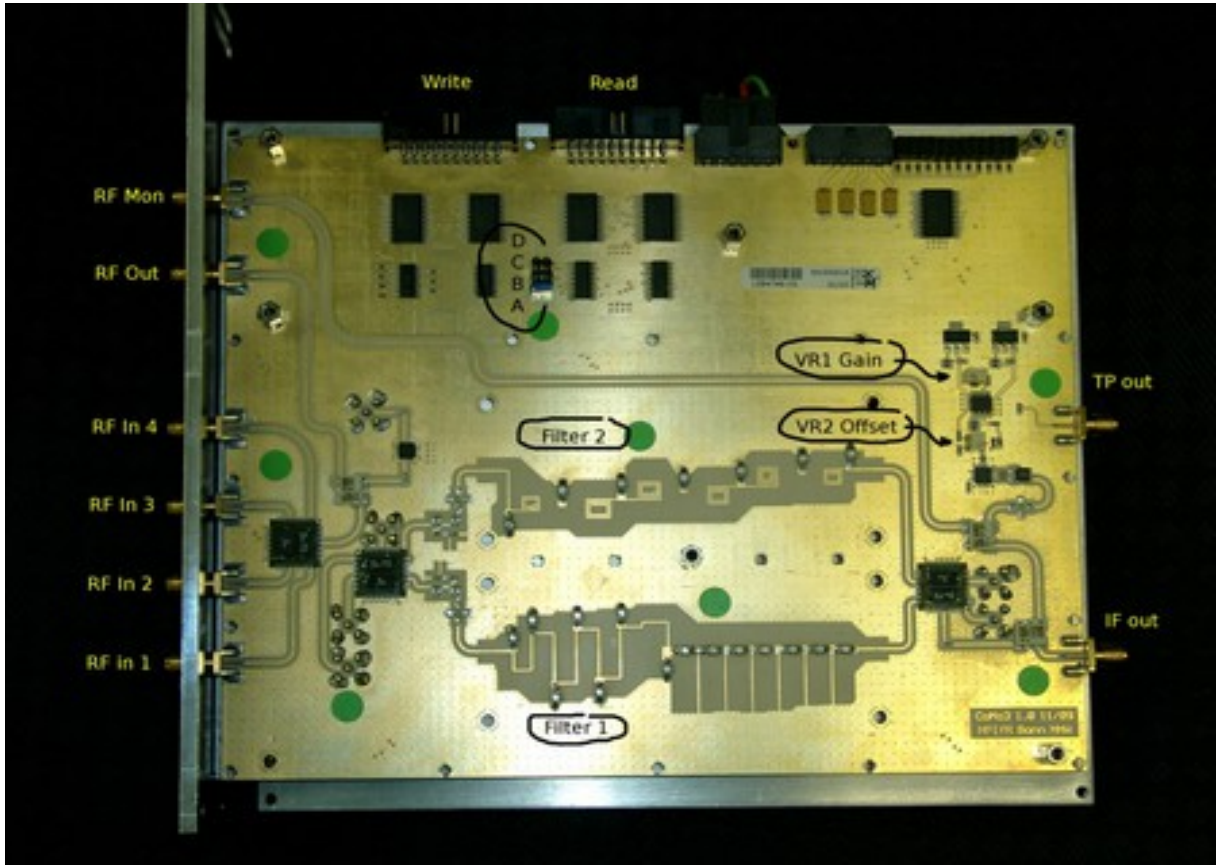
General Features

- 4/8 RF/IF Input out of 16 (4x4) in a range up to 2.2 (3.5) GHz
- 1024/2048 MHz sampling clock frequency
- More personalities for different observing modes
- Input 4/8 polarizations / bands
- Output 4/8 groups of 32 data channel
- Output as VSI interfaces or as 10G Ethernet streams
- Control under Field System or other client console

Component description

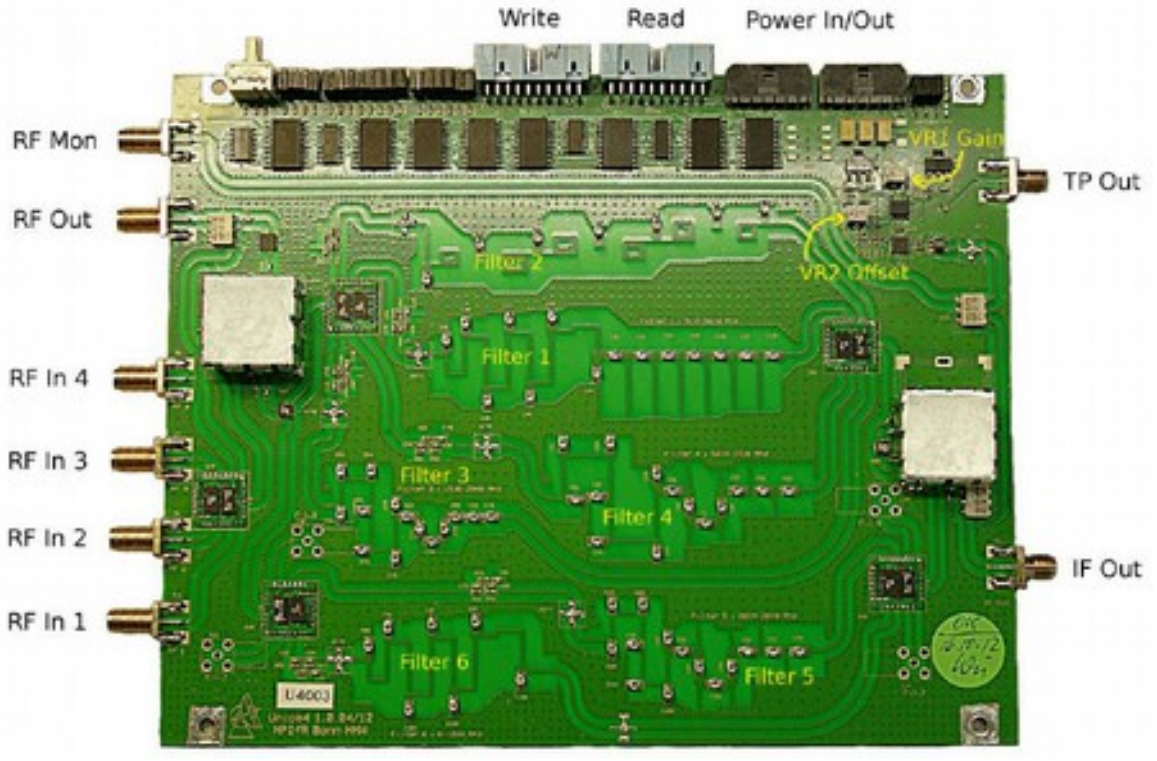
1. Analog Conditioning Module – CoMo
2. Analog-Digital Converter (ADB1 / ADB2)
3. Data Processing (Core2)
4. Connection and Service
   (FiLaIN/OUT – FiLa10G FILA10G-4)
5. Timing and Clock (CaT2 – Clock and Timing)
6. Computer Control (PCSet)

1. Conditioning Module (Unica3)



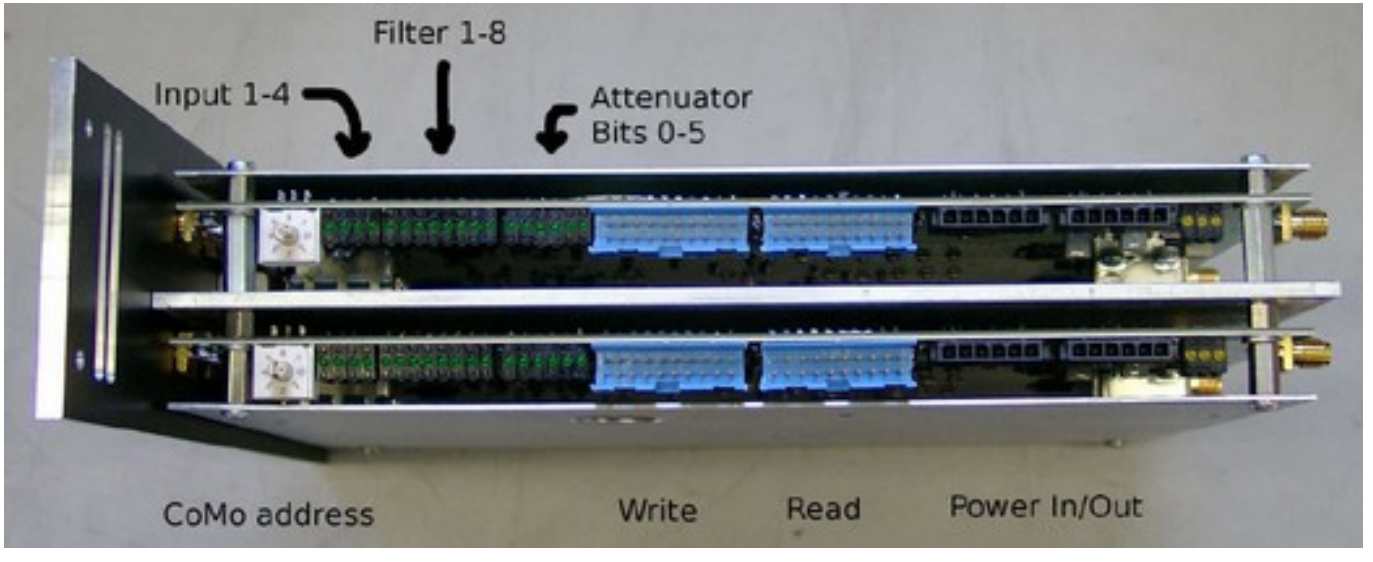
- 4 selectable RF inputs
- 4 selectable Nyquist f lters
- 31.5 dB programmable attenuation
- Total power full band
- Manual or automatic gain control

1. Conditioning Module (Unica4)

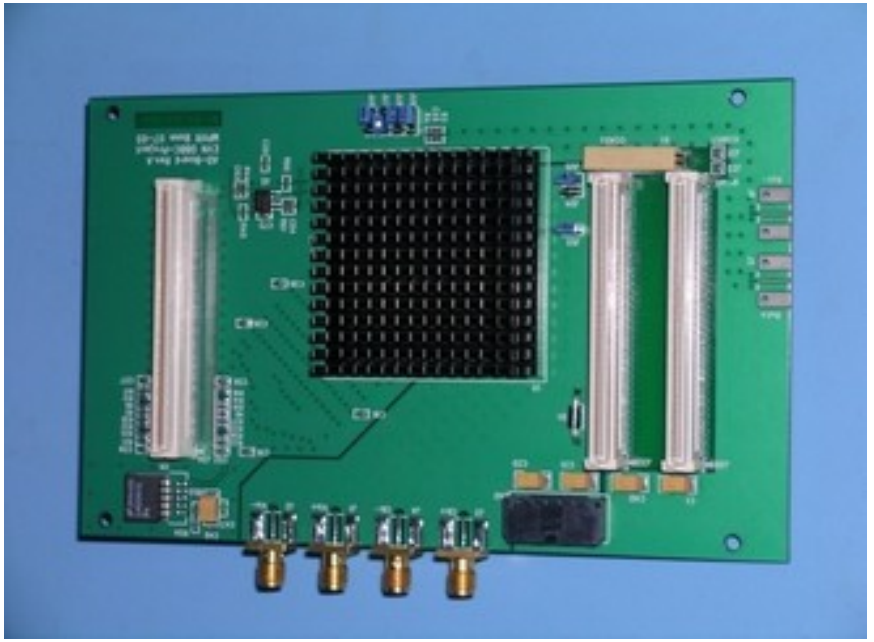


- Now with:
  8 selectable Nyquist f lters

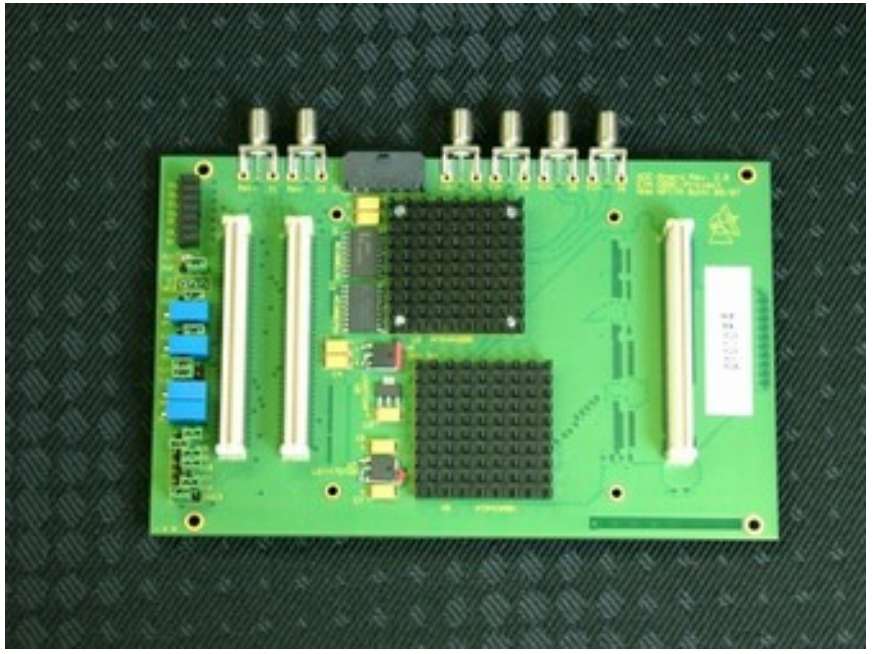
- 2 Unica boards build 1 CoMo



2. Analog to digital converter ADB1/2



- Analog input: 0 - 2.2 GHz
- Max Sampling clock 1.5 GHz
- Max Instantaneous bandwidth
  750 MHz (real) / 1.5 GHz (complex)
- Output data 2 x 8-bit @1/4 Sclk DDR

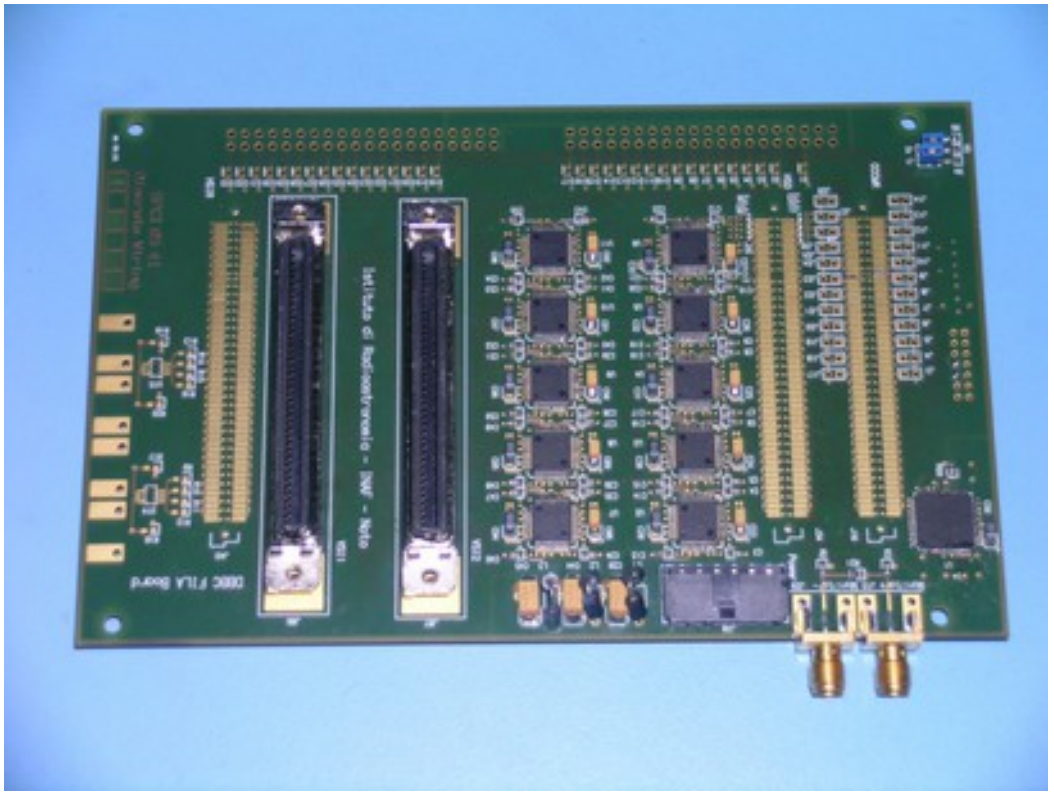


- Analog input: 0 – 3.5 GHz
- Max sampling clock 2.2 GHz
- Max instantaneous bandwidth
  1.1 GHz (real) / 2.2 GHz (complex)
- Output data 2 x 8-bit @1/4 Sclk DDR
  4 x 8-bit @1/8 Sclk DDR
- Piggy pack module support for 10-bit output and connection to Fila10G

3. Basic processing unit - Core2

- Input rate:
  (4 IF x 2 bus x 8-bit x SClk/4 DDR) b/s
  (2 IF x 4 bus x 8-bit x SClk/8 DDR) b/s
  ….
- Typical output rate:
  (64 ch x 32-64-128) Mb/s
- Programmable architecture
  - Digital down conversion (DDC)
    1 Core2 = 4 BBCs
  - Poly-phase Filter Bank (PFB)
    1 Core2 = 16 Poly-phase f lters
- 1 VSI 32 channel output

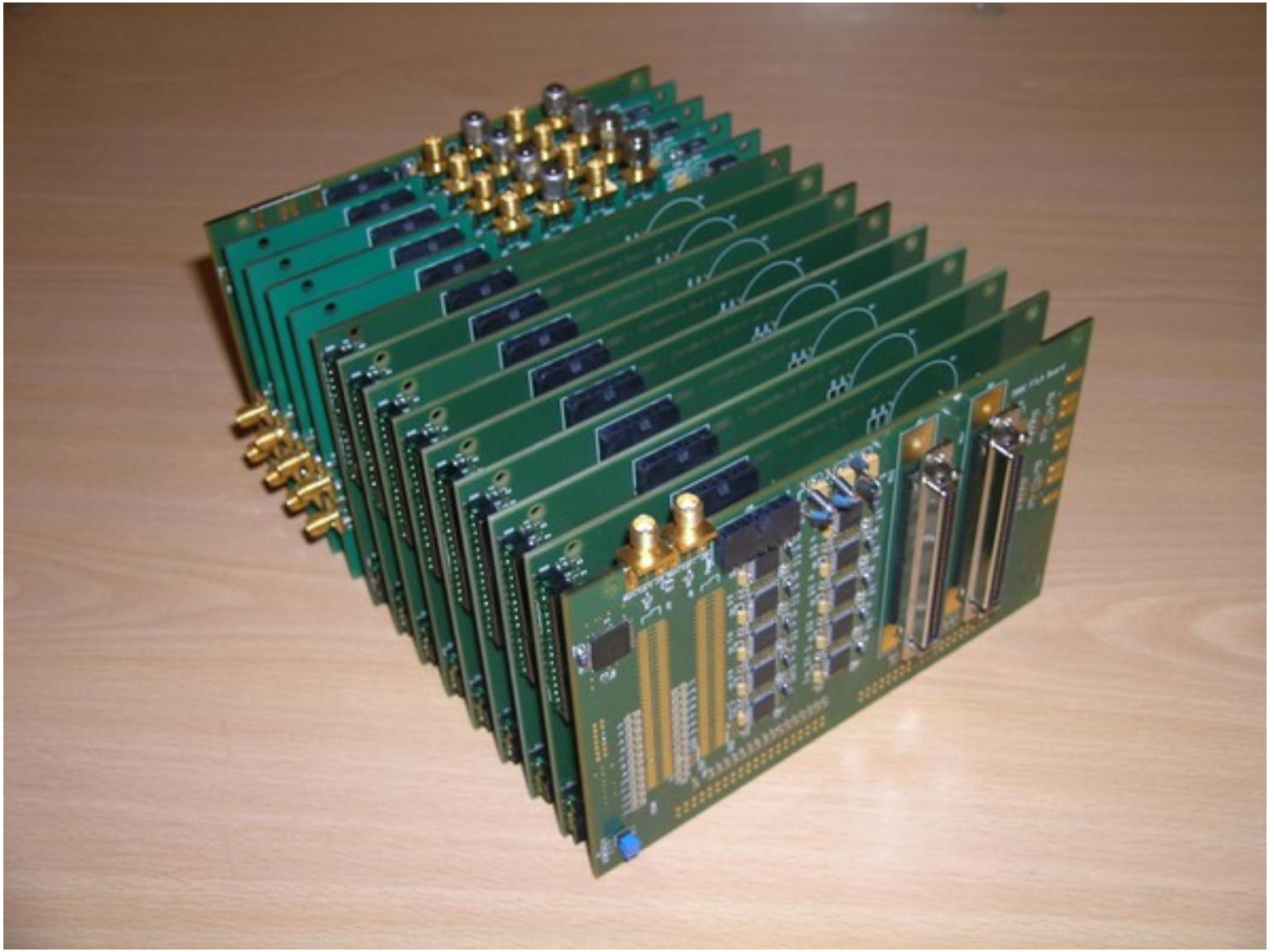
4. Connection and service - FiLaBoard



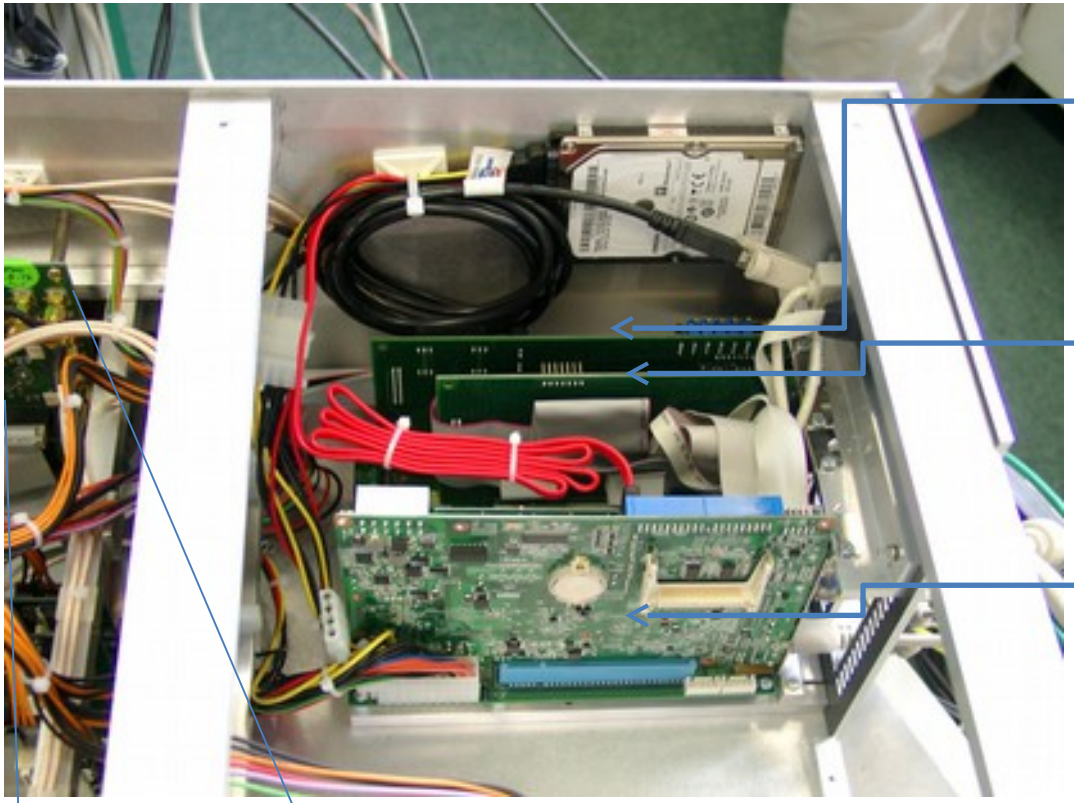
First and Last board in the stack

- First: IN
  - Communication interface
  - JTAG programming channel
  - 1pps in
- Last: OUT
  - 2 VSI interfaces
  - 1pps monitor out
  - 80 Hz continues calibration out

Complete Module Stack



6. PC Set – Control computer



ADLink PCI9111HR:
Communication with Conditioning Modules for IF total power measure, automatic gain control, registers control, etc.

ADLink PCI7200:
Communication with 32-bit bus for Core2 register setting, total power measurement,

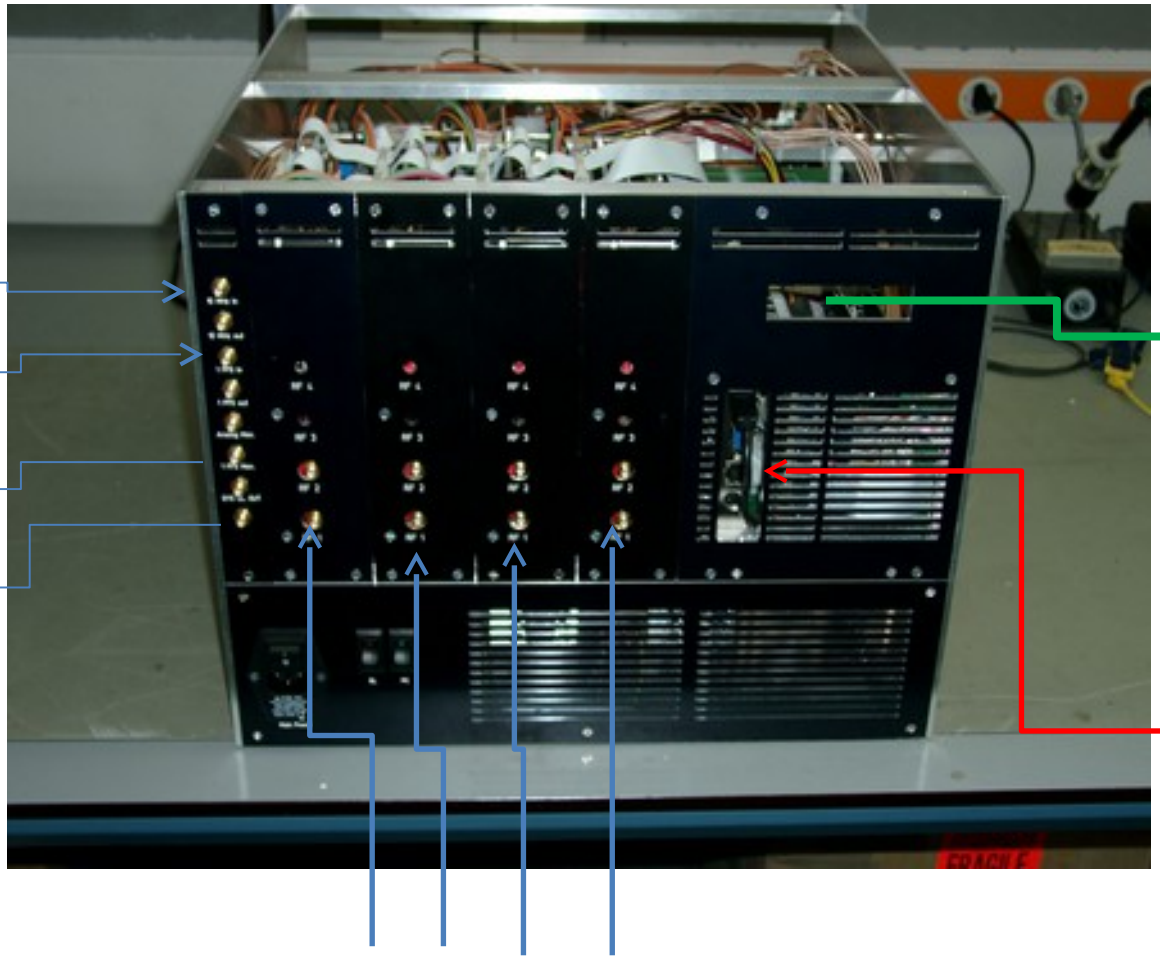
state statistics, etc.

Adventech PCI-7030:
Half Size PCI Motherboard (Intel Atom) on PCI backplane

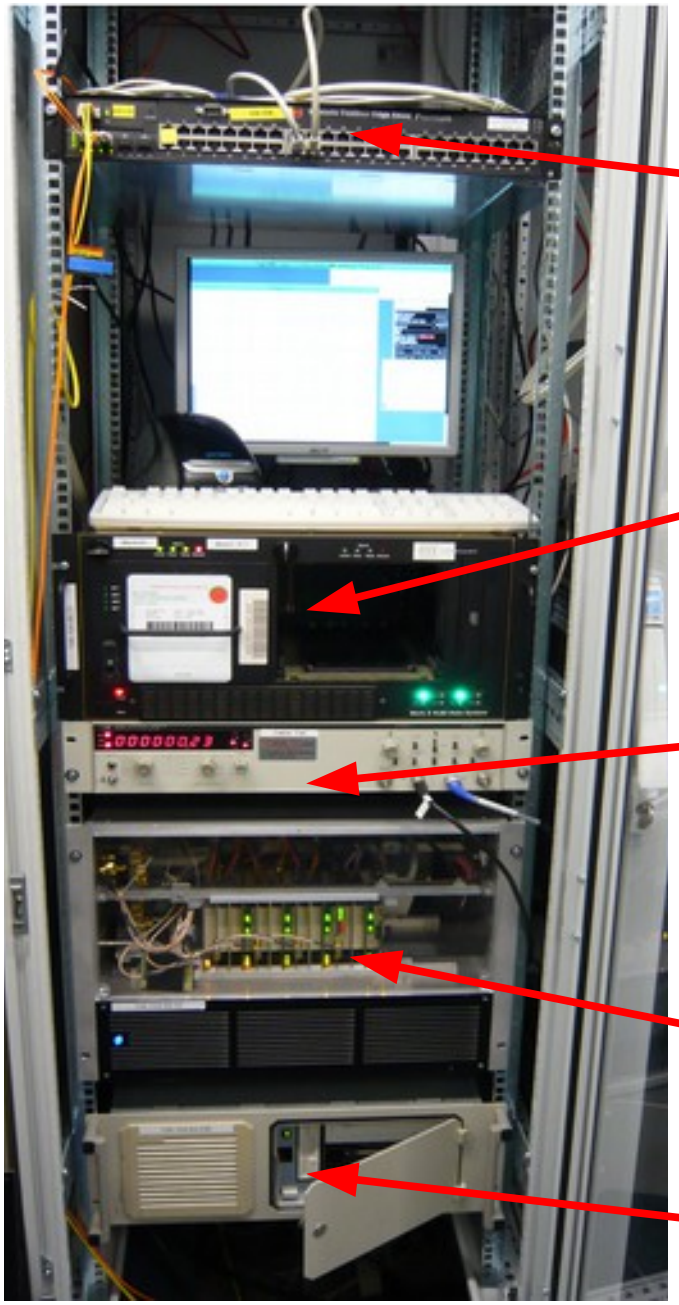
Xilinx programmer:
FPGA device configuration through USB – JTAG interface

Installation of a DBBC

How to connect the DBBC



Installation of a DBBC



e-VLBI 10 GE switch

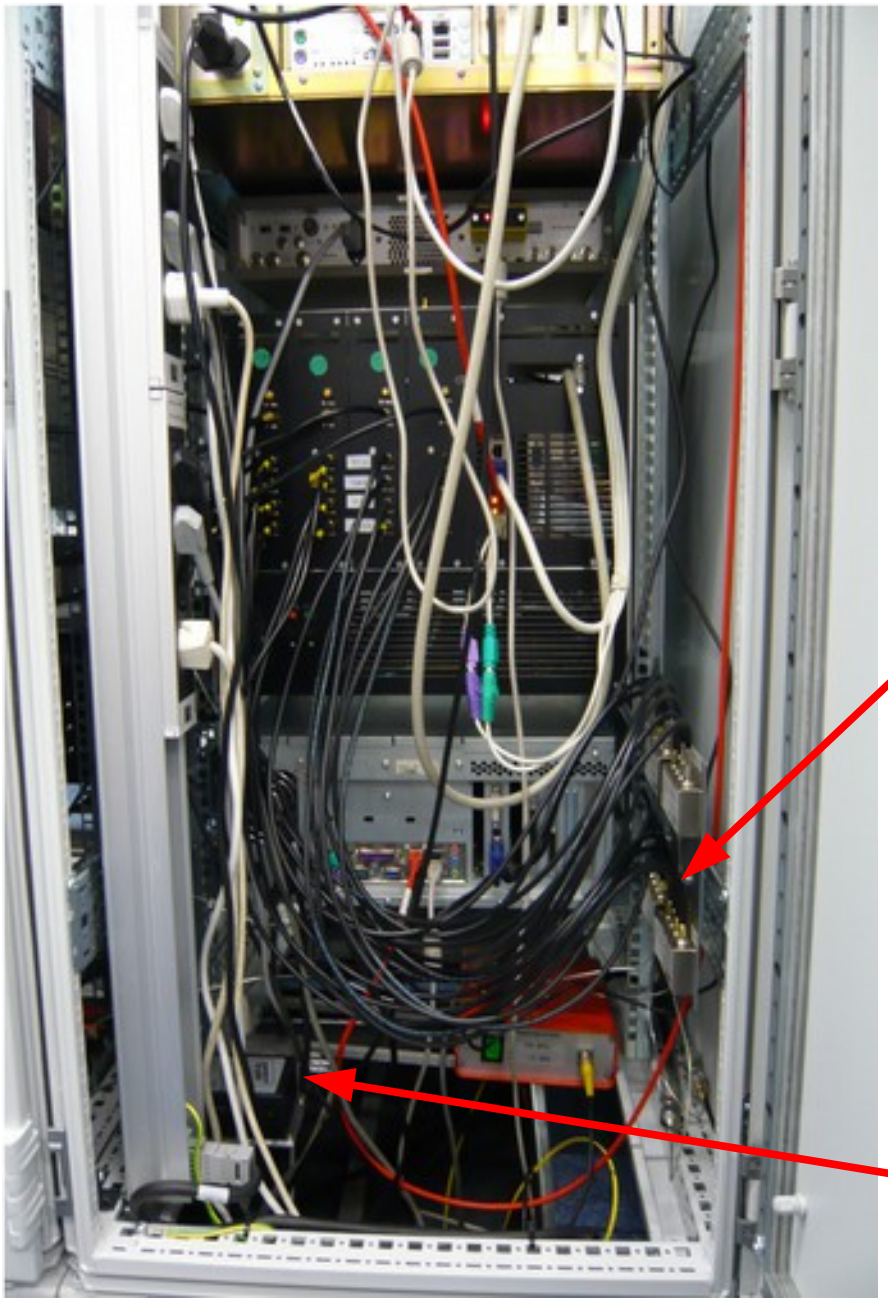
Mark5B+ disk recorder

Counter to monitor
gps – 1pps out (MK5B)

DBBC

Field System PC

Installation of a DBBC



4x4 IF-Splitter to provide all possible IFs at the DBBC Inputs:

IF1: a. 500-1000 IF RCP
b. 0-500 IF RCP
c. 500-1000 IF LCP
d. 0-500 IF LCP

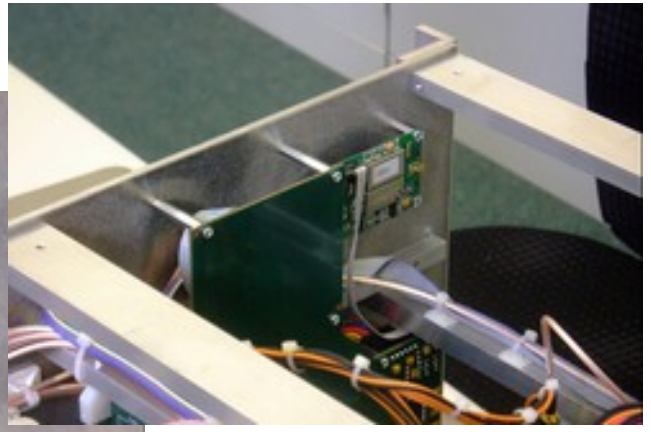
IF2: a. 500-1000 IF RCP
b. 0-500 IF RCP
c. 500-1000 IF LCP
d. 0-500 IF LCP

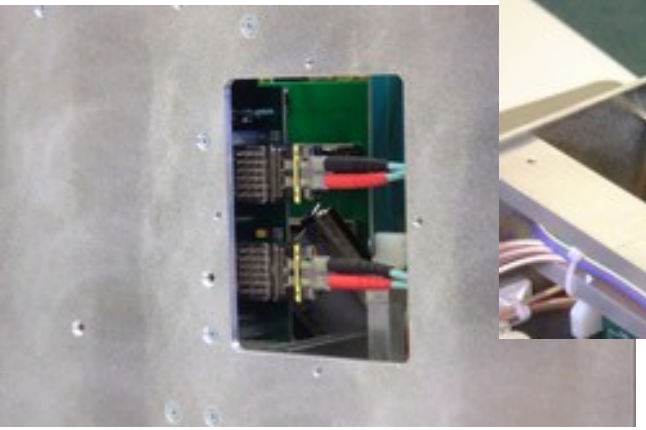
IF3: a. 500-1000 IF RCP
b. 0-500 IF RCP
c. 500-1000 IF LCP
d. 0-500 IF LCP

IF4: a. 500-1000 IF RCP
b. 0-500 IF RCP
c. 500-1000 IF LCP
d. 0-500 IF LCP

blank – sync generation from 80 Hz

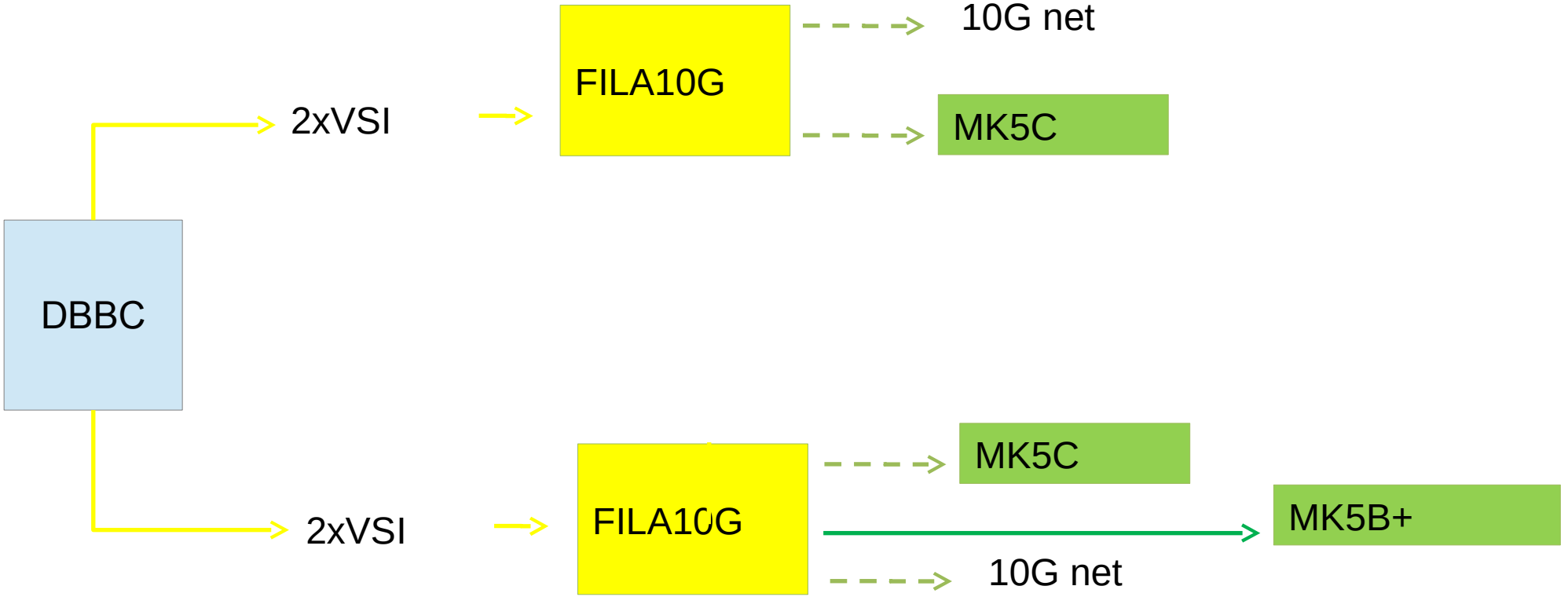
FiLa10G (SA)





- Two independent 10G Ethernet UDP port
- Physical interface optical XFP
- 10G port fully bidirectional
- Installed inside the DBBC box or as stand-alone
- Data rate: 1 – 2 – 4 Gbps each 10G port
- Format mode: RAW, MK5B or VDIF

Connection examples



FiLa10G Software

- FILA10G Files:

  c:\DBBC\bin\timesyncFILA10G.exe (MK5B time set)
  c:\DBBC\bin\vdif_timesyncFILA10G.exe (VDIF time set)
  c:\DBBC\bin\sendstr.exe (serial communication)
  c:\DBBC_conf\FilesDBBC\fila10g_v3.3.1.bit
  c:\DBBC\doc\DBBC2 FILA10G Command set v3.3.1.pdf

Note: a program to sync with a NTP server is required (eg. NetTimeSetup-314.exe) or new FiLa10G modules have a GPS module build in that can be used to get the GPS time.

Setting up the FiLa10G

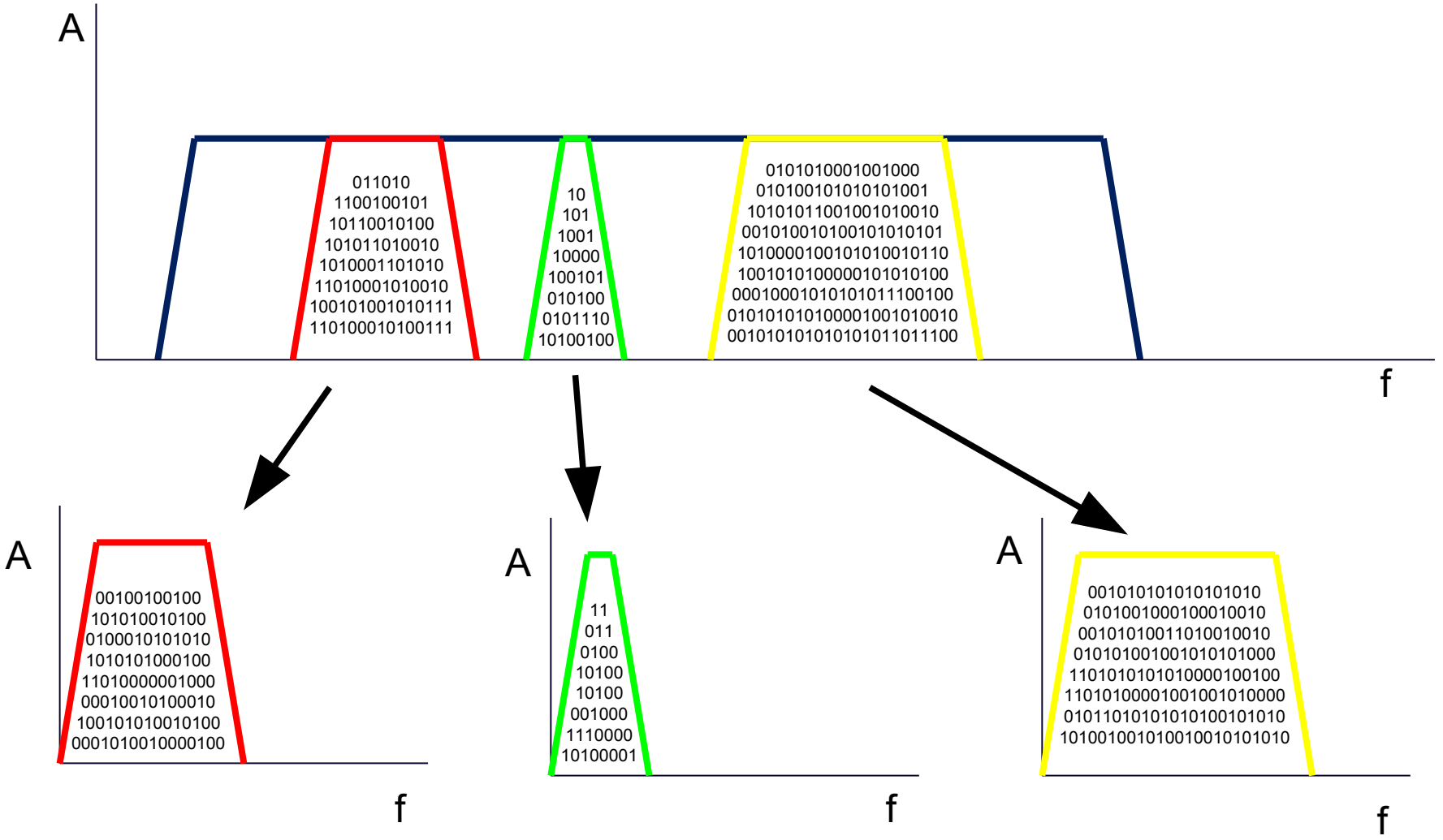
- Upload of the f rmware is
  - automatically made by the DDC/PFB control software (internal FiLa10G)
  - done with an additional Xilinx JTAG programmer using a script for IMAPCT (external FiLa10G-SA)
- Communication is through serial port or Ethernet in the stand-alone version
- Commands available (see document)
- VDIF packet size setting (see document)
- Script f les can be used for block of commands (see batch)

Observing modes

- DDC: tunable, channel bandwidth between 1 MHz and 16 MHz, U&L, Continuous cal with 80 Hz synchronization, modes: geo, astro, astro2, w-astro, lba, test
  DDC-E: like DDC but bandwidth up to 32 MHz (astro3)
- PFB: fixed tuning, channel bandwidth 32/64 MHz, all U or L depending on the Nyquist zone
- DSC: full 4 x 512/1024 MHz, max 8 x 1024 MHz band direct sampling conversion, all U or L depending on the Nyquist zone
- SPECTRA: 4Kch/IF spectrometer, max 32K channels

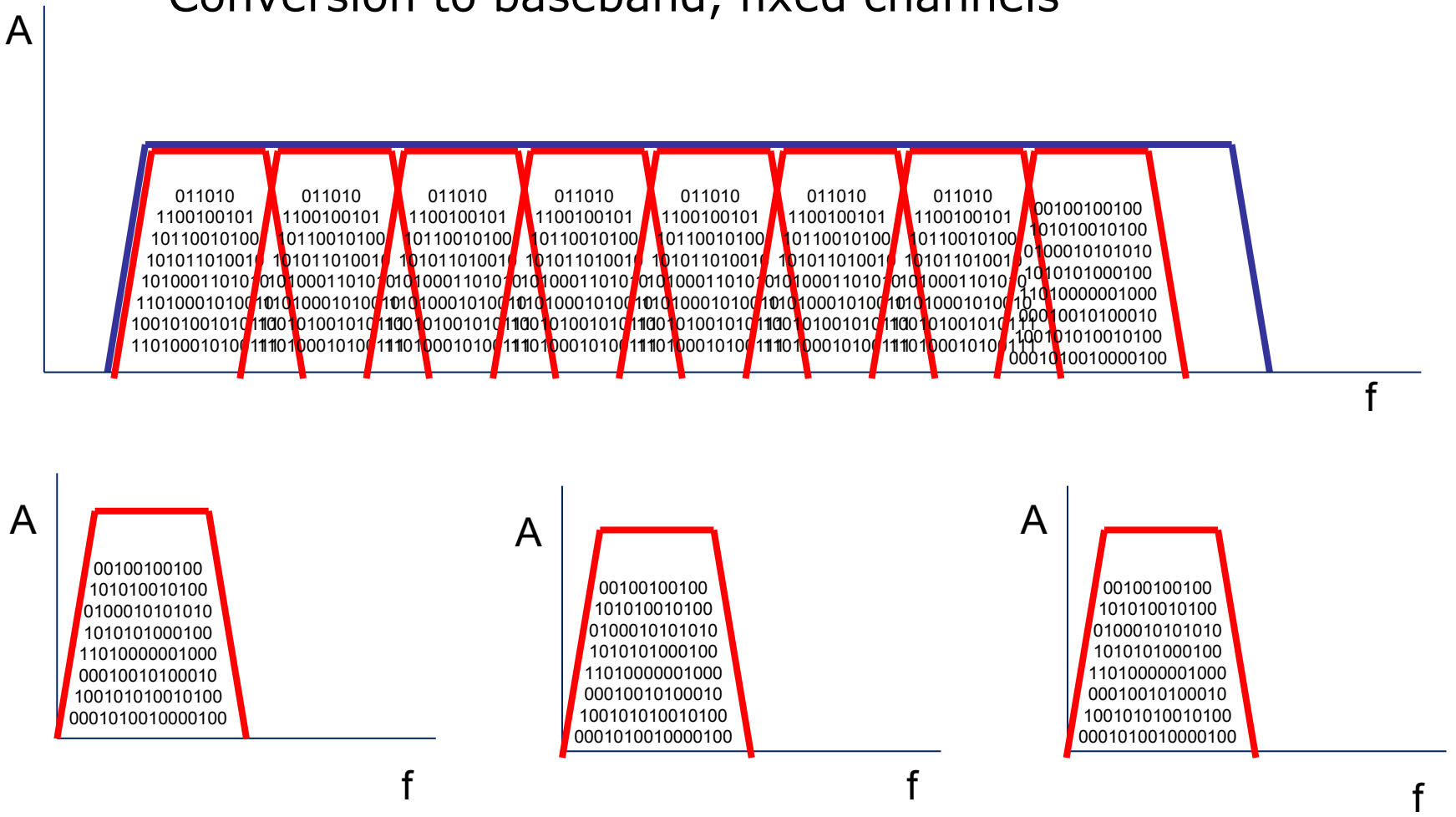
DDC – digital down conversion

Conversion to baseband, tunable channels of variable bandwidht

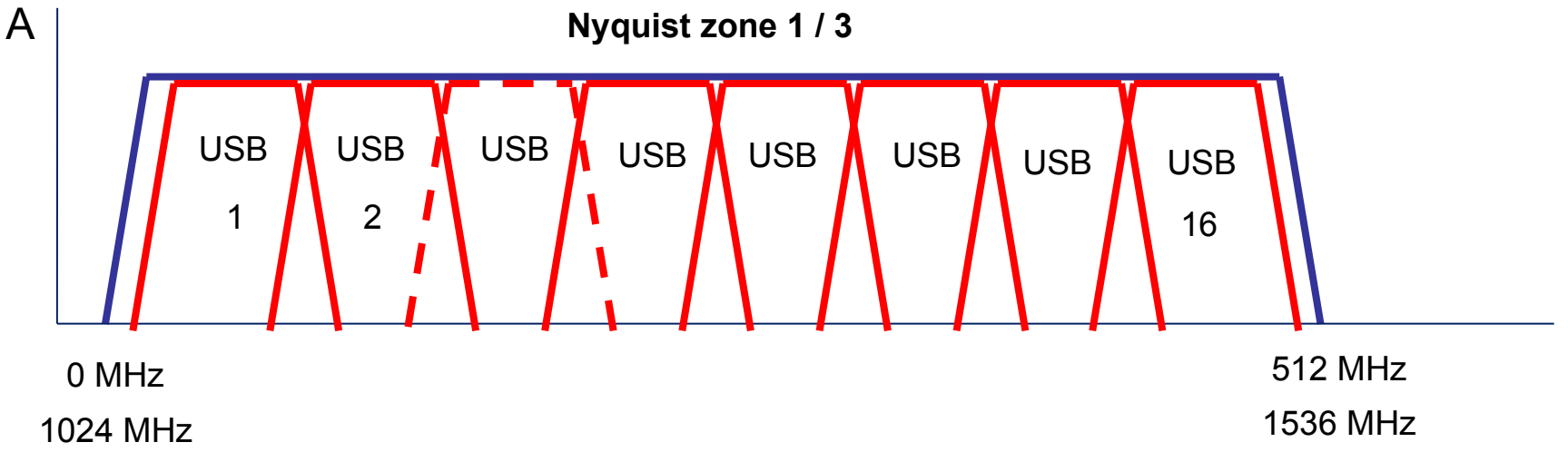


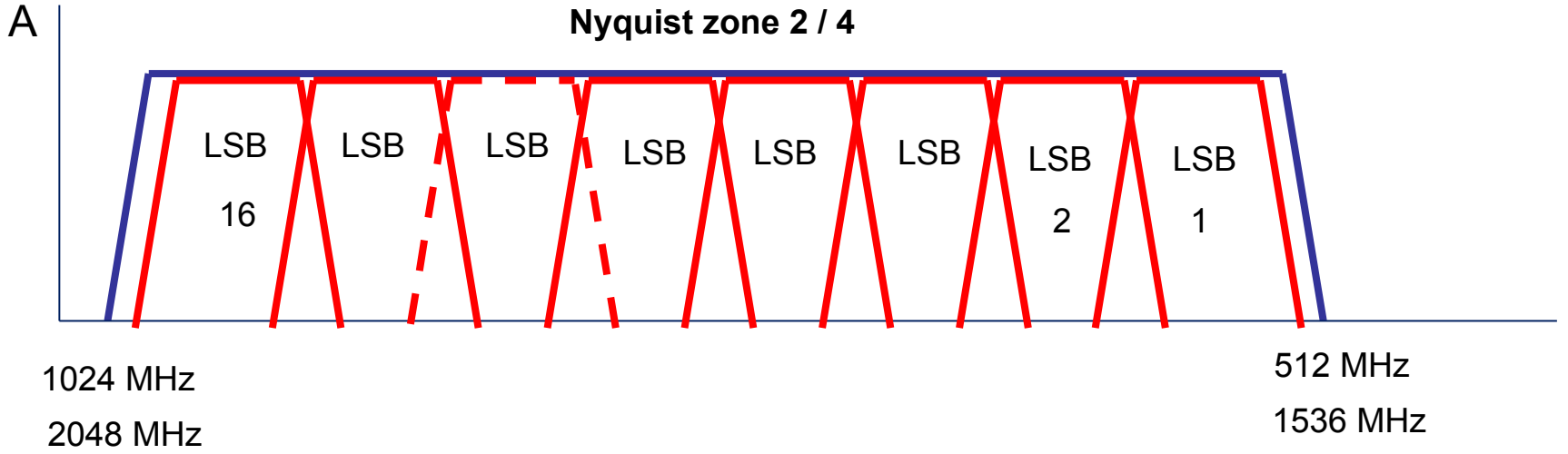
PFB – poly-phase filter bank

Conversion to baseband, fixed channels



PFB – poly-phase filter bank





Software

How the observing mode is selected

- Using a dedicated firmware
- Using a dedicated control software
- Using a dedicated configuration text file

Software (Windows XP)

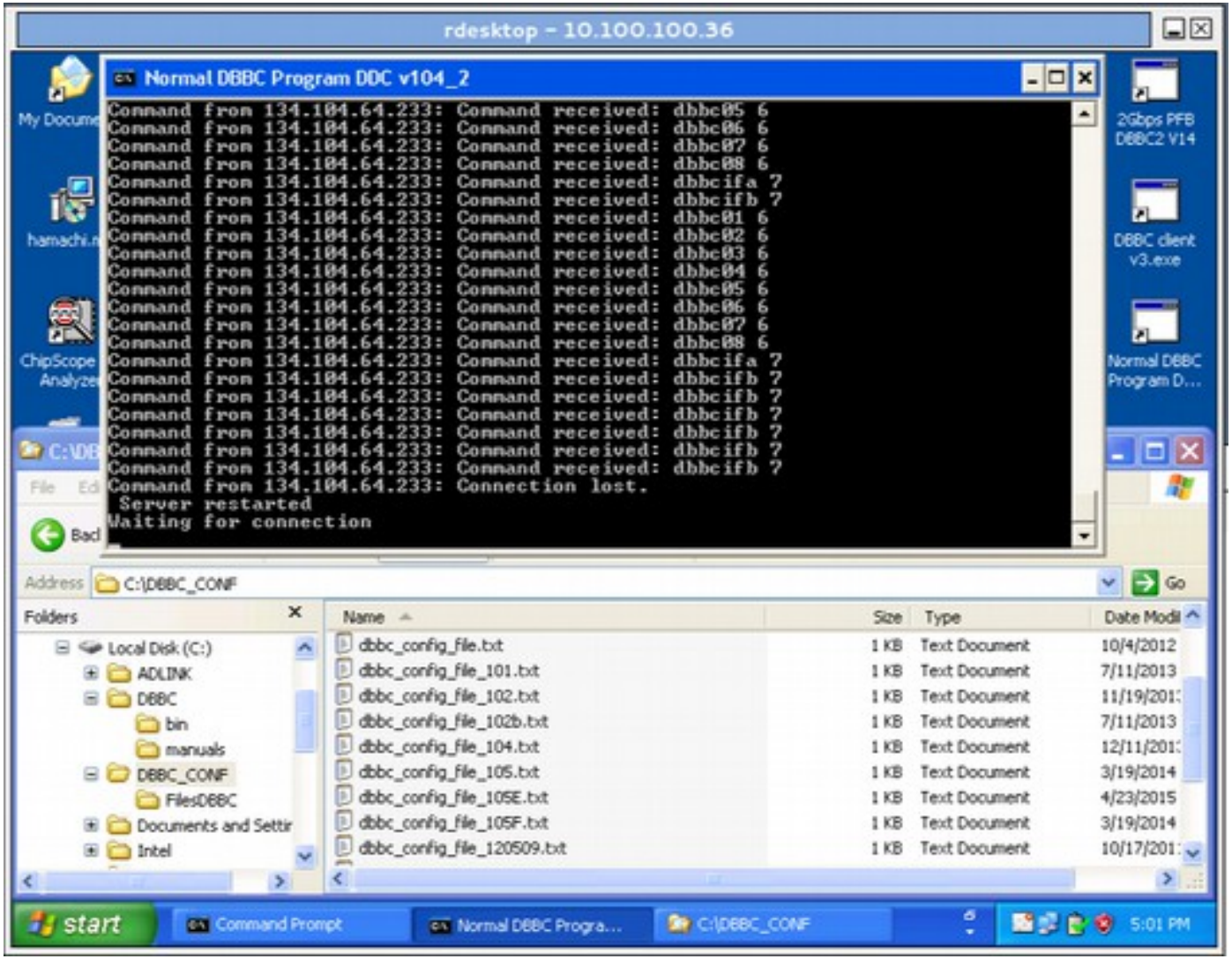
Files Structure:

C:\DBBC\bin
→ control software

C:\DBBC\doc
→ manuals

C:\DBBC_CONF\
→ conf guration text f les

C:\DBBC_CONF\FilesDBBC
→ f rmware



Main Menu

- Home
- Products
- Support
- Contacts
- Registration
- Links

Menu utente

- Your details
- Forum
- Invia un articolo
- Amministrazione
- Logout

Downloads

Overview Search Downloads Submit file

Overview

Page: 1 of 1

Number of Categories: 6

DDC - Tunable 16 bbc	Files: 4
BASE - General	Files: 4
FILA10G - 10G Ethernet	Files: 2
PFB - Polyphase 16 bands	Files: 3
SPECTRA - Spectrometer	Files: 1
Technical Notes	Files: 10

search...

Software

- General:

  BASE Package
  c:\DBBC\bin\DBBC client v3.exe (general client)
  c:\DBBC\bin\clock1024.exe (CAT2 1024)
  c:\DBBC\bin\clock2048.exe (CAT2 2048)
  c:\DBBC\bin\ad9858.exe (CAT1)
  c:\DBBC\bin\power.exe (on-off hardware)
  c:\DBBC\bin\agc_if.exe (CoMo Unica3 test)
  c:\DBBC\bin\agc_if_unica4.exe (CoMo Unica4 test)

Software

- DDC:

  c:\DBBC\bin\DBBC2 Control DDC v104.exe (server)
  c:\DBBC_conf\dbbc_config_file_104.txt
  c:\DBBC_conf\FilesDBBC\dbbc2_ddc_v104.bit
  c:\DBBC\doc\DBBC2 DDC command set v104.pdf

- PFB:

  c:\DBBC\bin\DBBC2 Control PFB v15.exe (server)
  c:\DBBC_conf\dbbc_poly_config_file_15.txt
  c:\DBBC_conf\FilesDBBC\ dbbc2_pfb_v15.bit
  c:\DBBC\doc\DBBC2 PFB command set v15.pdf

DDC configuration file

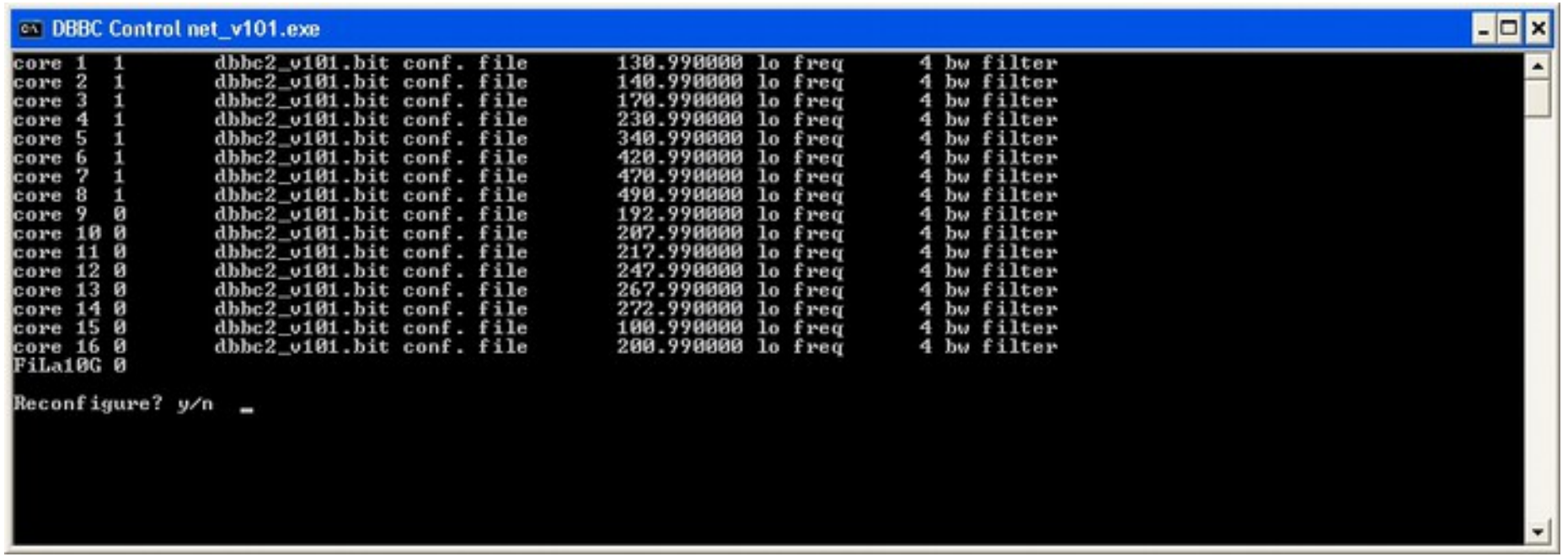
c:\DBBC_conf\dbbc_config_file_104.txt

Example:

```
1  dbbc2_ddc_v104.bit    597.00   8   ←the first number is indication of ADB1|2, in this case ADB1 is on
1  dbbc2_ddc_v104.bit    682.00   8     IFA  and ADB2 on IFB, ADB1 in IFC, no Core2 for IFD
1  dbbc2_ddc_v104.bit    853.00   8     If no Core2 is inserted in the first and second column put 0.
1  dbbc2_ddc_v104.bit    938.00   8     The second parameter is the firmware file name to be used.
2  dbbc2_ddc_v104.bit    597.00   8    The third and fourth parameters are frequency and bandwidth respectively.
2  dbbc2_ddc_v104.bit    682.00   8
2  dbbc2_ddc_v104.bit    853.00   8
2  dbbc2_ddc_v104.bit    938.00   8
1  dbbc2_ddc_v104.bit    597.00   8
1  dbbc2_ddc_v104.bit    682.00   8
1  dbbc2_ddc_v104.bit    853.00   8
1  dbbc2_ddc_v104.bit    938.00   8
0  dbbc2_ddc_v104.bit    597.00   8     Each Core2 board supports 4 bbcs so if not present 0 has to be inserted in
0  dbbc2_ddc_v104.bit    682.00   8    four lines
0  dbbc2_ddc_v104.bit    853.00   8
0  dbbc2_ddc_v104.bit    938.00   8
1   fila10g_v2_1.bit   ← if a FILA10G is installed set 1st version 1 (with ACE), 2nd version (without ACE 2), otherwise 0
1 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFA
1 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFB
1 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFC
1 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFD
0 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFE
0 38000                                   ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFF
0 38000                                   ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFG
0 38000                                   ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFH
107 112 0 0                          ←  phase calibration values
CAT2 1024                          ←  CAT1|2 and sampling frequency
```

Starting the software

DDC: running **DBBC2 Control DDC v104.exe**



after the Core2 configuration is completed

then run a client ex. **DBBC Client v3.exe or Field System**

DDC Mode Commands and Form Table (see documents)

First tests with the DBBC

- Cabling the DBBC: IF, 1pps, 10 MHz, (80 Hz calibration?)
- Starting the DDC software (server) on the DBBC Windows PC
  - Newest version always available at http://www.hat-lab.com/hatlab/support currently v104_2 or v105 for DDC
- Configuration file needs to be edit for your hardware installation.

First functionality can be tested with the DBBC_client or from the FS:

- select different IF inputs for the ADBs and let AGC adjustment work, e.g.

```
> dbbcifa              # for query
> dbbcifa=2,agc,2 # to set RF input 2, agc on, IF filter 2 (0-500 MHz)
```

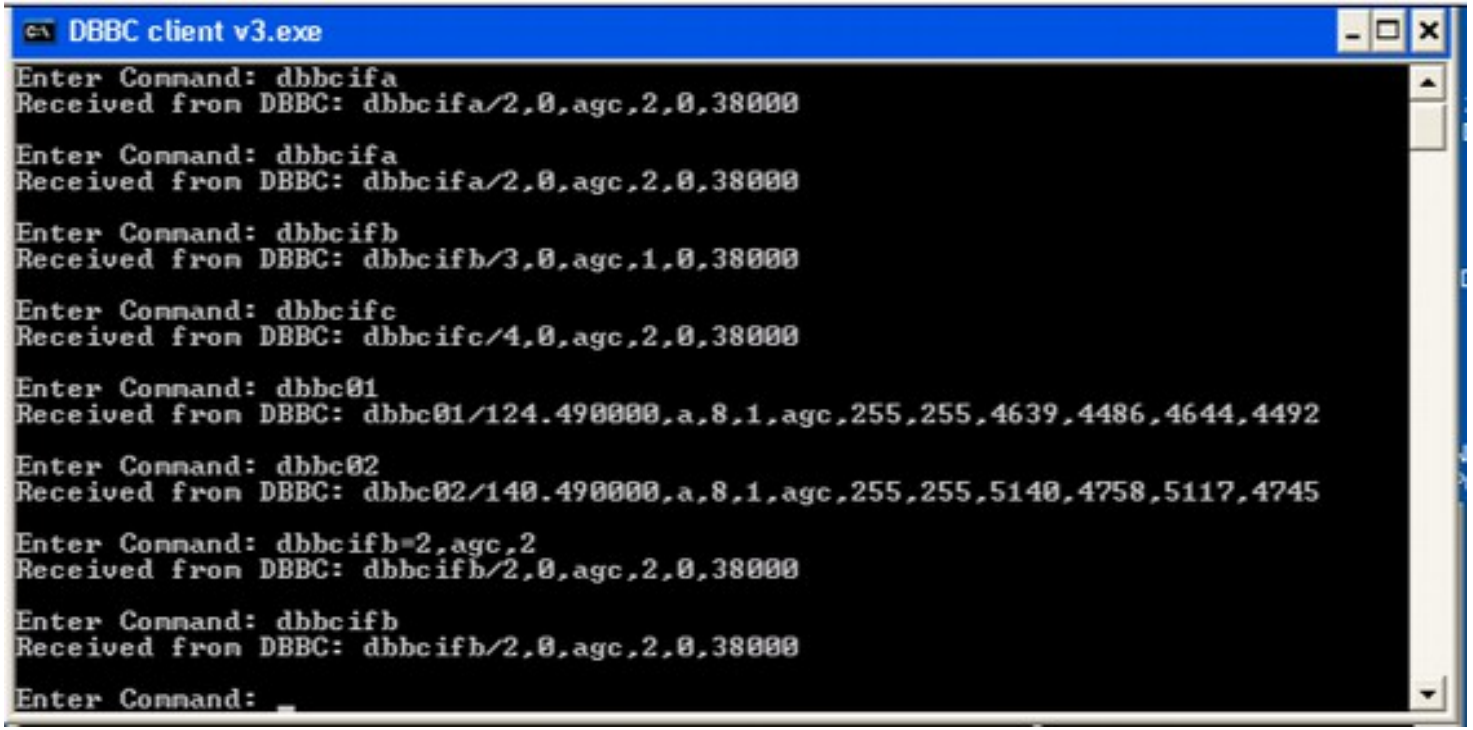
read out BBCs set different frequencies, ...

```
> dbbc01                          # for query
> dbbc01=596.00,a,16.00 # to set BBC freq=596 MHz, IFA, BBC
                                        band width = 16 MHz
```

First tests with the DBBC

> dbbcifa # for query
> dbbcifa=2,agc,2 # to set RF input 2, agc on, IF filter 2 (0-500 MHz)

read out BBCs set different frequencies, ...
> dbbc01 # for query
> dbbc01=596.00,a,16.00 # to set BBC freq=596 MHz, IFA, BBC band width = 16 MHz



Connecting a Mark5B(+)

Connect the DBBC VSI1 port to the Mark5B using VSI cable.

Set Mark5B needs to be synced to the 1pps on the VSI cable.

```
tstDIM > clock_set=32:ext
tstDIM > 1pps_source=vsi
tstDIM > dot_set=:force
tstDIM > dot?                  # query several times to see if it stays synced
```

Test the quality of the connection

```
DBBC > dbbcform=test,tvg       # starts TVG on the DBBC
tstDIM > tvr=0xffffffff        # TVR LED should be green.
```

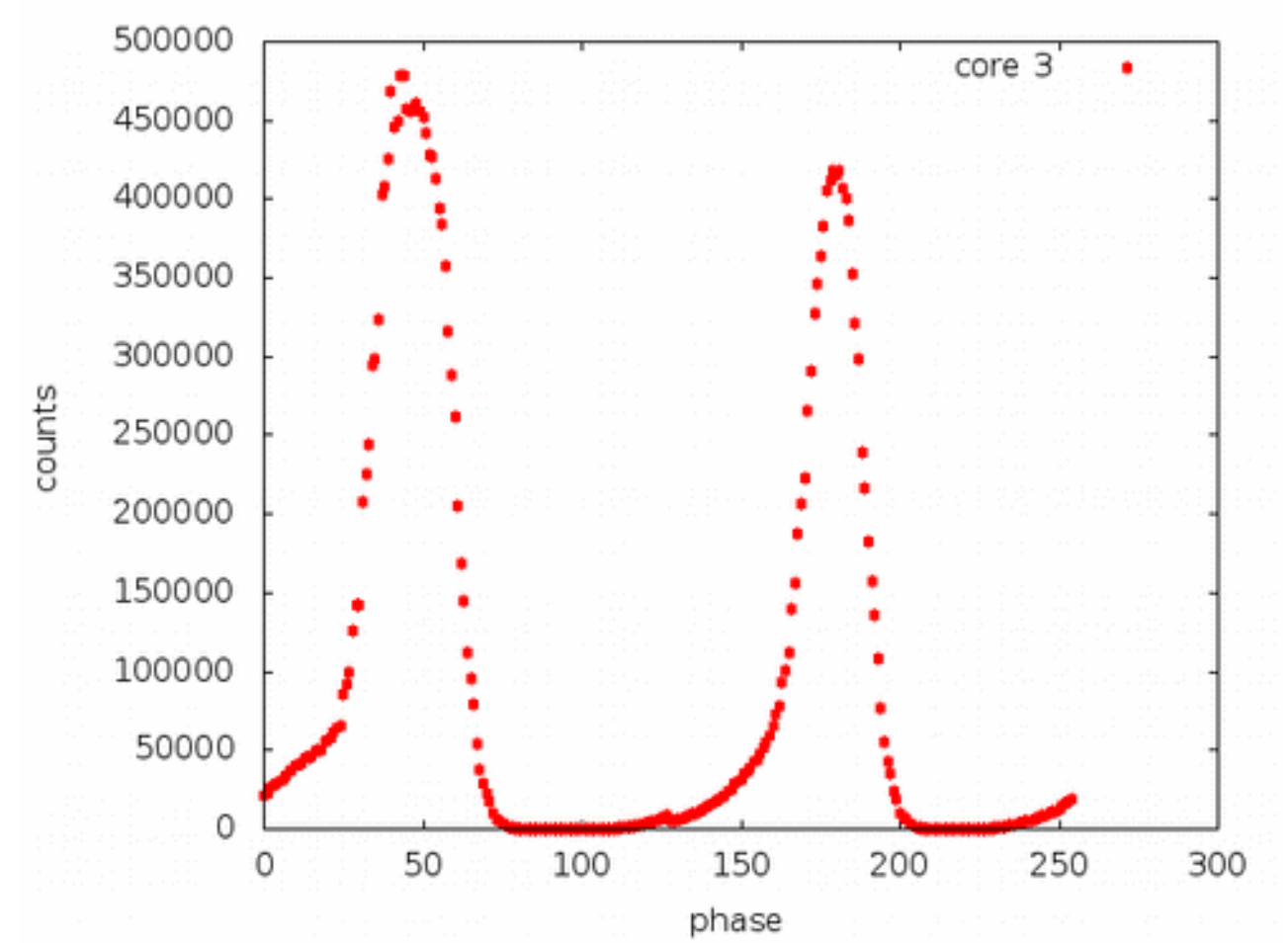
If it is not green it might help to carefully disconnect and reconnect the VSI cable on both ends, sometimes cleaning the connectors with dry air is required.

Calibration of the DBBC

Calibration or phase optimization is required at the system installation and has to be repeated after a hardware modification in the stack, transportation, or a new firmware. Periodically as a general check.

- Connect a synthesizer tuned to 764 MHz to all IFs.
- Load the firmware to test.
- Point all dbbcifa,b,c,d to this input
- Run the DBBC command: calibration=all
- … wait

Calibration of the DBBC



…

252	106	3959	16276	10431
253	135	5588	17455	10729
254	161	5276	18712	11039
255				

minM1 00050 ele1 **107** minM2 00050 ele2 **79** minM3 00049 ele3 **92** minM4 00051 ele4 **224**

….

60	270437	872	261803	16988
61	285347	653	205494	12851
62	289611	395	169170	10302
63	301585	352	144859	7090
64	309365	169	111552	3386
65	317749	102	95884	2313
66	322930	79	79745	1817
67	339064	67	54644	1305
68	332014	57	37490	881
69	338031	55	28940	526
70	324313	54	22799	296
71	320547	52	17611	223
72	310049	51	10504	187
73	276350	51	6440	148
74	260401	51	4751	106
75	251864	51	3334	84
76	204246	51	2061	76
77	169837	51	1407	60
78	149612	51	1155	56
79	97942	51	361	54
80	74886	51	228	53
81	55966	50	130	53
82	46097	51	113	53
83	28929	51	80	53
84	21030	53	69	52
85	7957	55	59	52
86	5530	55	51	52
87	2958	57	51	52
88	2078	61	50	52
89	1368	80	50	52
90	734	79	50	52
91	247	117	50	52

…

DDC configuration file

c:\DBBC_conf\dbbc_config_file_104.txt

Example:

```
1  dbbc2_ddc_v104.bit    597.00   8   ←the first number is indication of ADB1|2, in this case ADB1 is on
1  dbbc2_ddc_v104.bit    682.00   8     IFA  and ADB2 on IFB, ADB1 in IFC, no Core2 for IFD
1  dbbc2_ddc_v104.bit    853.00   8     If no Core2 is inserted in the first and second column put 0.
1  dbbc2_ddc_v104.bit    938.00   8     The second parameter is the firmware file name to be used.
1  dbbc2_ddc_v104.bit    597.00   8    The third and fourth parameters are frequency and bandwidth respectively.
1  dbbc2_ddc_v104.bit    682.00   8
1  dbbc2_ddc_v104.bit    853.00   8
1  dbbc2_ddc_v104.bit    938.00   8
1  dbbc2_ddc_v104.bit    597.00   8
1  dbbc2_ddc_v104.bit    682.00   8
1  dbbc2_ddc_v104.bit    853.00   8
1  dbbc2_ddc_v104.bit    938.00   8
1  dbbc2_ddc_v104.bit    597.00   8     Each Core2 board supports 4 bbcs so if not present 0 has to be inserted in
1  dbbc2_ddc_v104.bit    682.00   8    four lines
1  dbbc2_ddc_v104.bit    853.00   8
1  dbbc2_ddc_v104.bit    938.00   8
0   fila10g_v2_1.bit   ← if a FILA10G is installed set 1st version 1 (with ACE), 2nd version (without ACE 2), otherwise 0
1 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFA
1 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFB
1 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFC
1 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFD
0 38000                                    ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFE
0 38000                                   ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFF
0 38000                                   ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFG
0 38000                                   ← no unica=0 unica3=1, unica4=2, initial CoMos target values for IFH
107 79 92 224                          ←  phase calibration values
CAT2 1024                        ←  CAT1|2 and sampling frequency
```

Test recordings

- Test recordings are good to control the correct sampling (bit statistics), band pass shape, and pcal tones
- The Mark5B comes with a set of programs that allow to check the bit statistics (bstate), do auto- or cross correlations (vlbi2), and extract phase cal (bpcal).
- More power full are the mark5access programs:
  m5bstate, m5pcal, m5spec, m5timeseries, …
  Available from the EVN TOG wiki pages
  https://deki.mpifr-bonn.mpg.de/Working_Groups/EVN_TOG/DBBC/DBBC_Test_Procedures
- jive5ab allows to stream data directly on a local disk, which avoids to record on diskpacks and use disk2file for small tests.

Test recordings

oper@eff-mark5c-1:~$ m5spec

m5spec ver. 1.3.1 Walter Brisken, Chris Phillips 20120508

A Mark5 spectrometer. Can use VLBA, Mark3/4, and Mark5B formats using the mark5access library.

Usage : m5spec <infile> <dataformat> <nchan> <nint> <outfile> [<offset>]

<infile> is the name of the input file

<dataformat> should be of the form: <FORMAT>-<Mbps>-<nchan>-<nbit>, e.g.:
VLBA1_2-256-8-2
MKIV1_4-128-2-1
Mark5B-512-16-2
VDIF_1000-64-1-2 (here 1000 is payload size in bytes)

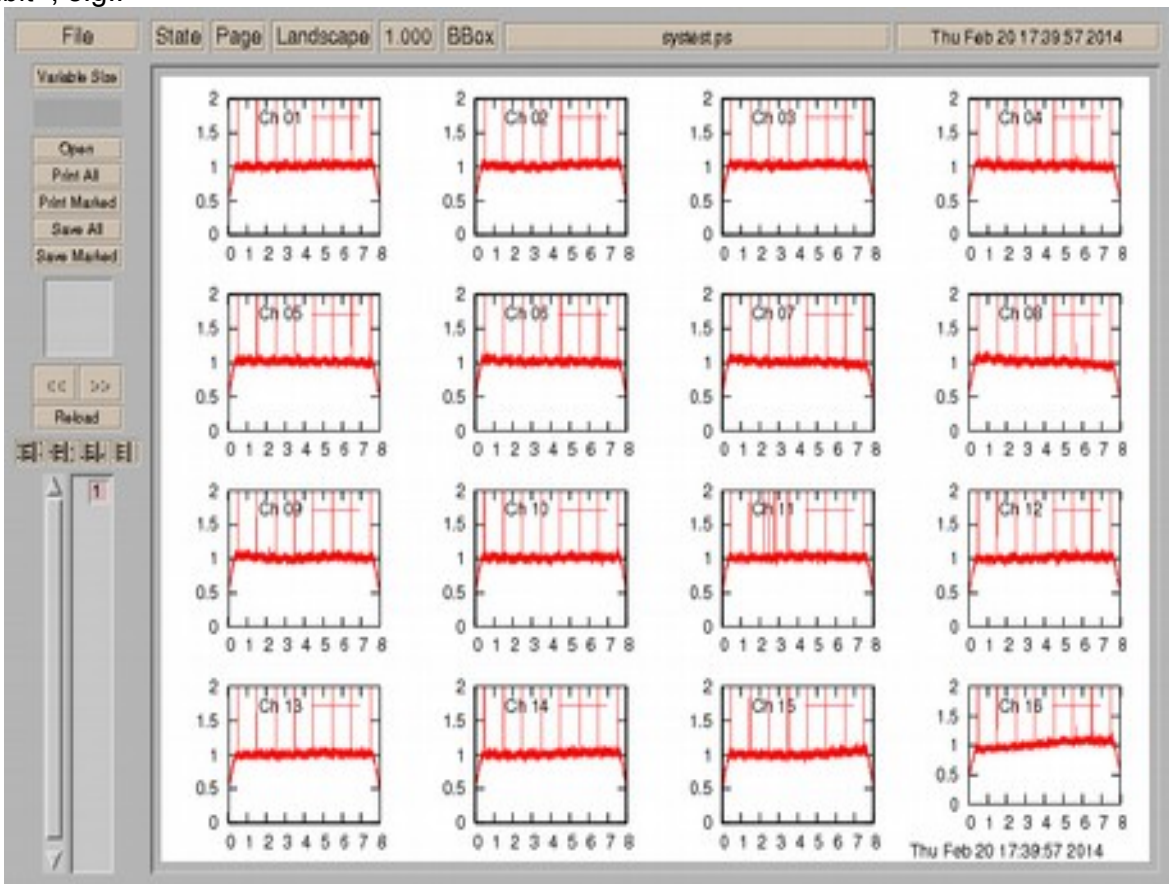
<nchan> is the number of channels to make per IF

<nint> is the number of FFT frames to spectrometize

<outfile> is the name of the output file

<offset> is number of bytes into file to start decoding

The following options are supported
-dbbc Assume dBBC polarisation order (all Rcp then all Lcp)
-nopol Do not compute cross pol terms
-help This list



Test recordings

> bstate

Usage: bstate <input m5b fname> <# frames>

> bstate n13c1_ef_no0002.m5a 200

Ch	--	-	+	++	–	-	+	++	gfact
0	88032	157895	160426	93647	17.6	32.1	31.6	18.7	1.00
1	93899	151616	154405	100080	18.8	30.9	30.3	20.0	0.95
2	92338	153774	156561	97327	18.5	31.3	30.8	19.5	0.97
3	91497	154665	157139	96699	18.3	31.4	30.9	19.3	0.97
4	84797	161299	163577	90327	17.0	32.7	32.3	18.1	1.03
5	89860	155939	158073	96128	18.0	31.6	31.2	19.2	0.98
6	88426	157547	159995	94032	17.7	32.0	31.5	18.8	1.00
7	85429	160711	162749	91111	17.1	32.5	32.1	18.2	1.02
8	89485	153806	157650	99059	17.9	31.5	30.8	19.8	0.97
9	92445	150796	154915	101844	18.5	31.0	30.2	20.4	0.95
10	89559	153929	157131	99381	17.9	31.4	30.8	19.9	0.97
11	92958	151219	155066	100757	18.6	31.0	30.2	20.2	0.95
12	89607	153163	157750	99480	17.9	31.6	30.6	19.9	0.97
13	84856	158081	162791	94272	17.0	32.6	31.6	18.9	1.01
14	84164	159461	163177	93198	16.8	32.6	31.9	18.6	1.02
15	83381	159953	163898	92768	16.7	32.8	32.0	18.6	1.02

Test recordings

- *> vlbi2*

  vlbi file1 file2 -proctime proctime [-rev <0|1>] [-2bit <0|1>] [-tforce <0|1>]

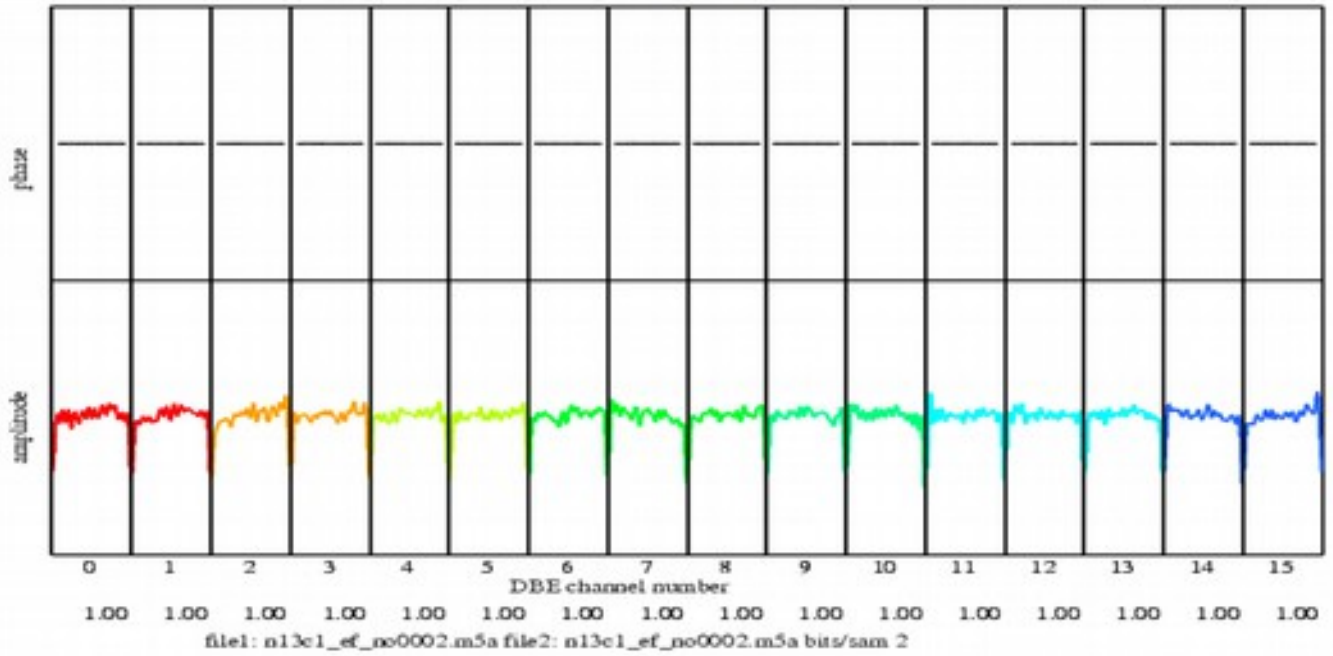
  2bit: 1 to enable 2-bit input

  rev: 1 to reverse channels in the plot

  tforce: 1 to force correlation, ignoring timestamps

  > vlbi2 n13c1_ef_no0002.m5a n13c1_ef_no0002.m5a -2bit 1 # for autocorrelation

> gv dd1.pos



Test recordings

- > bpcal
  Usage: bpcal <input m5b fname> <tone freq (KHz)> <# frames>
  > bpcal n13c1_ef_no0002.m5a 2490 500

  integration time 0.078 sec

ch	amp	phase(dg)
0	1	153.7
1	0	-93.5
2	1	83.2
3	2	-20.0
4	1	-54.9
5	2	-111.1
6	0	-179.6
7	1	-152.4
8	12	-94.5
9	11	-82.5
10	11	-69.3
11	12	-47.9
12	12	24.3
13	12	-58.8
14	10	-154.2
15	9	134.2

Field System integration

- The DBBC is fully integrated into the Field System for DDC mode operation. See /usr2/fs/misc/dbbc.txt for all details.
- There are the typical control-files that need to be adapted for a new backend and one special for the DBBC IP address:
  - *dbbad.ctl* hold the DBBC IP address
  - *equip.ctl* for the FS
  - *skedf.ctl* for DRUDG
  - Some more in point.prc, station.prc, and .Xresources

→ Once this is done the FS should be ready to DRUDG and observe DBBC schedules.

Field System integration

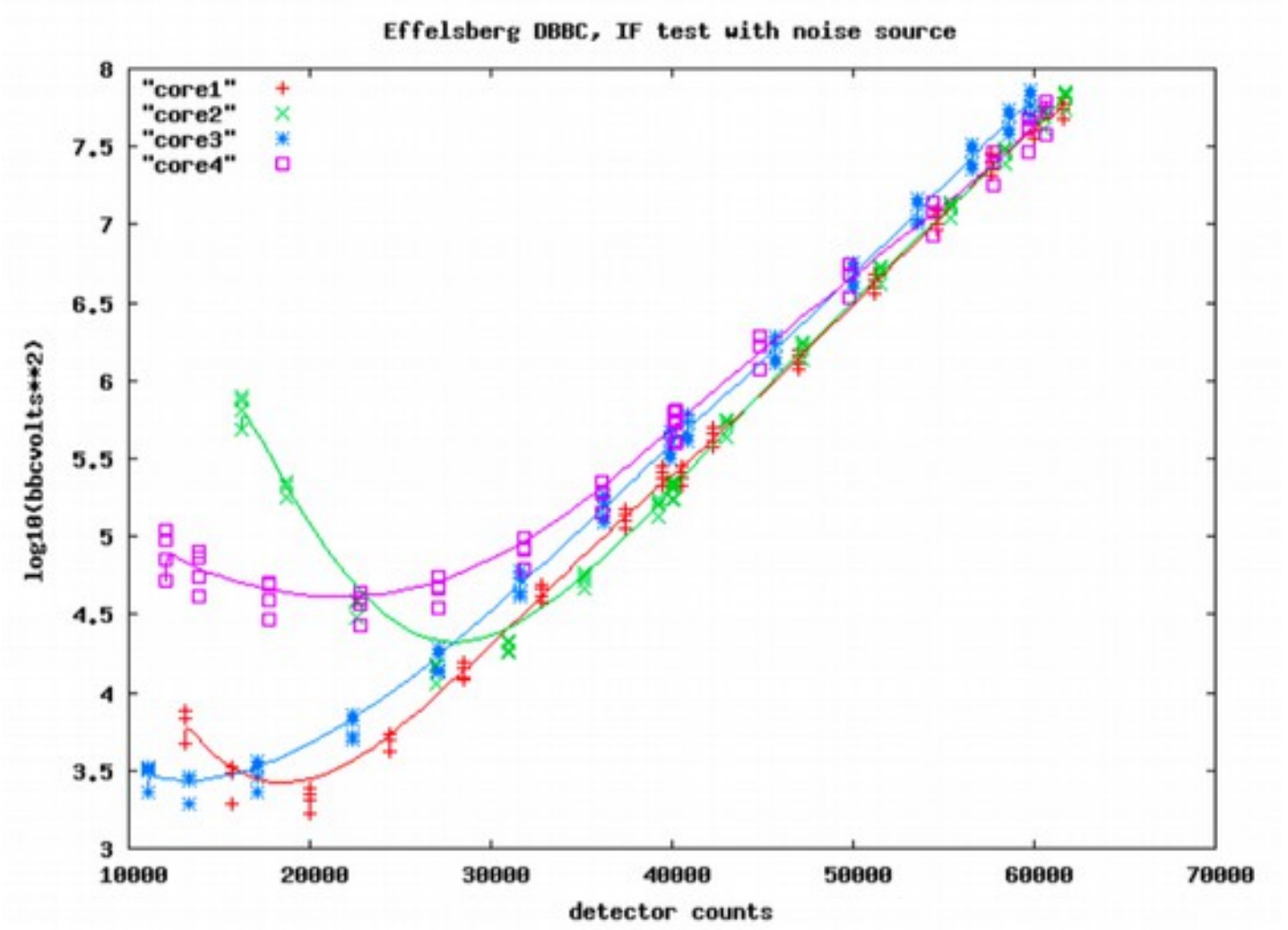
```
define  proc_library  00000000000x
" EUR135     EFLSBERG  Ef
" drudg version 2015Jan29 compiled under FS  9.11.07
"< DBBC     rack >< Mark5B   recorder 1>
enddef
define  exper_initi   00000000000x
proc_library
sched_initi
logsw_jv
mk5=DTS_id?
mk5=OS_rev?
mk5=SS_rev?
mk5=status?
enddef
define  setupsx       00000000000x
pcalon
tpicd=stop
mk5b_mode=ext,0x55555555,,8.000
mk5b_mode
form=geo
form
dbbcsx4
ifdsx
cont_cal=on,4
bbc_gain=all,agc,12000
tpicd=no,200
bank_check
tpicd
enddef
```

```
define  dbbcsx4       00000000000x
bbc01=100.99,a,4.00
bbc02=110.99,a,4.00
bbc03=140.99,a,4.00
bbc04=200.99,a,4.00
bbc05=310.99,b,4.00
bbc06=390.99,b,4.00
bbc07=440.99,b,4.00
bbc08=460.99,b,4.00
bbc09=112.99,c,4.00
bbc10=127.99,c,4.00
bbc11=137.99,c,4.00
bbc12=167.99,c,4.00
bbc13=187.99,d,4.00
bbc14=192.99,d,4.00
enddef
define  ifdsx         00000000000x
ifa=4,agc,2,38000
ifb=4,agc,2,38000
ifc=2,agc,2,38000
ifd=2,agc,2,38000
lo=loa,8110.00,usb,rcp,1
lo=lob,8110.00,usb,rcp,1
lo=loc,2100.00,usb,rcp,1
lo=lod,2100.00,usb,rcp,1
enddef
```

Estimate the best IF level

- IF commands (dbbcifa, or ifa (FS)) allow to specify values for the IF target counts where the AGC should adjusted to.
- With an increasing number of DBBCs the best target IF levels seem to cluster around 35000 to 45000 counts, but it might be worth to test those for your DBBC.
  - Best to use with a true receiver with phase-cal on.
  - Then change the attenuation in steps of 2.5 dB over the whole range, while checking detector counts, bbc counts and doing some short 10 sec recordings at the Mark5B
  - Analyse the recordings using bpcal to measure the Pcal-tone amplitudes.

Estimate the best IF level



Estimate the best IF level

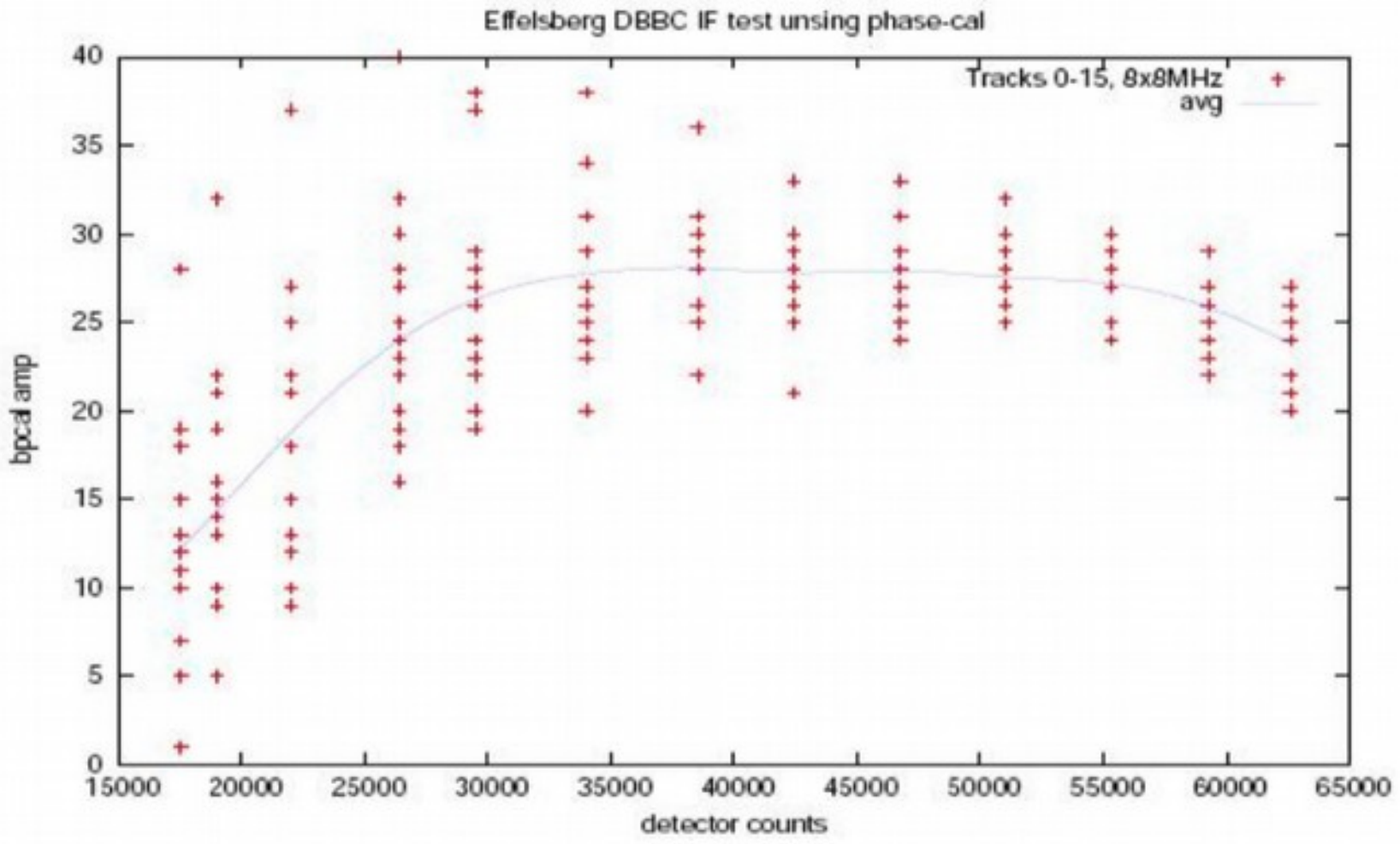
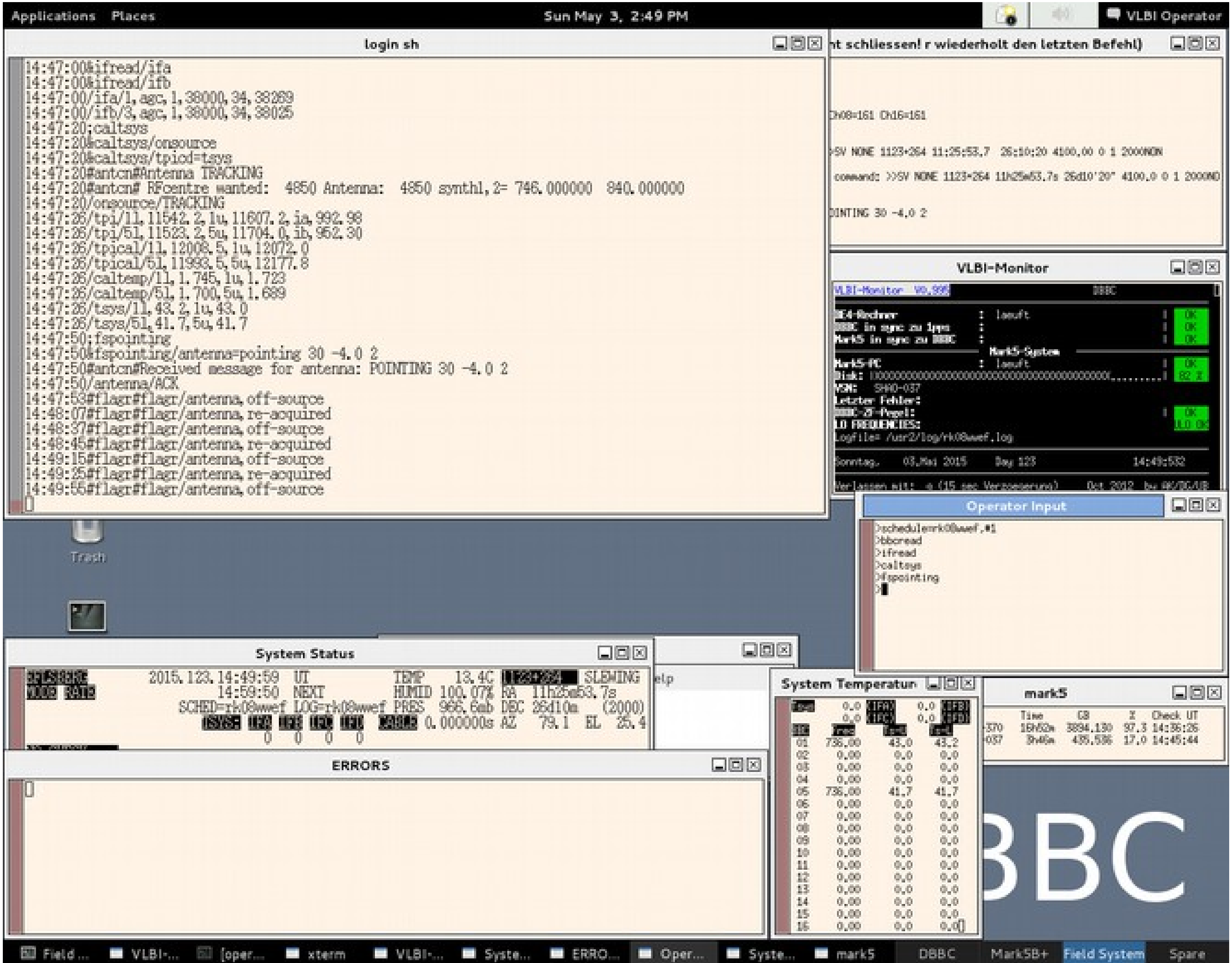


Figure 2: Phase-cal amplitude calulated by bpcal over 0.15 sec against detector counts.

Field System integration



Field System integration

VLBI - Kontrollliste / Checkliste

erstellt am: Dienstag, 28. April 2015 6:48 Uhr

Programm-Name: **rk08ww** Art: DBBC

Beginn : SUN., MAY. 03, 2015 Tag: 123 Startzeit: 15:00:00 UTC
Ende : SUN., MAY. 03, 2015 Tag: 123 Endzeit : 16:00:00 UTC

1. Quelle: 1123+264 Azimut: 80.8 Elevation: 26.9

		1. Freq		Kontrolle:
Empfaenger:		860mm		
Version:		LINE_500MHz		
Pruefen :	ULO1 -	746	MHz	○
(Empfaengerraum)	ULO2 -	840	MHz	○
	ESM1:	5		○
	RX:	2		○
SDH :	Sky_freq =	04850*LSB		○
Zusaetzlich :	XFFTS: Auf 500 MHz oder 2 GHz Filter einstellen MultiFiBa Mode auf 161, Pegel am xfftsGUI okay?			○
	ULO-Select Wahlschalter (S 315) nach unten; Phasen-Diskriminator (S 172-2) an!			○
Starten der Schedule mit:	schedule = rk08wwwf,#1 (#1= to start at the first line)			○
	Phasecal: on Bei aktiver Schedule kann mit 'phasecal = on/off' die Phasecal geschaltet werden. Zur Kontrolle sollte in den Bandpass des XFFTS gezoomt werden, dort kann man die Toene in einem Abstand von 1 MHz als Kamm sehen.			○
BBC-Pegel	Abfragen mit bbcread (zeigt auch die BBC Frequenzen an) Einstellung erfolgt automatisch, Pegel counts variable. (benutzte Videokonverter: siehe Rueckseite)			
IFD-Einstellung:	Abfrage mit ifread Einstellung erfolgt automatisch, Pegel sollte um 38000 liegen			○
Tsys messung:	caltsys (Antenne und OBSINP muessen im VLBI Modus sein) (Tsys in benutzten BBCs okay; S7 laeuft?) Tsys= _____			
(Typische Werte bei schwache Quellen: z.B. 18cm=35-40, 6cm=30-35, 5cm=30, 4cm=25-30, 1.3cm=90-100 (wetterabhaengig))				
SCHEDULE laeuft?	keine **HALT** in 'System Status' fenster			○
Aufnahme auf:	DiskPack (Rueckseite beachten!!!) Total: 83.654 GB			
Korrelator:	**** Moskau ****			
SumLo =	4100.00			
Bemerkungen:				

Nach dem Experiment:
ggf. DiskPack entnommen ○
ggf. Phasecal abgeschaltet ○
ggf. ULO-Select Wahlschalter (S 315) nach oben! ○

Angaben kontrolliert und Programm gestartet von:

Wetter: _____

Baender/DiskPacks:

01. _____ 05. _____
02. _____ 06. _____
03. _____ 07. _____
04. _____ 08. _____

Probleme, Ausfaelle:

*****Neu***:**
Die Schedules werden nicht mehr ausgedruckt, koennen aber bei Bedarf im FS PC1 VNC-Fenster mit:
/home/oper>gv /usr2/sched/Listings/rk08wwsnp.ps
/home/oper>lpr /usr2/sched/Listings/rk08wwsnp.ps
angesehen bzw. ausgedruckt werden.

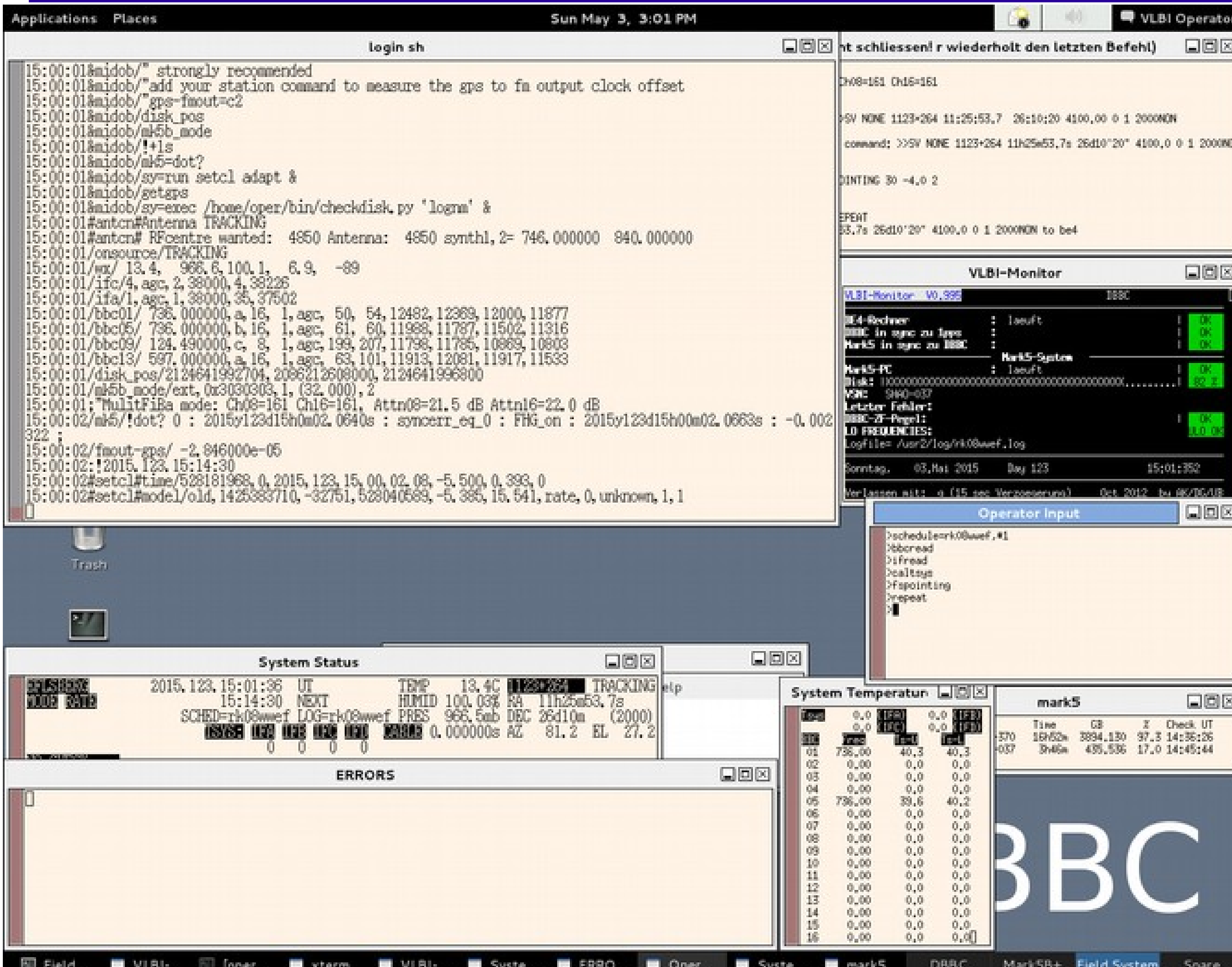
DBBC und IF Einstellung:

```
rk5b_mode=ext,0x03030303,,32.000
formastro
ifa=1,agc,1,38000
ifb=3,agc,1,38000
```

Einstellung der Videokonverter:

```
procedur  dbbc01d :
bbc01=736.00,a,16.00
bbc05=736.00,b,16.00
```

Field System integration



Field System integration

```
01#antcn# RFcentre wanted:  4850 Antenna:  4850 synth1,2= 746.000000  840.000000
15:15:01/onsource/TRACKING
15:15:01/wx/ 13.5,  966.5,  99.9,  3.5,  -89
15:15:01/ifc/4,agc,2,38000,4,37932
15:15:01/ifa/1,agc,1,38000,33,38377
15:15:01/bbc01/ 736.000000,a,16,  1,agc,  49,  53,11963,11894,11467,11389
15:15:01/bbc05/ 736.000000,b,16,  1,agc,  62,  61,12076,11881,11586,11381
15:15:01/bbc09/ 124.490000,c,  8,  1,agc, 202, 211,11244,11272,10319,10293
15:15:01/bbc13/ 597.000000,a,16,  1,agc,  63, 103,11917,11867,11927,11293
15:15:01/disk_pos/2152462417920,2124641996800,2124661996800
15:15:01/mk5b_mode/ext,0x3030303,1,(32.000),2
15:15:01;"MulitFiBa mode: Ch08=161 Ch16=161,  Attn08=21.5 dB Attn16=22.0 dB
15:15:02/mk5/!dot? 0 : 2015y123d15h15m02.0478s : syncerr_eq_0 : FHG_on : 2015y123d15h15m02.0502s : -0.00
2376 ;
15:15:02/fmout-gps/ -2.845000e-05
15:15:02:!2015.123.15:29:30
15:15:02#setcl#time/5282771971,0,2015,123,15,15,02.06,-5.228,0.643,0
15:15:02#setcl#model/old,1425383710,-32751,528040589,-5.385,15.541,rate,0,unknown,1,1
15:15:02;" Disk 00 (1.81e-03,  0.00e+00) is OK!
15:15:02;" Disk 01 (1.75e-03,  0.00e+00) is OK!
15:15:02;" Disk 02 (1.41e-03,  0.00e+00) is OK!
15:15:02;" Disk 03 (2.04e-03,  0.00e+00) is OK!
15:15:02;" Disk 04 (1.83e-03,  0.00e+00) is OK!
15:15:02;" Disk 05 (1.98e-03,  0.00e+00) is OK!
15:15:02;" Disk 06 (2.19e-03,  0.00e+00) is OK!
15:15:02;" Disk 07 (2.00e-03,  0.00e+00) is OK!
```

```
>SV NONE 1123+264 11:25:53.7  26:10:20 4100.00 0 1 2000NON
>SV NONE 1123+264 11:25:53.7  26:10:20 4100.00 0 1 2000NON
>SV NONE 1123+264 11:25:53.7  26:10:20 4100.00 0 1 2000NON
>SV NONE 1123+264 11:25:53.7  26:10:20 4100.00 0 1 2000NON
```

VLBI-Monitor

```
VLBI-Monitor V0.995                                   DBBC
DE4-Rechner          : laeuft                    | OK
DBBC in sync zu 1pps :                           | OK
Mark5 in sync zu DBBC:                           | OK
                       Mark5-System
Mark5-PC             : laeuft                    | OK
Disk: |XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX,.......| 84 %
VSN:  SHAO-037
Letzter Fehler:
DBBC-ZF-Pegel:                                   | OK
LO FREQUENCIES:                                  LO 02
Logfile= /usr2/log/rk08wwef.log

Sonntag,   03.Mai 2015     Day 123                15:16:31
Verlassen mit:  q (15 sec Verzoegerung)     Oct 2012  bu MK/DG/JB
```

Operator Input

```
>schedule=rk08wwef,#1
>bbcread
>ifread
>caltsys
>fspointing
>repeat
>
```

System Status

```
DISPLBENC          2015.123.15:16:33  UT          TEMP    13.6C  1123+264   TRACKING
MODE  RATE              15:29:30  NEXT          HUMID   99.87% RA  11h25m53.7s
                SCHED=rk08wwef LOG=rk08wwef PRES  966.6mb DEC 26d10m    (2000)
                 SYS  LO1  LO2  LO3  LO4  CABLE 0.000000s AZ   83.9  EL   29.6
                   0    0    0    0
```

ERRORS

System Temperatur

Ifa	0.0	(IFA)	0.0	(IFB)
Ifc	0.0	(IFC)	0.0	(IFD)

BBC	Freq	Ta-U	Ta-L
01	736.00	38.3	38.4
02	0.00	0.0	0.0
03	0.00	0.0	0.0
04	0.00	0.0	0.0
05	736.00	38.8	38.1
06	0.00	0.0	0.0
07	0.00	0.0	0.0
08	0.00	0.0	0.0
09	0.00	0.0	0.0
10	0.00	0.0	0.0
11	0.00	0.0	0.0
12	0.00	0.0	0.0
13	0.00	0.0	0.0
14	0.00	0.0	0.0
15	0.00	0.0	0.0
16	0.00	0.0	0.0

mark5

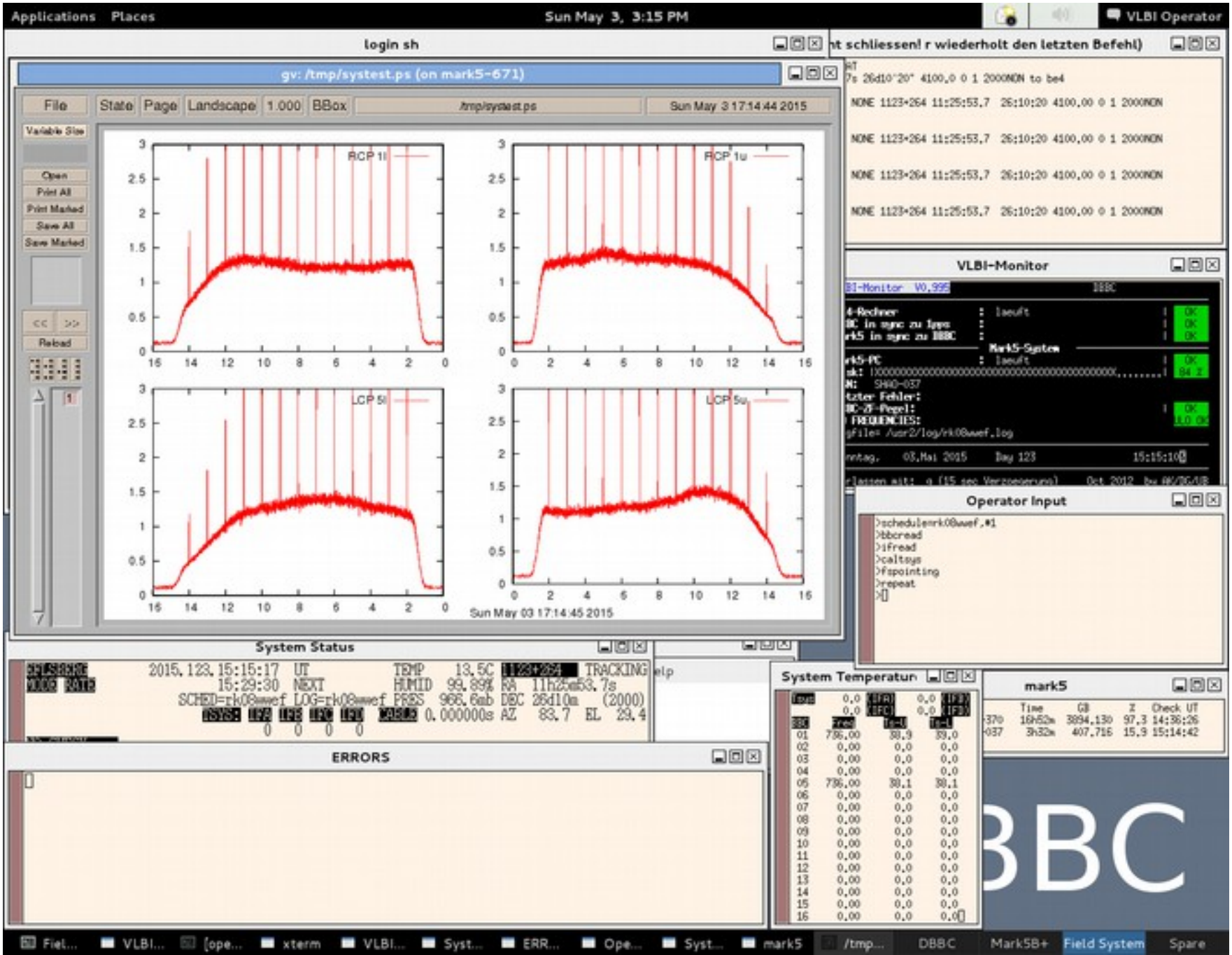
	Time	GB	%	Check UT
:370	16h52m	3894.130	97.3	14:36:26
:037	3h32m	407.716	15.9	15:14:42

BBC

Trash

Field... | VLBI-... | [oper... | xterm | VLBI-... | Syste... | ERRO... | Oper... | Syste... | mark5 | DBBC | Mark5B+ | Field System | Spare

Field System integration



Field System integration