RN3 — WP 11 JRA DIVA

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EVN-TOG Madrid 2016

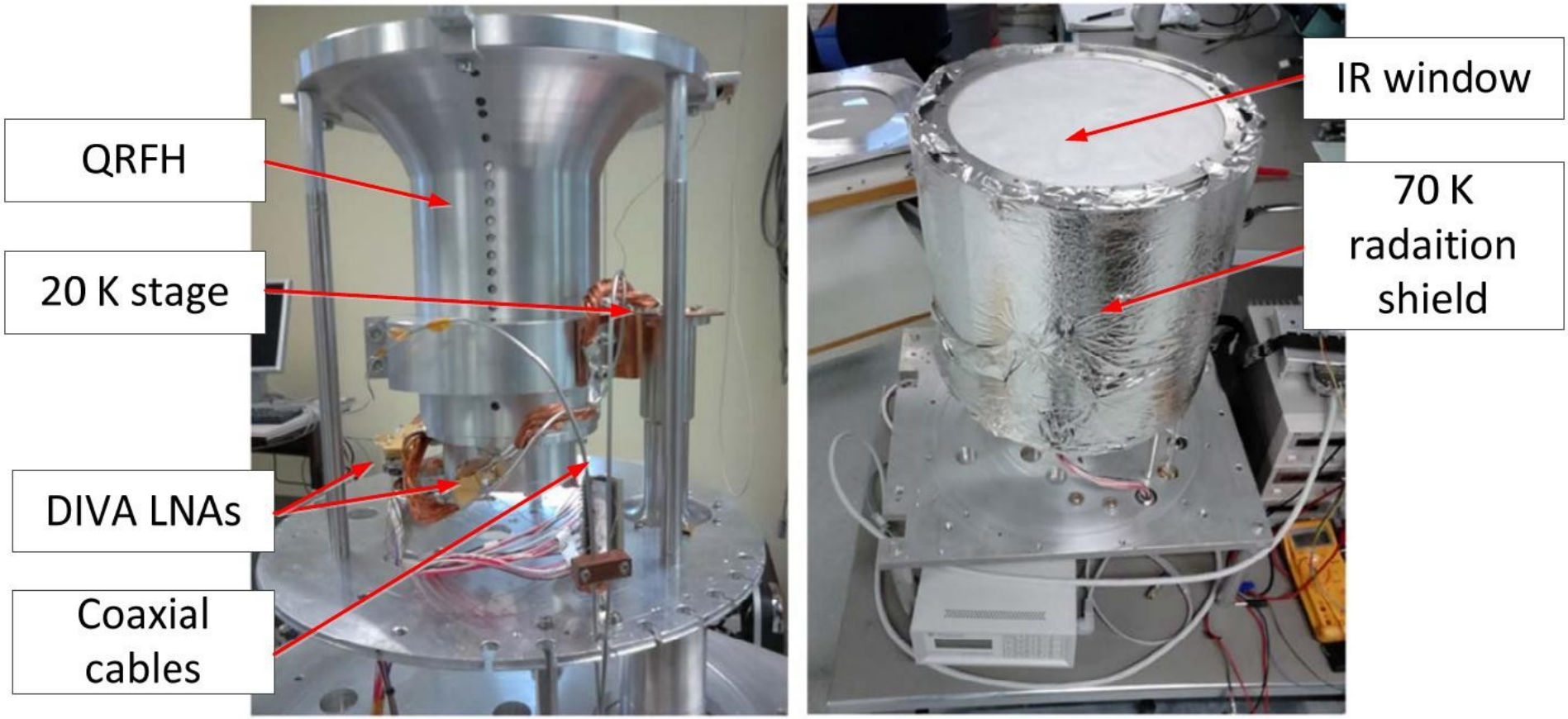
Contract No: 283393

RadioNet3 - DIVA – Task 1: wide-band receiver

Two VLBI-related (and SKA-related) Tasks

Task 1: Low noise wide-band integrated receiver for VLBI and SKA

- MMIC Design – 1.5 GHz to 5.5 GHz
- Normal machined metal housing for MMIC
- QRFH feed
- Dewar
- Tested in the lab
  - Receiver noise of about 15 K between 3 GHz and 5.5 GHz
- Partners: ASTRON, OSO, MPG, IAF



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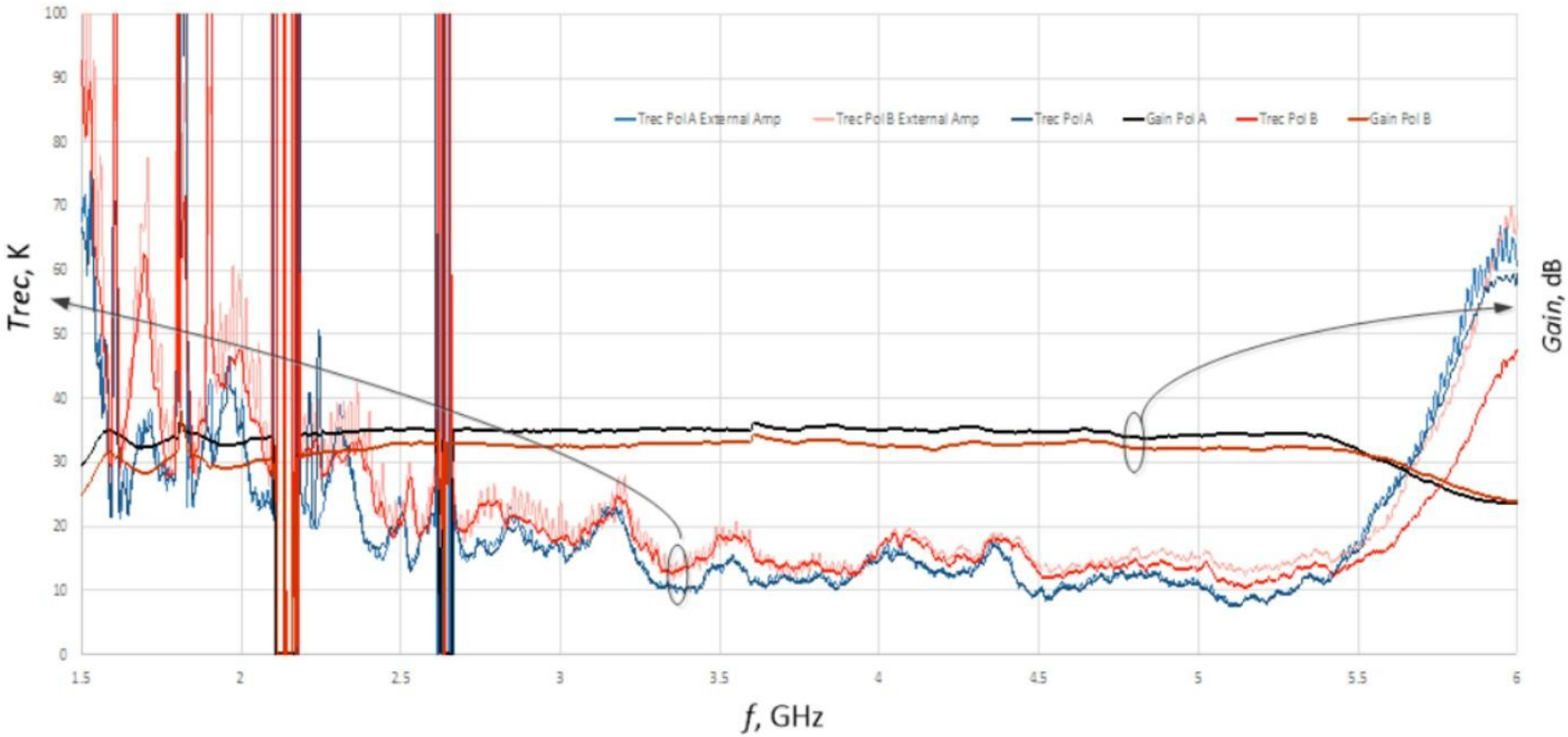

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RadioNet3 - DIVA – Task 2: DBBC3

Task 2: DBBC3 VLBI backend (32 Gbps)

- Analogue board with downconverter
- 4 GHz wide ADC (ADB3L) (4x 1GHz interleaved)
- Virtex 7 processing board (CORE3H)
  - “DBBC2 firmware”, wide-band DSC mode, more....
- FiLA40G postprocessor (fast server + disks)
  - VDIF threading, corner turning, decimation, ...
- Test in lab: zero-baseline
- VLBI: Onsala – Effelsberg (@ 16 Gbps, 1 pol)
  - Fringes with OSO DBBC3 to DBBC2s

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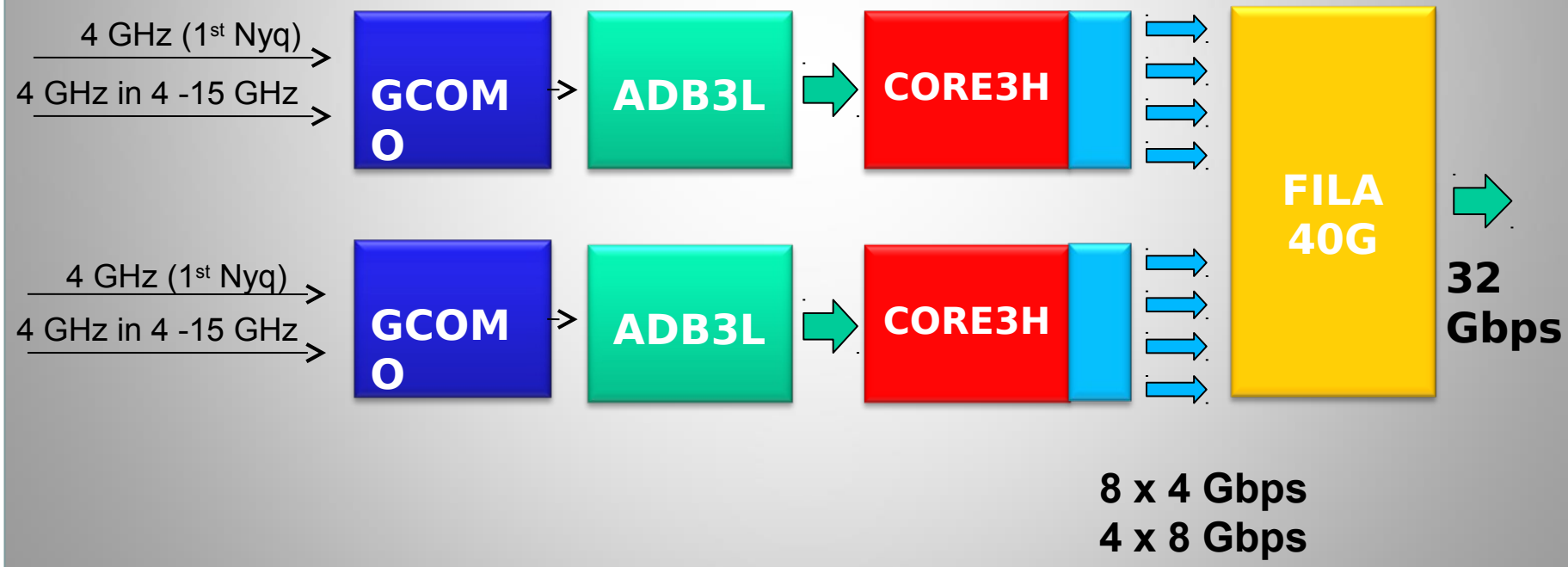
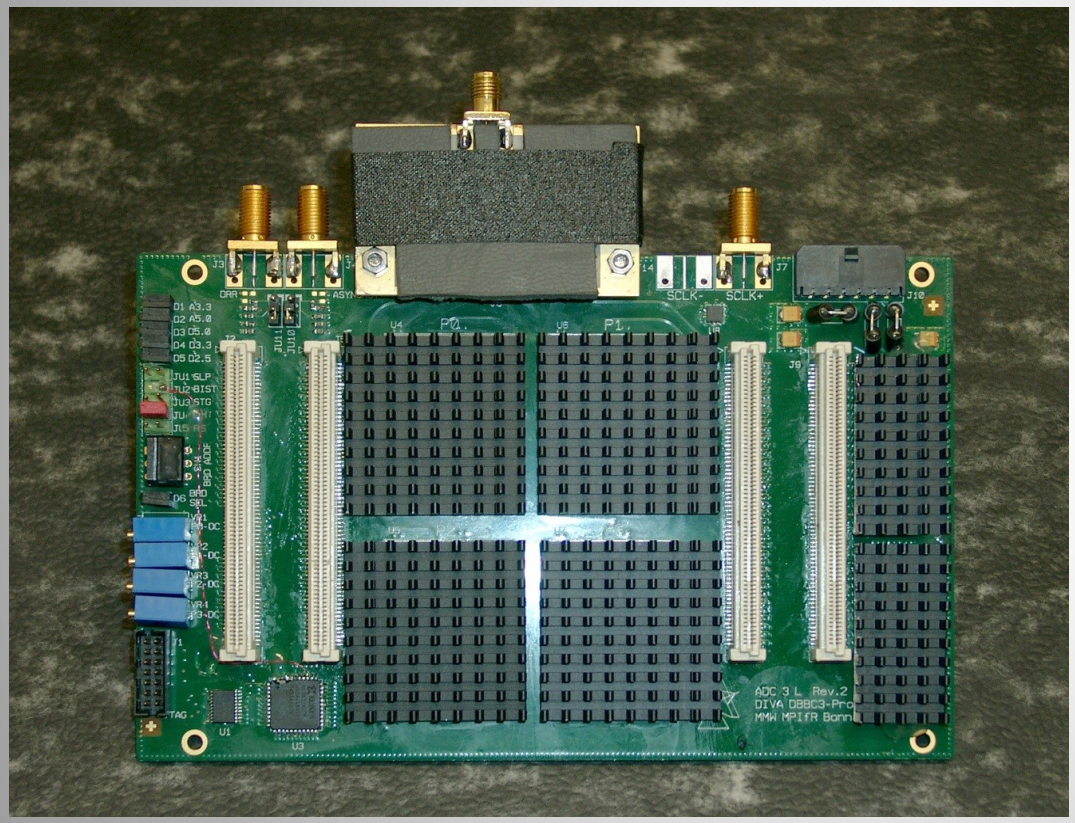
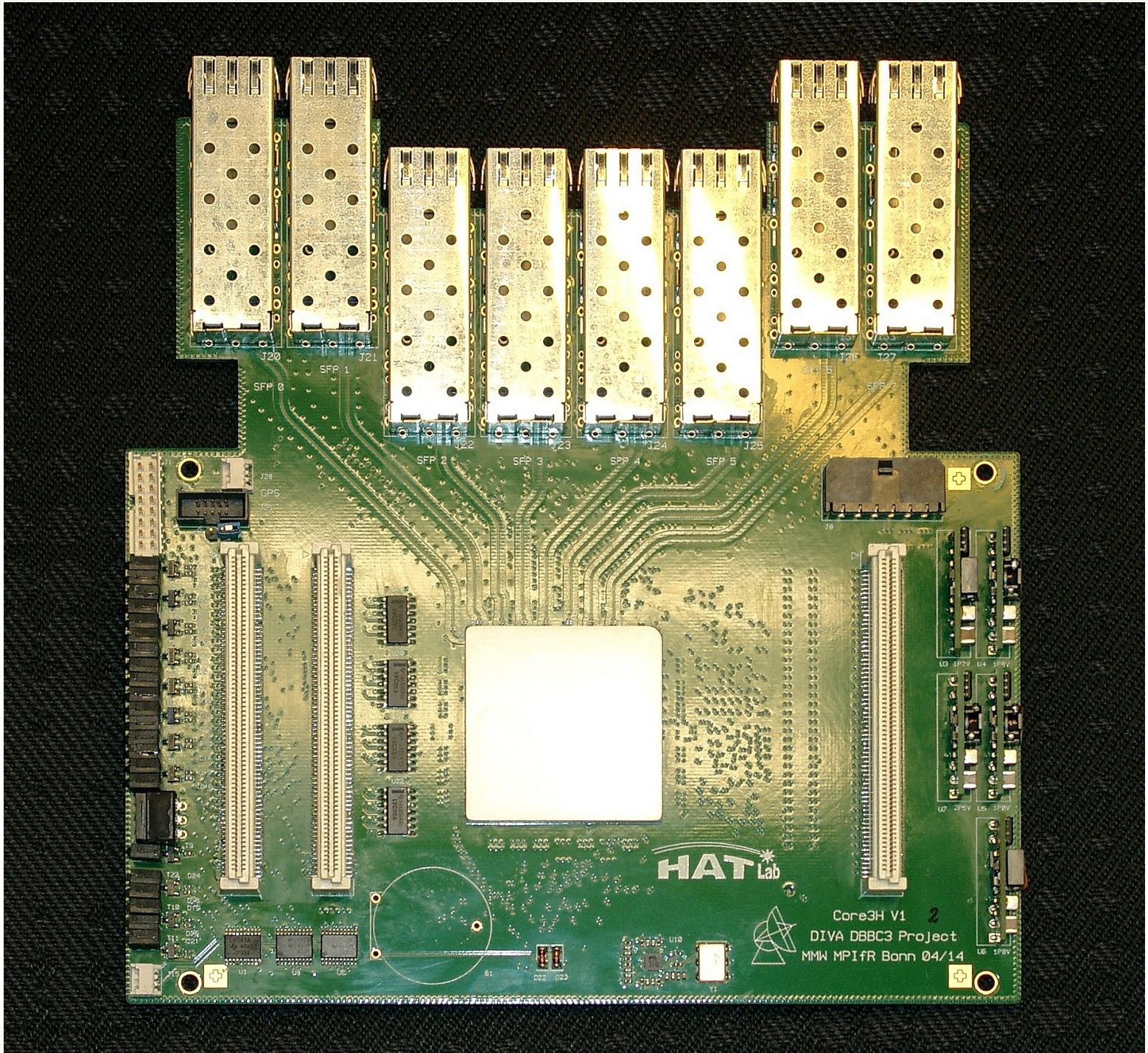
DBBC3L-2L2H Architecture



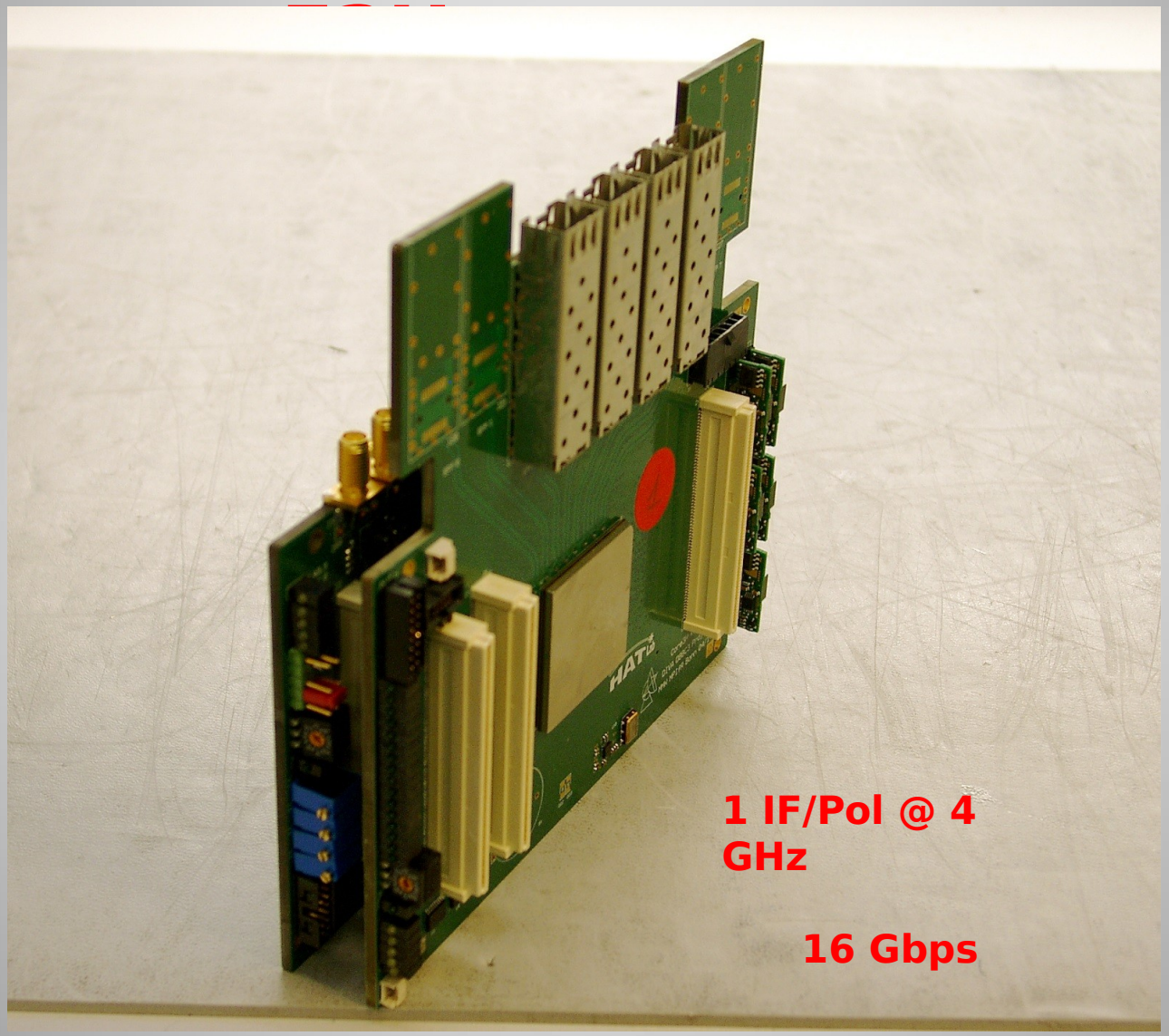
ADB3L



- Number of IFs: **1 - 4**
- Equivalent Sample Rate IF: **8 GSps**
- Instantaneous bandwidth: **4 GHz**
- Sampling representation: **10 bit**
- Real/Complex Sampling
- Compatibility with existing DBBC


J20
J21
J22
J23
J24
J25
J26
J27
SFP 0
SFP 1
SFP 2
SFP 3
SFP 4
SFP 5
SFP 6
SFP 7
GPS
HAT Lab
Core3H V1
DIVA DBBC3 Project
MMW MPIfR Bonn 04/14

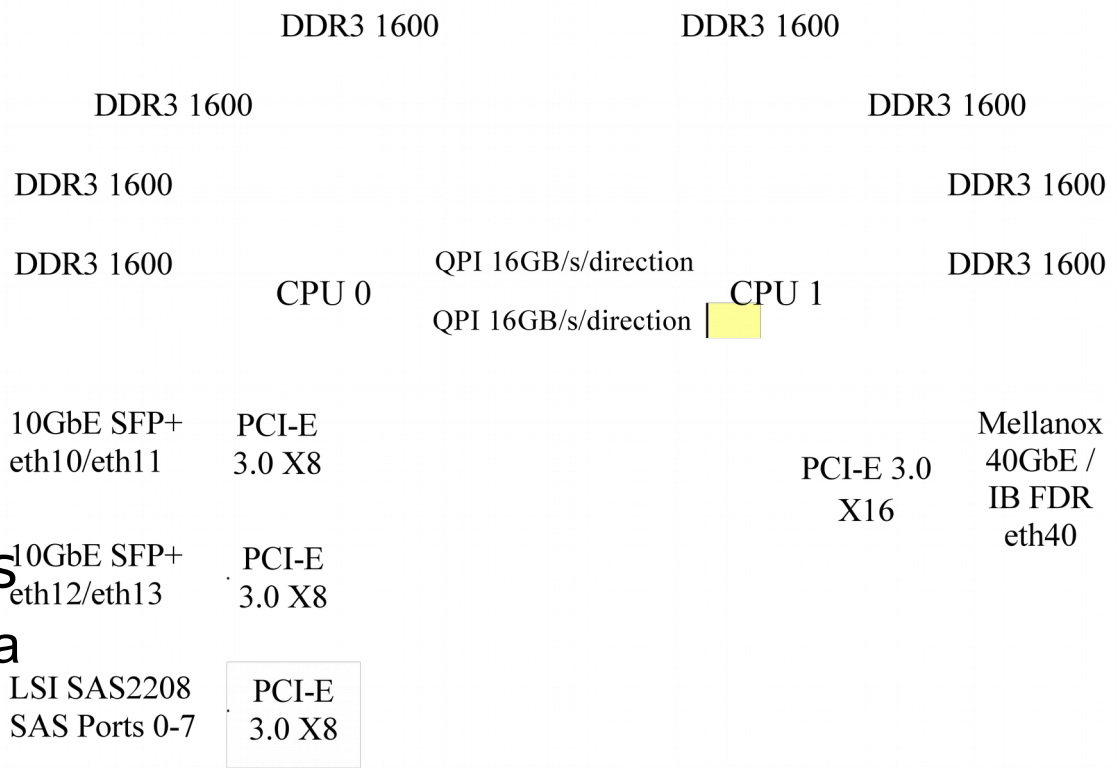
ADB3L+COR

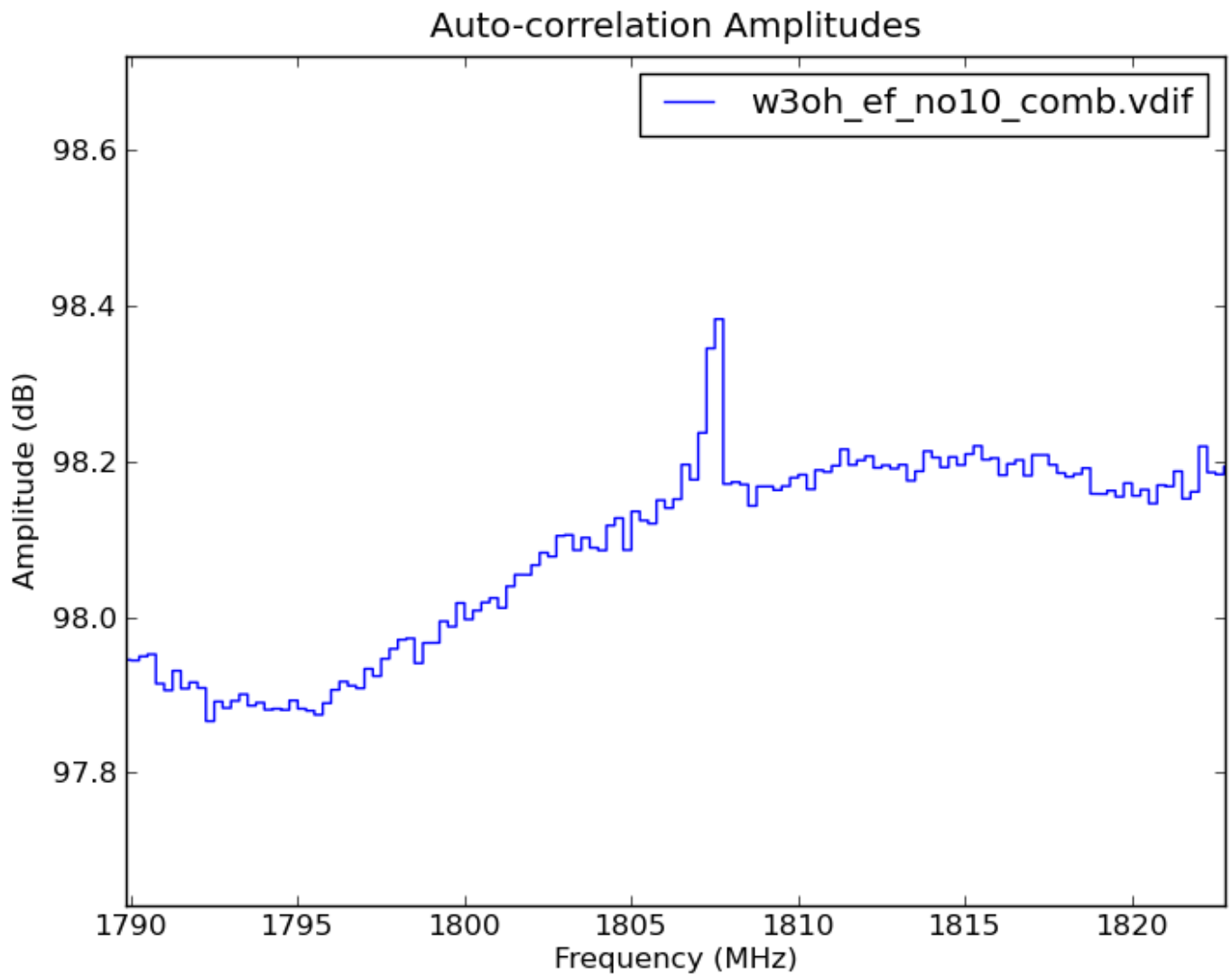


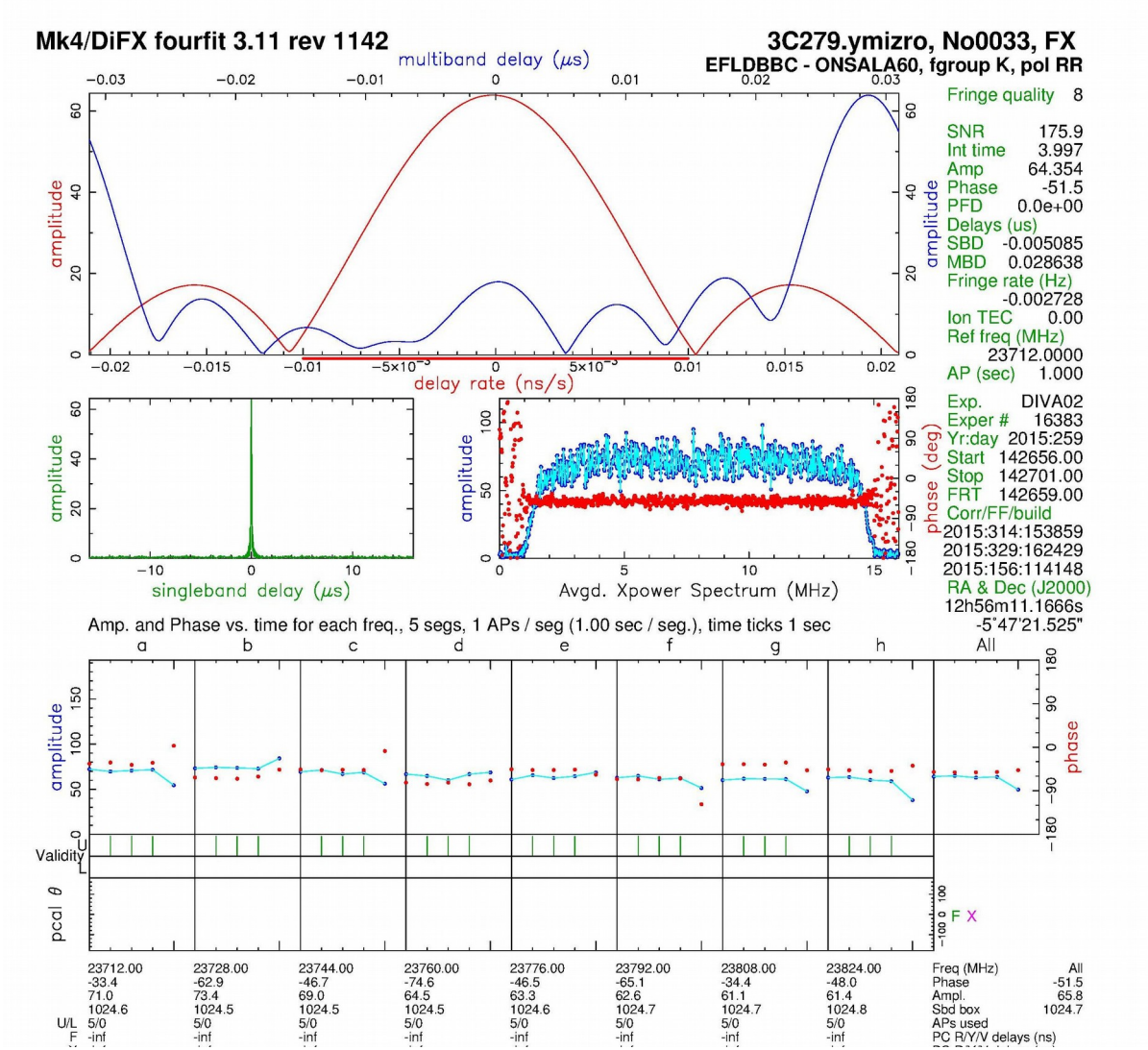

DBBC 3
EUROPEAN
NETWORK
HAT Lab
RadioNet

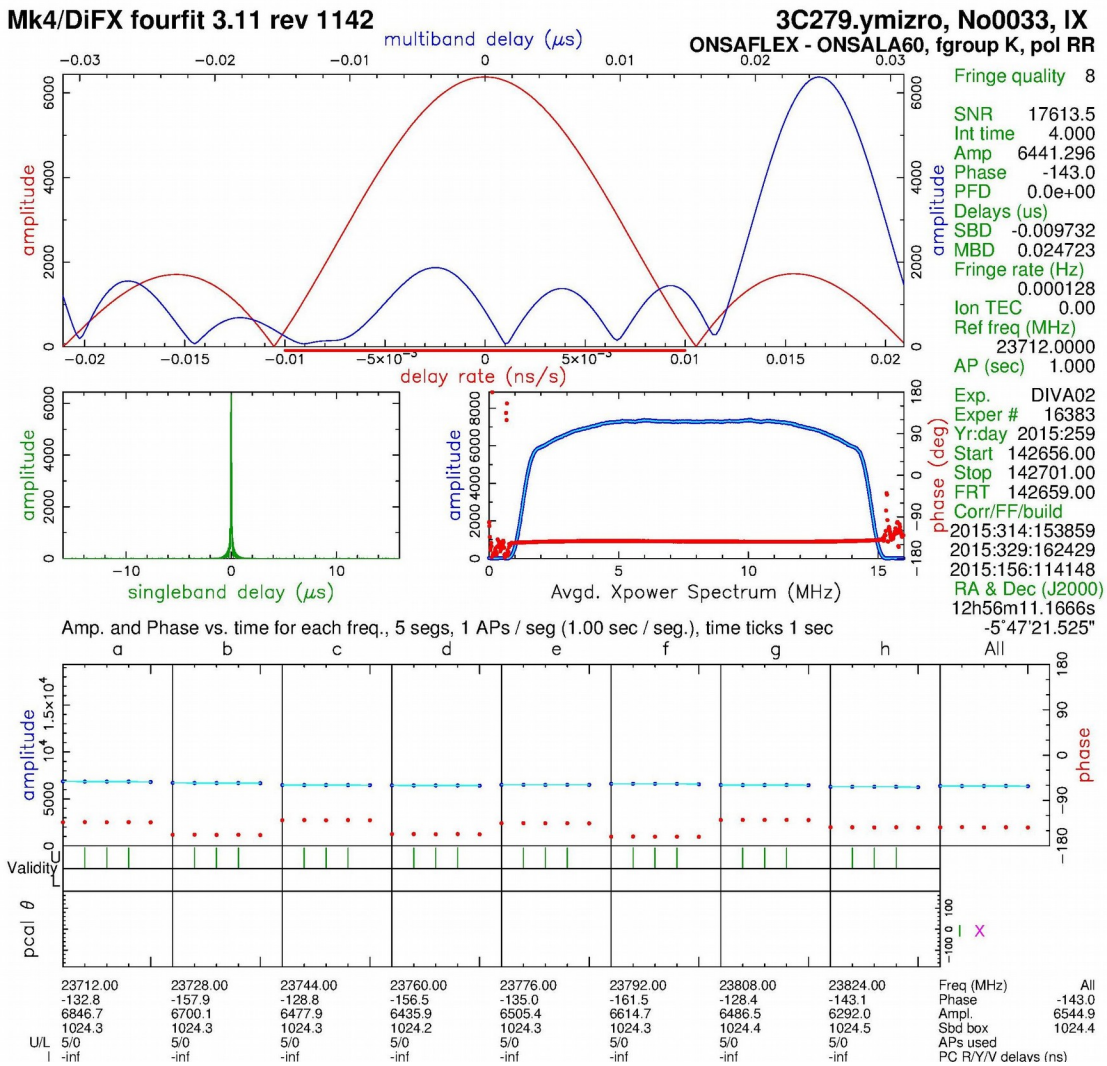
FILA40G Architecture for 32 Gbps

- 2 x Intel Xeon E5-2670
  - 8 core 2.60 GHz
- 8 x 8GB DDR3 1600
- 8 Onboard SAS2 ports
- 4 free PCI 3.0 x8 slots
  - To be used to add extra SAS2/3 ports




Auto-correlation Amplitudes
w3oh_ef_no10_comb.vdif
98.6
98.4
98.2
98.0
97.8
Amplitude (dB)
1790
1795
1800
1805
1810
1815
1820
Frequency (MHz)


Mk4/DiFX fourfit 3.11 rev 1142
3C279.ymizro, No0033, FX
EFLDBBC - ONSALA60, fgroup K, pol RR
multiband delay (μs)
amplitude
delay rate (ns/s)
singleband delay (μs)
Avgd. Xpower Spectrum (MHz)
phase (deg)
Fringe quality 8
SNR 175.9
Int time 3.997
Amp 64.354
Phase -51.5
PFD 0.0e+00
Delays (us)
SBD -0.005085
MBD 0.028638
Fringe rate (Hz)
-0.002728
Ion TEC 0.00
Ref freq (MHz)
23712.0000
AP (sec) 1.000
Exp. DIVA02
Exper # 16383
Yr:day 2015:259
Start 142656.00
Stop 142701.00
FRT 142659.00
Corr/FF/build
2015:314:153859
2015:329:162429
2015:156:114148
RA & Dec (J2000)
12h56m11.1666s
-5°47'21.525"
Amp. and Phase vs. time for each freq., 5 segs, 1 APs / seg (1.00 sec / seg.), time ticks 1 sec
a b c d e f g h All
Validity
pcal θ
F X
23712.00 23728.00 23744.00 23760.00 23776.00 23792.00 23808.00 23824.00
-33.4 -62.9 -46.7 -74.6 -46.5 -65.1 -34.4 -48.0
71.0 73.4 69.0 64.5 63.3 62.6 61.1 61.4
1024.6 1024.5 1024.5 1024.5 1024.6 1024.7 1024.7 1024.8
U/L 5/0 5/0 5/0 5/0 5/0 5/0 5/0 5/0
F -inf -inf -inf -inf -inf -inf -inf -inf
Freq (MHz) All
Phase -51.5
Ampl. 65.8
Sbd box 1024.7
APs used
PC R/Y/V delays (ns)


Mk4/DiFX fourfit 3.11 rev 1142
3C279.ymizro, No0033, IX
ONSAFLEX - ONSALA60, fgroup K, pol RR
multiband delay (μs)
amplitude
delay rate (ns/s)
singleband delay (μs)
Avgd. Xpower Spectrum (MHz)
phase (deg)
Fringe quality 8
SNR 17613.5
Int time 4.000
Amp 6441.296
Phase -143.0
PFD 0.0e+00
Delays (us)
SBD -0.009732
MBD 0.024723
Fringe rate (Hz)
0.000128
Ion TEC 0.00
Ref freq (MHz)
23712.0000
AP (sec) 1.000
Exp. DIVA02
Exper # 16383
Yr:day 2015:259
Start 142656.00
Stop 142701.00
FRT 142659.00
Corr/FF/build
2015:314:153859
2015:329:162429
2015:156:114148
RA & Dec (J2000)
12h56m11.1666s
-5°47'21.525"
Amp. and Phase vs. time for each freq., 5 segs, 1 APs / seg (1.00 sec / seg.), time ticks 1 sec
a b c d e f g h All
amplitude
phase
Validity
pcal θ
23712.00 23728.00 23744.00 23760.00 23776.00 23792.00 23808.00 23824.00
-132.8 -157.9 -128.8 -156.5 -135.0 -161.5 -128.4 -143.1
6846.7 6700.1 6477.9 6435.9 6505.4 6614.7 6486.5 6292.0
1024.3 1024.3 1024.3 1024.2 1024.3 1024.3 1024.4 1024.5
U/L 5/0 5/0 5/0 5/0 5/0 5/0 5/0 5/0
I -inf -inf -inf -inf -inf -inf -inf -inf
Freq (MHz) All
Phase -143.0
Ampl. 6544.9
Sbd box 1024.4
APs used
PC R/Y/V delays (ns)

Firmware under development

- **DSC @4 GHz**
- **PFB @ 256 MHz**
- **DDC @ 128-64-32-16-8 MHz**

…. plus “DBBC2” firmware (partially ported)