

Results from the Yebes RAEGE telescope



P. de Vicente

Observatorio de Yebes - CDT (IGN)



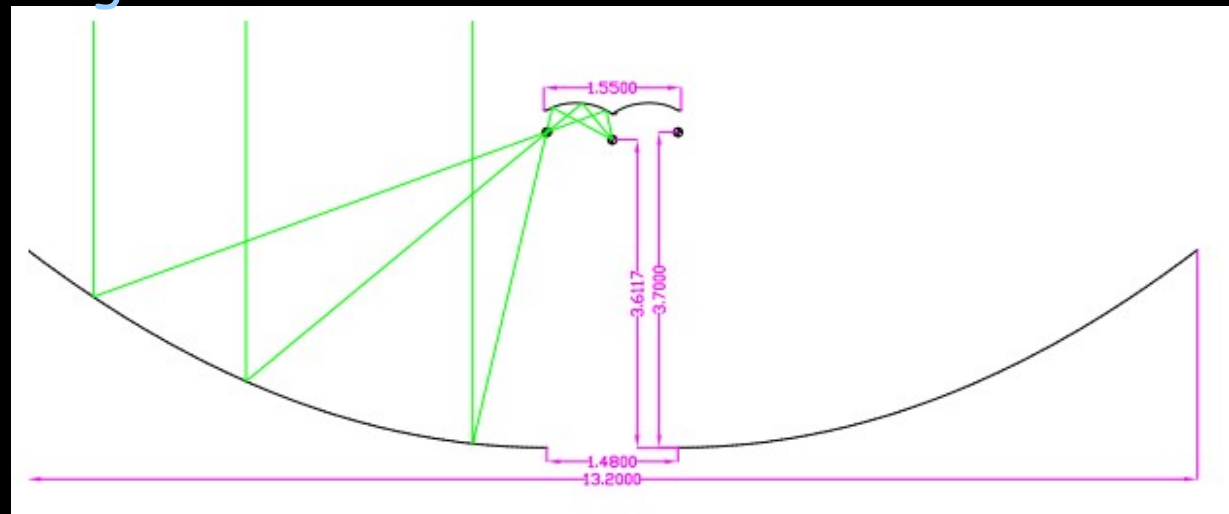
MINISTERIO
DE FOMENTO

DIRECCIÓN GENERAL
DEL INSTITUTO
GEOGRÁFICO
NACIONAL

OBSERVATORIO
ASTRONÓMICO
NACIONAL

The telescope

- Designed by Mt-Mechatronics
- Mechanics built by Asturfeito
- Telescope finished by end of 2013
- Diameter: 13.2 m
- Max. Az. speed: 12 degs /s
Max. El. speed: 6 degs /s
- Subreflector shape: ring focus



The telescope



El cabin:
Receivers + com.

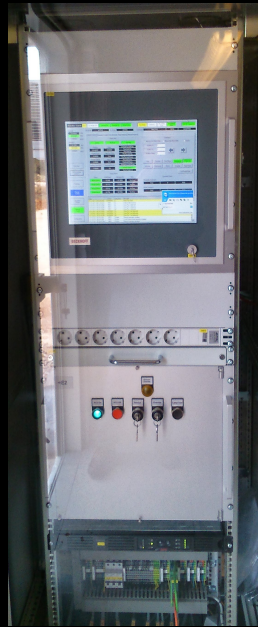
Az cabin:
encoders + HCU

Tower basement
Cable grnd. unit

Container: Servos + ACU

The Antenna Control Unit

Main axes ACU



Hexapod CU



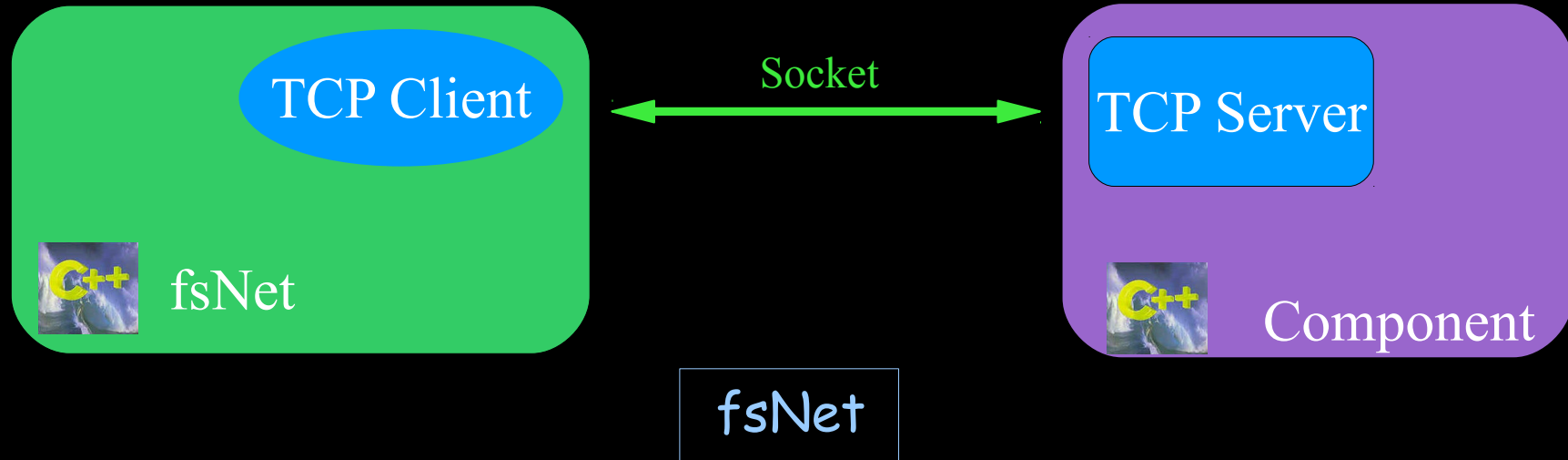
- Runs Windows with real time kernel: TwinCAT from Beckhoff
- Requires IRIG-B signal to keep UTC
- Local Control Panel & Handheld panel (emergency cases)

Remote Control System

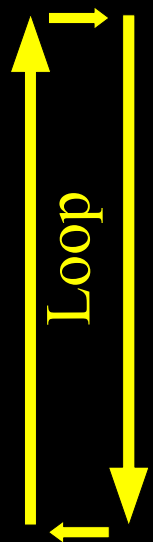
CORBA
via Alma Common Software



The Field System connection



Opens 1 (or 2) socket (s)



Reads shared memory (local + FS)

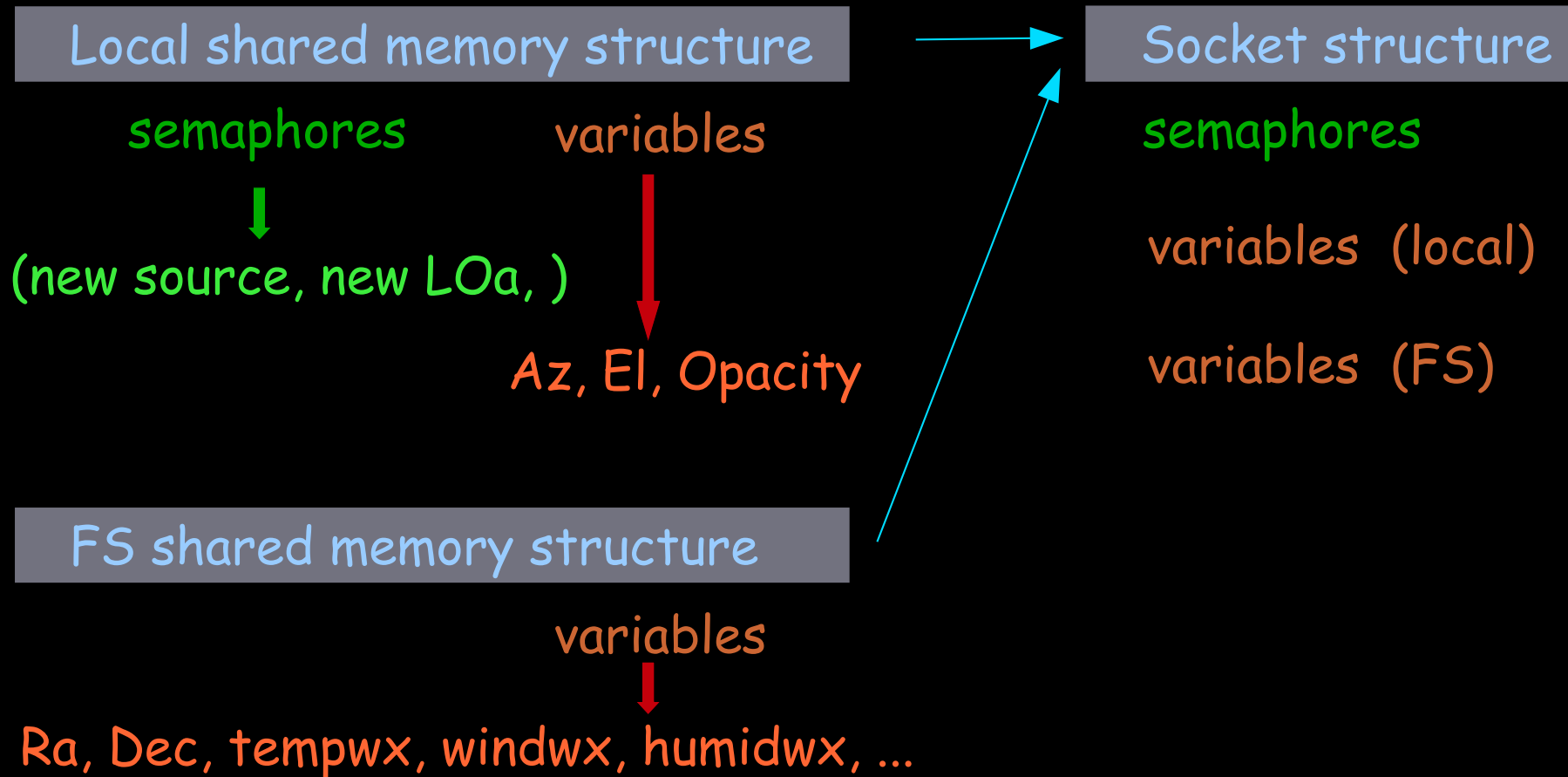
Copies part of the shared memory to an internal structure

Sends the structure

Receives the structure

Copies the internal structure to shared memory (local + FS)

The Field System connection



The Field System connection

TCP client exchanges a structure with

Variables

- source position
- LO frequencies
- calibration mode
- ← weather status
- ← antenna position

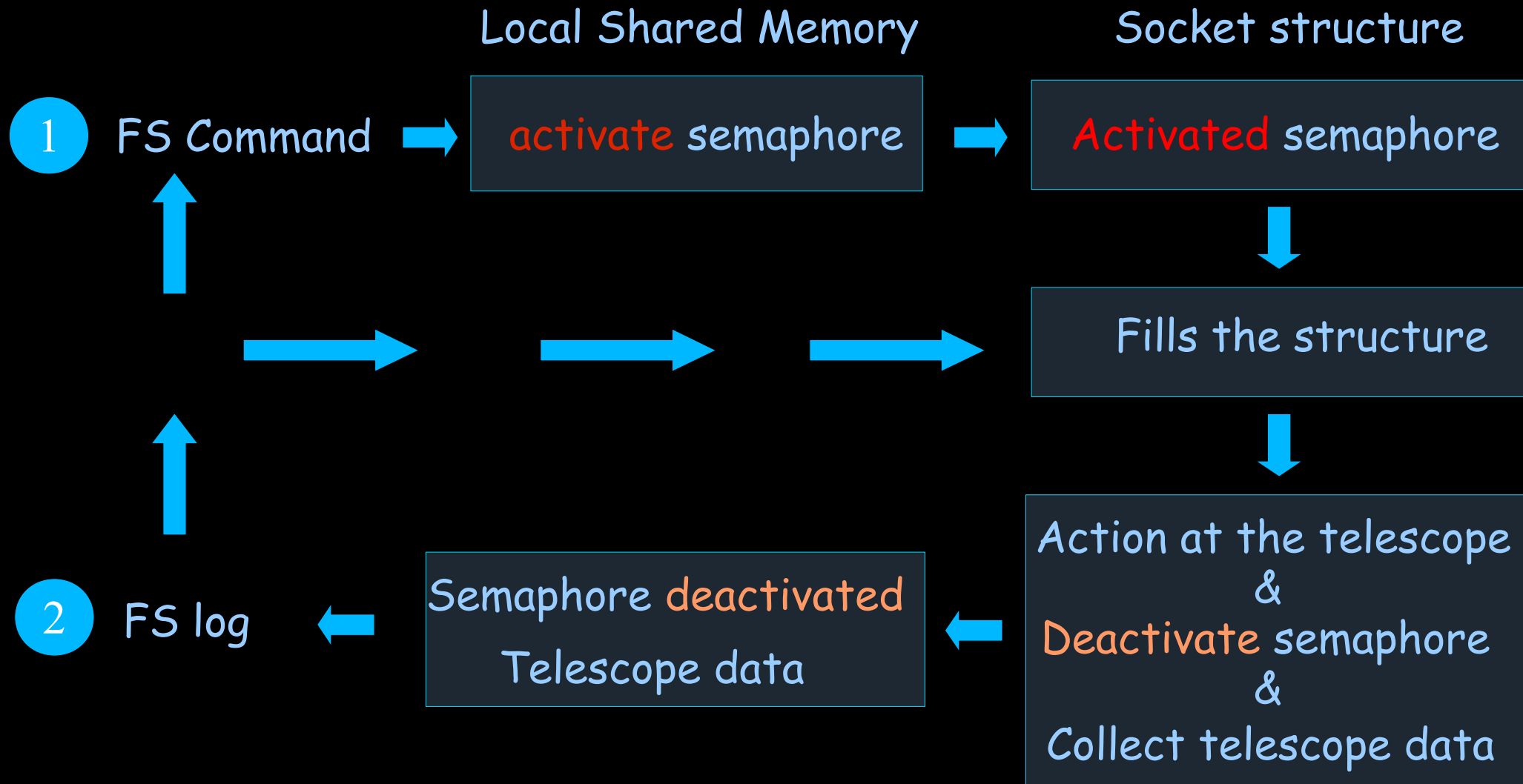
FS

Semaphores

- ↔ New source
- ↔ New LO
- ↔ Cal. op. required
- ↔ Stow

RT

The Field System connection



Exporting the code

- Used at:

Ishioka (for the commissioning phase - Toyo)

- Will be used at:

Ny Alesund

Other antennas by MT-Mechatronics ?

- Connection to Field System easily adapted to a twin telescope

Local connection and data transport

Data is transferred via optical fiber to the 40m backends room

Current SD backends: Continuum detectors

Possibility to connect an FFTS



— Multimode fiber

Data / Control

— Monomode fiber

IF (2.5 GHz)

+

5 MHz, IRIG-B,
80 Hz

VLBI equipment

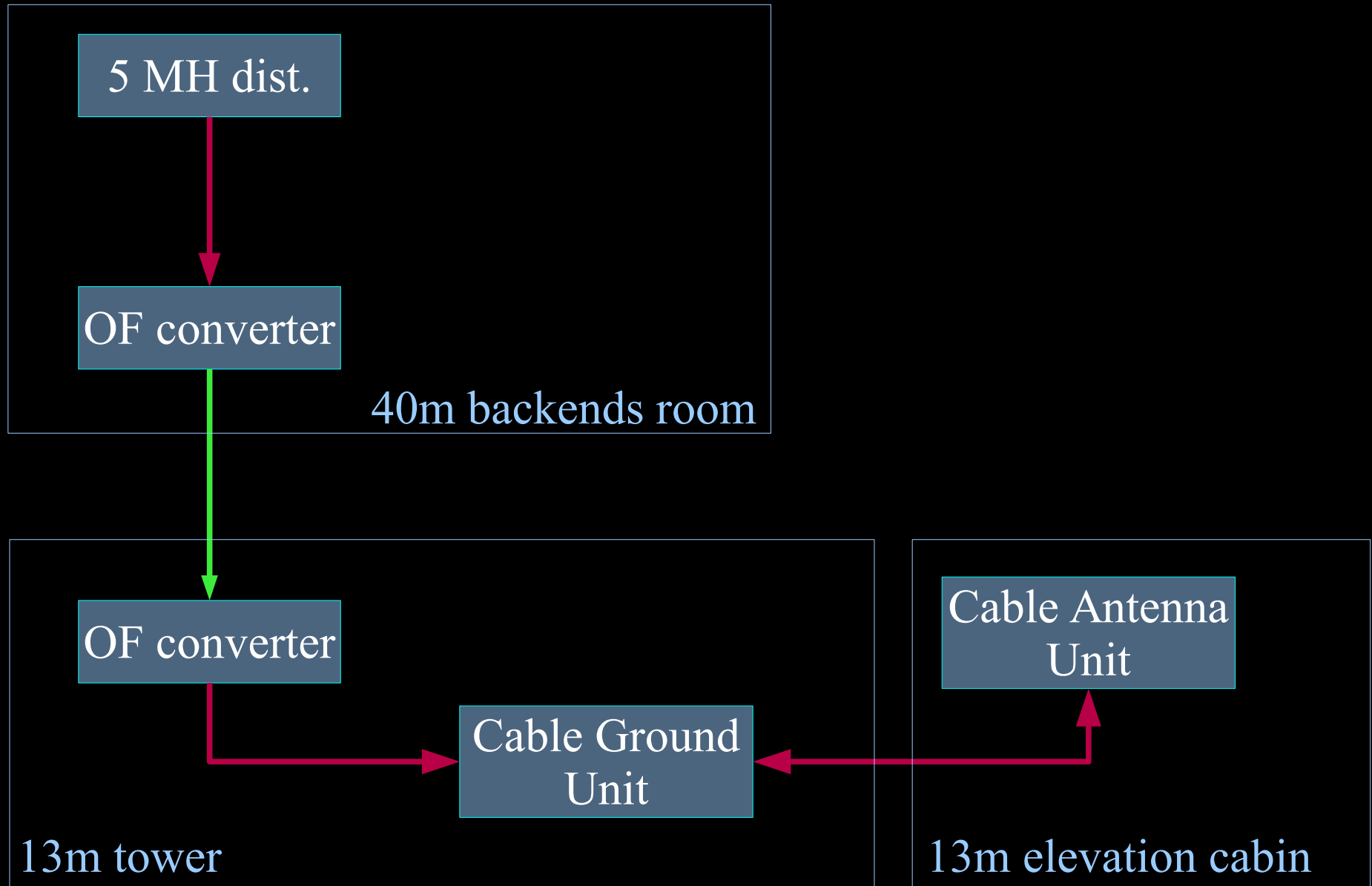
Currently

- 1 x DBBC2 (4 IFs)
2 x 500 MHz (2 VSI VDIF)
- 1 x Mark5B+
Max: 2 Gbps (1 x 512 MHz)
- Phase cal (5 MHz pulses)
- Cable measurement

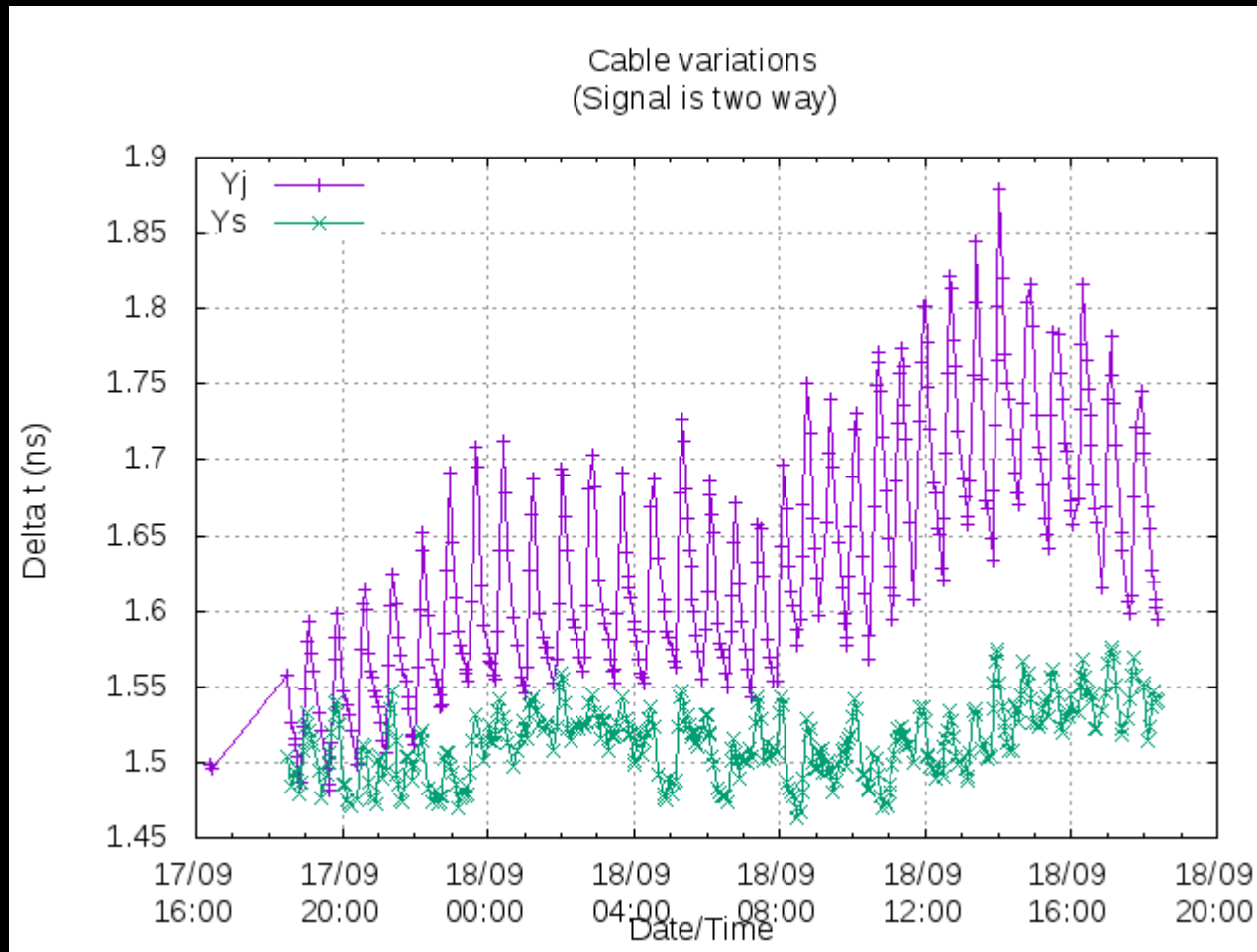
Soon ..

- 2 x DBBC2 with Fila10G
2 x 4 x 1 GHz (VDIF)
- 1 (or 2) x Mark6
Max: 16 Gbps
- Phase cal (5 MHz pulses)
- Cable measurement

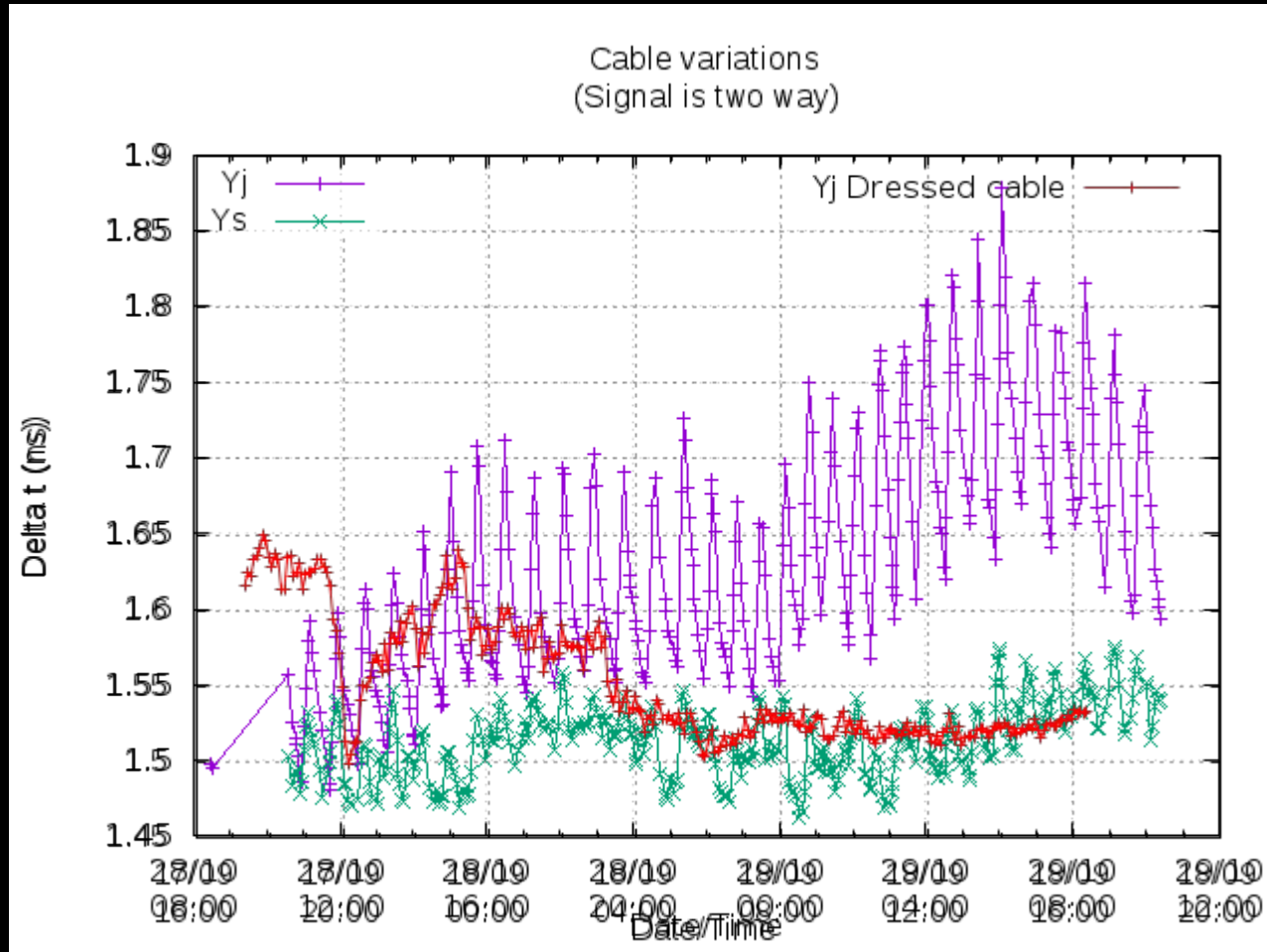
Cable length variations - temperature dependence



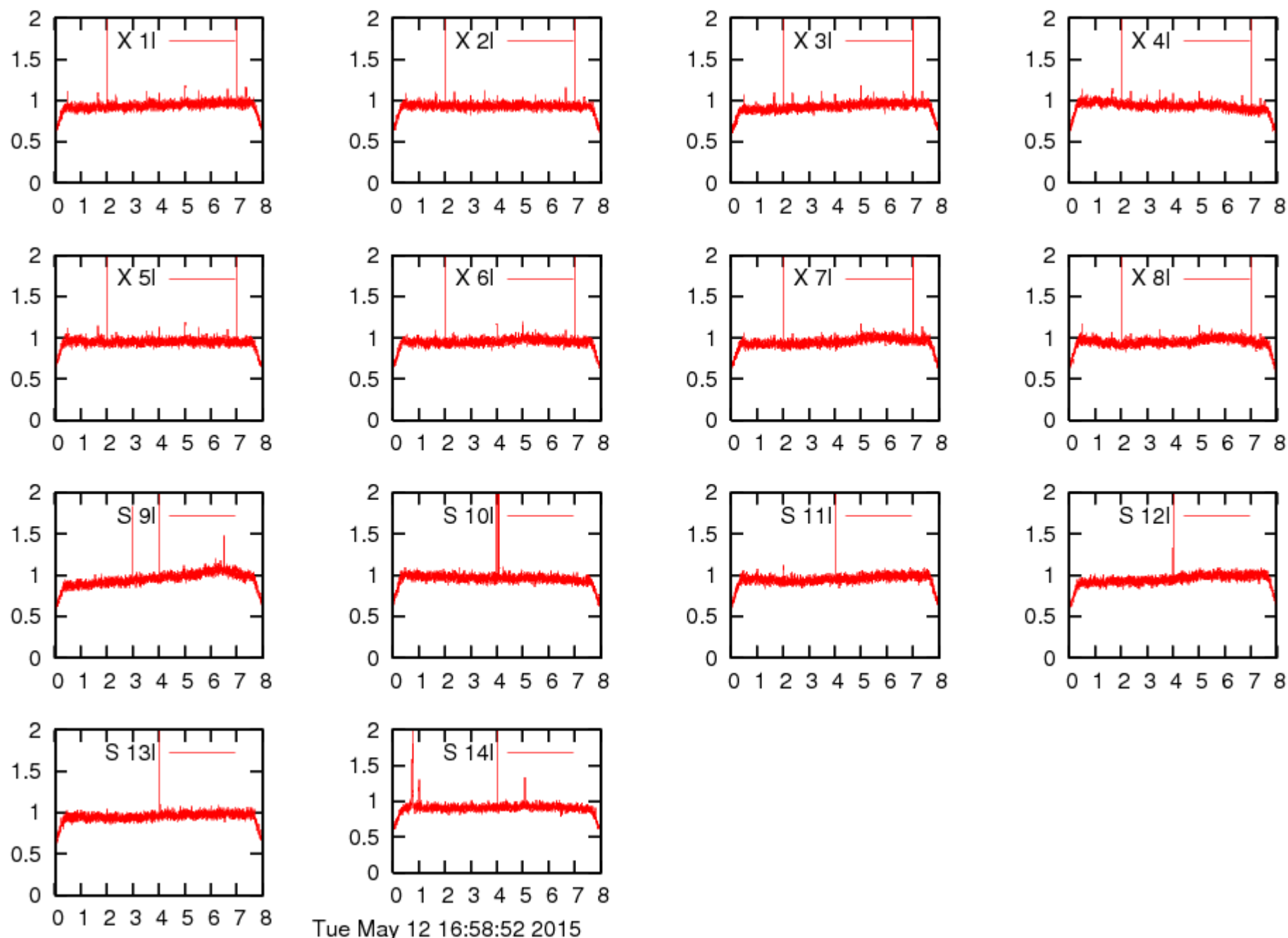
Cable length variations - temperature dependence



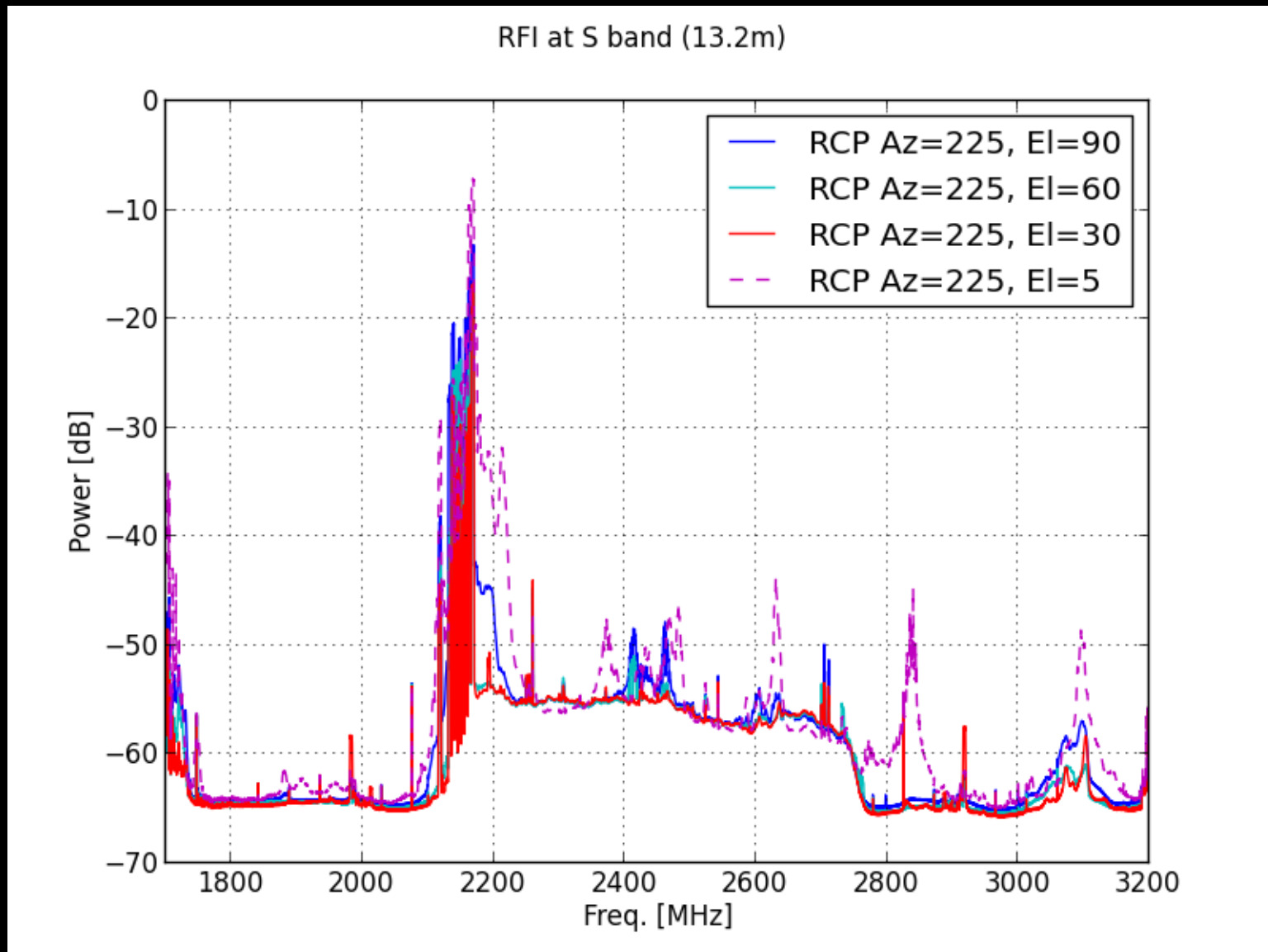
Cable length variations - temperature dependence



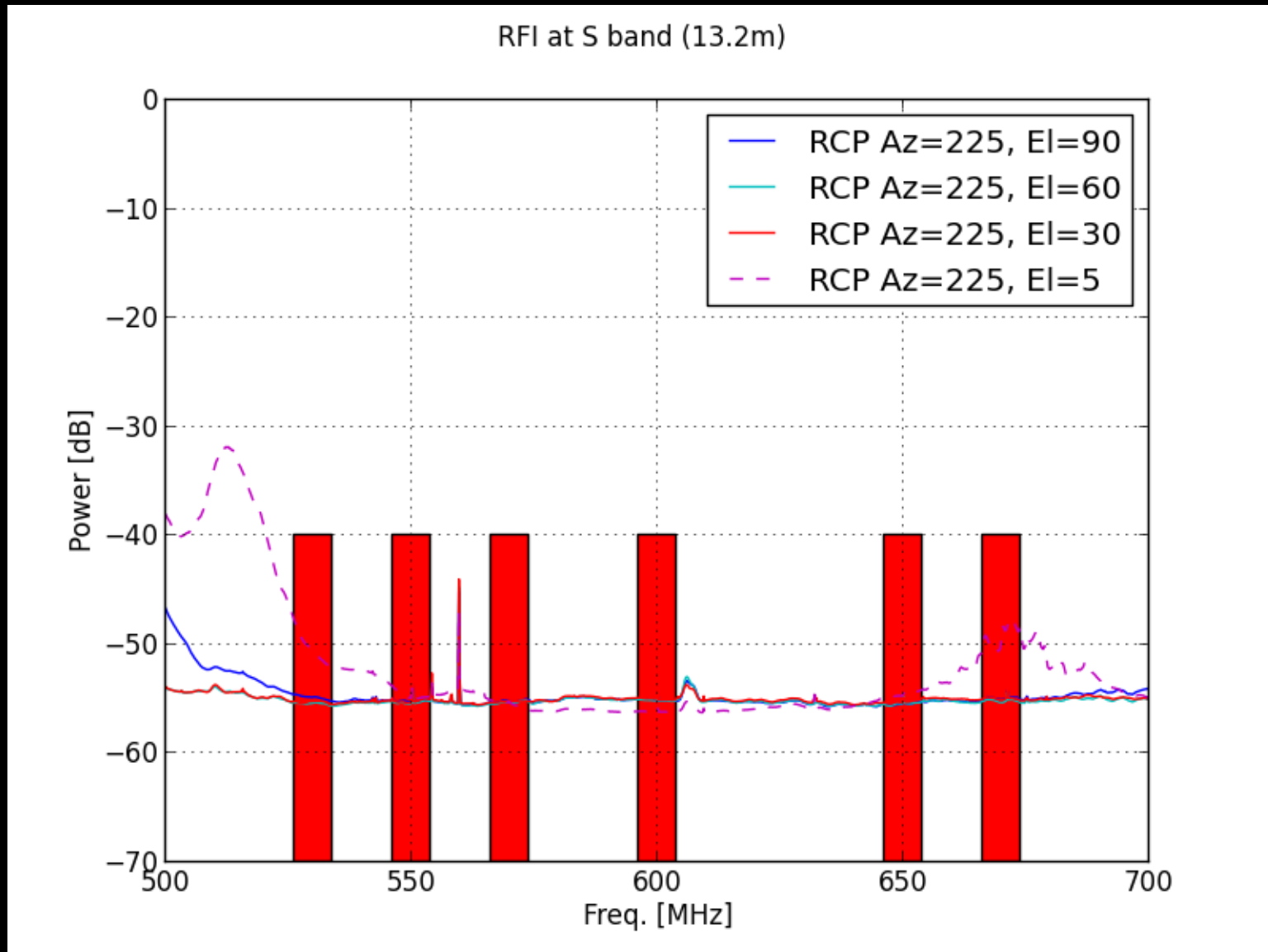
RFI, a problem at low frequencies



RFI, a problem at low frequencies



RFI, a problem at low frequencies



The three band receiver

	Freq. Range GHz	BW (MHz)	Pol	LO (GHz)
S band	2.2 - 2.7	500	RCP/LCP	1.7
X Band	7.0 - 9.5	950	RCP/LCP	0.1-20 / 20 mHz
Ka band	28.0 - 33.0	500	RCP/LCP	0.1-20 / 20 mHz

Main characteristics of the antenna

	Efficiency	SEFD (Jy)	T _{sys} (K)	HPBW('')
S band	~70 %	1700	50	~2550
X Band	~75 %	1300	40	~675
Ka band	~60 %	4000	100	~190

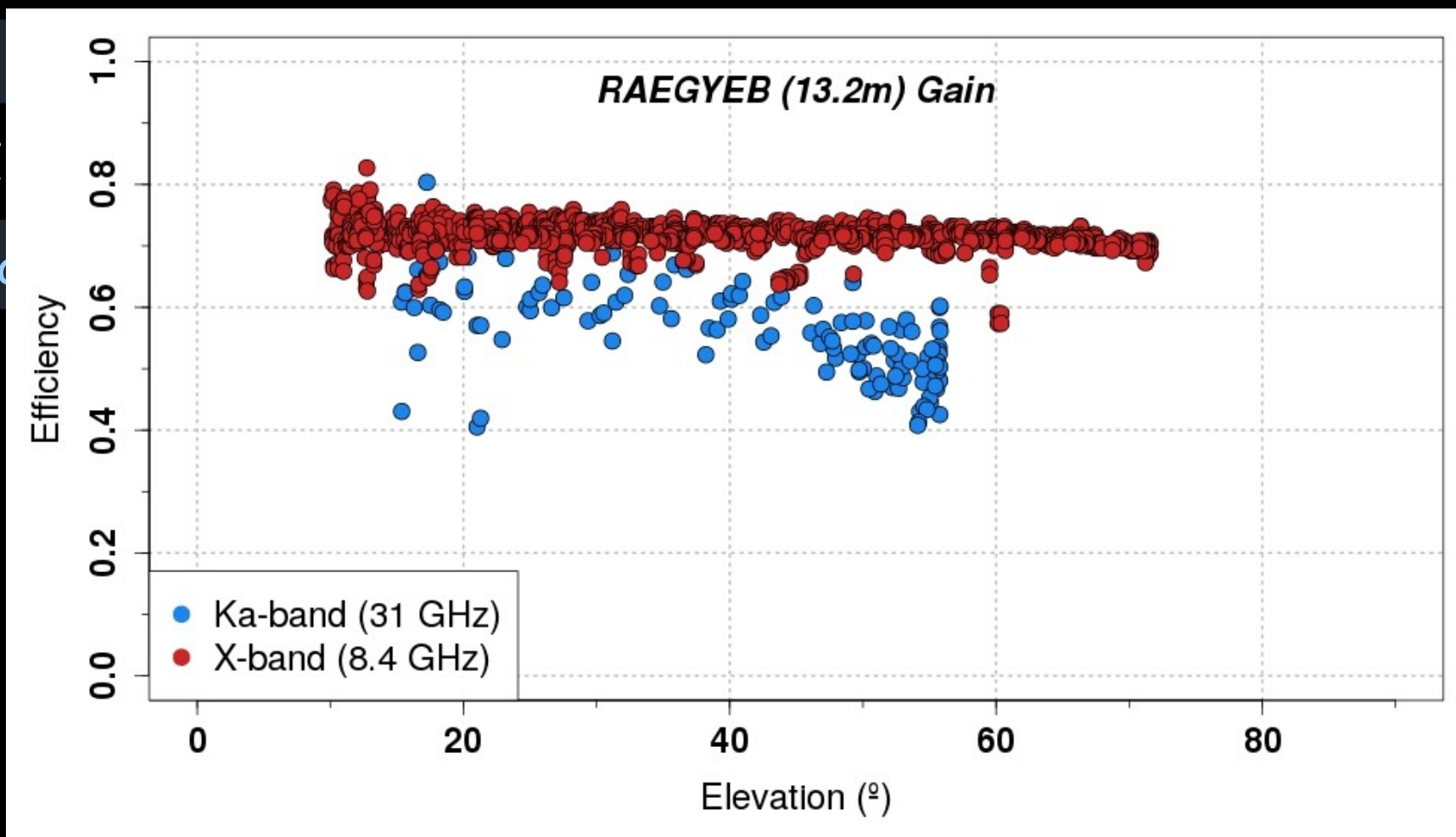
Main characteristics of the antenna

Efficiency

SEFD (Jy)

T_{sys} (K)

HPBW('')

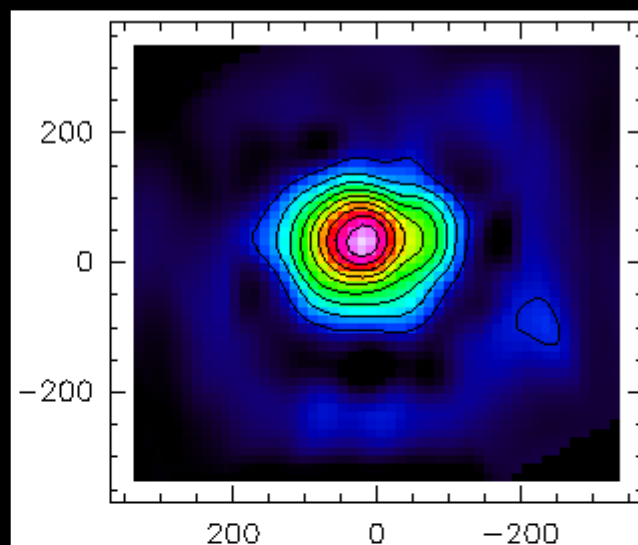
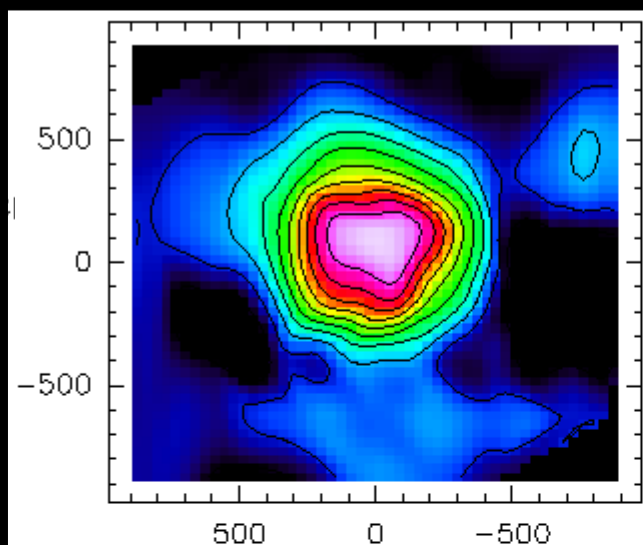


Main characteristics of the antenna

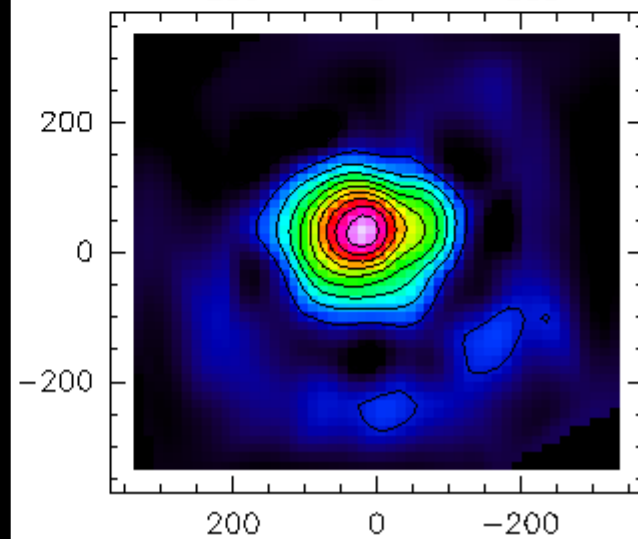
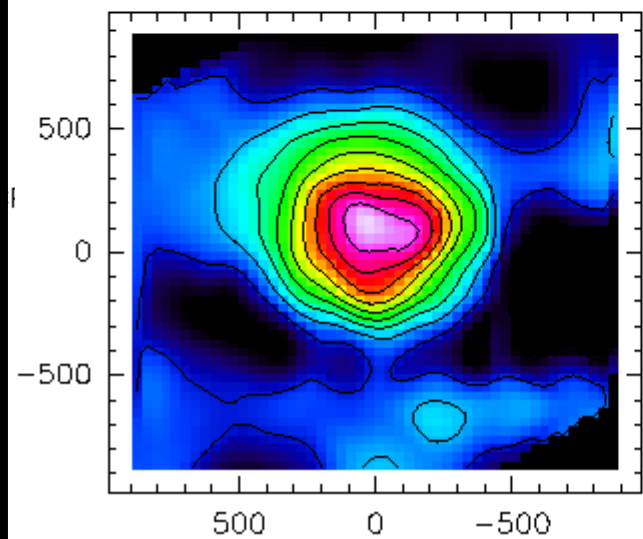
3C84 X band

Venus Ka band

RCP



LCP



In the IVS network

● Experiments:

R4663 (first fringes, only X band)

R1675, R1677, R1678, R1679, R1680 (S + X bands)

● Since April 14, 2015: once per week R1 + R4 sessions

● R1675 produced first coordinates (Leonid Petrov):

Postfit residuals were in a range of 20-30 ps. That is usual for this kind of experiments.

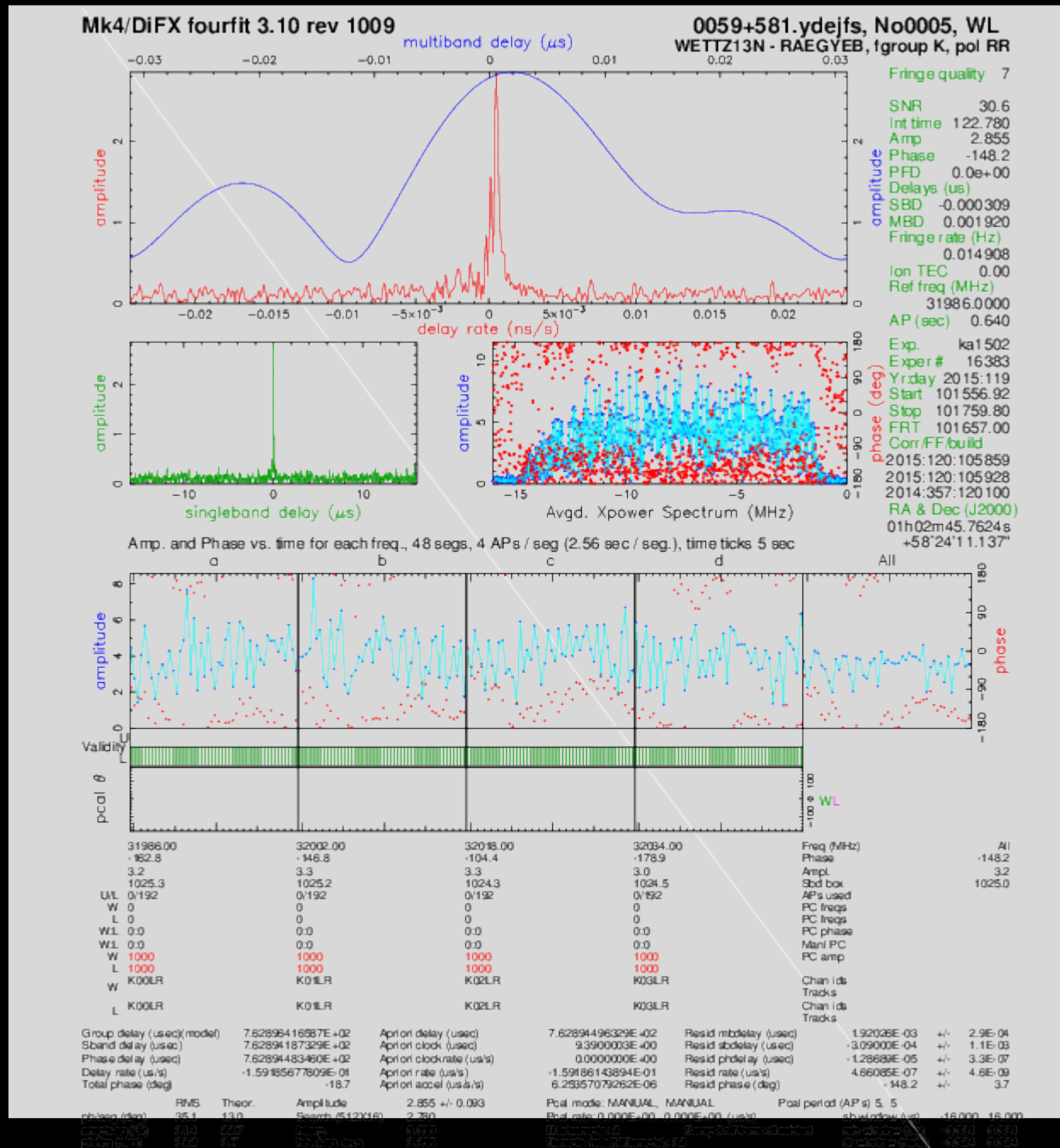
Here are results:

Uncertainties:

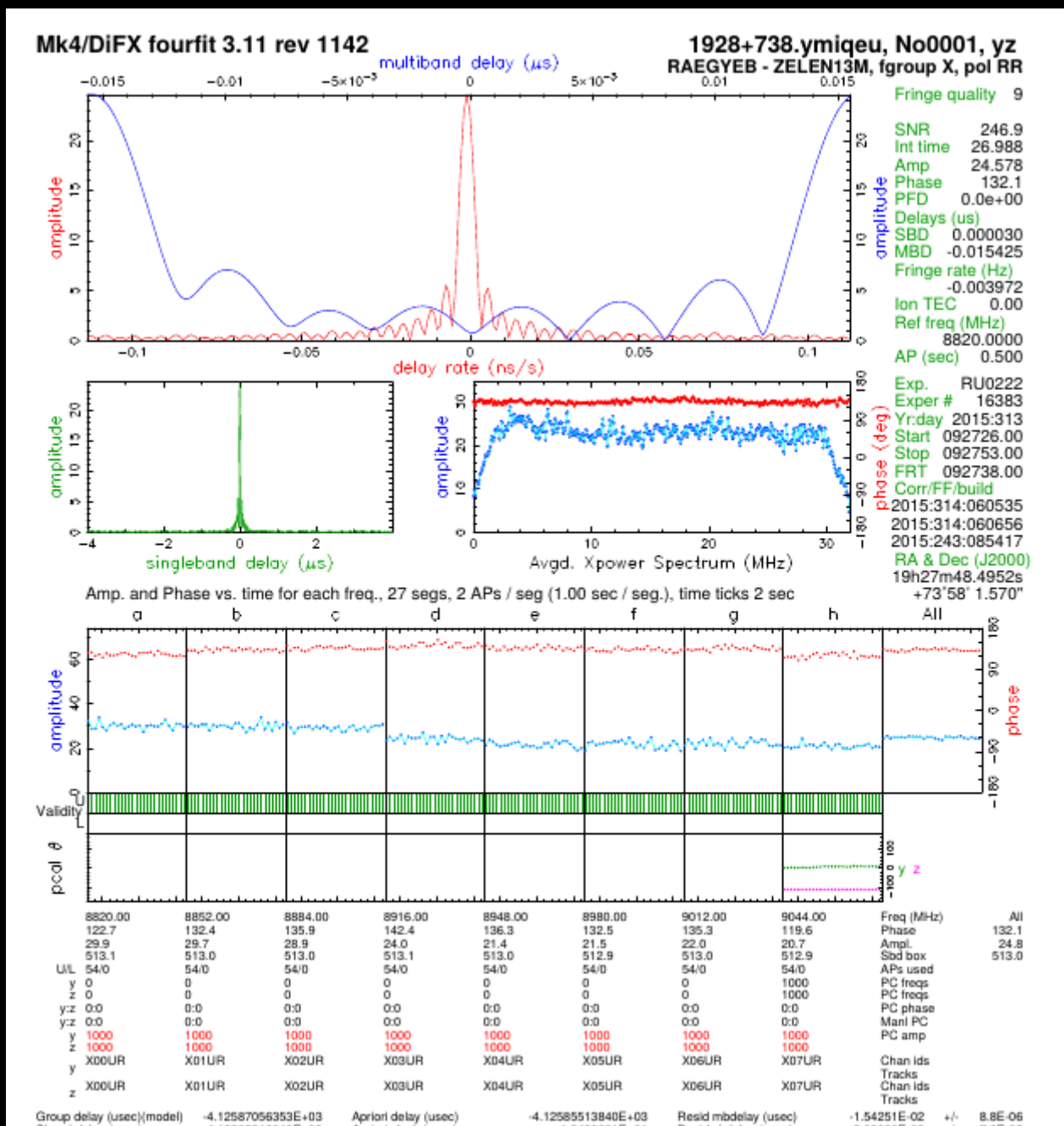
1845. RAEGYEB 7389 EURA X Comp	4848831105.43 mm	0.430 mm	3.977 mm	3.977 mm	global
1846. RAEGYEB 7389 EURA Y Comp	-261629794.91 mm	0.088 mm	3.704 mm	3.704 mm	global
1847. RAEGYEB 7389 EURA Z Comp	4122976237.47 mm	0.474 mm	3.130 mm	3.130 mm	global
1848. RAEGYEB 7389 EURA X Velo	-1.95 mm/yr	7.961 mm/yr	0.284 mm/yr	0.284 mm/yr	global
1849. RAEGYEB 7389 EURA Y Velo	21.31 mm/yr	1.445 mm/yr	0.385 mm/yr	0.385 mm/yr	global
1850. RAEGYEB 7389 EURA Z Velo	14.98 mm/yr	5.092 mm/yr	0.156 mm/yr	0.156 mm/yr	global

Velocities were tied to YEBES40M velocities.

Ka band (32 GHz) fringes between Wettzell & Yebe



X band fringes between Zc (512 MHz) & Yj (PFB 256 MHz)





Thank You !!