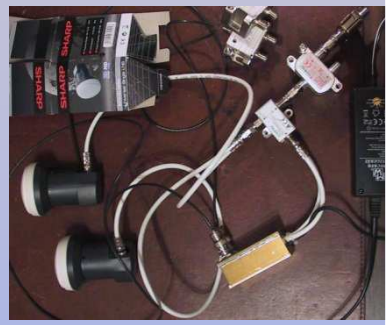
ASTROPEILER STOCKERT



Observational Results with a Ku-band Interferometer

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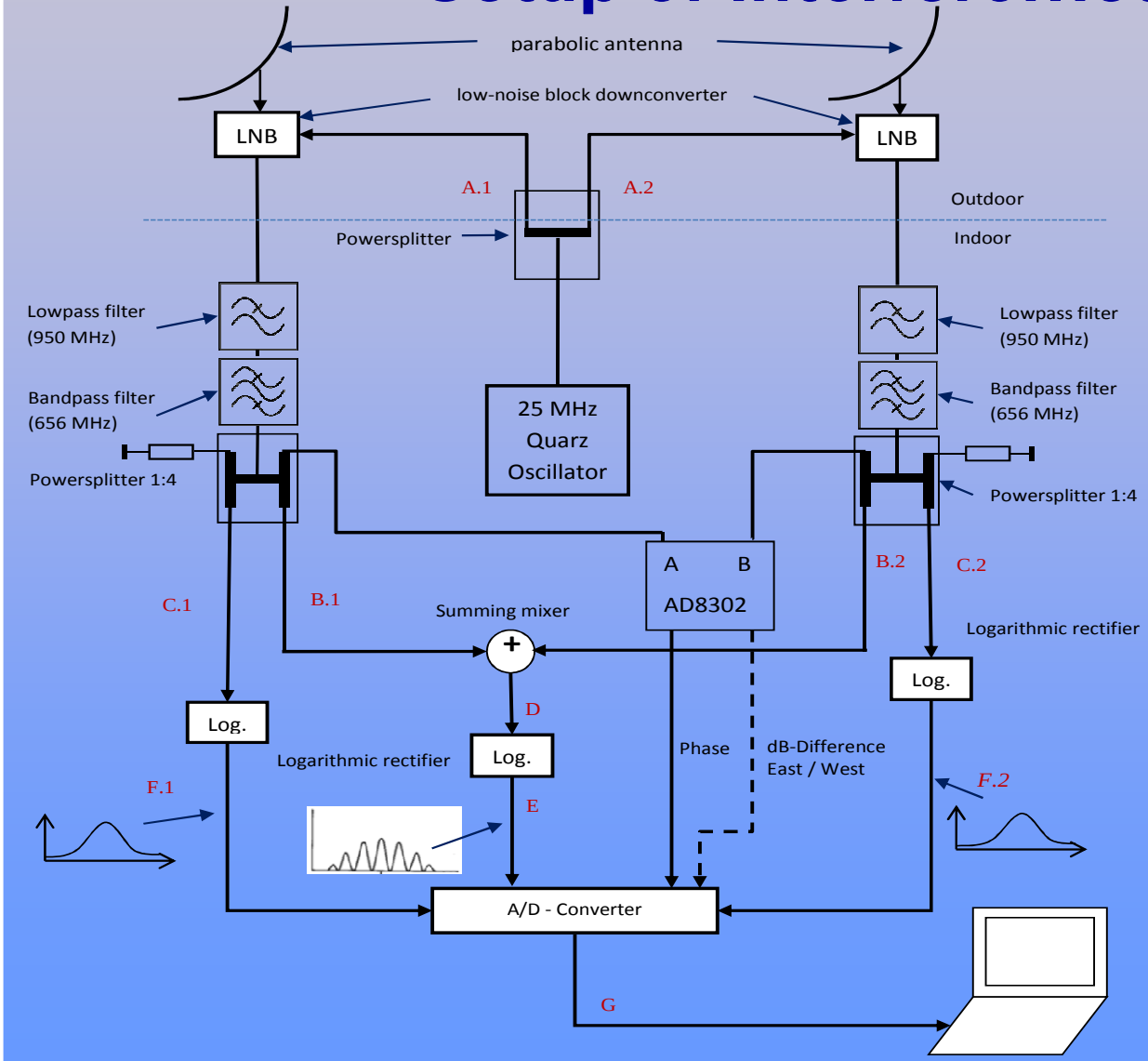
Horst Thum, Noah Schneiders

Astropeiler Stockert e.V.

Setup of Interferometer

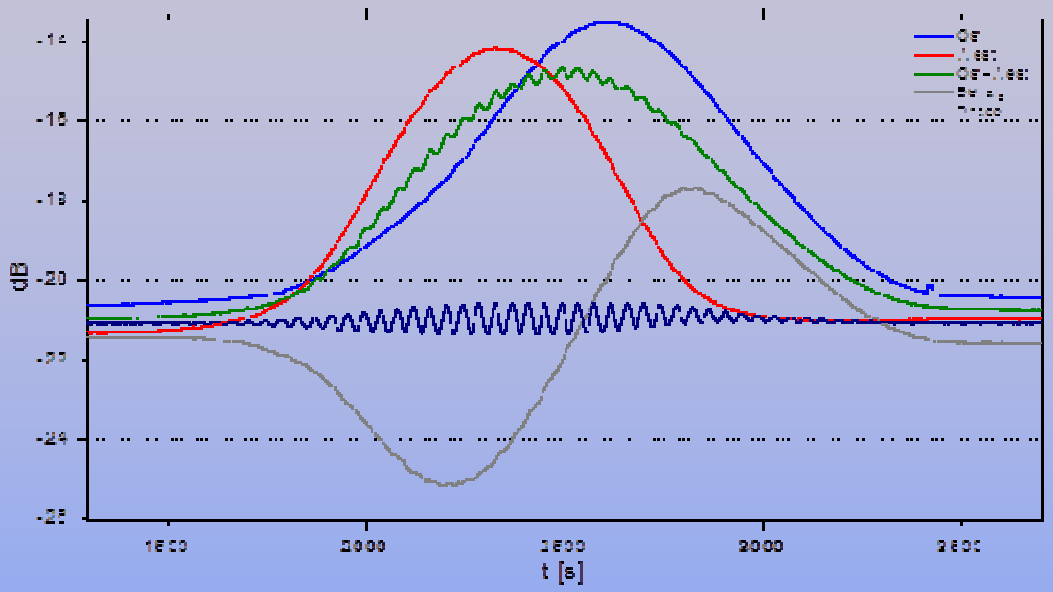


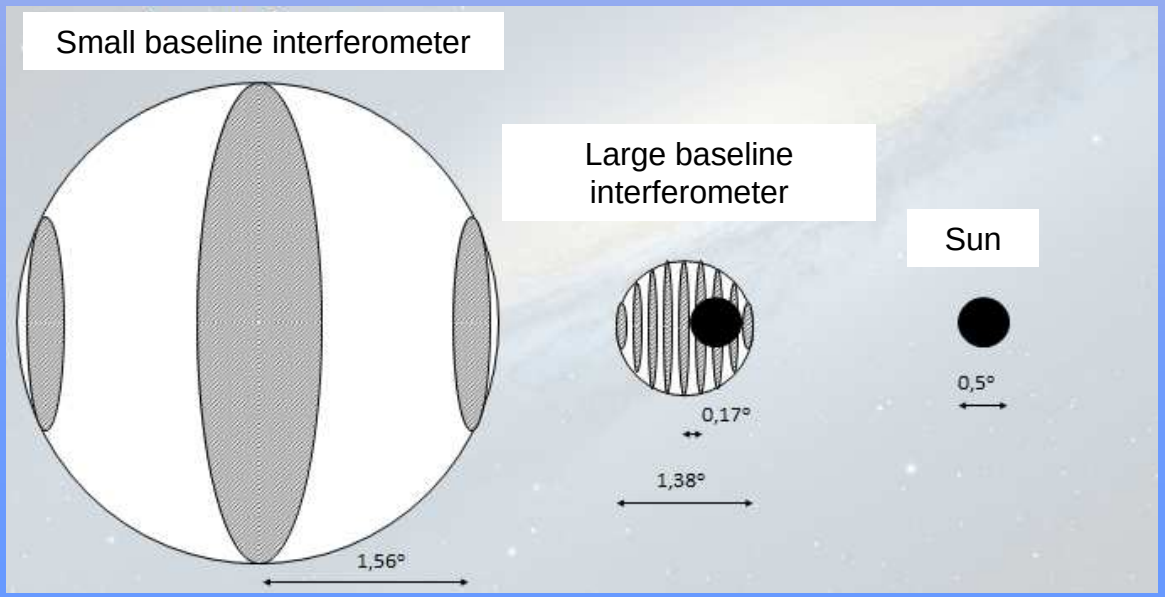
What do we use for phase measurement?

It is an Analog Device AD8302, which is an industry standard IC for VSWR, impedance diagnostics and other measurements.

Solar transit first light

- Angular error of the antenna
- No big fringes in East+West direction

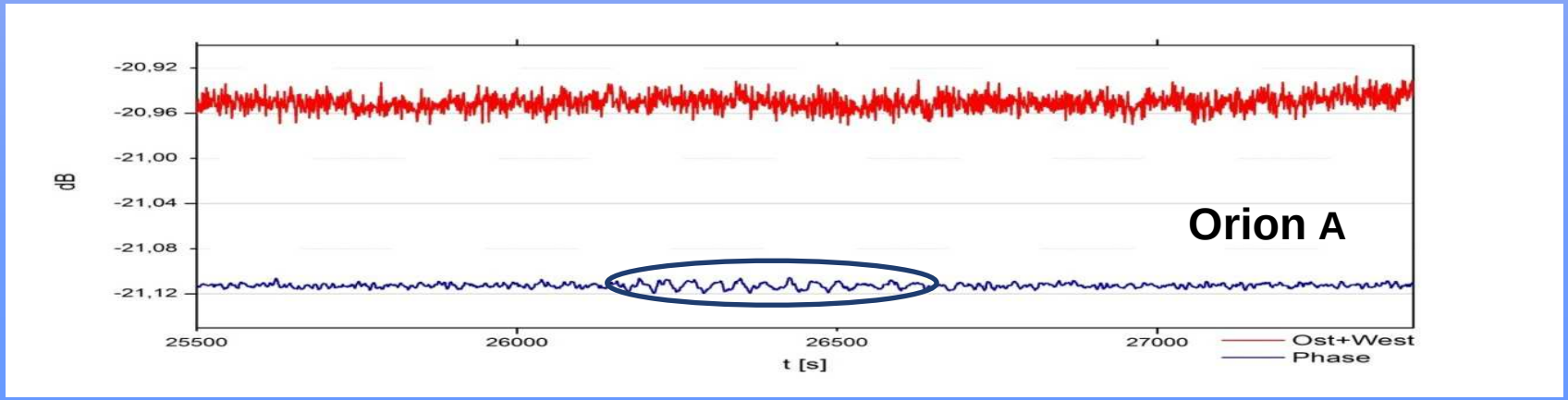




At 10 GHz, the baseline has be below 2 m to see fringes down to zero for a sun measurement. This is due to the large object size.

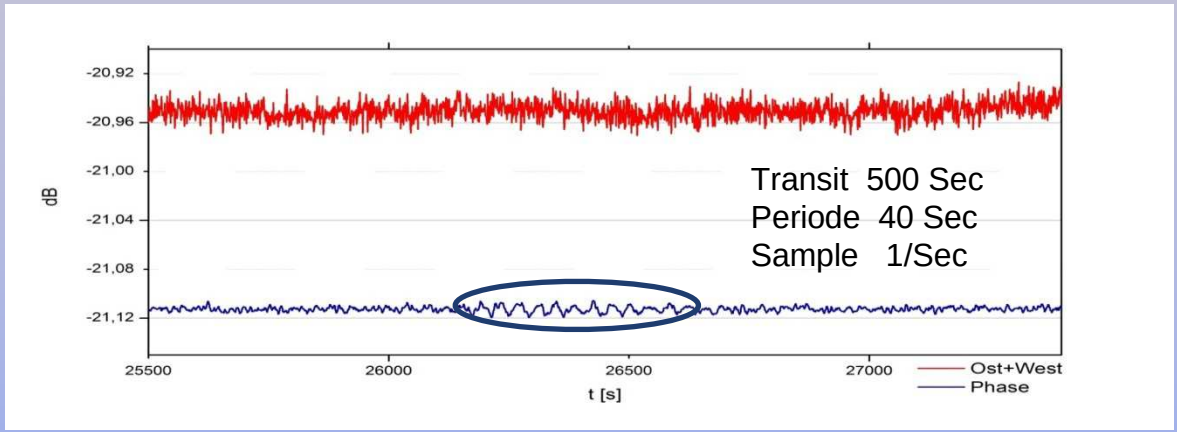
Phase measurements are possible with any object size.

- Opening angle of dish antenna $\alpha_{3dB} \approx 57{,}296° \cdot \frac{\lambda}{D}$ (Grad)
- Half power width for setup used $\alpha_A \approx 57{,}296° \cdot \frac{0{,}03m}{1{,}2m} \approx 1{,}4°$
- Half power width for fringes $\alpha_F \approx 57{,}296° \cdot \frac{0{,}03m}{10{,}38} \approx 0{,}17°$
- Number of fringes at 50% Power $N = \alpha_A / \alpha_F \approx 8$
- Earth rotation $360° \triangleq 24\,h \rightarrow 1° \triangleq 240\,sec$
- Finges period minimal at Dec. = 0° $t = 0{,}17° * 240 \approx 40\,sec$
- Fringes measured (at target Dec) $t_{mes} = t / \cos Dec$



Detecting weak signals by Fourier transformation

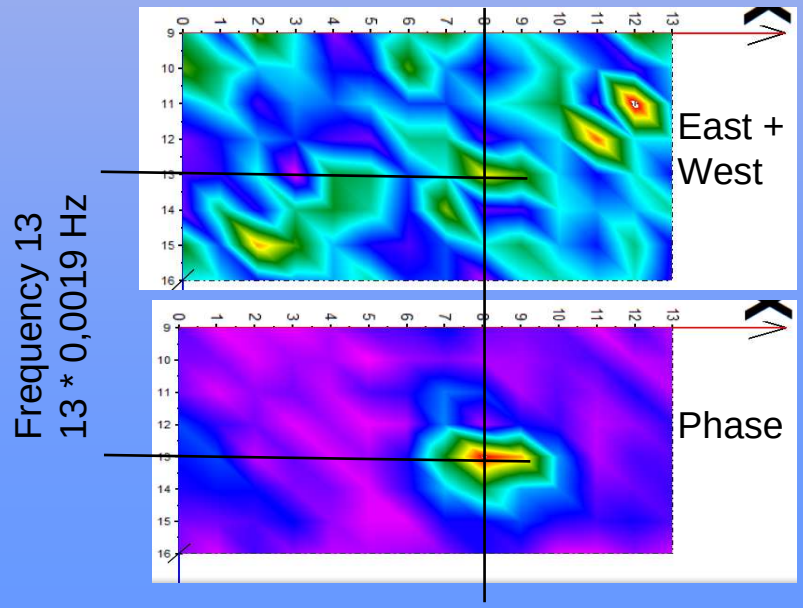
Orion A Transit



Objekt

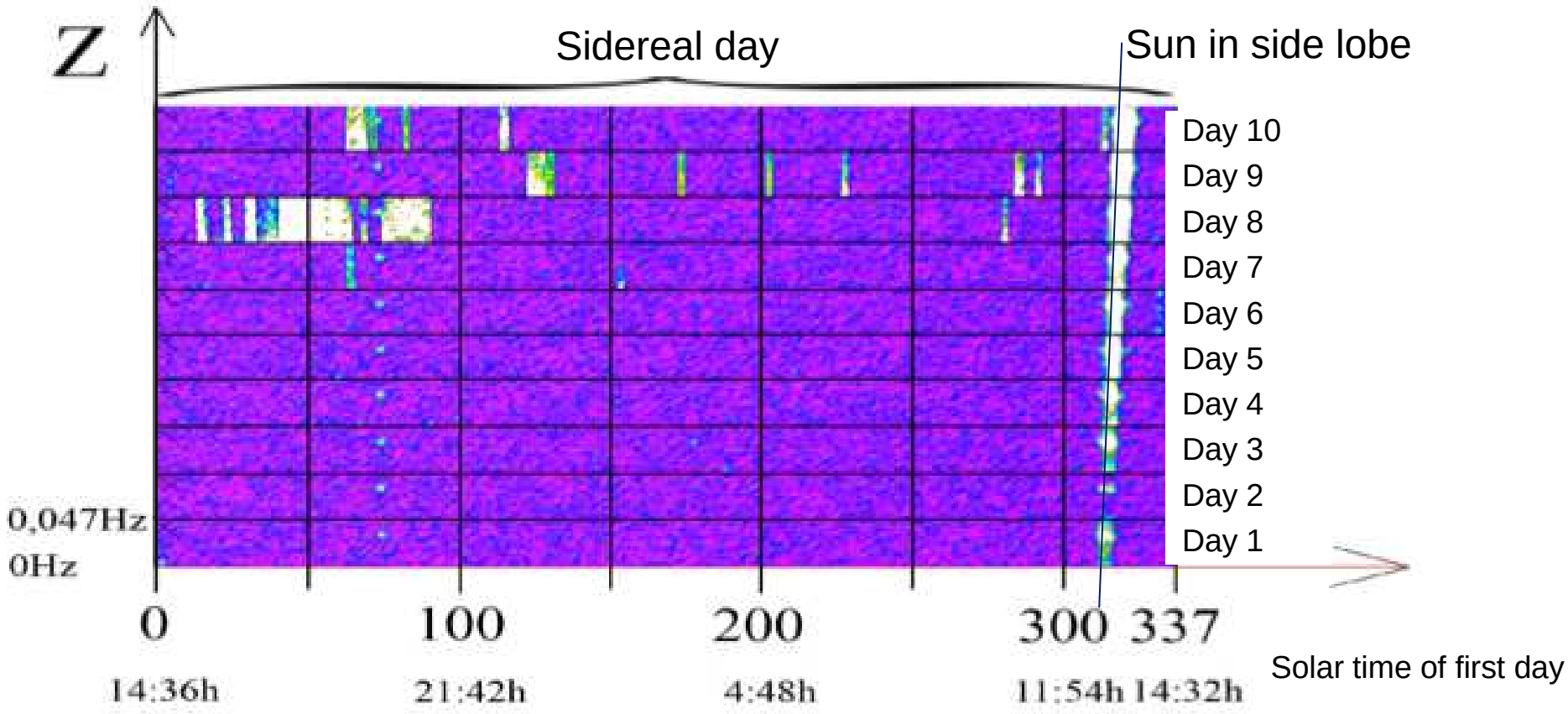
0.000000000	0.086168557	0.061953699	0.060483619
0.086459315	0.159212357	0.220930156	0.179895711
0.143838288	0.13998848	0.163982146	0.260027531
0.221190314	0.185041594	0.161609607	

Time 8 * 256 Sec



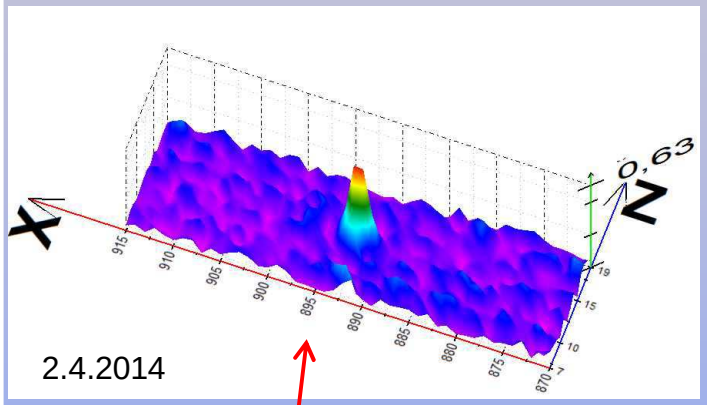
Observation over multiple days

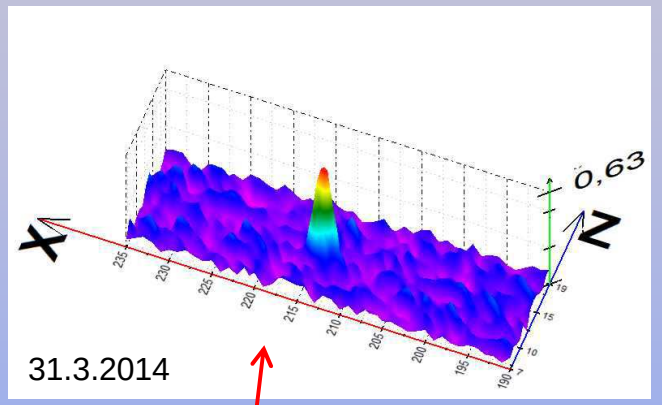
Orion A observation over 10 days

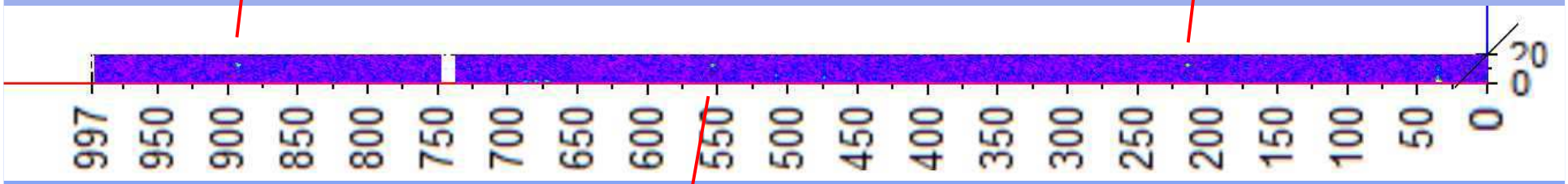


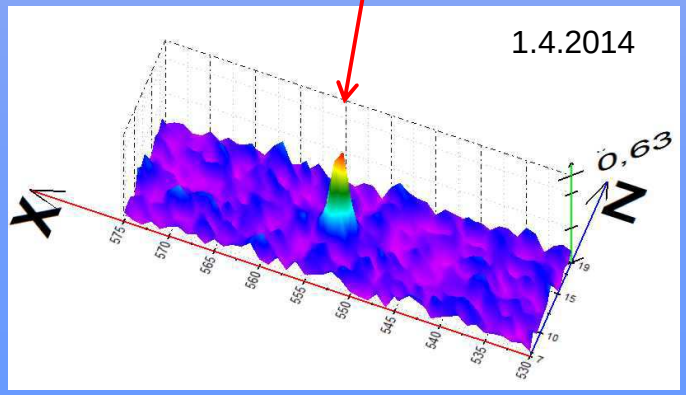
Other sources: Omega Nebula M17

345 Jansky

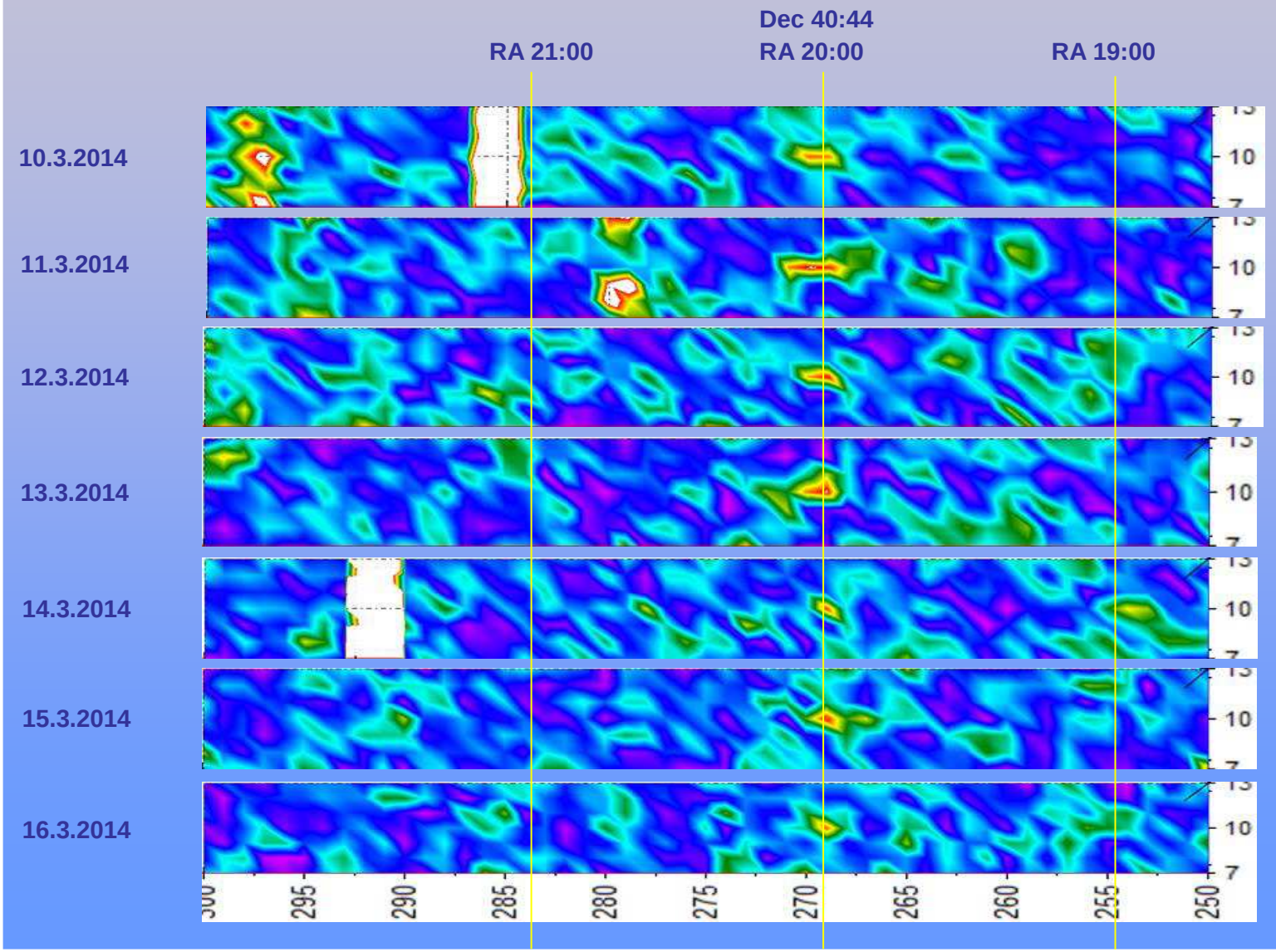








Other sources: Cygnus A 3C405 130 Jansky



Fringe-Frequency:

0.025 Hz = FFT-Line 13

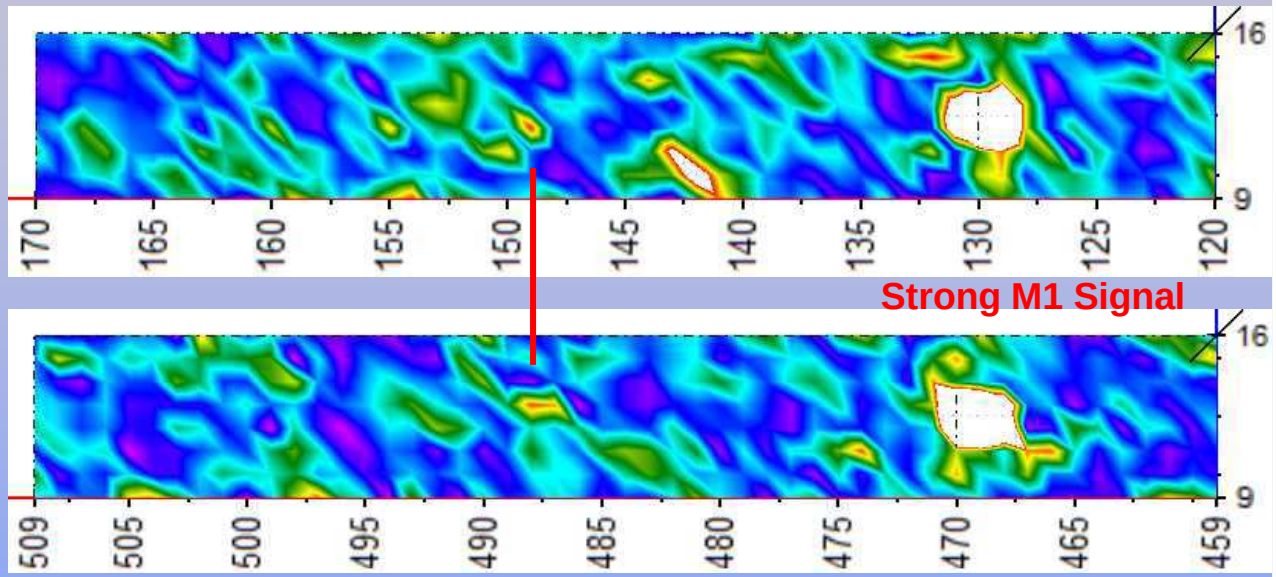
Cyg A Dec = 40.75

13 *Cos 40.75 = 10

Fringe Frequency = 0.019 Hz

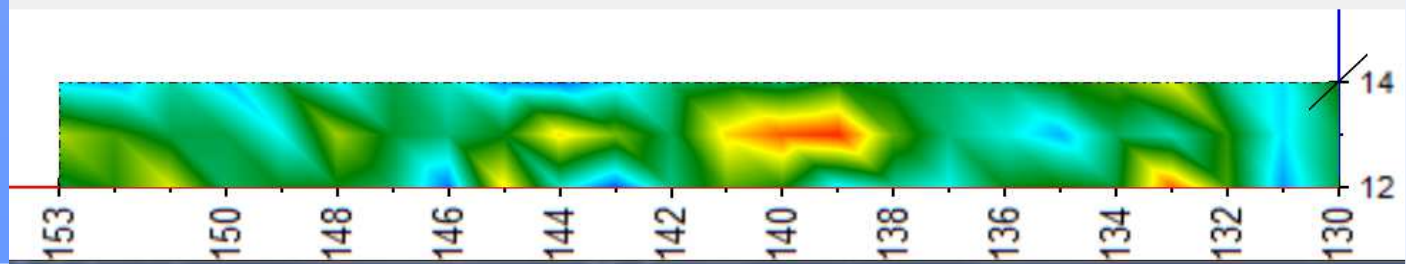
Observation at the Limit

Is Jupiter really
70 Jansky strong?



Virgo A (M87)
38 Jansky ?

Integrating over
4 days



Summary of results

Objekt		10GHz Obj. Jansky		FFT-Phase "Power"	f Line	Stockert Elev.
Sonne		3000000		186	13	
Mond		42000		3,8	12,5	
Cassiop A	3c461	372,9				99
Swan NGC 6618	M17 W38	345,2	Ref	0.67/0.73	13	23,3
Crab/Taur.	3c144, M1	518	300	0,59	12,2	61,28
Orion A 3c145	M42, M43	314,6	Ref	0,6/0,76	13,1	34,1
Cygnus A	3c405	132,4	Ref	0,24/0,26	10	80,3
Sagittarius A	? 60-360J	100	200	0,32/0,42	11	10,5
W51, 3c400		100	140	0,25/0,33	13	54,2
Virgo	3c274, M87	38,5	Ref	0,12/0,19	13	51,75
Jupiter		70	40	0,18	13	
Cyg Loop	W78	50				69,2
Andromeda	M31	60				51,1
Cygnus X		40				80,3
Orion B	3c147	50				37,6
3c273		37,1				41,8

As reference points, the details
of Franz, F5SE were taken

Conclusion

- We have built a transit interferometer from commercial CATV / SAT-TV components
- We have designed a simple phase measurement system
- We have demonstrated, that the phase information provides more detection sensitivity than evaluating the amplitude
- Using the Fourier transformation of the recorded time serious of the phase signal allows to detect relatively weak sources otherwise buried in noise
- With this technique, it was possible to observe a number of galactic and extragalactic sources
- Published values for flux density may be erroneous for the Ku-Band range