PAON-4 status

Instrument, observations and data analysis

R. Ansari

16 July 2015

- Data takings handled by Claude Pailler
- Some checkings performed on the instrument during a mission to Nançay on 1-2 July 2015 - Installation of temperature probes on the antenna and central electronic box
- Progress on data analysis, thank to Q. Huang's work and Thomas Etourneau (graduate student)
- Observed gain variations are due to temperature, mostlty due to the mixer
- The origin of the correlated noise not yet fully understood: both the amplification chain and the mixer are responsible. Part of the correlated noise might be due to oscillations due to high gains in the amplification chain
- 7 x 24 hours scan (-2.25 deg ... + 2.25 deg) around Cygnus are being performed to do map making

Targets

CIBLES

CasA :	AD : 23 h 23 min	D : 58,8025°	z : 11,42°N
CygA :	AD : 19 h 59 min	D : 40,7339°	z : 6,65°S
Crab :	AD : 5 h 34 min	D : 22,0144°	z : 25,37°S
VirA :	AD : 12 h 30 min	D : 12,3911°	z : 34,99°S
3C286 :	AD : 13 h 31 min	D : 30,5092°	z : 16,87°S

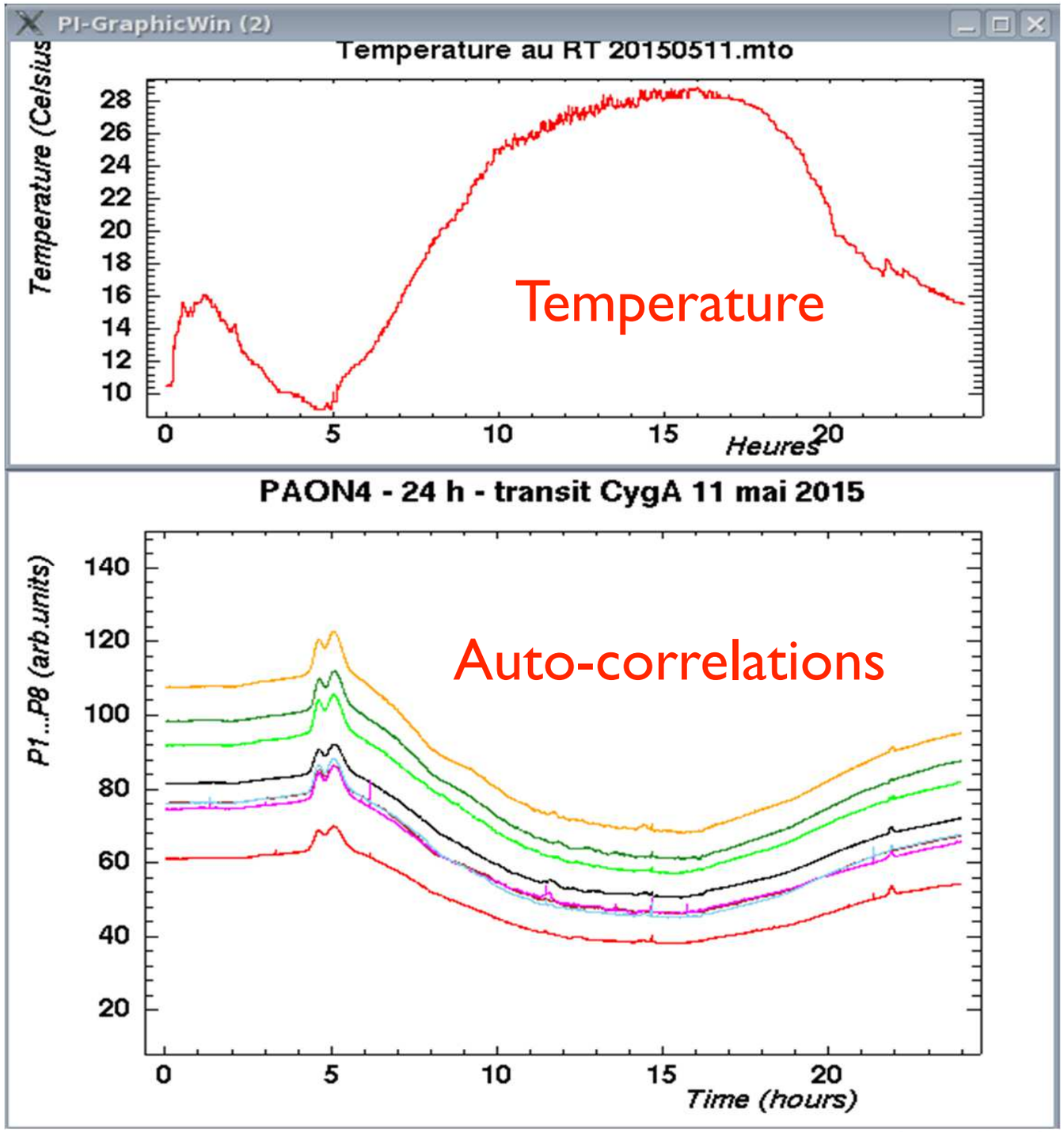
distance zénithale $z = |D_{(déclinaison)} - l_{(latitude)}|$

latitude PAON4 $l = 47,382°$

From Claude Pailler presentation

https://indico.lal.in2p3.fr/event/2912/contribution/3/material/slides/0.pdf

Gain variations with temperature



From Claude Pailler presentation

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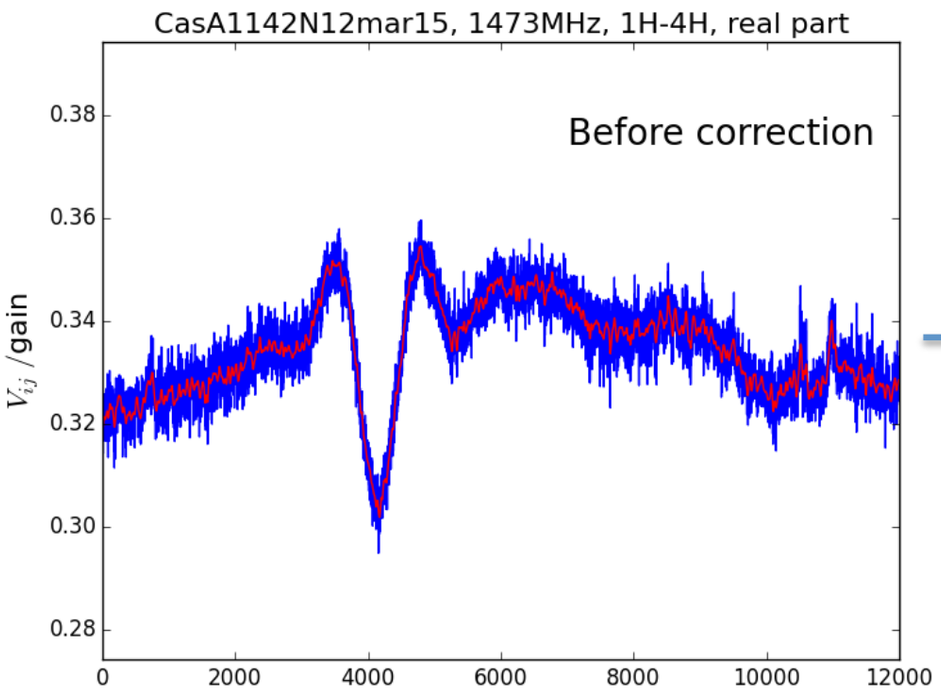
Extraction of array characteristics from cross-correlations

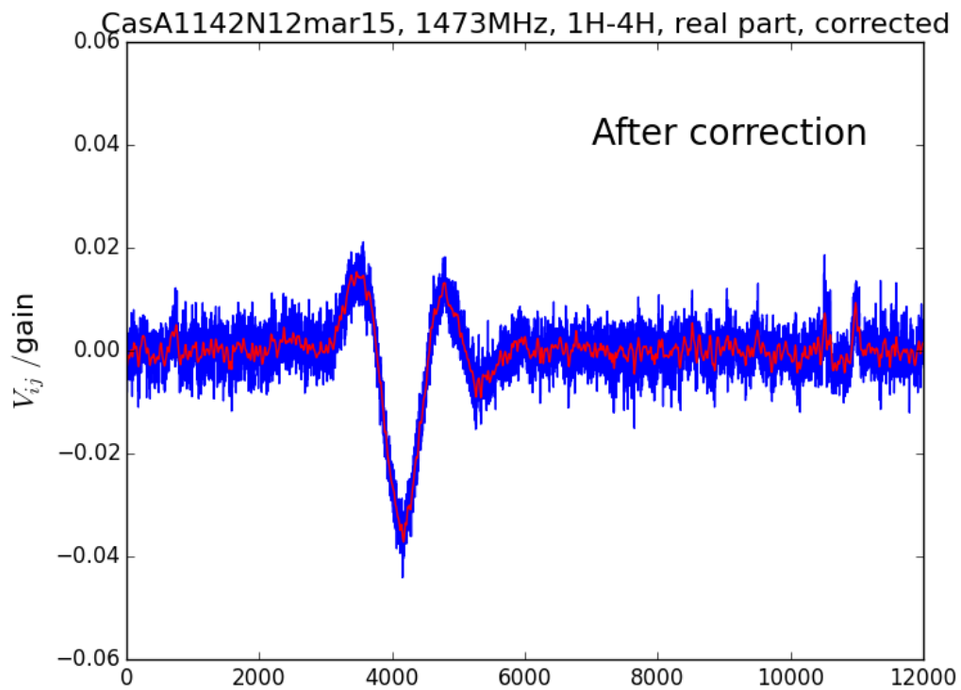
(Qizhi Huang)

- Fit fringes (real & imaginary part) on all antenna pairs (6 cross-correlations for each polarization)
- Extract array geometry (baselines), effective diameters for each antenna, the phase difference term due to electronics, cables ... $\Delta\Phi_{ij}$
- Extract also the antenna alignment (antenna axis direction)

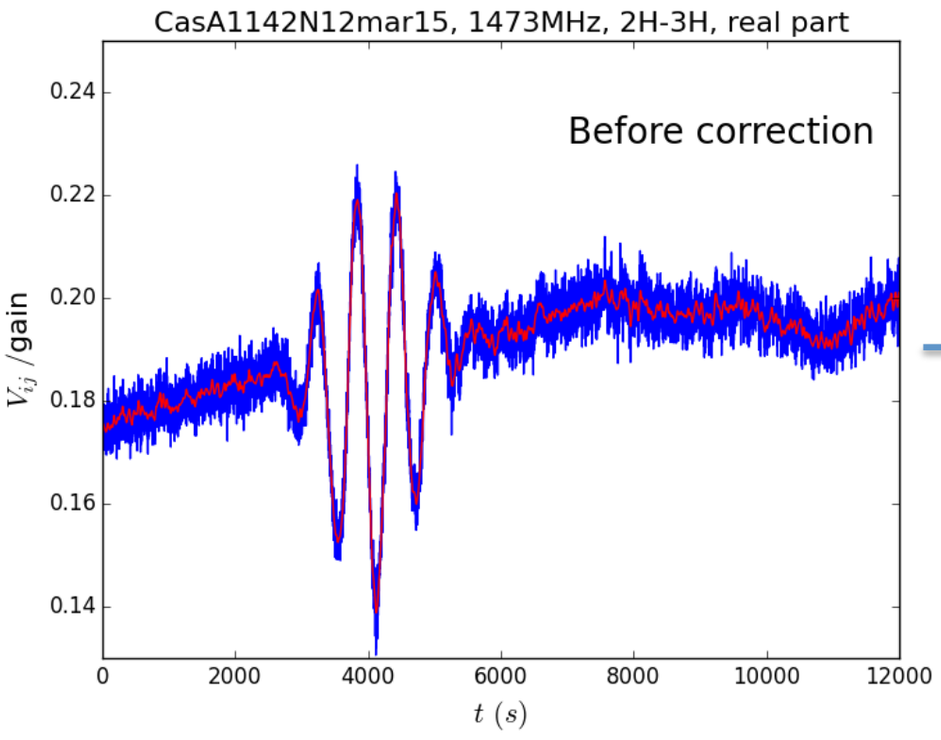
From Q. Huang presentation
https://indico.lal.in2p3.fr/event/2912/contribution/5/material/slides/0.pdf

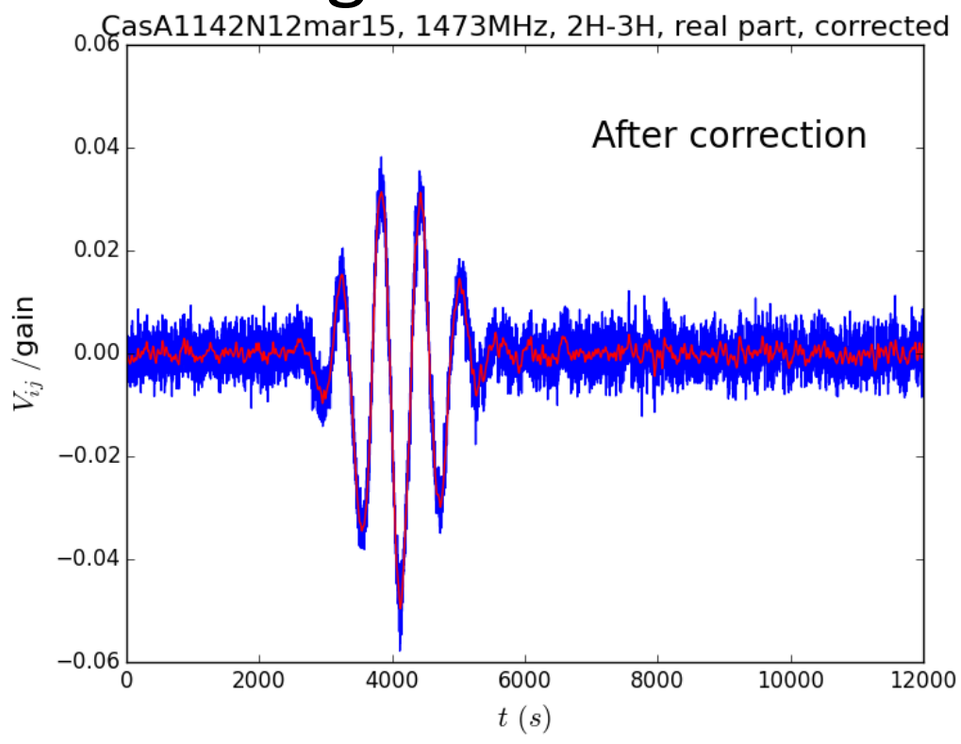
Correct data (2)





Note that we need to rotate the fringe a little.





From Q. Huang presentation

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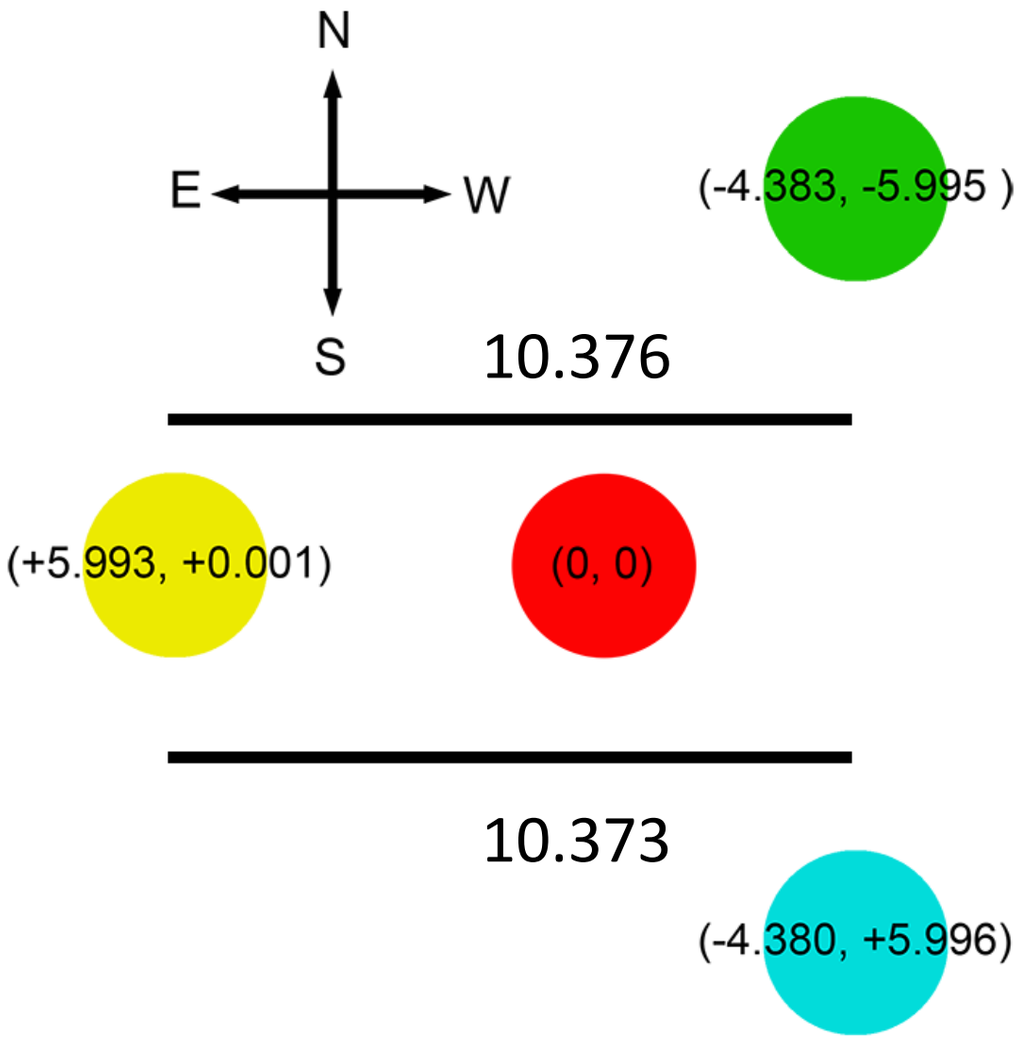
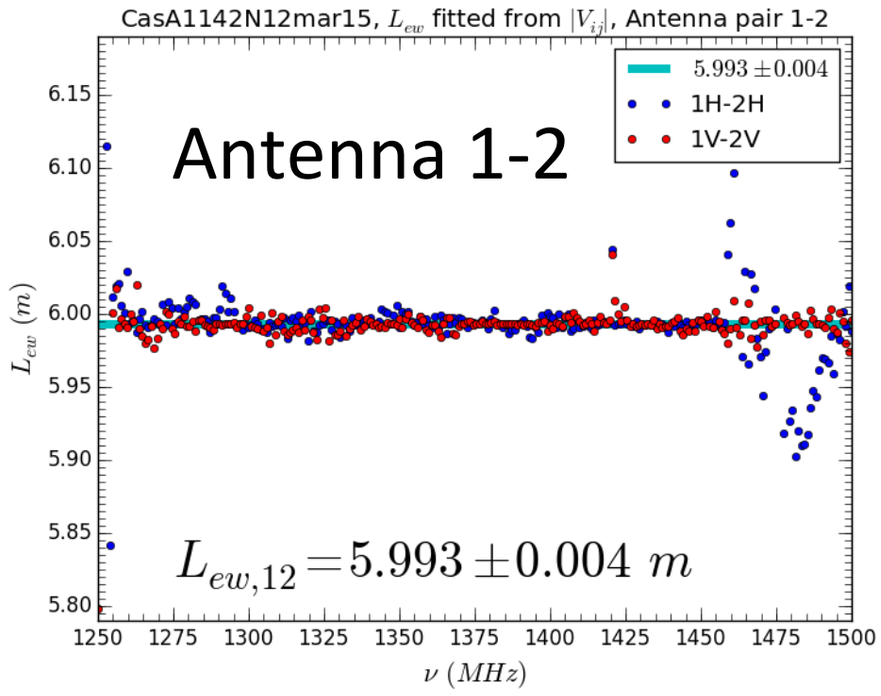
Array geometry (baselines) determined from fringes in full agreement with on ground measurements of the antenna position (1)

Antenna geometry



East-West baseline of Antenna pair 1-2



From Q. Huang presentation

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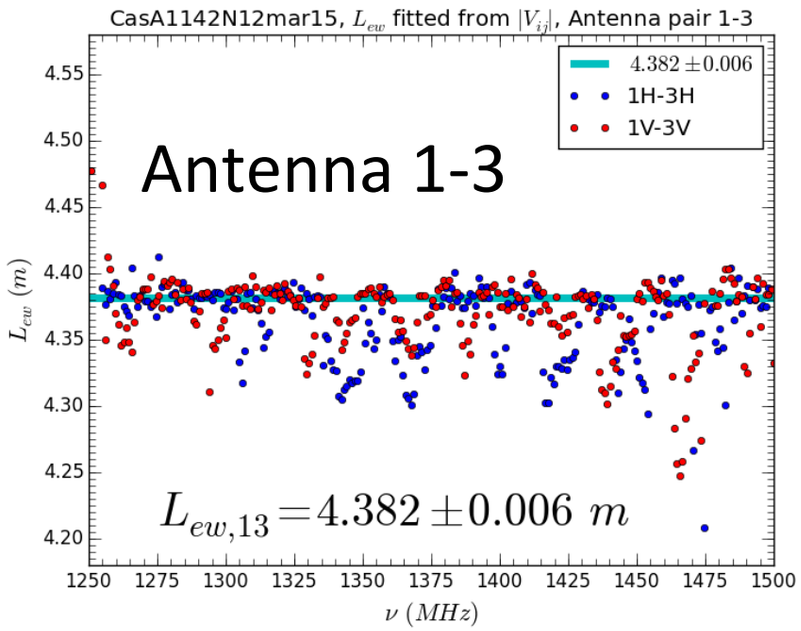
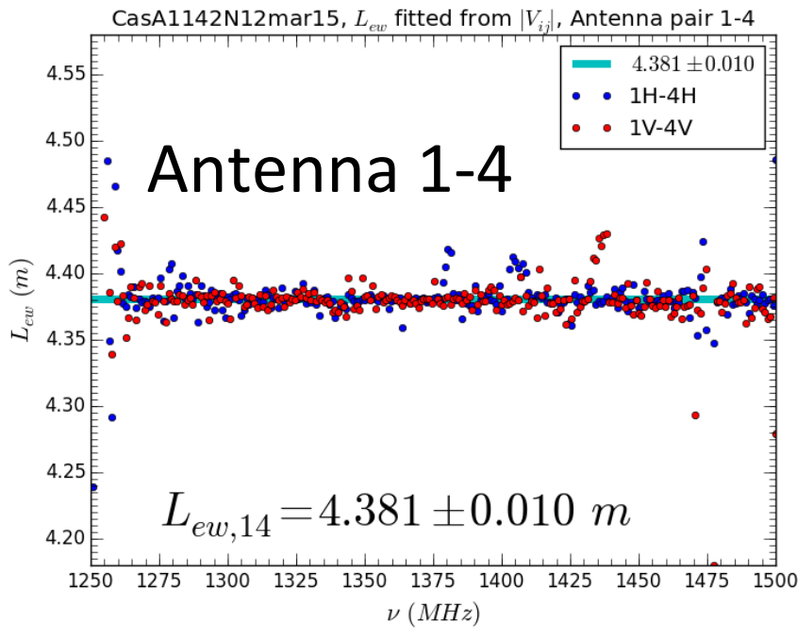
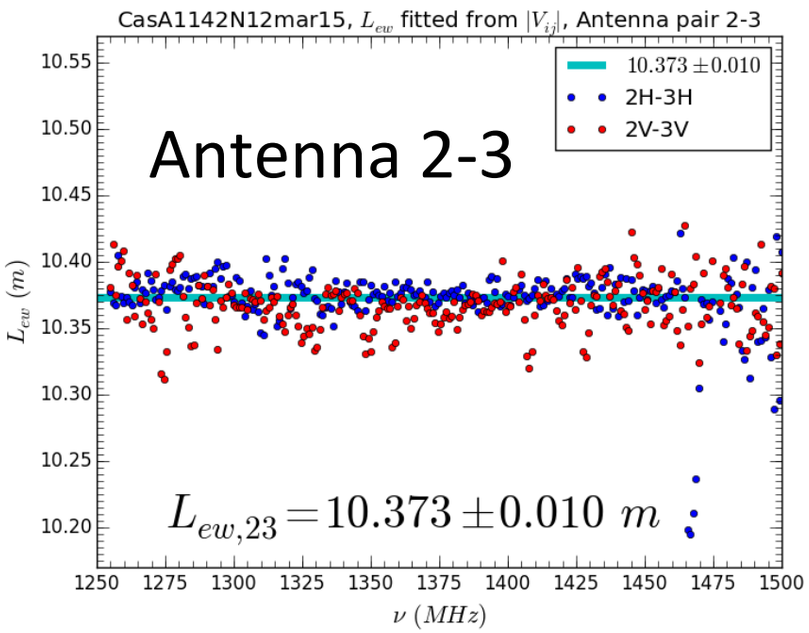
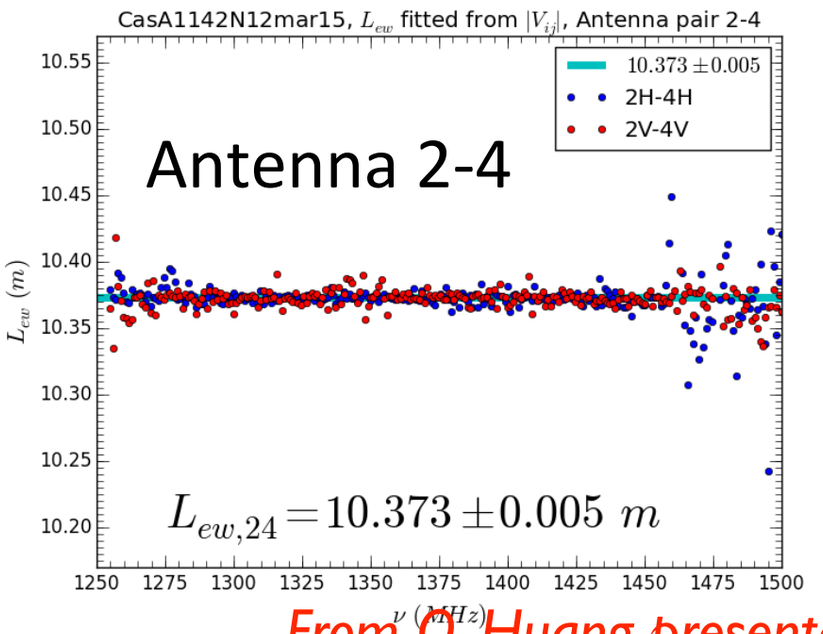
Array geometry (baselines) determined from fringes in full agreement with on ground measurements of the antenna position (II)

East-West baseline









From Q. Huang presentation

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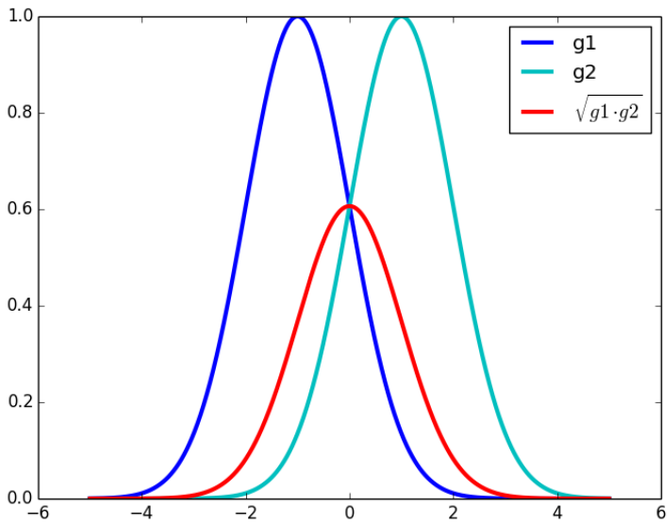
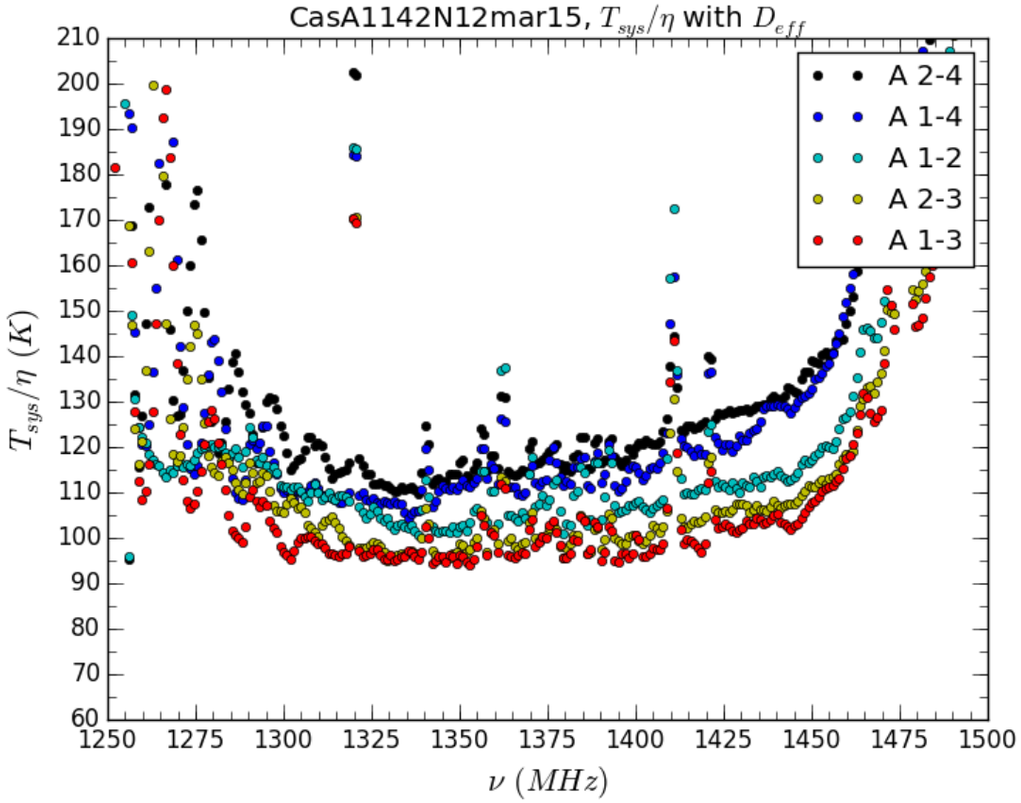
Antenna axis misalignment up to ~ 1 degree - This seems to be due to the feed positionning - We need to correct feed positions - Need to be taken into account for system System temperature Tsys determination from fringes

System temperature

- Consider the alignments of the antennas, I correct the amplitude of the fringe, and then calculate the system temperature



Different alignments will lead to a smaller amplitude

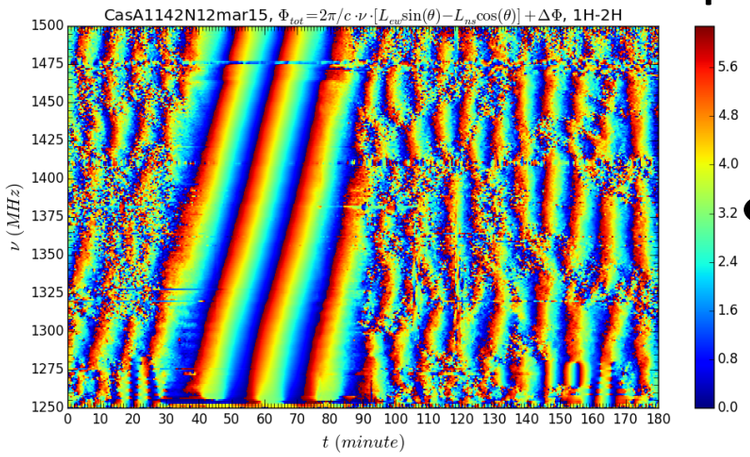


From Q. Huang presentation

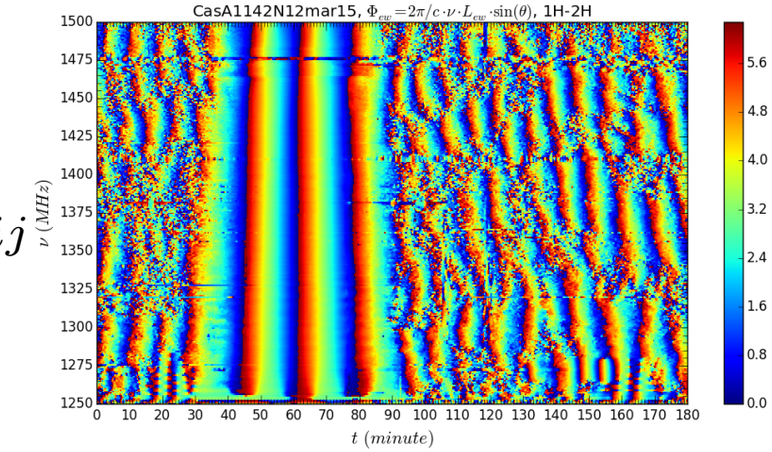
https://indico.lal.in2p3.fr/event/2912/contribution/5/material/slides/0.pdf

Fringes (time-frequency maps) before and after correcting for phases

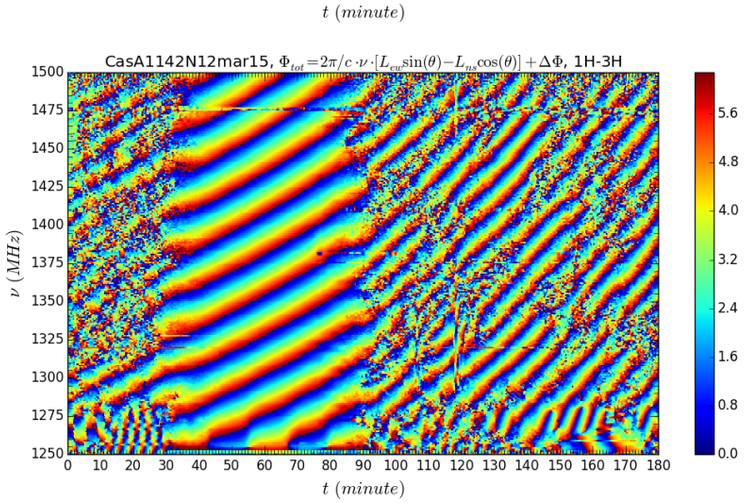
- Here, I use total phase to minus the additional phase due to the cable and the phase due to North-South baseline

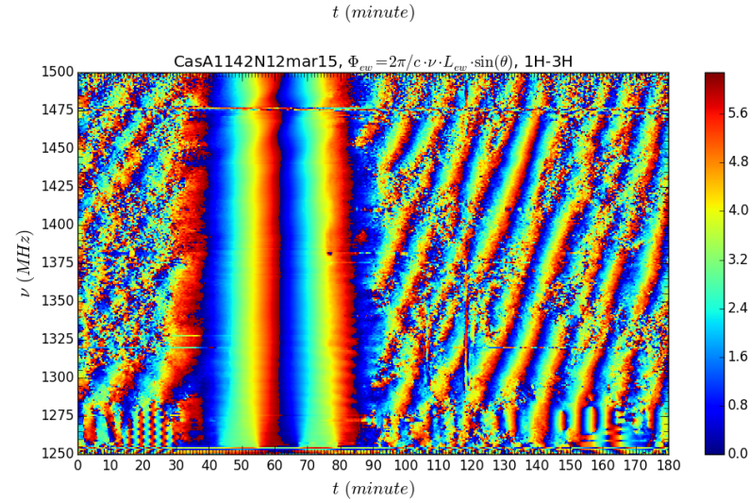


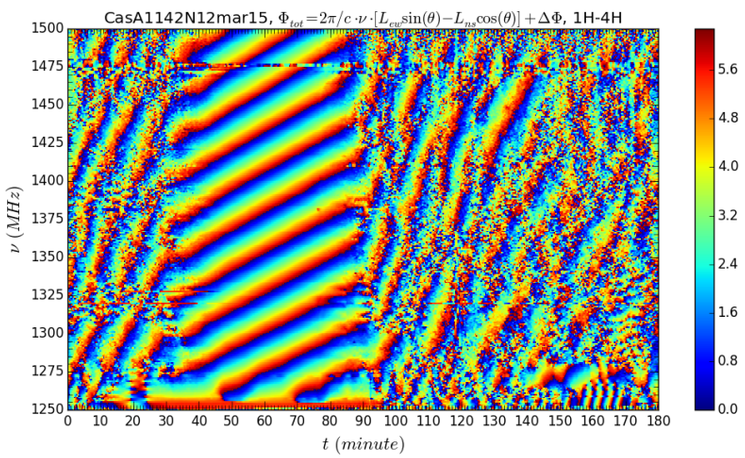
$\Phi_{tot,ij}$

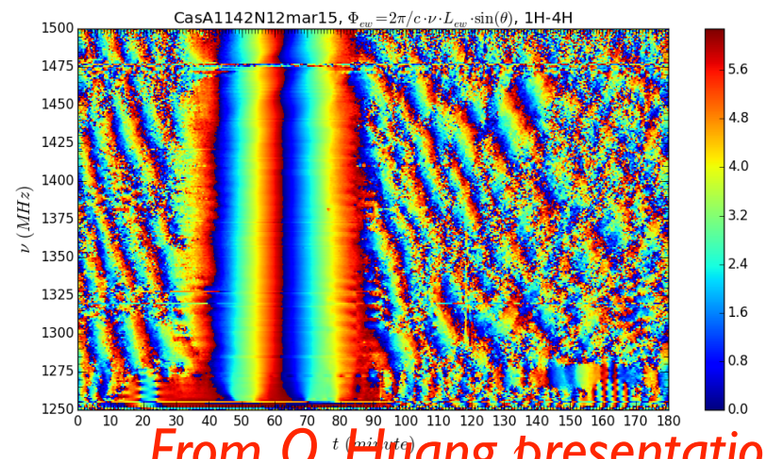


$\Phi_{ew,ij}$









From Q. Huang presentation

https://indico.lal.in2p3.fr/event/2912/contribution/5/material/0/0.pdf

Study of gains, Milky way 21 cm signal extraction

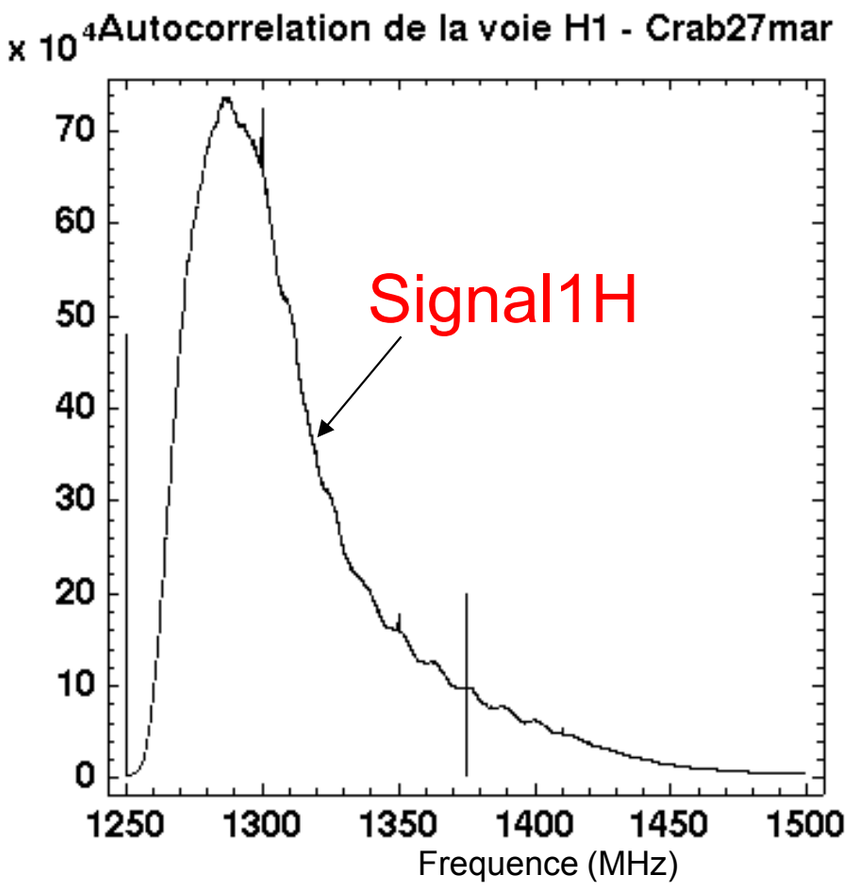
(Thomas Etourneau)

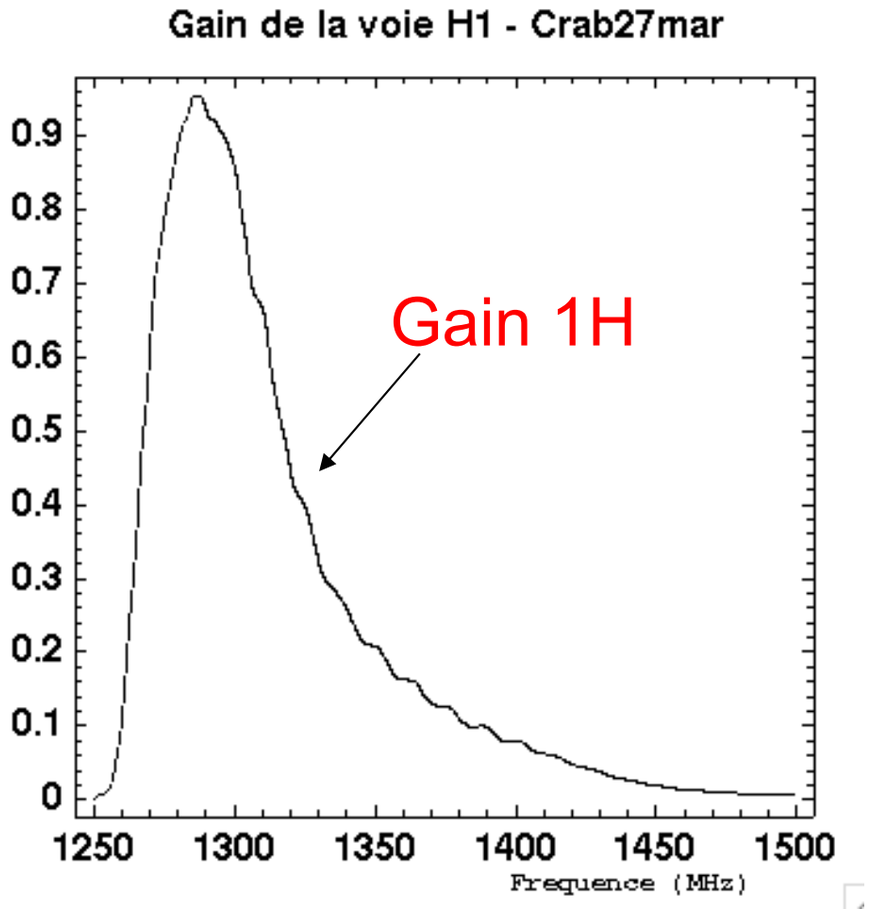
- Analysis of autocorrelation signals - study the g(ν) gain term stability
- Search for transient signals (satellites …)
- Extraction of the Milky way 21 cm signal over 24 hours.

From T. Etourneau presentation
https://indico.lal.in2p3.fr/event/2912/contribution/4/material/slides/0.pdf

Normalized frequency dependent gain term g(ν) extracted from autocorrelations

Allure du spectre des auto-corrélations





From T. Etourneau presentation

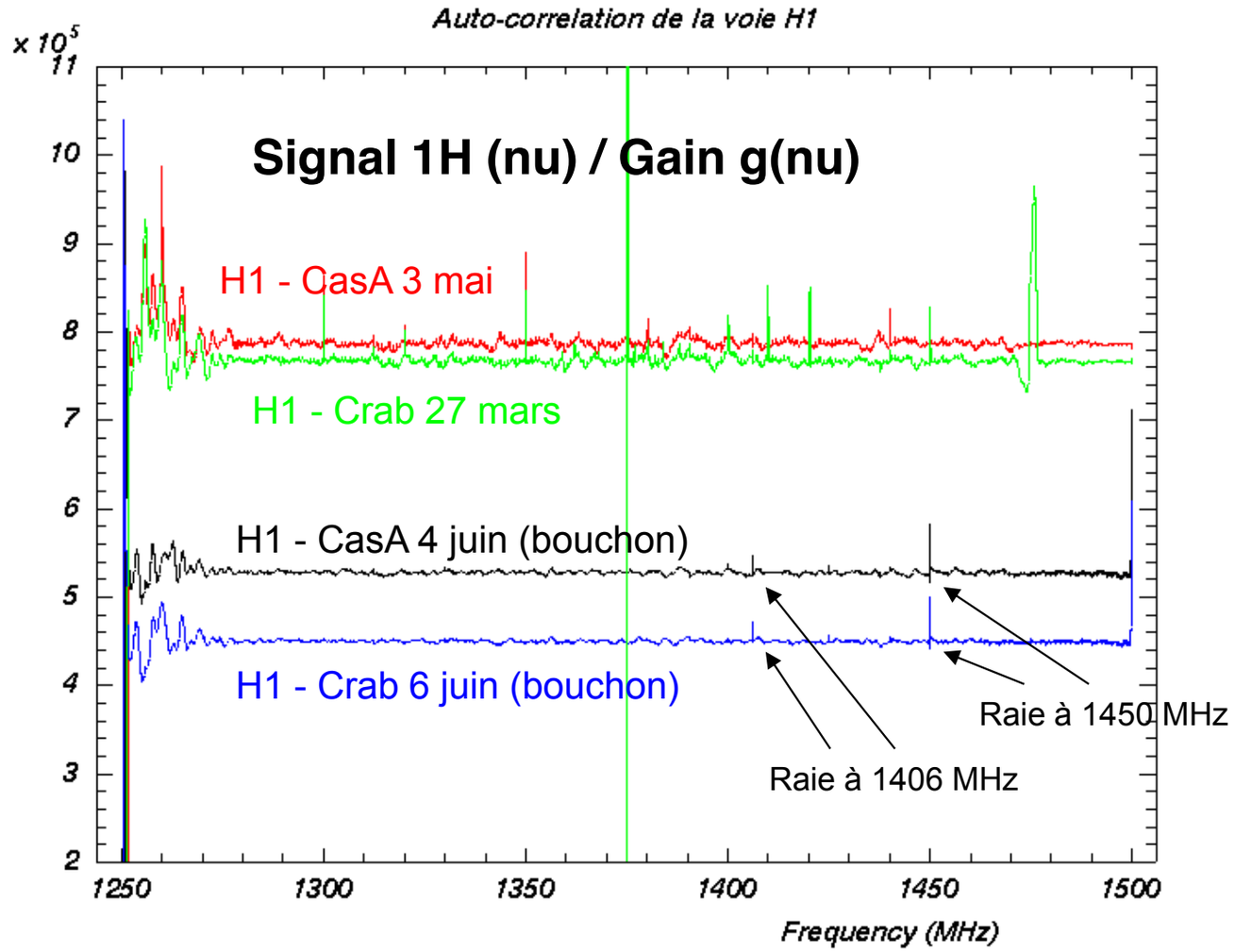
https://indico.lal.in2p3.fr/event/2912/contribution/4/material/slides/0.pdf

Gain corrected spectra and narrow band RFI / electronic generated RFI

Analyse des auto-corrélations

Normalisation des auto-corrélations par leur gain :

On observe :
- Une coupure au milieu du spectre
- 2 raies dans le spectre du bruit (1406 et 1450 MHz)



From T. Etourneau presentation

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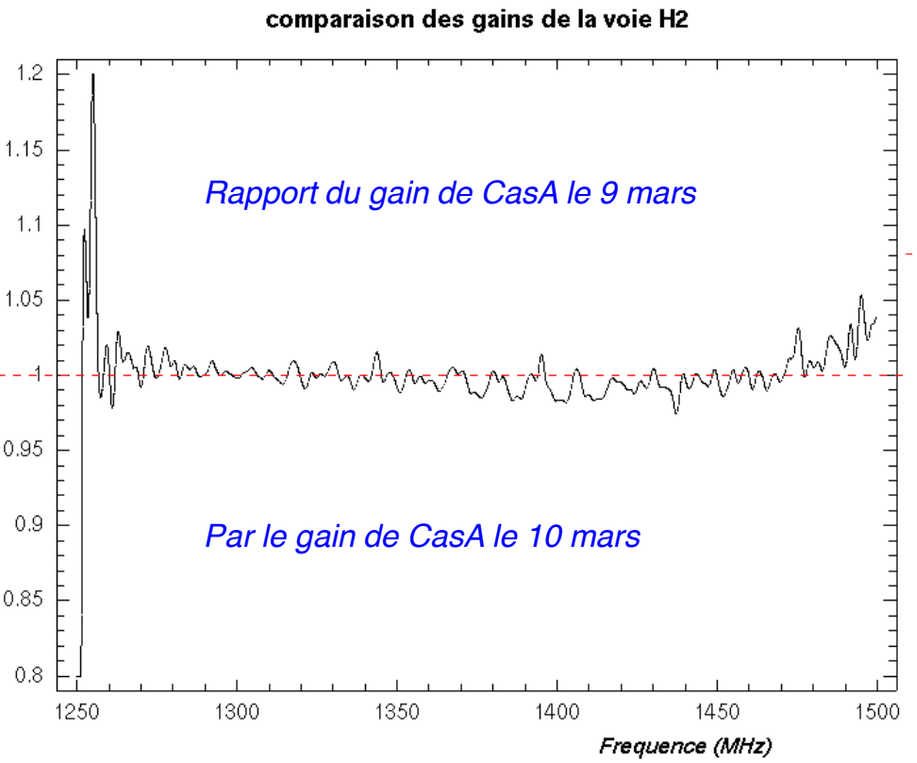
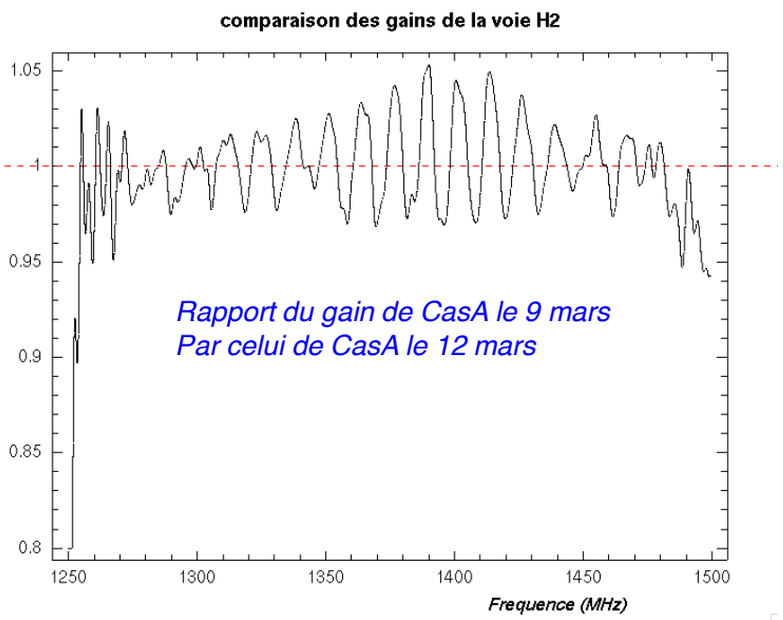
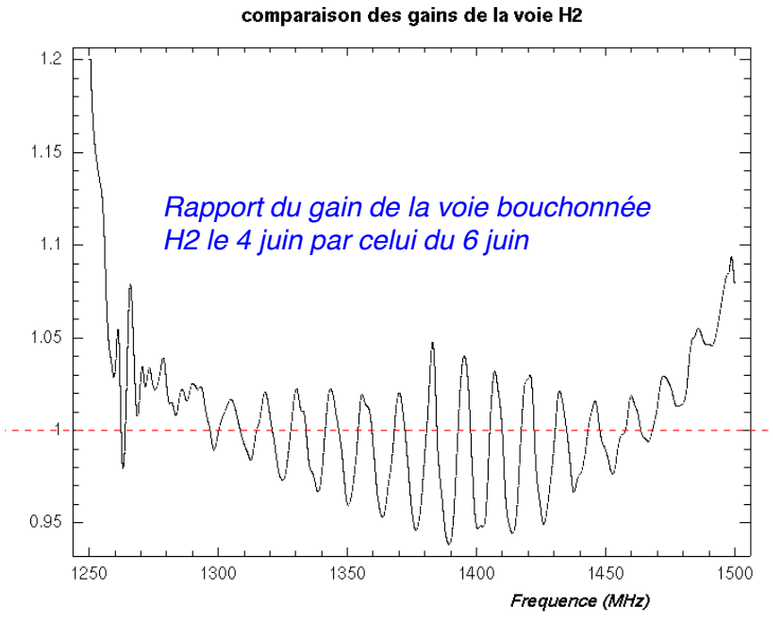
g(ν) gain term stability

Analyse des gains







On constate que :

- La forme reste constante, pas de variation avec le temps
- Le gain présente une oscillation en fonction de la fréquence, avec une période T = 13 MHz

- Overall stability of g(ν)
- But standing waves in cables

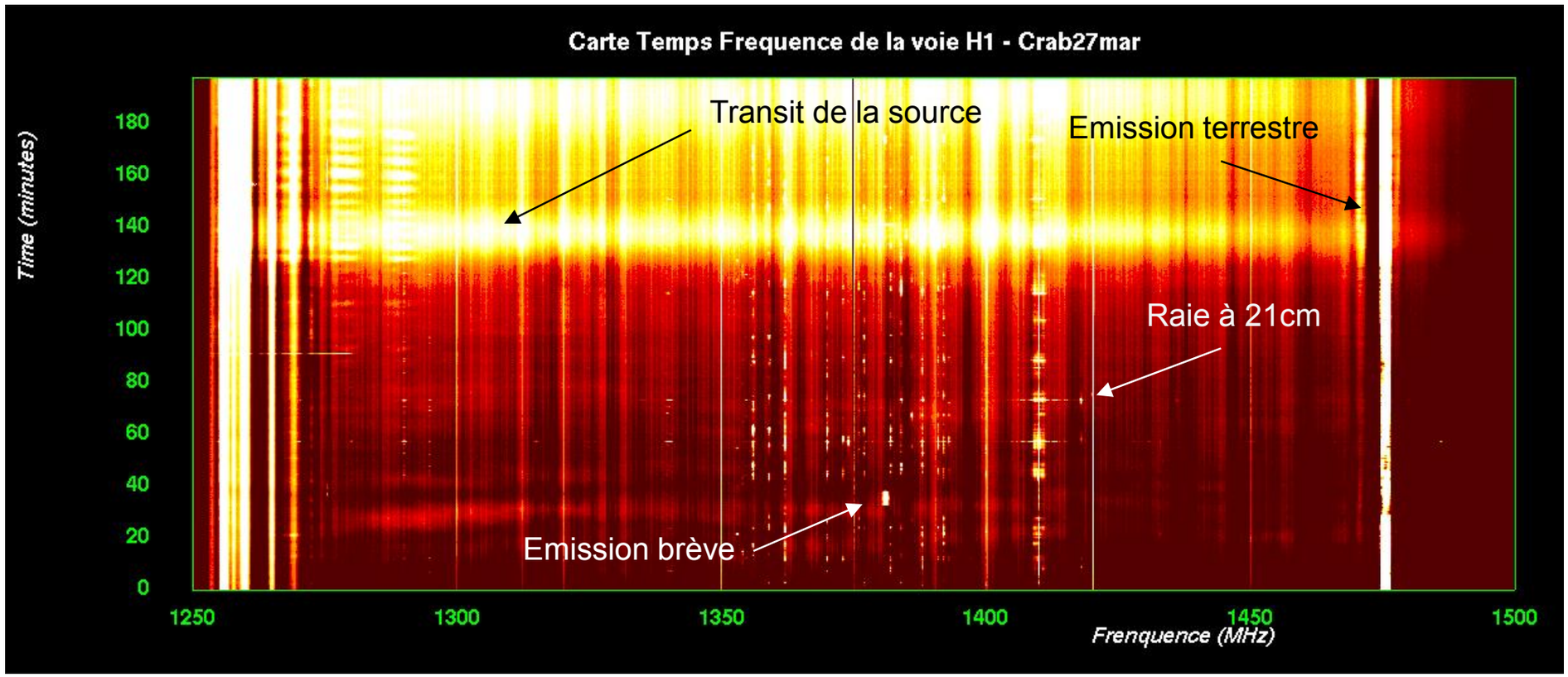
From T. Etourneau presentation

https://indico.lal.in2p3.fr/event/2912/contribution/4/material/slides/0.pdf

2D time-frequency maps : source transit, Galactic 21 cm, transients

Analyse des cartes

On observe : L'émission de la source, des raies, des émissions brèves, …



From T. Etourneau presentation

https://indico.lal.in2p3.fr/event/2912/contribution/4/material/slides/0.pdf

7 δ scans (7 x 24 h) , every 0.75 degree in declination around cygnus for testing map making

Δ_z	Z	Début	Méridien	Fin	Nom Réf.	
-2,25°	4,40°S	Me 8-7 17 h 00	9-7 0 h 44	9-7 17 h 00	CygA24h440S9jul15	
-1,50°	5,15°S	J 9-7 22 h 00	10-7 0 h 40	10-7 22 h 00	CygA24h515S10jul15	
-0,75°	5,90°S	S 11-7 22 h 00	12-7 0 h 32	12-7 22 h 00	CygA24h590S11jul15	
0	6,65°S	L 13-7 4 h 00	14-7 0 h 24	14-7 4 h 00	CygA24h665S13jul15	
+0,75°	7,40°S	Ma 14-7 15 h 00	15-7 0 h 21	En cours	CygA24h740S14jul15	
+1,50°	8,15°S					
+2,25°	8,90°S					

Being carried out by Claude Pailler