

PAON4: fit des franges d'interférences

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PLAN

- CasA 31Oct17
 - Modèle et fit des Auto-corrélations;
 - Modèle et fit des Cross-corrélations
 - Modèle et fit des phases instrumentales
 - Rotation de phases
- Phases de CasA 31 Oct 17 appliquées sur CasA 25 Nov 17.
- Pour plus de détails voir <https://bao-radio.lal.in2p3.fr/index.php/PAON4/Analyses>

Usage du transit de Cas A

Source brillante et « ponctuelle »

Les Auto-corrélations : voie par voie séparément (4 auto) et fréquence par fréquence.

$$V_{ii}(N_{a,i}, D_i, a_{z,i}, Ct_{a,i}, Slope_{a,i}; h) = \underbrace{B(N_{a,i}, D_i, a_{z,i}; h)}_{\text{Beam}} + \underbrace{Ct_{a,i} + h * Slope_{a,i}}_{\text{Fond linéaire}}$$

Beam

Fond linéaire

$$B(N, D, a_z; h) = N \times \exp[-0.22 x^2]$$

$$x = \pi \left(\frac{\nu}{c} \right) D \|\mathbf{n}_s \times \mathbf{n}_p\|$$

D: diamètre effectif

$$\mathbf{n}_p = \begin{pmatrix} l_1 \\ m_1 \\ n_1 \end{pmatrix} = \begin{pmatrix} \cos a_z & -\sin a_z & 0 \\ \sin a_z & \cos a_z & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} l_0 \\ m_0 \\ n_0 \end{pmatrix}$$

a_z : défaut de pointé azimut

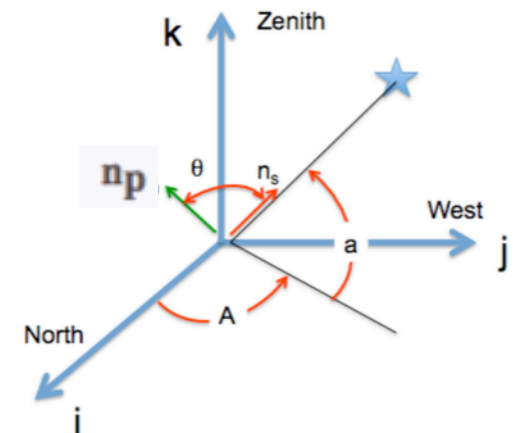
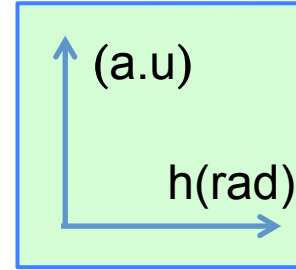
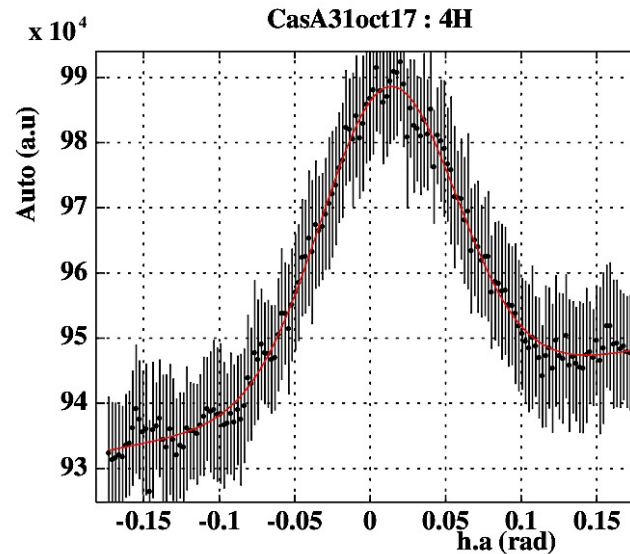
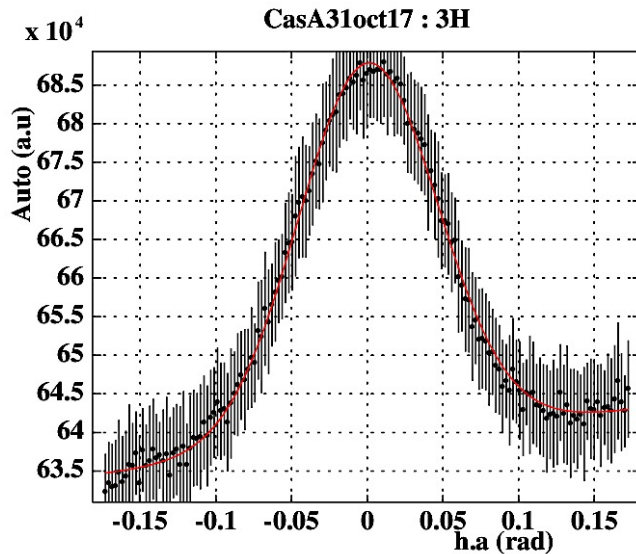
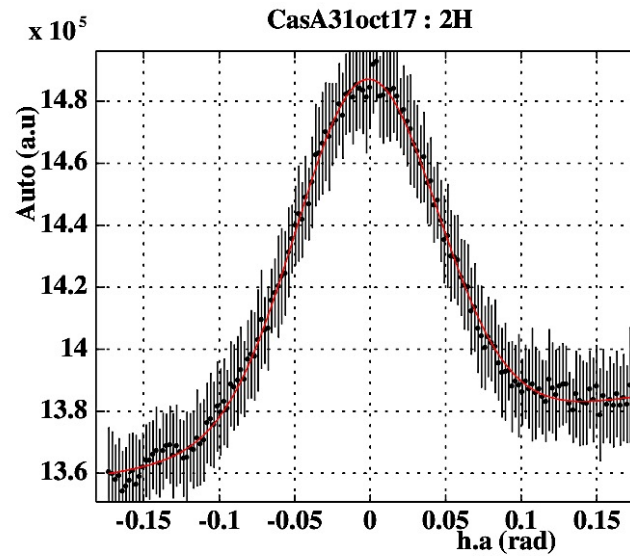
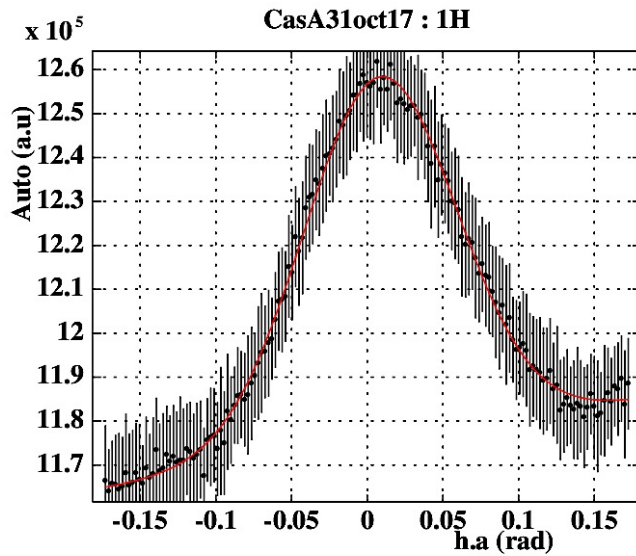


FIGURE 2.5 - Définition des axes est angles dans le repère dit "horizontal".

Exemple: CasA 31 Oct 17



1349MHz



Les Cross-corrélations : fit combiné des 6 cross

Les défauts en azimut (a_z) et les diamètres effectifs (D) sont fixés aux valeurs estimées à partir des auto-corrélations

Partie réelle

Fond plat

$$V_{ij}^R(N_{b,i}, N_{b,j}, \mathbf{n}_{b,ij}, \Delta\Phi_{ij}, Ct_{b,ij}; h) = V_{ij}^{nosc}(N_{b,i}, N_{b,j}) \times \cos\left(\varphi_{ij}(\mathbf{n}_{b,ij}, \Delta\Phi_{ij}; h)\right) + Ct_{b,ij}$$

$$V_{ij}^{nosc}(N_{b,i}, N_{b,j}) = \sqrt{B(N_{b,i}, \tilde{D}_i, \tilde{a}_{z,i}; h) B(N_{b,j}, \tilde{D}_j, \tilde{a}_{z,j}; h)}$$

Moyenne géométrique des beams

N_b : normalisation ici prise indépendante de N_a (cf. auto-corr)

$$\varphi_{ij}(\mathbf{n}_{b,ij}, \Delta\Phi_{ij}; h) = -2\pi \left(\frac{\nu}{c}\right) \mathbf{n}_s \cdot \mathbf{n}_{b,ij} + \Delta\Phi_{ij}$$

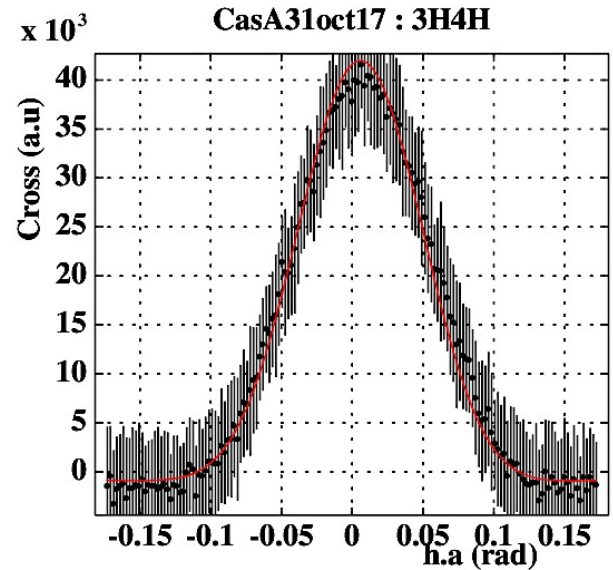
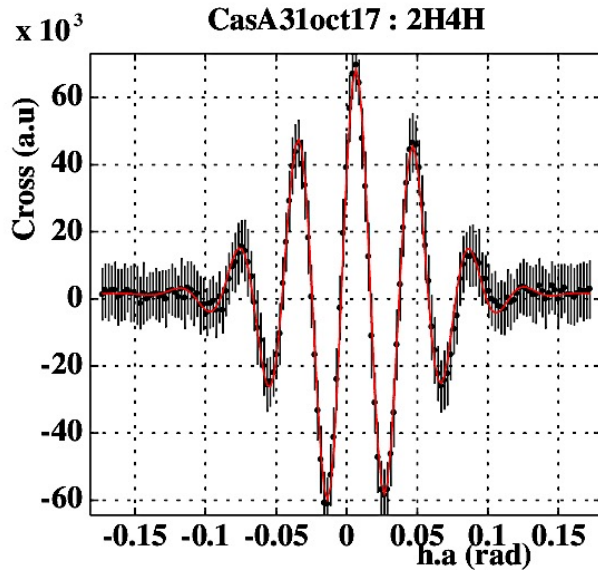
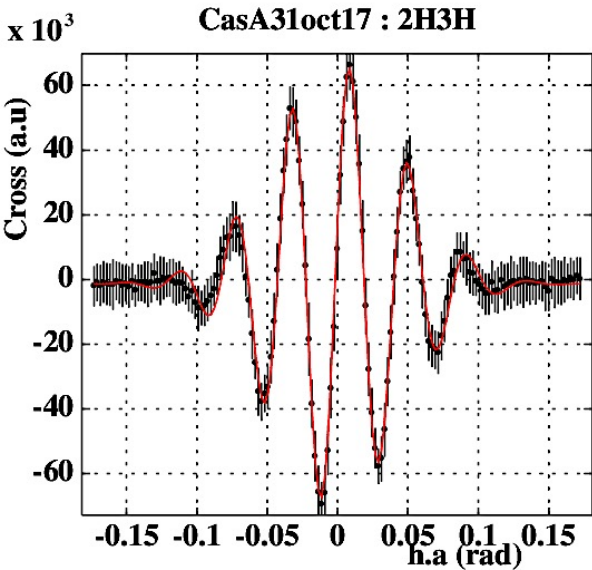
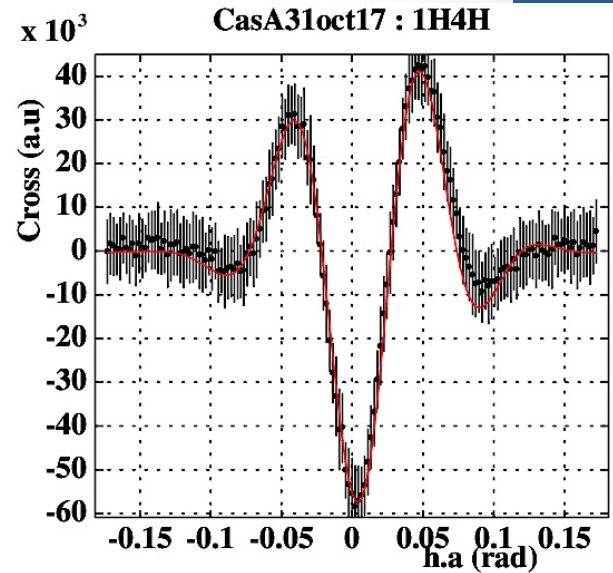
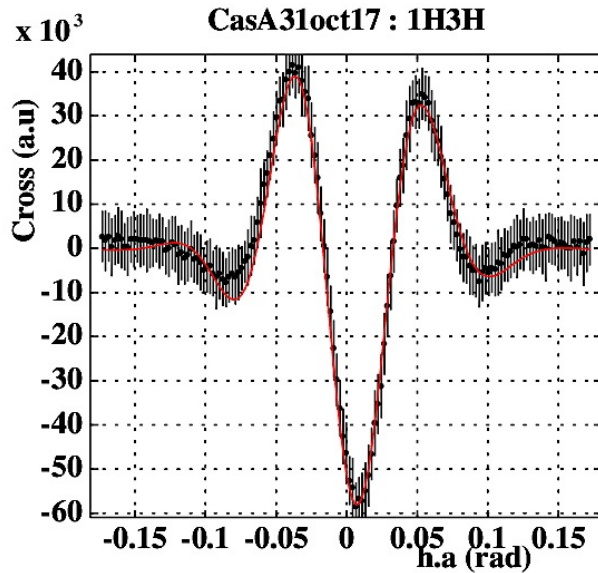
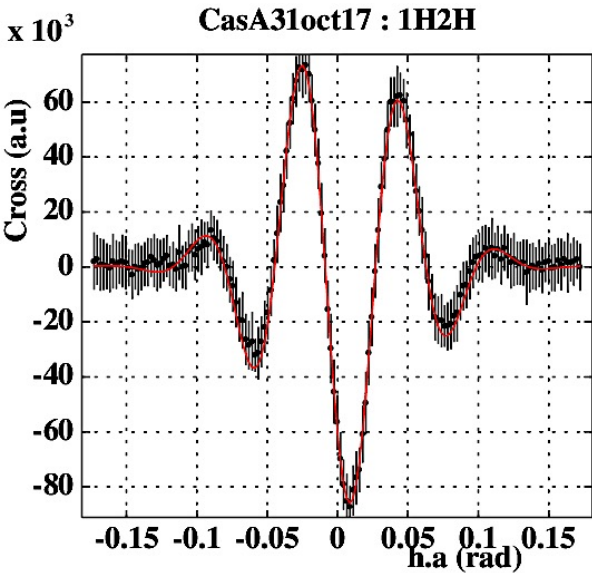
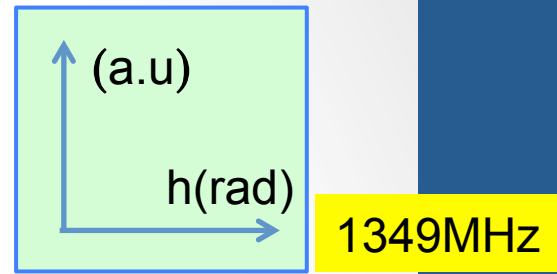
Déphasage instrumental

Vecteur des lignes de base fixées au valeur géométrique (fit instable sinon)

convention

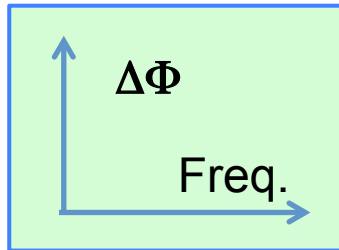
$$\Phi_{1H} = 0$$
$$(\mathbf{x}_1, \mathbf{y}_1, \mathbf{z}_1) = 0$$

Exemple: CasA 31 Oct 17

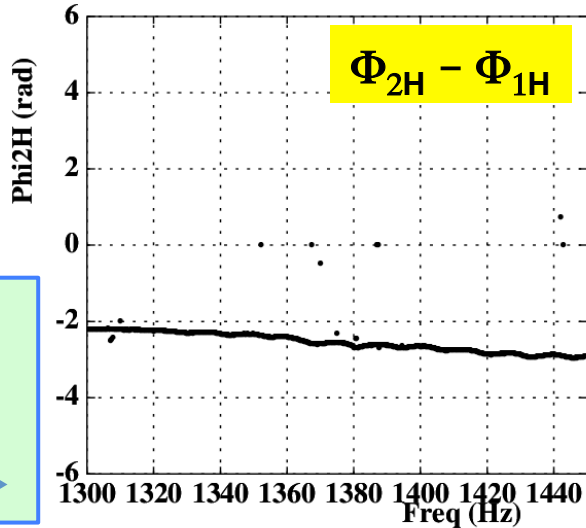


Les phases instrumentales

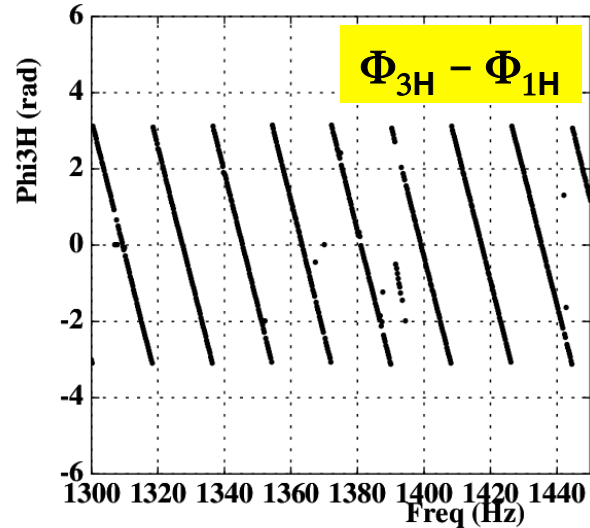
$$\Phi_{1H} = 0$$



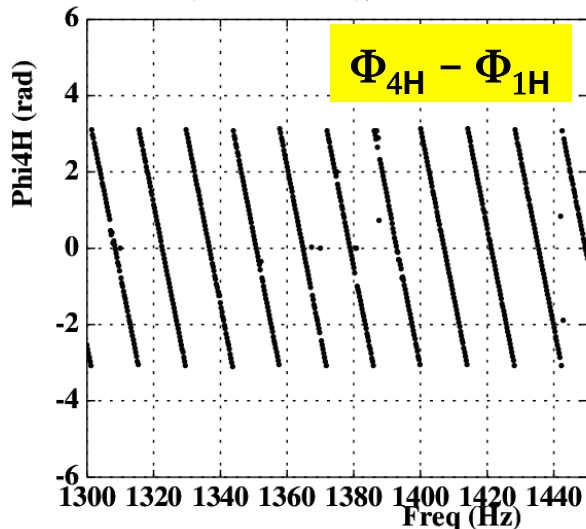
(CasA31oct17), $\Phi_{1H}=0$



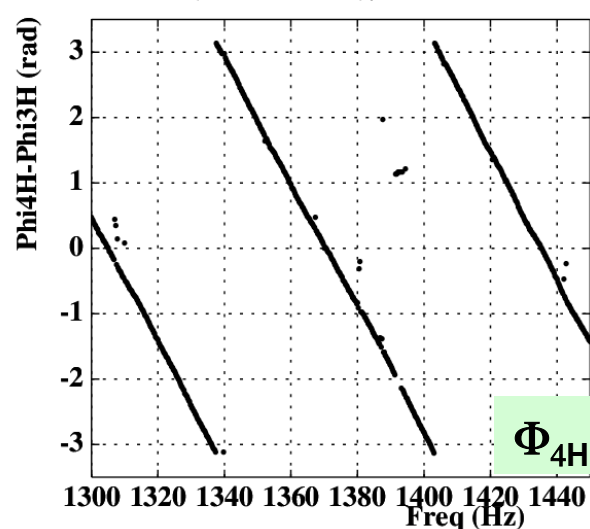
(CasA31oct17), $\Phi_{1H}=0$



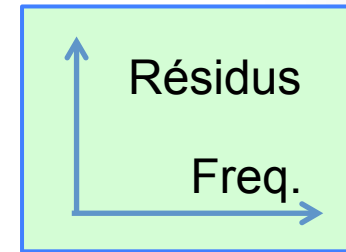
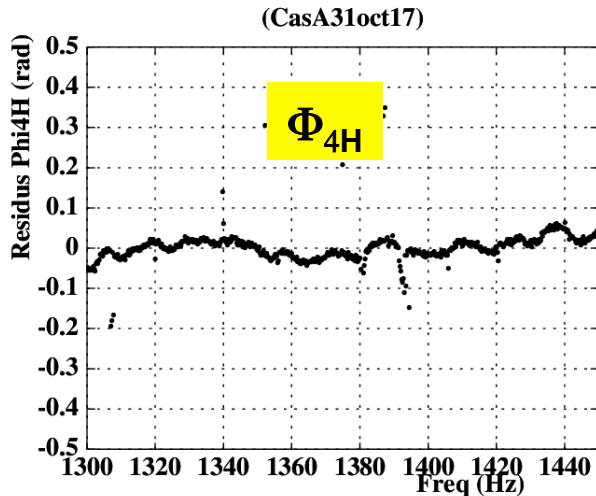
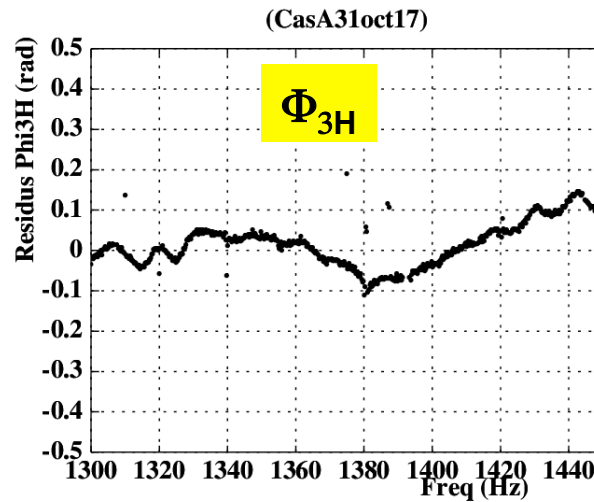
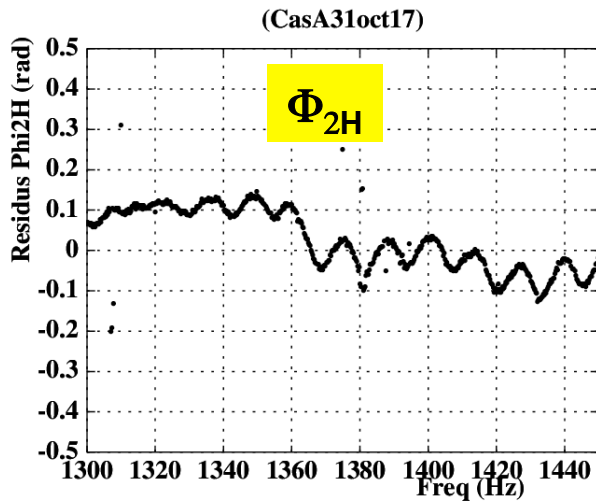
(CasA31oct17), $\Phi_{1H}=0$



(CasA31oct17), $\Phi_{1H}=0$



Les phases instrumentales (modèles)



$$\Phi_{2H}(\nu) = p_1 + p_2(\nu - p_0)$$

Forme « linéaire »

$$\Phi_i(\nu) = 2 \arctan \left(\tan^{-1} \left[\pi \{ *p_{0,i} * (\nu + p_{1,i}) + 1/2 \} \right] \right)$$

Forme « dents de scie »

Rotation de phases

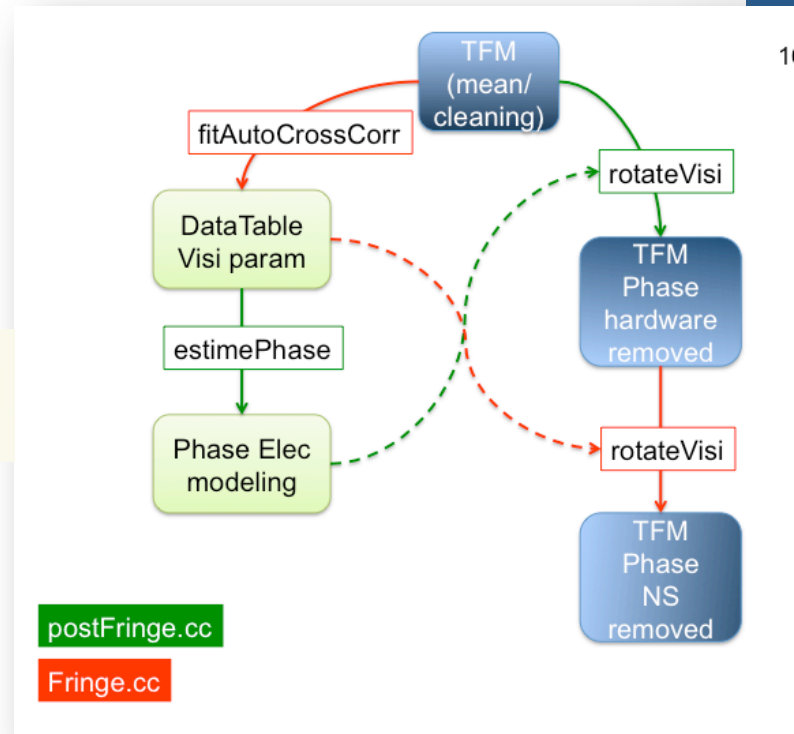
L'idée est en **premier** lieu de **corriger les cartes Temps-Fréquence des phases instrumentales** pour pouvoir amorcer le map-making.

En **second** lieu on peut aussi vouloir **garder que les phases E-W** pour tous les couples de voies et voir si les franges d'interférences sont « synchrones ».

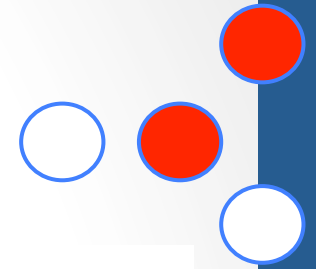
$$\tilde{V}_{pq}(\nu, t) = V_{pq}(\nu, t) \times \exp\{i (\Phi_p(\nu) - \Phi_q(\nu))\}$$

$$\tilde{\tilde{V}}_{pq}(\nu, t) = \tilde{V}_{pq}(\nu, t) \times \exp\{2\pi i \left(\frac{\nu}{c}\right) \mathbf{n}_s(t) \cdot \bar{\mathbf{n}}_{\mathbf{b},pq}\}$$

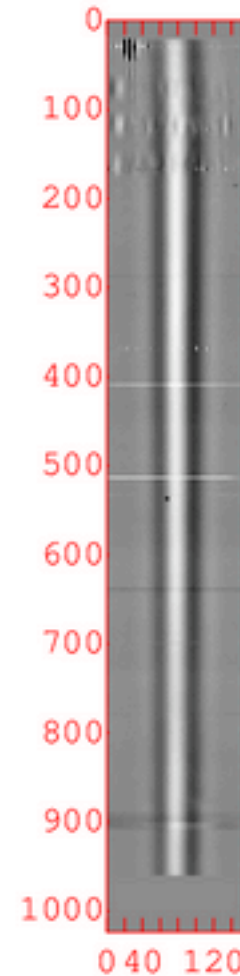
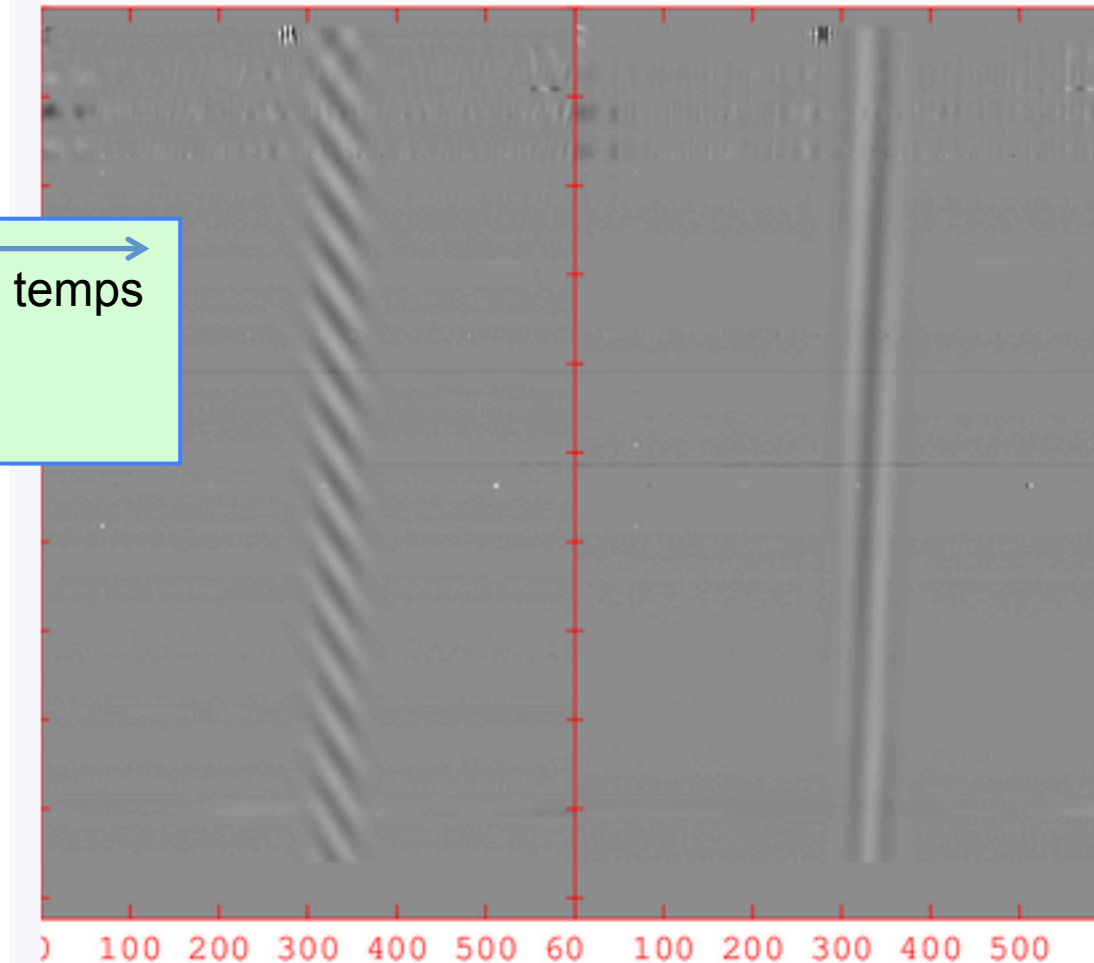
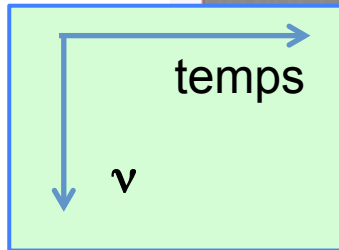
$$\bar{\mathbf{n}}_{\mathbf{b},pq} = \begin{pmatrix} x_q - x_p \\ 0 \\ z_q - z_p \end{pmatrix} \begin{matrix} \text{N-S} \\ \\ \text{« Vertical »} = 0 \end{matrix}$$



Exemple CasA 31 Oct 17

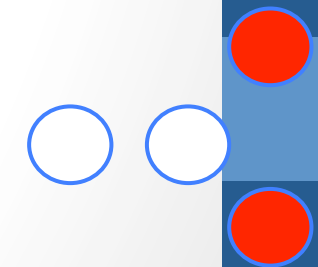
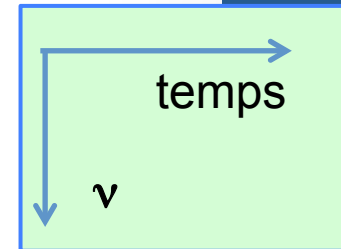
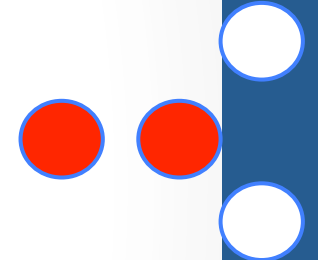
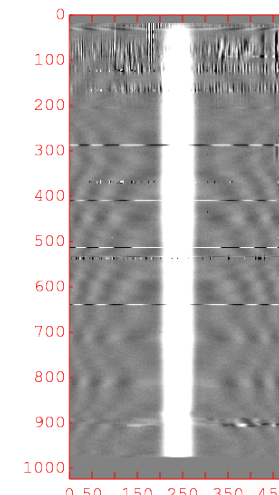
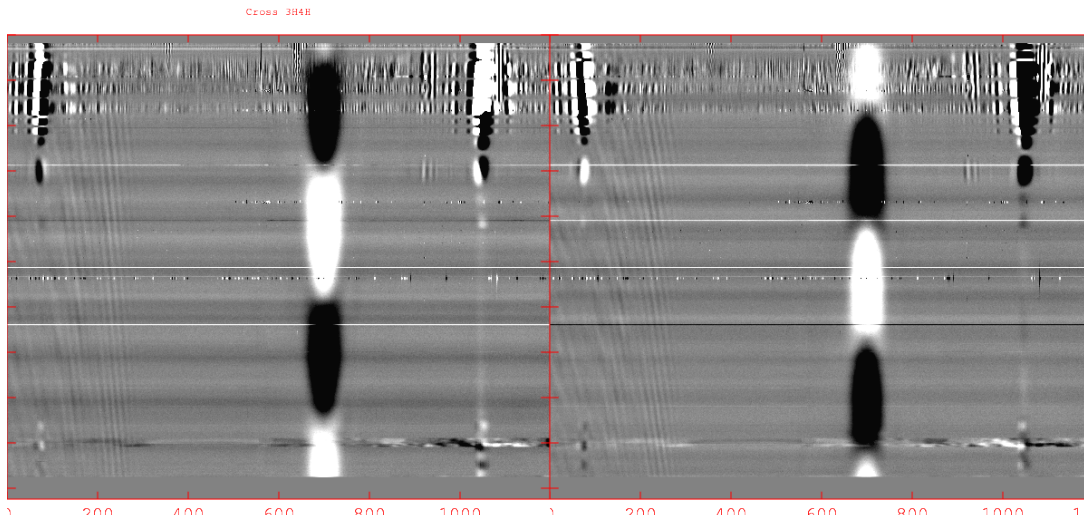
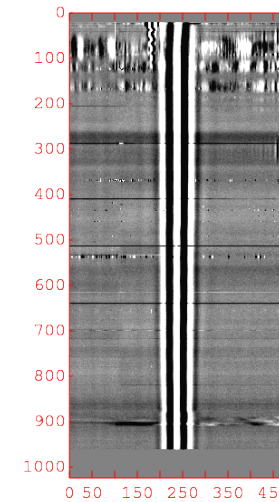
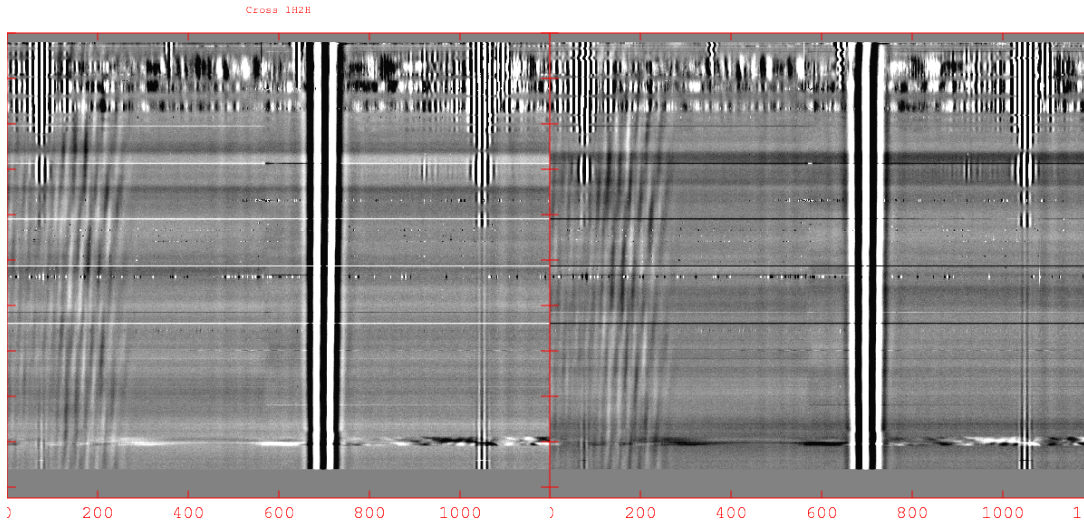


Cross 1H4H

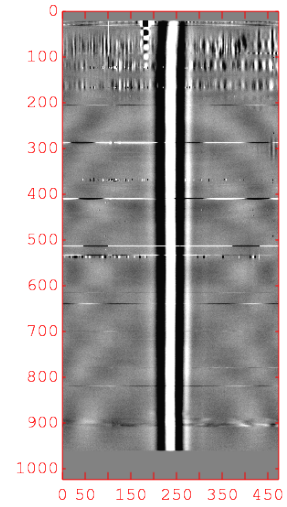
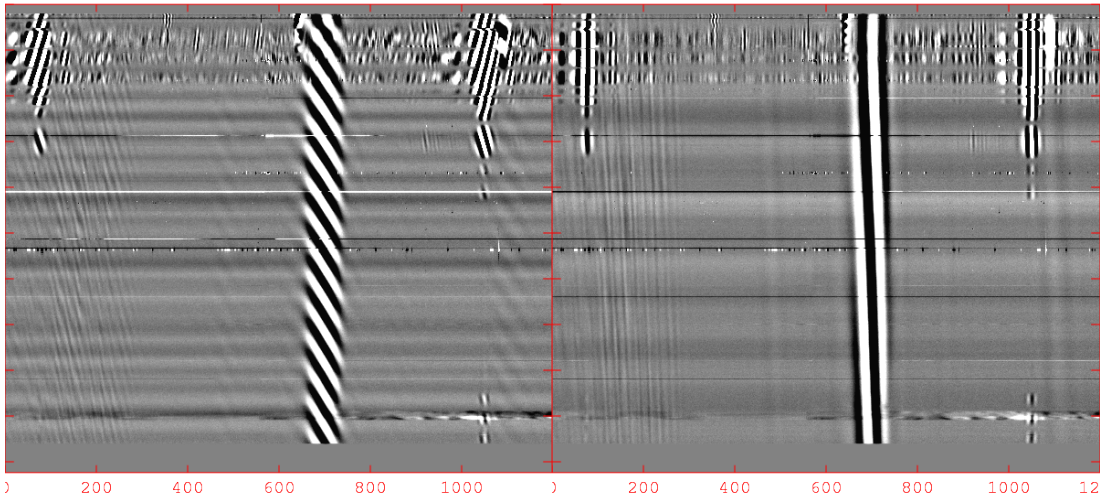


Test de stabilité des phases inst.

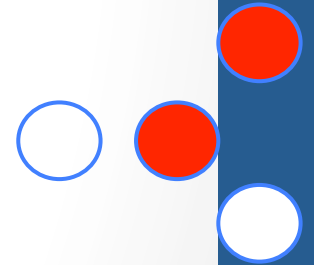
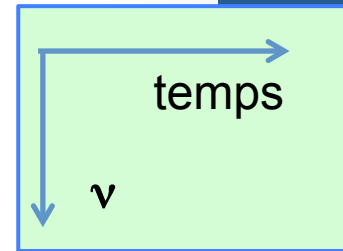
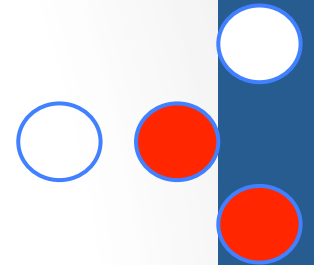
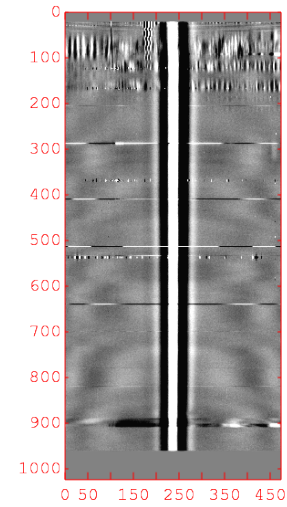
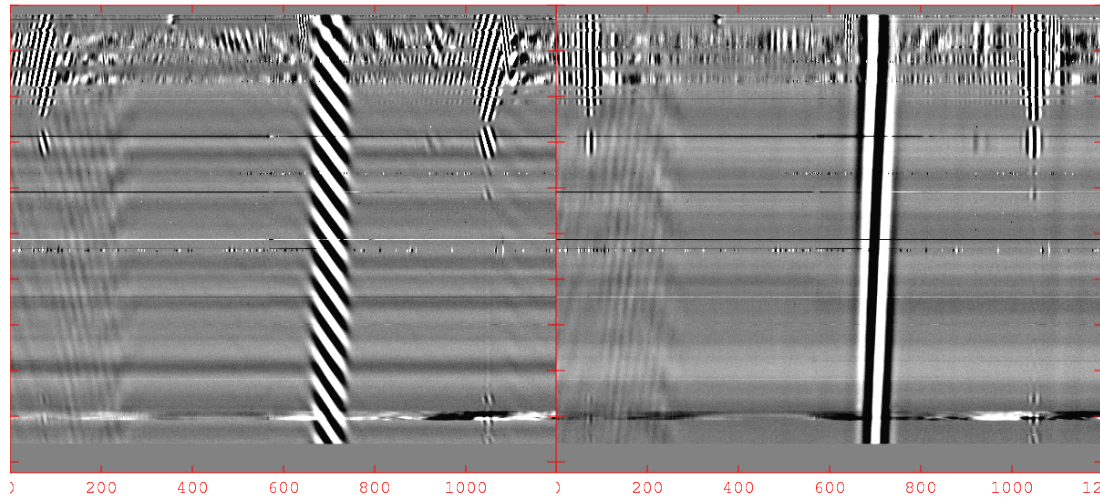
Phases du 31 Oct 17 appliquées telles quelles sur l'observation du 25 Nov 17



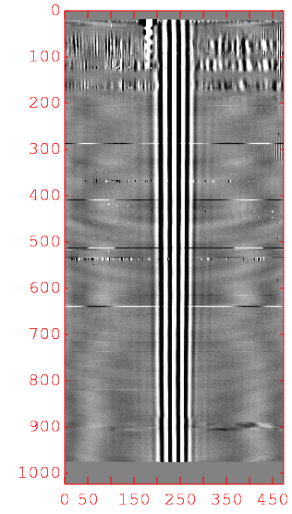
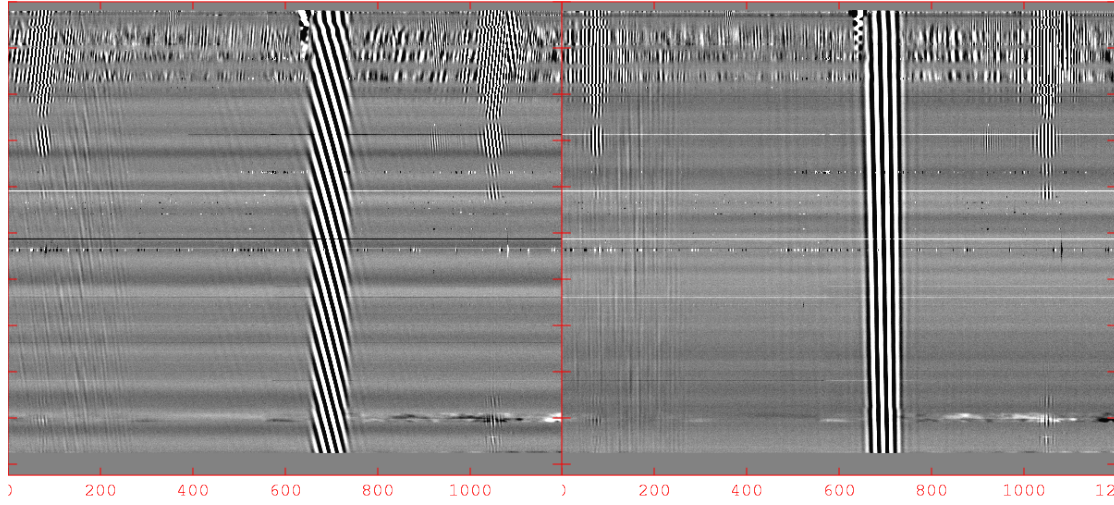
Cross LH3H



Cross LH4H



Cross 283H



Cross 284H

