Calibrating LBA

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3/2/16 - LSM

Let’s start with PHASES

Circular polarization

Ionosphere delay and FR are diagonal and phase only

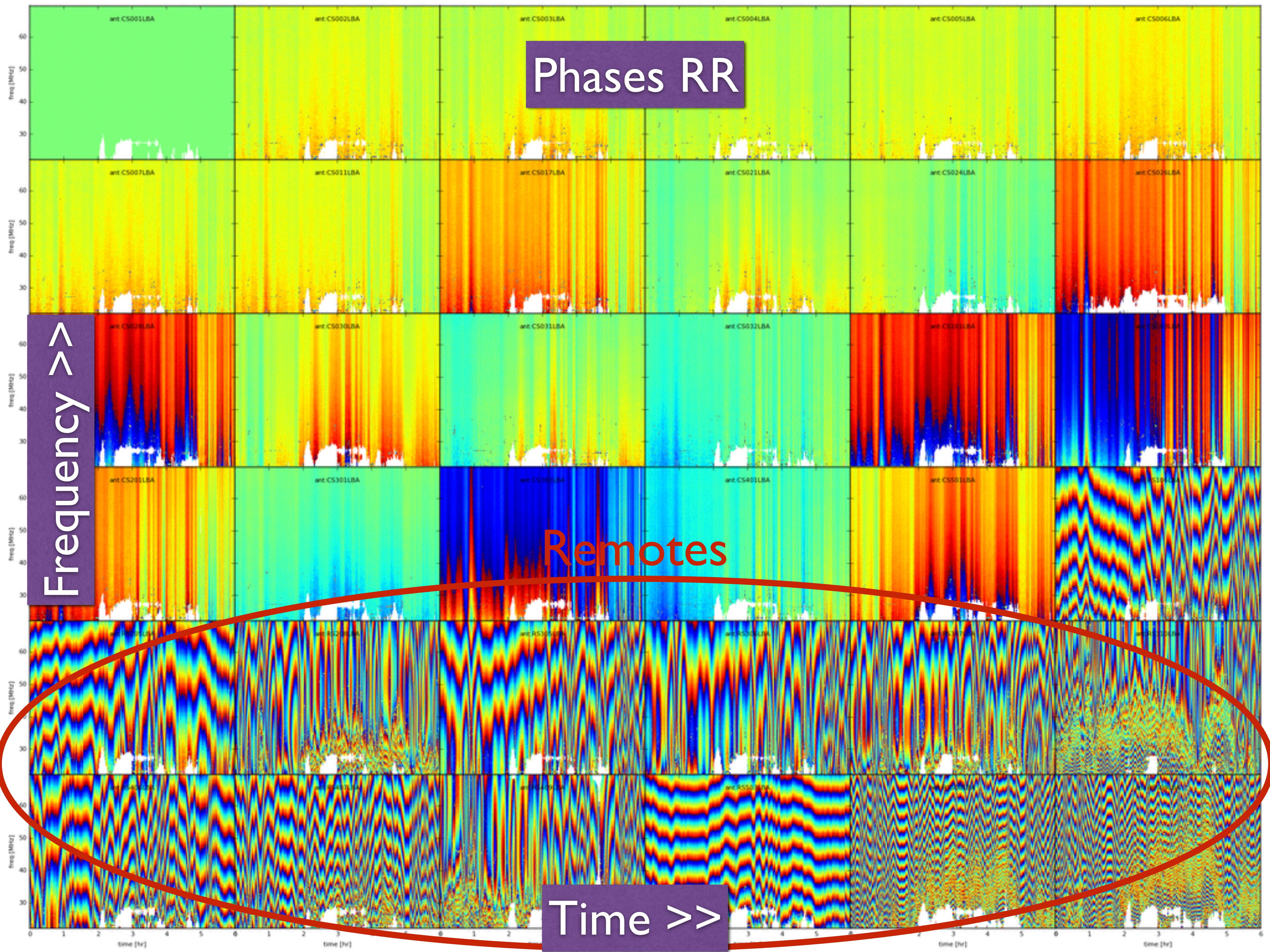
$$\mathbf{J} = \begin{bmatrix} e^{j(\theta+\varphi)} & 0 \\ 0 & e^{j(\theta-\varphi)} \end{bmatrix} = \begin{bmatrix} e^{j\phi_R} & 0 \\ 0 & e^{j\phi_L} \end{bmatrix}$$

We can reconstruct two terms

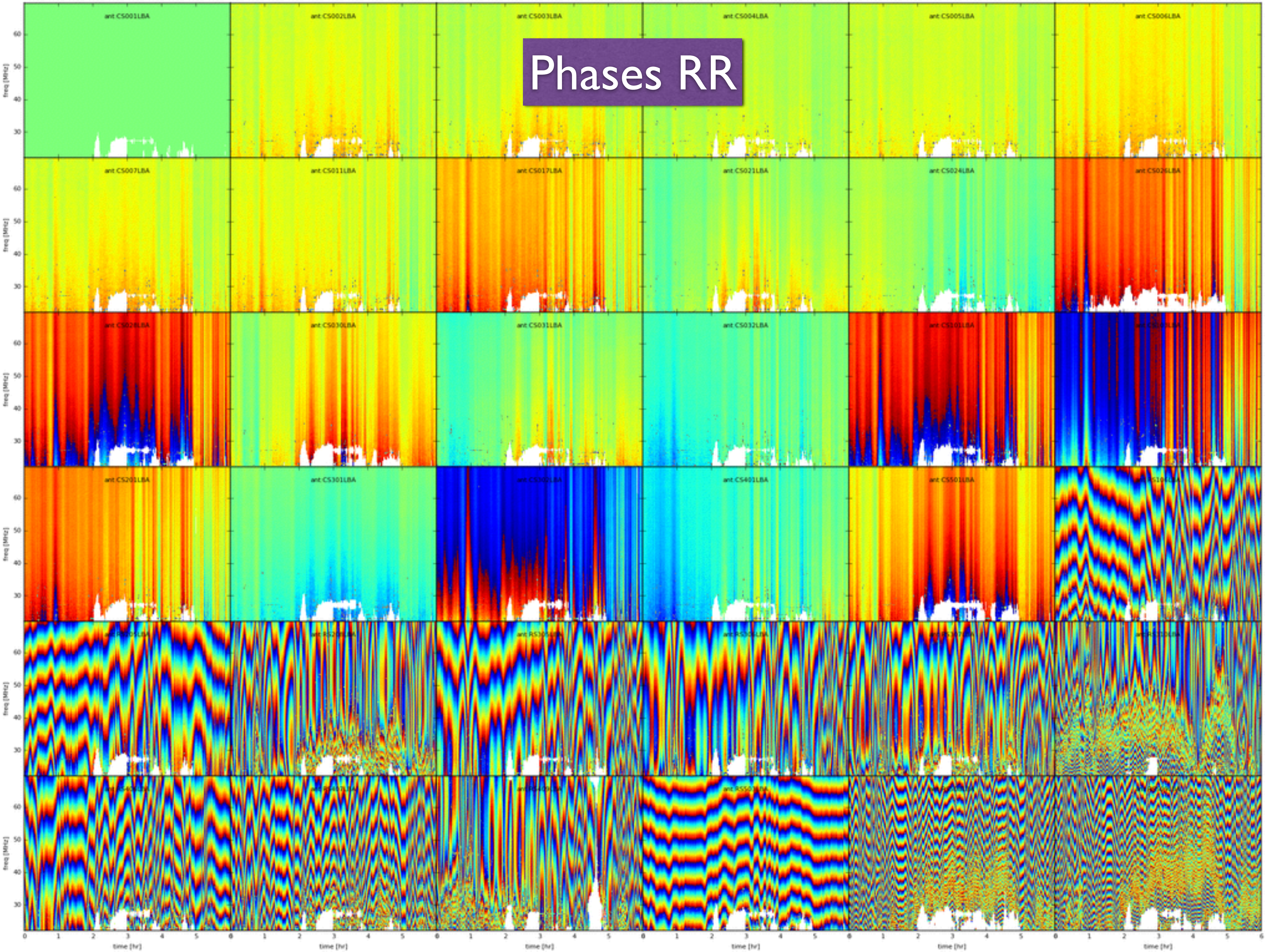
$$\Delta\theta = (\Delta\phi_R + \Delta\phi_L)/2,$$
$$\Delta\varphi = (\Delta\phi_R - \Delta\phi_L)/2.$$

Delays $\longrightarrow$ $\Delta\theta = 2\pi f \Delta t + 8.44797245 \times 10^9 \Delta TEC/f$

Faraday rotation $\longrightarrow$ $\Delta\varphi = \Delta RM\lambda^2.$


Phases RR
Frequency >>
Remotes
Time >>
ant CS001LBA
ant CS002LBA
ant CS003LBA
ant CS004LBA
ant CS005LBA
ant CS006LBA
ant CS007LBA
ant CS011LBA
ant CS017LBA
ant CS021LBA
ant CS024LBA
ant CS026LBA
ant CS030LBA
ant CS031LBA
ant CS032LBA
ant CS401LBA
ant CS501LBA
freq [MHz]
time [hr]

Phases RR



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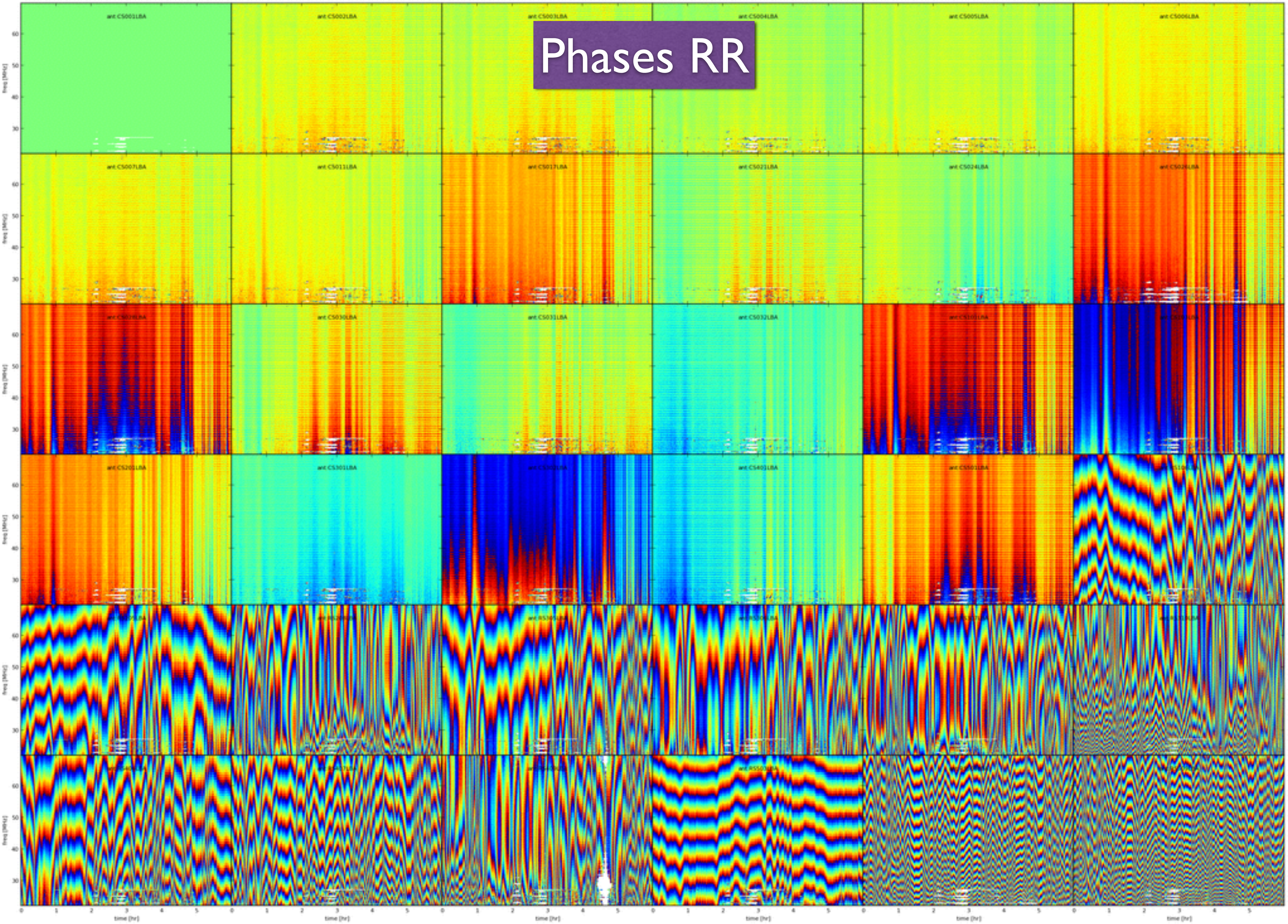
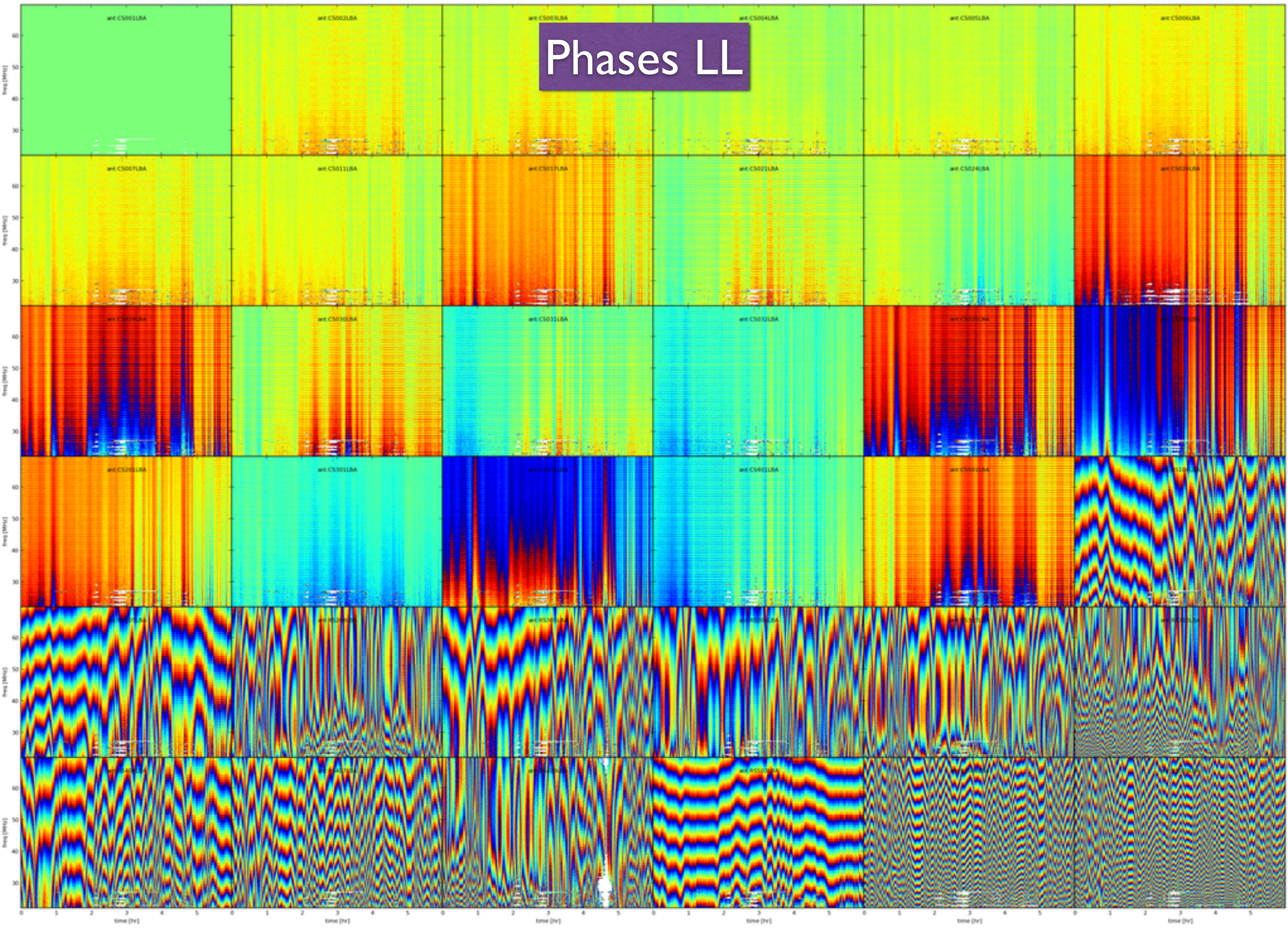
ant:CS401LBA
ant:CS501LBA
freq [MHz]
time [hr]

Phases RR

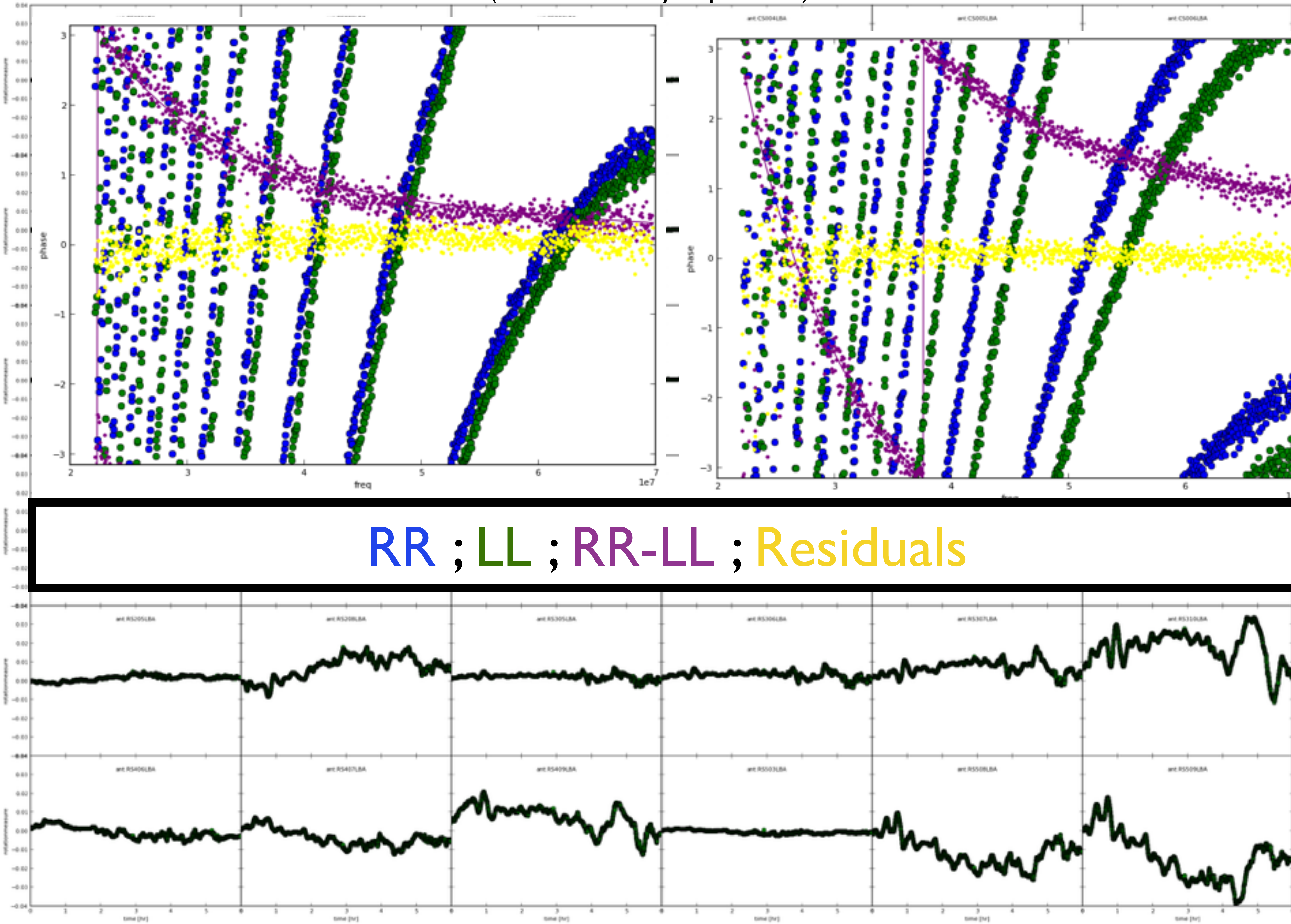


Phases LL



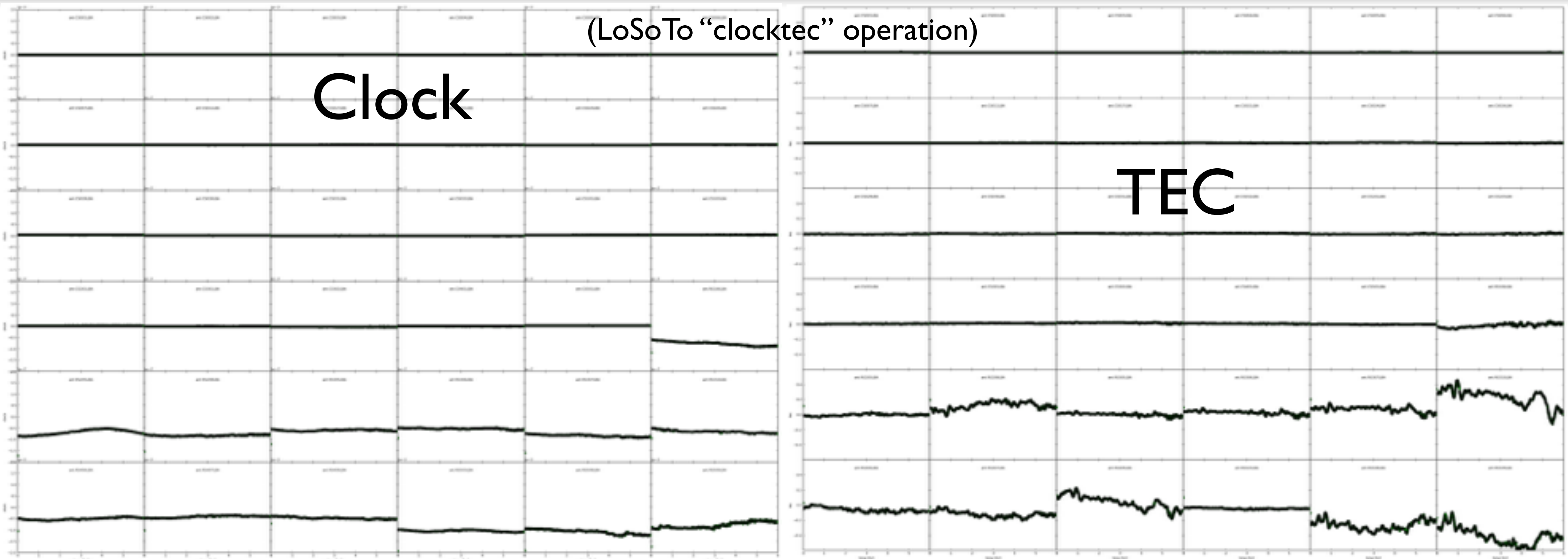
Rotation Measure

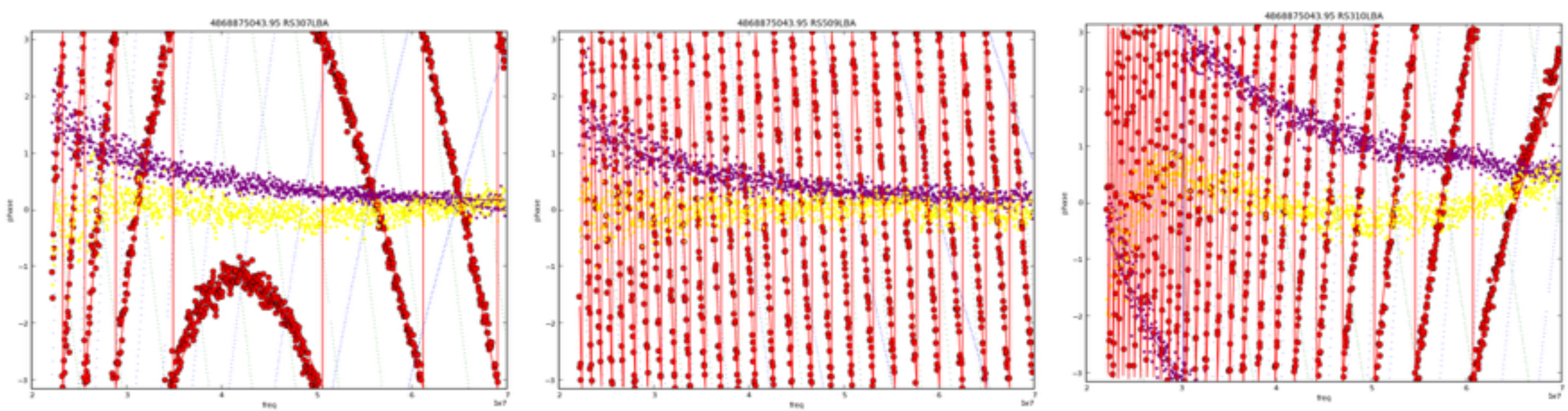
(LoSoTo “faraday” operation)



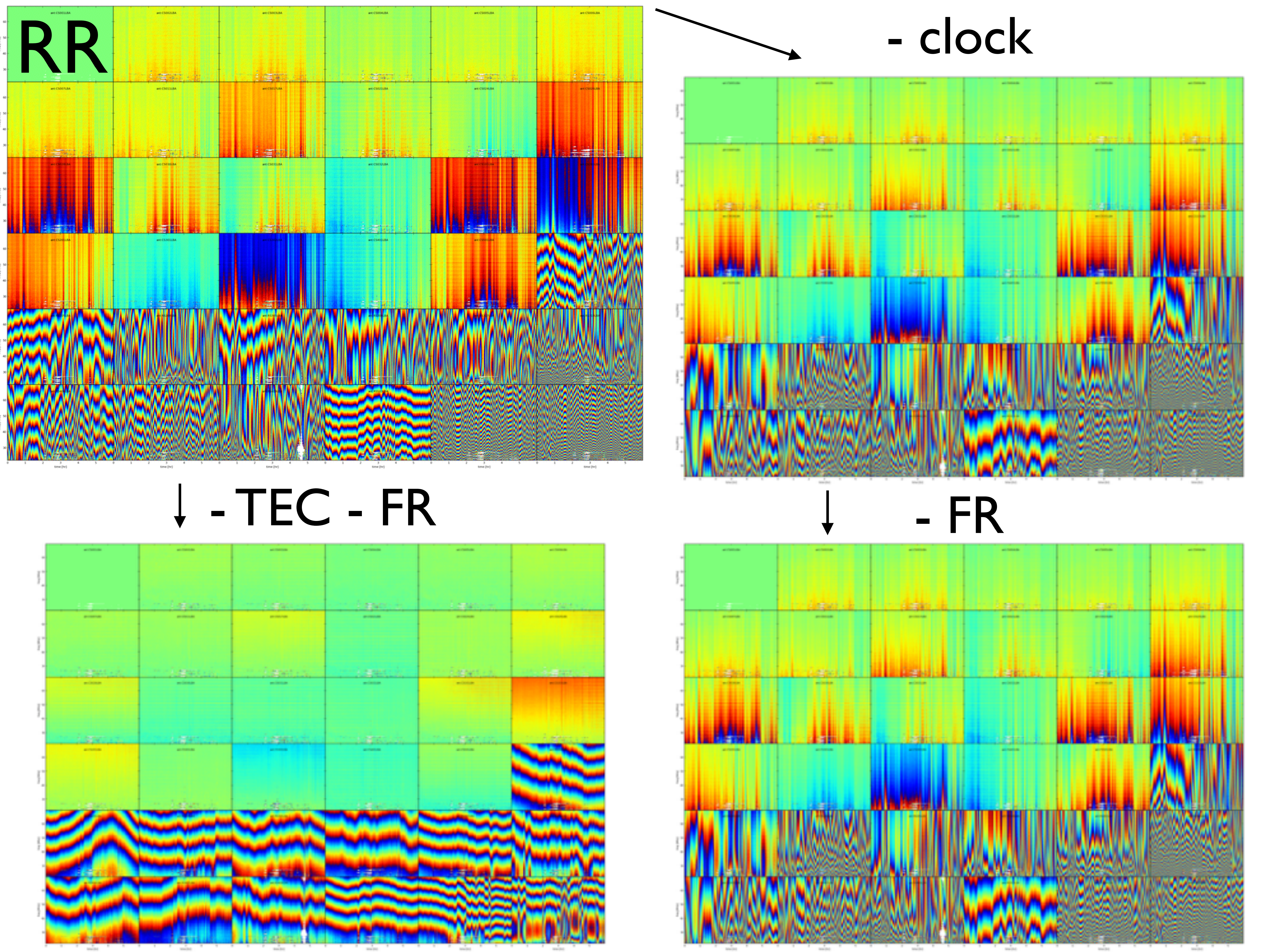
Clock/TEC separation

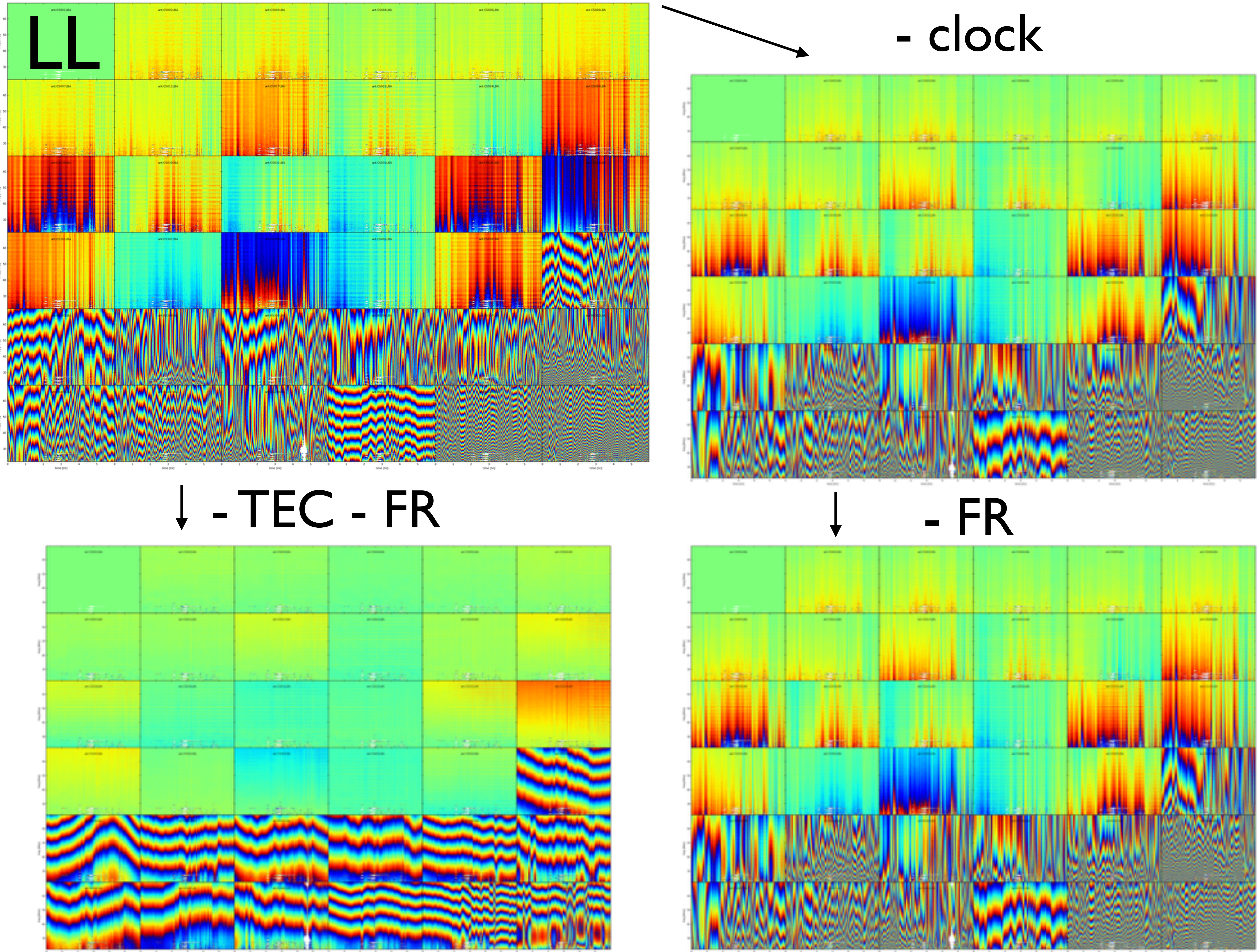
(LoSoTo "clocktec" operation)



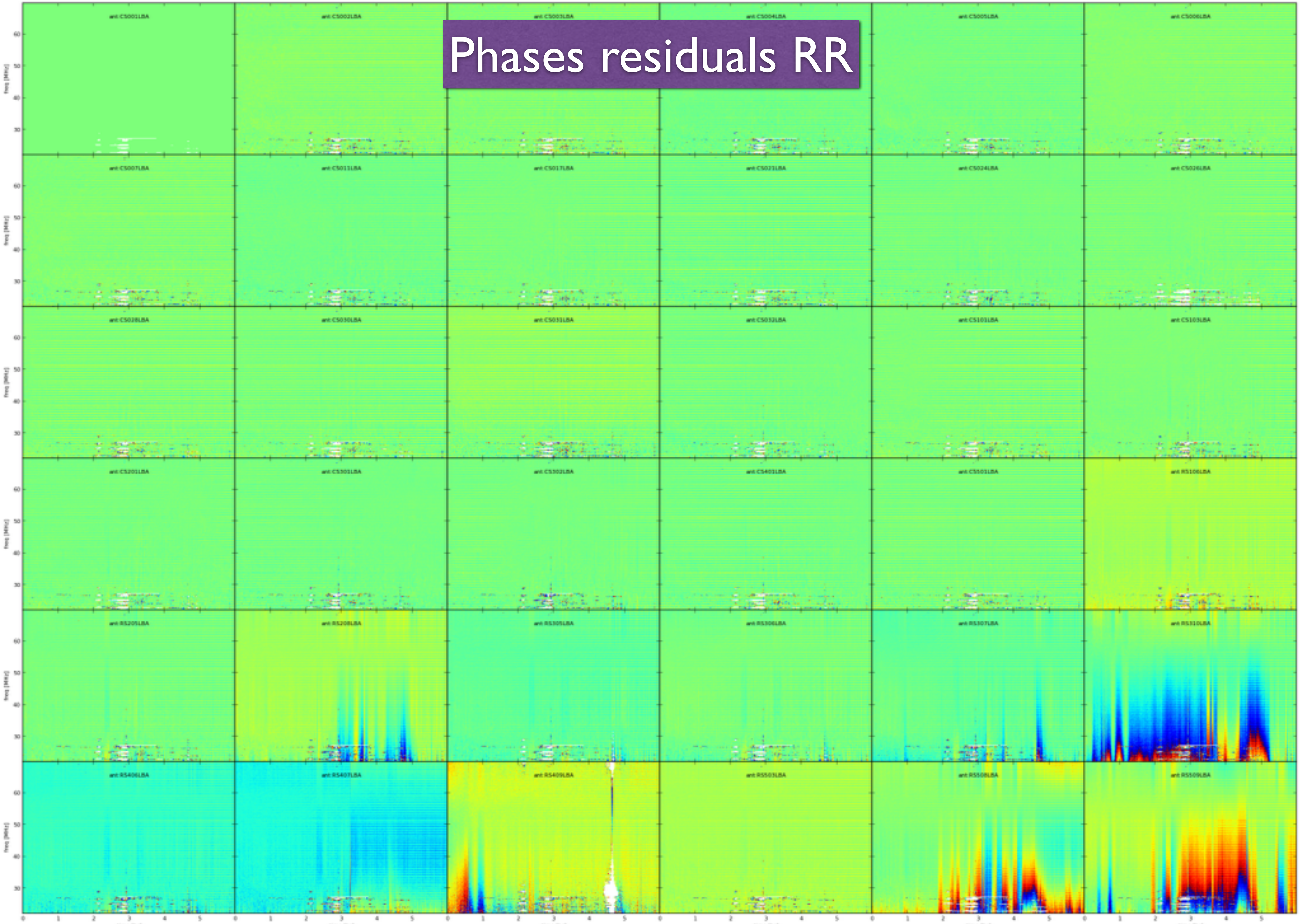


$$\Delta\theta = 2\pi f \Delta t + 8.44797245 \times 10^9 \Delta TEC/f$$

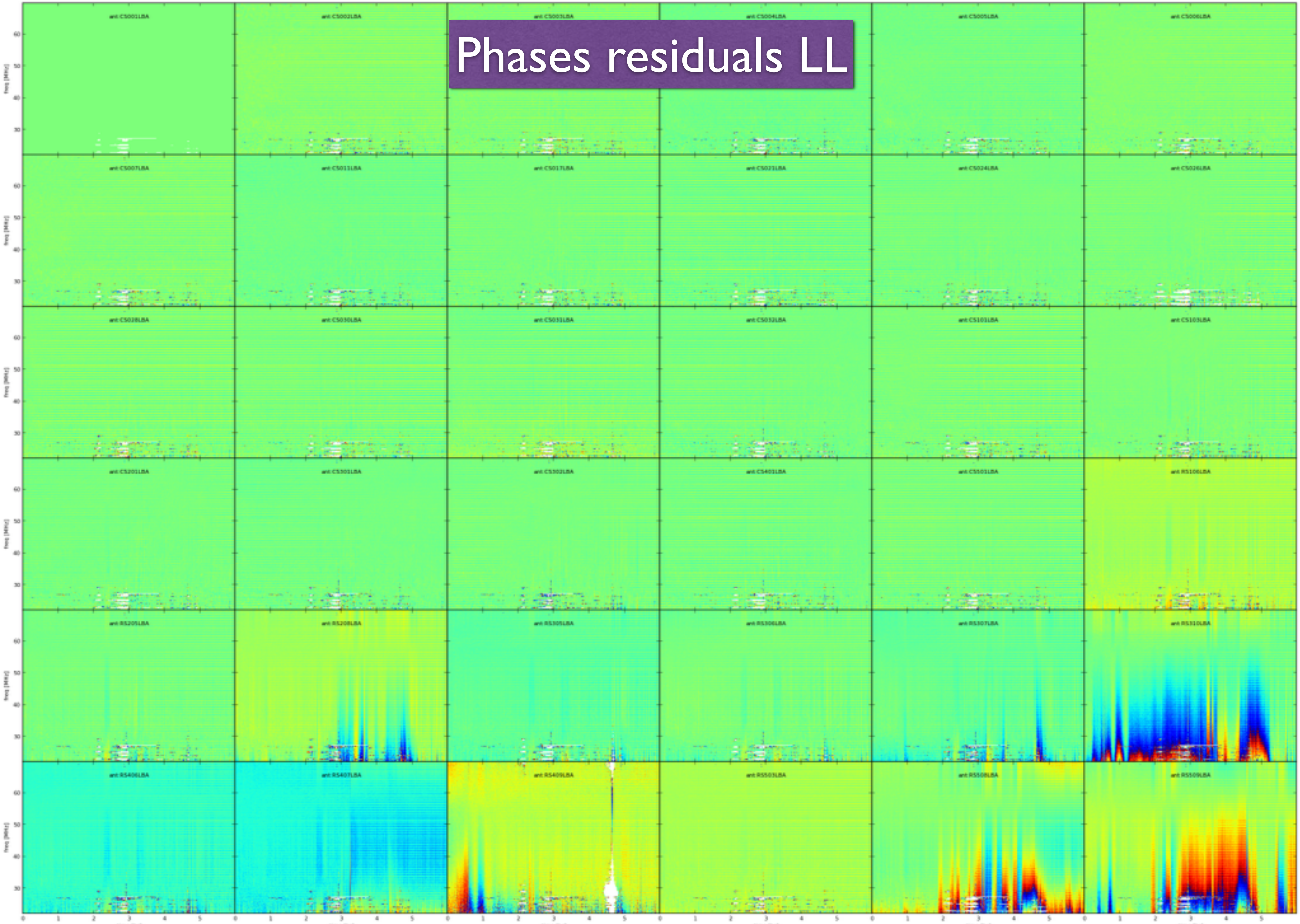

RR
- clock
- TEC - FR
- FR


LL
- clock
- TEC - FR
- FR

Phases residuals RR



Phases residuals LL

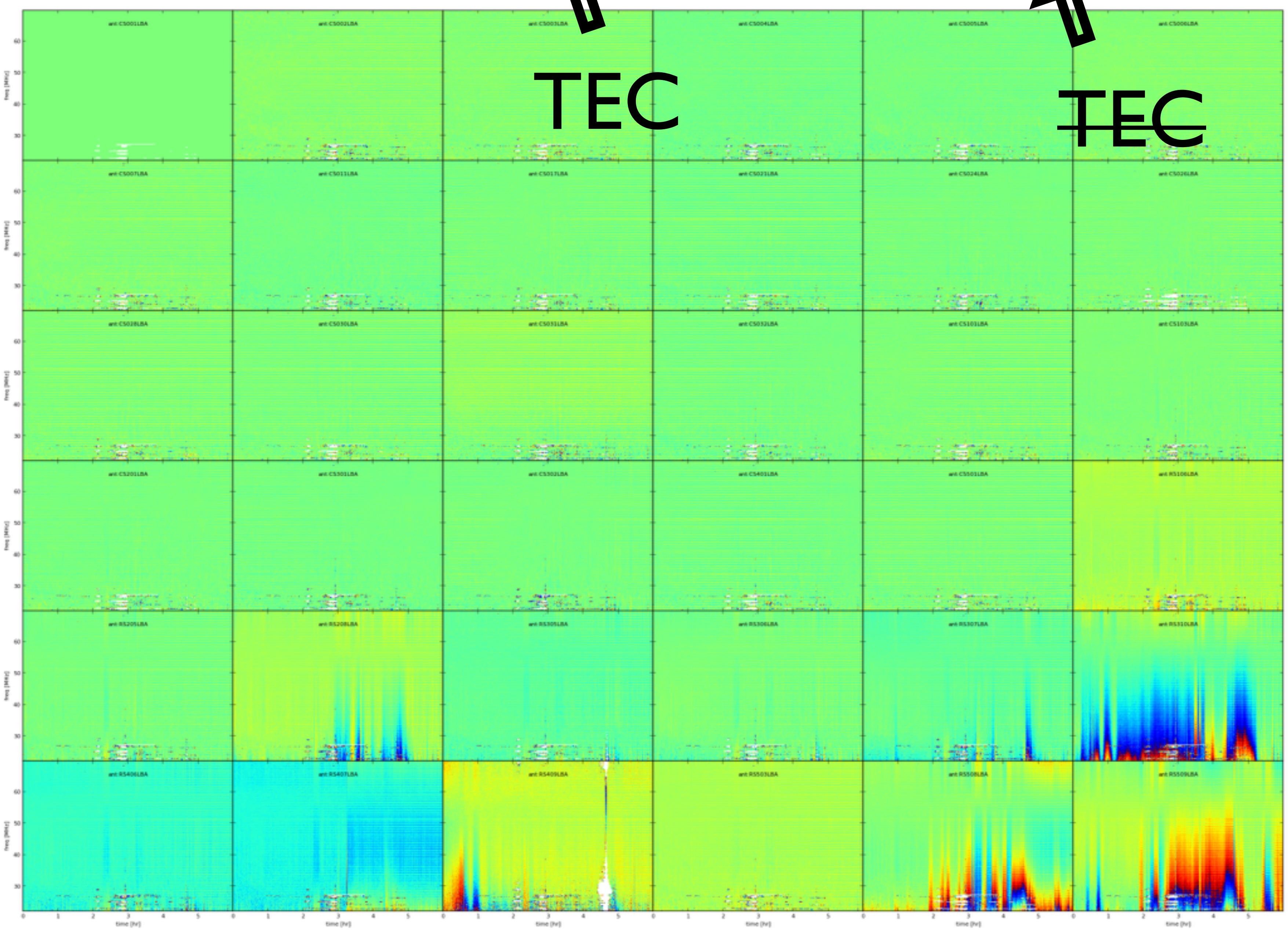


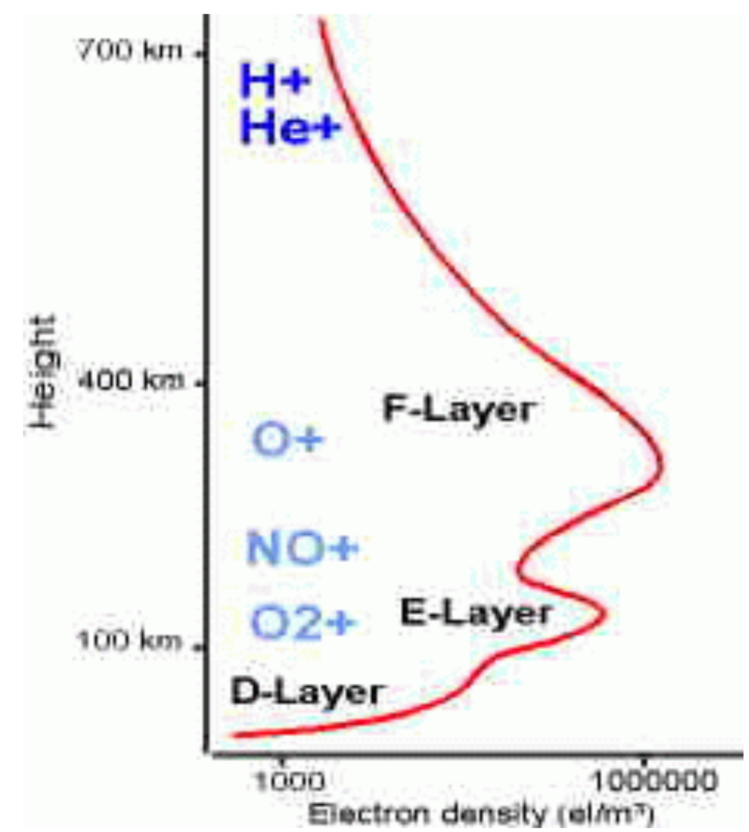
Higher orders

I order II order III order

$$\iota \approx \frac{\kappa}{c\nu^2}\int_0^d n_\mathrm{e}(x)\ \mathrm{d}x. + \frac{3\kappa^2}{2c\nu^4}\int_0^d n_\mathrm{e}^2(x)\ \mathrm{d}x. + \frac{5\kappa^3}{2c\nu^6}\int_0^d n_\mathrm{e}^3(x)\ \mathrm{d}x. + \cdots.$$

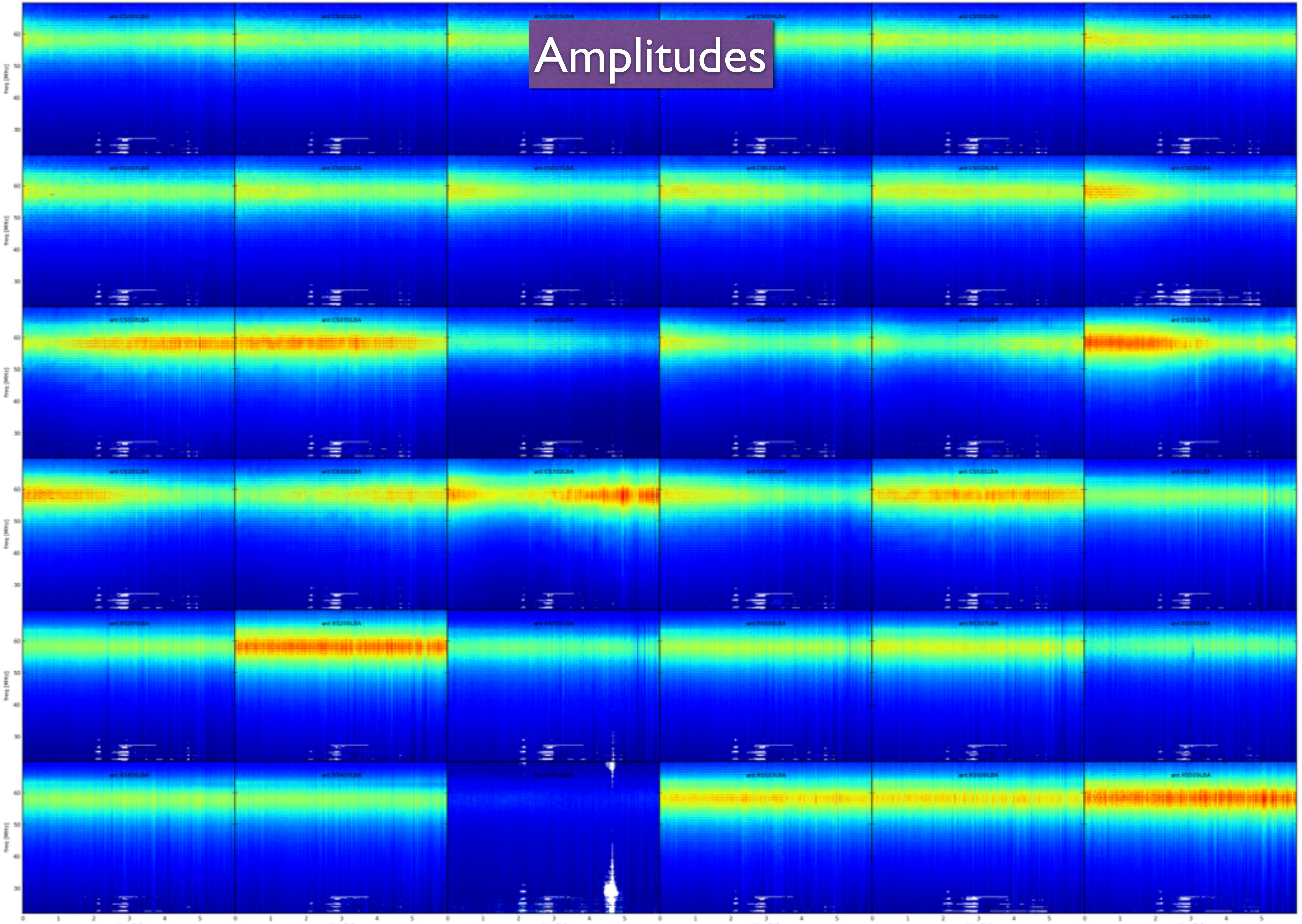
TEC ~~TEC~~

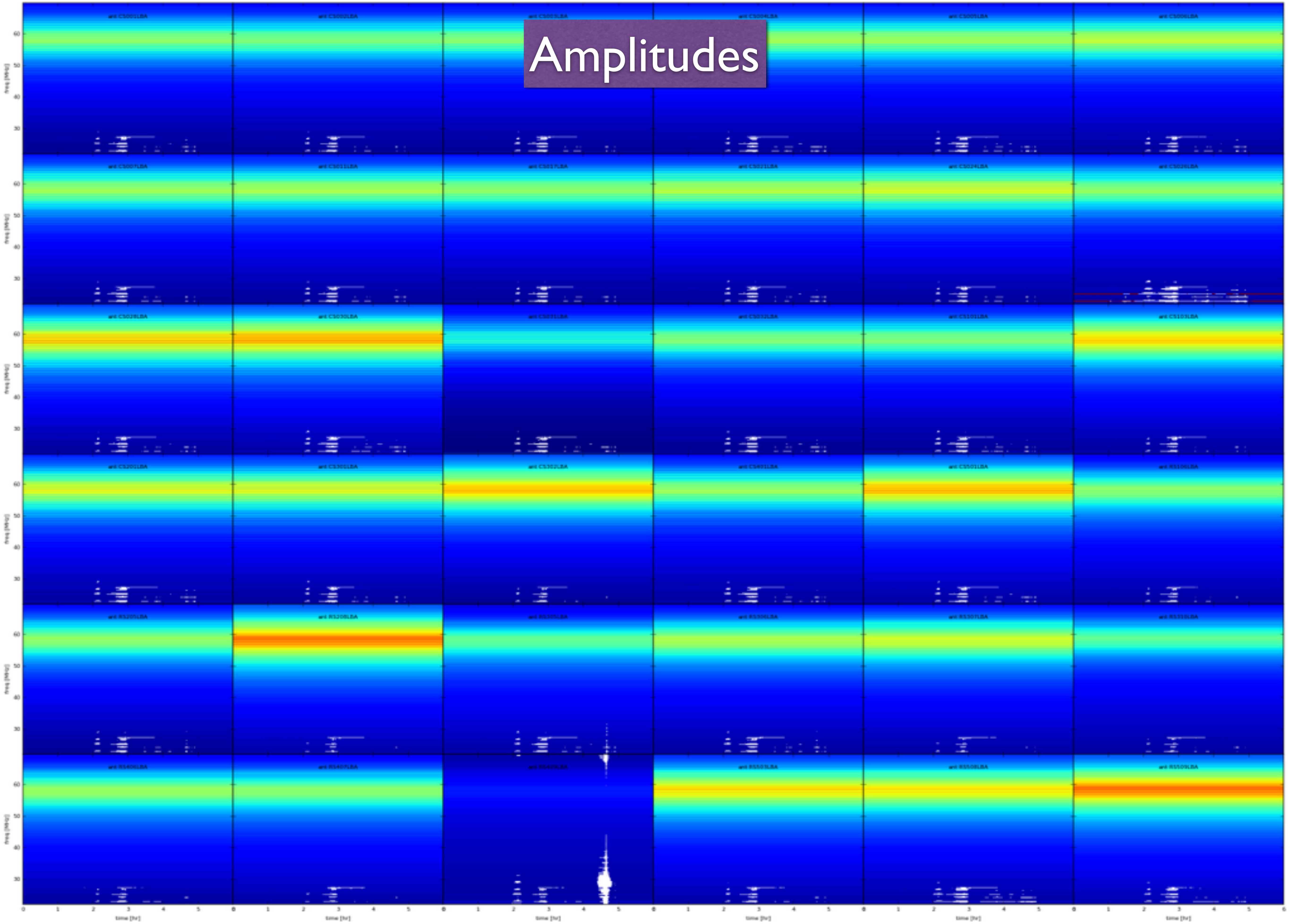




What about AMPLITUDES?

Amplitudes




Amplitudes

Amplitudes residuals