2017 CasA transits analysis (episode 4 : recap)

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Tianlai zoom
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Outline

Recap of previous presentations : Reza (feb.), OP (21/03, 11/04), T. Moulin (june)

- Analysis of 6 CasA transits in Oct. 2017
- software tools in JSkyMap Gitlab repo
- 8 parameters fits of visi vs time for 105 ~ good baselines (120 in total)
- pointing (or time ?) change vs day
- Phase analysis : stability and geometry
- Phase vs frequency parameters link with geometry
- Phase variation with transit - comparision with NS

Visibility model

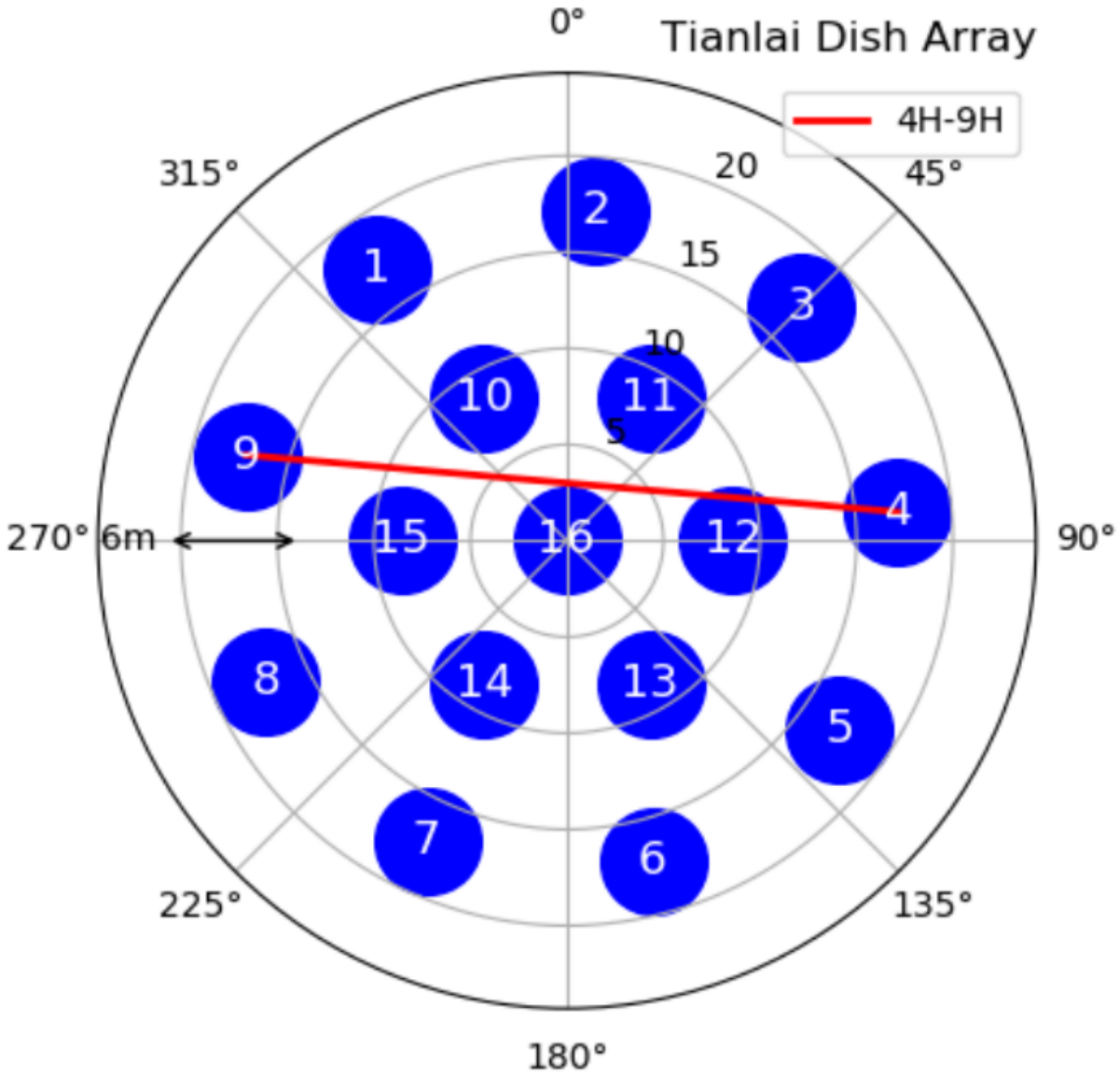
8 parameters model for real and imaginary parts of visibility at each frequency

$$Re(V(t)) = o_r + A\frac{\exp(-(t-t_0)^2/\sigma^2)}{\sigma\sqrt{2\pi}}\cos\left(\omega(t-t_0)+\eta(t-t_0)^2+\phi\right)$$

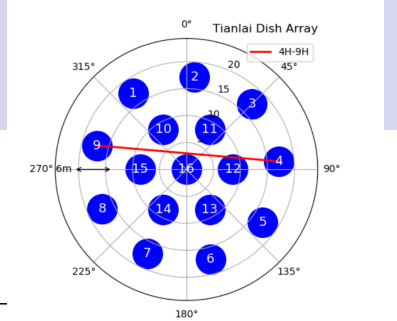
$$Im(V(t)) = o_i + A\frac{\exp(-(t-t_0)^2/\sigma^2)}{\sigma\sqrt{2\pi}}\sin\left(\omega(t-t_0)+\eta(t-t_0)^2+\phi\right)$$

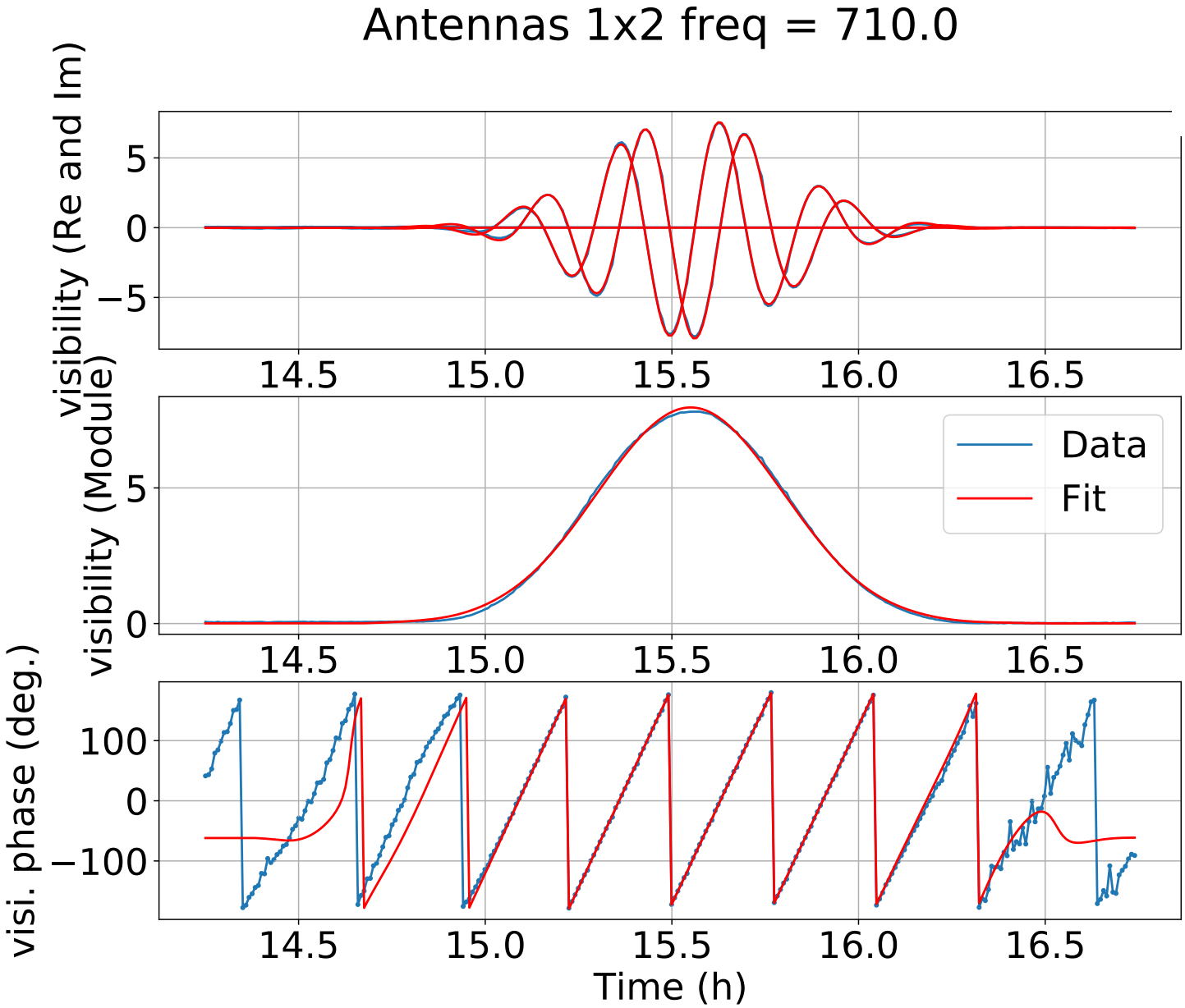
fit over time interval (1-3h) around transit, implemented in python
Approximate formula (small hour angle $\Rightarrow t-t_0$ development)
Gaussian beam model here
Bessel $J_1(x)/x$ function, cosine beam are also implemented
time expressed in sidereal time : transit time t_0 should be the same for all transits

Dish array map



Examples of visibility fits





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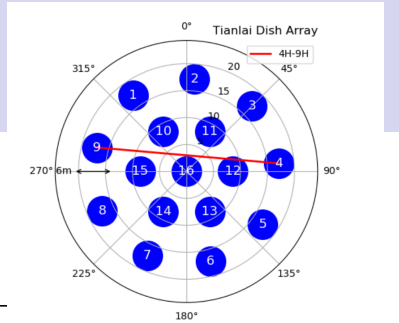
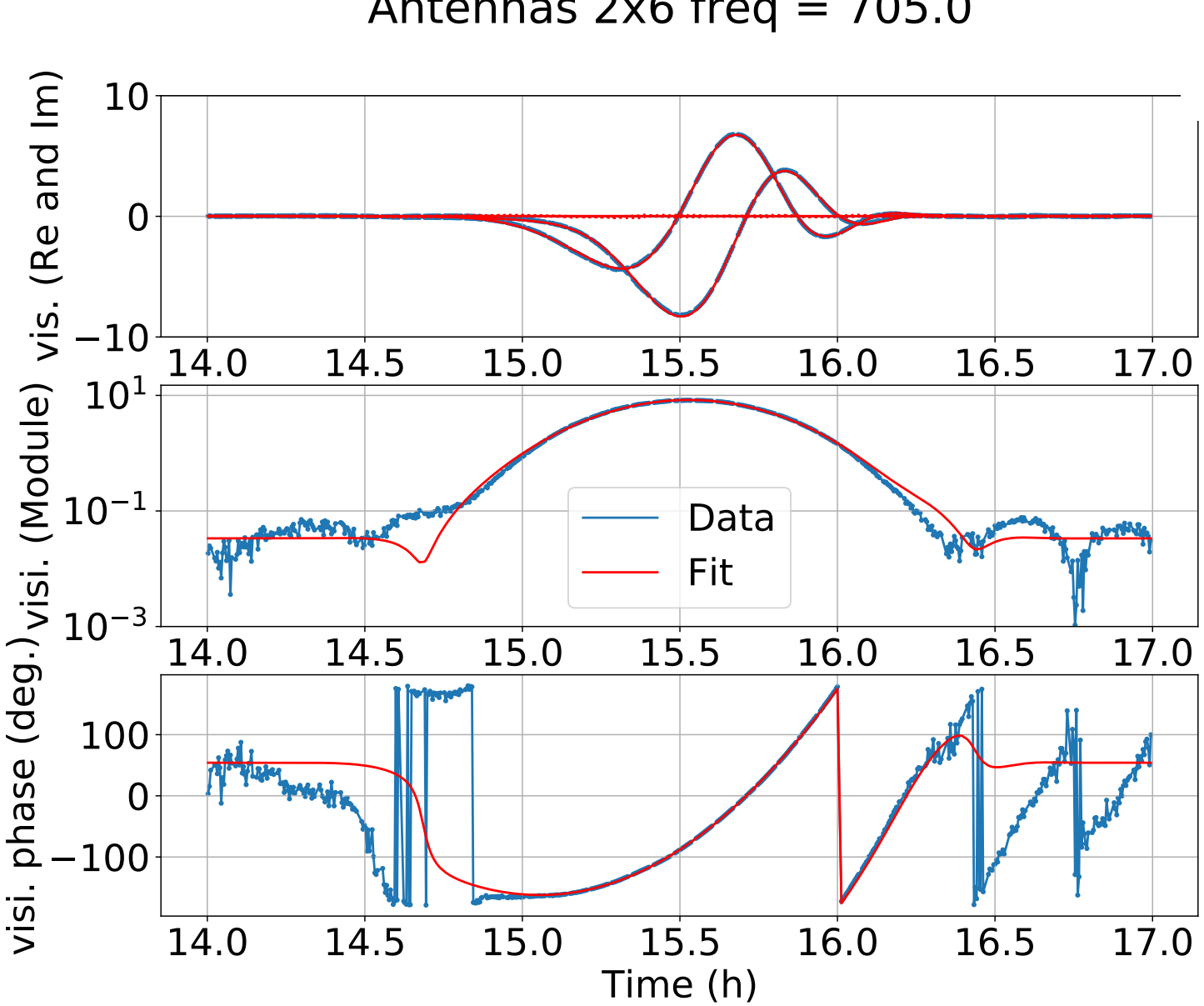
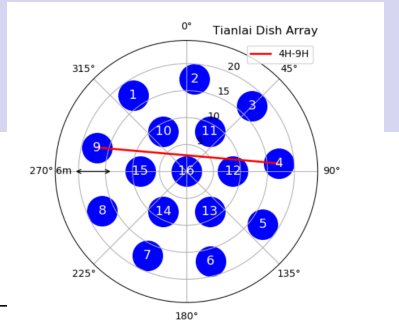
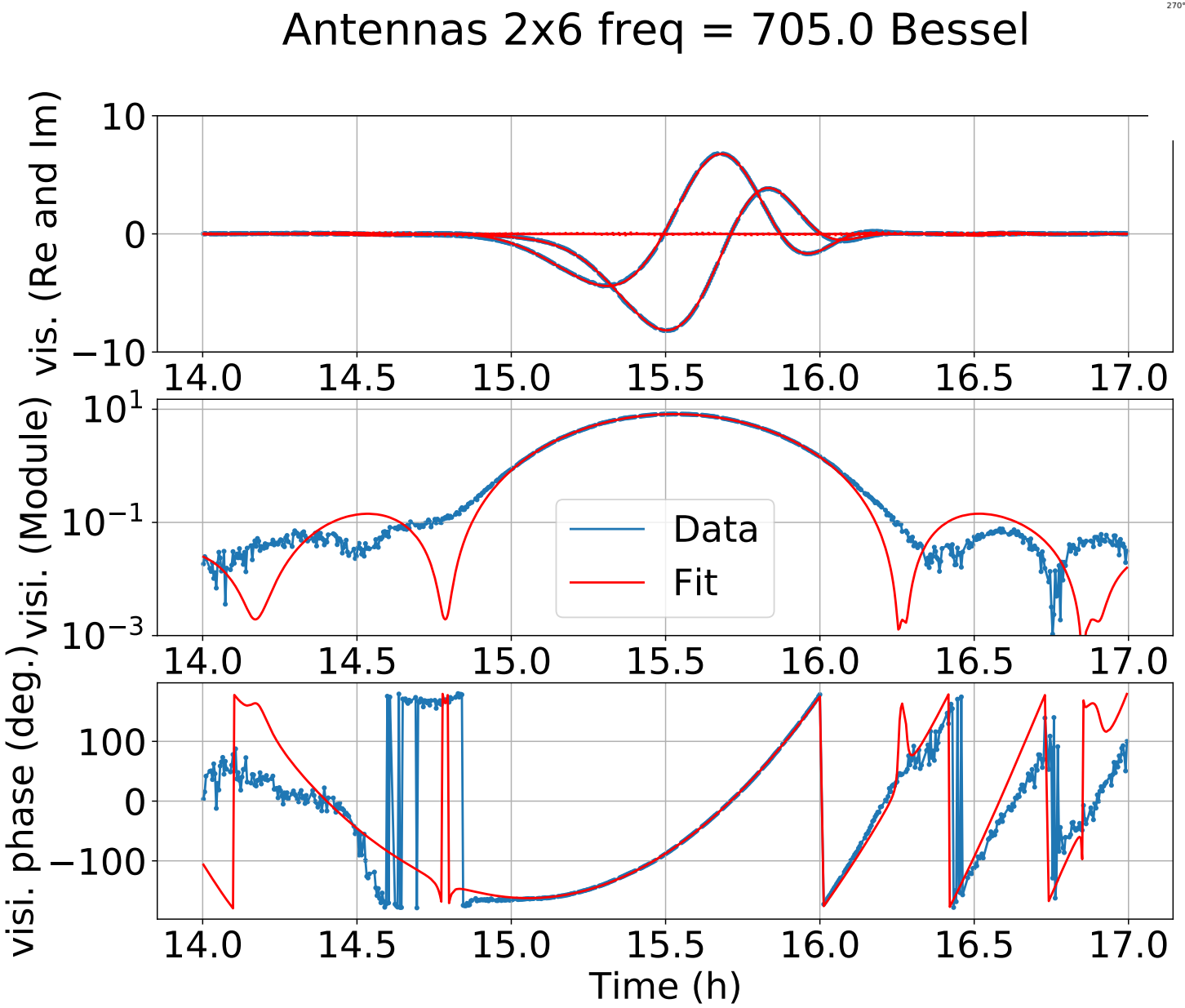


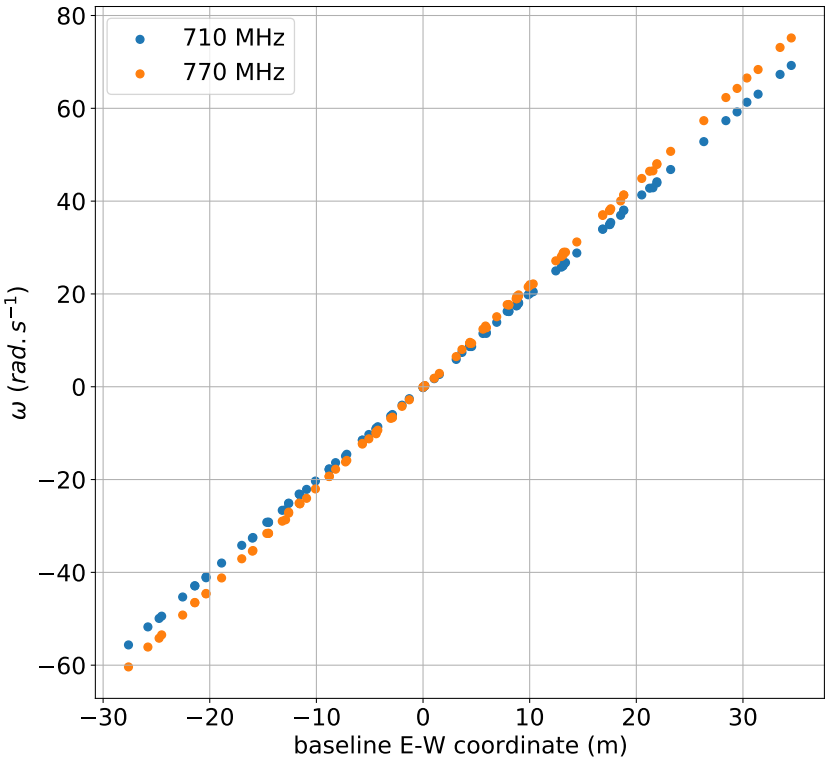


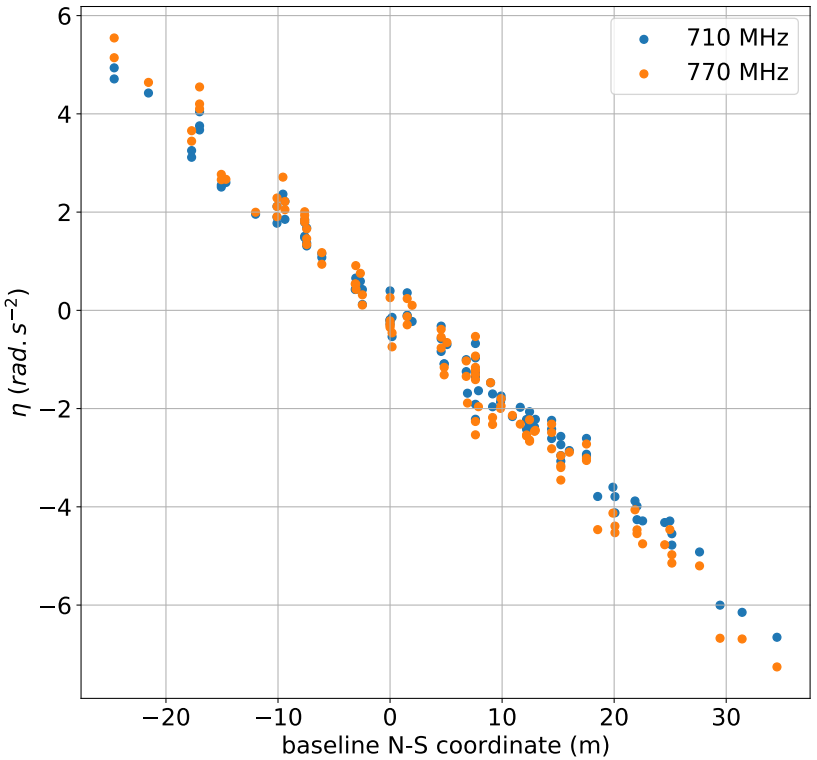
Examples of visibility fits





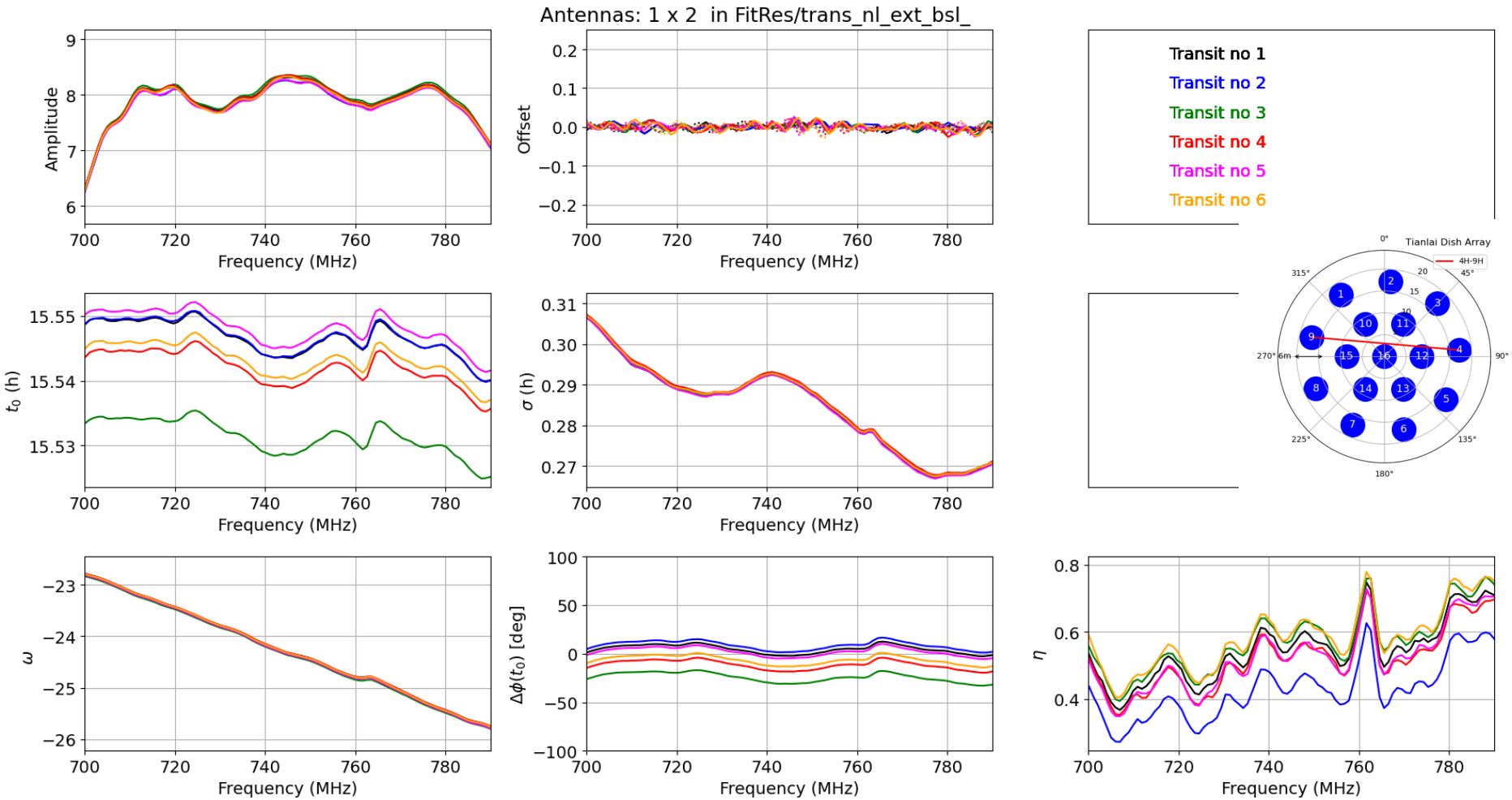
ω and η vs array geometry





seems OK

Fit results vs frequency



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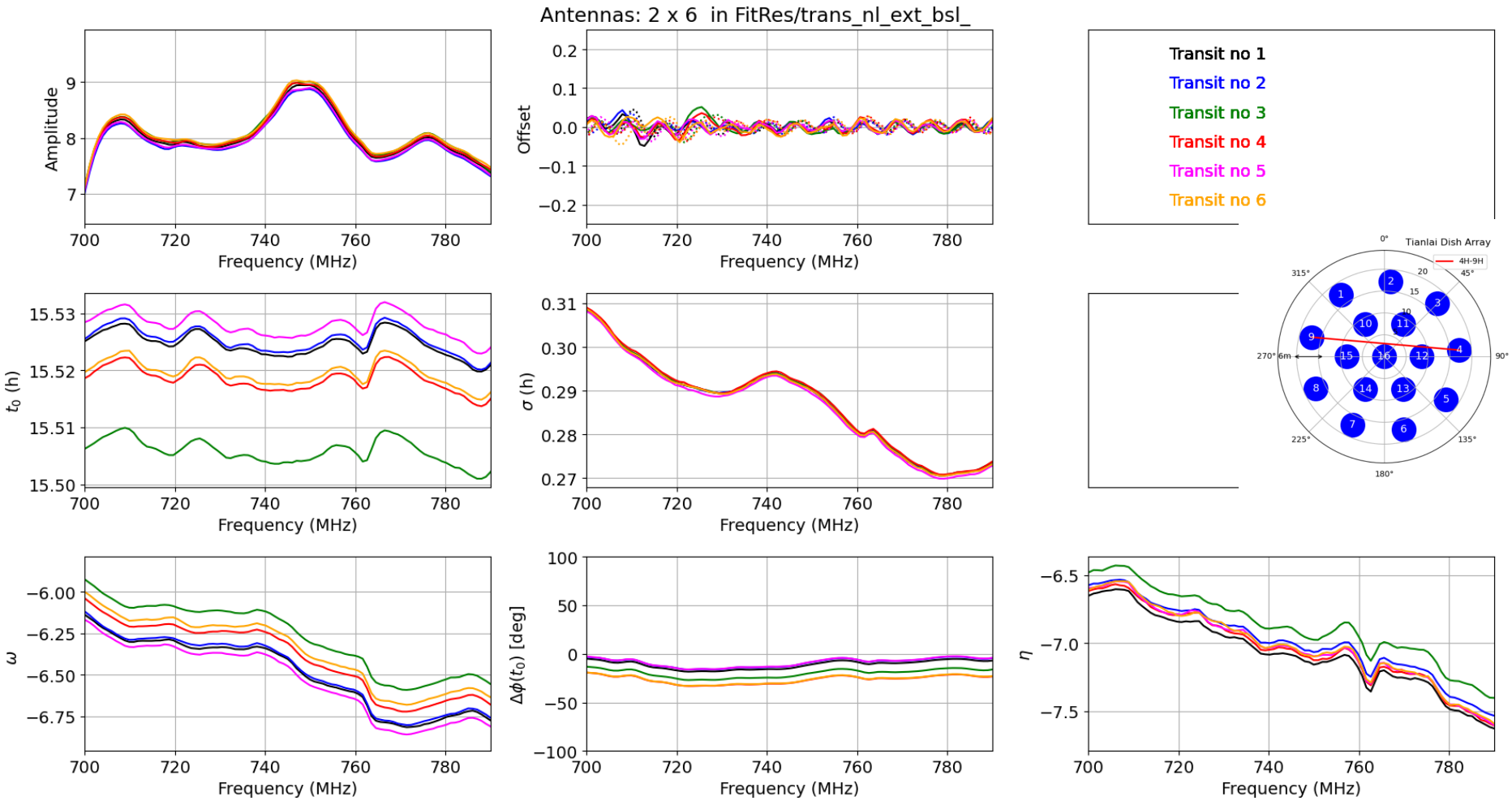

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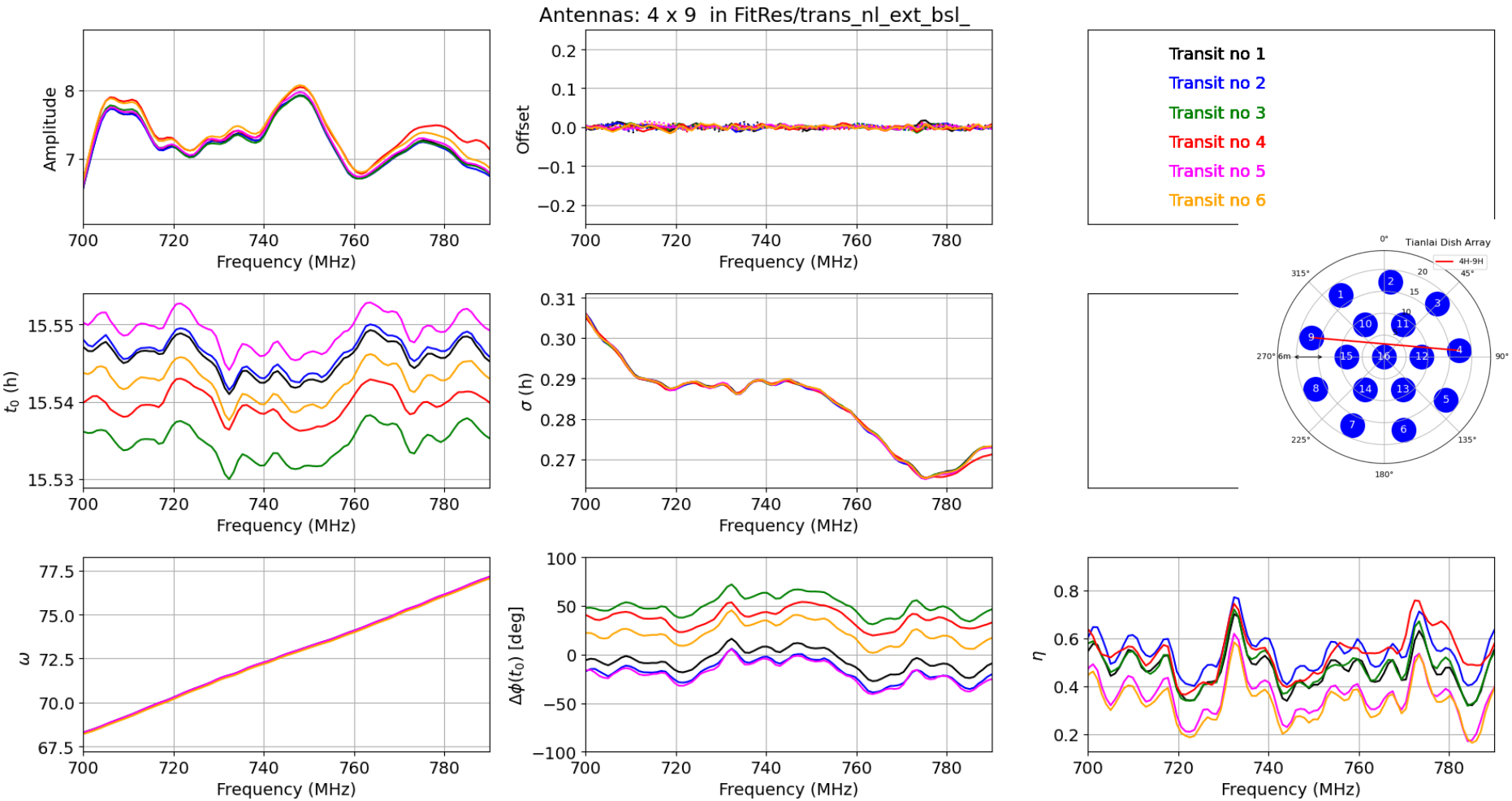
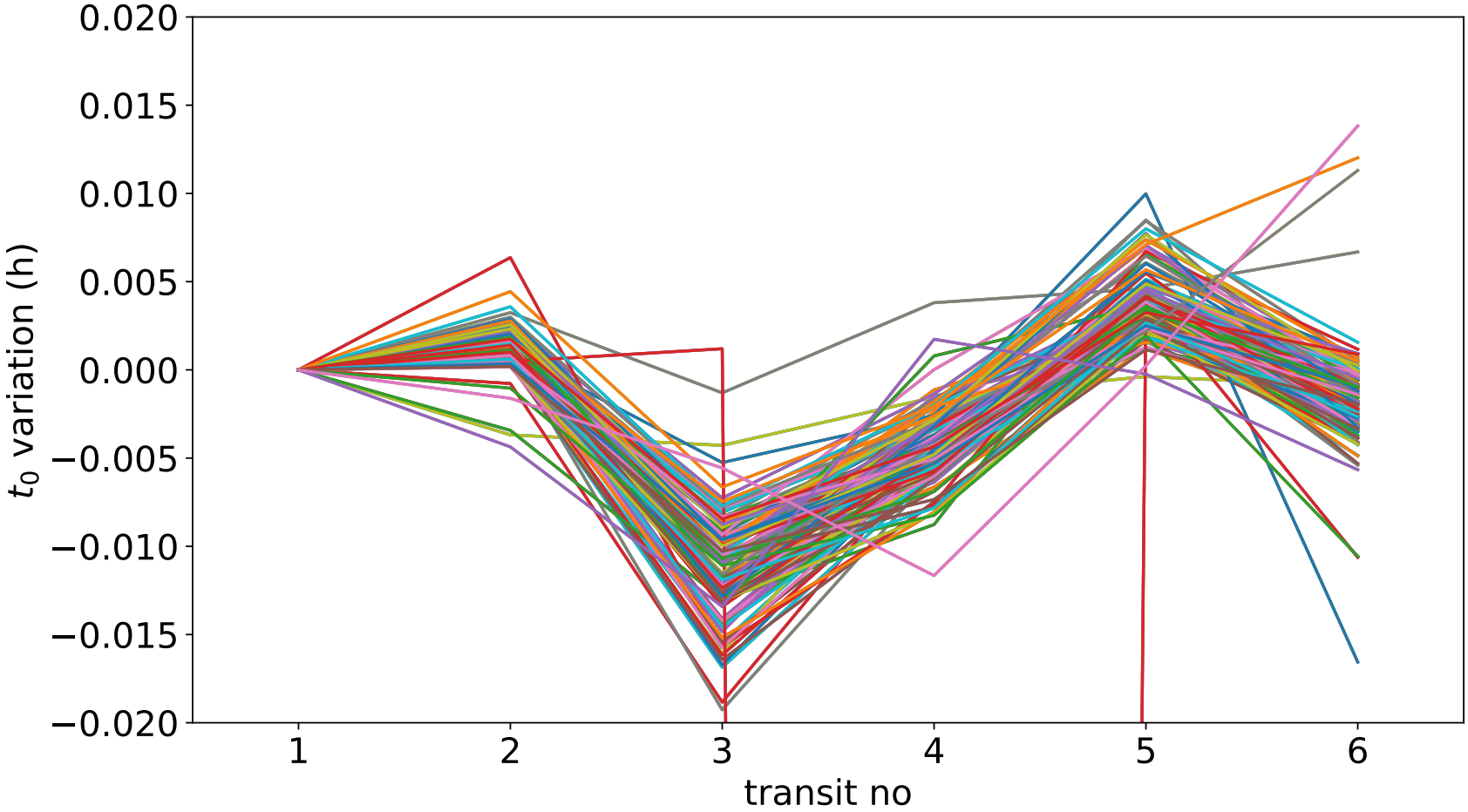


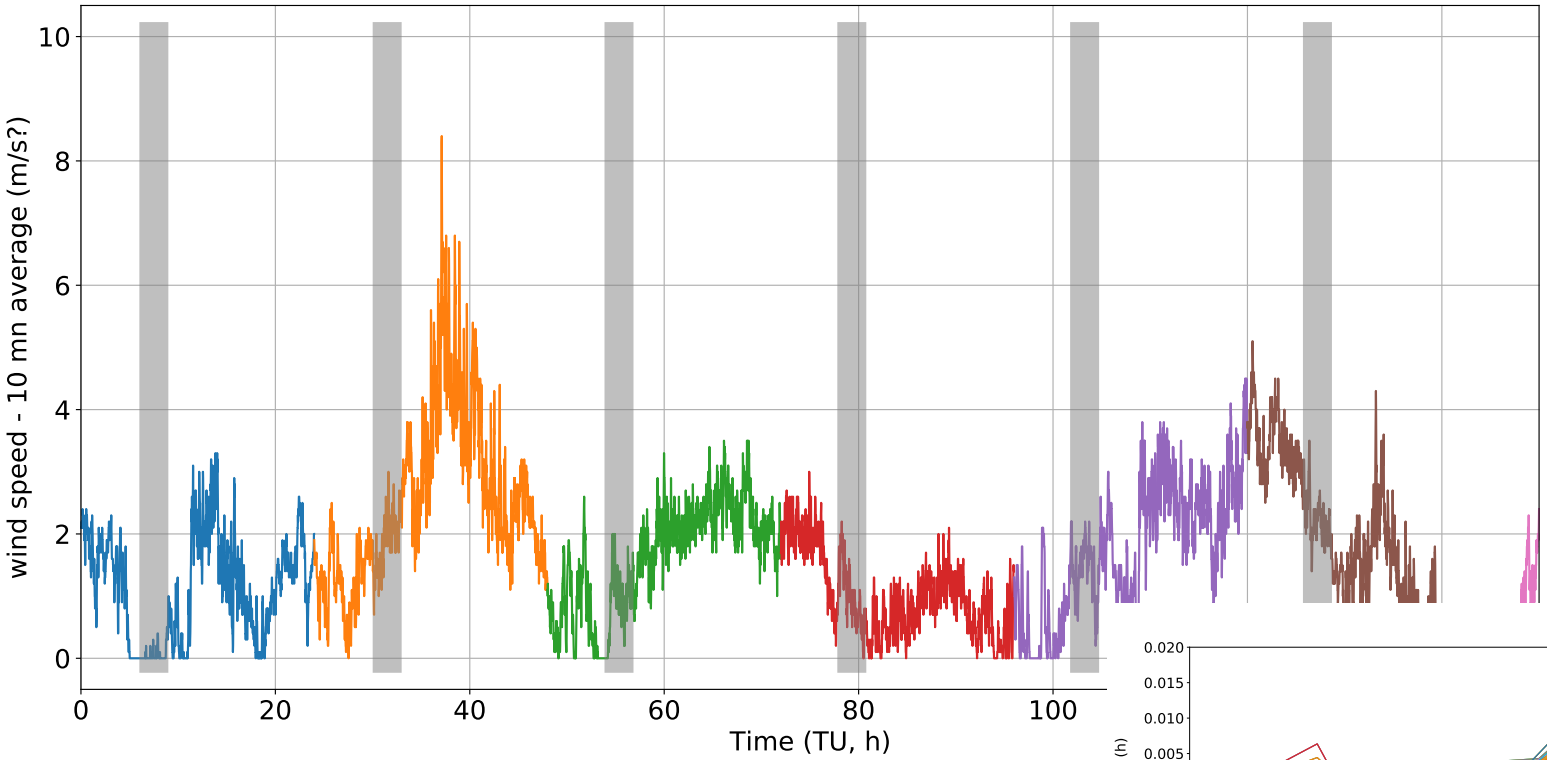
t_0 variations vs 1st transit at one frequency

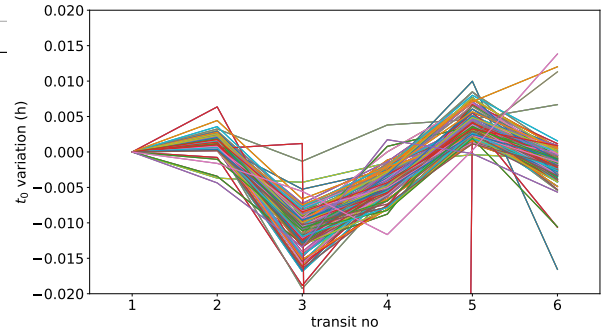


Amplitude $\sim 0.01\ h \sim 36\ sec \sim 4.5\ arcmin(on\ the\ sky)$

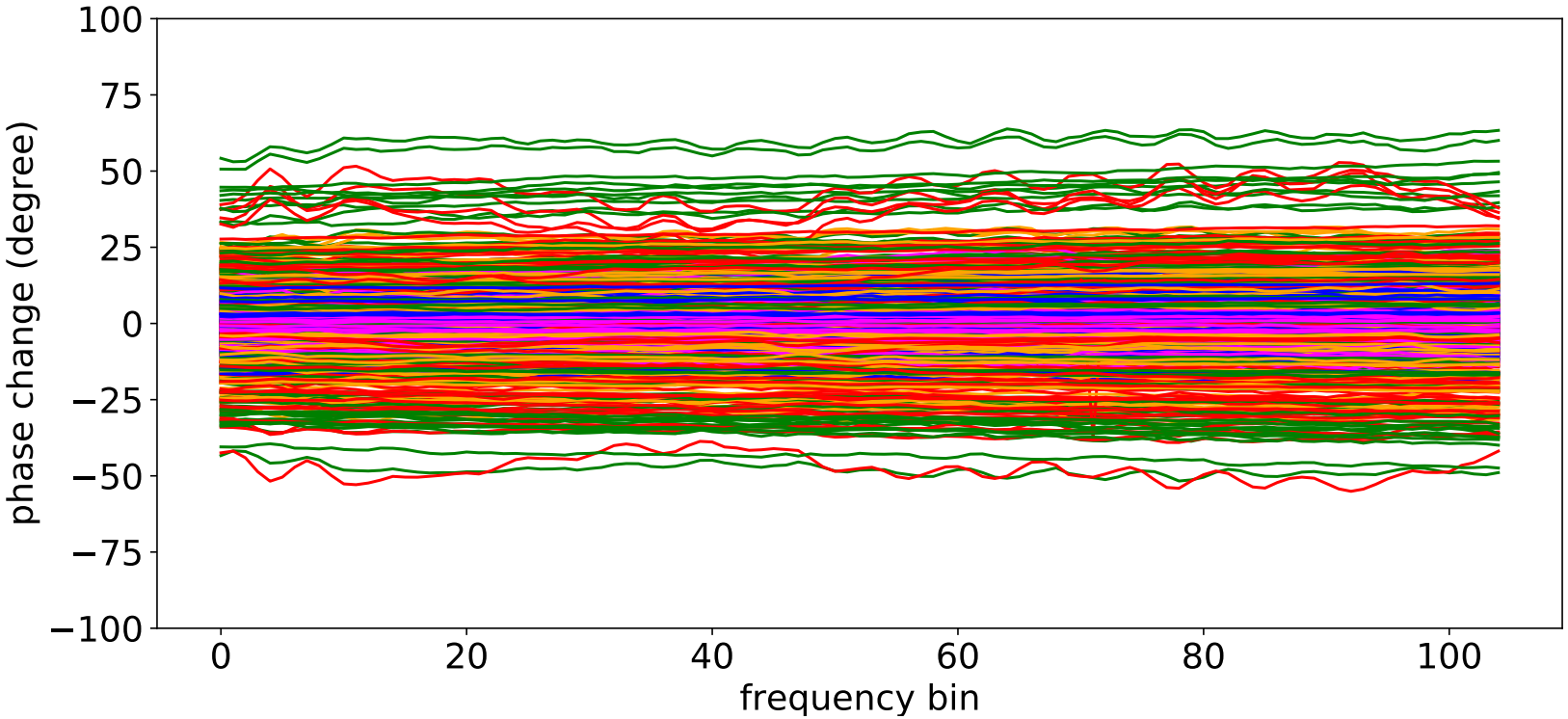
Wind speed : no correlation ?

gray bands = transits



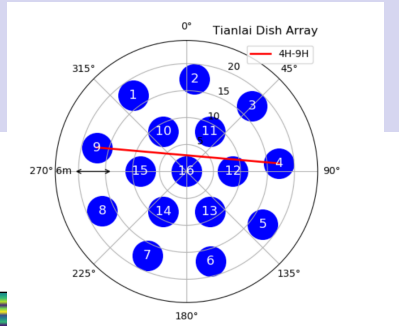


Fitted phase variations between transits

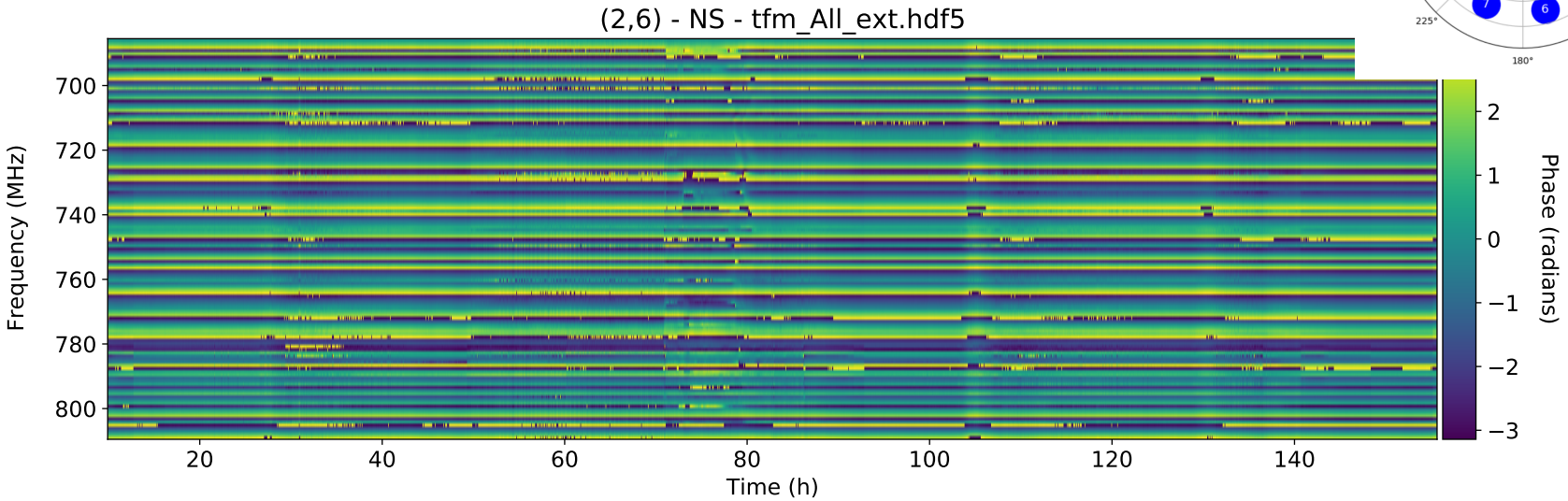


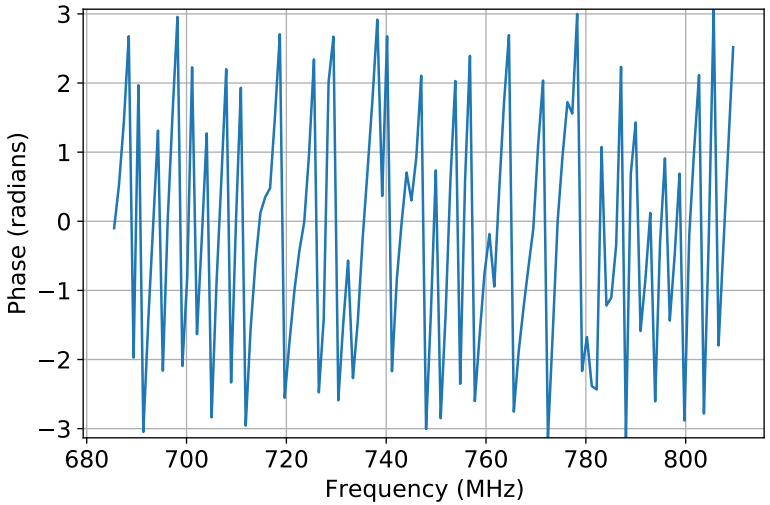
for most baselines, phase change between transits is ~ a offset constant vs frequency

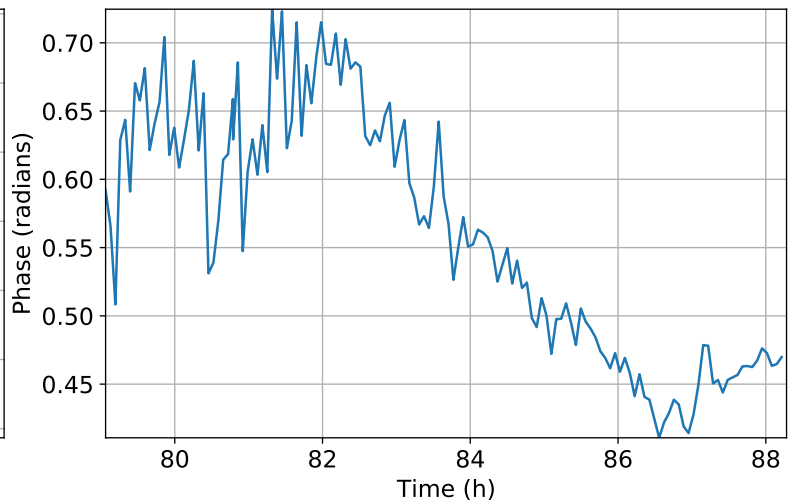
Noise source data (phase)



Raw data







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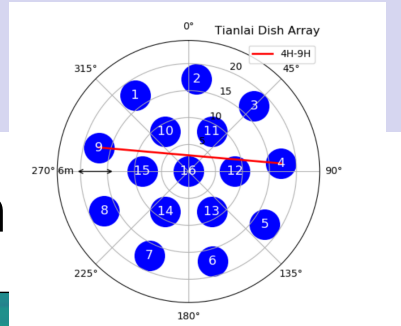
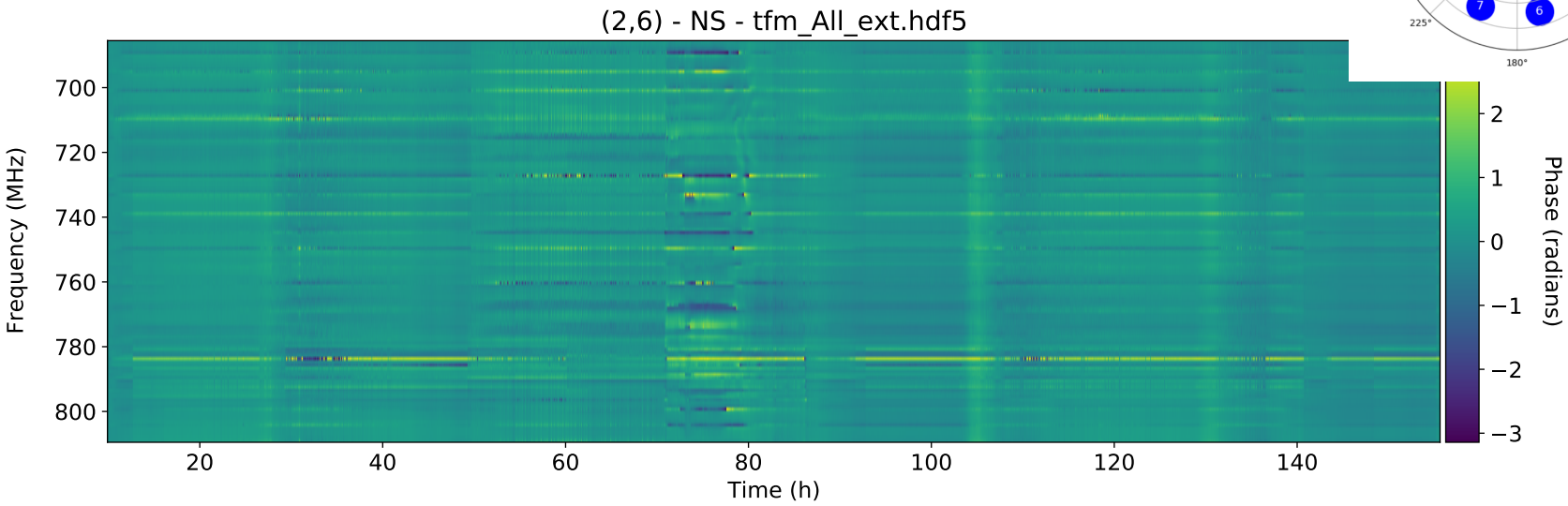
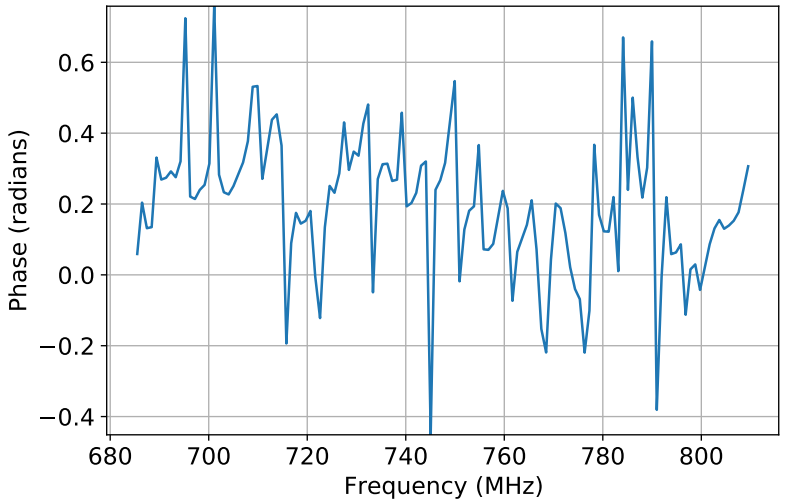
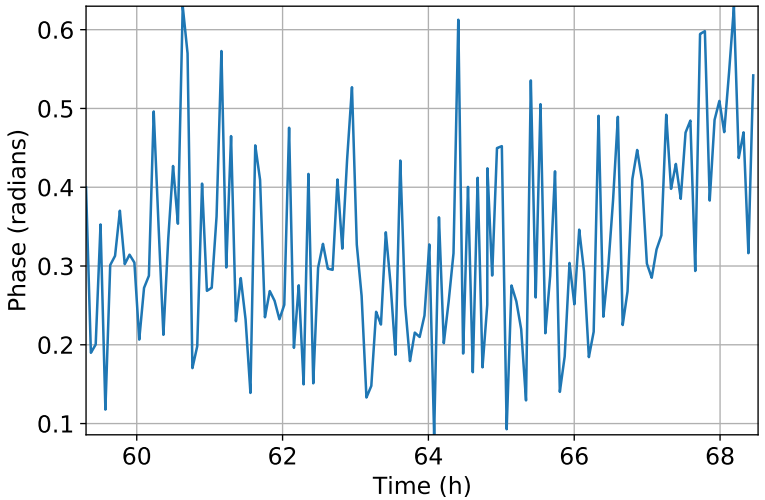


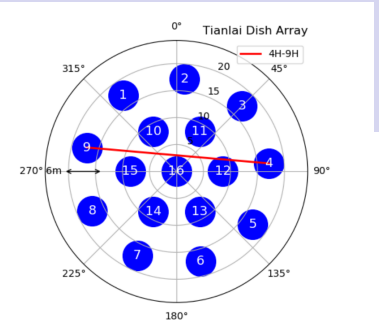
Relative variations wrt first measuremen

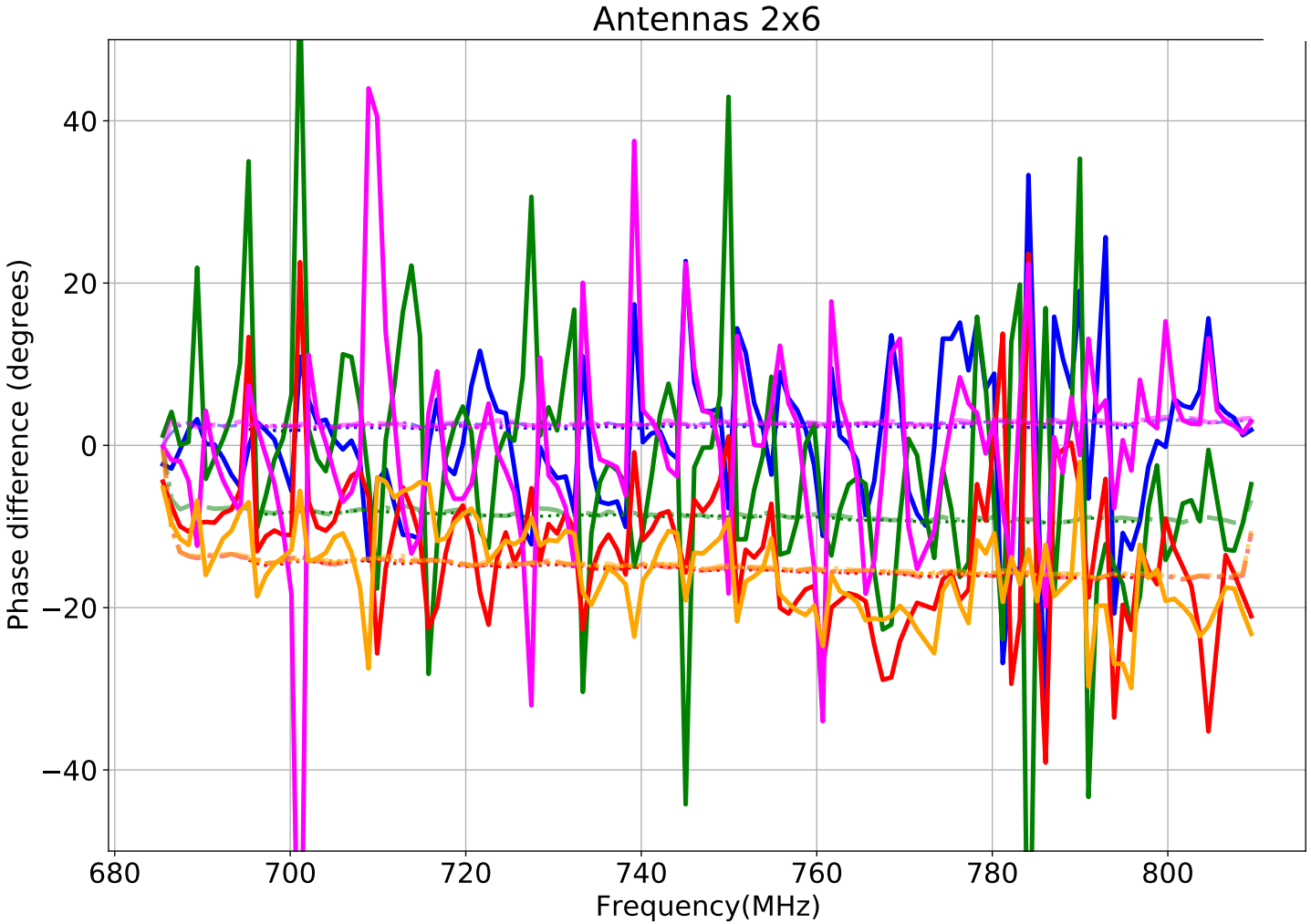






Comparisons with 1st transits (data anc





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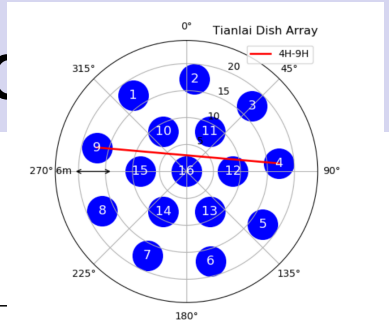

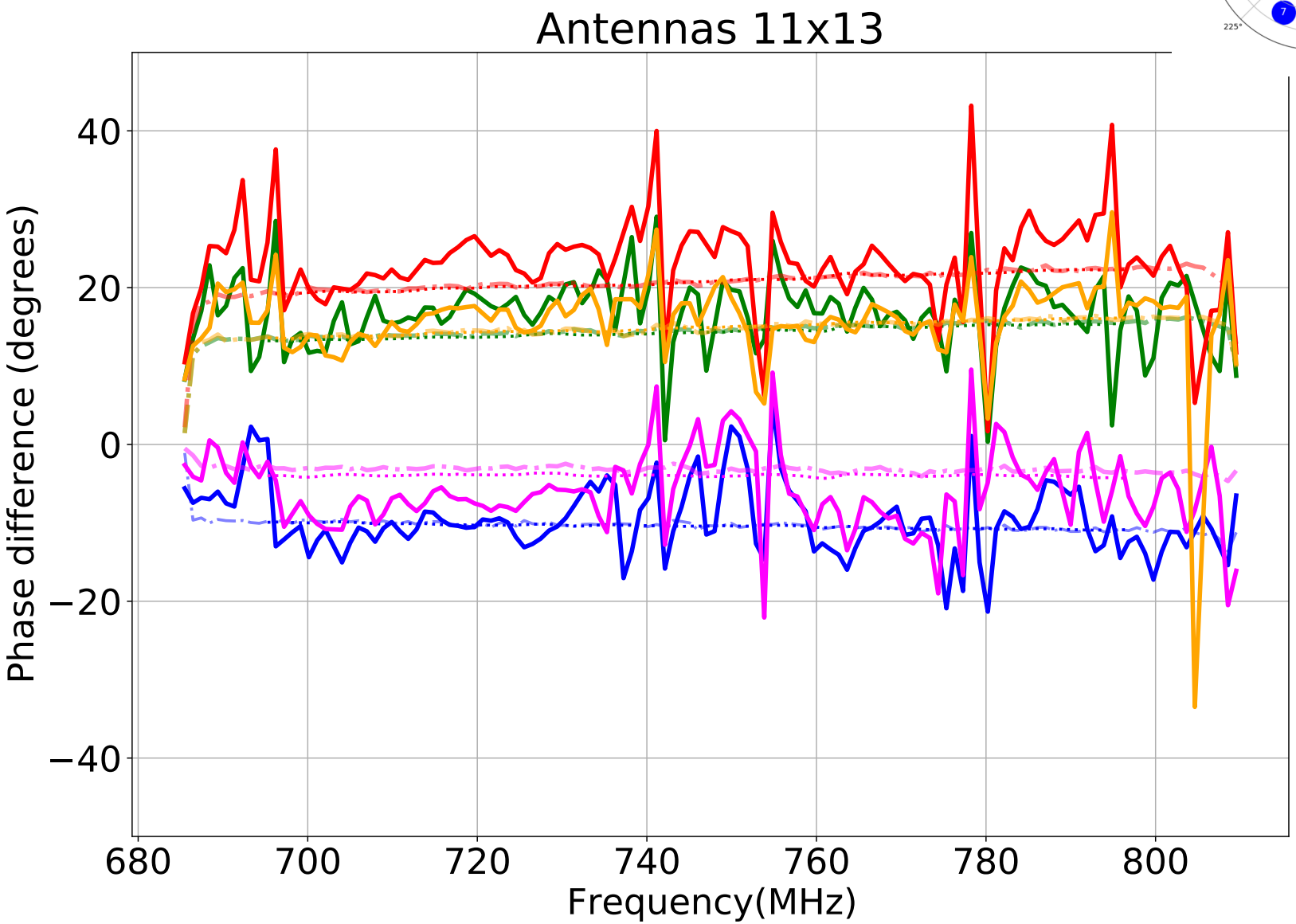

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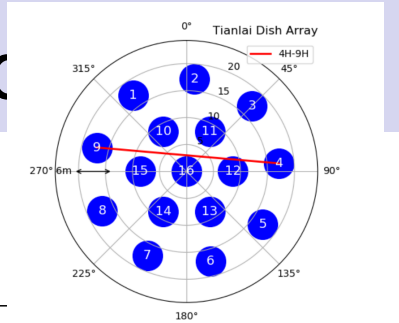
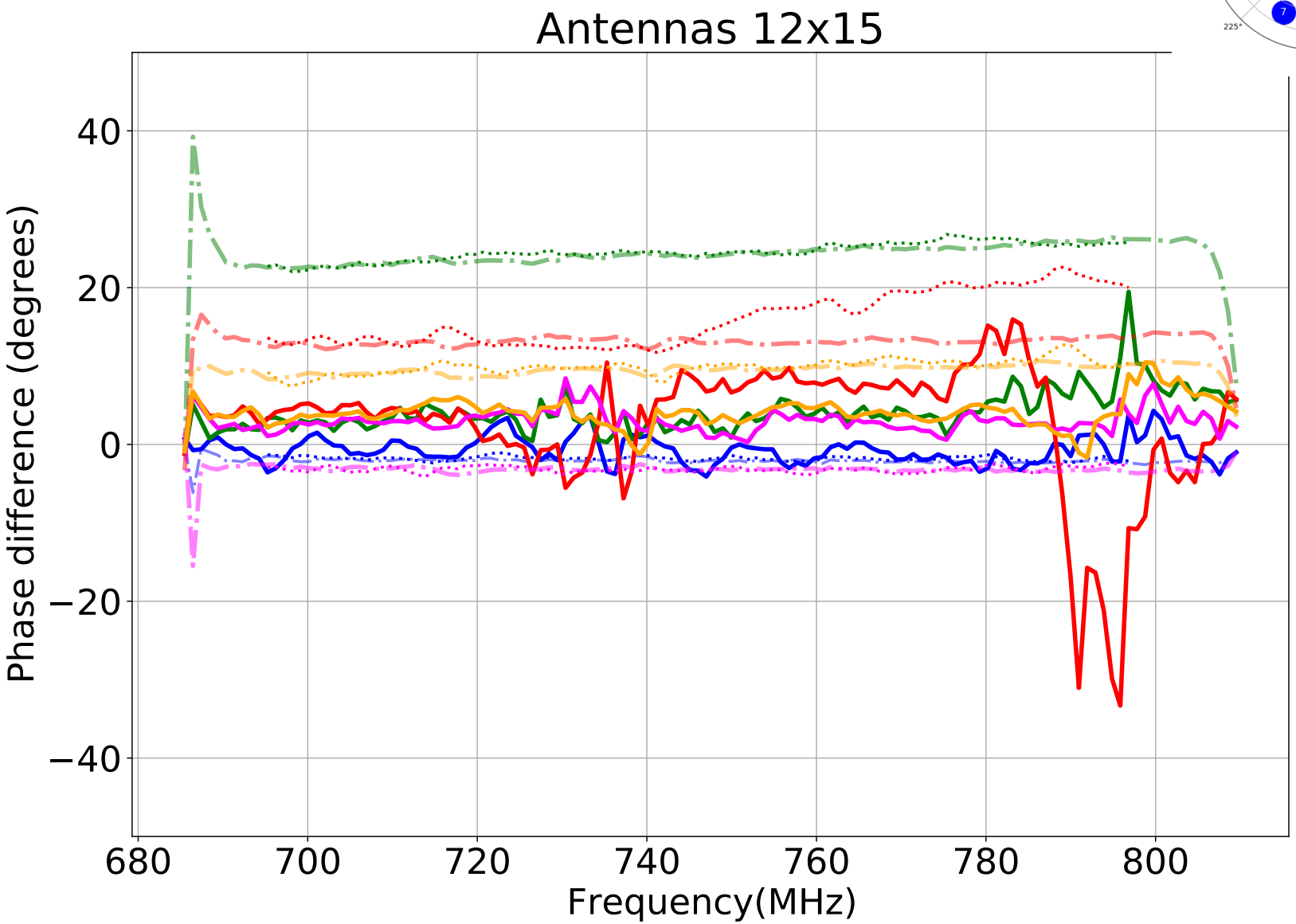
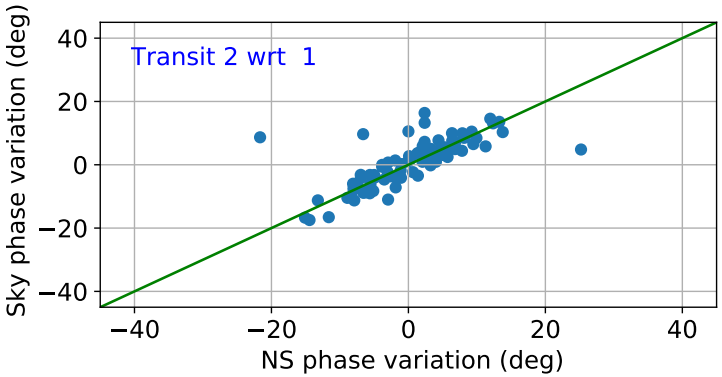
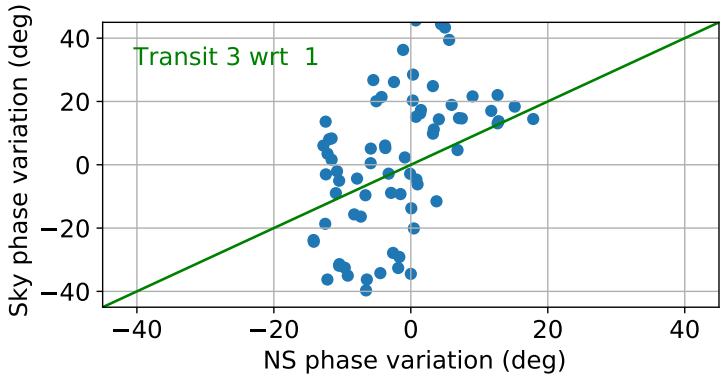
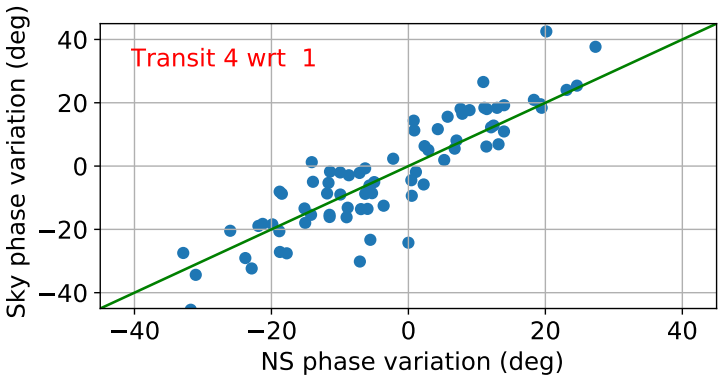


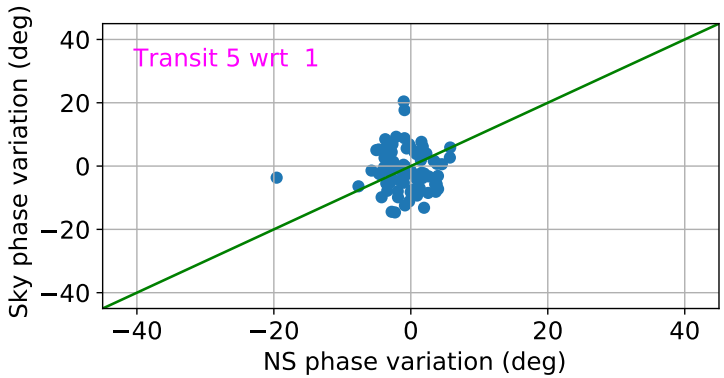


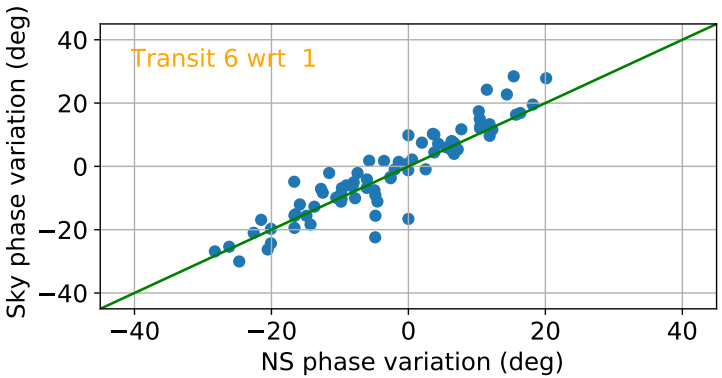
Phase averaged variations wrt 1st transit











Outliers (in 105 baselines) :

21
31
30
22
28

Outlook

- analysis of 9 CasA transits from oct. 2017
- question(s) on fitted transit time shift
- relative phase variation between transits : why is it constant wrt frequency ?
- comparision with Noise Source : NS phase seems noisy ; phases changes wrt transit 1 agree in 3 transits and differ (?) in 2
- so we'd like more data on CasA and other sources (CygA, M1, others ?)
- e.g. ~ several consecutive 24h integrations on one source, at a few sources declinations