Low-z Xcorrelation with optical surveys

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Overview

- Paper submission status
- (preliminary) Afterthoughts : alternative approaches (mid(-)latitude case) :
  - estimation of cross-correlation directly at visibility level
  - more hybrid approach with maps from sources' cube
  - what to do with these ?

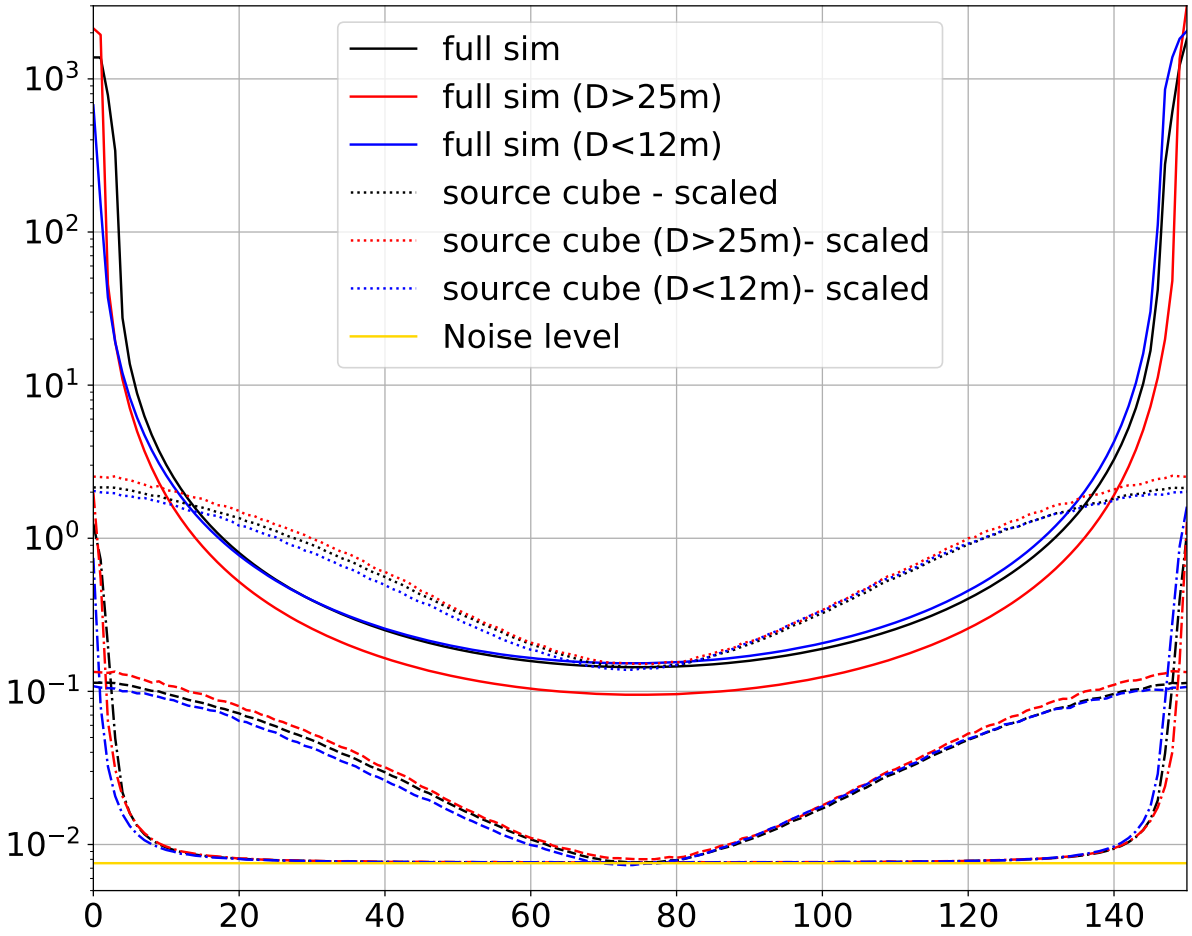
Paper status

- Second review arrived on Aug. 19th
- Discussed at previous zoom by Reza
- Several comments but most seem easy to comply with
- Some are strange, general tone not so friendly ?

Alternative method (I)

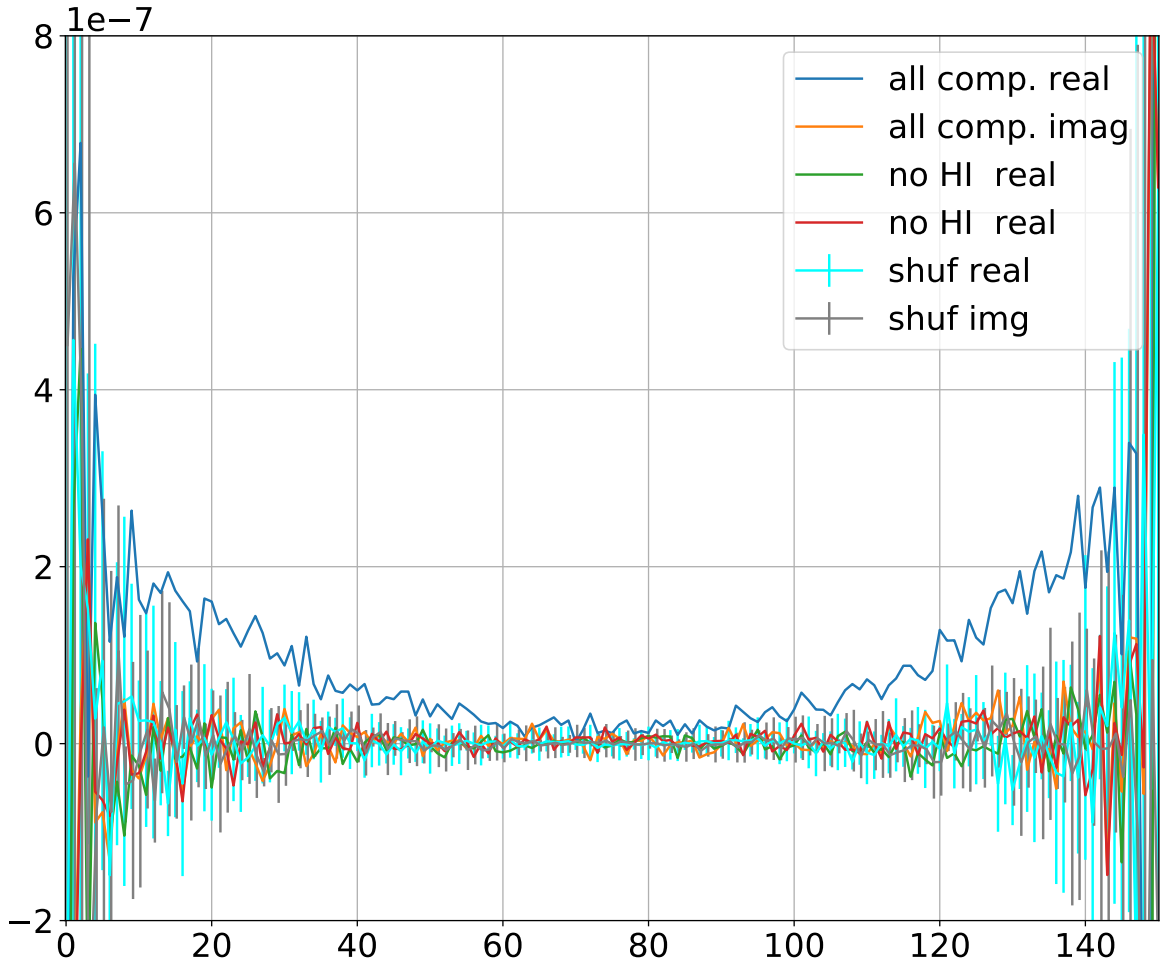
- visibility level approach
- compute visibilities from catalogs (as in paper, position only) at same frequencies and declinations (6) than simulations, various components (HI, continuum aka NCCS+Haslam, noise) combinations
- add noise (or not) on the flight
- assemble 3D arrays $V(RA + \delta, n_{\text{baseline}}, \nu)$ (simulation and datacube)
- 1D FFTs of these arrays in ν axis ($W(d, b, \tau)$)
- compute auto- and cross-correlation averaged over direction and baselines $\langle W_{sim}(d, b, \tau) W^*_{cube}(d, b, \tau) \rangle_{d,b}$
- can select on baselines length (D) and/or sky coords
- No explicit component separation
- shuffled catalogs used for error estimates

Auto-correlations



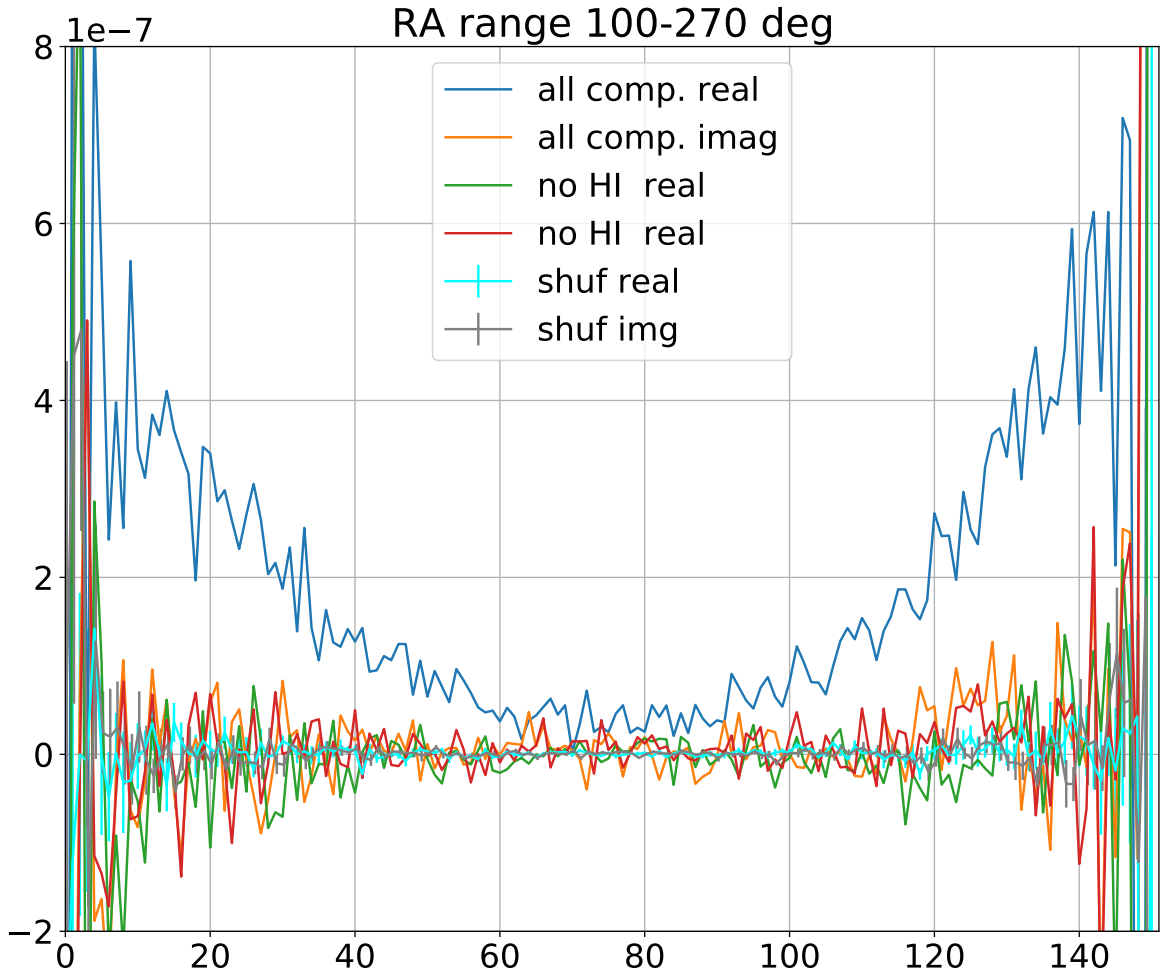
plain : all RAs ; dashed : 100<RA<270 deg ; source cube normalisation arbitrary

Cross-correlations (all sky)



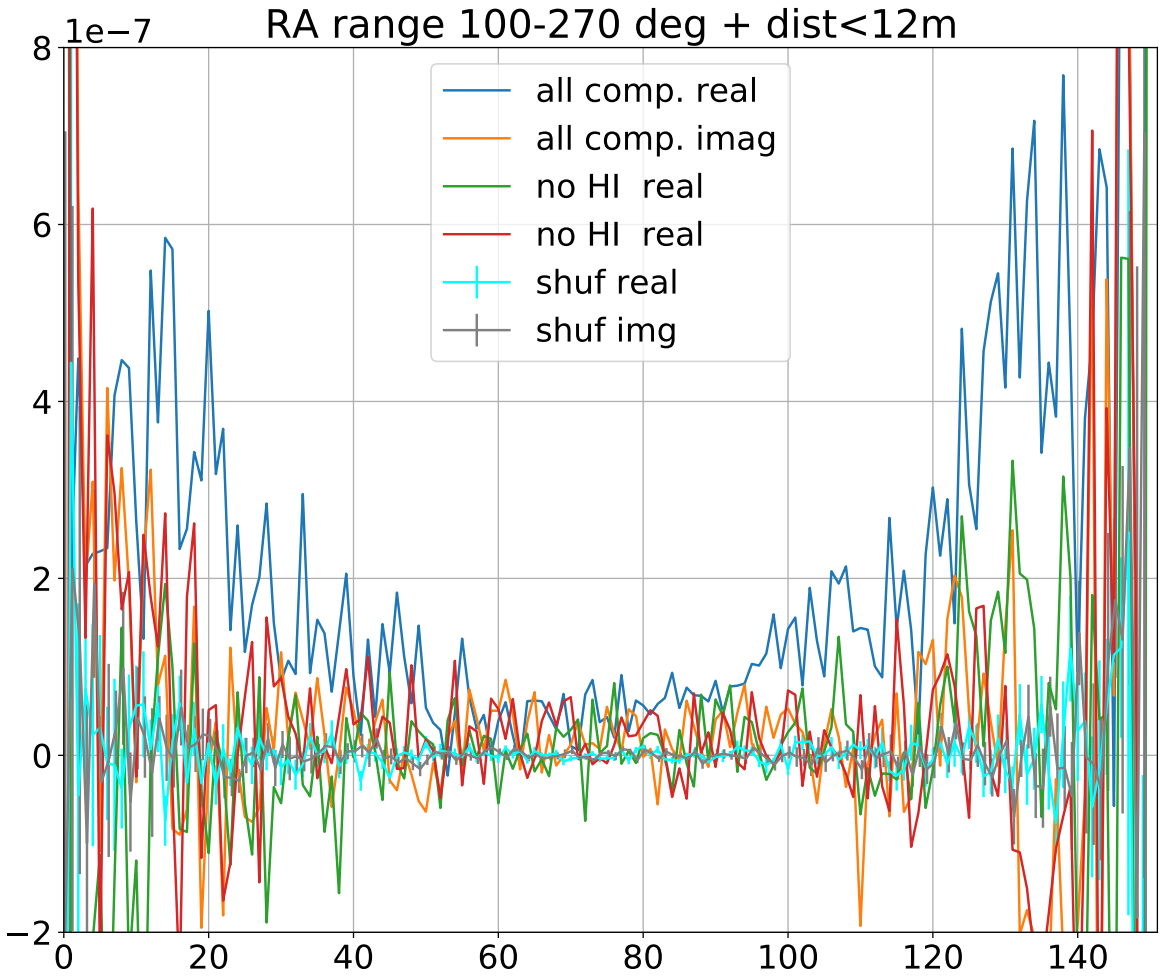
all RAs combined - large signal

Cross-correlations (RAs of interest)



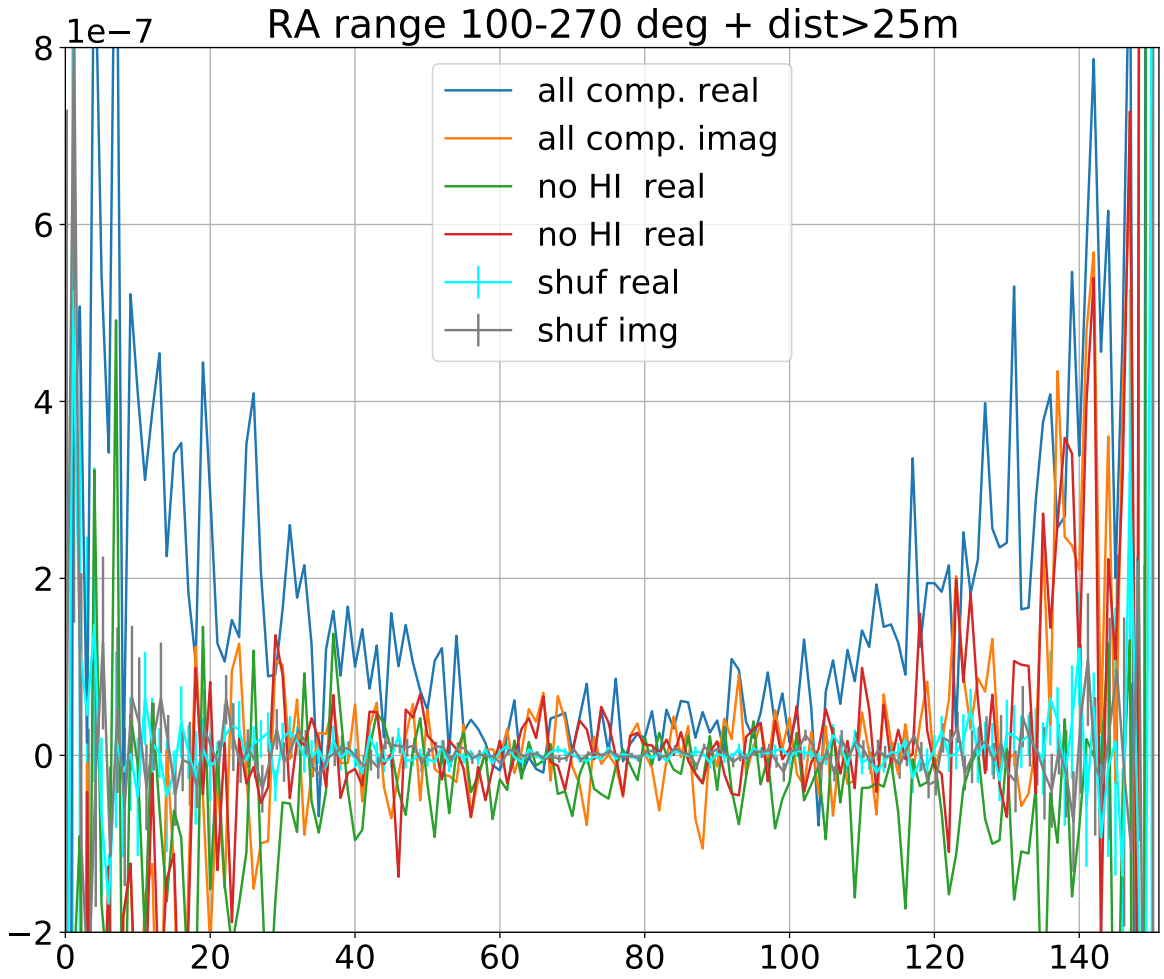
larger signal, w/o foreground removal

Cross-correlations : baseline size effect ?



difference not clearly seen

Cross-correlations : baseline size effect ?



difference not clearly seen

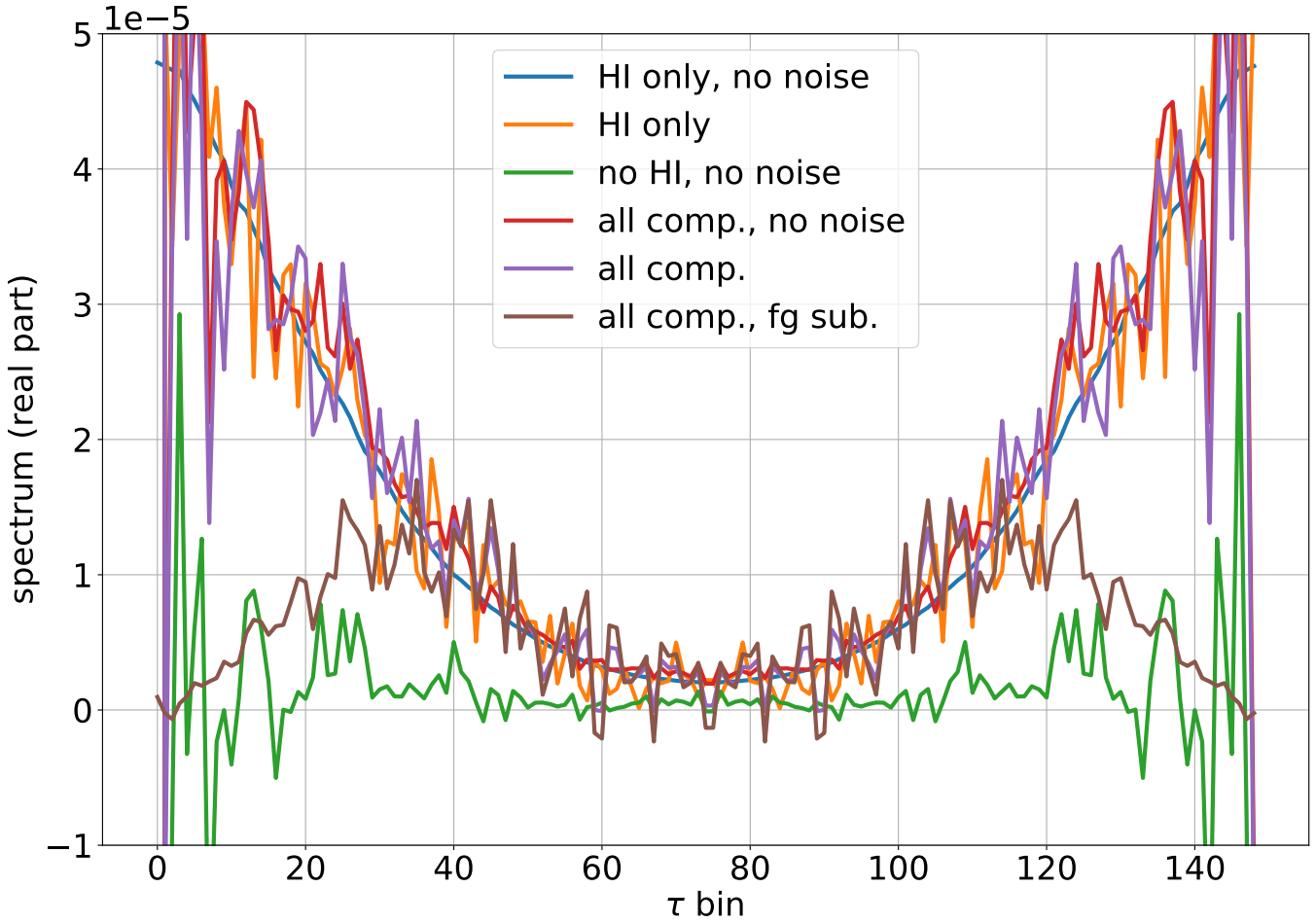
Map-based approach

- previous results too optimistic ? (e.g.source position errors, non gaussian noise features,...)
- built maps (M) from source catalog based visibilities
- same parameters & filtering as in paper's production
- optional component removal : subtract average of neighbouring freqs

$$M^{sub}(\nu) = M(\nu) - (M(\nu+1) + M(\nu-1))/2$$

- compute FFT along ν axis as previously
- averaged cross-correlation over direction (map pixel)

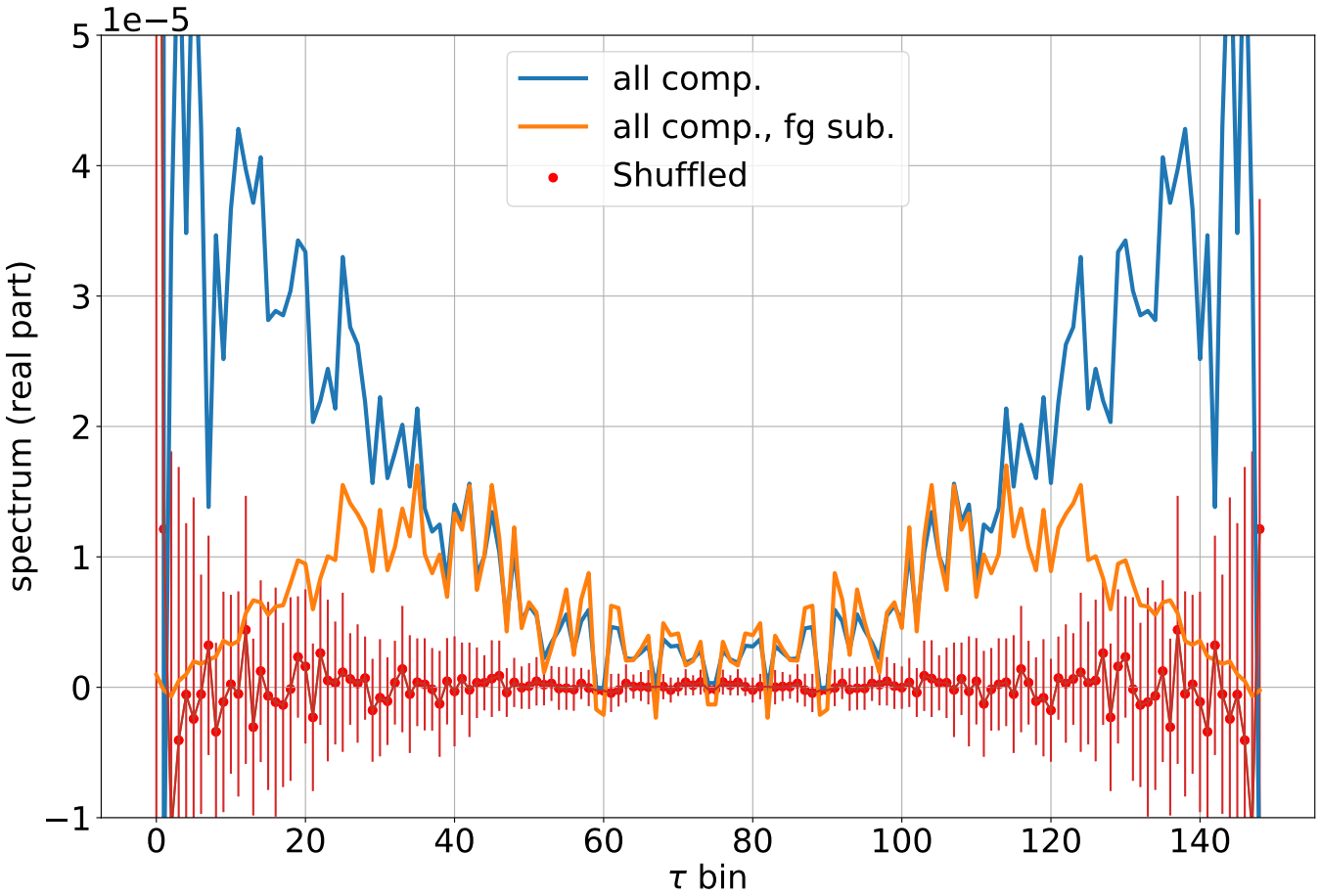
Cross-correlations of maps



highlighted textsignal seems large even w/o fg removal

fg removal affects low τ

Cross-correlations of maps : significance



signal seems significant even after fg removal

Conclusions

- At visibiliy level :
  - large significance
  - even w/o foreground removal
  - too optimistic ?
- Using maps built from visibilities :
  - also large significance
  - even w/o foreground removal
  - foreground effect removal : depletion at low τ ($\Leftrightarrow$ removal of component slowly varying in frequency)
- Future : comparison of S/N between methods ?
- THANK YOU