



Fibre Assignment Completeness in the DESI Bright Galaxy Survey

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Outline

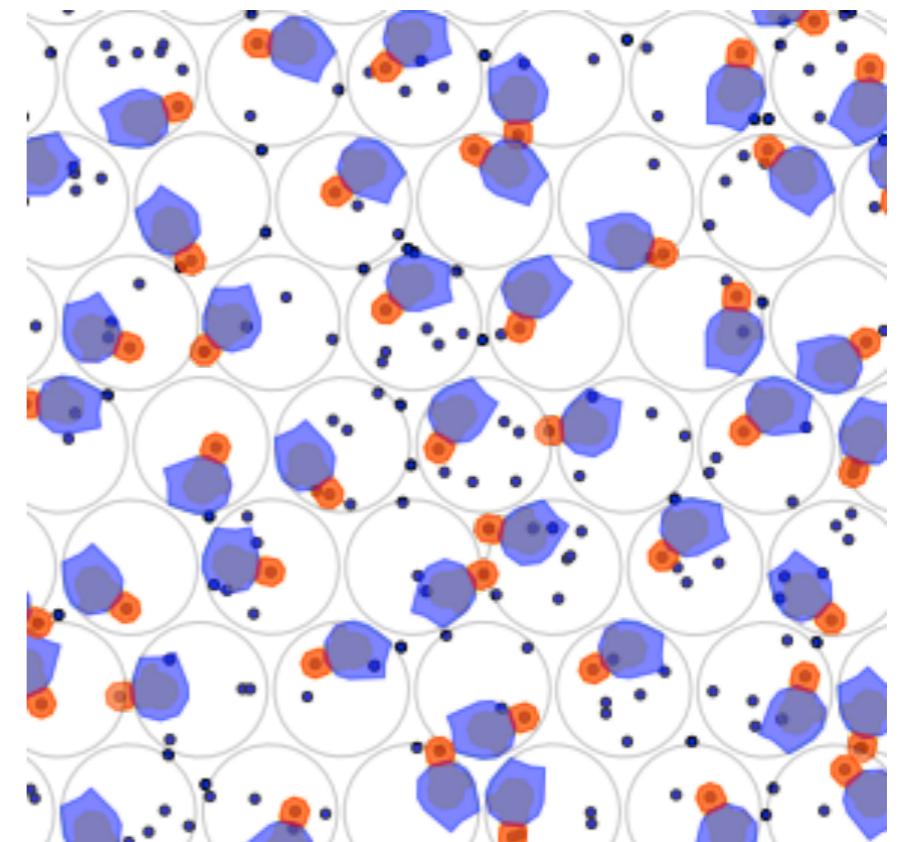
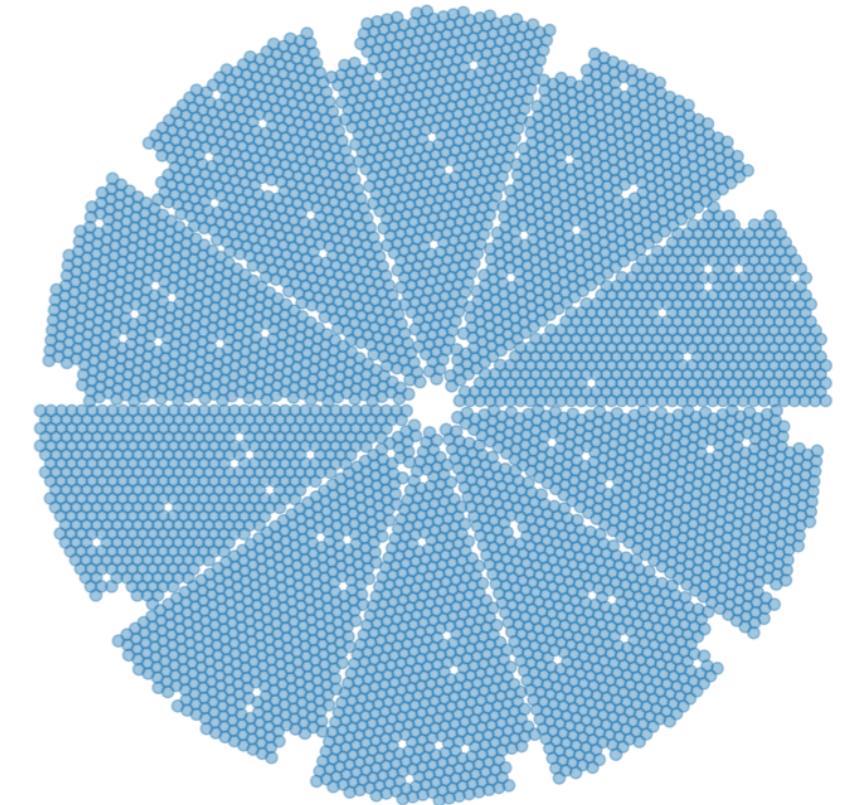
- DESI fibre assignment
- Incompleteness in the BGS due to fibre assignment
- Inverse pair weighting correlation function correction method
- Results from applying correction to BGS mock

DESI Fibre Assignment

- DESI tile contains 5000 fibres
- Each fibre controlled by robotic fibre positioner, can target any galaxy with its 6mm patrol region
- Each galaxy given a random sub-priority
- Place fibre on galaxy in patrol region with highest sub-priority

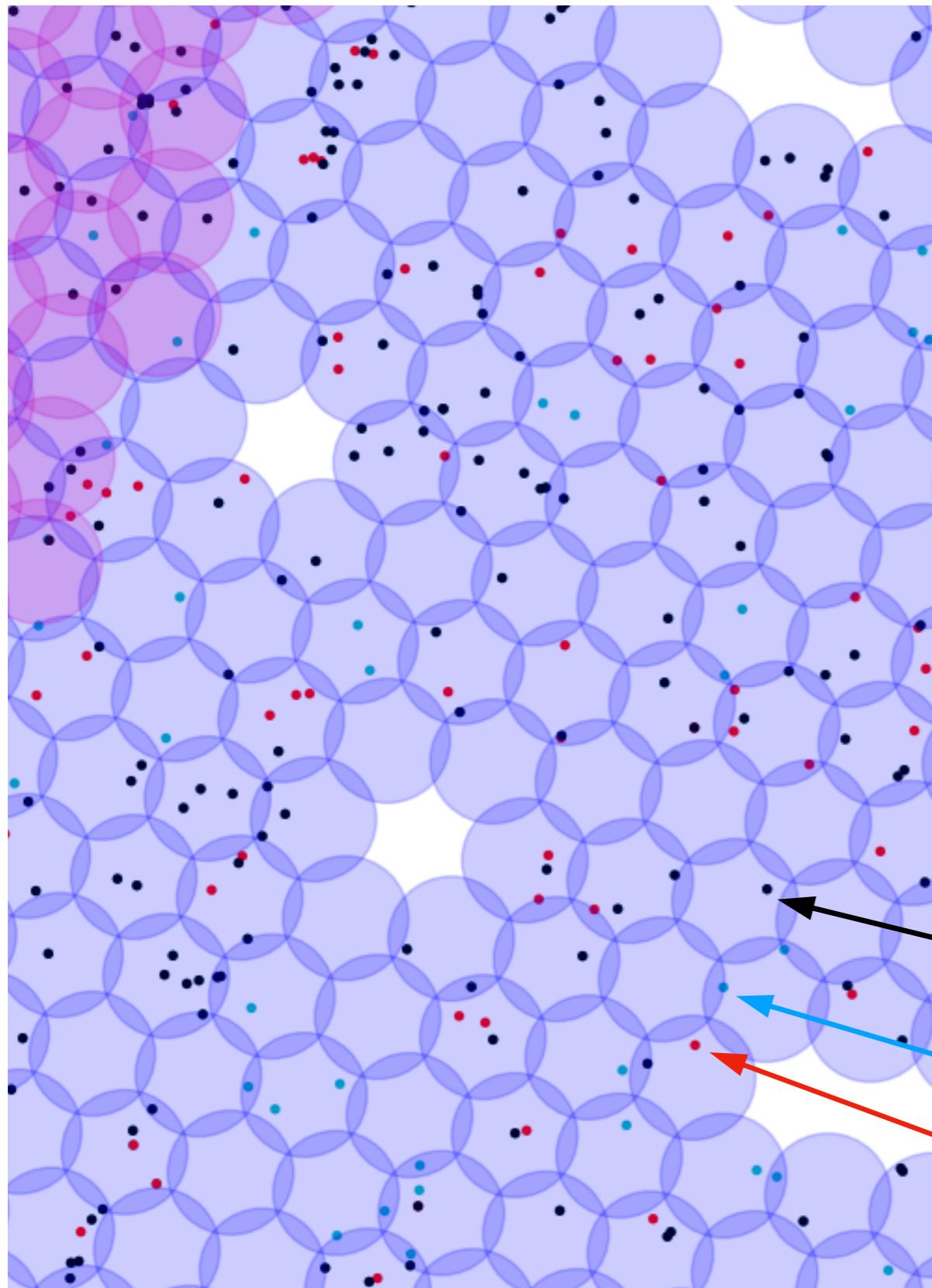


arxiv:1611.00037



credit: Jaime Forero-Romero

Untargetable Pairs



- Modifications are needed to give pairs a non-zero probability of being targeted
- Randomly promote small fraction of priority 2 galaxies to priority 1
- Dither tile positions by a small angle

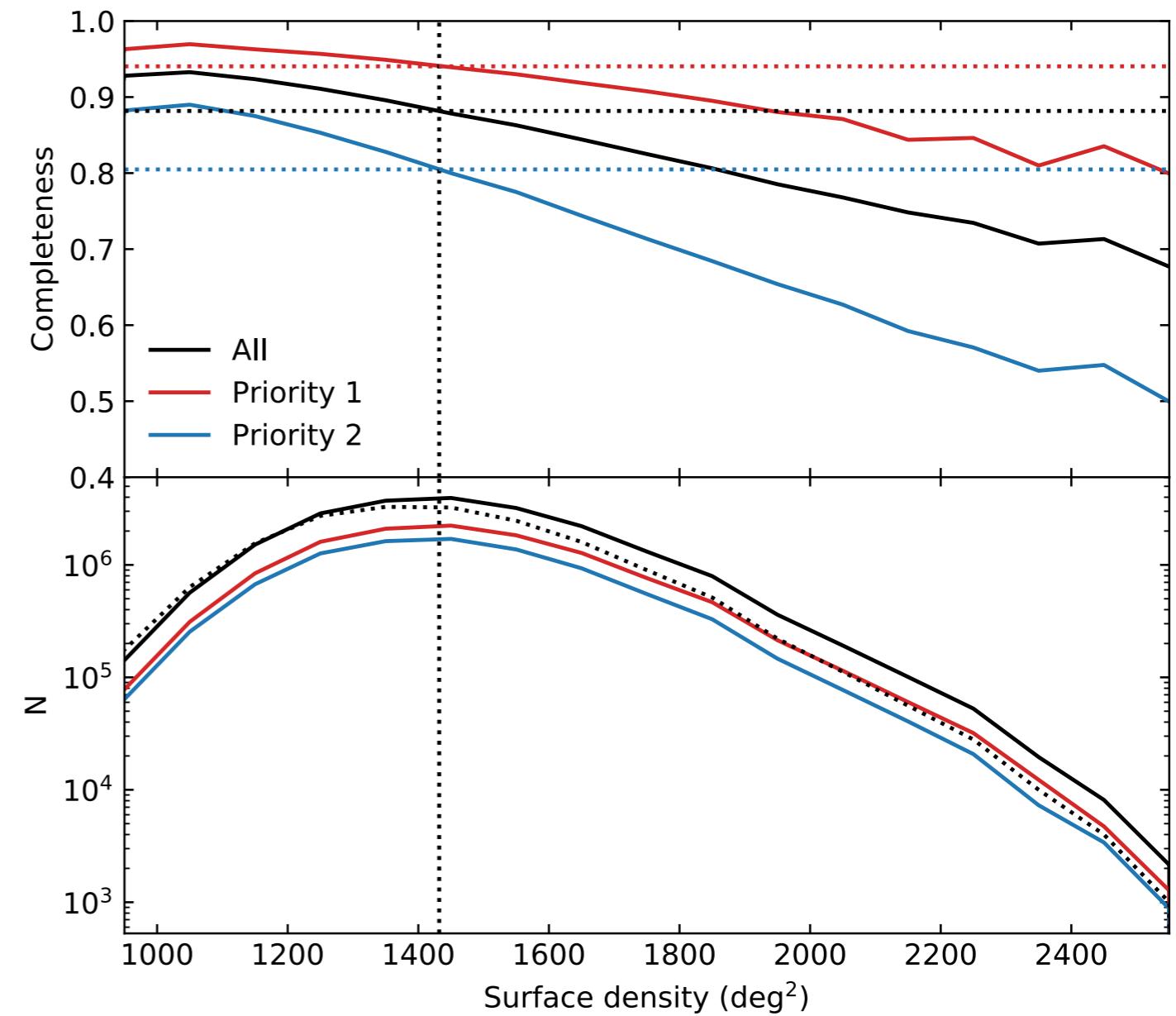
Priority 1

Priority 2, can be targeted

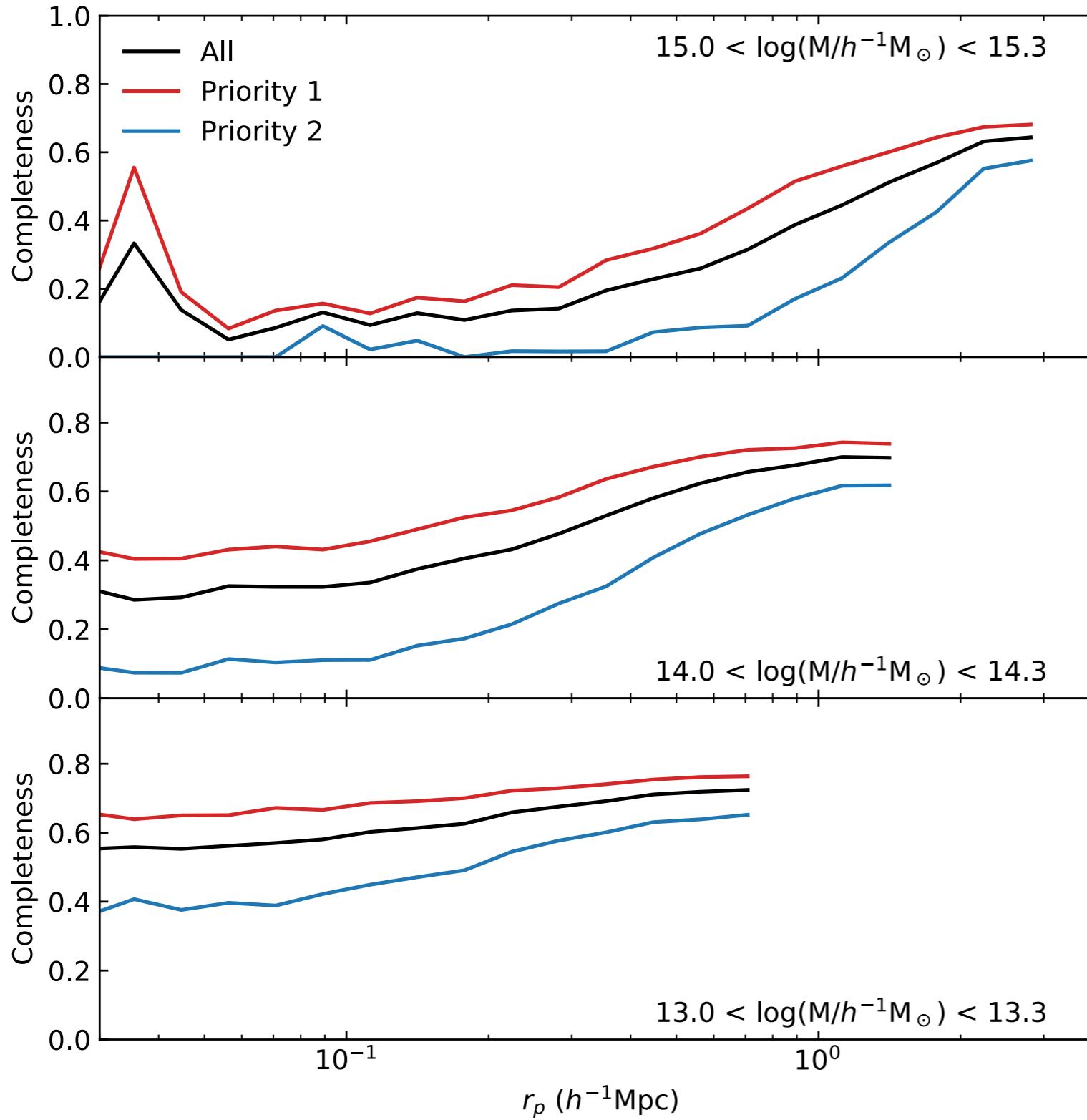
Priority 2, can't be targeted

Incompleteness

- Run fibre assignment on MXXL BGS mock catalogue (Smith et al 2017)
- Promote 10% of priority 2 to priority 1, dither tiles randomly by 3 times patrol radius
- Completeness after 3 passes vs surface density



Incompleteness



- Completeness near the centre of large clusters

Correcting Galaxy Clustering Measurements

- Pair-weighting method of Bianchi & Percival (2017)

$$\xi(\vec{s}) = \frac{DD(\vec{s}) - 2DR(\vec{s}) + RR(\vec{s})}{RR(\vec{s})} \quad \text{Landy Szalay estimator}$$

- Run fibre assignment 100s (or 1000s) of times to get probability of targeting each galaxy pair, p_{ij}

- Pair weight $w_{ij} = \frac{1}{p_{ij}}$

- Weighted DD counts $DD(\vec{s}) = \sum w_{ij} \frac{DD^{(p)}(\theta)}{DD(\theta)}$

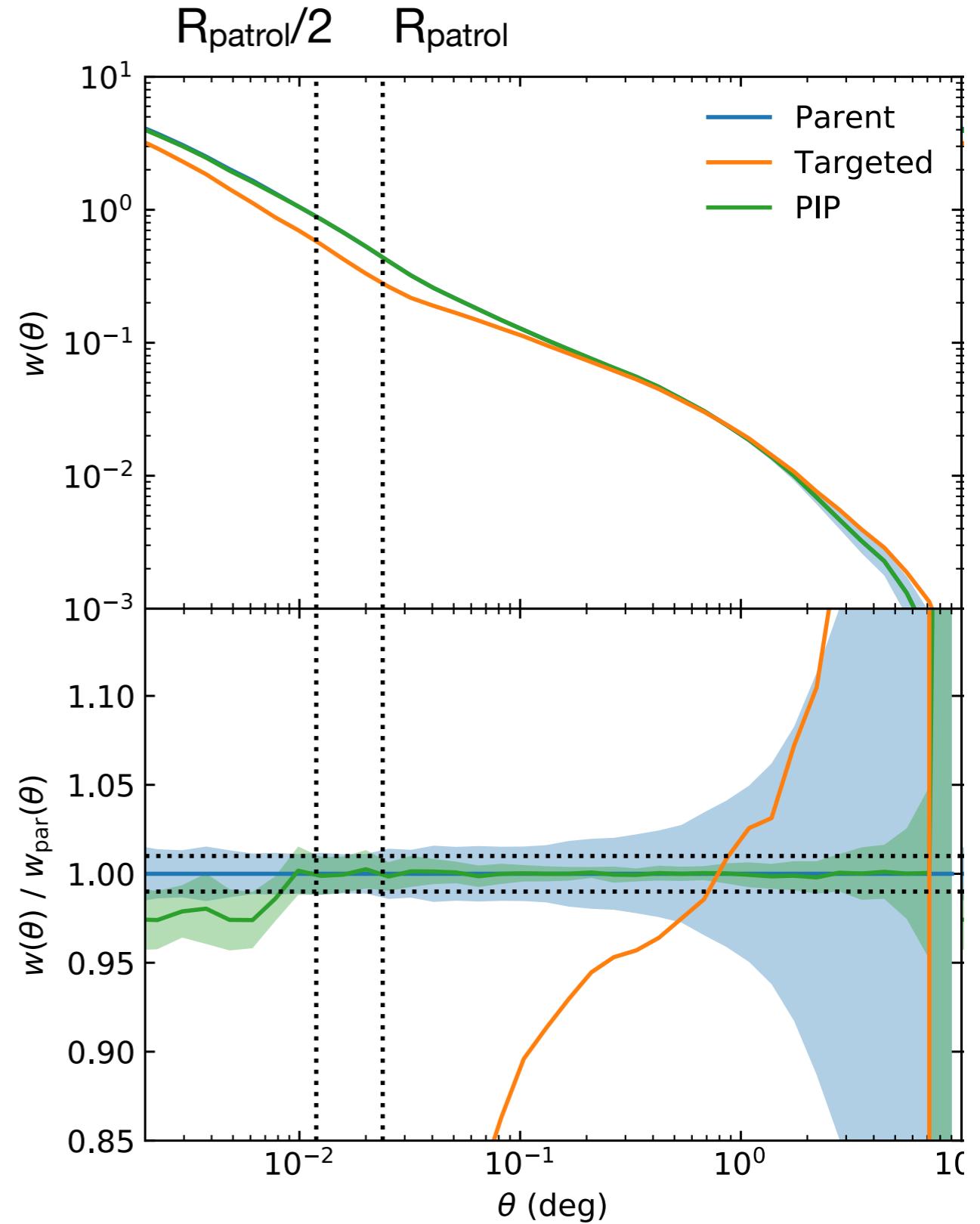
parent sample
targeted sample
(with weights)

- Unbiased (if $p_{ij} > 0$ for all pairs)

Angular weight
(reduce variance)

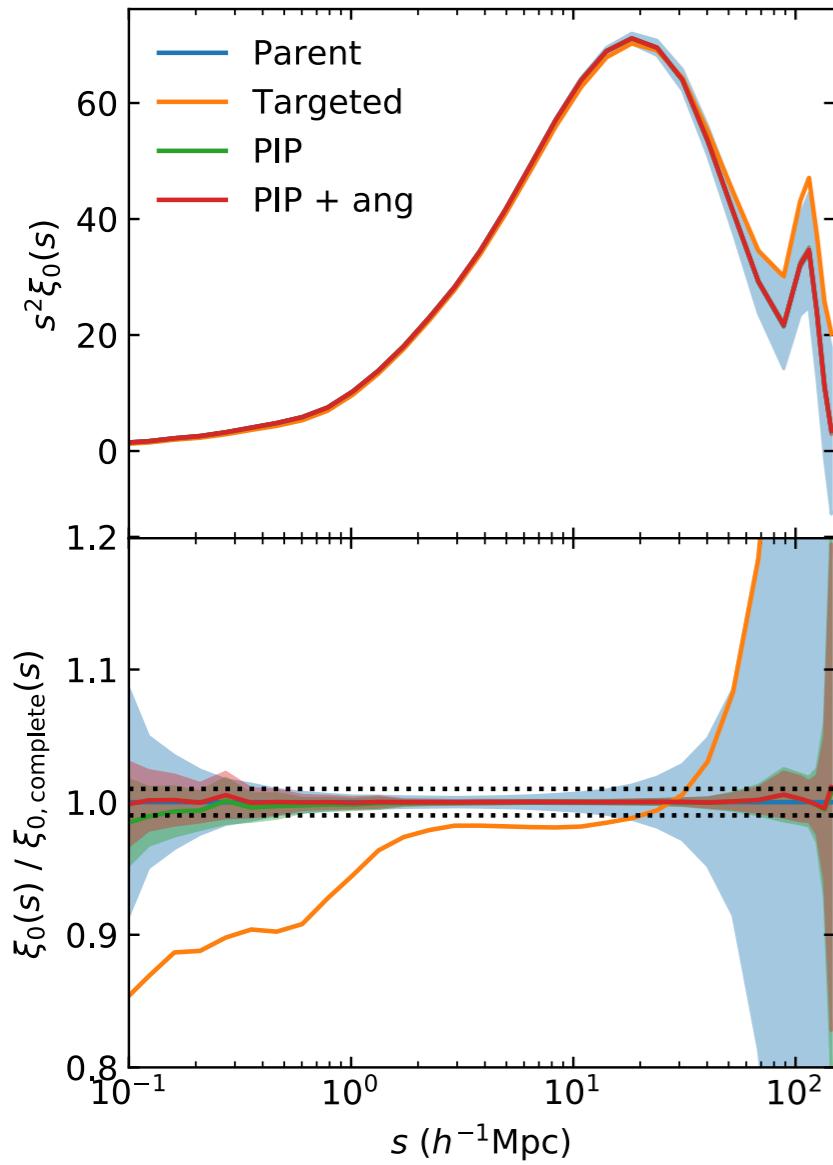
Angular Correlation Function

- After 3 passes of tiles
- 2048 realizations
- Volume limited sample
 - $-22 < M_r < -21$
 - $0.09 < z < 0.35$
 - $n = 2 \times 10^{-3} \text{ (Mpc/h)}^{-3}$
- Bias at small scales due to fibre collided pairs in regions covered by 1 tile (at the edge)

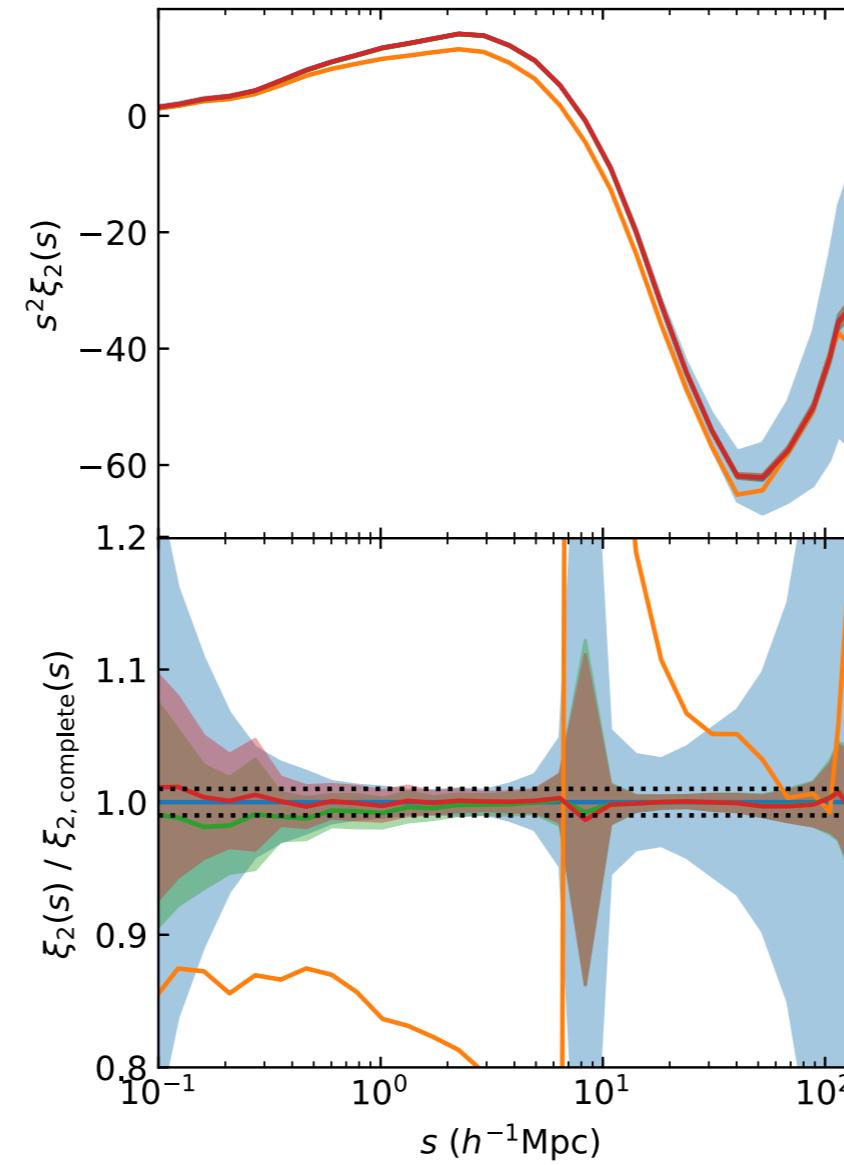


Multipoles - After 3 passes

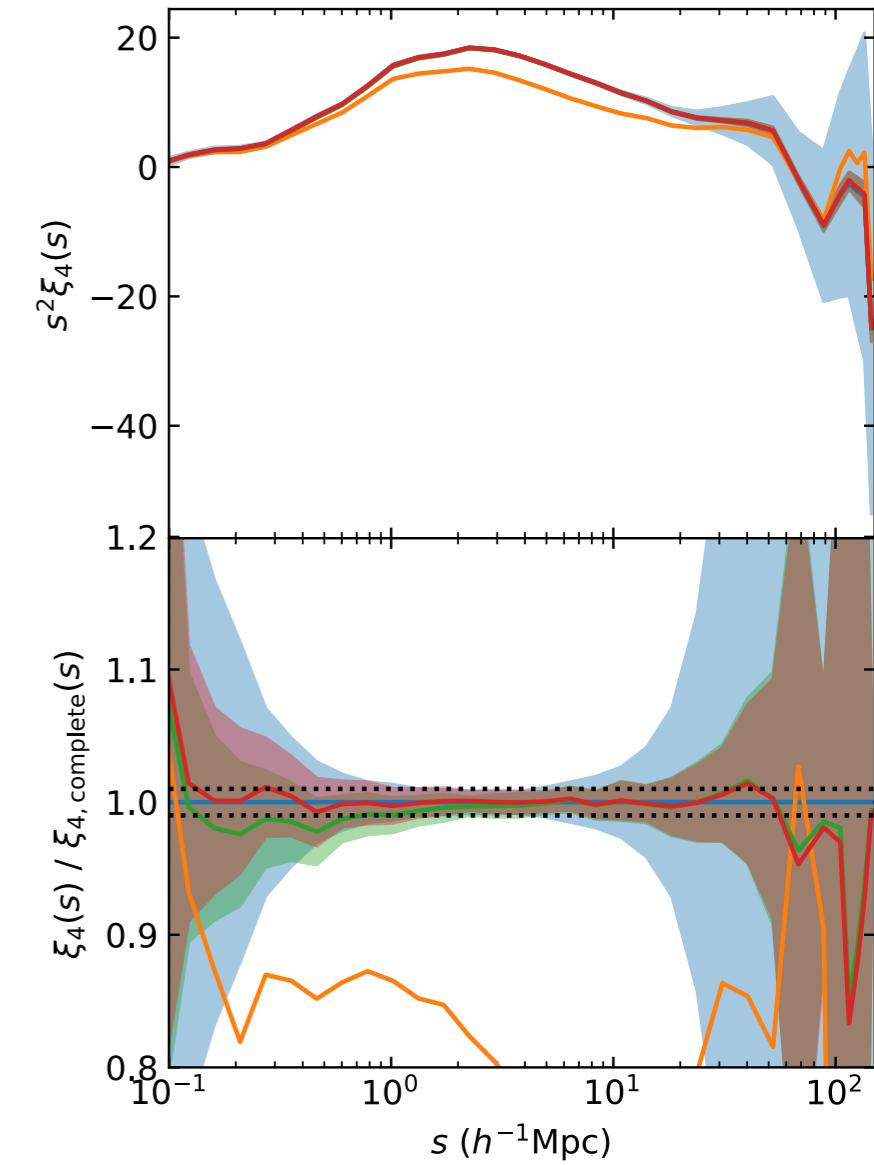
Monopole



Quadrupole

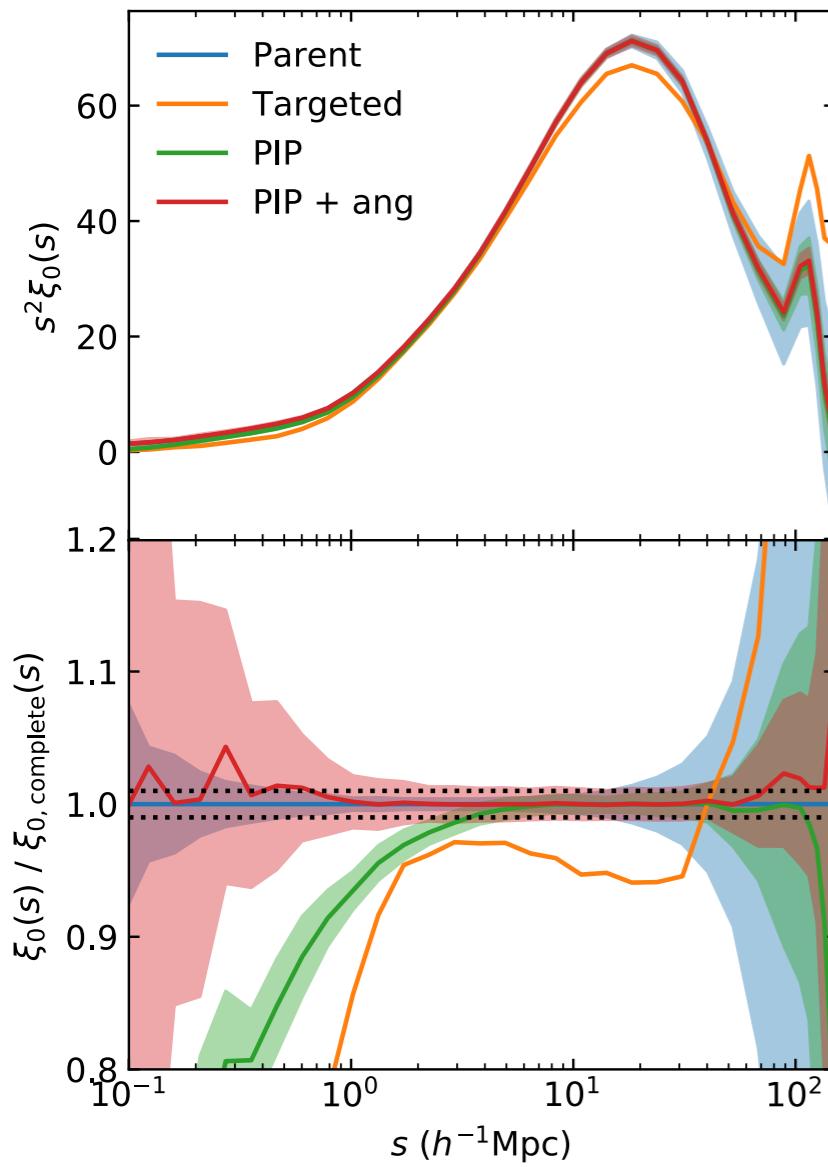


Hexadecapole

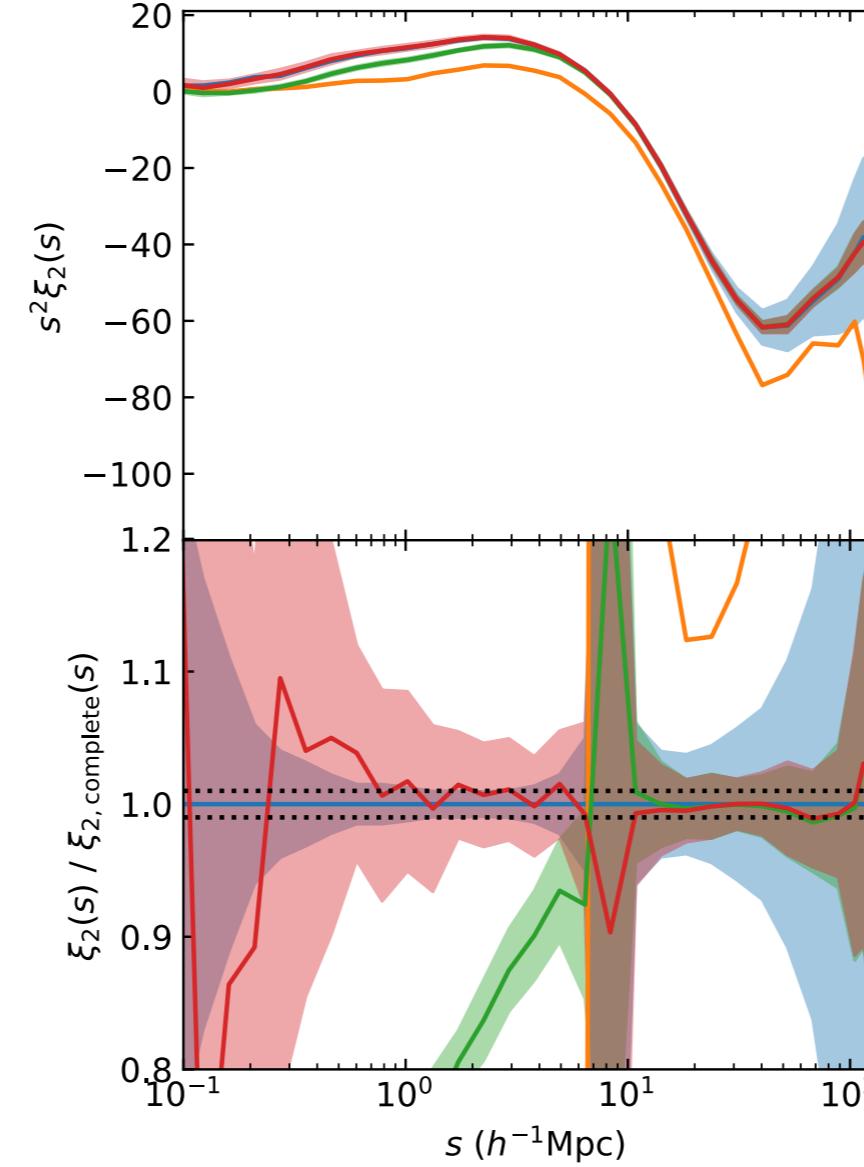


Multipoles - After 1 pass

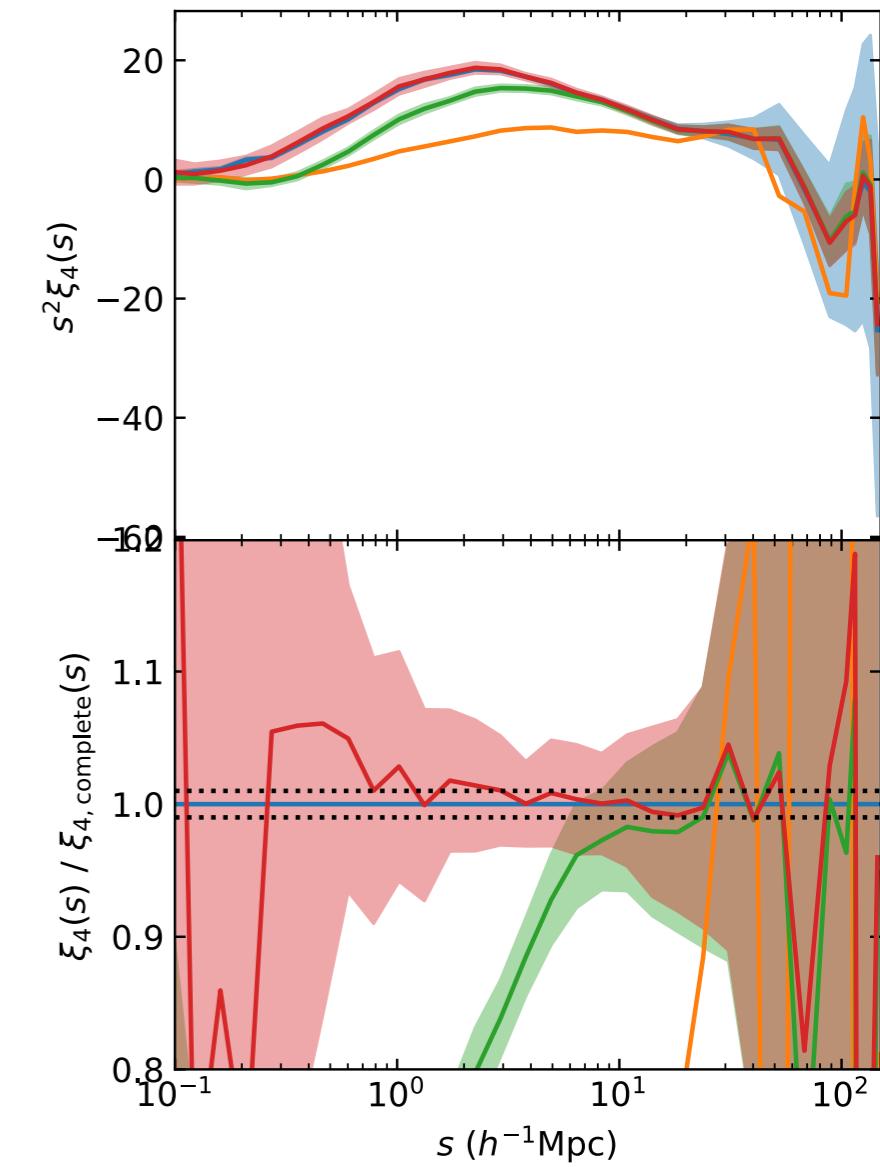
Monopole



Quadrupole



Hexadecapole



Conclusions

- Completeness in the BGS strongly affected by galaxy surface density
- Low completeness near the centre of massive clusters
- Galaxy clustering measurements strongly affected by fibre assignment
- Inverse pair weighting (combined with angular weighting) produces unbiased correction
- After 3 passes, scatter between realizations is very small, but with only 1 pass, scatter is very large, especially at small scales