Cosmic Variance of LAEs/OII

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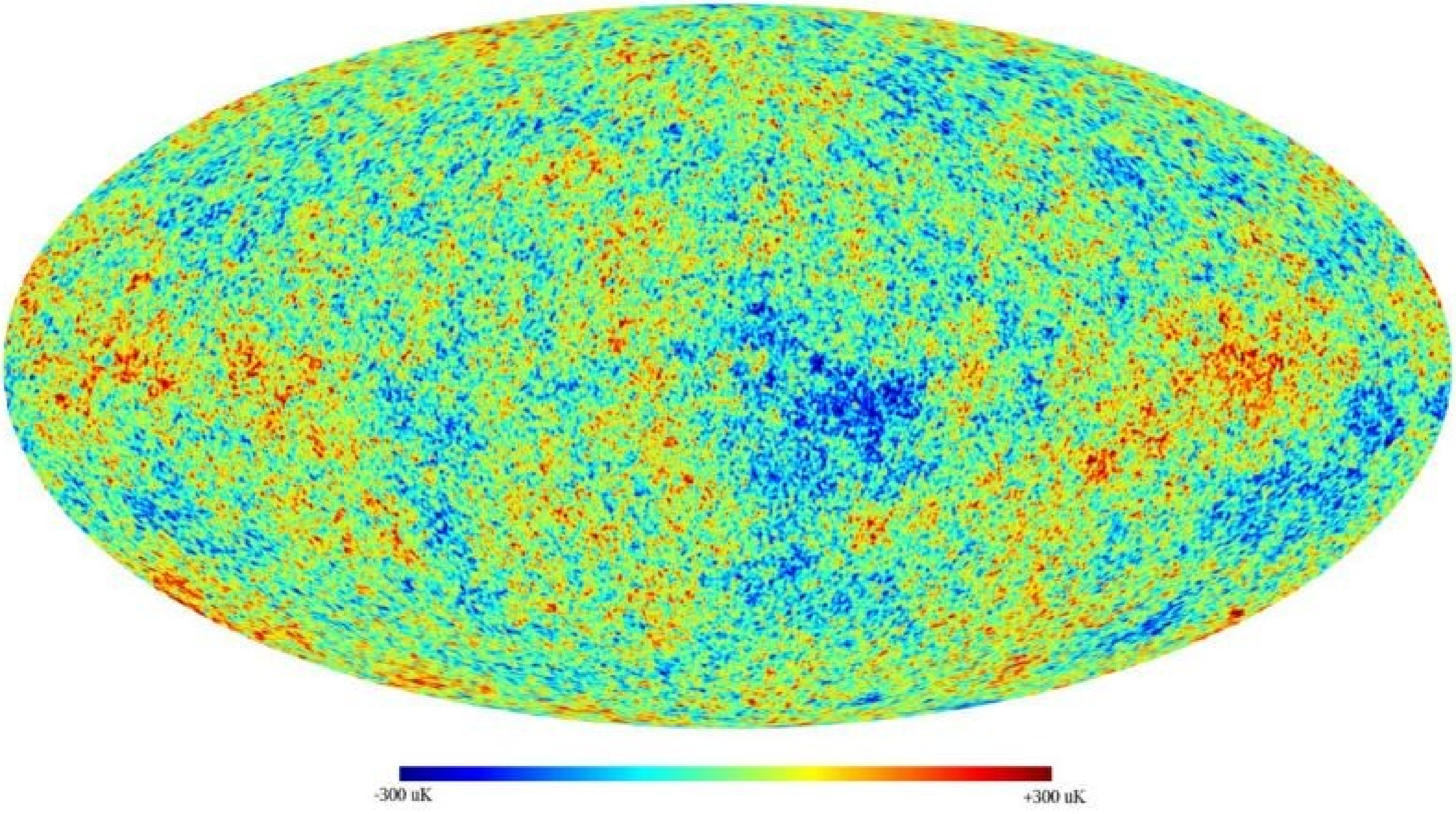
MPE

Cosmic Variance



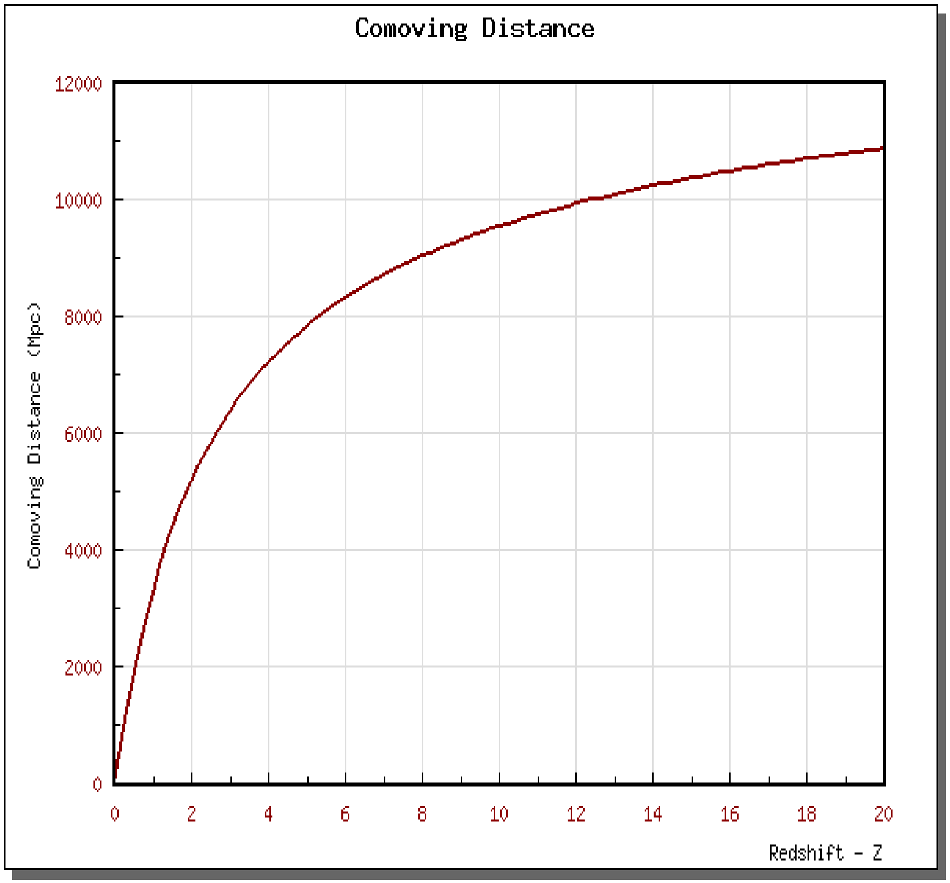
Effects of Cosmic Variance

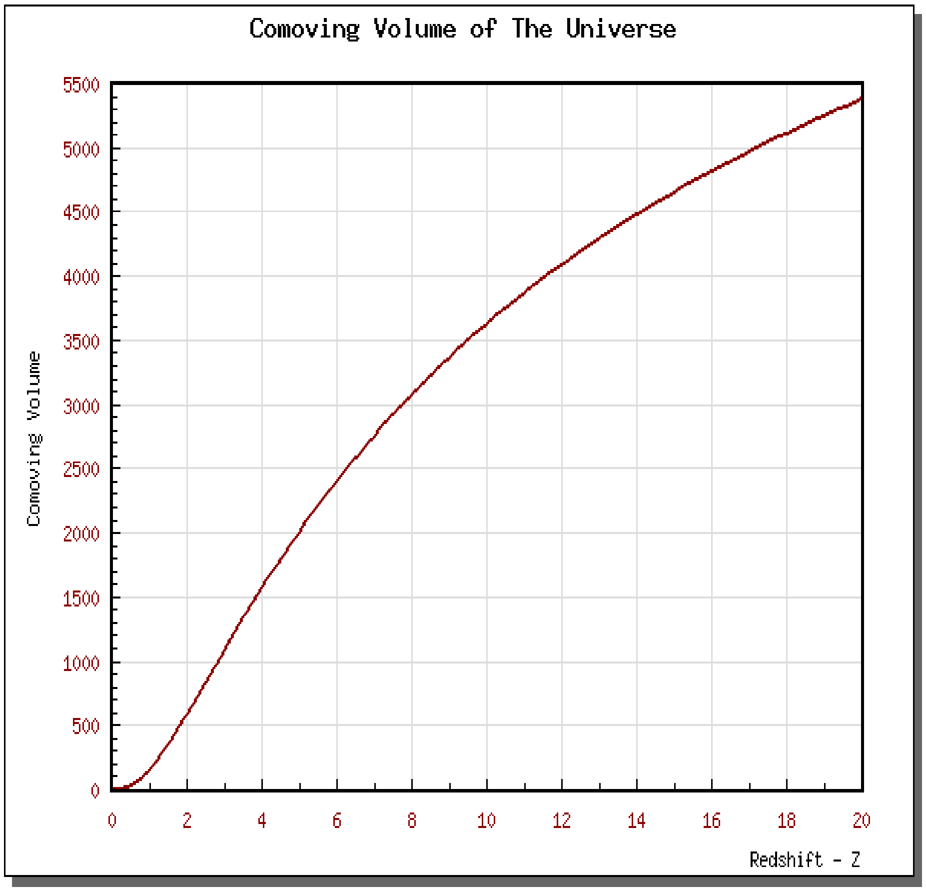
- Two-Point Statistics
  - Power Spectrum
  - Correlation Function
- One-Point Statistics
  - Number Counts
  - Luminosity Functions
  - ...

Dependencies of CV

- Volume
- Correlation Function (Power Spectrum)
- Bias
  - $\sigma_{cv} = b\sigma_{cv}(DM)$

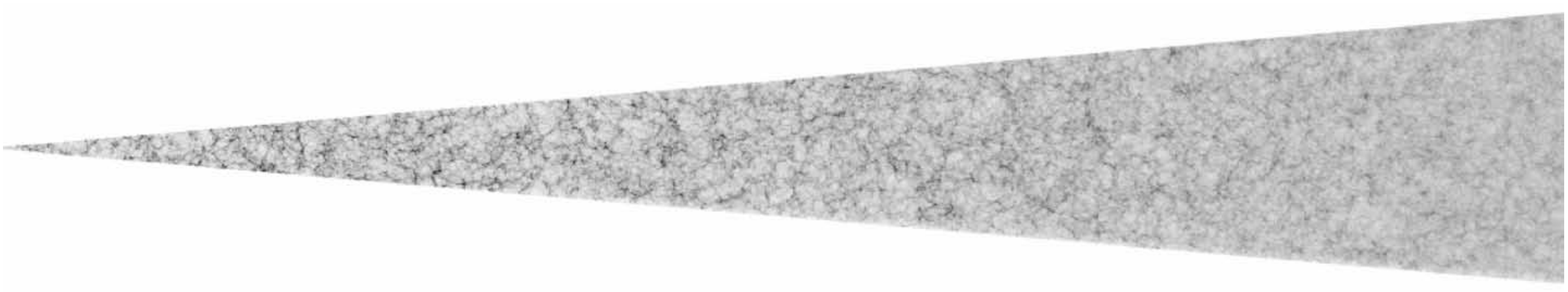
Dependencies of CV





LAEs vs OII

- LAEs: $z = 1.9 – 3.8$ $V = 9\ Gpc^3$
- OII: $z = 0 – 0.5$ $V = 0.3\ Gpc^3$
- SDSS : $z = 0.2 – 0.6$ $V = 4\ Gpc^3$



Hubble Volume Simulation
Evrard et al. 2002

Cosmic Variance vs. Poissonian Noise

- Two-Point Statistics:

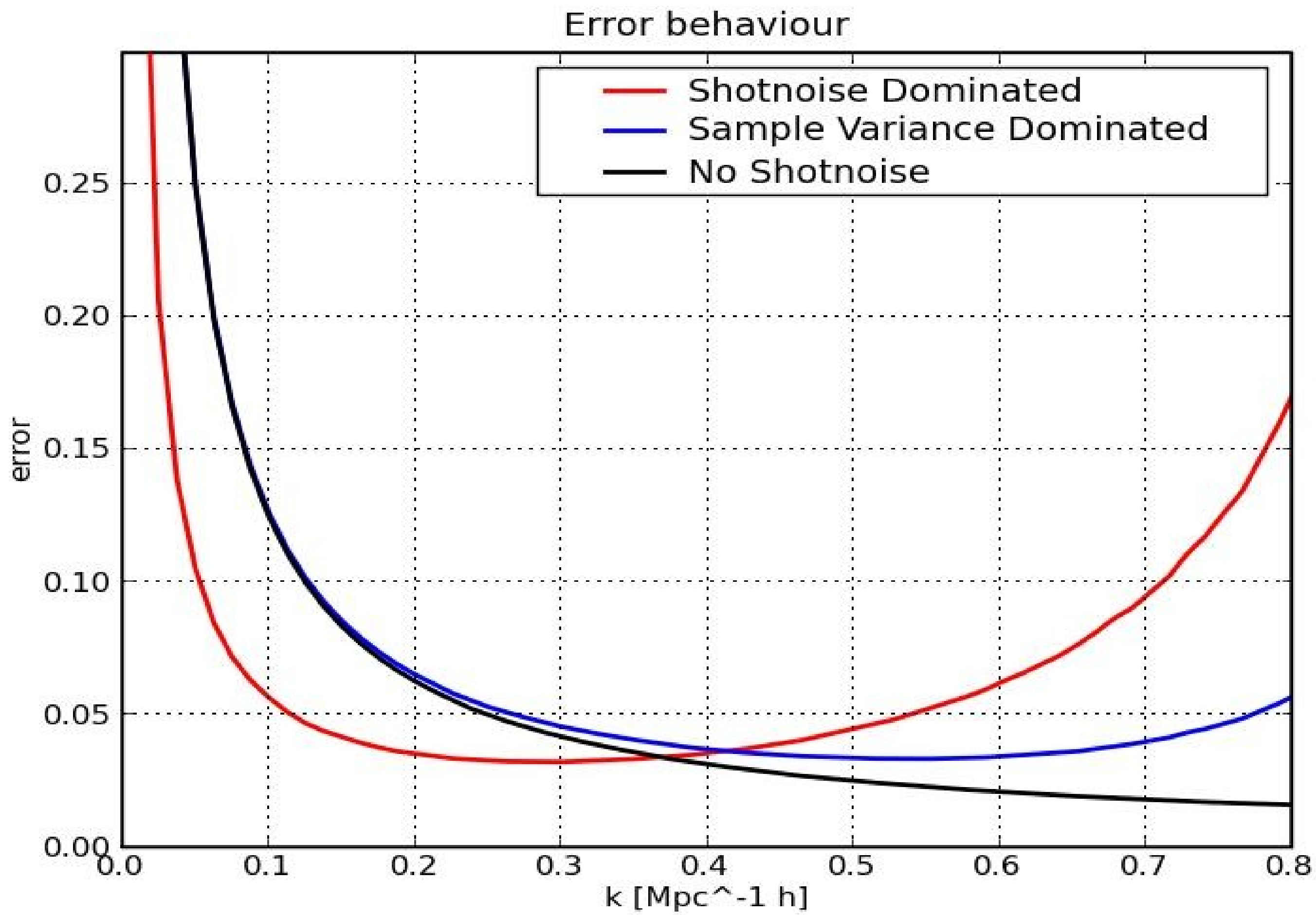
$$\sigma_{P(k)} = \frac{\sqrt{2\pi}}{kL}\left(1 + \frac{1}{\bar{n}\,P(k)}\right)$$

- One-Point Statistics:

$$\sigma_p = \frac{1}{\sqrt{N}}$$

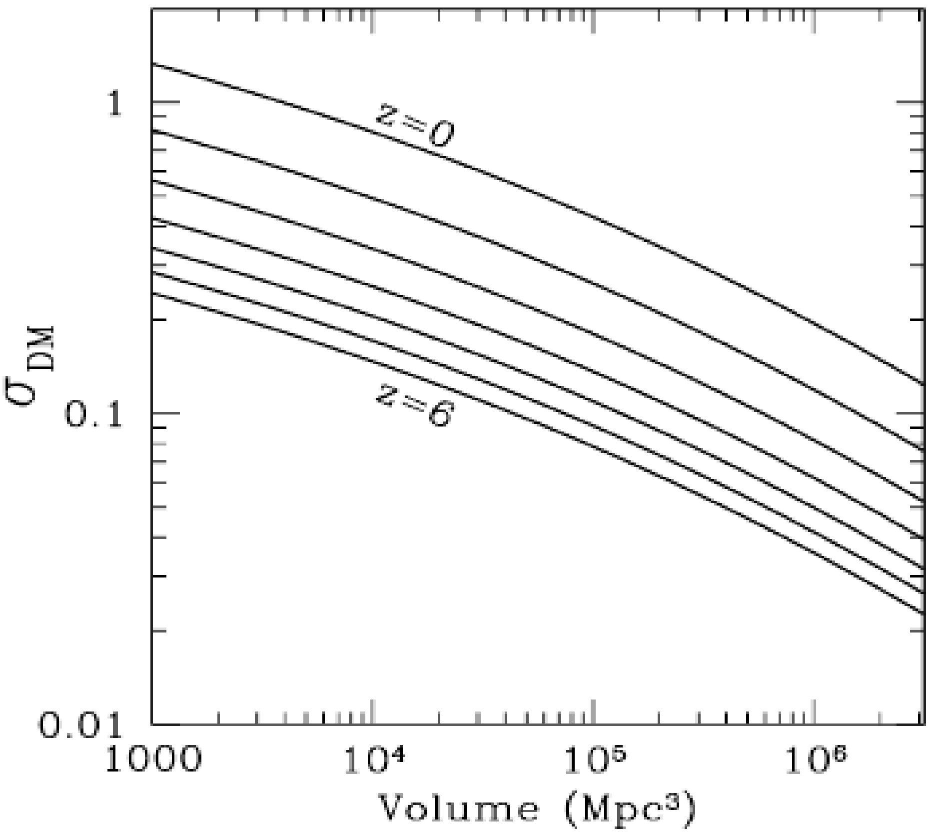
$$\sigma_{cv} = \frac{1}{V}\sqrt{\int_V \int_V d^3x_1\, d^3x_2\, \xi\left(|\vec{x}_1 - \vec{x}_2|\right)}$$

Values of CV errors in TPS



Values of CV errors in OPS

Somerville et al 2004

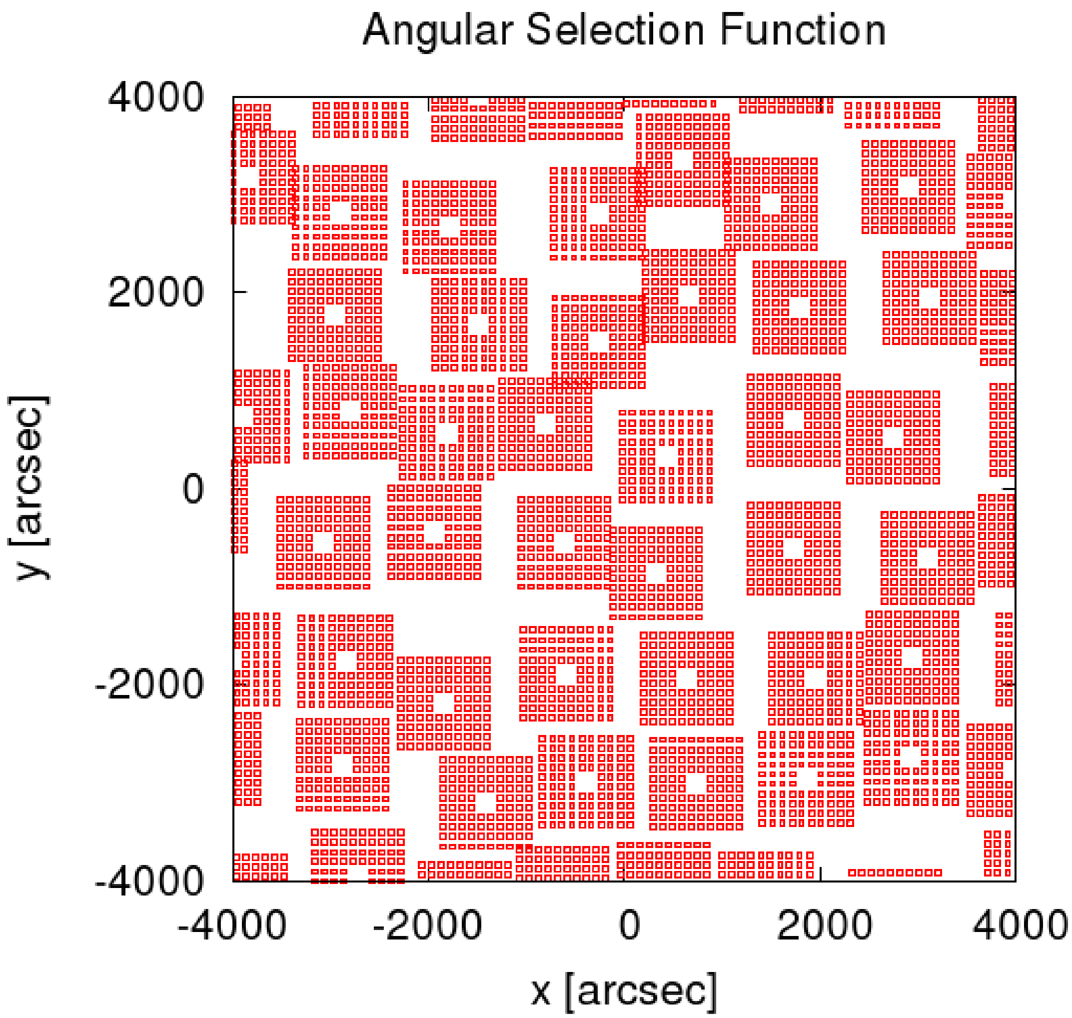


- Errors halve about every multiples of 10 in Volume
- LAEs
  - $\sigma_{cv} \approx 0.01$
  - $\sigma_p \approx 0.001$
- OIIs
  - $\sigma_{cv} \approx 0.04$
  - $\sigma_p \approx 0.001$

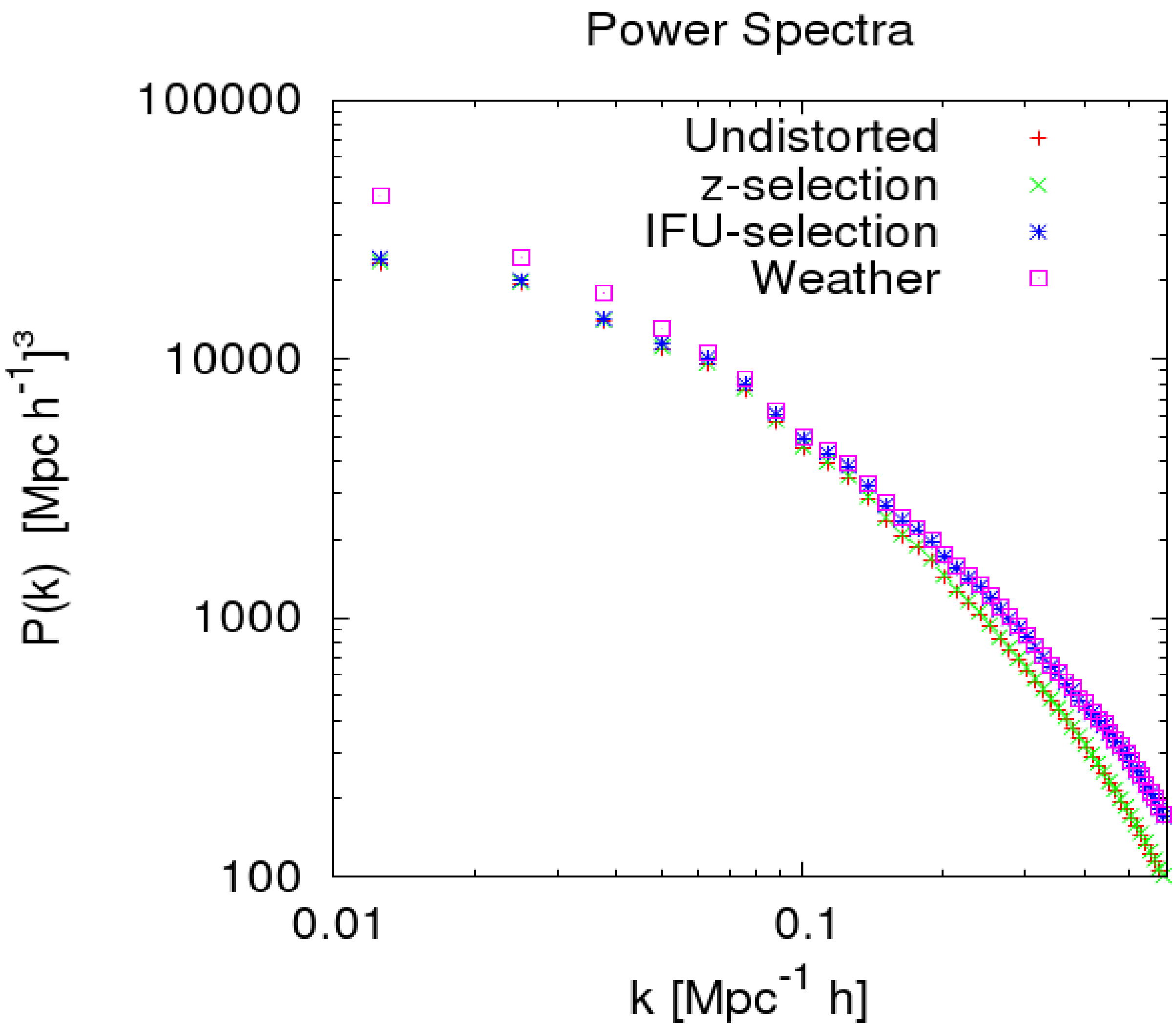
Conclusions

- The One-Point statistics of HETDEX are dominated by Cosmic Variance not by Poissonian noise
- Two-Point Statistics are dominated by Cosmic Varaince on large scales, Poissonian Noise on small scales and eqally at the scales of interest in between (by design)

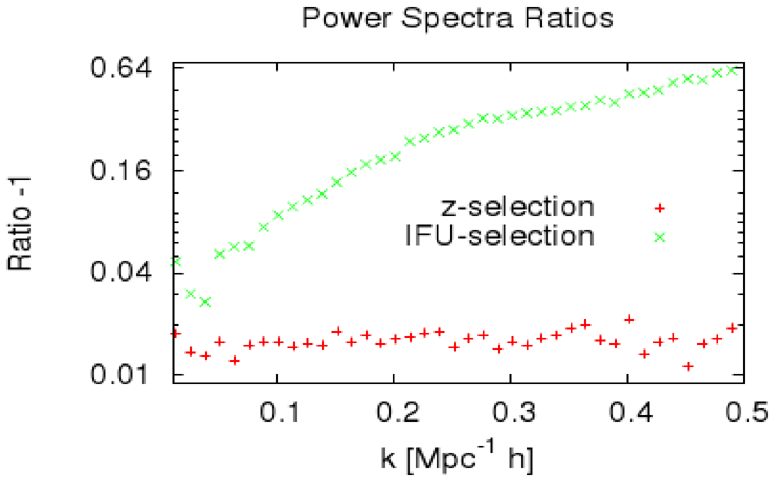
Window Function



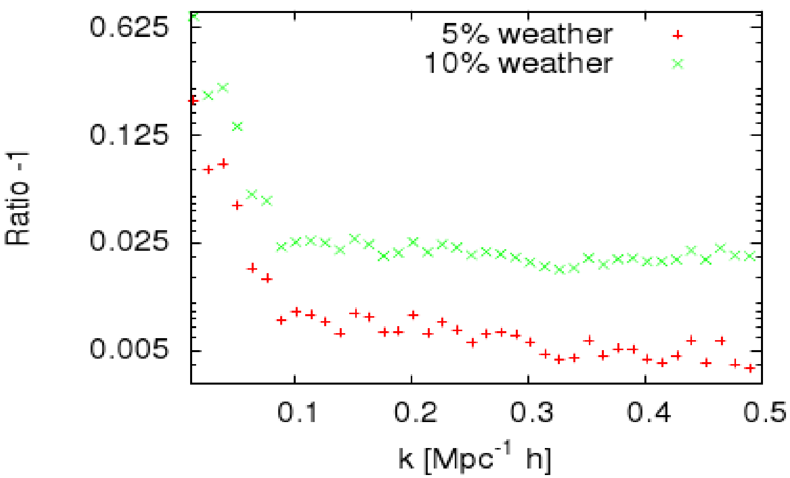
Resulting Power Spectra



Ratios of Power Spectra

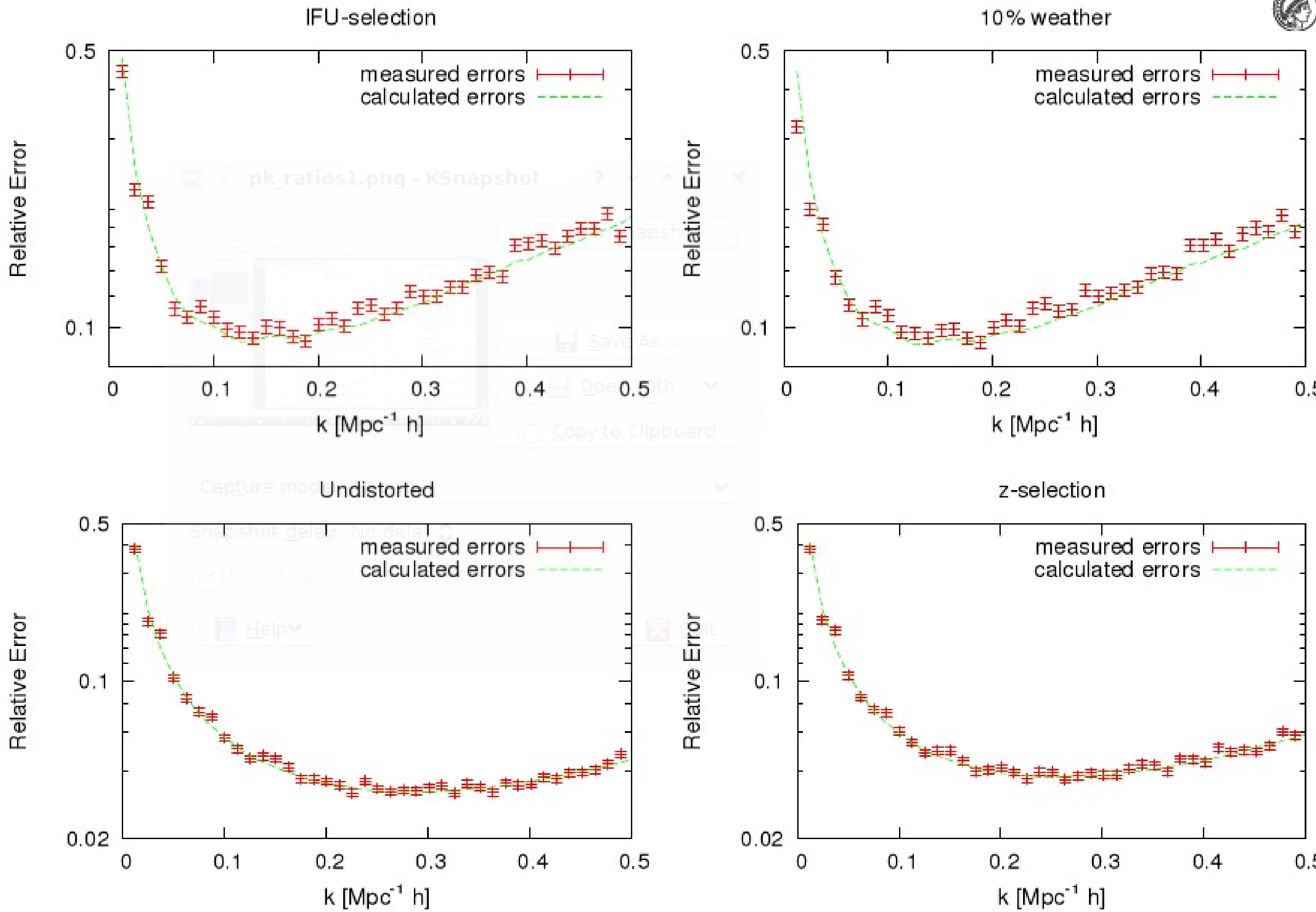


- Z - selection
- Angular(IFU) – selection

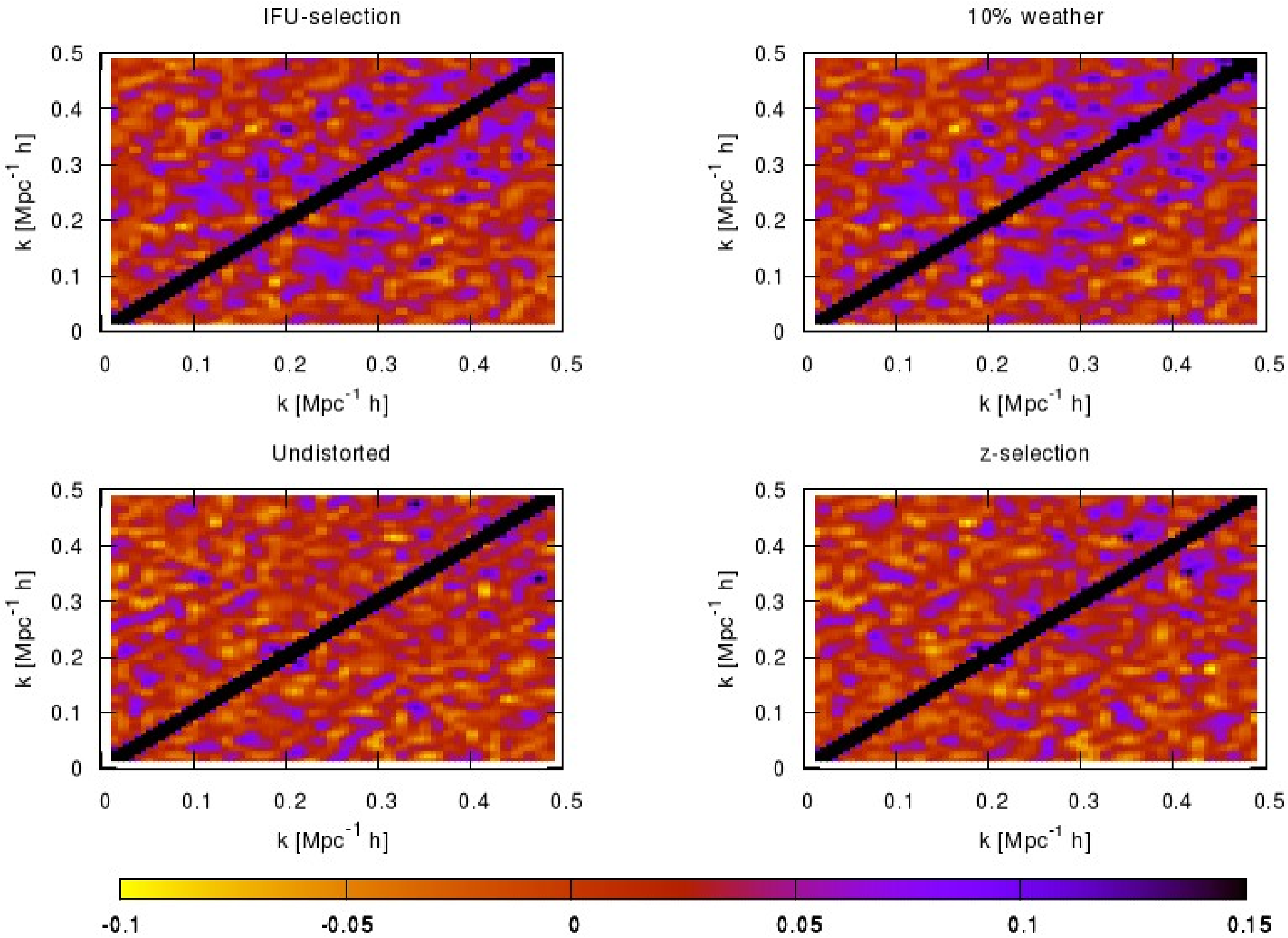


- Zero point erros (weather)

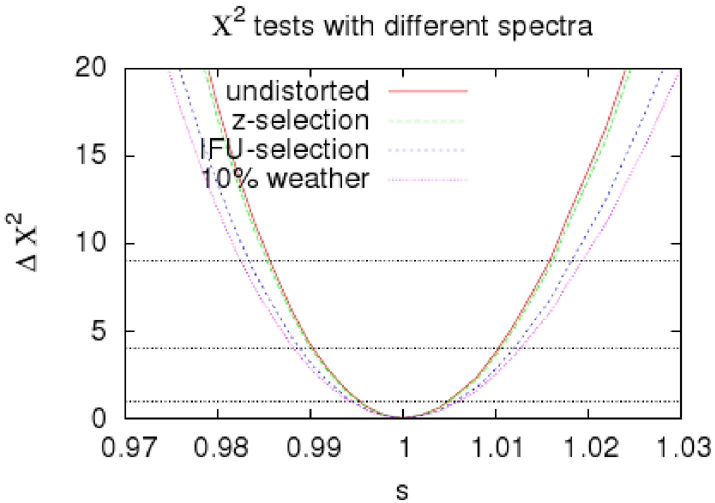
Errors

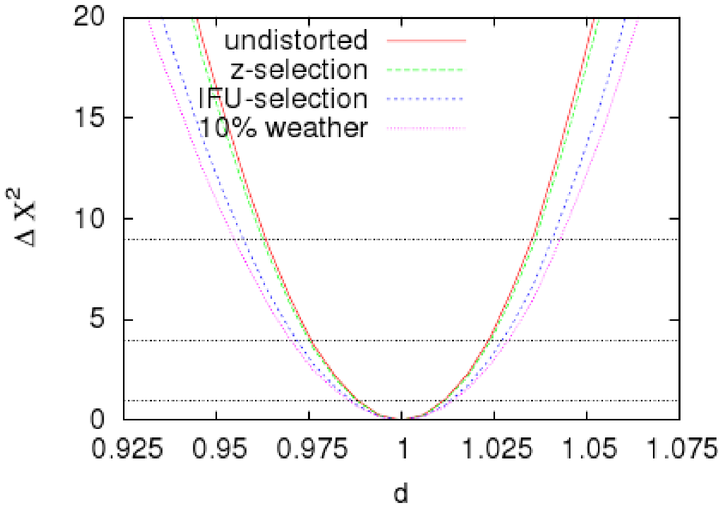

IFU-selection
10% weather
Undistorted
z-selection
measured errors
calculated errors
Relative Error
k [Mpc^{-1} h]
0.5
0.1
0.02
0
0.1
0.2
0.3
0.4
0.5

Correlation Matrices



Effects on Cosmological Test





- s = stretch factor
- Determines changes in geometry

- d = amplitude accuracy
- Determines changes in growth history

Conclusions

- Window function heavily distorts power spectrum
- Shape of power spectrum can be recovered via convolution/deconvolution
- Errors do not change much
- Introduced correlations are small
- Resulting change in accuracy is on the order of 15%