Optimizing galaxy samples for clustering measurements in photometric surveys

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with
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DES Y1

Galaxy clustering: **redMaGiC**

accurate photo-zs: $\sigma_z/(1+z) < 0.017$

small (~660000 galaxies)

Q: Can we **extend** the sample in future analyses?

Make it general:

- Adopt a simple **model**
- Explore the $\sigma_{z,0}$ - $N_{\rm g}$ parameter space

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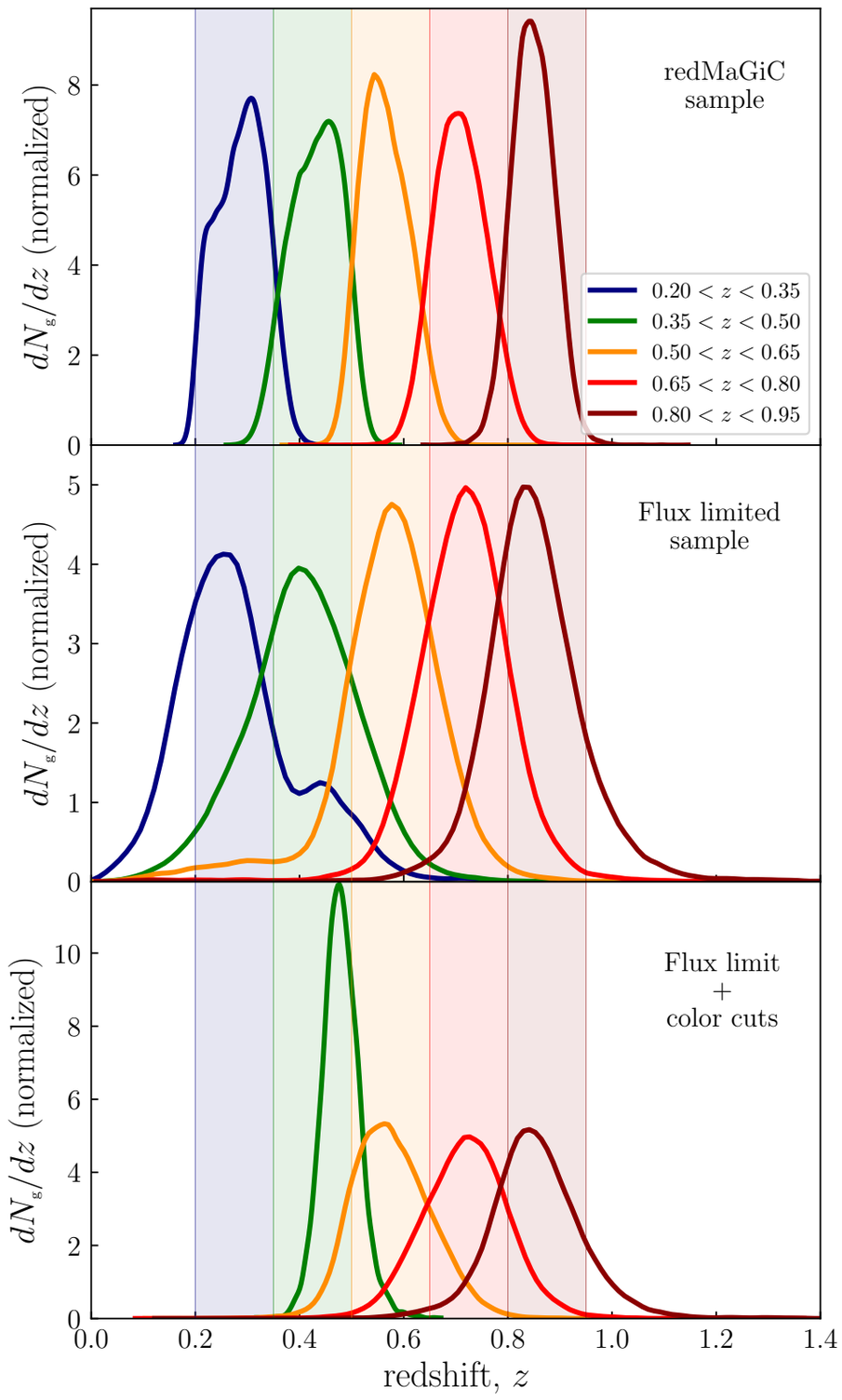
Data



Model

- Gaussian photo-zs:

$$p^i(z_{\rm ph}|z) = \frac{1}{\sqrt{2\pi}\sigma_z} \exp\left[-\frac{(z_{\rm ph} - z - z^i_{\rm b})^2}{2\sigma_z^2}\right]$$

$$\sigma_z = \sigma_{z,0}(1+z)$$

- Common redshift distribution:

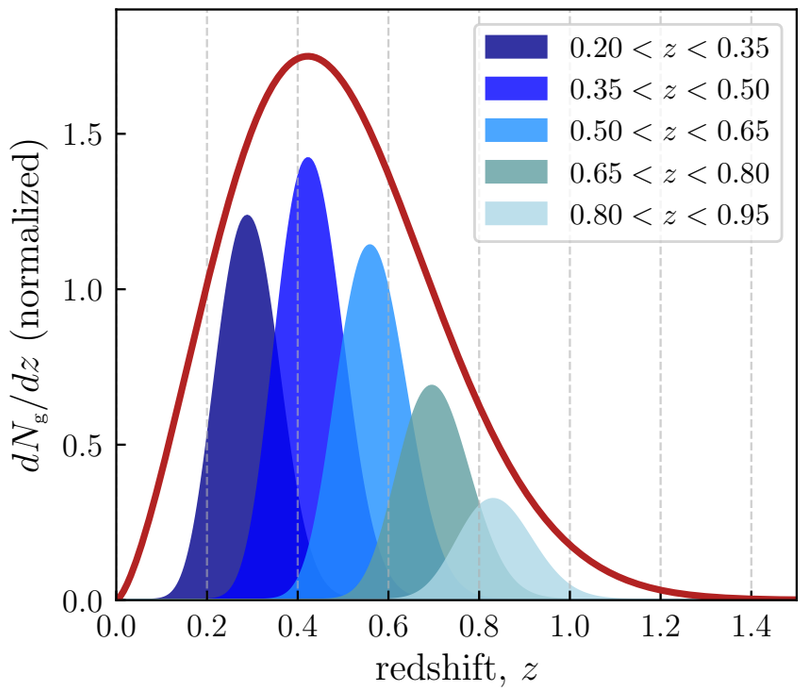
$$\frac{dN_{\rm g}}{dz} \propto z^\alpha \exp\left[-\left(\frac{z}{z_0}\right)^\beta\right]$$

$$z_0 = 0.5$$

$$\alpha = 1.47$$

$$\beta = 2.09$$

- Priors: $\sigma(\sigma_{z,0}) = \sigma(z^i_{\rm b}) \propto \sigma_{z,0}$



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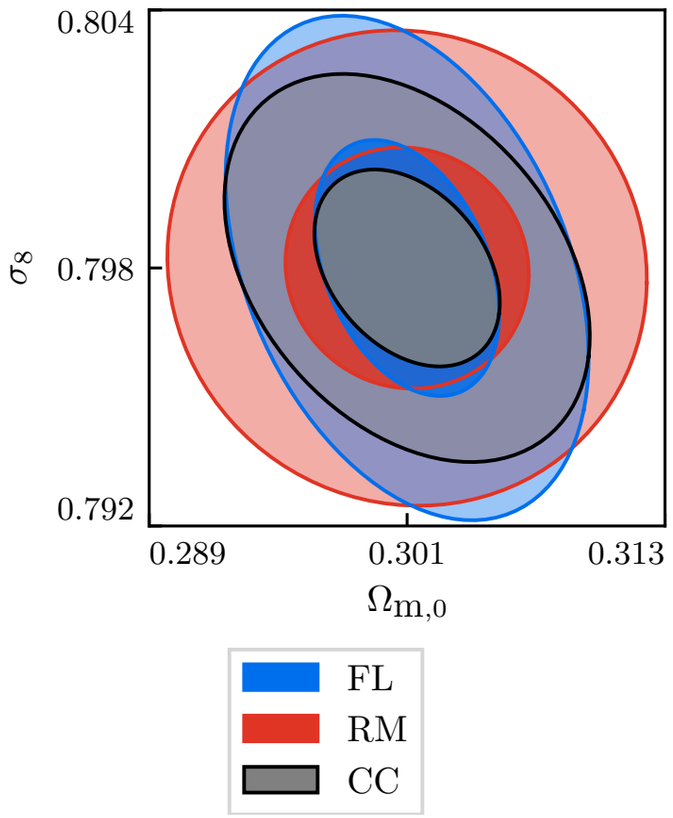
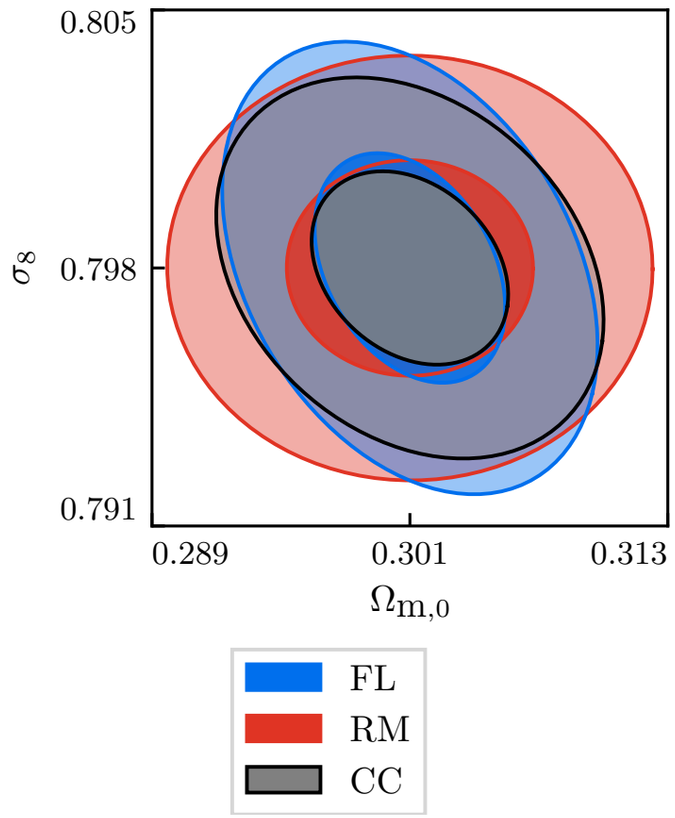
Forecasts

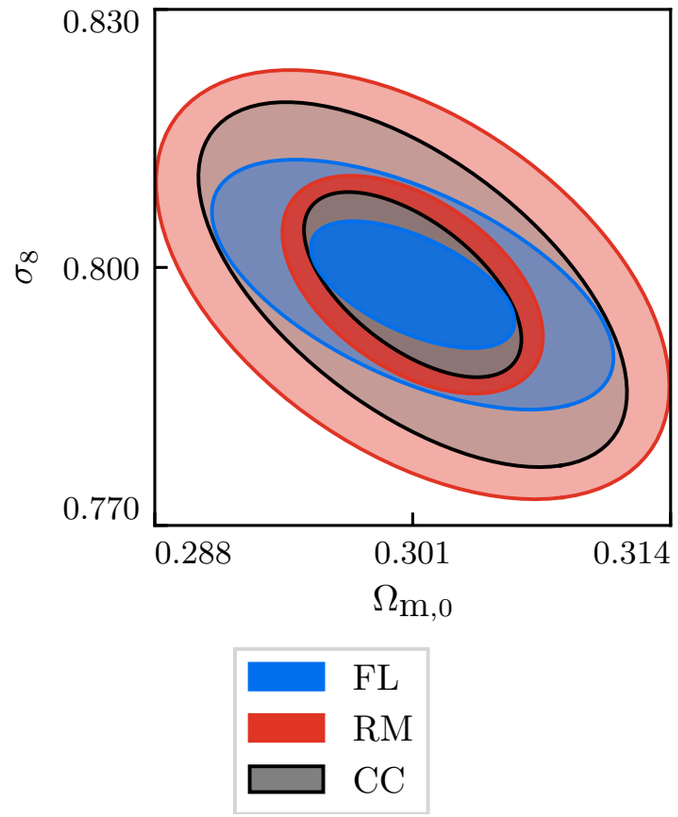
From data



Model (fixed scatter)



Model (free scatter)

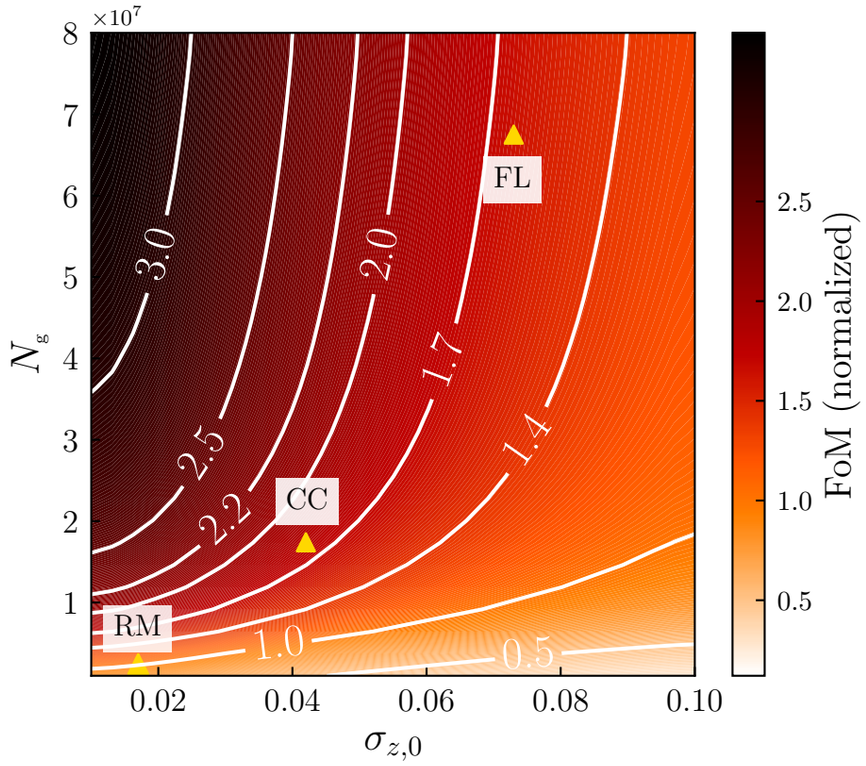


Scaled to Y3 footprint

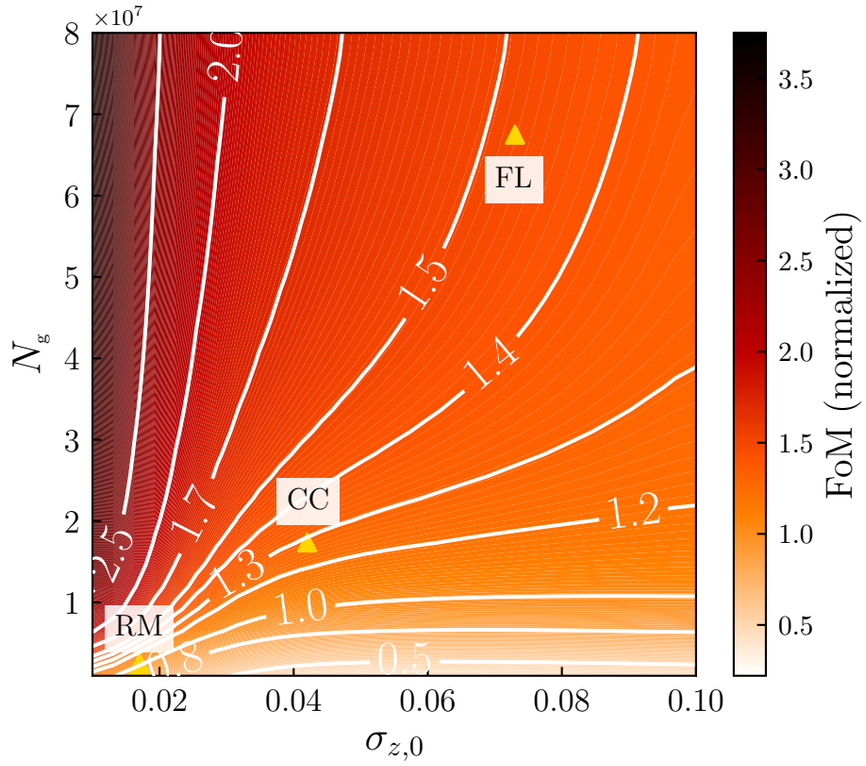
Wide range of samples:

Figure of Merit (FoM) for: $\Omega_m - \sigma_8$

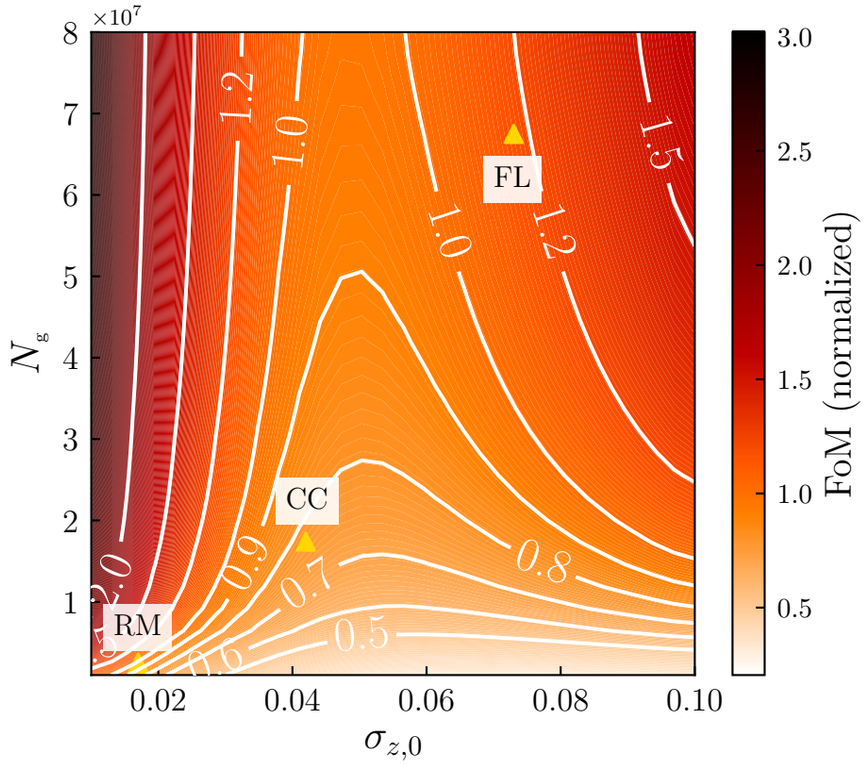
Auto-Correlations only



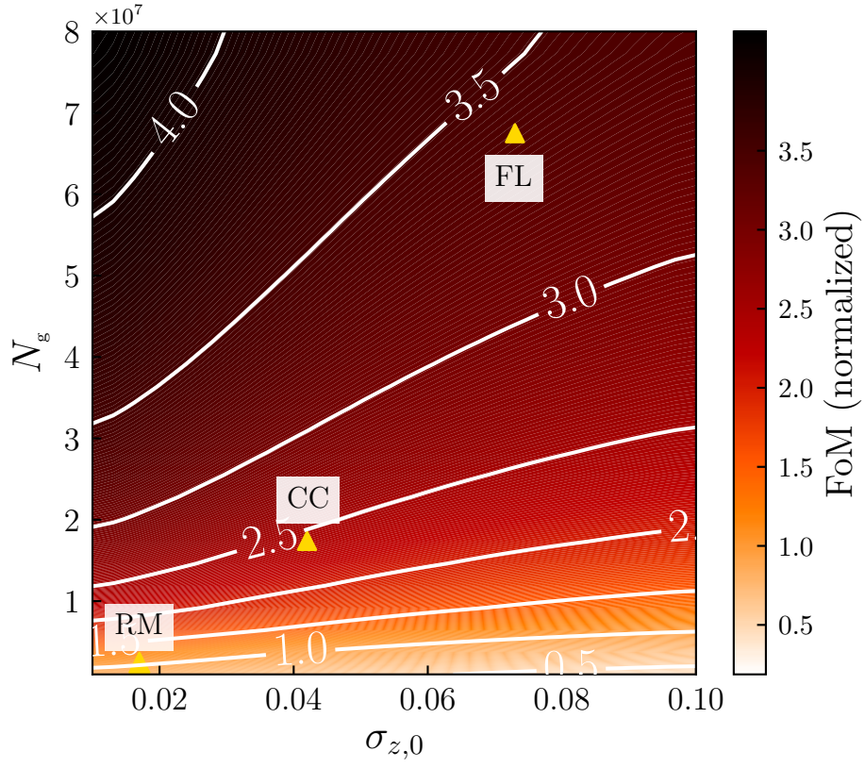
Free photo-z parameters



Conservative priors $\sigma(\sigma_{z,0}) = \sigma(z_{\rm b}^i) = 0.4\sigma_{z,0}$

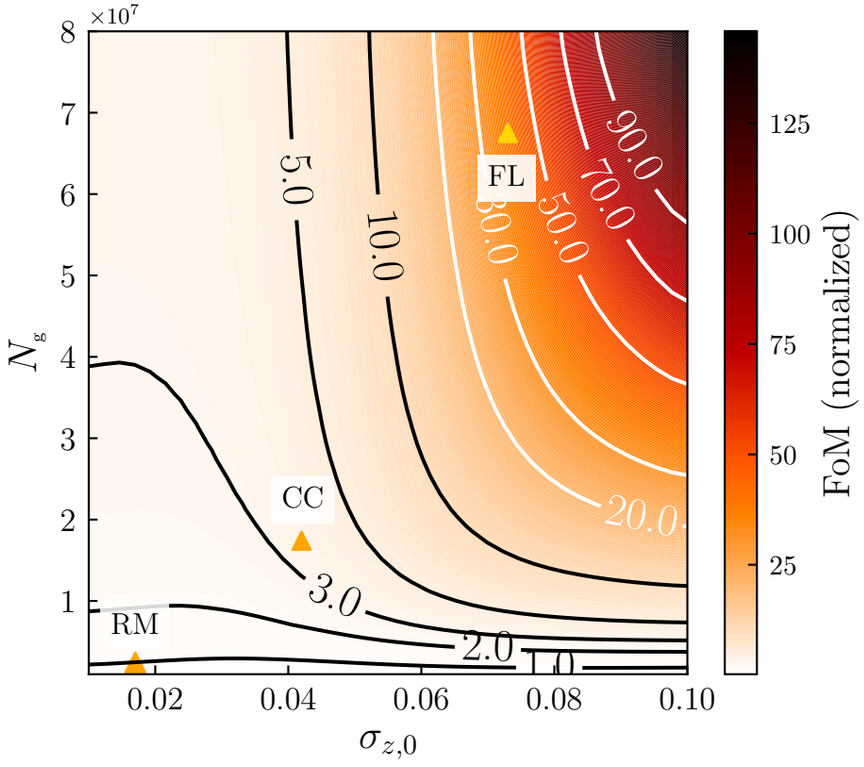


Optimistic priors $\sigma(\sigma_{z,0}) = \sigma(z_{\rm b}^i) = 0.04\sigma_{z,0}$

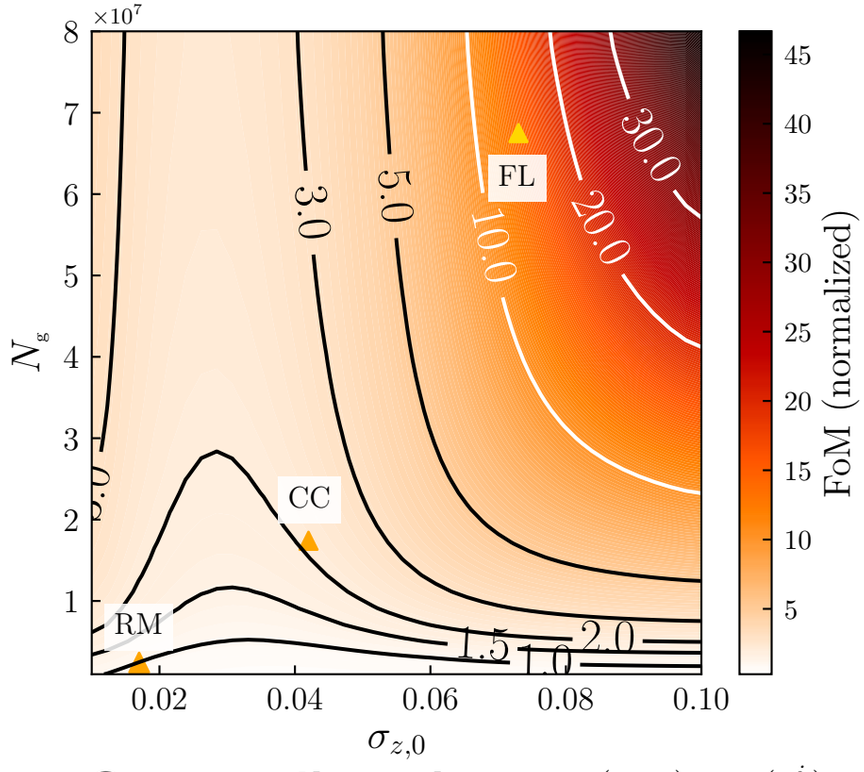


Fixed photo-z parameters

Auto- and Cross-correlations



Free photo-z parameters



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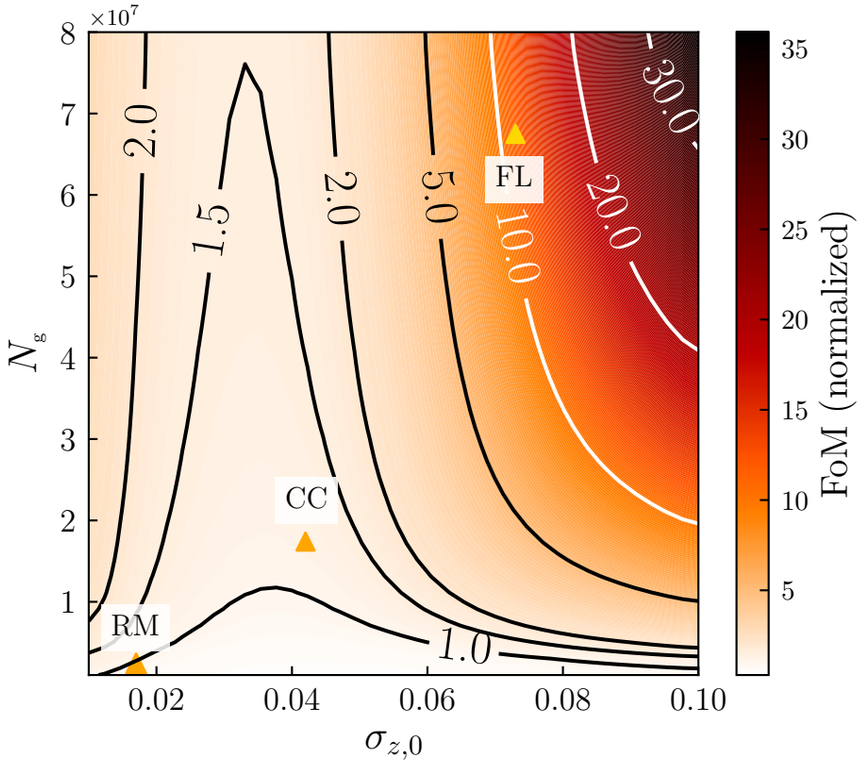

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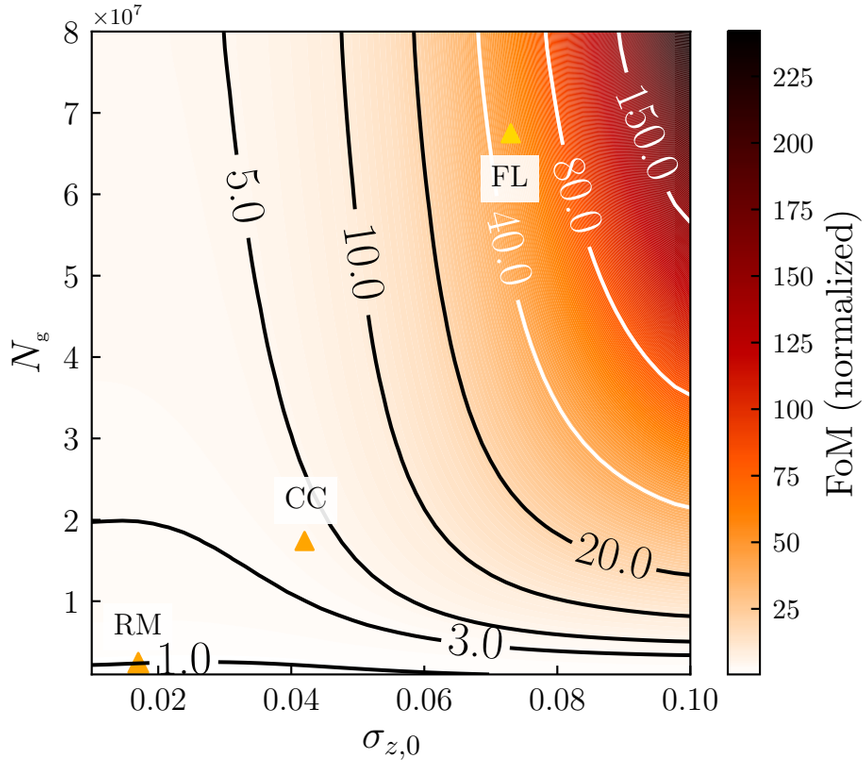
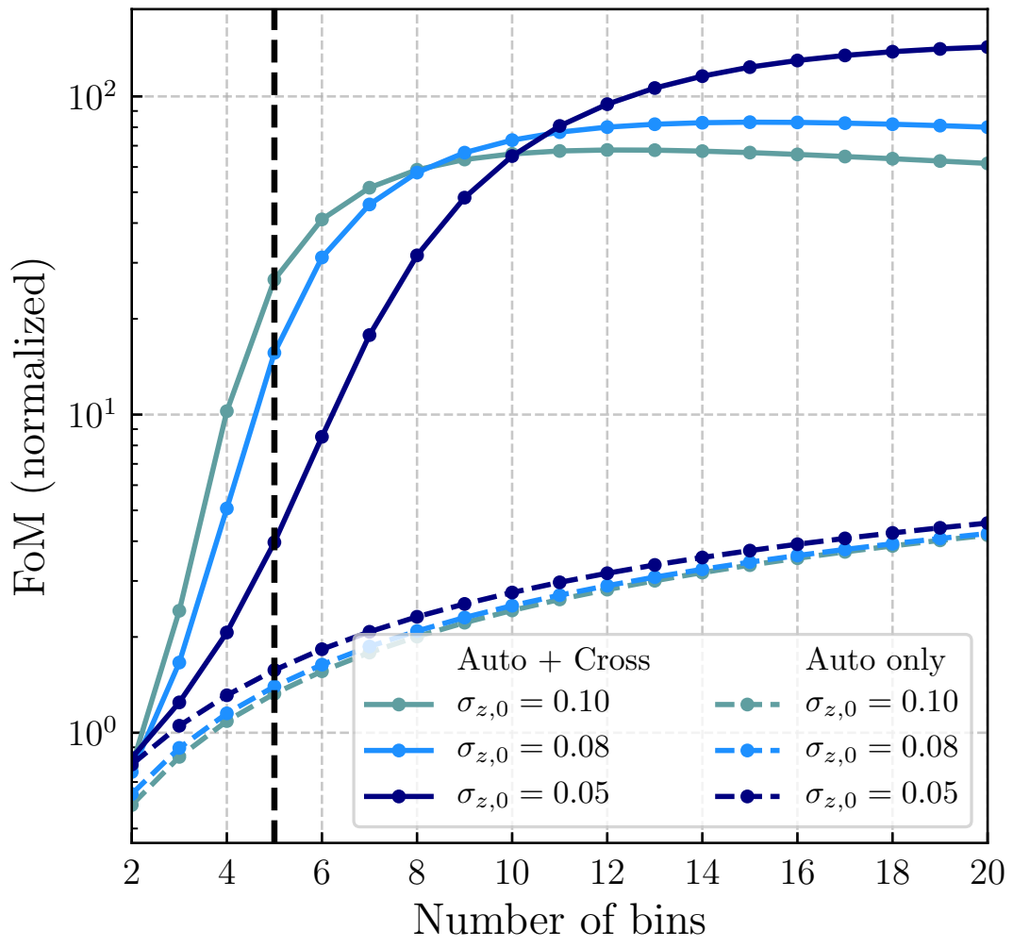
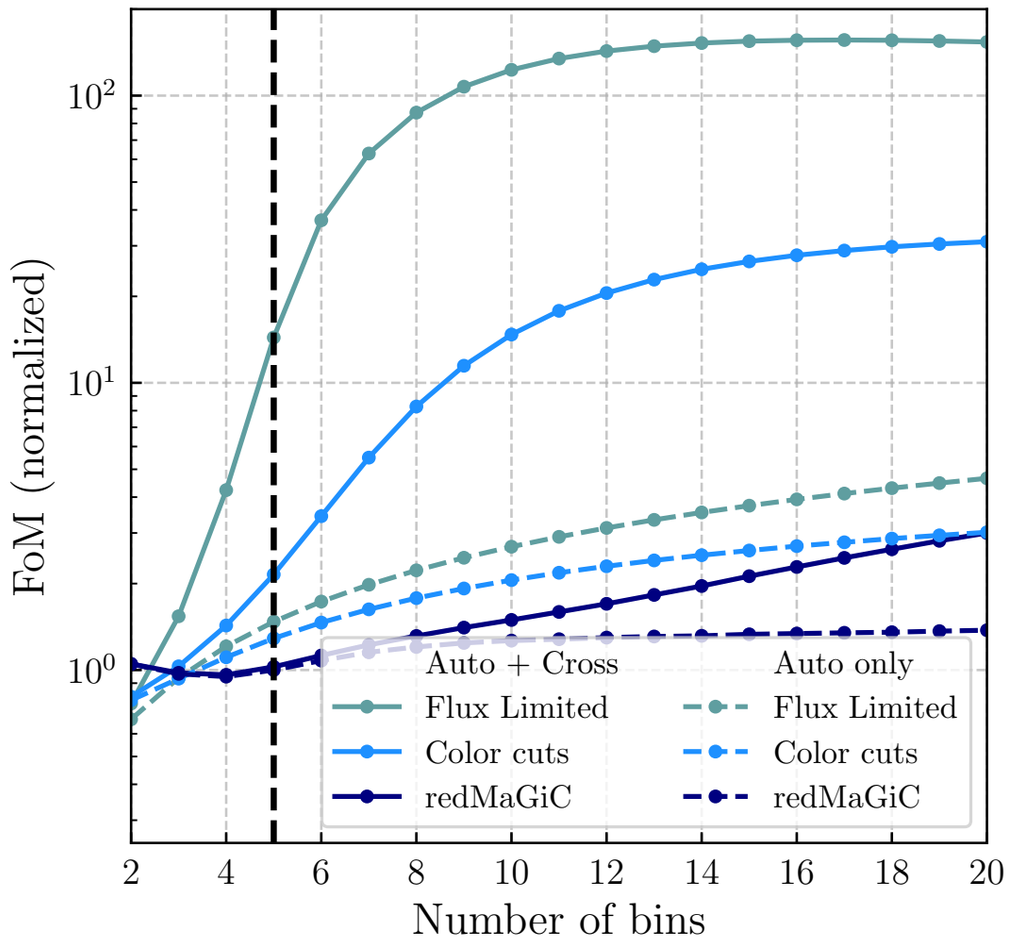


Fixed photo-z parameters

Dependence on the bin size

(or number of bins)



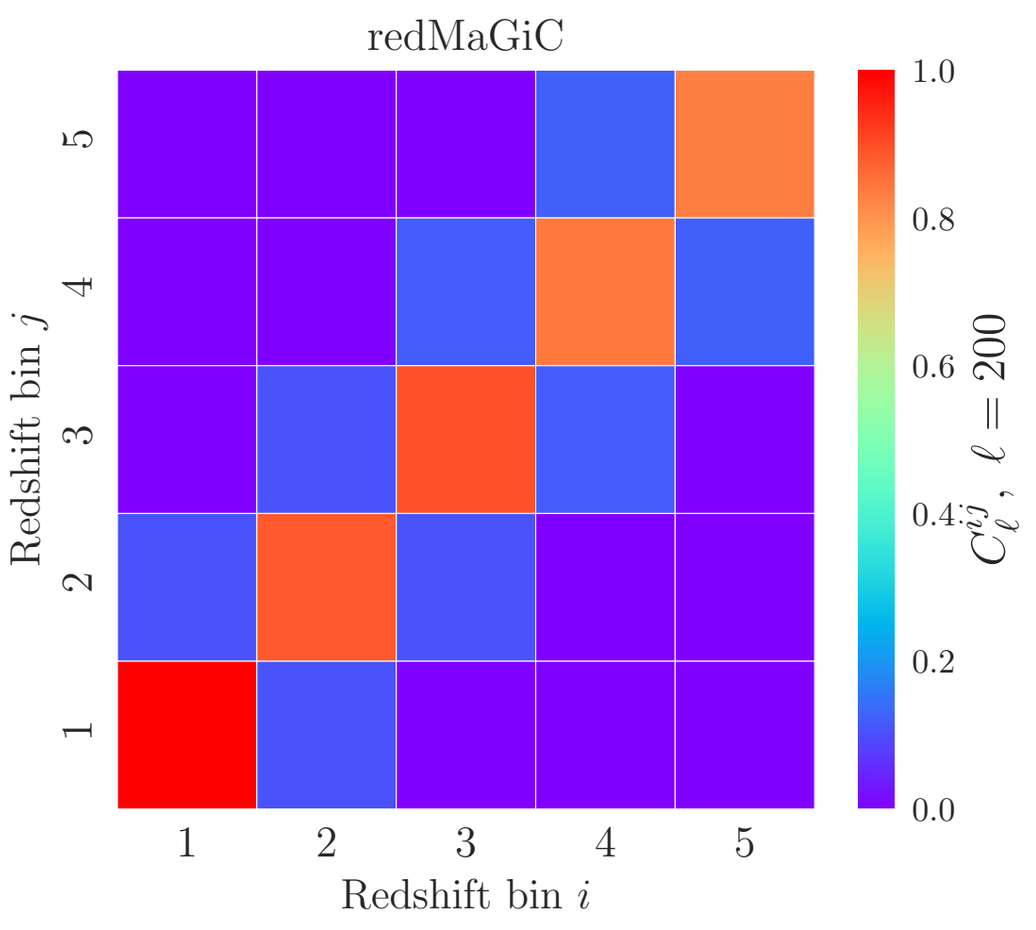


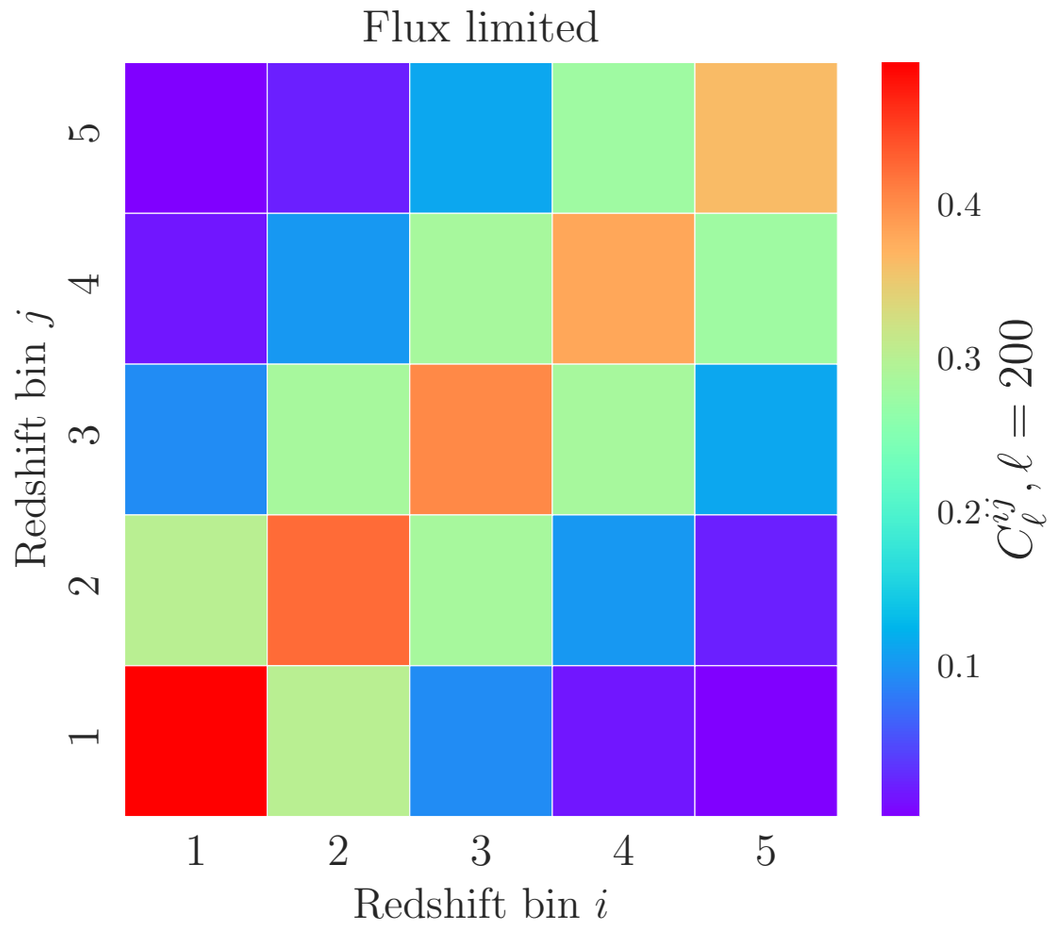
All samples have size: $N_{\rm g} = 4 \times 10^7$ galaxies

Thank you!

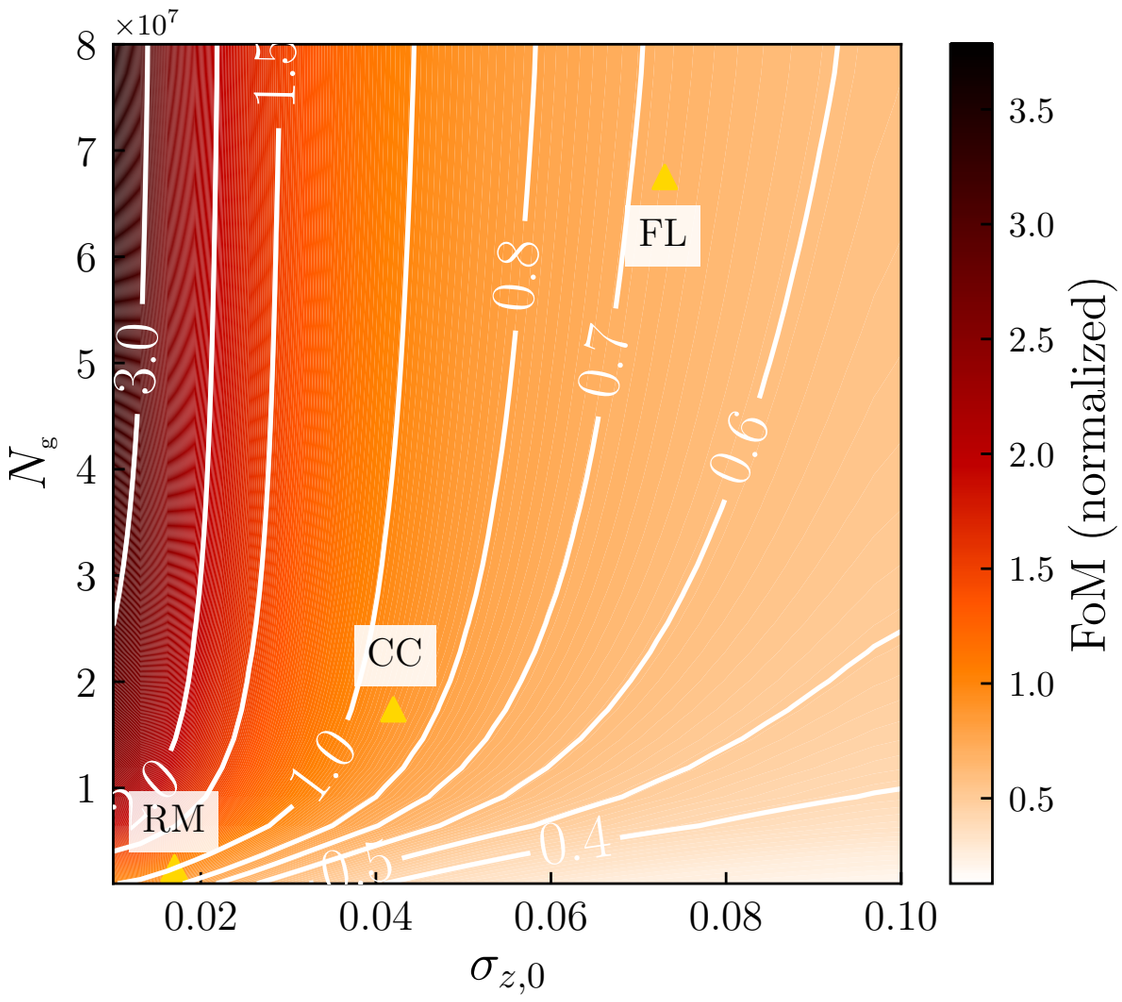
Backup slides

why when cross correlations are included
FL gives better constraints?

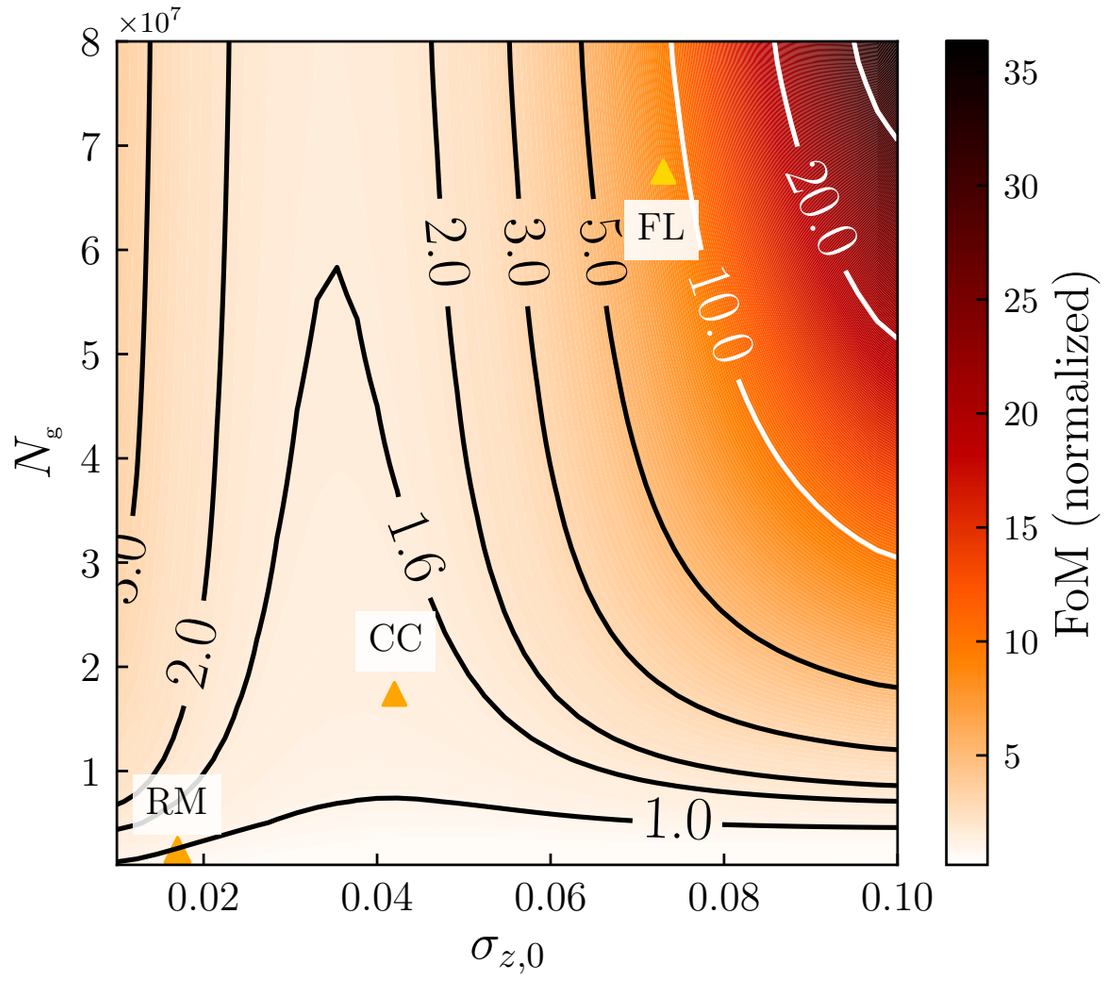




Results with fixed photo-z scatter



Conservative priors, auto-spectra only



Conservative priors, auto- and cross-spectra

Overall ~ 4.4 higher FoM