

Constraints on Physical Parameters of 21-cm Models from Cohen/Fialkov/Barkana: Part 2

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1 Description

In this report we show an additional analysis following the one described in Report #114¹.

Here, we only focus on the dependence of the physical parameter constraints on the level of systematic uncertainty assumed in the analysis.

The bottom line is that, although the systematic uncertainty is introduced through a diagonal covariance matrix, it has a significant effect, which consists of spreading the high-probability regions to large fractions of the distributions. This covariance matrix is a generic first-order estimate for the systematic uncertainty, but its effect is large and not averaged down. This systematics covariance is added to the noise uncertainty, which we do not discuss here, and is kept fixed at its nominal value.

Figures 1-7 show the physical parameter constraints for different levels of systematic uncertainty, from 0 mK through 50 mK. Figure 6 shows the nominal results, with a level of systematic uncertainty of 35 mK.

Figure 8 shows the model with the highest likelihood from Figure 1 (0 mK). Figure 9 shows the model with the highest likelihood from Figure 2 (5 mK). As the figures show, the best fit models do not reduce the residuals significantly, relative to a foregrounds-only fit. The residuals are only marginally lower, and their likelihood seems significantly better in Figure 1 and Figure 2 but this is true only at a level comparable to the numerical precision.

¹http://loco.lab.asu.edu/loco-memos/edges_reports/report114.pdf

2 Constraints as a Function of Systematic Uncertainty

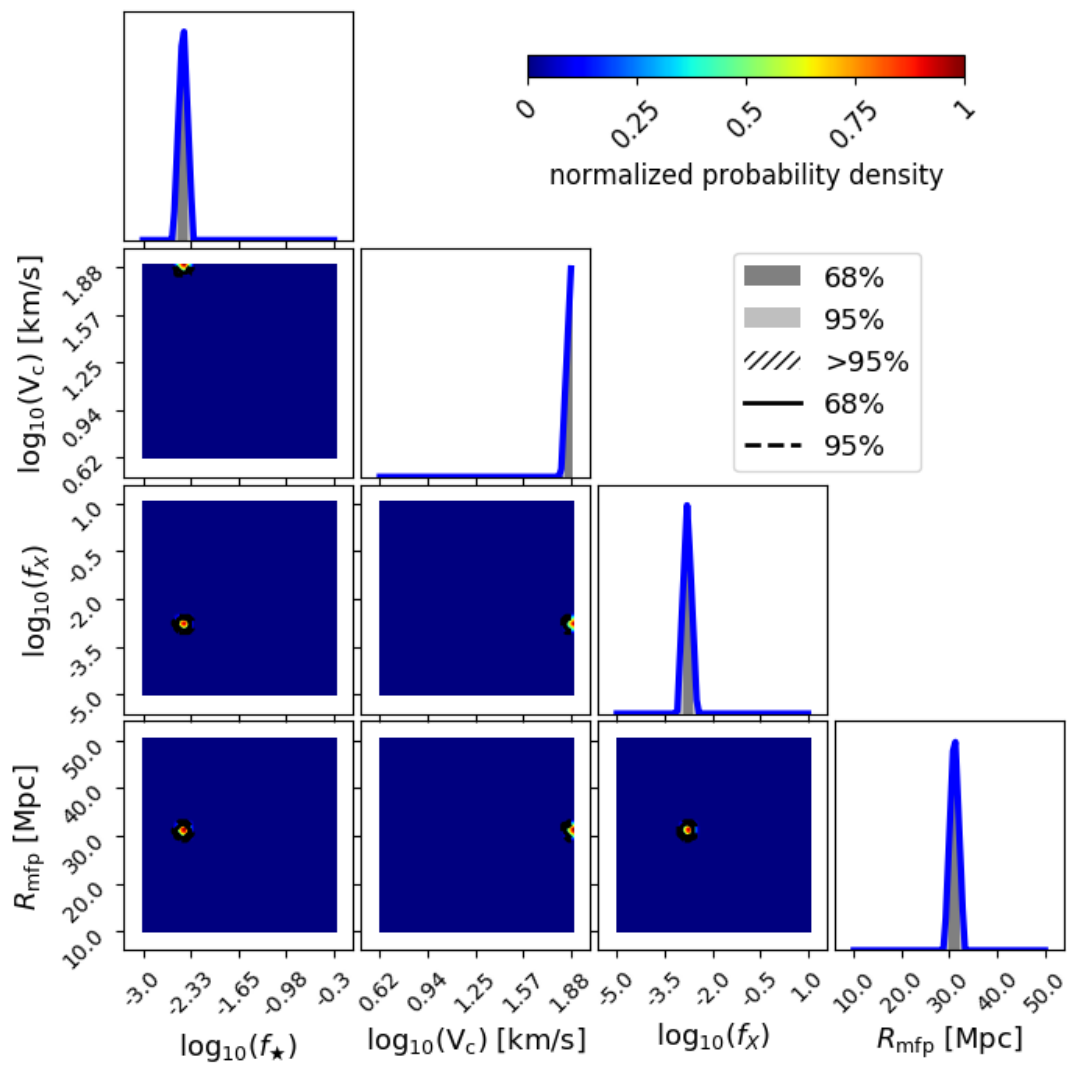


Figure 1: Constraints assuming no systematic uncertainty (0 mK). Only noise uncertainty is accounted for.

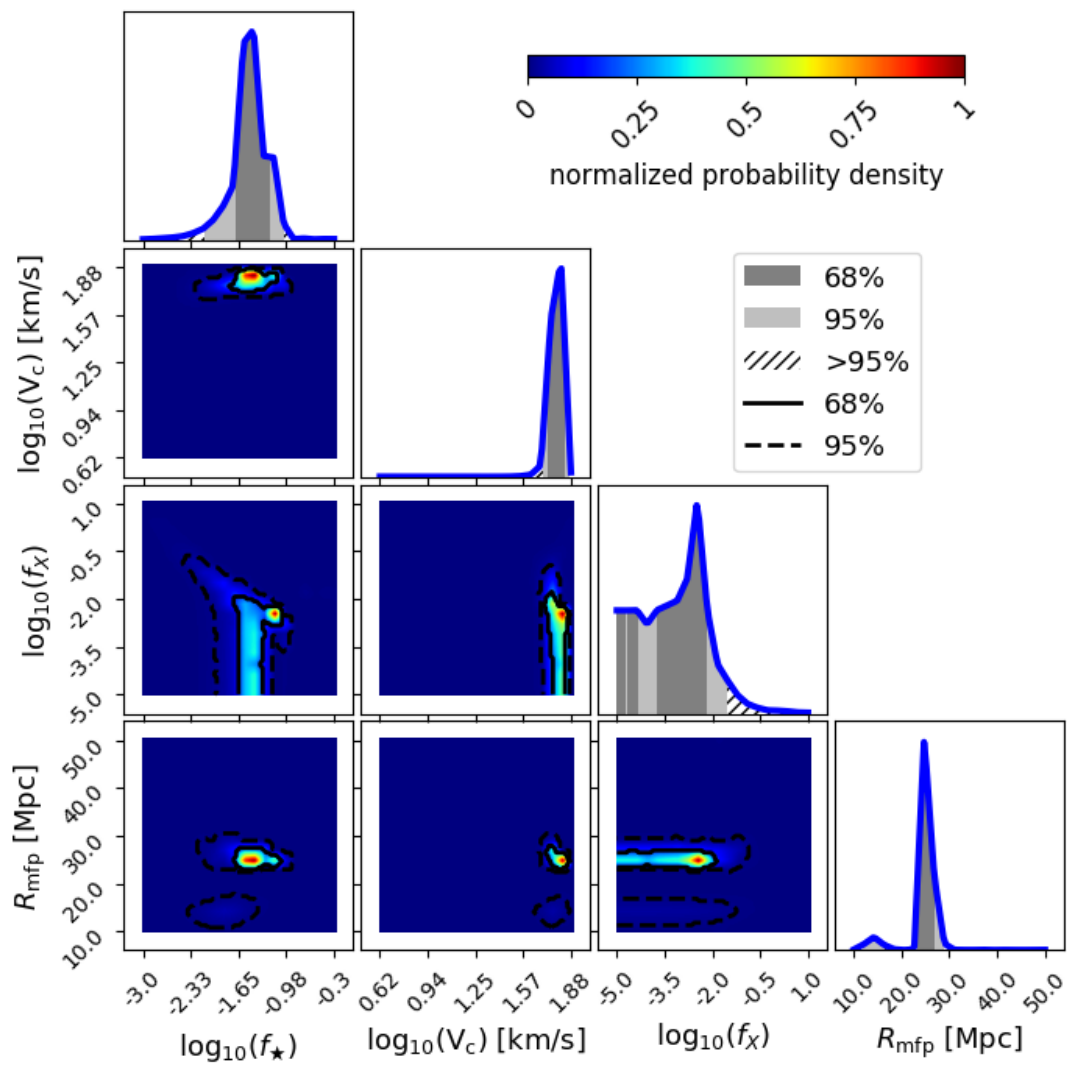


Figure 2: Constraints assuming 5 mK of systematic uncertainty (standard deviation).

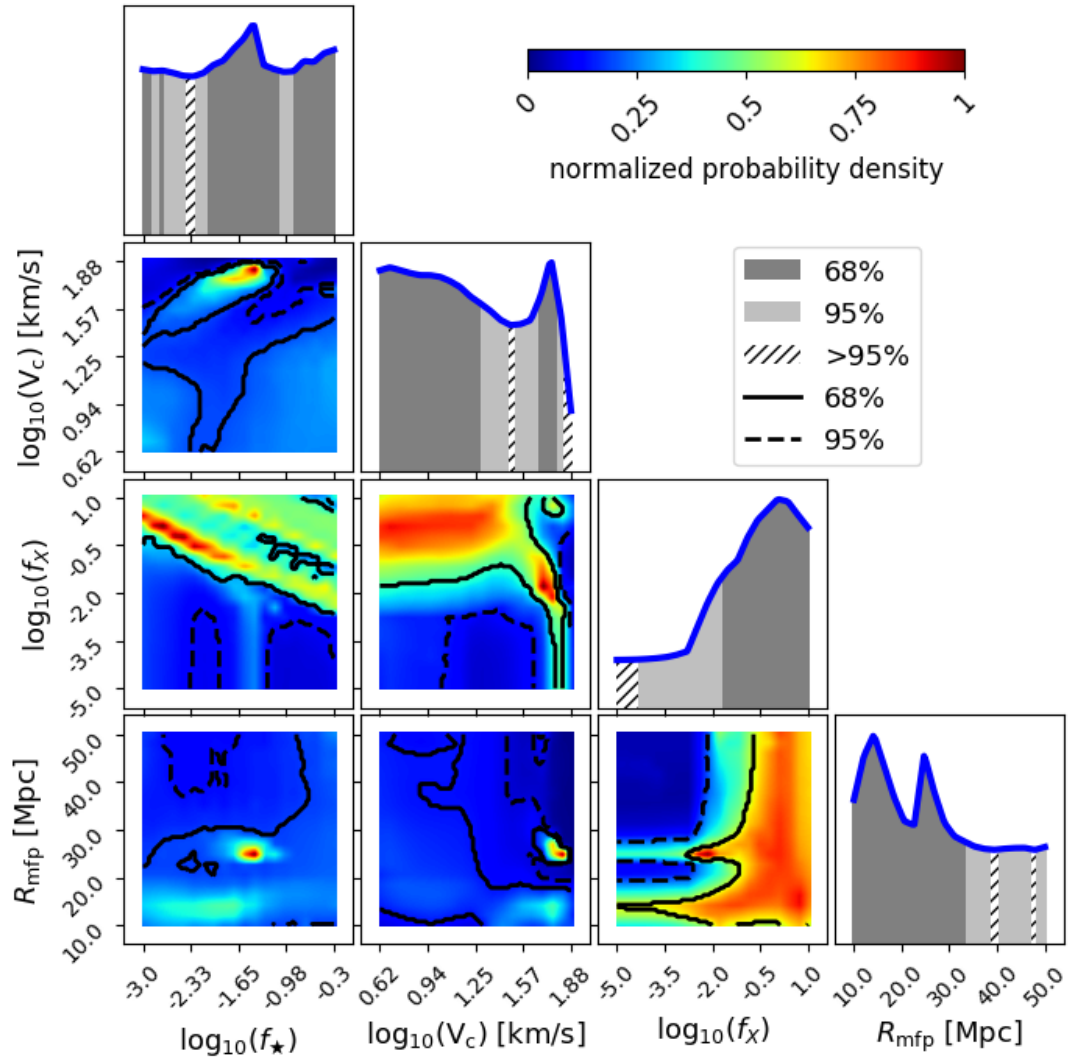


Figure 3: Constraints assuming 10 mK of systematic uncertainty (standard deviation).

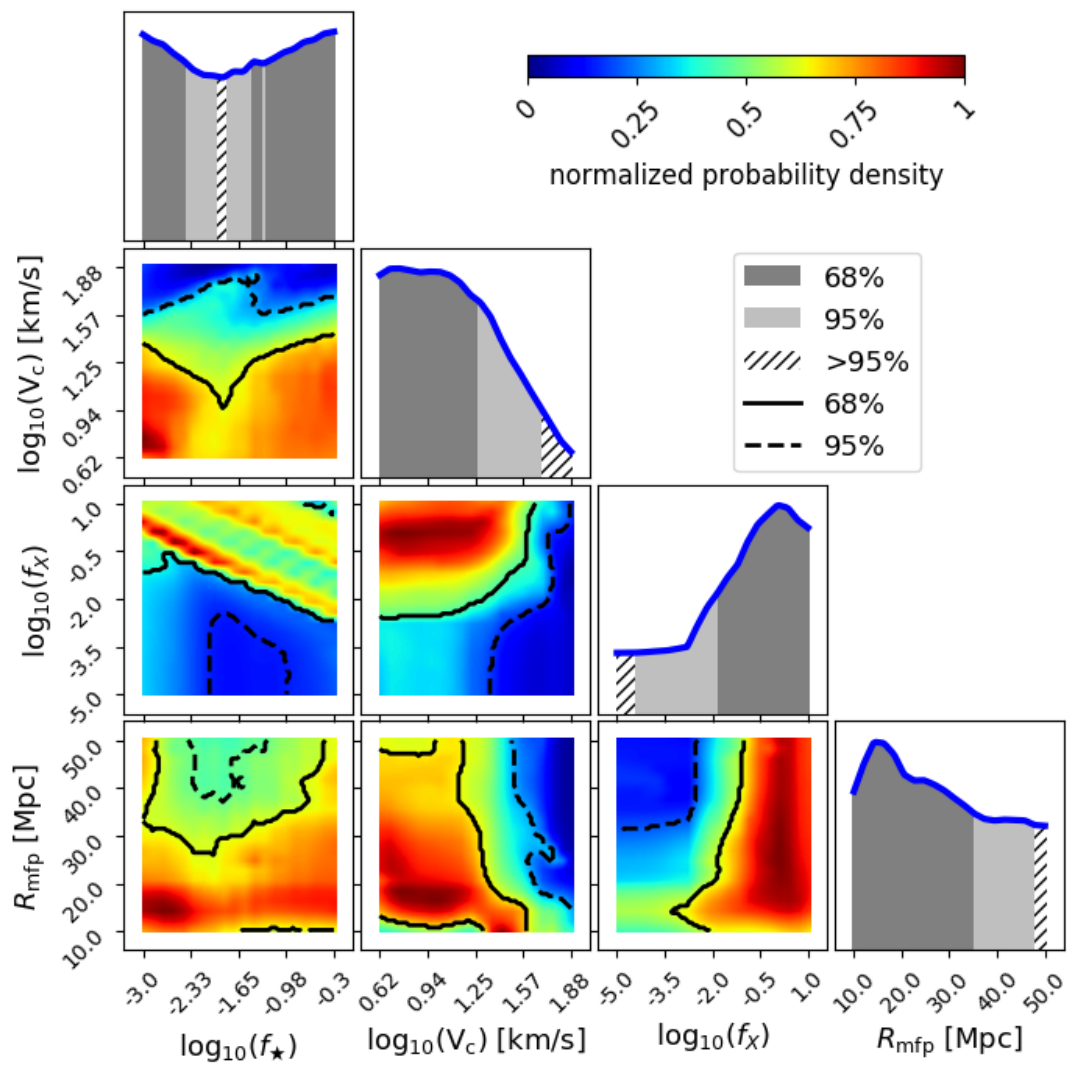


Figure 4: Constraints assuming 15 mK of systematic uncertainty (standard deviation).

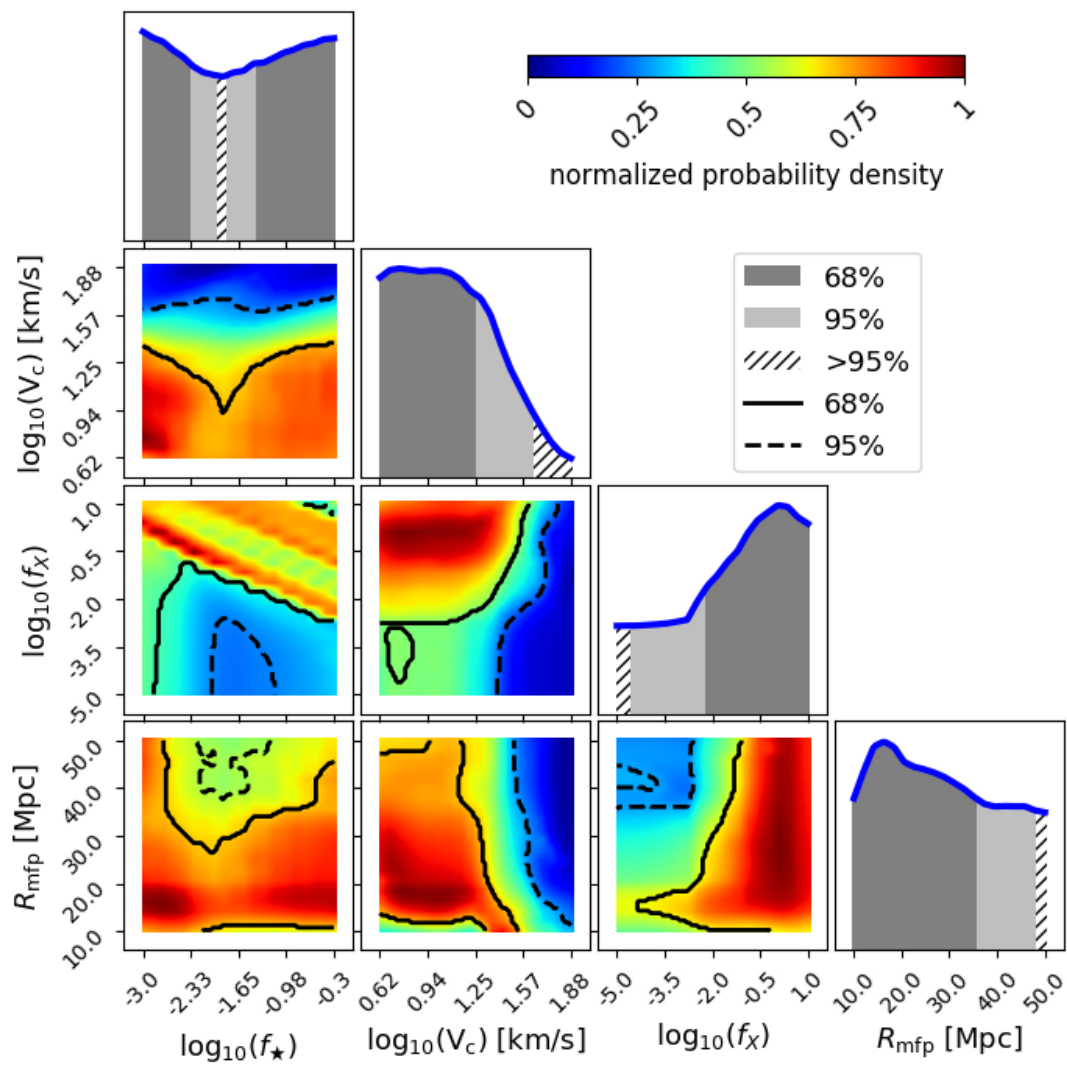


Figure 5: Constraints assuming 20 mK of systematic uncertainty (standard deviation).

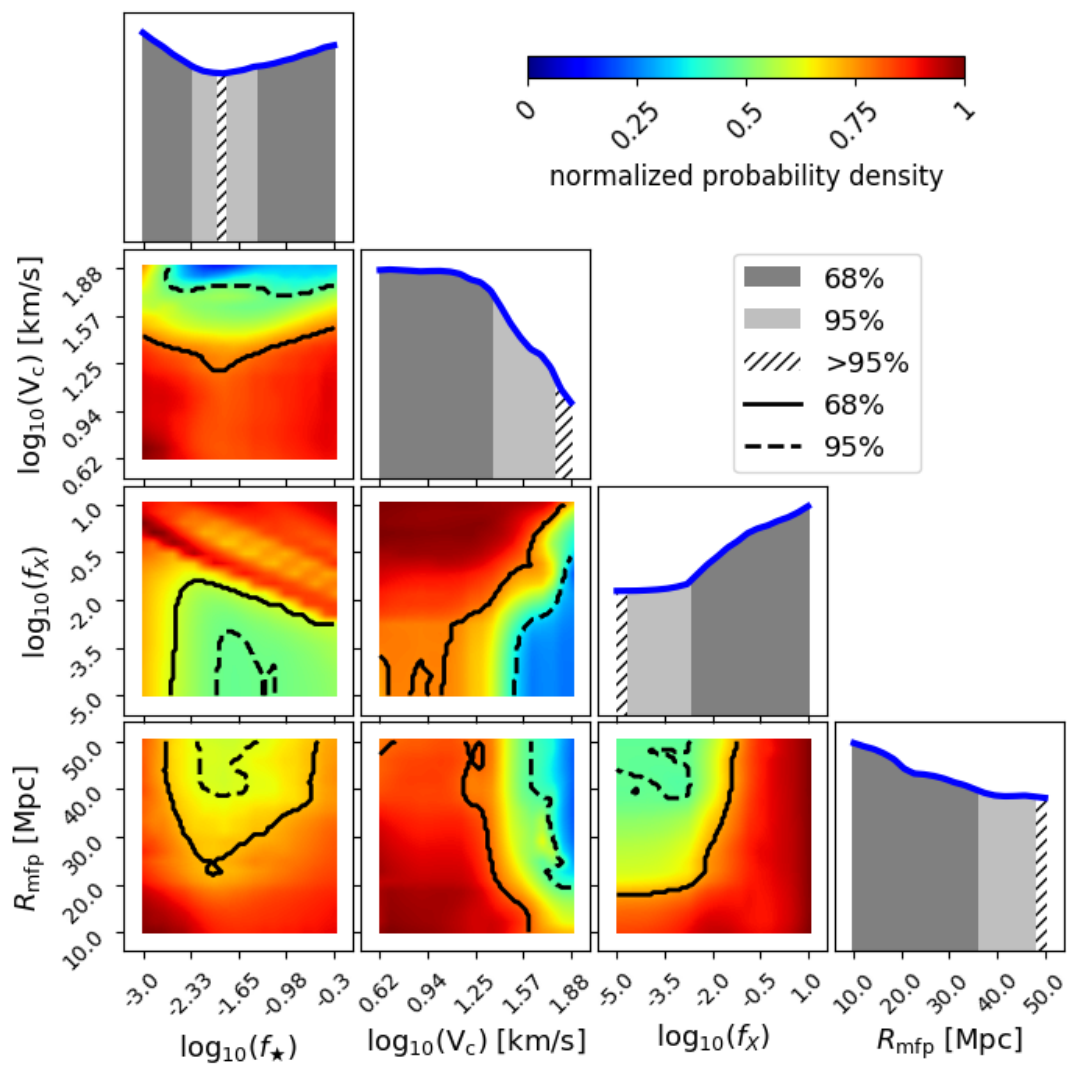


Figure 6: Constraints assuming 35 mK of systematic uncertainty (standard deviation). These are our nominal results.

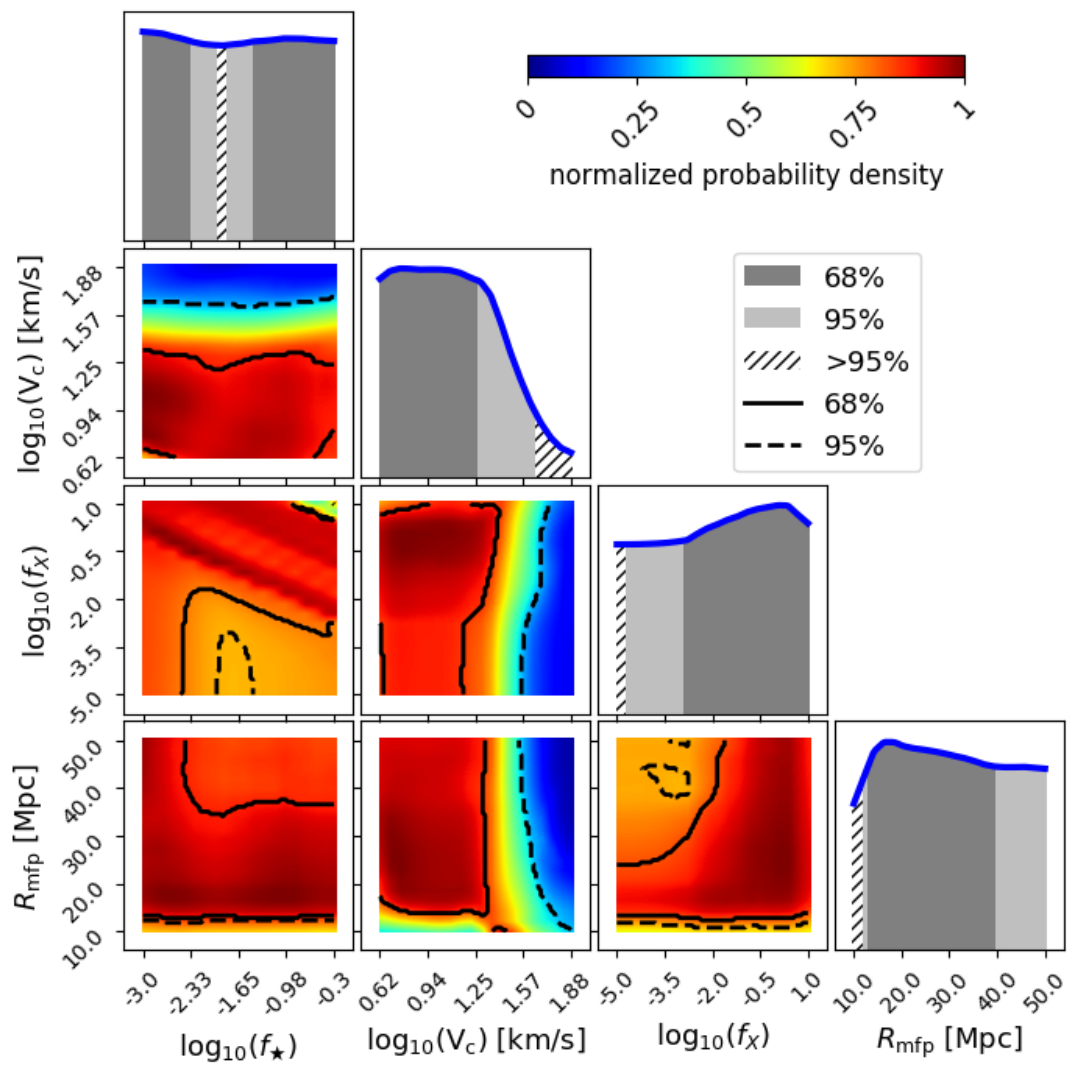


Figure 7: Constraints assuming 50 mK of systematic uncertainty (standard deviation).

3 Best-Fit Models

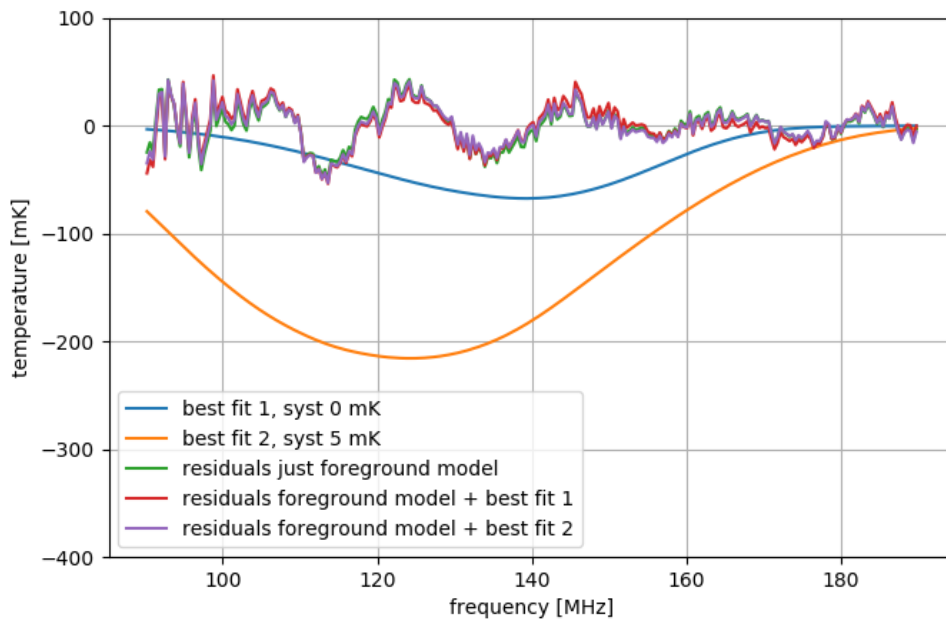


Figure 8: The best fits and residuals when assuming 0 mK and 5 mK (standard deviation) of systematic uncertainties. Also shown are the residuals for a foreground-model-only case.