Update on DR2 papers

Madeleine GINOLIN - 11 janvier 2024

Stretch paper

Done

To be reviewed

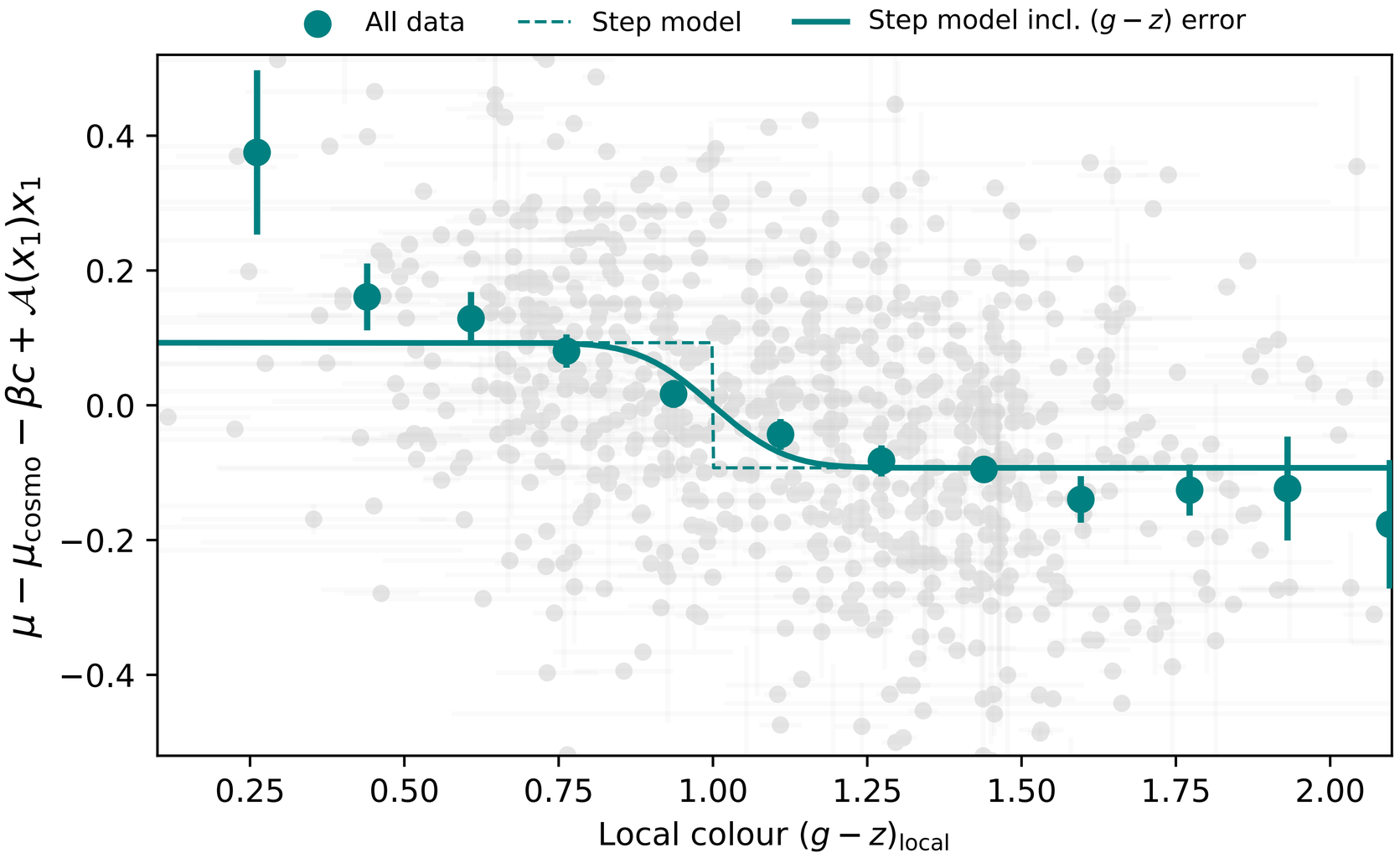
Ongoing

1. Introduction
2. Data
3. Stretch distribution
    1. The nearby SN Ia stretch distribution
    2. Correlation between SN stretch and SN environment
4. Stretch-residuals relation
    1. SNe Ia standardisation
    2. Environmental dependency of the stretch standardisation
    3. Linearity of the stretch-residuals relation
    4. Environmental dependency of the stretch-magnitude non-linearity
5. SN Ia standardised magnitudes (steps)
6. Discussion
    1. Robustness tests
    2. Broken α and linear standardisation biases
7. Conclusion

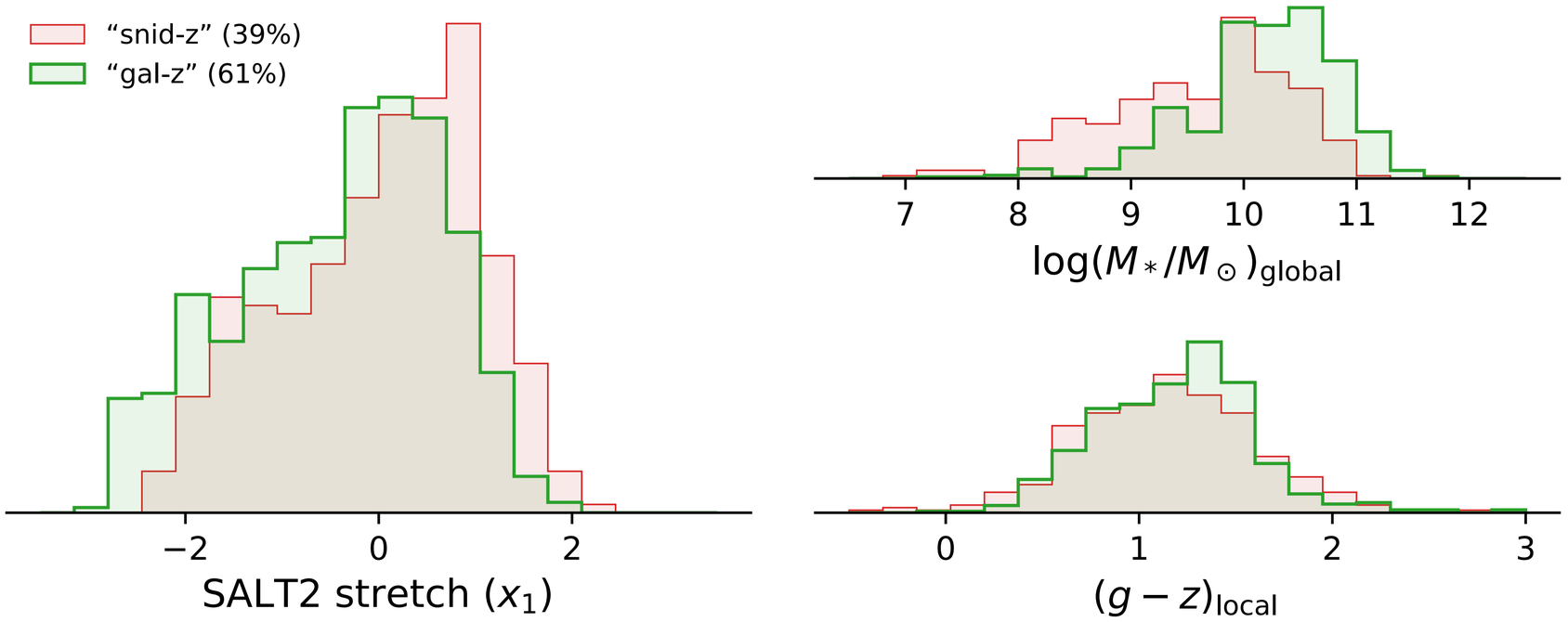
A. Fitting procedure

Overleaf

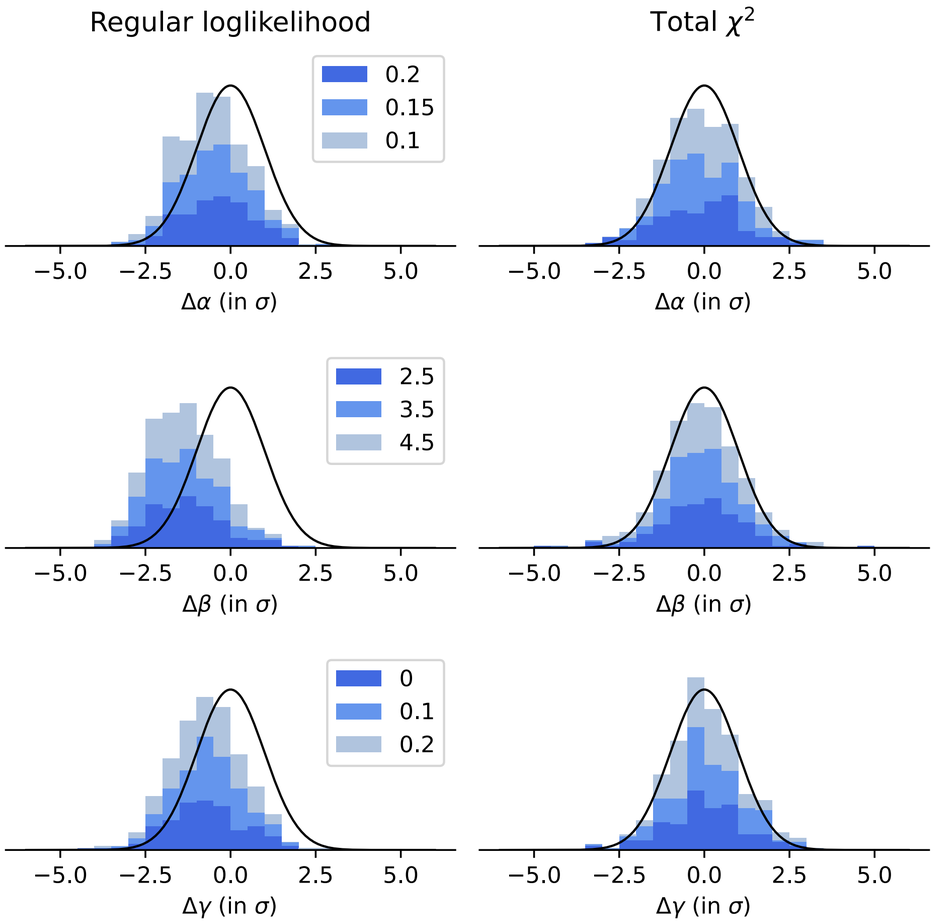
Step values


All data
Step model
Step model incl. $(g-z)$ error
$\mu - \mu_{\rm cosmo} - \beta c + \mathcal{A}(x_1)x_1$
0.4
0.2
0.0
−0.2
−0.4
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Local colour $(g-z)_{\rm local}$

Mass evolution of the stretch modes



EDRIS vs regular likelihood minimisation



See Dylan's talk (this afternoon) for more details

Colour paper

Done

To be reviewed

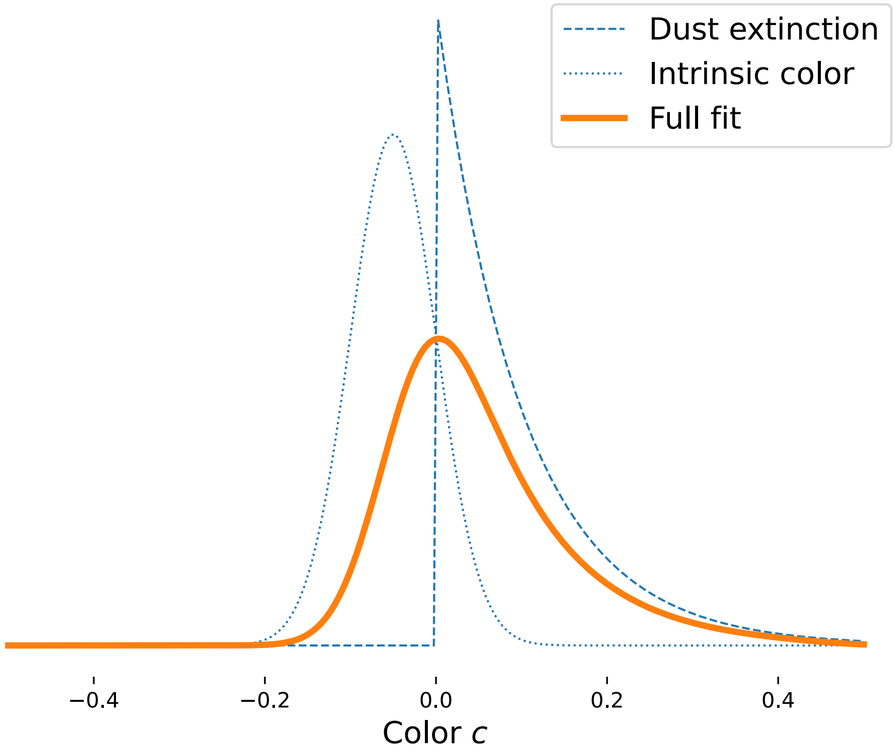
Ongoing

1. Introduction
2. Data
3. Colour distribution
4. Colour-residuals relation
    1. β dependence on environment
    2. Linearity of the colour-residuals relation
5. Colour dependency of SN Ia standardised magnitudes (steps)
6. Discussion
    1. Robustness tests
7. Conclusion

Colour distribution

$$P(c) = \mathcal{N}(c \mid c_{\rm int}, \sigma_c) * \begin{cases} 0 & \text{if } c \leq 0 \\ \frac{1}{\tau} e^{-c/\tau} & \text{if } c > 0 \end{cases}$$

Jha et al 2007
Mandel et al 2011, 2017



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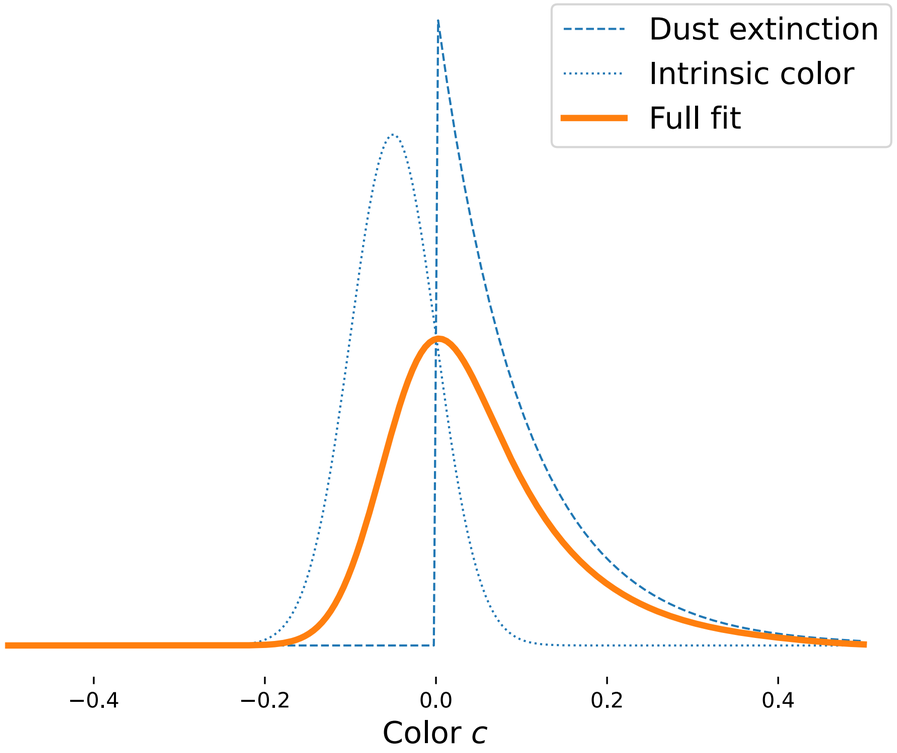
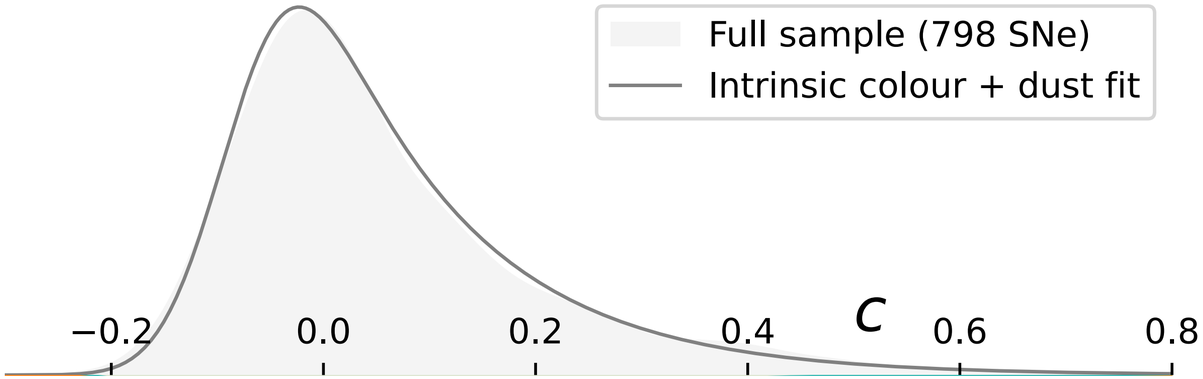
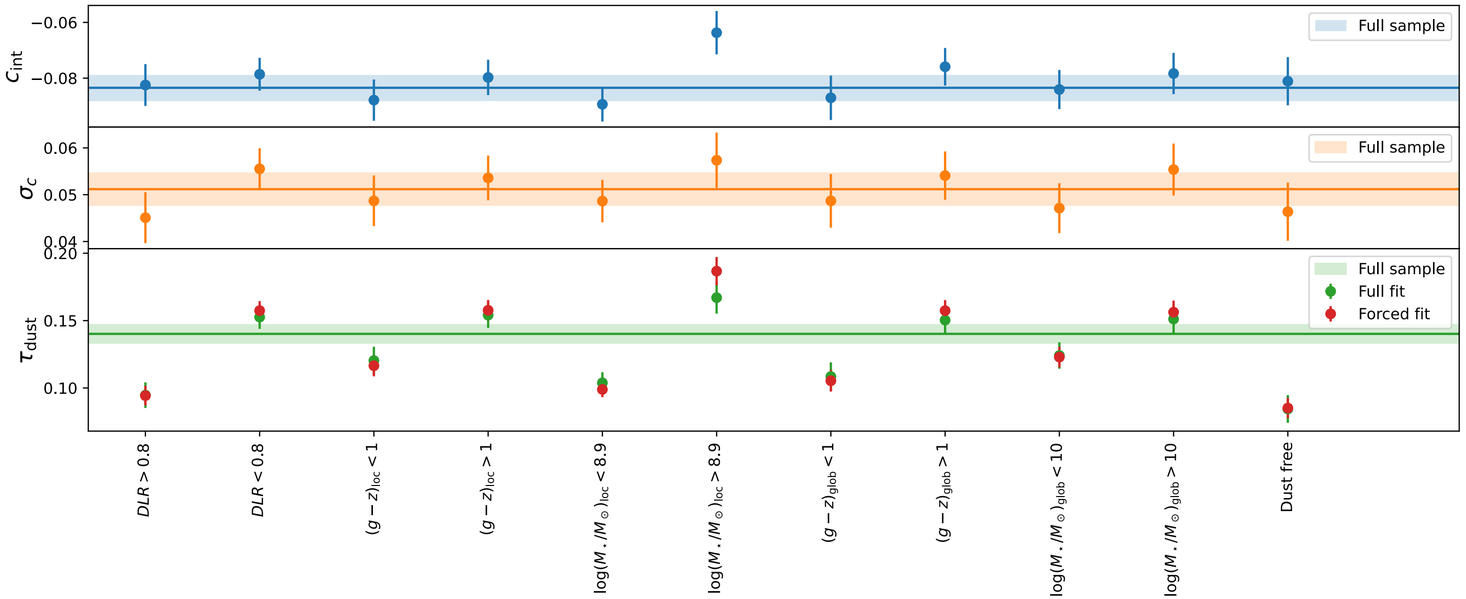




Colour distribution

Searching for a dustless sample

$$P(c) = \mathcal{N}(c \mid c_{\rm int}, \sigma_c) * \begin{cases} 0 & \text{if } c \leq 0 \\ \frac{1}{\tau} e^{-c/\tau} & \text{if } c > 0 \end{cases}$$



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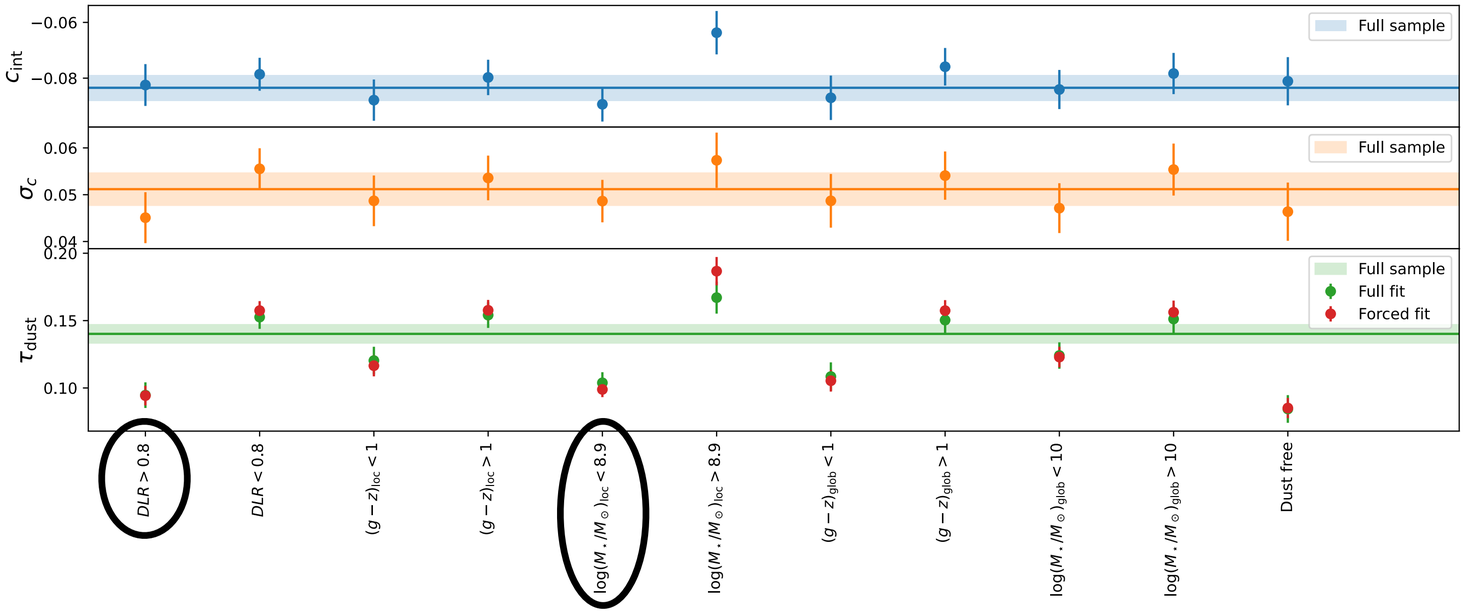

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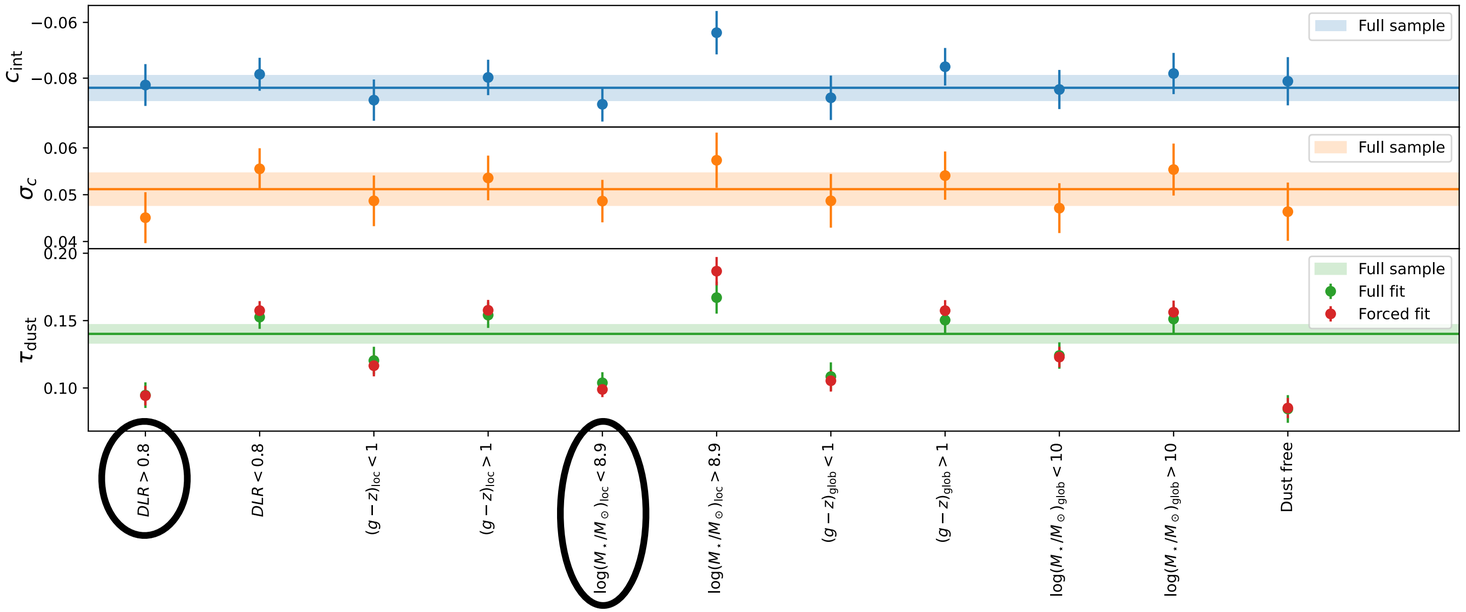
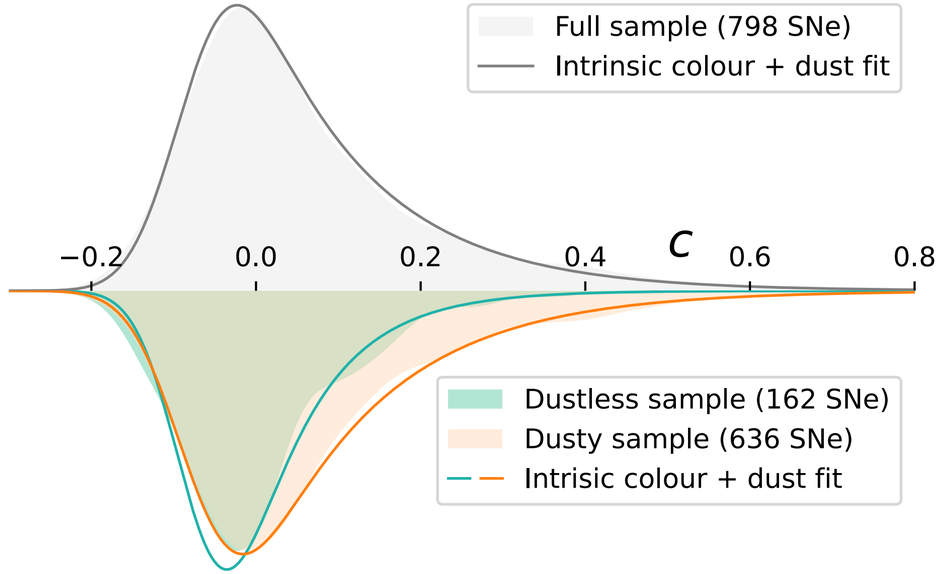
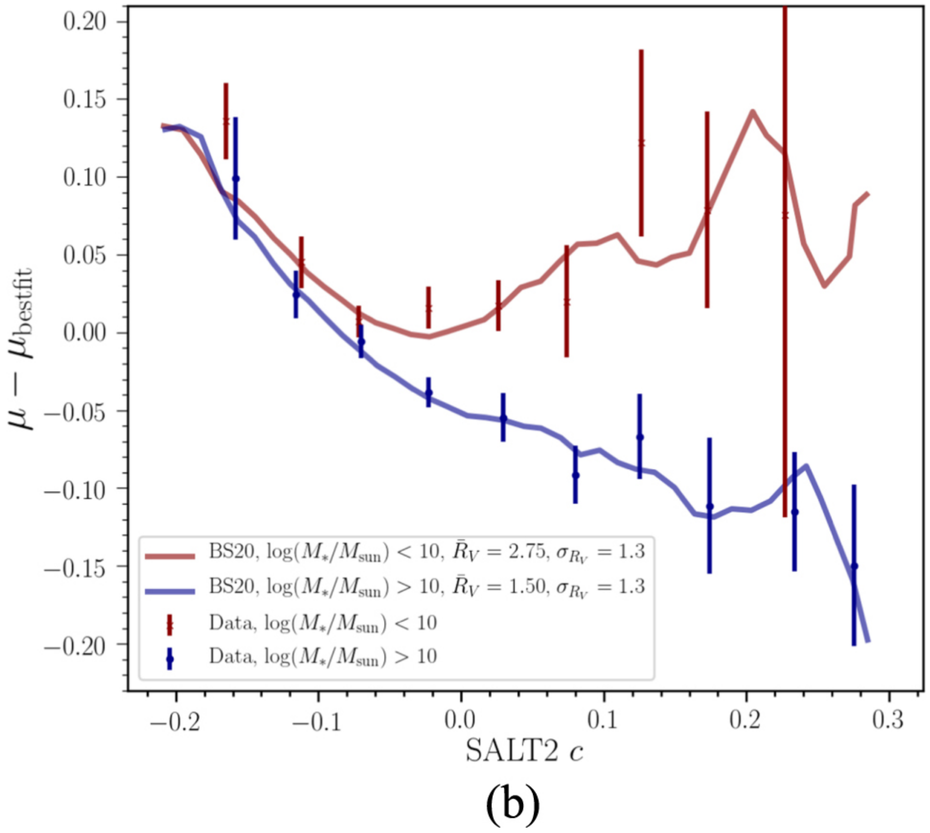


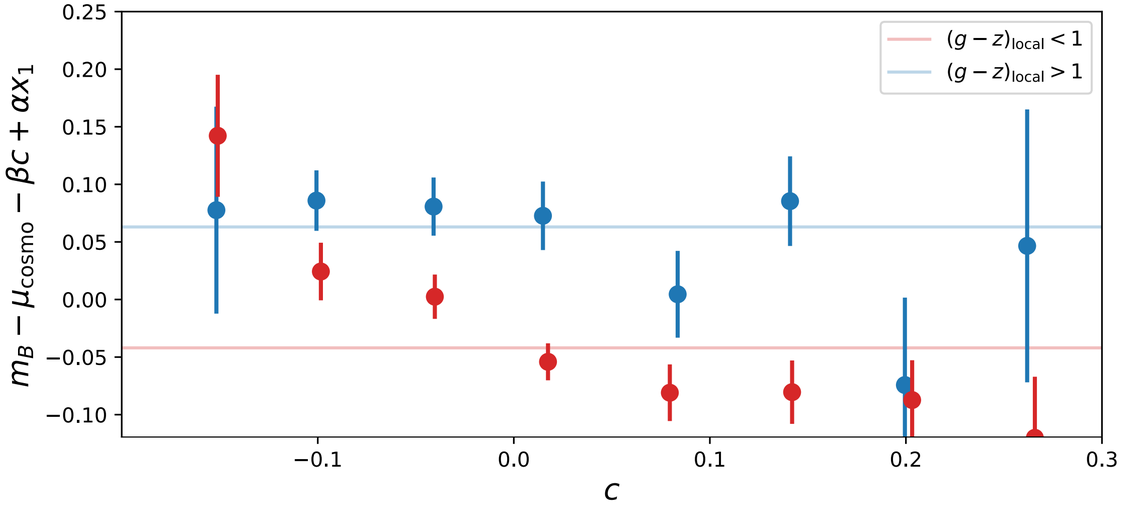


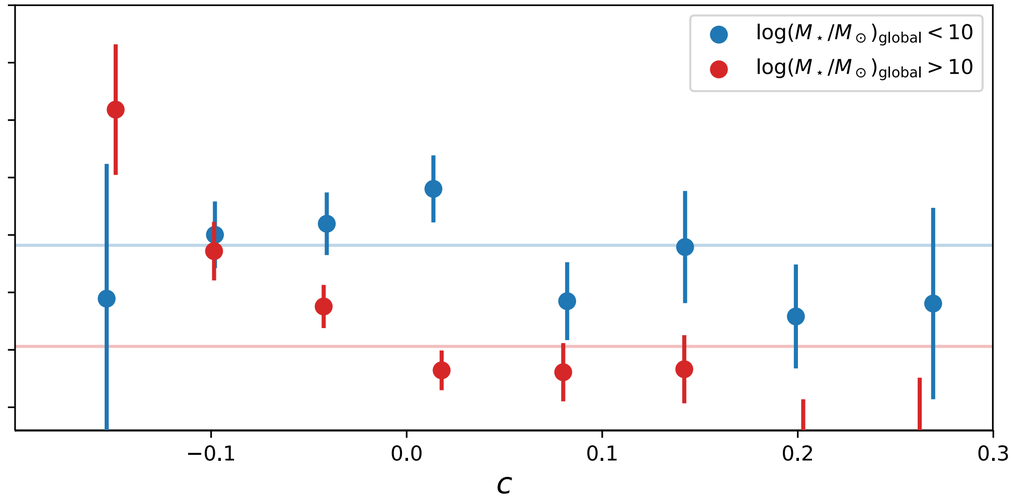
BS20 plots

Residuals against colour



(b)





BS20 plots

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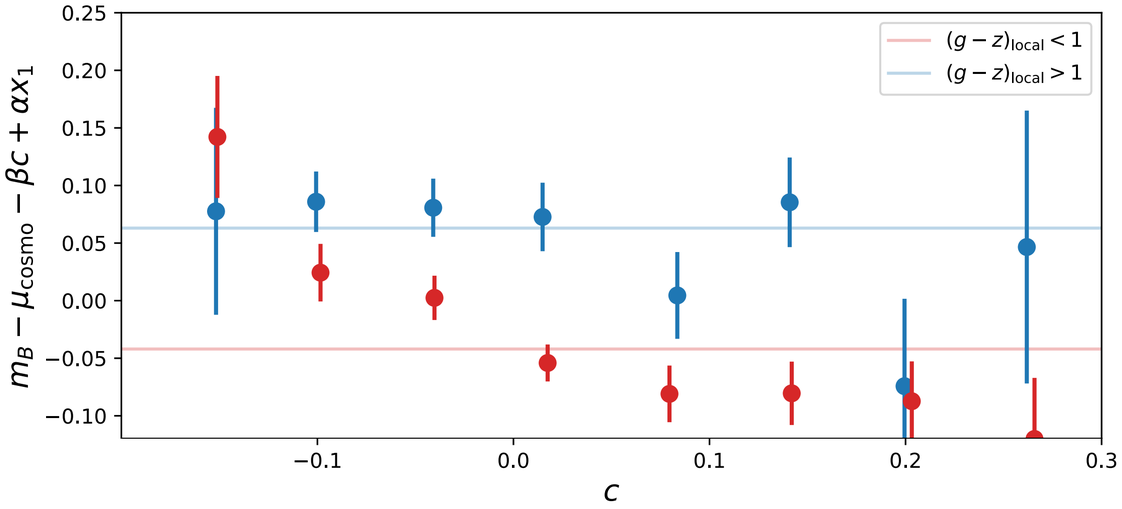
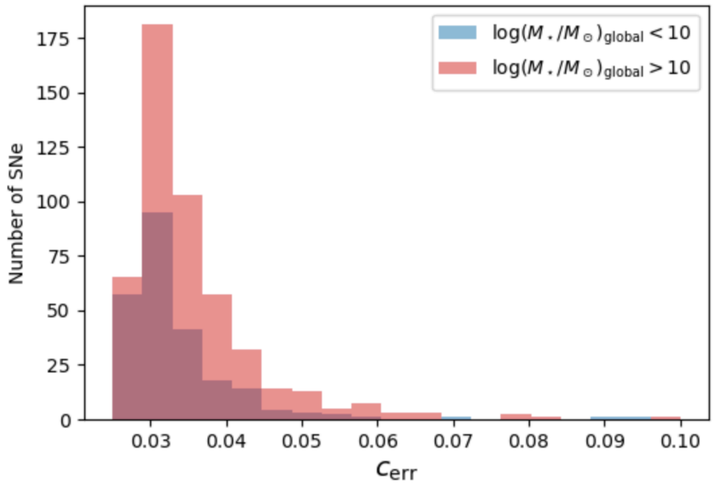
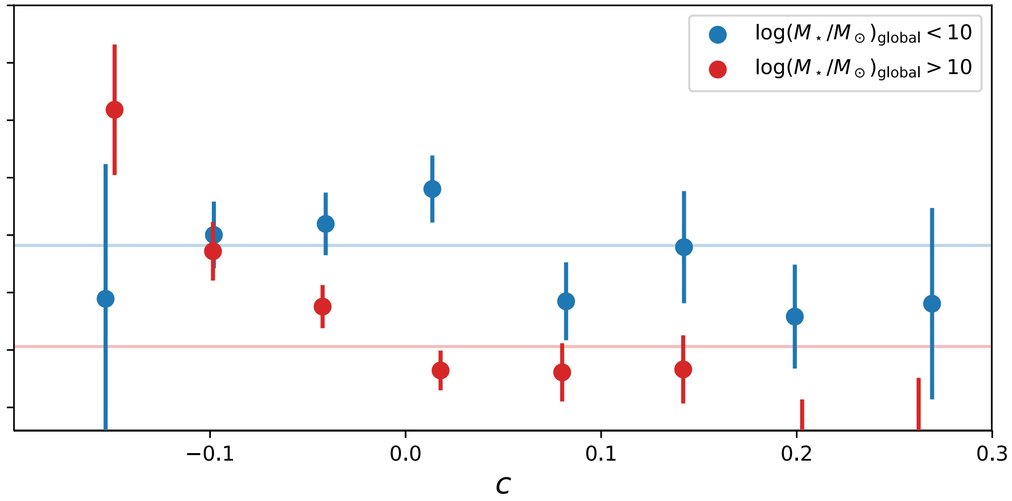
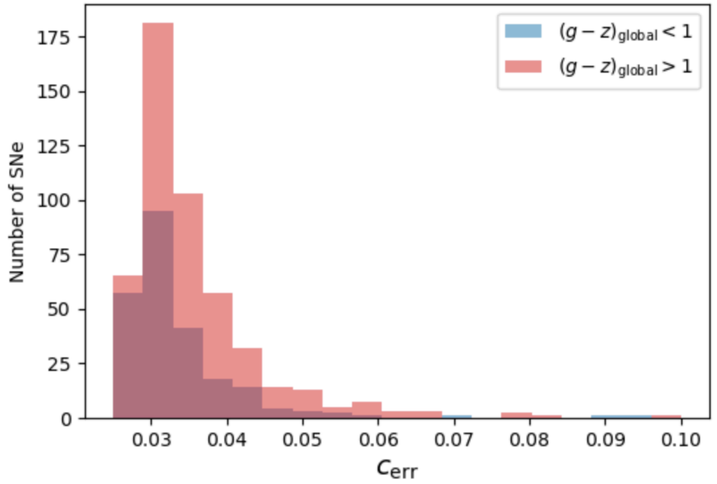


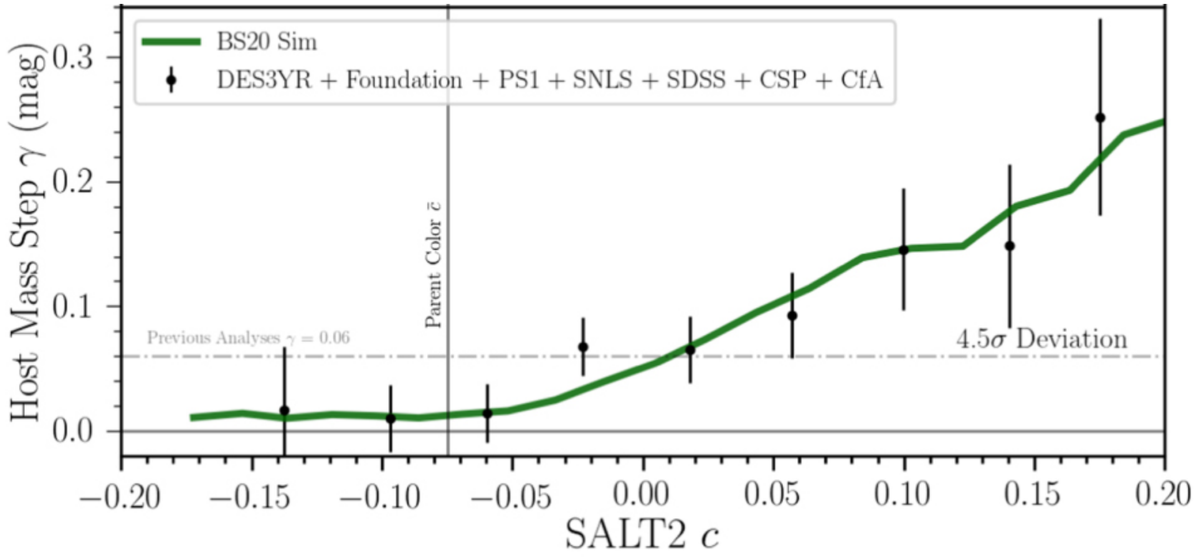


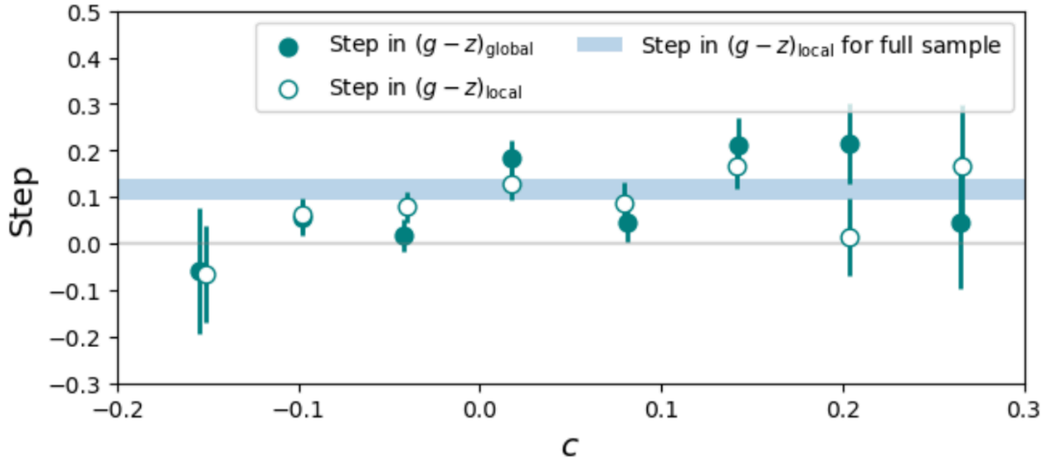


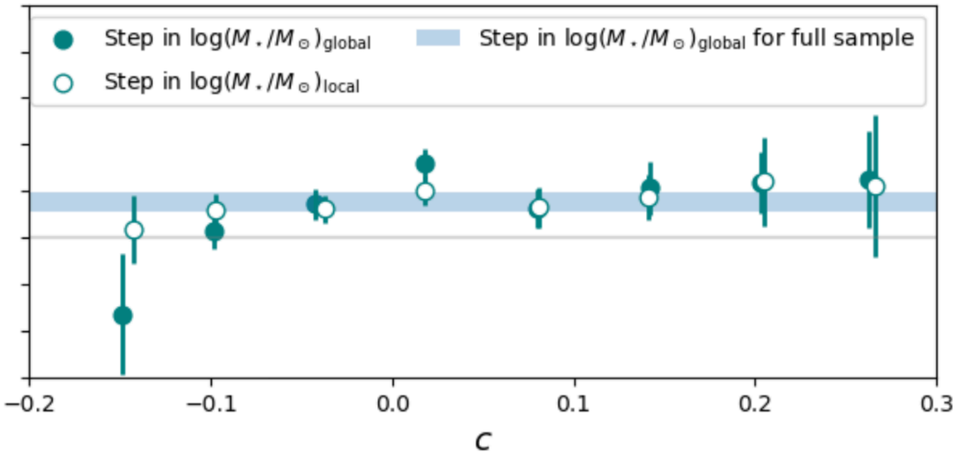


BS20 plots

Steps against colour

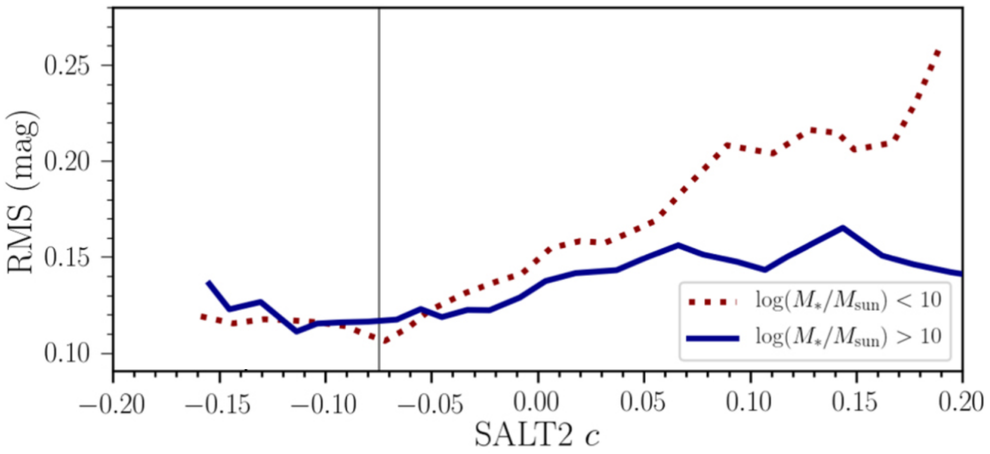


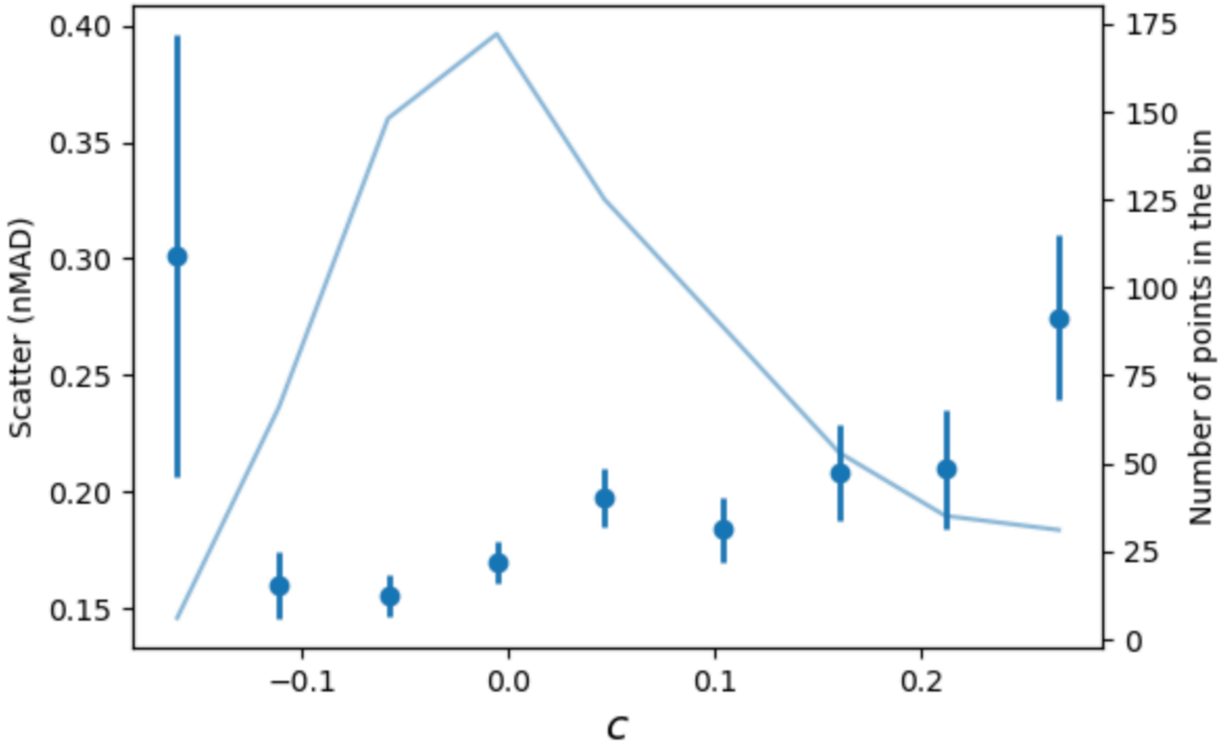




BS20 plots

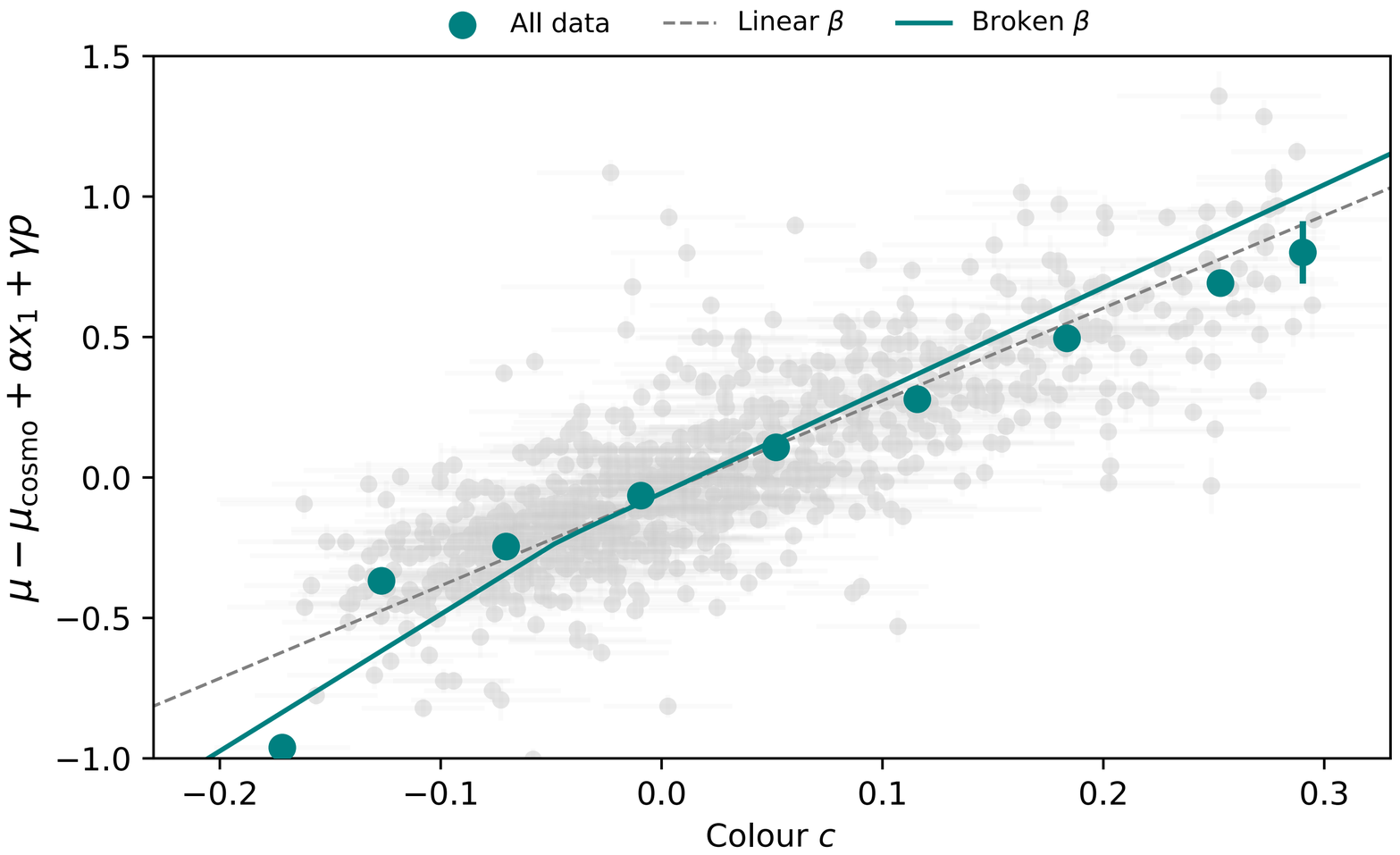
Scatter against colour





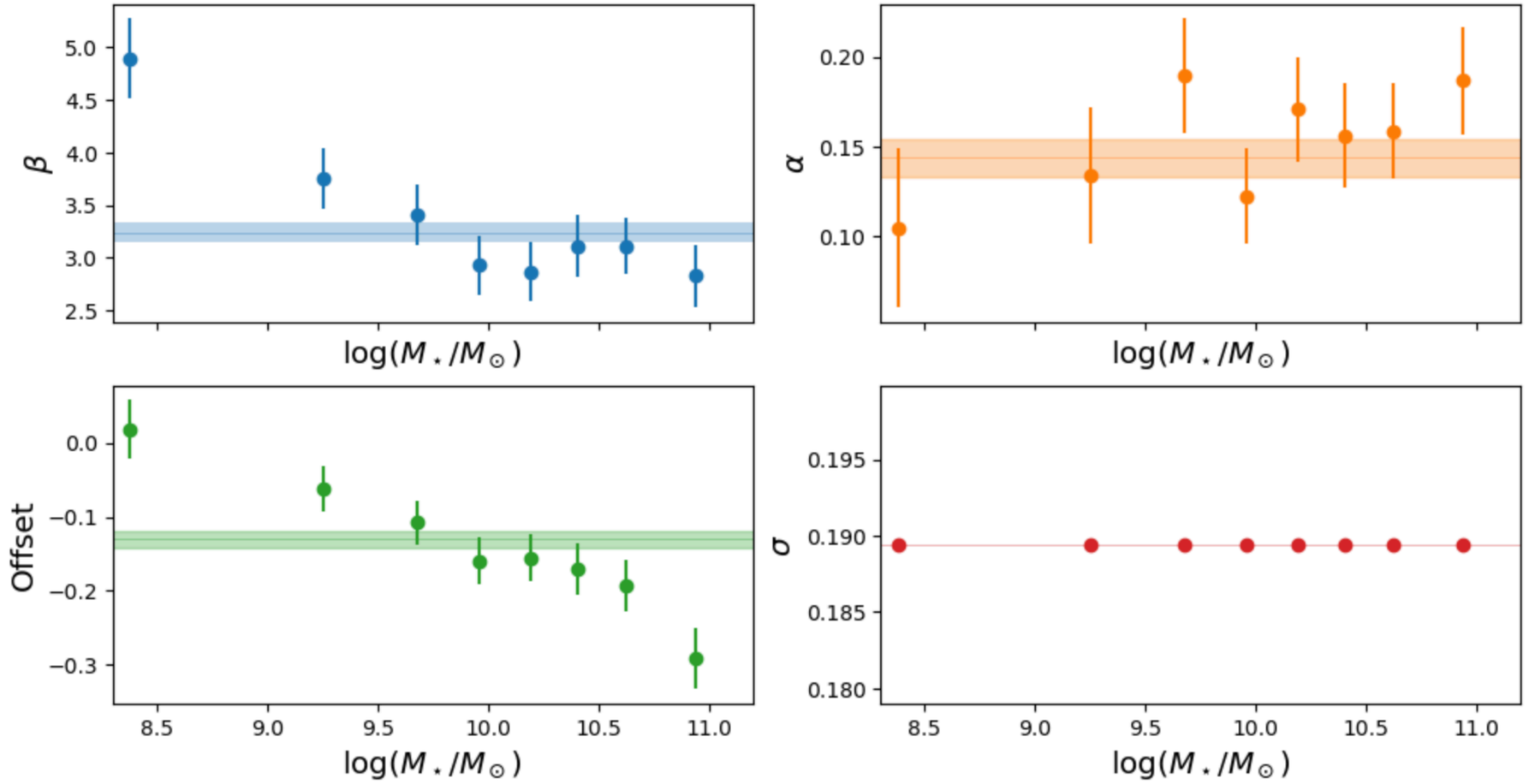
Colour standardisation

Linearity of the colour-residuals relation



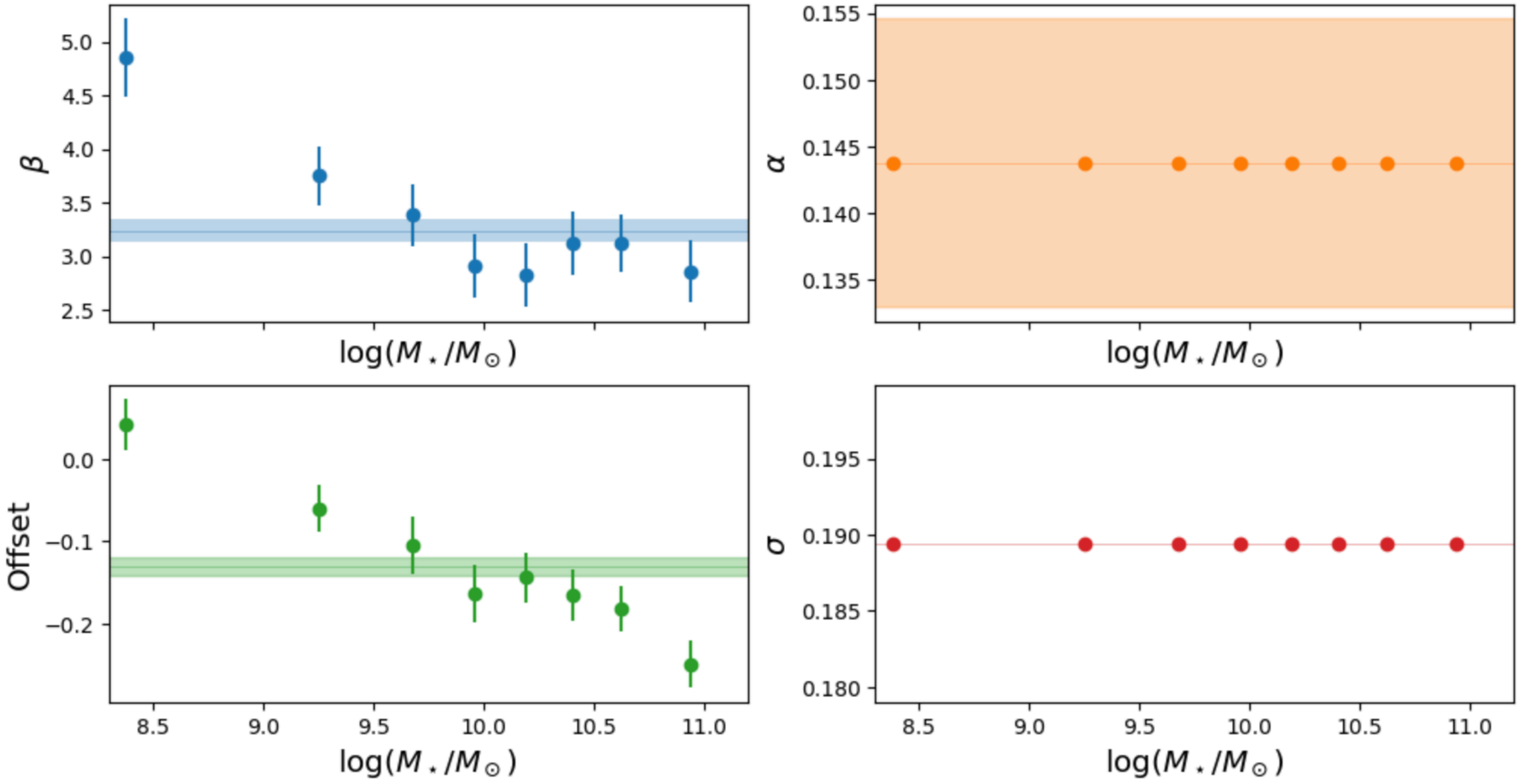
β evolution with environment

Simple case (α free)



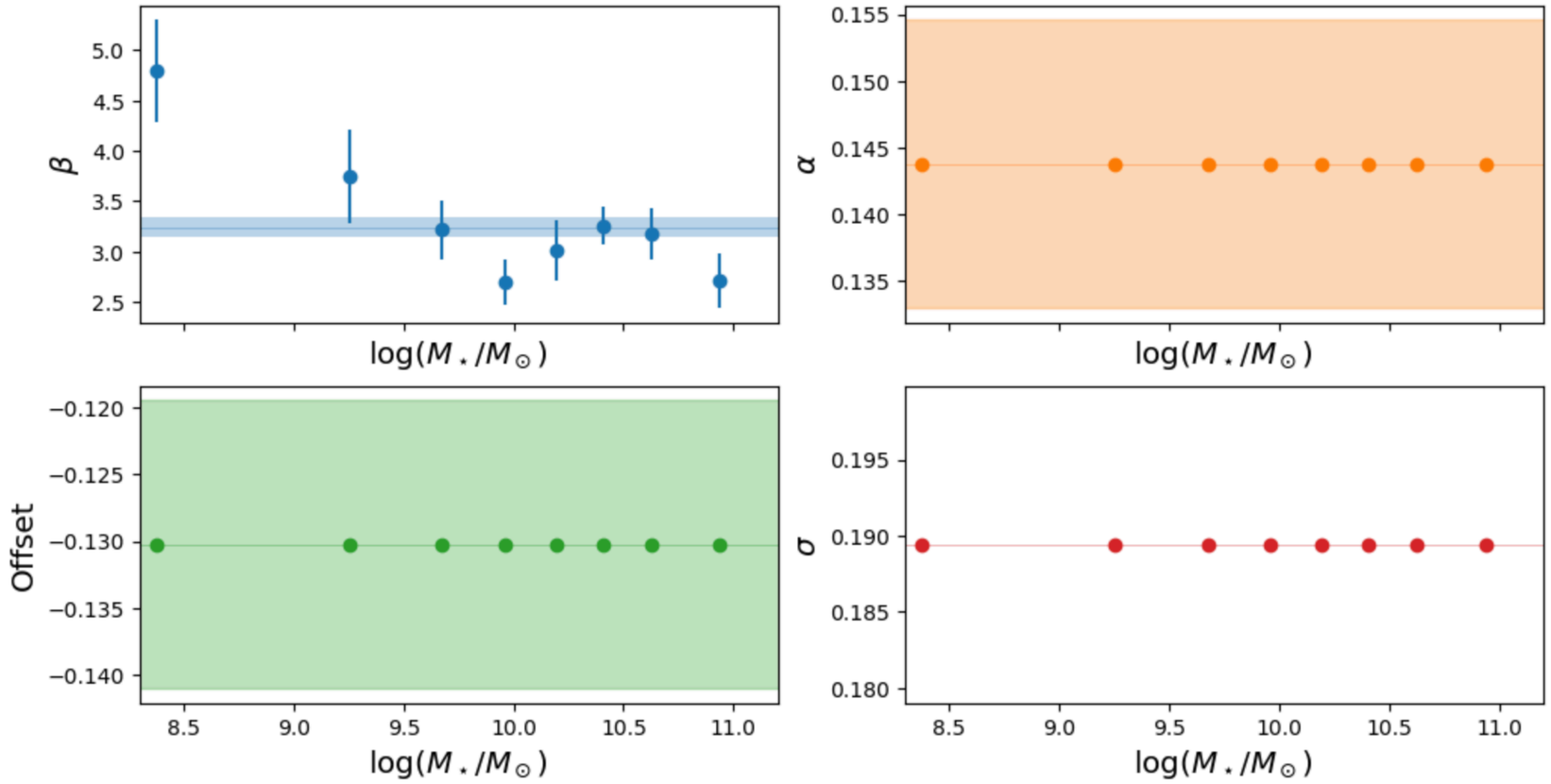
β evolution with environment

Simple case (α fixed)



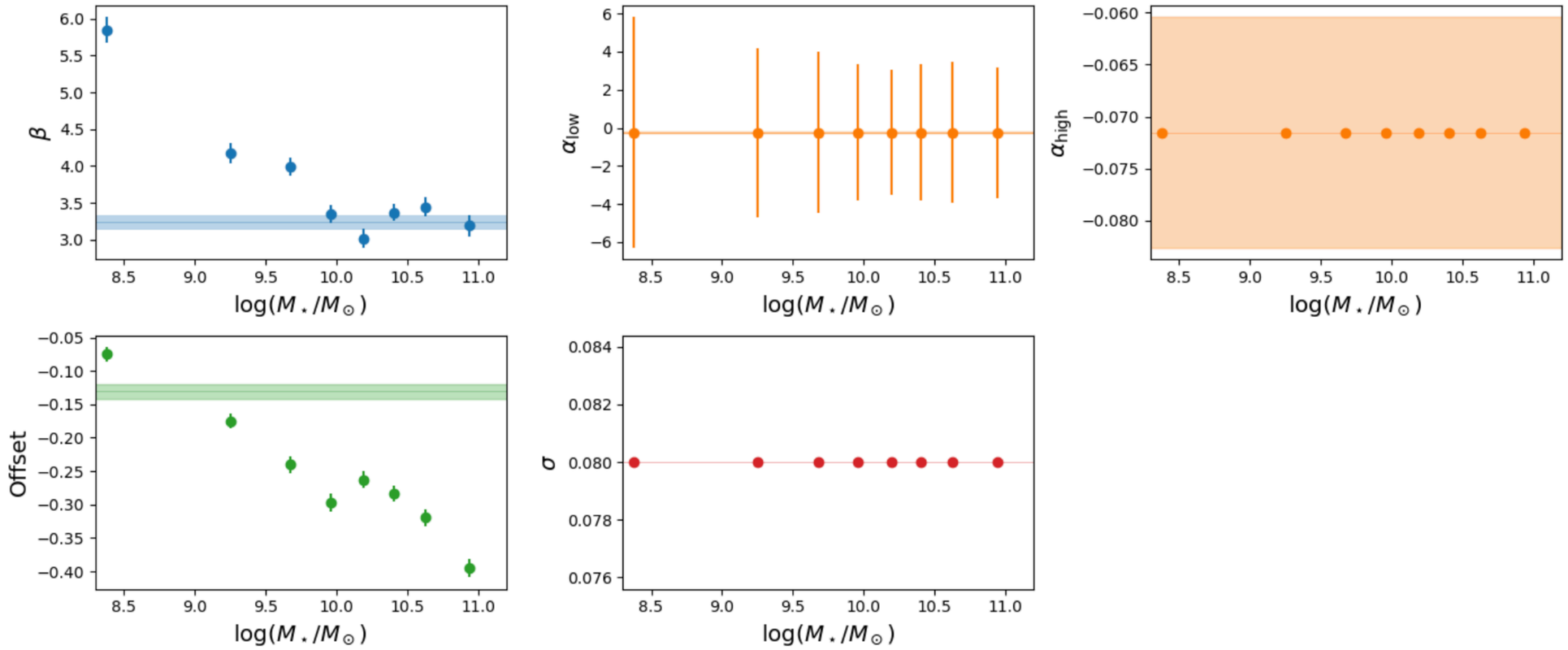
β evolution with environment

Simple case (fixing everything)



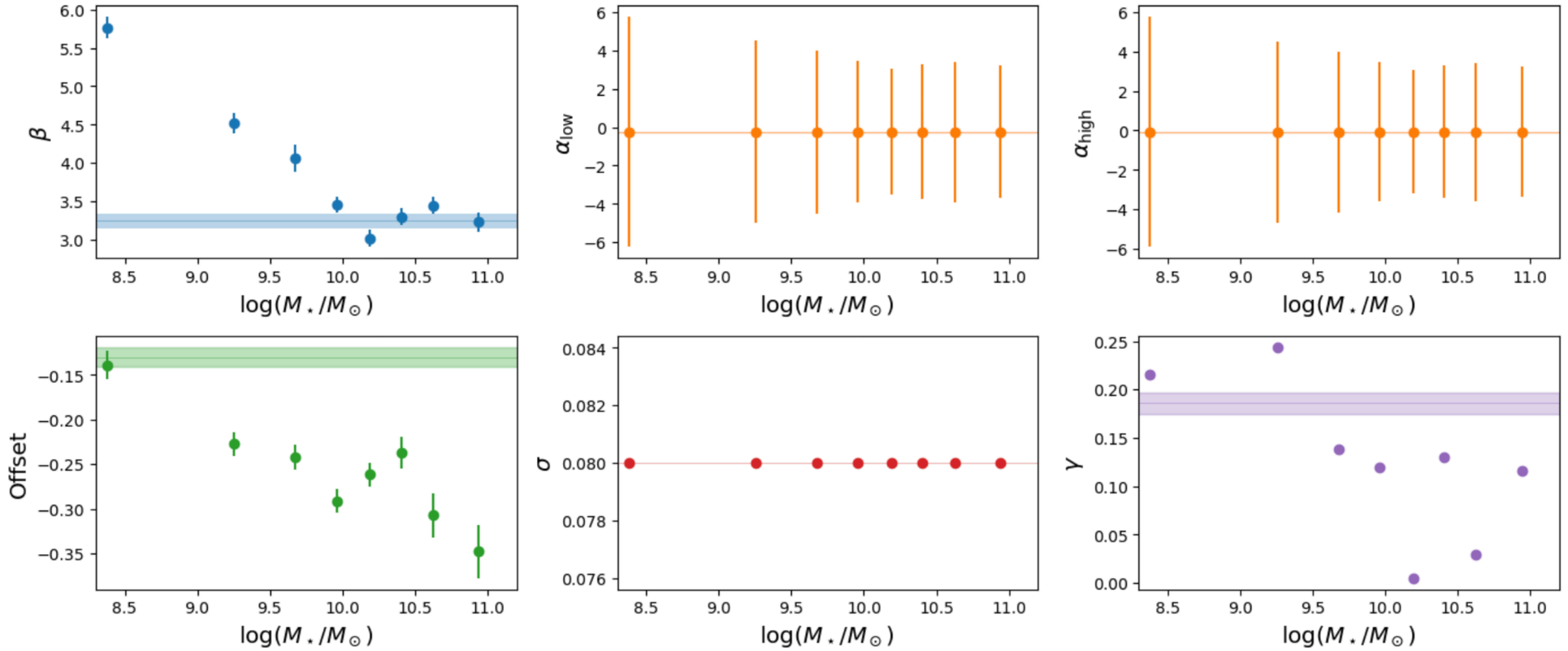
β evolution with environment

Adding the broken α ($\alpha_{\rm high}$ and $\alpha_{\rm low}$ fixed)



β evolution with environment

Adding a local colour step



β evolution with environment

Remaining questions

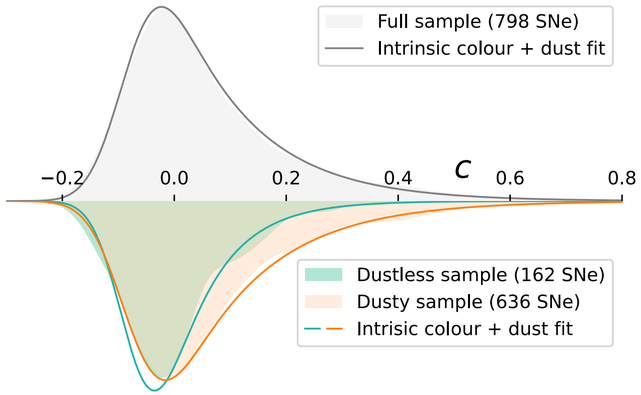
➡ Which model to fit for each mass bin

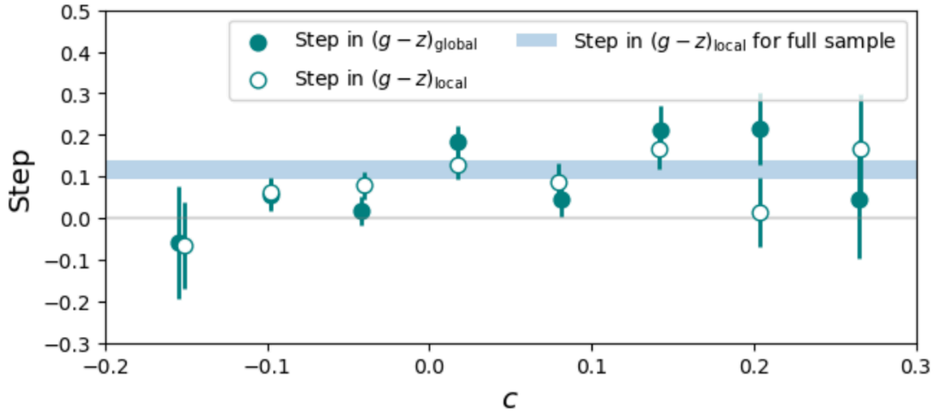
- Simple case: only (β, α) + offset
- Broken-α standardisation: $(\beta, \alpha_{\rm low}, \alpha_{\rm high})$ + offset
- Adding a local colour step: (β, α, γ)

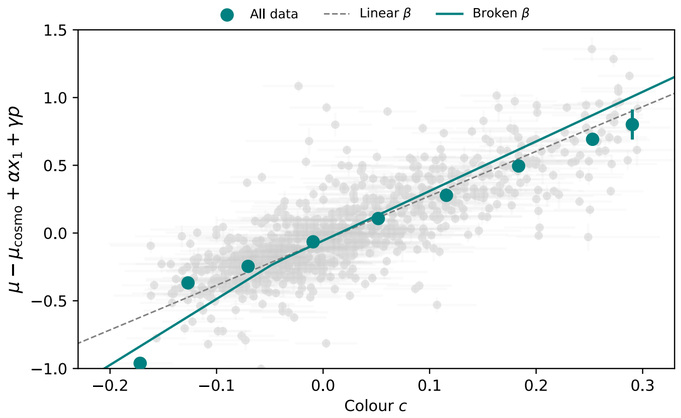
➡ What to fix/free

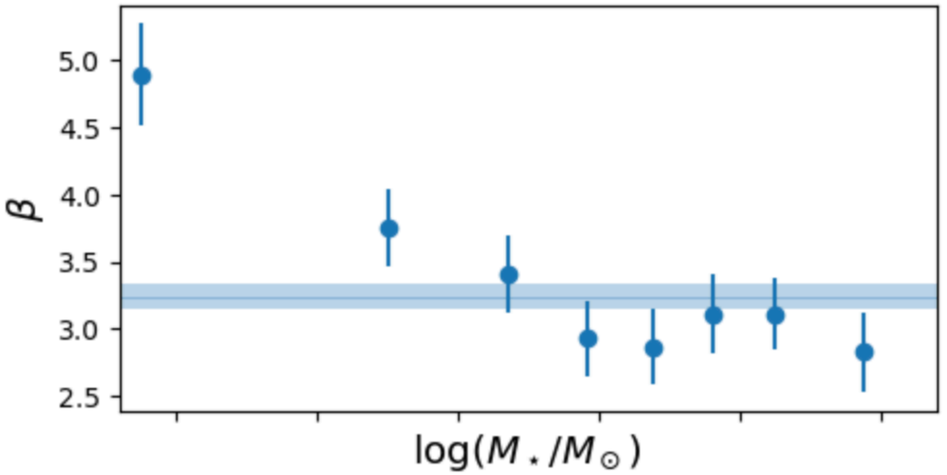
➡ Evolution with other environment proxies?

Colour paper









β evolution with environment

Fixing everything with a broken α