Updates on DR2 papers

Standardisation, colour, stretch

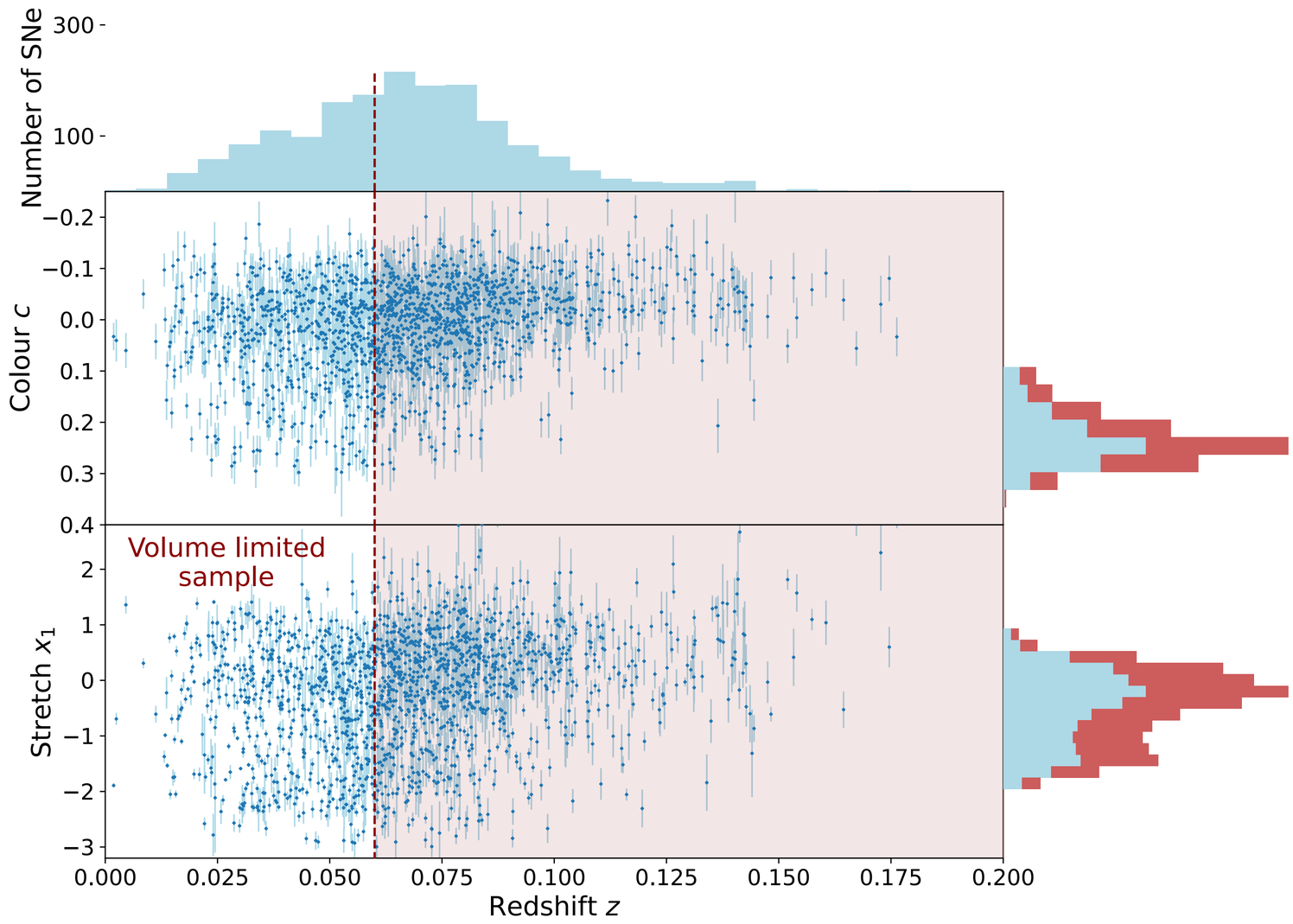
Madeleine GINOLIN - 11th September 2023

ZTF DR2

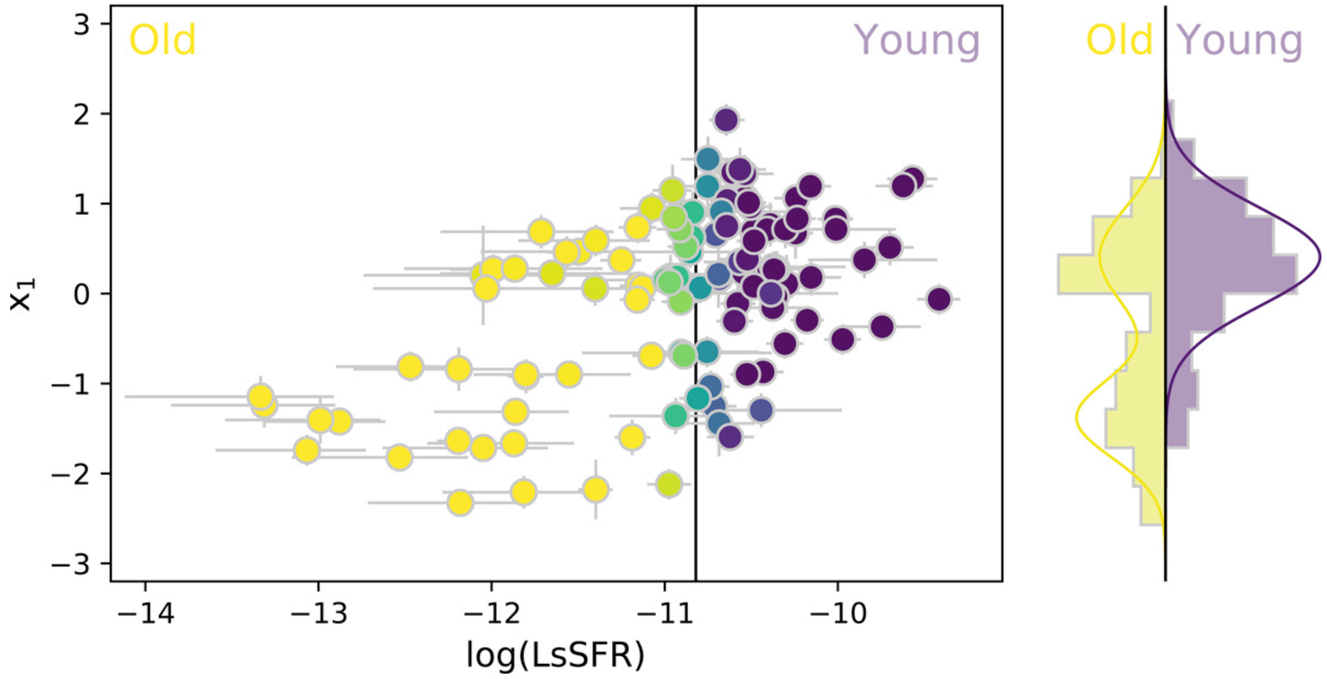
Volume limited sample

- Redshift cut: no selection effects
- Additional cuts:
  - $|x_1| < 3,\ \sigma_{x_1} < 1$
  - $|c| < 0.3,\ \sigma_c < 0.3$
  - $\sigma_{t_0} < 1$
  - `['snia-norm', 'snia', 'snia-pec-91t']`
  - SALT fit probability $\chi^2_{\mathrm{SALT}} > 10^{-4}$

➡ **889 SNe** in the final sample

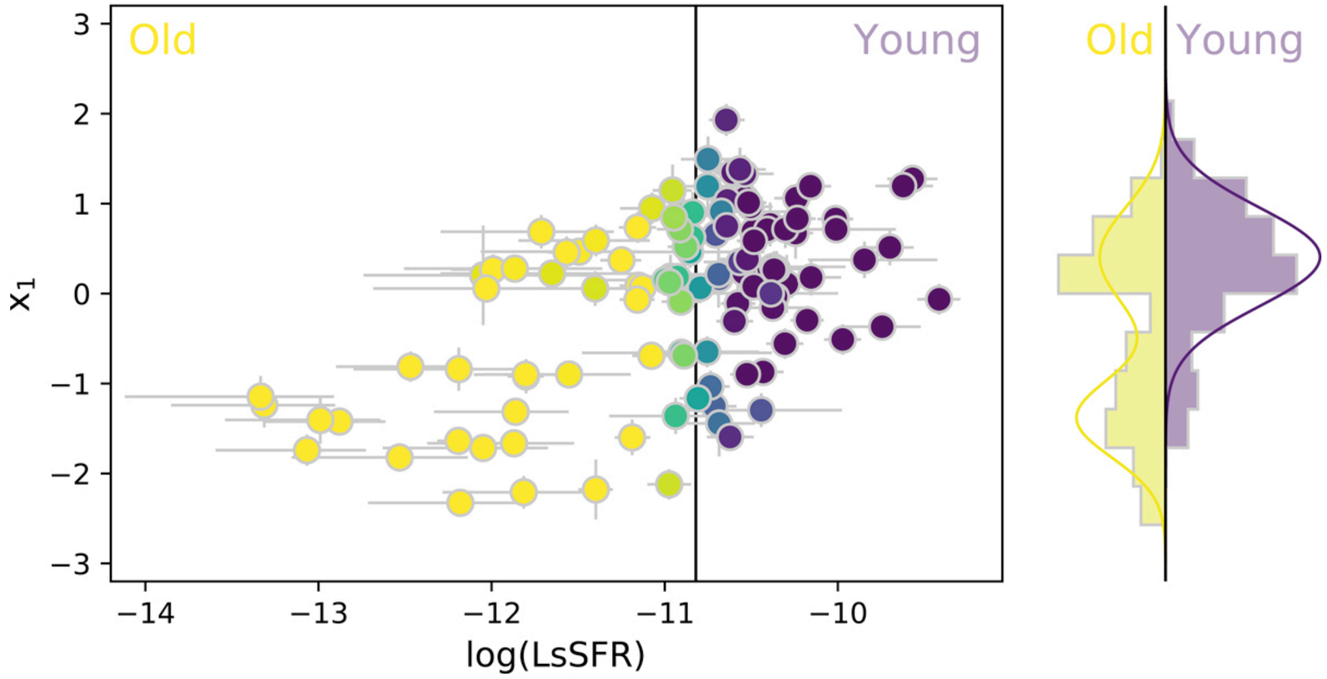


Stretch distribution



Nicolas et al (2021)
SNF - 114 SNe

Stretch distribution



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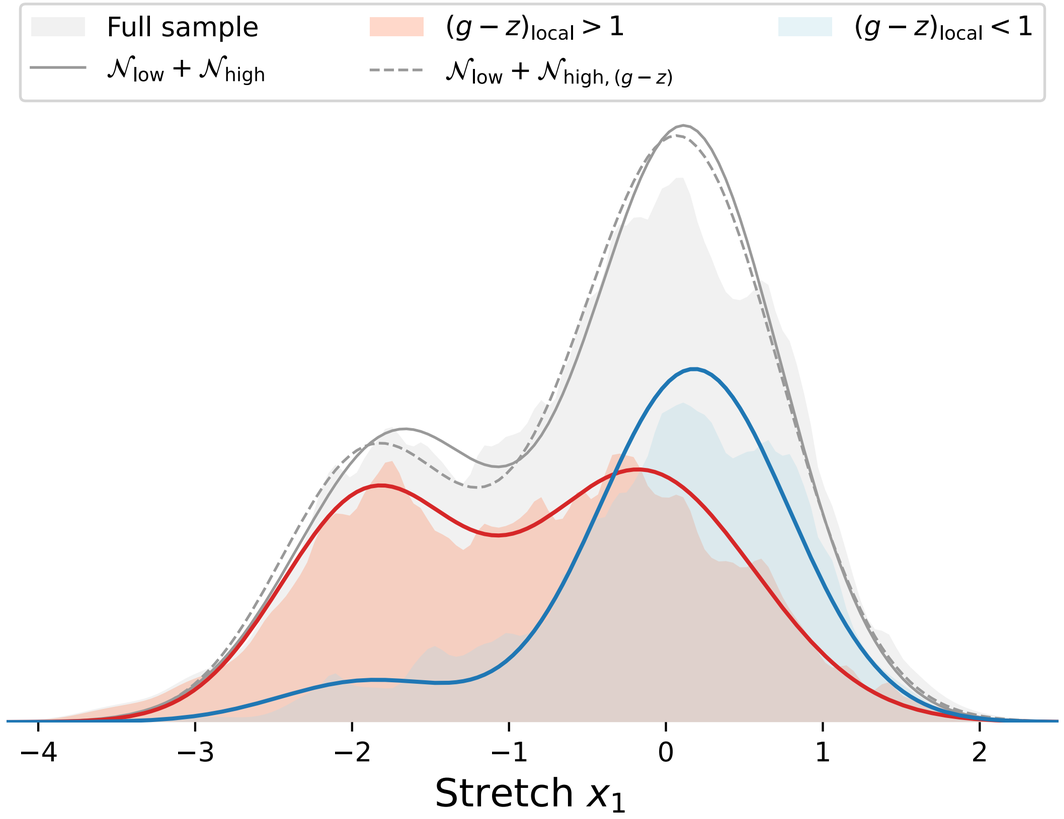
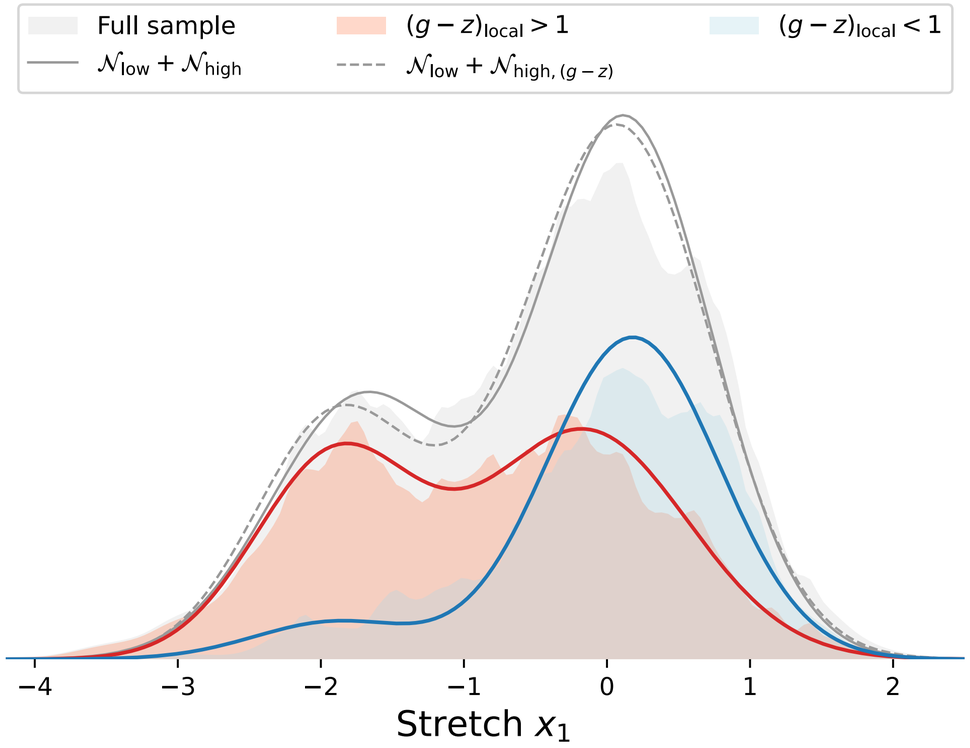


Stretch distribution

Drift of the high stretch mode



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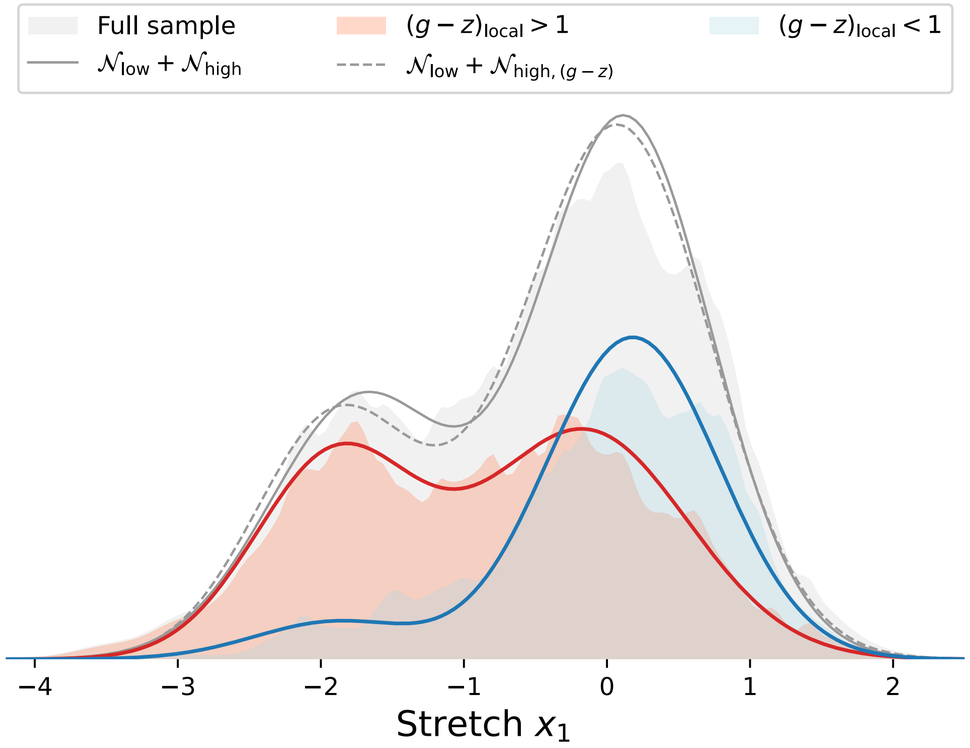
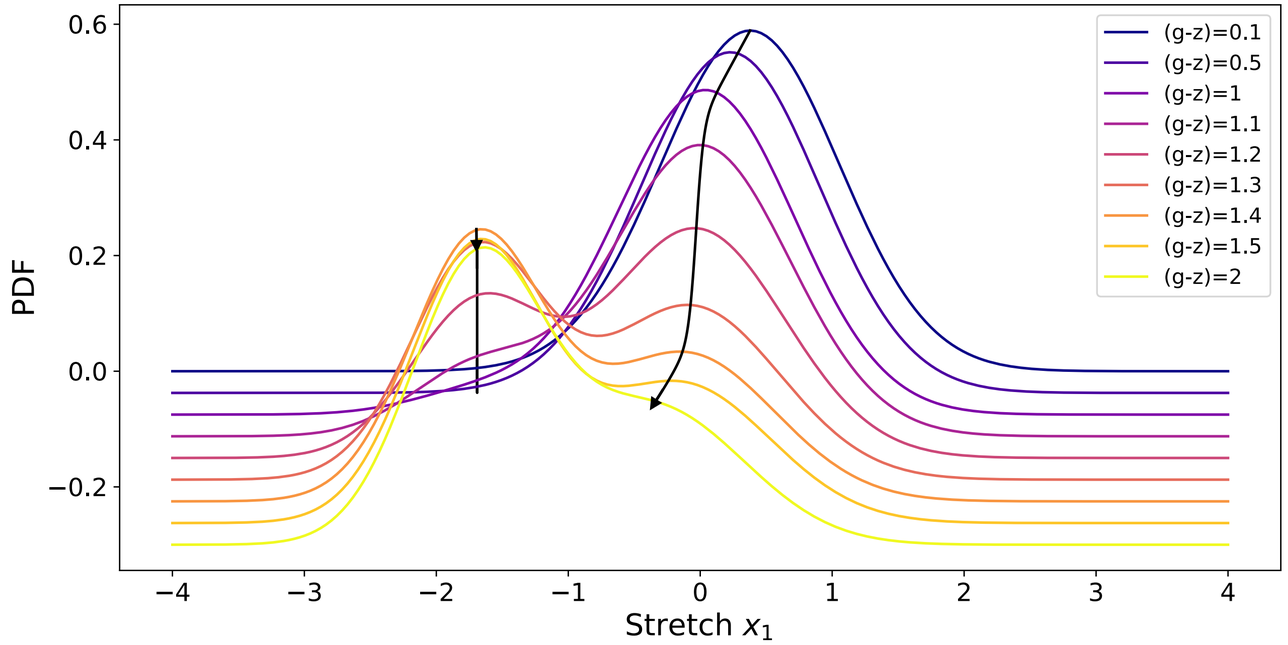
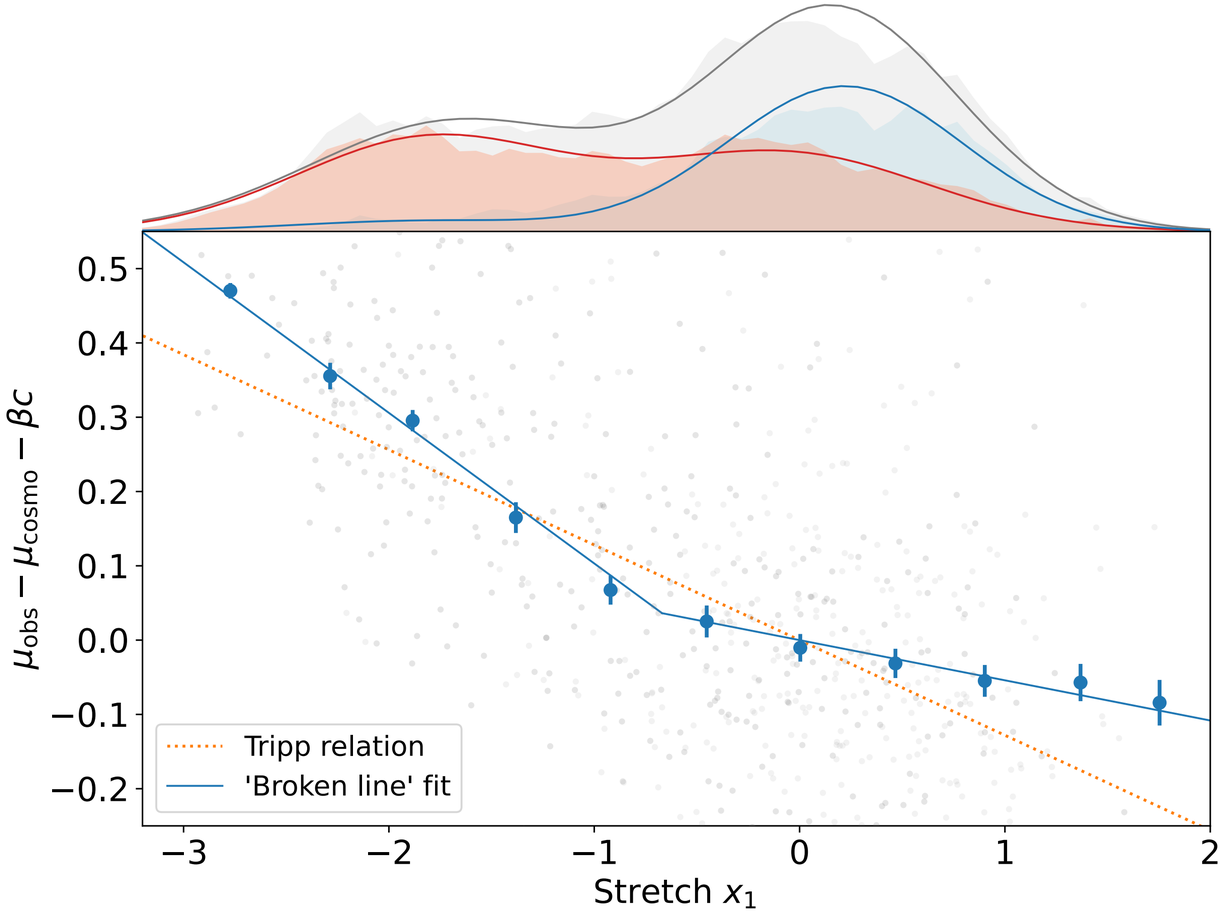




Standardisation

Non linearity of the stretch-residuals relation



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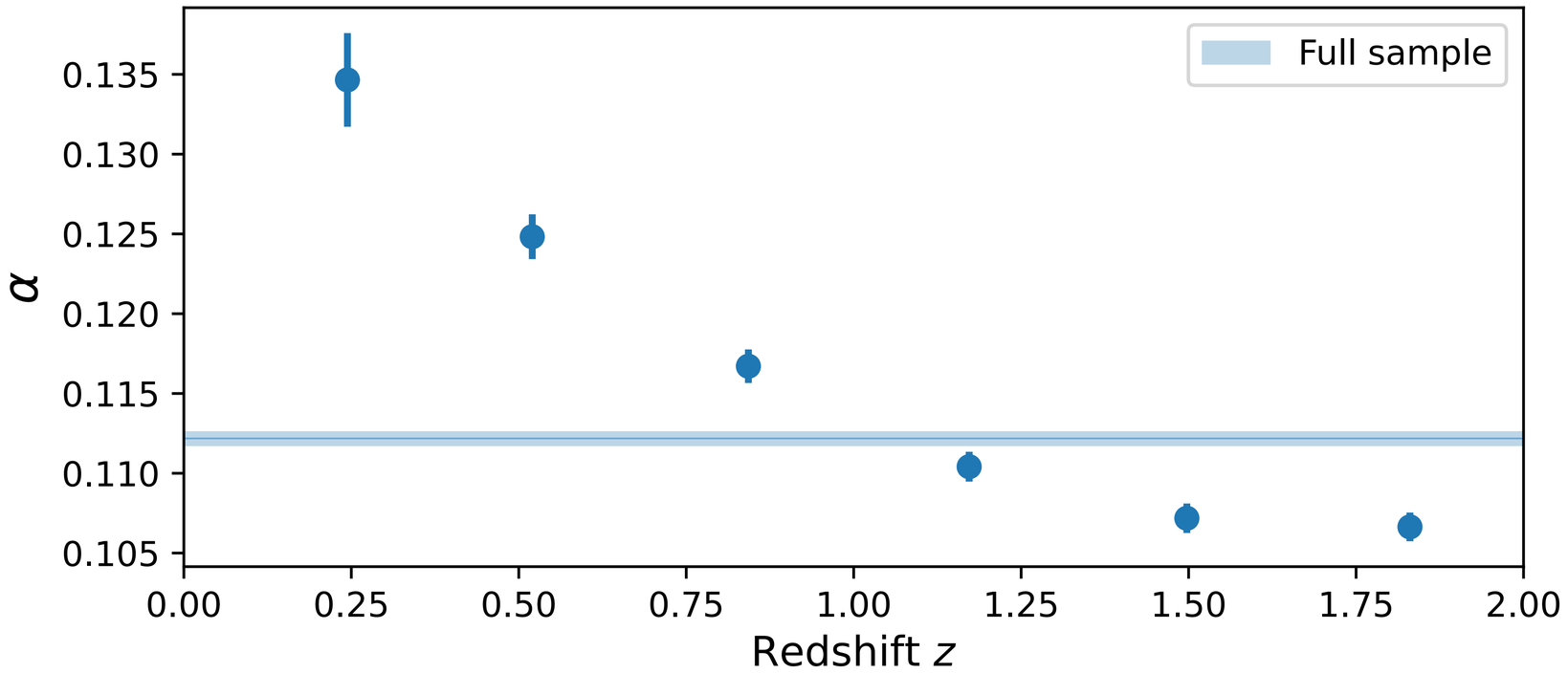
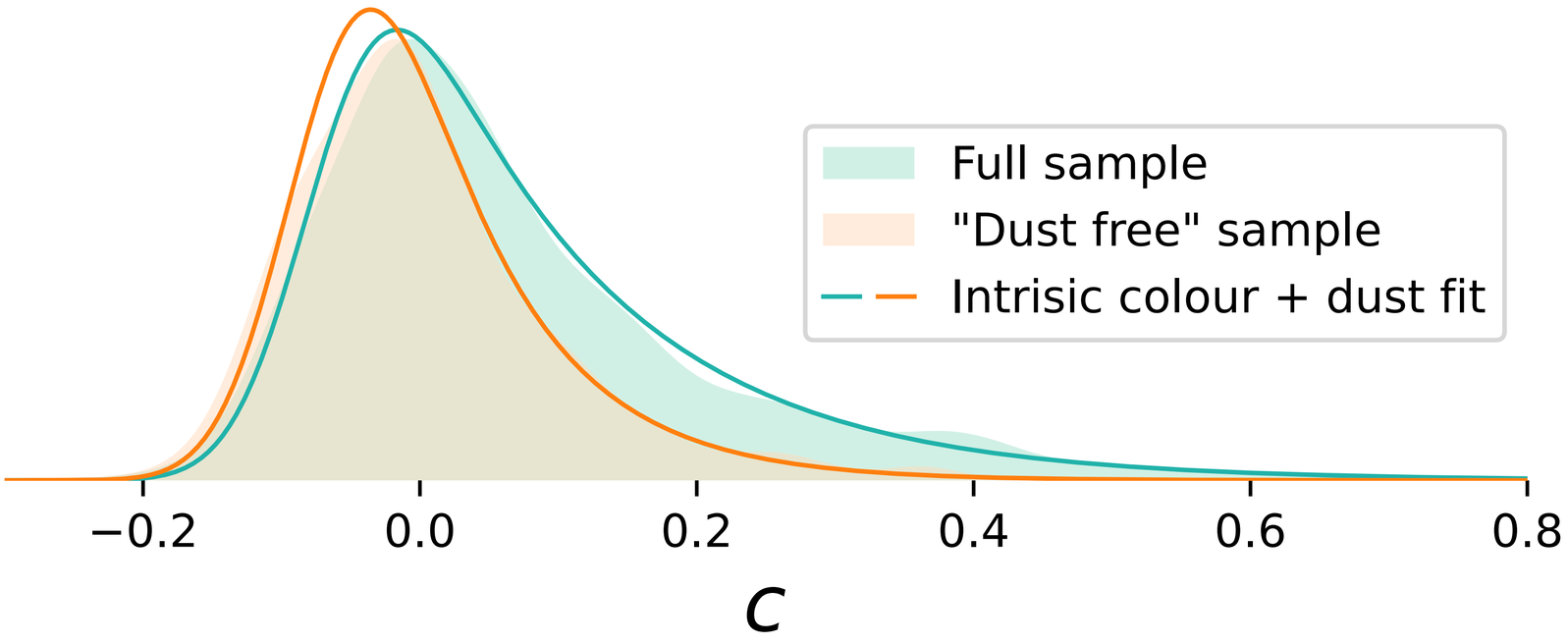


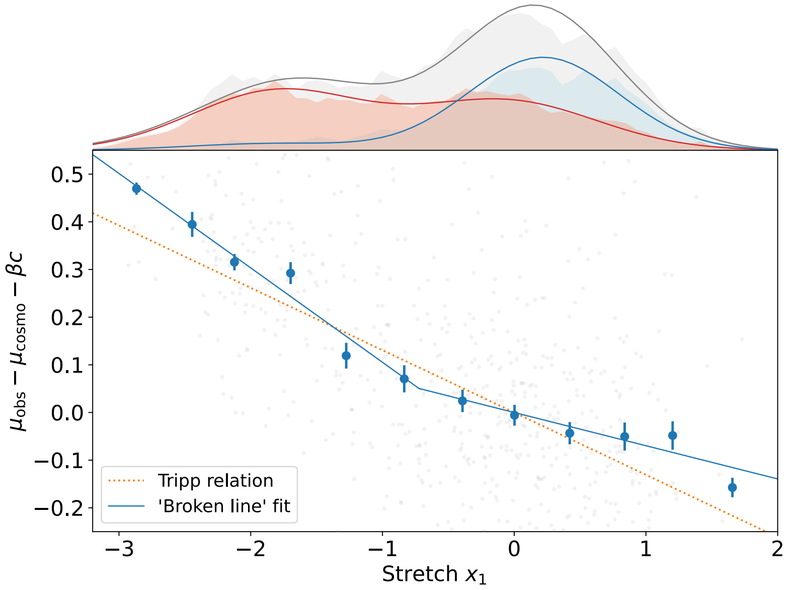
Colour distribution

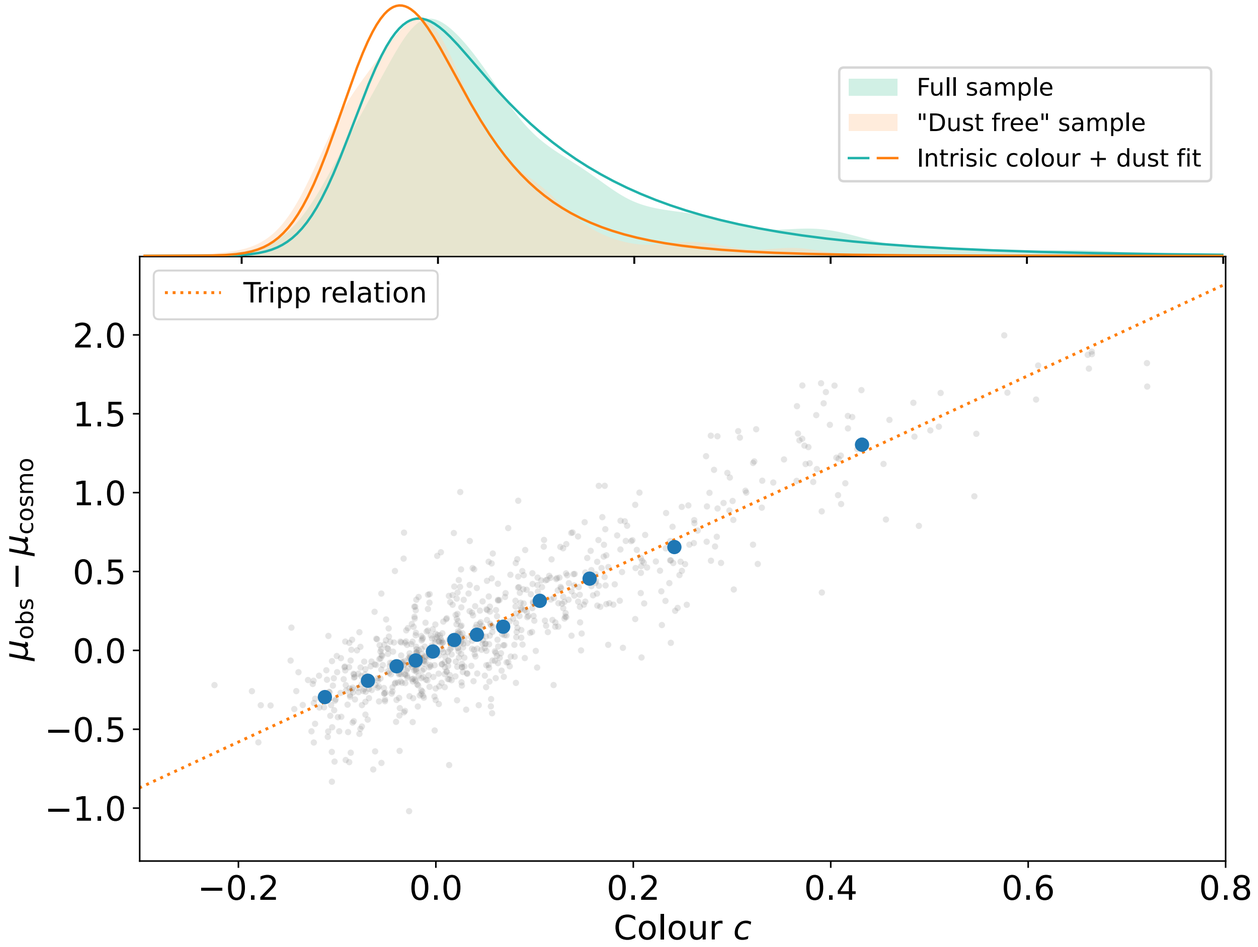


« Dust free » means:
- DLR > 0.8
- $\log(M_\star/M_\odot) < 8.9$

Standardisation

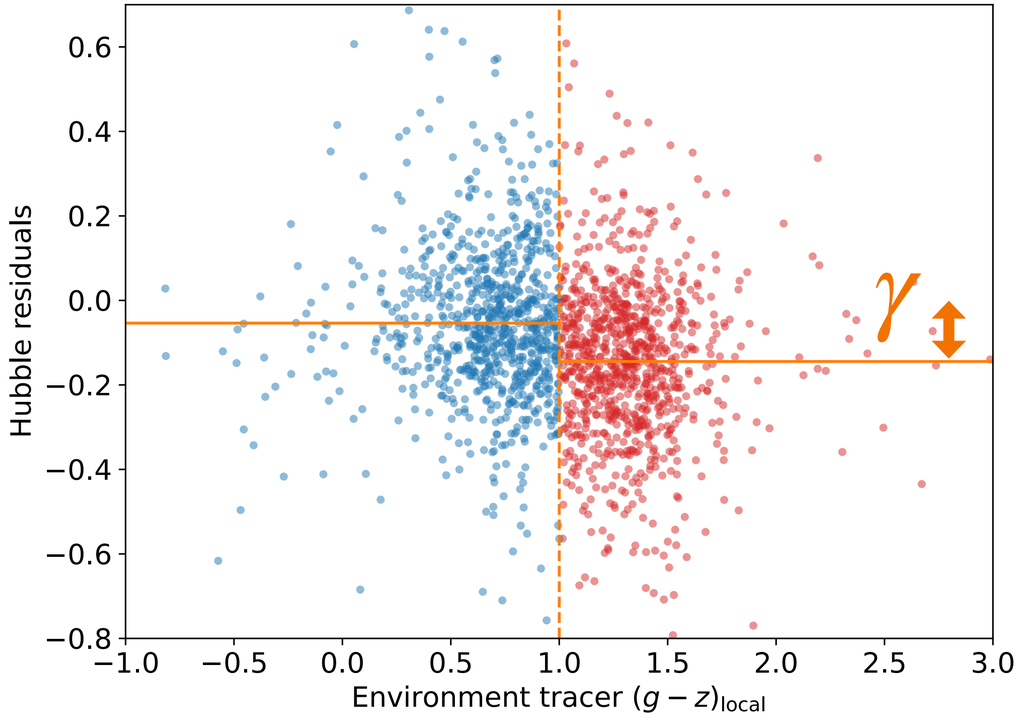
Linearity of the colour-residuals relation

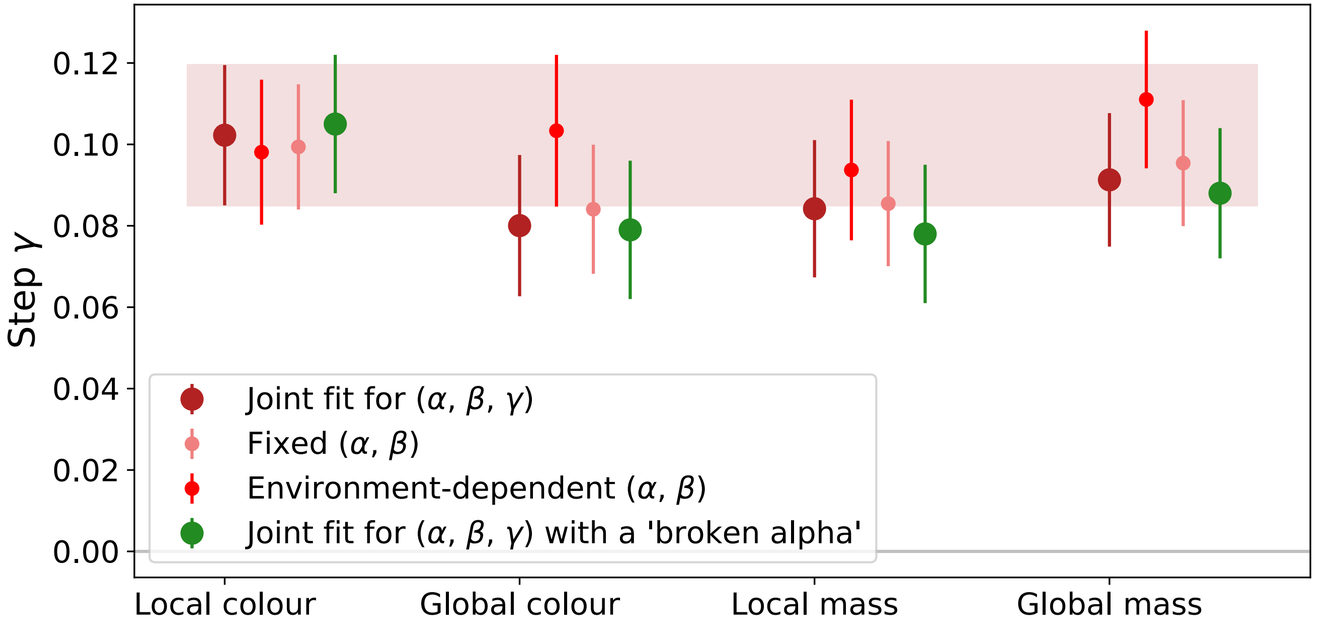




Standardisation

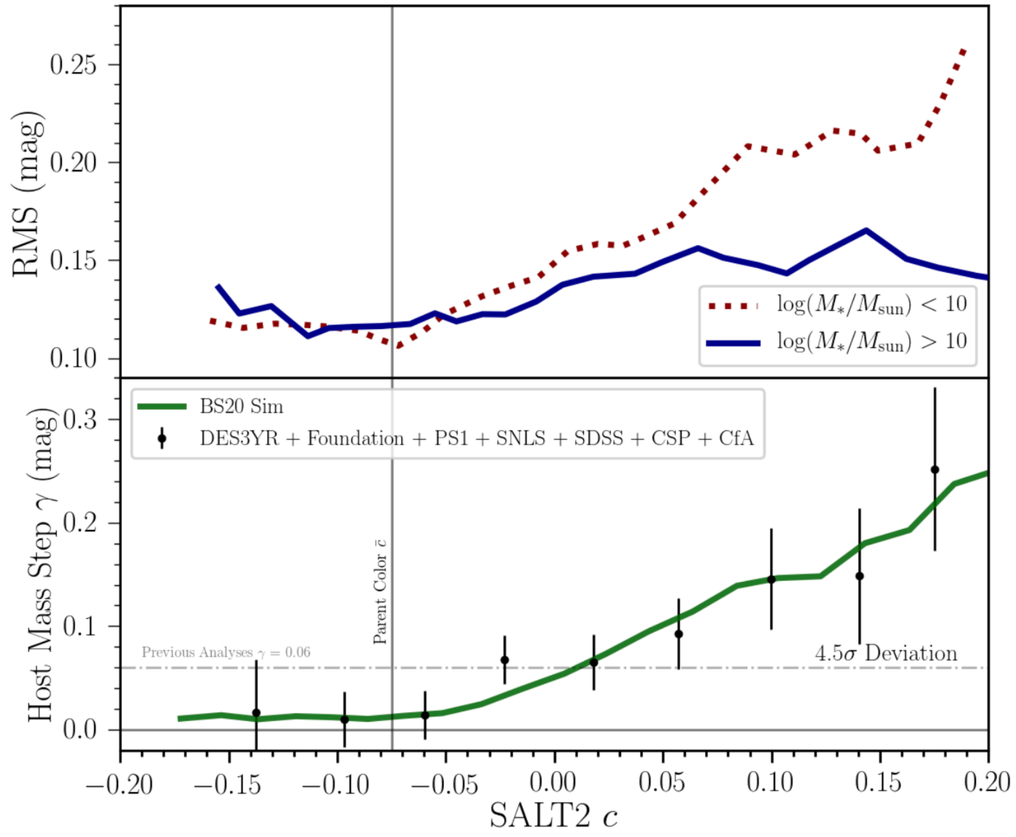
Steps



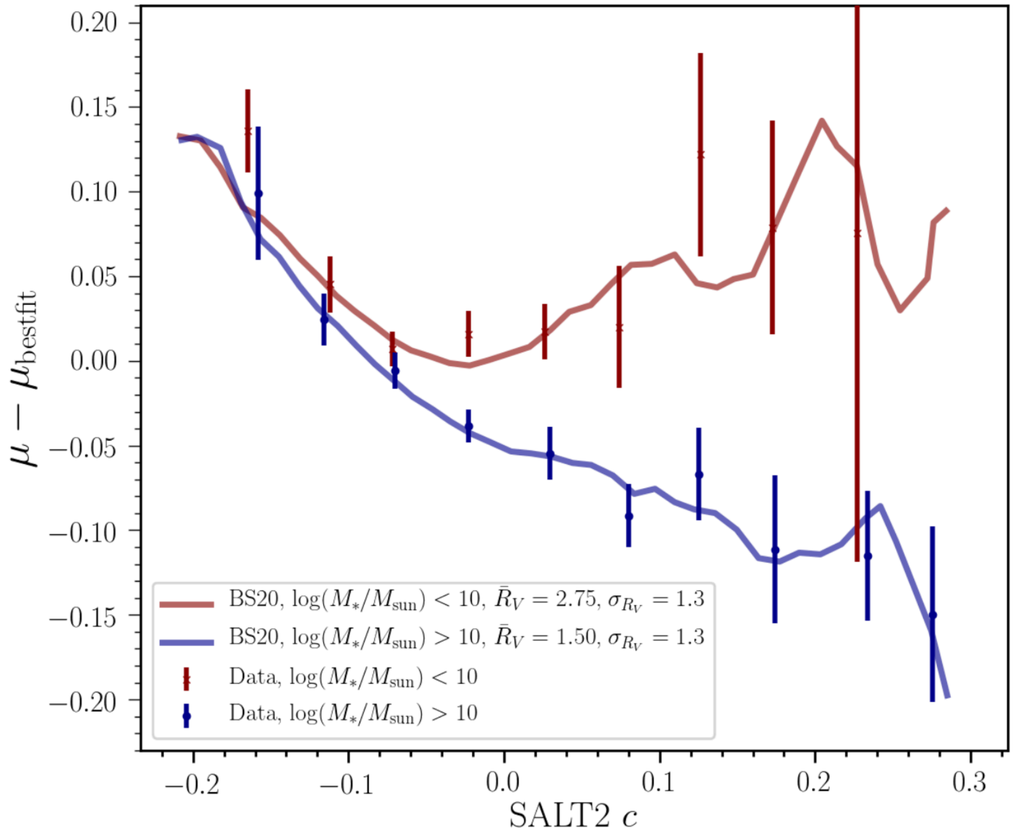


Standardisation

Is step due to dust?

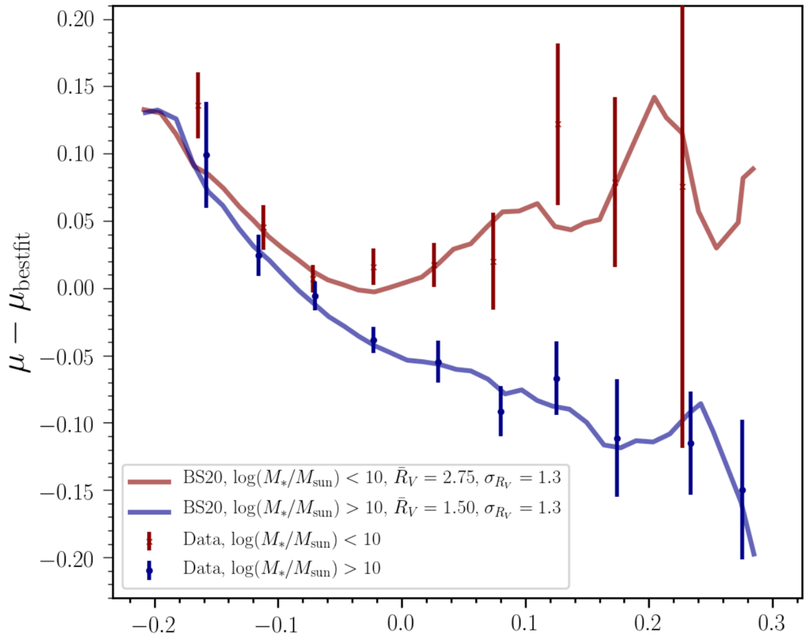


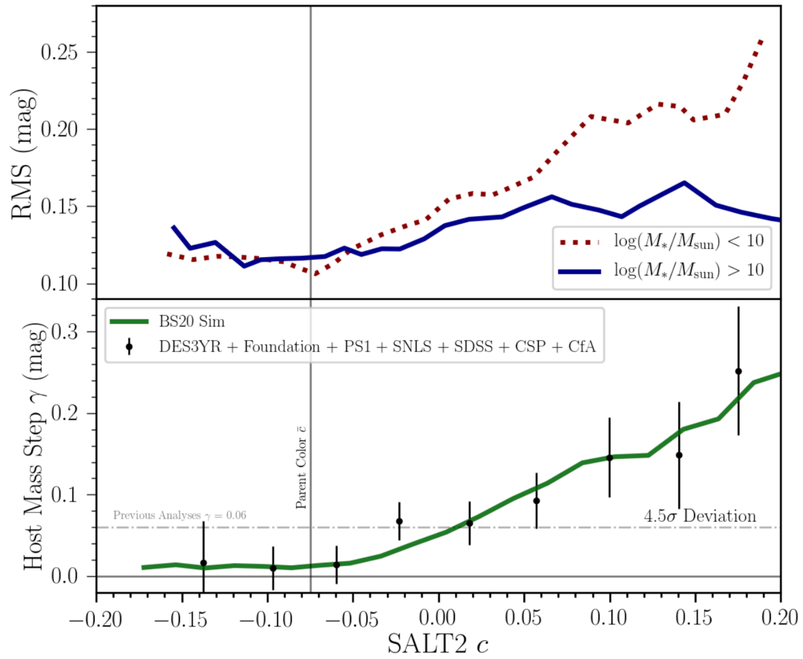
(a)

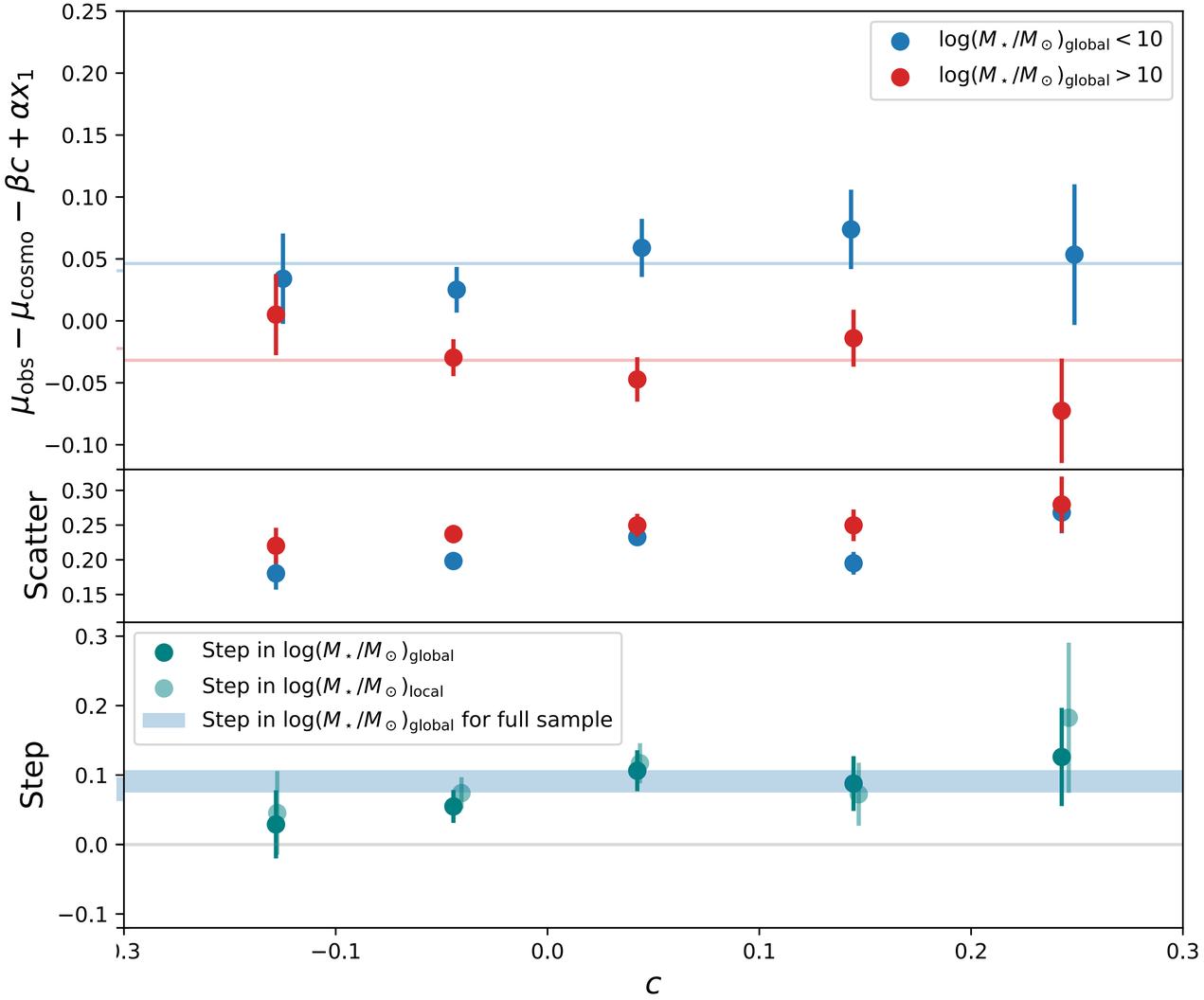


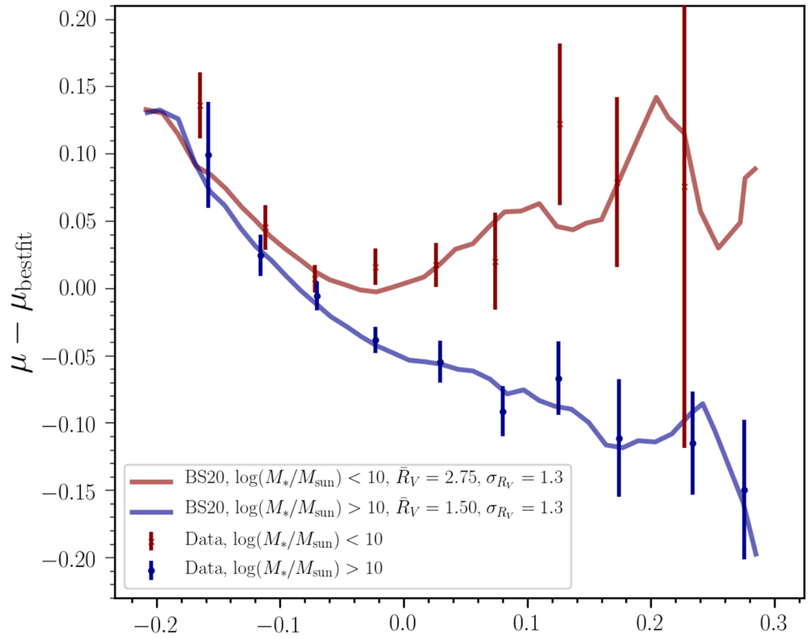
(b)

Brout & Scolnic 2020


$\mu - \mu_{\rm bestfit}$
BS20, $\log(M_*/M_{\rm sun}) < 10$, $\bar{R}_V = 2.75$, $\sigma_{R_V} = 1.3$
BS20, $\log(M_*/M_{\rm sun}) > 10$, $\bar{R}_V = 1.50$, $\sigma_{R_V} = 1.3$
Data, $\log(M_*/M_{\rm sun}) < 10$
Data, $\log(M_*/M_{\rm sun}) > 10$


RMS (mag)
$\log(M_*/M_{\rm sun}) < 10$
$\log(M_*/M_{\rm sun}) > 10$
Host Mass Step γ (mag)
BS20 Sim
DES3YR + Foundation + PS1 + SNLS + SDSS + CSP + CfA
Parent Color $\bar{c}$
Previous Analyses $\gamma = 0.06$
4.5σ Deviation
SALT2 c


$\mu_{\rm obs} - \mu_{\rm cosmo} - \beta c + \alpha x_1$
$\log(M_*/M_\odot)_{\rm global} < 10$
$\log(M_*/M_\odot)_{\rm global} > 10$
Scatter
Step
Step in $\log(M_*/M_\odot)_{\rm global}$
Step in $\log(M_*/M_\odot)_{\rm local}$
Step in $\log(M_*/M_\odot)_{\rm global}$ for full sample
c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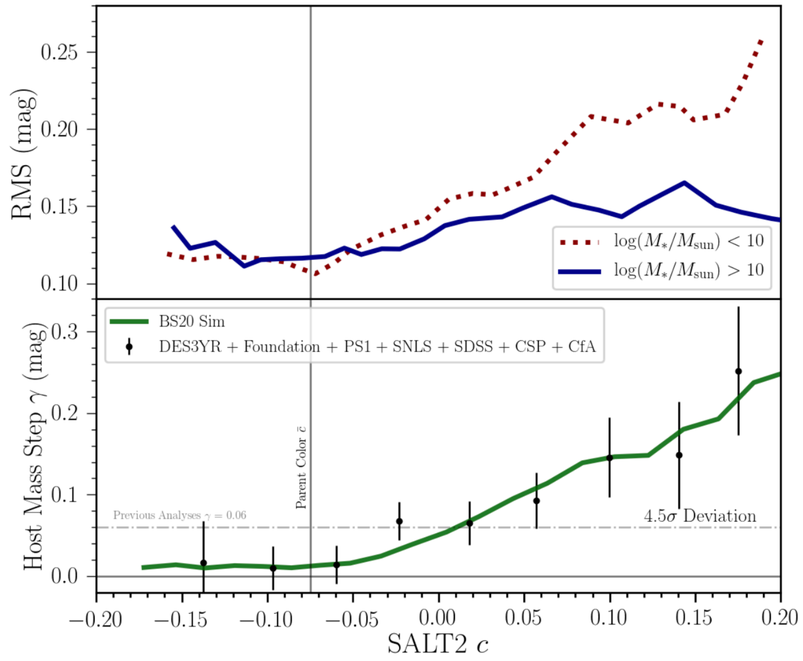
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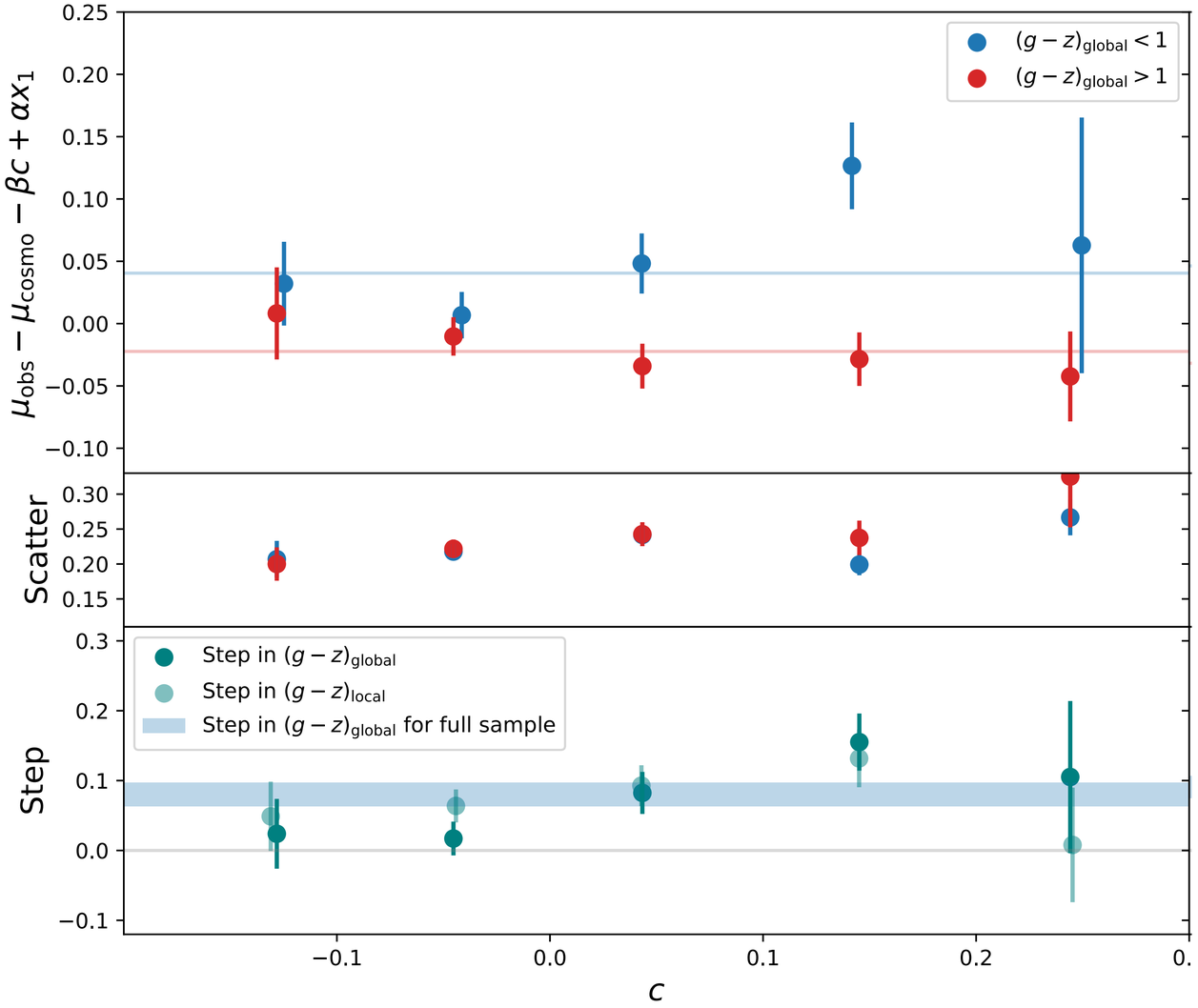
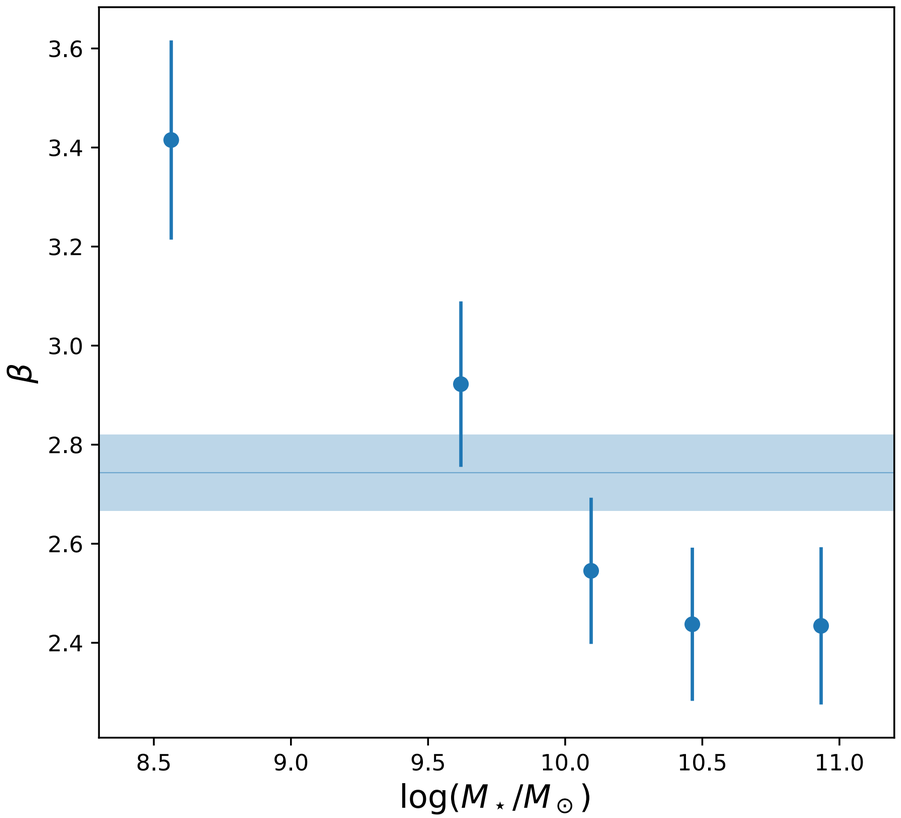
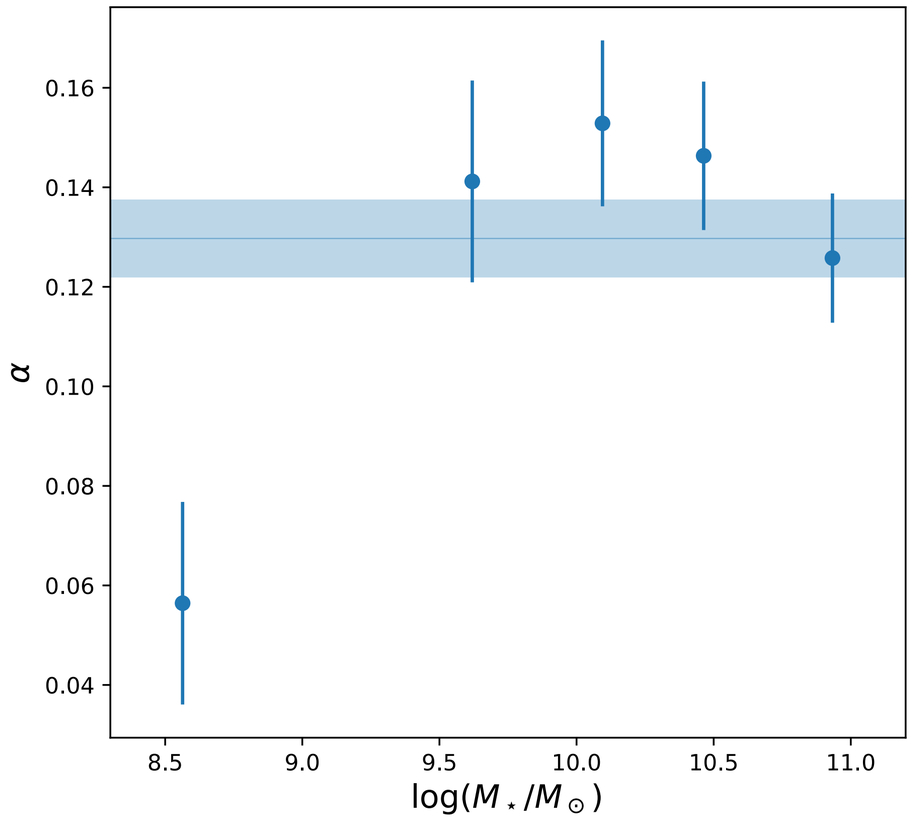

$\mu_{\rm obs} - \mu_{\rm cosmo} - \beta c + \alpha x_1$
$(g-z)_{\rm global} < 1$
$(g-z)_{\rm global} > 1$
Scatter
Step
Step in $(g-z)_{\rm global}$
Step in $(g-z)_{\rm local}$
Step in $(g-z)_{\rm global}$ for full sample
c

Beta evolution with mass





Papers

Stretch & steps

- Confirmed double peak x_1 distribution
- Drift of the high stretch mode with environment
- Non linearity of the residuals-stretch relations
- Step value ~0.10, for all methods and tracers + not affected by ‘broken alpha’

Colour & dust

- Red tail of the SNe colour distribution seen for the first time
- This red tail is affected by dust-selected cuts
- Step might not be due only to dust
- β drift with global mass