



# Host dependency of supernovae standardisation with the ZTF volume limited sample

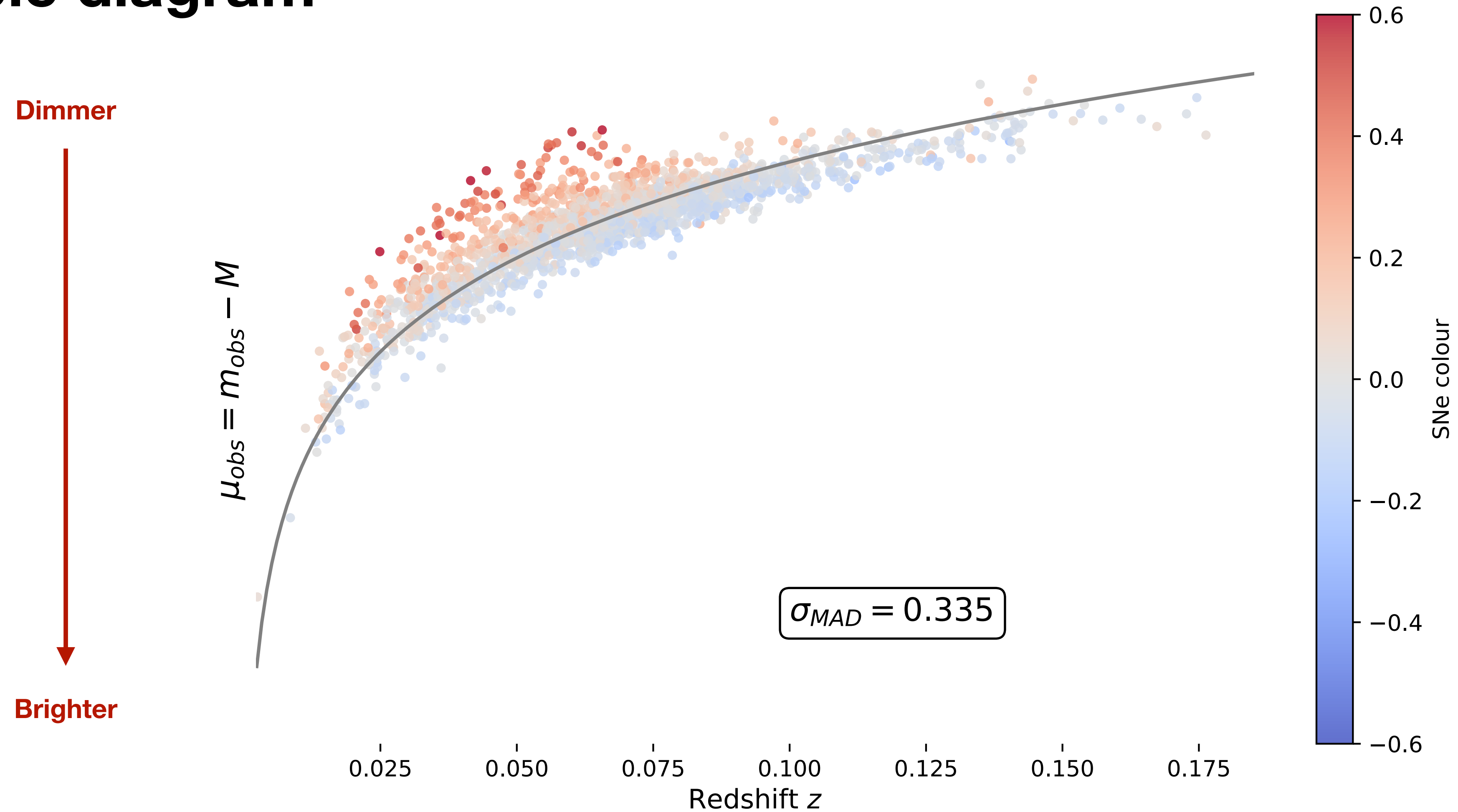
Supervisor: Mickaël Rigault

Madeleine GINOLIN - 6<sup>th</sup> November 2023



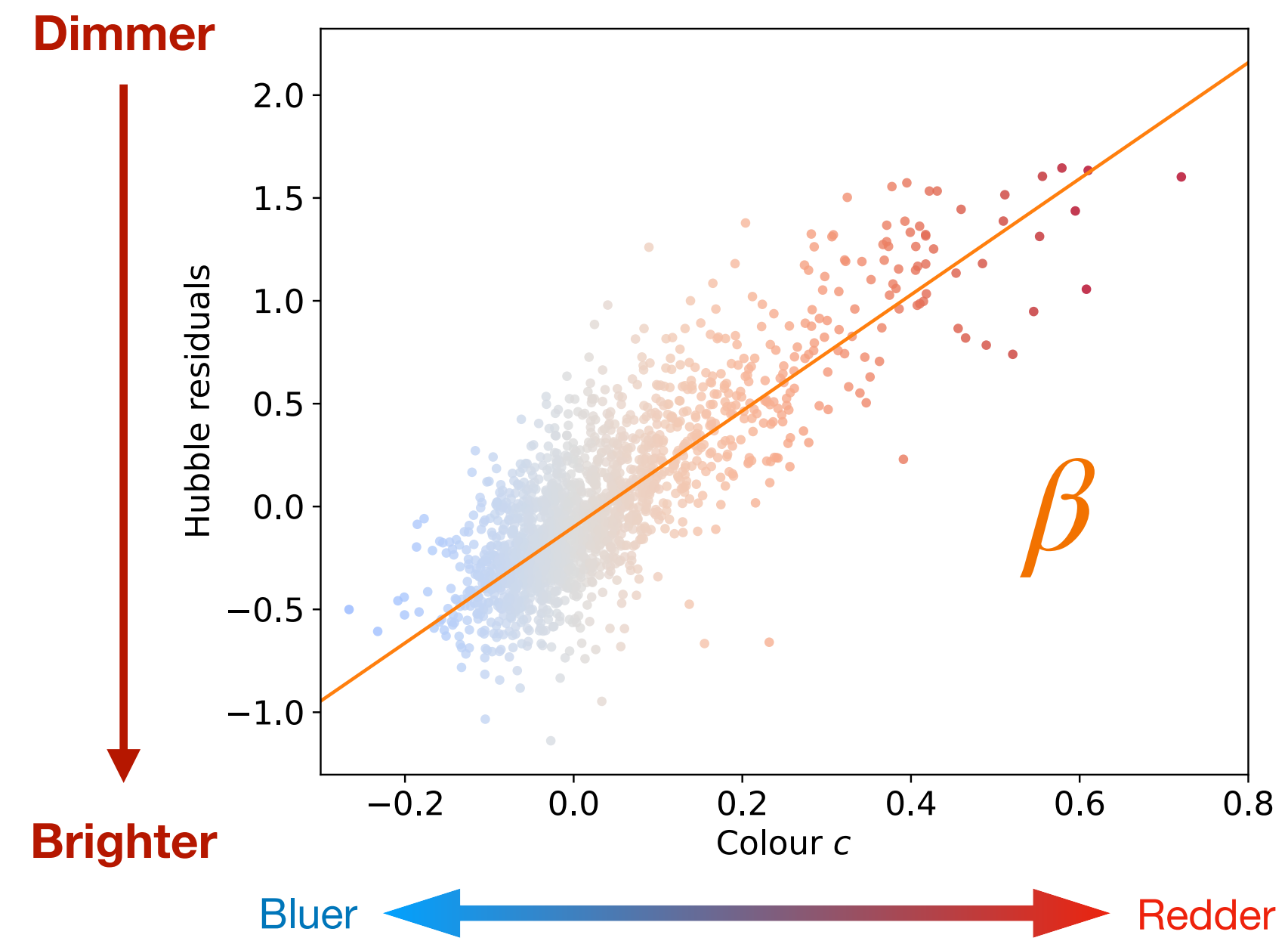
# Cosmology with SNe

## Hubble diagram



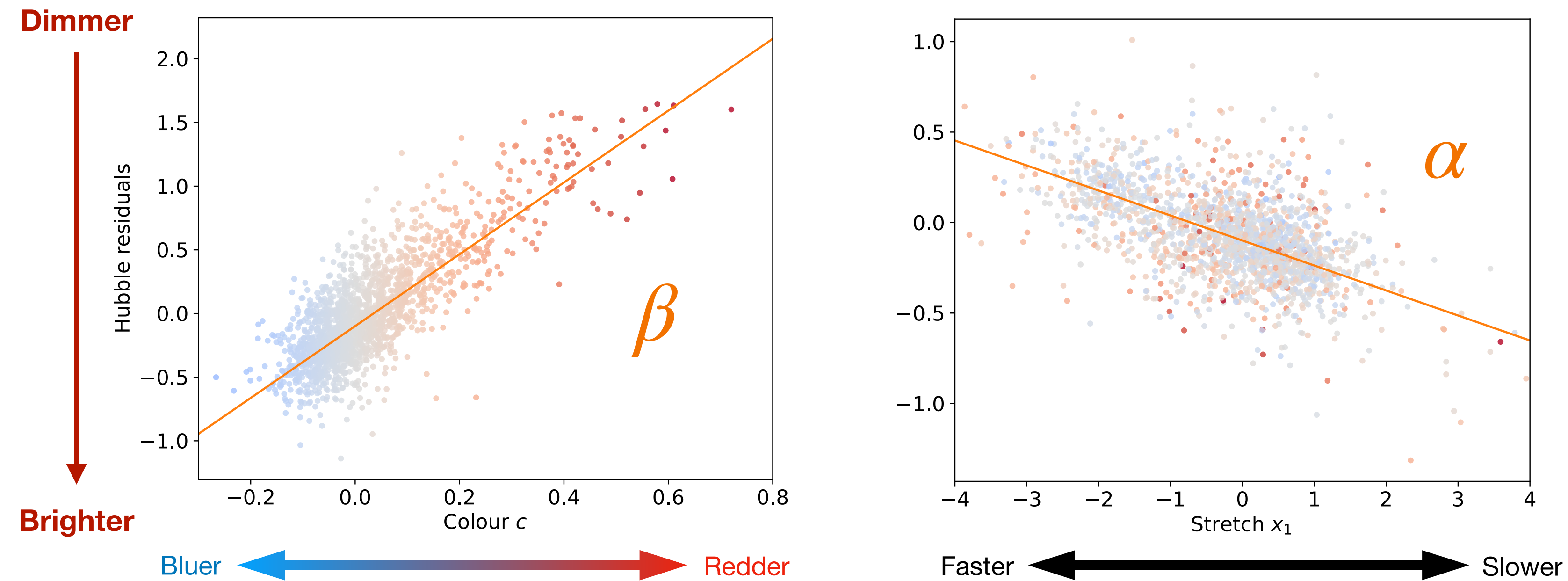
# Cosmology with SNe

## Standardisation



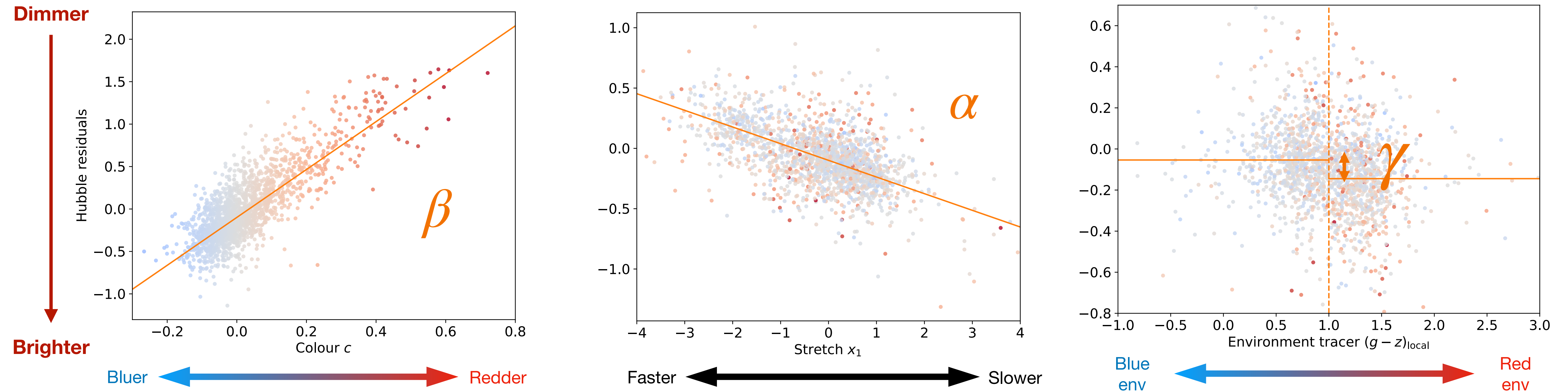
# Cosmology with SNe

## Standardisation



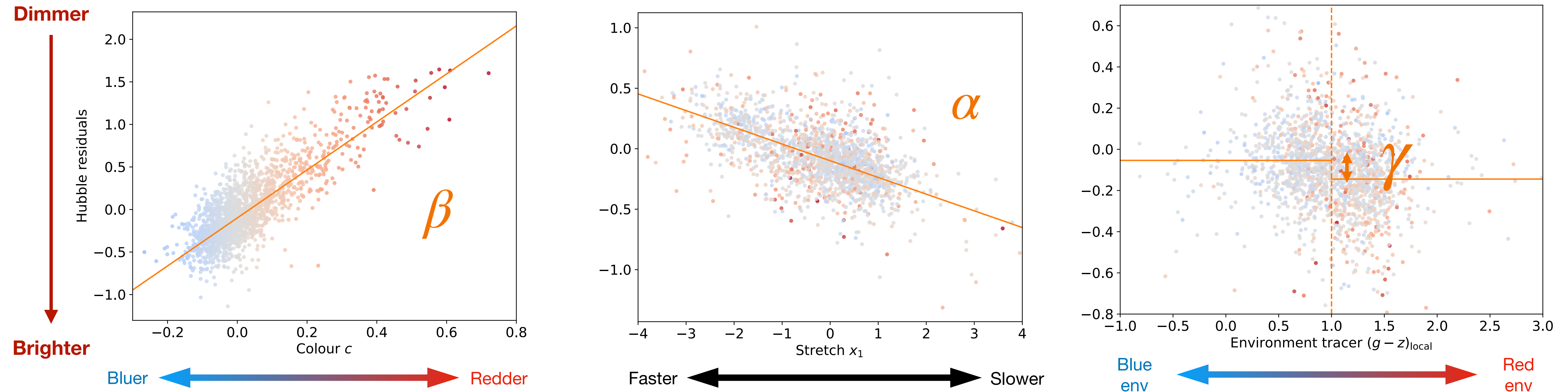
# Cosmology with SNe

## Standardisation



# Cosmology with SNe

## Standardisation

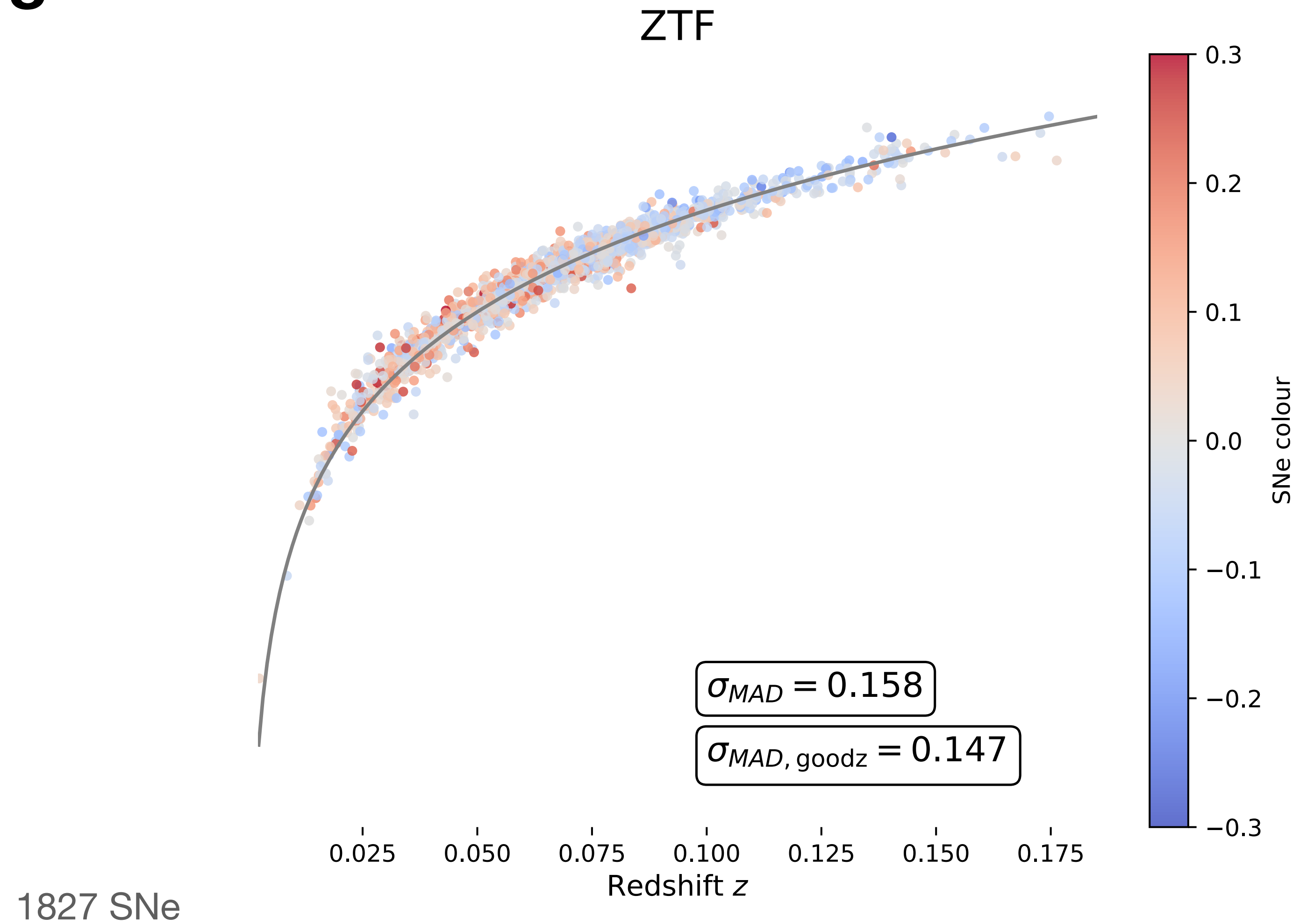


$$\mu_{model} + M = m_{obs} - \beta c + \alpha x_1 + p\gamma$$

(Phillips 1993, Tripp 1998)

# Cosmology with SNe

## Hubble diagram

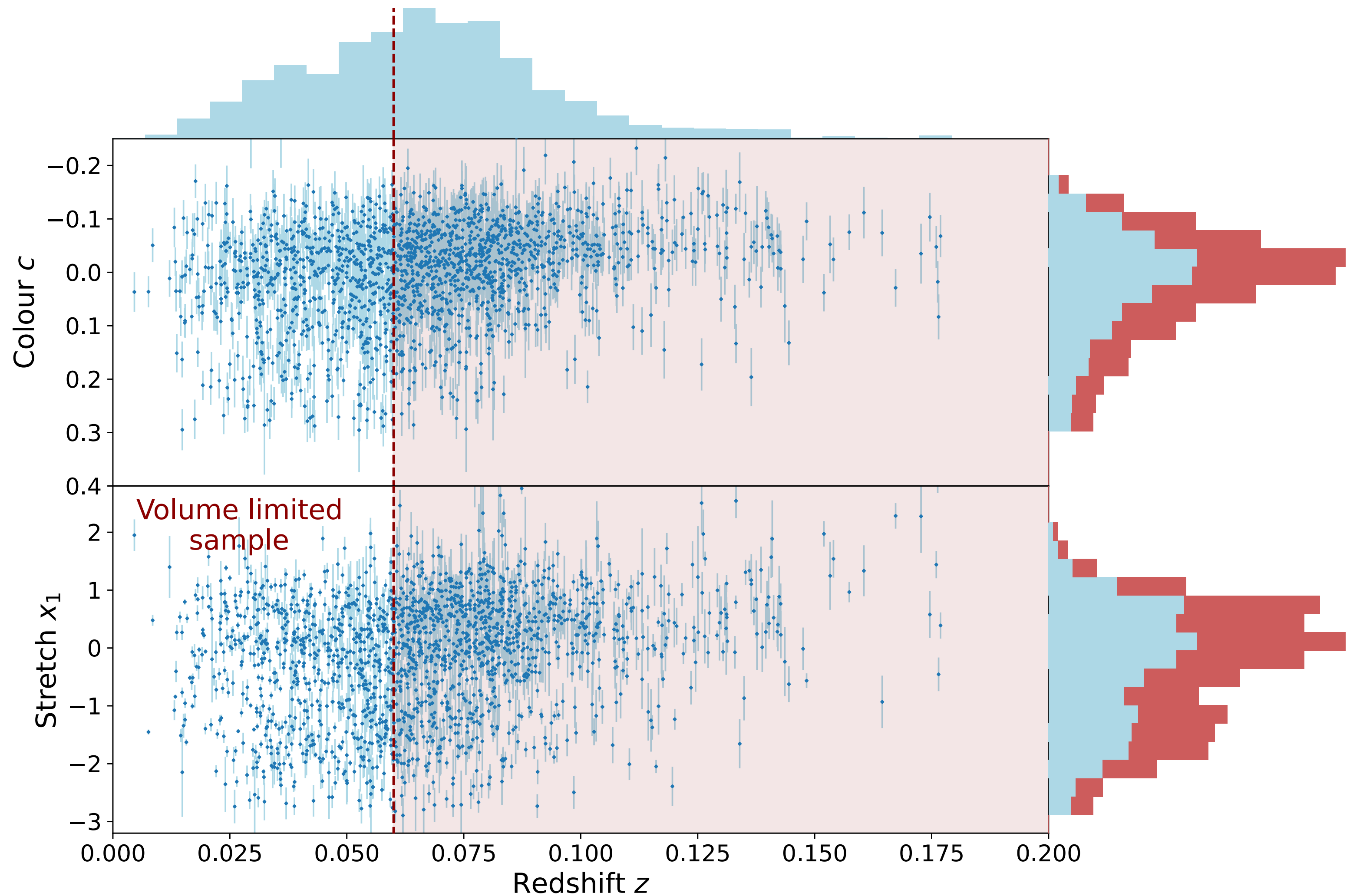


# ZTF DR2

## Volume limited sample

- Redshift cut: no selection effects
- Additional cuts:
  - $(x_1, x_1^{\text{err}})$
  - $(c, c^{\text{err}})$
  - $t_0^{\text{err}}$
  - Normal SNe Ias
  - SALT fit probability  $\chi^2_{\text{SALT}}$

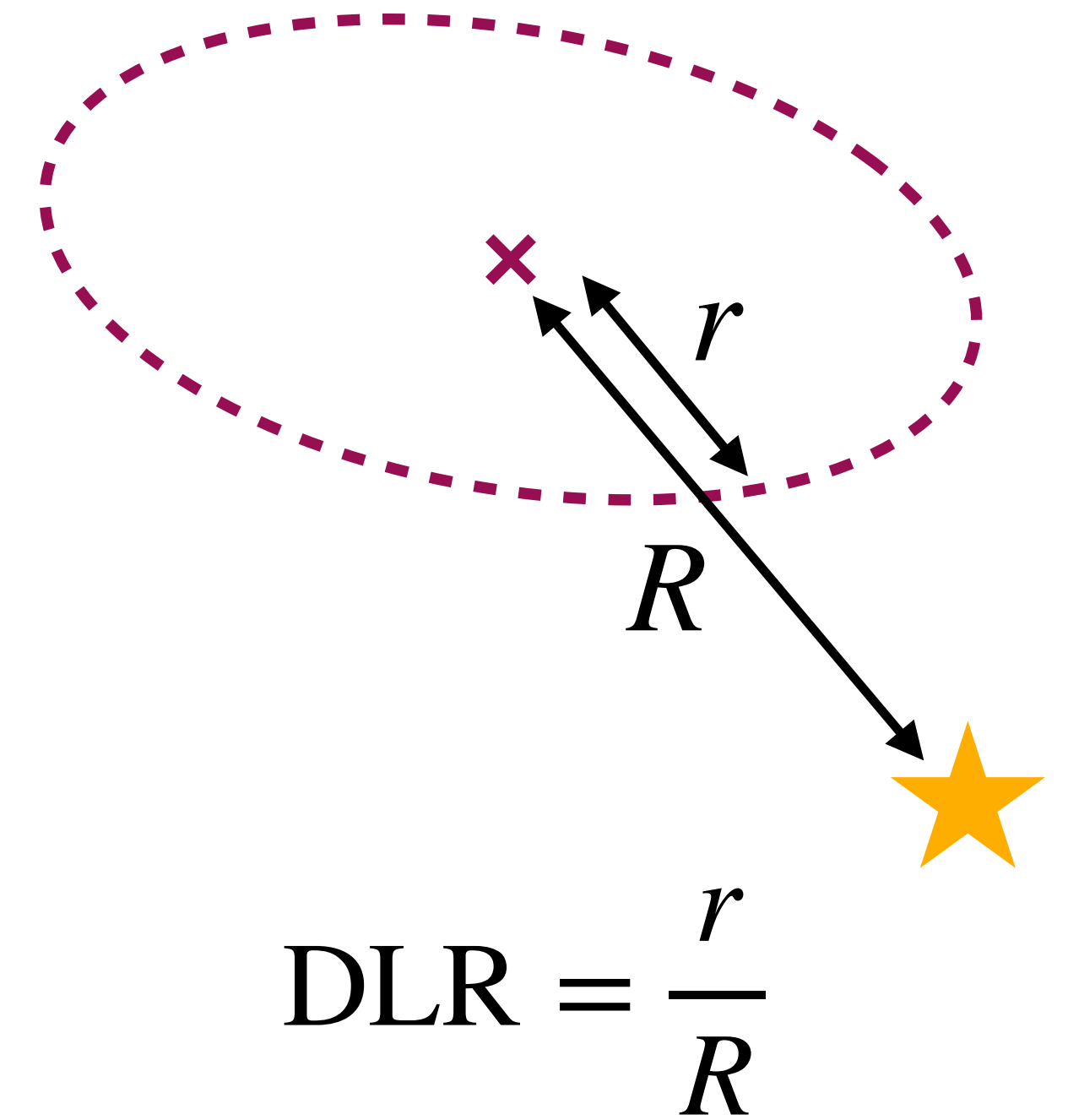
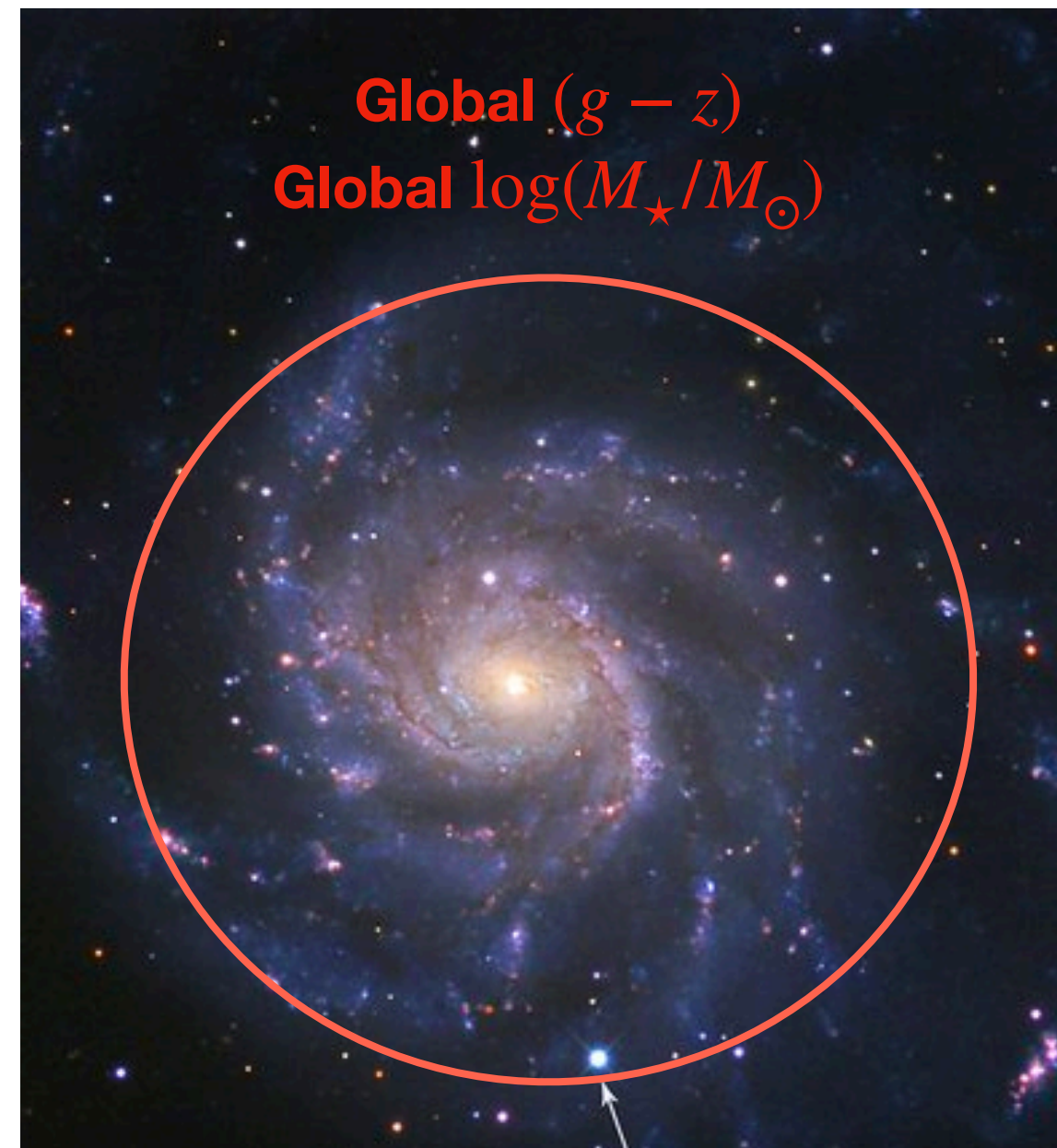
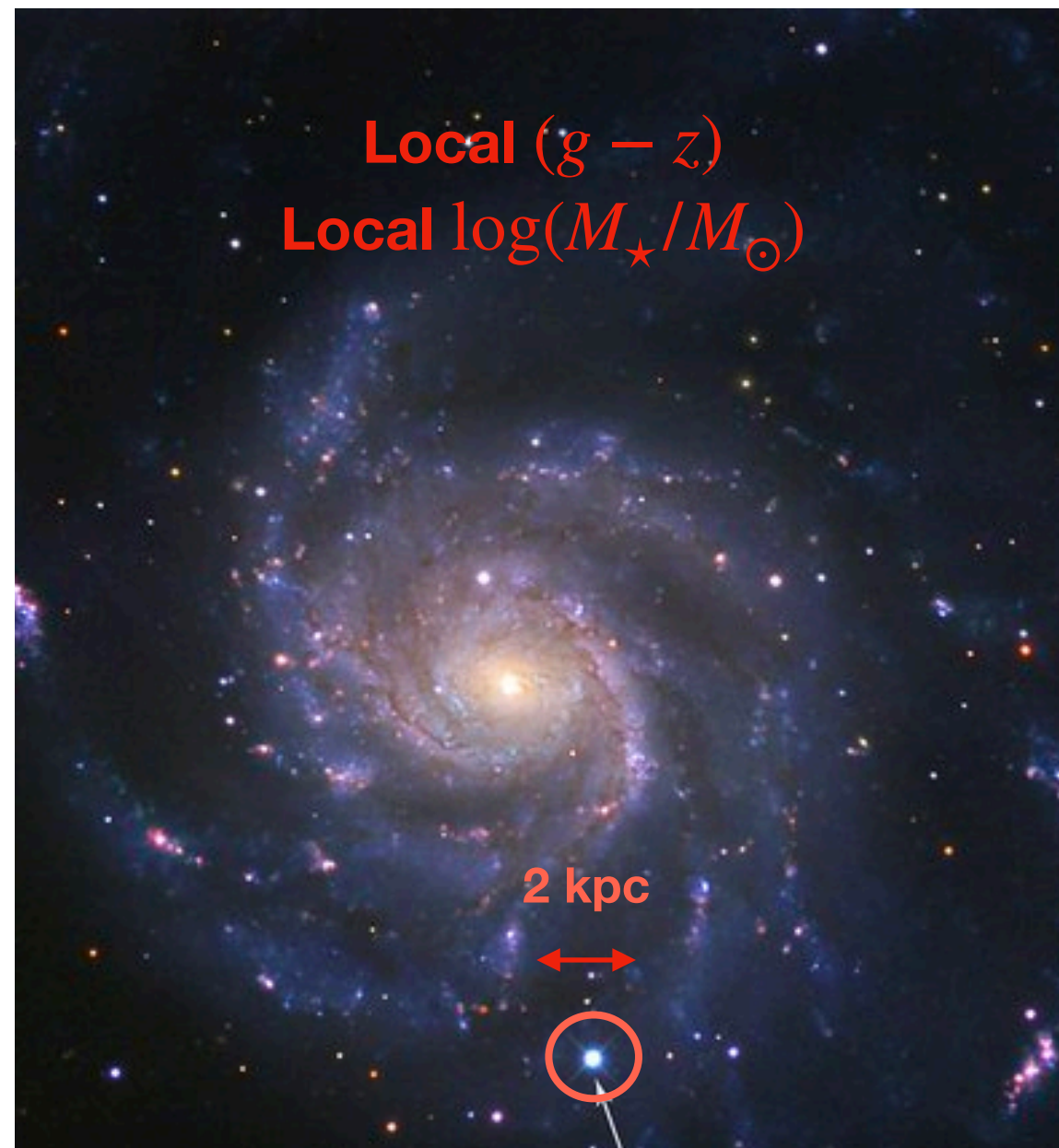
➔ **889 SNe** in the final sample





# ZTF DR2

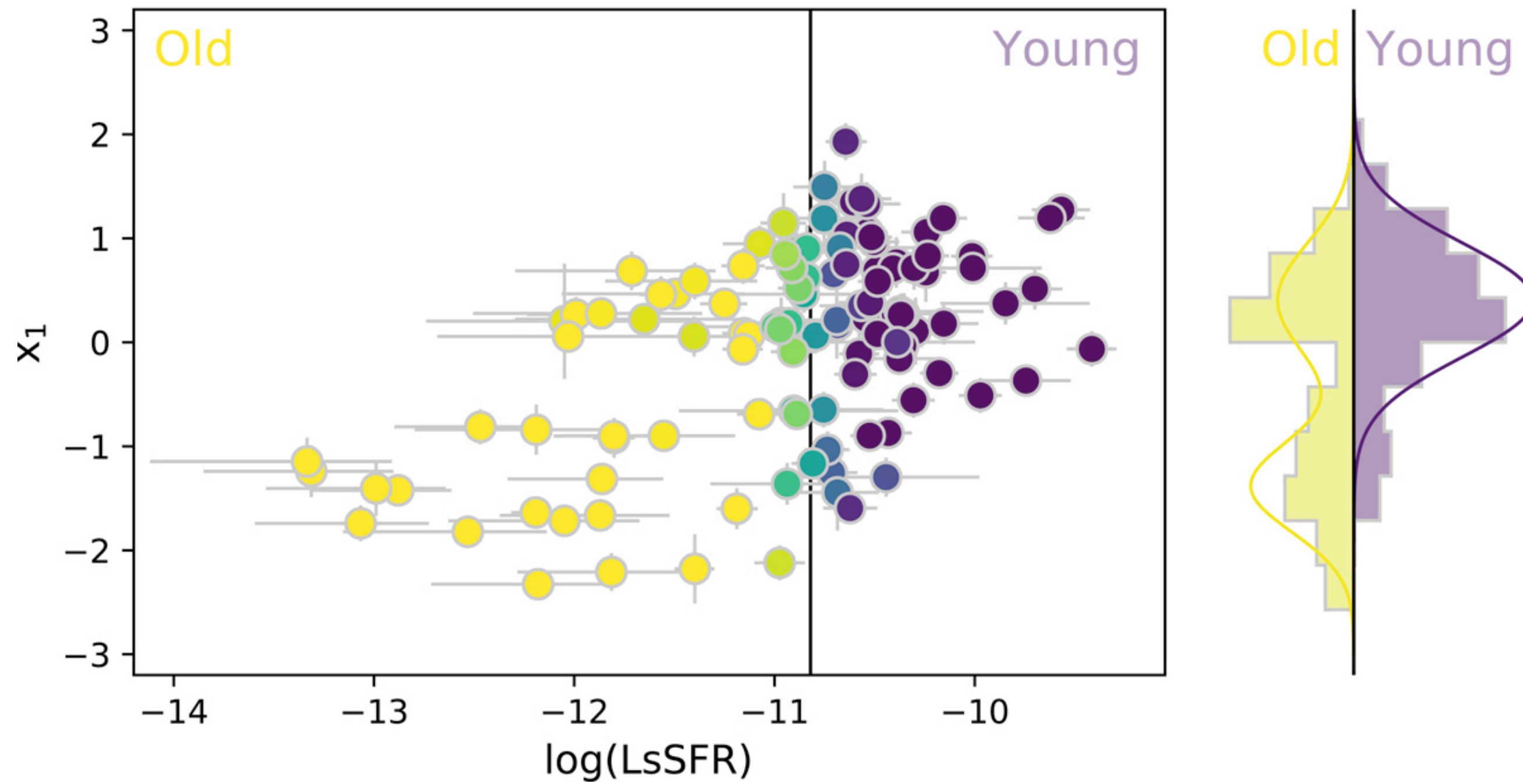
## Host properties



DLR technique  
(Sullivan et al 2006, Gupta et al 2016)

# Standardisation

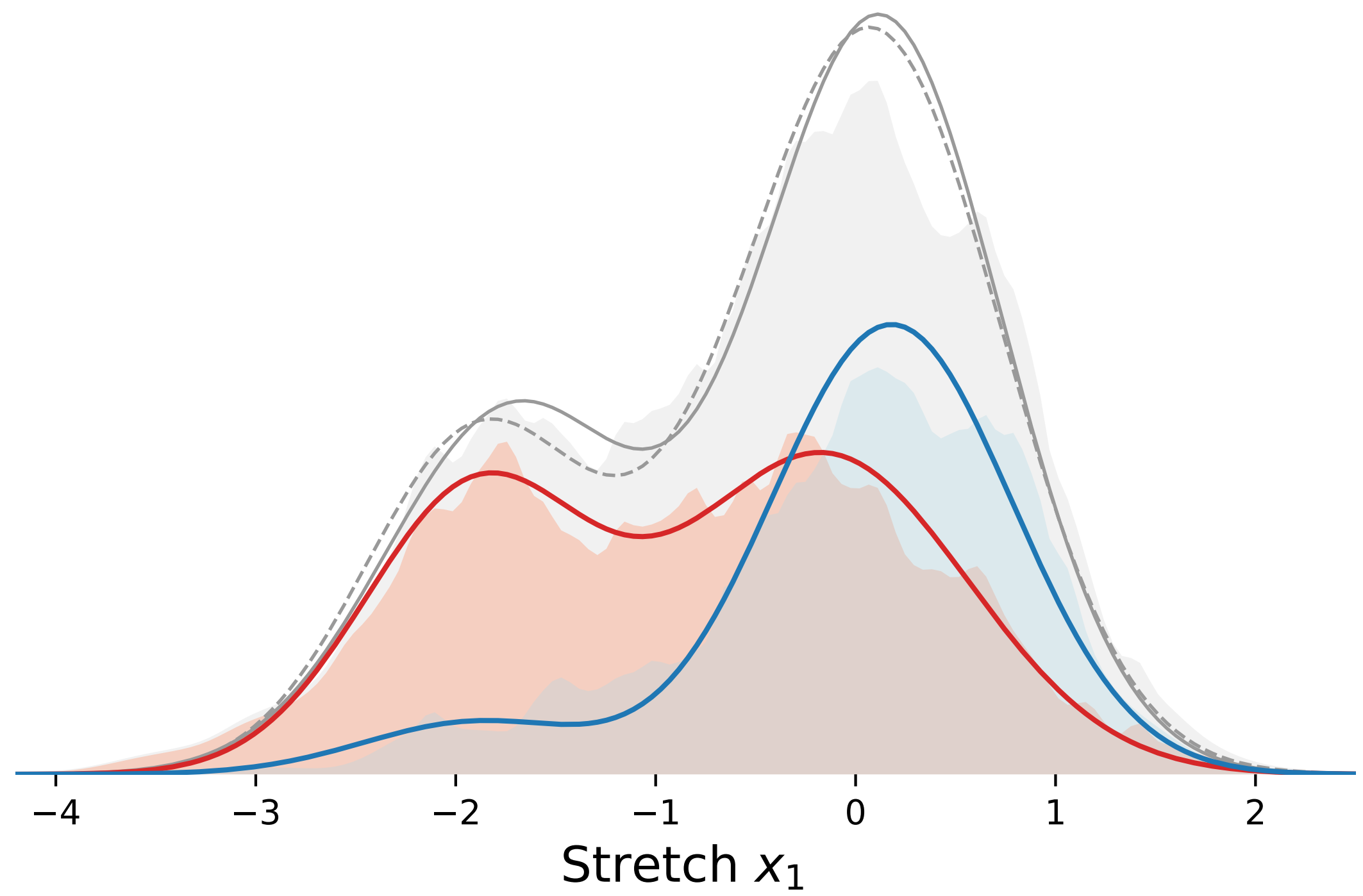
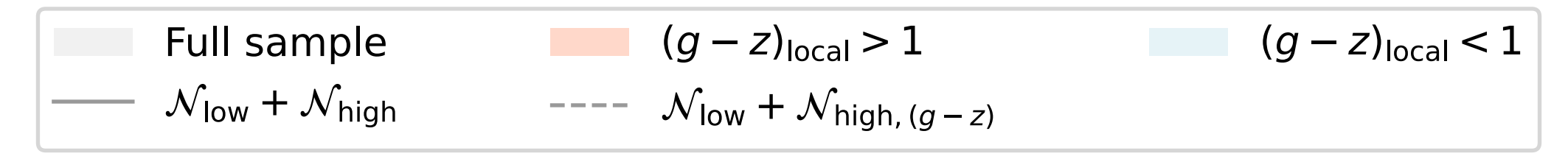
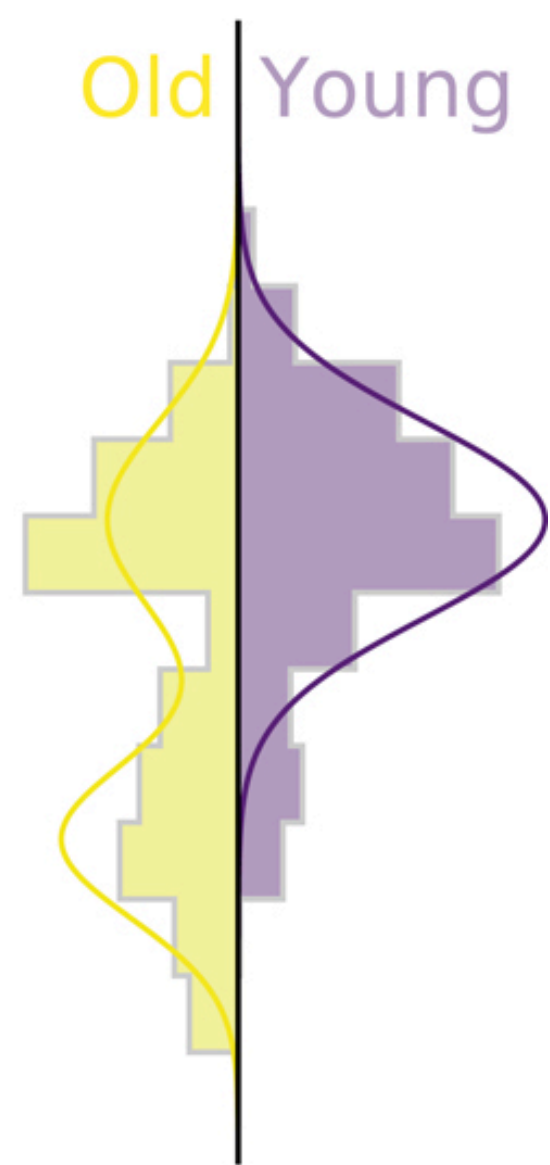
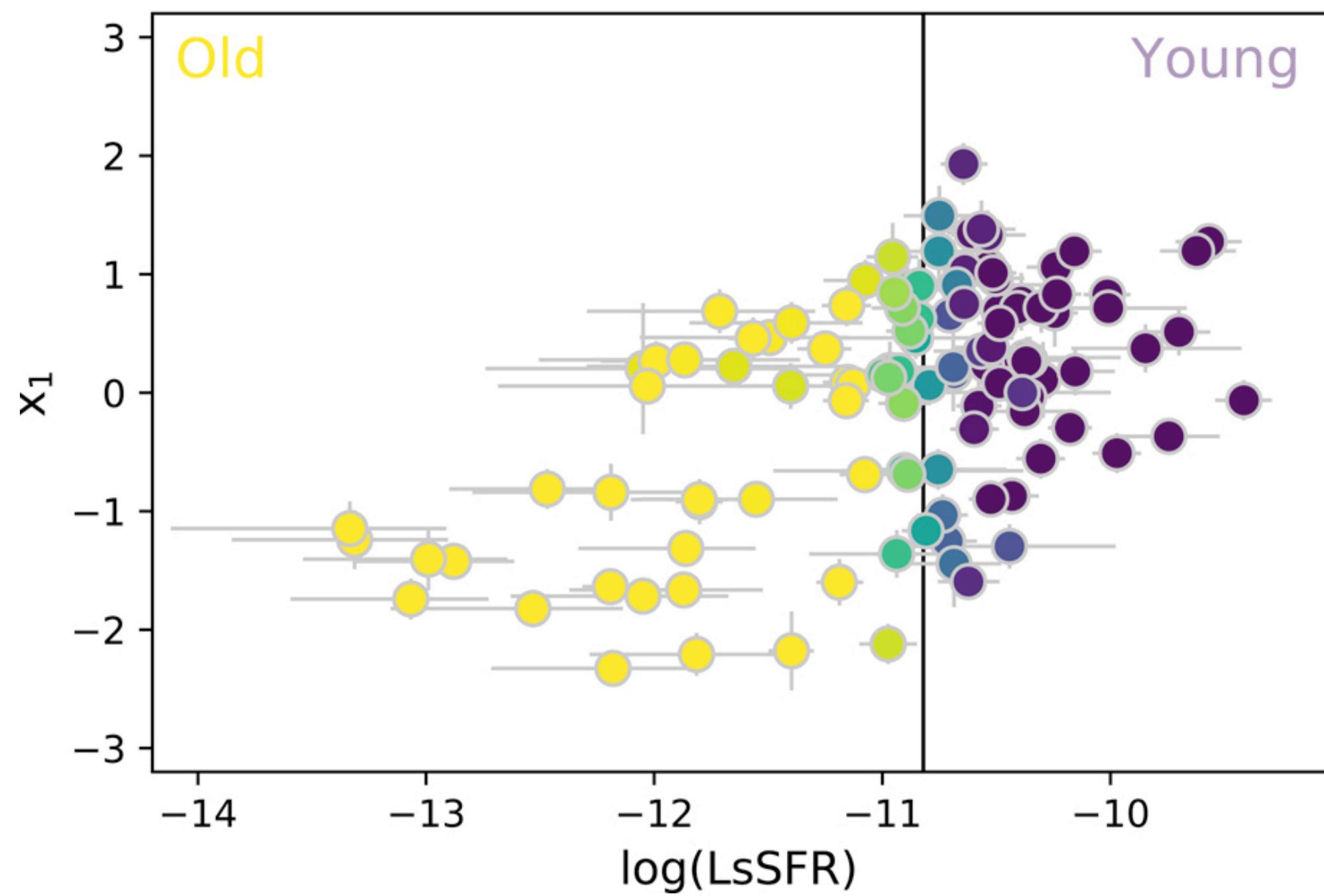
## Stretch distribution



Nicolas et al (2021)  
SNF - 114 SNe

# Standardisation

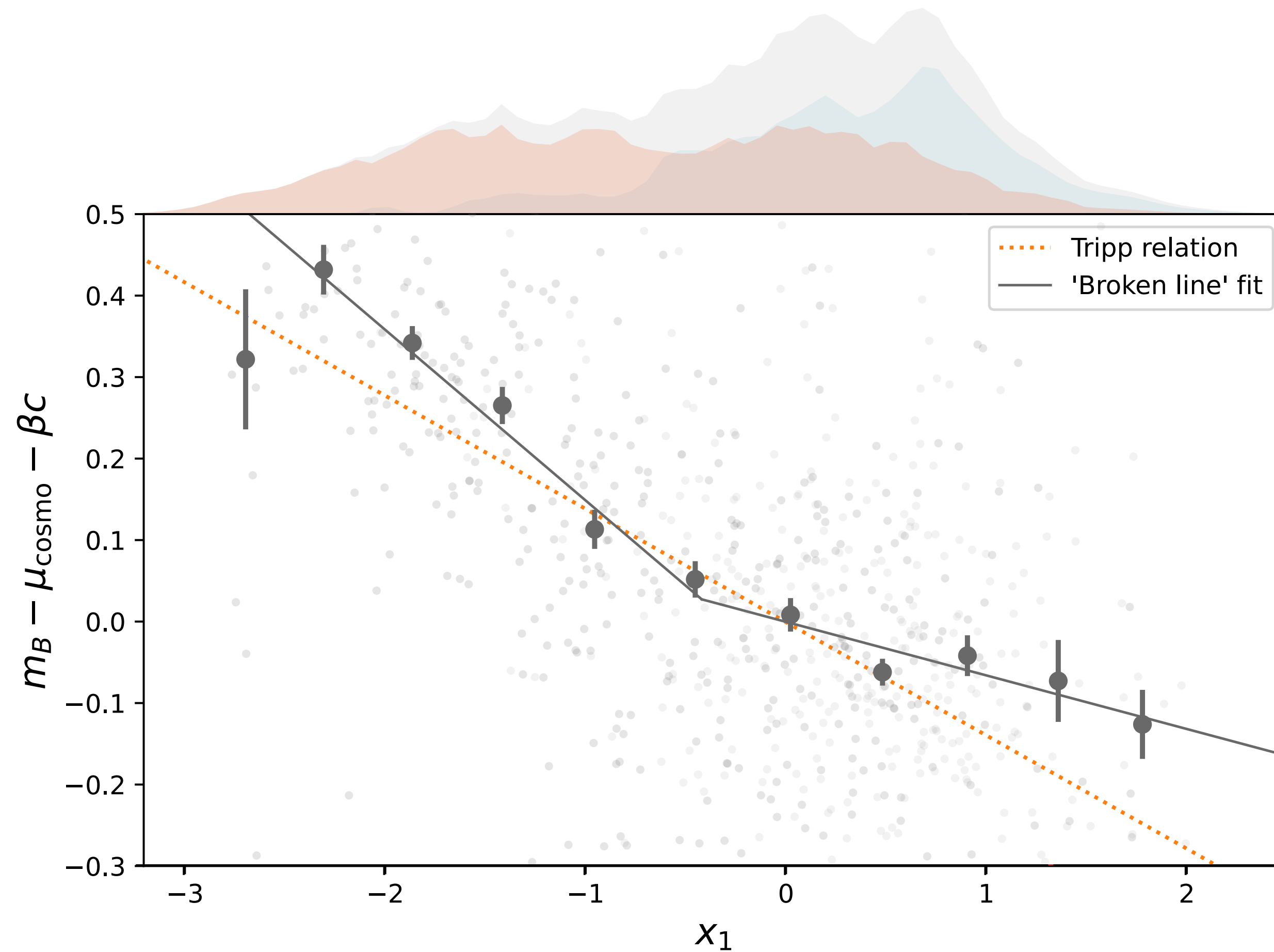
## Stretch distribution



Nicolas et al (2021)  
SNF - 114 SNe

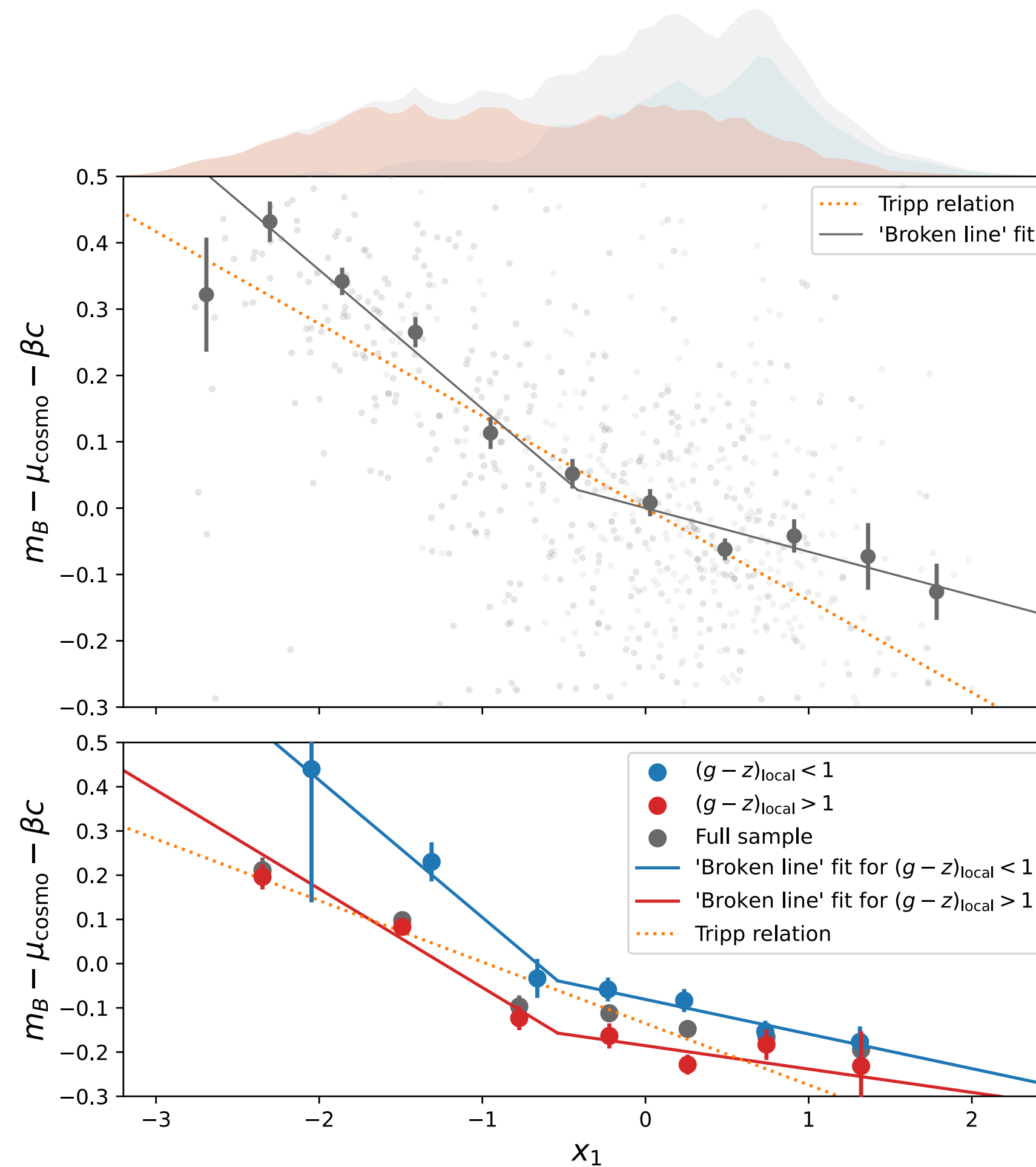
# Standardisation

## Non linearity of the stretch-residuals relation



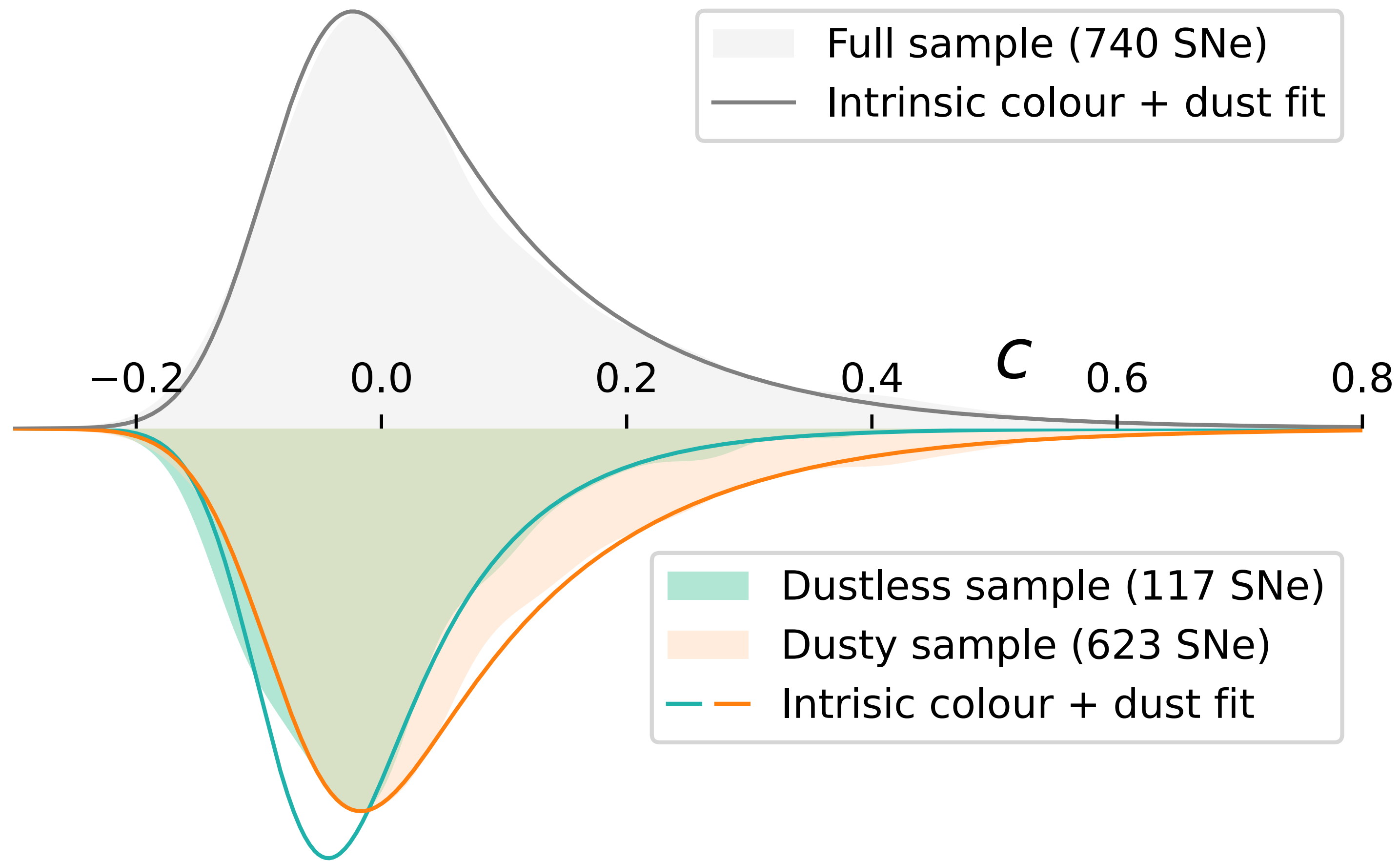
# Standardisation

## Non linearity of the stretch-residuals relation

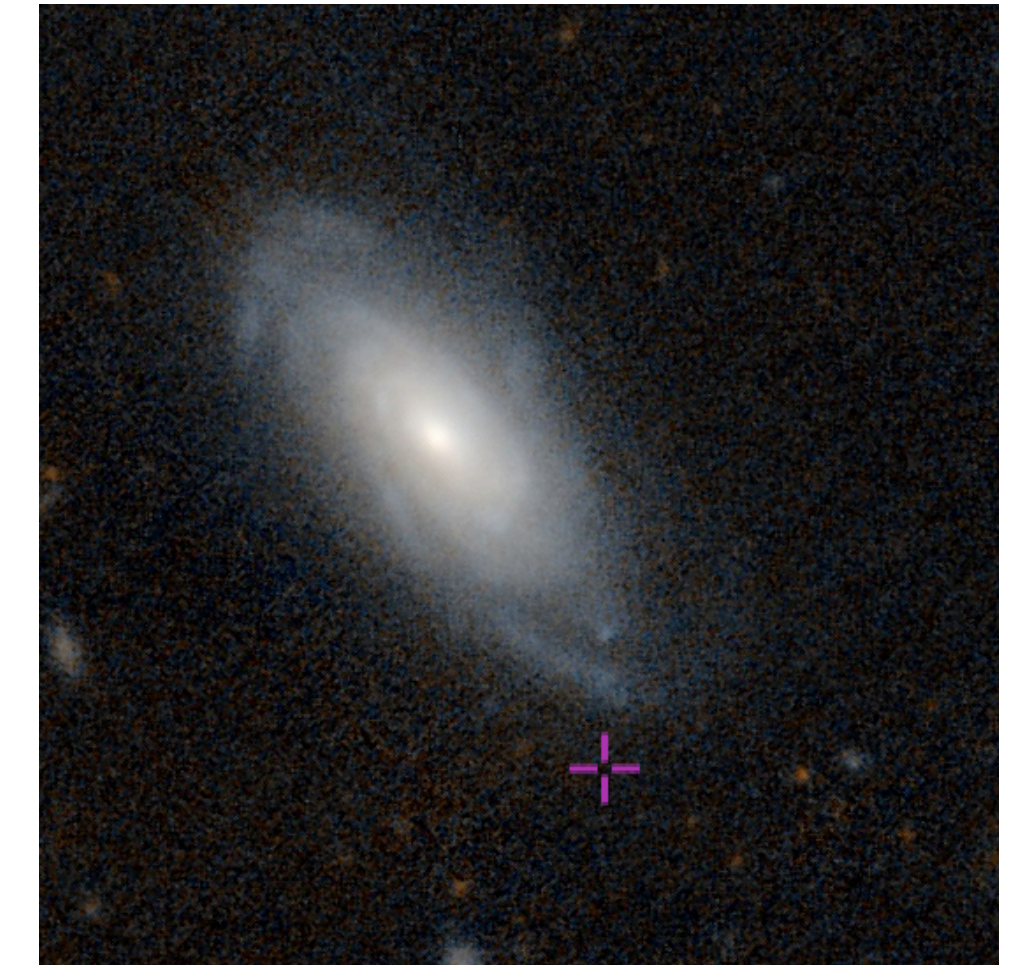


# Standardisation

## Colour distribution

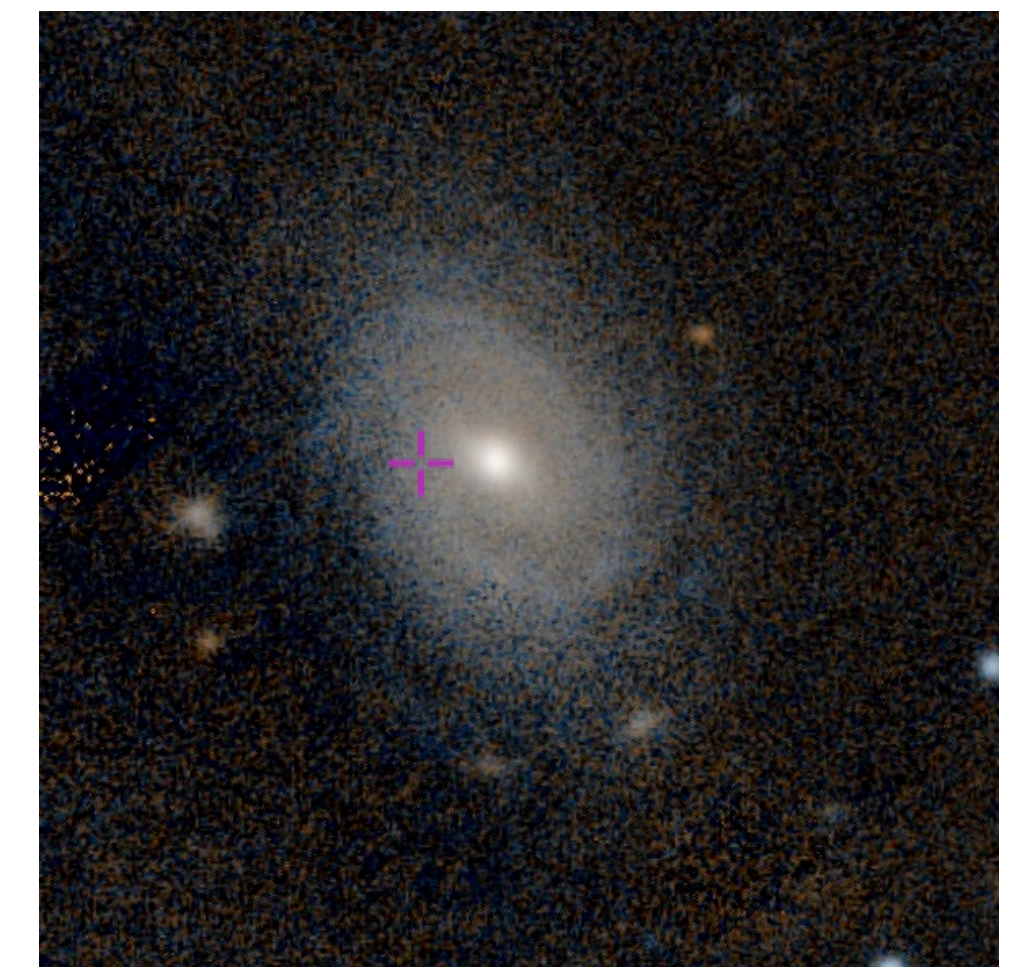


« Dustless » example



ZTF18aahfze

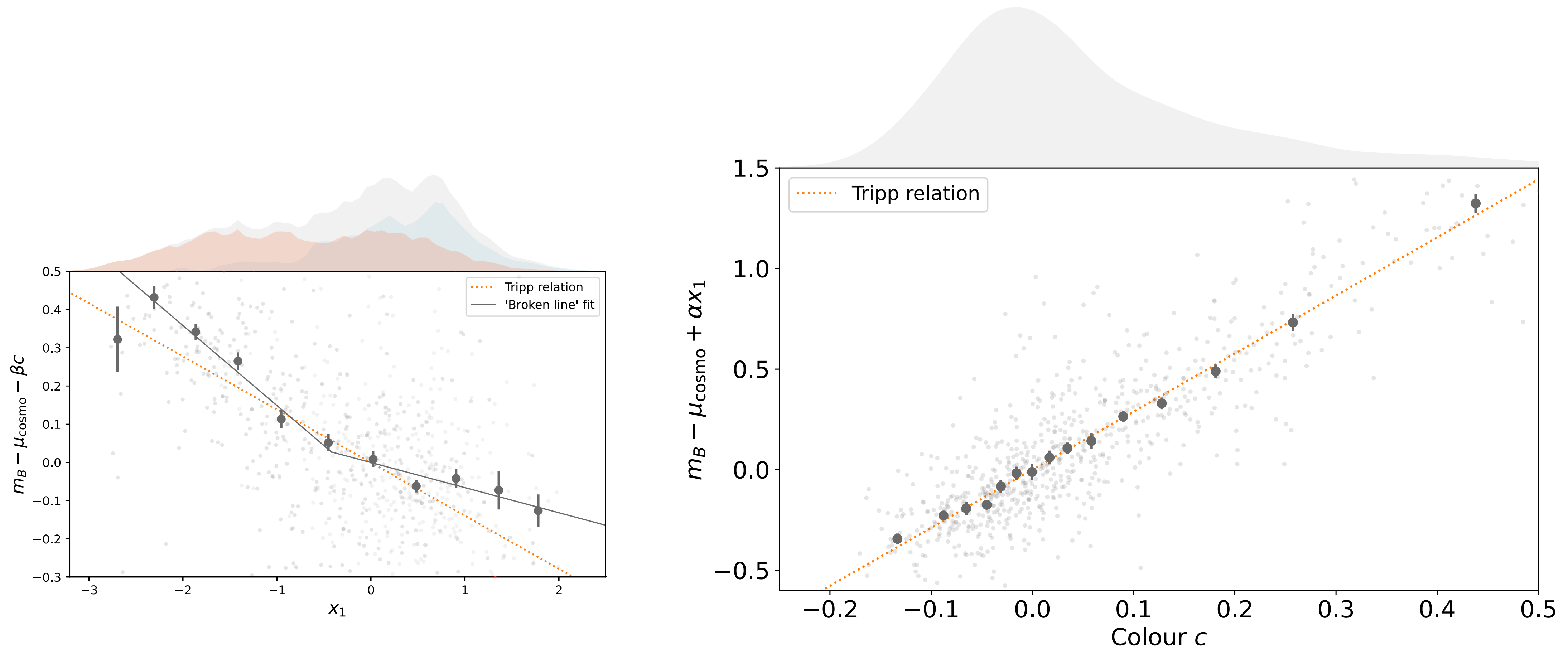
« Dusty » example



ZTF18aaqfziz

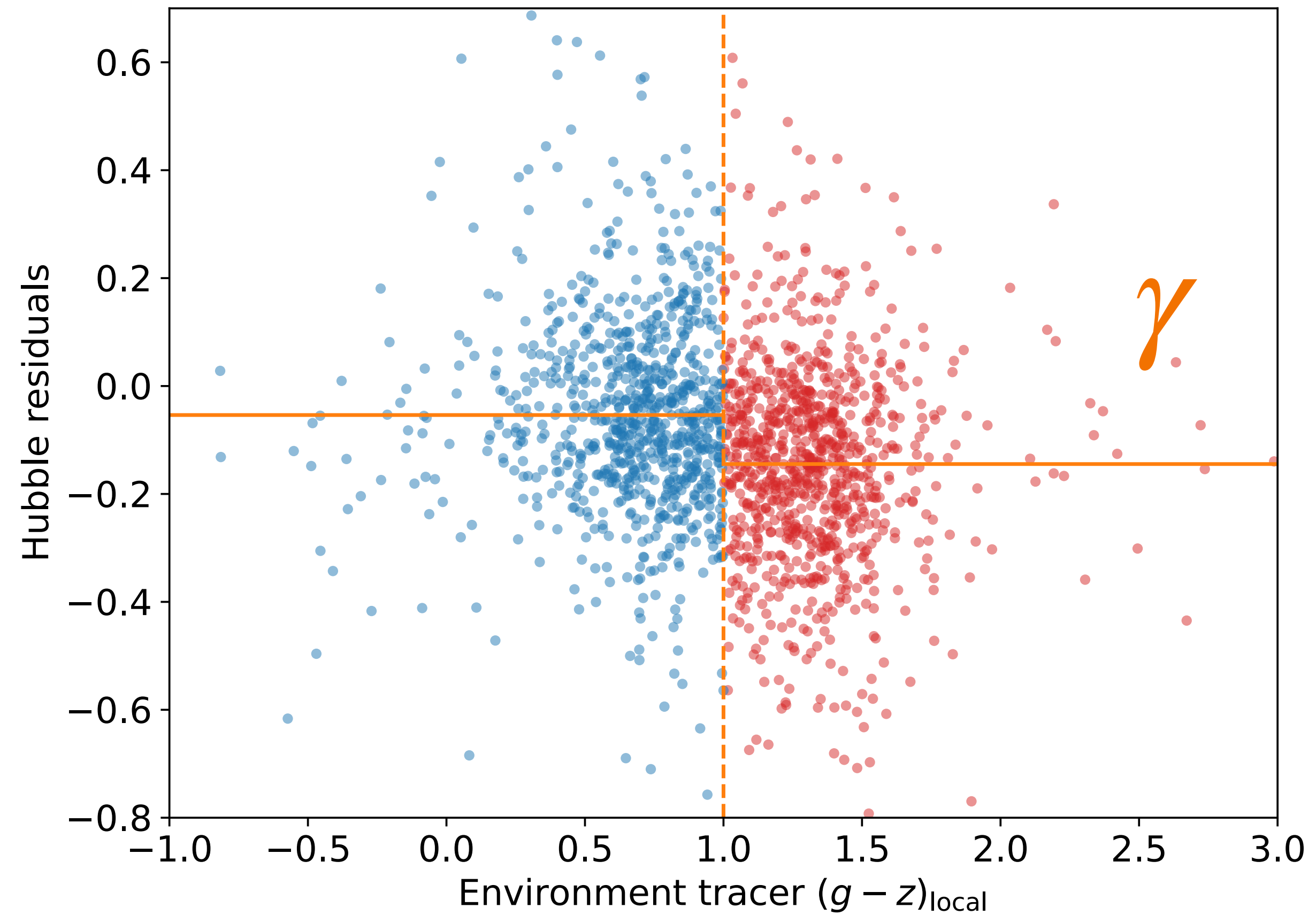
# Standardisation

## Linearity of the colour-residuals relation



# Standardisation

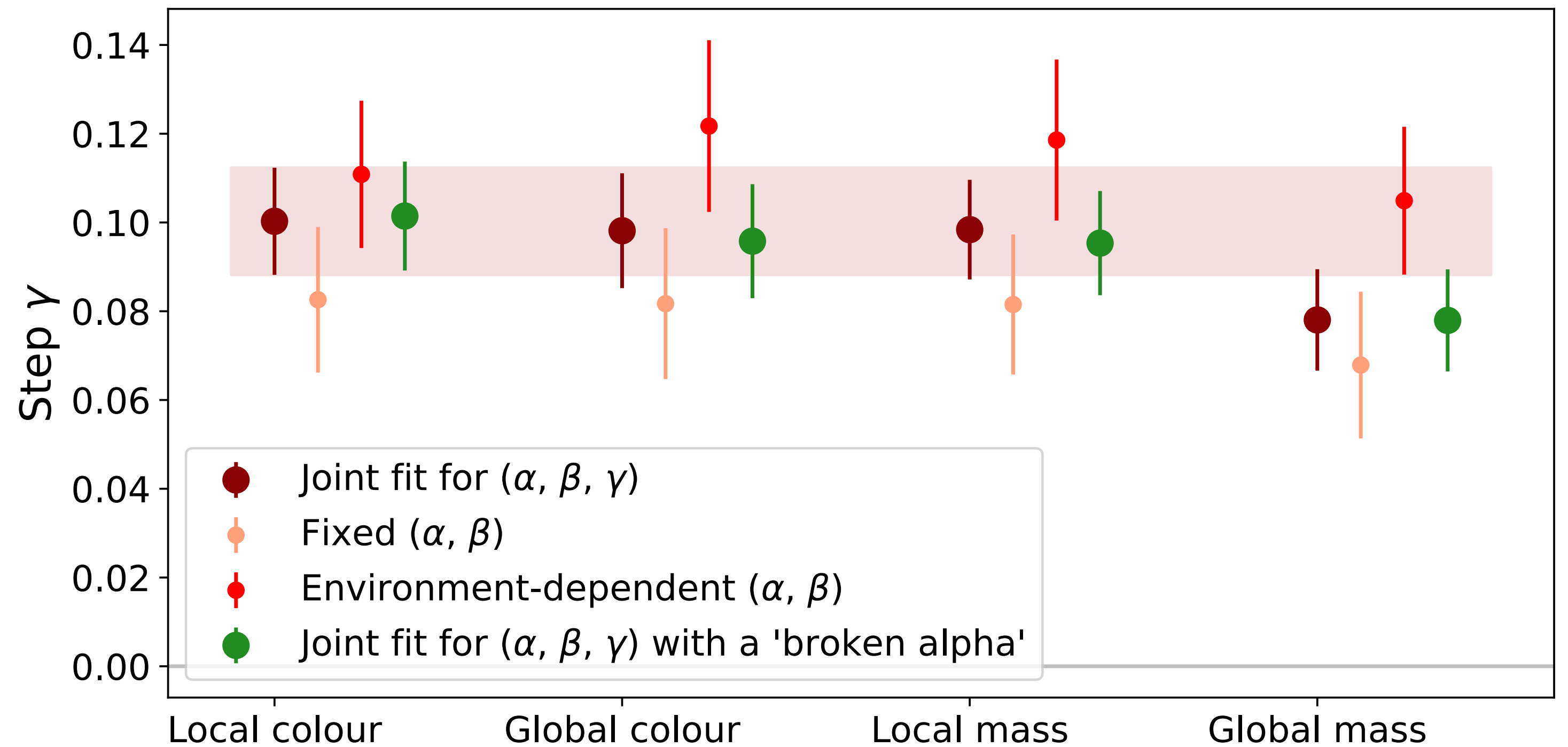
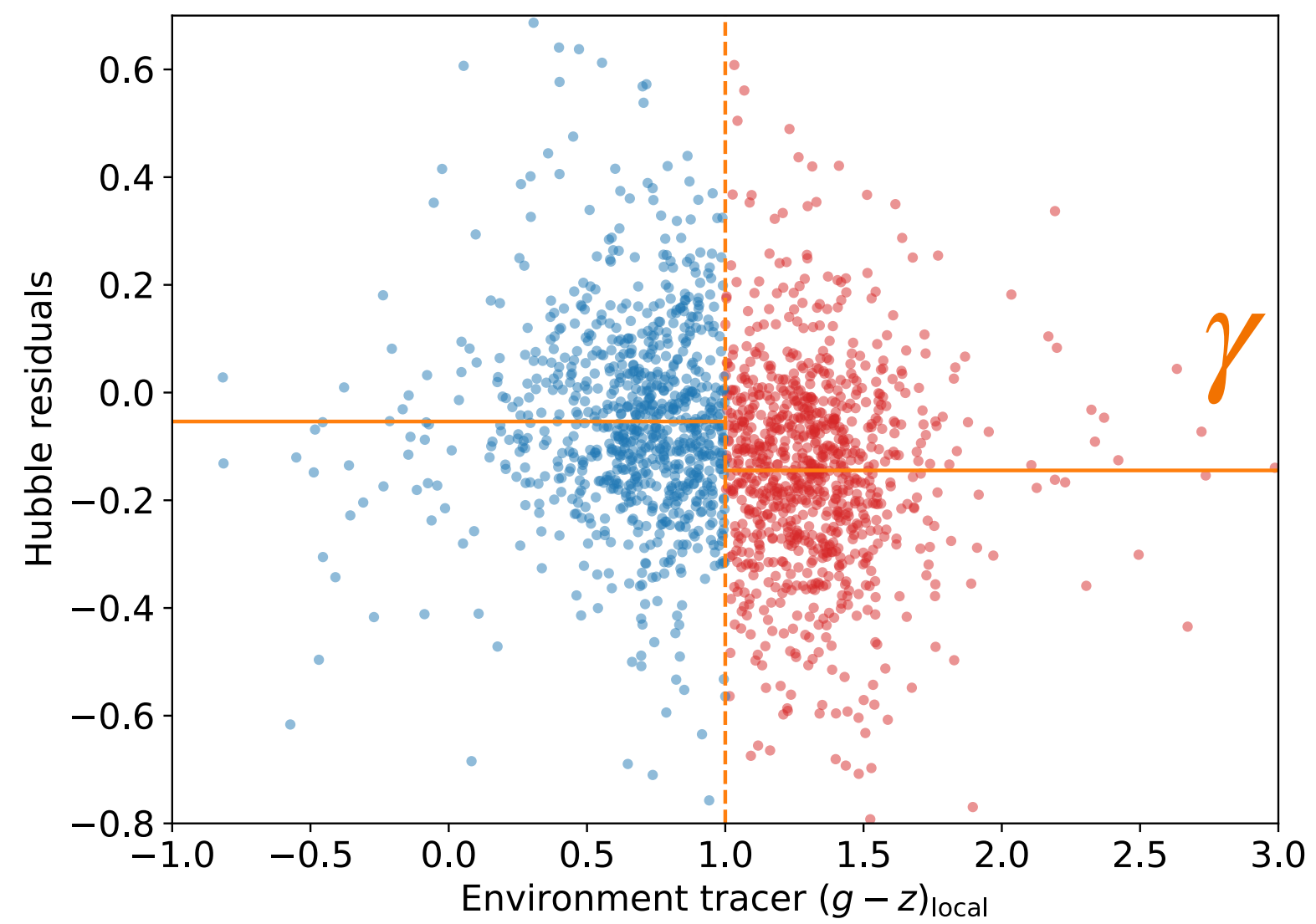
## Steps





# Standardisation

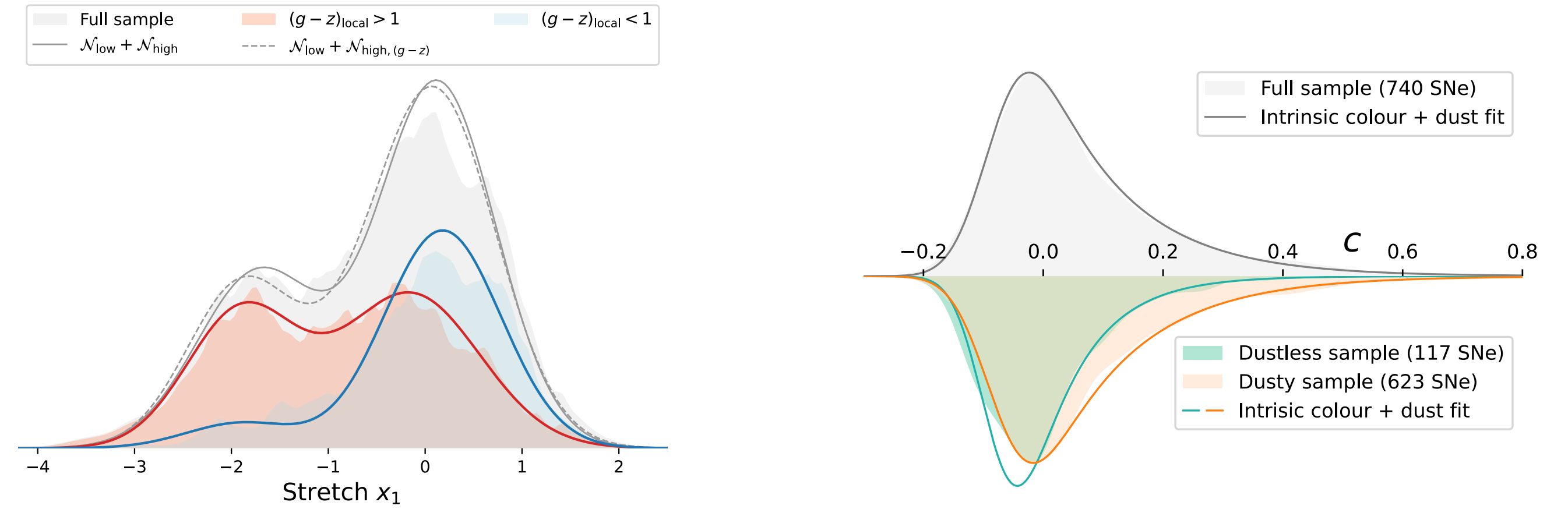
## Step dependency on tracer



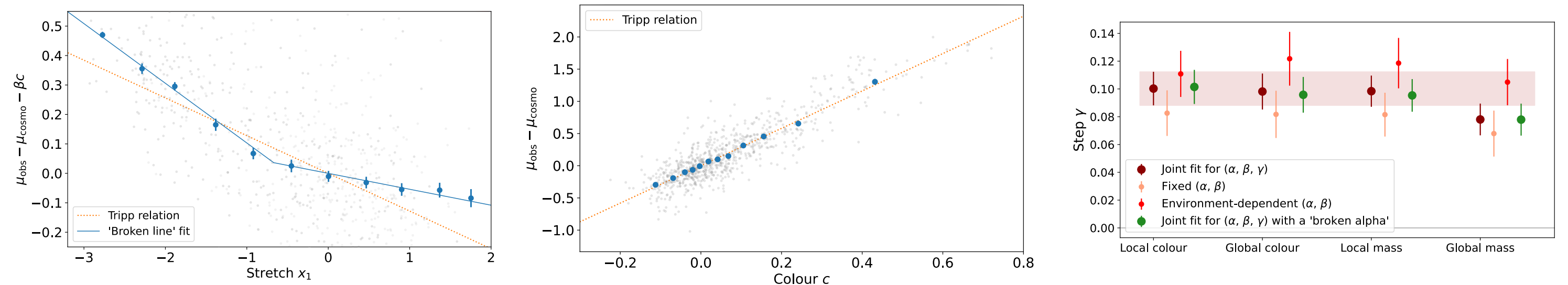
# Conclusion

ZTF DR2

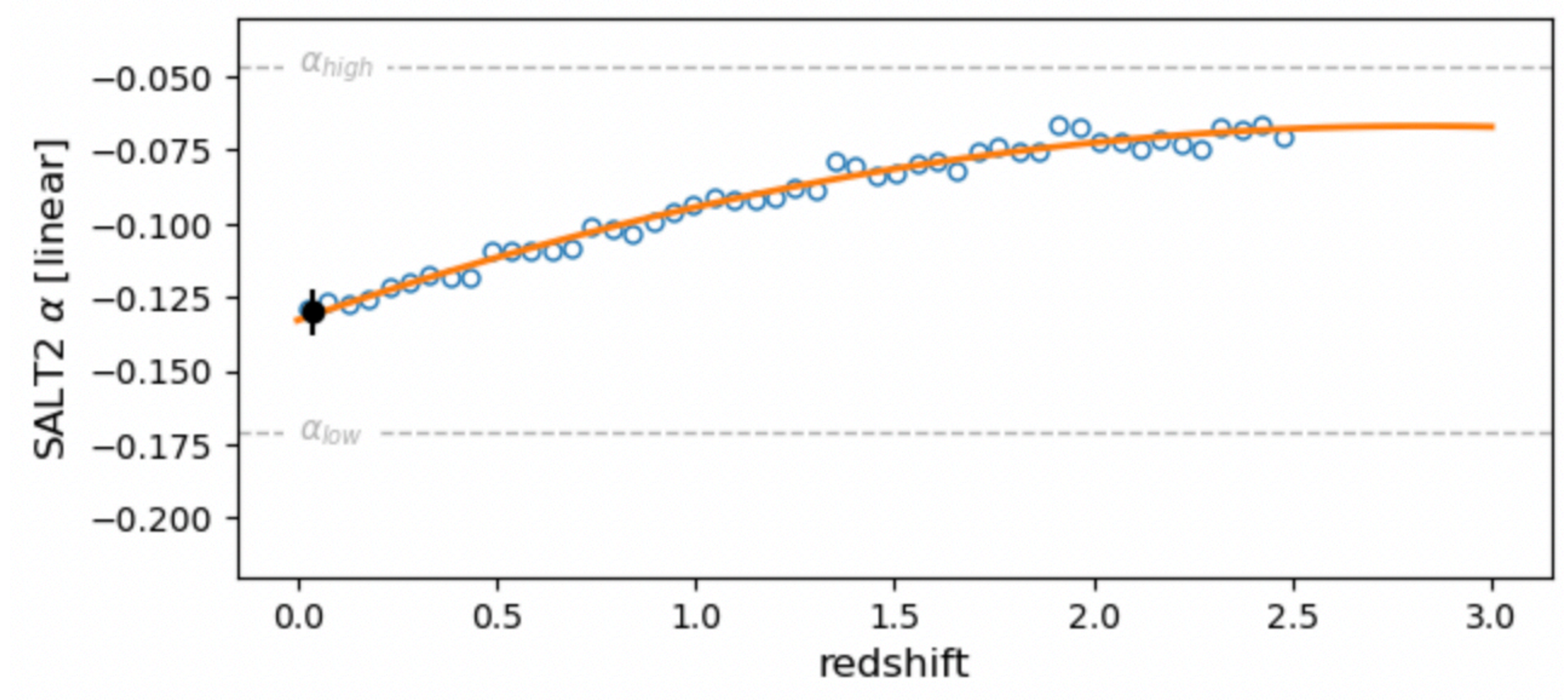
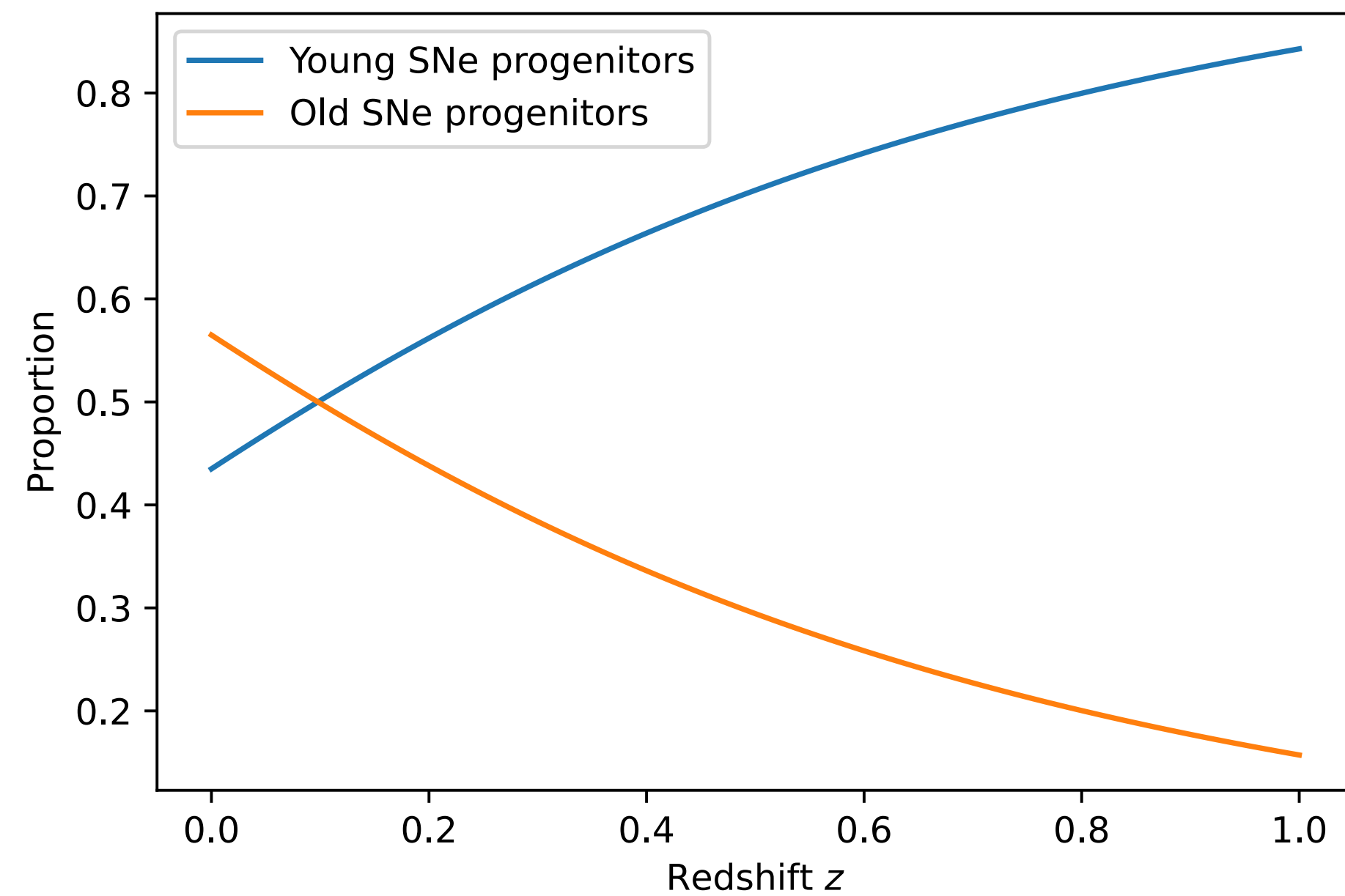
## Supernovae physical properties



## Standardisation dependency on environment



# $\alpha$ evolution with redshift



# Steps & contamination - Briday et al (2021)

