Star Formation VS Mergers

The stellar mass growth of massive galaxies from z=3 using number density selection techniques

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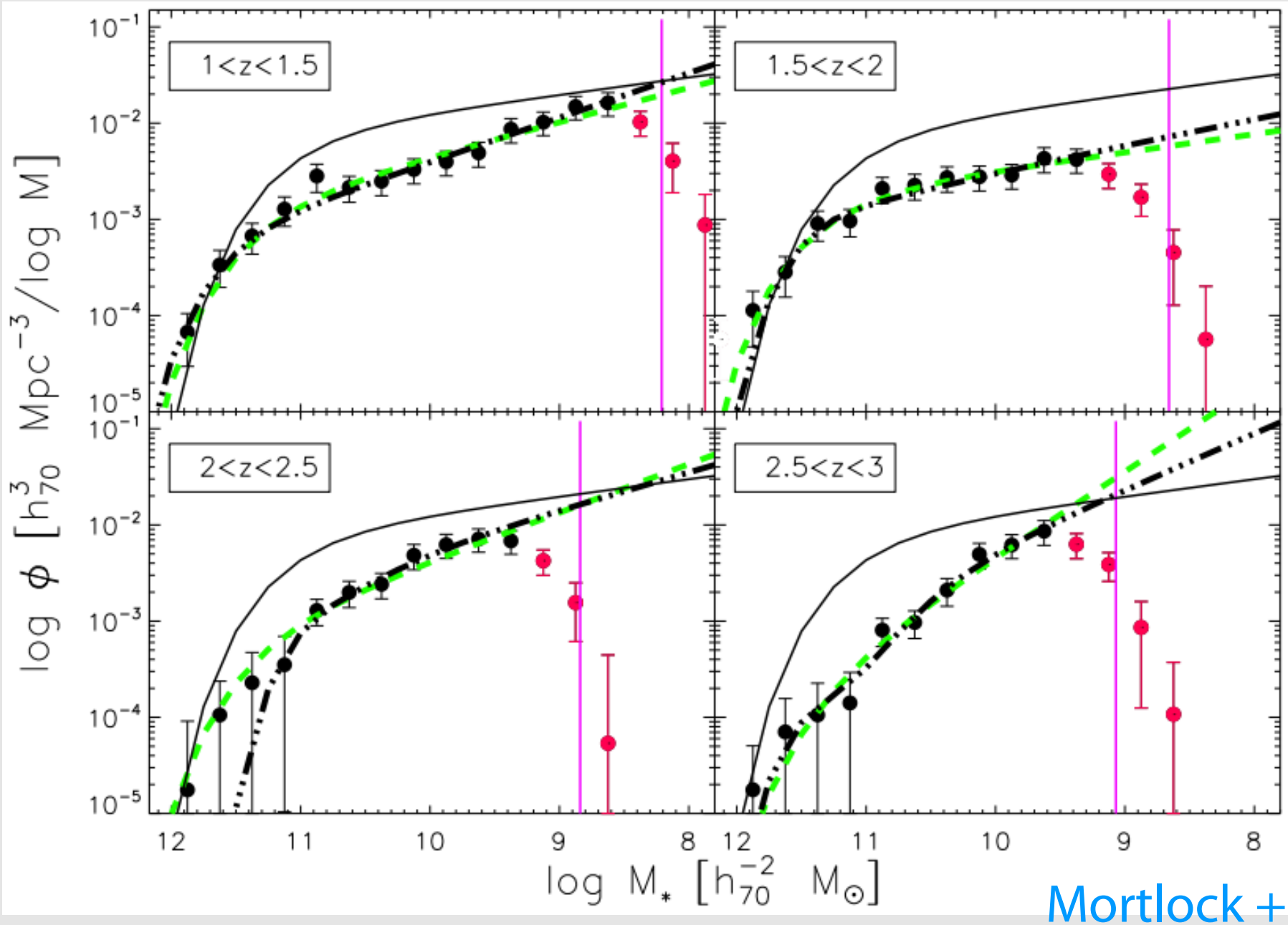
DEX workshop Jan 2014

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

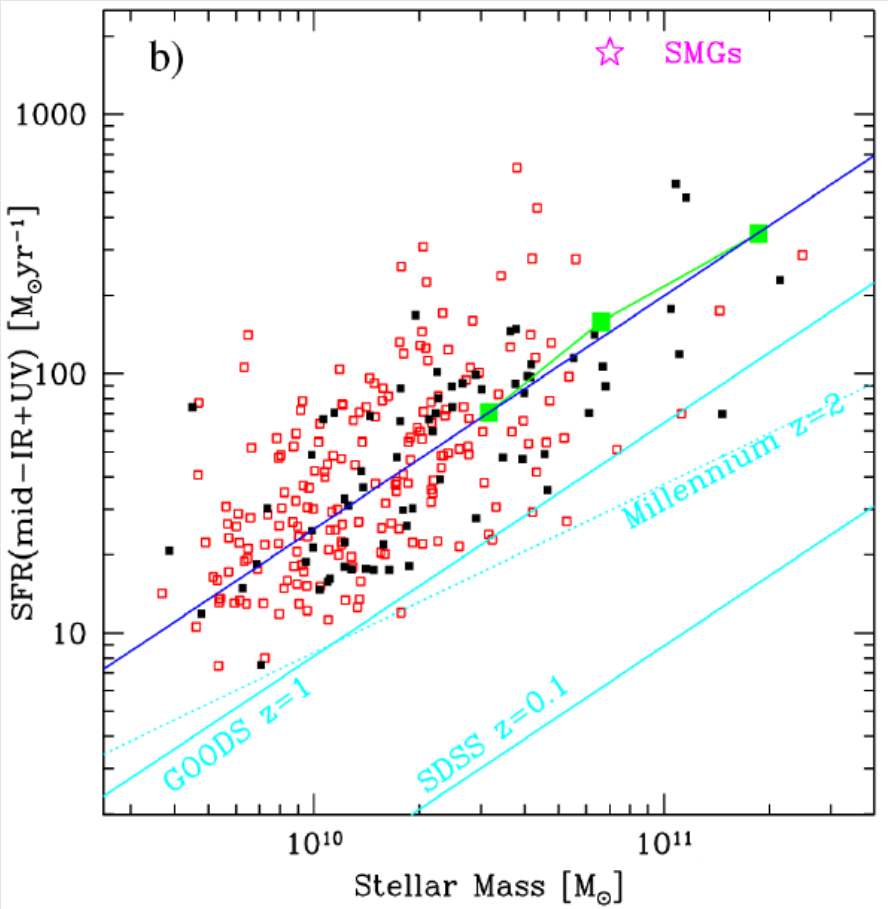
Introduction



Mortlock +11

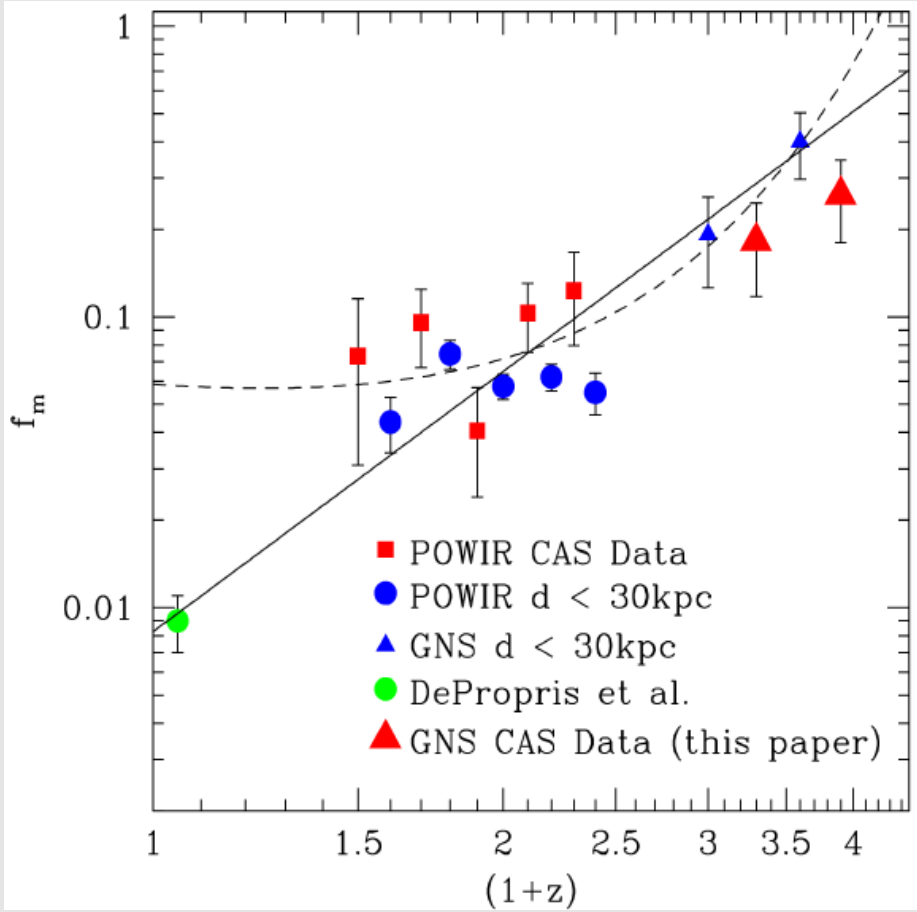
Introduction

Star Formation



Daddi +07

Mergers



Bluck +12

This Work

Investigate the processes that drive the stellar mass growth of massive galaxies over $0.3<z<3.0$

- Dominant process in stellar mass growth?
- How does this vary in redshift?
- Disentangle Major and Minor mergers

UKIDSS Ultra Deep Survey

Deep infra-red survey covering ~0.8 sqr deg

Limiting magnitudes achieved so far (AB, 5σ, 2" aperture):

DR8:

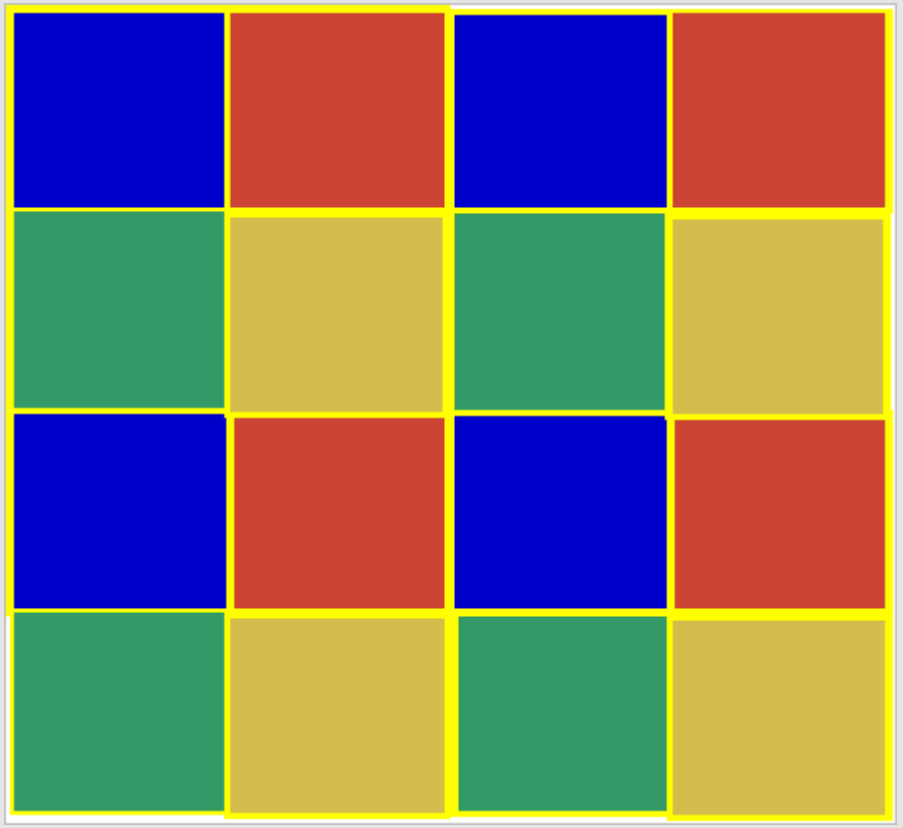
J=24.9, H=24.2, K=24.6

(504 hours)

DR10:

J=25.3, H=24.8, K=25.0

(840 hours)



0.8 square deg

Stellar masses and photometric redshifts derived from SED fitting to 11 bands

- U, B, V, R, i, z, J, H, K, IRAC 1, IRAC 2

Star Formation Rates

UV 2800A derived SFRs

$$SFR_{UV}(\mathrm{M_\odot yr^{-1}}) = 8.24 \times 10^{-29} L_{2800}(\mathrm{ergs\,s^{-1}\,Hz^{-1}})$$

Kennicutt +98

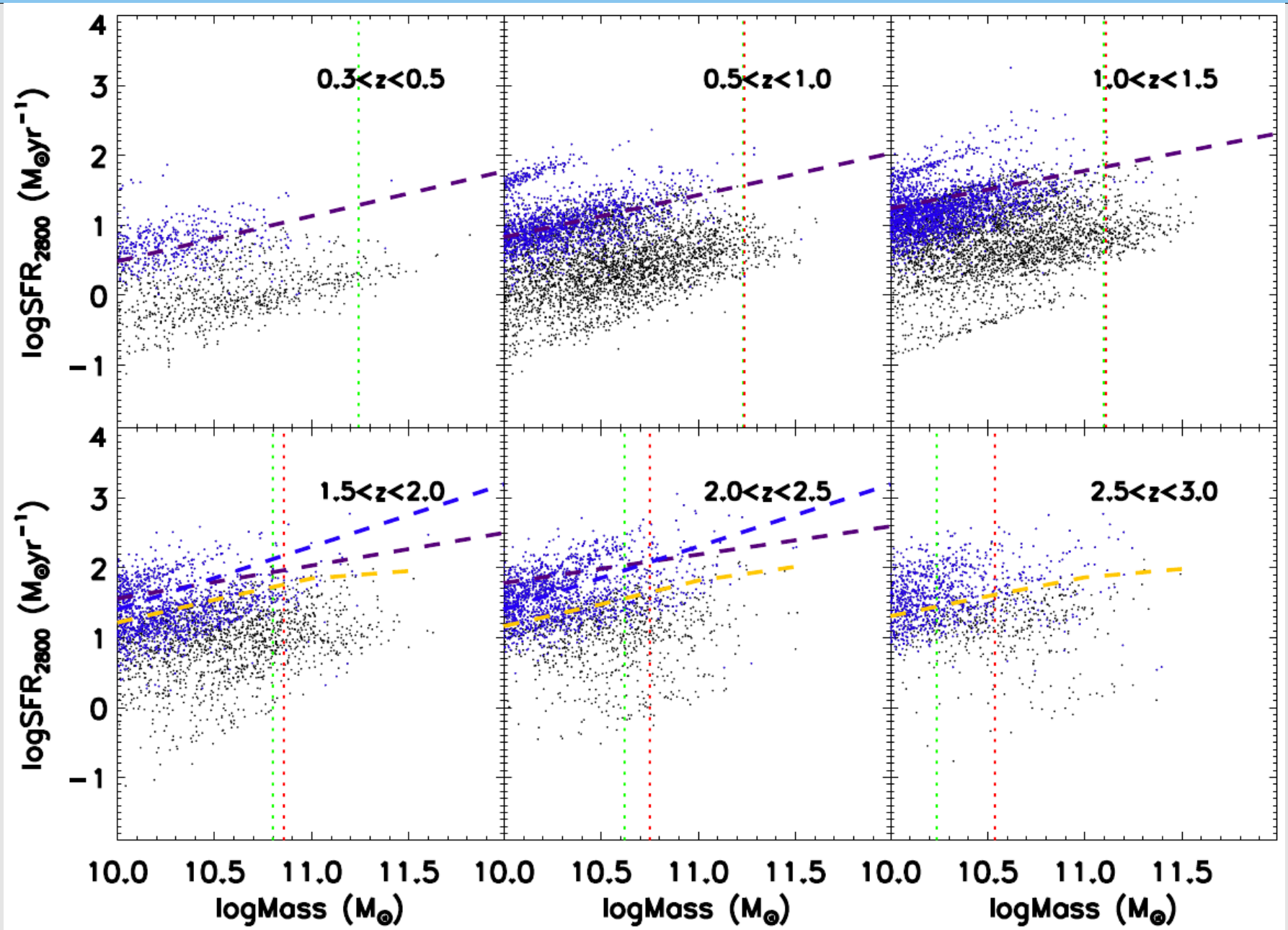
Dust correction from SED fitted UV slope

$$A_{2800} = 1.67\beta + 3.71$$

Merurer +99 Fischera & Dopita +05

UVJ selection technique to correct SFRs of passive galaxies

SFR VS Stellar Mass



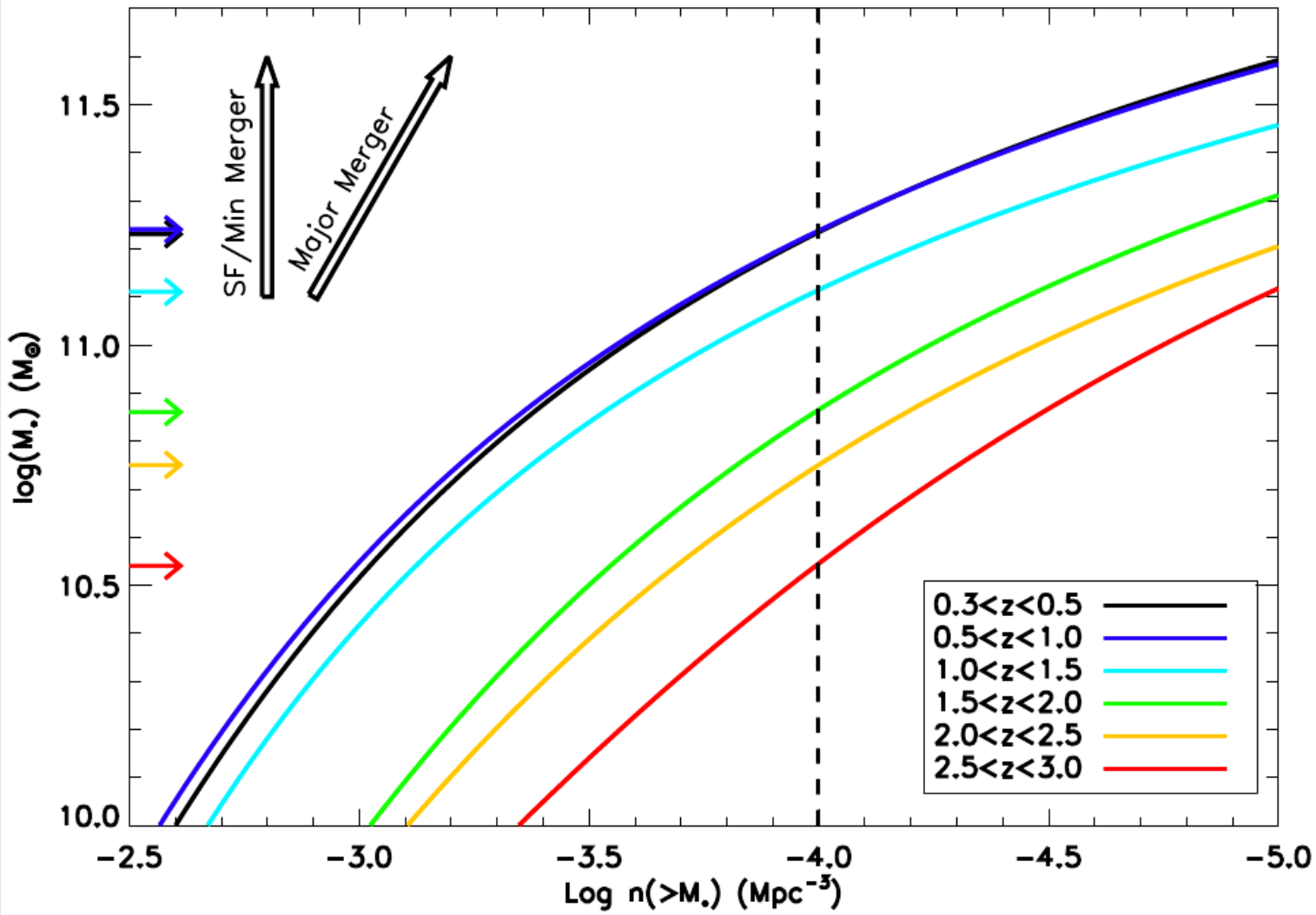
Galaxy Selection 1

Constant number density selection

- 1 X 10^-4 Mpc^-3

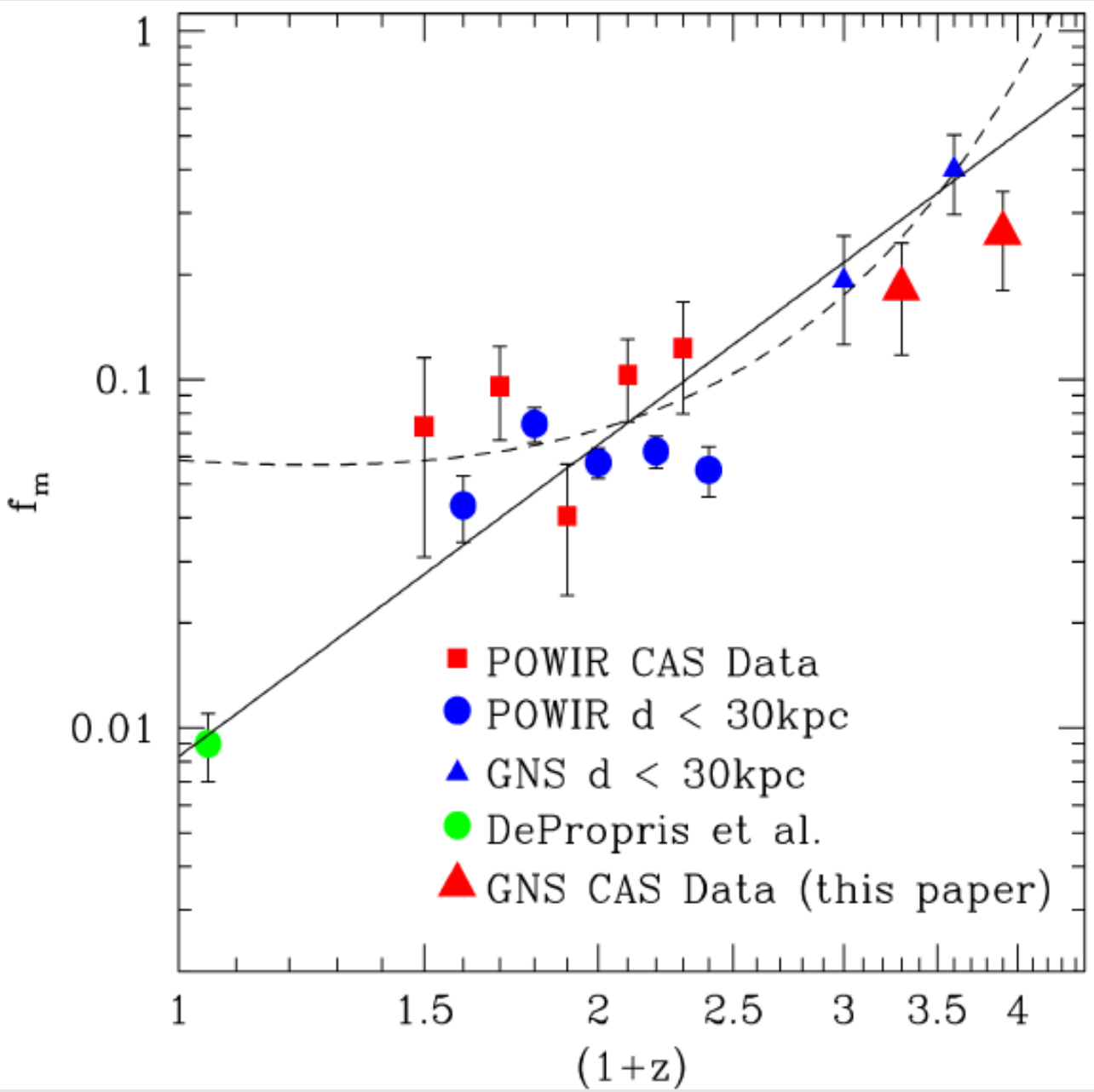
- Spacial density of the direct progenitors is invariant with time

- i.e. all massive galaxies at z=0.3 have a progenitor at all redshifts



Integrated stellar mass functions from Mortlock (in prep)

Major Mergers



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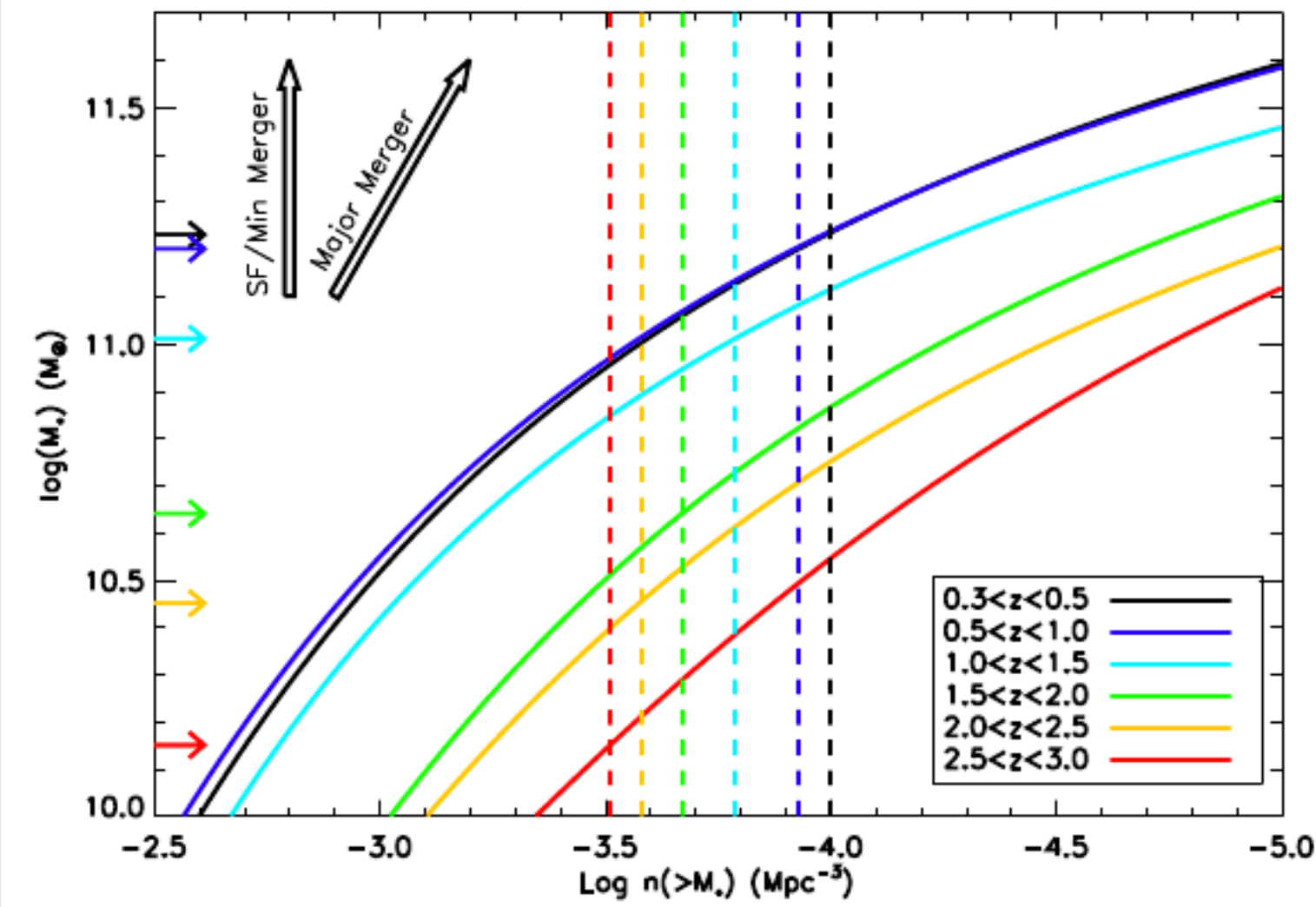
Galaxy Selection 2

Major merger adjusted number density selection

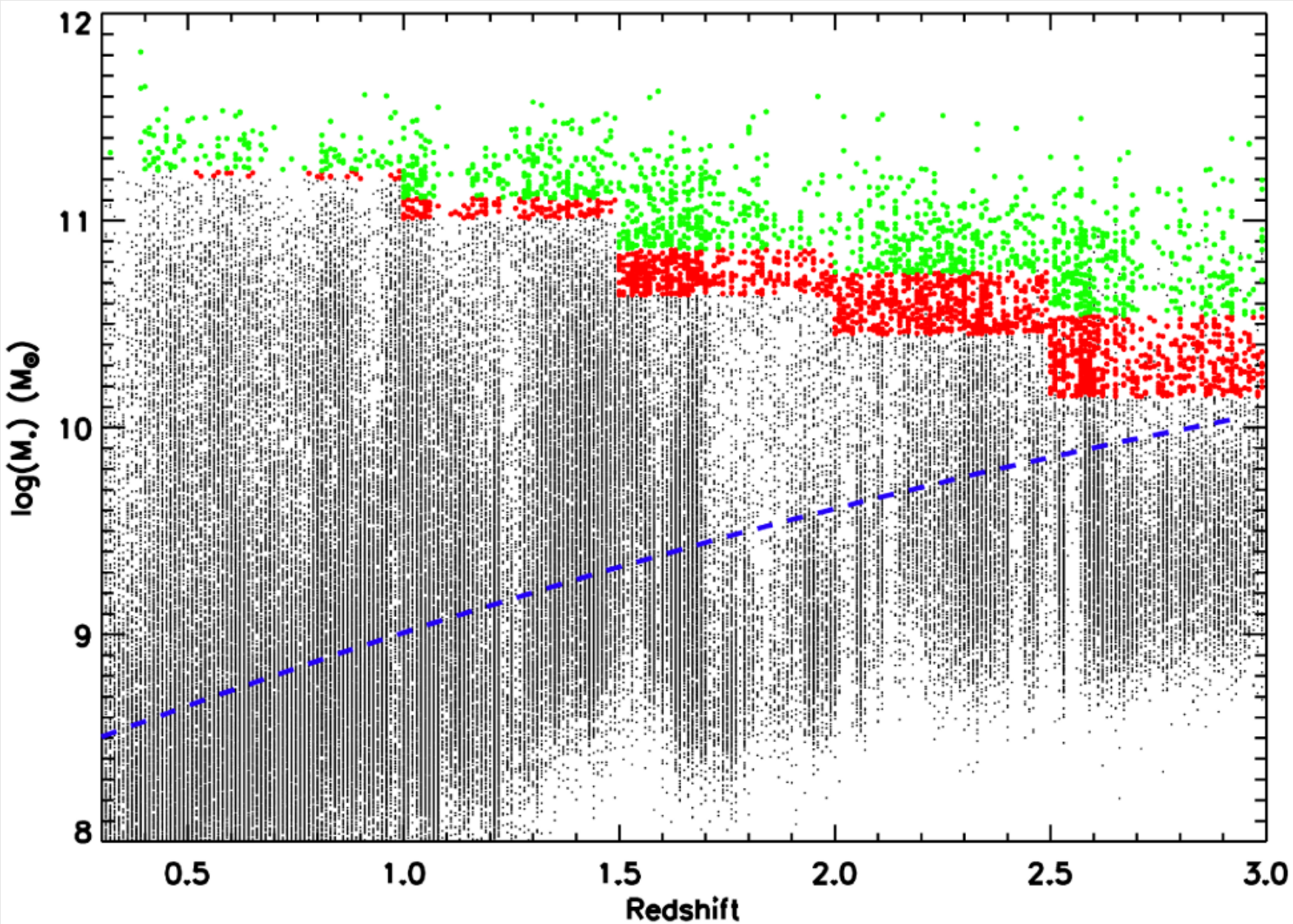
- 1 X 10^-4 Mpc^-3 at z=0.3

- Spacial density corrected to account for galaxies lost to major mergers

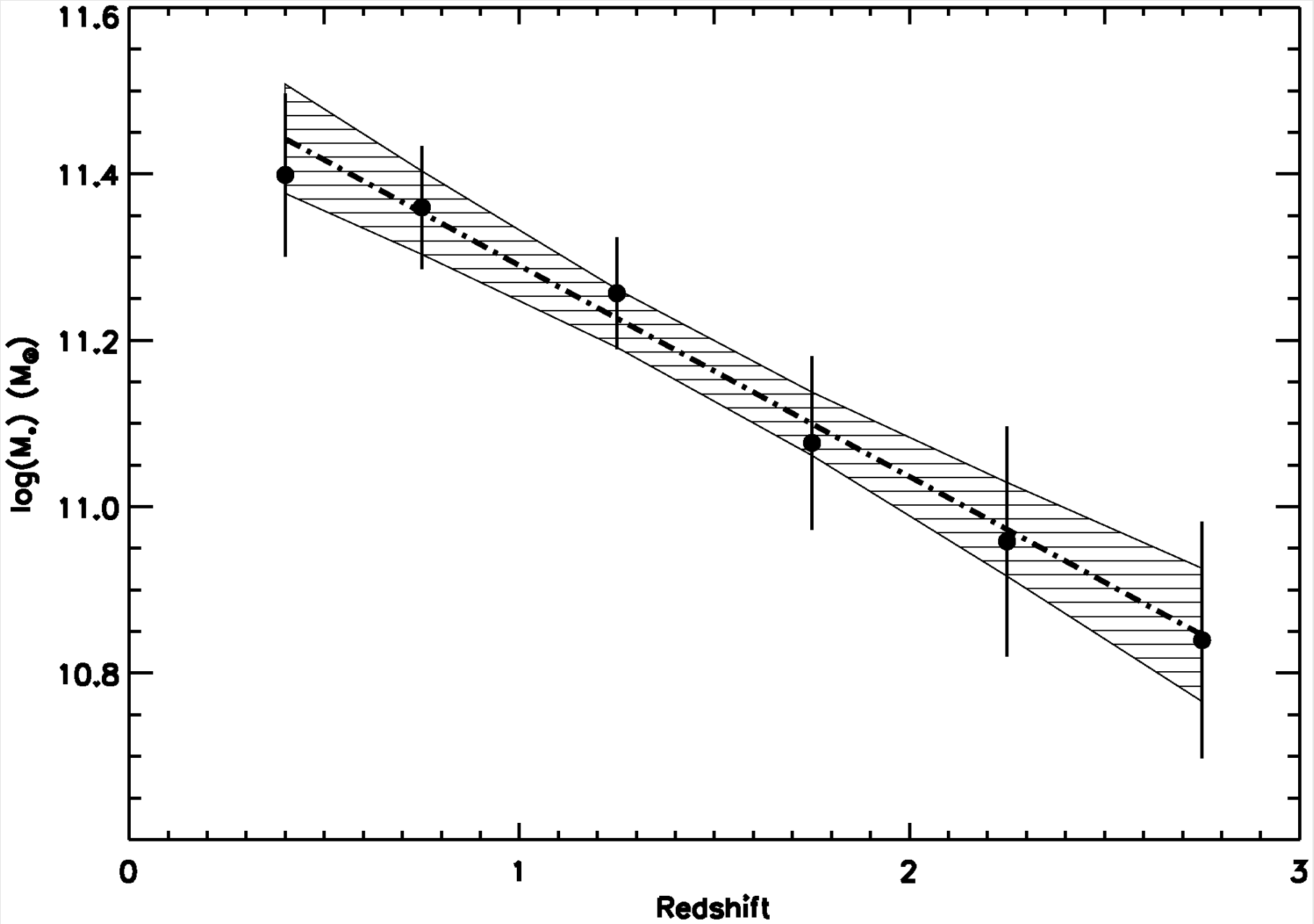


Integrated stellar mass functions from Mortlock (in prep)

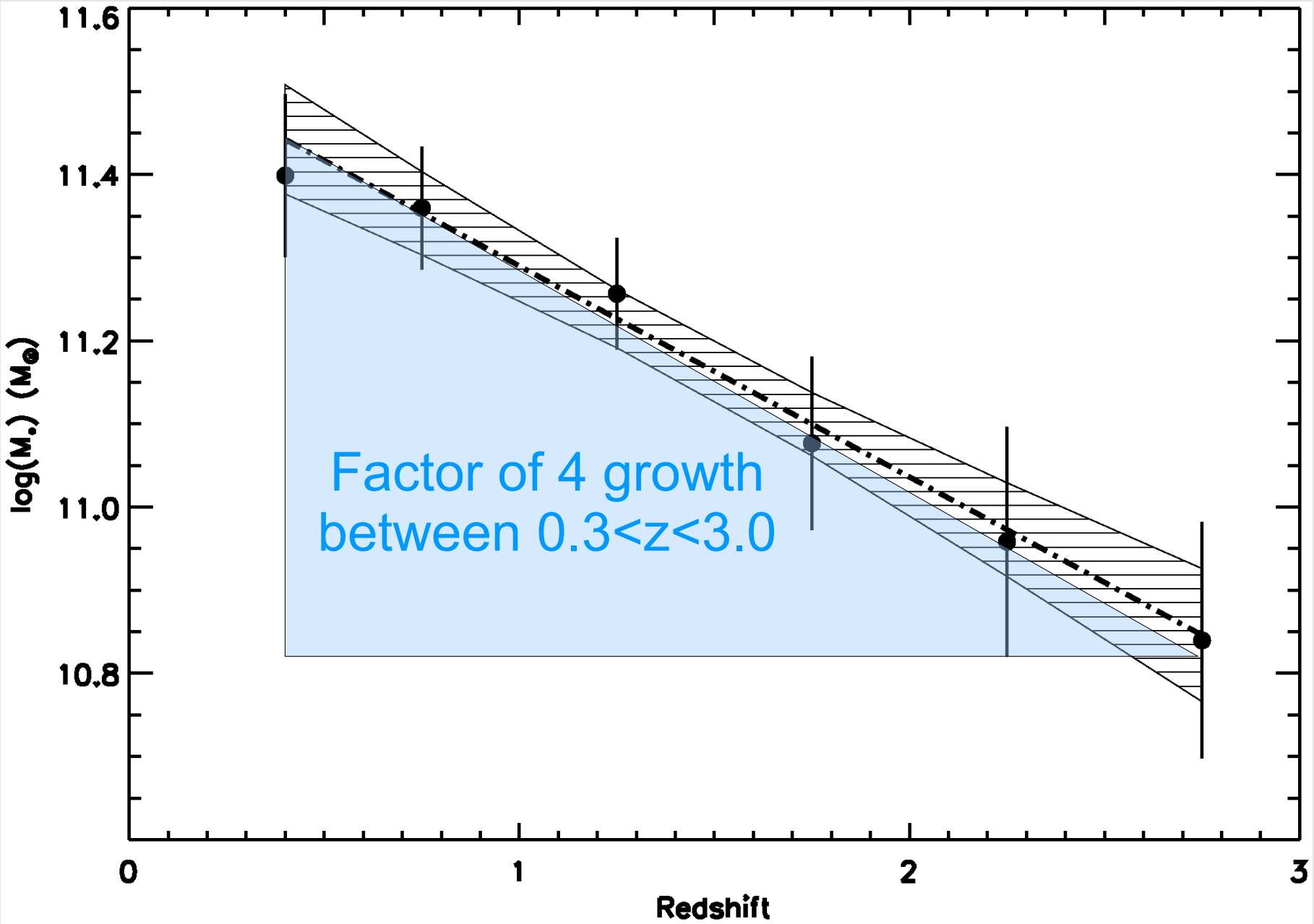
Galaxy Sample



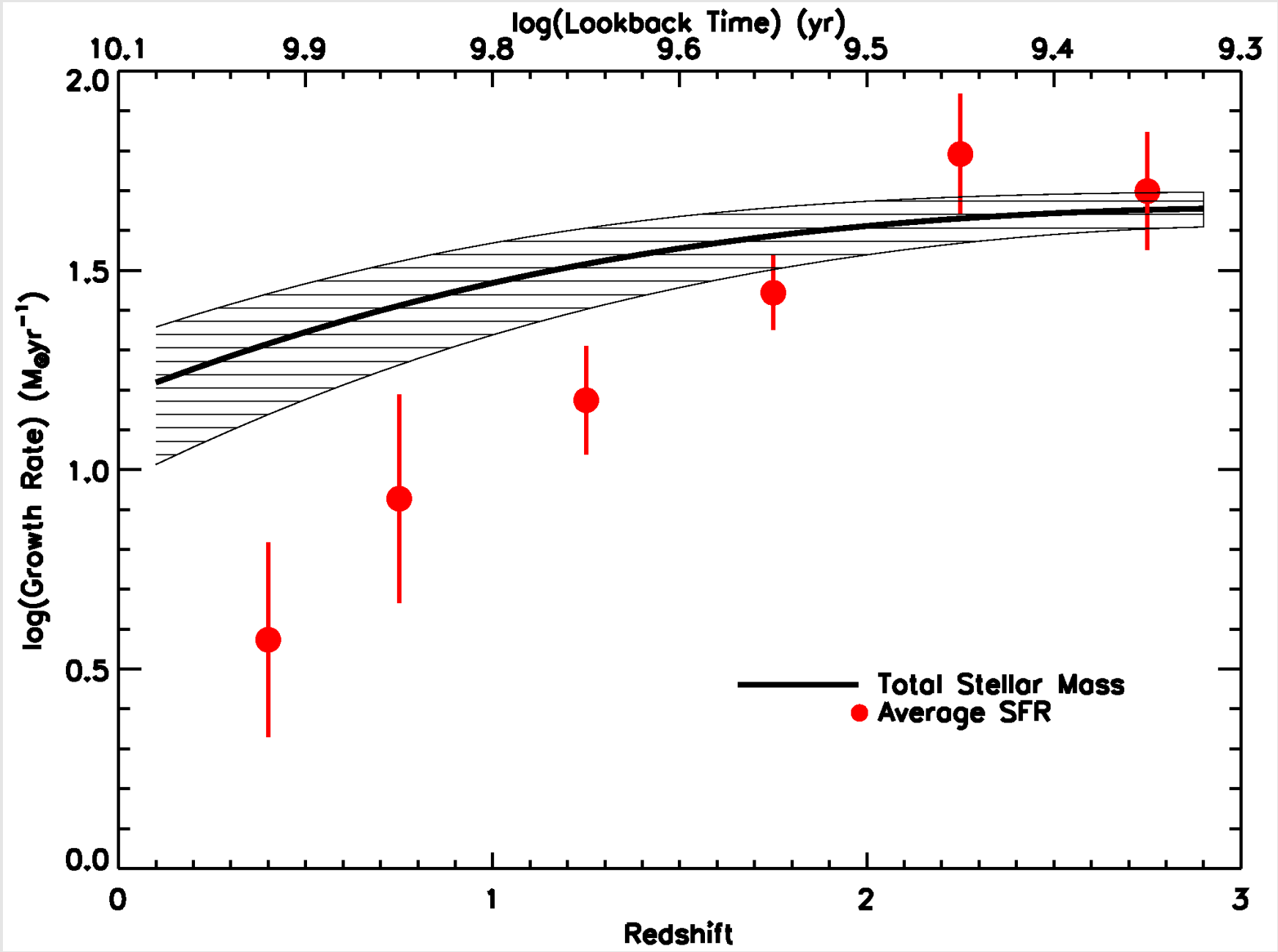
Stellar Mass Growth



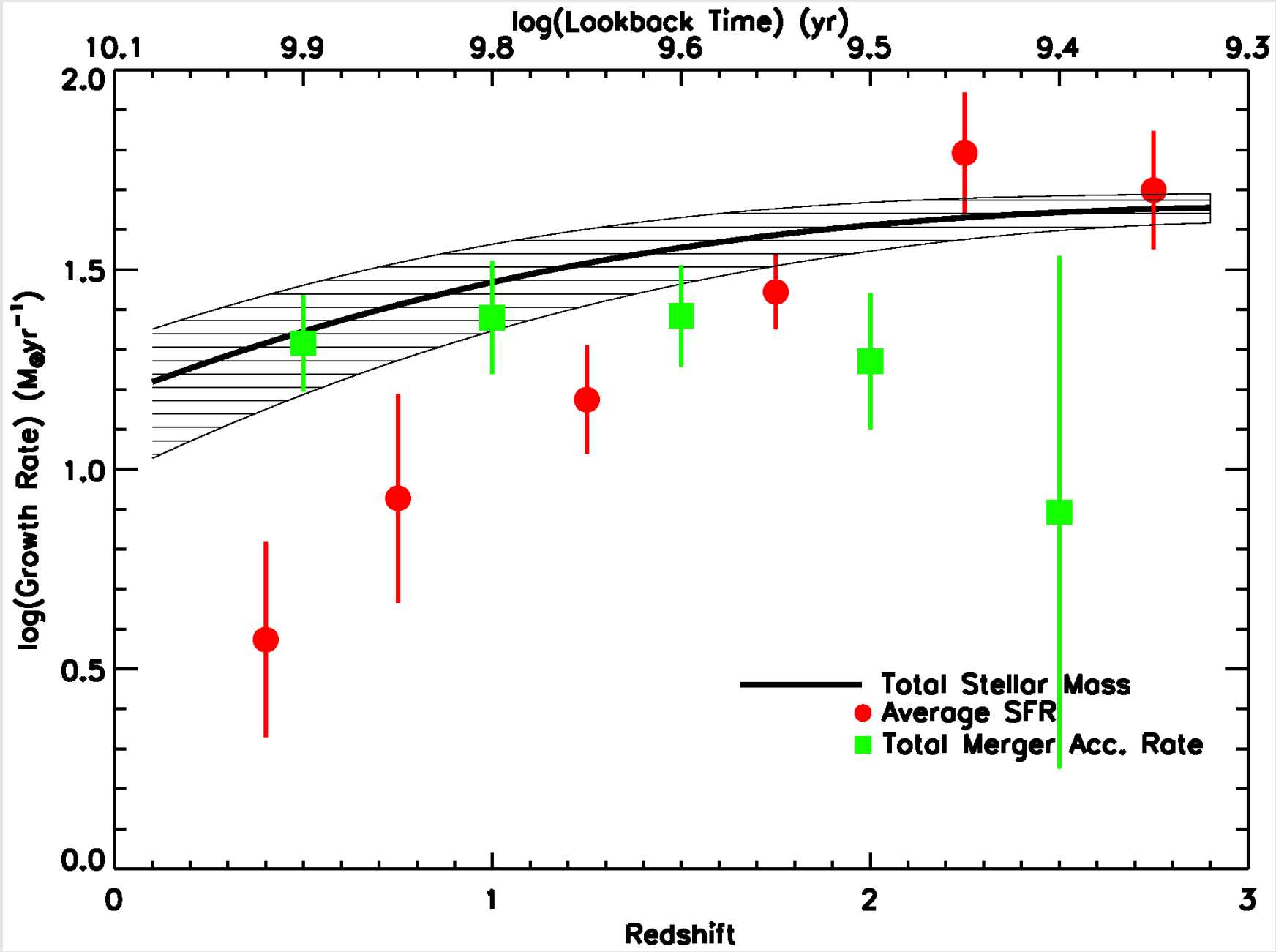
Stellar Mass Growth



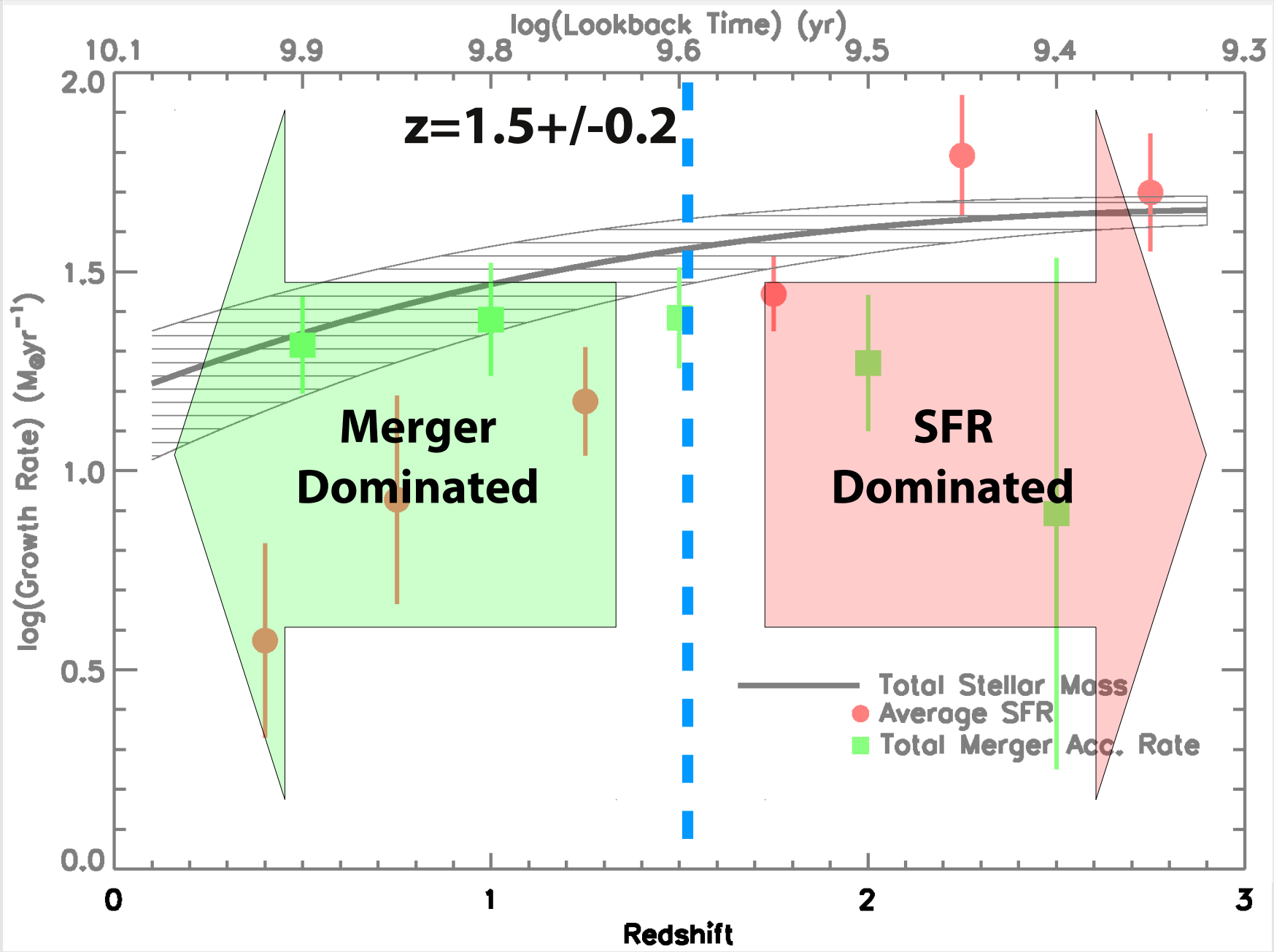
Stellar Mass Growth Rates



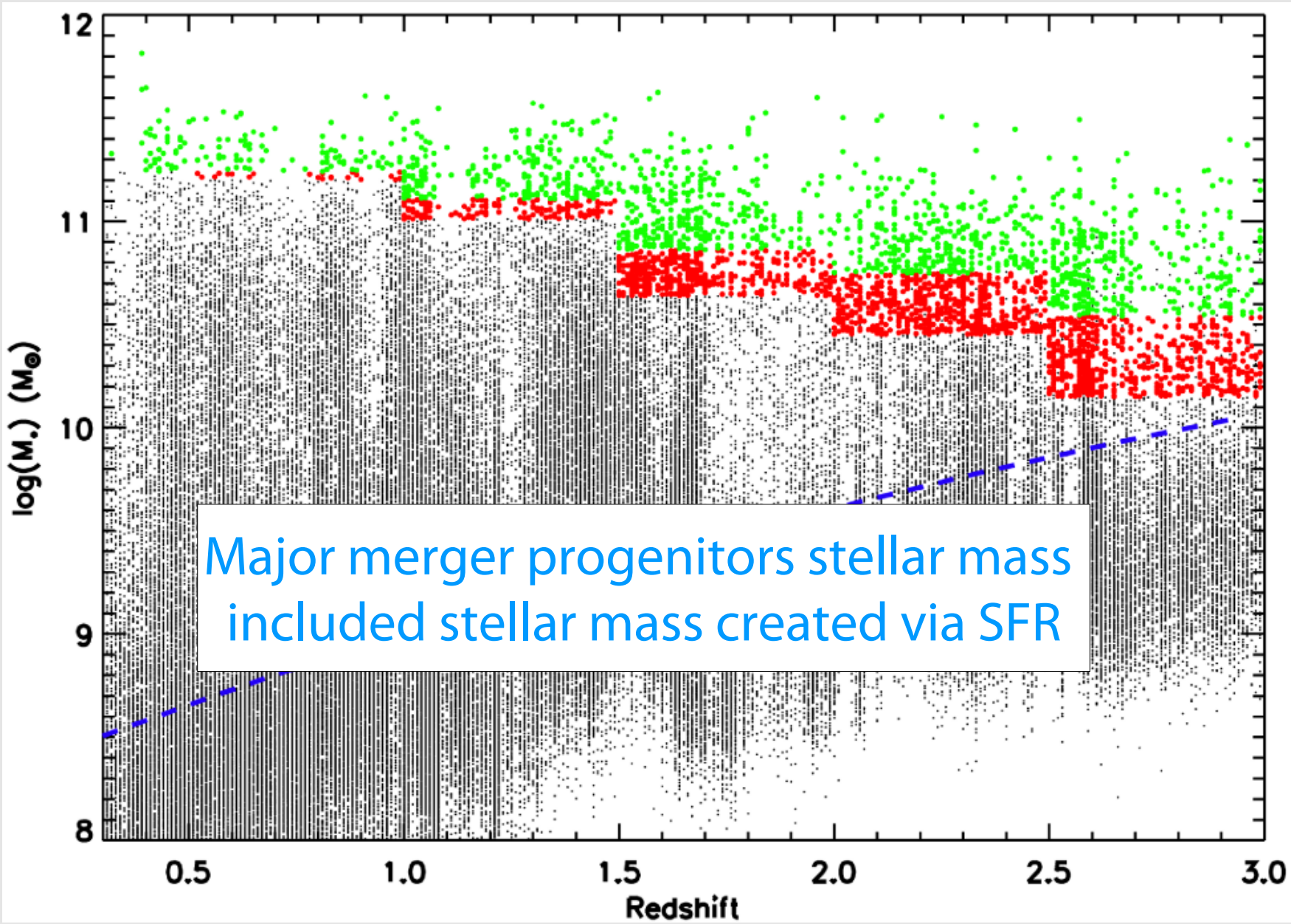
Mergers VS SFR



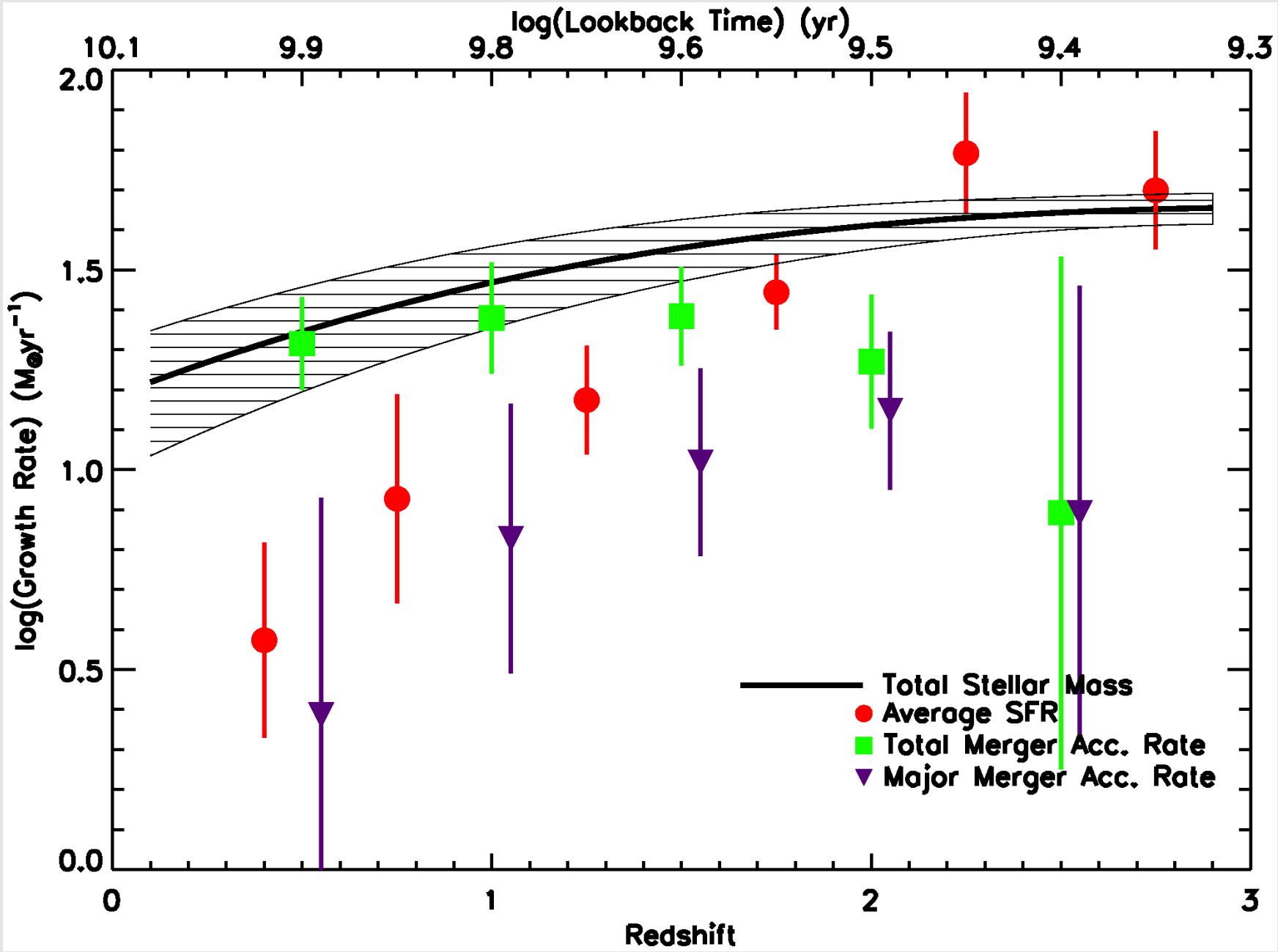
Dominate Stellar Mass Growth Process 1



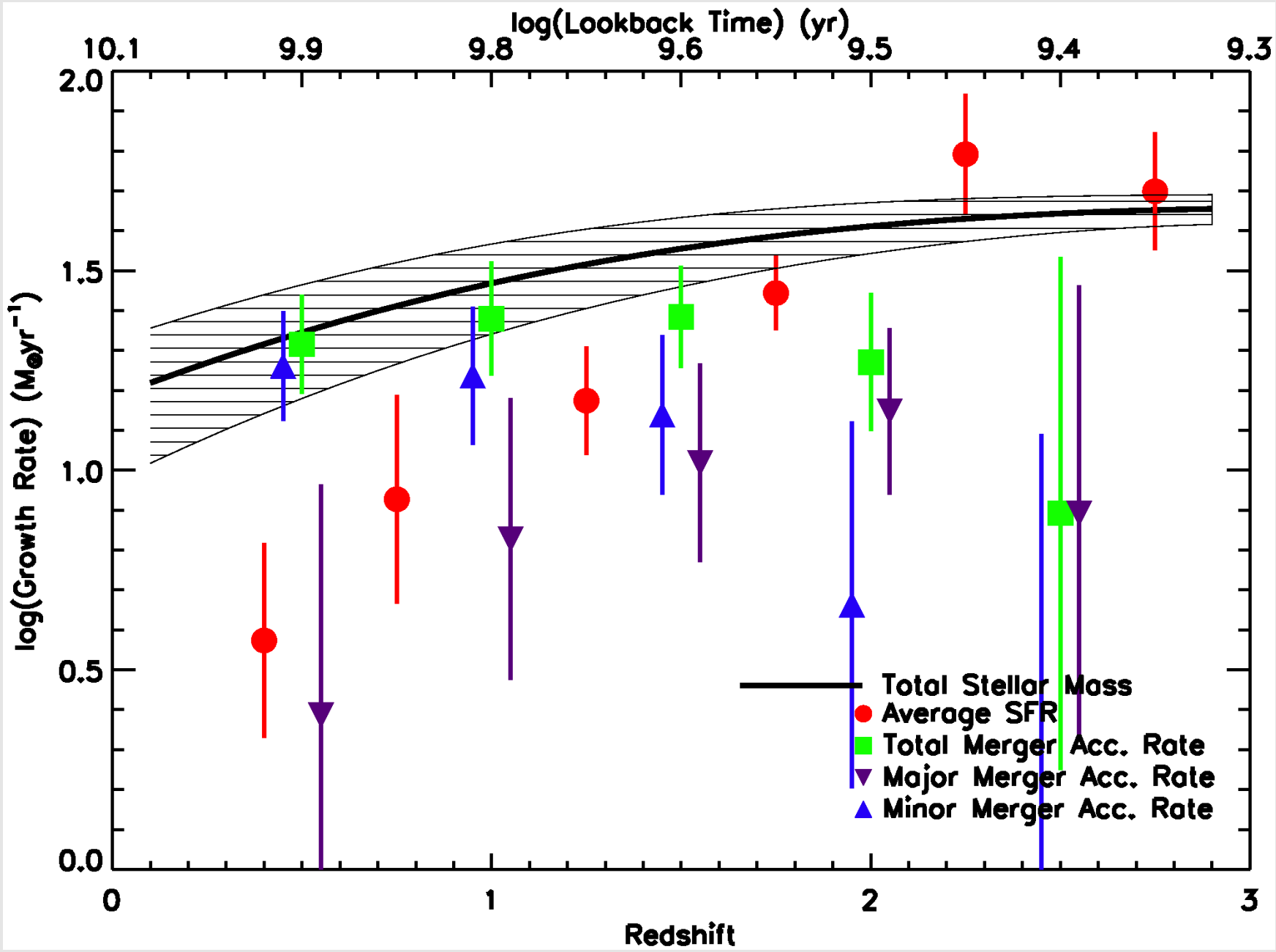
Major Merger Progenitors



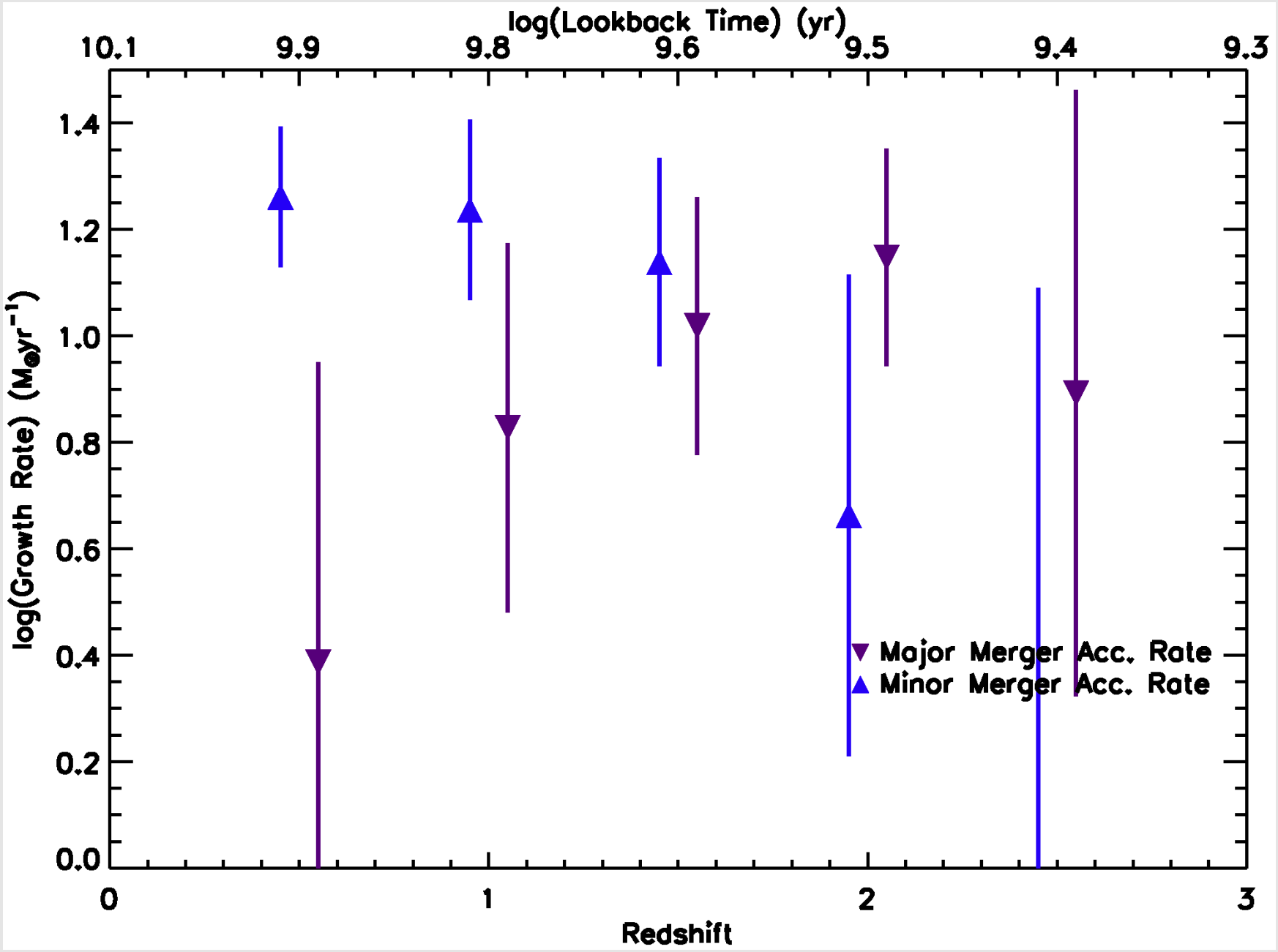
Major Merger Rate



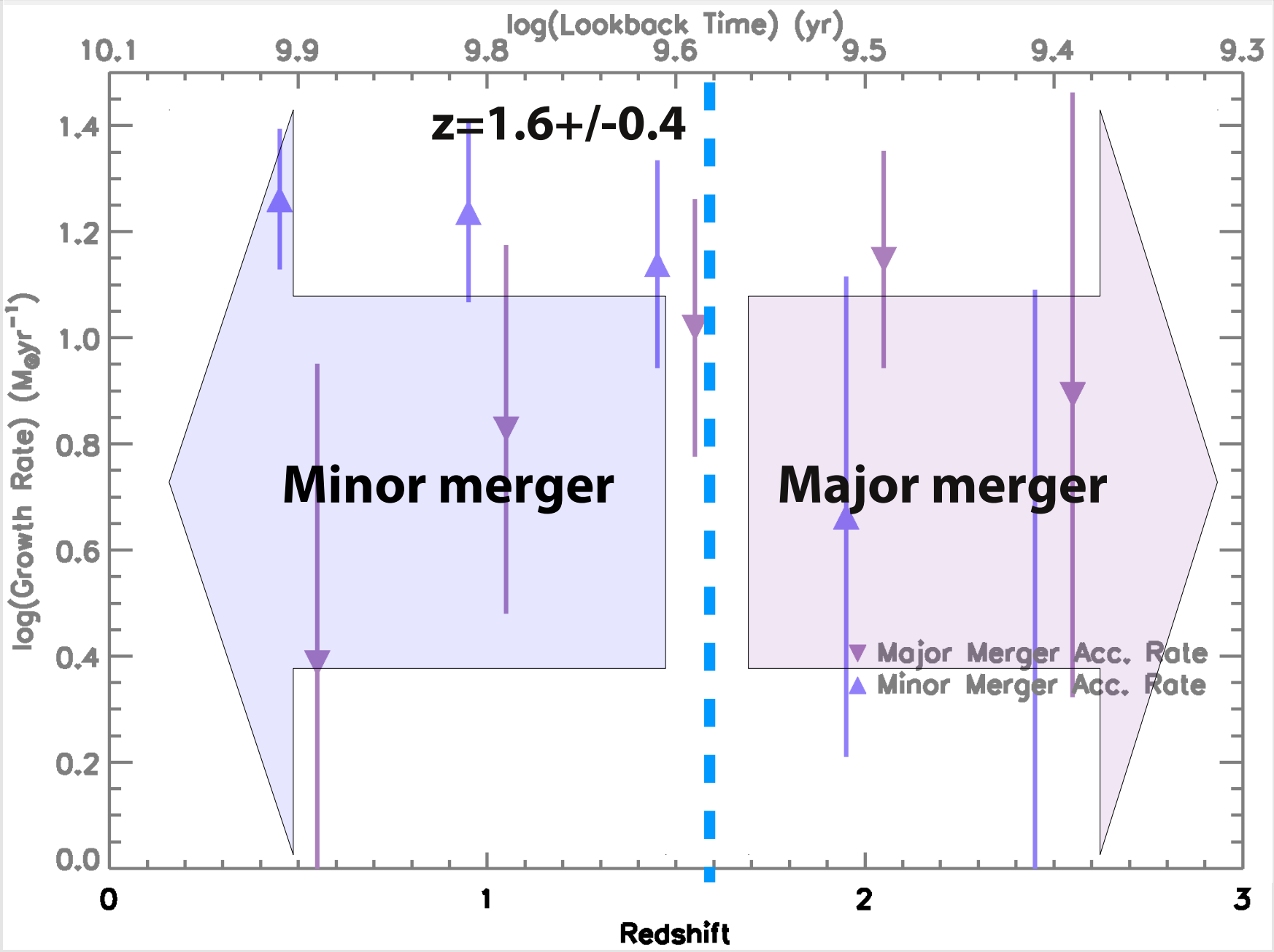
Minor Merger Rate



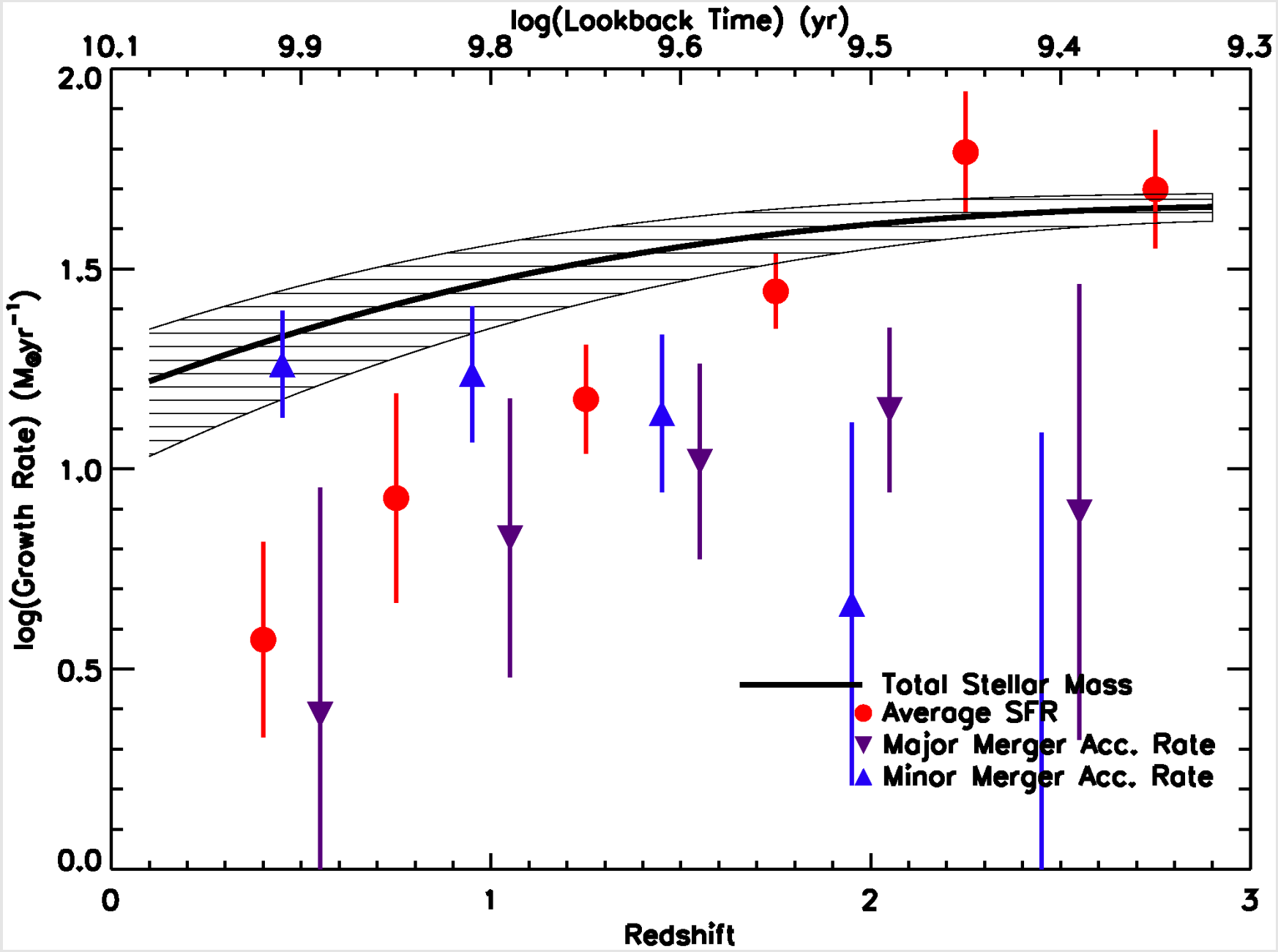
Dominate Merger Process



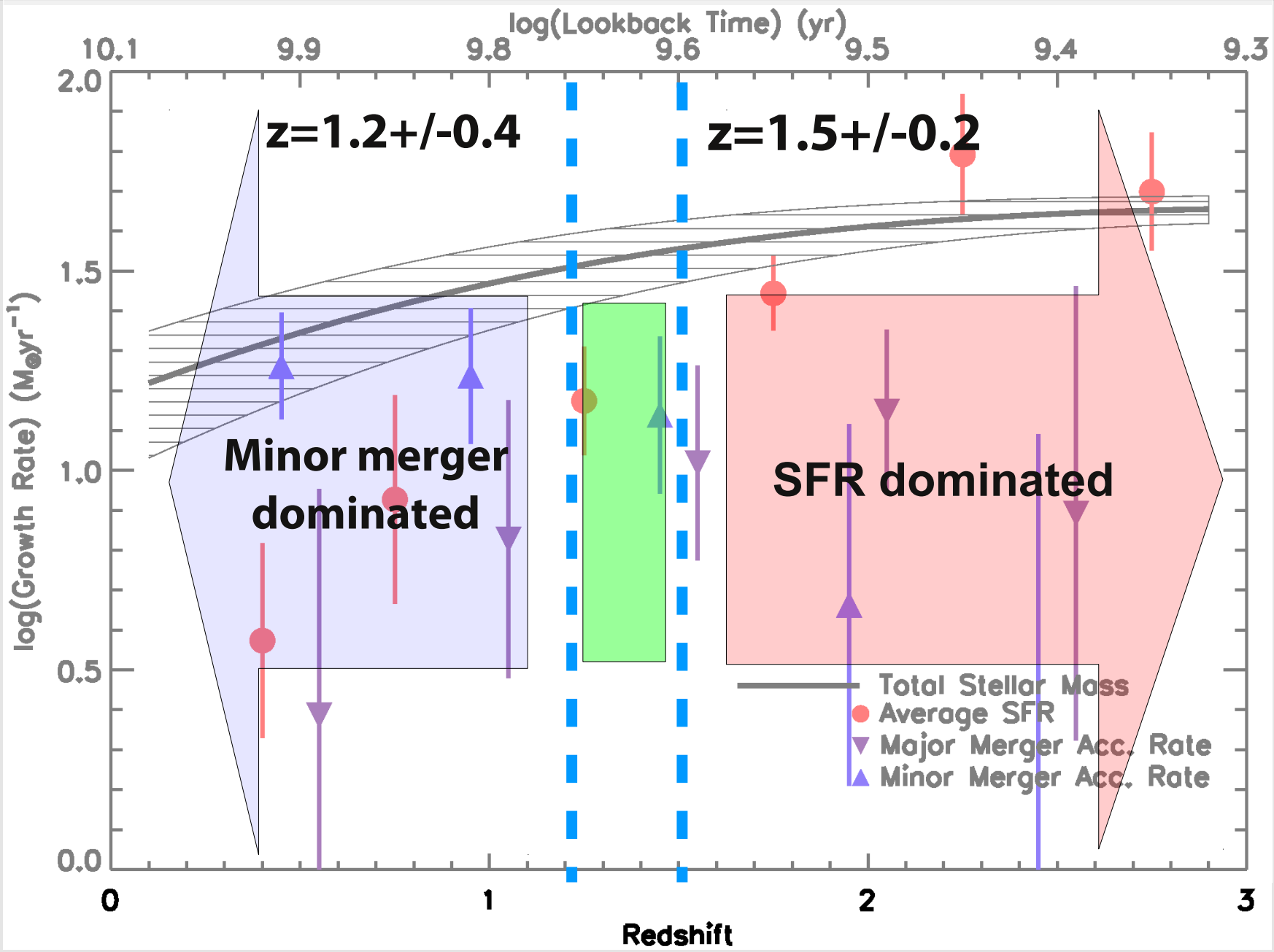
Dominate Merger Process



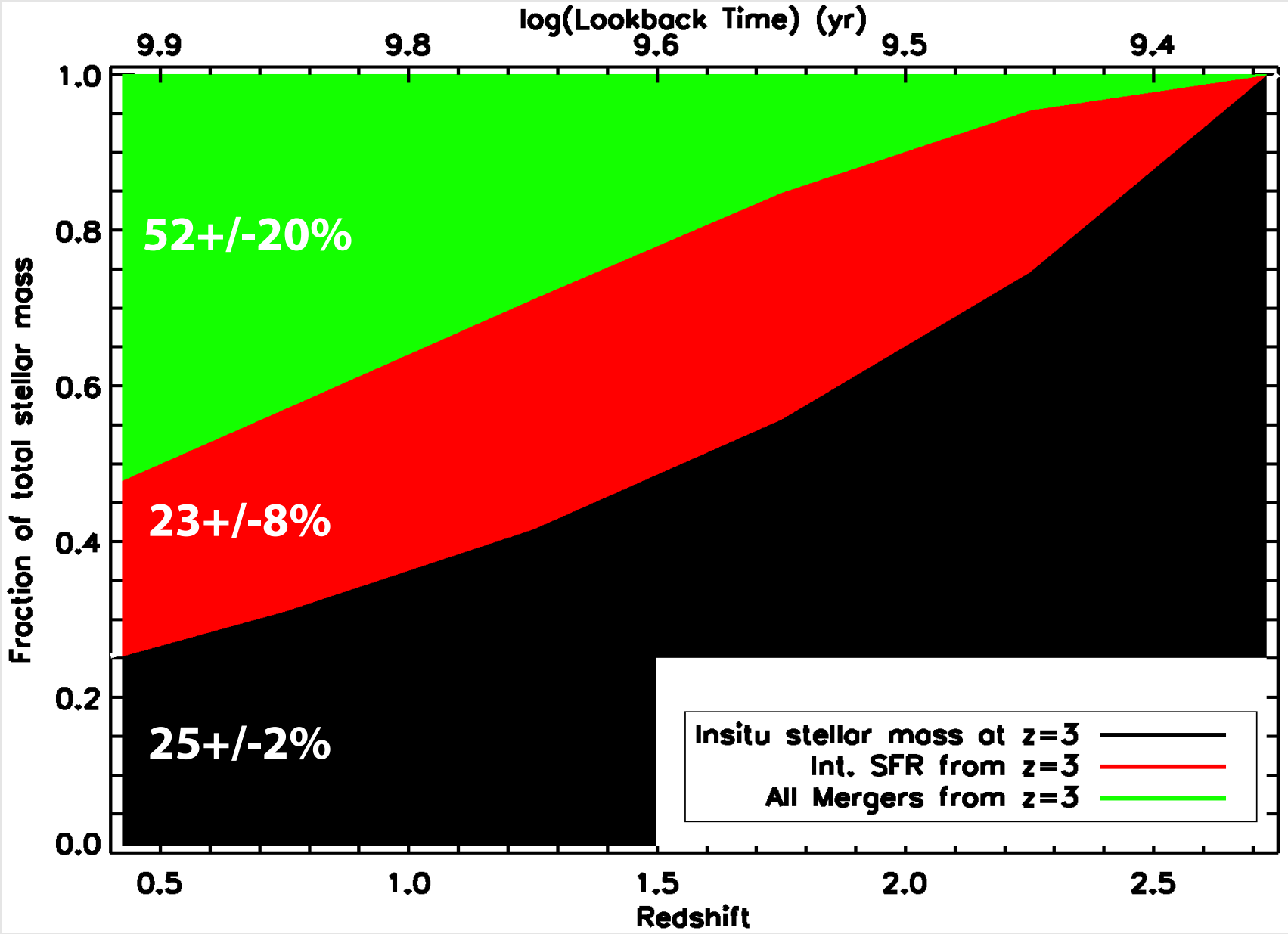
Dominate Stellar Mass Growth Process 2



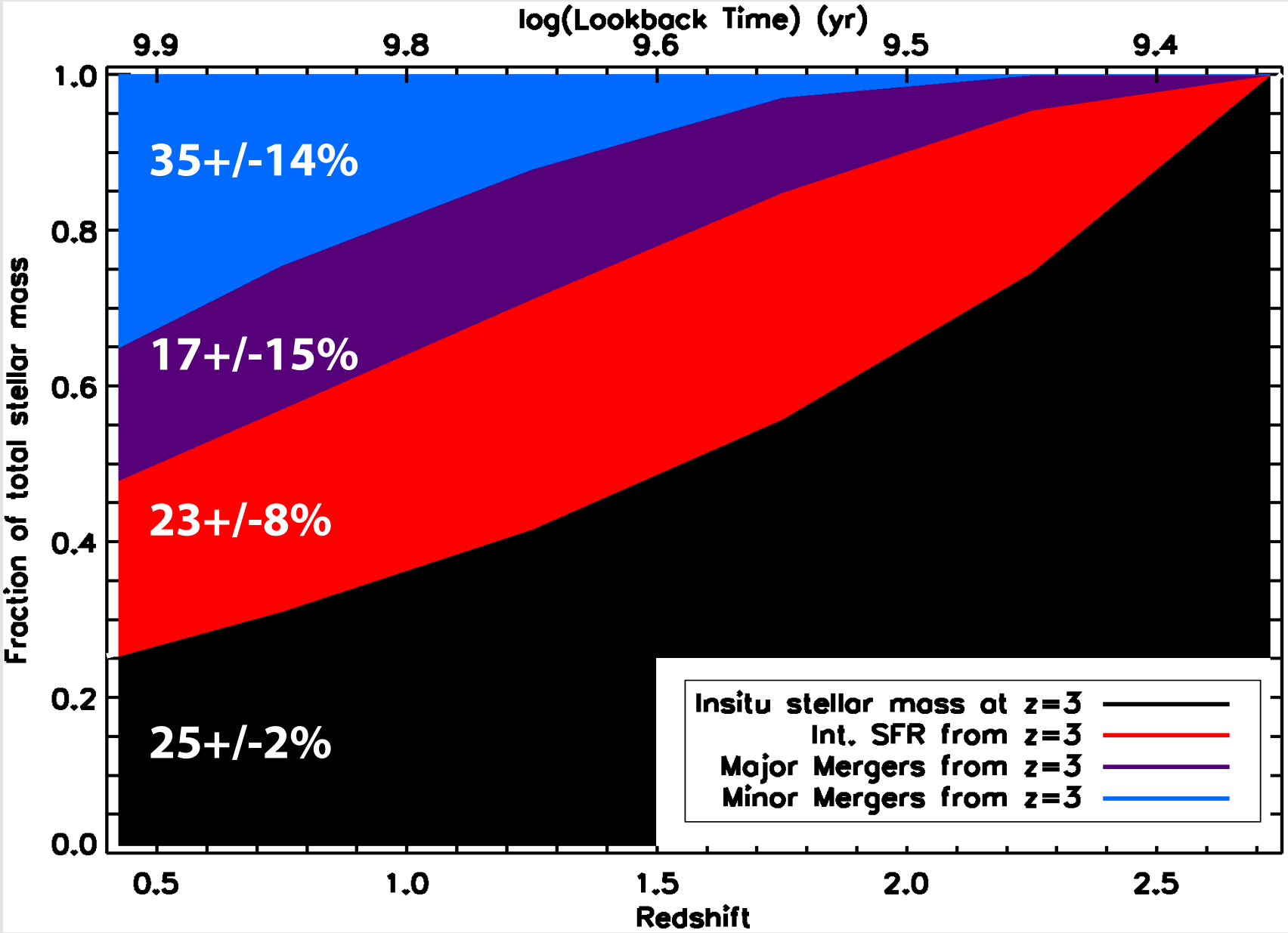
Dominate Stellar Mass Growth Process 2



Relative Contributions



Relative Contributions



Summary

The progenitors of the most massive galaxies grow in stellar mass by a factor of 4 between 0.3-3.0

Star formation

- between 0.3-3.0 builds 23+/-8% of massive galaxies stellar mass at z=0.3

- Dominant stellar mass growth process at z>1.5+/-0.2

Mergers

- between 0.3-3.0 builds 52+/-15% of massive galaxies stellar mass at z=0.3

- Dominant stellar mass growth process at z<1.5+/-0.2

Major Mergers

- account for 17+/-15% of the z=0.3 stellar mass

- are at no point are solely the dominant form of stellar mass growth

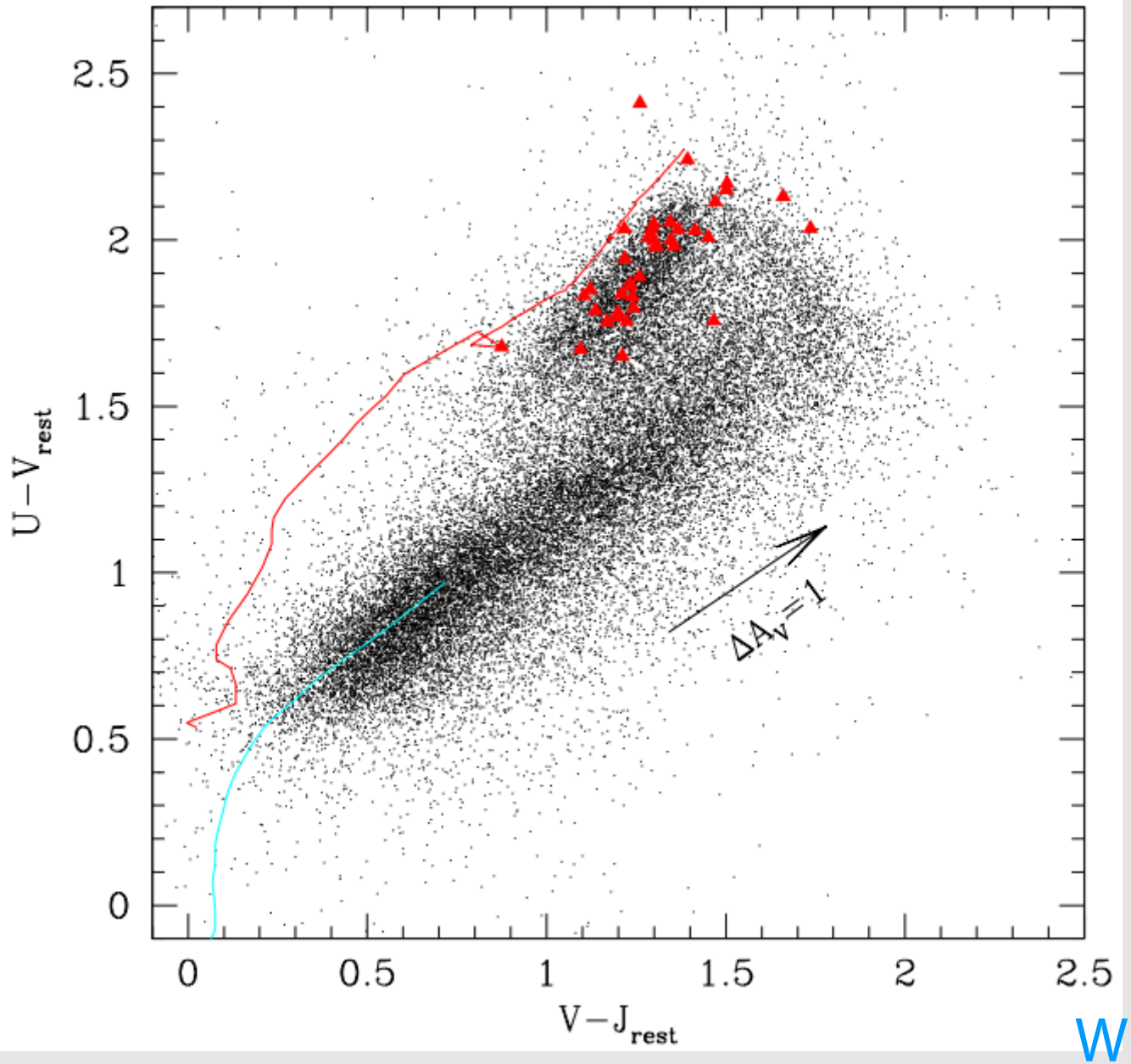
Minor Mergers

- account for 35+/-14% of the z=0.3 stellar mass

- at z<1.2+/-0.4 are solely the dominant form of stellar mass growth

Gas accretion + Size evolution

Passive Galaxy Selection



Williams +09