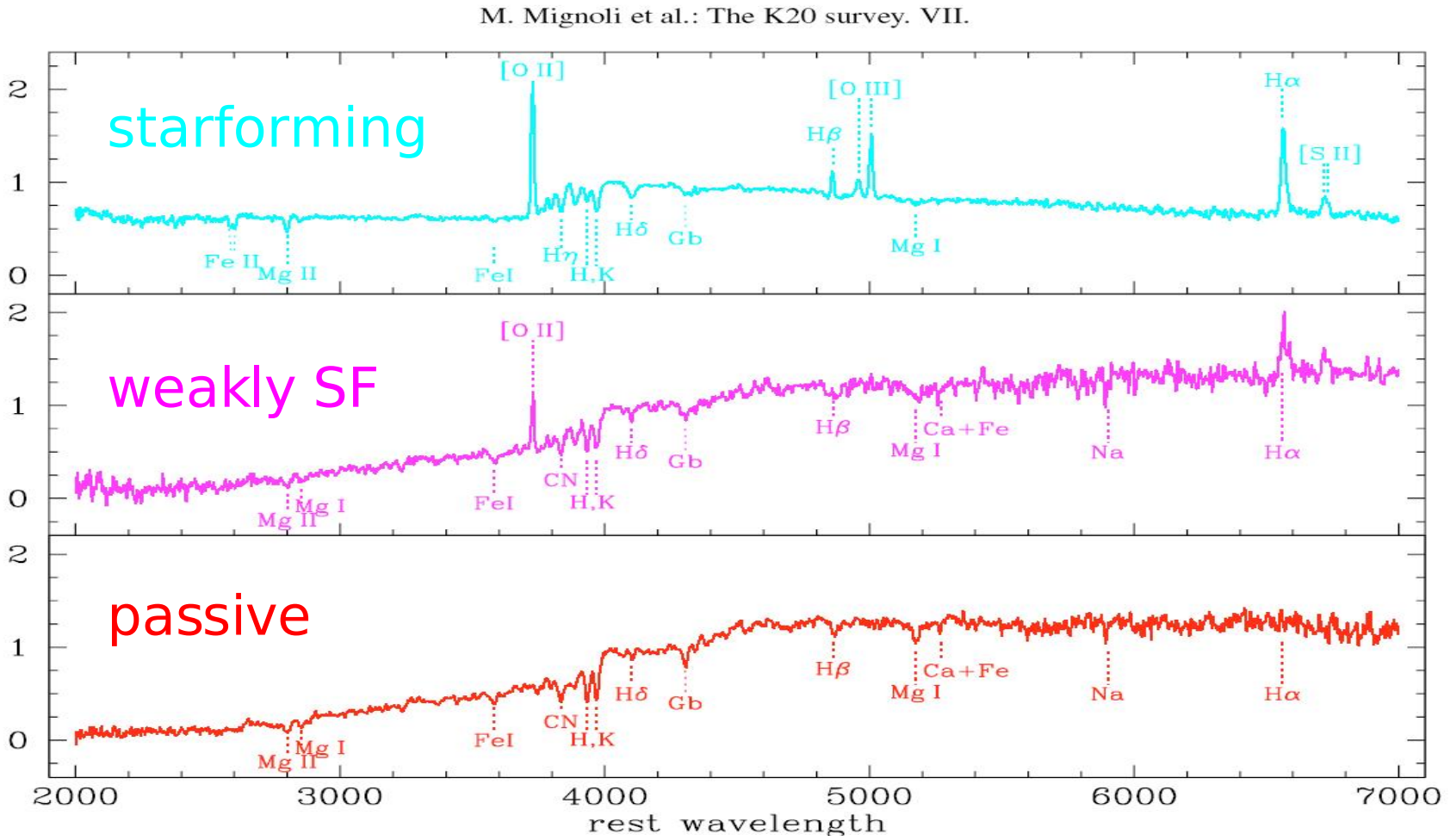
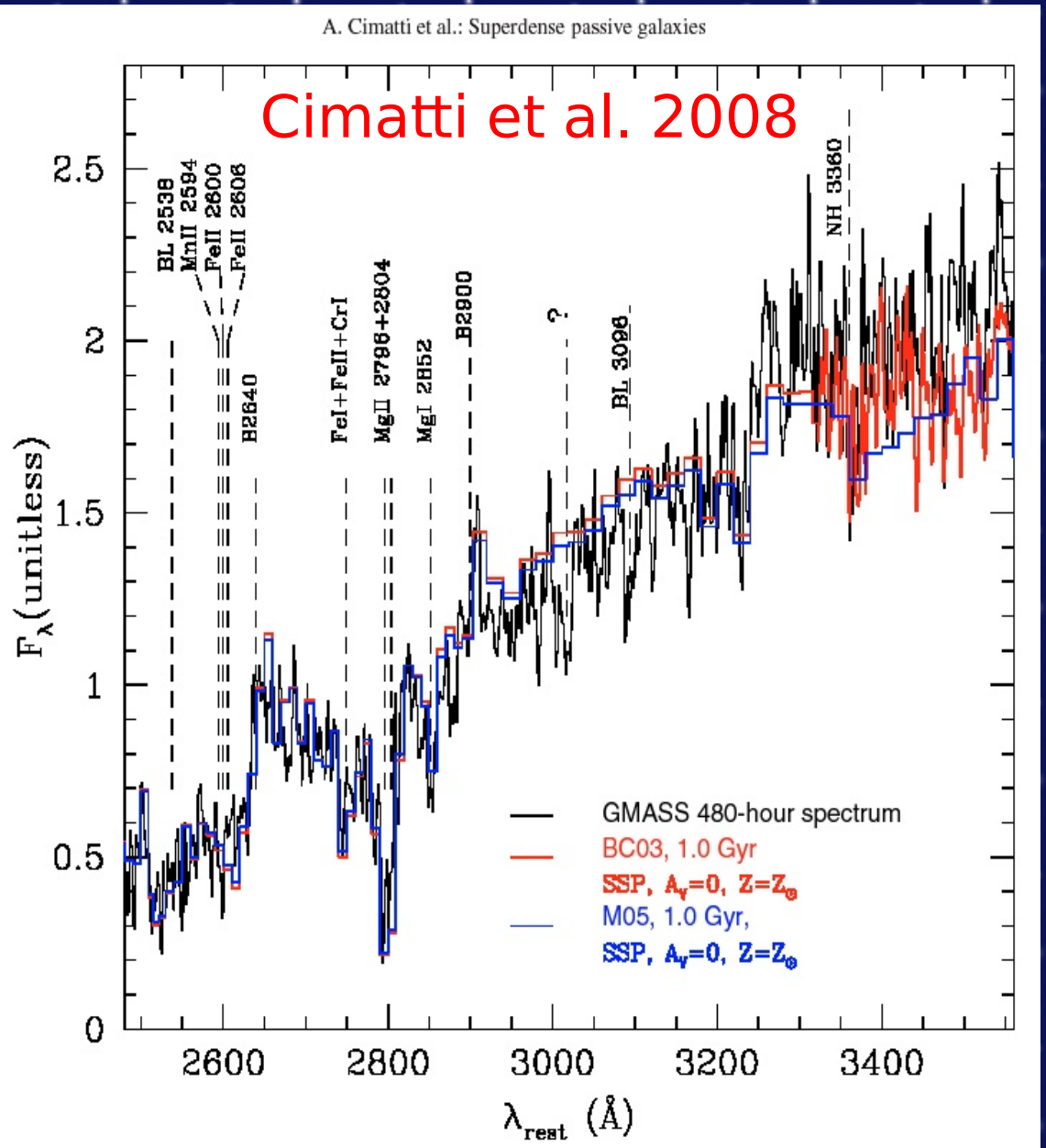
A Plea for a high-multiplex J-Band spectrograph @ VLT

Alvio Renzini, MOS Workshop, ESO March 910, 2009

Beyond redshift 1.4 life gets hard for spectroscopists



Getting redshifts of red galaxies by looking in the ultraviolet (!)

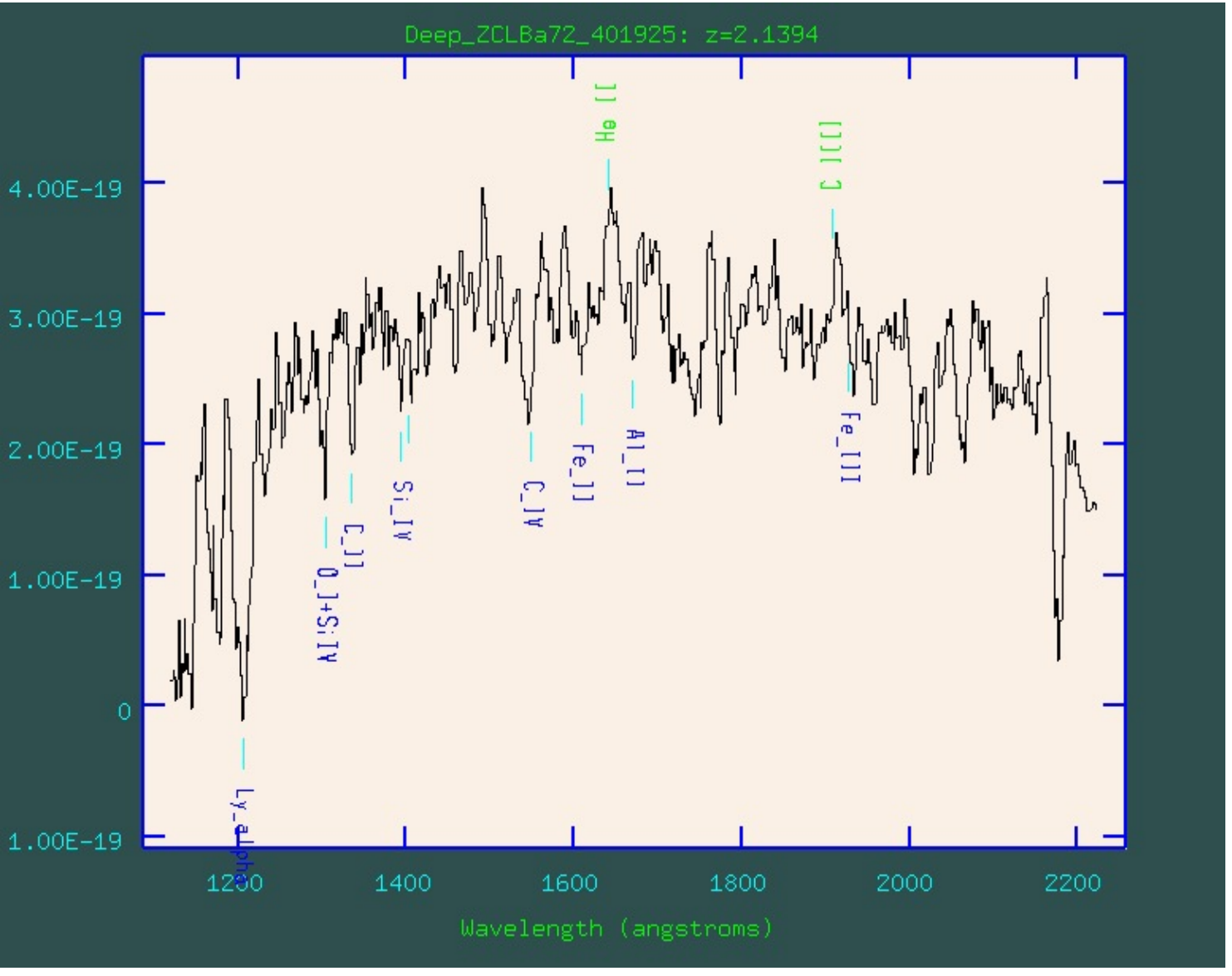


13 GMASS Passive galaxies at <z>=1.6

30 to 60 hours per galaxy

Total integration time for this stacked FORS2 spectrum: 480h (!)

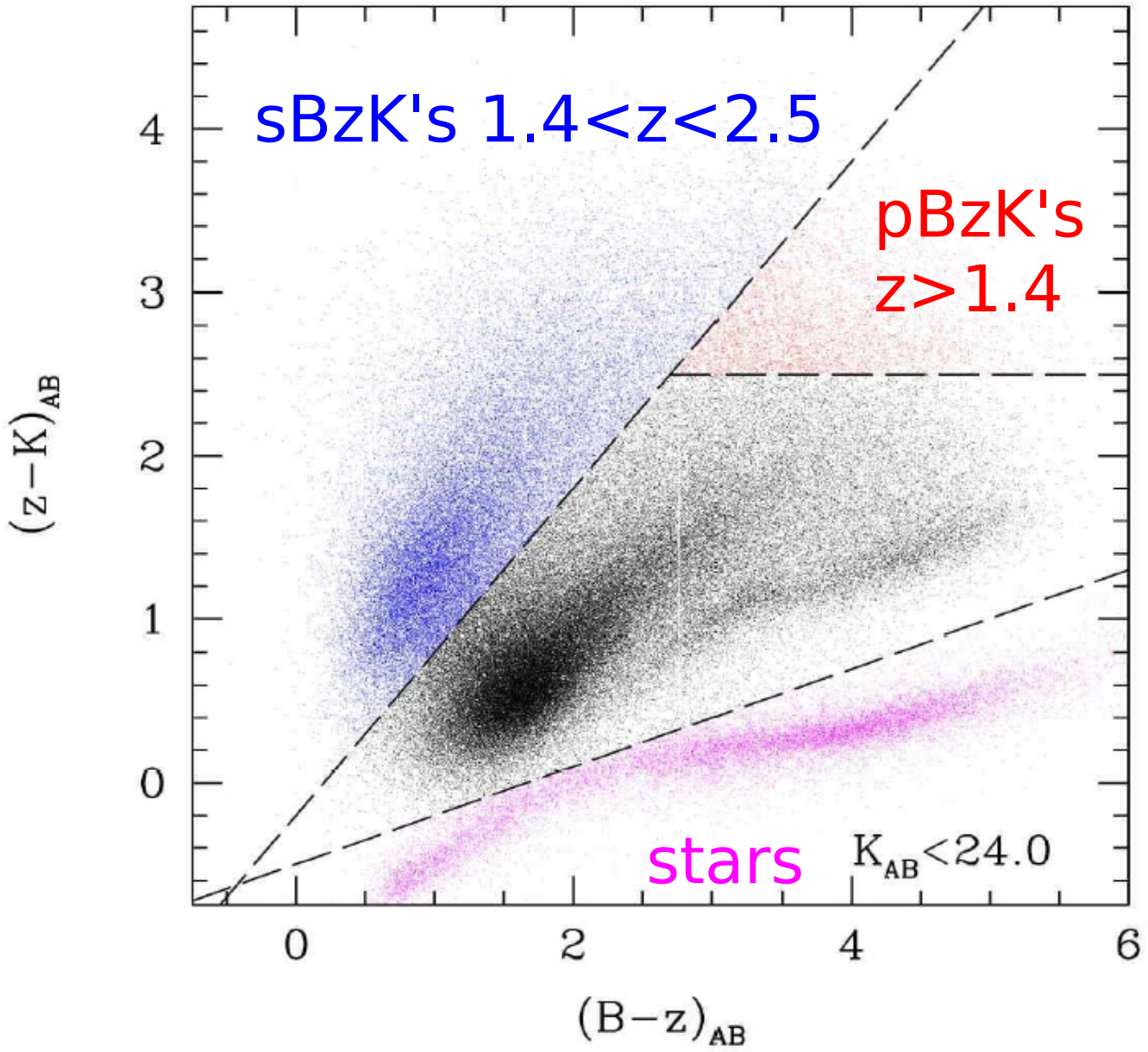
Getting redshifts of emission-line galaxies using absorption lines



An example from zCOSMOS:

The VIMOS spectrum of a typical SF galaxy @ z~2

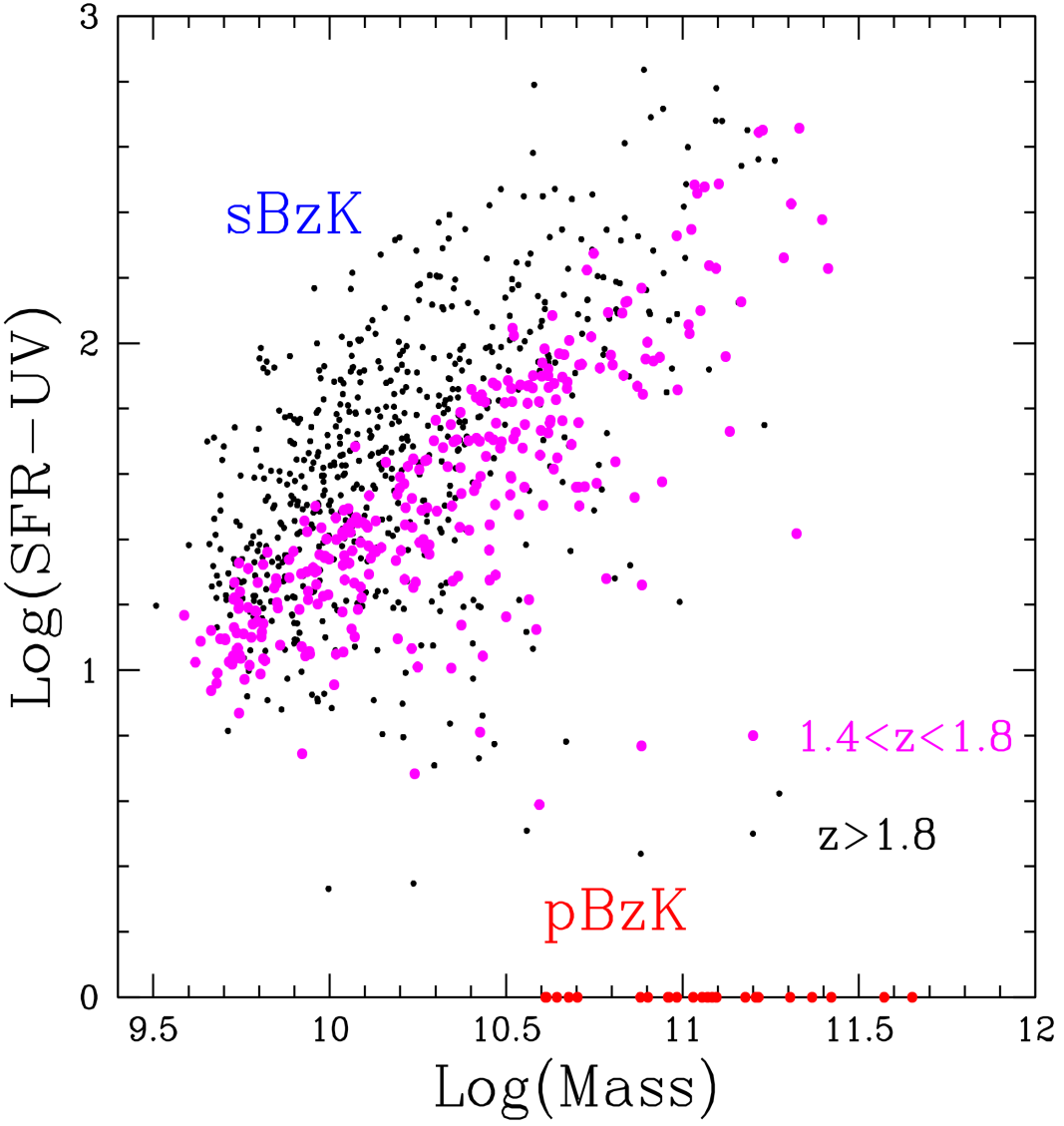
Our Preferred playgroud: BzK-selected galaxies



COSMOS Field,
McCracken et al. 2009

Today, some Pilot Experiments over the GOODS-South field, using the database from Daddi et al. 2007

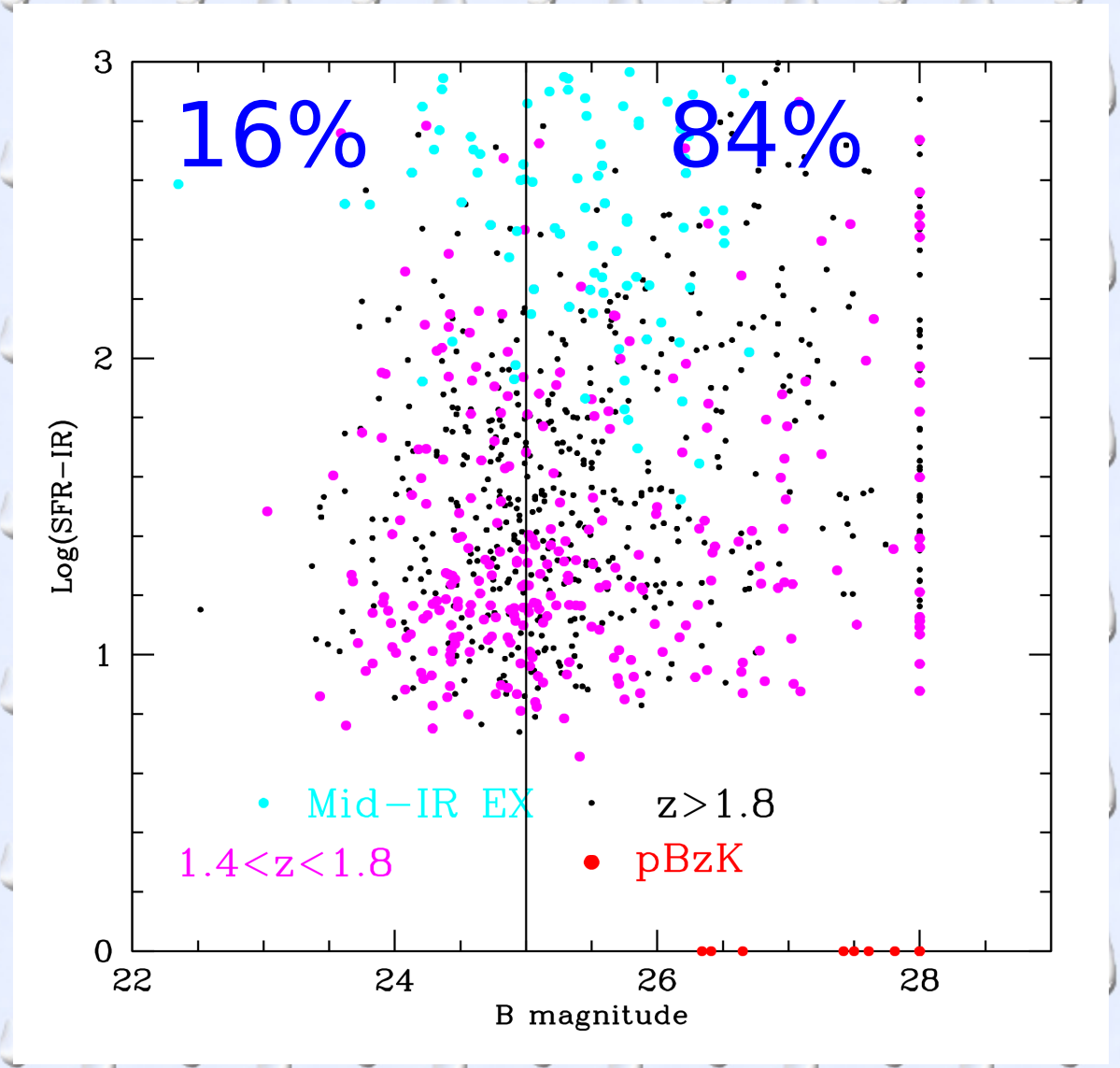
SFR vs Mass for ~1000 BzK Galaxies



SFR from rest-frame UV + extinction correction

All mass & SFR data from Daddi et al. 2007!

BzK-selected 1.4<z<2.5 galaxies in GOODS-S to $K_{Vega} < 22$

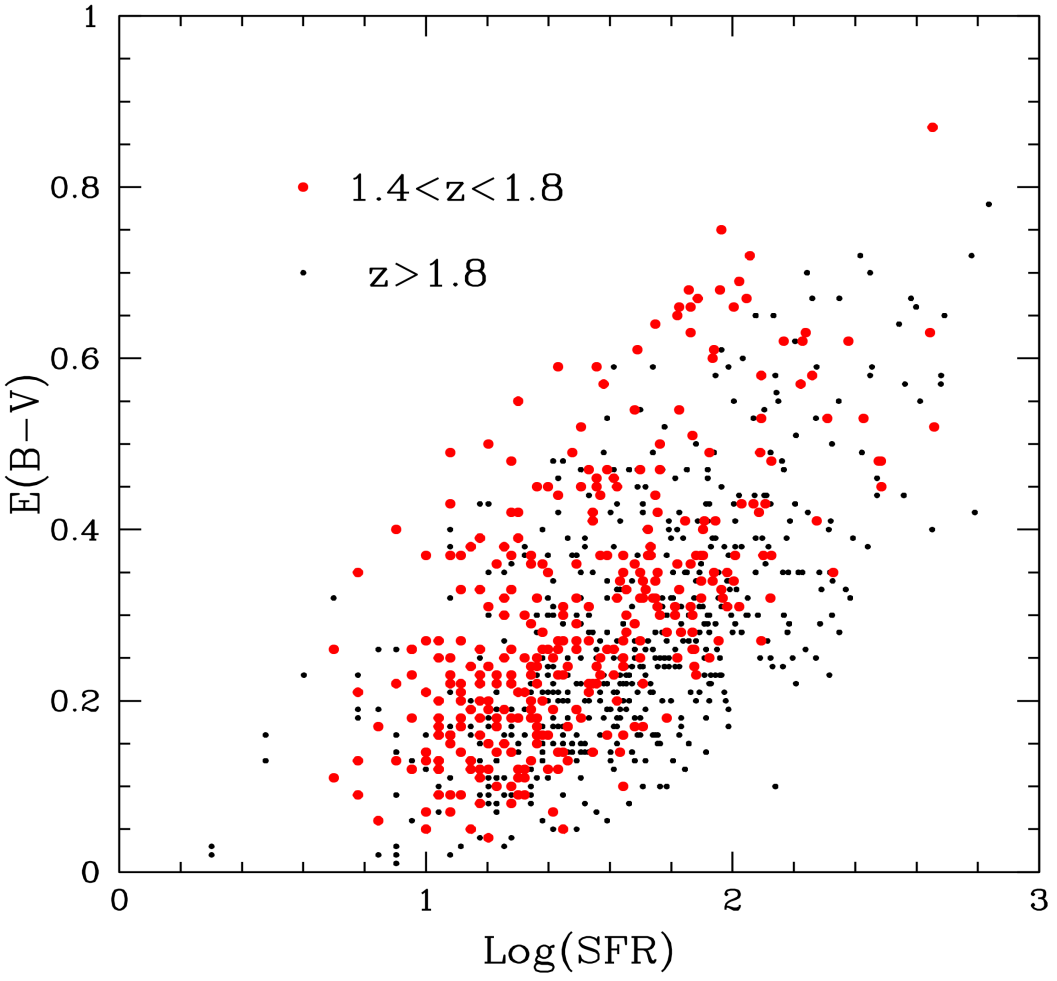


Data from Daddi et al 2007

To B=25, the current limit of VIMOS w/ 5h integration, one picks only <~16% of the total SFR at 1.4<z<2.5.

The most actively SF galaxies are fainter than B=25

The problem is that more actively SF galaxies are more extincted and with VIMOS we are forced to look at them in the rest-frame UV

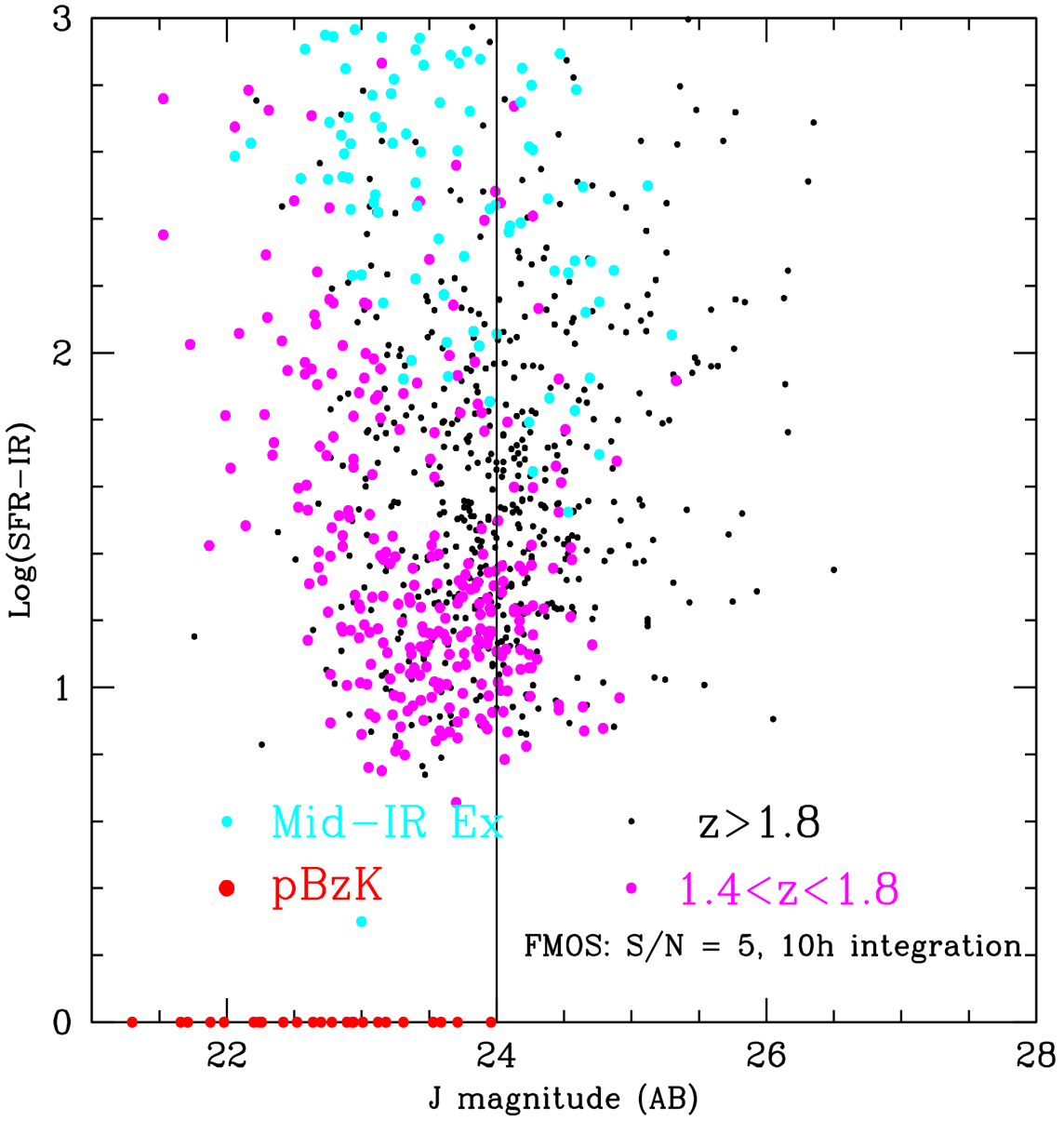


When Extinction is important, it helps going to the infrared

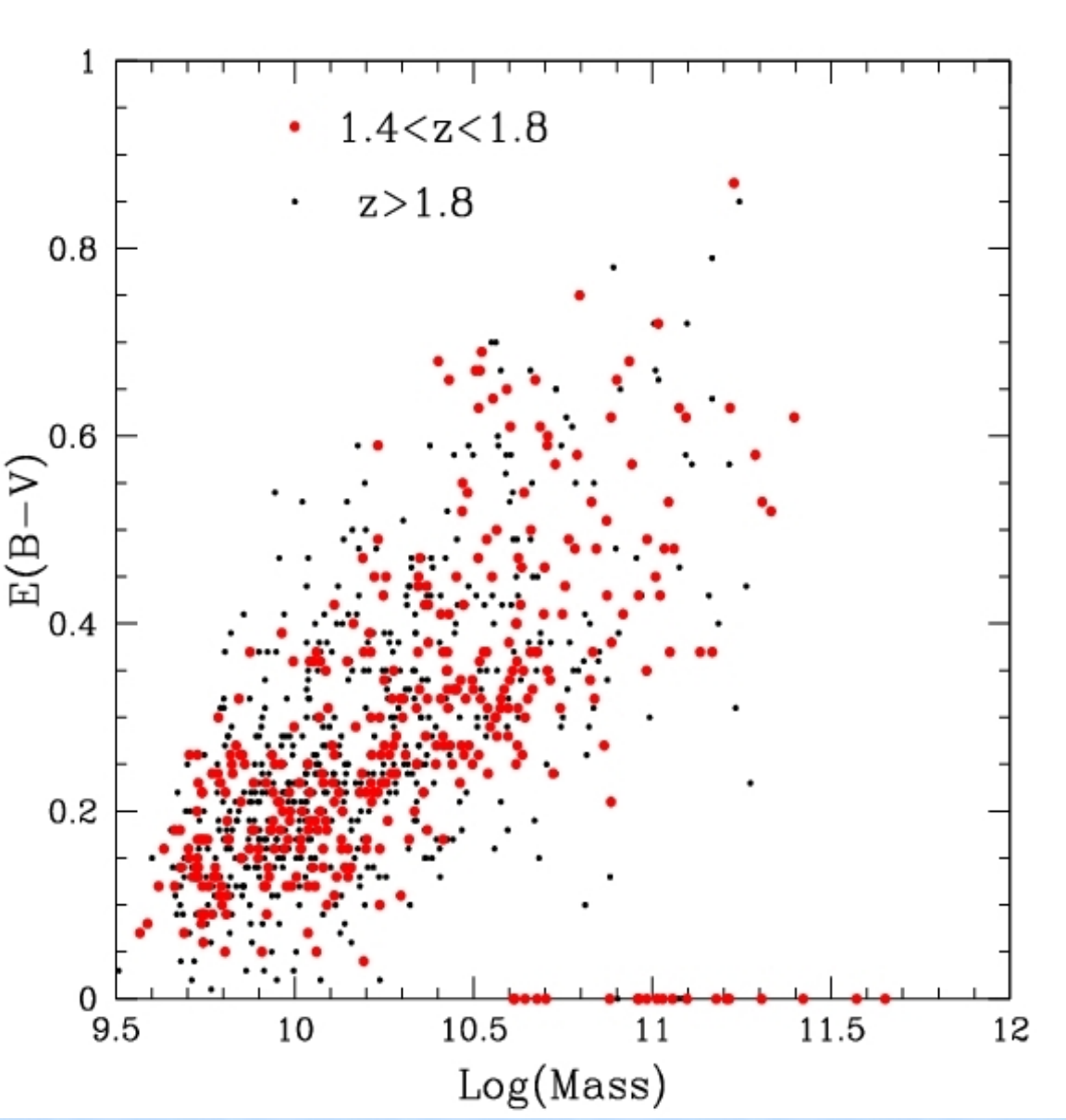
One needs an high-multiplex Near-IR multiobject spectrograph!

Getting just to the J band allows to do emission line ([OII]) redshifts

Most actively SF galaxies are the brightest in the J band and passive ones kick in

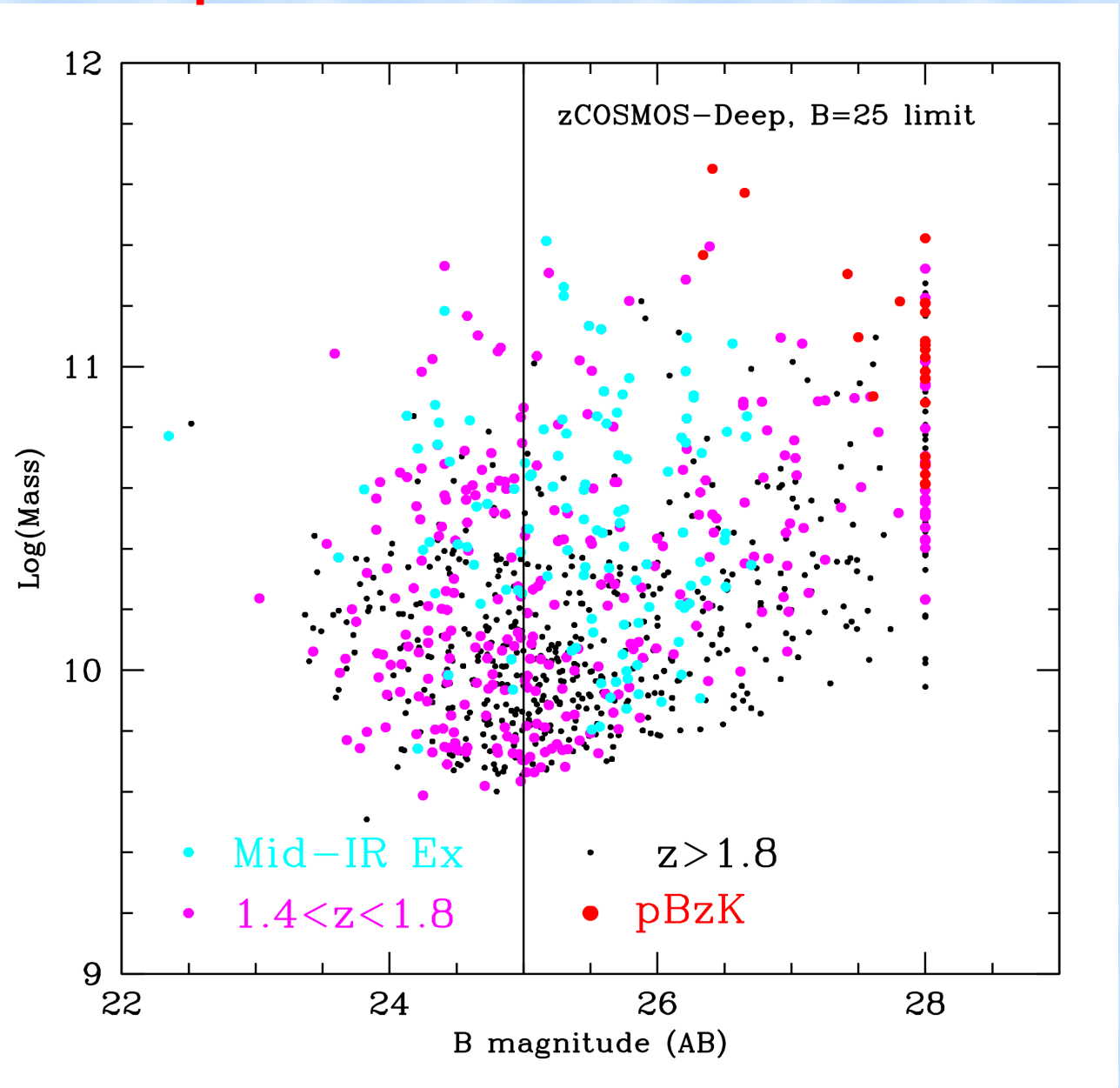


Of course, more massive SF galaxies are more extincted



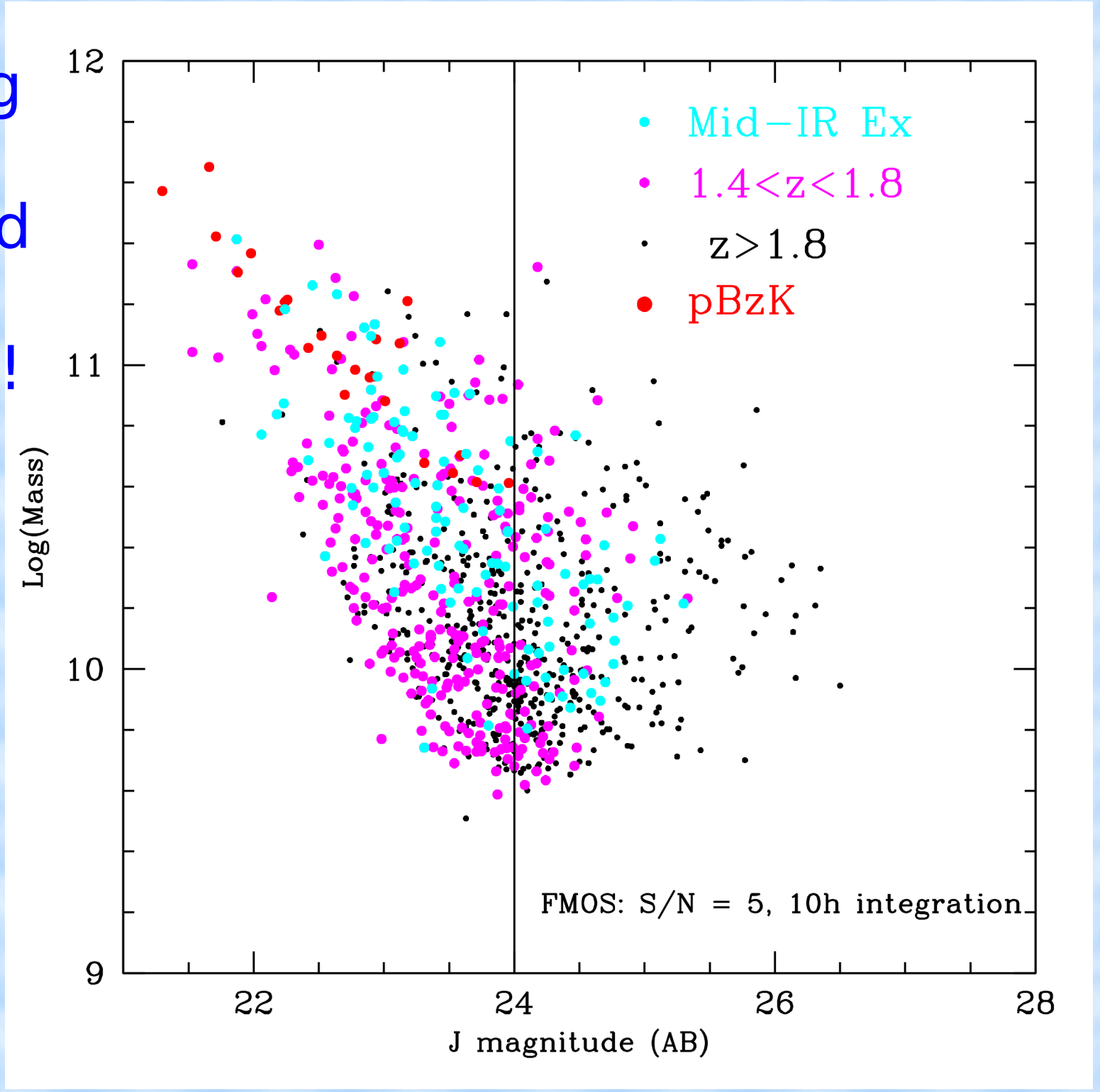
And, again, with VIMOS we are forced to look at them in the most extincted rest-frame UV (!!!)

And therefore we lose most of the stellar mass @z~2 in a B-magnitude limited sample, to which we are forced w/ VIMOS



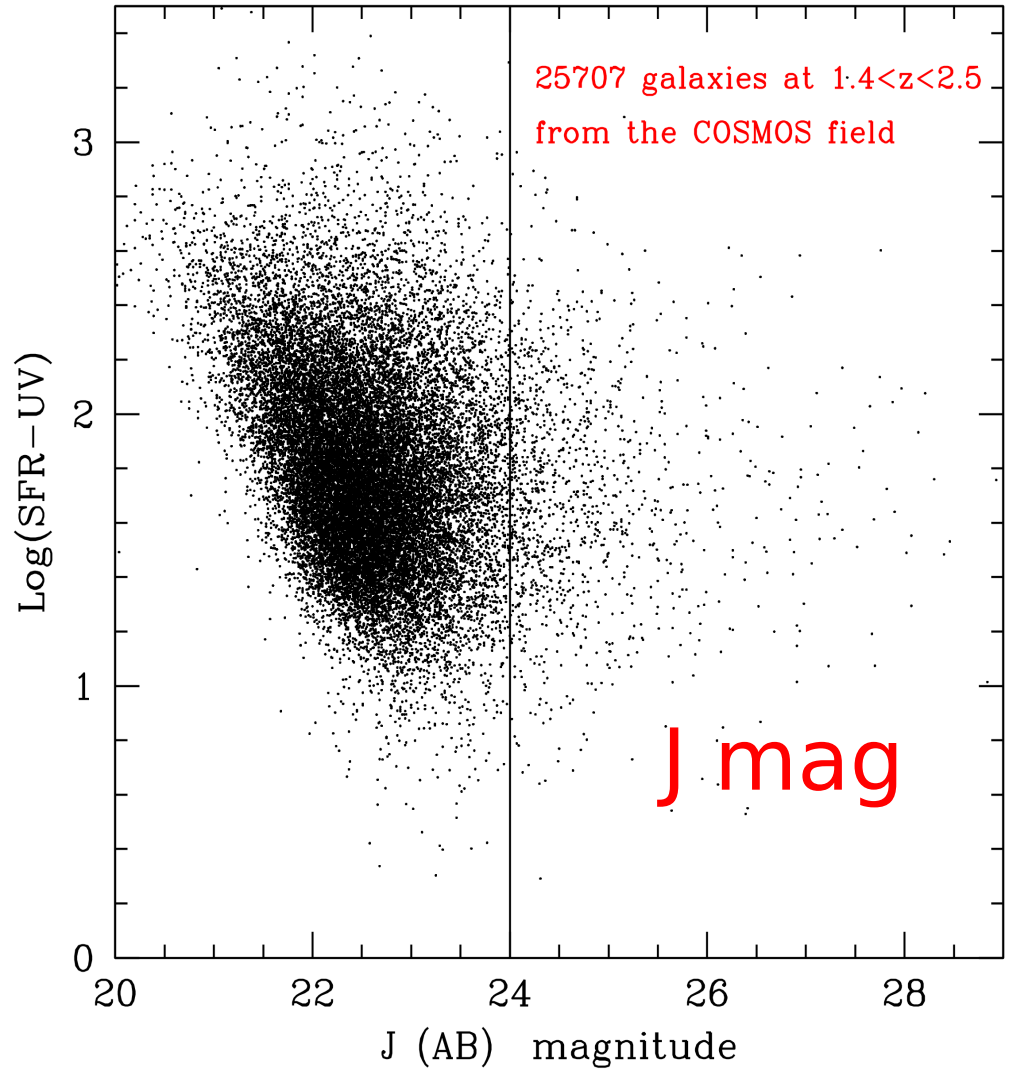
Again, going to just the J band would help enormously!

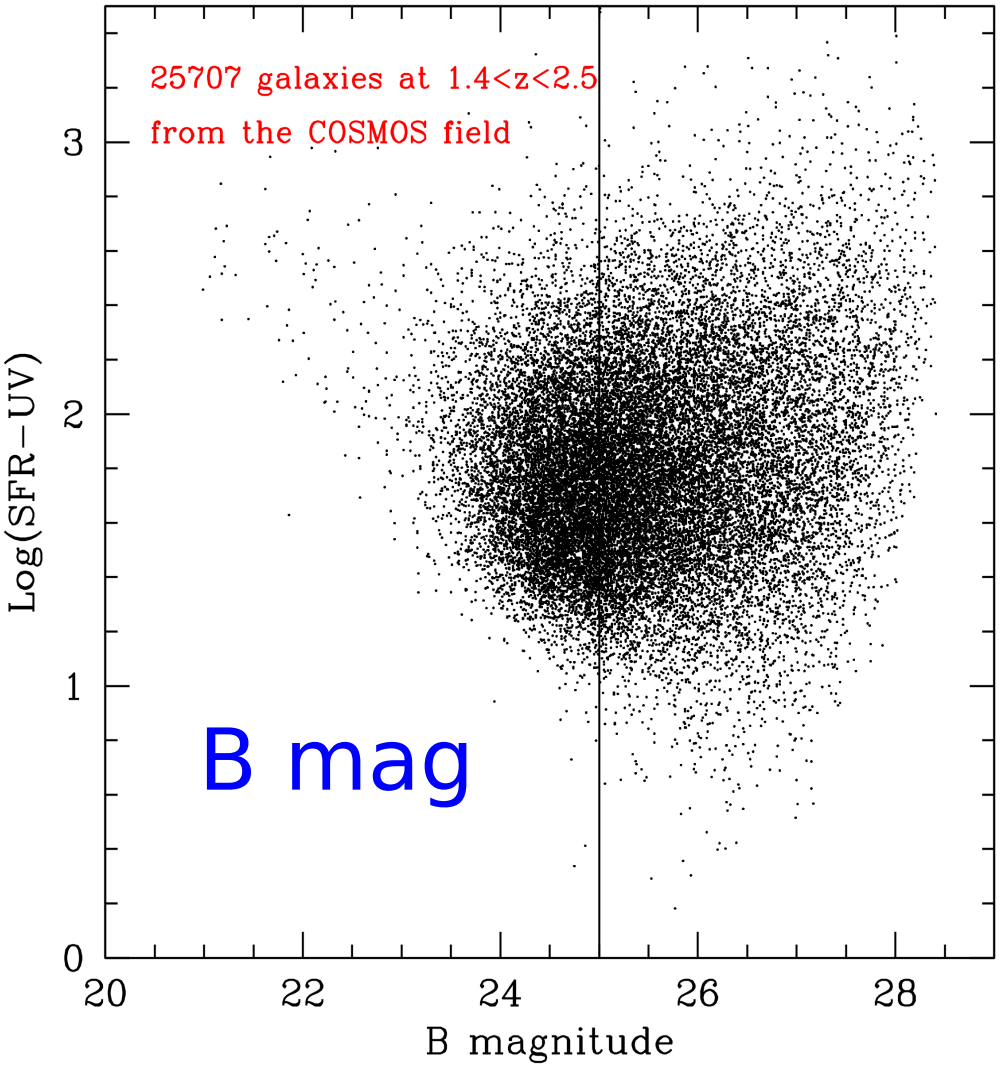
But where, how, and when?



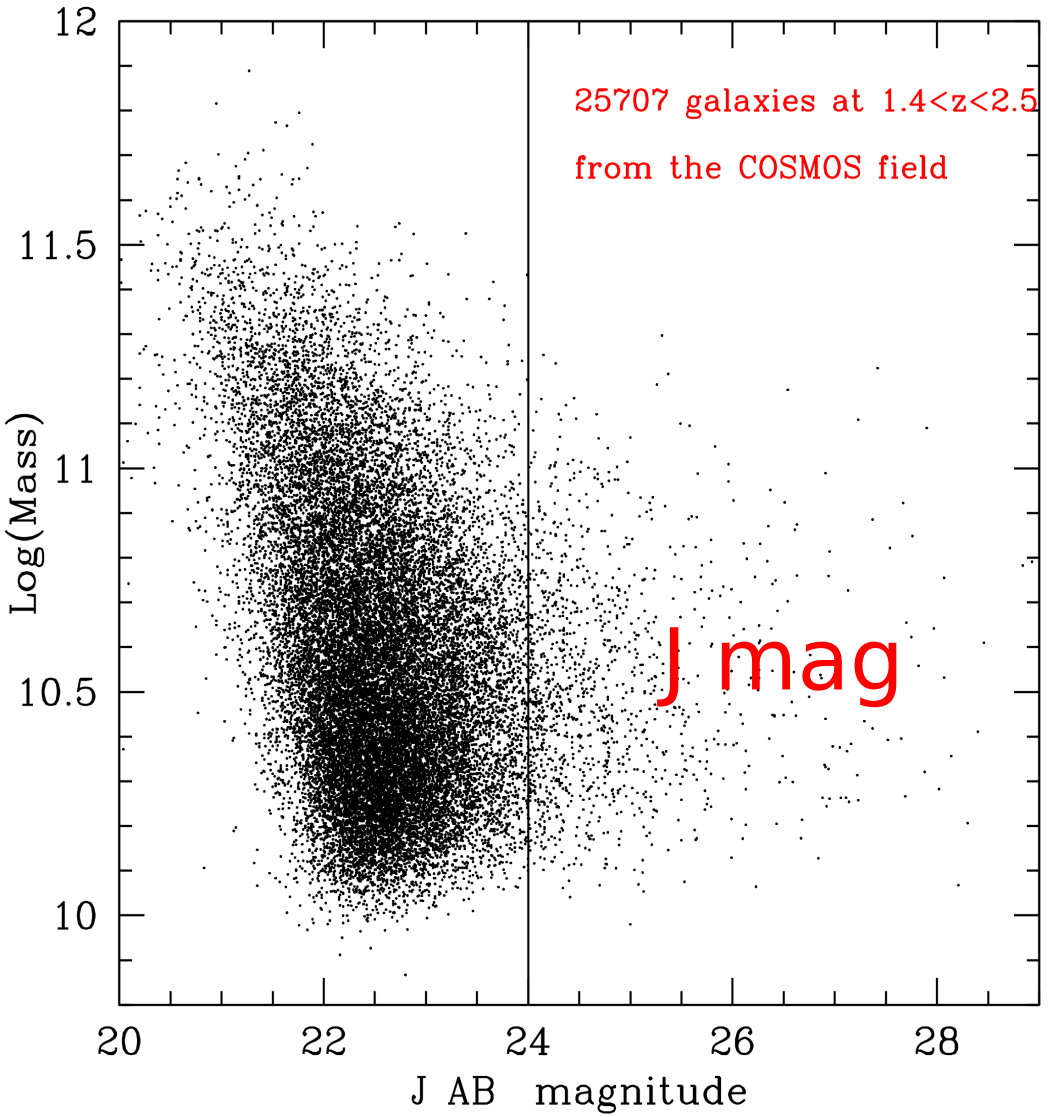
The same using 25,707 galaxies at 1.4<z<2.5 in the COSMOS field

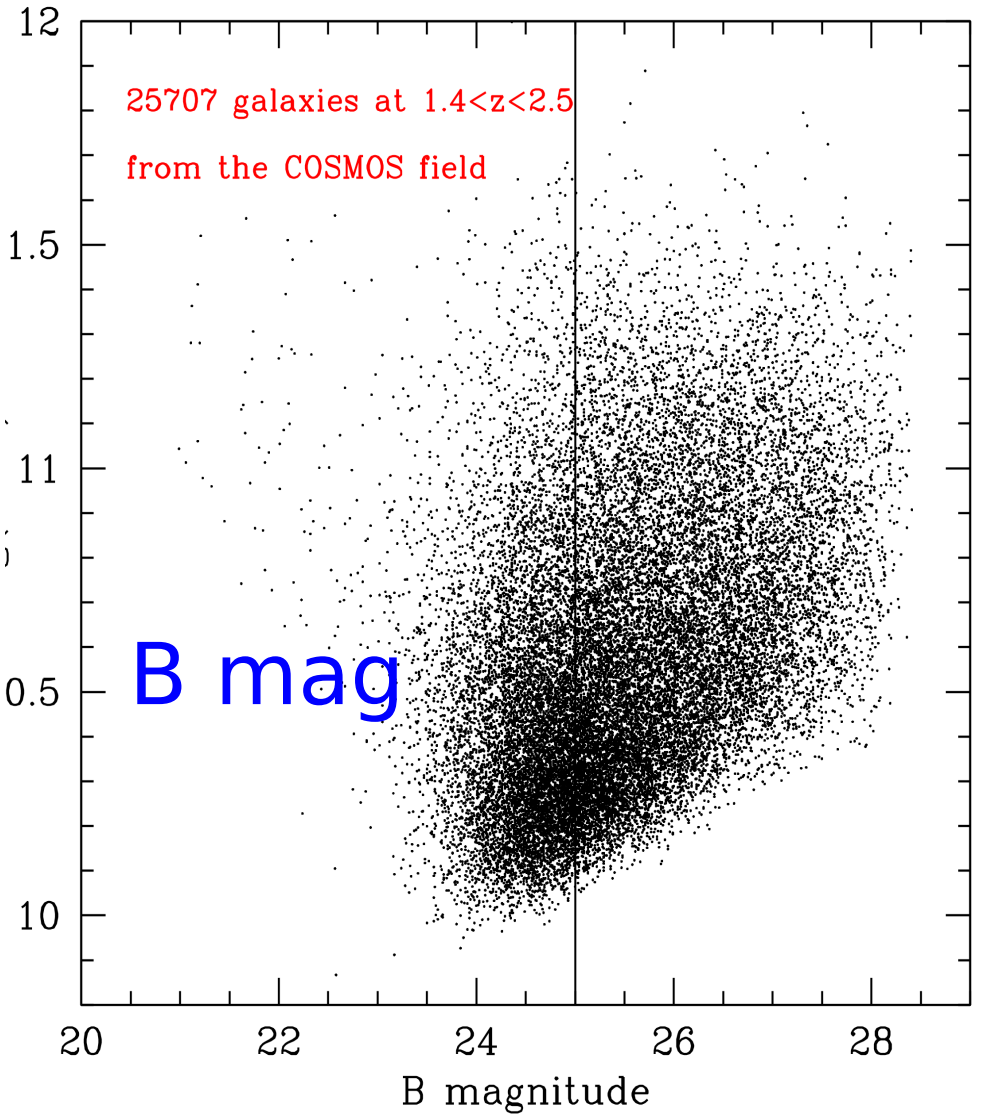
Star Formation Rate





... and for the Stellar Mass

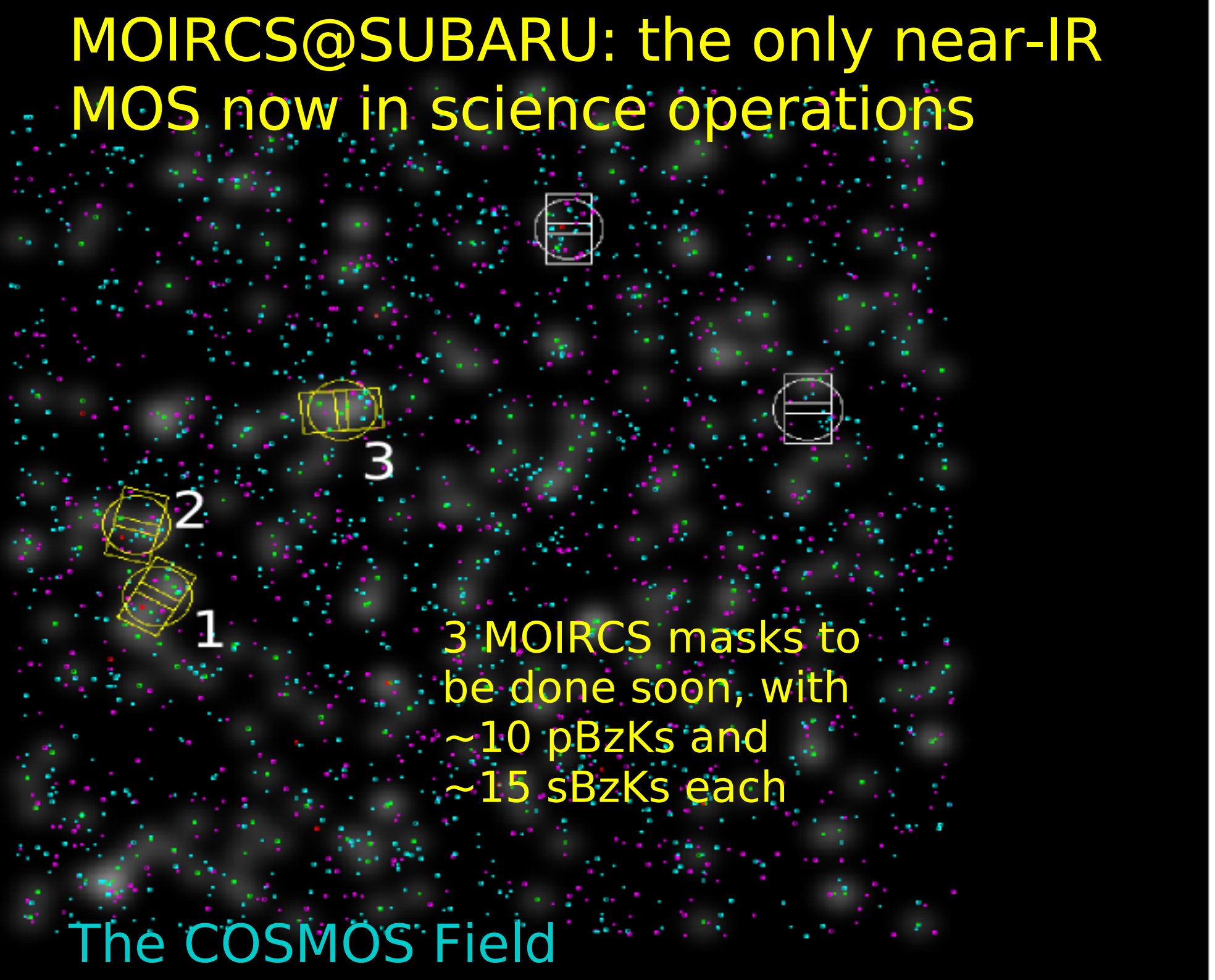




Advantages of J-band spectroscopy

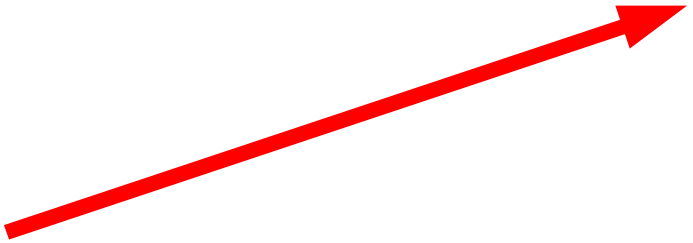
- For passive z>1.4 galaxies: J-band samples the strongest features (CaII H&K; 4000 Å Break)
- For star forming z>1.4 galaxies: get redshifts from [OII] in emission instead from weak absorptions up to z~2.8
- For all z>1.4 galaxies: most massive/most star forming galaxies are brightest in the J band
- Ly-α enters the J band @ z~7 and leaves it @ z~10.5: explores the re-ionization universe
- J-band (H-band) spectrographs don't need cryogenics and can cover wide fields at affordable costs

MOIRCS@SUBARU: the only near-IR MOS now in science operations



FoV & status of Near-IR MOSses

	FoV	status
• KMOS@VLT: 7'.2 ⌀	40	in construc.
• MOIRCS@SUBARU: 7'x4'	28	in operation
• EMIR@GTC: 6'x4'	24	in construc.
• Lucifer@LBT: 4'x3'	12	in commiss.
• FMOS@SUBARU: 30' ⌀	700	in commiss.



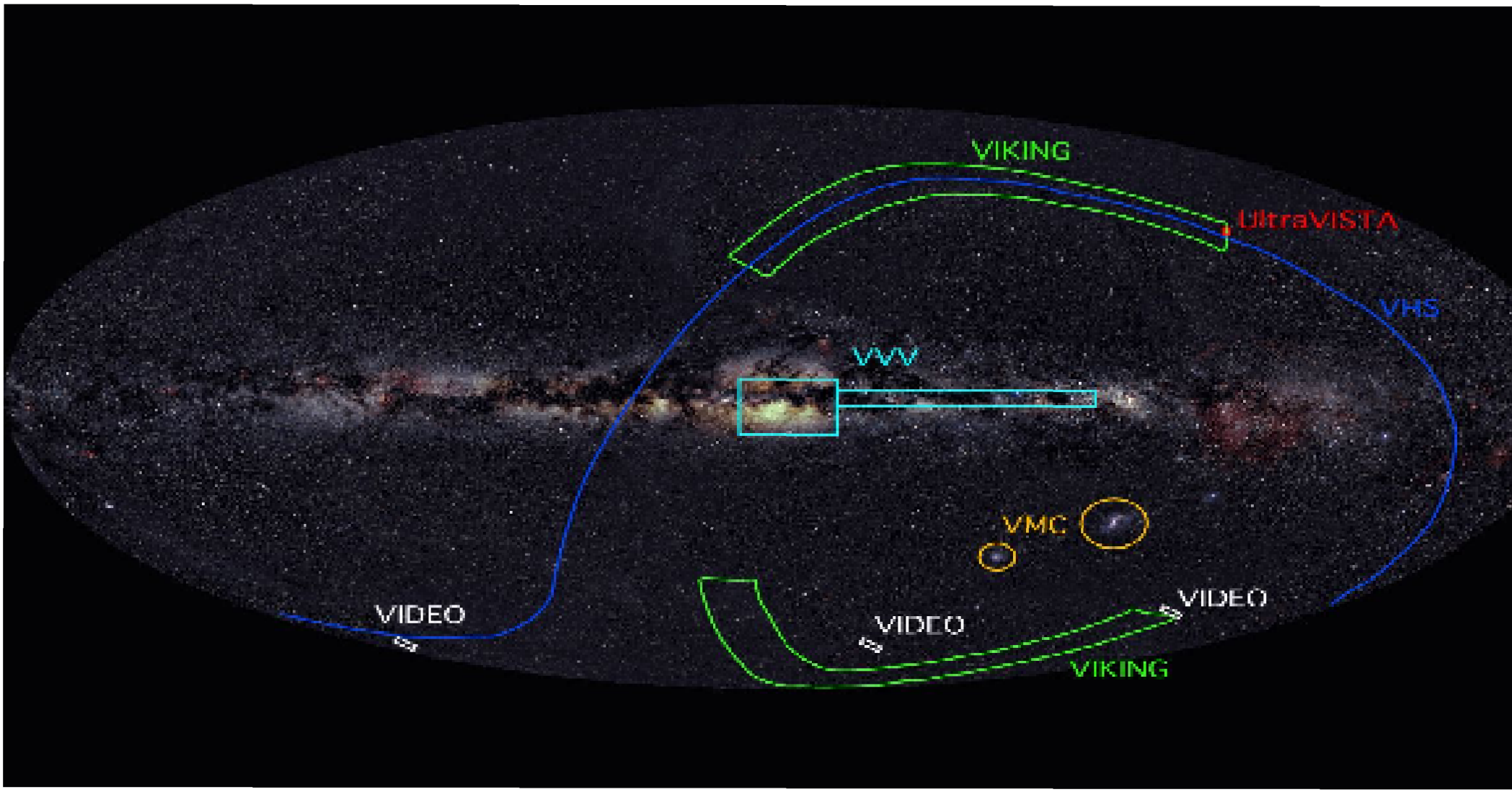
FMOS clearly offers the only chance for a massive production, on a short timescale

More on FMOS@SUBARU

- Fibre Multiplex: 400
- Wavelength coverage: 0.9-1.8 μm
- In 1 shot with R=500, in 4 shots w/ R=2200

- The central COSMOS square degree: ~3600 sBzKs and ~700 pBzKs to K_{Vega} = 20,
  or ~11 FMOS pointings, i.e. ~100-200h of telescope time in total

A last point: VISTA public surveys & a plethora of potential targets for J-(H-)band spectroscopy



Conclusions

- At the peack of cosmic star formation and galaxy assembly (z~2) with VIMOS we are (most unnaturally) forced to look at:
- Actively starforming highly extinceted galaxies, and
- Passive, red & dead galaxies ..
- In their rest-frame UV ....

We wish to look at them where they are less extincted, and have emission lines (starforming galaxies), or where they emit most of their light (passive galaxies): i.e. In the J band .....

The fastest/cheapest possible J-band MOS @ the VLT

- Refurbish Oz-Poz, completing the two “idle” plates with ~400 fibers feeding a
- J(+H)-band Spectrograph with a 4Kx4K detector, hence getting R~4000
- FoV 25 arcmin ⌀, or ~ 500 arcmin^2, still competitive with FMOS@SUBARU
- Hang it below the Nasmyth platform, or replace GIRAFFE
- Problem: Needs a different field corrector