E-ELT DRM

The Physics and Mass Assembly of Galaxies

Update

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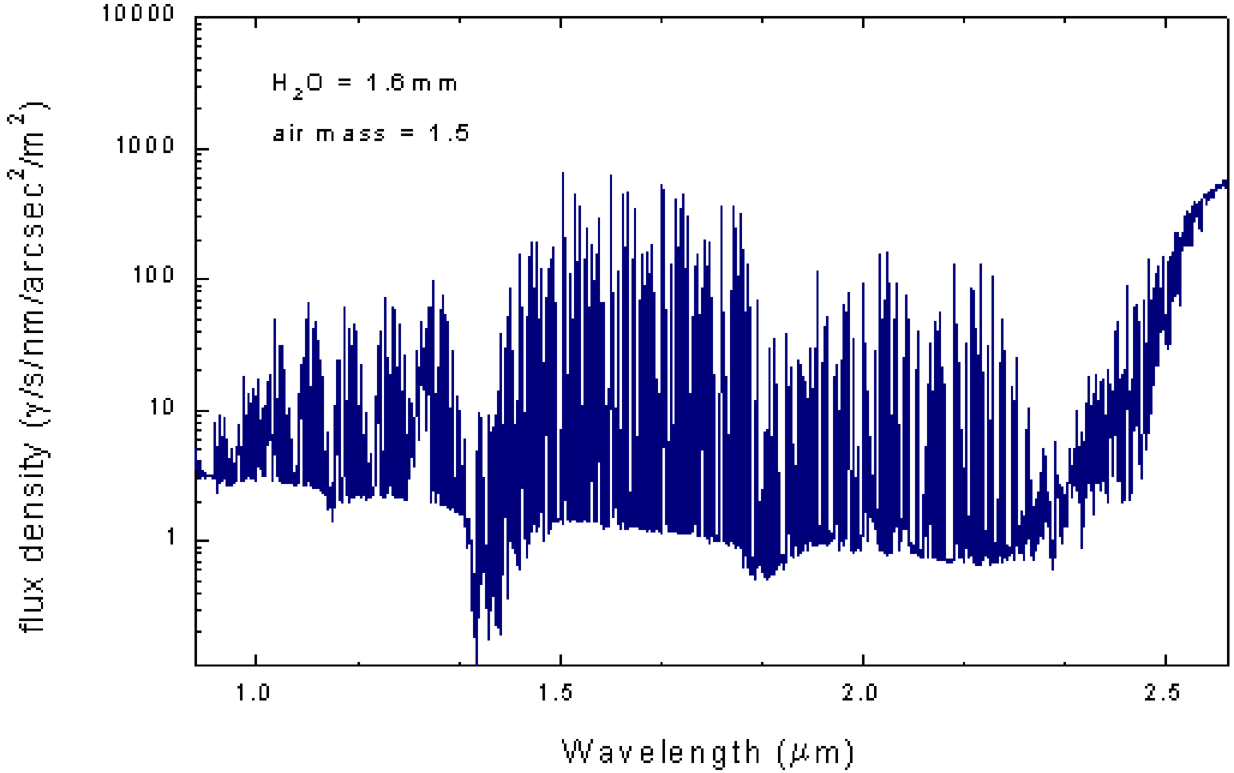
ELT SWG meeting – Oct 9, 2007

Pipeline updates

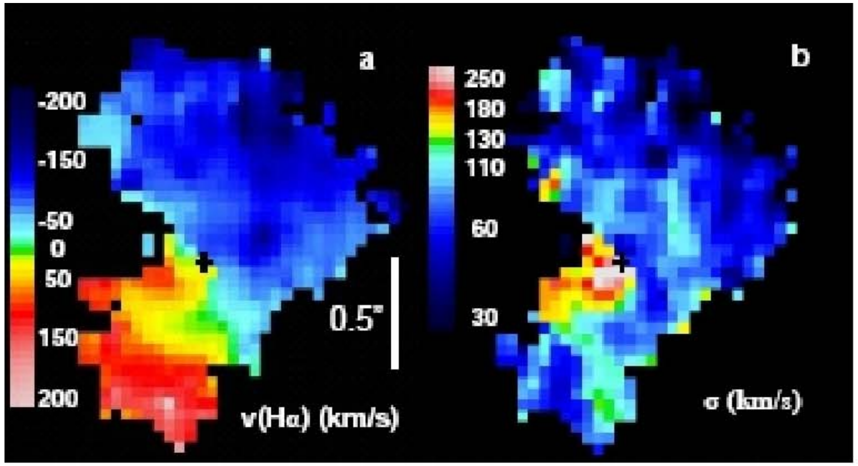
- **Complete sky model (Mauna Kea), including OH sky lines**

http://www.gemini.edu/sciops/ObsProcess/obsConstraints/ocSkyBackground.html



- **Thermal background : from EAGLE preliminary study - in agreement with TMT/GMT studies**
  - → **Telescope: T=280K ε=5%**
  - → **Target aquisition system: T=240K ε=15%**
  - → **Spectrograph: T=150K ε=69%**

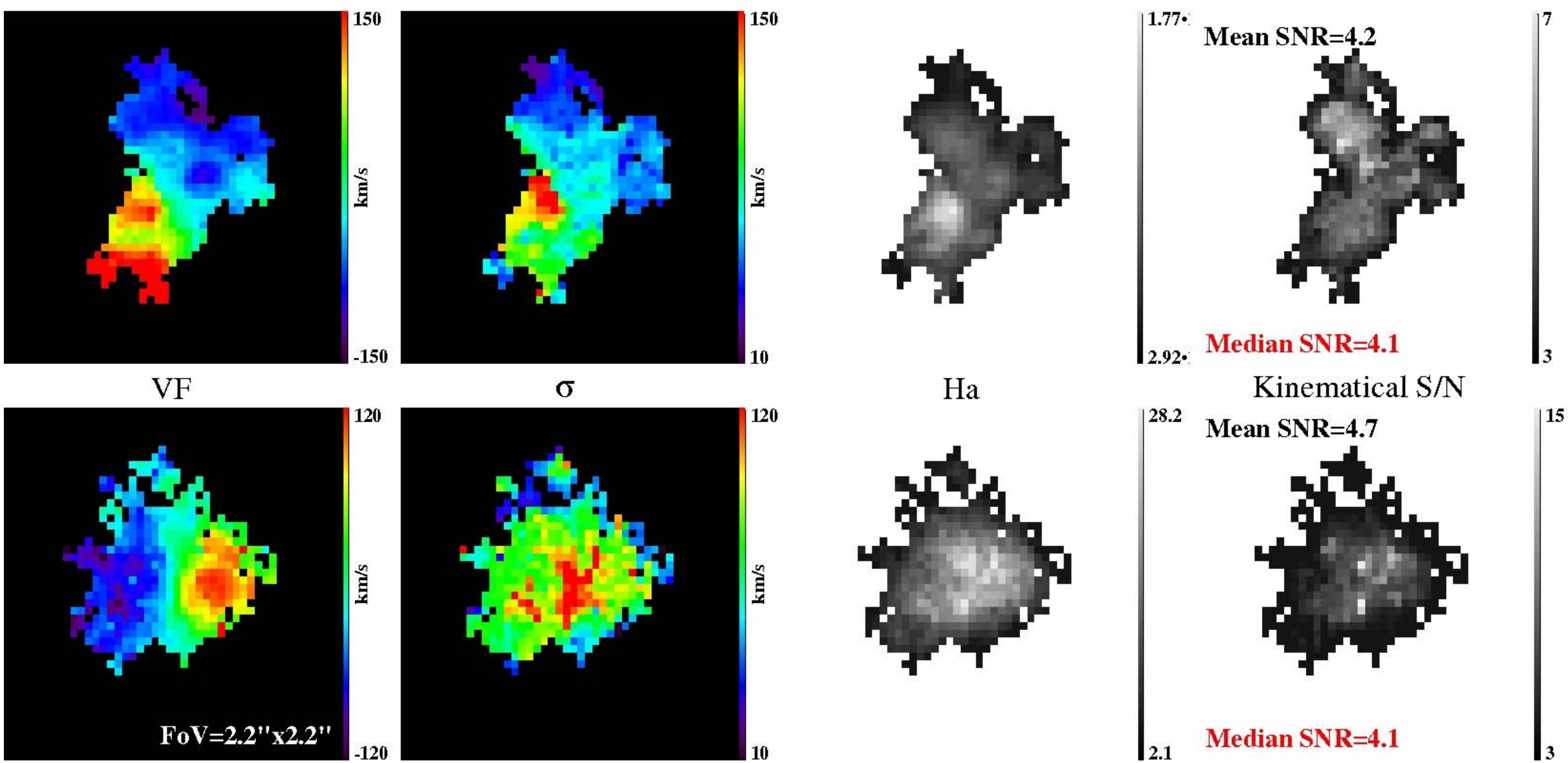
Pipeline validation



Genzel et al. (2006)
SINFONI data

R_{gal}~0.8″, M_{tot}=1.1×10^{11}$M_\odot$, M_*=8×10^{10}$M_\odot$
V_c=230 km/s, EW_{rest}=140 A

z=2.3834
K=21.47 EWo(Ha)=140A
Tintg=6hr
50x100mas FWHM=150" (smoothed to 190)"



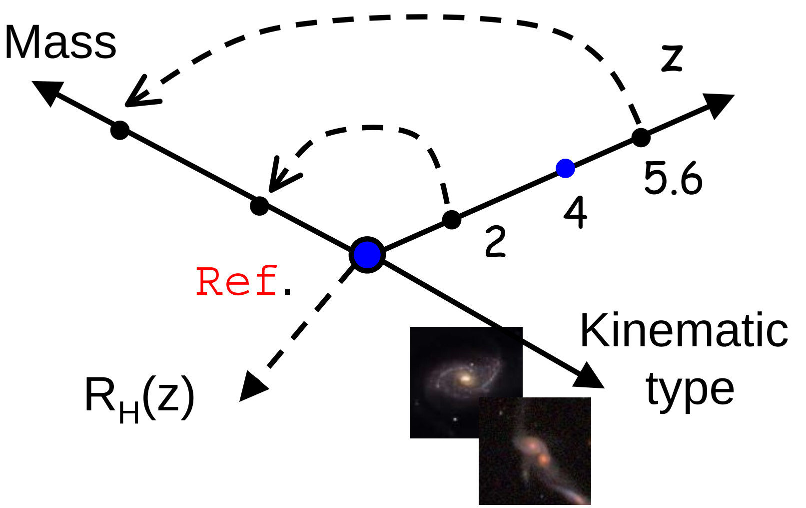
SNR/Mass limit for 3D studies ?

- **We define M_{lim} = $M_{stellar}$ @ SNR=5 (spatial mean in the [OII] emission line), set up from kinematical studies**
- **SNR=SNR(SB,z,EE,D,EW_0,T_{exp},R,Δpix,…) ➔ M_{lim}=M_{lim}(SB,z,EE,D,EW_0,T_{exp},R,Δpix)**

Reference case (z=4, M* galaxy)

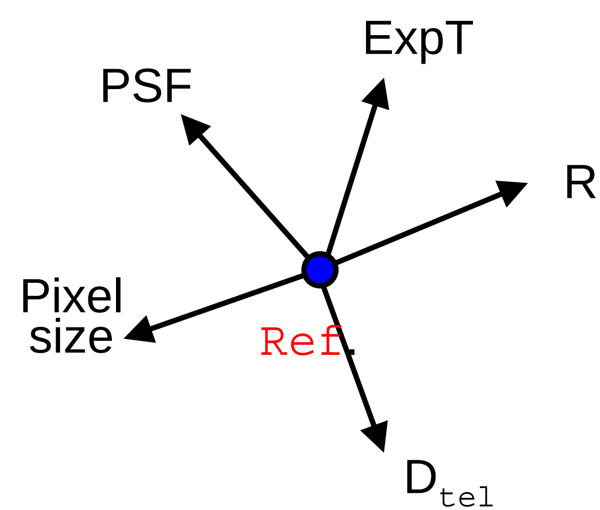
Physical params

z=4, H_{AB}=24.3 (M* @z=4)
V_{max}≈ 230 km/s → Log(M*)=10.7 $M_\odot$
EW_0=30A ([OII] in H band)
R_H=200 mas, R_{gal}= $4R_H$=0.8"(5.6 kpc)



Instrument params

D=42m ExpTime=24h
R=5000 Δ_{pix}=50 mas



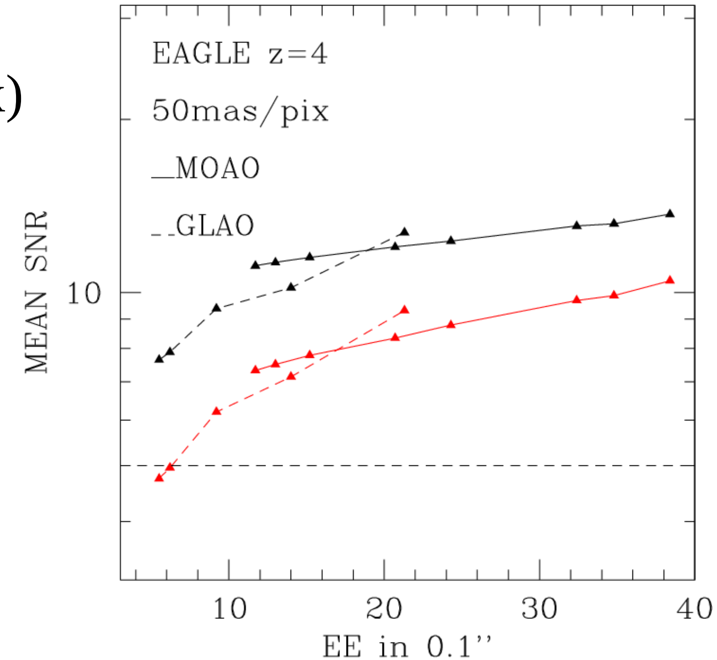
MOAO – « EAGLE »

<u>Impact of EE on M_{lim}:</u> M_{lim}(SB,z,EE,D,EW_0,T_{exp},R,Δpix)

ΔEE =11.7 to 38.4%

ΔSNR ~ 0.1 ΔEE^{MOAO}

➔ΔSNR~2.7 small impact of EE



We can choose a « representative » MOAO PSF:

EE~21% SNR~12

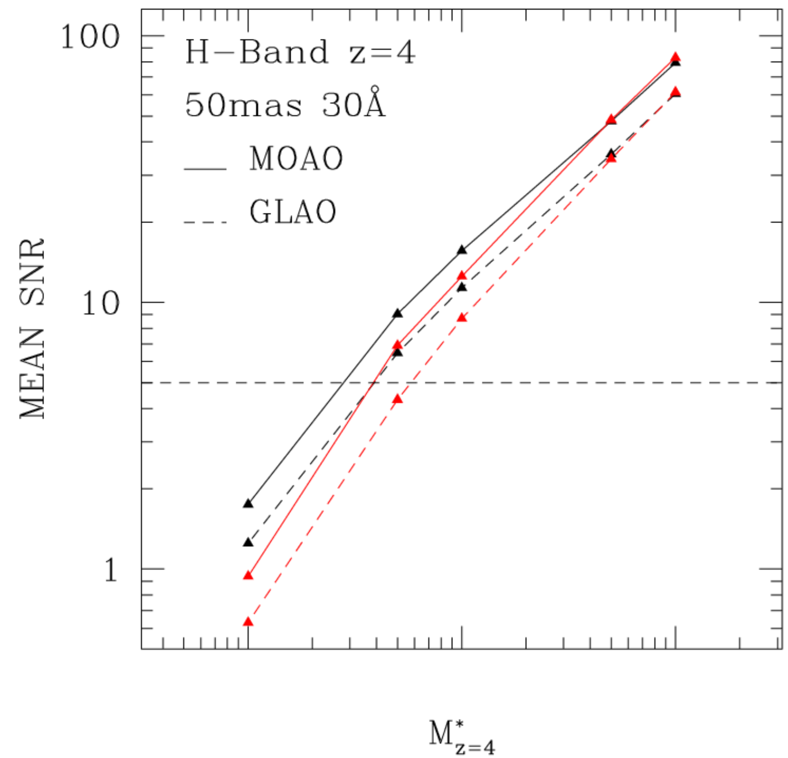
➔ ΔSNR/SNR~0.2

Log SNR ~ Log(M/M*)

ΔSNR/SNR ~ Δ(M/M*)/(M/M*)

ΔEE leads to Δ(M/M*)/(M/M*)~0.2

➔ M_{lim}=M_{lim}(SB,z,~~EE~~,D,EW_0,T_{exp},R,Δpix)



MOAO – « EAGLE »

<u>Impact of Telescope/instrument:</u> $M_{lim}(SB,z,D,EW_0,T_{exp},R,\Delta pix)$

M_{lim} scales as:

42m/D

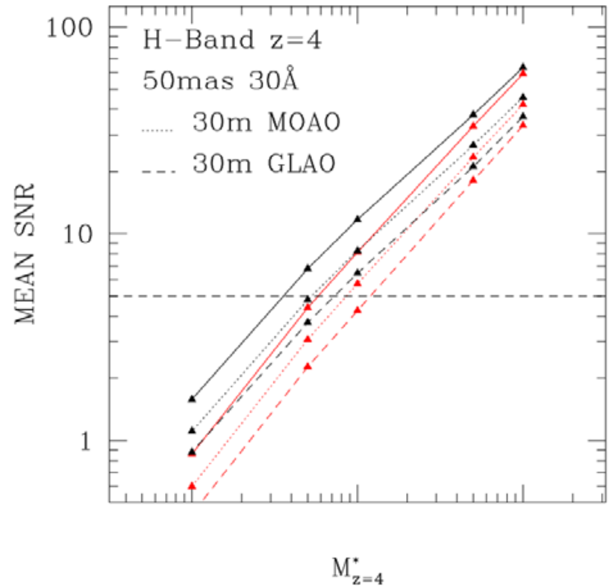
30Å/EW_0

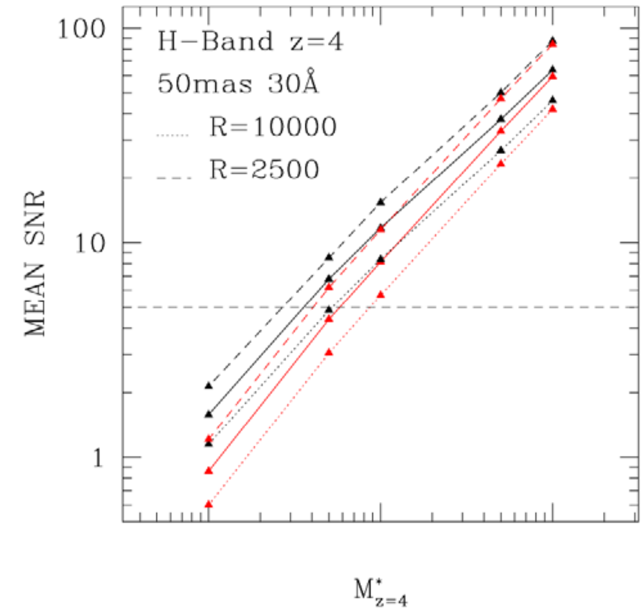
$\sqrt{(24hr/T_{exp})}$

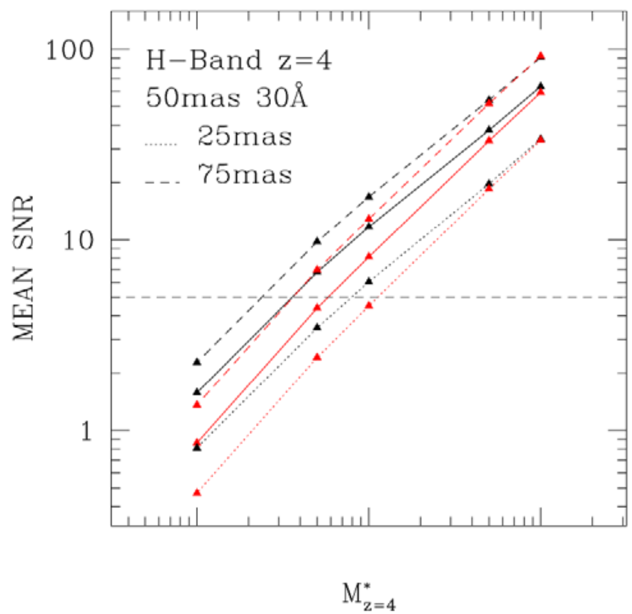
$\sqrt{(R/5000)}$

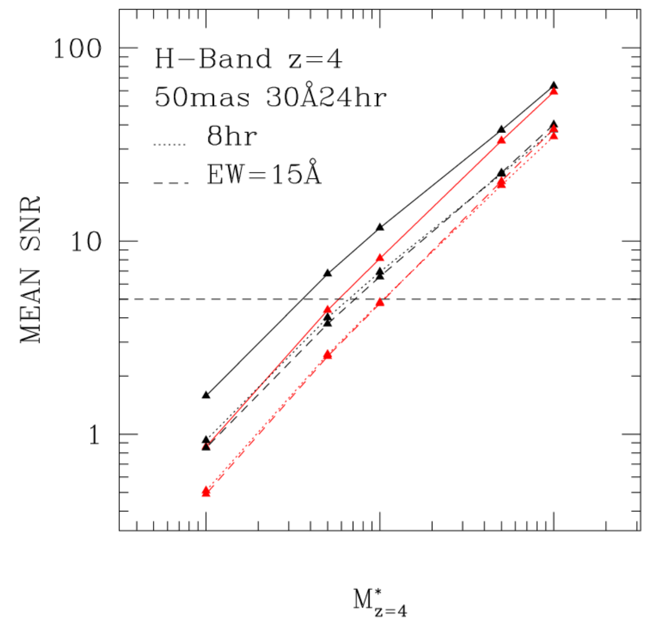
50mas/Δpix

Accuracy: $\pm$ 0.1 M*









MOAO – « EAGLE »

<u>Impact of SB on M_{lim}:</u> M_{lim}(SB,z,D,EW_0,T_{exp},R,Δpix)

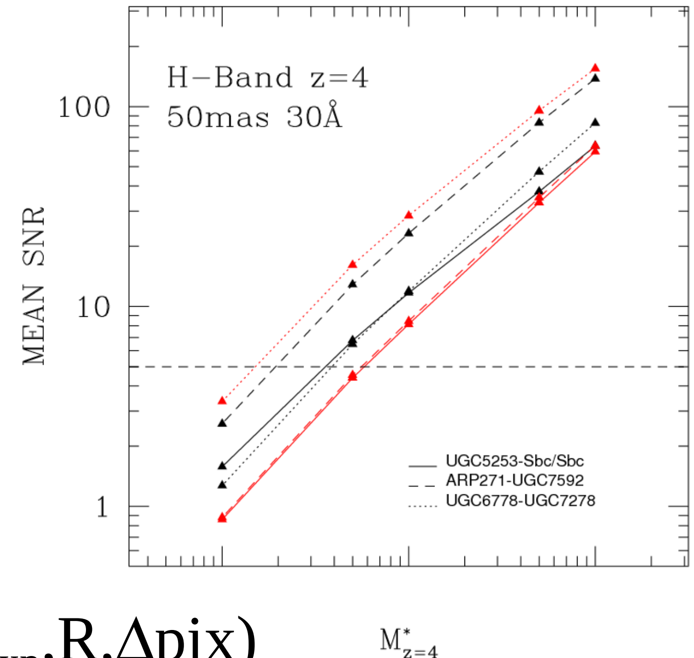
Sp: UGC5253 - UGC6778

Major Merger: Sbc/Sbc – ARP271

Irr: UGC7592 - UGC7278

➔ $\Delta(M_{lim}/M^*) = 0.15$ to 0.58

➔ $M_{lim}/M^* = 0.365 \pm 0.215$

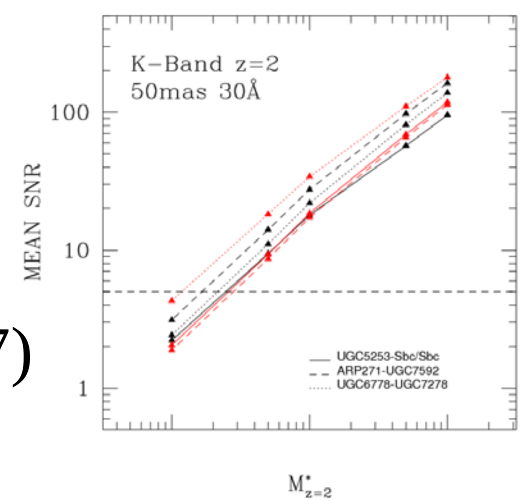


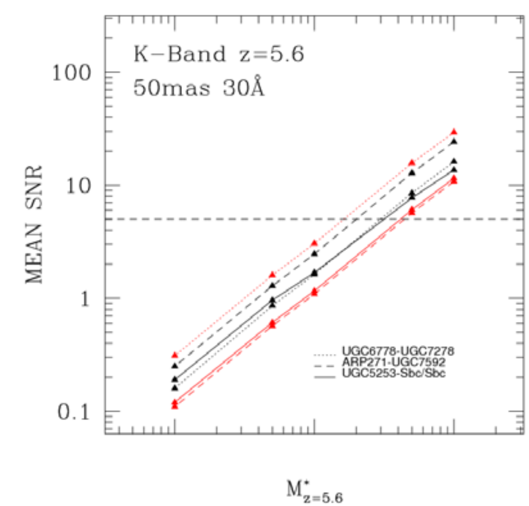
<u>Impact of z on M_{lim}:</u> M_{lim}(SB,z,D,EW_0,T_{exp},R,Δpix)

M_{lim}/M^* (z=2)= 0.2 ± 0.08

M_{lim}/M^* (z=5.6)= 3.01 ± 1.39

$M_{lim}(z) \sim 0.195 + 0.0001527.\exp(z/0.57)$





MOAO/GLAO

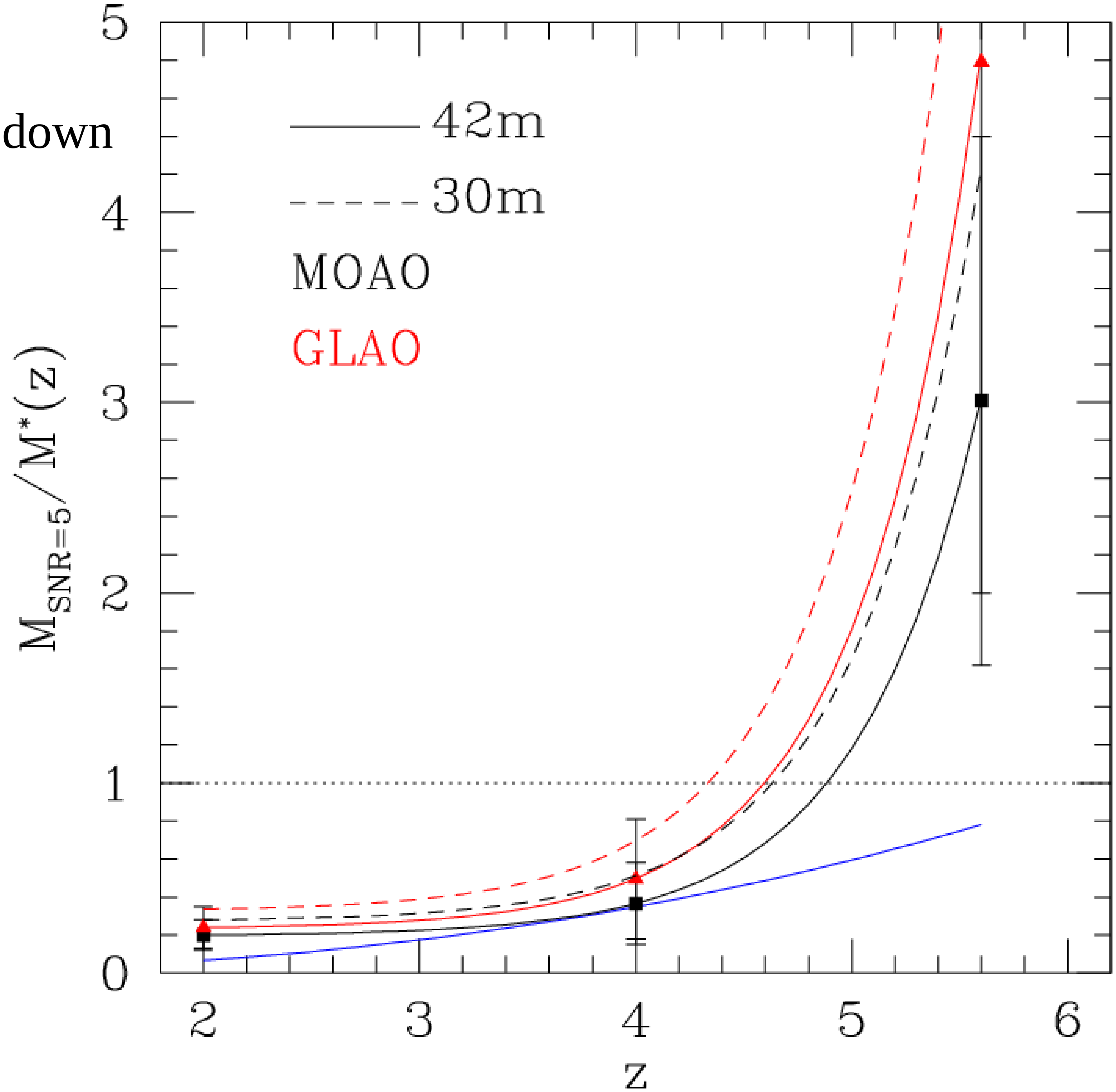
The MF can be probed down to M* up to:

With a 42m telescope:

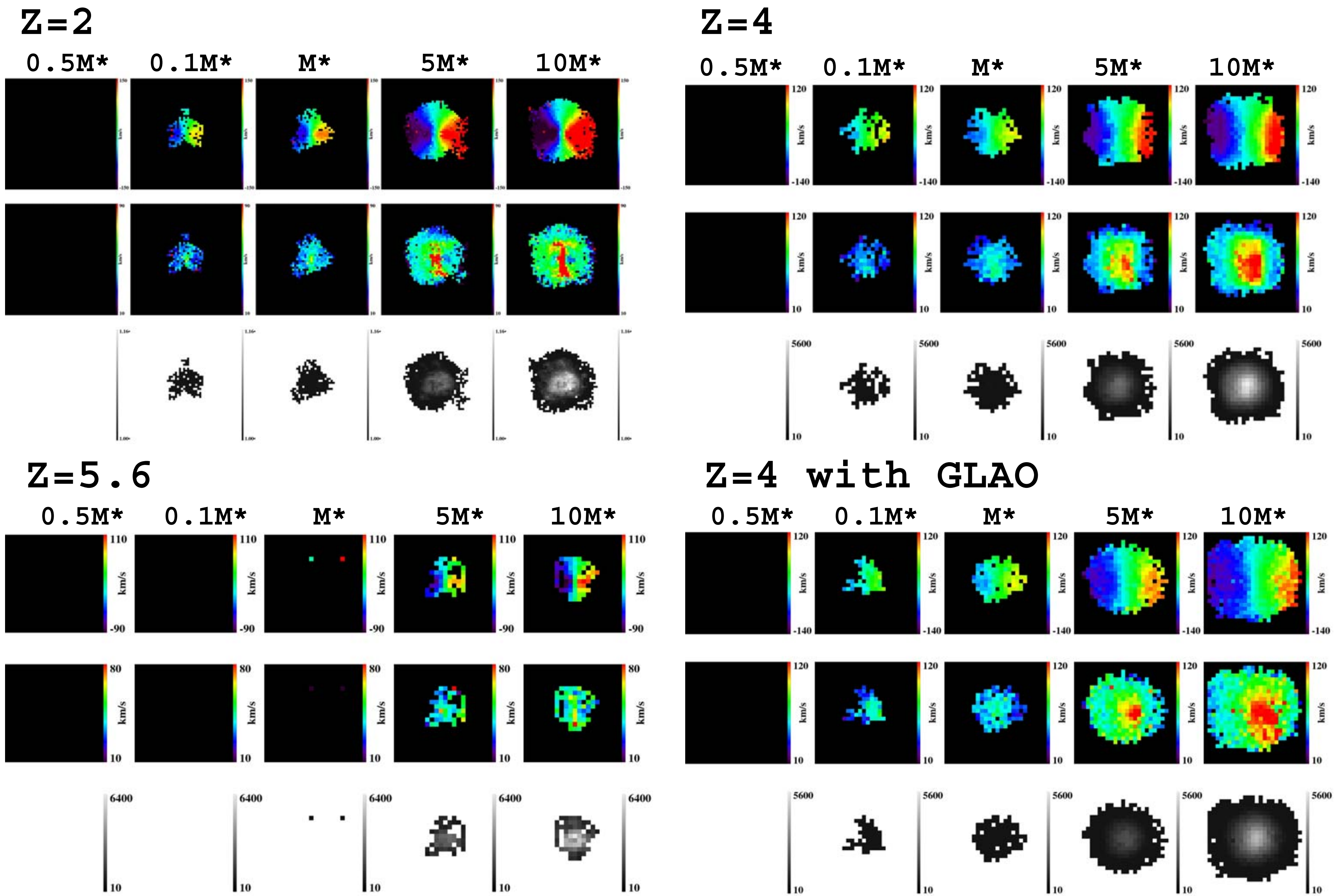
- with MOAO: z~4.9
- with GLAO: z~4.6

With a 30m telescope:

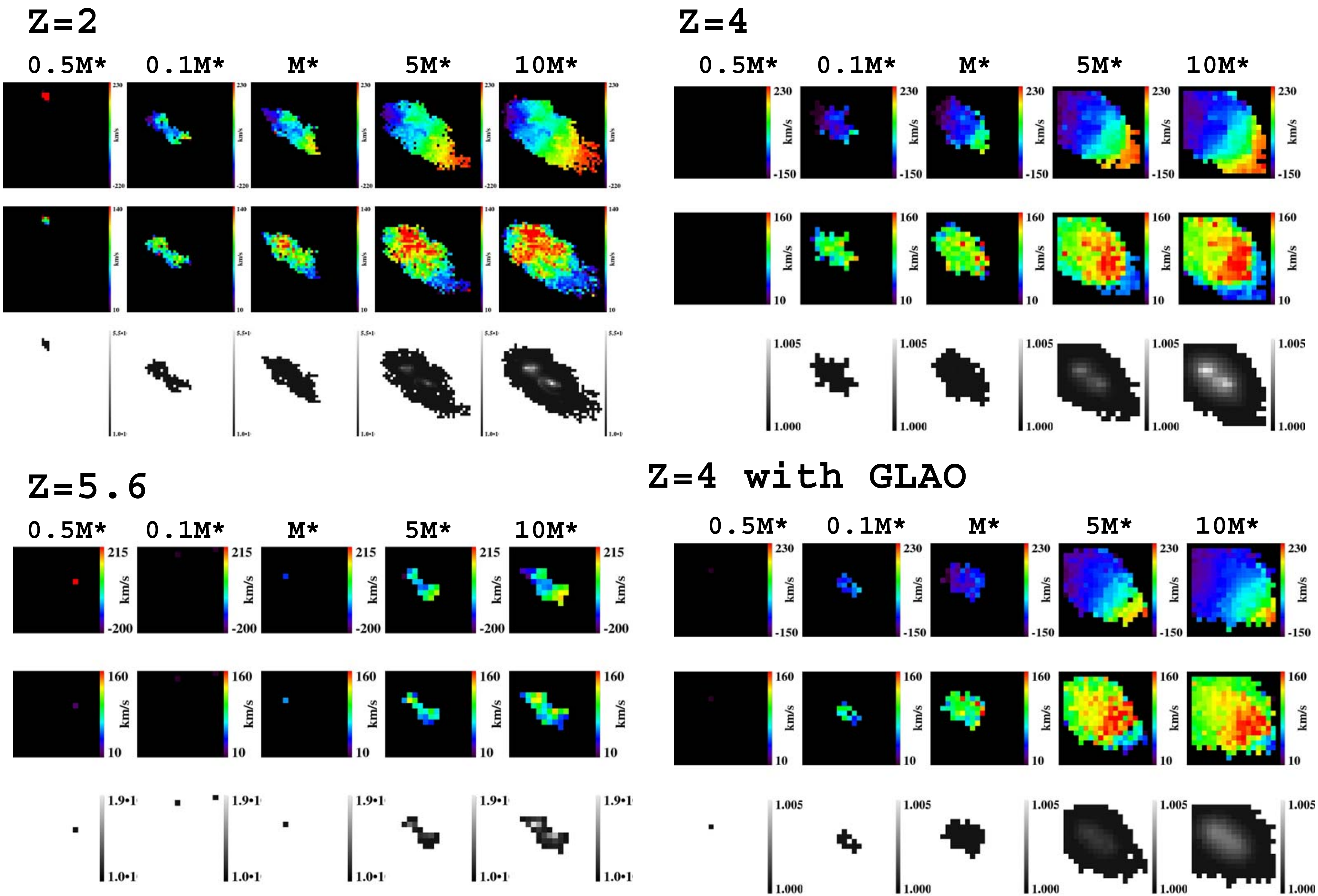
- with MOAO: z~4.6
- with GLAO: z~4.3



Kinematical classification: rotating disk



Kinematical classification: major merger

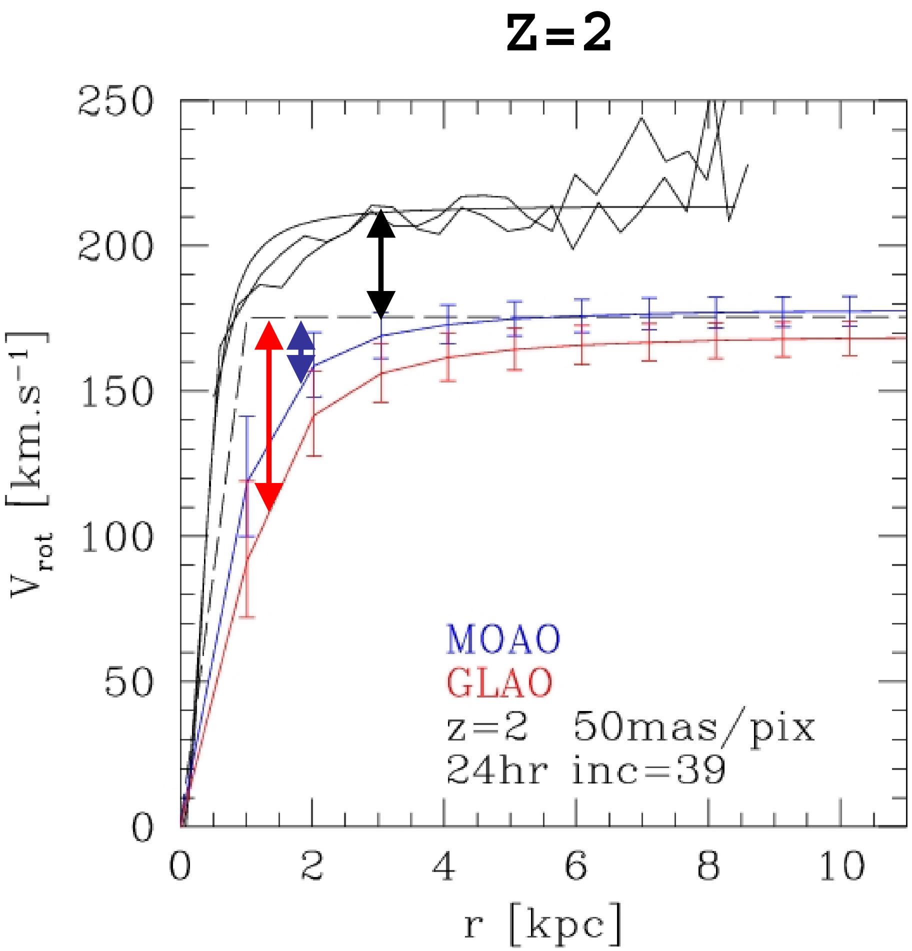


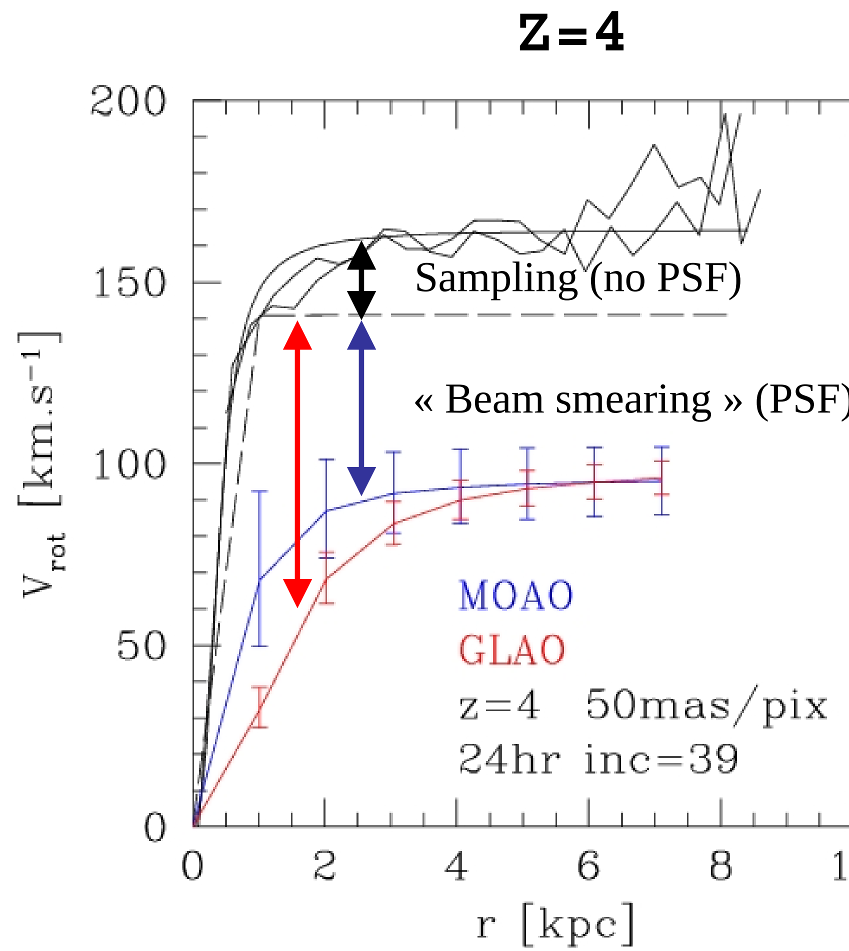
Rotation Curves (UGC5253)

✓ Accuracy on the RC is limited by the spatial resolution and sampling

✓ z=2: $FWHM_{MOAO}$~12mas $FWHM_{GLAO}$~161mas $D_{gal}/2\Delta pix=17$

✓ z=4: $FWHM_{MOAO}$~11mas $FWHM_{GLAO}$~235mas $D_{gal}/2\Delta pix=8$





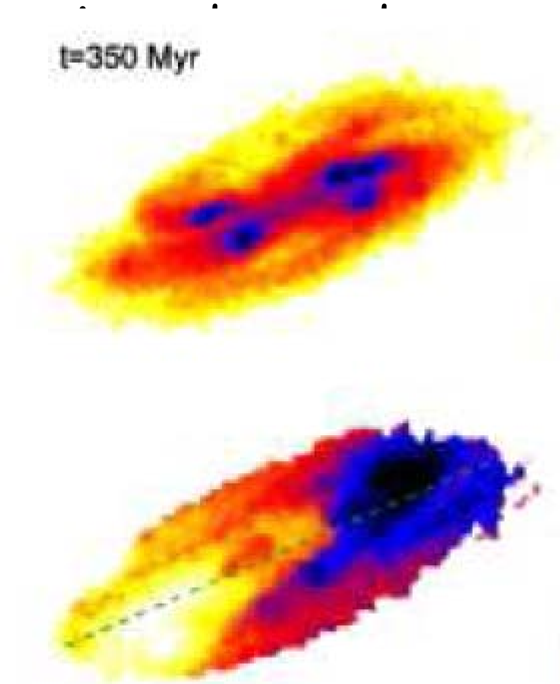
Summary

- Simulation pipeline now complete and successfully compared to SINFONI observations @ z=2.38. Need for a sky model for Paranal.

- Reliable kinematics out to z~5.6 of super-M* galaxies. The Galaxy Mass Function can be sampled down to M* up to z~4.9 using MOAO. Kinematical classification possible tools. RCs (plateau) recovered up to z~2 (Bosma thumb : D_{gal}/2Dpix > 14).

- No breaking points in telescope diameter (z~4.9 30m telescope). SNR scales as D, so loss ~ 42/3 can be compensated by longer exposures (eg, 24

- GLAO : not significantly different from MOAO classification when enough SNR is provided. Ho provides us with a better resolution → better r



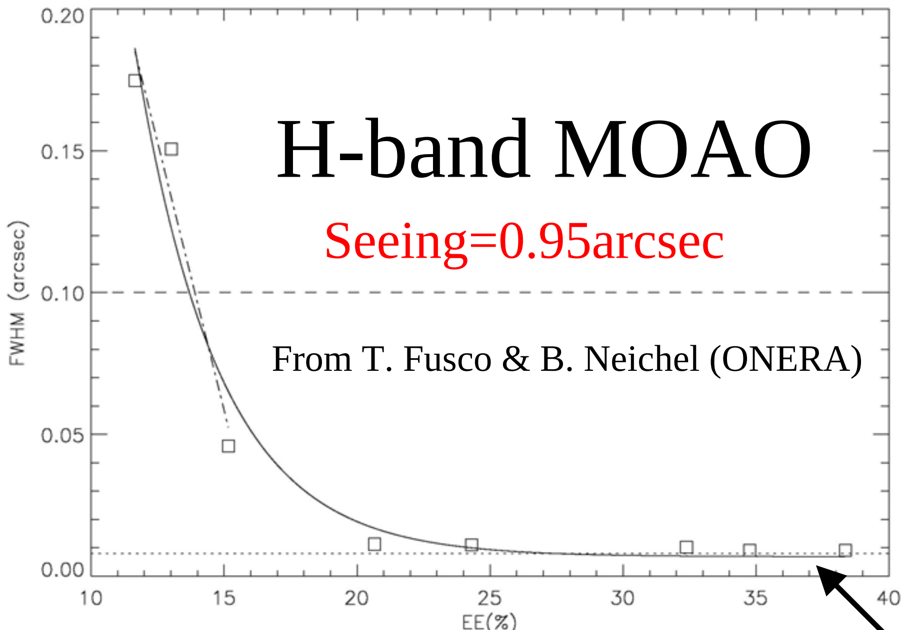
- *ToDo: MCAO/LTAO single IFU case*

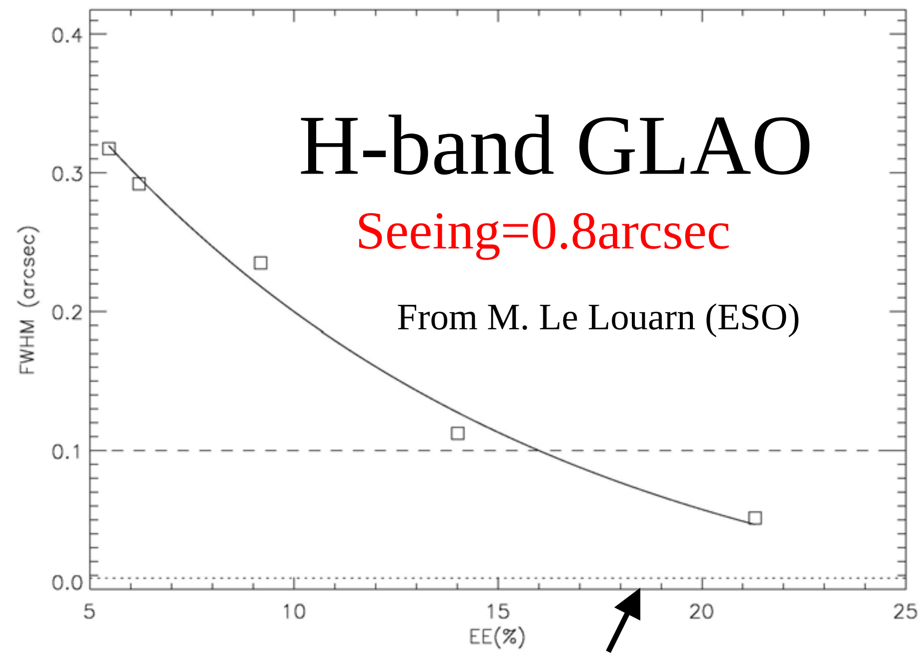
- *ToDo: Influence of knotty/clumpy galaxies: simulations of F. Bournaud (see astro-ph/0708.0306)*

- *Galaxy mass assembly DRM almost completed*

Pipeline updates

- **GLAO PSFs:** **EE in 100 mas**





Diffraction limit of a 42m telescope @ 1.65µm