Mass Assembly Survey with SINFONI in VVDS

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ASTRO LATT PHYSIQUE

Mass Assembly Survey with SINFONI in VVDS

People & Places

About 15 astronomers located in France, Italy, Germany and United Kingdom are involved in the MASSIV project

LATT – Toulouse
T. Contini (PI)
F. Lamareille
J. Moultaka
E. Perez-Montero
J. Queyrel

LAM – Marseille
P. Amram
B. Epinat
O. Le Fèvre
L. Tresse

INAF – Milano
B. Garilli
L. Paioro

INAF – Bologna
S. Bardelli
D. Vergani
E. Zucca

ESO – Garching
M. Kissler-Patig

Oxford Astrophysics
M. Lemoine-Busserolle

Staff – Postdoc – PhD student – Database manager

Galaxy Kinematics at High Redshift: Why?

Probing the **mass assembly history of galaxies** at the crucial **1 < z < 2** epoch:

- peak of the cosmic star formation activity
- transition between the morphological diversity observed @ z~3-4 and the modern-day Hubble sequence

➢ Complete census of the **mix of dynamical types** mergers, spheroïds, disks, perturbed kinematics, etc

➢ Determination of **dynamical mass**, **mass-to-light ratio**, and **metallicity**

➢ Evolution of fundamental scaling relations:
Tully-Fisher, Mass-Metallicity, Size-Velocity, etc

Galaxy Kinematics at High Redshift: How?

- At **z < 1.5**: velocity fields obtained with **optical spectrographs**, [OII]3727 emission line is still visible

- At higher redshifts (**1.5 < z < 3.5**), **NIR observations** are mandatory:
  [OII] in *J*-band, Hβ & [OIII] in *H*-band, Hα in *K*-band

- First attempts on small samples using **long-slit NIR spectrographs** (ISAAC/VLT, NIRSPEC/Keck, ...)

  Pettini et al. (2001), Lemoine-Busserolle et al. (2003), Erb et al. (2003,2004), van Starkenburg et al. (2006)

  but ... long-slits have **strong limitations**

- **Integral-field spectrographs** (**IFU**) are better to derive **accurate velocity fields**

  Flores et al. (2004) @ z~0.5, Swinbank et al. 2005, Forster-Schreiber et al. (2006) @ z~2.0, Law et al. (2007) @ z~2-3

Mass Assembly Survey with SINFONI in VVDS

VVDS offers the best suited parent sample to select high-z galaxies for NIR 3D spectroscopic follow-up :

- **largest & deepest** spectroscopic survey of distant universe
- well-defined & **minimal bias**
- complete, **representative** & statistically significant
- secure & **accurate redshifts** for efficient NIR follow-up

Mass Assembly Survey with SINFONI in VVDS

ESO "Large Program" (PI: T. Contini)
started in P79 for **2 years (2007-09)**
--> **300 hours in** *Service mode*

Sample: ~ **140 VVDS star-forming galaxies selected in three fields F02, F22 & F14**

- spanning a **wide range of stellar masses** log(M)=[9,12]
- with **"bright" [OII] emission** up to z~1.4
- selection in the **ultra-deep** (I_{AB} < 24.75) VVDS sample **for z > 1.4**

Strategy: **AO-assisted SINFONI** observations

- *JH* bands to observe redshifted **bright emission lines** (Hα, [OIII])
- **high spatial resolution** (~0.2") to probe the dynamics from EL velocity fields

Mass Assembly Survey with SINFONI in VVDS

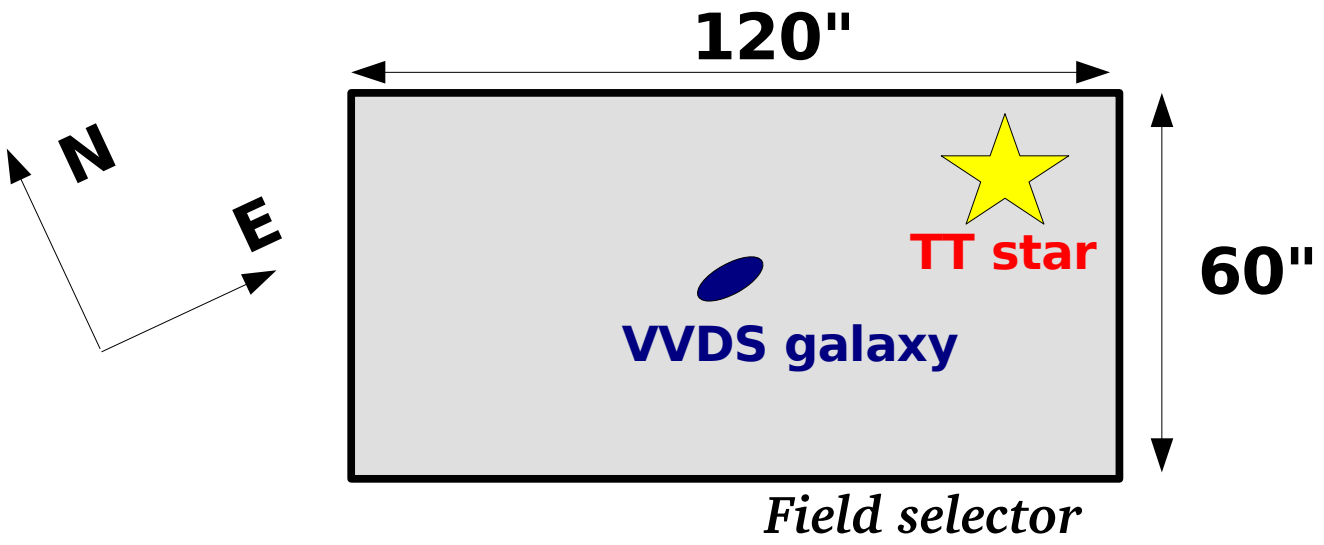
Sample selection criteria

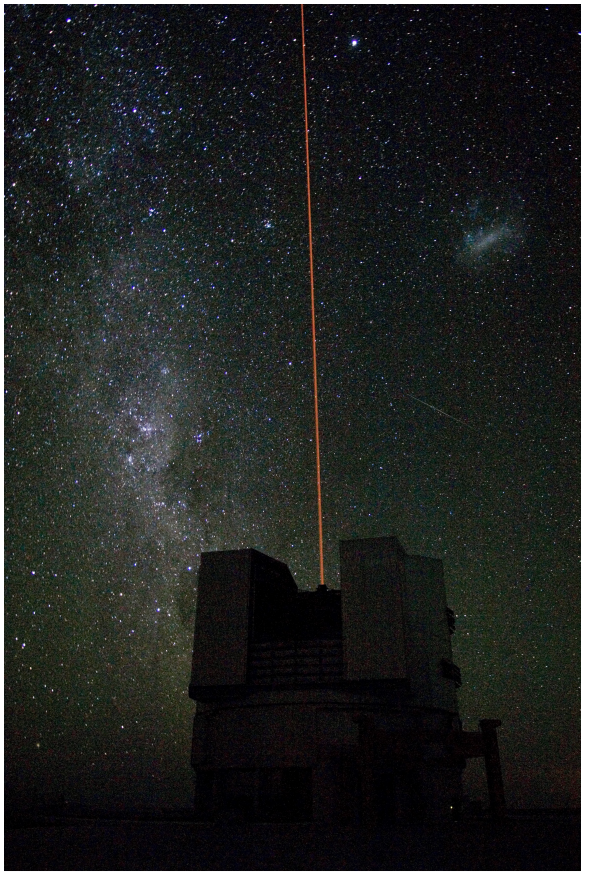
- **Secure redshift**: zflag=2-9 (or 22-29) + visual (+ zphot) check
  - z=0.900-1.049 -> Hα in J band
  - z=1.193-1.240 -> [OIII] in J band
  - z=1.240-1.814 -> Hα in H band
- **Avoid the z=1.049-1.193 range** (Hα between the J & H bands)
- **Avoid bright sky lines** ***($\Delta\lambda$>=9Å for f_{OH}>100)***
- **Lower limits on [OII]3727 EW**:
  - EW([OII]) < -40 and S/N > 6 **or**
  - EW([OII]) < -25 and S/N >10

Mass Assembly Survey with SINFONI in VVDS

AO/LGS assisted observations

--> **constraints on distance/mag of TT star**





First Light of the VLT Laser Giude Star

ESO PR Photo 07a/06 (23 February 2006)

- J **band:** magR < 16.5 (< 15.5 if dist < 30")
- H **band:** magR < 17.5

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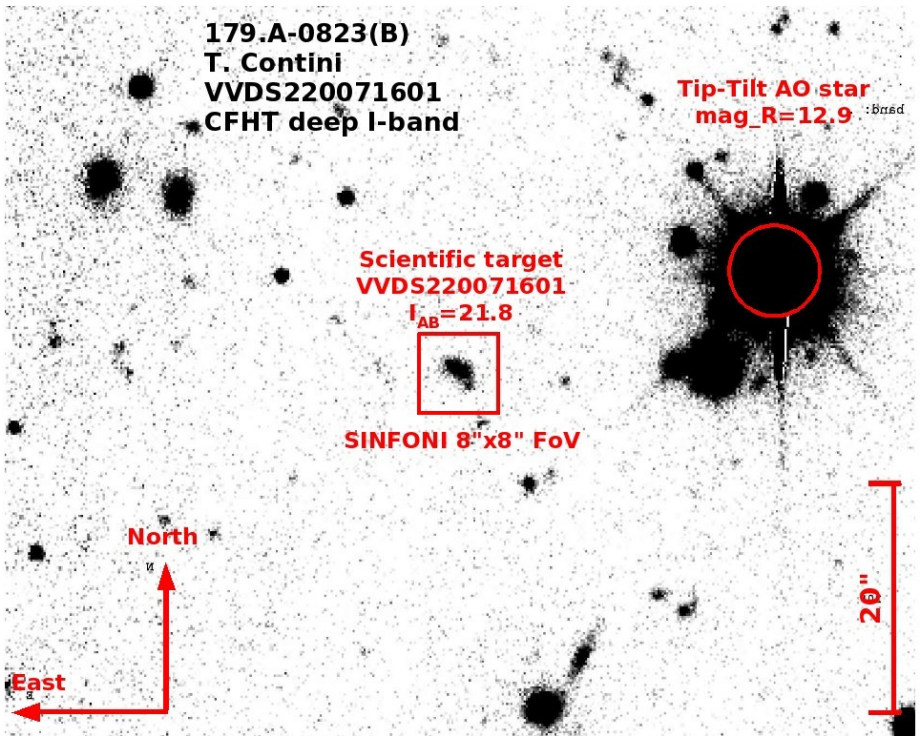
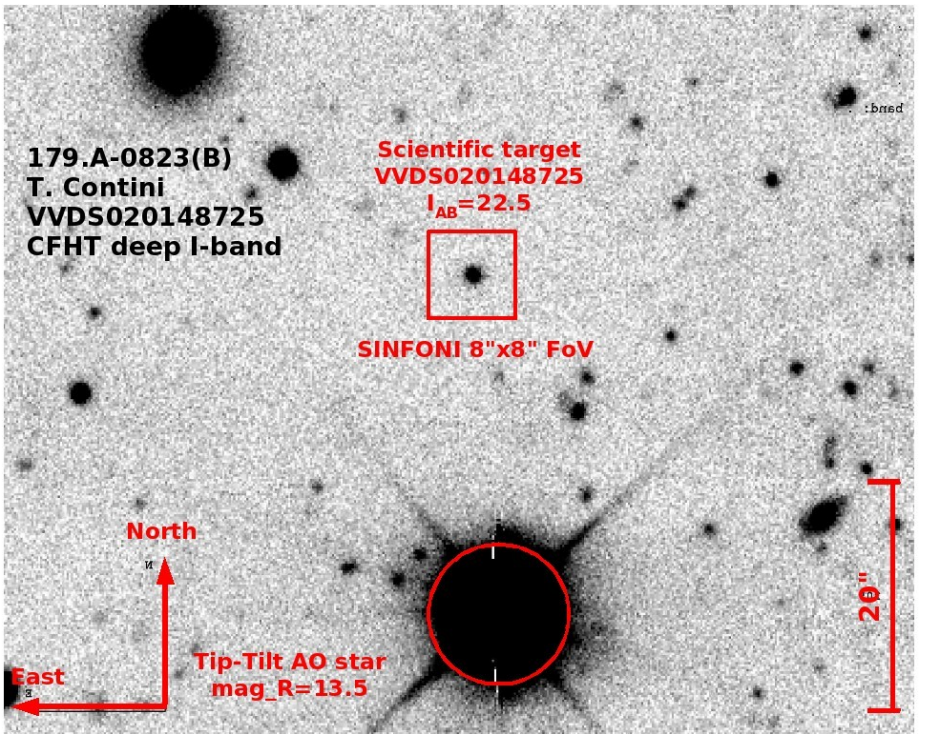
Examples of 1.0 < z < 1.4 VVDS targets



VVDS220071601 - z=1.3538



VVDS020148725 - z=1.3266

MASSIV
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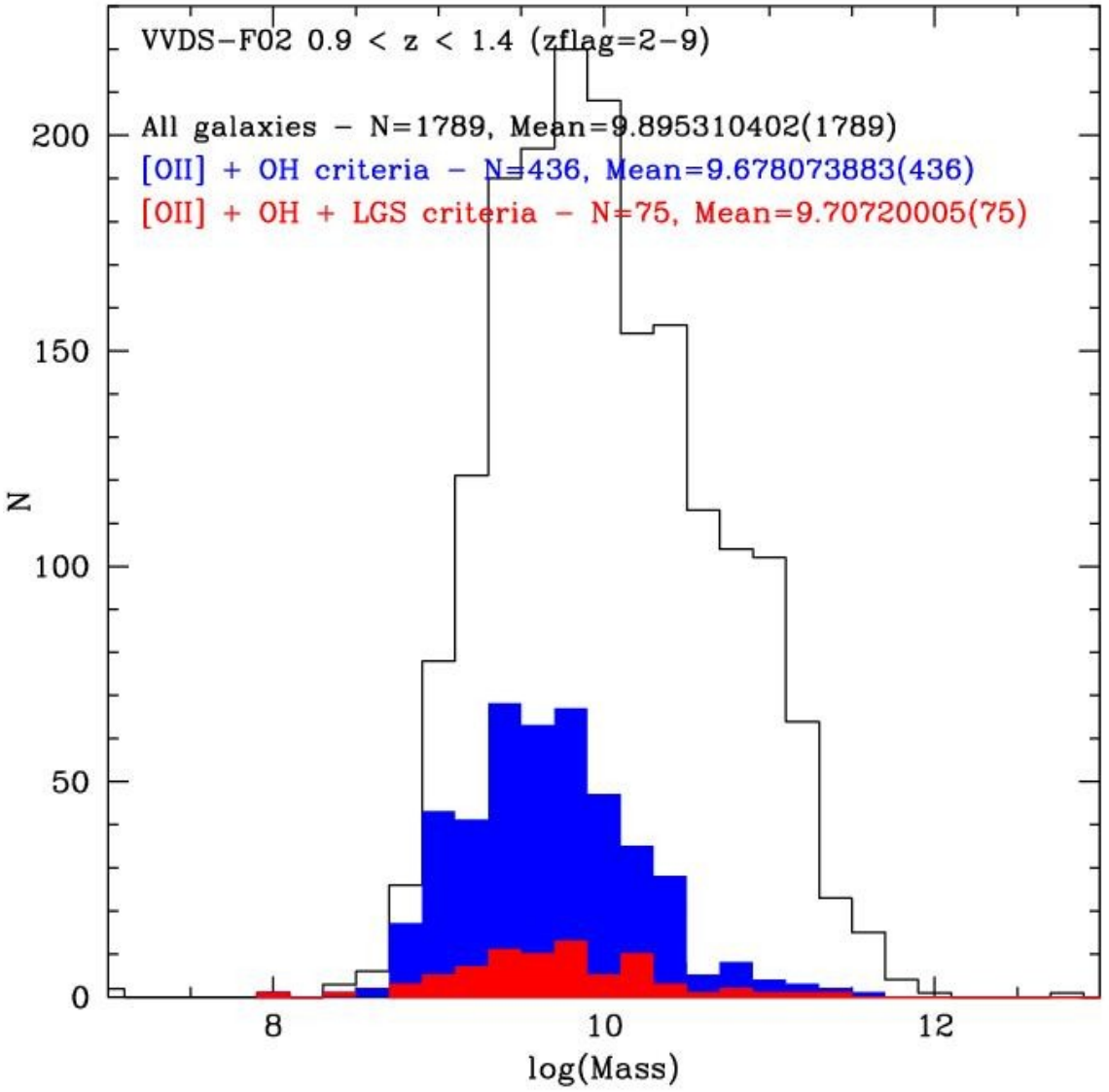
Mass Assembly Survey with SINFONI in VVDS



Full F02 0.9<z<1.4 sample N=1789

[OII]+OH criteria N=436 (24%)

[OII]+OH+LGS criteria N=75 (4%)

MASSIV
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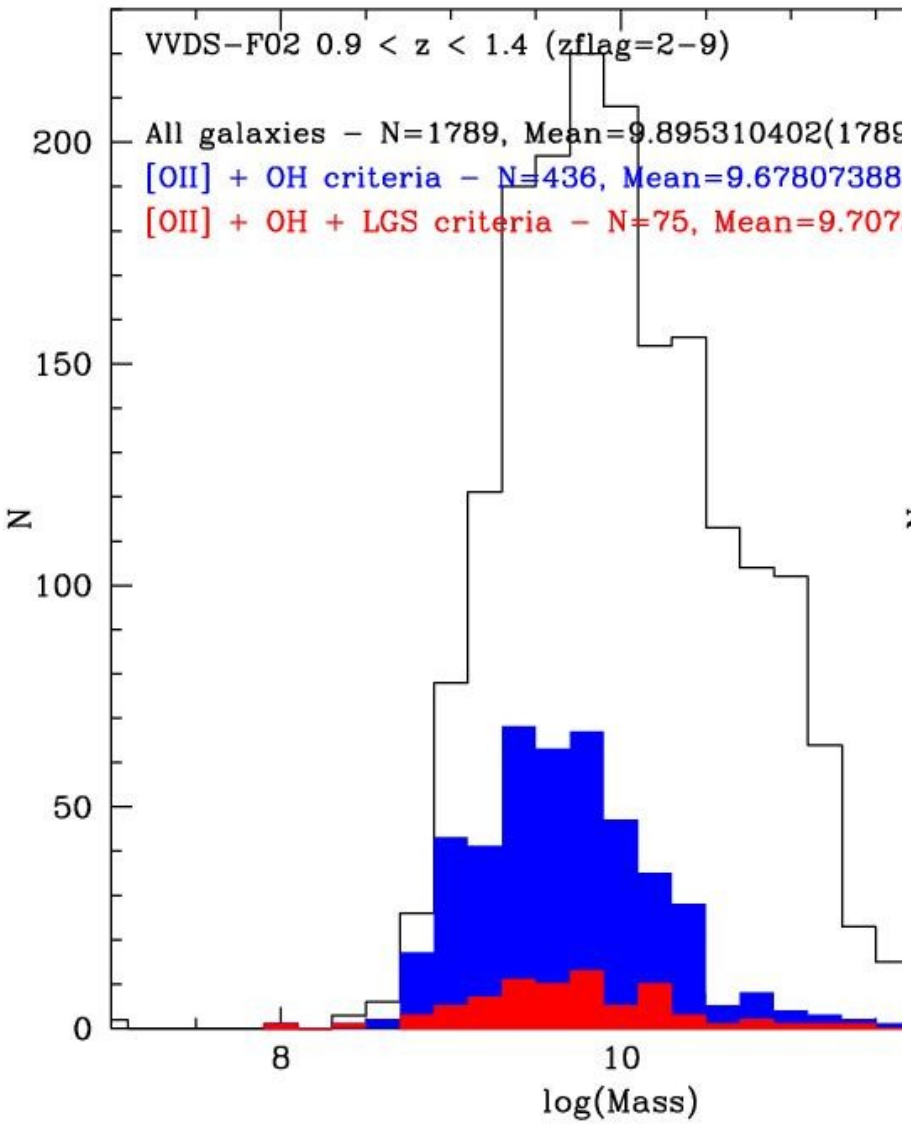

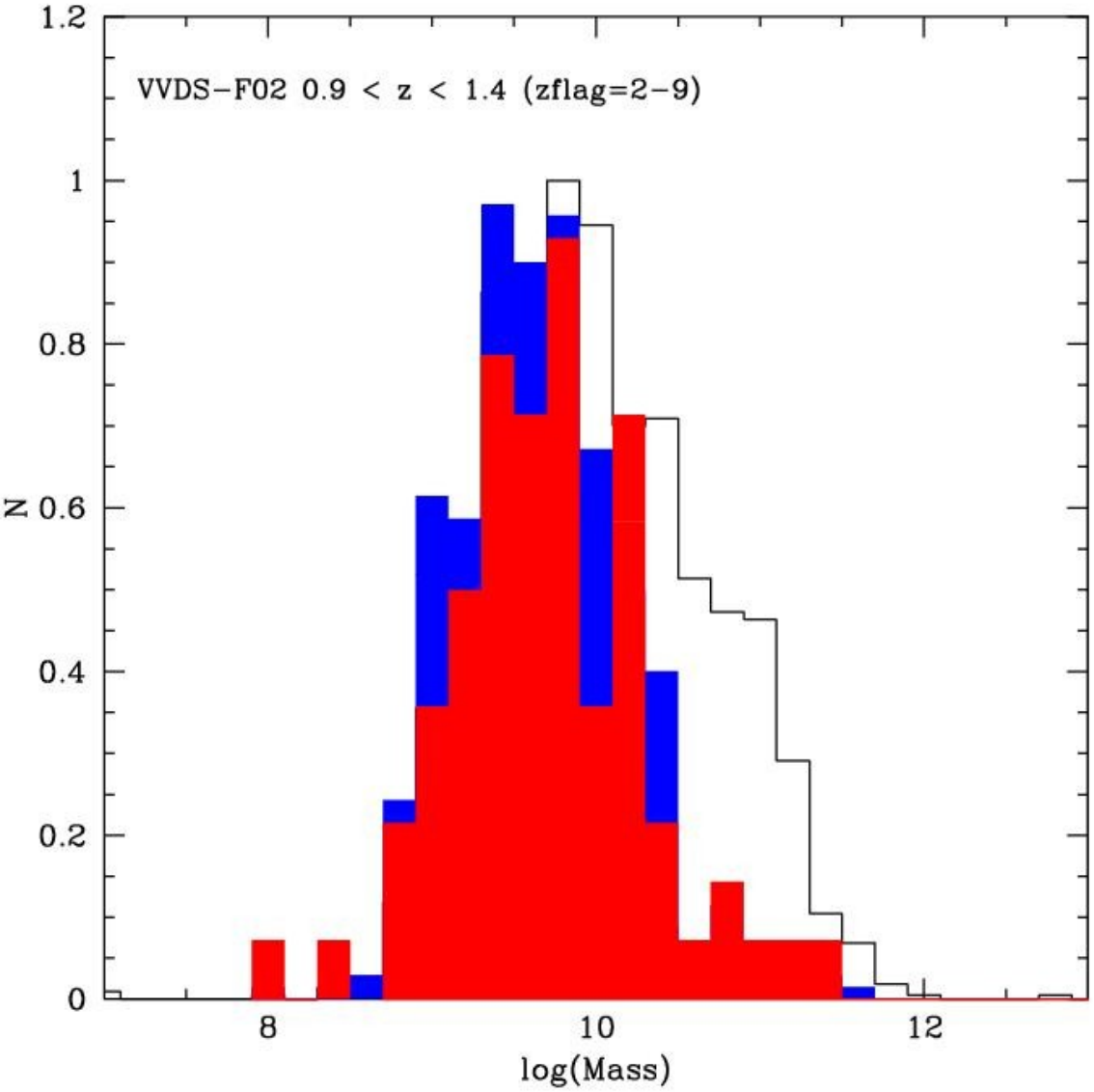

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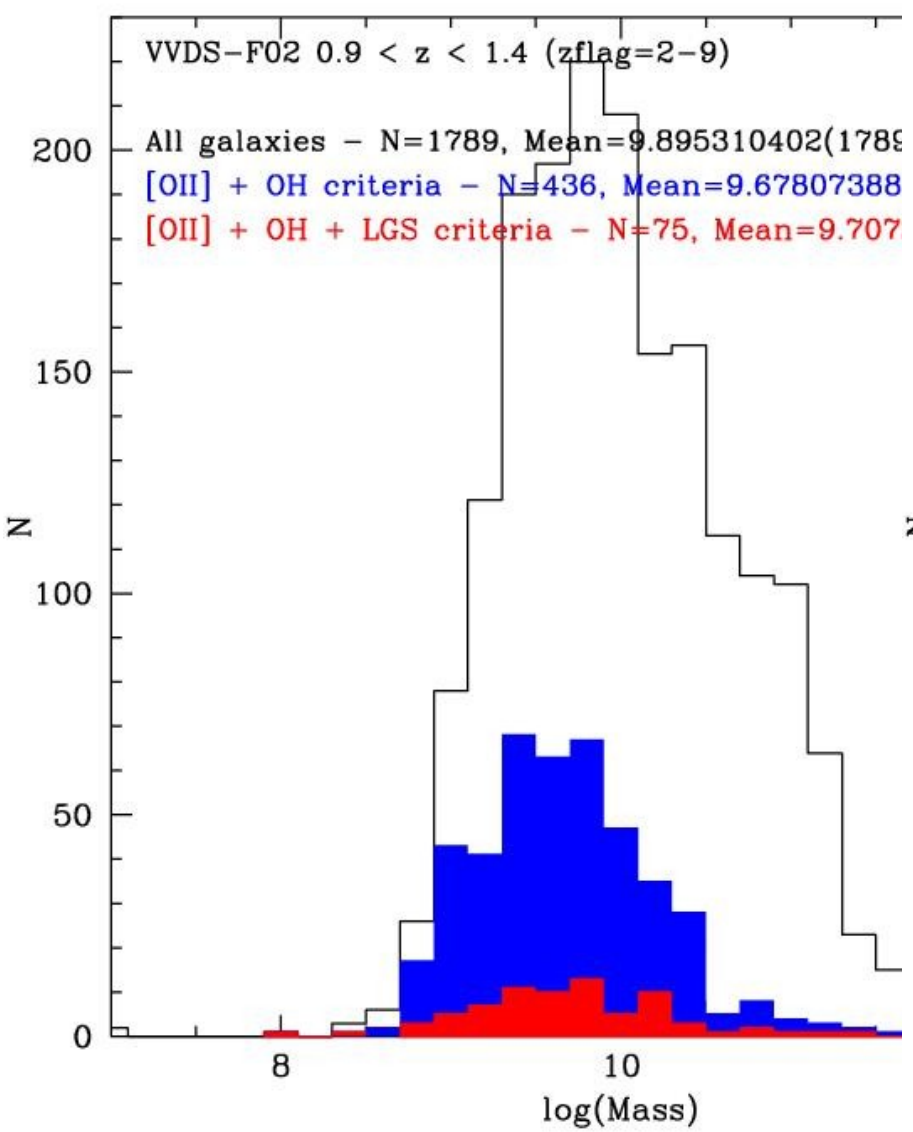
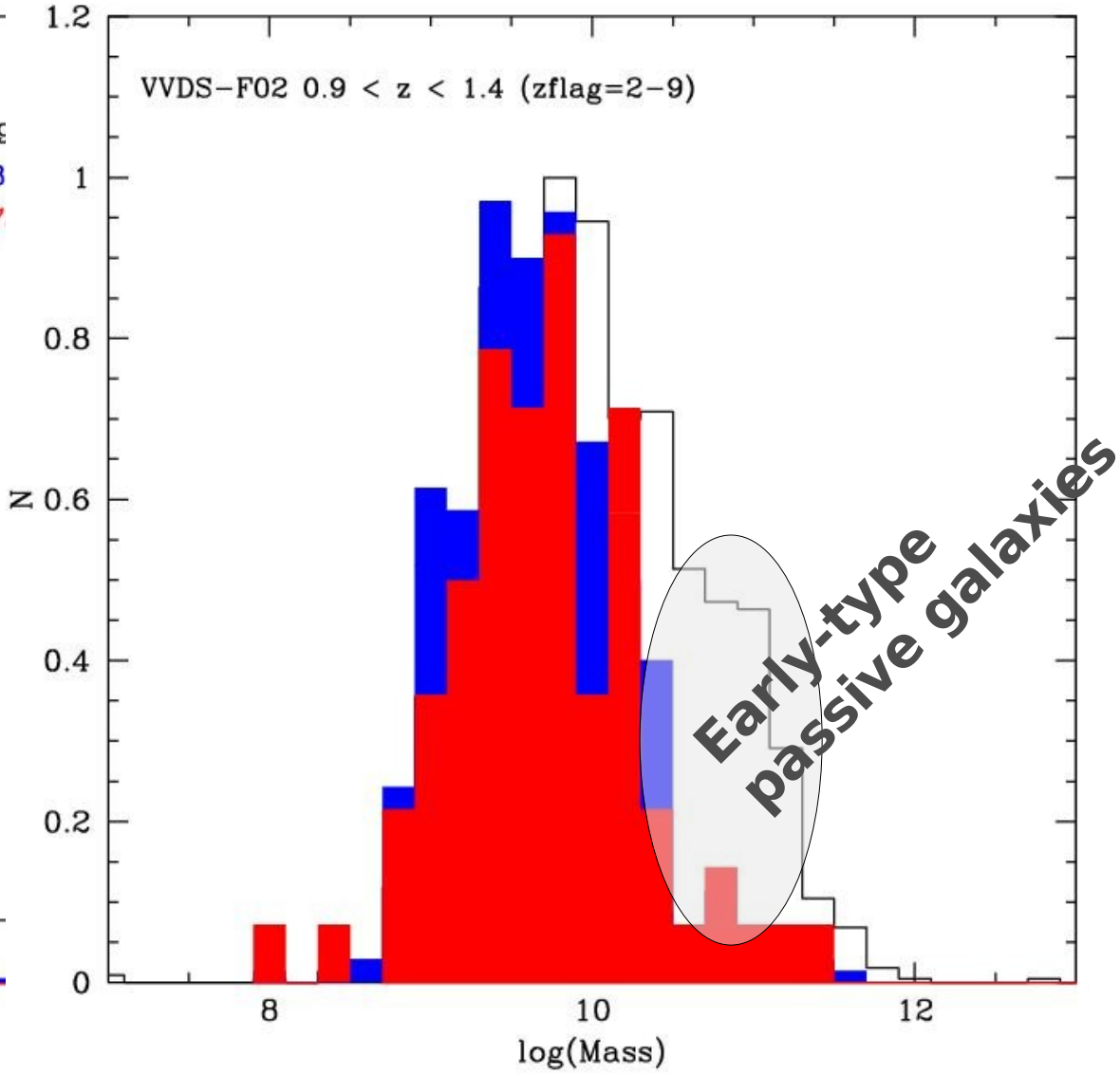




Mass Assembly Survey with SINFONI in VVDS

Observations scheduling

2007

P79A	spring '07	9.5h	F14	z<1.4	no AO	completed
P79B	sum/aut '07	61.5h	F22/F02	z<1.4	AO-LGS	open(10% comp)
P80C	autumn '07	76.0h	F02	z<1.8	AO-LGS	open(0%)

2008

P81D	spring '08	10.0h	F14	z<1.4	no AO	completed
P81E	sum/aut '08	64.0h	F22,F02	z<1.8	AO-LGS	open
P82F	autumn '08	82.0h	F02	z<1.8	AO-LGS	

Mass Assembly Survey with SINFONI in VVDS

Observations scheduling

2007

P79A	**spring '07**	**9.5h**	**F14**	**z<1.4**	**no AO**	**completed**
P79B	**sum/aut '07**	**61.5h**	**F22/F02**	**z<1.4**	**AO-LGS**	**open (10% comp)**
P80C	**autumn '07**	**76.0h**	**F02**	**z<1.8**	**AO-LGS**	**open (0%)**

2008

P81D	**spring '08**	**10.0h**	**F14**	**z<1.4**	**no AO**	**completed**
P81E	**sum/aut '08**	**64.0h**	**F22,F02**	**z<1.8**	**AO-LGS**	**open**
P82F	**autumn '08**	**82.0h**	**F02**	**z<1.8**	**AO-LGS**	

Important delay (~ 1 year), mainly due to major problems with Laser Guide Star Facility

--> **Carry-over status for 2007 runs**

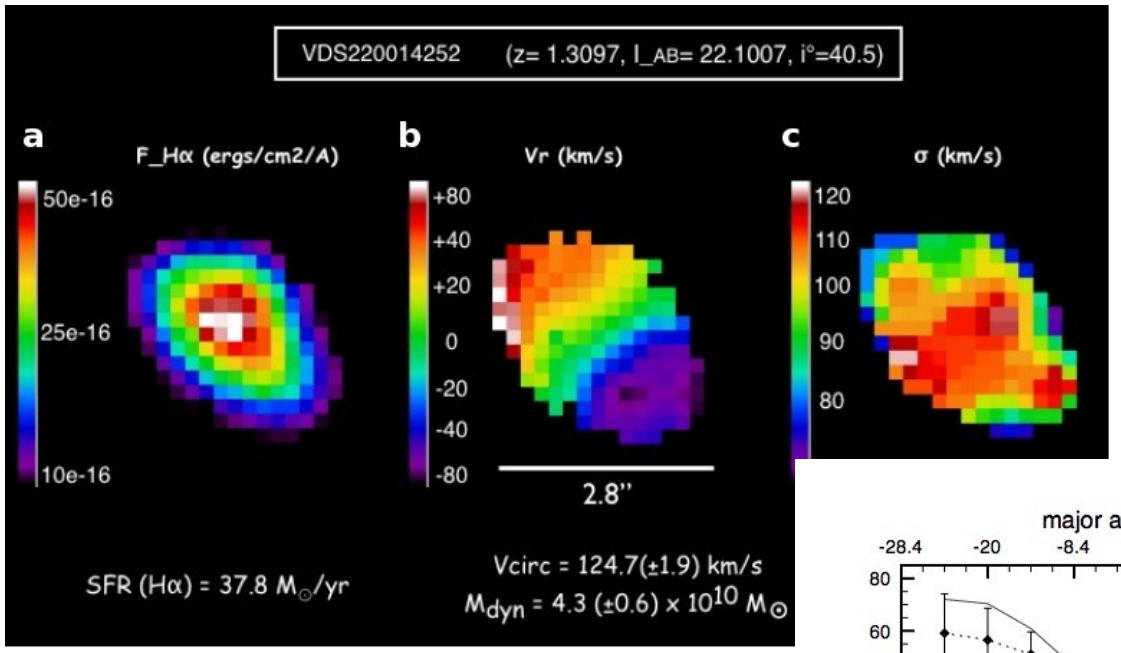
Mass Assembly Survey with SINFONI in VVDS

First results from pilot runs

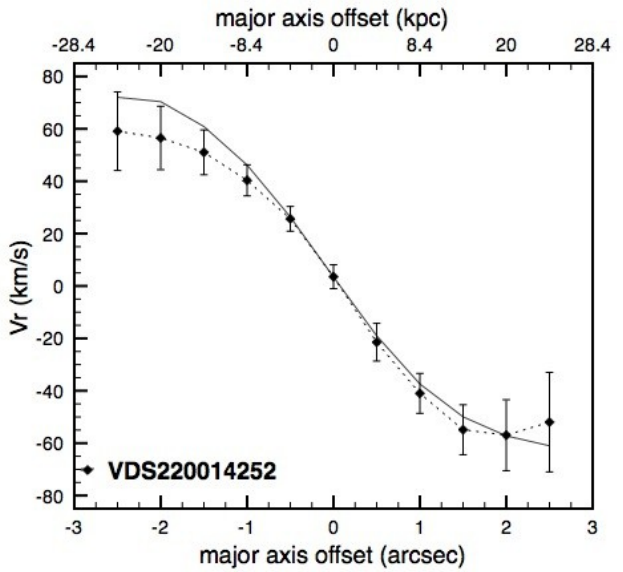
- ✔ **PI: M. Lemoine-Busserolle**
- ✔ **8 nights in Nov 05/06**
- ✔ **13 VVDS galaxies in F02 (I_{AB}<24) and F22 (I_{AB}<22.5) fields**
  - **4 galaxies @ z~3.3-3.7 (5h exp. time)**
  - **9 galaxies @ z~1.3-1.5 (2h exp. time)**
- ✔ **no AO – FoV = 8"x8" – 0.25 spaxel**

MASSIV
Mass assembly survey with SINFONI in VVDS

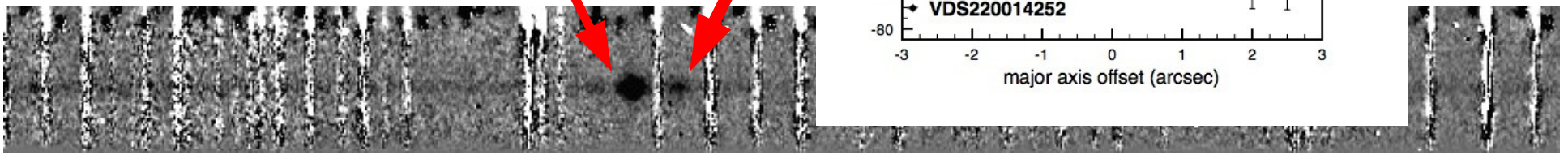
Mass Assembly Survey with SINFONI in VVDS



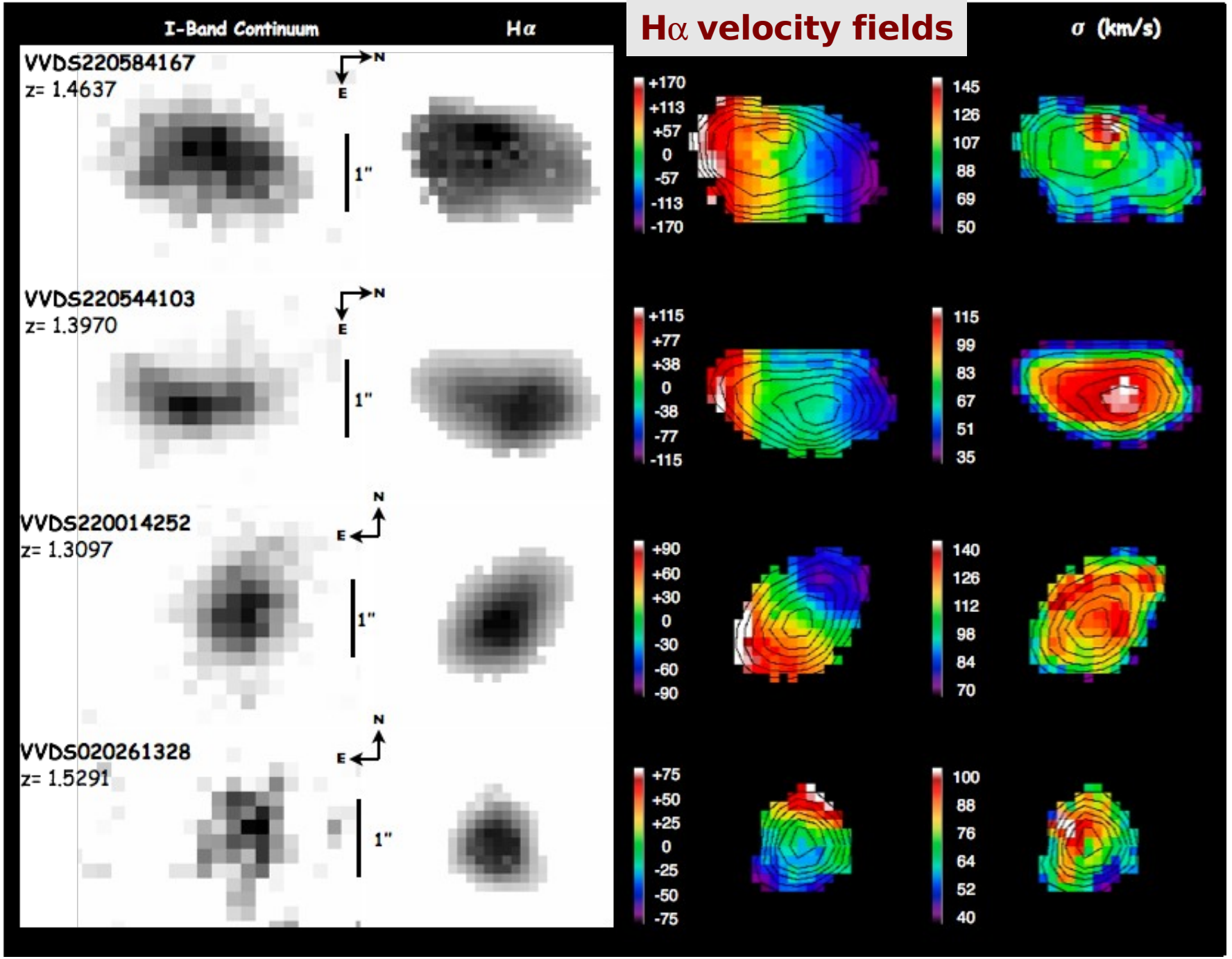
VVDS220014252
z=1.3097



Hα [NII]

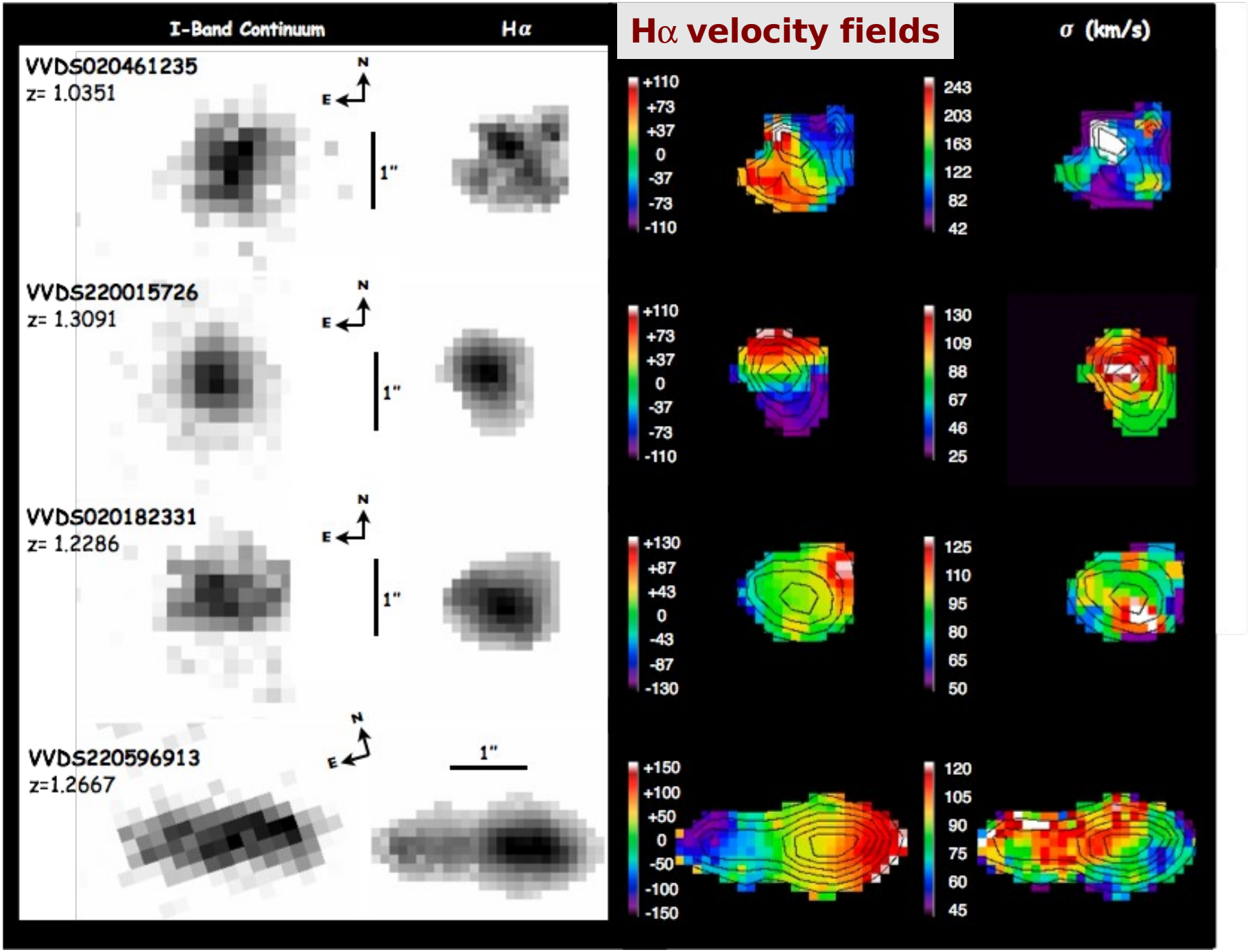


First results from Pilot runs - Galaxies @ z~1.2-1.5



Lemoine-Busserolle et al. (2008a)

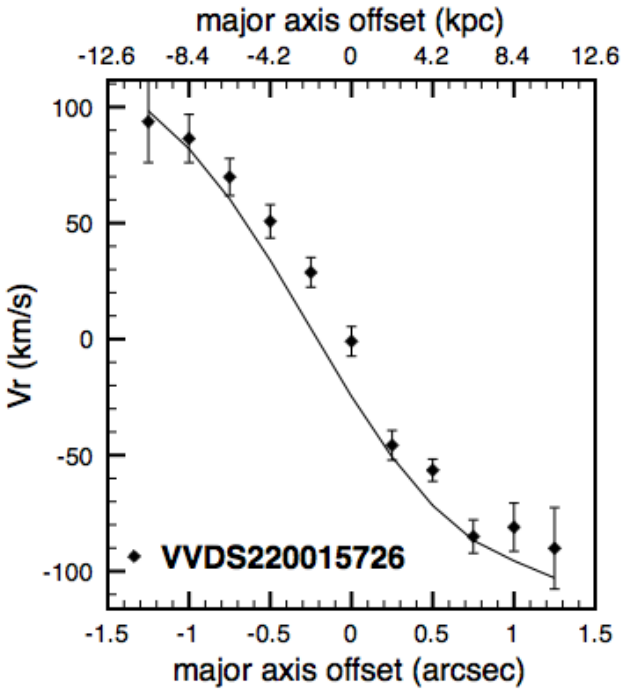
First results from Pilot runs - Galaxies @ z~1.2-1.5

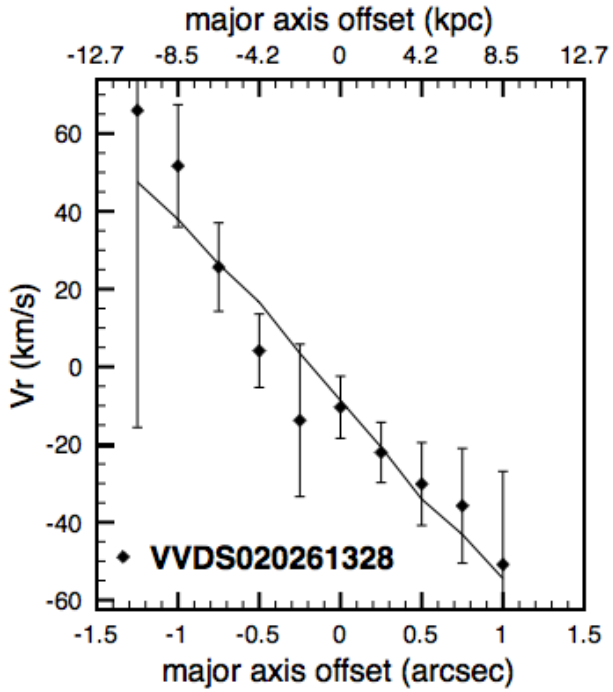


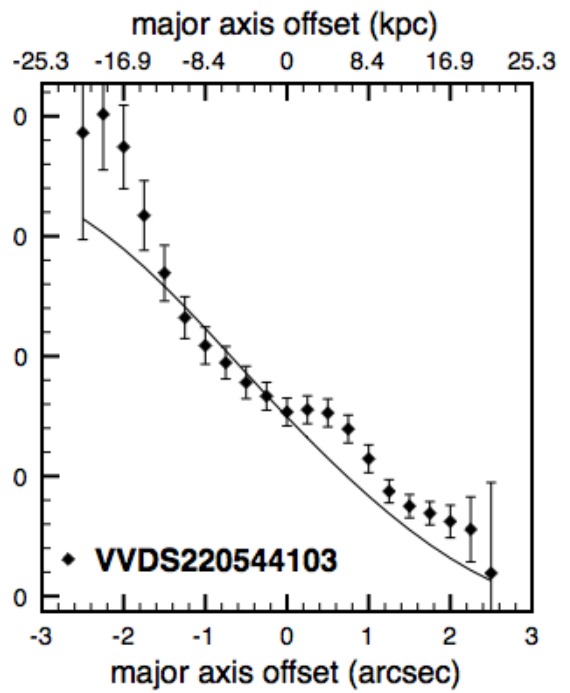
Lemoine-Busserolle et al. (2008a)

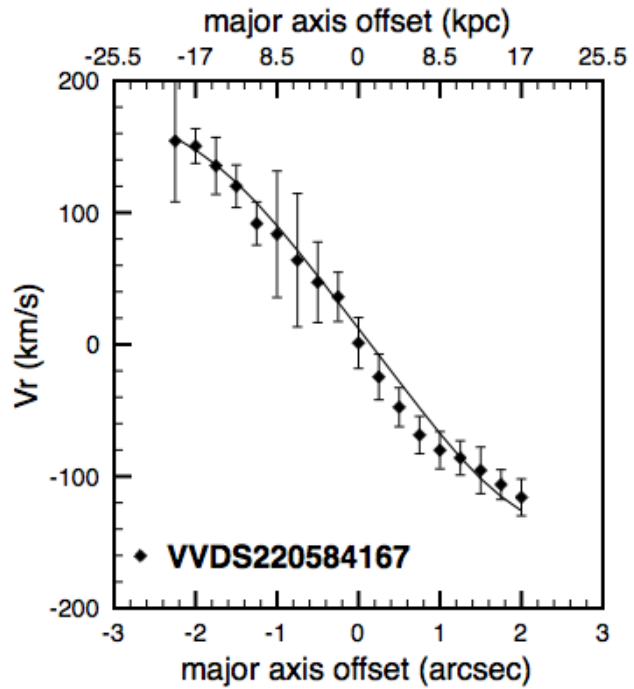
First results from Pilot runs - Rotating disks @ z~1.2-1.5

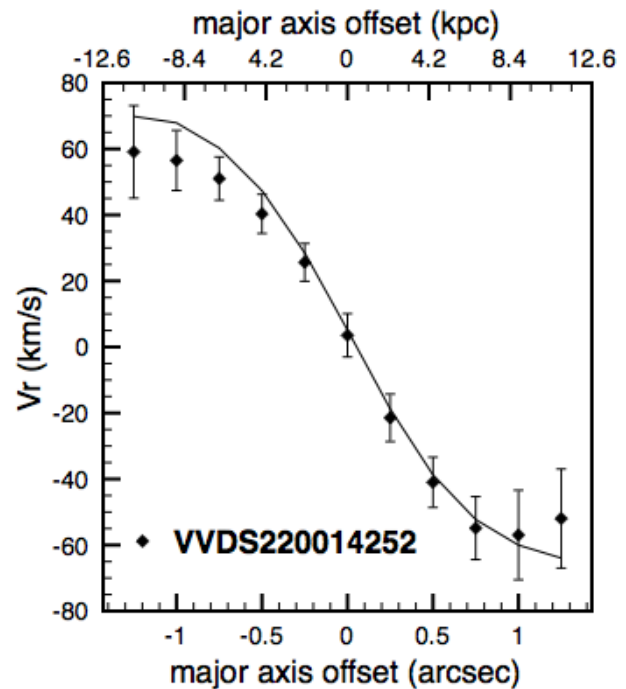
Lemoine-Busserolle et al. (2008a)

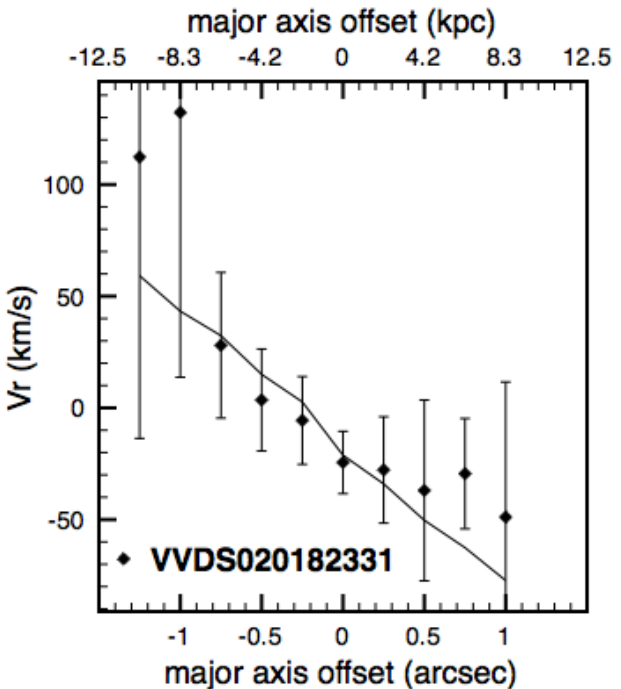






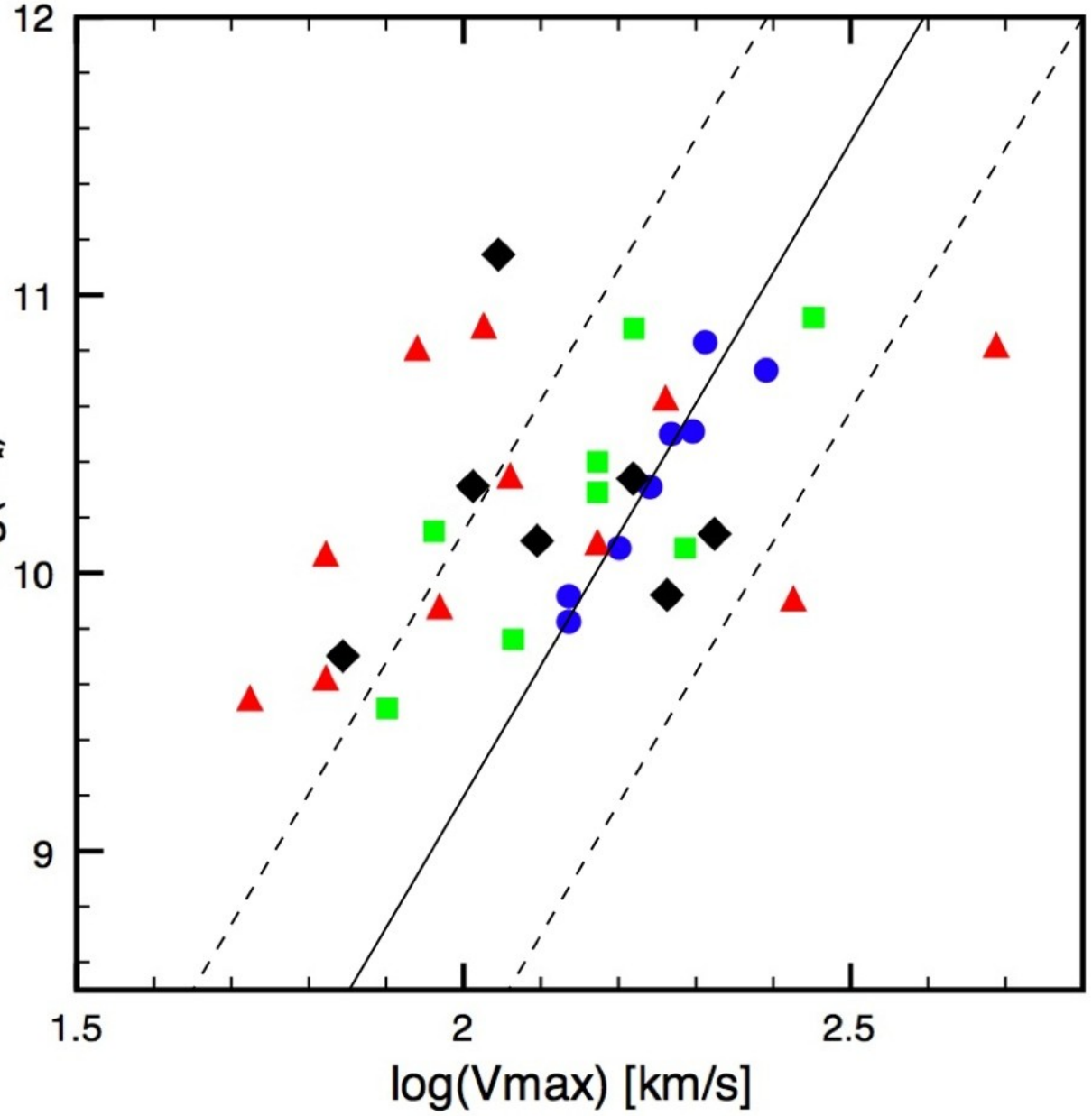






First results from Pilot runs - Rotating disks @ z~1.2-1.5

Lemoine-Busserolle et al. (2008a)



Stellar Mass

Maximum Rotation Velocity

Galaxies @ z~0.7
(Flores et al. 2005)

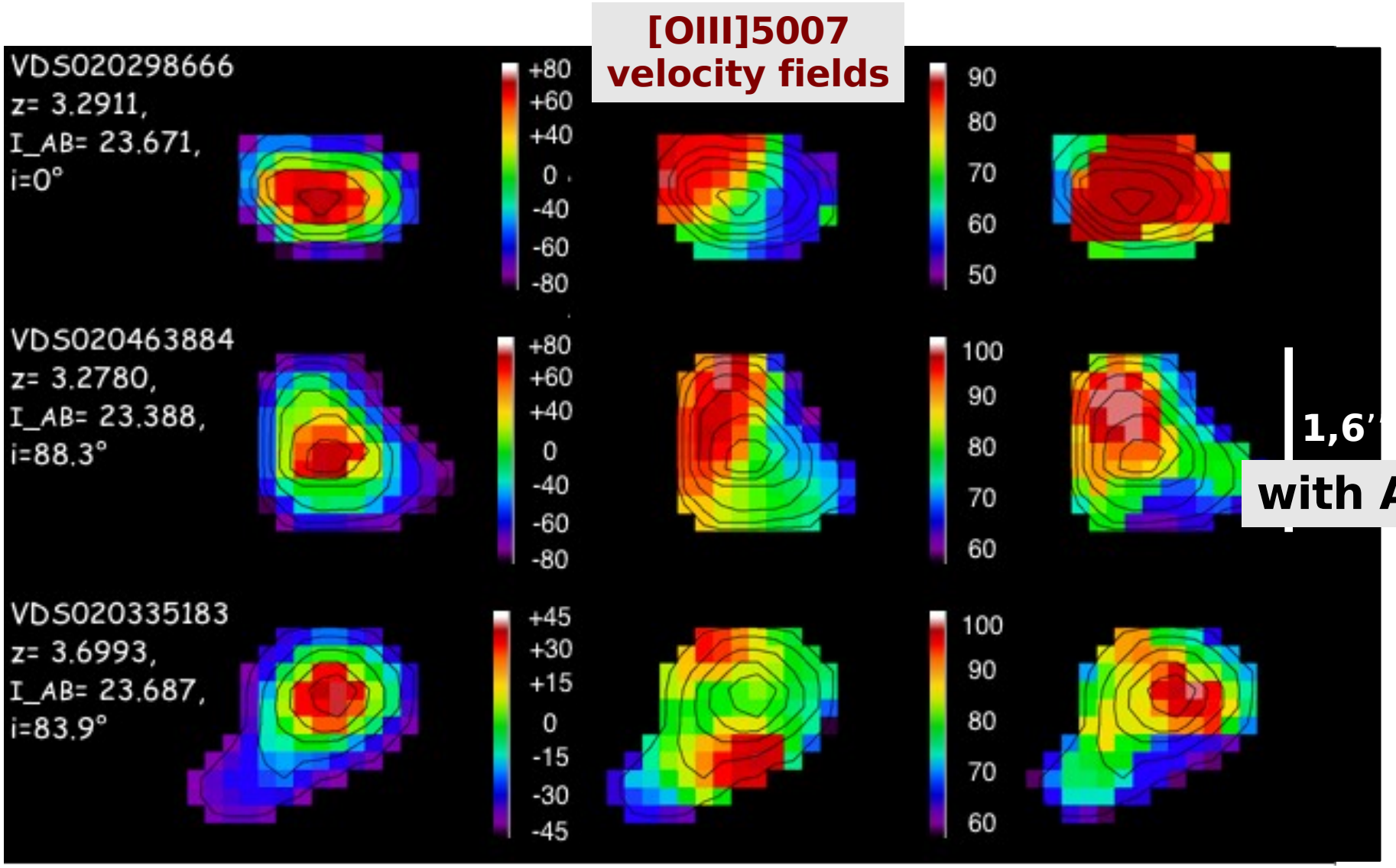
rotating disk

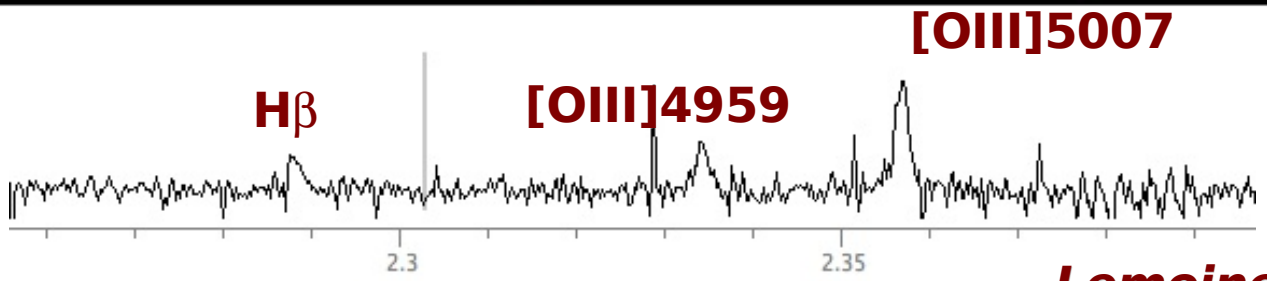
perturbed rotation

complex kinematics

VVDS Galaxies @ z~1.3

First results from Pilot runs - Galaxies @ z~3.3-3.7

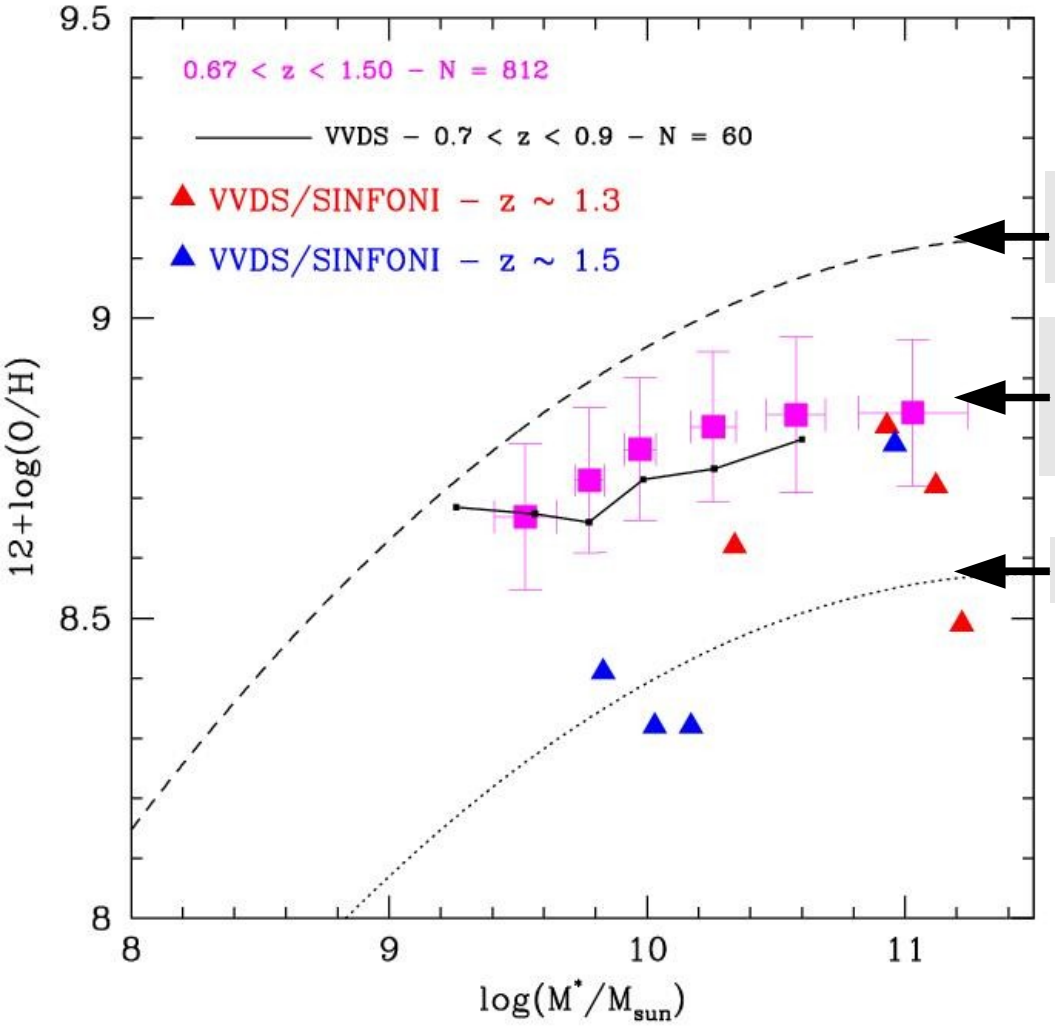




Lemoine-Busserolle et al. (2008b)

The MZ relation @ z~1.4 with MASSIV

Mass assembly survey with SINFONI in VVDS

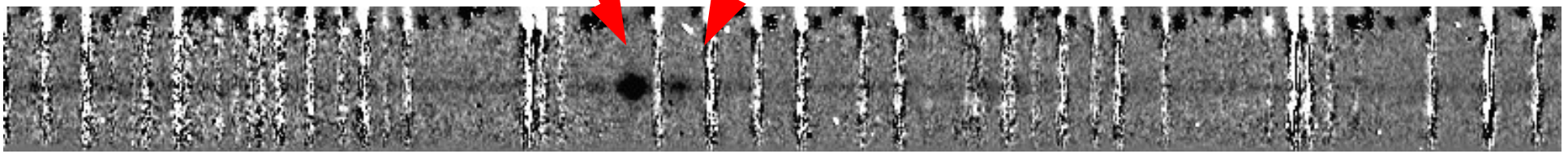


z~0 SDSS
Tremonti et al. (2004)

z~0.9
VVDS - Lamareille et al. (2008)
zCOSMOS - Contini et al. (2008)

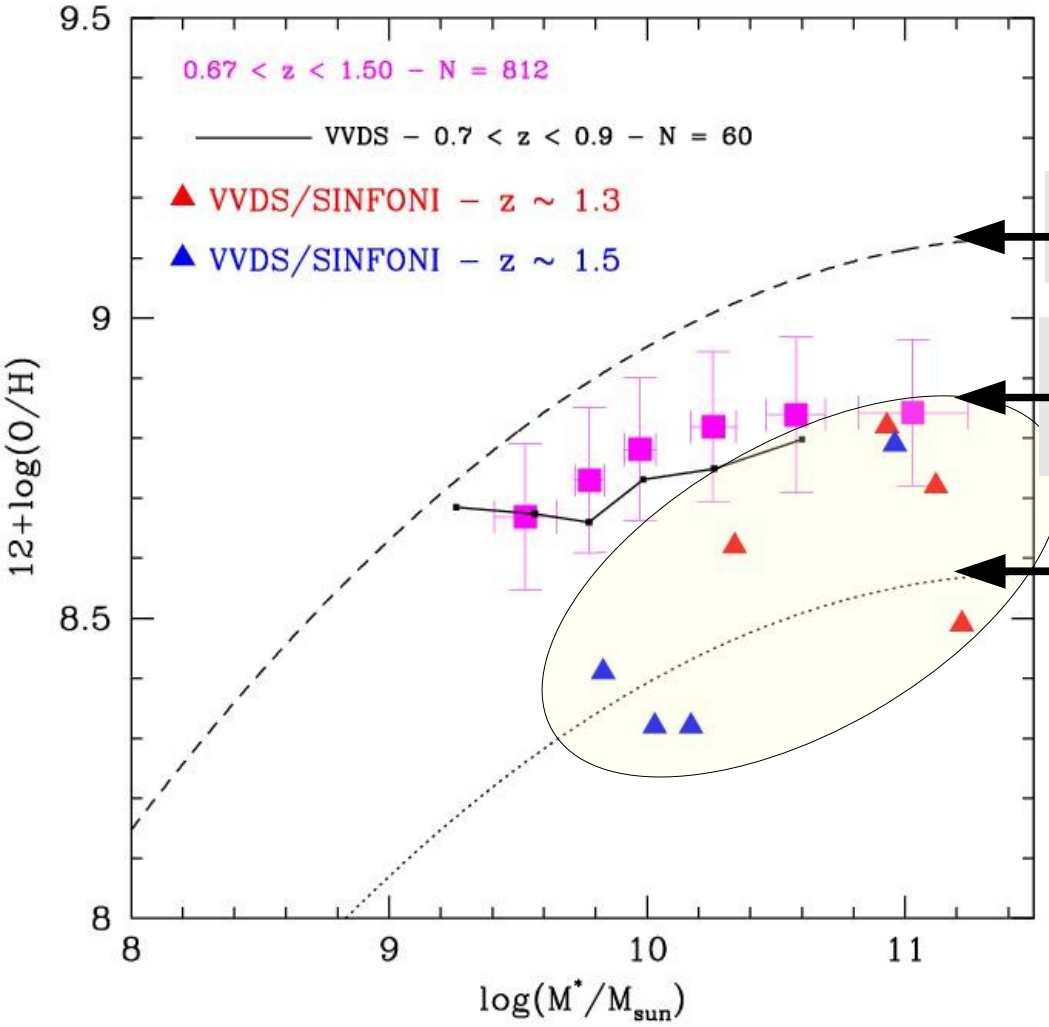
z~2 Erb et al. (2004)

Hα [NII]



The MZ relation @ z~1.4 with MASSIV

Mass assembly survey with SINFONI in VVDS



z~0 SDSS
Tremonti et al. (2004)

z~0.9
VVDS - Lamareille et al. (2008)
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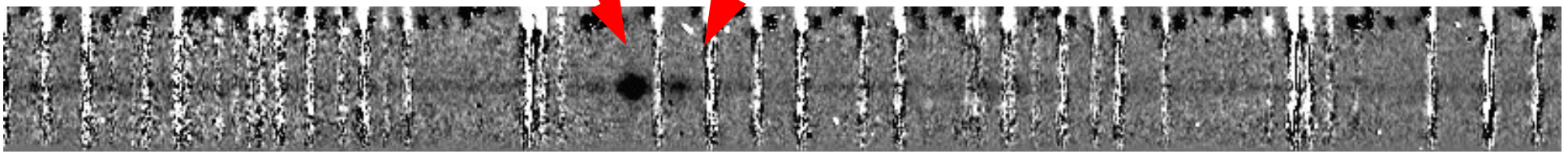
z~2 Erb et al. (2004)

z ~ 1.3-1.5
MASSIV survey
Queyrel et al. (2008)

O/H from [NII]/Hα ratio

Hα [NII]



See **Benoit Epinat** poster + talk for preliminary 

results