The Power of the Multiplex Capability of the VIMOS ESO VLT Spectrograph with *Tilted* Slits & for Large Survey of Kinematics

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The need for Large Kinematic Representative Samples with Limited Telescope Time over Treasury Galaxy Fields

Large Redshift Surveys yield to a steady advance towards galaxy population evolutions

- but there is still room for different scenarios
  At which levels is the observed evolution due to number density or galaxy/IGM evolution?

  → Study galaxy populations of DMH of same mass.

- How the properties of the baryon matter relate to physical properties of their DMH?

  → Study the halo kinematic properties via measurable galaxy kinematics

It is a challenge to acquire maximal rotation velocity and dispersion velocities over pre-existing, large and representative multi-lambda surveys.

A strategy consists in a fast spectroscopic follow-up using both the multiplex and *tilted* slit VIMOS capabilities

Previous Works from Deep Surveys

- Based on small & morphologically selected samples (<100 galaxies)
  for instance, Vogt et al. '96, '97, '00, Conselice et al. 05, etc.

- Study of the R=2100 Keck DEIMOS spectra
  Weiner et al. 2006, Kassin et al. 2007

  Alignment of the slits were done from ground-based R imaging,
  which led to many rejected data due to misalignment with ACS PA.

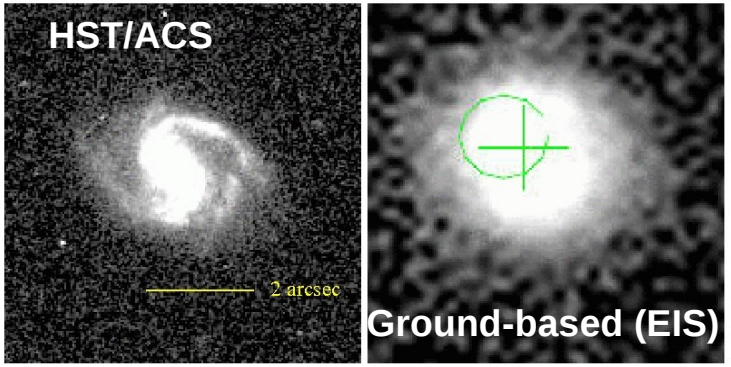
  V_{rot} & σ for ~380 gal. in GOODS and ~500 gal. in DEEP2

Its demonstrates the feasibility of such projects.

Tilted Slits & HR VIMOS Observations tested in October 2002 within the VVDS

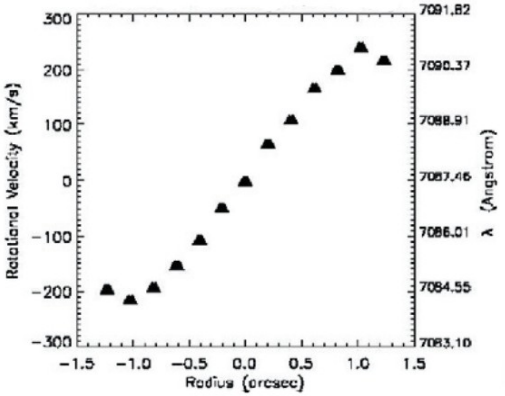
30 *tilted* 1” slits aligned along the major axis of HST/ACS galaxies selected from the R=280 VVDS-CDFS spectra

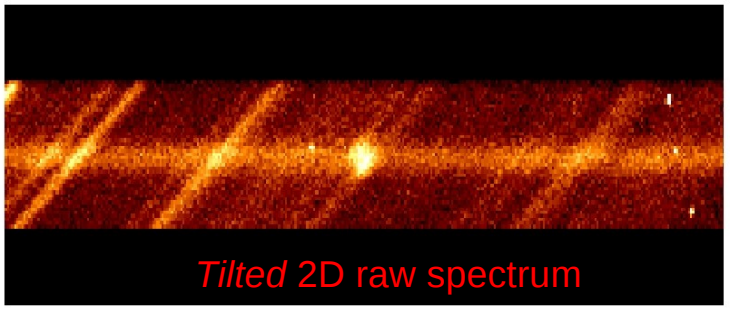
Velocity resolution < 30 km/s

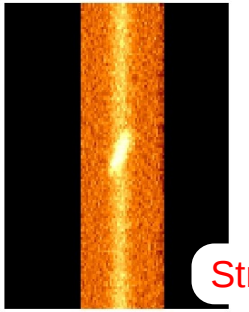


Z=0.5016
F775W=19.5
I=39 deg
PA=43 deg

Observed rotation curved





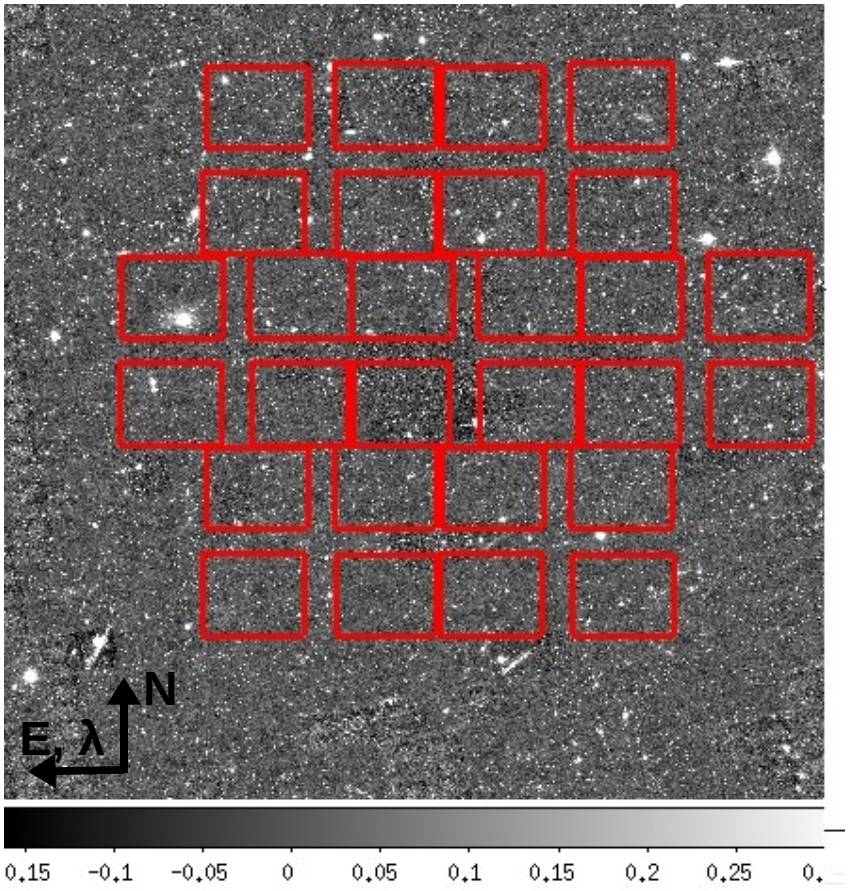


Straightened 2D reduced spectrum

ESO Messenger March 2003, Le Fèvre & VVDS team

On-Going Program over the COSMOS field

8'x7' VIMOS FOVs over COSMOS



PI Tresse P83

High-Resolution R=2500 (0.6 Å/pix) spectroscopy
with 1" *Tilted* Slits

► along the major axis given by
the 2 deg^2 HST/ACS images (Scoville et al.)

► of sources with known redshift from
zCOSMOS VIMOS survey (Lilly et al.)
10 000 bright sample I_{AB} = 22.5 z<1.2
Velocity accuracy ~100km/s (R=580, 2.5 Å/pix)

The square COSMOS field enables
an excellent multi-λ coverage
with many space and ground-based facilities

~25-30 HR spectra per quadrant, 100-120 per pointing

Examples of Selected Galaxies

To reach efficiency and representativeness

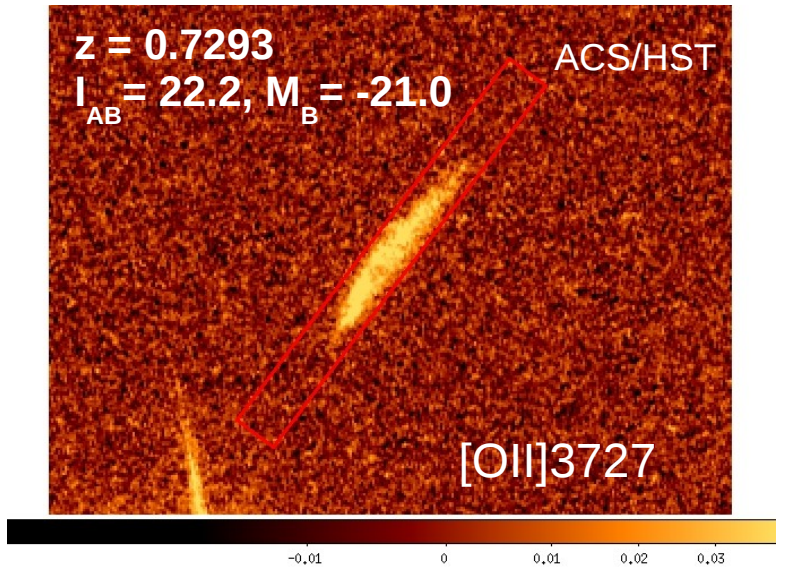
Targets selected only on:

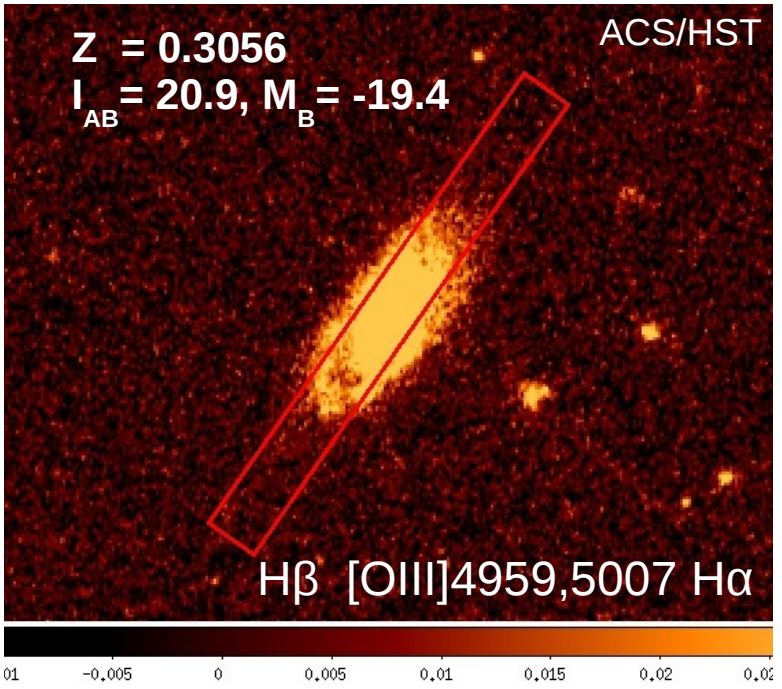
$I_{AB} = 22.5$
$|PA| < 60$ and $e > 0.30$
Emission-line flux $> 10^{-17}$ erg/s/cm^2

Note that VIMOS presents no limit to tilt the slit

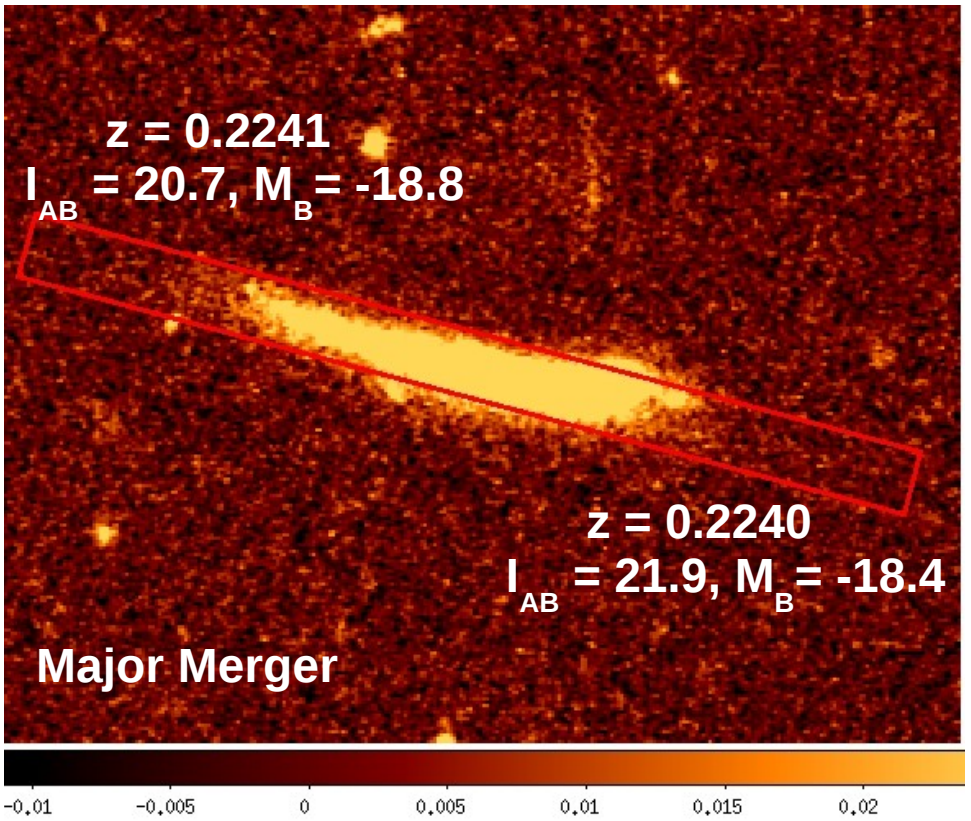
HR Red-grism $5700 < \lambda < 9300$ Å
[OII] $0.53 < z < 1.5$
[OIII] $0.14 < z < 0.86$
Hα $0 < z < 0.42$

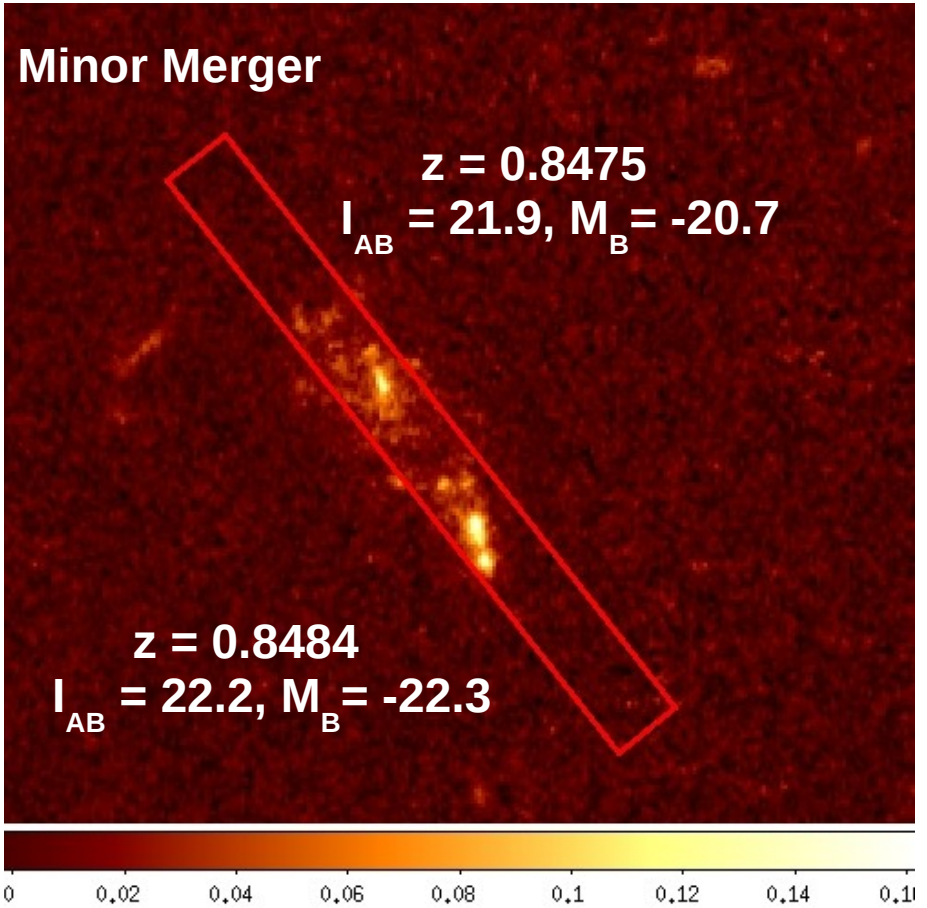
Enough targets to fill the VIMOS maks
with ~100 HR 1" *tilted* slits per pointing





Mergers are among the Random Sample Targets

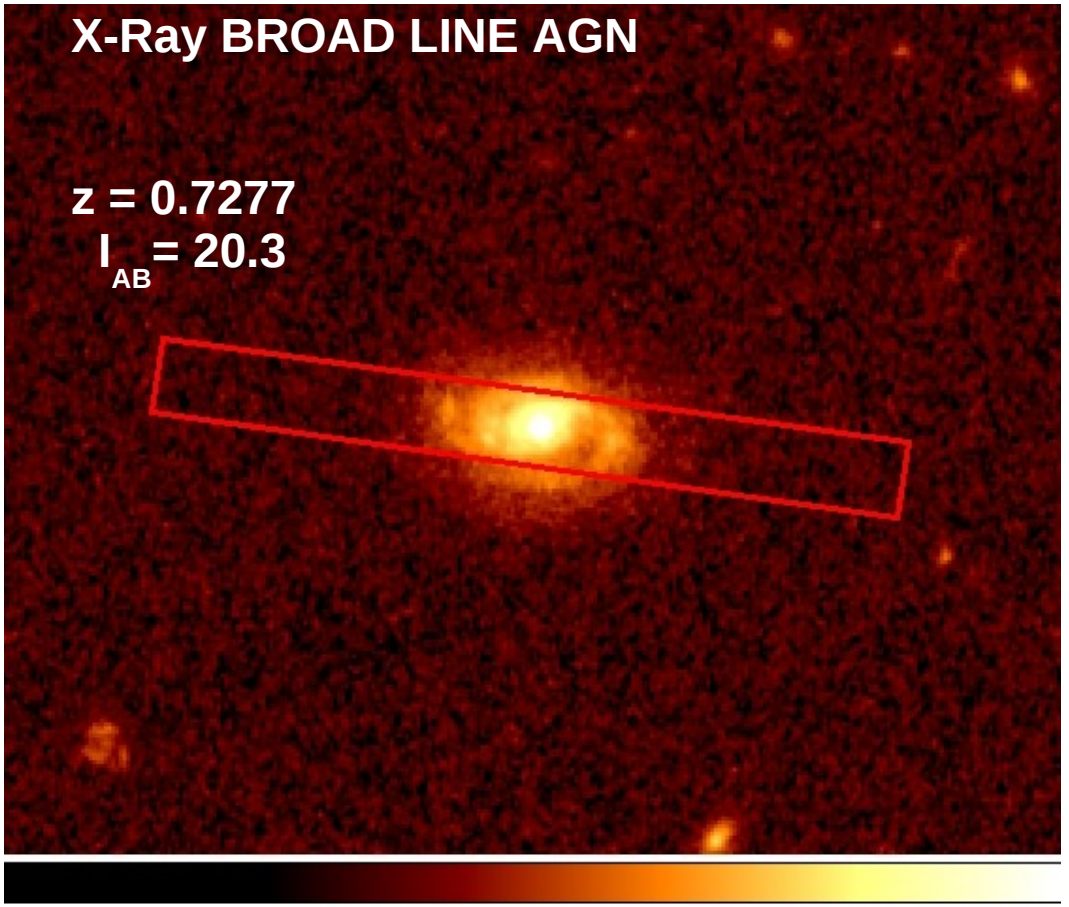




Specific Targets

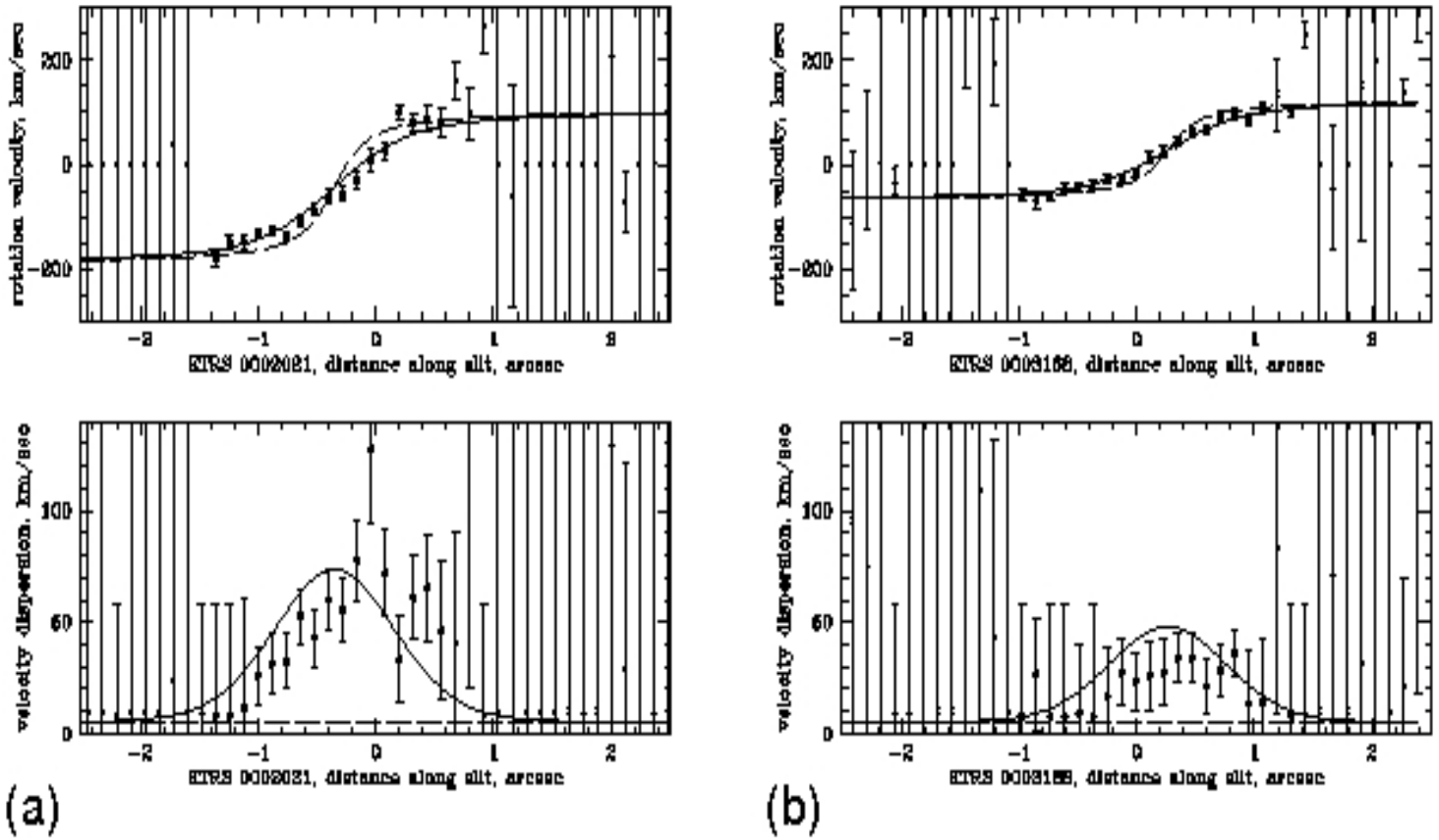
Measure of CaH, CaK & Gband absorption line dispersions in AGN

- To explore the velocity dispersions and infer the black hole mass (Greene & Ho 2006)
- To compare the estimated growth rate with SDSS local samples (Heckman et al. 2004)



Performances Expected

- Emission line widths measured down to 15 km/s
- Velocity centroids for rotation curves good to 10 km/s
- Seeing < 0.8” to minimize the blur

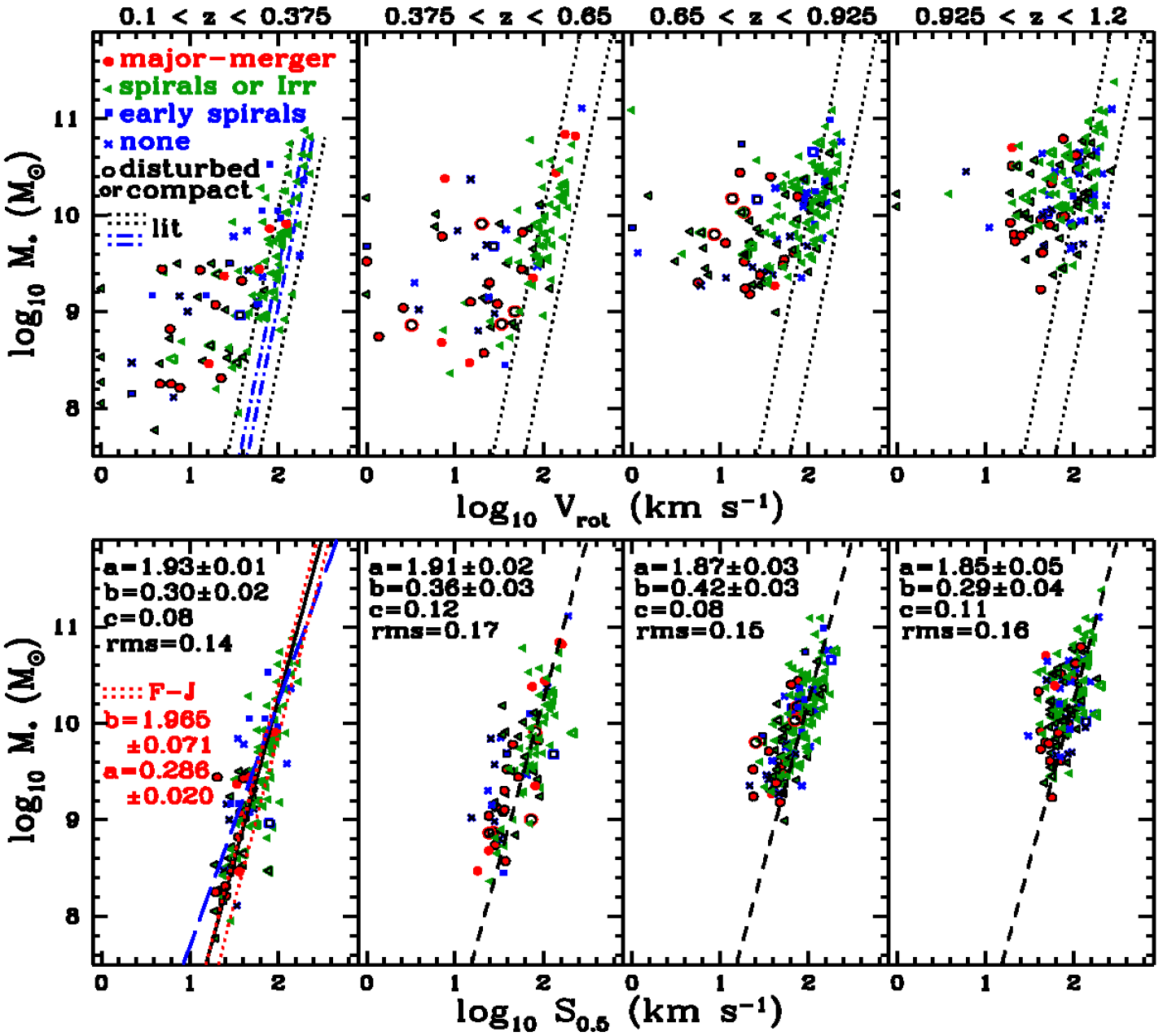


z=0.85

z=1.02

Weiner et al., 2006

The stellar mass Tully-Fisher in different environments of COSMOS 70% sampling



Kassin et al., 2007

Deimos R~2100

544 galaxies

Kinematic estimator which accounts for disordered or non circular motions

$$S^2 = V_{rot}^2 + \sigma^2$$

Large Science Outputs at z < 1

Statistical and representative sample of galaxies

- **Lines fluxes**
  accurate SFR (Ha, [OII]), metallicity ([OII], [OIII]), electron density ([OII]3726.1,3728.8)

- **Scaling laws** (Tully-Fisher, Fondamental Plane, Faber-Jackson or Kormendy relations)
  versus already derived parameters (stellar masses, SSFR, morphology, color, environment,..)

- Evolution of **well-ordered and disturbed disks**

- Evolution of **galaxy populations of same dark matter halo mass**

- **Direct comparison with models**

- **AGN studies** (black hole masses and growth rates)

Prospectives...

It is a Grey Time VIMOS Project, Seeing < 0.8”

It is a very efficient program with 100 targets at ounce
within a telescope time very limited

~25h allocated P83 = 7 pointings, 700 HR spectra.

- Testing and updating the VIPGI pipeline to reduce *tilted* slits

- Need to automatize and update the VMMPS procedure !!!
  to automatically position *tilted* slits
  knowing the PA of the sources

- Follow-up with dark time, shorter telescope time or better S/N

- Larger HR program over faint sources I_{AB} = 24 at z<1 & z>1
  The upgrade of the VIMOS detectors represents a plus !
  More sensitive and less fringing in the red.

- Second pass with *tilted* slits along the minor axis
  or shifted *tilted* slit to integrate the whole low-z galaxy

- Control quality using IFU for a controlled sample

- In addition, it provides very accurate redshifts, down to 10-20 km/s