Evolution of galaxy dynamics over the last 10 Gyrs with MUSE/VLT

Author: Mercier Wilfried
Supervisor: Contini Thierry (IRAP)
Co-Supervisor: Epinat Benoit (LAM)

Internship at IRAP
11 March 2019 - 26 July 2019

Galaxy evolution through time

Why studying kinematics ?

Explain the co-evolution of morphology with kinematics

- ▷ main processes responsible for disc formation and settling ?
- ▷ impact of merging, inflows and outflows on these processes ?
- ▷ kinematics → rotation curve → dark matter and angular momentum distribution ?

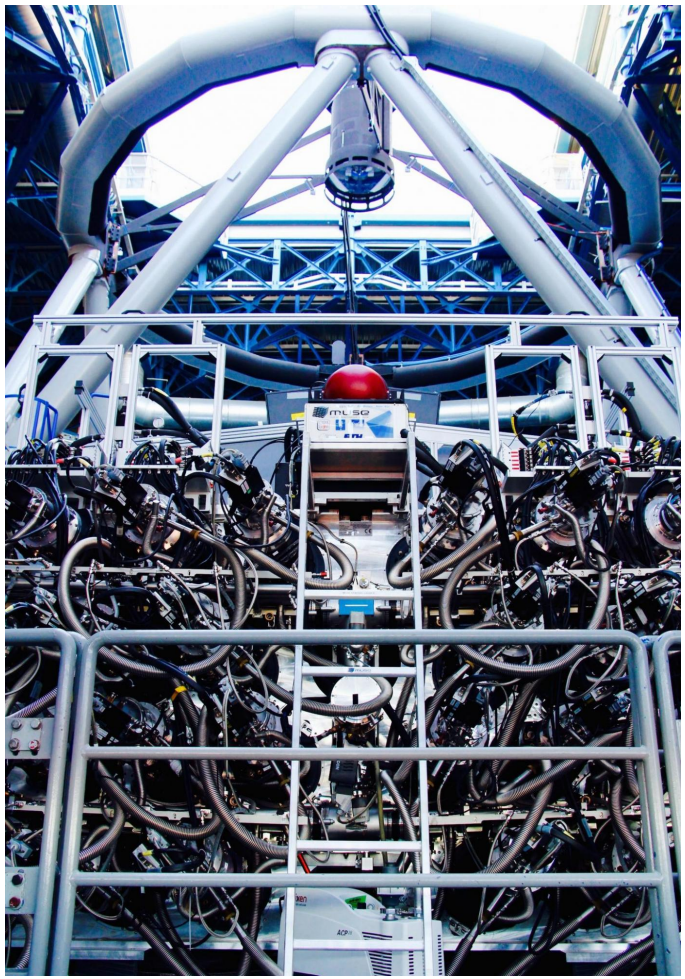
Integral Field Spectroscopy & MUSE

IFS:

- ▷ 3D cubes (2D spatial + 1D spectral)
  → **photometry + kinematics**

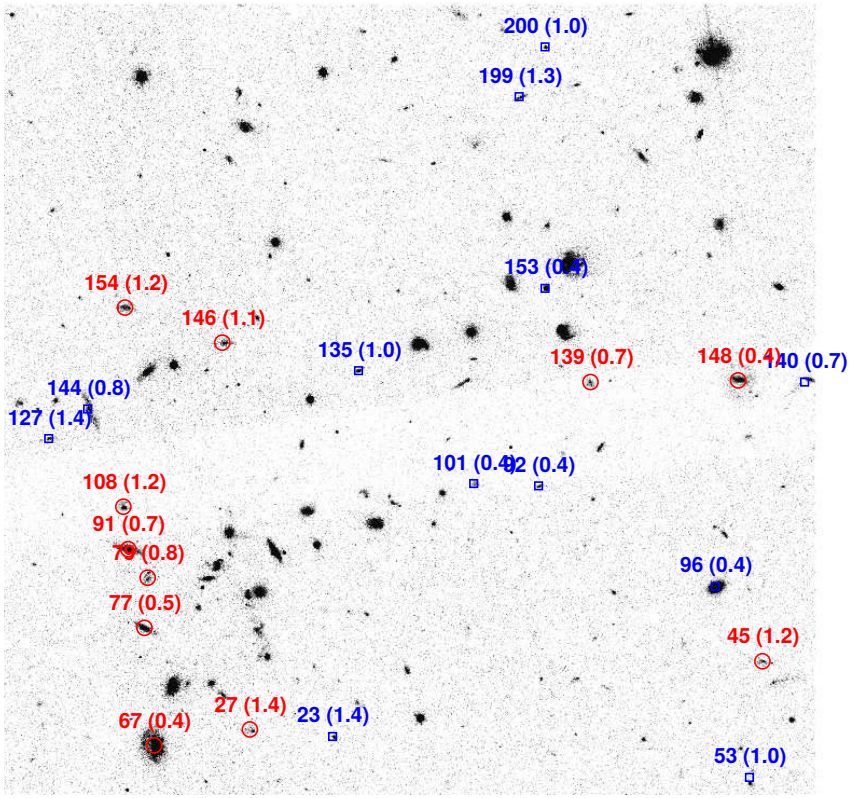
MUSE:

- ▷ $1 \times 1\,\mathrm{arcmin}^2$ FoV → **environment**
- ▷ 0.2 arcsec spatial sampling
- ▷ spectral range $[4650\,\text{Å}, 9300\,\text{Å}]$
- ▷ seeing-limited or AO observations
- ▷ high sensitivity
  → **low-mass galaxies + blind surveys**



MUSE instrument. Credit: Contini Thierry (IRAP)

Our sample



HST image of COSMOS group CGr30

- ▷ 16 MUSE fields in COSMOS area
- ▷ exposures from 1 to 10 hr
- ▷ seeing-limited (FWHM $\lesssim 0.7$”) or AO (FWHM $\lesssim 0.5$”)
- ▷ **$\sim$ 500 field galaxies with [OII] detection**
  - · HST-ACS counterparts
  - · **$0.4 \leq z \leq 1.4$**

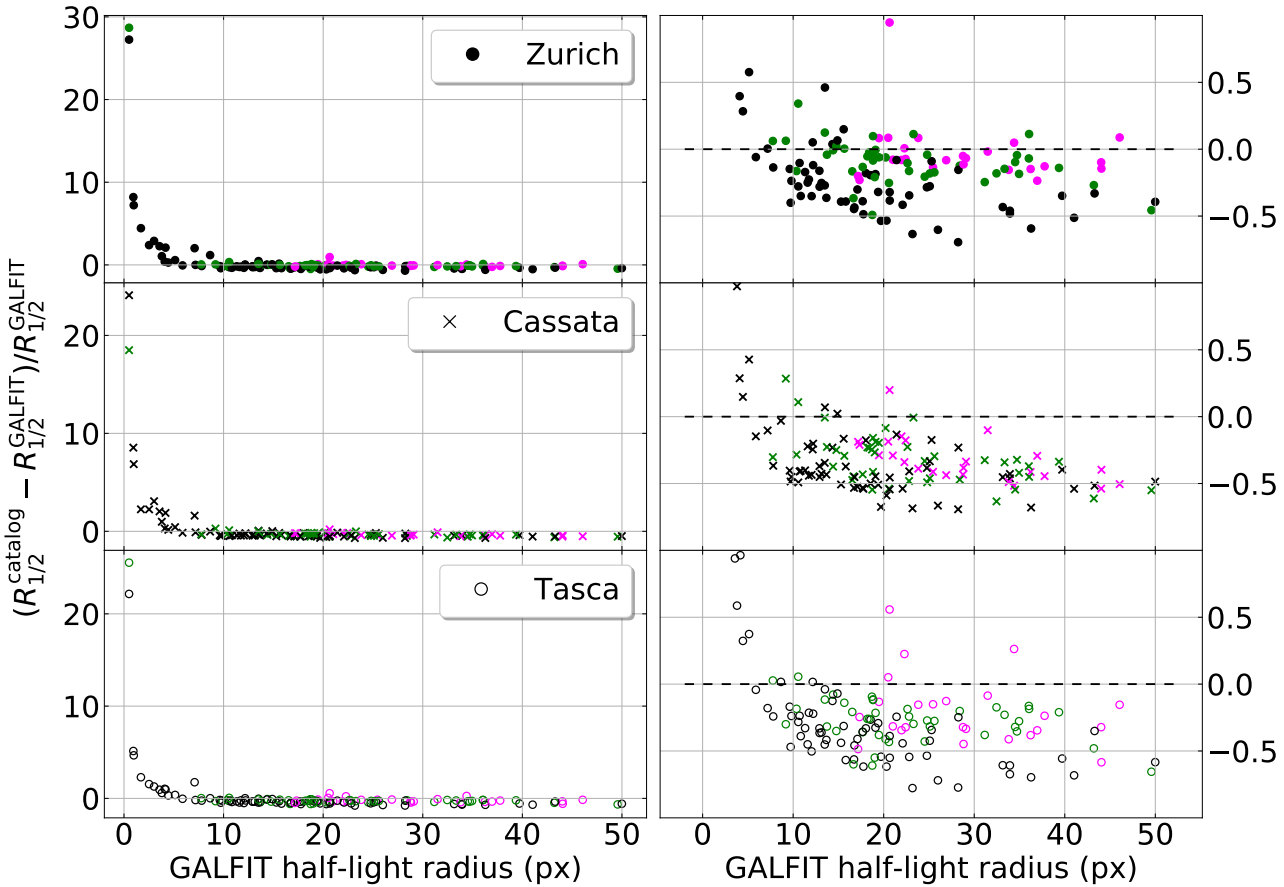
Methodology

I. Morphological information
   - ▷ **half-light radius** $R_{1/2}$ to select resolved galaxies
     - · Cassata, Tasca and Zurich catalogues
   - ▷ **ellipticitiy** to compute the inclination
     - · fixed input for the kinematical model

II. Kinematical modelling
   - ▷ recover $V_{\rm max}$ and $\sigma_{\rm v}$

III. Tully-Fisher relation

Checking morphological parameters
Half-light radius

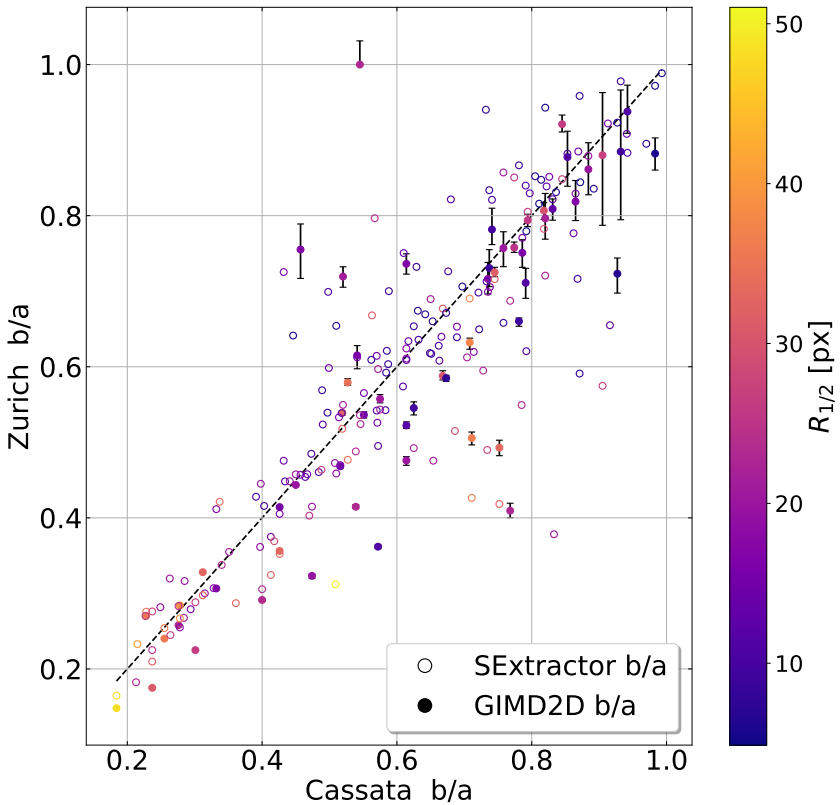


spheroidal disk-like irregulars

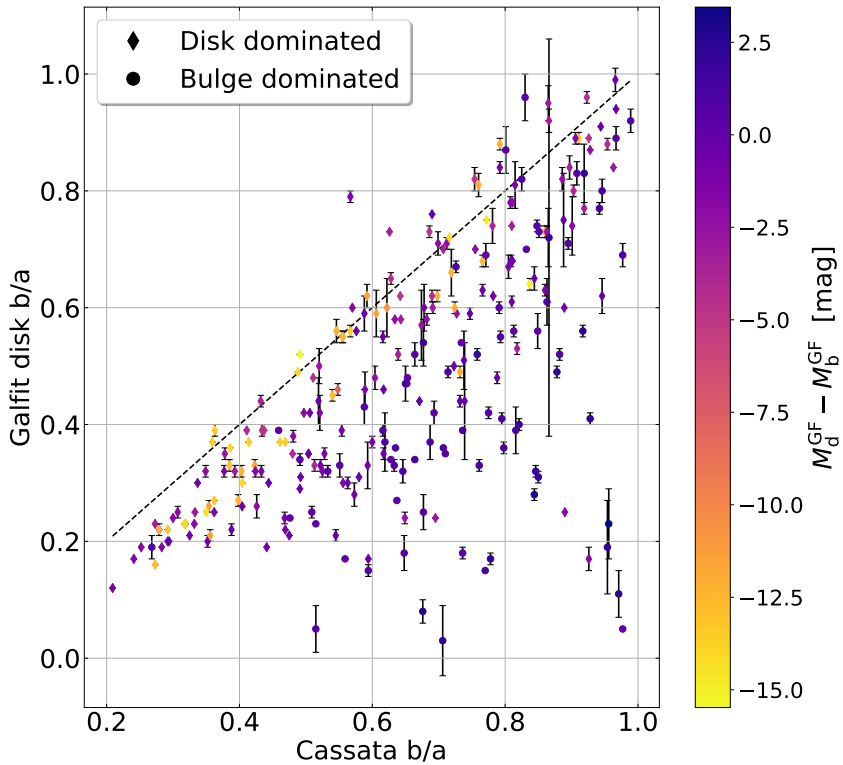
GALFIT run by V. Abril-Melgajero (LAM) on structure galaxies

- ▷ GALFIT radius used as a reference

Checking morphological parameters
Ellipticity

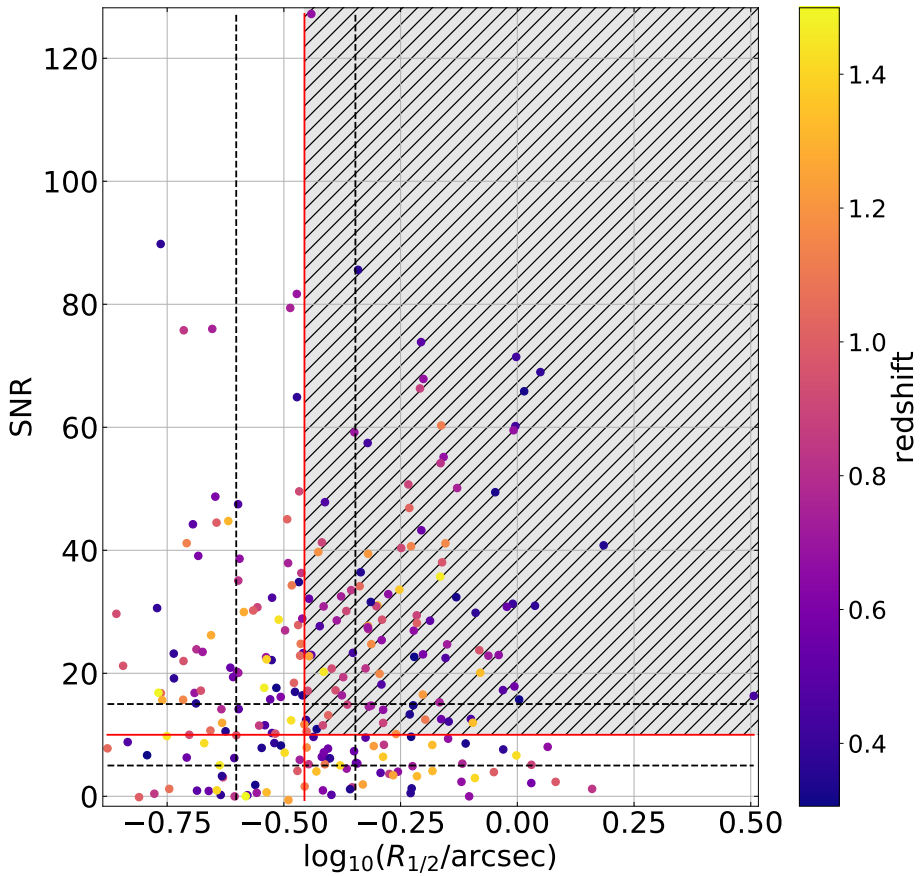


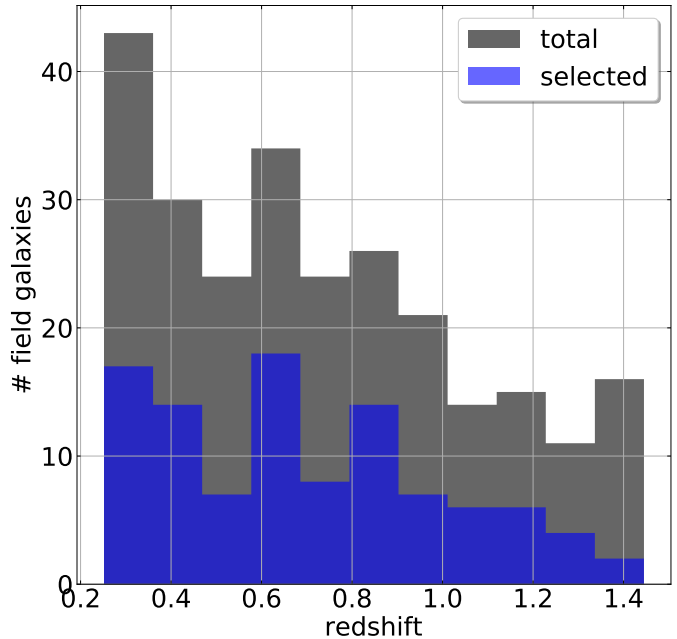
▷ values are consistent between catalogues



▷ scatter is due to bulge dominated (spherically symmetric) systems

Characteristics of our sample
Redshift distribution



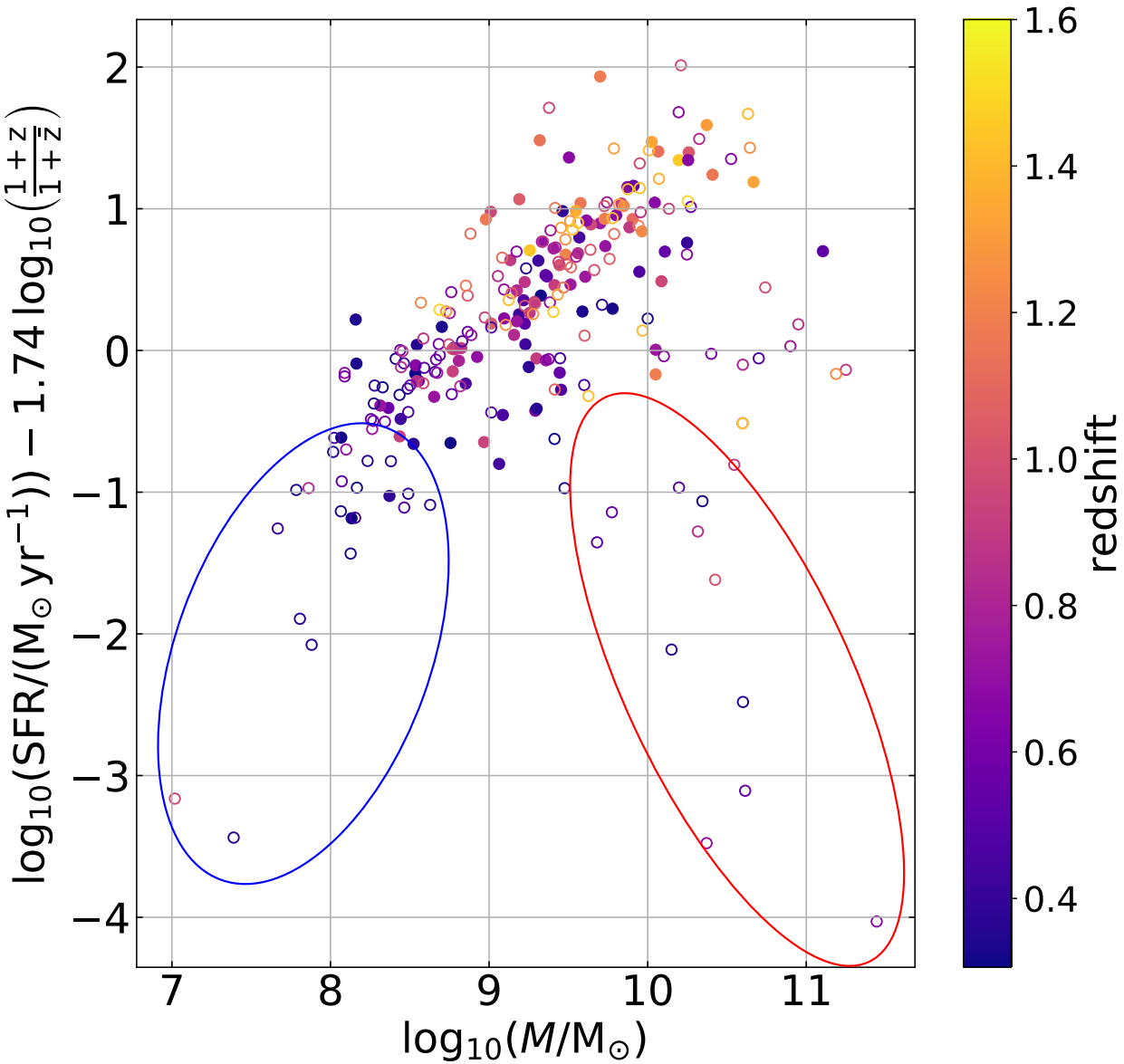


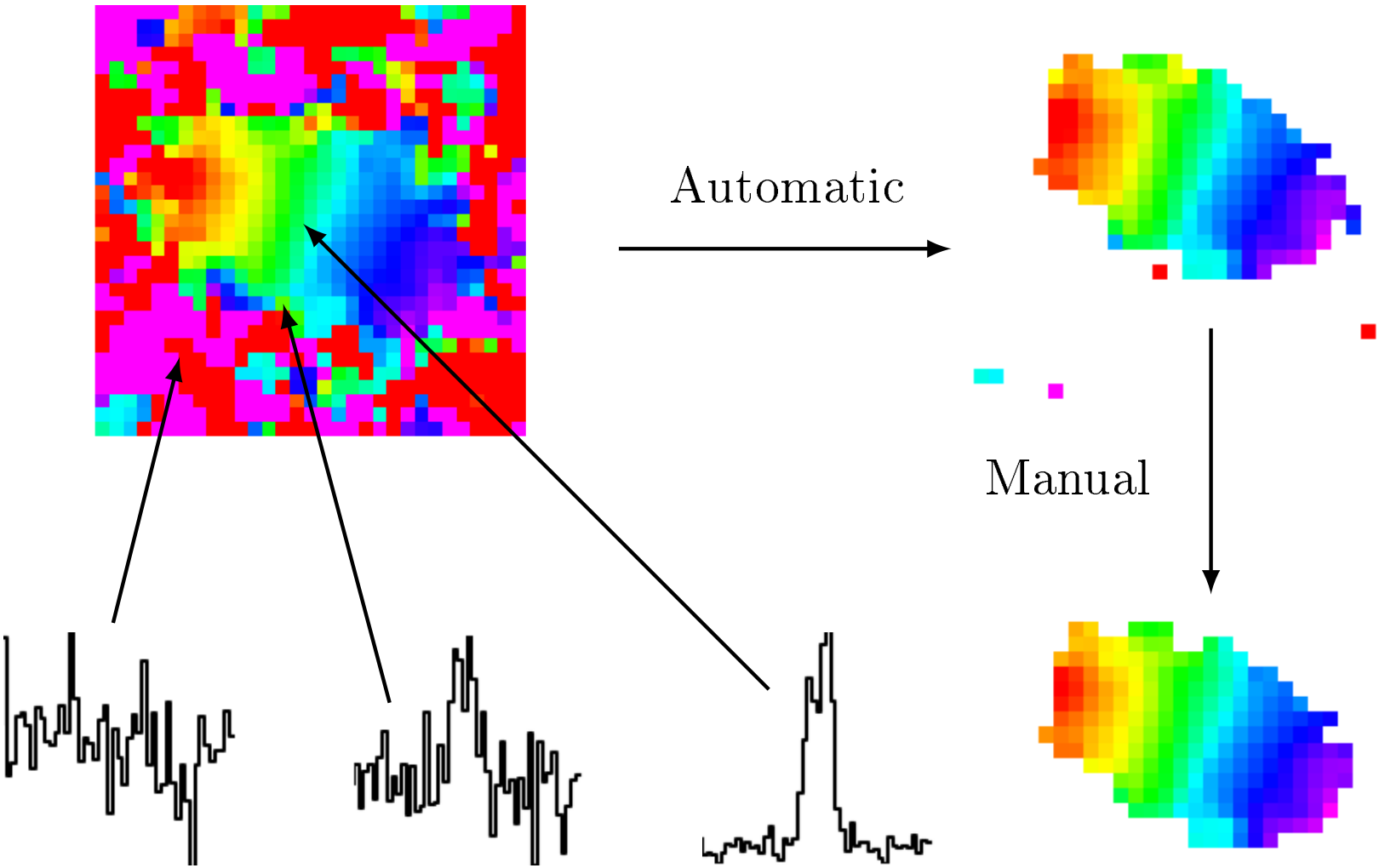
The total number corresponds to galaxies with photometric data in Cassata and/or Zurich catalogues.

- ▷ sample of **103 galaxies** with $R_{1/2} > 0.35$" and SNR > 5
- ▷ we loose galaxies at $z \approx 1.4$
- ▷ redshift distribution is not drastically changed

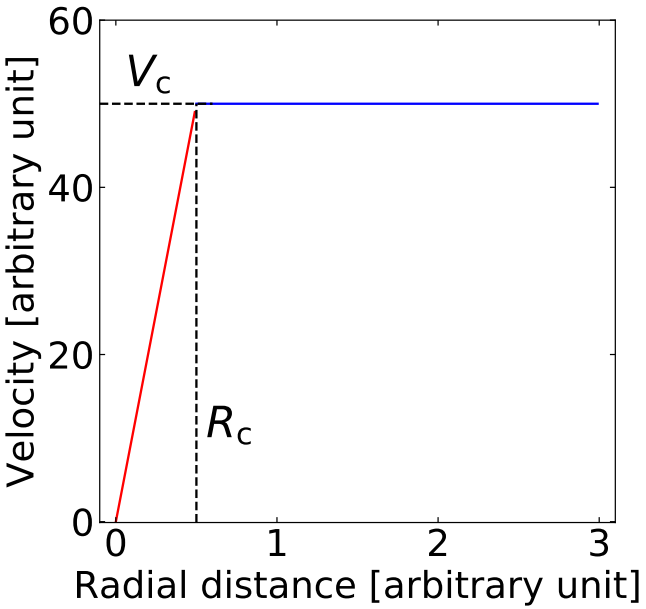
Characteristics of our sample
Mass-SFR relation

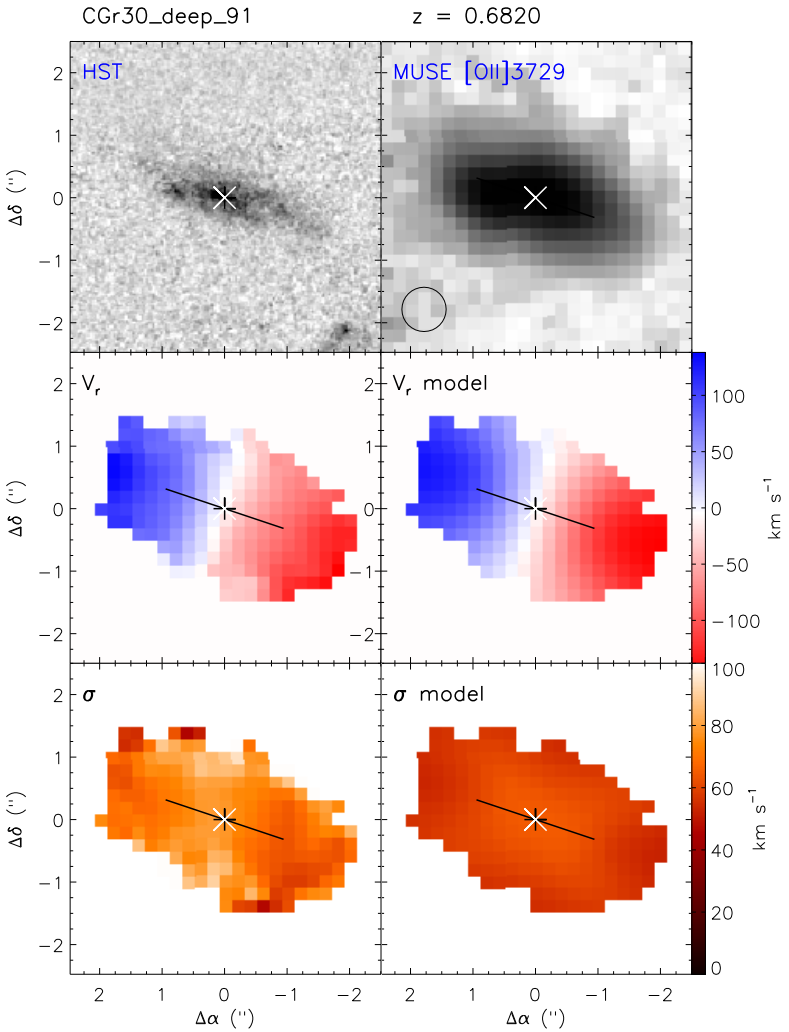
- ▷ Most of our sample galaxies are on the main sequence
- ▷ massive quiescent (low [OII]) and very low mass galaxies are lost

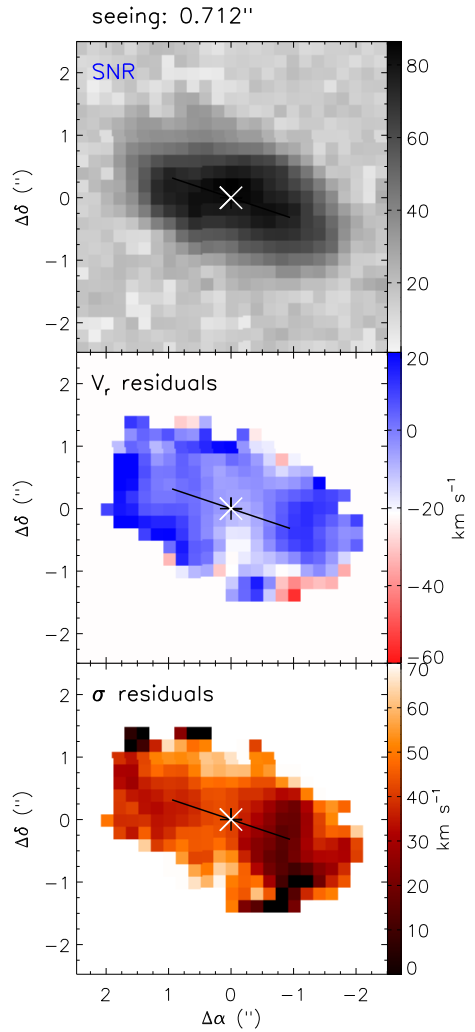



Automatic
Manual

Use a ramp model with a linear internal variation and a plateau.



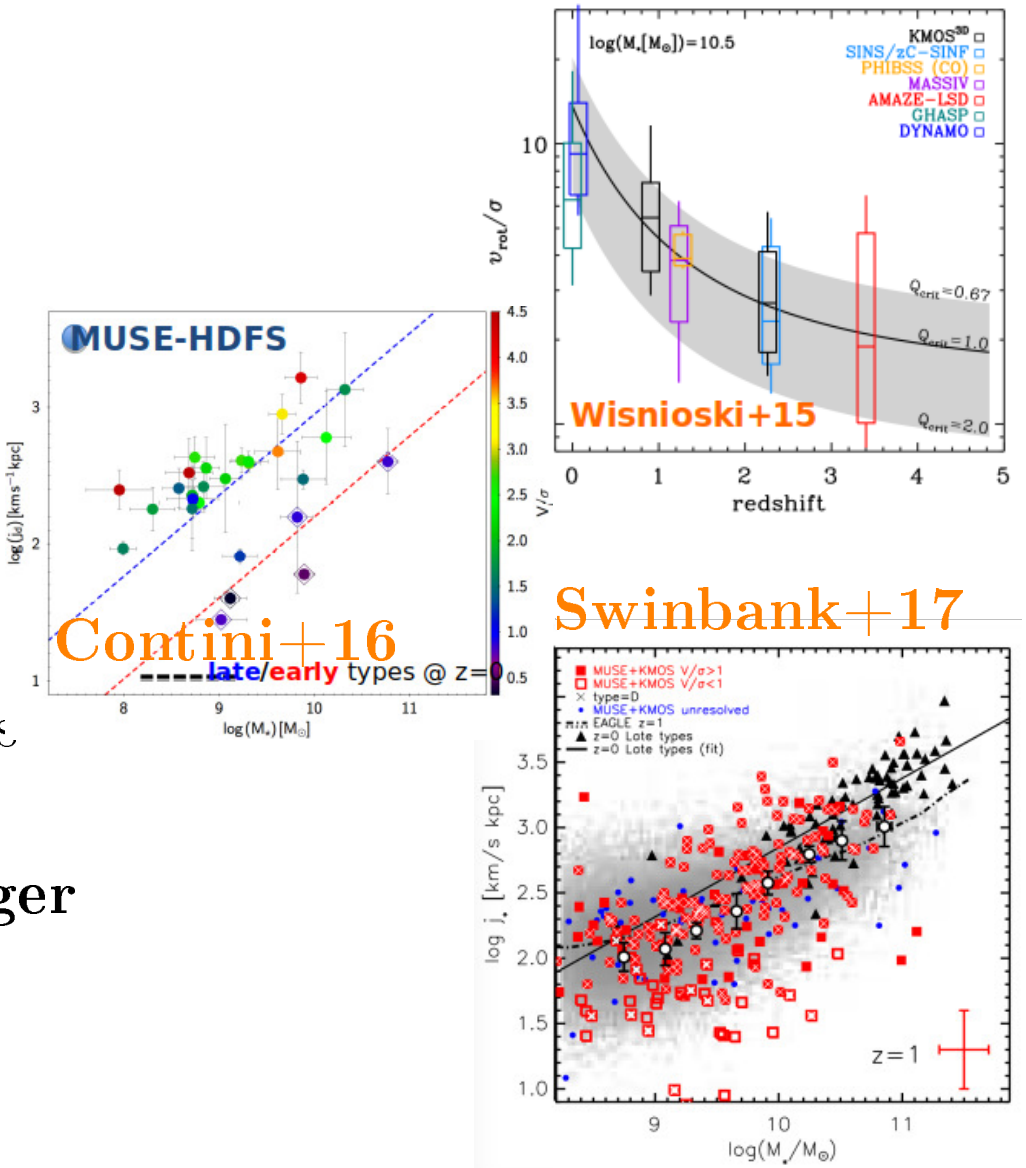




Perspectives

Short term:

- ▷ TFR evolution with z

Long term:

- ▷ Improve morphological modelling
- ▷ Angular momentum evolution ?
- ▷ Dark matter vs. luminous mass ?
- ▷ **better selection + larger sample**