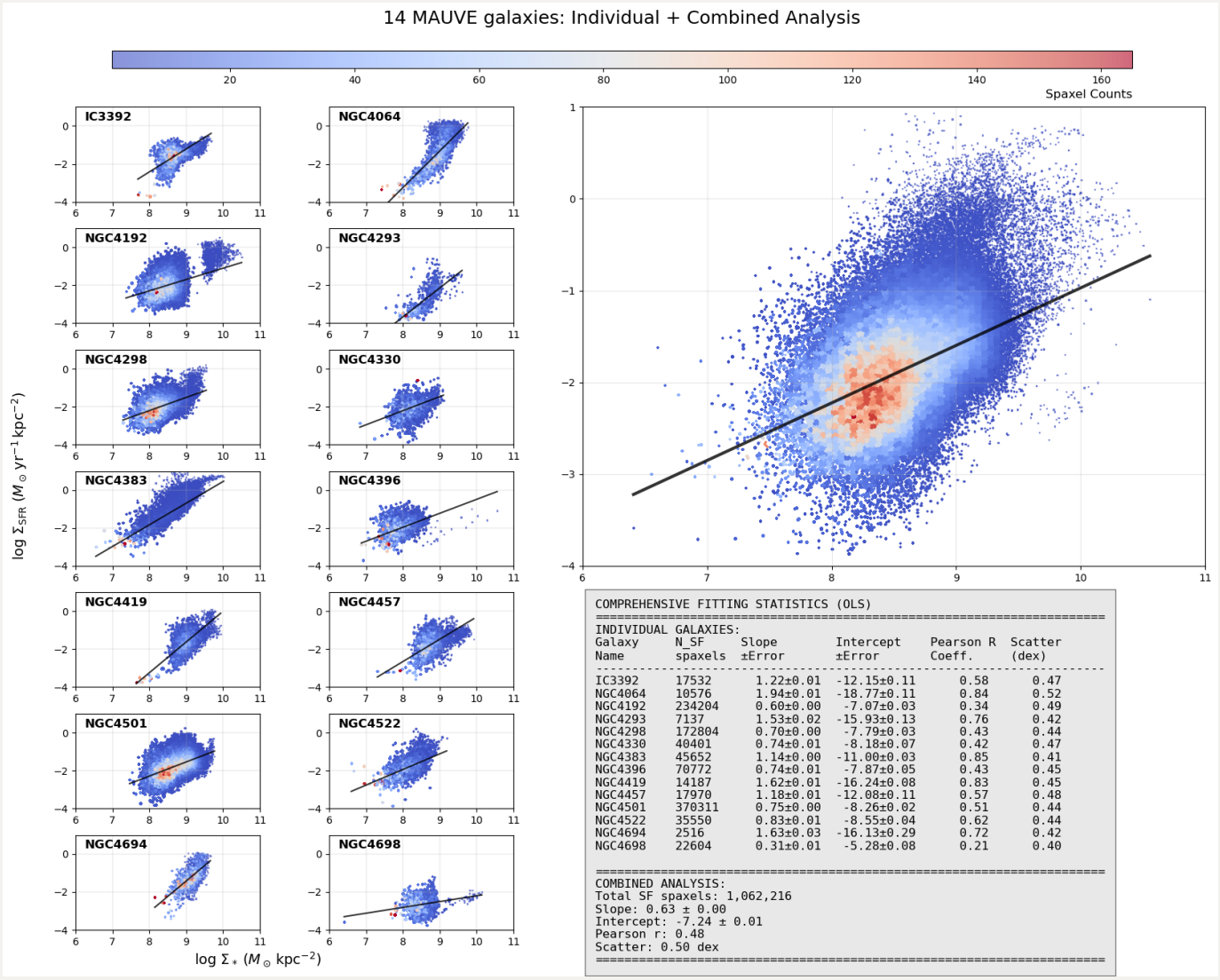
20250723 rSFMS slope

OLS or ODR

Here is a summary of some work that try to fit rSFMS. Some may use OLS (ordinary least squares), some may use ODR (orthogonal distance regression), some fit the mean values (Abdurro'uf & Akiyama (2017)), and some fit the median values (Sánchez et al. (2020, 2021)).

STUDY (YEAR)	DATA SAMPLE (SURVEY)	SLOPE (RSFMS)	FIT METHOD & NOTES
Cano-Díaz et al. (2016)	CALIFA IFU (~200–300 gal.; kpc scale)	**0.72 ± 0.04** (OLS)	OLS linear fit on SF spaxels (H α-based) – sub-linear.
Hsieh et al. (2017)	MaNGA IFU (536 SF gal.; kpc scale)	**0.715 ± 0.001** (OLS)	OLS fit (huge spaxel sample) – sub-linear, very tight.
Abdurro'uf & Akiyama (2017)	Local massive spirals (IFU/imaging; kpc)	**0.99**	Ridge-line/median method – ~unity slope (linear).
Medling et al. (2018)	SAMI IFU (~800 gal.; ~1 kpc)	**0.72 ± 0.04** (OLS)	OLS fit on SF spaxels – sub-linear.
Lin et al. (2019)	ALMaQUEST (14 gal.; 5.4k spaxels; kpc)	**1.19 ± 0.01** (ODR)	*ODR fit* – super-linear; OLS would be ~0.7.
Cano-Díaz et al. (2019)	CALIFA IFU (morphology study; kpc)	**0.94 ± 0.08** (OLS)	OLS fit (SF regions only) – nearly linear.
Sánchez et al. (2020)	Multiple surveys combined (kpc scales)	**0.98 ± 0.02**	**linear regression** with weights = σ^2 to binned means (0.15 dex–wide intervals of the *x-axis* variable)
Sánchez et al. (2021)	EDGE–CALIFA IFU (~100 gal.; ~kpc)	**1.02 ± 0.16**	same as Sánchez et al. (2020)
Ellison et al. (2021a)	ALMaQUEST (28 gal.; 15k spax.; kpc)	**0.68** (OLS); **1.37** (ODR)	Both methods used – slope highly method-dependent. Checkout why
Barrera-Ballesteros et al. (2021a)	EDGE–CALIFA IFU (~90 gal.; ~2 kpc)	**0.92** (OLS)	OLS on 500 pc binned regions – mildly sub-linear; ODR slightly higher.

Then I also perform the OLS and ODR to see my results.

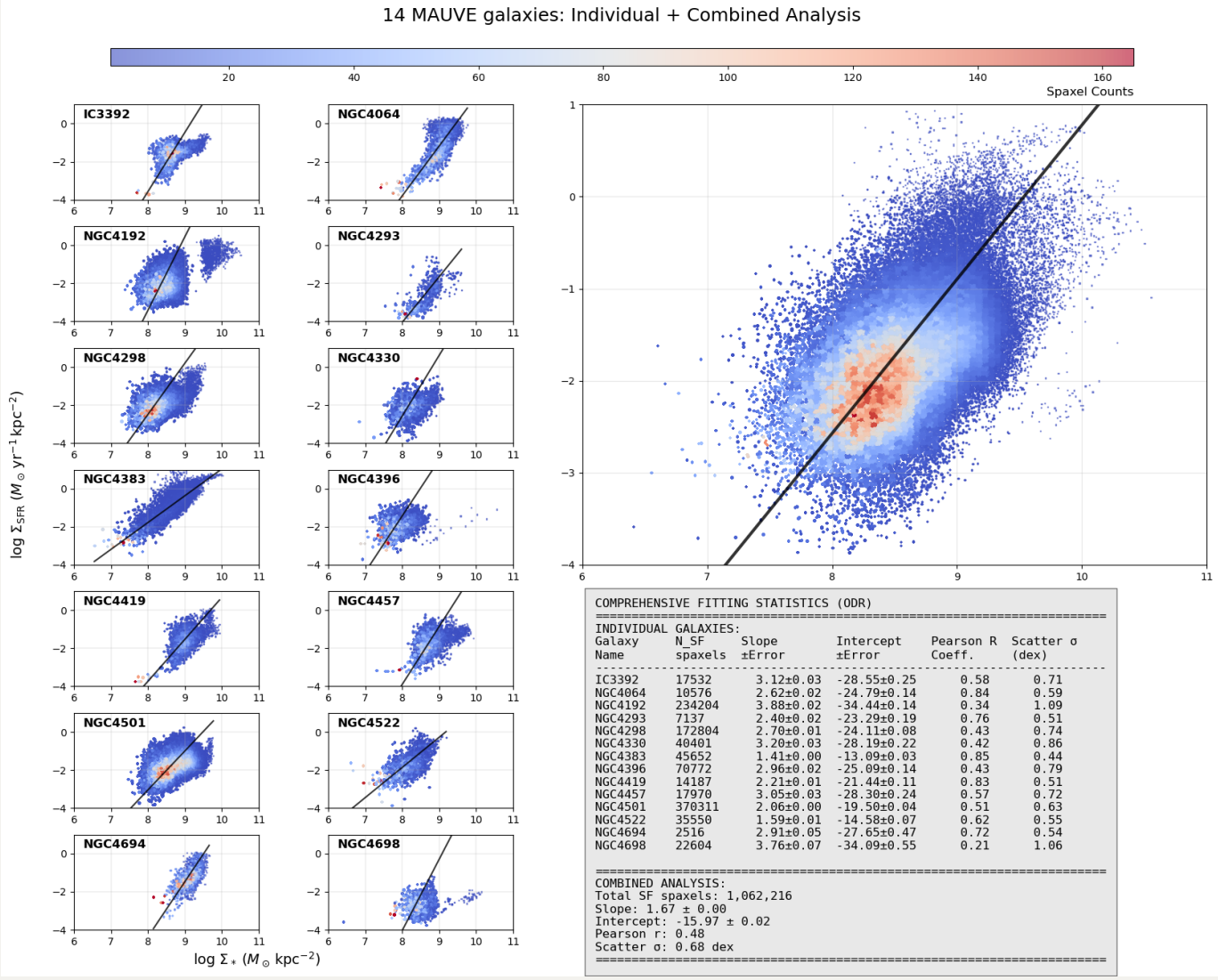


COMPREHENSIVE FITTING STATISTICS (OLS)

INDIVIDUAL GALAXIES:

Galaxy Name	N_SF spaxels	Slope ±Error	Intercept ±Error	Pearson R Coeff.	Scatter (dex)
IC3392	17532	1.22±0.01	-12.15±0.11	0.58	0.47
NGC4064	10576	1.94±0.01	-18.77±0.11	0.84	0.52
NGC4192	234204	0.60±0.00	-7.07±0.03	0.34	0.49
NGC4293	7137	1.53±0.02	-15.93±0.13	0.76	0.42
NGC4298	172804	0.70±0.00	-7.79±0.03	0.43	0.44
NGC4330	40401	0.74±0.01	-8.18±0.07	0.42	0.47
NGC4383	45652	1.14±0.00	-11.00±0.03	0.85	0.41
NGC4396	70772	0.74±0.01	-7.87±0.05	0.43	0.45
NGC4419	14187	1.62±0.01	-16.24±0.08	0.83	0.45
NGC4457	17970	1.18±0.01	-12.08±0.11	0.57	0.48
NGC4501	370311	0.75±0.00	-8.26±0.02	0.51	0.44
NGC4522	35550	0.83±0.01	-8.55±0.04	0.62	0.44
NGC4694	2516	1.63±0.03	-16.13±0.29	0.72	0.42
NGC4698	22604	0.31±0.01	-5.28±0.08	0.21	0.40

COMBINED ANALYSIS:
Total SF spaxels: 1,062,216
Slope: 0.63 ± 0.00
Intercept: -7.24 ± 0.01
Pearson r: 0.48
Scatter: 0.50 dex



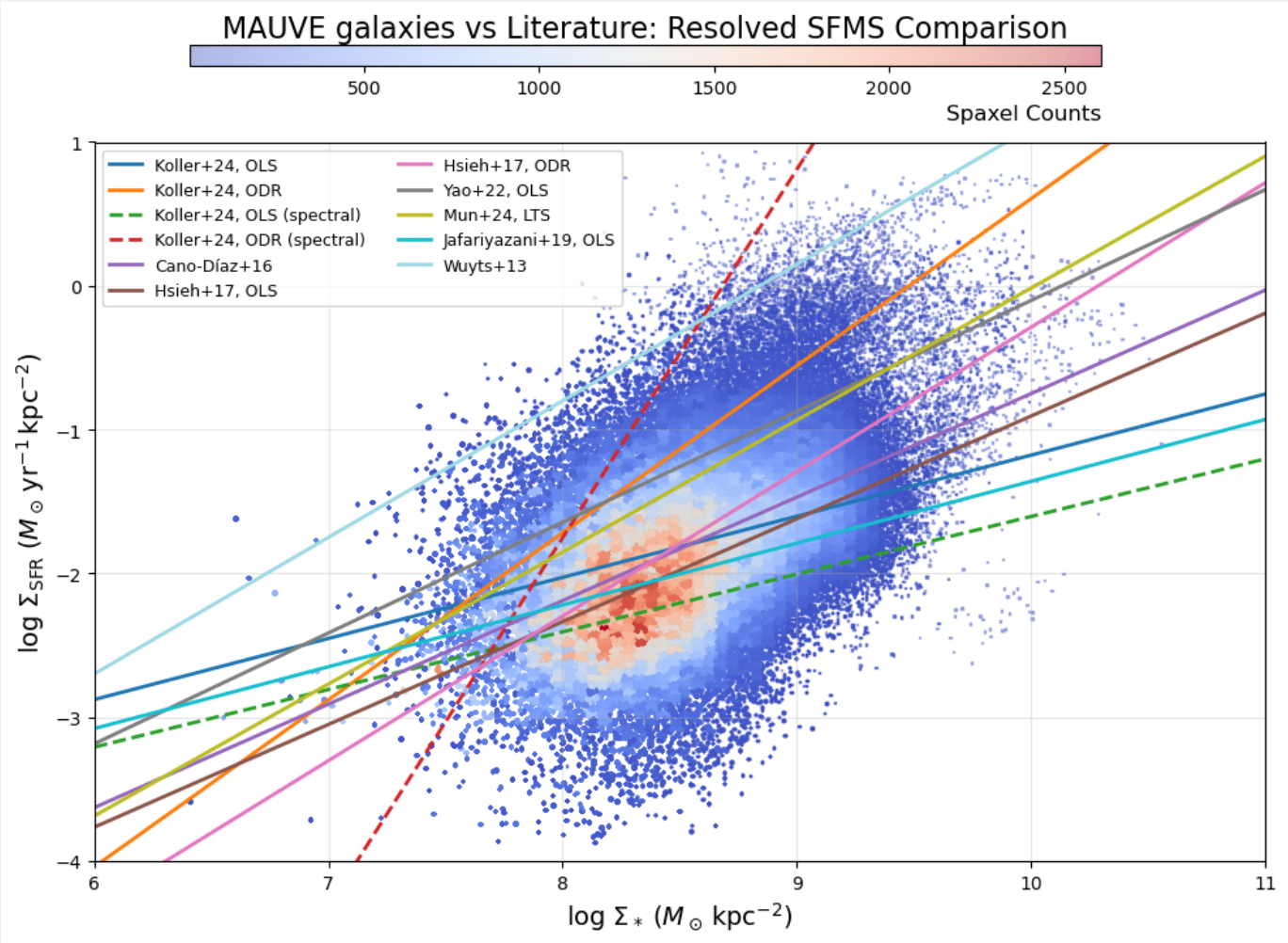
Overlapping others' fitting lines on my data

Here I erase my fitting lines and adopt the summary table from Koller et al. 2024 (because stellar mass surface density in kpc square) to check if MAUVE galaxies still fall in the same parameter space.

Table 1. Best-fit values of the rSFMS for our work and several other publications.

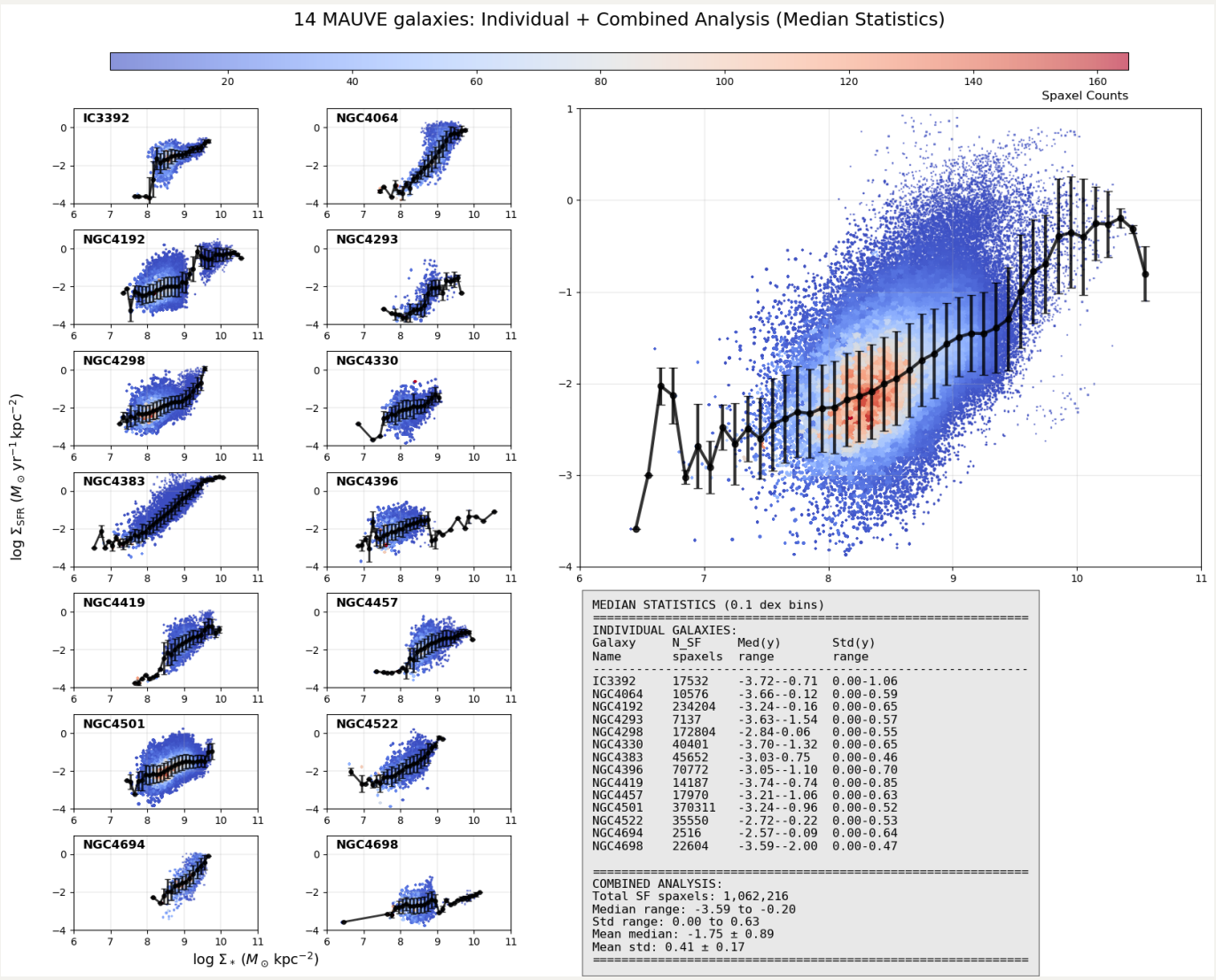
Reference	Data [(a)]	Method [(b)]	z	b	a
1	80%	OLS	0.3	0.425 ± 0.014	-5.428 ± 0.104
1	80%	ODR	0.3	1.162 ± 0.022	-11.014 ± 0.164
2	80%	OLS	0.3	0.401 ± 0.015	-5.615 ± 0.116
2	80%	ODR	0.3	2.562 ± 0.056	-22.248 ± 0.431
3	80%	–	0	0.72 ± 0.04	-7.95 ± 0.29
4	–	OLS	<0.15	0.715 ± 0.001	-8.056 ± 0.008
4	–	ODR	<0.15	1.005 ± 0.004	-10.338 ± 0.014
5	$\log(\Sigma_*) > 7$	OLS	0.26	0.771 ± 0.032	-7.812 ± 0.249
6	–	LTS	$0.25 < z < 0.42$	0.918 ± 0.005	-9.196 ± 0.006
7	–	OLS	$0.1 < z < 0.42$	0.43 ± 0.05	-5.66 ± 0.05
8	$\log(\Sigma_*) < 8.8$	–	$0.7 < z < 1.5$	0.95	−8.4

Notes. Results by Mun et al. (2024) also utilize the MAGPI survey but for a wider redshift range of $0.25 < z < 0.42$. [(a)]Data range used for the fitting. [(b)]Linear fitting method: ordinary least-square (OLS), orthogonal distance regression (ODR), or least trimmed squares (LTS). References: (1) This work (SF-spaxels); (2) this work (spectral decomposition); (3) Cano-Díaz et al. (2016); (4) Hsieh et al. (2017); (5) Yao et al. (2022); (6) Mun et al. (2024); (7) Jafariyazani et al. (2019); (8) Wuyts et al. (2013).



Looks like still in similar space, but maybe a bit quench?

Below I show the median trend of MAUVE galaxies.



MEDIAN STATISTICS (0.1 dex bins)

INDIVIDUAL GALAXIES:

Galaxy Name	N_SF spaxels	Med(y) range	Std(y) range
IC3392	17532	-3.72--0.71	0.00-1.06
NGC4064	10576	-3.66--0.12	0.00-0.59
NGC4192	234204	-3.24--0.16	0.00-0.65
NGC4293	7137	-3.63--1.54	0.00-0.57
NGC4298	172804	-2.84-0.06	0.00-0.55
NGC4330	40401	-3.70--1.32	0.00-0.65
NGC4383	45652	-3.03-0.75	0.00-0.46
NGC4396	70772	-3.05--1.10	0.00-0.70
NGC4419	14187	-3.74--0.74	0.00-0.85
NGC4457	17970	-3.21--1.06	0.00-0.63
NGC4501	370311	-3.24--0.96	0.00-0.52
NGC4522	35550	-2.72--0.22	0.00-0.53
NGC4694	2516	-2.57--0.09	0.00-0.64
NGC4698	22604	-3.59--2.00	0.00-0.47

COMBINED ANALYSIS:
Total SF spaxels: 1,062,216
Median range: -3.59 to -0.20
Std range: 0.00 to 0.63
Mean median: -1.75 ± 0.89
Mean std: 0.41 ± 0.17