HECTOR Galaxy Survey

Hector + SAMI Busy Week October 2022

Task : An analysis of allocation of galaxies to hexabundles (Oguzhan Cakir)

Current algorithm for allocation of galaxies as follows:

1. **For galaxies with SB < 23 and 5"<Re<12", the galaxy with largest Re is placed are placed on the largest bundle.**
2. **Low mass galaxies go to Spector (lowest mass to smallest bundles).**
3. **Remaining galaxies are allocated based on largest Re to largest bundles.**

There are two spectrographs, the higher resolution (HR) spectrograph "Spector" and the lower resolution (LR) "AAOmega".

We aim to investigate the low-mass galaxies (i.e. faint galaxies) with Spector in order to be able to study their properties better.

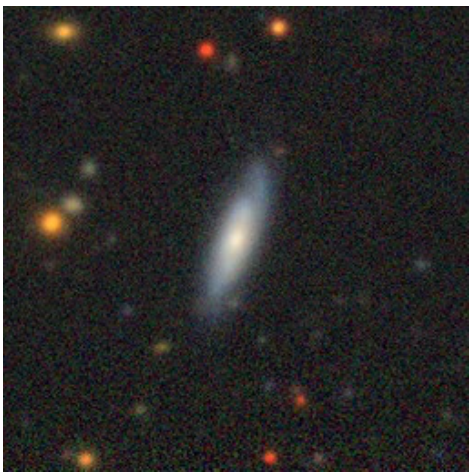
Overall, the algorithm performs well in terms of allocating galaxies (i.e. applying criteria). However, there are interesting cases such as the allocation of low-mass galaxies to the biggest hexabundles of AAOmega and vice versa.

In the next section, I point out these cases that are taken from A2399 cluster field with thumbnails and cubes. To trace the size of a galaxy on the hexabundle, Halpha emission line was used.

Hexabundle	Type	Size
A	AAOmega LR	25.9 arcsec
B	AAOmega	25.9 arcsec
C	AAOmega	22.4 arcsec
D	AAOmega	19.0 arcsec
E	AAOmega	15.5 arcsec
F	AAOmega	15.5 arcsec
G	AAOmega	15.5 arcsec
H	AAOmega (star)	12.1 arcsec
I	Spector HR	19.0 arcsec
J	Spector	15.5 arcsec
K	Spector	15.5 arcsec
L	Spector	15.5 arcsec
M	Spector	15.5 arcsec
N	Spector	15.5 arcsec
O	Spector	15.5 arcsec
P	Spector	15.5 arcsec
Q	Spector	15.5 arcsec
R	Spector	15.5 arcsec
S	Spector	15.5 arcsec
T	Spector	15.5 arcsec
U	Spector (star)	12.1 arcsec

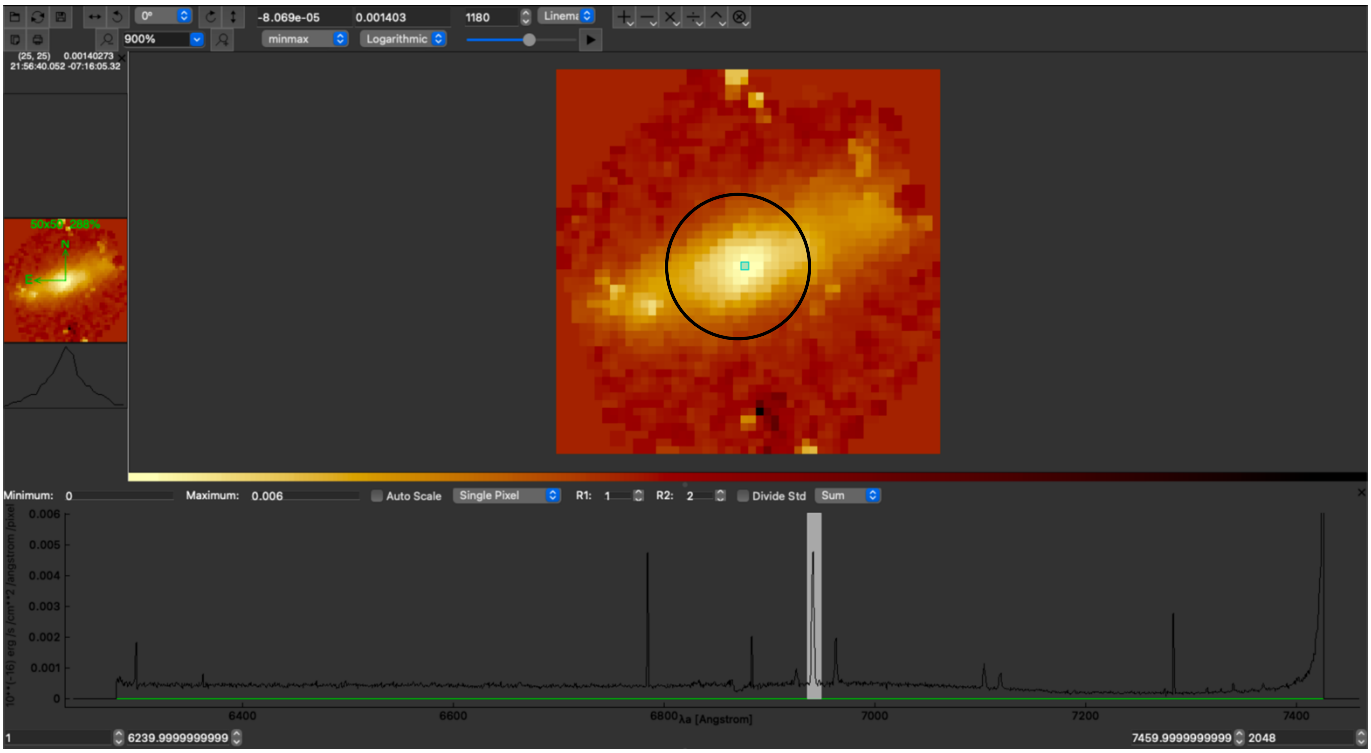
Table 1: Hexabundle sizes

Case 1:



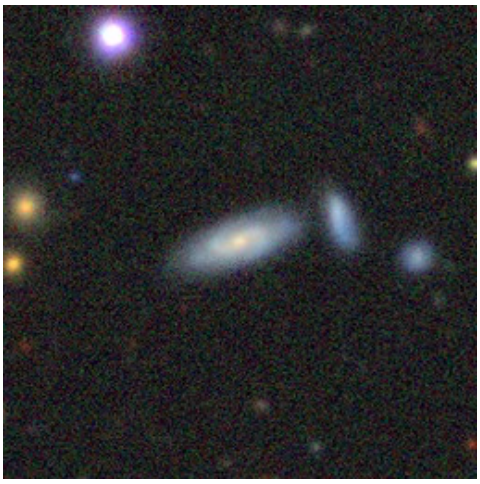
ID : 901029000302940 (A2399 centre tile001)

- A low-mass galaxy : log(M∗) = 9.90
- μ = 21.87 mag arcsec^{-2}
- Re = 5.51 arcsec
- Only this galaxy satisfies the criteria, therefore it's allocated to the hexabundle A, even though its low mass!
- Halpha emission is weak outside of the circle.

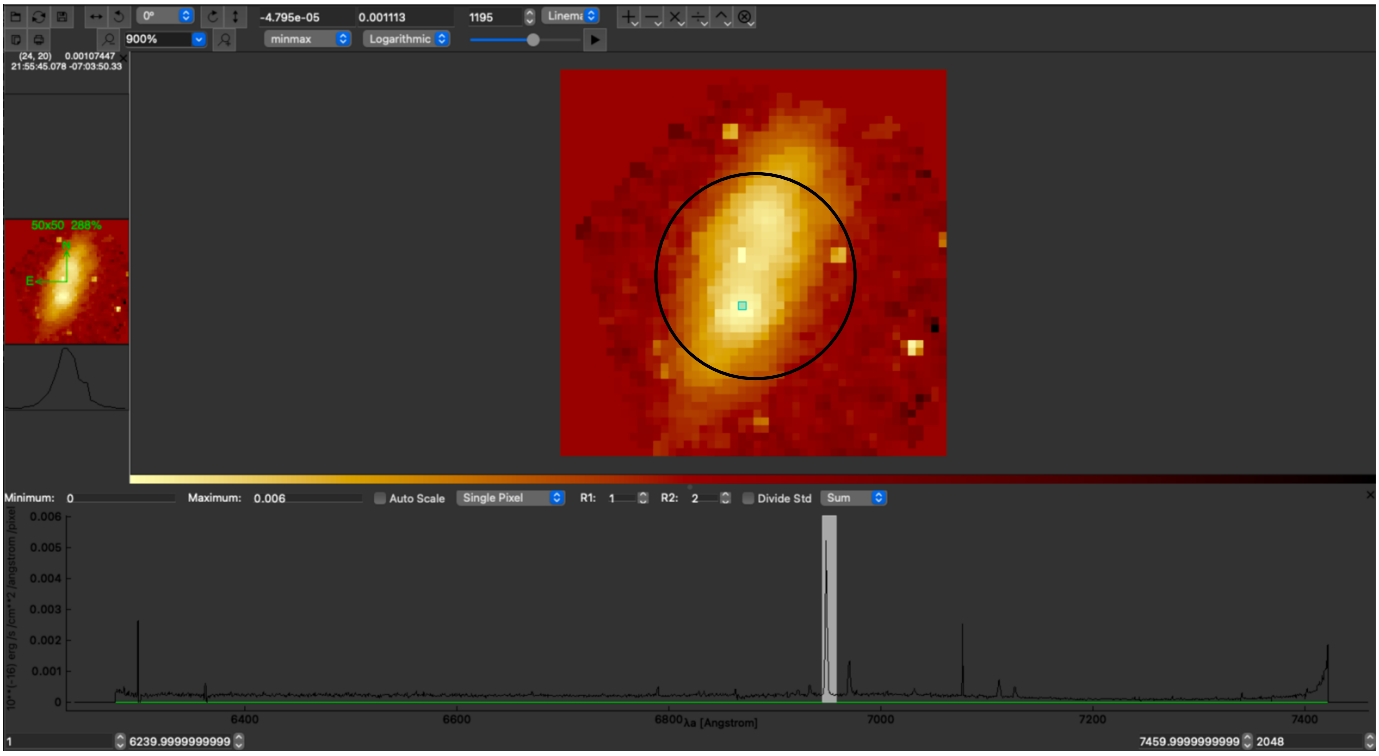


Case 2:

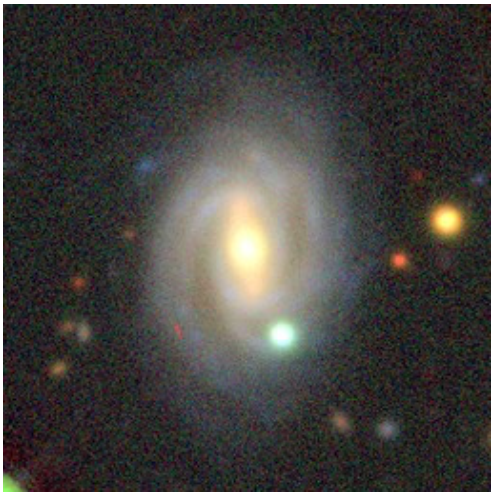
ID : 901029143203670 (A2399 centre tile001)



- A low-mass galaxy : $\log(M_*) \sim 9.80$
- $\mu = 21.74$ mag arcsec^{-2}
- Re = 4.94 arcsec (second largest Re for Re < 12")
- It's allocated to the hexabundle B.
- Halpha emission is weak outside of the circle.

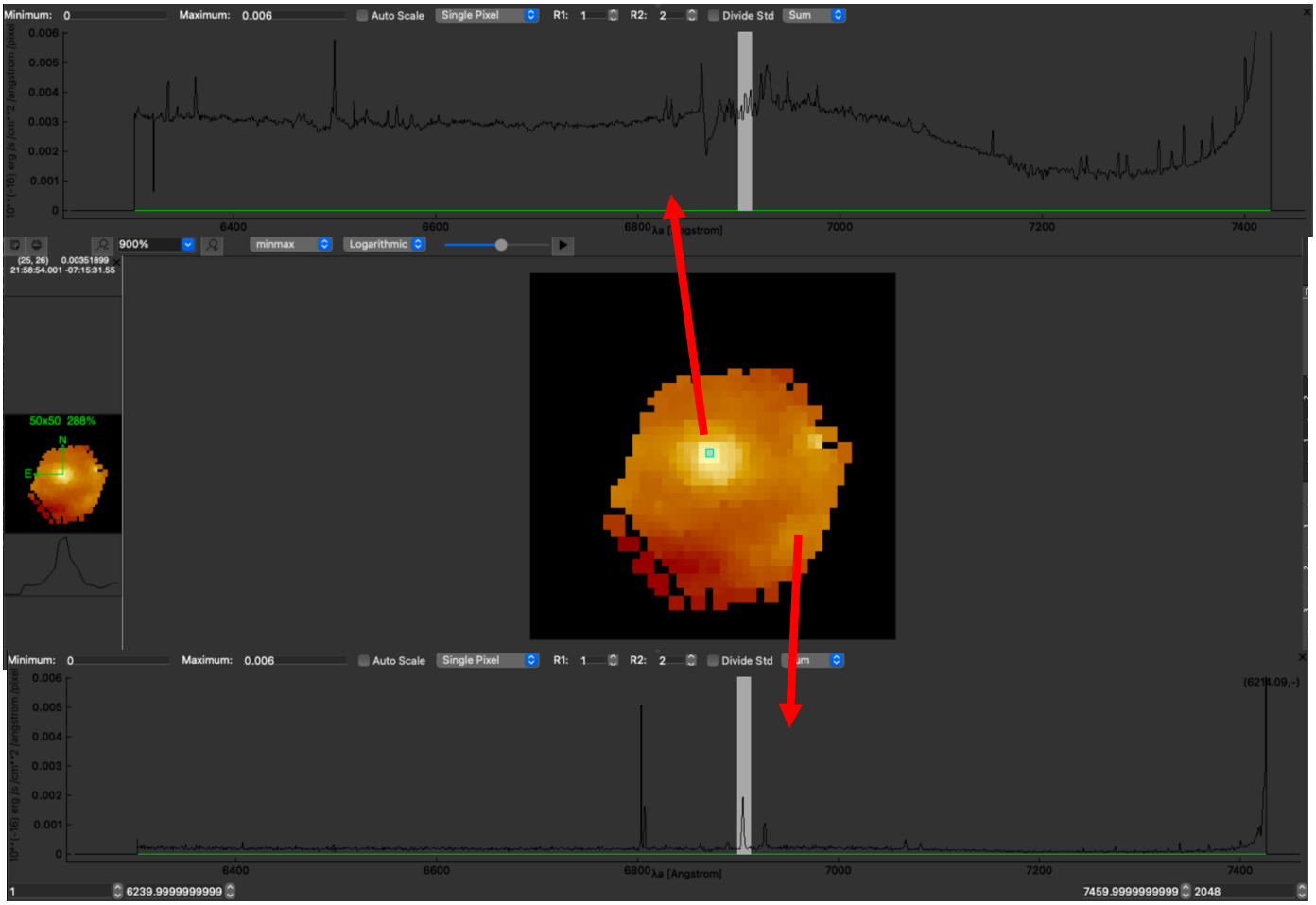


Case 3:

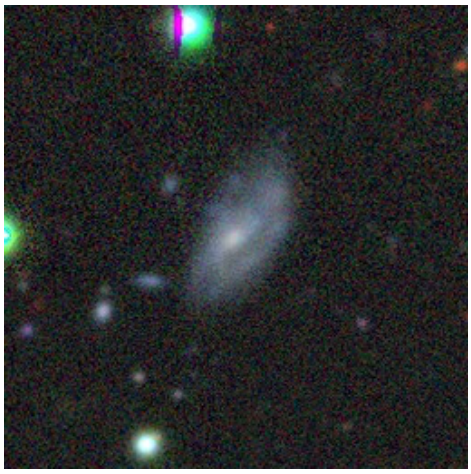


ID : 901029000504533 (A2399 centre tile001)

- The most massive galaxy in the tile: log(M∗) ~ 11
- A huge sprial galaxy !
- μ ~ 21.52 mag arcsec^{-2}
- Re ~ 15.63 arcsec
- It's allocated to the smallest AAOmega hexabundle, G. Hexanbundle G covers ~ 0.5 Re of this galaxy.
- Halpha emission can be traced on the spiral arm (on the right edge of hexabundle, see below). However, the spetrum of the central region seems bizarre. Recalibration may be needed (?).

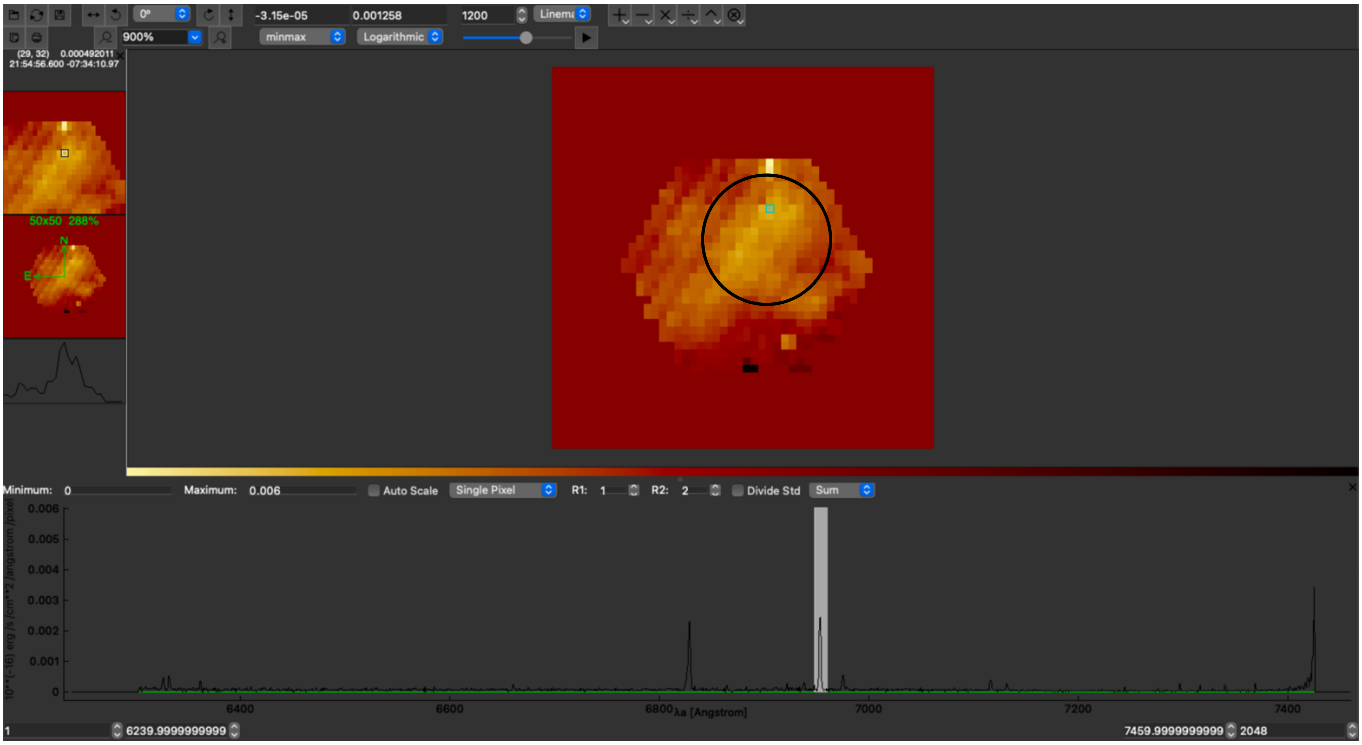


Case 4:

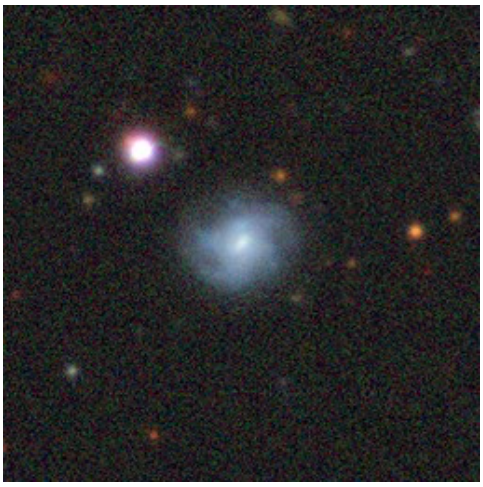


ID : 901028857105107 (A2399 centre tile003)

- A low-mass LSB galaxy : $\log(M_*) \sim 9.65$
- $\mu = 23.42$ mag arcsec^{-2}
- Re = 13.35 arcsec (largest Re in the tile)
- It's allocated to the hexabundle G.
- Halpha emission is weak outside of the circle.

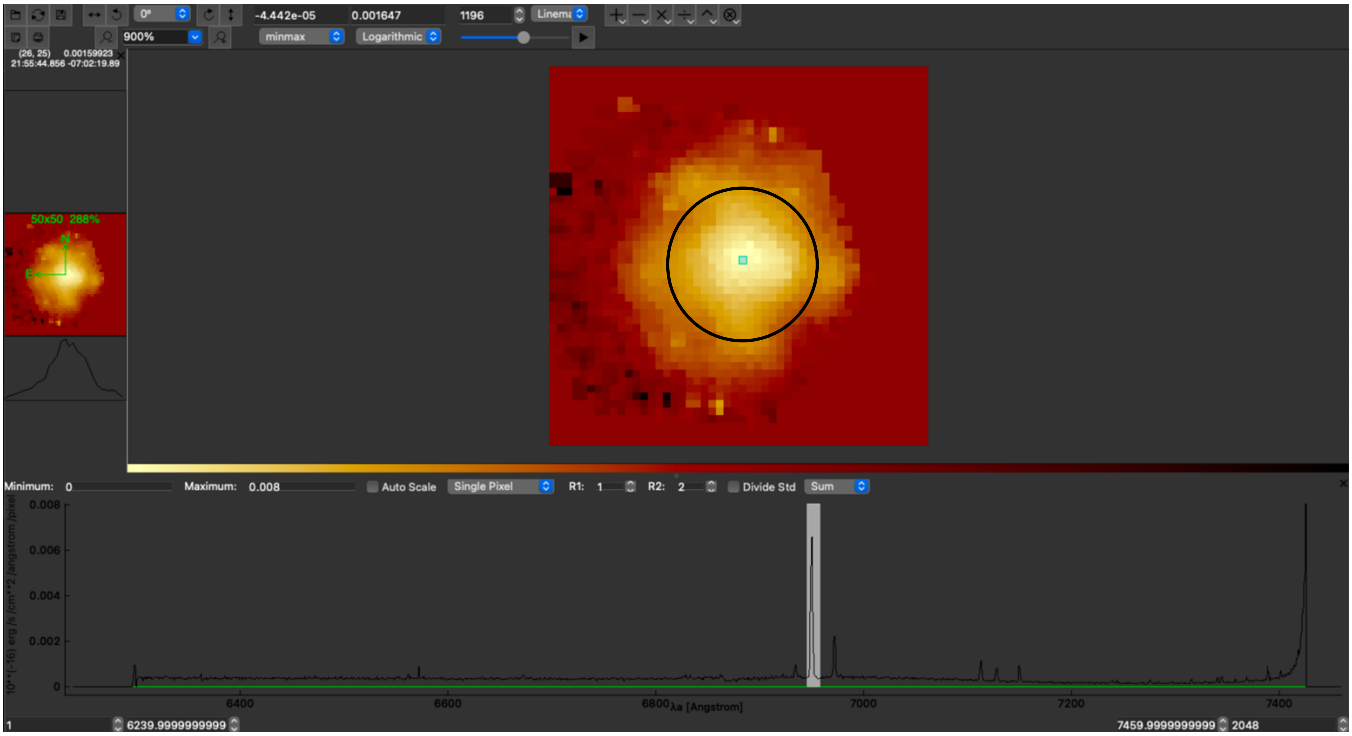


Case 5:



ID : 901029143203656 (A2399 centre tile004)

- A low-mass galaxy : log(M∗) ~ 9.73
- μ = 21.21 mag arcsec^{-2}
- Re = 4.30 arcsec
- It's allocated to the hexabundle C according to the third criteria.
- Halpha emission is weak outside of the circle.



Conclusion / Discussion:

- Overall, the algorithm allocates the galaxies well accordingly to the criteria mentioned above. Even for the cases where low-mass on the largest hexabundles, it is mathematically true (via the first criteria).

- Especially the cases like Case 3 may be reallocated to a larger hexabundle for the cluster fields? However, even with the largest hexabundle, Case 3 reaches out to ~1 Re (Hector aims galaxy to be imaged out to ~2 Re). Depending on the science case, this may need further discussion?

- On the other hand, galaxy properties may be overestimated by SED fitting, and ProFound photometric measurements (only using optical bands).

- In several cases, the shape of the spectrum is odd. Therefore, recalibration may be needed. Also Hector spectra are not telluric corrected. Especially, in the redshift range of A2399, there are telluric absorption line close to the Halpha.