Which red nuggets can DESI bring to the table?

by **Christoph Saulder**

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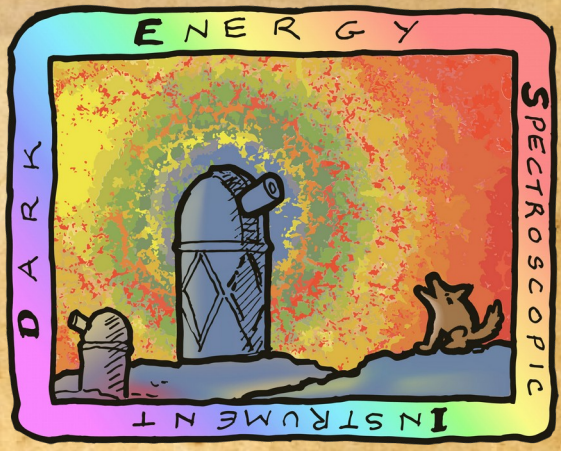
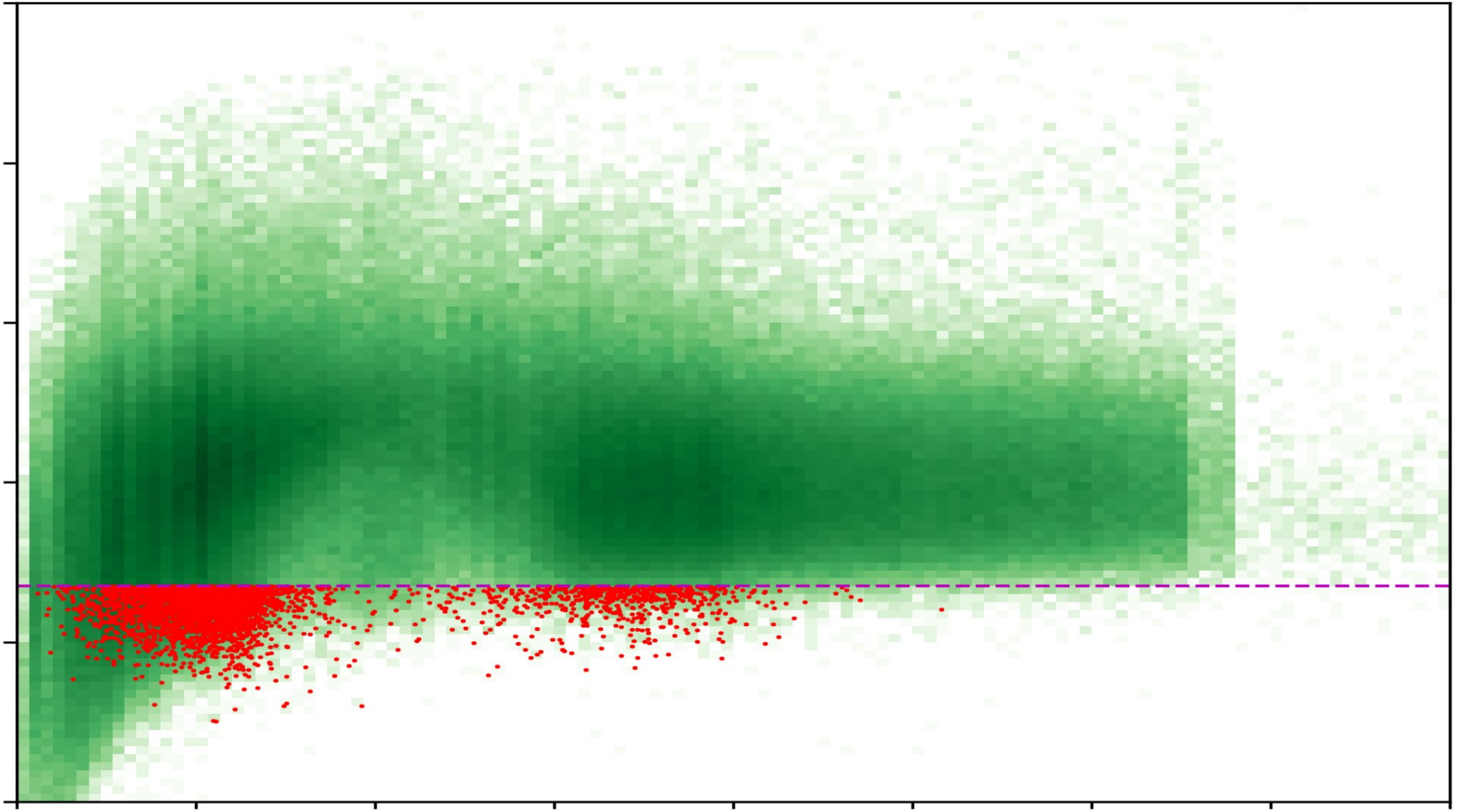


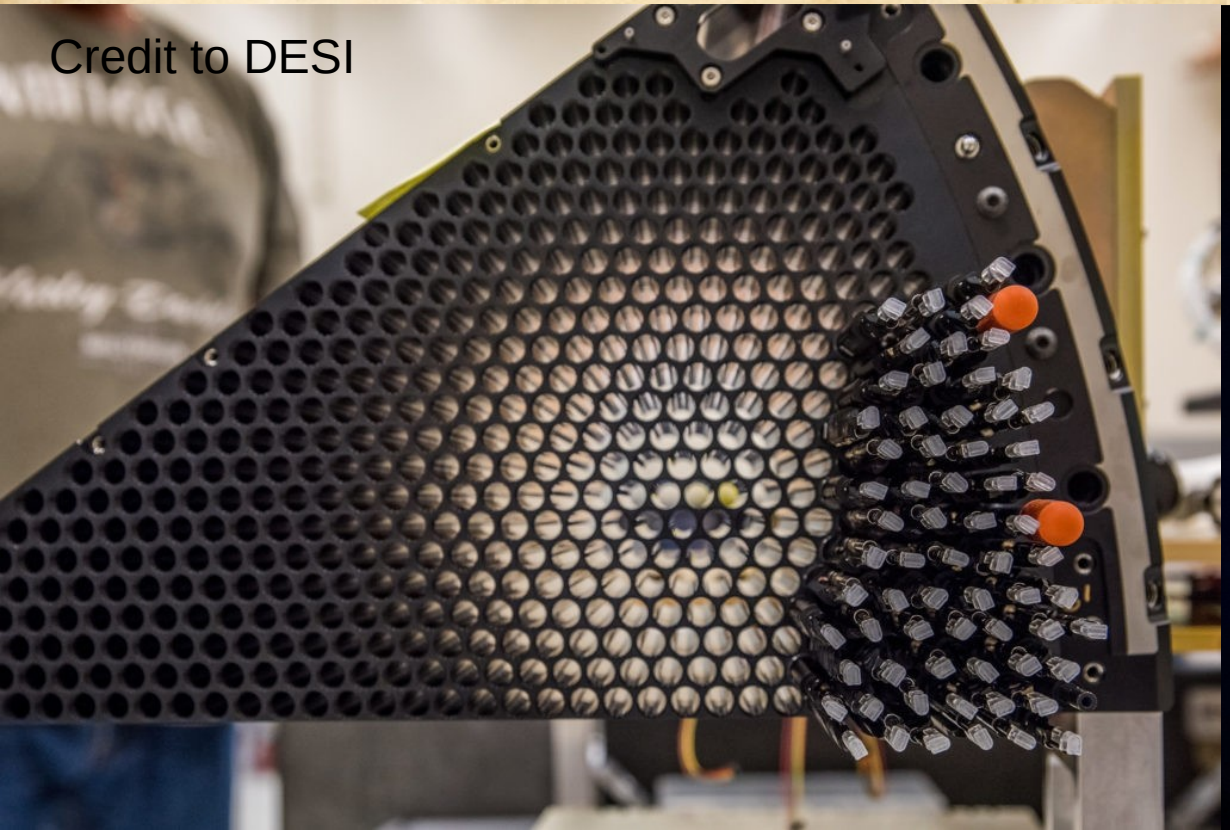


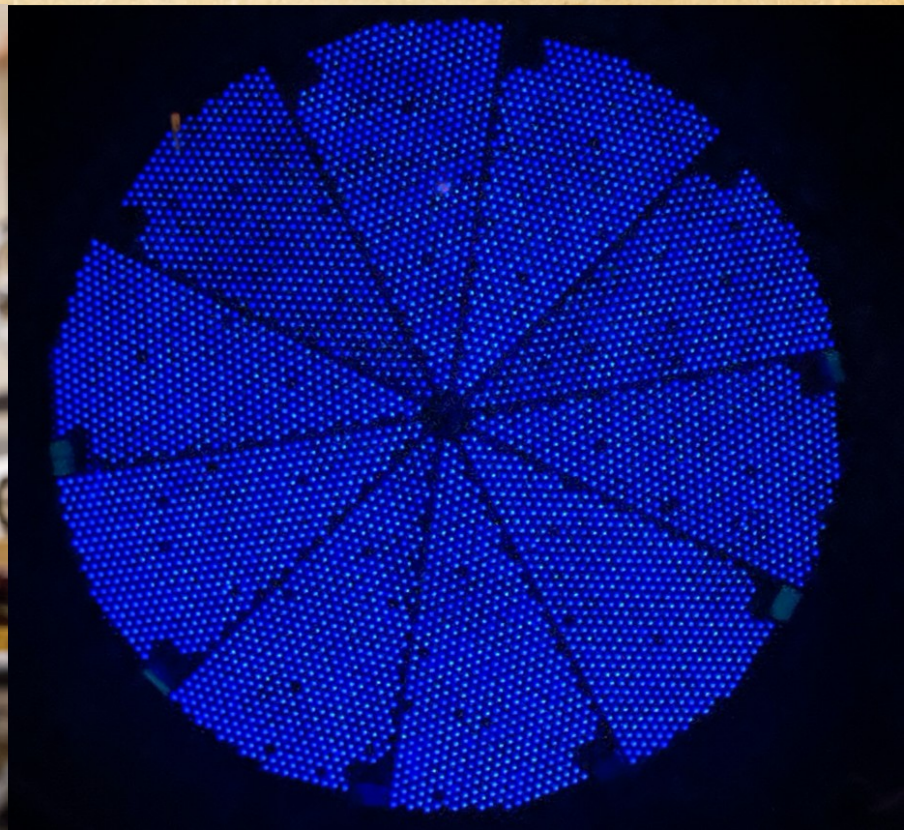
DESI - scope

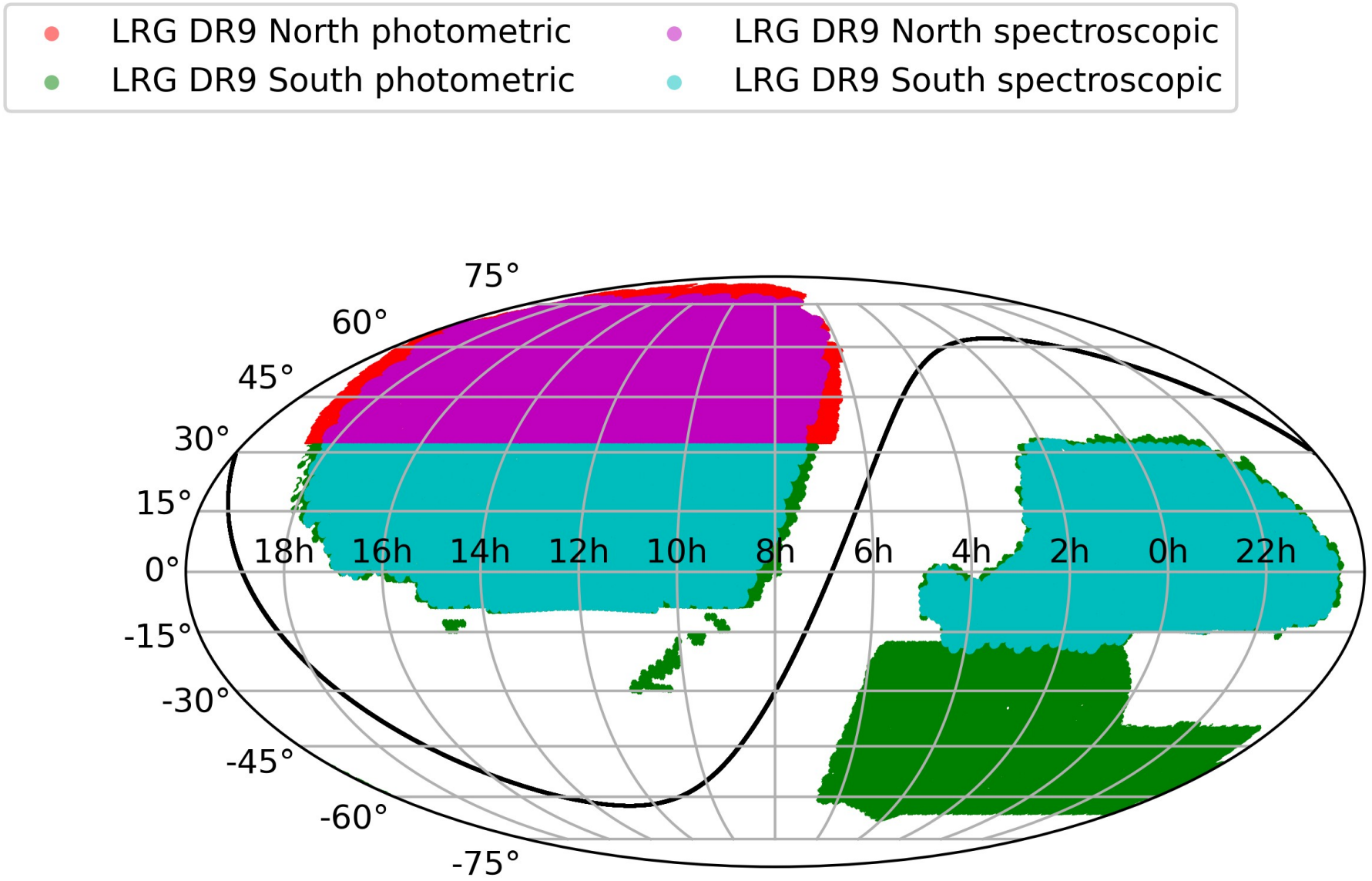
- Dark Energy Spectroscopic Instrument (survey)
- Ongoing spectroscopic survey
  - Survey validation (will become part of the Early Data Release, that will become public likely near the end of 2022) since March 2020 (including Covid related delays).
  - Main survey since May 2021
  - ~5 years in total
- Large footprint: ~14000 square degree
- DESI Legacy Imaging Survey DR9
  - Photometric survey for target selesction (grz+WISE)

DESI focal plane layout

- 5000 fibres that move within a patrol radius (10 petal of 500 fibres)





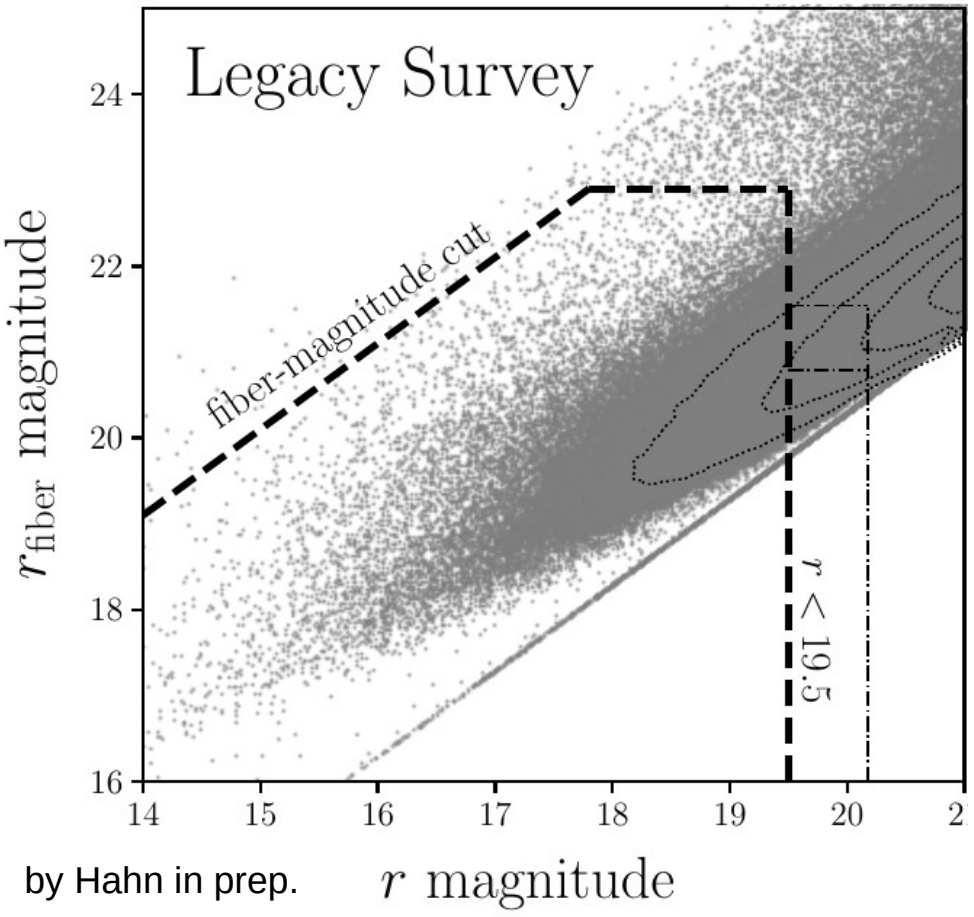

LRG DR9 North photometric
LRG DR9 North spectroscopic
LRG DR9 South photometric
LRG DR9 South spectroscopic
75°
60°
45°
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
18h
16h
14h
12h
10h
8h
6h
4h
2h
0h
22h

DESI target classes

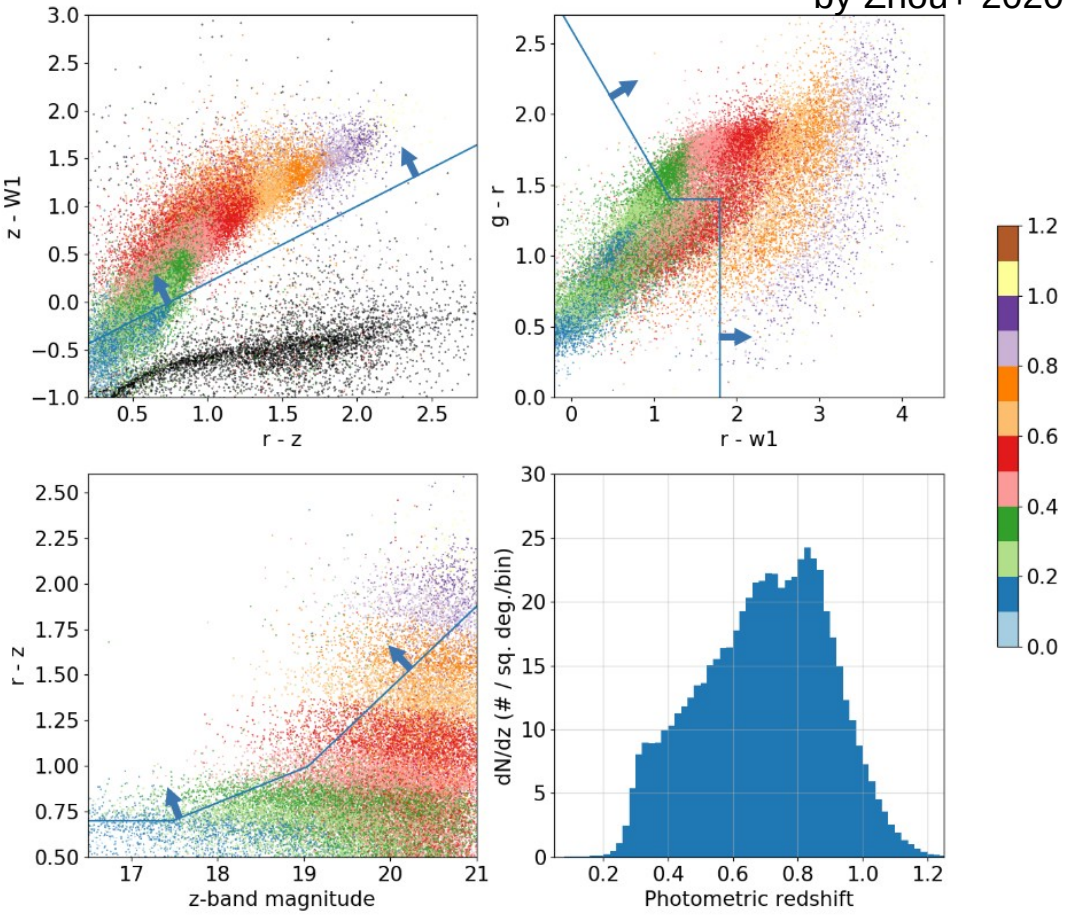
- Milky Way Science targets (MWS) - bright programme
- **Bright Galaxy Survey (BGS)** - bright programme
- **Luminous Red Galaxies (LRG)** - dark programme
- Emission Line Galaxies (ELG) - dark programme
- Quasars (QSO) - dark programme
- Various secondary targeting programmes providing deeper spectra for some targets (like elliptical galaxies of the BGS if they are part of the DESI peculiar velocity survey) or additional targets.

BGS and LRG target selection

by Zhou+ 2020



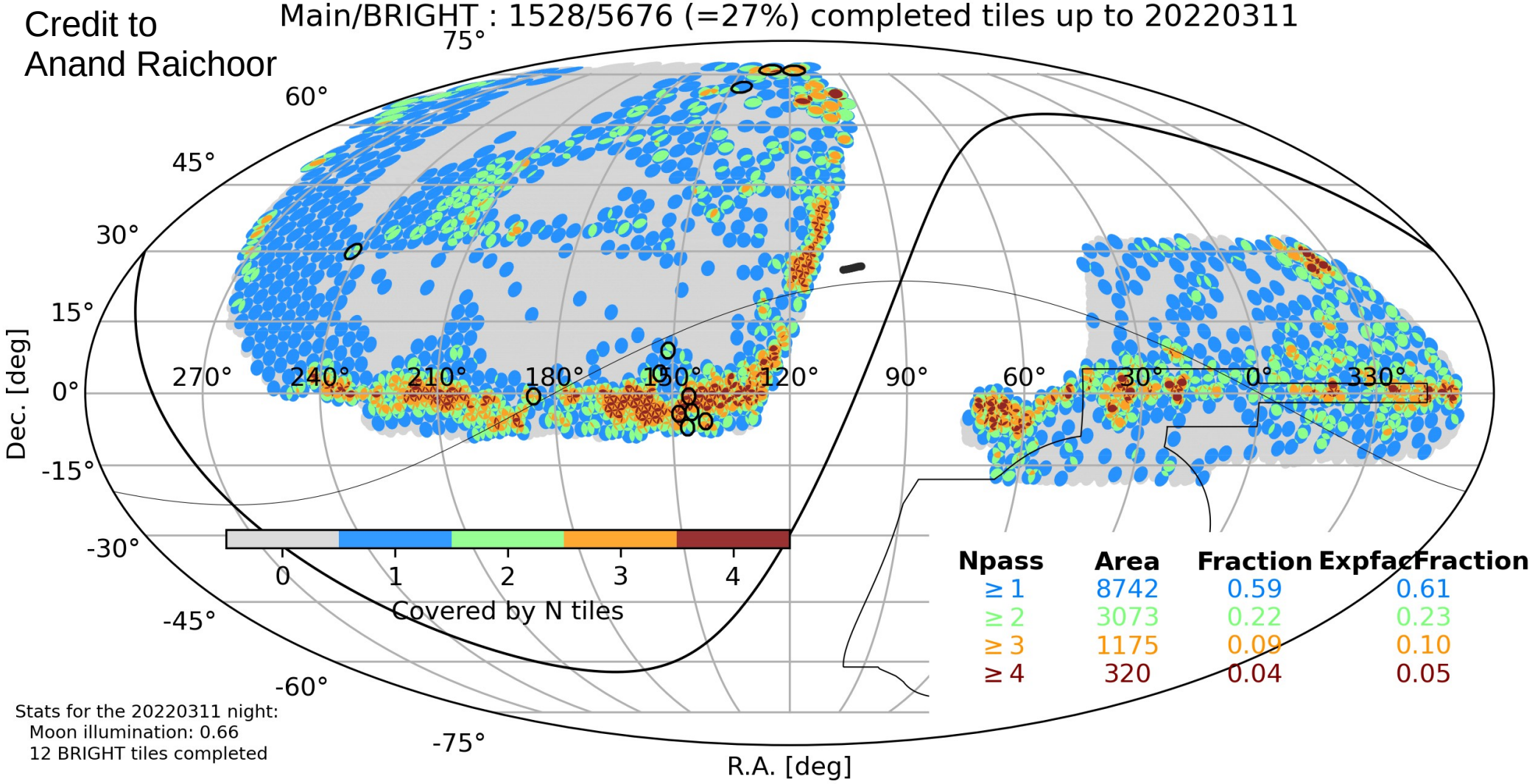
by Hahn in prep.



DESI status

- SV3 aka 1% survey … completed last year and will be part of the EDR … slightly deeper than the main survey.
- Internal DA0.2 release: main survey data until July 2021
- Overall good progress (survey on schedule), but due to some technical issues last year a strange mixture between width first and depth first survey strategy
- Photometric data (model fits) and photometric redshifts are already public
- Spectroscopic data currently only for DESI members and external collaborators (for specific projects)

Credit to
Anand Raichoor



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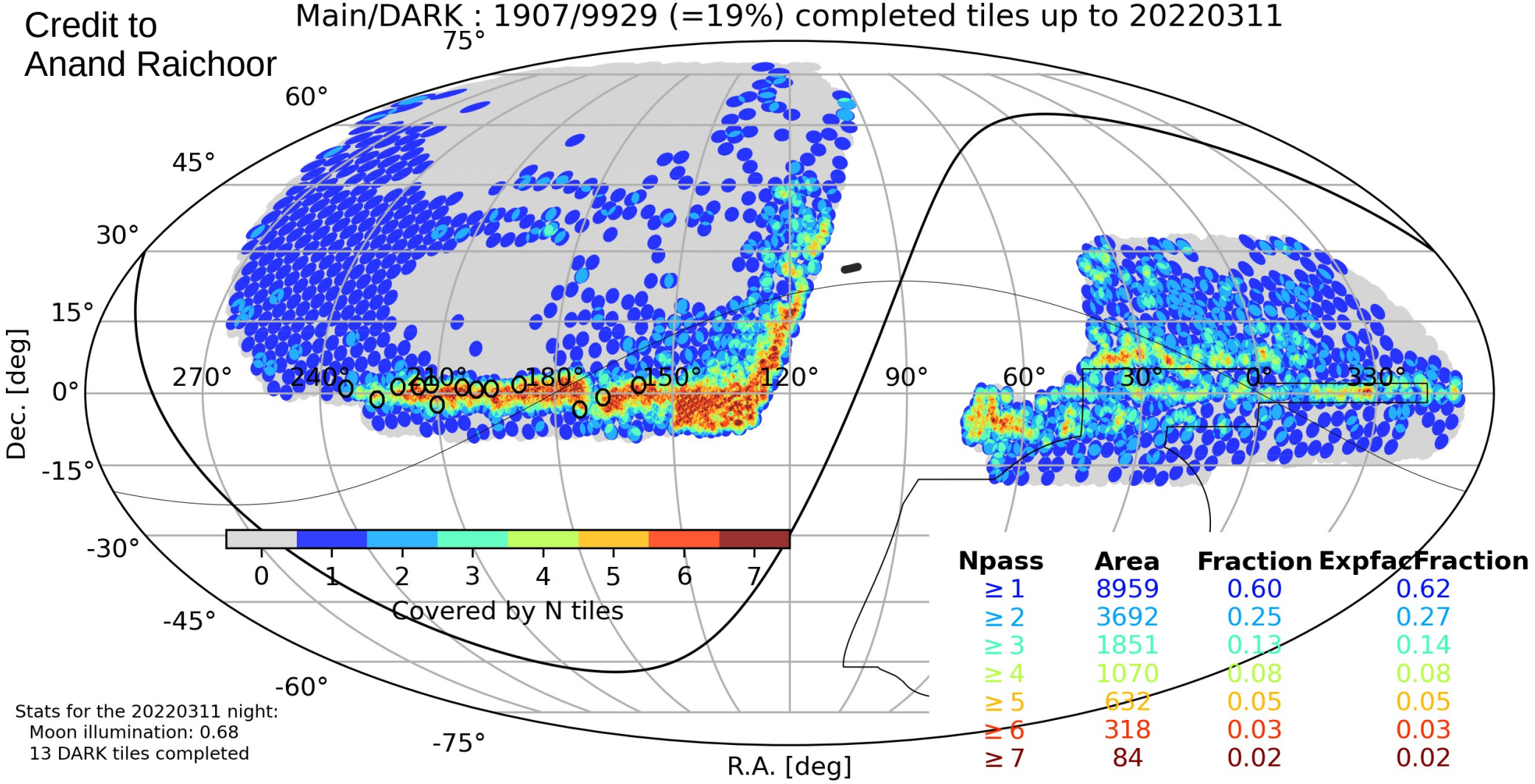


Npass	Area	Fraction	ExpfacFraction
≥ 1	8959	0.60	0.62
≥ 2	3692	0.25	0.27
≥ 3	1851	0.13	0.14
≥ 4	1070	0.08	0.08
≥ 5	632	0.05	0.05
≥ 6	318	0.03	0.03
≥ 7	84	0.02	0.02

DESI supplementary data products

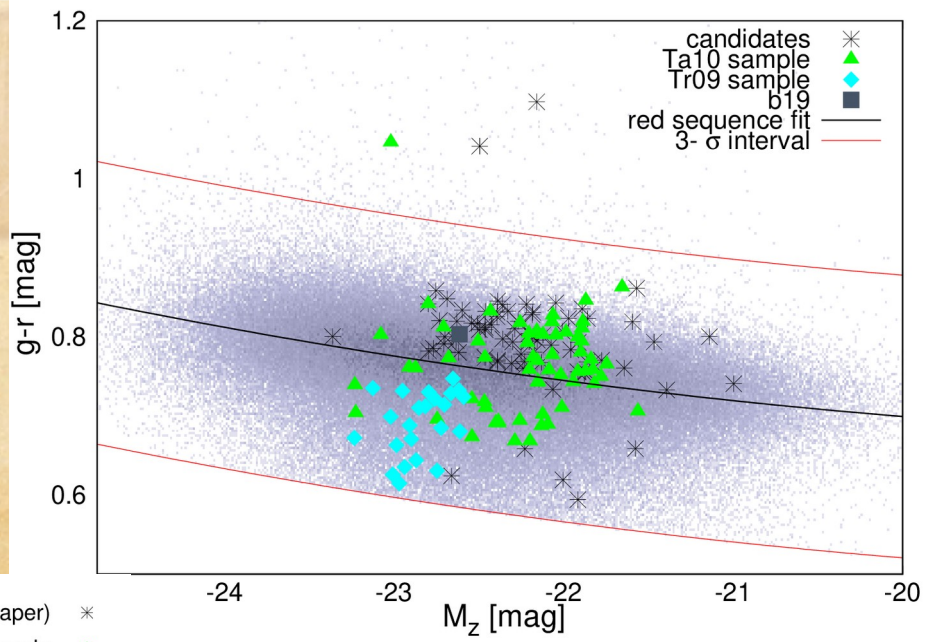
- Photometric redshifts (Zhou+ 2021)
- Fastspec and Fastphoto catalogues (Moustakas+ in prep.)
- Central velocity dispersion measurements (Said+ in prep.)
- Stellar mass models … eventually, some group is working on that

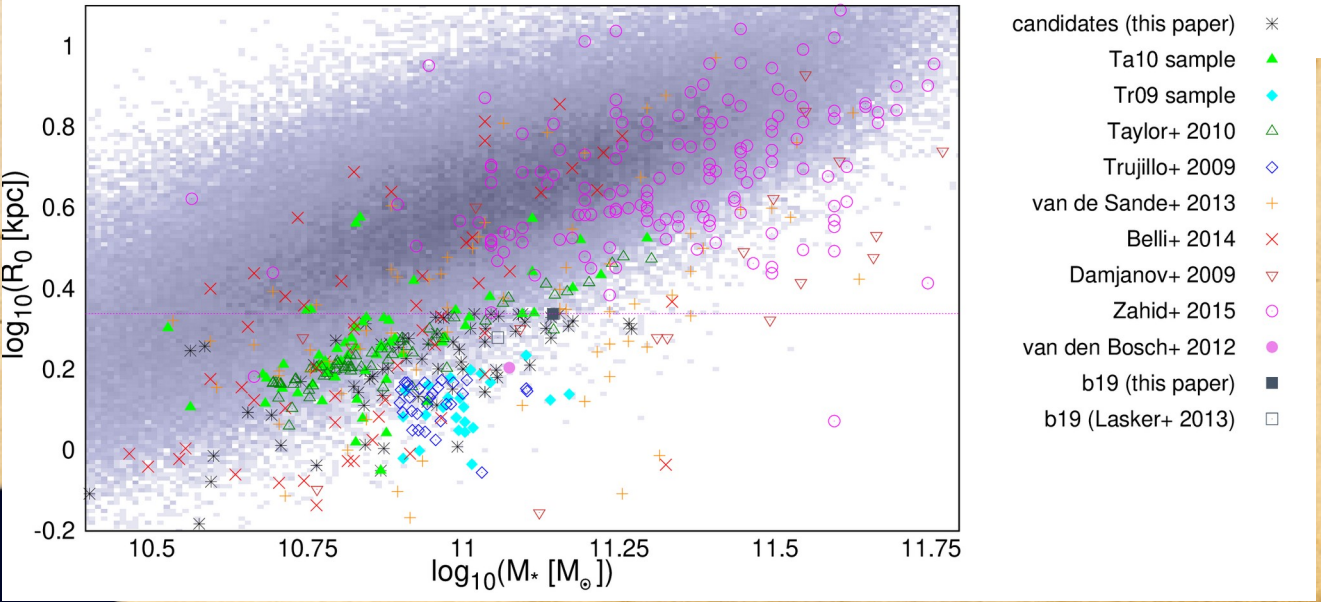
Red nugget (relics) selection

- Work is still in an very early stage
- Colour-cut → red-sequence
- Size-cut (physical size needs redshifts) (R_{eff}<1.5 kpc)
- Magnitude limits (in the future stellar mass limits) (M_z<-21.5mag)
- First tests on the SV3

Previous work (partially outdated?)

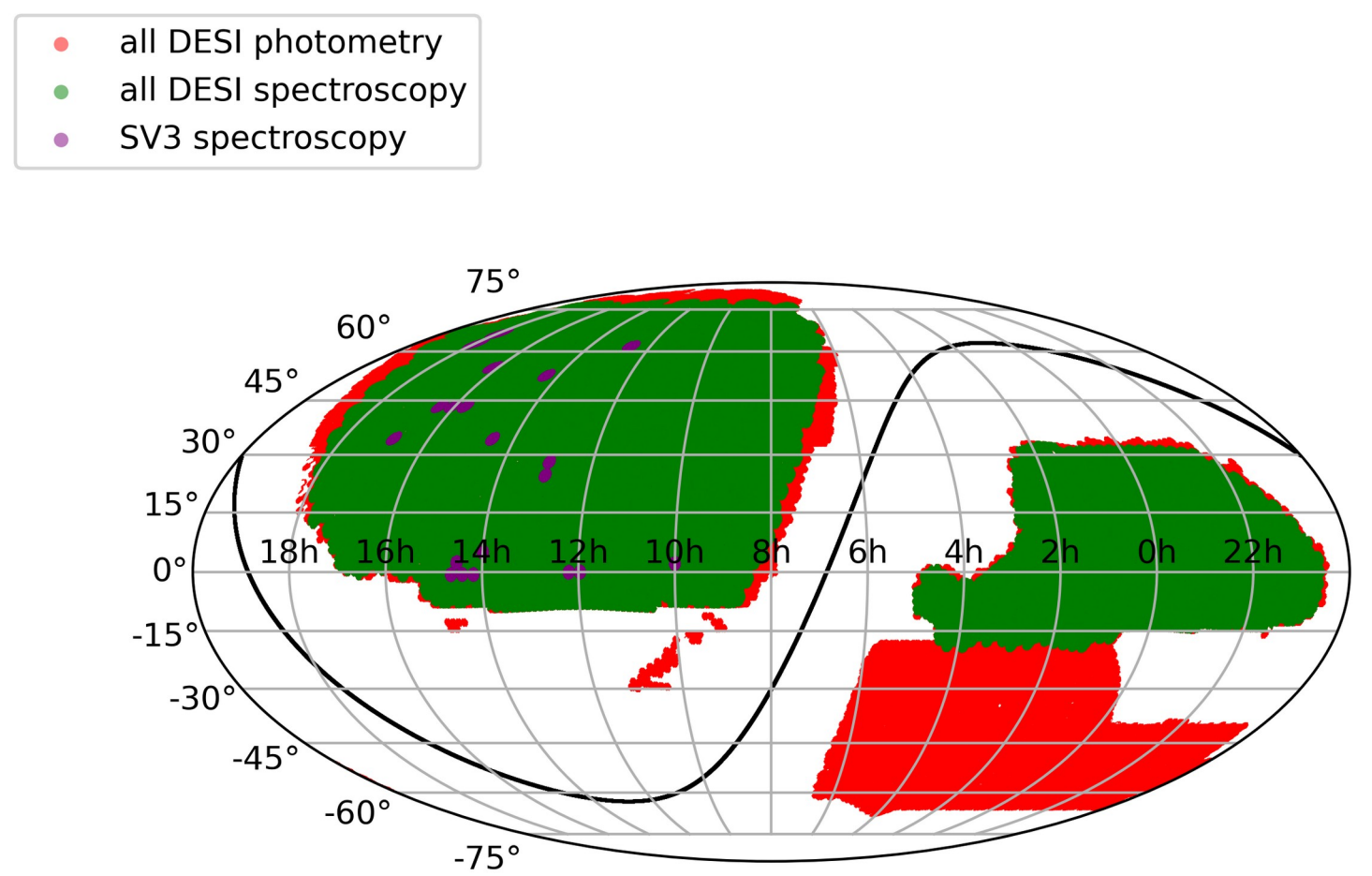
Various locations on the red sequence depending on the subtype of nuggets



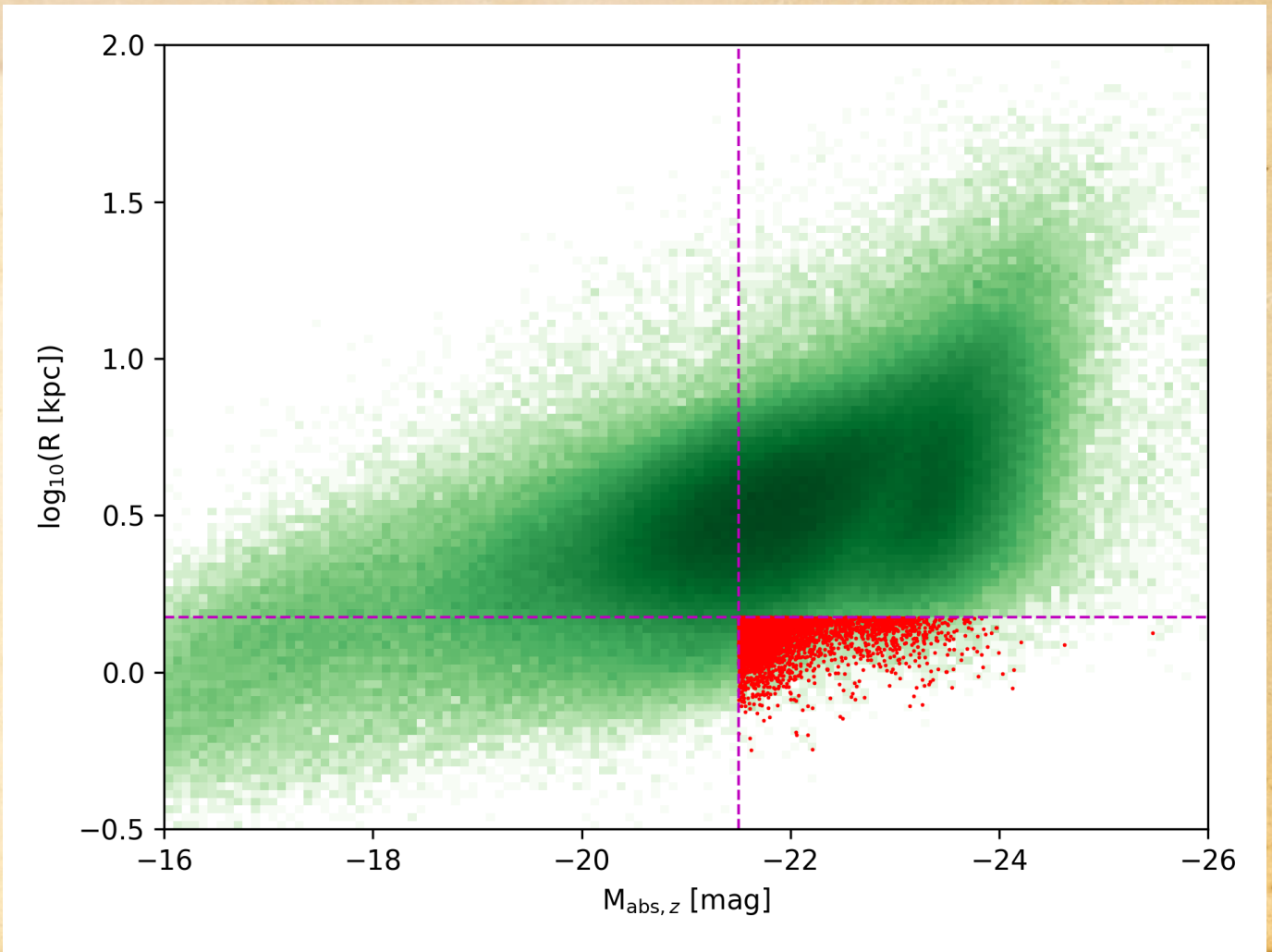


stellar mass and sizes are model dependent

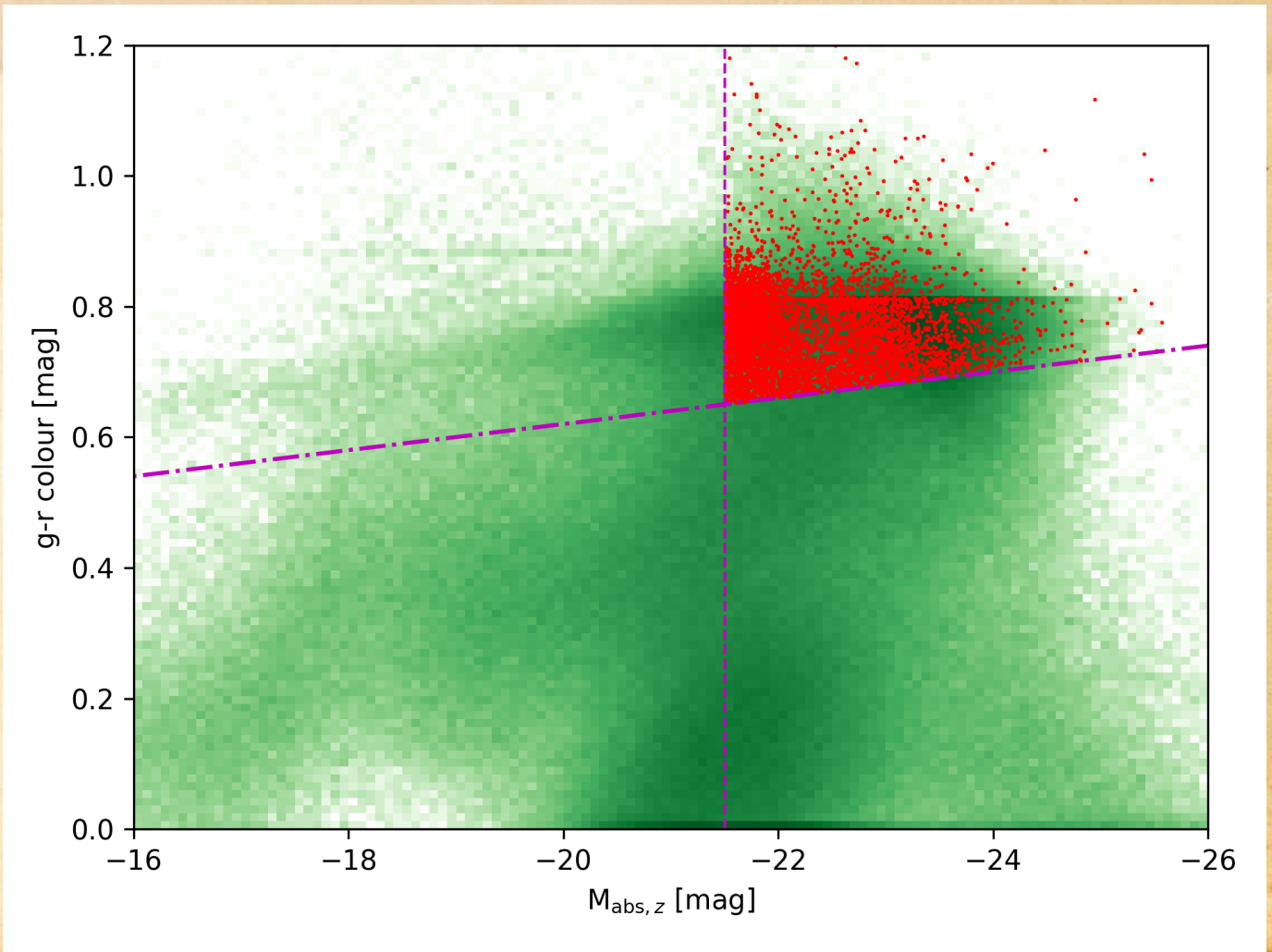
Testing with the early data release



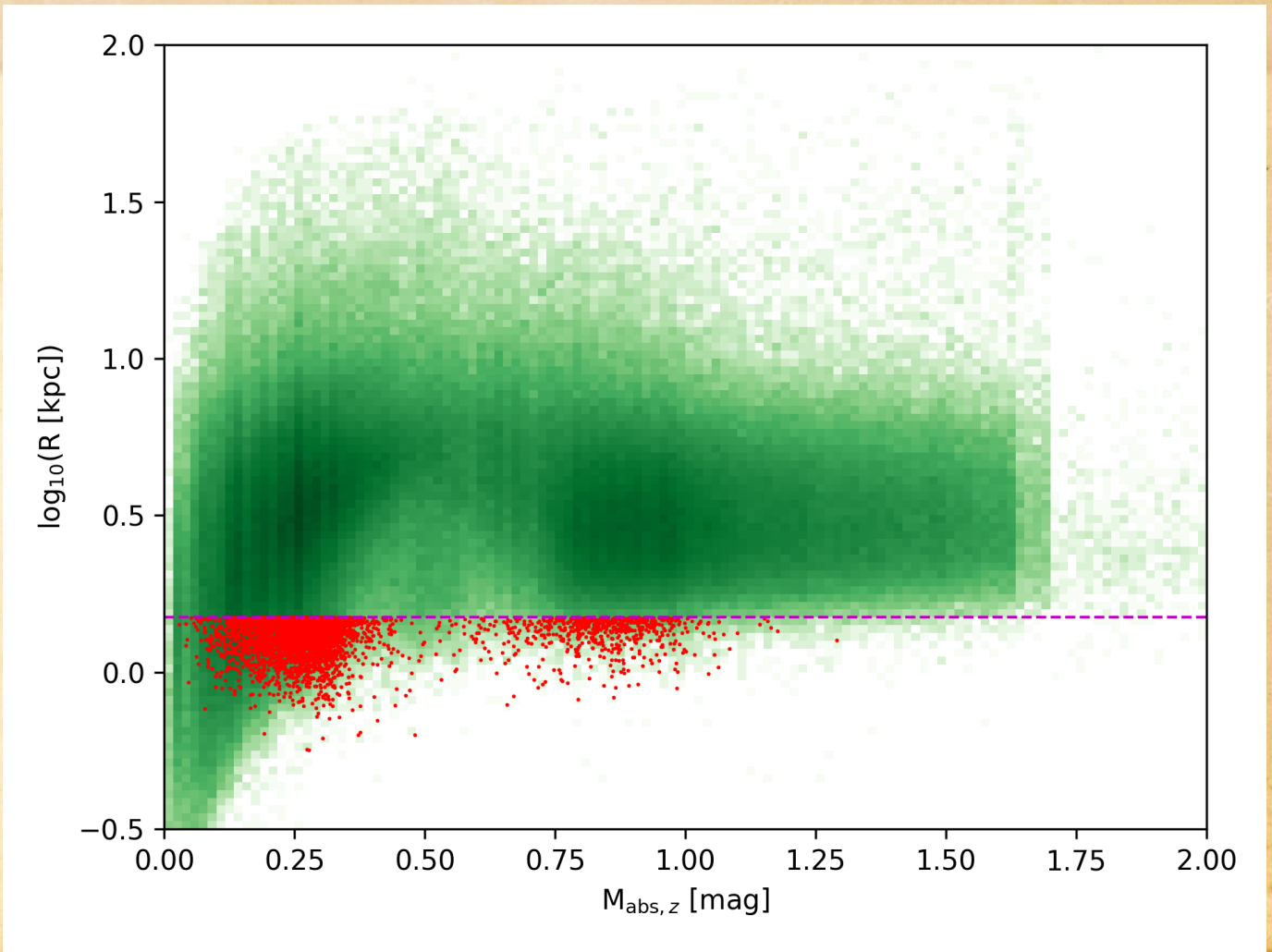
First results – magnitude-size plane



First results – Colour magnitude diagram

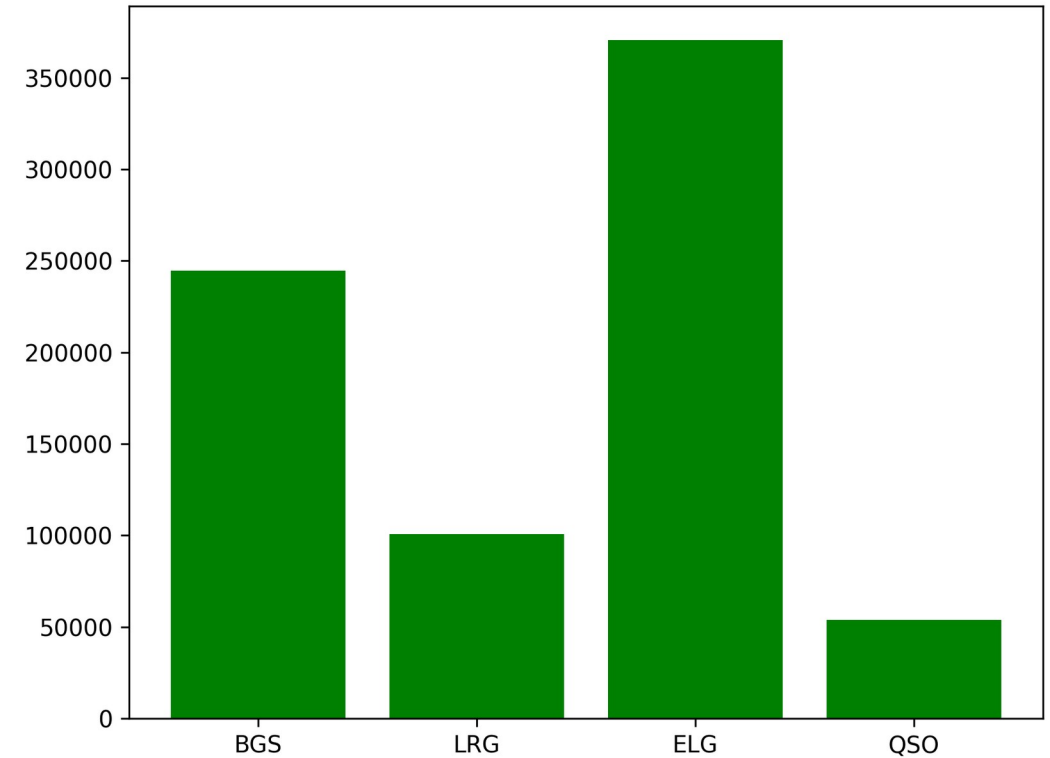


First results – Redshift vs. size

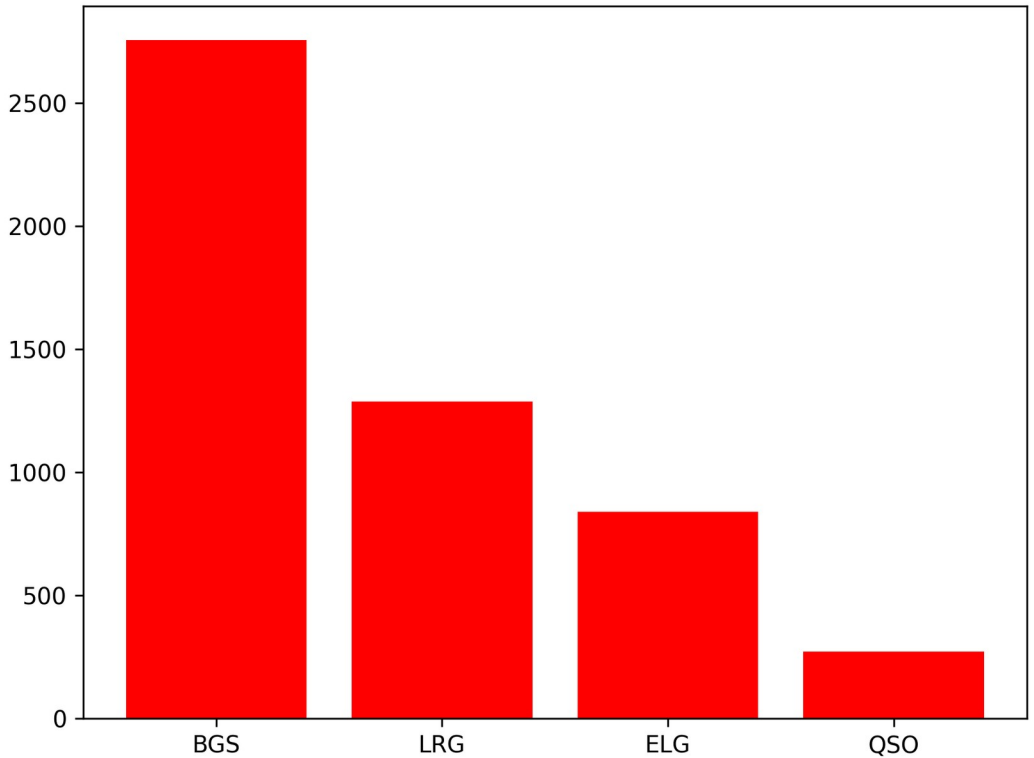


Most promising spectroscopic target classes

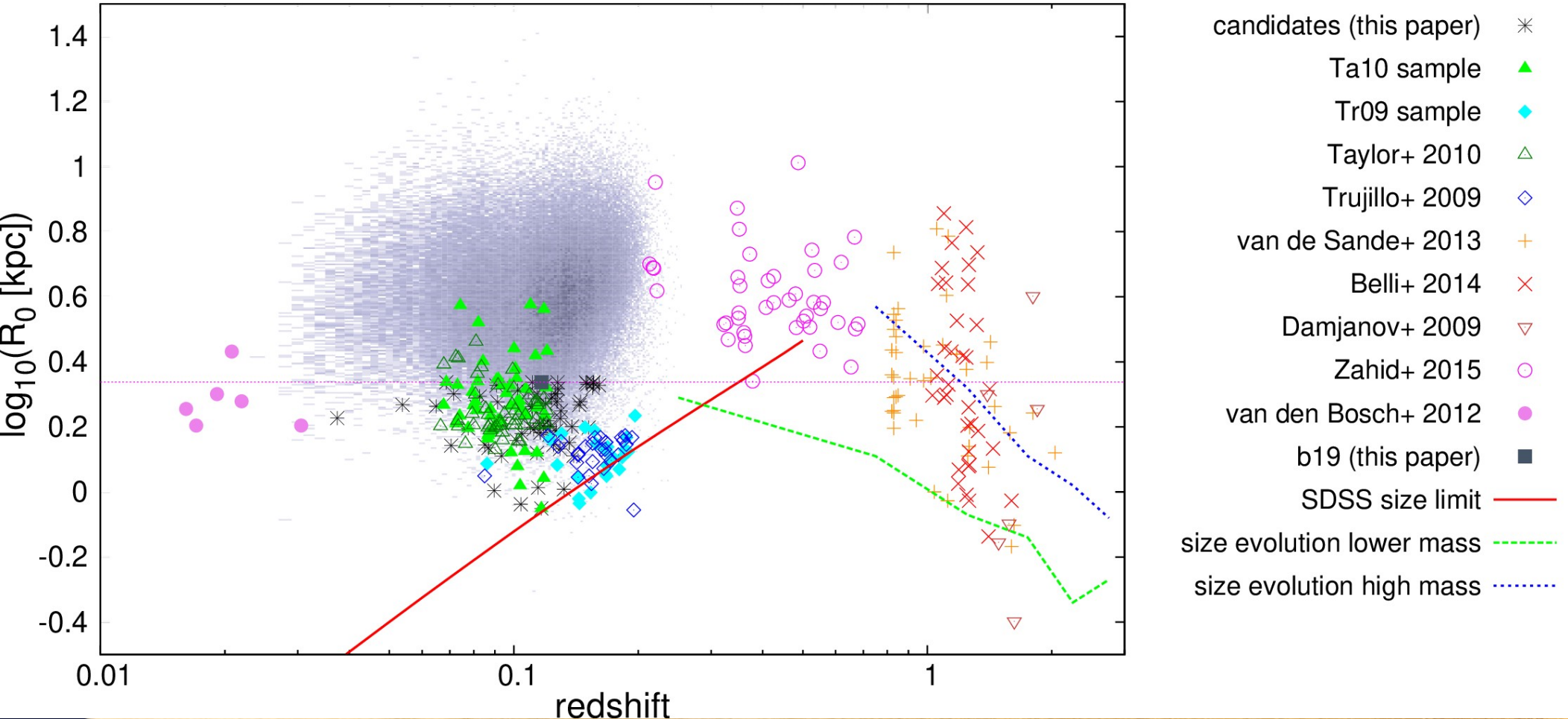
all galaxies with good spectra



potential red nuggets



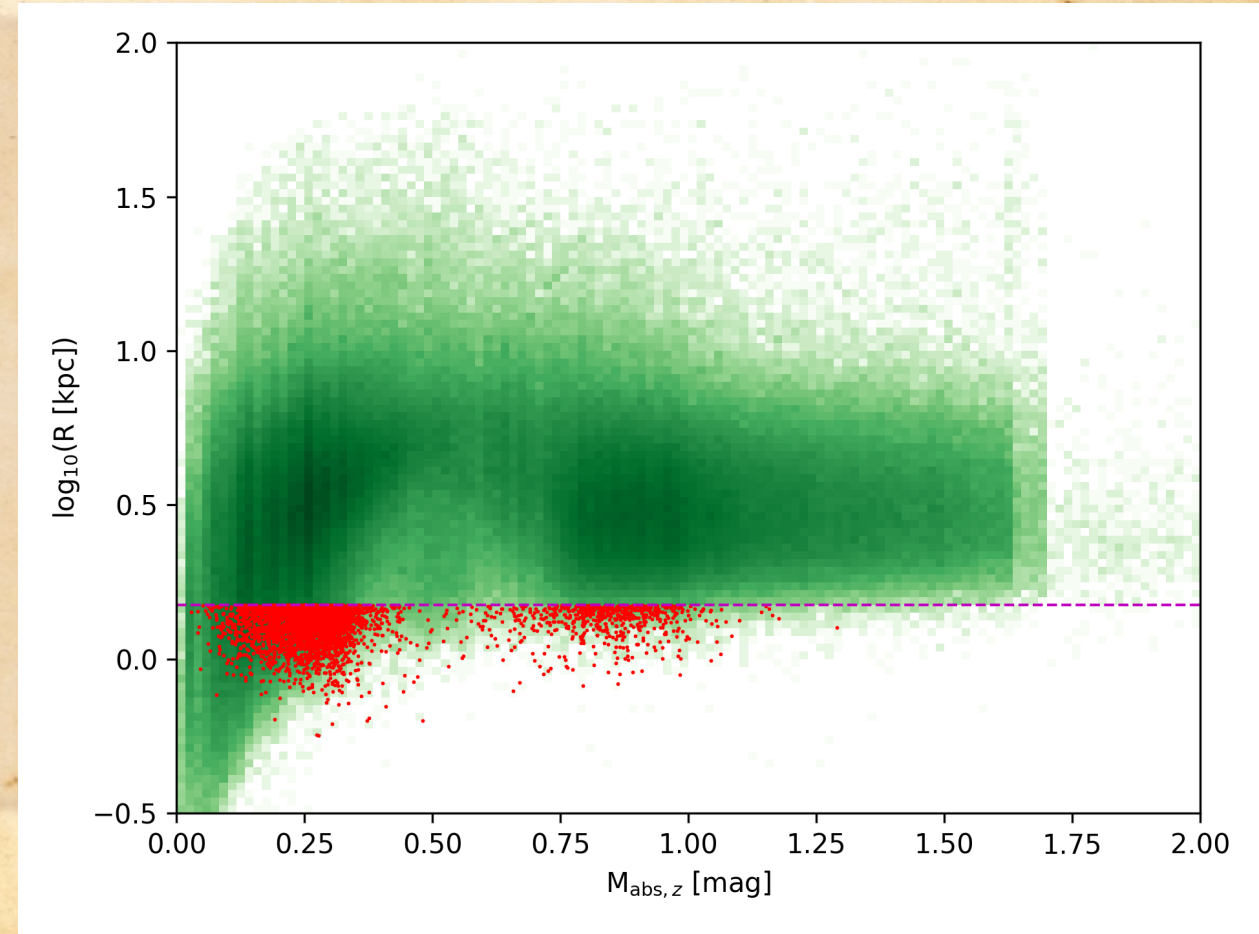
Size evolution – previous work



Summary and Conclusions

- Spectroscopic red nugget candidates in DESI are hugely biased towards the target classes of DESI
- BGS (very low redshift) and LRG (z~0.8) will contribute the most
- Gap in redshift distribution due target selection of DESI
- Photometric data alone would allow for a wider selection → estimate what red nuggets we will miss in the spectroscopic data
- Available spectroscopic and photometric data will allow for some additional measurements: various line strengths, morphology, …
- Selection criteria need to be more refined and adjusted to the survey (different criteria for different redshifts?)

ANY QUESTIONS?



BACKUP SLIDES

Evolution of the Sersic index