The impact of confusing Hβ with [O III] on the determination of the BAO peak with WFIRST

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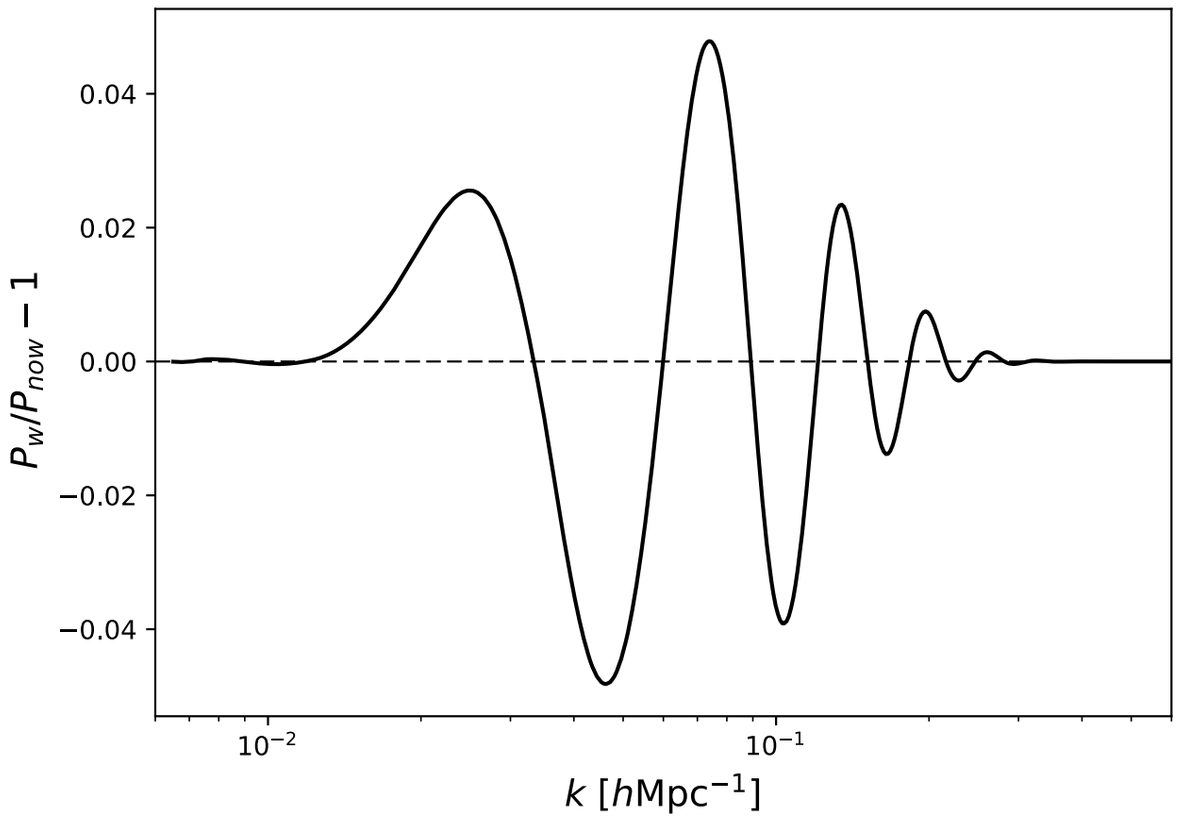
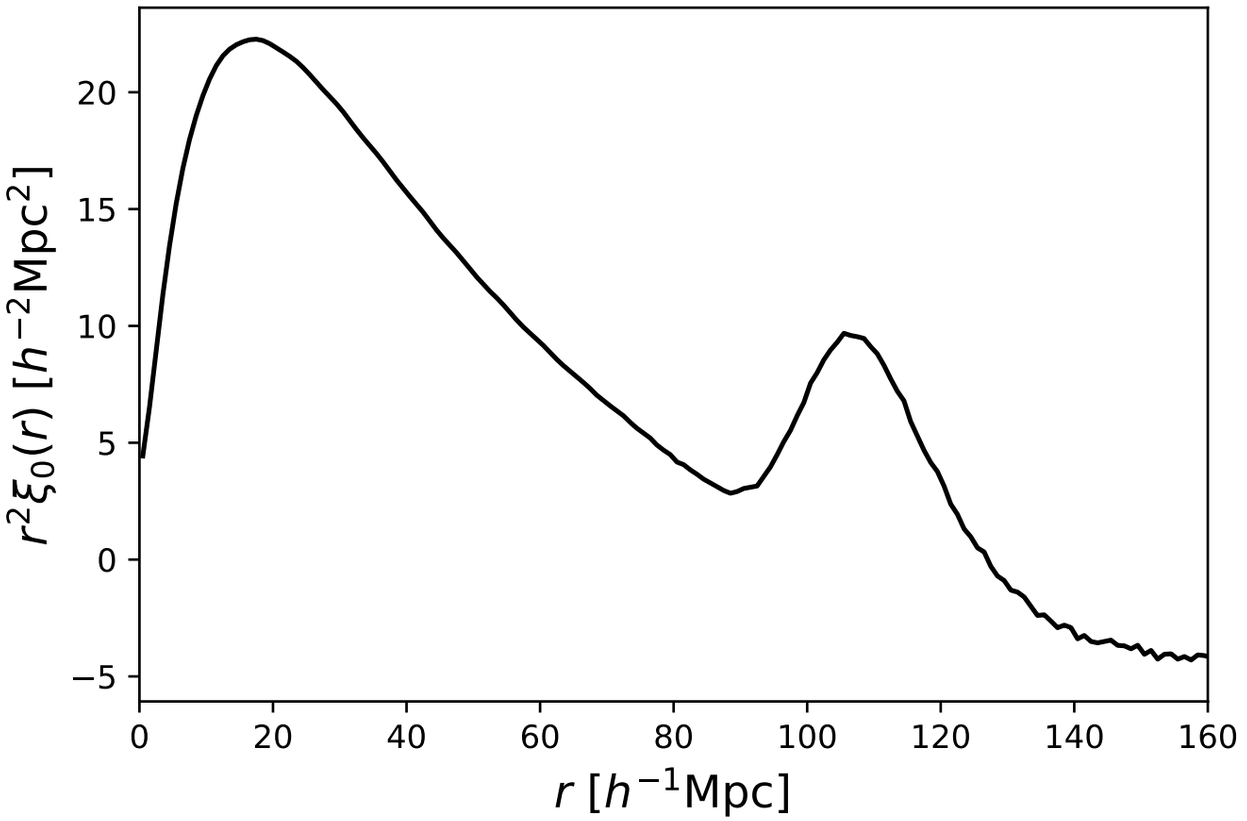
The BAO





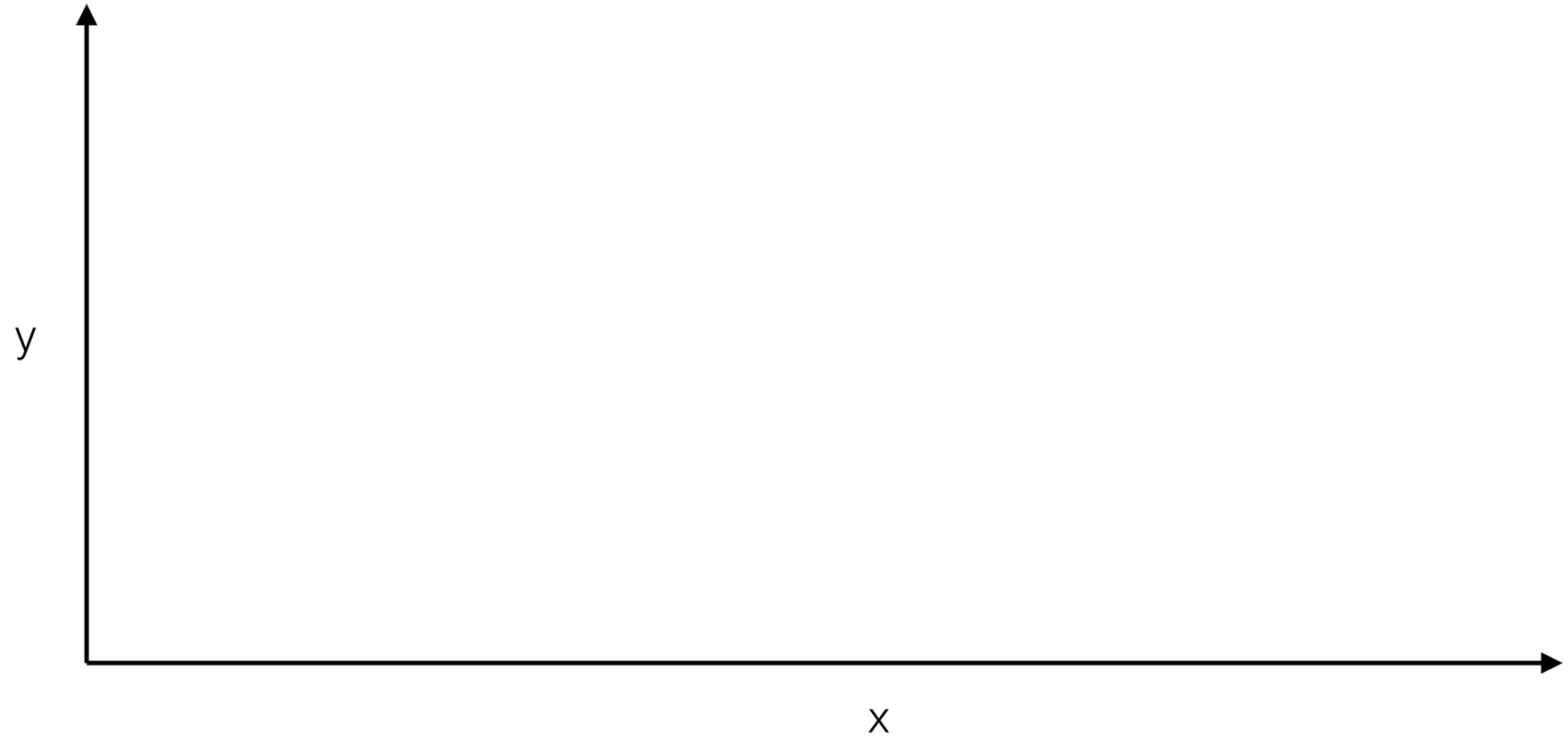
We need a precise measurement of the position of the BAO peak in order to extrapolate the expansion history of the Universe

A possible systematic error can be introduced by interlopers galaxies

The interloper problem

Galaxies

Cartesian plane



The interloper problem

[O III] line identification → λ_{obs}, λ_{em} = 500.7 nm → Galaxy redshift, Cosmology → Galaxy position

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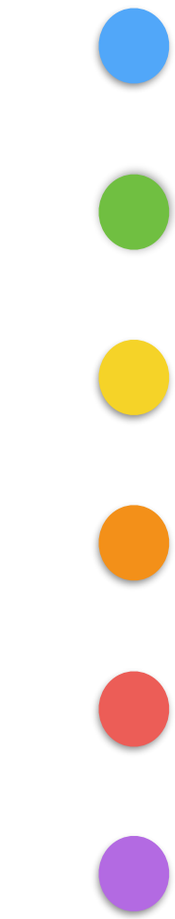

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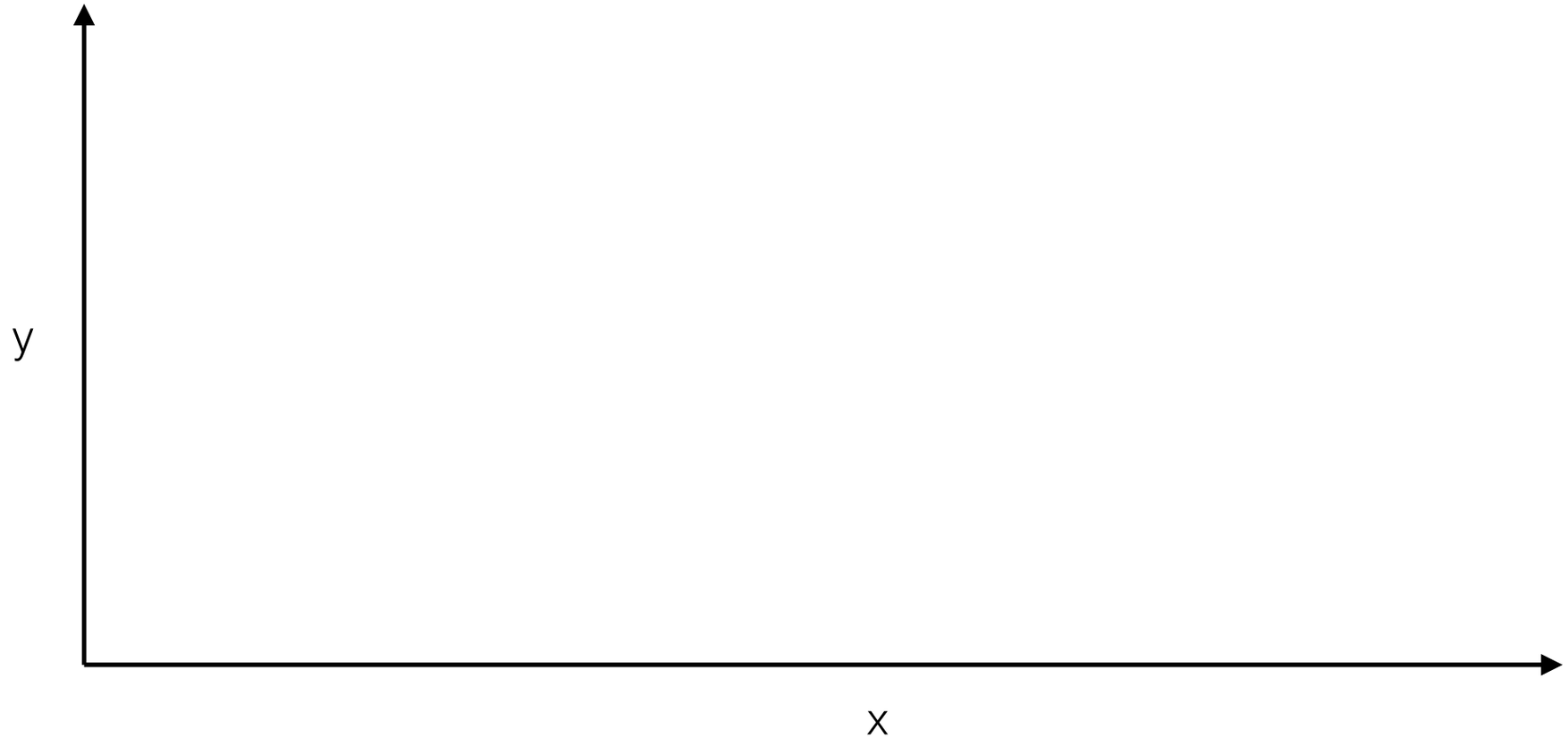

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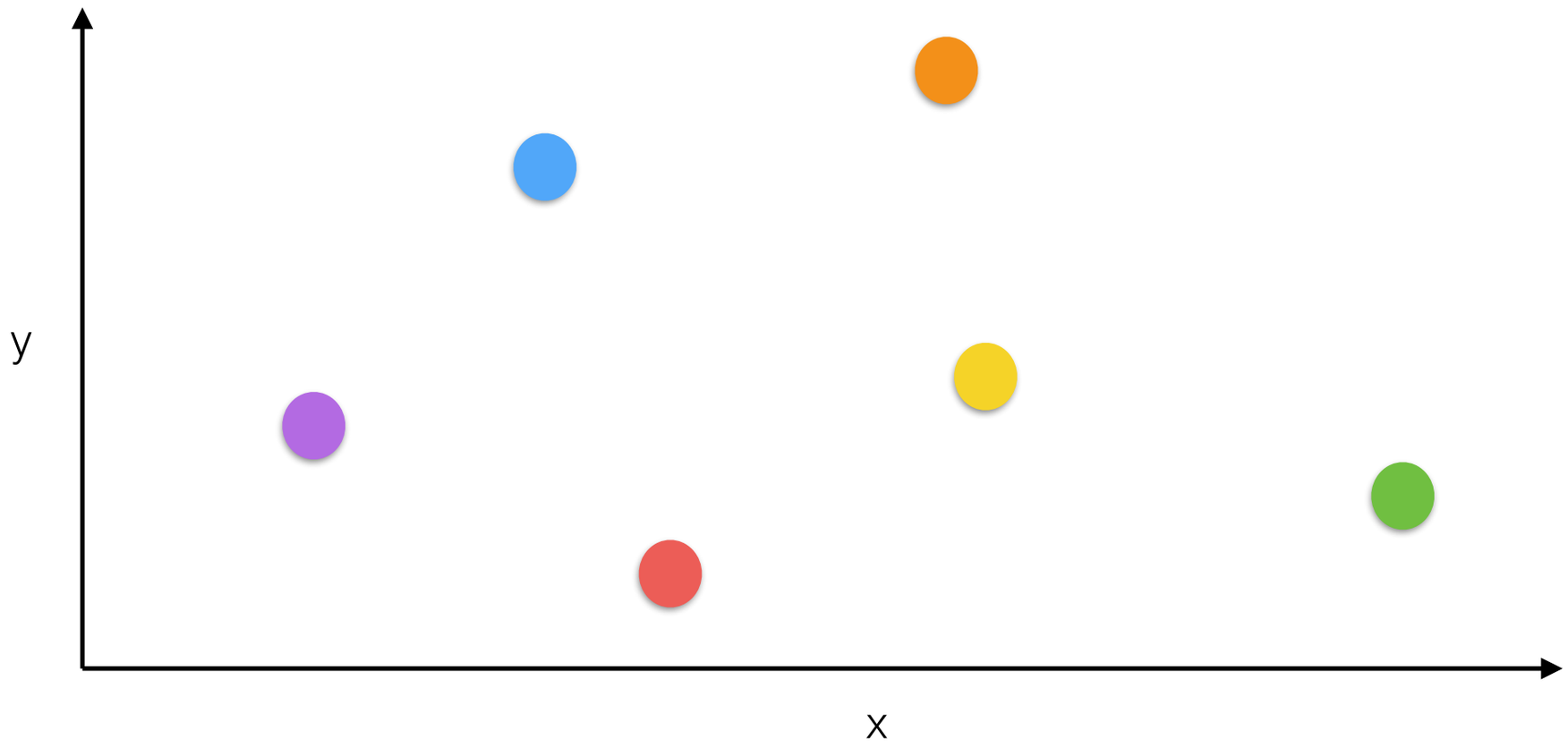

The interloper problem

Hβ line

~~[O III] line~~

identification

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true λ_{em} =486.1 nm

→ Galaxy redshift

Cosmology

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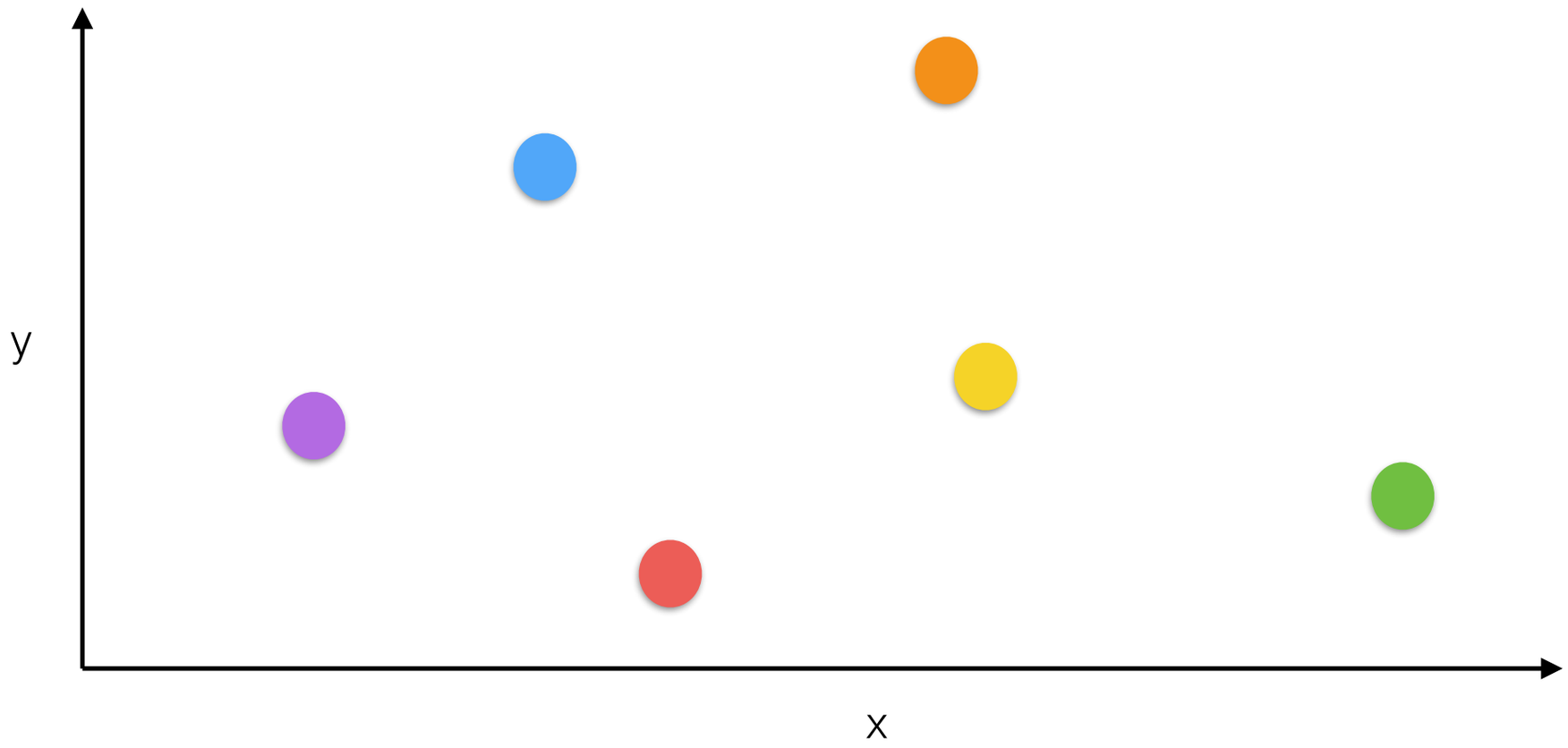

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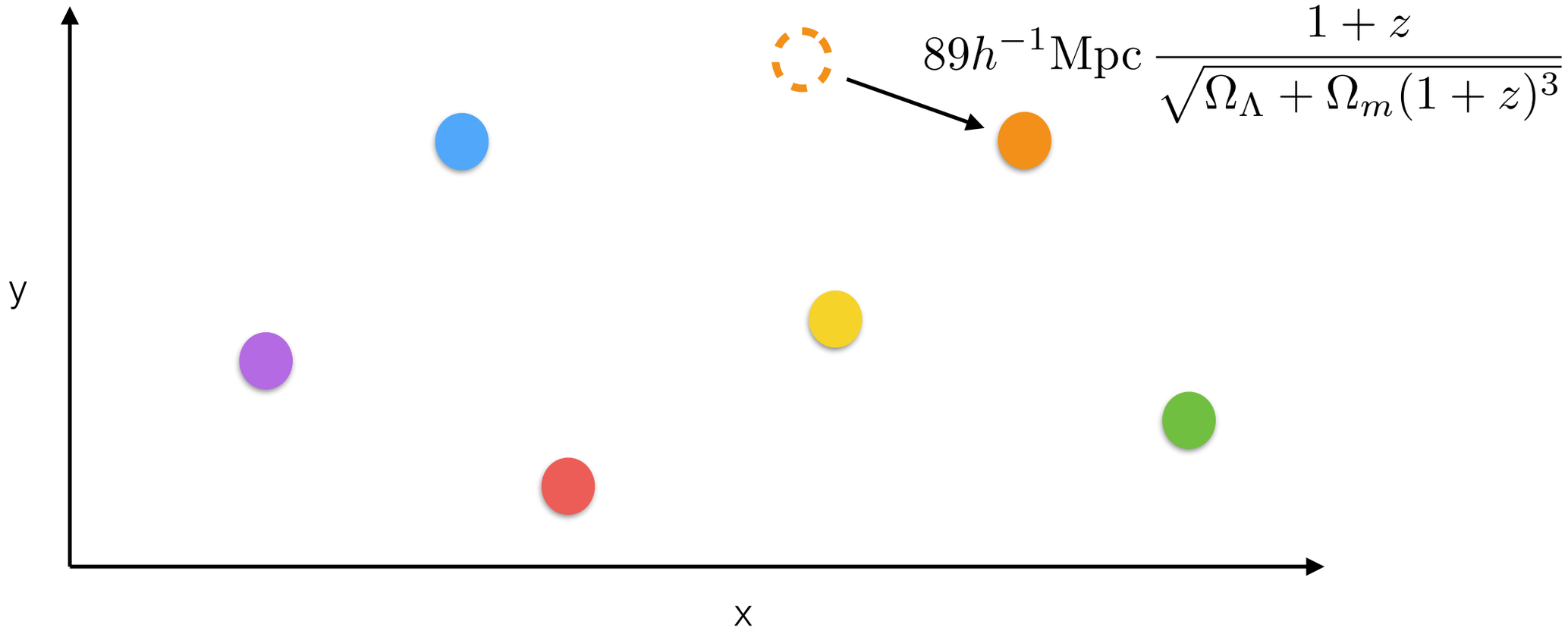

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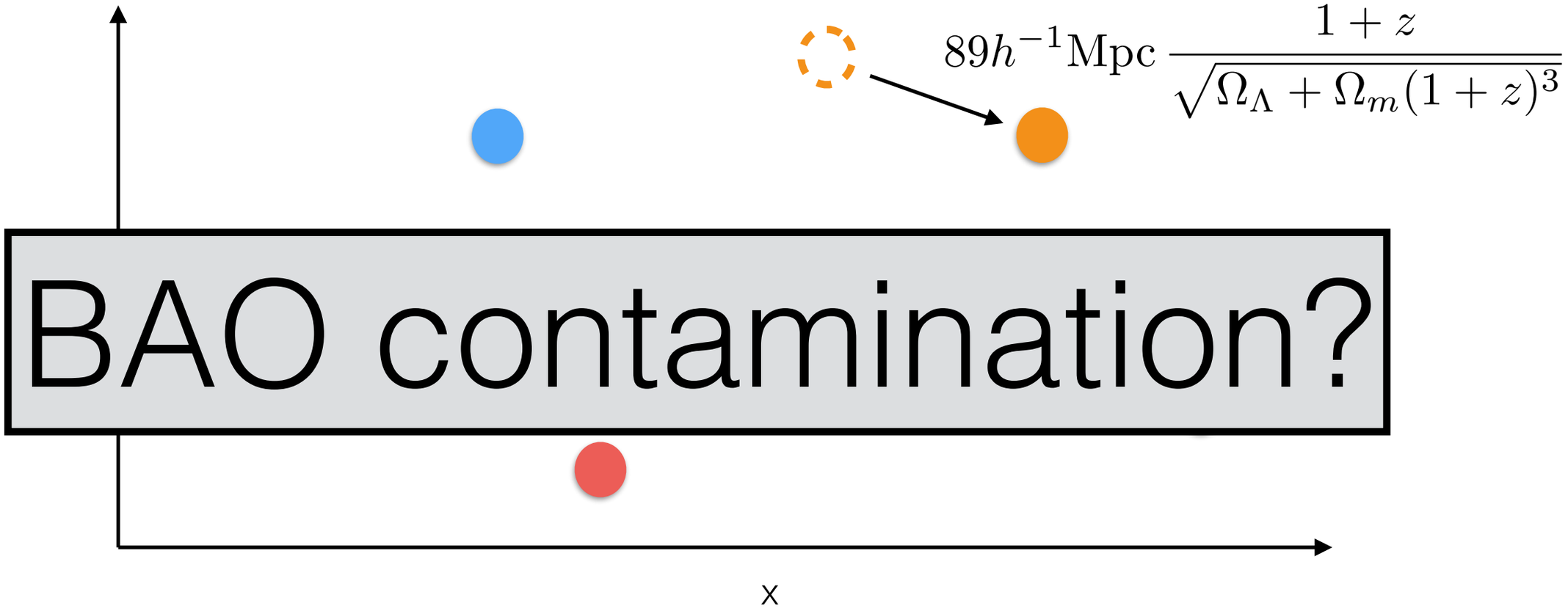


Starting galaxy catalogue

- **Aardvark-v1.2** simulation generated by the Stanford group led by Risa Wechsler
- 10313 sq. degrees
- redshift: z<2.2
- number of galaxies: 2 billions
- each galaxy contains its own spectral energy distribution generated to fit most updated luminosity function and color evolution measurement at low redshift
- galaxy magnitudes and shapes include impact of shear and magnification. Useful for cross-correlation between photometric and spectroscopic data

First WFIRST [O III] mock galaxy catalogue

- Selection of galaxies having [O III] flux above the WFIRST detection limit

  ↓

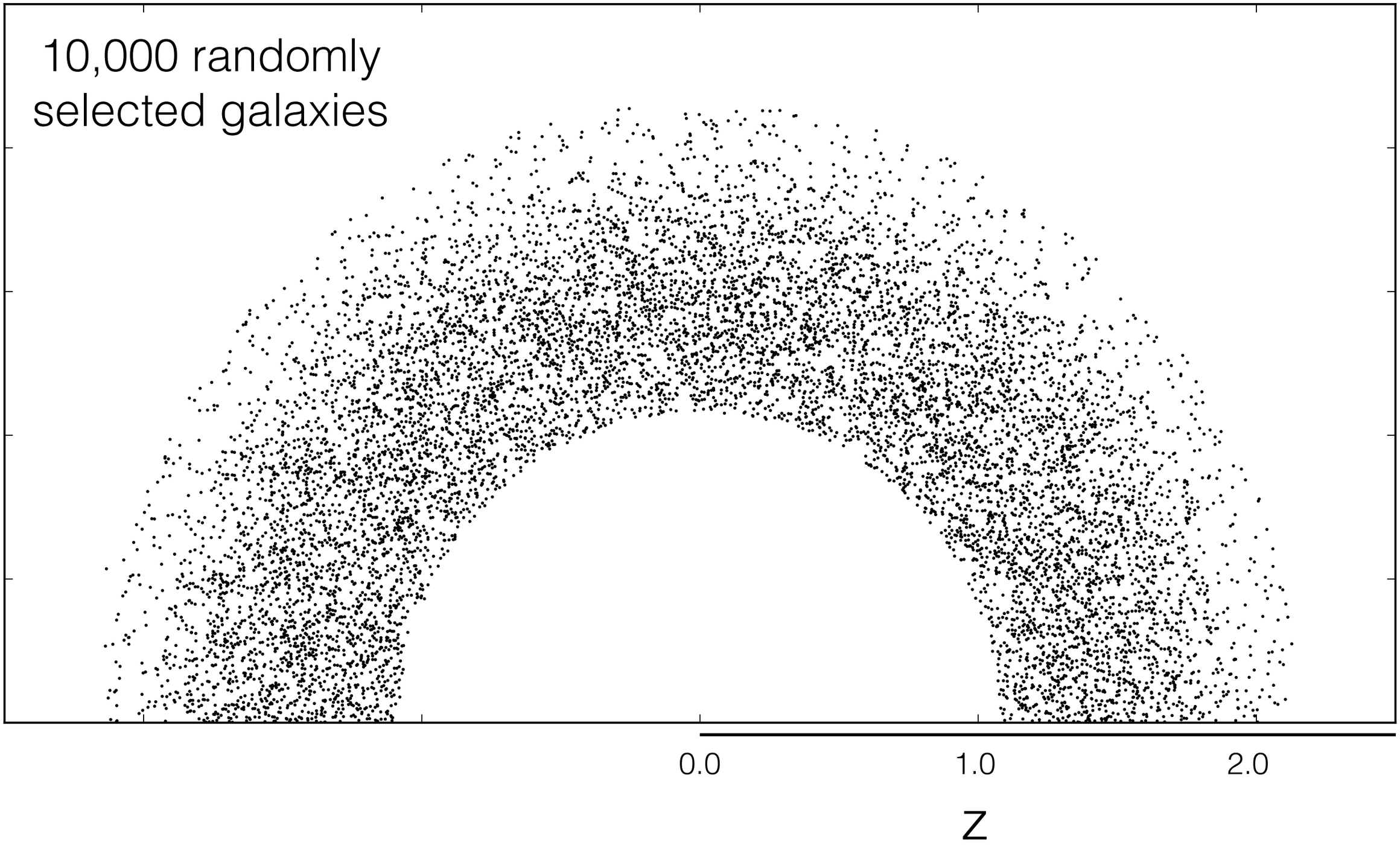
  Should we (A) use the detection limit (5 times more galaxies than expected) or (B) match for the forecasted WFIRST number of [O III] galaxies?

- redshift: $1.08 < z < 2.2$

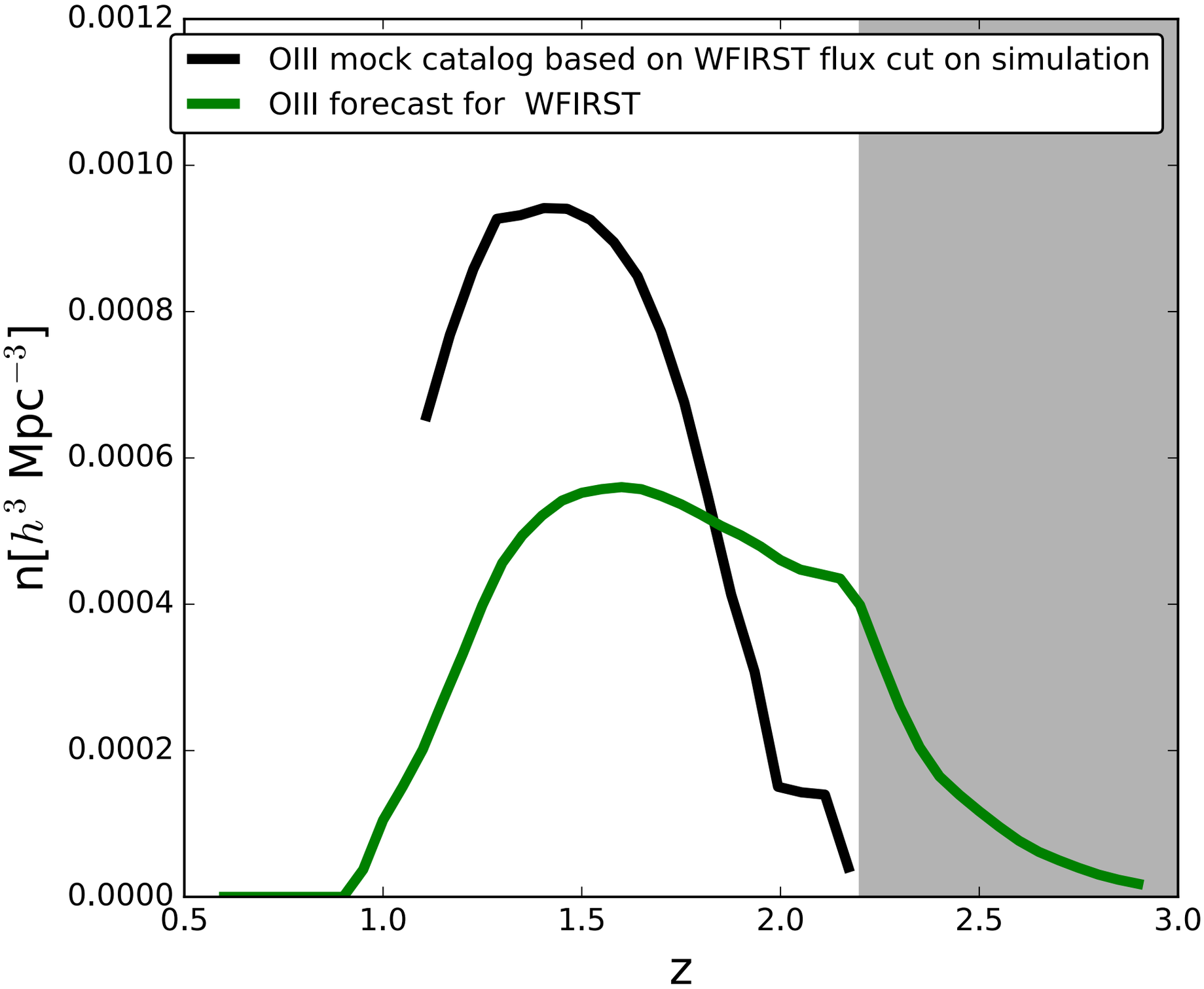
- number of [O III] galaxies: ~ 10^7

- we plan to make this catalogue public when the limit is decided and host it on NERSC

WFIRST [O III] mock galaxy catalogue



[O III] galaxy number density



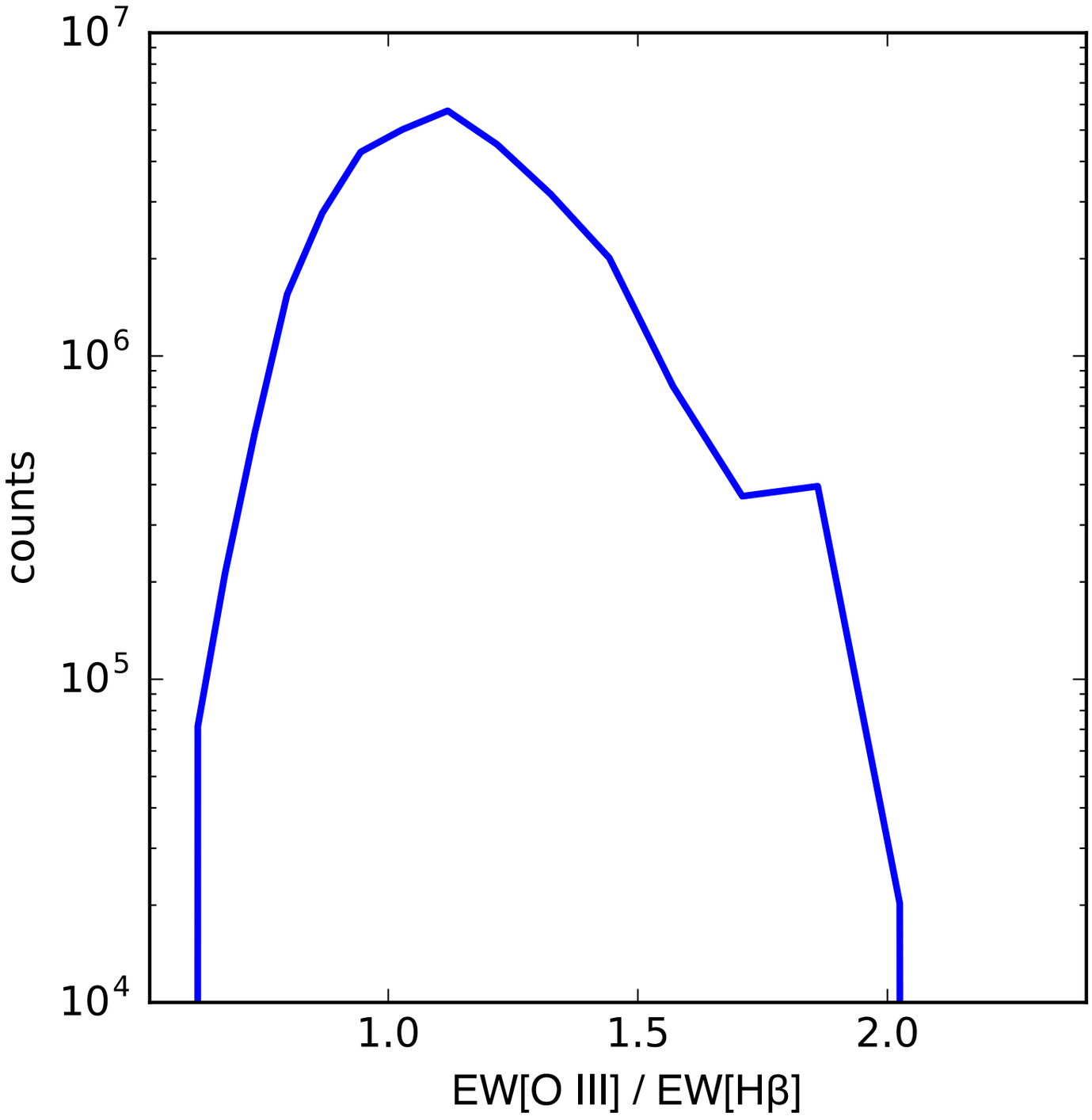
How to introduce the interloper galaxies

- We do have Hβ and [O III] line flux from simulation directly.

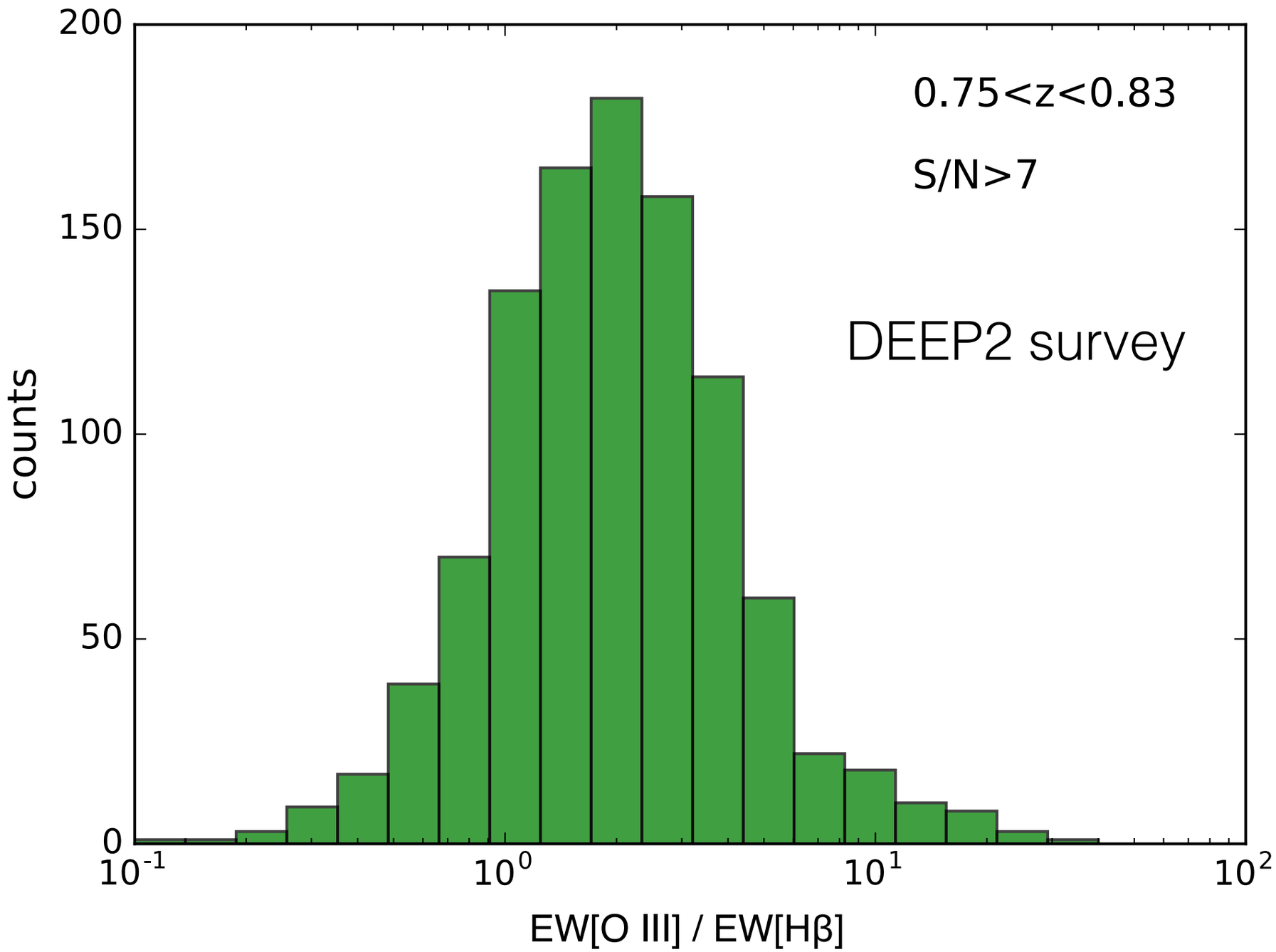
- We want to double check this against observation first.

- We find them to be quite different and are working with Risa's group to improve the simulations.

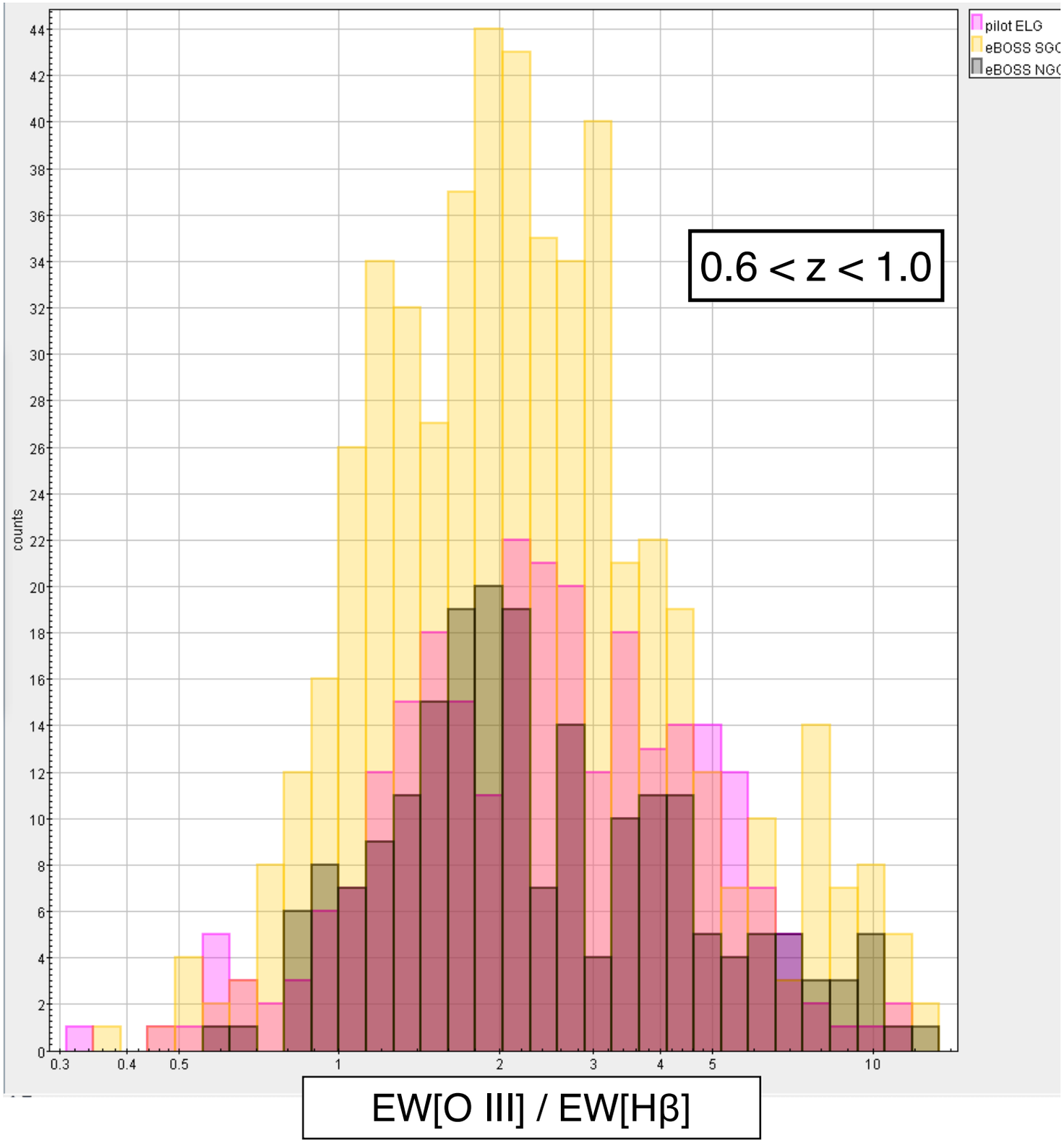
What we see in simulation:
Equivalent width ratio between [O III] and Hβ



What we see in observation (DEEP2): Equivalent width ratio between [O III] and Hβ



What we see in observation (SDSS4): Equivalent width ratio between Hβ and [O III]



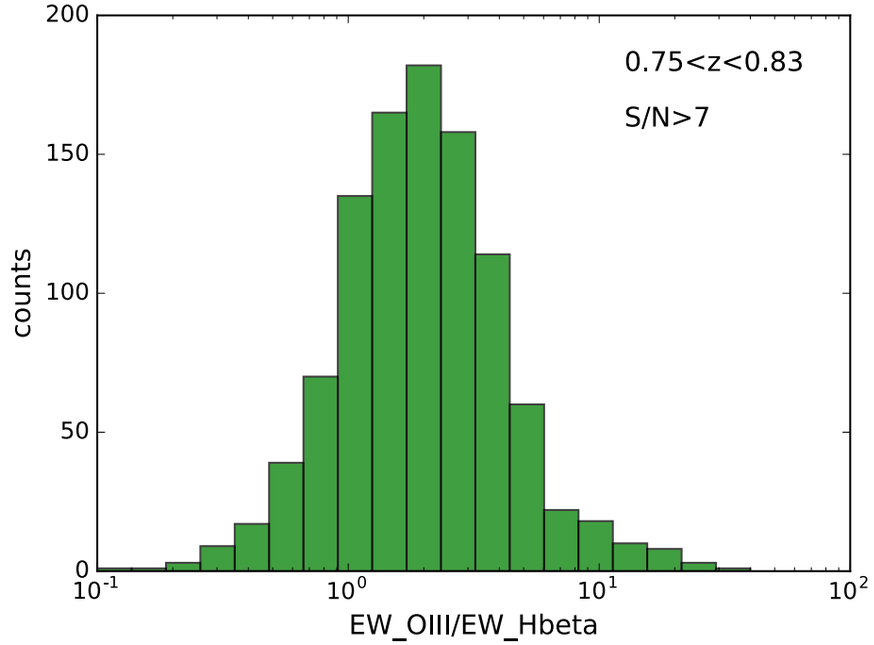
- No evidence of strong redshift evolution
- Suggests that we can use this for WFIRST population until we have better high redshift sample

Plot by Johan Comparat

What next…

- Apply the equivalent width ratio to the mock galaxy catalogue

[O III] flux of each galaxy



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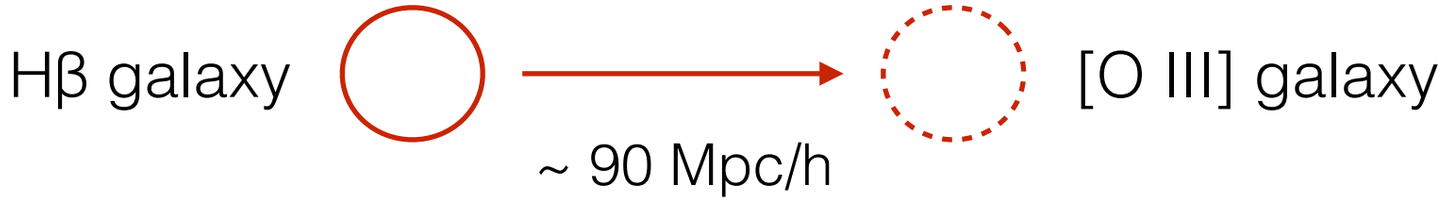

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- the same analysis can be done for Euclid

Thank you!