



# FIRST LIGHT AND REIONIZATION EXPLORER (FLARE)

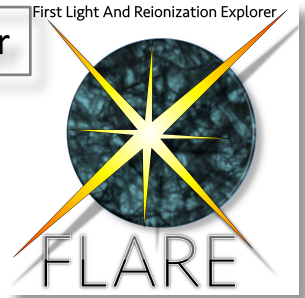
## Mission ESA M5

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**FLARE is the one and only facility (in activity or planned) able to select and identify more than a few first-light objects at  $12 < z < 15$ .**

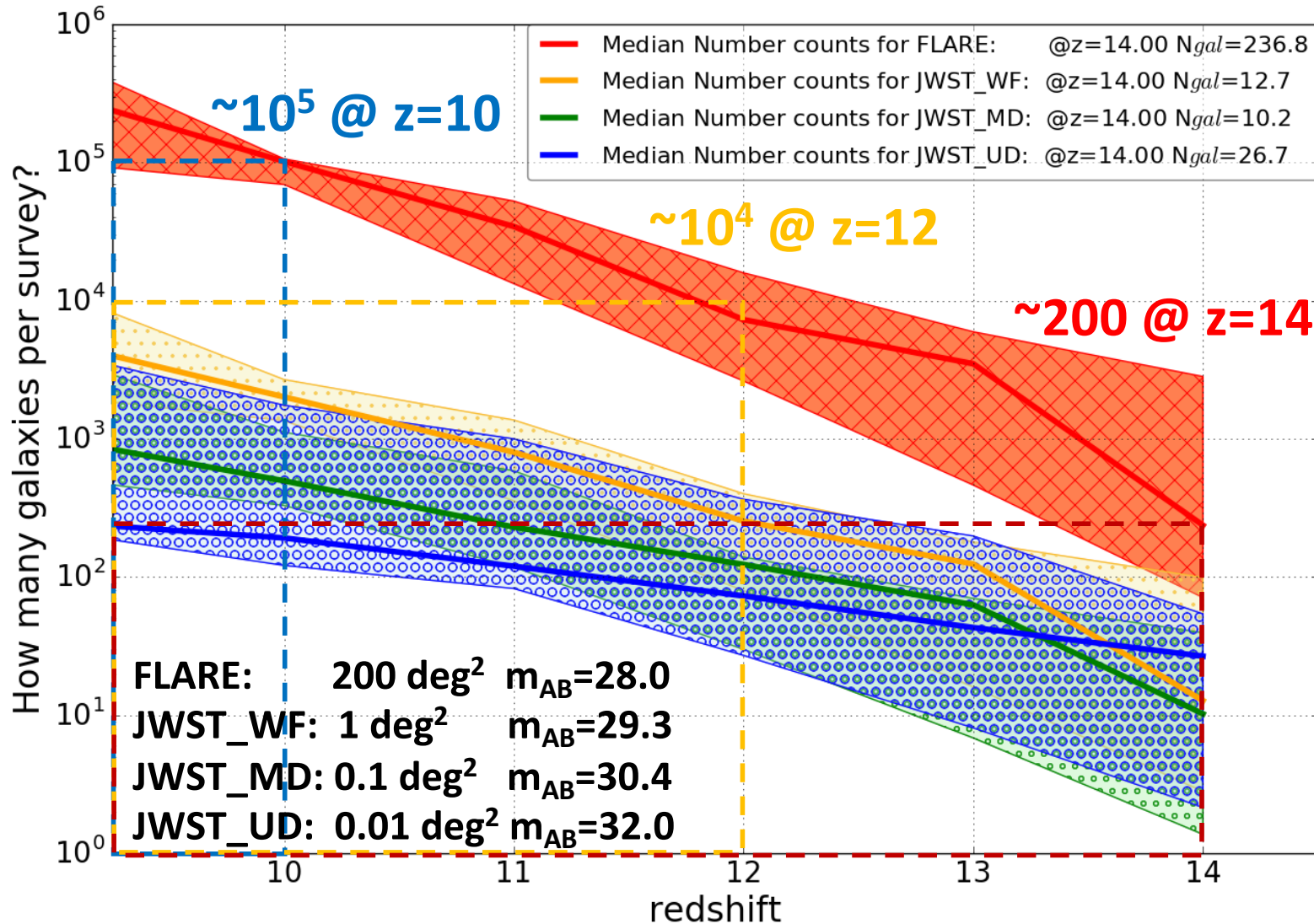
<i>Wavelength range</i>	$1\mu m < \lambda < 5\mu m$
<i>Angular resolution</i>	$0.4'' - 0.6''$
<i>Spectral resolution</i>	$R = \lambda / \Delta\lambda \sim 750$ ([NII] & H $\alpha$ resolved)
<i>Imaging extragalactic survey</i>	$200 \text{ deg}^2$ to $m_{AB} = 28$
<i>Integral-Field spectroscopic extragalactic survey</i>	$1.5 \text{ deg}^2$ to $f_\lambda = 2 \times 10^{-18} \text{ erg/cm}^2/\text{s}$
<i>Milky Way imaging survey</i>	$5000 \text{ deg}^2$ to $m_{AB} = 25.5$
<i>Milky Way Integral-Field spectroscopic survey</i>	$40 \text{ deg}^2$ to $f_\lambda \sim 10^{-16} \text{ erg/cm}^2/\text{s}$ (TBC)

+ d'info ? → cf. poster !



# FLARE: How many galaxies?

JWST: « inefficient » at  $z \gtrsim 10-12$

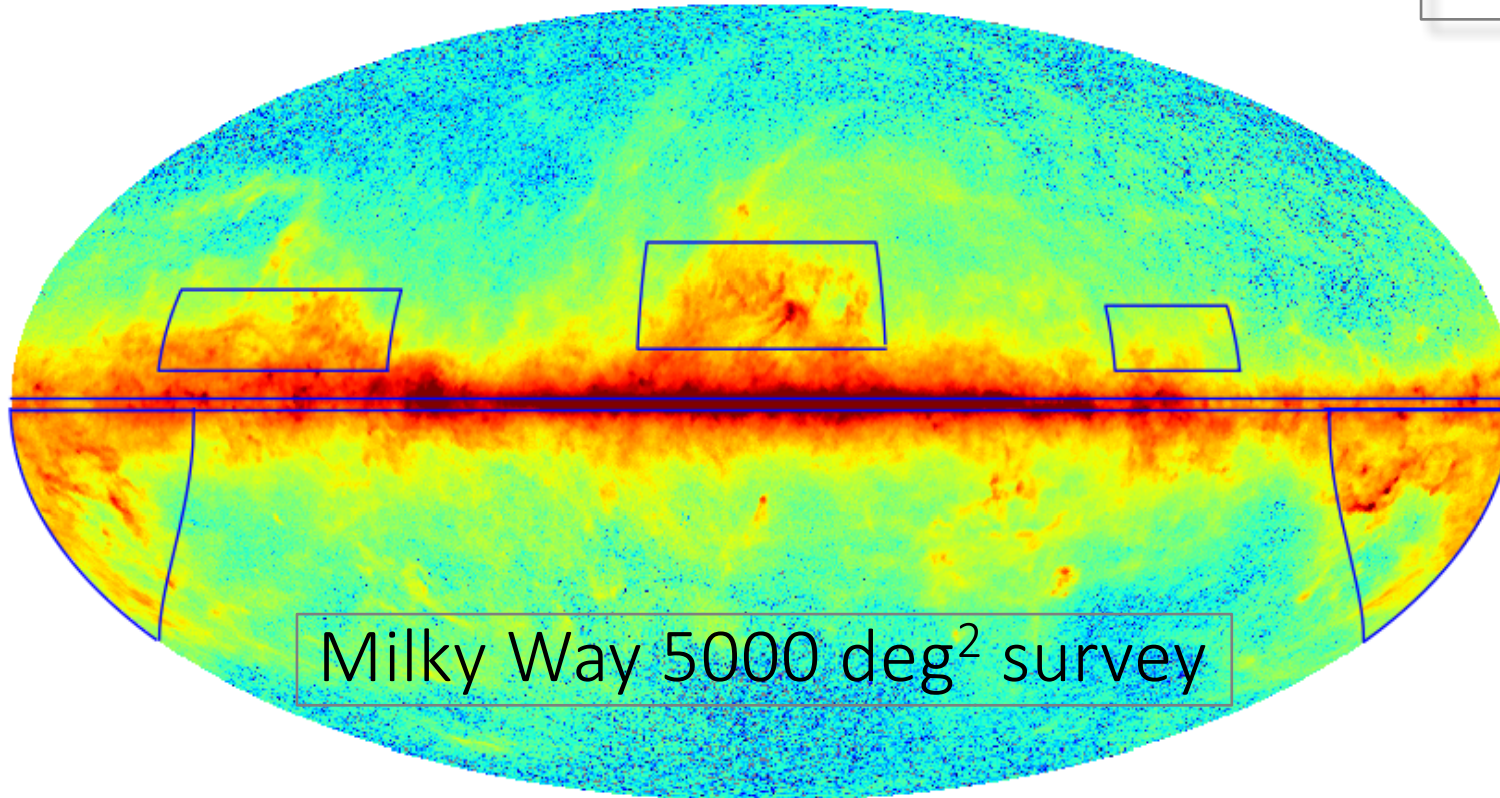


## Census of 'first-light' objects

- **Photometric selection:** 200 "first-light" objects @  $z \gtrsim 14$  to  $m_{AB} = 28$  over 200deg<sup>2</sup>.
- **Emission line selection:** blind integral-field spectroscopic survey to  $f_{\lambda} = 2 \times 10^{-18}$  erg/cm<sup>2</sup>/s over ~1.5 deg<sup>2</sup>.
- **Pointed observations of quasars and their early black holes at  $z > 6$ .**



Mollweide view



- **Sub-arcsec** (0.4 – 0.6'') crucial to analyse the local physics of star formation.
- **$\lambda > 2\mu\text{m}$**  needed to “see” deep inside the dusty clouds.

- **The total surface (including the Gould Belt regions & the galactic plane on  $\pm 1^\circ$  height =  $720 \text{ deg}^2$ ) would cover about  $5000 \text{ deg}^2$  (1/8th of the sky).**
- *3D tomography of molecular clouds in the Galactic plane: the comparison of the stellar photometry with a model of stellar population synthesis (the so-called modèle de Besançon) permits to assign a distance and a reddening value to each star and build **3D extinction maps of the Galactic plane.***

# Merci



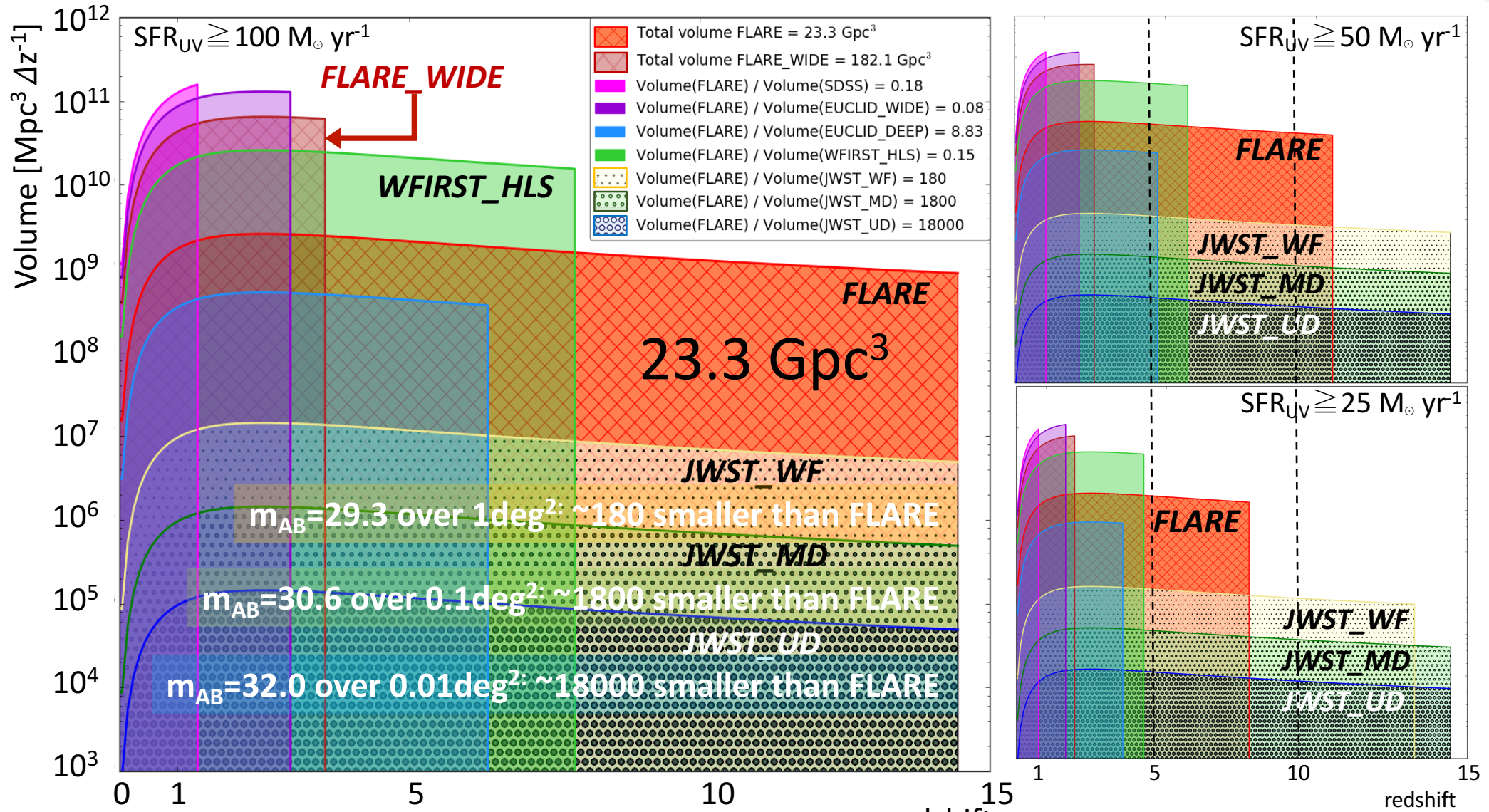
# Slides pour questions (if any)







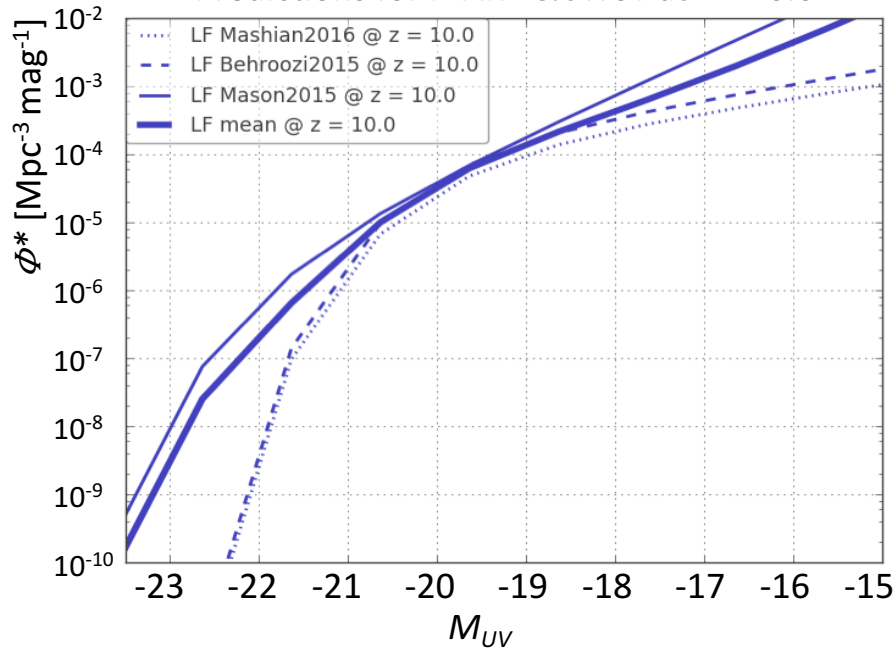
# Volume explored by various surveys (detectability at 150nm $\Rightarrow$ **WFIRST-HLS** & **Euclid**) including FLARE extragalactic and MW surveys



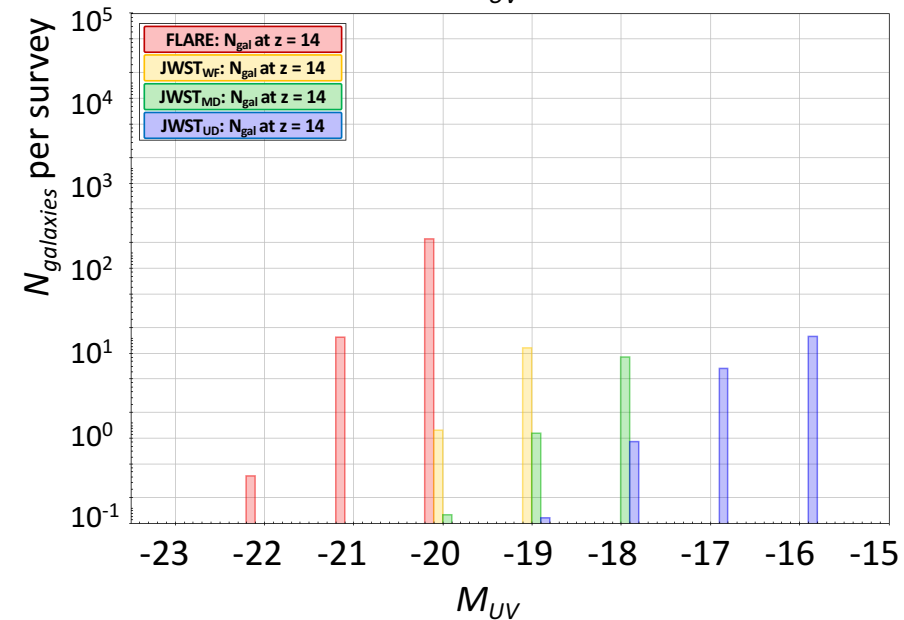
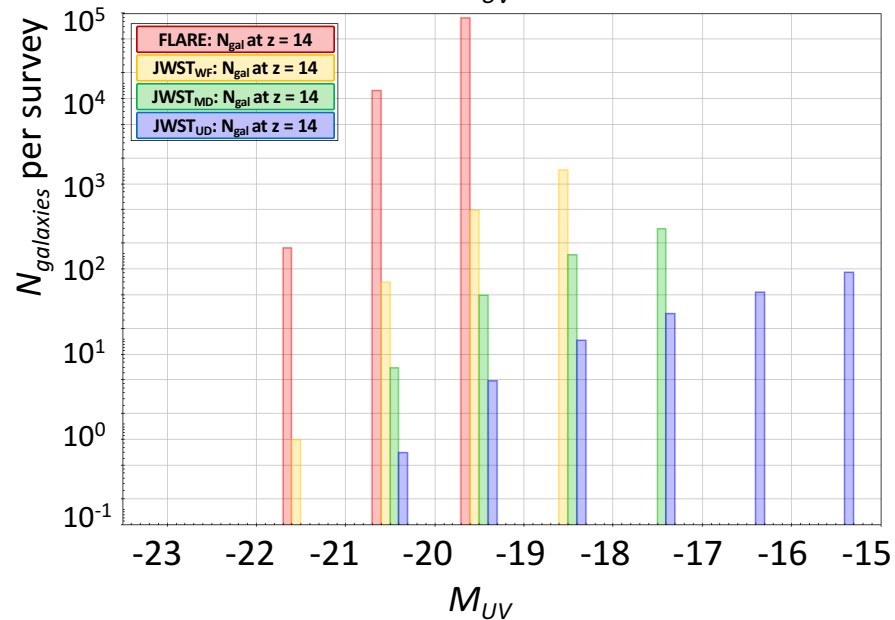
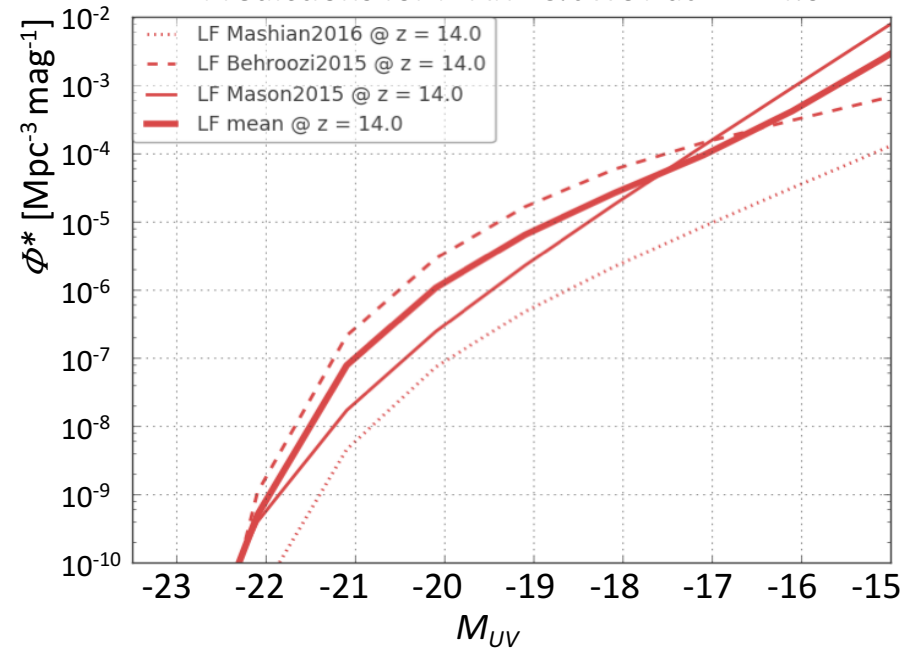


# How many galaxies? $\Rightarrow 10^5$ at $z=10$ & $\sim 200$ at $z=14$

Predictions for FLARE & JWST at  $z = 10.0$

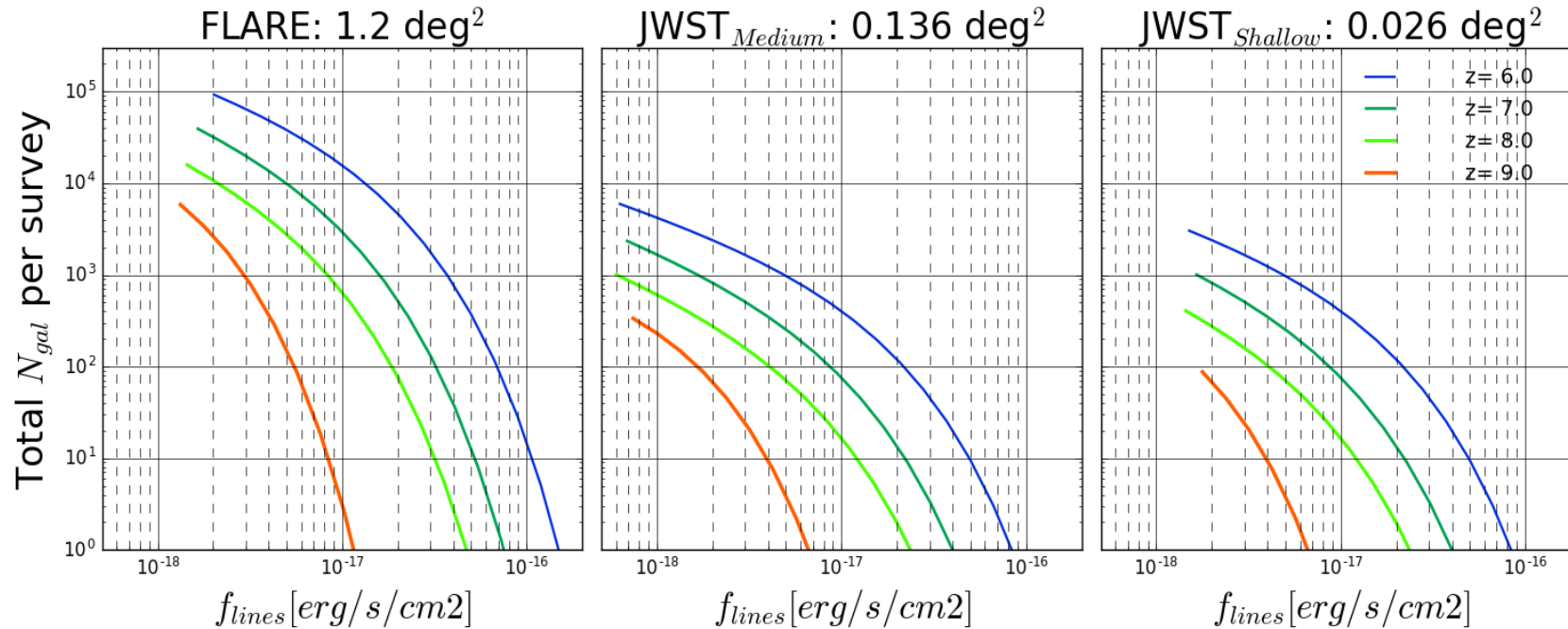


Predictions for FLARE & JWST at  $z = 14.0$



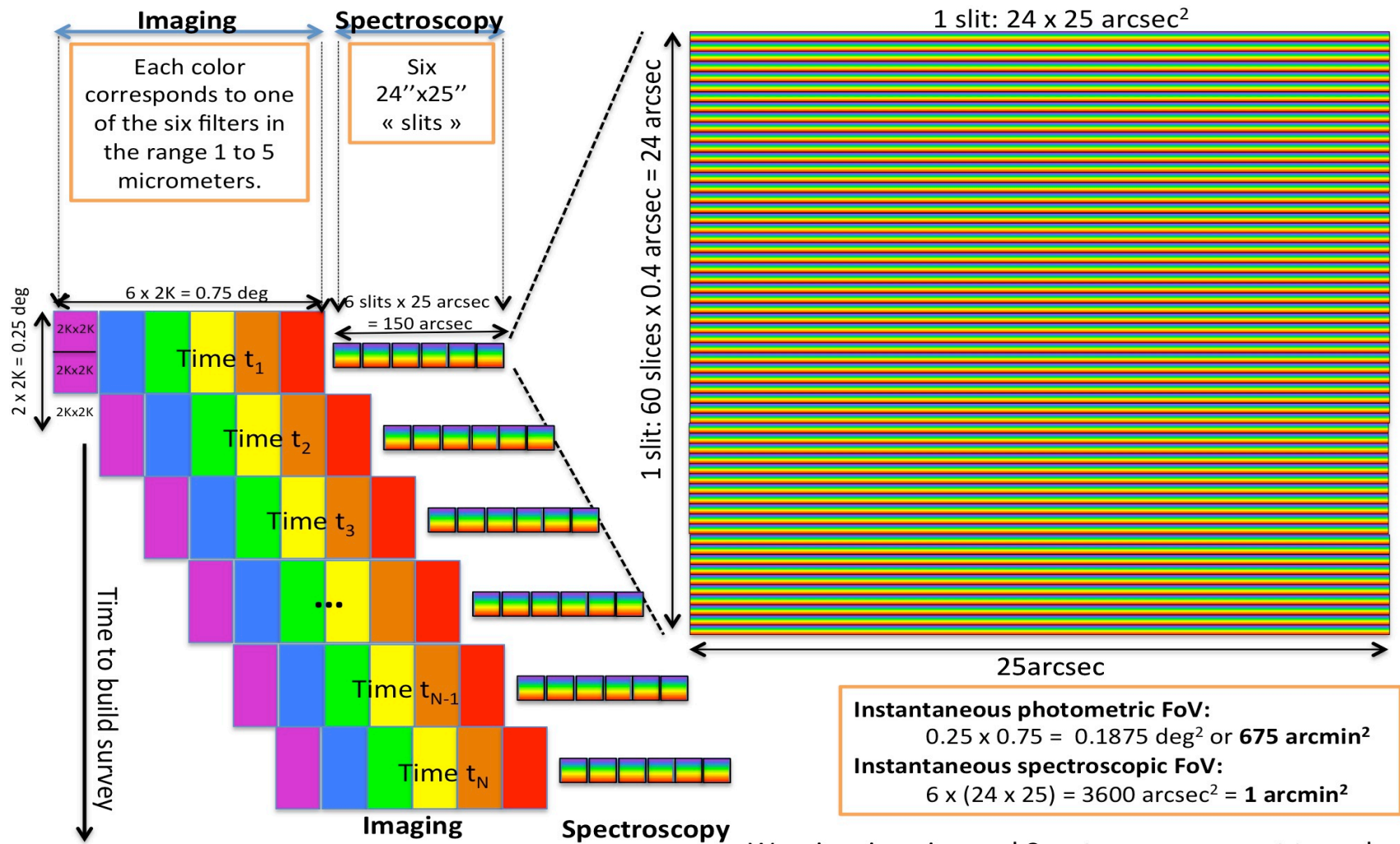


# How many galaxies (spectroscopy)?



*Number of galaxies that could be detectable by FLARE (left) and by the three JWST surveys ( $R > 1000$ ). For the medium and shallow spectroscopic surveys (middle and right panels). **At any redshift, FLARE will detect more than 10 times the number of objects that JWST could collect.***





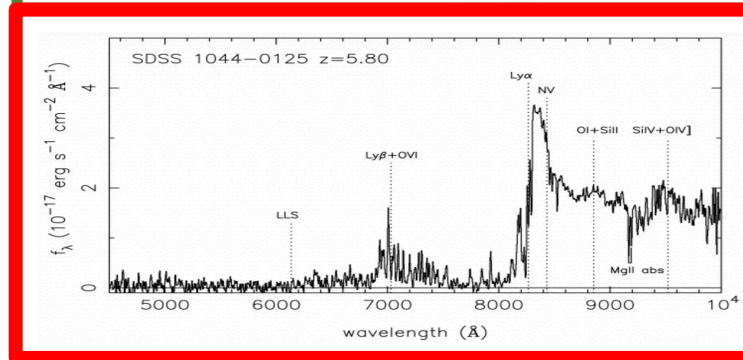
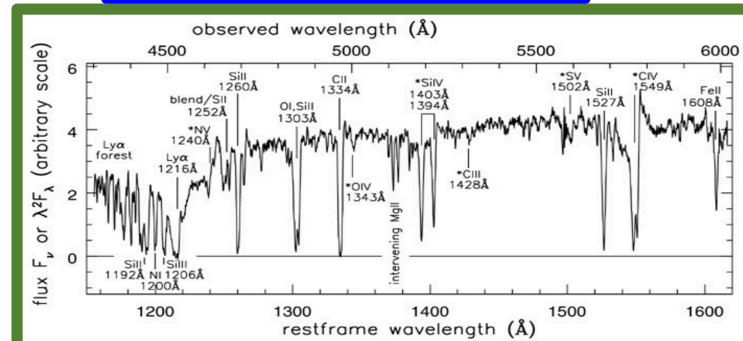
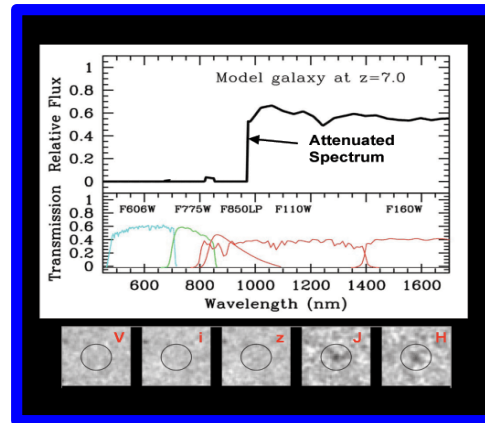
Warning: imaging and Spectroscopy are not to scale

*Figure 15: FLARE's footprint on the sky. Note that the imaging and spectroscopic fields of view are not at the same scale. Since we have no moving parts in FLARE, the 6-band imaging survey is build by stepping the 6-band 2Kx6K imager over the sky. At the end of the survey, 200deg<sup>2</sup> will be covered. Simultaneously (parallel observations), the 6-slits IFS covers ~1.5 deg<sup>2</sup> of the sky. The final IFS survey is not contiguous but covers a regular pattern of ~1 arcmin<sup>2</sup> fields.*



FLARE will create **an unbiased census of 'first-light' objects that dwell in the early universe, before the end of reionisation** in the same  $1-5\mu\text{m}$  range than JWST, but over **much larger** fields of view (x100 JWST)

- **Photometric selection:** 200 "first-light" objects @  $z \gtrsim 14$  ( $m_{AB}=28$ ) over  $\sim 200\text{deg}^2$ .
- **Emission line selection:** blind integral-field spectroscopic survey over  $\sim 1.5\text{deg}^2$ .
- **Pointed observations of quasars and their early black holes at  $z > 6$ .**



**A.« How did the universe originate and what is it made of? »: When and How Did Galaxies Form?**