The Cosmic Evolution Early Release Science Survey (CEERS)

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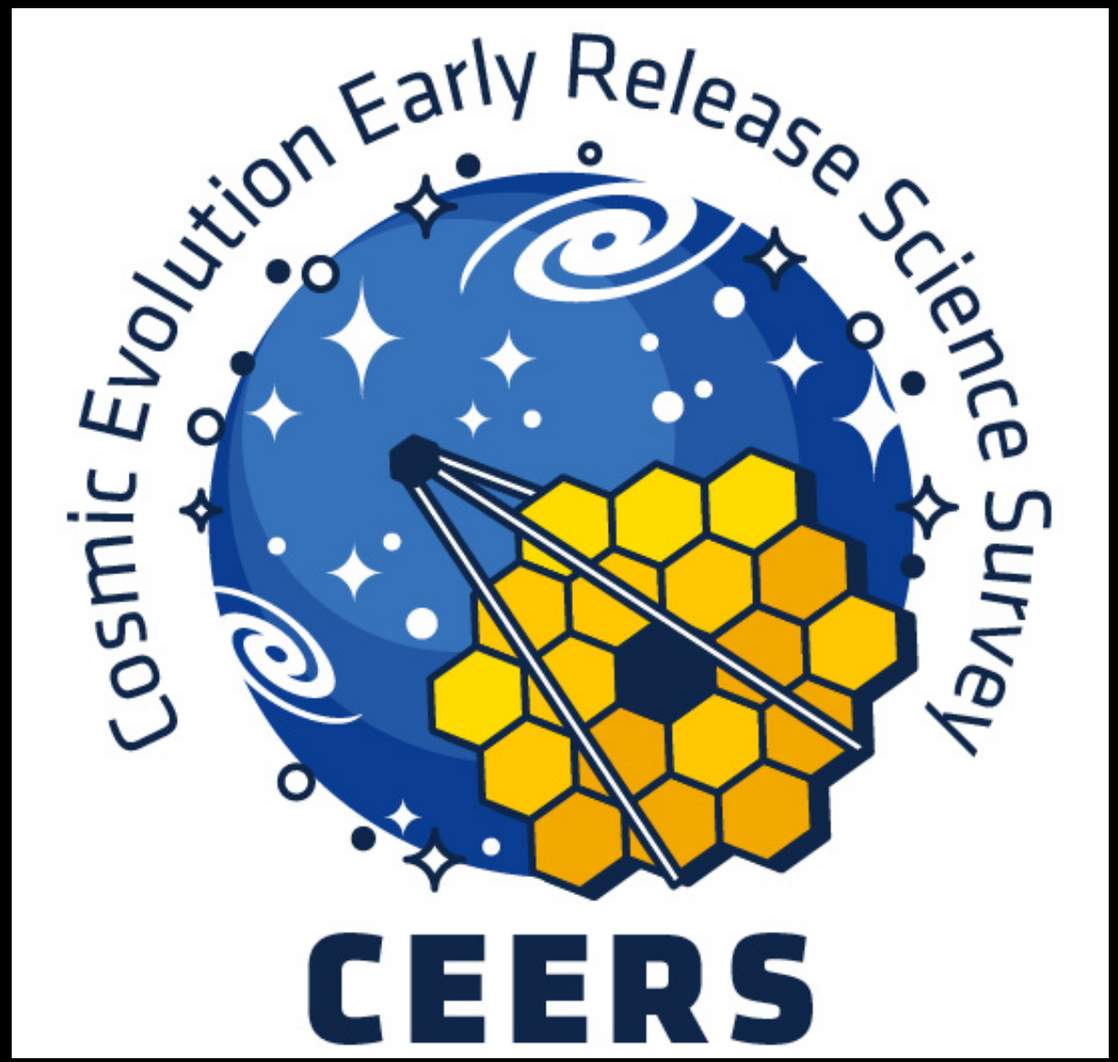
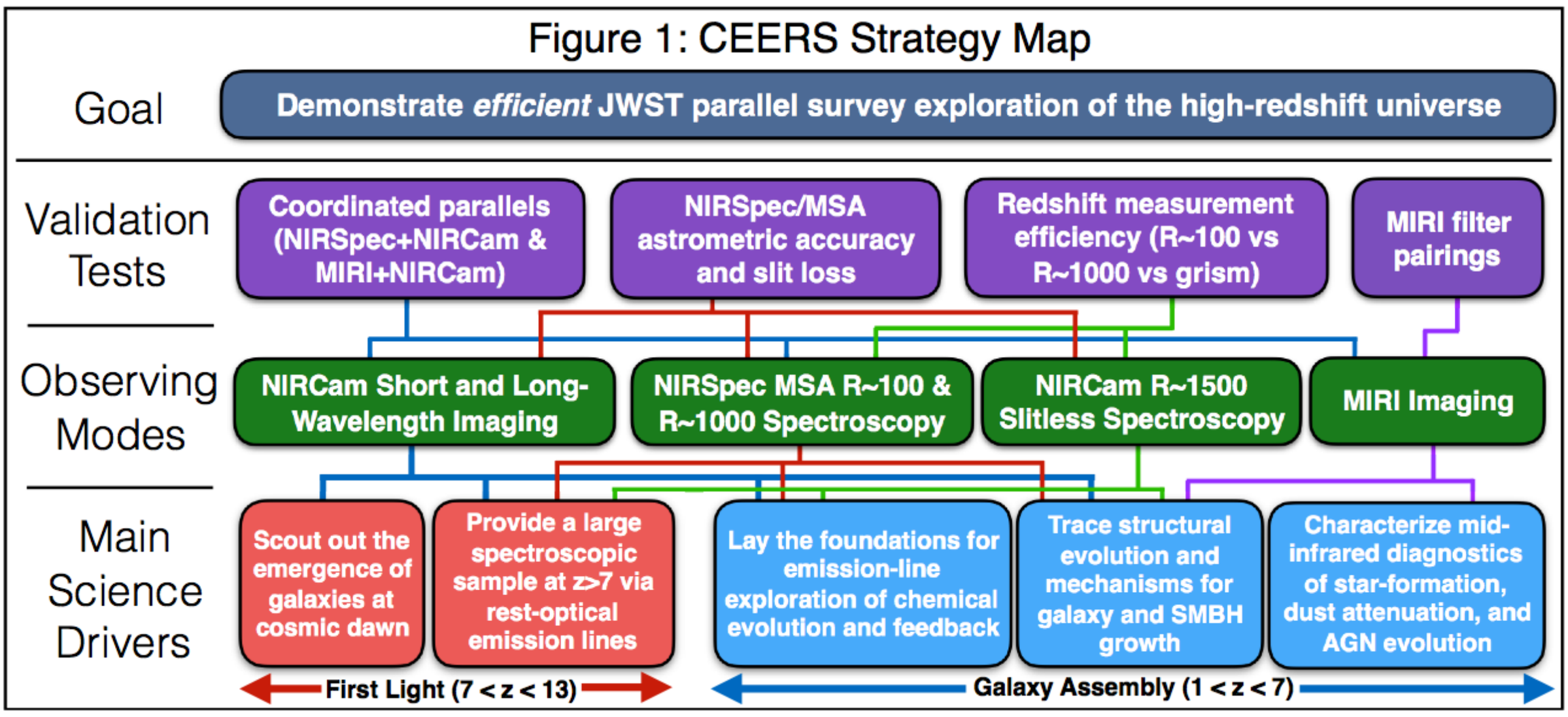
Co-I's: Mark Dickinson (NOAO), Harry Ferguson (STScI), Andrea Grazian (Rome), Norman Grogin (STScI), Jeyhan Kartaltepe (RIT), Lisa Kewley (ANU), Dale Kocevski (Colby), Anton Koekemoer (STScI), Jennifer Lotz (STScI), Casey Papovich (Texas A&M), Laura Pentericci (Rome), Pablo Perez-Gonzalez (Madrid), Nor Pirzkal (STScI), Swara Ravindranath (STScI), Rachel Somerville (Rutgers), Jon Trump (UConn) & Steve Wilkins (Sussex)

Full CEERS team: 105 scientists over 10 countries, including 28 institutions



CEERS Strategy

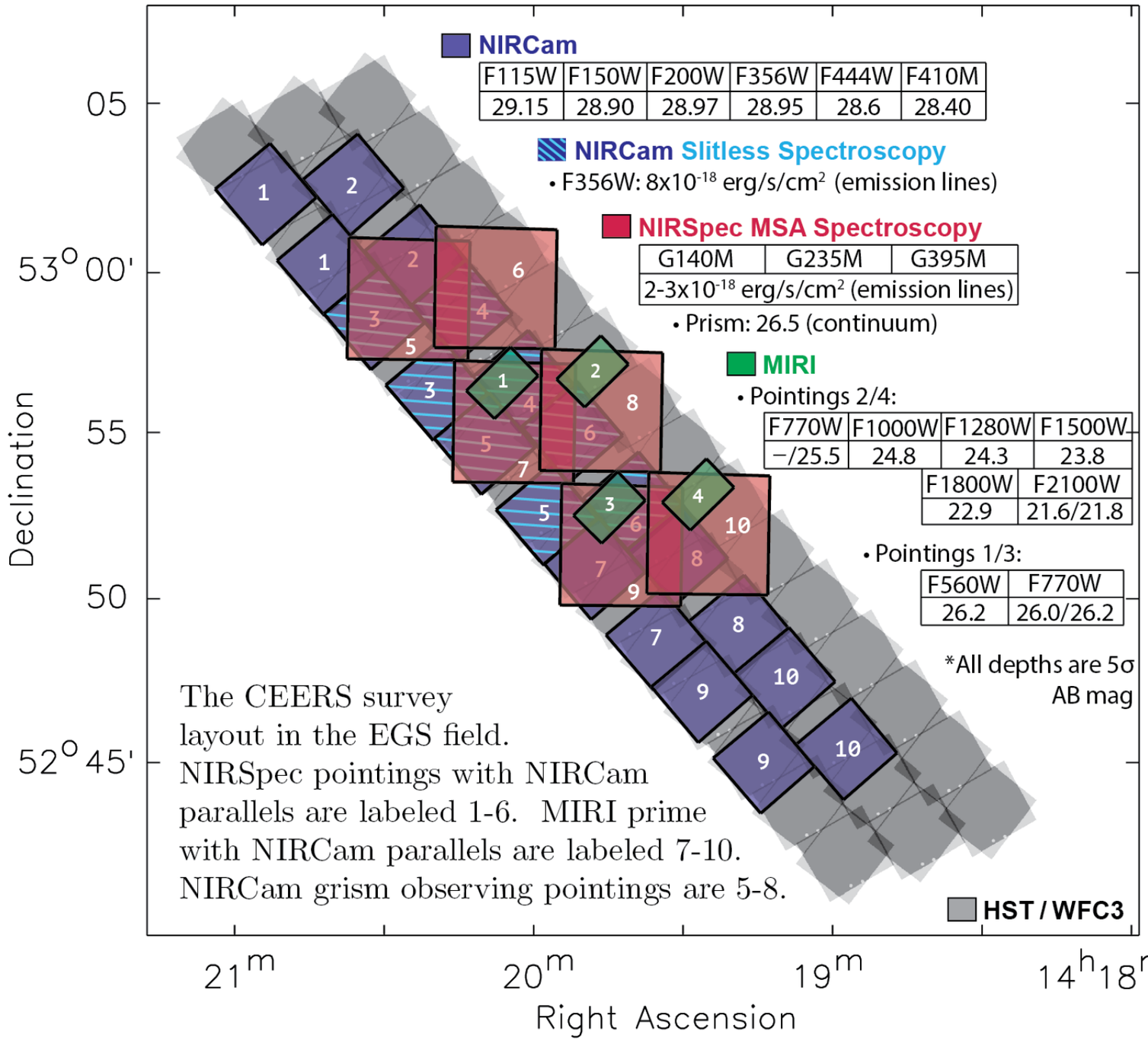
Figure 1: CEERS Strategy Map



- Coordinated parallels involving three instruments and four observing modes, to perform numerous validation tests, and targets several science drivers across $1 < z < 13$.

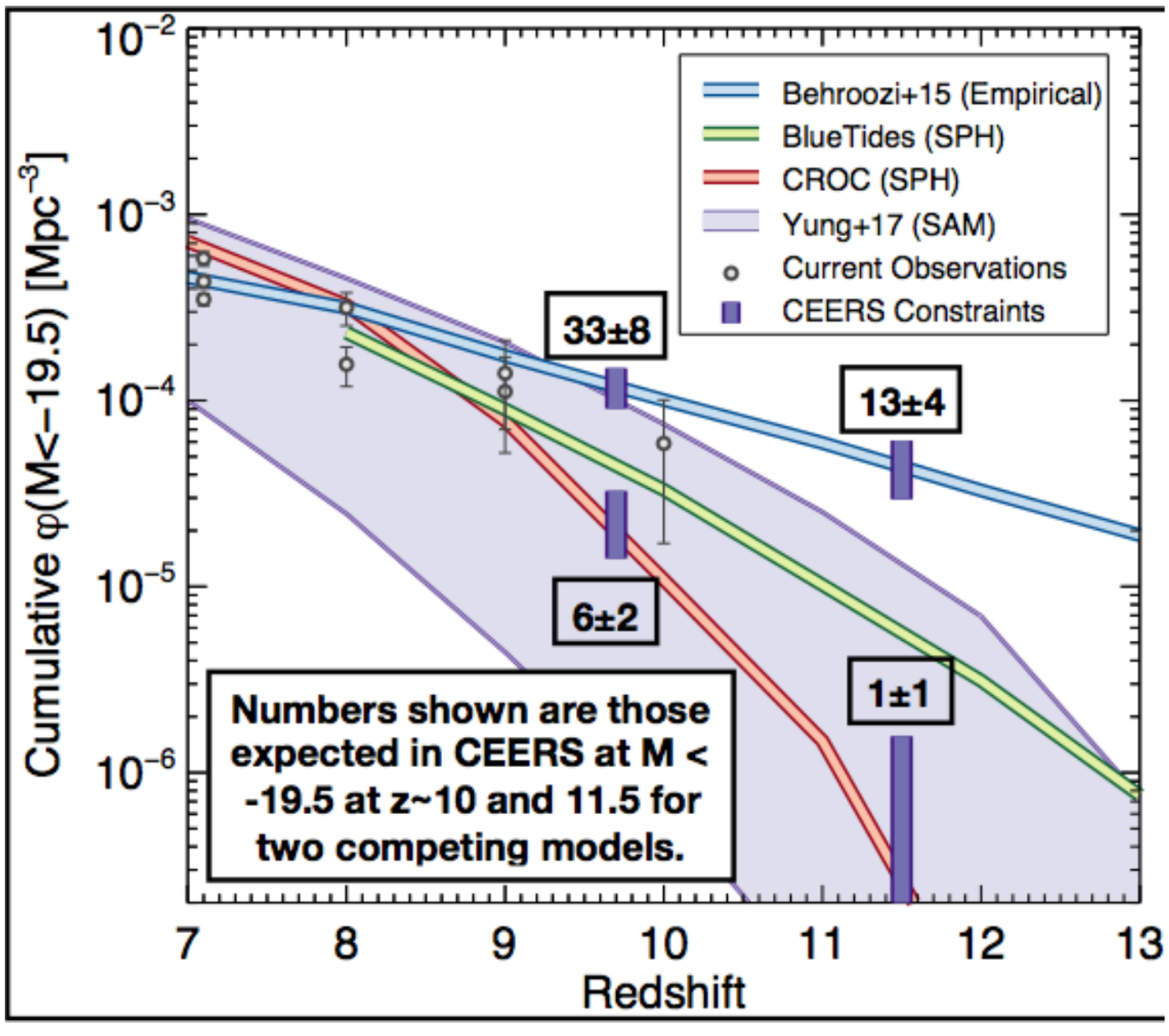
CEERS Observing Plan

- Primary Field: EGS
  - Image shows observations during December (can also be done in ~June)
- 4 pointings: MIRI prime w/ NIRCam in parallel
  - MIRI: 2 pointings deep F560W & F770W, 2 pointings shallower obs out to 21 μm.
- 6 pointings: NIRSpec prime with NIRCam parallel
  - Imaging in 5-6 filters (1.2-4.5 μm).
  - R~1000 spectroscopy in all six pointings, R~100 in four pointings.
- 4 pointings: NIRCam grism prime (F356W)



Science Goal #1

- CEERS should detect ~5-50 galaxies at z > 10, which can distinguish between models which assume different star-forming efficiencies.



Science Goal #2

- CEERS will detect numerous diagnostic emission lines out to z~10, allowing spectroscopic confirmation and measurement of key physical properties, including ionization parameter and metallicity.

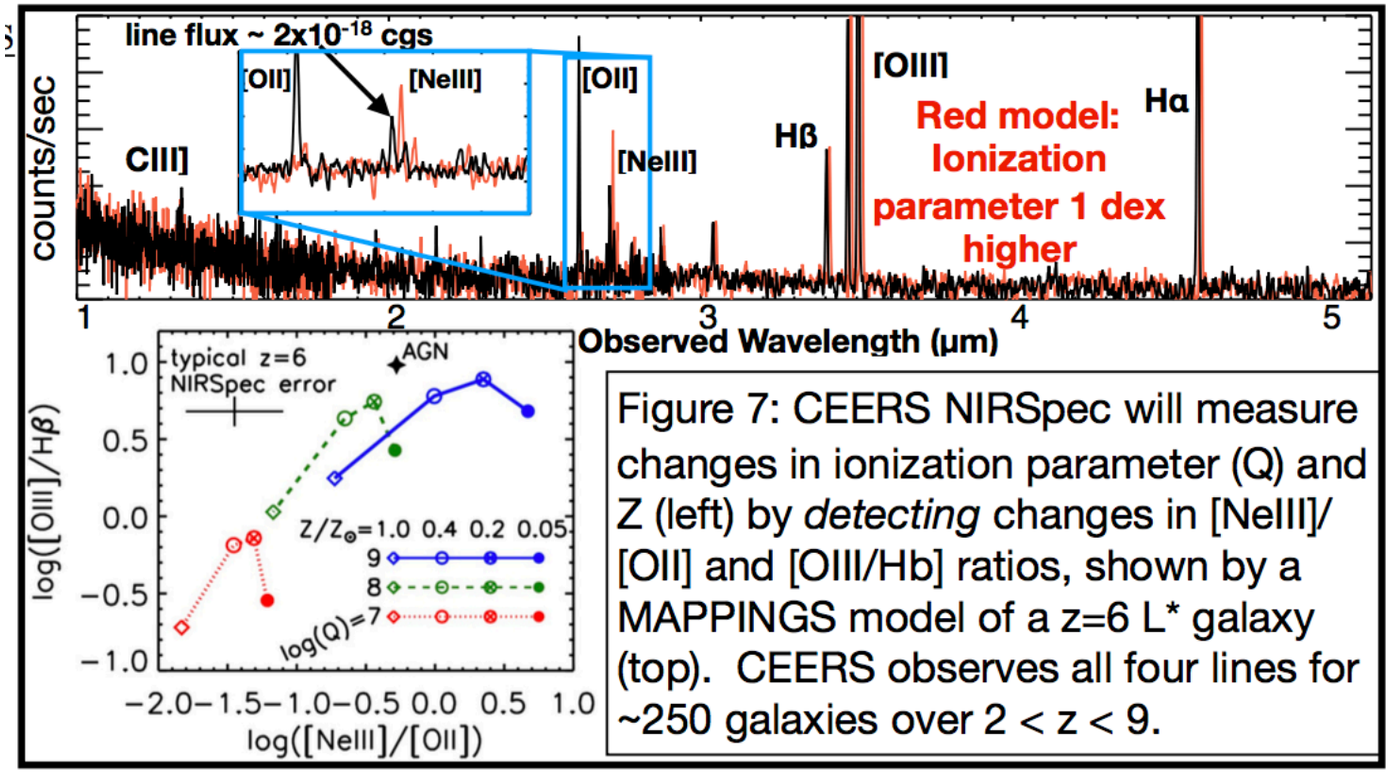


Figure 7: CEERS NIRSpec will measure changes in ionization parameter (Q) and Z (left) by *detecting* changes in [NeIII]/[OII] and [OIII/Hb] ratios, shown by a MAPPINGS model of a z=6 L* galaxy (top). CEERS observes all four lines for ~250 galaxies over 2 < z < 9.

Table 1: #Galaxies Observed by CEERS NIRSpec

	All z	6 < z < 9	3 < z < 6	1 < z < 3
R~1000 (6 pointings)	330	32	97	161
R~100 (4 pointings)	299 (150)	27 (21)	82 (57)	150 (55)

*** Numbers in parentheses are those covered at both R~100 and ~1000**

Science Goal #3

- CEERS will unveil high-resolution rest-optical morphologies for modestly-high redshift galaxies, and high-resolution imaging in the PAH/hot-dust continuum for galaxies at moderate redshifts.

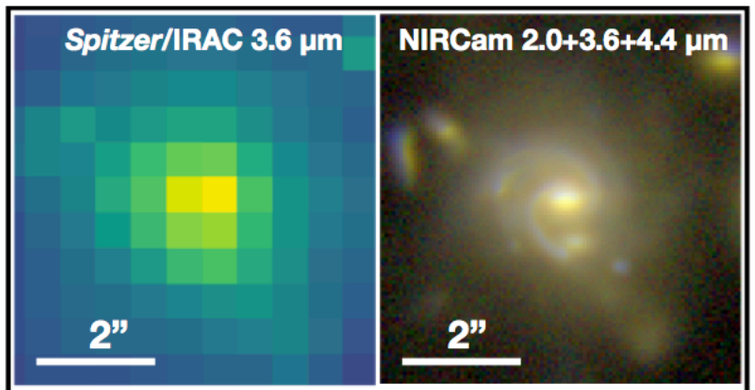


Figure 5: Simulated IRAC (left) and NIRCam (right) images of a z~2 galaxy, highlighting CEERS' ability to probe rest-optical sub-structure.

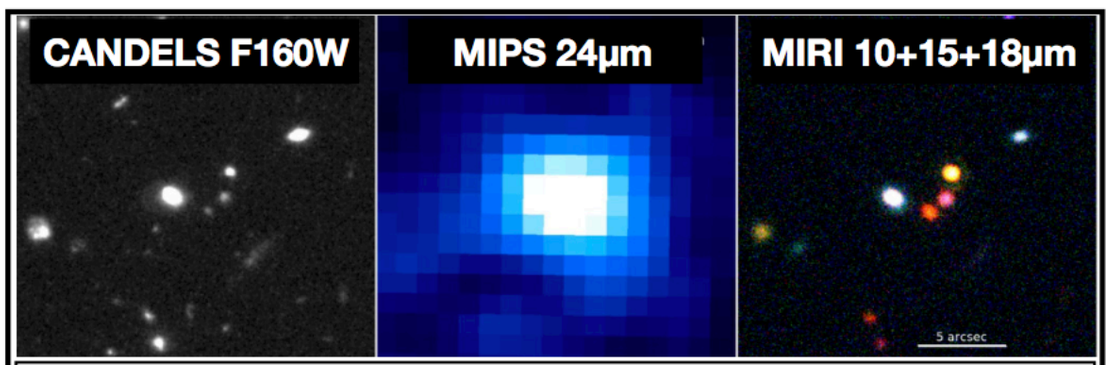
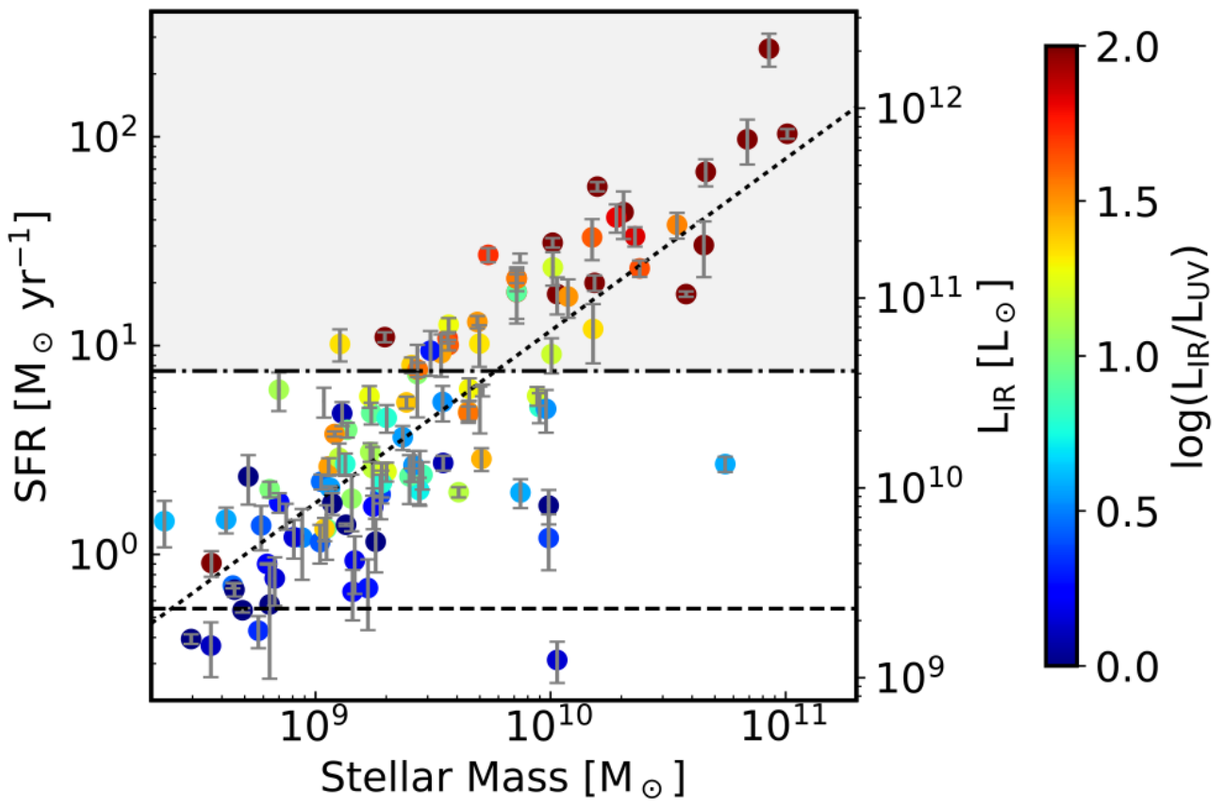
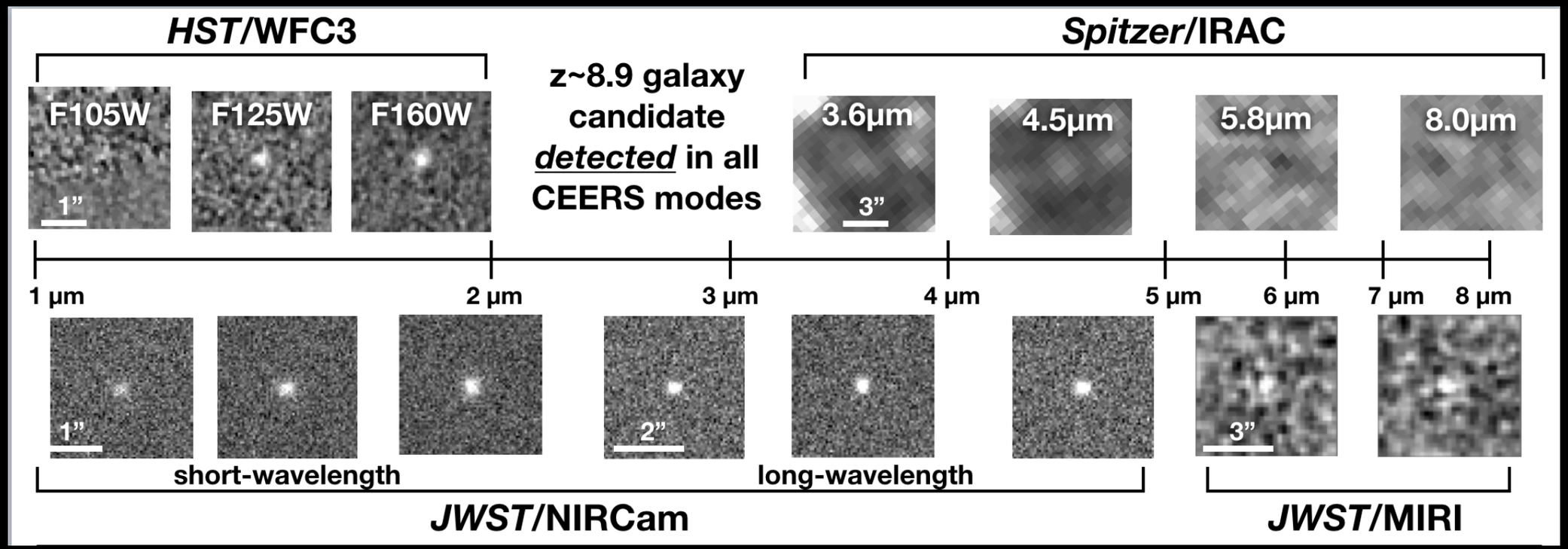


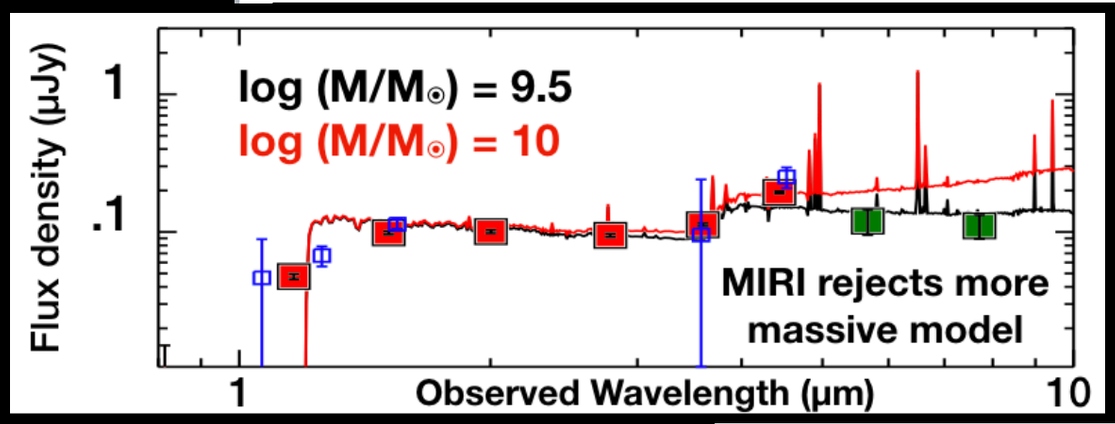
Figure 6: *HST*/WFC3, *Spitzer*/MIPS, and mock CEERS MIRI images of part of the EGS. CEERS goes 1 dex deeper than previous MIPS data.

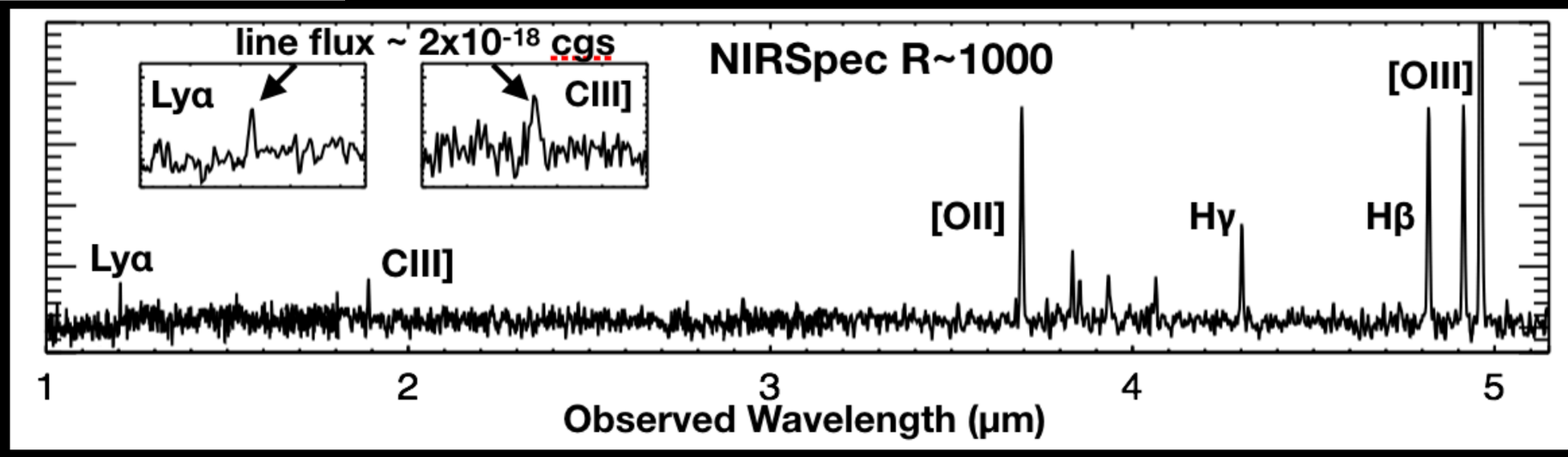
M* vs. SFR from our MIRI simulations. CEERS goes 1 dex deeper than MIPS/FIDEL.



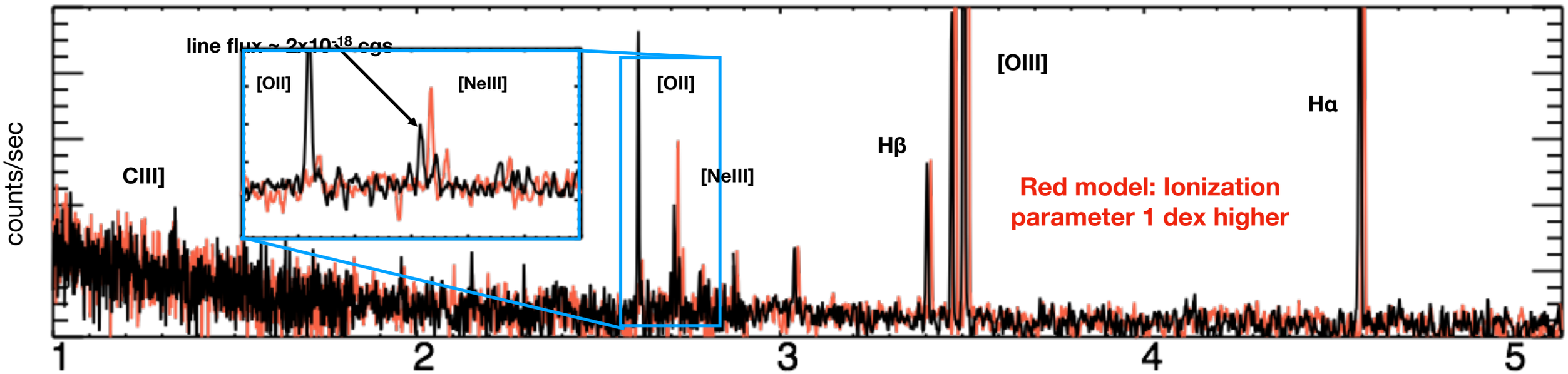
Example z~9 Observation

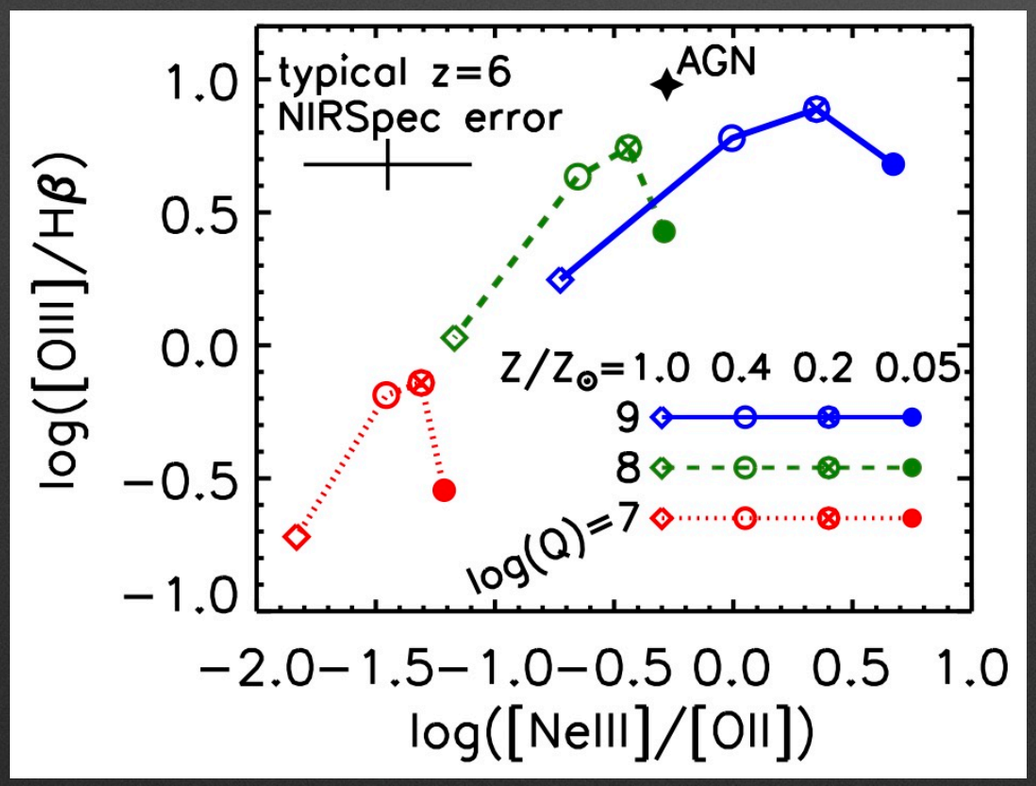






Example z~6 Observation

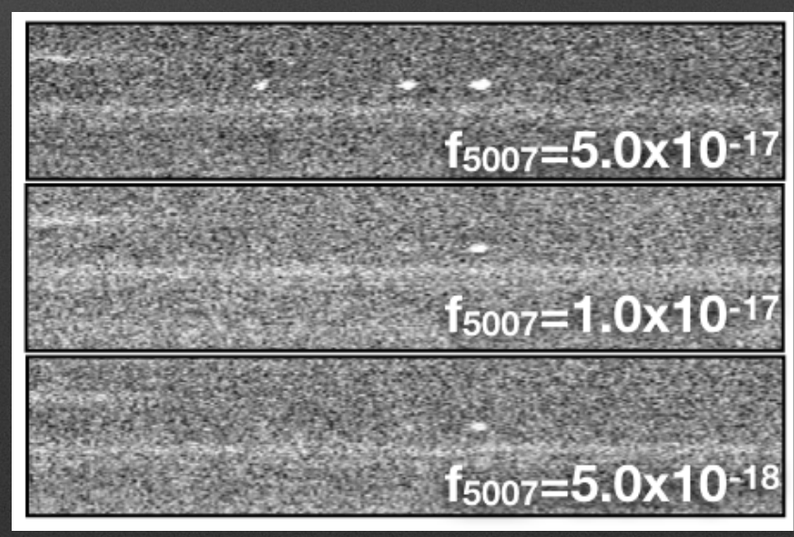




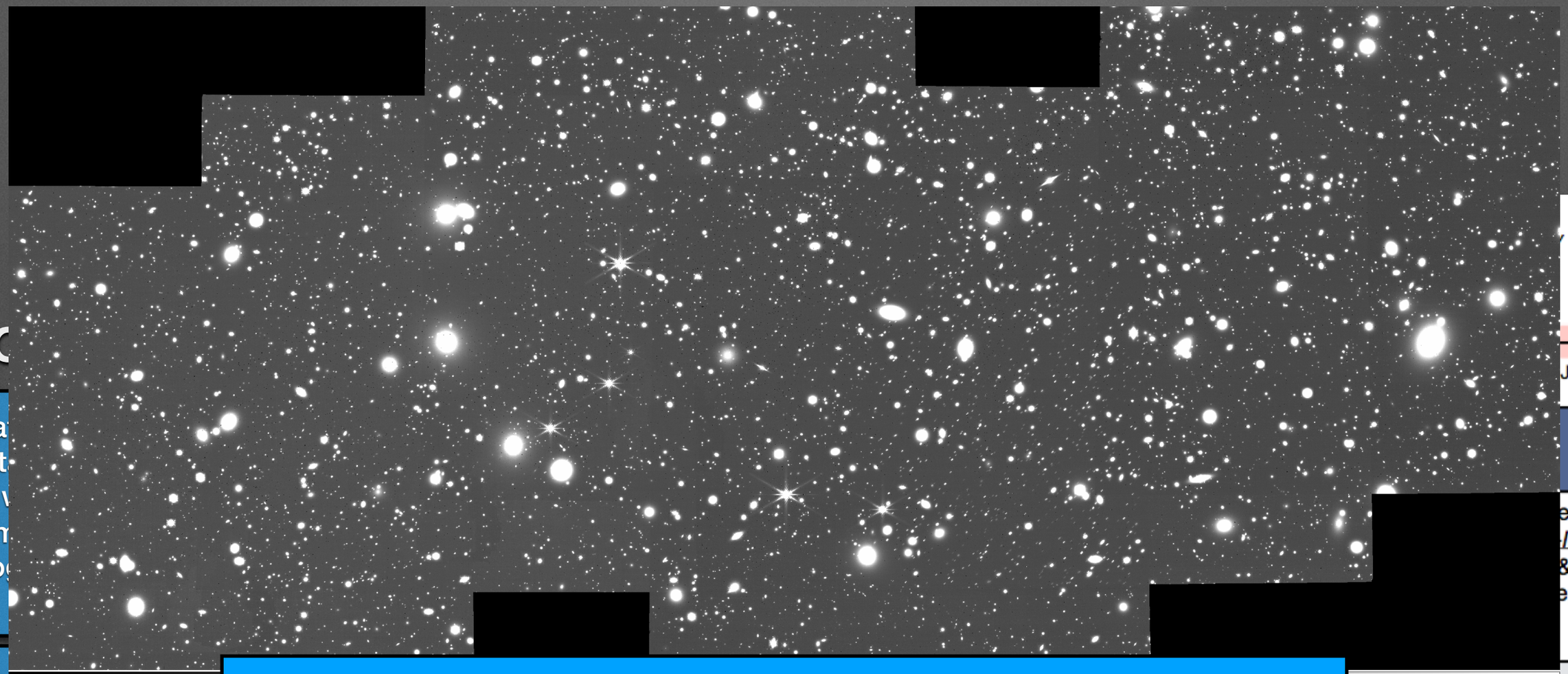
CEERS NIRSpec will measure changes in ionization parameter (Q) and Z (left) by *detecting* changes in [NeIII]/[OII] and [OIII/Hb] ratios, shown by a MAPPINGS model of a z=6 L* galaxy (top). CEERS observes all four lines for ~250 galaxies over $2 < z < 9$.

NIRCam Grism

- We included a NIRCam grism component to:
  - Allow direct measures of slit-losses
  - Demonstrate this is a mode for science, and specifically compare to NIRSpec R~100 and R~1000
- Perform a blind search for emission lines at high-z.
  - We expect ~50 [OIII] lines at 5.3 < z < 7, almost all from galaxies un-detected in CANDELS.
    - Also sensitive to Hα and [OII] at lower and higher redshift.



1245s F356W grism integration @ z=6



NIRCam F277W simulation of part of the CEERS field, led by Micaela Bagley

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v1 products and catalogs 5-6 months after data acquisition

Final release, including slit-loss analysis, ~11-12 months after acquisition

Level 2	*Dickinson, Kartaltepe, Trump, Pentericci, Ravindranath, Pirzkal, Finkelstein*	s: *HST*+NIRCam, MIRI: *Finkelstein, Ferguson, Papovich, Grazian, Perez-Gonzalez* 3) Release sample of z>9 candidates: *Finkelstein+team*
Level 3	1) v2 Reduced 2D and 1D Spectra 2) Publish v2 Spectroscopic Catalog *Dickinson, Kartaltepe, Trump, Pentericci* 3) Publication of NIRSpec slit-loss and MSA vs. grism scientific efficiency analysis: *Dickinson, Finkelstein, Pirzkal, Ferguson*	1) v2 Image mosaics 2) v2 EGS multi-wavelength cats (incl, photo-z, M*, SFR): *Finkelstein, Ferguson, Papovich, Grazian, Perez-Gonzalez, Wilkins, Pirzkal* 3) *F200W* Morphology catalogs (e.g., R_e, n_{Sersic}, Gini, M20): *Lotz, Kartaltepe, Kocevski*

Names given after each task denote the Investigator(s) who will lead each aspect, in collaboration with postdocs, students and/or RIAs under their supervision.

Jun

Finkelstein
z-Gonzalez

NB: Timeline needs to be updated for new launch date

Summary

- CEERS is designed to provide data to nearly all blank-field investigations into the 0.5 < z < 12 universe.
  - It will include data representative of medium-depth *JWST* surveys in nearly all modes.
    - 1-5 μm imaging w/ NIRCam, 5-20 μm imaging w/ MIRI
    - 1-5 μm R~100 and R~1000 spectroscopy with NIRSpec
    - 3-4 μm grism spectroscopy with NIRCam
- The CEERS team is dedicated to a rapid release of high quality reduced data products and catalogs.

Communication: We are in the process of setting up a website which we will use to communicate with the community (hosting a blog, and also using twitter).