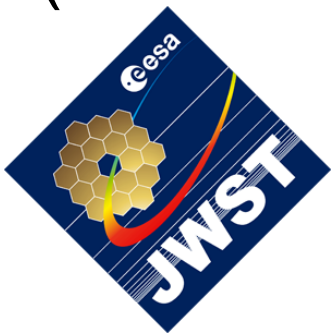
The potential of a wide-field NIRSpec spectroscopic galaxy survey with JWST

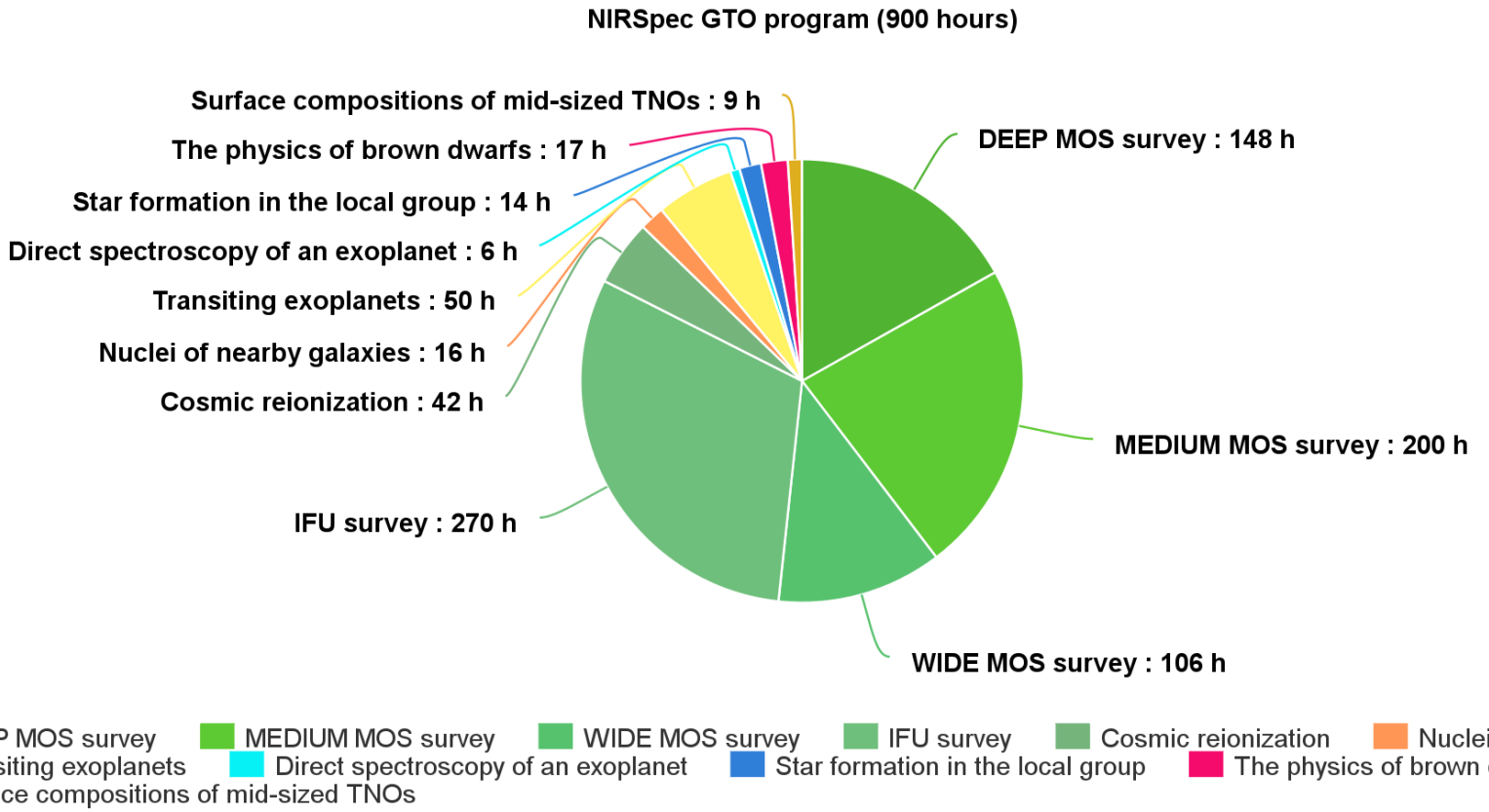
Bernd Husemann (MPIA Heidelberg)



Pierre Ferruit (PI), Marijn Franx (Leiden), Hans-Walter Rix (MPIA Heidelberg), Michael Maseda (Leiden), Santiago Arribas (CSIC Madrid), Andrew Bunker (Oxford), Roberto Maiolino (Cambridge), Stephane Charlot (Paris), Chris Willot (Herzberg Institute)

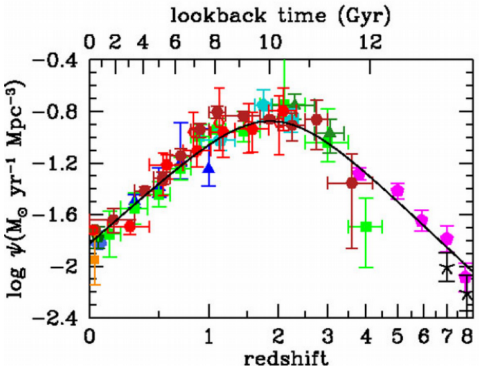
and the entire NIRSpec GTO team

The NIRSpec GTO Programme

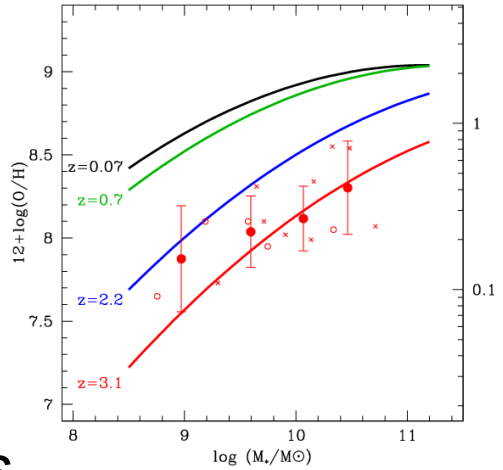


More than 780hours planned on high-z galaxy surveys

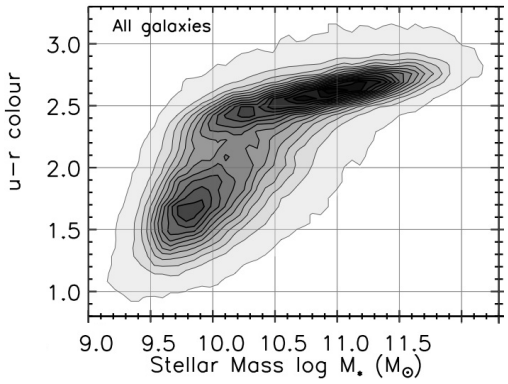
Scientific drivers for MOS surveys



Tracing the history of cosmic star formation



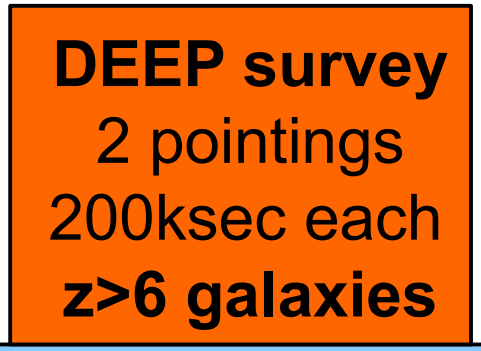
Constraining the build-up of metals with time



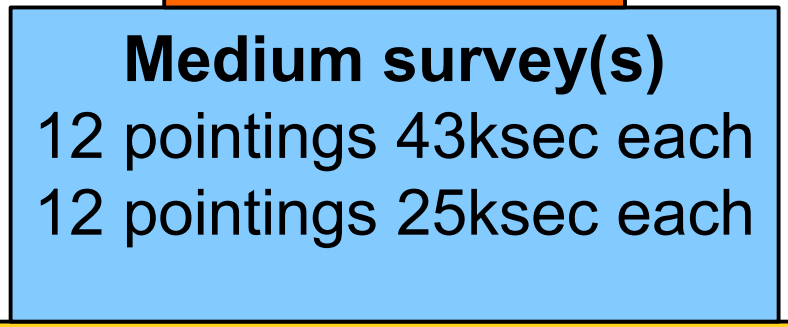
Unravel the build-up of today's most massive galaxies and the galaxy bimodality

Characterize the first galaxies and black holes

The MOS Survey wedding cake



GOODS-S with NIRCam
PRISM and all R1000



GOODS-N/S with NIRCam
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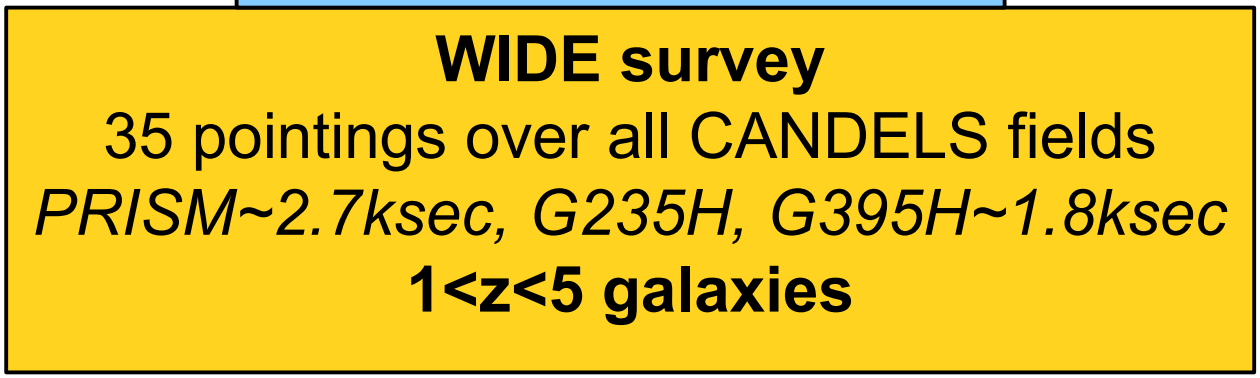
G395H for long exposures



No parallels
Based on HST

The MOS Survey wedding cake

DEEP survey
2 pointings
200ksec each
z>6 galaxies

GOODS-S with NIRCam
PRISM and all R1000

Medium survey(s)
12 pointings 43ksec each
12 pointings 25ksec each

GOODS-N/S with NIRCam
PRISM and all R1000
G395H for long exposures

WIDE survey
35 pointings over all CANDELS fields
PRISM~2.7ksec, G235H, G395H~1.8ksec
1<z<5 galaxies

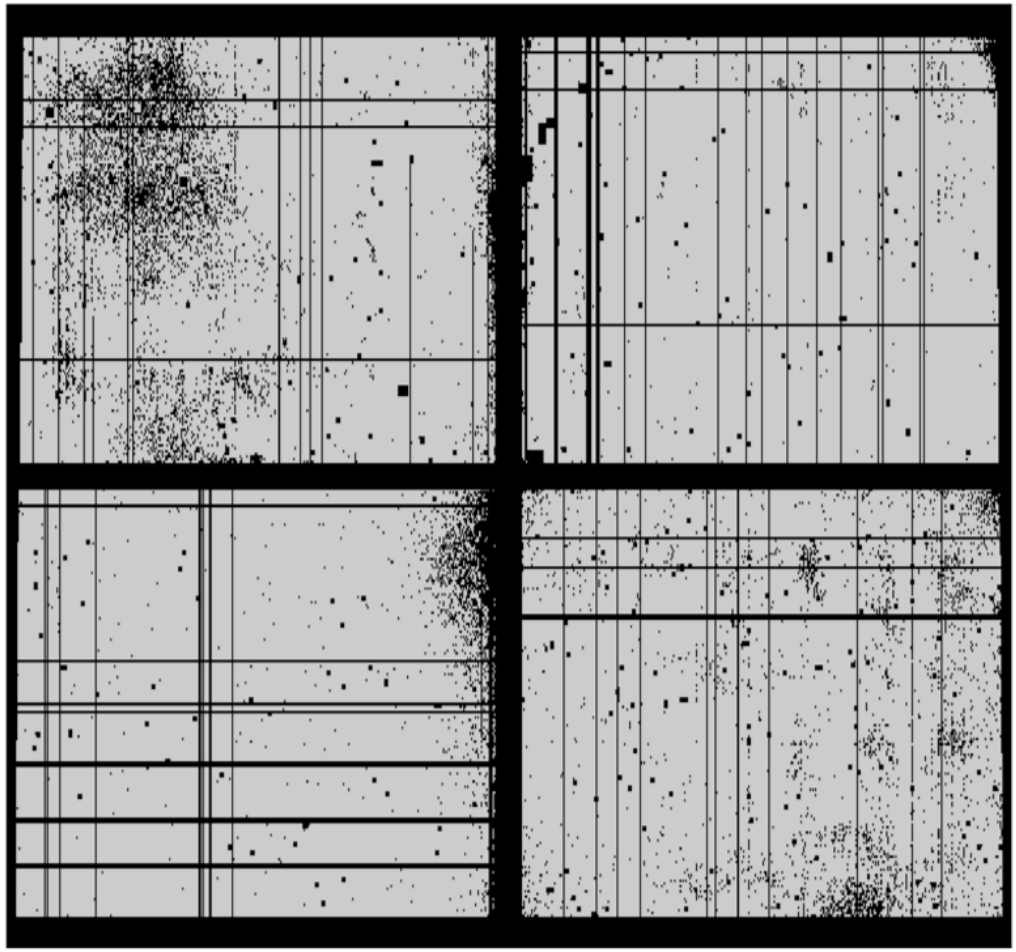
No parallels
Based on HST

The prospects of NIRSpec WIDE

- **Extra-ordinary statistical power**
  - ➔ 35 pointings with ~200 galaxies → **7000 galaxies**
  - ➔ Looking at galaxies binned in various parameters
- **Connecting the low and high-redshift Universe**
  - ➔ Mainly 2<z<5 at cosmic noon of star formation
- **R~2700 spectroscopy covering Hα and/or [OIII]**
  - ➔ Census of galactic outflows in SF galaxies
  - ➔ Spatially-resolved slit kinematics across galaxies

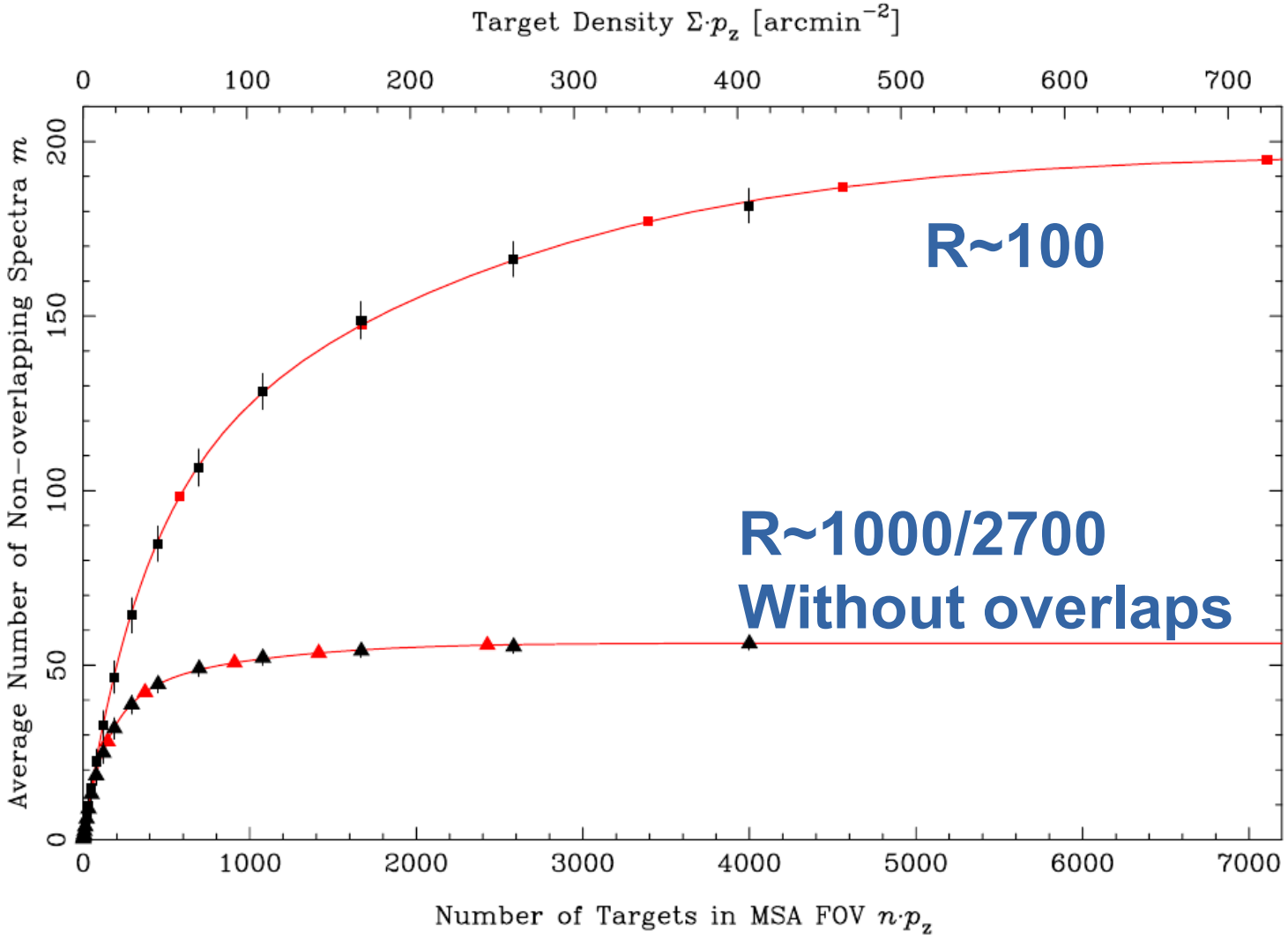
➔ **Lots of serendipitous discoveries expected**

Difficulties start with NIRSpec MSA

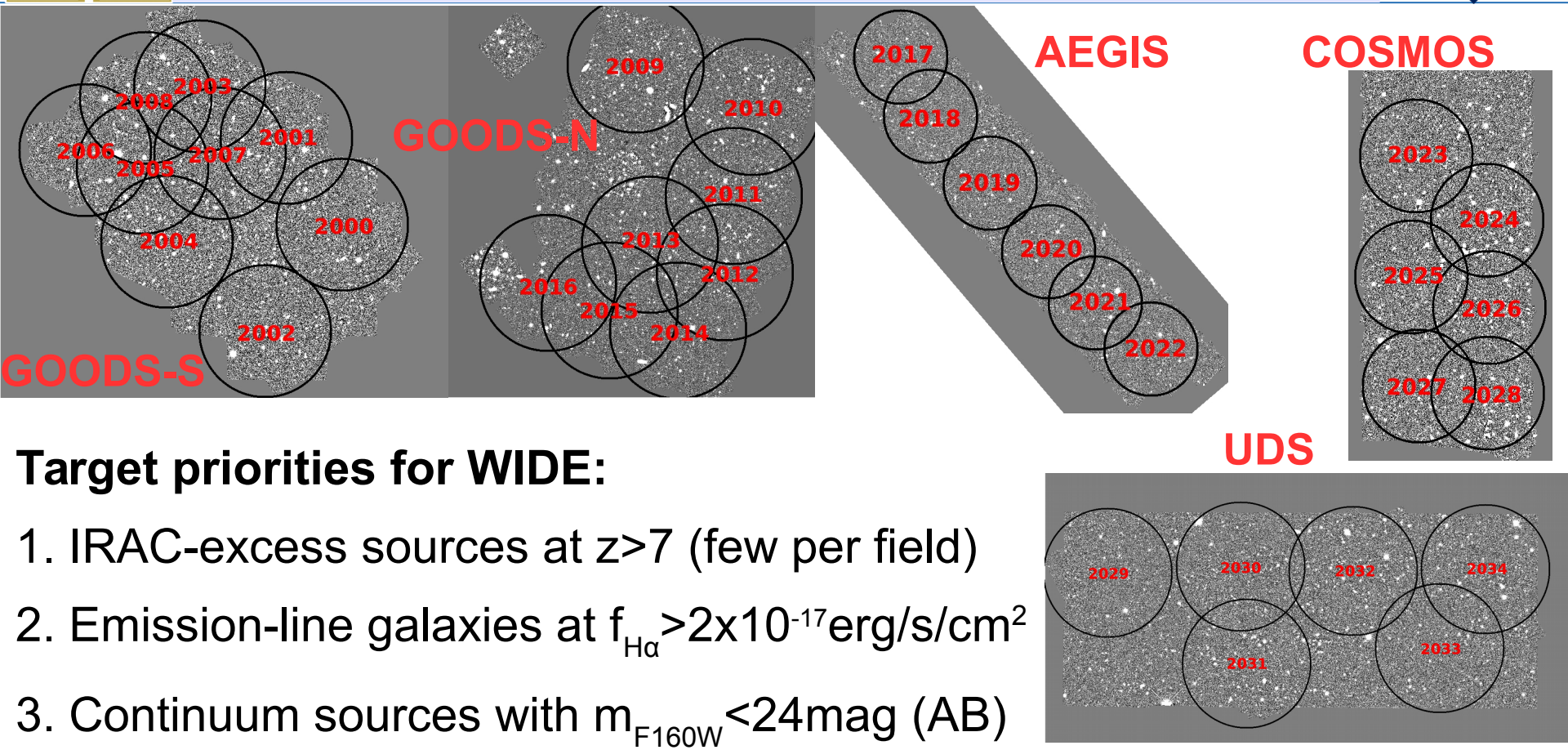


Closed shutters → very complex mask design

NIRSpec MSA: Needs Overbooking!



The WIDE survey fields and target selection



Target priorities for WIDE:

1. IRAC-excess sources at z>7 (few per field)
2. Emission-line galaxies at $f_{H\alpha}>2\times10^{-17}$erg/s/cm^2
3. Continuum sources with $m_{F160W}<24$mag (AB)
4. Filler targets (z<2, X-ray sources, etc.)

➔ **Reserved almost the entire CANDELS catalog**

Consequence of MSA design for ERS and GO proposal

- **Oversized catalogs are required as inputs for MSA**
  - ➔ Most of the CANDELS catalog included in GTO Phase 1
  - ➔ For WIDE we expect <5% of the catalog to be observed

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  - ➔ See NIRSpec MOS section of ERS special policy

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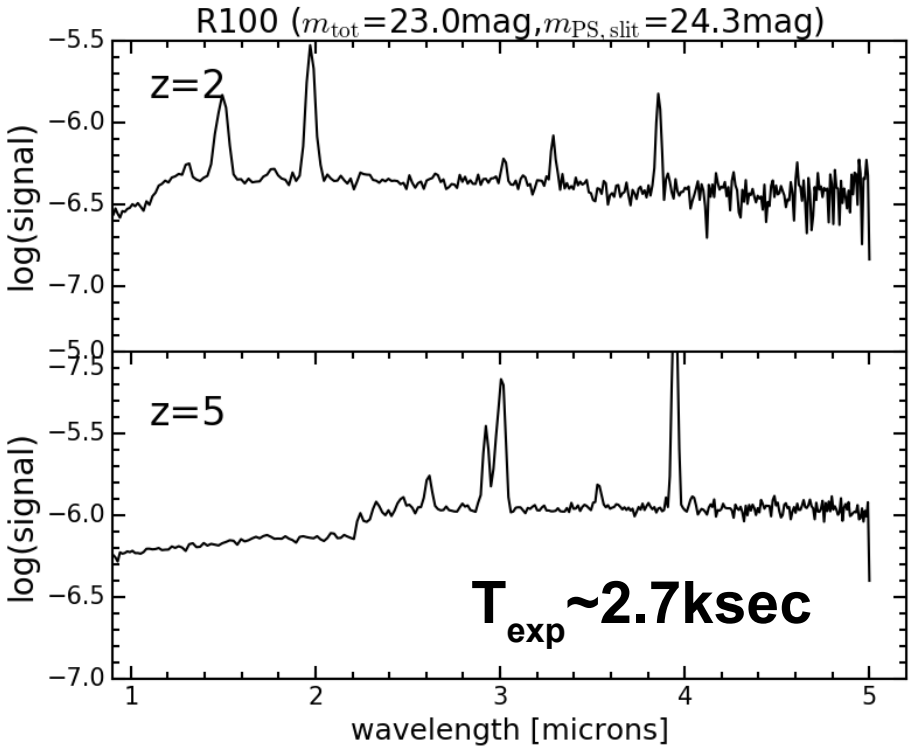
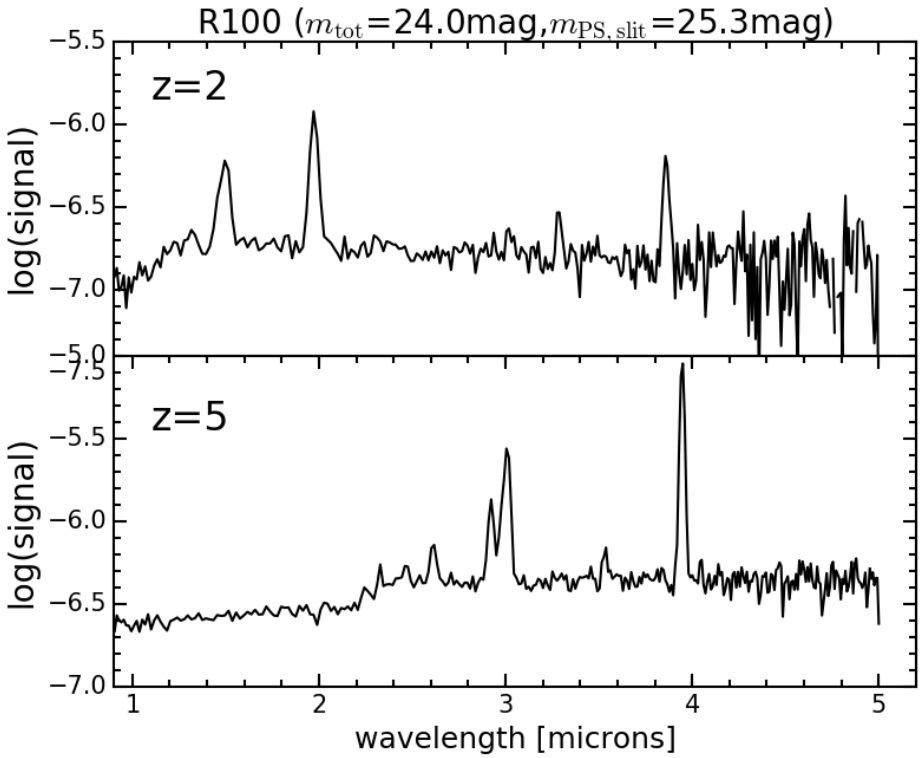
  - ➔ See NIRSpec MOS section of ERS special policy
- **ERS observation are possible according to STScI policy and likely remain for following GO calls**

  ➔ **Do not be hesitant to still apply for these fields**

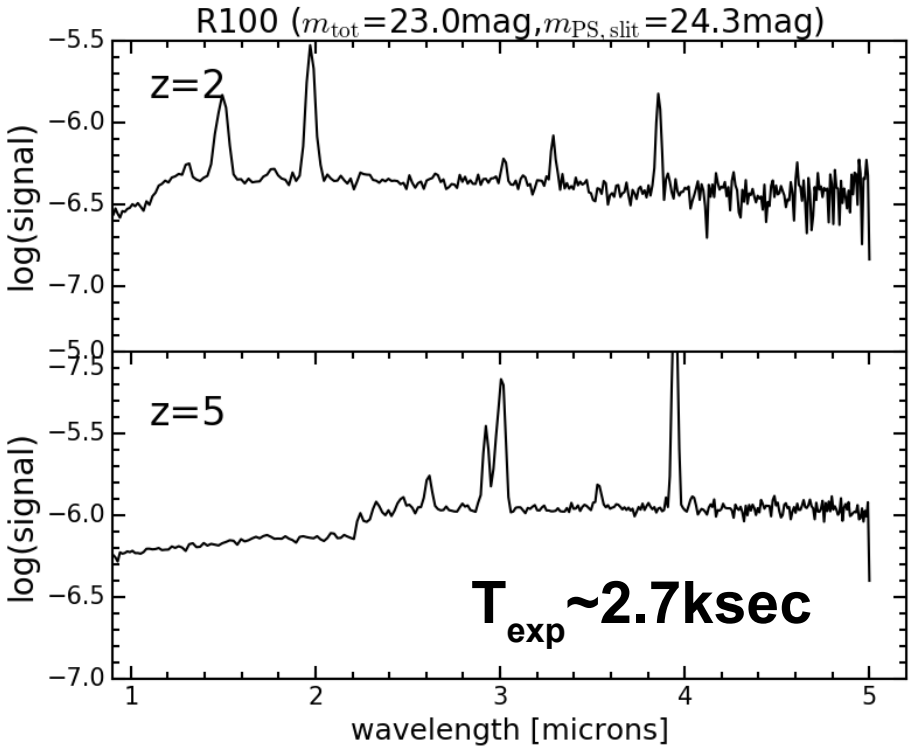
Simulated WIDE survey spectra

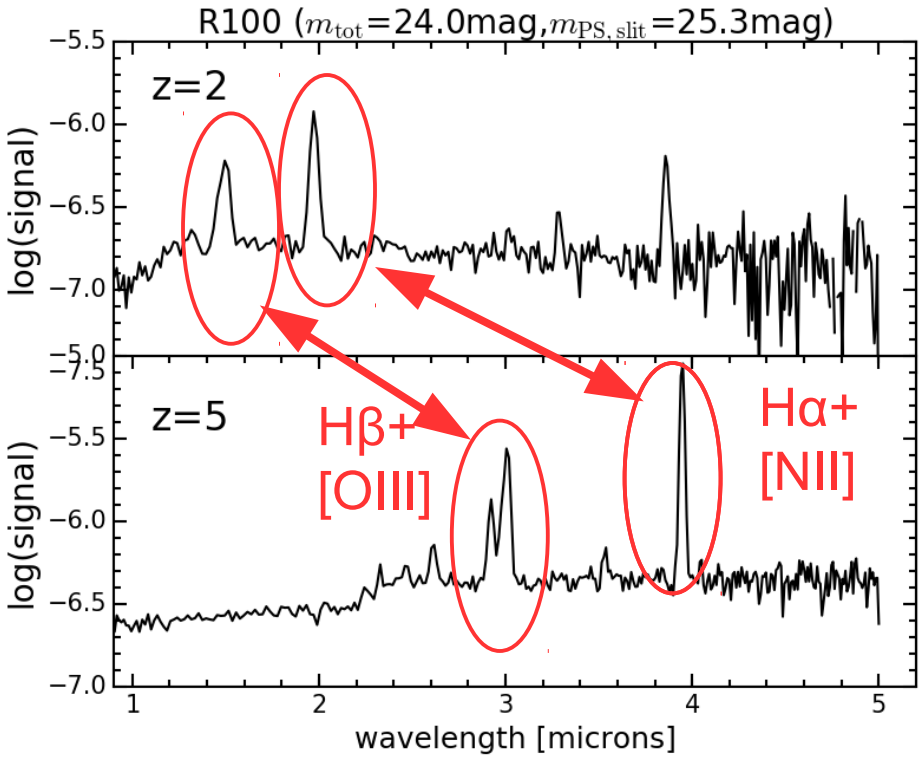




- Detect stellar continuum with Balmer break

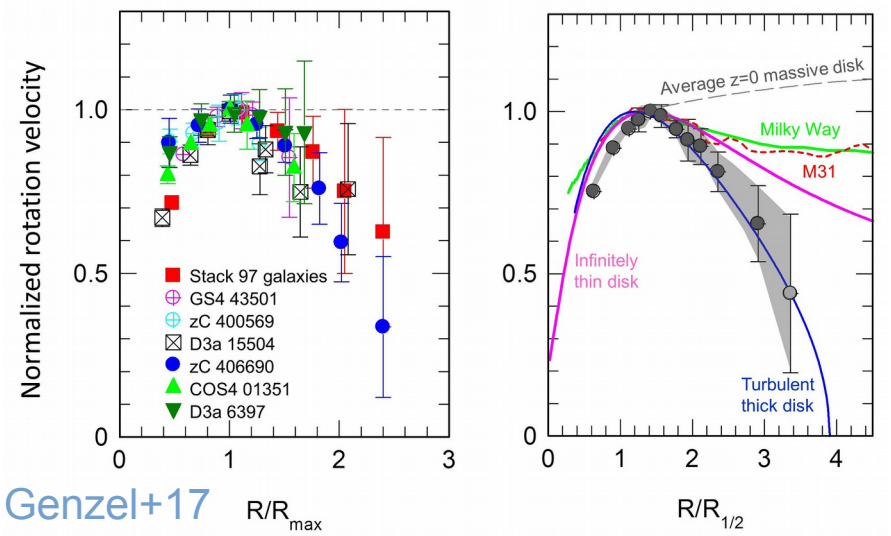
Simulated WIDE survey spectra





- Detect stellar continuum with Balmer break
- Emission lines for star forming galaxies, but some blended
  → **Need higher resolution grating observations**

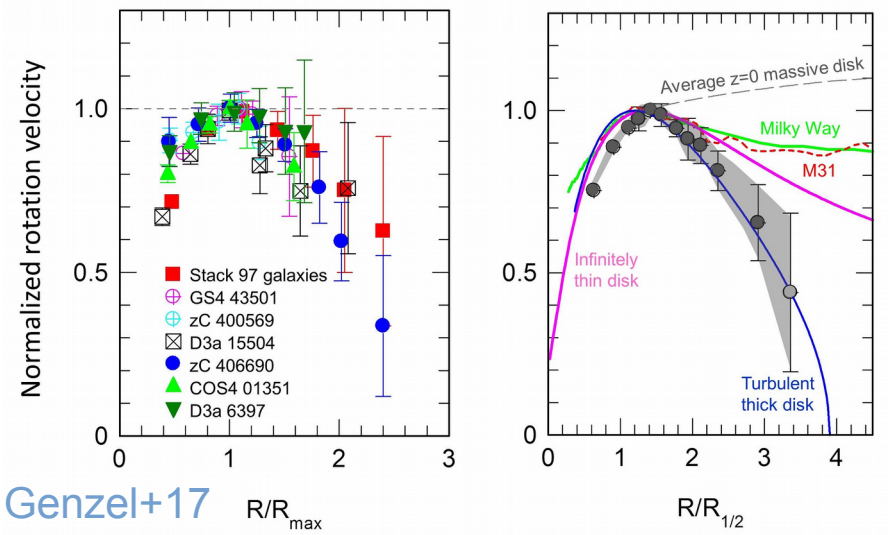
Science case for R2700 resolution



Genzel+17

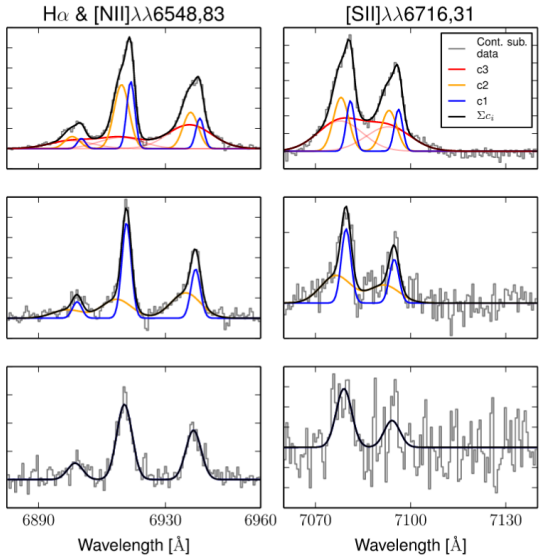
Solve controversy on gas kinematics of high-z galaxies

Science case for R2700 resolution



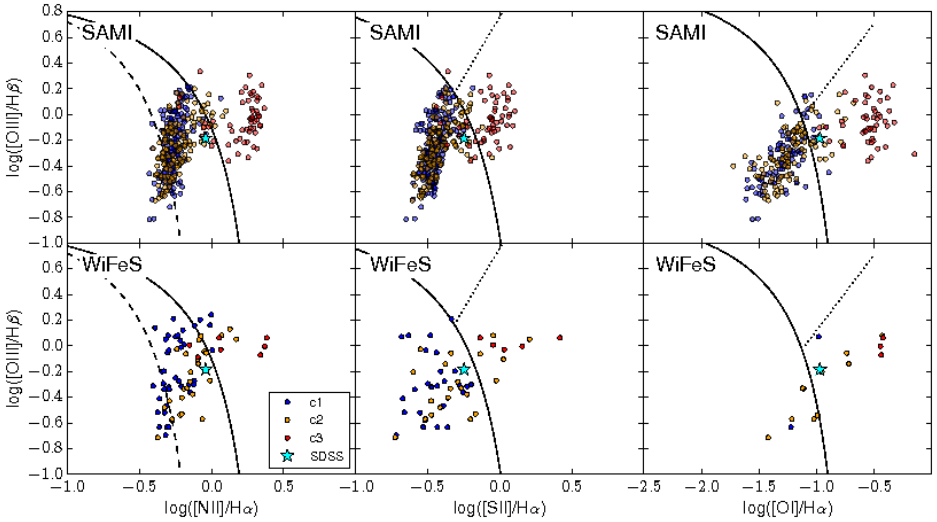
Genzel+17

presence and excitation of outflows

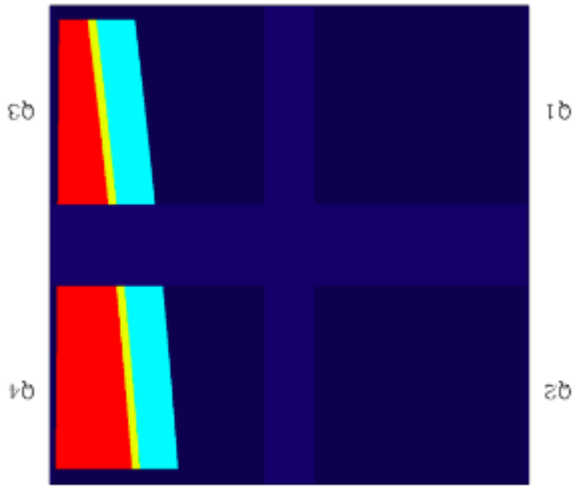


Ho+14

Solve controversy on gas kinematics of high-z galaxies



R2700 grating challenge for WIDE



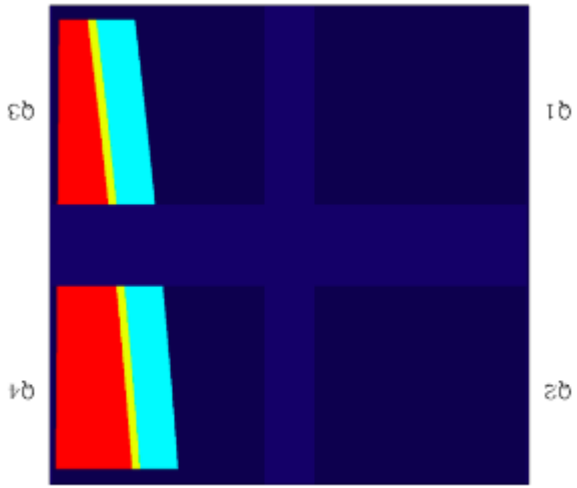
R2700 shutters with full wavelength range:

Light blue: G140H (1.0-1.8μm)

red: G235H (1.7-3.1μm)

Yellow: G395H (2.9-5.2μm)

R2700 grating challenge for WIDE



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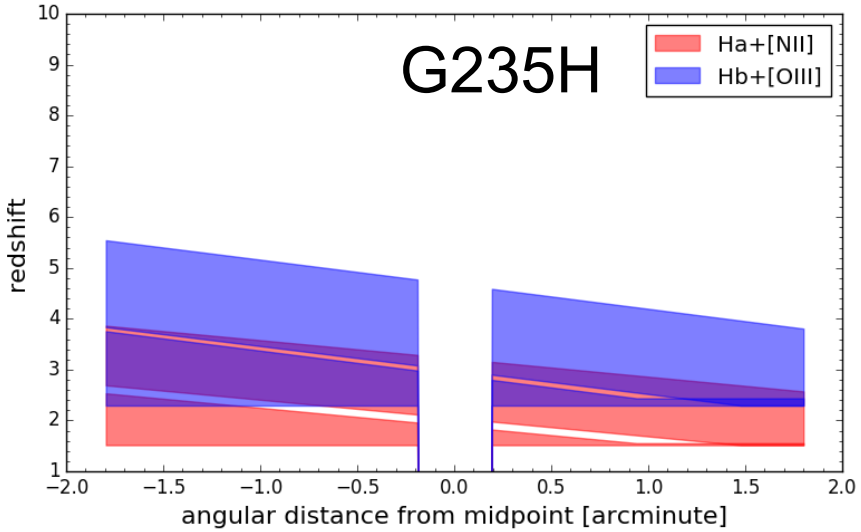
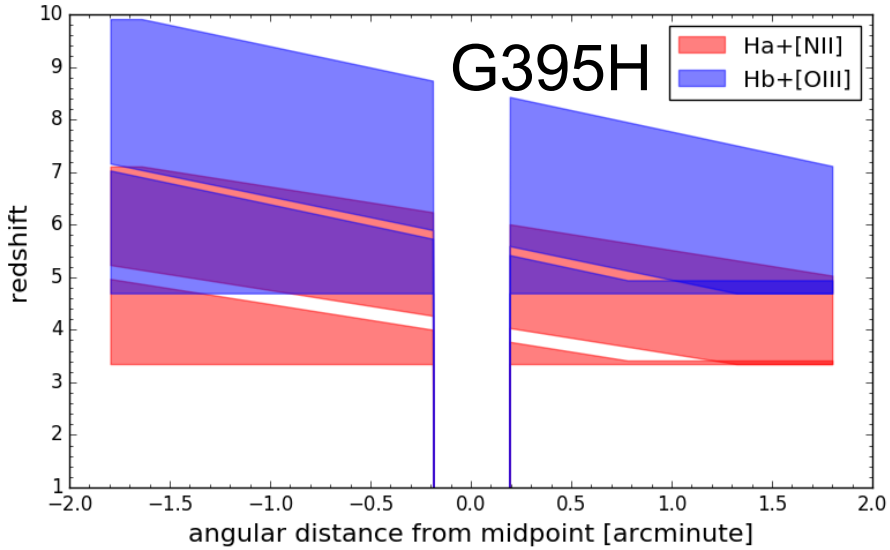
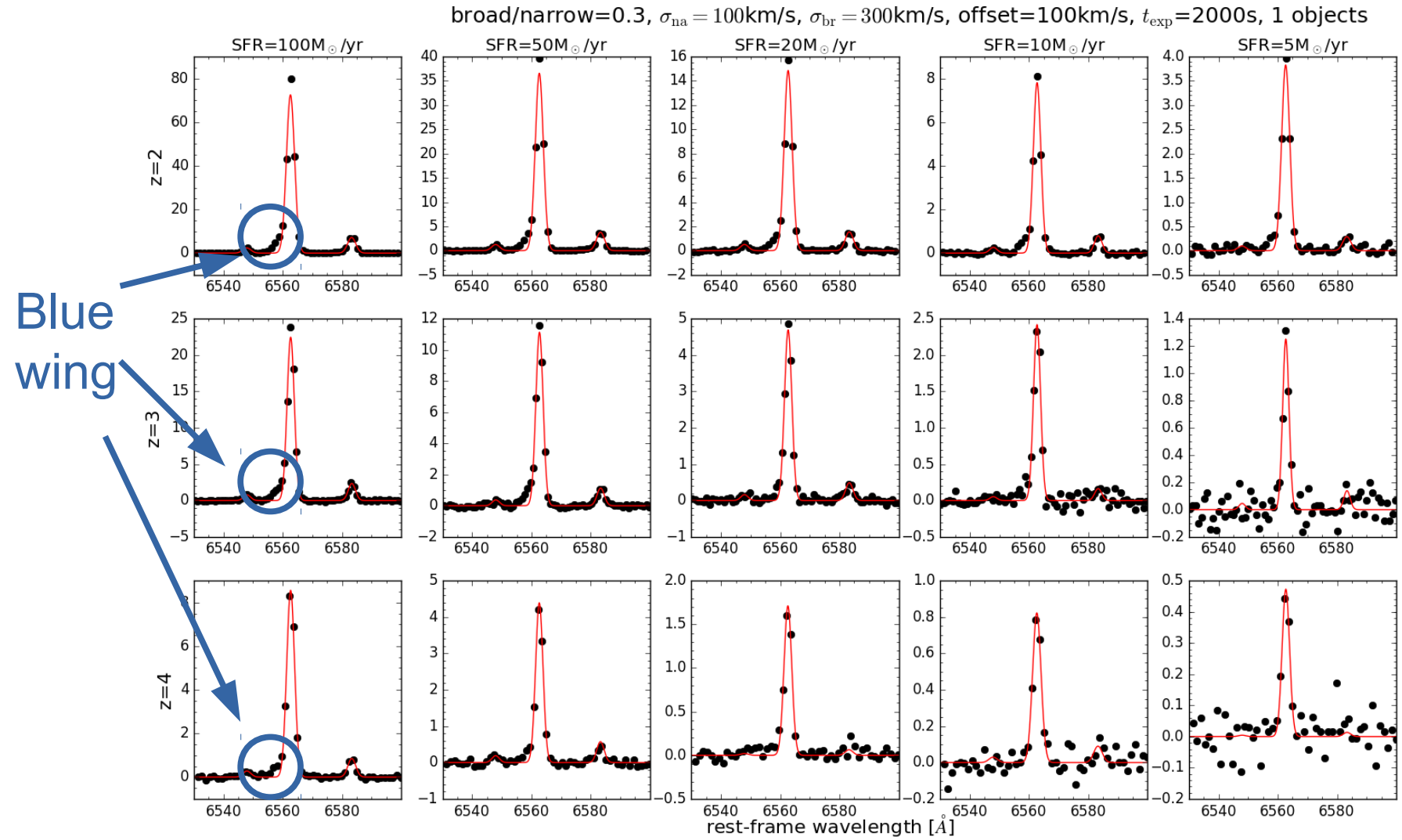
Emission lines can still be observed!





Simulated Hα line outflows shapes



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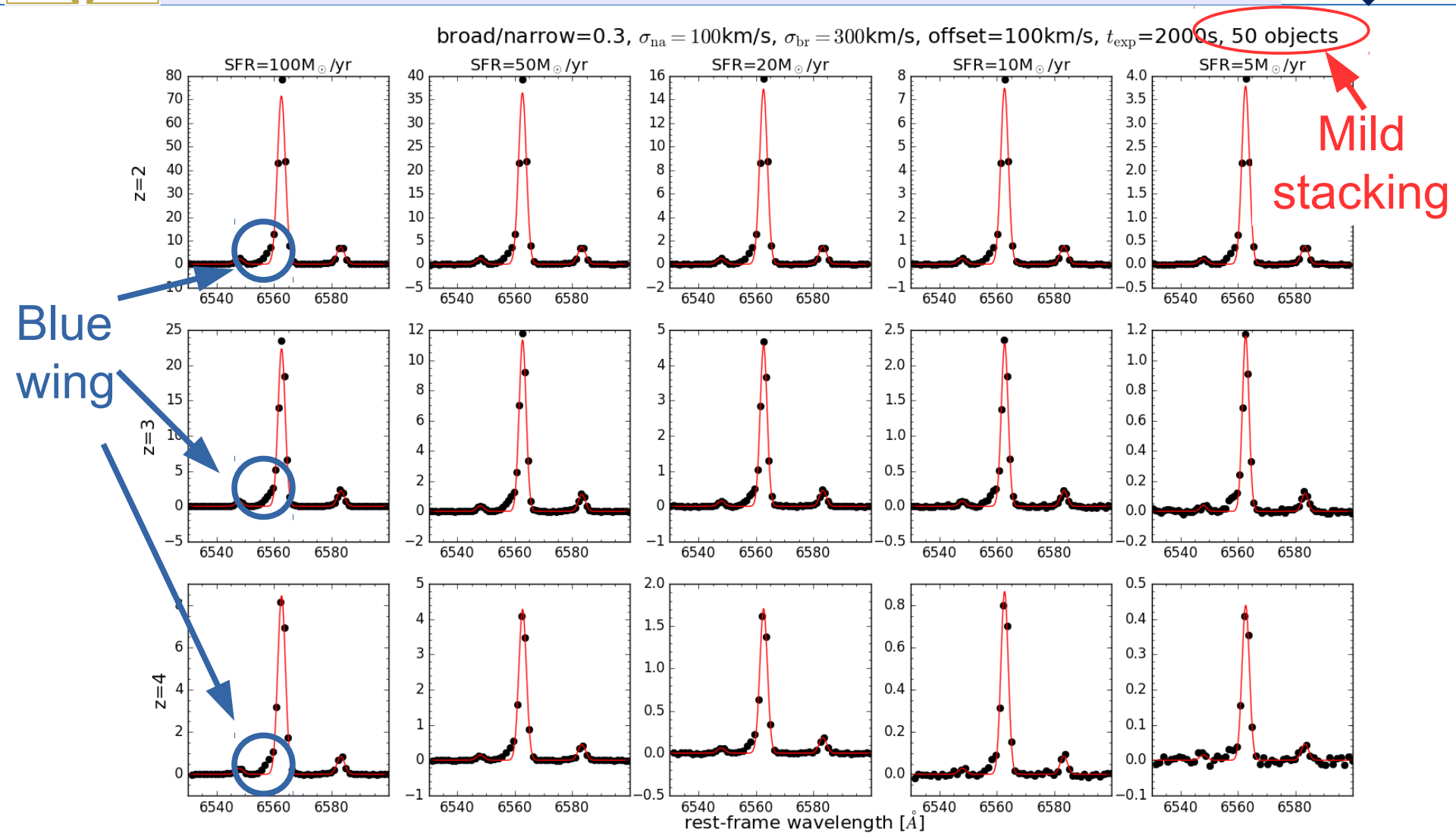


Fast public release plan for WIDE

- **Experience**
  - ➔ Strategies for MSA designs in general
  - ➔ Guidelines for using the R2700 in MOS mode
  - ➔ Possibly advanced software for the MSA design

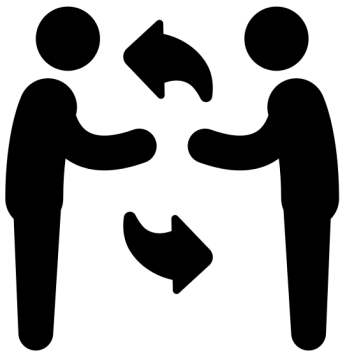
- **Data**
  - ➔ Raw and reduced data for one of the first field
  - ➔ High-level data products on best-effort basis for this field

➔ **Aim is to guide GO Cycle 1/2 proposers, but plan is still being consolidated!**

Summary

NIRSpec GTO surveys will deliver huge legacy datasets to be explored for many science cases

Lot's of the details have still to be worked out
Policies and procedures are being developed



NIRSpec GTO team is planning to share their experience with the community