

HUGO: THE HIGH-Z UNIVERSE GRB OBSERVATORY

SERGIO CAMPANA

INAF - OSSERVATORIO ASTRONOMICO DI BRERA

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M. RIVA, S.J. SMART, N.R. TANVIR, S.D. VERGANI

Comment

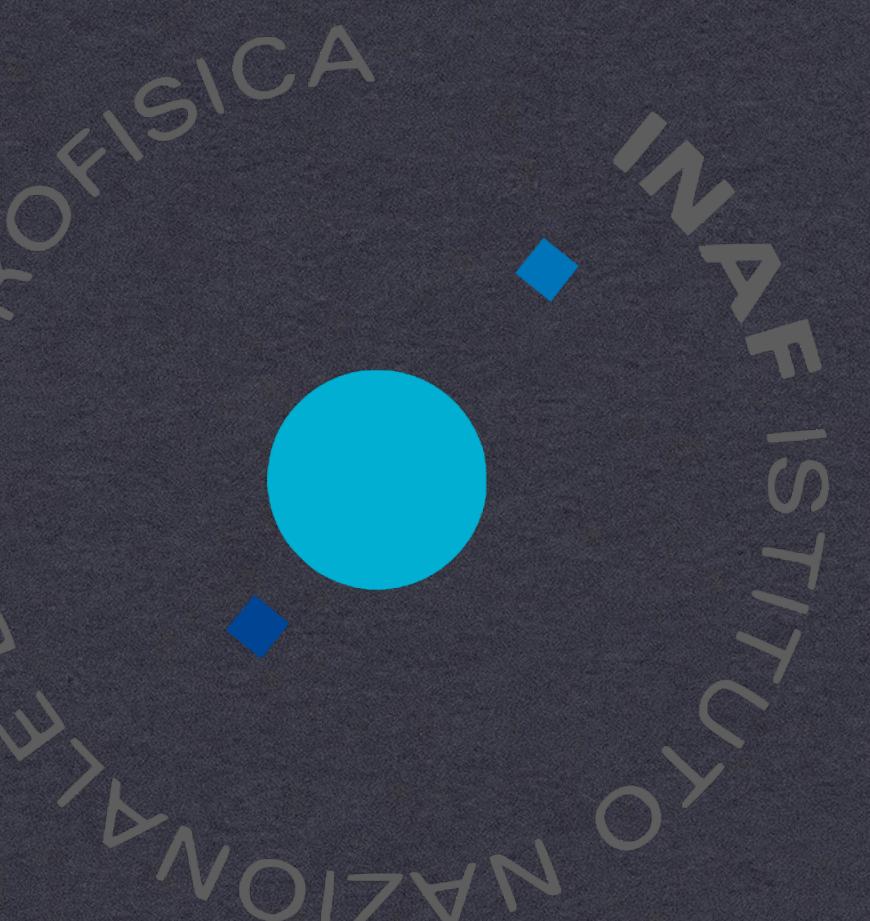
nature astronomy

<https://doi.org/10.1038/s41550-022-01804-x>

Finding high-redshift gamma-ray bursts in tandem near-infrared and optical surveys

S. Campana, G. Ghirlanda, R. Salvaterra, O. A. Gonzalez, M. Landoni, G. Pariani, A. Riva,
M. Riva, S. J. Smartt, N. R. Tanvir and S. D. Vergani

 Check for updates



High-redshift Universe

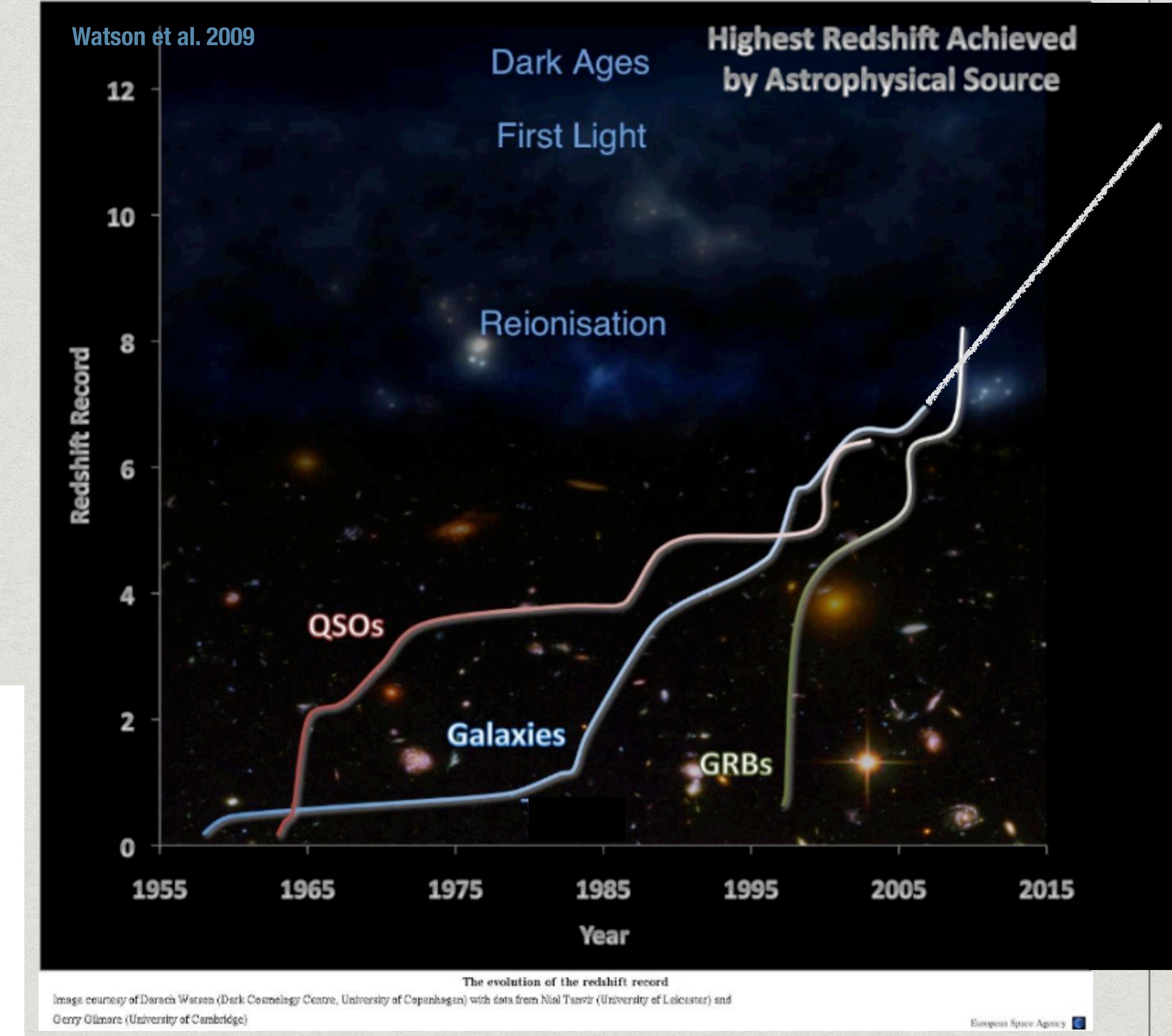
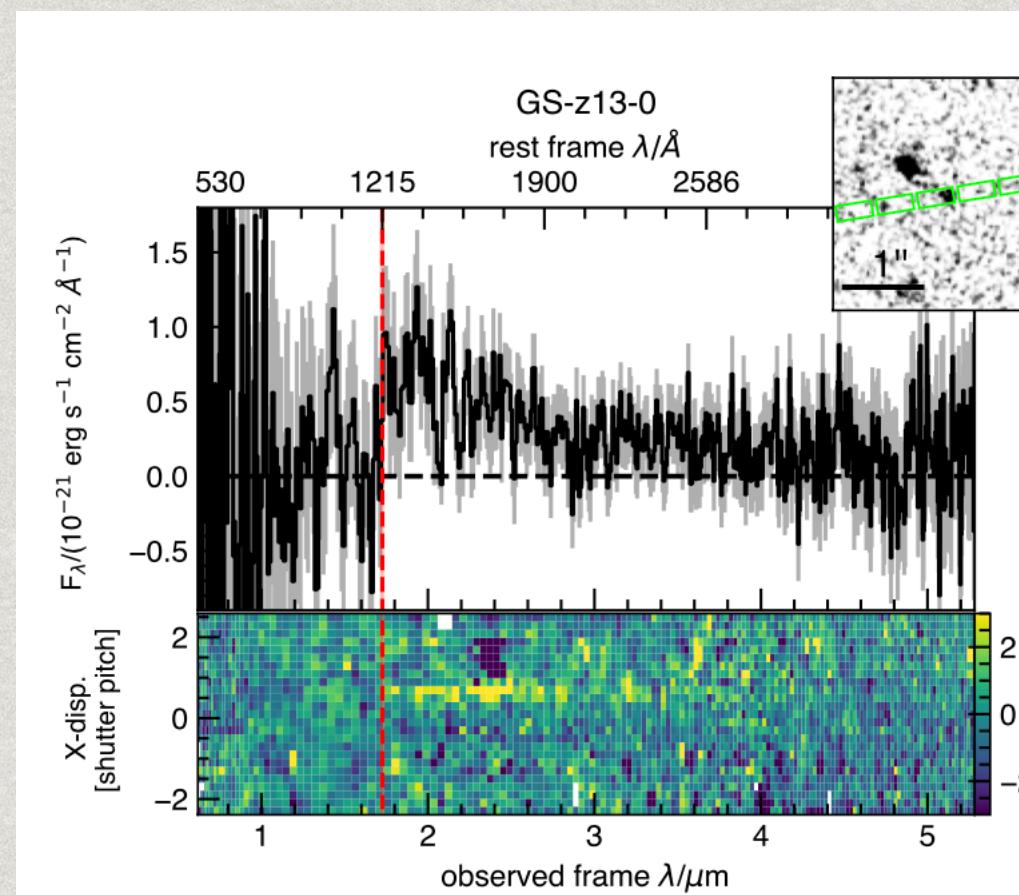
GN-z11 @ H=26 z~11

Candidate JWST z~17

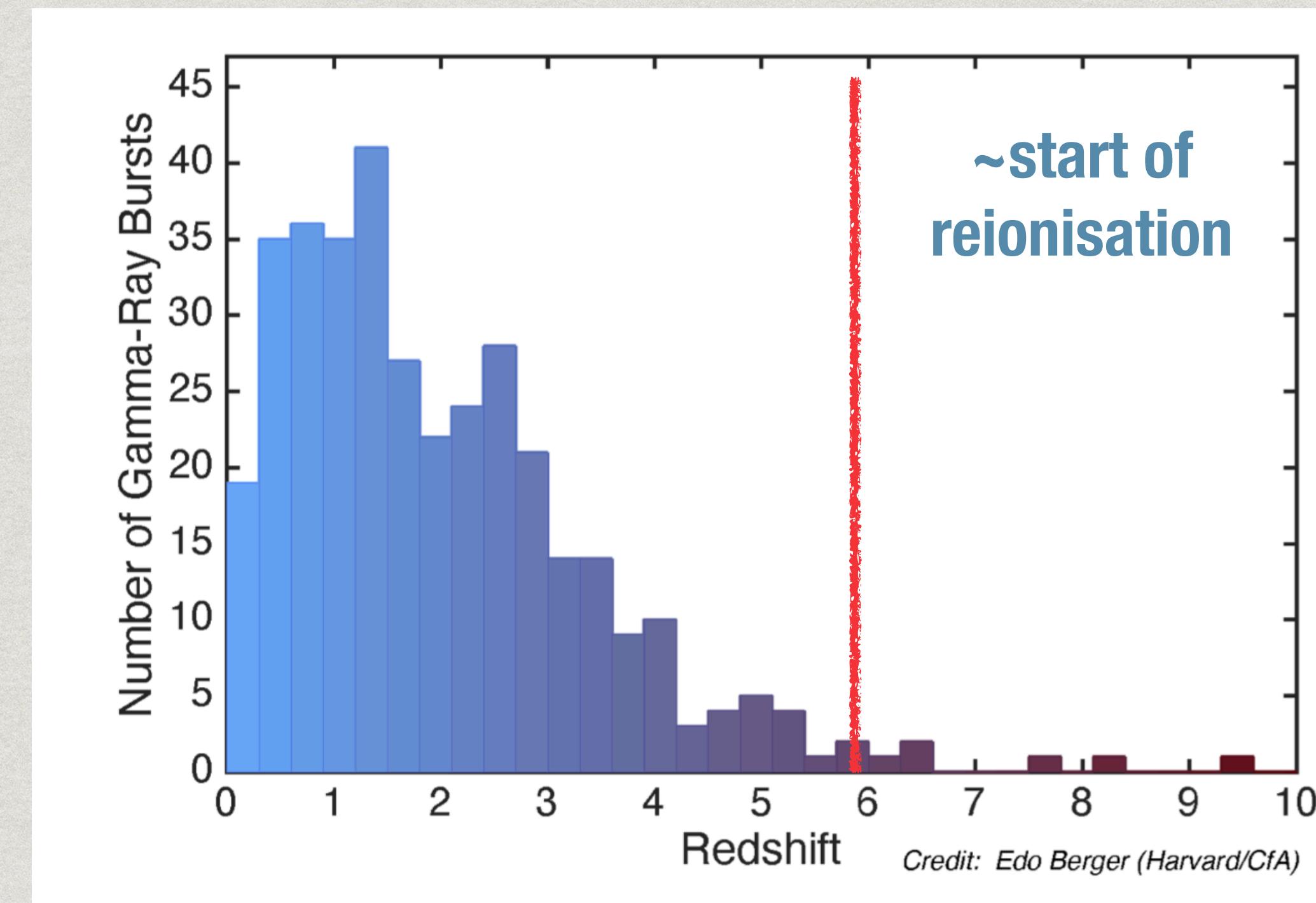
(JADES) GS-z13-0 @ z=13
F200W(HST)>28

~10 hr JWST

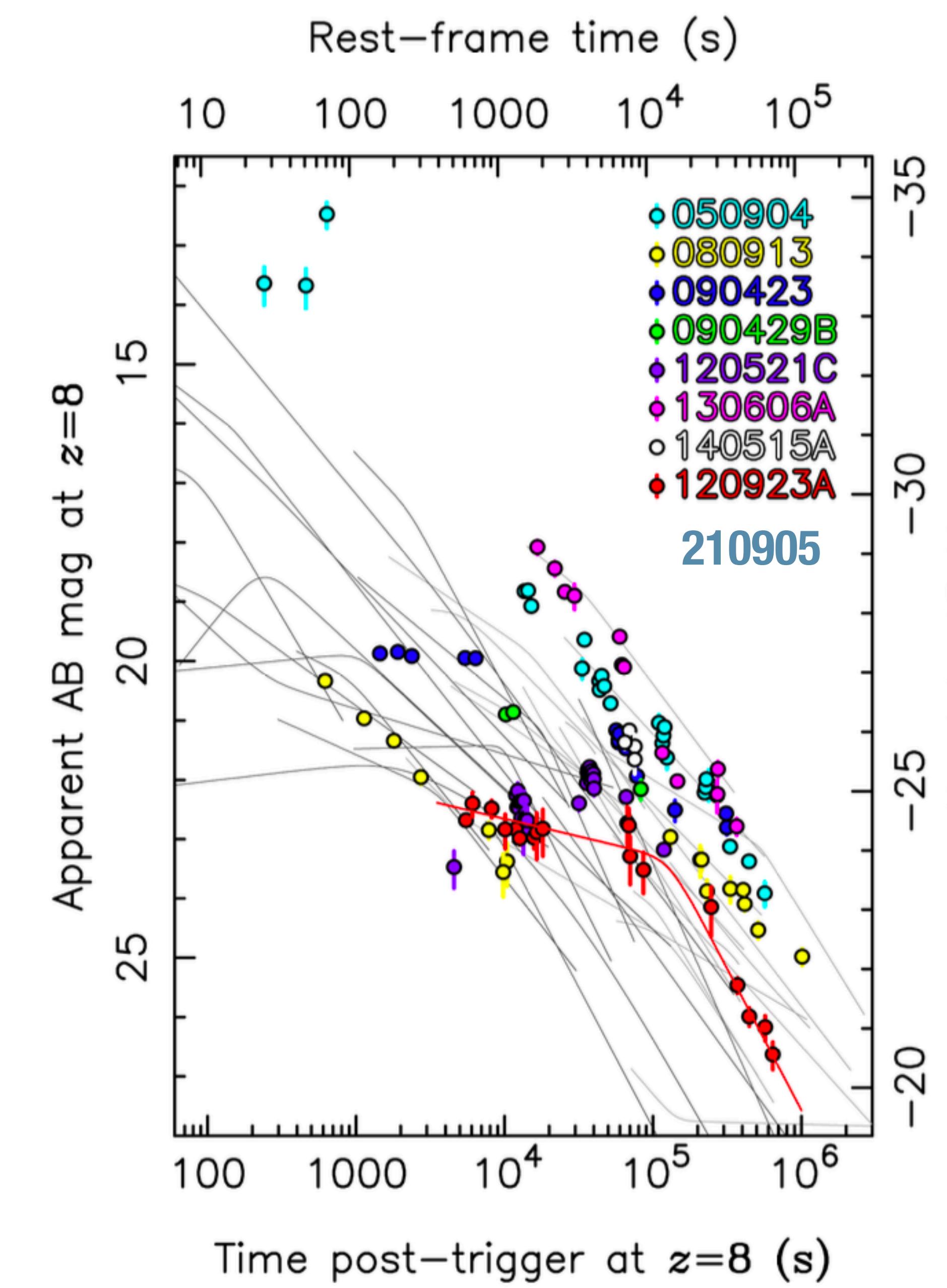
Curtis-Lake et al. 2023



High-redshift Universe: GRBs

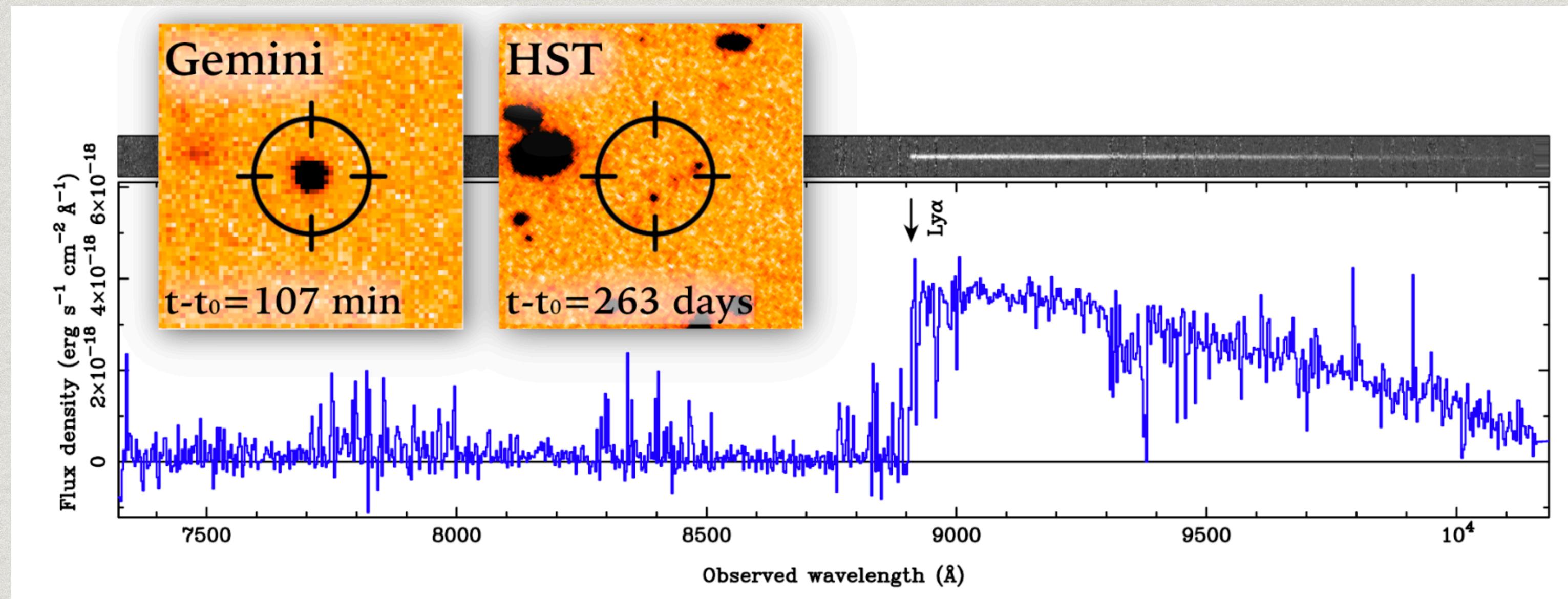
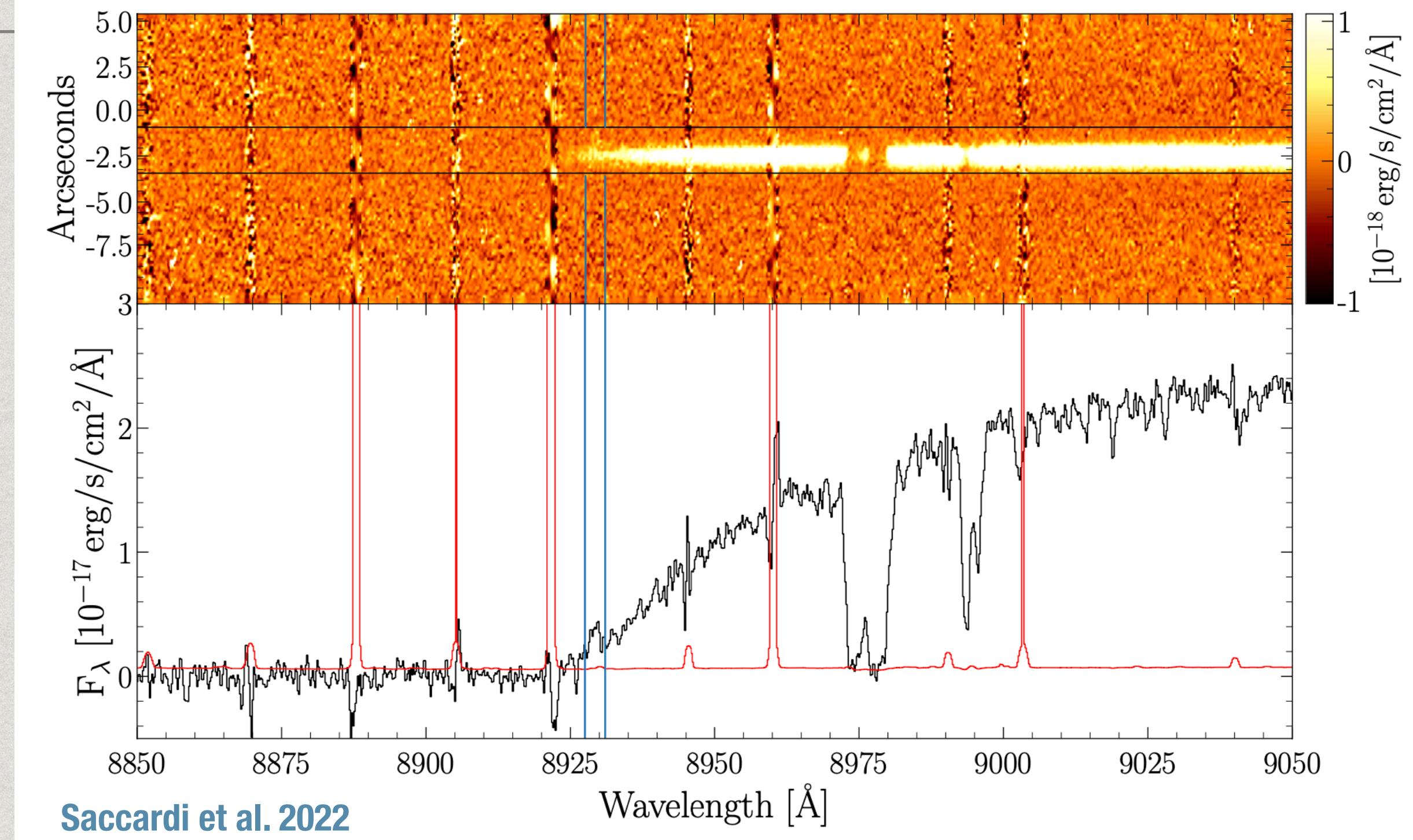


Melandri et al. 2015



High-redshift Universe: GRBs

GRB 050904 @ z=6.3
3.4d after the GRB H~21
Detected with a 25cm telescope!

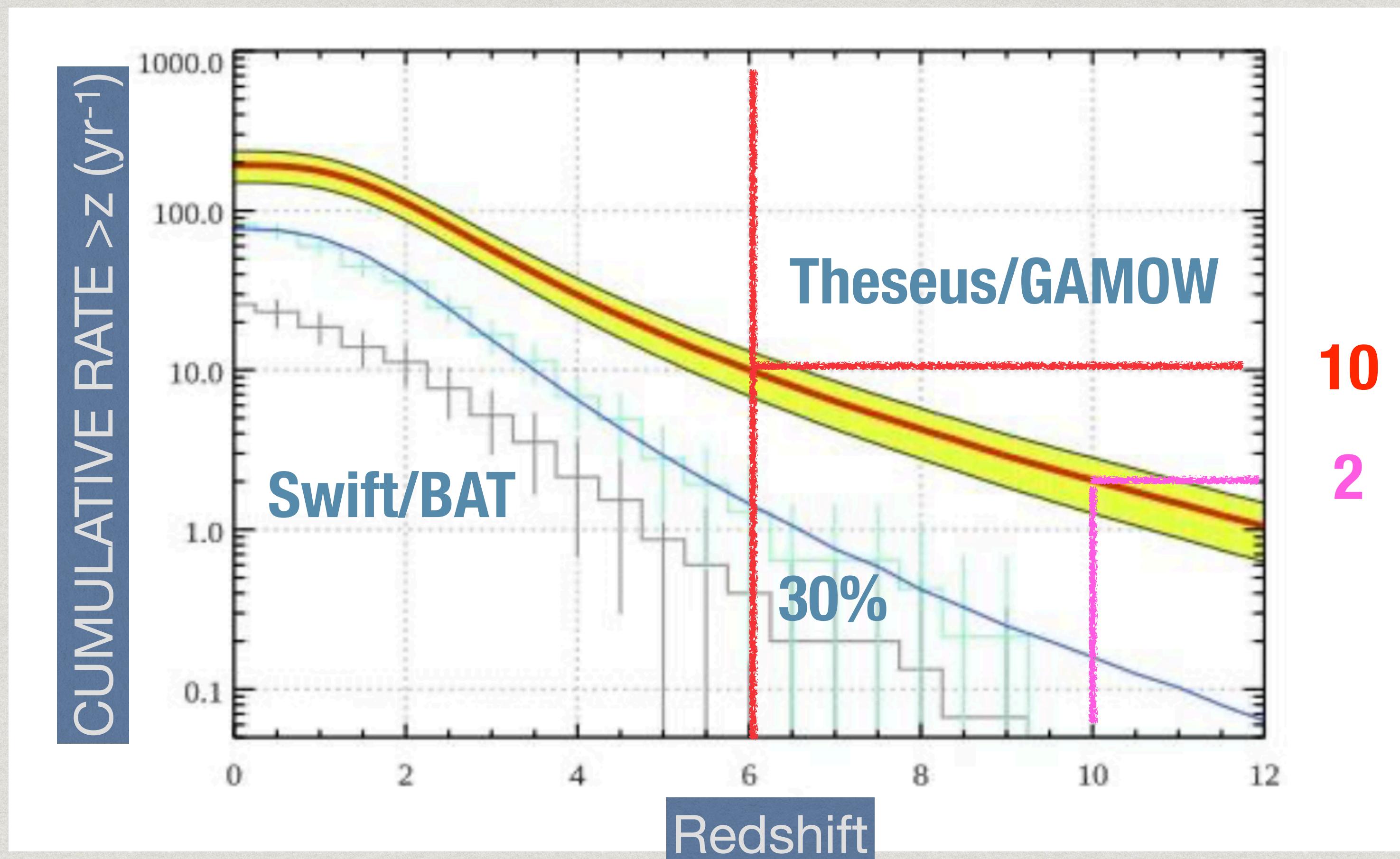


GRB 210905A @ z=6.3
2.3hr after the GRB H~18.4

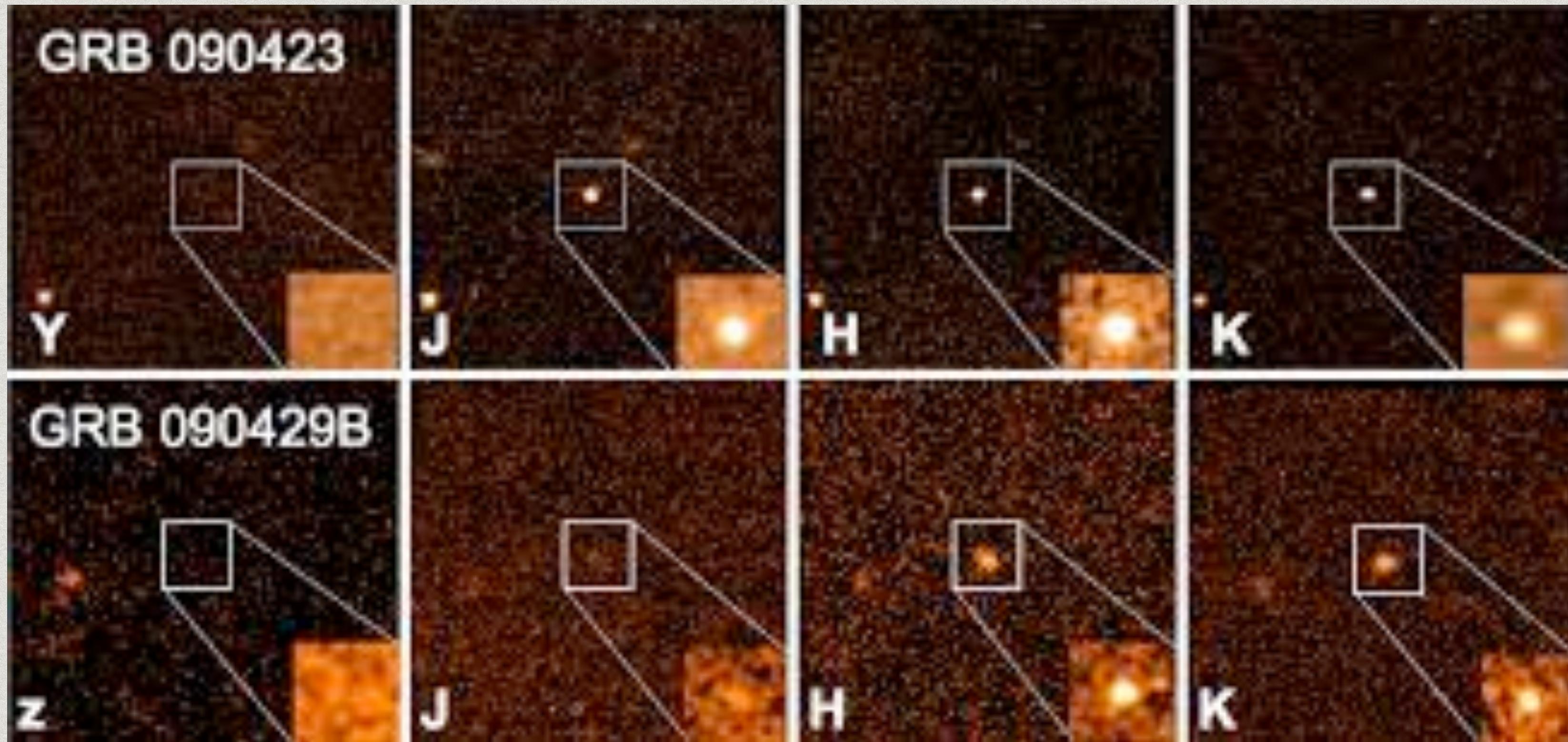
GRB 140515A @ z=6.3
15hr after the GRB H~20.5

Melandri et al. 2015

High-redshift Universe: detections



HUGO's principle

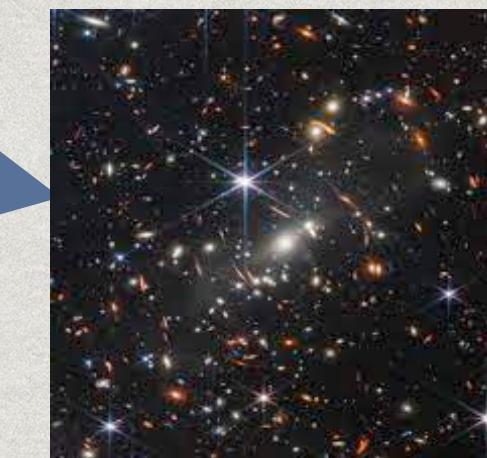


The Universe is working for us

Tandem observations



Vera Rubin Observatory
FOV=9.6 deg²
Exposures~30s
R_{lim}~24.5



**VERY
SAME
field**



HUGO Observatory
FOV=9.6 deg²
Exposures~15+15s
H_{lim}~21

HUGO **RUBIN**



Streams collision

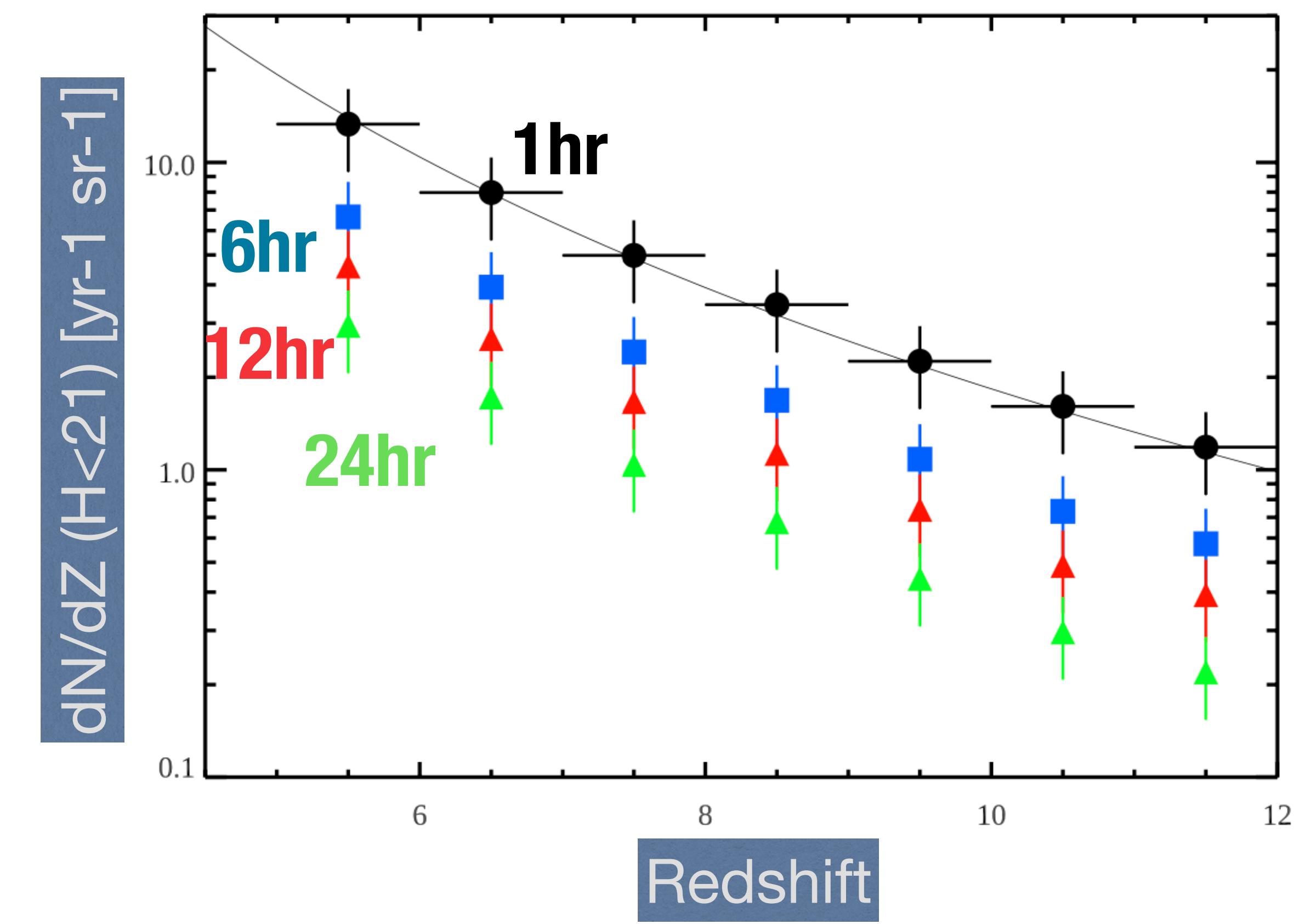
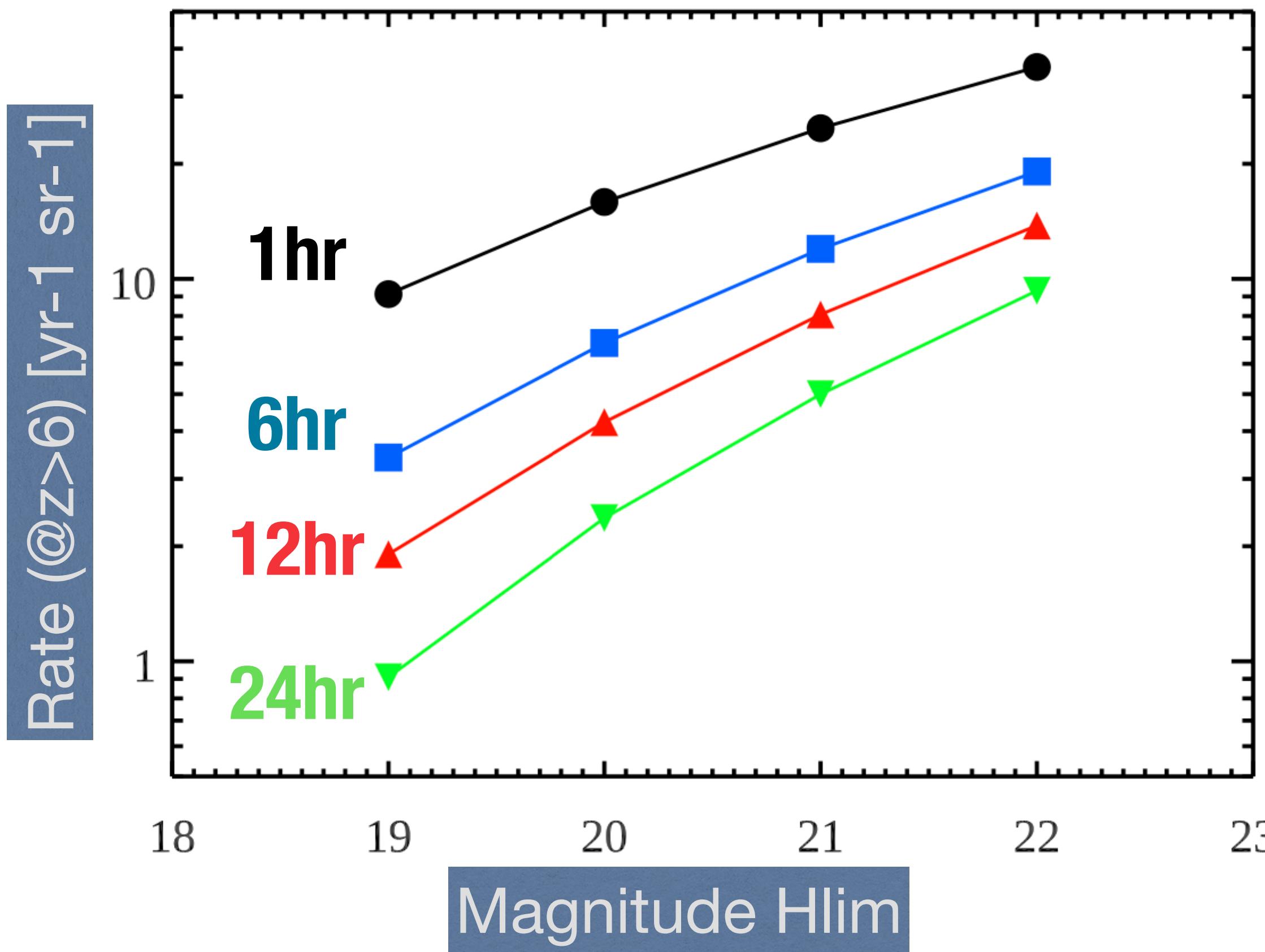


Transients detected in the NIR (H-band) by HUGO
and NOT detected at the same time in the optical (R-band) by VRO,
with a R-H>3.5 and no optical-NIR counterpart
are very strong high-redshift GRBs

SOXS
X-shooter

HUGO predictions

Populations synthesis code by
Ghirlanda & Salvaterra
(same as Theseus and GAMOW)



HUGO predictions

Assume:

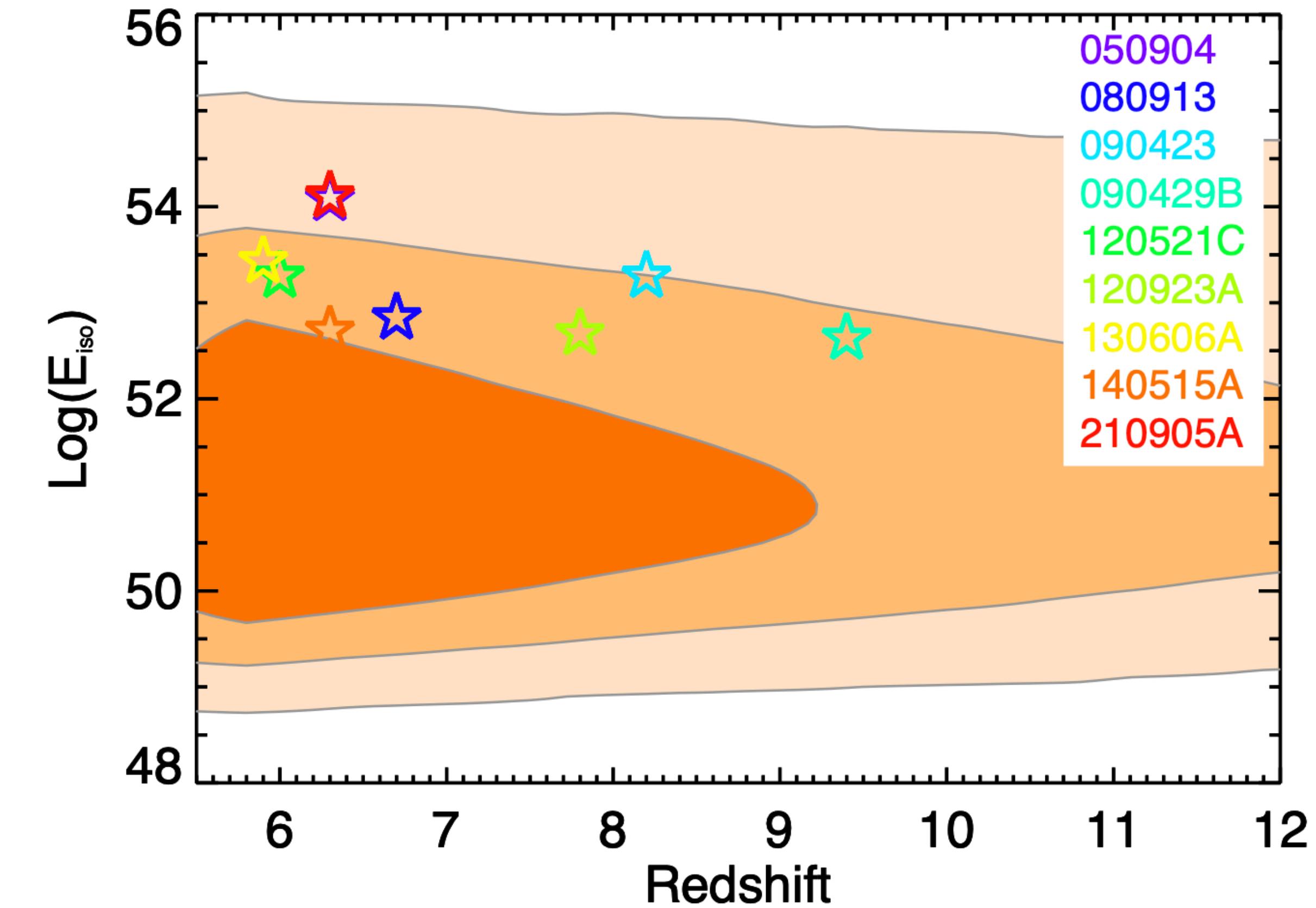
- 10 hr per night
- 80% good weather
- 73% open shutter time

Telescope:

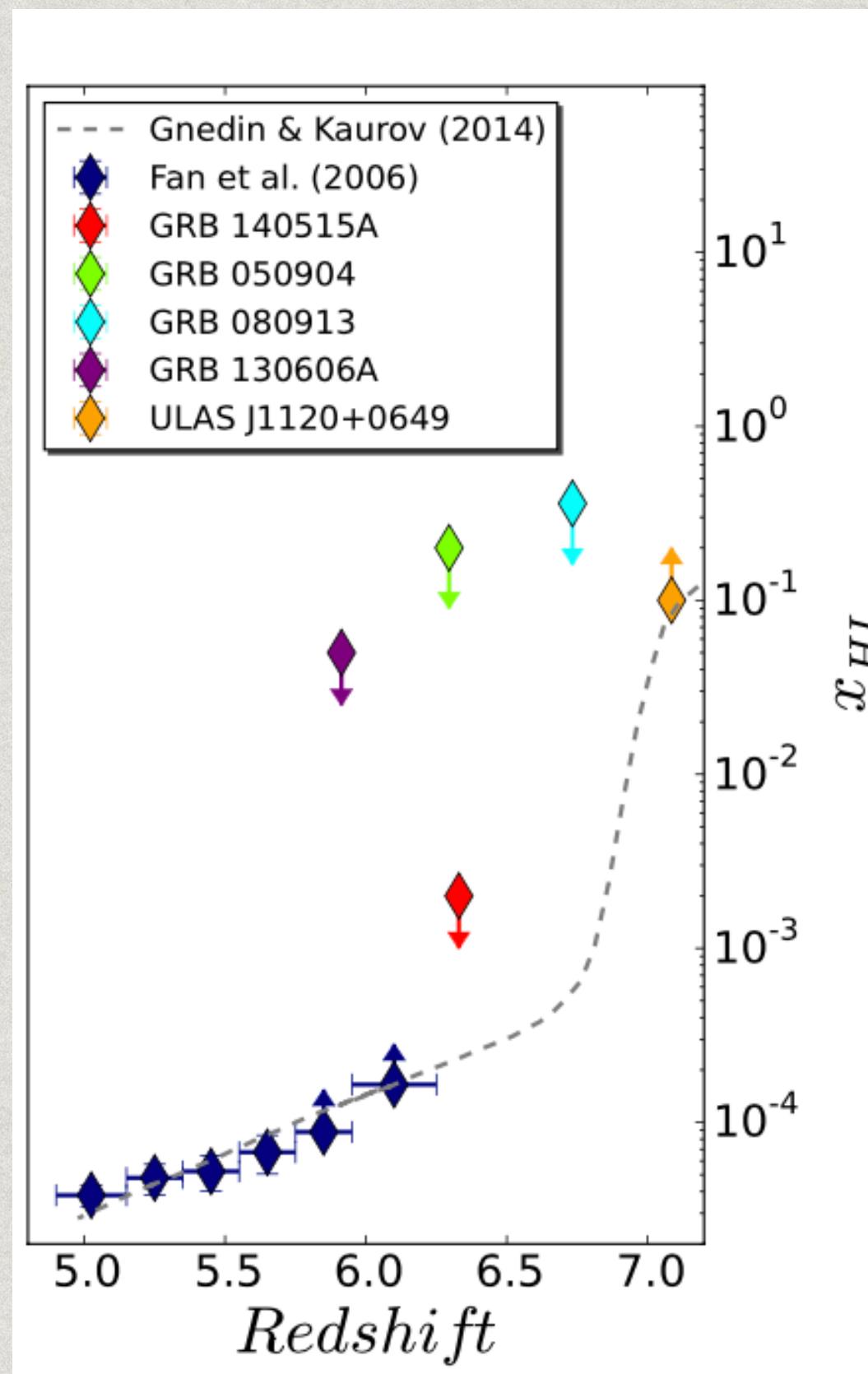
- H~21 in 30s
- Southern hemisphere
- Same FOV as VRO

11.0 GRB /yr @ z>6
2.7 GRB/yr @ z>10

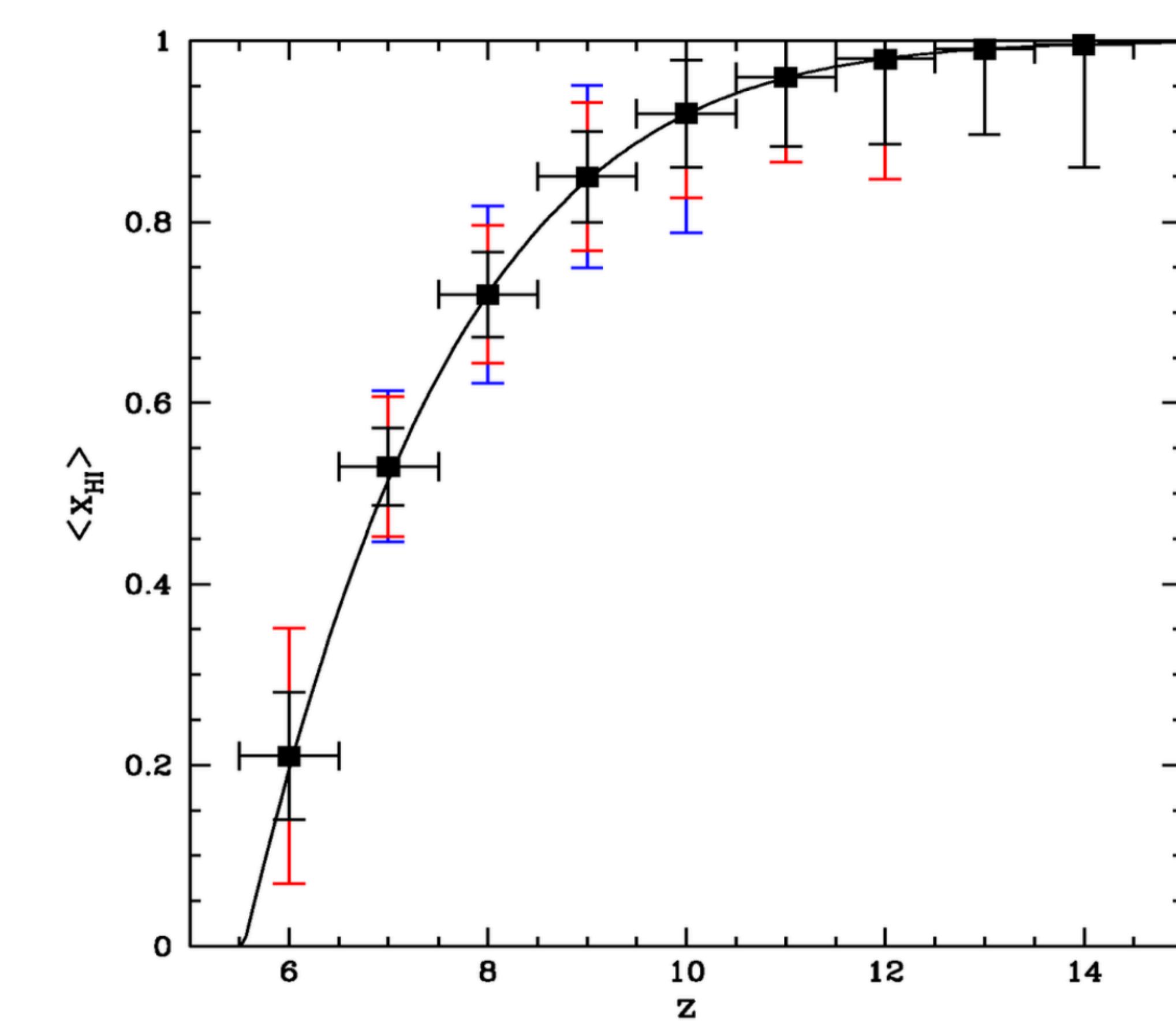
Sampling a different GRB population



Just one scene case: Reionisation



Current
situation



HUGO 2-yr (red)
HUGO 8-yr (Black)

GAMOW paper

HUGO: VRO NIR eye

Fact-sheet for the HUGO project

Science^	#	Telescope+		Budget+	
High-redshift GRBs ($z>6$)	>40	Diameter	~ 3.5 m	Telescope	10-30 M€
High-redshift GRBs ($z>10$)	>4	FOV	~ 10 deg ²	Operations	<5 M€
Kilonovae*	>30	Pixel size	0.5-1.5"	Site	Southern (ESO?)
Transients with Rubin	>4000	$H_{\text{lim}}^{\$}$ @ 30 s	~ 21	Robotic	Yes

^ 4 yr time-frame

* depending on the rate of GW triggers

+ to be defined by this study

\\$ H-band 5 σ limiting AB magnitude in 30 s exposure (same as Rubin LSST)



Telescope	Instrument	Total Exposure time to SNR=5
TNG (3.6m)	NICS	190 s
UKIRT (3.8m)	WFCAM	132 s
CFHT (3.6m)	WIRCAM	114 s
NTT (3.6m)	SOFI	84 s
GeminiN (8.1m)	NIRI	75 s
VISTA (4.1m)	VIRCAM	70 s
GeminiS (8.1m)	FLAMINGO2	60 s
LBT (8.4m)	LUCI	47 s
Keck (10m)	OSIRIS	40 s
Subaru (8.3m)	MOIRCS	18 s
GTC (10.4m)	CIRCE	8 s
VLT (8.2m)	HAWK-I	8 s