DINGO: Design Study

Martin Meyer, Arniston, 2010

Image credit: Swinburne

DINGO Team

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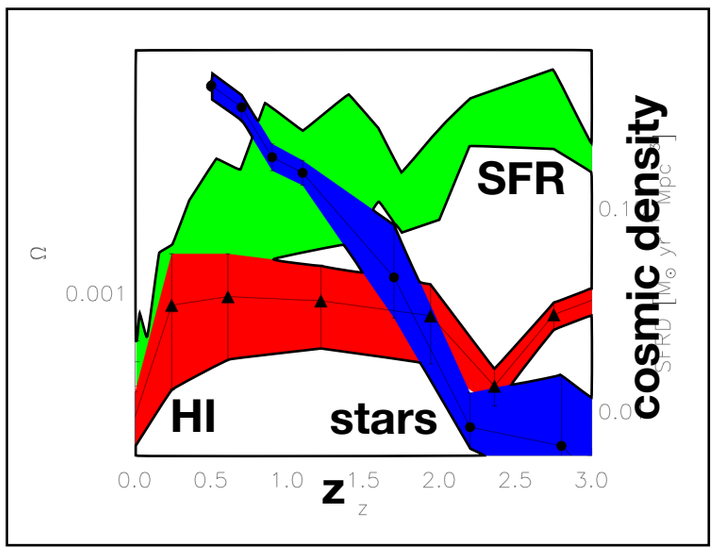
Goals

How Does Ω_{HI} Evolve?

- How does the cosmic density of HI evolve?
- How do we explain Ω_{HI} cf. Ω_{SFR}?



How Does the HI Cosmic Web Evolve?

- How does the distribution of HI in the universe evolve?
- What factors does this depend on? (environment, halo mass etc)

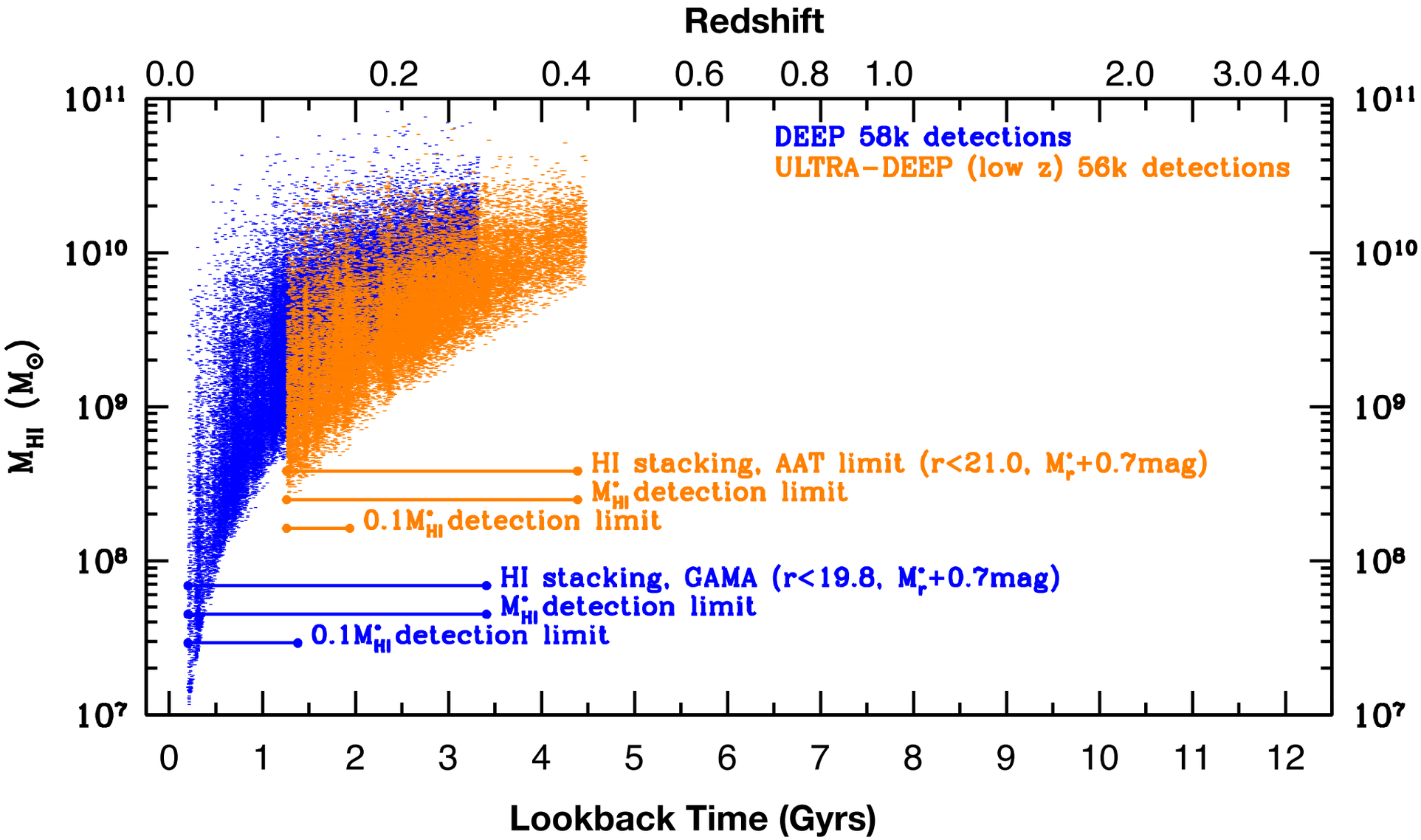
DINGO Science Questions

What Drives Galaxy Formation and Evolution?

- What regulates the baryonic processes in galaxies? (*multiwavelength*)
- What star formation efficiencies and gas infall rates are required?
- What are the halo properties of gas-rich galaxies?
- How does the Tully-Fisher relation evolve?

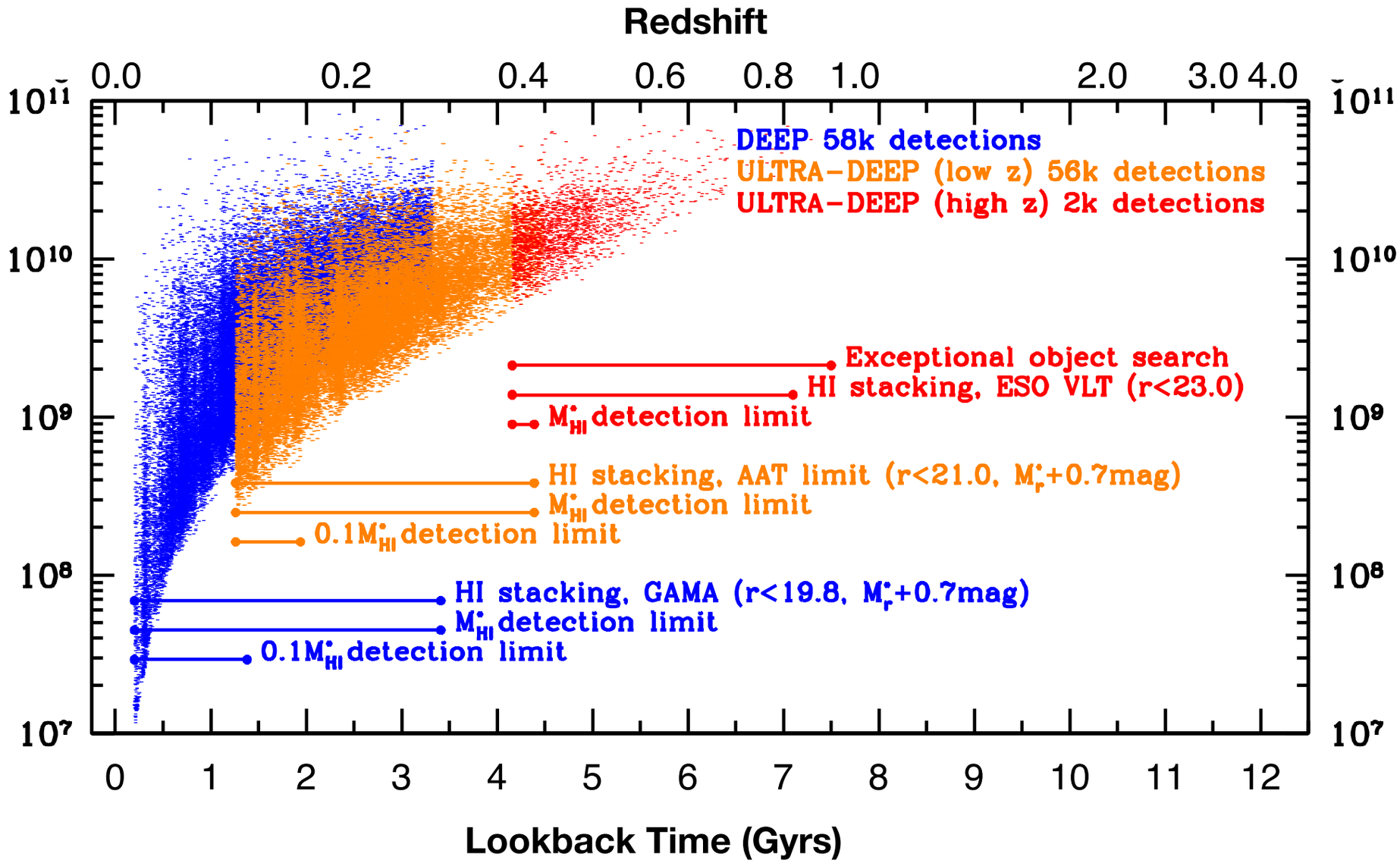
DINGO Observations

- **Deep**: 150 deg^2, 0 < z< 0.26, 500 hours/pointing
- **Ultradeep**: 60 deg^2, 0.1 < z< 0.43, 2500 hours/pointing



0.4 < z < 1.0

- **Deep**: 150 deg^2, 0 < z< 0.26, 500 hours/pointing
- **Ultradeep**: 60 deg^2, 0.1 < z< 0.43, 2500 hours/pointing
- **Ultradeep high-z**: 30 deg^2, 0.4 < z < 1, 2500 hours/pointing



Blind HI Pathfinder Surveys

	WALLABY	DINGO Deep	DINGO Ultradeep	MeerKAT Ultradeep I	MeerKAT Ultradeep II
Area	~30,000 deg^2	150 deg^2	60 deg^2	2+ deg^2	1+ deg^2
Hours/Field	8	500	2500	1000	4000
Detections	5x10^5	~6x10^4	~6x10^4	~10^4	~2x10^4
Redshift	z<0.26	0.0<z<0.26	0.1<z<0.43	0<z<0.58	0<z<1.4
Cube Pixels	2,048x2,048 (10”)	2,048x2,048 (10”)	2,048x2,048 (10”)	1,800x1,800 (2”)	1,800x1,800 (2”)
Cube Channels	16,384 (4 km s^{-1})	16,384 (4 km s^{-1})	16,384 (4 km s^{-1})	16,384	16,384
Observations (~10hr)	1200 (330 TB)	250 (69 TB)	500 (138 TB)	200 (40 TB)	400 (80 TB)
Final Cubes	1200 (330 TB)	5 (1.38 TB)	2 (550 GB)	2 (400 GB)	1 (200 GB)

Blind HI Pathfinder Surveys

	WALLABY	DINGO Deep	DINGO Ultradeep	MeerKAT Ultradeep I	MeerKAT Ultradeep II
Area	~30,000 deg^2	150 deg^2	60 deg^2	2+ deg^2	1+ deg^2
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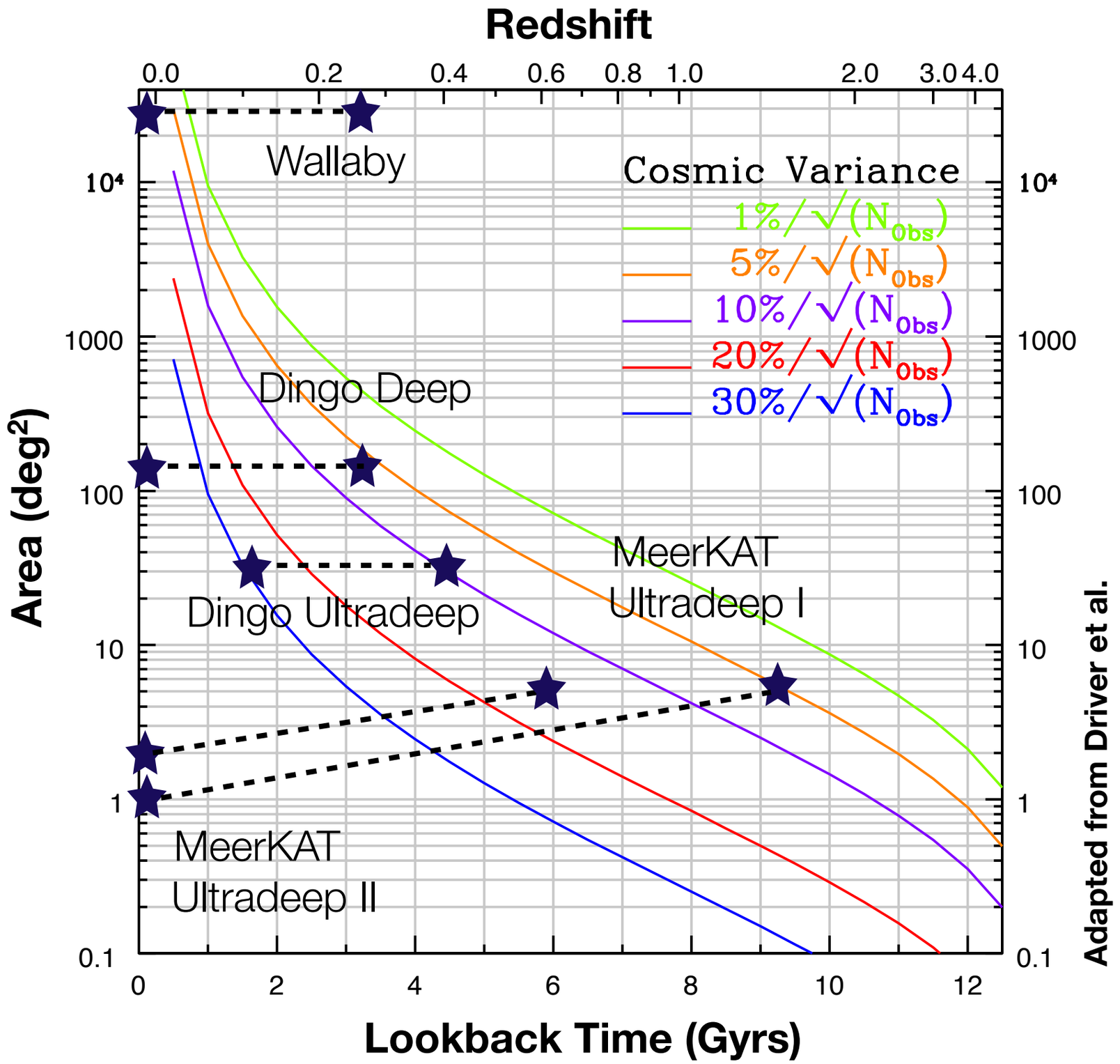
Detections	5x10^5	~6x10^4	~6x10^4	~10^4	~2x10^4
Redshift	z<0.26	0.0<z<0.26	0.1<z<0.43	0<z<0.58	0<z<1.4
Cube Pixels	2,048x2,048 (10”)	8,192x8,192 (10”→3”)	8,192x8,192 (10”→3”)	1,800x1,800 (2”)	1,800x1,800 (2”)
Cube Channels	16,384 (4 km s^{-1})	16,384 (4 km s^{-1})	16,384 (4 km s^{-1})	16,384	16,384
Observations (~10hr)	1200 (330 TB)	250 (1.1 PB)	500 (2.2 PB)	200 (40 TB)	400 (80 TB)
Final Cubes	1200 (330 TB)	5 (22 TB)	2 (8.8 TB)	2 (400 GB)	1 (200 GB)

HI Survey Areas and Sensitivities

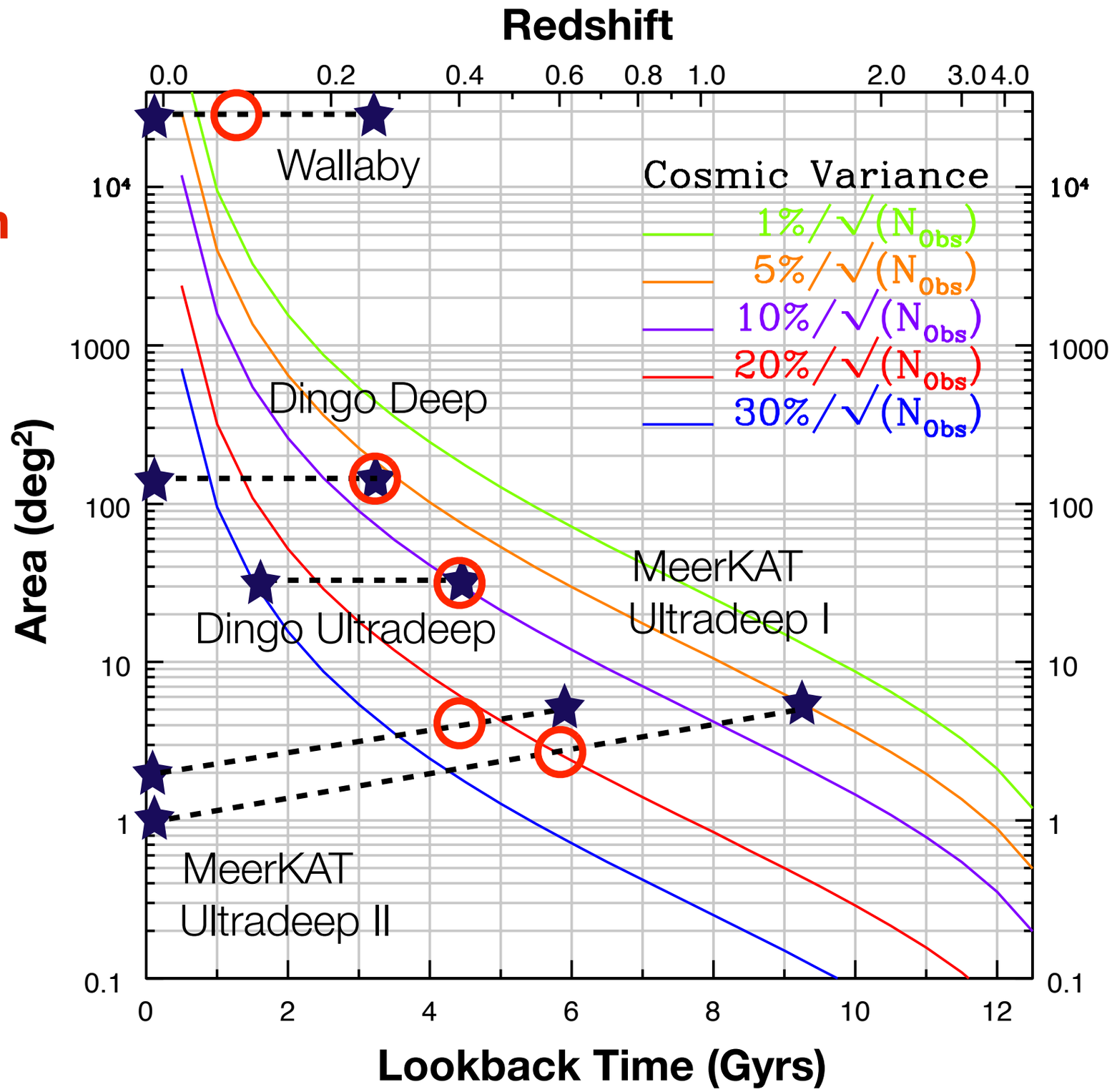
★--★ z limits



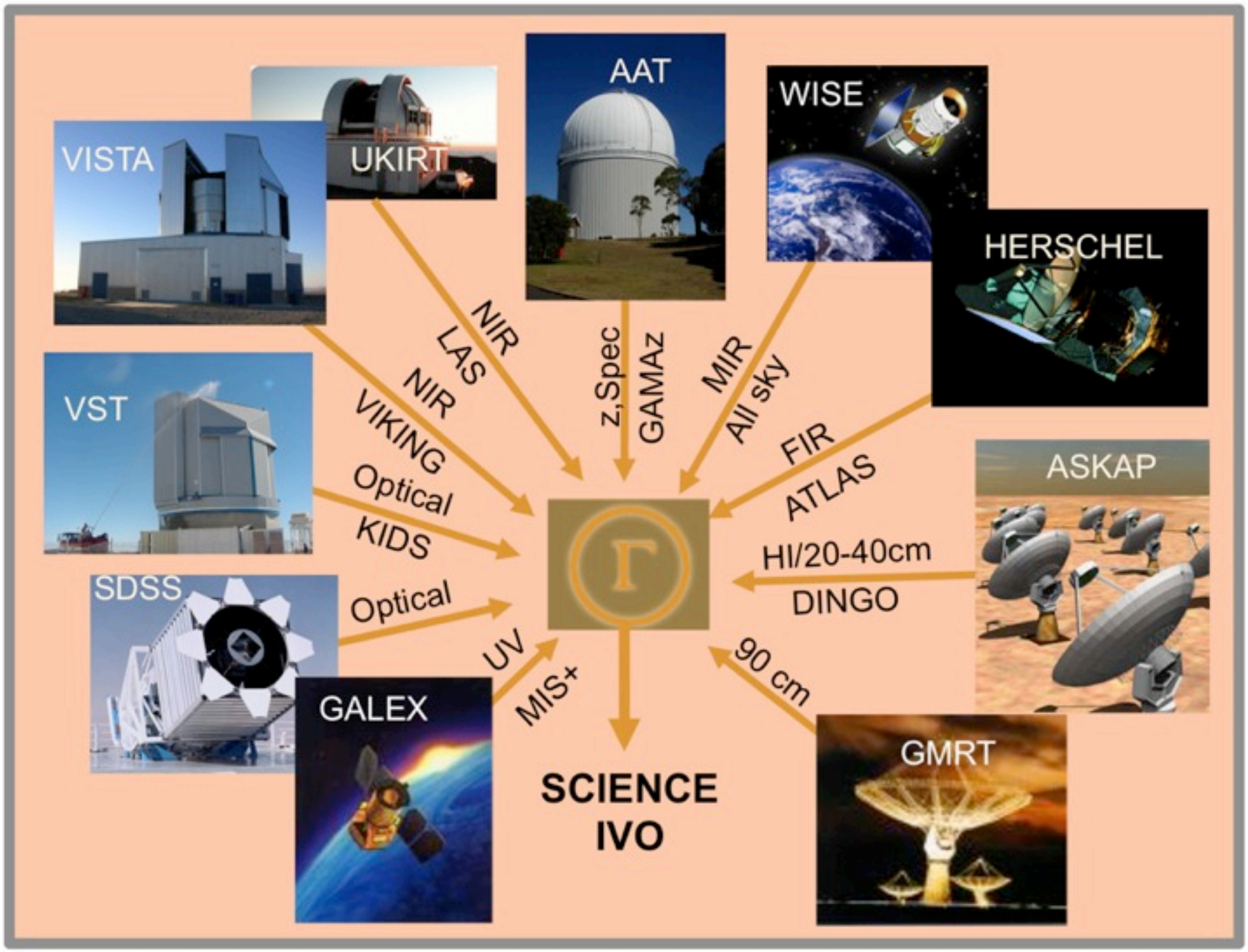
HI Survey Areas and Sensitivities

★--★ z limits

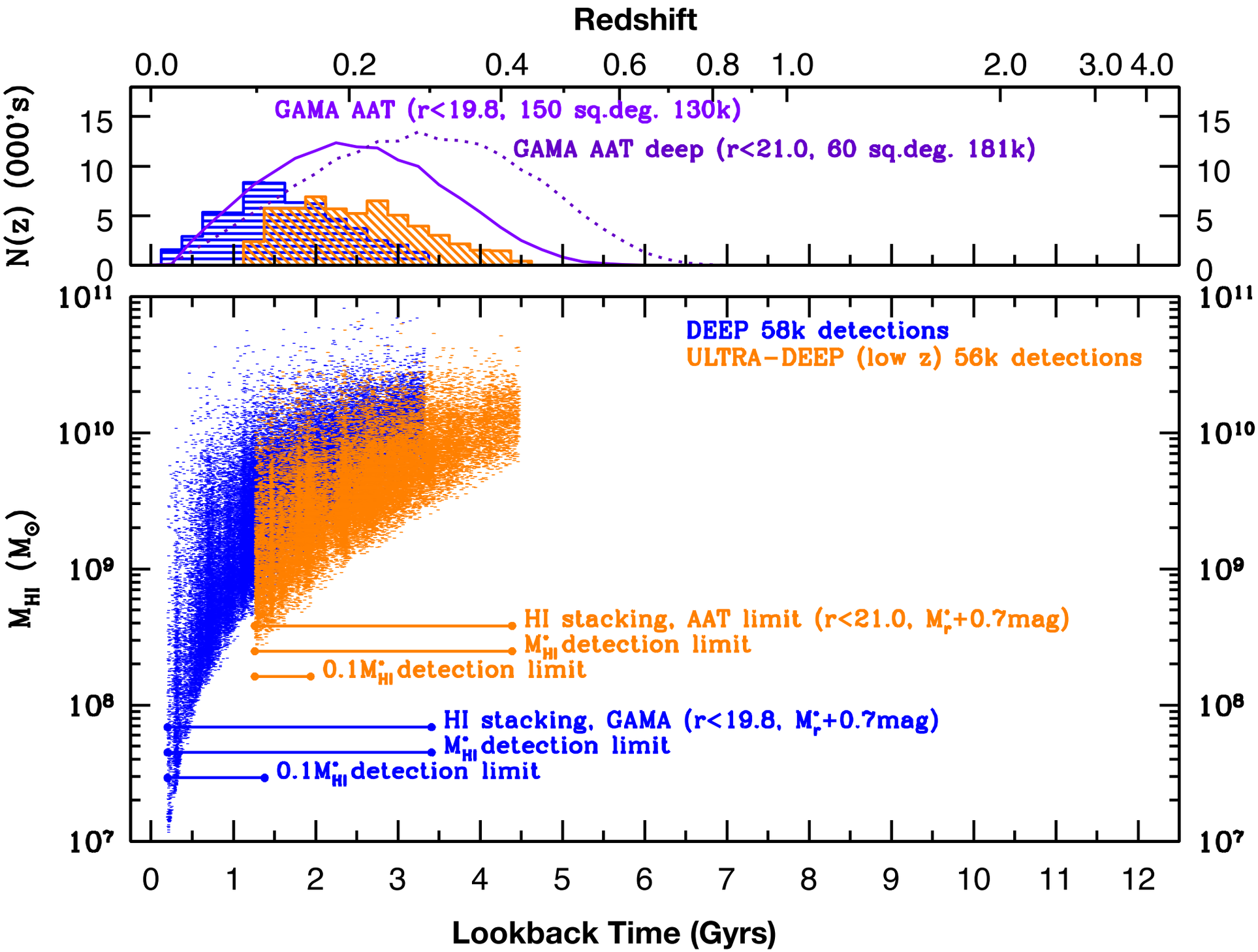
○ M_{HI}* detection limit



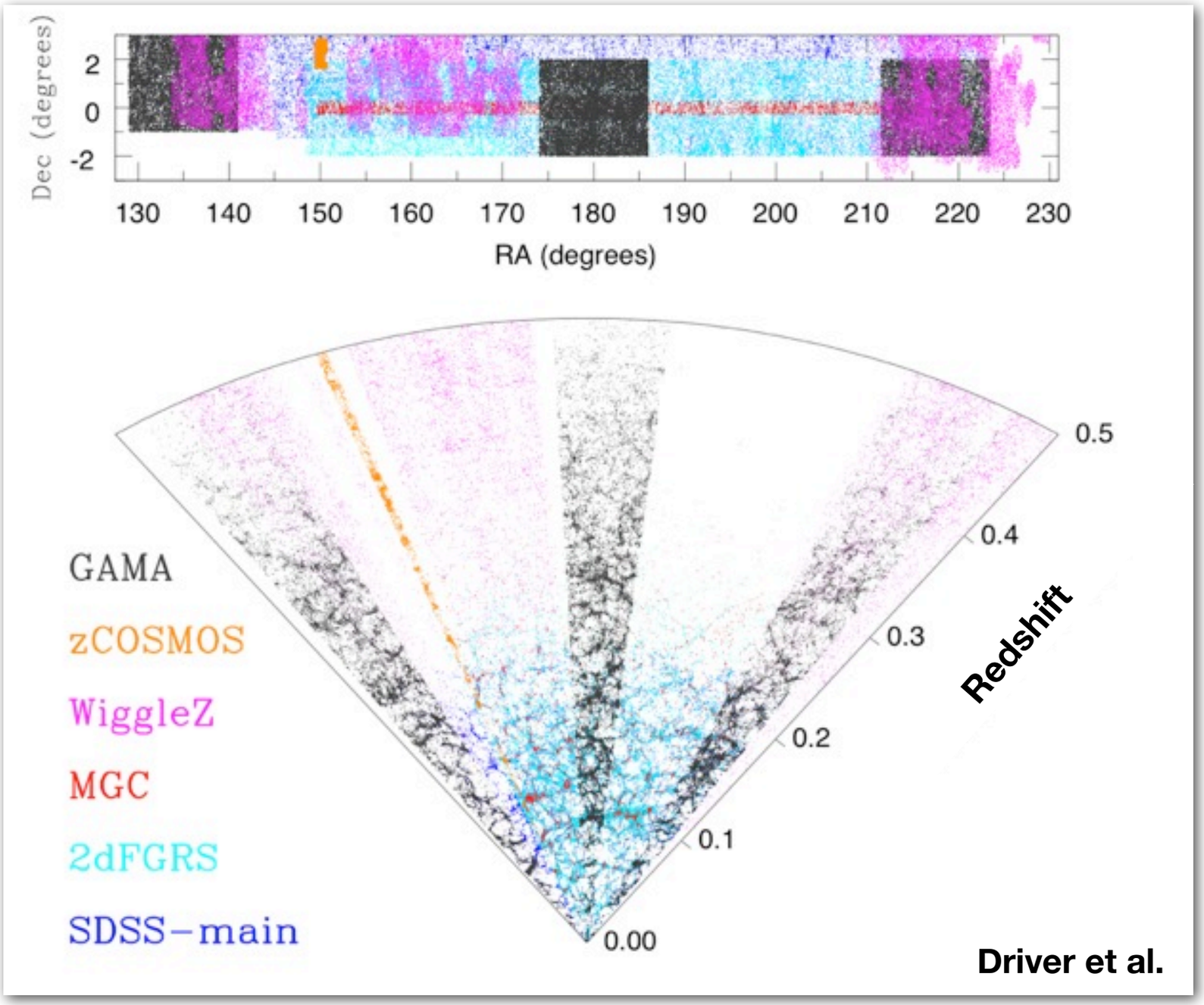
GAMA - the Multiwavelength Data



GAMA Redshifts



GAMA Redshifts



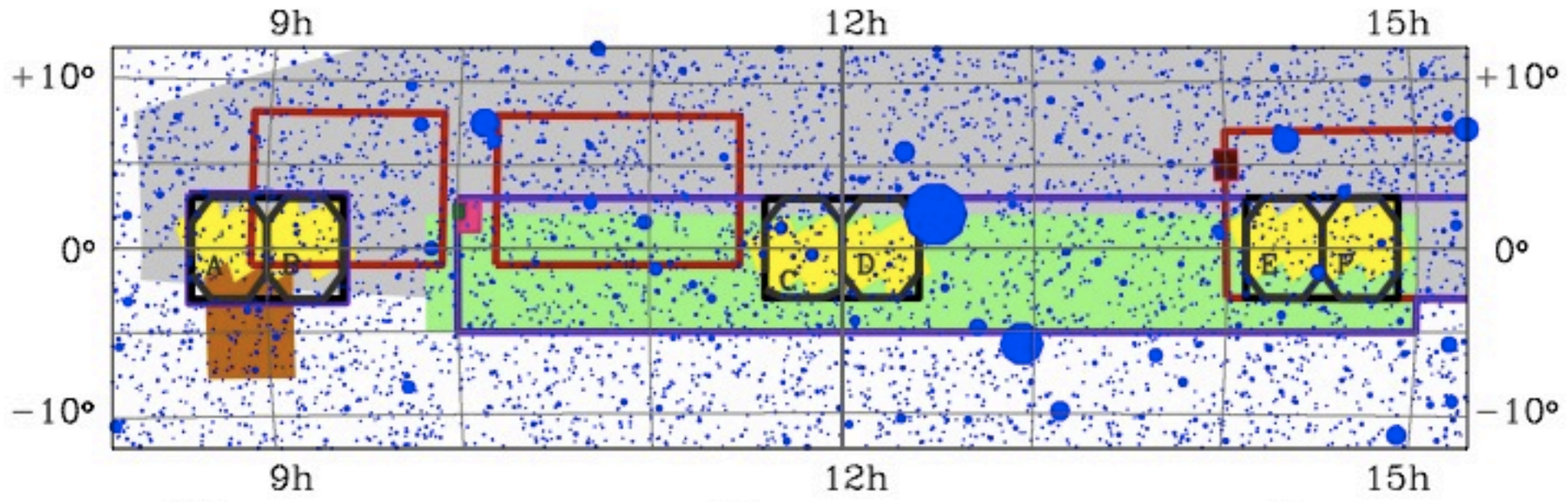
GAMA I z-survey finishes this year!

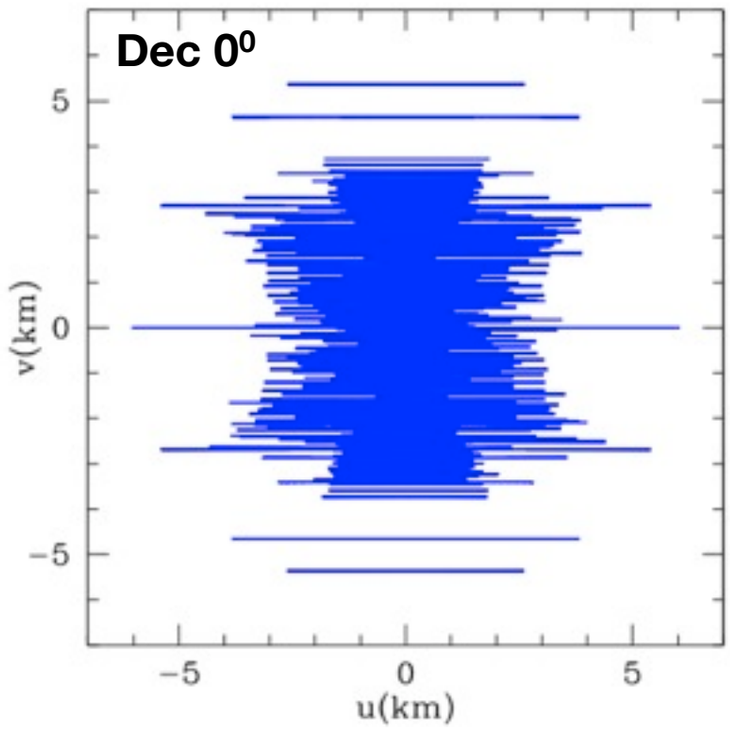
3 4x12 deg^2 regions:

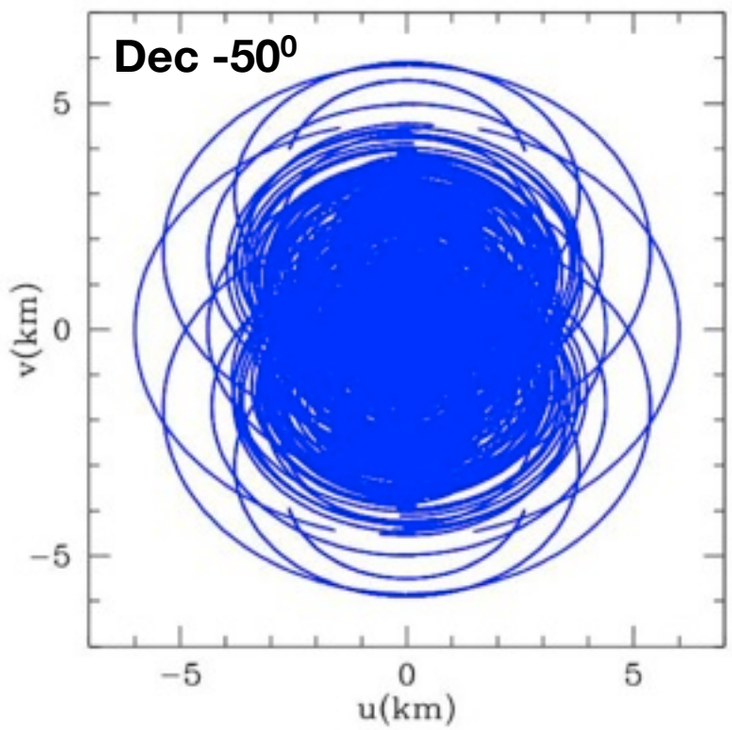
- GAMA09 r<19.4
- GAMA12 r<19.8
- GAMA15 r<19.4

115K redshifts

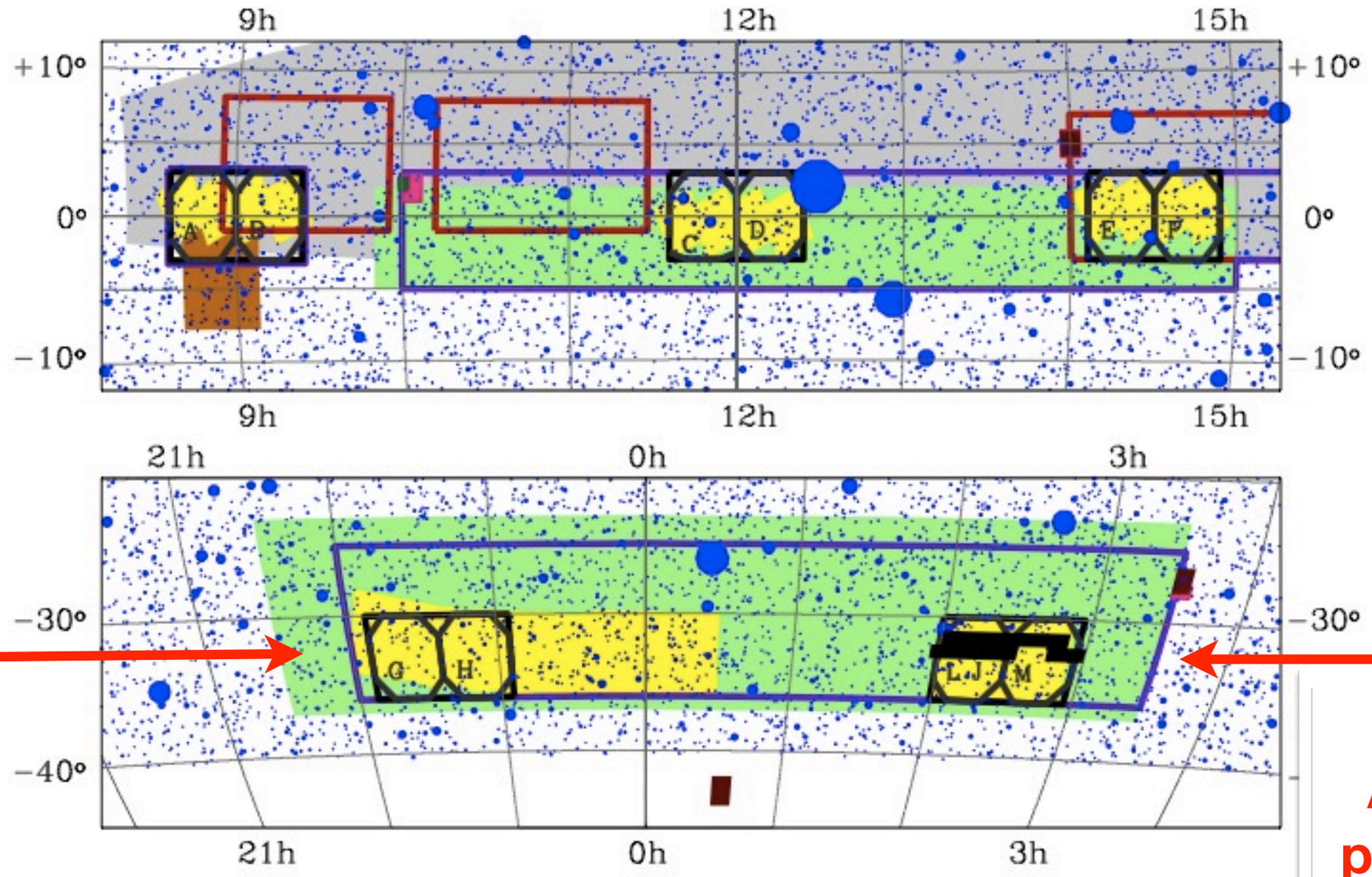
Field Selection







Field Selection



GAMA II
AAT large programme submitted Mar 2010

GAMA Redshifts

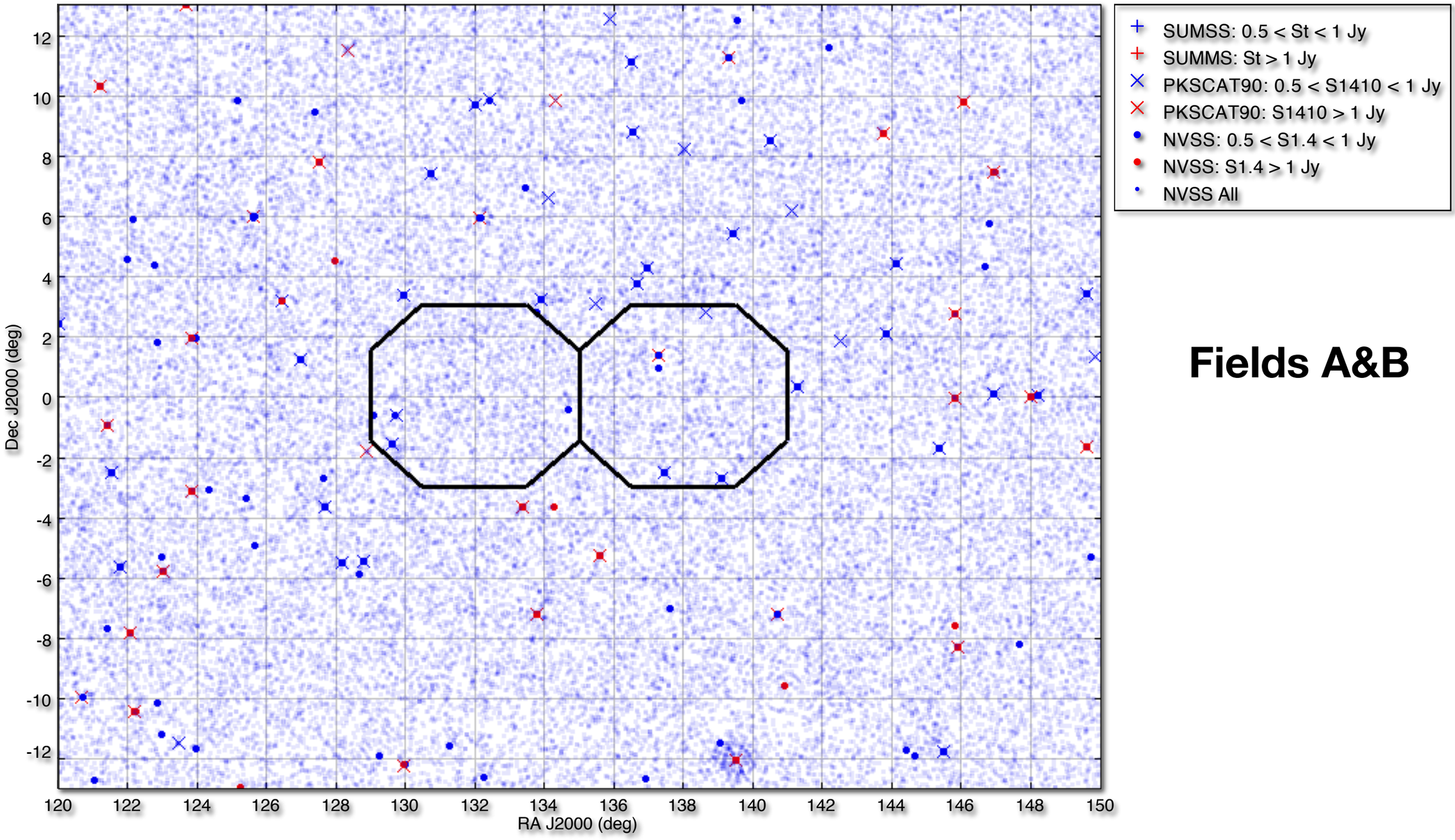
	GAMA I	GAMA II
Survey Blocks	4x12 deg^2	6x12 deg^2
Fields	3: 9h, 12h, 15h	5: 9h, 12h, 15h, 2h, 23h
Targets	115 000	330 000
r < 19.4	144 deg^2	360 deg^2
r < 19.8	48 deg^2	360 deg^2
	Current	**Proposed (174 nights)**

GAMA Redshifts

	GAMA I	GAMA II	Ultradeep z's
Survey Blocks	4x12 deg^2	6x12 deg^2	6x12 deg^2
Fields	3: 9h, 12h, 15h	5: 9h, 12h, 15h, 2h, 23h	5: 9h, 12h, 15h, 2h, 23h
Targets	115 000	330 000	330 000+
r < 19.4	144 deg^2	360 deg^2	360 deg^2
r < 19.8	48 deg^2	360 deg^2	360 deg^2
r < 21	0 deg^2	0 deg^2	60 deg^2

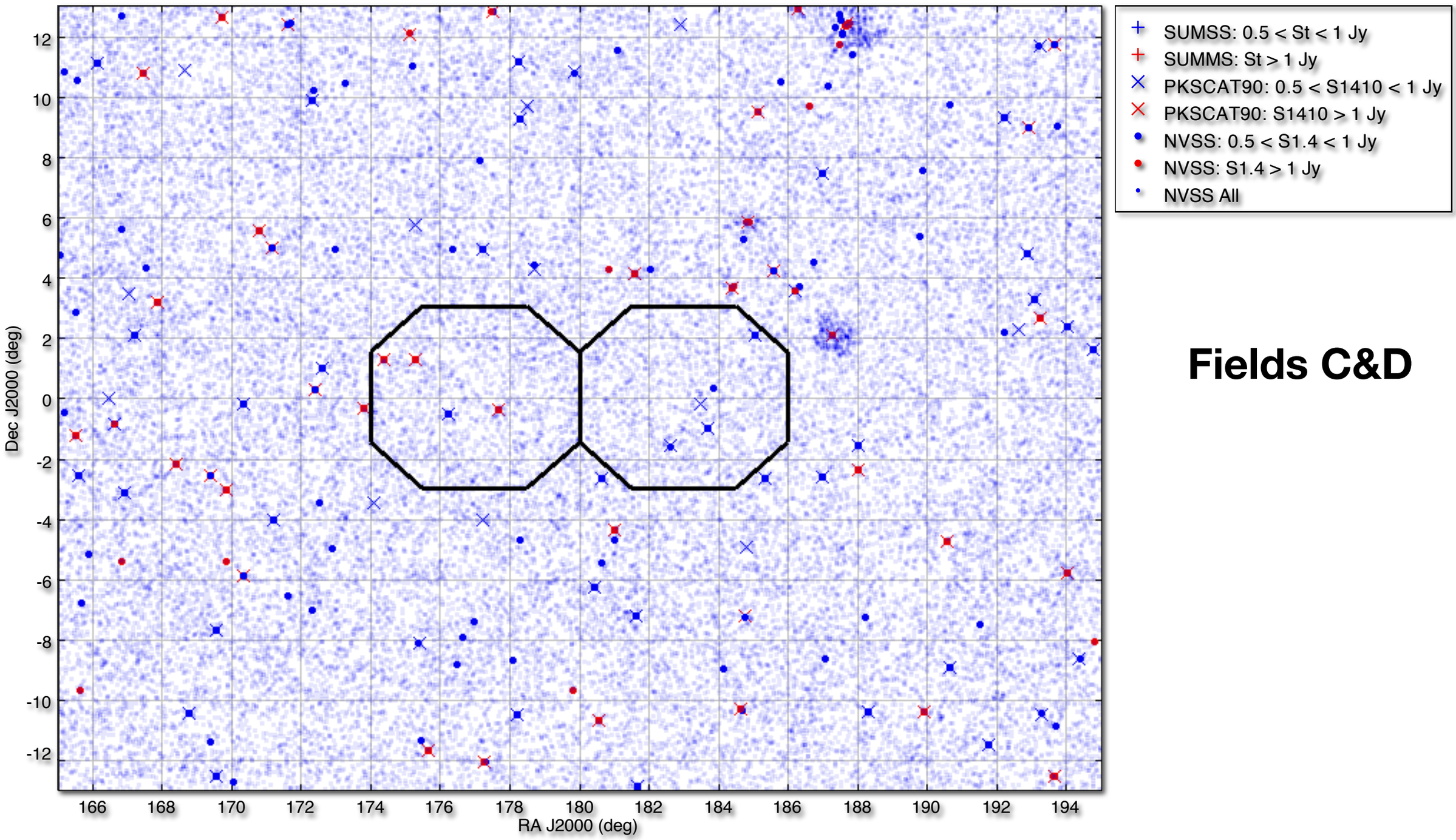
Current **Proposed (174 nights)** **Future?**

Field Selection: AB



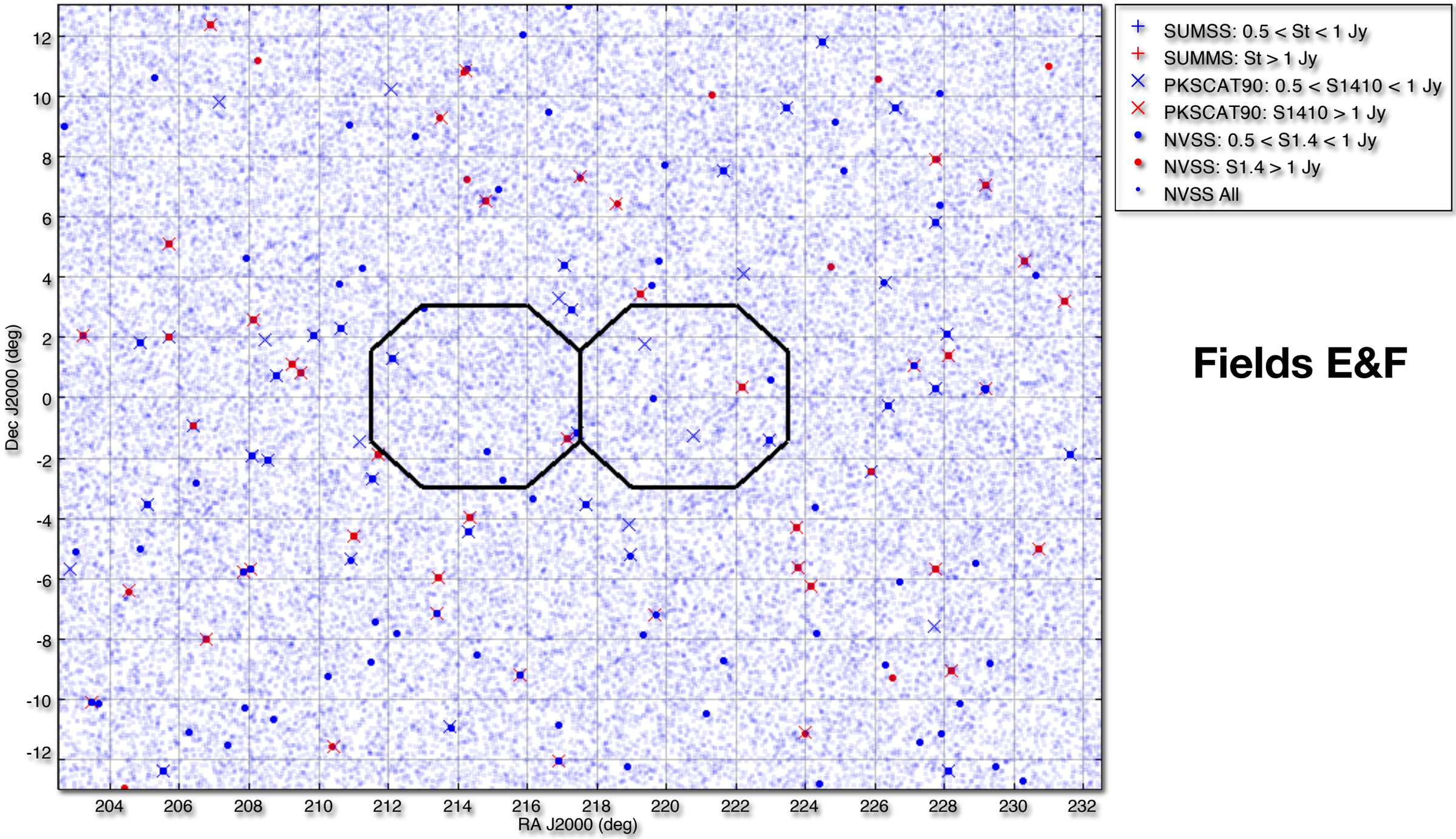
Fields A&B

Field Selection: CD



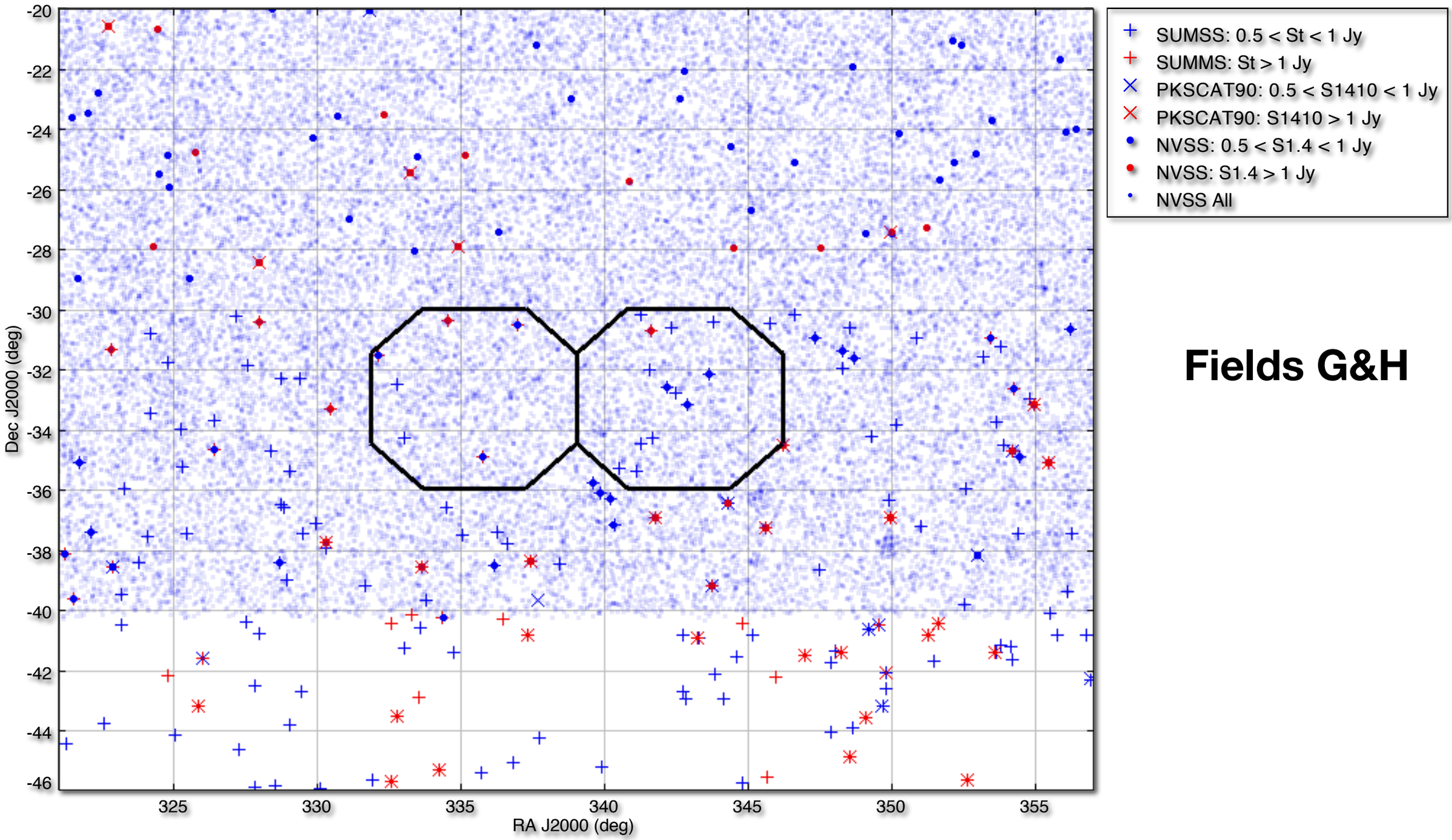
Fields C&D

Field Selection: EF



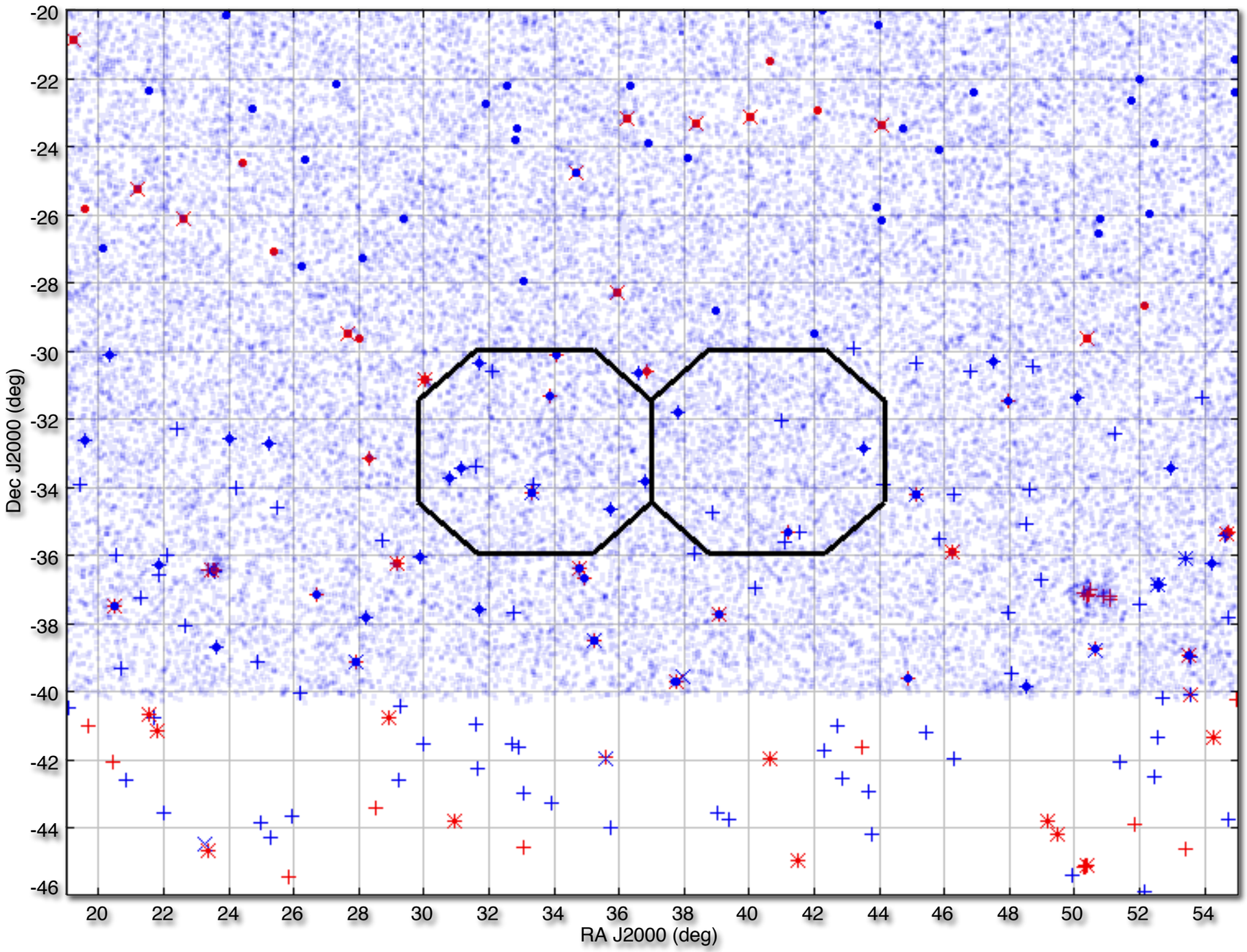
Fields E&F

Field Selection: GH



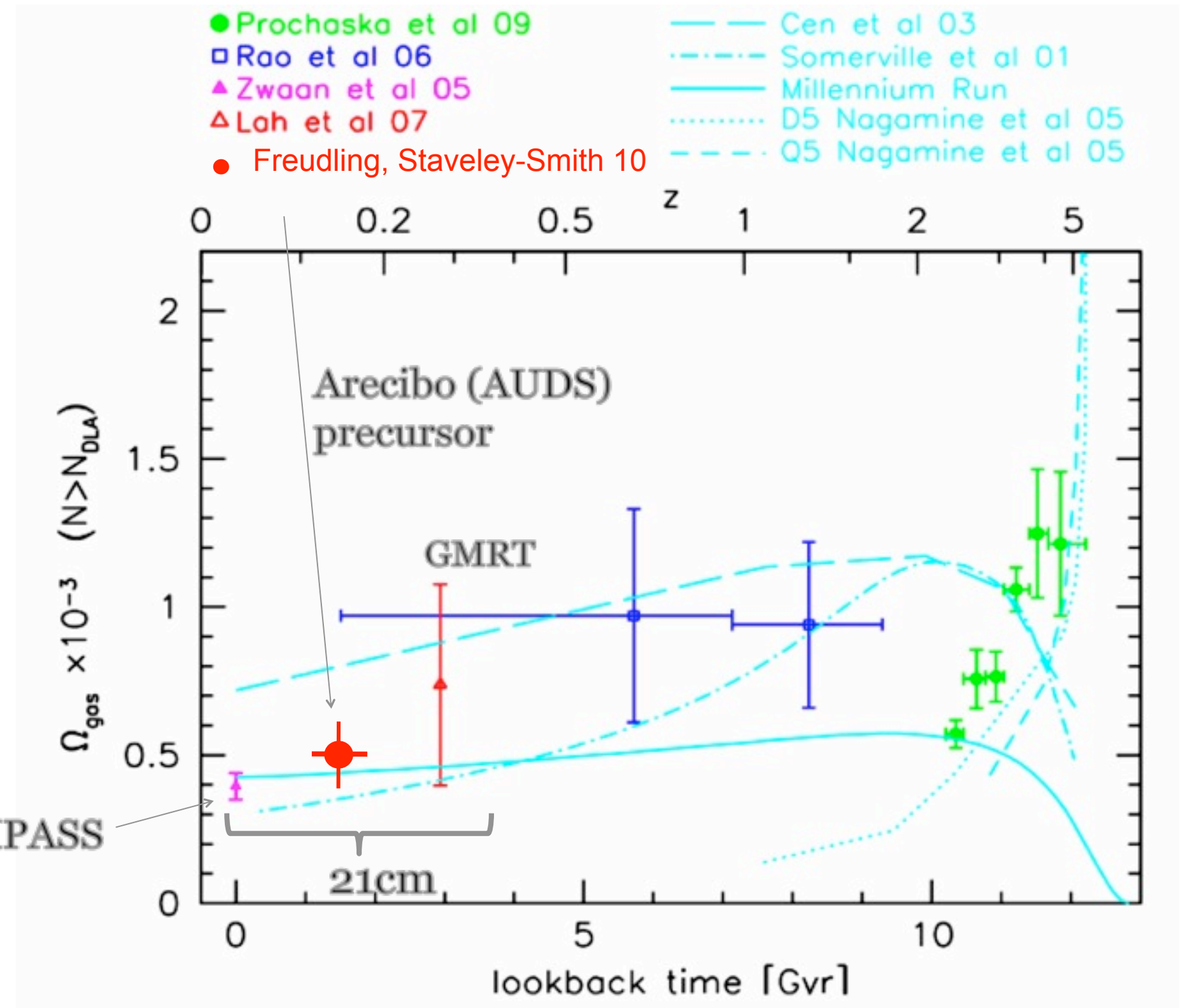
Fields G&H

Field Selection: LM



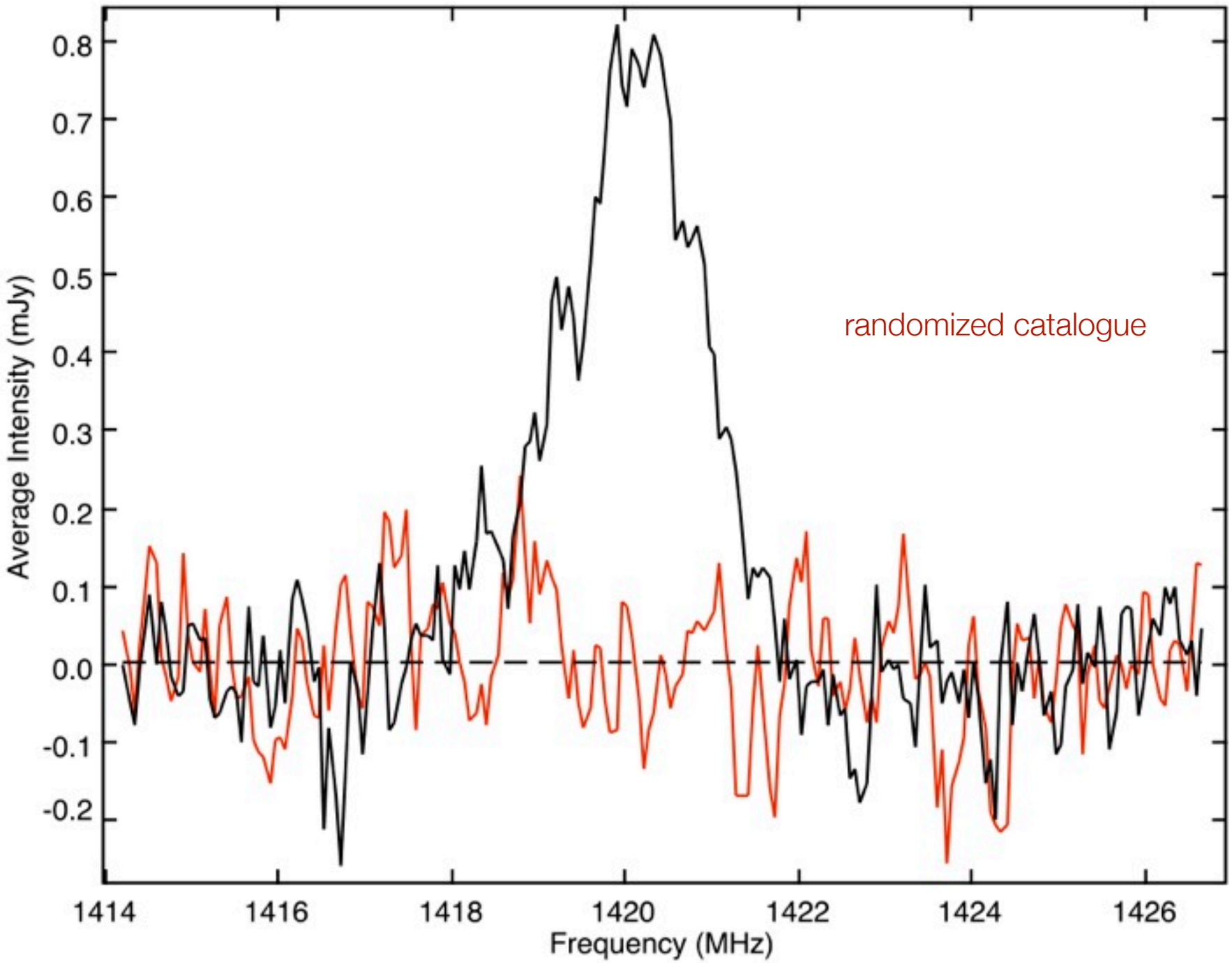
Fields L&M

Evolution of Ω(HI) - AUDS

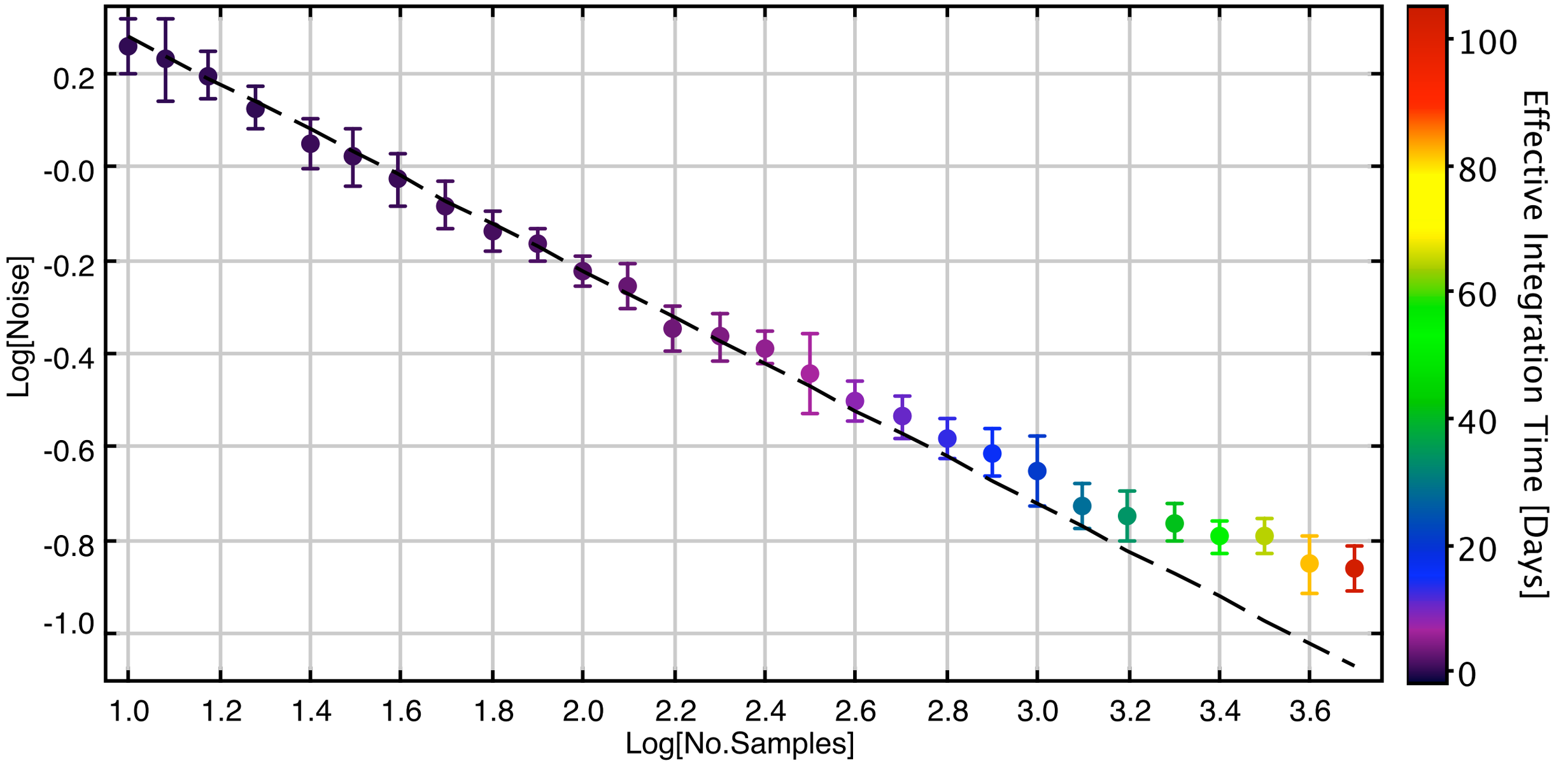


A stacked HI signal at z=0.1 with Parkes

(GAMA9 field; Delhaize et al.)

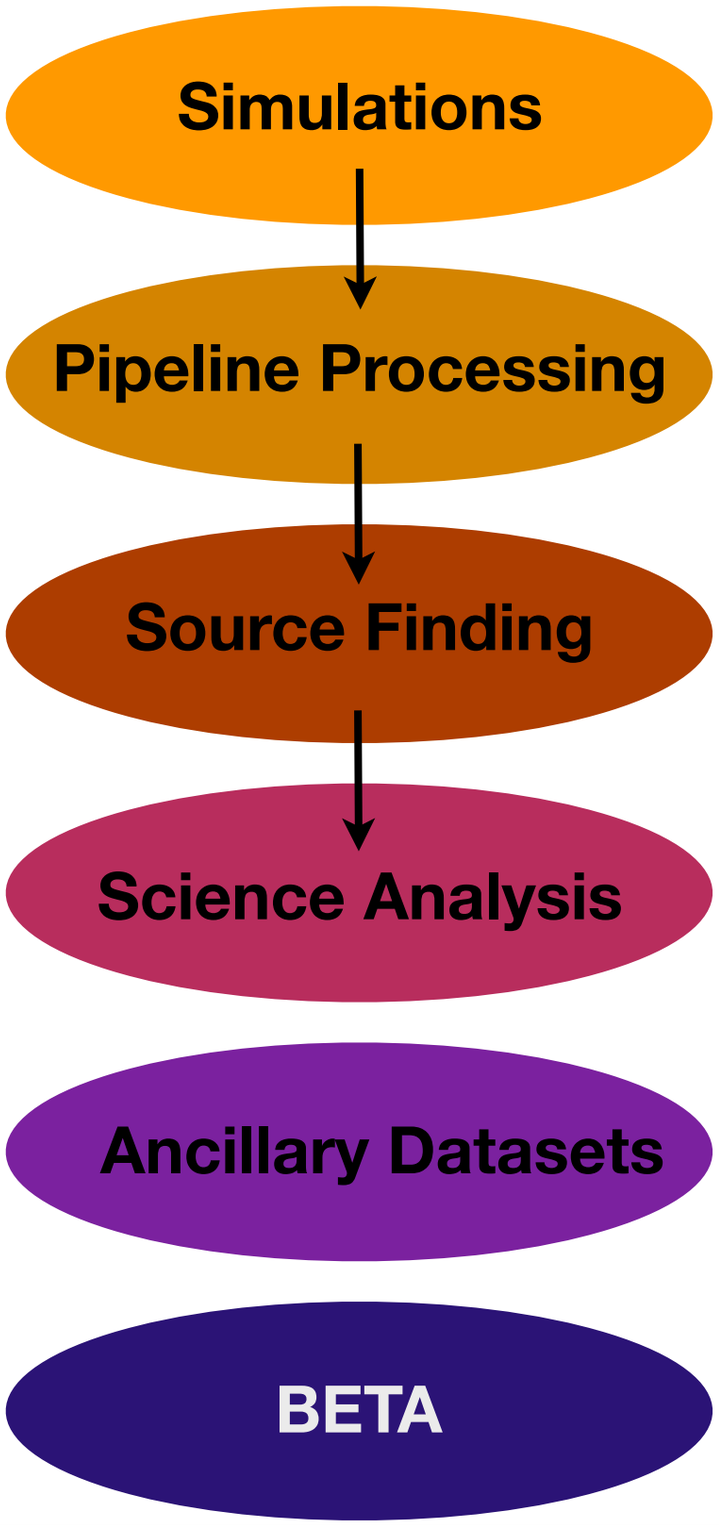


GAMA HI Stacking



Delhaize

Where to from here?



- examine various evolutionary scenarios

  Duffy, Whiting
- ‘observe’ simulated data (eg. ASKAPsoft)
- RFI, cube combination methodology
- highest resolution data cubes possible?
- DuChamp/new software

  Jurek, Westmeier
- parametrization, completeness and reliability

- how well are stated science goals met?
- results consistent with best deep datasets?
- cosmic variance

  Ongoing, SSFs!
- GAMA progress

  GAMA II submitted
- optical spectroscopy

  1st dish on-site!
- receiver performance and stability, dynamic range, calibration accuracy, bandpass stability, noise characteristics, sidelobe response...

Super Science Fellows

- ICRAR awarded 5 ‘Super Science Fellowships’

- 2 positions for DINGO/ WALLABY related work:
  - deep HI science simulations
  - multiwavelength analysis

- 3 year, ECR postdoctoral positions w/ excellent research support

- Will appear in June AAS listings, application deadline July 2010