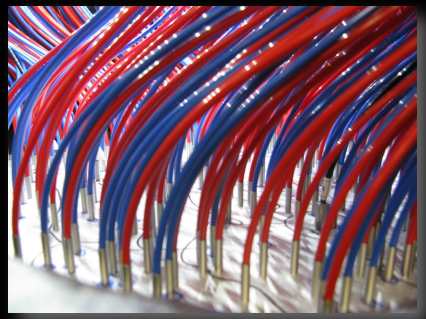
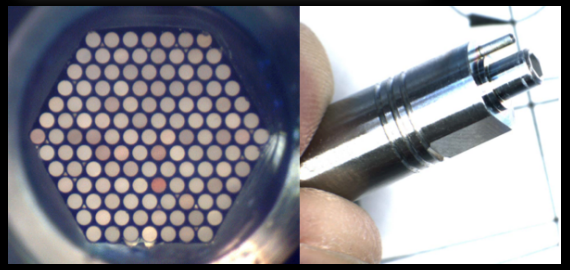
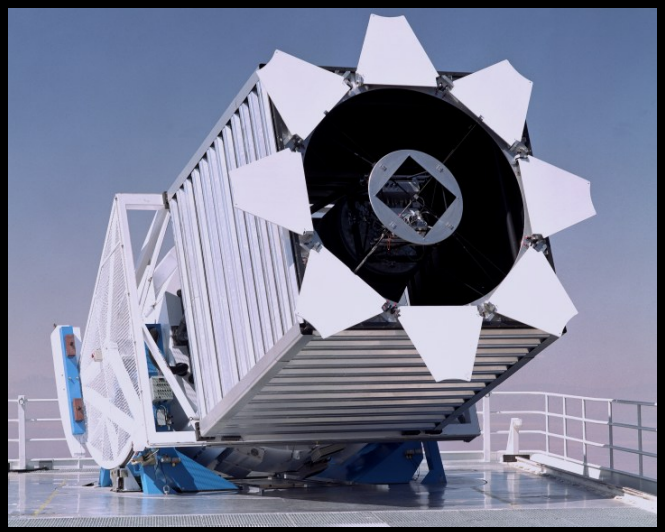
Karen Masters

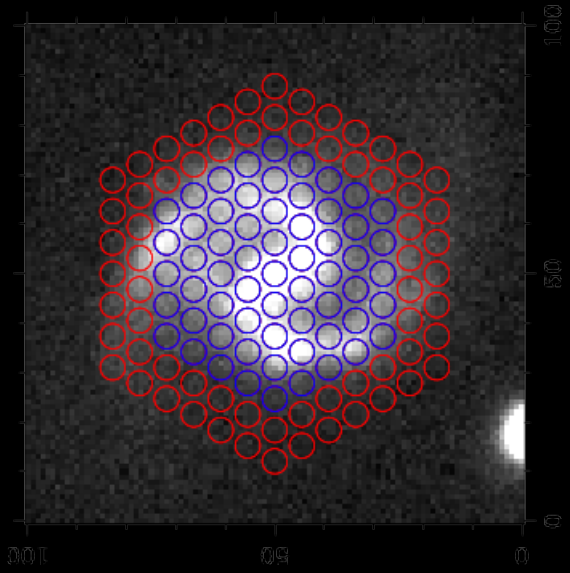
ICG Portsmouth

(on behalf of the MaNGA Team)









University of Portsmouth

ICG Portsmouth

SEPnet South East Physics Network

SDSS

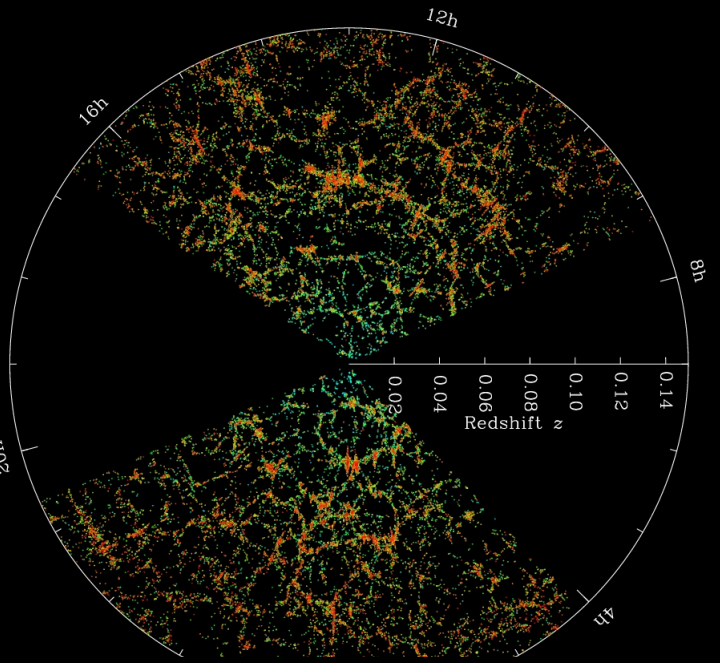
14 years of Sloan Surveys

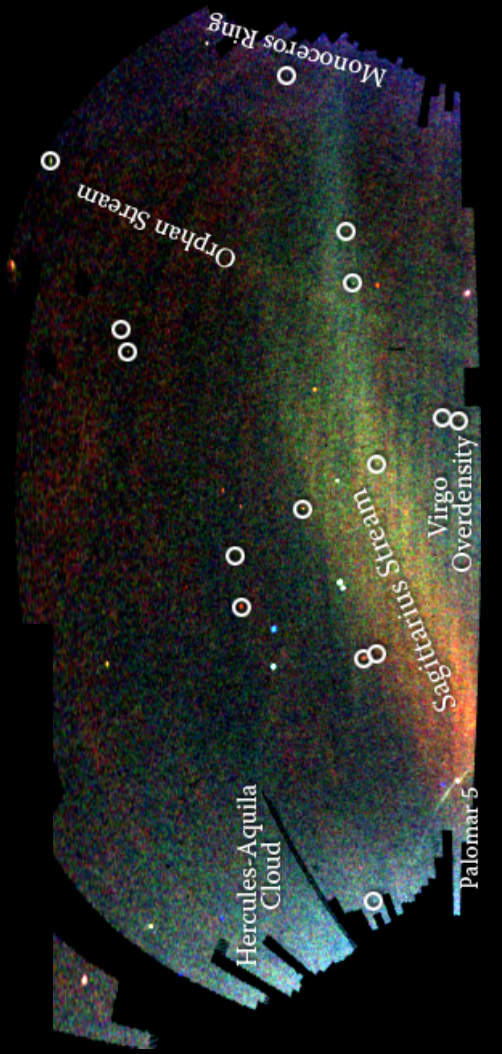
2000-2005 SDSS-I
2005-2008 SDSS-II
2008-2014 SDSS-III
2014-2020 SDSS-IV

10 public data releases

5000+ scientific papers

Cited collectively more than 200,000 times





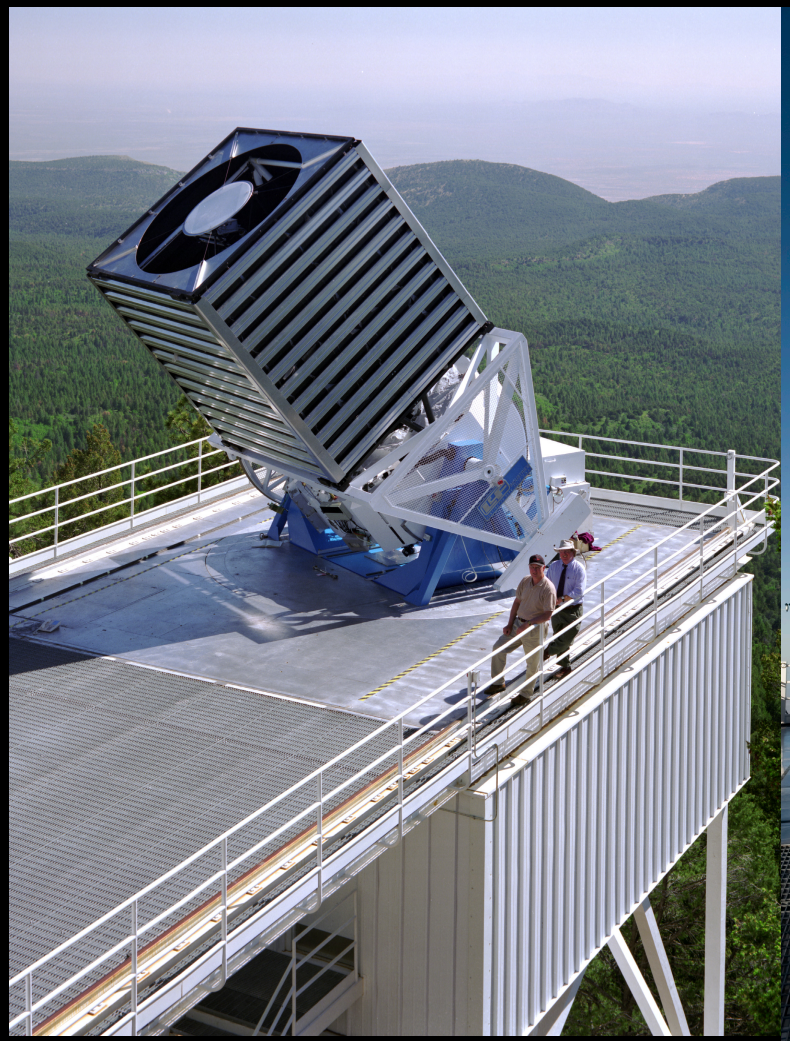
SDSS-IV:

- eBOSS (extended BOSS)
- APOGEE2 (MW stars)
- MaNGA: Mapping Nearby Galaxies at Apache Point Observatory

"The galaxy survey for people who love galaxies"

SDSS Telescope

(Apache Point Observatory, New Mexico)

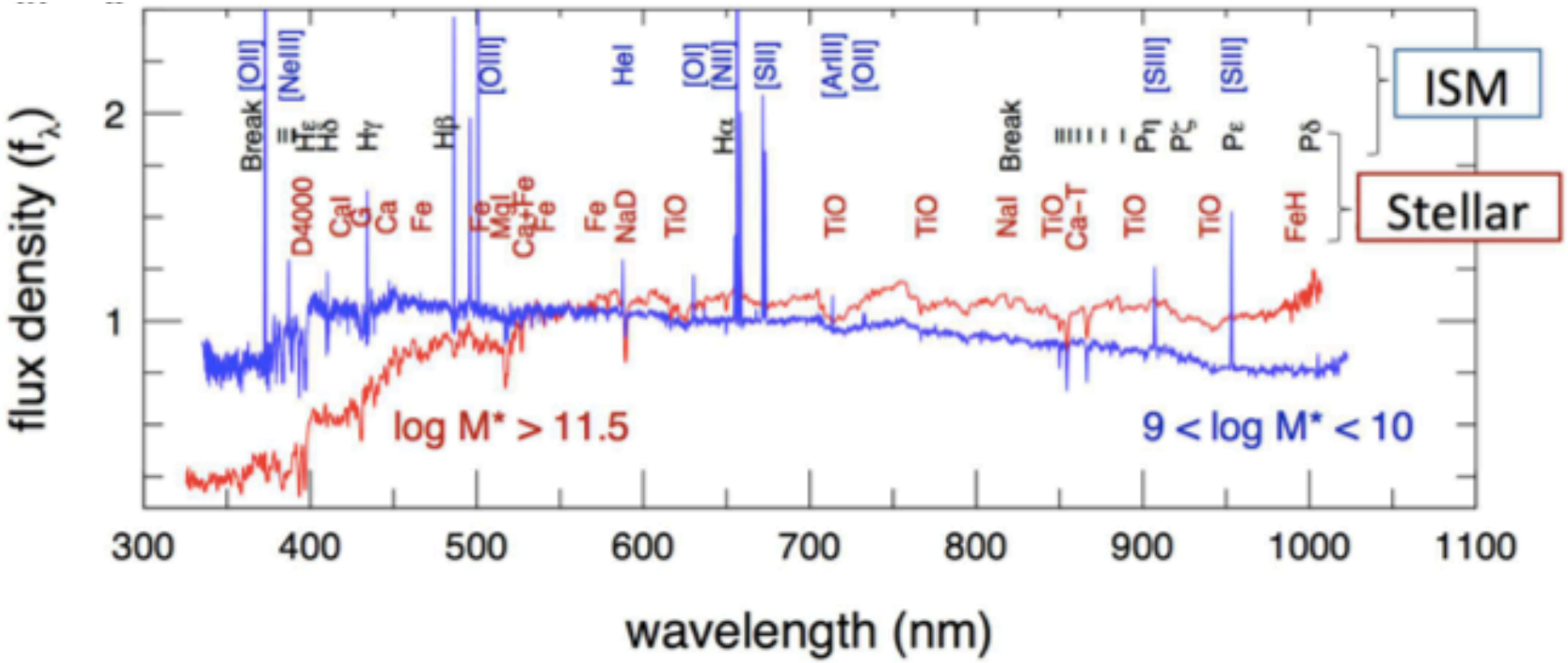


BOSS Spectrograph

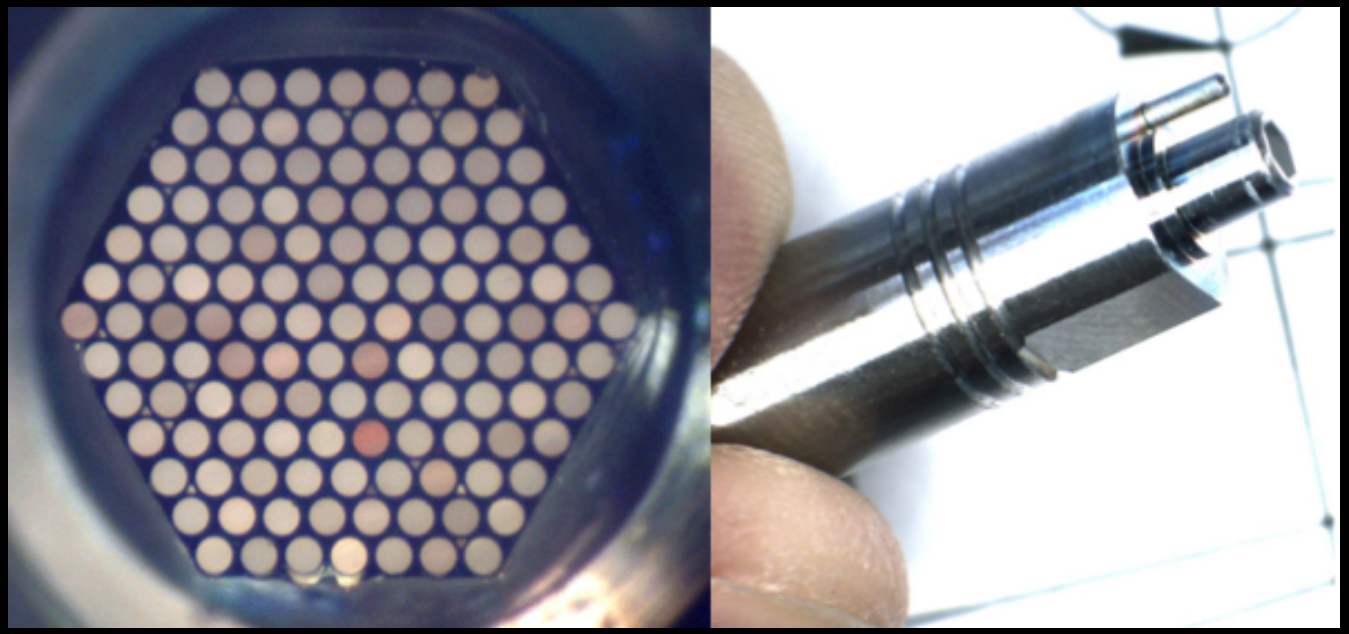
APOGEE NIR Spectrograph

BOSS Spectra

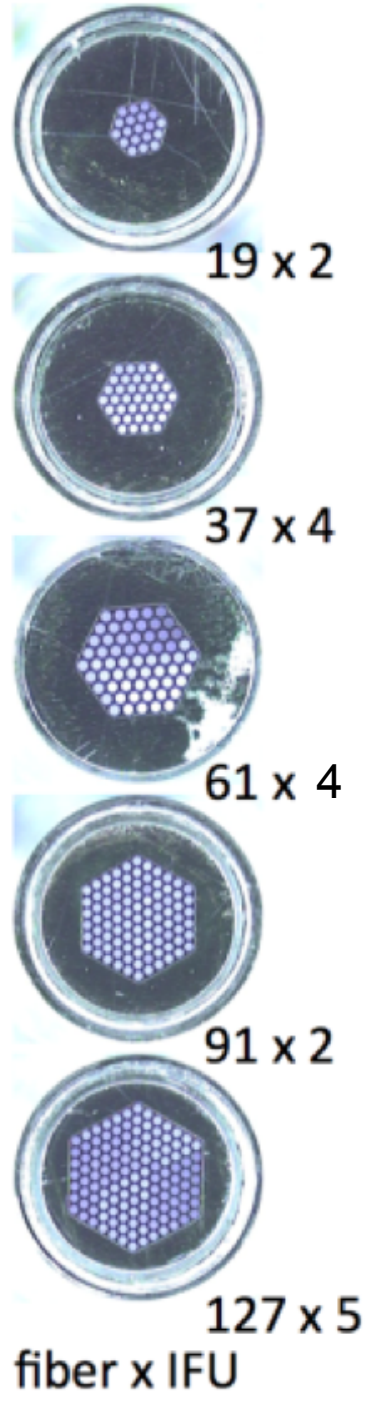
spectral resolution: 50 – 70 km/s
spectral coverage: 3600 –10,000A



MaNGA Bundles



Test cartridge observed in Jan 2013 (18 galaxies)
First real cartridge is at the telescope for testing
March – first full commissioning tests (+ more galaxies)
Production one cart/month Mar-Aug 2014
Survey operations start July 2014



MaNGA has many applications

Kinematics

- Stellar kinematics maps
- Ionised gas kinematics maps
- Kinemetry
  - non-parametric description of velocity field
- Dynamical models

Composition

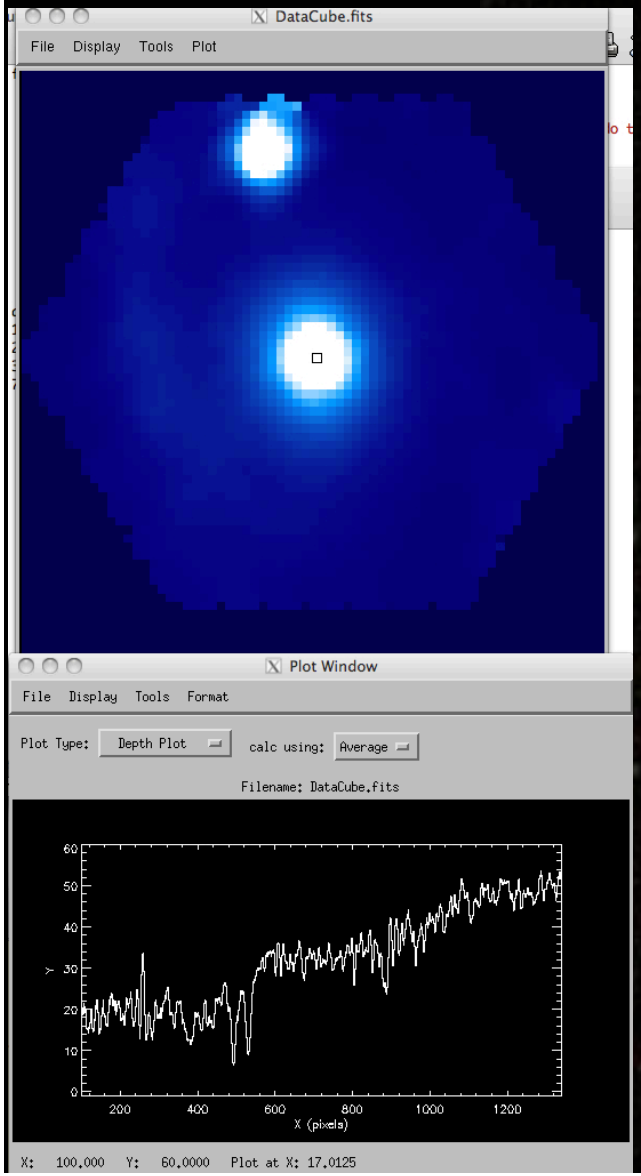
- Ionised gas emission maps
- Stellar absorption line-strengths maps
- Resolved template fitting
- Derived maps and gradients of:
  - metallicities
  - ages
  - star-formation rates
  - chemical abundances
  - initial mass function (IMF)

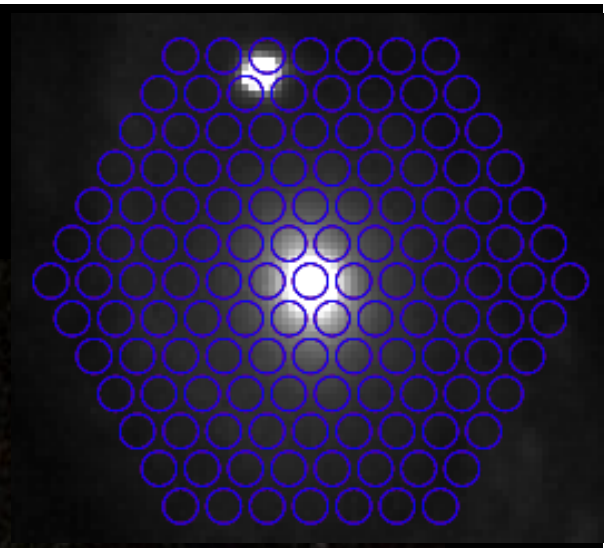
Ancillary enabled

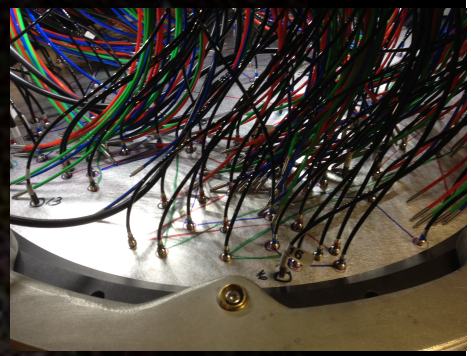
HI mass + rotation curves (large HI surveys)
Lensing halo masses (deep imaging)
X-ray gas tracers (eROSITA)
Star-formation rates (WISE, GALEX)

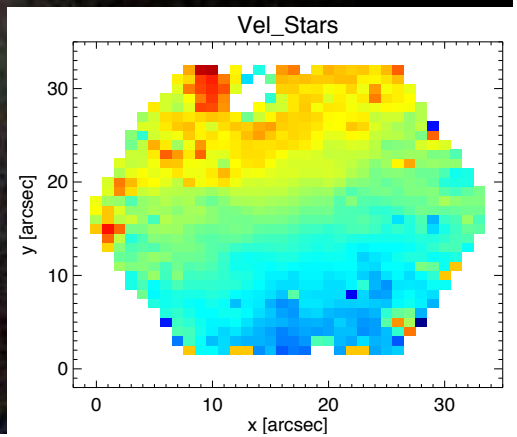
MaNGA Works!

Jan 2013 test observations of 18 galaxies with prototype 19, 61 and 127 fibre bundles



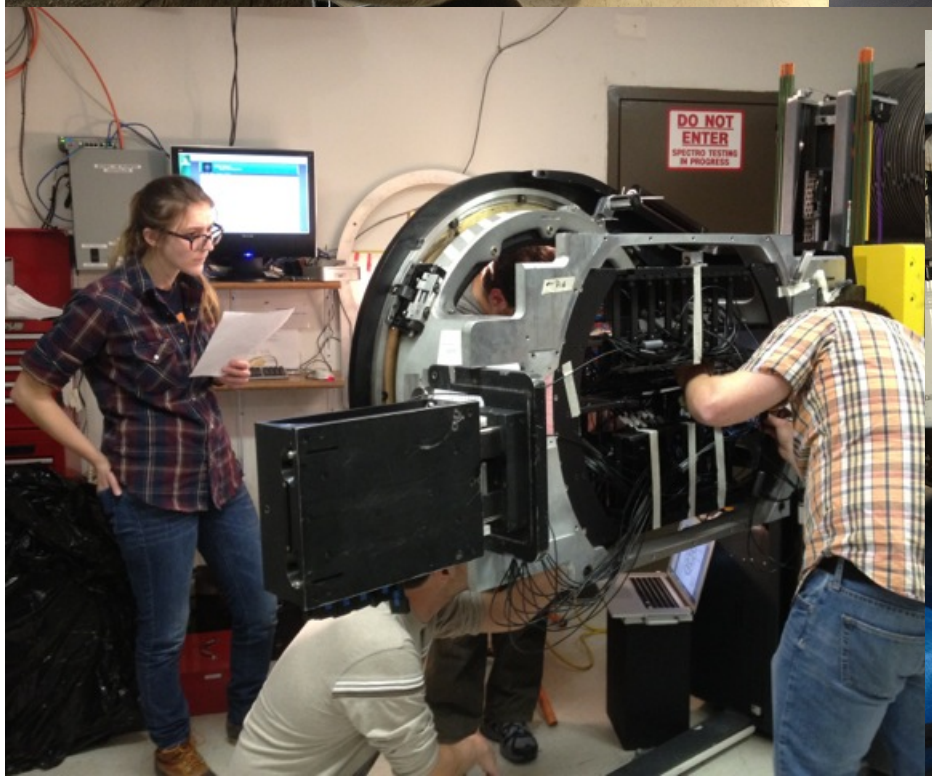


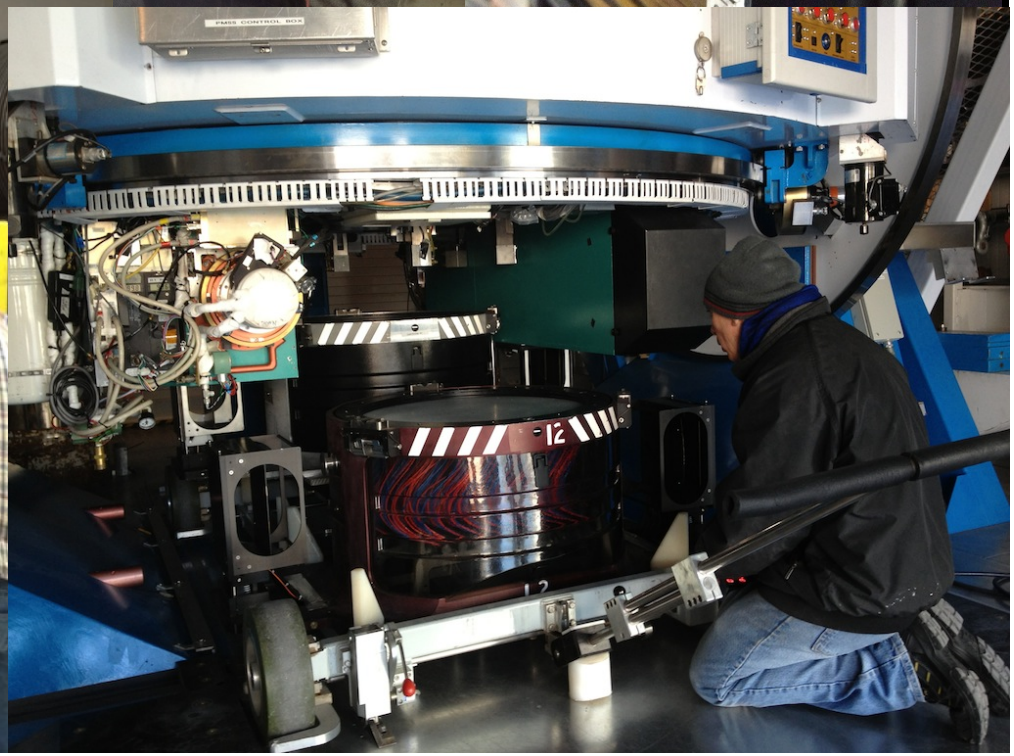




WARNING: Not a typical MaNGA galaxy


A30
A19
A37
E15
A30
A19
B30
A30
D30
A30
A19

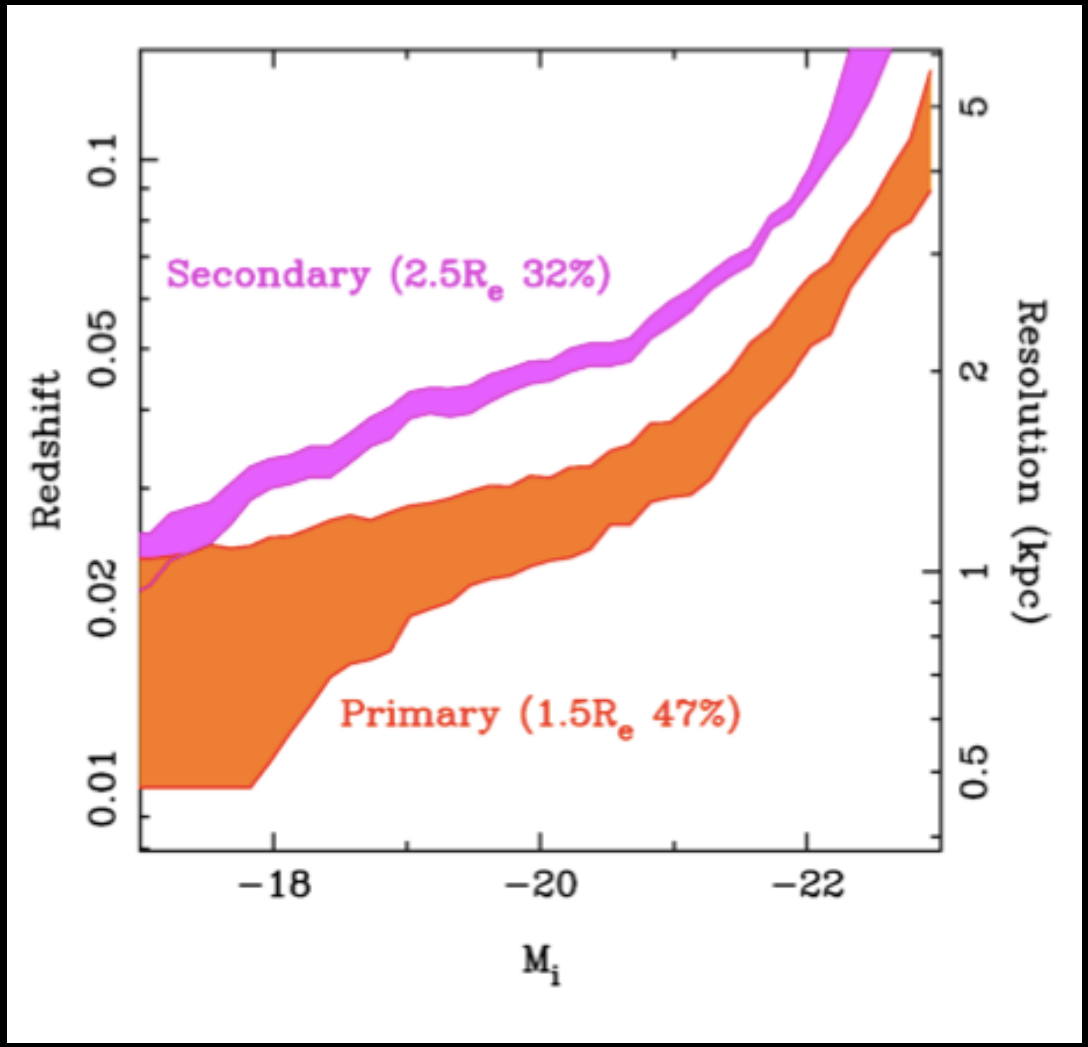

DO NOT
ENTER
SPECTRO TESTING
IN PROGRESS


PASS CONTROL BOX
12

Sample Selection

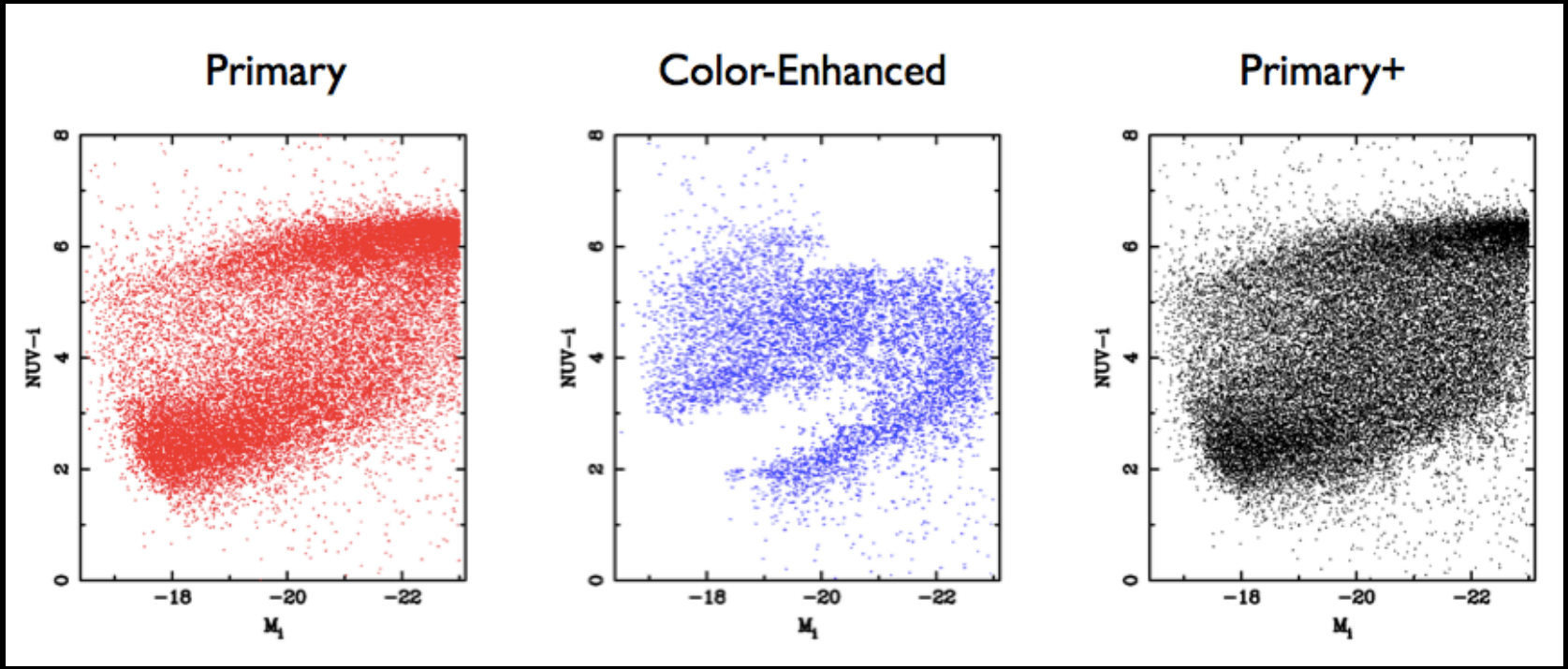
(David Wake)

- Six year survey, 17 galaxies per plate, sharing telescope with eBOSS and APOGEE2
- ~10,000 galaxies from SDSS Main Galaxy Sample (NY VAGC)
- $0.025 < z < 0.15$
- Stellar masses $M > 10^9 M_\odot$ (flat selection)



Sample Selection

(David Wake)

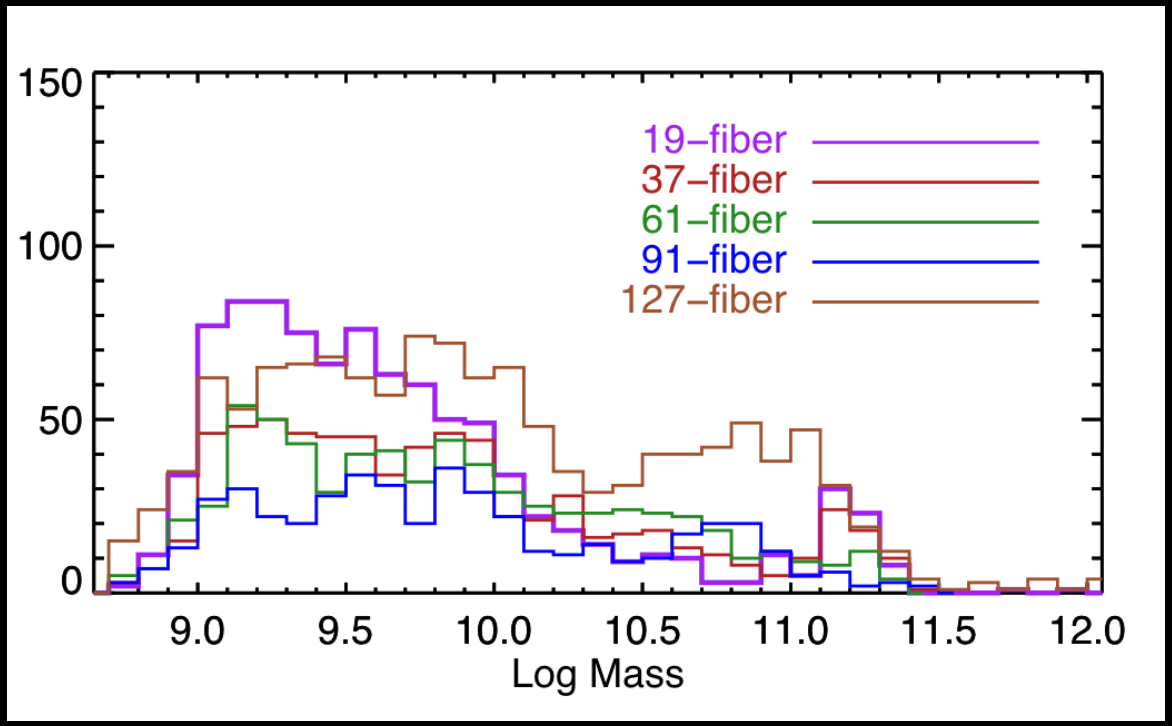


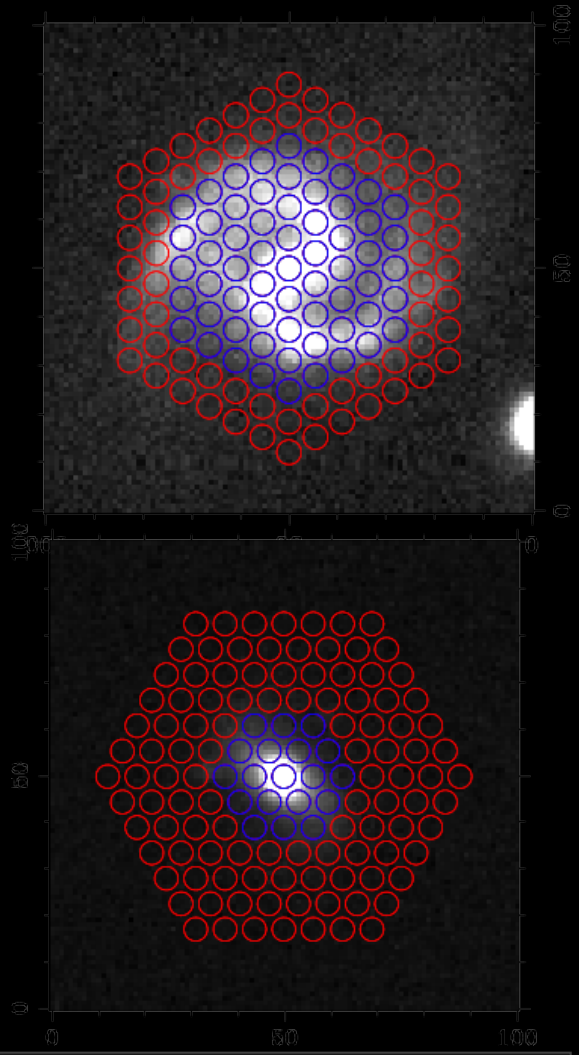
Colour-enhanced
- extra galaxies in sparse regions of NUV-i vs i plane
- 16% of sample

Ancillary samples (proposed) – 5-10% of sample

Spatial Resolution

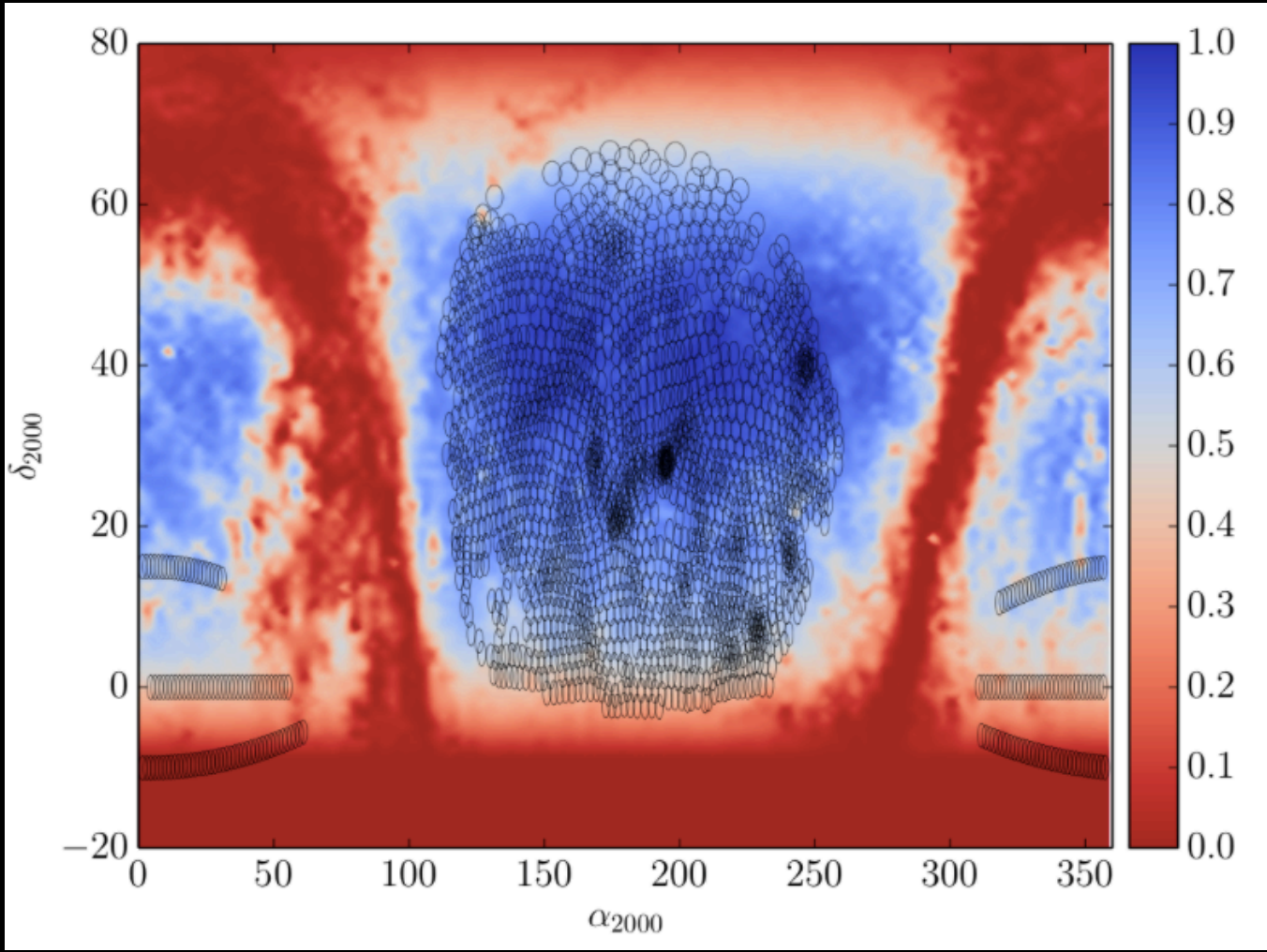
- 2” fibers -> 2.4” psf after 3 point dither (~1kpc at z=0.02)
- Bundle sizes 12-33” diameter





Field Selection

(Jose Sanchez-Gallego, Kentucky)

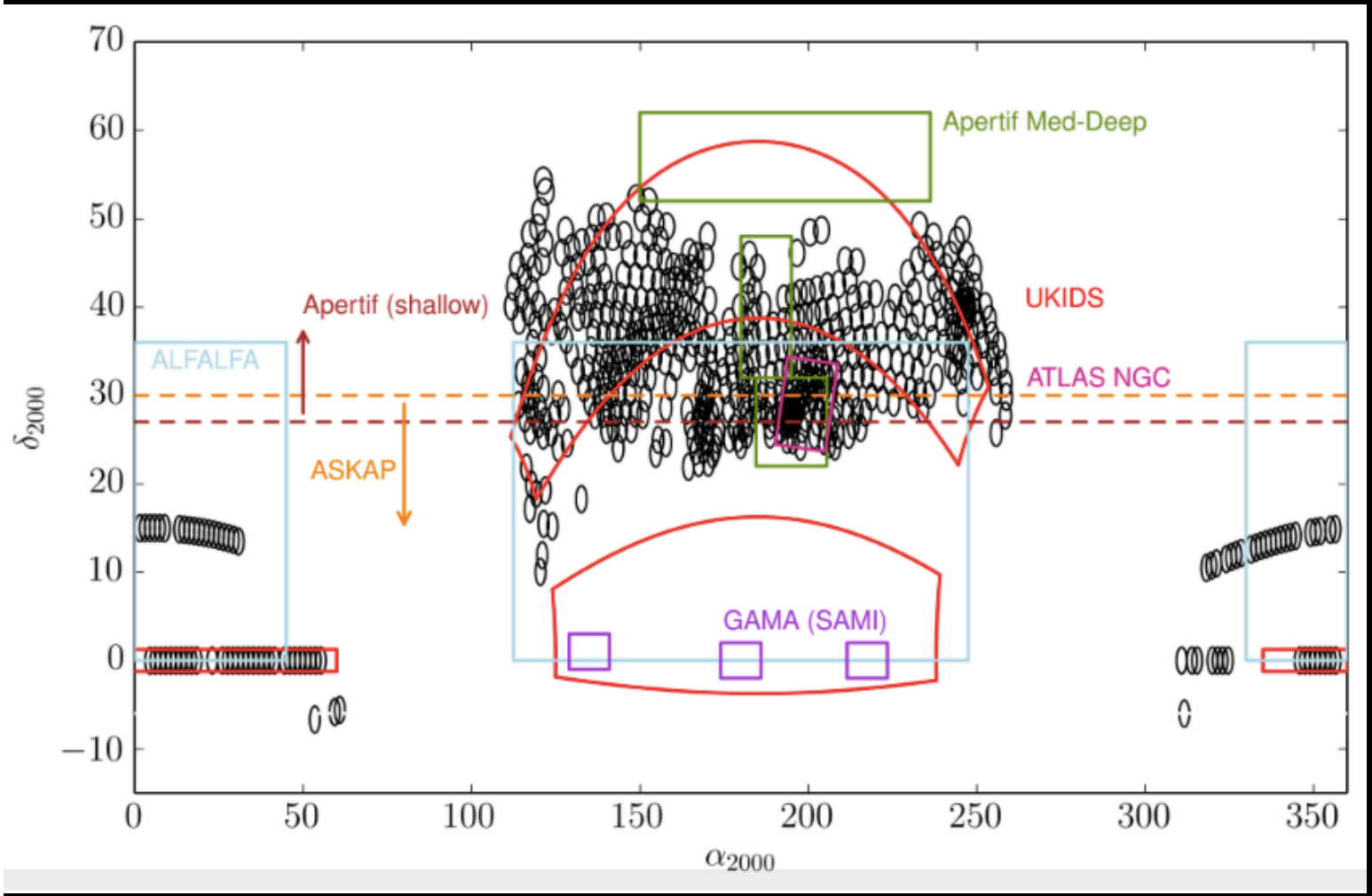


All possible plates in SDSS MGS

Colours indicate both Galactic extinction, and observing limits

17 MaNGA galaxies per plate

Baseline Survey



Possible numbers:

N = 10404

In HI survey sky:
$N\alpha$ = 5712

N_{APd} = 1496

N_{APs} = 7701

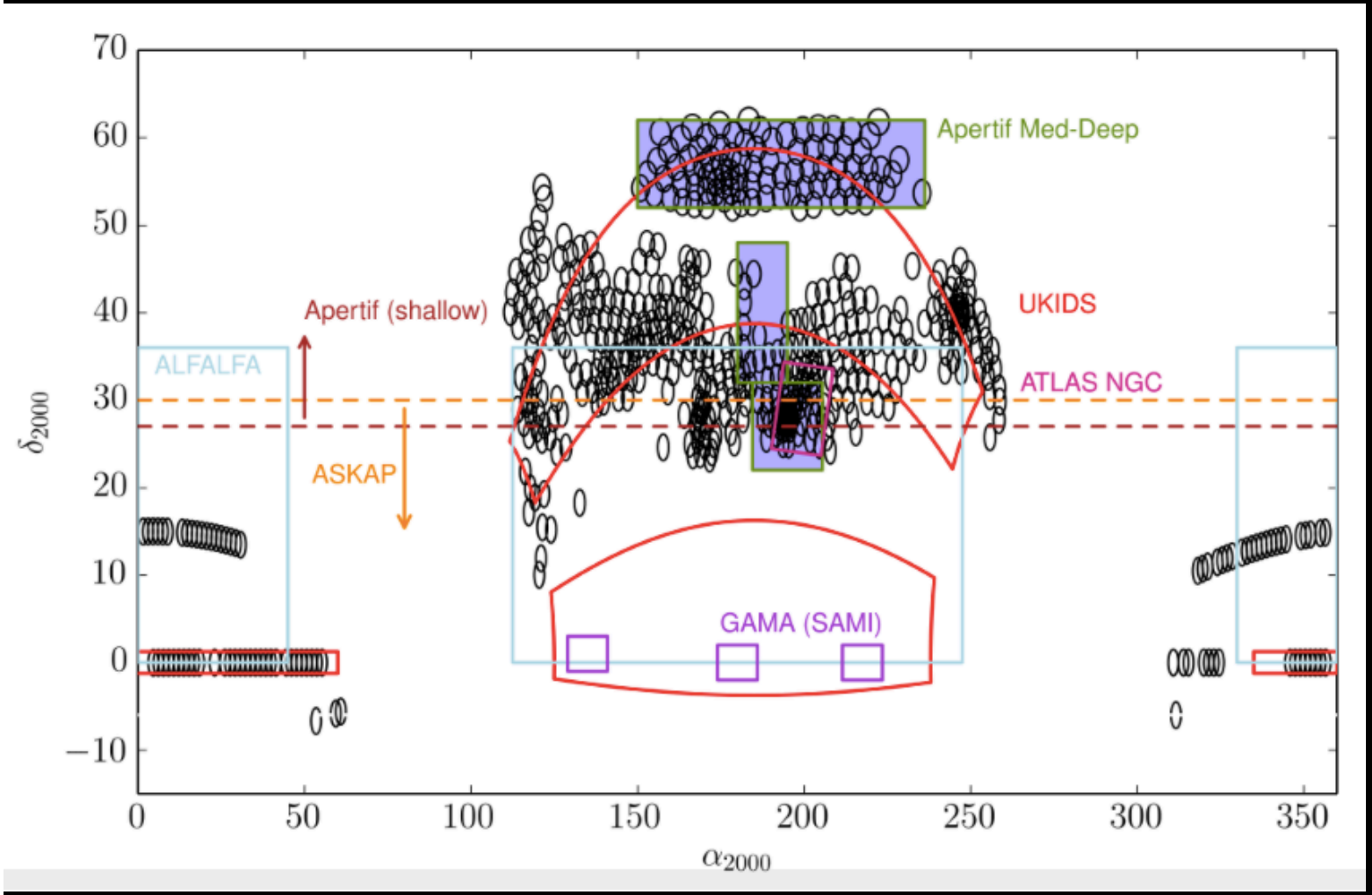
N_{ASKAP} = 4233

Six years of observing with typical weather, and time as allocated (sharing telescope with eBOSS and APOGEE).

Credit:Jose Sanchez-Gallego (Kentucky)

WARNING: Decision not yet made

APERTIF Deep



Negligible impact on total number of galaxies

More high airmass observations

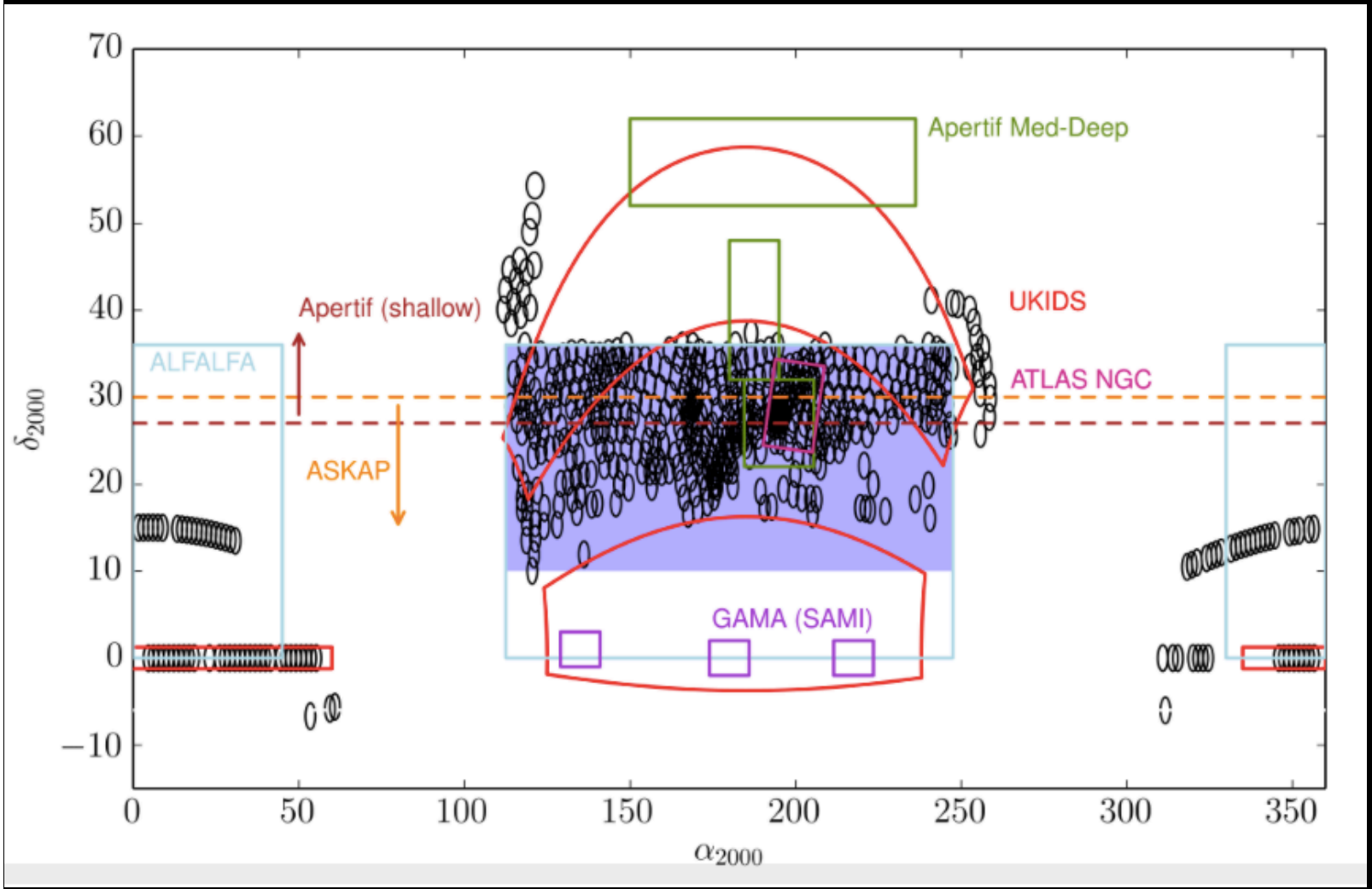
Reduces overlap with ALFALFA

Simulation with prioritses fields in proposed APERTIF Deep areas

Credit:Jose Sanchez-Gallego (Kentucky)

WARNING: Decision not yet made

ALFALFA



Noticable reduction in total number of plates

(N=9673)

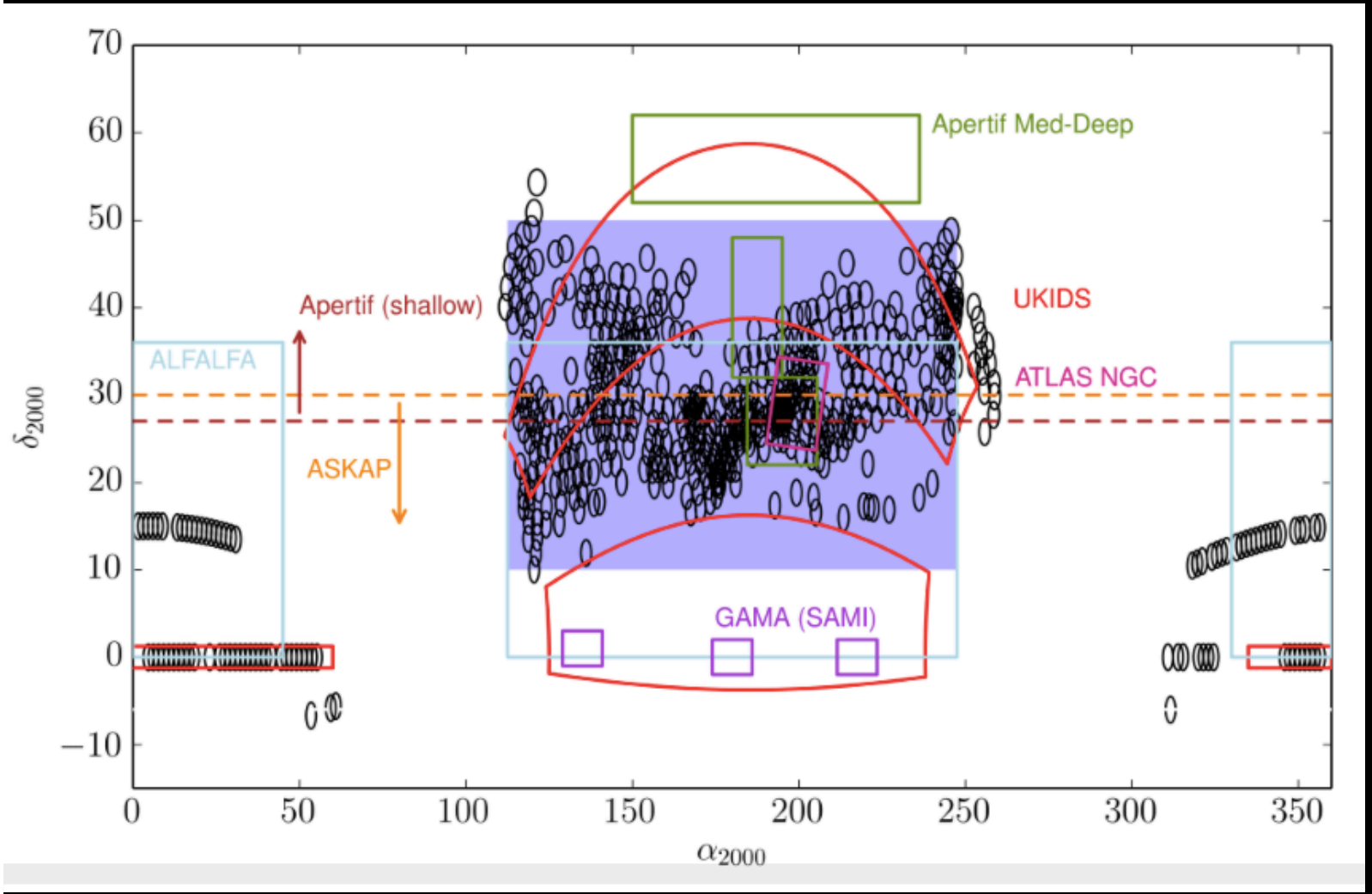
Loose a lot of APERTIF/ UKIDSS overlap

Simulation with priorises fields in ALFALFA sky

Credit:Jose Sanchez-Gallego (Kentucky)

WARNING: Decision not yet made

Mid Latitude Ranges

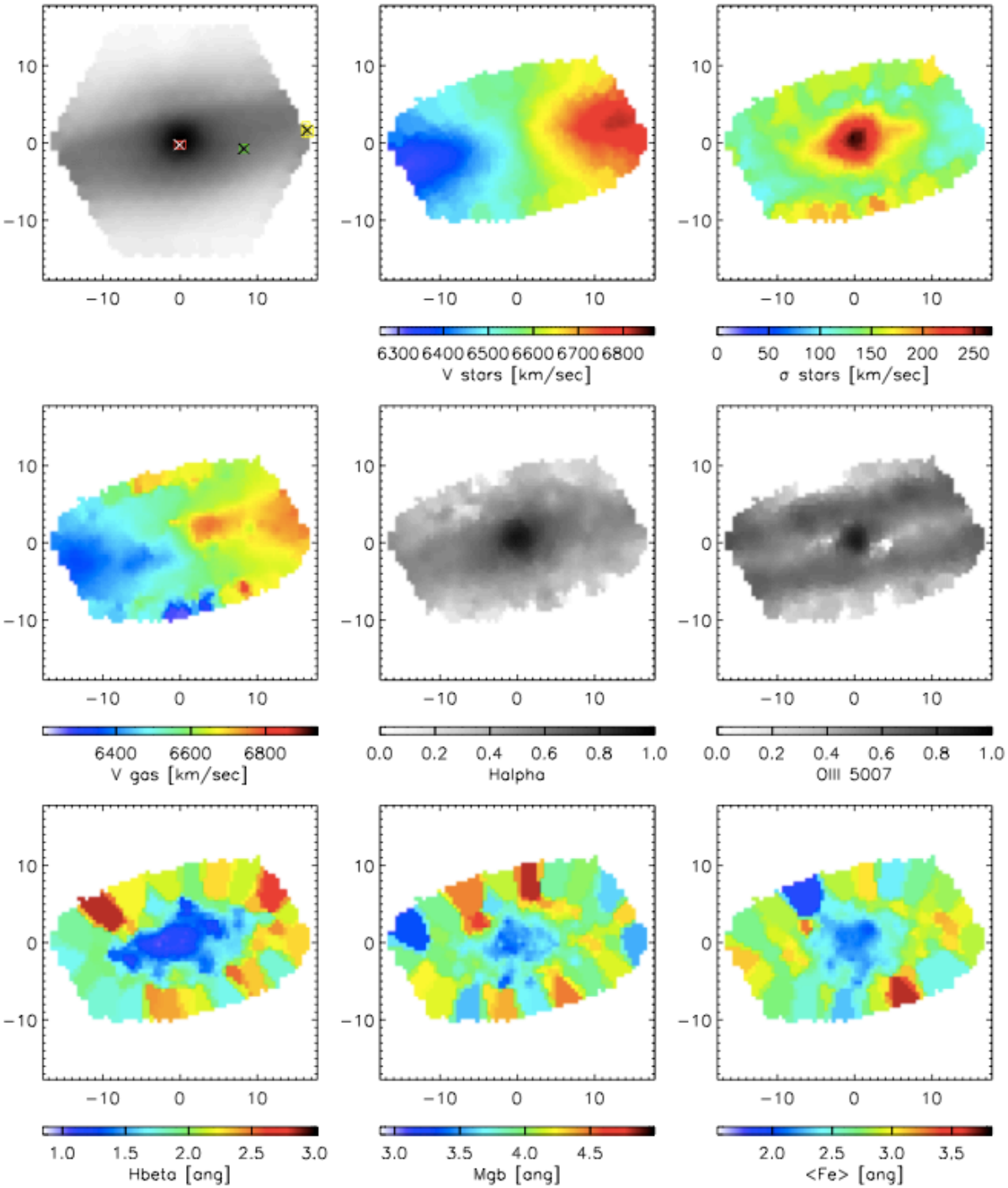


Quite similar to the baseline survey

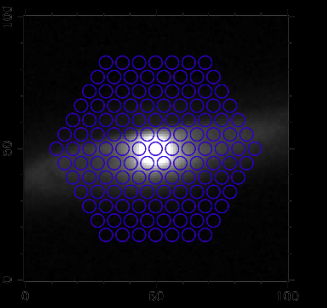
Simulation which prioritises Dec=10-50^{o} (maximise overlap with a range of HI surveys)

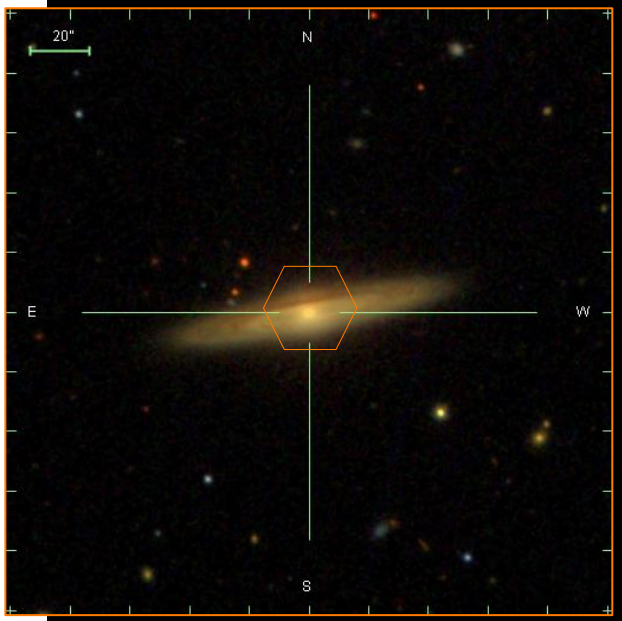
Credit:Jose Sanchez-Gallego (Kentucky)

WARNING: Decision not yet made

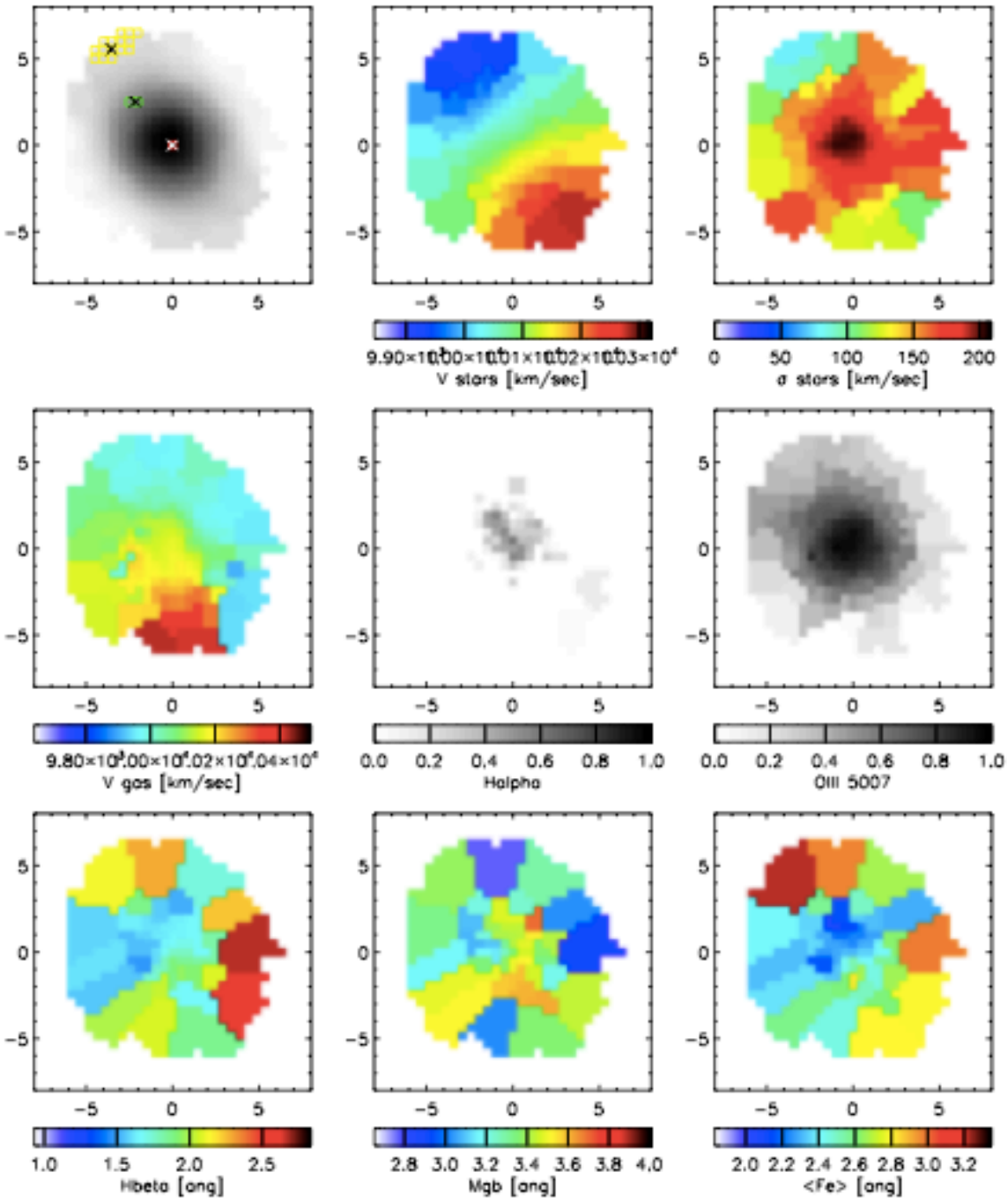


127 fibre bundle
(to 1.6Re)

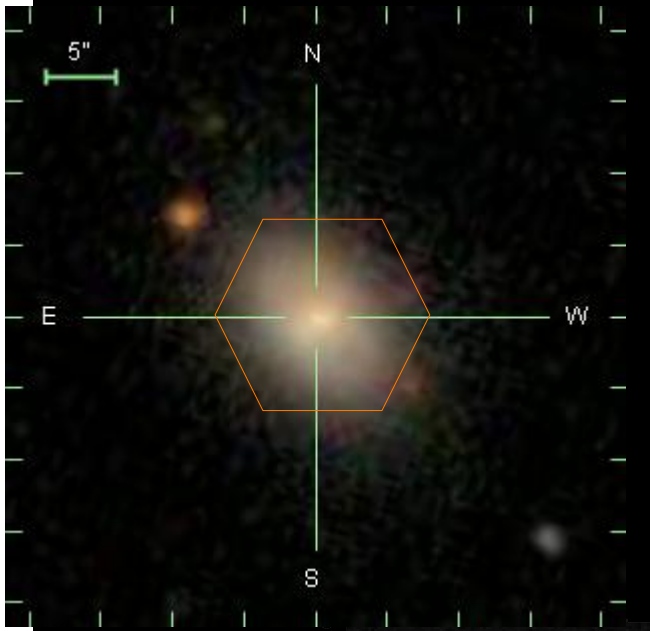


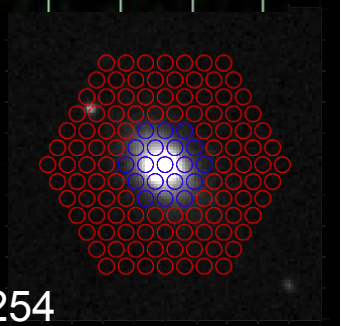


UGC 6036 (field 4 – 2 hrs)
Plots from the prototype DAP
(Lodovico Coccato)



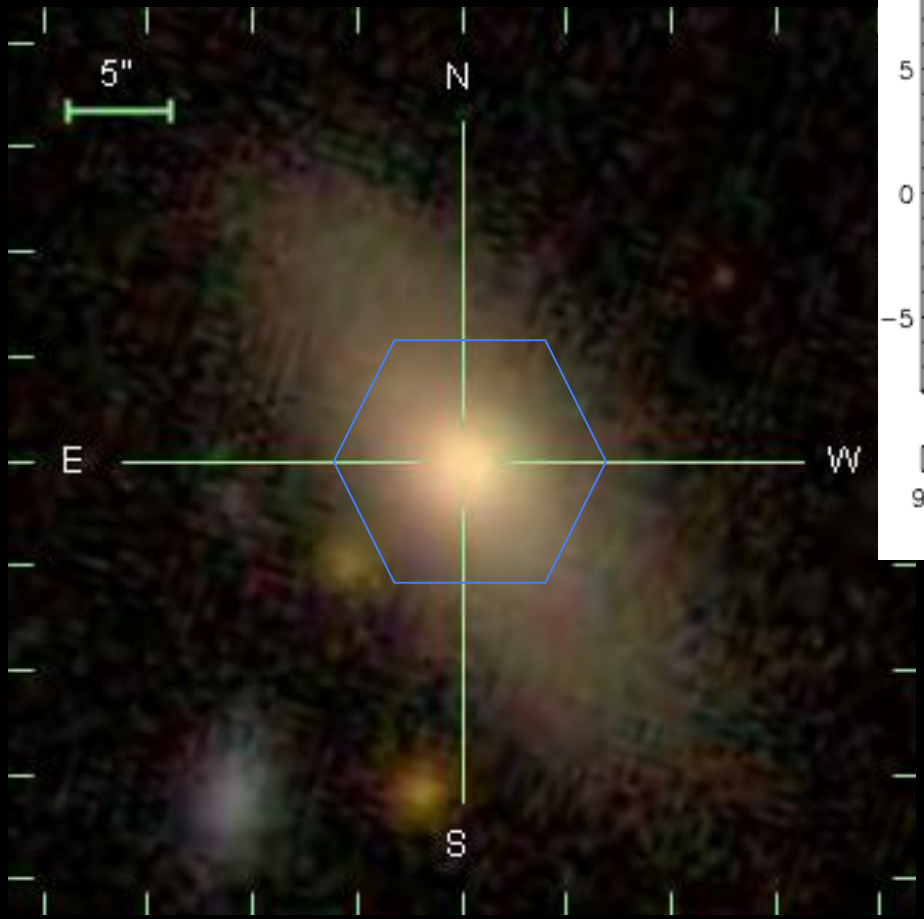
19 fibre bundle
(to 2.2Re)

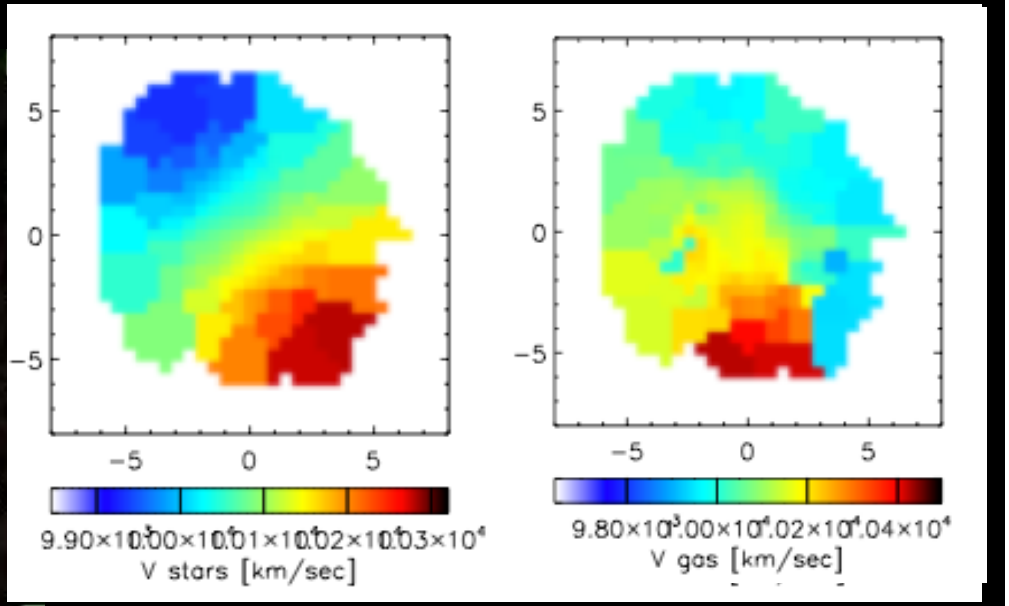




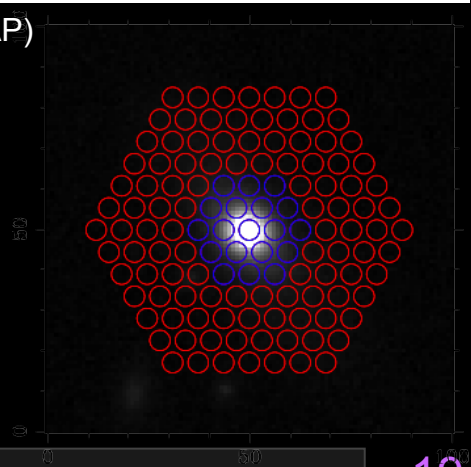
145.126 +21.254
(field 9 – 3 hours)
Plots from the DAP
(Lodovico Coccato)

Misaligned Gas Kinematics in Test Data





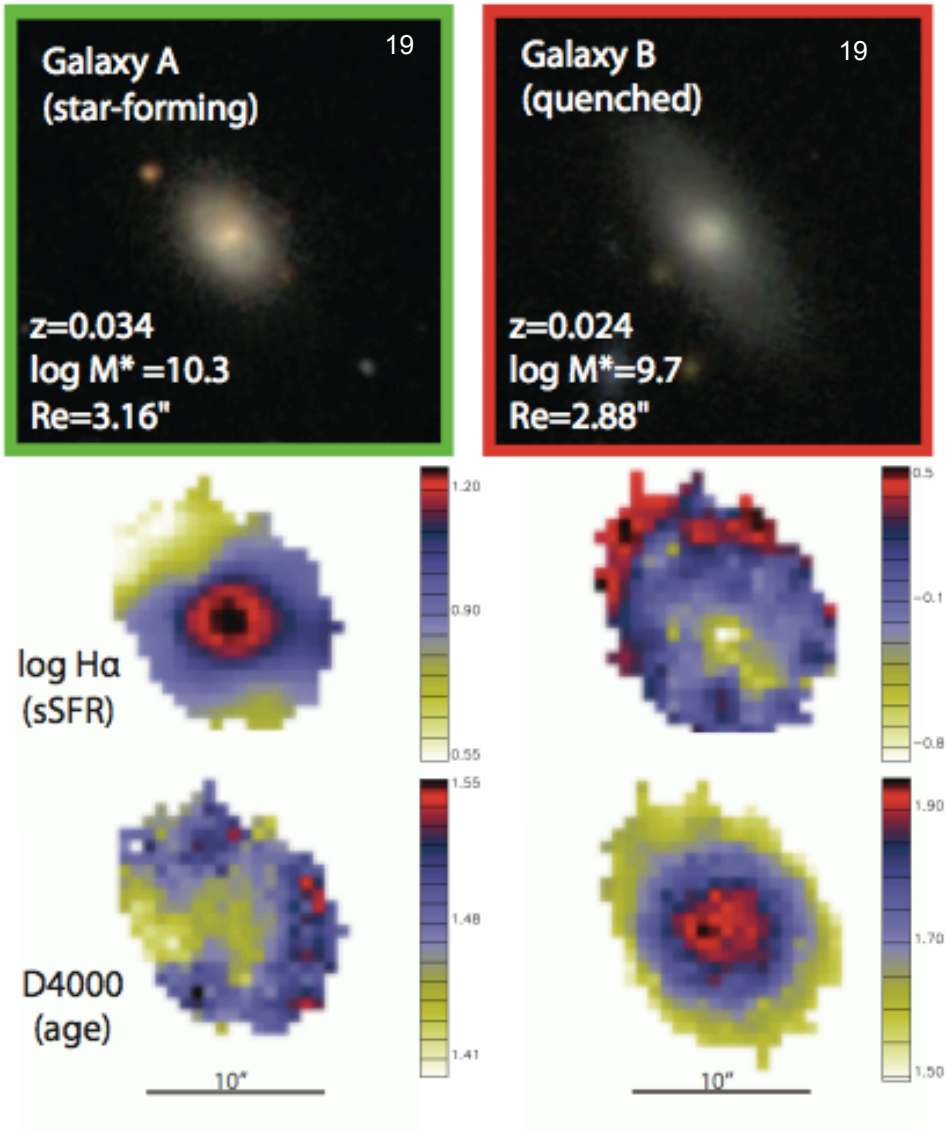
(Maps from the prototype DAP)

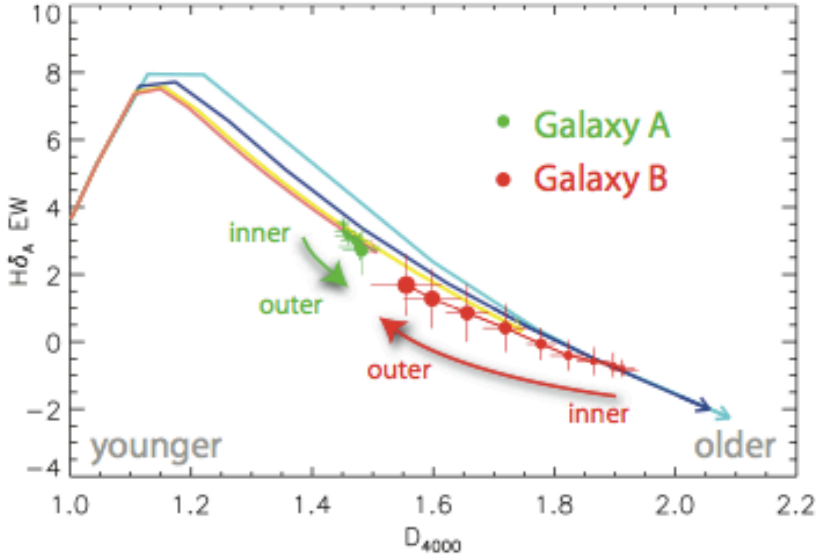


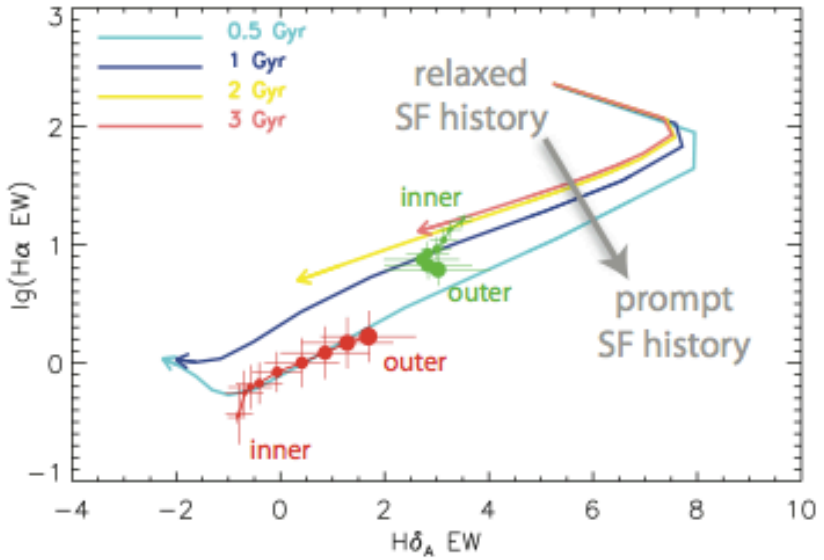
(19 fibre bundle)

Quenching Profiles

(Cheng Li)

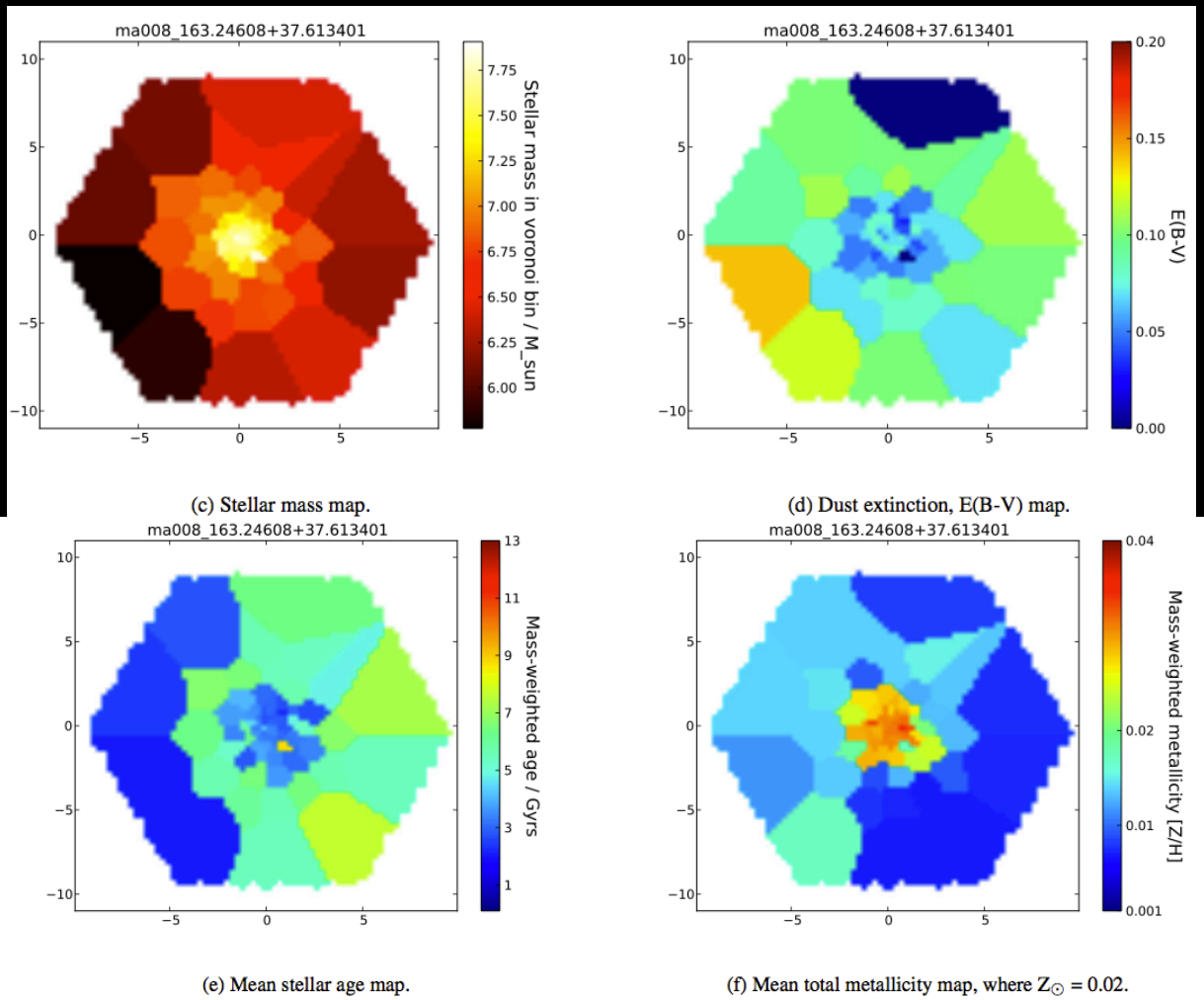


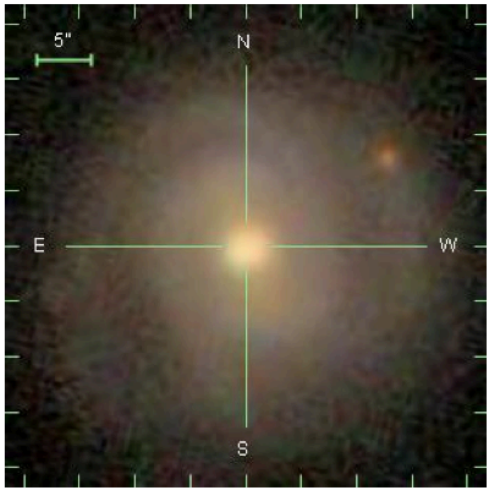




Stellar Population Maps

(David Wilkinson)





(a) SDSS Imaging data with 5" scale.

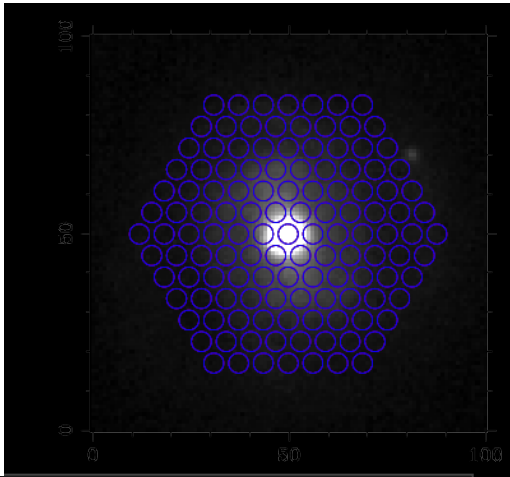
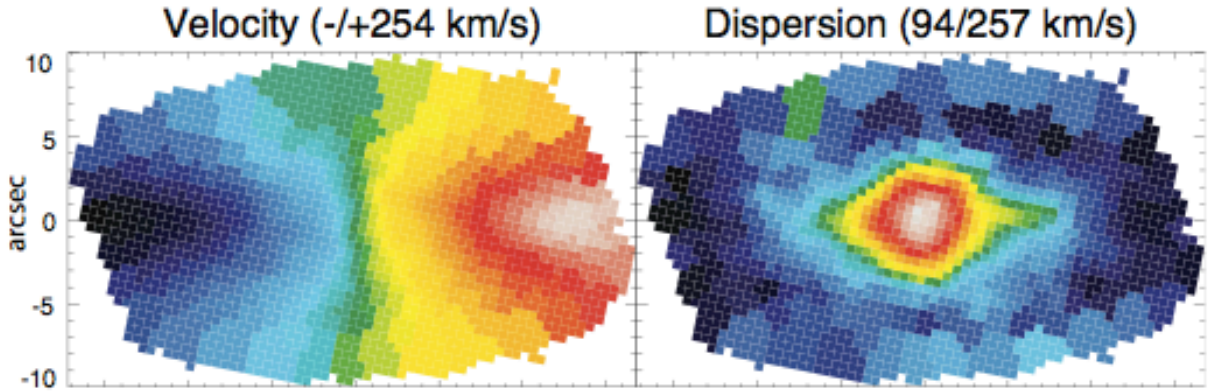


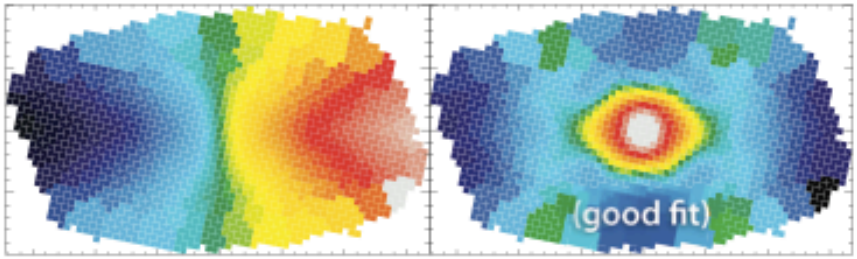
Figure 6. Stellar population maps of galaxy 6 in table 1, all analyzed using MILES-based models with its full parameter range. Each coloured area represents a single spectrum that has been Voronoi binned using all of the pixels in that area.

Galaxy Dynamics

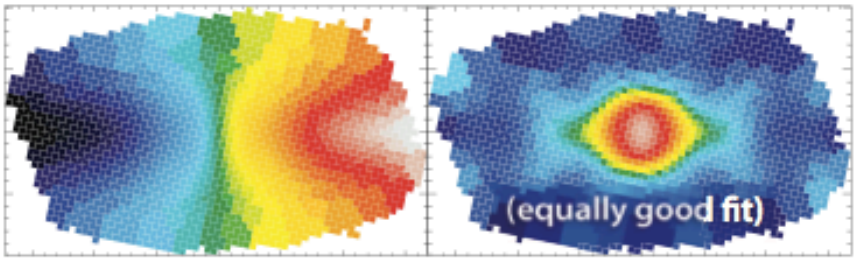
(Remco van den Bosch)



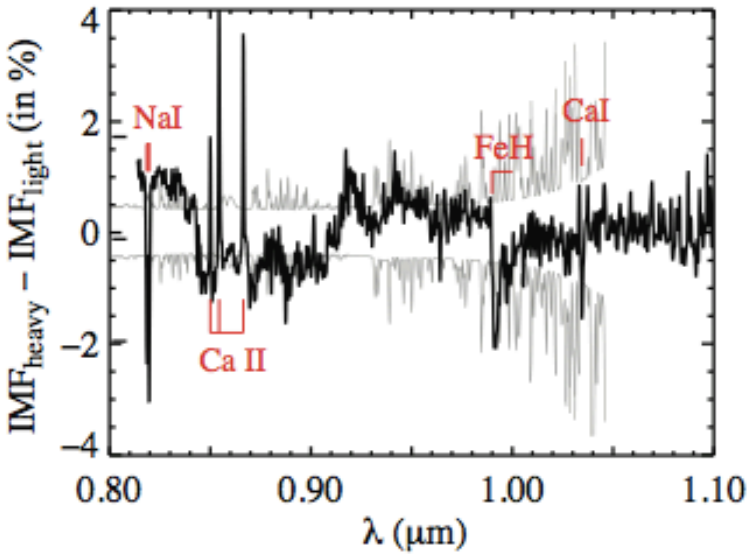
Model 1: No dark matter, heavy IMF



Model 2: NFW dark matter, light IMF

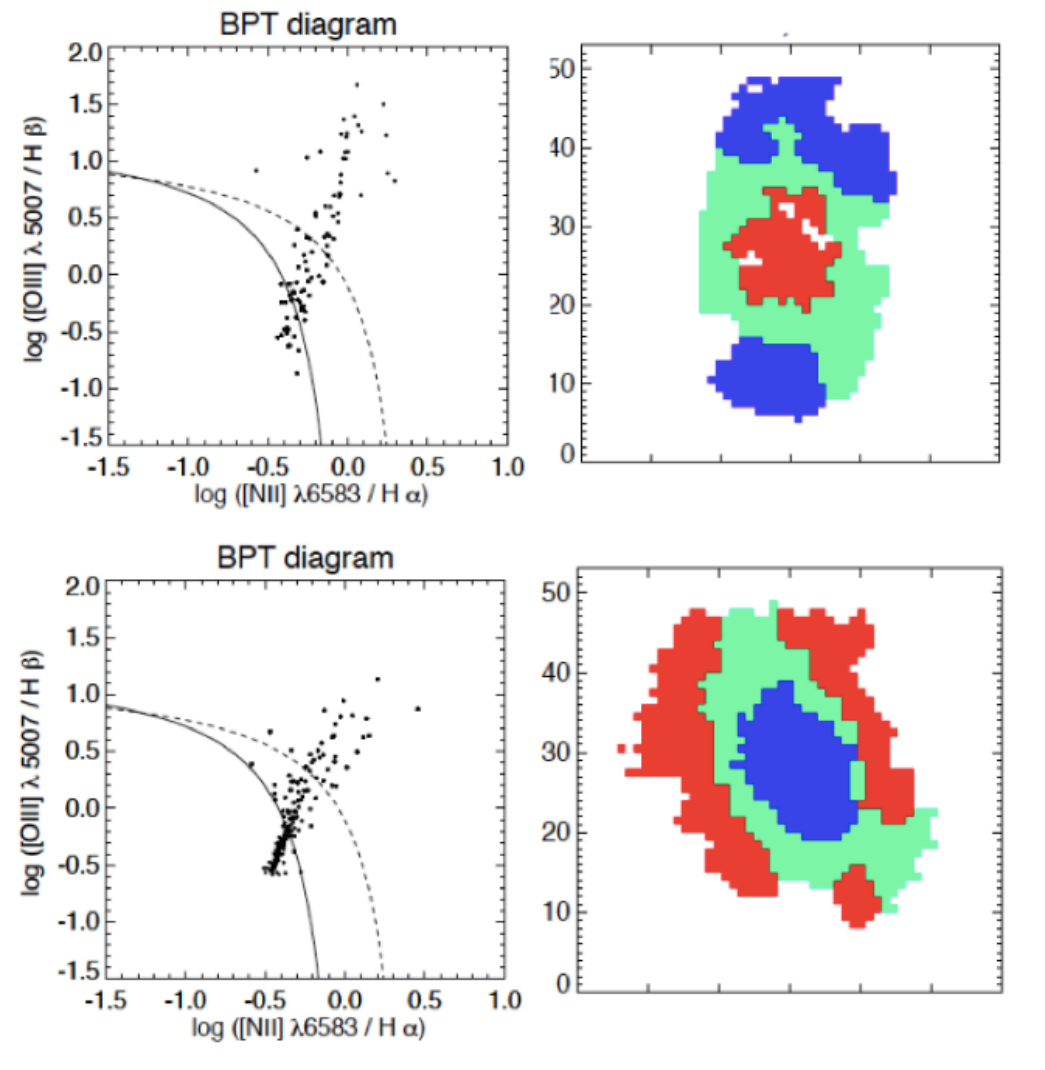


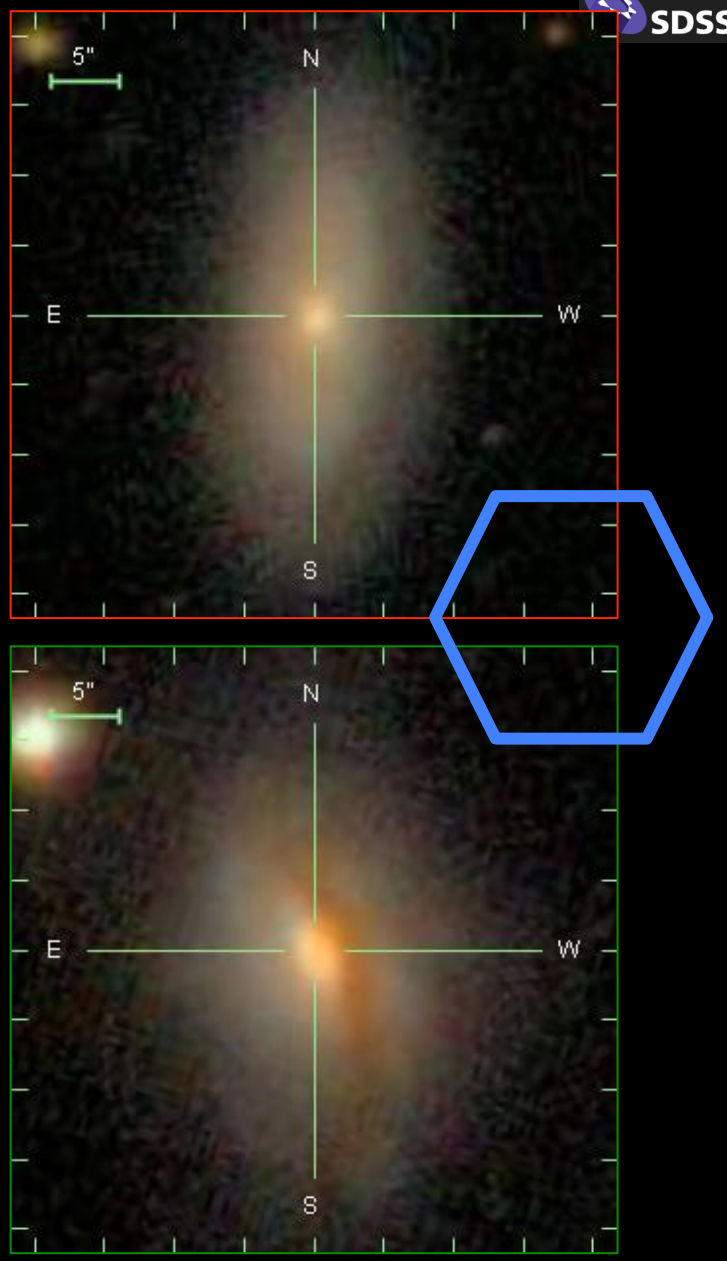
Near-IR features break the degeneracy



Resolved BPT

(Francesco Belfiore, Roberto Maiolino)





ICG Portsmouth

MaNGA

SDSS

PI: Kevin Bundy (IPMU Japan)

Chief Engineer and Project Manager: Nick MacDonald (UWashington)

Project Scientist: Renbin Yan (Kentucky)

Instrument Scientist: Niv Drory (UNAM Mexico)

Lead Data Scientist: David Law (Toronto)

Sample Design Lead: David Wake (Wisconsin/Openi University)

Lead Observer: Anne-Marie Weijmans (St Andrews)

SDSS-IV Project Scientist: Matt Bershady (Wisconsin)

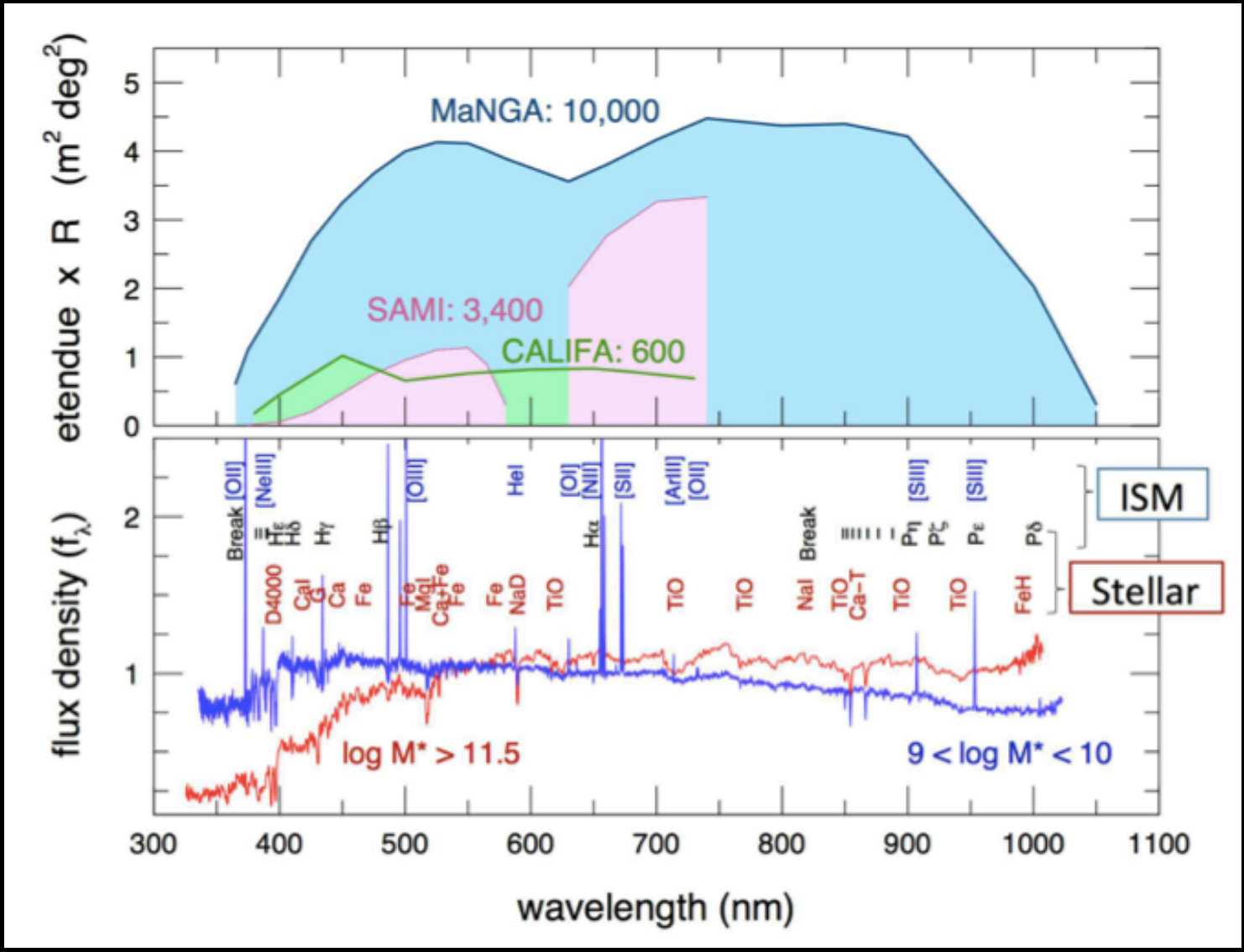
Starts July 2014

DR1(~1600) July 2016

Science Team:

- Co-chairs: Daniel Thomas (ICG), Sebastian Sanchez (Spain)
  - Kinematics: Eric Emsellem (ESO), Mike Merrifield (Nottingham), Karen Masters (ICG), Remco van den Bosch (MPIA)
  - Composition: Christy Tremonti (Wisconsin), Roberto Maiolino (Cambridge), Cheng Li (Shanghai), Alfonso Aragon-Salamanca (Nottingham)

IFU Survey Comparison



Summary of Survey Simulations

Simulation	Total # galaxies	# ALFAFA area	# APERTIF deep	#APERTIF shallow	#ASKAP
Baseline	10404	5712	1496	7701	4233
Apertif deep	10013	4658	2771	7701	3485
ALFALFA	9673	8500	1445	4896	6664
Mid Latt	10013	7055	1309	5372	6460

Non-adaptive tiling

Simulation	Total # galaxies	# ALFAFA area	# APERTIF deep	#APERTIF shallow	#ASKAP
Baseline	9486	4165	1207	6443	3808
Apertif deep	9537	3604	2091	6834	3366
ALFALFA	8687	6630	731	3451	6120
Mid Latt	9231	5117	850	4998	5100

Credit:Jose Sanchez-Gallego (Kentucky)

WARNING: Decision not yet made

MaNGA Timeline

This month:	Commissioning Run
Apr/May 2014	Submit survey description papers
Mar-Aug 2014	Full instrument production (1 cart/month)
July 2014	Survey starts ~1600 galaxies/year
Aug 2014	First cubes to SDSS collaboration
Oct 2014	High level science products to collaboration
Oct-Dec 2014	Science verification
Jan 2016	Final reduction pipeline for first public data
July 2016	First public data release (DR13) (data from July 2014-2015)