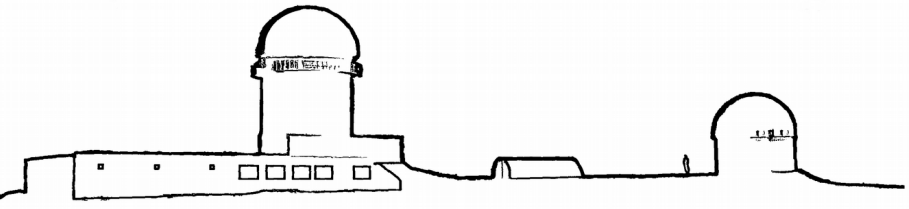
Javalambre
Physics of the Accelerating Universe
Astrophysical
Survey

The J-PAS survey:
pushing the limits of spectro-photometry

Silvia Bonoli

For the J-PAS collaboration



AYA2015-66211-C2-2P

UNIÓN EUROPEA
Fondo Europeo de Desarrollo Regional
"Una manera de hacer Europa"

SDSS

CFHTLenS

GAMA

SDSS III

VIPERS
VIMOS PUBLIC EXTRAGALACTIC REDSHIFT SURVEY

Pan-STARRS

DARK ENERGY SURVEY

Prime Focus Spectrograph
SuMIRe

eBOSS

euclid consortium

WIDE-FIELD INFRARED SURVEY TELESCOPE
WFIRST
ASTROPHYSICS • DARK ENERGY • EXOPLANETS

Hyper Suprime-Cam
@ Subaru

PAU

DESI
DARK ENERGY SPECTROSCOPIC INSTRUMENT

4MOST

HETDEX
Hobby-Eberly Telescope Dark Energy Experiment

LSST
Large Synoptic Survey Telescope

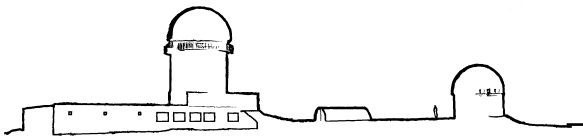
Photometry

- Unbiased samples
- Faster & cheaper
- Large Volumes
- High number density

vs.

Spectroscopy

- SED of targets
- Precise redshifts

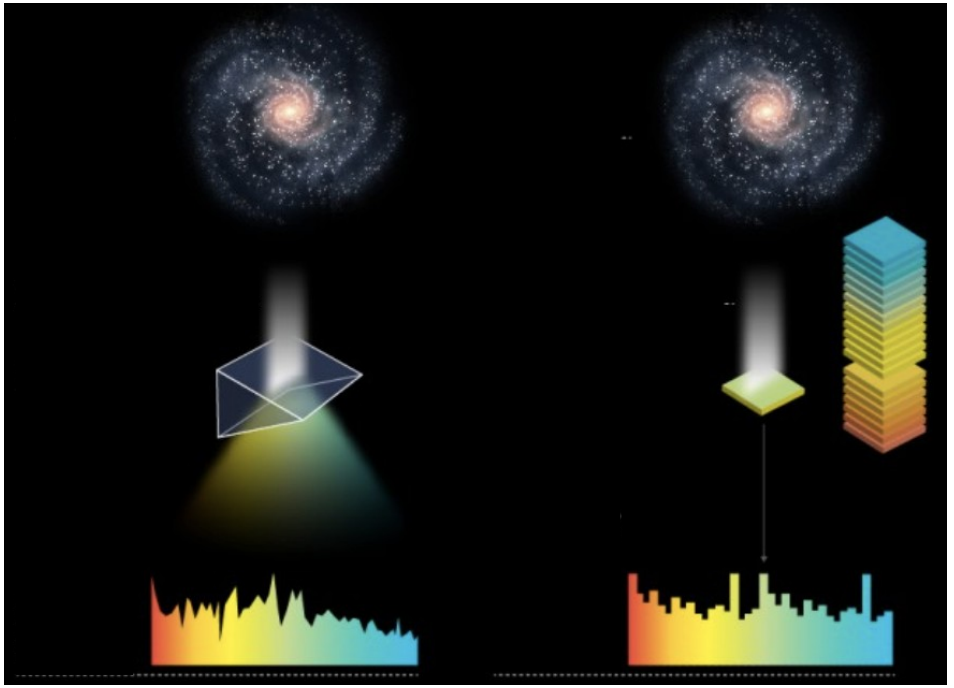


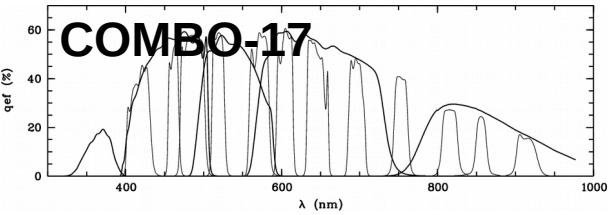
Photometry vs. Spectroscopy

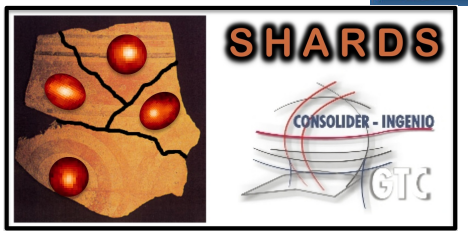
- Unbiased samples
- Faster & cheaper
- Large Volumes
- High number density

- SED of targets
- Precise redshifts

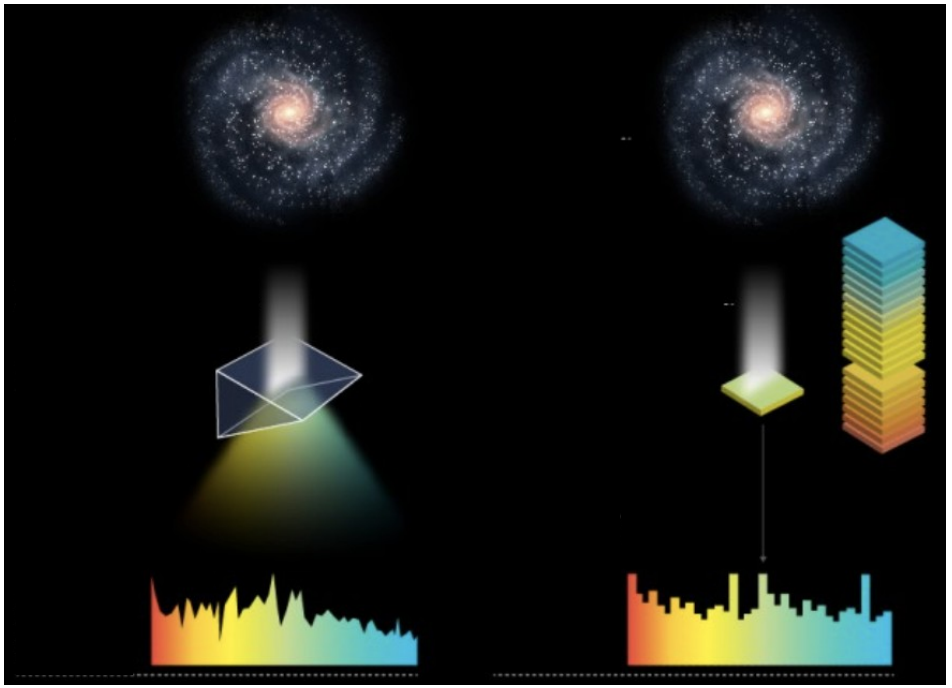
Spectro-Photometry







Spectro-Photometry



J-PAS

Javalambre Physics of the Accelerating Universe Astrophysical Survey

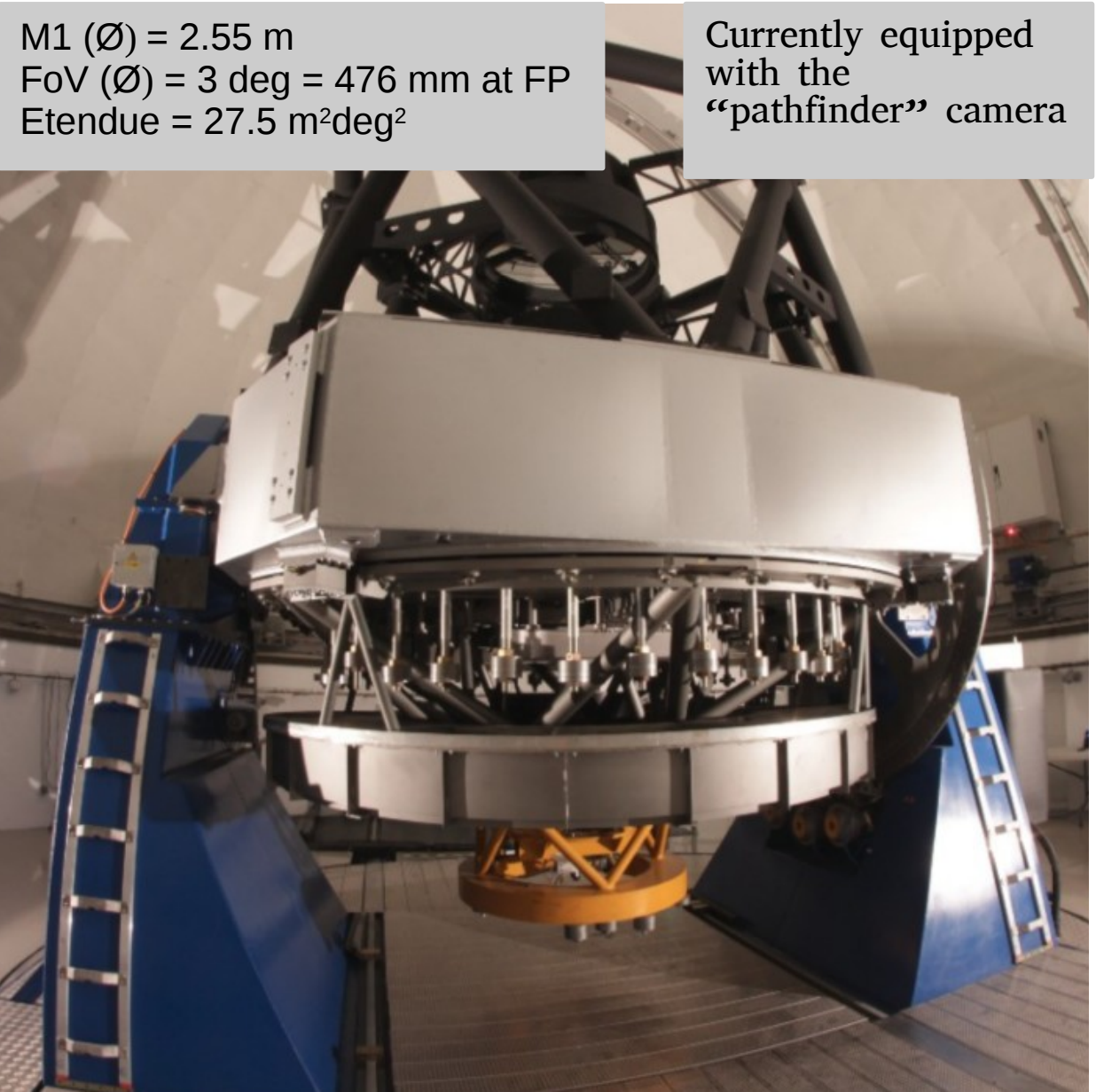
J-PLUS

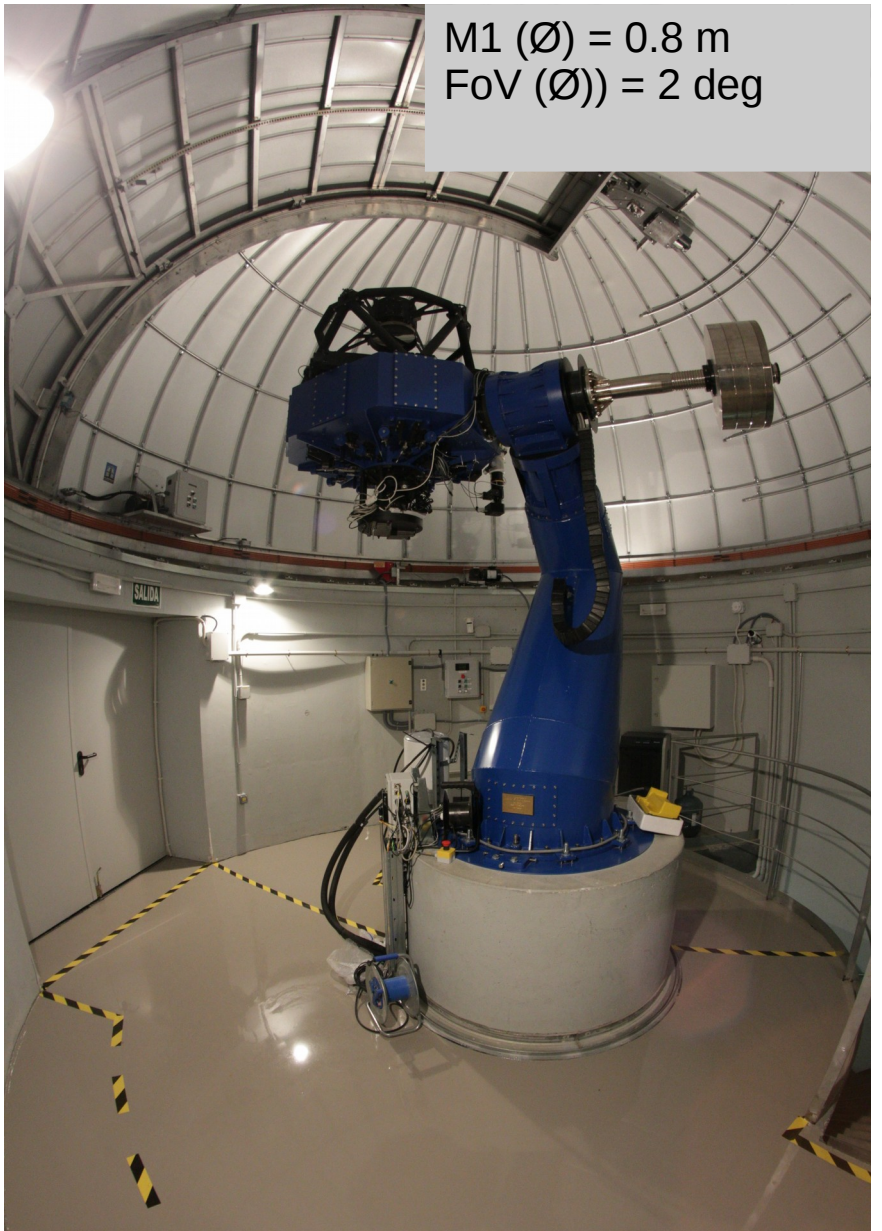
The OAJ observatory

M1 (Ø) = 2.55 m
FoV (Ø) = 3 deg = 476 mm at FP
Etendue = 27.5 m^2deg^2

Currently equipped with the "pathfinder" camera

M1 (Ø) = 0.8 m
FoV (Ø)) = 2 deg





JPCam

T80Cam

JPCam

T80Cam

J-PAS

Javalambre Physics of the Accelerating Universe Astrophysical Survey

J-PLUS

The camera JPCam

1.2 Giga pixels
(14 CCD of 9200x9200)
0.22 arcsec/pixel
4.5 deg²

Subsistemas principales

Actuator System
NTE SENER

Filter and Shutter Unit
(TBD)

JPCam interface with T250

Filter and Shutter Unit
- Filter Unit
- Shutter Unit
- Anti-cond. Sys.
- e-Box

Actuator System
- ISS
- Hexapod
- CSS
- e-Box

Camera
e2v

e2v camera
- Cryostat
- Image acquisition system

The camera JPCam

1.2 Giga pixels
(14 CCD of 9200x9200)
0.22 arcsec/pixel
4.5 deg²

	Telescope		Camera				
	Size	**FoV**	**# CCDs**	**CCD format**	**# of pixels**	**Resolution**	**Filters**
LSST	8.4m	9.6 sq. deg.	189	4096 x 4096	3.2 Gpixels	0.2"/pix	u, g, r, i, z, y
PanStarrs	1.8m	6.7 sq. deg.	60	4600 x 4600	1.3 Gpixels	0.26"/pix	g, r, i, z, y
JPCam	**2.5m**	**4.9 sq. deg.**	**14**	**9231 x 9216**	**1.2 Gpixels**	**0.23"/pix**	**54NB + 2BB**
HyperSuprimeCam	8.2m	1.8 sq. deg.	112	2048 x 4096	940 Mpixels	0.18"/pix	r, i, z, y
VIS (Euclid)	1.2m	0.5 sq. deg.	36	4096 x 4096	520 Mpixels	0.1"/pix	R, I, Z
DECam	4m	3 sq. deg.	62	2048 x 4096	500 Mpixels	0.27"/pix	g, r, i, z, y
Megacam	3.6m	1 sq. deg.	32	2048 x 4096	340 Mpixels	0.19"/pix	u, g, r, i, z
Omegacam	2.6m	1 sq. deg.	32	2048 x 4096	340 Mpixels	0.21"/pix	u, g, r, i, z
JPAS-Path Finder	**2.5m**	**0.45 sq. deg.**	**1**	**10580x10560**	**110 Mpixels**	**0.23"/pix**	**g, r, i + NBs**
T80Cam	**0.8m**	**2.1 sq. deg.**	**1**	**10580x10560**	**110 Mpixels**	**0.5"/pix**	**u, g, r, i, z + 7NB**
SuprimeCam	8.2m	0.25 sq. deg.	10	2048 x 4096	80 Mpixels	0.2"/pix	g, r, i, z, y

e2v

- Cryostat
- Image acquisition system

The filter system

- **54 NB filters**
(FWHM~145Å; Δλ~10nm)
From 3785Å to 9100Å

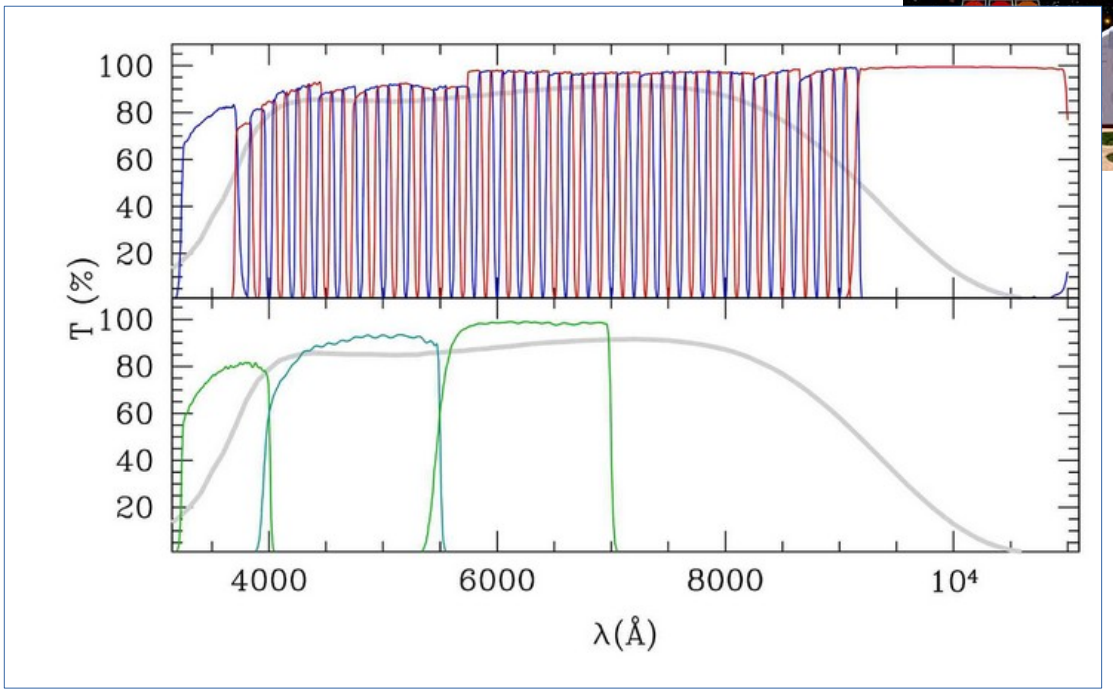
- **1 Blue MB filter**
(FWHM~260Å; λ_c~3600Å)

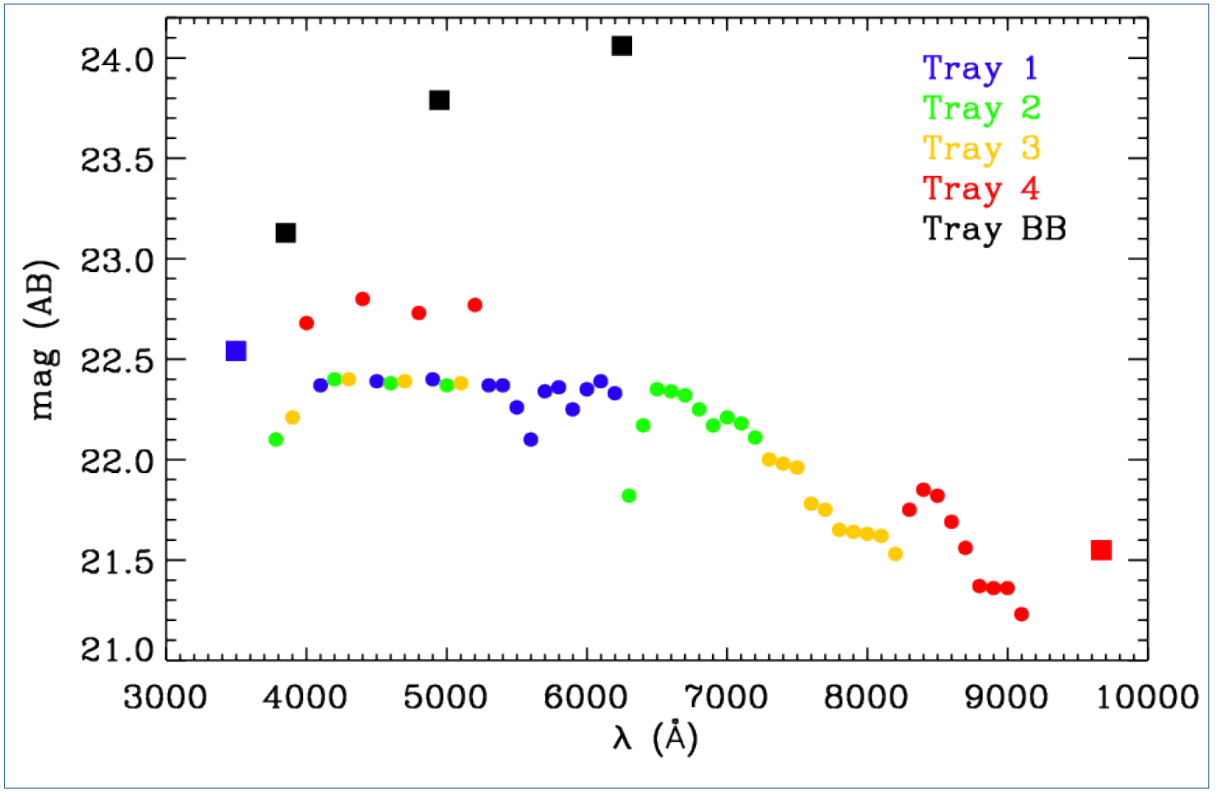
- **1 Red BB filter**
(FWHM~620Å; λ_c~9500Å)

- **Sloan u, g, r**

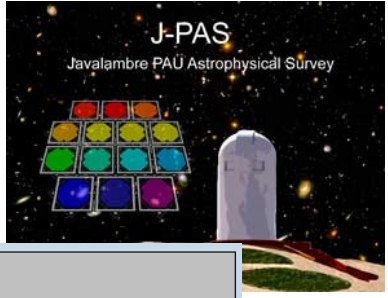
Pseudo-spectrum (R~**50**)
for every pixel of the sky

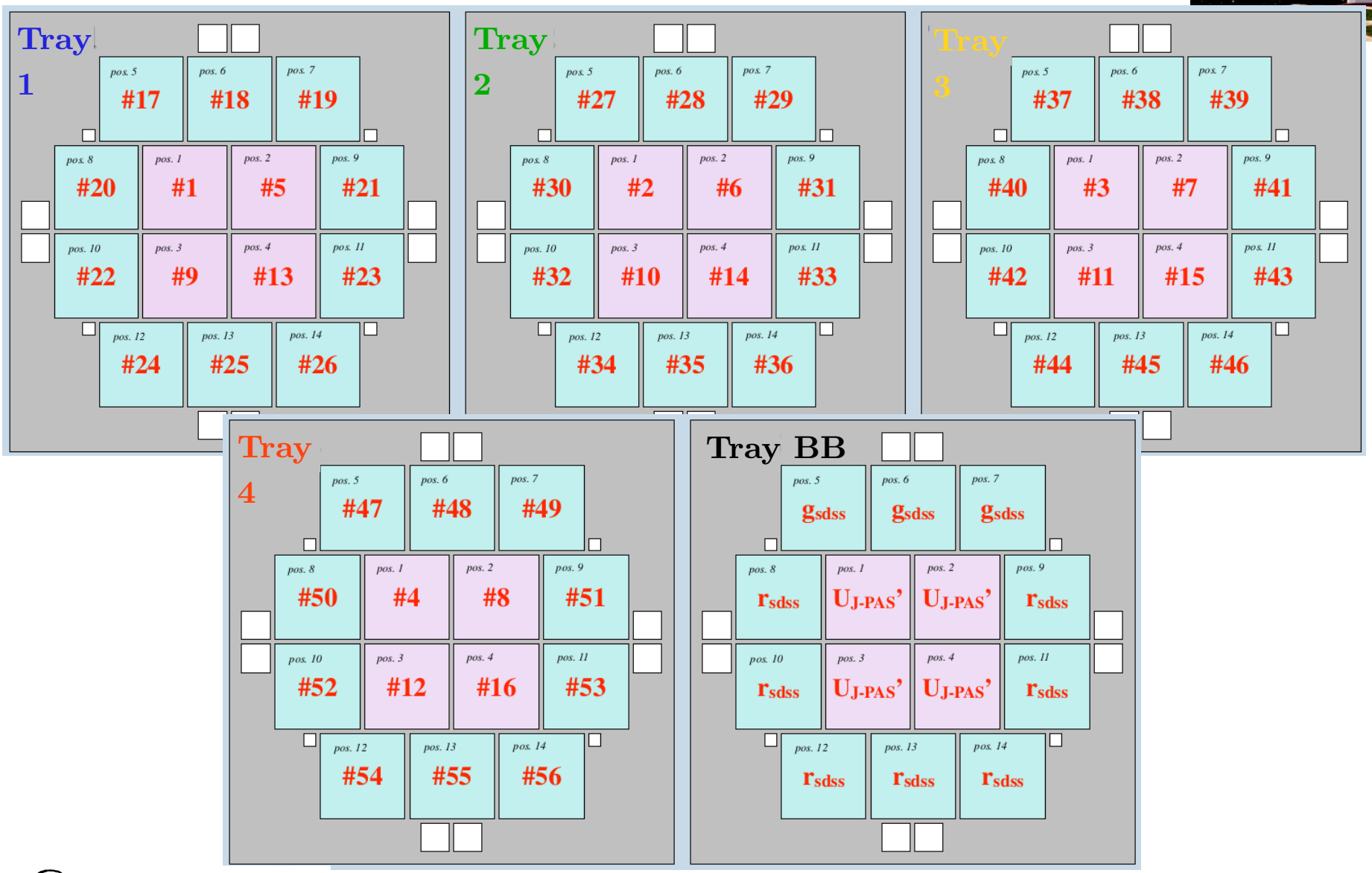
5σ
3” aperture





The camera + filters





The filter system

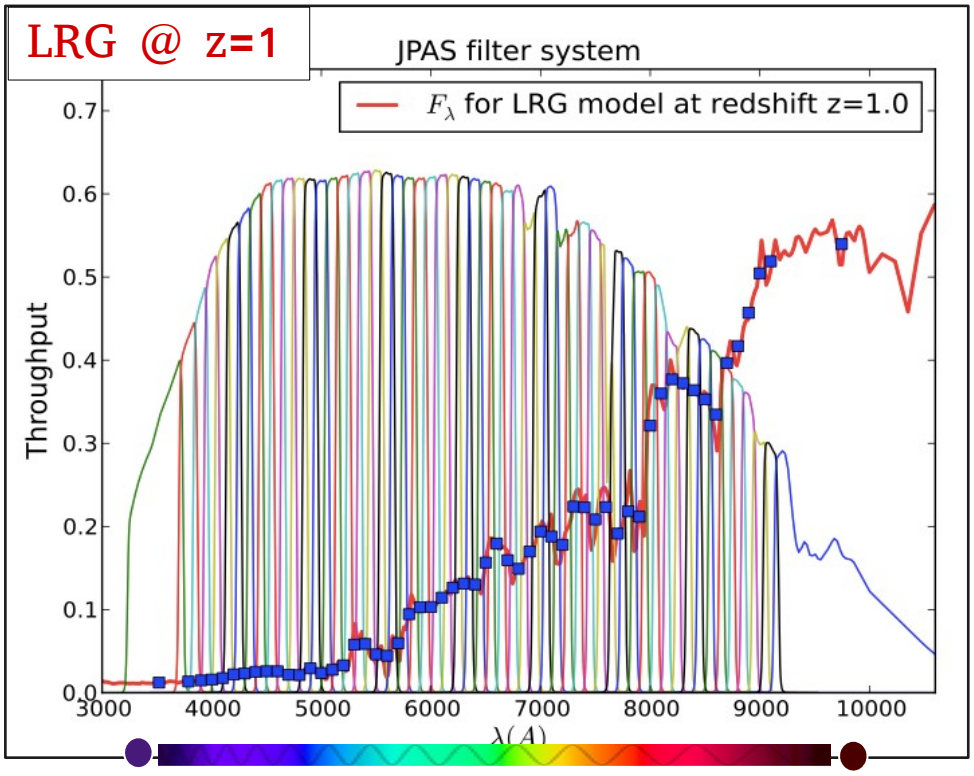
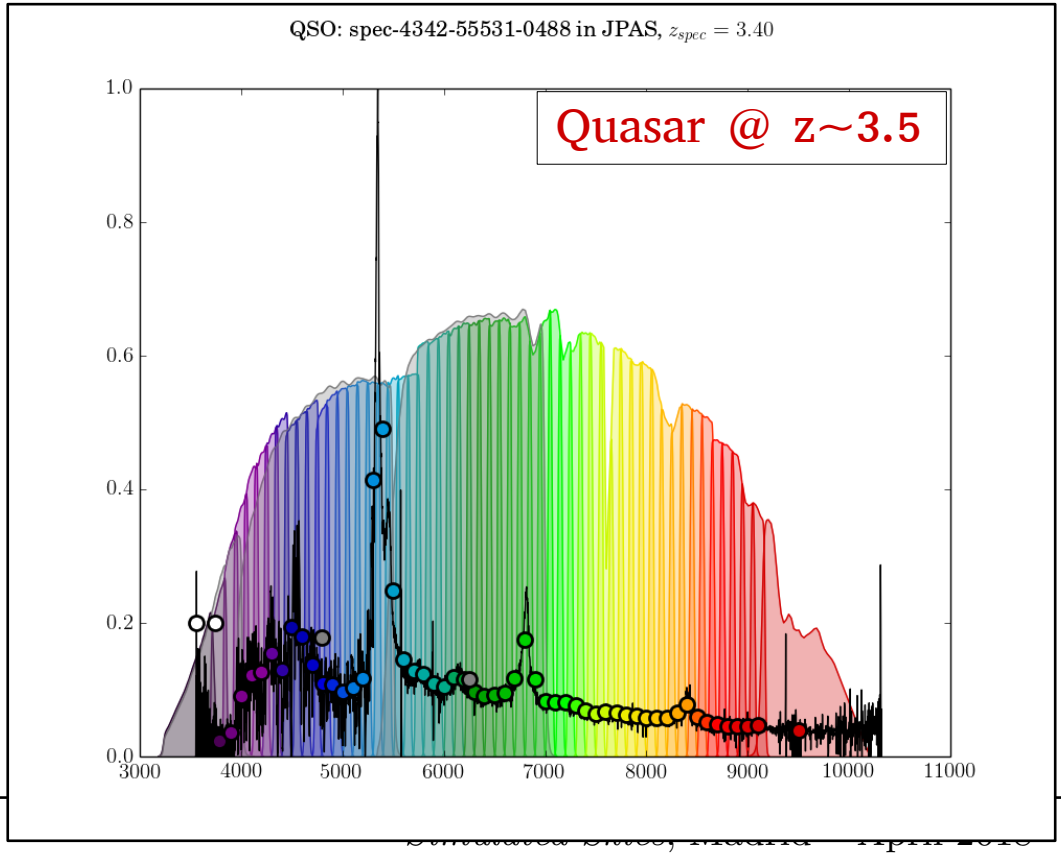


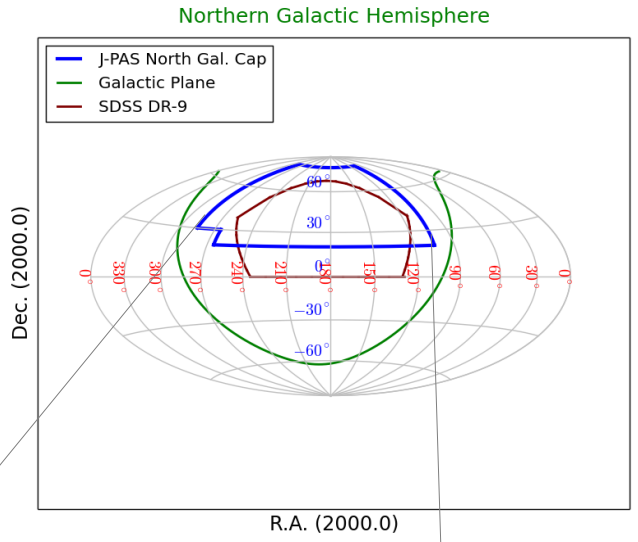
Photo-z precision as good as 0.003(1+z)

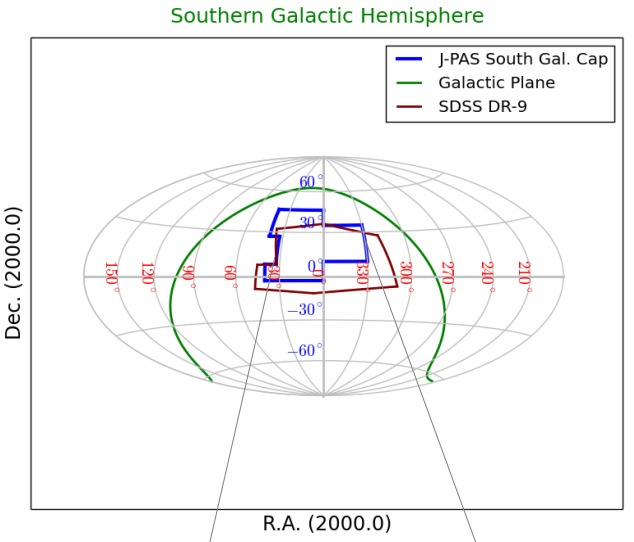


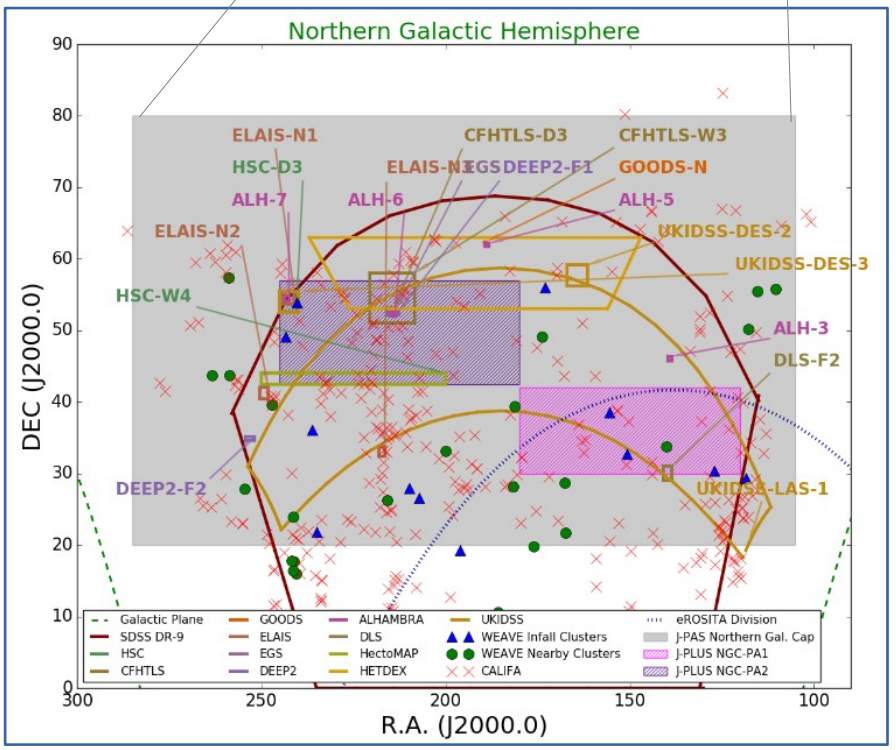
Footprint

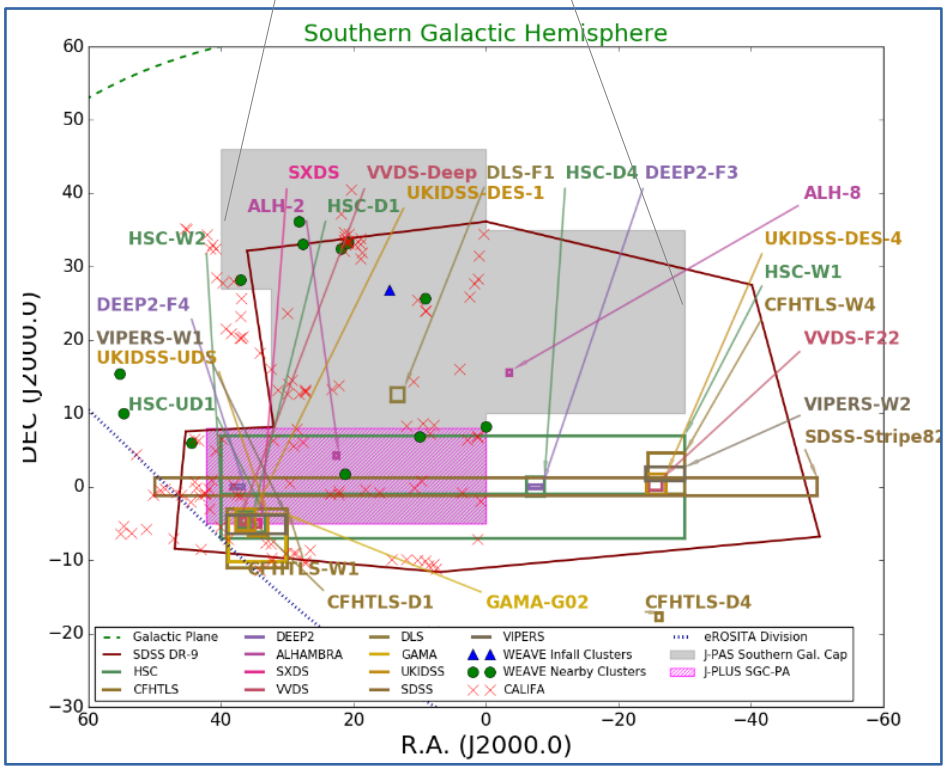
Expected survey speed:

~ **1000 deg² /yr**









Cosmology experiments

Type Ia Supernovae

~4000 SNIa
- exposure cadence
- redshift from SN SED or host galaxy
- characterization of environment

Clustering

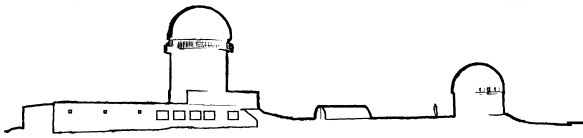
- 90M galaxies (LRG, ELG) with photo-z precision of 0.3%
- 2M QSOs
- ks LAE

Clusters

- 700k clusters with more than 10 members – down to ~few 10^{13} M_{sun}
- Combine lensing and optical richness for mass calibration

Lensing

- Optimization of BB observations in the best nights
- Redshift precision for lenses and background galaxies



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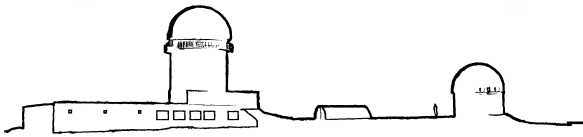
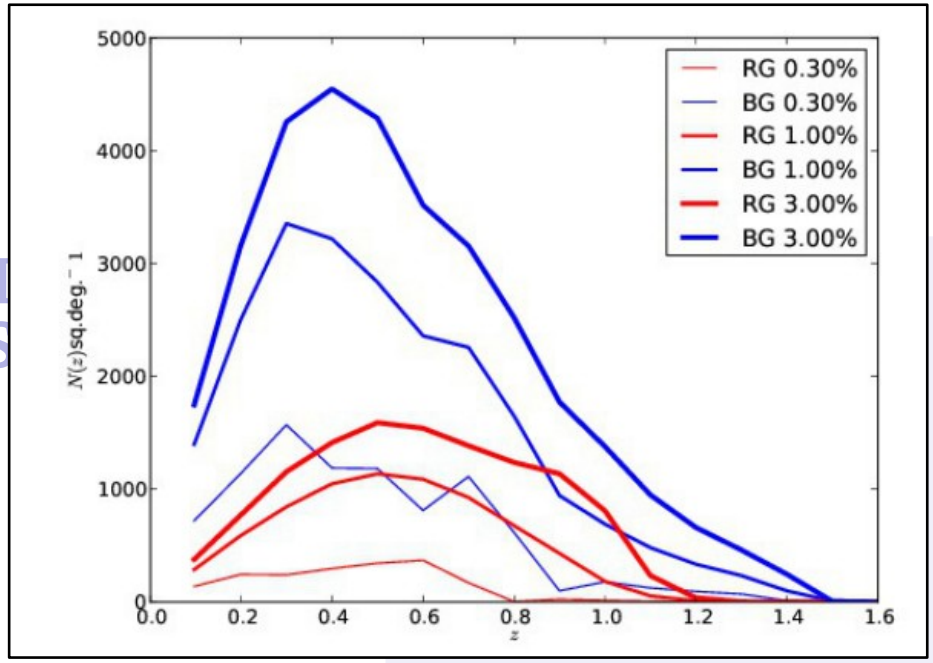


Cosmology experiments

Photo-z error	Red	Blue
0.3%	17M	73M
1%	64M	200M
3%	100M	285M



- 90M galaxies (LRG, ELG) with photo-z precision of 0.3%
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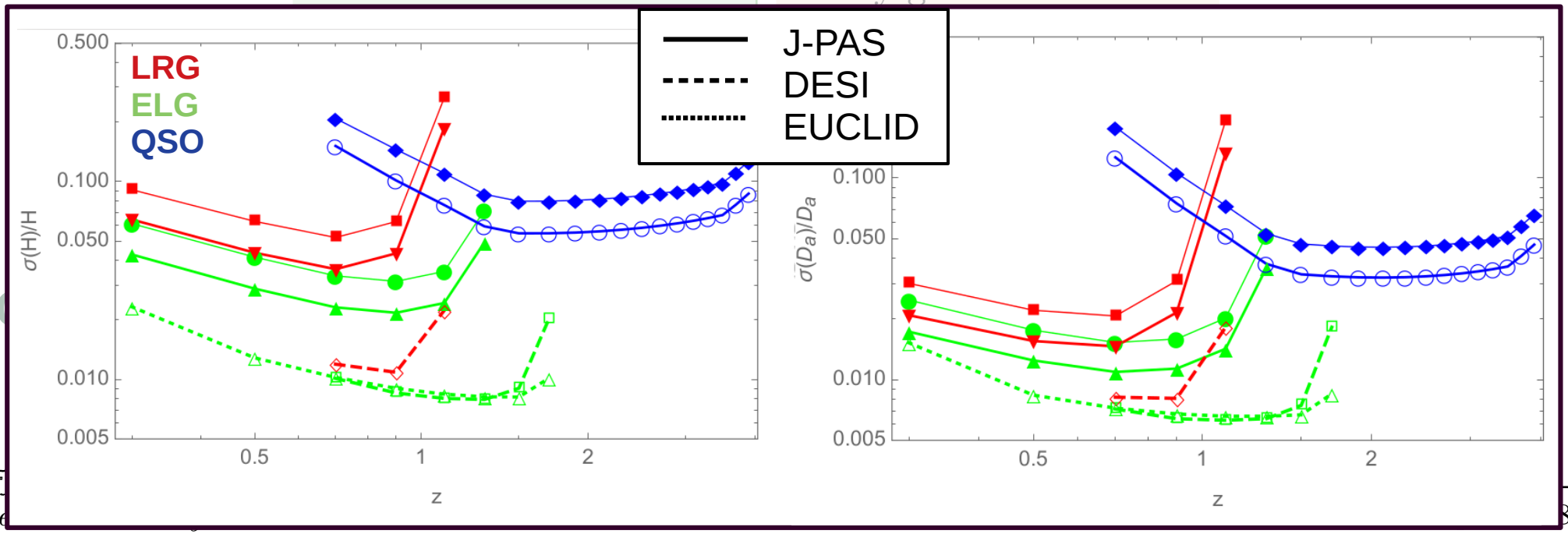
- ks LAE

Clustering

- Very good median

Raul Abramo's forecasts



Cosmology experiments

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- exposure cadence
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- 90M galaxies (LRG, ELG) with photo-z precision of 0.3%
- 2M QSOs
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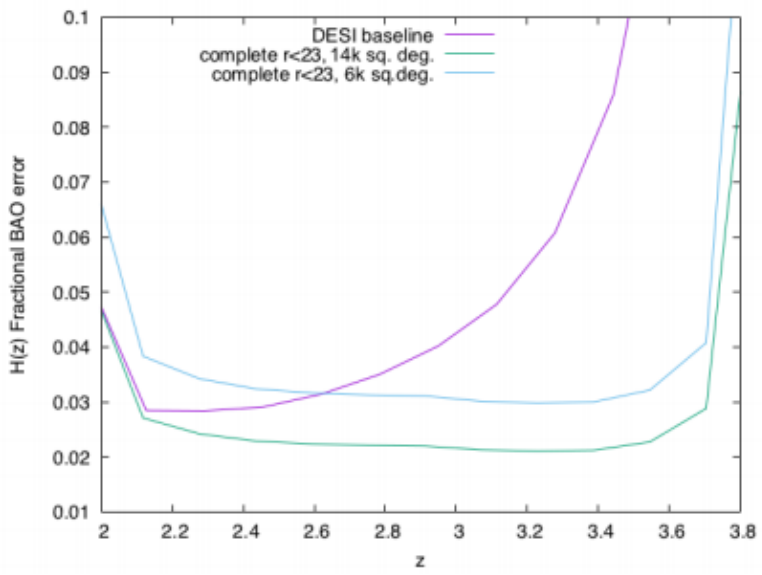
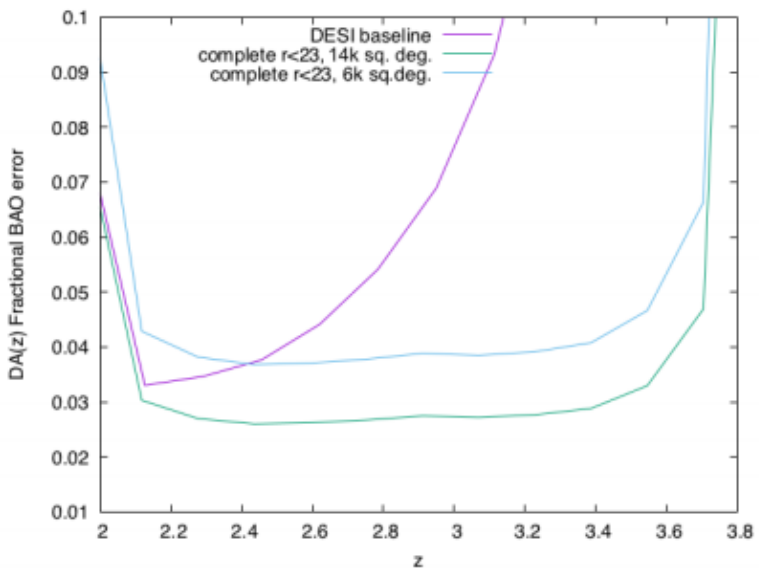
Clustering

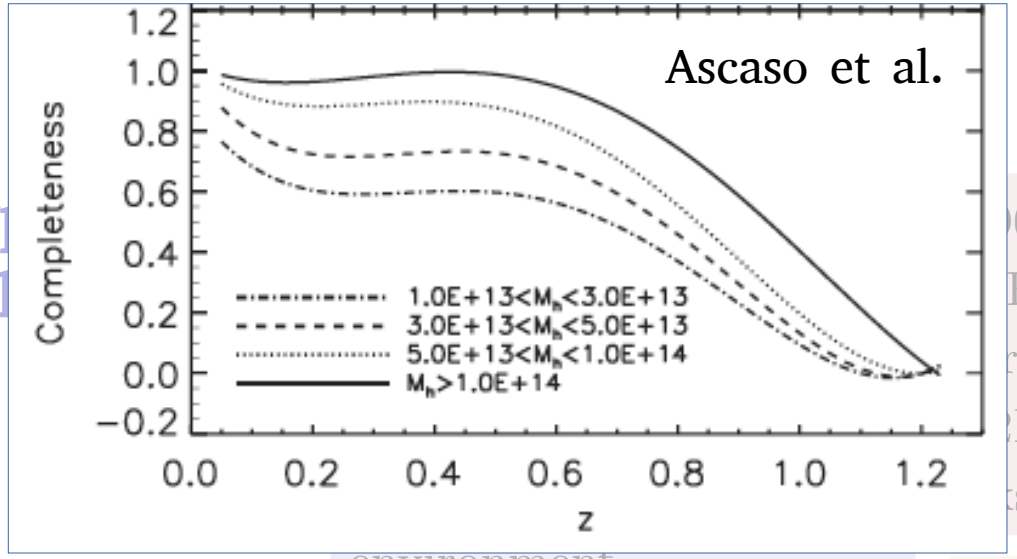
WEAVE-QSO survey: Follow-up of 0.5M QSOs at z>2.2

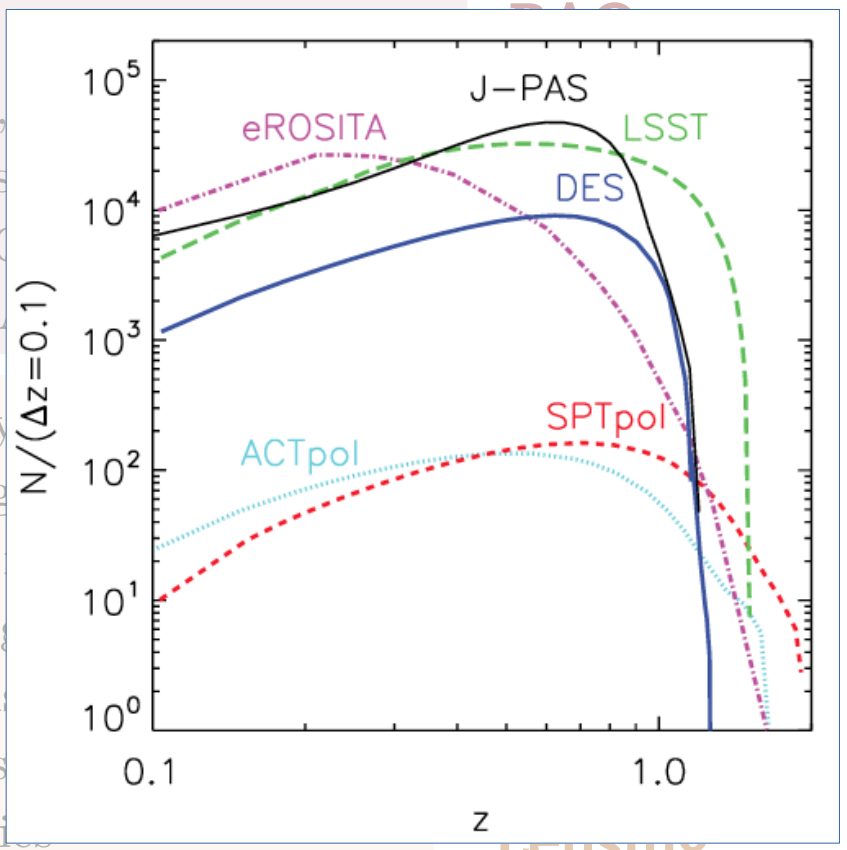




Pieri et al., 2016

Cosmology experiments





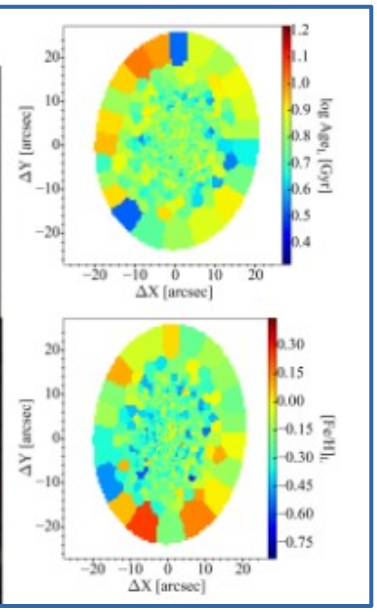
- 700k clusters with more than 10 members – down to ~few 10^{13} M_{sun}
- Combine lensing and optical richness for mass calibration

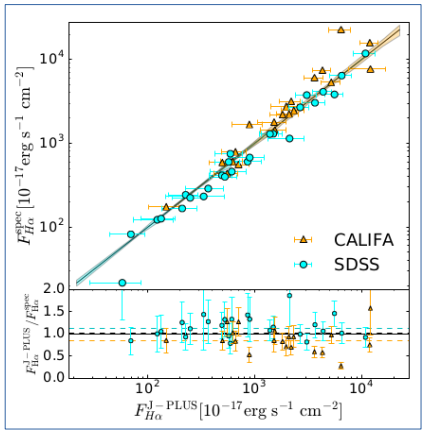
Clusters

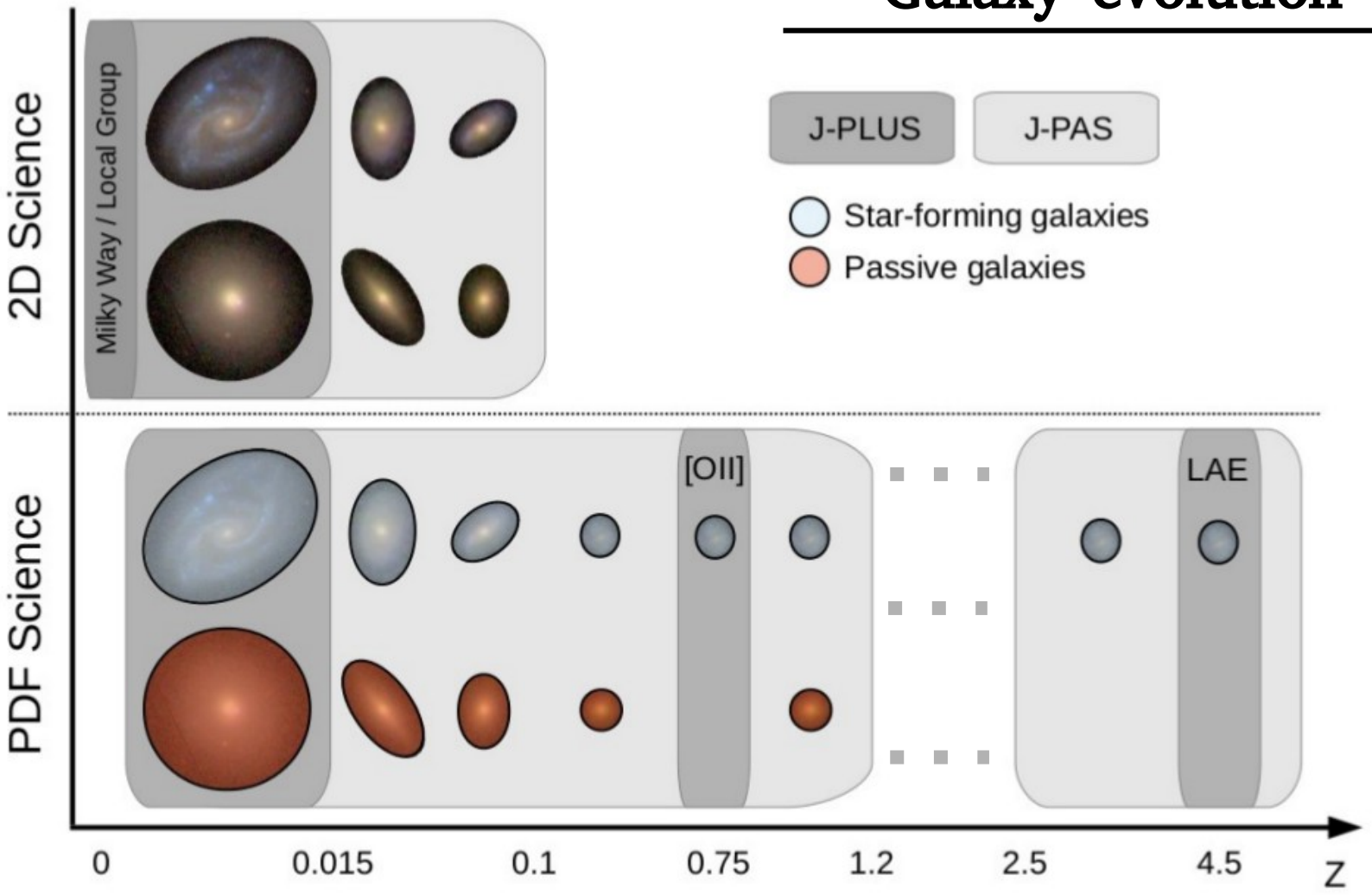
Synergy with eRosita (DE)

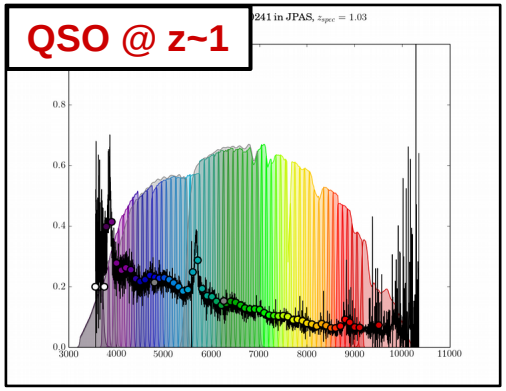
eROSITA

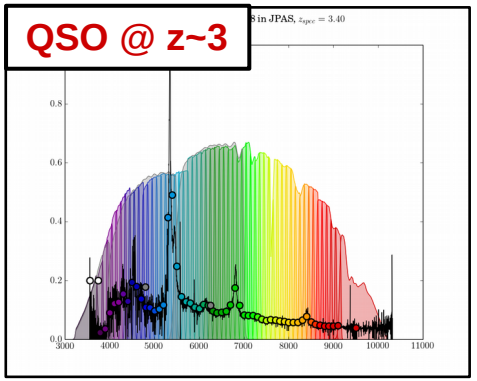
Galaxy evolution





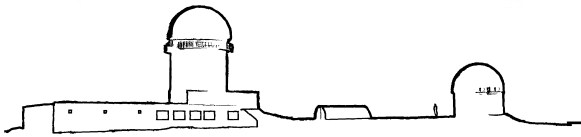






Galactic science

- **Characterize the basic** physical properties of the observed stars (temperature, gravity, metallicity…)
- Discovery and characterization of stellar populations of **ultra** dwarf galaxies
- **RR-Lyrae** variable stars – should be able to be observed up to ~200 kpc. Used as tracers of galactic subsystems
- Tidal streams and low surface brightness structures
- **White Dwarfs** - age indicators of the group they belong to
- **PNe** – provide important information to study low-mass stars evolution and the early chemical composition of the Galaxy
- Search for **ultra** metal-poor stars (only ~100 already known with [Fe/H]<-3 up to now)
- Characterization of **binary** (and multiple) stars (e.g, CVs, AM CVs)



Time-line for J-PAS

Current time-line:

- Early/Mid 2018: **Start of mini-JPAS** - Final assembly and fine-tuning of JPCam

- Mid/End 2018: Coating of the T250 mirror

- Beginning 2019: Installation of JPCam and **Start of J-PAS**

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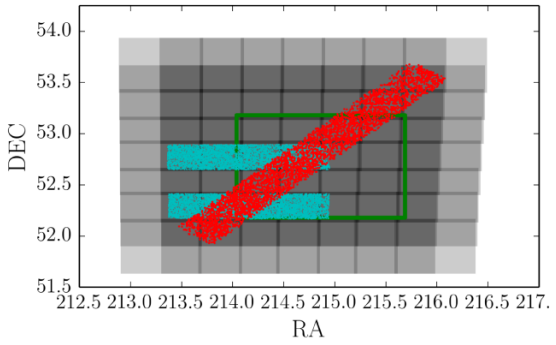

mini-JPAS (~3 deg2 at full-depth with all the filters on the AEGIS field)

Goals:
- telescope final testing (e.g., actuator system)
- data-reduction pipeline testing
- scientific-analysis pipelines testing
- first scientific results

www.j-pas.org

Collaboration board:

Javier Cenarro (CEFCA)
Renato Dupke (ON)
Laerte Sodre' (USP)
Jose' Vilchez (IAA-CSIC)

Scientific coordinators:

Silvia Bonoli (CEFCA)
Renato Dupke (ON)

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