J-PAS

The Javalambre-Physics of the Accelerating Universe Astrophysical Survey

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J-PAS Builder Institutions

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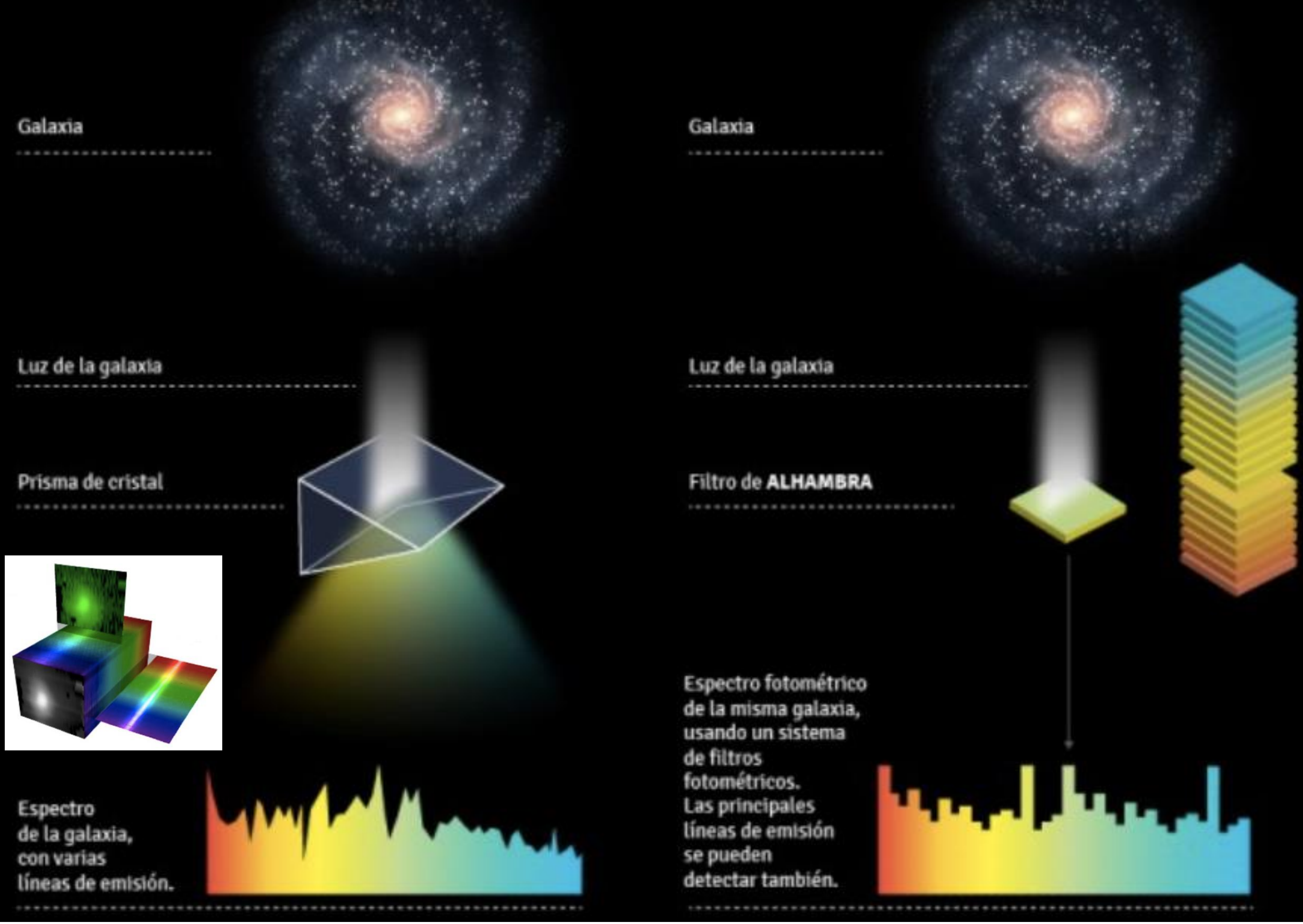
INSTITUTO de ASTROFISICA de ANDALUCIA
CSIC
I·A·A

From Cenarro (2019)



Benitez et al. 2009 – Simulated with lower (by >10) resolution templates and 300A filters)

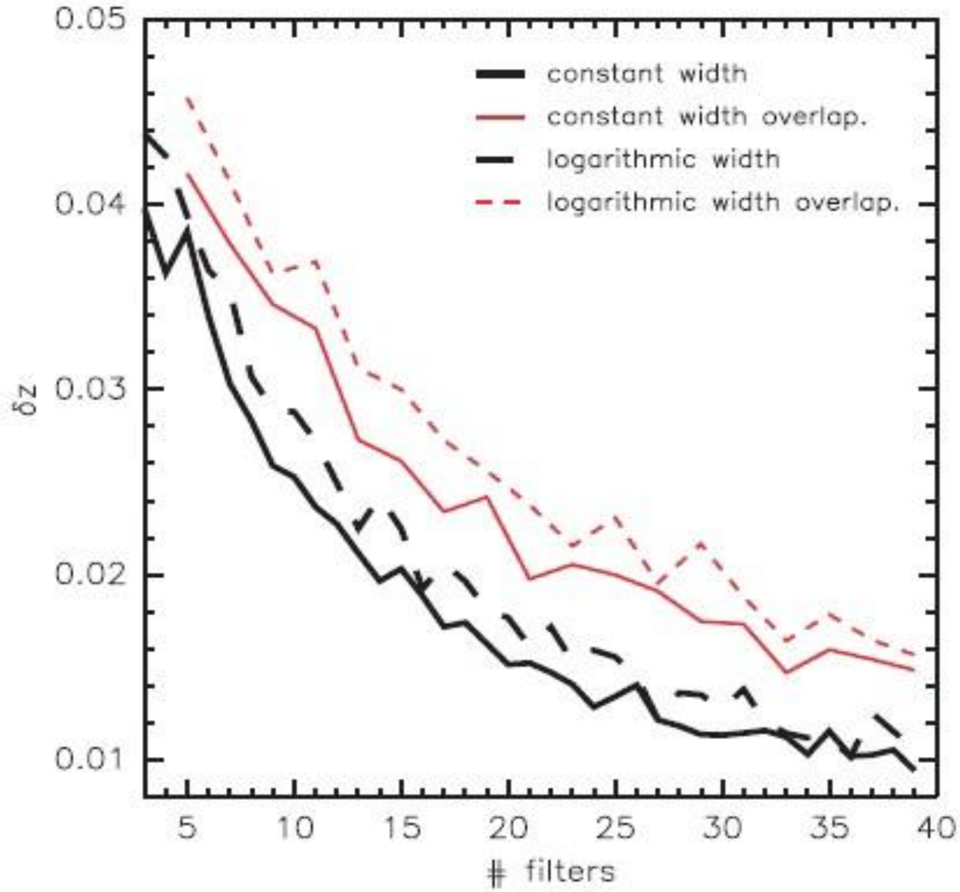
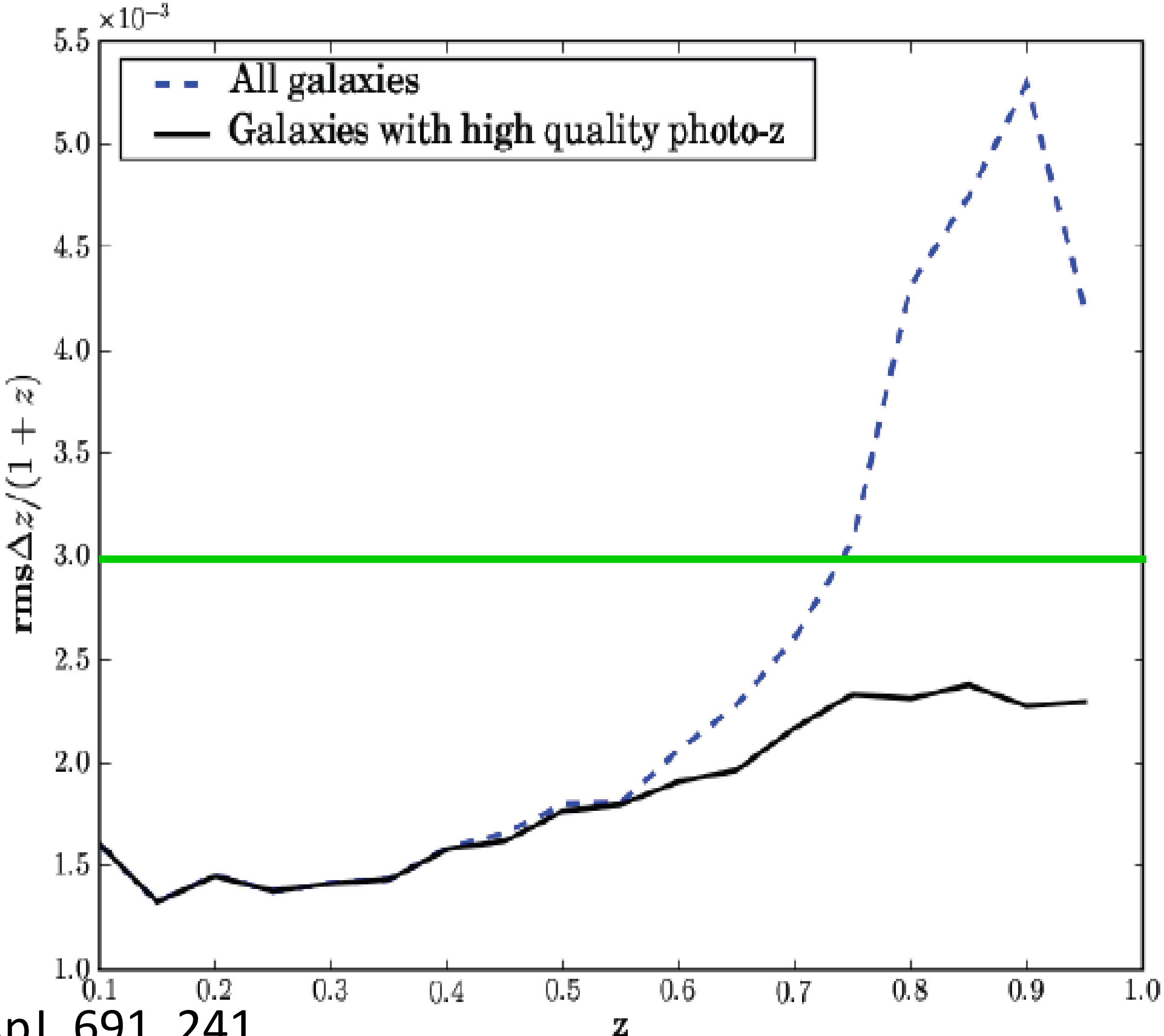


Figure 4. Dependence of the rms of quantity $(z - z_b)/(1 + z)$ for those galaxies with odds $>$ 0.99 as a function of the number of filters for the four types of filter systems considered in the Letter and including near-IR observations (see

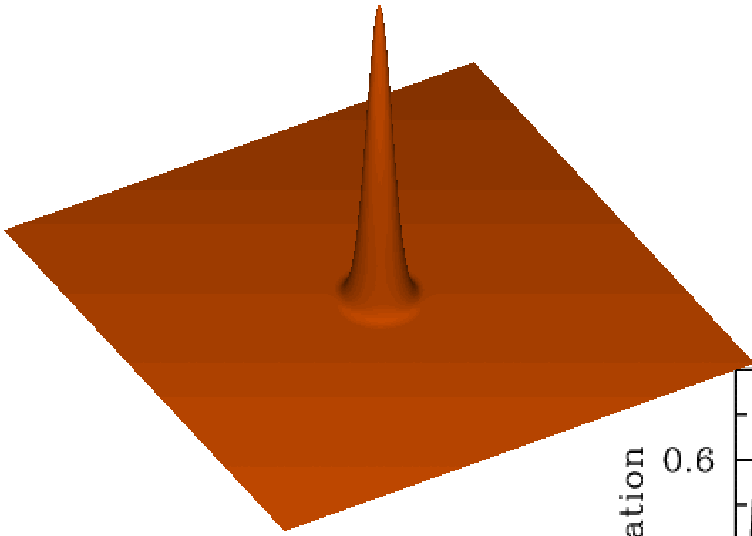
Δz r.m.s as a function of the true z

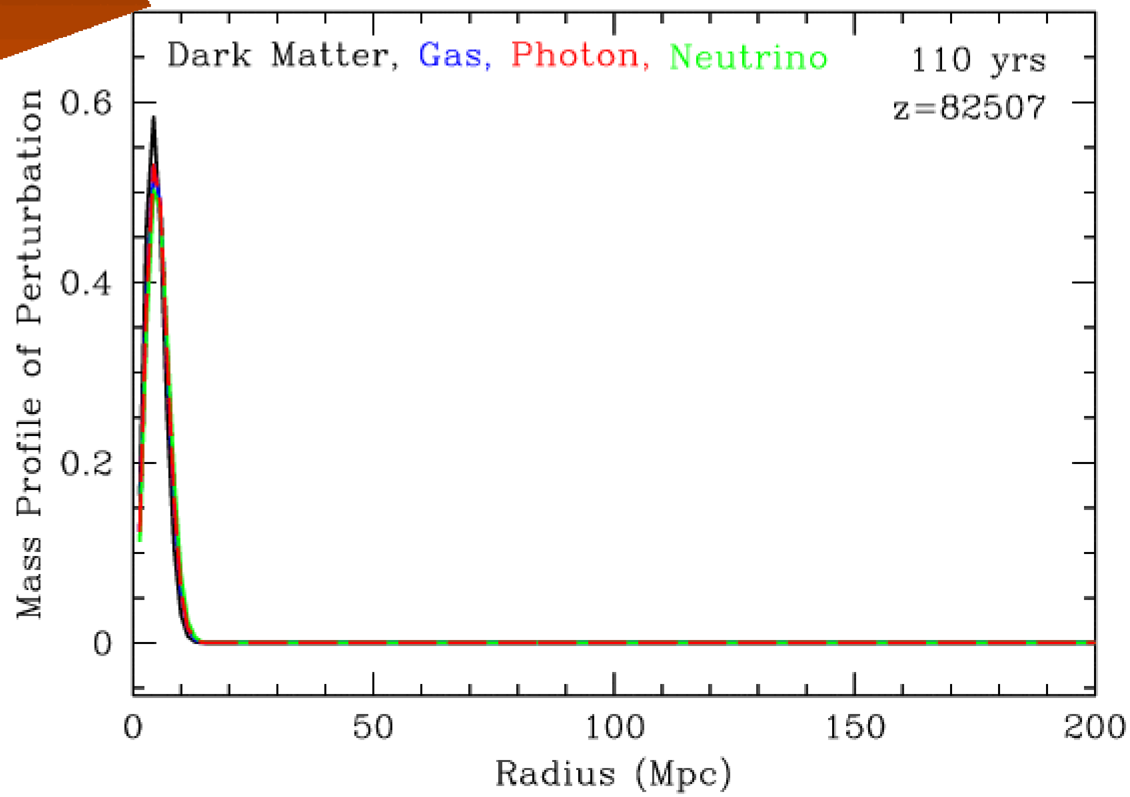
Bayesian photo-z quality indicator ("BPZ odds") can selects galaxies with high precision photo-z

Measuring the BAO radial scale requires quasi-spectroscopic precision: 0.003(1+z).

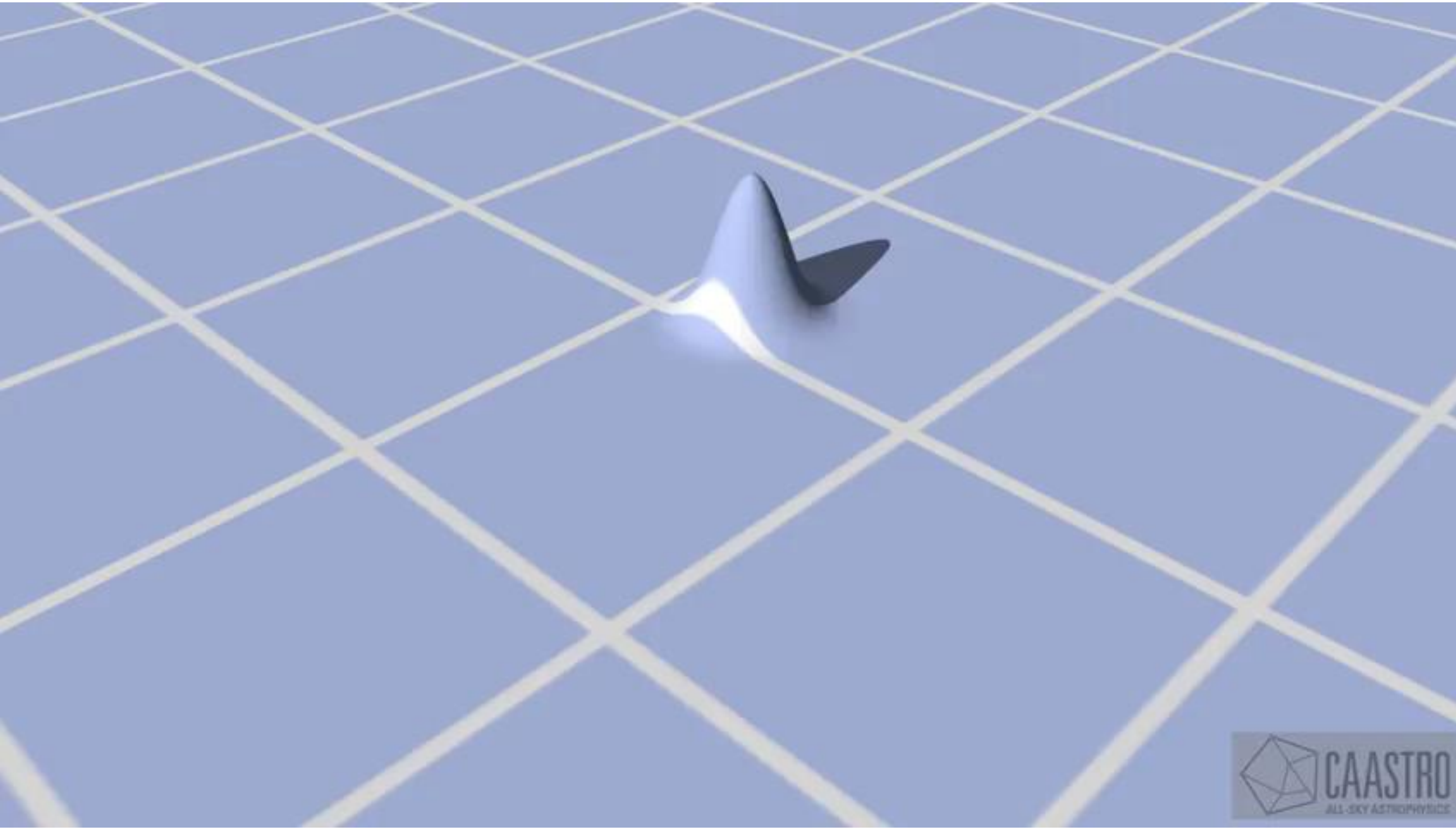


Benitez et al. 2009 ApJ, 691, 241



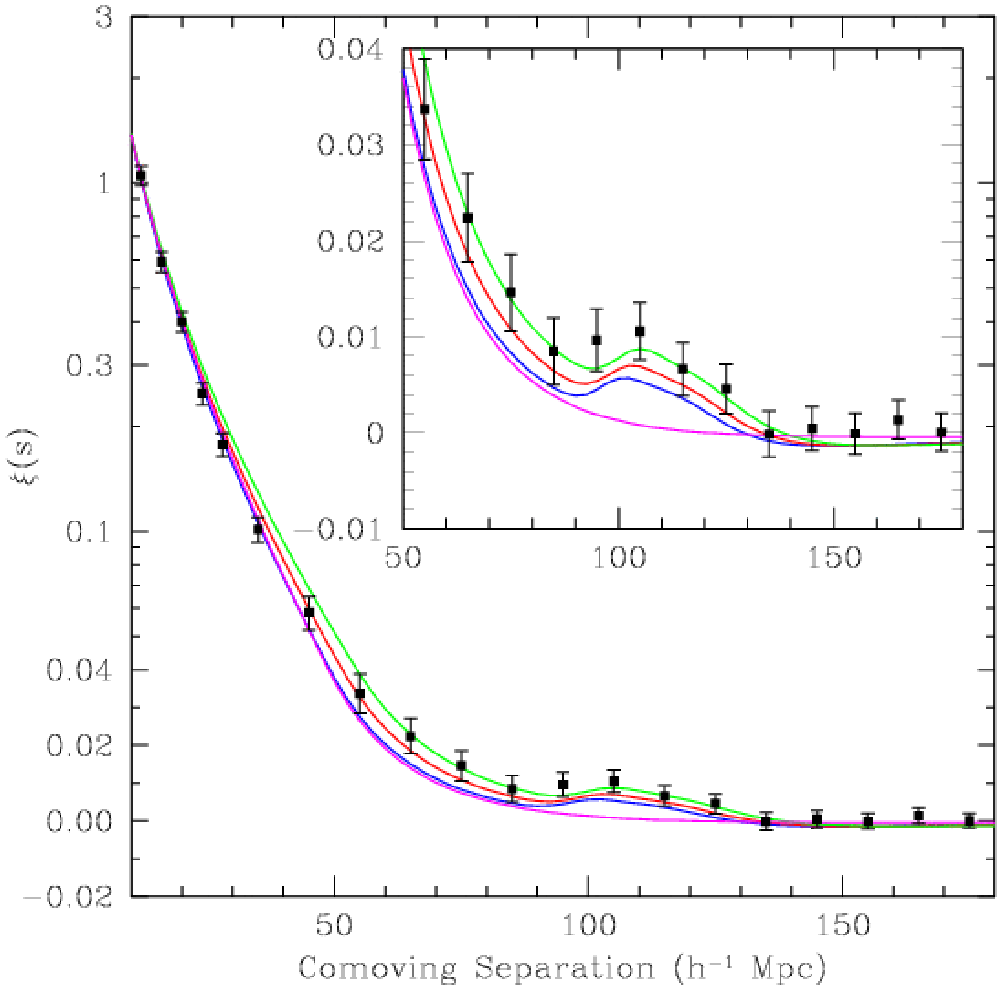


Originally at http://cmb.as.arizona.edu/~eisenste/acousticpeak/



CAASTRO - Centre of Excellence for All-sky Astrophysics

BAO measured in SDSS data (Eisenstein et al. 2005)



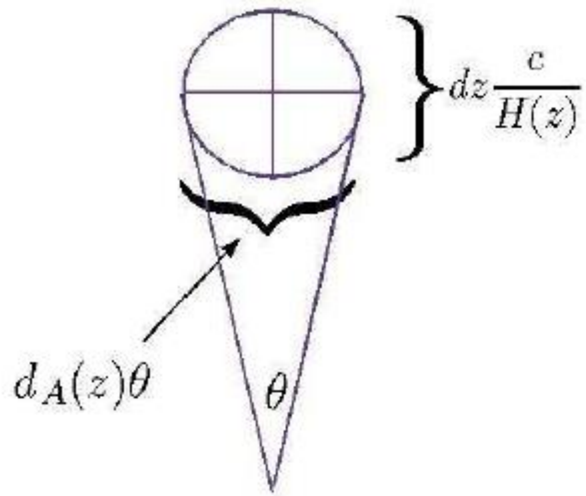
$$\xi(r) = \langle \delta(\vec{r}_1)\delta(\vec{r}_2) \rangle, \delta(\vec{r}) = \frac{\rho(\vec{r}) - \bar{\rho}}{\bar{\rho}}$$

3.5-σ detection of BAO

BUT even better to get radial!

For a flat universe

$$H(z) = h\sqrt{\Omega_m(1+z)^3 + \Omega_X \exp\left[3\int_0^z \frac{1+w(z)}{1+z}dz\right]}$$



- If we could measure H(z), we would get the dark energy density evolution
- However it is easy to measure **a** (redshift) but not **da/dt**
- We can indirectly measure H(z) through the measurement of distances:

$$D_A(z) = \frac{c}{1+z}\int_0^z \frac{dz}{H(z)}$$

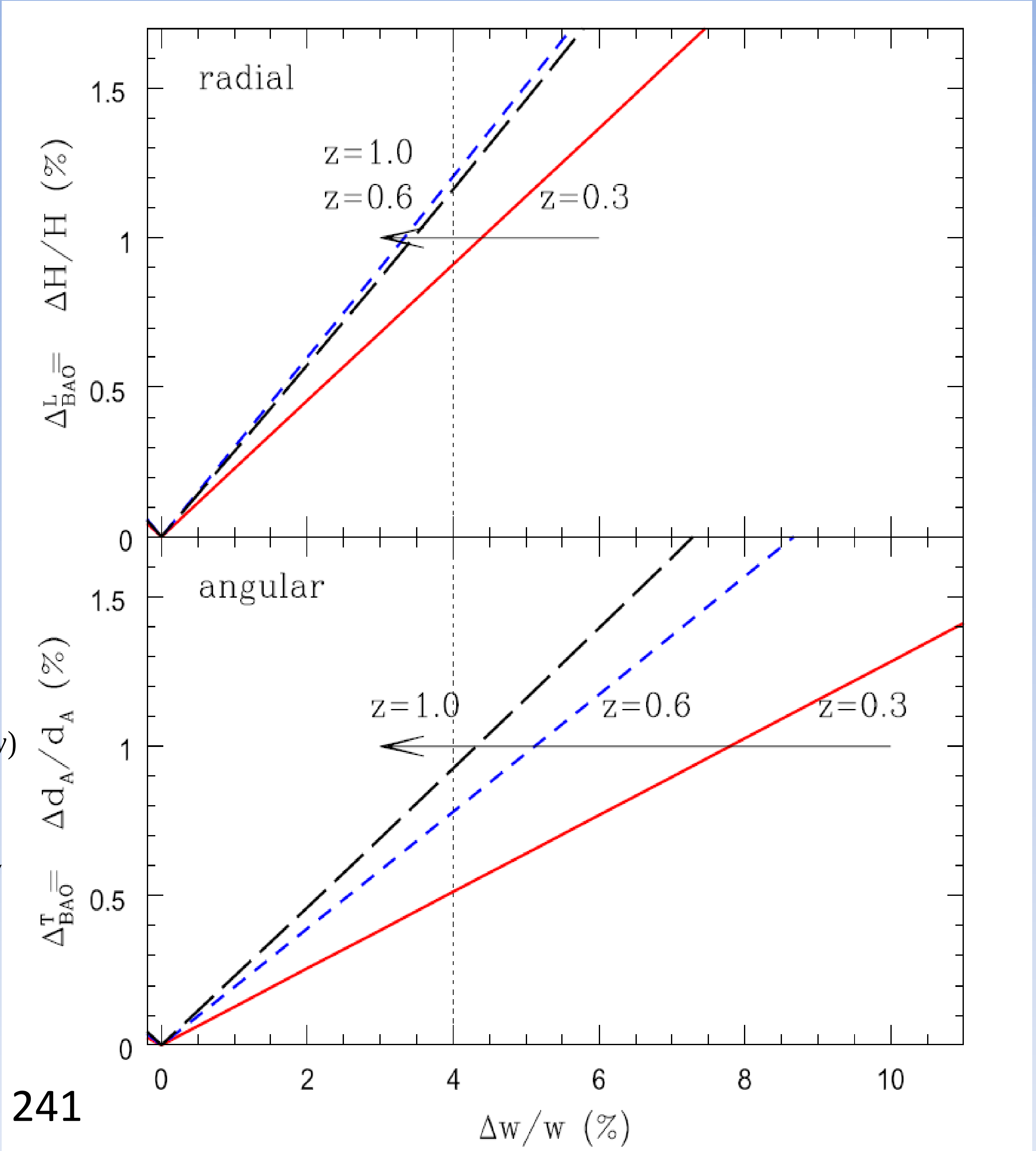
To measure dw/dz we need $d^2H(z)/dz^2$ or $d^3D_A(z)/dz^3$

Importance of measuring in the radial direction:

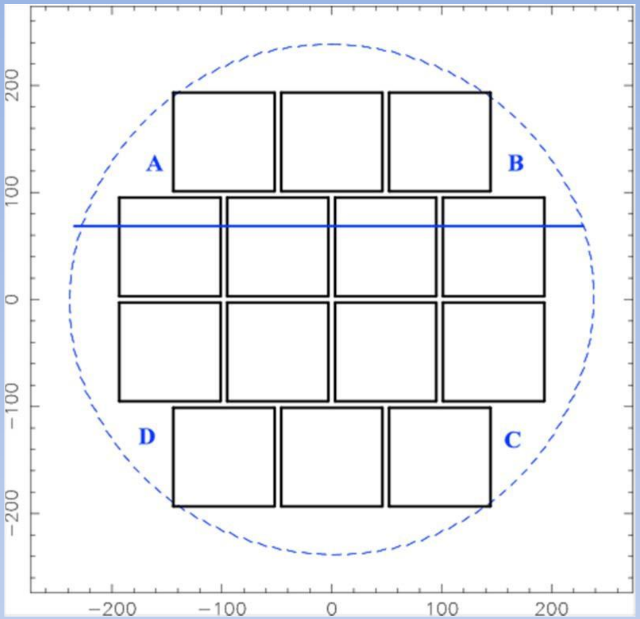
Assume flat universe, *w*=constant and Ω_m=.25

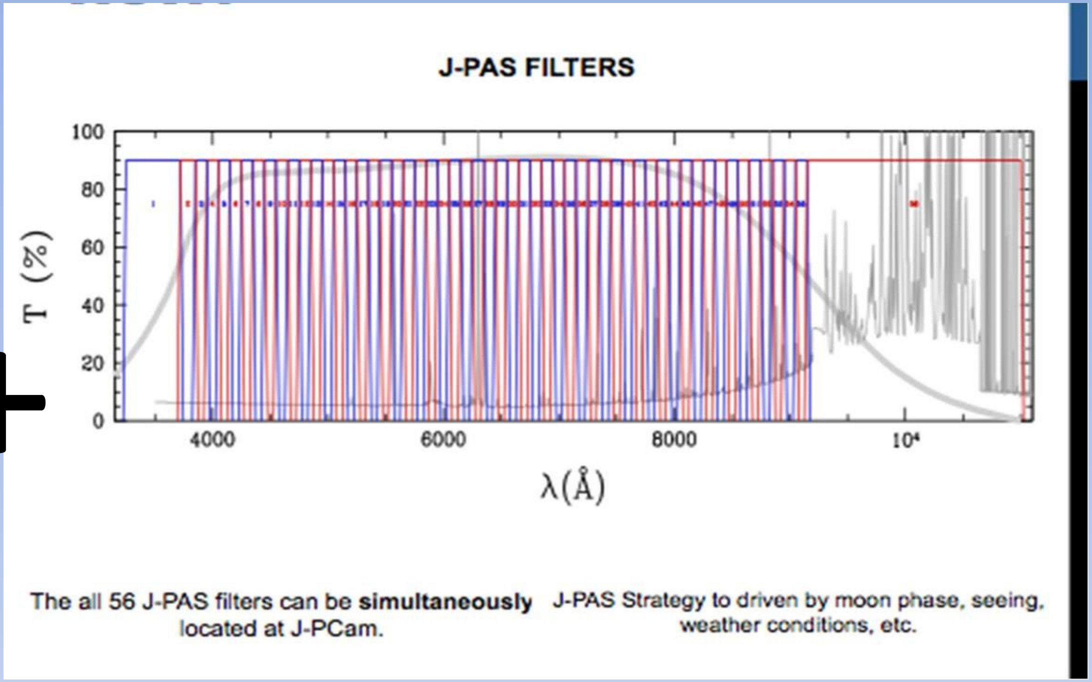
$$\frac{H^2(z)}{H_0^2}=\Omega_m(1+z)^3+$$
$$+(1-\Omega_m)(1+z)^{3(1+w)}$$

Error propagation:



Benitez et al. 2009 ApJ, 691, 241





Equivalent to a ~5000/ multiplex spectrograph

-A full system of NB filters has an effective throughput smaller than spectrographs but that is compensated by their stupendous multiplexing **IF** the FOV is large enough

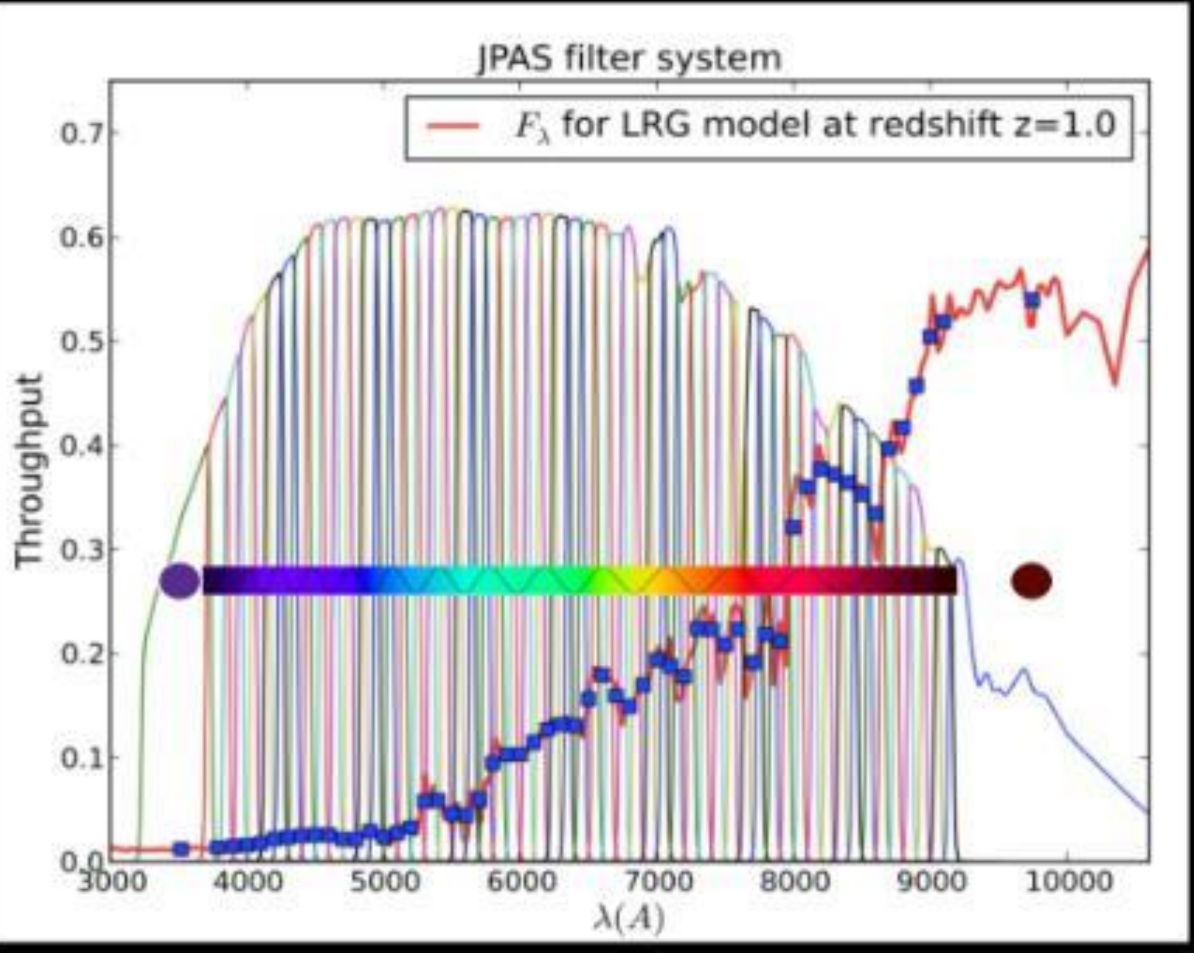
-To surpass the efficiency of state-of-the art spectrographs, the camera size must be very large, >4 sq.degs

- But <u>still costs an order of magnitude less </u>than comparable spectrograhs

J-PAS

JAVALAMBRE PHYSICS OF THE ACCELERATED UNIVERSE ASTROPHYSICAL SURVEY

DEFINITION & IMPLEMENTATION



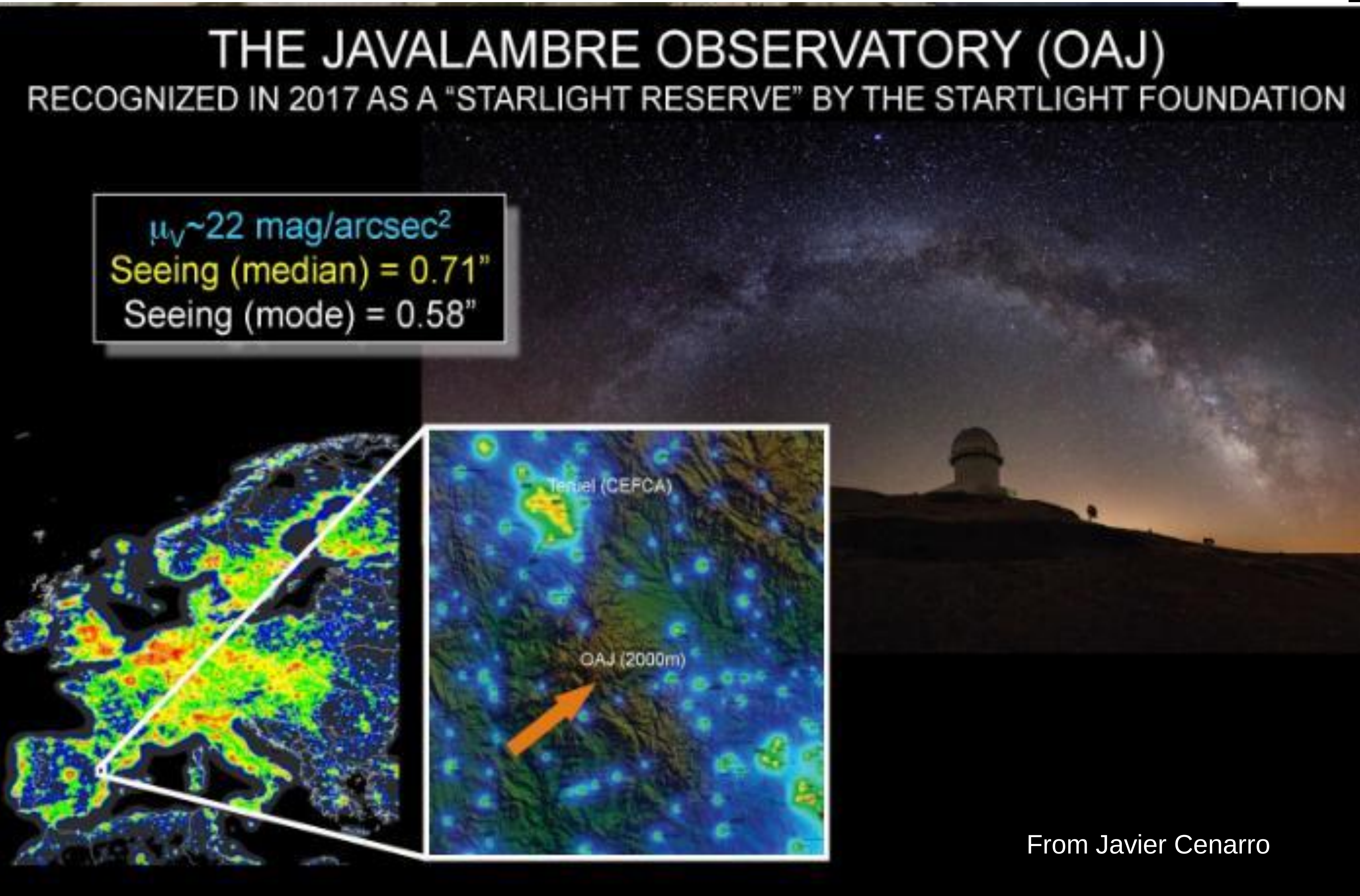
8500 deg^2 (14Gpc^3)

- 54 NB Filters (FWHM~14.5nm; $\Delta\lambda$~10nm)
- 1 Blue MB filter (FWHM~260Å; λ_c~3600Å)
- 1 Red BB filter (FWHM~620Å; λ_c~9500Å)
- Sloan u, g, r

In ~ 7 years

- BAOs: $\delta z / (1+z) < 0.003$
- Weak Lensing, Clusters, SNe

From Javier Cenarro


THE JAVALAMBRE OBSERVATORY (OAJ)
RECOGNIZED IN 2017 AS A “STARLIGHT RESERVE” BY THE STARTLIGHT FOUNDATION
μ_V~22 mag/arcsec^2
Seeing (median) = 0.71”
Seeing (mode) = 0.58”
Teruel (CEFCA)
OAJ (2000m)
From Javier Cenarro

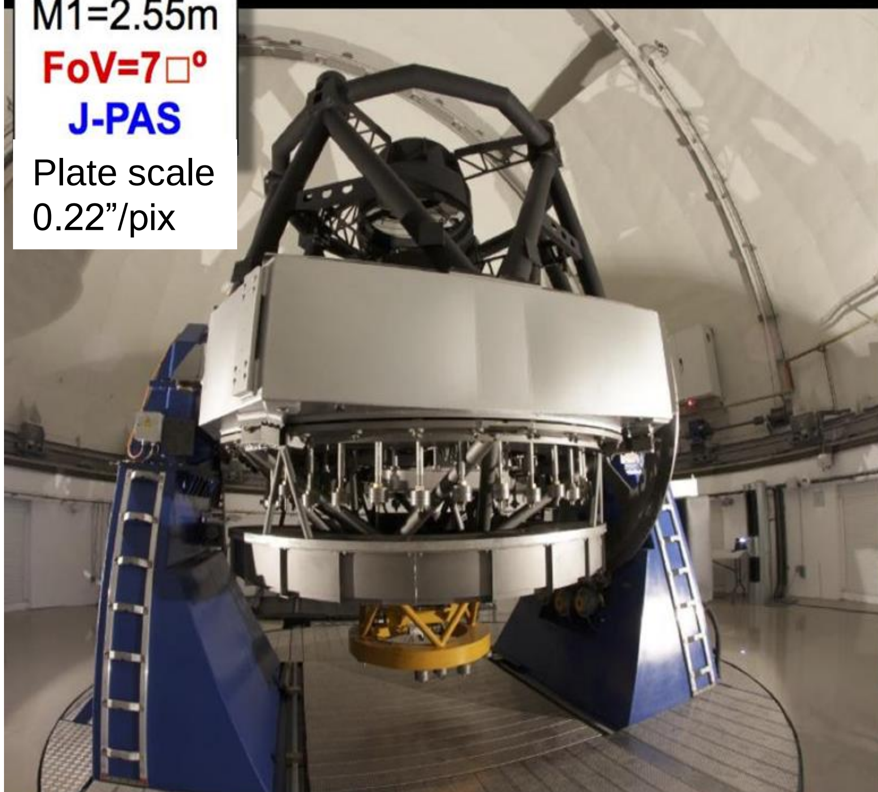
A campaign group with the slogan *Teruel existe* ("Teruel exists") was founded in 1999 to press for greater recognition and investment in the town and the province.

CEFCA

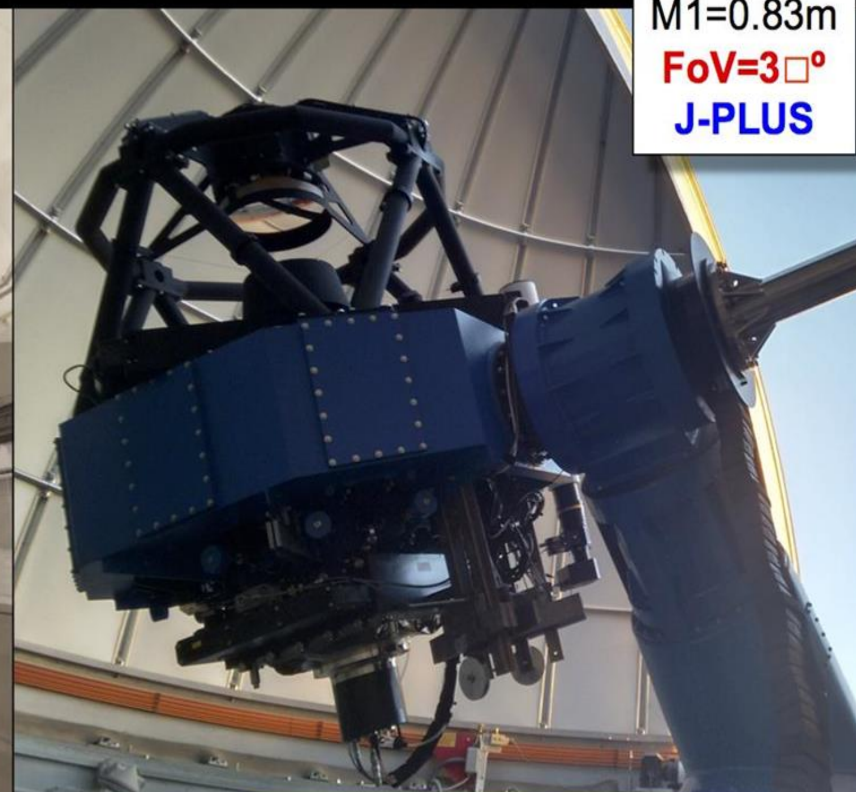
LARGE FOV TELESCOPES AT THE OAJ

FOR LARGE SKY SURVEYS

JST/T250
M1=2.55m
FoV=7□°
J-PAS
Plate scale
0.22”/pix



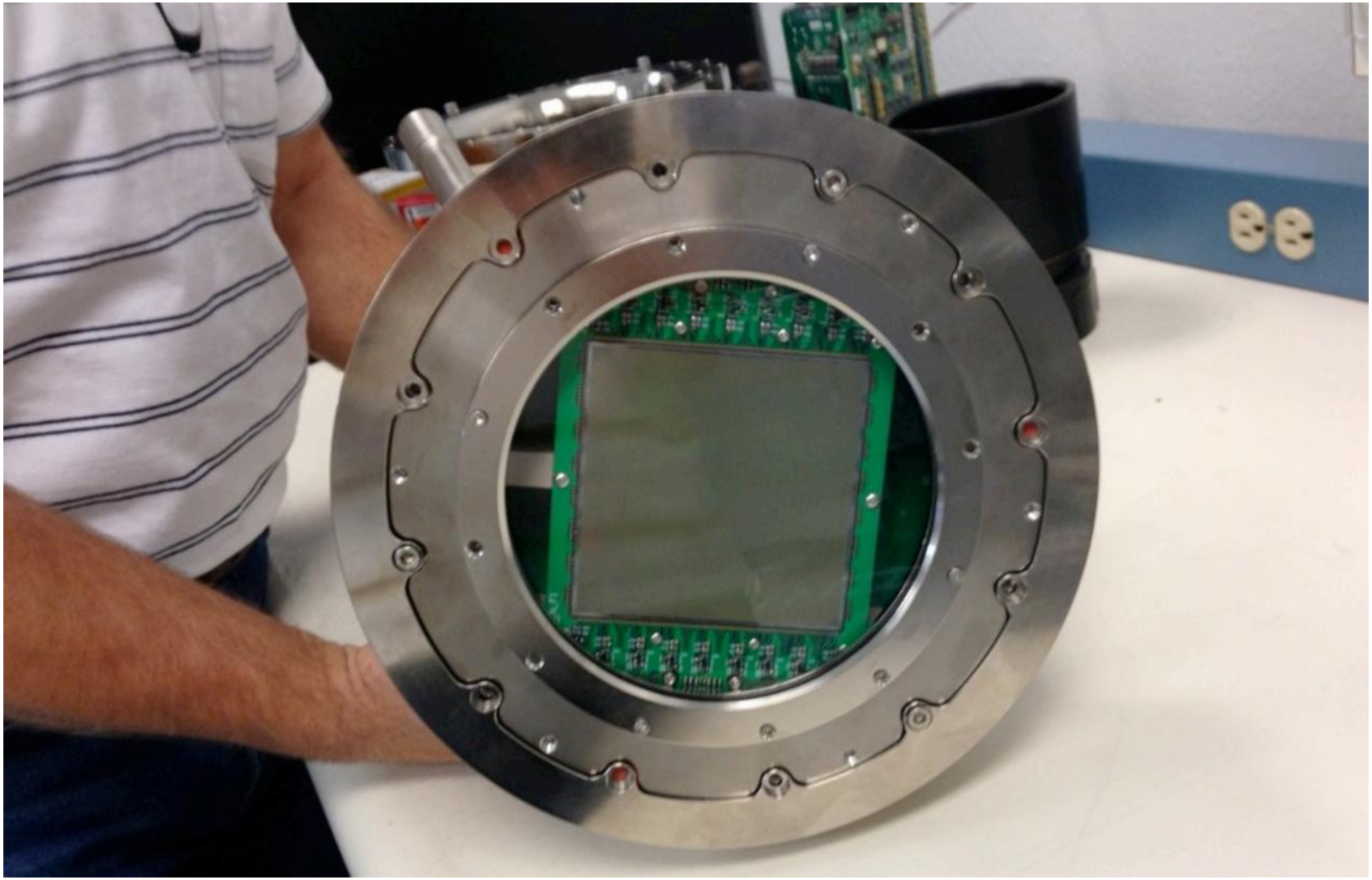
JAST/T80
M1=0.83m
FoV=3□°
J-PLUS



On site with PathFinder (Commissioning+mini-jpas)

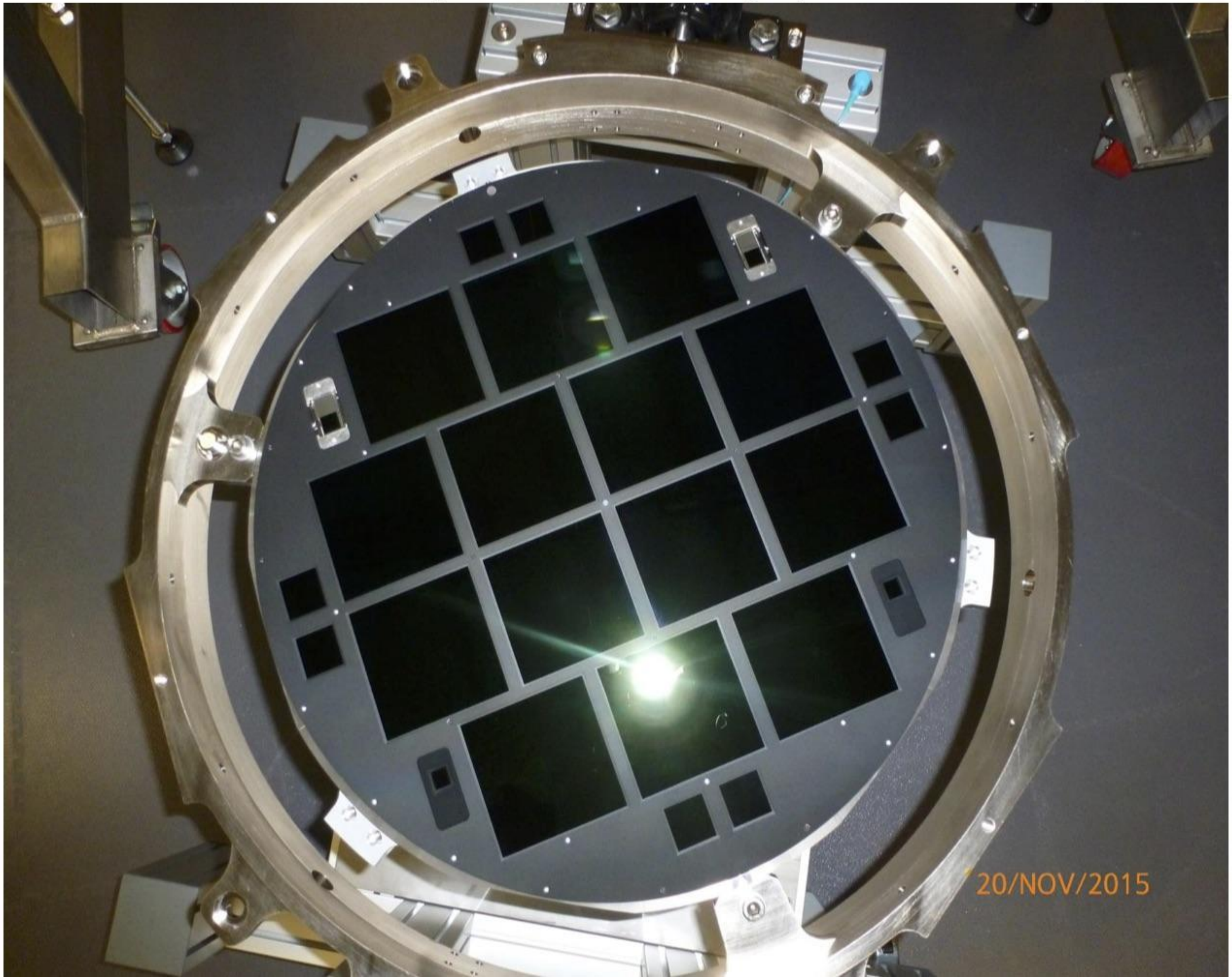
In science operations since Nov 2015

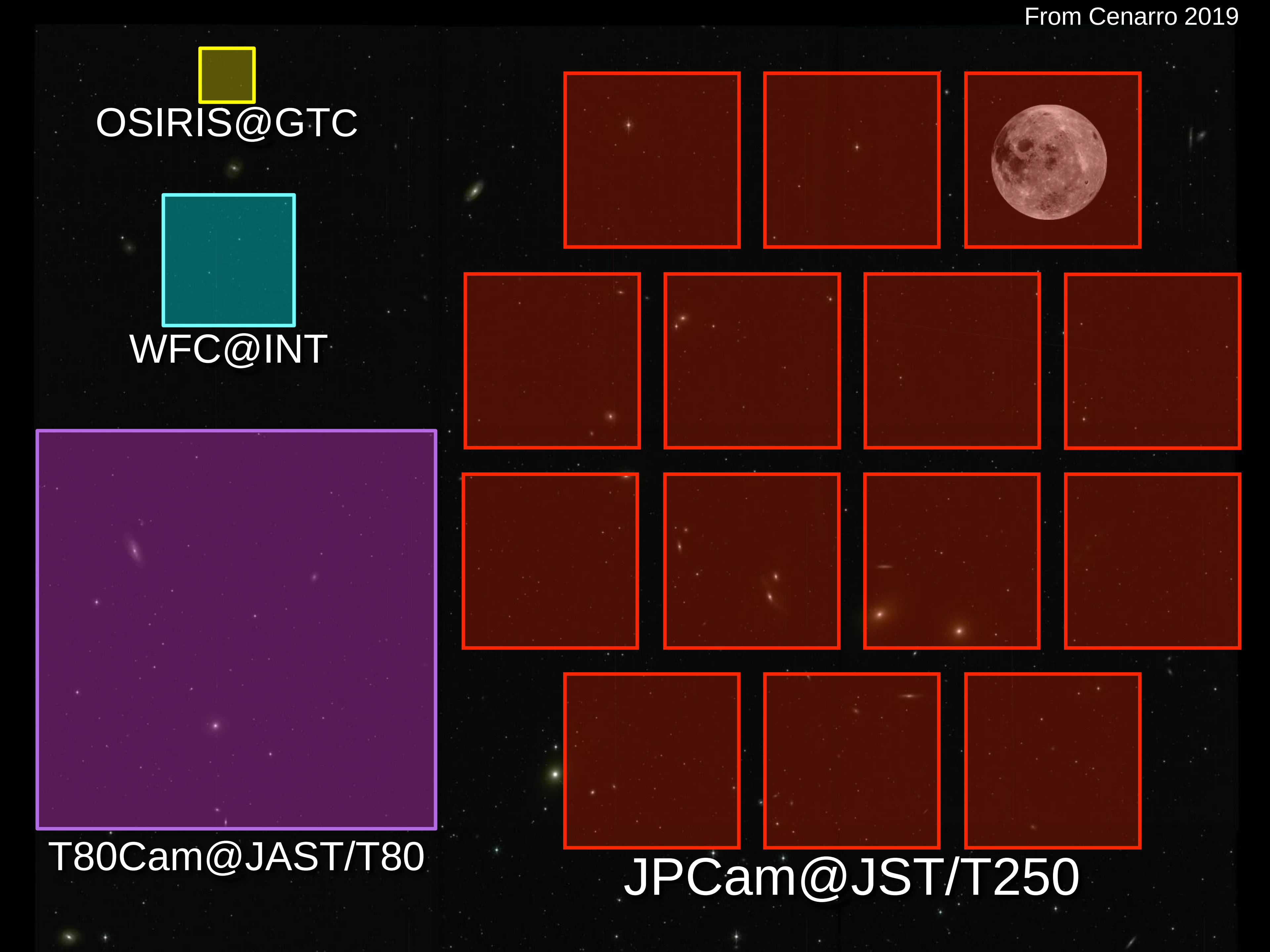
CCD installed in T80Cam – 5/2013
Taking data since 2015



JPCam CryoCam

Grade-5 focal plane assembly (ev2 – Nov'15)



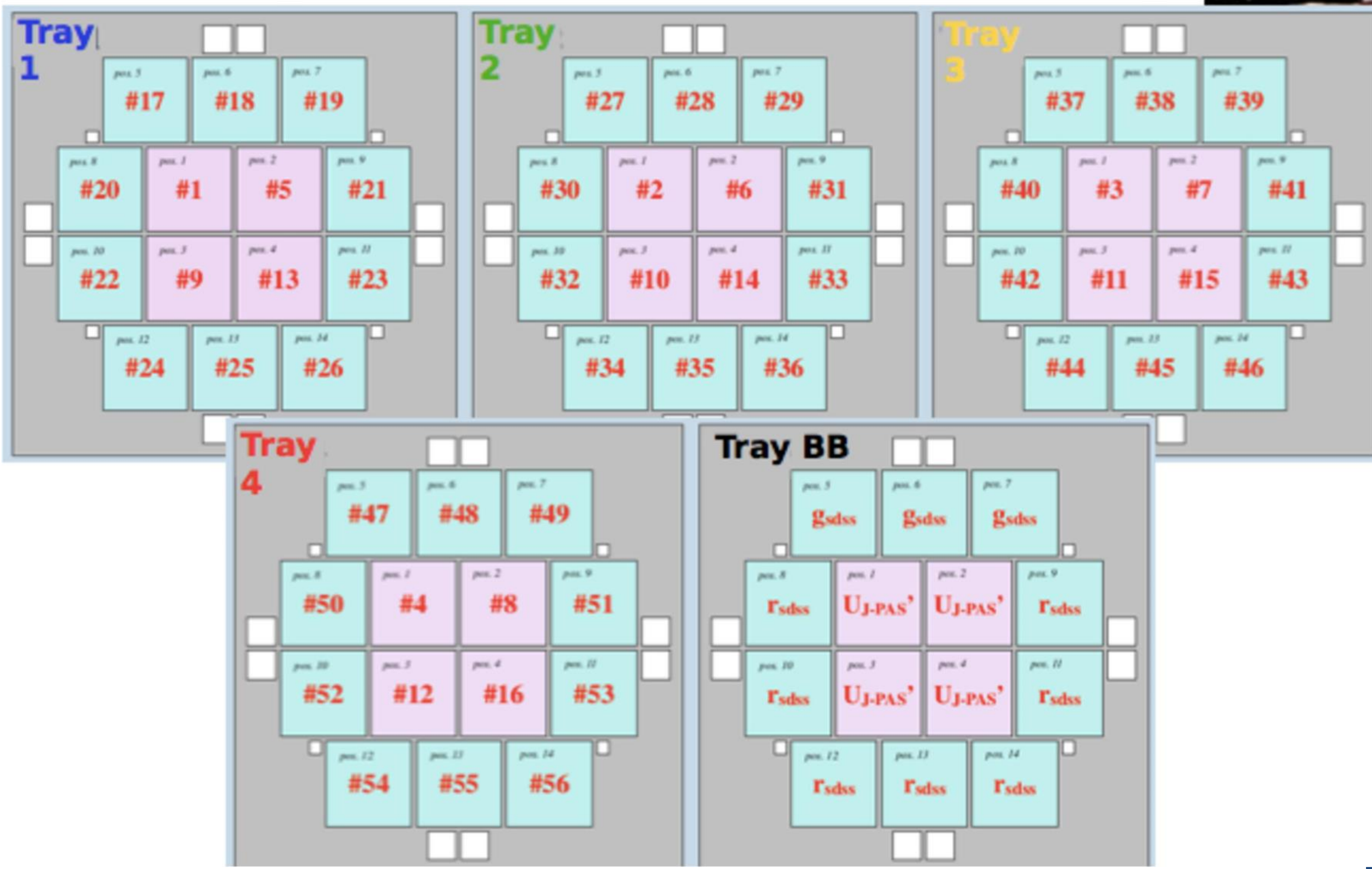

From Cenarro 2019
OSIRIS@GTC
WFC@INT
T80Cam@JAST/T80
JPCam@JST/T250

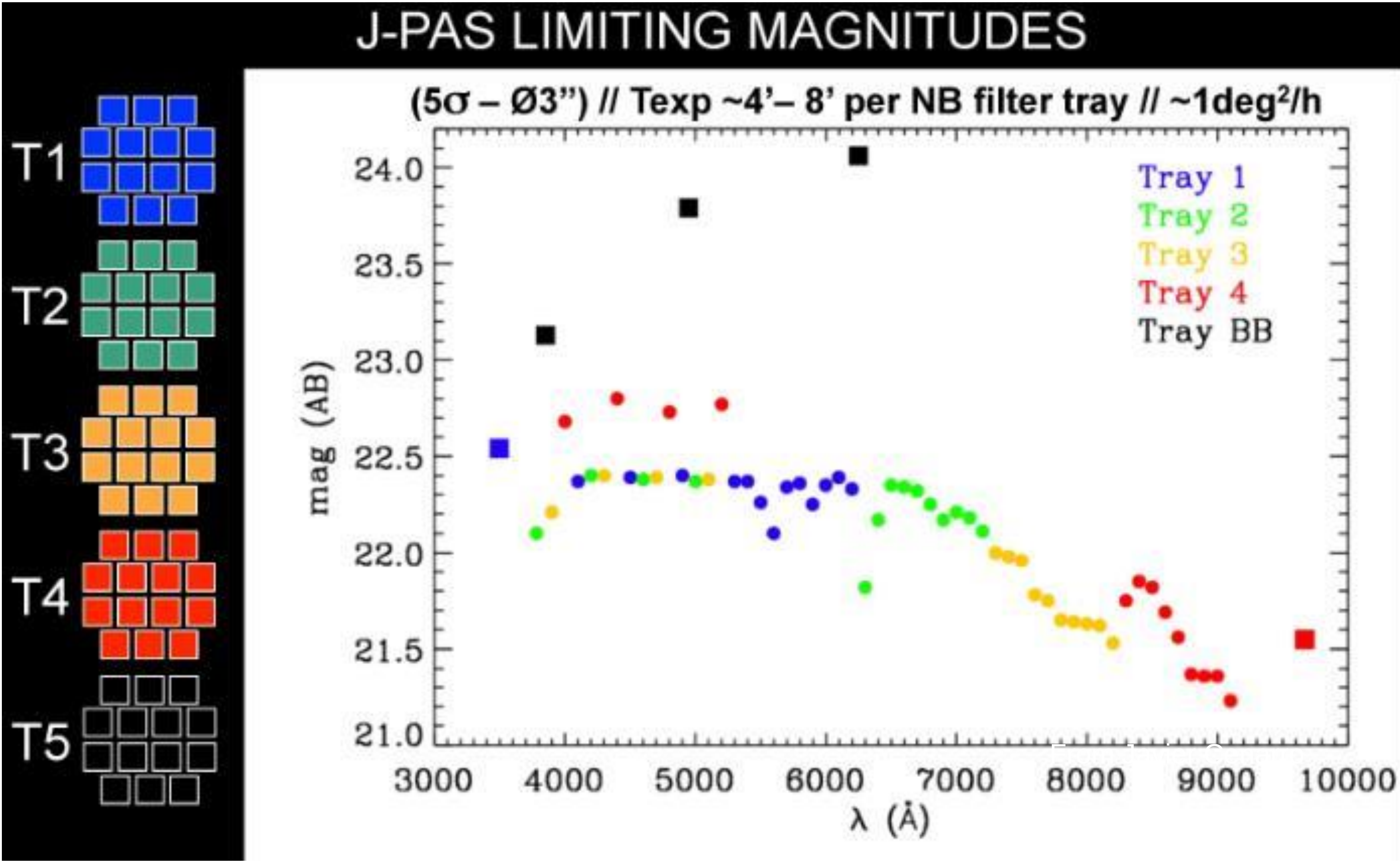
JPCam	
FoV	Ø=3.0º (full performance) Ø = 3.1º (reduced performance)
Ø EE50	0.23" / 10 μm / 1 pix
Ø EE80	0.45" / 20 μm / 2 pix
CCD format	(14 x) 9216 x 9232 pix 10 μm/pix **1.2 Gpixel camera**
Pixel scale	0.23"/pix
Full well	123ke$^-$
Read out time	13.5s
Read out noise	8 e$^-$/pixel (goal 4e-)
Dark current	0.001e$^-$/s/pix
FoV coverage	4.7□º (fill factor ~70%)
# filters	56 + BB (J-PAS filters)

At 5.6 e- now

The camera + filters

Every CCD "sees" a different filter in each tray x (4+1) trays



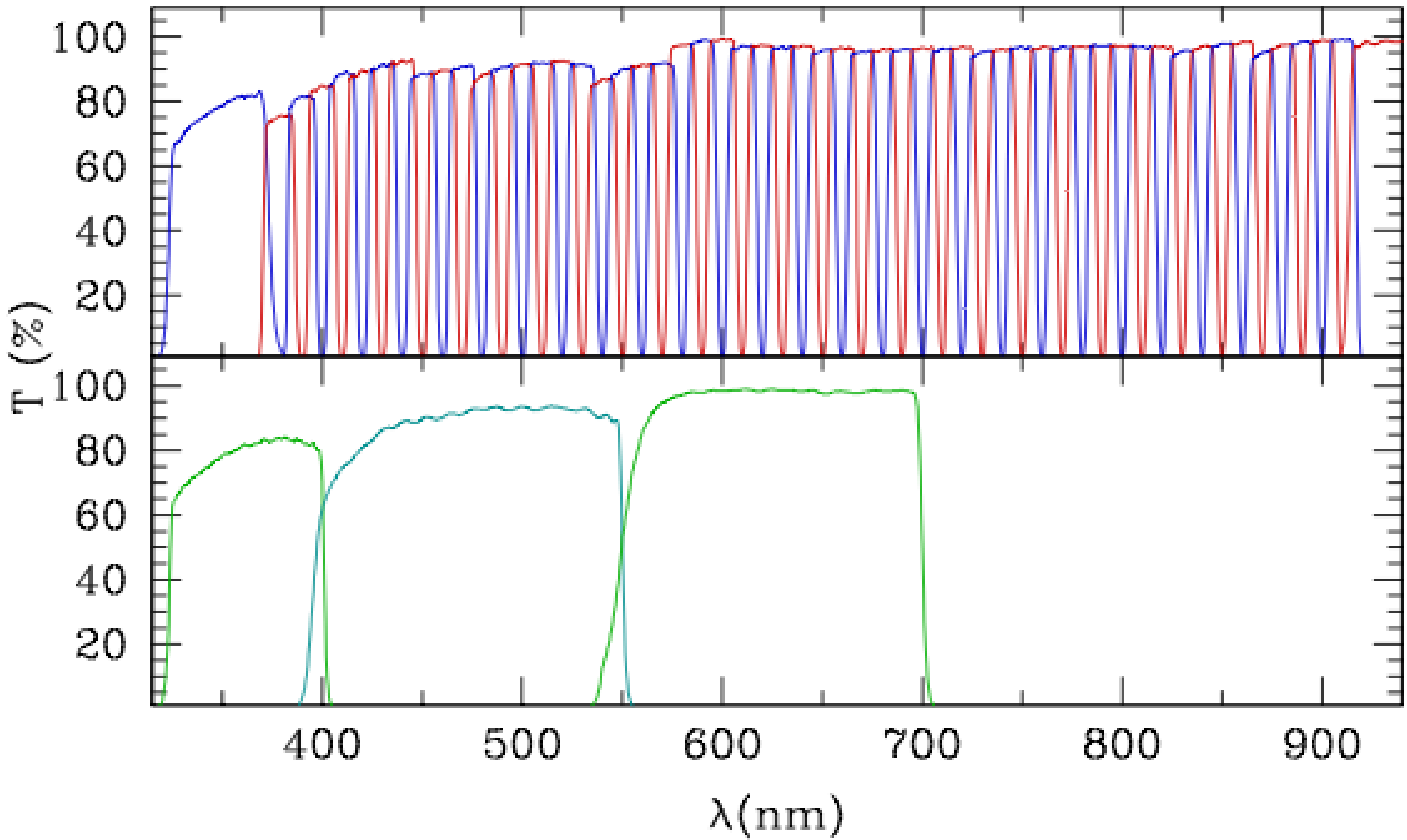


Predicted – see miniJPAS

From Javier Cenarro

J-PAS Filters

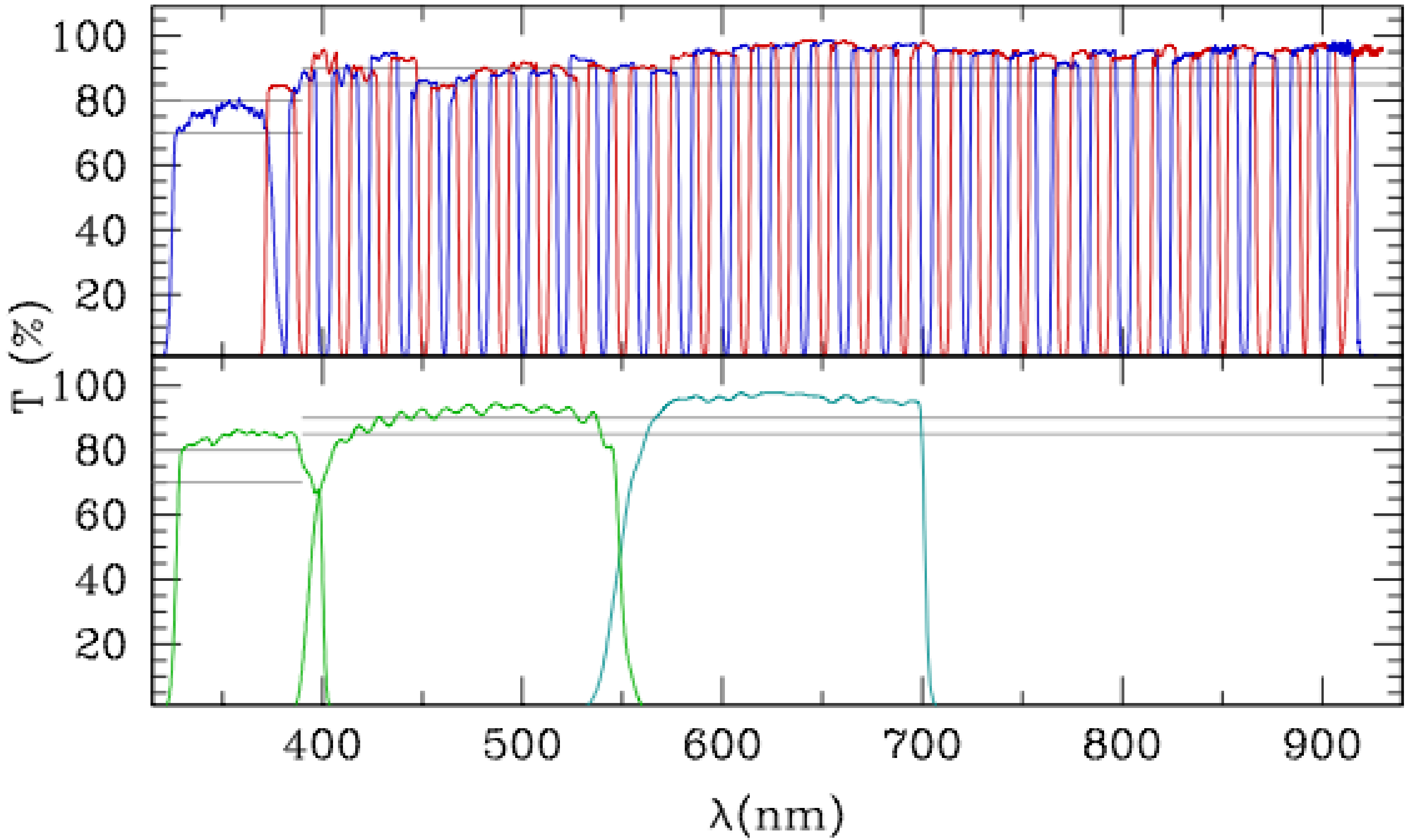
J-PAS filter system
Theoretical transmission curves



J-PAS Filters

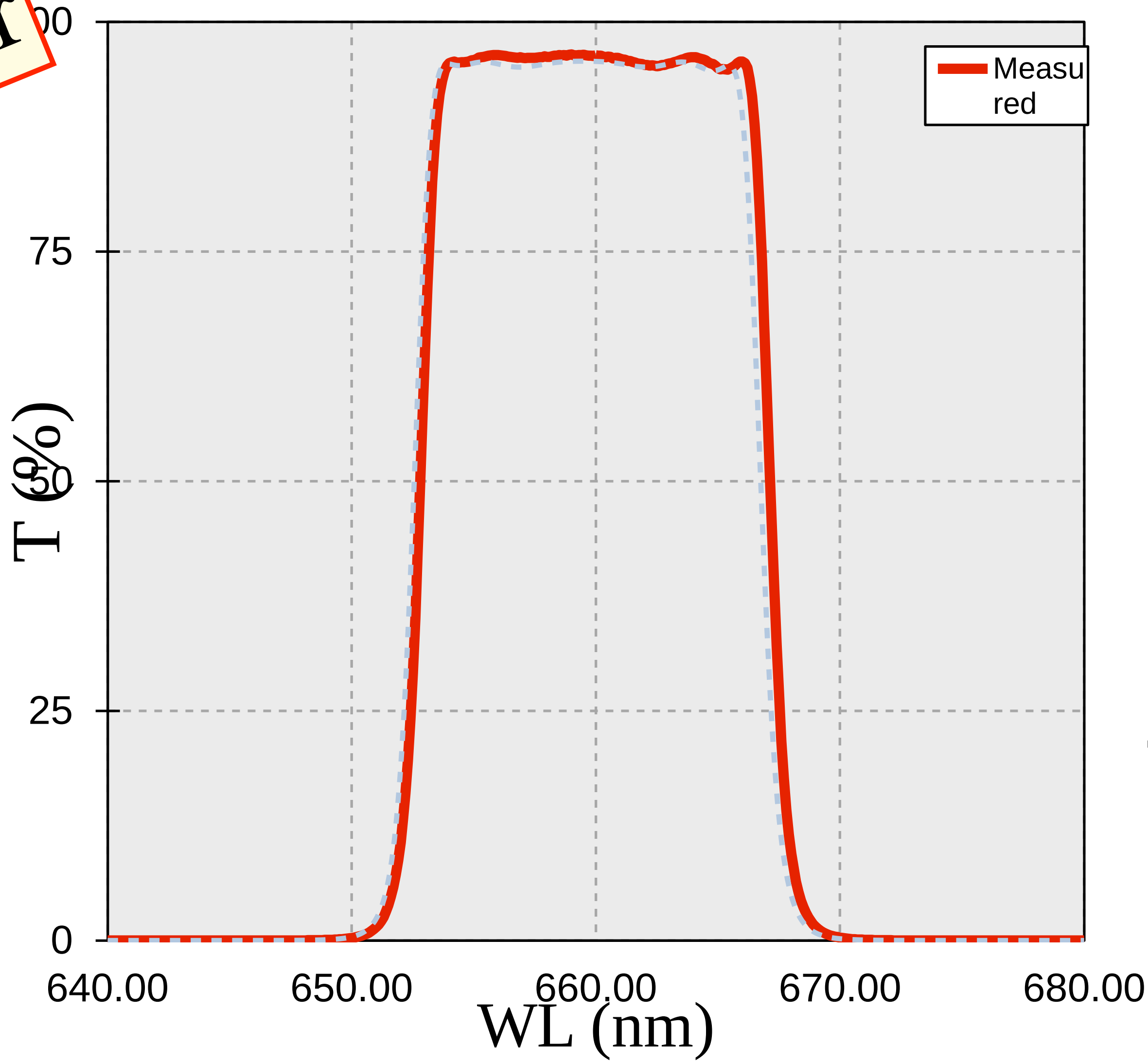
J-PAS filter system

Measured transmission curves



J-PAS Filters

Hα filter



CWL(measured): 659,97nm

CWL(theory): 659,66nm

FWHM (measured): 14,38nm

FWHM (theory): 14,50nm

Tmax (measured): 96,6%

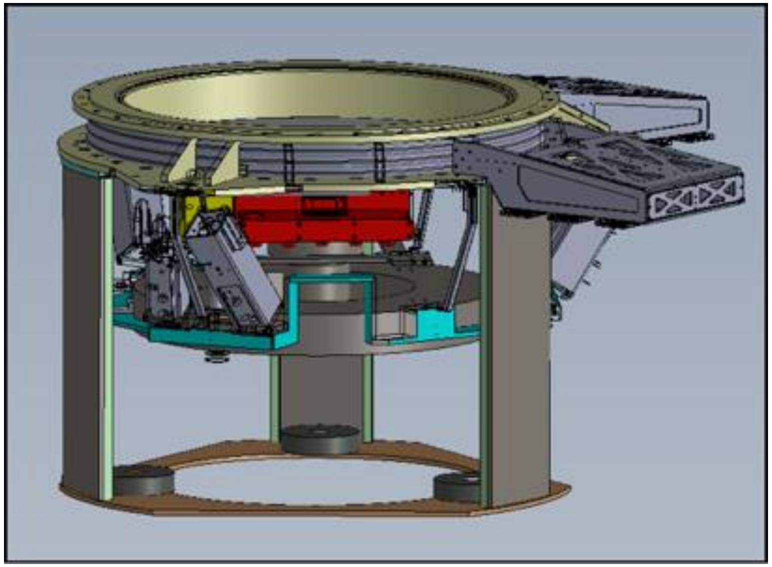
PATHFINDER SURVEY

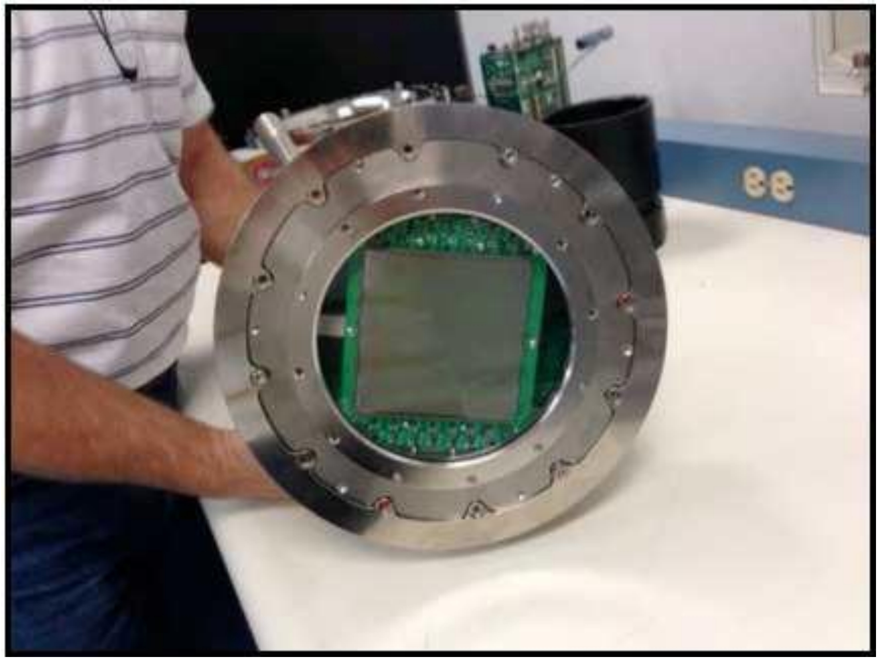
Pathfinder camera: 1 single e2V CCD camera (9.2kx9.2k, 0.227 "/ pix), 0.30 sq.deg effective area

Pathfinder Survey: - mini-JPAS++

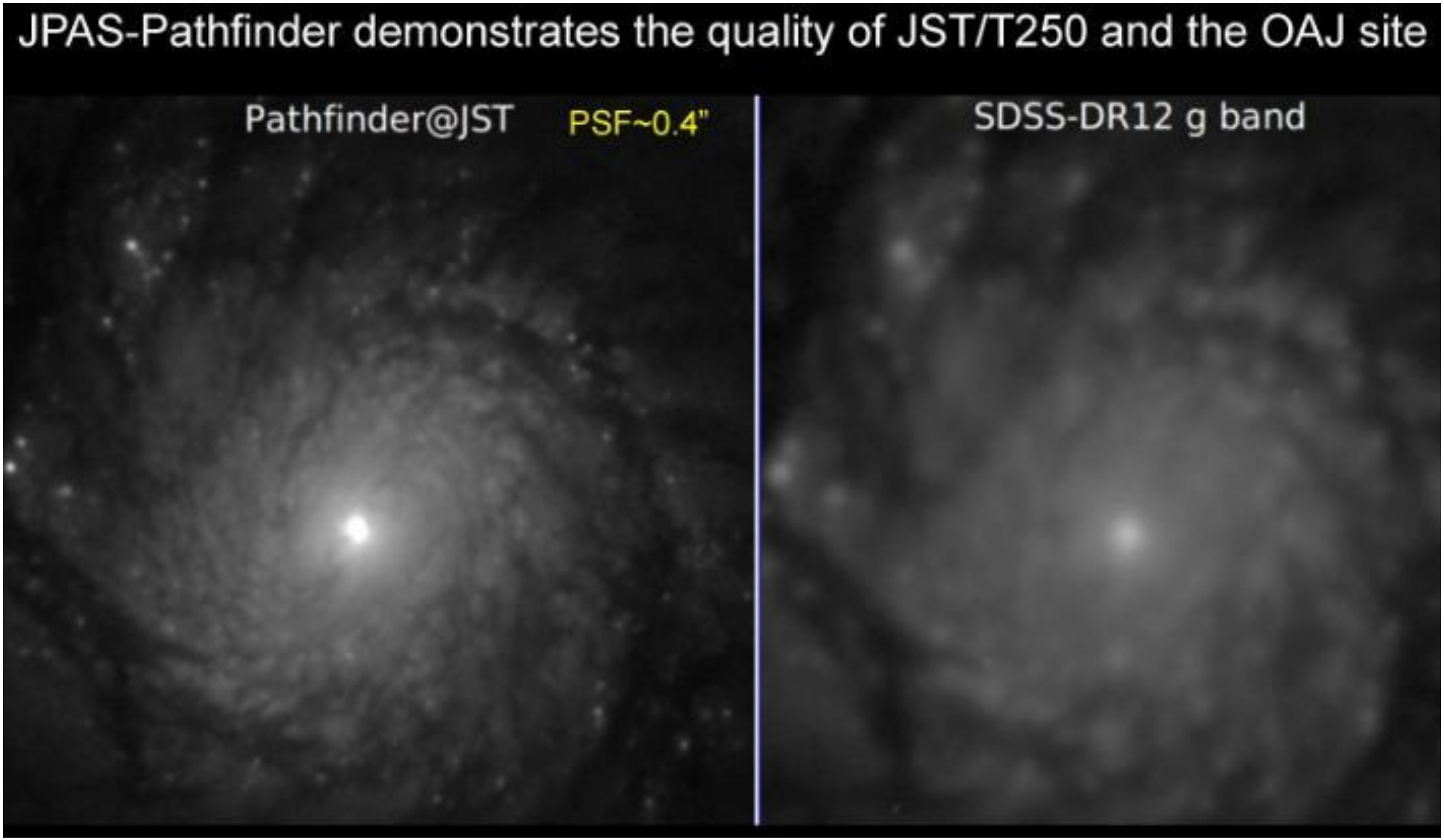
A few sq.deg. covered with 56+ filters to the same depth of the main survey

Main field AEGIS, but also NEP full (joint JWST), several galaxies and clusters partially.

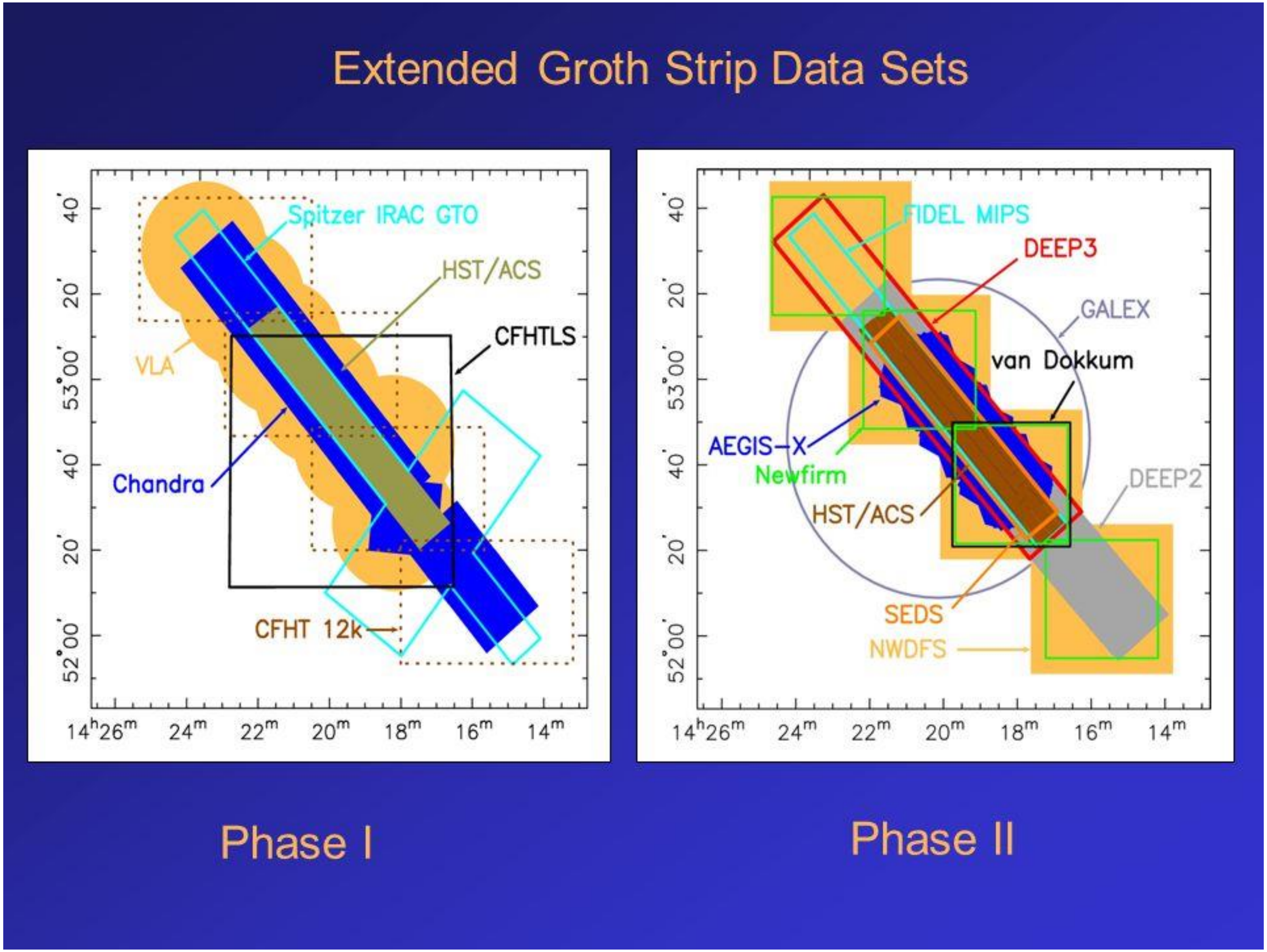




M51, resulting from the combination of 6x10s single exposures with no filter (left), and a g band image from SDSS (right).

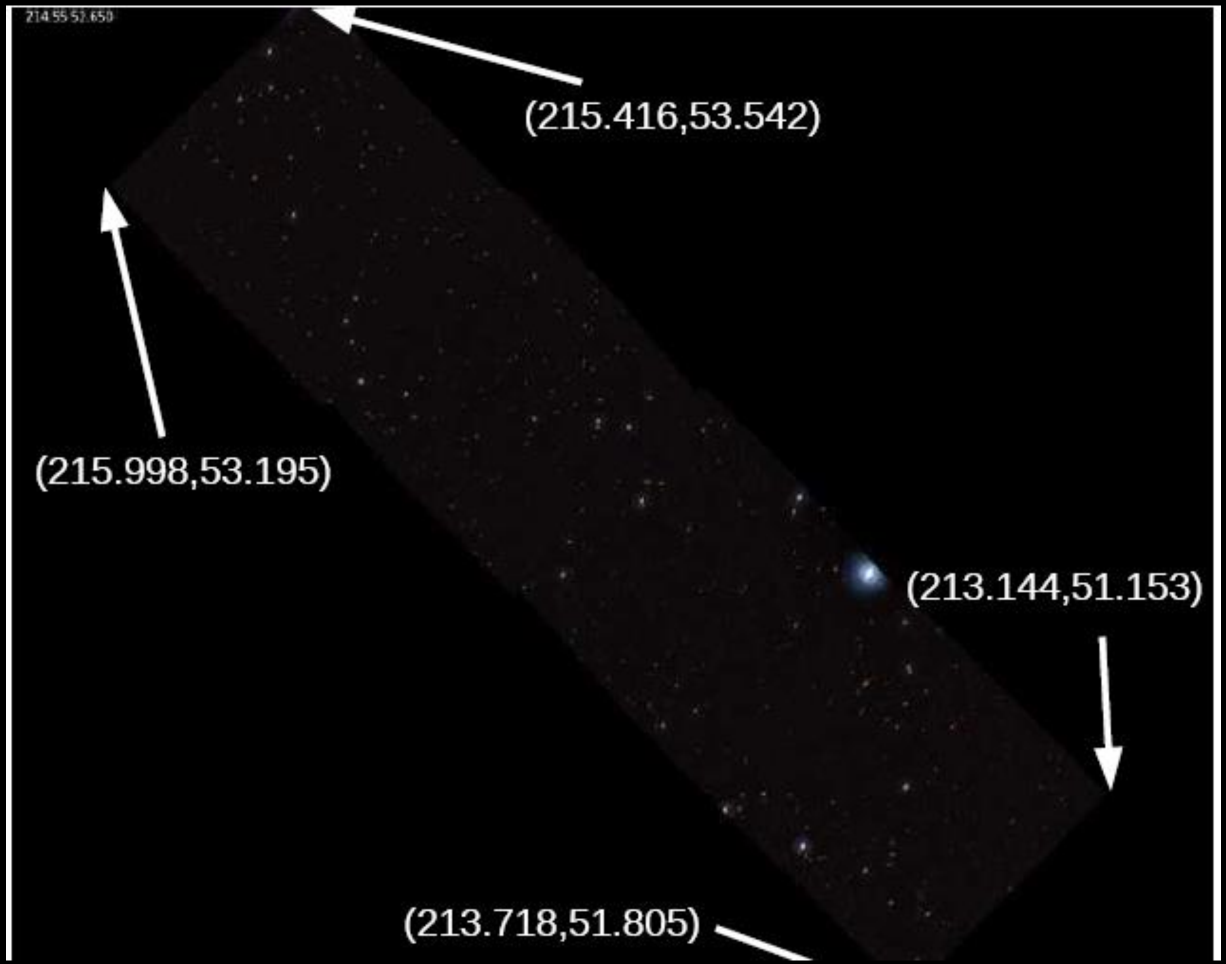


BEST PRIMARY FIELD aka mini-JPAS field:
AEGIS
FIELD RA=216.6° Dec=+52.7° Size ~ 1 sq deg



FIELD	TILE_ID	RA (deg)	DEC (deg)
AEGIS001	1324	214.2825	52.5143
AEGIS002	1320	214.8285	52.8487
AEGIS003	1427	215.3879	53.1832
AEGIS004	1488	213.7417	52.1770

Jesús Varela & the UPAD Team (CEFCA)



Pixel scale	0.228”
Single Coadd Image Size	
--- Full image (pixels)	11500 x 11500
--- Scientific area (pixels)	~ 7777 x 8473
--- Scientific area (arcmin)	~ 29.55 x 32.20
--- Scientific area (FoV)	~0.26 deg²
Full Mini-JPAS area	1.952° x 0.496°
	0.967 deg²
Fraction of Overlapping area	7.5%

miniJPAS made the data available to the community in December 2019!

From Cenarro 2019

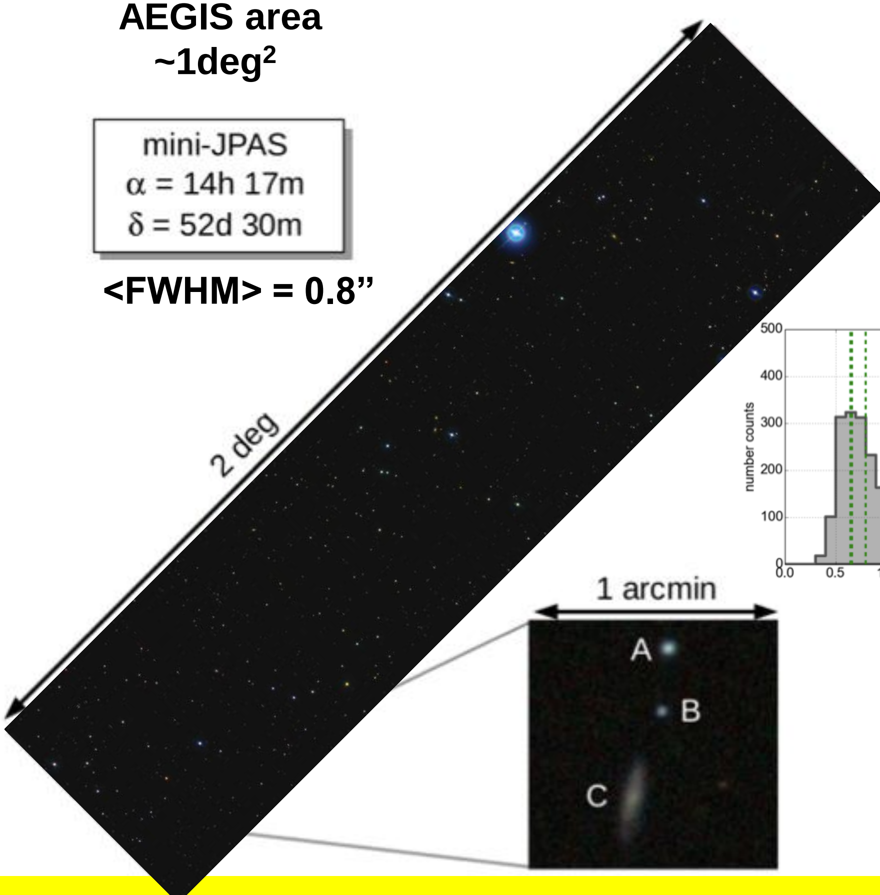
JPAS-PATHFINDER@JST/T250

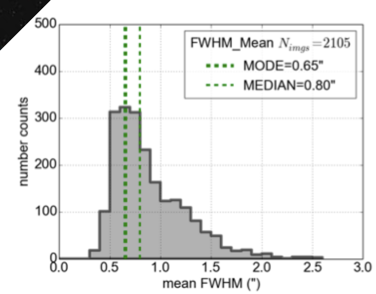
Mini-JPAS: 1 deg^2 with the 56 J-PAS filters

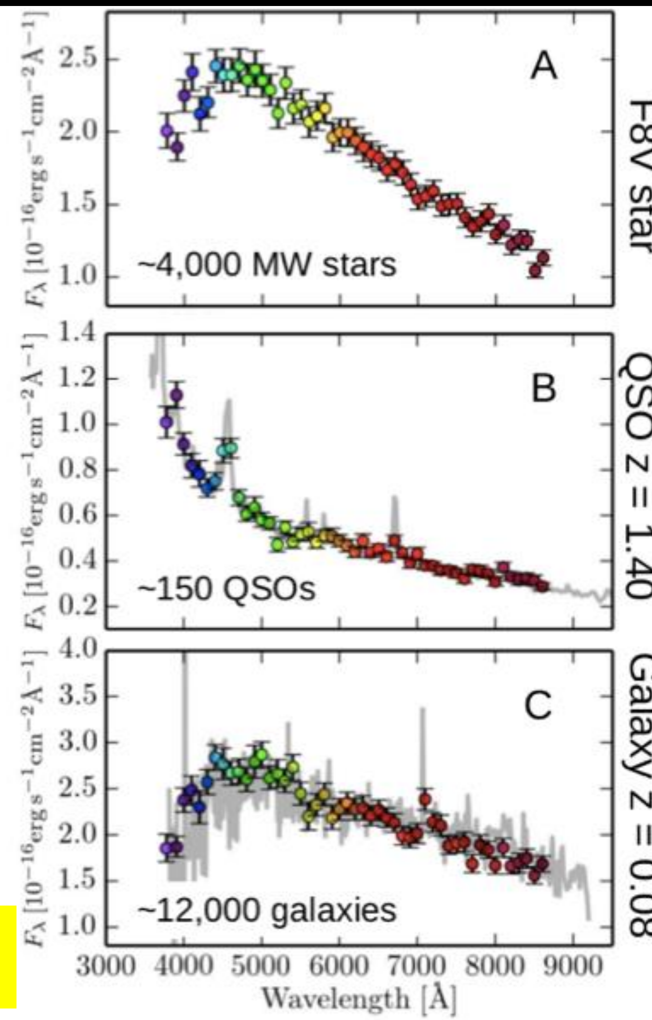
AEGIS area
~1deg^2

mini-JPAS
α = 14h 17m
δ = 52d 30m

<FWHM> = 0.8”



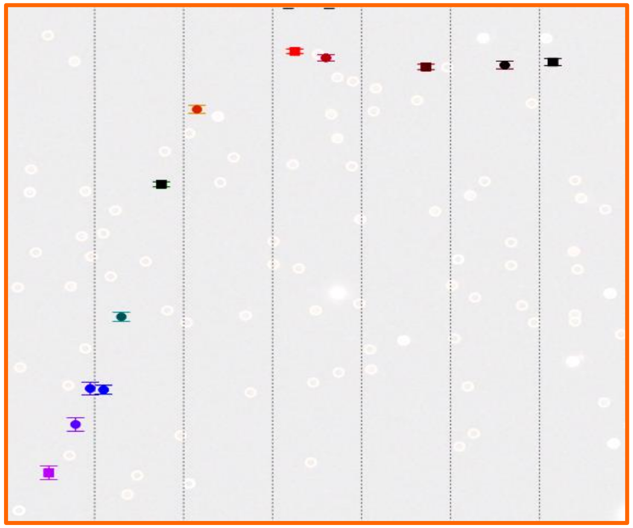


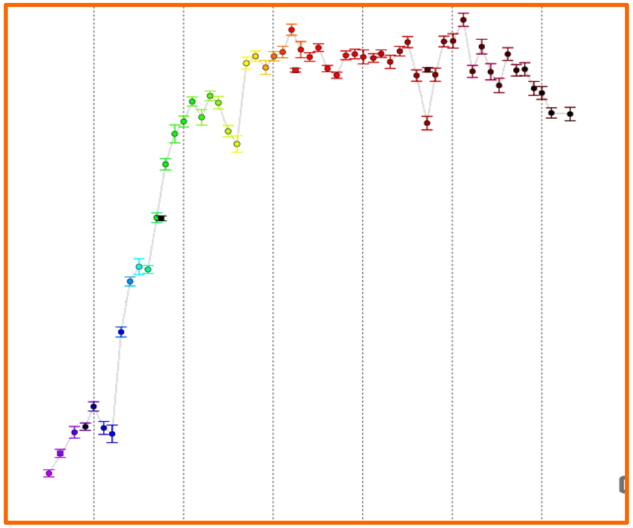


Public release of mini-JPAS: 2019 Dec 2-4, Teruel
http://riastronomia.es/en/the-universe-in-56-colours-science-with-the-first-j-pas-data/

Elliptical galaxy @ z = 0.07

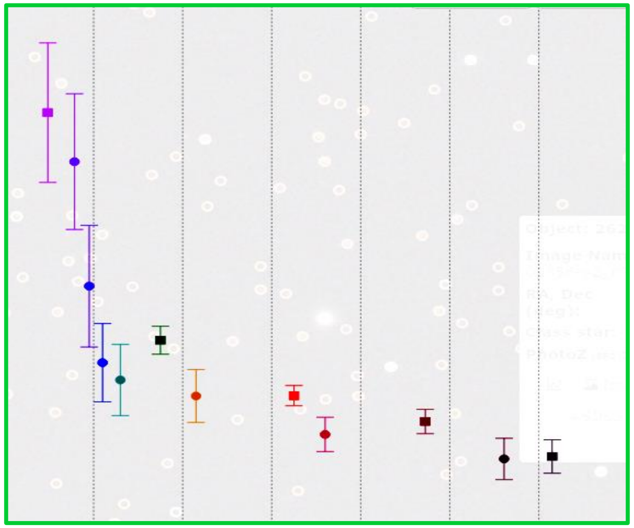
From Cenarro 2019

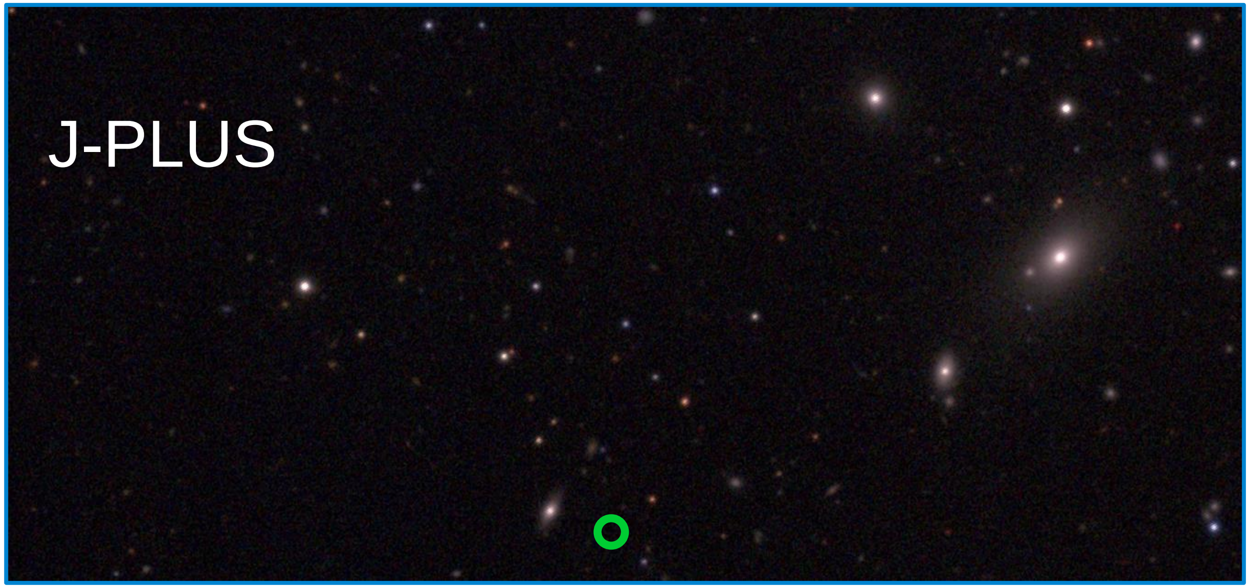


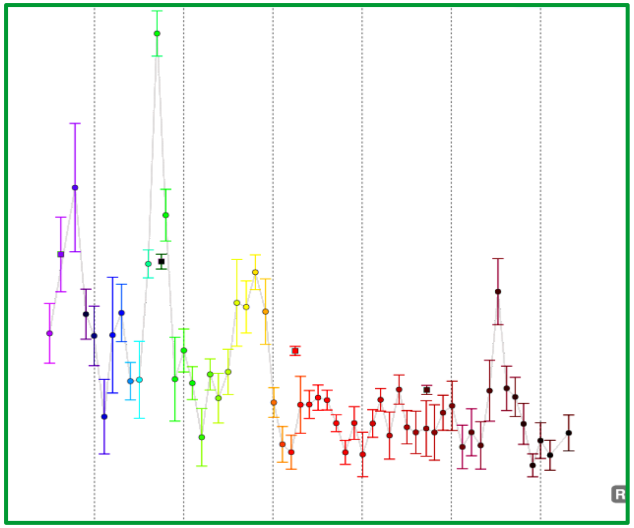


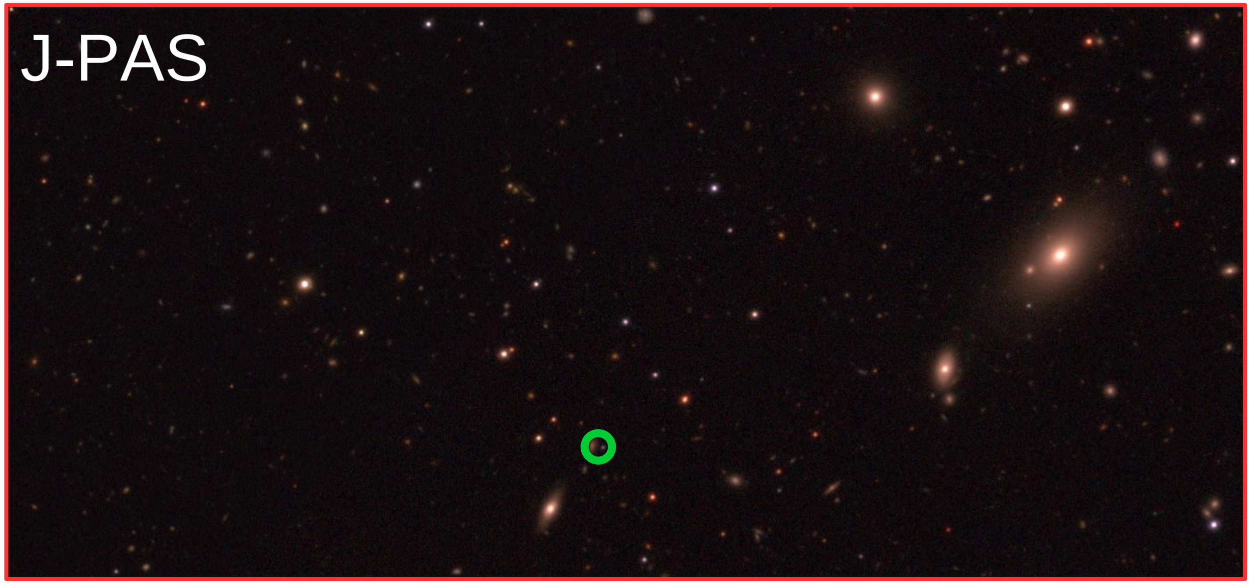
QSO @ z = 2.04

From Cenarro 2019

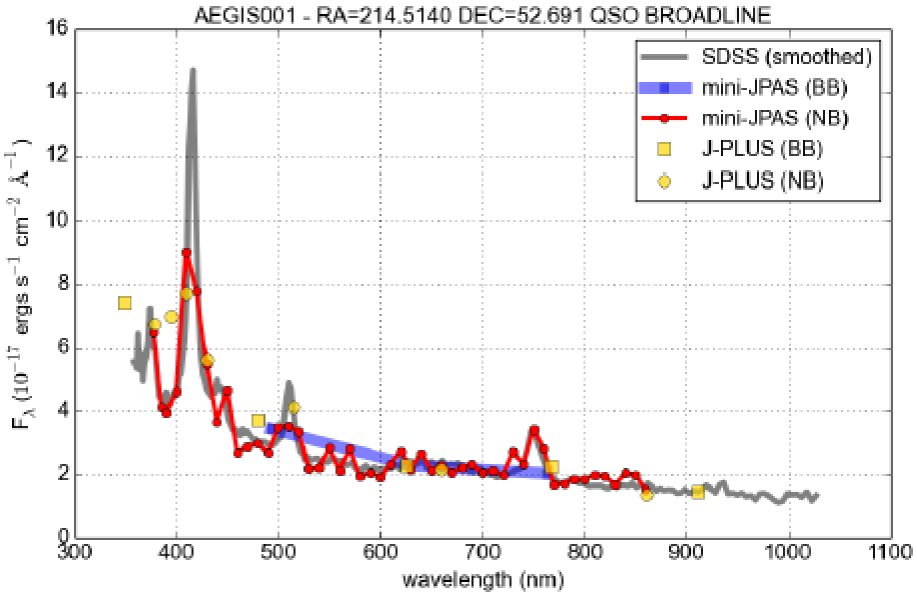


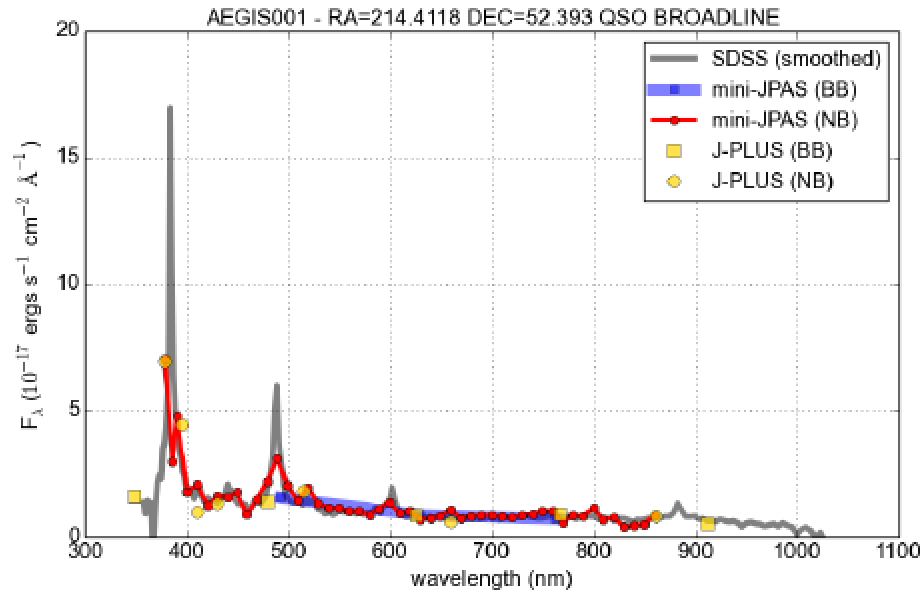


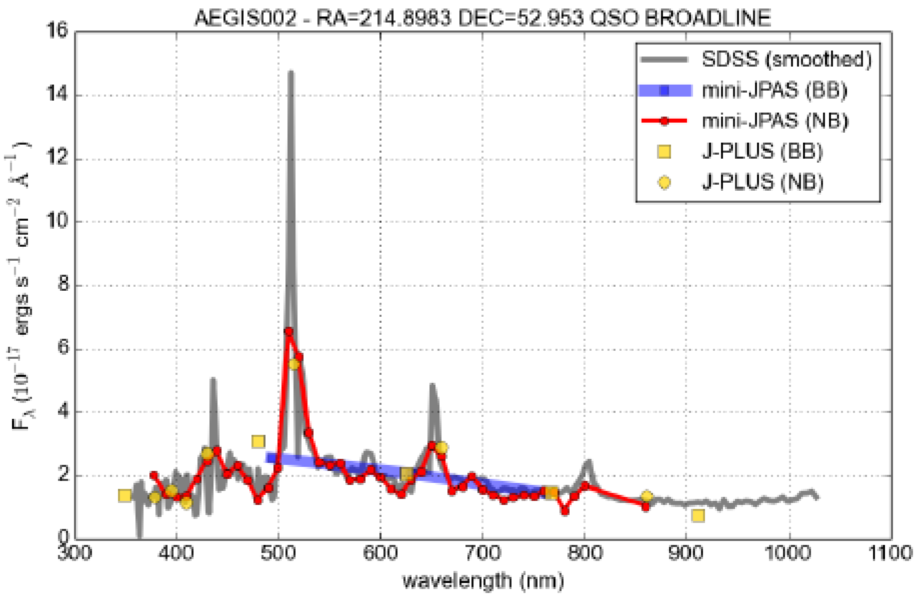


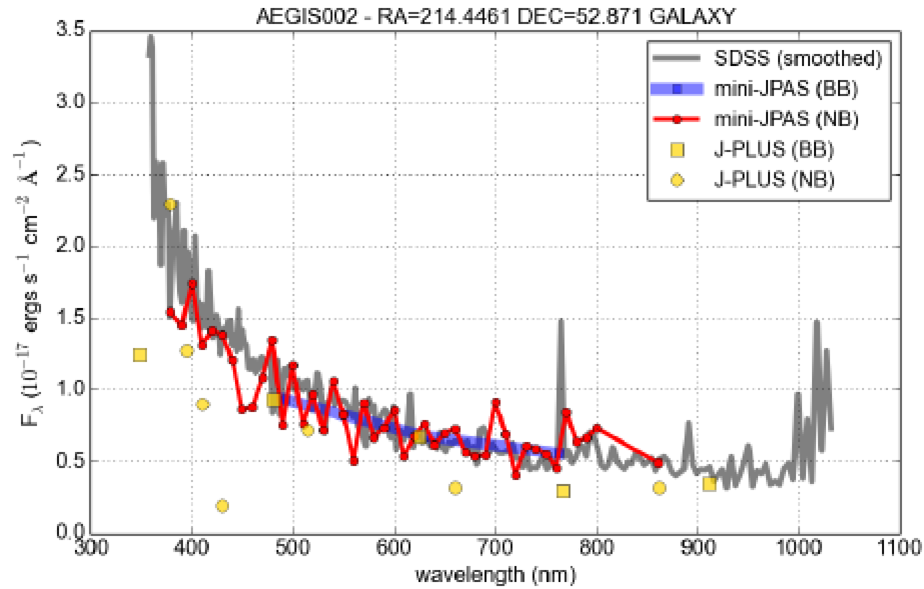


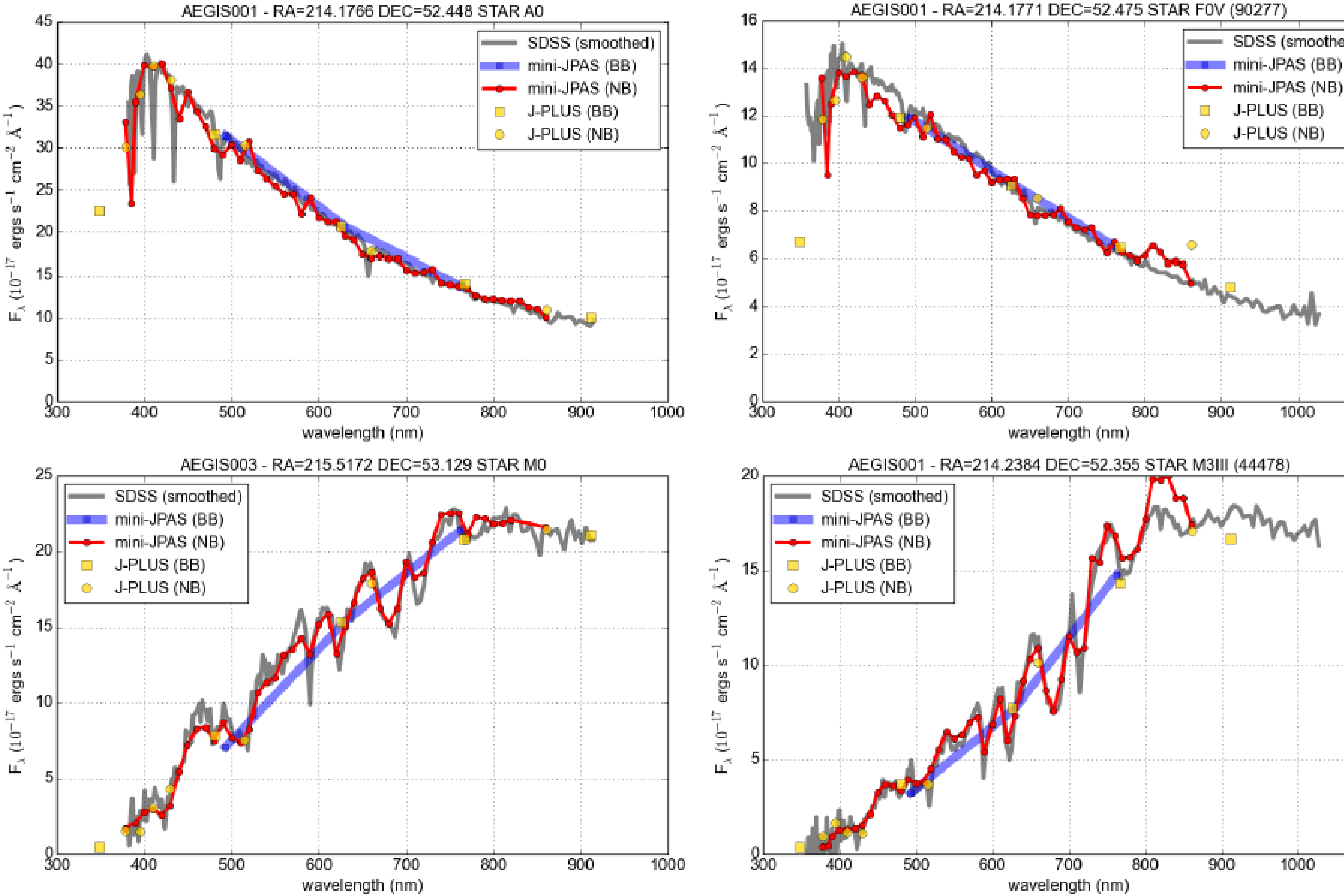
PathFinder 1st data - Out of the oven










AEGIS001 - RA=214.1766 DEC=52.448 STAR A0
AEGIS001 - RA=214.1771 DEC=52.475 STAR F0V (90277)
AEGIS003 - RA=215.5172 DEC=53.129 STAR M0
AEGIS001 - RA=214.2384 DEC=52.355 STAR M3III (44478)
SDSS (smoothed)
mini-JPAS (BB)
mini-JPAS (NB)
J-PLUS (BB)
J-PLUS (NB)
F_λ (10^{-17} ergs s^{-1} cm^{-2} Å^{-1})
wavelength (nm)

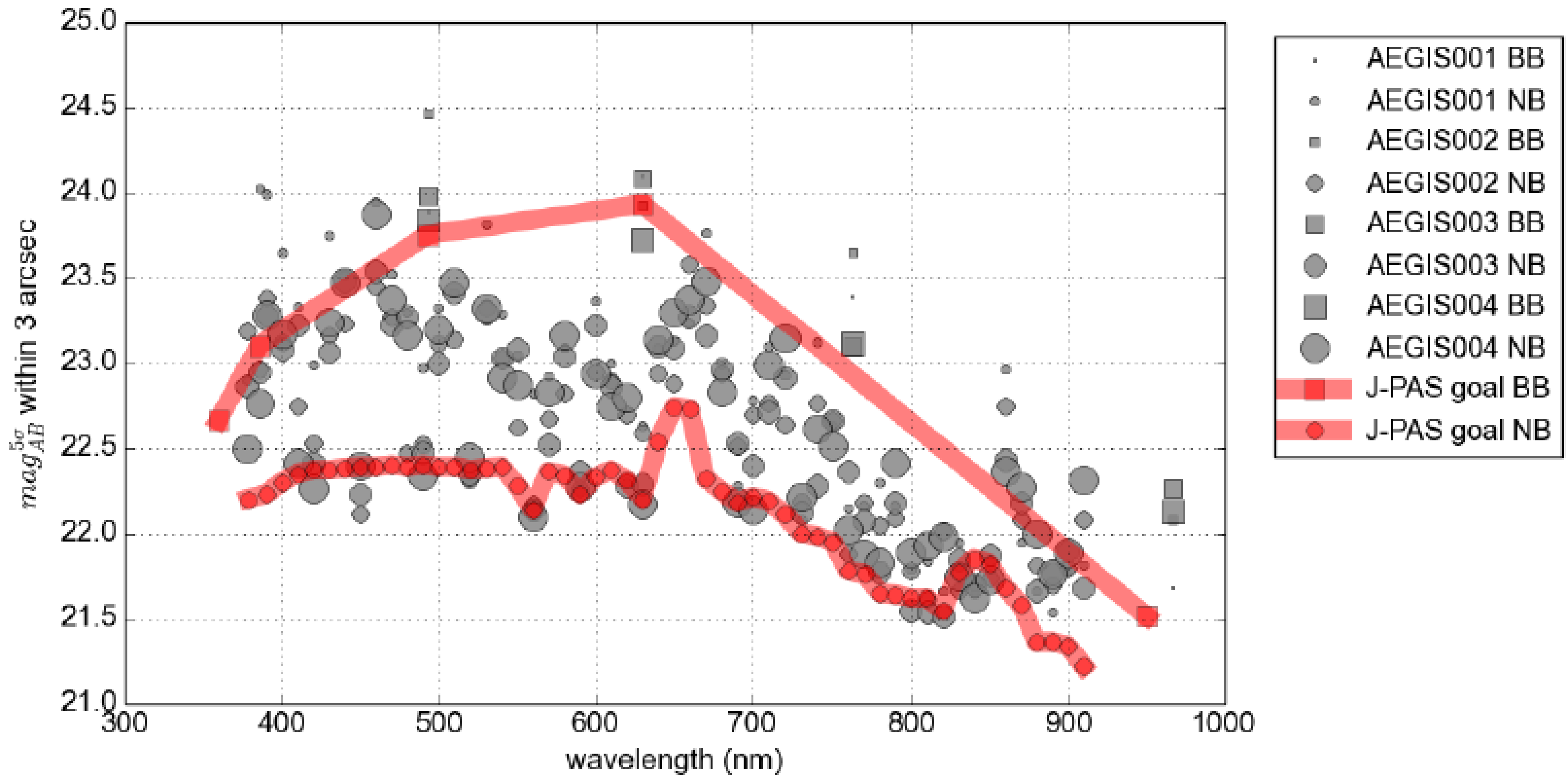
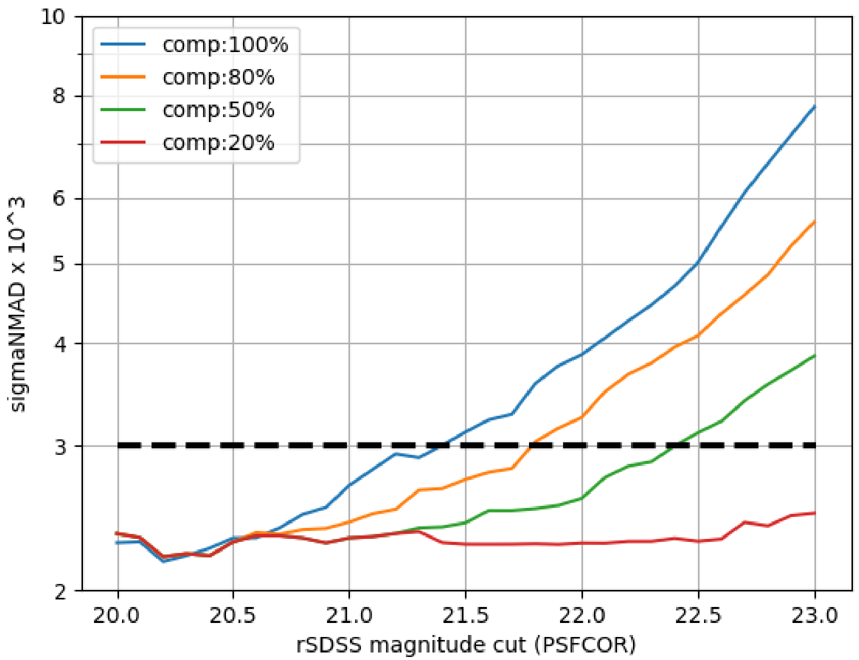


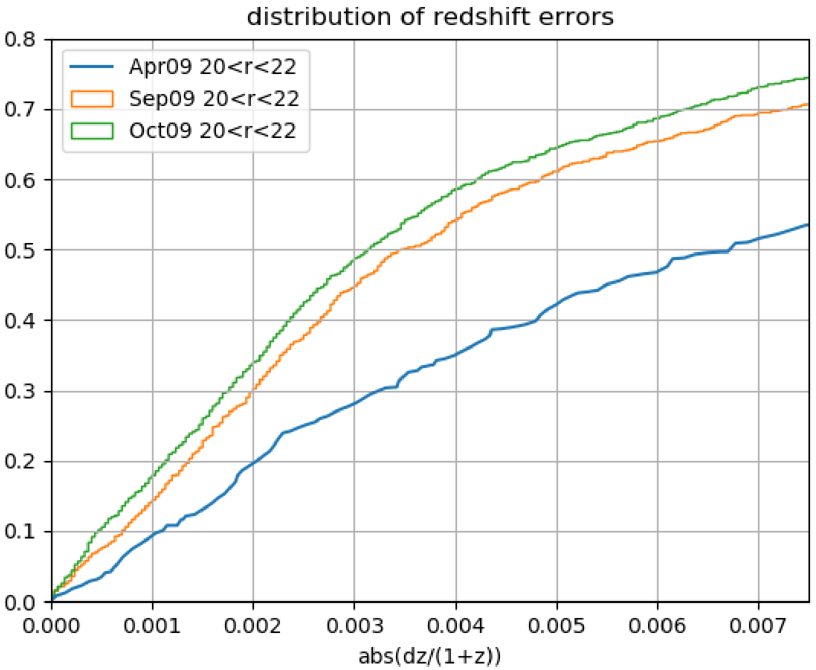
Figure 3: Estimated depths (5σ within 3 arcsec aperture) on AEGIS so far, computed from the noise in the tiles, compared with the J-PAS goal depths from Paper 0. The estimated depths for the narrow band (NB) and the broad band (BB) filters are plotted with different symbols.

Current photo-z

sigmaNMAD of the distribution of redshift errors, dz/(1+z), as a function of magnitude in the r band (PSFCOR aperture), for several cuts in odds representing the highest 20, 50 and 80% of the sample as well as the full sample (100%)

Comparison with Lephare results as of the time of the April data release and recent results with TOPZ (taken from last week's plot from Antti).
0.3% or better accuracy now achieved for ~45% of galaxies in the 20<r<22 range.



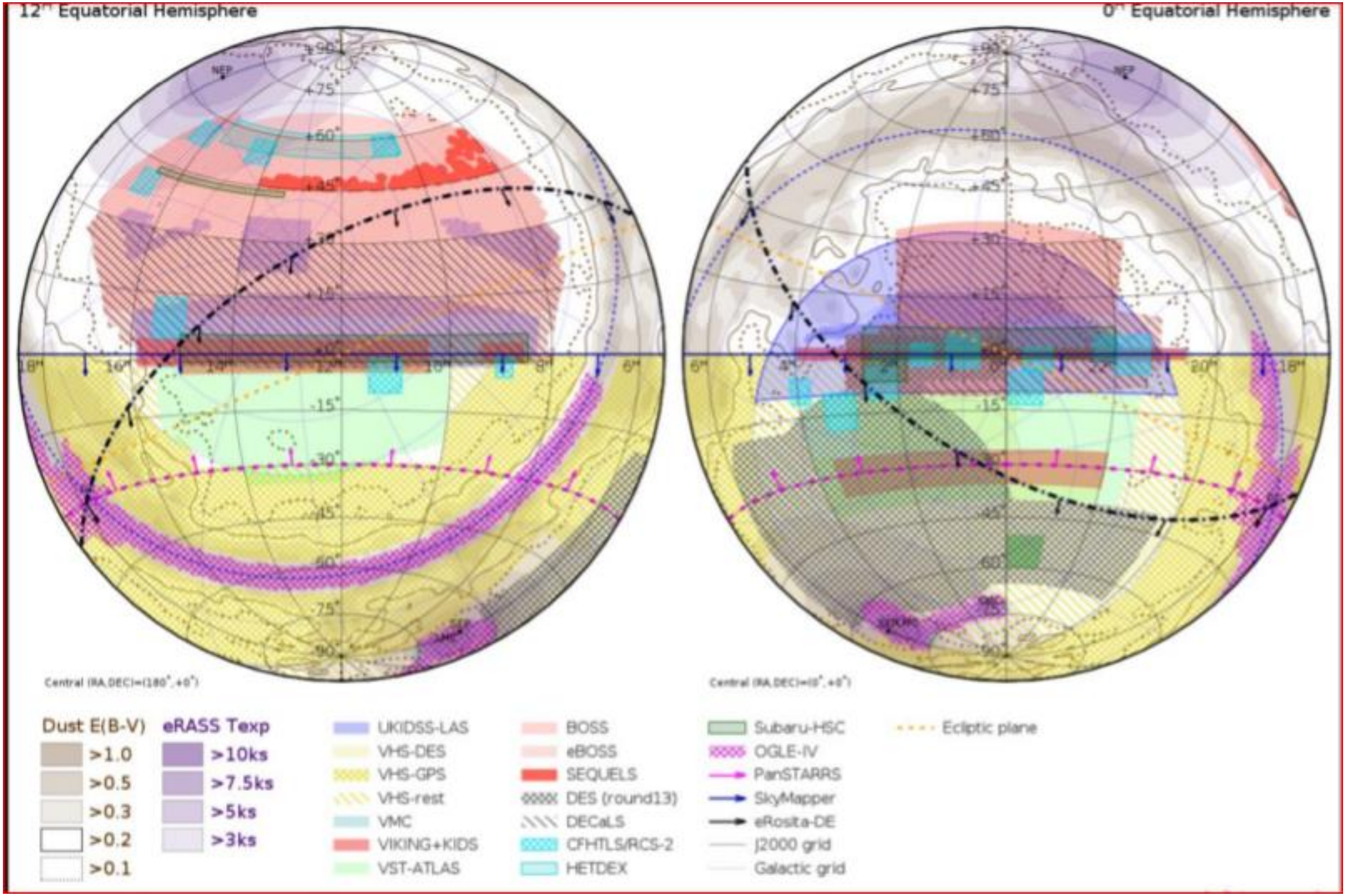


OTHER FIELDS OBSERVED BY PATHFINDER

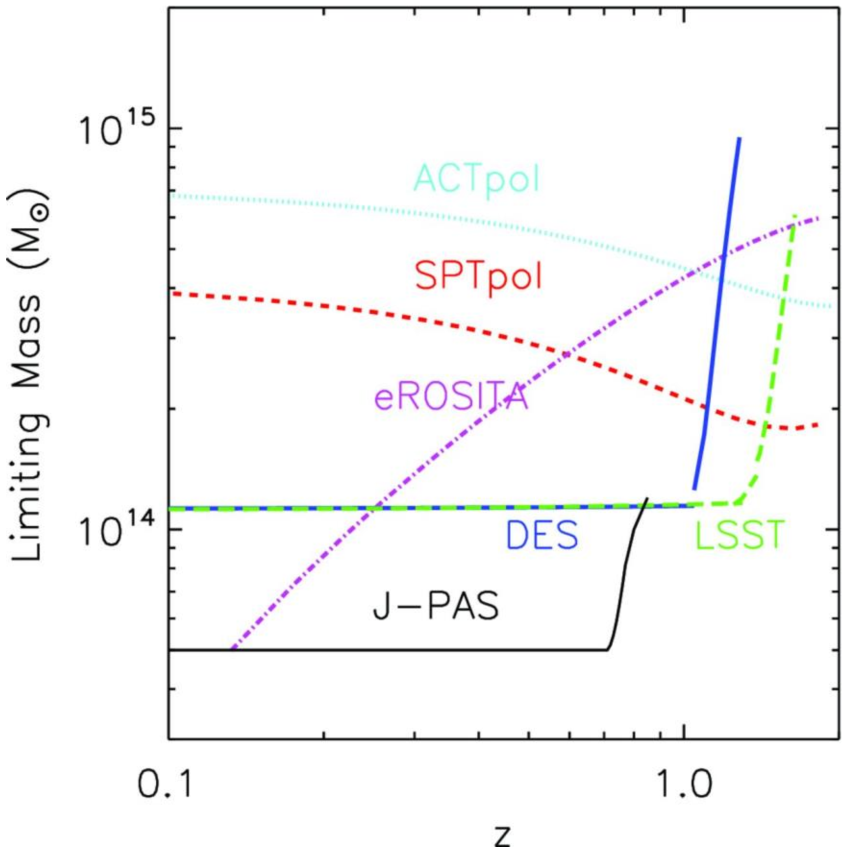
-Besides AEGIS (miniJPAS) PATHFINDER also successfully finished collecting full J-PAS-like data for other field, the North Ecliptic pole (NEP) region, as a complementation of a joint JWST North Ecliptic Pole Time-Domain Field (WTDF). http://lambda.la.asu.edu/jwst/neptdf/

-PATHFINDER also finished observing data for several different science projects with partial wavelength coverage, including the Hercules cluster.

Synergies with eROSITA, JWST, EUCLID, WEAVE QSO

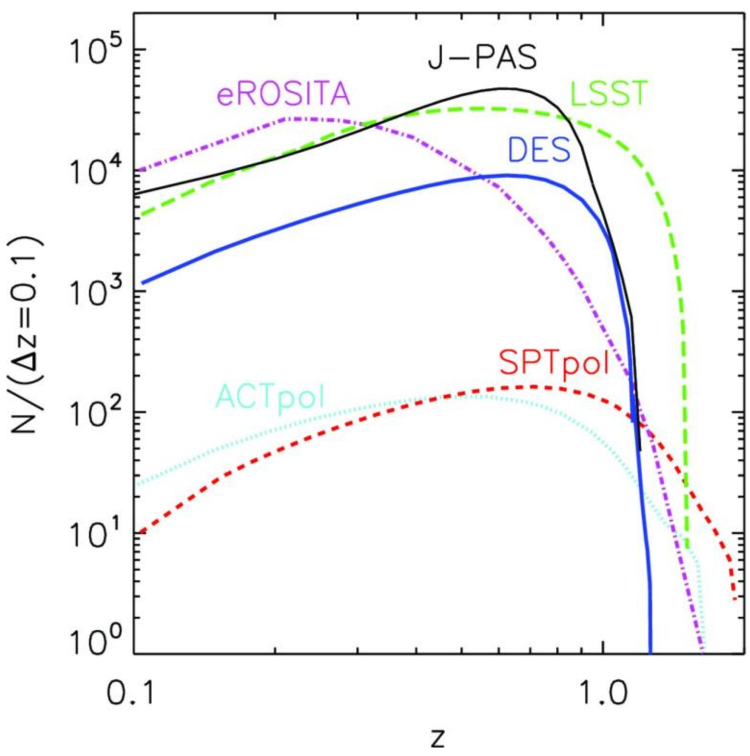


Selection function for different next-generation surveys: J-PAS (black solid line), DES (blue three dot–dashed line), LSST (green long dashed line), SPTpol (red short dashed line) and ACTpol (dotted cyan line).



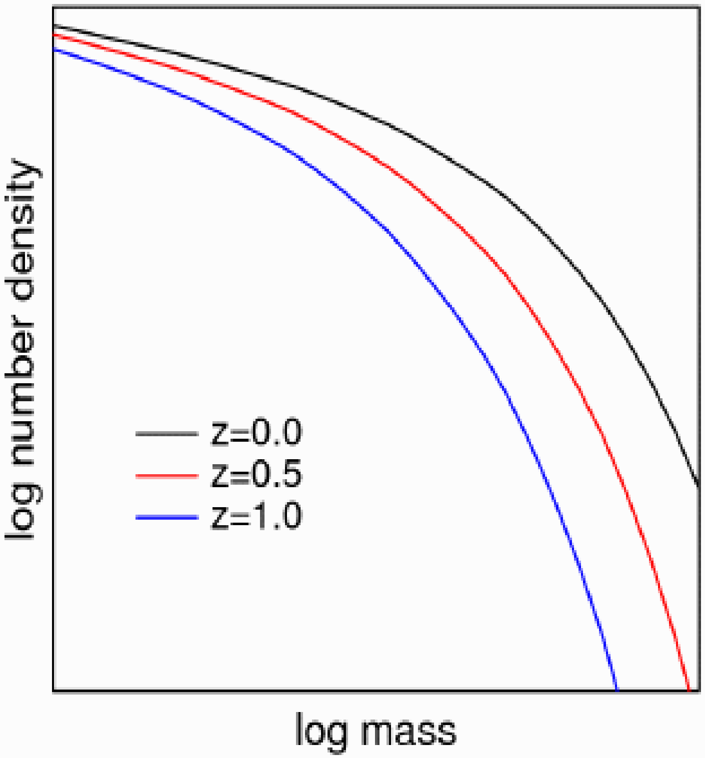
Ascaso, Benitez , Dupke & J-PAS col 2015

Total number of groups/clusters per redshift bin as a function of redshift for different next-generation surveys: J-PAS (black solid line), DES (blue three dot–dashed line), LSST (green long dashed line), SPTpol (red short dashed line) and ACTpol (dotted cyan line).

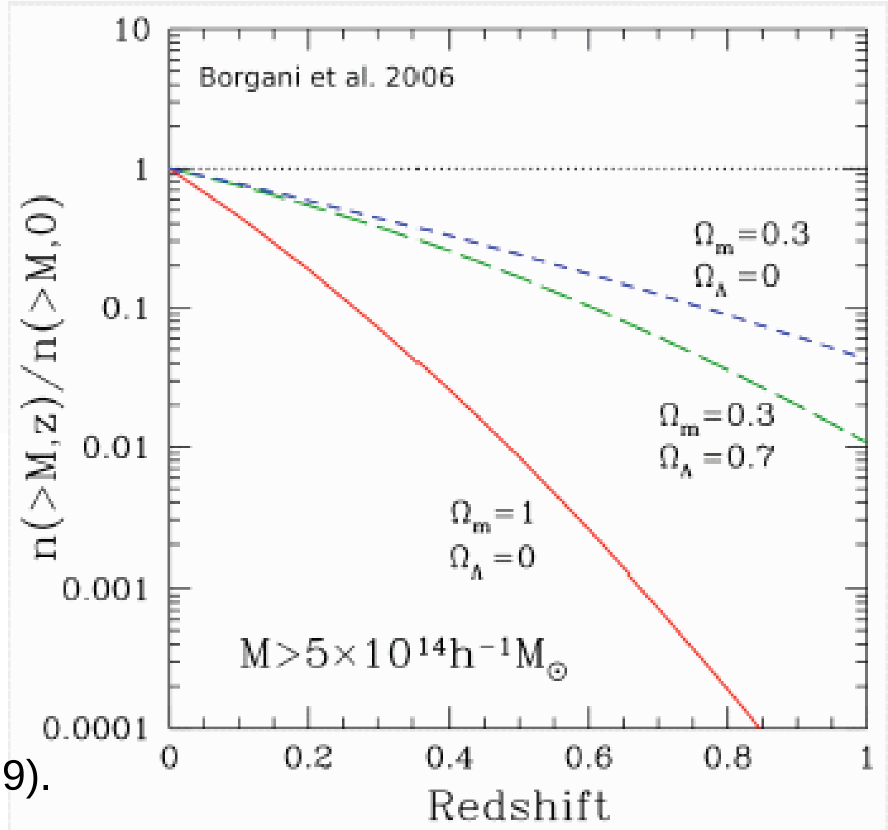


Because of 100% completitude in redshifts and excellent redshift precision, low mass detection limits are extremely low
Note that we arbitrarily stop at 4×10^{13}…

Cluster abundance as a function of mass and redshift probes the mass function and expansion history.

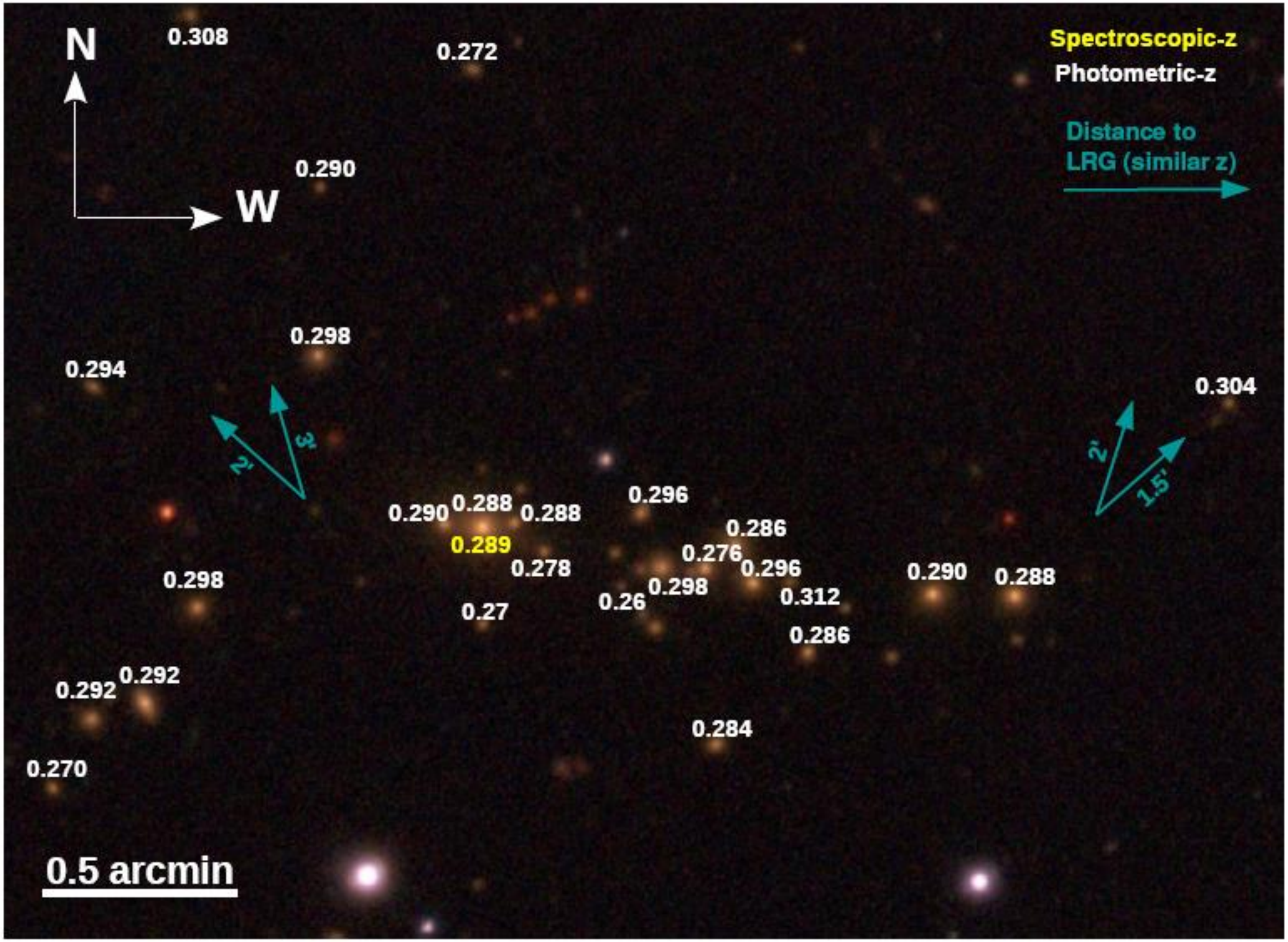


- Low redshift clusters → Ω_m, σ_8
- Evolution → dark energy

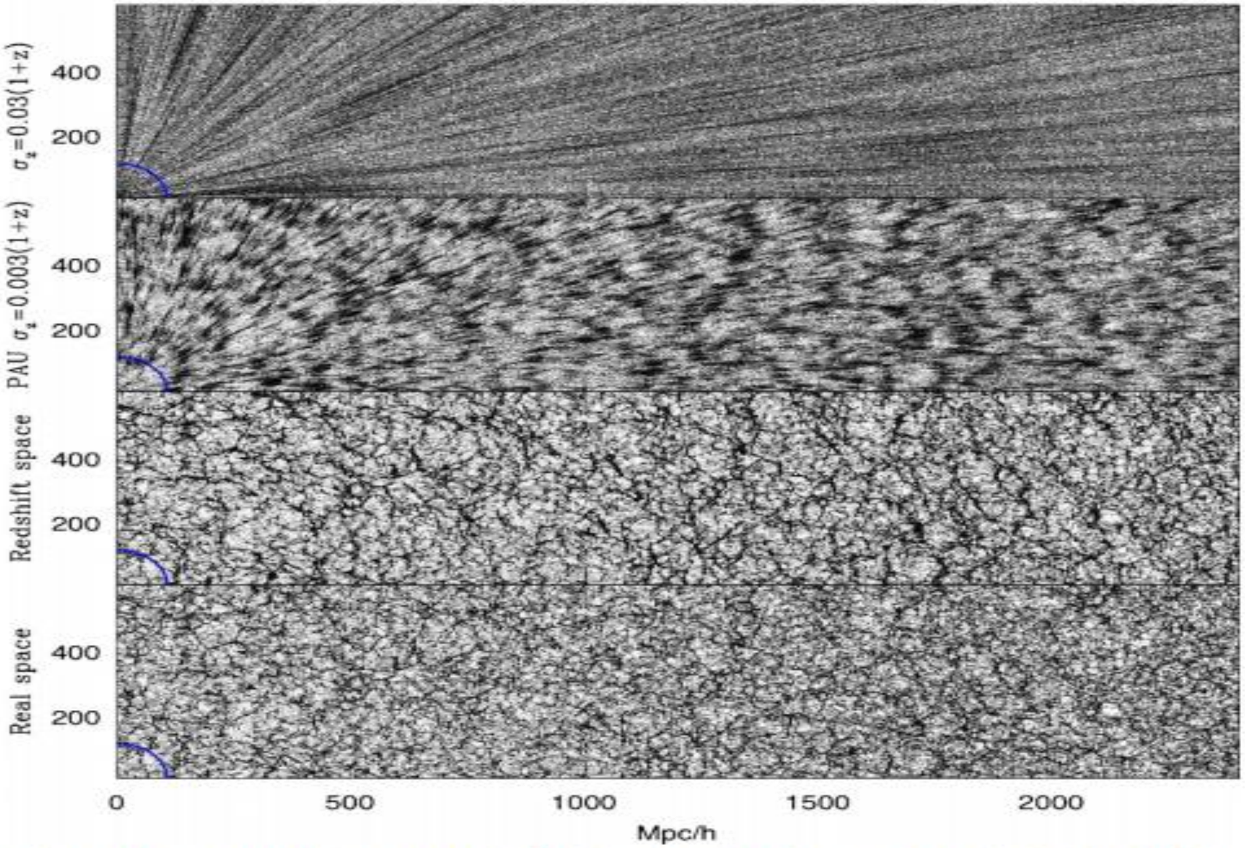


- Clusters are thought to be "fair samples".
- If so $f_b \sim \Omega_b/\Omega_m$ (White et al 1993).
- Ω_b comes from Big Bang nucleosynthesis (Schramm & Turner 1998)
- Strong constraints to Ω_m (e.g. Bahcall et al 1999).

JPC 22211771



Bonoli & J-PAS Collaboration 2020, TB Sumitted



ure 2. Systematic effects in the light cone: panels show a 1 Mpc h^{-1} thick section of the light cone distribution in MICE3072 in comoving coordinates. The bottom panels corresponds to the actual DM distribution in the simulation in real (bottom) and redshift space (upper panels). The top two panels also include a ussian distributed) photo-z error distortion of $\sigma_z = 0.003(1 + z)$, as expected from PAU galaxies, and an order-of-magnitude worse case, $\sigma_z = 0.03(1 + z)$. The) scale is shown by a section of circle with radius 100 Mpc h^{-1} around the observer.

olor version of this figure is available in the online journal.)

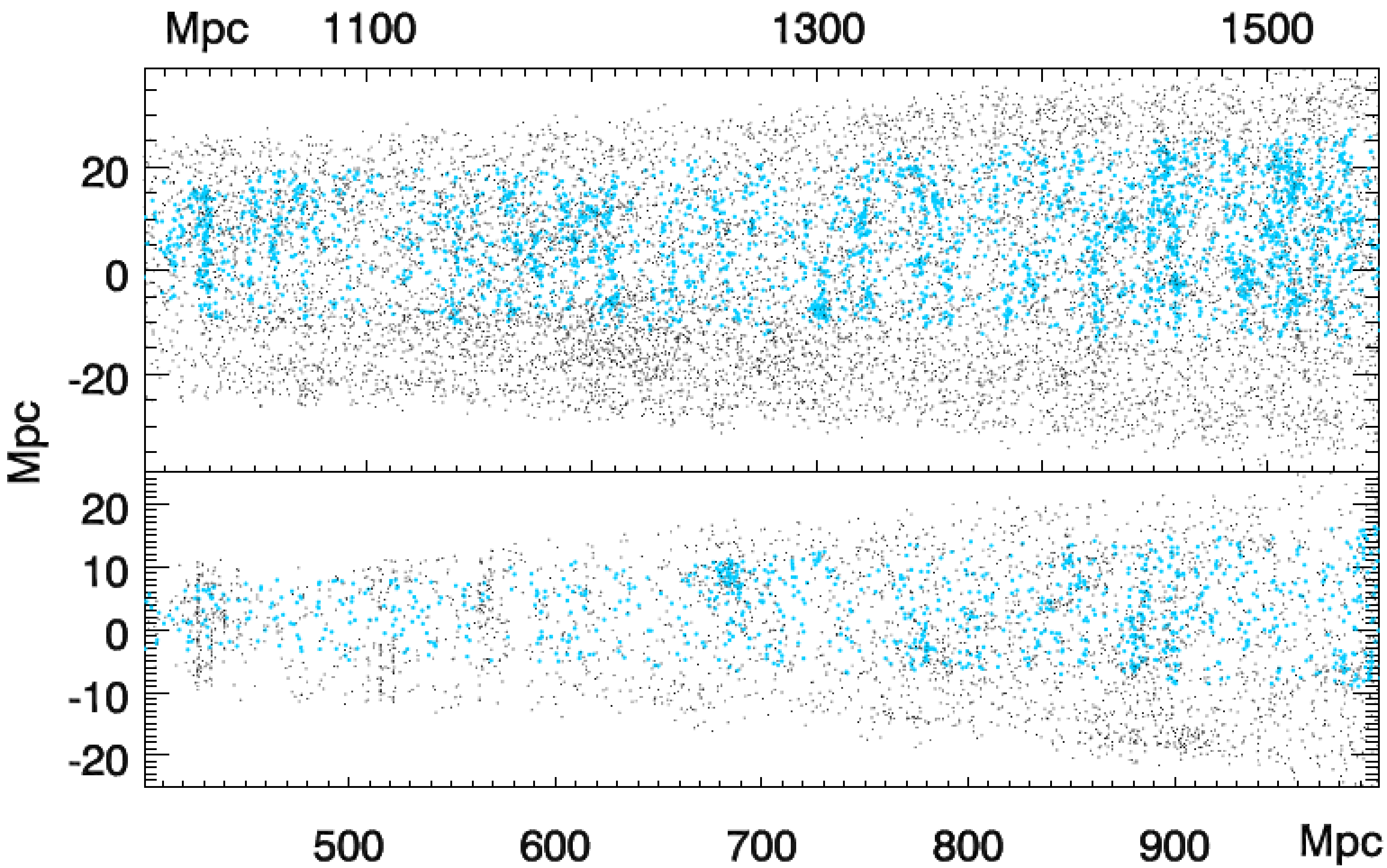
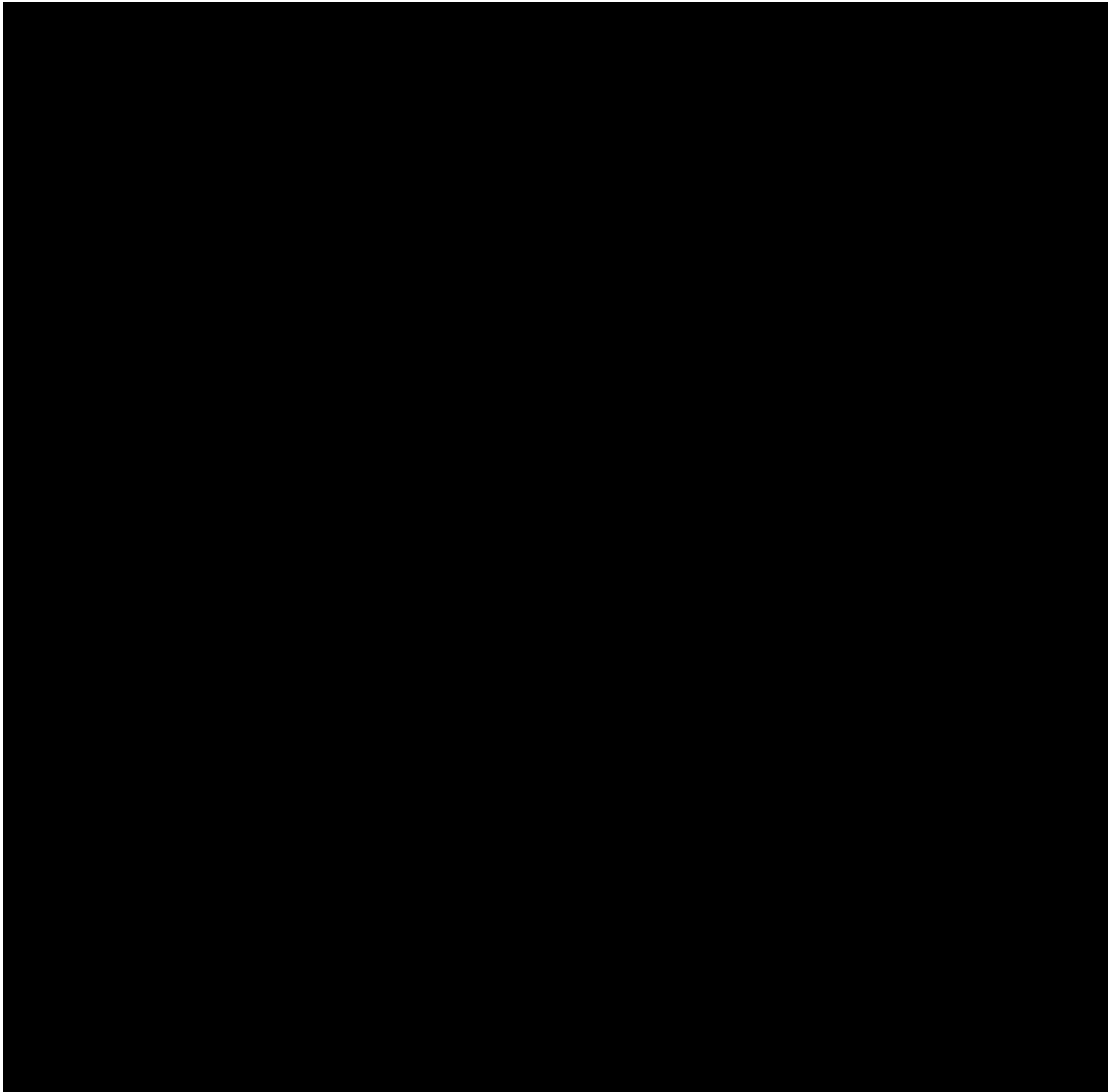
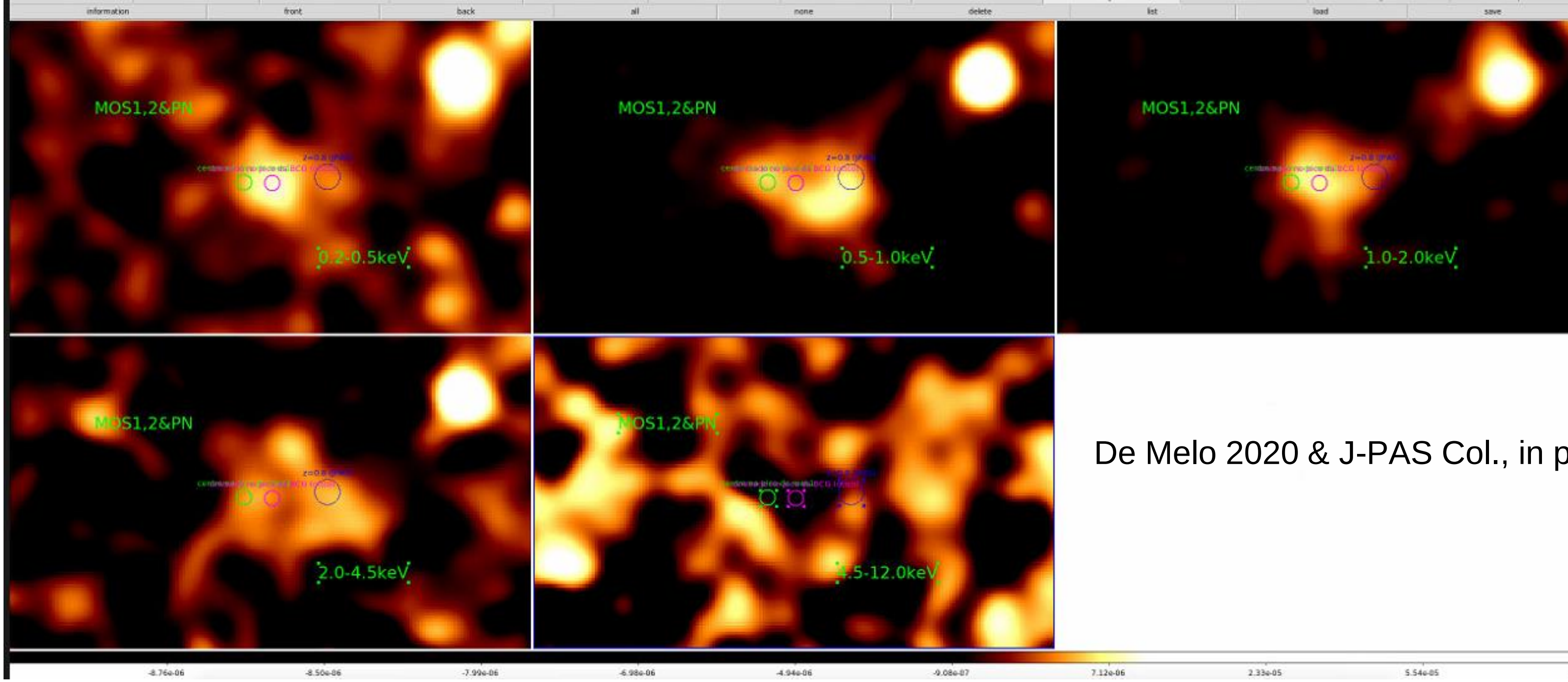
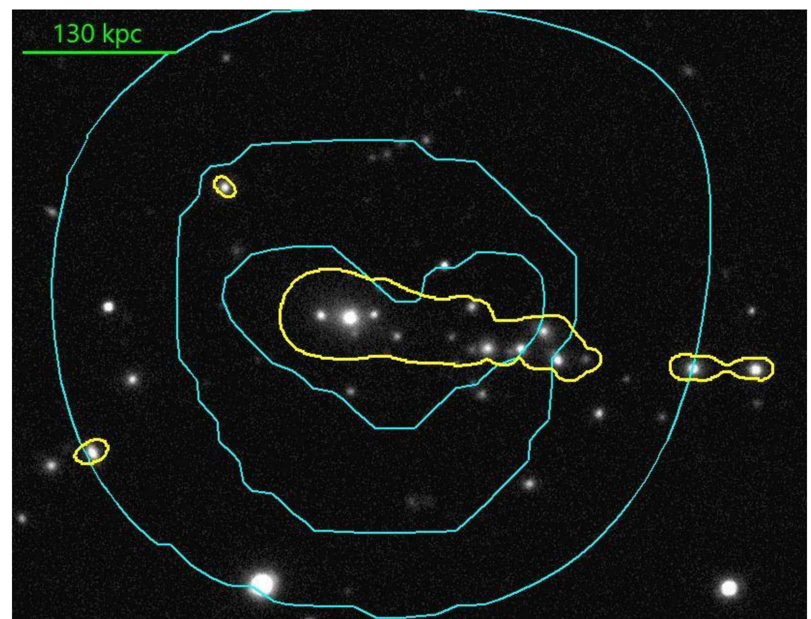


Fig. 22. Comparisson of miniJPAS and DEEP3. The black dots are the projected positions of objects in the miniJPAS footprint with photometric redshifts. The blue dots are the positions for objects with spectroscopic redshifts from DEEP3. LSS and clusters are evident in both data sets. The y axis corresponds to the distance along the longest axis in the rectangular miniJPAS footprint. **-Raul- This figure needs to be updated, to show both axes in the same scale; in this way, it creates the impression that there are spurious structures across the line of sight.**





De Melo 2020 & J-PAS Col., in prep



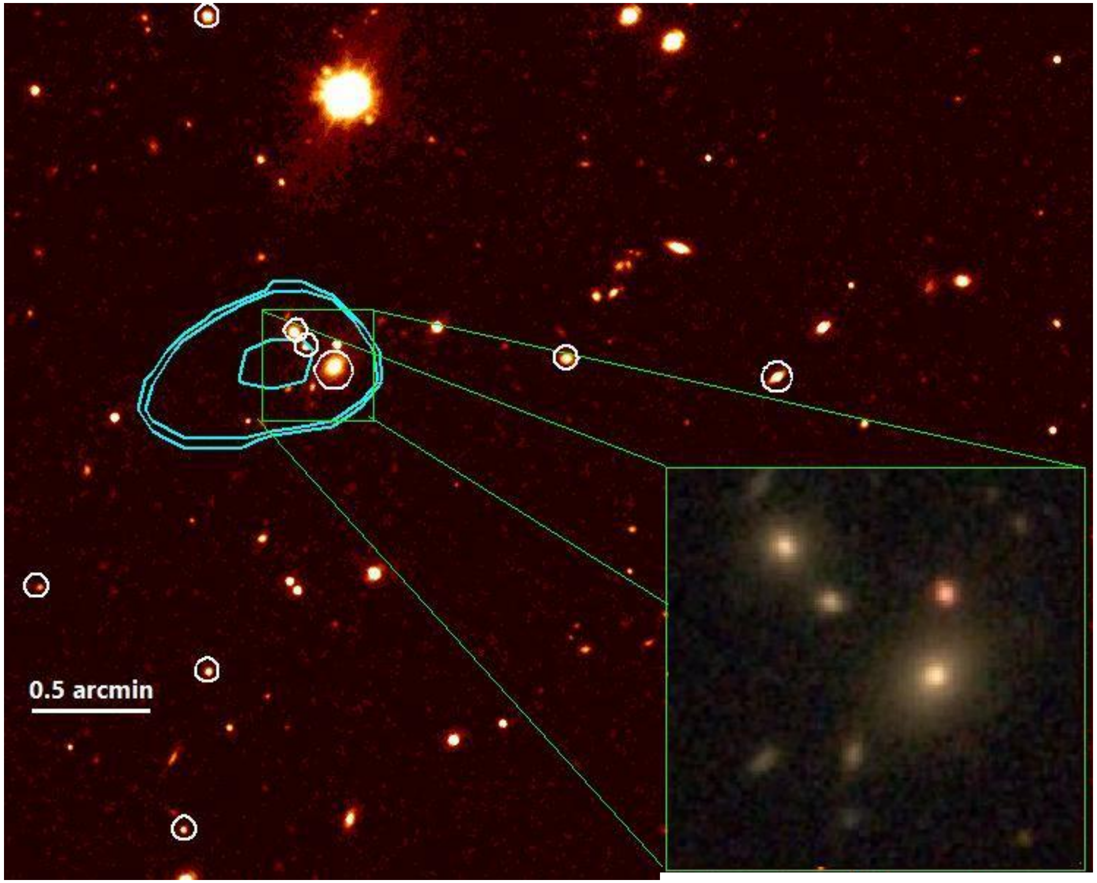
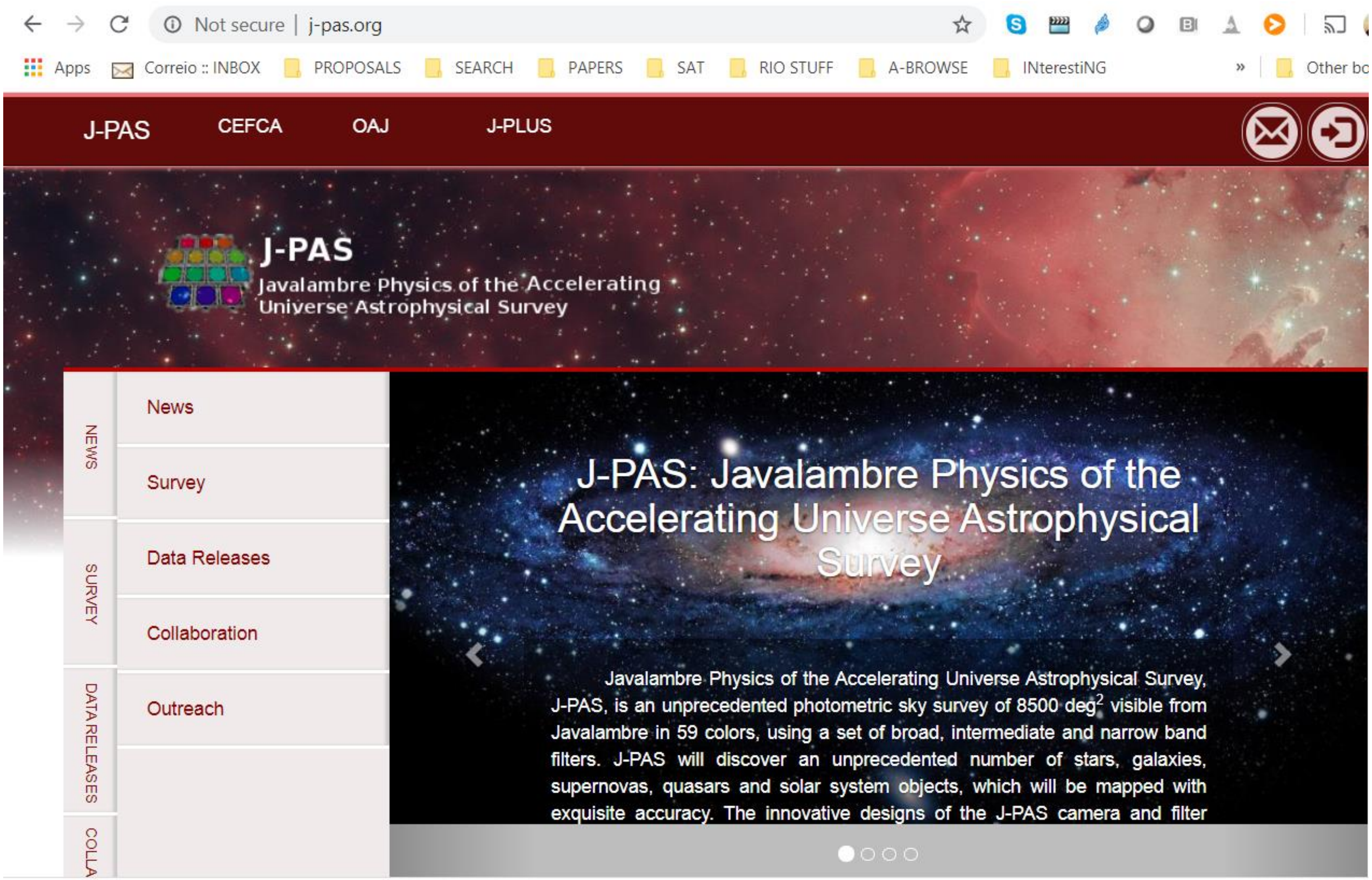


Fig. 26. Example of a low-mass cluster (group) detected by all three cluster finder algorithms in the miniJPAS/Chandra AEGIS field. The system, centered in galaxy JPFC2241-16656 is at RA=14:17:12 DEC=+52:35:36 and has photo-z=0.238. Its mass (derived from Chandra observations) is $2.9\times10^{13} M_{\odot}$. In the image, white circles are galaxy members (within a window of $\pm 4\sigma_{los}$ (or 840 km/s)) within R_{200}(507 h_{70}^{-1} kpc) (Evrard 1996ApJ...469..494). These galaxies had membership probability larger than 88% as provided by the AMICO code. The contours in cyan show the extended X-ray emission in the 0.5-2 keV range on scales of half to one arcminute obtained by the analysis of Chandra data (for details refer to Erfanianfar et al. 2013). In the bottom right we show a zoom-in of the BCG surroundings for illustration.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Javalambre Physics of the Accelerating Universe Astrophysical Survey
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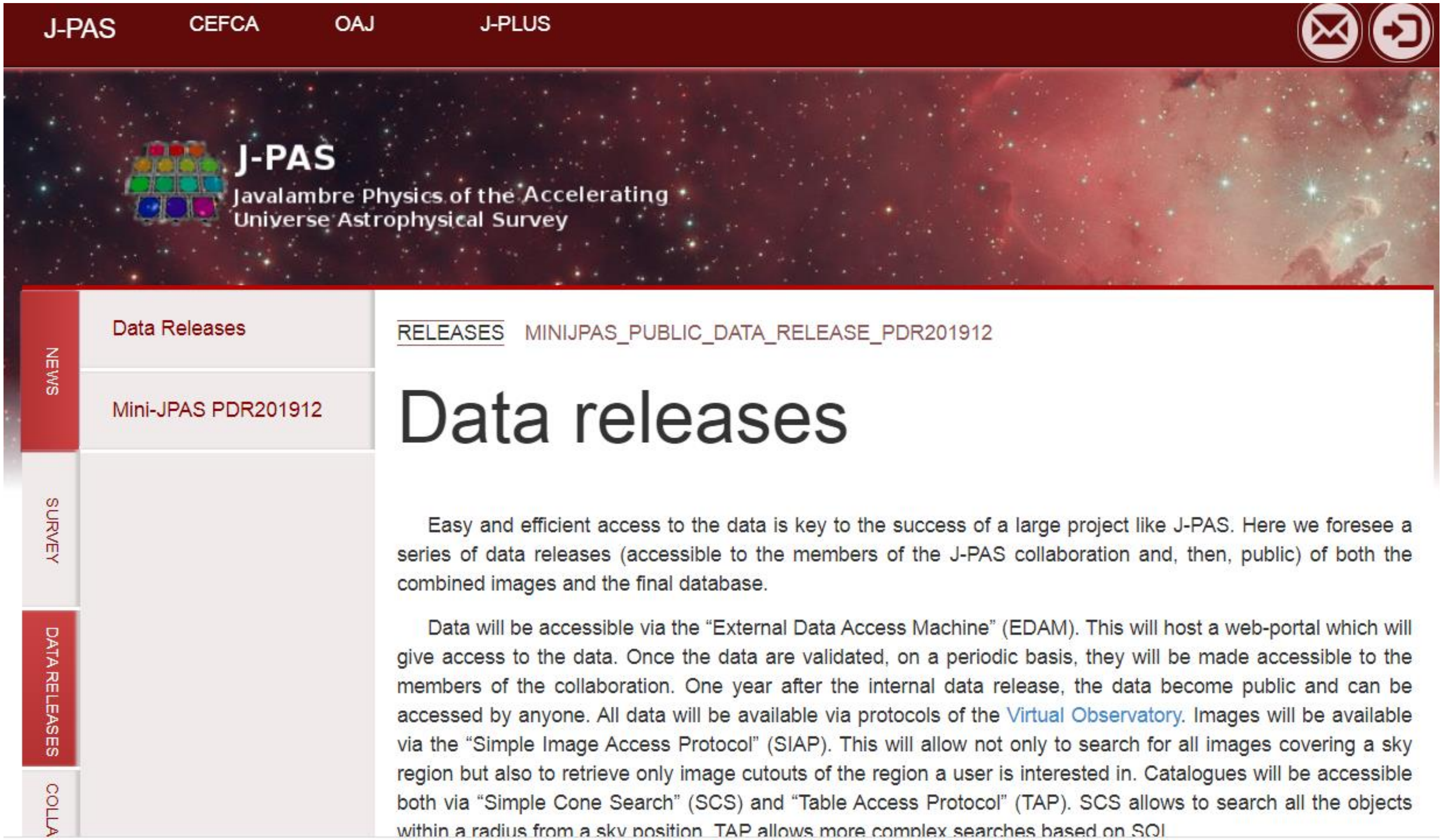
DATA RELEASES
COLLA
News
Survey
Data Releases
Collaboration
Outreach
J-PAS: Javalambre Physics of the Accelerating Universe Astrophysical Survey
Javalambre Physics of the Accelerating Universe Astrophysical Survey, J-PAS, is an unprecedented photometric sky survey of 8500 deg2 visible from Javalambre in 59 colors, using a set of broad, intermediate and narrow band filters. J-PAS will discover an unprecedented number of stars, galaxies, supernovas, quasars and solar system objects, which will be mapped with exquisite accuracy. The innovative designs of the J-PAS camera and filter



J-PAS
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Javalambre Physics of the Accelerating Universe Astrophysical Survey
NEWS
SURVEY
DATA RELEASES
Data Releases
Mini-JPAS PDR201912
RELEASES
MINIJPAS_PUBLIC_DATA_RELEASE_PDR201912
Data releases
Easy and efficient access to the data is key to the success of a large project like J-PAS. Here we foresee a series of data releases (accessible to the members of the J-PAS collaboration and, then, public) of both the combined images and the final database.
Data will be accessible via the "External Data Access Machine" (EDAM). This will host a web-portal which will give access to the data. Once the data are validated, on a periodic basis, they will be made accessible to the members of the collaboration. One year after the internal data release, the data become public and can be accessed by anyone. All data will be available via protocols of the Virtual Observatory. Images will be available via the "Simple Image Access Protocol" (SIAP). This will allow not only to search for all images covering a sky region but also to retrieve only image cutouts of the region a user is interested in. Catalogues will be accessible both via "Simple Cone Search" (SCS) and "Table Access Protocol" (TAP). SCS allows to search all the objects

be allowed to browse through RGB images, select individual targets and get their measured properties. The web-portal also supports searches of lists of targets which deliver post-stamps, data and spectral energy distributions. Finally, the web-portal gives the possibility to perform searches to the database (using the TAP protocol above) with helpful examples and online help.

MiniJ-PAS Public Data Release (PDR201912)

MiniJ-PAS Public Data Release (December 2019) (MINIJ-PAS-PDR201912) comprises 4 AEGIS fields observed with 60 optical bands amounting to 1deg2. MINIJ-PAS-PDR201912 is based on images collected by the JST/T250 telescope and the PathFinder instrument.

View details »

Mini-JPAS PDR201912

MiniJ-PAS Public Data Release (PDR201912)

MiniJ-PAS Public Data Release (December 2019) (MINIJ-PAS-PDR201912) comprises 4 AEGIS fields observed with 60 optical bands amounting to 1deg^2. MINIJ-PAS-PDR201912 is based on images collected by the JST/T250 telescope and the PathFinder instrument.

This first public data release includes two types of data: FITS images and single and dual catalogue data (parameters measured from images, such as photometry or morphology data). Single catalogues are the ones where the detection and photometry have been done on each image independently. Meanwhile, dual catalogues are the catalogues where the detection and photometry have been done using as reference image the r-SDSS image.

DATA ACCESS: http://archive.cefca.es/catalogues/minijpas-pdr201912

DATA ACCESS MANUAL: Download manual here

GLOBAL MASKS: http://archive.cefca.es/catalogues/vo/siap/minijpas-pdr201912/get_global_masks

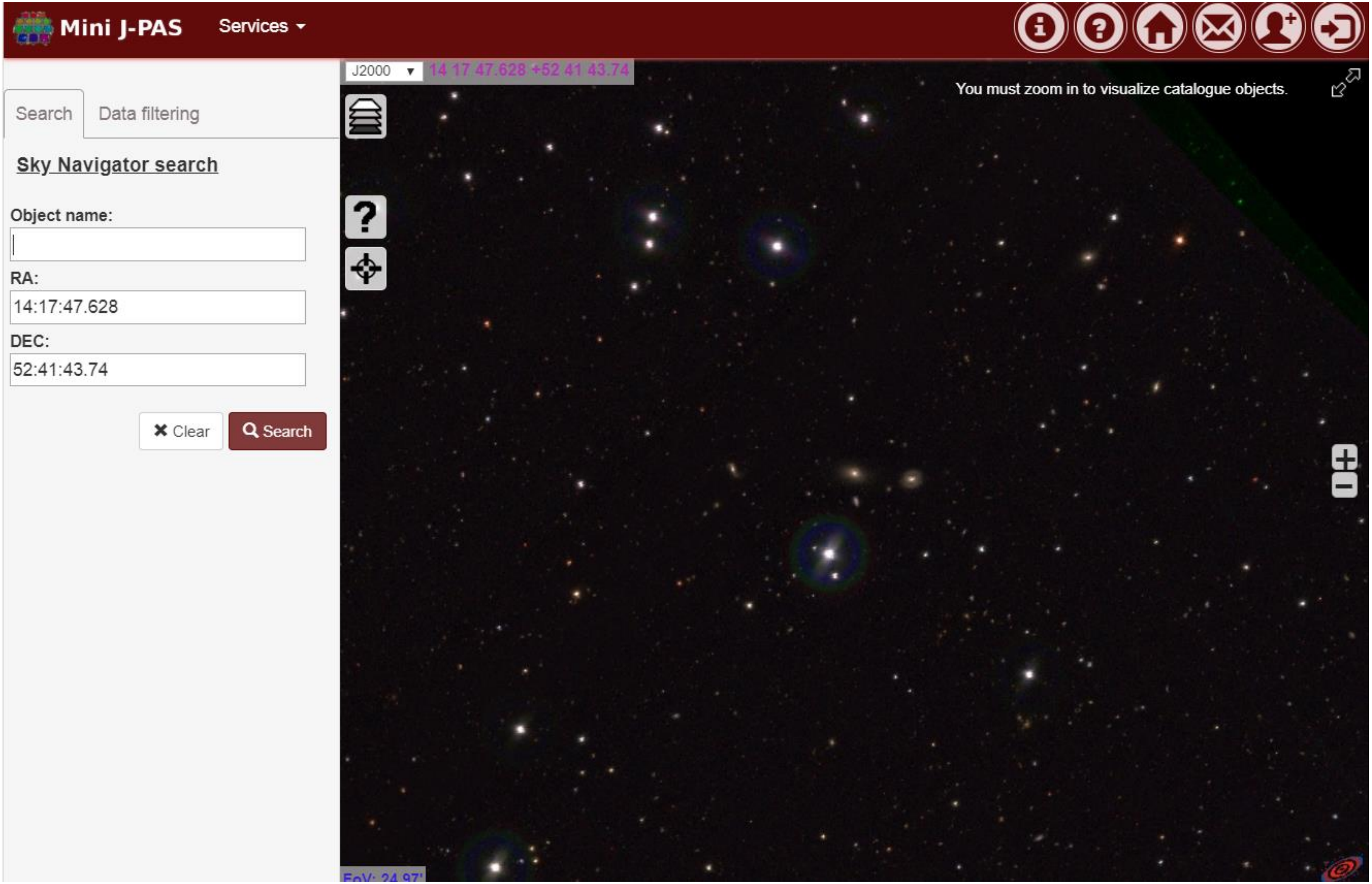
Mini J-PAS Services

MINIJ-PAS-PDR201912 - Data Access Services

MiniJ-PAS Public Data Release (December, 2019) provides access to the combined scientific images in 60 filters covering a total area of ~ 1deg^2. Mini_J-PAS-PDR201912 is based on images collected by the JST/T250 telescope and the Pathfinder instrument. This third internal data release covers the same area as the first MiniJ-PAS internal data release but data has been reprocessed using an improved version of the pipeline. This data release includes two types of data: FITS images and single and dual catalogue data (parameters measured from images, such as photometry or morphology data). Single catalogues are the ones where the detection and photometry had been done on each image independently. While, dual catalogues are the catalogues where the detection and photometry had been done using as reference image the r-SDSS image.

MiniJ-PAS web site offers dual catalogues data through several different online data access tools, each suited to a particular need. The table below gives a short description of each of tool indicating when you might use each one, based on what information you know already and what information you want to find out. Click on the name of a tool to access to it. Single catalogue data is also available but, currently, only through V.O. services.

Tool	What it Does	Use it when...
Sky Navigator	Lets you navigate through the sky by panning and zooming. When you click on an object, you get a summary of it and you have options to see its photospectrum, explore it or search it in other catalogues.	You are looking through the sky for objects to study.
Object List Search	Lets you upload a list of sky positions, object names or objects identifiers, then	You want to quickly scan through a list of objects or you have a list of sky objects

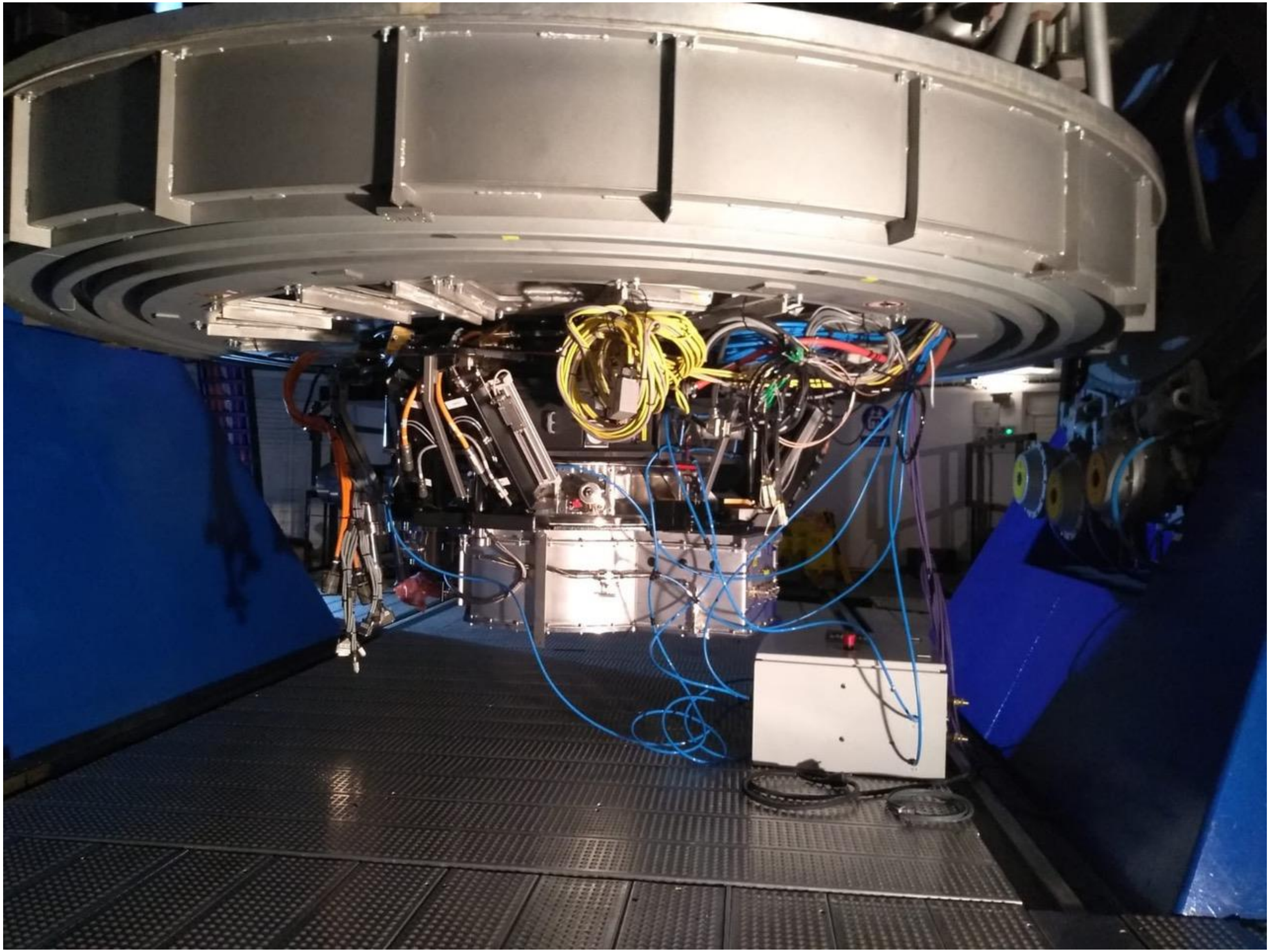

Mini J-PAS
Services
J2000
14 17 47.628 +52 41 43.74
You must zoom in to visualize catalogue objects.
Search
Data filtering
Sky Navigator search
Object name:
RA:
14:17:47.628
DEC:
52:41:43.74
Clear
Search
FoV: 24.97'

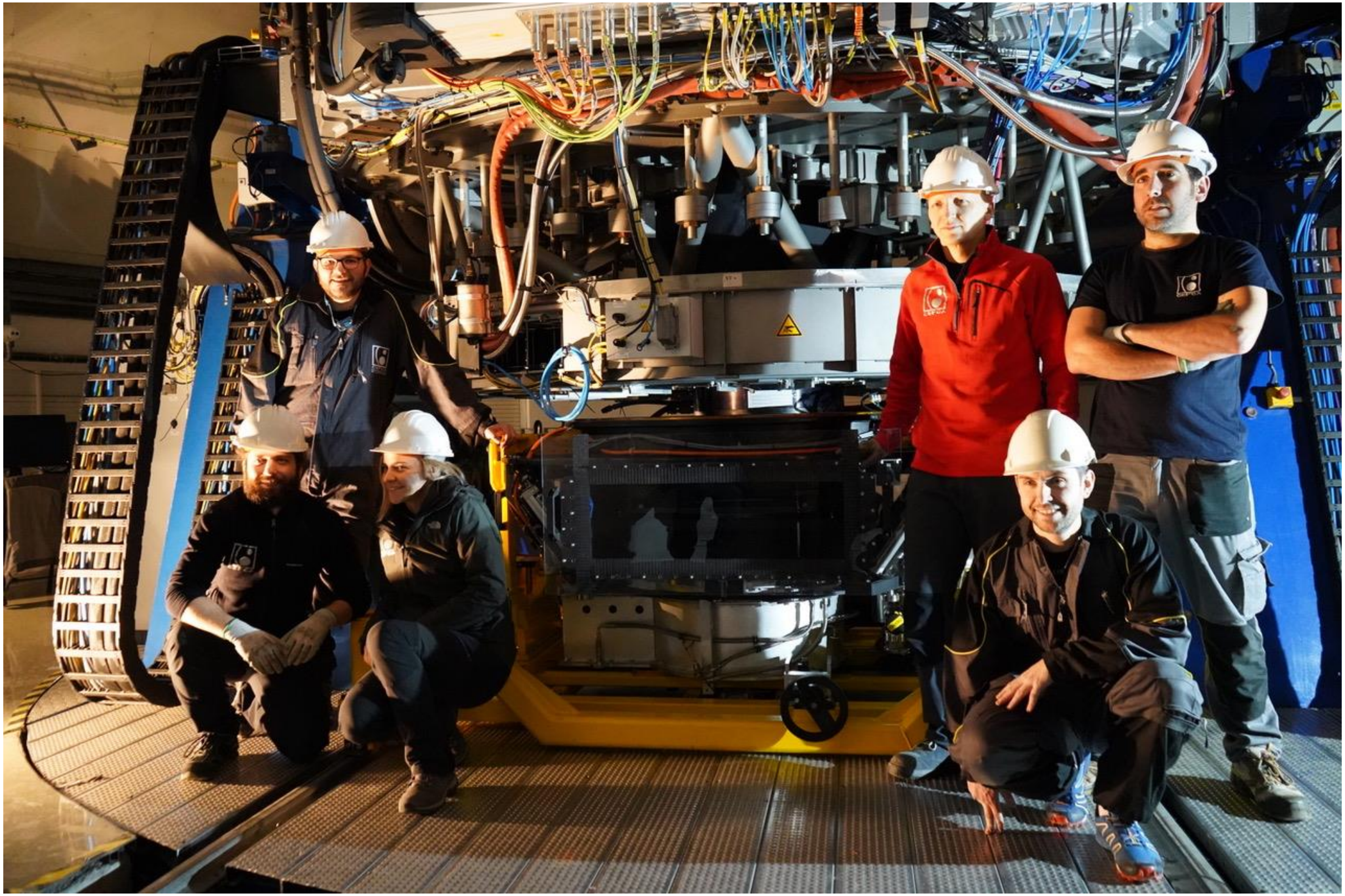
JPAS = ALL SKY IFU

- 8500 sq.deg. survey with 54 contiguous NB filters, 100A apart 3700A< λ < 9200A + 2 MedB and 3 BB for lensing (u,g,r/i). Full coverage 3300A< λ < 10100A
- Dark site with 0.71 arcsec seeing: Javalambre in Teruel, Spain
- 2.5m tel. + 5 sq.deg. JPCam, 1.2Gpix/shot
- It will measure 0.3% photo-z for ~100M galaxies (EType z<1.05 and ELG z<1.4)
- ~ 400-500 M galaxies with 3% photo-z,
- ~ few M QSOs with 0.3% photo-z > Measure w all the way to z=3
- ~ 0.8 arcsec image of the Northern Sky
- Extremely mass sensitive optical cluster catalog
- Excellent characterization of low-z SN systematics
- A few 1000s SNIe survey, no spectroscopy required
- Pixel-by-pixel low-res spectrum of the whole northern sky up to m~23/ arcsec^2
- It will measure radial BAOs up to z~1.4 → 14 $(Gpc/h)^3$
- Clusters (10^5), Weak lensing, SN(10^4), QSOs (several x 10^6), Galaxy evolution (10^8), Stars (10^8), Asteroids, etc


AMOS
CEFCA

Feb 13th





CURRENT STATUS

- J-PLUS has already >2000 sq deg observed
- PathFinder data is being analyzed and DR was on Dec 2020
- JPCam ALREADY installed in T250 – 1st light in the next couple of weeks

SCIENCE WORKING GROUPS

Theory & Fundamental Physics

Jailson Alcaniz (ON) & Antonio Maroto (UCM)

LSS & Cosmology

Valerio Marra (UFES) & Carlos Monteagudo (CEFCA/IAC)

Clusters of Galaxies & Lensing

Eduardo Cypriano (IAG-USP), Chema Diego (IFCA), Renato Dupke (ON)

Galaxy Evolution

Rosa Delgado (IAA) & Adriana Cortesi (UFRJ)

Resolved Stellar Populations

Simone Daflon (ON) & Vinicius Placo (Notredame/IAG)

Transients

Alvaro Candal (ON) & Beatriz Siffert (UFRJ)

More details at (arXiv:1403.5237)

J-PAS: The Javalambre-Physics of the Accelerated Universe Astrophysical Survey

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