Towards 1% Photometric Calibration of ESO's Public Kilo Degree Survey (KiDS)

Gijs A. Verdoes Kleijn
OmegaCEN / Target
Kapteyn Astronomical Institute

on behalf of KiDS production team

Public surveys ΩCAM-VST

KIDS-N (+VIKING @ VISTA)

KiDS, 1500 sq.deg. ugri

Main driver…

- Dark matter/energy: weak lensing tomography with phot-zs from KiDS+VIKING

…+ much more science:

Gal. evolution vs environment/activity, z>6.5
QSOs, BDs, WDs, MW-streams and more…..

KIDS-S (+VIKING@VISTA)

groningen

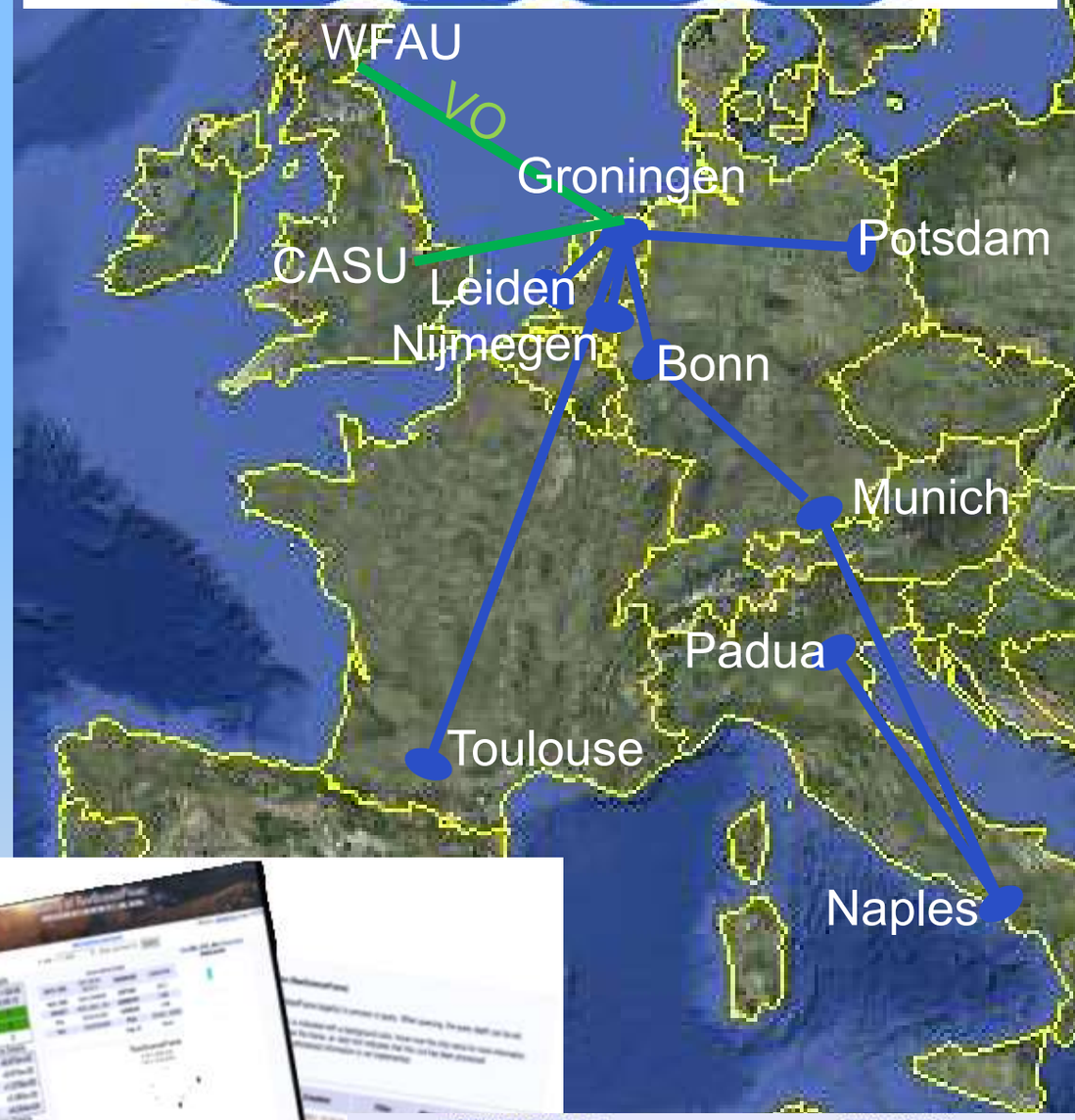
KiDS

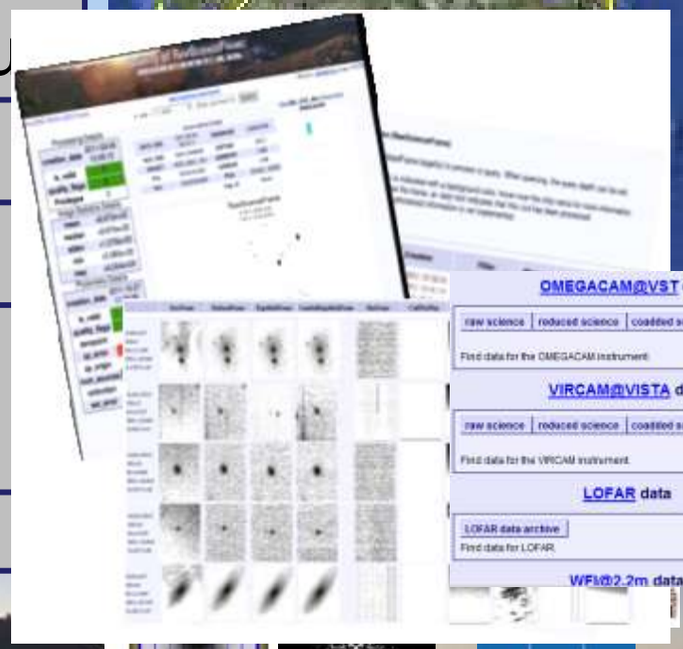
KiDS team

Kuijken (PI), 50+ team members total

DISTRIBUTED SURVEY HANDLING	
OmegaCEN LEAD CENTRE Valentijn	**Verdoes Kleijn**, Begeman, Boxhoorn,Buddelmeijer, Belikov, Bout, McFarland, Sikkema
Leiden Obs. Kuijken	**de Jong**, Helmich, Irisarri, Pila-Diez, van den Burg
OAC / Naples Univ Capaccioli	**Grado**, Getman, La Barbera, Napolitano, Rifatto, Dall'Ora, Puddu
Padua Obs.	Radovich
Rome Obs.	Huang
AIfA Bonn Schneider	Hildebrandt, Erben, Cordes, van Uitert
CASU, WFAU, Terapix	

ASTRO WISE





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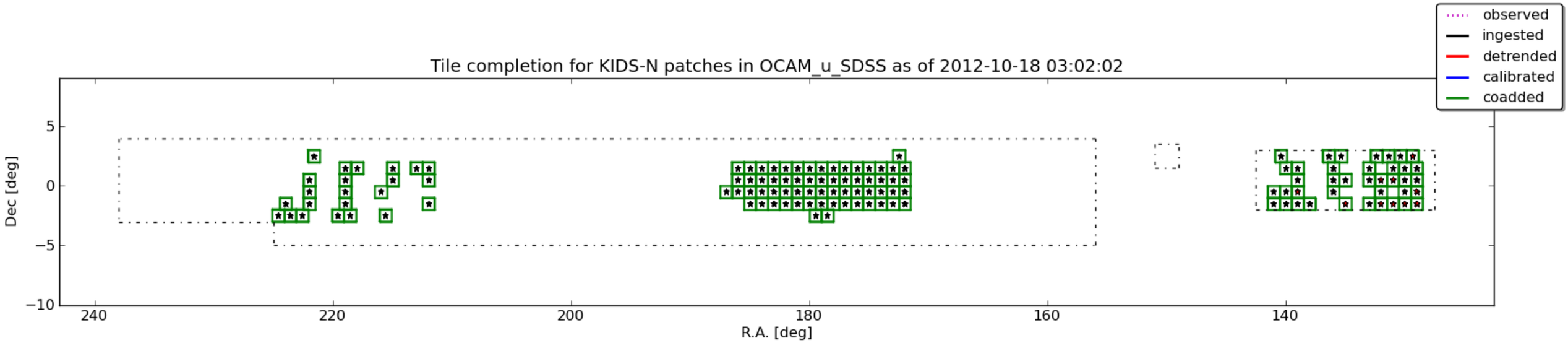

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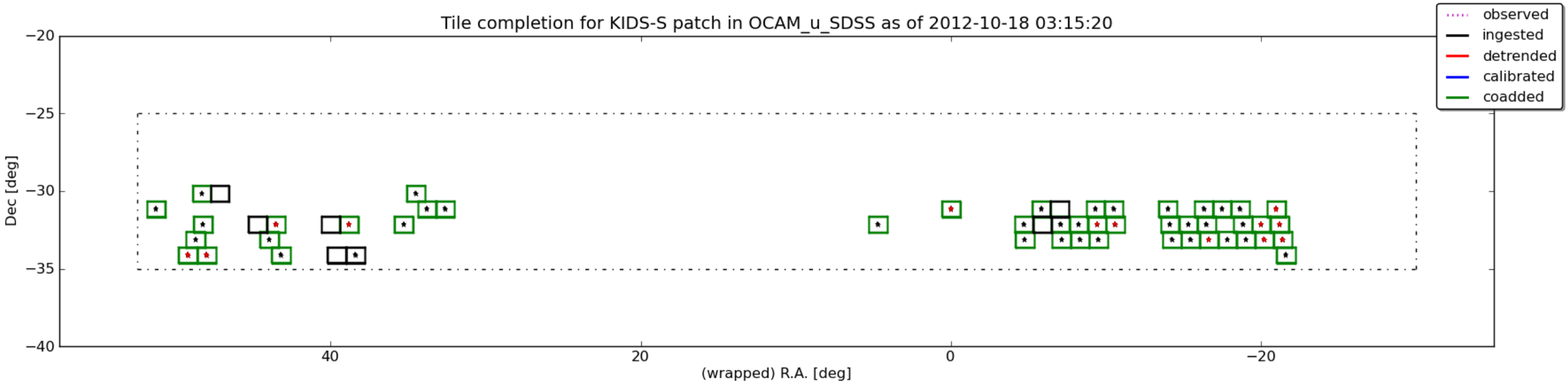

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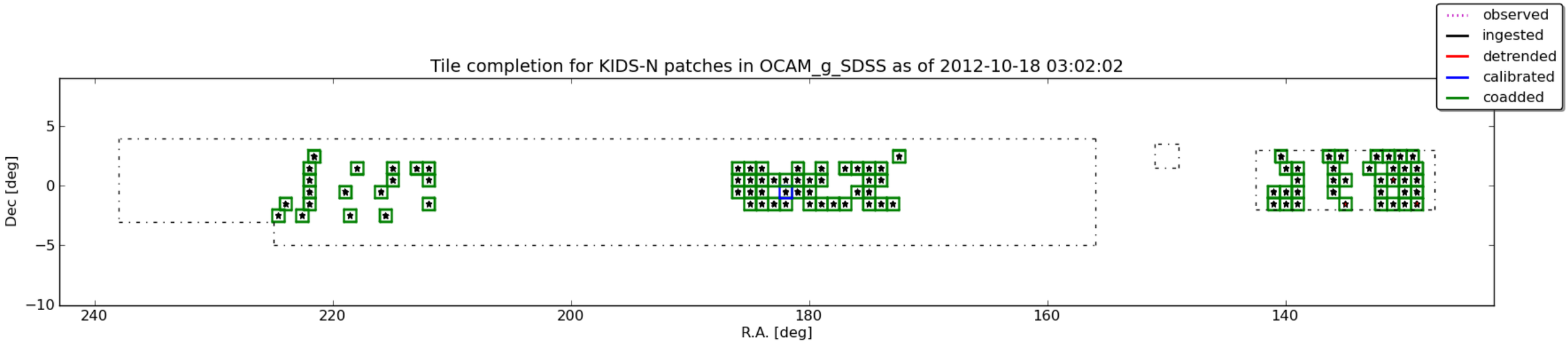

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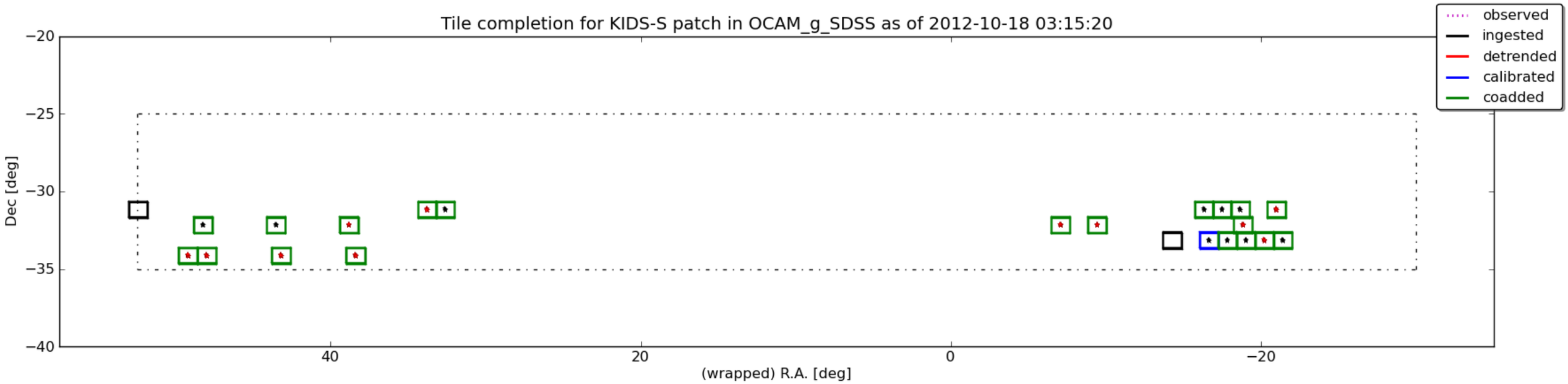

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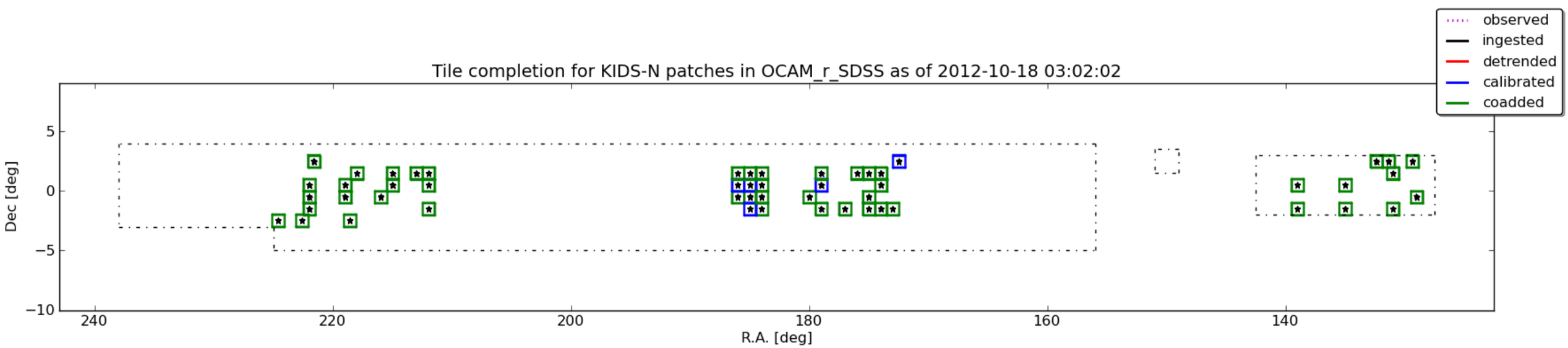

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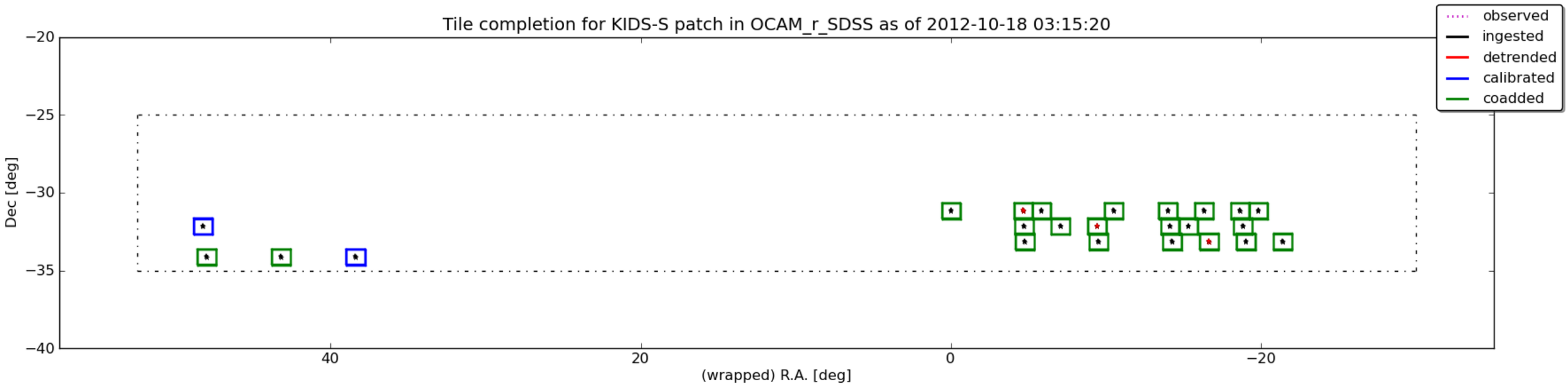

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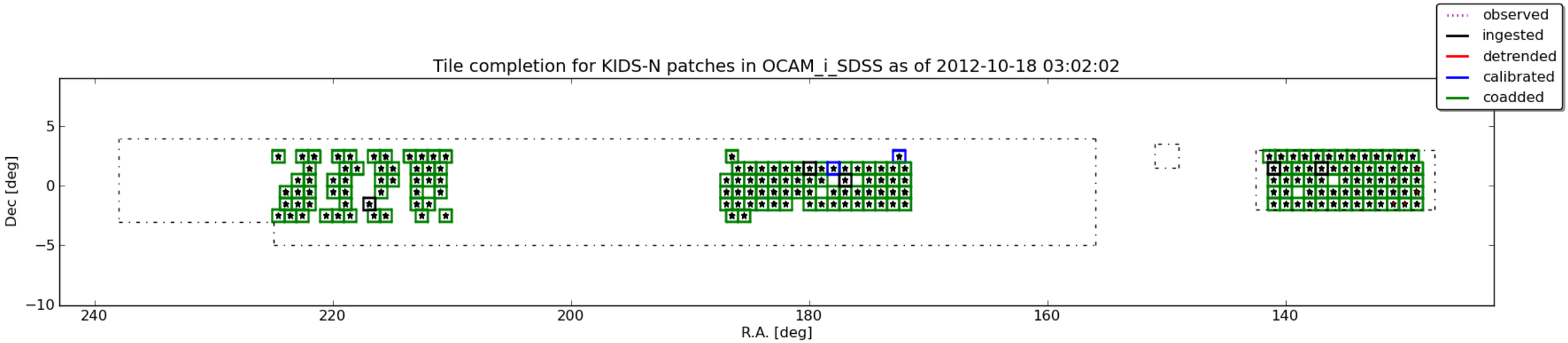

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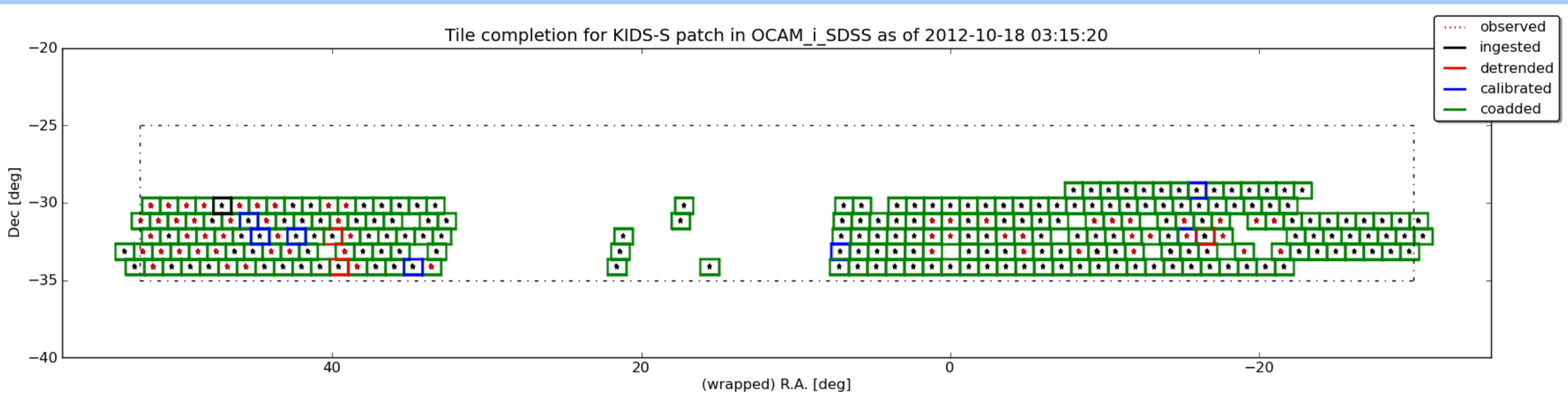

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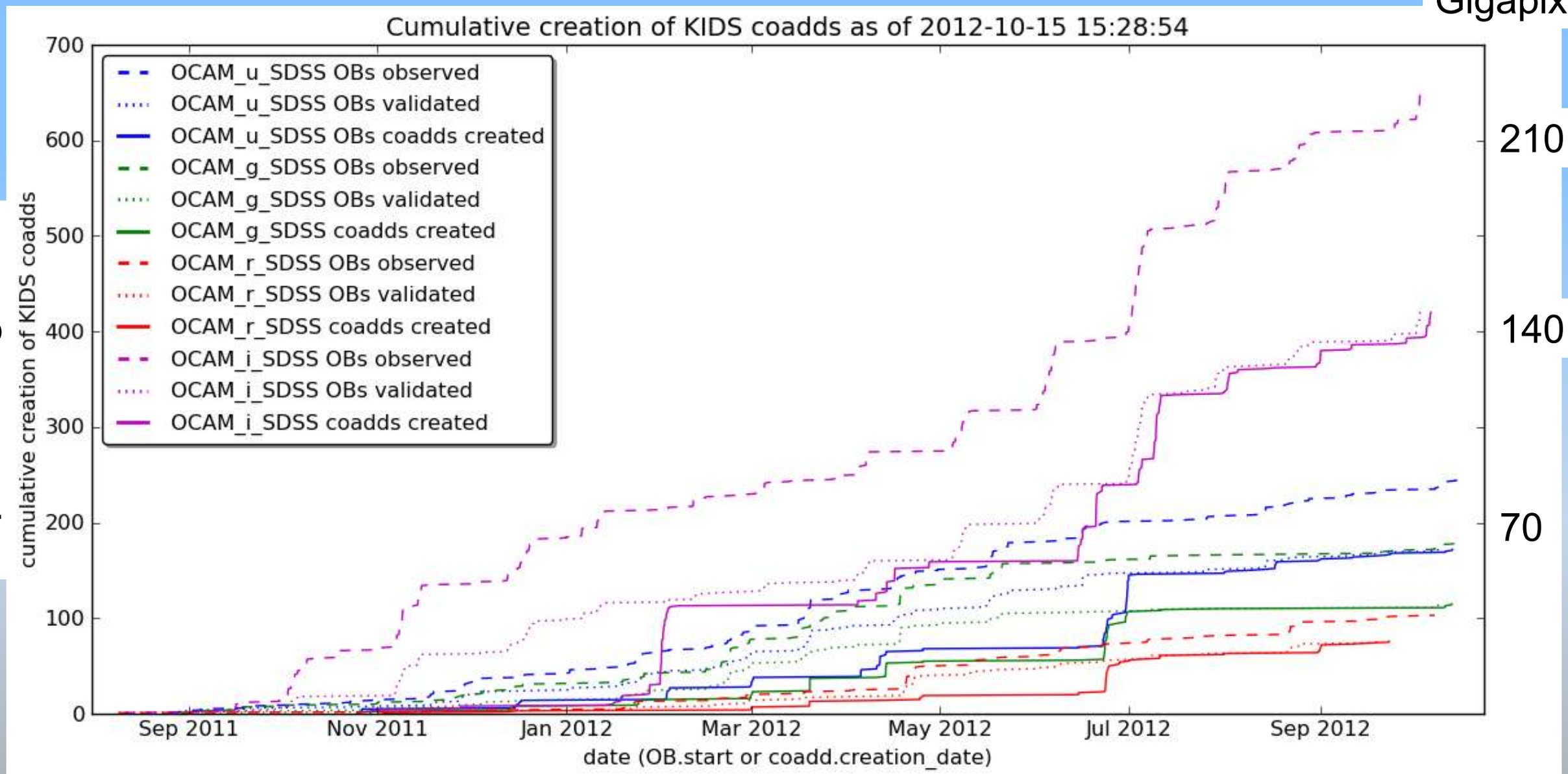
Query results for table CoaddedRegriddedFrame

Shown: 100 rows out of 1013 entries, from project 'KIDS'

SAMP: 1. Test Java 2. Connect to the hub 3. Broadcast : Aladin / Topcat



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KiDS collaborative Quality Control

http://wiki.astro-wise.org/projects:kids:survey_progress:internaldelivery1.0

AstroWISE DBView CalTS Process — see 5 previous comments — DBname: awgverdoes project: KIDS

is_valid = 2: publishable | Enter comment here. | + <plus comment> | Submit

Processing Details

creation_date	2012-03-16 19:39:50
is_valid	2
quality_flags	0
Privileges	2

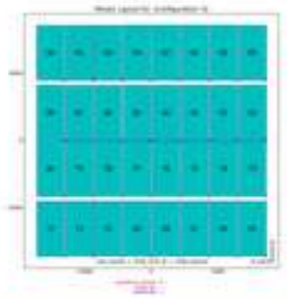
Image Statistics Details

mean	+6.476e-12
median	+1.027e-13
stdev	+3.219e-10
min	-6.448e-09
max	+3.1[illegible]

Observational Details

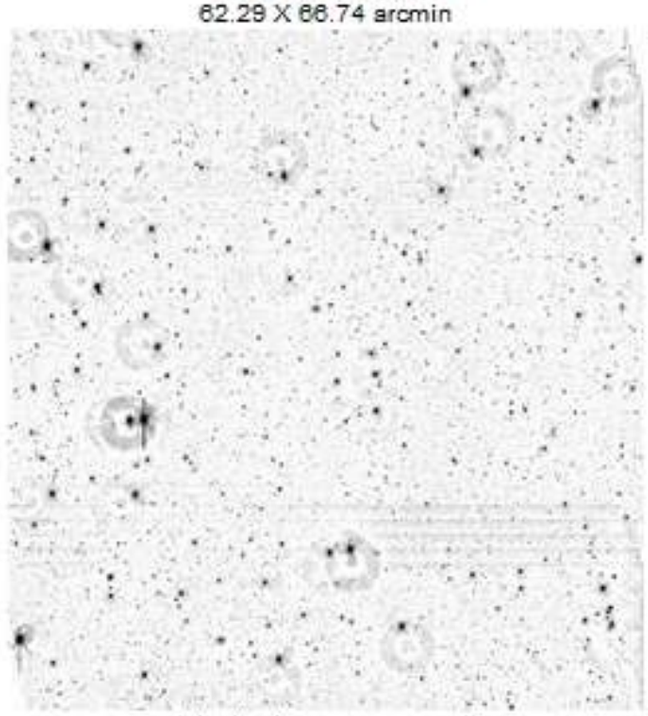
DATE_OBS		OBSERVER	
MJD_OBS		EXPTIME	
OBJECT	KIDS_355.3_-31.2	AIRMSTRT	
R.A.	23:41:21.5534	AIRMEND	
Dec.	-31:09:33.6264	Filter	OCAM_r_SDSS
		mag_id	SloanR

Mosaic of Instrument **OMEGACAM**



CoaddedRegriddedFrame

18687 X 20023 pixel
62.29 X 66.74 arcmin



(pixel values are reversed)

WeightFrame

18687 X 20023 pixel
62.29 X 66.74 arcmin

Quick Views on Delivery 1.0

1. Photo Gallery (beta release):

- Photo Gallery u,g,r,i
- Photo Gallery u
- Photo Gallery g
- Photo Gallery r
- Photo Gallery i

KiDS internal release v1

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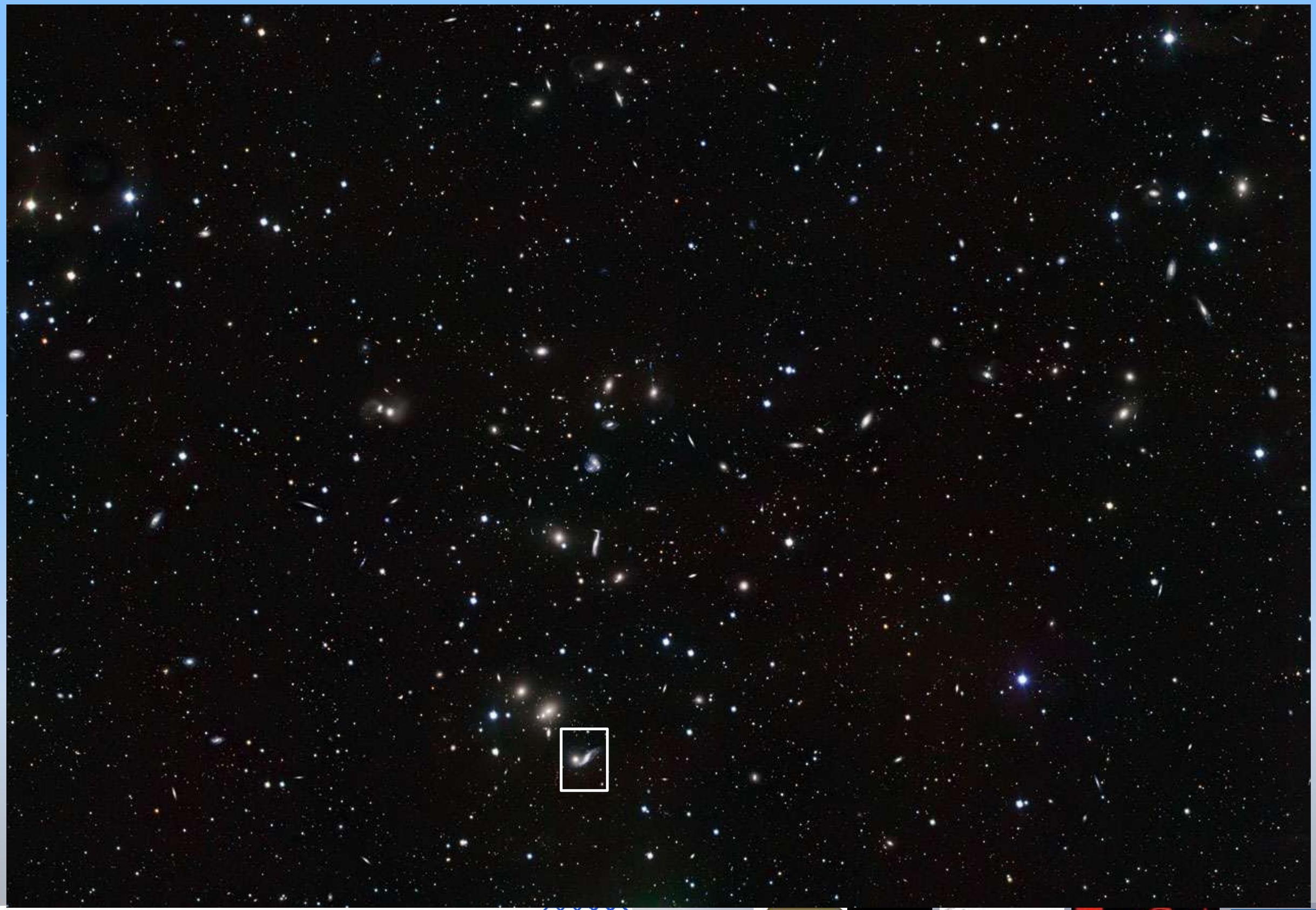

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Evolution from clusters to outskirts in one shot

eso1211 — Photo Release

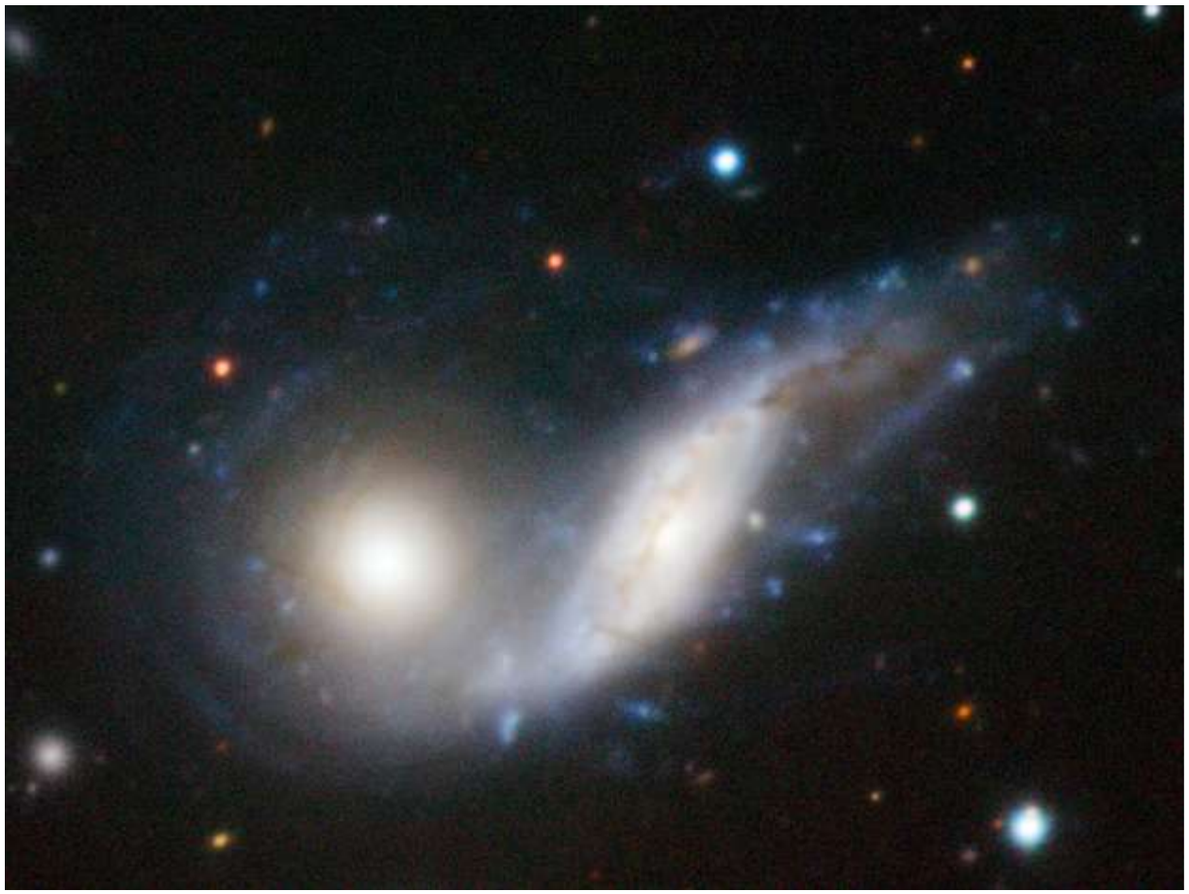
SPACE SCOOP

Choose your language:

Galaxies Get Up Close and Personal

VST captures collisions in young galaxy cluster

7 March 2012



Galaxy transformations in Hercules Galaxy Cluster

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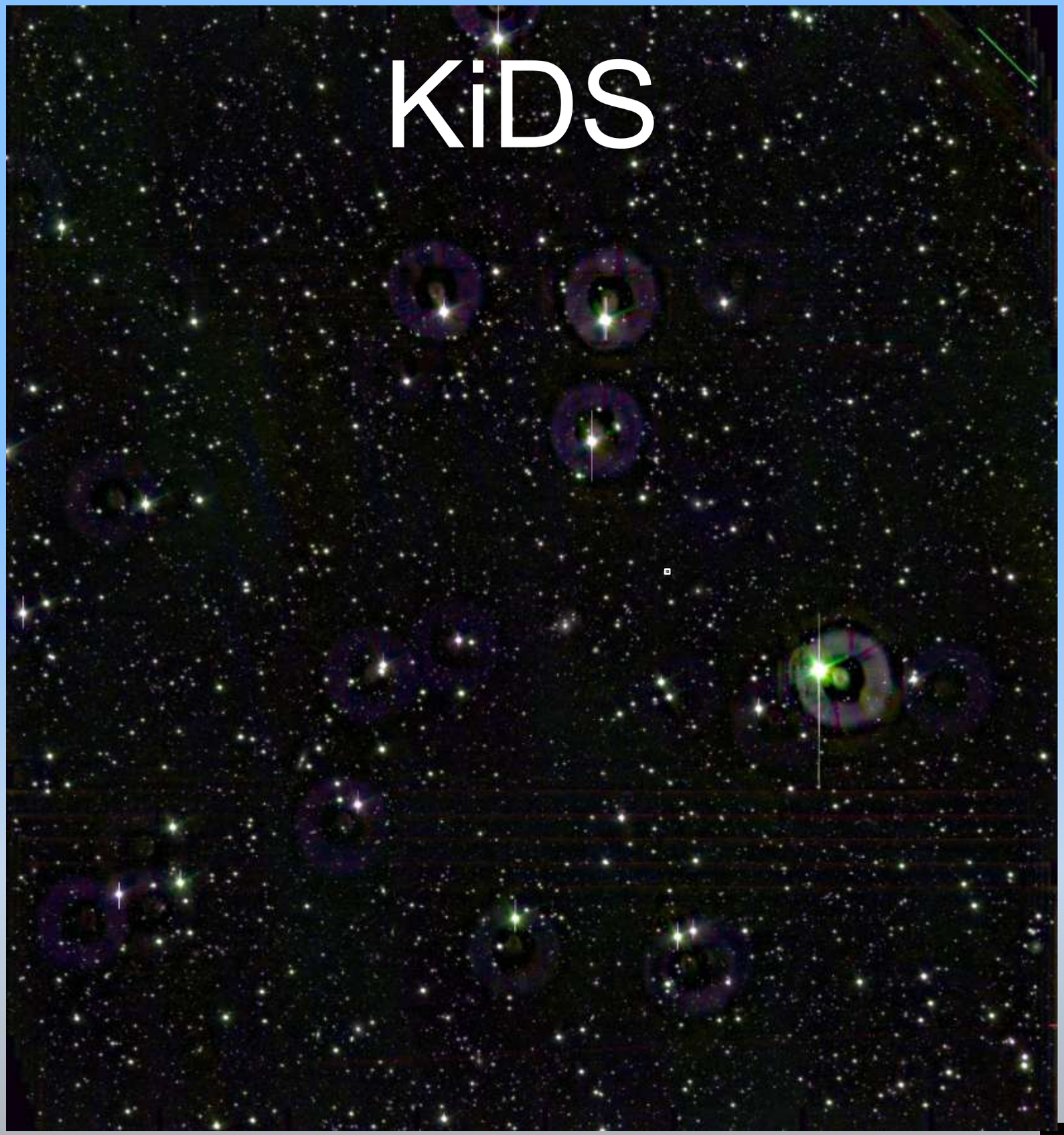

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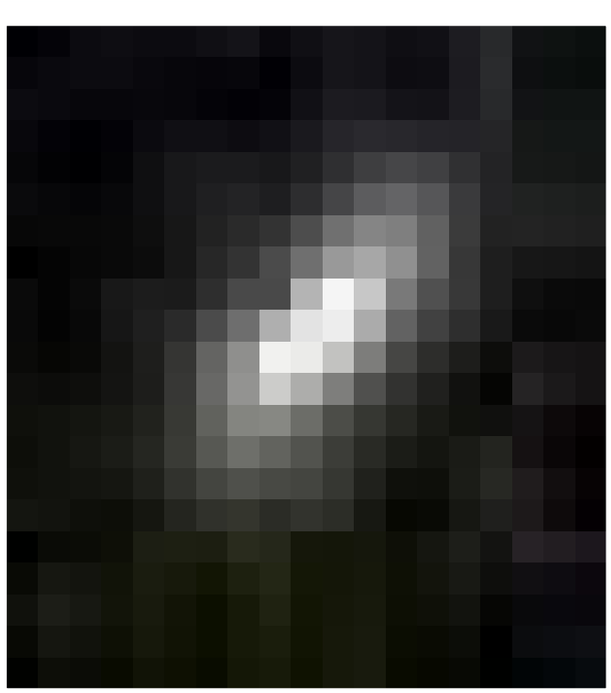
Galaxy shapes



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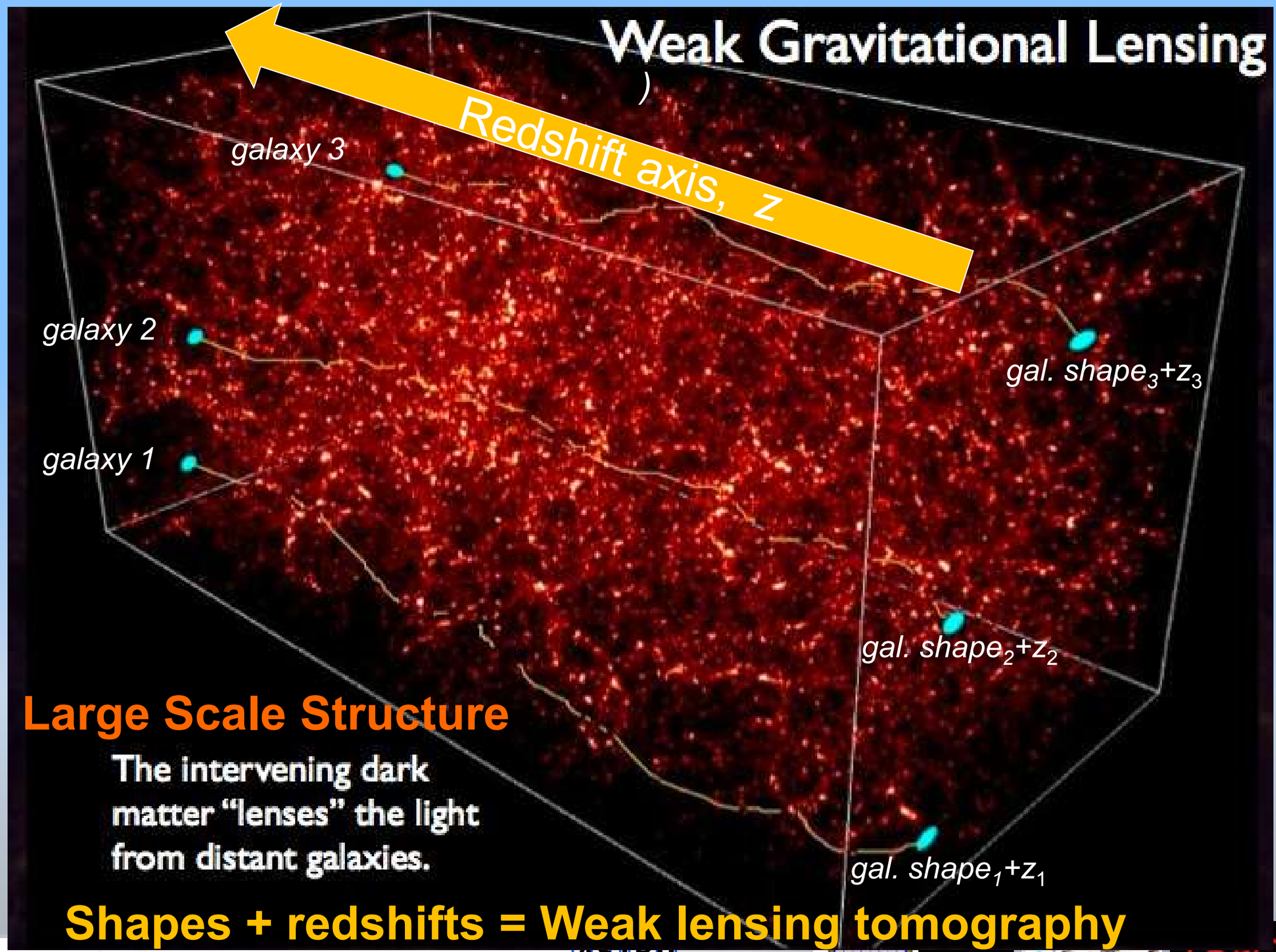
Dark Matter with KiDS in 3D



Shapes + redshifts = Weak lensing tomography

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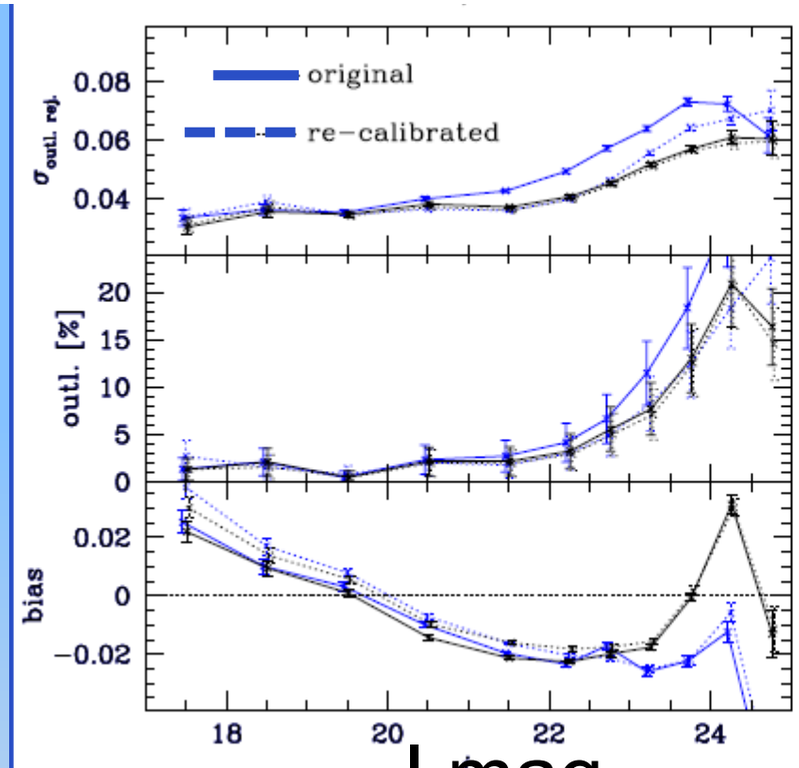
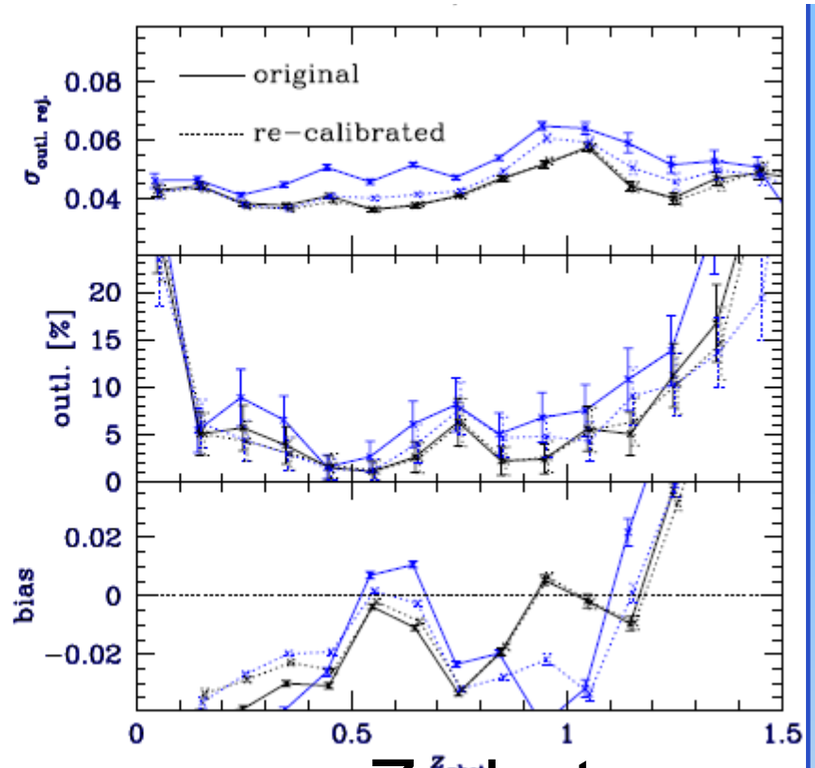
Why goal of 1%:
σ(phot. redshift) – σ(ZPT) "degeneracy"

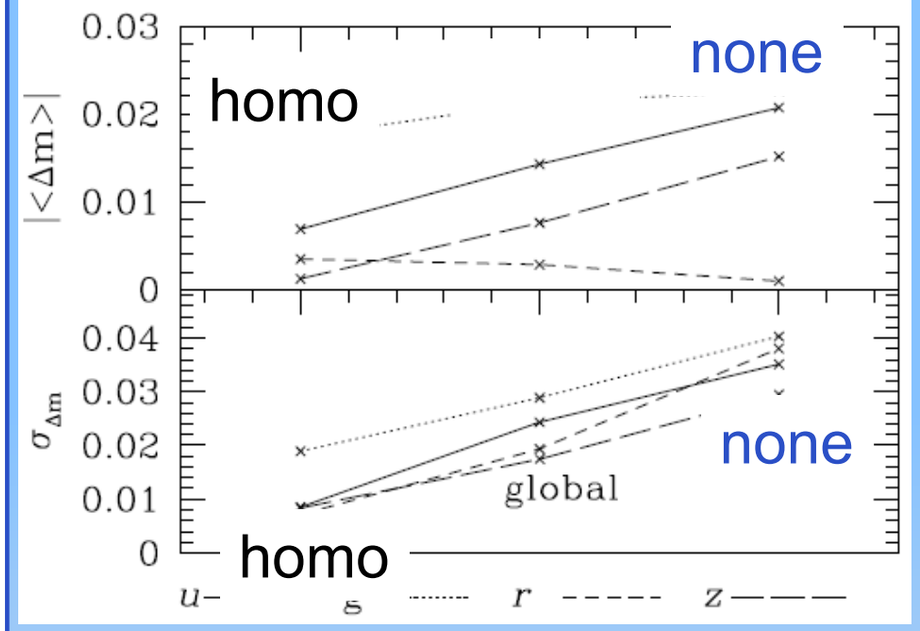
---- = Homogenized image quality vs **--- = none**



I mag



Z phot



Hildebrandt, Erben, Kuijken et al., 2012

Goal: 1% survey photometry

camera

+

telescope

+

atmosphere

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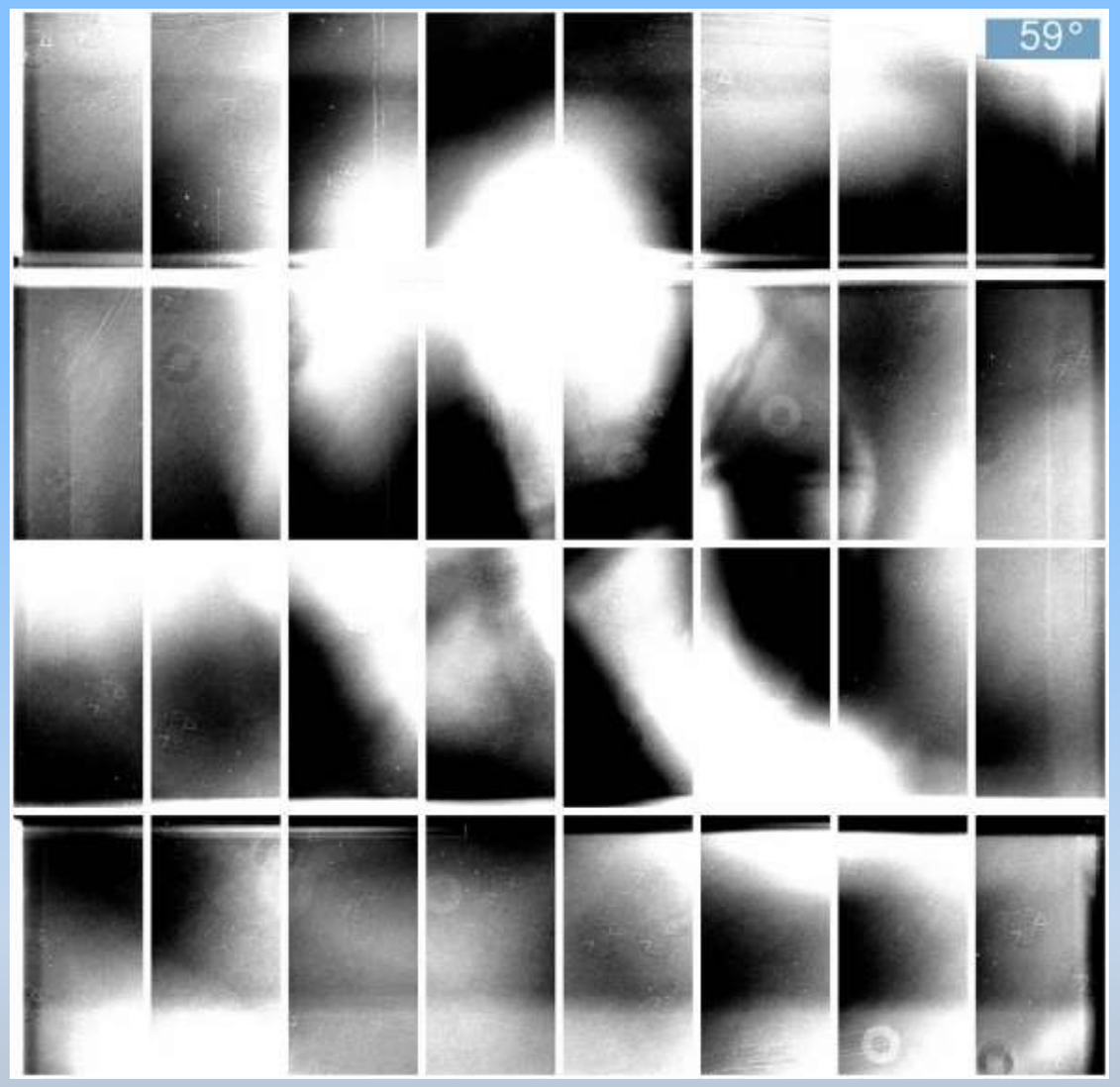
Photometric homogenization single-coadd

- Stray light & vignetting
  - twilights
- CCD-to-CCD gain variations (vs time)



Twilight Sloan g vs rotator angle camera-telescope

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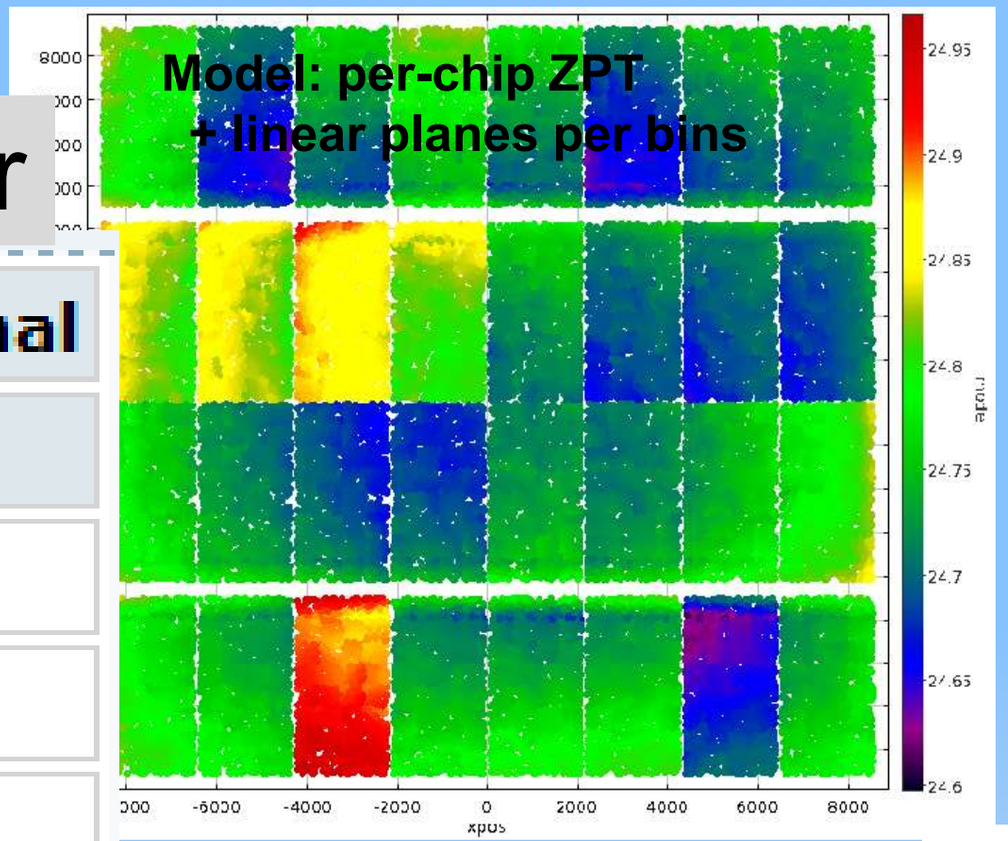
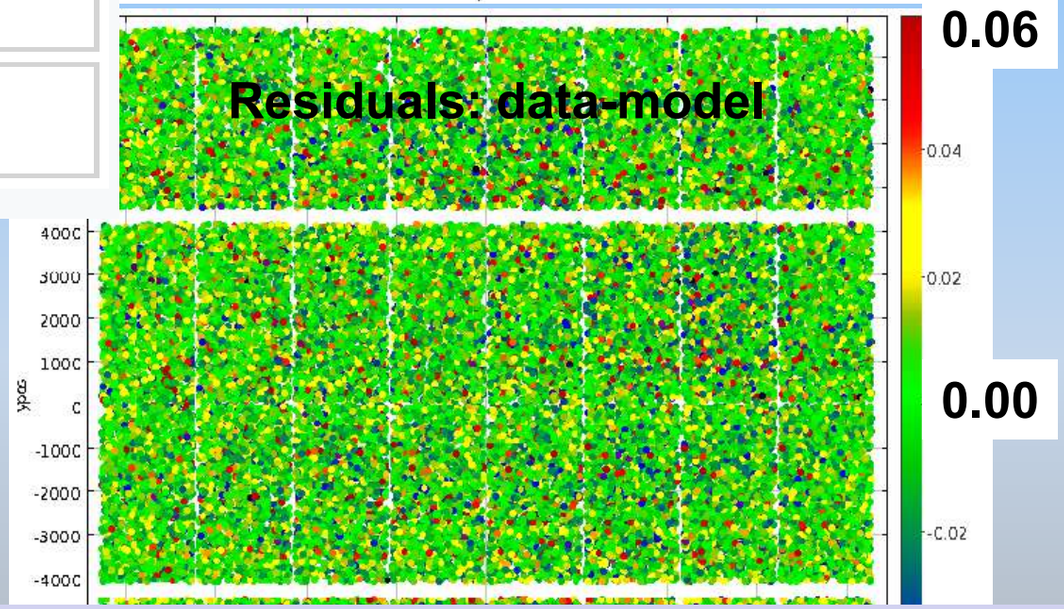
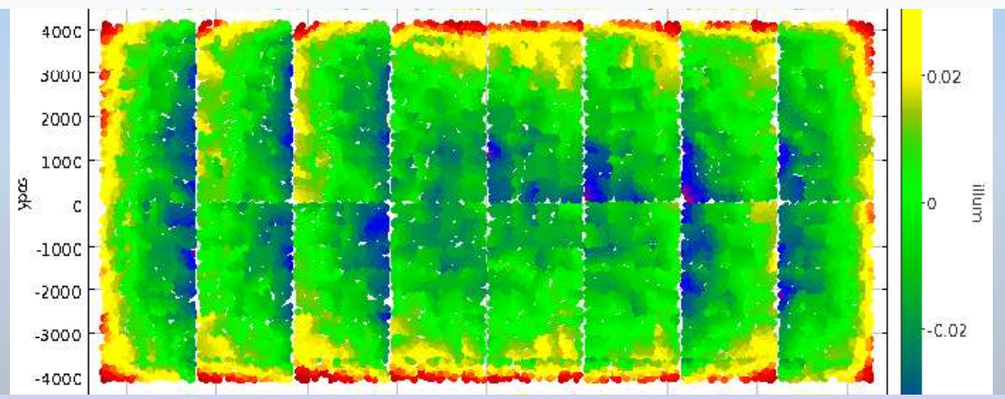
Coadd internal homogenization (r)

Residuals after illu-corr

filter	rms internal	rms external
	(mag)	(mag)
u	0.016	0.027
g	0.010	0.020
r	0.009	0.020
i	0.011	0.020



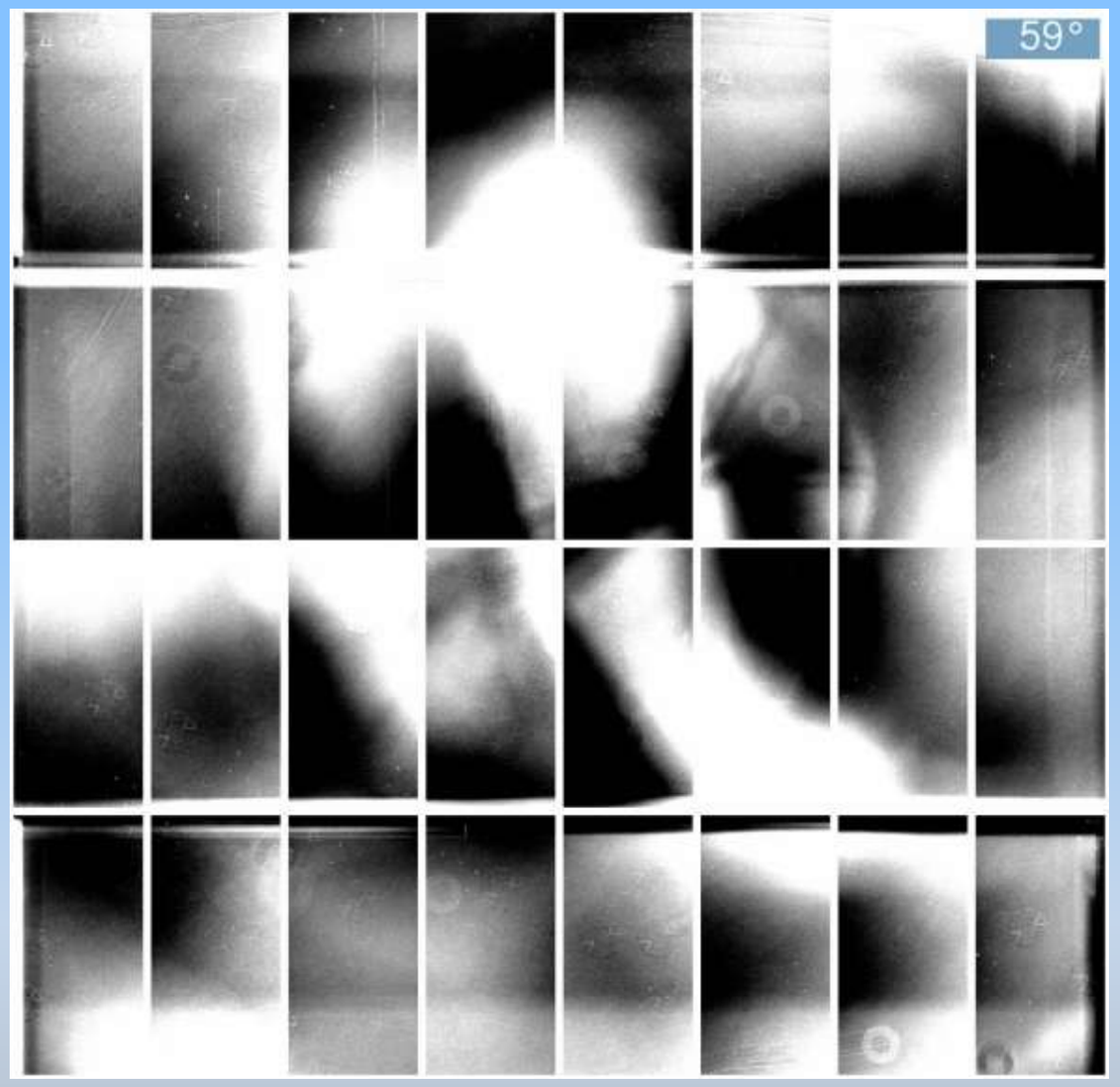




VST-TRE-OCM-23100-3608, also at wiki.astro-wise.org/projects:omegacam:portal:illuminationcorrection

Photometric homogenization single-coadd

- Stray light & vignetting
- Corrected flatfields to 1% (gri) and 1.5% (u) accuracy over full FoV



Twilight Sloan g vs rotator angle camera-telescope

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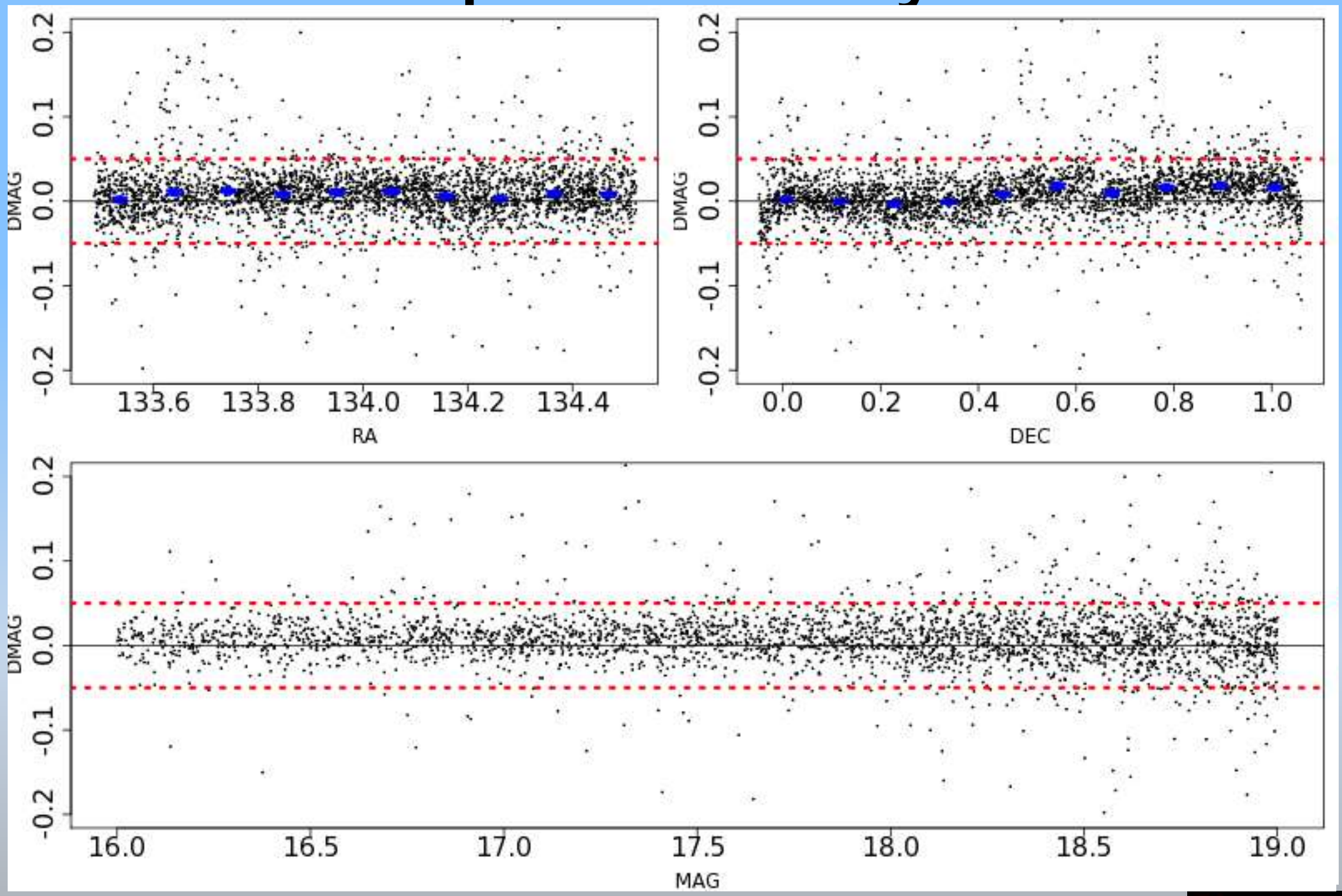
KiDS – SDSS DR8 single-coadd i-photometry



No SDSS-OCAM color terms applied yet

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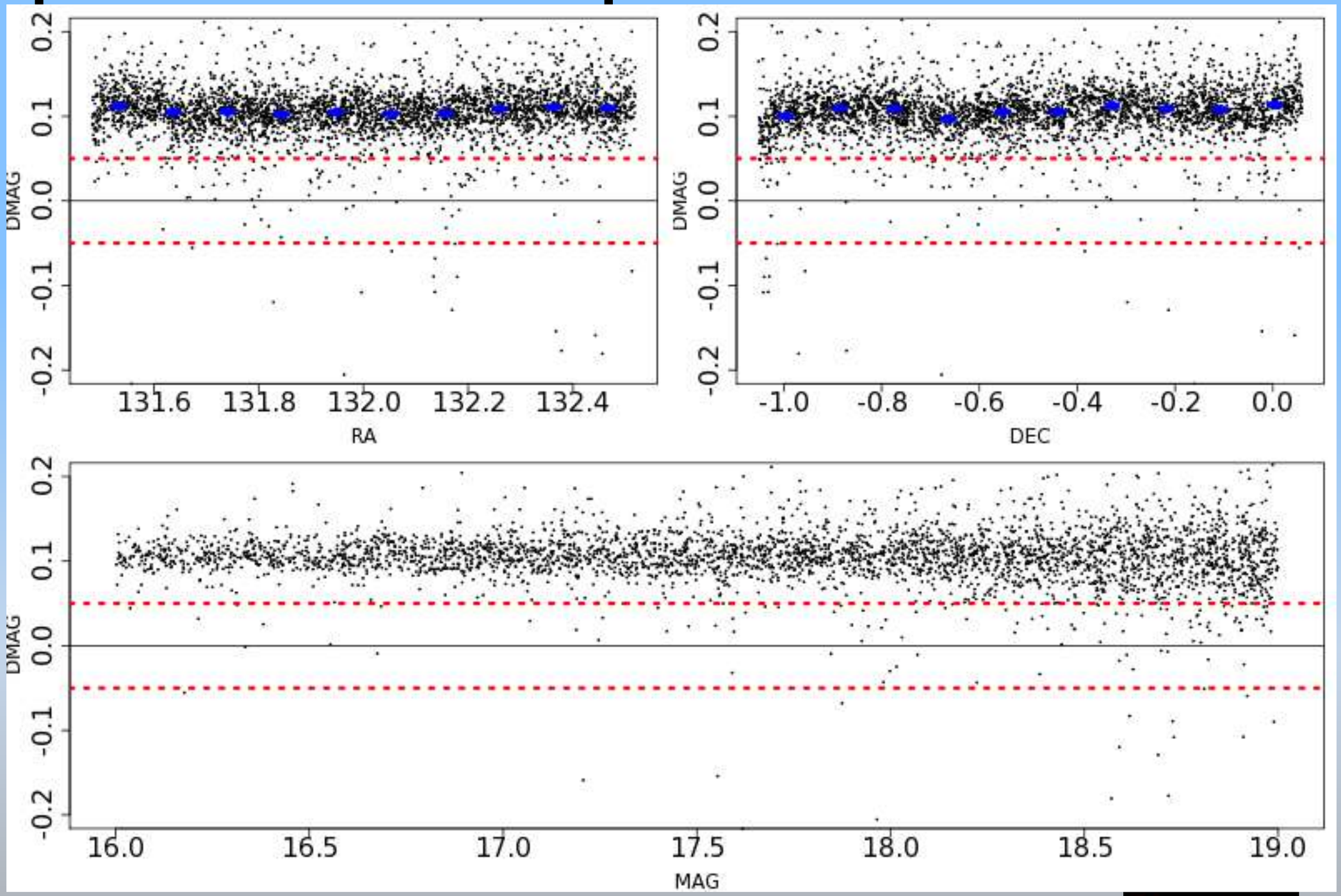
KiDS – SDSS DR8 single-coadd i-photom: non-photometric atmos



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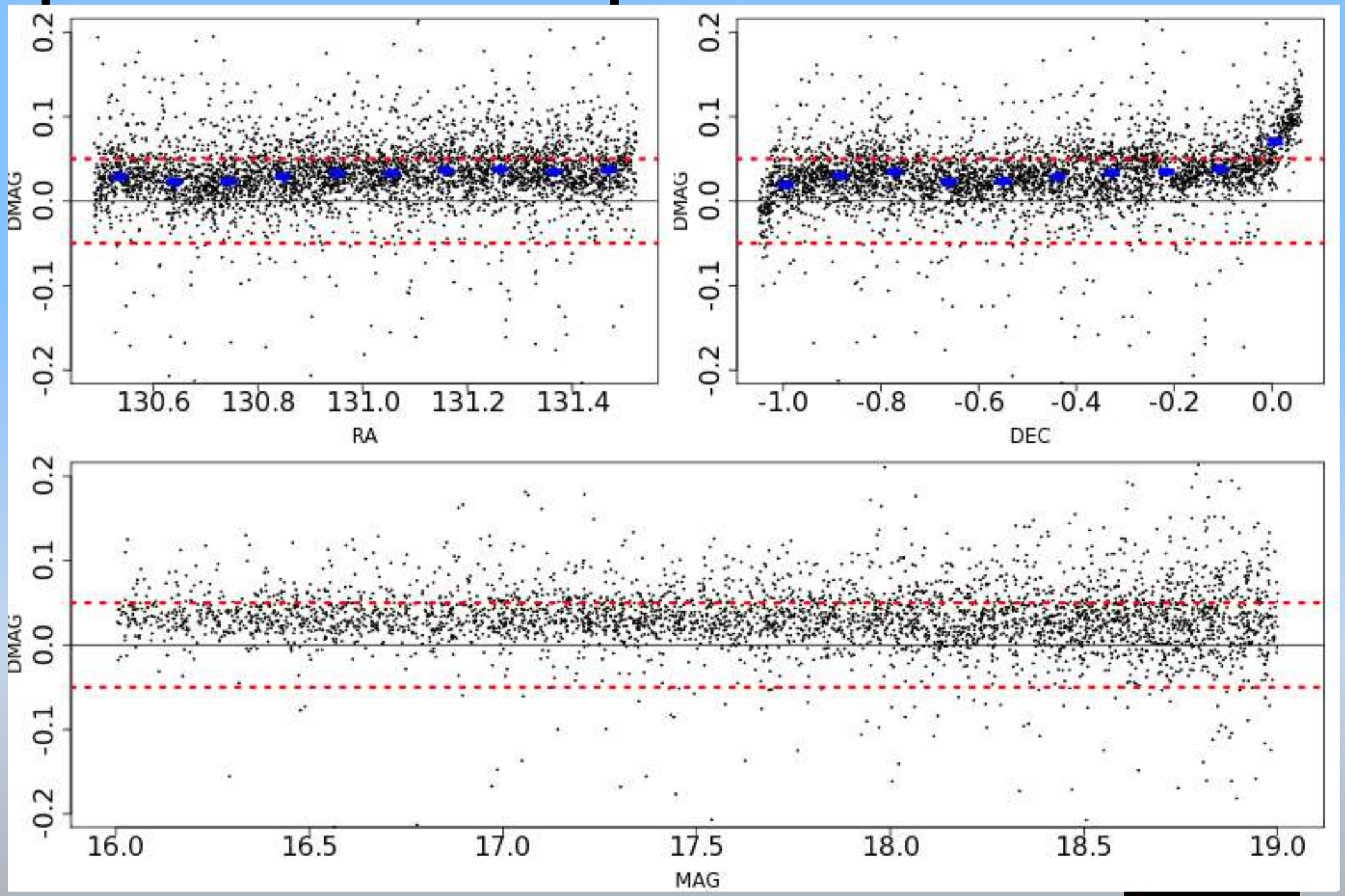
KiDS – SDSS DR8 single coadd i-photom: non-photometric atmos



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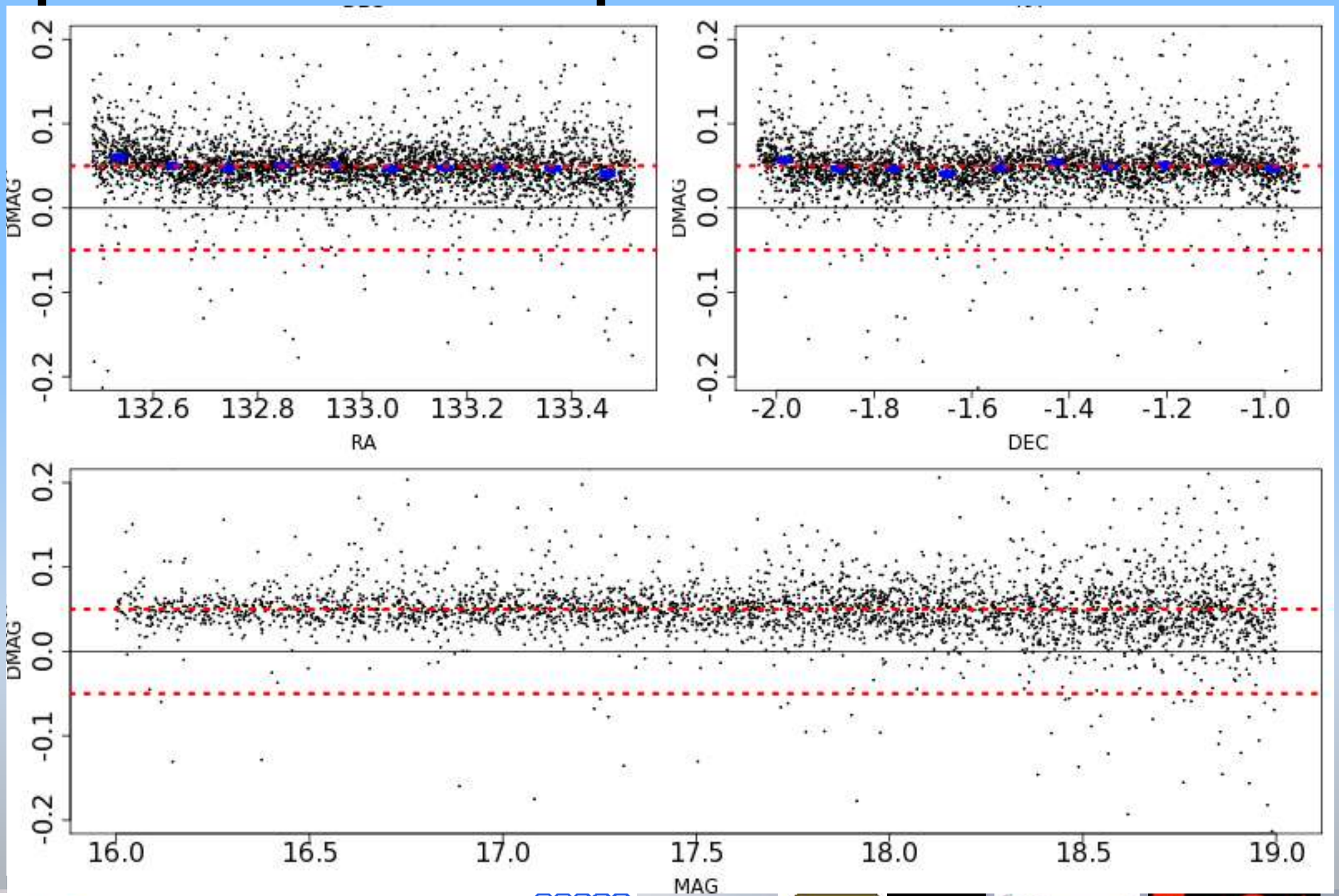
KiDS – SDSS DR8 single-coadd i-photom: non-photometric atmos



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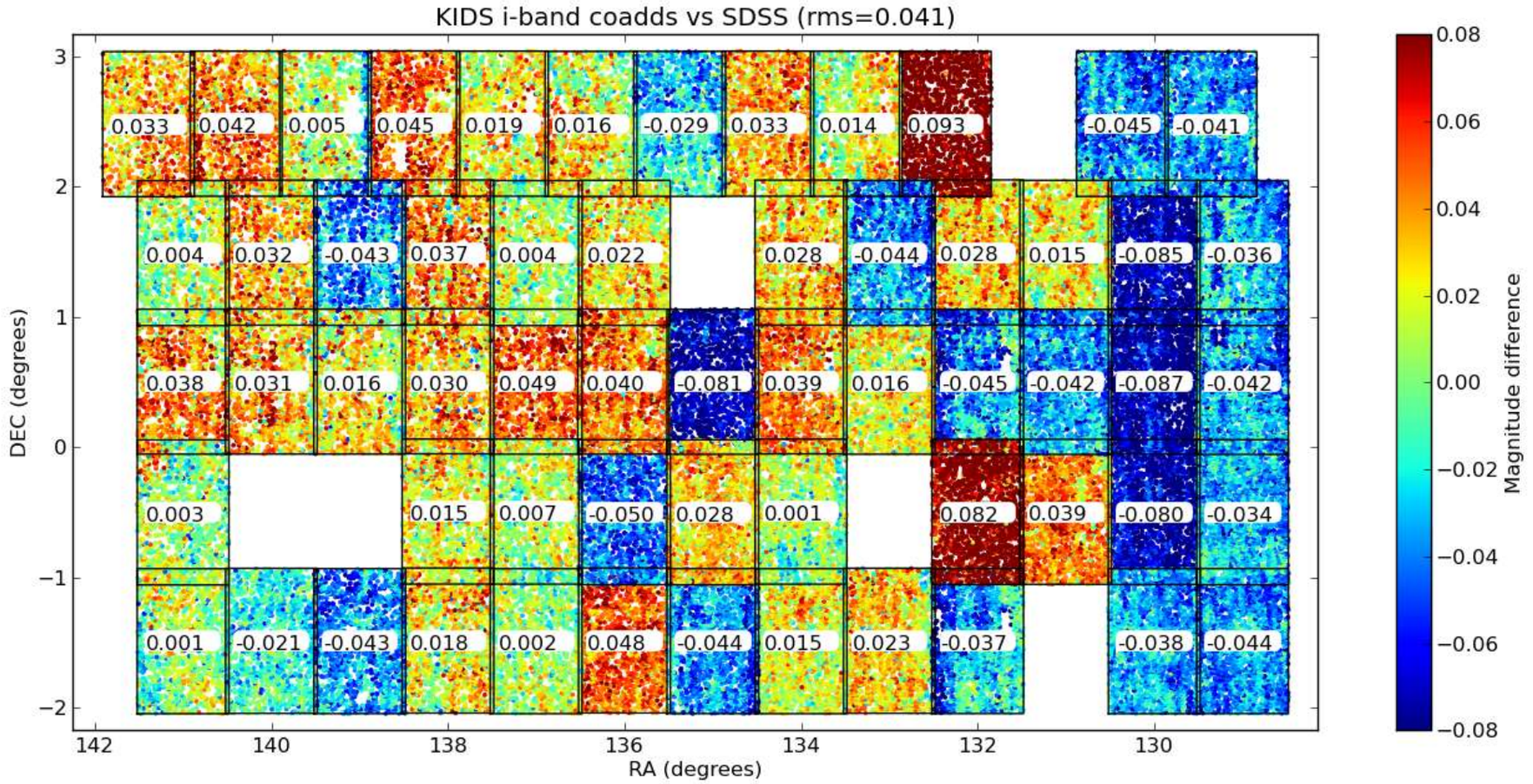
Survey photometric homogenization multiple coadds



Constraints	internal rms (mmag)	External (SDSS) std (mmag)
Nightly zeropoint-only	55	41

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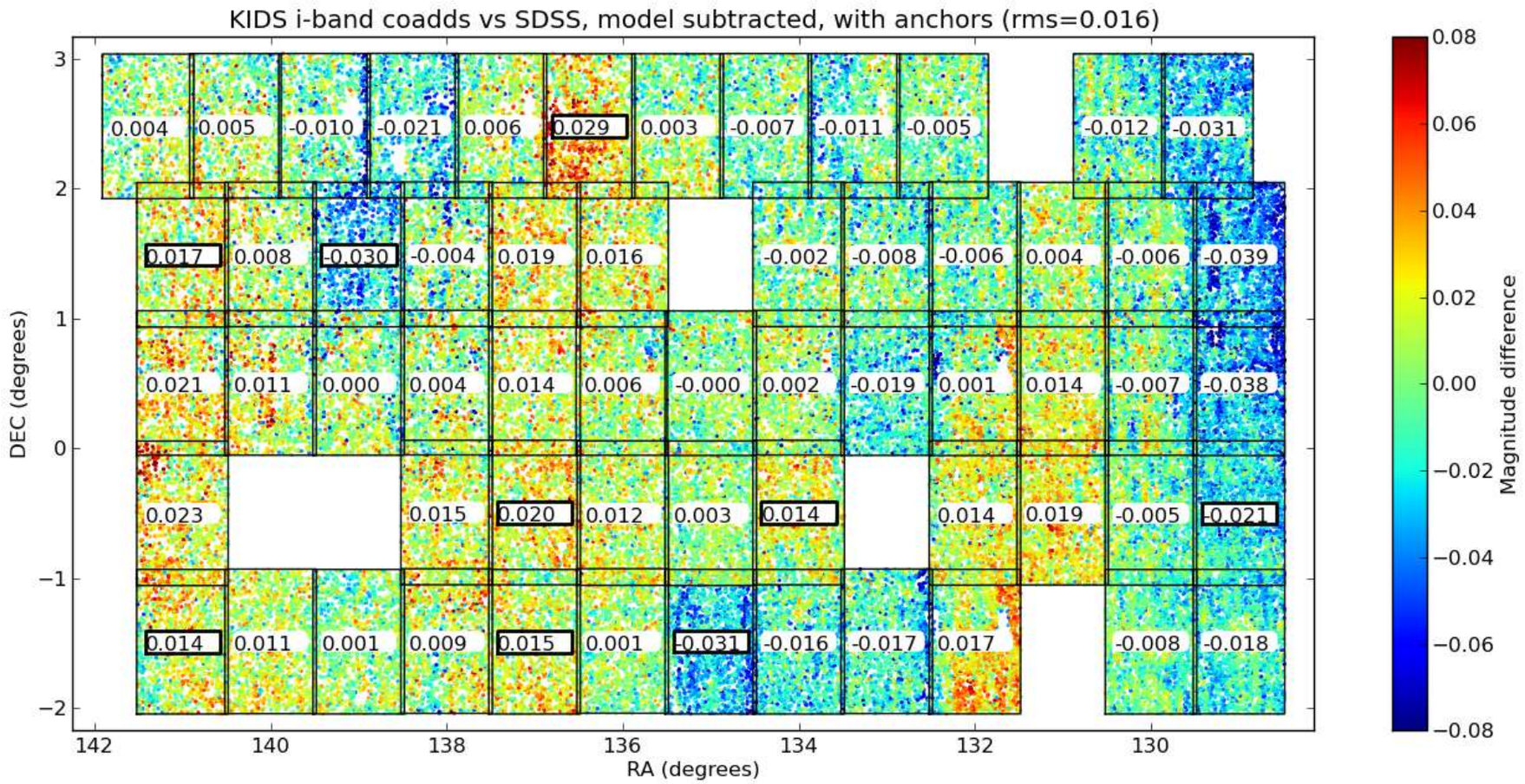
Survey photometric homogenization multiple coadds



Constraints	internal rms (mmag)	External (SDSS) std (mmag)
Nightly zeropoint-only	55	41
Overlaps + anchors	13	16

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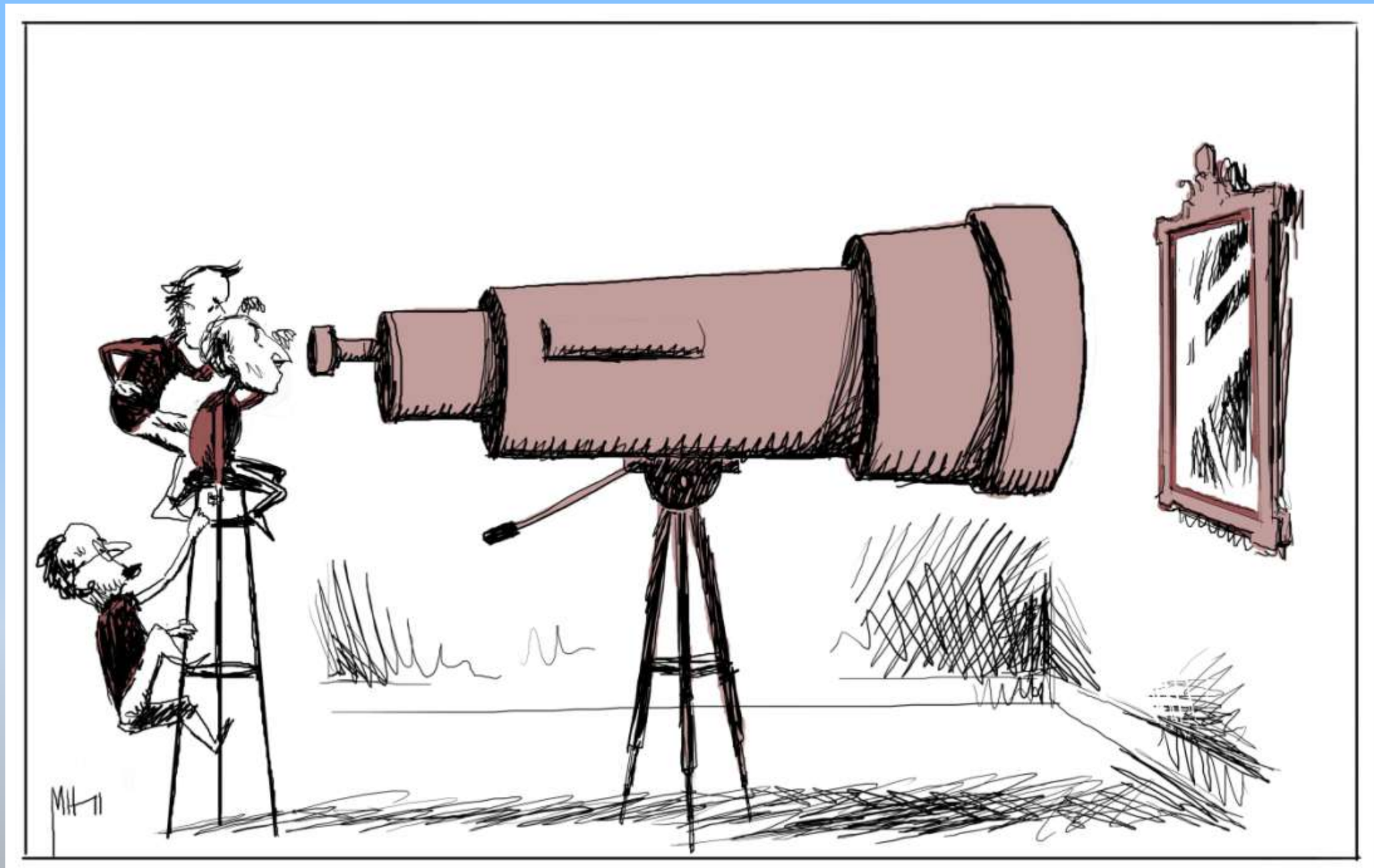
Internal calibration

Where next?



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Exploit survey calibration plan!

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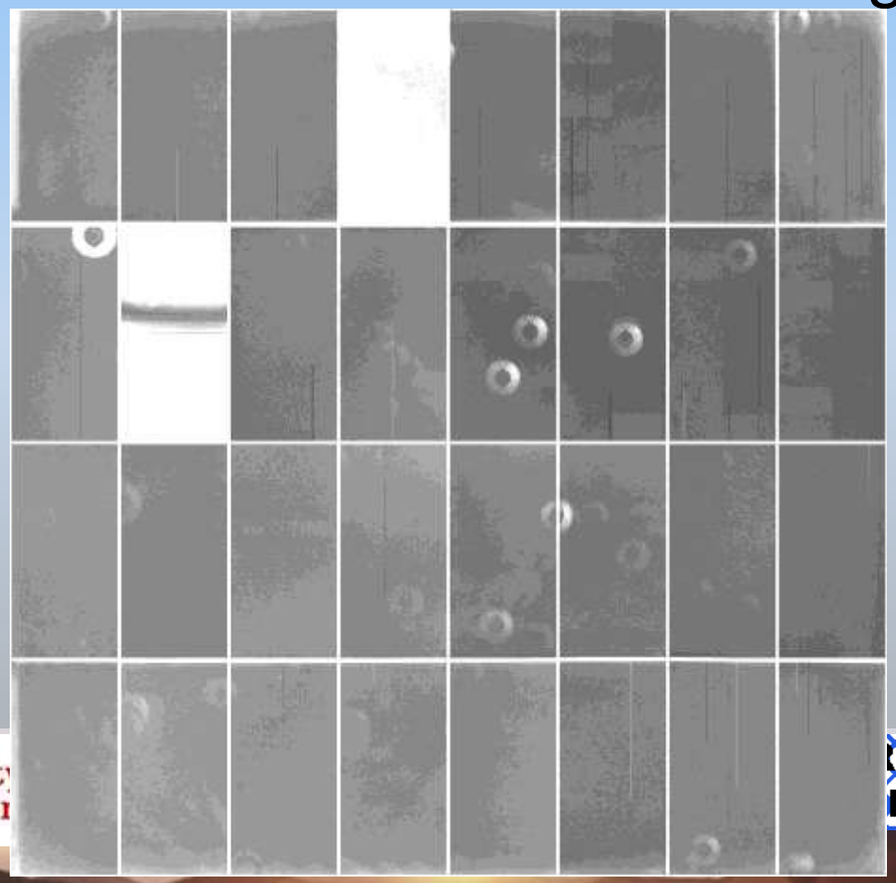
OCAM+VST monitoring: photom. calib unit 1 & 2

- 2 sets x 4 halogen
- Current stabilizer
- Fixed dome-screen near zenith

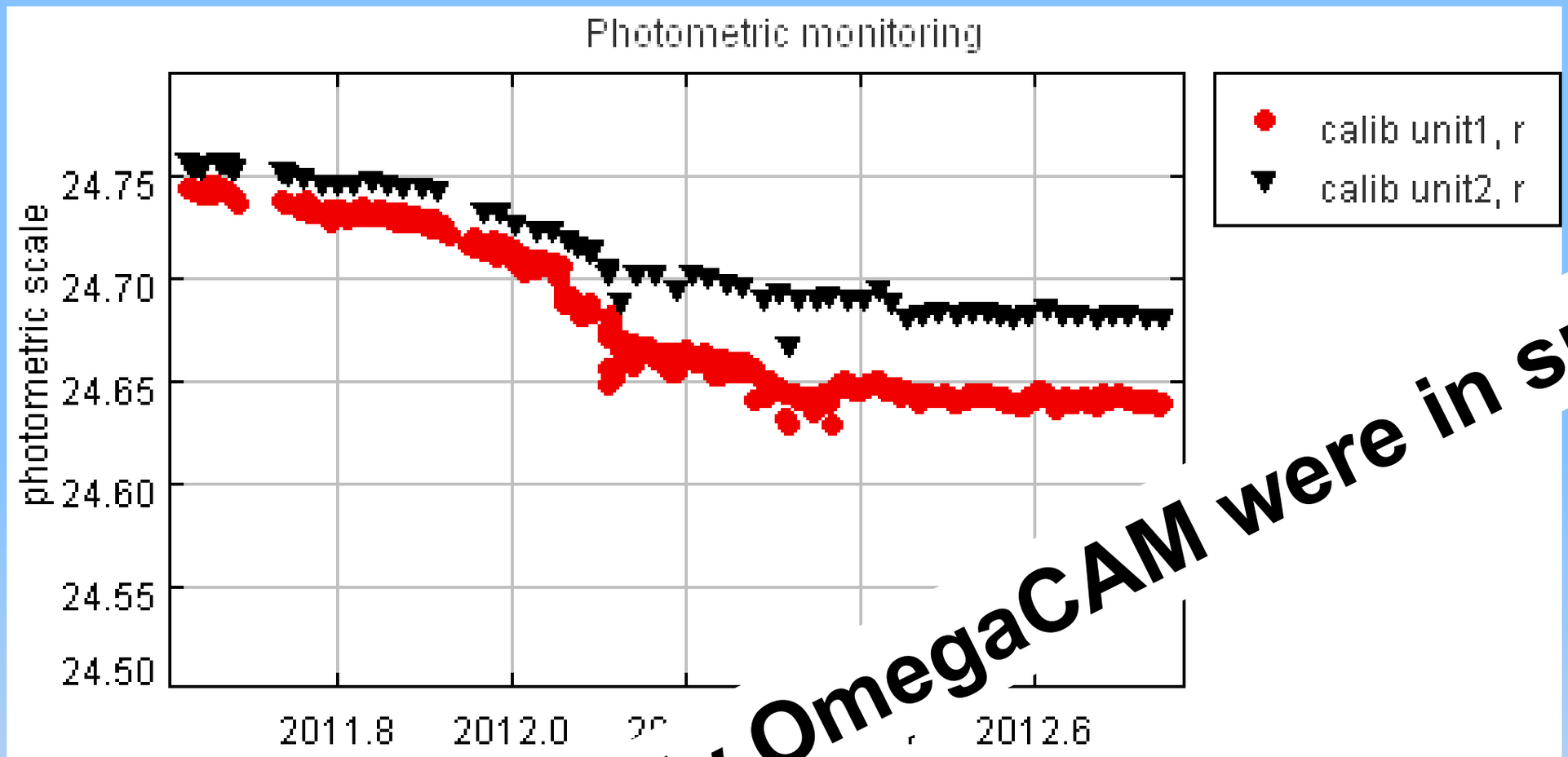
i' domeflats aug11 ->feb12

Stdev, i

Black->white= 1 -> 1.6mmag



Photom.scale: in-dome

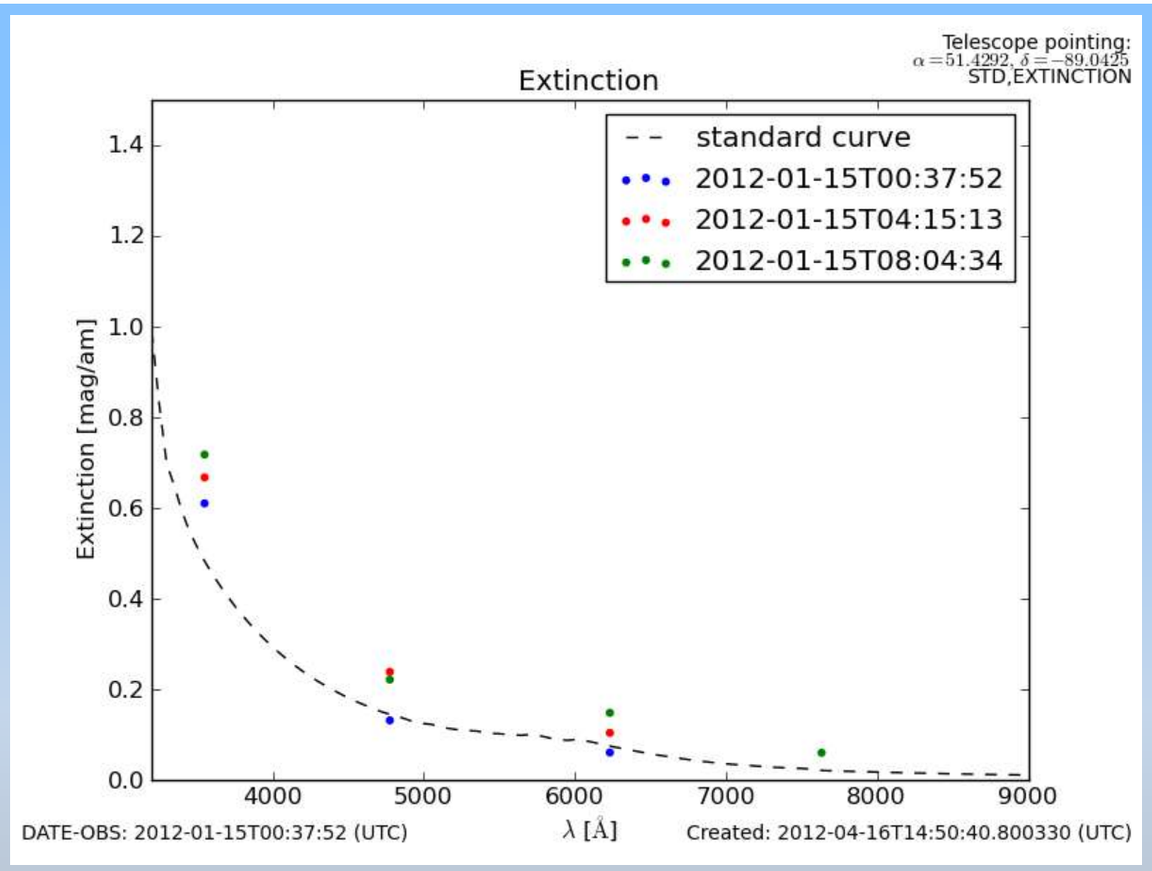


If only OmegaCAM were in space…

Observation target	Photo…asure	Filter	Systematic std (mmag)	Measurement std (mmag)
Calib unit 1/2	OCAM+VST	r	(on trend) 1.8/1.3	<<1
Overlap	**OCAM+VST+ATMOS**	**i**	**(total) 55.0**	**2**

Extinction monitoring: polar field

Coordinates	α =51.429167, δ=-89.0425 (J2000)
Filter	4 quadrant glass filter: u,g,r, and i
Exposure time	100s
Airmass	2.3-2.5
Magnitude limit	u,g,r,i, 17,19,19,19



3x nightly observed:
connecting all nights photometrically

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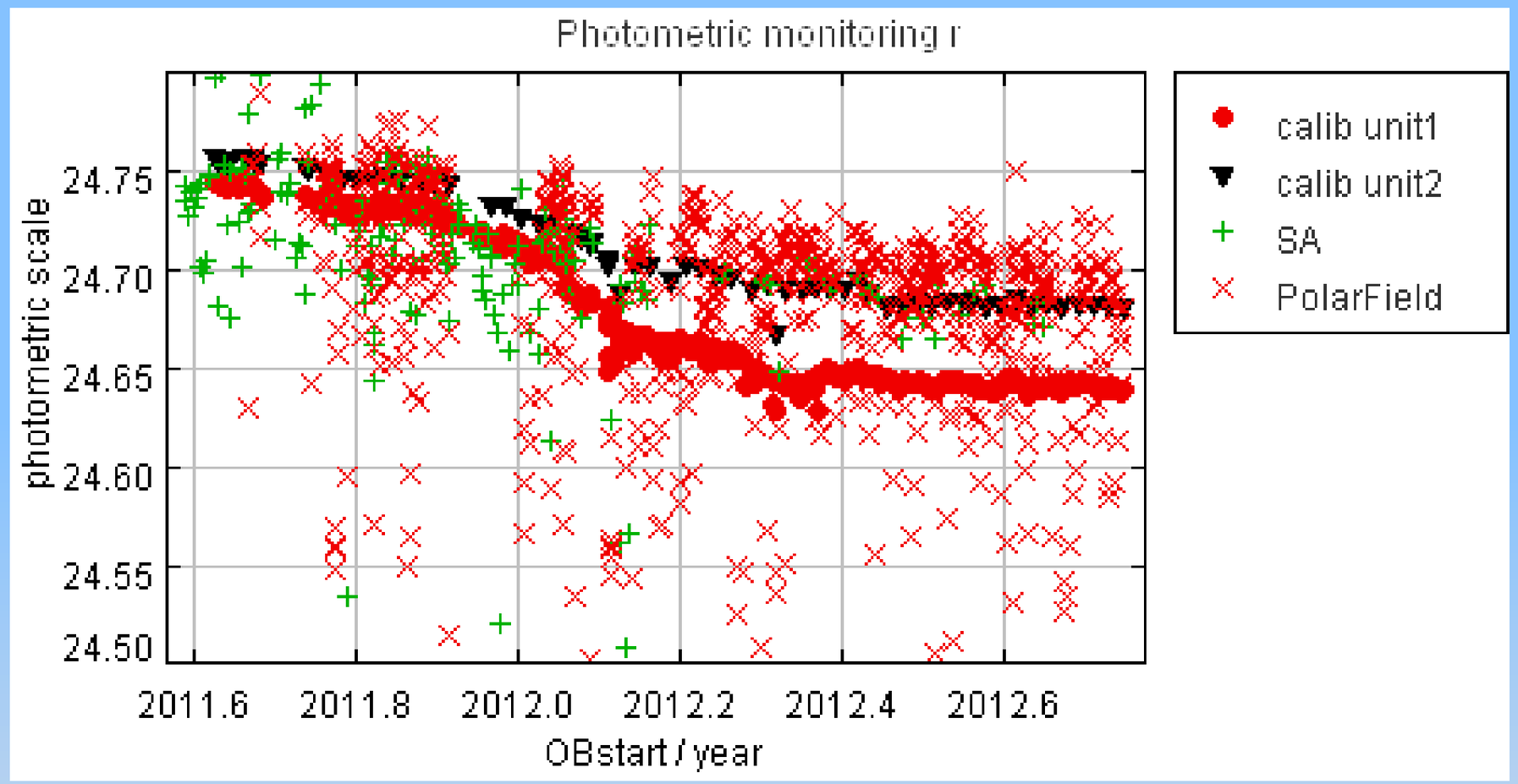
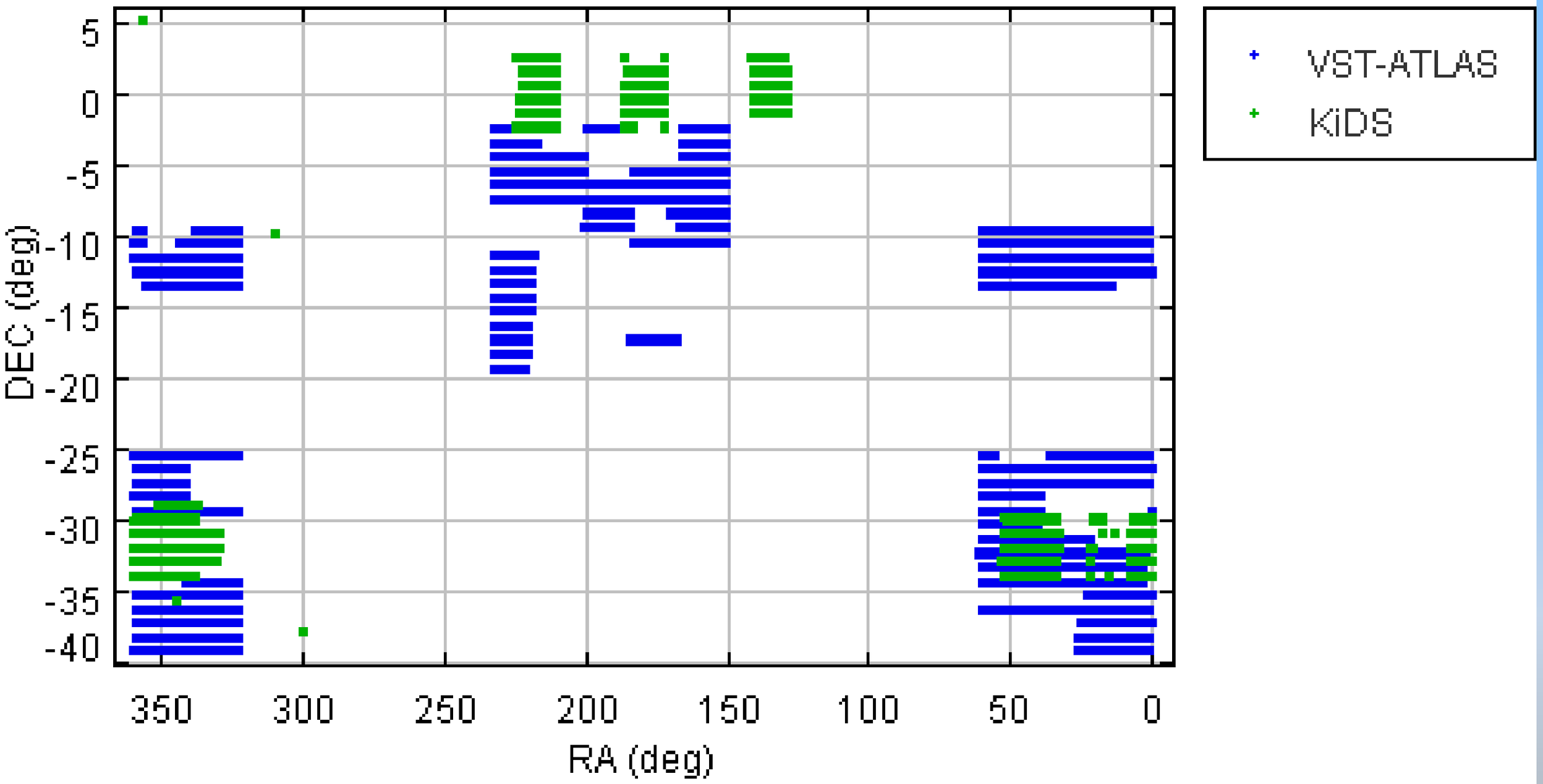
Photom.scale: in-dome + on-sky



Observation target	Photom. measure	Filter	Systematic std (mmag)		Measurement std (mmag)
Calib unit 1/2	OCAM+VST	r	(on trend)	1.8/1.3	<<1
SA	OCAM+VST**+ATMOS**	r	(on trend)	~30.0	~5
Polar Field	OCAM+VST**+ATMOS**	r	(on trend)	~30.0	~4 (eventually)
Overlap	**OCAM+VST+ATMOS**	**i**	**(total)**	**55.0**	**2**

VST-ATLAS and KiDS, i



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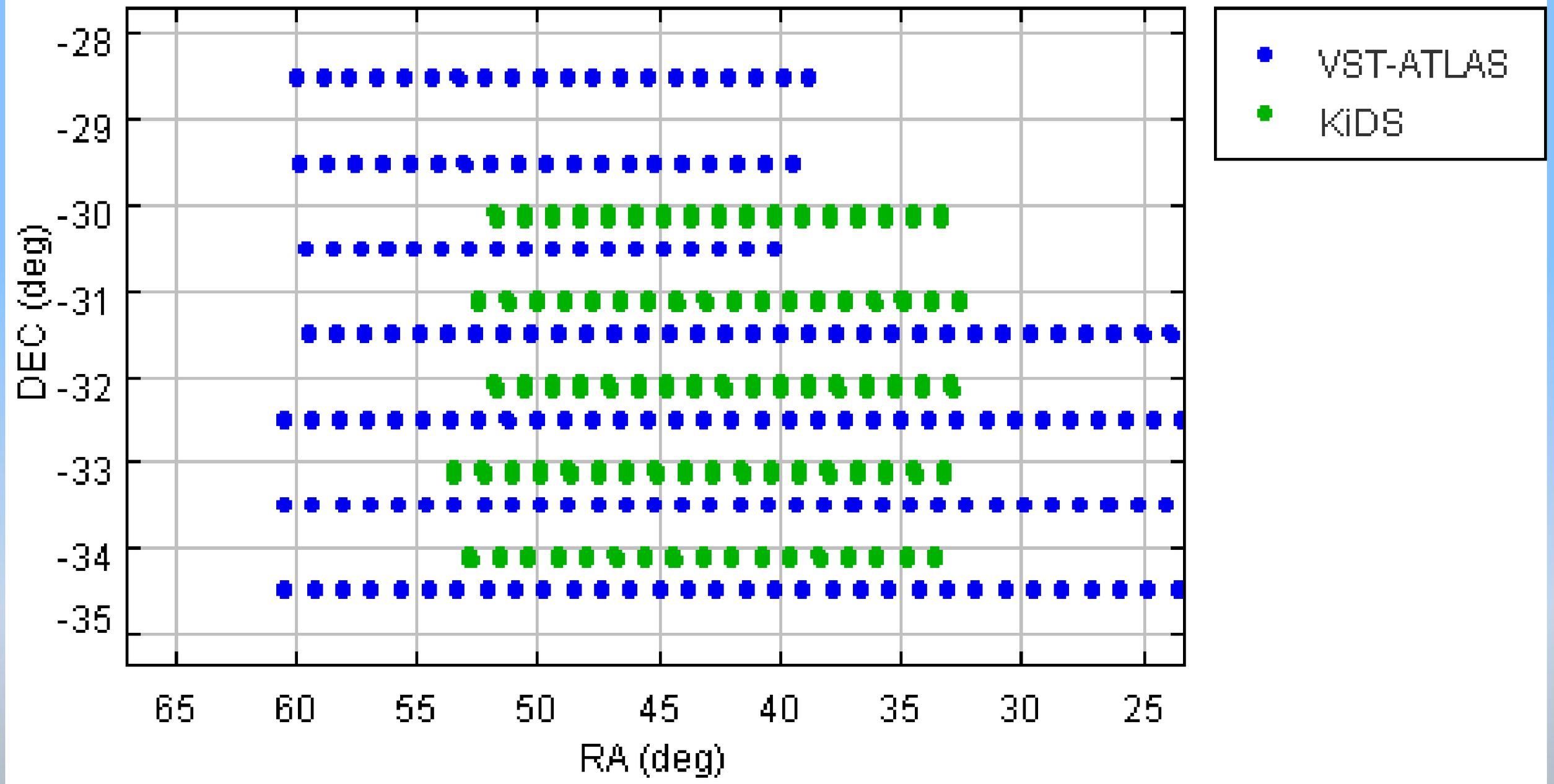
VST-ATLAS and KiDS, i



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KiDS

Conclusions

- KiDS: achieving unique combination of (image quality + depth + area)
  - Fierce competition: survey speed = crucial
- 1(gri)-1.5% (u) single coadd photometric homogeneity
- 2% survey photometry nightly SA + overlap-only: 2%
- On track for 1%
  - exploit OmegaCAM's survey Calib. Plan
  - VST-ATLAS overlap

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KiDS Publications

Topic	Authors	Publication
OmegaCAM imager	Kuijken etal.	2011, Messenger, Vol. 146
Astro-WISE for KiDS production and QC	Verdoes Kleijn etal.	2011, astro-ph/1112.0886
Astro-WISE Survey Pipeline	McFarland etal.	2011, astro-ph/1110.2509
The Kilo-Degree Survey	de Jong etal.	2012, astro-ph/1206.1254
Monitoring OmegaCAM photometry with Astro-WISE	Verdoes Kleijn etal.	2012, submitted
First QSO with KiDS+VIKING	Mwebaze etal.	2012, in prep.

arXiv.org Search Results

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The URL for this search is http://arxiv.org/find/all/1/OR+au:Astro_WISE+all:+EXACT+Astro_WISE/0/1/0/all/0/1

Showing results 1 through 17 (of 17 total) for (au:Astro_WISE OR all:"Astro WISE")

1. arXiv:1208.6299 [pdf, other]

The Data Zoo in Astro-WISE

Gijs A. Verdoes Kleijn, Andrey N. Belikov, John P. McFarland

Comments: Accepted for publication in topical issue of Experimental Astronomy on Astro-WISE information system

Subjects: **Instrumentation and Methods for Astrophysics (astro-ph.IM)**

2. arXiv:1208.0447 [pdf, ps, other]

The Astro-WISE datacentric information system

K. Begeman, A. N. Belikov, D. R. Boxhoorn, E. A. Valentijn

Comments: 21 pages, 6 figures, accepted by Experimental Astronomy for topical issue on Astro-WISE

Subjects: **Instrumentation and Methods for Astrophysics (astro-ph.IM)**

→ Astro-WISE Topical issue

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