ARCHES Integrated cluster finder

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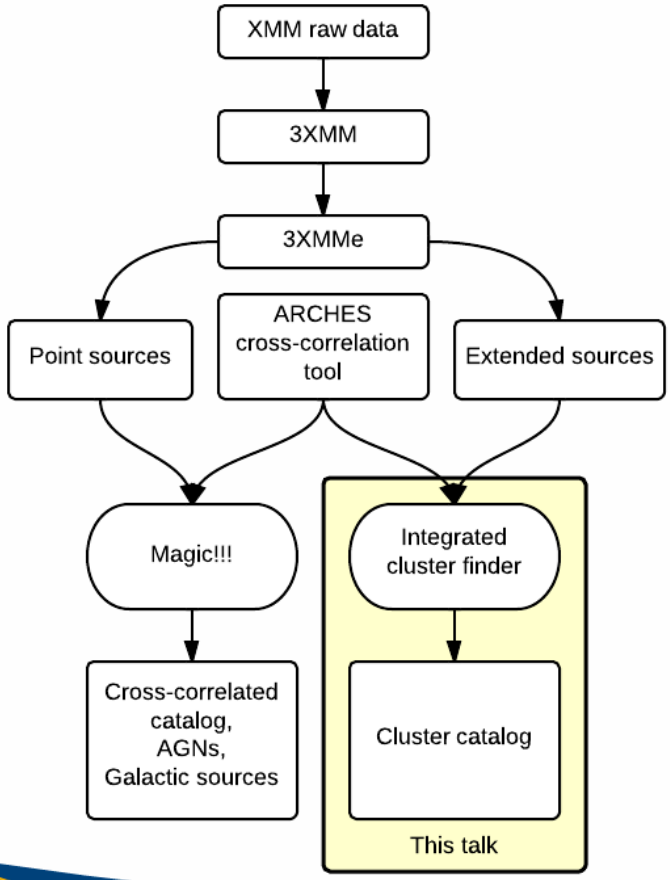
June 18, 2014

ARCHES

What is ARCHES

Astronomical **R**esource **C**ross-matching for **H**igh **E**nergy **S**tudies.



3XMMe – the heart of ARCHES

3XMM

- 3.2 years of data added after 2XMMi;
- 794 deg^2;
- $\sim$ 530000 detections/$\sim$ 370000 sources

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3XMMe

- $\sim$ 250000 sources ($\sim$ 340000 detections) with highest quality;
- Flags to mark sources as candidates for science themes (galactic, AGN, clusters);
- Flag to indicate where detections lie in fields affected by bright stars or galaxies;

ARCHES Integrated cluster finder

Goal Search for galaxy clusters and estimate their parameters (redshift, size, X-ray parameters) in multi-wavelength photometric and spectroscopic data, using X-ray information on the expected cluster positions.

Data Following catalogs are used (so far): SDSS DR9, CFHTLS (Deep and Wide), UKIDSS LAS DR9, AllWISE.

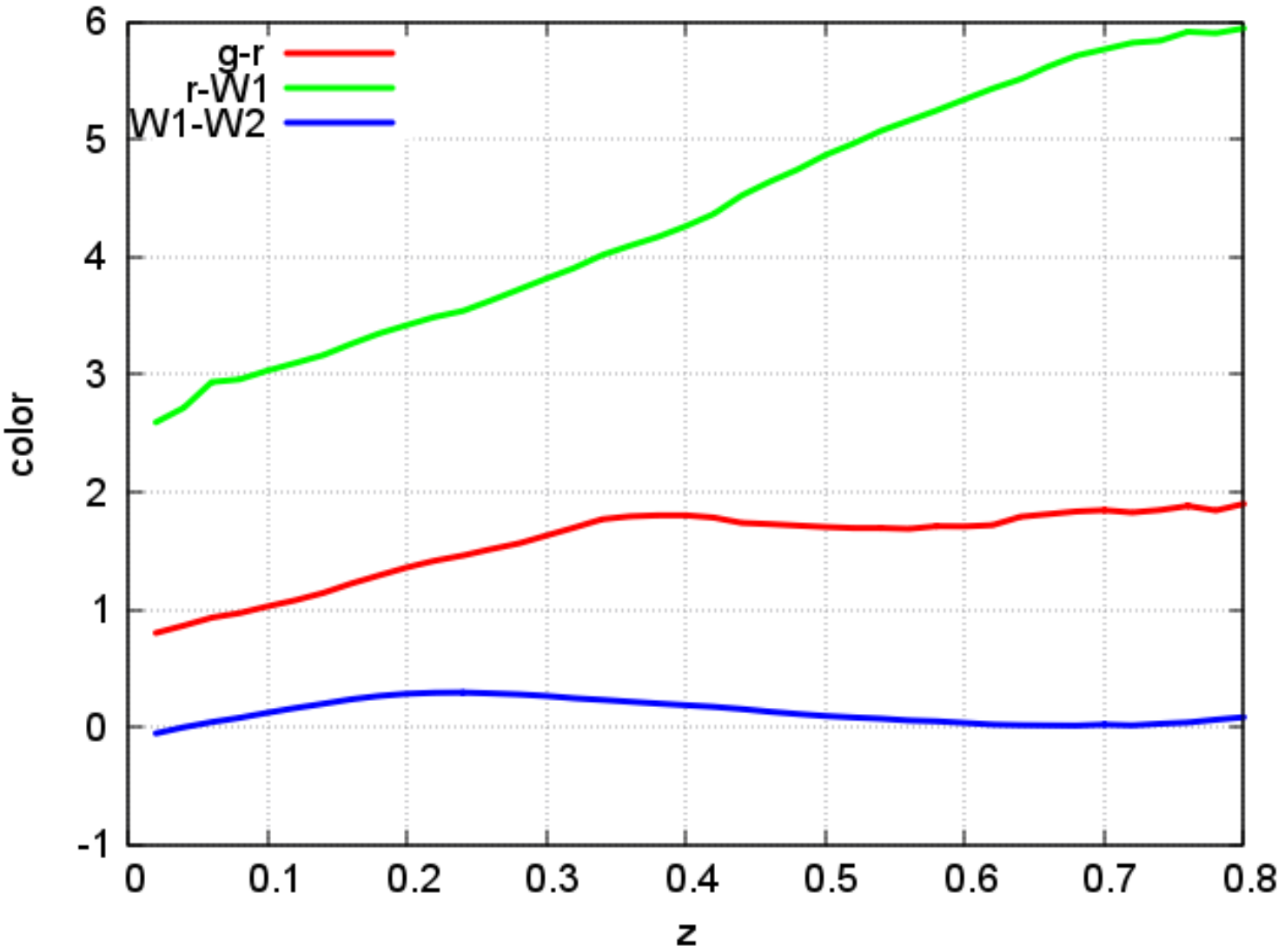
Spectra Spectroscopic data used: BOSS, VIPERS.

Future VHS, VIKING, DES, Pan-STARRS, PhotoZ surveys (SWIRE, ALHAMBRA etc.)

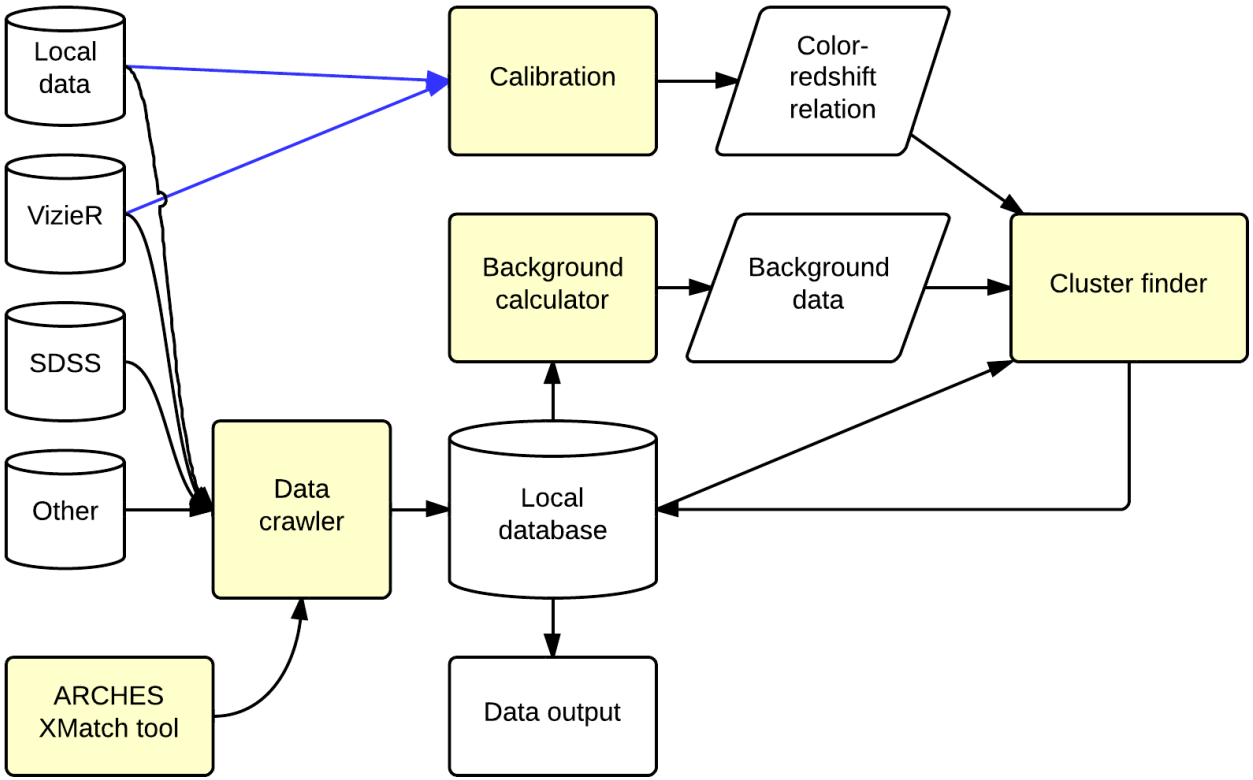
Cluster finder basics

- Utilize color-redshift relation to estimate redshift
- Use optical AND infrared colors to increase precision $\Rightarrow$ we need a cross-match tool (ARCHES Xmatch)
- Use spectral observations to calibrate color-redshift relation.
- Estimate background and spurious detection probability.
- Inputs: position (X-ray source coordinates), luminosity function, density profile.
- Outputs: redshift, multiplicity, BCG position.

Color-redshift relation



Data flow


Local data
VizieR
SDSS
Other
ARCHES XMatch tool
Data crawler
Calibration
Color-redshift relation
Background calculator
Background data
Cluster finder
Local database
Data output

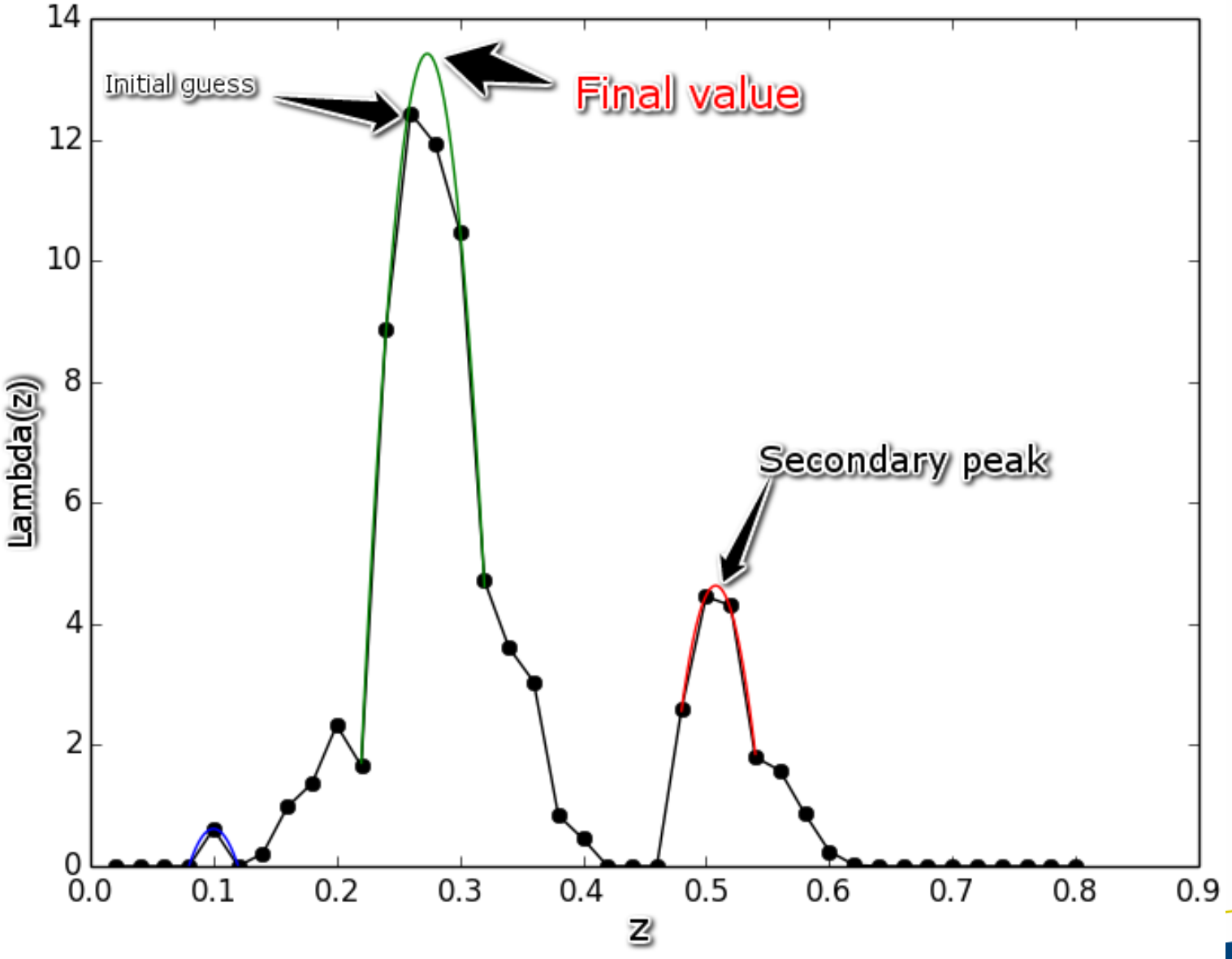
Multiplicity function $\lambda(z)$

$$\lambda(z) = \sum_{r<R_{max}(z)} \frac{\lambda(z)u(z,x)}{\lambda(z)u(z,x) + b(z,x)}$$

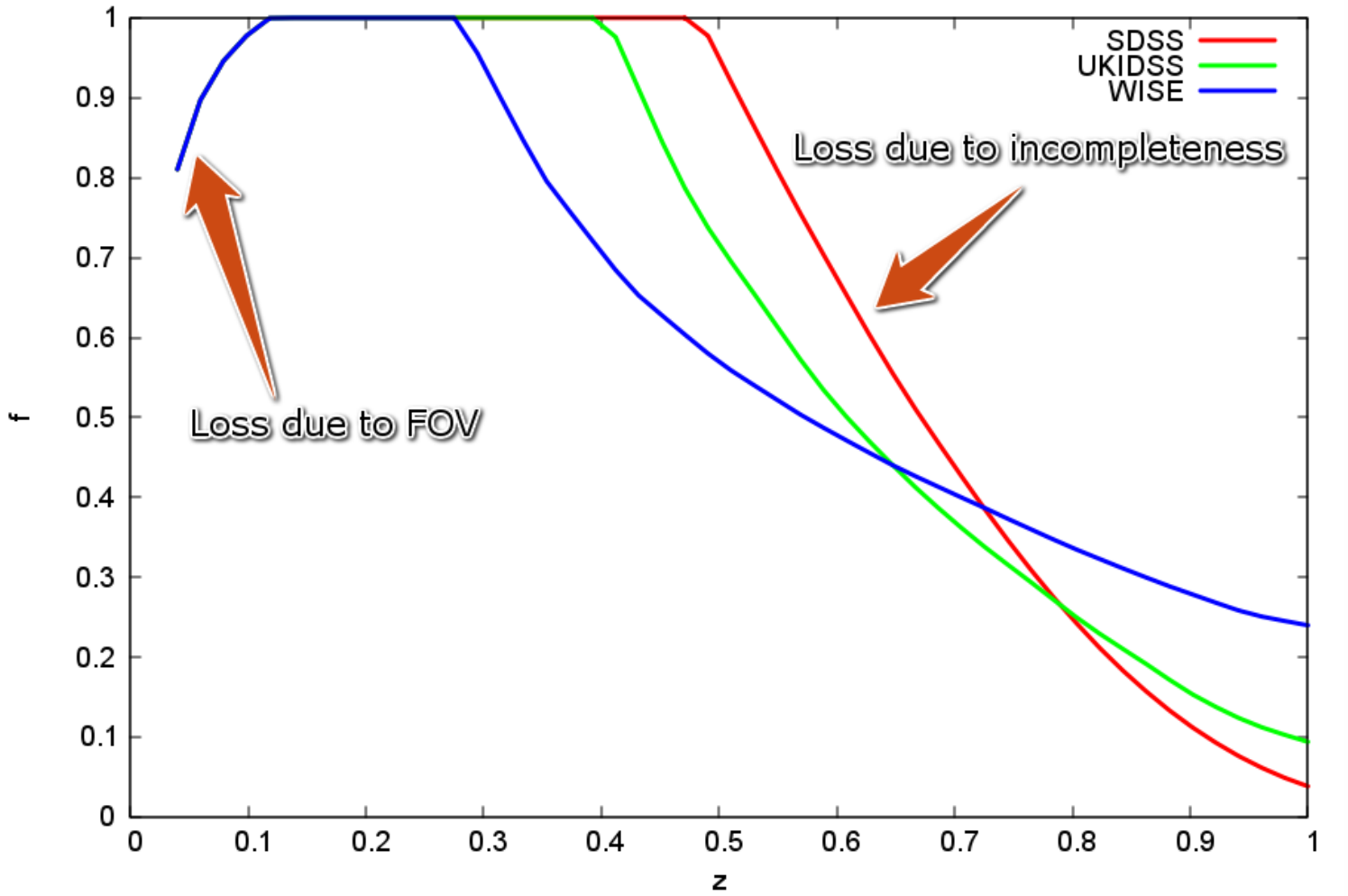
where x is a vector containing color and positional information, u – cluster profile, b – background.

$$R_{max}(z) = min(R_{1Mpc}(z), 8')$$

Peak finding



Completeness



Reference dataset: Takey et al. 2013

Astronomy & Astrophysics manuscript no. aa20213-12
September 2, 2013

The 2XMMi/SDSS Galaxy Cluster Survey

II. The optically confirmed cluster sample and the $L_X - T$ relation⋆

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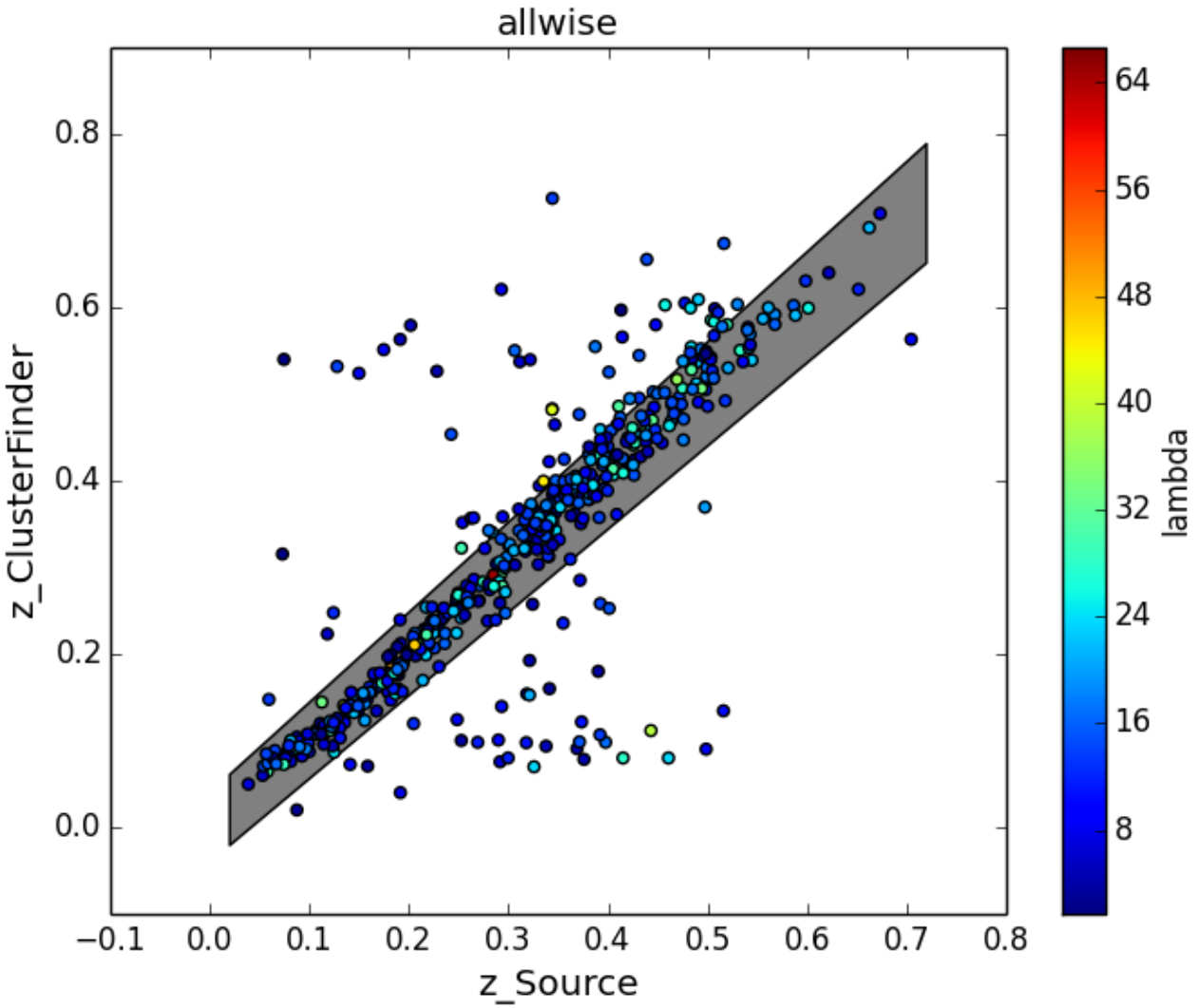
e-mail: atakey@aip.de
[2] National Research Institute of Astronomy and Geophysics (NRIAG), Helwan, Cairo, Egypt

- 2XMM – SDSS DR8 data;
- 530 clusters identified;
- 75% new X-ray clusters;
- 310 with spectroscopic redshifts of at least 1 member;

  X-ray positions were used as input.

State of the art: ICF vs. Takey

85% have $|z_{icf} - z_{input}| < z_{err}$



Development status and plans

Status

$\sim$ 1500 X-Ray sources flagged for cluster science in 3XMMe.
$\sim$ 900 in SDSS DR9 footprint.
$\sim$ 600 “good” detections.

Plans

Cluster finder and cluster catalog – to be ready by end of June 2014.
2nd part of the project – scaling relations ($L_X - T$).
Catalog public release – July 2015.

Removed from 3XMMe:

- Bad mosaics, high background, hotspots
- Offaxis sources ($> 12'$)
- Low exposure observations

3XMMe cluster sources

- Extended sources with low extent error
- High galactic latitude ($|b| > 20^\circ$)
- $4' <$ Offaxis $< 12'$
- High detection likelihood