Characterizing the Impact of SPT AGN on SZ Cluster Finding

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GCEU conference in Pucon, Chile – Nov.2009

Outline

- Motivation
- SPT (sub-mm point sources) + BCS (optical counterparts)
- Searching for nearby clusters
  - Red-sequence method
- Indication in SZ cluster finding
  - In terms of point source contamination

Motivation

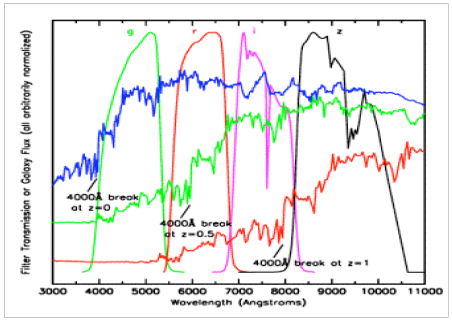
- SZ cluster finding :
  - Look for sudden flux decrements *after* point sources removed.
  - You lose clusters if you had point sources along the line of the sight to your clusters.
  - Want to quantify what the probability for this to happen, in order to take that incompleteness in cosmological studies.
- Other studies :
  - Simulations/observations with radio source distribution in clusters (e.g., Sehgal et al. 2009, Lin et al, 2006)
  - >> This approach underestimates the probability because it doesn't take into account for accidental superposition with random clusters.
- Our approach :
  - Use many samples to find nearby clusters around sub-mm point sources
  - Estimate probability that those clusters are massive enough to have been found if there were not point sources.

South Pole Telescope + Blanco Cosmology Survey

SPT Point Sources (87 deg^2):
- AGN & SMG

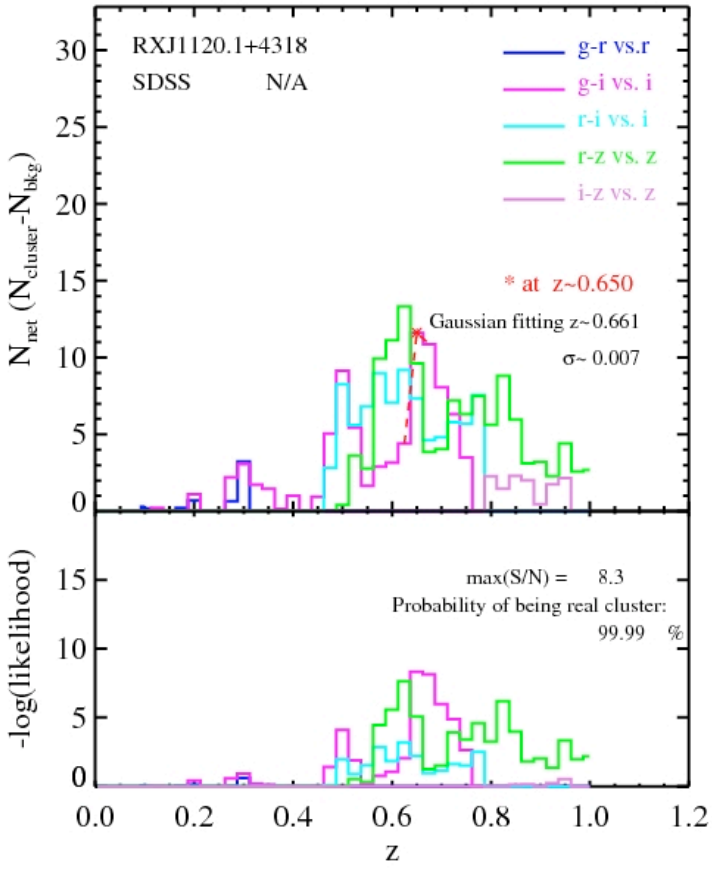
BCS counterparts (50 deg^2):
AGN – most of them
SMG – none of them
Depth of the BCS
Wavelength in BCS

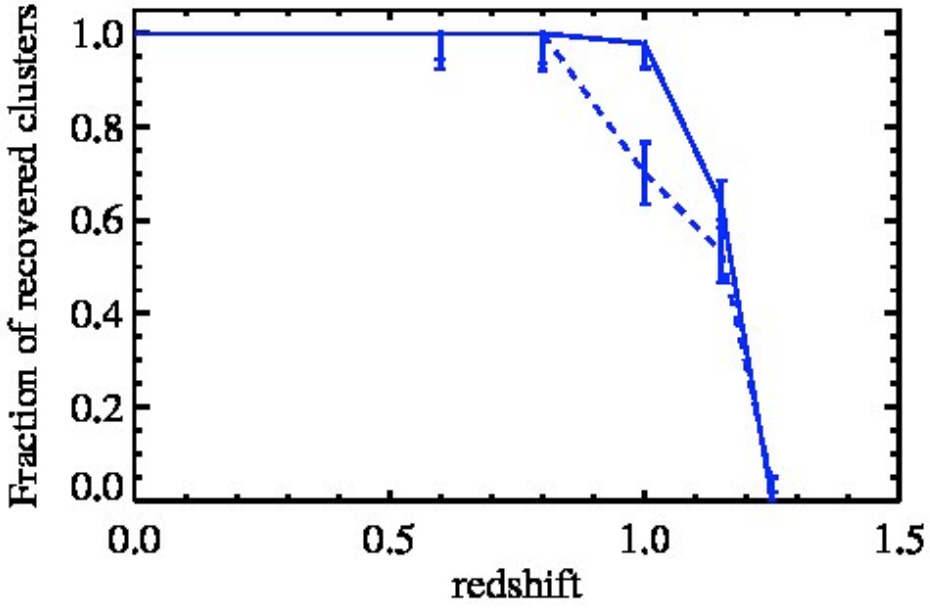
Searching for clusters
- Red sequence method

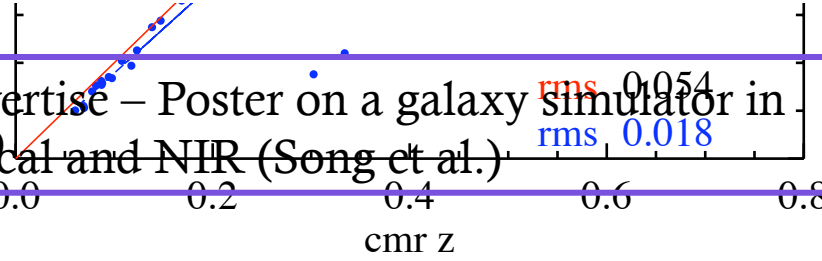


- Cluster galaxies simple enough to model
  - Bruzual & Charlot Stellar Synthesis Population models with 6 different metallicities, but same evolution (Bruzual & Charlot, 2003).
- Calibrate the model colors and magnitudes so that we reproduce Coma red-sequence at z=0.023.
- Based on models, look for overdensity in color-magnitude space.
  - Statistical background treatment: providing confidence level of the detection

Red-sequence method continues..







Advertise – Poster on a galaxy simulator in optical and NIR (Song et al.)

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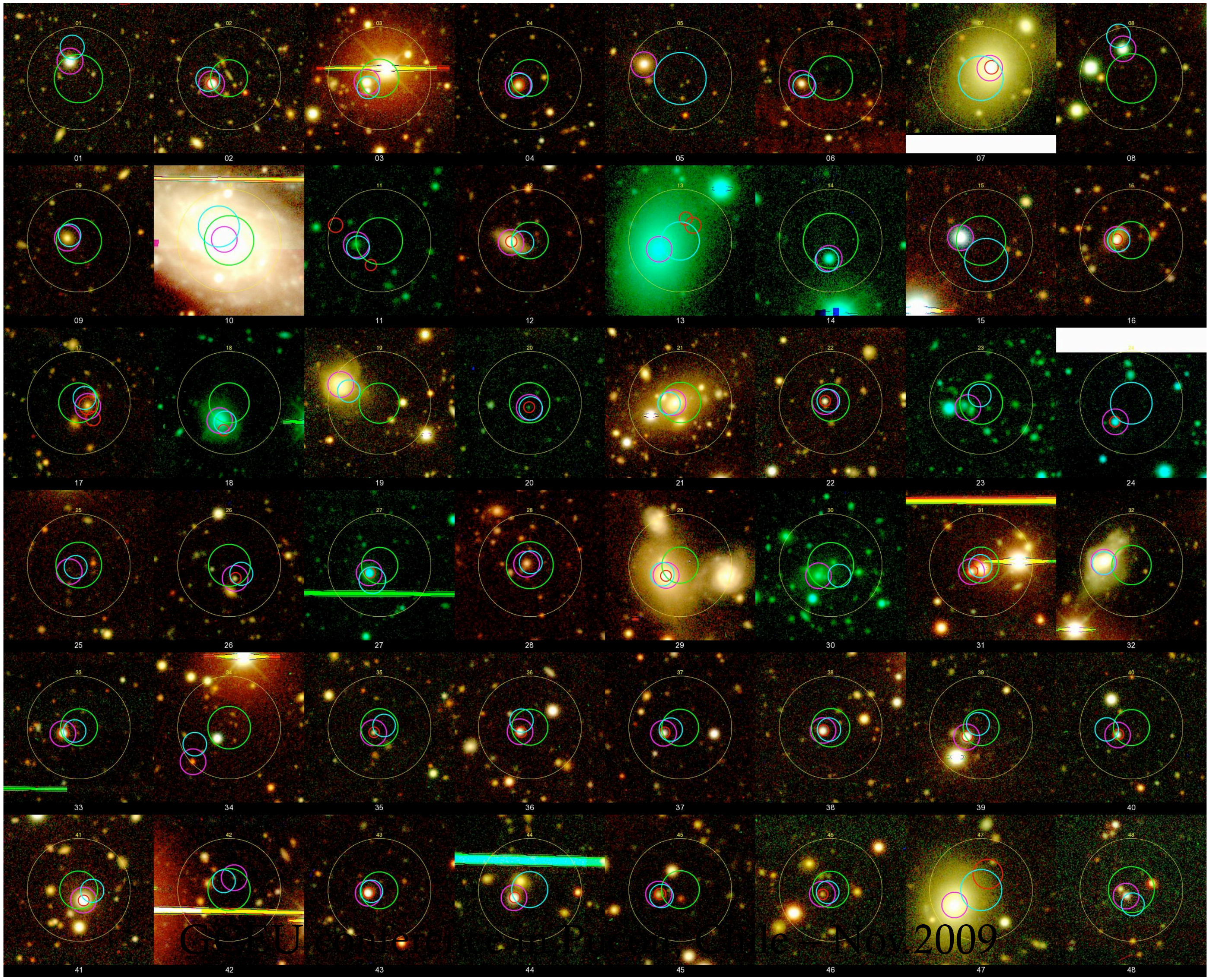
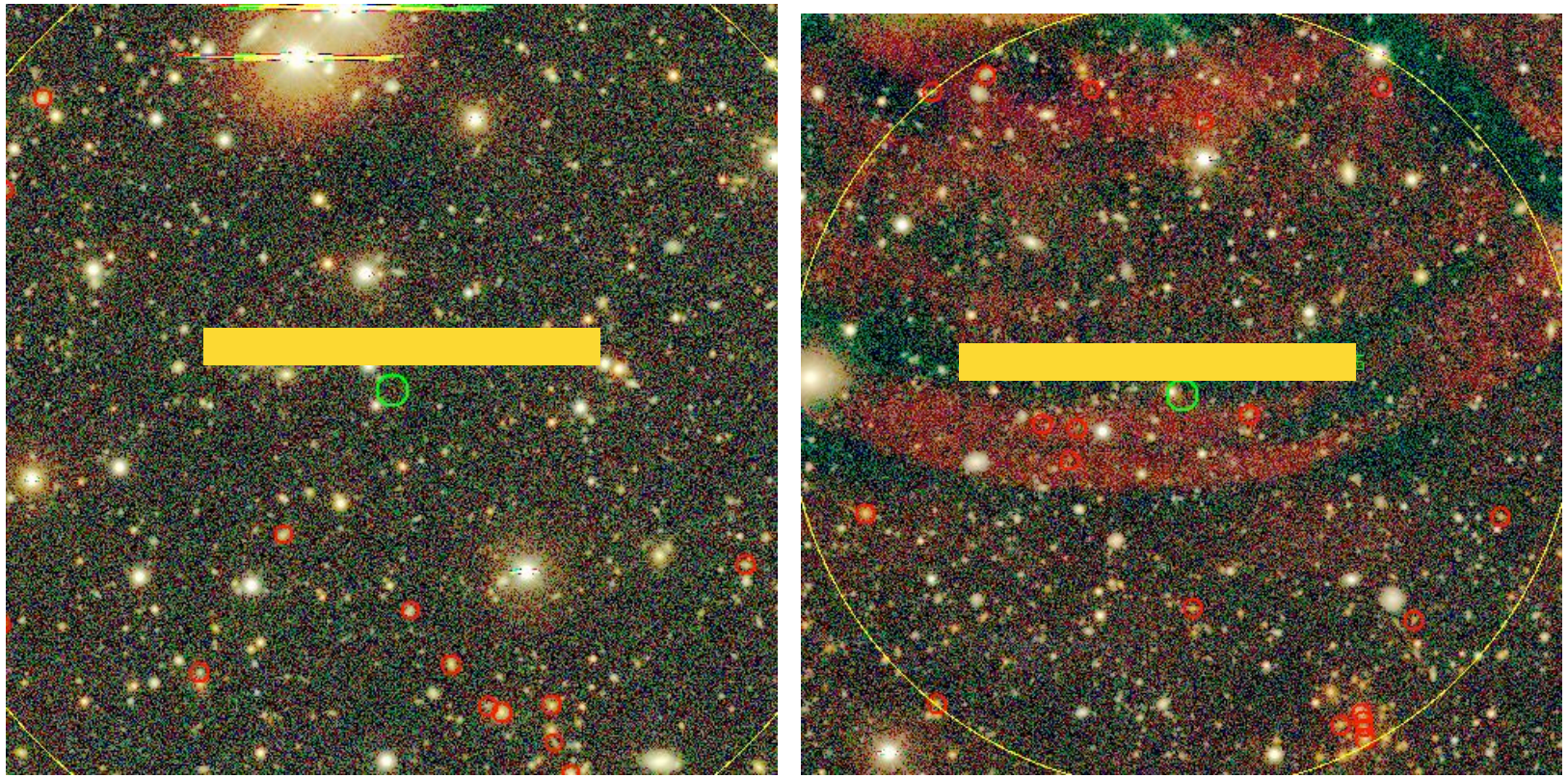
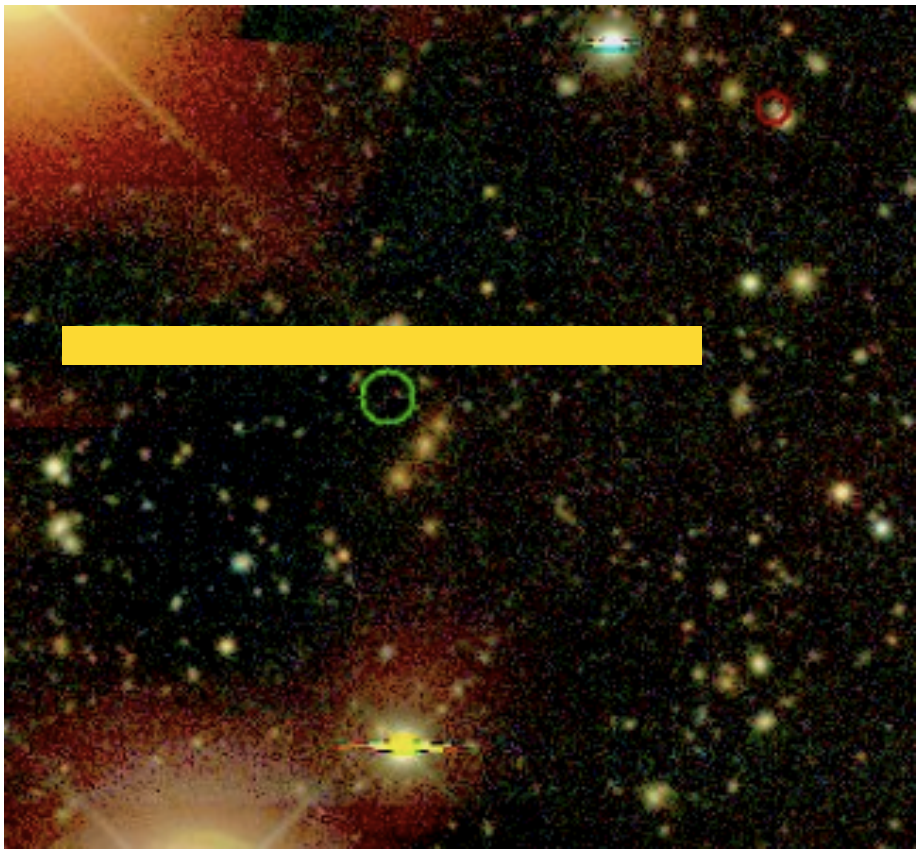
SPT AGN Optical Counterparts

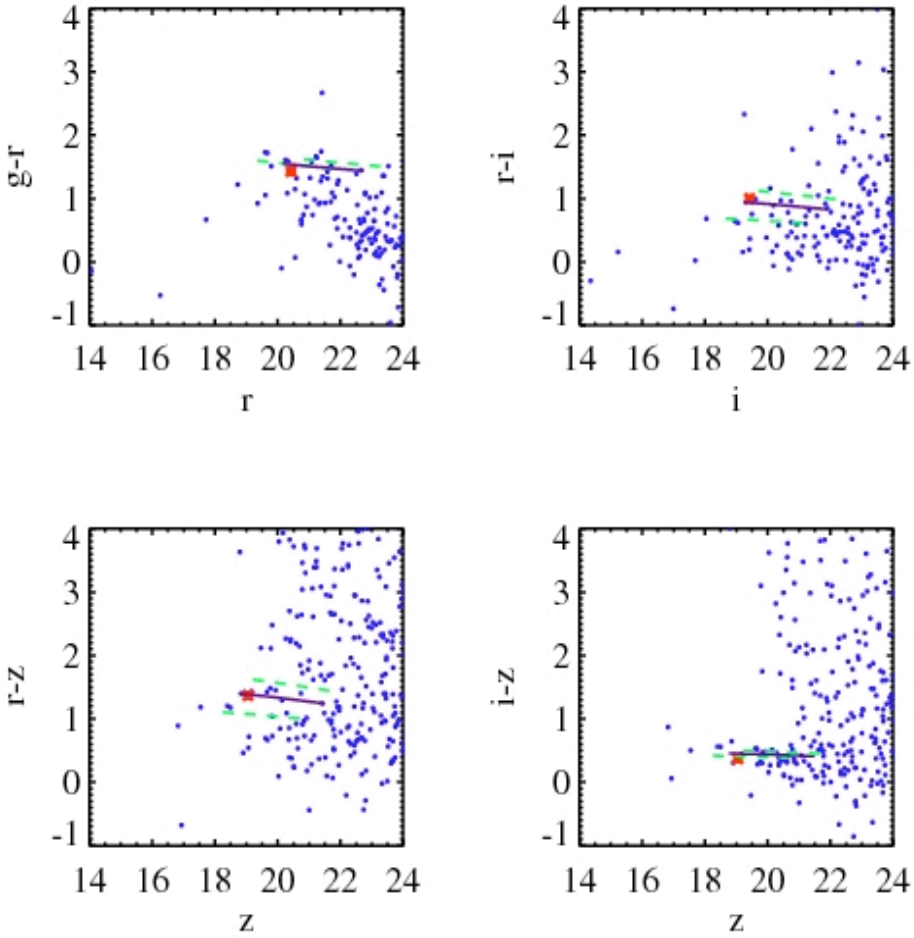


Nearby Clusters!



Sometimes we find it right there…

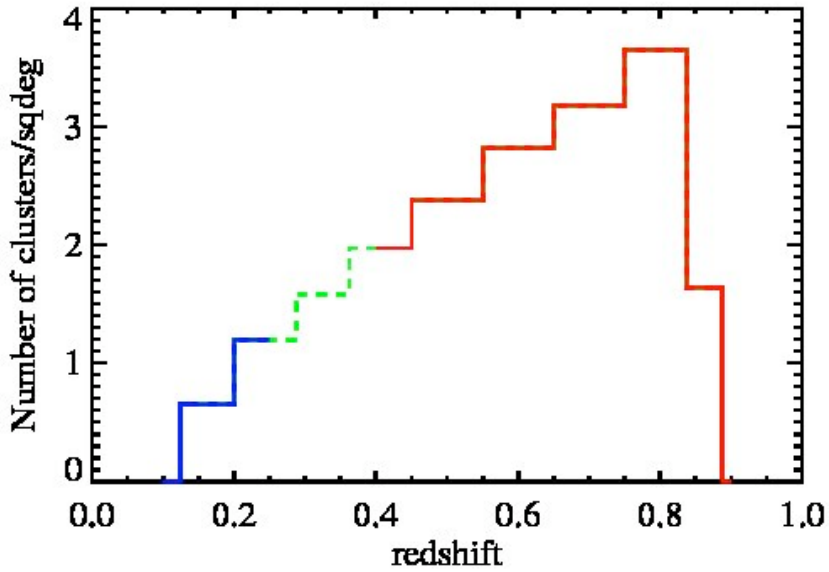




Z~0.45

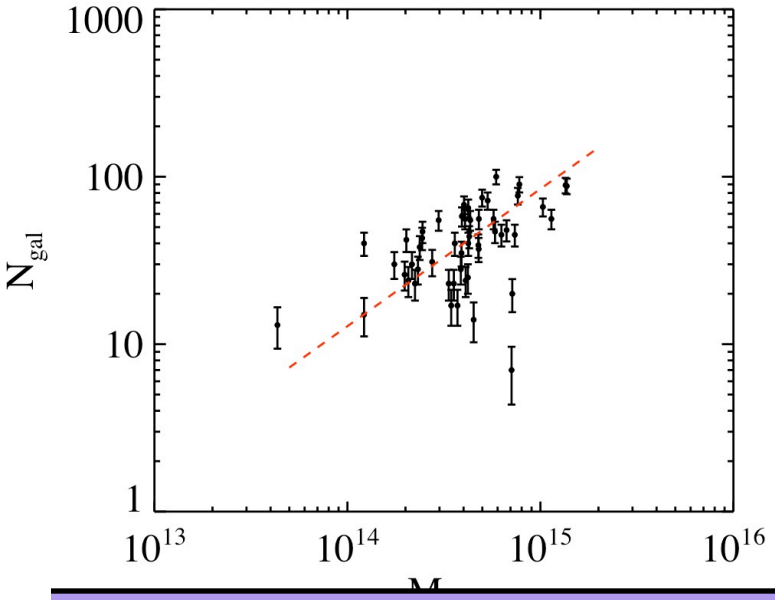
What's expected & what do we see?

- Estimation of the chance for superposition : maxBCG (z<0.25)+RCS (0.35<z<0.95)
  - >> ~15% of random superposition.



Category	Number of AGN pointings
Total AGN in 5 hr field (~85 deg^2)	104
AGN with good BCS coverage	41
AGN excluded for data quality	4
AGN possible physical cluster assoc.	5
AGN with random cluster superposition	4
AGN in a busy region	4
Isolated AGN	24

Mass estimates



- Mass indicator – excess number of red-sequence galaxies
- Probability for the system to be above certain threshold (e.g., $3 \times 10^{14}\ M_{\odot}$)

ID	Mass indicator	Probability of being massive enough system
SPT-AGN #7	8	0.6%
SPT-AGN #11	6	0.04%
SPT-AGN #14	23	31%
SPT-AGN #18	5	0.008%
SPT-AGN #19	11	2%

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position
of chance
ed by SPT

In the near future, we will…

- Have more optical/NIR data coming – lots of telescope time granted in this fall!!
  - For better statistics
  - Current result include only less than 40 systems.
  - We might increase number of sample from the current observations.
  - Study of cluster-AGN connection
    - 9 samples out of 41 samples - 20% association.
    - With 100 SPT AGN, 20 clusters with AGN.
- Take-home message – orange flag in SZ cluster finding due to the point source contaminations.