Preparing to create a DELVE Gold catalog

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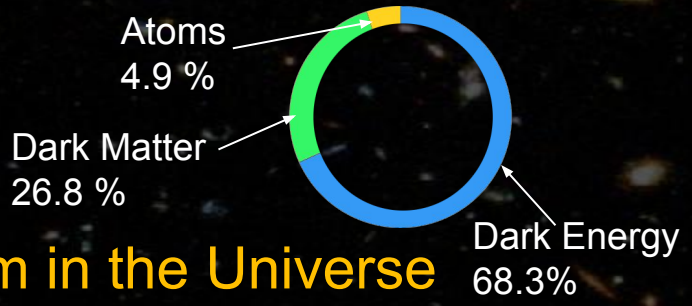
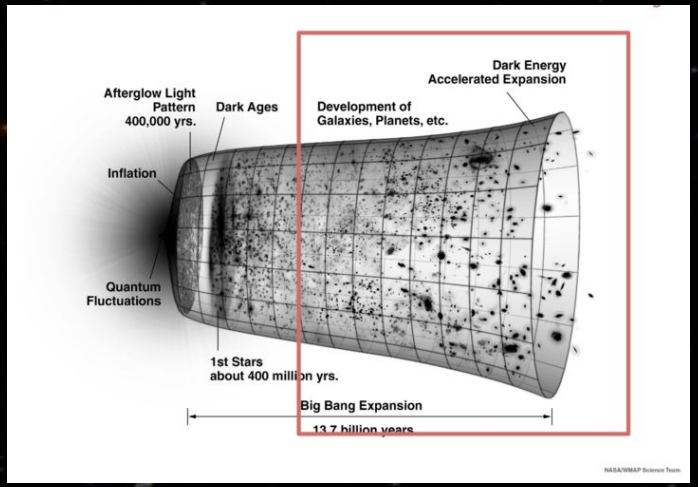
Theoretical background

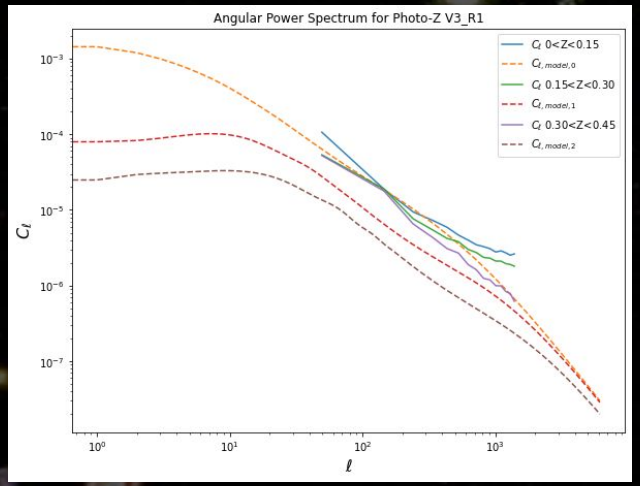


- Dark energy is the dominant energy form in the Universe
- It is responsible for the accelerated expansion of the Universe
- Flat-Λ Cold Dark Matter (ΛCDM) is currently the most widely accepted cosmological model (Λ: Cosmological Constant)
- Dark energy and dark matter are not directly observable
- Use distribution of galaxies as tracer
- Dark matter increases clustering, dark energy decreases clustering

Theoretical background (cont)

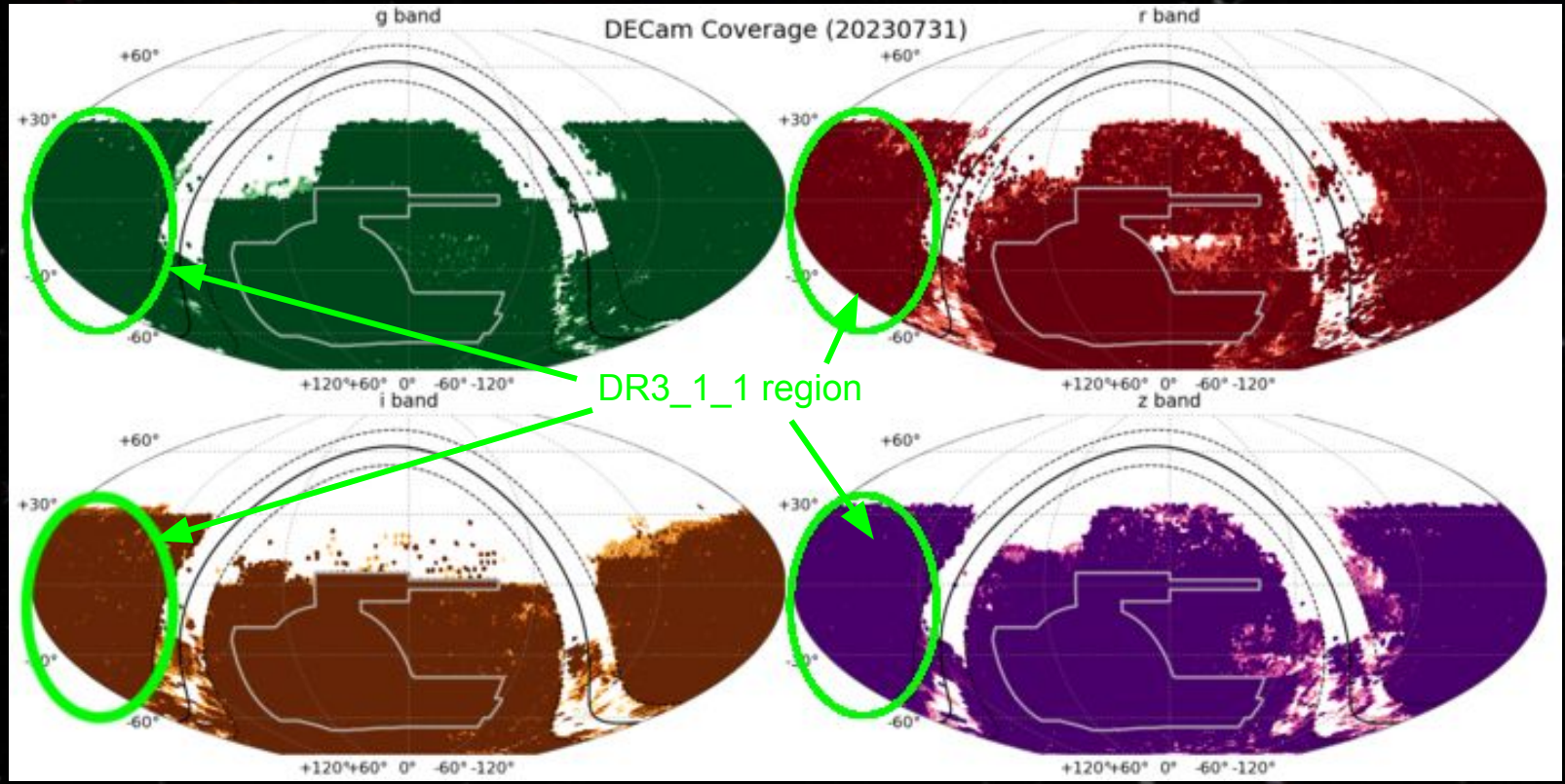
- Use angular power spectra (among other tools) to study clustering
- Sample selection and observing conditions play a large role.





Introduction to DELVE

- DELVE moving towards publishing data release 3 by end of calendar year
  - Covers >17,000 sq degrees in all four observational bands simultaneously (g,r,i,z)
- Want to create high confidence Gold catalog similar to DES Y6


DECam Coverage (20230731)
g band
r band
i band
z band
DR3_1_1 region
+60°
+30°
-60°
+120° +60° 0° -60° -120°

Primary study goals

1. Test DES Gold flags against DELVE DR3_1_1
2. Develop additional flags, as necessary
3. Develop generalized technique for studying flag combinations

Work done in conjunction with Kai Herron

Gold flag description

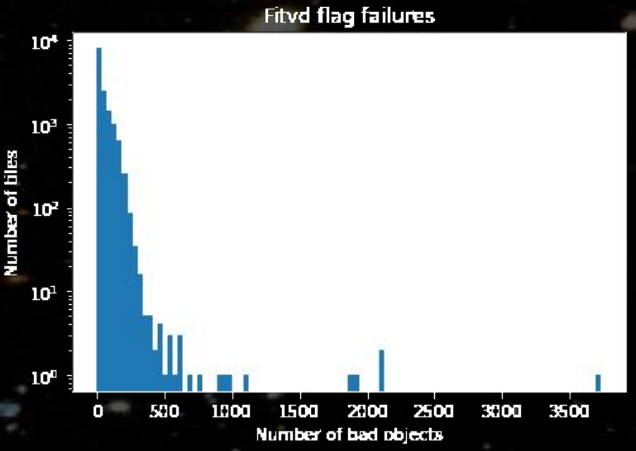
- Seven DES Gold flags
  1. Fitvd - Indicates a problem with fitvd processing
  2. Source Extractor - Standard SourceExtractor quality selection problems
  3. Saturation - Objects that saturated the CCD pixel
  4. Superspreader - Objects that are bleed-over objects

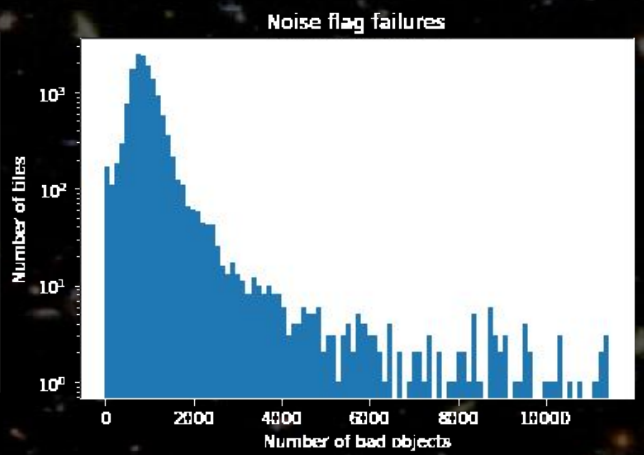
Gold flag description (cont)

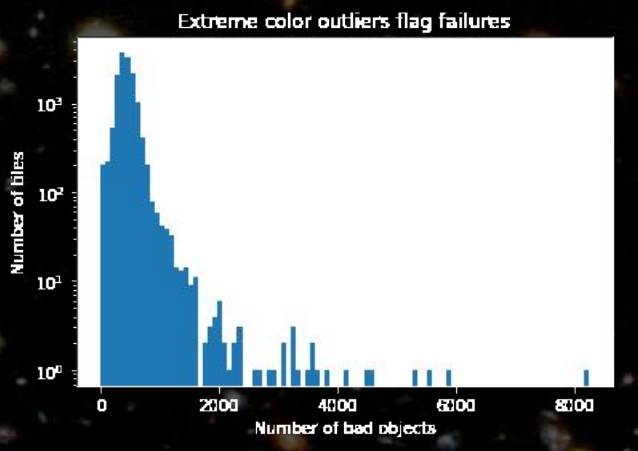
- Seven DES Gold flags
  5. Noise - Objects that are probably instrumental noise
  6. Color - Objects who color band magnitudes differ from the adjacent band by more than 5 magnitudes
  7. Phantom - Bright objects that do not span multiple epochs

Study results

- Initial results showed significant issues





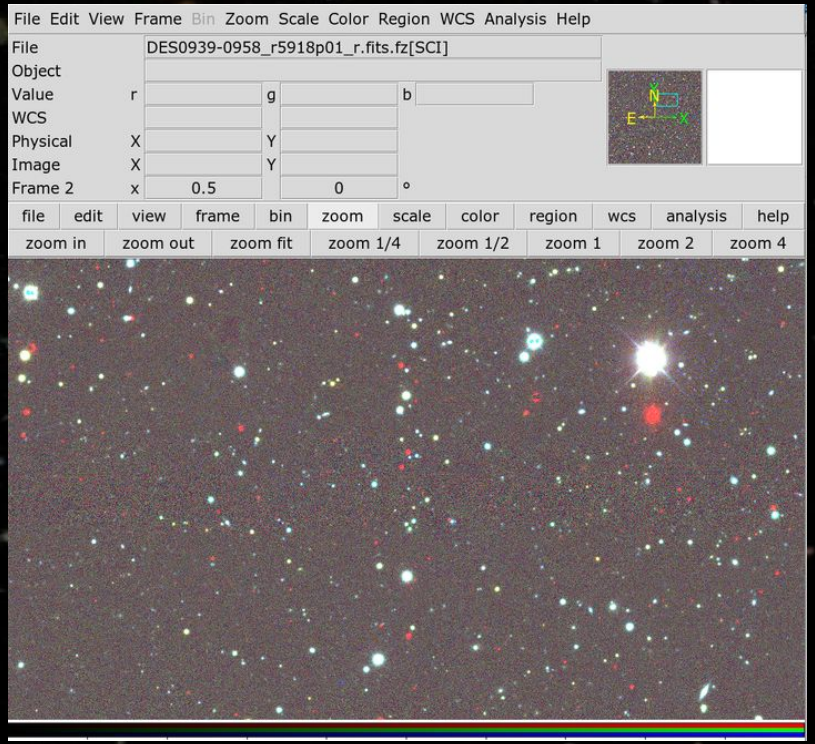


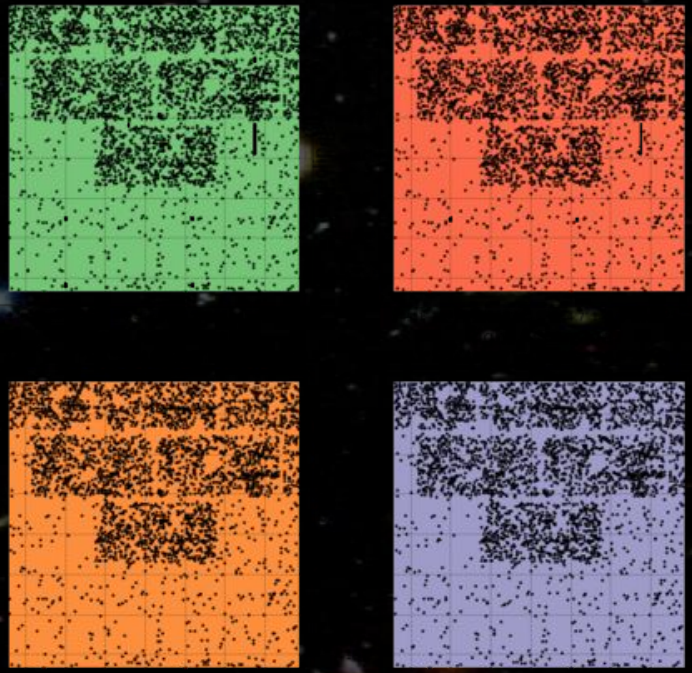
  - Not enough to immediately suspect methodology, but concerning

Study results (cont)

- Focused on the objects that showed a >5 mag difference between adjacent filter bands
  - Indicated tiles where different filters didn’t overlap
  - Detailed tile review carried out by Kai Herron

Study results (cont)



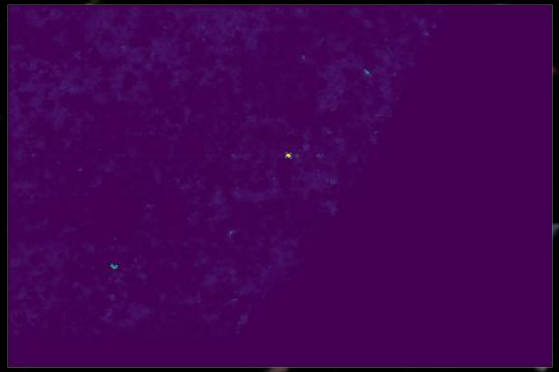


Study results (cont)

- Original visual inspection did not consider z-band
- Kai created new rgb images using (r,i,z) only
- Looked at portions of tiles with overdensities of color offsets to identify image processing issues
- Flagged tiles for reprocessing

Identifying hotspots

- Created overlaid map montage of various flags to visually identify tiles with issues



  - Used all flags, not just DES Gold flags

Creating additional flags

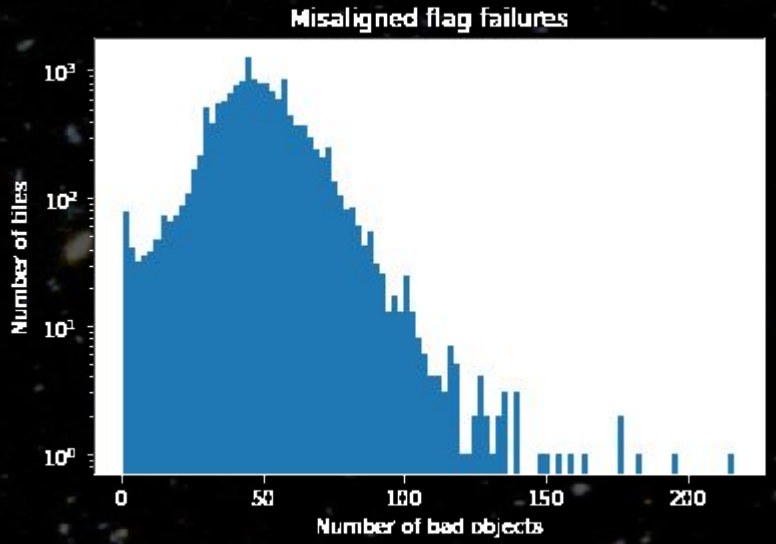
- Object data comes from two data sets
  - coadd summary object table
  - sof object table
- Both include RA and Dec information for object
- Initially asked how good are the positional matches
  - Raised by astrometric offsets associated with color flag

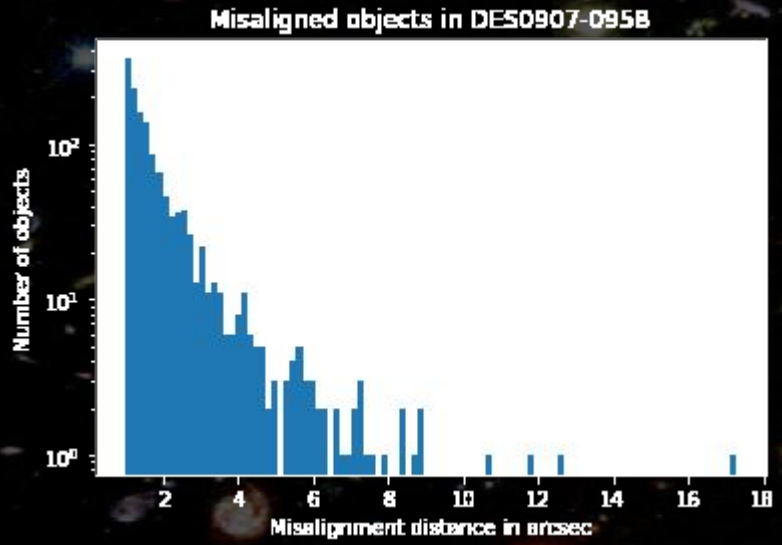
Creating additional flags (cont)

- Built new flag comparing positions from two data sets
- Also created flags for each filter band to identify objects that are too faint but not identified by a sentinel value
  - Latter flags not used

Misalignment problem

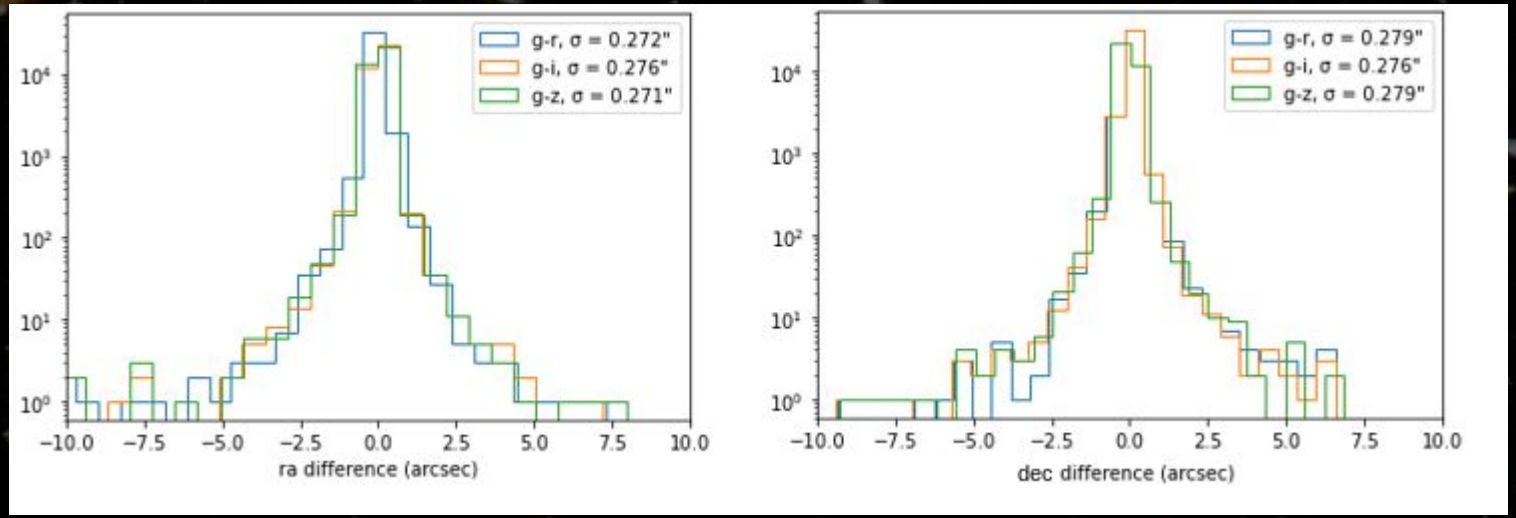
- Misalignments were more significant than expected
  - Globally and on single tile





Misalignment problem (cont)

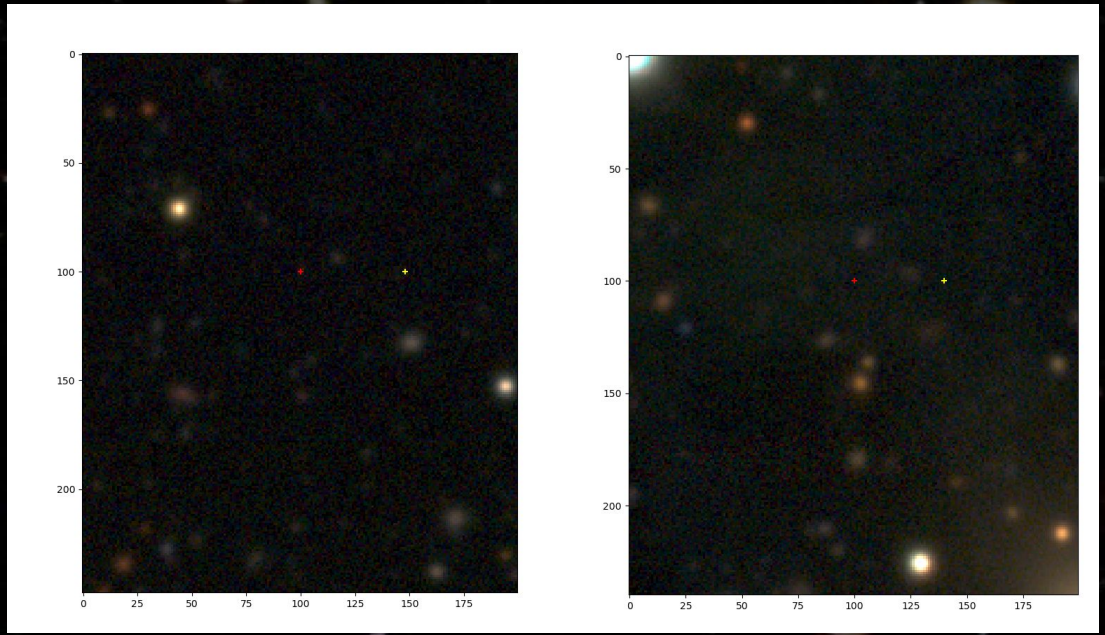
- Data didn’t match expectations or results from others



Chin Yi Tan’s plot of offsets

Misalignment problem (cont)

- Kai looked at cutout images of tiles with greatest issues

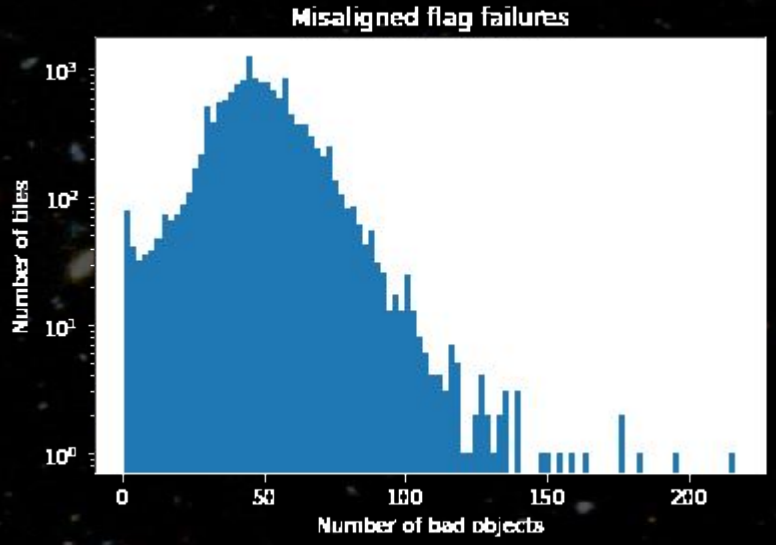


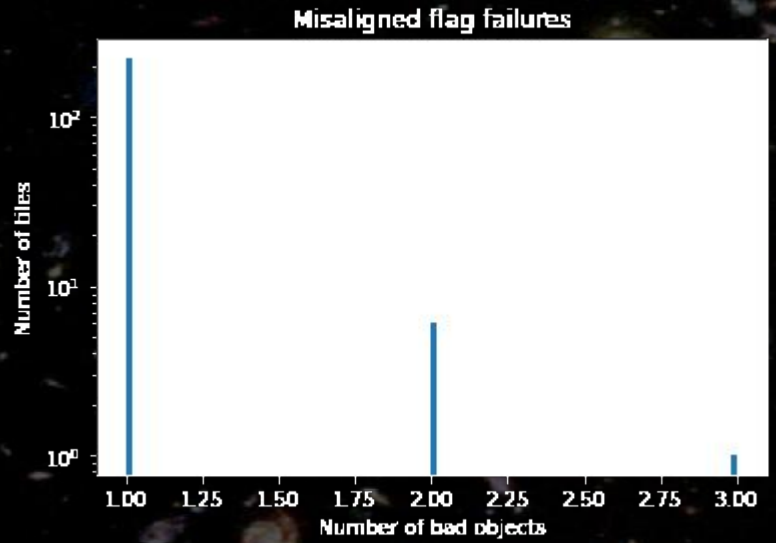
Misalignment problem (cont)

- Alex identified as apparent noise and recommended applying magnitude limit cutoff
  - i-filter magnitude, corrected for extinction, < 22.2
  - Similar to DES maglim cutoff
- Repeated tests for all flags with maglim cutoff included

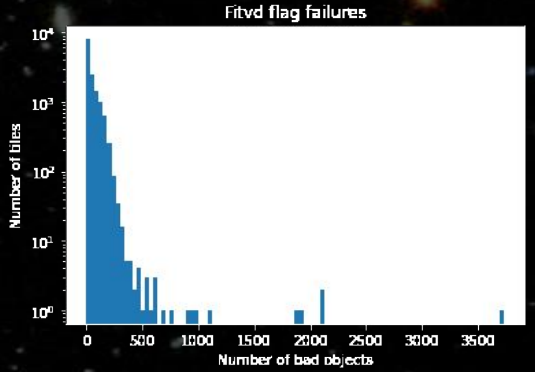
Flag test with maglim cutoff

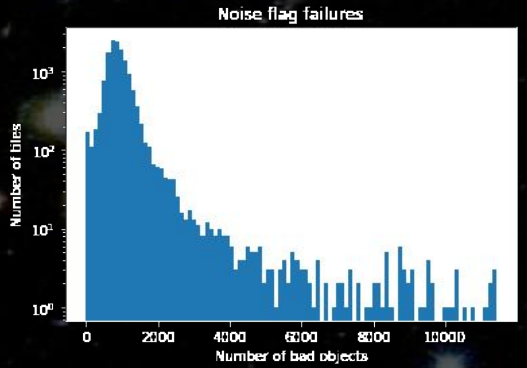
- Misalignment issue vanished!
- Other flag issues significantly reduced as well

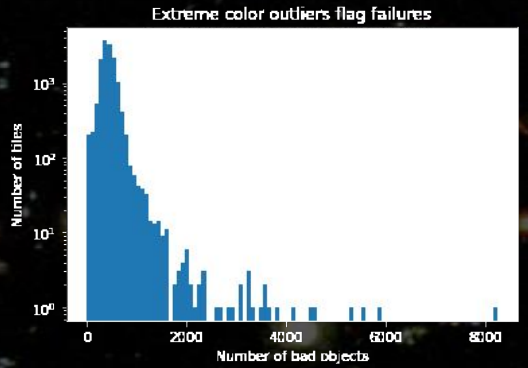




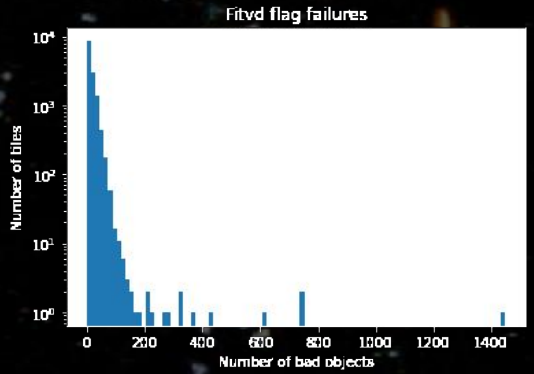
Before maglim cut

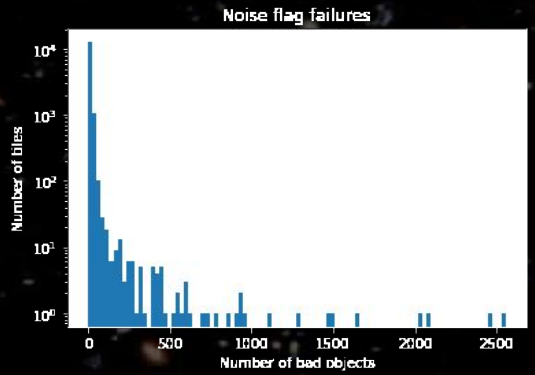


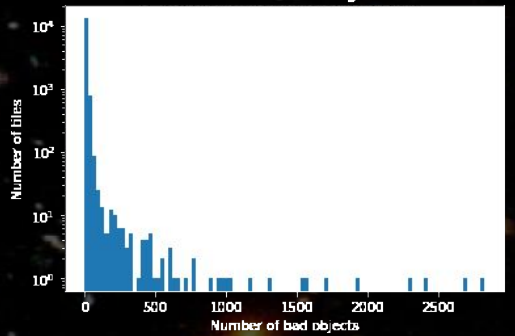




After maglim cut

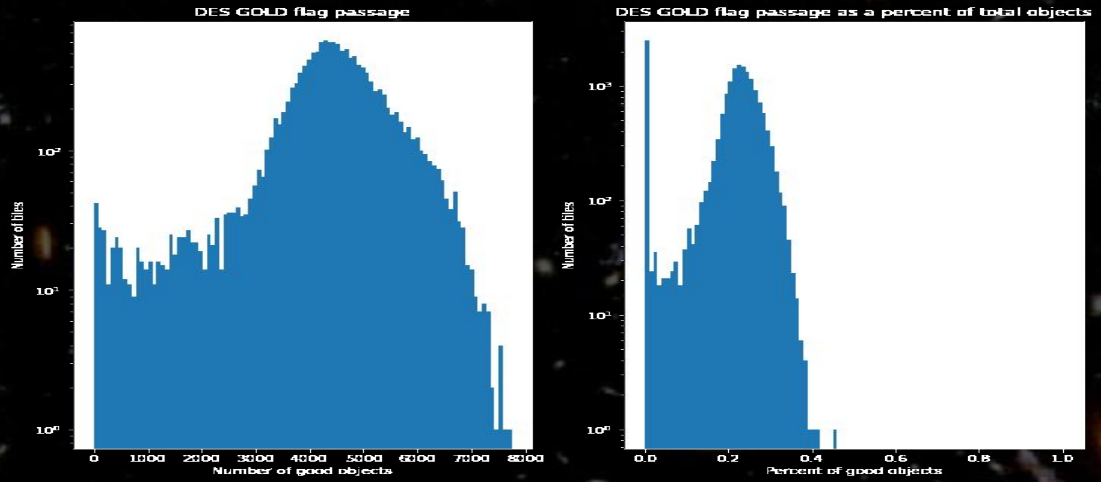






Global Gold flag check

- Looked at how many objects pass all Gold flag checks, maglim cuts, star masking, and within coverage of all bands



- Result unexpected - needs more study

Generalized multiflag program

- Global result reinforces need for generalized multiflag analysis program
- Flags can be entered by name or integer numbers
- Allows for extended boolean logic
  - ‘fitvd and 30 or 128 and ((gband or rband) or not (iband and zband))'
- Runs, but slower than expected/desired

Conclusions

- Spent much of the summer chasing rabbit (misalignments) down hole (real?? – Nope!)
- Gold flags are probably good to use
  - Need to study approach to verify this
- Need optimized multiflag capabilities for continued studies

Future plans

- Look at gold flag passage question
- Optimize multiflag program and make available to collaboration
- Consider removing added flags
- Create Gold catalog and use to generate angular power spectra