Lossy Compression WG Status

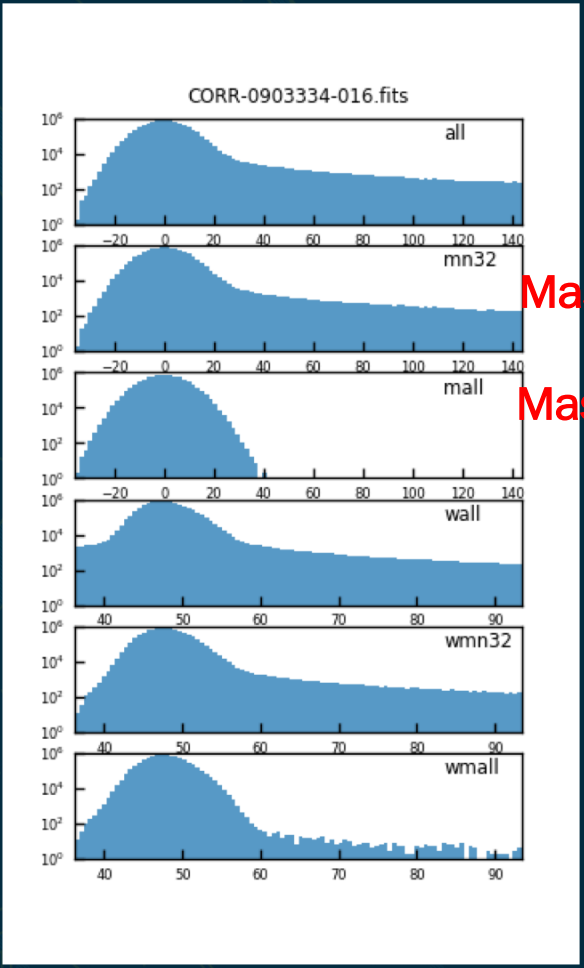
Overview

- ✓ Obtain test set
- ✓ Apply quantization
- ✓ Quantitative Assessment of Image (pixel-level) alterations
  - ✓ Individual/single-epoch images
  - ✓ Aggregate/coadd images (suffers from small number statistics (a sample of 2)
  - Bright-end (truncation) needs a little more attention
- ✓ Quantitative Assessment of Catalog/Measurement
  - Individual image level (emerging)
  - Coadd level (not yet attempted)
- ✓ Measure Compression Algorithm Benchmarks

Typical Pixel Distributions

Image

Weight



Mask Defects

Mask Source & Defects

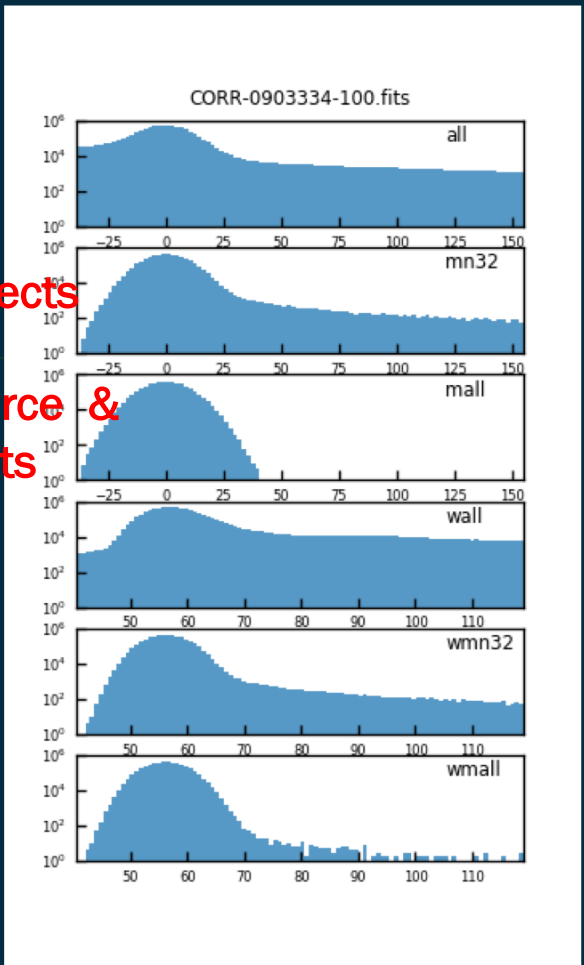
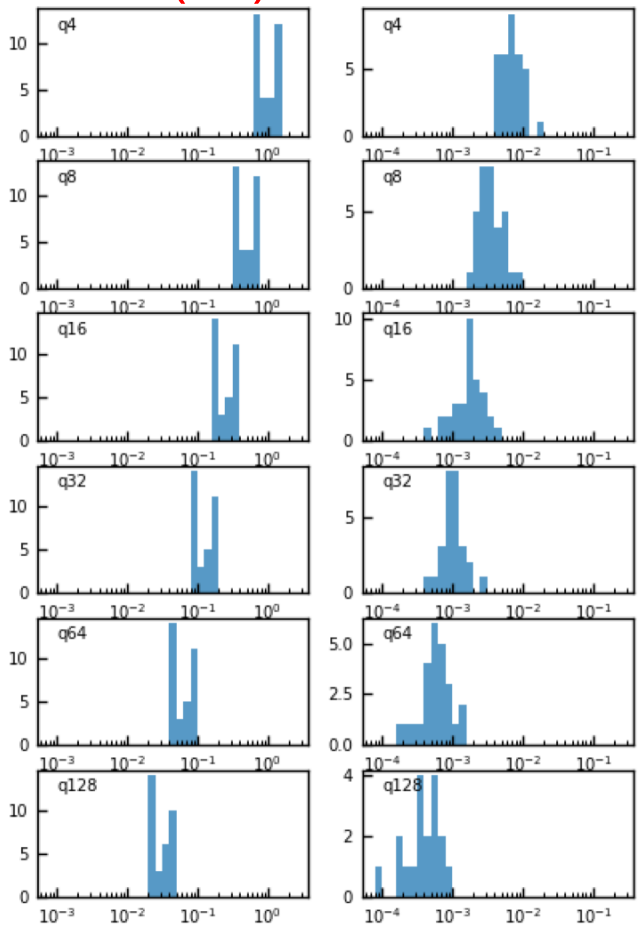


Image Difference

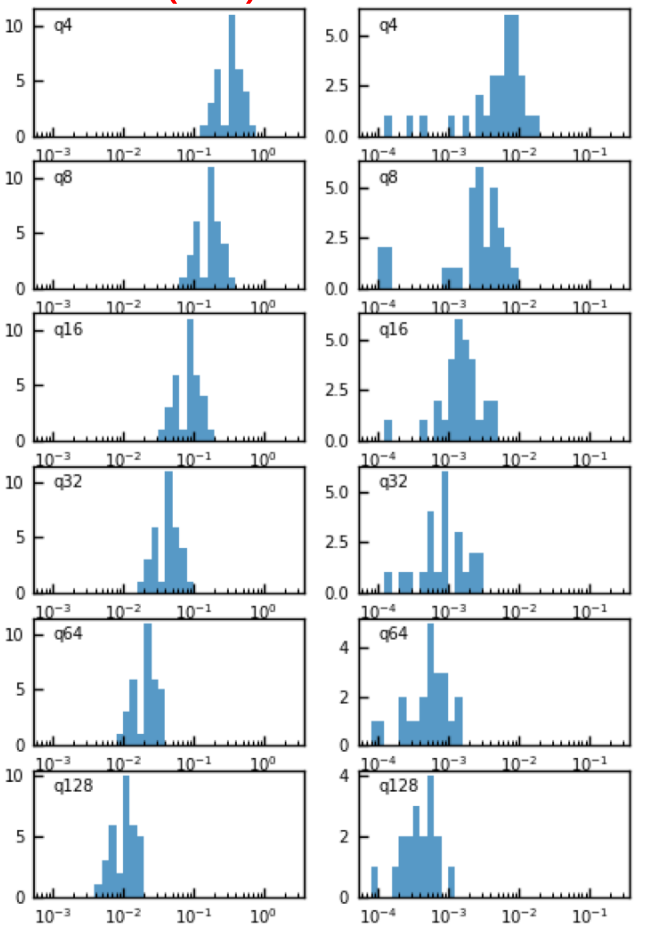
Image

RMS(diff) % increase noise

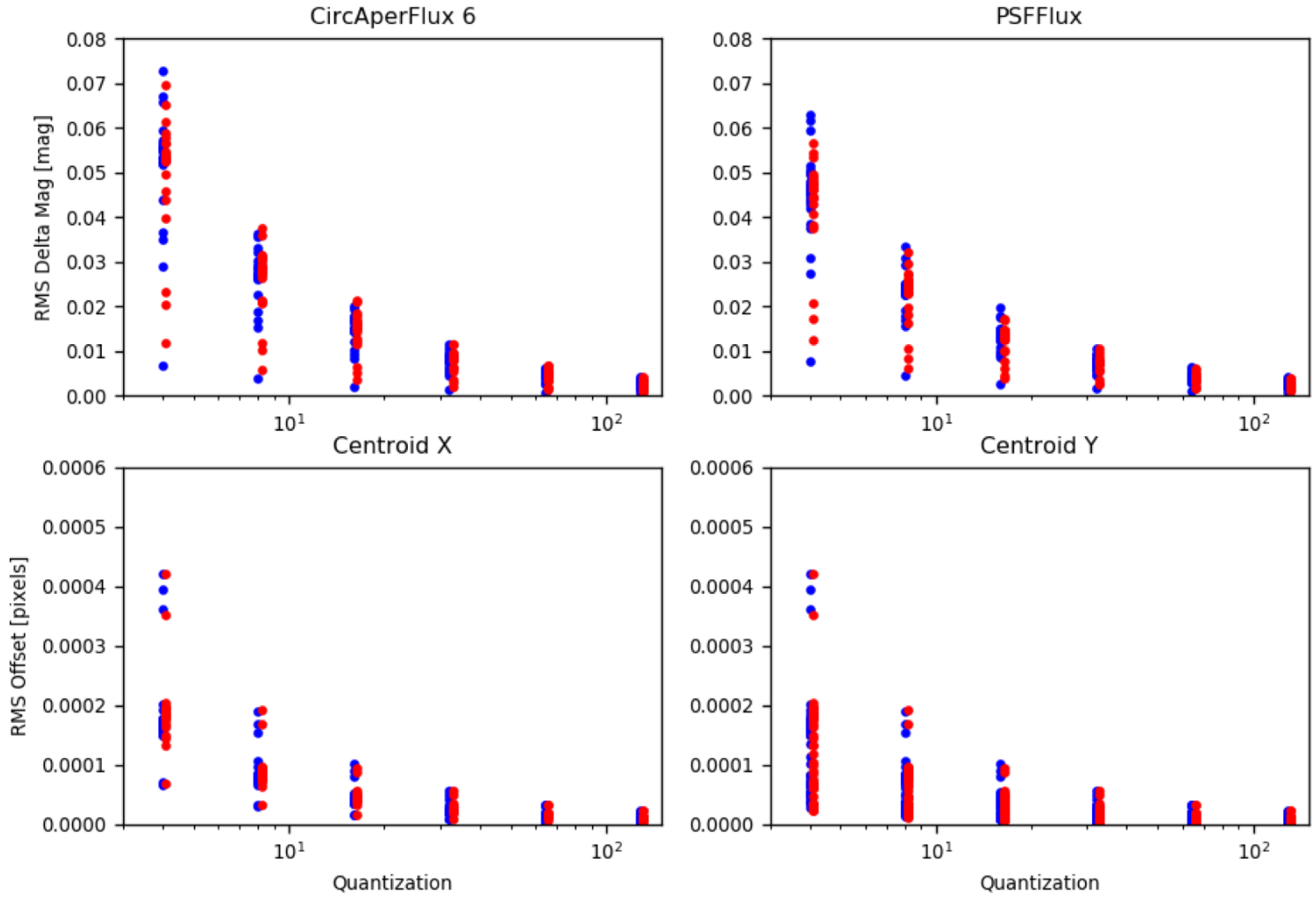


Weight

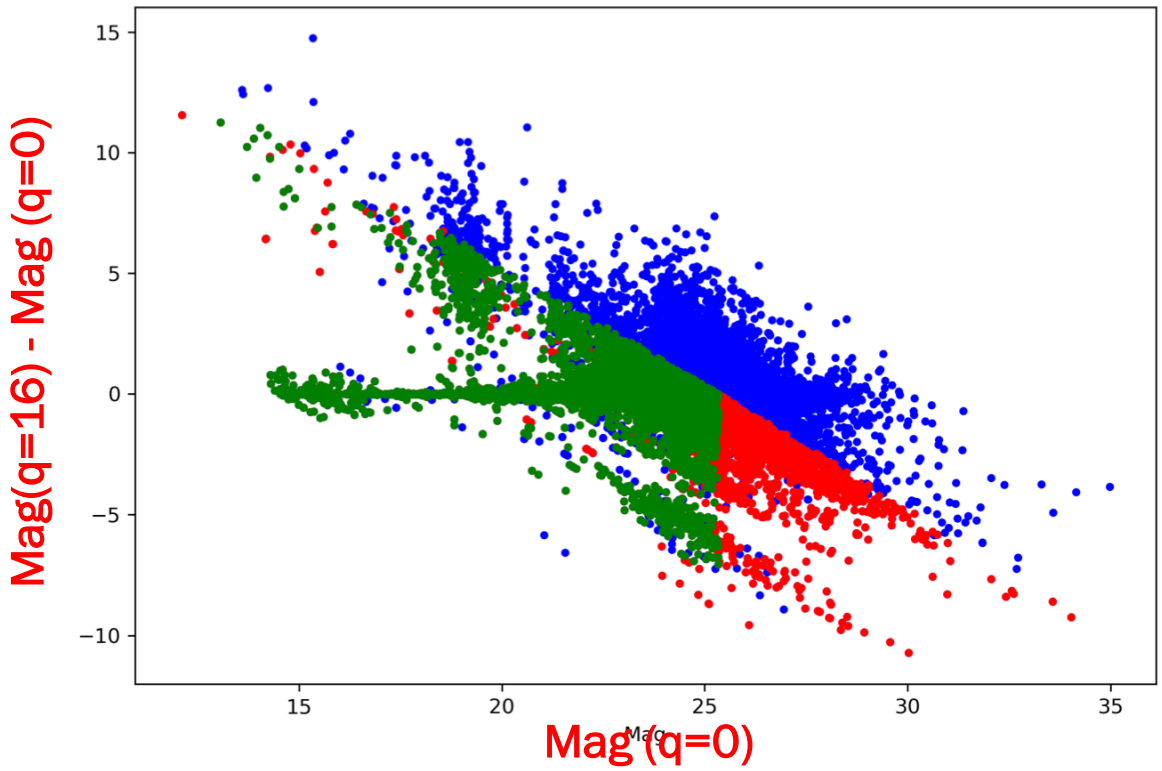
RMS(diff) % increase noise



Aggregate Catalog Quantities

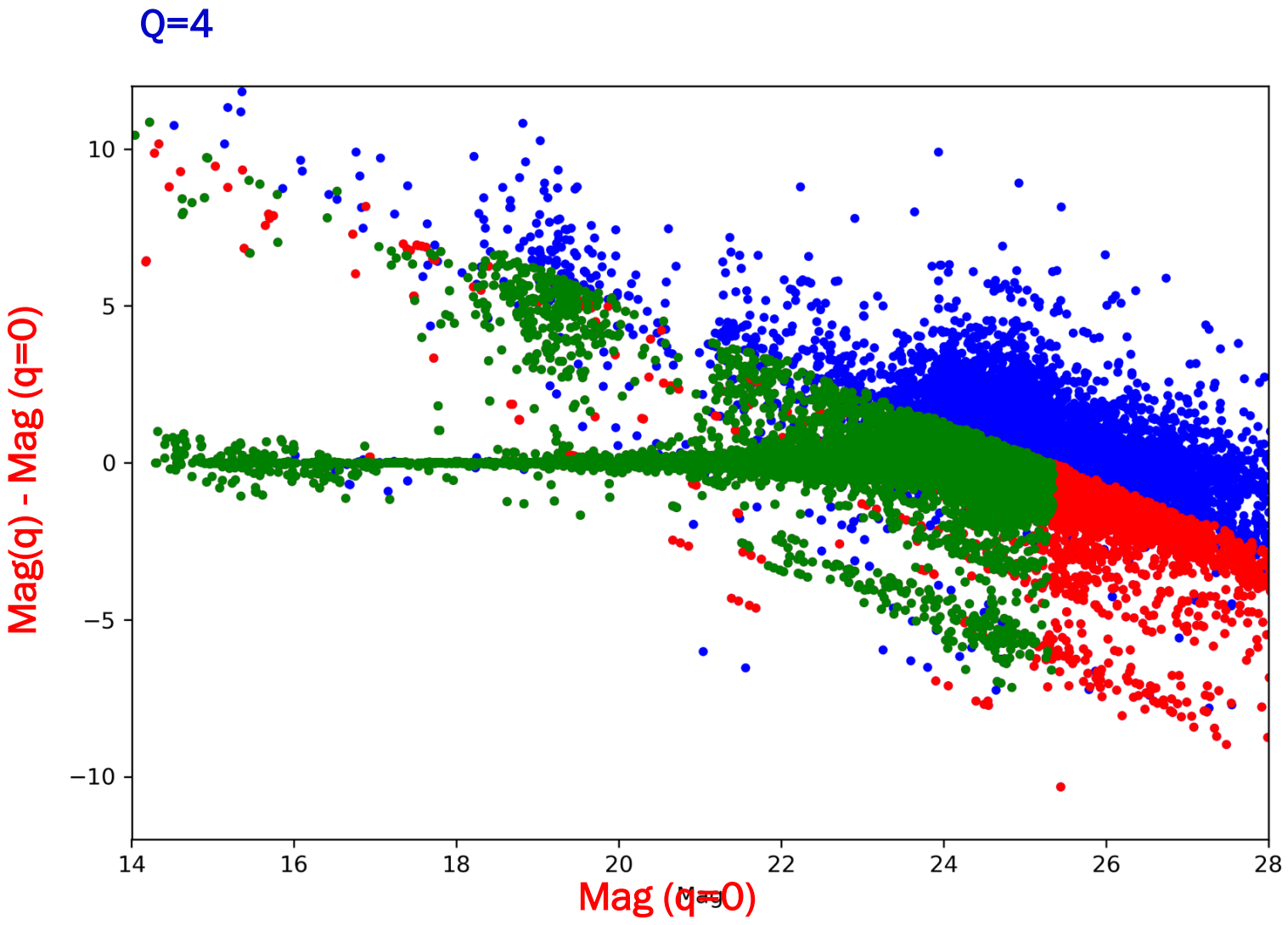


Source/Object level comparisons

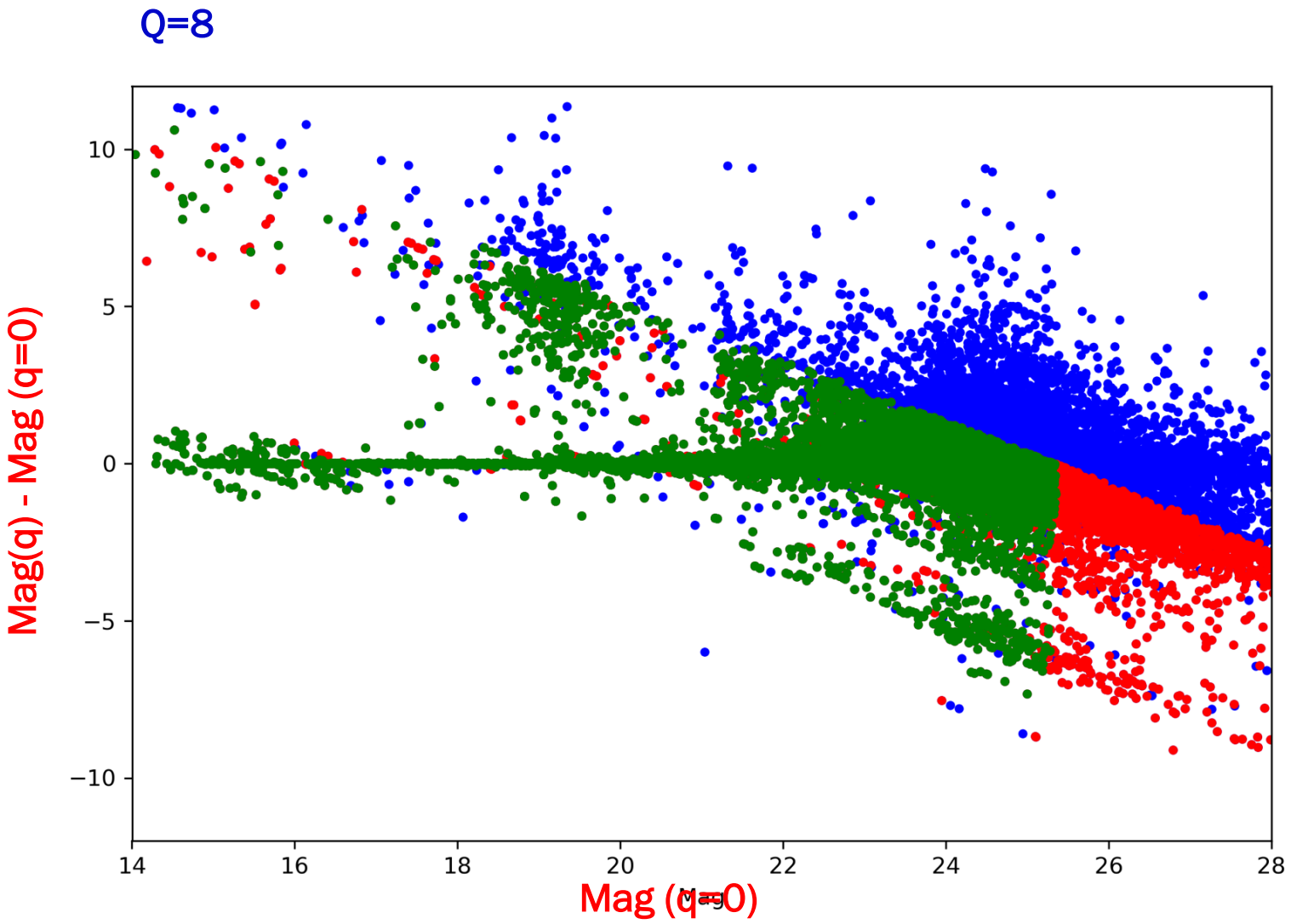


Blue all matched sources
Red cut sigma_mag (q=0) < 1 mag
cut Flag(q=0) != 0
Green repeat cut for q=16

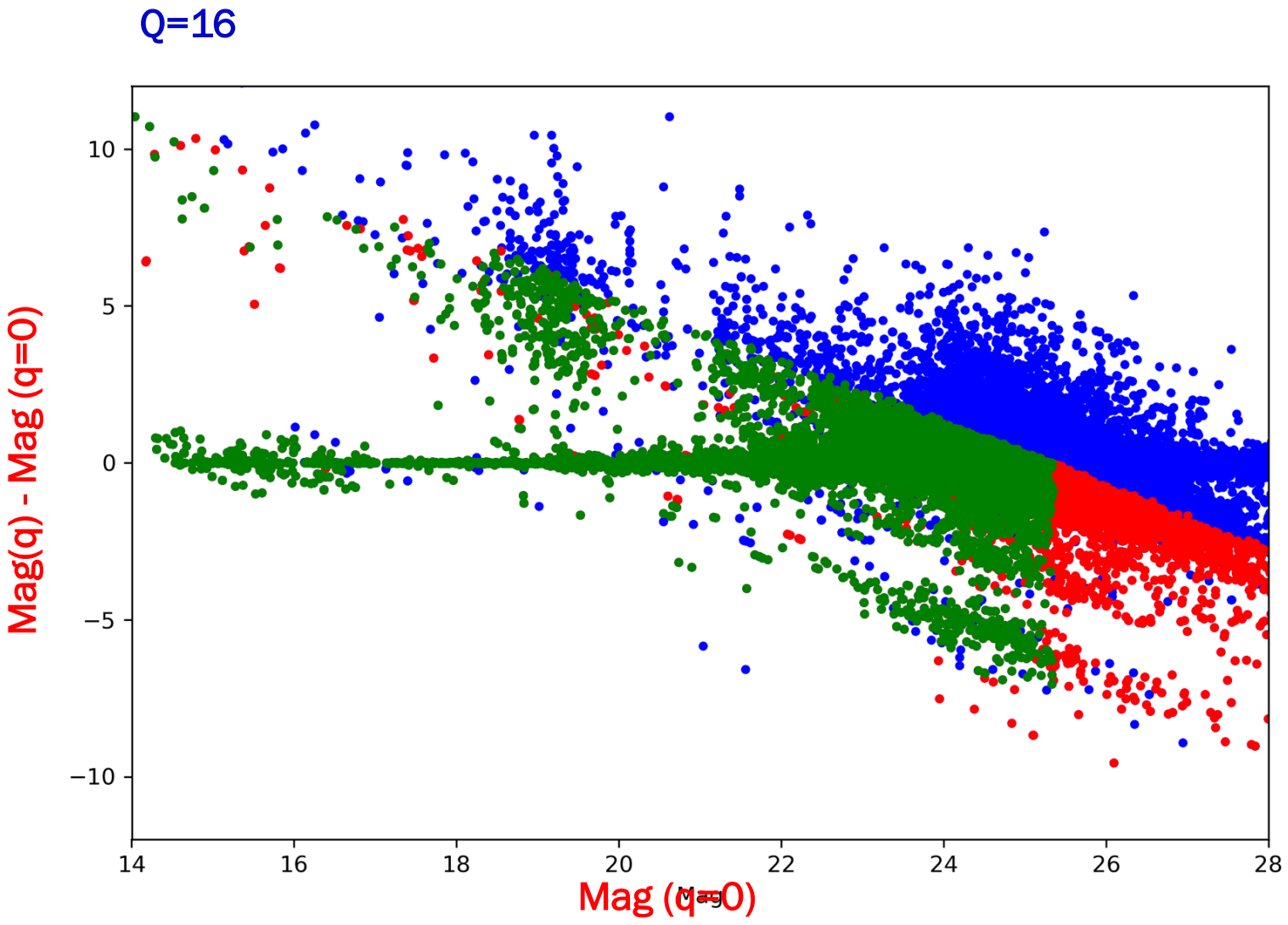
Source/Object level comparisons



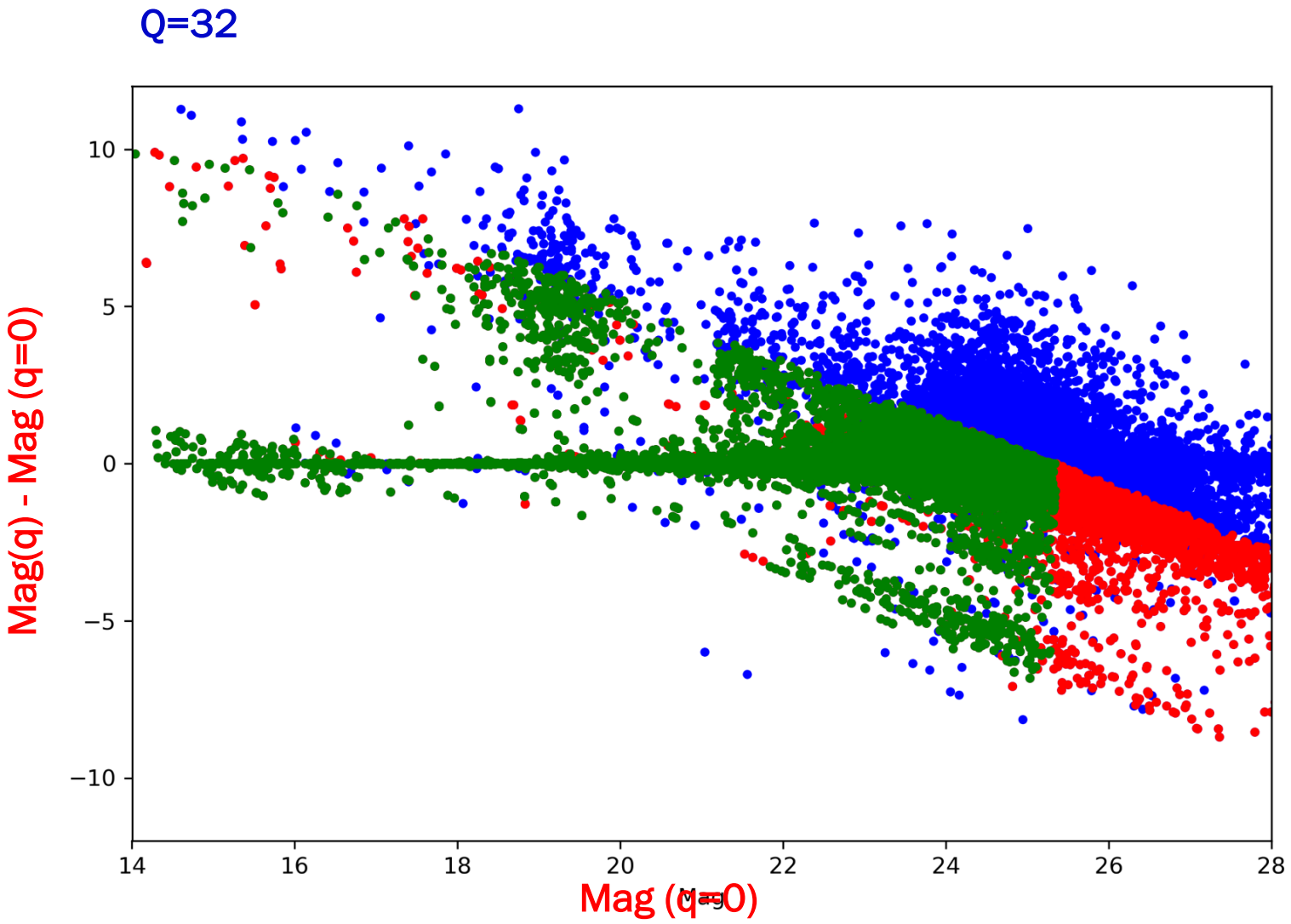
Source/Object level comparisons



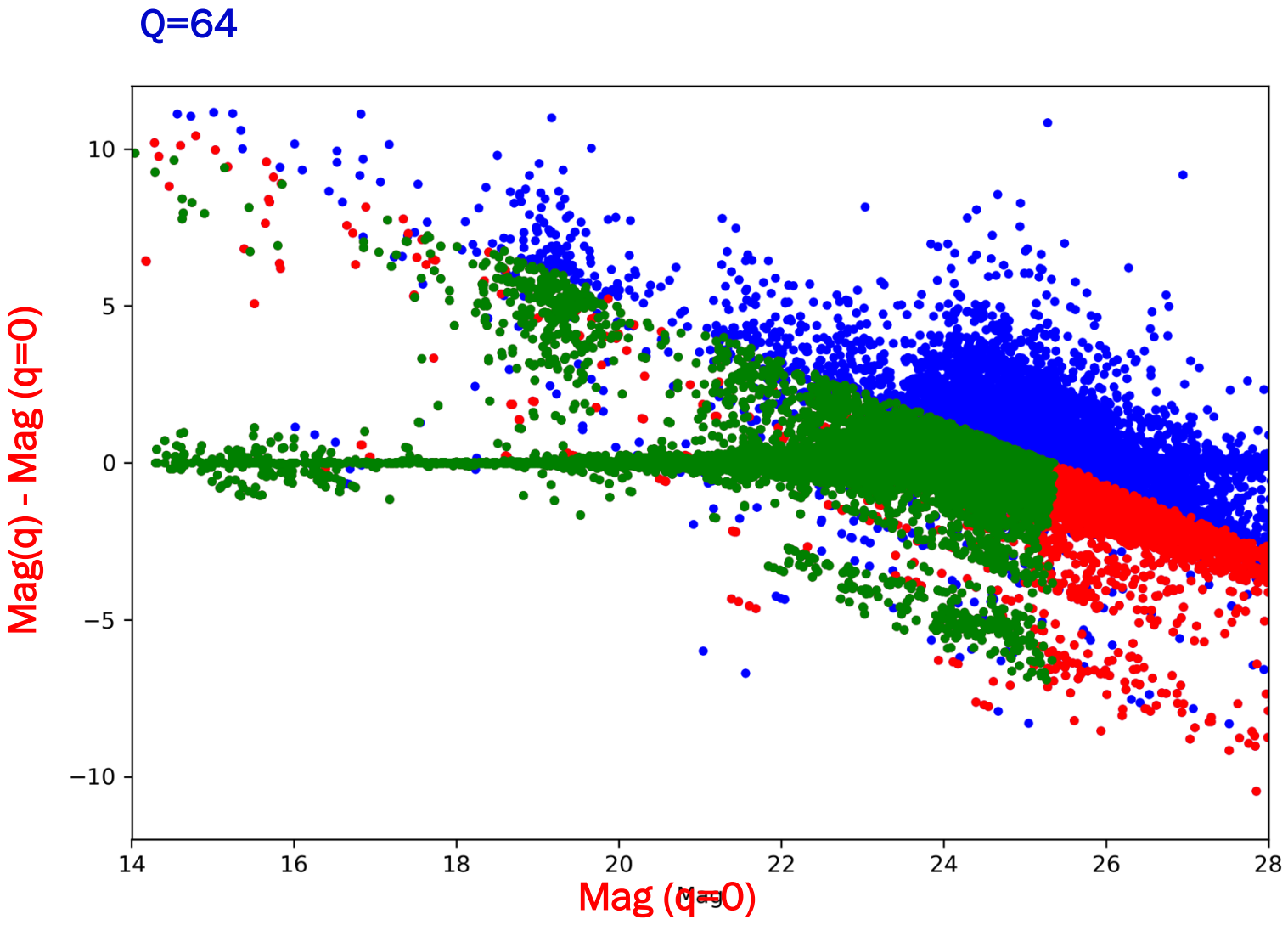
Source/Object level comparisons



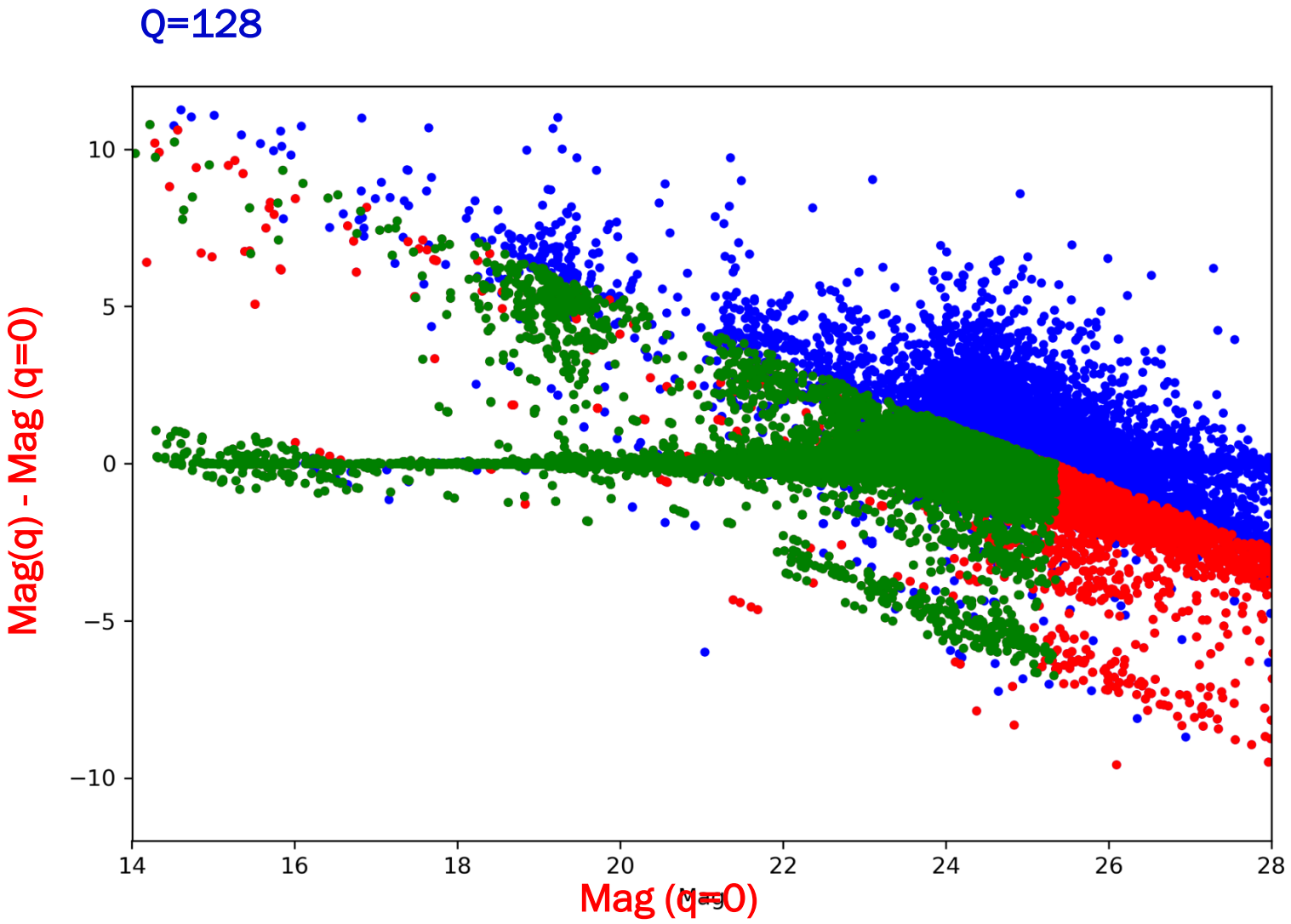
Source/Object level comparisons

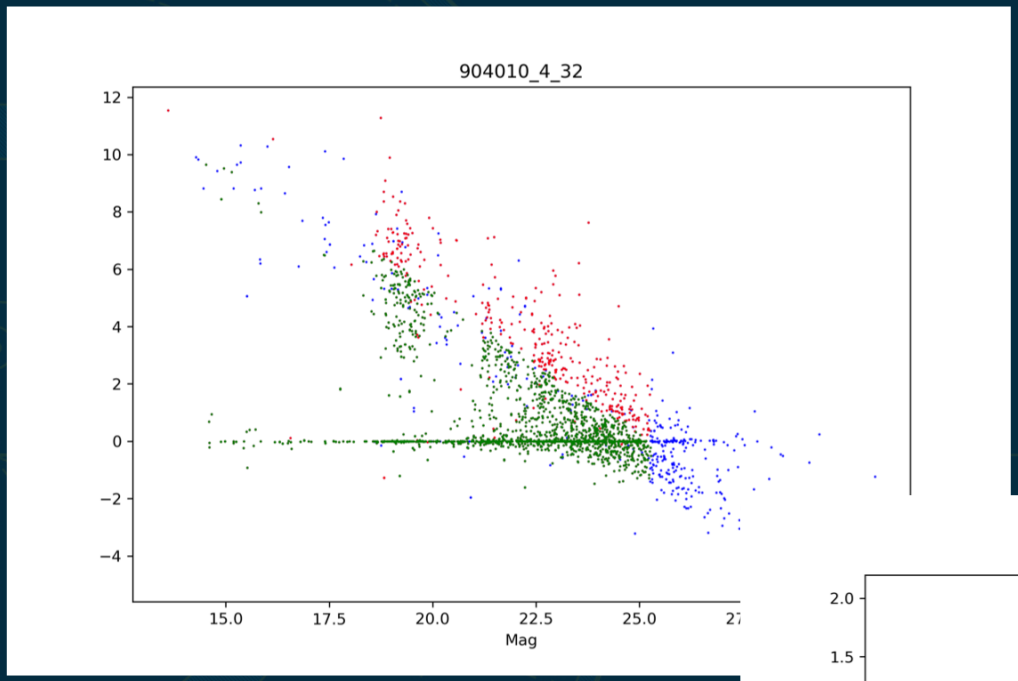


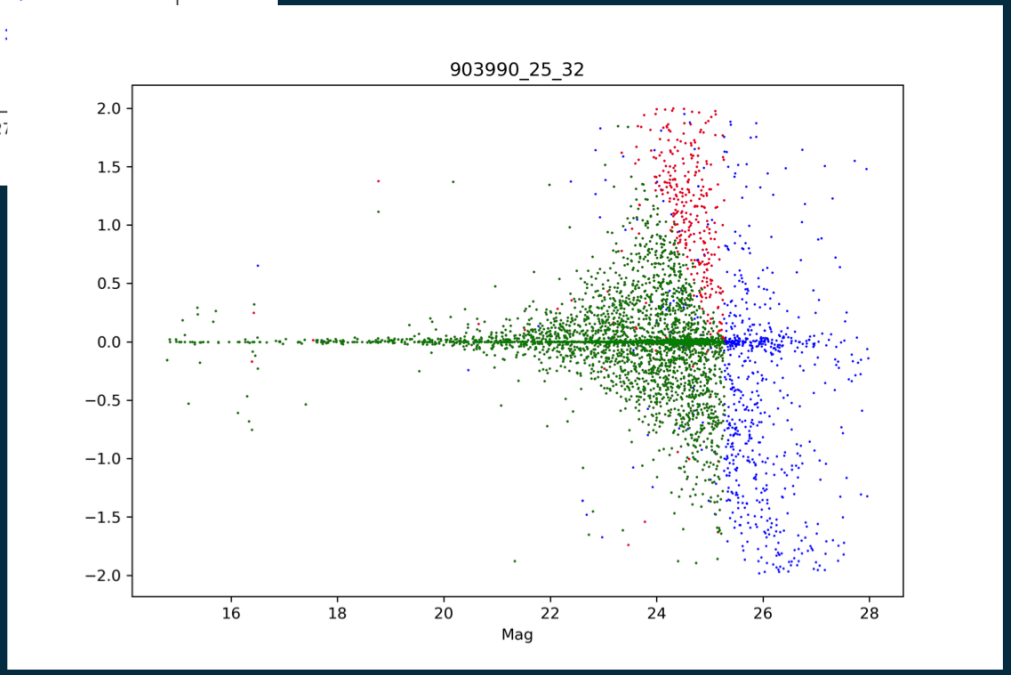
Source/Object level comparisons



Source/Object level comparisons

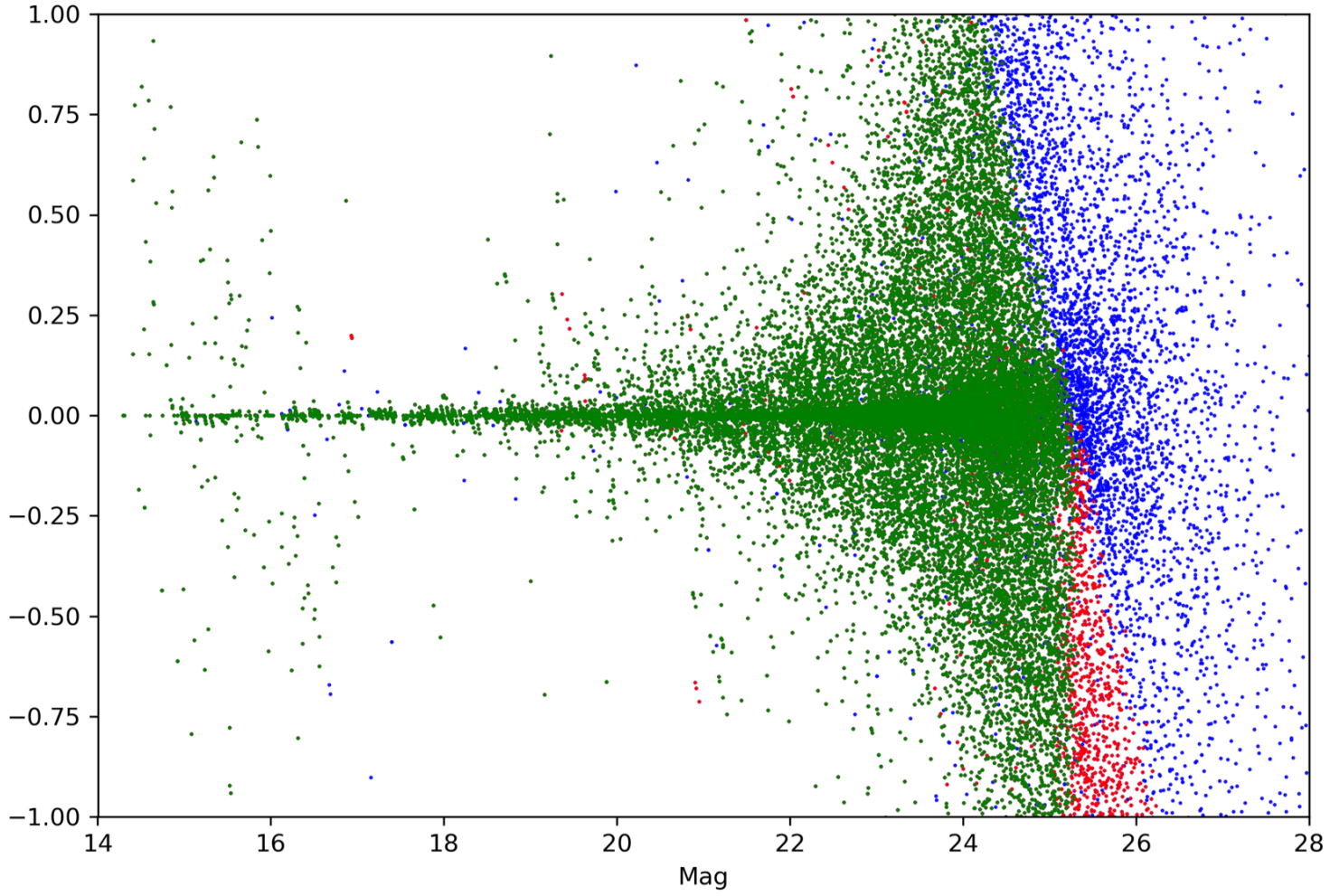



904010_4_32
12
10
8
6
4
2
0
−2
−4
15.0
17.5
20.0
22.5
25.0
Mag

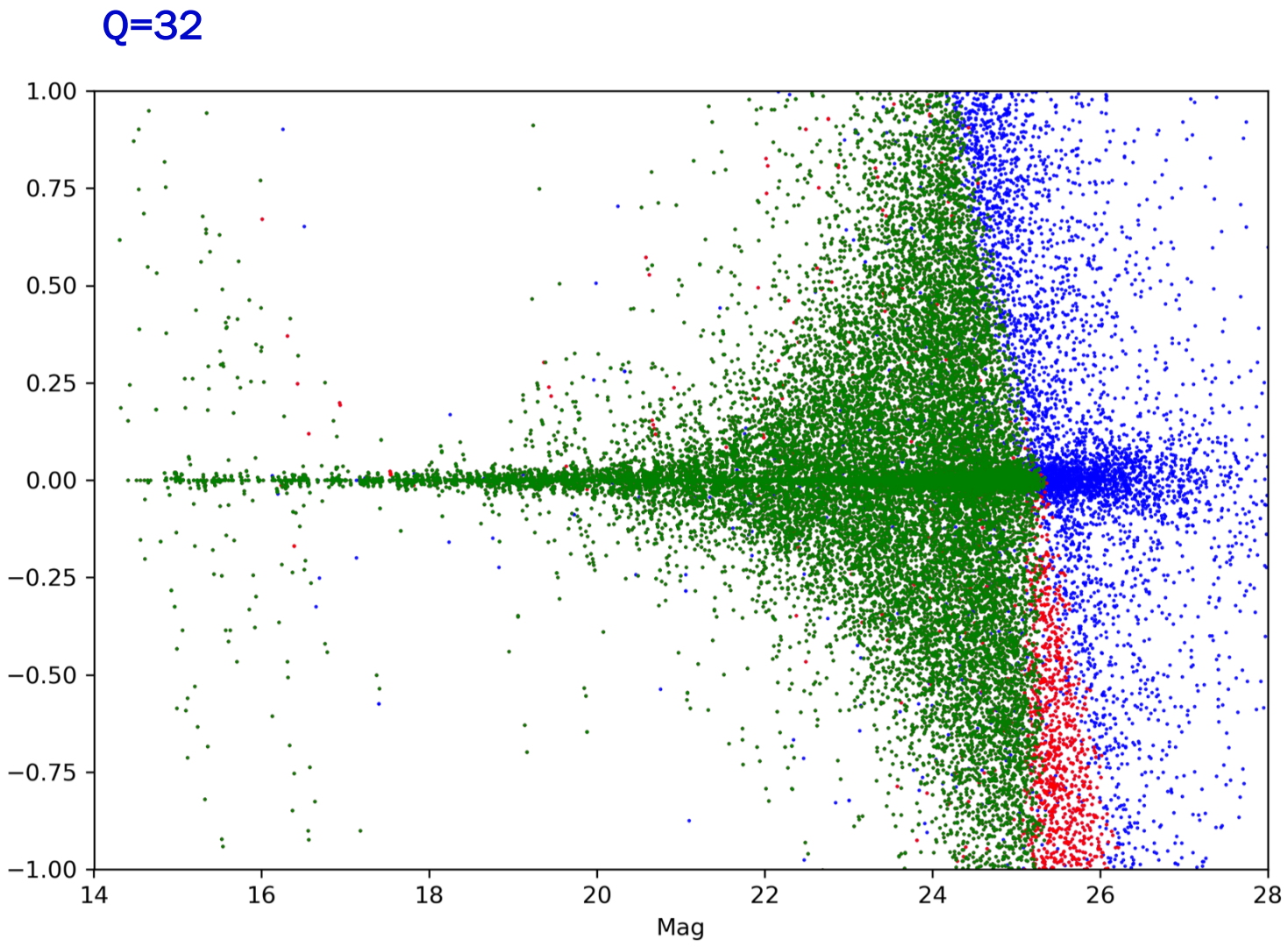

903990_25_32
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
16
18
20
22
24
26
28
Mag

Source/Object level comparisons

Q=4

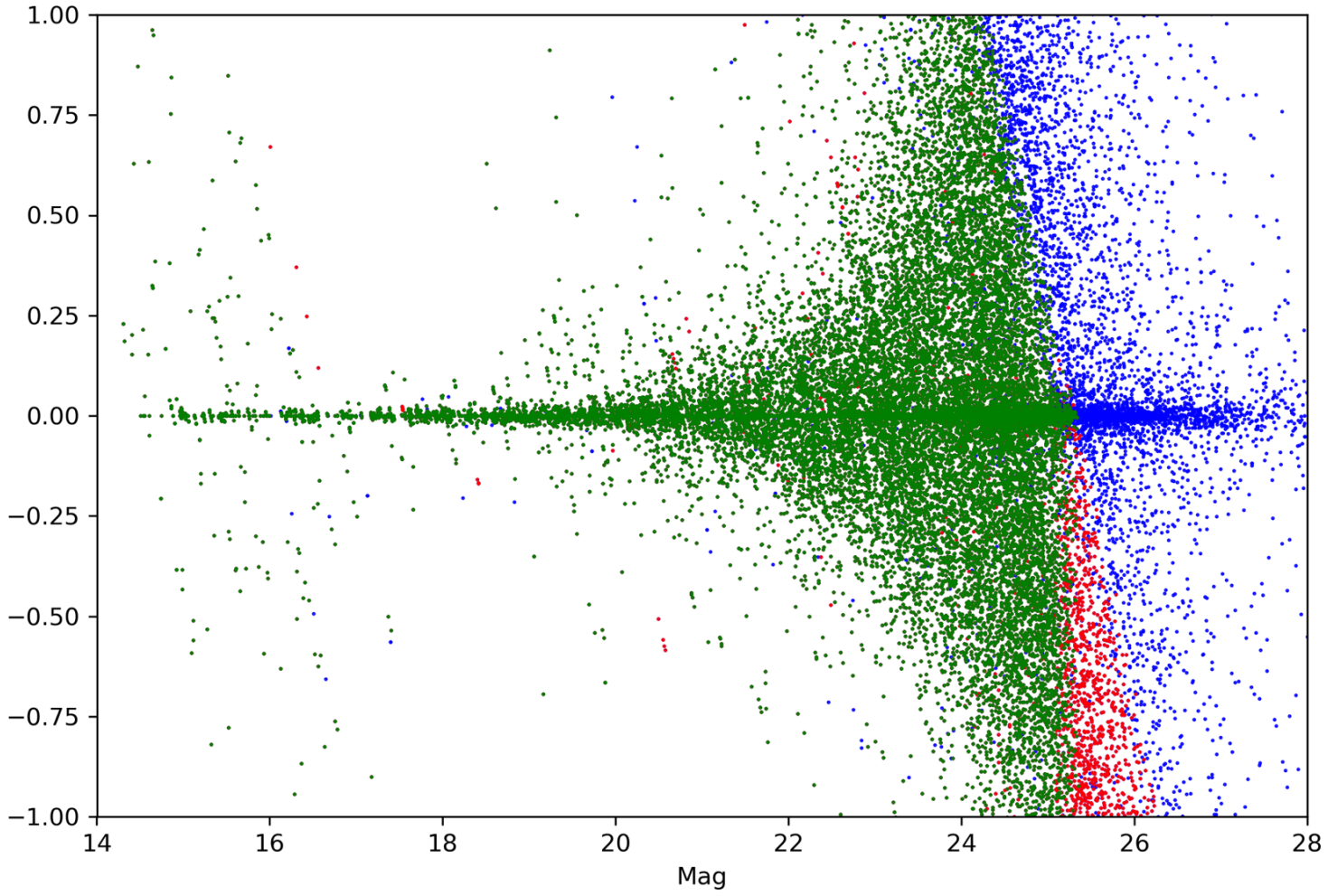


Source/Object level comparisons



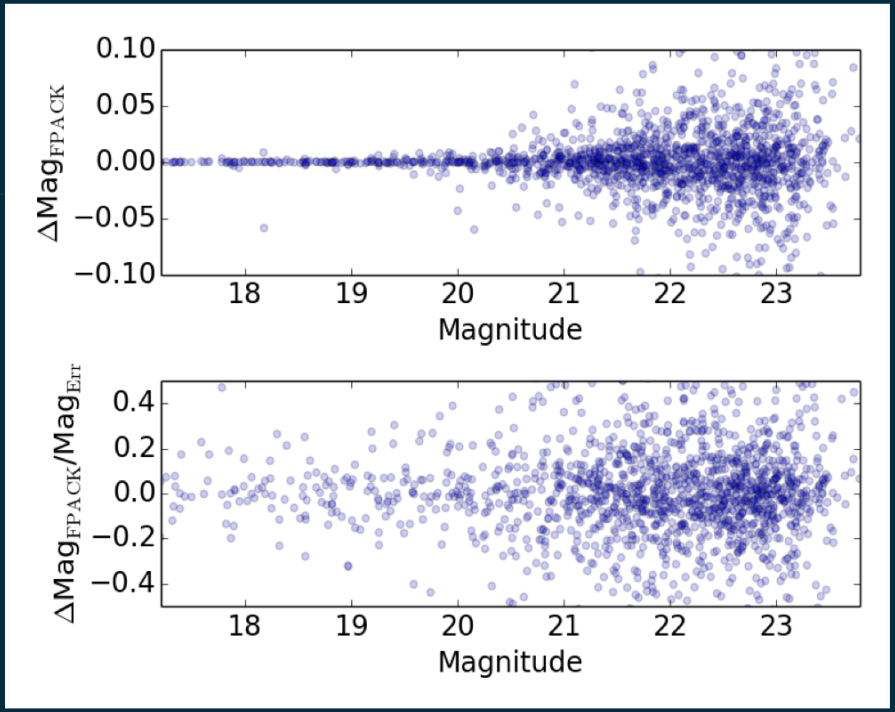
Source/Object level comparisons

Q=128



Catalog Performance (DES)

- Detrend image & mask artifacts
- Catalog objects
- FPACKed and unpacked image
- Made another catalog
- Difference
  - RMS ~ 0.2*Mag_{Err} for q = 4
  - Increases Mag_{Err} 2% in quadrature
- Lose ~1% of sources
- Gain ~1% new sources
- Similar population to outliers



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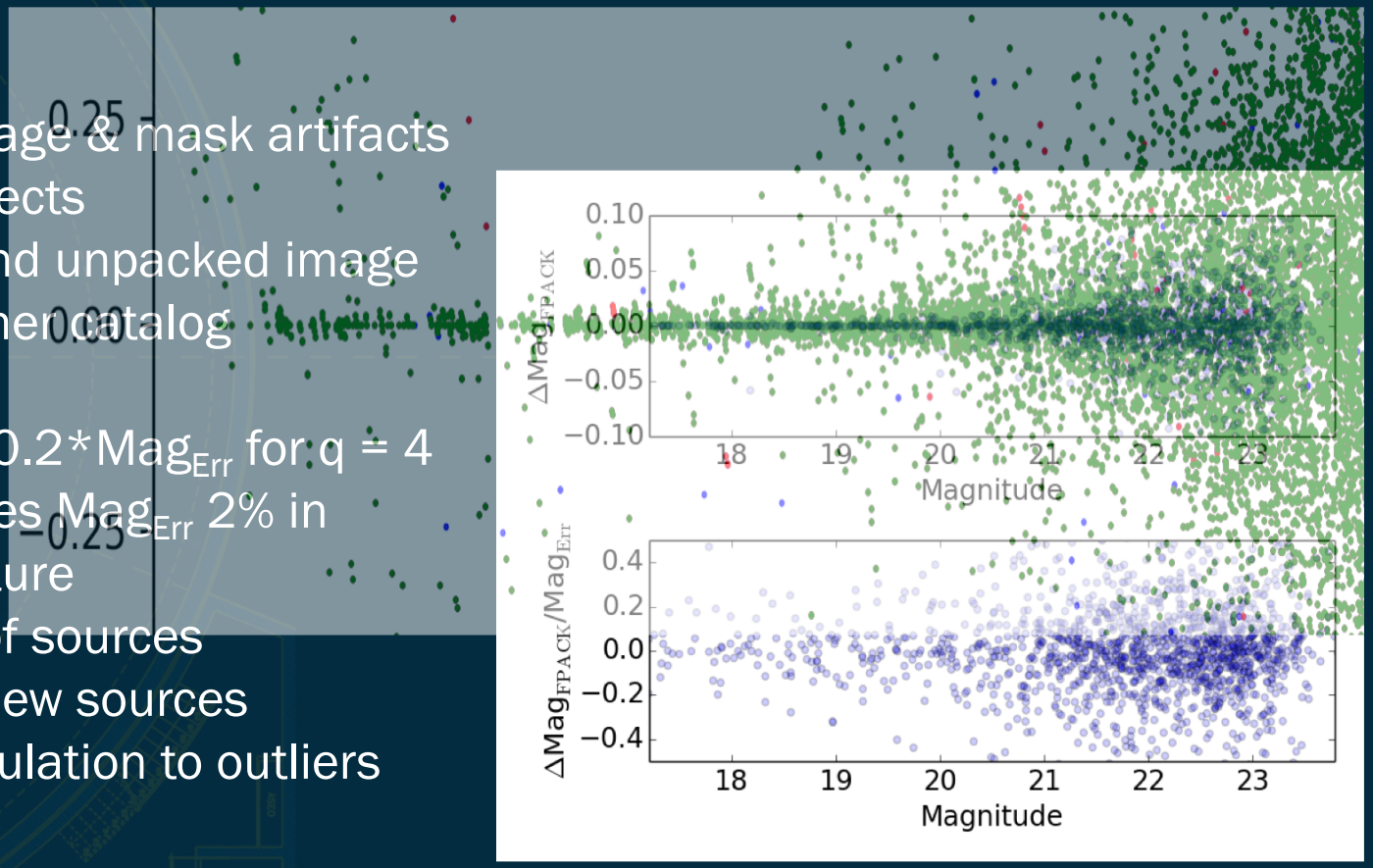

Algorithmic Benchmarks

TABLE 1: Compression Factor Achieved

q	gzip	pigz	bzip2	pbzip2	lbzip2	lz4	lzop	zstd	zstdb
q4	6.73	6.73	9.96	9.95	9.96	3.69	3.11	6.29	6.29
q8	5.54	5.53	8.20	8.20	8.21	3.34	2.96	5.42	5.42
q16	4.69	4.69	5.41	7.01	7.03	3.11	2.82	4.82	4.82
q32	4.04	4.03	6.14	6.14	6.14	2.93	2.66	4.35	4.35
q64	3.62	3.62	5.47	5.47	5.48	2.82	2.47	3.94	3.94
q128	3.38	3.37	4.88	4.88	4.88	2.66	2.32	3.56	3.57
vanilla	1.71	1.71	1.80	1.80	1.80	1.50	1.49	1.72	1.72

TABLE 2: Time to Compress per File

q	gzip	pigz	bzip2	pbzip2	lbzip2	lz4	lzop	zstd	zstdb
q4	4.45	1.18	5.00	1.42	0.85	0.21	0.24	0.36	0.12
q8	6.06	1.64	4.91	1.39	0.82	0.21	0.24	0.42	0.15
q16	8.27	2.24	4.33	1.39	0.82	0.27	0.27	0.55	0.18
q32	10.30	2.76	5.27	1.42	0.79	0.24	0.27	0.58	0.21
q64	11.79	3.00	5.39	1.52	0.88	0.24	0.30	0.61	0.24
q128	12.76	3.21	5.91	1.61	0.94	0.27	0.30	0.67	0.21
vanilla	3.36	0.97	8.94	2.79	1.58	0.15	0.12	0.30	0.15

TABLE 3: Time so Decompress per File

q	gzip	pigz	bzip2	pbzip2	lbzip2	lz4	lzop	zstd	zstdb
q4	0.21	0.24	2.30	1.21	1.27	0.15	0.18	0.27	0.24
q8	0.24	0.27	2.33	1.12	1.24	0.18	0.18	0.27	0.27
q16	0.27	0.27	2.02	1.12	1.21	0.18	0.18	0.27	0.24
q32	0.30	0.30	2.42	1.24	1.24	0.15	0.18	0.27	0.24
q64	0.30	0.30	2.42	1.27	1.09	0.18	0.21	0.27	0.27
q128	0.30	0.33	2.82	1.30	1.24	0.24	0.21	0.30	0.27
vanilla	0.39	0.36	4.36	1.48	1.27	0.15	0.12	0.24	0.24