

PS1 Sample queries

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Get high-fidelity stars in given area

Goal/Description

We want to get all objects with R degrees of a given position that are high fidelity stellar-like objects.

We get all objects within 0.2 degree of RA=334.0 and Dec=0.0 which have mean magnitudes in griz (i.e. at least 1 detection in each band that can be used for the mean mag). In addition, we require QfPerfect>0.85 in all bands. We select stars with the difference between Kron and PSF magnitude as described [here](#).

Note that **the search radius is in arcminutes**. This is a recent change in the interface to make the PS1 database functions consistent with those used for SDSS, GALEX, Kepler, the HSC, and other MAST catalogs.

Tables used

- MeanObjectView
- [StackObjectAttributes](#)

Query

```
SELECT o.objID,
o.raMean, o.decMean, o.raMeanErr, o.decMeanErr,
o.qualityFlag,
o.gMeanPSFMag, o.gMeanPSFMagErr, o.gMeanPSFMagNpt,
o.rMeanPSFMag, o.rMeanPSFMagErr, o.rMeanPSFMagNpt,
o.iMeanPSFMag, o.iMeanPSFMagErr, o.iMeanPSFMagNpt,
o.zMeanPSFMag, o.zMeanPSFMagErr, o.zMeanPSFMagNpt,
o.yMeanPSFMag, o.yMeanPSFMagErr, o.yMeanPSFMagNpt,
o.rMeanKronMag, o.rMeanKronMagErr,
o.nDetections, o.ng, o.nr, o.ni, o.nz,o.ny,
o.gFlags, o.gQfPerfect,
o.rFlags, o.rQfPerfect,
o.iFlags, o.iQfPerfect,
o.zFlags, o.zQfPerfect,
o.yFlags, o.yQfPerfect,
soa.primaryDetection, soa.bestDetection
INTO mydb.[HighFidelityStarsDR2]
FROM dbo.fGetNearbyObjEq(334, 0.0, 0.2*60.0) as x
JOIN MeanObjectView o on o.ObjID=x.ObjId
LEFT JOIN StackObjectAttributes AS soa ON soa.objID = x.objID
WHERE o.nDetections>5
AND soa.primaryDetection>0
AND o.gQfPerfect>0.85 and o.rQfPerfect>0.85 and o.iQfPerfect>0.85 and o.zQfPerfect>0.85
AND (o.rmeanpsfmag - o.rmeankronmag < 0.05)
```

Results

696 objects, here are the first 10:

107763340 006509592	334.00 067427	-0.19 2394 01	0.0 0192	0.0 0245	60	19.6313	0.00 7621	14	18.36 53	0.0 065 28	15	17.24 44	0.0 023 47	26	16.72 25	0.0 024 55	12	16.48 51	0.0 158 98	13	18.46 99	0.0 097 61	93	16	17	34	12	14	11 50 00	0.99 98 73	11 50 00	0.99 92 91	11 50 00	0.99 96 34	11 50 00	0.99 90 44	11 50 00	0.99 90 00	1	1		
107763340 149672418	334.01 502523	-0.19 8394 02	0.0 0518	0.0 0285	52	21.9751	0.08 3929	3	20.79 48	0.0 316 93	15	19.64 86	0.0 130 22	17	19.11 14	0.0 128 57	12	18.80 21	0.0 265 64	14	20.98 95	0.0 536 47	65	3	15	20	13	14	11 50 00	0.99 94 62	11 50 00	0.99 96 44	11 50 00	0.99 90 03	11 50 00	0.99 96 28	11 50 00	0.99 89 82	1	1		
107763340 365446394	334.03 656773	-0.19 51062	0.0 2425	0.0 2707	52	21.8092	0.06 2935	6	21.32 68	0.0 751	12	21.09 11	0.0 276 63	24	20.51 95	0.0 4418	10	19.35 65	0.0 003 43	1	21.41 59	0.0 682 16	63	8	14	29	10	2	16 89 22	0.99 93 25	11 50 00	0.99 90 06	11 50 00	0.99 90 03	11 50 00	0.99 96 32	16	0.99 91 82	1	1		
107773339 339718616	333.93 399766	-0.18 4857 65	0.0 0422	0.0 0798	60	21.0967	0.05 7864	12	19.896	0.0 112 42	12	18.614	0.0 0688	29	18.02 34	0.0 046 13	10	17.77 39	0.0 225 77	9	20.01 17	0.0 311 77	85	12	12	37	12	12	11 50 00	0.99 94 04	11 50 00	0.99 90 15	11 50 00	0.99 90 00	11 50 00	0.99 95 15	11 50 00	0.99 95 26	1	1		
107773339 418197028	333.94 187857	-0.18 6141 46	0.0 1971	0.0 3959	52	21.5705	0.01 2027	2	20.981	0.0 080 91	6	20.586	0.0 2858	27	20.32 25	0.0 494 34	8	20.32 66	0.0 430 02	1	20.97 79	0.1 531 02	60	4	9	35	11	1	11 50 00	0.999	11 50 00	0.99 90 29	11 50 00	0.99 90 00	11 50 00	0.99 96 28	11 50 00	0.99 92 53	11 49 92	0.99 77 65	1	1
107773339 602519327	333.96 026447	-0.18 4273 45	0.0 0452	0.0 079	60	21.079	0.01 8093	6	19.76 09	0.0 144 22	6	18.456	0.0 046 37	21	17.86 12	0.0 060 05	10	17.60 79	0.0 353 27	6	19.82 38	0.0 158 97	65	8	11	25	10	11	11 50 00	0.99 91 68	11 50 00	0.99 90 58	11 50 00	0.99 90 13	11 50 00	0.99 90 12	11 50 00	0.99 92 00	11 50 00	0.99 81 33	1	1
107773339 666312601	333.96 664968	-0.18 98753	0.0 0262	0.0 0237	60	18.3317	0.00 5523	14	17.77 11	0.0 027 63	14	17.531	0.0 031 37	27	17.42 43	0.0 063 55	7	17.36 89	0.0 168 66	8	17.85 09	0.0 0506	77	14	16	29	8	10	11 50 00	0.99 94 79	11 50 00	0.99 90 42	11 50 00	0.99 90 05	11 50 00	0.99 90 86	11 50 00	0.99 90 06	1	1		
107773339 901521365	333.99 016194	-0.19 0867 22	0.0 0392	0.0 0732	52	21.9495	0.06 7887	9	20.83 39	0.0 248 21	13	19.37 54	0.0 051 45	33	18.642	0.0 1119	12	18.29 68	0.0 151	12	20.87 94	0.0 820 54	81	9	14	33	13	12	11 50 00	0.99 90 95	11 50 00	0.99 90 07	11 50 00	0.99 90 04	11 50 00	0.99 90 28	11 50 00	0.99 90 06	11 50 00	0.99 91 11	1	1
107773339 922175058	333.99 225189	-0.18 78471	0.0 0356	0.0 2173	60	17.8118	0.00 5868	12	17.05 28	0.0 025 85	12	16.75 43	0.0 022	26	16.62 07	0.0 0568	12	16.50 89	0.0 097 86	12	17.11 91	0.0 033 35	87	14	14	31	14	14	11 50 00	0.99 97 04	11 50 00	0.99 90 42	11 50 00	0.99 90 00	11 50 00	0.99 90 77	11 50 00	0.99 92 38	11 50 00	0.99 90 07	1	1
107773340 107508029	334.01 078438	-0.18 5362 36	0.0 057	0.0 057	60	17.1406	0.00 1898	12	16.58 37	0.0 029 45	13	16.33 75	0.0 018 91	22	16.22 93	0.0 022 24	13	16.146	0.0 082 95	9	16.64 36	0.0 011 66	87	16	15	30	14	12	11 50 00	0.99 90 84	11 50 00	0.99 90 64	11 50 00	0.99 90 00	11 50 00	0.99 90 35	11 50 00	0.99 90 00	1	1		

Galaxy Candidates for K2 SN Search

Goal/Description

Query

Results

12	16	14	16	14	10	21	20	0	0	14	19	0	19	10	19	0	18	0	14	18	0	18	0	13	18	0	18	0	0	0	0	0	0	61	51	8	2	2	2	1	1	1	1	1	1									
53	3.	49	3.	49		03	03	60	07	19	02	25	01	528	26	01	63	02	14	99	01	37	01	564	69	03	03	07	09	09	09	09	20	8	61	2	66	67	25	08	06	02	1	1										
91	32	49	32	49		00	00	60	48		77	66	01		81	15	63	14	57	69	01	29			12	06	12	05	99	95	96	24	20	66	71	062	084	483	192	737	1.08	1.06	1.02	1	1									
63	03	93	02	93		93	89	89	30		03	63	63			38	97	55							68	42	66	61	66	66	66	92	92	93	576	61	66	981	062	483	887	192	737	1.08	1.06	1.02	1	1						
32	03	41	82	88		93			92																																													
03	08																																																					
96	97																																																					
12	16	14	16	14	10	20	20	0	0	14	19	0	18	0	15	0	18	0	13	19	0	18	0	14	19	0	18	0	0	0	0	0	0	53	44	5	5	4	4	2	1	1	3	27	1	1								
53	3.	49	3.	49		03	00	55	02		03	558	92	23	53	02	62	00		37	03	56	29		12	82	38	05	99	99	99	00	0	49	5	04	27	71	5	08	80	59	46	27	1	1								
91	63	58	54	58		33	38	83	04		79	66	14	74	16	72	78	25		367	37	21	86		71	72	29	01	19	57	65	23	77	15	407	787	913	588	124	763	538	33	589	605										
63	49	64	36	36	125																																																	
58	62	29	13	62	02																																																	
49	64																																																					
64																																																						
12	16	14	16	14	8	20	20	0	0	14	20	0	19	0	15	0	19	0	11	19	0	18	0	8	19	0	18	0	0	0	0	0	0	53	44	5	5	4	4	2	2	2	1	1	3	27	1	1						
53																																																						

11 87 91 64 36 48 70 43 45	16 4 36 48 99 64 27	8 99 48 99 54 27	16 4 36 48 99 64 27	8 99 48 99 54 27	12	19 14 29	0 05 26 52	18 22 54	0 01 775	10	18 15 85	0 04 72 54	17 04 19 22	0 01 06 84	24	17 83 59	0 01 45 82	16 73 99	0 00 64 93	15	17 529 42 07	0 03 42 07	16 475 63 07	12	17 38 21	0 03 26 85	16 52 17	0 01 67 94	0 09 25	0 09 27	0 09 91 77	0 09 84 46	61	51 20 24 576	9 41 188	7 51 037	8 15 557	6 79 108	6 69 249	3 239 89	2 972 712	2 98 567	2 58 303	1 1	1			
11 87 91 64 41 68 31 19 20 47 24	16 4 41 20 68 31	8 99 51 804 73 11	16 4 41 20 73 11	8 99 51 64 07	11	20 44 82	0 04 99 55	19 99 32	0 03 12 26	10	19 45 95	0 05 50 58	19 06 36	0 03 49 54	21	19 13 87	0 00 99 42	18 69 94	0 01 29 18	18	18 90 02	0 02 81 31	18 42 24	0 01 70 08	16	18 75 51	0 03 906 34 53	18 04 84 06	0 09 24	0 09 25	0 09 95 36	0 09 96 98	0 09 90 67	53	44 49 15 712	3 239 407	3 36 128	3 61 715	2 58 874	5 26 149	1 32 37	1 90 188	1 78 232	1 067 54 819	1 1	1		
11 87 91 64 46 39 08 91 17	16 4 46 39 088 58	8 99 88 65 58	16 4 46 38 23 95	8 99 88 23 95	12	20 58 45	0 01 39 54	20 52 22	0 02 51 29	9	19 53 92	0 01 41 82	19 46 73	0 02 80 32	25	19 22 91	0 00 95 82	19 09 12	0 01 04 08	8	18 98 44	0 01 93 72	18 86 41	0 01 21 95	10	18 86 94	0 03 332 72 61	18 05 09 69	0 09 24	0 09 27	0 09 52	0 09 58	0 09 909	53	44 49 15 712	1 71 052	2 17 727	1 84 635	1 71 799	1 60 121	0 81 05 68	0 78 24 21	0 69 683 57 71	1	1			
11 23 11 67 39 03 61 25 57	16 7 39 03 65 82	3 59 34 22 92	16 7 39 03 65 82	3 59 34 26 79	10	20 61 91	0 02 88 19	20 08 52	0 03 47 35	13	19 22 42	0 01 54 24	18 60 72	0 01 99 27	30	18 65 17	0 02 91 03	18 03 81	0 01 02 67	15	18 69 67	0 02 44 08	17 833 64 86	0 01 64 86	15	18 27 45	0 05 08 07	17 59 22	0 02 94 65	0 09 42	0 09 52	0 09 18	0 09 68	0 09 97 59	61	51 20 24 576	4 49 931	5 25 92	5 923 45	6 45 203	9 71 826	1 71 36	1 89 471	2 12 116	2 27 382	2 50 151	1	1
11 23 11 67 39 03 61 25 57	16 7 39 03 65 82	3 59 34 22 92	16 7 39 03 65 82	3 59 34 26 79	10	20 61 91	0 02 88 19	20 08 52	0 03 47 35	13	19 22 42	0 01 54 24	18 60 72	0 01 99 27	30	18 65 17	0 02 91 03	18 03 81	0 01 02 67	15	18 69 67	0 02 44 08	17 833 64 86	0 01 64 86	15	18 27 45	0 05 08 07	17 59 22	0 02 94 65	0 09 42	0 09 52	0 09 18	0 09 68	0 09 97 59	61	51 20 24 576	5 75 997	6 37 828	5 77 622	5 69 946	6 93 83	1 83 295	2 14 678	1 96 195	1 98 665	1 96 887	1	1
11 23 11 67 39 27 39 51 35	16 7 39 09 613 27	3 59 56 27 97	16 7 39 09 613 27	3 59 56 27 97	8	21 29 23	0 07 54 64	20 53 47	0 03 857	12	19 88 38	0 034 27 46	19 02 05 44	0 02 05 44	37	19 35 58	0 02 37 52	18 79 83	0 01 36 54	14	19 31 37	0 03 55 08	18 55 01	0 02 55 01	12	18 91 65	0 03 51 94	18 19 12	0 03 99 55	0 09 96 03	0 09 97 02	0 09 90 66	53	44 49 15 712	2 69 325	3 55 384	2 87 281	3 02 684	13 9 143 11 87	0 82 11	1 09 999	1 06 384	1 13 938	-9 99	1	1		

Obtain lightcurves for a given set of objects

Goal/Description

The goal is to obtain light curves for a list of objects. The list of objects with their RA/Dec position is uploaded into Mydb, the PS1 objects are identified, and then the light curves are obtained. Here we upload a list of 13 RR Lyrae stars from the Catalina sky survey into mydb.[RRLcatalina]

Query #1: Match Catalina RR Lyrae stars to PS1 objects

We search for objects in the PS1 DB that are within 3 arcsec of the Catalina positions. Most of the parameters (mean mags, # of detections, etc) we get from the MeanObjectView table. We also join the StackObjectAttributes table in order to get primaryDetection and bestDetection (BestDetection is corrupted in DR2, but will be fixed in DR2.1, see the description of StackObjectThin table for a more detailed description). These RR Lyrae stars are bright, thus we can expect many detections, and we therefore require o.nDetections>5. We only want to use objects for which the majority of pixels were not masked, thus the cut on QFperfect>=0.95. In order to select only stars (and exclude galaxies), we require (o.rmeanpsfmag - o.rmeankronmag)< 0.05, as described here.

```

SELECT d.CSS_ID, d.RA as CSSRA, d.Dec as CSSDec, d.V, d.Period, d.Amp, d.Npts, d.Dist, d.Red, d.CSIDnum,
o.objID,
o.raMean, o.decMean, o.raMeanErr, o.decMeanErr,
o.qualityFlag,
o.gMeanPSFMag, o.gMeanPSFMagErr, o.gMeanPSFMagNpt,
o.rMeanPSFMag, o.rMeanPSFMagErr, o.rMeanPSFMagNpt,
o.iMeanPSFMag, o.iMeanPSFMagErr, o.iMeanPSFMagNpt,
o.zMeanPSFMag, o.zMeanPSFMagErr, o.zMeanPSFMagNpt,
o.yMeanPSFMag, o.yMeanPSFMagErr, o.yMeanPSFMagNpt,
o.rMeanKronMag, o.rMeanKronMagErr,
o.nDetections, o.ng, o.nr, o.ni, o.nz,o.ny,
o.gFlags, o.gQfPerfect,
o.rFlags, o.rQfPerfect,
o.iFlags, o.iQfPerfect,
o.zFlags, o.zQfPerfect,
o.yFlags, o.yQfPerfect,
soa.primaryDetection, soa.bestDetection
  INTO mydb.[RRLPS1]
  FROM mydb.[RRLcatalina] d
CROSS APPLY dbo.fGetNearbyObjEq(d.RA, d.Dec, 3.0/60.0) as x
JOIN MeanObjectView o on o.objID=x.objID
LEFT JOIN StackObjectAttributes AS soa ON soa.objID = x.objID
WHERE o.nDetections>5
AND soa.primaryDetection>0
AND o.gQfPerfect>0.85 and o.rQfPerfect>0.85 and o.iQfPerfect>0.85 and o.zQfPerfect>0.85
AND (o.rmeanpsfmag - o.rmeankronmag < 0.05)

```

Results (25 minutes)

There are 12 out of 13 matches, and below are the first 10 entries

C S S _J 22 03 09 . 8+ 05 16 33	33 0. 79 097	5. 27 593	16 68 86 98	0. 63 86 98	0. 38	294 15 62	0. 057	11 04 11 80 64 018	11 43 33 30 79 10 21 16 43	33 0. 79 59 125	5. 27 59 626	0. 00 217 427	0. 00 427	60	17 06 65	0. 00 33 94	5	16 68 73	0. 00 20 55	3	16 59 98	0. 01 256	17	16 49 21	0. 01 88 82	8	16 54 24	0. 01 22 65	12	16 72 16	0. 00 79 11	75	12	7	28	11	17	11 50 00	0. 99 94 97	11 50 00	0. 99 92 65	11 50 00	0. 99 96 39	11 50 00	0. 99 96 97	11 50 00	0. 99 96 78	1
C S S _J 22 19 49 . 2- 02 40 20	33 4. 95 521	-2 67 224	16 51 94 91	0. 70 94 91	0. 37	249 14 12	0. 085	10 01 12 00 04 060	10 47 93 34 95 46 54 43 34 47	33 4. 95 67 25 015	-2 67 25 015	0. 03 063 043	0. 02 043	60	16 74 44	0. 00 61 59	5	16 46 11	0. 00 67 58	6	16 47 71	0. 00 44 79	13	16 37 52	0. 00 56 38	7	16 35 94	0. 01 81 96	7	16 50 58	0. 00 37 76	63	8	11	23	10	11	11 50 00	0. 99 96 46	11 50 00	0. 99 98 25	11 50 00	0. 99 96 72	11 50 00	0. 99 87 27	11 50 00	0. 99 93 31	1
C S S _J 22 05 59 . 8- 02 39 49	33 1. 49 951	-2 66 365	18 11 365	0. 53 717	0. 89	234 27 82	0. 152	10 01 11 80 04 001	10 48 03 31 96 69 23 60	33 1. 49 66 38 05 67	-2 66 38 05 67	0. 00 559 857	0. 00 857	52	18 65 98	0. 03 43 48	7	18 44 56	0. 03 26 74	8	18 08 95	0. 03 00 17	19	17 92 96	0. 04 67 95	10	17 99 23	0. 00 375	9	18 48 06	0. 02 48 47	67	12	12	21	12	10	11 50 00	0. 99 91 29	11 50 00	0. 99 93 10	11 50 00	0. 99 96 38	11 50 00	0. 99 92 17	11 50 00	0. 99 87 98	1
C S S _J 22 04 57 . 2- 05 14 11	33 1. 23 867	-5 23 656	15 64 643	0. 53 643	0. 75	173 9. 67	0. 06	10 04 11 80 31 10 930	10 17 13 23 88 67 55 94 78 63 86	33 1. 23 23 88 82	-5 67 469 529	0. 00 469 529	0. 00 529	60	16 27 17	0. 02 75 81	6	15 59 56	0. 03 394	6	15 88 79	0. 03 45 06	12	15 89 23	0. 01 70 74	3	15 85 42	0. 00 79 46	5	15 73 68	0. 07 63 47	73	16	14	24	10	9	11 50 00	0. 99 96 81	11 50 00	0. 99 93 84	11 50 00	0. 99 95 01	11 50 00	0. 99 87 61	11 50 00	0. 99 79 96	1

C S S _J 21 56 02 . 1- 05 20 21	32 9. 00	-5 . 33	16 . 51	0. 75 58	0. 47	218 . 14	17 . 77	0. 036	10 04 11	10 15 93	32 9. 33	-5 . 01	0. 01 67	0. 01 841	60	16 . 84	0. 00 78	6	16 . 42	0. 02 20	15	16 . 37	0. 00 80	15	16 . 34	0. 00 35	8	16 . 37	0. 01 80	11	16 . 48	0. 02 34	72	10	16	22	12	12	11 50 00	0. 99 99	11 50 00	0. 99 96	11 50 00	0. 99 94	11 50 00	0. 99 91	11 50 00	0. 99 94	1
C S S _J 22 08 20 . 9- 02 02 22	33 2. 08	-2 . 03	17 . 01	0. 56 16	0. 95	263 . 17	17 . 61	0. 092	10 01 11	10 55 03	33 2. 08	-2 . 21	0. 00 27	0. 01 02	60	17 . 75	0. 00 38	8	17 . 382	0. 00 89	13	17 . 16	0. 03 364	23	17 . 17	0. 00 74	4	16 . 94	0. 01 34	4	17 . 38	0. 00 94	80	14	21	29	8	8	11 50 00	0. 99 96	11 50 00	0. 99 92	11 50 00	0. 99 98	11 50 00	0. 99 88	11 50 00	0. 99 96	1
C S S _J 22 27 07 . 9+ 05 12 59	33 6. 78	5. 21 646	16 . 19	0. 55 25	0. 73	275 . 11	11 . 29	0. 173	11 04 12	11 42 03	33 6. 78	5. 21 64	0. 00 177	0. 00 188	60	16 . 33	0. 00 62	6	16 . 22	0. 11 75	7	16 . 27	0. 01 69	25	16 . 16	0. 02 45	9	16 . 084	0. 02 85	9	16 . 28	0. 13 48	87	13	15	36	12	11	11 50 00	0. 99 95	11 50 00	0. 99 89	11 50 00	0. 99 96	11 50 00	0. 99 92	11 50 00	0. 99 85	1
C S S _J 21 54 35 . 8- 00 54 50	32 8. 64	-0 . 91	17 . 75	0. 57 52	0.9	257 . 24	24 . 14	0. 126	10 01 11	10 69 03	32 8. 64	-0 . 91	0. 00 219	0. 00 138	52	18 . 14	0. 07 48	7	17 . 87	0. 05 72	10	17 . 61	0. 04 20	17	17 . 76	0. 11 41	9	17 . 669	0. 01 11	10	17 . 90	0. 06 23	75	12	12	26	13	12	11 50 00	0. 99 96	11 50 00	0. 99 93	11 50 00	0. 99 92	11 50 00	0. 99 96	11 50 00	0. 99 90	1
C S S _J 22 29 42 . 0- 04 05 19	33 7. 42	-4 . 08	18 . 08	0. 47 56	1. 19	230 . 29	29 . 63	0. 067	10 04 12	10 30 03	33 7. 42	-4 . 08	0. 00 245	0. 00 194	52	18 . 838	0. 02 24	9	18 . 552	0. 01 008	8	18 . 50	0. 01 38	14	18 . 23	0. 11 88	8	18 . 34	0. 01 94	10	18 . 63	0. 01 17	82	14	16	26	12	14	11 50 00	0. 99 95	11 50 00	0. 99 95	11 50 00	0. 99 94	11 50 00	0. 99 96	11 50 00	0. 99 935	1
C S S _J 22 31 05 . 2+ 00 05 38	33 7. 77	0. 09 404	16 . 97	0. 67 02	0.4	278 . 17	17 . 7	0. 071	11 01 12	10 81 13	33 7. 77	0. 09 39	0. 01 024	0. 01 061	60	17 . 19	0. 01 30	7	16 . 98	0. 00 65	14	16 . 87	0. 01 28	30	16 . 84	0. 01 55	8	16 . 74	0. 01 12	9	17 . 02	0. 00 59	94	14	22	35	10	13	11 50 00	0. 99 95	11 50 00	0. 99 96	11 50 00	0. 99 97	11 50 00	0. 99 91	11 50 00	0. 99 96	1

Query #2: Get the detections

Now we get all detections associated with these objIDs

```

SELECT
o.objID, o.raMean, o.decMean,
d.ra, d.dec, d.raErr, d.decErr,
d.detectID, d.obstime, d.exptime, d.airmass, d.psfflux, d.psffluxErr, d.psfQf, d.psfQfPerfect, d.psfLikelihood,
d.psfChiSq, d.extNSigma, d.zp, d.apFlux, d.apFluxErr,
d.imageID, d.filterID,
d.sky, d.skyerr, d.infoflag, d.infoflag2, d.infoflag3,
o.qualityFlag,
o.gMeanPSFMag, o.gMeanPSFMagErr, o.gMeanPSFMagNpt,
o.rMeanPSFMag, o.rMeanPSFMagErr, o.rMeanPSFMagNpt,
o.iMeanPSFMag, o.iMeanPSFMagErr, o.iMeanPSFMagNpt,
o.zMeanPSFMag, o.zMeanPSFMagErr, o.zMeanPSFMagNpt,
o.yMeanPSFMag, o.yMeanPSFMagErr, o.yMeanPSFMagNpt,
o.rMeanKronMag, o.rMeanKronMagErr,
o.nDetections, o.ng, o.nr, o.ni, o.nz,o.ny,
o.gFlags, o.gQfPerfect,
o.rFlags, o.rQfPerfect,
o.iFlags, o.iQfPerfect,
o.zFlags, o.zQfPerfect,
o.yFlags, o.yQfPerfect,
o.primaryDetection, o.bestDetection
INTO mydb.[RRLPS1det]
FROM mydb.[RRLPS1] o
JOIN Detection d on d.objID = o.objID

```

Results (30 seconds)

There are 946 detection entries for the 12 objects, and below are the first 10 entries

10	17	31	23	88	88	78	63	86	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	1.	23	88	67	88	82	94	-5	33	
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[illegible]

Query #1: Get the ObjID for the star

```

SELECT
o.objID,
o.raMean, o.decMean, o.raMeanErr, o.decMeanErr,
o.qualityFlag,
o.gMeanPSFMag, o.gMeanPSFMagErr, o.gMeanPSFMagNpt,
o.rMeanPSFMag, o.rMeanPSFMagErr, o.rMeanPSFMagNpt,
o.iMeanPSFMag, o.iMeanPSFMagErr, o.iMeanPSFMagNpt,
o.zMeanPSFMag, o.zMeanPSFMagErr, o.zMeanPSFMagNpt,
o.yMeanPSFMag, o.yMeanPSFMagErr, o.yMeanPSFMagNpt,
o.rMeanKronMag, o.rMeanKronMagErr,
o.nDetections, o.ng, o.nr, o.ni, o.nz,o.ny,
o.gFlags, o.gQfPerfect,
o.rFlags, o.rQfPerfect,
o.iFlags, o.iQfPerfect,
o.zFlags, o.zQfPerfect,
o.yFlags, o.yQfPerfect
  INTO mydb.[RRL_584630948352256_PS1]
FROM dbo.fGetNearbyObjEq(46.341468915923, 1.54199810825252, 1.0/60.0) as x
JOIN MeanObjectView o on o.ObjID=x.ObjID

```

Results (1 entry, < 1 min)

objID	ra Mean	dec Mean	raMeanErr	decMeanErr	quality Flag	gMeanPSF Mag	gMeanPSFMagErr	gMeanPSFMagNpt	rMeanPSFMag	rMeanPSFMagErr	rMeanPSFMagNpt	iMeanPSFMag	iMeanPSFMagErr	iMeanPSFMagNpt	zMeanPSFMag	zMeanPSFMagErr	zMeanPSFMagNpt	yMeanPSFMag	yMeanPSFMagErr	yMeanPSFMagNpt	rMeanKron Mag	rMeanKronMagErr	n Detections	ng	nr	ni	nz	ny	g Flags	gQf Perfect	r Flags	rQf Perfect	i Flags	iQf Perfect	z Flags	zQf Perfect	y Flags	yQf Perfect
109850463414820867	46.543414146986	1.1900002168119	0.003030392000004649162	0.00392000000000075195	60	17.639998999999999	0.029890021999999999	12	17.1961994171143	0.0448860004544258	13	17.481199264	0.0493410006165504	23	17.5072889	0.057957001000051	10	17.52680019992396	0.021818001010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	11500004029750824	0.999500197378845	1150009700	0.99970032997608185	1150009500	0.999901197052	1150008900	0.99950000		

Query #2: Get the detections

```

SELECT
o.objID, o.raMean, o.decMean,
d.ra, d.dec, d.raErr, d.decErr,
d.detectID,
  d.obstime, d.exptime, d.airmass, d.psfflux, d.psffluxErr, d.psfQf,
d.psfQfPerfect, d.psfLikelihood, d.psfChiSq, d.extNSigma, d.zp,
d.apFlux, d.apFluxErr,
d.imageID, d.filterID,
d.sky, d.skyerr, d.infoflag, d.infoflag2, d.infoflag3,
o.qualityFlag,
o.gMeanPSFMag, o.gMeanPSFMagErr, o.gMeanPSFMagNpt,
o.rMeanPSFMag, o.rMeanPSFMagErr, o.rMeanPSFMagNpt,
o.iMeanPSFMag, o.iMeanPSFMagErr, o.iMeanPSFMagNpt,
o.zMeanPSFMag, o.zMeanPSFMagErr, o.zMeanPSFMagNpt,
o.yMeanPSFMag, o.yMeanPSFMagErr, o.yMeanPSFMagNpt,
o.rMeanKronMag, o.rMeanKronMagErr,
o.nDetections, o.ng, o.nr, o.ni, o.nz,o.ny,
o.gFlags, o.gQfPerfect,
o.rFlags, o.rQfPerfect,
o.iFlags, o.iQfPerfect,
o.zFlags, o.zQfPerfect,
o.yFlags, o.yQfPerfect
  INTO mydb.[RRL_584630948352256_PS1det]
FROM mydb.[RRL_584630948352256_PS1] o
JOIN Detection d on d.ObjID = o.ObjID

```

Below are the first 10 entries out of 92 total entries

[illegible]

10	46	1.	46	1.	0.	0.	21	56	40	1.	0.	2.	0.	0.	0.	1.	0.	0.	2.	0.	2.	52	2	2.	2.	10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3
98	.	54	.	54	00	00	05	20		05	00	96	99	99	90	04	11	.	68	04	79	41	69	75	2.	2.	27	74	912	.	63	02	.	04	.	04	.	04	.	50	79	.	52	18	.	21	14			
50	34	19	34	19	39	45	51	6.		87	04	14	90	90	99	83	31	.	68	04	79	41	69	75	2.	2.	27	74	912	.	63	02	.	04	.	04	.	50	79	.	52	18	.	21	14					
46	14	99	14	99	94	13	77	51		40	75	50	01	01	37	59	18	02	80	00	39	01			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
34	69	06	75	94	40	17	87	80		01	61	03	97	97	02	99	00	00	39	01					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
14	86		38		01	01	50	227		97	59	63	98	98	41	01	03	57	69	93					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
82					47	04	00			98	90	09	27	27	16	19	28	67	93	32					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
08					34	47	00			28	58	54	881	881	516	93	541	822	22	3					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
67					864	383	80			09	E-	06													10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										91	06														10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										06	00	04	99	99	.	09	.	.	00	00	61	69			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										11	05	36	92	92	54	79	59	67	05	91	61			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										69	30	29	43	43	86	49	98	88	28	00	75			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										98	63	93	97	97	17	98	34	99	33	08					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										19	59	11	46	46	00	16	02	76	70	70					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										56	96	98	85	85	53	89	49	50	26	31					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										48	25	67	669	669	48	45	06	146	48	26					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										60	E-	06												10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										24	06													10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										06	00	04	99	99	.	09	.	.	00	00	61	69			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										11	05	36	92	92	54	79	59	67	05	91	61			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										69	30	29	43	43	86	49	98	88	28	00	75			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										98	63	93	97	97	17	98	34	99	33	08					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										19	59	11	46	46	00	16	02	76	70	70					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										56	96	98	85	85	53	89	49	50	26	31					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										48	25	67	669	669	48	45	06	146	48	26					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										60	E-	06												10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										24	06													10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										06	00	04	99	99	.	09	.	.	00	00	61	69			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										11	05	36	92	92	54	79	59	67	05	91	61			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										69	30	29	43	43	86	49	98	88	28	00	75			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										98	63	93	97	97	17	98	34	99	33	08					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										19	59	11	46	46	00	16	02	76	70	70					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										56	96	98	85	85	53	89	49	50	26	31					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										48	25	67	669	669	48	45	06	146	48	26					10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										60	E-	06												10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										24	06													10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										06	00	04	99	99	.	09	.	.	00	00	61	69			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3	
										11	05	36	92	92	54	79	59	67	05	91	61			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										69	30	29	43	43	86	49	98	88	28	00	75			10	128	73	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	10	17	0.	92	14	18	3		
										98	63	93	97	97	17	98	34	99	33	08					10	128	73	60	17	0.	12	17																		

98	50	46	34	14	99	54	76	87	1.	43	1.	0.	0.	3.	0.	0.	0.	99	99	99	10	24	0.	0.	2.	42	52	16	57	1	1.	3.	1.	3.	16	0	10	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	92	14	18	30	17	13	11	0.	0.	11	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
98	50	46	34	14	99	54	76	87	1.	43	1.	0.	0.	3.	0.	0.	0.	99	99	99	10	24	0.	0.	2.	42	52	16	57	1	1.	3.	1.	3.	16	0	10	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	92	14	18	30	17	13	11	0.	0.	11	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
50	34	14	99	95	54	76	87	1.	43	1.	0.	0.	0.	3.	0.	0.	0.	99	99	99	10	24	0.	0.	2.	42	52	16	57	1	1.	3.	1.	3.	16	0	10	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	92	14	18	30	17	13	11	0.	0.	11	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
46	34	14	99	95	54	76	87	1.	43	1.	0.	0.	0.	3.	0.	0.	0.	99	99	99	10	24	0.	0.	2.	42	52	16	57	1	1.	3.	1.	3.	16	0	10	60	17	0.	12	17	0.	13	17	0.	23	17	0.	10	17	0.	92	14	18	30	17	13	11	0.	0.	11	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
34	69	06	07	45	119	12	40	28	37	37	91	12	49	48		97	02					00	99	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00	99	00</

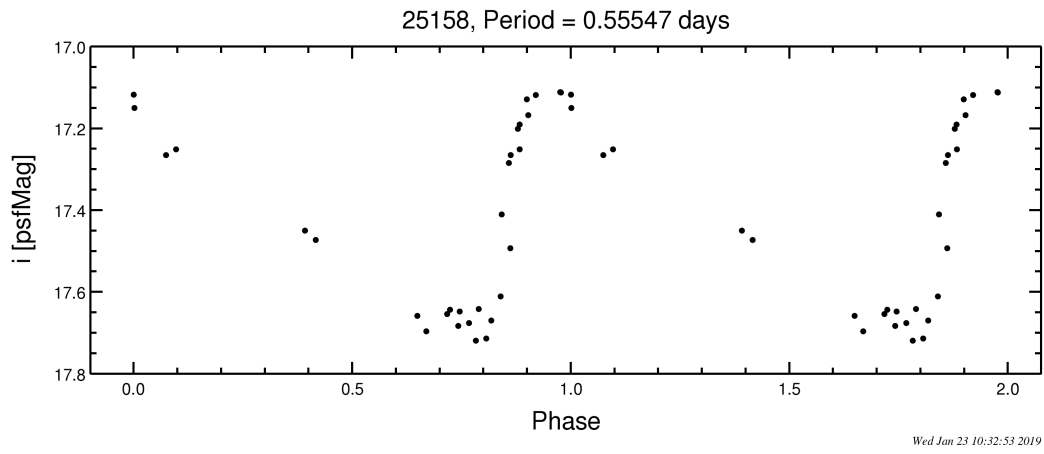
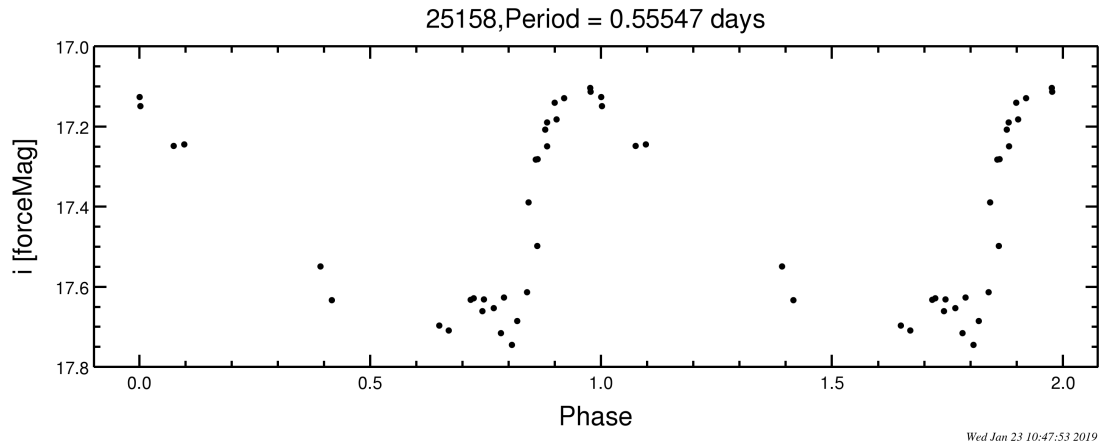


FIG. 1: PS1 i-band light curve for the RR Lyrae from aperture photometry (left panel) and PSF photometry (right) from the Detection table.

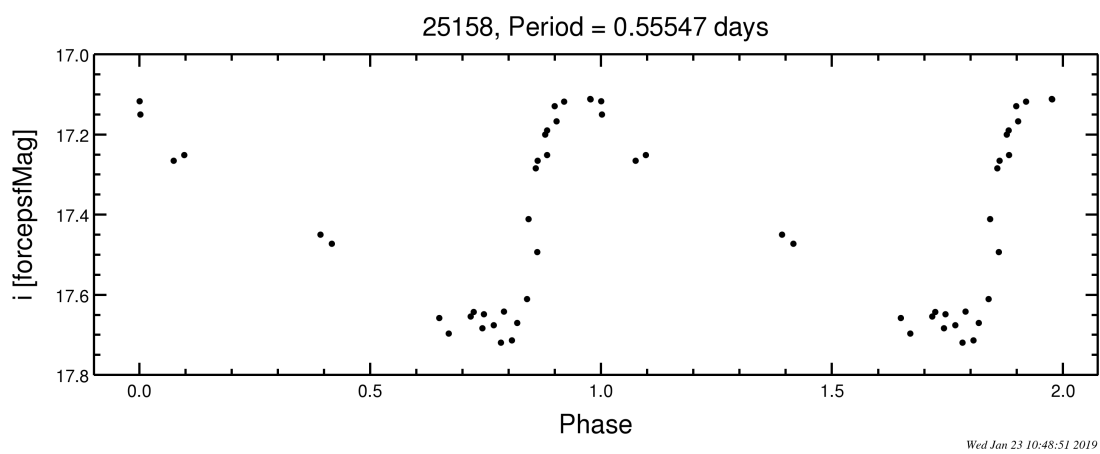
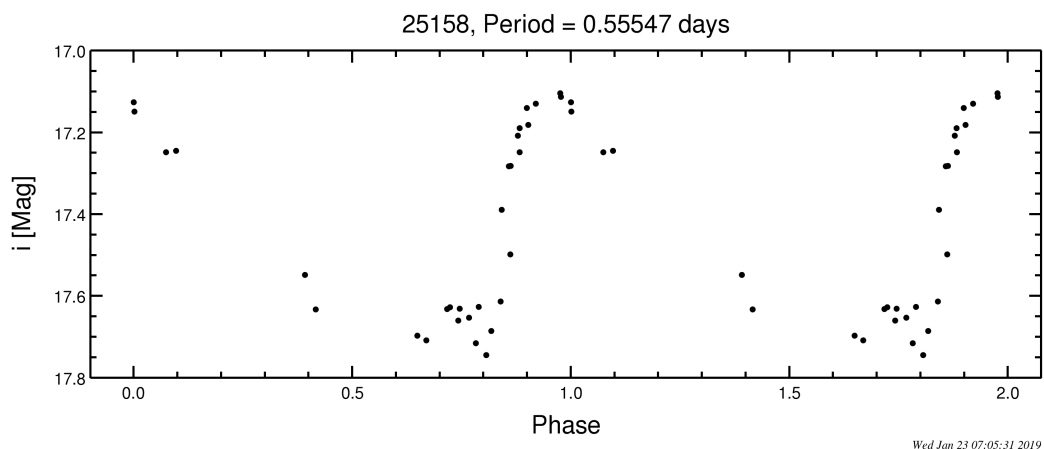
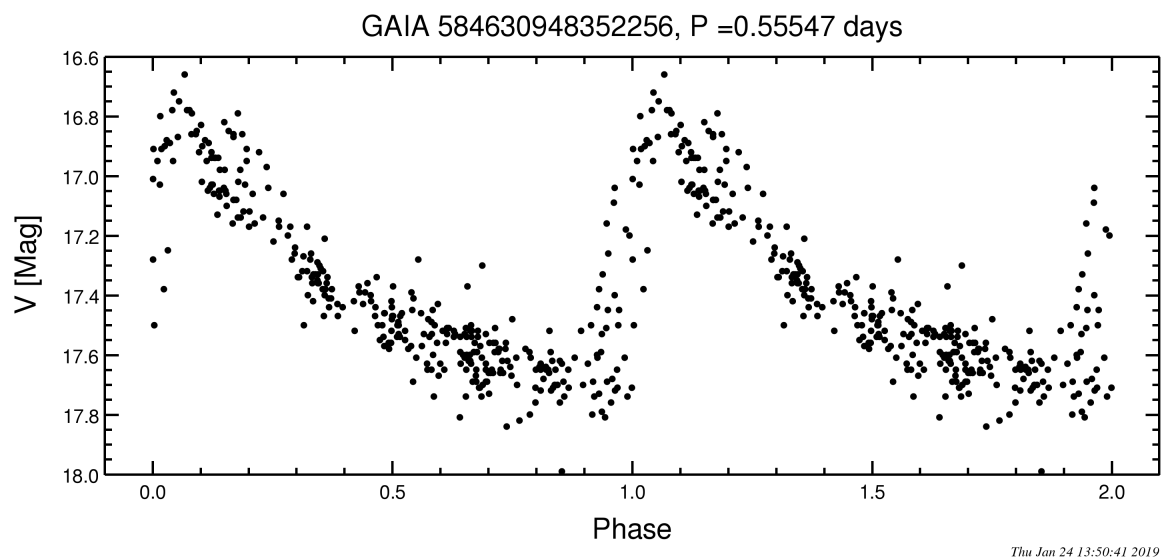


FIG. 2: PS1 i-band light curve for the same star from aperture photometry (left panel) and PSF photometry (right) from the force detection table.

As a comparison, the Catalina Sky Survey V-band light curve:



Select mean objects and associated detections within 3 deg of HDF; compare photometry and astrometry with Gaia DR2

This mini-project illustrates how to extract mean objects with predefined quality parameters and then the associated detections. The goal ultimately is to understand the astrometric properties of PanSTARRS **before** the Gaia adjustments, therefore we are interested in the original detections; forced measurements are not useful.

Step 1: Obtain mean objects in cone search, filtering for objects with a high probability of Gaia matches

We start with a cone search of ObjectThin within a 3 degree radius of the nominal HDF position (169.2,61.3). We select only mean objects with at least three detections and mean PSF magnitude $r < 21.0$ (Gaia sources are sparse at fainter magnitudes). The following search was run in CasJobs and took 8: 29, returning 192,611 objects.

```
select o.objID, o.raMean, o.decMean, o.raMeanErr, o.decMeanErr,
       o.raStack, o.decStack, o.raStackErr, o.decStackErr, o.epochMean,
       o.nDetections, o.ng, o.nr, o.ni, o.nz, o.ny, o.objInfoFlag, o.qualityFlag,
       m.gMeanPSFMag, m.rMeanPSFMag, m.iMeanPSFMag, m.zMeanPSFMag, m.yMeanPSFMag,
       m.gMeanPSFMagErr, m.rMeanPSFMagErr, m.iMeanPSFMagErr, m.zMeanPSFMagErr, m.yMeanPSFMagErr,
       m.gMeanKronMag, m.rMeanKronMag, m.iMeanKronMag, m.zMeanKronMag, m.yMeanKronMag,
       m.gFlags, m.rFlags, m.iFlags, m.zFlags, m.yFlags
into mydb.MyTable_HDF_3deg from fGetNearbyObjEq(169.20,62.30,180.0) nb
inner join ObjectThin o on o.objid=nb.objid and o.nDetections>3
inner join MeanObject m on o.objid=m.objid and o.uniquePsp0Bid=m.uniquePsp0Bid and m.rMeanPSFMag<21.0
```

The output table is 48,200 kb; here is a sample of the first few rows:

bigint [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	small int [2]	small int [2]	small int [2]	small int [2]	small int [2]	small int [2]	int [4]	tiny int [1]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	int [4]	int [4]	int [4]	int [4]					
objID	ra Mean	dec Mean	raMeanErr	decMeanErr	raStack	decStack	raStackErr	decStackErr	epoch Mean	n Detections	ng	nr	ni	nz	ny	objInfoFlag	qualityFlag	gMeanPSFMag	rMeanPSFMag	iMeanPSFMag	zMeanPSFMag	yMeanPSFMag	gMeanPSFMagErr	rMeanPSFMagErr	iMeanPSFMagErr	zMeanPSFMagErr	yMeanPSFMagErr	gMeanKronMag	rMeanKronMag	iMeanKronMag	zMeanKronMag	yMeanKronMag	gFlags	rFlags	iFlags	zFlags	yFlags
1796 8171 2835 7537 58	17 1.2 83 55 97	59 6500 73 58 63	0.003 2999 0008 6054 21	0.008 2999 9987 03599 484	17 1.2 83 56 737	59 0000 73 58 7497	0.001 0000 0004 7497 45	0.001 0000 0004 7497 45	568 87. 065 8912	72	6	17	24	12	13	50 36 35 968	60 19. 638 599 395 752	18. 609 249 139 2676	17. 447 399 523 4043	16. 921 674 200 9258	16. 674 200 9996 9834	0.00 9003 8698 9998 8174 438	0.00 4497 9998 9105 8174 592	0.00 4377 9998 0863 8174 507	0.00 8810 9998 0324 507	19. 653 664 399 6133	18. 664 199 829 1016	17. 511 400 222 7783	16. 990 499 496 46	16. 762 800 216 6748	11 50 50 11	11 50 50 11	11 50 50 11	11 50 50 11	11 50 50 11		
1818 8168 7299 1481 48	16 8.7 29 93 686	61 . 57 28 46	0.013 2200 0008 07643 19	0.014 2999 9992 2514 814	16 8.7 29 92 33	61 . 57 29 7497	0.001 0000 0004 7497 45	0.001 0000 0004 7497 45	560 67. 984 236 11	75	11	12	27	16	9	44 49 15 712	53 21. 253 200 531 0059	20. 462 699 890 1367	20. 115 600 585 9375	19. 921 500 106 8115	19. 507 600 784 3018	0.06 0488 9988 8992 31	0.05 1541 0006 0462 95	0.03 9379 5339 9178 16	0.07 9178 9963 8414 38	21. 032 400 131 2256	19. 982 799 530 0293	19. 518 299 102 7832	19. 316 999 435 4248	19. 115 800 857 5439	16 16 89 16	16 89 22 16	16 89 22 16	16 89 22 16	16 89 22 16		
1849 0165 0524 0089 66	16 5.0 52 38 444	64 . 09 01 52	0.008 9800 0039 1602 52	0.016 1300 0035 28595 038	16 5.0 52 37 86	64 . 09 01 7497	0.001 0000 0004 7497 45	0.001 0000 0004 7497 45	568 50. 597 314 81	103	9	18	41	21	14	50 36 35 968	60 14. 876 899 719 2383	44. 468 199 729 9194	332 295 500 457 7637	267 674 600 526 9775	14. 267 800 331 1157	0.00 3291 9999 2120 266	0.00 2353 9999 9655 783	0.00 2094 4273 9998 455	0.00 4273 9998 7748 265	14. 931 599 617 0044	14. 531 100 273 1323	14. 388 999 938 9648	14. 354 100 227 356	14. 297 499 656 6772	11 50 50 11	11 50 50 11	11 50 50 11	11 50 50 11	11 50 50 11		
1832 0173 2358 8632 25	17 3.2 35 97 321	62 . 66 87 87	0.013 4899 5800 83711	0.016 5800 35 97525	17 3.2 35 88 201	62 . 66 87 7497	0.001 0000 0004 7497 45	0.001 0000 0004 7497 45	561 70. 754 027 78	68	9	10	26	13	10	44 49 15 712	53 19. 226 999 282 8369	18. 673 999 906 377	18. 729 600 392 7002	18. 514 356 897 2168	18. 356 9989 5286 56	0.09 9587 1236 0009 5115	0.06 1236 0015 1115	0.11 4125 2370 0010	0.03 2370 999 999 954	16. 322 999 597 2236	15. 967 399 387 168	15. 911 100 597 5732	15. 893 300 056 4575	16. 109 600 067 1387	16 16 89 16	16 89 22 16	16 89 22 16	16 89 22 16	16 89 22 16		
1839 6166 2062 1554 29	16 6.2 06 23 493	63 . 30 39 11	0.010 1699 9967 39626	0.004 9600 0004 9322	16 6.2 06 30 584	63 . 30 39 7497	0.001 0000 0004 7497 45	0.001 0000 0004 7497 45	570 09. 841 261 57	68	6	14	22	17	9	43 65 27 104	52 20. 306 100 845 3369	19. 952 843 399 118	19. 815 850 599 212	19. 815 354 700 360	19. 468 9990 7457 4188	0.01 8285 9996 4869 83	0.01 1083 3592 0001 1938	0.01 4632 9998 9998 8631	0.09 5564 9998 8631 9297	20. 402 999 877 0889	20. 055 999 755 0781	19. 945 199 966 5254	19. 930 299 758 3105	19. 196 399 018 501	11 50 50 16	11 50 50 16	11 50 50 16	11 50 50 16	11 50 50 16		
1840 9165 2132 9162 64	16 5.2 13 17 557	63 . 41 29 31	0.039 6599 9931 09703	0.045 7100 0114 08329	16 5.2 13 15 854	63 . 41 29 7497	0.001 0000 0004 7497 45	0.001 0000 0004 7497 45	564 55. 006 773	31	4	4	8	10	5	44 49 15 712	53 21. 010 499 954 2236	19. 222 280 799 122	19. 930 354 599 212	19. 354 900 360 6465	19. 4137 8970 0046 13876	0.13 8970 9997 1920 92	0.03 4945 9997 1920 25	0.01 7548 9979 98238	0.13 7548 9979 0418 59	19. 569 434 700 241	19. 434 955 600 830	18. 620 292 088 3105	18. 292 89 018 501	16 16 22 16	16 89 22 16	16 89 22 16	16 89 22 16	16 89 22 16			

1822	16	61	0.009	0.008	16	61	0.001	0.001	568	71	9	6	24	17	15	50	60	18.	17.	17.	17.	16.	0.00	0.00	0.00	0.00	0.00	18.	17.	17.	17.	17.	11	11	11	11
9163	3.2	. 61	8700	1099	3.2	. 61	0.000	0.000	90.							36	60	520	598	183	025	903	7381	5032	3556	5563	6905	596	665	270	104	200	600	50	50	
2855	85	90	0018	9982	85	90	0004	0004	193							35		799	100	500	800	600	9998	9999	0000	9999	0001	000	100	500	200	600	00	00		
3910	44	85	3582	0590	51	85	7497	7497	043							968		636	662	289	704	692	6517	0668	9186	9118	671	097	183	363	723					
25	234	46	31	02	981	84	07	45	98									8408	2314	917	9561	749	429	893	376	397	397	3867	6563	1055	1592	2666				
1817	16	61	0.006	0.014	16	61	0.001	0.001	567	83	13	14	22	18	16	50	60	15.	15.	15.	15.	15.	0.00	0.00	0.00	0.00	0.00	15.	15.	15.	15.	15.	11	11	11	11
8168	8.6	. 61	1499	5800	8.6	. 61	0.000	0.000	78.							36		682	307	175	163	149	3380	2305	3481	2041	2662	728	354	221	216	185	50	50		
6296	29	48	9979	0019	29	48	0004	0004	062							36		700	100	800	599	399	9999	0000	9999	0000	199	700	699	699	899	00	00			
3386	67	98	7344	1927	64	99	7497	7497	1412							096		157	296	323	967	757	0040	8910	7097	4914	1351	958	088	714	600	734				
28	41	49	21		809	21	45	45										1655	0205	4863	9565	3853	064	894	254	234	535	8013	501	6606	2197	4971				
1849	16	64	0.014	0.016	16	64	0.001	0.001	562	86	12	14	35	21	4	44	53	21.	20.	20.	20.	19.	0.02	0.03	0.02	0.04	0.09	21.	20.	20.	19.	19.	16	16	16	11
0165	5.1	. 64	9800	2300	5.1	. 64	0.000	0.000	21.							49		161	583	248	026	577	8948	8169	3500	2869	5078	004	272	011	737	330	89	89	50	
1016	01	08	0044	0018	01	08	0004	0004	054							15		399	799	500	800	999	9999	9986	9994	0016	9973	199	499	800	300	299	22	22	00	
4085	63	98	37566	29863	59	98	7497	7497	085							712		841	362	823	155	114	41349	7558	3578	2696	1397	981	084	765	872	377	16	16	16	
75	871	23	17		224	59	45	45	65									3086	1826	9746	6396	9902		48	24	84	63	6895	4727	9912	8027	4414				
1839	16	63	0.011	0.003	16	63	0.001	0.001	570	72	1	15	23	15	18	43	52	21.	20.	19.	19.	18.	0.13	0.02	0.01	0.01	0.03	21.	21.	19.	19.	18.	16	11	11	11
6166	6.0	. 63	1300	5399	6.0	. 63	0.000	0.000	31.							65		908	943	761	217	971	0292	8215	1008	6232	2907	248	038	878	340	977	89	50		
0492	49	30	0046	9994	49	30	0004	0004	880							27		599	899	199	399	300	9967	0004	0000	0006	0016	800	000	999	399	24	00	00		
3325	05	15	46182	6951	081	15	7497	7497	798							232		853	154	951	597	125	64183	0590	0131	6387	7417	277	106	441	603	826	72			
32	936	24	98		183	45	45	45	61									5156	6631	1719	168	1221		76	13	65	53	71	8115	5283	2715	0498				
1817	16	61	0.027	0.031	16	61	0.001	0.001	558	48	5	10	16	11	6	44	53	21.	20.	20.	20.	19.	0.07	0.03	0.03	0.04	0.10	21.	20.	20.	19.	19.	11	16	16	11
8168	8.4	. 61	5999	3999	8.4	. 61	0.000	0.000	31.							49		674	805	468	066	652	8189	5766	7687	3595	3969	600	425	052	568	364	50	89		
4177	17	48	9968	9881	17	48	0004	0004	922							15		400	300	500	099	900	9988	0017	9982	0011	0002	400	699	600	700	299	00	22	22	
2941	75	61	11152	38676	74	61	7497	7497	870							712		329	674	137	166	695	6512	9076	65028	0149	79903	924	234	860	790	774	16	16		
64	907	71	11		215	877	45	45	37									5898	4385	3291	8701	8008	76	19		38	6826	0088	5957	4053	1699					
1817	16	61	0.015	0.024	16	61	0.001	0.001	559	67	13	14	19	14	7	44	53	20.	20.	20.	20.	19.	0.01	0.02	0.03	0.04	0.10	20.	19.	19.	19.	19.	16	16	16	11
8168	8.5	. 61	7800	5299	8.5	. 61	0.000	0.000	96.							49		453	282	028	026	761	2954	6145	0764	3905	4230	248	958	795	628	558	89	89		
5428	42	48	0001	9912	42	48	0004	0004	658							15		500	100	499	199	899	9996	0000	0004	0011	9999	100	700	000	799	599	22	22	00	
0551	84	69	60933	20236	81	70	7497	7497	587							712		747	677	603	340	948	9273	1072	9030	3368	46594	280	180	076	438	472	16	16		
78	354	84	68		239	29	45	45	96									6807	4902	2715	8203	1201	81	88	78	03	7617	180	037	2939	4766	0459				

Note that the mean object astrometric parameters (raMean, decMean) have been post-processed to match with corresponding Gaia sources, and therefore are not indicative of the underlying PanSTARRS astrometry.

Step 2: Obtain detections associated with objects selected in Step 1

The following query identifies all detections associated (i.e., having the same ObjID) as the mean objects obtained in Step 1, and extracts relevant parameters for each. The query ran for 3:18 and returned 8,560,632 rows (detections), or an average of over 40 per mean object.

```
select d.detectID, d.objid, d.obstime, d.exptime, d.airmass, d.psfflux, d.psffluxErr, d.psfQF,
d.imageID, d.filterID, d.sky, d.skyerr, d.infoflag, d.infoflag2, d.infoflag3, d.ra, d.dec, d.raerr, d.decerr
into mydb.MyTable_HDF_det2
from Detection d
inner join MyDB.MyTable_HDF_3deg mm on d.objid=mm.objid
```

The resulting table is about 1.3 GB, exceeding the standard limit in CasJobs. A sample of the first several rows follows.

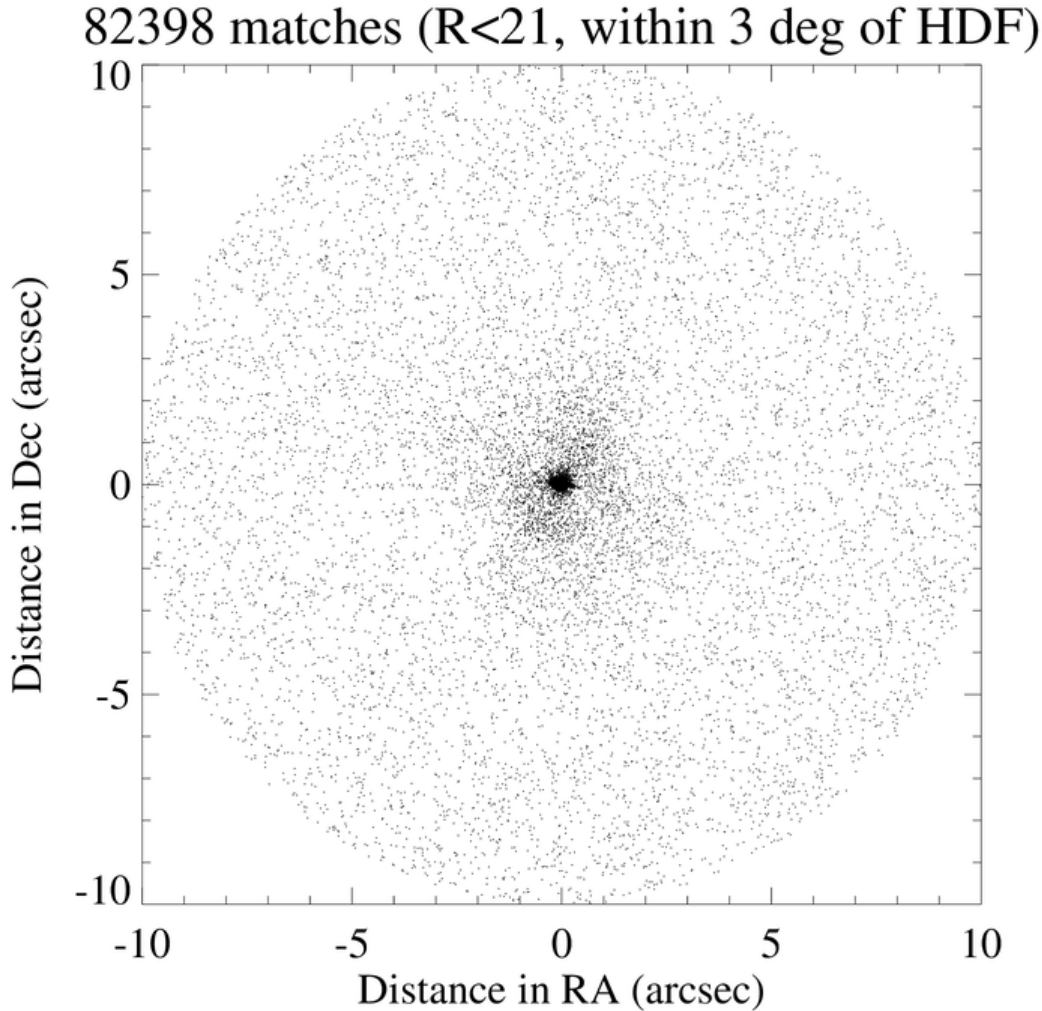
bigint [8]	bigint [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	bigint [8]	tinyint [1]	float [8]	float [8]	bigint [8]	int [4]	int [4]	float [8]	float [8]	float [8]	float [8]
------------	------------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	------------	-------------	-----------	-----------	------------	---------	---------	-----------	-----------	-----------	-----------

detectID	objid	obstime	exp time	airmass	psfflux	psffluxErr	psfQF	imag eID	flt erID	sky	skyerr	infofl ag	infofl lag2	infofla g3	ra	dec	raerr	decerr
1482500043 10000540	1791616884 98759335	55583.5 003176	45	1.3484499 4544983	1.919649912 45186E-05	1.327769950 87625E-06	0.99891799 6883392	2844 0031	3	5.785109897 26055E-05	3.173030108 88281E-06	3566 7969	0	7374 912	168.849 91255	59.307 20106	0.03775979 95102406	0.03775979 95102406
1482506663 10001421	1791616884 98759335	55583.5 069285	45	1.9347899 9137878	1.467039965 06403E-05	1.326140022 68383E-06	0.99880897 9988098	2844 1031	3	5.763780063 71669E-05	3.130639925 07523E-06	3566 7969	0	7374 912	168.849 81296	59.307 15457	0.04934319 85378265	0.04934319 85378265
1233257111 70000179	1791616884 98759335	55334.2 573031	30	1.2808400 3925323	4.310740041 54652E-05	3.706609959 40852E-06	0.99955701 8280029	1693 7517	4	5.736530147 26005E-05	4.783209988 09068E-06	3566 7969	0	1247 82656	168.849 84276	59.307 21012	0.04670640 08116722	0.04670640 08116722
1234266461 70000229	1791616884 98759335	55335.2 666525	30	1.2865400 3143311	4.953450115 86323E-05	5.493689968 97163E-06	0.99960201 9786835	1698 9317	4	7.647740130 7784E-05	5.548019998 96881E-06	3566 7969	0	1247 82656	168.849 82005	59.307 15227	0.06020810 08255482	0.06020810 08255482
1234253881 70000181	1791616884 98759335	55335.2 540732	30	1.2806999 6833801	2.964630039 05956E-05	3.380899897 8202E-06	0.99766701 4598846	1698 7017	4	7.845940126 5718E-05	5.753110144 72391E-06	3565 1585	0	7374 912	168.849 92647	59.307 14316	0.06189449 87654686	0.06189449 87654686
1167535461 70000094	1791616884 98759335	55268.5 356725	36	1.14778800 0106812	1.730350049 91107E-05	1.851779984 46306E-06	0.99884200 0961304	1477 4017	2	1.619840077 18274E-05	2.141709956 04945E-06	3565 1585	0	7374 912	168.849 95451	59.307 1895	0.05811170 11606693	0.05811170 11606693
1167544161 70000227	1791616884 98759335	55268.5 443795	36	1.5157899 8565674	1.998640072 99766E-05	2.026770062 00247E-06	0.99870902 299881	1477 5517	2	1.648020042 92142E-05	2.175879899 36874E-06	3565 1585	0	7374 912	168.849 78545	59.307 19865	0.05506790 05682468	0.05506790 05682468
1156446631 70000366	1791616884 98759335	55257.4 468208	32	1.2816599 6074677	2.900899926 31692E-05	4.257500222 59308E-06	0.99919897 3178864	1443 7617	3	9.262000094 16789E-05	4.894070116 27918E-06	3566 7969	0	1080 05440	168.850 06837	59.307 16401	0.07962950 31905174	0.07962950 31905174
1171512021 70000279	1791616884 98759335	55272.5 123379	52	1.4306000 4711151	7.238600019 3081E-06	1.122470052 90556E-06	0.95072901 2489319	1488 0017	1	6.346670033 96316E-06	1.662440013 20592E-06	3566 7969	0	7374 912	168.849 91705	59.307 26753	0.08420000 22530556	0.08420000 22530556
1156436651 70000161	1791616884 98759335	55257.4 368465	32	1.2868399 6200562	3.171090065 73446E-05	3.910809937 22426E-06	0.99926900 8636475	1443 5917	3	9.123959898 71584E-05	4.865430128 12035E-06	3566 7969	0	1080 05440	168.849 82811	59.307 24274	0.06699889 89830017	0.06699889 89830017
2235616606 50000401	1791616884 98759335	56336.6 168684	43	1.5010700 2258301	7.672029823 87971E-06	1.164579998 65816E-06	0.99800902 6050568	5808 7965	1	4.418679964 14658E-06	1.753550009 19808E-06	3566 7969	0	7374 912	168.849 59486	59.307 38858	0.08270119 8756948	0.08270119 8756948

2235623036 50000363	1791616884 98759335	56336.6 232838	43	1.5306700 4680634	6.949700036 78463E-06	1.121140030 59105E-06	0.99859702 5871277	5808 8865	1	4.630499915 94744E-06	1.780150000 74083E-06	3565 1585	0	7374 912	168.849 97658	59.307 14763	0.08789809 79323387	0.08789809 79323387
1865493883 60000546	1791616884 98759335	55966.4 940736	30	1.2878400 0873566	2.577539999 03798E-05	2.913579919 5501E-06	0.99768698 2154846	4519 1836	4	9.486859926 25542E-05	5.997790140 09982E-06	3566 7969	0	7374 912	168.849 95928	59.307 22864	0.06158199 90634918	0.06158199 90634918
1865485963 60000476	1791616884 98759335	55966.4 861404	30	1.2945699 6917725	3.006320002 89625E-05	3.192250005 66803E-06	0.99845999 4792938	4519 0336	4	9.636610047 89174E-05	6.030159966 03062E-06	3565 1585	0	7374 912	168.849 88062	59.307 17744	0.05784339 83027935	0.05784339 83027935
1948288613 60000399	1791616884 98759335	56049.2 888798	45	1.2796000 2422333	2.231690086 7736E-05	1.715460030 02732E-06	0.99719297 8858948	4833 9036	3	5.707910167 98466E-05	3.153030093 01715E-06	3566 7969	0	7374 912	168.849 7873	59.307 23566	0.04186490 17810822	0.04186490 17810822

Step 3: Match objects and detections with the closest Gaia DR2 source

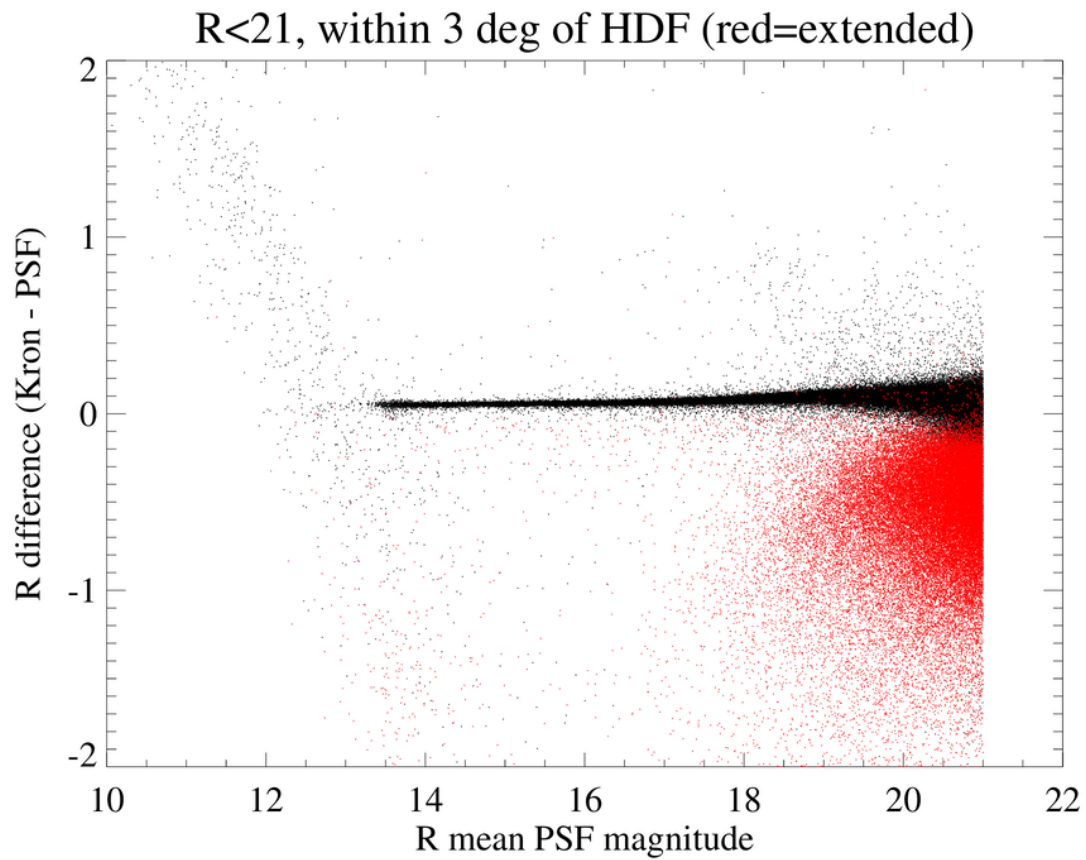
The same region of the sky contains 86,685 Gaia DR2 sources, of which 77448 have a valid five-parameter astrometric solution, and 68638 have also a valid G magnitude. For the first matching stage, we do not require valid magnitude or five-parameter astrometry; the direct positional match with a generous 10" radius finds 82,398 matches, with the vast majority well within 1":



In this comparison, it is useful to distinguish point sources from extended sources. The latter will likely be treated differently in Gaia vs. Pan-STARRS, and their astrometric and photometric accuracy is likely poorer. One way to distinguish point from extended sources is to use the difference between Kron and PSF magnitudes; another is encoded in the QF_OBJ_EXT bit (bit 1) from the qualityFlag parameter in ObjectThin (extracted from the query in Step 1):

ExtendedFlag = (qualityFlag AND 1)

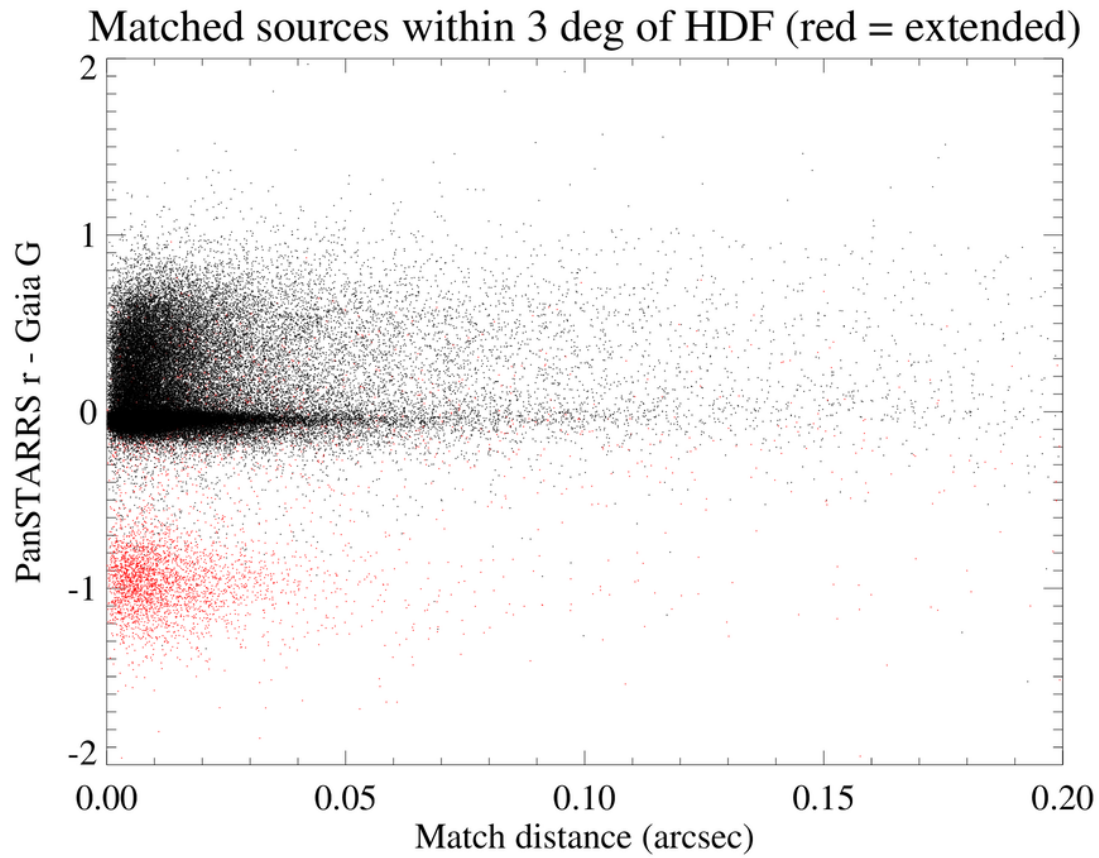
(this is a bitwise AND). The ExtendedFlag thus defined correlates well with the Kron vs. PSF magnitude difference (which presumably is part of the definition):



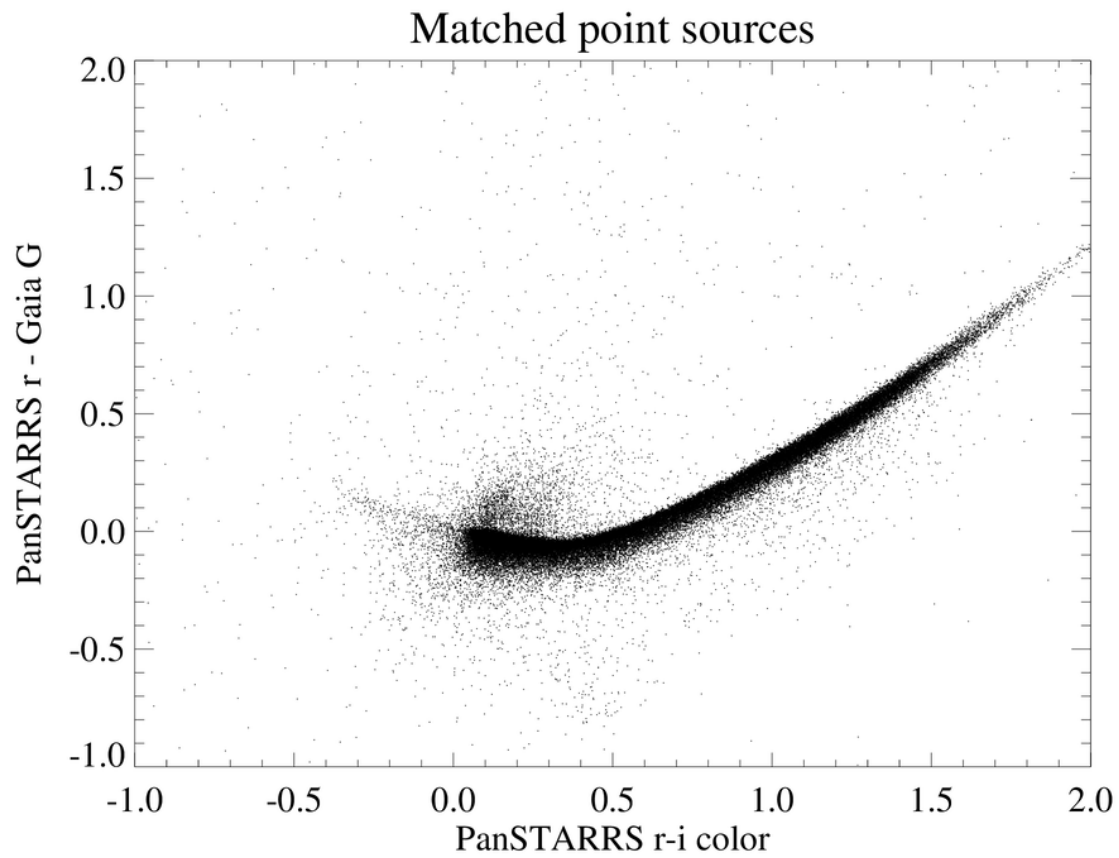
Red dots in this plot have `ExtendedFlag == true`. In the following, we use `ExtendedFlag` to identify extended objects.

Step 4: compare Gaia and PanSTARRS magnitudes for point sources

The match distance distribution shows clearly that "true" matches likely have match distances $\ll 1''$. This plot shows that PanSTARRS r-band PSF magnitudes and Gaia G band magnitudes match very well for "true" point source matches (separation $< 0.2''$):

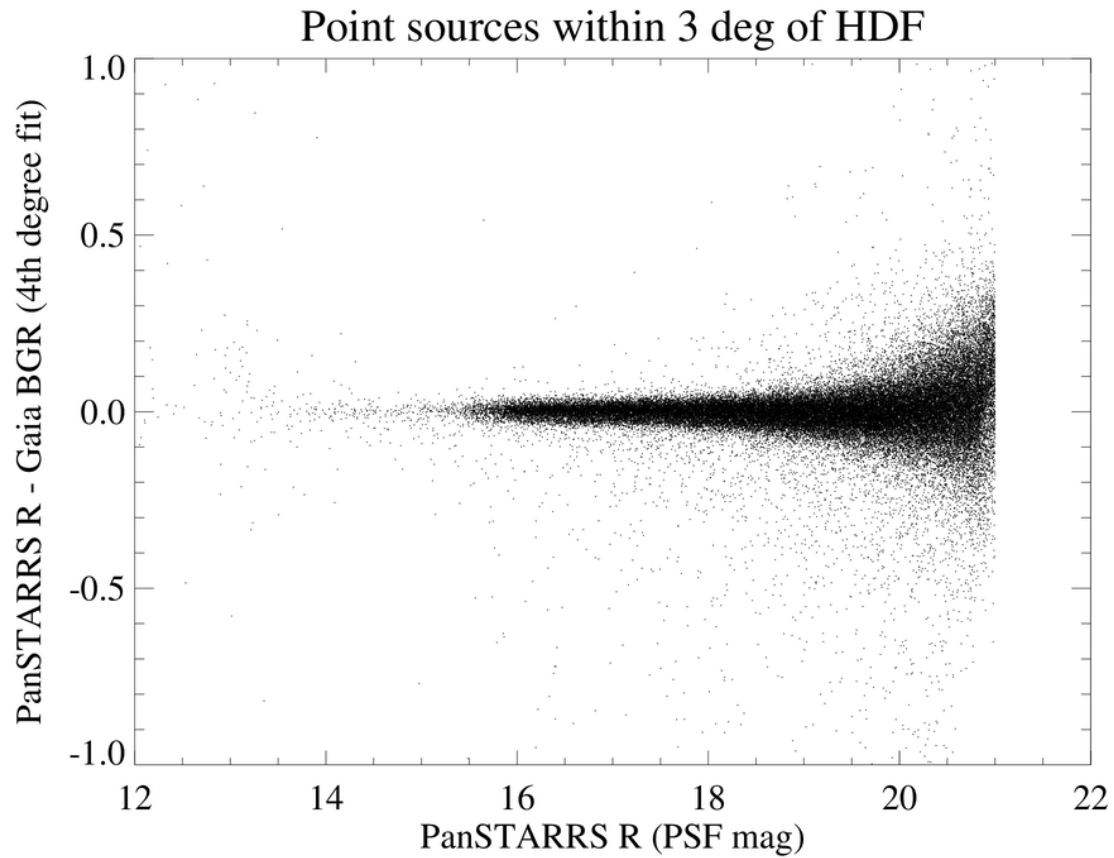


The plot shows two populations of point sources: a narrow band with $r-G \sim 0$, containing a majority of the matches, and a broader distribution at positive $r-G$ values (brighter in G than in r). Extended sources are mostly brighter in PanSTARRS r, as expected since Gaia, with its higher angular resolution, would only measure the core of the object. (We will neglect extended sources henceforth.) It turns out that the second population of point sources, at positive $r-G$, is constituted of very red stars, for which the extremely broad G passband is dominated by red photons. This becomes clear if the $r-G$ magnitude difference is plotted against PanSTARRS colors, e.g., $r-i$:



where the region of positive $r - G$ (Gaia brighter) corresponds with positive $r - i$ (red stars). The narrowness of the sequence testifies to the quality of Gaia and PanSTARRS magnitudes.

We can take one additional step and attempt to define a color transformation that maps Gaia magnitudes (G , B , and R) into PanSTARRS r . A degree 4 polynomial results in a very good match, albeit with large scatter at faint magnitudes, where Gaia B and R magnitudes lose precision:

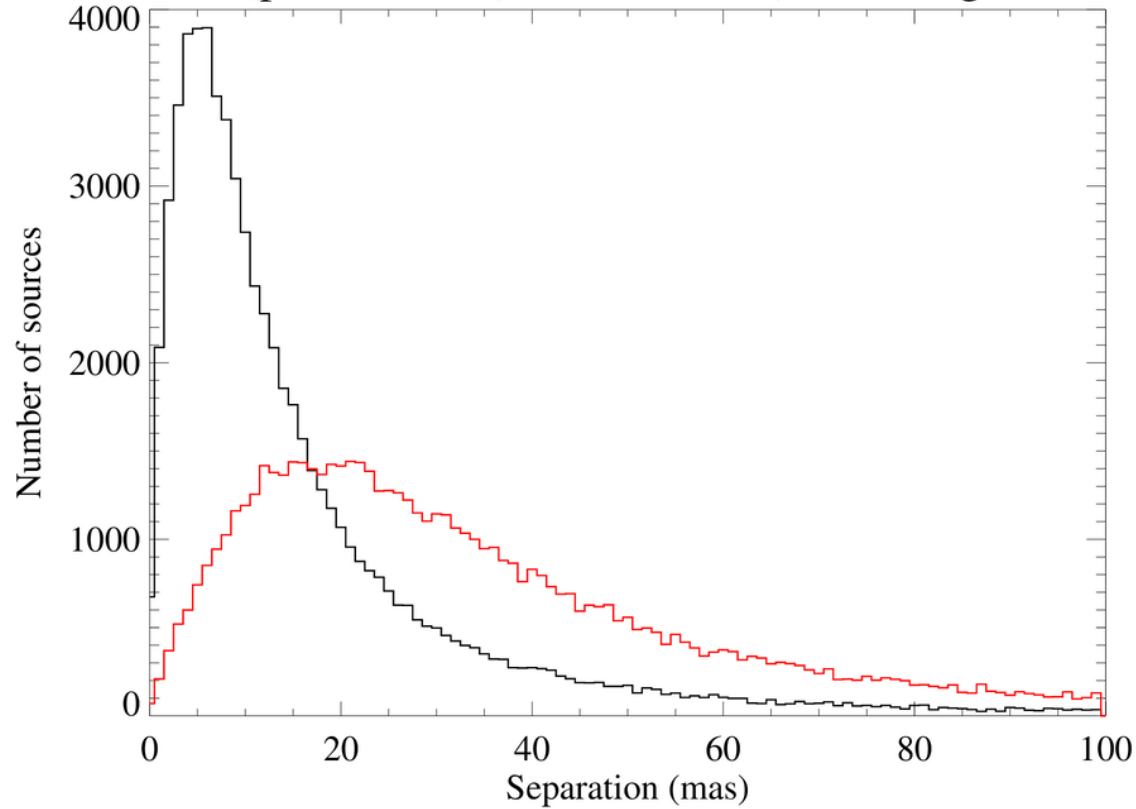


It would also be possible to define a combination of PanSTARRS magnitudes to map into Gaia G, but the above plots clearly show that magnitudes are well matched, so this has not been pursued further.

Step 5: Compute mean detection positions and compare to Gaia astrometry

Finally, we compare the astrometric match between Gaia and PanSTARRS using both mean object quantities and the average of detection positions. Mean object astrometry is obtained from the DR2 table `ObjectThin` and has been adjusted to Gaia. Detection positions are taken from the DR2 Detection table, and have **not** been adjusted to Gaia. Accordingly, if we assign to each matched object a "mean detection" position corresponding to the average of its detections (as indicated by `objID`), this position is a true indicator of the underlying quality of PanSTARRS astrometry **before** Gaia matching:

PanSTARRS (point sources) vs Gaia DR2 (red=average of detect



The black histogram shows the match distance for mean object (typically Gaia-adjusted) positions; it peaks at 5 mas, with a significant tail beyond 20 mas. The red histogram uses the mean position of detections; it peaks at 20 mas, with a significant tail beyond 50 mas. More analysis is in progress to better understand how proper motions might impact the relative astrometry for both matched and unmatched PanSTARRS sources. In particular, we plan to use detection positions to obtain proper motion estimates or bounds for sources that do not have Gaia proper motions. Note that separations based on mean detection positions have not been adjusted for the (known) proper motion of the corresponding Gaia source; this is ongoing.

In summary, we show that 1) most Gaia sources within the chosen area have PanSTARRS matches; 2) point-source photometry is very consistent between Gaia and PanSTARRS, with obvious deviations related to both extended sources and point sources of extreme colors; and 3) detection positions can be used to understand the validity of PanSTARRS astrometry after matching to Gaia, and potentially offer information of source proper motions.