PS1 Sample queries

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    - Step 1: Obtain mean objects in cone search, filtering for objects with a high probability of Gaia matches
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    - Step 3: Match objects and detections with the closest Gaia DR2 source
    - Step 4: compare Gaia and PanSTARRS magnitudes for point sources
    - Step 5: Compute mean detection positions and compare to Gaia astrometry

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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:

107763340006509592	334.00067427	-0.19239401	0.00192	0.00245	60	19.6313	0.007621	14	18.3653	0.006528	15	17.2444	0.02347	26	16.7225	0.02455	12	16.4851	0.015898	13	18.4699	0.09761	93	16	17	34	12	14	115000	0.999873	115000	0.999291	115000	0.999634	115000	0.999044	115000	0.999622	1	1
107763340149672418	334.01502523	-0.19839402	0.00518	0.00285	52	21.9751	0.083929	3	20.7948	0.031693	15	19.6486	0.013022	17	19.1114	0.012857	12	18.8021	0.026564	14	20.9895	0.053647	65	3	15	20	13	14	115000	0.999462	115000	0.999644	115000	0.999309	115000	0.999628	115000	0.998982	1	1
107763340365446394	334.03656773	-0.1951062	0.02425	0.02707	52	21.8092	0.062935	6	21.3268	0.0751	12	21.0911	0.027663	24	20.5195	0.04418	10	19.3565	0.00343	1	21.4159	0.068216	63	8	14	29	10	2	16892216	0.999325	115000	0.999636	115000	0.999367	115000	0.999632	16892216	0.998982	1	1
107773339339718616	333.93399766	-0.18485765	0.00422	0.00798	60	21.0967	0.057864	12	19.896	0.011242	12	18.614	0.00688	29	18.0234	0.004613	10	17.7739	0.022577	9	20.0117	0.031177	85	12	12	37	12	12	115000	0.999404	115000	0.999715	115000	0.999856	115000	0.999515	115000	0.999526	1	1
107773339418197028	333.94187857	-0.18614146	0.01971	0.03959	52	21.5705	0.012027	2	20.981	0.008091	6	20.586	0.02858	27	20.3225	0.049434	8	20.3266	0.143002	1	20.9779	0.153102	60	4	9	35	11	1	115000	0.999	115000	0.999029	115000	0.999628	115000	0.999253	114992	0.997765	1	1
107773339602519327	333.96026447	-0.18427345	0.00452	0.0079	60	21.079	0.018093	6	19.7609	0.014422	6	18.456	0.004637	21	17.8612	0.006005	10	17.6079	0.035327	6	19.8238	0.015897	65	8	11	25	10	11	115000	0.999168	115000	0.999158	115000	0.999613	115000	0.999212	115000	0.998133	1	1
107773339666312601	333.96664968	-0.1898753	0.00262	0.00237	60	18.3317	0.005523	14	17.7711	0.002763	14	17.531	0.003137	27	17.4243	0.006355	7	17.3689	0.016866	8	17.8509	0.00506	77	14	16	29	8	10	115000	0.999479	115000	0.999742	115000	0.999548	115000	0.99868	115000	0.998906	1	1
107773339901521365	333.99016194	-0.19086722	0.00392	0.00732	52	21.9495	0.067887	9	20.8339	0.024821	13	19.3754	0.005145	33	18.642	0.01119	12	18.2968	0.0151	12	20.8794	0.082054	81	9	14	33	13	12	115000	0.999095	115000	0.999729	115000	0.999428	115000	0.999706	115000	0.99911	1	1
107773339922175058	333.99225189	-0.1878471	0.00356	0.02173	60	17.8118	0.005868	12	17.0528	0.002585	12	16.7543	0.0022	26	16.6207	0.00568	12	16.5089	0.009786	12	17.1191	0.003335	87	14	14	31	14	14	115000	0.999704	115000	0.999442	115000	0.999577	115000	0.999238	115000	0.999307	1	1
107773340107508029	334.01078438	-0.18536236	0.0057	0.0057	60	17.1406	0.001898	12	16.5837	0.002945	13	16.3375	0.001891	22	16.2293	0.002224	13	16.146	0.008295	9	16.6436	0.001166	87	16	15	30	14	12	115000	0.999684	115000	0.999464	115000	0.999912	115000	0.999435	115000	0.999022	1	1

Galaxy Candidates for K2 SN Search

Goal/Description

The Kepler Extra-Galactic Survey (KEGS) is a program using the Kepler telescope to search for supernovae, active galactic nuclei, and other transients in galaxies. We have to identify galaxies in a suitable redshift range (z<=0.12) a priori, which will be monitored by K2. Here is an example to get galaxies for Campaign 14. We only select objects with r<=19.5, and we make a cut on (rmeanpsfmag - rmeankronmag)>=0.05 in order to remove stars (More info about Star-Galaxy Separation is here). We only want to use objects for which the majority of pixels were not masked, thus the cut on QFperfect>=0.95. We also obtain the petrosian radii in order to be able to select galaxies by size.

Query

```
SELECT  o.objID,
ot.raStack, ot.decStack, ot.raMean, ot.decMean,
ot.ng,  o.gMeanPSFMag,o.gMeanPSFMagErr,o.gMeanKronMag,o.gMeanKronMagErr,
ot.nr,  o.rMeanPSFMag,o.rMeanPSFMagErr,o.rMeanKronMag,o.rMeanKronMagErr,
ot.ni,  o.iMeanPSFMag,o.iMeanPSFMagErr,o.iMeanKronMag,o.iMeanKronMagErr,
ot.nz,  o.zMeanPSFMag,o.zMeanPSFMagErr,o.zMeanKronMag,o.zMeanKronMagErr,
ot.ny,  o.yMeanPSFMag,o.yMeanPSFMagErr,o.yMeanKronMag,o.yMeanKronMagErr,
o.gQfPerfect,o.rQfPerfect,o.iQfPerfect,o.zQfPerfect,o.yQfPerfect,
ot.qualityFlag,ot.objInfoFlag,
sp.gpetRadius,sp.rpetRadius,sp.ipetRadius,sp.zpetRadius,sp.ypetRadius,
sp.gpetR50,sp.rpetR50,sp.ipetR50,sp.zpetR50,sp.ypetR50,
soa.primaryDetection, soa.bestDetection
       INTO mydb.[C14]
FROM MeanObject AS o
JOIN fgetNearbyObjEq(160.68333, 6.85167 , 8.5*60.0) cone ON cone.objid = o.objID
JOIN ObjectThin AS ot ON ot.objID = o.objID
LEFT JOIN StackPetrosian AS sp ON sp.objID = o.objID
LEFT JOIN StackObjectAttributes AS soa ON soa.objID = o.objID
 WHERE ot.ni >= 3
     AND ot.ng >= 3
     AND ot.nr >= 3
     AND soa.primaryDetection>0
     AND (o.rMeanKronMag > 0 AND o.rMeanKronMag <= 19.5 )
     AND (o.gQfPerfect >= 0.95)
     AND (o.rQfPerfect >= 0.95)
     AND (o.iQfPerfect >= 0.95)
     AND (o.zQfPerfect >= 0.95)
     AND (o.rmeanpsfmag - o.rmeankronmag > 0.05)
```

Results

First 10 out of 161,920 Rows of MyDB Table C14

125391633203089697	163.32030341	14.49934933	163.32028882	14.49933092	10	21.0093	0.036089	20.6731	0.074827	14	19.7703	0.026601	19.2563	0.01528	10	19.2681	0.011538	18.6397	0.021455	14	18.9957	0.016901	18.3729	0.01564	13	18.6968	0.030642	18.1266	0.037591	0.999566	0.999635	0.999213	0.999209	0.999349	61	512024576	8.6166	2.71981	2.66062	2.67084	2.77483	1.25887	1.19192	1.08737	1.0683	1.02985	1	1
125391634958624964	163.49586429	14.49541362	163.49583602	14.49541125	10	20.3336	0.030038	19.5583	0.020455	14	19.7966	0.03558	18.9214	0.022374	15	19.5316	0.025872	18.6278	0.009325	13	19.367	0.033795	18.5621	0.032986	14	19.1271	0.038272	18.3829	0.051101	0.999619	0.999457	0.998965	0.999023	0.999377	53	444915712	5.27407	5.04787	4.27913	4.71588	5.21124	2.08763	1.80538	1.5933	1.46589	3.27605	1	1
125391635282559255	163.52826527	14.49899141	163.52823941	14.49899527	8	20.9598	0.062091	20.1741	0.026735	14	20.3923	0.062902	19.417	0.029026	15	20.0727	0.036366	19.0168	0.024443	11	19.8652	0.025211	18.8208	0.031221	8	19.2406	0.092635	18.7778	0.141102	0.999726	0.999435	0.9992	0.999113	0.999185	53	444915712	4.60435	5.28031	4.94089	5.31433	4.2082	2.20738	2.36534	2.07909	2.09779	1.98962	1	1
125391636122615271	163.61224801	14.49564107	163.61222312	14.4956375	10	21.0158	0.045075	20.3179	0.073374	16	20.0838	0.039024	19.361	0.032028	23	19.6738	0.024572	18.9632	0.014486	13	19.4487	0.020207	18.7097	0.024255	12	19.2102	0.063186	18.5949	0.073146	0.999603	0.999763	0.999656	0.998814	0.999592	53	444915712	3.83093	3.52666	3.35348	4.64719	3.17508	1.43311	1.45691	1.24687	1.44055	1.13158	1	1

118791643648704345	164.36486427	8.99489954	164.36488729	8.99490711	12	19.1429	0.052652	18.2254	0.01775	10	18.1585	0.047254	17.1922	0.010684	24	17.8359	0.014582	16.7399	0.006493	15	17.529	0.034207	16.475	0.016307	12	17.3821	0.032685	16.5217	0.016764	0.999406	0.999925	0.999627	0.999177	0.998446	61	512024576	9.41188	7.51037	8.15557	6.79108	6.69249	3.239	2.89972	2.98712	2.58567	2.53303	1	1
118791644119204724	164.41206831	8.9951804	164.41207311	8.99516407	11	20.4482	0.049955	19.9932	0.031226	10	19.4595	0.055058	19.0636	0.034954	21	19.1387	0.009942	18.6994	0.012918	18	18.9002	0.028131	18.4224	0.017008	16	18.7551	0.03906	18.3453	0.048406	0.999824	0.999525	0.999536	0.999698	0.999067	53	444915712	3.239	3.36407	3.61128	2.58715	5.26874	1.32149	1.37188	1.33232	1.067	1.54819	1	1
118791644639089117	164.4639088	8.99886558	164.4638893	8.99882395	12	20.5845	0.013954	20.5222	0.025129	9	19.5392	0.014182	19.4673	0.028032	25	19.2291	0.009582	19.0912	0.010408	8	18.9844	0.019372	18.8641	0.012195	10	18.8694	0.03332	18.7261	0.050969	0.999824	0.999727	0.999752	0.998658	0.99909	53	444915712	1.71052	2.17727	1.84635	1.71799	1.60121	0.810568	0.902419	0.786221	0.69683	0.685771	1	1
112311673903612557	167.39036582	3.59342292	167.39034643	3.59342679	10	20.6191	0.028819	20.0852	0.034735	13	19.2242	0.015424	18.6072	0.019927	30	18.6517	0.029103	18.0381	0.010267	15	18.6967	0.024408	17.833	0.016486	15	18.2745	0.050807	17.5922	0.029465	0.999542	0.999752	0.999918	0.999668	0.999759	61	512024576	4.49931	5.2592	5.923	6.45203	9.71826	1.7136	1.89471	2.12116	2.27382	2.50151	1	1
112311673903612557	167.39036582	3.59342292	167.39034643	3.59342679	10	20.6191	0.028819	20.0852	0.034735	13	19.2242	0.015424	18.6072	0.019927	30	18.6517	0.029103	18.0381	0.010267	15	18.6967	0.024408	17.833	0.016486	15	18.2745	0.050807	17.5922	0.029465	0.999542	0.999752	0.999918	0.999668	0.999759	61	512024576	5.75997	6.37828	5.77622	5.6901	6.93946	1.83295	2.14678	1.96195	1.98665	1.96887	1	1
112311673927395135	167.3927613	3.59560997	167.39274475	3.59561368	8	21.2923	0.075464	20.5347	0.03857	12	19.8838	0.034	19.2746	0.020544	37	19.3558	0.023752	18.7983	0.013654	14	19.3137	0.033713	18.5508	0.025501	12	18.9165	0.035194	18.1912	0.03329	0.999655	0.999603	0.99976	0.999207	0.999066	53	444915712	2.69325	3.55384	2.87281	3.02684	139.143	0.821187	1.09999	1.06384	1.13938	-999	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

CSS_J220309.8+051633	330.79097	5.27593	16.68	0.638698	0.38	294	15.62	0.057	1104118064018	114333307910211643	330.7910125	5.2759626	0.00217	0.00427	60	17.0665	0.003394	5	16.6873	0.002055	3	16.5998	0.01256	17	16.4921	0.018882	8	16.5424	0.012265	12	16.7216	0.007911	75	12	7	28	11	17	115000	0.999497	115000	0.999265	115000	0.999639	115000	0.999697	115000	0.998978	1
CSS_J221949.2-024020	334.95521	-2.67224	16.51	0.709491	0.37	249	14.12	0.085	1001120004060	104793349551433447	334.95514654	-2.6725015	0.03063	0.02043	60	16.7444	0.006159	5	16.4611	0.006758	6	16.4771	0.004479	13	16.3752	0.005638	7	16.3594	0.018196	7	16.5058	0.003776	63	8	11	23	10	11	115000	0.999646	115000	0.999825	115000	0.999672	115000	0.998727	115000	0.999331	1
CSS_J220559.8-023949	331.49951	-2.66365	18.11	0.53717	0.89	234	27.82	0.152	1001118004001	104803314996713860	331.49966923	-2.66380567	0.00559	0.00857	52	18.6598	0.034348	7	18.4456	0.032674	8	18.0895	0.030017	19	17.9296	0.046795	10	17.9923	0.00375	9	18.4806	0.022847	67	12	12	21	12	10	115000	0.999129	115000	0.99931	115000	0.999638	115000	0.999217	115000	0.998798	1
CSS_J220457.2-051411	331.23867	-5.23656	15.64	0.53643	0.75	173	9.67	0.06	1004118010930	101713312388786386	331.23888082	-5.23675594	0.00469	0.00529	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0.999384	115000	0.999501	115000	0.998761	115000	0.997996	1

CSS_J215602.1-052021	329.00905	-5.33921	16.51	0.757558	0.47	218	14.77	0.036	1004117008292	101593290092623326	329.00923968	-5.33928719	0.0167	0.01841	60	16.8494	0.0078	6	16.4217	0.022047	15	16.3759	0.008041	15	16.3468	0.003574	8	16.3721	0.018063	11	16.4827	0.023415	72	10	16	22	12	12	115000	0.999921	115000	0.999677	115000	0.999406	115000	0.999167	115000	0.999435	1
CSS_J220820.9-020222	332.08714	-2.0397	17.01	0.561687	0.95	263	17.61	0.092	1001119018133	105553320871392714	332.08715134	-2.03979472	0.0027	0.0102	60	17.7555	0.003879	8	17.382	0.008932	13	17.1634	0.03364	23	17.1783	0.007448	4	16.9441	0.013463	4	17.3846	0.009404	80	14	21	29	8	8	115000	0.999685	115000	0.999274	115000	0.999878	115000	0.998871	115000	0.999672	1
CSS_J222707.9+051259	336.78311	5.21646	16.19	0.552557	0.73	275	11.29	0.173	1104120055941	114263367831840264	336.78319546	5.21647999	0.00177	0.00188	60	16.3358	0.006233	6	16.2293	0.117566	7	16.2794	0.016904	25	16.1658	0.024596	9	16.084	0.028519	9	16.2807	0.134897	87	13	15	36	12	11	115000	0.999558	115000	0.99899	115000	0.999677	115000	0.999277	115000	0.998572	1
CSS_J215435.8-005450	328.64951	-0.91416	17.75	0.575212	0.9	257	24.14	0.126	1001117050169	106903286496013281	328.64959053	-0.91431682	0.00219	0.00138	52	18.1409	0.074842	7	17.8706	0.057256	10	17.6159	0.042086	17	17.7657	0.024178	9	17.669	0.011157	10	17.9065	0.062371	75	12	12	26	13	12	115000	0.999682	115000	0.999313	115000	0.999291	115000	0.999697	115000	0.999024	1
CSS_J222942.0-040519	337.42517	-4.08876	18.08	0.475699	1.19	230	29.63	0.067	1004120034845	103093374253263940	337.42533413	-4.08873128	0.00245	0.00194	52	18.838	0.022485	9	18.552	0.01008	8	18.5071	0.013825	14	18.2355	0.118849	8	18.3454	0.019402	10	18.6314	0.011776	82	14	16	26	12	14	115000	0.999522	115000	0.999581	115000	0.999479	115000	0.999669	115000	0.99935	1
CSS_J223105.2+000538	337.77177	0.09404	16.97	0.670228	0.4	278	17.7	0.071	1101121002733	108113377718393164	337.77185997	0.09391985	0.01024	0.01061	60	17.1952	0.013075	7	16.9806	0.006582	14	16.8766	0.012872	30	16.8465	0.015577	8	16.7479	0.011255	9	17.0236	0.005972	94	14	22	35	10	13	115000	0.999502	115000	0.999683	115000	0.999733	115000	0.999191	115000	0.999694	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

101713312388786386	331.23888082	-5.23675594	331.23887966	-5.23673709	0.0142129	0.0204369	281041231200000230	56911.4125766	45	1.13479	0.00236808	3.23403E-05	0.0749382	0.0282996	0.001481	1.22177	3.17838	24.5609	0.000101192	1.15941E-06	79216420	3	7.38736E-05	3.65002E-06	102760453	128	32768	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2
101713312388786386	331.23888082	-5.23675594	331.23888835	-5.23673367	0.00872209	0.0136836	281040069200000148	56911.4009661	45	1.12094	0.00235791	2.46269E-05	0.115458	0.115458	-0.683352	1.38811	-0.407894	24.5606	0.000115057	1.24099E-06	79214720	3	6.59469E-05	3.4392E-06	102760453	128	32768	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2
101713312388786386	331.23888082	-5.23675594	331.23887945	-5.23675267	0.00255273	0.00272007	272155268140000054	56822.5529494	45	1.23978	0.00160025	5.42303E-06	0.998273	0.998273	0.718458	1.85151	0.36052	24.6031	0.00163074	4.55078E-06	75434414	3	9.63136E-05	4.39628E-06	102760453	128	7374912	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2
101713312388786386	331.23888082	-5.23675594	331.23887517	-5.23675357	0.00255573	0.00279838	272154101140000055	56822.5412889	45	1.29101	0.00163992	5.55706E-06	0.999095	0.999095	0.577144	1.65577	0.557561	24.6016	0.00165362	4.55156E-06	75432714	3	0.000102506	4.54961E-06	102760517	128	7374912	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2
101713312388786386	331.23888082	-5.23675594	331.23888039	-5.23675471	0.00251159	0.00252325	272156434140000061	56822.5646058	45	1.19898	0.001599	5.33245E-06	0.999192	0.999192	0.162726	1.95035	1.39596	24.6048	0.00165668	4.56818E-06	75436114	3	9.17713E-05	4.18141E-06	102760453	128	7374912	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2
101713312388786386	331.23888082	-5.23675594	331.23888187	-5.23675805	0.00228002	0.00229566	272157596140000058	56822.5576232	45	1.16719	0.00160726	5.26372E-06	0.999501	0.999501	0.222933	1.89115	1.21877	24.6047	0.00165819	4.55018E-06	75437814	3	8.90853E-05	4.19146E-06	102760517	128	7374912	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2

101713312388786386	331.23888082	-5.23675594	331.23887668	-5.23673914	0.0022578	0.0019803	273861056470000149	56839.6107502	30	1.13731	0.00197136	8.18044E-06	0.885171	0	-0.226784	1.2275	-1.20868	24.2217	0.00172437	6.86483E-06	76384947	4	5.24721E-05	5.20364E-06	102760453	160	34880	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2
101713312388786386	331.23888082	-5.23675594	331.23888109	-5.23674994	0.00334748	0.00308122	274160857470000086	56842.6087543	30	1.148	0.00144126	7.36061E-06	0.934025	0	-0.358647	1.03449	-0.917947	24.2402	0.00138292	6.01342E-06	76561547	4	6.60553E-05	5.55748E-06	102760517	160	34880	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2
101713312388786386	331.23888082	-5.23675594	331.23887875	-5.23674419	0.00621135	0.00628081	284035135370000088	56941.351618	45	1.17746	0.00125442	5.51837E-06	0.999367	0.999367	0.0518508	1.20217	1.94437	24.5348	0.00127698	4.00209E-06	80756237	3	5.62479E-05	3.33006E-06	102760453	128	7342144	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2
101713312388786386	331.23888082	-5.23675594	331.23887939	-5.2367617	0.00649579	0.00662178	284036359370000086	56941.3638651	45	1.21437	0.00125844	5.59236E-06	0.99913	0.99913	0.0215391	2.1285	2.2984	24.5234	0.00114858	3.81474E-06	80758037	3	5.97269E-05	3.37162E-06	102760453	128	7374912	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	2

Query #3: Get the forced detections

Now we get the forced photometry

```
SELECT
o.objID, o.raMean, o.decMean,
fwm.detectID, fwm.obstime, fwm.exptime, fwm.airmass, fwm.Fpsfflux, fwm.FpsffluxErr, fwm.FpsfQf, fwm.
FpsfQfPerfect, fwm.FpsfChiSq, fwm.zp, fwm.FapFlux, fwm.FapFluxErr,
fwm.forcedWarpID, fwm.filterID,
fwm.Fsky, fwm.Fskyerr, fwm.Finfoflag, fwm.Finfoflag2, fwm.Finfoflag3,
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.[RRLPS1forceddet]
 FROM mydb.[RRLPS1] o
JOIN ForcedWarpMeasurement fwm on fwm.ObjID = o.ObjID
```

Results (3:45 minutes)

There are 824 forced detection entries for the 12 objects, and below are the first 10 entries

101713312388786386	331.23888082	-5.23675594	2473948760665753129	55509.1963096	30	1.12528	0.00226155	8.89297E-06	0.998447	0.899065	1.70509	24.2184	0.00225853	7.8829E-06	57306884	4	2.44443E-07	5.58402E-06	169869889	0	124781568	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998

101713312388786386	331.23888082	-5.23675594	2473949315790276137	55509.2069606	30	1.11611	0.00237623	8.73044E-06	0.997987	0.619015	1.98874	24.2053	0.00234477	8.07563E-06	57306886	4	-7.89231E-08	4.77904E-06	706740801	8	0	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998
101713312388786386	331.23888082	-5.23675594	2473960382578820649	56084.5997338	30	1.16011	0.00154027	7.7769E-06	0.998149	0.998149	1.79974	24.2926	0.00168208	6.49405E-06	57306888	4	1.73045E-07	6.09569E-06	1698669889	0	7341056	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998
101713312388786386	331.23888082	-5.23675594	2473961698449425961	56439.5801154	60	1.34319	0.00156916	9.80598E-06	0.272597	0.180329	1.17526	24.2592	0.000423637	2.32656E-06	57306890	4	-1.71004E-07	3.96178E-06	1698669889	0	0	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998
101713312388786386	331.23888082	-5.23675594	2473962046341776937	56595.2046749	60	1.15427	0.00151238	4.94983E-06	0.998573	0.998573	3.21986	24.2944	0.00155572	4.46429E-06	57306893	4	8.98555E-08	3.09952E-06	1698669889	0	40895488	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998
101713312388786386	331.23888082	-5.23675594	2473962214919243305	56084.5880277	30	1.19001	0.00150664	7.84793E-06	0.998277	0.998277	1.7081	24.2845	0.00161956	6.38274E-06	57306894	4	3.2375E-07	6.02042E-06	1698669889	0	7341056	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998
101713312388786386	331.23888082	-5.23675594	2474105536904169001	55451.3857987	40	1.11324	0.000895305	6.75477E-06	0.725763	0.559601	71.772	24.69	0.00205695	5.07366E-06	57306901	2	6.39024E-09	1.49626E-06	1698669889	0	0	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998
101713312388786386	331.23888082	-5.23675594	2474105805339625001	55801.4656768	40	1.16095	0.000616471	4.43598E-06	0.998961	0.998961	63.0533	24.6782	0.00206805	5.10856E-06	57306905	2	5.8963E-08	1.63808E-06	1698669889	0	7341056	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998
101713312388786386	331.23888082	-5.23675594	2474105863321683497	55801.4755793	40	1.18592	0.001098	4.21394E-06	0.998708	0.998708	2.32906	24.6883	0.001268	4.01415E-06	57306906	2	1.10105E-07	1.71416E-06	1698669889	0	108004352	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998
101713312388786386	331.23888082	-5.23675594	2474105881038423593	55804.378647	40	1.13812	0.00159737	7.25792E-06	0.613981	0.505588	12.0862	24.692	0.00101107	3.5996E-06	57306907	2	7.46216E-08	1.61881E-06	1698669889	0	0	60	16.2717	0.027581	6	15.5956	0.03394	6	15.8879	0.034506	12	15.8923	0.017074	3	15.8542	0.007946	5	15.7368	0.076347	73	16	14	24	10	9	115000	0.999681	115000	0998

Obtain lightcurves for a single object

Goal/Description

Star CSS J030521.9+013231 (Catalina Sky Survey), 584630948352256 (GAIA) is an RR Lyrae with period = 0.55547 days and coordinates RA = 46.341468915923 and DEC = 1.54199810825252 (ref. GAIA DR2, 2018yCat.1345....0G). In the following, we obtain the PSF and aperture photometry light-curves, both forced and unforced, for this star.

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	raMean	decMean	raMeanErr	decMeanErr	qualityFlag	gMeanPSFMag	gMeanPSFMagErr	gMeanPSFMagNpt	rMeanPSFMag	rMeanPSFMagErr	rMeanPSFMagNpt	iMeanPSFMag	iMeanPSFMagErr	iMeanPSFMagNpt	zMeanPSFMag	zMeanPSFMagErr	zMeanPSFMagNpt	yMeanPSFMag	yMeanPSFMagErr	yMeanPSFMagNpt	rMeanKronMag	rMeanKronMagErr	nDetections	ng	nr	ni	nz	ny	gFlags	gQfPerfect	rFlags	rQfPerfect	iFlags	iQfPerfect	zFlags	zQfPerfect	yFlags	yQfPerfect
109850463414820867	46.34146986	1.54199906	0.003030000002168119	0.003920000004649162	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	0.999719977378845	115000	0.999532997608185	115000	0.99897301197052	115000	0.99940699338913

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
```

Results (92 entries, < 1 min)

Below are the first 10 entries out of 92 total entries

objID	raMean	decMean	ra	dec	raErr	decErr	detectID	obsTime	exptime	airmass	psfFlux	psfFluxErr	psfQf	psfQfPerfect	psfLikelihood	psfChiSq	extNSigma	zp	apFlux	apFluxErr	imageID	filterID	sky	skyErr	infoFlag	infoFlag2	infoFlag3	qualityFlag	gMeanPSFMag	gMeanPSFMagErr	gMeanPSFMagNpt	rMeanPSFMag	rMeanPSFMagErr	rMeanPSFMagNpt	iMeanPSFMag	iMeanPSFMagErr	iMeanPSFMagNpt	zMeanPSFMag	zMeanPSFMagErr	zMeanPSFMagNpt	yMeanPSFMag	yMeanPSFMagErr	yMeanPSFMagNpt	rMeanKronMag	rMeanKronMagErr	nDetections	ng	nr	n
109850463414820867	46.34146986	1.54199906	46.34146583	1.54199913	0.00930372998118401	0.00968925002962351	205661127730000150	56157.6114477	30	1.09653997421265	0.000312418007524684	4.38540018876665E-06	0.998354017734528	0.998354017734528	-0.996145009994507	0.87238597869873	-0.00483113015070558	24.2665996551514	0.000312874995870516	2.82292990050337E-06	51263373	4	5.3173800552031E-05	4.96299981023185E-06	102760517	128	74483776	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448600045424258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3
109850463414820867	46.34146986	1.54199906	46.34147101	1.54199584	0.00886464025825262	0.00930058024823666	205661834730000139	56157.6185191	30	1.08464002609253	0.000308797985780984	4.30704994869302E-06	0.997886002063751	0.997886002063751	-0.751219987869263	0.885471999645233	-0.317032009363174	24.2646007537842	0.000307006994262338	2.80717995337909E-06	51264773	4	5.40842011105269E-05	4.96676011607633E-06	102760517	128	74483776	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448600045424258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3
109850463414820867	46.34146986	1.54199906	46.34147032	1.54199486	0.0164823997976578	0.0181090999394655	205463519730000149	56155.6353733	30	1.07035005092621	0.000426476006396115	1.07013001979794E-05	0.997506976127625	0.997506976127625	-0.401959002017975	0.956974983215332	-0.838127017021179	23.2819004058838	0.000432489003287628	5.24767983733909E-06	51173573	5	0.0000280673004454002	1.65041001309874E-05	102760517	128	24152128	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448600045424258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3
109850463414820867	46.34146986	1.54199906	46.34147529	1.54200729	0.0182096995413303	0.0185215994715691	205463914730000143	56155.6393177	30	1.06675004959106	0.000479478010674939	1.25105998449726E-05	0.997026979923248	0.997026979923248	-0.114679001271725	1.0324399471283	-1.57750999927521	23.2794990539551	0.000439649011241272	5.31304021933465E-06	51174373	5	0.0000393002992495894	1.91349008673569E-05	102760453	128	91260992	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448600045424258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3
109850463414820867	46.34146986	1.54199906	46.34148671	1.54200009	0.0101944999976933	0.00999847985804081	211347106730000086	56214.471324	43	1.07359004020691	0.000336864992277697	3.1451399991056E-06	0.998880982398987	0.970811009407043	0.973133027553558	0.571017026901245	0.0336785987019539	24.4729995727539	0.000340317987138405	2.1996900159138E-06	53141773	1	7.04271997165051E-06	1.81308996616281E-06	102760517	128	7374912	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448600045424258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3
109850463414820867	46.34146986	1.54199906	46.34147048	1.54200066	0.00933390017598867	0.00870789960026741	211348410730000082	56214.4843629	43	1.06252002716064	0.00031947300885804	2.96693997370312E-06	0.999378979206085	0.988252997398376	0.108993001282215	0.560401022434235	1.60274004936218	24.4773998260498	0.000329762988258153	2.17397996493673E-06	53143773	1	7.01579983797274E-06	1.76822004505084E-06	102760517	128	7374912	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448600045424258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3
109850463414820867	46.34146986	1.54199906	46.3414713	1.54199819	0.00333002000115812	0.00338827003724873	210557093660000079	56206.5712068	45	1.1161299943924	0.000518793996889144	2.92105005428311E-06	0.998327016830444	0.998327016830444	0.673599004745483	1.16014003753662	0.421213001012802	24.5793991088867	0.000522513990290463	2.58356999438547E-06	52699966	3	3.55550982931163E-05	2.70530995294394E-06	102760517	128	124815424	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448600045424258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3
109850463414820867	46.34146986	1.54199906	46.34146626	1.54200241	0.00347141991369426	0.00354815996252	210558442660000091	56206.5846906	45	1.15272998809814	0.000516125001013279	2.92271010948753E-06	0.997906982898712	0.76691597700119	-0.288893014192581	1.1114000082016	-1.06054997444153	24.5781002044678	0.000511877005919814	2.55920008385147E-06	52701966	3	3.64152001566254E-05	2.64890991275024E-06	102760517	128	34880	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448600045424258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3

109850463414820867	46.34146986	1.54199906	46.34147538	1.54199994	0.00399440014734864	0.00451317010447383	210551778750000080	562206.5180227	40	1.05874001979828	0.000475615990580991	2.96145003630954E-06	0.999001979827881	0.999001979827881	0.909937024116516	1.04835999011993	0.113118000328541	24.6802005767822	0.000480396993222544	2.4879000193323E-06	52694175	2	2.86260001303162E-05	2.47058005697909E-06	102760517	128	7374912	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3
109850463414820867	46.34146986	1.54199906	46.34147262	1.54199939	0.0036491600330919	0.00408963998779655	210553046750000073	562206.530699	40	1.06116998195648	0.000530635996256024	3.04362993119867E-06	0.999243974685669	0.999243974685669	-0.548617005348206	1.09794998168945	-0.599834024906158	24.6788997650146	0.000528337026480585	2.61910008703126E-06	52696175	2	2.90354000753723E-05	2.51040000875946E-06	102760517	128	7374912	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	3

Query #3: Get the forced detections

```
SELECT
o.objID, o.raMean, o.decMean,
fwm.detectID,
 fwm.obstime, fwm.exptime, fwm.airmass, fwm.Fpsfflux, fwm.FpsffluxErr,
fwm.FpsfQf, fwm.FpsfQfPerfect, fwm.FpsfChiSq, fwm.zp, fwm.FapFlux,
fwm.FapFluxErr,
fwm.forcedWarpID, fwm.filterID,
fwm.Fsky, fwm.Fskyerr, fwm.Finfoflag, fwm.Finfoflag2, fwm.Finfoflag3,
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_PS1forceddet]
FROM mydb.[RRL_584630948352256_PS1] o
JOIN ForcedWarpMeasurement fwm on fwm.ObjID = o.ObjID
```

Results (84 entries, <1 min)

Below are the first 10 entries out of 84 total entries

objID	raMean	decMean	detectID	obstime	exptime	airmass	Fpsfflux	FpsffluxErr	FpsfQf	FpsfQfPerfect	FpsfChiSq	zp	FapFlux	FapFluxErr	forcedWarpID	filterID	Fsky	Fskyerr	Finfoflag	Finfoflag2	Finfoflag3	qualityFlag	gMeanPSFMag	gMeanPSFMagErr	gMeanPSFMagNpt	rMeanPSFMag	rMeanPSFMagErr	rMeanPSFMagNpt	iMeanPSFMag	iMeanPSFMagErr	iMeanPSFMagNpt	zMeanPSFMag	zMeanPSFMagErr	zMeanPSFMagNpt	yMeanPSFMag	yMeanPSFMagErr	yMeanPSFMagNpt	rMeanKronMag	rMeanKronMagErr	nDetections	ng	nr	ni	nz	ny	gFlags	gQfPerfect	rFlags
109850463414820867	46.34146986	1.54199906	2476119315535889690	55507.3712258	43	1.1457200050354	0.000350218993844464	2.648800091265E-06	0.9981449842453	0.9981449842453	0.76509702205658	24.4563999176025	0.000359496014425531	2.33503010349523E-06	42521653	1	6.85637999708888E-08	1.56919998062222E-06	169869889	0	7341056	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000
109850463414820867	46.34146986	1.54199906	2476119333789500698	55507.3823453	43	1.11626005172729	0.00033984100446105	2.61849004346004E-06	0.998072028160095	0.998072028160095	0.749981999397278	24.4640998840332	0.00034841601154767	2.29292004405579E-06	42521654	1	5.37593010108139E-08	1.50972005030781E-06	169869889	0	7341056	60	17.6399002075195	0.0298919994938405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000

109850463414820867	46.34146986	1.54199906	2476119407877686554	55871.5445119	43	1.35336995124817	0.000254604005021974	3.88524995287298E-06	0.999324023723602	0.999324023723602	1.10263001918793	24.0970001220703	0.000262874993495643	2.28175008487597E-06	42521657	1	1.09932997816031E-07	3.17848002850951E-06	169869889	0	108004352	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	09919778
109850463414820867	46.34146986	1.54199906	2476119517399352602	55871.5567211	43	1.44556999206543	0.000370891997590661	3.16761997964932E-06	0.998957991600037	0.998957991600037	1.09637999534607	24.3684997558594	0.000371723988791928	2.40599001699593E-06	42521658	1	8.86901005969776E-08	1.9790900296357E-06	169869889	0	7341056	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	09919778
109850463414820867	46.34146986	1.54199906	2476119506930369818	56214.471324	43	1.07359004020691	0.000324029999319464	3.07633990814793E-06	0.999710977077484	0.973115980625153	0.630757987499237	24.4608993530273	0.000337912992108613	2.1908799681114E-06	42521659	1	3.48615003531449E-09	1.4986300129749E-06	169869889	0	7341056	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	09919778
109850463414820867	46.34146986	1.54199906	2476119488676758810	56214.4843629	43	1.06252002716064	0.00030059099663049	2.80448989542492E-06	0.999800980091095	0.989282011985779	0.589187026023865	24.4556999206543	0.000332294992404059	2.18906006921316E-06	42521660	1	-1.36515003745785E-08	1.61688001298899E-06	169869889	0	7341056	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	09919778
109850463414820867	46.34146986	1.54199906	2476119737516426522	56620.367559	43	1.06630003452301	0.000523413997143507	3.3680000797176E-06	0.999117970466614	0.999117970466614	0.876505970954895	24.4757995605469	0.000526870018802583	2.74996000371175E-06	42521661	1	5.30874011417382E-08	1.7956000419872E-06	169869889	0	124781568	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	09919778
109850463414820867	46.34146986	1.54199906	2476119783687324954	56630.3025631	43	1.12948000431061	0.000269720010692254	2.32235993280483E-06	0.999089002609253	0.999089002609253	1.24161005020142	24.4652004241943	0.000284440990071744	2.03790000341542E-06	42521662	1	-8.71303029725823E-12	1.5039599929878E-06	169869889	0	124781568	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	09919778
109850463414820867	46.34146986	1.54199906	2476119928105600282	56630.3156559	43	1.09965002536774	0.000349843990989029	2.72148008662043E-06	0.998916983604431	0.998740971088409	1.31017994880676	24.4706001281738	0.000353882991475984	2.25994995162182E-06	42521663	1	1.1416600109726E-08	1.47287005347607E-06	169869889	0	7341056	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	09919778
109850463414820867	46.34146986	1.54199906	2476125473445250330	55859.5429067	43	1.17981994152069	0.00030532298842445	2.5323899990326E-06	0.999700009822845	0.999700009822845	1.77898001670837	24.4183998107791	0.000315776007482782	2.18451009459386E-06	42521664	1	2.13619006927956E-08	1.4864200466036E-06	169869889	0	7341056	60	17.6399002075195	0.029891999438405	12	17.1961994171143	0.0448860004544258	13	17.4811992645264	0.0493410006165504	23	17.5072002410889	0.0579570010304451	10	17.5268001556396	0.0218189992010593	10	17.2178001403809	0.0414300002157688	92	14	18	30	17	13	115000	0.999504029750824	115000	09919778

The following figures show the PS1 i-band light curve for the RR Lyrae based on the detection and force detection aperture and PSF photometry:

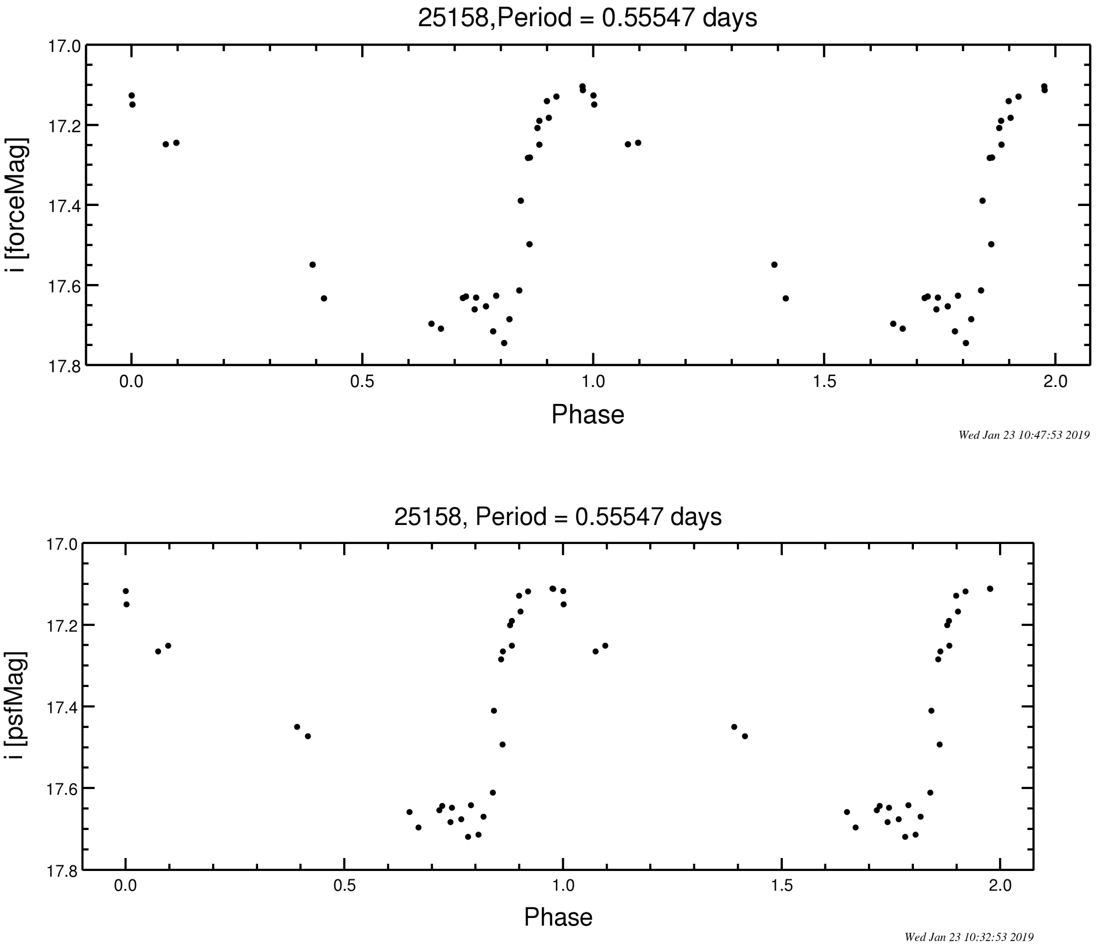


FIG. 1: PS1 i-band light curve for the RR Lyrae from aperture photometry (left panel) and PSF photometry (right) from the Detection table.

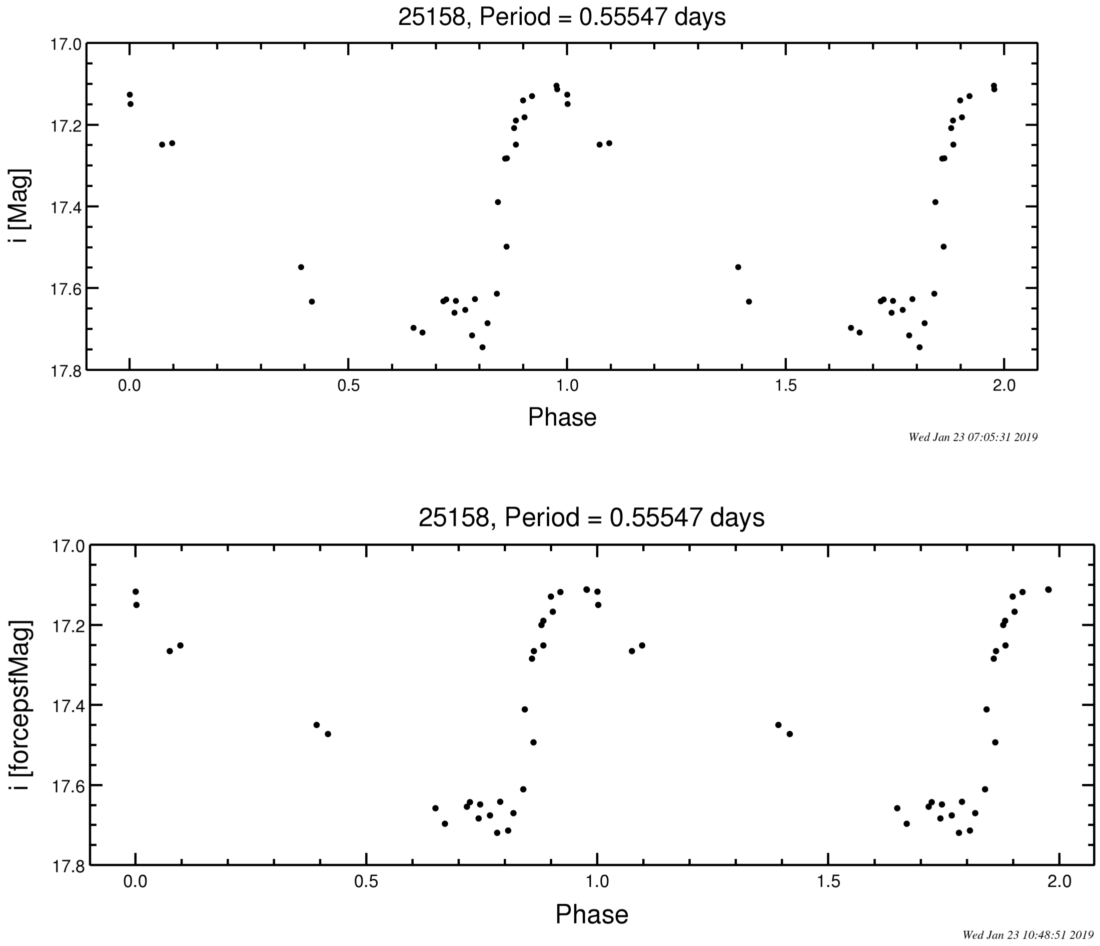
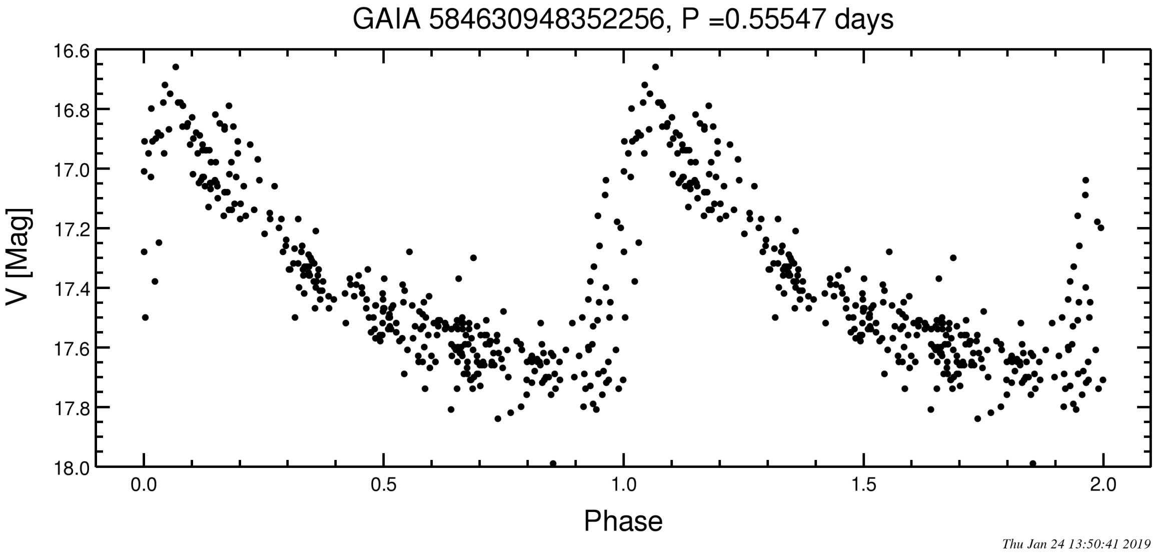


FIG. 2: PS1 i-band light curve for the same star from aperture photometry (left panel) and PSF photometry (right) from the force detection table.

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.uniquePspsOBid=m.uniquePspsOBid 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]	float [8]	smallint [2]	smallint [2]	smallint [2]	smallint [2]	smallint [2]	smallint [2]	int [4]	tinyint [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]	float [8]	float [8]	float [8]	int [4]	int [4]	int [4]	int [4]	int [4]

objID	raMean	decMean	raMeanErr	decMeanErr	raStack	decStack	raStackErr	decStackErr	epochMean	nDetections	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
179681712835753758	171.2835597	59.73586369	0.00365000008605421	0.00829999998703599	171.28356484	59.7358737	0.00100000004749745	0.00100000004749745	56887.0658912	72	6	17	24	12	13	503635968	60	19.638599395752	18.6096992492676	17.4473991394043	16.9216995239258	16.6742000579834	0.00900399964302778	0.00869899988174438	0.00449799979105592	0.00437799980863929	0.00881099980324507	19.6539993286133	18.6641998291016	17.5114002227783	16.99049949646	16.7628002166748	115000	115000	115000	115000	115000
181881687299148148	168.72993686	61.57284619	0.0132200000807643	0.01429999992514	168.72992814	61.57293381	0.00100000004749745	0.00100000004749745	56067.98423611	75	11	12	27	16	9	444915712	53	21.2532005310059	20.4626998901367	20.1156005859375	19.8505001068115	19.5076007843018	0.0604889988899231	0.0515410006046295	0.0393799990415573	0.0353390015661716	0.0791789963841438	21.0324001312256	19.9827995300293	19.5182991027832	19.3169994354248	19.1158008575439	16892216	16892216	16892216	16892216	16892216
184901650524008966	165.05238444	64.09015276	0.00898000039160252	0.0161300003528595	165.05237038	64.09018605	0.00100000004749745	0.00100000004749745	56850.59731481	103	9	18	41	21	14	503635968	60	14.8768997192383	14.4681997299194	14.3325004577637	14.2959995269775	14.2678003311157	0.00329199992120266	0.00235399999655783	0.0020949998870492	0.00427399994805455	0.00417299987748265	14.9315996170044	14.5311002731323	14.3889999389648	14.354100227356	14.2974996566772	115000	115000	115000	115000	115000
183201732358863225	173.23597321	62.66878769	0.0134899998083711	0.0165800005197525	173.23588201	62.66875933	0.00100000004749745	0.00100000004749745	56170.75402778	68	9	10	26	13	10	444915712	53	19.2269992828369	18.673999786377	18.7296009063721	18.5142993927002	18.3567008972168	0.0419979989528656	0.0995870009064674	0.0612360015511513	0.114125996828079	0.032370001077652	16.3229999542236	15.967399597168	15.9111003875732	15.8933000564575	16.1096000671387	16892216	16892216	16892216	16892216	16892216
183961662062155429	166.20623493	63.30391117	0.0101699996739626	0.0049600004932284	166.20625584	63.303914	0.00100000004749745	0.00100000004749745	57009.84126157	68	6	14	22	17	9	436527104	52	20.3061008453369	19.952299118042	19.8433990478516	19.8155994415283	19.4687004089355	0.0182859990745783	0.0110839996486902	0.0135920001193881	0.0146329998970032	0.0955649986863136	20.4029998779297	20.0559997558594	19.9451999664307	19.9302997589111	19.1963996887207	115000	115000	115000	115000	115000
184091652132916264	165.21317557	63.41293128	0.0396599993109703	0.0457100011408329	165.21315854	63.4129482	0.00100000004749745	0.00100000004749745	56455.00677083	31	4	4	8	10	5	444915712	53	21.0104999542236	20.2220001220703	20.2807998657227	19.9305992126465	19.3549003601074	0.134137004613876	0.0389700010418892	0.0149459997192025	0.137548997998238	0.0378380008041859	19.5697002410889	19.4346008300781	18.9556007385254	18.6208000183105	18.292200088501	16892216	16892216	16892216	16892216	16892216

182291632855391025	163.28544234	61.90854662	0.00987000018358231	0.00810999982059002	163.28551981	61.90858407	0.001000000004749745	0.001000000004749745	56890.19304398	71	9	6	24	17	15	503635968	60	18.5207996368408	17.5981006622314	17.183500289917	17.0258007049561	16.903600692749	0.00738199986517429	0.00503299990668893	0.00355600006878376	0.00556399999186397	0.0069050001911819	18.5960006713867	17.6651000976563	17.2705001831055	17.1042003631592	17.0216007232666	115000	115000	115000	115000	115000
181781686296338628	168.6296741	61.48984991	0.00614999979734421	0.014580000191927	168.62964809	61.48992146	0.001000000004749745	0.001000000004749745	56778.0621412	83	13	14	22	18	16	503636096	60	15.6827001571655	15.3071002960205	15.1758003234863	15.1635999679565	15.1493997573853	0.00338099990040064	0.00230500008910894	0.00348199997097254	0.00204199994914234	0.00266200001351535	15.7281999588013	15.354700088501	15.2216997146606	15.2166996002197	15.1858997344971	115000	115000	115000	115000	115000
184901651016408575	165.10163871	64.08982317	0.0149800004437566	0.0162300001829863	165.10159224	64.08985955	0.001000000004749745	0.001000000004749745	56221.05408565	86	12	14	35	21	4	444915712	53	21.1613998413086	20.5837993621826	20.2485008239746	20.0268001556396	19.5779991149902	0.028948999941349	0.0381699986755848	0.0235009994357824	0.0428690016269684	0.0950789973139763	21.0041999816895	20.2724990844727	20.0118007659912	19.7373008728027	19.3302993774414	16892216	16892216	16892216	16892216	115000
183961660492332532	166.04905936	63.30152498	0.0111300004646182	0.00353999994695187	166.049081	63.3015183	0.001000000004749745	0.001000000004749745	57010.88079861	72	1	15	23	15	18	436527232	52	21.9085998535156	20.9438991546631	19.7611999511719	19.217399597168	18.9713001251221	0.130292996764183	0.0282150004059076	0.0110080000013113	0.0162320006638765	0.0329070016741753	21.24880027771	21.0380001068115	19.8780994415283	19.3409996032715	18.9773998260498	16892472	115000	115000	115000	115000
181781684177294164	168.41775907	61.48617111	0.0275999996811152	0.0313999988138676	168.41774215	61.48661877	0.001000000004749745	0.001000000004749745	55831.92287037	48	5	10	16	11	6	444915712	53	21.6744003295898	20.8453006744385	20.4685001373291	20.0660991668701	19.6529006958008	0.0781899988651276	0.0357660017907619	0.037687998265028	0.0435950011014938	0.103969000279903	21.6004009246826	20.4256992340088	20.0526008605957	19.5687007904053	19.3642997741699	115000	16892216	16892216	16892216	115000
181781685428055178	168.54284354	61.48698468	0.015780000160933	0.024529991220236	168.54281239	61.48702946	0.001000000004749745	0.001000000004749745	55996.65858796	67	13	14	19	14	7	444915712	53	20.4535007476807	20.2821006774902	20.0284996032715	20.0261993408203	19.7618999481201	0.0129549996927381	0.0261450000107288	0.0307640004903078	0.0439050011336803	0.104230999946594	20.2481002807617	19.9587001800537	19.7950000762939	19.6287994384766	19.5585994720459	16892216	16892216	16892216	16892216	115000

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.

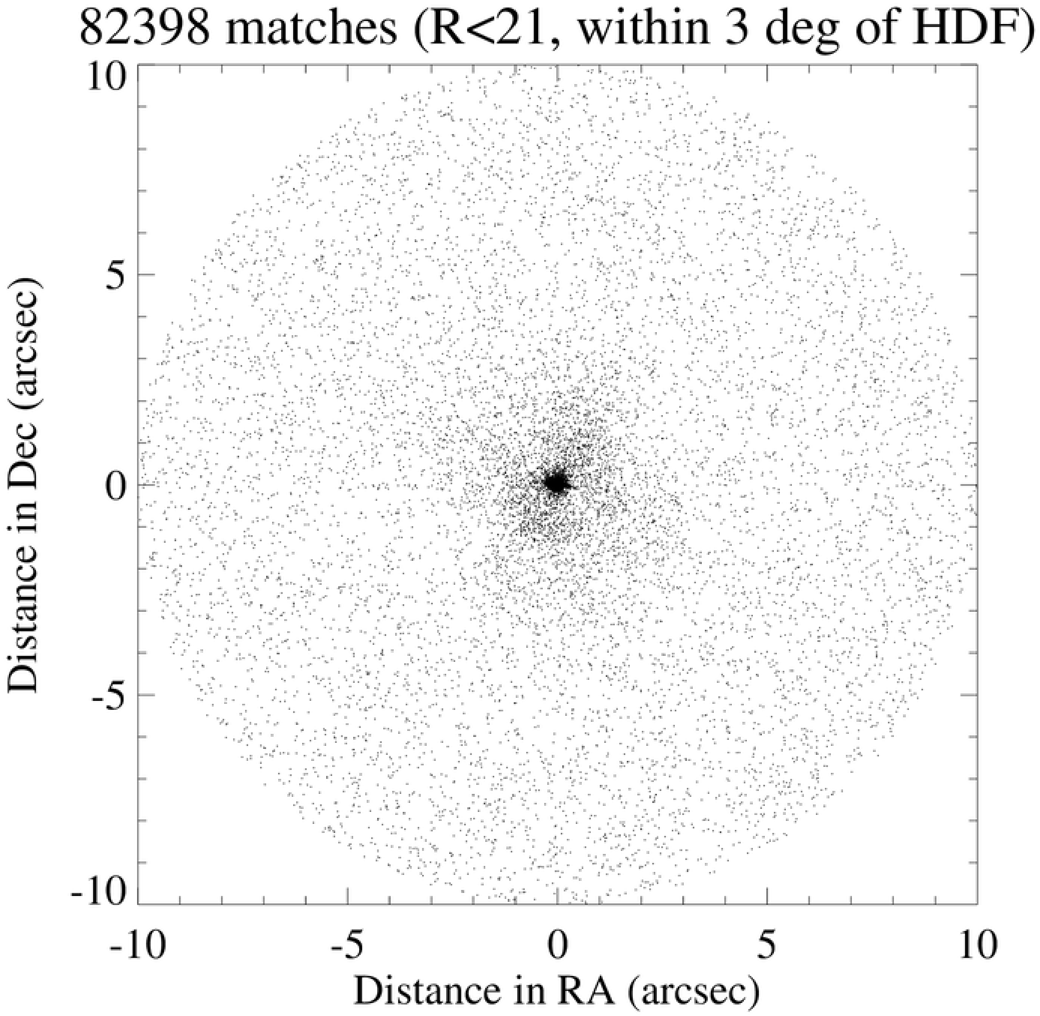
bigint [8]	bigint [8]	float [8]	float [8]	float [8]	float [8]	float [8]	float [8]	bigint [8]	tinyint [1]	float [8]	float [8]	bigint [8]	int [4]	int [4]	float [8]	float [8]	float [8]	float [8]

detectID	objid	obstime	exptime	airmass	psfflux	psffluxErr	psfQF	imageID	filterID	sky	skyerr	infoflag	infoflag2	infoflag3	ra	dec	raerr	decerr
148250004310000540	179161688498759335	55583.5003176	45	1.34844994544983	1.91964991245186E-05	1.32776995087625E-06	0.998917996883392	28440031	3	5.78510989726055E-05	3.17303010888281E-06	35667969	0	7374912	168.84991255	59.30720106	0.0377597995102406	0.0377597995102406
148250666310001421	179161688498759335	55583.5069285	45	1.33478999137878	1.46703996506403E-05	1.32614002268383E-06	0.998808979988098	28441031	3	5.76378006371669E-05	3.13063992507523E-06	35667969	0	7374912	168.84981296	59.30715457	0.0493431985378265	0.0493431985378265
123325711170000179	179161688498759335	55334.2573031	30	1.28084003925323	4.31074004154652E-05	3.70660995940852E-06	0.999557018280029	16937517	4	5.73653014726005E-05	4.78320998809068E-06	35667969	0	124782656	168.84984276	59.30721012	0.0467064008116722	0.0467064008116722
123426646170000229	179161688498759335	55335.2666525	30	1.28654003143311	4.95345011586323E-05	5.49368996871635E-06	0.999602019786835	16989317	4	7.6477401307784E-05	5.54801999896881E-06	35667969	0	124782656	168.84982005	59.30715227	0.0602081008255482	0.0602081008255482
123425388170000181	179161688498759335	55335.2540732	30	1.28069996833801	2.96463003905956E-05	3.3808998978202E-06	0.997667014598846	16987017	4	7.8459401265718E-05	5.75311014472391E-06	35651585	0	7374912	168.84992647	59.30714316	0.0618944987654686	0.0618944987654686
116753546170000094	179161688498759335	55268.5356725	36	1.47788000106812	1.73035004991107E-05	1.85177998446306E-06	0.998842000961304	14774017	2	1.61984007718274E-05	2.14170995604945E-06	35651585	0	7374912	168.84995451	59.3071895	0.0581117011606693	0.0581117011606693
116754416170000227	179161688498759335	55268.5443795	36	1.51578998565674	1.99864007299766E-05	2.02677006200247E-06	0.99870902299881	14775517	2	1.64802004292142E-05	2.17587989936874E-06	35651585	0	7374912	168.84978545	59.30719865	0.0550679005682468	0.0550679005682468
115644663170000366	179161688498759335	55257.4468208	32	1.28165996074677	2.90089992631692E-05	4.25750022259308E-06	0.999198973178864	14437617	3	9.26200009416789E-05	4.89407011627918E-06	35667969	0	108005440	168.85006837	59.30716401	0.0796295031905174	0.0796295031905174
117151202170000279	179161688498759335	55272.5123379	52	1.43060004711151	7.2386001193081E-06	1.12247005290556E-06	0.950729012489319	14880017	1	6.34667003396316E-06	1.66244001320592E-06	35667969	0	7374912	168.84991705	59.30726753	0.0842000022530556	0.0842000022530556
115643665170000161	179161688498759335	55257.4368465	32	1.28683996200562	3.17109006573446E-05	3.91080993722426E-06	0.999269008636475	14435917	3	9.12395989871584E-05	4.86543012812035E-06	35667969	0	108005440	168.84982811	59.30724274	0.0669988989830017	0.0669988989830017
223561660650000401	179161688498759335	56336.6168684	43	1.50107002258301	7.67202982387971E-06	1.16457999865816E-06	0.998009026050568	58087965	1	4.41867996414658E-06	1.75355000919808E-06	35667969	0	7374912	168.84959486	59.30738858	0.0827011987566948	0.0827011987566948

223562303650000363	179161688498759335	56336.6232838	43	1.53067004680634	6.94970003678463E-06	1.12114003059105E-06	0.998597025871277	58088865	1	4.63049991594744E-06	1.78015000074083E-06	35651585	0	7374912	168.84997658	59.30714763	0.0878980979323387	0.0878980979323387
186549388360000546	179161688498759335	55966.4940736	30	1.28784000873566	2.57753999903798E-05	2.9135799195501E-06	0.997686982154846	45191836	4	9.48685992625542E-05	5.99779014009982E-06	35667969	0	7374912	168.84995928	59.30722864	0.0615819990634918	0.0615819990634918
186548596360000476	179161688498759335	55966.4861404	30	1.29456996917725	3.00632000289625E-05	3.19225000566803E-06	0.998459994792938	45190336	4	9.63661004789174E-05	6.03015996603062E-06	35651585	0	7374912	168.84988062	59.30717744	0.0578433983027935	0.0578433983027935
194828861360000399	179161688498759335	56049.2888798	45	1.27960002422333	2.2316900867736E-05	1.71546003002732E-06	0.997192978858948	48339036	3	5.70791016798466E-05	3.15303009301715E-06	35667969	0	7374912	168.8497873	59.30723566	0.0418649017810822	0.0418649017810822

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

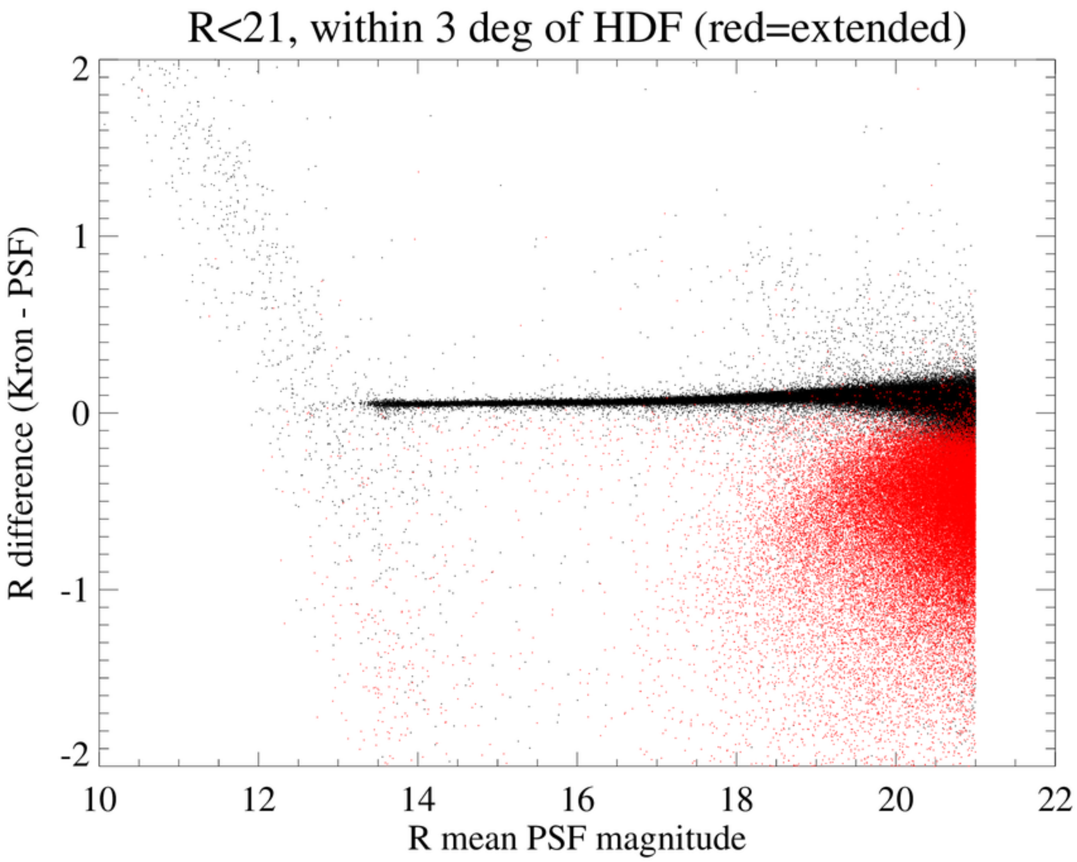
The same region of the sky contains 86,685 Gaia DR2 sources, of which 77448 have a valid five-parameter astrometric solution, and 68638 have also a valid G magnitude. For the first matching stage, we do not require valid magnitude or five-parameter astrometry; the direct positional match with a generous 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 wuill 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)

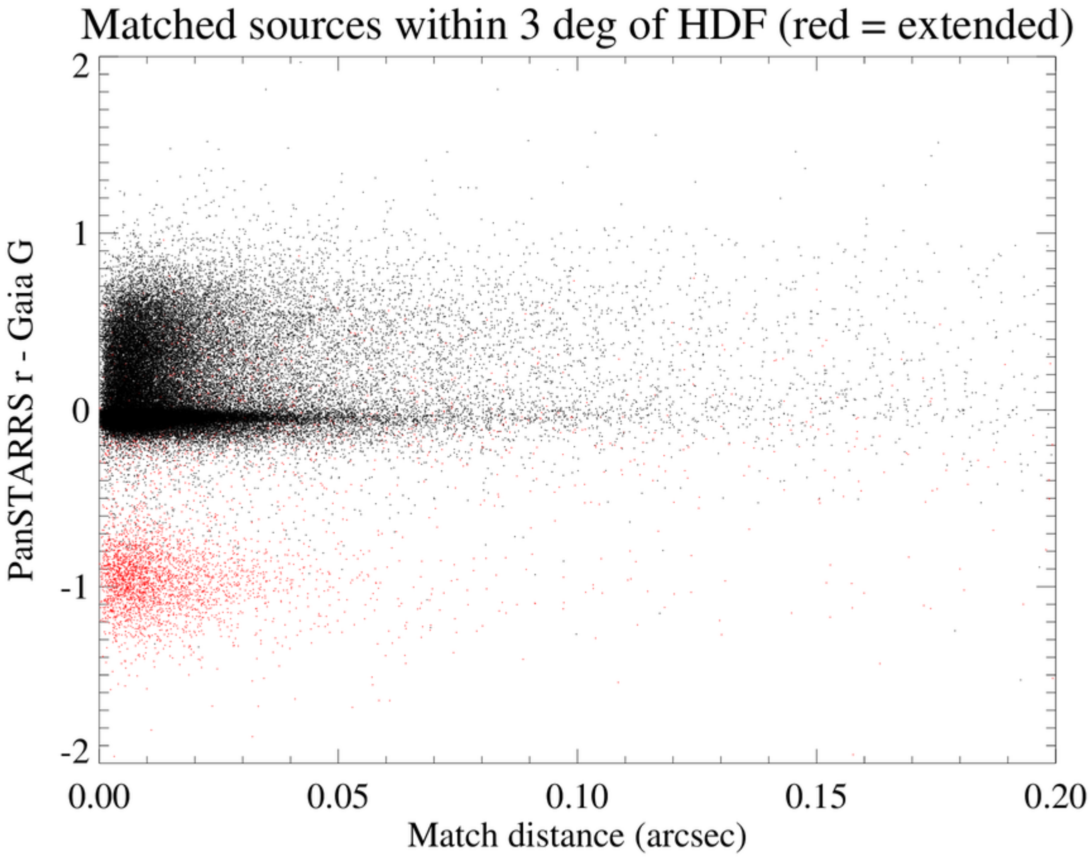
(this is a bitwise AND). The ExtendedFlag thus defined correlates well with the Kron vs. PSF magnitude difference (which presumably is part of the definition):



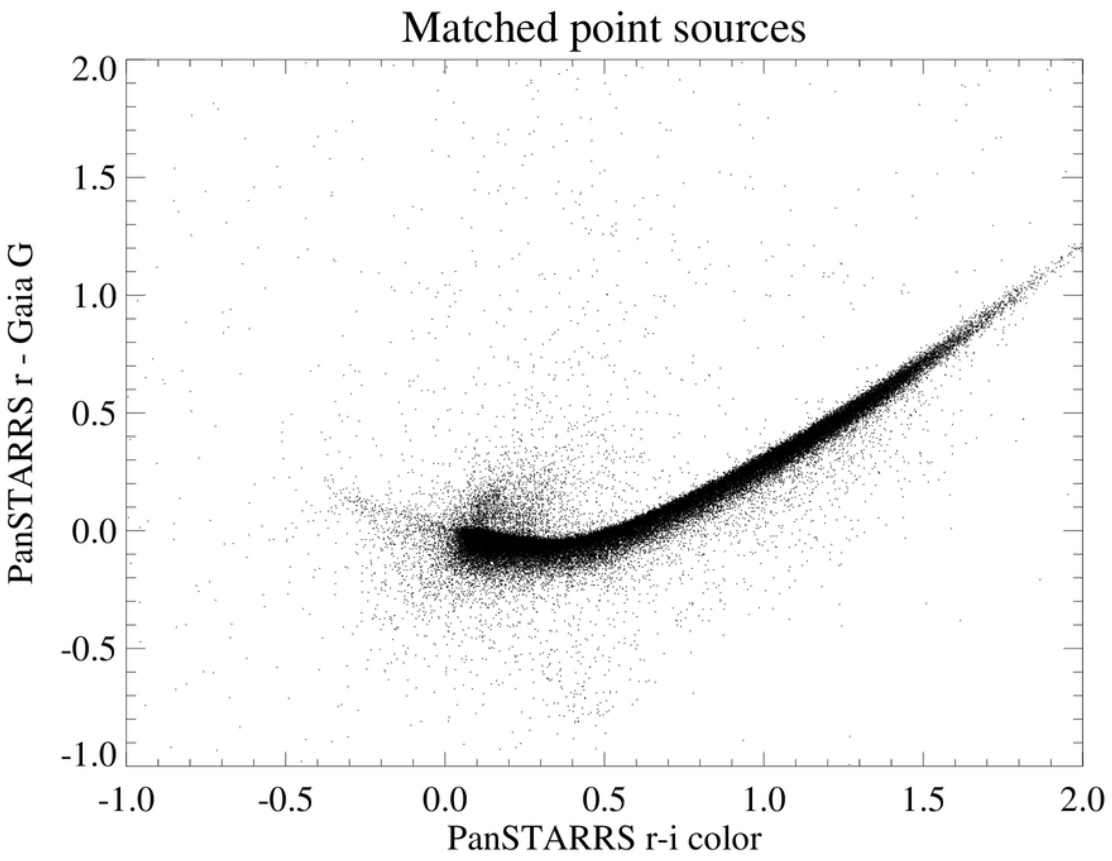
Red dots in this plot have ExtendedFlag == true. In the following, we use ExtendedFlag to identify extended objects.

Step 4: compare Gaia and PanSTARRS magnitudes for point sources

The match distance distribution shows clearly that "true" matches likely have match distances << 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"):

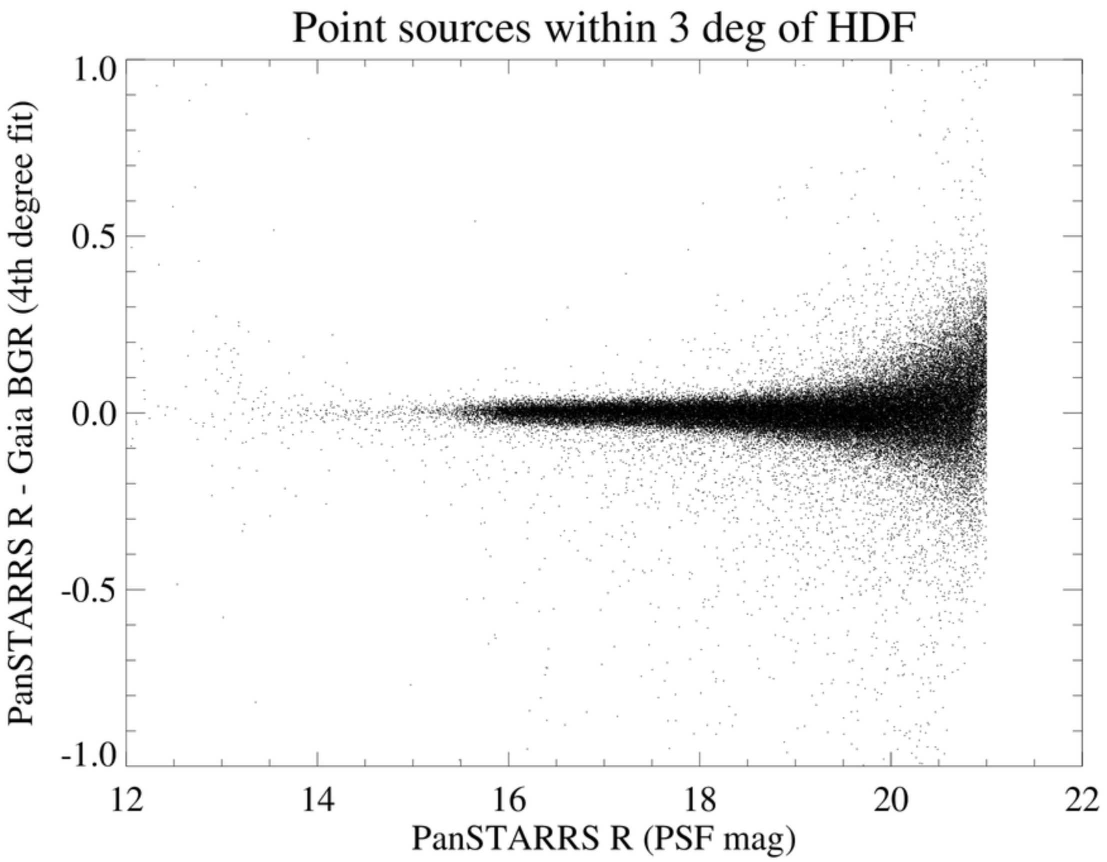


The plot shows two populations of point sources: a narrow band with r-G ~ 0, containing a majority of the matches, and a broader distribution at positive r-G values (brighter in G than in r). Extended sources are mostly brighter in PanSTARRS r, as expected since Gaia, with its higher angular resolution, 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.

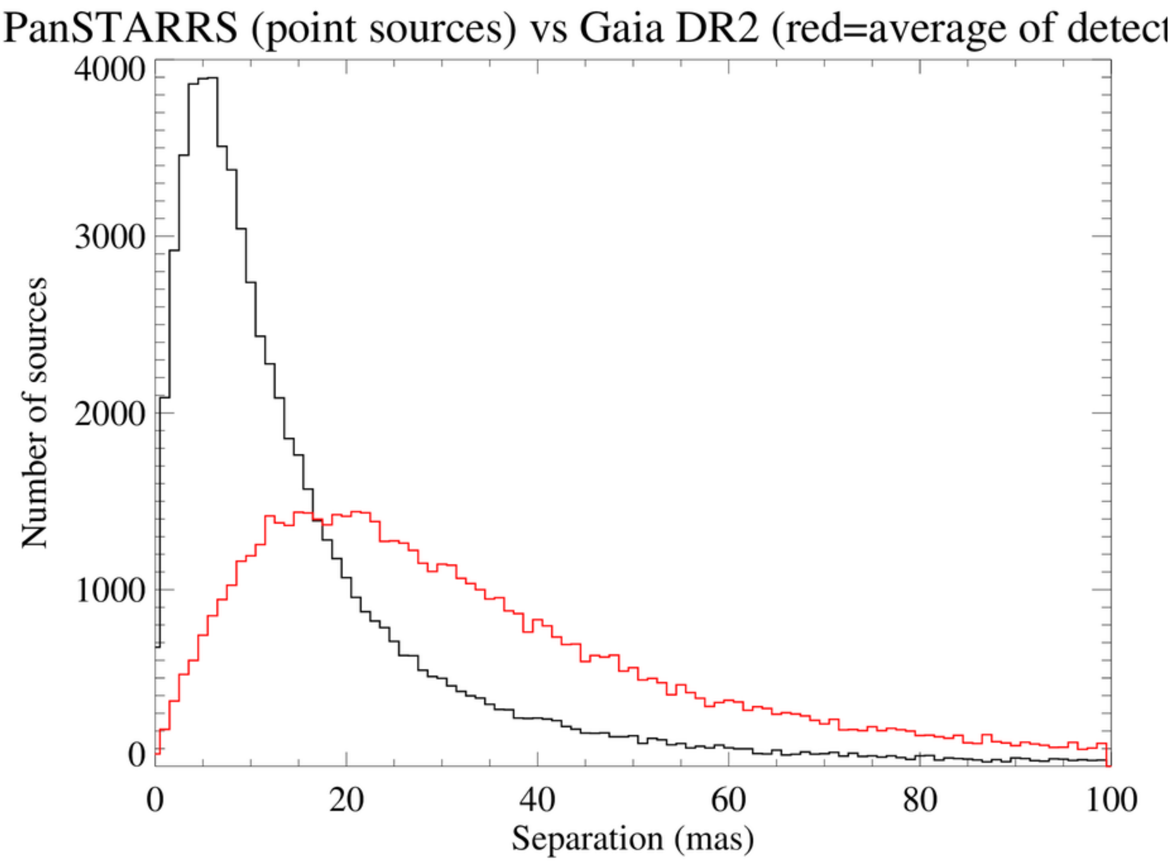
We can take one additional step and attempt to define a color transformation that maps Gaia magnitudes (G, B, and R) into PanSTARRS r. A degree 4 polynomial results in a very good match, albeit with large scatter at faint magnitudes, where Gaia B and R magnitudes lose precision:



It would also be possible to define a combination of PanSTARRS magnitudes to map into Gaia G, but the above plots clealy 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:



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 vaidity of PanSTARRS astrometry after matching to Gaia, and potentially offer information of source proper motions.