Faint Object Survey Field Selection

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In order to minimize the dynamic range requirement for a faint-object survey, one might select a “blank” field for the survey in which the flux of the brightest source is as faint as possible. To find such fields, we sampled the entire sky observed by the NVSS. For each sampled pointing we defined an observing field and located the brightest source in that field, picking out those fields where the brightest source flux was relatively low.

A search of the entire sky as observed with the NVSS was performed for each of 6 different circular survey field sizes (see Table 1). For each field size, a histogram of peak source fluxes was created (Figure 1). The low-intensity tail consists of fields which may be of particular interest to surveys (Table 2). For small fields of around 2 to 5 square degrees, the requirement for dynamic range may be reduced by an order of magnitude from what would be necessary with a naively selected median field.

The scan pattern is over-sampled, with each pointing being offset in RA or DEC by half the field radius. Thus, it may be possible to improve upon these results by fine-tuning individual pointings.

Proper searching should include a primary-beam weighted search area outside of the survey area proper to ensure low flux densities outside the beam half-power point. While this is simple to do in software, it requires an additional parameter for the primary beam width.

In using these results, one should keep in mind the possibility that selection of special fields with minimum peak flux may bias the science of the survey. In particular, this technique avoids bright sources such as quasars that may exist at peaks in the matter density distribution.

Table 1. Ratio of median peak flux to lowest peak flux for each of the 6 search radii.

Field Size (sq. deg.)	Median peak flux	Minimum peak flux	Median/Minimum
2	313.4	26	12.1
5	553.4	68.3	8.10
10	837.1	144	5.81
20	1221	235.3	5.19
50	2042	455.3	4.48
100	2878	770.3	3.74

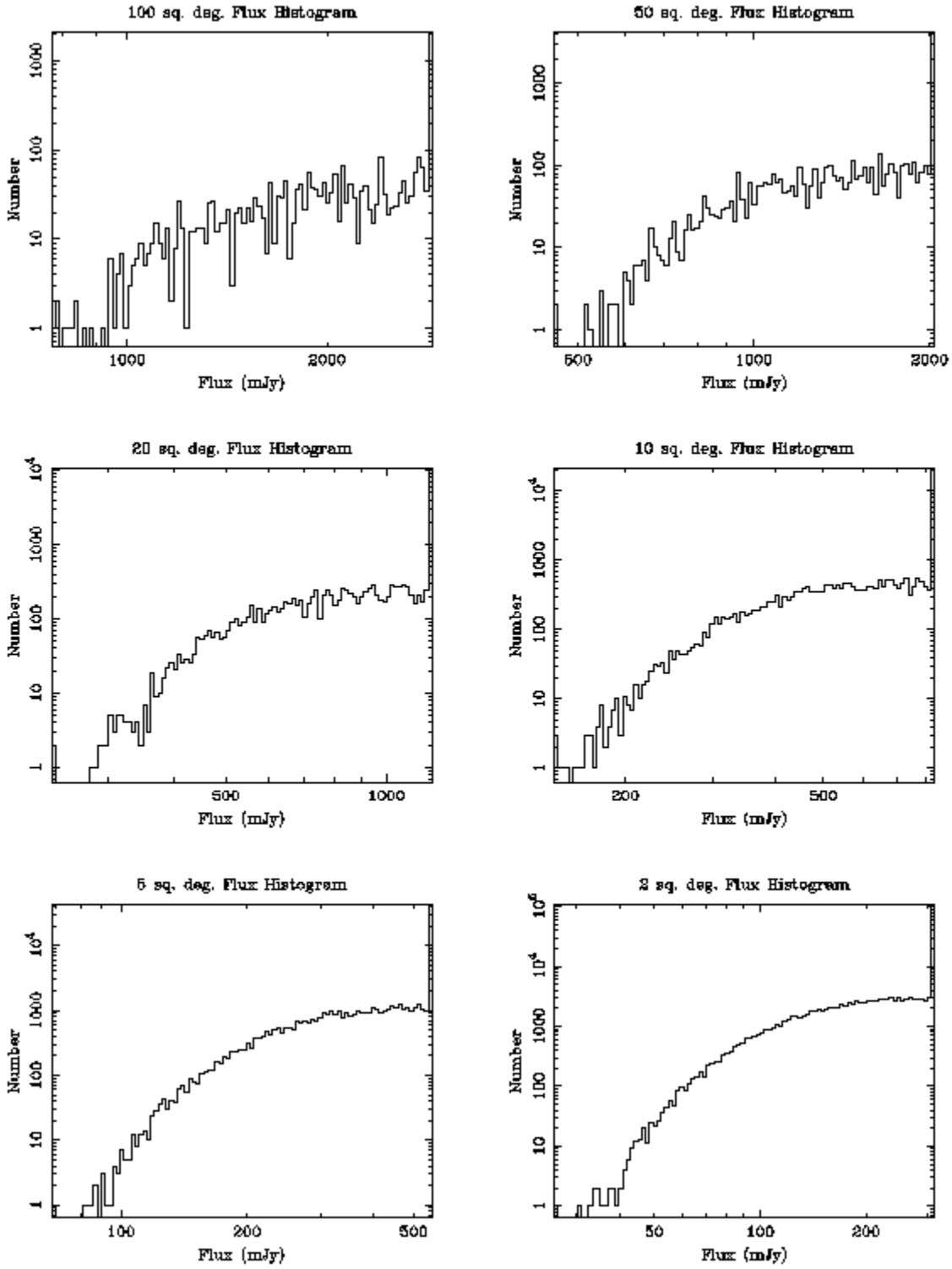

Fig. 1. Logarithmic histograms of the low peak flux tail of the distribution of fields for each of the 6 search radii.

100 sq. deg. Fields

09:15:35.43	00:16:13.20	770.3
09:04:15.11	02:33:02.21	790
09:04:15.11	05:22:17.62	790
03:27:27.45	22:17:50.09	805.3
03:07:49.56	25:07:05.51	819.4
09:57:04.39	-14:22:30.26	827.8
08:57:08.57	08:11:33.03	843.9
09:08:34.28	08:11:33.03	843.9
12:25:42.85	27:56:20.92	866.8
01:13:28.16	39:13:22.57	888.1

50 sq. deg. Fields

15:48:04.47	26:10:09.24	455.3
05:36:00.00	60:04:45.58	459.2
20:06:42.23	06:13:19.63	517.9
20:14:44.91	06:13:19.63	517.9
18:52:01.38	-15:43:10.93	525.4
20:31:59.99	02:13:57.71	546
16:57:29.10	22:10:47.32	550.6
20:31:59.99	00:14:16.75	551.4
14:47:02.39	46:06:58.85	562.3
16:16:41.73	50:06:20.77	568.6

20 sq. deg. Fields

23:02:11.38	-15:58:17.63	235.3
13:33:40.81	19:21:08.24	237
17:51:09.47	00:49:57.97	279.5
09:30:56.84	-02:05:39.61	286.3
08:52:17.74	25:39:36.43	286.7
02:07:52.58	24:23:54.79	291.2
02:04:36.92	68:33:12.14	291.9
05:27:16.36	62:14:43.95	294.1
05:33:54.78	60:59:02.31	296.5
05:23:28.69	60:59:02.31	299.8

10 sq. deg. Fields

09:24:33.94	-01:52:56.61	144
07:16:14.79	22:12:11.82	145.9
23:07:54.41	-16:09:19.38	146.5
23:45:11.56	15:04:00.43	148.4
13:09:02.46	43:36:45.98	150.5
18:32:28.23	50:44:57.37	153.6
07:12:23.16	22:12:11.82	158.8
04:57:46.66	36:28:34.59	161.5
16:16:57.66	45:23:48.82	164.3
10:36:09.86	43:36:45.98	167.4

5 sq. deg. Fields

10:41:59.36	09:15:35.13	68.3
22:16:07.16	45:12:51.83	80.9
15:37:44.51	29:26:41.35	83.2
13:37:38.95	14:18:21.68	85.1
10:17:52.89	-12:11:12.72	86.2
13:39:13.35	07:22:02.67	86.2
22:11:48.40	11:09:07.59	90.3
15:01:53.68	02:19:16.12	90.7
06:01:53.88	-03:59:12.07	90.8
15:19:59.99	40:47:56.09	92.7

2 sq. deg. Fields

00:23:56.57	20:58:58.74	26
03:19:12.16	-18:54:40.47	30.3
04:38:54.06	36:08:34.05	33.3
11:00:11.07	68:51:21.81	33.9
05:37:41.48	-24:05:50.97	34.1
01:03:25.71	21:22:54.93	34.3
03:06:52.21	29:21:38.78	34.3
10:05:59.48	38:56:07.39	35.5
22:43:11.99	-03:45:05.16	36.4
23:12:41.39	57:17:12.23	37.3

Table 2. Lowest peak flux fields for each search radius.

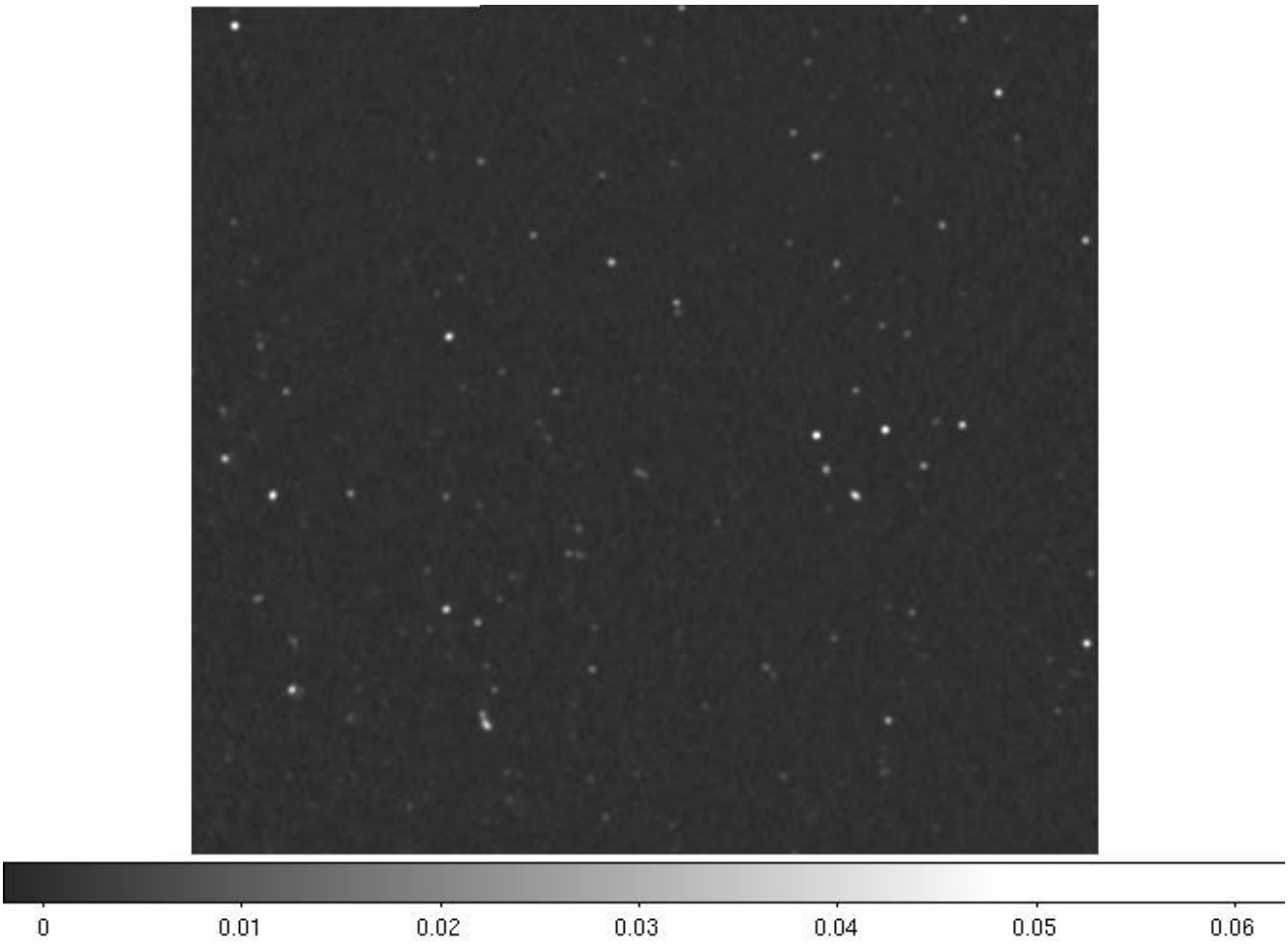

Figure 2. NVSS image of field at 1042+0915; peak flux is 68.3 mJy. Image is 2 degrees across.