

HI source finding using optical surveys

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HI source finding

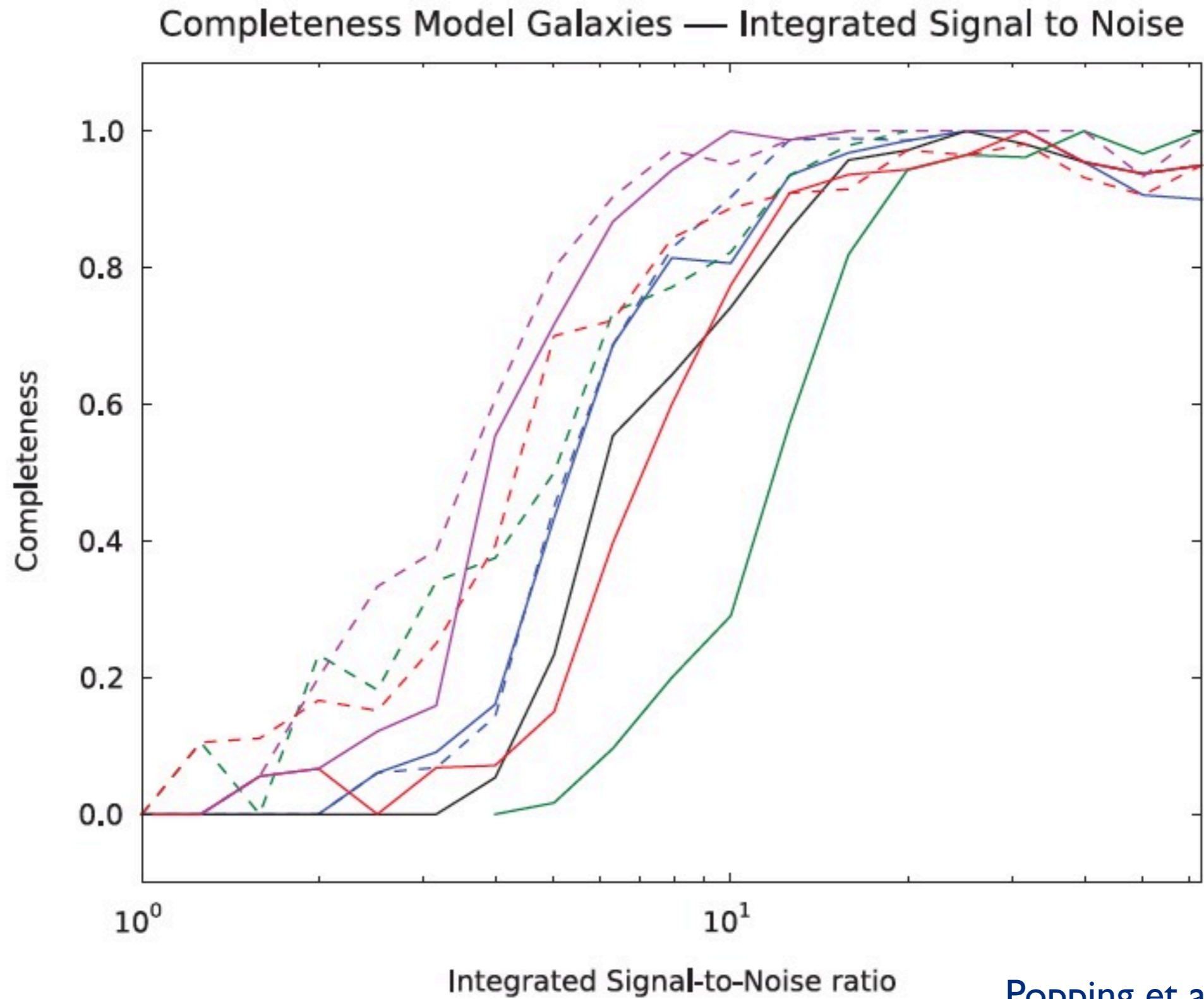
A lot of work has been done on source finding

- many source finding busy weeks
- many different algorithms
- number of papers
- SoFiA

This is important and a great result, but are we there yet ...?

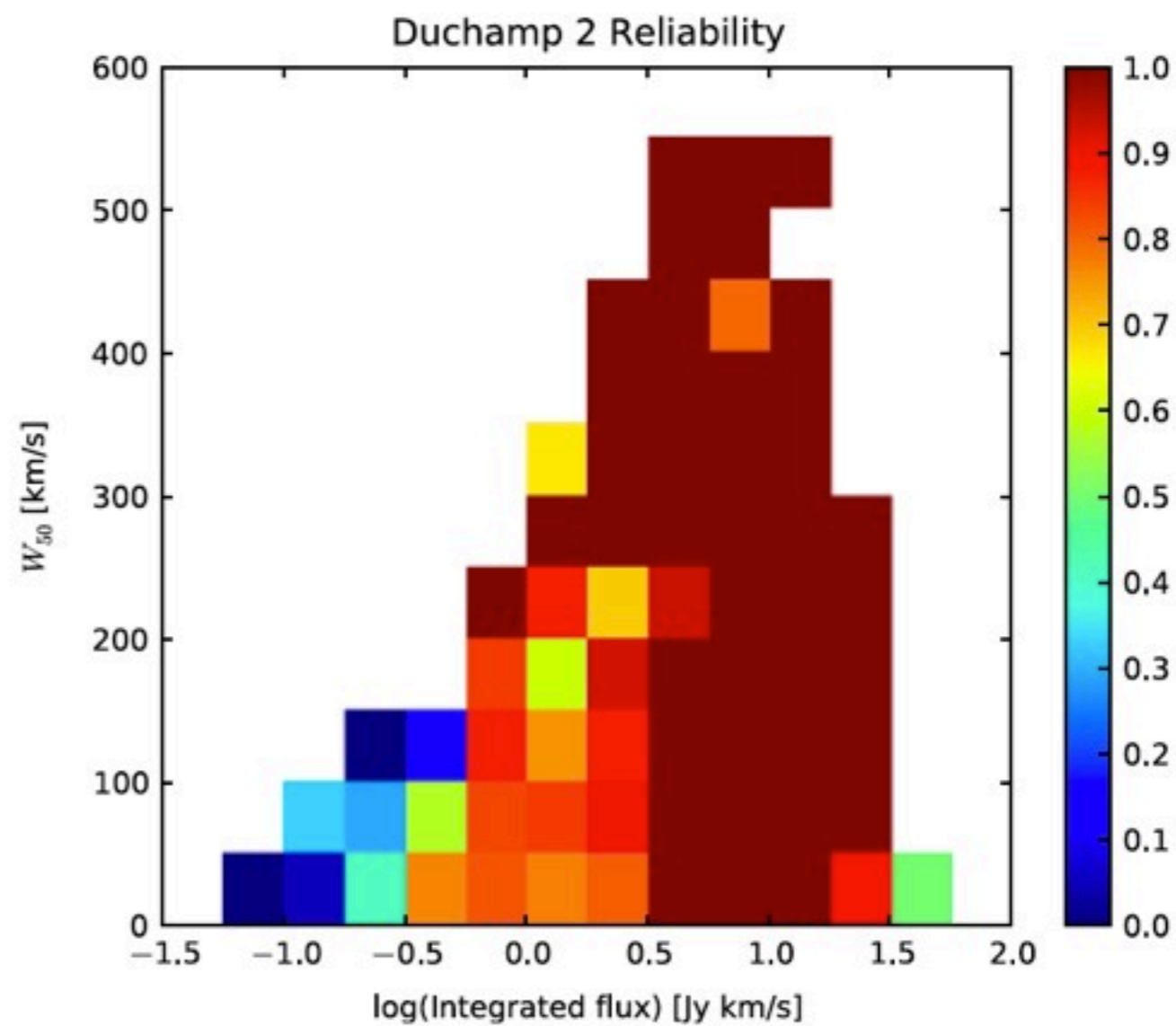
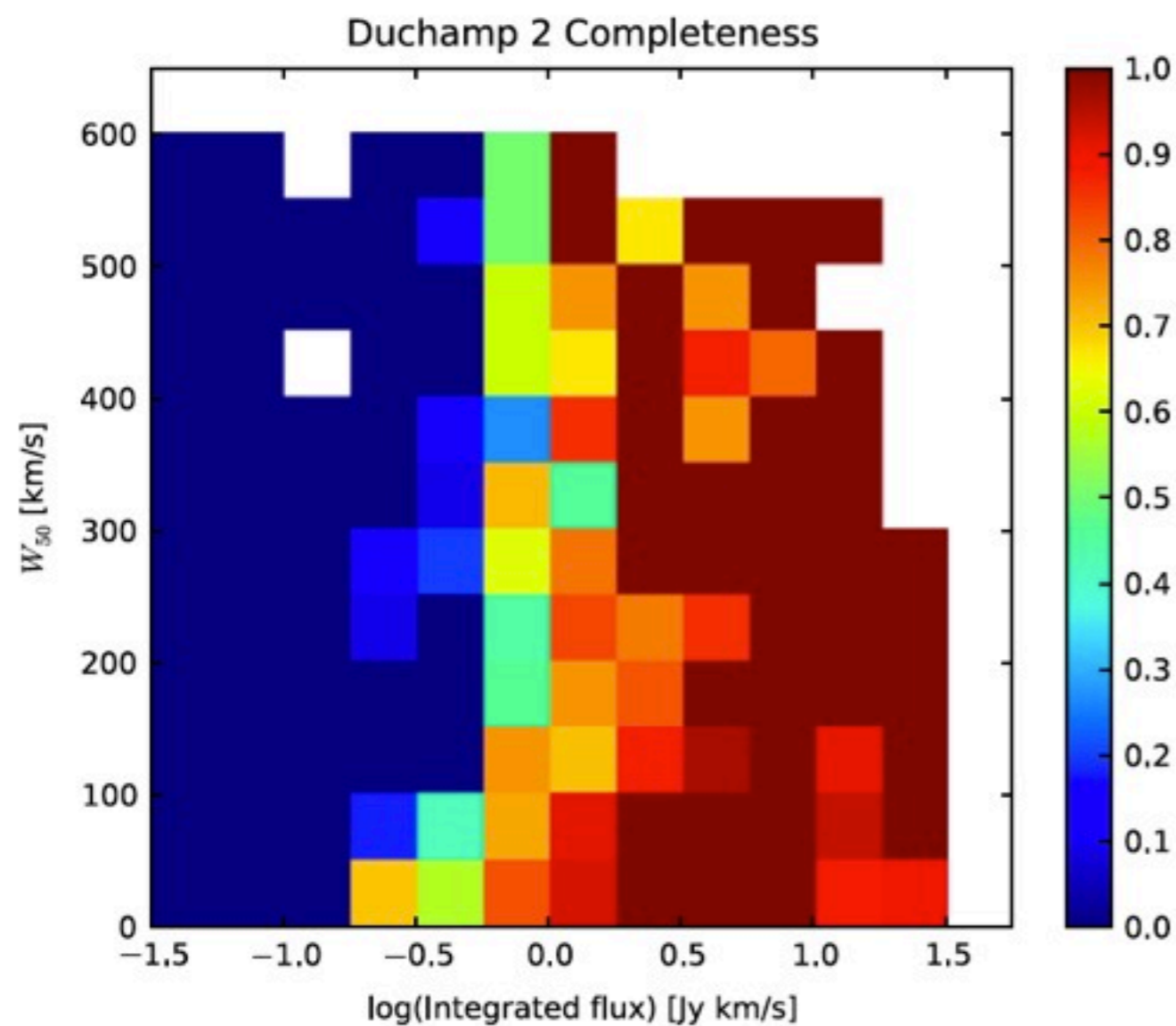


HI source finding



Popping et al., pasa 2012

HI source finding



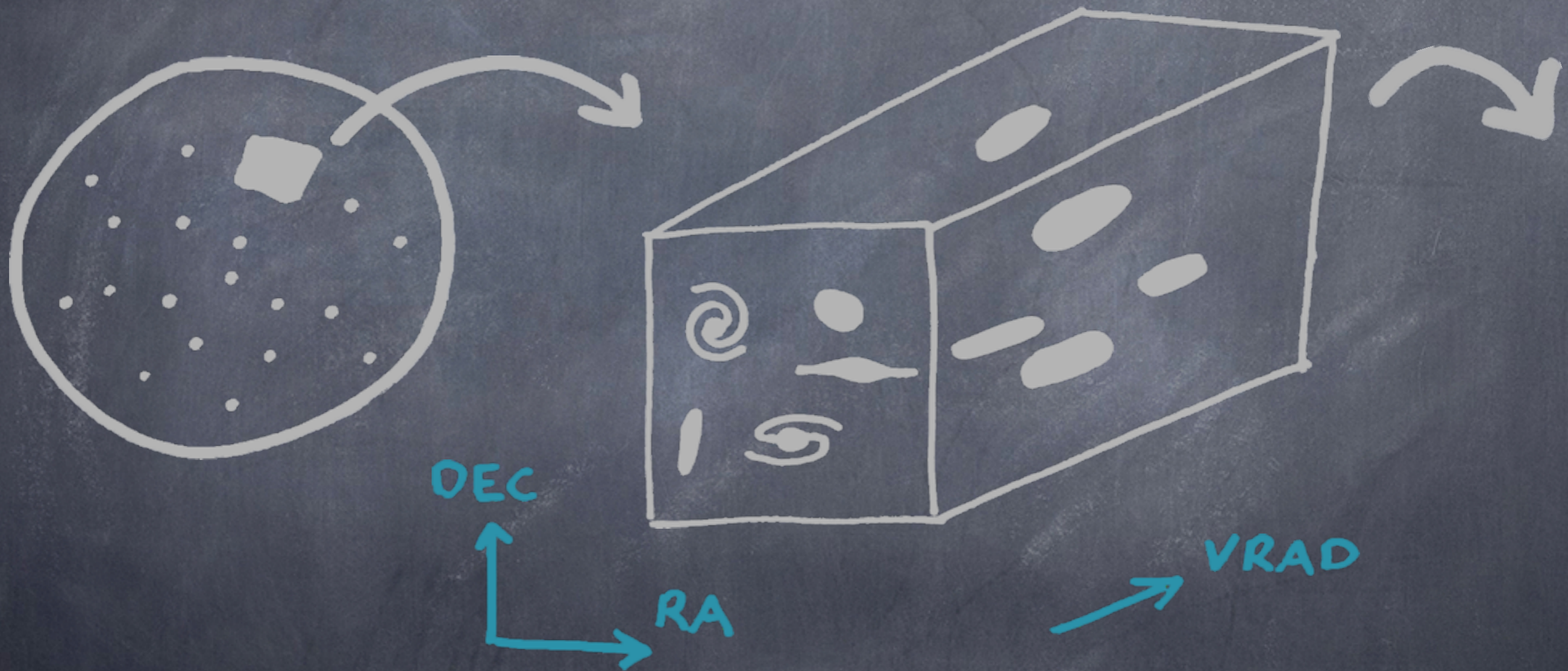
Popping et al., pasa 2012



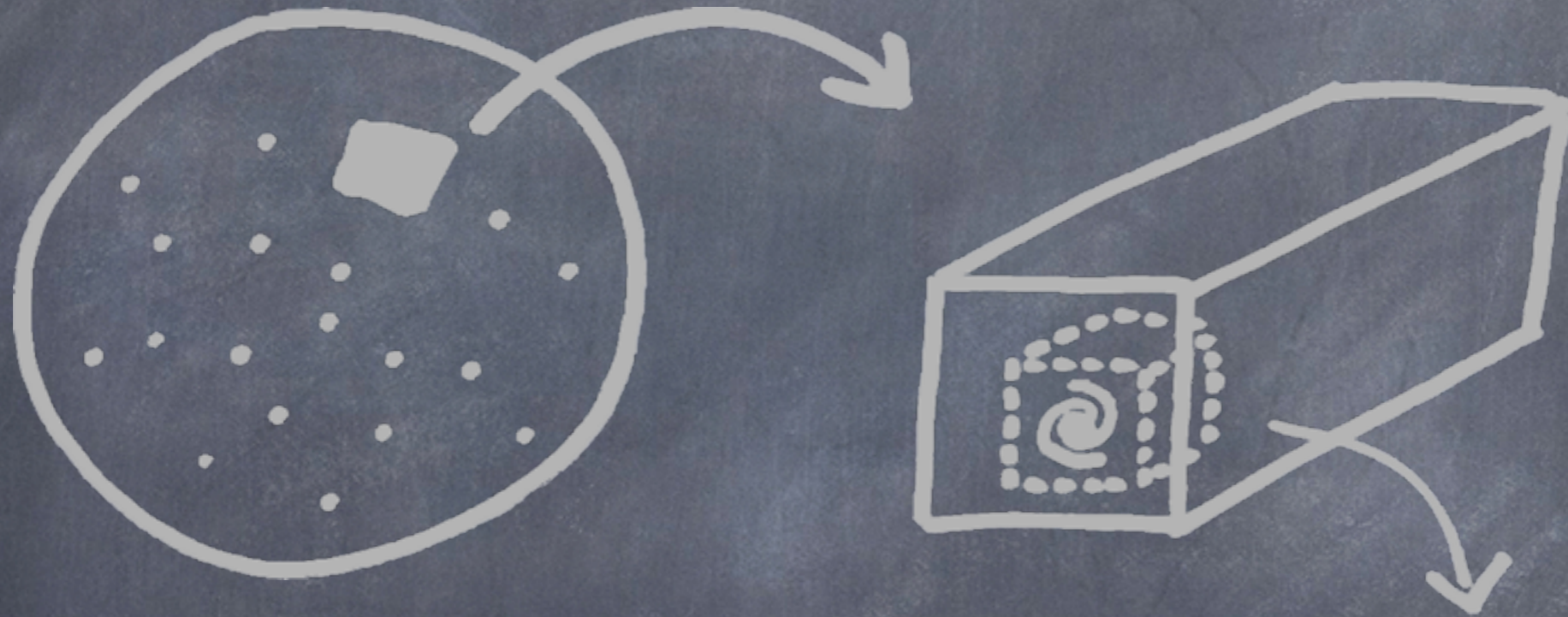
HI source finding

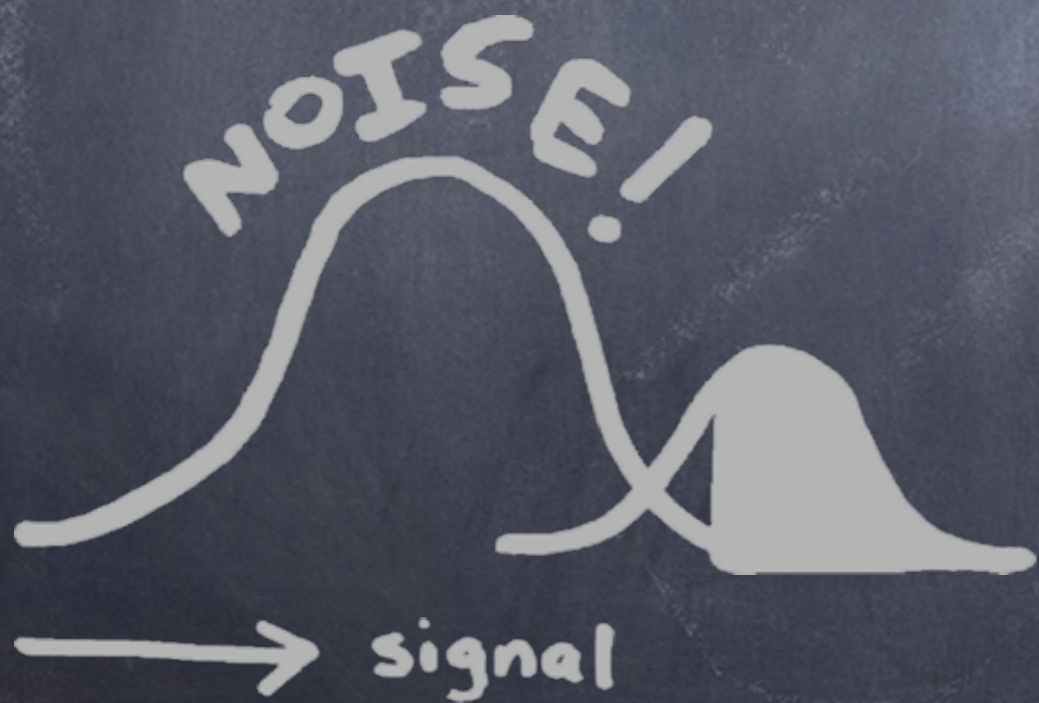
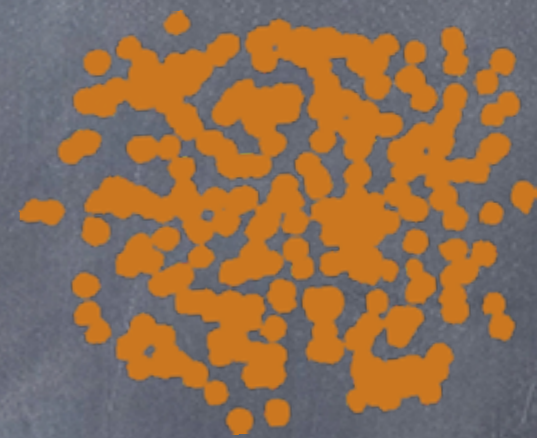
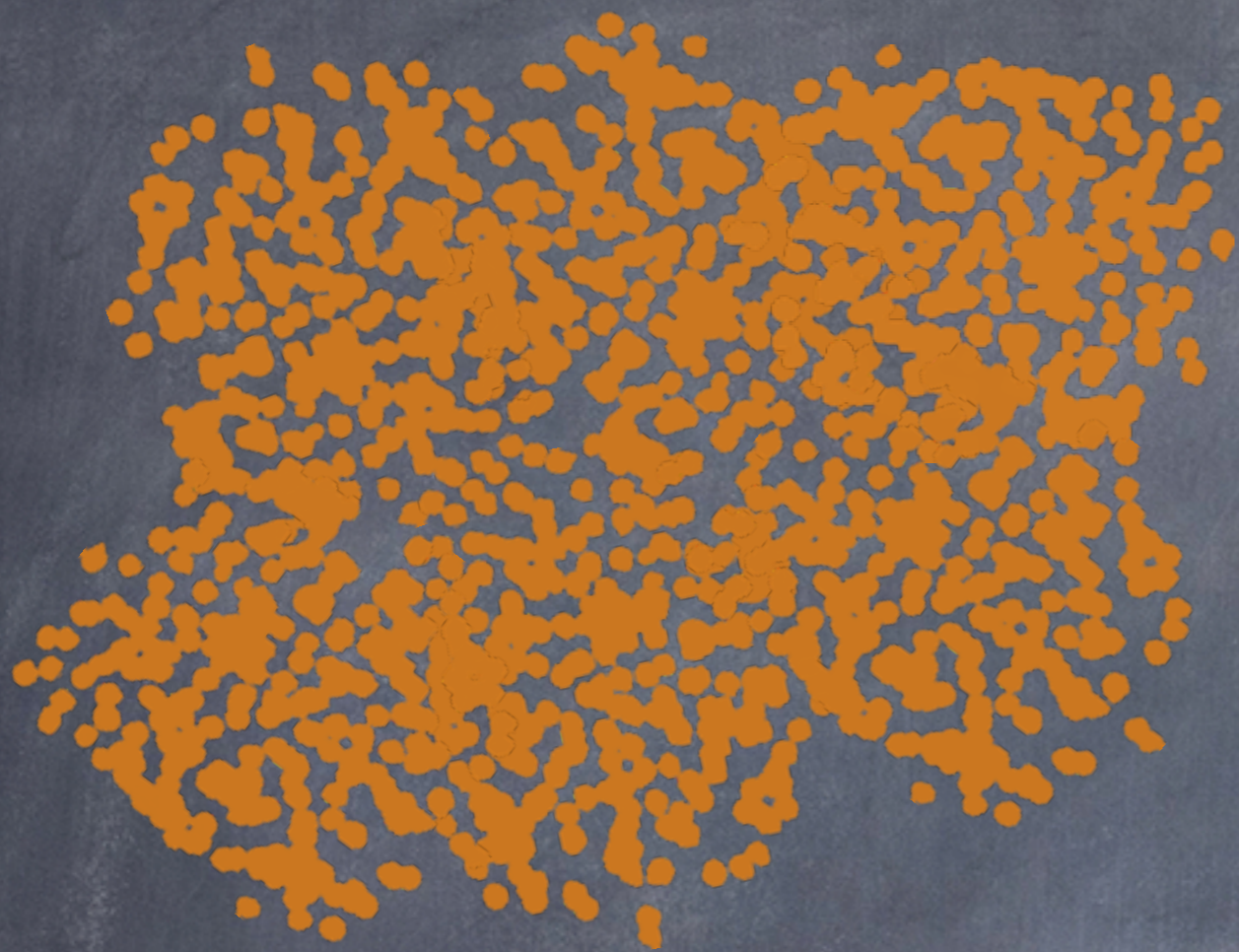
- Previous plots are in the “ideal world” with perfect noise
- Difficult to get a high completeness on sources with low flux levels
- Difficult to get a good reliability
- Both can be improved by using information (Ra, Dec, z) from optical catalogues
- People have known/assumed this, however the topic has largely been neglected.

Blind source finding



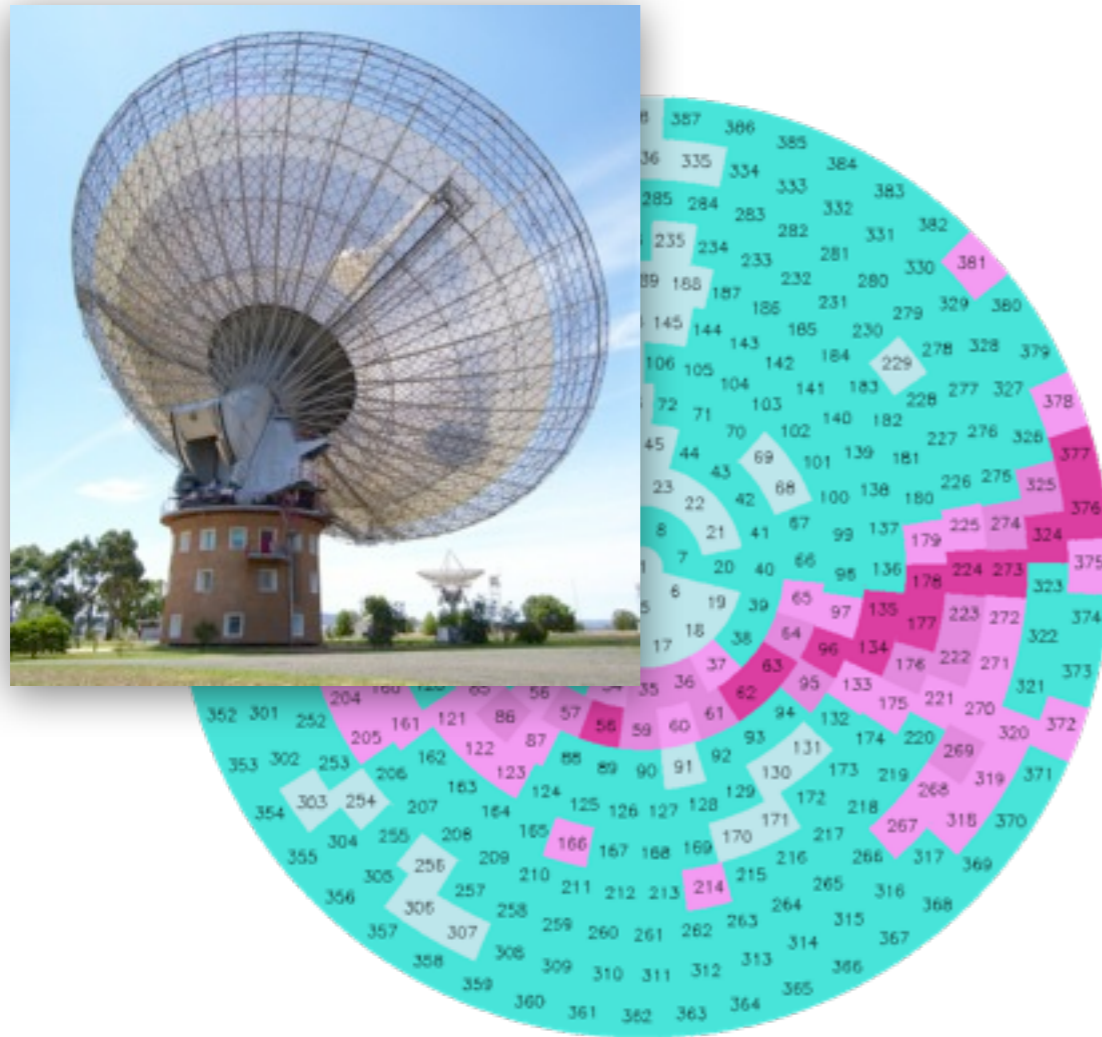
Targeted source finding







HIPASS II + GAMA



GAMA



Good test case, where we have a lot of information

number of redshifts in GAMA: 2417

number of galaxies in hipass: 35

number of galaxies in hopcat: 30



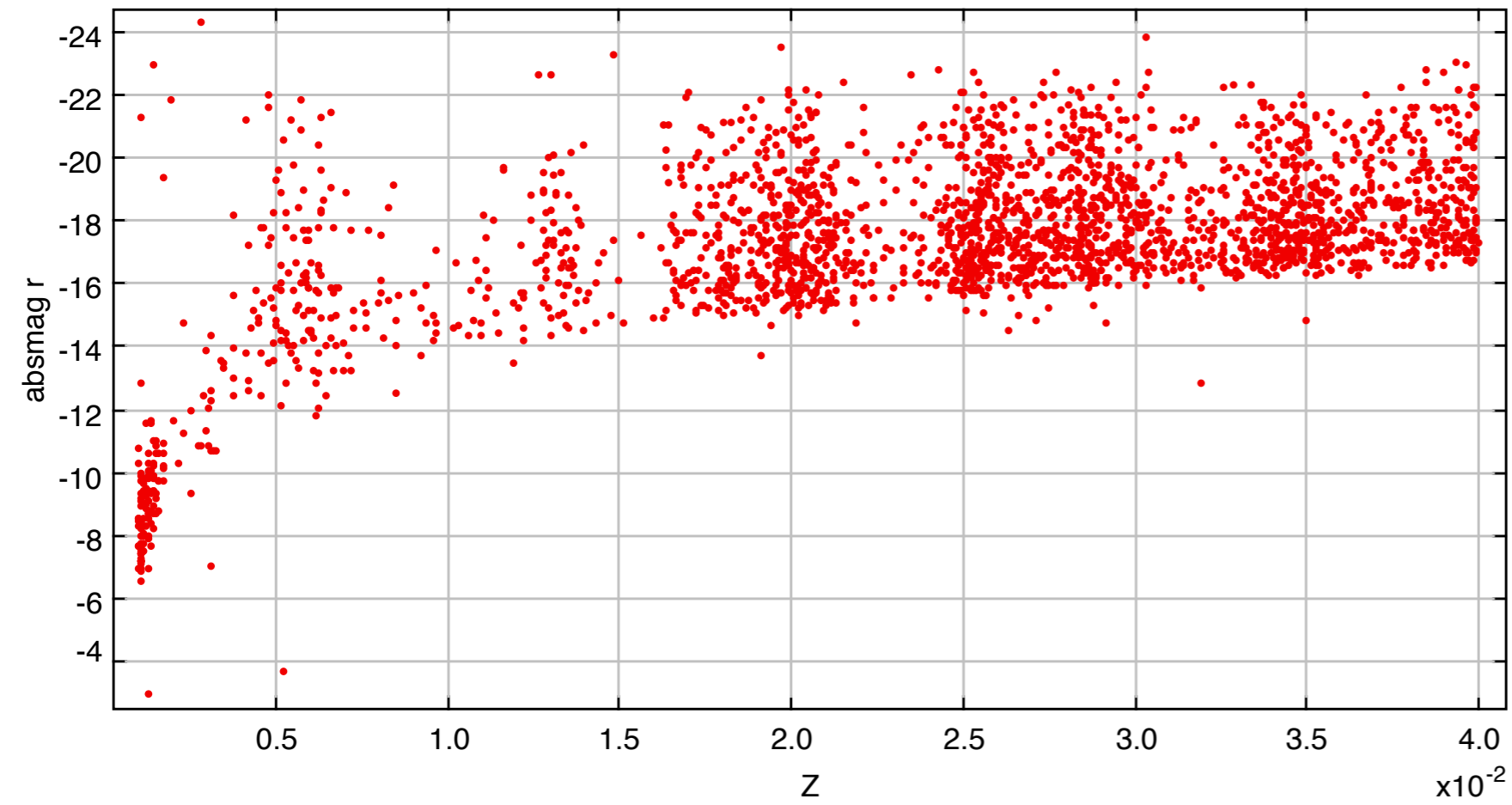
Python script:

- read optical catalogue (with, RA, DEC and z)
- convert position to x,y,z in HIPASS cubes
- extract a small cubelet around the given position
- look for HI detection using DUCHAMP
- extract spectrum, moment map etc ..



HIPASS + GAMA

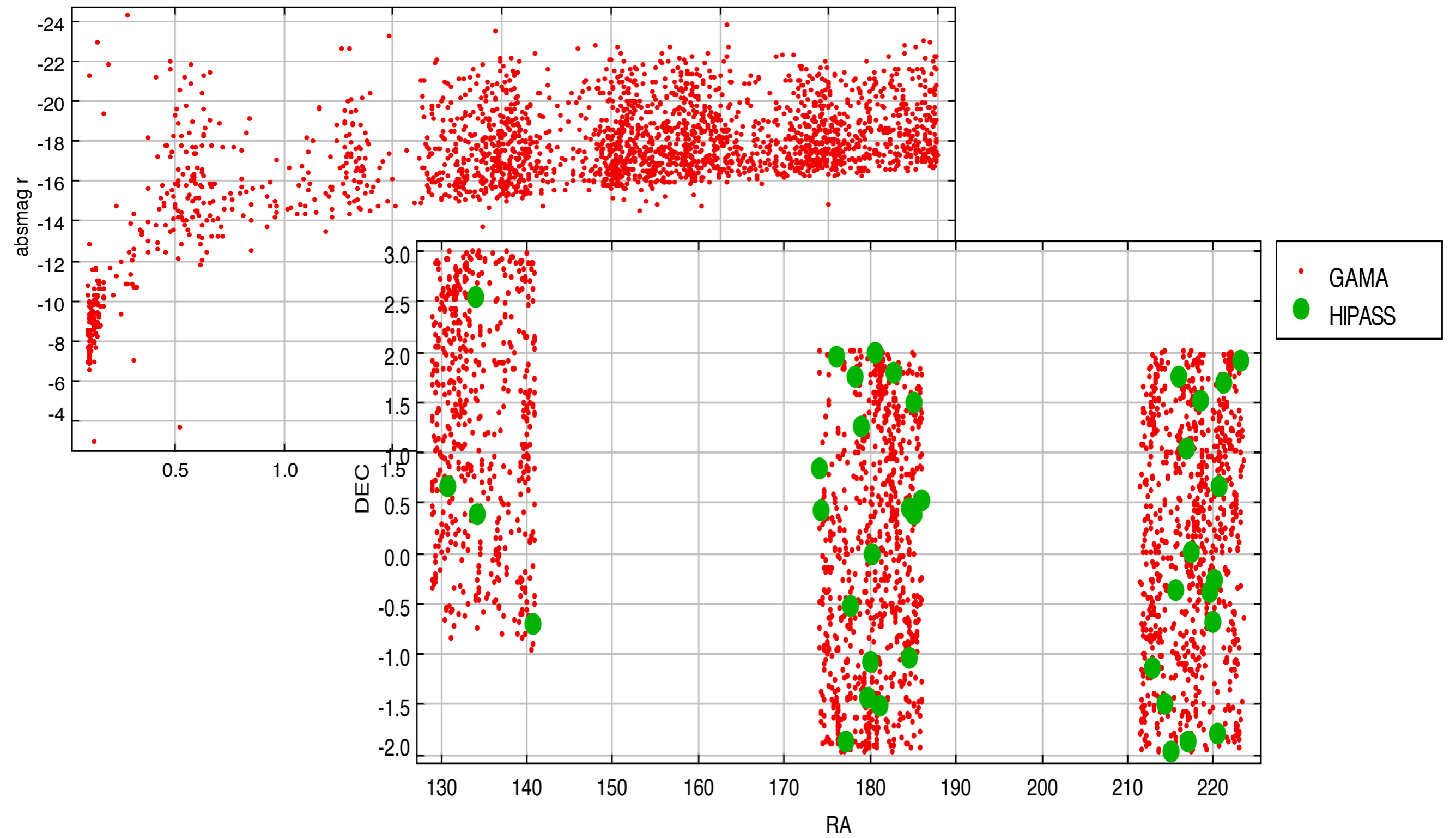
GAMA





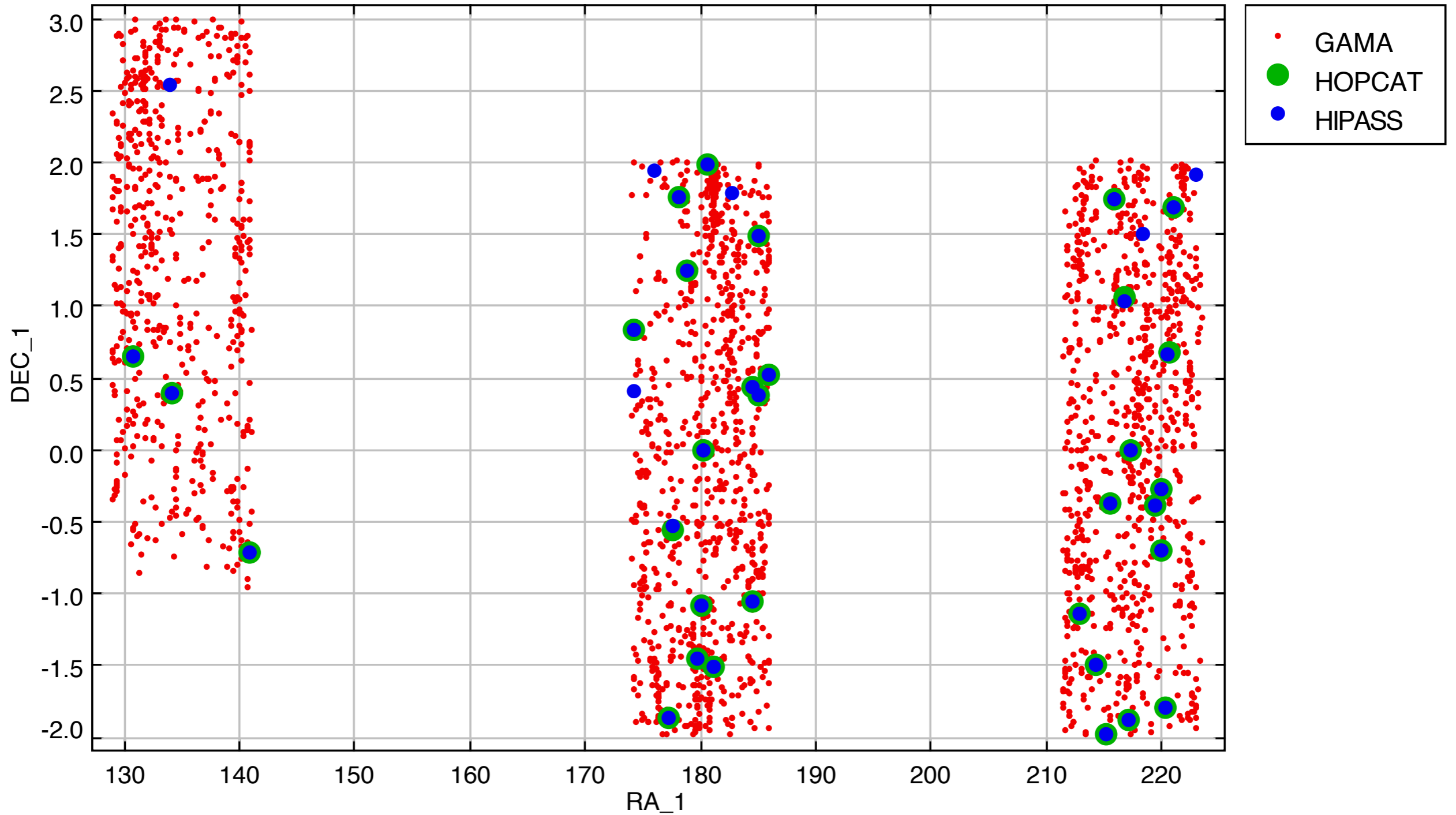
HIPASS + GAMA

GAMA



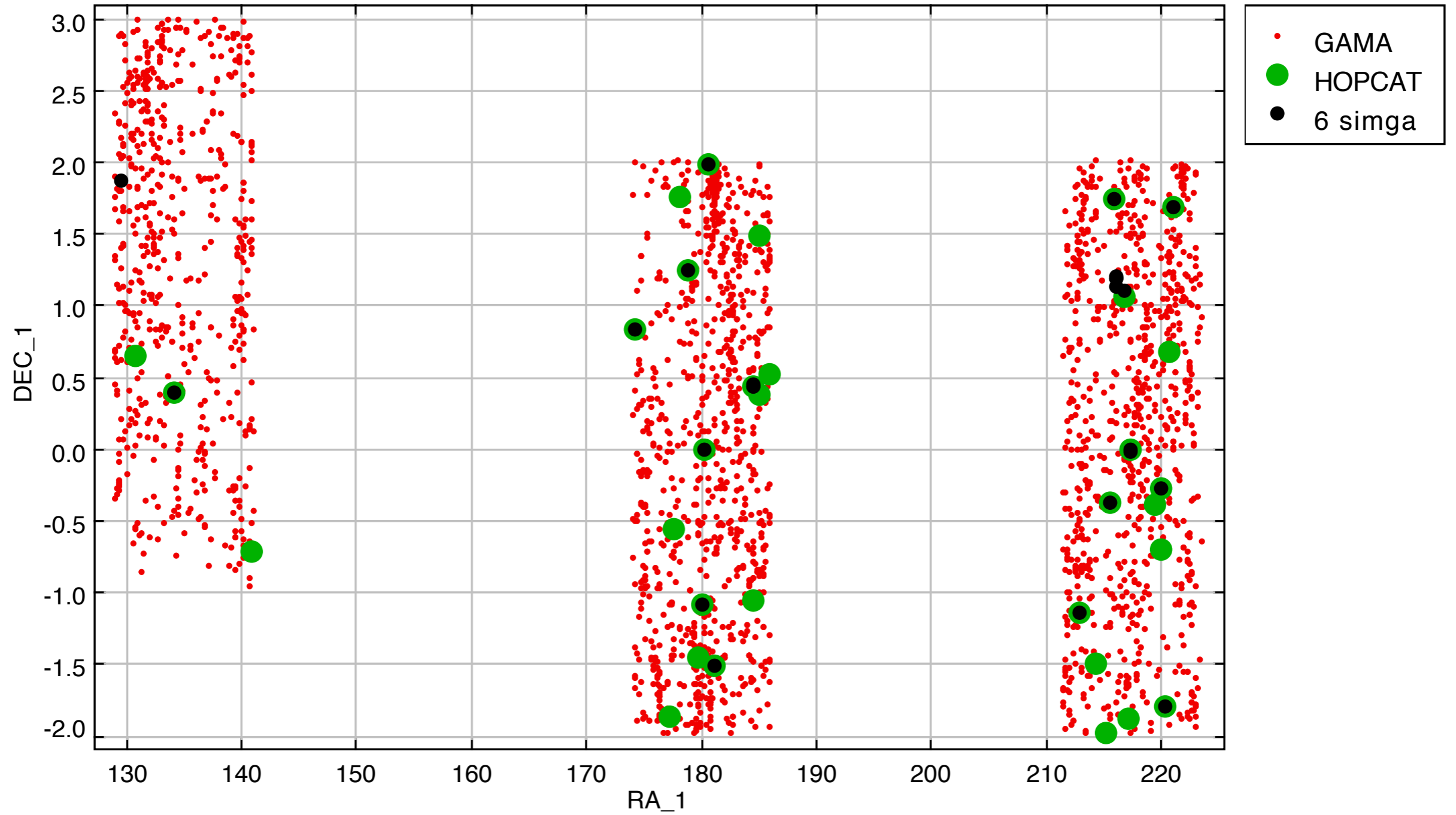


HOPCAT



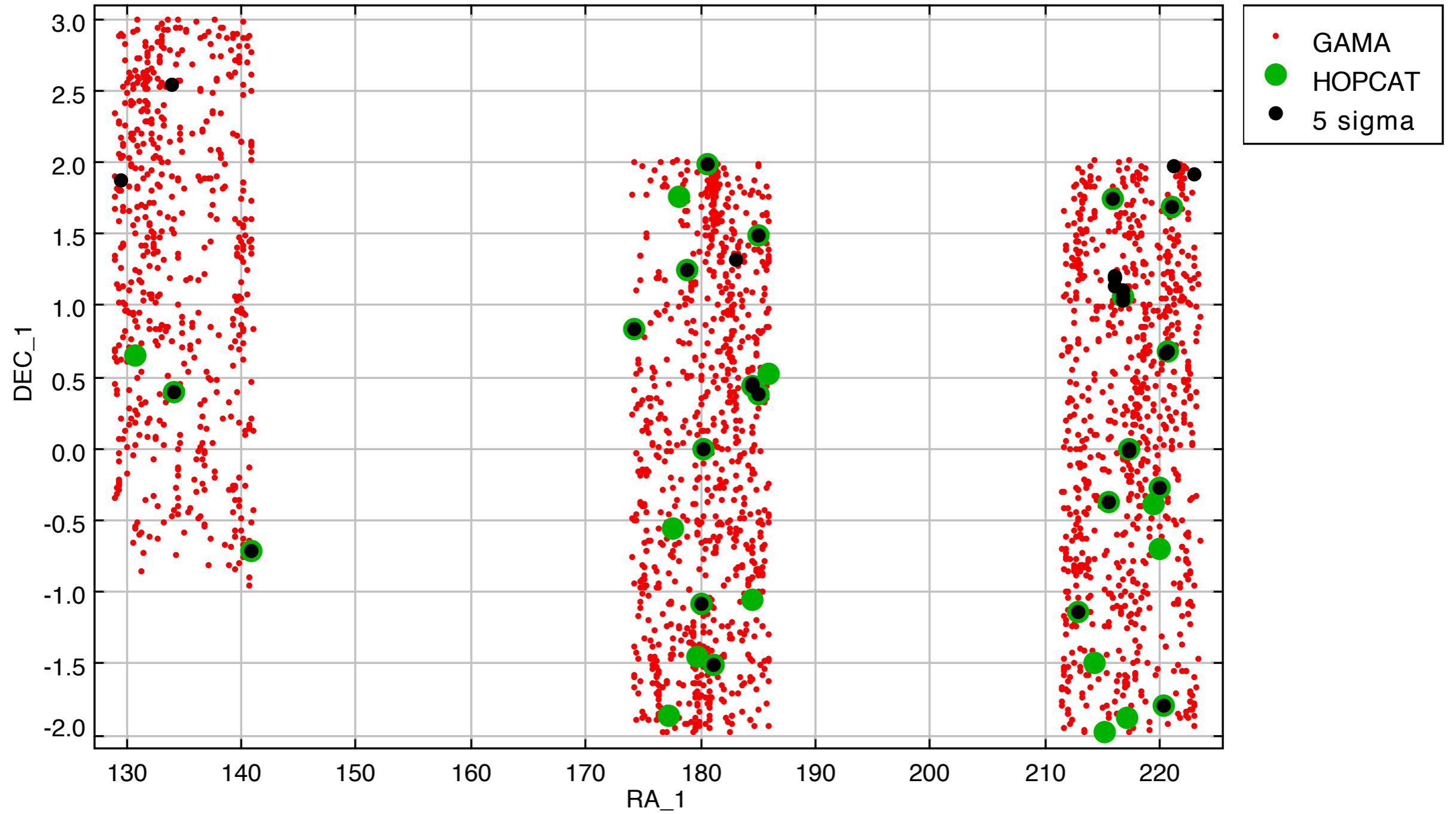


6 σ threshold



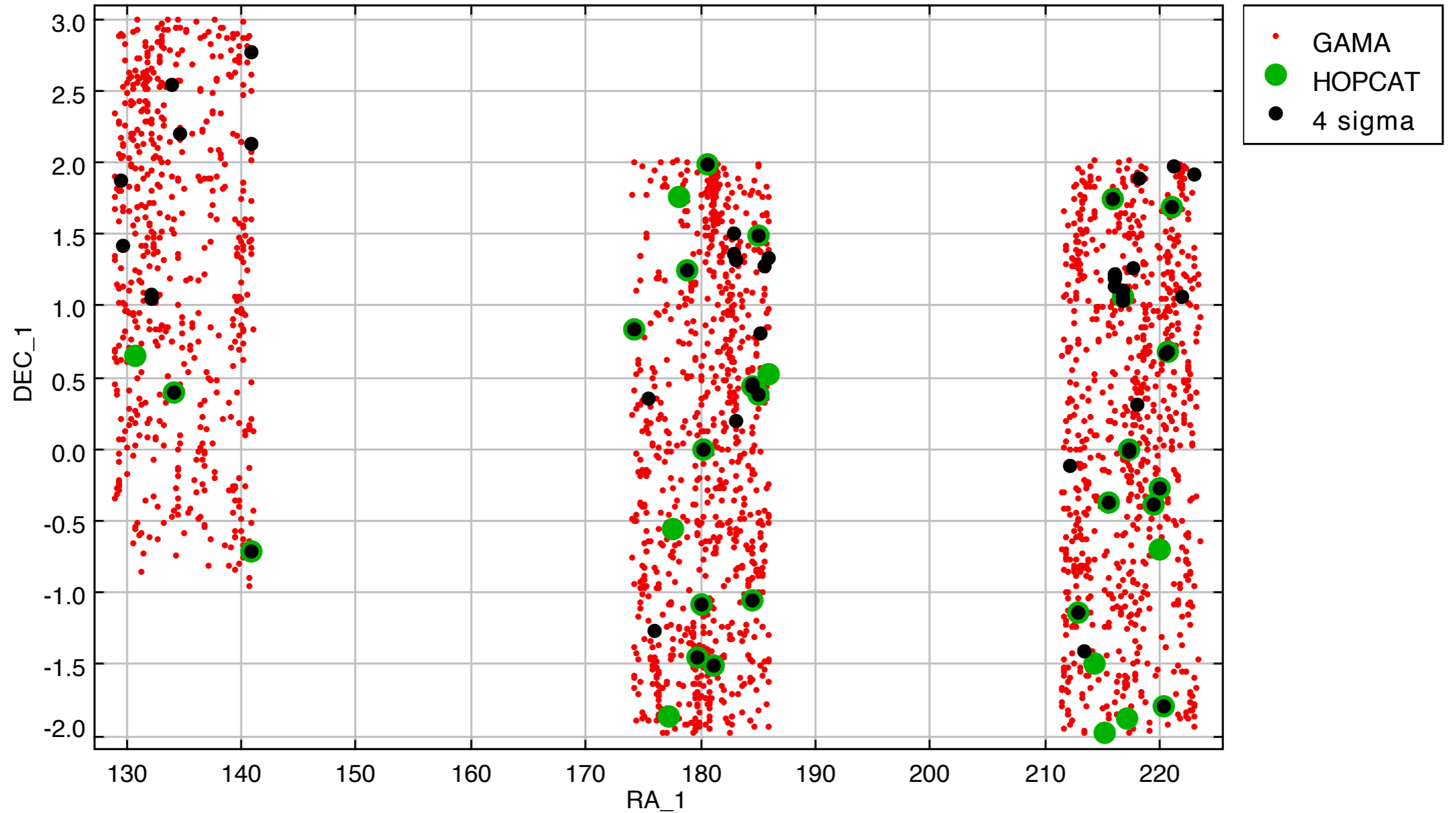


5 σ threshold



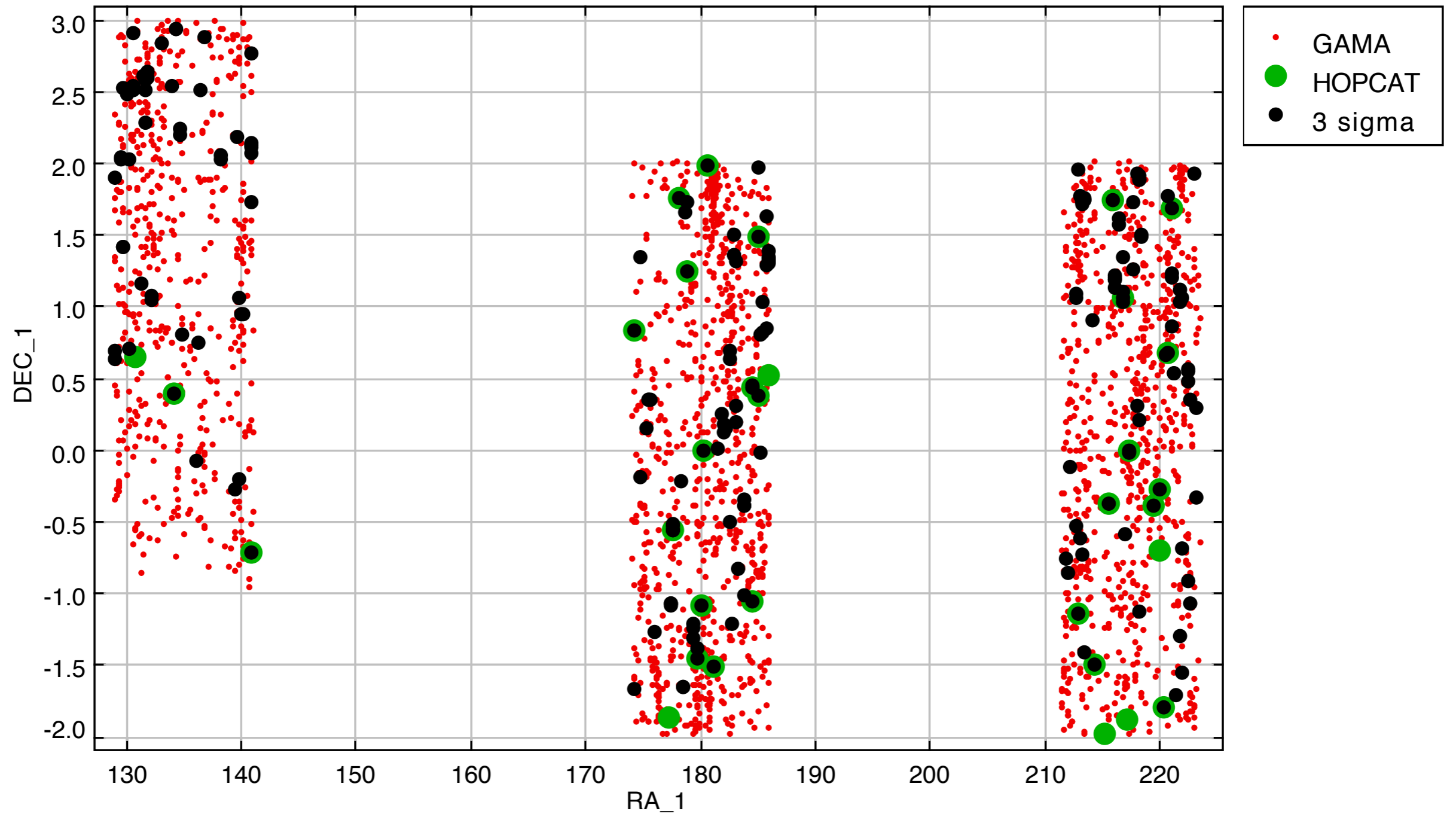


4 σ threshold



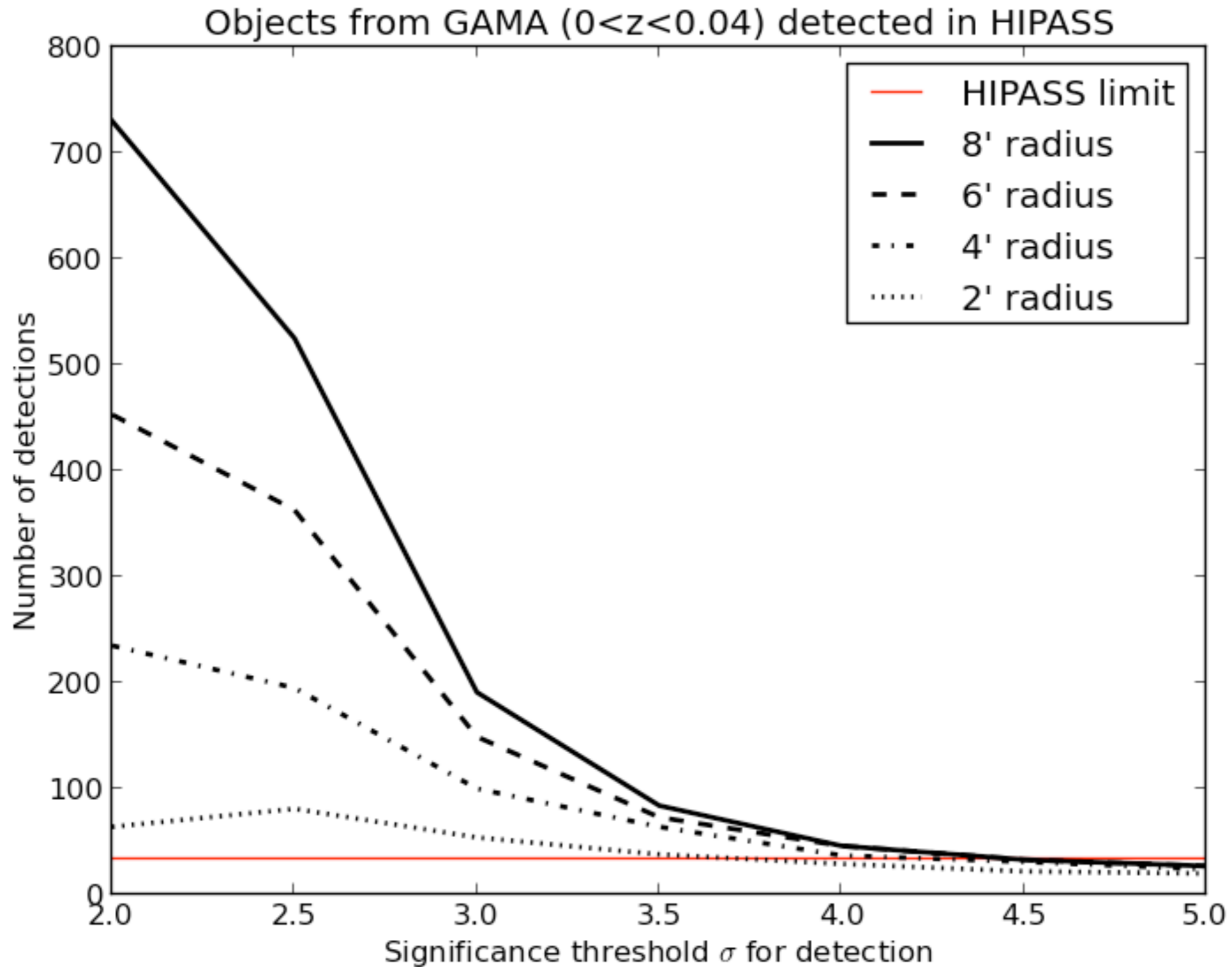


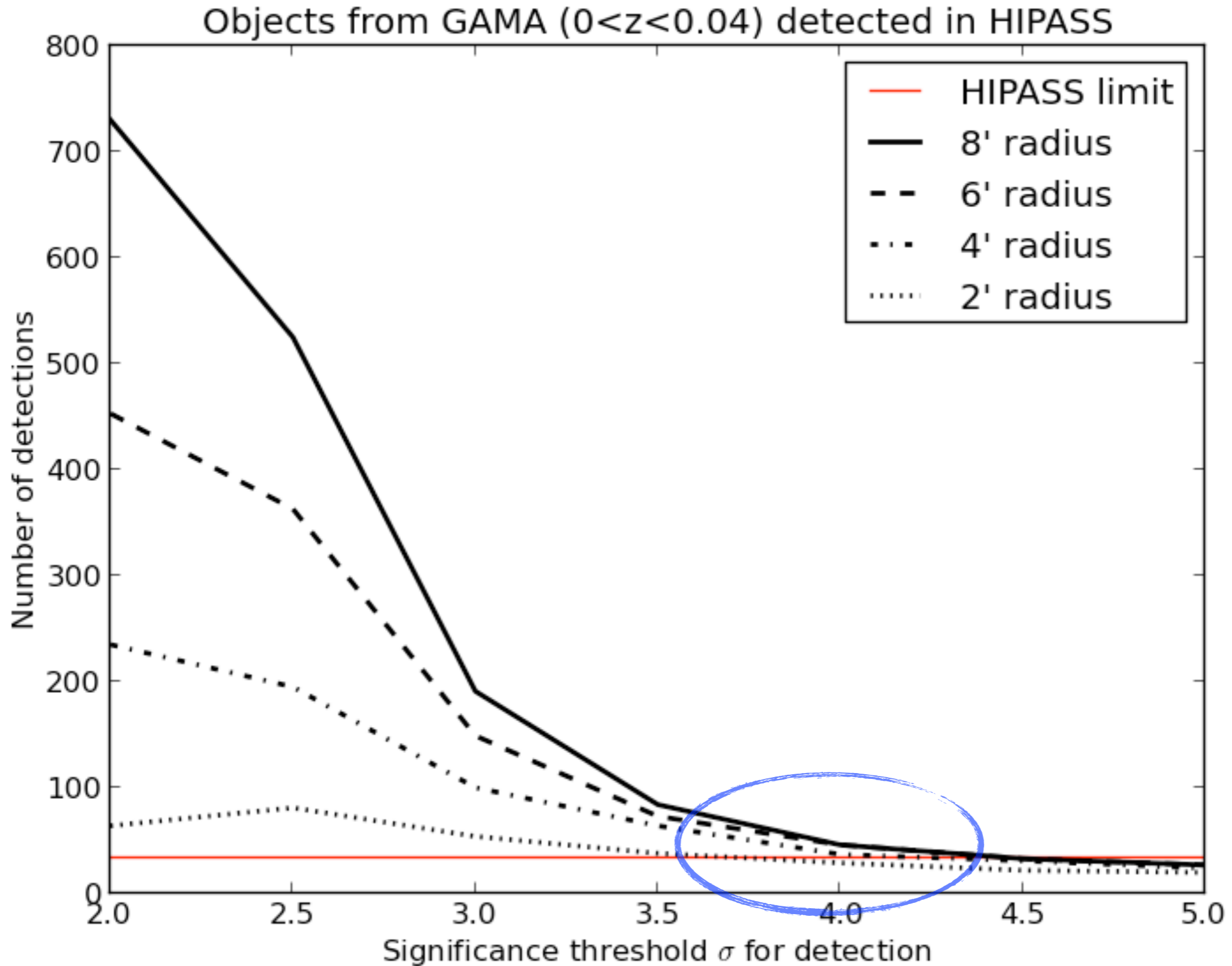
3 σ threshold





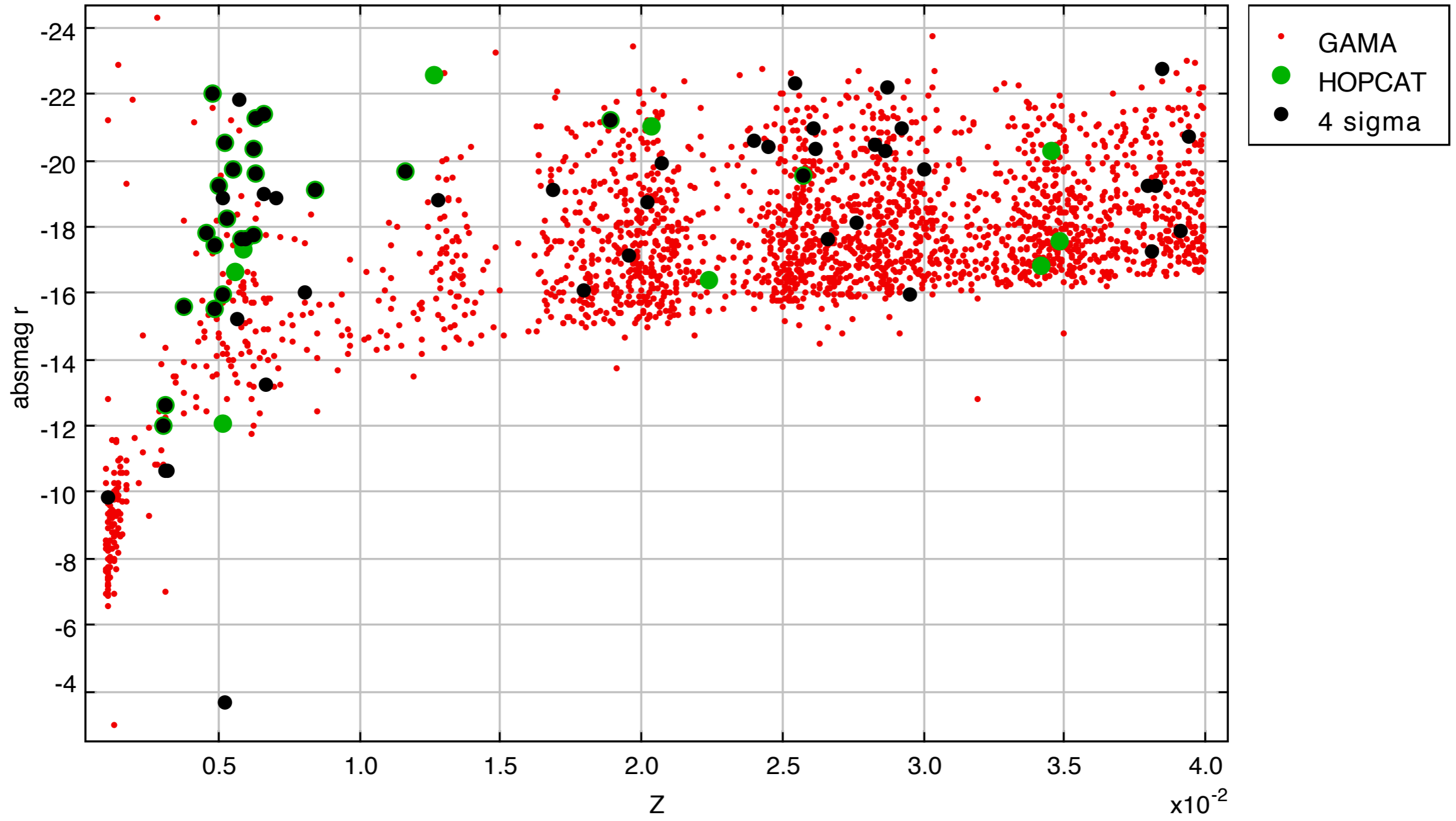
Search results







4 σ threshold





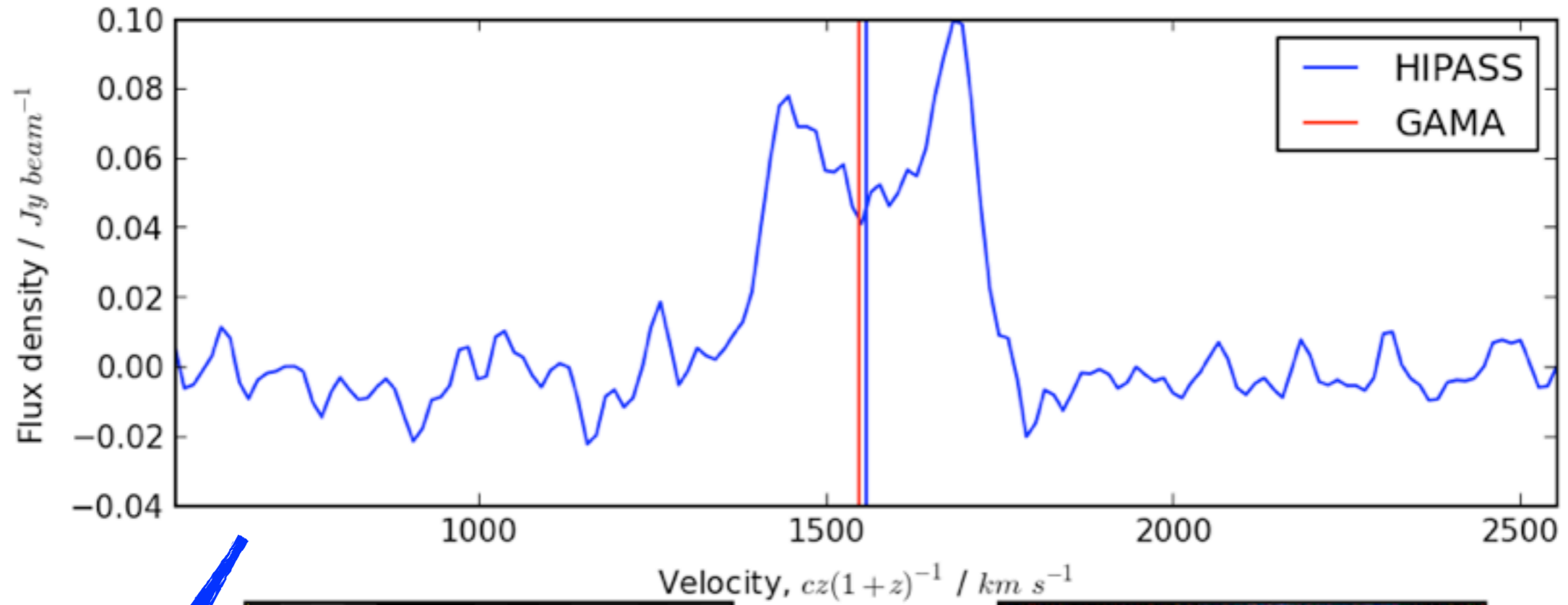
- Most HOPCAT/HIPASS sources recovered, however not all
When inspecting data, these did not look like proper detections (HIPASS II ?)
- Confusion is a problem, especially at high redshift
Parkes beam is huge
- Many new detections
Not all reliable, at low threshold levels more artifacts and random noise peaks

number of galaxies in hipass: 35
number of galaxies in hopcat: 30

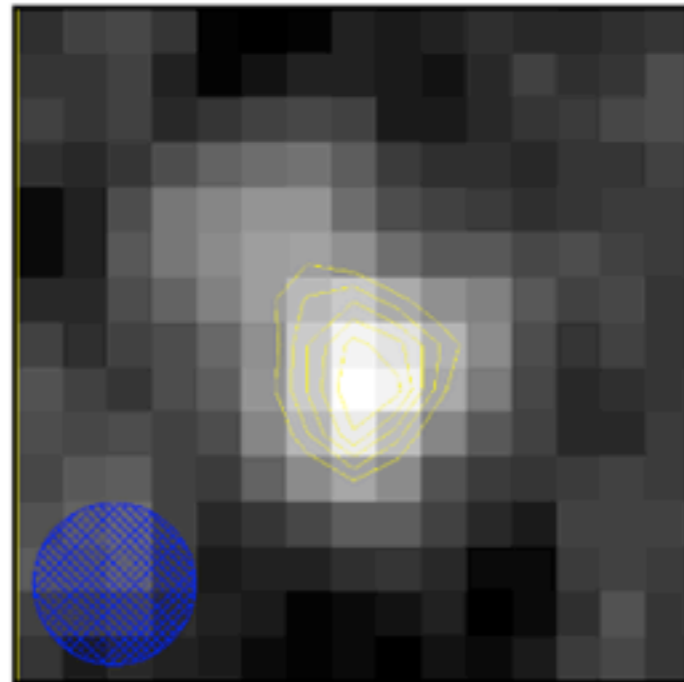
search results:

6 σ : 24 matches
5 σ : 35 matches
4 σ : 59 matches
3 σ : 198 matches

GAMA ID: 321075, HI RA: 14:44:29.9, HI Dec: +01:44:04
GAMA RA: 14:44:24.4, GAMA Dec: 1:40:47.2, Separation: 0:03:33.1



known

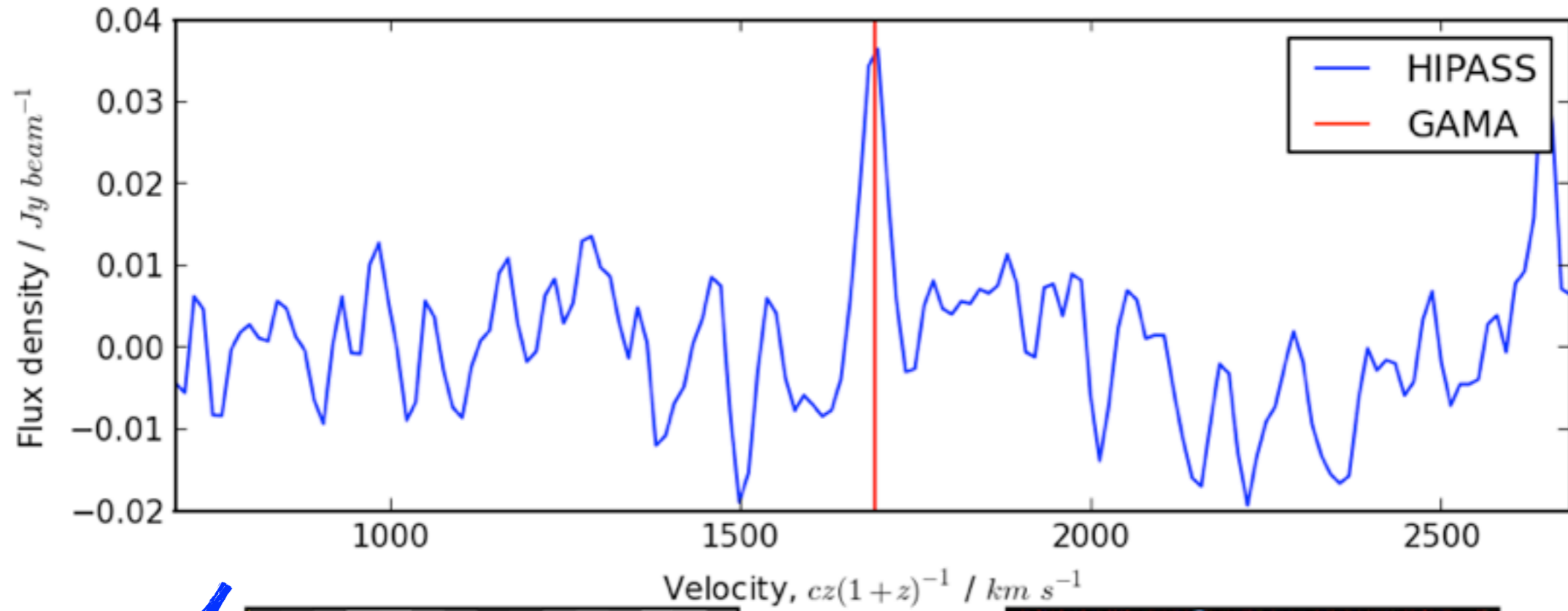


HIPASS zero-moment map

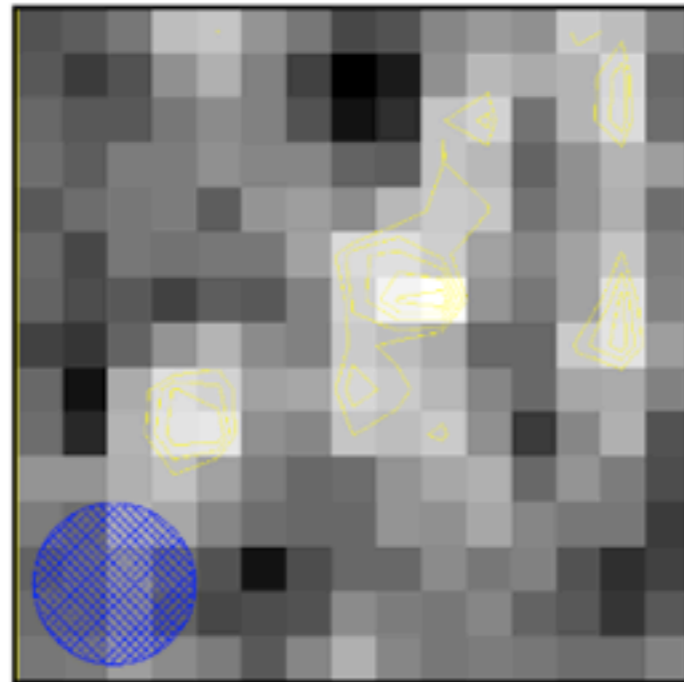


GAMA image

GAMA ID: 143446, HI RA: 11:43:27.4, HI Dec: -01:15:28
GAMA RA: 11:43:45.6, GAMA Dec: -1:16:35.8, Separation: 0:04:40.6



new !!

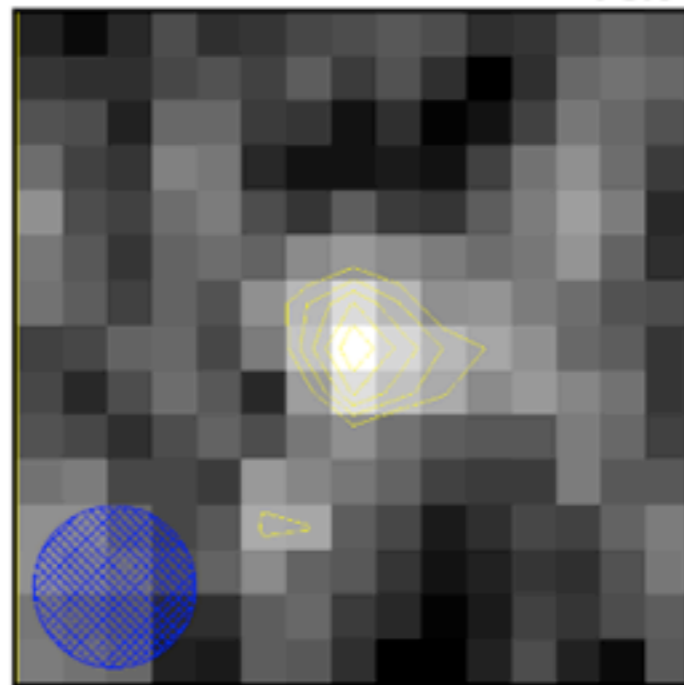
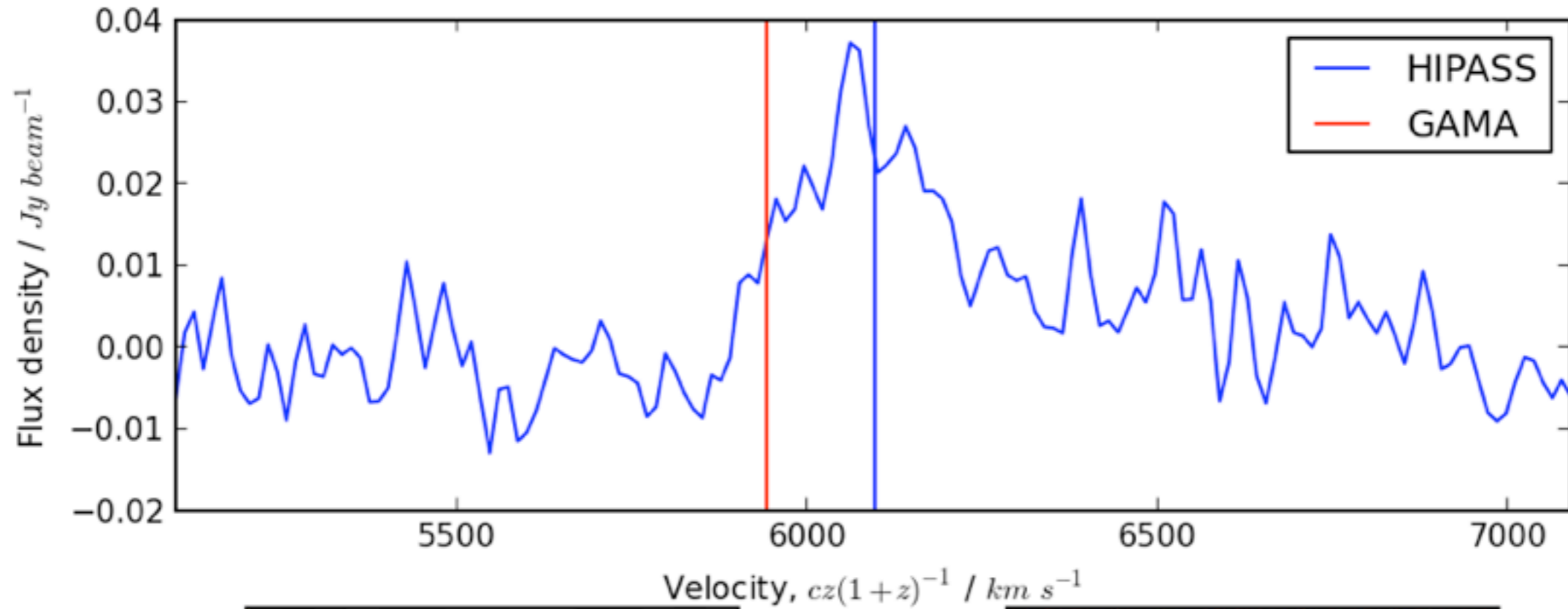


HIASS zero-moment map

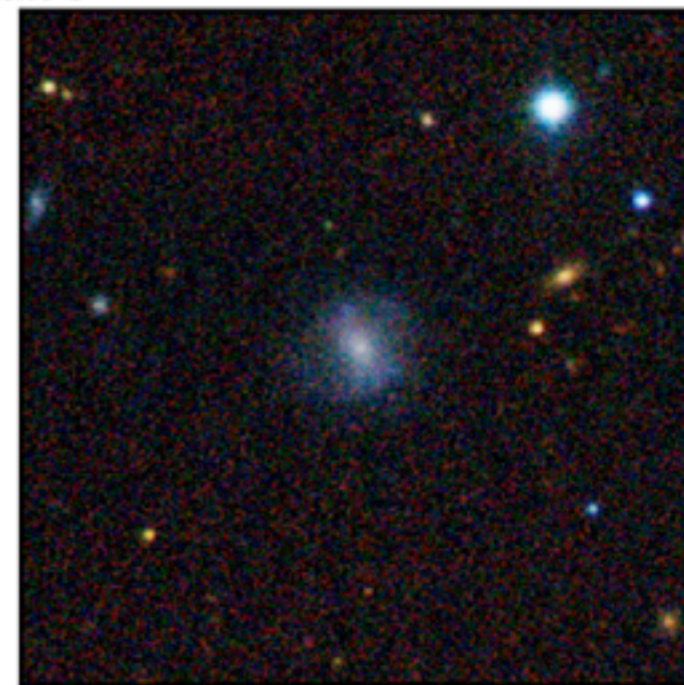


GAMA image

GAMA ID: 273309, HI RA: 12:12:08.7, HI Dec: +01:20:11
GAMA RA: 12:12:9.2, GAMA Dec: 1:18:41.0, Separation: 0:01:30.3



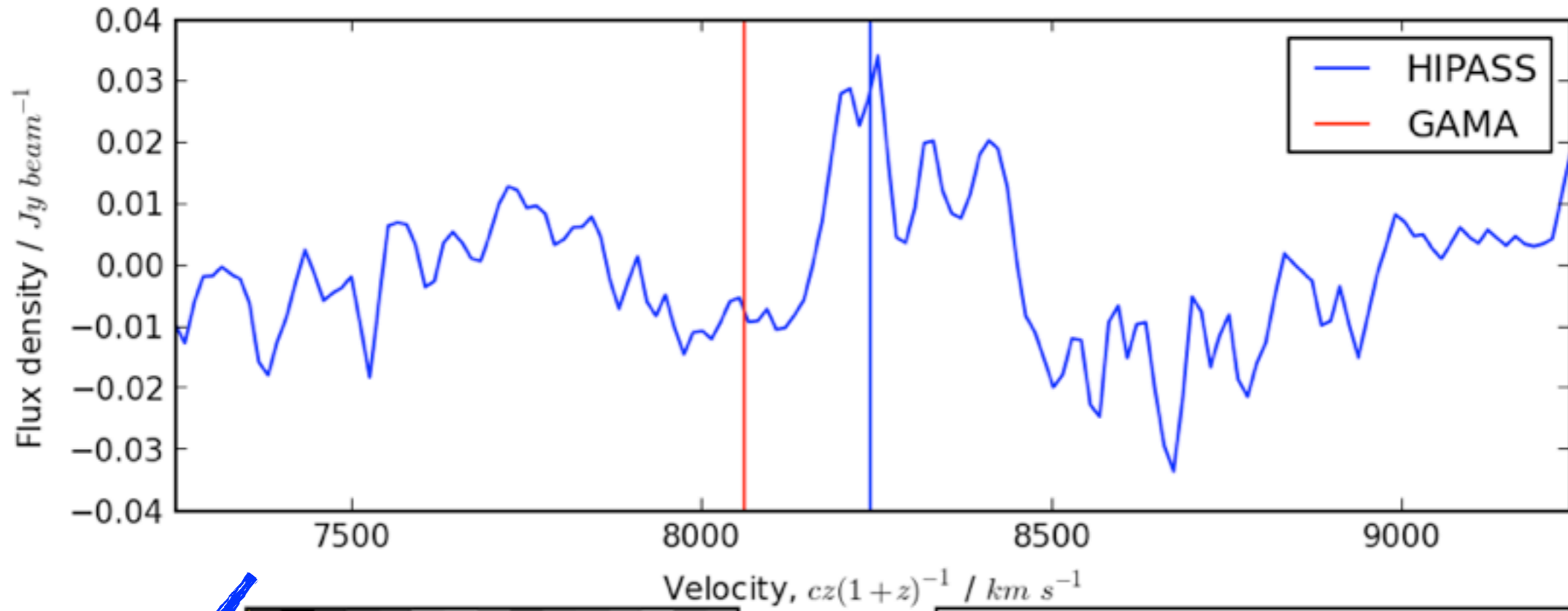
HIPASS zero-moment map



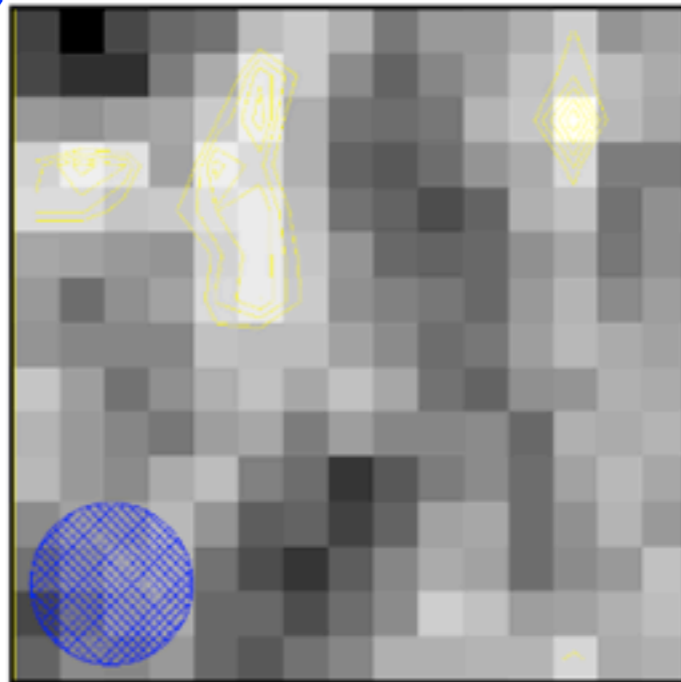
GAMA image

new !!

GAMA ID: 252285, HI RA: 14:52:23.9, HI Dec: +01:48:08
GAMA RA: 14:52:22.3, GAMA Dec: 1:53:44.2, Separation: 0:05:37.0



iffy ..??

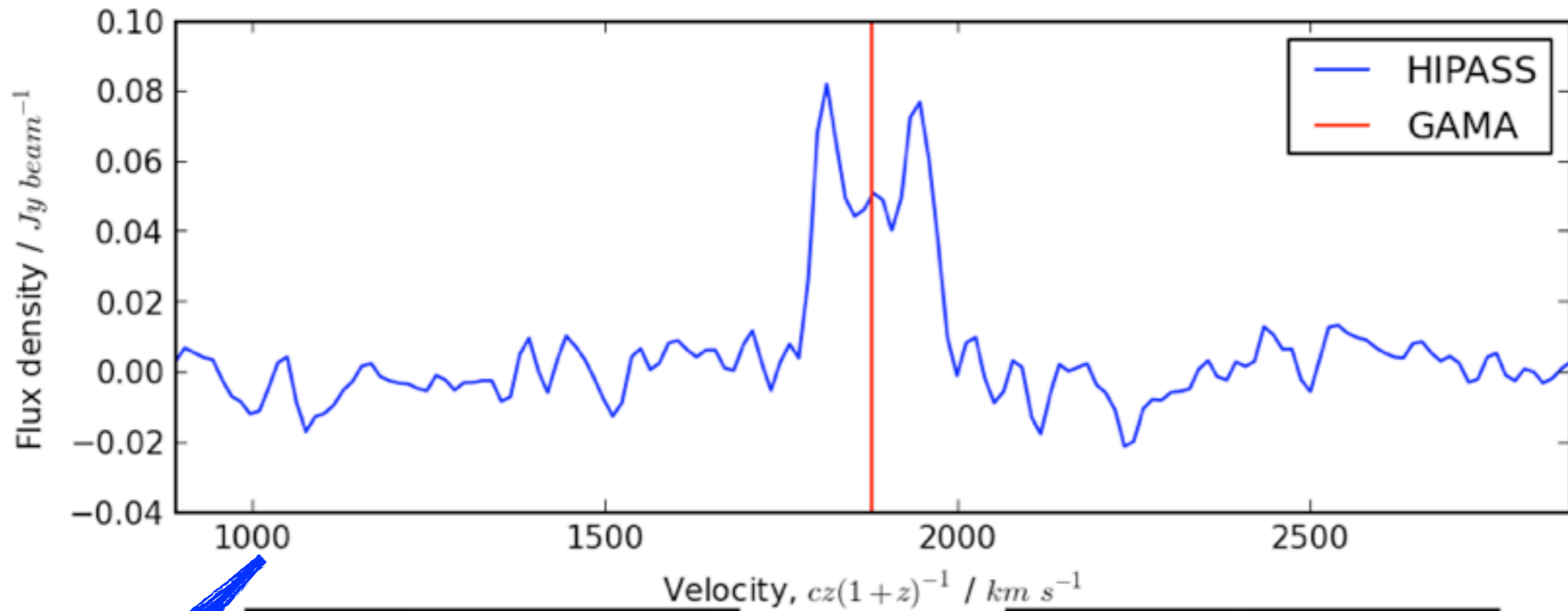


HIPASS zero-moment map

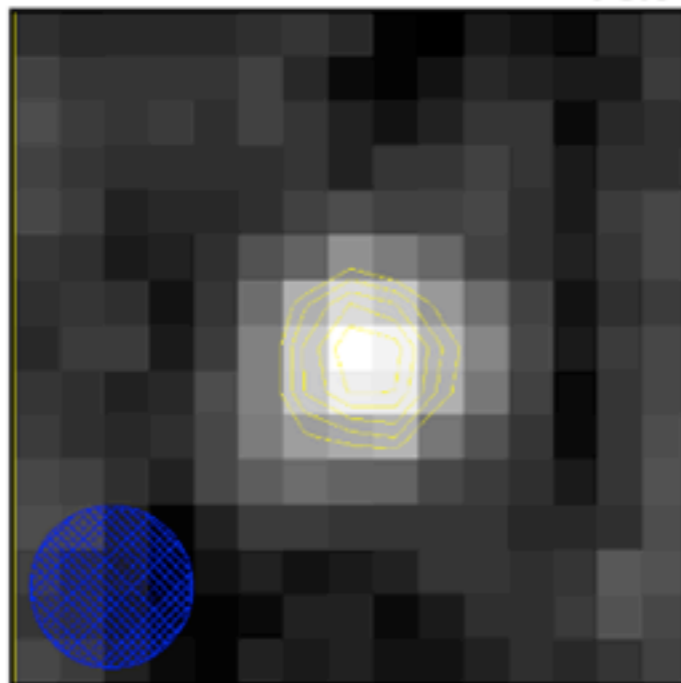


No GAMA image available

GAMA ID: 22741, HI RA: 11:55:34.5, HI Dec: +01:15:05
 GAMA RA: 11:55:36.9, GAMA Dec: 1:14:13.9, Separation: 0:01:2.7



KNOWN



HIPASS zero-moment map

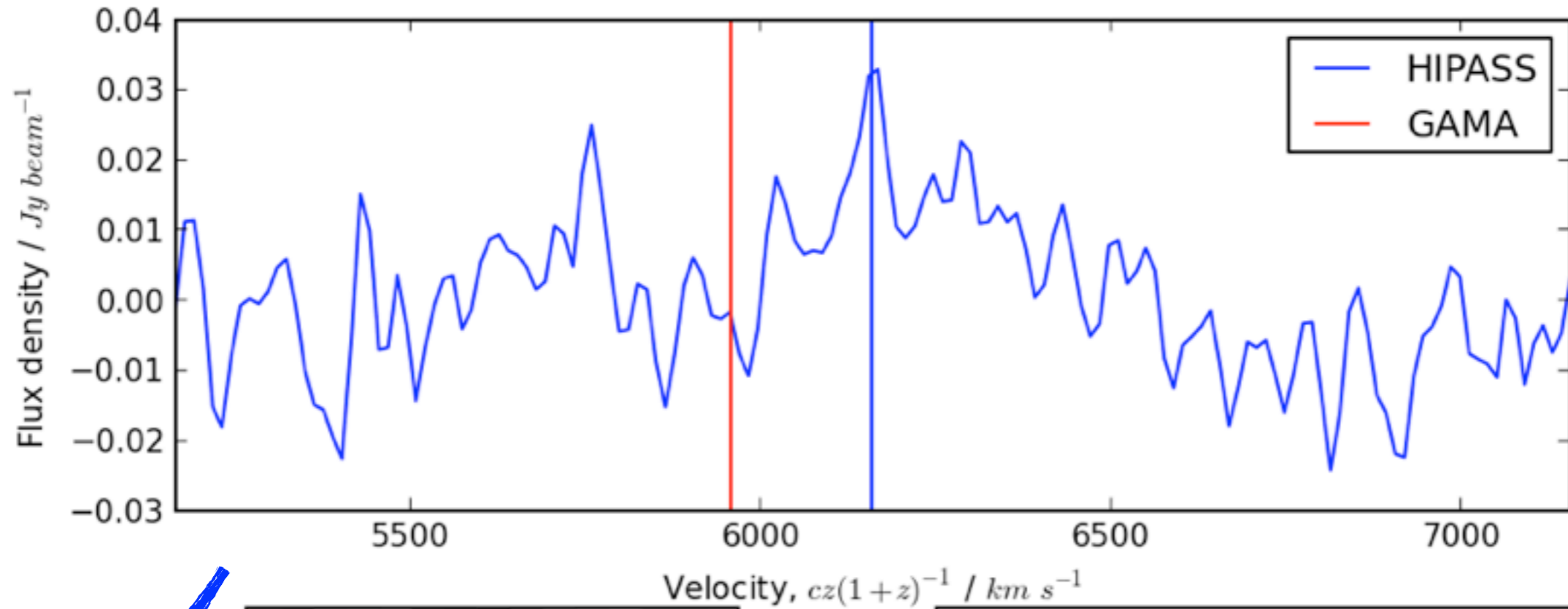


GAMA image

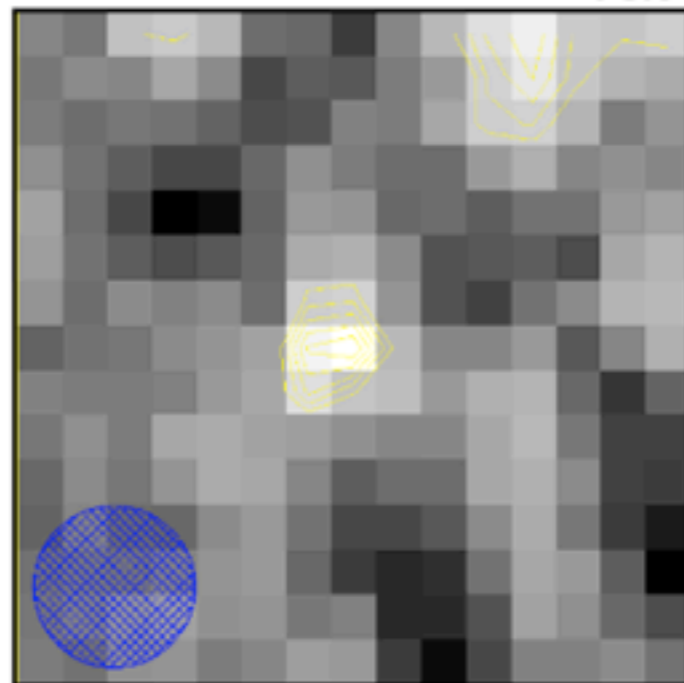


examples ...

GAMA ID: 537072, HI RA: 12:15:29.2, HI Dec: -01:05:50
GAMA RA: 12:15:29.5, GAMA Dec: -1:01:30.5, Separation: 0:04:19.6



naah..

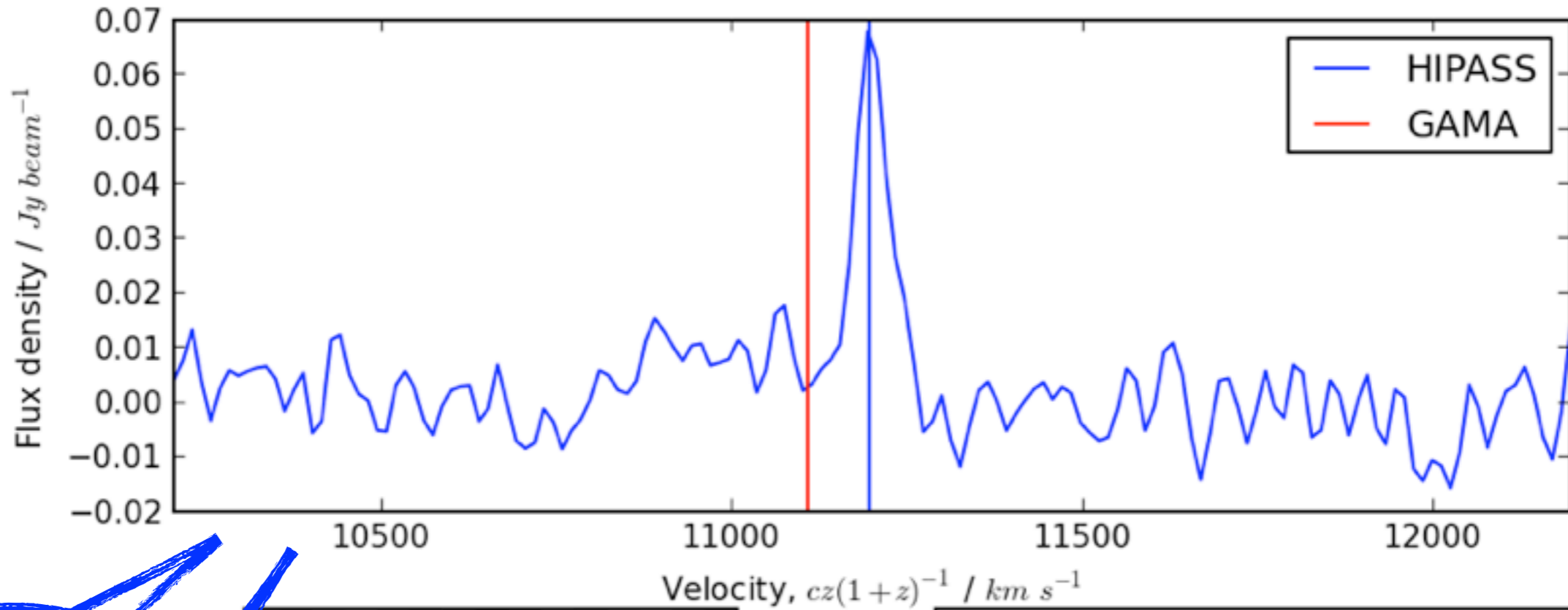


HIPASS zero-moment map

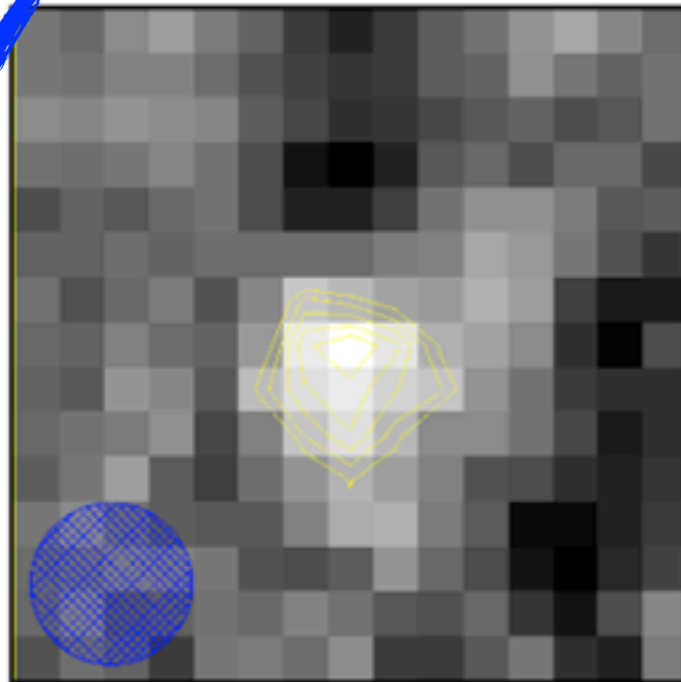


No GAMA image available

GAMA ID: 228105, HI RA: 14:24:35.1, HI Dec: +01:10:43
GAMA RA: 14:24:33.2, GAMA Dec: 1:10:38.6, Separation: 0:00:28.1



new
confused

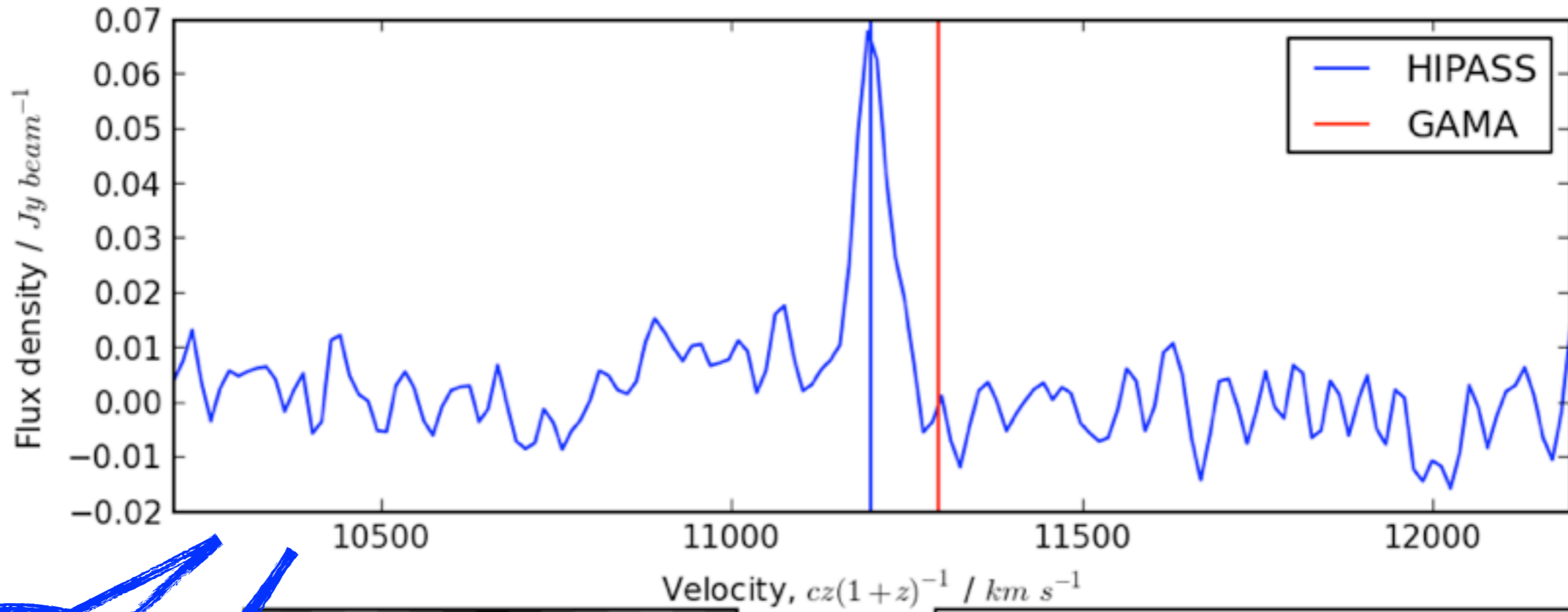


HIPASS zero-moment map



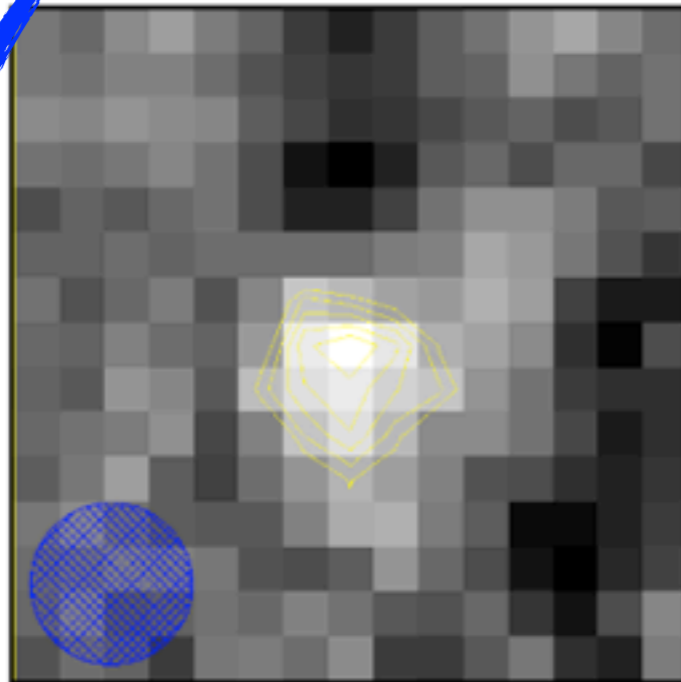
No GAMA image available

GAMA ID: 228104, HI RA: 14:24:34.9, HI Dec: +01:10:47
GAMA RA: 14:24:31.5, GAMA Dec: 1:11:15.3, Separation: 0:00:58.3



new

confused



HIPASS zero-moment map



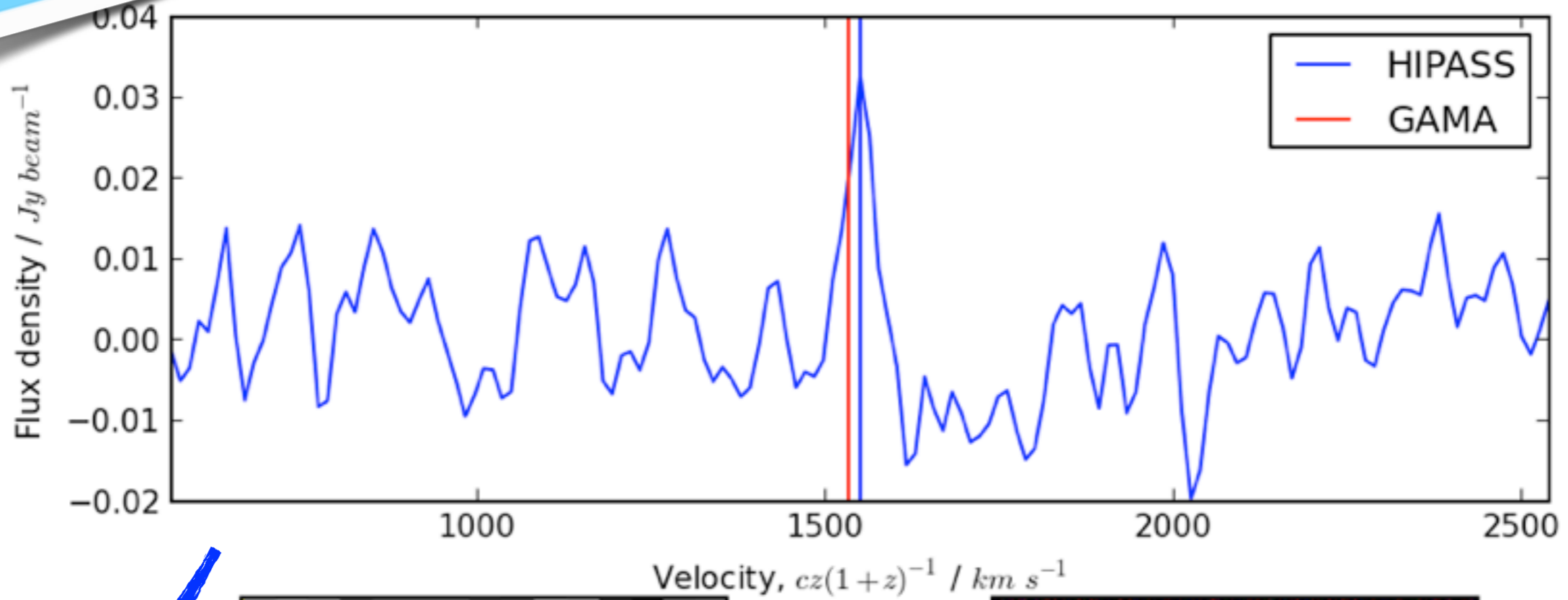
No GAMA image available



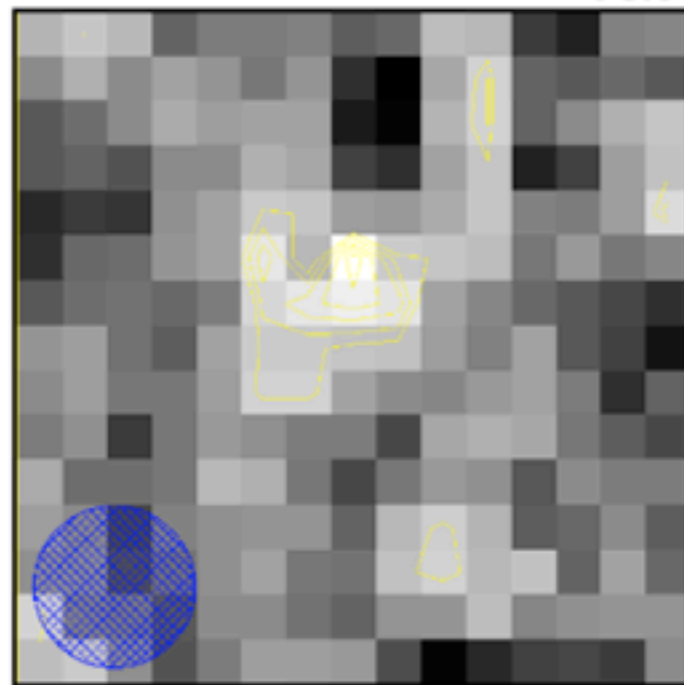
examples ...

Lower threshold ..

GAMA ID: 492013, HI RA: 14:17:00.4, HI Dec: -01:30:13
GAMA RA: 14:17:3.5, GAMA Dec: -1:30:22.4, Separation: 0:00:46.9



new !!

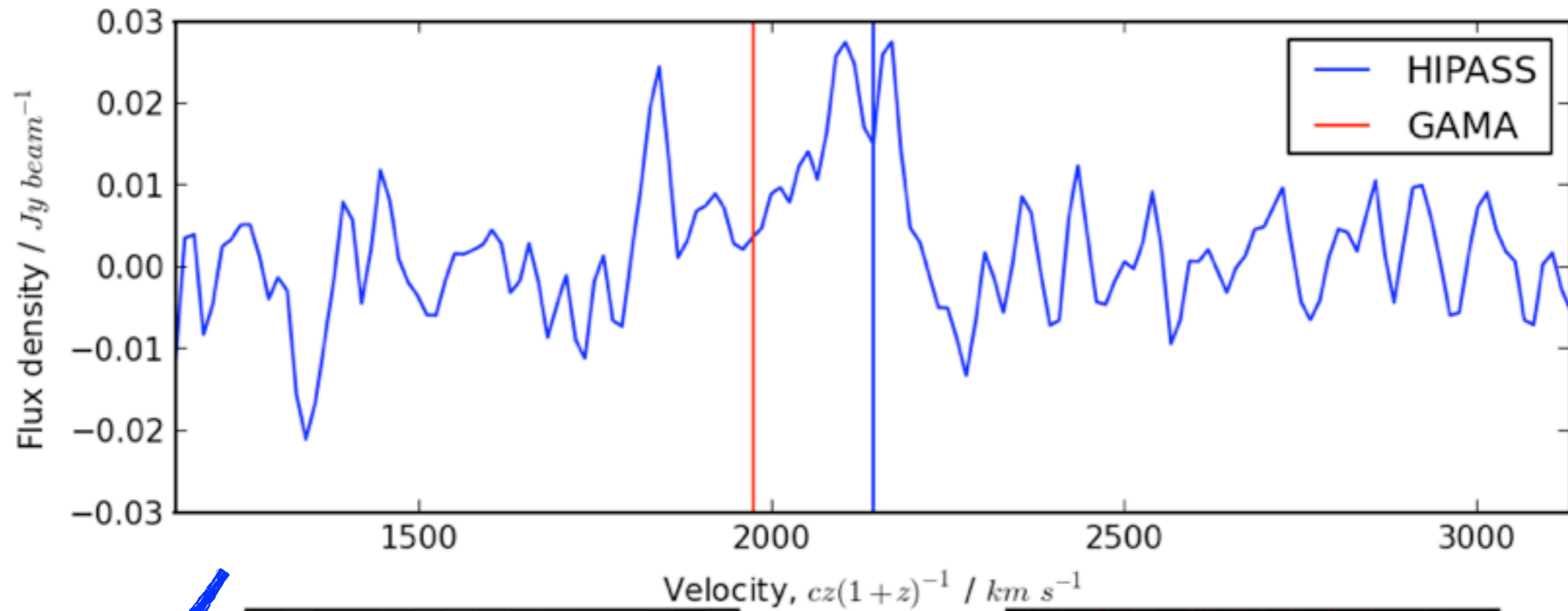


HIPASS zero-moment map

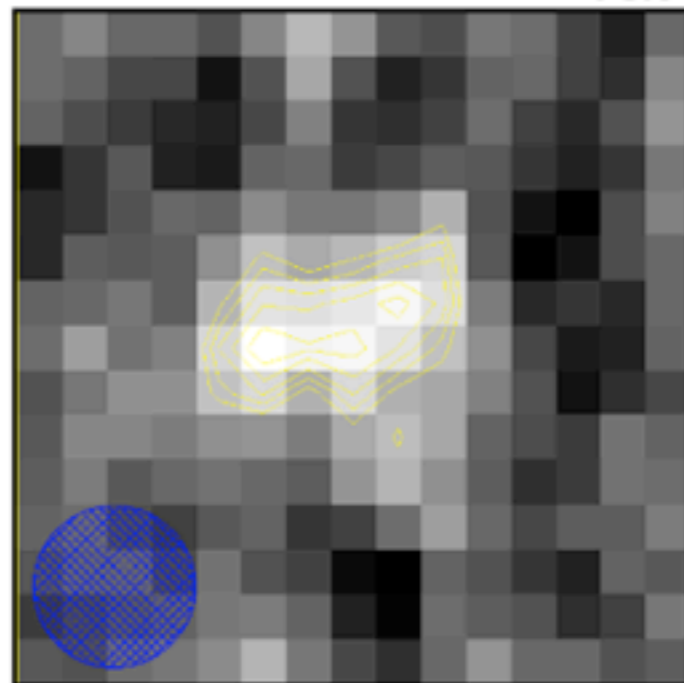


GAMA image

GAMA ID: 220687, HI RA: 12:11:12.3, HI Dec: +01:29:08
GAMA RA: 12:11:19.9, GAMA Dec: 1:29:32.7, Separation: 0:01:56.6



new !!



HIPASS zero-moment map



GAMA image



number of galaxies in hipass: 35

number of galaxies in hopcat: 30

58 cross matches between GAMA and HIPASS II

50 individual detections when taking out confusion

45 true detections after inspecting cubes by eye

5 questionable or false detections

~30% more detections than HICAT

~90% reliable detections

even higher detection rates can be achieved at lower clipping levels,
however at the cost of reliability

Blind search on full HIPASS II cubes using the same DUCHAMP
parameters gives >500 detections (reliability < 10%)



Source finding using optical catalogues is a very useful addition to blind HI searches !!

- Using optical catalogues can significantly increase the number of detections
- Cross matching has a very high reliability
- Using prior information makes source finding much faster
- Optical information can be used as check/filter for blind searches
- Method can be applied to much data discussed this week

Great scientific potential !

- Tully-Fisher Relation
- HI properties of optical galaxies (type, color etc ...)