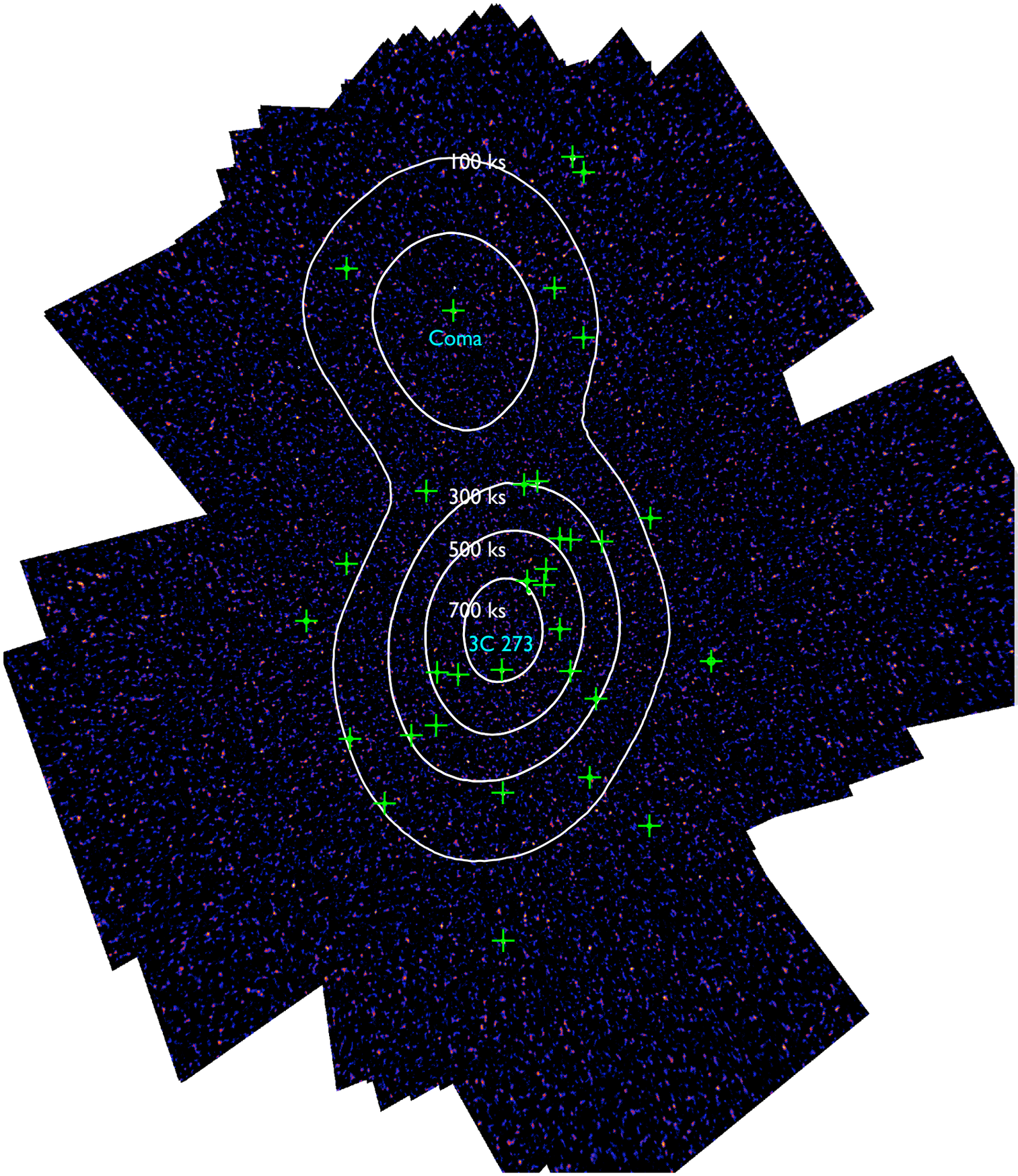
The deepest extragalactic field observed by INTEGRAL

Stéphane Paltani, Roland Walter & co



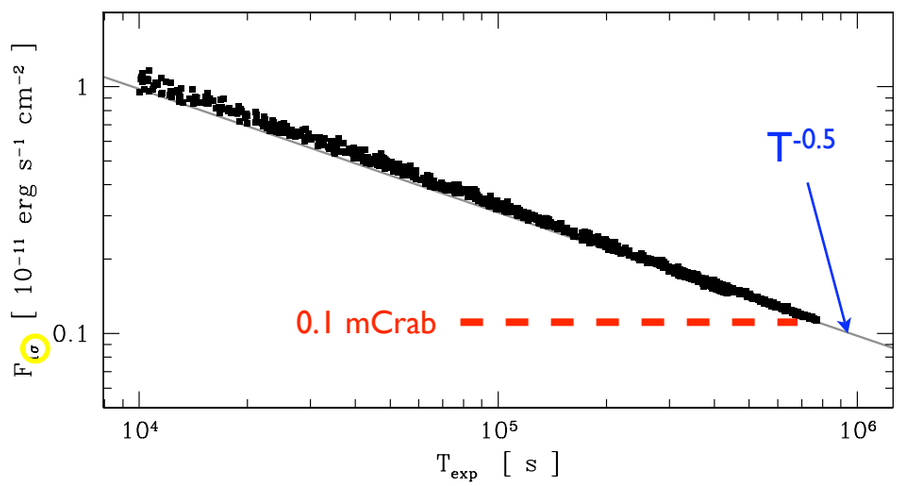
Data:

3.9 Ms elapsed time
3 Ms open time (mostly 5x5 dithering)
1 Ms core programe (rectangular pattern)

1660 pointings (Rev. 0036–0464)
(10 pointings excluded)

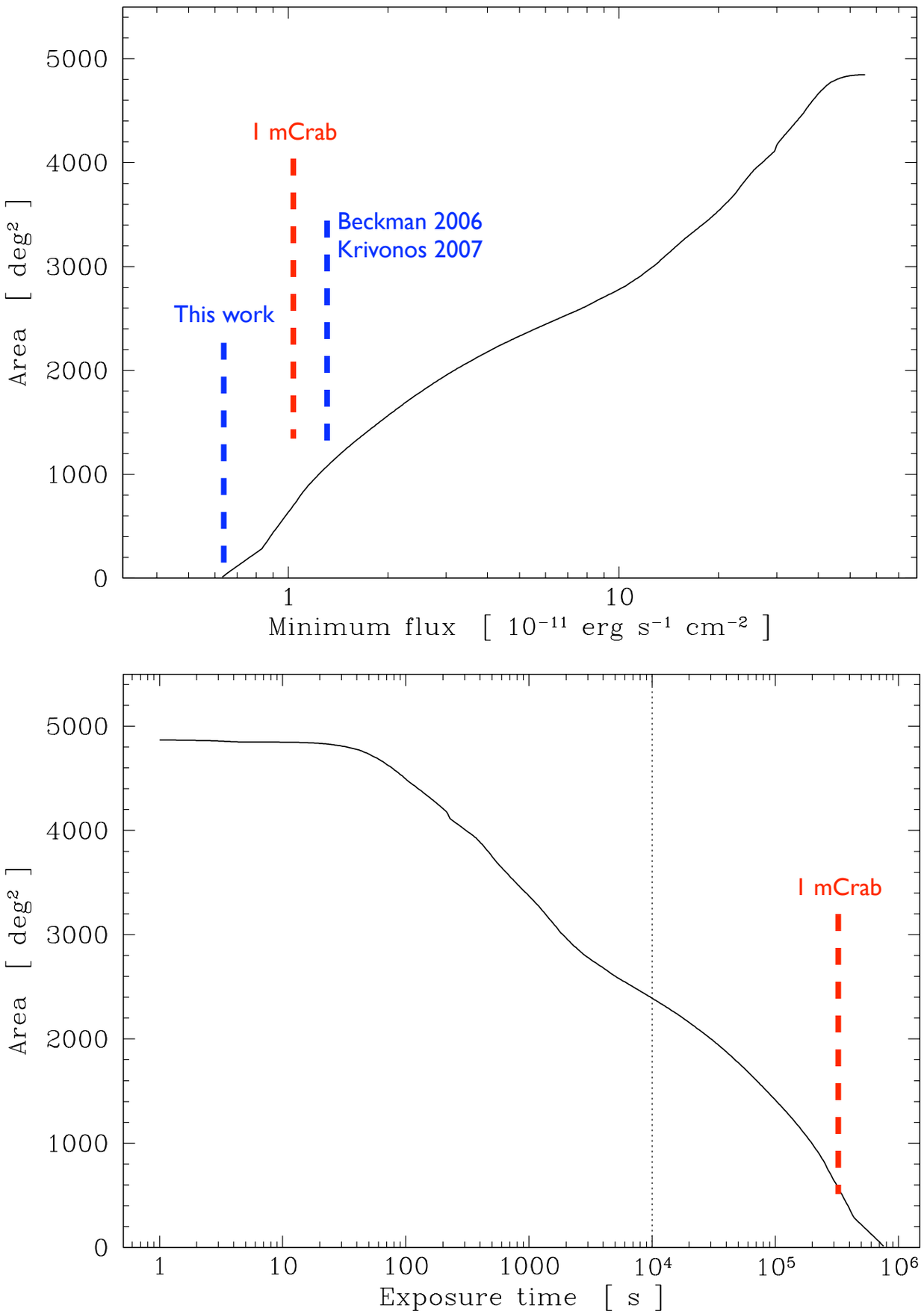
Analysis:

Analysis performed with OSA 6
20-60 kev, to optimize sensitivity
Maximum effective exposure: ~ 775 ks



Selection: effective exposure > 10 ksec

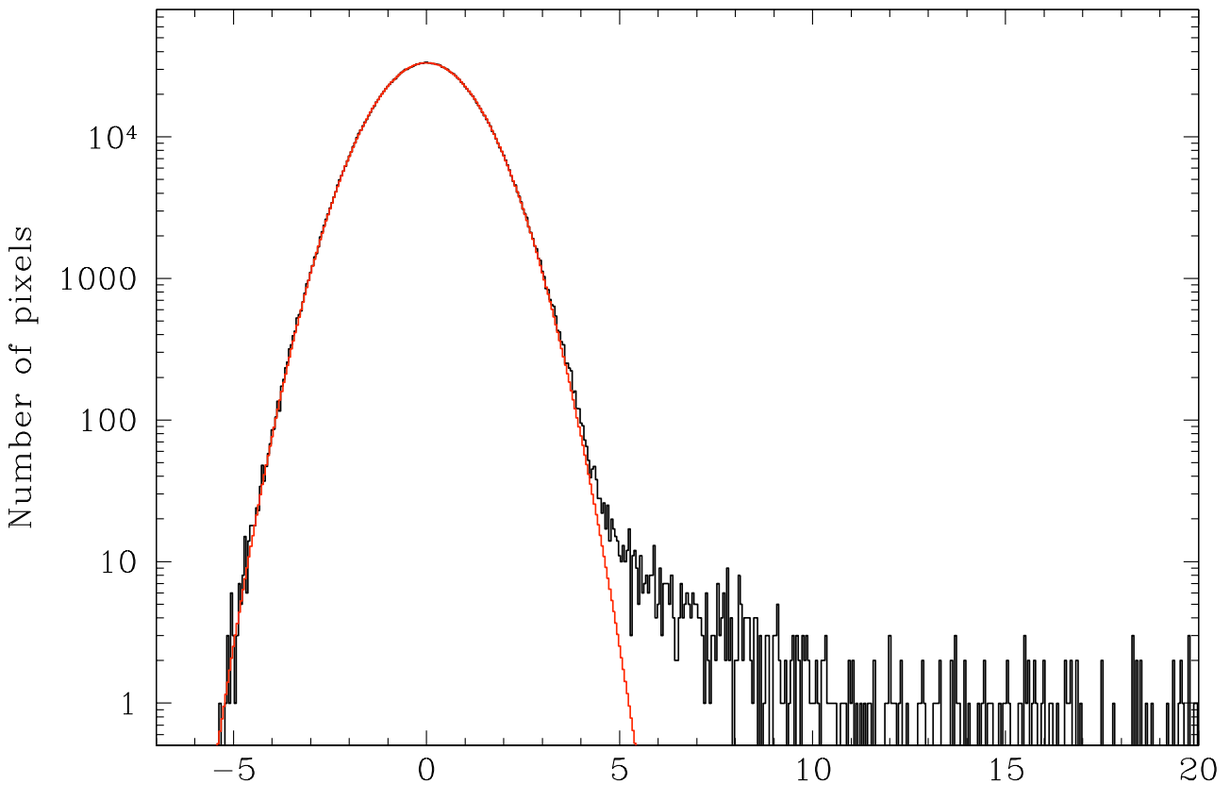
Sensitivity and sky area



Maximum sensitivity : 0.6 mCrab
(eff. exp. ~ 0.8 Msec)

Total area: 4900 deg^2
eff. exp. > 10 ksec : 2390 deg^2 (10 mCrab)
eff. exp. > 100 ksec : 1415 deg^2

Image quality and source detection

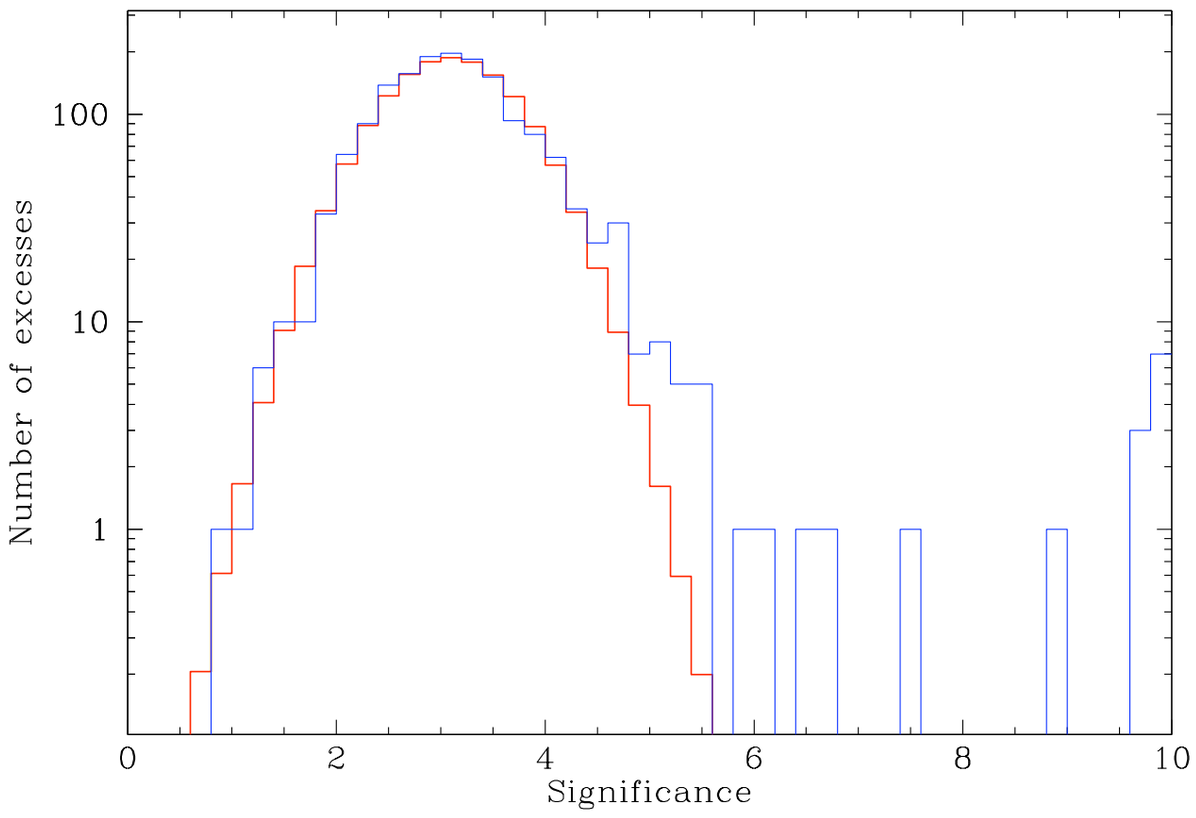


<u>Significance map:</u>

Significance distribution: (exp > 10ks)

total number of pixels: 1916838
average: 0.0086±0.0008
σ width: 1.15

Perfect gaussian fit (X^2_υ=0.73)
No negative tail
1 pixel at -5.3σ, as expected



<u>Source detection:</u>

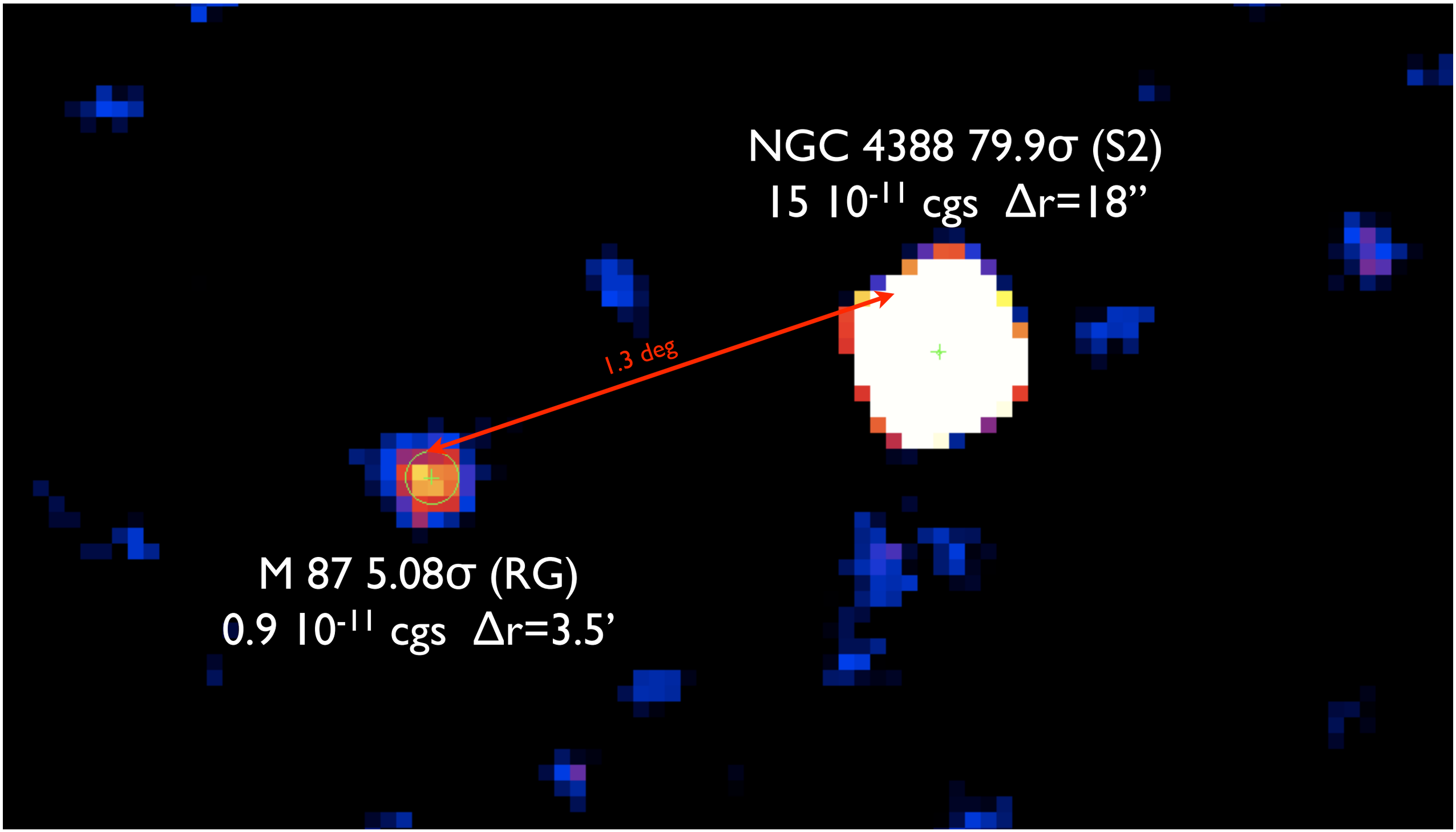
1) select all pixels with signif. > 3
2) get excesses position and significance (psf fit)
3) remove duplicated entries

→34 excesses with signif. > 5.0
→18 excesses with signif. > 5.5

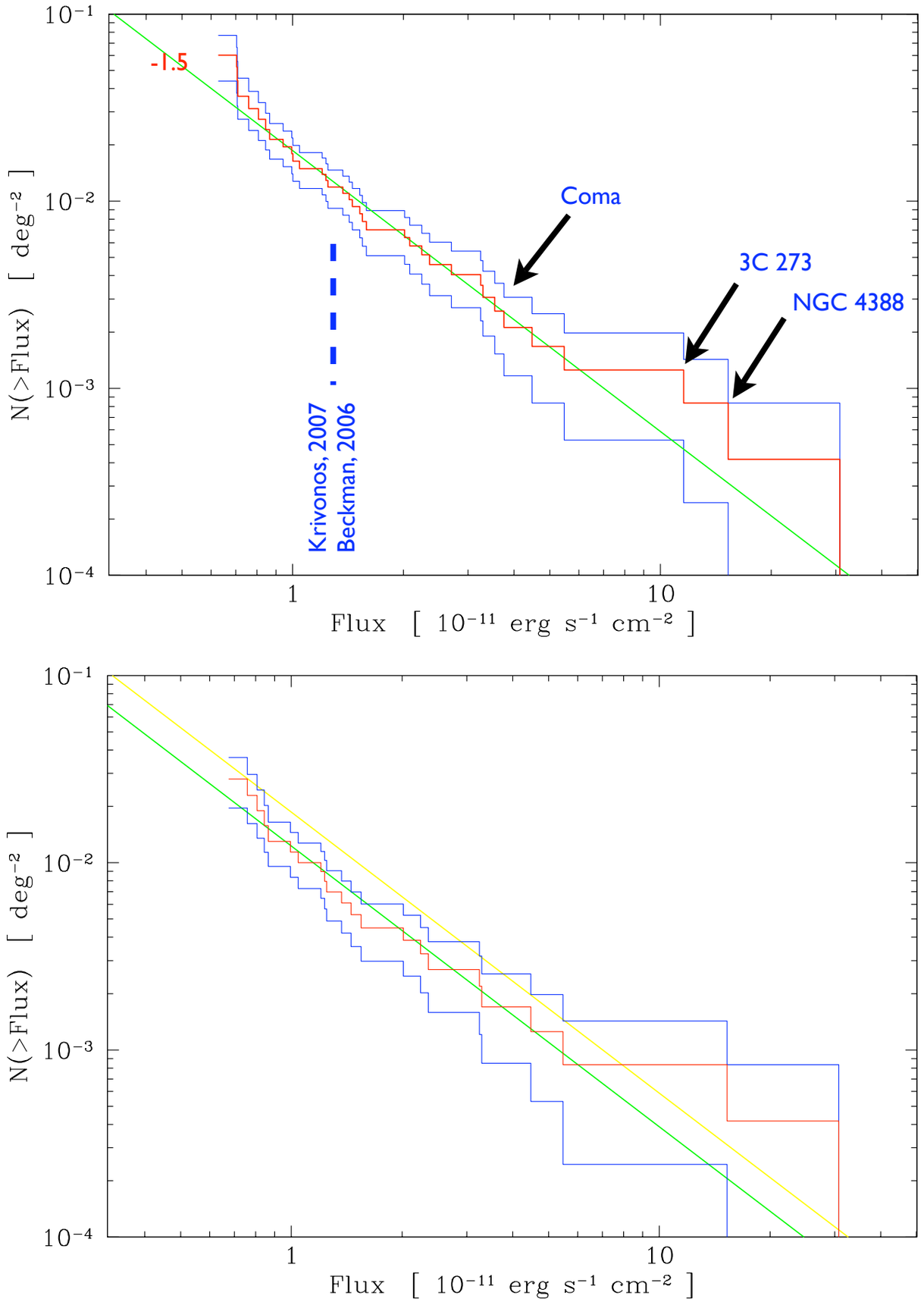
All excesses above 5.5σ are real sources
75% of the excesses at 5.0σ are real sources
65% of the excesses at 4.5σ are real sources

4 out of the 34 selected sources could be spurious

Sources


NGC 4388 79.9σ (S2)
15 10-11 cgs Δr=18”
1.3 deg
M 87 5.08σ (RG)
0.9 10-11 cgs Δr=3.5’

Log N – Log S



All excesses with significance > 5σ

Number of sources: 34
Log N – Log S fully compatible with -1.5 slope

All sources with significance > 5.5σ (18) excluding 3c273 and Coma and all sources with signif. <5.5 and identified as Seyfert (6)

Number of sources: 22
Log N – Log S fully compatible with -1.5 slope

10 excesses with 5 < signif. < 5.5
a good fraction of them is real

Source identification

Num.	Name	RA	Dec	Pos. error arc min	Identification	Class
		J2000.0				
1	IGR J12291+0203	12 29 07	+ 2 03 03	0.20	3C 273	Blazar
2	IGR J12258+1240	12 25 46	+12 39 45	0.35	NGC 4388	Seyfert 2

WILL SOON BE PUBLISHED

<u>18 sources with signif. > 5.5 :</u>

12 are Seyfert AGNs
2 blazars
1 cluster
2 galaxies
1 Rosat source

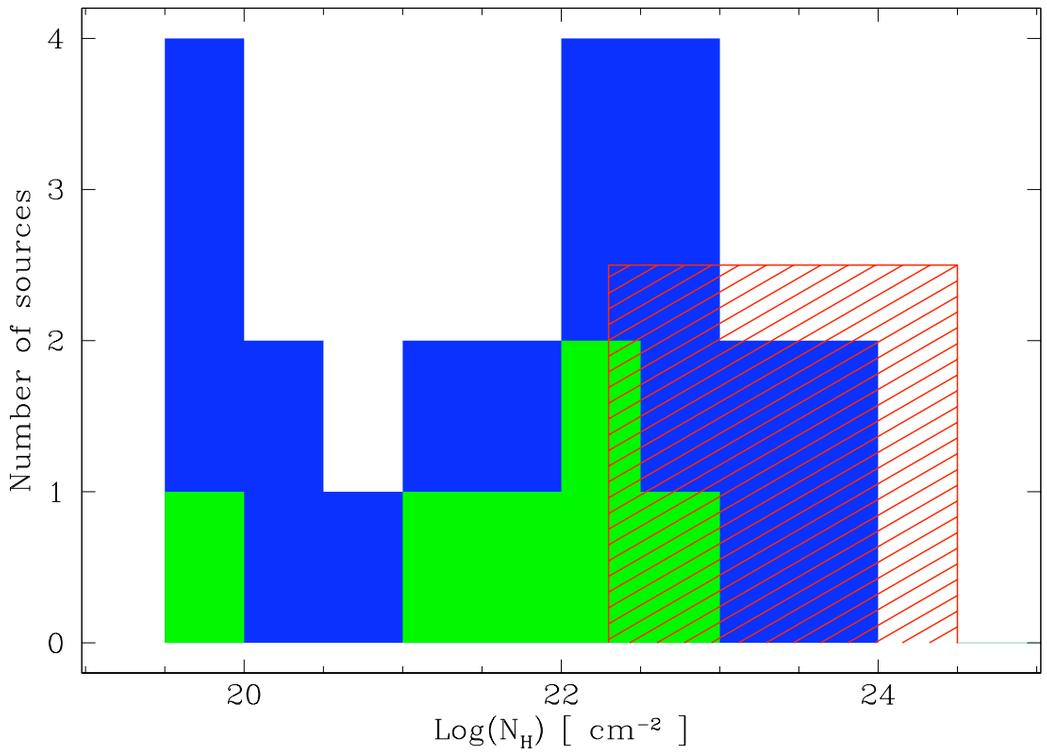
<u>16 sources with 5 < signif. < 5.5 :</u>

8 correspond to AGNs
4 correspond to galaxies
4 correspond to X-ray/infrared/radio sources

z = 2.14

Some sources with 4.5 < signif. < 5 and interresting counterparts were also selected for follow-up observations

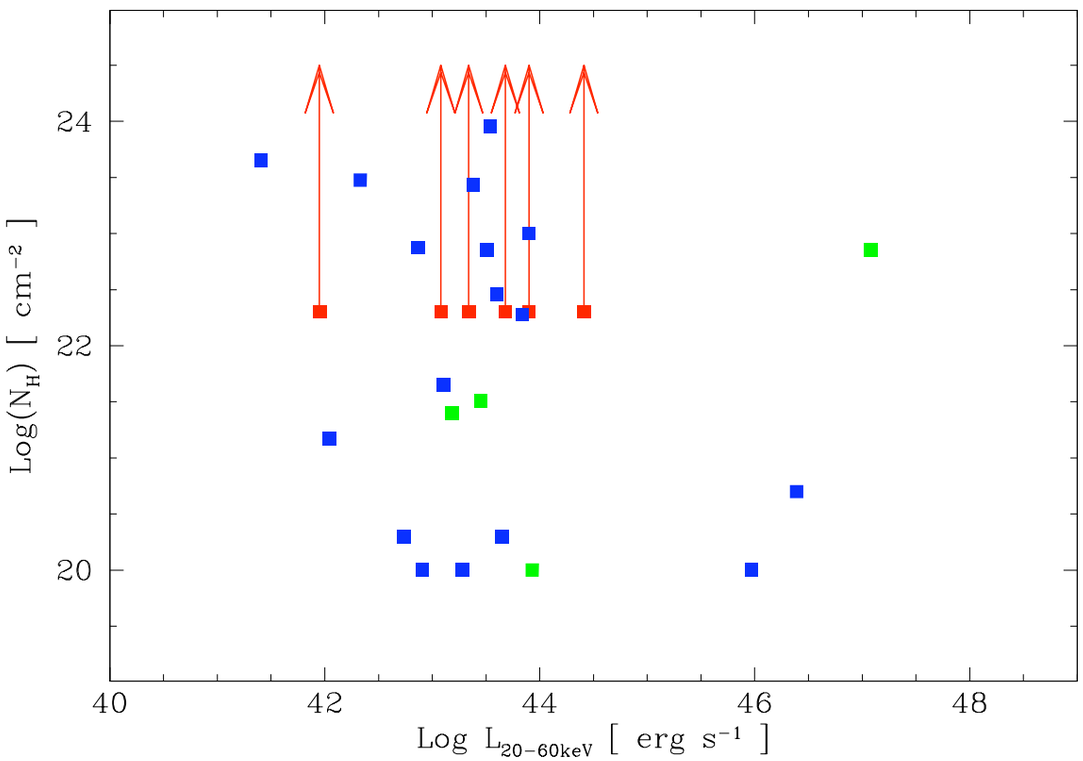
Absorbed sources



NH distribution:

17 sources with observed NH
6 sources with NH derived from Rosat count rates
11 sources without Rosat counterpart

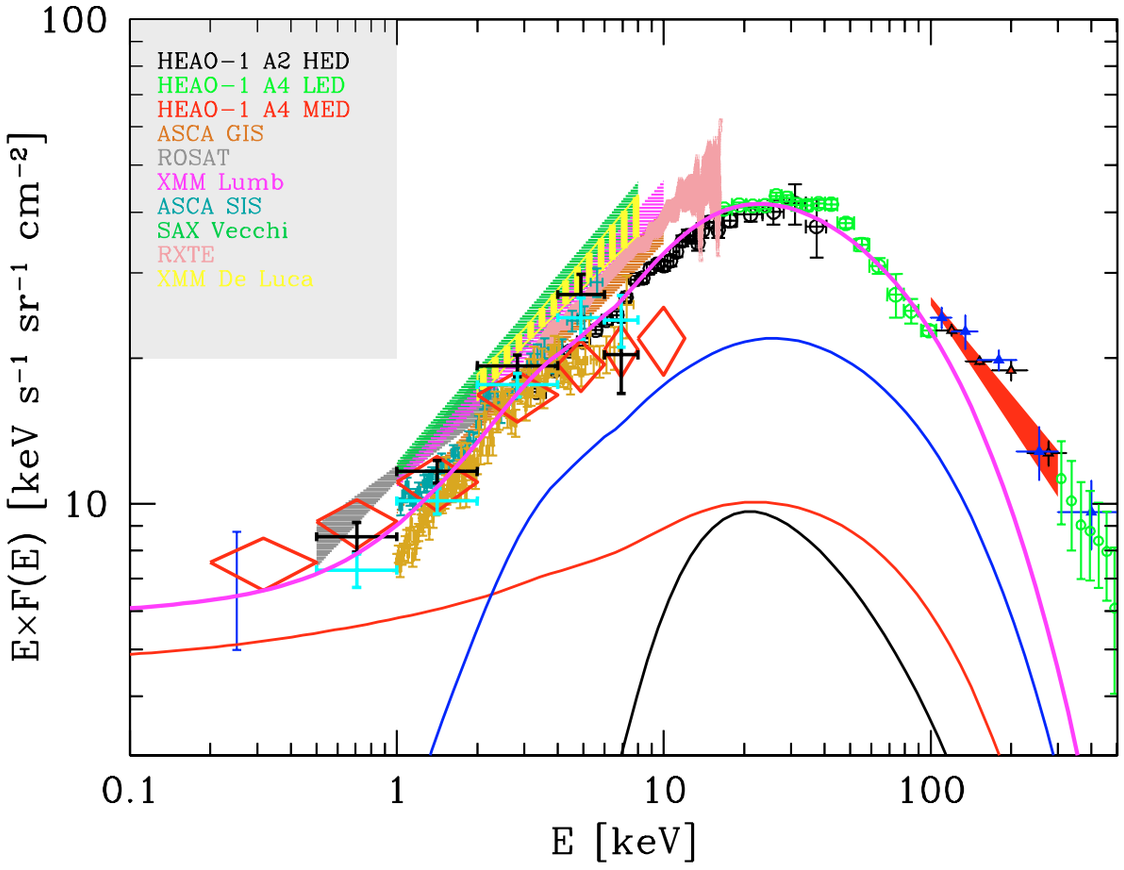
Sources with NH $>10^{22}$ cm^{-2} 54-68%
Compton thick sources < 29%



NH distribution with luminosity:

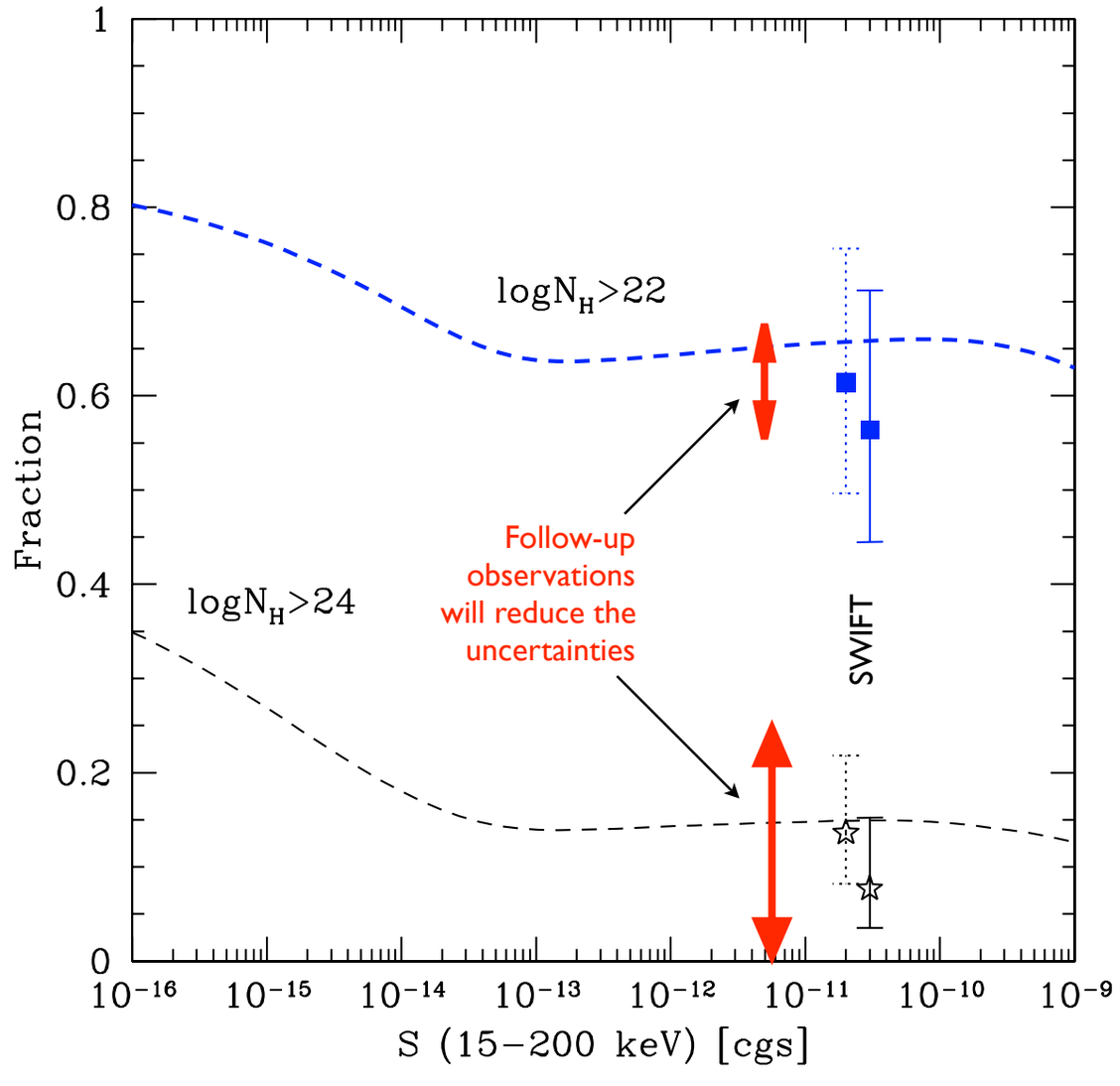
6 sources lack a redshift
No correlation between NH and $L_{20\text{-}100keV}$

Cosmic X-ray background synthesis



With the current source identification, the INTEGRAL deep exposure data are compatible with synthesis models of the X-ray background (Gilli, Comastri & Hasinger, 2007)

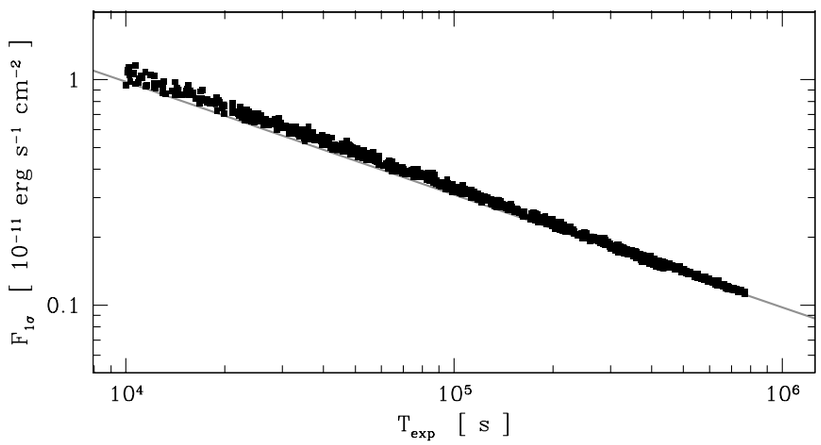
New source identification and NH determination (observations going on with Chandra) will soon allow to obtain better constrains

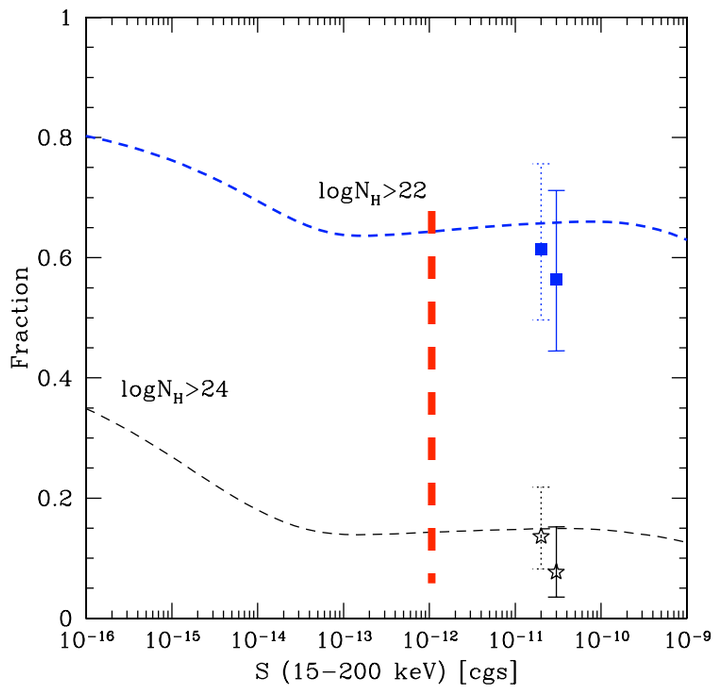


Conclusions/Perspectives

Conclusions :

- Sensitivity is limited by statistics up to 10^6s
- 9 out of 34 sources have unclear identification, work is on going
- 11 out of 34 sources do not have any soft X-ray detection
- Log N – log S is as expected
- For now, the fraction of absorbed and Compton thick AGNs are as expected





An ultra deep (10^7s) extragalactic field :

- Seems technically possible (where will systematics start ?)
- Reaches 0.3 source/deg^2, no confusion
- ~100 sources down to 10^{-12} erg s^{-1} cm^{-2}
- GC not the right choice: confusion & systematics

- Study of the faint end of the luminosity function
- Probing AGN evolution is behind INTEGRAL capabilities unless there are surprises
- Study the average source spectrum
- Study the high energy spectra of 3C 273, NGC 4348

- If INTEGRAL does not do it, there is no hope to probe that parameter space for the next 15-20 years
- It is probably a mistake to split the exposure time in several fields, however with yearly AO, this is likely to happen