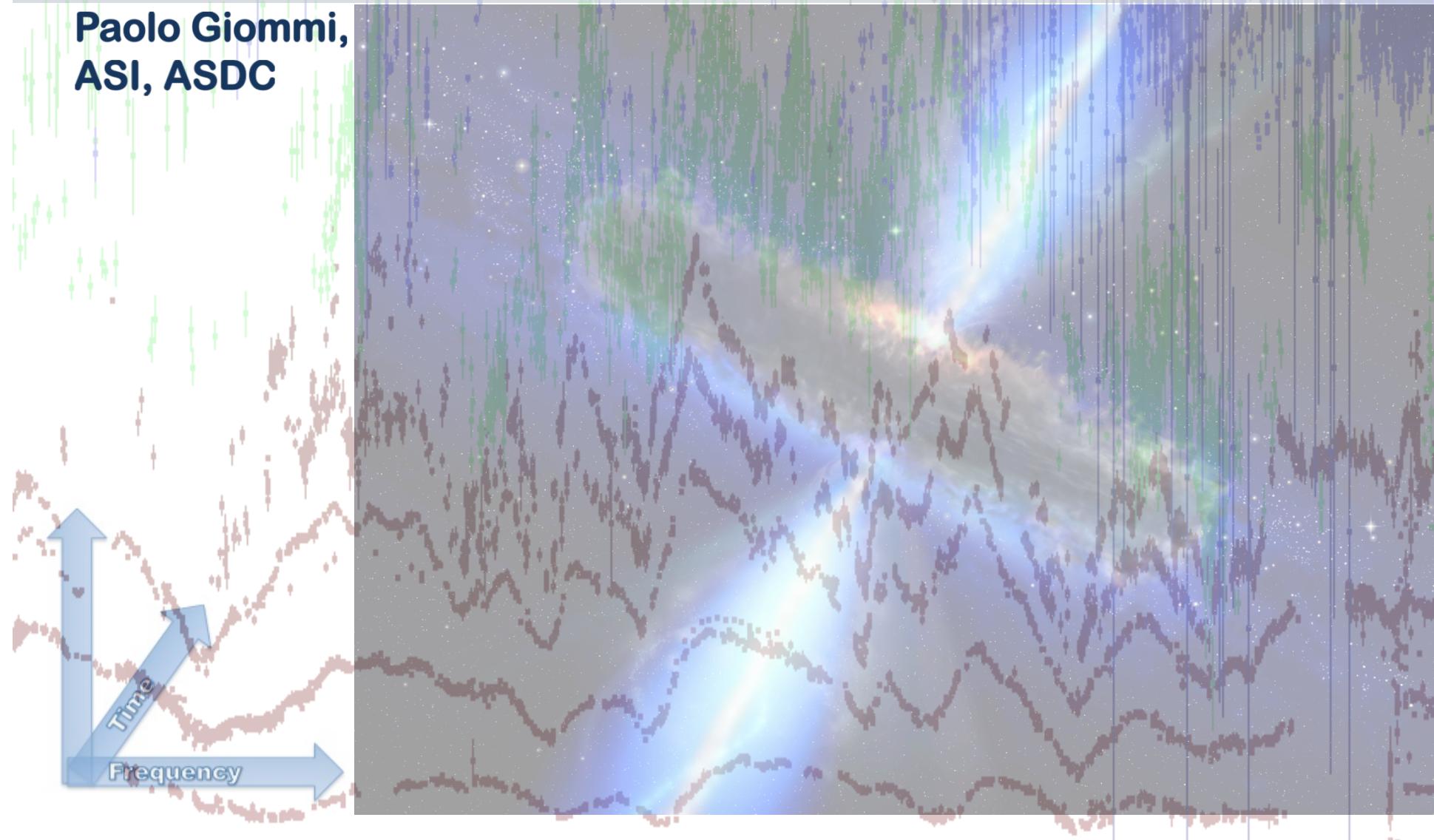
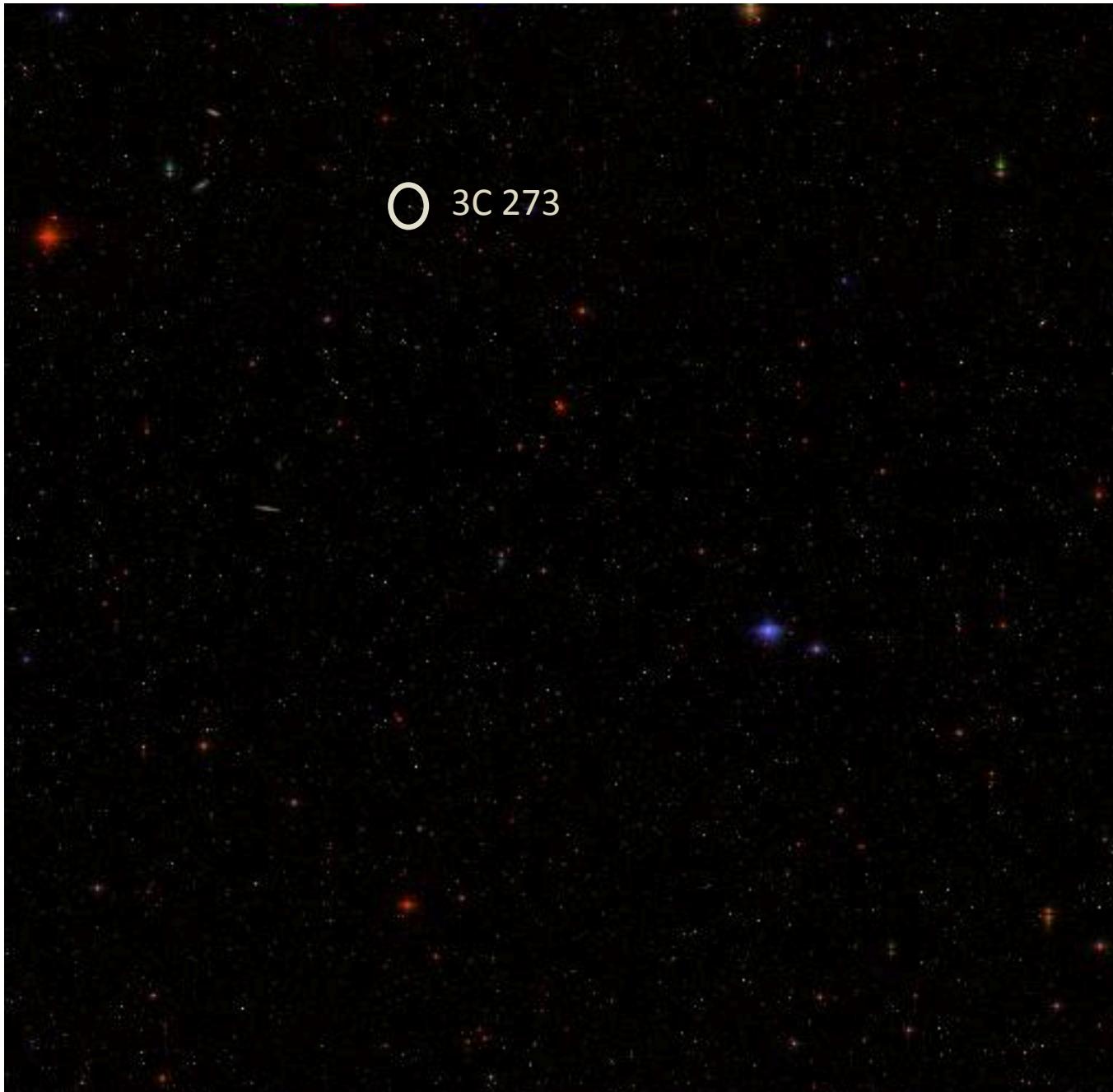


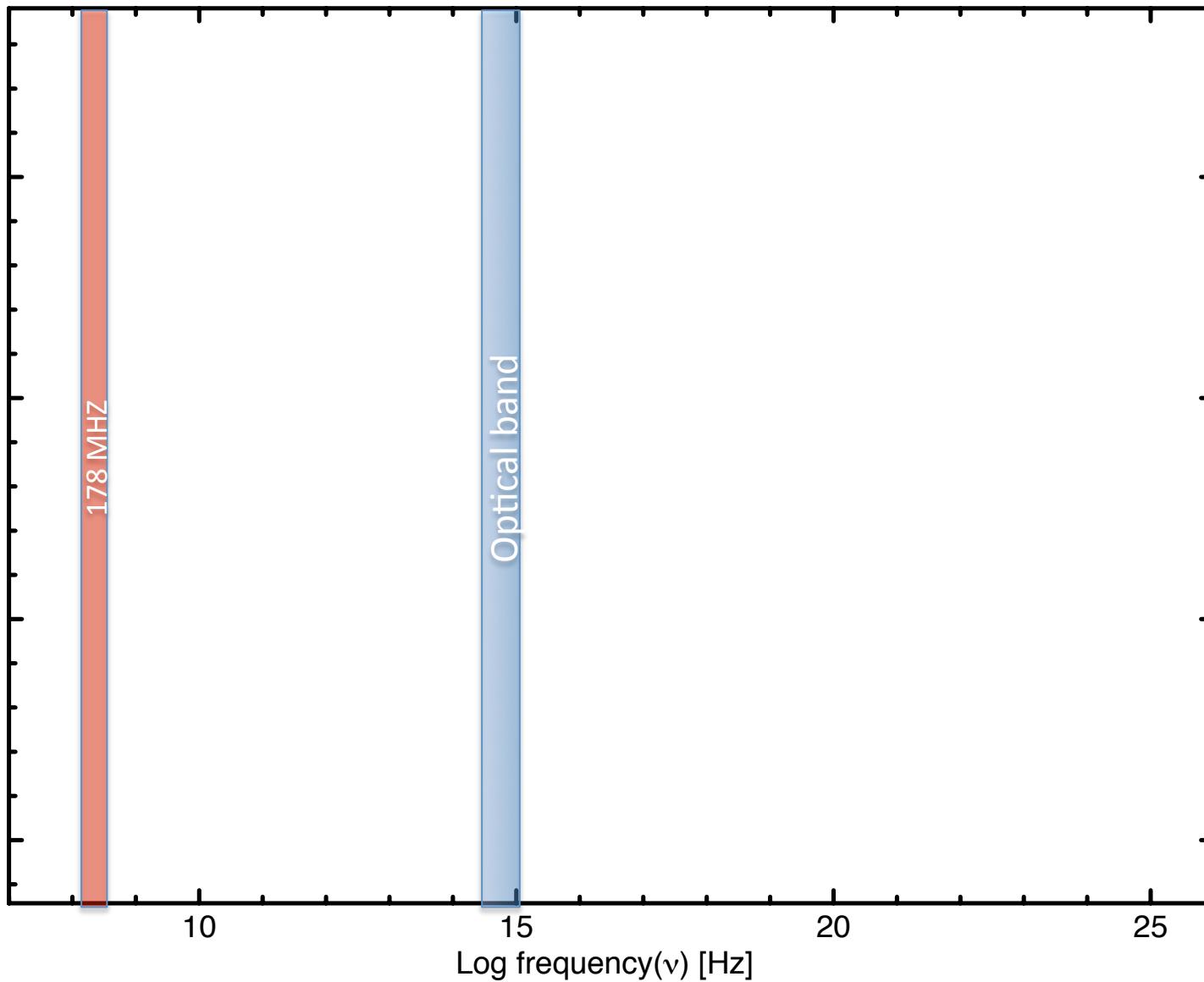
Gamma-ray and multi-frequency studies of Blazars

Paolo Giommi,
ASI, ASDC

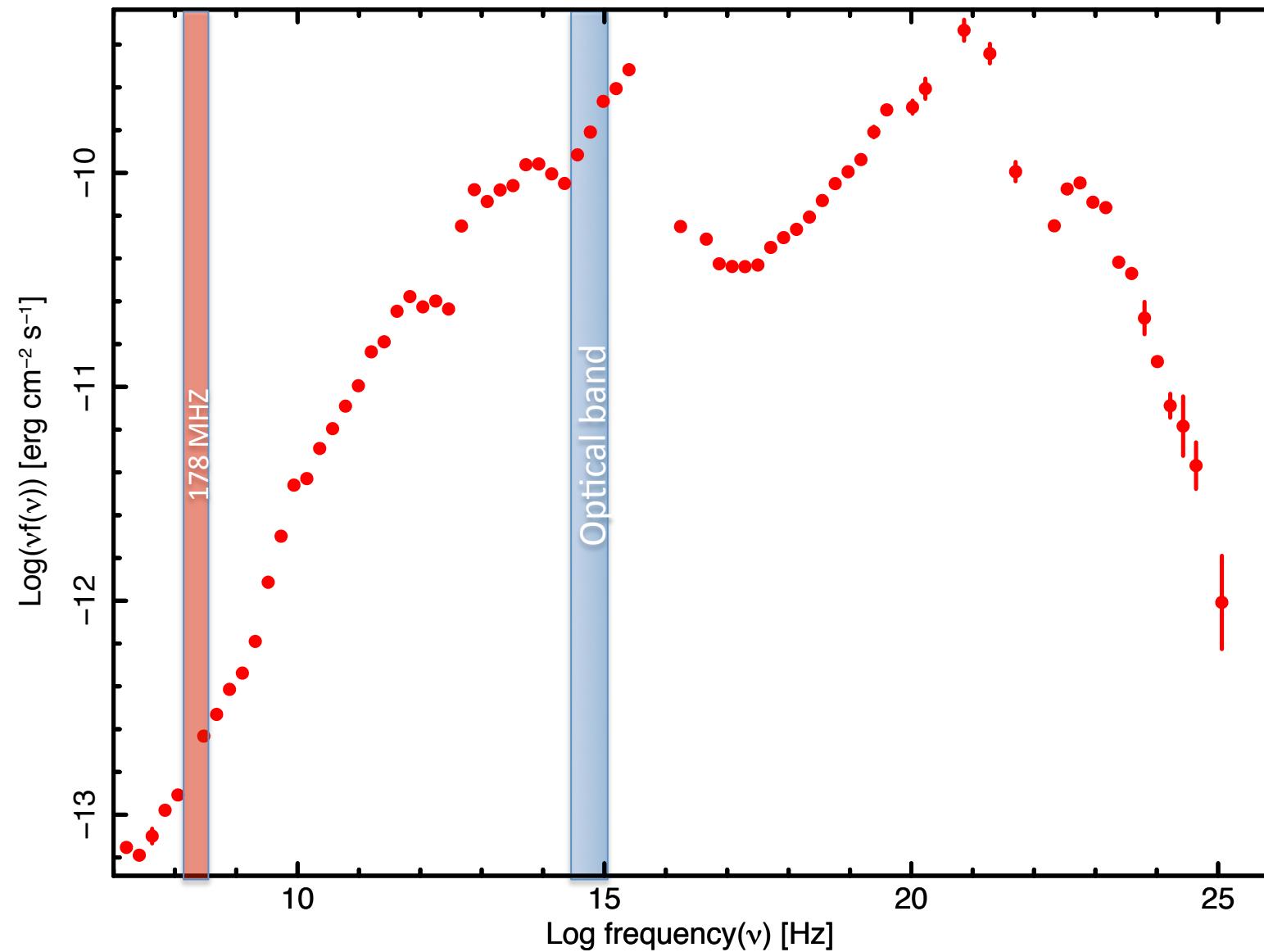




The electromagnetic spectrum

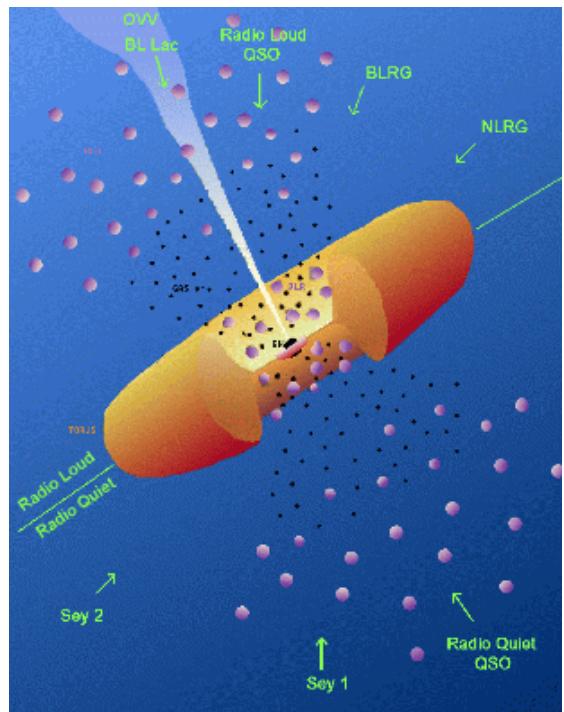


The electromagnetic spectrum





AGN : Two main categories



1. *Dominated by (mostly) thermal emission from accretion disk -*

Radio quiet AGN (>~90 %)

(normal QSO powered by accretion onto a SM black hole)

1. *Dominated by Non-Thermal radiation –*

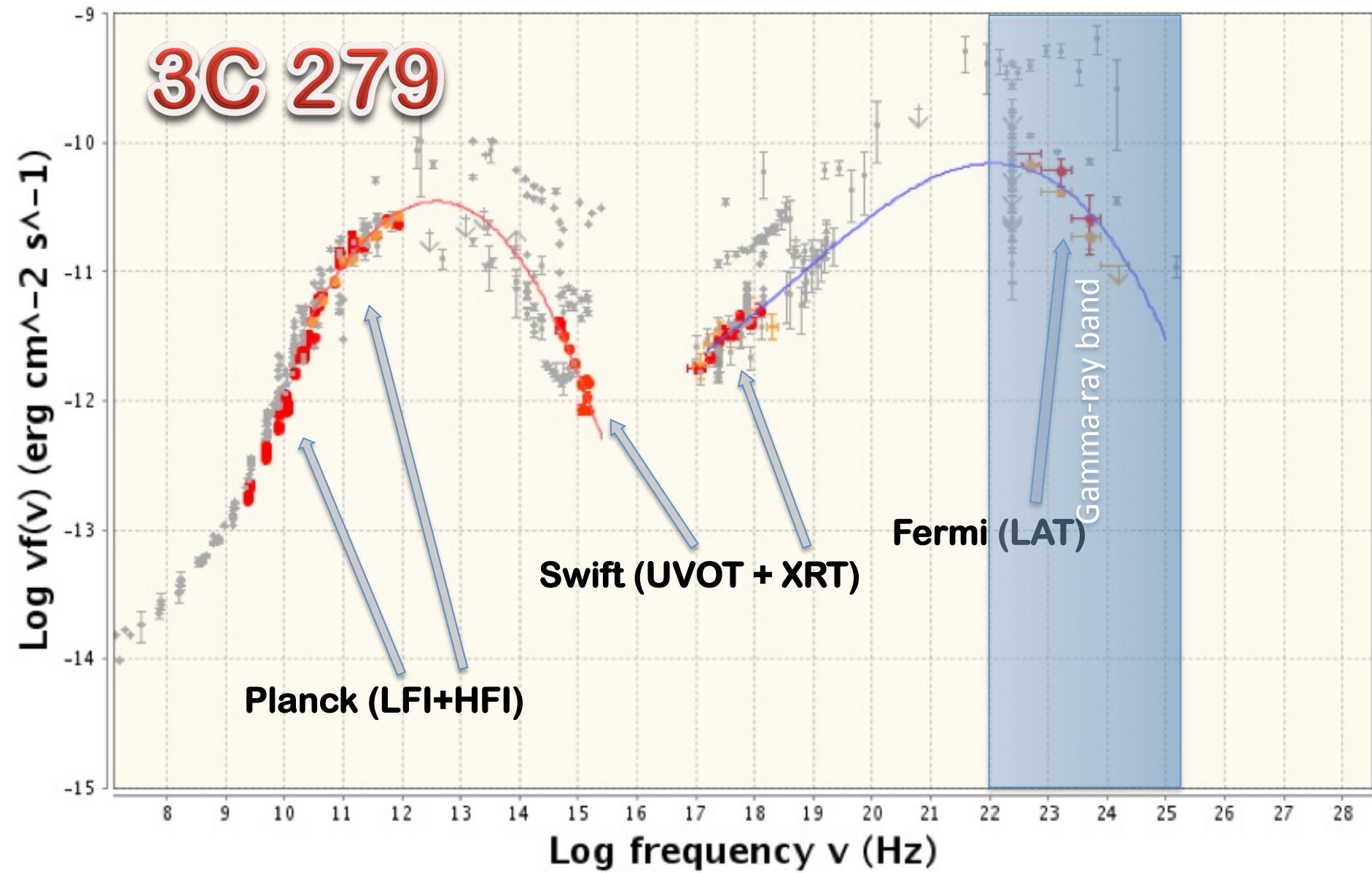
Jet dominated AGN (< 10%)

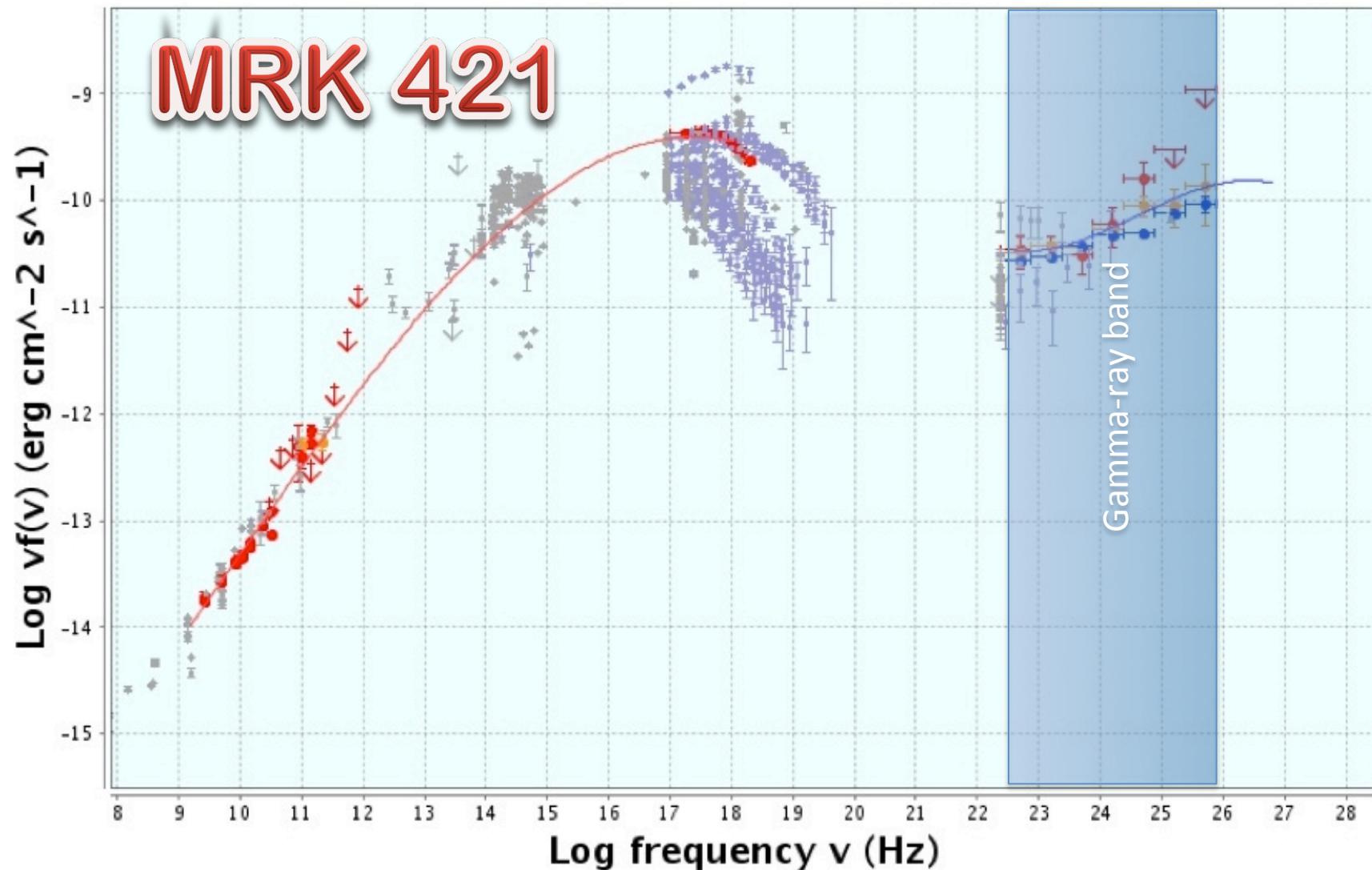
When $\Theta < \theta_{\text{blazar}}$ Blazar

As of today, about 3,150 blazars are known (Bzcat, edition 4.1, Massaro et al. 2012).

This number is increasing rapidly but it remains a small percentage
of the over one million AGN known

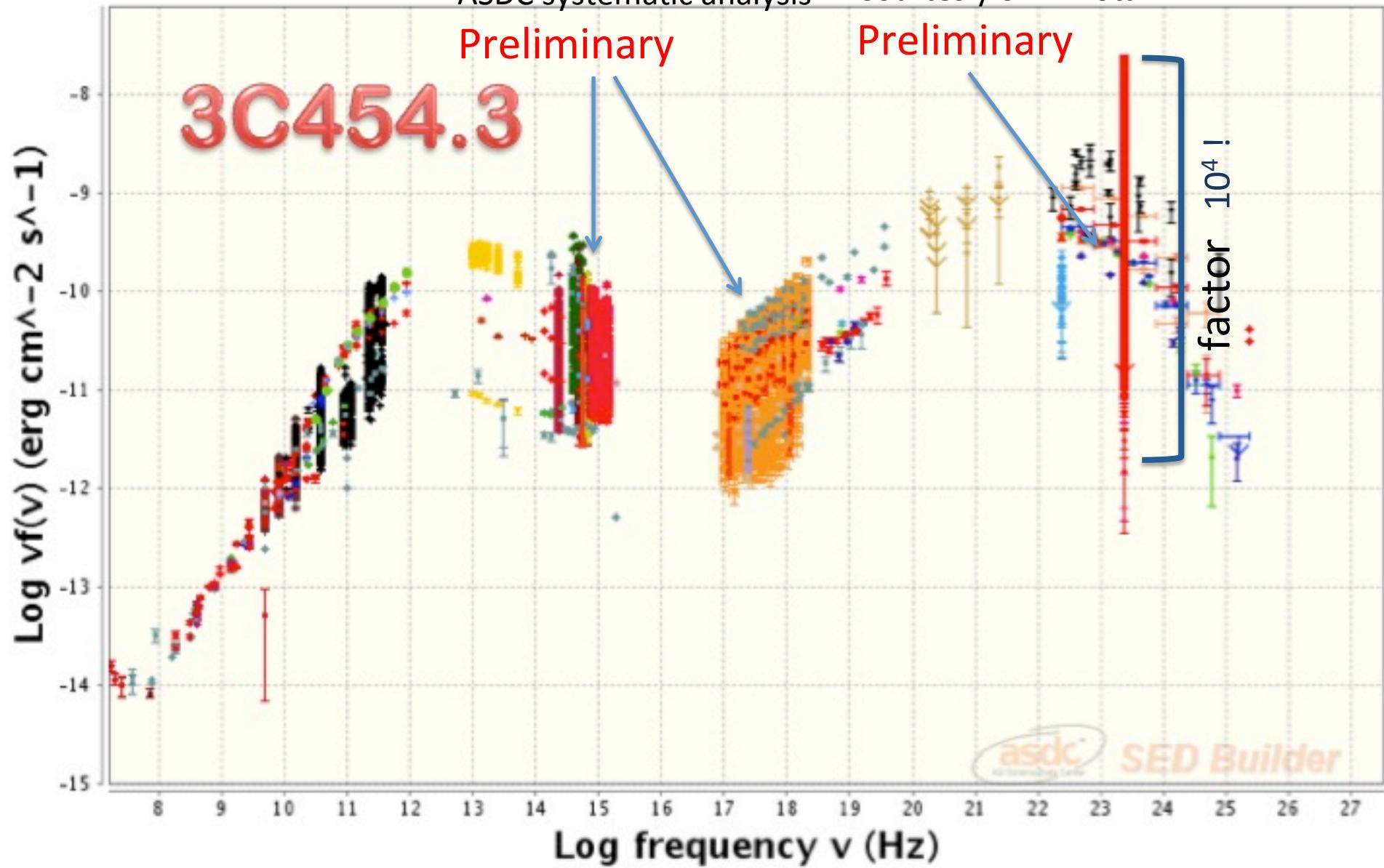
Flesch, E. The Million Quasars (MILLIQUAS) Catalog, Version 3.1
(22 October 2012) <http://quasars.org/milliquas.htm>





Swift XRT +UVOT archive
ASDC systematic analysis

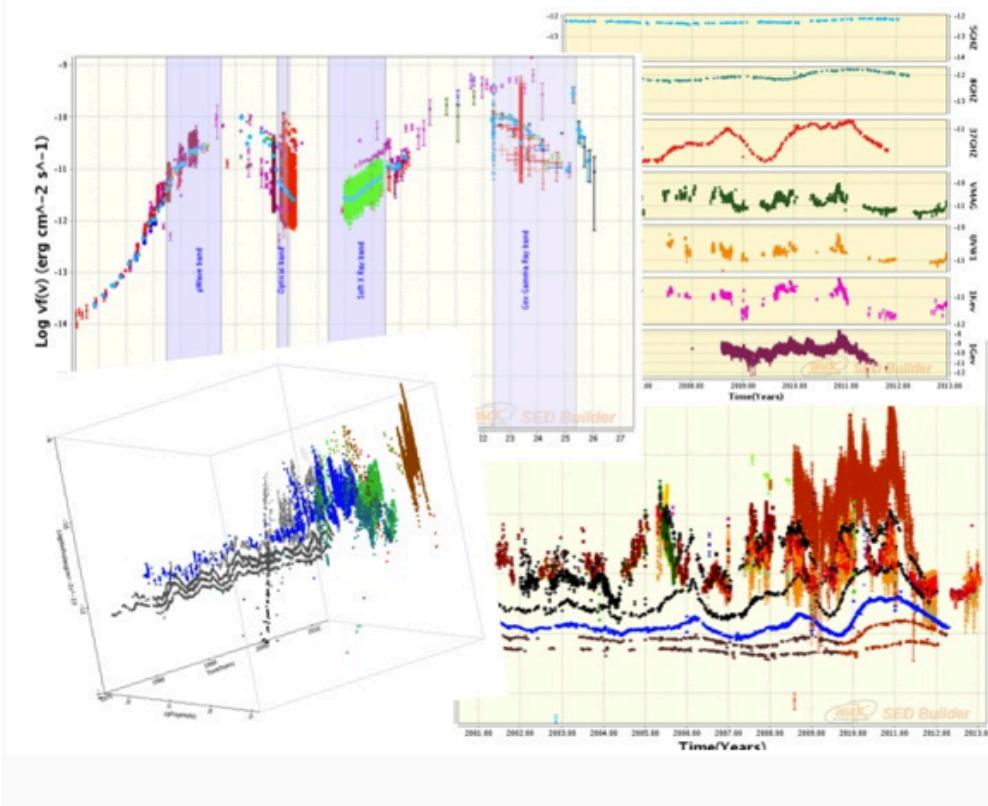
Fermi adattive bin 1GeV light-curve
Courtesy of B. Lott



<http://tools.asdc.asi.it/SED/>

SED^(t) builder V3.0

A tool to build and handle Spectral Energy Distributions, time-resolved SEDs and multi-frequency light-curves



ASDC Catalogs

Type	Name	Credits	Search	Options
+ AT	CLASSCAT	U		
+ CRATES	CRATES	V U		
+ CRATESGAPS	DIXON	V U		
+ GBT	FIRST	U		
+ JVASPOL	JVASPOL	U		
+ KUEHR	KUEHR	V U		
+ NIEPPOCAT	NIEPPOCAT	U		
+ NVSS	NVSS	V U		
+ PKSCAT90	PKSCAT90	V U		
+ PMN	PMN	V U		
+ Planck	SUMSS	U		
+ VLNEP	VLNEP	U		
+ VLSS	VLSS	V U		
+ WENSS	WENSS	U		
+ WMAP				
+ Infrared				
+ Optical UV				
+ Soft X Ray				
+ Hard X Ray				
+ Gamma Ray				
+ VHE				
External Catalogs				
2MASS	2MASS	V U		
Catalina RTS	Catalina RTS	V U		
NED	NED	V U	3C279	V U
SDSS7	SDSS7	U		
SDSS10	SDSS10	U		
USNO A2.0	USNO A2.0	V U		
USNO B1	USNO B1	V U		
User Catalogs				
3	3			
G	G			

A UV and X-ray spectral database of the blazars most frequently observed by Swift.

P. Giommi^{1,2}, M. Perri^{1,3}, M. Capalbi⁴, V. D'Elia^{1,3}, F. Verrecchia, G. Tagliaferri⁴, G. Cusumano⁵, et al.^{1,3}

2104 in preparation

Systematic XRT (and UV+BAT) analysis of
4056 observations of 113 blazars
frequently observed by Swift
between
2004 and early 2014
8152 XRT orbit-based spectra

Some examples

MKN421 : 560 observations, 1178 orbits, 1738 XRT spectra
3C454.3 : 350 observations, 740 orbits, 1090 XRT spectra
PKS2155-304 : 126 observations, 284 orbits, 410 spectra

Results will be available via a dedicated on-line catalog (www.asdc.asi.it/xrtspectra)
and spectral through the ASDC SED tool (tools.asdc.asi.it/SED)

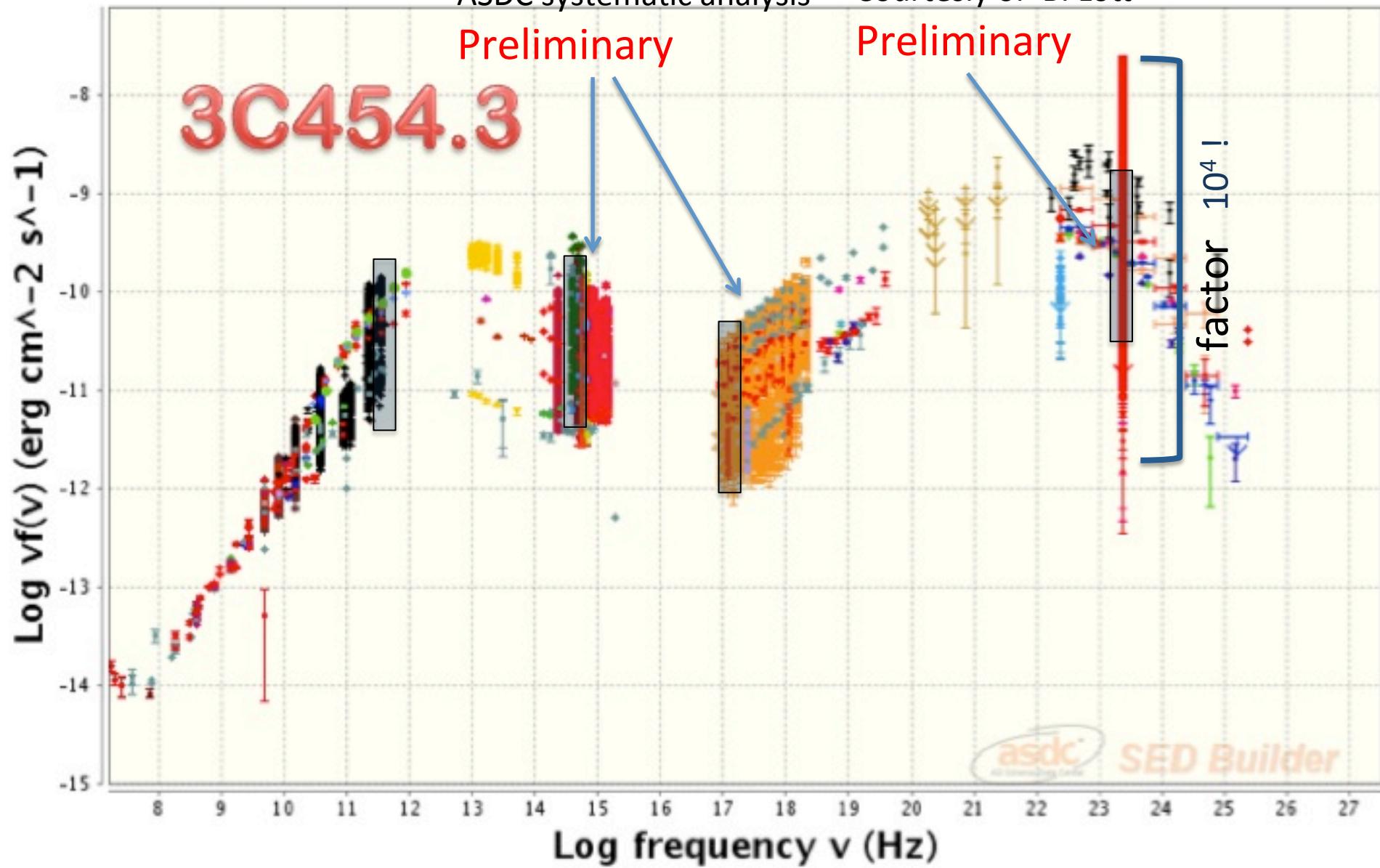
The ASDC X-ray spectral database of blazars frequently observed by Swift

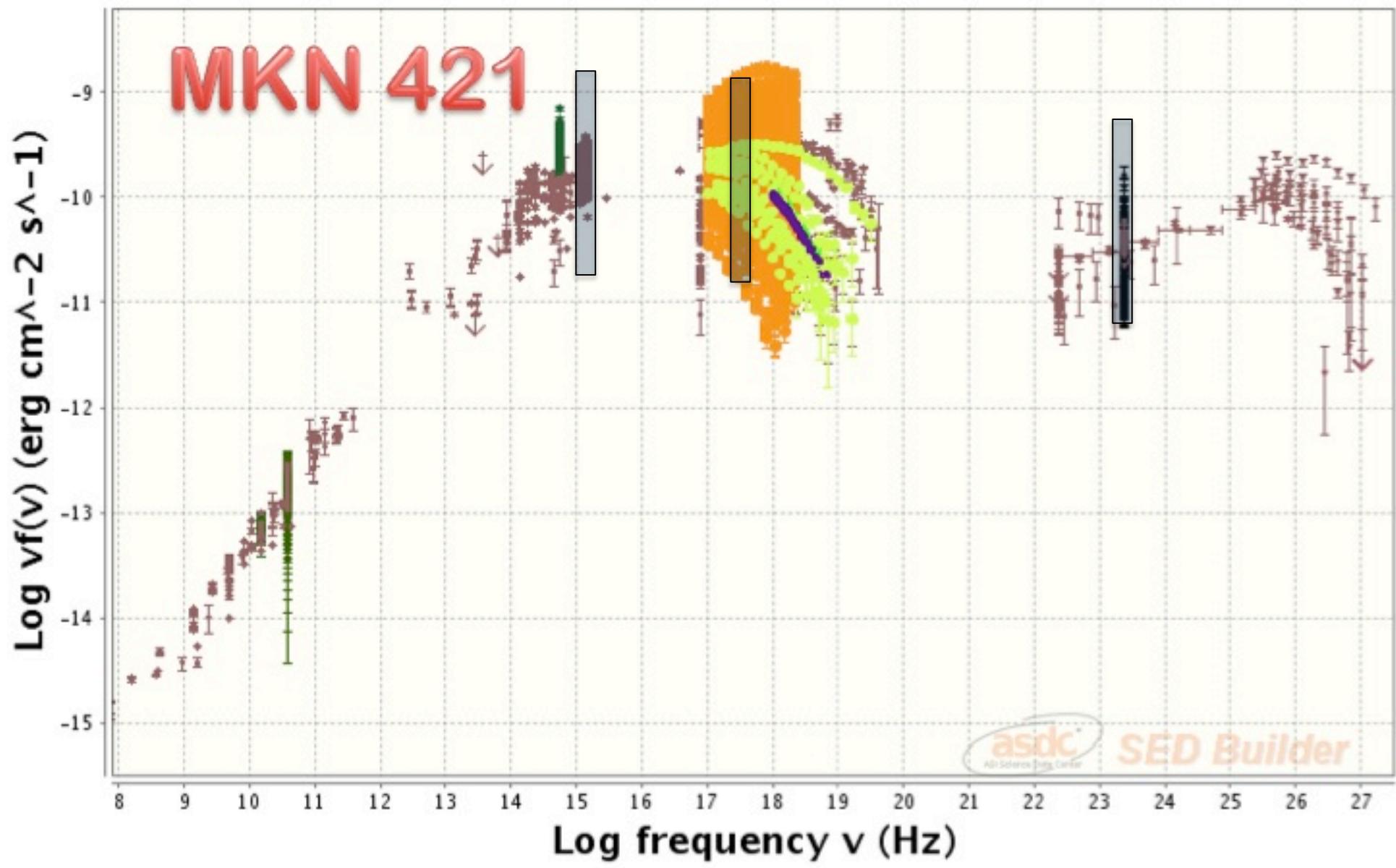
Last update: 28-04-2014

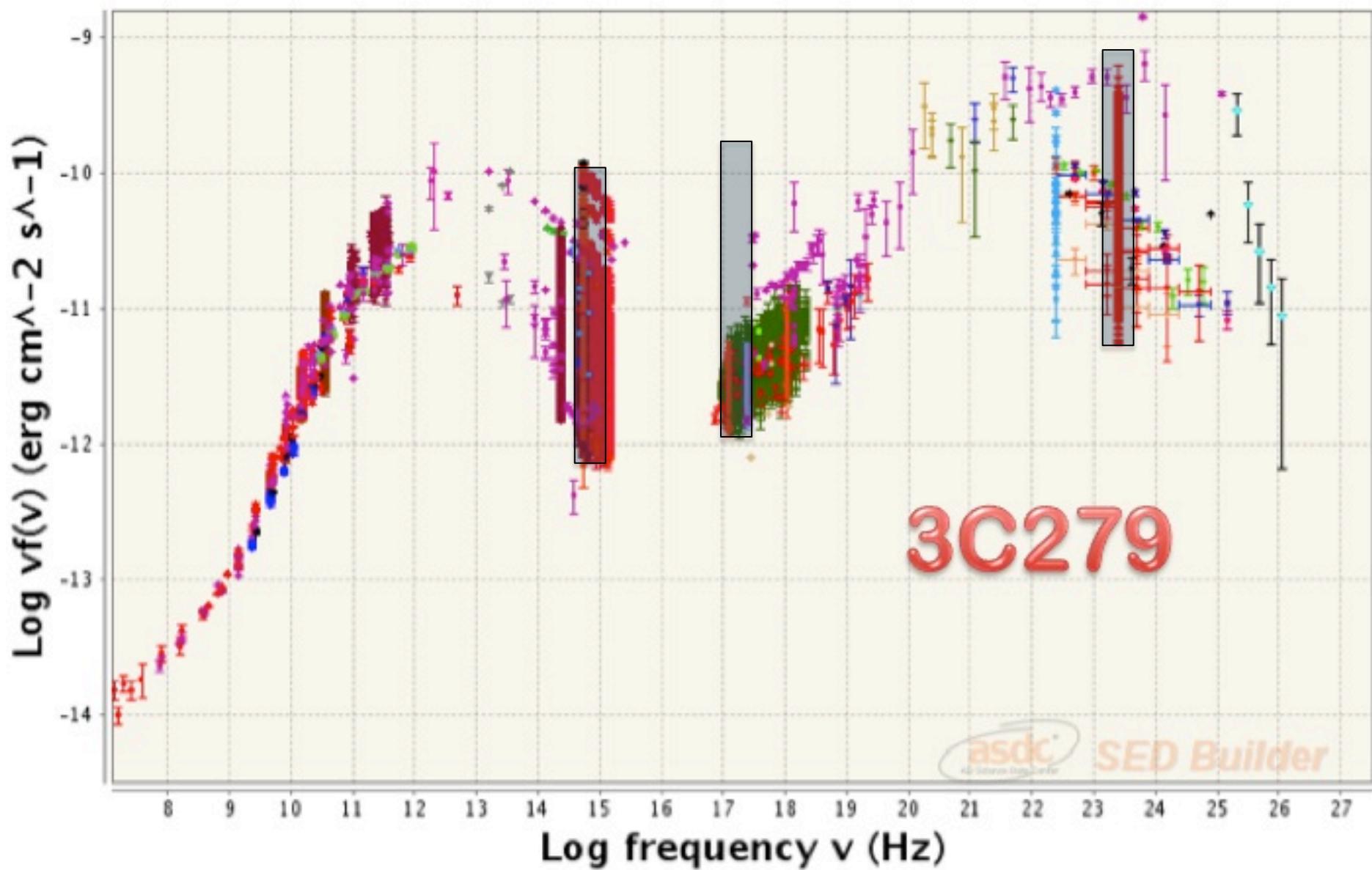
Entry number	Name	Phot index	Norm_pl	Alpha LP	Beta LP	Norm_lp	Flux210 pl	Observation time	Orbit
		Photon index	Norm_pl	alpha_lp_with_err	beta_lp_with_err	Norm_lp	Flux 2-10	obs_time	Orbit
Selection mode:									
<input type="checkbox"/> All									
1	<input checked="" type="checkbox"/> Select ASDC Data Explorer BZQJ2151-3027	1.09+/-0.22	0.0023	1.25+/-0.34	-0.37+/-0.66	0.0022	2.5e-11+/-6.9e-12	2014.24134	3
2	<input checked="" type="checkbox"/> Select ASDC Data Explorer BZQJ2151-3027	1.21+/-0.12	0.0021	1.16+/-0.26	0.07+/-0.38	0.0021	1.9e-11+/-2.2e-12	2014.23875	2
3	<input checked="" type="checkbox"/> Select ASDC Data Explorer BZQJ2151-3027	1.03+/-0.13	0.0021	1.2+/-0.28	-0.28+/-0.42	0.0021	2.6e-11+/-5.7e-12	2014.23841	1
4	<input checked="" type="checkbox"/> Select ASDC Data Explorer BZQJ2151-3027	1.11+/-0.08	0.0021	1.11+/-0.16	-0.01+/-0.24	0.0021	2.2e-11+/-2.4e-12	2014.23841	TOT
5	<input checked="" type="checkbox"/> Select ASDC Data Explorer PKS2004-447	1.52+/-0.25	0.0001	1.41+/-0.45	0.36+/-1.04	0.00011	5.5e-13+/-1.4e-13	2014.20553	TOT
6	<input checked="" type="checkbox"/> Select ASDC Data Explorer PKS2004-447	1.42+/-0.43	0.000091	1.59+/-0.57	-0.67+/-0.58	0.000086	5.8e-13+/-2.5e-13	2014.20245	TOT
7	<input checked="" type="checkbox"/> Select ASDC Data Explorer PG1553+113	2.46+/-0.11	0.007	2.51+/-0.11	-0.34+/-0.29	0.0067	9.3e-12+/-8.2e-13	2014.1766	TOT
8	<input checked="" type="checkbox"/> Select ASDC Data Explorer PG1553+113	2.46+/-0.11	0.007	2.51+/-0.11	-0.34+/-0.29	0.0067	9.3e-12+/-1.2e-12	2014.1766	1
9	<input checked="" type="checkbox"/> Select ASDC Data Explorer PKS1222+216	2.31+/-0.26	0.0015	2.38+/-0.29	-0.42+/-0.9	0.0014	2.5e-12+/-9.8e-13	2014.17531	3
10	<input checked="" type="checkbox"/> Select ASDC Data Explorer PKS1222+216	2.08+/-0.35	0.0015	2.17+/-0.32	-0.78+/-1.14	0.0014	3.5e-12+/-2e-12	2014.17496	2
11	<input checked="" type="checkbox"/> Select ASDC Data Explorer PKS1222+216	2.22+/-0.37	0.0015	2.38+/-0.41	-0.74+/-1.27	0.0014	2.8e-12+/-1.8e-12	2014.17456	1
12	<input checked="" type="checkbox"/> Select ASDC Data Explorer PKS1222+216	2.17+/-0.19	0.0015	2.37+/-0.17	-1.08+/-0.46	0.0013	2.9e-12+/-9.3e-13	2014.17456	TOT
13	<input checked="" type="checkbox"/> Select ASDC Data Explorer PKS1424+240	2.28+/-0.18	0.0021	2.25+/-0.2	0.27+/-0.74	0.0021	3.5e-12+/-6.5e-13	2014.17388	TOT
14	<input checked="" type="checkbox"/> Select ASDC Data Explorer PKS1424+240	2.28+/-0.18	0.0021	2.25+/-0.2	0.27+/-0.74	0.0021	3.5e-12+/-1.2e-12	2014.17388	1

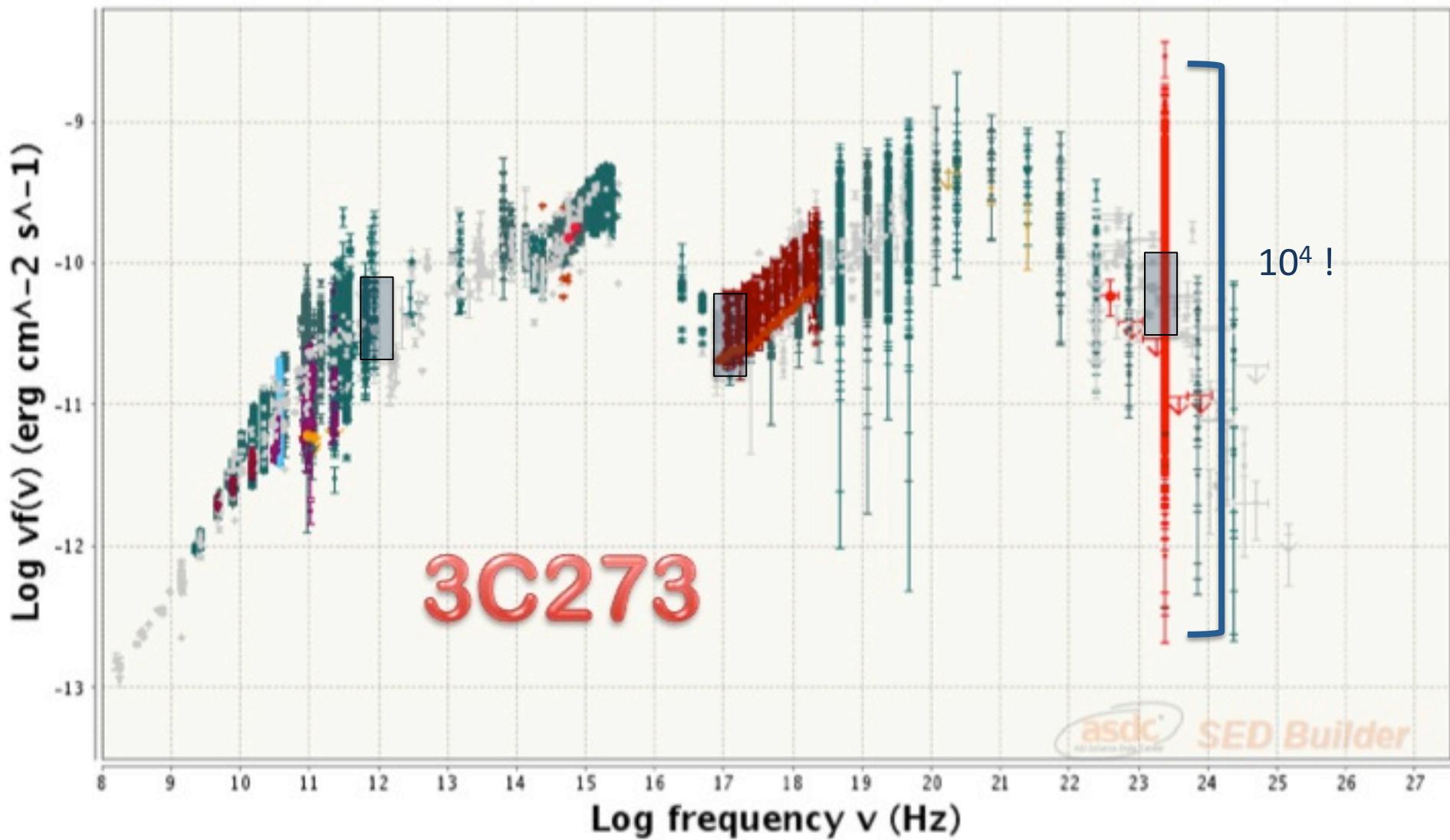
Swift XRT +UVOT archive
ASDC systematic analysis

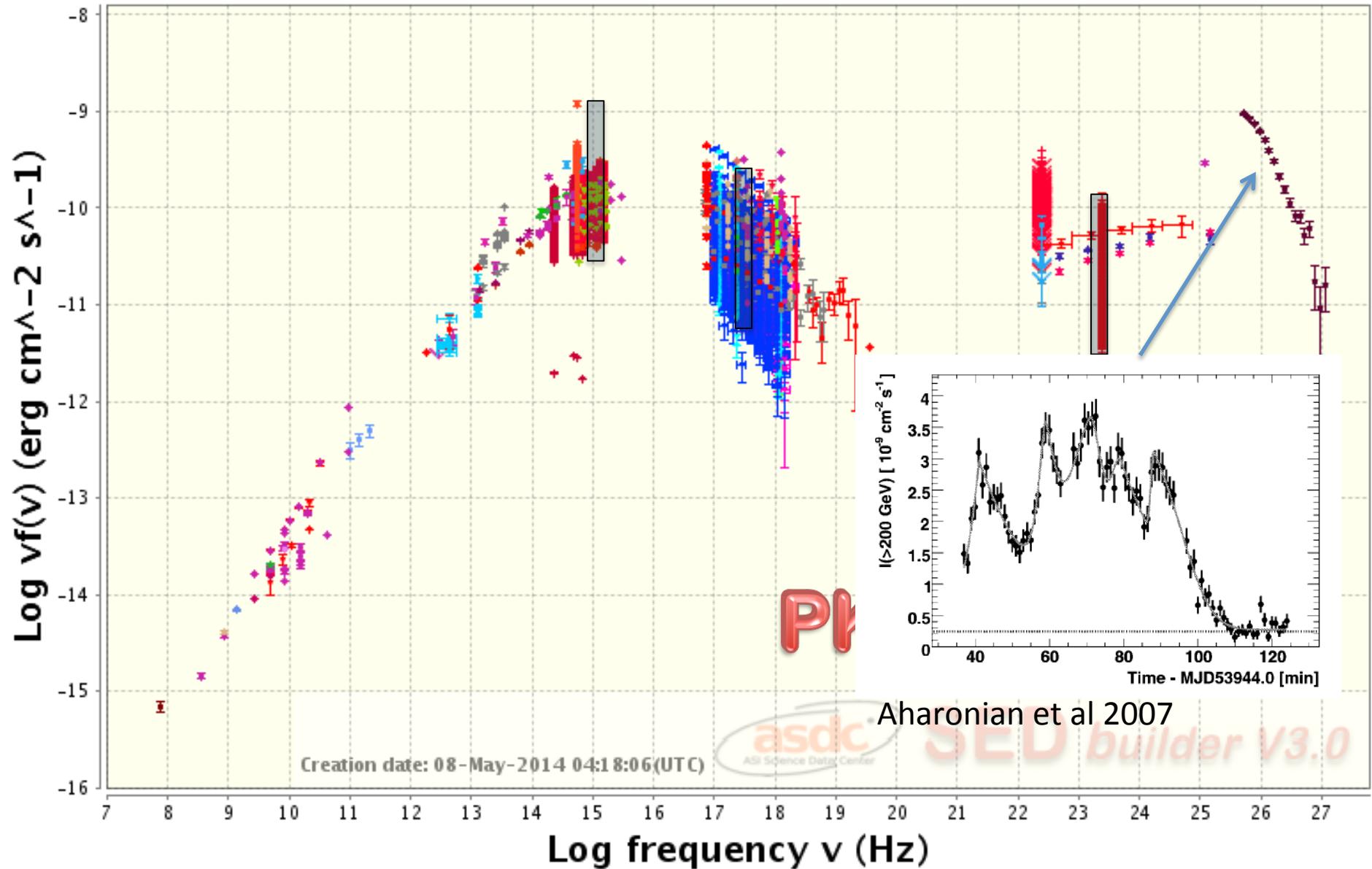
Fermi adattive bin 1GeV light-curve
Courtesy of B. Lott



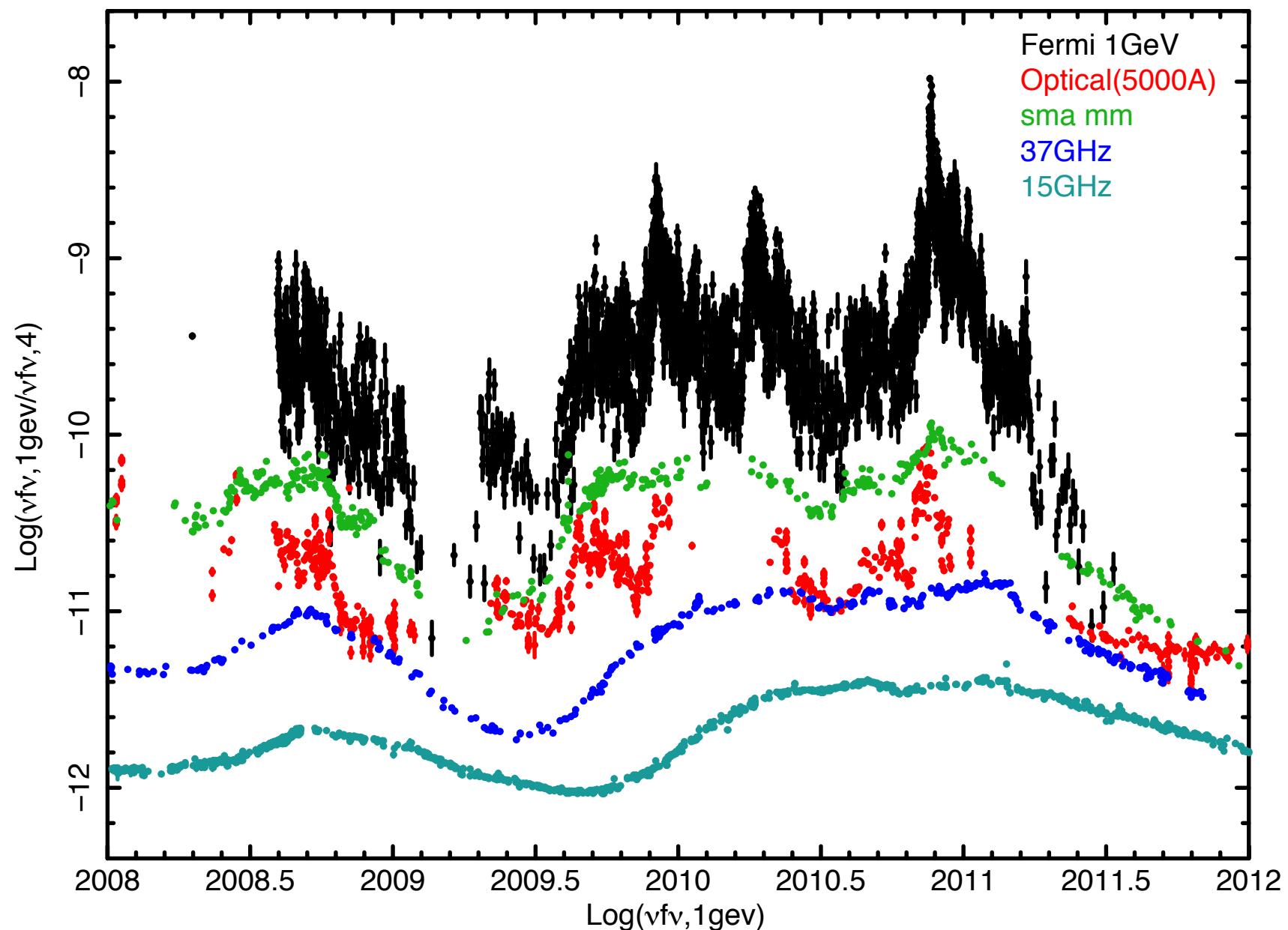




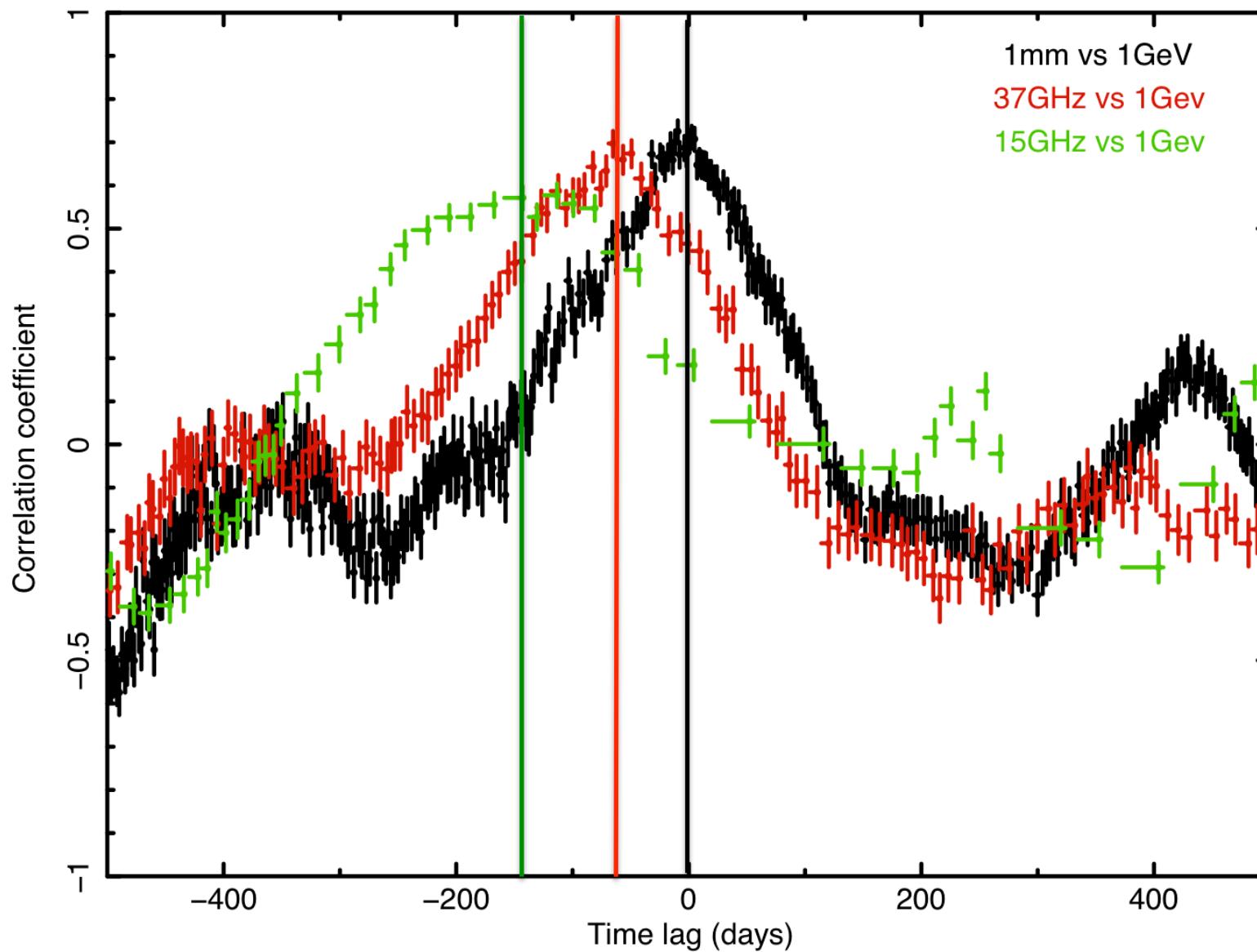




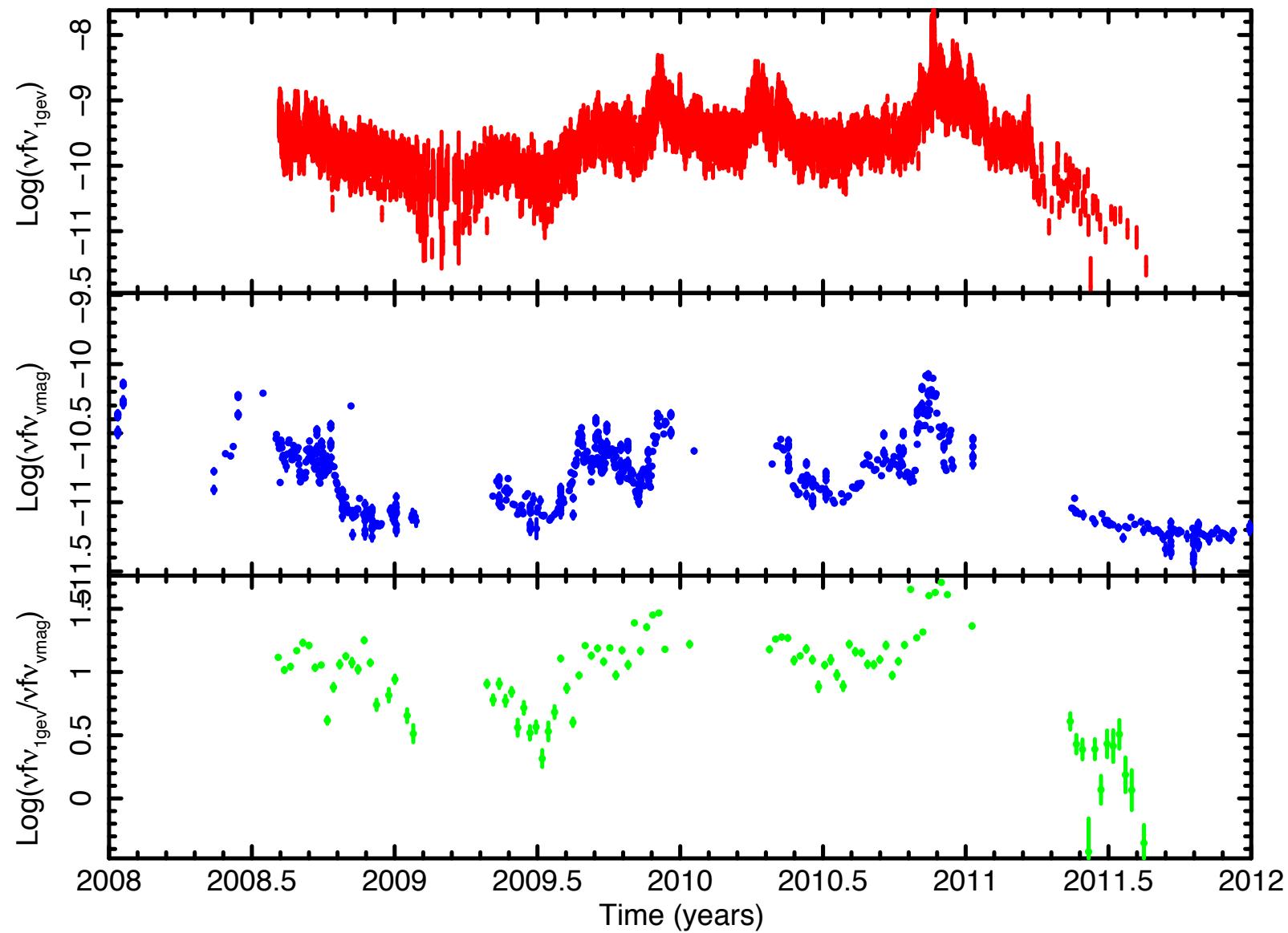
3C454_3 – light curve rebinned to snr ≥ 4



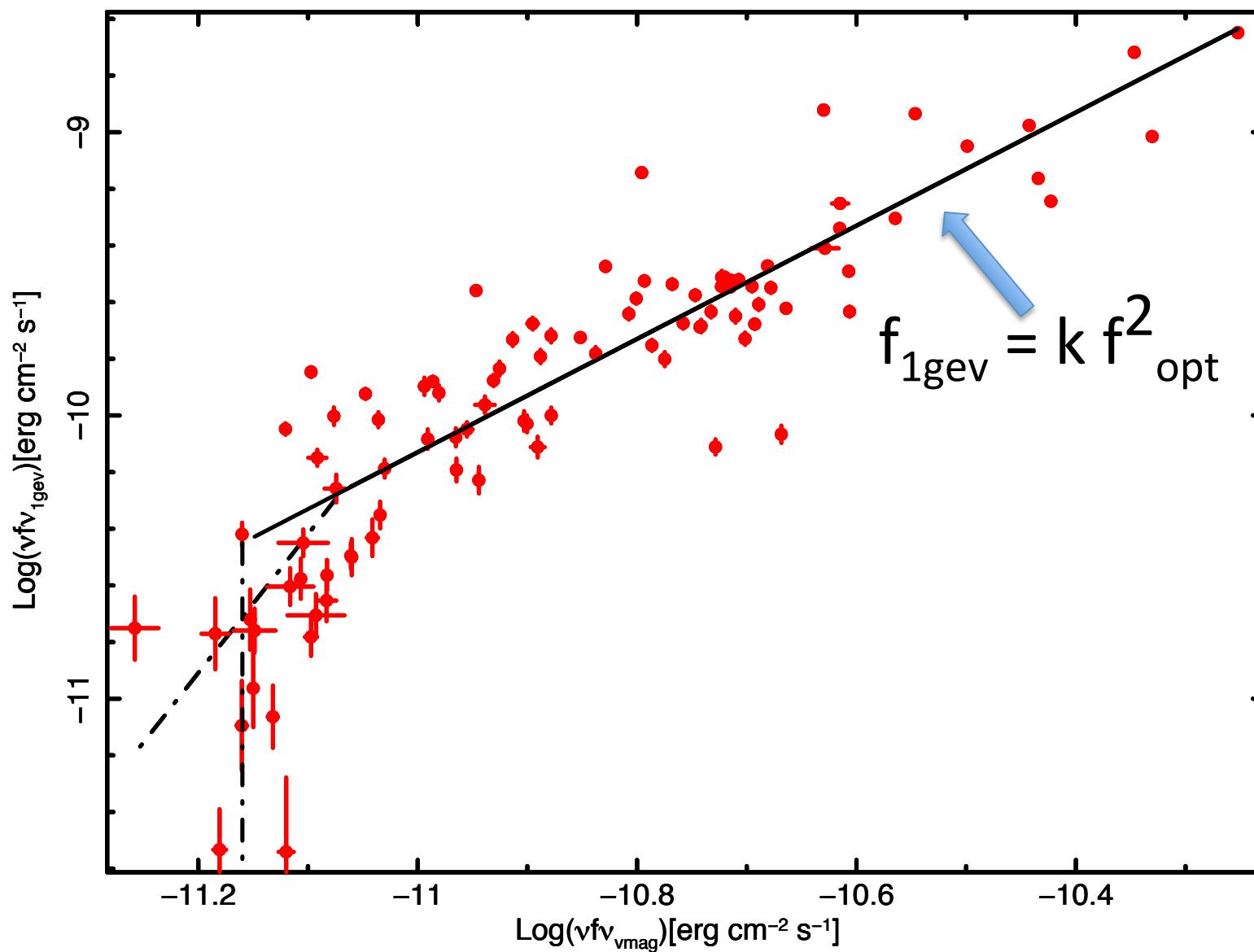
3C454.3 cross-correlation of light-curves in different energy bands



3C454_3 light curves and flux ratio



3C454.3

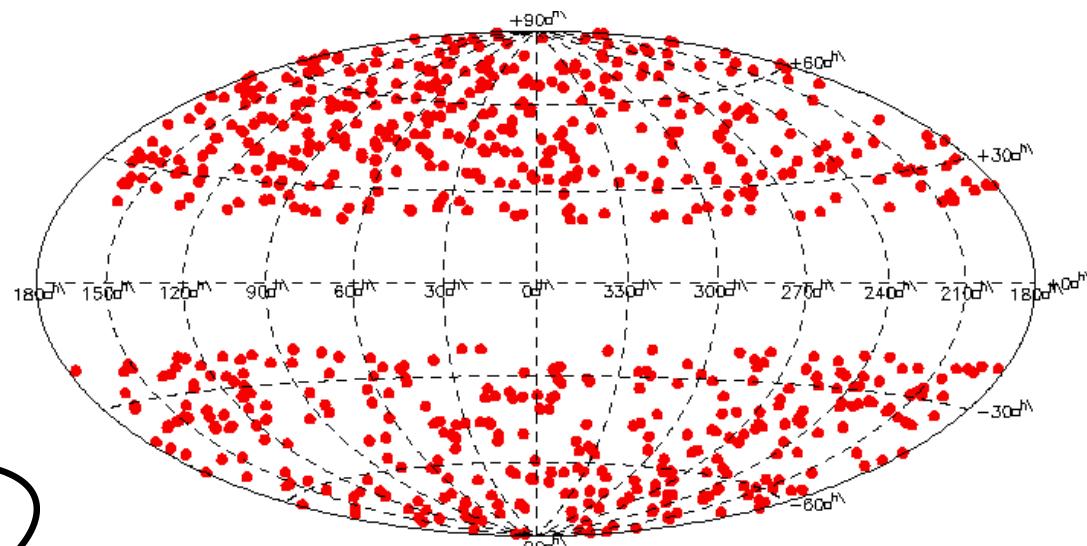




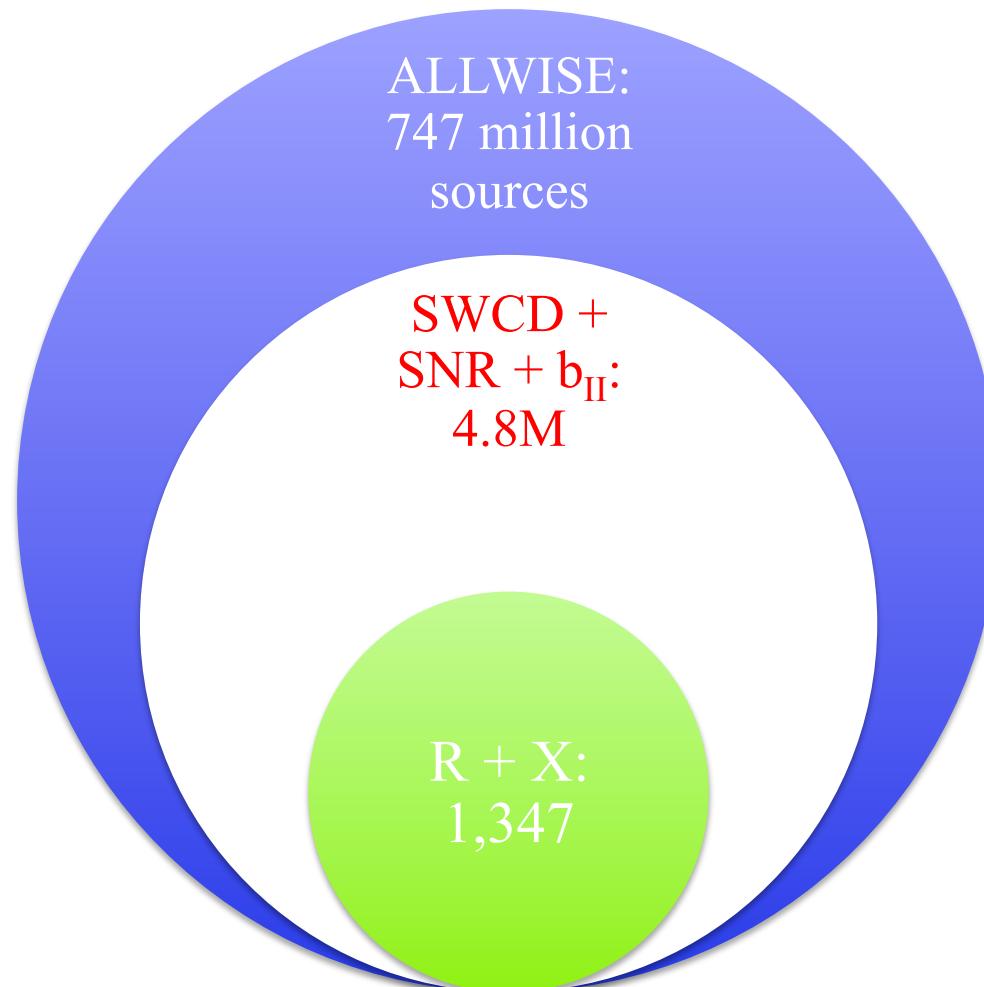
1WHSP: an IR-based sample of ~1,000 VHE γ -ray blazar candidates

B. Arsioli^{1,2}, B. Fraga^{1,2}, P. Giommi³, P. Padovani^{4,5}, and M. Marrese³

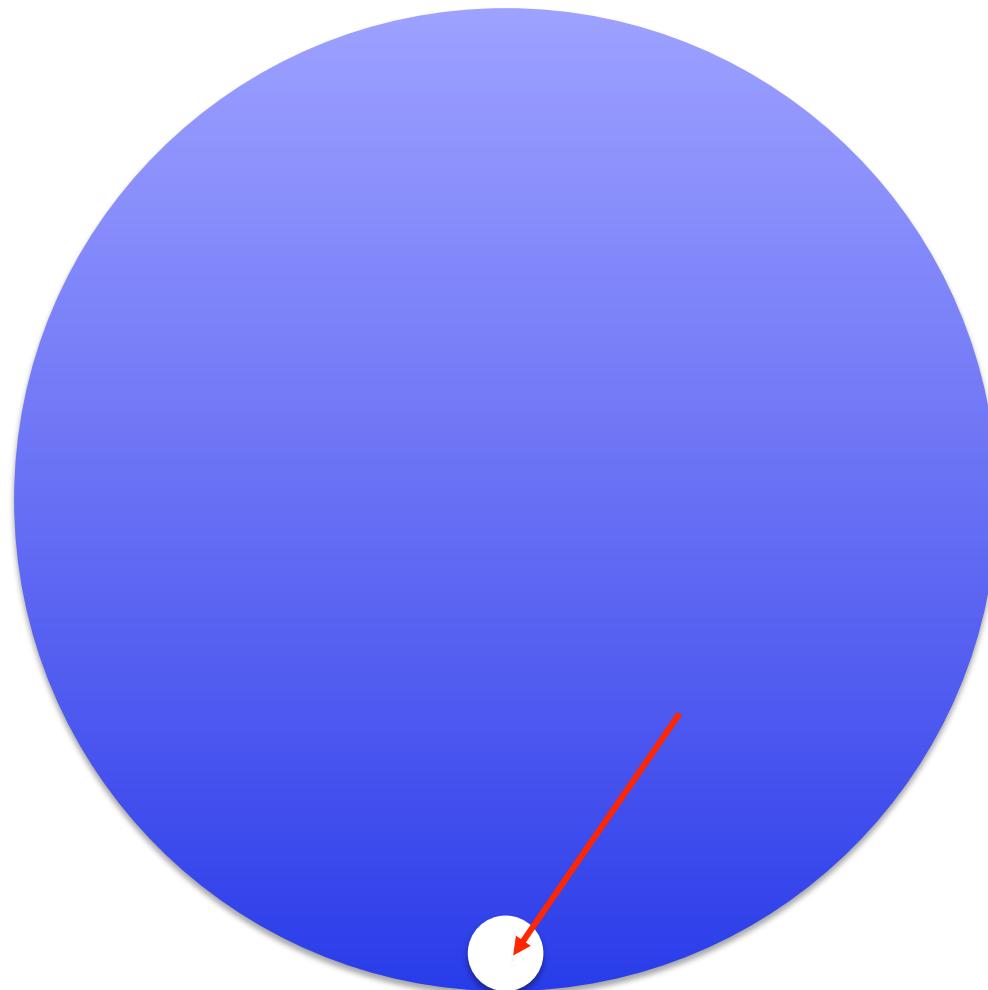
Submitted to A&A



Looking for HSPs in WISE: how to find a needle in a haystack!



Looking for HSPs in WISE: how to find a needle in a haystack!





A simplified view of blazars: clearing the fog around long-standing selection effects

P. Giommi,¹★ P. Padovani,² G. Polenta,^{1,3} S. Turriziani,¹ V. D'Elia^{1,3} and S. Piranomonte³

¹ASI Science Data Center, c/o ESRIN, via G. Galilei, 00044 Frascati, Italy

²European Southern Observatory, Karl-Schwarzschild-Strasse 2, D-85748 Garching bei München, Germany

³INAF-Osservatorio Astronomico di Roma, via Frascati 33, I-00040 Monteporzio Catone, Italy

A simplified view of blazars



The discovery of high-power high synchrotron peak blazars

P. Padovani,¹★ P. Giommi² and A. Rau³

¹European Southern Observatory, Karl-Schwarzschild-Str. 2, D-85748 Garching bei München, Germany

²ASI Science Data Center, c/o ESRIN, via G. Galilei, I-00044 Frascati, Italy

³Max-Planck-Institut für Extraterrestrische Physik, Giessenbachstr. 1, D-85748 Garching bei München, Germany



A simplified view of blazars: the γ -ray case

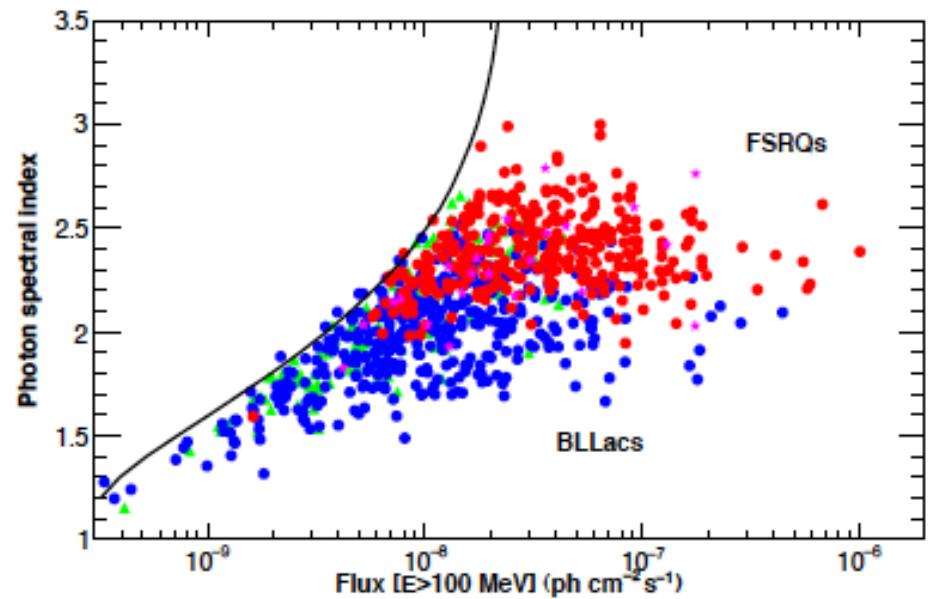
P. Giommi,^{1,2}★ P. Padovani^{2,3} and G. Polenta^{1,4}

¹ASI Science Data Center, c/o ESRIN, via G. Galilei, I-00044 Frascati, Italy

²Associated to INAF – Osservatorio Astronomico di Roma, via Frascati 33, I-00040 Monteporzio Catone, Italy

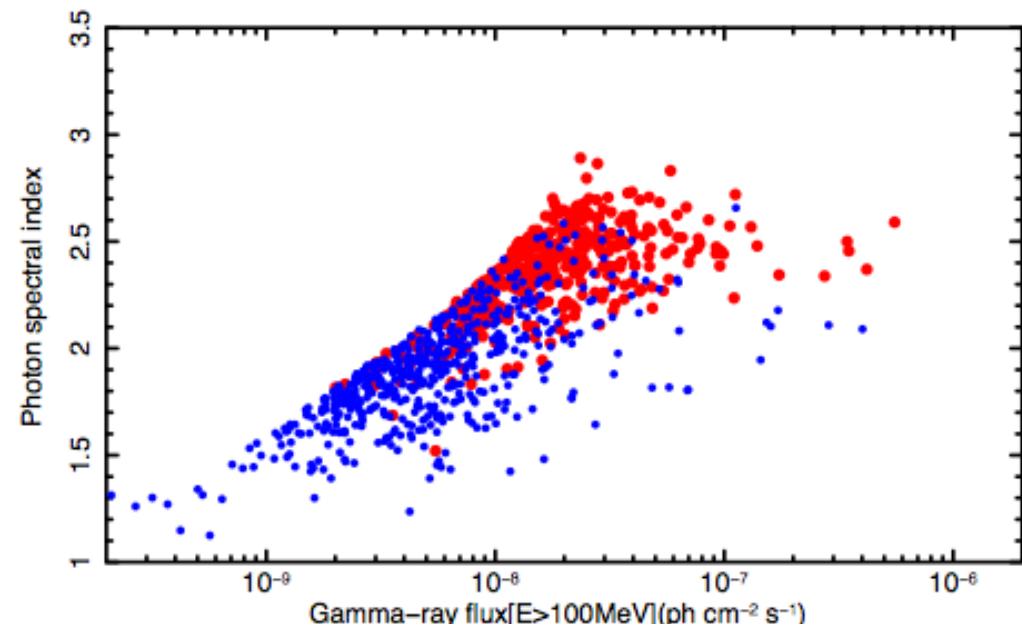
³European Southern Observatory, Karl-Schwarzschild-Str. 2, D-85748 Garching bei München, Germany

⁴INAF – Osservatorio Astronomico di Roma, via Frascati 33, I-00040 Monteporzio Catone, Italy

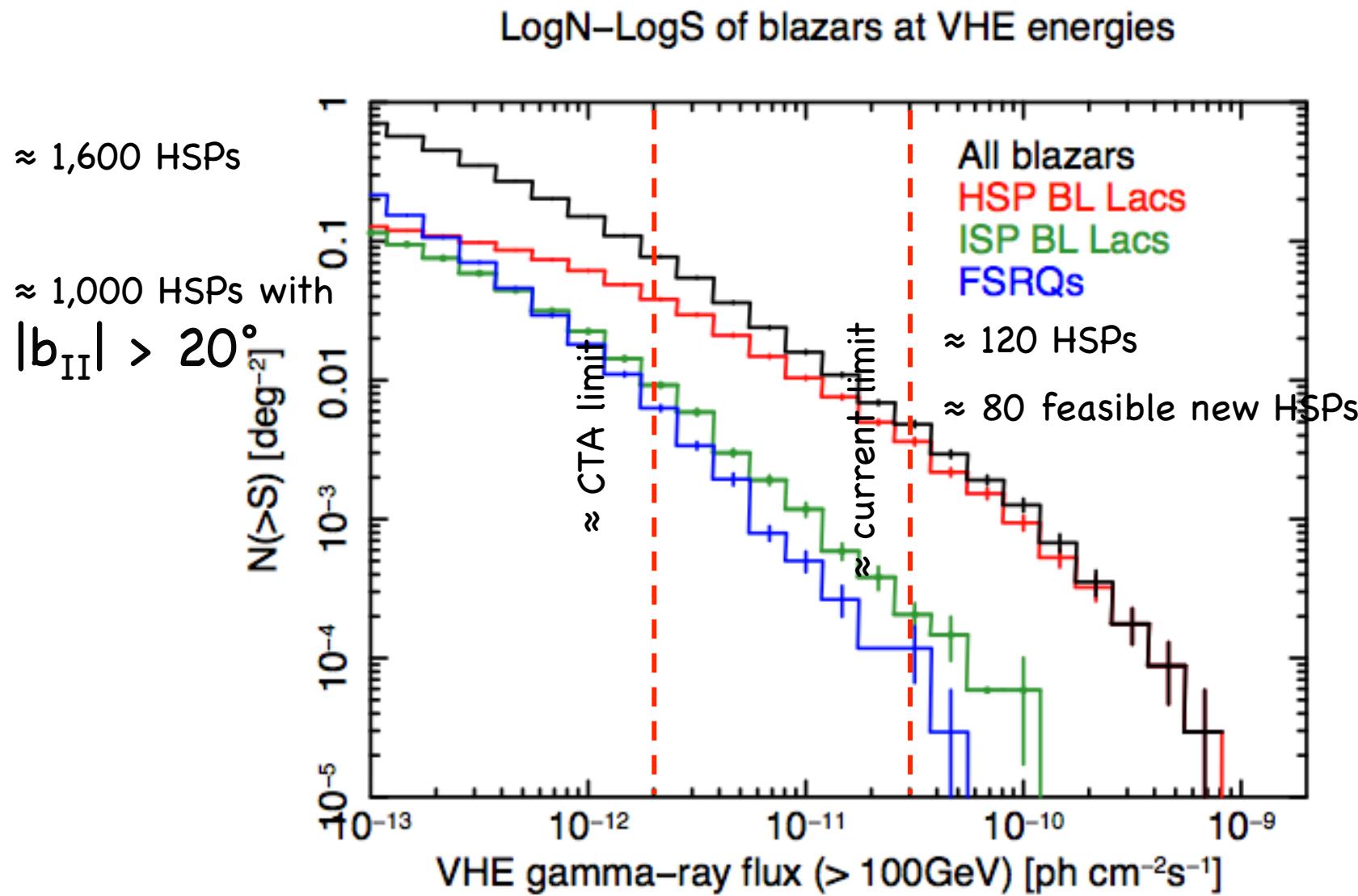


← Ackermann et al. 2012
(Fermi 2LAC clean sample)

Simplified view
Simulation



New results: the VHE band



Preliminary