



Chandra X-ray Observatory



TGCat

*Transmission Grating Catalog
and Archive*



Dr. Michael Nowak
Chandra X-ray Science Center
– on behalf of the TGCat team –
<http://tgcat.mit.edu/>

TGCAT: TRANSMISSION GRATINGS CATALOG

- Location: <http://tgcat.mit.edu/>
- Description: Huenemoerder et al. 2011, AJ, 141, 129
- Examples & video demos:
http://tgcat.mit.edu/tgHelp.php?guide=help/tgcat_demos.html
- Help desk: tgcat@space.mit.edu
- Software: <http://space.mit.edu/cxc/analysis/tgcat/index.html>
 - *S-lang* script running under *ISIS*, implementing *CIAO* tools

WHY TGCAT?

- Gratings spectra can be a little bit more difficult to extract. (*CIAO* scripts frequently improving – **chandra_repro** will usually do a good job, but if you're not already in X-ray ...)
- We provide human-vetted extractions, spectra, lightcurves, fluxes in bands of interest, and diagnostic plots
 - If the summed spectra is all you need, you can start and stop with *TGCat*.
- Plots! In many different units for different astronomers (wavelength, energy, frequency).
 - Ability to sum spectra and visually search for features.
 - Summed spectra *almost* good enough to fit

WORKED EXAMPLE: M8 I*

- Search for the source.
- Identify multiple observations.
- Look at them individually
 - Visually judge long term variability
- Sum the observations, and look at the combined plot
 - Visually identify weak features
- Download the Data Products

TGCat Query Quick Search Help Topics Help

If you use **TGCat** in your research, please cite: [Huenemoerder et al. 2011 \(AJ, 141, 129\)](#).

Start Here Select functionality from menu items

- Name
- Cone Search
- Type
- Spectral Properties
- Obsid
- Arbitrary Extraction Column
- Arbitrary Source Column
-
- Latest Query Results
- My Recent Queries

TGCat Announcements [all]

| 2017-10-23 23:30:03 - posted by tgcatt

2 new extractions reviewed and added to the archive [Show Me](#)

Serendipitous Source Extraction Request Form

If you use **TGCat** in your research, please cite: [Huenemoerder et al. 2011 \(AJ, 141, 129\)](#).



Related Catalog Projects:
CSC X-Atlas BiRD HotGAS MAST



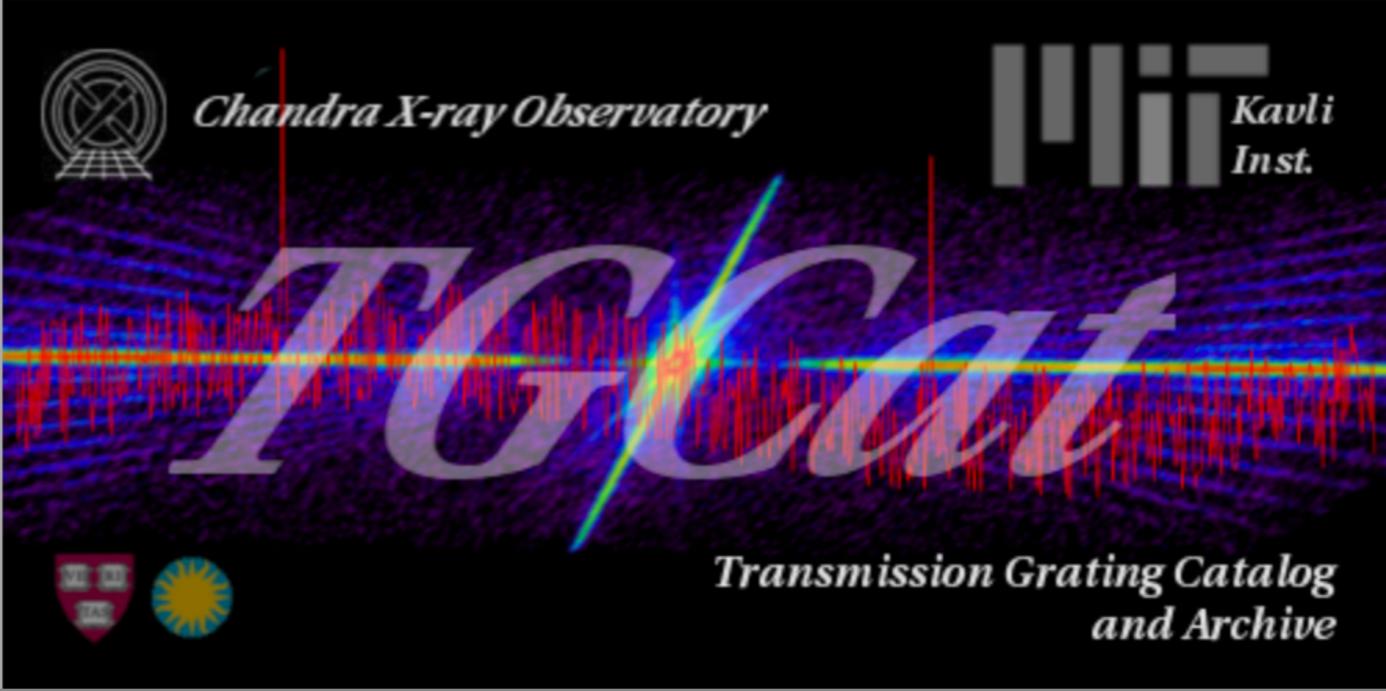
Many Choices for Search – We'll Use *Quick Search*

TGCat Query Quick Search Help Topics

Quick Search: Go

For research, please cite: [Huenemoerder et al. 2011 \(AJ, 141, 129\)](#).

Start Here. Select functionality from menu items



The banner image features the Chandra X-ray Observatory logo on the left, the Kavli Institute logo on the right, and the TGCat logo in the center. Below the TGCat logo, it reads 'Transmission Grating Catalog and Archive'. The background of the banner is a dark blue and purple grid with a bright, multi-colored light source in the center.

% is a Wild Card – be generous with its use, since we might not have spelled it the way you are expecting!

TGCat	Query	View	Actions	Help Topics				Help
---- currently viewing source table ----								
+/-	Links	object	simbad_ID	ra (h:m:s)	decl (d:m:s)	pType	other_types	num_extractions
<input type="checkbox"/>	s d b i	LS Com (HD 111812)	V* LS Com	12:51:41.930	+27:32:26.592	V*	*, IR, UV, V*, X	1
<input type="checkbox"/>	s d b i	M 81*	M 81	09:55:33.170	+69:03:55.116	LIN	AGN, G, GiG, GiP, IR, LIN, QSO, Rad, X	15
<input type="checkbox"/>	s d b i	Nova CSSo81007	[DDM2009] CSSo81007 J030559+054715	03:05:58.538	+05:47:14.748	No*	No*	1

Loaded source table: 3 rows; selection limited

Three Sets of Targets Come Up –
Choose the Middle, Consisting
of 15 Observations

TGCat	Query	View	Actions	Help Topics				Help
		---- cur	Limit	source table ----				
+/-	Links	object	simbad_ID	Download(h:m:s)	decl (d:m:s)	pType	other_types	num_extractions
<input type="checkbox"/>	s d b i	LS Com (HD 111812)	V* LS Com	Go to Extractions Table 12:51:41.930 Filter results	+27:32:26.592	V*	*, IR, UV, V*, X	1
<input checked="" type="checkbox"/>	s d b i	M 81*	M 81	Clear filters 09:55:33.170 Reset query	+69:03:55.116	LIN	AGN, G, GiG, GiP, IR, LIN, QSO, Rad, X	15
<input type="checkbox"/>	s d b i	Nova CSSo81007	[DDM2009] CSSo81007 Jo30559+054715	Tag Query 03:05:58.538	+05:47:14.748	No*	No*	1

tgcat.mit.edu/tgData.php?q=110980_64cfa242aebb8a96#

Use *Actions* Tab and *Limit*

TGCat	Query	View	Actions	Help Topics	Help
<i>----- currently viewing source table -----</i>					
<input type="checkbox"/>	sdbi	M 81*	M 81	09:55	Limit Download Go to Extractions Table Filter results Clear filters Reset query Tag Query
					other_types num_extractions AGN, G, GiG, GiP, IR, LIN, QSO, Rad, X 15

tgcat.mit.edu/tgData.php?q=110982_b61b1fc3dc945795#

Then View the List of Extractions

---- currently viewing extractions table ----

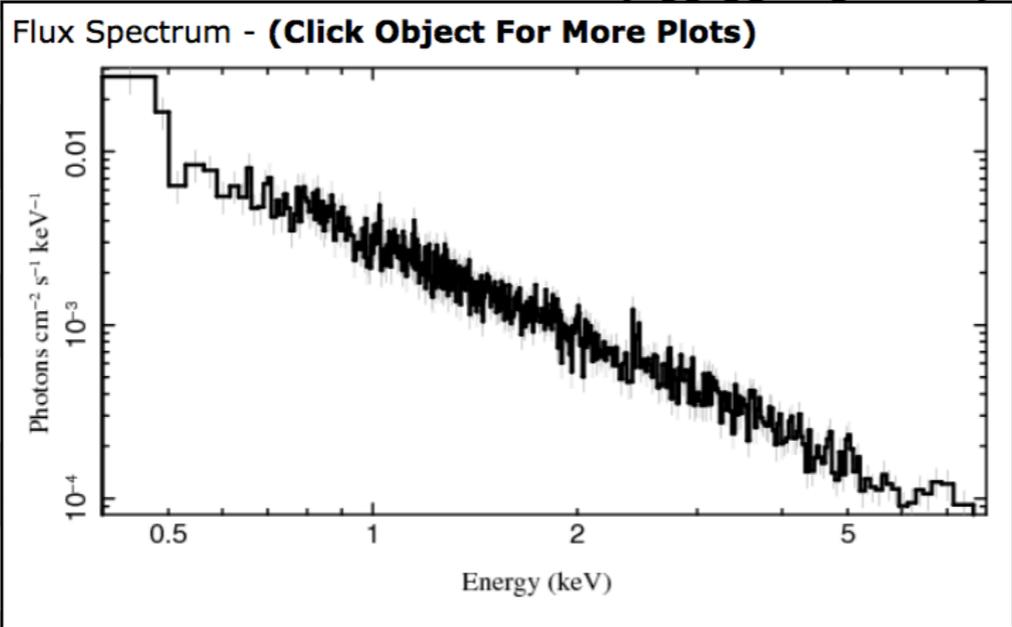
+/-	Links	obsid	object	instrument	grating	ra (h:m:s)	decl (d:m:s)	date_obs (y-m-d t)	exposure (s)
<input type="checkbox"/>	o p v s	5600	M 81*	ACIS	HETG	09:55:33.170	+69:03:55.188	2005-08-14 09:51:46	37727.6
<input type="checkbox"/>	o p v s	5601	M 81*	ACIS	HETG	09:55:33.194	+69:03:55.080	2005-07-19 14:26:03	83362.2
<input type="checkbox"/>	o p v s	6174	M 81*	ACIS	HETG	09:55:33.170	+69:03:55.152	2005-02-24 06:56:59	46038
<input type="checkbox"/>	o p v s	6346	M 81*	ACIS	HETG	09:55:33.163	+69:03:54.972	2005-07-14 01:44:55	54492.1
<input type="checkbox"/>	o p v s	6347	M 81*	ACIS	HETG	09:55:33.175	+69:03:55.008	2005-07-14 19:26:08	63877.6
<input type="checkbox"/>	o p v s	6892	M 81*	ACIS	HETG	09:55:33.202	+69:03:55.224	2006-02-08 20:21:15	14764.7
<input type="checkbox"/>	o p v s	6893	M 81*	ACIS	HETG	09:55:33.211	+69:03:55.260	2006-03-05 23:42:33	14764.7
<input type="checkbox"/>	o p v s	6894	M 81*	ACIS	HETG	09:55:33.194	+69:03:55.224	2006-04-01 10:38:21	14767.9
<input type="checkbox"/>	o p v s	6895	M 81*	ACIS	HETG	09:55:33.178	+69:03:55.116	2006-04-24 08:18:52	14563
<input type="checkbox"/>	o p v s	6896	M 81*	ACIS	HETG	09:55:33.154	+69:03:55.188	2006-05-14 13:01:03	14767.8
<input type="checkbox"/>	o p v s	6897	M 81*	ACIS	HETG	09:55:33.156	+69:03:55.044	2006-06-09 18:14:02	14764.6
<input type="checkbox"/>	o p v s	6898	M 81*	ACIS	HETG	09:55:33.163	+69:03:55.152	2006-06-28 23:36:01	14857.4
<input type="checkbox"/>	o p v s	6899	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.080	2006-07-13 13:41:33	15199.8
<input type="checkbox"/>	o p v s	6900	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.152	2006-07-28 11:10:19	14415.8
<input type="checkbox"/>	o p v s	6901	M 81*	ACIS	HETG	09:55:33.156	+69:03:55.080	2006-08-12 16:15:46	14767.8

Loaded extractions table: 15 rows; selection limited

Basic List of Observation Properties Given

---- currently viewing extractions table ----

+/-	Links	obsid	object	instrument	grating	ra (h:m:s)	decl (d:m:s)	date_obs (y-m-d t)	exposure (s)
<input type="checkbox"/>	opvs	5600	M 81*	ACIS	HETG	09:55:33.170	+69:03:55.188	2005-08-14 09:51:46	37727.6
<input type="checkbox"/>	opvs	5601	M 81*	ACIS	HETG	09:55:33.194	+69:03:55.080	2005-07-19 14:26:03	83362.2
<input type="checkbox"/>	opvs	6174	M 81*	ACIS	HETG	09:55:33.170	+69:03:55.152	2005-02-24 06:56:59	46038
<input type="checkbox"/>	opvs	6346	M 81*	ACIS	HETG	09:55:33.163	+69:03:54.972	2005-07-14 01:44:55	54492.1
<input type="checkbox"/>	opvs	6347	M 81				03:55.008	2005-07-14 19:26:08	63877.6
<input type="checkbox"/>	opvs	6892	M 81				03:55.224	2006-02-08 20:21:15	14764.7
<input type="checkbox"/>	opvs	6893	M 81				03:55.260	2006-03-05 23:42:33	14764.7
<input type="checkbox"/>	opvs	6894	M 81				03:55.224	2006-04-01 10:38:21	14767.9
<input type="checkbox"/>	opvs	6895	M 81				03:55.116	2006-04-24 08:18:52	14563
<input type="checkbox"/>	opvs	6896	M 81				03:55.188	2006-05-14 13:01:03	14767.8
<input type="checkbox"/>	opvs	6897	M 81				03:55.044	2006-06-09 18:14:02	14764.6
<input type="checkbox"/>	opvs	6898	M 81*	ACIS	HETG	09:55:33.163	+69:03:55.152	2006-06-28 23:36:01	14857.4
<input type="checkbox"/>	opvs	6899	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.080	2006-07-13 13:41:33	15199.8
<input type="checkbox"/>	opvs	6900	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.152	2006-07-28 11:10:19	14415.8
<input type="checkbox"/>	opvs	6901	M 81*	ACIS	HETG	09:55:33.156	+69:03:55.080	2006-08-12 16:15:46	14767.8

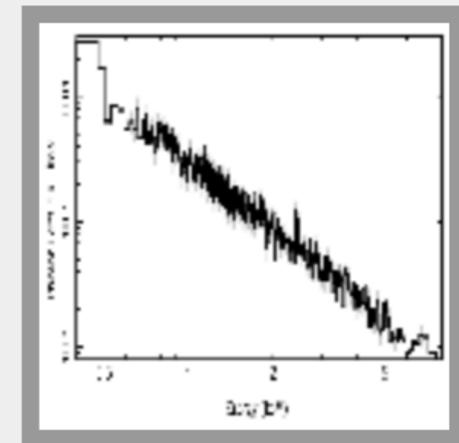
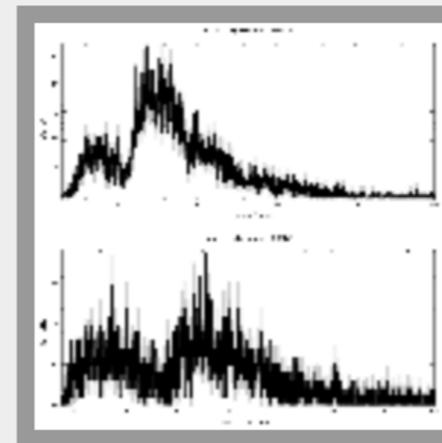
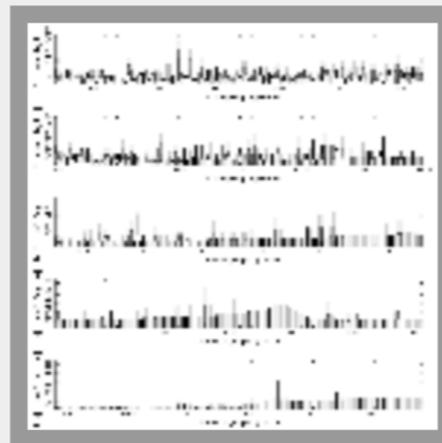
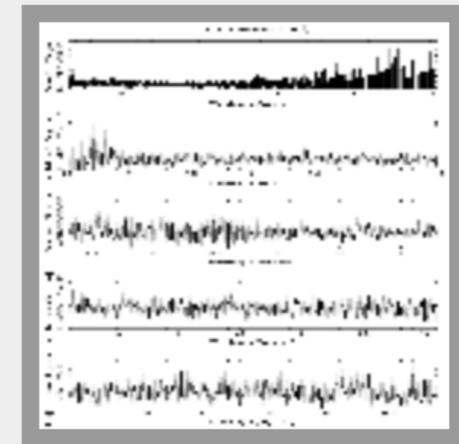
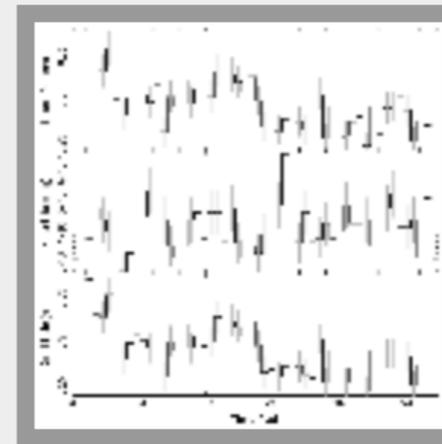
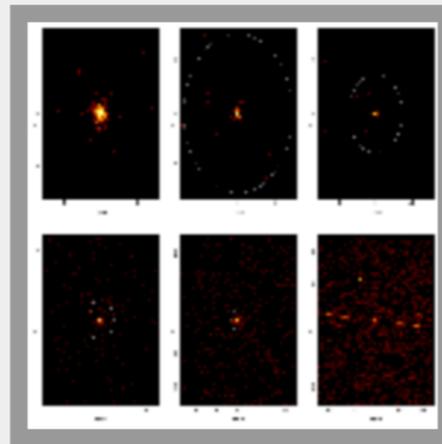
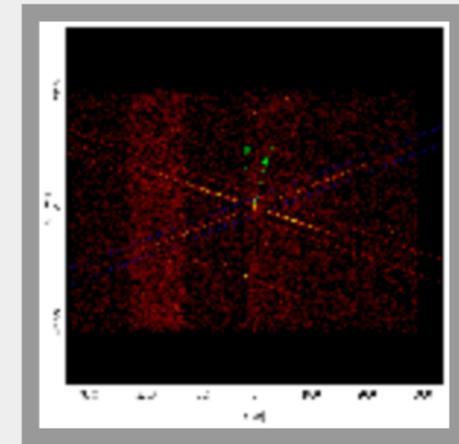
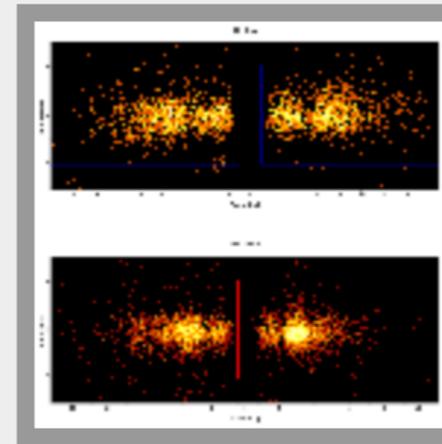
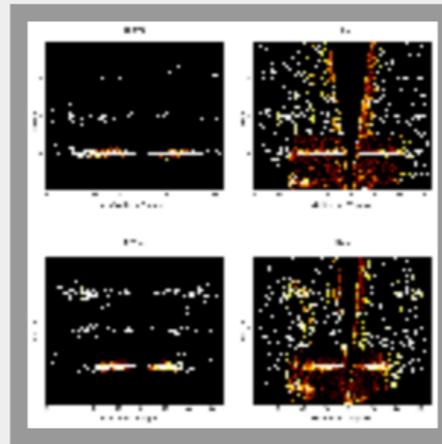


Hovering Shows a Spectral Plot

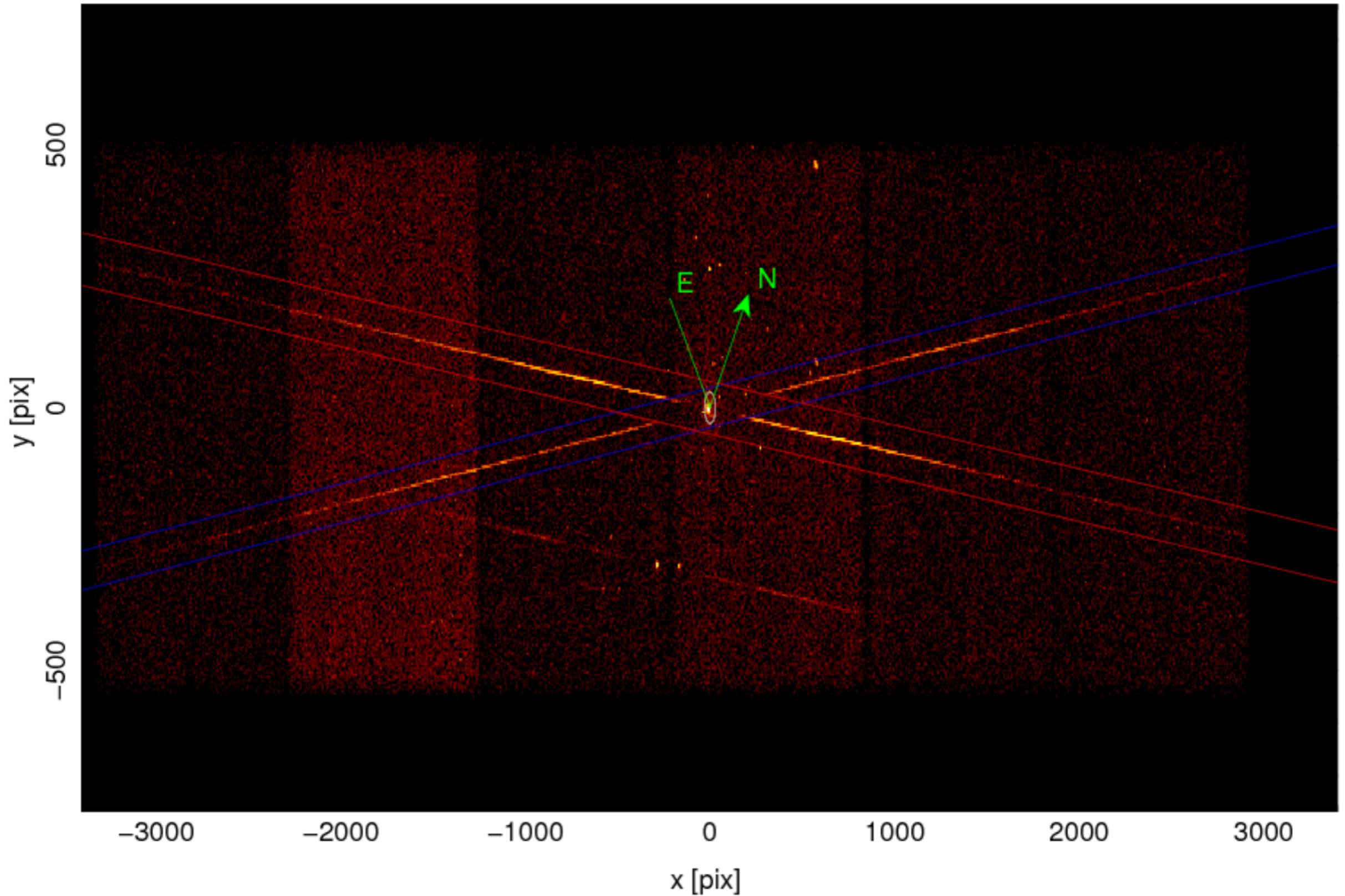
M 81*

single extraction product

id	3969
srcid	1859
obsid	6346
review	good
obi	1
target	M81*
object	M 81*
simbad_ID	M 81
instrument	ACIS
grating	HETG
exposure(s)	5.4e+4
ra	148.88818
decl	69.06527
heg_band(c/s)	2.9e-1
meg_band(c/s)	3.0e-1
leg_band(c/s)	3.0e-1
letg_acis_band(c/s)	3.0e-1
zero_order(c/s)	1.8e-1
readmode	TIMED
datamode	FAINT
proc_date	2012-02-03 06:59:03
zo_method	tgdetect
date_obs	2005-07-14 01:44:55



Clicking on an Observation Brings Up Summary

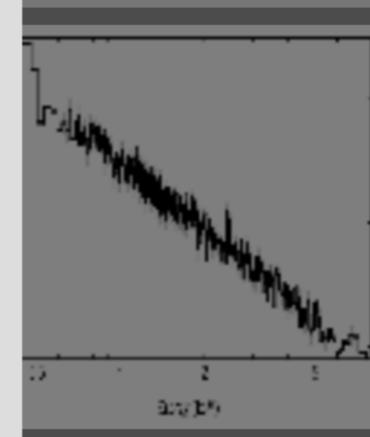
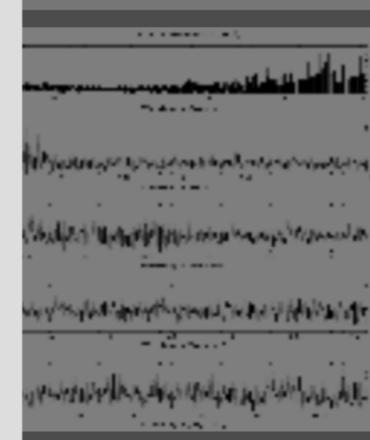
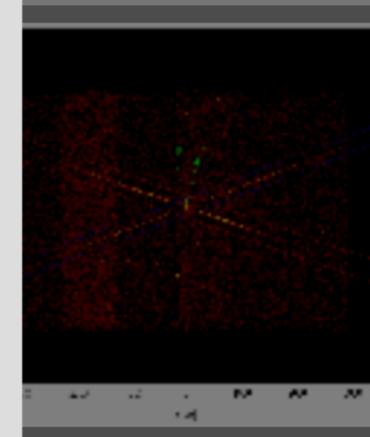
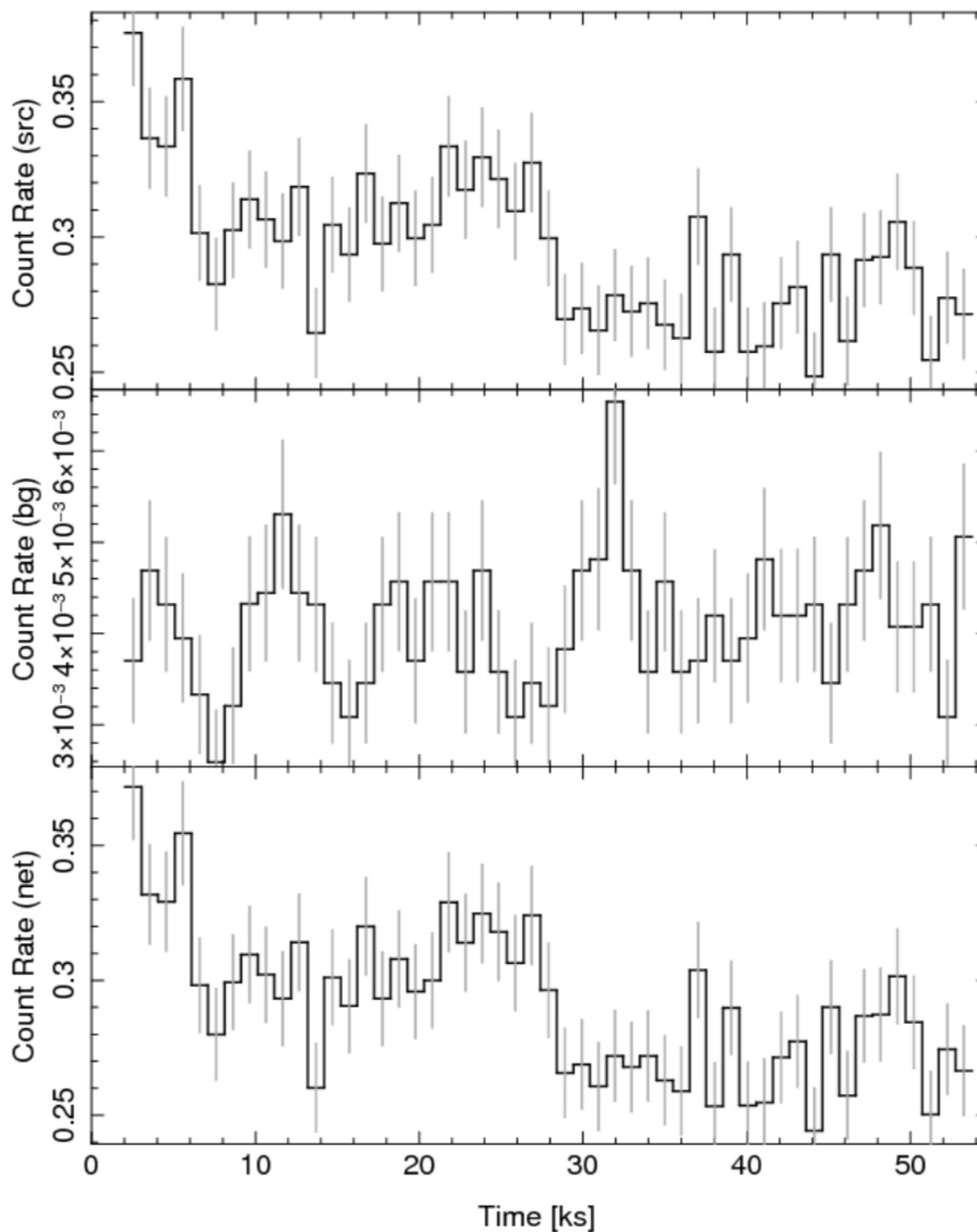


Note Other Objects in Field

M 81*

single extraction product

id	3969
srcid	1859
obsid	6346
review	good
obi	1
target	M81*
object	M 81*
simbad_ID	M 81
instrument	ACIS
grating	HETG
exposure(s)	5.4e+4
ra	148.88818
decl	69.06527
heg_band(c/s)	2.9e-1
meg_band(c/s)	3.0e-1
leg_band(c/s)	3.0e-1
letg_acis_band(c/s)	3.0e-1
zero_order(c/s)	1.8e-1
readmode	TIMED
datamode	FAINT
proc_date	2012-02-03 06:3
zo_method	tgdetect
date_obs	2005-07-14 01:4



Some Lightcurve Variability

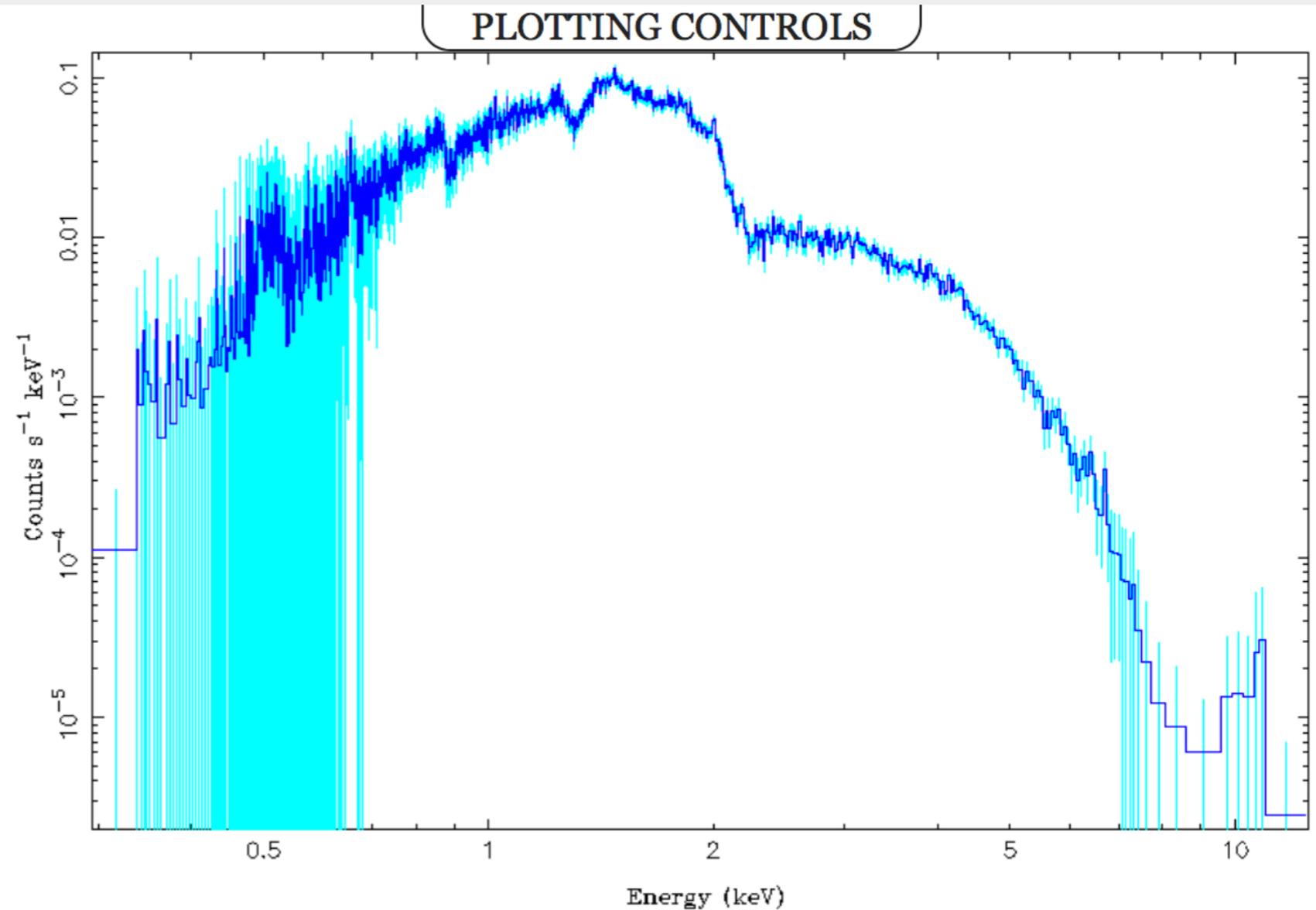
TGCat	Query	View	Actions	Help Topics					Help
---- currently viewing extractions table ----									
+/-	Links	obsid	object	instrument	Download	ra (h:m:s)	decl (d:m:s)	date_obs (y-m-d t)	exposure (s)
<input checked="" type="checkbox"/>	o p v s	5600	M 81*	ACIS	Go to Source Table	HETG 09:55:33.170	+69:03:55.188	2005-08-14 09:51:46	37727.6
<input checked="" type="checkbox"/>	o p v s	5601	M 81*	ACIS	Plot (Combined)	HETG 09:55:33.170	+69:03:55.080	2005-07-19 14:26:03	83362.2
<input checked="" type="checkbox"/>	o p v s	6174	M 81*	ACIS	Plot (Multiple)	HETG 09:55:33.170	+69:03:55.152	2005-02-24 06:56:59	46038
<input checked="" type="checkbox"/>	o p v s	6346	M 81*	ACIS	Filter results	HETG 09:55:33.163	+69:03:54.972	2005-07-14 01:44:55	54492.1
<input checked="" type="checkbox"/>	o p v s	6347	M 81*	ACIS	Clear filters	HETG 09:55:33.175	+69:03:55.008	2005-07-14 19:26:08	63877.6
<input checked="" type="checkbox"/>	o p v s	6892	M 81*	ACIS	Reset query	HETG 09:55:33.202	+69:03:55.224	2006-02-08 20:21:15	14764.7
<input checked="" type="checkbox"/>	o p v s	6893	M 81*	ACIS	Tag Query	HETG 09:55:33.211	+69:03:55.260	2006-03-05 23:42:33	14764.7
<input checked="" type="checkbox"/>	o p v s	6894	M 81*	ACIS	HETG	09:55:33.194	+69:03:55.224	2006-04-01 10:38:21	14767.9
<input checked="" type="checkbox"/>	o p v s	6895	M 81*	ACIS	HETG	09:55:33.178	+69:03:55.116	2006-04-24 08:18:52	14563
<input checked="" type="checkbox"/>	o p v s	6896	M 81*	ACIS	HETG	09:55:33.154	+69:03:55.188	2006-05-14 13:01:03	14767.8
<input checked="" type="checkbox"/>	o p v s	6897	M 81*	ACIS	HETG	09:55:33.156	+69:03:55.044	2006-06-09 18:14:02	14764.6
<input checked="" type="checkbox"/>	o p v s	6898	M 81*	ACIS	HETG	09:55:33.163	+69:03:55.152	2006-06-28 23:36:01	14857.4
<input checked="" type="checkbox"/>	o p v s	6899	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.080	2006-07-13 13:41:33	15199.8
<input checked="" type="checkbox"/>	o p v s	6900	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.152	2006-07-28 11:10:19	14415.8
<input checked="" type="checkbox"/>	o p v s	6901	M 81*	ACIS	HETG	09:55:33.156	+69:03:55.080	2006-08-12 16:15:46	14767.8

Go Back to Extractions Window, Choose All Observations,
Choose *Actions* Tab and *Plot (Combined)*

Multi Preview

combined extraction product

object	Multi Preview
obsid	5600, 5601, 6174, 6346...' target='_blank'> 5600, 5601, 6174, 6346...
ids	3938, 3940, 3951, 3969...
srcids	1859
instruments	ACIS
gratings	HETG
total_exposure(s)	4.3e+5
ra	148.88822
decl	69.06531
heg_band(c/s)	3.0e-1
meg_band(c/s)	3.1e-1
leg_band(c/s)	3.1e-1
letg_acis_band(c/s)	3.1e-1
zeroth_order(c/s)	1.9e-1
proc_date	2012-02-03 16:09:25
date_obs	2006-01-30 19:45:42

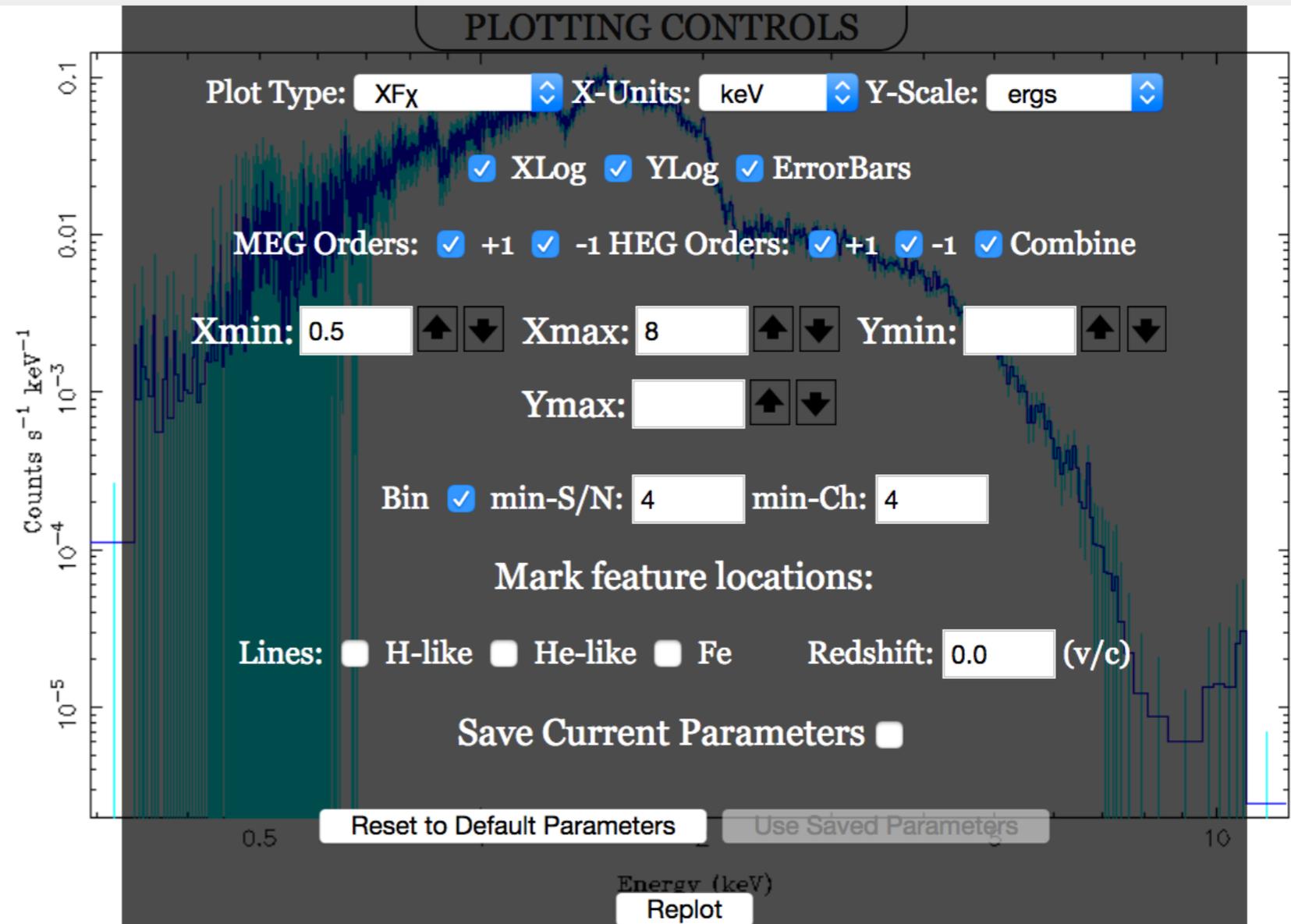


Preliminary Plot of All Data Combined

Multi Preview

combined extraction product

object	Multi Preview
obsid	5600, 5601, 6174, 6346... target='_blank'> 5600, 5601, 6174, 6346...
ids	3938, 3940, 3951, 3969...
srcids	1859
instruments	ACIS
gratings	HETG
total_exposure(s)	4.3e+5
ra	148.88822
decl	69.06531
heg_band(c/s)	3.0e-1
meg_band(c/s)	3.1e-1
leg_band(c/s)	3.1e-1
letg_acis_band(c/s)	3.1e-1
zeroth_order(c/s)	1.9e-1
proc_date	2012-02-03 16:09:25
date_obs	2006-01-30 19:45:42

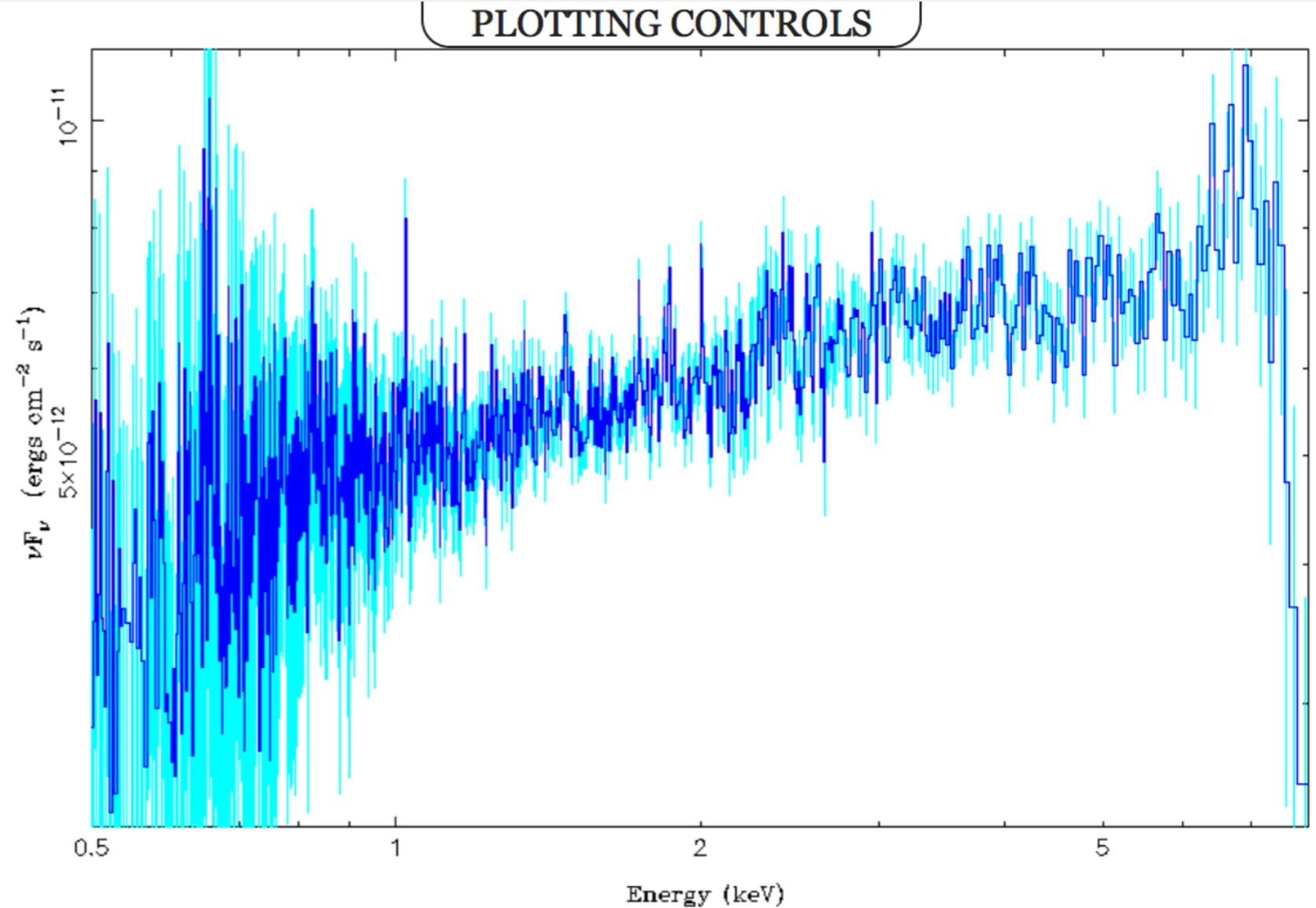


Change the Plot Defaults, and Plot Flux

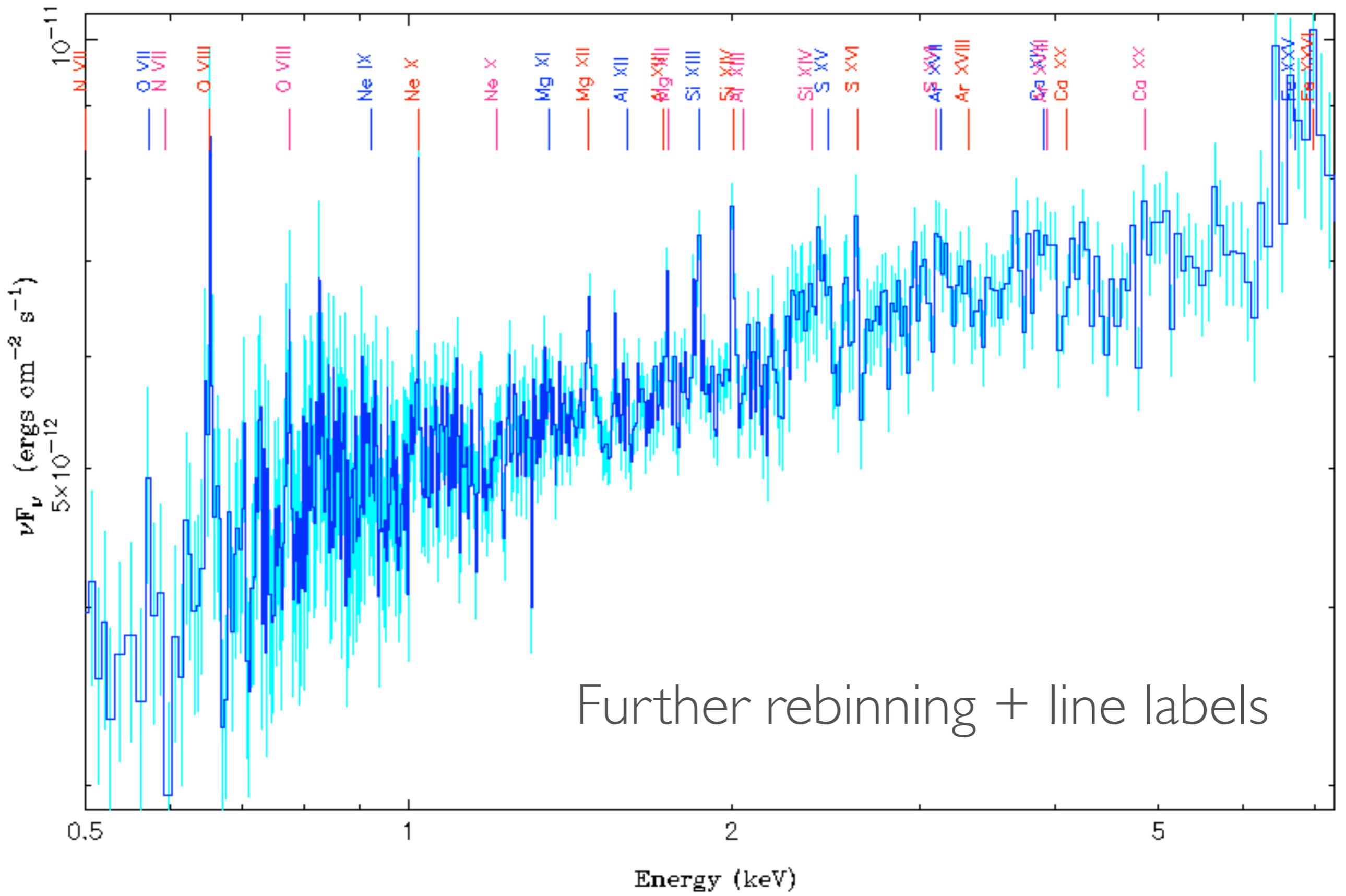
Multi Preview

combined extraction product

object	Multi Preview
obsid	5600, 5601, 6174, 6346...' target='_blank'> 5600, 5601, 6174, 6346...
ids	3938, 3940, 3951, 3969...
srcids	1859
instruments	ACIS
gratings	HETG
total_exposure(s)	4.3e+5
ra	148.88822
decl	69.06531
heg_band(c/s)	3.0e-1
meg_band(c/s)	3.1e-1
leg_band(c/s)	3.1e-1
letg_acis_band(c/s)	3.1e-1
zeroth_order(c/s)	1.9e-1
proc_date	2012-02-03 16:09:25
date_obs	2006-01-30 19:45:42



Note the Fe K α , Fe xxv, and Fe xxvi Lines
Rebin Some More, Label Lines, Replot



Further rebinning + line labels

---- *currently viewing extractions table* ----

+/- Links obsid object instrument grating ra (h:m:s) decl (d:m:s) date_obs (y-m-d t) exposure (s)

+/-	Links	obsid	object	instrument	grating	ra (h:m:s)	decl (d:m:s)	date_obs (y-m-d t)	exposure (s)
<input checked="" type="checkbox"/>	o								7.6
<input checked="" type="checkbox"/>	o								2.2
<input checked="" type="checkbox"/>	o								38
<input checked="" type="checkbox"/>	o								2.1
<input checked="" type="checkbox"/>	o								7.6
<input checked="" type="checkbox"/>	o								4.7
<input checked="" type="checkbox"/>	o								4.7
<input checked="" type="checkbox"/>	o								7.9
<input checked="" type="checkbox"/>	o								63
<input checked="" type="checkbox"/>	o								7.8
<input checked="" type="checkbox"/>	o								4.6
<input checked="" type="checkbox"/>	o p v s	6898	M 81*	ACIS	HETG	09:55:33.163	+69:03:55.152	2006-06-28 23:36:01	14857.4
<input checked="" type="checkbox"/>	o p v s	6899	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.080	2006-07-13 13:41:33	15199.8
<input checked="" type="checkbox"/>	o p v s	6900	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.152	2006-07-28 11:10:19	14415.8
<input checked="" type="checkbox"/>	o p v s	6901	M 81*	ACIS	HETG	09:55:33.156	+69:03:55.080	2006-08-12 16:15:46	14767.8

Please select the products you wish to download:

default:

- PHA2 (Level 2 counts spectrum file)
 PHA1 (Column format spectrum)
 RMF (Response matrix file)
 ARF (Ancillary response file)

auxillary:

- EVT2 (Level 2 event file)
 LTC (Binned light curve file)
 OBSPAR (Observation parameter file)
 SUM (Summary image/tables)

email address: OR tag:

Apply

Close

Go Back to Extractions Window, Choose All Observations,
Choose *Actions* Tab and *Download*

<input type="checkbox"/>	opvs	6900	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.152	2006-07-28 11:10:19	14415.8
<input type="checkbox"/>	opvs	6901	M 81*	ACIS	HETG	09:55:33.156	+69:03:55.080	2006-08-12 16:15:46	14767.8

Loaded extractions table: 15 rows; selection limited; ■ package queued, your pkgid is 1653 ■ [Go to Download Area](#)

Look at Bottom of Page to See Link to
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TGCat	Query	Quick Search	Help Topics					Help
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Current Available Packages

pkg-id	queue time	tag	status	size(kB)	objects	obsids	file-types
1653	10/25/17-20:46	-	COMPLETED	731,984	M 81*	5600, 5...(15)	arf, ph...(3)

1 package currently staged; note that packages stage only ~1 day; this page auto-refreshes every 30s (last: 20:54:35)

Download When the Package is Ready!

OTHER ASPECTS OF TGCAT:

- Upon request, we will do custom extractions of other sources in the fields
 - e.g., stellar fields might have multiple possible sources
 - The M8 I* field has a ULX with dispersed spectra
- All the *TGCat* software is available on the site
 - You can run the pipelines on your own data, via *TGCat* in *ISIS*, calling *CIAO* routines
 - You can customize the parameters. Same is true of **chandra_repro**, but you get *TGCat* summary plots.