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
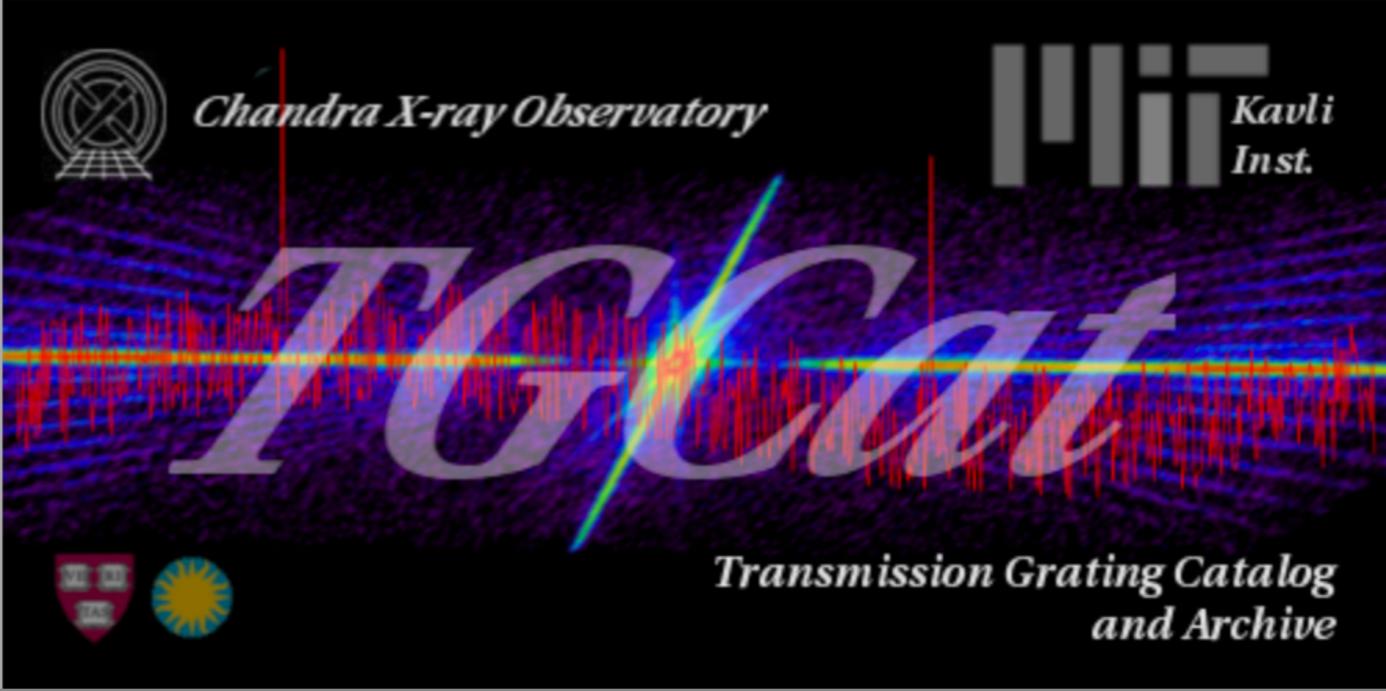
- Examples & video demos:
http://tgcat.mit.edu/tgHelp.php?guide=help/tgcat_demos.html

- 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: M81*

- 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

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

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

+/-	Links	object	simbad_ID	ra (h:m:s)	decl (d:m:s)	pType	other_types	num_extractions
☐	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
☐	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
☐	s d b i	Nova CSS081007	[DDM2009] CSS081007 J030559+054715	03:05:58.538	+05:47:14.748	No*	No*	1

---- currently viewing source table ----

Loaded source table: 3 rows; selection limited

TGCat   Query   View   Actions   Help Topics   Help

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

Use *Actions* Tab and *Limit*

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)
☐	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
☐	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
☐	o p v s	6174	M 81*	ACIS	HETG	09:55:33.170	+69:03:55.152	2005-02-24 06:56:59	46038
☐	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
☐	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
☐	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
☐	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
☐	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
☐	o p v s	6895	M 81*	ACIS	HETG	09:55:33.178	+69:03:55.116	2006-04-24 08:18:52	14563
☐	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
☐	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
☐	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
☐	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
☐	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
☐	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
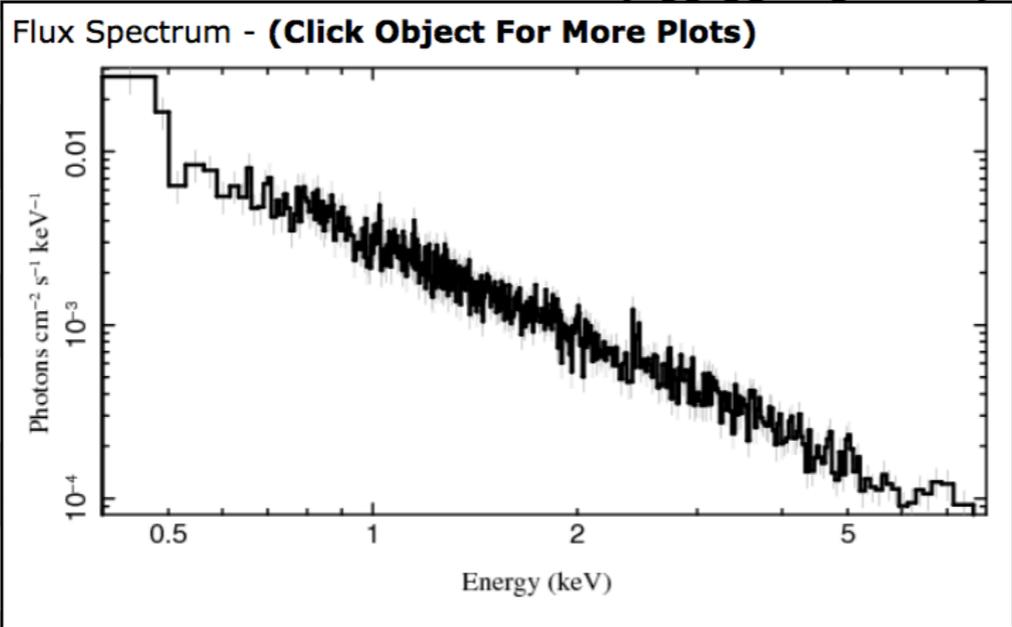
Hovering Shows a Spectral Plot

M 81*

single extraction product

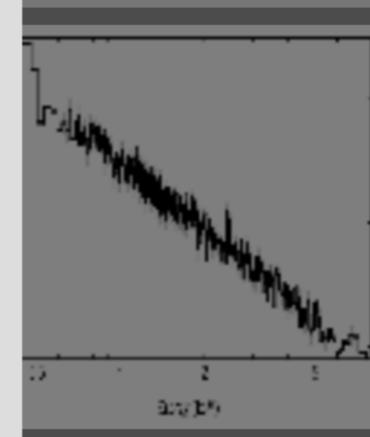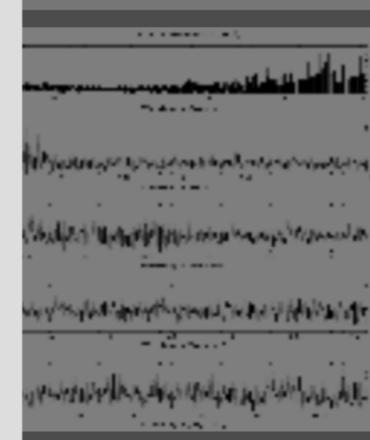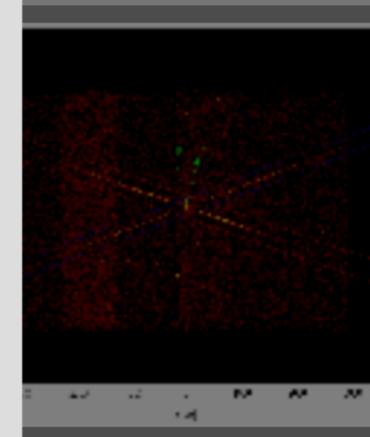|	
id	3969
srcid	1859
obsid	6346
review	good
obi	1
target	M81*
object	M 81*
simbad_ID	M 81
instrument	ACIS
grating	HETG
exposure(s)	5.4e+4
ra	148.88818
decl	69.06527
heg_band(c/s)	2.9e-1
meg_band(c/s)	3.0e-1
leg_band(c/s)	3.0e-1
letg_acis_band(c/s)	3.0e-1
zero_order(c/s)	1.8e-1
readmode	TIMED
datamode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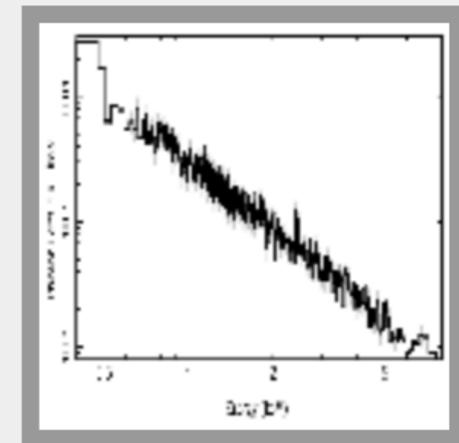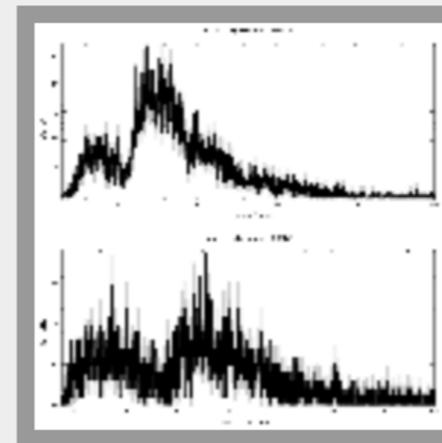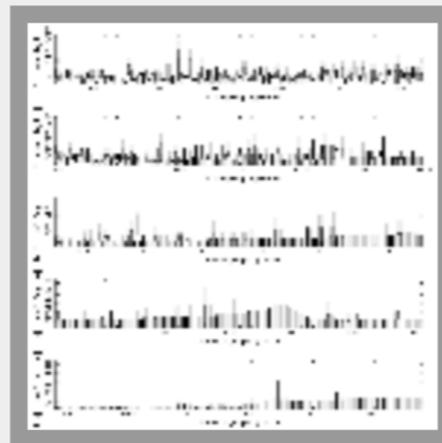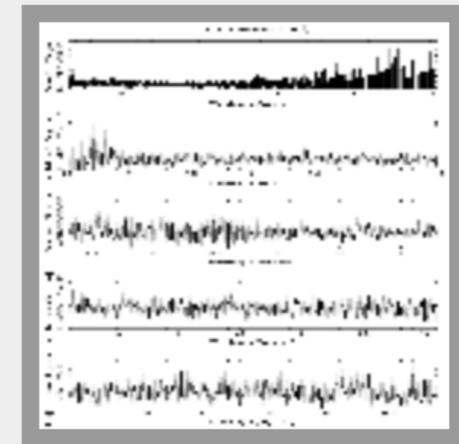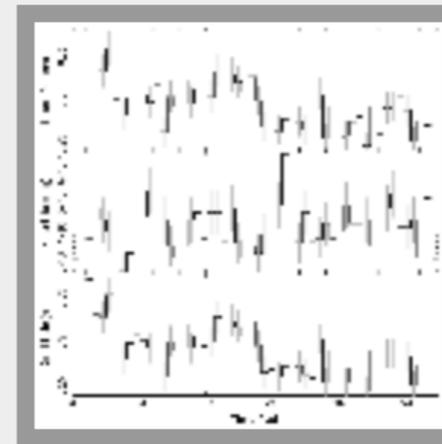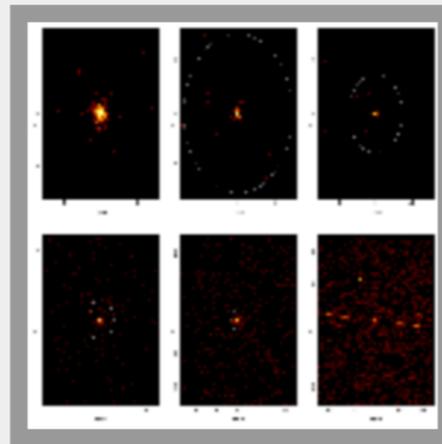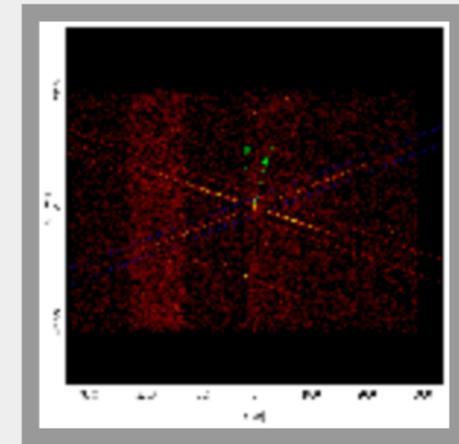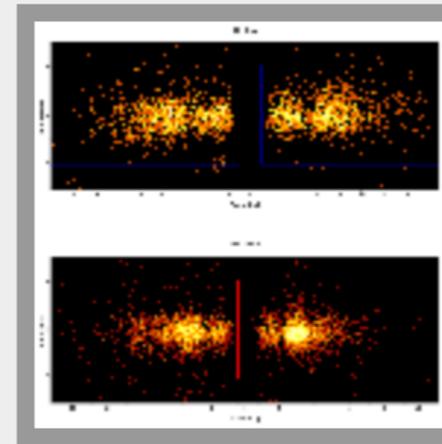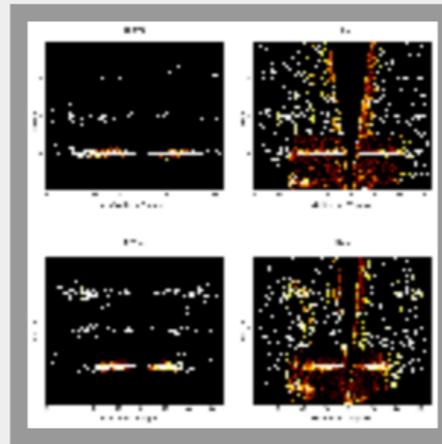
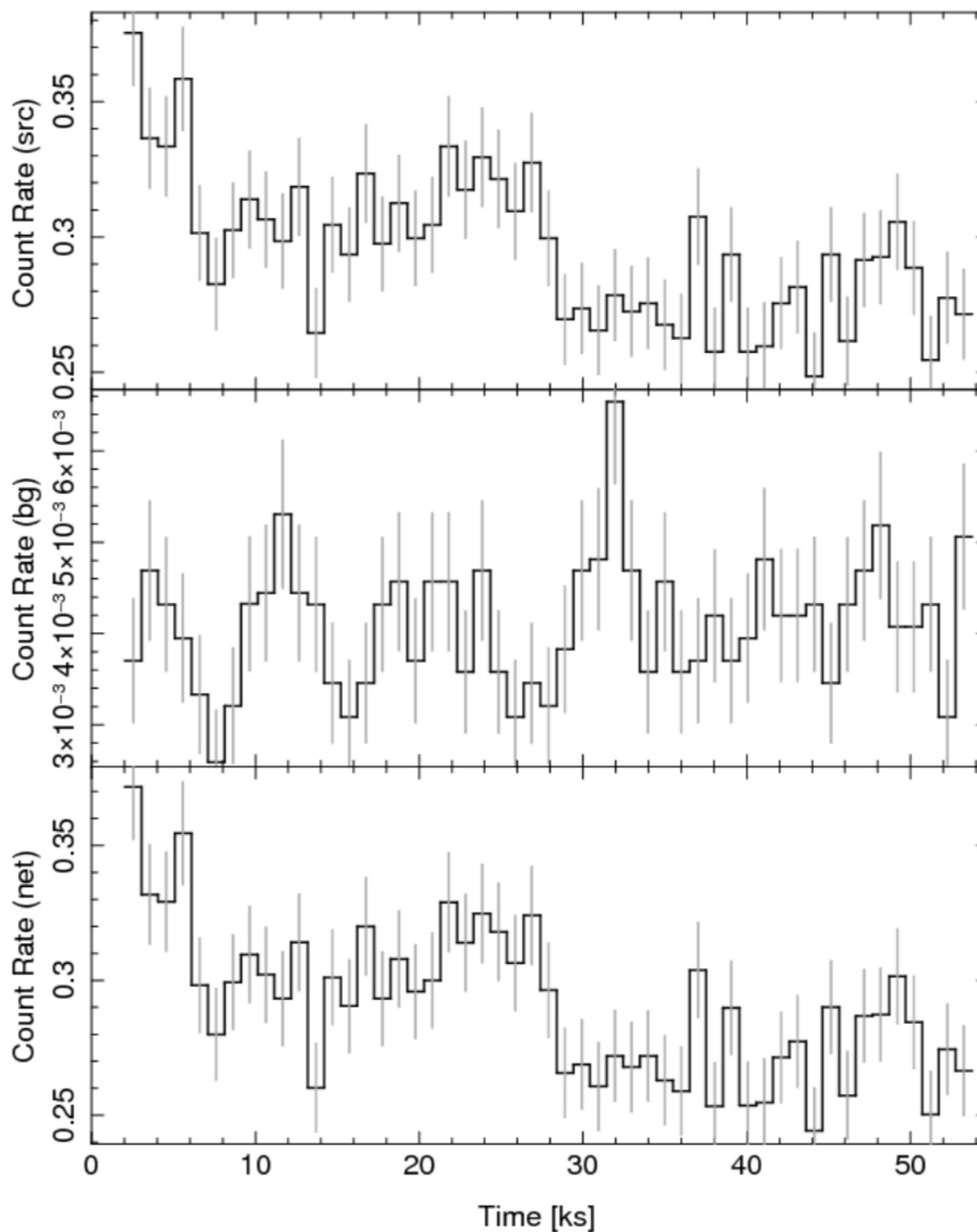Clicking on an Observation Brings Up Summary
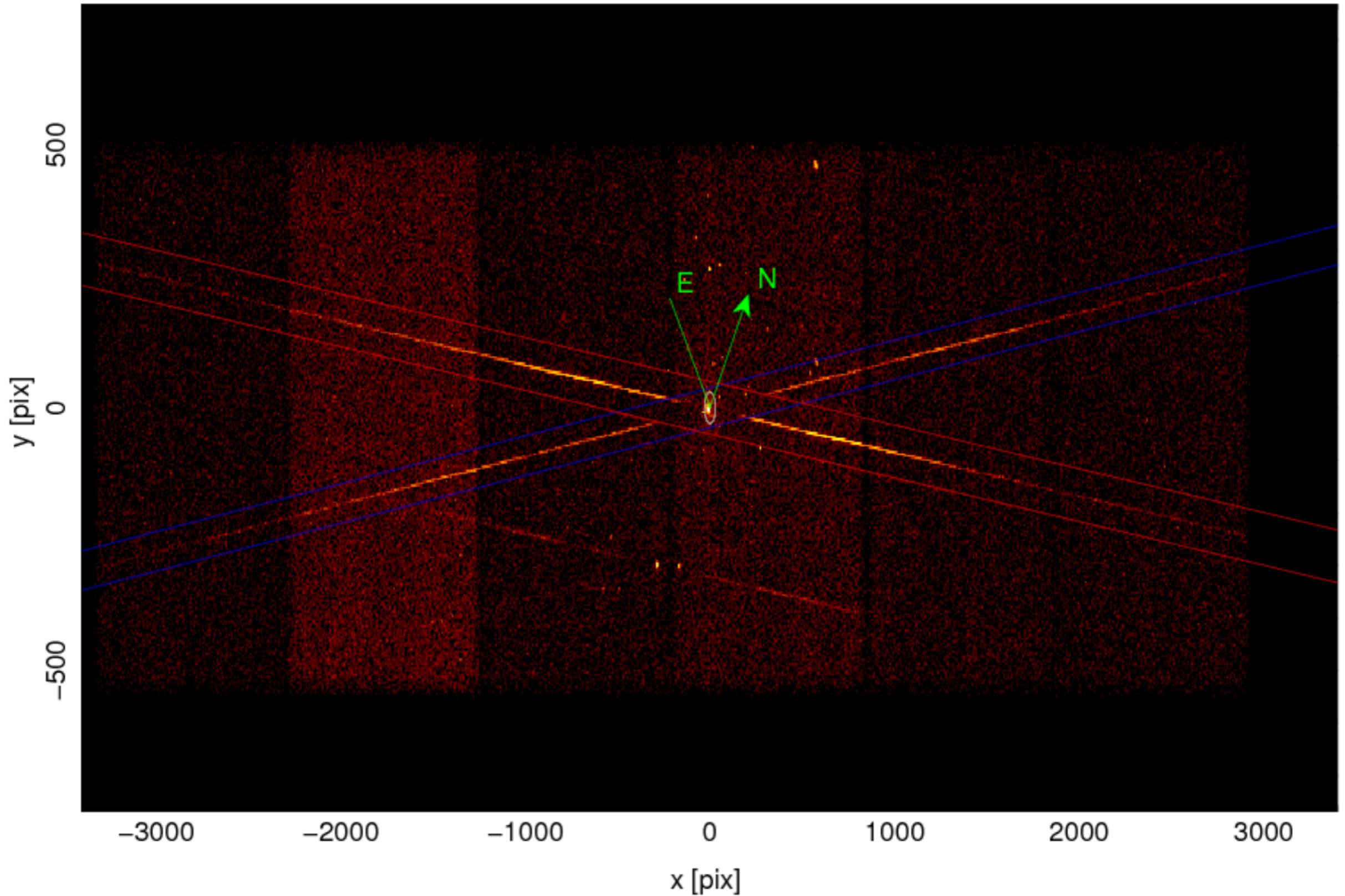
Note Other Objects in Field

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:
zo_method	tgdetect
date_obs	2005-07-14 01:4

Some Lightcurve Variability

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

Preliminary Plot of All Data Combined

Change the Plot Defaults, and Plot Flux

Note the Fe Kα, Fe XXV, and Fe XXVI Lines
Rebin Some More, Label Lines, Replot
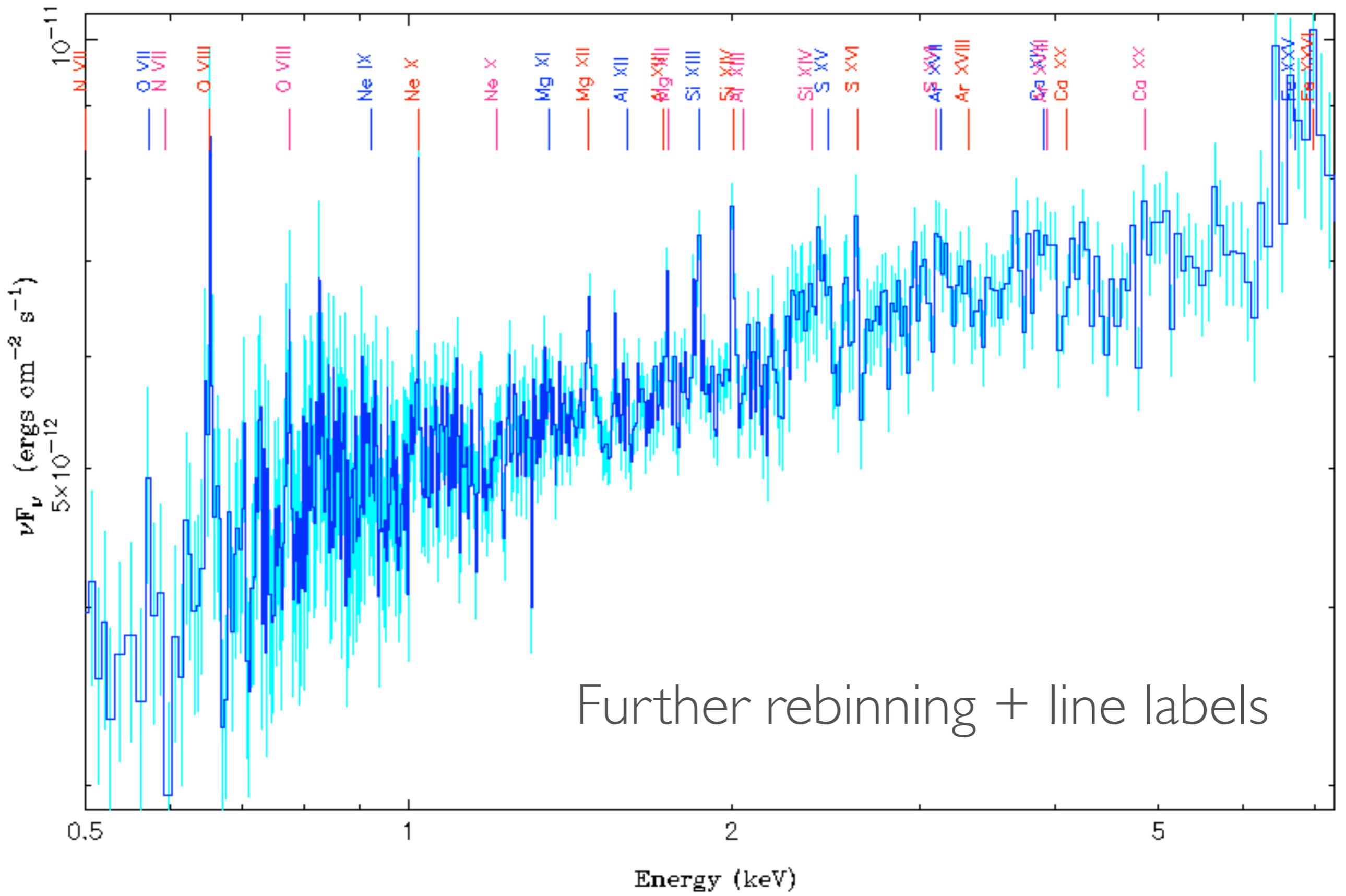
Further rebinning + line labels

---- *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)

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]

☑	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
☑	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
☑	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
☑	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 *Download*

	opvs	6900	M 81*	ACIS	HETG	09:55:33.149	+69:03:55.152	2006-07-28 11:10:19	14415.8
	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
Go to Download Area

TGCat	Query	Quick Search	Help Topics	Help

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 M81* 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.