Creating response matrices for extended regions

What we need :

- A screened events file
- The distribution of Alexey Vikhlinin's tools available from http://hea-www.harvard.edu/ jcm/asc/dist/av/av103.tar

The thread step by step

1. Define the region to extract the spectrum.
2. Extract a PI spectrum.

   ```
   dmextract "evt.fits[sky=region(src.reg)][bin pi]" pi.fits
   ```

3. Create the weighting map used to weight the different FEFs. This is a binned image in detector coordinates.

   ```
   dmcopy "evt.fits[sky=region(src.reg),energy=500:2000]
   [bin det=8]" wmap.fits
   ```

4. Find the temperature of the CCD during the observation.

   ```
   dmlist "evt.fits" header | grep FP_TEMP
   ```

5. Update the parameter file
6. Generate the response matrix (rmf).

   ```
   calcrmf -phafile pi.fits -wmap wmap.fits -o rmf.fits @par.file
   ```

7. Generate the ancillary response matrix (arf).

   ```
   calcarf -phafile pi.fits -wmap wmap.fits -o arf.fits @par.file
   ```

8. Now you can fit the spectrum with SHERPA or XSPEC.

```
#######################################################################
#######   DATA FILES   ################################################

evtfile = evt.fits /
# The events file for the spectrum extraction is specified in the
# command line _before_ @par.file; the evtfile parameter here
# is used by calcarf and calcrmf as a place to find the pixlib
# keywords

# gtifile = evt_proc_pi.fits[gti] / GTI file; ASSUME THAT GTI
                                  /filtering is done

fptemp=-110   # Focal plane temperature

#######################################################################
#######   EXTRACT SPECTRUM PARAMETERS  ################################

specbin = 1  / bin output spectrum by N; this job is better left for grpp
bindetmap=8  / binning factor for Wmap in the PHA primary header by N
ecol    = PI / use PI/PHA channels to make the spectrum

#######################################################################
#######   CALIBRATION DATA  ###########################################

CALDIR = /soft/ciao/CALDB/data/chandra/
hrma_onaxis_area = ../caldata/hrmaD1999-07-22axeffaN0004.fits
hrma_vignetting  = ../caldata/hrmaD1999-07-22vignetN0003.fits
ccd_qe =           ../caldata/acisD1997-04-17qeN0002.fits
ccd_qeu =          ../caldata/acisD1999-09-16qeuN0002.fits
correct_qeu=yes


IN-FLIGHT FEFS:
fefdir=\$CALDIR/acis/cpf/fefs/FP-110/
fefaffix=_D1999-09-16fef_piN0002.fits
```

```
ref_pi_rmf=../avdata/ref.rmf / ref_pi_rmf is needed to
                                        / define the energy grid
   / in the ARF and RMF


##########################################################################
#######   MISC  ##########################################################

xcol    = X      /  X and Y column names for "sky" coordinates
ycol    = Y      /

xdetcol = DETX   /  X and Y column names for detector coordinates
ydetcol = DETY   /

timename = TIME  /  Time column name

gtiname = GTI /  GTI extension name
eventsname = EVENTS /  Events
```

NUCLEAR SPECTRUM

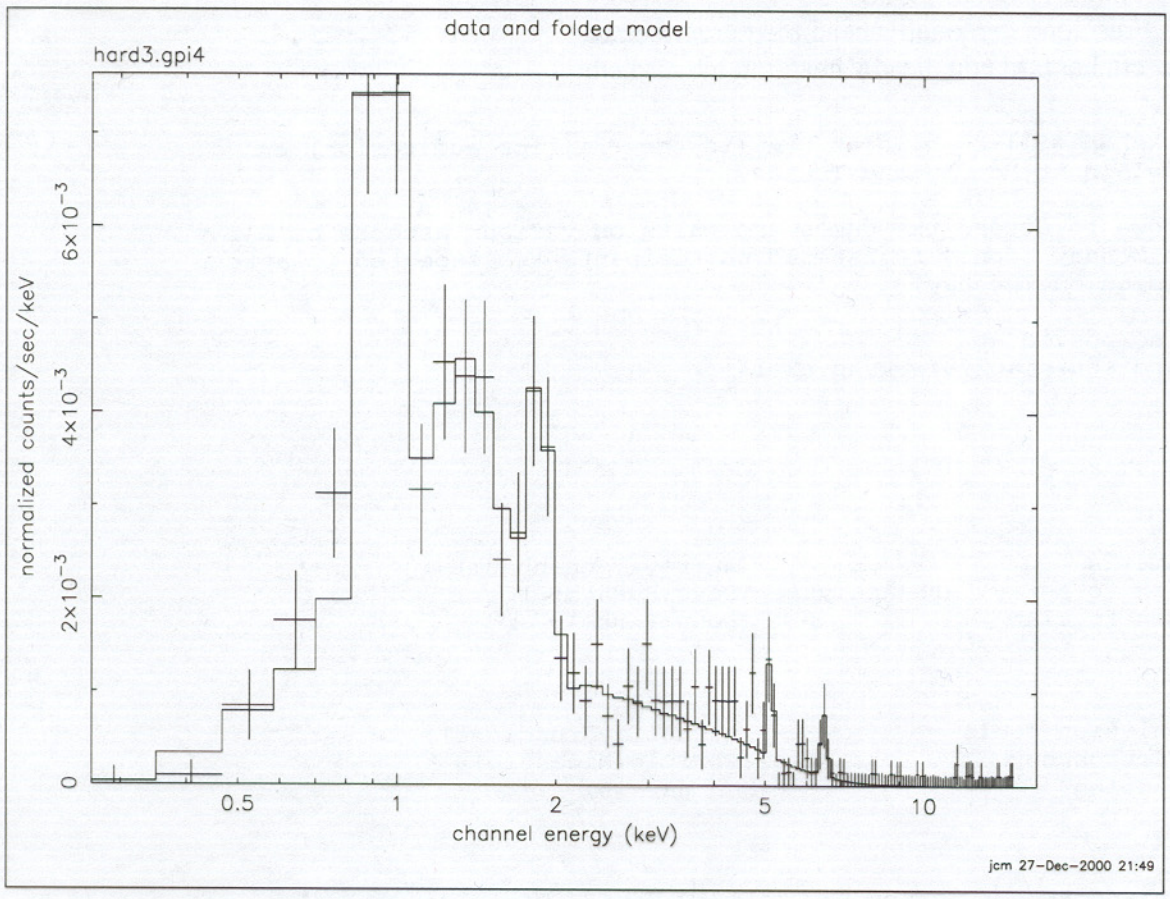


Figure 9: A preliminary analysis of the spectrum of the nuclear region shows contributions from thermal plasma at several temperatures and from a hard source. The luminosity of the power law component (see talk by Clements) is about 4×10^{40} erg/s, either a weak AGN or a super-Eddington binary.

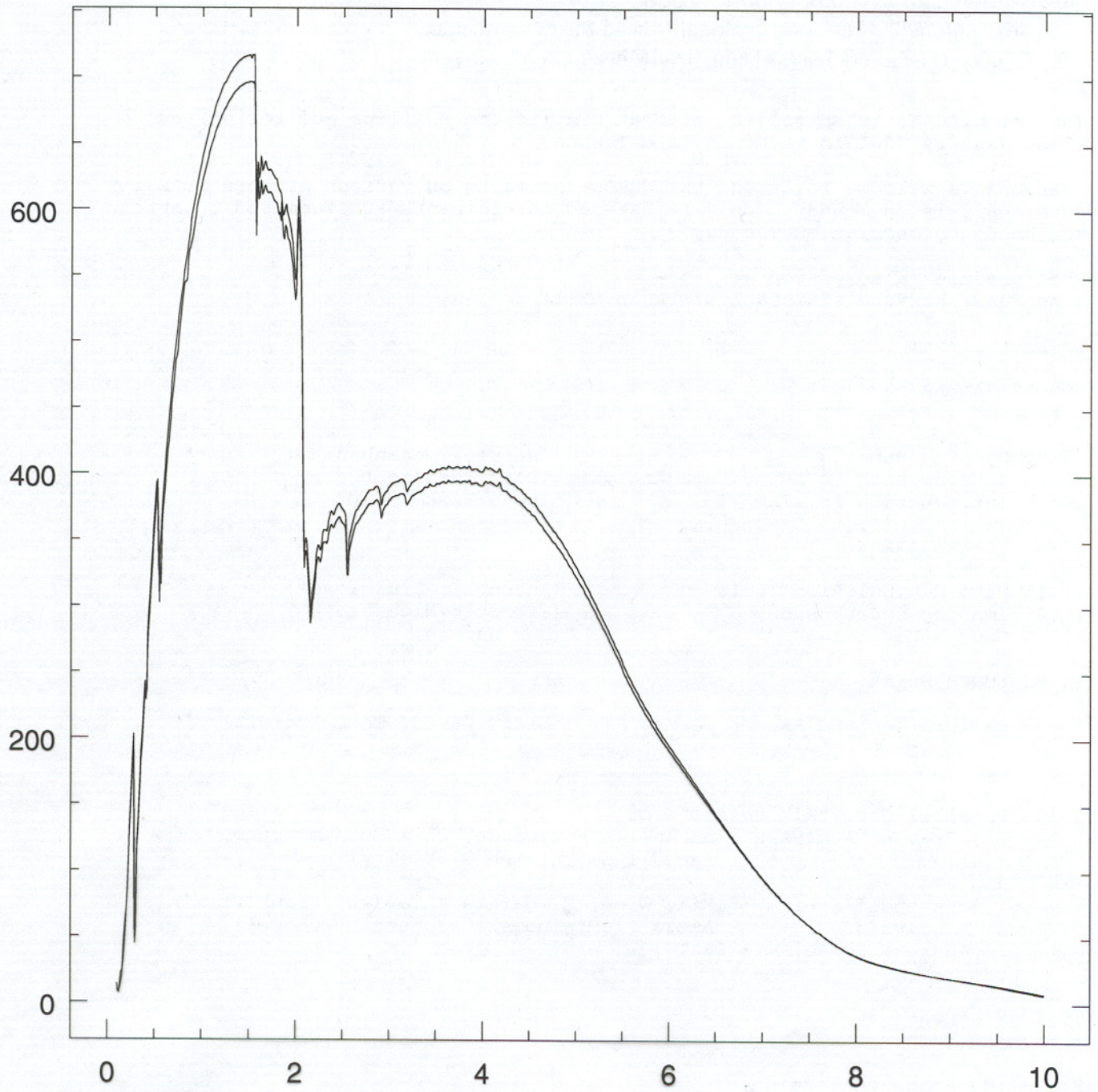
$$N(P) = \int ARF(E)\, RMF(E,P)\, f(E)\, dE$$

$$N(P) = \iiint ARF(E,\theta,\phi,c_x,c_y)\, RMF(E,P;c_x,c_y)\, f(E)\, dE\, dc_x\, dc_y$$

- off axis angle (θ azimuth)
- Chip c location on chip

A few more things ...

- Weighting by counts or by area ? It depends
- QEU correction
- The pixlib : Make sure to use the correct pixlib for your data
- The "dummy" rmf


600
400
200
0
0
2
4
6
8
10