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.
   
   \texttt{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.
   
   \texttt{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.
   
   \texttt{dmplist "evt.fits" header | grep FP_TEMP}

5. Update the parameter file
6. Generate the response matrix (rmf).
   
   \texttt{calcrmf -phafitie pi.fits -wmap wmap.fits -o rmf.fits @par.file}

7. Generate the ancillary response matrix (arf).
   
   \texttt{calcarf -phafitie pi.fits -wmap wmap.fits -o arf.fits @par.file}

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

```
# 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 grppp
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/acisD1999-09-16qeun00002.fits
correct_qeu=yes

IN-FLIGHT FEFS:

fefdirl=$CALDIR/acis/cpf/fefs/FP-110/
feitofflfix=_D1999-09-16fefd_piN00002.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
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 $4 \times 10^{40}$ erg/s, either a weak AGN or a super-Eddington binary.

$$N(P) = \int \text{ARF}(E) \text{RMF}(E, p) f(E) \, dE$$

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

- off-axis angle (e, phi)
- chip e 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