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Running XID from start to finish

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1 Summary

This document describes how to perform each stage of the XID work from an XMM source list and image(s) and a number of optical (WFC, APM) and IR (CIRSI) source lists and images.

The routines used in the process are mostly IDL, with some CSH scripts also used to create / check for directory structures and PHP scripts update and display the output webpages. Table 1 shows the location of the scripts and corresponding documentation.

Scripts	Location	Documentation
IDL	*/home/xmmssc/soft/idl/pro/*	*/home/xmmssc/xidops/docs/idl/*
CSH	*/home/xmmssc/soft/csh/*	*/home/xmmssc/xidops/docs/csh/*
PHP	*/home/xmmssc/soft/php/*	*/home/xmmssc/xidops/docs/php/*

Table 1: XID scripts and documentation

Contents

2 Images and source lists

2.1 Where to put them

Images and source lists need to be placed in a specific directory structure to be accessed by the routines without the need to specify the locations of individual input files beyond the actual file names. All data used and produced during the XID work is saved on:

*/data/cass101a/xmmssc/public_html/***field** (data directory)

for a given field. Symbolic links to the data are created from a user–specified xidops directory

(usually */home/xmmssc/public_html/xidops/***field/**)

and from

*/home/xmmssc/public_html/xid/***field/** (public directory)

for the public data.

The **field** directory, all the necessary subdirectories to place the input files into and the symbolic links can be created by calling the CSH script `mk_fielddir`. The first argument should be the name the **field** directory will have in all three locations, the second, if present, should be the path to the xidops directory (default */home/xmmssc/public_html/xidops/*). The script checks for all required directories and links and creates them if they are not there.

The data files available should then be placed as described in Table 2. It does not matter if only some of the data is available as long as there is a least an XMM source list.

2.2 A few restrictions

To make things simpler some of the files names are expected to follow certain patterns:

- XMM source lists may have user specified file names. If the file is an ASCII table (.txt file) the first three lines should describe its format (example in documentation for `dbcreate_xmm_txt` routine). It can also be an EML FITS file. The only required information is RA, Dec and flux or counts for the '52' band.

Name in data dir	Name in xidops dir	Contents
xmm_data/	*xmmssc/*	XMM source lists and images
wfc/	*wfc/*	WFC source lists and images
cirsi/	*cirsi/*	CIRSI source lists and images
dss/	*dss/*	DSS images and APMCAT sourcelists
dbase/	*dbase/*	where the database files will go

Table 2: Input directories for XID work

- The names of XMM images should be of the form _n**-img.fits_ where '**' is '25', '52', '24', '41' or'57'. XID work can proceed in the absence of any images.
- WFC images and unmerged source lists sould have a name of the form _r_runno._fit_ and _r_runno__*_cat.fit_ where '*' is '1', '2', '3' or '4' respectively. It is assumed that if an image is present all four coresponding source lists are and vice–cersa.
- Merged WFC source lists should have a name of the form **name**__*.mer_ where '*' is '1', '2', '3' or '4'. It is assumed that if one list is present all four are.
- The name of CIRSI source lists and images is user–specified.
- APMCAT source lists and DSS images should have a name of the form _apmcat-****-_**field**._fct_ and _dss_stsci_****-***.fits_ respectively, where '****' is 'ukst' or 'poss1' or 'poss2' and '***' is 'red' or 'blue'.

3 Fields_status.txt

The ASCII file */home/xmmssc/public_html/xidops/fields_status.txt* contains information about what data is available and is used by IDL and PHP scripts to perform the XID analysis and display the results.

Whenever new data is added the file should be updated. Each line corresponds to one field. The header line and an example line are shown below. Note the header line is not exactly split up as the field lines are.

```
fieldname:GO;Xray Source List;list;expt.;25;52;24;41;57:Xray Image,25,52,24,41,
57:ApmCat:DSS Images,gen1,poss2 r,poss2 b:WFC Data,plots,merged,i,z,r,g,U:
CIRSI Data,list,image:Directory:RA<br>(J2000):Dec<br>(J2000):bII<br>(deg)

LOCKMAN HOLE:Y fits/,Y gh/;FITS xmmout.fits,GH gh.txt;0,0;Y,N;Y,Y;Y,Y;Y,Y;N,N:
n25-img.fits,n52-img.fits,n24-img.fits,n41-img.fits,n57-img.fits:poss1:Y,Y,Y:
izrgulockman_*.mer,r219698,r219697,r219699,r219779,r219778:LH.cat.fits,LH.fits:
/~xmmssc/internal/lockman-hole/:10 52 40.80 :+57 27 16.2:+53.15
```

The lines have been artificially cut so they fit in the page. Also there would be no blank lines between fields (although a `#` at the beginning of the line causes it to be ignored).

In this case almost all the information that can be available is. Fields are separated by '`:`' and within that by '`;`' then/or '`,`'. As a rule, '`N`' signifies the information is not available, '`S`' that it is there but not yet ready for XID work and '`Y`' that it is available and processed.

- The first field contains the field name, in upper case (or the sorting by field name in some display tables doesn't work properly). As a rule I have generally separated numbers from letters (*i.e.* '`A 399`' rather than '`A399`').
- The next field contains information about the X-ray source list(s). It is split into sub–fields by '`;`'.
  - The first sub–field should contain '`N`' if there is no source list, '`Y`' followed by a space and the name of the subdirectory where output specific to that source list will be stored if there is a list (don't forget trailing slash). Note that if there is more than one source list, information relevant to the second is separated form the first by a '`,`' within each sub–field. One can also have '`S`' instead of '`Y`' if the data is know to have been taken but no source list is available yet.
  - The next sub–field contains the type of source list in upper case letters, which will be used to differentiate multiple lists in the PHP tables, followed by a space and the relevant file name (file name only, not path, the scripts assume it has been correctly placed in the right subdirectory). If there is no source list this sub–field should contain '`N`', if it is not ready it should start with '`S`'.
  - The next sub–field contains the X-ray exposure time in seconds. If you have a source list but you don't know the exposure time put '`0`', it will show up as '?' in the PHP tables.
  - The next sub–field contains information about which bands are present in the list and is split into five bands by '`,`', each containing '`Y`' or '`N`' as appropriate. The bands are: `25`: 0.2 to 0.5 keV, `52`: 0.5 to 2 keV, `24`: 2 to 4.5 keV, `41`: 4.5 to 10 keV, `57`: ?. If your source list does not contain the `52` band, pretend it does so the scripts work (if the source list is ASCII, label on of the flux / counts columns accordingly).
- The next field contains the file names of X-ray images, separated by '`,`'. Use '`N`' if there is no image for that band. Note there may be an image even if there is no data for that band in the source list, and vice–versa.
- The next field specifies if there is an AMPCAT source list or not and whether it is POSS1 or UKST data. Set to '`N`' (no list), '`S comment`' (not there yet) or simply '`ukst`' or '`poss1`' if the source list is present.
- The next field contains info about the presence of DSS images (UKST or POSS1 red, POSS2 red, POSS2 blue, separated by '`,`'. Set to either '`N`', '`S`' or '`Y`'.
- The next field contains information about WFC data, separated into sub–fields by ','.
  - The first sub–field should contain the name if the merged source list (of the form '`name_*.mer`') or '`N`' or '`S name_*.mer`' if the list exists but is not available yet.
  - The next five sub–fields contain, for each of the five bands, '`r******`' where '`******`' is the run number, or '`N`' or '`S r******`' if the data has been taken but lists and images are not available yet. It is assumed that both images and source lists are available together.
- The next field should contain the CIRSI source list and image names (separated by '`,`').
- The next field should contain the full path of the xidops directory. It must start with '`~`' rather than 'home//' and the trailing slash must be present.
- The next three fields contain RA, Dec (J2000) and galactic latitude (degrees) to the precision shown in the example.

Once the directories to receive the input files have been created and the files placed in them, and *fields_status.txt* has been updated as shown above, a subdirectory for each source list should be created, named as indicated in *fields_status.txt*. The XID work is then ready to begin.

4 Generate_from_files.pro

The IDL routine `generate_from_files` reads in information from *fields_status.txt* (unless another input file has been selected using the infile keyword), prompts the user for the field to work on and the XMM source list if there are more than one (unless they have been specified using the field_name and xmm_list keywords respectively).

Only fields with an XMM source list (i.e. where the 2nd field in *fields_status.txt* starts with '`Y`') can be handled by `generate_from_files`.

Other things that can be specified in the call to `generate_from_files` are the maximum offsets for XMM / CIRSI /WFC matches and XMM / APM matches (offmax and offmax_apm keywords respectively).

The program then runs through the relevant line of *fields_status.txt*, determine what data is there, then checks that the directory structure for placing its output into is present by calling the CSH script `mk_outdirs`. Again, data is stored in the data directory with links to it from the xidops and public directories. If all or some of the output subdirectories and links are missing they are created.

The program then check if IDL databases have been made from each of the available source lists. Note that the names are automatically set: the XMM database is called after the source list directory (*i.e.* if the directory in question is *eml/* the database will be called 'eml'), the CIRSI database is called 'cirsi', the APMCAT one 'ukst' or 'poss1', the unmerged WFC databases are called 'wfc*' where '*' is 'i', 'z', 'r', 'g' or 'u' and the merged one is called according to the names of the bands specified by the user, in the specifed order. For instance, if the bands available are [i,z,g,g,U] (there may be more than one run for a given band) and the user specifies bands [0,1,2,4] the database will be called 'izgu'. If any databases are missing they are created.

The program then runs through every single stage of XID work, each time aking the user if he wants them done. If data is missing to complete one stage, it is skipped. When prompted the user should enter 'y' or 'n'.

- Hardness ratio plots
  - (ps output)
  - (gif output)
- Plots of log(N¿S) versus log(S)
  - (ps output)
  - (gif output)
- Plots of XMM 52 flux versus WFC r–mag (if the unmerged WFC r–band list is available)
  - (ps output)
  - (gif output)
- WFC colour-colour or colour-magnitude plots (if the WFC merge list is available)

  - (ps output)
  - (gif output)

- WFC Quality control plots (if there is any unmerged WFC data)
  - Plots of statistic versus magnitude
    - (ps output)
    - (gif output)
  - Differential magnitude histograms
    - CCD by CCD, (ps output)
    - class by class, (ps output)
    - CCD by CCD, (gif output)
    - class by class, (gif output)
  - Differential position angle histograms
    - CCD by CCD, (ps output)
    - class by class, (ps output)
    - CCD by CCD, (gif output)
    - class by class, (gif output)
  - Differential ellipticity histograms
    - CCD by CCD, (ps output)
    - class by class, (ps output)
    - CCD by CCD, (gif output)
    - class by class, (gif output)
  - Spatial distribution plots
    - (ps output)
    - (gif output)
- Likelyhood ratio histograms (if the unmerged WFC i–band data is available)
  - (ps output)
  - (gif output)
- XMM / CIRSI / WFC ASCII matching table (if CIRSI or merged WFC data is available)
- XMM / CIRSI / WFC matching individual object WWW pages (if CIRSI or merged WFC data is available). Note can be long as the gif-cutouts are created for all available XMM, WFC and CIRSI images if they are not there already.
- APM colour-magnitude plots (if the APMCAT list is available)
  - (ps output)
  - (gif output)
- Plots of XMM 52 flux versus APM red–mag (if the APMCAT list is available)
  - (ps output)
  - (gif output)
- XMM / APMCAT ASCII matching table (if APMCAT data is available)

- XMM / APMCAT matching individual object WWW pages (if CIRSI APMCAT data is available). Note can be long as the gif-cutouts are created for all available XMM and DSS images if they are not there already.

5 Accessing the ouput through WWW pages

PHP scripts control the WWW interface to the XID work. As they create and manipulate files in the xidops and public directories, the necessary permissions must be set. This is done by ensuring the directories have group xmmssc and group write permission is set as webman is part of the xmmssc group (PHP operates as webman on www.ast.cam.ac.uk). These permissions can be set on the entire xidops and public directories by typing:

```
chgrp -R xmmssc field_dir
chmod -R g+w field_dir
```

at the command line. If one wants to avoid this on can create another group whose members are oneself and webman.

The PHP script `fields_status` (found in */home/xmmssc/public_html/xidops/*) generates a summary table of all XID fields for which XMM source lists are available with links to index pages leading to all the plots and tables that can be generated from the input files. The index pages are updated everytime the script is downloaded unless the query string is set to 'no_update'. If any files the scripts attempts to create a link to does not exist the linked text appears grey.

The PHP script `data_status` (found in */home/xmmssc/public_html/xid/*) generates a similar table but without any information on XMM data, only WFC, APM and CIRSI data. It contains links to FWC quality control plots only, and also has a 'no_update' option.

Note that the WFC quality control plots could be produced in the absence of any XMM data by individually calling the database creation and plot-making programs called by `generate_from_files`.