



OM data reduction using SAS

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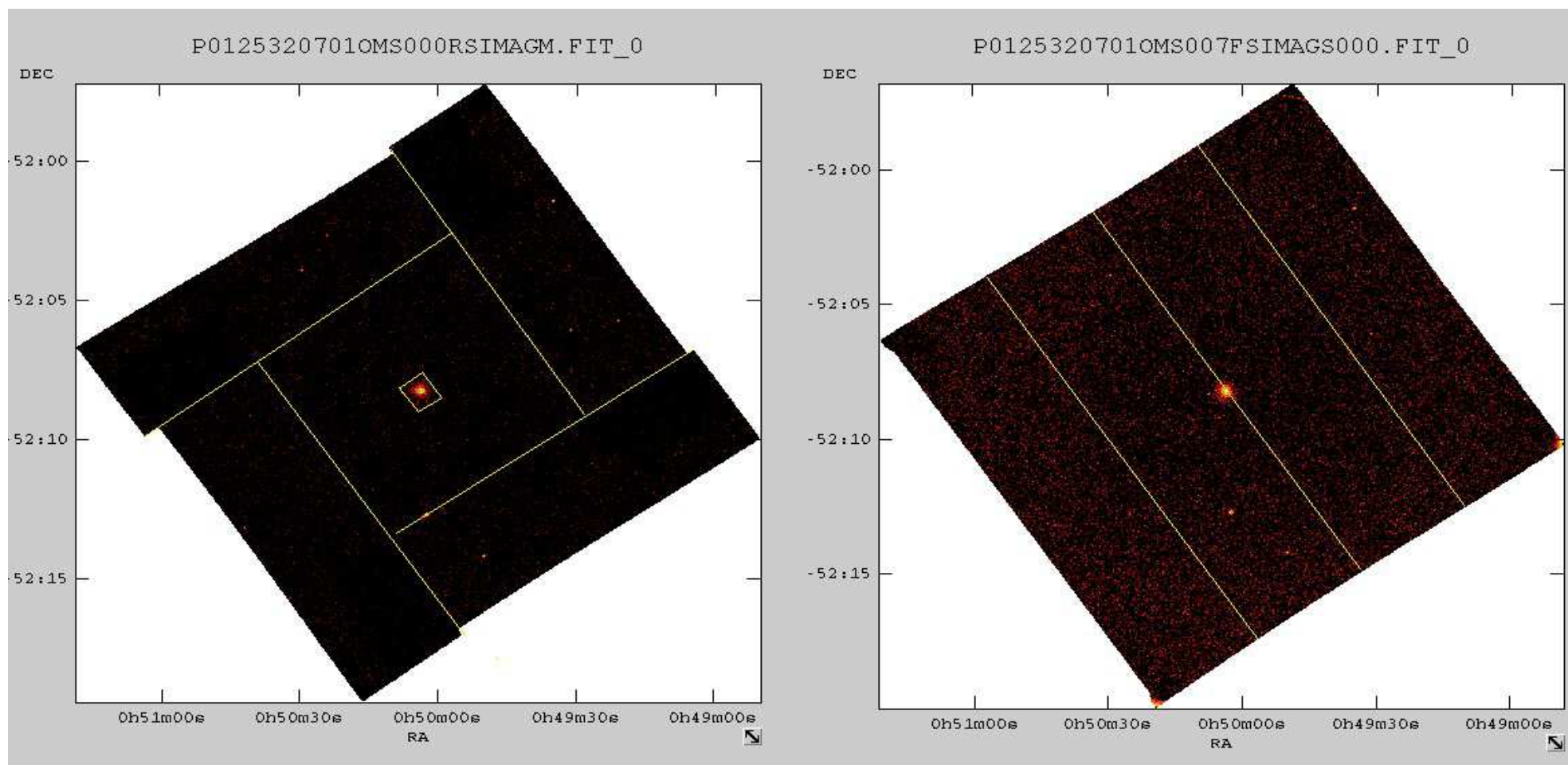
MSSL, UCL, UK

- **Detector windows: default image, default image/fast, and user defined mode:**
 - Up to five different windows in the same exposure
 - A maximum of 2 of them can be in fast mode
- ⇒ **As many image and/or event list files as windows**
- **Full frame image modes: the whole FOV is obtained in a single exposure**
- ⇒ **One image file (High res.) or 4 image files (Low res.)**
- **There are additional files containing instrument configuration and house-keeping data for each exposure**
- **Observing with OM grisms produces image data in user defined mode or in full frame low resolution**

OM observing modes & data types



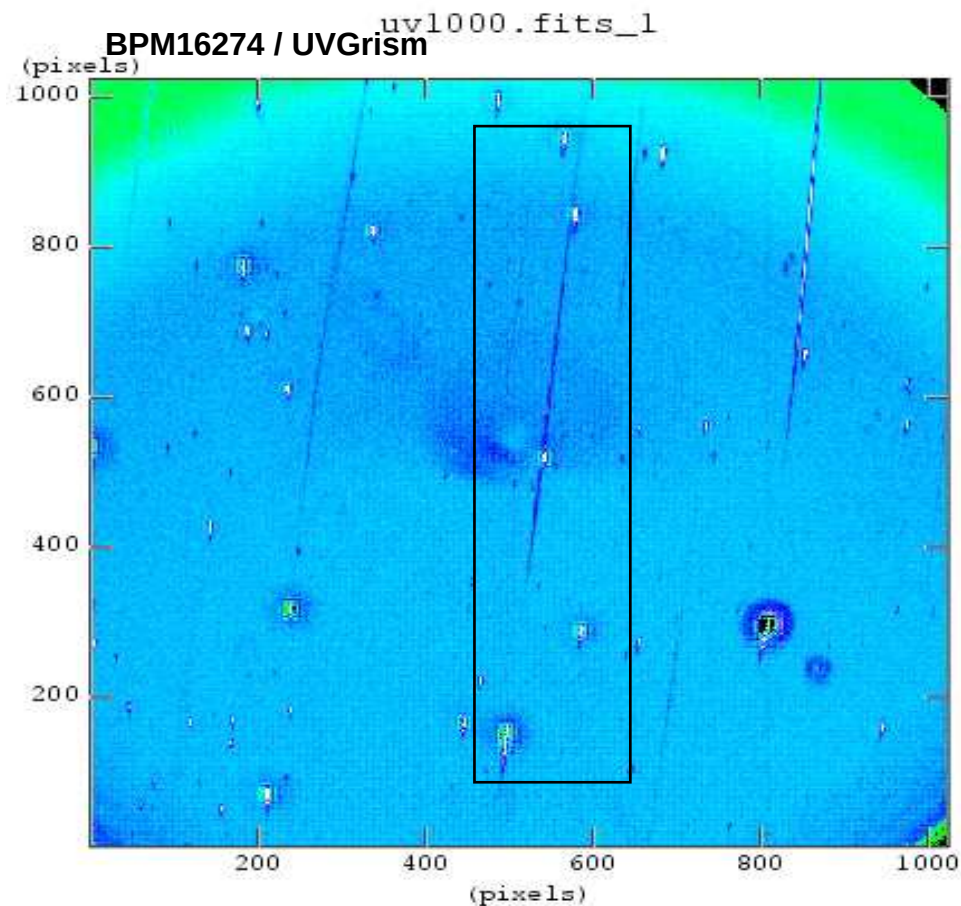
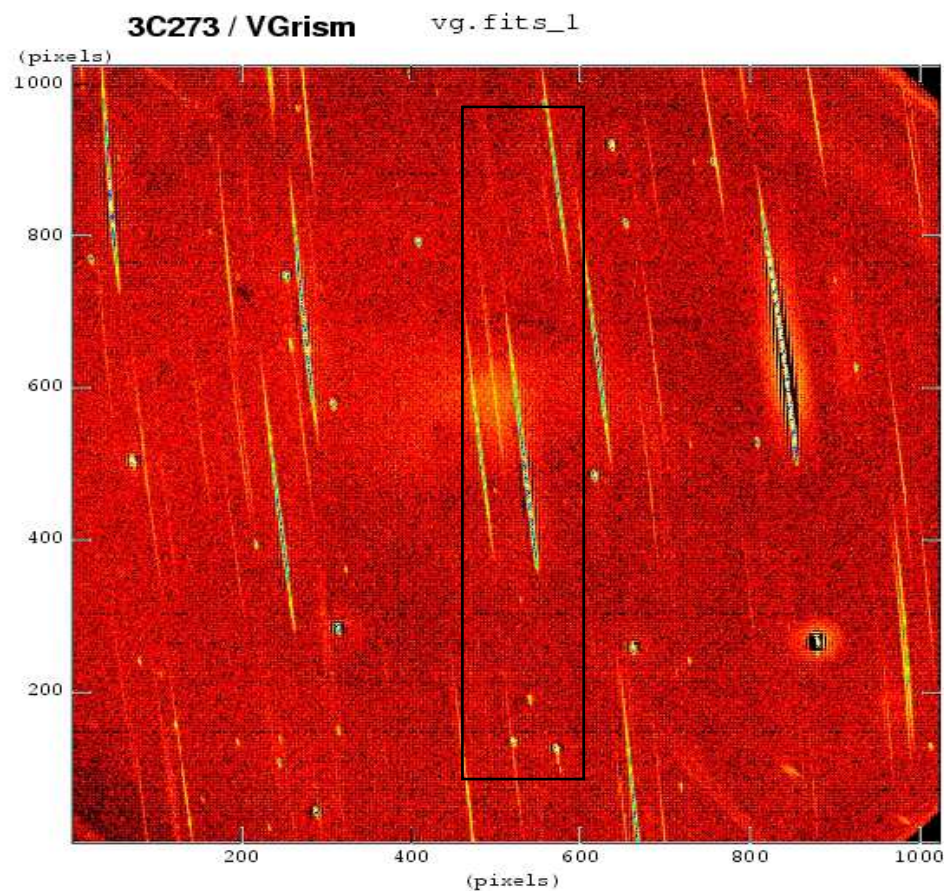
Difference between default windows configuration and full frame



Observing with OM grisms

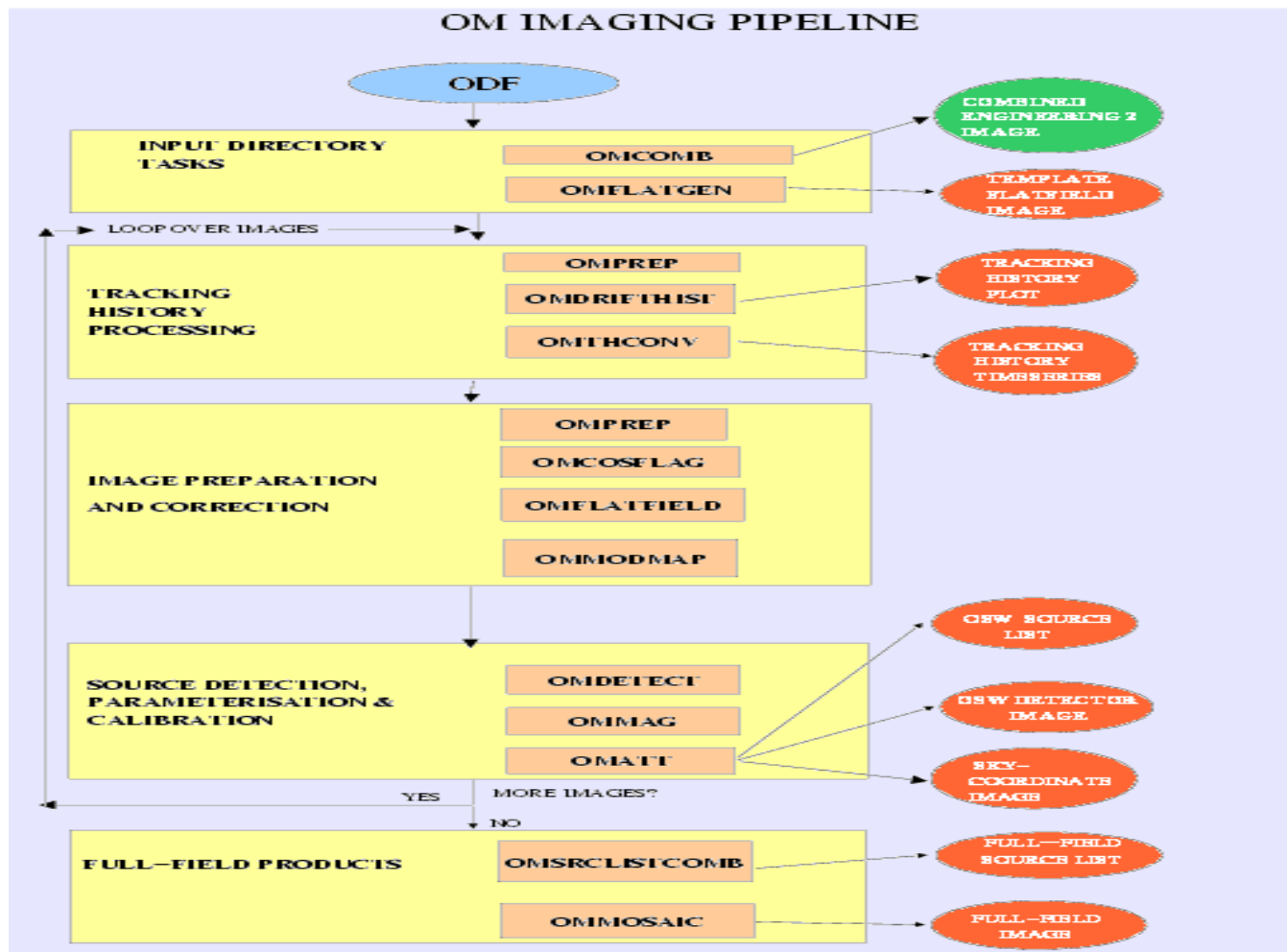


Image mode full frame low res. Or user def. window centred on target spectrum.



- All operations to be applied to OM data (SAS tasks) are combined into processing chains: **(Perl scripts where all tasks are concatenated, with default parameters and naming convention)**
 - **omichain:** for image data, to perform photometry of all sources in the field of view
 - **omfchain:** for fast mode data, to derive light curves of the sources in the fast mode window
 - **omgchain:** to extract flux calibrated spectra obtained with OM grisms
- The standard pipeline executes the chains on all exposures, with predefined parameters
- The chains can be applied “by hand” to an observation, or in case of *omichain* to a given filter(s) or a given exposure(s). (Some parameters are adjustable)
- Individual tasks can be run by hand, although most of them need as input the output from another task previously run

OM image mode data reduction: omichain



➤ Data preparation

- combine full frame low resolution files
- get flat-field

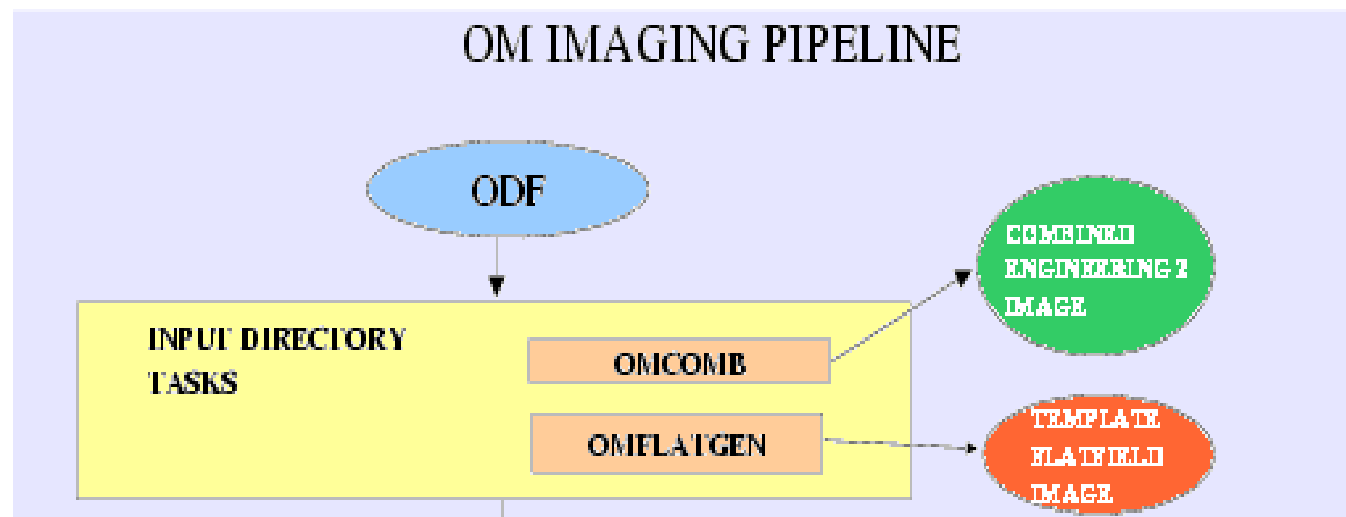
➤ Processing (per exposure)

- all corrections, source detection, astrometry & photometry

➤ Final combined results

- all exposures and filters

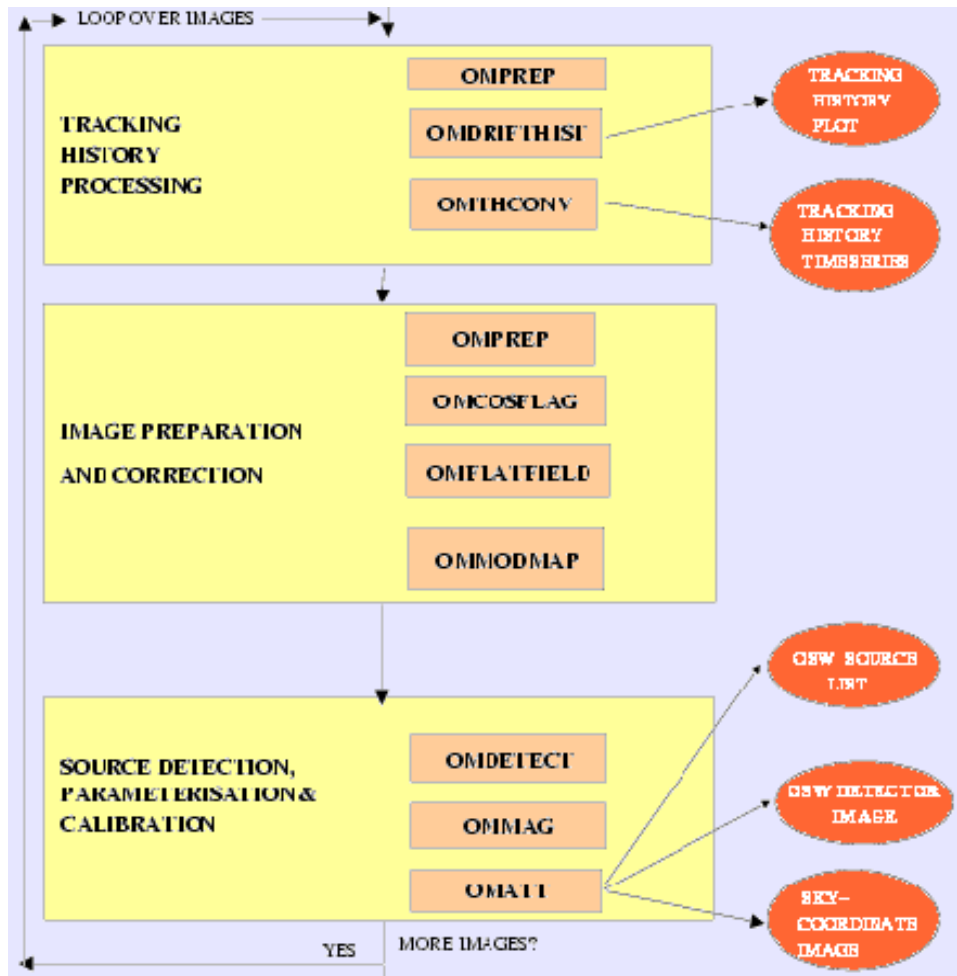
OM image mode data reduction



➤ Data preparation

- **omcomb:** combines full frame low resolution files (4) into single full field file
- **omflatgen:** obtains flat-field template

OM image mode data reduction



➤ Preparation of tracking correction

- omprep
- omdrifthist
- omthconv

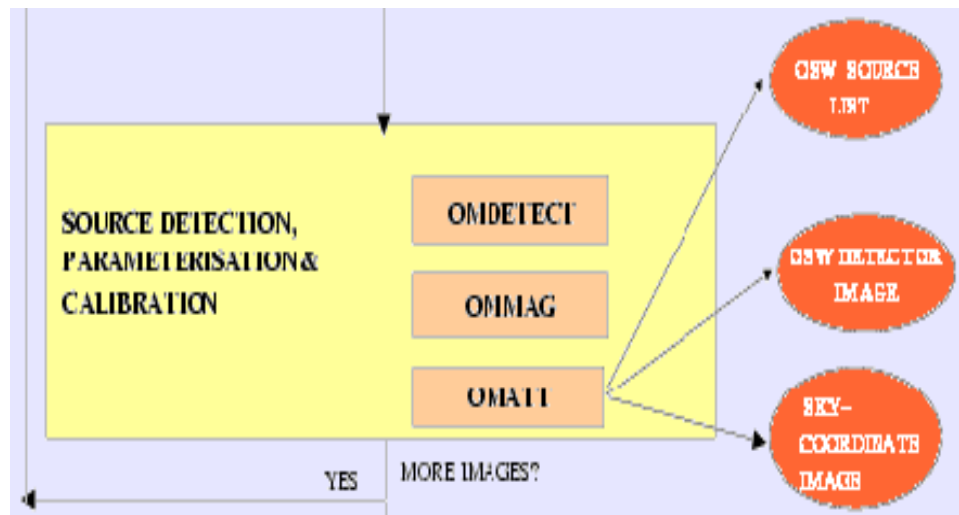
➤ Corrections: bad pixels, fixed pattern (mod8), flat-fielding

- omprep
- omcosflag
- omflatfield
- ommodmap

➤ Source detection, astrometry and photometry

- omdetect
- ommag
- omatt

OM image mode data reduction

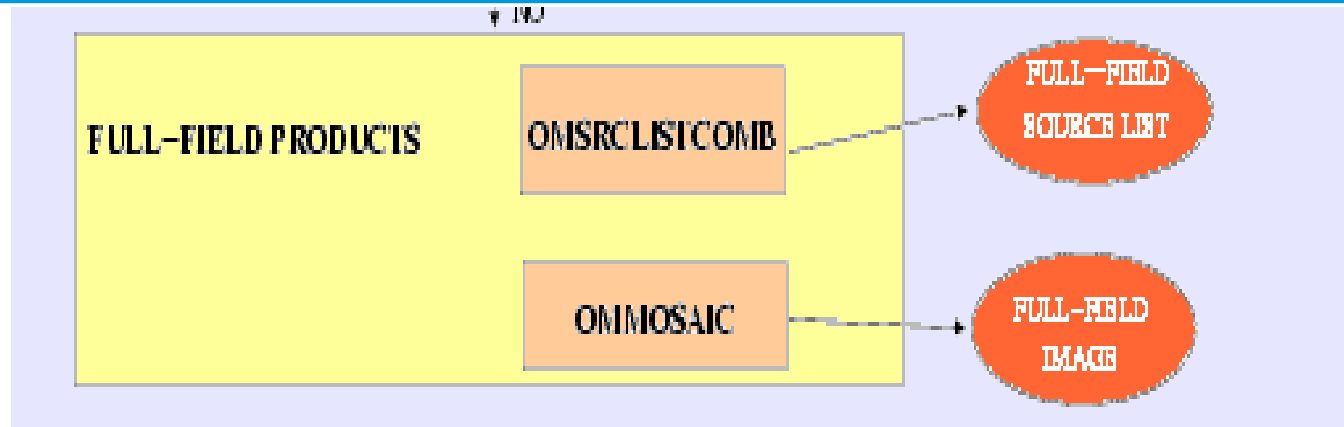


➤ Source detection, astrometry and photometry

- **omdetect**
- **ommag**
- **omatt**

- **omdetect:** source detection (sextractor like), positions, shape, errors, count rates (sources & background), coincidence loss and dead time corrections,,.... Detection depends on parameters:
 - **nsigma, boxscale, smothsize, contrast**
- **ommag:** , PSF corrections, **computation of magnitudes and colour corrections**
- **omatt: astrometry: distortion correction, sky images, coordinates (catalogue X-correlation)**

OM image mode data reduction



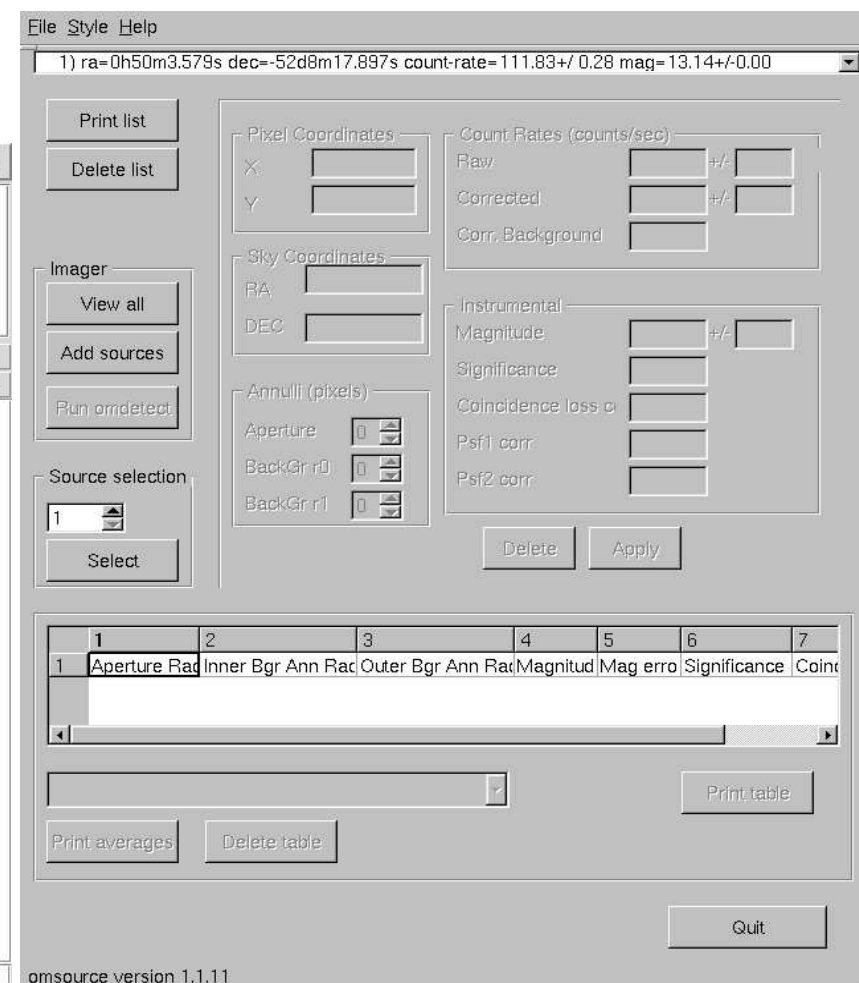
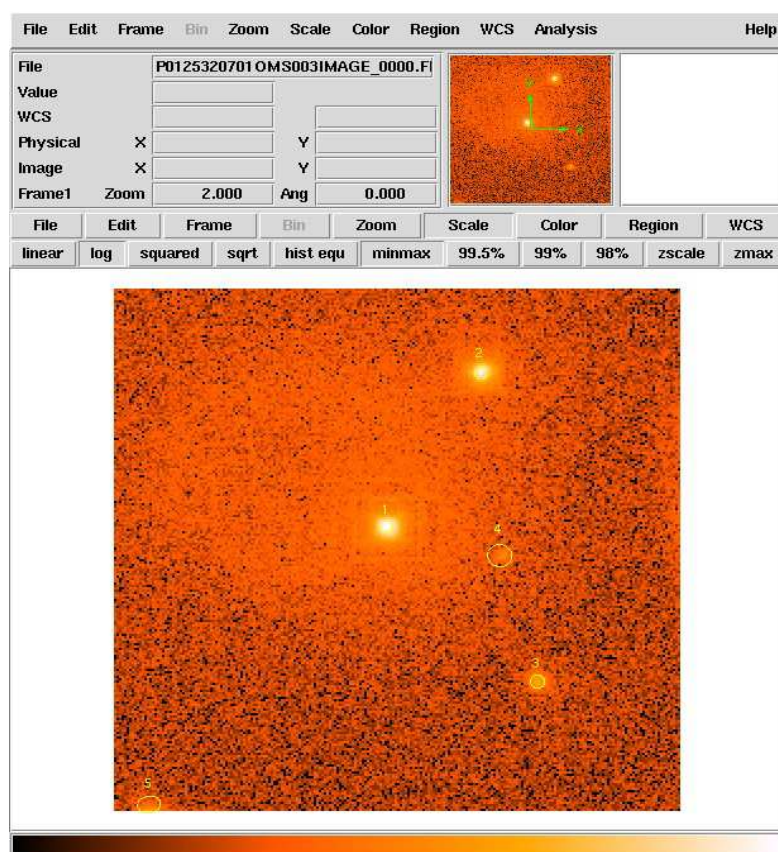
- Final combined results
 - all exposures and filters
 - **omsrclistcomb**: merges results from all filters and exposures
 - **ommosaic**: merges exposures obtained with the same filter into full field images
- With SAS 9.0 and newer:
 - deeper detection on mosaiced co-added images
- With SAS 10:
 - **omvariability**: in multiple exposures with the same filter

OM image mode: interactive photometry



You can select interactively your source in a processed image, and *omsource* will perform aperture photometry

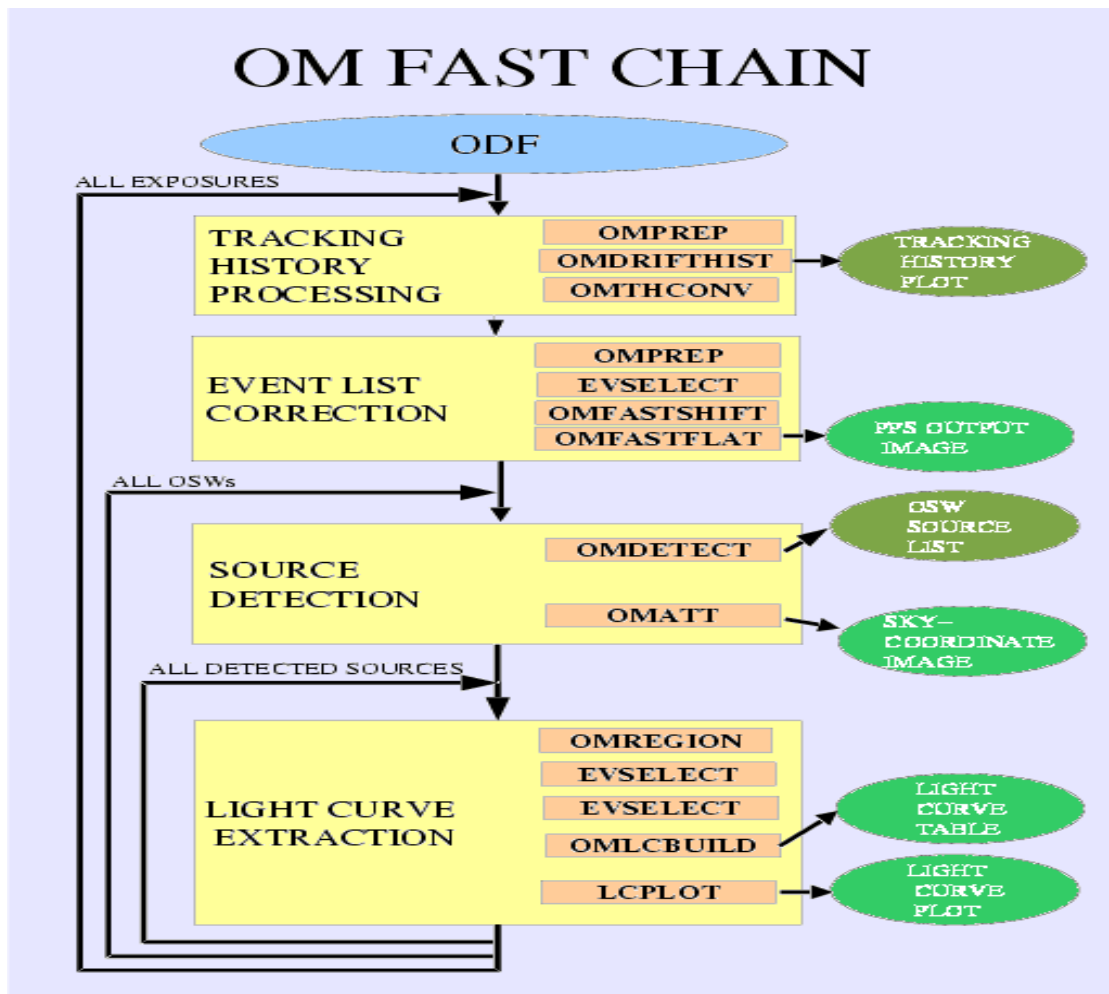
omsource
input image
[old source list]
new source list



Omphotom:

- **Allows a user to recompute the photometry of one or more sources in an OM source-list in one of several different ways, using specified parameters.**
- **It can reprocess a list of sources from various source-list files.**
- **Also allows the photometry to be re-computed using several different methods.**
- **The program allows OM fast mode data to be reprocessed, and in order to estimate the background more reliably the appropriate image can be used to determine it.**

OM fast mode data reduction: omfchain



➤ Preparation: tracking correction

- omprep
- omdrifthist
- omthconv

➤ Event selection & corrections: tracking, flat-fielding

- omprep
- evselect
- omfastshift
- omfastflat

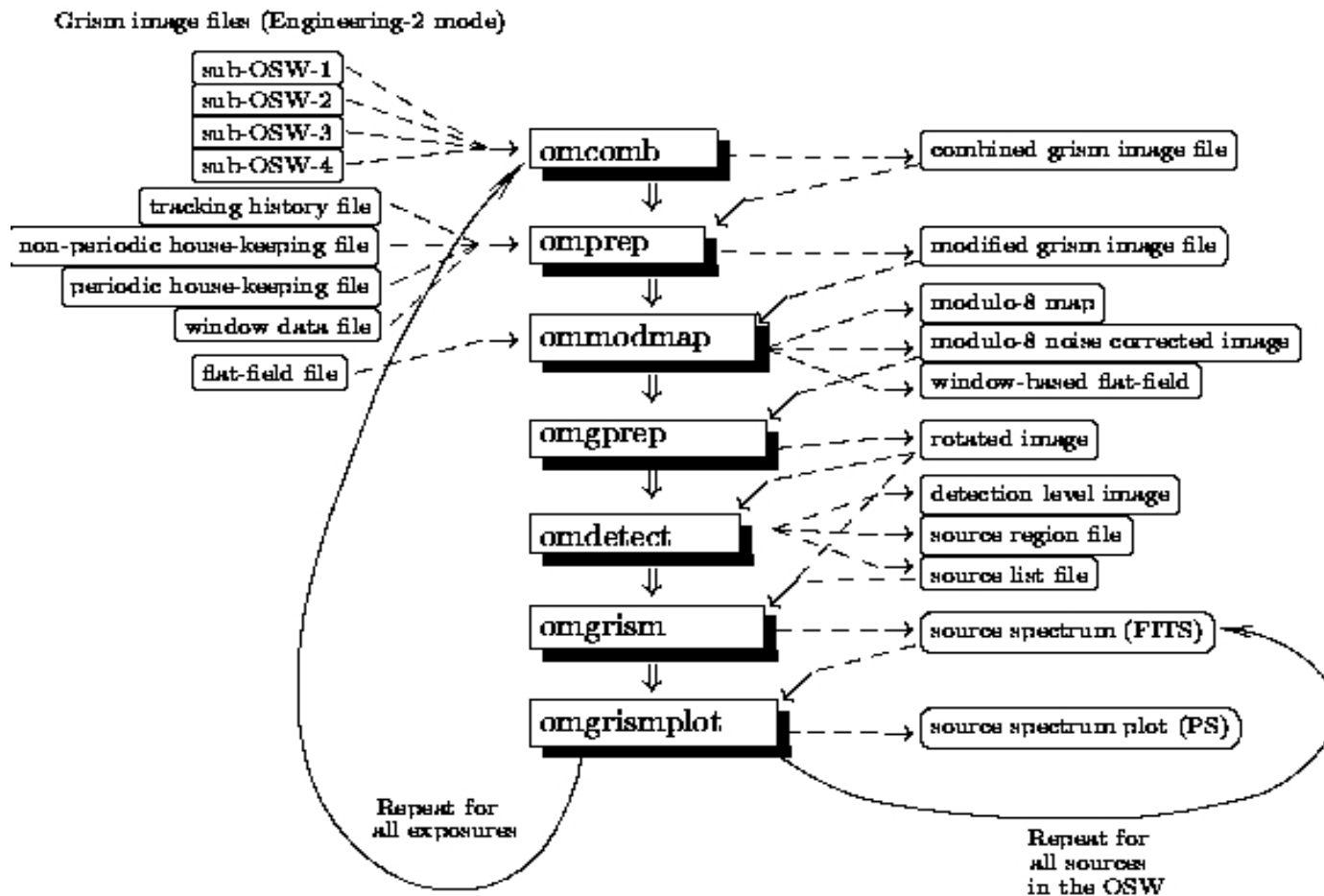
➤ Source detection & astrometry

- omdetect
- omatt

➤ Light curve:

- omregion
- evselect (source & bckgd)
- omicbuild
- lcplot

OM grisms data reduction: omgchain



➤ Data preparation

- combine full frame low resolution files

Image processing

- mod_8 correction
- un-distortion
- rotation

Source detection , spectral extraction and calibration

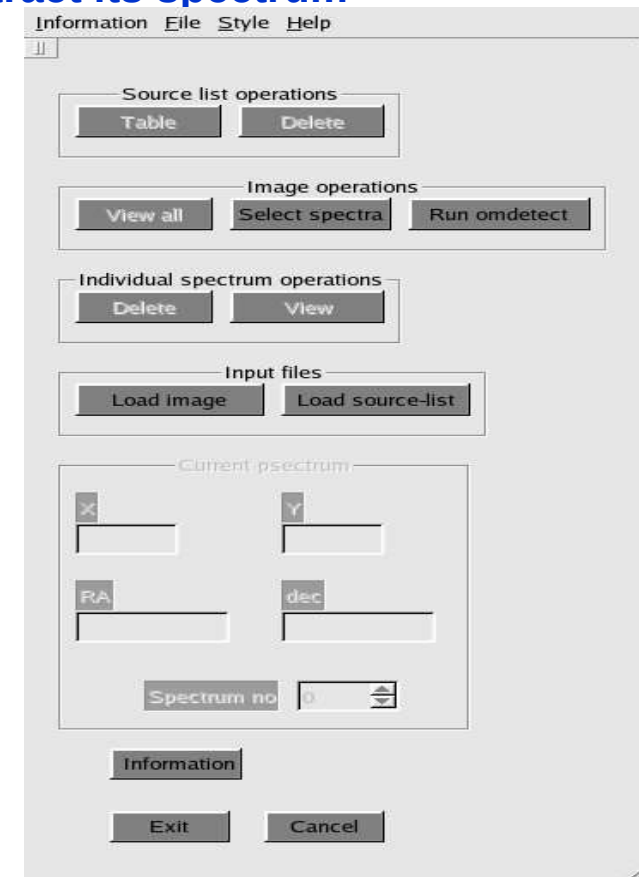
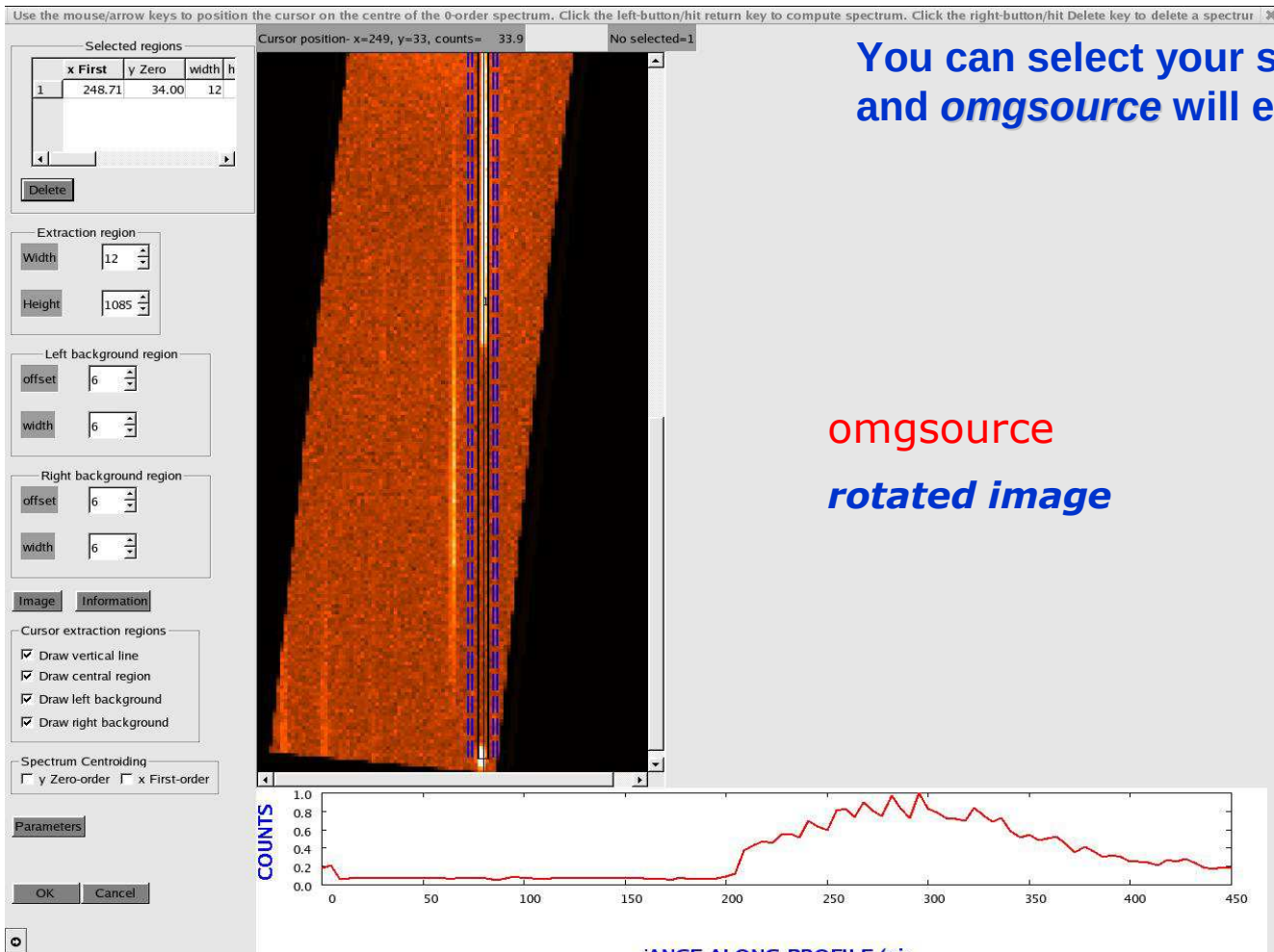
- look for all spectra (zero and 1st orders), correlate them, extract them and calibrate them (wavelength, flux)

OM grisms interactive extraction



You can select your source in a rotated image, and *omgsource* will extract its spectrum

omgsource
rotated image



- The pipeline (omichain, omfchain) should produce final calibrated results.
However, some checks are necessary!
- Imaging analysis:
 - detection algorithm may fail in presence of straylight features:
 - *parameters in omdetect should be modified*
 - *omsource or omphotom can be run interactively*
 - the PSF is used to derive count rates (crowded fields)
 - photometry of extended sources
 - catalogue X-correlation needs additional external data (catalogue file)
- Timing analysis:
 - fast mode in crowded fields
 - contamination by nearby objects
 - source miss-centring or S/C drift
 - contiguous light curves (*not available*)
- Grisms spectra:
 - faint spectra: *omgsource can be run interactively*
 - overlapping orders and background : *omgsource can help*
 - source identification: *astrometry is included*

OM count rate to flux conversion



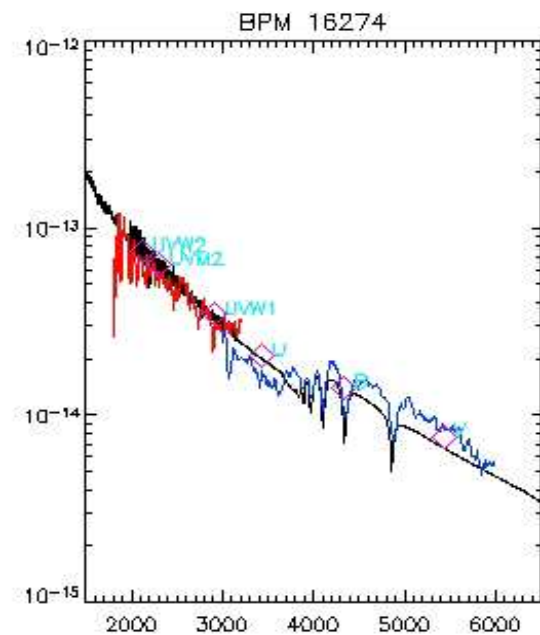
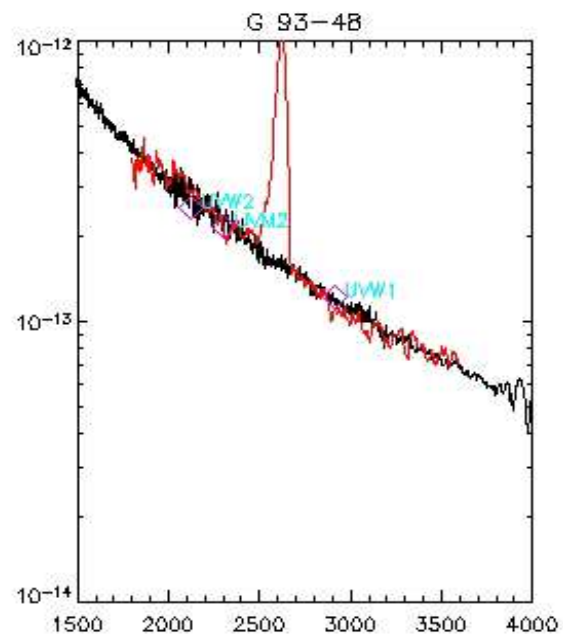
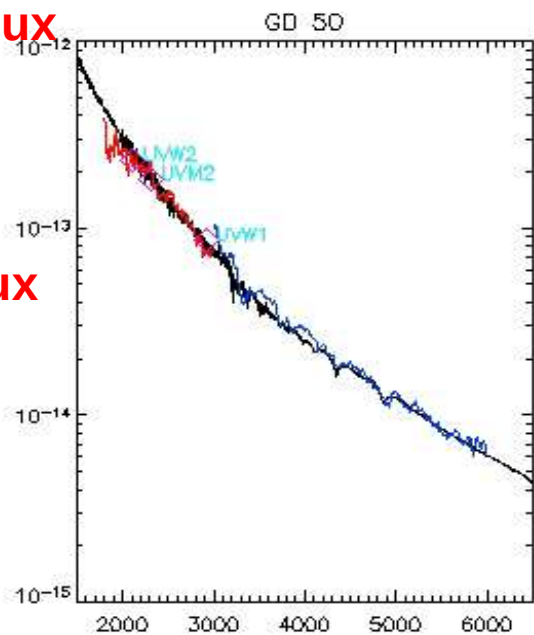
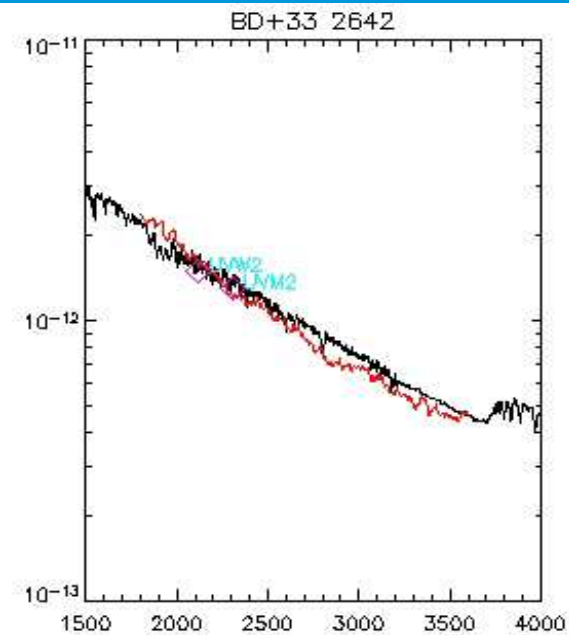
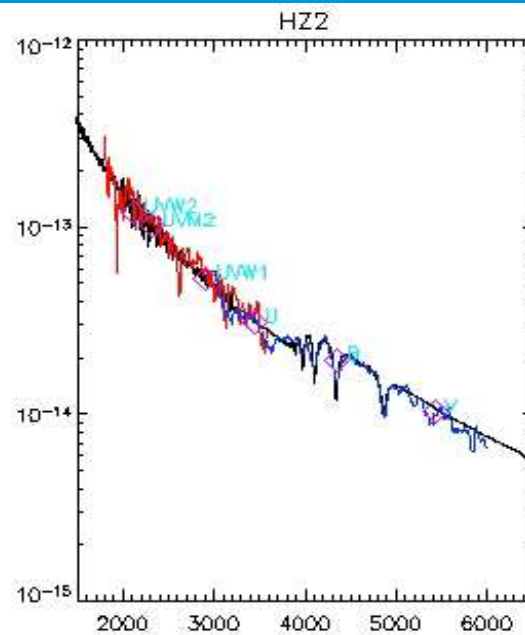
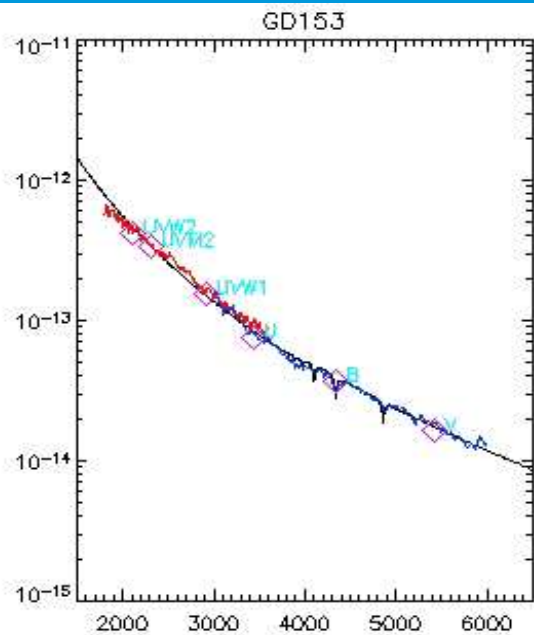
Count rate to Flux conversion :

- **Average conversion factors for time sensitivity variation corrected count rate, based on white dwarfs are:**

	UVW2	UVM2	UVW1	U	B	V
lambda (A)	2120	2310	2910	3440	4500	5430
factor	5.71	2.20	4.76	1.94	1.29	2.49
(erg/ct/cm2/A)	E-15	E-15	E-16	E-16	E-16	E-16

- **Spectral type dependencies are provided as recipe in SAS Web pages**
AB magnitude and flux included in SAS processing

OM filters flux
and grisms
versus
standard flux



Input data files: ODF



First exposure of a default image + fast mode observation:

•Data from the exposure:

0261_0125320701_OMS00200IMI.FIT / ODF Constituent
0261_0125320701_OMS00200PFX.FIT / ODF Constituent
0261_0125320701_OMS00200RFX.FIT / ODF Constituent
0261_0125320701_OMS00200THX.FIT / ODF Constituent
0261_0125320701_OMS00200WDX.FIT / ODF Constituent
0261_0125320701_OMS00201FAE.FIT / ODF Constituent
0261_0125320701_OMS00202IMI.FIT / ODF Constituent

•OM house-keeping data:

0261_0125320701_OMX00000NPH.FIT / ODF Constituent
0261_0125320701_OMX00000PEH.FIT / ODF Constituent

•S/C data:

0261_0125320701_SCX00000ATS.FIT / ODF Constituent
0261_0125320701_SCX00000TCS.FIT / ODF Constituent
0261_0125320701_SCX00000SUM.SAS / ODF Constituent

Output data files: Pipeline/XSA products



OM Exposure-Specific Products

Instrument	Exposure ID	Inst Mode	Filter	Start time	Duration	Stop time
OM	S002	Image	V	2001-05-12T20:39:21	1001	2001-05-12T20:56:02

Filename	Content	V&V Flags	OM Science Window	Source Number
P0125320701OMS002TSHPLT0000.PDF	OM TRACKING HISTORY PLOT	-	-	-
P0125320701OMS002TSTRTS0000.FIT	OM TRACKING STAR TIMESERIES	-	-	-
P0125320701OMS002IMAGE_0000.FIT	OM OSW IMAGE	-	0	-
P0125320701OMS002SIMAGE0000.FIT	OM OSW SKY IMAGE	-	0	-
P0125320701OMS002SIMAGE0000.PNG	OM OSW SKY IMAGE	-	0	-
P0125320701OMS002SWSRLI0000.FIT	OM OSW SOURCE LIST	-	0	-
P0125320701OMS002IMAGEF1000.FIT	OM FAST MODE OSW IMAGE	-	1	-
P0125320701OMS002SIMAGF1000.FIT	OM FAST MODE OSW SKY IMAGE	-	1	-
P0125320701OMS002SWSRLI1000.FIT	OM OSW SOURCE LIST	-	1	-
P0125320701OMS002TIMESR1001.FIT	OM OSW SOURCE TIMESERIES	-	1	1
P0125320701OMS002TIMESR1001.PDF	OM OSW SOURCE TIMESERIES	-	1	1
P0125320701OMS002IMAGE_2000.FIT	OM OSW IMAGE	-	2	-
P0125320701OMS002SIMAGE2000.FIT	OM OSW SKY IMAGE	-	2	-
P0125320701OMS002SIMAGE2000.PNG	OM OSW SKY IMAGE	-	2	-
P0125320701OMS002SWSRLI2000.FIT	OM OSW SOURCE LIST	-	2	-

Image mode data:	omichain
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Interactive aperture	omsource
photometry:	omphotom

Fast mode data:	omfchain
	omphotom

Grism spectra extraction:	omgchain
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Grism interactive extraction:	omgsource
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