

VO2012

Virtual Observations 2012

WERKCOLLEGE 6: ASTRO-WISE INFORMATION SYSTEM

Document identifier: **VO2012-W6-01**

Date: **October 8, 2012**

Activity:

Document status:

Document link:

Abstract: This werkcollege shows main interfaces and web services of Astro-WISE and goes through basic astronomical data processing of images with Astro-WISE.

1. ASTRO-WISE AND EXERCISES OVERVIEW

These exercises will familiarize you with the Astro-WISE system. You will start with a single raw exposure and remove instrumental effects from that image. Next you will obtain an astrometric solution for the image, create an image of which the pixels are resampled to a predefined pixel grid on the sky, and then add the different CCD detectors that comprise the WFI instrument onto that grid. Finally you will create a source list, which is a catalog of all sources in your frame and their properties.

In the course of this process the different aspects of the Astro-WISE system will be addressed.

2. EXERCISE 1

You have been given a DATE-OBS. This is the observation date for a particular exposure made with the Wide-Field Imager (WFI) on the MPI2.2m telescope on the mountain La Silla in Chili. Find your exposure in the database using the Database Viewer, and have a look at it.

Explanation Go to the Database Viewer web page:

<http://dbview.astro-wise.org>

1. Log in to the DBViewer by clicking on “DBUser”.
2. Select project “STUDENTWISE”
3. Select “raw science”, then fill in a narrow-enough DATE_OBS range (separated with a “,”).
4. Click on “(image)” in the resulting table to display the image in the browser

3. EXERCISE 2

In order to remove instrumental effects from your image, several so-called calibration files are required. Check whether the necessary calibration files are present in our database. For the benefit of calibration scientists who use Astro-WISE a webservice (“CalTS”) has been created. Each calibration file (if it exists) is either valid for a certain period or it is invalid. With CalTS you can inspect, invalidate, comment or change the valid range of calibration files.

Explanation

Go to the CalTS web page:

<http://calts.astro-wise.org>

and find the night your observation was taken.

1. Log in to the Calibration Timestamp service by clicking on the name below “DB User” at the top left.
2. Select project “STUDENTWISE”, instrument “WFI” and filter #843 (V). Further, select the observing night for your exposure.
3. A typical calibration exposure used in optical astronomy is a bias. Is there a valid master bias for your exposure?
 - (a) Select “Master Bias”.

- (b) *What do you think is displayed in the table?*
- (c) *You can click on the “I” to display the image in the browser.*
- 4. *Same question for “Master Flat”.*

4. EXERCISE 3

Use the Target Processor webservice:

<http://process.astro-wise.org>

to derive a Master Bias for you night of observations.

Explanation

1. *Log in to the Target Processor by clicking on the name below “DB User” at the top left. Select project “STUDENTWISE” and instrument “WFI”.*
2. *In order to process data follow the steps under “State”. That is, click on “Preselect target” and select “MasterBias”.*
3. *Under “Options” (lower left) open “Process Parameters”, fold out BiasFrame and BiasFrameParameters, then tag the box for “OVERSCAN_CORRECTION”. Finally hit “Submit”.*
4. *Select the year and month belonging to your exposure. Note the graph displayed at the top of the screen. This is a graphical representation of the potential raw bias exposures that may be used to create a MasterBias. Hover the mouse over the boxes, and click on the box belonging to your night.*
5. *Select all raw biases, then hit “Process”*
6. *Hit “Submit” in the Job Submit page that you now get. The job will be submitted to the HPC compute cluster at the University of Groningen.*
7. *You can monitor the progress of the job by clicking on “view”*
8. *Wait for the process to finish before continuing with the next exercise*

5. EXERCISE 4

Use the Target Processor webservice to derive the following targets for your exposure (in this order):

1. ReducedScience
 - (a) *Log in to the Target Processor by clicking on the name below “DB User” at the top left. Select project “STUDENTWISE” and instrument “WFI”.*
 - (b) *In order to process data follow the steps under “State”. That is, click on “Preselect target” and select “ReducedScience”.*
 - (c) *Locate your exposure by filling in the night your exposure was observed as well as the filter used (V or #843). You will see a graphical representation of observed data. Hover the mouse over the blocks to see the night of observation and the telescope’s pointing.*

- (d) Click on the block belonging to your night of observations and your object. Remember that your exposure may have been observed past midnight so it may be found in the night which seems to precede the exposure.
 - (e) Tag your exposure in the list and hit “Query” at the bottom
 - (f) In the “Query results” screen your prospective target is displayed. In particular it shows if the data has been processed before and if so, whether is up to date. In other words, if a calibration scientist creates a new calibration file, all *ReducedScienceFrames* created with the old calibration file will become outdated. Such an outdated calibration file will be indicated with a red shading in this screen.
 - (g) Click on “Process”, then “Submit” to start the data-reduction
 - (h) Wait for the process to finish before continuing with the next step.
2. Astrometric
- (a) Select as target “Astrometric” then follow the above procedure. If there is an existing *AstrometricParameters* object, why is it outdated?
3. RegriddedFrame
- (a) Select as target “RegriddedFrame” then follow the above procedure
4. SourceList
- (a) Select as target “SourceList” then follow the above procedure. However, first set under “Options” → “Preferences” → “Attribute” → “SourceList.frame” to “RegriddedFrame” (Submit).

6. EXERCISE 5

Now that you have created a *RegriddedFrame*, find your data again in the database using the Database Viewer.

7. ASTRO-WISE: WORK WITH CATALOGS

In the previous step you have created *SourceList* for the image you reduced from WFI raw image. This image is in Johnson V filter. The goal of this exercise is to cross-identify the image with USNO-A2 catalog and build a cross-matched catalog for your image with V, B and R magnitudes.

8. ASTRO-WISE PROMPT

Login to virgo cluster (virgo01, for example). Set up and start awe prompt:

1. In order to automatically log in to the database when you start up AstroWISE you need to create a directory `.awe` in your home directory as follows (from the `virgoXX` command prompt):

```
virgoXX>cd
virgoXX>mkdir .awe
virgoXX>cd .awe
```

Now create a file here called 'Environment.cfg' with the following content:

```
[global]
database_user      : <your database username>
database_password  : <your database password>
database_name      : db.astro.rug.astro-wise.org
project            : STUDENTWISE
combined_sourcelist_tablename : SOURCELIST*SOURCES**04
```

Make sure only you can read the contents of the file; type at the virgoXX command prompt:

```
virgoXX>chmod a-rwx,u+rw Environment.cfg
```

2. At OmegaCEN/Kapteyn Astronomical Institute, the AWE software is set up by executing the appropriate one of the following commands from the shell prompt:

```
virgoXX>source ~aworacle/bin/coraenv
```

Now you should be able to start AstroWISE from the command prompt:

```
virgoXX>awe
```

9. SELECT YOUR SOURCELIST

In awe prompt select your SourceList by SLID (SLID for your SourceList can be found in dbview.astro-wise.org).

For example,

```
awe> sl=SourceList.SLID==1325611
awe> print sl[0].info()
SourceList: Name of SourceList : SL-JBIRCHMANN-0001325611
SourceList ID      : 1325611
Sources in list    : 1512
Parameters in list : 36

|
+-COMBINE_METHOD: -1
+-OBJECT: 2df_V_4
+-SLID: 1325611
+-associatelist: -1
+-astrom_params: None
+-chip: <astro.main.Chip.Chip object at 0x4045c6cc>
+-creation_date: 2010-03-30 13:16:13
+-detection_frame: None
+-filename: UNDEFINED
+-filter: <astro.main.Filter.Filter object at 0xa6a9a0c>
+-filters:
+-frame: <astro.main.RegriddedFrame.RegriddedFrame object at 0xa6a982c>
+-globalname:
+-instrument: <astro.main.Instrument.Instrument object at 0xa6a9e2c>
+-is_valid: 1
+-llDEC: -29.4049873231
+-llRA: 12.2781963985
+-lrDEC: -29.4051773888
+-lrRA: 12.1231330977
```

```

+-name: SL-JBIRCHMANN-0001325611
+-number_of_sources: 1512
+-object_id: '82D368DA6A4C5251E0407D81E60E121D'
+-process_params: <astro.main.SourceList.SourceListParameters object at 0xa6a9cec>
+-sexconf: <astro.main.Config.SextractorConfig object at 0xa6a996c>
+-sexparam: <class 'common.database.typed_list.typed_list'>(<type 'str'>, [])
+-sources: {'BackGr': <class 'common.util.types.single_float'>, 'FIELD_POS': <type 'int'>,
  'ERRA_IMAGE': <class 'common.util.types.single_float'>,
  'Level': <class 'common.util.types.single_float'>,
  'MAGERR_ISO': <class 'common.util.types.single_float'>,
  'FLUXERR_ISO': <class 'common.util.types.single_float'>,
  'MAG_ISO': <class 'common.util.types.single_float'>, 'SeqNr': <type 'int'>,
  'MU_MAX': <class 'common.util.types.single_float'>,
  'FLUX_RADIUS': <class 'common.util.types.single_float'>,
  'FLUX_ISO': <class 'common.util.types.single_float'>,
  'MaxVal': <class 'common.util.types.single_float'>,
  'Xpos': <class 'common.util.types.single_float'>, 'YM2': <type 'float'>,
  'NPIX': <type 'int'>,
  'ERRTHETA_IMAGE': <class 'common.util.types.single_float'>,
  'Ypos': <class 'common.util.types.single_float'>,
  'MAG_APER': <class 'common.util.types.single_float'>,
  'FLUX_APER': <class 'common.util.types.single_float'>,
  'MAGERR_APER': <class 'common.util.types.single_float'>,
  'CLASS_STAR': <class 'common.util.types.single_float'>,
  'Flag': <type 'int'>, 'FWHM_IMAGE': <class 'common.util.types.single_float'>,
  'Corr': <type 'float'>,
  'FLUXERR_APER': <class 'common.util.types.single_float'>,
  'ERRB_IMAGE': <class 'common.util.types.single_float'>,
  'XM2': <type 'float'>}
+-ulDEC: -29.1350273459
+-ulRA: 12.2775697283
+-urDEC: -29.1352153404
+-urRA: 12.1229084302
None

```

Select SourceList with USNO-A2 data (SLID=62915)

```

awe> sl2=SourceList.SLID==62915
awe> print sl2[0].info()
SourceList: Name of SourceList : USNO Catalog
SourceList ID      : 62915
Sources in list    : 526280881
Parameters in list : 14

|
+-COMBINE_METHOD: -1
+-OBJECT:
+-SLID: 62915
+-associatelist: -1
+-astrom_params: None
+-chip: None
+-creation_date: 2006-09-21 09:26:42
+-detection_frame: None
+-filename: ldac.cat
+-filter: None
+-filters:
+-frame: None
+-globalname:
+-instrument: None
+-is_valid: 1
+-llDEC: -90.0
+-llRA: 360.0
+-lrDEC: -90.0
+-lrRA: 0.0
+-name: USNO Catalog
+-number_of_sources: 526280881
+-object_id: '1DEDB223CCA71AF7E0407D81C5067A45'
+-process_params: <astro.main.SourceList.SourceListParameters object at 0xa6a9fac>
+-sexconf: <astro.main.Config.SextractorConfig object at 0xa6a9fec>
+-sexparam: <class 'common.database.typed_list.typed_list'>(<type 'str'>, [])
+-sources: {'USNO_RMAG': <class 'common.util.types.single_float'>, 'USNO_Q': <type 'int'>,
  'USNO_BMAG': <class 'common.util.types.single_float'>,

```

```
'USNO_FIELD': <type 'int'>,
'USNO_GSC': <type 'int'>}
+-ulDEC: 90.0
+-ulRA: 360.0
+-urDEC: 90.0
+-urRA: 0.0
```

10. MAKE CROSS-MATCHING IN ASTRO-WISE

To do a crossmatching you have to create a `AssociateList` with will contain cross-identification between two or more `SourceList`s:

```
awe> AL=AssociateList()
```

Add preselected `SourceList` to `AssociateList`:

```
awe> AL.input_lists.append(sl[0])
awe> AL.input_lists.append(sl2[0])
```

Set a radius of crossmatching (in arcseconds)

```
awe> AL.set_search_distance(5.0)
```

Set a type of associations (read more about different association types on http://www.astro-wise.org/portal/howtos/man_howto_sourcelists/man_howto_sourcelists.shtml)

```
awe> AL.associatelisttype=1
```

Create `AssociateList`

```
awe> AL.make()
[virgo01] 15:41:58 - Preparing for the matching
[virgo01] 15:41:59 - Found 1151 sources in SourceList with SLID = 1325611
[virgo01] 15:41:59 - Found 336 sources in SourceList with SLID = 62915
[virgo01] 15:41:59 - Looking for pairs
[virgo01] 15:42:00 - Looking for closest pairs
[virgo01] 15:42:00 - Filtered out 5 pairs
[virgo01] 15:42:00 - Found 111 pairs
[virgo01] 15:42:00 - Inserting first half of pairs
[virgo01] 15:42:04 - Inserting second half of pairs
[virgo01] 15:42:05 - Inserting null associations from last input list
[virgo01] 15:42:08 - Inserting null associations from first input list
[virgo01] 15:42:18 - Created Chain AssociateList with ALID = 227791, name = "" and 1376 associates!
```

and commit it to the system

```
awe> AL.commit()
awe> print AL
Name of AssociateList : Assoc-JBIRCHMANN-----55285.5710524-52b784ad0cea38e925296ae9bda132bb9a736
AssociateList ID      : 227791
Associates in list    : 1376
```

11. CREATE A NEW SOURCELIST WITH COMBINED CATALOG

If you continue the same session, you already have `AssociateList` in `AL`, overwise find `AssociateList` by `ALID` number the same way you have found `SourceList`s in the previous step. Initialize a `CombinedList`:

```
awe> cl=CombinedList(AL)
```

Select which attributes you wish to have in an output `SourceList` (`A,B,MAG_APER,MAG_ISO,USNO_RMAG` and `USNO_BMAG` should present!)

```
awe> cl.set_user_defined_attributes(['A','B','MAG_APER','MAG_ISO','USNO_RMAG','USNO_BMAG'])
```

Do not change COMBINED_METHOD!. COMBINED_METHOD=2 is set by default and will create catalog which covers your AssociateList only. COMBINED_METHOD=1 or COMBINED_METHOD=3 will include sources which are not in AssociateList, which mean that the whole USNO catalog will be copied to this new SourceList. Make and commit a new SourceList

```
awe> cl.make()
awe> cl.commit()
SourceList: Name of SourceList : SL-JBIRCHMANN-0001325621
SourceList ID      : 1325621
Sources in list    : 1376
Parameters in list : 13

|
+-COMBINE_METHOD: 2
+-OBJECT:
+-SLID: 1325621
+-associatelist: 227791
+-astrom_params: None
+-chip: None
+-creation_date: 2010-03-30 13:45:29.153417
+-detection_frame: None
+-filename:
+-filter: None
+-filters:
+-frame: None
+-globalname:
+-instrument: None
+-is_valid: 1
+-llDEC: -29.4049873231
+-llRA: 12.2781963985
+-lrDEC: -29.4051773888
+-lrRA: 12.1231330977
+-name: SL-JBIRCHMANN-0001325621
+-number_of_sources: 1376
+-object_id: '82D383338B0B97BFE0407D81E60E120B'
+-process_params: <astro.main.SourceList.SourceListParameters object at 0xa6b49cc>
+-sexconf: <astro.main.Config.SExtractorConfig object at 0xa6b48cc>
+-sexparam: <class 'common.database.typed_list.typed_list'>(<type 'str'>, [])
+-sources: {'MAG_ISO': <class 'common.util.types.single_float'>, 'USNO_RMAG': <class 'common.util.types.single_float'>, 'USNO_BMAG': <class 'common.util.types.single_float'>, 'MAG_APER': <class 'common.util.types.single_float'>}
+-ulDEC: -29.1350273459
+-ulRA: 12.2775697283
+-urDEC: -29.1352153404
+-urRA: 12.1229084302
```

12. RESULTS

Check your new SourceList in dbview.astro-wise.org. With the use of dbview extract SourceList in any format you like (csv or VOTable) and build 3 figures:

1. coordinate plot of all sources with different symbols for stars and galaxies (use A/B ration to make a guess about the object classification)
2. CMD in B-(B-V) coordinates
3. CMD in V-(V-R) coordinates