User's Guide to WdsPick

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Abstract: WdsPick is a program developed to help the astronomer making measurements of double stars. WdsPick offers two complementary functions. First, a filter-based mechanism for building lists of target stars from the Washington Double Star Catalog [1] and navigating through these lists. Second, a connection to the well-known SkyChart [2] application for automatically visualizing star positions and pointing telescopes.

Introduction

The behavior of the program is illustrated in Figure 1, showing both the `WdsPick` and `SkyChart` applications side by side (left and right respectively).

Here `WdsPick` is navigating through a list of 98 target stars. The current selection is BU 1216, whose main elements are shown (including ephemerides computed from the Sixth Catalog of Orbits of Visual Binary Stars [2]). A connection has been established with
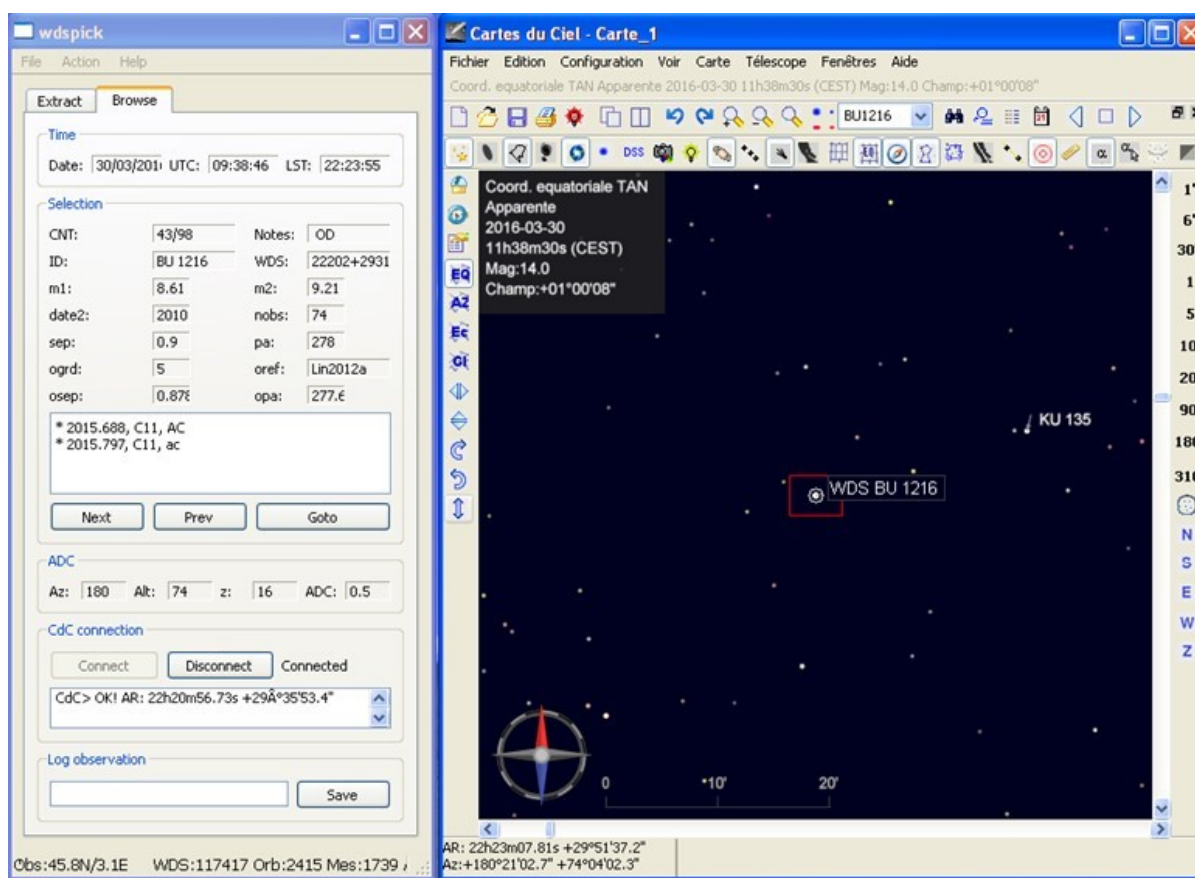

Figure 1. WdsPick in action, connected to the SkyChart application.

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the `SkyChart` application and the latter has been instructed to point to the corresponding position. If the `SkyChart` application is actually controlling a telescope (by means of an ASCOM interface, for example), initiating a physical GOTO would then automatically bring the target star in the FOV (or the camera).

Starting WdsPick

When started, the application shows the window as illustrated in Figure 2.

The three main components of this window are

- a **menu bar** with three menus (`File`, `Action` and `Help`) at the top
- two *tabs* named `Extract` and `Browse` respectively (with the former initially selected)
- a **status bar** showing some informations at the bottom

The `Help` menu gives access to the `About` action which prints some information on the program.

The `Action` menu has only one item, `Extract`. Invoking this action is equivalent to hitting the `Extract` button located at the bottom of the `Extract` tab*,* or typing "Ctl-E".

The `File` menu has three items for loading or saving so-called *specification files* (see below) or quitting the application respectively.

The information shown in the **status bar** are, from left to right,

- the coordinates of the observatory (longitude and latitude),
- the number of entries read in the WDS and the ORB files,
- the number of entries read in MES file (see below),
- the number of entries read in the ADC file (see below).

Initially, the application shows the `Extract` tab, whose function is to specify the criteria used for building the target list.

Building a Target List

This is achieved by specifying a set of filters in the `Extract` tab and clicking on the `Extract` button.

Available filters include

- the equatorial coordinates (*RA* and *Declination*),
- the magnitudes of the primary and secondary components (*m1* and *m2*),
- the difference in magnitudes between the two components (*dm*),
- the separation between components (*sep*, in arc seconds),

Figure 2. WdsPick main window.

- the year of the last observation, as reported in the WDS (*date2*),
- the total number of observations, as reported in the WDS (*nobs*),
- the discoverer code of the star (*disc*),
- the notes, as recorded in the WDS (*notes*).

For *RA*, *Dec*, *m1*, *m2*, *dm* and *sep*, a minimal value and/or a maximal value can be specified. Note that the specified value is included in the selection, except for the upper bound of *RA*. For the *disc* and *notes* criteria, the specified value simply has to occur in the corresponding WDS field. For example, for restricting targets to stars discovered by W. Struve, select the *Disc* criterium and enter "STF" in the corresponding text field. The filter set shown in Figure 3, for example,

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will select stars
- located between 6h and 7h of RA and 0 and 60° of declination,
- with a primary (resp. secondary) component brighter than or equal to magnitude 10 (resp. 12),
- with a separation between 0.5" and 1",
- with no observation reported since 2010,
- and having an orbit listed in the 6th Orbit Catalog.

The matching entries are extracted from the WDS file (this can take a few seconds) and the application automatically switches to the Browse tab.

The current set of filters can be saved in (resp. loaded from) a file by invoking Save (resp. Open) from the File menu (keyboard shortcuts : Ctl-S and Ctl-O resp.).

Note that it is possible to go back to the Extract tab at any any time to change the filter set and build a new target list.

Browsing the target list

Figure 4 shows the Browse tab obtained with the aforementioned criteria.   The different items are grouped in five categories: Time, Selection, ADC, CdcConnection, and Log.

Time group

Here WdsPick displays the current date, UTC time, and local sidereal time (LST). The latter is correct only if the local coordinates of the observatory have been provided in the *wdspick.ini* file. The local sidereal time is used to compute the horizontal coordinates of the target stars (azimuth and altitude, displayed in the ADC group).

Selection group

This group gathers the commands to navigate through the target list. The CNT field gives the total number of selected entries and the index of the currently selected entry. The other fields display the information retrieved from the WDS for this entry. For stars listed in the 6th Catalog of Orbits, some orbital informations are also given (orbit grade, reference, and the predicted separation and position angle, computed from the ephemerides given in the catalog and the current date).

In the text section at the bottom of the group, WdsPick can also display information related to previous measurements of the selected target. This is useful, for example, to avoid re-measuring a given star
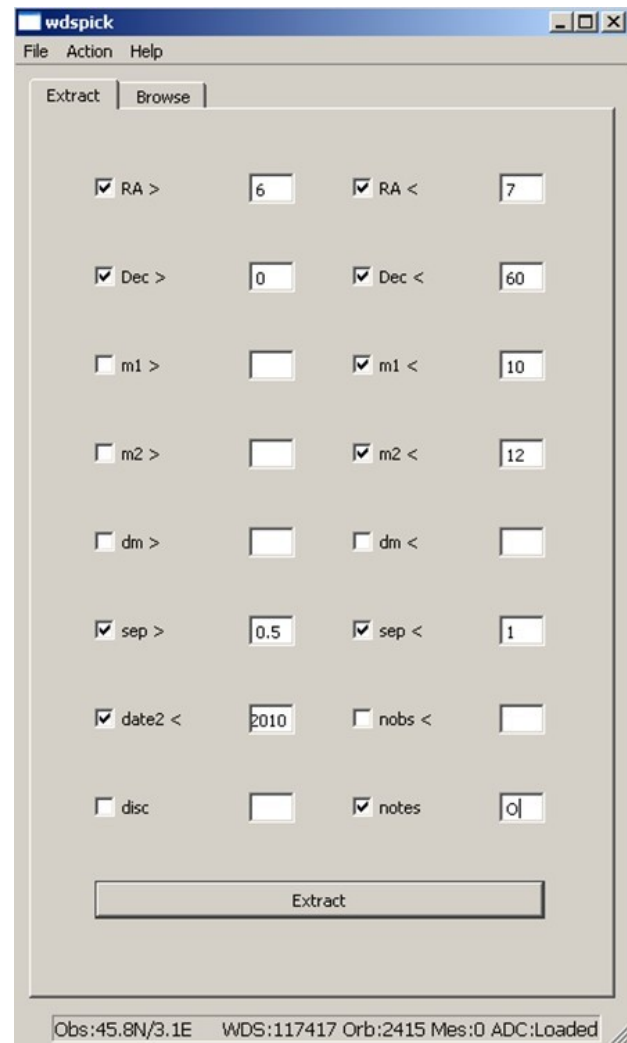

Figure 3. Building a target list with the Extract tab.

which has been recently successfully measured or, on the contrary, to suggest a new measurement if the previous ones have been noted as dubious or imprecise. For this, the list of such previous measurements can be provided in the so-called MES file. The name of this file is specified in the *wdspick.ini* file. Its format is detailed in Section *Parameterizing and Customizing*. The number of entries currently available is the MES file is displayed in the status line of the application after the "Mes:" indication.

The Next and Prev buttons can be used to navigate freely in the target list.

Once a connection has been established between WdsPick and the SkyChart application (see below),
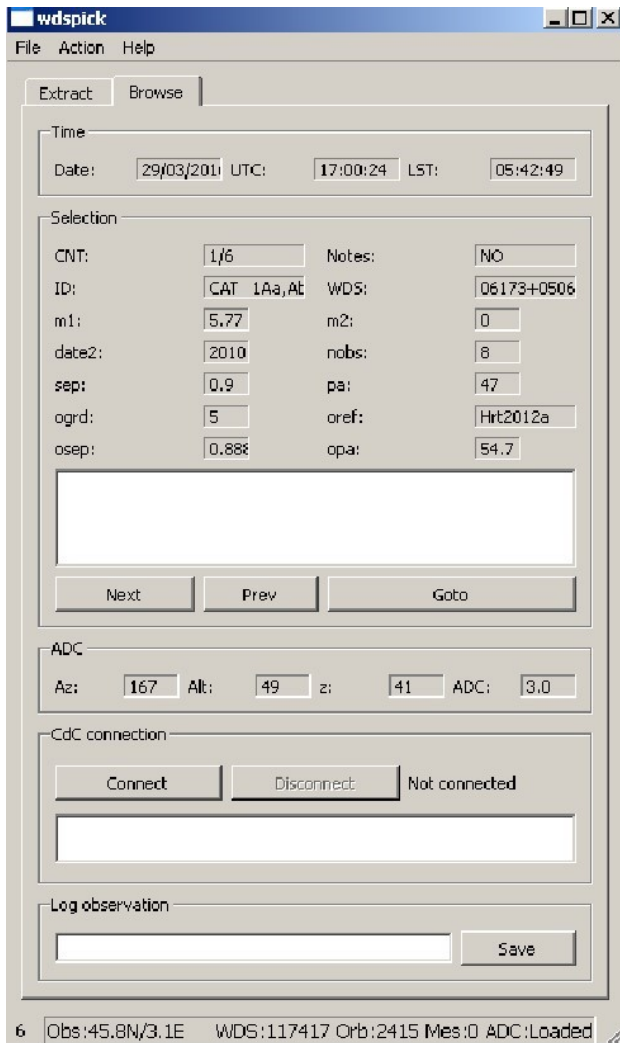
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Figure 4. The `Browse` *tab obtained after clicking the* `Extract` *button in Figure 3.*

the `Goto` button instructs `SkyChart` to point to the current selection (as shown in Figure 1).

ADC group

`WdsPick` integrates a rudimentary mechanism for simplifying the usage of an atmospheric dispersion corrector (ADC) when observing or imaging double stars at high spatial resolution. With such a device, the angle between the rotating prisms (which controls the amount of correction) must be adjusted according to the altitude (or equivalently the zenithal distance) of the observed star. If the relation between the zenithal distance and the corresponding ADC setting is known (it can be established either theoretically or experimentally) and listed in the ADC file (the name of this file is also specified in the *wdspick.ini*), `WdsPick` will display the cor-

responding value in the `ADC` field. The availibility of ADC data is signaled in the status bar of the application after the 'Adc:' indication. In any case, `WdsPick` will display the altitude, zenithal distance and azimuth of the current selection. The latter (azimuth) can be useful, for instance, in order to prevent crossing the local meridian when pointing star (which, with certain types of telescope mounts can trigger unwanted movements).

Cdc Connection group

This group controls the connection between the `WdsPick` and `SkyChart` applications. Connection is established using TCP sockets. Connection is requested by clicking on the `Connect` button and can be closed by clicking on the `Disconnect` button. The small text field just below displays relevant messages issued by the `SkyChart` application. Note that the `SkyChart` application can be launched before or after `WdsPick`, the only important point being that it is actually running (and not already connected on the specified address/port) when `WdsPick` initiates the connection. It is recommended to close the connection (by clicking the `Disconnect` button before quitting one of the applications).

Log group

This group controls writing to the observing session log. Entering a comment in the text field and clicking on the `Save` button automatically adds a line to the log file containing the name of the current selection (if applicable), the current time and the comment. The name of the log file is "*<prefix>*YY-MM-DD.log", where *<prefix>* is specified in the *wdspick.ini* file (default is *"wdspick_"*). This file is always written in the directory containing the `WdsPick` executable. An example of log file is given in the next section.

Parameterizing and Customizing

WdsPick relies on several external files for correct / optimal operation. All of these files are regular text files and can be freely viewed and/or edited

The wdspick.ini file

This file is mandatory and must be located in the directory containing the application executable. It contains the main parameters of the application, in the form "<parameter_name> = <value>" (one parameter per line). Valid parameters are (with default value if not found in the .ini file)

- **wds_file** : path to the file containing the WDS catalog (default : *wds.txt*)
- **orb_file** : path to the file containing the 6th Orbit catalog (default : *orb.txt*)
- **wds_cat_index** : number of the catalog for dou-

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ble stars under `SkyChart` (default : *5*)
- **cdc_tcp_addr** : IP address for connecting to `SkyChart` (default : *127.0.0.1*)
- **cdc_tcp_port** : port number for connecting to `SkyChart` (default : *3292*)
- **mes_file** : path to the file containing the previous measurements (default : *mesures.txt*)
- **adc_file** : path to the file containing the ADC settings (default : *adc.txt*)
- **log_file_prefix** : prefix for naming the log file (cf Sec. "Log Group") (default : *_wdspick*)
- **launch_cdc_on_start** : if "yes", `WdsPick` automatically launches `SkyChart` when starting (default : *no*)
- **cdc_path** : path to `SkyChart` application, when launched from `WdsPick` (default : *C:\Program Files\Ciel\skychart.exe*)
- **cdc_args** : arguments to pass to the `SkyChart` application, when launched from `WdsPick` (default : *none*)
- **obs_long** : longitude of the observatory (floating point format, negative for east) (default : *0.0*)
- **obs_lat** : latitude of the observatory (floating point format, negative for south) (default : *45.0*)

File paths can be specified in absolute or relative format. In the latter case, they are relative to the directory containing the `WdsPick` executable.

An example of *wdspick.ini* file is given in Listing 1.

The WDS file

This file is mandatory. It is an image of the WDS catalog, in text format. It can be generated by first downloading the catalog from USNO web site (http://ad.usno.navy.mil/wds/Webtextfiles/wdsnewframe.html) and saving its contents in text format (select all, copy, paste into text editor). For convenience, the distribution includes a copy of the latest catalog (March 2016).

An excerpt of the WDS file included in the distri-

bution is given in Listing 2.

```
wds_file = wds.txt
orb_file = orb.txt
wds_cat_index = 5
cdc_tcp_addr = 127.0.0.1
cdc_tcp_port = 3292
mes_file = mesures.csv
log_file_prefix = wdspick_
launch_cdc_on_start = no
cdc_path = C:\Program Files\Ciel\skychart.exe
cdc_args =
obs_long = -3.0760
obs_lat = 45.7956
adc_file = adc.txt
```

Listing 1. An example of the `wdspick.ini` *file.*

The ORB file

This file is optional, but strongly recommanded. It is an image of the 6th Catalog of Orbits, in text format. As for the WDS file, it can be generated by first downloading the catalog USNO web site (http://ad.usno.navy.mil/wds/orb6/orb6ephem.html) and then saving its contents in text format (select all, copy, paste into text editor). For convenience, the distribution also includes a copy of the latest catalog (march 2016).

An excerpt of the ORB file included in the distribution is given in Listing 3.

The MES file

This file is optional. It should contain a list of previous observations to be displayed when a star is selected in the target list. Observations must be listed one per line, with each line having the form :

<p align="center"><code>ID;DATE;COMMENT</code></p>

where
- ID is the WDS discoverer+components designation of the star (ex: "ES 2543AC", "A 1248", ...)
- DATE is the date of the observatio, in decimal format (ex: 2015.576)
- COMMENT is any associated comment

An example of MES file is given in Listing 4.

```
...
07598+1341STF1170      1830 2011   52  97 107   2.2   2.4  8.74  9.09 F5      -011-002 -011-002 +14 1801      075945.52+134119.9
07598+0029BAL1128      1893 1999    3  85  86  17.9  17.9  8.7  12.2  A0      +000+005          +00 2150    D 075950.72+002847.5
07598-0311HJ    75     1825 2000    3 270 275  25.0  25.4 11.43 11.4        -001+001                        D 075953.80-025219.4
...
```

Listing 2. Excerpt of the file `wds.txt` *included in the distribution.*

```
00024+1047 A  1249AB       4    Zir2003    69.7   0.208    68.7   0.222    67.8   0.236    67.0   0.250    66.3   0.263
00026-0829 A    428        4    Tok2015c  322.5   0.121   317.3   0.115   311.8   0.111   305.7   0.107   299.3   0.104
00046+4206 CHR 122Aa,Ab    4    Cve2008a  311.4   0.114   309.2   0.121   307.2   0.127   305.4   0.133   303.8   0.139
```

Listing 3. Excerpt of the file `orb.txt` *included in the distribution.*

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```
...
STF  60AB;2009.022;Mewlon 210
STF  60AE;2009.022;Mewlon 210
STF  73AB;2013.904;C11, imprecise
STF  73AB;2013.918;C11, ok
...
```

Listing 4. Excerpt of a measurement file.

The ADC file

This file is optional. It should contain a list of zenithal distances and corresponding ADC settings to be displayed a star is selected in the target list. Correspondances must be listed one per line, with each line having the form :

```
Z;R
```
where
- Z is the zenithal distance, ranging from 0 to 90°, by steps of 1°
- R is the corresponding ADC setting (in decimal format).

The LOG file

This file is generated by WdsPick. It is filled whenever the user enters some comments in the text field of the Log group and click the Save button.

An example of LOG file is given in Listing 5.

Related Work

Several tools have been developed for extracting data from the WDS catalog and building target lists, such as S. Caille's website doublestars.free.fr [4] (in french, no longer maintained), D. Chiron's WdsTool [5], T. Bryant's tool [6] or the StelleDoppie database [7]. Because manually copying identifiers or corodinates from between applications can be tedious and error prone, we think that WdsPick offers a more integrated and practical solution. Moreover, since all the required data is available on disk, it does not require an Internet connexion, as do these programs.

Availability

WdsPick is available in binary form for Windows and Mac OS X platforms from the author's web site at the following URL : http://www.astrosurf.com/legalet/Astro/WdsPIck.html

References

[1] http://ad.usno.navy.mil/wds

[2] http://www.ap-i.net/skychart/en/start

[3] http://ad.usno.navy.mil/wds/orb6

[4] http://doublestars.free.fr

[5] http://wdstool.com/wds_index_us.php

[6] T.V. Bryant., "An Online Tool that Searches the WDS", *JDSO*, **11**, 164-166, 2015.

[7] http://stelledoppie.goaction.it

```
2016-02-05 20-04-18: seeing=4/10 transparency=2/5. Starting..
2016-02-05 20-06-28: HDS 575: no companion viewed
2016-02-05 20-10-38: A  1839: ok +ref
2016-02-05 20-18-26: A  2034: ok +ref
2016-02-05 20-34-31: D     6: ok adc=1.5
2016-02-05 20-39-05: STT  95: ok texp=10ms
```

Listing 5. Example of session log file.