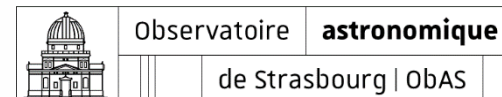


Position recognition using the current VOTable standard Aladin Desktop implementation

Interop Tucson – 10-13 November 2023

Pierre Fernique



Command 00:05:12.38 +67:51:55.3

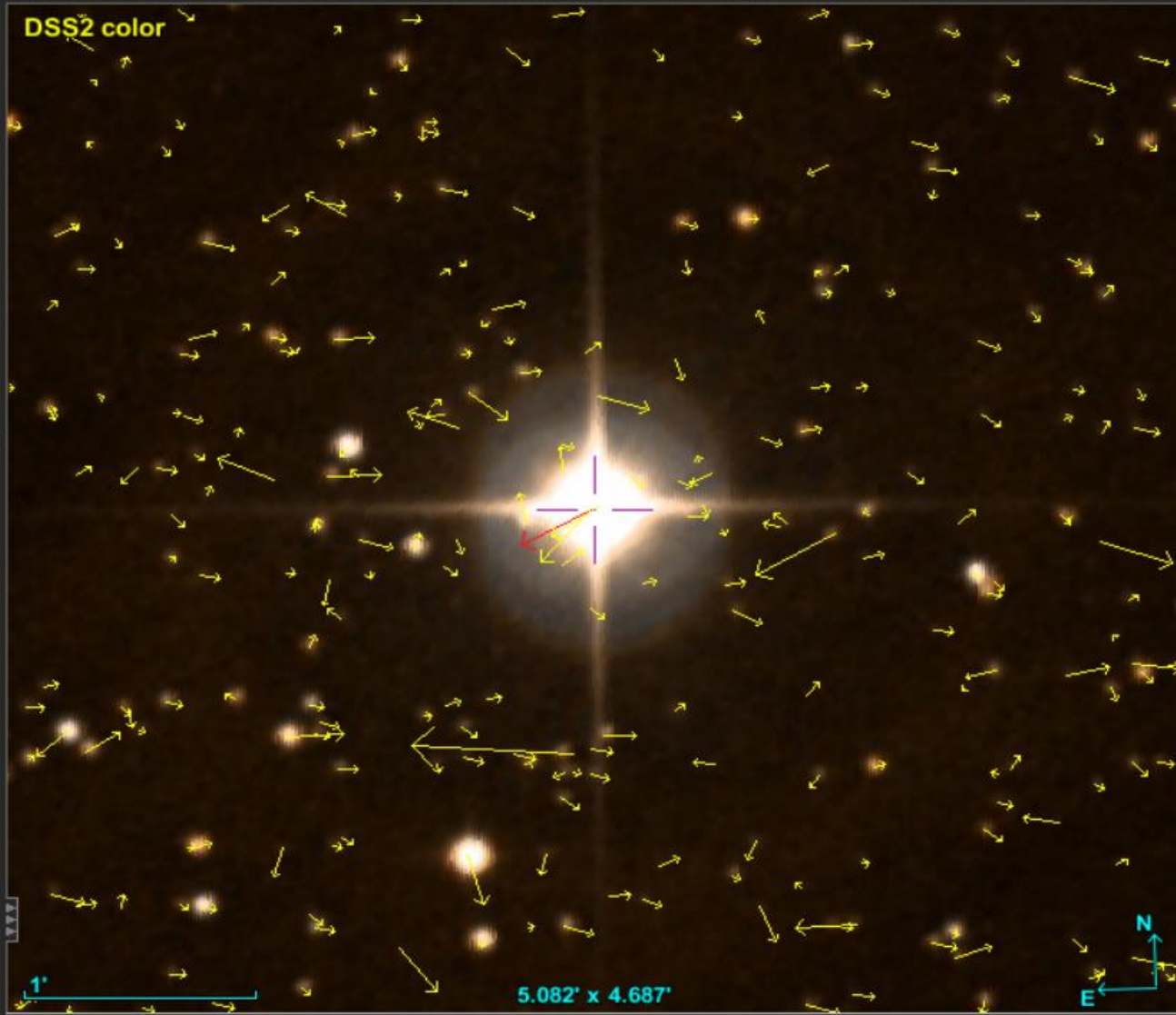
Frame ICRS

Projection Aitoff



DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Gaia Simbad NED +

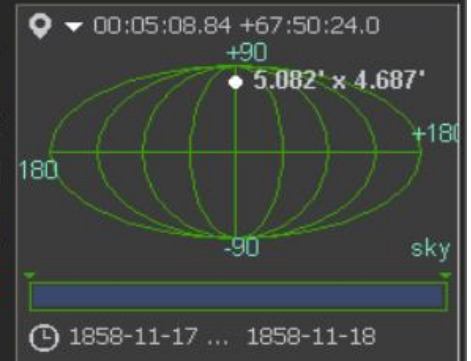
DSS2 color



- select
- pan
- dist
- phot
- draw
- tag
- moc
- spect
- filter
- cross
- x y
- rgb
- assoc
- crop
- cont
- pixel
- prop
- del

Filter0
 CDS/I/355/gaiadr3
 CDS/I/259/nc2
 CDS/P/DSS2/color

J2000 - +
 size - +
 dens. - +
 opac. - +
 zoom - +



grid study wink redo north hdr multiview match

□ Context – Aladin Desktop

- By design, Aladin Desktop needs the **precise celestial positions** of each source it displays.
- It is important to take into account the **epoch of observations**, particularly since Gaia (epoch 2016).
- Depending on the input data format, the task is more or less easy

=> VOTable is by far the easiest case

□ The method (1/2)

Simple cases:

- Knowledge of the **reference system**
=> **COOSYS fulfils this role** without ambiguity or complexity
- **Recognition of the columns** concerned by the **position**
=> based on **UCDs** (perfect)
- If absent (because optional in VOTable) Aladin falls back on more delicate rules based on NAME and UNIT (not so good).

□ VOTable Tycho example

As Vizier is providing

```
<VOTABLE>
  <RESOURCE>
    <COOSYS system="eq_FK5" equinox="J2000" epoch="J2000"/>
    <TABLE>
      <FIELD name="ra" ucd="pos.eq.ra" unit="deg"/>
      <FIELD name="dec" ucd="pos.eq.dec" unit="deg"/>
      <FIELD name="pmra" ucd="pos.pm;pos.eq.ra" unit="mas/yr"/>
      <FIELD name="pmdec" ucd="pos.pm;pos.eq.dec" unit="mas/yr"/>
      ...
    </TABLE>
  </RESOURCE>
</VOTABLE>
```

□ The method (2/2)

Complex case of multi-tables, multi-reference system and/or multi-column positions:

- Take into account the **ref** attribute described in VOTables to unambiguously associate the correct columns to the right reference system
- Takes into account the **UCD main** tag

*=> It does the job,
and has done it well for years*

□ VOTable Gaia example

As VizieR is providing

```
<VOTABLE>
  <RESOURCE>
    <COOSYS ID="sysA" system="eq_FK5" equinox="J2000" epoch="J2000" />
    <COOSYS ID="sysB" system="ICRS" epoch="J2016" />
    <TABLE>
      <FIELD name="raj2000" ucd="pos.eq.ra;meta.main" ref="sysA" unit="deg"/>
      <FIELD name="dej2000" ucd="pos.eq.dec;meta.main" ref="sysA" unit="deg"/>
      <FIELD name="ra" ucd="pos.eq.ra" ref="sysB" unit="deg"/>
      <FIELD name="dec" ucd="pos.eq.dec" ref="sysB" unit="deg"/>
      <FIELD name="pmra" ucd="pos.pm;pos.eq.ra" ref="sysB" unit="mas/yr"/>
      <FIELD name="pmdec" ucd="pos.pm;pos.eq.dec" ref="sysB" unit="mas/yr"/>
      ...
    </TABLE>
    ...
  </RESOURCE>
</VOTABLE>
```

□ 2 tricky points

- PMRA not 'pre-'multiplied by cosine
 - Very rare cases
 - Determination by unit analysis (mas/yr vs ms/yr)
- Multiple refs
 - => epoch ref to COOSYS and to TIMESYS
 - very rare cases, currently not managed by any data provider

□ My suggestions (by waiting for DM solution)

- Recommendations to the VOTable authors:
 1. Do not forget **COOSYS**
 2. Do not forget **UCDs for position columns**
 3. Use VOTable **XML ref** mechanism in case of multiple COOSYS
- If really required: authorize multiple XML ref for FIELD just by adding a 'S' in the VOTable schema at the good place (REFID -> REFIDS)

And **wait MIVOT alternative** for a solid and more global solution (see Laurent M. talk => **Aladin Desktop 12.107 prototype** implementation)

fixes the equatorial or ecliptic systems (as e.g., "J2000" as the default for "eq_FK5" or "B1950" as the default for "eq_FK4"), and **epoch** specifies the epoch of the positions if necessary. Note that the **COOSYS** may be deprecated in the future in favor of a more generic way of describing the conventions used to define the positions of the objects studied in the enclosed tables.

in VOTable 1.4 (2019) specs