Referencing STC in VOTable
Version 0.8

IVOA Note 2008-09-10

This version:
http://www.ivoa.net/Documents/latest/VOTableSTC-2008-05-17.html

Latest version:
http://www.ivoa.net/Documents/latest/VOTableSTC.html

Previous versions:

Editor(s):
François Ochsenbein

Authors:
François Ochsenbein  Observatoire Astronomique de Strasbourg, France
Jonathan McDowell  Harvard-Smithsonian Center for Astrophysics, Cambridge MA, USA
Arnold Rots  Harvard-Smithsonian Center for Astrophysics, Cambridge MA, USA

Abstract
This note describes the recommended way to reference the coordinate systems in usage in Astronomy for an accurate specification of spatial and temporal reference frames. It was made in agreement between the VOTable and the Data Models Working Groups.

Status of this document
This is an IVOA Note. It attempts to clarify how to reference unambiguously, in a VOTable document containing space- and/or time-related data, the reference systems in which these data are expressed, systems which are described by the STC data model.

Comments to this note are welcome; it is expected that the expression of other data models into VOTable terms will be added in the future.

Acknowledgments
This document is based on the W3C documentation standards, but has been adapted for the IVOA.
## Contents

1 Introduction ........................................ 3

2 The space-time coordinates .......................... 3

3 The utype attribute ................................... 3

4 Specifying coordinate components in VOTable ........ 3

5 Examples ............................................ 4
   5.1 List of observations ................................ 5
   5.2 Extract of the Hipparcos catalog ................. 6
   5.3 Ephemeride of Comets ............................. 8

6 Summary of Interpretation and Defaults ............... 10
   6.1 stc:AstroCoords components ................. 11
   6.2 stc:AstroCoordSystem components .......... 11

7 References ......................................... 12
1 Introduction

Astronomical catalogues are a very common source of tabular data, and among these the catalogs collecting astronomical sources observed at specific sky locations and epochs have routinely to be compared to other catalogues containing informations related to the same sources, but observed or modelled in different contexts: observations at different epochs, different wavelengths, simulated results, etc. An accurate knowledge of the meaning of the parameters included in these catalogues is therefore essential if one expects to derive scientifically significant conclusions from the comparisons of these data.

The VOTable format is an IVOA standard which ensures that large data collections, which can be structured as a set of tables, can efficiently be exchanged within the Virtual Observatory framework with a full understanding of the data meaning (the metadata). A lot of details may be required for a full description of the elements stored in these data collections, but the locations in space and time (the coordinates, spatial and temporal) are essential if any comparison of the sources observed is attempted.

The data in the context of the Virtual Observatory are described by data models, which formalize the context of the data for their accurate interpretation. Data described in this way can then be more efficiently compared with data of similar nature but coming out from other horizons, and valid conclusions or scientific results can be drawn with higher confidence.

2 The space-time coordinates

In the context of astronomical catalogues, spatial (location in the sky) and temporal (date/time) parameters are one characterisation of virtually any observation, and these parameters are therefore fundamental if one wishes to make any comparison of the behaviour of the astronomical sources described in different catalogs – typically catalogs of observations made in widely different wavelength regimes. Since several systems are currently in use to express the spatial coordinates, a dedicated COOSYS element was introduced in the original version (1.0) of VOTable: it did specify some minimal level of details about the coordinate system used in the table, and was merely an enumeration of the most commonly coordinate frames used in astronomy (ICRS, historical equatorial frames, galactic, ecliptic, etc) associated to a couple of parameters (equinox and epoch). This VOTable-specific way of specifying the frames used for spatial location is deprecated in VOTable version 1.2, in favor of a more generic way of specifying the space and time coordinates using the utype attributes and the GROUP constructs[1].

3 The utype attribute

VOTable is not a data model, it is more a container for data which can be structured as tables, with emphasis on a single description (the schema or metadata) for a potentially large number of elements (the tuples or rows). The description of the data cannot include all components of all the data models developed in the Virtual Observatory framework, but their accurate description requires to reference the data model, and to say how the various FIELDS composing the table are related to this data model. This relation — referencing a data model — is specified by the utype attribute, introduced in the version 1.1 of VOTable for this purpose; utype can also be an attribute of the PARAM, GROUP, TABLE and RESOURCE elements [1].

The syntax of the utype attribute has not yet been fixed in the Virtual Observatory context. This note assumes a syntax made from the model name (stc) followed by a colon (:), and the dot-separated hierarchy of elements, as e.g. stc:AstroCoords.Position2D.Value2.C1 to refer to first component of a 2-D astronomical coordinate. The prefix (stc) should also be declared with the name space convention (as xmlns:stc=http://...) to specify the version of the STC data model used.

4 Specifying coordinate components in VOTable

The specification of an astronomical spatial and/or temporal coordinates requires essentially 2 definitions [2]:

1. the definition of the coordinate system (the frame in which the coordinates are expressed), which can
be an AstroCoordSystem (for astronomically defined frames) or a more generic CoordSys entity; these definitions may however be omitted in the case of coordinate systems referenced in the STC library (see the example in section 5.1)

2. what is the exact role of the numbers listed in the document, which is defined by the AstroCoords element in the astronomical context, or by the Coords element in a more generic context.

In a VOTable context, the utype attribute is used to specify the exact role of a specific field or parameter within the STC data model. The utype is an attribute of the FIELD element, and for instance the right ascension and declination components are defined by the attributes utype="stc:AstroCoords.Position2D.Value2.C1" and utype="stc:AstroCoords.Position2D.Value2.C2" respectively.

The full specification of the STC components in a VOTable is constructed with 2 GROUPs which follow the STC hierarchy:

1. the coordinate system (AstroCoordSystem) is specified in a VOTable GROUP containing the necessary PARAMeters or PARAMrefs to completely specify the coordinate system; this GROUP must have the attributes
   - utype="stc:AstroCoordSystem"
   - ID="coordSys_name", where coordSys_name is any name which satisfies the ID/IDREF requirements (begin with a letter, and contain alphanumeric characters or the underscore without any whitespace). such that it can be referenced from the utype="stc:AstroCoords" group (item#2)
   This group may be omitted in the case where the coordinate system is part of the STC library [2].
2. the coordinates components are grouped in a GROUP element with the properties:
   - the attribute utype="stc:AstroCoords"
   - an attribute ref="coordSys_name" where coordSys_name is the ID assigned in the first GROUP. A coordinate system existing in the STC library may be referenced by a ivo://STClib/CoordSys identifier (see section 5.1)
   - an attribute ID="coordGroup_name" such that the group can be referenced from FIELD elements; like coordSys_name, the coordGroup_name assigned name must satisfy the ID/IDREF requirements. This GROUP may include PARAMeters to qualify the coordinates if needed, and/or FIELDref references (see the examples below).
3. finally the individual coordinates, defined as FIELD elements, must have the attributes
   - utype="stc:AstroCoords.cootype.coorep.comp" which specifies the role of the field in the STC data model. The italicized components are:
     - cootype can be "Position2D" for spherical coordinates, "Position3D" for 3-D coordinates, "Time" for the time axis;
     - coorep is the coordinate representation: "TimeInstant" for the time axis, "Value2" for spherical coordinates, "Value3" for 3-D coordinates (cartesian or spherical, depending on the parameter defining the flavour, which is characterized by utype="stc:AstroCoordSystem.SpaceFrame.CoordFlavor"
     - comp indicates the component: "C1", "C2", "C3" for the spatial axes, "ISOTime", "MJDTime" or one of the other times defined in the STC [2] for the axis time.
   - ref="coordGroup_name" which refers to the GROUP defined in item#2 (having the utype="stc:AstroCoords").

It is quite possible to have several groups of coordinates in a single table, either in a common system (a common value of the ref attribute of the GROUPs having utype="stc:AstroCoordSystem"), or in several different systems.

5 Examples

Three examples are given here. The first one uses the STClib described in the Appendix C of the STC model [2], the other two give a more complete definition of the coordinate system used.

In all examples, we emphasize with different colors the STC-related utypes and the corresponding ID/ref attributes to visualize their role in the XML output below. We draw attention to the possibility of the double referencing, that is:
1. each **FIELD** which represents a component of the space-time coordinates is referencing the "AstroCoords" **GROUP**. This reference is *required* to ensure a correct interpretation (made by **ref="Coo1"** in the first example below)

2. within the "AstroCoords" **GROUP**, the components *may* be enumerated by means of **FIELDref** elements. This second referencing is *optional*.

### 5.1 List of observations

This simple example of a VOTable document lists 3 observations made with a telescope; each observation is characterized by the location of the CCD center, date/time of observation, and the exposure time. The XML serialisation looks like the following:

```xml
<?xml version="1.0"?>
<VOTABLE version="1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xmlns:stc="http://www.ivoa.net/xml/STC/stc-v1.30.xsd"
         xsi:noNamespaceSchemaLocation="http://www.ivoa.net/xml/VOTable/v1.2">
  <RESOURCE name="myObservations">
    <TABLE name="results">
      <DESCRIPTION>Observation log</DESCRIPTION>
      <PARAM name="Telescope" datatype="float" ucd="phys.size;instr.tel"
             unit="m" value="3.6"/>
      <GROUP ID="Coo1" utype="stc:AstroCoords"
             ref="ivo://STClib/CoordSys#UTC-ICRS-TOPO">
        <FIELDref ref="ObsStart" /> <!-- second referencing, optional -->
        <FIELDref ref="RAJ2000" /> <!-- second referencing, optional -->
        <FIELDref ref="DEJ2000" /> <!-- second referencing, optional -->
      </GROUP>
      <FIELD name="RAJ2000" ucd="pos.eq.ra;meta.main" ref="Coo1"
             utype="stc:AstroCoords.Position2D.Value2.C1"
             datatype="float" precision="4" unit="deg"/>
      <FIELD name="DEJ2000" ucd="pos.eq.dec;meta.main" ref="Coo1"
             utype="stc:AstroCoords.Position2D.Value2.C2"
             datatype="float" precision="4" unit="deg"/>
      <FIELD name="ObsStart" ucd="time.start;obs" datatype="char"
             arraysize="19" unit="s" ref="Coo1"
             utype="stc:AstroCoords.Time.TimeInstant.ISOTime"/>
      <FIELD name="ExpTime" ucd="time.duration;obs.exposure"
             datatype="float" width="6" precision="1" unit="s"/>
    </FIELD>
    <DATA>
      <TABLEDATA>
        <TR>
          <TD>035.0798</TD><TD>-05.2336</TD><TD>2005-11-01T12:00:55</TD><TD>1200</TD>
        </TR>
        <TR>
          <TD>035.0547</TD><TD>-05.2253</TD><TD>2005-11-01T12:25:20</TD><TD>600</TD>
        </TR>
        <TR>
          <TD>035.0463</TD><TD>-05.2503</TD><TD>2005-11-01T12:36:20</TD><TD>600</TD>
        </TR>
      </TABLEDATA>
    </DATA>
  </TABLE>
</RESOURCE>
</VOTABLE>
```
The spherical coordinates (RAJ2000, DEJ2000) defined as FIELDs have their utype attribute which specify their role in the STC model; their ref="Cool1" attribute designates the GROUP having the attribute ID="Cool1". In this example the coordinate system (UTC-ICRS-TOPO) is known in the STC library (see Appendix C of [2]), which is enough to fully define the time reference (UTC), the frame orientation (ICRS) and the reference point (TOPOcentric).

5.2 Extract of the Hipparcos catalog

The Hipparcos catalog is the primary realization of the International Celestial Reference System (ICRS) for optical wavelengths. Its positions and proper motions are given for the epoch J1991.25 (roughly the mid-point of the mission). The astrometric frame is barycentric (the barycenter of the Solar system is assumed to be the origin of the frame); and the times used throughout the Hipparcos catalog (for the epoch photometry) is the geocentric terrestrial time [3].

Notice that the GROUP defining the coordinate system (first group below) is itself made of 2 groups, one for the definition of the time axis, and the second for the definition of the spatial axes.
<table>
<thead>
<tr>
<th>HIP</th>
<th>Vmag</th>
<th>RA (ICRS)</th>
<th>DE (ICRS)</th>
<th>Plx</th>
<th>pmRA</th>
<th>pmDE</th>
<th>e_Plx</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.10</td>
<td>0.00091185</td>
<td>1.08901332</td>
<td>3.54</td>
<td>0.00091185</td>
<td>0.00091185</td>
<td>0.00091185</td>
</tr>
<tr>
<td>2</td>
<td>9.27</td>
<td>0.00379737</td>
<td>-19.49883745</td>
<td>21.90</td>
<td>0.00379737</td>
<td>0.00379737</td>
<td>0.00379737</td>
</tr>
<tr>
<td>3</td>
<td>6.61</td>
<td>0.00500795</td>
<td>38.85928608</td>
<td>2.81</td>
<td>0.00500795</td>
<td>0.00500795</td>
<td>0.00500795</td>
</tr>
<tr>
<td>4</td>
<td>8.06</td>
<td>0.00838170</td>
<td>-51.89354612</td>
<td>3.10</td>
<td>0.00838170</td>
<td>0.00838170</td>
<td>0.00838170</td>
</tr>
</tbody>
</table>
5.3 Ephemeride of Comets

This example gives the position of the comet 125P as a function of time. Notice that the planetary model used is added there via a PARAM having utype="stc:AstroCoordSystem.SpaceFrame.ReferencePosition.PlanetaryEphem"
<GROUP ID="Ephem" utype="stc:AstroCoords" ref="JPL-DE405">
  <PARAM name="Ephemerides" datatype="char" arraysize="*"
    utype="stc:AstroCoords.coord_sys_id" value="UTC-ICRS-GEO"/>
  <FIELDref ref="RA1"/>
  <FIELDref ref="DE1"/>
  <FIELDref ref="Dist1"/>
</GROUP>

<Field name="UTC" ucd="time.epoch" datatype="double" ref="Ephem"
  utype="stc:AstroCoords.Time.TimeInstant.JDTime" width="9" precision="1">
  <DESCRIPTION>Date UTC</DESCRIPTION>
</FIELD>

<Field name="RA" ucd="pos.eq.ra" ref="Ephem" ID="RA1"
  utype="stc:AstroCoords.Position3D.Value3.C1" datatype="double" width="12" precision="8" unit="deg">
  <DESCRIPTION>alpha, degrees</DESCRIPTION>
</FIELD>

<Field name="DE" ucd="pos.eq.dec" ref="Ephem" ID="DE1"
  utype="stc:AstroCoords.Position3D.Value3.C2" datatype="double" width="12" precision="8" unit="deg">
  <DESCRIPTION>delta, degrees</DESCRIPTION>
</FIELD>

<Field name="Dist" ucd="pos.distance" ref="Ephem" ID="Dist1"
  utype="stc:AstroCoords.Position3D.Value3.C3" datatype="double" width="12" precision="9" unit="AU">
  <DESCRIPTION>Distance from geocenter</DESCRIPTION>
</FIELD>

<Field name="Vmag" ucd="phot.mag;em.opt.V" datatype="float"
  width="5" precision="2" unit="mag">
  <DESCRIPTION>Visual magnitude</DESCRIPTION>
</FIELD>

<Data>
  <TableData>
    <TR>
      <TD>2454284.0</TD><TD>180.1745177</TD><TD>+10.2710289</TD>
      <TD>1.468825725</TD><TD>17.06</TD>
    </TR>
    <TR>
      <TD>2454286.0</TD><TD>181.2970157</TD><TD>+09.8077289</TD>
      <TD>1.476798829</TD><TD>17.07</TD>
    </TR>
    <TR>
      <TD>2454288.0</TD><TD>182.4335757</TD><TD>+09.3344139</TD>
      <TD>1.484770578</TD><TD>17.09</TD>
    </TR>
    <TR>
      <TD>2454290.0</TD><TD>183.5839061</TD><TD>+08.8513908</TD>
      <TD>1.492750033</TD><TD>17.11</TD>
    </TR>
    <TR>
      <TD>2454292.0</TD><TD>184.7477408</TD><TD>+08.3589893</TD>
      <TD>1.500745242</TD><TD>17.13</TD>
    </TR>
  </TableData>
</Data>
</TABLE>
</RESOURCE>
</VOTABLE>
6 Summary of Interpretation and Defaults

A VOTABLE resource may contain multiple TABLEs and each of these tables may contain many header PARAMs and many FIELD columns, possibly giving several sets of positions and times in several different coordinate systems. For any PARAM or FIELD that gives an STC utype, there must be a ref attribute pointing to the GROUP that contains the STC AstroCoords (or Coords) definition. This is how we tie a particular utype to a particular STC instance. For example:

```xml
<Field name="ObsStart" utype="stc:AstroCoords.Time.TimeInstant.ISOTime" ref="Coo1" .../>
```
says that the column in question contains the Time value for an AstroCoords instance whose frame is defined in the group which begins with `<GROUP ID="Coo1" utype="stc:AstroCoords" .../>`.

An AstroCoords instance may contain all of space, time, spectral and redshift coordinates. It is often meaningful to omit the spectral and redshift coordinates. Space and time coordinates are usually more tightly coupled. While in practice for some common coordinate systems and astronomical contexts it is reasonable to give a position with no time, or a time not explicitly tied to a position, this is not recommended.

This AstroCoords instance in turn contains a reference to the relevant AstroCoordSystem (or CoordSys) used, either to a group having a stc:AstroCoordSystem (or stc:CoordSys) utype, or with an appropriate reference to the bf STClib component.

### Table 1: Most important stc:AstroCoords components in FIELD elements

<table>
<thead>
<tr>
<th>utype</th>
<th>ucd</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>stc:AstroCoords.Time...</td>
<td>time components(1).</td>
<td></td>
</tr>
<tr>
<td>TimeInstant.ISOTime</td>
<td>time.start,obs.exposure</td>
<td>Date with ISO-8601 convention (e.g. 2008-10-25T12:14:15)</td>
</tr>
<tr>
<td>TimeInstant.JDTime</td>
<td>time.start</td>
<td>Julian date, applies to e.g. a variable phenomenon (e.g. 2454765.09323)</td>
</tr>
<tr>
<td>TimeInstant.TimeOrigin.JDTime</td>
<td>time</td>
<td>Reference date</td>
</tr>
<tr>
<td>TimeInstant.TimeOffset</td>
<td>time</td>
<td>Time elapsed since the TimeOrigin</td>
</tr>
<tr>
<td>stc:AstroCoords.Position2D...</td>
<td>position on the celestial sphere</td>
<td></td>
</tr>
<tr>
<td>Value2.C1</td>
<td>pos.eq.ra</td>
<td>Right ascension or longitude</td>
</tr>
<tr>
<td>Value2.C2</td>
<td>pos.eq.dec</td>
<td>Declination or Latitude</td>
</tr>
<tr>
<td>Error2Radius</td>
<td>stat.error;pos.eq</td>
<td>Error radius of the spherical position</td>
</tr>
<tr>
<td>Error2.C1</td>
<td>stat.error;pos.eq.ra</td>
<td>Error on the Right Ascension or Longitude</td>
</tr>
<tr>
<td>Error2.C2</td>
<td>stat.error;pos.eq.dec</td>
<td>Error on the Declination or Latitude</td>
</tr>
<tr>
<td>stc:AstroCoords.Velocity2D...</td>
<td>proper motion on the celestial sphere</td>
<td></td>
</tr>
<tr>
<td>Velocity1D</td>
<td>pos.pm</td>
<td>Total proper motion</td>
</tr>
<tr>
<td>Velocity2D.C1</td>
<td>pos.pm;pos.eq.ra</td>
<td>Proper motion in RA or Longitude</td>
</tr>
<tr>
<td>Error2.C1</td>
<td>stat.error;pos.pm;pos.eq.ra</td>
<td>Error on a proper motion in RA or Longitude</td>
</tr>
<tr>
<td>stc:AstroCoords.Position3D...</td>
<td>position in a 3-D spherical system(2), as in section 5.3</td>
<td></td>
</tr>
<tr>
<td>Value3.C1</td>
<td>pos.ecliptic.lon</td>
<td>Ecliptic longitude</td>
</tr>
<tr>
<td>Value3.C2</td>
<td>pos.ecliptic.lat</td>
<td>Ecliptic latitude</td>
</tr>
<tr>
<td>Value3.C3</td>
<td>pos.distance;pos.barycentric</td>
<td>Distance to solar system barycenter</td>
</tr>
</tbody>
</table>

(1) the reference position to which the time applies is defined in a parameter having a utype stc:AstroCoordSystem.SpaceFrame.ReferencePosition

(2) requires to specify a SPHERICAL frame (in stc:AstroCoordSystem.SpaceFrame.CoordFlavor component) and a value of 3 for the number of axes (in stc:AstroCoordSystem.SpaceFrame.coord_naxes)
6.1 stc:AstroCoords components

The actual coordinate components which are present in a VOTable as FIelds are characterized by

- a reference to a GROUP gathering the coordinate components, e.g. ref="Coo1"
- their utype, e.g. utype="stc:AstroCoords.Position2D.Value2.C1" for the right ascension.
- their ucd attribute, e.g. ucd="pos.eq.ra"
- ... and the other attributes necessary for a correct interpretation of the data: datatype, unit, width, precision, etc...

Illustrations with actual examples are given in section 5 above; the most important utype and ucd attributes of use in this context are listed in Table 1. Many more parameters are actually available in the STC model [2], which should be consulted for details.

6.2 stc:AstroCoordSystem components

The coordinate systems used in a VOTable, if these are not part of the STC Standard Library (Appendix C of [2]), must be defined in GROUP elements having the utype="stc:AstroCoordSystem" attribute, and an ID attribute to which the group of coordinate elements defined above can refer.

Table 2: Most important TimeScale values

<table>
<thead>
<tr>
<th>TimeScale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT</td>
<td>Terrestrial time</td>
</tr>
<tr>
<td>TAI</td>
<td>Temps Atomique International TT+32.184s</td>
</tr>
<tr>
<td>UTC</td>
<td>Coordinated Universal Time TAI+leap seconds</td>
</tr>
<tr>
<td>LST</td>
<td>Local Sideral Time (needs ObservationLocation)</td>
</tr>
<tr>
<td>LOCAL</td>
<td>Local definition</td>
</tr>
</tbody>
</table>

Table 3: Most important ReferencePosition values

<table>
<thead>
<tr>
<th>ReferencePosition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOPOCENTER</td>
<td>local position, on the surface of Earth</td>
</tr>
<tr>
<td>GEOCENTER</td>
<td>center of Earth</td>
</tr>
<tr>
<td>HELIOCENTER</td>
<td>center of Sun</td>
</tr>
<tr>
<td>BARYCENTER</td>
<td>barycenter of the Solar System</td>
</tr>
<tr>
<td>LSR</td>
<td>Local Standard of Rest</td>
</tr>
<tr>
<td>GALACTIC_CENTER</td>
<td>center of our Galaxy</td>
</tr>
</tbody>
</table>

Table 4: Most important astronomical frame types

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPHERICAL</td>
<td>Spherical coordinates, 2-D (2 angles) and 3-D(additional distance) coord_naxes required for 3-D</td>
</tr>
<tr>
<td>CARTESIAN</td>
<td>Cartesian frame</td>
</tr>
<tr>
<td>POLAR</td>
<td>Longitude + polar distance</td>
</tr>
</tbody>
</table>

The temporal, spatial (and eventually the spectral, velocity / redshift) components are defined as subgoups with the appropriate utypes, following the schema:
The most frequent values of the parameters defining the time are summarized in Table 2 (time scales) and Table 3 (reference location of time measurements); among the parameters which define a spatial frame, Table 3 defines the origin of the frame (which may differ from the reference location of time measurements), Table 4 defines the frame type and dimensionality (standard frames used in astrometry are 2-D spherical), and Table 5 summarized the most frequently frames used in astrometry.

<table>
<thead>
<tr>
<th>Frame</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICRS</td>
<td>International Reference System</td>
<td>Compatible with FK5(J2000)</td>
</tr>
<tr>
<td>FK5</td>
<td>Equatorial frame based on FK5</td>
<td>Requires the Equinox (default J2000)</td>
</tr>
<tr>
<td>FK4</td>
<td>Equatorial frame based on FK4</td>
<td>Requires the Equinox (default B1950)</td>
</tr>
<tr>
<td>ECLIPTIC</td>
<td>Ecliptic frame</td>
<td>Requires the Equinox ((default J2000)</td>
</tr>
<tr>
<td>GALACTIC</td>
<td>Galactic frame</td>
<td>Also named GALACTICII</td>
</tr>
<tr>
<td>SUPER_GALACTIC</td>
<td>Local Group</td>
<td></td>
</tr>
<tr>
<td>J2000</td>
<td>Equatorial on FK5, Equinox=J2000</td>
<td></td>
</tr>
<tr>
<td>B1950</td>
<td>Equatorial on FK4, Equinox=B1950</td>
<td></td>
</tr>
</tbody>
</table>

7 References

[1] François Ochsenbein, et al. VOTable Recommendation
http://ivoa.net/Documents/latest/VOTable.html

[2] Arnold Rots Space-Time Coordinate Metadata for the Virtual Observatory (v1.30)
http://ivoa.net/Documents/latest/STC.html