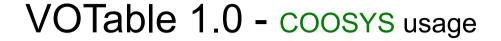
Coordinate specification in VOTable - State of the art -

Pierre Fernique - CDS





Coordinates story



VOTable 1.1 - coosys usage

Referencing STC in VOTable (note 1.1 – author Ochsenbein)

VOTable 1.2 - COOSYS is deprecated, in favor of a reference to STC=> IVOA note « Referencing STC in VOTable » (note 1.1), but example inside related to note 2.0.

Referencing STC in VOTable (note 2.0 – author Demleitner)

VOTable 1.3 – ref note 1.1 but example 2.0.

2004

COOSYS VOTable 1.1 REC example

```
<VOTABLE version="1.1" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"</pre>
xsi:noNamespaceSchemaLocation="http://www.ivoa.net/xml/VOTable/VOTable/v1.1">
 <CODSYS ID="J2000" equinox="J2000." epoch="J2000." system="eq_FK5"/>
<RESOURCE name="myFavouriteGalaxies"</pre>
  <TABLE name="results">
    <DESCRIPTION>Velocities and Distance estimations
    <PARAM name="Telescope" datatype="float" ucd="phys.size;instr.tel"
          unit="m" value="3.6"/>
    datatype="float" width="6" precision="2" unit="deg"/>
    <FIELD name="Dec" ID="col2" "pos.eq.dec;meta.main" ref="J2000"
          datatype="float" width="6" precision="2" unit="deg"/>
```



STC note 1.1

VOTable 1.3 REC reference

```
<GROUP ID="Coo1" utype="stc:AstroCoords" >
  <PARAM name="cooframe" datatype="char" arraysize="*" ucd="pos.frame"</pre>
         utype="stc:AstroCoords.coord_system_id"
         value="UTC-ICRS-TOPO" />
  <FIELDref ref="ObsStart" />
  <FIELDref ref; "RAJ2000"/>
  <FIELDref ref "DEJ2000"/
</GROUP>:
<FIELD name="FAJ2000" ucd="pos.eq.ra;meta.main" ref="Coo1"</pre>
       ID="RAJ2000" utype="stc:AstroCoords.Position2D.Value2.C1"
       datatype="float" precision="4" unit="deg \ />
<FIELD name DEJ2000" ucd="pos.eq.dec;metalmain" ref="Coo1"
       ID="DEJ2000" utype="stc:AstroCoords Position2D.Value2.C2"
       datatype="float" precision="4" unit=\deg" />
<FIELD name="ObsStart" ucd="time.start;obs" datatype="char" xtype="iso8601"</pre>
       arraysize="19" unit="s" ID="ObsStart ref="Coo1"
       utype="stc:AstroCoords.Time.TimeInstant.ISOTime" />
<FIELD name="ExpTime" ucd="time.duration;obs.exposure"
       datatype="float" width="6" precision="1" unit="s"/>
```



STC note 1.1

VOTable 1.3 REC reference

```
<GROUP ID="Coo1" utype="stc:AstroCoords" \geq
   <PARAM name="cooframe" datatype="char" arraysize="*" ucd="pos.frame"</pre>
          utype="stc:AstroCoords.coord_system_id"
          value="UTC-ICRS-TOPO" />
                                                              stc:AstroCoords
   <FIELDref ref="ObsStart" />
   <FIELDref ref="RAJ2000"/>
                                                  stc:AstroCoords.coord_system_id
   <FIELDref ref="DEJ2000"/>
 </GROUP>
 <FIELD name="RAJ2000" ucd="pos.eq.ra;meta.main" ref="Coo1"
        ID="RAJ2000" utype="stc:Ast/roCoords.Position2D.Value2.C1"
        datatype="float" precision = "4" unit="deg" />
 <FIELD name="DEJ2000" ucd="pos.eq.dec;meta.main" ref="Coo1"</pre>
        ID="DEJ2000" utype="stc:/AstroCoords.Position2D.Value2.C2"
        datatype="float" precision="4" unit="deg" />
 <FIELD name="ObsStart" ucd="t/ime.start;obs" //atatype="char" xtype="iso8601"</pre>
                                     | "ObsStart/" ref="Coo1"
stc:AstroCoords.Position2D.Value2.C1
                                      .TimeInstant.ISOTime" />
                                          ~~`obs.exposure"
        stc:AstroCoords.Position2D.Value2.C1 on="1" unit="a"/>
```

STC note 2.0

VOTable 1.3 REC example

```
<VOTABLE version="1.3" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"</pre>
xmlns="http://www.ivoa.net/xml/VOTable/v1.3"
xmlns:stc="http://www.ivoa.net/xml/STC/v1.30" >
  <RESOURCE name="myFavouriteGalaxies">
    <TABLE name="results">
      <DESCRIPTION>Velocities and Distance estimations
      <GROUP utype="stc:CatalogEntryLocation">
        <PARAM name="href" datatype="char" arraysize="*"
               utype="stc:AstroCoordSystem.href" value="ivo://STClib/CoordSys#UTC-ICRS-TOPO
        <PARAM name="URI" datatype="char" arraysize="*"
               utype="stc:DataModel.URI" value="http://www.ivoa.net/xml/STC/stc-v1.30.xsd"/
        <FIELDref utype="stc:AstroCoords.Position2D.Value2_21" ref="col1"/>
        <FIELDref utype="stc:AstroCoords.Position2D.Value2.C2" ref="col2"/</pre>
     </GROUP>
     <PARAM name="Telescope" datatype="float" ucd="phys.size;instr.tel"
             unit="m" value="3 6"/>
      <FIELD name="RA" ID="col1" ucd="pos.eq.ra;meta.main"</pre>
             datatype="float" width="6" precision="2" unit="deg"/>
      <FIELD name="Dec" ID="col2" ucd="pos.eq.dec;meta.main"</pre>
             datatype="float" width="6" precision="2" unit="deg"/>
      <FIELD name="Name" ID="col3" ucd="meta.id;meta.main"</pre>
             datatype="char" arraysize="8*"/>
```

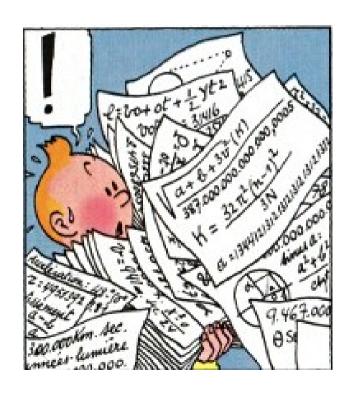
STC note 2.0

stc:CatalogEntryLocation

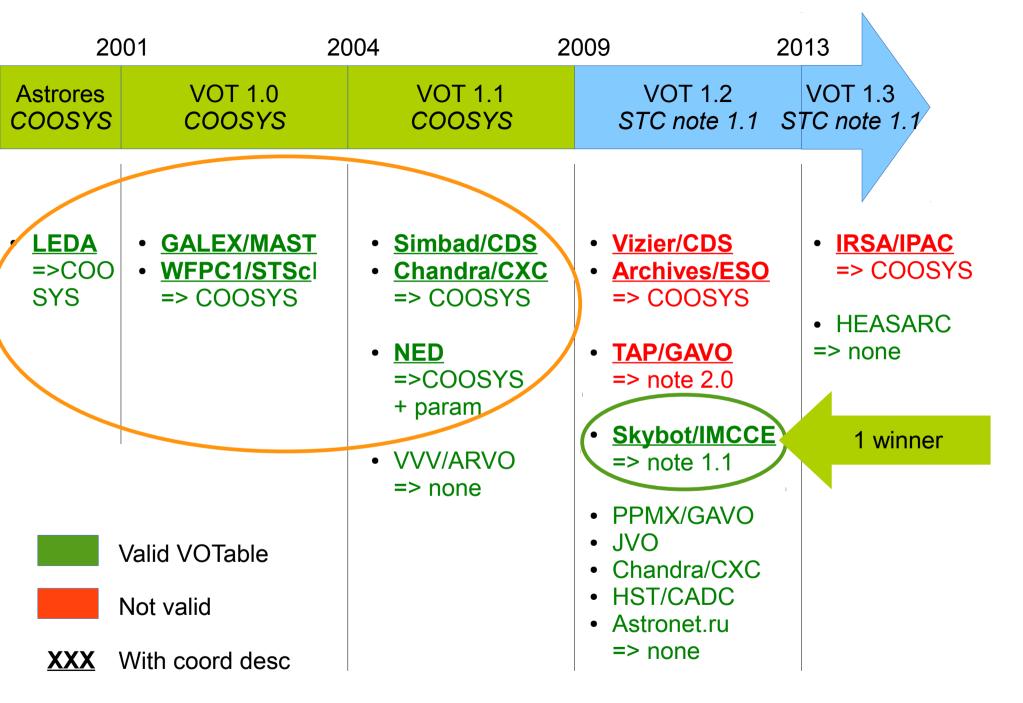
```
<VOTABLE version="1.3" xmlns:xsi="ht/to://w|</pre>
                                                  stc:AstroCoordSystem.href
xmlns="http://www.ivoa.net/xml/VO/Table/v1
xmlns:stc="http://www.ivoa.net/xml/STC/x1.30" >
  <RESOURCE name="myFavouriteGa/laxies">
                                                  stc:AstroCoords.Position2D.Value2.C1
    <TABLE name="results">
      <DESCRIPTION>Velocities and Distance es;
                                                    stc:AstroCoords.Position2D.Value2.C2
      <GROUP utype="stc:CatalogEntryLocation">
        <PARAM name="href" datatype="char" arraysize="*"
               utype="stc:AstroCoordSystem.href/ value="ivo://STClib/CoordSys#UTC-ICRS-TOPO
        <PARAM name="URI" datatype="char" arraysize="*"
               utype="stc:DataModel.LRI" value="http://www.ivoa.net/xml/STC/stc-v1.30.xsd"/
        <FIELDref utype="stc:AstroCoords.Position2D.Value2.C1" ref="col1"/>
        <FIELDref utype="stc:AstroCoords.Position2D.Value2.C2" ref="col2"/>
      </GROUP>
      <PARAM name="Telescope" datatype="float" ucd="phys.size;instr.tel"
             unit="m" value="3.6"/>
      <FIELD name="RA" ID="col1" ucd="pos.eq.ra;meta.main"</pre>
             datatype="float" width="6" precision="2" unit="deg"/>
      <FIELD name="Dec" ID="col2" ucd="pos.eq.dec;meta.main"</pre>
             datatype="float" width="6" precision="2" unit="deg"/>
      <FIELD name="Name" ID="col3" ucd="meta.id;meta.main"</pre>
             datatype="char" arraysize="8*"/>
```

Which standard is really implemented?

20 providers has been checked last week...









Planck/ESA ??

State of the art / Provider side

- Since we deprecated COOSYS (2009), only IMCEE has been achieved to describe coordinates according to the current standard
- A large part of the providers has prefered to keep COOSYS:
 - either by avoiding to upgrade their VOTable,
 - or by providing erroneous VOTable
- Other part of providers has just decided to remove coordinate description
- GAVO implements the STC note 2.0 (the author of the note 2.0)
- NED decided to define its own private method (dedicated param)



State of the art / Client side

Aladin Desktop & Lite, TOPcat, Stilts, Saada, CDS/Xmatch, VAOportal, DS9, Savot java lib, SAMP java lib, ...

 Most of clients still uses empirical discovery rules based on column name, UCD, unit.

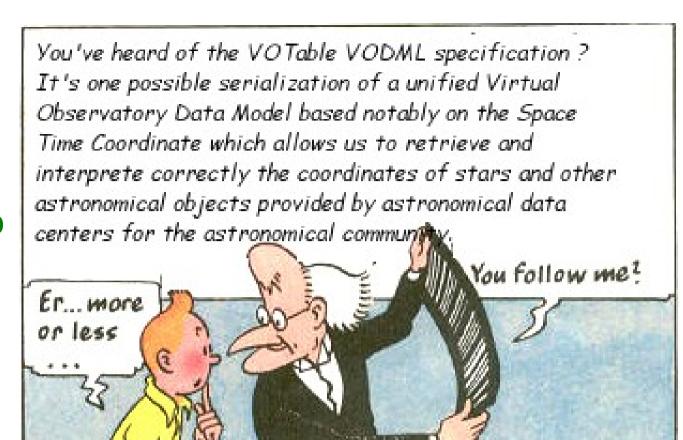
 Some clients use explicit description (ask the user's help, or via explicit parameters)

 One client tries to interpret COOSYS and/or STC Note and/or variations



Why?

- 1)Providers and developers are too lazy?
- 2)In fact, coordinate specification is not really required?
- 3)STC note is too complex?
- 4)The STC « note » status is guilty?



- 5)There is a risk that STC note continues to change?
- 6) Need more time than 5 years?



GAIA is observing...

The implicit ICRS/ep2000 default will be no longer a solution

```
<GROUP utype="stc:CatalogEntryLocation">
  <PARAM arraysize="*" datatype="char" name="CoordFlavor"
          utype="stc:AstroCoordSystem.SpaceFrame.CoordFlavor" value"SPHERICAL"/>
   <PARAM arraysize="*" datatype="char" name="coord_naxes"
          utype="stc:AstroCoordSystem.SpaceFrame.CoordFlavor.coord_naxes" value="3"/>
  <PARAM arraysize="*" datatype="char" name="CoordRefFrame"
          utype="stc:AstroCoordSystem.SpaceFrame.CoordRefFrame" value="ICRS"/>
  <PARAM arraysize="*" datatype="char" name="Epoch"
          utype="stc:AstroCoords.Position3D.Epoch" value="2010.0"/>
  <PARAM arraysize="*" datatype="char" name="yearDef"
          utype="stc:AstroCoords.Position3D.Epoch.yearDef"/value="J"/>
  <PARAM arraysize="*" datatype="char" name="URI"
          utype="stc:DataModel.URI" value="http://www.iyoa.net/xml/STC/stc-v1.30.xsd"/>
  <FIELDref ref="alpha" utype="stc:AstroCoords.Position3D.Value3.C1"/>
   <FIELDref ref="delta" utype="stc:AstroCoords.Posit/ion3D.Value3.C2"/>
  <FIELDref ref="distance" utype="stc:AstroCoords./osition3D.Value3.C3"/>
  <FIELDref ref="mualpha" utype="stc:AstroCoords./velocity3D.Value3.C1"/>
   <FIELDref ref="mudelta" utype="stc:AstroCoords.Velocity3D.Value3.C2"/>
   <FIELDref ref="radialvelocity" utype="stc:AstroCoords.Velocity3D.Value3.C3"/>
</GROUP>
```



How to improve the situation?

- 1) Remove any coordinate specification & continue to use empirical discovery rules based on Name/UCD/Unit
 - => Easy to do, Imply basic ICRS/ep2000 default, Have to recognize that this issue is too complex for IVOA.

2) Back to COOSYS?

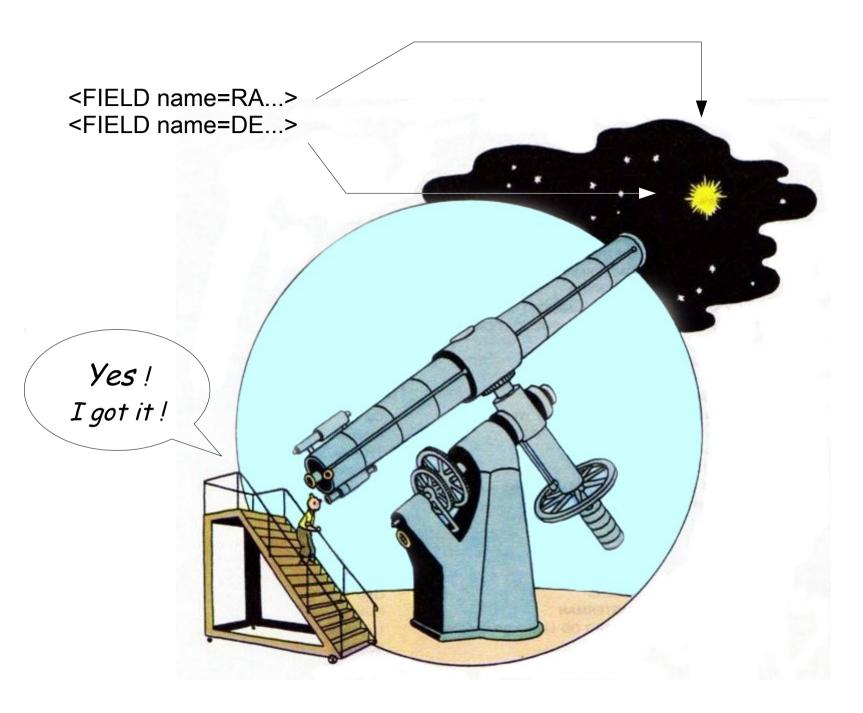
=> Easy to do, Back to a clean situation, Have to recognize that we failed to improve coordinate specification



How to improve the situation?

- 3)Fix & validate the STC note? (thanks to the new note IVOA process)
 - => Solve the issue, Re-activate STC note process/debates, Is there a real chance to succeed? Will clash with future VODML serialization.
- 4) Deprecate the STC note & wait the future VODML STC2 description of coordinates ? (when it will be ready)
 - => More elegant/unified solution. Probably a long process as based on not yet stable DM. Probably complex & difficult to implement. Is there a real chance to succeed?







Suggestion (pragmatic approach)

What about 2 + 4 solution ?

Un-deprecate COOSYS to clean up the situation immediately.

Move to VODML when it will be usable (DM effort achieved – notably STC2).

Note: The 2 methods do not clash and could be used together for a smooth transition.

