

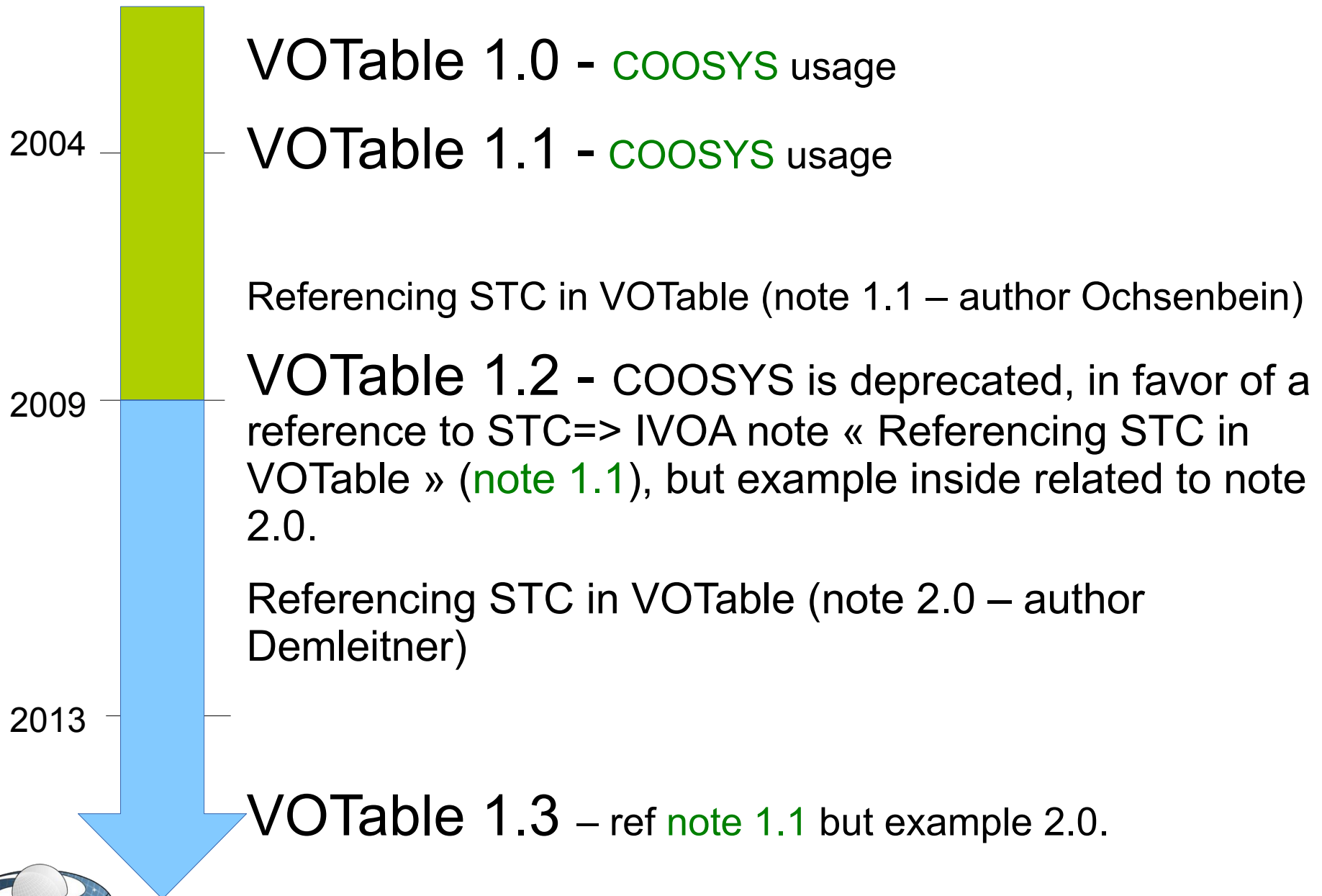
Coordinate specification in VOTable

- State of the art -

Pierre Fernique - CDS



Coordinates story



COOSYS

VOTable 1.1 REC example

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



STC note 1.1

VOTable 1.3 REC reference

```
<GROUP ID="Cool" utype="stc:AstroCoords" >
  <PARAM name="cooframe" datatype="char" arraysize="*" ucd="pos.frame"
    utype="stc:AstroCoords.coord_system_id"
    value="UTC-ICRS-TOPO" />
  <FIELDref ref="ObsStart" />
  <FIELDref ref="RAJ2000" />
  <FIELDref ref="DEJ2000" />
</GROUP>

<FIELD name="RAJ2000" ucd="pos.eq.ra;meta.main" ref="Cool"
  ID="RAJ2000" utype="stc:AstroCoords.Position2D.Value2.C1"
  datatype="float" precision="4" unit="deg" />
<FIELD name="DEJ2000" ucd="pos.eq.dec;meta.main" ref="Cool"
  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"
  arraysize="19" unit="s" ID="ObsStart" ref="Cool"
  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="Cool" utype="stc: AstroCoords" >  
  <PARAM name="cooframe" datatype="char" arraysize="*" ucd="pos.frame"  
    utype="stc: AstroCoords.coord_system_id"  
    value="UTC-ICRS-TOPO" />  
  <FIELDref ref="ObsStart" />  
  <FIELDref ref="RAJ2000" />  
  <FIELDref ref="DEJ2000" />  
</GROUP>
```

stc: AstroCoords

stc: AstroCoords.coord_system_id

```
<FIELD name="RAJ2000" ucd="pos.eq.ra;meta.main" ref="Cool"  
  ID="RAJ2000" utype="stc: AstroCoords.Position2D.Value2.C1"  
  datatype="float" precision="4" unit="deg" />  
<FIELD name="DEJ2000" ucd="pos.eq.dec;meta.main" ref="Cool"  
  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"  
  ID="ObsStart" ref="Cool"  
  utype="stc: AstroCoords.TimeInstant.ISOTime" />  
<FIELD name="ExpTime" ucd="time.duration;obs.exposure"  
  ID="ExpTime" ref="Cool"  
  utype="stc: AstroCoords.Position2D.Value2.C1"  
  precision="1" unit="s" />
```

stc: AstroCoords.Position2D.Value2.C1

stc: AstroCoords.Position2D.Value2.C1

STC note 2.0

VOTable 1.3 REC example

```
<VOTABLE version="1.3" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  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</DESCRIPTION>
      <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.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"
        datatype="float" width="6" precision="2" unit="deg" />
      <FIELD name="Dec" ID="col2" ucd="pos.eq.dec;meta.main"
        datatype="float" width="6" precision="2" unit="deg" />
      <FIELD name="Name" ID="col3" ucd="meta.id;meta.main"
        datatype="char" arraysize="8*" />
    </TABLE>
  </RESOURCE>
</VOTABLE>
```

STC note 2.0

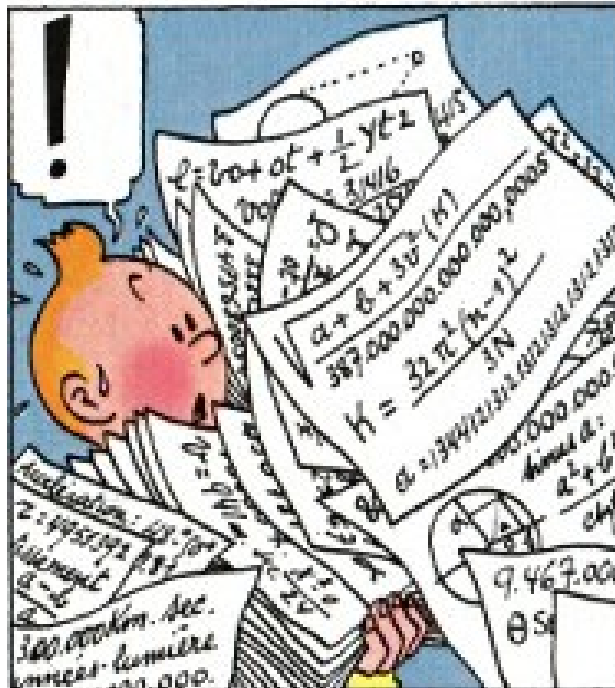
```
<VOTABLE version="1.3" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.ivoa.net/xml/VOTable/v1.0"
  xmlns:stc="http://www.ivoa.net/xml/STC/v1.30" >
  <RESOURCE name="myFavouriteGalaxies">
    <TABLE name="results">
      <DESCRIPTION>Velocities and Distance estimates</DESCRIPTION>
      <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.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"
        datatype="float" width="6" precision="2" unit="deg"/>
      <FIELD name="Dec" ID="col2" ucd="pos.eq.dec;meta.main"
        datatype="float" width="6" precision="2" unit="deg"/>
      <FIELD name="Name" ID="col3" ucd="meta.id;meta.main"
        datatype="char" arraysize="8*"/>
    </TABLE>
  </RESOURCE>
</VOTABLE>
```

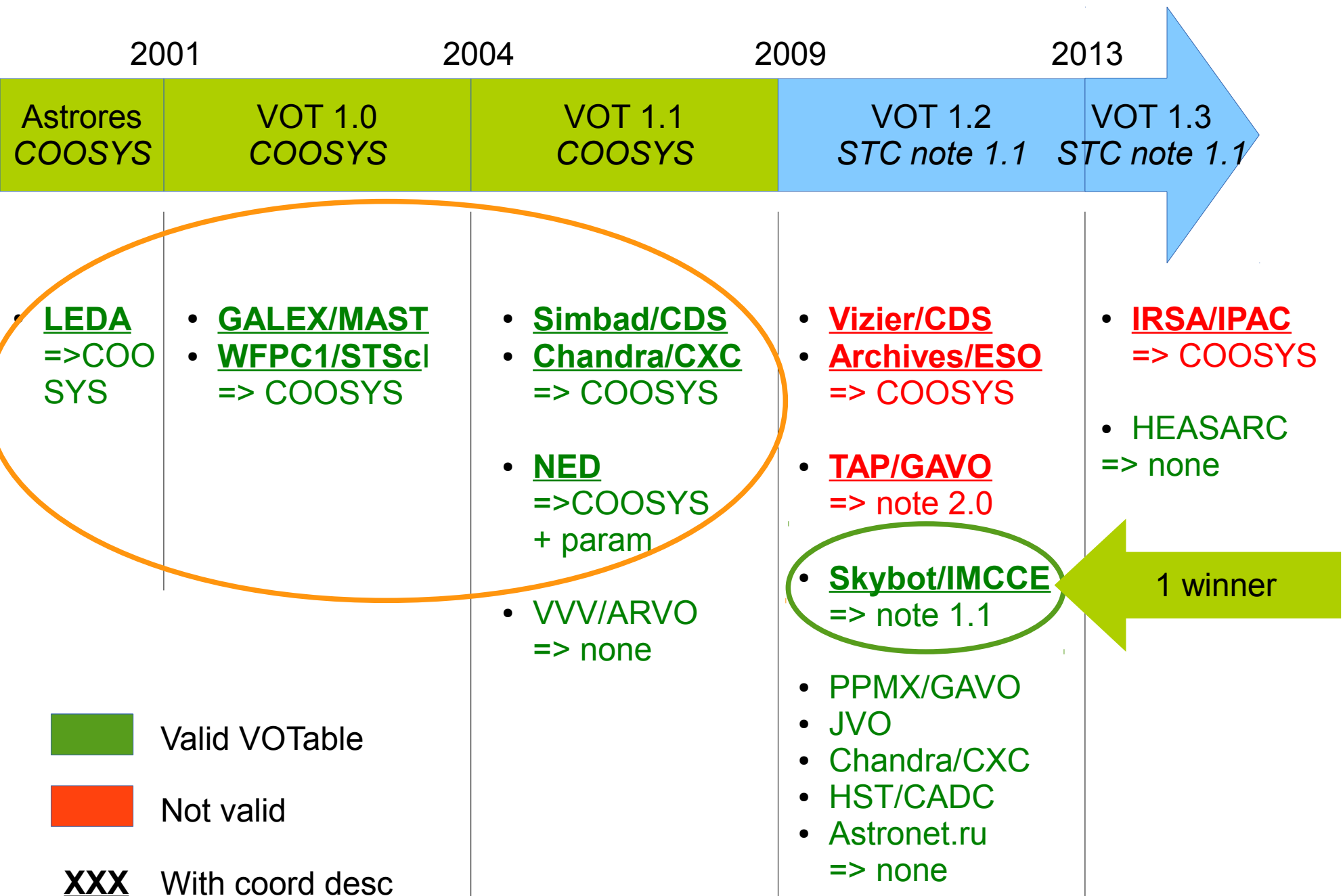
Annotations:

- stc:CatalogEntryLocation
- stc:AstroCoordSystem.href
- stc:AstroCoords.Position2D.Value2.C1
- stc:AstroCoords.Position2D.Value2.C2

Which standard is really implemented ?

20 providers has been checked last week...





 Valid VOTable

 Not valid

XXX With coord desc

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 preferred 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

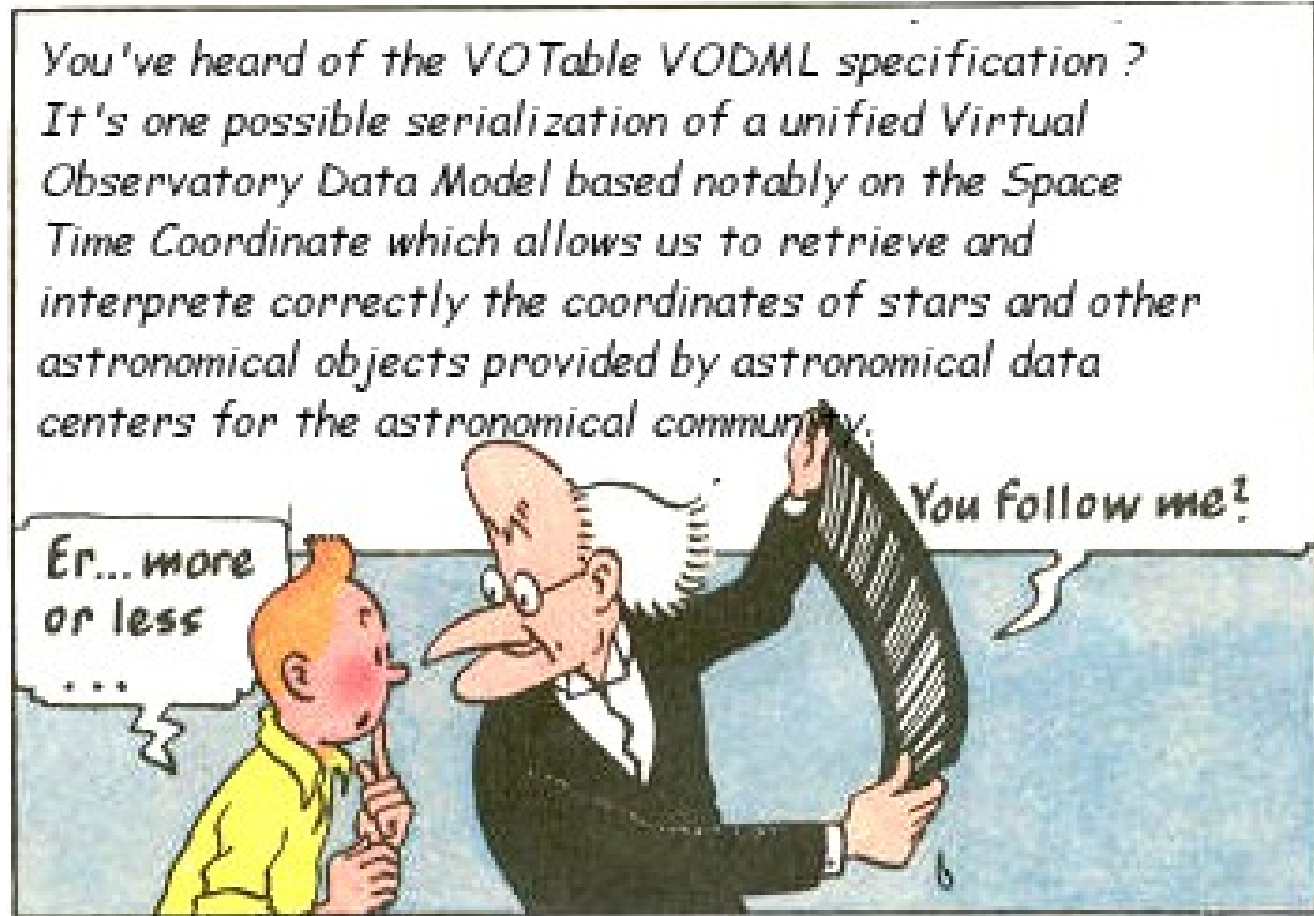
Aladin Desktop & Lite, TOPcat, Stilts, Saada, CDS/Xmatch, VAOportal, DS9, Savot java lib, SAMP java lib, ...

- 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.ivoa.net/xml/STC/stc-v1.30.xsd"/>
  <FIELDref ref="alpha" utype="stc:AstroCoords.Position3D.Value3.C1"/>
  <FIELDref ref="delta" utype="stc:AstroCoords.Position3D.Value3.C2"/>
  <FIELDref ref="distance" utype="stc:AstroCoords.Position3D.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>
```

Epoch J2010



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 ?

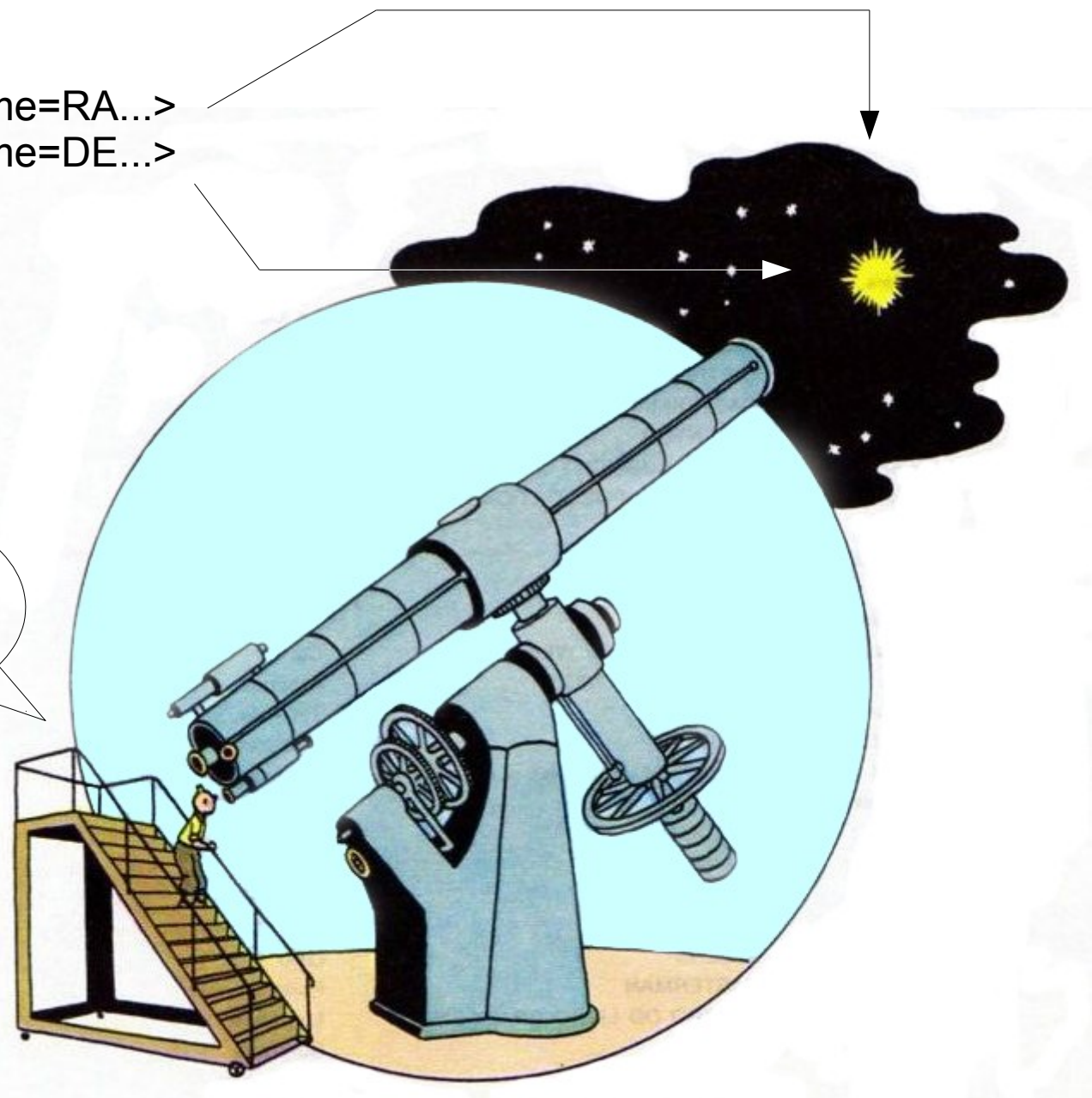
3) Fix & validate the STC note ? (thanks to the new note IVOA process)
=> **Solve the issue**, Re-activate STC note process/debates, **Is there a real chance to succeed ? Will clash with future VODML serialization.**

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 ?**



<FIELD name=RA...>
<FIELD name=DE...>

*Yes!
I got it!*



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.

