Map (VizieR) tables with measurement

Contributors:

G.Landais, F.Bonnarel, M.Louys, A.Nebot, L.Michel

Table metadata - pre-requisite

VOTable serialization for the VizieR tables

~20,000 catalogues, 40,000 tables coming from :

- authors publications
- Surveys and space agencies : Gaia, PanSTARRS, ESO, CADC, ..

Impossible to fit systematically tables into a VO DataModel

State of the art

- Format: VOTable V1.3, (1.1, 1.2) and 1.4 : COOSYS, TIMESYS -
- Metadata available with UCD,
- Columns association with the **VizieR nomenclature**
  e.g: Bmag, e_Bmag, f_Bmag...

Questions

- How to map VizieR table with measurement ?
  (photometry, position, time)
- *Howto adapt the current VizieR nomenclature to a VO-serialisation ?*

Serialisation proposal

Serialization based on 2 main concepts

1) **Measurement** : add metadata on table using measurements/coords DM
2) **Columns association** to link a reference field to a list of dependent fields.
   Association mechanism that allows :
   - Plots (x,y) (e.g.: lighcurves, SED)
     error, limits possible with measurement groups
   - Multi-plots(x,y1,y2,..) : (e.g.: multispec)

     → DM VOInstance serialisation

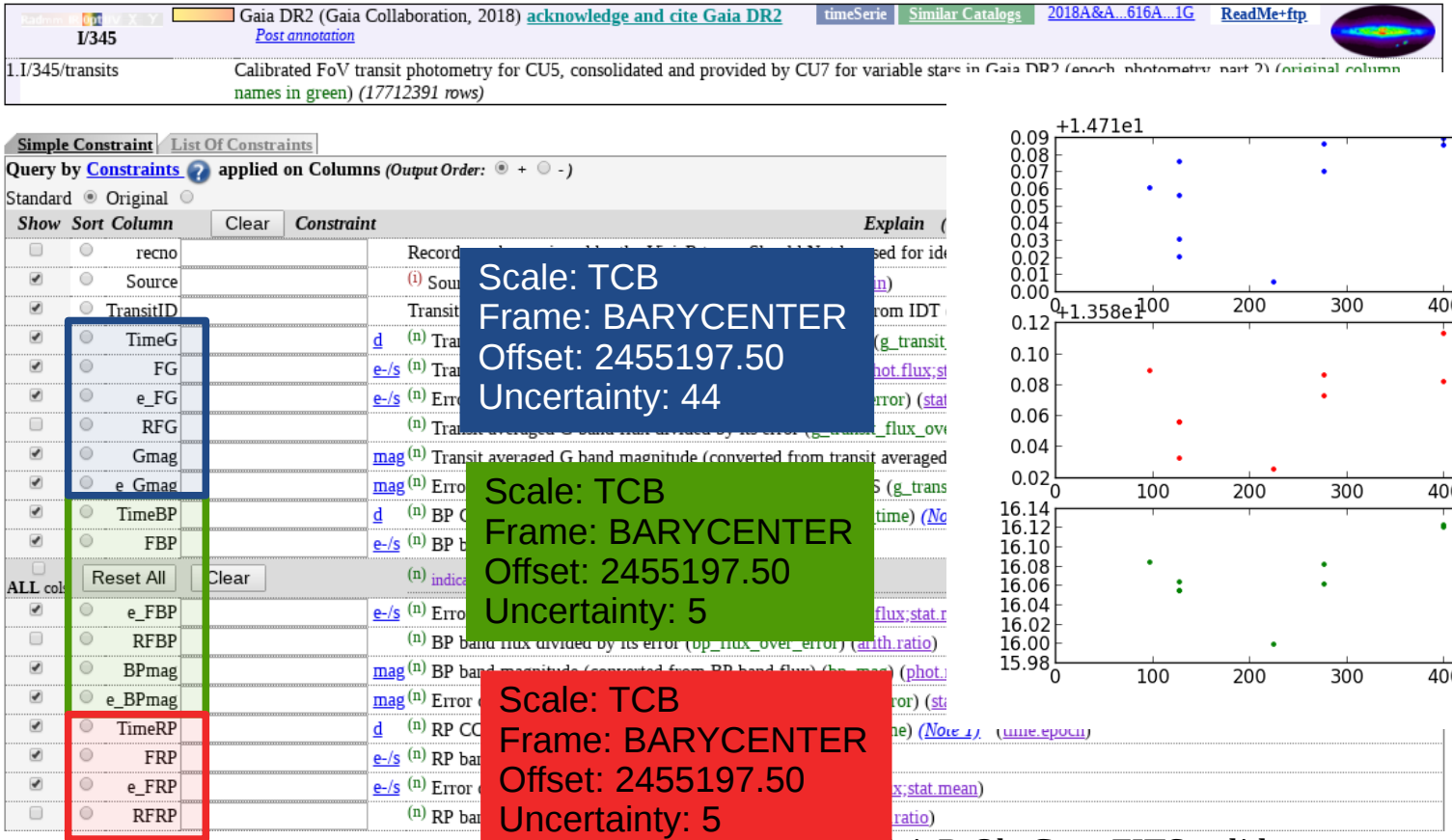
Requirements

- Independence of measurement and association
- No mandatory measurement property (mapping allows empty meta-data)
- A simple serialization based on GROUP, utype
- A GROUP is referring (only) 1 measure
- Readable serialisation by limiting the nested group (avoid too much GROUP into GROUP...)

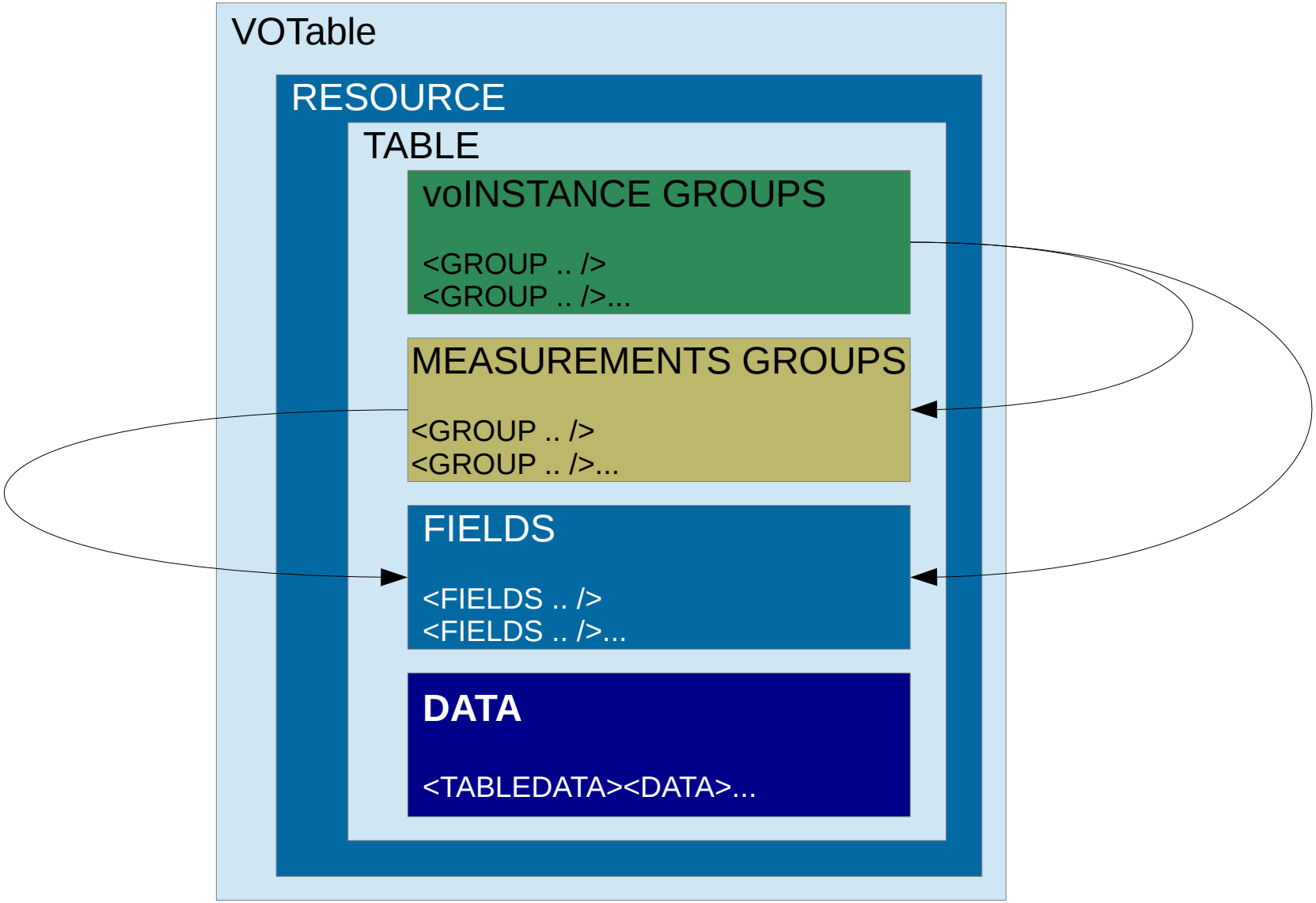
Example

GAIA transits table serialization to light curves

- 3 time columns (TimeG, TimeRP, TimeBP)
- Photometry related to one time-column (Gmag, RPMag, BPmag)
- Table composed with observations (Source)



VOTable serialization architecture



Define measurement using coords/stc

FIELDS described in VOTAble header

```
<FIELD name="Source" ucd="meta.id;meta.main" datatype="long" width="19">
  <DESCRIPTION>Source Identifier (source id) (G2)</DESCRIPTION>
</FIELD>
<FIELD name="TimeG" ucd="time.epoch" ref="time 1" id=" timeG" datatype="double" unit="d">
  <DESCRIPTION>? Transit averaged G band observation time</DESCRIPTION>
</FIELD>
<FIELD name="Gmag" ucd="phot.mag;stat.mean;em.opt" id=" Gmag" datatype="double" unit="mag">
  <DESCRIPTION>? Transit averaged G band magnitude </DESCRIPTION>
</FIELD>
<FIELD name="e Gmag" ucd="stat.error;phot.mag;em.opt.B" id=" e Gmag" datatype="double" unit="mag">
  <DESCRIPTION>? Error on transit averaged G band magnitude</DESCRIPTION>
</FIELD>
```

Measurements applied to FIELDS

```
<TIMESYS ID="time 1" refposition="BARYCENTER"
         timeorigin="2455197.500000" timescale="TCB"/>
```

```
<!-- Time definition applied to column TimeG -->
<GROUP ID='dm-timeG' utype='meas:Time'>
    <PARAM utype='coords:TimeFrame.refposition' value='BARYCENTER'/>
    <PARAM utype='coords:TimeOffset.timeorigin' value='2455197.500000'/>
    <PARAM utype='coords:TimeFrame.timescale' value='TCB'/>
    <PARAM utype='meas:Error.symmetrical.radius' value='44'/>
    <FIELDref ref='TimeG' utype='coords:TimeOffset.value'/>
</GROUP>
```

TIMESYS generalized into a DataModel group

```
<!-- Photometry definition applied to magnitude Gmag -->
<GROUP ID="dm-photG" name=" phot" ucd="phot" utype="spec:PhotometryPoint">
  <DESCRIPTION>Photometry assigned by CDS: not part of original data</DESCRIPTION>
  <PARAM name="id" utype="photdm:PhotometryFilter.identifier" value="GAIA/GAIA2/G"/>
  <PARAM name="desc" utype="photdm:PhotometryFilter.description" value="https://www.cosmos.esa.int/web/gaia/iow 20180316"/>
  <PARAM name="zeropoint" utype="photdm:ZeroPoint.ZeroPointFlux" value="3.296e+03"/>
  <PARAM name="value" utype="photdm:PhotometryFilter.SpectralAxis.Coverage.Location.Value" unit='um' value="0.623"/>
  <PARAM name="extent" utype="photdm:PhotometryFilter.SpectralAxis.Coverage.Bounds.Extent" unit='um' value="0.4183"/>
  <FIELDref ref=" Gmag" utype="spec:PhotometryPoint"/>
  <FIELDref ref=" e Gmag" utype="spec:PhotometryPointError"/>
</GROUP>
```

⚠ Photometry is not a part of authors data

⚠ All values are optional

Compose with fields

Link measurements with voInstance (see L.Michel talk)

Example of the composition of a VOInstance for a Gaia lightcurve (time+photometry)

```
<!-- Light curve on dm-timeG and dm-photG -->
<GROUP name='timeserieG' utype="cab-sdm:VOModelInstance">
    <PARAM name="title" utype="cab-sdm:VOModelInstance.semantic" value="lightcurves"/>
    <PARAM name="filterSource" utype="cab-sdm:VOModelInstance.filter" value="Source"/>
    <GROUP name='time' ref='dm-timeG' utype="meas set:VOModelInstance.Instance.main">
        <FIELDref ref=" timeG"/>
    </GROUP>
    <GROUP name='phot' ref='dm-timeG' utype="cab-sdm:VOModelInstance.Instance.dependant">
        <FIELDref ref=" Gmag"/>
        <FIELDref ref=" e Gmag"/>
    </GROUP>
</GROUP>
```

You can also use the TIMESYS ref

voInstance	
(1) voInstance.semantic	Free text describing the voInstance
(0..n) voInstance.filter	Apply on data (similar as GROUP BY in SQL)
(1) voInstance.main	The reference column (i.e.: x-axis in a plot)
(1..n) voInstance.ndPoint	Set of columns associated to the reference column

In VizieR?

The VizieR limits

- Measurement possible when metadata are available
- limited to position, time, photometry
  the expensive meta-data cost in VizieR wokflow compromised today other measurement groups.
- photometry meta-data are not part of original data : similar filter used !

→ Provenance information must be cited in VOTable and clearly displayed to final users.