



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)

1/345 Gaia DR2 (Gaia Collaboration, 2018) [acknowledge and cite Gaia DR2](#) timeSeries Similar Catalogs [2018A&A...616A...1G](#) [ReadMe+ftp](#)

1.1/345/transits Calibrated FoV transit photometry for CU5, consolidated and provided by CU7 for variable stars in Gaia DR2 (epoch photometry part 2) (original column names in green) (17712391 rows)

Simple Constraint List Of Constraints

Query by Constraints applied on Columns (Output Order: + -)

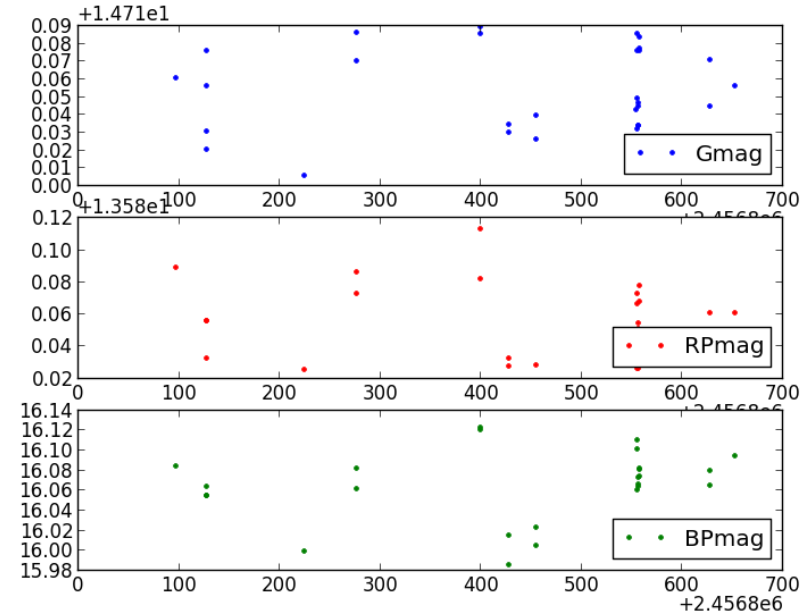
Standard Original

Show	Sort	Column	Clear	Constraint	Explain
<input type="checkbox"/>	<input type="radio"/>	recno			Record number
<input checked="" type="checkbox"/>	<input type="radio"/>	Source			Source name
<input checked="" type="checkbox"/>	<input type="radio"/>	TransitID			Transit ID
<input checked="" type="checkbox"/>	<input type="radio"/>	TimeG			Time of G band transit
<input checked="" type="checkbox"/>	<input type="radio"/>	FG			Flux in G band
<input checked="" type="checkbox"/>	<input type="radio"/>	e_FG			Error in G band flux
<input type="checkbox"/>	<input type="radio"/>	RFG			Ratio of G band flux to total flux
<input checked="" type="checkbox"/>	<input type="radio"/>	Gmag			G band magnitude
<input checked="" type="checkbox"/>	<input type="radio"/>	e_Gmag			Error in G band magnitude
<input checked="" type="checkbox"/>	<input type="radio"/>	TimeBP			Time of BP band transit
<input checked="" type="checkbox"/>	<input type="radio"/>	FBP			Flux in BP band
<input type="checkbox"/>	<input type="radio"/>	e_FBP			Error in BP band flux
<input type="checkbox"/>	<input type="radio"/>	RFBP			Ratio of BP band flux to total flux
<input checked="" type="checkbox"/>	<input type="radio"/>	BPmag			BP band magnitude
<input checked="" type="checkbox"/>	<input type="radio"/>	e_BPmag			Error in BP band magnitude
<input checked="" type="checkbox"/>	<input type="radio"/>	TimeRP			Time of RP band transit
<input checked="" type="checkbox"/>	<input type="radio"/>	FRP			Flux in RP band
<input checked="" type="checkbox"/>	<input type="radio"/>	e_FRP			Error in RP band flux
<input type="checkbox"/>	<input type="radio"/>	RFRP			Ratio of RP band flux to total flux

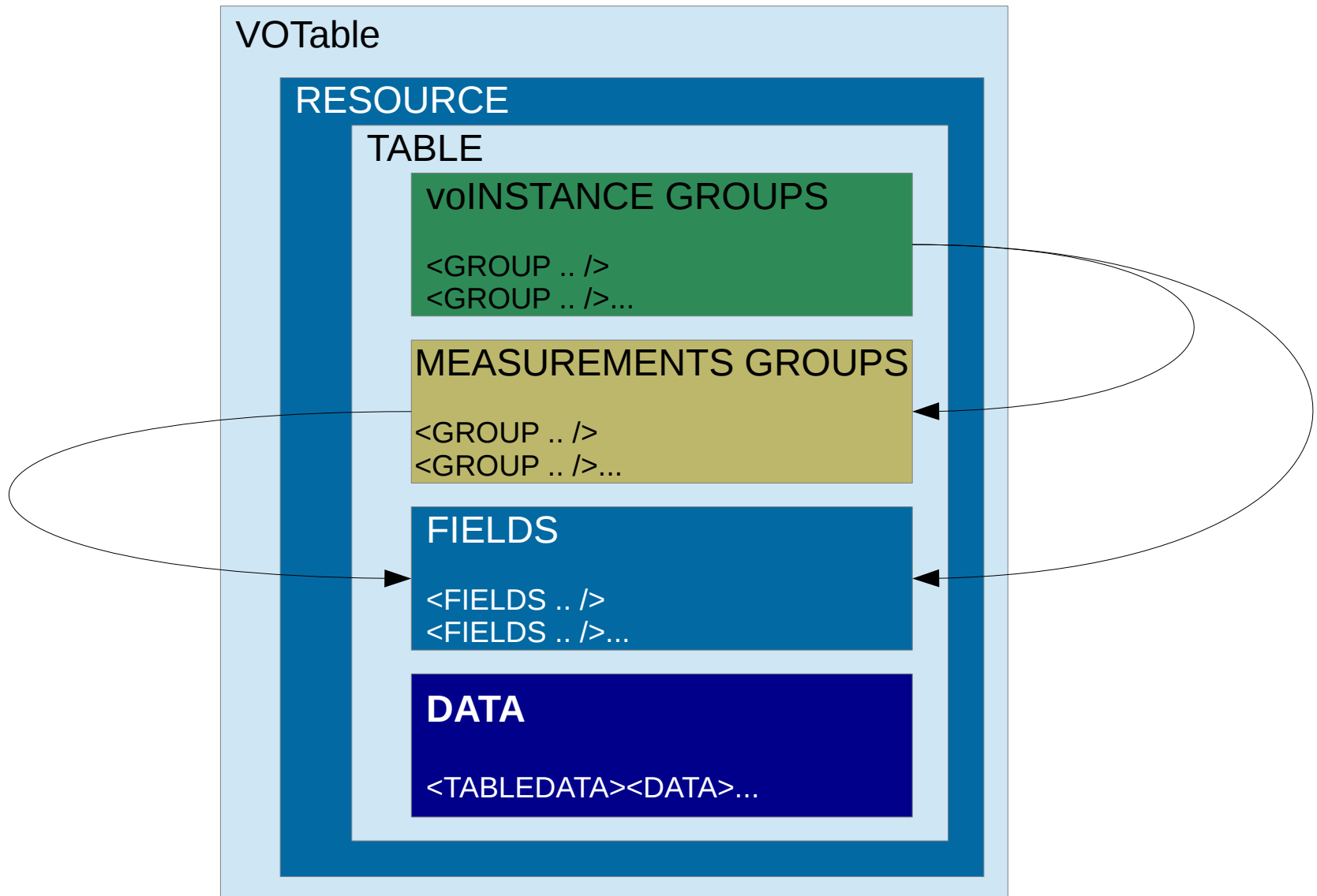
Scale: TCB
 Frame: BARYCENTER
 Offset: 2455197.50
 Uncertainty: 44

Scale: TCB
 Frame: BARYCENTER
 Offset: 2455197.50
 Uncertainty: 5

Scale: TCB
 Frame: BARYCENTER
 Offset: 2455197.50
 Uncertainty: 5



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

```
<!-- Time definition applied to column TimeG -->
<GROUP ID='dm-timeG' utype='meas:Time'>
  <PARAM utype='coords:TimeFrame.reposition' 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>

<!-- 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>
```

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

TIMESYS generalized into a DataModel group



Photometry is not a part of authors data



All values are optional


□ Compose with fields



Link measurements with volInstance (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 

volInstance	
(1) volInstance.semantic	Free text describing the volInstance
(0..n) volInstance.filter	Apply on data (similar as GROUP BY in SQL)
(1) volInstance.main	The reference column (i.e.: x-axis in a plot)
(1..n) volInstance.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 workflow 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.