VO-DML, vodataservice tablesets description for VOtables and utypes

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Acknowledgments :
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Utypes as « ivoa roles »

- There are use cases where applications want to know an accurate definition of what a given FIELD is supposed to be in the VO context.
- Let's call that an « ivoa role »
- It's different than using a full model
- It's cannot be achieved fully by names or ucds
  - « access_referenece » and « access_format » in Obscore
  - Names Are perfectly defined in Obscore context
  - Use Obscore utypes outside

On the typology of the different annotations usage see
my presentation in Shangaï :

There is complementarity, no exclusion with other annotation attempts

What is the relationship between « ivoa roles » and data models

- Computer science defines « roles » and relationship with objet data models
- In « ORM » roles ares seen as predicates affecting entities in « facts » (sentences)
  - Entities can be groupped in classes
  - Roles separate in relationship/attributes +...
  - ....values
- See my Trieste presentation for more details :

http://wiki.ivoa.net/internal/IVOA/InteropOct2016DM/ivoa_roles.pdf

- Important property for us is that simple roles may be chained/combined in more complex roles
  - As we look for individual FIELDS « ivoa roles », it is important to distinguish them
    - The stat error of the Target position has a different « ivoa role » than a stat error in location position of the dataset

What is the relationship between « ivoa roles » and data models

- The utypes may be given by the model specification document
- The utypes may be stored in TAP schema (and they are in some cases)
- Can we derive them properly from vo-dml-xml ?
  - It would be nice
  - Cannot be derived easily from the vo-dml-xml as tested last year
  - but from an instance representation (so called « Mapping » record)

TAP schema and utypes. Obscore case

Table 6 `TAP_SCHEMA.columns` values for the mandatory fields of an ObsTAP table. All Utypes have the data model namespace prefix **"obscore:"** omitted in the table. The Datatype, Size, Principal, Index, and Std values shown here are informative for TAP 1.0 only; later versions of TAP may specify different values.

Column Name	*Datatype*	*Size*	*Units*	*ObsCoreDM Utype*	*UCD*	*Principal*	*Index*	*Std*
dataproduct_type	adql:VARCHAR	TBD	NULL	ObsDataset.dataProductType	meta.id	1	TBD	1
calib_level	adql:INTEGER	NULL	NULL	ObsDataset.calibLevel	meta.code;obs.calib	1	TBD	1
obs_collection	adql:VARCHAR	TBD	NULL	DataID.collection	meta.id	1	TBD	1
obs_id	adql:VARCHAR	TBD	NULL	DataID.observationID	meta.id	1	TBD	1
obs_publisher_did	adql:VARCHAR	TBD	NULL	Curation.publisherDID	meta.ref.uri;meta.curation	1	TBD	1
access_url	adql:CLOB	NULL	NULL	Access.reference	meta.ref.url	1	0	1
access_format	adql:VARCHAR	NULL	NULL	Access.format	meta.code.mime	1	0	1
access_estsize	adql:BIGINT	NULL	kbyte	Access.size	phys.size;meta.file	1	0	1
target_name	adql:VARCHAR	TBD	NULL	Target.name	meta.id;src	1	0	1
s_ra	adql:DOUBLE	NULL	deg	Char.SpatialAxis.Coverage.Location.Coord.Position 2D.Value2.C1	pos.eq.ra	1	0	1
s_dec	adql:DOUBLE	NULL	deg	Char.SpatialAxis.Coverage.Location.Coord.Position 2D.Value2.C2	pos.eq.dec	1	0	1
s_fov	adql:DOUBLE	NULL	deg	Char.SpatialAxis.Coverage.Bounds.Extent.diameter	phys.angSize;instr.fov	1	0	1
s_region	adql:REGION	NULL		Char.SpatialAxis.Coverage.Support.Area	pos.outline;obs.field	1	0	1
s_resolution	adql:DOUBLE	NULL	arcsec	Char.SpatialAxis.Resolution.Refval.value	pos.angResolution	1	TBD	1
s_xel1	adql:BIGINT	NULL	NULL	Char.SpatialAxis.numBins1	meta.number	1	TBD	1
s_xel2	adql:BIGINT	NULL	NULL	Char.SpatialAxis.numBins2	meta.number	1	TBD	1
t_min	adql:DOUBLE	NULL	d	Char.TimeAxis.Coverage.Bounds.Limits.StartTime	time.start;obs.exposure	1	0	1
t_max	adql:DOUBLE	NULL	d	Char.TimeAxis.Coverage.Bounds.Limits.StopTime	time.end;obs.exposure	1	0	1
t_exptime	adql:DOUBLE	NULL	s	Char.TimeAxis.Coverage.Support.Extent	time.duration;obs.exposure	1	TBD	1
t_resolution	adql:DOUBLE	NULL	s	Char.TimeAxis.Resolution.Refval.value	time.resolution	1	0	1
t_xel	adql: BIGINT	NULL	NULL	Char.TimeAxis.numBins	meta.number	1	TBD	1

TAP schema and utypes. RegTAP case

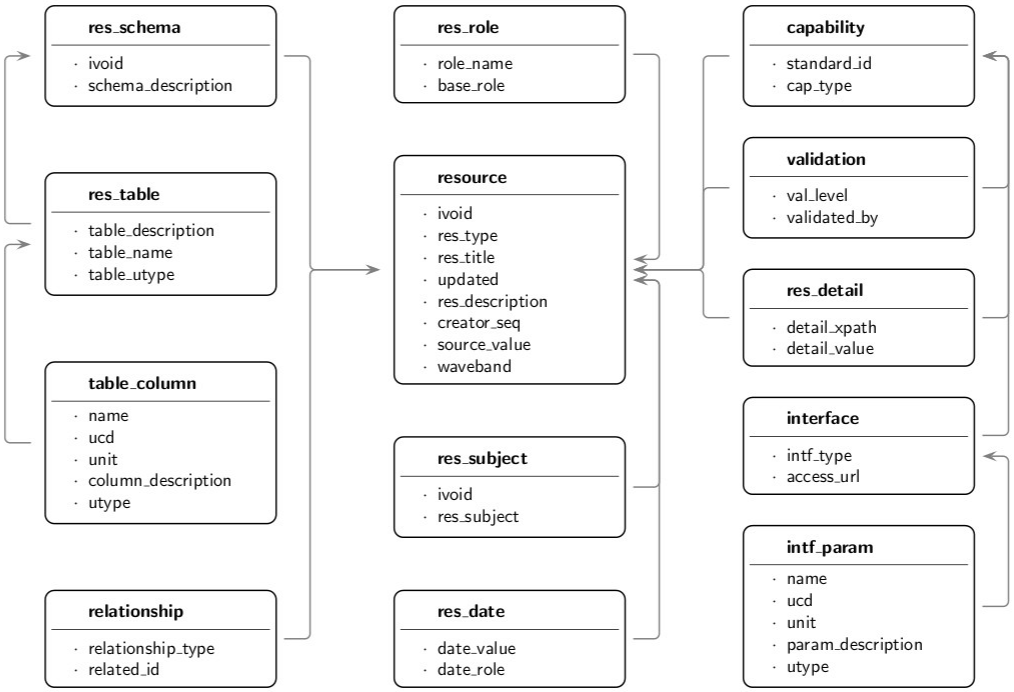


Figure 2: A sketch of the Relational Registry schema, adapted from Demleitner (2014). Only the columns considered most interesting for client use are shown. Arrows indicate foreign key-like relationships.

TAP schema and utypes. RegTAP case

(naturally) joined.

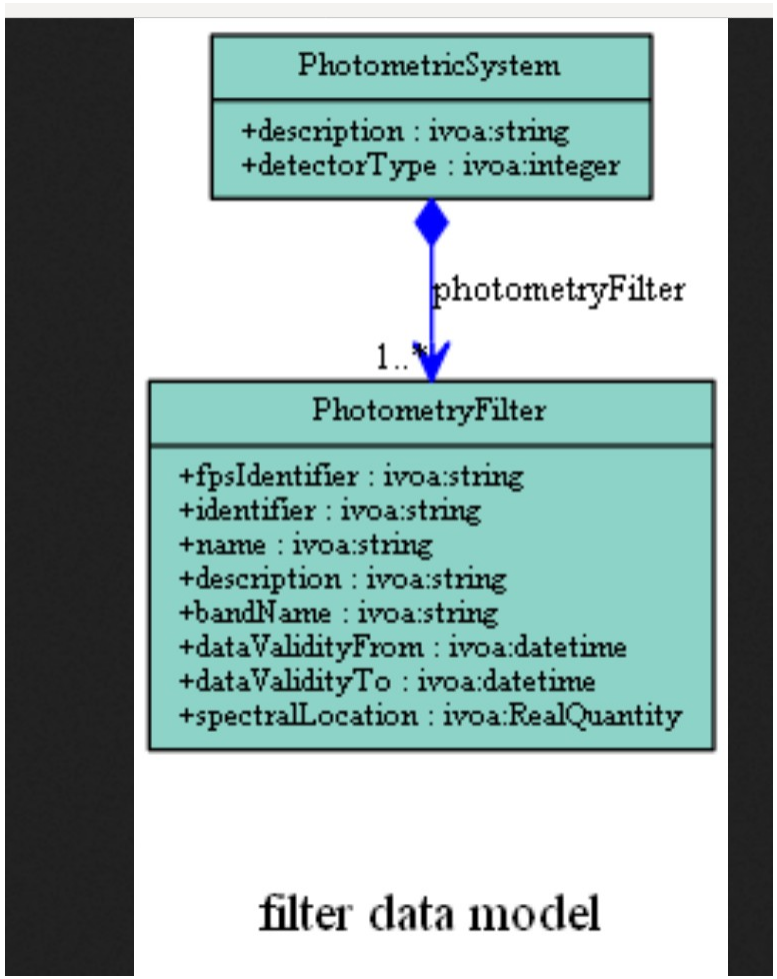
Column names, utypes, ADQL types, and descriptions for the rr.intf_param table

ivoid	char(*)	The parent resource.
`xpath:/identifier`		
intf_index	short(1)	The index of the interface this parameter belongs to.
name	char(*)	The name of the parameter.
`xpath:name`		
ucd	char(*)	A unified content descriptor that describes the scientific content of the parameter.
`xpath:ucd`		
unit	char(*)	The unit associated with all values in the parameter.
`xpath:unit`		
utype	char(*)	An identifier for a role in a data model that the data in this parameter represents.
`xpath:utype`		
std	short(1)	If 1, the meaning and use of this parameter is reserved and defined by a standard model. If 0, it represents a database-specific parameter that effectively extends beyond the standard.
`xpath:@std`		
datatype	char(*)	The type of the data contained in the parameter.
`xpath:dataType`		
extended_schema	char(*)	An identifier for the schema that the value given by the extended attribute is drawn from.
`xpath:dataType/@extendedSchema`		
extended_type	char(*)	A custom type for the values this parameter contains.
`xpath:dataType/@extendedType`		
arraysize	char(*)	The shape of the array that constitutes the value, e.g., 4, *, 4*, 5x4, or 5x*, as specified by VOTable.
`xpath:dataType/@arraysize`		
delim	char(*)	The string that is used to delimit elements of an array

TAP schema and utypes. ProvTAP case

```
<schema>
  <name>provenance</name>
  <description>Provenance schema</description>
  <table type="output">
    <name>Entity</name>
    <description>instances of Entity class</description>
    <column>
      <name>e_id</name>
      <dataType xsi:type="vod:TAPType">VARCHAR</dataType>
      <ucd>meta.id</ucd>
      <utype>voprov:Entity.id</utype>
    </column>
    <column>
      <name>e_name</name>
      <dataType xsi:type="vod:TAPType">VARCHAR</dataType>
      <ucd>meta.title</ucd>
      <utype>voprov:Entity.name</utype>
    </column>
    <column>
      <name>e_type</name>
      <dataType xsi:type="vod:TAPType">VARCHAR</dataType>
      <ucd>meta.code.class</ucd>
      <utype>voprov:Entity.type</utype>
    </column>
    <column>
      <name>e_rights</name>
      <dataType xsi:type="vod:TAPType">VARCHAR</dataType>
      <ucd>meta.code.class</ucd>
      <utype>voprov:Entity.rights</utype>
    </column>
    <column>
      <name>e_annotation</name>
      <dataType xsi:type="vod:TAPType">VARCHAR</dataType>
      <ucd>meta.description</ucd>
      <utype>voprov:Entity.annotation</utype>
    </column>
    <column>
      <name>e_hadMember</name>
      <dataType xsi:type="vod:TAPType">VARCHAR</dataType>
      <ucd>meta.code.member</ucd>
      <utype>voprov:Entity.hadMember</utype>
    </column>
    <column>
      <name>e_description</name>
      <dataType xsi:type="vod:TAPType">VARCHAR</dataType>
      <ucd>meta.id</ucd>
      <utype>voprov:Entity.description</utype>
    </column>
    <foreignKey>
      <targetTable>EntityDescription</targetTable>
      <fkColumn>
        <fromColumn>e_description</fromColumn>
        <targetColumn>ed_id</targetColumn>
      </fkColumn>
    </foreignKey>
  </table>
  <table type="output">
```

From VO-DML to utypes
1) model (filter toy model)



filter data model

From VO-DML to utypes
2) filter vo-dml xml

```
<name>filter</name>
<description>
  This is an alternative version of the data model for Photometric Calibration ...
</description>
<title>Filter</title>
<version>0.x</version>
<lastModified>2018-03-01T08:13:05</lastModified>
<import>
  <name>ivoa</name>
  <url>
    http://volute.g-vo.org/svn/trunk/projects/dm/vo-dml/models/ivoa/vo-dml/IVOA-v1.0.vo-dml.xml
  </url>
  <documentationURL>
    http://volute.g-vo.org/svn/trunk/projects/dm/vo-dml/models/ivoa/vo-dml/IVOA-v1.0.html
  </documentationURL>
</import>
<objectType>
  <vodml-id>PhotometricSystem</vodml-id>
  <name>PhotometricSystem</name>
  <description>
    TODO : Missing description : please, update your UML model asap.
  </description>
  <attribute>
    <vodml-id>PhotometricSystem.description</vodml-id>
    <name>description</name>
    <description>String representation Photometric system</description>
    <datatype>
      <vodml-ref>ivoa:string</vodml-ref>
    </datatype>
    <multiplicity>
      <minOccurs>0</minOccurs>
      <maxOccurs>1</maxOccurs>
    </multiplicity>
  </attribute>
  <attribute>
    <vodml-id>PhotometricSystem.detectorType</vodml-id>
    <name>detectorType</name>
    <description>Type of detector (e.g energy or photon counter)</description>
    <datatype>
      <vodml-ref>ivoa:integer</vodml-ref>
    </datatype>
    <multiplicity>
      <minOccurs>1</minOccurs>
      <maxOccurs>1</maxOccurs>
    </multiplicity>
  </attribute>
  <composition>
    <vodml-id>PhotometricSystem.photometryFilter</vodml-id>
    <name>photometryFilter</name>
    <description>
      TODO : Missing description : please, update your UML model asap.
    </description>
    <datatype>
      <vodml-ref>ivoa:string</vodml-ref>
    </datatype>
    <multiplicity>
      <minOccurs>1</minOccurs>
      <maxOccurs>1</maxOccurs>
    </multiplicity>
  </attribute>
  <attribute>
    <vodml-id>PhotometryFilter.dataValidityFrom</vodml-id>
    <name>dataValidityFrom</name>
    <description>
      TODO : Missing description : please, update your UML model asap.
    </description>
    <datatype>
      <vodml-ref>ivoa:datetime</vodml-ref>
    </datatype>
    <multiplicity>
      <minOccurs>1</minOccurs>
      <maxOccurs>1</maxOccurs>
    </multiplicity>
  </attribute>
  <attribute>
    <vodml-id>PhotometryFilter.dataValidityTo</vodml-id>
    <name>dataValidityTo</name>
    <description>
      TODO : Missing description : please, update your UML model asap.
    </description>
    <datatype>
      <vodml-ref>ivoa:datetime</vodml-ref>
    </datatype>
    <multiplicity>
      <minOccurs>1</minOccurs>
      <maxOccurs>1</maxOccurs>
    </multiplicity>
  </attribute>
  <attribute>
    <vodml-id>PhotometryFilter.spectralLocation</vodml-id>
    <name>spectralLocation</name>
    <description>
      TODO : Missing description : please, update your UML model asap.
    </description>
    <datatype>
      <vodml-ref>ivoa:RealQuantity</vodml-ref>
    </datatype>
    <multiplicity>
      <minOccurs>1</minOccurs>
      <maxOccurs>1</maxOccurs>
    </multiplicity>
  </attribute>
</objectType>
</vo-dml:model>
```

From VO-DML to utypes
3) Light Mapping = instance representation

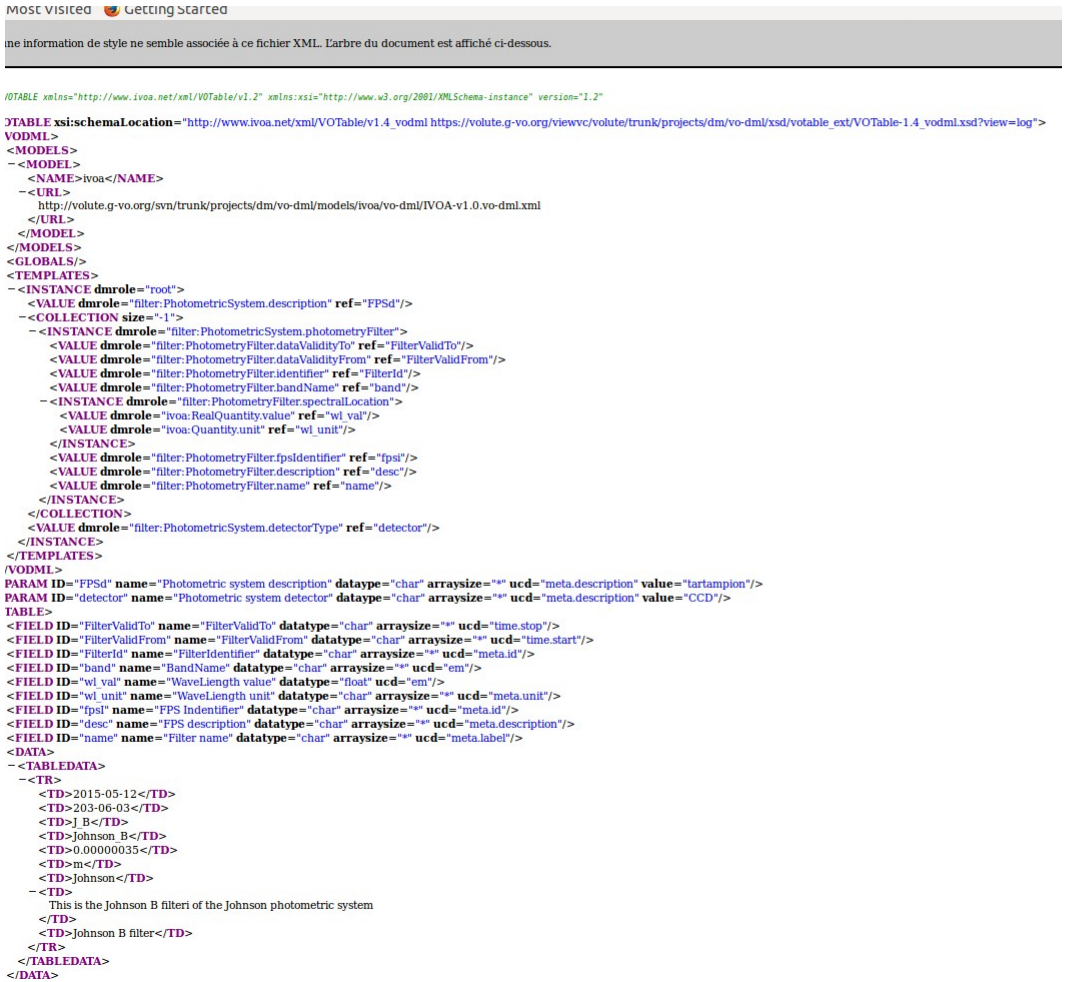
Most Visited Getting Started

```
DML>
MODELS>
 <MODEL>
   <NAME>ivoa</NAME>
   <URL>http://volute.g-vo.org/svn/trunk/projects/dm/vo-dml/models/ivoa/vo-dml/IVOA-v1.0.vo-dml.xml</URL>
 </MODEL>
/MODELS>
GLOBALS/>
TEMPLATES>
 <INSTANCE dmrole="root">
   <VALUE dmrole="filter:PhotometricSystem.description" ref="@@@@@@"/>
   <COLLECTION size="-1">
     <INSTANCE dmrole="filter:PhotometricSystem.photometryFilter">
       <VALUE dmrole="filter:PhotometryFilter.dataValidityTo" ref="@@@@@@"/>
       <VALUE dmrole="filter:PhotometryFilter.dataValidityFrom" ref="@@@@@@"/>
       <VALUE dmrole="filter:PhotometryFilter.identifier" ref="@@@@@@"/>
       <VALUE dmrole="filter:PhotometryFilter.bandName" ref="@@@@@@"/>
       <INSTANCE dmrole="filter:PhotometryFilter.spectralLocation">
         <VALUE dmrole="ivoa:RealQuantity.value" ref="@@@@@@"/>
         <VALUE dmrole="ivoa:Quantity.unit" ref="@@@@@@"/>
       </INSTANCE>
       <VALUE dmrole="filter:PhotometryFilter.fpsIdentifier" ref="@@@@@@"/>
       <VALUE dmrole="filter:PhotometryFilter.description" ref="@@@@@@"/>
       <VALUE dmrole="filter:PhotometryFilter.name" ref="@@@@@@"/>
     </INSTANCE>
   </COLLECTION>
   <VALUE dmrole="filter:PhotometricSystem.detectorType" ref="@@@@@@"/>
 </INSTANCE>
/TEMPLATES>
ODML>
```

From VO-DML to utypes
4) Light Mapping = instance representation

- It is important to see that the Mapping is a formal representation of an INSTANCE of a class of the model
- We must define a root class (or several) which gives a « point of view » on the model

From VO-DML to utypes
5) Light Mapping = associate a path in the representation to a FIELD



Most Visited Getting Started

ne information de style ne semble associée à ce fichier XML. L'arbre du document est affiché ci-dessous.

```
/OTABLE xmlns="http://www.ivoa.net/xml/VOTable/v1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2"

DTABLE xsi:schemaLocation="http://www.ivoa.net/xml/VOTable/v1.4_vodml https://volute.g-vo.org/viewvc/volute/trunk/projects/dm/vo-dml/xsd/votable_ext/VOTable-1.4_vodml.xsd?view=log">
VODML>
<MODELS>
 −<MODEL>
    <NAME>ivoa</NAME>
   −<URL>
      http://volute.g-vo.org/svn/trunk/projects/dm/vo-dml/models/ivoa/vo-dml/IVOA-v1.0.vo-dml.xml
    </URL>
  </MODEL>
</MODELS>
<GLOBALS/>
<TEMPLATES>
 −<INSTANCE dmrole="root">
    <VALUE dmrole="filter:PhotometricSystem.description" ref="FPSd"/>
   −<COLLECTION size="-1">
     −<INSTANCE dmrole="filter:PhotometricSystem.photometryFilter">
        <VALUE dmrole="filter:PhotometryFilter.dataValidityTo" ref="FilterValidTo"/>
        <VALUE dmrole="filter:PhotometryFilter.dataValidityFrom" ref="FilterValidFrom"/>
        <VALUE dmrole="filter:PhotometryFilter.identifier" ref="FilterId"/>
        <VALUE dmrole="filter:PhotometryFilter.bandName" ref="band"/>
       −<INSTANCE dmrole="filter:PhotometryFilter.spectralLocation">
          <VALUE dmrole="ivoa:RealQuantity.value" ref="wl_val"/>
          <VALUE dmrole="ivoa:Quantity.unit" ref="wl_unit"/>
        </INSTANCE>
        <VALUE dmrole="filter:PhotometryFilter.fpsIdentifier" ref="fpsi"/>
        <VALUE dmrole="filter:PhotometryFilter.description" ref="desc"/>
        <VALUE dmrole="filter:PhotometryFilter.name" ref="name"/>
      </INSTANCE>
    </COLLECTION>
    <VALUE dmrole="filter:PhotometricSystem.detectorType" ref="detector"/>
  </INSTANCE>
</TEMPLATES>
/VODML>
PARAM ID="FPSd" name="Photometric system description" datatype="char" arraysize="*" ucd="meta.description" value="tartampion"/>
PARAM ID="detector" name="Photometric system detector" datatype="char" arraysize="*" ucd="meta.description" value="CCD"/>
TABLE>
<FIELD ID="FilterValidTo" name="FilterValidTo" datatype="char" arraysize="*" ucd="time.stop"/>
<FIELD ID="FilterValidFrom" name="FilterValidFrom" datatype="char" arraysize="*" ucd="time.start"/>
<FIELD ID="FilterId" name="FilterIdentifier" datatype="char" arraysize="*" ucd="meta.id"/>
<FIELD ID="band" name="BandName" datatype="char" arraysize="*" ucd="em"/>
<FIELD ID="wl_val" name="WaveLiength value" datatype="float" ucd="em"/>
<FIELD ID="wl_unit" name="WaveLiength unit" datatype="char" arraysize="*" ucd="meta.unit"/>
<FIELD ID="fpsi" name="FPS Indentifier" datatype="char" arraysize="*" ucd="meta.id"/>
<FIELD ID="desc" name="FPS description" datatype="char" arraysize="*" ucd="meta.description"/>
<FIELD ID="name" name="Filter name" datatype="char" arraysize="*" ucd="meta.label"/>
<DATA>
 −<TABLEDATA>
   −<TR>
      <TD>2015-05-12</TD>
      <TD>203-06-03</TD>
      <TD>J_B</TD>
      <TD>Johnson_B</TD>
      <TD>0.00000035</TD>
      <TD>m</TD>
      <TD>Johnson</TD>
     −<TD>
        This is the Johnson B filteri of the Johnson photometric system
      </TD>
      <TD>Johnson B filter</TD>
    </TR>
  </TABLEDATA>
</DATA>
```

From VO-DML to utypes
5) Light Mapping = associate a path in the representation to a FIELD using the dmroles

name="Photometric system description"
dmrole="filter:PhotometricSystem.description

name="FilterValidTo
dmroles= filter:PhotometricSystem.photometryFilter,
"filter:PhotometryFilter.dataValidityTo »

name= « WaveLength value"»
dmroles="filter:PhotometricSystem.photometryFilter"
"filter:PhotometryFilter.spectralLocation"
"ivoa:RealQuantity.value"

Propose to store the ivoaroles in an xml document (instead of using concatanation)

- Simple utype example :

```
<ivoaroles>
  <ivoarole>
    <utype>lmsource:source.Source.name</utype>
    <role><doc>http://ivoa.net/std/lmsourceToymodel-0.1.pdf#section5/page3</doc><definition>the source name or
identifier</definition>
      <vodml>
        <vodml-role>lmsource:source.Source.name</vodml-role>
      </vodml>
    </role>
  </ivoarole>
  ......
</ivoaroles>
```

- Composed utype example

```
<ivoaroles>
<ivoarole>
  <utype>lmsource:source.Source.position.coord</utype>
  <role><doc>http://ivoa.net/std/lmsourceToymodel-0.1.pdf#section5/page3</doc><definition>the source position value</definition>
    <vodml>
      <vodml-role>source.Source.position</vodml-role>
       <vodml-role>domain.spatial.Position2D.coord</vodml-role>
     </vodml>
   </role>
</ivoarole>
```

Utype strings

Doc and definitions

Sequence of vodml-roles