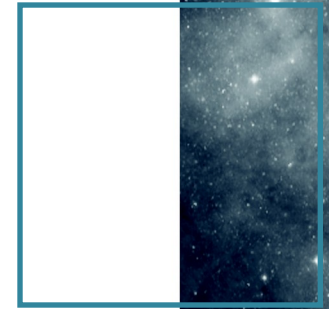


# Instrument Field of View DM and mapping in VOT



---

F.Bonnarel, T.Boch, M.Louys, L.Michel,  
C.Nogueira



# Motivation : replace Instrument FoV facility in Aladin → HST

Aladin v11.0

File Edit Image Catalog Overlay Coverage Tool View Interop Help

Available data → 27808  
in view out view

Command  Frame ICRS Projection Aitoff

DSS PanSTARRS SDSS ZMASS GALEX Gaia Simbad NED +

DSS2 color

Server selector

Others File FoV... Tools...

Image servers: SkyView, Aladin Hips2fits, Sloan, DSS..., Archives...

Catalog servers: SIMBAD, TAP, Gaia, SkyBot, NED, hyperLEDA, VO

Instrument fields of view ?  
Specify a position, select one instrument and press the SUB...

Target (ICRS, name)

Angle (in degrees)

Instrument	Tele...	Description	Author
CFH12K	CFHT	Large field camera	CFH
ESPADONS	CFHT	Echelle Spectropolarimetric device	CFH
MEGACAM	CFHT	Wide field imaging camera	CFH
MEGAPRIME	CFHT	Wide field imaging camera + guiders	CFH
MegaCam	CFHT	Mosaic camera with 40 2kx4.5k CC...	CFHT
WIRCAM	CFHT	Wide field IR camera	CFH
HST	HST	All Hubble Space Telescope FoVs	STScI/T...
WFCINT	INT	Isaac Newton Telescope Wide Fie...	Luis Co...
SOFI	NTT	ESO NTT single CCD camera	ESO-CDS

Create your o... Load it...

Reset Clear SUBMIT Close ?

select from -- all collections --

exp. sort view scan filter

grid study wink north hdr multiview match

15' 1.298' x 52.2'

ALADIN

Last news  
Aladin manual has been released (dedicated to version 11, in english and french) Ok

epoch size dens. opac. zoom

05 41 11.64166  
-02 15 02.4480

0 sel / 0 src 698Mb



# Motivation: replace Instrument FoV facility in Aladin → MEGACAM

Aladin v11.0

File Edit Image Catalog Overlay Coverage Tool View Interop Help

Command [DSS PanSTARRS SDSS ZMASS GALEX Gaia Simbad NED +]

Frame ICRS Projection Aitoff

Available data → 27808  
● in view ● out view

- Collections → 27808
  - Image → 503
  - Data base → 4
  - Catalog → 25997
  - Cube → 27
  - Ancillary → 74
  - Outreach → 50
  - Others → 1153

DSS2 color

Server selector

Others File FoV... Tools...

Instrument fields of view ?

Specify a position, select one instrument and press the SUB...

Target (ICRS, name) 05 41 12.60240 -02 15 16.8480

Angle (in degrees) 0.0

Instrument	Tele...	Description	Author
CFH12K	CFHT	Large field camera	CFH
ESPADONS	CFHT	Echelle Spectropolarimetric device	CFH
MEGACAM	CFHT	Wide field imaging camera	CFH
MEGAPRIME	CFHT	Wide field imaging camera + guiders	CFH
MegaCam	CFHT	Mosaic camera with 40 2kx4.5k CC...	CFHT
WIRCAM	CFHT	Wide field IR camera	CFH
HST	HST	All Hubble Space Telescope FoVs	STScI/T...
WFCINT	INT	Isaac Newton Telescope Wide Fiel...	Luis Co...
SOFI	NTT	ESO NTT single CCD camera	ESO-CDS
SuperCam	GEMINI	The Subaru Prime Focus Camera / GEMINI	CFH

Create your o... Load it...

Reset Clear SUBMIT Close ?

2.257' x 1.513'

epoch size dens. opac. zoom

05 41 12.60240 -02 15 16.8480

MEGACAM CDS/P/DSS2

242 sel / 0 src 458Mb

# Motivation : replace Instrument FoV facility in Aladin → Editor

## Instrument Footprint Editor

Footprint name:



New



Save



Test in Aladin



Copy shape



New rect



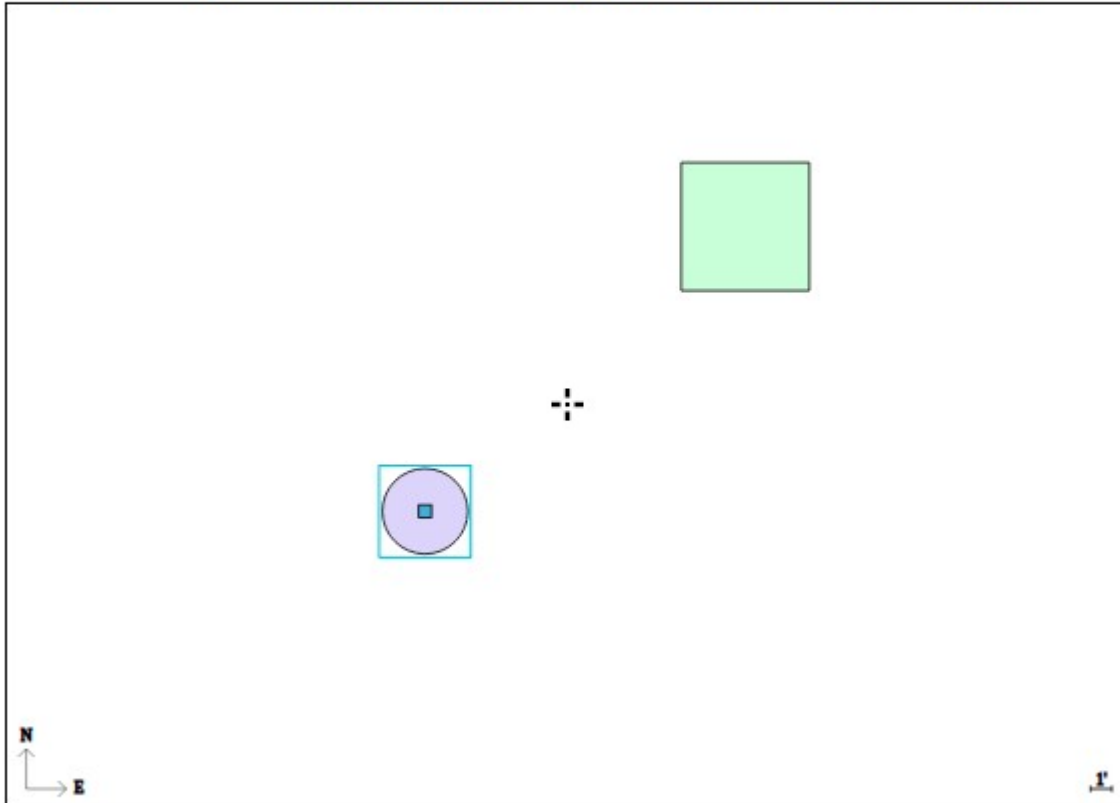
New circle



Zoom out



Zoom in



Properties  
Circle

Center.X	<input type="text" value="-400"/>	arcsec
Center.Y	<input type="text" value="-300"/>	arcsec
Radius	<input type="text" value="120"/>	arcsec





# Motivation :

- Replace Instrument FoV facility in Aladin : IVOA NOTE for old specification



## A Footprint Overlay Specification using current VO Standards: VOTABLE, SIA and STC Version 1.01

IVOA Note February 15, 2008

**This version:**

<http://www.ivoa.net/Documents/Notes/Footprint/Footprint-20080215.pdf>

**Latest version:**

<http://www.ivoa.net/Documents/latest/Footprint.html>

**Previous versions:**

<http://www.ivoa.net/Documents/Notes/Footprint/Footprint-20070709.pdf>

**Editors:**

F.Bonnarel

**Authors:**

T.Boch, F.Bonnarel, F.Chereau, M.Dolensky, T.Donaldson, P.Fernique, JC.Malapert, F.Pierfederici

### Abstract

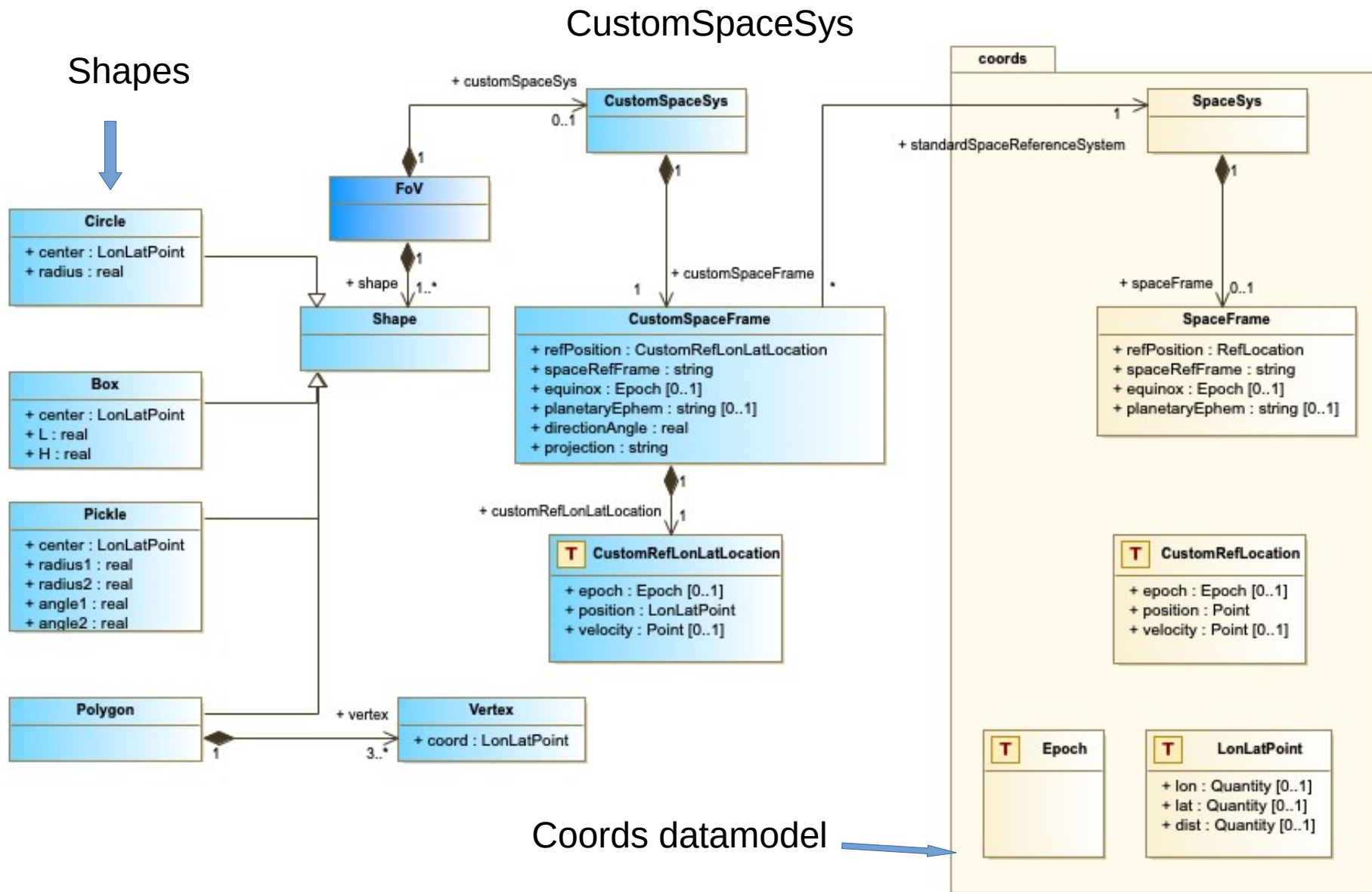
This document defines a mechanism for embedding observation footprint description, emphasizing how those descriptions could be attached to DAL query responses or describe instruments signature. Software with interfaces conforming to this specification will enable automatic overlay of observational data with a World Coordinate System obtained from multiple image and spectrum servers or observing tools, regardless of map scale and for various projections and coordinate systems. By itself, this is an extraordinarily useful capability, but it also provides one foundation for interoperability involving more sophisticated capabilities such as proposal preparation.

# Limitations → New project

- Standardisation was simply
  - VOTable,
  - STC1 utypes, GROUPS, and Fov structure (obsoleted)
  - not an IVOA recommendation (only a Note)
- Restart the project by
  - deriving a new FoV data Model from Coords,
  - using the upcoming MIVOT mapping syntax to describe model elements
- Explore usage outside Aladin
- Prototype model and serialization examples with a developer student intern



# The FOV datamodel



# The FOV datamodel

- Extending coords model :
  - Coordinates classes
  - coordinates systems classes
- Define CustomSpaceSys on the tangent plane :
  - projection instrument specific
  - variable positions and orientation
- Define shapes (instrument specific) in this custom CoordSpaceSys





# The Serialisation / Mapping using MIVOT

- Working Draft
- Xml schema
- Validation in python
- parsing code in python
- Map data models features (Coords, Meas, PhotDM, Mango) on top of VOTables

DRAFT – please do not distribute



## Model Instances in Votables Version 1.0

**IVOA Working Draft 2022-04-10**

Working group  
DM

This version  
<http://www.ivoa.net/documents/mivot/20220410>

Latest version  
<http://www.ivoa.net/documents/mivot>

Previous versions  
This is the first public release

Author(s)  
François Bonnarel, Gilles Landais, Laurent Michel, Jesus Salgado, Gerard Lemson

Editor(s)  
Laurent Michel, Mark Cresitello Dittmar

### Abstract

Vodml-instance-vot (TBD) proposes a syntax to map VOTable data on any model serialized in VO-DML. Vodml-instance-vot annotations are grouped in a single XML block located in the resource head. The annotations operate as a bridge between the data and the model. It can denote the way data are connected to each other as well as different tables can be joined together. It is also able to carry data or meta-data that are missing in the VOTable. The annotation block is made of bricks that facilitate both annotation process and model instance reconstruction. It has been designed so as not to alter the original VOTable content, thus limiting its impact on legacy clients.

# The Serialisation / Mapping using MIVOT

```
<!--
Example of an instrumental footprint mapped with the VODML mapping syntax.
No elaborated models here: we work with a mock model named "instfov"
We assume that an instrumental footprint has 2 components:
- one shape (Shape) giving the footprint shape
- one pointing (Pointing) giving the observation pointing.

The shape does not depends on any particular pointing: it is defined as a GLOBALS
The pointings do depend on the table data: there are mapped in the TEMPLATES
-->
<VOTABLE xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.ivoa.net/xml/VOTable/v1.3" version="1.4" xsi:schemaLocat
</RESOURCE type="results">
  <!-- Mapping resource -->
  <RESOURCE type="meta">
    <dm-mapping:VODML xmlns:dm-mapping="http://www.ivoa.net/xml/merged-syntax">
      <dm-mapping:REPORT status="OK">hand-made mapping: ad hoc model so far </dm-mapping:REPORT>
      <!-- list of mapped models -->
      <dm-mapping:MODEL name="instfov" url="https://www.ivoa.net/xml/instfov.xml"/>
      <dm-mapping:MODEL name="coords" url="https://www.ivoa.net/xml/Coords-v1.xsd"/>
      <!-- Mapping of quantities that do not depend on table rows -->
      <dm-mapping:GLOBALS>
        <dm-mapping:INSTANCE dmid=" fov" dmtpe="instfov:Fov">
          <dm-mapping:COLLECTION dmrole="instfov:Fov.shape">
            <dm-mapping:INSTANCE dmtpe="instfov:Circle">
              <dm-mapping:ATTRIBUTE dmrole="instfov:Circle.radius" dmtpe="ivoa:real" value="0.6"/>
              <dm-mapping:INSTANCE dmtpe="instfov:Circle.center" dmtpe="coords:LonLatPoint">
                <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="2.0"/>
                <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="1.5"/>
                <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
              </dm-mapping:INSTANCE>
            </dm-mapping:INSTANCE>
            <dm-mapping:INSTANCE dmtpe="instfov:Box">
              <dm-mapping:ATTRIBUTE dmrole="instfov:Box.L" dmtpe="ivoa:real" value="0.5"/>
              <dm-mapping:ATTRIBUTE dmrole="instfov:Box.H" dmtpe="ivoa:real" value="0.7"/>
              <dm-mapping:INSTANCE dmtpe="instfov:Box.Center" dmtpe="coords:LonLatPoint">
                <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="-2.0"/>
                <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="-1.5"/>
                <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
              </dm-mapping:INSTANCE>
            </dm-mapping:INSTANCE>
            <dm-mapping:INSTANCE dmtpe="instfov:Polygon">
              <dm-mapping:COLLECTION dmrole="instfov:Polygon.vertex">
                <dm-mapping:INSTANCE dmtpe="coords:LonLatPoint">
                  <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="0.5"/>
                  <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="-1.5"/>
                  <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
                </dm-mapping:INSTANCE>
                <dm-mapping:INSTANCE dmtpe="coords:LonLatPoint">
                  <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="0.5"/>
                  <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="1.5"/>
                  <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
                </dm-mapping:INSTANCE>
                <dm-mapping:INSTANCE dmtpe="coords:LonLatPoint">
                  <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="-0.5"/>
                  <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="1.5"/>
                  <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
                </dm-mapping:INSTANCE>
              </dm-mapping:COLLECTION>
            </dm-mapping:INSTANCE>
            <dm-mapping:INSTANCE dmid=" custcoordsys" dmrole="instfov:Fov.customSpaceSys" dmtpe="instfov:CustomSpaceSys">
              <dm-mapping:INSTANCE dmrole="instfov:CustomSpaceSys.customSpaceFrame" dmtpe="instfov:CustomSpaceFrame">
                <dm-mapping:INSTANCE dmrole="instfov:CustomSpaceFrame.refPosition custom" dmtpe="instfov:CustomRefLonLatLocation">
                  <dm-mapping:INSTANCE dmrole="instfov:CustomRefLonLatLocation.position" dmtpe="coords:LonLatPoint">
                    <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="250.0"/>
                    <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="35.0"/>
                    <dm-mapping:REFERENCE dmrole="instfov:LonLatPoint.standardSpaceReferenceSystem" dmref="_universalCoordSys"/>
                  </dm-mapping:INSTANCE>
                  <dm-mapping:ATTRIBUTE dmrole="coords:SpaceFrame.spaceRefFrame" dmtpe="ivoa:string" value="ICRS"/>
                  <dm-mapping:ATTRIBUTE dmrole="instfov:CustomSpaceFrame.directionAngle" dmtpe="ivoa:real" value="30"/>
                  <dm-mapping:ATTRIBUTE dmrole="instfov:CustomSpaceFrame.projection" dmtpe="ivoa:string" value="TAN"/>
                </dm-mapping:INSTANCE>
              </dm-mapping:INSTANCE>
            </dm-mapping:INSTANCE>
            <dm-mapping:INSTANCE dmid=" universalCoordSys" dmtpe="coords:SpaceSys">
              <dm-mapping:INSTANCE dmrole="coords:SpaceSys.spaceFrame" dmtpe="coords:SpaceFrame">
                <dm-mapping:INSTANCE dmrole="coords:SpaceFrame.refPosition" dmtpe="coords:stdRefLocation">
                  <dm-mapping:ATTRIBUTE dmrole="coords:stdRefLocation.position" dmtpe="ivoa:string" value="BARYCENTER"/>
                </dm-mapping:INSTANCE>
                <dm-mapping:ATTRIBUTE dmrole="coords:SpaceFrame.spaceRefFrame" dmtpe="ivoa:string" value="ICRS"/>
              </dm-mapping:INSTANCE>
            </dm-mapping:INSTANCE>
          </dm-mapping:COLLECTION>
        </dm-mapping:INSTANCE>
      </dm-mapping:GLOBALS>
    </dm-mapping:VODML>
  </RESOURCE>
</VOTABLE>
```

Shapes



CustomSpaceSys



Standard SpaceSys



# The Serialisation/Mapping using MIVOT

- 3 flavors :
  - Fixed :
    - Everything constant (stored in GLOBALS element)
  - Multicentric :
    - Pointings and orientations retrieved from VOTable TABLE FIELDS/ROWS (refs from TEMPLATES element)
  - Interactive
    - Pointings and orientation to be completed by a service (via service descriptor or NaN values in GLOBALS structure )





# Project status

- Parsing of mapping block achieved
- First display within Aladin (only fixed mapping)



# Project status

DSS2 color



# Future work

- Convert the existing instrument FOV library into the new format
- Develop an editor to create FoV in the new format
- Extend the usage of the format to new instruments (X-ray : XMM, Chandra)
- Use the standard to display sources detected during an observation on top of the FoV display
- Propose the improved model as an IVOA recommendation and reuse this FoV model into IVOA Proposal data model

