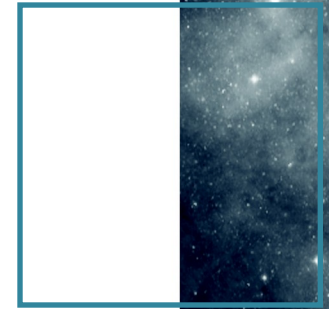


Instrument Field of View DM : A step forward



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 → Editor

Instrument Footprint Editor

Footprint name:



New



Save



Test in Aladin



Copy shape



New rect



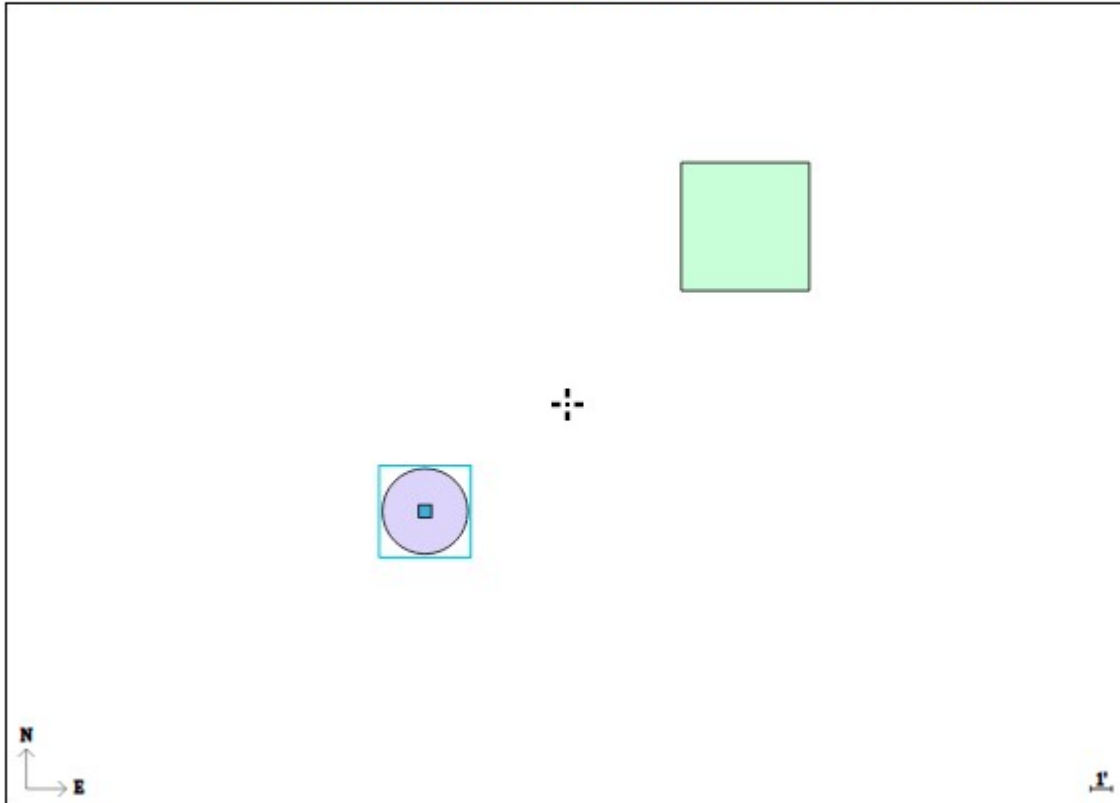
New circle



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 |



Why a new project ?

- Old system was used by several projects (HST, CFHT,) but not by several clients.
- Old « standardisation » was simply
 - VOTable,
 - STC1 utypes, GROUPS, and Fov structure (obsoleted)
 - not an IVOA recommendation (only a Note)
- Restart the project in a more interoperable way by
 - deriving a new FoV data Model from Coords,
 - using MIVOT mapping syntax to describe model elements
- Explore usage outside AladinDesktop



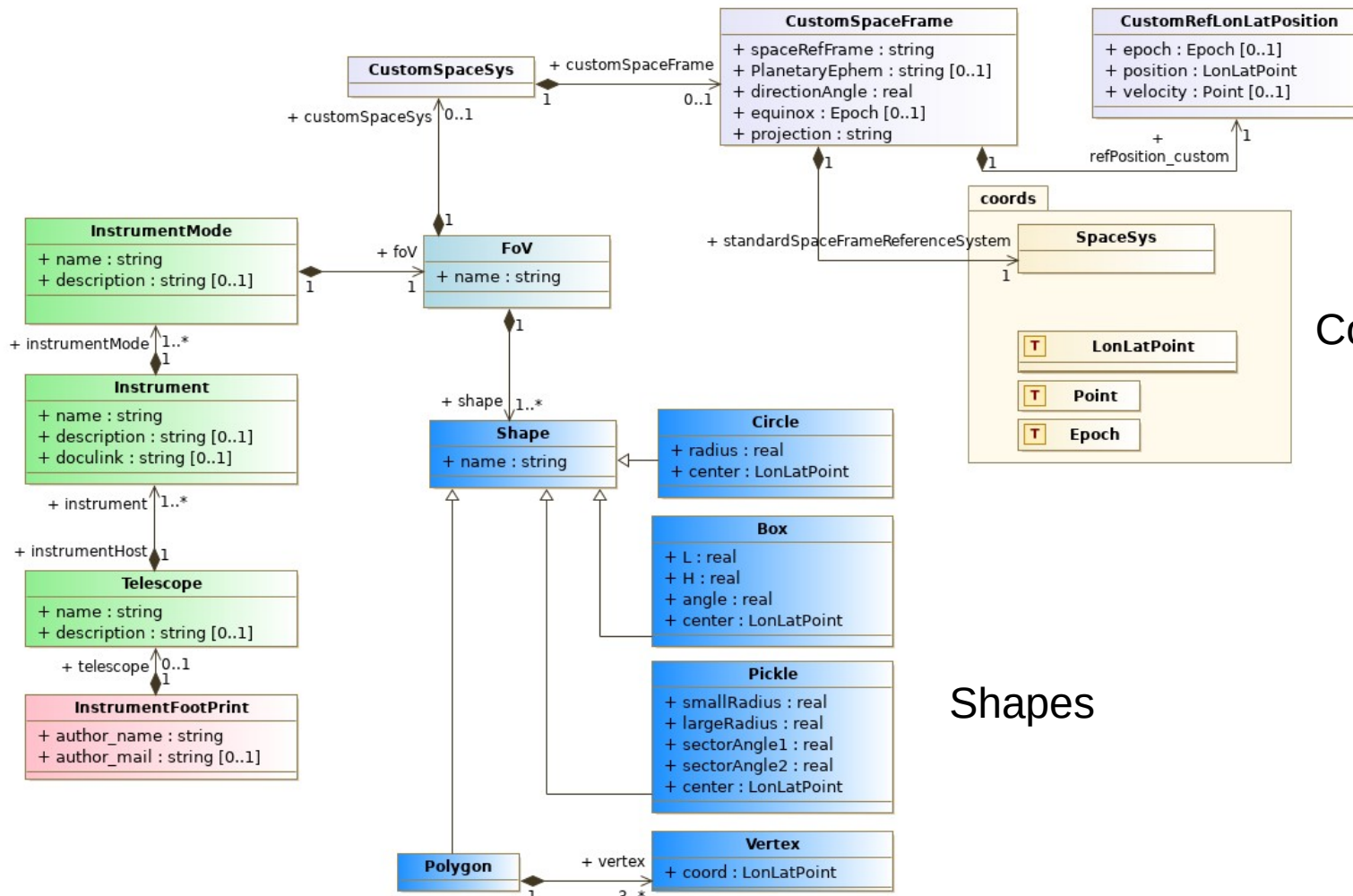
Project status

- Data model developed in 2022 by CDS + Laurent Michel
- Serialization in VOTable using MIVOT specification
- First implementation in AladinDesktop and AladinLite prototypes done by an intern in 2022
- No user-driven rendering up to now :
 - This is a really important feature of the old style version for observation preparation



The FOV datamodel (vo-dml consistent)

CustomSpaceSys



Coords datamodel

Shapes

CONTEXT



The FOV datamodel

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



The Serialisation : Mapping using MIVOT

- MIVOT Provides :
 - Mapping of *instances* of data models (Coords, Meas, PhotDM, Mango) on top of VOTables
 - VO tools (PyVO, Aladin, TopCat) start to generate full serialization of *instances* of datamodels
 - Also the cas for our footprint datamodel



The Serialisation / Mapping using MIVOT

Telescope
Instrument
Mode

Shapes

```
<VOTABLE xmlns="http://www.ivoa.net/xml/VOTable/v1.3" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.4" xsi:schemaLocation="http://www.ivoa.net/xml/VOTable/v1.3 http://www.ivoa.net/xml/VOTable/v1.3">
  <RESOURCE xmlns="" type="results">
    <RESOURCE type="meta">
      <VODML xmlns:dm-mapping="http://www.ivoa.net/xml/merged-syntax">
        <REPORT status="OK">hand-made mapping: ad hoc model so far</REPORT>
        <MODEL name="instfov" url="https://www.ivoa.net/xml/instfov.xml"/>
        <MODEL name="coords" url="https://www.ivoa.net/xml/Coords-v1.xsd"/>
      </VODML>
      <GLOBALS>
        <INSTANCE dmid="footprint" dmtpe="instfov:InstrumentalFootPrint">
          <ATTRIBUTE dmrole="instfov:InstrumentalFootPrint.author_name" dmtpe="ivoa:string" value="Laurent MICHEL"/>
          <ATTRIBUTE dmrole="instfov:InstrumentalFootPrint.author_email" dmtpe="ivoa:string" value="laurent.michel@astro.unistra.fr"/>
          <INSTANCE dmrole="instfov:InstrumentalFootPrint.telescope" dmtpe="instfov:Telescope">
            <ATTRIBUTE dmrole="instfov:Telescope.name" dmtpe="ivoa:string" value="MockedTelescope"/>
            <ATTRIBUTE dmrole="instfov:Telescope.description" dmtpe="ivoa:string" value="mocked telescope"/>
          </INSTANCE>
          <COLLECTION dmrole="instfov:Telescope.instrument">
            <INSTANCE dmtpe="instfov:Instrument">
              <ATTRIBUTE dmrole="instfov:Instrument.name" dmtpe="ivoa:string" value="MockCamera"/>
              <ATTRIBUTE dmrole="instfov:Instrument.description" dmtpe="ivoa:string" value="mocked camera"/>
              <COLLECTION dmrole="instfov:Instrument.insrumentMode">
                <INSTANCE dmtpe="instfov:InstrumentMode">
                  <ATTRIBUTE dmrole="instfov:InstrumentMode.name" dmtpe="ivoa:string" value="AllFrames"/>
                  <ATTRIBUTE dmrole="instfov:InstrumentMode.description" dmtpe="ivoa:string" value="full frames together"/>
                  <INSTANCE dmid="_fov" dmrole="instfov:InstrumentMode.fov" dmtpe="instfov:Fov">
                    <COLLECTION dmrole="instfov:Fov.shape">
                      <INSTANCE dmtpe="instfov:Polygon">
                        <COLLECTION dmrole="instfov:Polygon.vertex">
                          <INSTANCE dmtpe="coords:LonLatPoint">
                            <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="0.04156275976724854"/>
                            <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="0.0187580621064599"/>
                            <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
                          </INSTANCE>
                          <INSTANCE dmtpe="coords:LonLatPoint">
                            <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="0.04156275976724854"/>
                            <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="-0.017449787534225568"/>
                            <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
                          </INSTANCE>
                          <INSTANCE dmtpe="coords:LonLatPoint">
                            <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="0.021889720144084225"/>
                            <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="-0.032651556467337785"/>
                            <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
                          </INSTANCE>
                          <INSTANCE dmtpe="coords:LonLatPoint">
                            <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="0.022166805209199225"/>
                            <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="0.034789018435923705"/>
                            <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
                          </INSTANCE>
                        </COLLECTION>
                      </INSTANCE>
                    </COLLECTION>
                  </INSTANCE>
                </COLLECTION>
              </INSTANCE>
            </COLLECTION>
          </INSTANCE>
          <INSTANCE dmtpe="instfov:Pickle">
            <ATTRIBUTE dmrole="instfov:Pickle.smallRadius" dmtpe="ivoa:real" value="0.009722222222222222"/>
            <ATTRIBUTE dmrole="instfov:Pickle.largeRadius" dmtpe="ivoa:real" value="0.018055555555555554"/>
            <ATTRIBUTE dmrole="instfov:Pickle.sectorAngle1" dmtpe="ivoa:real" value="0"/>
            <ATTRIBUTE dmrole="instfov:Pickle.sectorAngle2" dmtpe="ivoa:real" value="180"/>
            <INSTANCE dmrole="instfov:Circle.center" dmtpe="coords:LonLatPoint">
              <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="0"/>
              <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="0"/>
              <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
            </INSTANCE>
          </INSTANCE>
          <INSTANCE dmtpe="instfov:Pickle">
            <ATTRIBUTE dmrole="instfov:Pickle.smallRadius" dmtpe="ivoa:real" value="0.009722222222222222"/>
            <ATTRIBUTE dmrole="instfov:Pickle.largeRadius" dmtpe="ivoa:real" value="0.018055555555555554"/>
            <ATTRIBUTE dmrole="instfov:Pickle.sectorAngle1" dmtpe="ivoa:real" value="0"/>
            <ATTRIBUTE dmrole="instfov:Pickle.sectorAngle2" dmtpe="ivoa:real" value="90"/>
            <INSTANCE dmrole="instfov:Circle.center" dmtpe="coords:LonLatPoint">
              <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtpe="ivoa:real" value="0"/>
              <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtpe="ivoa:real" value="0"/>
              <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
            </INSTANCE>
          </INSTANCE>
        </COLLECTION>
      </INSTANCE>
    </COLLECTION>
  </RESOURCE>
</VOTABLE>
```


AladinDesktop : Collection of new version of previous footprints

The screenshot displays the Aladin v11.0 software interface. The main window shows a star field with several instrument footprints overlaid. The 'Server selector' dialog box is open, showing the 'Instrument fields of view' section. The dialog includes a 'Target (ICRS, name)' field with the value '20 34 54.14816+60 08 22.6540' and an 'Angle (in degrees)' field with the value '30'. Below these fields is a table listing various instruments and their details.

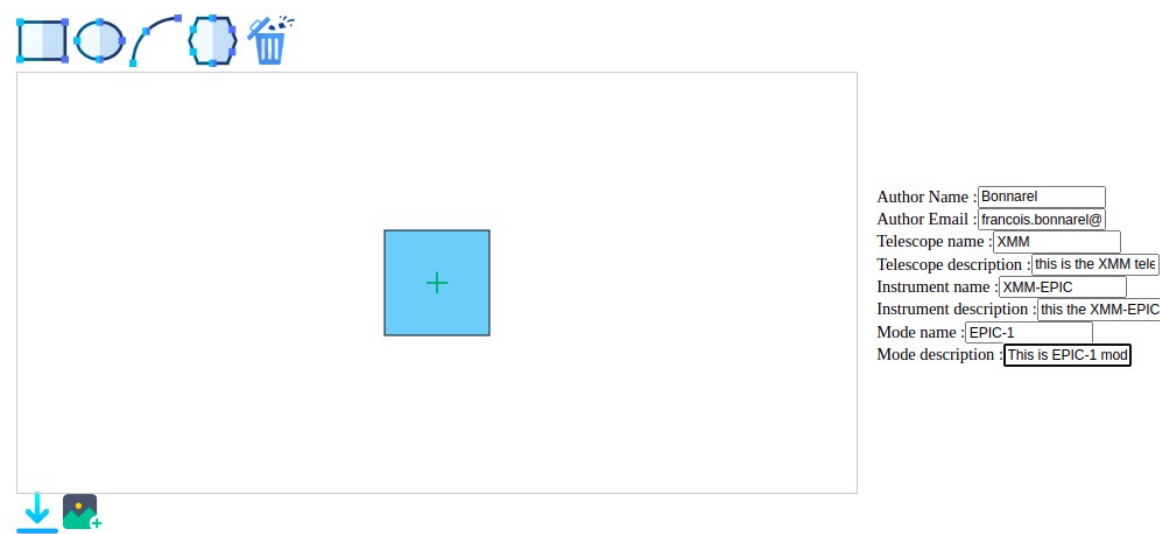
| Instrument | Teles... / | Description | Author |
|---------------|-------------|--|--------------|
| NEW_Suprim... | SUBARU | The Subaru Prime Focus Camera (Supri... | CDS/S. D... |
| NEW_Schulm... | Schulma... | Schulman 32-inch Telescope | Adam BL... |
| NEW_HSC | Subaru | Hyper-SuprimeCam | Herve B... |
| NEW_VIRcam | VISTA | Wide Field IR camera | Laurent ... |
| NEW_FOR51 | VLT | ESO FOcal Reducer/low dispersion Spe... | ESO-CDS |
| NEW_FOR52 | VLT | ESO FOcal Reducer/low dispersion Spe... | ESO-CDS |
| NEW_ISAAC | VLT | ESO infrared imager and spectrograph | ESO-CDS |
| NEW_VIMOS | VLT | ESO VIMOS mosaic camera | ESO |
| NEW_DECam | Victor M... | Dark Energy Camera with imaging (blue... | Luis Cicu... |

The interface also shows a menu bar (File, Edit, Image, Catalog, Overlay, Coverage, Tool, View, Interop, Help), a toolbar, and a sidebar with 'Available data' and 'Collections' lists. The bottom right corner features a control panel with sliders for 'epoch', 'size', 'dens.', 'opac.', and 'zoom', along with a small globe icon.

JavaScript Editor interface

- Draw instrument footprints description with the editor and save it in MIVOT format

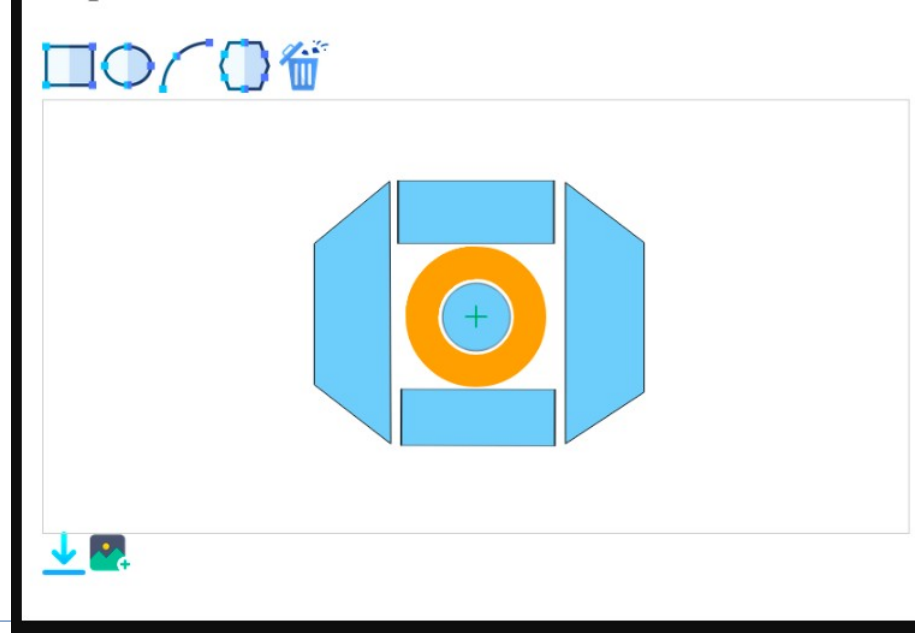
Footprint editor



The screenshot shows the 'Footprint editor' interface. At the top left, there is a toolbar with five icons: a square, a circle, a curved line, a square with a circle inside, and a trash can. Below the toolbar is a large white canvas containing a single blue square with a green plus sign in the center. To the right of the canvas is a form with the following fields: Author Name (Bonnaire), Author Email (francois.bonnaire@), Telescope name (XMM), Telescope description (this is the XMM tele), Instrument name (XMM-EPIC), Instrument description (this the XMM-EPIC), Mode name (EPIC-1), and Mode description (This is EPIC-1 mod). At the bottom left of the canvas, there are two small icons: a download arrow and a camera icon.

- Can also be done on top of an image of the sky with a given instrument

Footprint editor

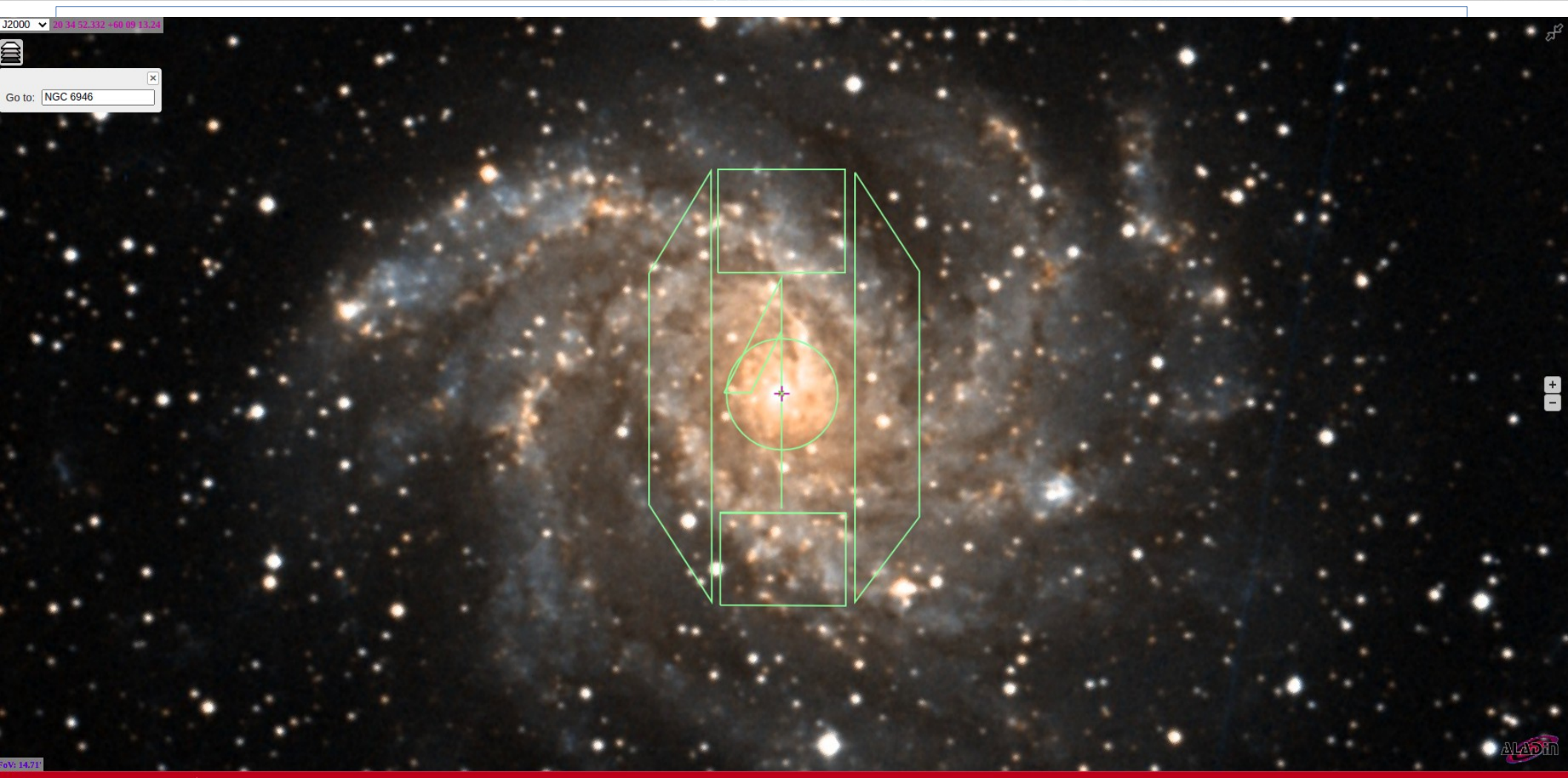


The screenshot shows the 'Footprint editor' interface with a sky image. The toolbar and form are identical to the previous screenshot. The canvas now displays a complex footprint shape overlaid on a dark blue sky image with stars. The footprint consists of a central blue circle with a green plus sign, surrounded by an orange ring, and four blue rectangular segments extending outwards. At the bottom left of the canvas, there are two small icons: a download arrow and a camera icon.



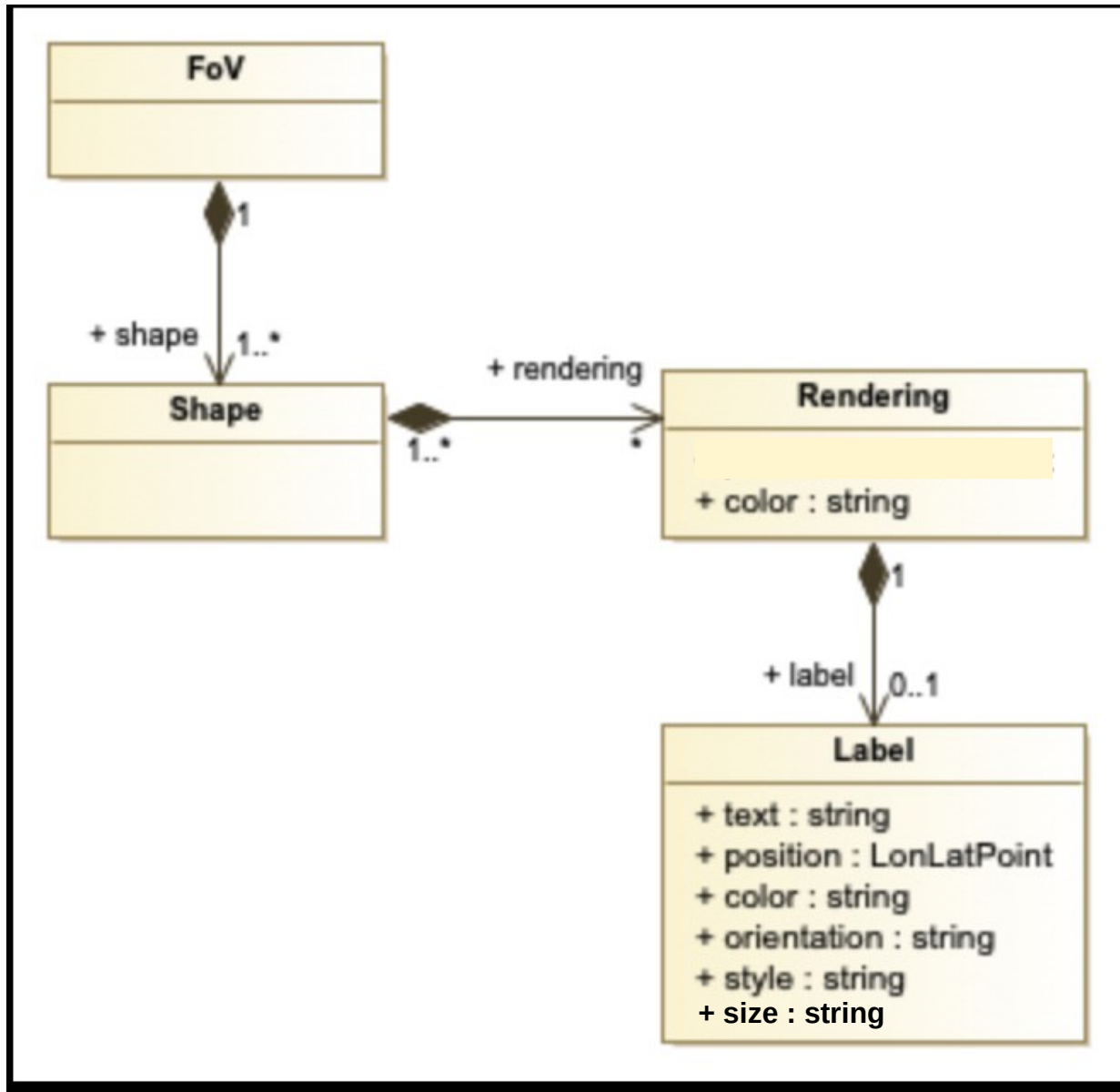
Loading footprints in AladinLite

→ interoperability with another tool



Rendering :

currently two classes, aggregated to shape
plan to move to a « package » which can be holed or not to the shapes



Rendering :

MIVOT addition

```
--<COLLECTION dmrole="instfov:Instrument.instrumntMode">
-<INSTANCE dmtype="instfov:InstrumentMode">
  <ATTRIBUTE dmrole="instfov:InstrumentMode.name" dmtype="ivoa:string" value="AllFrames"/>
  <ATTRIBUTE dmrole="instfov:InstrumentMode.description" dmtype="ivoa:string" value="full frames together"/>
-<INSTANCE dmid="_fov" dmrole="instfov:InstrumentMode.fov" dmtype="instfov:Fov">
  --<COLLECTION dmrole="instfov:Fov.shape">
    --<INSTANCE dmtype="instfov:Polygon">
      --<COLLECTION dmrole="instfov:Polygon.vertex">
        --<INSTANCE dmtype="coords:LonLatPoint">
          <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="0.04156275976724854"/>
          <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="0.0187580621064599"/>
          <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
        </INSTANCE>
        --<INSTANCE dmtype="coords:LonLatPoint">
          <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="0.04156275976724854"/>
          <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="-0.017449787534225568"/>
          <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
        </INSTANCE>
        --<INSTANCE dmtype="coords:LonLatPoint">
          <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="0.021889720144084225"/>
          <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="-0.032651556467337785"/>
          <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
        </INSTANCE>
        --<INSTANCE dmtype="coords:LonLatPoint">
          <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="0.022166805209199225"/>
          <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="0.034789018435923705"/>
          <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
        </INSTANCE>
      </COLLECTION>
    --<INSTANCE dmrole="instfov:Rendering">
      <ATTRIBUTE dmrole="instfov:Rendering.color" dmtype="ivoa:string" value="red"/>
    --<INSTANCE dmrole="instfov:Rendering.label" dmtype="instfov:Label">
      <ATTRIBUTE dmrole="instfov:Label.text" dmtype="ivoa:string" value="first camera"/>
    --<INSTANCE dmrole="instfov:Rendering.position" dmtype="coords:LonLatPoint">
      <ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="0.041610"/>
      <ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="0.01895"/>
      <REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
    </INSTANCE>
      <ATTRIBUTE dmrole="instfov:Rendering.color" dmtype="ivoa:string" value="blue"/>
      <ATTRIBUTE dmrole="instfov:Rendering.orientation" dmtype="ivoa:string" value="landscape"/>
      <ATTRIBUTE dmrole="instfov:Rendering.style" dmtype="ivoa:string" value="bold"/>
      <ATTRIBUTE dmrole="instfov:Rendering.size" dmtype="ivoa:string" value="medium"/>
    </INSTANCE>
  </INSTANCE>
</COLLECTION>
</INSTANCE>
</INSTANCE>
```

Polygon
description

Rendering of
The Polygon



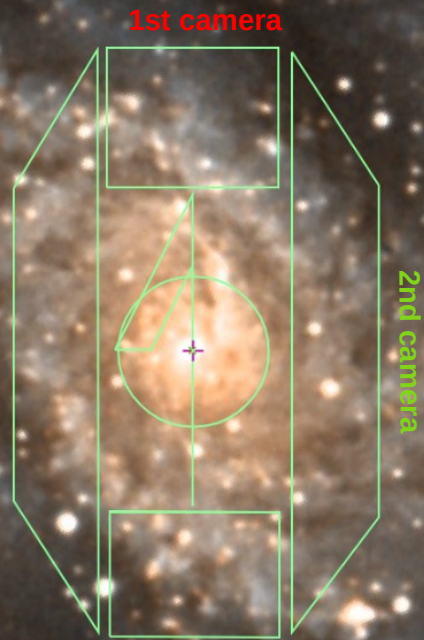
Rendering :

Lay out

J2000 30 34 52.332 -60 09 13.24

Go to:

PaV: 14.71



Working draft:



IVOA Instrumental FootPrint Data Model

Version 1.0

IVOA Working Draft 2024-05-22

Working Group

DM

This version

<https://www.ivoa.net/documents/InstrumentalFootPrintDataModel/2024052/>

Latest version

<https://www.ivoa.net/documents/InstrumentalFootPrintDataModel/>

Previous versions

This is the first public release

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Michel

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François Bonnarel

Abstract

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Acknowledgments

The authors would like to thank all the participants in DM-WG discussions for their ideas, critical reviews, and contributions to this document.

Conformance-related definitions

The words “MUST”, “SHALL”, “SHOULD”, “MAY”, “RECOMMENDED”, and “OPTIONAL” (in upper or lower case) used in this document are to be interpreted as described in IETF standard RFC2119 (Bradner, 1997).

The *Virtual Observatory (VO)* is a general term for a collection of federated resources that can be used to conduct astronomical research, education, and outreach. The *International Virtual Observatory Alliance (IVOA)* is a global collaboration of separately funded projects to develop standards and infrastructure that enable VO applications.

Future work

- Publish the working draft for an IVOA « instrument footprint datamodel »
 - Or move to
- Extend the usage of the format to new instruments (X-ray : XMM, Chandra)
- Extend the scope to new use cases :
 - Use the standard to display sources detected during an observation on top of the FoV display
 - ???
- Implement the rendering in the tools (AladinDesktop, AladinLite, editor)
 - Let the « rendering » of the footprint display in the serialization as optional.
 - only valid for instrument preparation
 - not to be shared among projects

