Instrument Field of View DM and mapping in VOT

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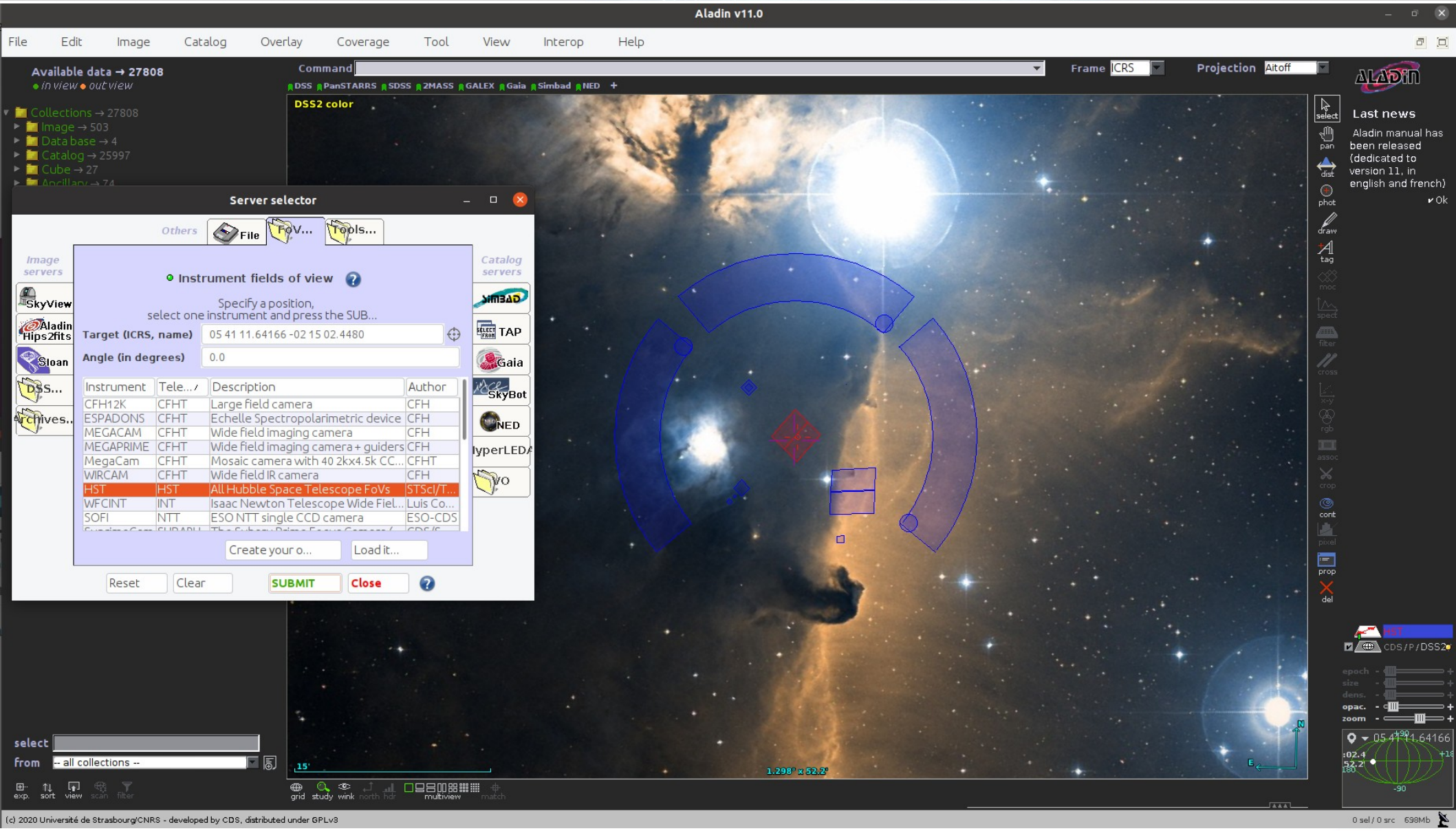
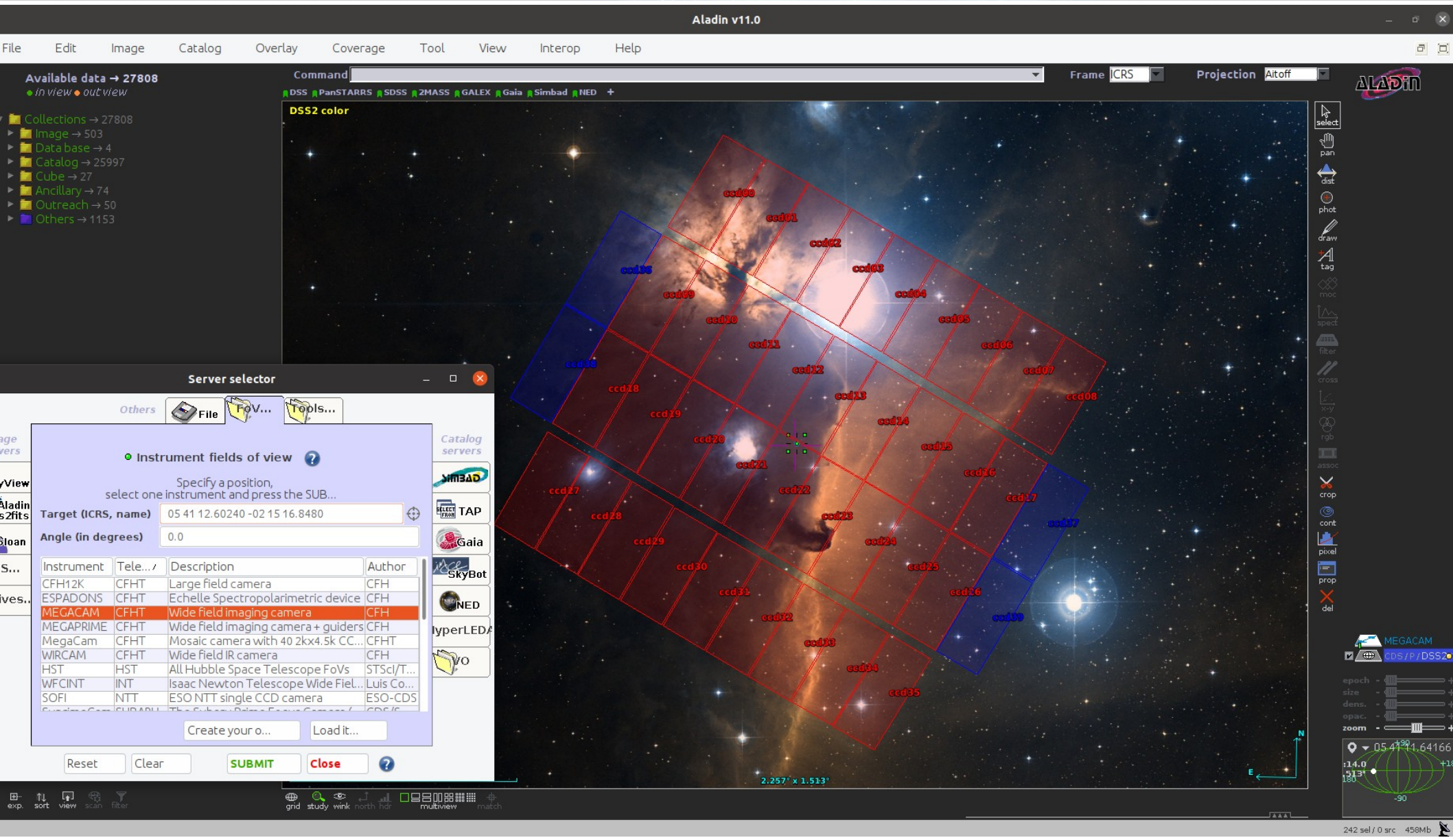
IVOA

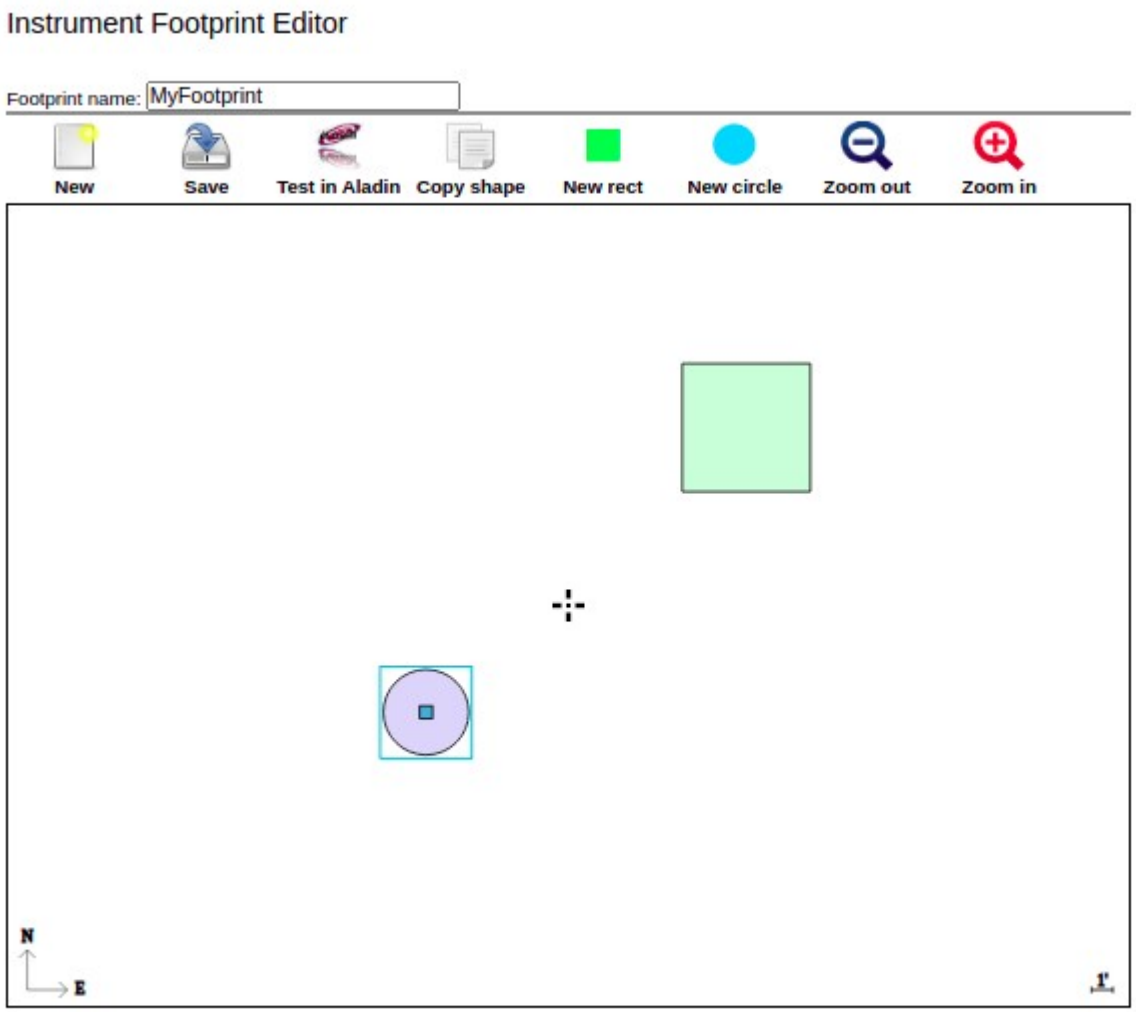
Motivation : replace Instrument FoV facility in Aladin → HST

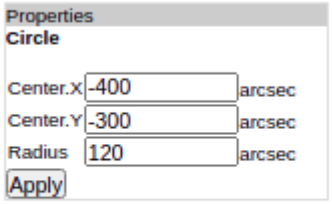


Motivation : replace Instrument FoV facility in Aladin → MEGACAM



Motivation : replace Instrument FoV facility in Aladin → Editor





Motivation :

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

International Virtual Observatory Alliance

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

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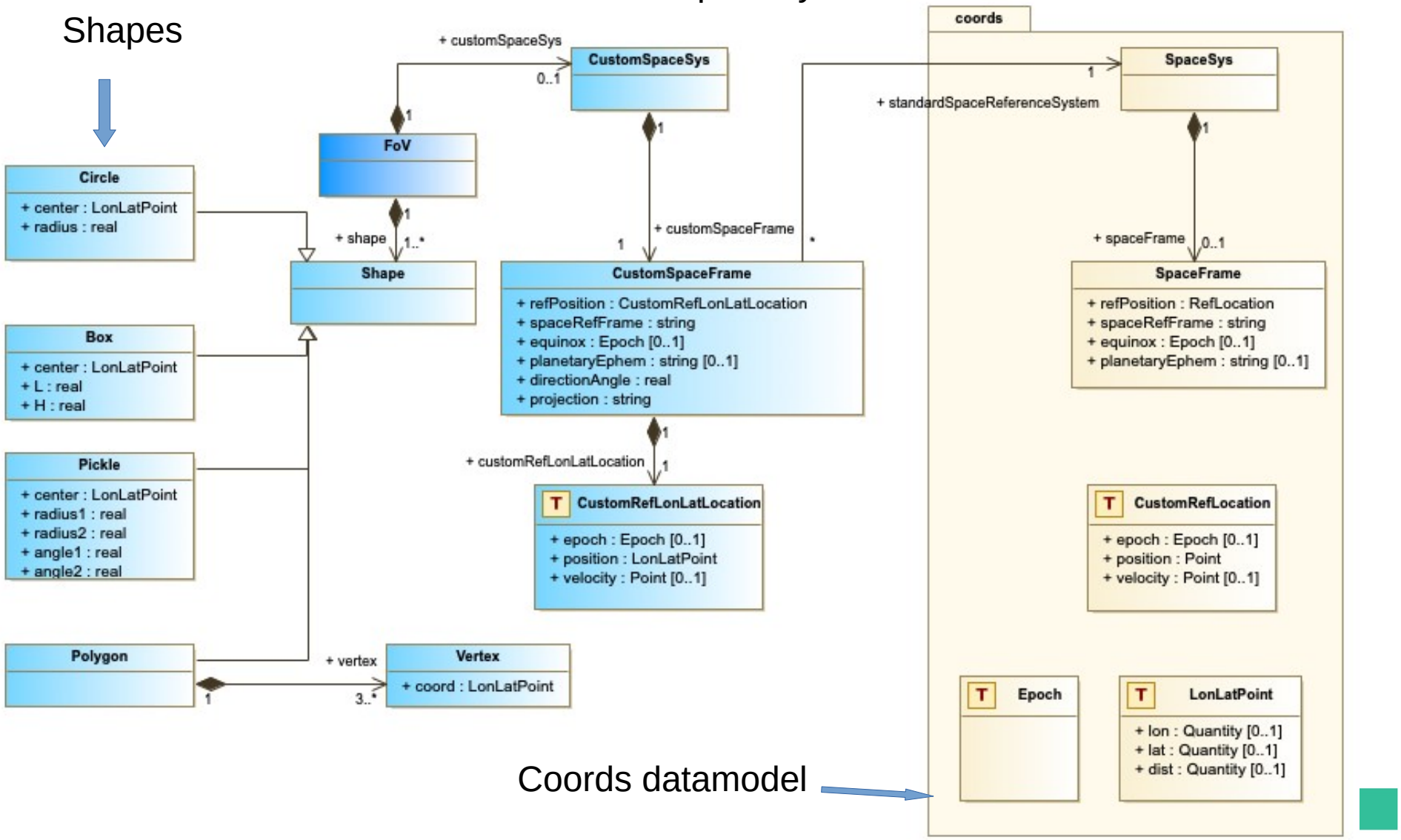
Abstract
This document defines a mechanism for embedding observation footprint description, emphasizing how those descriptions could be attached to DAL query responses or describe instruments signature.Software with interfaces conforming to this specification will enable automatic overlay of observational 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 developper 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

International Virtual Observatory Alliance

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

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Editor(s)
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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

Shapes

CustomSpaceSys

Standard SpaceSys

```
<!--
  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" dmtype="instfov:Fov">
       <dm-mapping:COLLECTION dmrole="instfov:Fov.shape">
        <dm-mapping:INSTANCE dmtype="instfov:Circle">
         <dm-mapping:ATTRIBUTE dmrole="instfov:Circle.radius" dmtype="ivoa:real" value="0.6"/>
         <dm-mapping:INSTANCE dmrole="instfov:Circle.center" dmtype="coords:LonLatPoint">
          <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="2.0"/>
          <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="1.5"/>
          <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
         </dm-mapping:INSTANCE>
        </dm-mapping:INSTANCE>
        <dm-mapping:INSTANCE dmtype="instfov:Box">
         <dm-mapping:ATTRIBUTE dmrole="instfov:Box.L" dmtype="ivoa:real" value="0.5"/>
         <dm-mapping:ATTRIBUTE dmrole="instfov:Box.H" dmtype="ivoa:real" value="0.7"/>
         <dm-mapping:INSTANCE dmrole="instfov:Box.Center" dmtype="coords:LonLatPoint">
          <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="-2.0"/>
          <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="-1.5"/>
          <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
         </dm-mapping:INSTANCE>
        </dm-mapping:INSTANCE>
        <dm-mapping:INSTANCE dmtype="instfov:Polygon">
         <dm-mapping:COLLECTION dmrole="instfov:Polygon.vertex">
          <dm-mapping:INSTANCE dmtype="coords:LonLatPoint">
           <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="0.5"/>
           <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="-1.5"/>
           <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
          </dm-mapping:INSTANCE>
          <dm-mapping:INSTANCE dmtype="coords:LonLatPoint">
           <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="0.5"/>
           <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="1.5"/>
           <dm-mapping:REFERENCE dmrole="coords:LonLatPoint.coordSys" dmref="_custcoordsys"/>
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           <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="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:COLLECTION>
      </dm-mapping:INSTANCE>
      <dm-mapping:INSTANCE dmid="_custcoordsys" dmrole="instfov:Fov.customSpaceSys" dmtype="instfov:CustomSpaceSys">
       <dm-mapping:INSTANCE dmrole="instfov:CustomSpaceSys.customSpaceFrame" dmtype="instfov:CustomSpaceFrame">
        <dm-mapping:INSTANCE dmrole="instfov:CustomSpaceFrame.refPosition_custom" dmtype="instfov:CustomRefLonLatLocation">
         <dm-mapping:INSTANCE dmrole="instfov:CustomRefLonLatLocation.position" dmtype="coords:LonLatPoint">
          <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lon" dmtype="ivoa:real" value="250.0"/>
          <dm-mapping:ATTRIBUTE dmrole="coords:LonLatPoint.lat" dmtype="ivoa:real" value="35.0"/>
          <dm-mapping:REFERENCE dmrole="instfov:LonLatPoint.standardSpaceReferenceSystem" dmref="_universalCoordSys"/>
         </dm-mapping:INSTANCE>
        </dm-mapping:INSTANCE>
        <dm-mapping:ATTRIBUTE dmrole="coords:SpaceFrame.spaceRefRame" dmtype="ivoa:string" value="ICRS"/>
        <dm-mapping:ATTRIBUTE dmrole="instfov:CustomSpaceFrame.directionAngle" dmtype="ivoa:real" value="30"/>
        <dm-mapping:ATTRIBUTE dmrole="instfov:CustomSpaceFrame.projection" dmtype="ivoa:string" value="TAN"/>
       </dm-mapping:INSTANCE>
      </dm-mapping:INSTANCE>
     </dm-mapping:INSTANCE>
     <dm-mapping:INSTANCE dmid="_universalCoordSys" dmtype="coords:SpaceSys">
      <dm-mapping:INSTANCE dmrole="coords:SpaceSys.spaceFrame" dmtype="coords:SpaceFrame">
       <dm-mapping:INSTANCE dmrole="coords:SpaceFrame.refPosition" dmtype="coords:stdRefLocation">
        <dm-mapping:ATTRIBUTE dmrole="coords:stdRefLocation.position" dmtype="ivoa:string" value="BARYCENTER"/>
       </dm-mapping:INSTANCE>
       <dm-mapping:ATTRIBUTE dmrole="coords:SpaceFrame.spaceRefRame" dmtype="ivoa:string" value="ICRS"/>
      </dm-mapping:INSTANCE>
     </dm-mapping:INSTANCE>
    </dm-mapping:GLOBALS>
   </dm-mapping:VODML>
  </RESOURCE>
 </RESOURCE>
</VOTABLE>
```

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

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