

Model Status

Coords, Meas, Trans, etc..

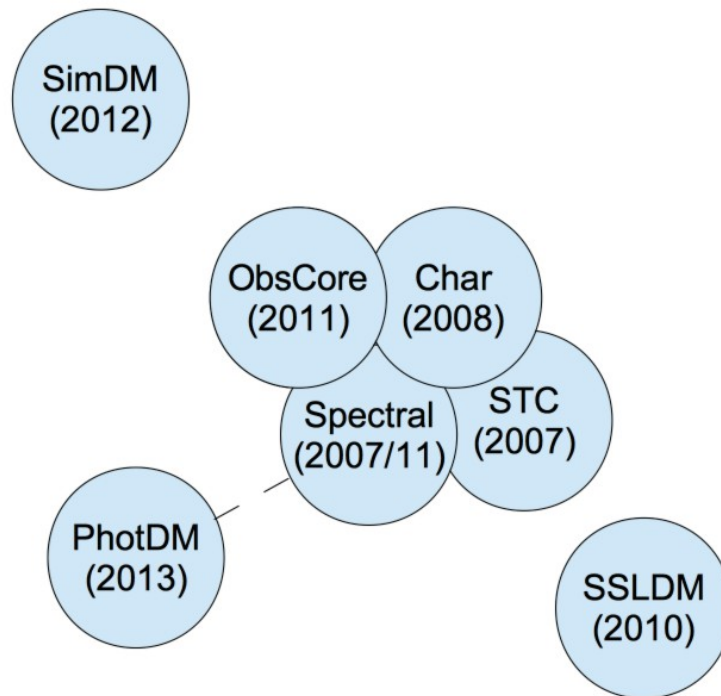
Mark Cresitello-Dittmar



Context

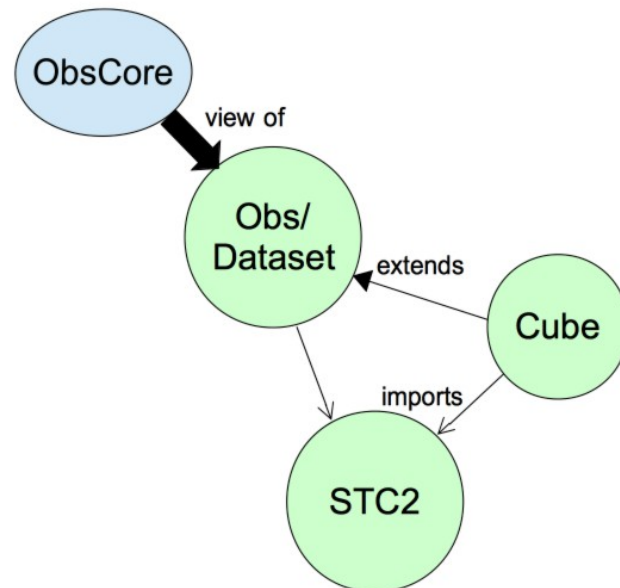
- Request (2013/14)
 - Model describing Image/NDCube data; expressed as an extension of ObsCore
- Additional criteria
 - Re-useable/modular models
 - Apply VO-DML (early adopter)
- Required refactoring of STC model
 - Insufficient for Cube requirements
 - not VO-DML

Context



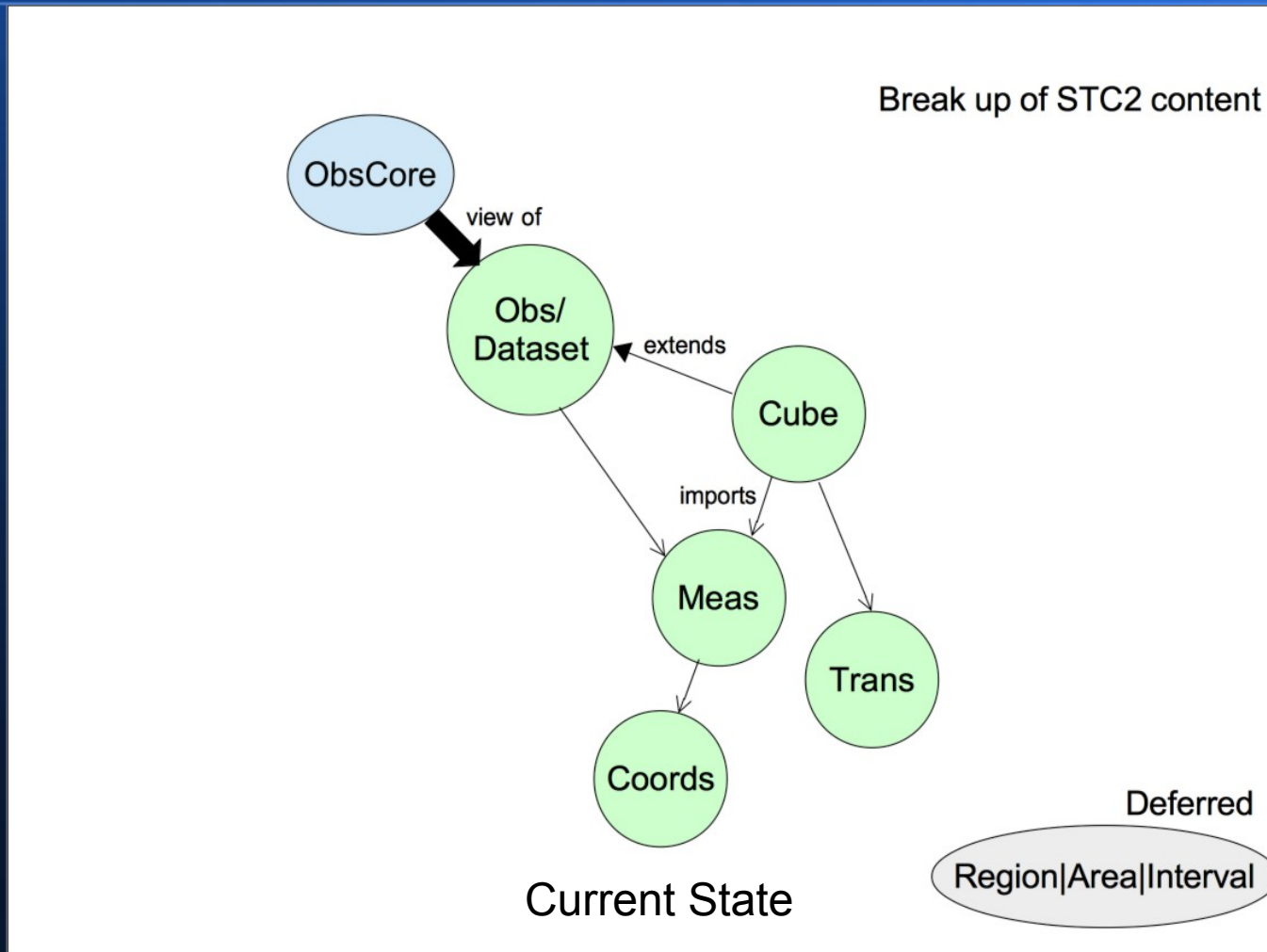
IVOA Data Model Landscape

Context

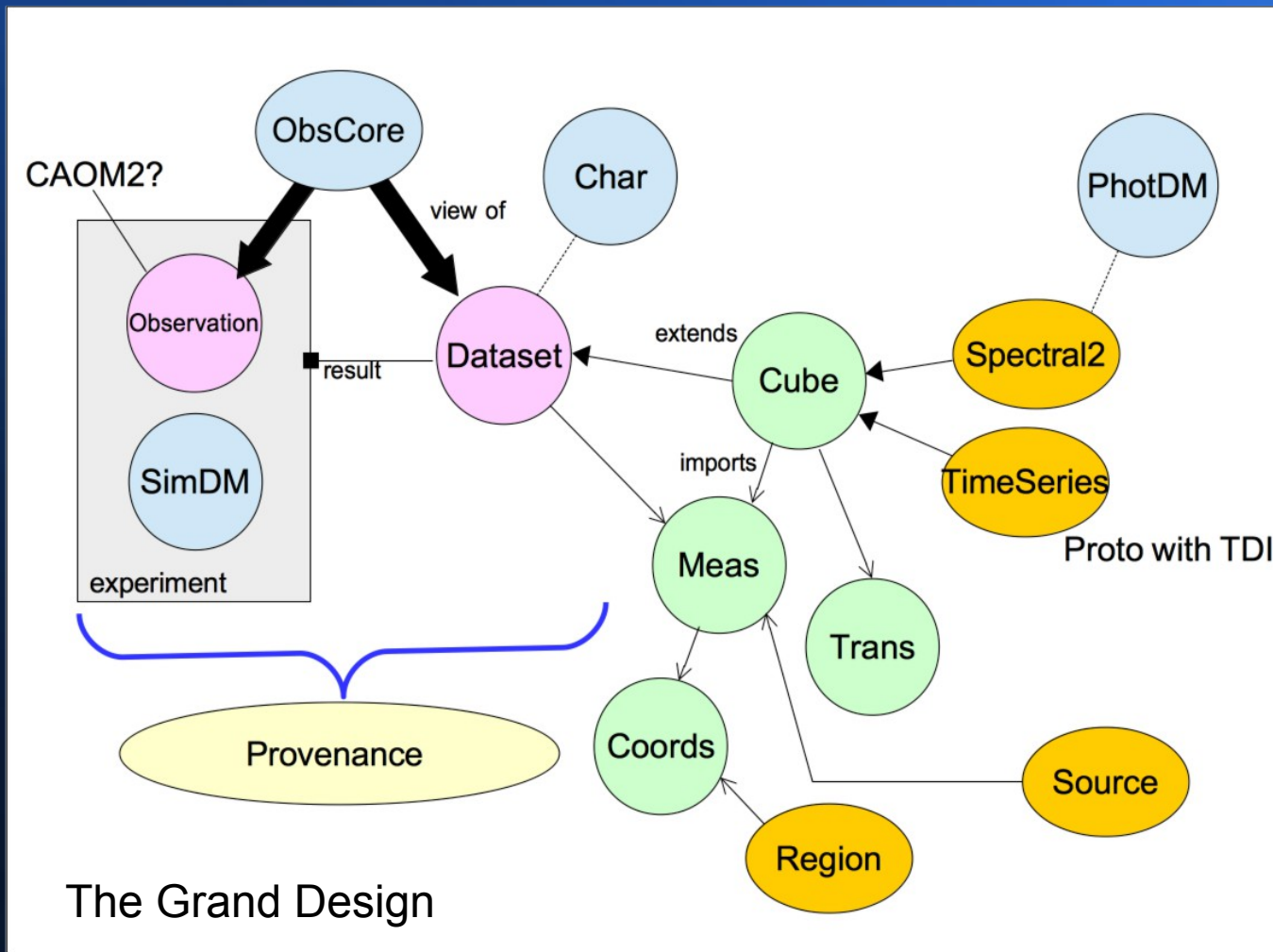


Initial Design

Context



Context



Usage Cases

Transform project

- Pass transform instances between AST and gWCS libraries
 - Exercises elements of model added for their needs
 - Uses YAML serialization; translation from XML
 - Lien on Transform model

TDIG – exercise prototype TimeSeries model using SPLAT

- Covers all models in development
- Has reviewed several serialization options
- No specified timetable
 - <https://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpMay2019TDIG>

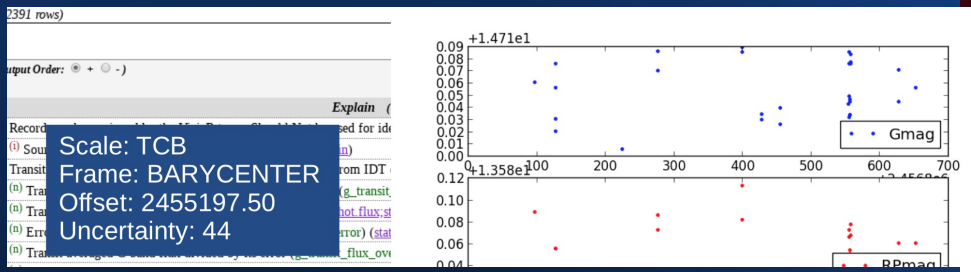
Usage Cases




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.symmetric.radius' value='44' />
  <FIELDref ref='TimeG' utype='coords:TimeOffset.value' />
</GROUP>
```

- `<FIELD name="ra" datatype="double" ucd="pos.eq.ra" unit="deg"/>`
 - `utype = « meas:EquatorialPosition.ra »`
 - `utype = « cab-msd:Source/meas:EquatorialPosition.ra »`





International
Virtual
Observatory
Alliance

**Time Series Cube Data Model
Version 1.0**

IVOA Note 2017-02-05

Working group
Time domain interest group

This version
<http://www.ivoa.net/documents/cubeDM/20170205>

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

Previous versions

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Editor(s)
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```
BANDPASS
<FIELD arraysize="*" datatype="char" ucd="band" ucd="instr.bandpass"
  utype="ssa:DataID.Bandpass">
  <DESCRIPTION>Photometric band. Values: G (per-transit combined SM-AF flux), BP (blue photometer integrated flux) and RP (red photometer integrated flux).
  </DESCRIPTION>
</FIELD>

TIME
<FIELD datatype="double" name="time" ucd="time.epoch" ucd="image_MJDateObs" unit="d"
  utype="spec:Spectrum.Data.TimeAxis.Value">
  <DESCRIPTION>Observing time [s]</DESCRIPTION>
</FIELD>

FLUX/MAGNITUDES
<FIELD datatype="float" name="flux" ucd="em.opt:phot.flux.stat.mean" unit="e-/s"
  utype="spec:Spectrum.Data.SpectraAxis.Value">
  <DESCRIPTION>Band flux value for the transit. For G band, it is a combination of individual SM-AF CCD fluxes. For BP and RP bands, it is an integrated CCD flux.
  </DESCRIPTION>
</FIELD>
<FIELD datatype="float" name="mag" ucd="phot.mag;em.opt" unit="mag">
  <DESCRIPTION>Vega magnitude. It is computed from the flux applying the DR2 zero-point defined in https://www.cosmos.esa.int/web/gaia/iov\_20180316 </DESCRIPTION>
</FIELD>

ERRORS FLUX/MAGNITUDES
<FIELD datatype="float" name="flux_error" ucd="em.opt:phot.flux.stat.error" unit="e-/s">
  <DESCRIPTION>Flux error. The uncertainty flux_error on flux depends on the passband band as follows: band G: [...] </DESCRIPTION>
</FIELD>
<FIELD datatype="float" name="flux_over_error" ucd="em.opt:phot.flux;stat.error">
  <DESCRIPTION>Band flux divided by its error.</DESCRIPTION>
</FIELD>
```

Source DM session

→ Sparse Cube Data Model

Work this semester

Example Serializations

- Enhanced example file generator to produce XML
 - VOTable – validates to v1.3 schema
 - VOTable w/ Mapping – validates to v1.3+ schema
 - XML – validates to model schema
- Updated example file suite..
 - covers all elements of all models
 - Cube examples: Event list, 2D Image, 4D Image
 - Includes virtual columns/axes

Work this semester

Re-review of model compatibility with AST and Astropy

- Primarily to inform response/changes from RFC comments
- Both: combine Frame and CoordSpace in their “Frame”
 - AST: naxes + various attributes[axis]
 - Astropy: coordinate 'representation'
- Both: Default and customizable coordinate space
- Both: Loose coupling; can represent Galactic in Cartesian

These models fully support the use cases for which they were designed and form a very solid foundation, which can be built upon to support a wide-variety of additional use cases.

Comments/Lessons

XML Serializations

- Model schema produced by xslt script (G. Lemson)
- No elements, only types
 - Created test schema importing/including model schema and defining elements which could be serialized
- To validate, order matters - annoying
 - attributes, references, compositions
 - inherited (base) elements before extended

Comments/Lessons

VOTable Serializations

- Image files fail validation at end
 - Uses `<FITS extnum='0'>` (primary HDU)
 - Fails - “Not positive integer”

Spectral Transform on 4D VLA image

- Transform type = AIPS “FELO-HEL”
 - Not supported by WCS Paper III which is the basis of the spectral transform definition

Coords Model Status

Coords in RFC 9/17 – 10/21

- Minor items by Mark C-D and Mark T.
- Issue found by David B. during transform implementation
 - Expanded scope to “import/export full image WCS”
 - Having trouble since Frame and CoordSpace only linked via Coordinate
 - Model change from 2017 while working to simplify/minimize the model

Measurement Model Status

Meas in RFC 9/17 – 10/21

- Quite a few comments from Markus D., F-X P., Mark T.
 - Typos, description enhancements (ProperMotion)
 - Odd elements (EquatorialPosition, CartesianPosition)
 - Addressing coords issue addresses this too
 - Things insufficiently defined for <X> other use-case (Ellipse); add to Next
 - Things likely incompatible with <X> other use-case (CovarianceMatrix); cut and add to Next

Transform Model Status

- Model in good shape
- Implementation in progress
 - Passing 'transform' between AST and gWCS via YAML
 - Expanded scope to 'import/export full image WSC'
 - Uncovered need for element connecting Frame and CoordSpace without the Coordinate
 - Seems like a very reasonable extension to the use-case, so should be addressed now.

Roadmap

RFC response (by Nov 1)

- Model changes for significant items [done]
- Will distribute proposed resolutions for comments
- Need to clean up, update docs, and examples
- Identify priority 'next' features/use cases

Work with implementation groups

- Complete transform implementation → RFC
- Work with TDIG on using TimeSeries in SPLAT
- Moving discussion/process up stream.. Dataset, Cube

Final Note

Additional Use Cases Encouraged!

- Need description of thread
- Resource to implement it