# Model Status:

## Spectrum RFE and Cube model status updates

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# Spectrum RFE

## The Request

- Presentations by Vandana Desai
  - Nov. 2020 Interop:
    - “Implementation of the IVOA Spectral Data Model at IPAC”
    - assessment of V1.1 Recommendation
  - May 2021 Interop:
    - “IVOA Spectral Models and Access in the Era of Big Data”
    - enhancement request to support IPAC use cases

# Spectrum RFE

## The specifics

- Add the following model elements
  - spec:Spectrum.Data.SpectralAxis.Order
  - spec:Spectrum.Data.SpectralAxis.RelOrder *
  - Spec:Spectrum.Data.FluxAxis.Accuracy.UpperLimit
  - Spec:Spectrum.Data.FluxAxis.Accuracy.LowerLimit

* RelOrder is a follow-on request by others; not in original RFE

# Spectrum RFE

## Preparatory Work Done

- Model migrated to Git (https://github.com/ivoa-std/SpectrumDM)
  - Ported current REC version; tagged release REC-V1.1-20111020
  - Created wd-v1.2 branch for RFE
  - Restructured repository to match other models

# Spectrum RFE

## Preparatory Work Done

Migrated Diagrams to proper UML

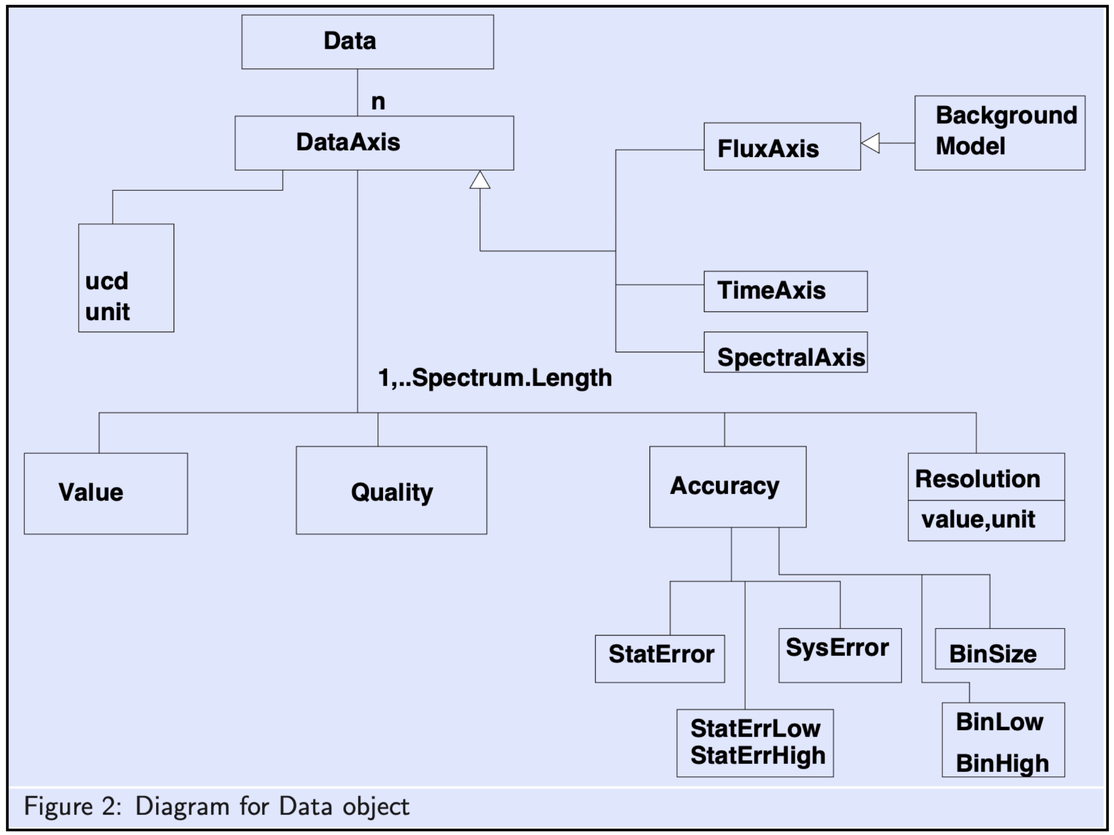
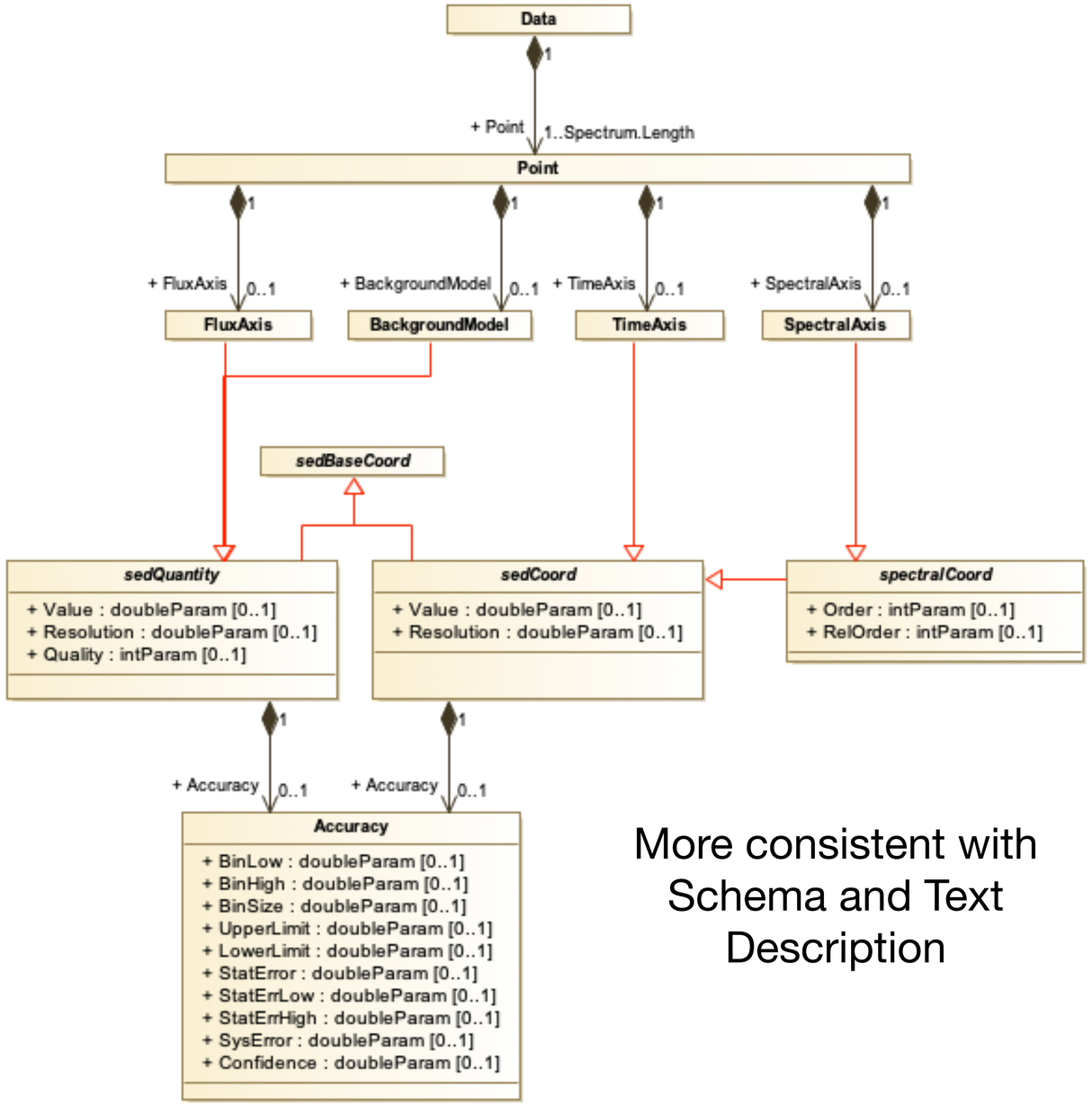



Figure 2: Diagram for Data object

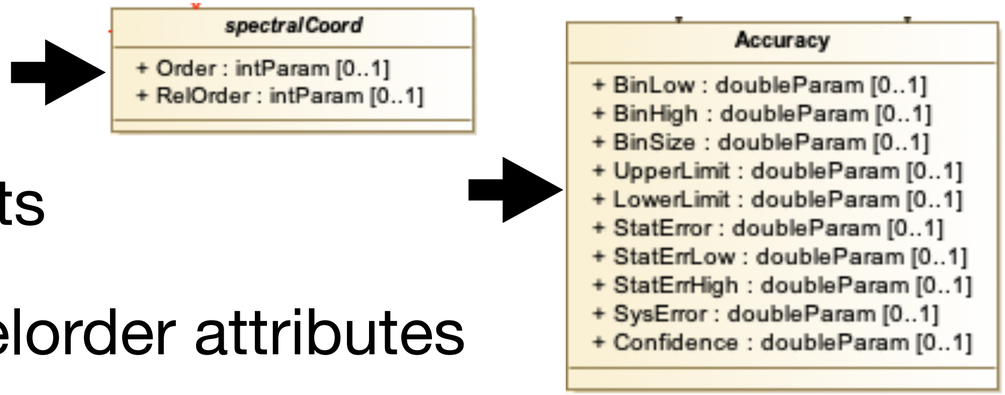



More consistent with Schema and Text Description

# Spectrum RFE

## List of Changes

- 2022 Jun 22: Document reset to WD for enhancement
- 2022 Jul 19: Added spectral order elements




- 2022 Jul 20: Added upper/lower limit elements
- 2023 Mar 17: Corrected case for order and relorder attributes
- 2023 Apr 27: Corrected UTypes in VOTable example 1 (missing Spectrum); add UCD assignments for Upper/Lower limits

# Spectrum RFE

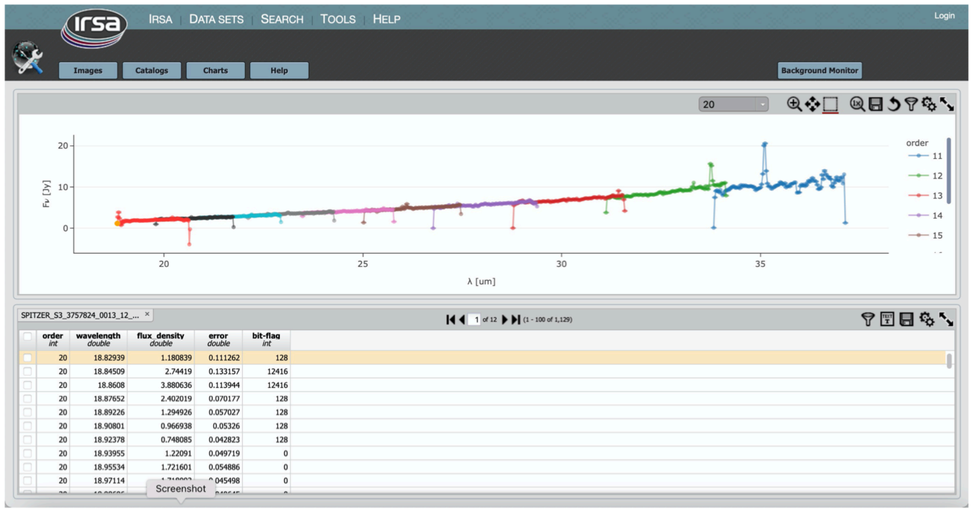
## Open Issues

- Issue #7: Document contains invalid/incorrect UCDs
    - Should we update the UCD vocabulary Reference in Section 3.4?
    - Should we update the bad UCDs?
        - some question on whether or not that is a major version change.
- If OK to change, I believe there was a sweep of UCDs by the semantics group for the Spectral-2.0 effort which we can perhaps fold into this update.

# Spectrum RFE

## Implementations: application

- IPAC Firefly Toolkit




Firefly-based IRSA Viewer tool shows multi-order Spitzer spectrum as a chart (top) and a table (bottom). Both are interactive.

Desai, IVOA Interop presentation; May 2021

- " For some time, IPAC's Firefly archive GUI toolkit has taken advantage of IVOA Spectral Data Model (SDM) v1.1 to provide users with automatic plots of spectra that are the result of a query or have been uploaded to the tool. The plotting capability uses the SDM to identify which data to plot on the x and y axes and to change units. Firefly has recently been updated to recognize the new utypes specified in the proposed Spectral Data Model v1.2, namely:

  spec:Spectrum.Data.SpectralAxis.Order
  spec:Spectrum.Data.FluxAxis.Accuracy.LowerLimit
  spec.Spectrum.Data.FluxAxis.Accuracy.UpperLimit

  The toolkit uses these new utypes to plot orders (as found in e.g. Spitzer spectra) as separate traces, and to plot upper and lower limits as arrows (as found in e.g. SEDs). These changes are currently in test and will be released in May. Upon release, these features will be available in IRSA, Rubin, and NED interfaces, all of which are built upon the open-source Firefly toolkit.

  In a future release, Firefly will recognize the spec:Spectrum.Data.SpectralAxis.RelOrder utype proposed in SDMv1.2. When Firefly encounters a spectrum with only RelOrder and not Order, it will automatically plot each unique RelOrder as a different trace, analogous to how it treats Order. If a spectrum contains both Order and RelOrder, Firefly will automatically plot traces based on Order but will provide the user a toggle to plot RelOrder."

https://hub.docker.com/r/ipac/firefly tag 2023.1.1

# Spectrum RFE

## Implementations: serialization

- Firefly Toolkit
  - Test bed of spectra formatted according to the Spectrum 1.2 spec.
- DaCHS SSA Service
  - Has added a Param for ‘order’ with appropriate UType to each table in the dataset.

SSA Server: https://dc.zah.uni-heidelberg.de/flashheros/q/echssa/ssap.xml?<query>
- example: http://dc.zah.uni-heidelberg.de/getproduct/flashheros/data_raw/ca98/blue/n0393.mt

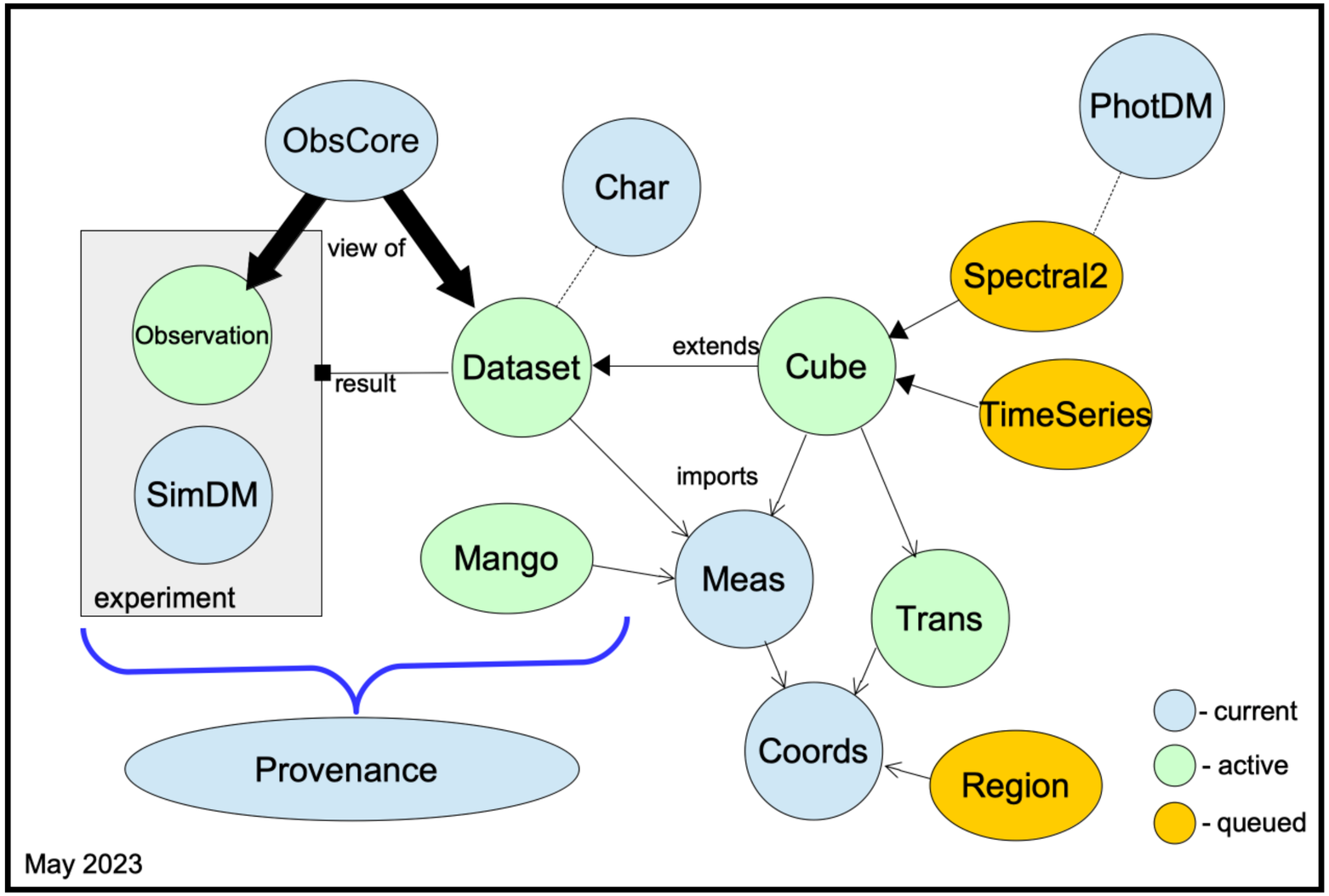
# Spectrum RFE

## What's next?

- Confirm that these implementations are sufficient for RFC ( I believe they are ). Note: none of them currently include RelOrder element.
- Resolve open issue regarding bad UCDs in the current REC.
- Submit document for RFC review.

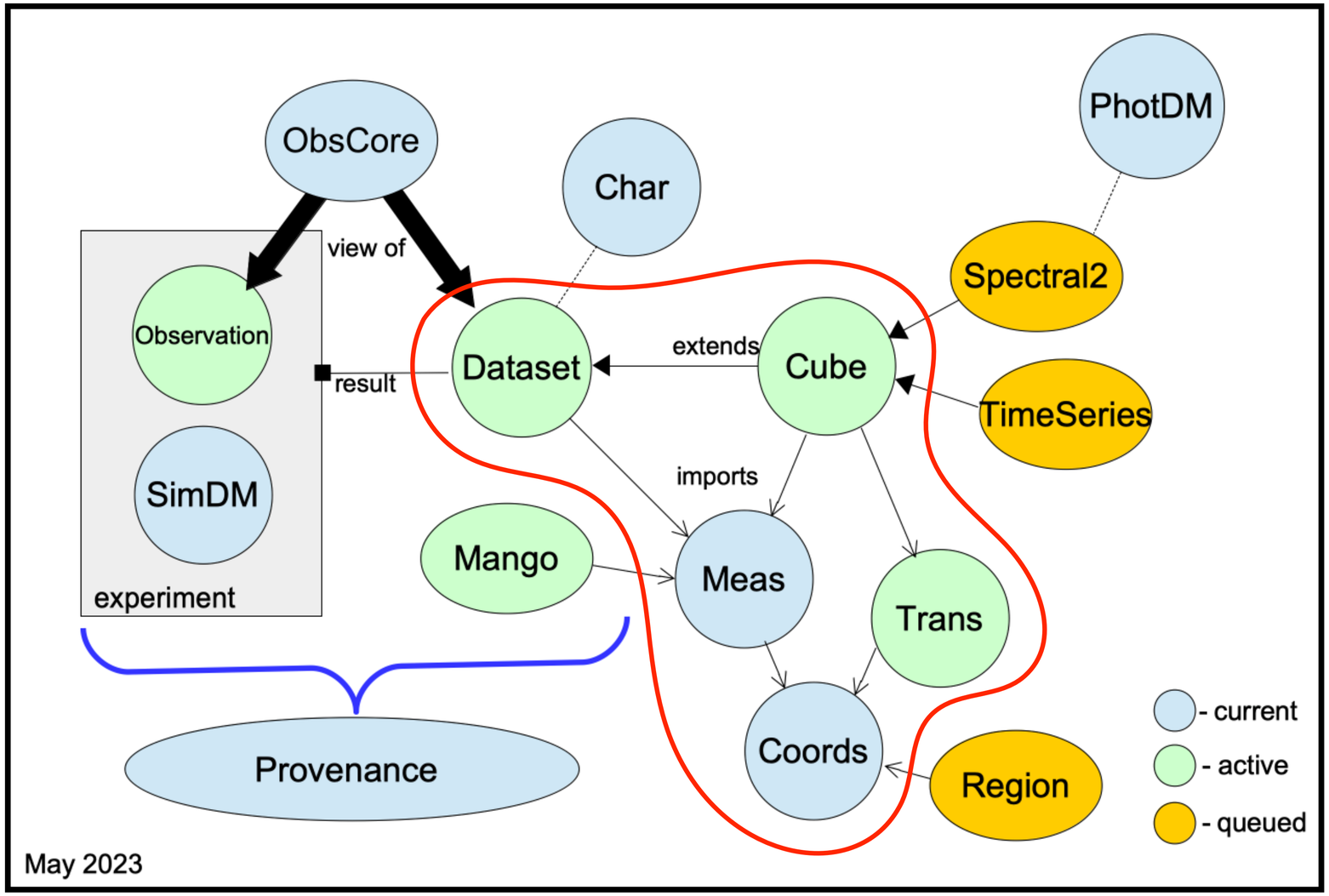
# Cube Model Group Status

## Data model ecosystem



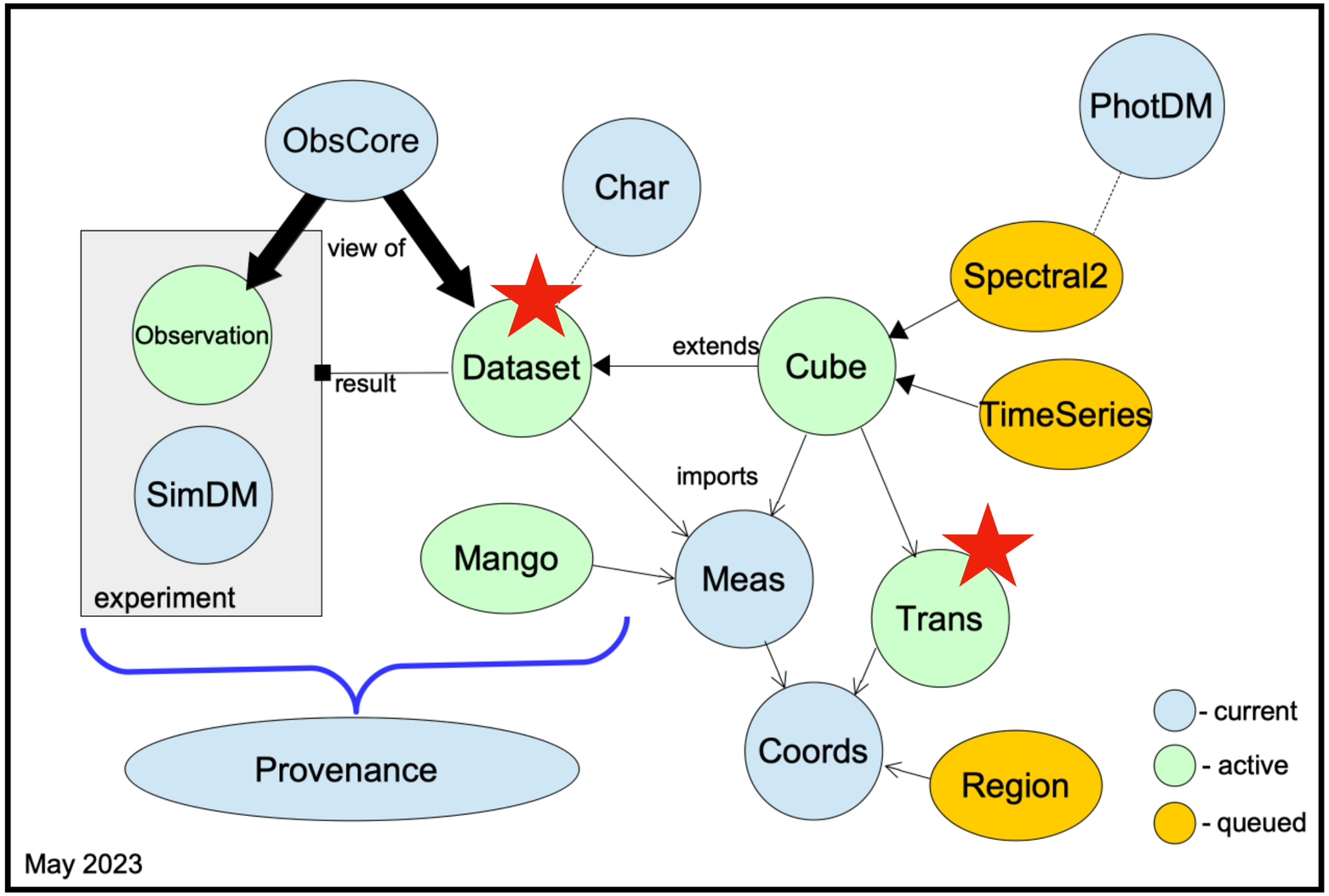
# Cube Model Group Status

## Cube model project



# Cube Model Group Status

## Current work emphasis



# Transform

## Introduction

- “This model covers the WCS Transform component (of STC), and includes the following concepts:
  - The description of mathematical operations which form the building blocks for conversions from one coordinate space to another.
  - The combination of individual operations into an arbitrarily complex Transform.”
- Has been static pending completion of dependent Coordinates model, which defines the coordinate systems on either end of the transform.

# Transform

## Work done

- Model migrated to Git (https://github.com/ivoa-std/TransformDM)
- Review of documentation for accuracy and open issues.

# Transform

## Open Issues

- Issue #2: rename Unit mapping to Identity
- Issue #3: rename Matrix mapping cells (M,N) => (row, col)

# Transform

## Implementations

- Example serializations in multiple formats (to be reviewed)
- AST: Library for Handling World Coordinate Systems, v9.2.3 - 2020
  - “contains YamlChan, which allows AST to read and write WCS information as ASDF.  It does not as yet include any support for conversion of spectral or time axes and does not support all ASDF transform classes”
  - http://starlink.eao.hawaii.edu/devdocs/sun211.htx/sun211ss544.html
- GWCS: Space Telescope - Generalized World Coordinate System
  - ASDF format allows interaction/trade of transform representations with AST library
  - https://gwcs.readthedocs.io/en/latest/
- Python Scripts: exercise exchange of WCS between the two (supplied by D. Berry)
  - AST transfers WCS to ASDF, used to apply bi-directional transform from/to pixel coordinates with both packages and display output for comparison
  - AST reads WCS headers from FITS image to AST FrameSet, then writes this as ASDF WCS object in Yaml

# Transform

## What's next?

- Resolve open issues
- Update example serializations
- Implement sample scripts as Jupyter notebooks in Git repo.
- Submit document for RFC review.

# Dataset Metadata

## Introduction

- VO-DML compliant model consolidating common Dataset metadata from progenitor models (ObsCore, Spectrum).
- To be re-used by other models describing datasets (Cube, Mango, TimeSeries, Spectrum2)

# Dataset Metadata

## Work Done

- Model available on Git (https://github.com/ivoa-std/DatasetDM)
- Update repository to plug into VO-DML Toolkit to support upcoming changes.
- Splinter Session at this interop
  - Discussion on content overlap between this model with Provenance and an Observation model (e.g. non-standard CAOM) to plan the roadmap going forward
    - More discussion needed on migration to an Observation model (vs SimulationDM). Should wait for dedicated use-cases before moving in this direction.
    - The Provenance-like elements in Dataset are not provenance, but extracted metadata useful to store within the dataset for other purposes.  If the Dataset is to include proper provenance, it would be attached as a separate node.

# Dataset

## What's next?

- Resolve open issues: several issues related to above discussions.
- Review within DM working group
- Identify and implement appropriate implementation thread(s)