Source Catalog Data Model

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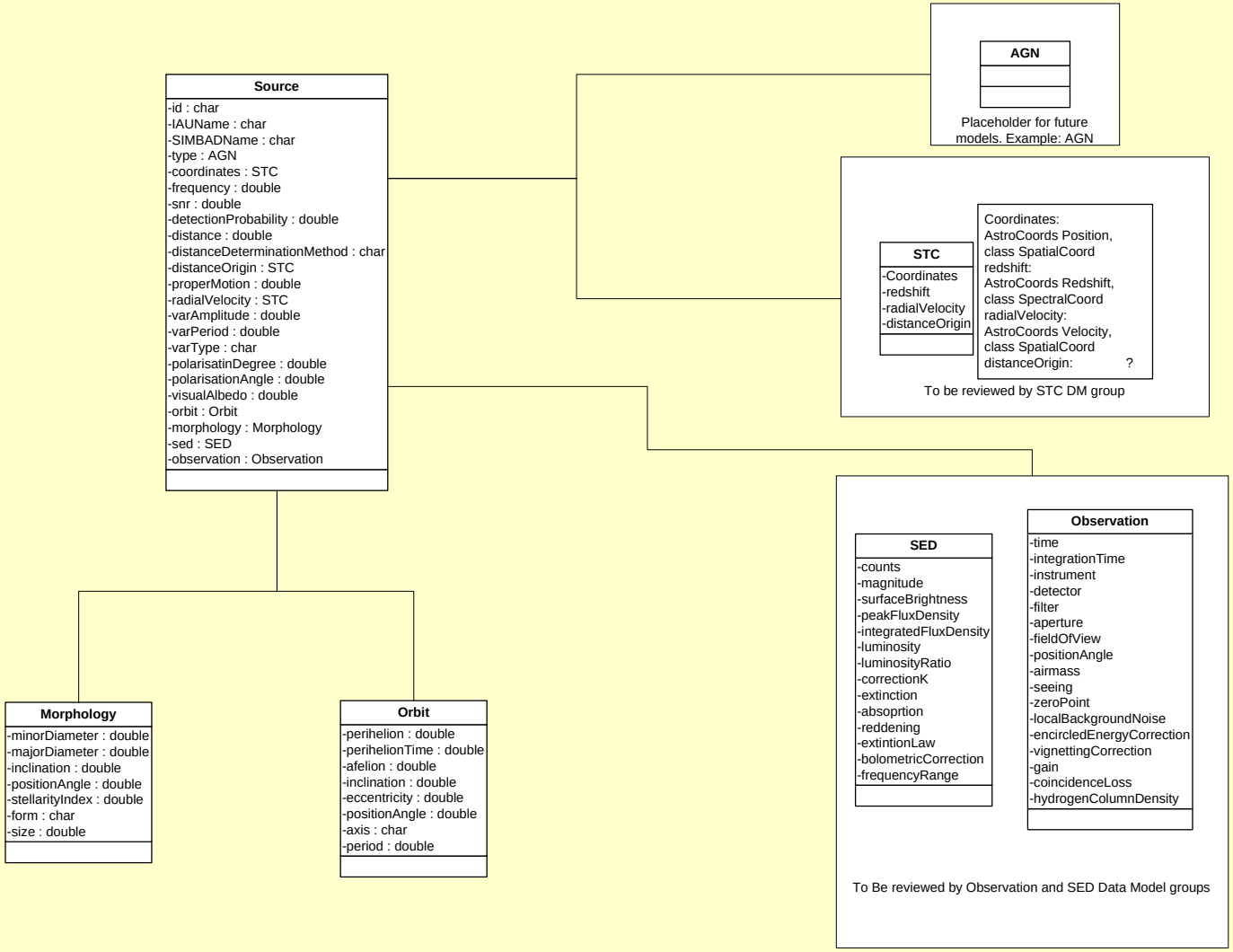
History

- Created after Cambridge, Boston.
- From Poona 2004 IVOA presentation:
  - […] Go for **Source Catalogue Data Model**, and see how it works. Then, review and decide
  - […] ***An example Use Case*** (M. Louys): Is the source in this catalogue the same as the one in this other catalogue?
- From Kyoto 2005 IVOA presentation:
  - Introduce a 'Source' container within de Catalog Data Model.
- Today:
  - Recent changes in the model.
  - Possible relationships with other models.
  - Open issues.

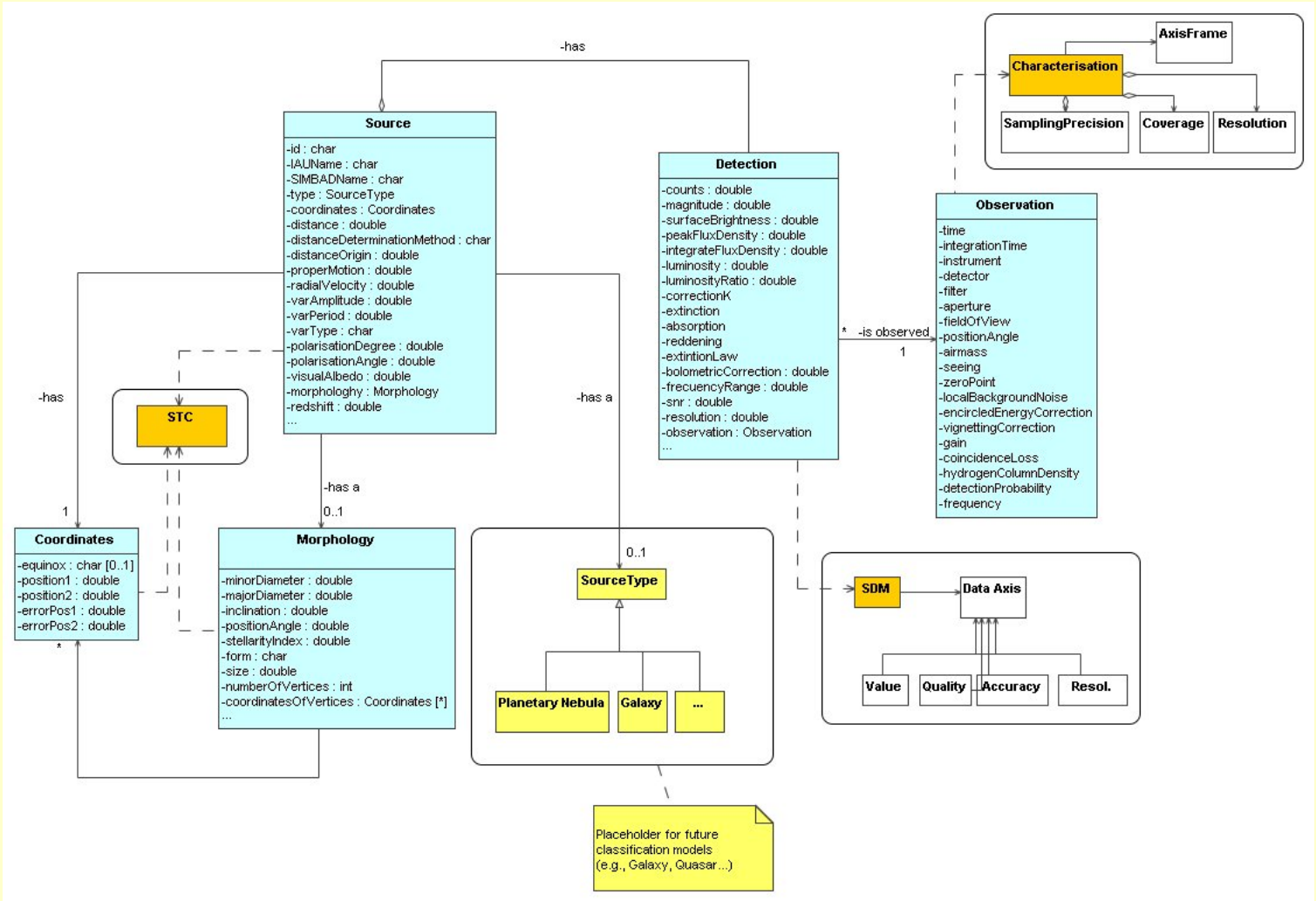
Recent changes

- ‘Catalog’ container taken out.
- ‘Source’ element split into ‘Source’ and ‘Detection’
  - Source now stands for the physical entity.
  - Detection reflects the observation of “[…]a radiation excess above the background fluctuations in a given sky position” (Matteo Guainazzi et al.)
  - A given source can be detected in different observations.
- ‘Orbit’ element taken out.
- ‘Morphology’ and ‘Source’ pointing to new ‘Coordinates’ container.
- Pointers to external models (Spectral Data Model, Characterization and STC) described and to be worked out.

The past…


Source
-id : char
-IAUName : char
-SIMBADName : char
-type : AGN
-coordinates : STC
-frequency : double
-snr : double
-detectionProbability : double
-distance : double
-distanceDeterminationMethod : char
-distanceOrigin : STC
-properMotion : double
-radialVelocity : STC
-varAmplitude : double
-varPeriod : double
-varType : char
-polarisatinDegree : double
-polarisationAngle : double
-visualAlbedo : double
-orbit : Orbit
-morphology : Morphology
-sed : SED
-observation : Observation
AGN
Placeholder for future models. Example: AGN
STC
-Coordinates
-redshift
-radialVelocity
-distanceOrigin
Coordinates: AstroCoords Position, class SpatialCoord
redshift: AstroCoords Redshift, class SpectralCoord
radialVelocity: AstroCoords Velocity, class SpatialCoord
distanceOrigin: ?
To be reviewed by STC DM group
Morphology
-minorDiameter : double
-majorDiameter : double
-inclination : double
-positionAngle : double
-stellarityIndex : double
-form : char
-size : double
Orbit
-perihelion : double
-perihelionTime : double
-afelion : double
-inclination : double
-eccentricity : double
-positionAngle : double
-axis : char
-period : double
SED
-counts
-magnitude
-surfaceBrightness
-peakFluxDensity
-integratedFluxDensity
-luminosity
-luminosityRatio
-correctionK
-extinction
-absoprtion
-reddening
-extintionLaw
-bolometricCorrection
-frequencyRange
Observation
-time
-integrationTime
-instrument
-detector
-filter
-aperture
-fieldOfView
-positionAngle
-airmass
-seeing
-zeroPoint
-localBackgroundNoise
-encircledEnergyCorrection
-vignettingCorrection
-gain
-coincidenceLoss
-hydrogenColumnDensity
To Be reviewed by Observation and SED Data Model groups

The present…UML model



Relationship with other models

Possible integration between models…

- **Source DM and STC** (Coordinates Data Model Internal Note)
  - SCDM:Source.distance → STC:Position1D.Value
  - SCDM:Source.radialVelocity → STC:Velocity2D.Value
  - SCDM:Source.properMotion → STC:Velocity2D.Value
  - SCDM:Source.redshift → STC:Redshift.Value
  - SCDM:Source.Coordinates.position1 → STC:Position1D.Value
  - SCDM:Source.Coordinates.errorPos1 → STC:Position1D.Error
  - SCDM:Source.Coordinates.equinox → STC:SpaceFrame.FKRefFrame.equinox
  - SCDM:Source.Morphology.positionAngle →…PosAngle.Value

Relationship with other models

Source DM and Characterization

- Most of the 'Observation' container properties can be described with the Provenance Model.
- SCDM:Source.Detection.Observation.time → Coverage.Location.RefVal
- SCDM:Source.Detection.Observation.fieldOfView → Coverage.Bounds
- SCDM:Source.Detection.Observation.positionAngle → Coverage.Bounds

Source DM and Spectral Data Model (v0.98c Rev 1)

- SCDM:Source.Detection.counts → Spectrum.Data.FluxAxis.Value
- SCDM:Source.Detection.magnitude → Spectrum.Data.FluxAxis.Value
- SCDM:Source.Detection.luminosity → Spectrum.Data.FluxAxis.Value
- SCDM:Source.Detection.surfaceBrightness → Spectrum.Data.FluxAxis.Value
- …etc

Open issues

- Source DM approach is based on ‘parameterization’ while the rest of the models go for ‘abstraction’.

- Pros:
  - Parameterization enables fast development, ensures a quick protocol evolution.
  - Abstraction makes any heterogeneous dataset fit into the model.

- Cons:
  - Excess of parameterization might make a model too complex.
  - Excess of abstraction might force complexity on discovery/querying. See samples.

Open issues : Sample 1

- Sample 1: "Give me all source names whose magnitude is greater than 3.0"

  Utype for magnitude within SED is Spectrum.Data.FluxAxis.Value, so first try would be like:

  SELECT SCDM:Source.IAUName FROM SCDM:Source WHERE Spectrum.Data.FluxAxis.Value > 3.0

  - **Problem:** Spectrum.Data.FluxAxis.Value utype holds many different quantities: magnitude, luminosity, brightness surface… etc.
  - **Current solution:** SED provides a mechanism based on UTYPE + UCDs to address the problem:

    SELECT SCDM:Source.IAUName FROM SCDM:Source WHERE Spectrum.Data.FluxAxis.Value > 3.0 and Spectrum.Data.FluxAxis.ucd='phot.mag'
  - **Remaining Problem:** How would you select different fluxes (e.g., surface brightness and luminosity) simultaneously?
  - **Proposed solution** Use parameterized model instead.

    SELECT SCDM:Source.Detection.surfaceBrightness, SCDM:Source.Detection.luminosity FROM SCDM:Source WHERE…

Open issues: Sample 2

- Sample 2: "Give me all source types whose right ascention is between 23.9 and 24.0 hours"

  Utype for a coordinate within STC is …Position1D.Value, so first try would be like:

  SELECT SCDM:Source.type FROM SCDM:Source WHERE …Position1D.Value > 23.9 and …Position1D.Value < 24.0

  - **Problem:** Position1D.Value utype can holds many different quantities: distance, different coordinates in different frames.
  - **Current Solution:** STC provides means to constrain the discovery by adding extra utypes.

    SELECT SCDM:Source.type FROM SCDM:Source WHERE …Position1D.Value > 23.9 and …Position1D.Value < 24.0 and SpaceFrame.FKRefFrame.equinox = 'J2000.0'
  - **Remaining problem:** How would you select different velocities (e.g., radial velocity and proper motion) simultaneously?
  - **Proposed Solution:** Use parameterized model instead.

    SELECT SCDM:Source.radialVelocity, SCDM:Source.properMotion FROM SCDM:Source WHERE…

Open issues: Conclusions

- Current models workaround the problem of not having a unique utype to identify queriable entities by different means, for example
  - Relying on UCDs.
  - Providing multiple utypes.
- Usage of simpler models, driven by a reasonable parameterization, solve the complexity on discovery (e.g., Line Model)