SourceDM: Status and VO/DML

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Issue/Revision: 1.0
Reference: Gaia Archive
Status: Issued
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Source DM

1. *Objective:*
    a. Create a simple (but useful) SourceDM definition that could help in the publishing of catalogues through VO protocols
    b. Support on the definition for catalogues metadata for near-future missions (e.g. Gaia, Euclid,…) and allow the mapping for old ones
    c. Support interoperability operations between catalogues (SED creation, crossmatch operations, etc)

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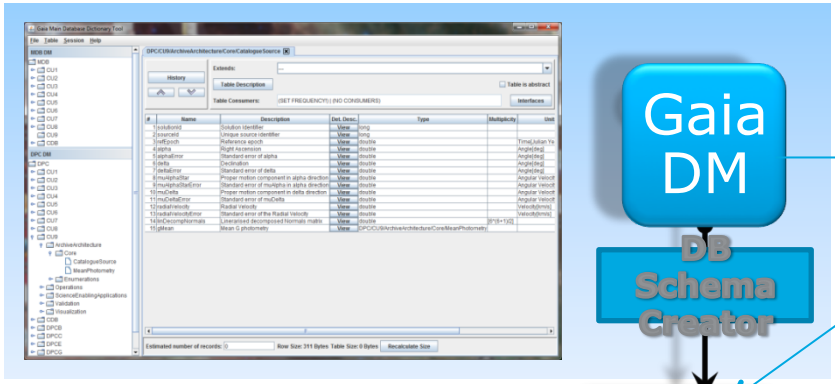
Gaia: DM in the core



Gaia DM

DB Schema Creator

gbin

Gaia Archive TAP server

- VO-DML Annotations in TAP_SCHEMA?
- Different structure?

TAP_SCHEMA

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<TABLE>
<GROUP utype="vo-dml:Instance.root" >
  <PARAM     name="type"     utype="vo-dml:Instance.type"     value="src:source.Source"
datatype="char" arraysize="*"/>
  <FIELDref ref="_designation" utype=" vo-dml:ObjectType.ID"/>
  <FIELDref ref="_designation" utype="src:source.Source.name"/>
  <PARAM name="type" utype="src:source.Source.classification" value="galaxy">
  <VALUES><OPTION value="galaxy"/><OPTION value="star"/>...</VALUES></PARAM>
  <GROUP utype="src:source.Source.position">
    <PARAM   name="type"   utype="vo-dml:Instance.type"   value="src:source.SkyCoordinate"
datatype="char" arraysize="*"/>
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    <FIELDref ref="_dec" utype="src:source.SkyCoordinate.latitude"/>
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  </GROUP>
</GROUP>
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<FIELD name="dec" ID="_dec"  unit="deg" .../>
<TR><TD>08120809-0206132</TD><TD>123.033734</TD><TD>-2.103671</TD></TR>
...
</TABLE>
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VOTable response with VO-DML

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Use cases (I)

Identities

- Are two sources of different catalogues the same astronomical object?

Crossmatching

- Are two measurements of two catalogues comparable to implement complex crossmatch functions (e.g. Bayesian)?

Native Frames

- Can we annotate properly the geometrical information? Native Frames? Epochs? Correlations?

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Use cases (II)

Precise Astrometry

- Can we annotate with the relevant level of detail astrometry from catalogues? (radial velocity, position of the observer,…)

Annotation

- Old catalogues are difficult to characterize. Information is found in documentation but this is difficult to be used for interoperability. Are we providing standards to annotate them?
- **Source type, Position, Radial Velocity, Proper motion, Parallax/distance, Classification, Photometry, Redshift**

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Data Combination

- Colors or even SEDs from photometry points
- Proper motions or even orbits from positional measurements
- Time series from, say, radial velocity measurements

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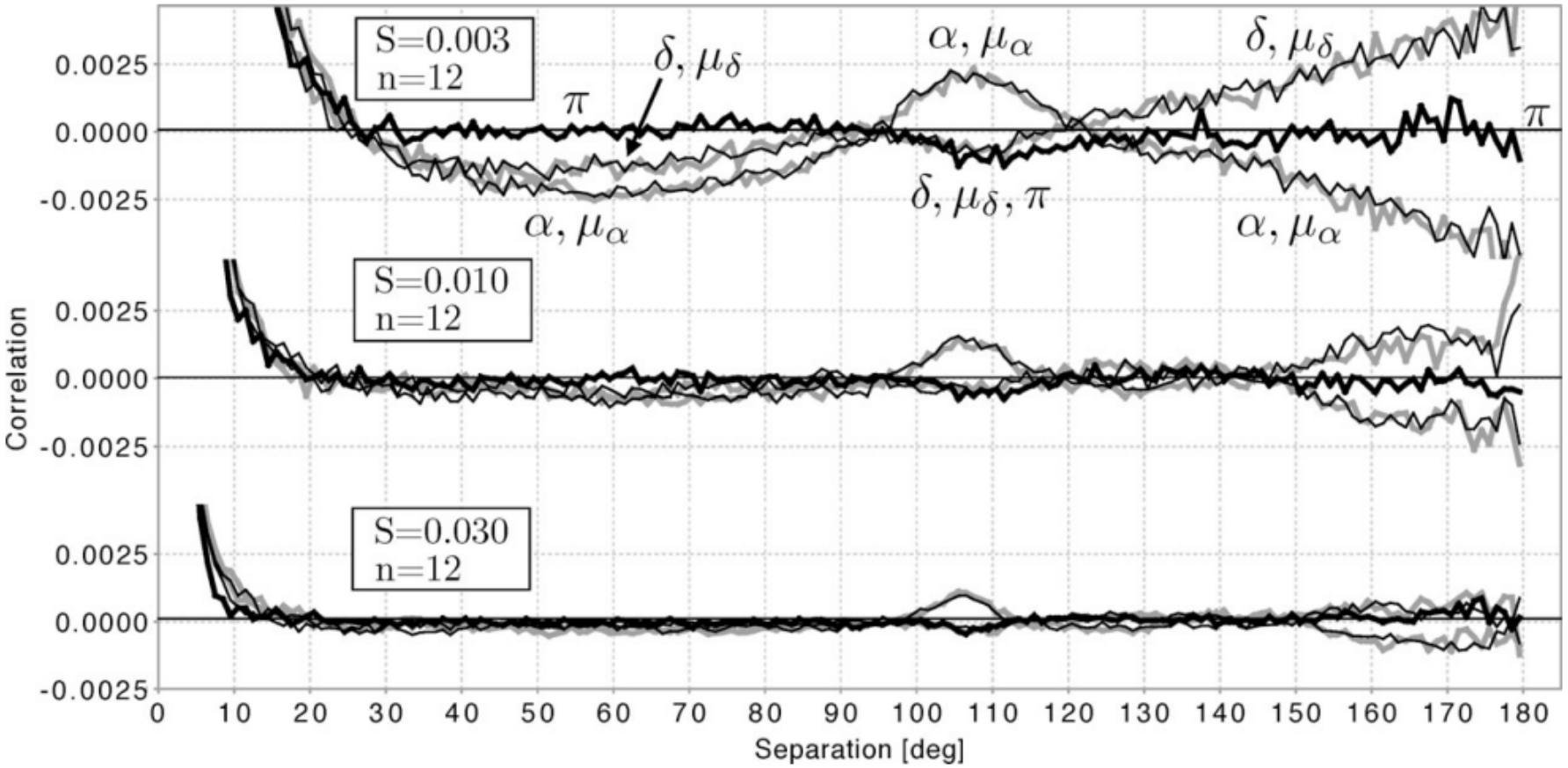
Precise Astrometry: Correlations



Holl et at, 2010

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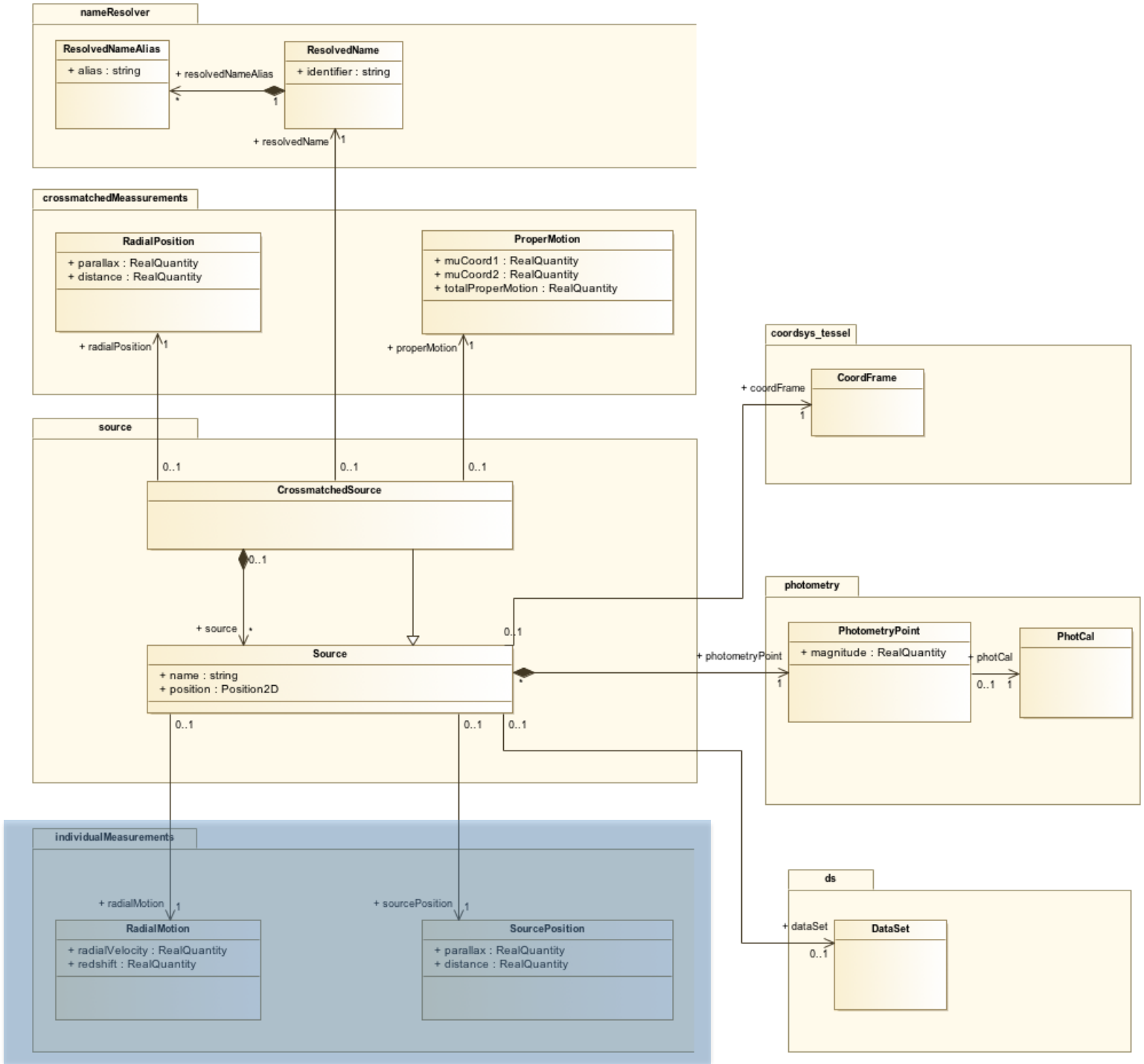
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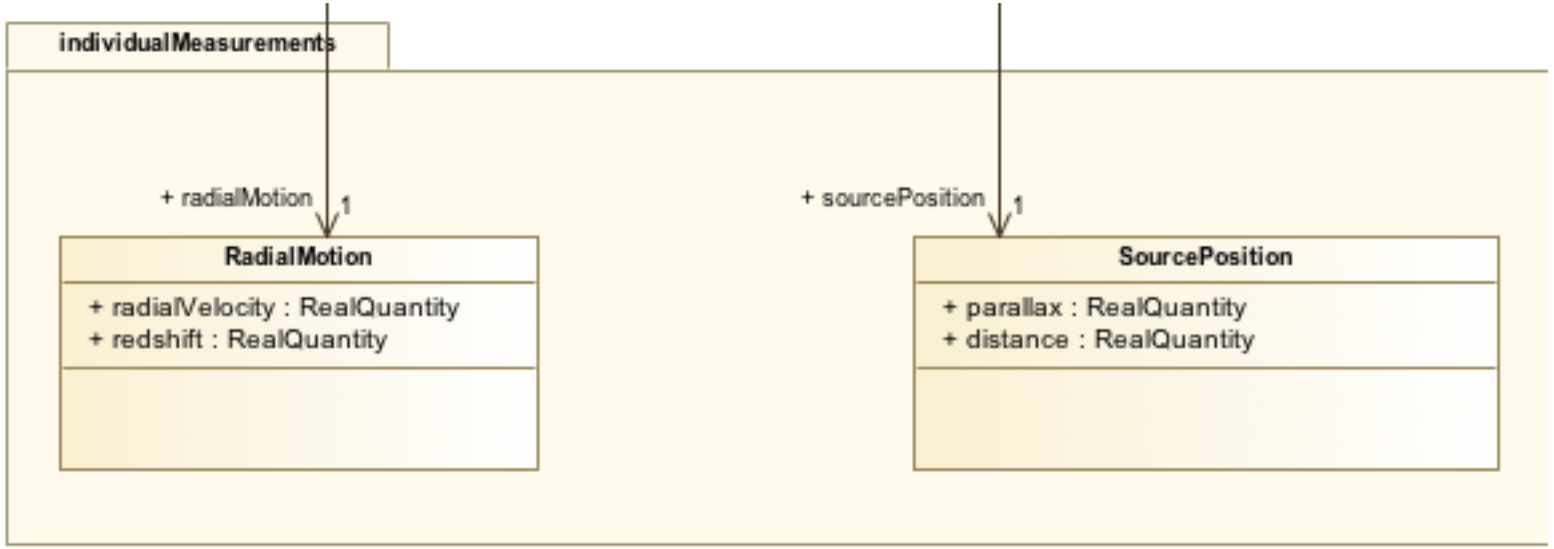
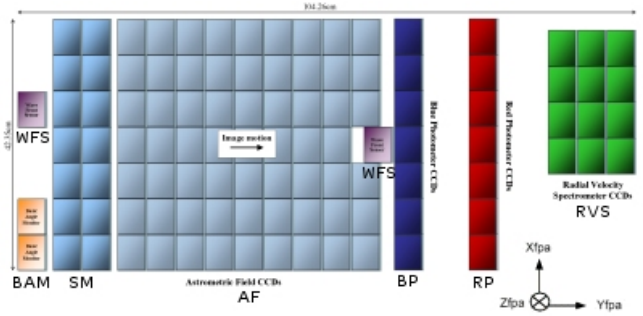
Individual Meassurements



- Radial velocity usually measured due to spectroscopic analysis
- Combination of the object radial velocity and cosmological redshifts



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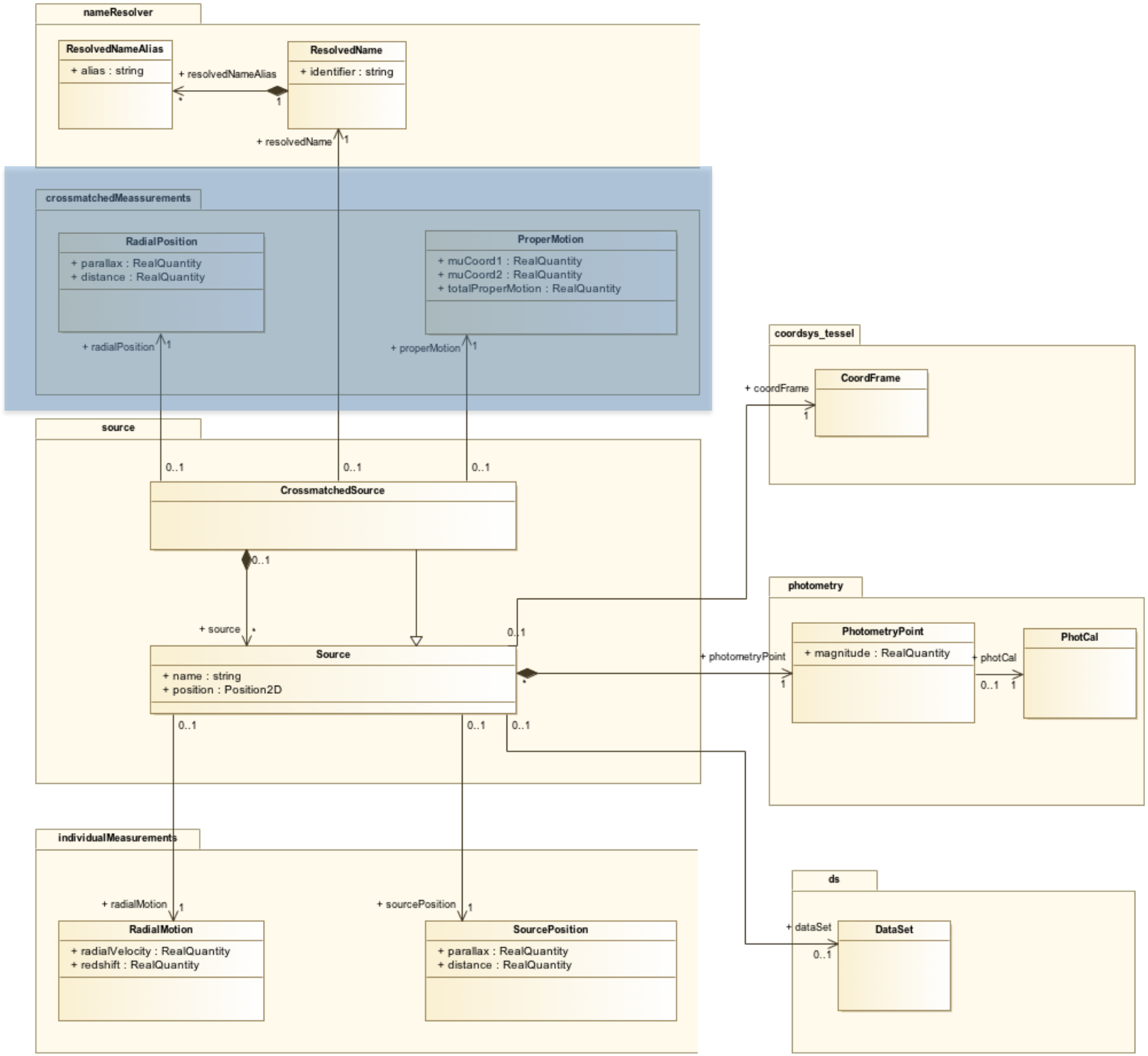
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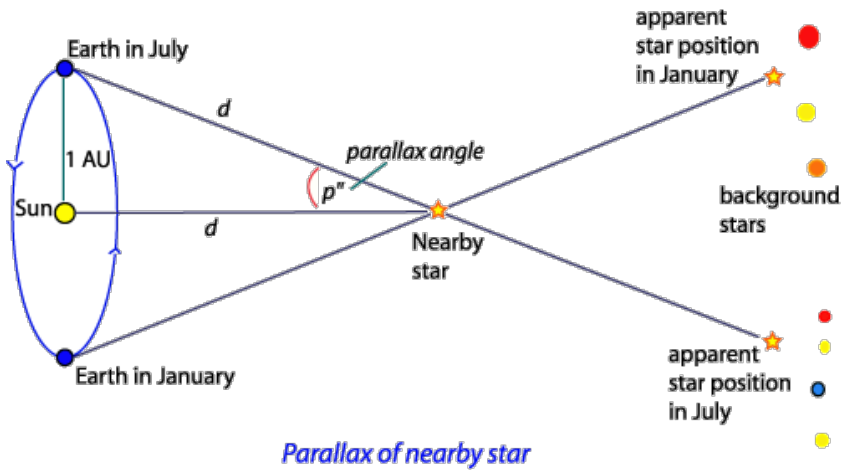
Crossmatched Meassurements

Conversion from parallaxes to distance requires certain assumptions Parallaxes are preferred as a closer concept to a measurement quantity

$d=1/\rho$

Where ρ is the parallax angle expressed in arseconds that produce a distance in parsecs.



Parallax of nearby star

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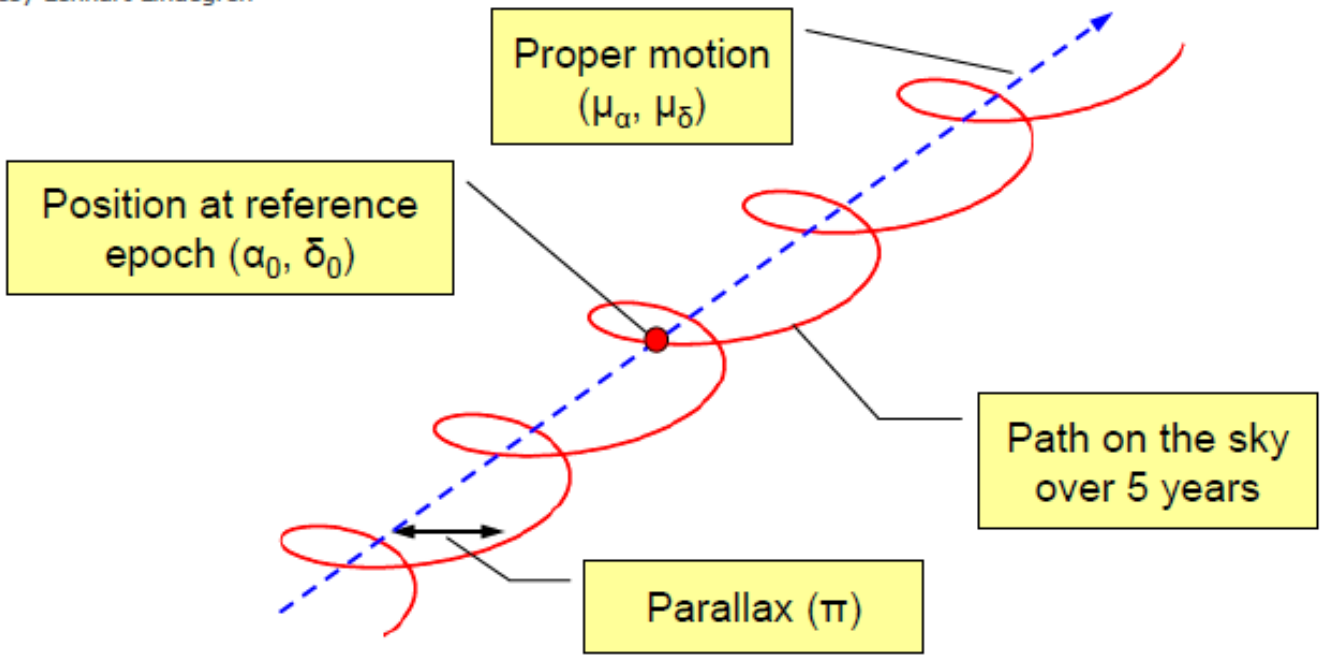
Crossmatched Meassurements (II)

Figure courtesy Lennart Lindegren



Monitor this path for 10^9 stars during 5 years and fit, for each object, a 5-parameter model to retrieve reference position, proper motion, and parallax (for a "given" instrument calibration and attitude)

$$pm\downarrow ra = \Delta ra / \cos(\delta)$$

$$pm\downarrow \delta = \Delta \delta$$

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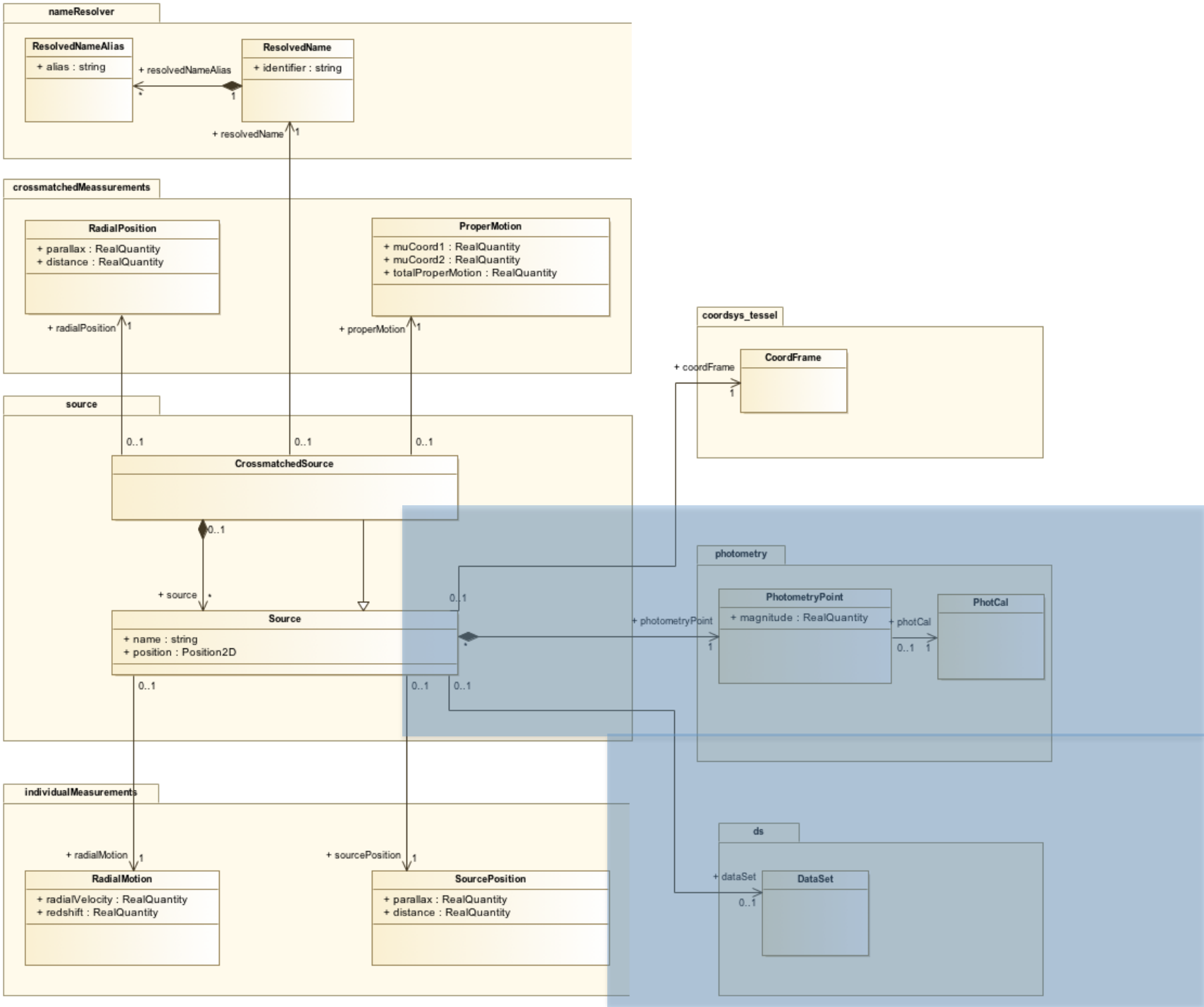
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Luminosities

1. Most of the catalogues are connected to luminosities through magnitudes/ fluxes
2. Photometric values are usually represented by:
    a. Magnitude value and error
    b. Photometric system description
    c. Zero point
    d. Link to transmission curve
    e. Colours?
3. Flux values are usually represented by:
    a. Flux value and error
    b. Spectral coverage
4. Include PhotometryPoint as direct element from PhotometryDM
5. More complex connections by link to SpectralDM 2.0
    a. Spectra
    b. Time Series

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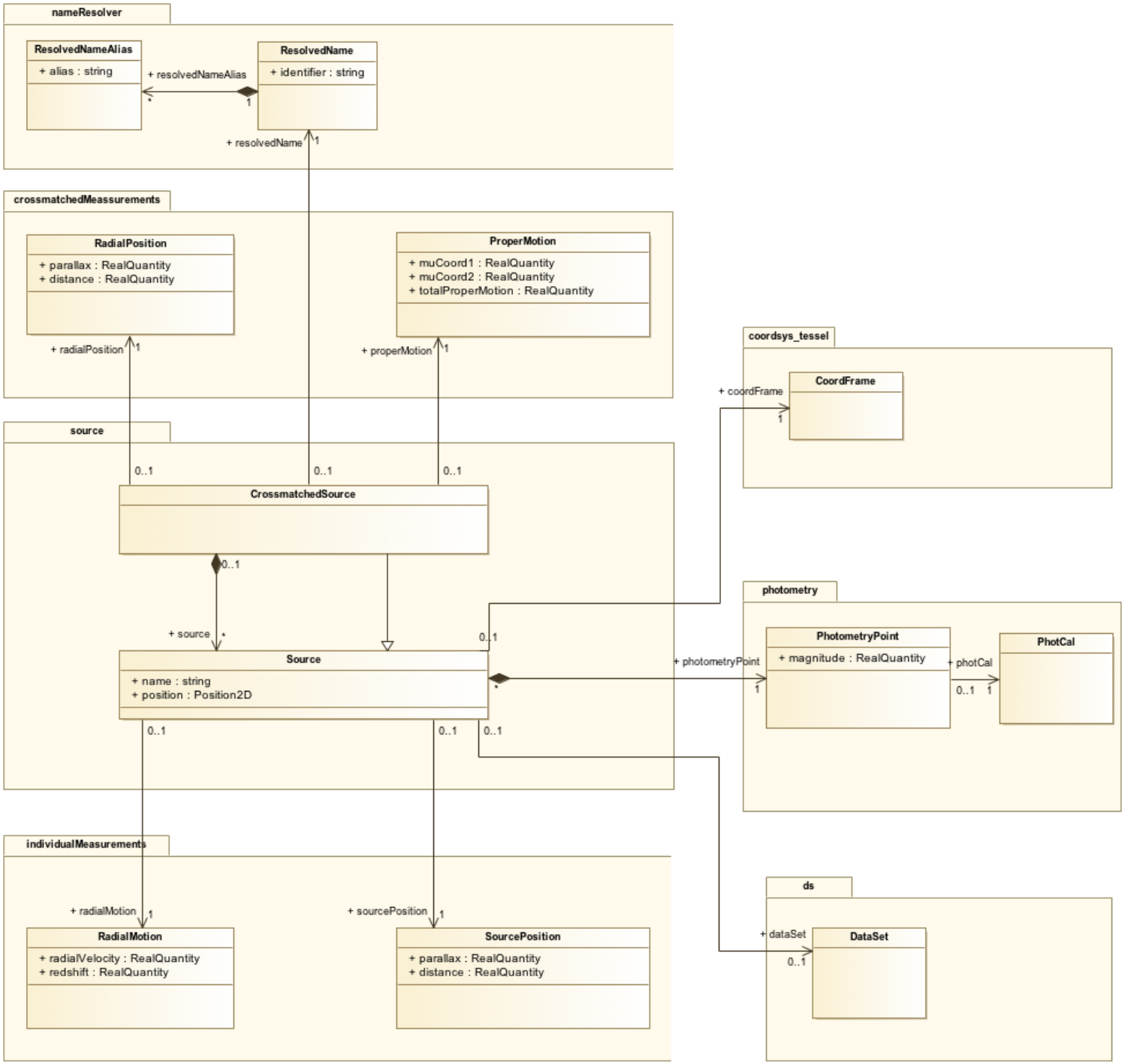
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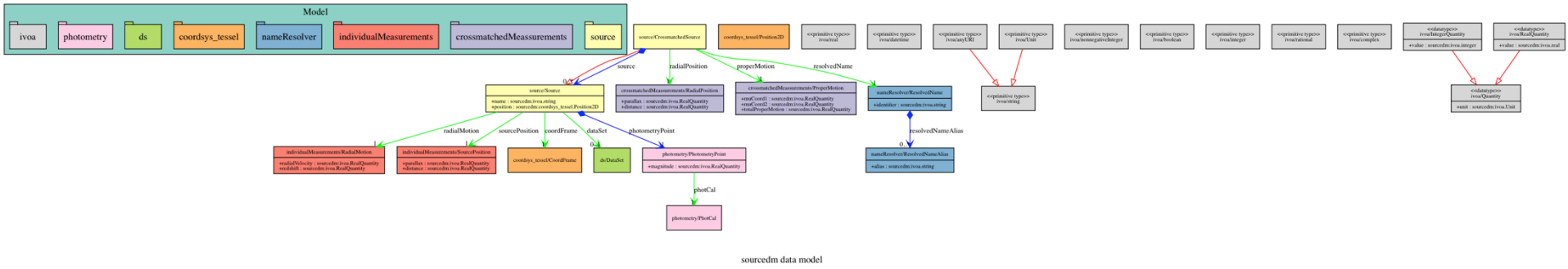
VO/DML

1. Exercise to migrate data model to Modelio and generate the VO/DML documentation
2. Some vulnerabilities found during the process
    a. XMI version not supported due to version date
        - (e.g. sed s/20110701/20100901/ sourcedm.xmi)
    b. Really appreciated by the notes created by Laurent Michel et al
3. SourceDM



sourcedm data model

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Conclusions

- First version of the VO/DML model created
- Maintain doc version and VO/DML models in line

- Exercise to map DR2 Gaia catalogue (CatalogueSource) to the IVOA Source DM
- Modify Gaia Archive TAP+ component to include VO/DML preamble with SourceDM metadata
- Agree with other catalogue providers on independent implementation

Thanks!

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