

Models and High Energy Data

Compatibility

Preamble

- Purpose of this presentation
 - To show current IVOA Data Models which include concepts presented for High Energy data.
 - To point out areas where there is good agreement.
 - To point out areas which MAY suit the described need
 - To point out areas which are NOT covered by the models
 - If possible, where they might fit into the ecosystem.

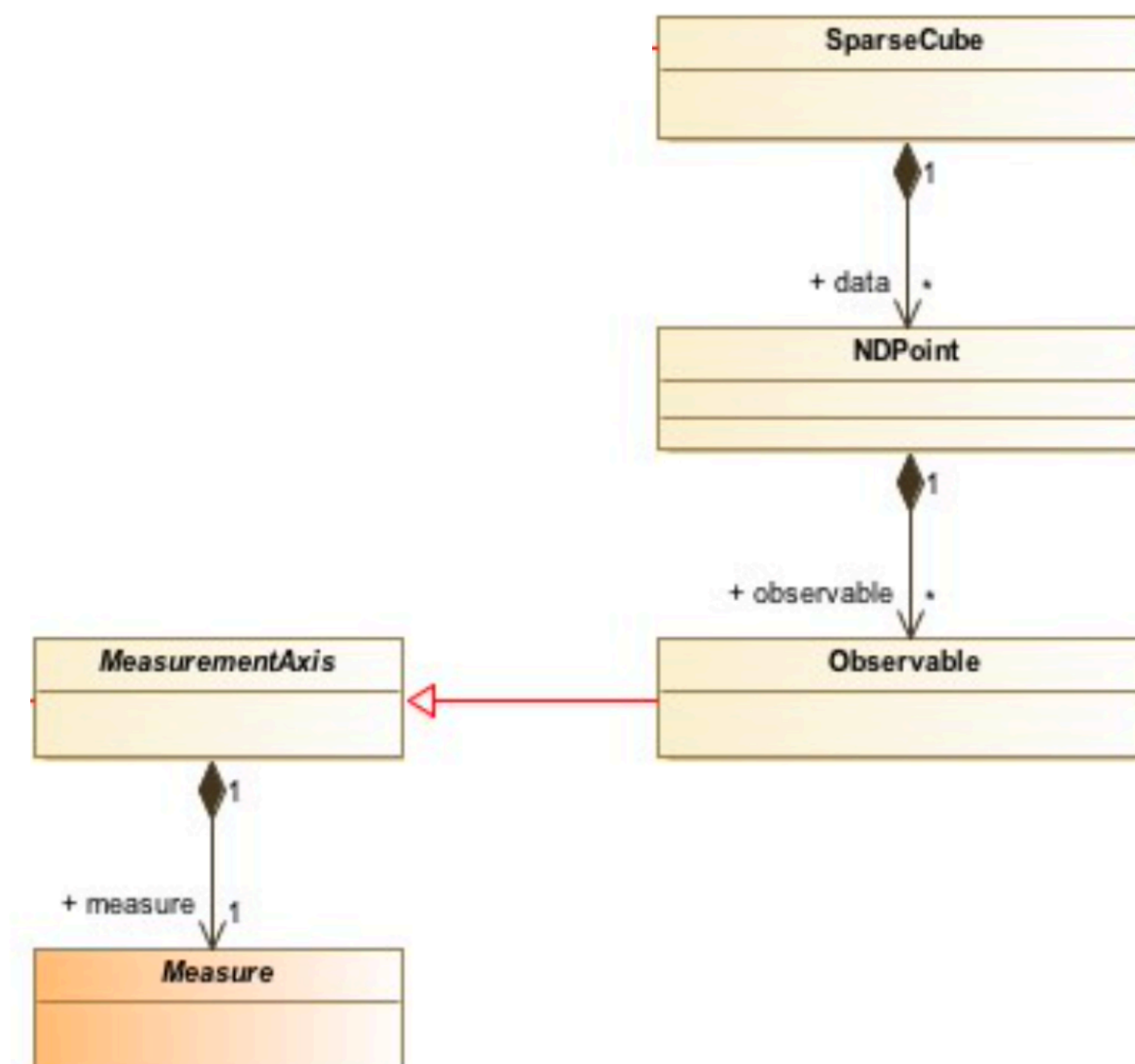
Event Data

- The Event List is one of the primary targets for the Cube Data Model.
- Measured properties for each detected photon.
 - Time of detection
 - Spatial Coordinates on detector
 - example: 2D Cartesian coordinates on CCD detector
 - Measure of energy deposited on detector
 - example: PHA channel
- These are processed and converted to Physical Properties
 - Time of event (standard time scale and reference position)
 - Sky position
 - Photon Energy

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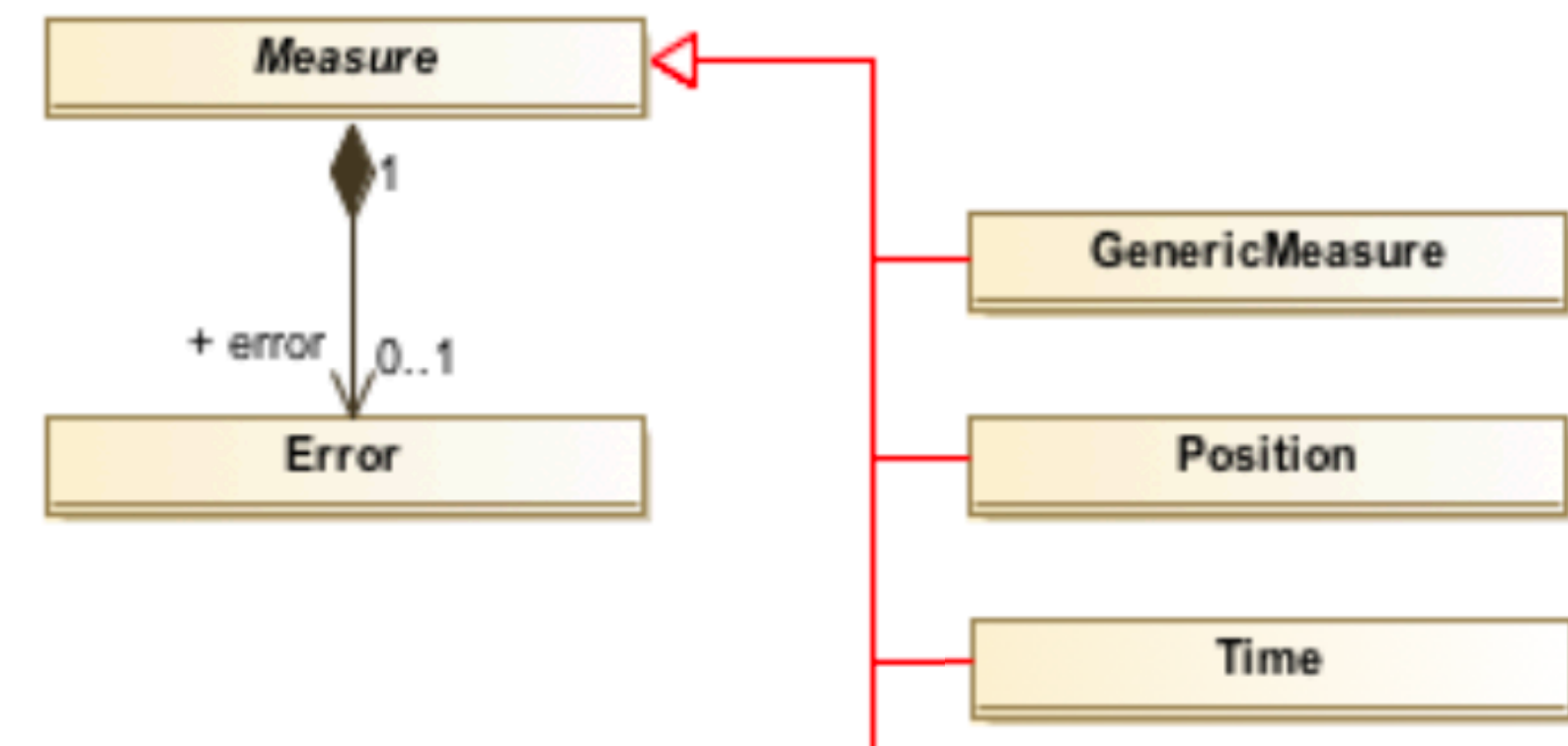
Cube Model



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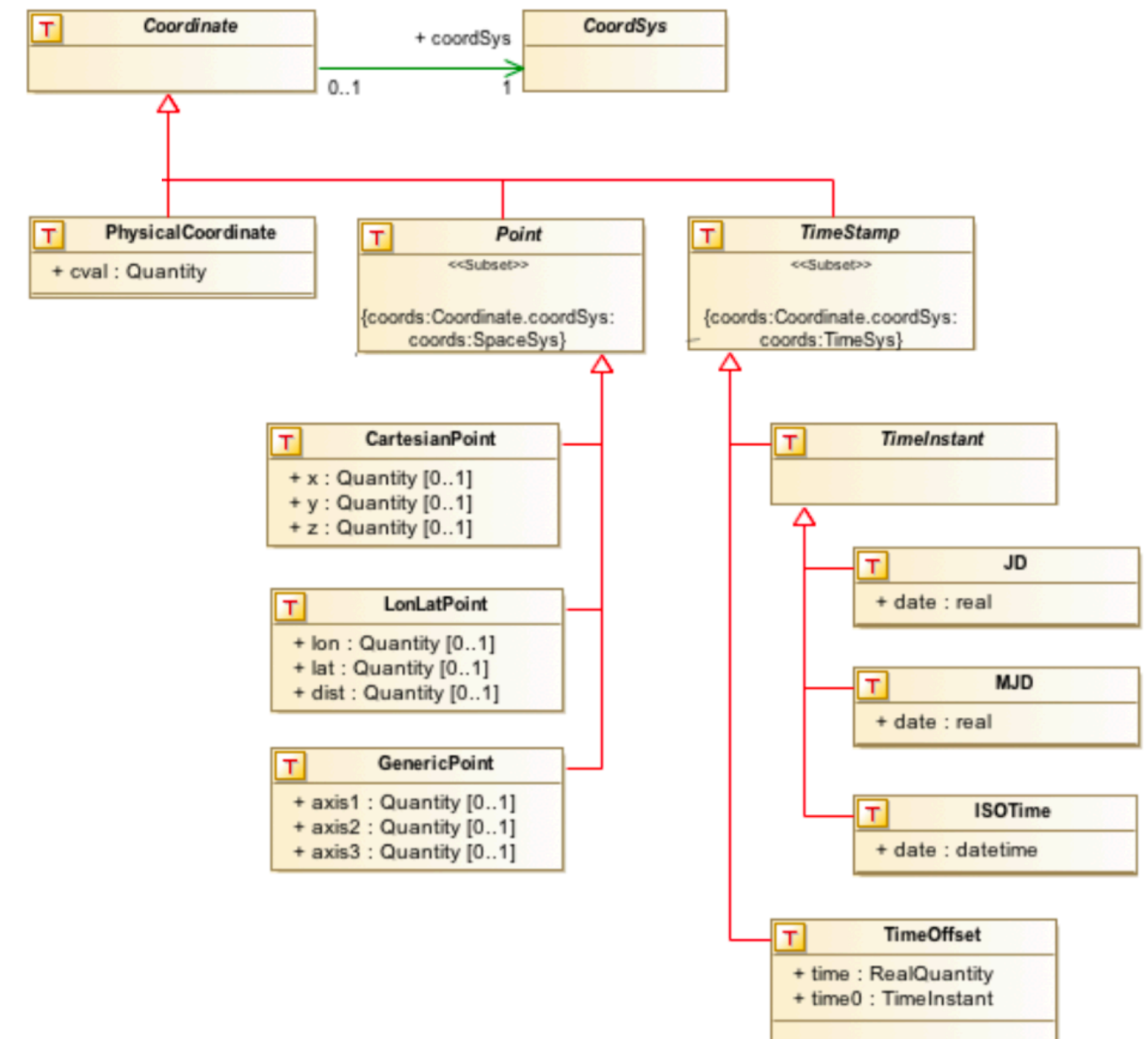
Measurements Model



Event Data

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 - example: **2D Cartesian coordinates** on CCD detector
 - Measure of energy deposited on detector
 - example: **PHA channel**
- These are processed and converted to Physical Properties
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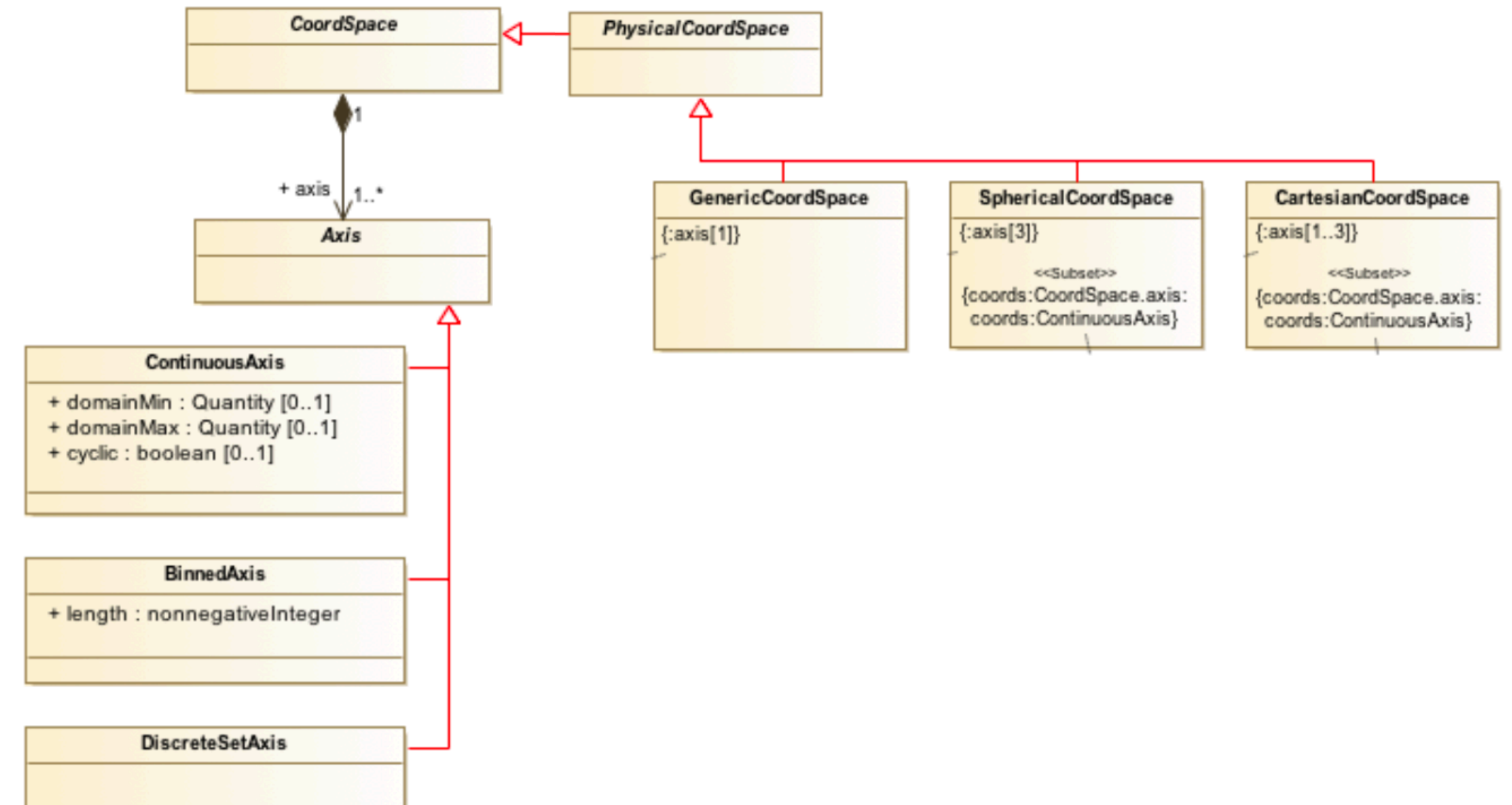
Coordinates Model



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- Measured properties for each detected photon.
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 - Spatial Coordinates on detector
 - example: 2D Cartesian coordinates on **CCD detector**
 - Measure of energy deposited on detector
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- These are processed and converted to Physical Properties
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Coordinates Model



Ancillary Data

ARF/RMF

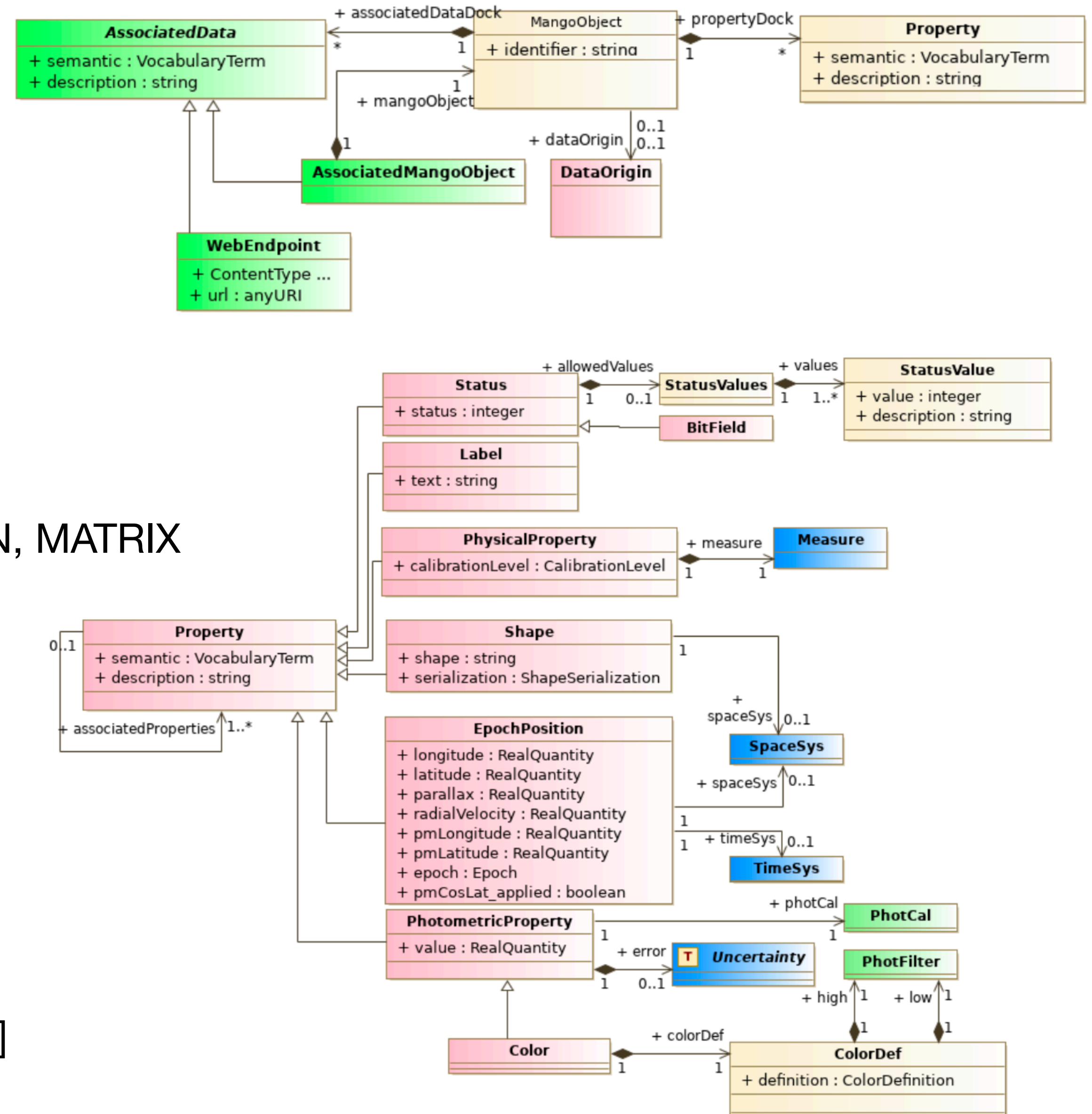
- As OGIP tables
 - RMF: MATRIX extension
 - BINTABLE
 - ENERG_LO, ENERG_HI, N_GRP, F_CHAN, N_CHAN, MATRIX
 - RMF: EBOUNDS extension
 - BINTABLE
 - CHANNEL, E_MIN, E_MAX
 - ARF: SPECRESP extension
 - BINTABLE
 - ENERG_LO, ENERG_HI, SPECRESP, [components]

Ancillary Data

ARF/RMF

- As OGIP tables
 - RMF: MATRIX extension
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 - **ENERG_LO, ENERG_HI, N_GRP, F_CHAN, N_CHAN, MATRIX**
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 - **CHANNEL, E_MIN, E_MAX**
 - ARF: SPECRESP extension
 - BINTABLE
 - **ENERG_LO, ENERG_HI, SPECRESP, [components]**

Mango Model



Ancillary Data

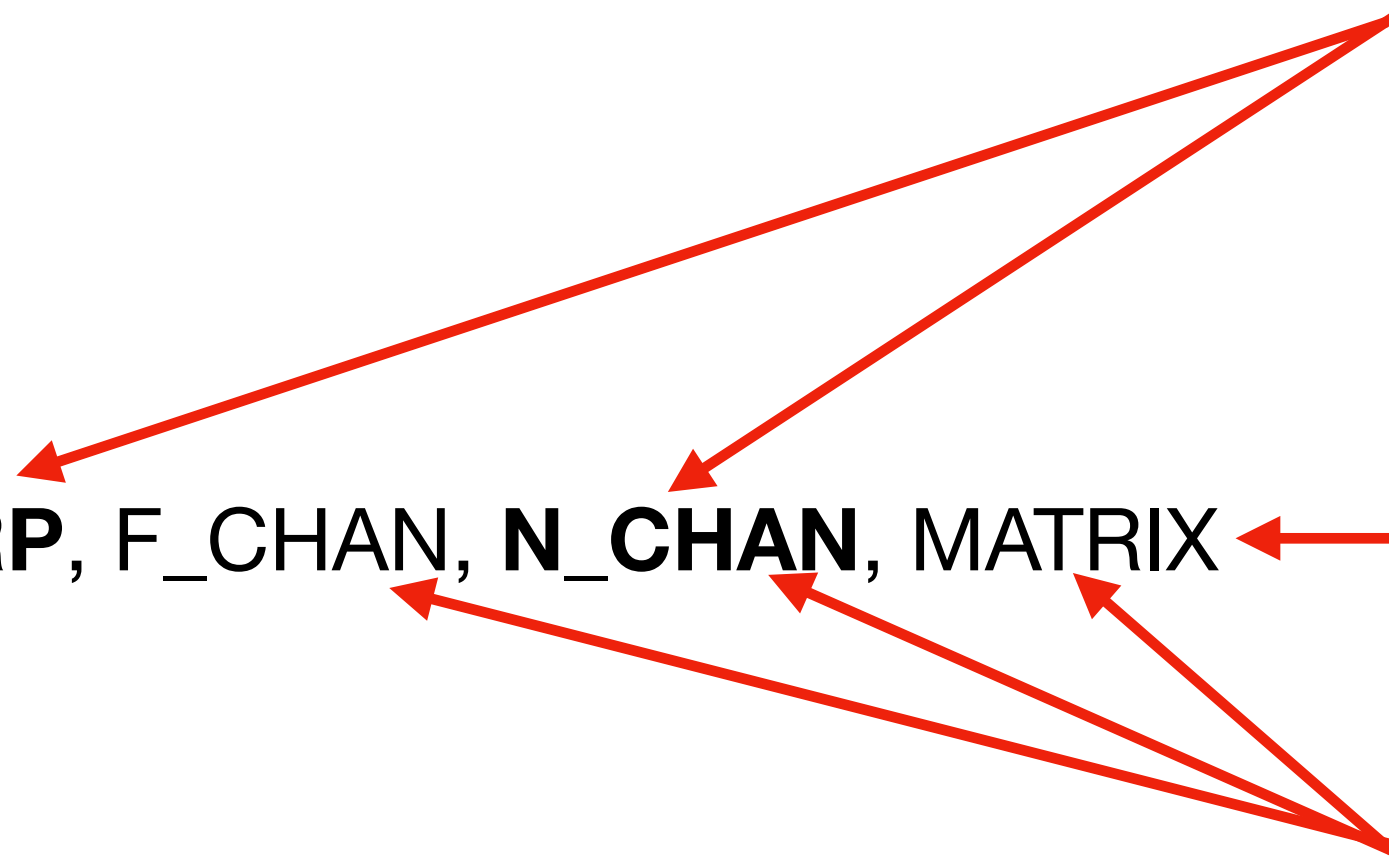
ARF/RMF

- As OGIP tables
 - RMF: MATRIX extension
 - BINTABLE
 - ENERG_LO, ENERG_HI, **N_GRP**, F_CHAN, **N_CHAN**, MATRIX
 - RMF: EBOUNDS extension
 - BINTABLE
 - CHANNEL, E_MIN, E_MAX
 - ARF: SPECRESP extension
 - BINTABLE
 - ENERG_LO, ENERG_HI, SPECRESP, [components]

Non-Physical - array sizes

Non-Physical - probability

Variable length arrays



Ancillary Data

ARF/RMF

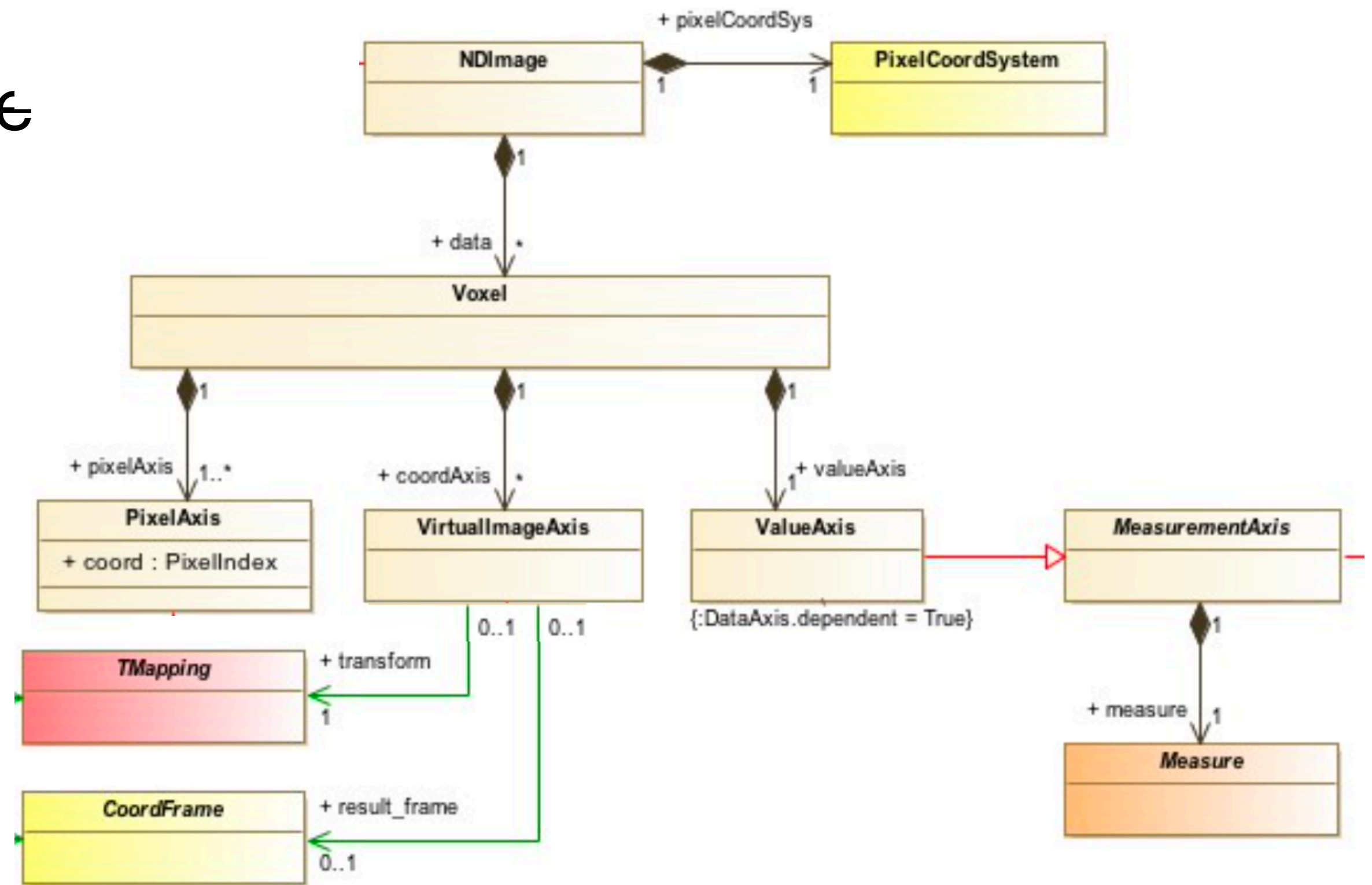
- As 2D Images serialized as OGIP Tables.
 - RMF:
 - Axes: (Channel, Energy)
 - Value: Probability
 - ARF:
 - Axes: (chipx, chipy)
 - Value: Spectral Response

Ancillary Data

ARF/RMF

- As 2D Images serialized as OGIP Table
 - RMF:
 - Axes: (**Channel, Energy**)
 - Value: Probability
 - ARF:
 - Axes: (**chipx, chipy**)
 - Value: **Spectral Response**

Cube Model



Ancillary Data

ARF/RMF

- As 2D Images serialized as OGIP Tables.

- RMF:

- Axes: (Channel, Energy)

- Value: Probability ← **Non-Physical - probability**

- ARF:

- Axes: (chipx, chipy)

- Value: Spectral Response

Annotating an Image instance, pointing to OGIP FITS file in VOTable DATA node, puts burden on software to recognize and convert the content

Associations

Associating the Event Data with corresponding ARF/RMF

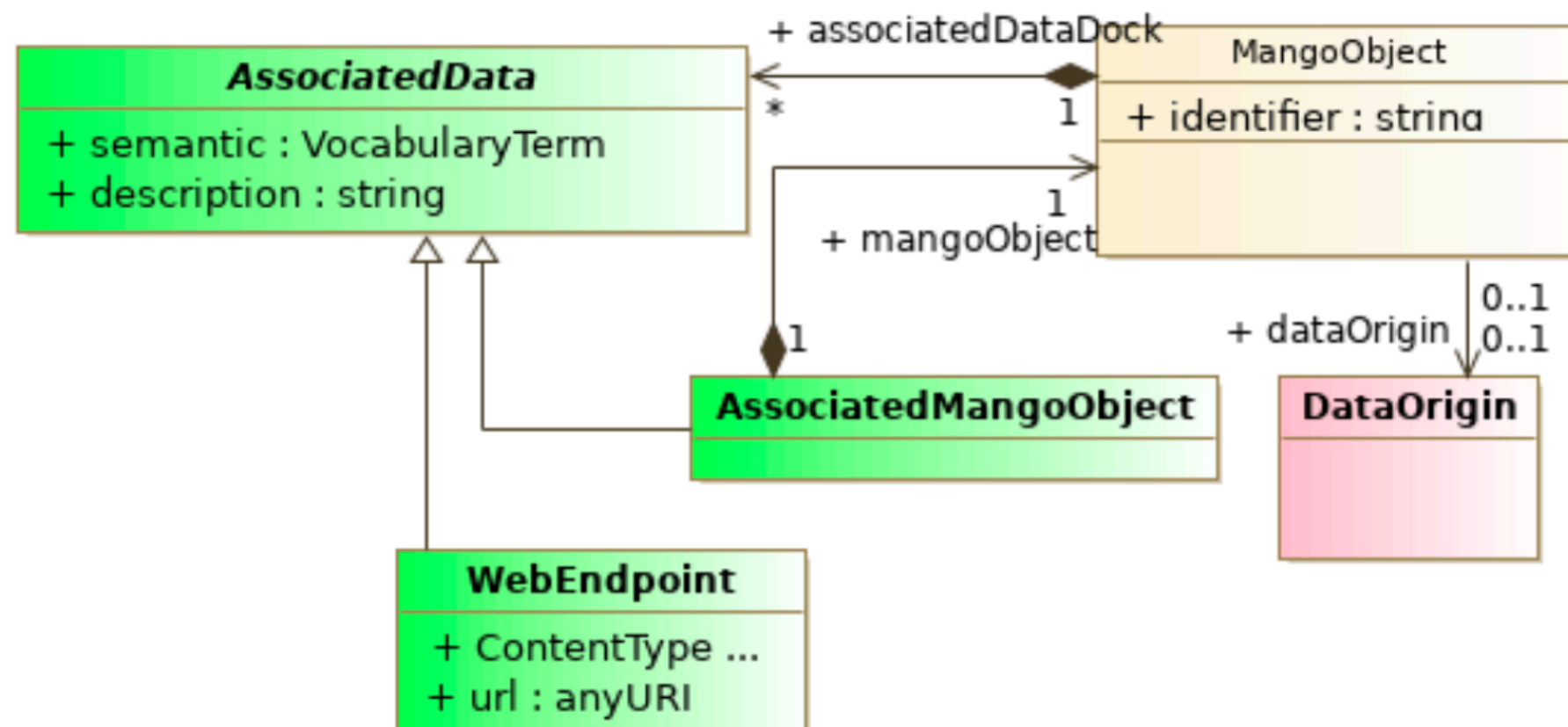
- HE Note: “the IRFs are applied to convert the events that were detected into an estimation of the real flux of particles arriving at the instrument and morphology of the source.”

Associations

Associating the Event Data with corresponding ARF/RMF

- HE Note: “the IRFs are applied to convert the events that were detected into an estimation of the real flux of particles arriving at the instrument and morphology of the source.”

Mango Model



* Can associate **MangoObject** to an external file or other **MangoObject**

* **An Event List is not a MangoObject**

Associations

Associating the Event Data with corresponding ARF/RMF

- HE Note: “the IRFs are applied to convert the events that were detected into an estimation of the real flux of particles arriving at the instrument and morphology of the source.”

Dataset Model

“we define an IVOA Dataset as ‘a file or files which are considered to be a single deliverable’. “

- * **Conceptually acknowledges a “Dataset” of >1 product.**
- * **This is NOT fleshed out in the model, it is an open topic.**

Associations

Associating the Event Data with corresponding ARF/RMF

- HE Note: “the IRFs are applied to convert the events that were detected into an estimation of the real flux of particles arriving at the instrument and morphology of the source.”

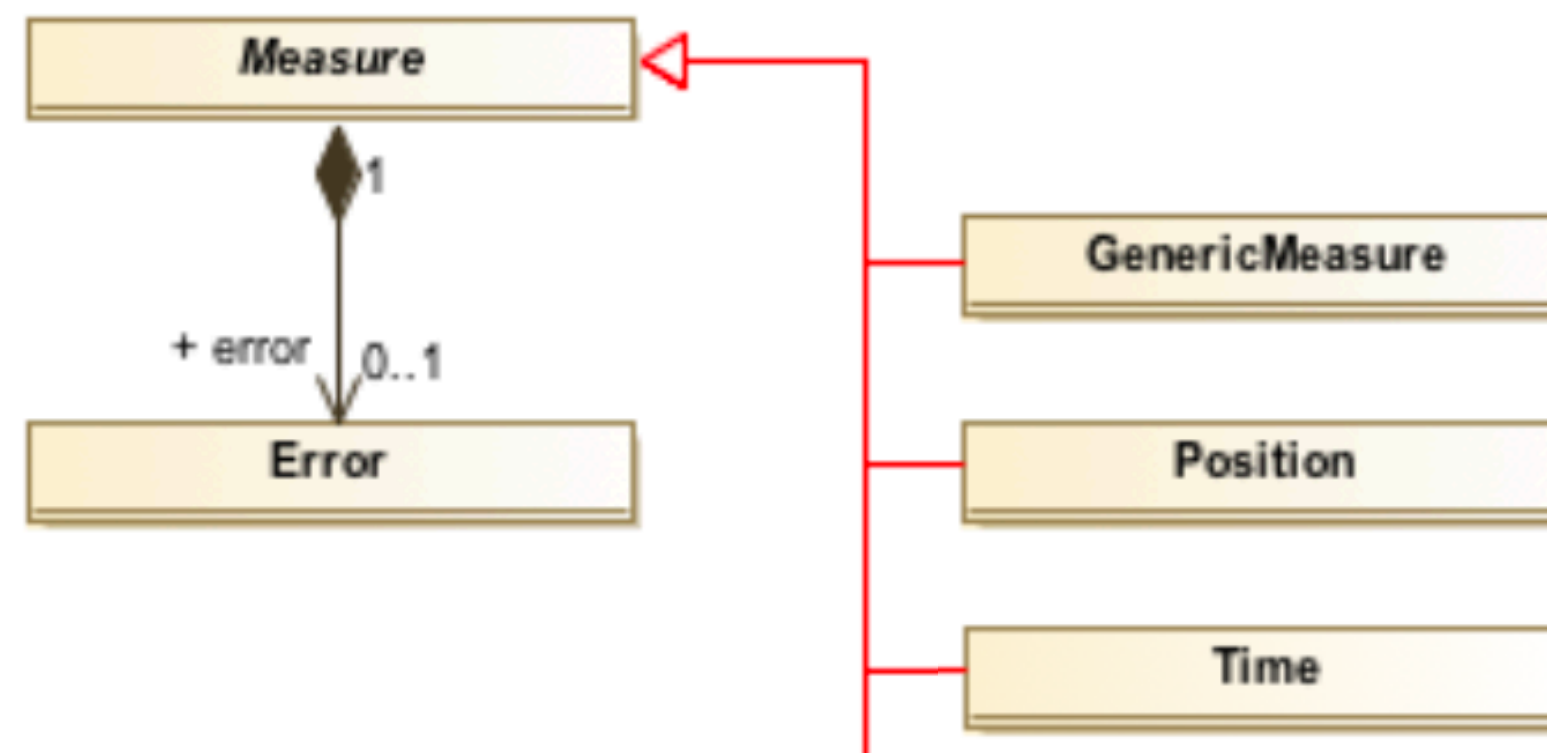
**Neither approach provides a means for conveying
HOW to apply the associated data.**

Probability Distributions

Measure obtained through probability analysis

- This is NOT part of the current model landscape.

- * Could branch PDF off Measure
- * But I don't believe it would have an associated Error



Probability Distributions

Measure obtained through probability analysis

- This is NOT part of the current model landscape.

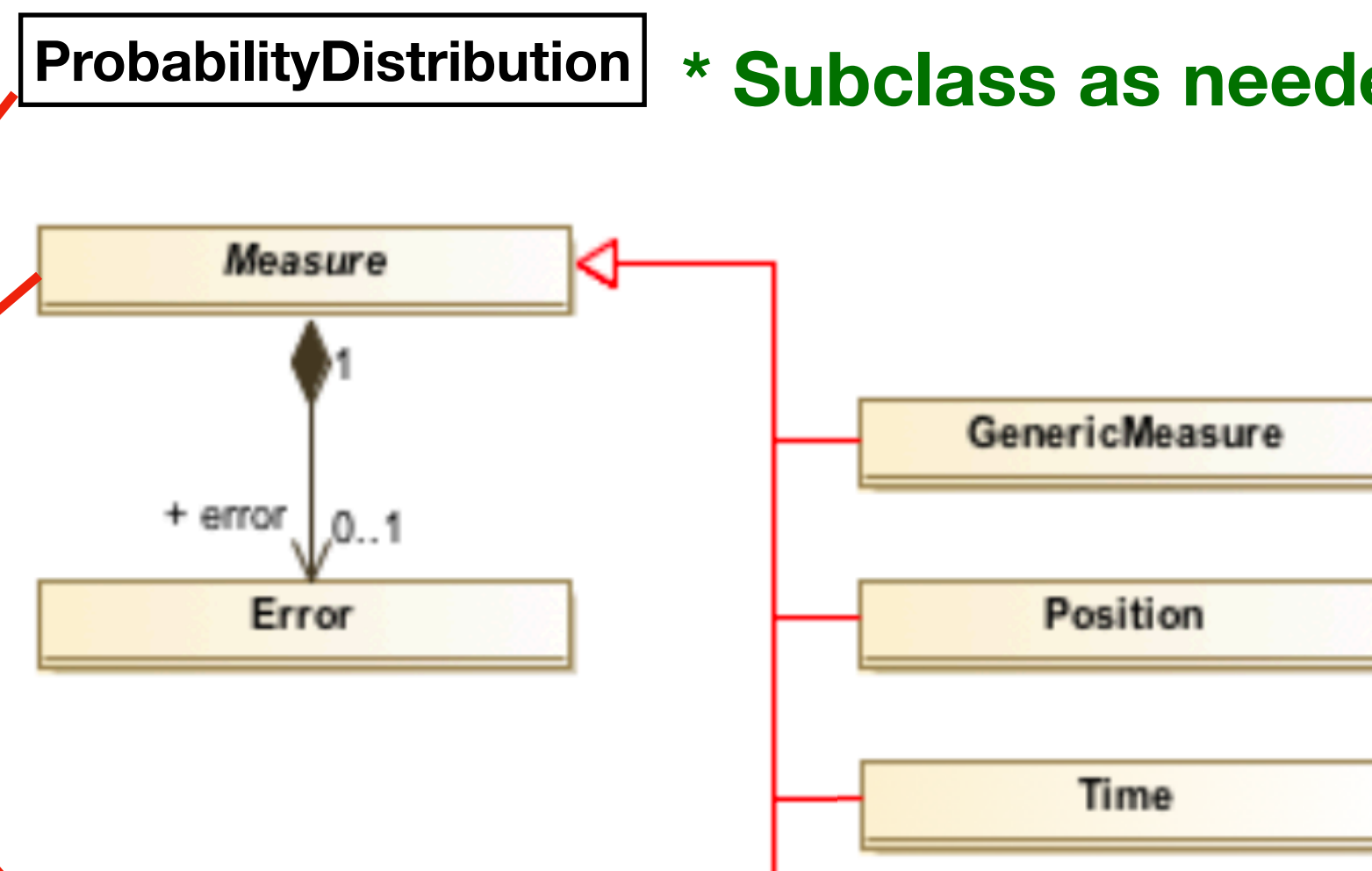
* Could make parent of Measure and extent PDF off THAT.

ProbabilityDistribution

* Subclass as needed by algorithm

* Cube Observables would be a collection of these.

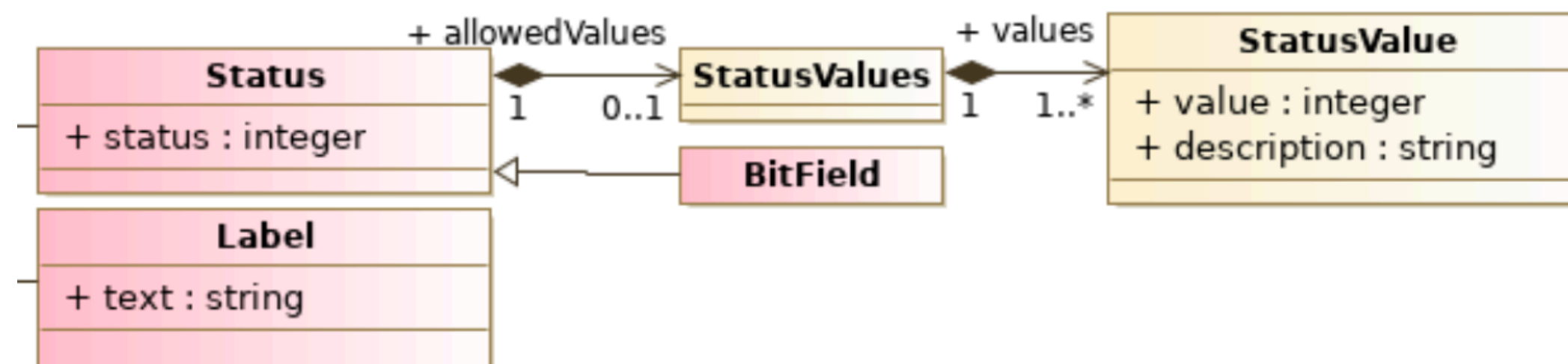
<something>



* This could be a nice hook to branch for other Property types currently in MANGO that could be shared by other models in different contexts

BitFlag ->

AssignedState ->



Conclusions

- There is good coverage for basic representation of high energy data products and catalogs. Current models can be extended to fill in missing content.
- Room for improvement in representing data which are not physical. HE input on what is missing would be very helpful.
- Definite need for input regarding Probability Distributions..
- There is a lot to discuss regarding associated data products, especially if the users are supposed to DO something with them.