SED Data Model Status

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Nara 2010

Status:

SED model development descoped in ~2005 to focus on single Spectrum model, approved in 2007

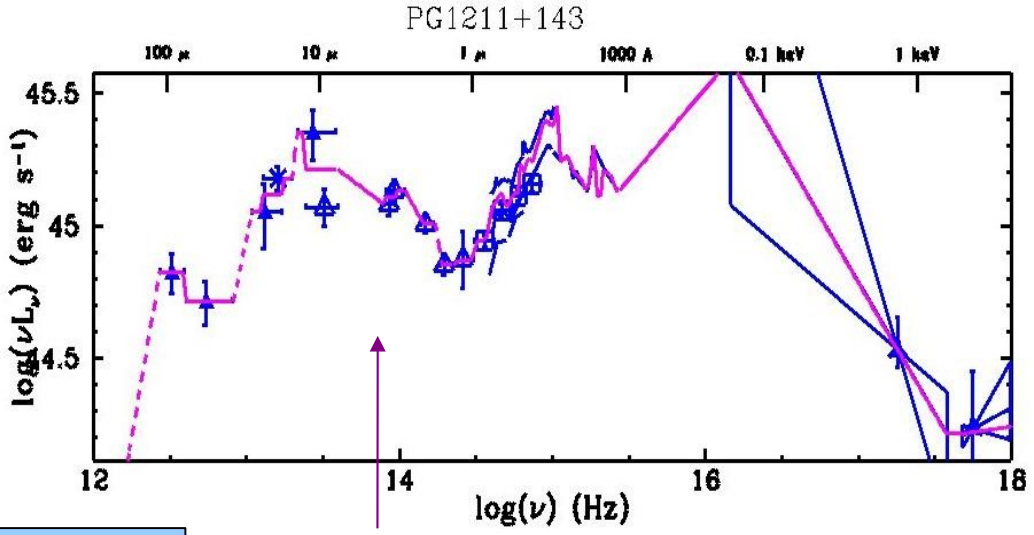
Ideas for Photometry model presented in DM working group and in US NVO meetings from 2007-2009

Proposal is to reuse Spectrum model for Photometry with minor additions

Proposal is to define the SED as an aggregation of Photometry and Spectrum segments

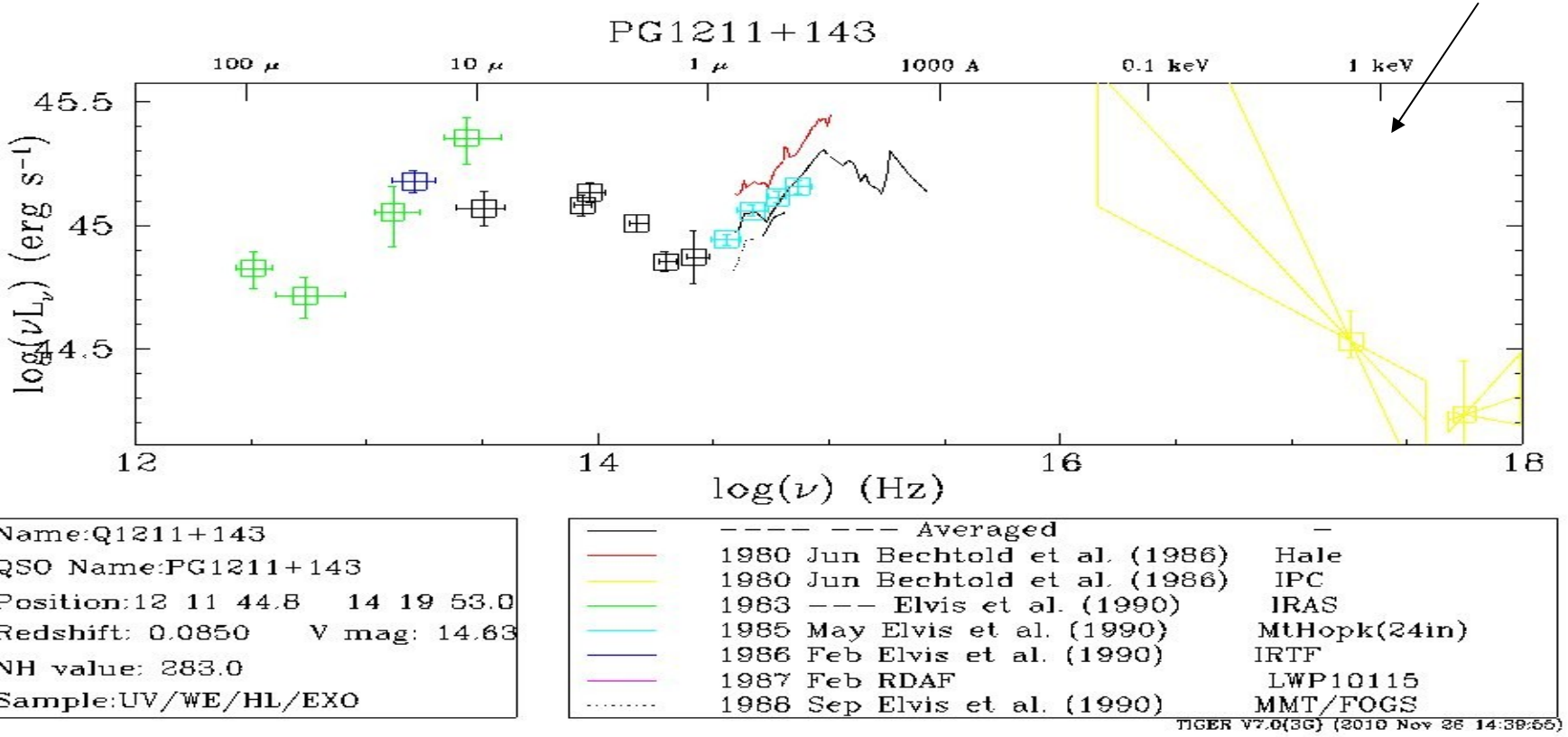
Building the SED

- Assemble aggregate SED
  - convert each segment to VO format
  - collect in one file with all metadata
- Create uniform SED
  - time average/blend phot. and spectra in each wavelength bin
  - interpolate across missing ranges?



Uniform SED

Aggregate SED

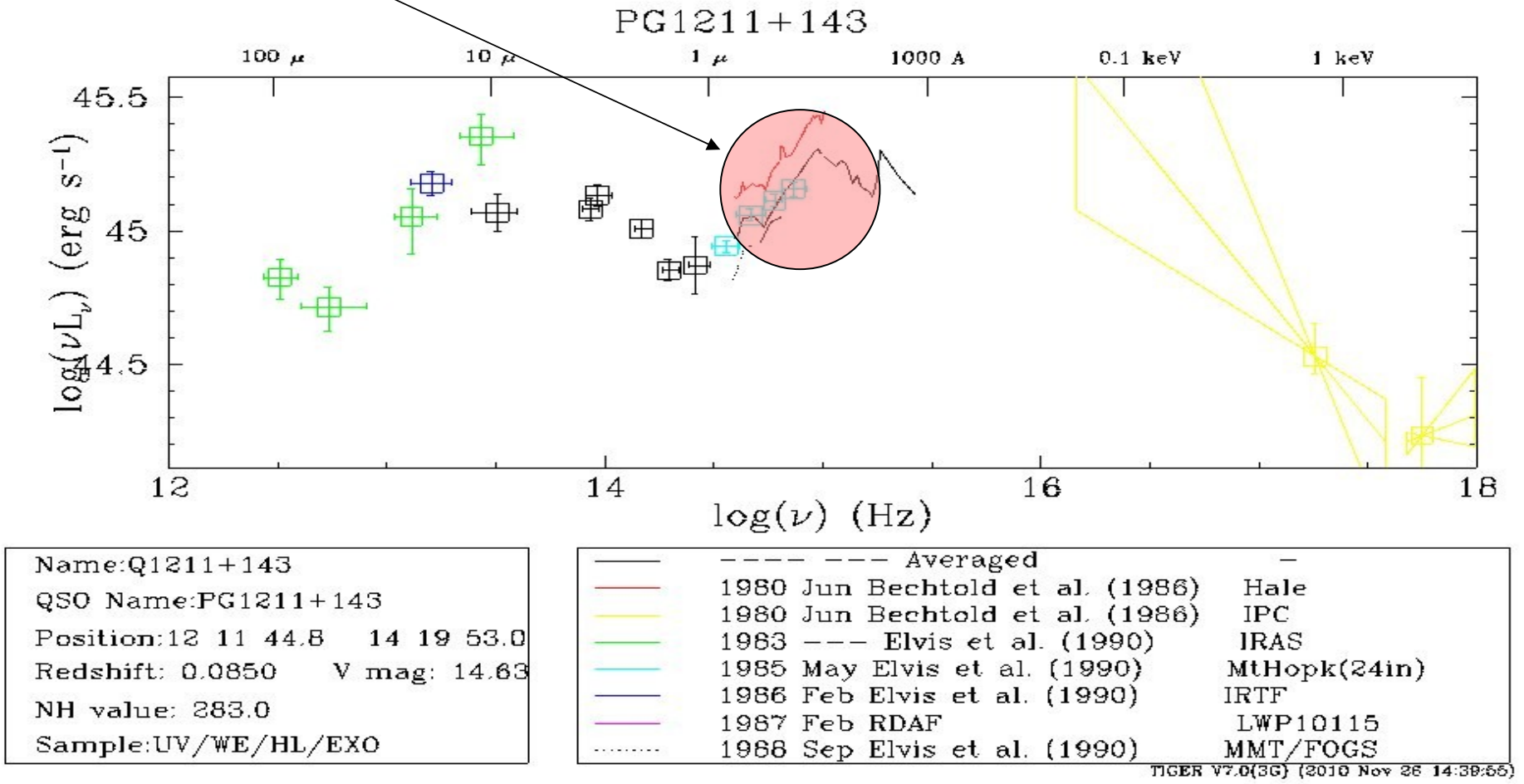


The hard part: combining overlapping data

Overlapping spectra and photometry is a common situation

What is the SED flux value here?

Implication: uniform SED data points don't have a 1-1 mapping back to aggregate SED segments.



Photometry Bands

* Many definitions of “effective wavelength”
  - transmission weighted
  - reference spectrum weighted
  - isophotal
  - pivot
  - etc, etc...

* Often just use a fiducial wavelength
  Degeneracy between choice of wavelength and value of zero point and color correction.
  e.g. use same wavelength for all V filters: easier to compare derived fluxes

* Magnitude equation:

$$F(\lambda 0) = F0 * 10^{**}(-0.4(m-m0-C))$$

where
F0 is the flux at $\lambda=\lambda 0$ for an object with the reference spectrum $fR(\lambda)$ and magnitude m0.

C is the color correction

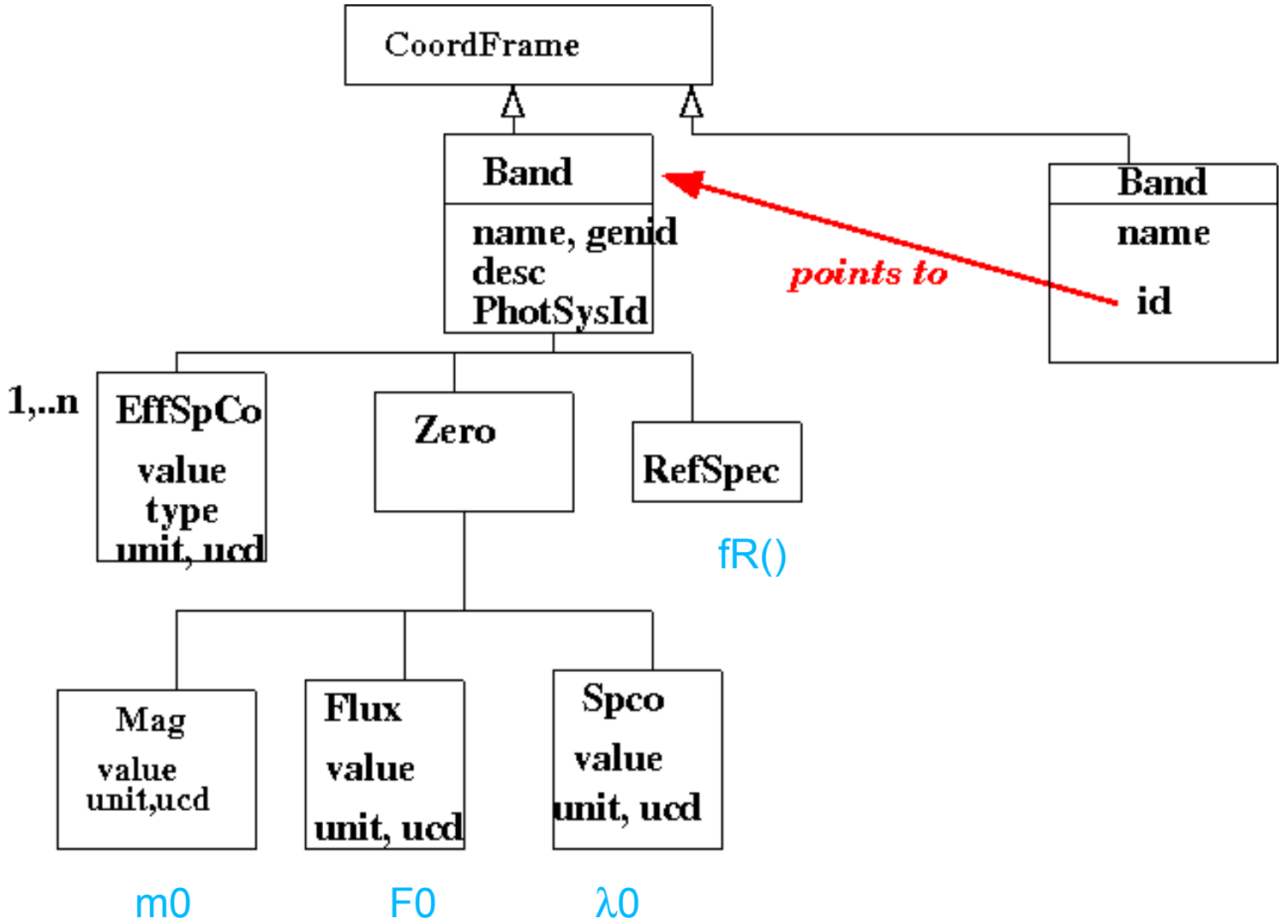
$$C = -2.5 \log c, \quad c = \frac{\int f(\lambda)T(\lambda)\, d\lambda}{\int fR(\lambda)T(\lambda) d\mathrm{lam}}$$

comparing the object spectrum with the reference spectrum.

Band parameters:

$\lambda 0$	fiducial wavelength
F0	zero point flux at fid. wave.
m0	zero point mag (usually 0.0)
$T(\lambda)$	transmission curve
$fR(\lambda)$	reference spectrum

Proposed Band model: use as a coordinate system on the Flux axis
Can exist in a Spectrum CoordSys, in full or as a reference to an external database of bands by (name, id)



Allow data providers to also supply their favorite effective wavelength definition (optionally) – or even more than one

```
<GROUP utype=”CoordSys”>
 <GROUP utype=”Band”>
  <GROUP utype=”Band.EffSpCo”>
   <PARAM utype=”Value” value=”5400.0”/>
   <PARAM utype=”Type”   value=”MLAM”/>
   <PARAM utype=”Unit”    value=”Angstrom”/>
   <PARAM utype=”UCD”    value=”em.wl”/>
  </GROUP>
 </GROUP>
</GROUP>
```

What flavor of effective wavelength is this? Allowed values:
EFLAM, EPLAM, MLAM, ISO, EFNU, EPNU, MNU, ISONU, PIVOT

Aperture corrections

Propose a new element within the CharacterizationAxis object:
Correction

First use:

FluxAxis.Correction.ApFrac.Value
FluxAxis.Correction.ApFrac.Applied

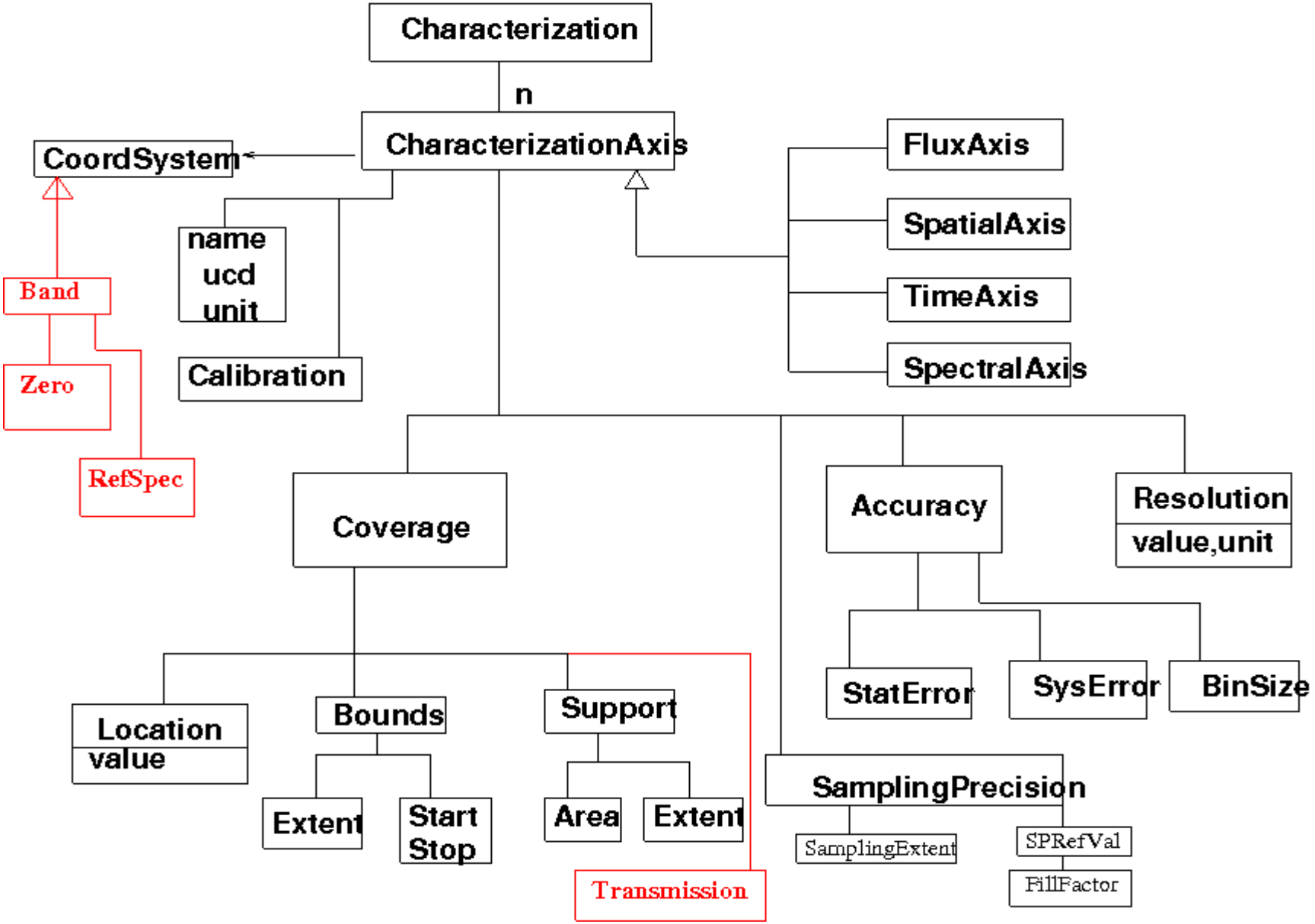
- Define aperture fraction from 0 to 1 as
fraction of source total flux contributing to measurement
- NOT necessarily point source fraction (e.g. measure part of spiral galaxy, use spatial model to extrapolate total flux)

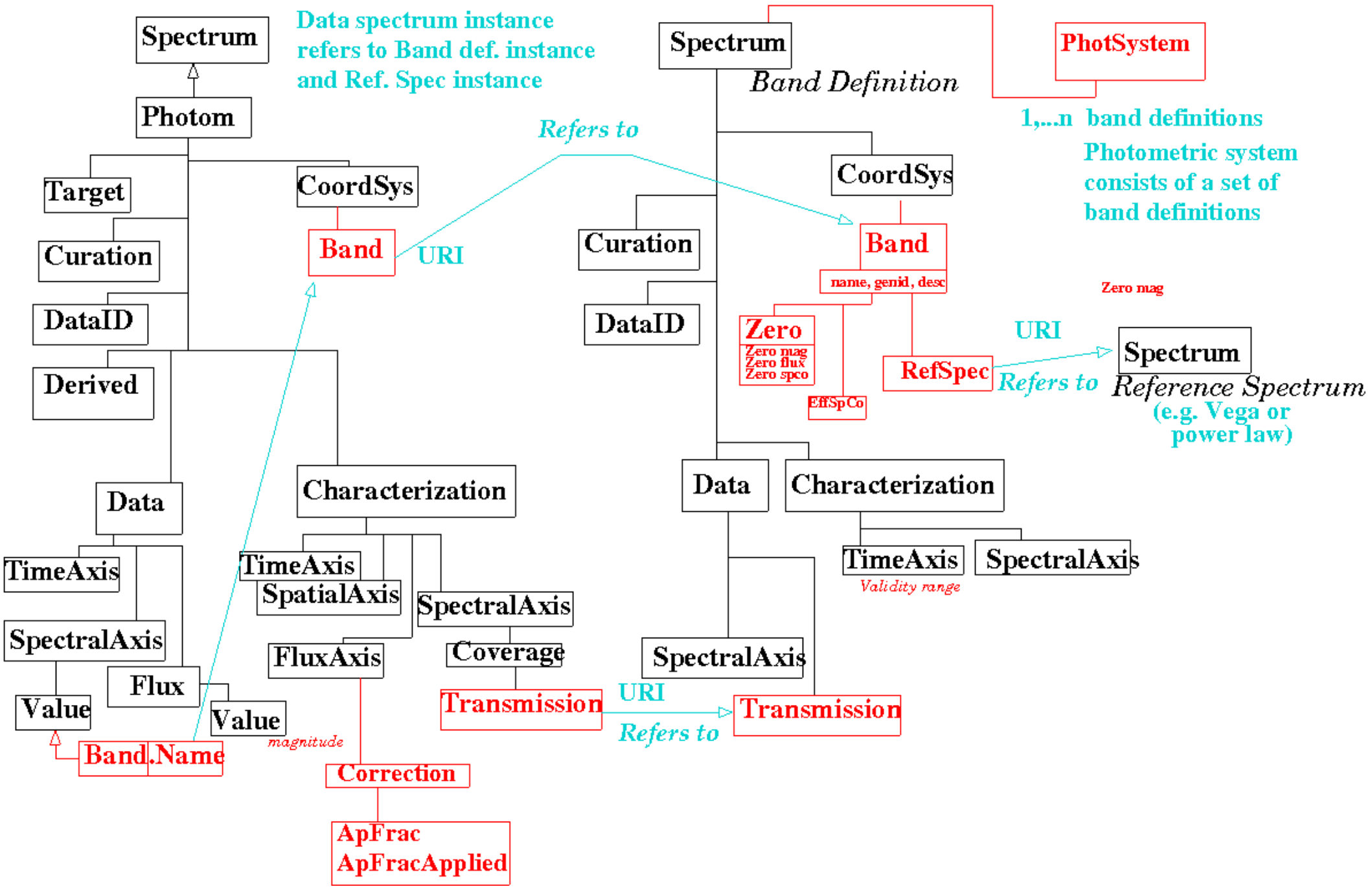
- Measured Flux = ApFrac * Total Flux

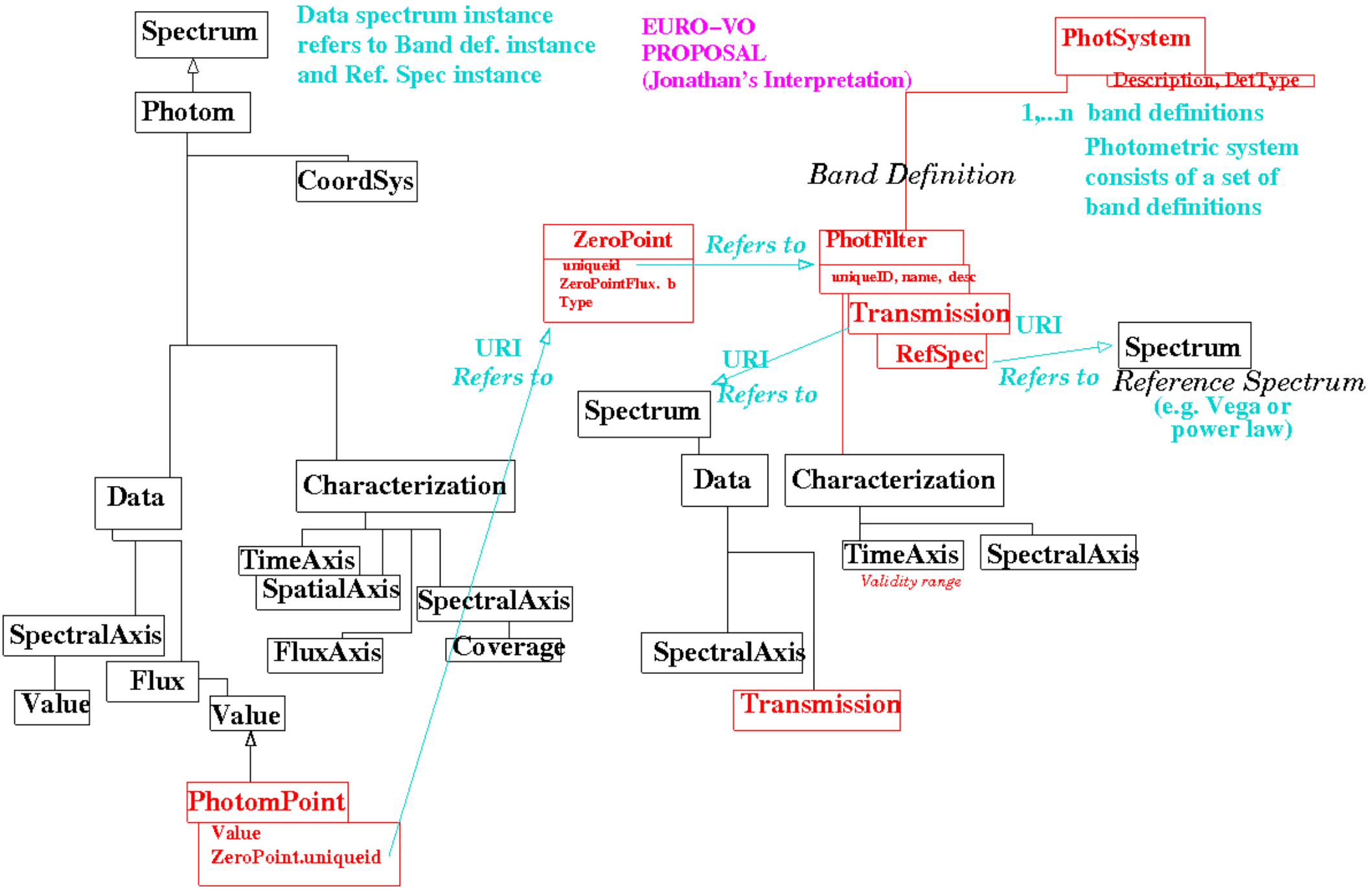
- Include flag to say whether the number in Data.FluxAxis.Value is the Measured Flux or the Total Flux, i.e.: has the correction been applied?
Both cases occur

Can envisage other cases of Correction to various Char axes

Proposal is to include the transmission as part of the Characterization. It is simply the 4th Coverage level on the spectral axis as discussed in the IVOA Char standard: degree of exposure as a function of spectral coordinate. It would be a URI pointing to the band def:




Spectrum
Data spectrum instance refers to Band def. instance and Ref. Spec instance
Photom
Target
CoordSys
Curation
Band
URI
Refers to
DataID
Derived
Data
Characterization
TimeAxis
SpectralAxis
TimeAxis
SpatialAxis
SpectralAxis
FluxAxis
Coverage
Flux
Value
Value
Band.Name
magnitude
Correction
ApFrac
ApFracApplied
Transmission
URI
Refers to
Transmission
Spectrum
Band Definition
PhotSystem
1,...n band definitions
Photometric system consists of a set of band definitions
CoordSys
Curation
Band
name, genid, desc
DataID
Zero
Zero mag
Zero flux
Zero spco
EffSpCo
Zero mag
URI
RefSpec
Refers to
Spectrum
Reference Spectrum
(e.g. Vega or power law)
Data
Characterization
TimeAxis
SpectralAxis
Validity range
SpectralAxis


Spectrum
Data spectrum instance refers to Band def. instance and Ref. Spec instance
EURO-VO PROPOSAL (Jonathan's Interpretation)
PhotSystem
Description, DetType
1,...n band definitions
Photometric system consists of a set of band definitions
Photom
CoordSys
Band Definition
ZeroPoint
uniqueid
ZeroPointFlux. b
Type
Refers to
PhotFilter
uniqueID, name, desc
Transmission
URI
RefSpec
URI
Refers to
URI
Refers to
Spectrum
Reference Spectrum
(e.g. Vega or power law)
Spectrum
Data
Characterization
Data
Characterization
TimeAxis
SpatialAxis
SpectralAxis
FluxAxis
Coverage
TimeAxis
SpectralAxis
Validity range
SpectralAxis
Flux
Value
Value
SpectralAxis
Transmission
PhotomPoint
Value
ZeroPoint.uniqueid