Intro: The following comments are provided based on review and use of the Spectral Data Model (V1.03) to implement an SED library for the VAO SED Access and Analysis project. The information was presented at the IVOA Interop in Naples on Tuesday May 17, 2011 and summarized here as input to the document review process. The comments are relevant to V1.1 and V1.2 of the model as well.

Scope: The document tends to go outside the scope of describing the Spectrum model.
- References to SEDs; descriptions of how Spectra will be combined and serialized, as well as a stub SED model. With the recent delivery of a draft SED model, this will likely be a source of confusion and conflicting definitions and should be removed.
- Information related to the SSA protocol is more appropriate for the SSA document.
  - Descriptions of how the SSA protocol will use the Spectrum model. It is within scope for the Spectrum model to define how users may extended or modify components, but it should not detail how a specific user will do so (eg. Changing Spectrum element of Utype to "SSA").
  - Section on "Packaging Model" defines an object describing the transmission format of the dataset and its allowed values -- an SSA specific concept.
- Detailed descriptions of Unit and UCD syntax and formatting. Suggest that general concepts, should be defined in a separate IVOA document and referred to within the Spectrum model. (There was a parallel discussion on this point with regard to Units during the meeting.)

Structure: An important part of understanding a document, is the organization of the information it contains. We found the bottom-up approach of this document, and loose coupling of diagrams, tables and text to be awkward.
- I'd like to make the following suggestions:
  - Put diagrams and model component descriptions up front. Make a stronger connection between the diagrams and text.
  - Then Utypes which map the model to various serializations.
  - Then UCDs and Units
  - Then the Schema
  - Then specific Serialization examples.
  - Tables and serialization examples should move to Appendices.
- Documents/URLs within the text should be tagged and included in the Reference list.
  - OGIP doc in "Units"
  - UCD doc in "UCDs"
  - STC doc in "Time Coordinate:
  - ST-ECF newsletter in 5.3.1 (signal-to-noise)
  - Resource Metadata doc in 5.4 (curation)
  - IVOA DAL service section 8.2
- Several fields which have enumerations for allowed values or data range validity. (Spectrum.Type, CoordFrame.ReferencePosition, Derived.Redshift.Confidence), It would be useful to raise the profile of these items.

Whats Missing:

How I can distinguish theoretical data from observed data. For example, if I serialize my Sherpa fit results as a Spectrum instance, what Spectrum model attribute allows me to state that the spectrum is theoretical?

Errors and other comments by Section:

Section 3.1 Model Components
- The text "**will** have arrays of the following values" reads like a statement of requirement, but the list includes optional fields, flux "upper and lower statistical errors" and spectral "bin min and max".
- Spectral coordinate 'central', is this the same as 'value'?

Section 3.2: Use cases
Bullet #3 = "The Curation.Publisher field" => "Curation.Publisher"
Bullet #5 => rephrase as " UCD and units of the spectral and flux axes (Spectrum.Char...)"
End paragraph => cut "(VO resources)" which is instance specific and presumptive.

Section 3.5: Utypes
- Discussion on overriding the "Spectrum" portion of Utypes. See 'scope' above
- This commentary should be with the table (which is 2 pages later) or the table could include the 'Spectrum' portion explicitly.

Section 3.6: Packaging Model
- I don't see where it ties in with the Spectrum model. This looks like it belongs in SSA.

Section 3.7: Data Model Fields
- Restating "Spectrum" handling implies it wasn't in the right place above.
- Type-o in that line "specrtrum"

Table 1:
- move to Appendix
- Optional fields with default values can be confusing. When I create a Sed object, I know to populate the manadatory field "DataModel" with the default value "Spectrum-1.0"... but when creating CoordSys, do I fill CoordSys.SpaceFrame.Name with "ICRS"?

Section 4.2: Flux Object
- paragraph 2 "The table contains" => "Table 3 contains"

Section 4.4: Time coordinate
- rephrase last line => "... the only valid unit values are 's' (seconds) and 'd' (days)."

Section 4.5: Position coordinate
- remove 'spatial' from " … is given in the spatial Spectrum.Char.SpatialAxis..."

Section 5.1: CoordSys Fields
- needs reference to Table 4

Section 5.1.1
- "are listed below" => "are listed in Table 5"

Section 5.1.2
- "are given below" => "are given in Table 6"

Section 5.2: Characterization
- "Note" on SSA should be in SSA.

Section 5.2.1: Coverage Fields
- Paragraph 5 - " TimeAxis.Coverage.Bounds.Extent" OR "TimeAxis.Coverage.Bounds.Start/Stop" are required. This conflicts with Table 1 listing MAN/OPT fields.

Section 5.3.2: Redshift measurement
- Reference to Sloan reads as it is the only usage of this field, rephrase so that it reads as an example usage of that attribute.

Section 5.3.2: Variability amplitude
- This value is a dimensionless "variation around the mean". Specify value restrictions and validity range (positive value; 0:N) Would N=1000.0 be OK?

Section 5.4: Curation model
- Found the wording confusing.
- References specifics from the "Resource Metadata" doc inconsistently.
- Two different versions of the doc are noted.

Section 5.7: Spectrum top level object.
- Paragraph 2, SIDim field.. what is this?
- Paragraph 3, regarding SED should be cut.
- Paragraph 4, remove "(in some serializations..."
- Paragraphs 5, are the Types listed supposed to be an allowed value enumeration?
- Cut last paragraph about SED or reference SED model.

Section 6.1: Extensibility.
  This section is FAR too open and may not meet the intent.
- It takes a simple model which is restricted to scalar values of types "int", "double", "char" and opens it up for the user to add any column/param, of any datatype, of any dimensionality.
- There are no restrictions as to where these items may be added.. a user can legally add a column to the existing "Target" group.
- Levels of extensibility are defined in terms of the serialization format.

  The corresponding schema does not support the abilities described in this section.
- There is no object in which to store an added column.
- The CustomParam object does exist, but is only associated with a couple of the model structures, so one cannot add parameters freely.
- It is not possible to store a custom Group.

Suggest that this section be re-written with specific guidelines on the above items. It should also state how a user should define the Utype for extended content.

Section 8.1: Mapping VOTable
- bullet "all the second level elements below RESOURCE except SPECTRUM map to an initial TABLE, while we map SPECTRUM to a second TABLE."
  All examples I've seen have 1 Spectrum Table only.. what else is there?
- Last bullet "optional name attribute that I have not used in the instance".. the instance example lines do have 'name' populated.
- Paragraph about generally mapping an arbitrary data model schema to VOTable.. does not need to be in this document.

Section 8.2
- cut "(Note that this may appear as one of many tables within an SED VOTable)"
- refers to "XML schema given in section 8.4", the schema is Section 7.1
- serialization instance
  - datatype=float.. are no float types in schema.
  - CoordSys.SpaceFrame.Name is described as a parameter in the example, but is a simple string attribute in the schema.. so there is no place to store the name or ucd.
  - Char.SpatialAxis has param with utype="name" presumably for the name attribute which is a simple string. We cannot store the parameter name/value both.
  - Group Char.TimeAxis.Coverage.Support has params TimeStart/TimeStop. These are labeled with the "Bounds" utype rather than "Support". Also, these are "Start/Stop" while Support has "Range".
  - Char.SpectralAxis.Name (same as for SpatialAxis)
  - Group DataID, "Creator" has Segment in Utype it is the only one. All these Utypes should have 'Spectrum'

Section 9.1
- FITS serialization design: talks about SED serialization which doesn't belong in this doc.
- Keywords and columns: 2nd paragraph talks about promoting keywords to columns. This is fine if it is generally true... can I promote a Param to Column for single Spectrum?
- VOClass keyword.. isn't this the Spectrum.Datamodel param?