

STC-based Time Series Table Format

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STC Characteristics

STC was designed for use in tables, which makes it very easy to incorporate it in a simple table schema. Even the simplest table design still allows full STC metadata content. The following properties of the STC metadata standard are pertinent in this context:

- Any element in an STC document may contain its actual value or a reference to another element in the document. This allows the document's author to define an STC quantity (in particular, a "leaf") and refer to a table column for its actual values. This property is comparable to the "Greenbank convention" in FITS. It also allows one to refer to high-level constructs (such as AstroCoordSystem) specified elsewhere (for instance, in WhereWhen).
- In addition, elements (in particular AstoCoordSystem and ObservatoryLocation, but not limited to these) may refer to an instantiation outside the document – for instance, in a library.
- STC's core coordinate axes are Time, Space, Spectral, and Redshift. However, it also allows arbitrary axes to be defined, such as Flux Density.
- STC is extremely flexible and covers a very wide range of situations. However, all users (servers and clients) are free to choose to implement only a subset that makes sense for their particular applications. The important thing is that if and when one communicates with a partner that recognizes a wider subset, there will be adequate metadata information to allow that partner to be able to do any necessary conversions.

Simple Table

I implemented a simple schema that defines a table with STC metadata:

<http://hea-www.harvard.edu/~arots/nvometa/STC/stcTab.xsd>

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2009 (http://www.altova.com) by Arnold Rots (Smithsonian Astrophysical Obsv.) -->
<xs:schema xmlns="stcTab.xsd" xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:stc="http://www.ivoa.net/xml/STC/stc-v1.30.xsd" xmlns:xlink="http://www.w3.org/1999/xlink"
  targetNamespace="stcTab.xsd" elementFormDefault="qualified">
  <xs:import namespace="http://www.ivoa.net/xml/STC/stc-v1.30.xsd"
    schemaLocation="http://www.ivoa.net/xml/STC/stc-v1.30.xsd"/>
  <xs:element name="STCTable" type="stcTableType"/>
  <xs:complexType name="stcTableType">
    <xs:sequence>
      <xs:element ref="stc:STCmetadata"/>
      <xs:element name="Table" type="tableType"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="tableType">
    <xs:sequence>
      <xs:element name="Documentation" type="docType" minOccurs="0"
        maxOccurs="unbounded"/>
      <xs:element name="Header" type="headerType"/>
      <xs:element name="TR" type="rowType" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="docType">
    <xs:sequence>
      <xs:element name="Label" type="xs:string"/>
      <xs:element name="Text" type="xs:string"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="headerType">
    <xs:sequence>
      <xs:element name="TH" type="columnType" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="columnType">
    <xs:simpleContent>
      <xs:extension base="xs:string">
        <xs:attribute name="id" type="xs:ID"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
  <xs:complexType name="rowType">
    <xs:choice maxOccurs="unbounded">
      <xs:element name="TD" type="xs:double"/>
      <xs:element name="TDI" type="xs:int"/>
      <xs:element name="TDT" type="xs:dateTime"/>
      <xs:element name="TDS" type="xs:string"/>
      <xs:element name="TDU" type="xs:anyURI"/>
      <xs:element name="TDA" type="stc:astroCoordAreaType"/>
    </xs:choice>
  </xs:complexType>
</xs:schema>

```

One may quibble about the details, for instance:

- Should the column headings be in FIELD elements, rather than TH elements?
- The schema defines different TD elements for different data types; this has the advantage that one can easily validate the correctness of the data type, but it does not enforce uniform typing along columns. There are other options in this regard, such as specifying the data type in the column header.
- The schema defines a bare-bones table. One might want to add additional metadata elements, such as descriptions.
- One might also consider allowing compound columns, consisting of values, errors, resolutions, and/or bounds.
- Units can be handled in the STC metadata, but it may be necessary to add them for columns that are not tied to an STC coordinate axis.

But these are details that should be fairly easy to work out. Note that the schema allows any type of table to be constructed, not just time series; for instance, it can be used to create lists of positions.

There are three sample time series, all providing flux densities as a function of relative time. The first is bare-bones:

<http://hea-www.harvard.edu/~arots/nvometa/STC/STCTable3.xml>

See also the text box on the next page.

It is pretty self-explanatory, as it references the standard STC libraries for ObservatoryLocation and AstroCoordSystem. The base time to which the time column is offset is provided in the metadata item ISOTime, while that relative time column is pointed to in TimeOffset. But, of course, the time columns could also have contained absolute time stamps, in JD, MJD, or ISO-8601.

The second example:

<http://hea-www.harvard.edu/~arots/nvometa/STC/STCTable2.xml>

adds a celestial position to the time series in the STC metadata.

The third example:

<http://hea-www.harvard.edu/~arots/nvometa/STC/STCTable.xml>

has a full AstroCoordSystem that also defined the Flux Density coordinate axis.

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- A Lightcurve table using the STC table extension schema
      that is based on STC -->
<STCTable xmlns="stcTab.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="stcTab.xsd
  http://hea-www.harvard.edu/~arots/nvometa/v1.30/stcTab.xsd">
  <ObsDataLocation xmlns="http://www.ivoa.net/xml/STC/stc-v1.30.xsd"
    xmlns:xlink="http://www.w3.org/1999/xlink"
    xsi:schemaLocation="http://www.ivoa.net/xml/STC/stc-v1.30.xsd
      http://www.ivoa.net/xml/STC/stc-v1.30.xsd">
    <!-- Observatory location: all referred to geocenter -->
    <ObservatoryLocation xsi:nil="true" xlink:type="simple"
      xlink:href="ivo://STCLib/Observatories#GEO"/>
    <!-- STC metadata that go with the table -->
    <ObservationLocation>
      <!-- Specify the coordinate system: TT, ICRS, Spectral, and
            Flux density as a generic coordinate -->
      <AstroCoordSystem id="UTC-ICRS-GEO" xsi:nil="true" xlink:type="simple"
        xlink:href="ivo://STCLib/CoordSys#UTC-ICRS-GEO"/>
      <AstroCoords coord_system_id="UTC-ICRS-GEO">
        <Time unit="s">
          <Name>Time</Name>
          <TimeInstant>
            <TimeOffset xsi:nil="true" idref="Time"/>
            <ISOTime>2007-09-27T12:34:56</ISOTime>
          </TimeInstant>
        </Time>
      </AstroCoords>
    </ObservationLocation>
  </ObsDataLocation>
  <!-- This is the table-proper -->
  <Table>
    <!-- Header definition -->
    <Header>
      <TH id="Time">Time</TH>
      <TH id="FDVal">FluxDensity</TH>
      <TH id="FDErr">FD Error</TH>
    </Header>
    <!-- and table body -->
    <TR>
      <TD>123.4</TD>
      <TD>56.7</TD>
      <TD>.98</TD>
    </TR>
    <TR>
      <TD>133.4</TD>
      <TD>46.7</TD>
      <TD>.98</TD>
    </TR>
    <TR>
      <TD>143.4</TD>
      <TD>36.7</TD>
      <TD>.98</TD>
    </TR>
    <TR>
      <TD>153.4</TD>
      <TD>26.7</TD>
      <TD>.98</TD>
    </TR>
    <TR>
      <TD>163.4</TD>
      <TD>16.7</TD>
      <TD>.98</TD>
    </TR>
  </Table>
</STCTable>

```