# Space-Time Coordinate Metadata Update

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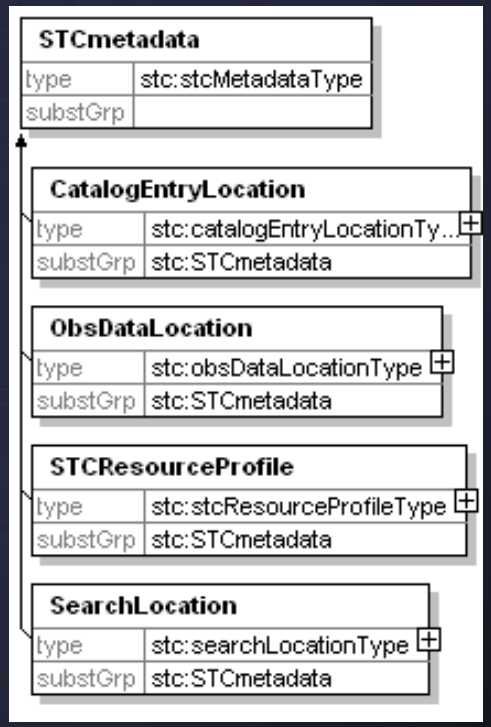
http://hea-www.cfa.harvard.edu/~arots/nvometa/STC2004-05.pdf

# STC Metadata Definition

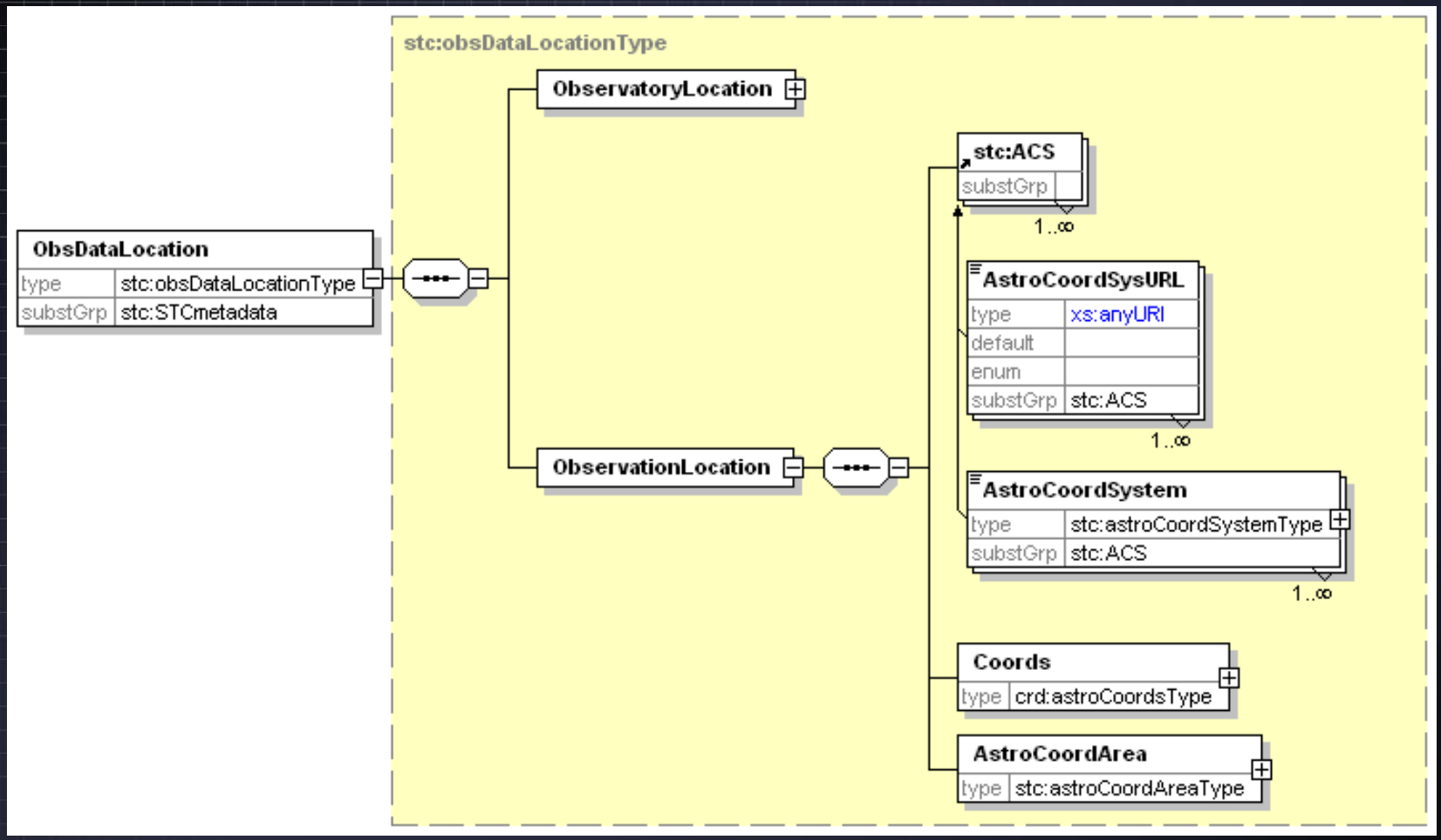
- Objective:
  - To provide a model to describe a position or volume in coordinate space that is:
    - Complete
    - Consistent
  - Intertwined coordinate axes:
    - Time
    - Space (position & velocity)
    - Spectrum
    - Redshift (includes Doppler velocity)

# STC in Three Slides (1)

- STC metadata comes in four contexts:
  - STCResourceProfile
  - SearchLocation
  - CatalogEntryLocation
  - ObsDataLocation
    - ObservationLocation
    - ObservatoryLocation
- Three components:
  - CoordinateSystem
  - CoordinateArea
  - Coordinates



# STC in Three Slides (2)



# STC in Three Slides (3)

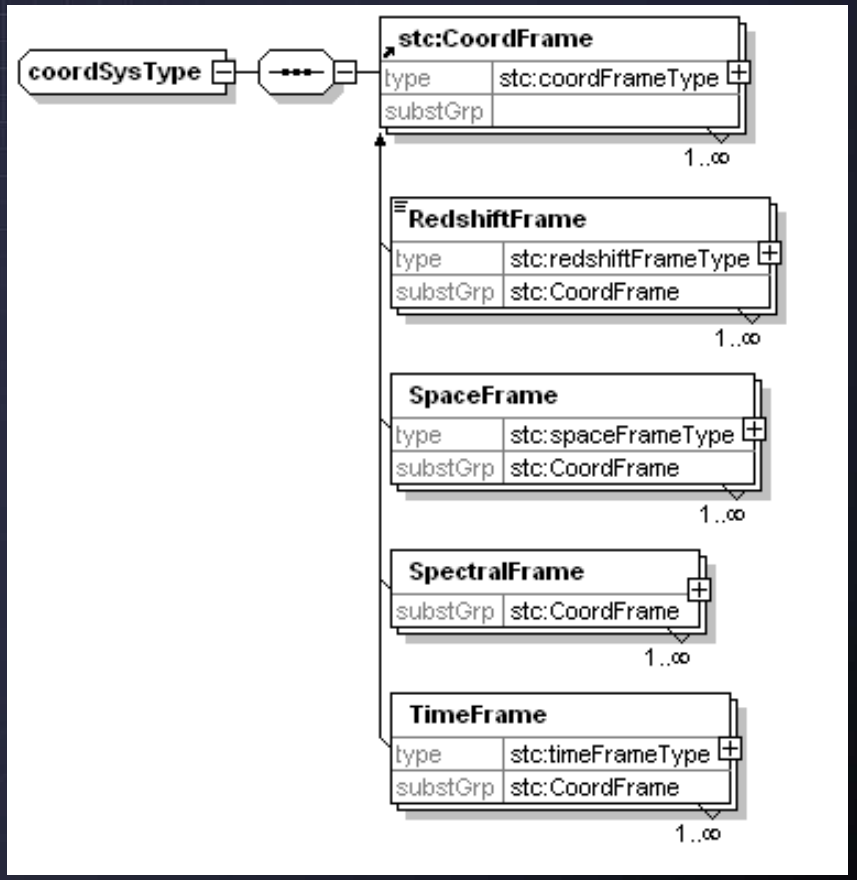
- Coordinates contain 6 components with common unit:
  - Name (UCD?)
  - Value
  - Error
  - Resolution
  - Size
  - Sampling size (pixel size)
- All may be
  - Value (scalar or vector numeric; string)
  - IDREF (values provided elsewhere, such as table column

# New Products

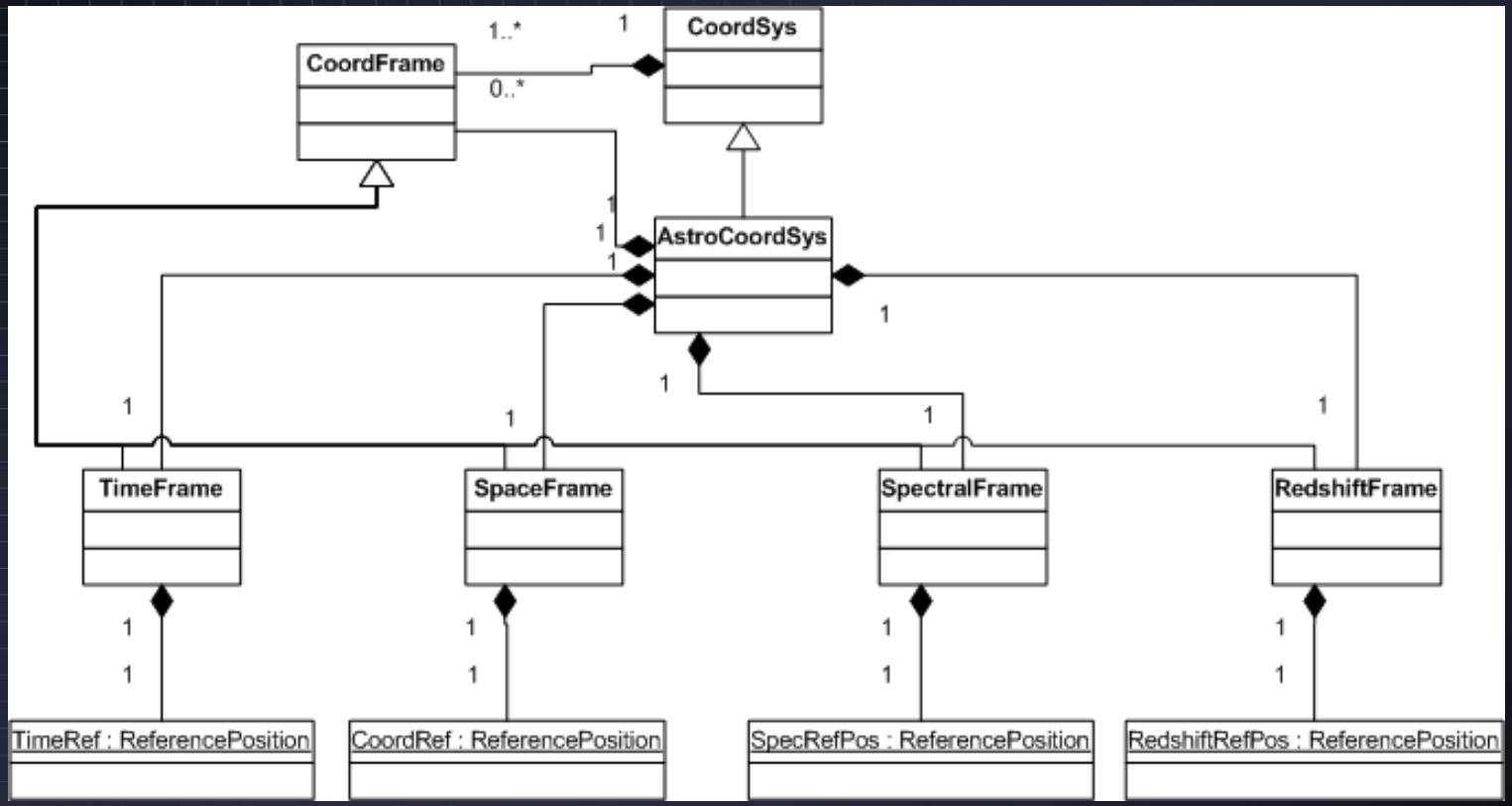
- Working draft version 0.51
  - Full description
  - UML representation included
- New schemata version 2.0
  - Choice groups -> Substitution groups
    - Oops, XMLSpy's validation is defective – revision required
  - Generalized CoordSys and Coords
  - Unit restrictions/simplifications
  - Substitution through URL reference
- Examples

# Generalized CoordSystem

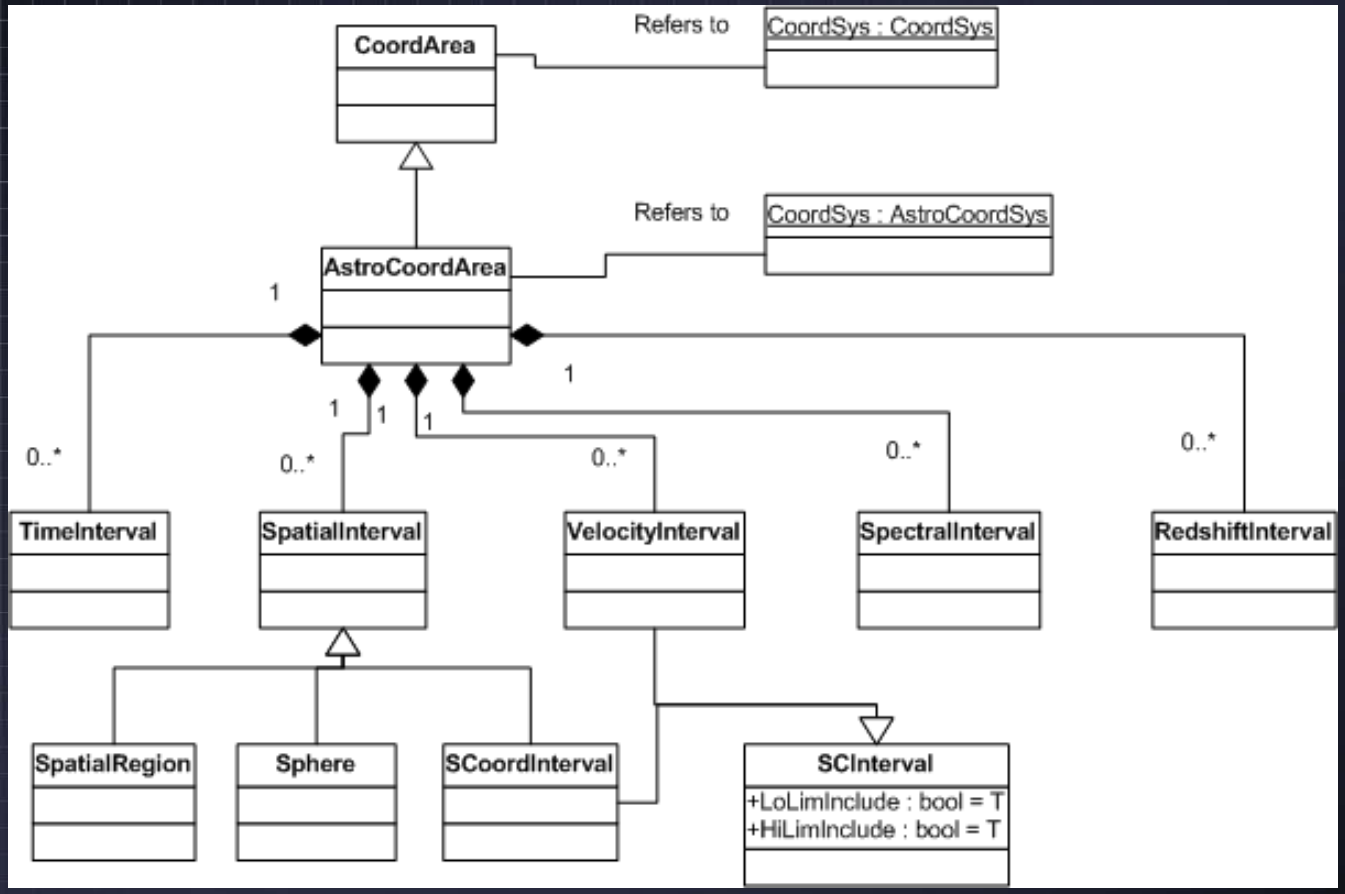
- Contains any number of Frames, of any kind
- AstroCoordSystem contains a specific set of frames plus optional generic ones
- Similarly with Coords and CoordIntervals



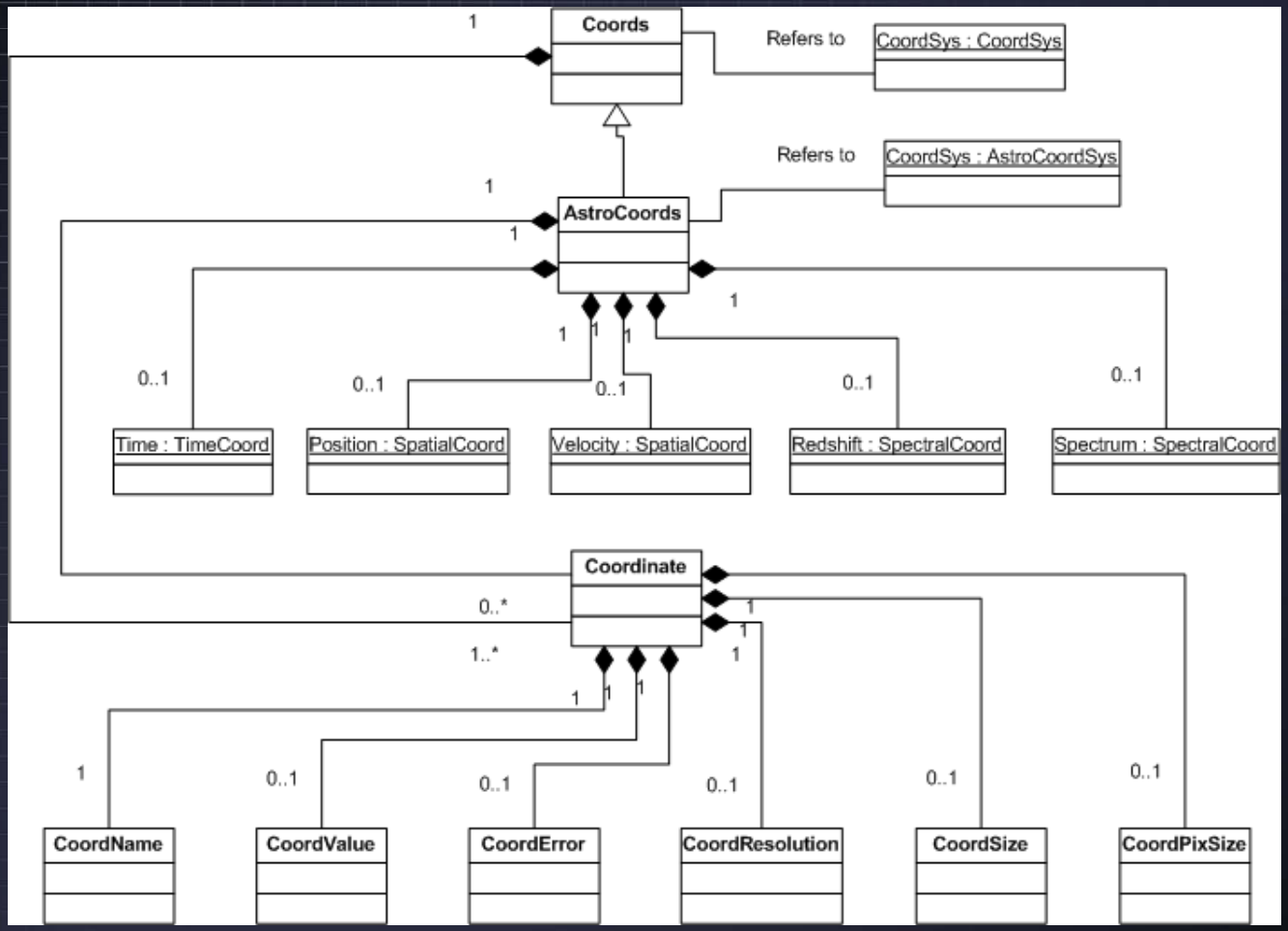
# CoordSystem Contains Frames



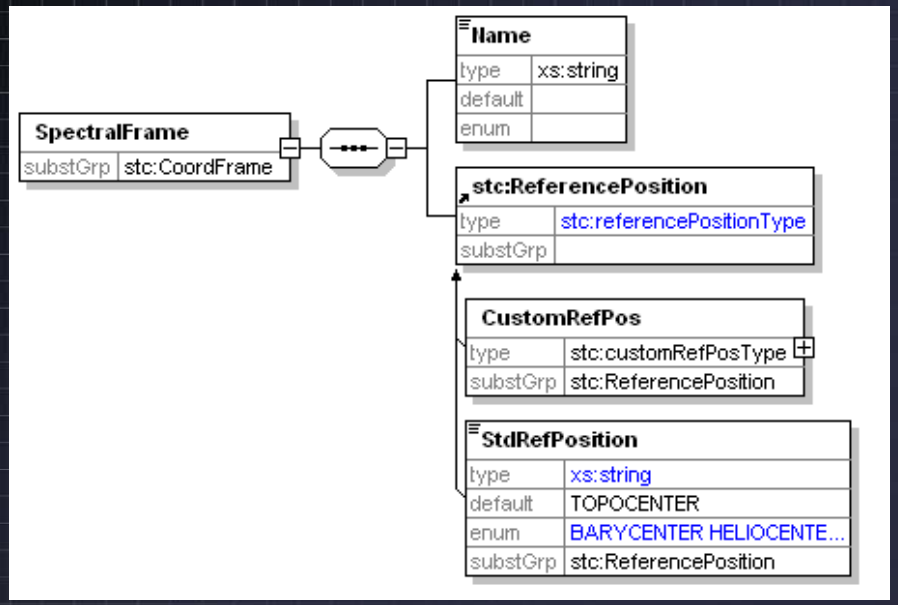
# CoordArea Defines a Volume

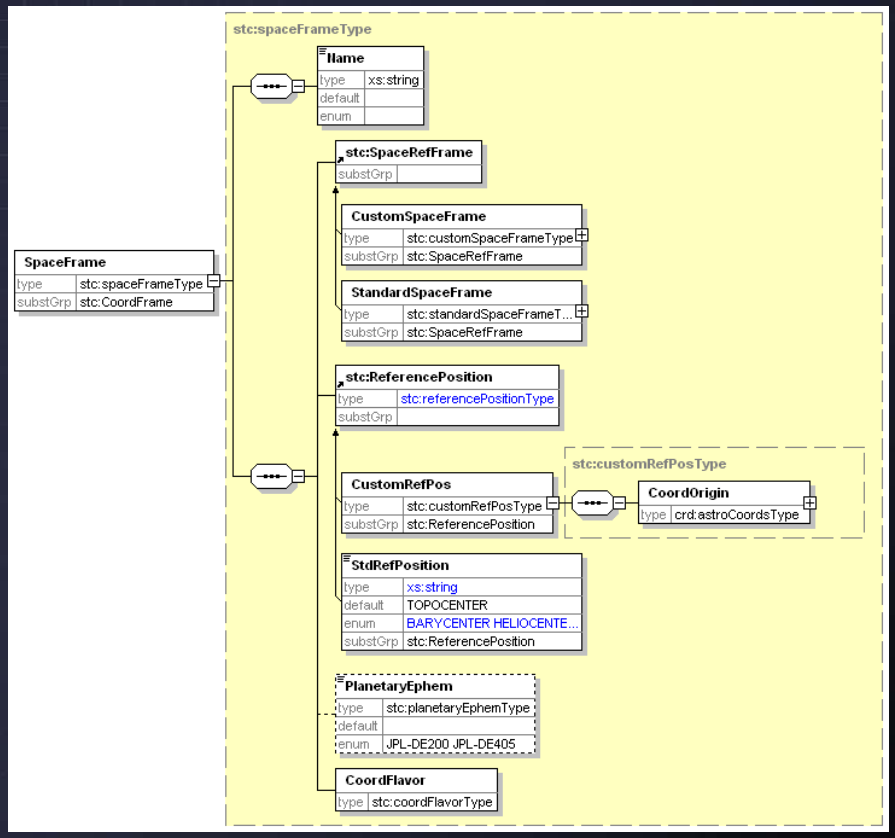


# Compound Coords



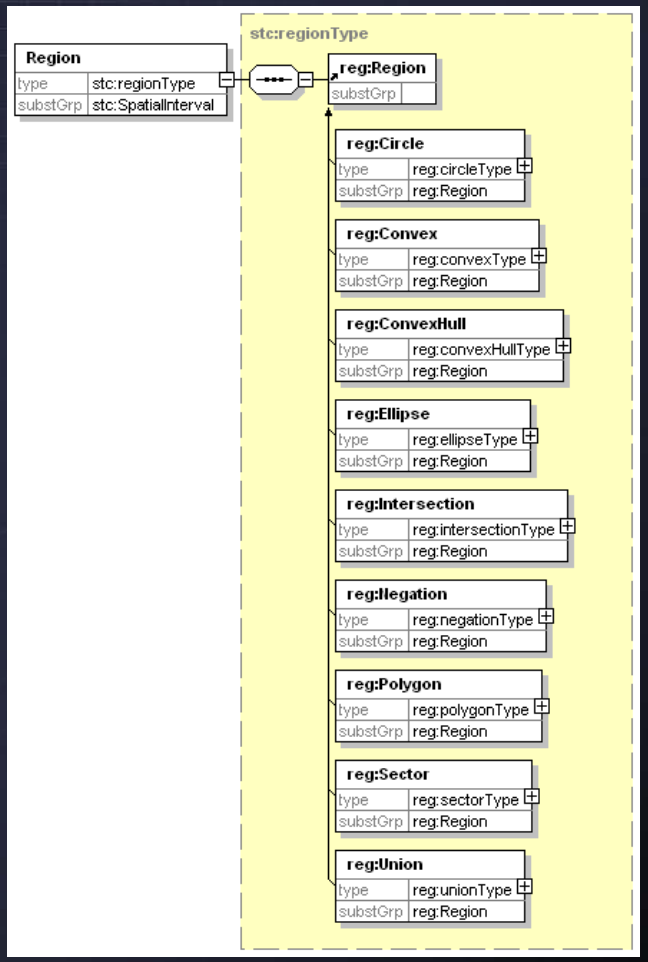
# What's in Frames?



# The Infamous Region

- A region may be a shape:
  - Circle
  - Ellipse
  - Polygon
  - Sector
  - Convex
  - ConvexHull
- Or the result of these operations on regions:
  - Negation
  - Intersection
  - Union



# Chandra STCResourceProfile

- Coordinate System

```
<AstroCoordSystem ID="ChandraCoordSys">
  <TimeFrame>
    <Name>Time</Name>
    <TimeScale>TT</TimeScale>
    <StdRefPosition>TOPOCENTER</StdRefPosition>
  </TimeFrame>
  <SpaceFrame>
    <Name>RA,Dec</Name>
    <StandardSpaceFrame>
      <RefSystem>ICRS</RefSystem>
    </StandardSpaceFrame>
    <StdRefPosition>TOPOCENTER</StdRefPosition>
    <PlanetaryEphem>JPL-DE405</PlanetaryEphem>
    <CoordFlavor coord_naxes="2" coord_type="SPHERICAL" coord_vel="false"/>
  </SpaceFrame>
  <SpectralFrame>
    <Name>Energy</Name>
    <StdRefPosition>TOPOCENTER</StdRefPosition>
  </SpectralFrame>
</AstroCoordSystem>
```

# Chandra STCResourceProfile (2)

- Coverage

```
<AstroCoordArea ID="ChandraCoverage" coord_system_id="ChandraCoordSys">
    <TimeInterval start_include="true" fill_factor="0.7">
        <StartTime>
            <crd:ISOTime timescale="TT">1999-07-23T18:00:00</crd:ISOTime>
        </StartTime>
    </TimeInterval>
    <PositionInterval unit="deg">
        <Coord2VecInterval fill_factor="0.02" lo_include="true" hi_include="true">
            <LoLimit2Vec>-90.0 0.0</LoLimit2Vec>
            <HiLimit2Vec>90.0 360.0</HiLimit2Vec>
        </Coord2VecInterval>
    </PositionInterval>
    <SpectralInterval lo_include="true" hi_include="true" fill_factor="1.0“
                                    unit="keV">
        <LoLimit>0.1</LoLimit>
        <HiLimit>12.0</HiLimit>
    </SpectralInterval>
</AstroCoordArea>
```

# Chandra STCResourceProfile (3)

- Coordinate properties in Resource

```
<CoordSpec coord_system_id="ChandraCoordSys">
        <crd:Time unit="s">
                <crd:Name>Time</crd:Name>
                <crd:Error>0.00005</crd:Error>
                <crd:Resolution>0.00002</crd:Resolution>
        </crd:Time>
        <crd:Position2D unit="deg">
                <crd:Name>ra dec</crd:Name>
                <crd:Error2>0.0003 0.0003</crd:Error2>
                <crd:Resolution2>0.0001 0.0001</crd:Resolution2>
                <crd:Size2>0.33 0.33</crd:Size2>
                <crd:PixSize2>0.0002 0.0002</crd:PixSize2>
        </crd:Position2D>
        <crd:Spectral unit="keV">
                <crd:Name>Energy</crd:Name>
                <crd:Error>0.01</crd:Error>
                <crd:Resolution>0.001</crd:Resolution>
        </crd:Spectral>
</CoordSpec>
```