The ASDC time-SED Builder

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in collaboration with
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with some inputs by other scientists @ASDC

Overview

- ASDC SED Builder version 2.0
  - Input Data
  - Main funcionalities
  - Time information
  - Export VOTable

- Ongoing work and future plans
  - Interoperability with VO tools (SAMP Web Profile)
  - and other steps to make the tool VO compliant
  - Collaboration for data/models interchange

ASDC t-SED v2.0

WEB based application available at :

http://tools.asdc.asi.it/SED/

- Java code
- Query to ASDC catalogs and external catalogs/services from radio to gamma rays
- Possibility to upload user data and
- Manage private catalogs (registered users)

- Plot axis (Y: flux density, vFv, Luminosity; X: frequency, wavelength, energy)
- Observation Time information
- Functions for the SED analysis (polynomial fit, compare data with templates of spectral models, emission models simulation, sensitivity curves of many instruments, photometric redshift estimation)

asdc ASI Science Data Center

tSED tool V2.0

Version 2.0

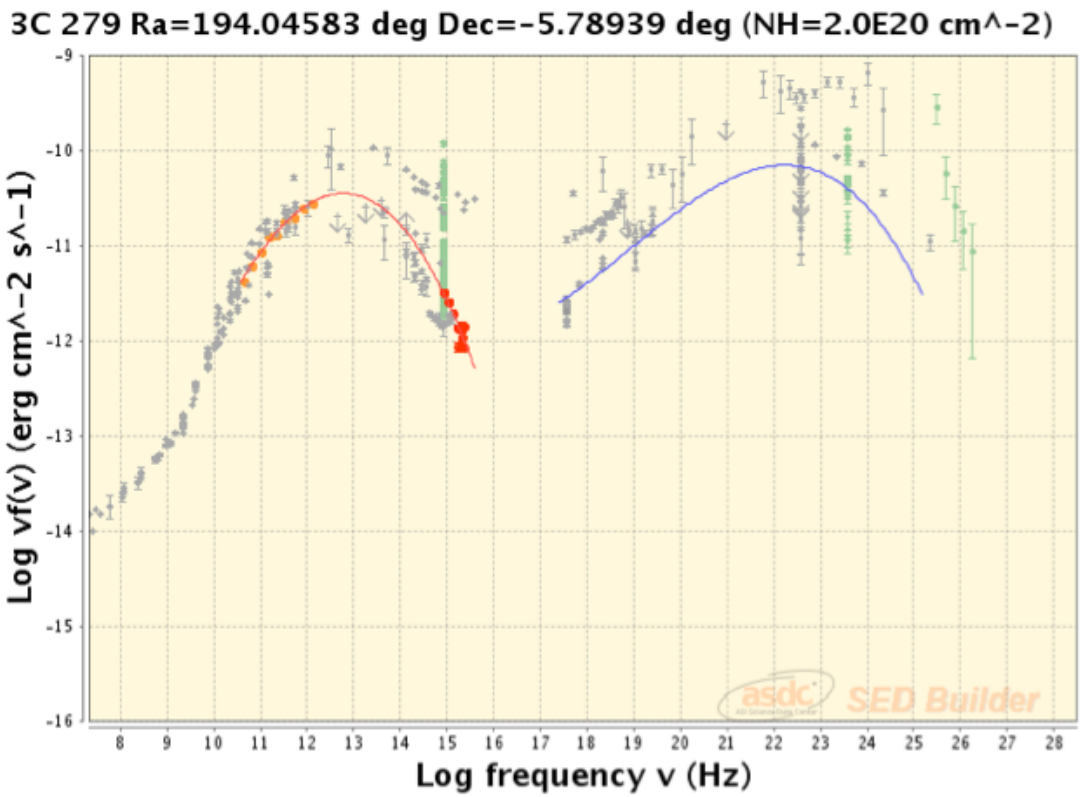
giulia (Logout) Feedback

Tutorial DATA EXPLORER

User Data Existing SEDs

Current SED Search and build new SEDs

Load Data | Show Data | Export Image | Save | Duplicate Sed | Export QDP SED | Export VOTable



Redshift: 0.536 Frame: Rest Frame

X Axis: Frequency (Hz) Y Axis: nuFnu (erg/cm2/s)

Update Plot

Input Data | Models | Fit Functions | Templates | Instr Sensitivity | Plot options | Existing SEDs

+ Time Filtering

ASDC Catalogs

	Type
+	Infrared
+	Radio
+	Optical UV
+	Soft X Ray
+	Hard X Ray
+	Gamma Ray

Input data

SED data points: vFv/Flux density/Luminosity -- Frequency/Wavelength/Energy – Time info

- Original data: different origin – different types:
  - ASDC and external catalogs/services (may contain different quantities, diff. units)
  - User data produced by his own analysis (particular format/units required)
  - SED produced through online analysis of ASDC archive data (possibility to add data not yet included in catalogs)
- For many catalogs: Functions applied to produce SED data on the fly
  - if instrument countrate is provided : flux density calculation using information about instrument response and assuming a spectral model
  - if observed flux is provided : emitted flux estimation (correction for Galactic absorption: X ray absorption or optical extinction)
  - if different units: conversion to uniform units
- Cone search query
  - radius adapted to each specific catalogs
  - radii can be changed by the users
  - data points can be checked and eventually excluded by the users

ASDC t-SED builder - Input catalogs

ASDC Catalogs

	Type
+	Radio
+	Infrared
+	Optical UV
+	Soft X Ray
+	Hard X Ray
+	Gamma Ray

External Catalogs

Name	Search	Op
2Mass		V
USNO B1		U
SDSS7		V
Ned		U
USNO A2.0		U

User Catalogs

Name
swift_obs00030793112
MKN501_PLANCK_UNFOLDI
MKN501_PLANCK_POINTLI... U

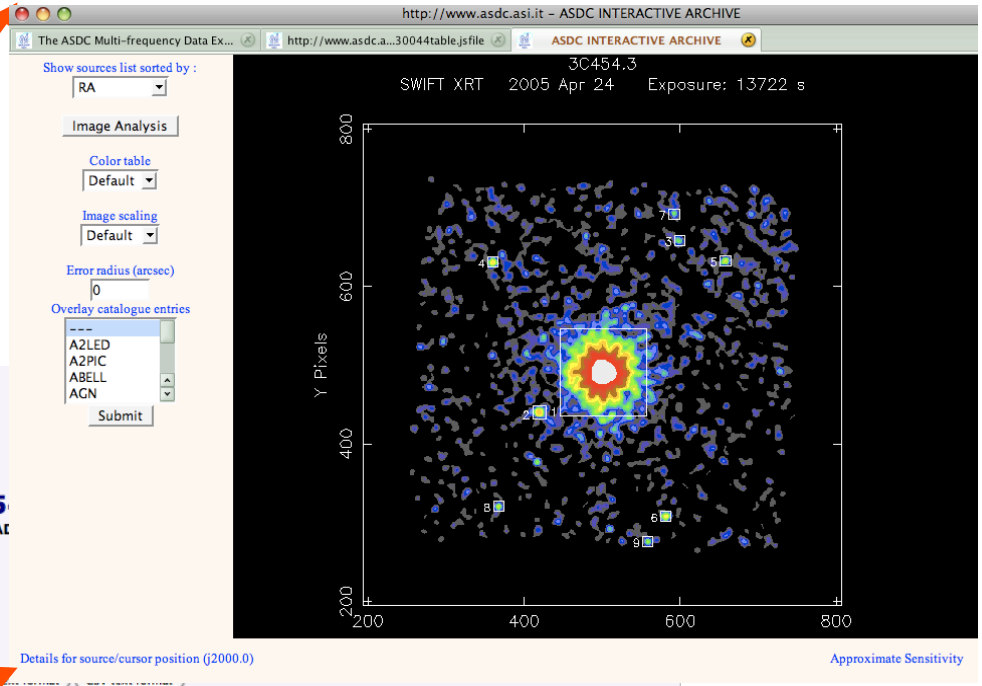
ASDC Catalogs

Type	Name	Options
- Radio	+ AT	
	CRATES	V
	DIXON	V
	FIRST	V
	+ GBT	
	JVASPOL	U
	KUEHR	V
	NIEPPOCAT	U
	NVSS	V
	PKSCAT90	U
	+ PLANCK	
	PMN	U
	SUMSS	U
	VLANEP	U
	VLSS	V
	WENSS	U
	+ WMAP	
- Infrared	+ AKARI/FIS	
	+ AKARI/IRC	
	WISE W1	U
	WISE W2	U
	WISE W3	U
	WISE W4	U
- Optical UV	+ GALEX	
	+ Swift	

	Name	Options
- Soft X Ray	+ ASCA	
	+ Ariel V	
	+ BeppoSAX	
	+ EXOSAT	
	+ Einstein	
	+ HEAO-1	
	+ ROSAT	
	+ Swift	
	+ UHURU	
	+ XMM	
- Hard X Ray	+ INTEGRAL	
	- Swift	BAT39MCAT (10-150keV) V U
		BAT39MCAT (15-30keV) U
		BAT54MCAT (15-150keV) U
		BAT54MCAT (15-50keV) U
		SWBAT58M (14-195 keV) U
- Gamma Ray	AGILE Grid	U
	EGRET3	U
	+ Fermi	

Multi-Mission Interactive Archive

SED data points can be obtained by the user's analysis performed through the WEB interface of the ASDC Multi-mission Archive



Help
Show/hide columns
Advanced filtering
Print current view of table
Print complete table
Reset all filters

Query results for: 3c45

Details: query by **COORDINATE** with **RA** = 34[illegible].490417; **DEC** = 16.148056; **EQUINOX** = 2000; **RAI**

Export Current view of Table in: Latex format | FITS format

Previous Page | Next Page | Page Size (# of lines) 50 | Refresh page | Reset all filters | Show all entries

Entry number		XRT Interactive Analysis	Archive	Target Name	obsid	RA (J2000) hh mm ss.d	Dec (J2000) dd mm ss.d	start_time	processing_date	xrt_exposure	uvot_exposure	bat_exposure	archive_date	Dist. from searched position arcmin
Selection mode: Include All					Stats					Stats	Stats	Stats		Stats
1	ASDC Data Explorer	Online Analysis	Data Access	3C454.3	00035030197	22 53 40.4	+16 11 07.0	Jan 7, 2011 06:34:00	Jan 13, 2011	1181.449	1180.611	1199	Jan 14, 2011	4.7
2	ASDC Data Explorer	Online Analysis	Data Access	3C454.3	00035030067	22 53 40.5	+16 07 34.6	Sep 16, 2009 22:15:00	Sep 22, 2009	1503.207	1478.167	1522	Sep 23, 2009	4.3
3	ASDC Data Explorer	Online Analysis	Data Access	3C454.3	00035030213	22 53 42.8	+16 07 27.1	Nov 7, 2011 11:12:00	Nov 13, 2011	1409.058	1352.714	1414	Nov 14, 2011	3.8

Standard Products

Show energy spectrum

0.3-10 keV lightcurve
0.3-2.keV lightcurve
2.0-10 keV lightcurve

Download Data

- Spectrum (pha file)
- Anc. Resp. File (arf)
- Red. Matrix File (rmf)
- Exposure Map File
- Lightcruve (FITS file)

Spectral analysis (with XSPEC)

NH (e.g. 3.e20) : default
default: NH=Galactic value
(from Dickey & Lockman 1990)
Freeze NH? yes no
Xspec Model : power
photon index : 1
norm : 1

Energy range for spectral analysis
Emin 0.3 Emax 10.0

Energy range for Xspec flux estima
Emin 2.0 Emax 10.0

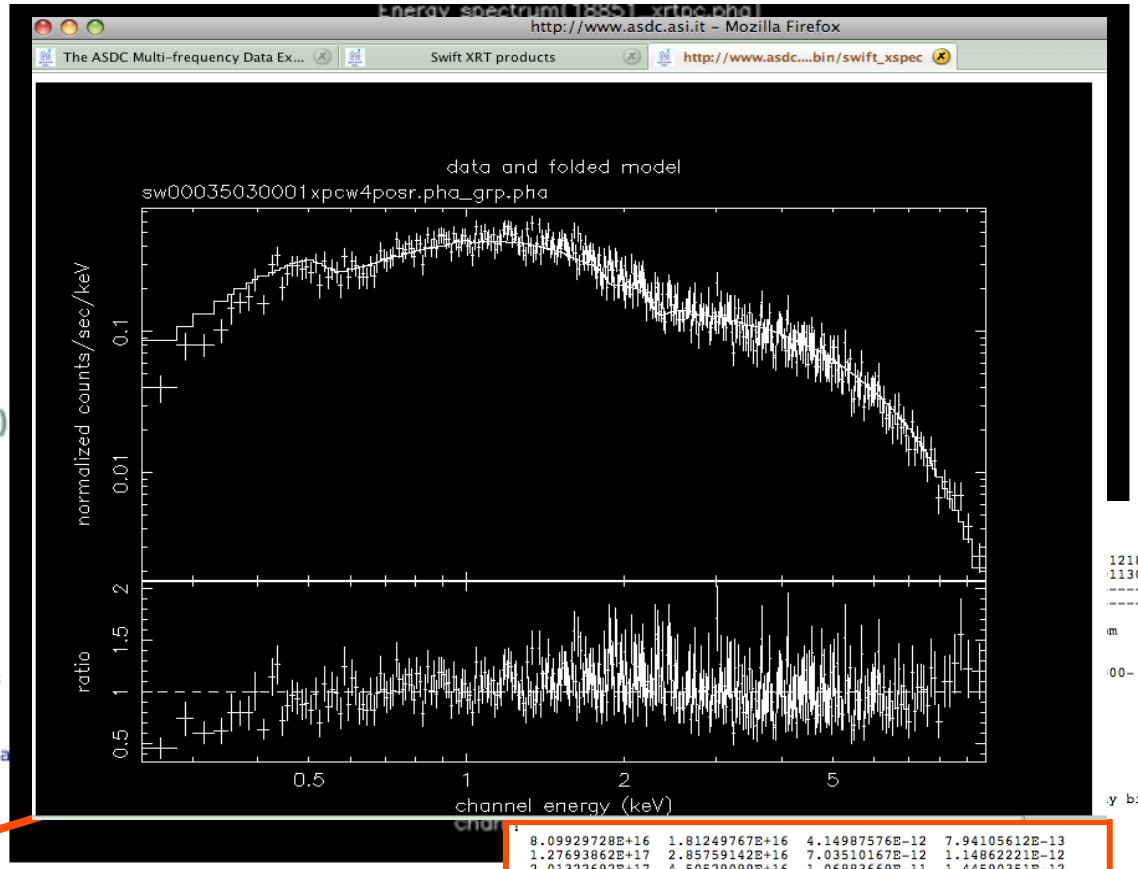
Number of SED bins 8

Submit

Timing analysis (with LCURVE)

Bin size (> 200) seconds 200
Plot type Linear Log
Energy range
Full band 0.3-2.0keV 2-10keV
Hardness ratio? yes no
nframe 4

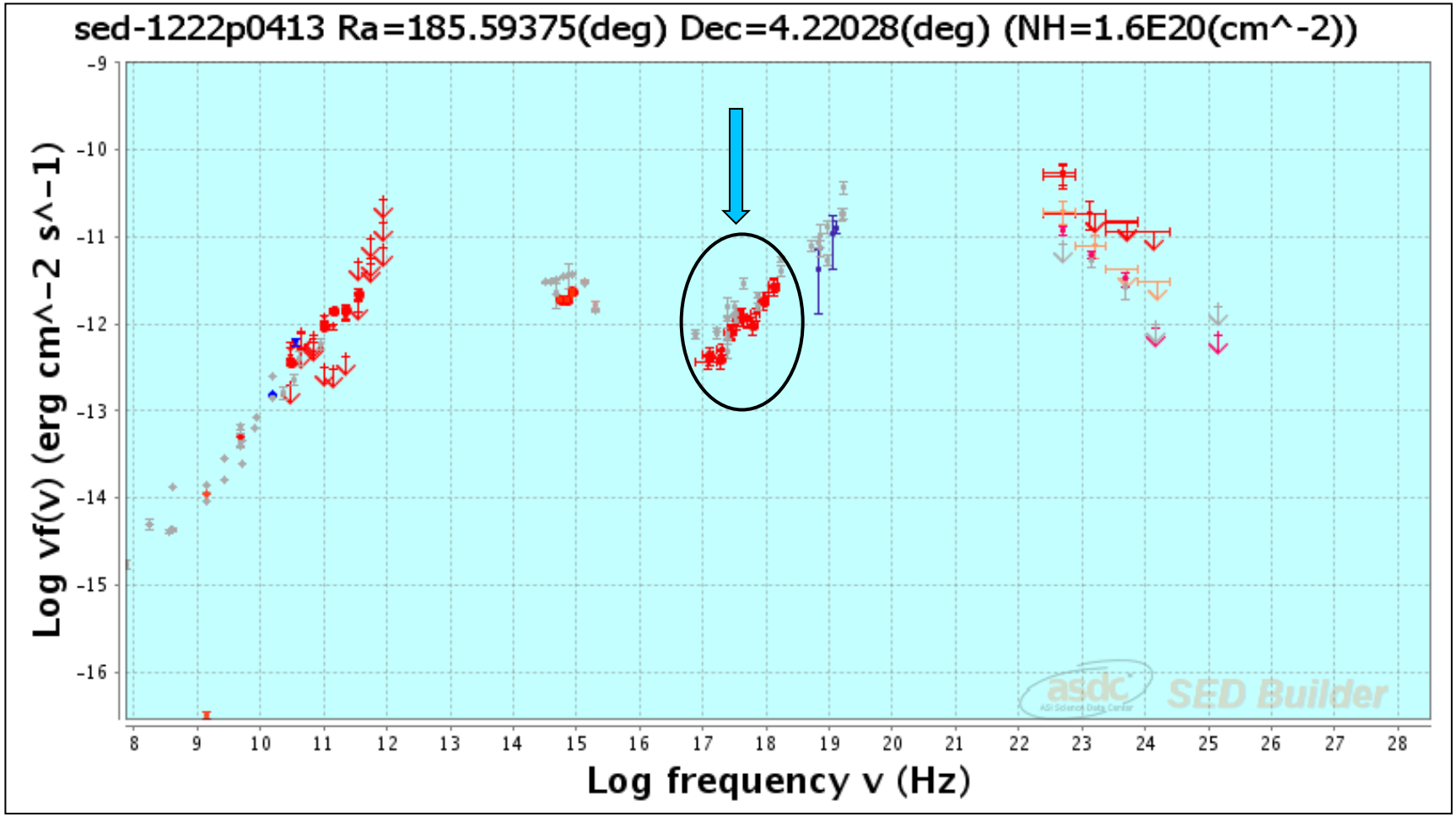
Submit



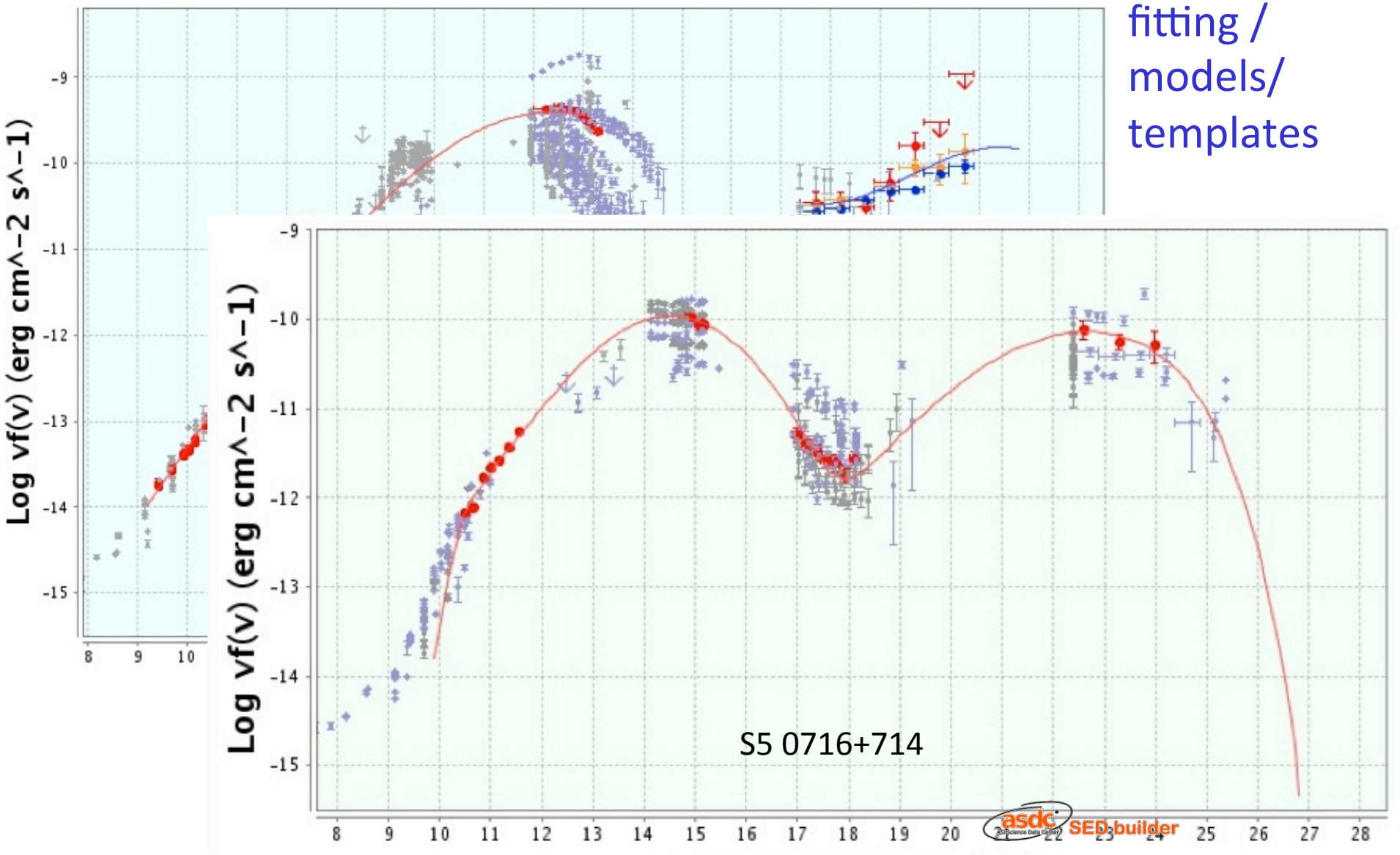
Data ready to be inserted in the SED

```
   8.09929728E+16   1.81249767E+16   4.14987576E-12   7.94105612E-13
   1.27693862E+17   2.85759142E+16   7.03510167E-12   1.14862221E-12
   2.01322692E+17   4.50529099E+16   1.06883669E-11   1.44590351E-12
   3.17406192E+17   7.10306072E+16   1.52838055E-11   1.96900656E-12
   5.00423991E+17   1.11987158E+17   2.19114241E-11   3.79577923E-12
   7.8897058E+17   1.7655944E+17   2.52916871E-11   4.76024515E-12
   1.24389441E+18   2.78364355E+17   3.36414334E-11   6.90554341E-12
   1.96112921E+18   4.38870444E+17   4.5380158E-11   9.95511139E-12
READ SERR 1 2
pl
   16.9084473   0. -11.3819647   0.0760417283
   17.1061707   0. -11.15273   0.0656805933
   17.3038921   0. -10.9710884   0.0551023148
   17.5016155   0. -10.8157682   0.0526283905
   17.6993389   0. -10.6593294   0.0693842247
   17.8970604   0. -10.5970221   0.0748945996
   18.0947838   0. -10.4731255   0.0810839832
   18.2925053   0. -10.3431339   0.0861360282
```

ASDC SED builder



fitting / models/ templates



Drawing a model

Redshift: 0.03 Frame:

X Axis: Frequency (Hz) Y Axis:

Update Plot

Input Data | Models | Fit Fu

Instr Sensitivity | Plot options | Existi

SSC (Numerical) | SSC (Analytical)

Model Documentation

Publications using the code shou
cite the following paper A.
Tramacere et al 2009, 2009 A
501, 879
For any bug fix and/or detail ple
contact Andrea Tramacere:
andrea.tramacere@unige.ch
Click here to see documentat

Log R(cm) 17

δ 10

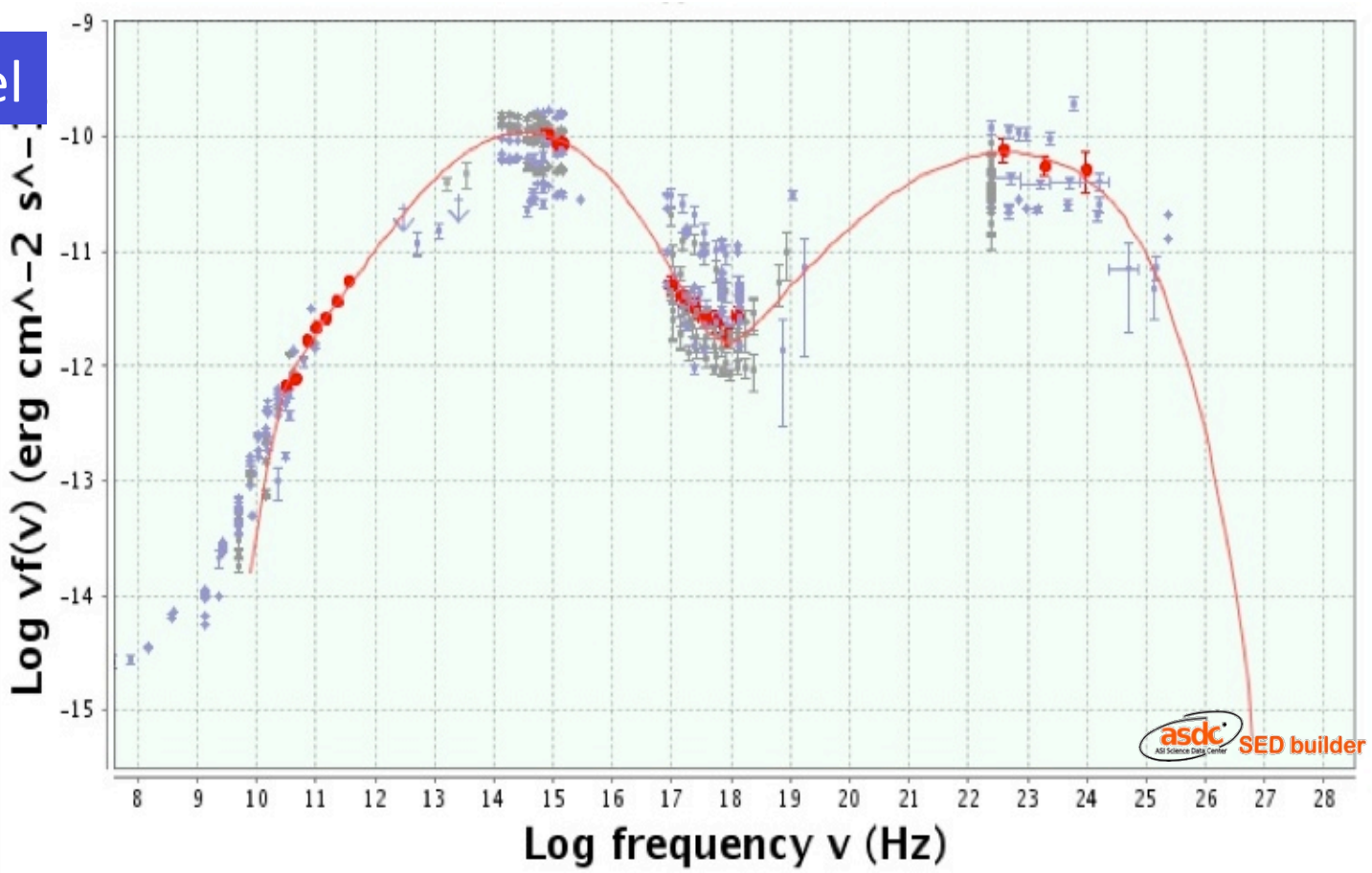
Log (γ min) 1

redshift 0

- Power Law
  - α 2
- Power Law + Cut Off
- Broken Power Law
- Log Parabola
- Power Law + Log Parabola

Synchrotron self-absorption
YES NO
fast accurate

Create New



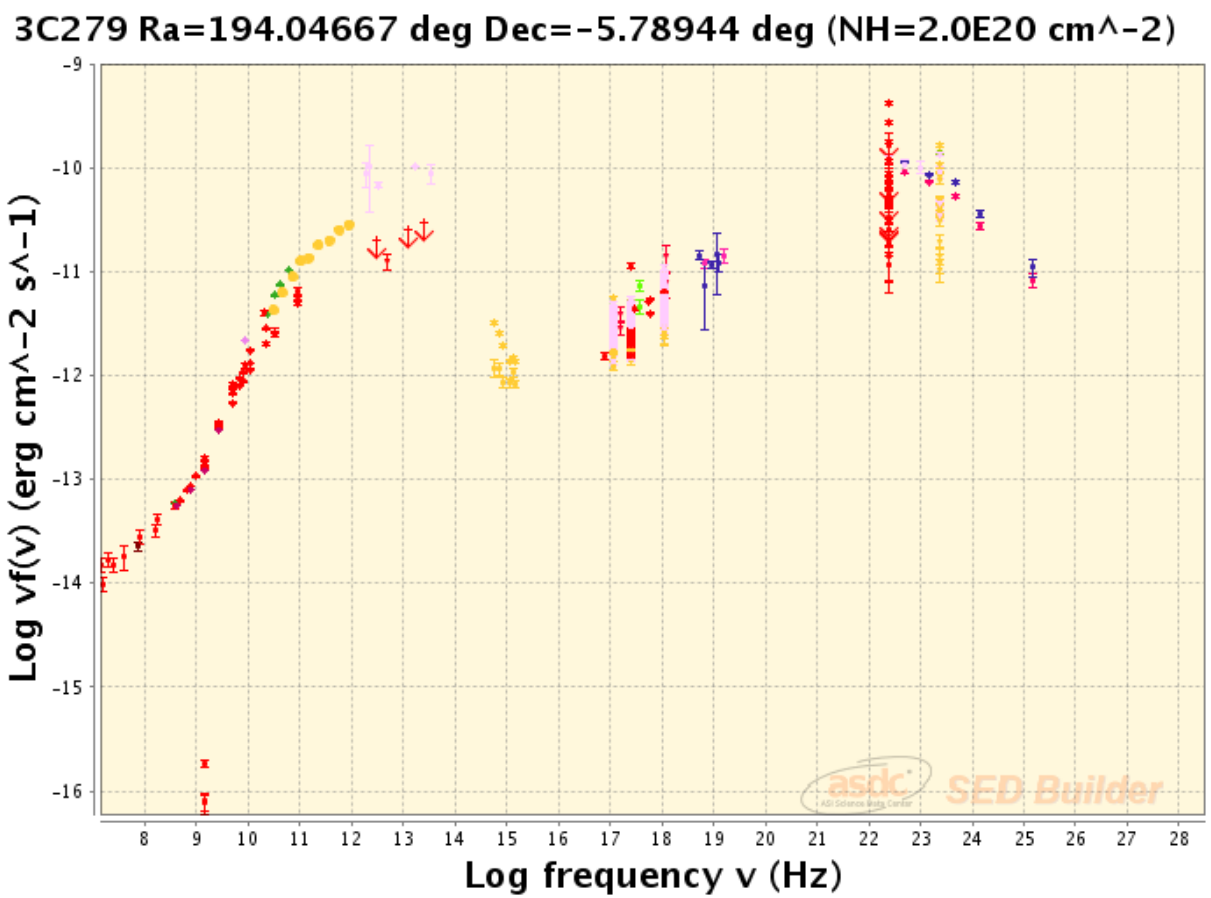
Source: S5 0716+714

Latest changes: Time information & VOTable export

- Time info associated to the catalogs data
  - to each entry (when available) or to the whole catalog (start_time/end_time)
  - time selection and plot
    - different time intervals in different colors within our tool
    - exploit the 3-D capability visualization of exsisting tools

- Export Votable (still in devel area)

following the Spectrum Data Model Vers. 1.2



Load Data | Show Data | Export Image

Save | Duplicate Sed

Export QDP SED | Export VOTable

Redshift: 0.0 Frame: Observed

X Axis: Frequency (Hz) Y Axis: nuFnu (erg/cm2/s)

Update Plot

Input Data | Models | Fit Functions

Templates | Instr Sensitivity | Plot options

Existing SEDs

- Time Filtering

Time Filtering

From: 2011-11-16 15:35:2 To: 2012-05-16 15:35:2

Include Interval Data Show available catalogs

Update Plot

Plot Options

	From	To
1	1970-05-16 13:25:1	1999-12-31 13:26:1
2	2000-01-01 15:21:2	2002-01-01 15:21:2
3	2002-01-01 15:21:2	2006-01-01 15:21:2
4	2006-01-01 15:21:2	2009-01-01 15:21:2
5	2009-01-01 15:21:2	2012-01-01 15:21:2

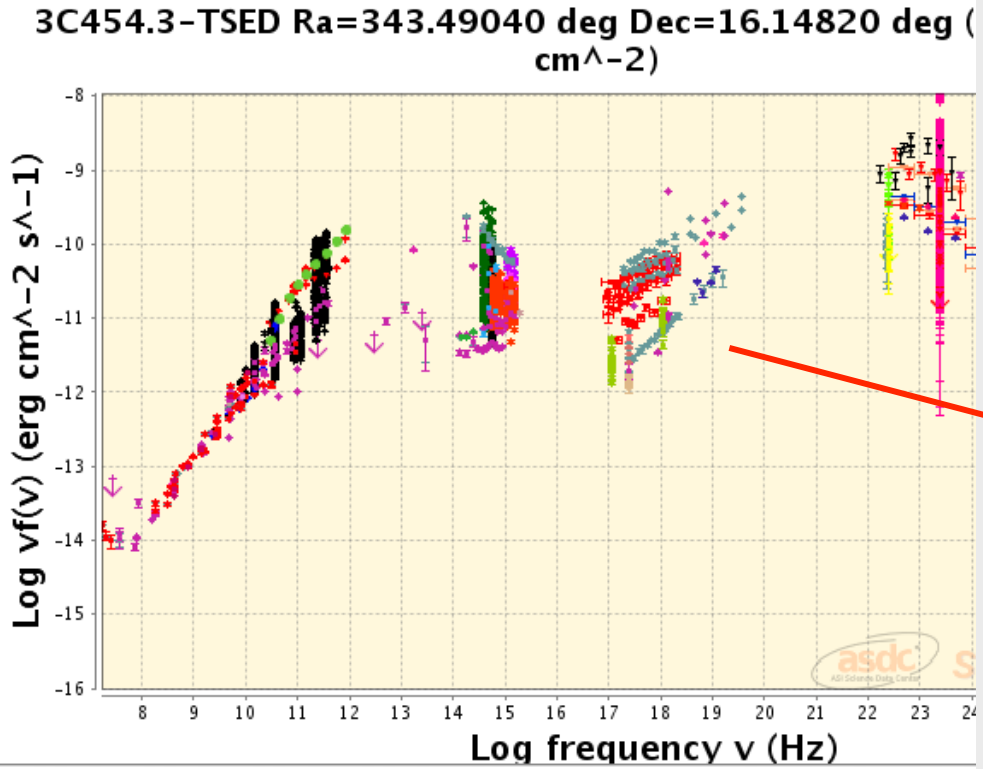
ASDC SED + TOPCAT

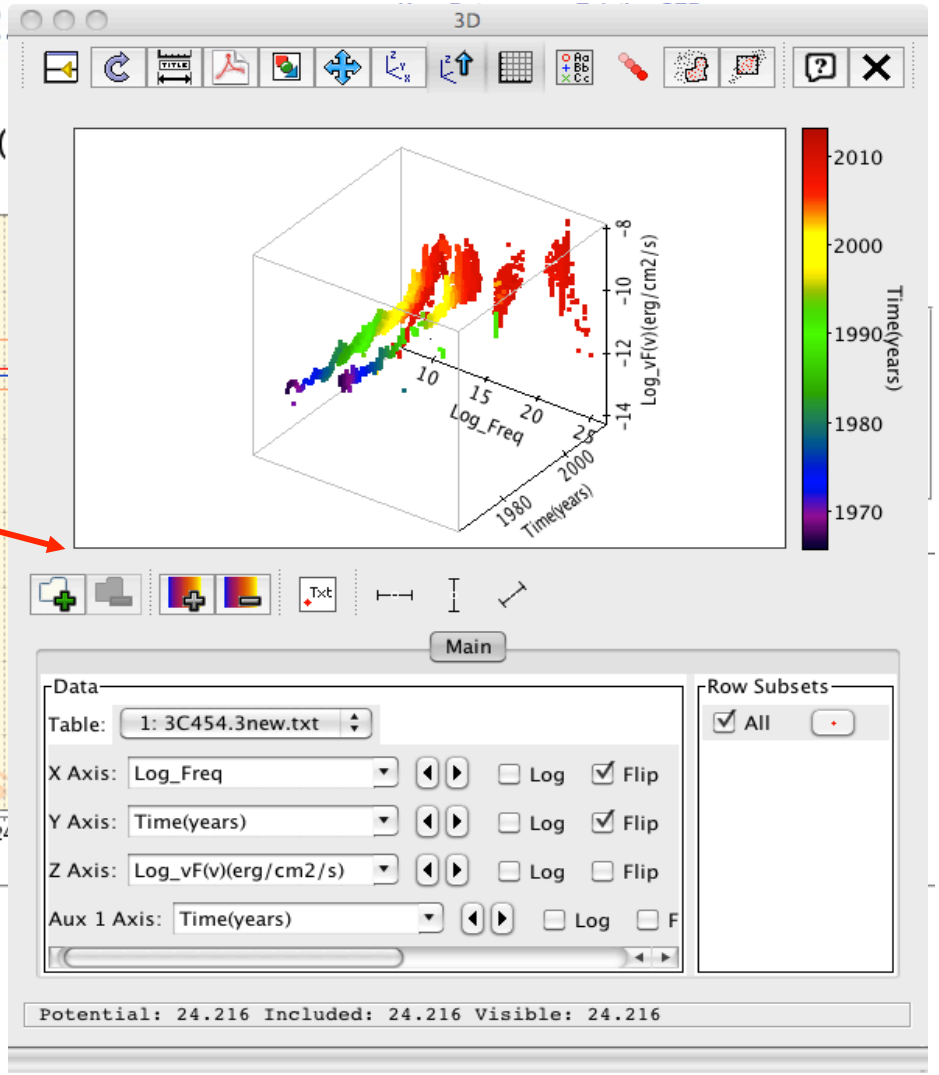
asdc ASI Science Data Center

time SED tool V2

capalbi (Logout) Feedback

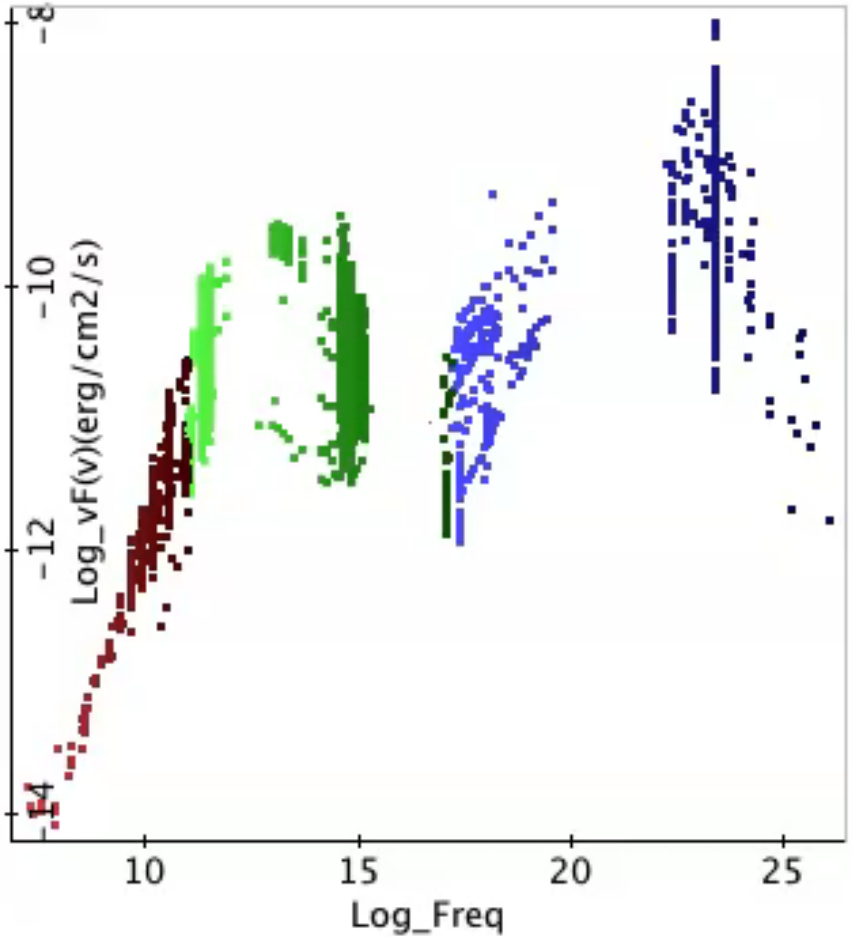
Tutorial DATA EXPLOR





Now: manual upload of an ASCII file.

Future: Interoperability (**SAMP web profile**)


-8
-10
-12
-14
Log_vF(v)(erg/cm2/s)
10
15
20
25
Log_Freq

SED Builder - Export VOTable

- Java code developed to write a VOTable following the IVOA Spectrum Data Model v.1.2 and SED/Photometry DM available some months ago
- Added Utypes to describe High Energy astronomical data (e.g. to keep track of the processing done from count rate to flux density calculation)
- Work in progress to populate metadata tables of the database used by the SED tool and software update to follow new versions of the IVOA standards

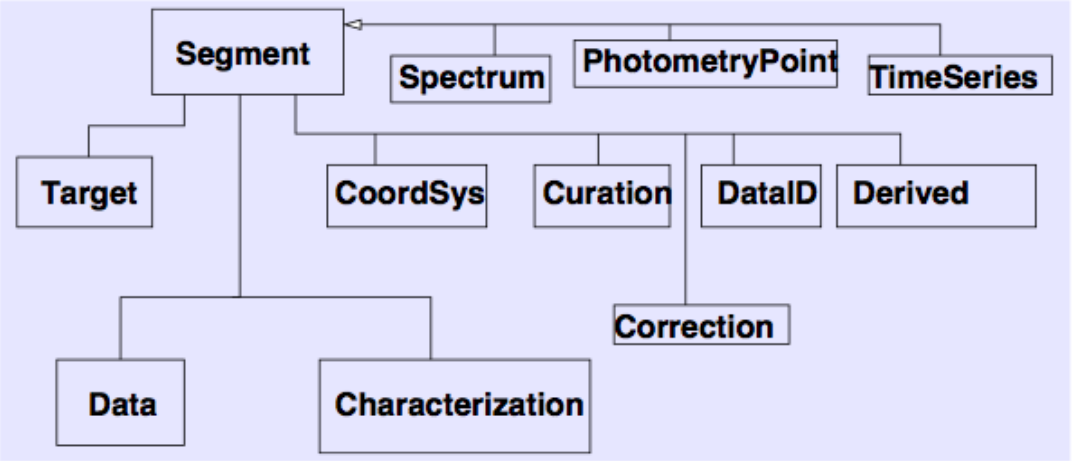


Figure 1: UML class diagram for the spectral data model.
The same underlying Segment model is used for Spectrum, PhotometryPoint and TimeSeries. The component classes such as Characterization, Curation, DataID and Derived are shown in detail below in diagram form and with further text description in Section 5.

Export VOTable

- VOTable size can be very large
- Data should be 'grouped' (for compatible metadata) but that is not always possible
- Is it possible to plan also a 'reduced' version to simplify the data interchange ?
- We need Utypes not included in the DM (e.g. to describe High Energy astronomical data, to keep track of the calculation performed to obtain physical units, to describe Error regions in case of ellipsoidal error regions)


```
    <PARAM name="Creators" utype="Spectrum.DataID.Task" ucd="meta.id" datatype="char" arraysize="*" value="ASDC_SED_BUILDER"/>
  </GROUP>
- <GROUP name="Curation" utype="Spectrum.Curation">
    <PARAM name="Publisher" utype="Spectrum.Curation.Publisher" ucd="meta.curation" datatype="char" arraysize="*" value="ASDC"/>
    <PARAM name="PublisherDID" utype="Spectrum.Curation.PublisherDID" ucd="meta.ref.url;meta.curation" datatype="char" arraysize="*" value="ASDC"/>
    <PARAM name="Rights" utype="Spectrum.Curation.Rights" datatype="char" arraysize="*" value="PUBLIC"/>
    <PARAM name="ContactName" utype="Spectrum.Curation.ContactName" ucd="meta.bib.author;meta.curation" datatype="char" arraysize="*" value="VO_HELPDESK"/>
    <PARAM name="ContactEmail" utype="Spectrum.Curation.ContactEmail" ucd="meta.ref.url;meta.email" datatype="char" arraysize="*" value="vo_helpdesk@asdc.asi.it"/>
  </GROUP>
- <GROUP name="Target" utype="Spectrum.Target">
    <PARAM name="TargetName" utype="Spectrum.Target.Name" ucd="meta.id;src" datatype="char" arraysize="*" value="3C273"/>
  </GROUP>
  <GROUP name="Derived" utype="Spectrum.Derived"/>
- <GROUP name="CoordSys" utype="Spectrum.CoordSys">
  - <GROUP name="SpaceFrame" utype="Spectrum.CoordSys.SpaceFrame">
      <PARAM name="SpaceFrameName" utype="Spectrum.CoordSys.SpaceFrame.Name " ucd="pos.frame" datatype="char" arraysize="*" value="FK5"/>
      <PARAM name="SpaceFrameUcd" utype="Spectrum.CoordSys.SpaceFrame.Ucd" datatype="char" arraysize="*" value="pos.frame;pos.eq"/>
      <PARAM name="SpaceFrameEquinox" utype="Spectrum.CoordSys.SpaceFrame.Equinox" ucd="time.equinox;pos.frame" datatype="char" arraysize="*" value="J2000"/>
    </GROUP>
  - <GROUP name="TimeFrame" ucd="time.scale" utype="Spectrum.CoordSys.TimeFrame">
      <PARAM name="TimeFrameName" utype="Spectrum.CoordSys.TimeFrame.Name" ucd="time.scale" datatype="char" arraysize="*" value="TT"/>
      <PARAM name="TimeFrameUcd" utype="Spectrum.CoordSys.TimeFrame.Ucd" datatype="char" arraysize="*" value="time"/>
      <PARAM name="TimeFrameZero" utype="Spectrum.CoordSys.TimeFrame.Zero" ucd="time;arith.zp" datatype="double" value="0.0"/>
```

Ongoing collaboration and future plans

- Collaboration between ASDC and VAO on ASDC t-SED and VAO IRIS
  - Making our data available for visualization within IRIS (IRIS component)
  - First step: ASDC VOTable succesfully ingested in IRIS

- Get prediction of theoretical models from ISDC Geneva (service providing results of simulations of emission models) or from other providers

- Making ASDC SED tool fully VO compliant

Making ASDC t-SED Builder fully VO compliant

- Save data as VOTable (almost done)
- Communicate with other VO tools – SAMP Web profile
- Query the IVOA Registry - but it is necessary:
  - to identify data useful to build a SED – via e.g. TAP
  - to get the necessary info to be able to apply specific operations on data, when needed

THANK YOU