

DataLink and Activation in TOPCAT/STILTS

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Outline

- TOPCAT Activation Action overhaul
- DataLink in TOPCAT
 - {Links}-response window
 - Relevant Activation actions
 - Service Descriptors as table metadata
- DataLink validator
- DataLink implementation experience
- Future Work

Activation Actions

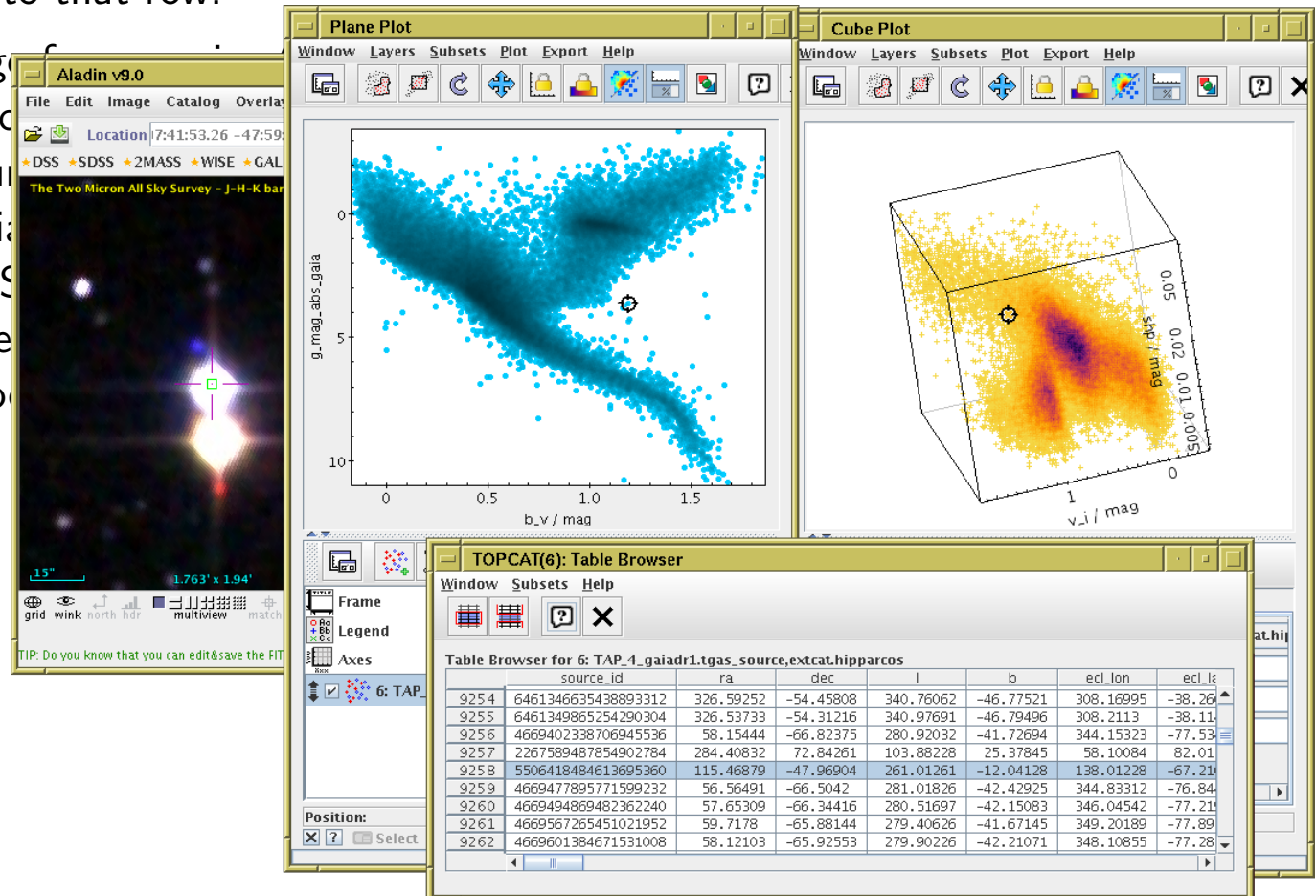
“Activation Action”: TOPCAT’s term for configurable per-row action

- Invoked per row by user action:
 - ▷ Select row in table view
 - ▷ Click on point in scatter plot
- Does something relating to that row:
 - ▷ Display cutout image from service (near sky coordinates in row)
 - ▷ View image in window (from URL/filename given in row)
 - ▷ Send image/spectrum via SAMP (from URL/filename given in row)
 - ▷ Send sky position via SAMP (from sky coordinates in row)
 - ▷ Send row index via SAMP (to client looking at same table)
 - ▷ Open resource in web browser (from URL/filename given in row)
 - ▷ Execute arbitrary code/run script (using any values in row)
 - ... etc?

Activation Actions

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 - ▷ Display cutout image
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 - ▷ Send sky position via S
 - ▷ Send row index via S
 - ▷ Open resource in web browser
 - ▷ Execute arbitrary command
 - ... etc?

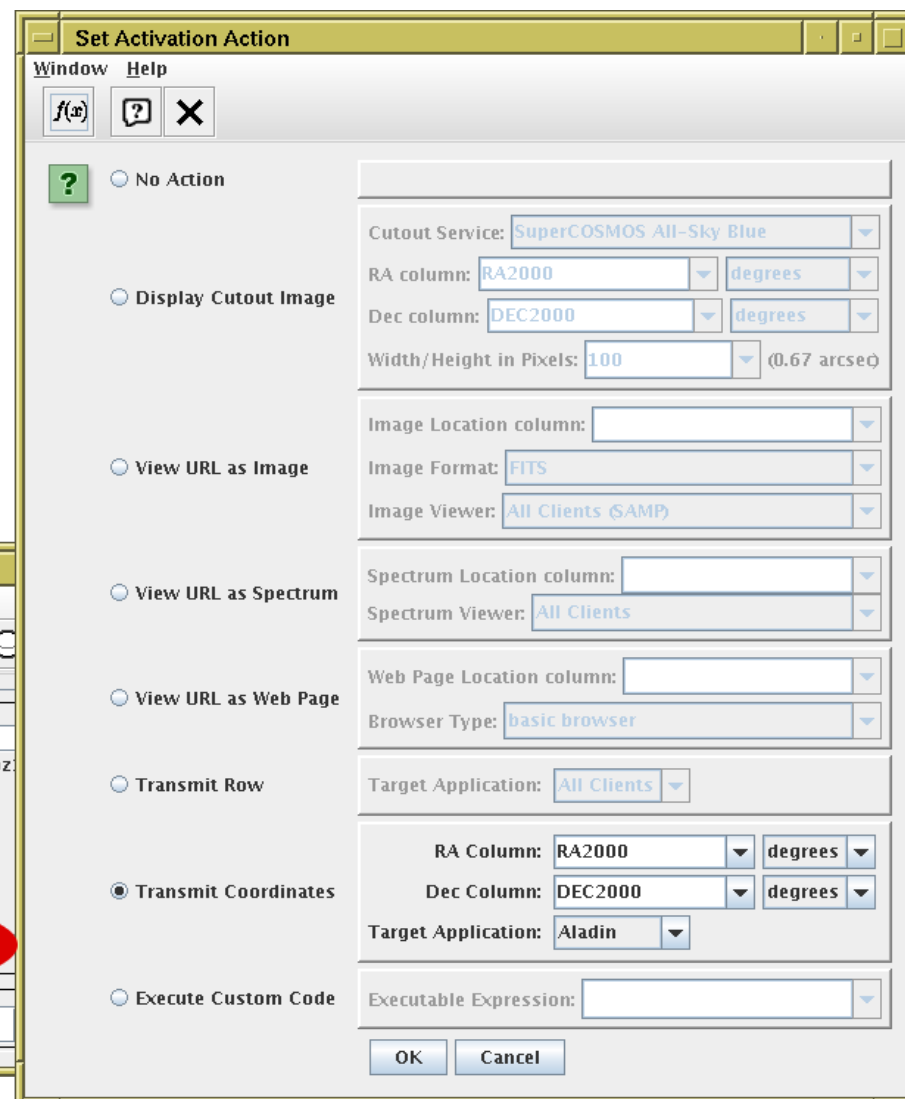
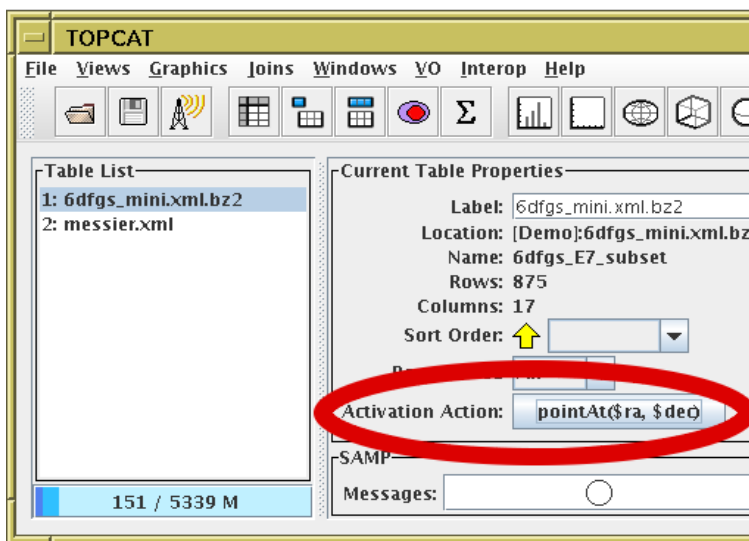


Existing Activation Window

Various issues

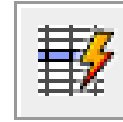
- Limited number of options
- Only one option at a time
- Too tall!
 - ▷ Cramped configuration GUI
 - ▷ Not extensible
- No Datalink
- Poor feedback on action outcome (stdout)
- Not persisted

Due for an overhaul



New Activation Window

Available from TOPCAT v4.6 (next week)



- Better configurability
- Visual report of action outcome
- SAMP action response reported
- Better explanation of capabilities
- Can have multiple actions at once
- Better feedback on available/useful options
- Invoke directly or by row selection
- Pluggable interface
- More options:
 - ▷ View DataLink table
 - ▷ Activate {links}-response row
 - ▷ Invoke Service Descriptor
 - ▷ Load table in TOPCAT by URL
 - ▷ Send table via SAMP by URL
 - ▷ Run system command
 - ... more in future?

TOPCAT(2): Activation Actions

Window Actions Help

Activation Actions for 2: messier.xml

Defined Actions

- Use Sky Coordinates in
- Send FITS Image
- Display image
- Transmit Sky Coordinates
- Load Table
- Send Spectrum
- Display Cutout Image
- View in Web Browser
- Execute code
- Transmit row

Description

Send the content of a file or URL column as a FITS image to an external application using SAMP

Configuration

Image Location Column: ImageURL

Image Viewer: All Clients (1)

Status

Invoke now on row 3

Results

Seq	Row	Status	Message
1	4	OK	Successfully sent to Aladin
2	13	OK	Successfully sent to Aladin
3	86	OK	Successfully sent to Aladin
4	87	FAIL	Error response from Aladin: Could not load image !
5	13	OK	Successfully sent to Aladin
6	3	OK	Successfully sent to Aladin

DataLink Refresher

DataLink defines (approximately) 2 things:

1. {Links} service — response is a table of a fixed form

name	description	required	UCD
ID	Input identifier	yes	meta.id;meta.main
access_url	link to data or service	one only	meta.ref.url
service_def	reference to a service descriptor resource		meta.ref
error_message	error if an access_url cannot be created		meta.code.error
description	human-readable text describing this link	no	meta.note
semantics	Term from a controlled vocabulary describing the link	yes	meta.code
content_type	mime-type of the content the link returns	no	meta.code.mime
content_length	size of the download the link returns	no	phys.size;meta.file

Table 1: Required Fields for Links

2. Service Descriptors — define how to invoke a service from a row

```
<RESOURCE name="EpochPhotom" type="meta" utype="adhoc:service">
  <DESCRIPTION>Epoch photometry</DESCRIPTION>
  <PARAM name="accessURL" ucd="meta.ref.url" arraysize="*" datatype="char"
    value="http://gaia.ari.uni-heidelberg.de/timeseries/gaiadr1"/>
  <GROUP name="inputParams">
    <PARAM name="sourceid" datatype="long" value="" ref="source_id_col"/>
    <PARAM name="resolution" datatype="double" unit='d' value="20"/>
    <PARAM name="band" datatype="double" value=""/>
  </GROUP>
</RESOURCE>
```

DataLink in TOPCAT

 View table as DataLink table

 Datalink activation actions:

- View DataLink table (identified by URL in row)
- Invoke row in {links}-response table (using {links}-response format)
- Invoke Service Descriptor

 View Service Descriptors in Parameter window

 Service Descriptors survive TOPCAT/STILTS save→load cycle

DataLink Window



Datalink View Window

- For use with {links}-response tables
- Top panel displays row data
- Bottom panel shows indicated link:
 - ▷ fixed URL
 - ▷ service descriptor
 - ▷ error
 - ▷ non-compliant
- For URL-like links, you can perform some configurable action
- For service descriptors, you can view/edit service parameters
- currently only provides basic GUI*
- Available from top-level **Views** menu (not very prominent)

TOPCAT(1): DataLink View

Window Help

DataLink View for 1: gavo-califa.vot

DataLink Table

	ID	access_url	service_def	
6	ivo://org.gavo.dc/~?califa...		procsvc0	
7	ivo://org.gavo.dc/~?califa...		procsvc1	
8	ivo://org.gavo.dc/~?califa...		procsvc2	
9	ivo://org.gavo.dc/~?califa...	http://dc.zah.uni-heidelb...		
10	ivo://org.gavo.dc/~?califa...	http://dc.zah.uni-heidelb...		
11	ivo://org.gavo.dc/~?califa...	http://dc.zah.uni-heidelb...		
12	ivo://org.gavo.dc/~?califa...	http://dc.zah.uni-heidelb...		
13	not-a-real-identifier			NotFc

Row Link Type

Fixed Access URL

Row Detail

access_url: http://dc.zah.uni-heidelberg.de/getproduct/califa/datadr3/COMB/

content_type: image/jpeg

content_length:

description: A preview for the dataset.

semantics: #preview

URL: http://dc.zah.uni-heidelberg.de/getproduct/califa/datadr3/COMB/ARP220.CC

Type: IMAGE Action: View image internally Invoke

DataLink Window



Datalink View Window

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- Available from top-level **Views** menu (not very prominent)

TOPCAT(1): DataLink View

Window Help

DataLink View for 1: gavo-califa.vot

DataLink Table

ID	access_url	service_def
6	ivo://org.gavo.dc/~?califa...	procsvc0
7	ivo://org.gavo.dc/~?califa...	procsvc1
8	ivo://org.gavo.dc/~?califa...	procsvc2
9	ivo://org.gavo.dc/~?califa...	
10	http://dc.zah.uni-heidelb...	
11	http://dc.zah.uni-heidelb...	
12	http://dc.zah.uni-heidelb...	
13	not-a-real-identifier	NotFc

Row Link Type

Service Invocation

Row Detail

content_type:

description: An interactive service on this dataset.

semantics: #proc

Standard ID: ivo://ivoa.net/std/SODA#sync-1.0

Resource ID:

URL: <http://dc.zah.uni-heidelberg.de/califa/q3/dl/dlget?ID=ivo%3a%2f%2forg.gavo.>

Type: UNKNOWN Action: Send FITS Image Invoke

Parameters

ID: ivo://org.gavo.dc/~?califa/datadr3/COMB/IC1078.COMB.rscube.fits

DEC:

RA:

SCALE:

BAND:

DataLink Window



Datalink View Window

- For use with {links}-response tables
- Top panel displays row data
- Bottom panel shows indicated link:
 - ▷ fixed URL
 - ▷ service descriptor
 - ▷ error
 - ▷ non-compliant
- For URL-like links, you can perform some configurable action
- For service descriptors, you can view/edit service parameters
currently only provides basic GUI
- Available from top-level **Views** menu (not very prominent)

ID	access_url	service_def
6	ivo://org.gavo.dc/~?califa...	procsvc0
7	ivo://org.gavo.dc/~?califa...	procsvc1
8	ivo://org.gavo.dc/~?califa...	procsvc2
9	http://dc.zah.uni-heidelb...	
10	http://dc.zah.uni-heidelb...	
11	http://dc.zah.uni-heidelb...	
12	http://dc.zah.uni-heidelb...	
13	not-a-real-identifier	NotFc

View DataLink Activation Action

Activation action for column with {links}-response URL

- Pops up Datalink table view on activation
- From that window links can be invoked (configurable actions)
- Q: How to identify a datalink URL column?

The image shows two overlapping windows from the TOPCAT software. The top window is titled 'TOPCAT(5): Activation Actions' and shows a list of 'Defined Actions' for the column '5: boydende1.vot'. The 'View Datalink Table' action is selected. The bottom window is titled 'TOPCAT(5): Activation - View Datalink Table' and displays a table of data links. The table has columns for ID, access_url, and service_desc. Row 3 is selected, and its details are shown below the table. The details include the access_url, content_type (image/fits), content_length (403292160), description (The full dataset), and semantics (#this). At the bottom, there is a 'URL' field with the value 'http://dc.zah.uni-heidelberg.de/getproduct/boydende/data/fits/HAR081_006478.fits', a 'Type' dropdown set to 'FITS_IMAGE', an 'Action' dropdown set to 'View image internally', and an 'Invoke' button.

TOPCAT(5): Activation Actions

Window Actions Help

Activation Actions for 5: boydende1.vot

Defined Actions

- Use Sky Coordinates in TO
- View Datalink Table
- Send Spectrum
- Transmit Sky Coordinates

Description

View the data in a file or URL column as a DataLink table

Configuration

Datalink Location Column: datalink_url

TOPCAT(5): Activation - View Datalink Table

DataLink Table

	ID	access_url	service_desc
1	1 ivo://org.gavo.dc/~?boydende/d...	http://dc.zah.uni-heidelberg.de/...	
2	2 ivo://org.gavo.dc/~?boydende/d...		procsvc
3	3 ivo://org.gavo.dc/~?boydende/d...	http://dc.zah.uni-heidelberg.de/...	
4	4 ivo://org.gavo.dc/~?boydende/d...	http://dc.zah.uni-heidelberg.de/...	

Row Link Type

Fixed Access URL

Row Detail

access_url: http://dc.zah.uni-heidelberg.de/getproduct/boydende/data/fits/HAR081_006478.fits

content_type: image/fits

content_length: 403292160

description: The full dataset.

semantics: #this

URL: http://dc.zah.uni-heidelberg.de/getproduct/boydende/data/fits/HAR081_006478.fits

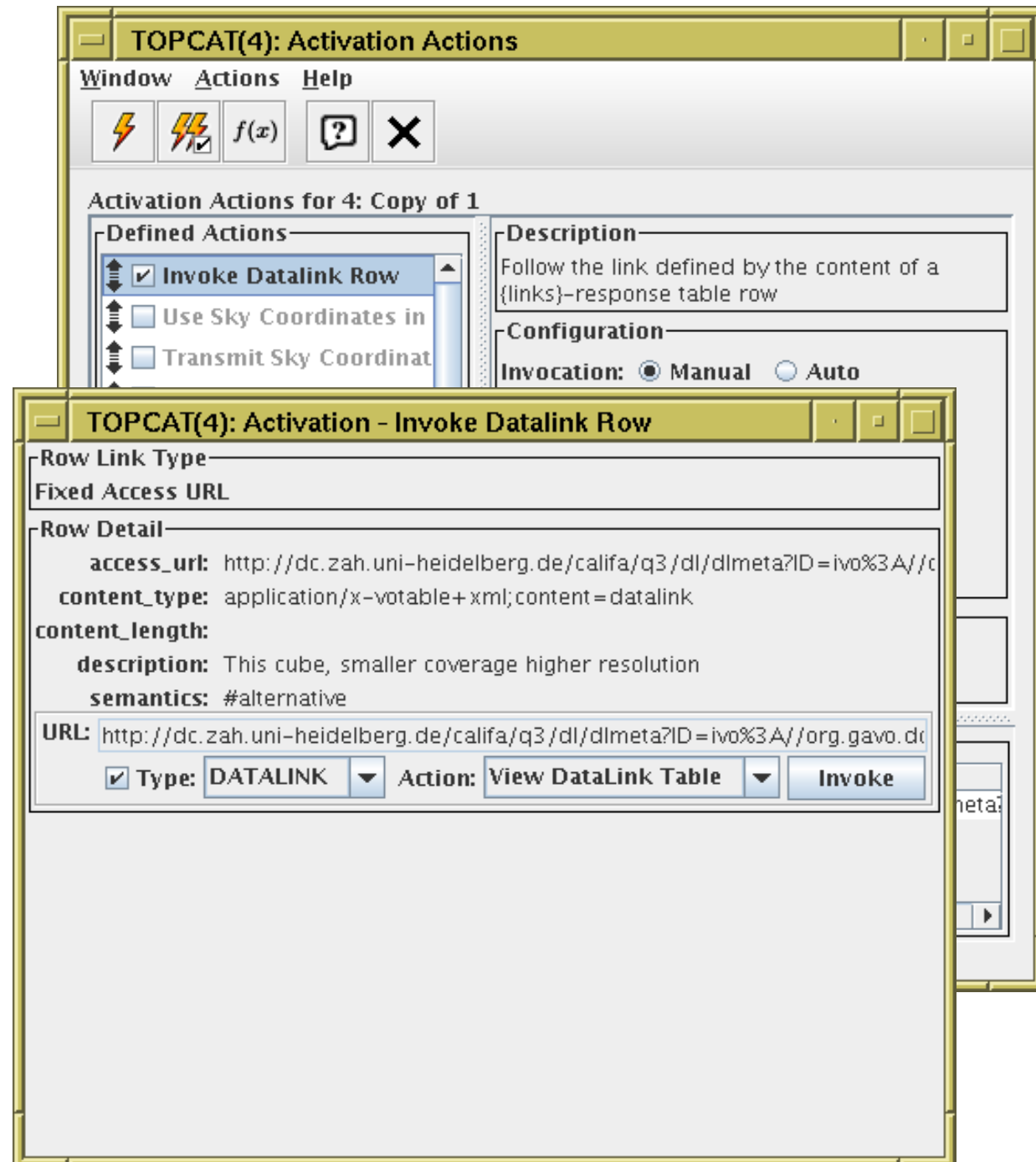
Type: FITS_IMAGE Action: View image internally Invoke

Invoke DataLink Row Activation Action

Activation action for rows of {links}-response table

- Pops up window for activated row's link:
 - ▷ fixed URL
 - ▷ service descriptor
 - ▷ error
- For URL-like links, you can perform a configurable action
- For service descriptors, you can view/edit service parameters *currently only has basic GUI*

DataLink window (similar functionality) may be more convenient than this activation action

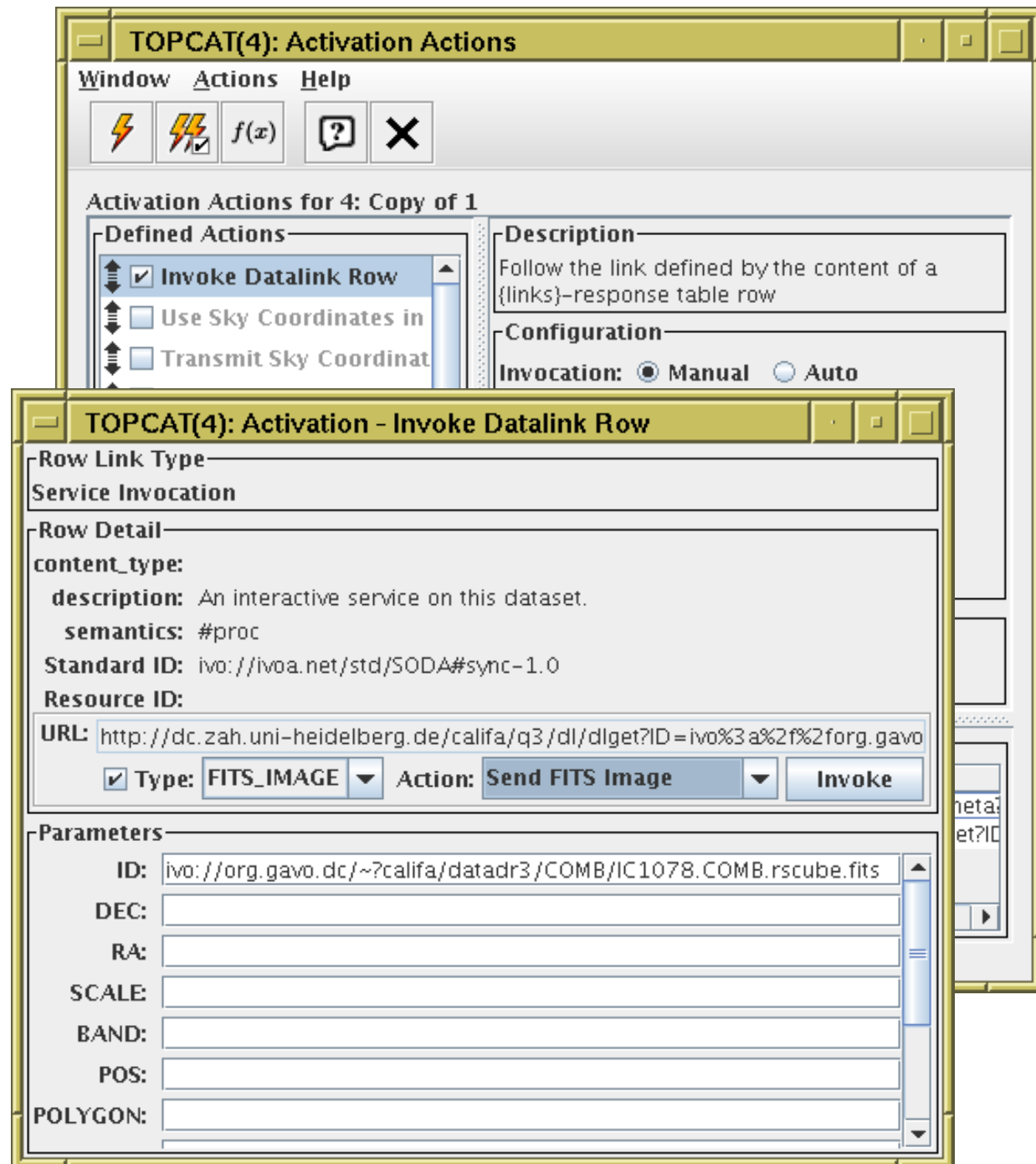


Invoke DataLink Row Activation Action

Activation action for rows of {links}-response table

- Pops up window for activated row's link:
 - ▷ fixed URL
 - ▷ service descriptor
 - ▷ error
- For URL-like links, you can perform a configurable action
- For service descriptors, you can view/edit service parameters
currently only has basic GUI

*DataLink window
(similar functionality)
may be more convenient
than this activation action*

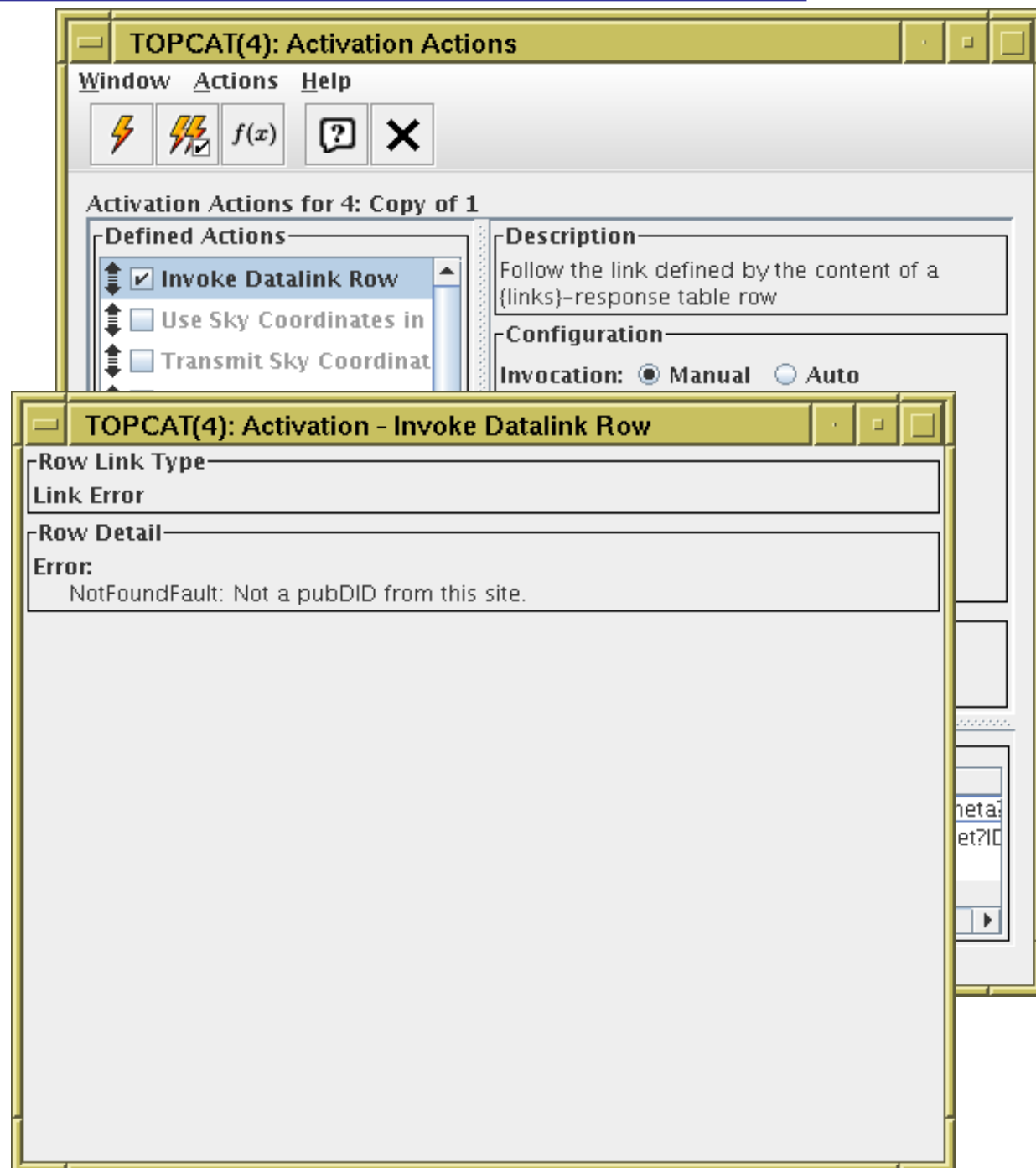


Invoke DataLink Row Activation Action

Activation action for rows of {links}-response table

- Pops up window for activated row's link:
 - ▷ fixed URL
 - ▷ service descriptor
 - ▷ error
- For URL-like links, you can perform a configurable action
- For service descriptors, you can view/edit service parameters
currently only has basic GUI

*DataLink window
(similar functionality)
may be more convenient
than this activation action*



Invoke Service Activation Action

Activation action for non-`{links}`-response table with Service Descriptor(s)

- Fills in service inputParams
 - ▷ column-referenced values filled in from table
 - ▷ fixed/defaulted values displayed for possible editing
 - ▷ undefaulted values can be filled in
currently only has basic GUI
- Configurable options to invoke the resulting URL
- Q: Are there services out there serving this kind of table?

TOPCAT(3): Activation Actions

Window Actions Help

Activation Actions for 3: rrlyrae_serv.vot

Defined Actions

- Invoke Service
- Use Sky Coordinates
- Transmit Sky Coordi
- Display Cutout Imag
- Execute code
- Transmit row

Description

Invoke a service defined by a ServiceDescriptor attached to the table

Configuration

Action: Load Table

Service: (unnamed)

Name: EpochPhotom

Description: Multi-band epoch photometry

Base URL: http://gaia.ari.uni-heidelberg.de/tim

IVOID:

Standard ID:

dummy:

fixed: dflt value

Status

Invoke now on row 13

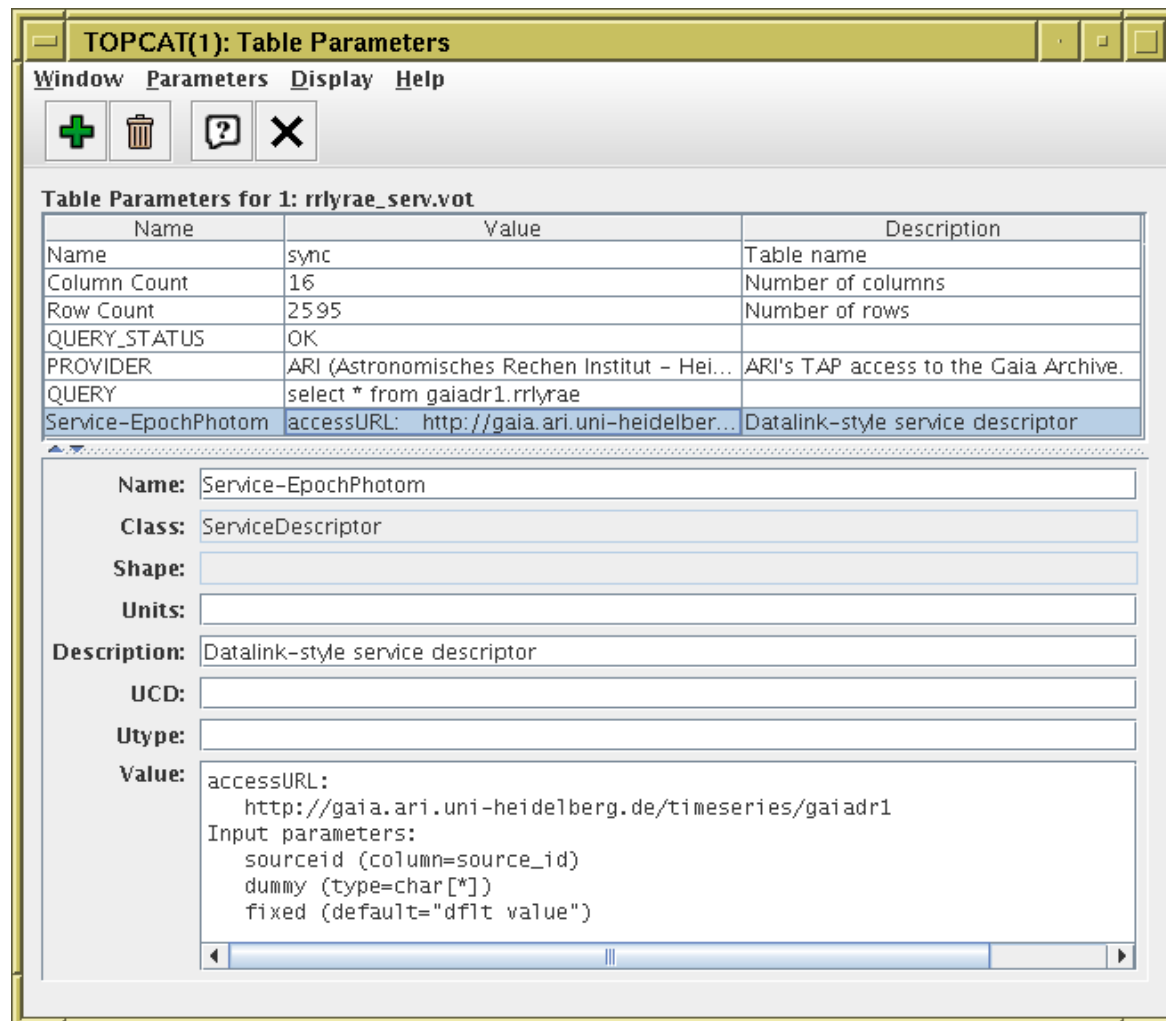
Results

Seq	Row	Status	Message
1	8	OK	4: gaiadr1?fixed=dflt%20value&sourceid=465888365458...
2	16	OK	5: gaiadr1?fixed=dflt%20value&sourceid=465889314215...
3	13	OK	6: gaiadr1?fixed=dflt%20value&sourceid=465889187084...

Service Descriptors as Parameters

Service Descriptors are now considered table *Parameters*

- Can be viewed in TOPCAT *Parameters Window*
 - ▷ Most useful for non-`{links}`-response tables with Service Descriptors
- Can be saved and loaded
 - ▷ VOTable-like formats only
- Done by STIL VOTable handler
 - ▷ Available to third-party applications code



TOPCAT(1): Table Parameters

Window Parameters Display Help

Table Parameters for 1: rrllyrae_serv.vot

Name	Value	Description
Name	sync	Table name
Column Count	16	Number of columns
Row Count	2595	Number of rows
QUERY_STATUS	OK	
PROVIDER	ARI (Astronomisches Rechen Institut - Hei...	ARI's TAP access to the Gaia Archive.
QUERY	select * from gaiadr1.rrlyrae	
Service-EpochPhotom	accessURL: http://gaia.ari.uni-heidelber...	Datalink-style service descriptor

Name: Service-EpochPhotom

Class: ServiceDescriptor

Shape:

Units:

Description: Datalink-style service descriptor

UCD:

Utype:

Value: accessURL:
http://gaia.ari.uni-heidelberg.de/timeseries/gaiadr1
Input parameters:
sourceid (column=source_id)
dummy (type=char[*])
fixed (default="dflt value")

DataLink Validator

New STILTS command `datalinklint`

- Checks content of {links}-response tables:
 - ▷ Correct **RESOURCE** structure of VOTable document
 - ▷ All required columns present with mandated metadata
 - ▷ Service descriptors correctly specified and referenced
 - ▷ Each row contains exactly one of `access_url`, `service_def`, `error_message`
 - ▷ Syntax of standard column values (`error_message`, `content_type`, `semantics`)
 - ▷ VOTable validation (`votlint`)
 - ▷ DALI error-response checking, if applicable
 - ▷ HTTP headers, if applicable
- Does *not* currently check link targets
- Just point it at the VOTable URL/filename
- Similar usage to `taplint`
 - ▷ Run from the command-line, output to stdout
 - ▷ `grep(1)`-friendly output, or JSON output option
 - ▷ Limits number of similar messages
 - ▷ Output level options (e.g. only **E**rrors)
- Available from STILTS v3.1-3 (next week)
- May contain bugs!
 - ▷ Please let me know if you disagree with its output

DataLink Validator Example

```
% stilts datalinklint \  
  votable='http://dc.g-vo.org/califa/q3/dl/dlmeta?ID=ivo://org.gavo.dc/~?califa/datadr3/COMB/ARP220.COMB.rscube.fits' \  
  truncate=119
```

This is the STILTS DataLink validator, 3.1-2+/?

```
I-GEDL-1 Retrieving DataLink document from http://dc.g-vo.org/califa/q3/dl/dlmeta?ID=ivo://org.gavo.dc/~?califa/data...  
I-VOHP-1 (1.1, c.75): Ignoring processing instruction <?xml-stylesheet href='/static/xsl/datalink-to-html.xsl' type=...  
E-DLCT-1 Incorrect Content-Type text/xml for DataLink service http://dc.g-vo.org/califa/q3/dl/dlmeta?ID=ivo://org.ga...  
E-RUCD-1 Wrong UCD for column service_def; meta.code != meta.ref  
I-SDDO-1 Service descriptor procsvc, 12 input params  
I-SDPR-1 FIXED parameter count 1 [ID]  
I-SDPR-2 ROW parameter count 0  
I-SDPR-3 USER parameter count 11 [DEC, RA, SCALE, BAND, POS, POLYGON, CIRCLE, PIXEL_1, PIXEL_2, PIXEL_3, KIND]  
I-SDDO-2 Service descriptor procsvc0, 12 input params  
I-SDPR-4 FIXED parameter count 1 [ID]  
I-SDPR-5 ROW parameter count 0  
I-SDPR-6 USER parameter count 11 [DEC, RA, SCALE, BAND, POS, POLYGON, CIRCLE, PIXEL_1, PIXEL_2, PIXEL_3, KIND]  
I-SDDF-1 Service descriptors defined: 2 referenceable, 0 anonymous  
I-IKAC-1 Row 1: access URL http://dc.zah.uni-heidelberg.de/califa/q3/dl/dlmeta?ID=ivo%3A//org.gavo.dc/%7E%3Fcalifa/d...  
E-SMCO-1 Unknown predicate 'alternative' from core DataLink vocabulary at row 1  
I-IKAC-2 Row 2: access URL http://dc.zah.uni-heidelberg.de/califa/q3/dl/dlmeta?ID=ivo%3A//org.gavo.dc/%7E%3Fcalifa/d...  
E-SMCO-2 Unknown predicate 'alternative' from core DataLink vocabulary at row 2  
I-IKSD-1 Row 3: service procsvc invocation (partial) http://dc.zah.uni-heidelberg.de/califa/q3/dl/dlget?ID=ivo%3a%2f...  
I-IKSD-2 Row 4: service procsvc0 invocation (partial) http://dc.zah.uni-heidelberg.de/califa/q3/dl/dlasync?ID=ivo%3a...  
I-IKAC-3 Row 5: access URL http://dc.zah.uni-heidelberg.de/califa/q3/dl/dlget?ID=ivo%3A//org.gavo.dc/%7E%3Fcalifa/da...  
I-IKAC-4 Row 6: access URL http://dc.zah.uni-heidelberg.de/getproduct/califa/datadr3/COMB/ARP220.COMB.rscube.fits?pr...  
I-DLNR-1 Datalink table rows checked: 6
```

Totals: Errors: 4; Warnings: 0; Infos: 18; Summaries: 0; Failures: 0

DataLink Implementation Feedback

Working with DataLink 1.0 REC:

- Found DataLink quite a difficult document to understand
 - ▷ Had to read it lots of times
 - ▷ Talks about distinct things (*Service Descriptors* & *{links} services*)
 - ▷ Service Descriptors referenced by *{links}* services work differently than standalone ones (see [Datalink service descriptor usage](#) DAL thread)
 - ▷ Intended use in some parts understood by authors but not explicit?
- Standalone Service Descriptors not so well thought through?
 - ▷ Name and description metadata really required; can be done ad hoc, but not discussed in DataLink document
- Service Descriptor positioning:
 - ▷ Service Descriptor resources (may be) after TABLE element: difficult when streaming VOTables
 - ▷ Hard to work with multiple tables-with-ServiceDescriptors in a single VOTable (use of XML IDs, can't use sibling RESOURCES)
- Datalink URL column pattern
 - ▷ How does (human or machine) consumer know column contains DataLink URL? (see [Characterising URL columns](#) DAL thread)
Answer: columnName.toLowerCase().contains("datalink")
 - ▷ Hard to come up with simple GUI
 - ▷ `gaia_source` links to 1-row datalink file — is there any point?

Future

- More activation actions:
 - SkyView image display?
 - SIA-based cutout image display?
 - View data of referenced table without loading?
 - Plot referenced table without loading?
- Activation Action persistence
- DataLink display/activation:
 - Improve Service Descriptor inputParam entry GUI
 - Your ideas here?
- DataLink validator refinements:
 - Feedback from use with real services → *Please try it out!*

Pre-releases:

ftp://andromeda.star.bristol.ac.uk/pub/star/topcat/pre/topcat-full_dlactiv.jar

ftp://andromeda.star.bristol.ac.uk/pub/star/stilts/pre/stilts_dlactiv.jar

Public releases: (just) before Gaia DR2, 25 April 2018

TOPCAT v4.6

STILTS v3.1-3