

The ESCAPE Science Analysis Platform & the Simple Application Messaging Protocol

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ESCAPE Science Analysis Platform (ESAP)

ESAP will allow EOSC researchers:

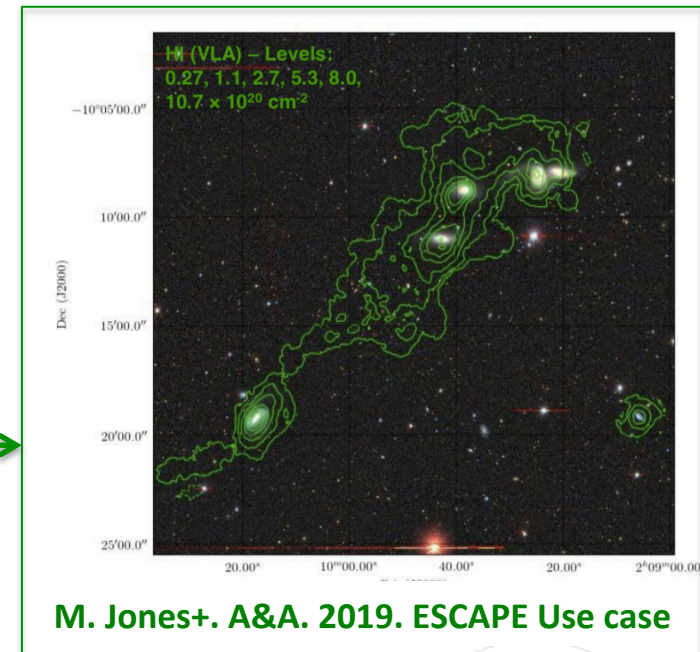
- to identify and stage existing data collections for analysis,
- tap into a wide-range of software tools and packages developed by the ESRIs,
- bring their own custom workflows to the platform,
- take advantage of the underlying computing infras. to execute those workflows.

(From the D5.2 Detailed Project Plan)

SKA use case:



- SKA data sets already stored in the data lake
- Some analysis requires data from external catalogues
 - Examples:
 - Object properties (e.g Galaxy centre, Diameter)
 - Searching for counterparts in other wavelengths →
 - Using single dish data to improve the detection of extended emission



→ Depending on the size, data staging is needed

ESCAPE Science Analysis Platform (ESAP)

<http://sdc.astron.nl/esap-gui/archives>

ASTRON Data Explorer Archives Query

Apertif Data Collection Query

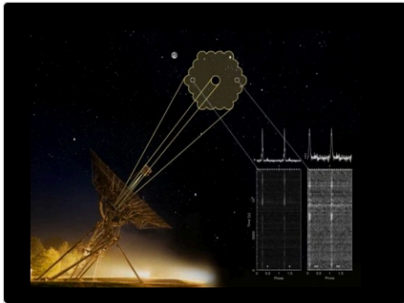
Catalog: Apertif Target: RA (degrees): dec (degrees): search radius (degrees): Apertif Co: Imaging

Processing Level: Processed DataProduct Type: All

Submit

Archive - WSRT-Apertif

Instrument	WSRT
Description	Apertif Surveys



Apertif Surveys

Data from the Apertif surveys include imaging and time-domain data. The time-domain products

Each catalogue is queried using different search parameters

ESAP Archives Query Rucio Interactive Analy

Archive - LOFAR-LTA

Instrument	LOFAR
Description	LOFAR LTA data



LOFAR LTA data

The data from all LOFAR cycle, commissioning and DDT projects since 2013 are stored in the archive. The interferometric data products that can be found

lorer Archives Query Login

ection Query

Object: A2255 RA: Dec: Units: sexagesimal Reference system: J2000

Search Radius Units: deg Antenna Type: HBA Public data only: yes no SAS Id: Data Product Type: Averaging Pipeline



Accessing VO catalogues



The screenshot shows a web browser window with the URL `sdc.astron.nl/esap-gui/archives/ivoa`. The page header includes the ESAP logo and navigation links for Archives, Query, Rucio, and Interactive Analysis. The main content area is titled "Archive - Virtual Observatory (VO)" and contains a table with the following information:

Instrument	Virtual Observatory
Description	Virtual Observatory (VO)

Below the table is a large image of the IVOA logo, which features a stylized globe with a grid and the text "IVOA" below it. Underneath the logo, the text reads "Virtual Observatory (VO)" and "The Virtual Observatory defines a set of standards that can be used to download astronomical data."

IVOA standards/protocols:

- Facilitate Astronomy data/tools interoperability
- Enable homogeneous access to different archives

Main VO protocols for accessing data:

- Cone Search
 - data in a sky region (RA,DEC, Radius)
- Simple Image Access (SIA)
 - Multi-D image datasets
- Table Access Protocol (TAP)
 - Accessing table data

→ VO services are registered in the IVOA Registry

Tools for querying VO catalogues

Functionalities designed to enhance:

- Service discovery

TOPCAT

Published in 2003



ESAP Archives Query Rucio Interactive Analysis

ESAP IVOA Query

Catalog*
IVOA

Keyword
[]

Service Type*
TAP: Tables

Waveband
All

[Get Registry Services](#)

Cone Search

Available Cone Services

Registry:

Keywords:

Match Fields: Short Name Title Subjects ID Publisher Description

Accept Resource Lists

Short Name	Title
SCS ALMA FITS	Simple Cone Search for ALMA FITS
J/MNRAS/485/1188	The ALMA Calibrator Catalogue (Bonato+, 2019)
J/MNRAS/478/1512	ALMA calibrator continuum observations catalog (Bonato+, 2018)
J/ApJS/244/40	A3COSMOS. I. ALMA continuum photometry catalogs (Liu+, 2019)
J/ApJS/244/25	The BAaDE SiO maser survey at 86GHz with ALMA (Stroh+, 2019)

AccessURL	Description	Version
https://vo.chivo.cl/alma_fits/...		

Resource Count: 100



Tools for querying VO catalogues

Functionalities designed to enhance:

- Service discovery
- Data discovery

Table Access Protocol (TAP) Query

Window TAP Registry Edit Interop Help

TOPCAT

Select Service Use Service Resume Job Running Jobs

Metadata

Find: califa hipparcos

Service	Schema	Table	Columns
hipno	int		Indexed
srcsel	char		
raj2000	double	deg	Indexed
dej2000	double	deg	Indexed
pmra	float	deg/yr	
pmde	float	deg/yr	
t_ra	float	yr	
err_ra	float	deg	
err_pmra	float	deg/yr	
t_de	float	yr	
err_de	float	deg	
err_pmde	float	deg/yr	
parallax	float	deg	
e_parallax	float	deg	

Service Capabilities

Query Language: ADQL-2.0 Max Rows: 2000 (default) Uploads: 20Mb

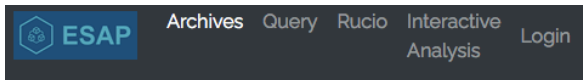
ADQL Text

Mode: Synchronous

```
ppmxl-1 ppmxl-2 califa 5
SELECT TOP 10000
  o.target_name, o.raj2000, o.dej2000, o.magz, o.magz,
  h.hipno, h.raj2000, h.dej2000, h.pmra, h.pmde
FROM califadr1.objects AS o
JOIN arihip.main AS h
ON 1=CONTAINS(POINT('ICRS', o.raj3000, o.dej2000),
  CIRCLE('ICRS', h.raj2000, h.dej2000, 5./3600.))
```

Examples

Run Query



ESAP IVOA Query

Catalog*

IVOA

Service Type*

TAP: Tables

ADQL Query

<http://gavo.aip.de/tap>

Query Registry



Tools for querying VO tools

Functionalities designed to enhance:

- Service discovery
- Data discovery
- Data identification



Published in 2000

The screenshot shows the ALADiN interface with a 2MASS color image. A red box highlights a region of interest. Below the image is a table of object data.

accref	owner	embargo	mime	acssize	central...	centerde...	imagetitle	instid	dateobs	naxes	pixelsize	pixelscale	reframe	wcs
http://d...			image/fits	268554240	162.508375	57.27291...	VLBA 1.4...	VLBA	55381.0	4	8192 819...	2.777780...	ICRS	
http://d...			image/fits	268554240	162.51925	57.26055...	VLBA 1.4...	VLBA	55381.0	4	8192 819...	2.777780...	ICRS	
http://d...			image/fits	268554240	162.530625	57.28122...	VLBA 1.4...	VLBA	55381.0	4	8192 819...	2.777780...	ICRS	
http://d...			image/fits	268554240	162.5335...	57.33833...	VLBA 1.4...	VLBA	55381.0	4	8192 819...	2.777780...	ICRS	
http://d...			image/fits	16896960	162.5335...	57.33838...	VLBA 1.4...	VLBA	55381.0	4	2048 204...	1.388890...	ICRS	
http://d...			image/fits	268554240	162.5346...	57.42038...	VLBA 1.4...	VLBA	55381.0	4	8192 819...	2.777780...	ICRS	
http://d...			image/fits	268554240	162.5523...	57.19361...	VLBA 1.4...	VLBA	55381.0	4	8192 819...	2.777780...	ICRS	
http://d...			image/fits	16896960	162.5523...	57.19360...	VLBA 1.4...	VLBA	55381.0	4	2048 204...	1.388890...	ICRS	
http://d...			image/fits	268554240	162.5560	57.19405	VLBA 1.4	VLBA	55381.0	4	8192 819	2.777780	ICRS	

Leveraging VO tools

→ If we can send the result data from these VO to ESAP, we will

- benefit from the potential of their functionalities to discover/identify data
- Open ESAP to the VO community (multi-wavelength)
- Avoid reinventing the wheel

→ Is this possible? Yes! Using SAMP

SAMP in a Nutshell



*International
Virtual
Observatory
Alliance*

SAMP - Simple Application Messaging Protocol

Version 1.11

IVOA Recommendation 2009-04-21

This version:

<http://www.ivoa.net/Documents/REC/App/SAMP-20090421.html>

Latest version:

<http://www.ivoa.net/Documents/latest/SAMP.html>

Previous versions:

1.0: <http://www.ivoa.net/Documents/WD/App/SAMP-20080625.html>

1.1: <http://www.ivoa.net/Documents/PR/App/SAMP-20081121.html>

Working Group:

Applications

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“SAMP is a messaging protocol that enables astronomy software tools to interoperate and communicate.”

- Astronomy tools are highly specialised (wavelength / observatory / field)
- Building a *monolithic* tool fulfilling all the requirements of all users is impractical
- Multi-wavelength studies require data interoperability and also **tool interoperability**

SAMP in action

Firefox Archivo Editar Ver Historial Marcadores Herramientas Ventana Ayuda

TOPCAT

Table Browser

Table Browser for 1:ugc000268-J_A+A_436_443-10d

_f	recono	CIG	n_CIG	Bmag	Bmagcor	LB	CIG_data	Simbad	NED	_RA	_DE
1	7,43177	7	7	15,6	15,3	10,51	CIG_data	Simbad	NED	2,77662	12,678
2	4,94356	8	*	15,4	14,18	10,32	CIG_data	Simbad	NED	3,838	12,84536
3	5,01237	9	*	15,4	14,54	10,45	CIG_data	Simbad	NED	3,15983	5,50514
4	5,92773	12	12	15,6	14,39	10,11	CIG_data	Simbad	NED	3,99021	14,07603
5	3,1519	13	13	14,7	13,63	10,37	CIG_data	Simbad	NED	4,06196	10,33219
6	2,7472	14	14	14,7	13,98	10,25	CIG_data	Simbad	NED	4,72171	10,59419
7	7,85546	16	16	15,6	15,42	9,68	CIG_data	Simbad	NED	5,397	1,1655
8	7,10969	17	17	15,7	15,27	9,84	CIG_data	Simbad	NED	5,83792	1,84656
9	5,42065	19	19	15,4	15,01	9,84	CIG_data	Simbad	NED	6,0675	14,23686
10	8,53005	21	21	15,7	14,51	10,4	CIG_data	Simbad	NED	6,398	17,39375
11	0,00044	22	22	15,	14,18	10,98	CIG_data	Simbad	NED	6,89758	8,87736
12	3,35842	24	24	15,6	15,01	10,09	CIG_data	Simbad	NED	7,72817	5,62167
13	1,56962	25	25	14,2	13,87	10,28	CIG_data	Simbad	NED	7,74246	10,28886
14	2,89074	30	30	15,	14,05	10,88	CIG_data	Simbad	NED	9,41654	10,35767
15	9,83249	33	33	13,6	13,15	10,35	CIG_data	Simbad	NED	10,86629	-0,12547
16	6,91275	40	40	15,7	14,78	10,66	CIG_data	Simbad	NED	13,70633	10,53747
17	9,74991	44	44	14,8	14,62	10,11	CIG_data	Simbad	NED	16,64833	10,52169
18	8,53105	1045	1045	13,	12,7	10,44	CIG_data	Simbad	NED	356,82937	5,91578

Total: 18 Visible: 18 Selected: 0

SAMP

69 / 1821 M

Messages: Clients:

168.966	13.308	11:15:51.84	13:18:27.36	HD097907	* n Leo	VOTable	ASCII	FITS	PNG	Links	0404	K3III
179.427	17.468	11:57:42.48	17:28:04.08	HD103877	HD 103877	VOTable	ASCII	FITS	PNG	Links	0425	Am
185.883	16.903	12:23:31.92	16:54:09.36	BD+172473	BD+17 2473	VOTable	ASCII	FITS	PNG	Links	0439	GS

Download all results as VOTable or CSV file

You can send these results to other VO Applications if they are already open in your computer. Maybe you could want to take a look to TOPCAT, Aladin, SPLAT-VO interesting VO applications.

[Send table to VO Apps](#) [Send table to VO Apps \(as SSAP\)](#)

This service uses SVOCat by the SVO

SAMP Table Display

astrojs.github.io/samps/examples/tdisplay.html

150%

Buscar

This client can receive a VOTable (TABLEDATA only) from another SAMP client (`table.load.votable`) and receive row highlight messages from it (`table.highlight.row`, `table.select.rowList`). If you click on a row in the loaded table, it will broadcast a `table.highlight.row` message.

This is a proof of concept only - it is not very robust or scalable. You probably shouldn't try to send a table with more than a few hundred rows.

Registered: No

Table

SAMP in action

The screenshot displays the Aladin v11.0 interface, which is used for astronomical data visualization and analysis. It features several overlapping windows:

- Table List:** Shows a list of tables, including 'The MILES stellar library Query'.
- Current Table Properties:** Displays details for the selected table, such as 'Label: The MILES stellar library Query', 'Location: samp:The MILES stellar library Query', 'Name: The MILES stellar library Query', 'Rows: 985', 'Columns: 17', and 'Sort Order: ↑'.
- Available data:** A tree view showing various data collections like 'Collections → 25022', 'Image → 410', 'Data base → 59', etc.
- SAMP Table Display:** A browser window showing a table of stars with columns for coordinates and identifiers.
- Aladin v11.0:** The main interface showing a sky map with stars, a toolbar with various tools (select, pan, zoom, etc.), and a 'Welcome to Aladin' message.
- access_url:** A list of URLs for accessing individual star data, such as `/v2/miles/dl.php?ID=HD102`.

At the bottom of the Aladin window, there is a table of star data:

RA	DEC	ID	name	application/x-votable+xml;content=datalink	http://svo2.cab.inta-csic.es/vocats/v2/miles/dl.php?ID=HD102
-0.01	SI	*	tet Vir	application/x-votable+xml;content=datalink	http://svo2.cab.inta-csic.es/vocats/v2/miles/dl.php?ID=HD114
0.5	I	BD	10 3166	application/x-votable+xml;content=datalink	http://svo2.cab.inta-csic.es/vocats/v2/miles/dl.php?ID=BD%20103166

SAMP in action

GUIpsy A Virtual Observatory compliant tool for the kinematical modelling of HI datacubes. S. Sanchez et al. 2014

Applications Places GUIpsy

File Set Edition Display Analysis Virtual Observatory Help

ROTCUR

INSET CIG85-MOM1 HEADER

BOX -255 -256 256 255

BUNIT KM/S SIDE Receding

CENTRE U 30.835781571151596 U 22.04902758393426 Fixed SAMP

VSYS 2627.04 KM/S Fixed SAMP

RADII 10:180:10; SAMP

VROT 10 20 30 40 50 60 70 80 90 100; Fixed SAMP

WIDTHS 10; Fixed

VEXP 0.0; Fixed

PA 160; Fixed

INCL 30; Fixed

FREEANGLE 0.0 DEG FIT TOLERANCE 0.001

WEIGHT COSINE

Save values Load Values

Help Apply Close

Aladin v9.0

File Edit Image Catalog Overlay Coverage Tool View Interop Help

Location 02:03:24.90 +22:01:59.0 Frame ICRS

DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Simbad

CIG85-MOM1.fits

Stack controls:

- the icon: show/hide a plane
- size: change object size
- zoom: adjust field size.

Contours

CIG85-MOM1.fit

epoch -

size -

opac. -

zoom -

34.13' x 34.13'

grid wink north hdr multiview match

Search

(c) 2016 Unistra/CNRS - by CDS - Distributed under GNU GPL v3

0 sel / 0 src 12Mb

```

gipsy.xeq("DIMINISH INSET=/home/lourdes/Documents/3gc/e2/CIG85 STOKES BOX=-255 -256 0
256 255 53 OUTSET=/home/lourdes/Documents/3gc/e2/CIG85-3D MAKEBLANK= OKAY=Y")

CIG85_3D0 = gipsy.Set("/home/lourdes/Documents/3gc/e2/CIG85-3D", create=False, write=True,
    
```

lourdes@ubuntu: ~/Do... lourdes@ubuntu: ~ GUIpsy Aladin v9.0

Examples of services using SAMP

The SAMP interface displays a star field with several observation windows overlaid. The windows are labeled: ALMA (Submm to Radio), Herschel (Far-IR to Submm), Chandra (Soft X-ray), and XMM-Newton (Soft X-ray). A color bar at the bottom indicates the spectral range from Gamma-ray to Radio. The interface also includes a search bar, navigation icons, and a 'Sci. Mode' toggle.



ChIVO

Help
Service Info
Metadata

Parameters

- Position/Name: L
- Search radius: 30

Result

Matched: 8

Send via SAMP

Identifier: lvo:/chivo/alma_fits/g/scs-alma-fits

Description: The resource contains the recommendations and requirements for ALMA FITS products of the Inter-ARC ALMA Science Archive Working Group (ASAWG) with the view of including a metadataset that is complete and easily accessible by the ChIVO Data Provider (CDP).

Keywords: Millimeter/submillimeter Astronomy

Created: 2017-06-05T18:01:00Z

Data updated: 2017-11-06

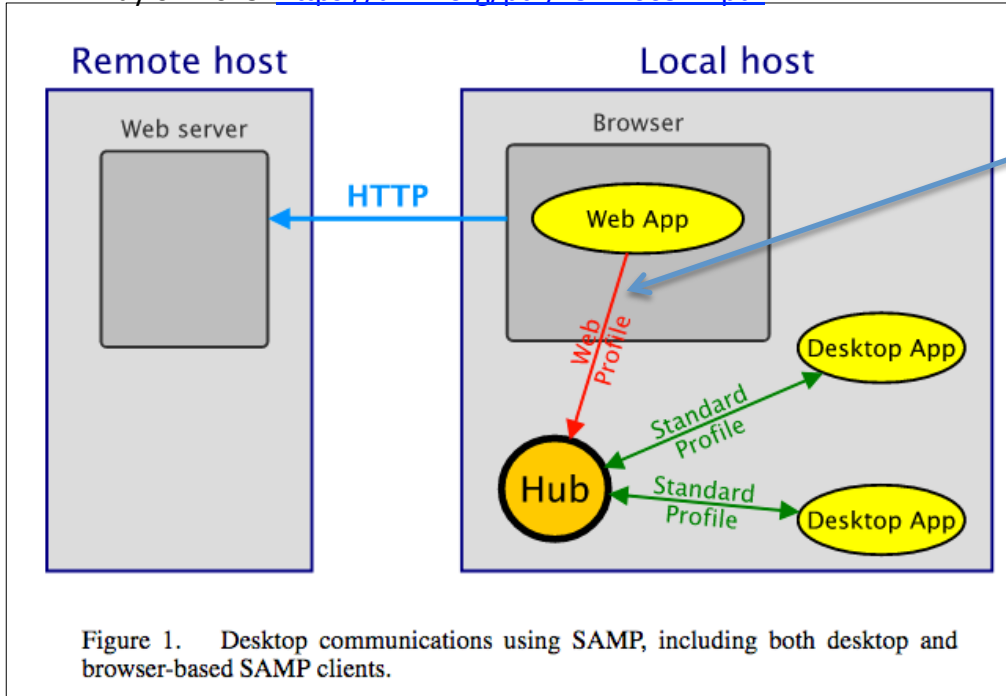
ALMA Observatory	Herschel Space Observatory	Go to	Send	Archive	Preview	Download	Observation ID	RA (J2000)	Dec (J2000)	Target name	Instrument	Filter (microns)
							1342254059	07h 13m 11.468s	-12° 35' 45.48"	Field 226_0	SPIRE	250, 350, 500
							1342254061	07h 16m 38.511s	-14° 31' 18.46"	Field 228_-1	PACS	70, 160
							1342254062	07h 17m 16.593s	-14° 33' 32.26"	Field 228_-1	SPIRE	250, 350, 500
							1342254060	07h 13m 11.467s	-12° 35' 45.48"	Field 226_0	SPIRE	250, 350, 500
							1342254062	07h 16m 38.511s	-14° 31' 18.46"	Field 228_-1	PACS	70, 160
							1342254061	07h 17m 16.588s	-14° 33' 32.23"	Field 228_-1	SPIRE	250, 350, 500

J2232+1143	uid__A001_X12b_X23b.J0010+1058_ph.spw17.l.fits	2.62919	10.9749	A001_X12b_X23b	4.0	300;300;1;1	2225140.0	-5440310.0	-2481030.0	g
J2148+0657	uid__A001_X13e_X55.J0010+1058_ph.spw9.l.fits	2.62919	10.9749	A001_X13e_X55	4.0	300;300;1;1	2225140.0	-5440310.0	-2481030.0	g
J2148+0657	uid__A001_X13e_X55.J0010+1058_ph.spw11.l.fits	2.62919	10.9749	A001_X13e_X55	4.0	300;300;1;1	2225140.0	-5440310.0	-2481030.0	g
J2148+0657	uid__A001_X13e_X55.J0010+1058_ph.spw13.l.fits	2.62919	10.9749	A001_X13e_X55	4.0	300;300;1;1	2225140.0	-5440310.0	-2481030.0	g
J2148+0657	uid__A001_X13e_X55.J0010+1058_ph.spw15.l.fits	2.62919	10.9749	A001_X13e_X55	4.0	300;300;1;1	2225140.0	-5440310.0	-2481030.0	g
J2232+1143	uid__A001_X12b_X23b.J0010+1058_ph.spw23.l.fits	2.62919	10.9749	A001_X12b_X23b	4.0	300;300;1;1	2225140.0	-5440310.0	-2481030.0	g
J2232+1143	uid__A001_X12b_X23b.J0010+1058_ph.spw21.l.fits	2.62919	10.9749	A001_X12b_X23b	4.0	300;300;1;1	2225140.0	-5440310.0	-2481030.0	g
J2232+1143	uid__A001_X12b_X23b.J0010+1058_ph.spw19.l.fits	2.62919	10.9749	A001_X12b_X23b	4.0	300;300;1;1	2225140.0	-5440310.0	-2481030.0	g



Web SAMP & HTTPS problem

M. B. Taylor. 2019. <https://arxiv.org/pdf/1912.00917.pdf>



The problem:

- URL <http://localhost:21012/> (XMLHttpRequest API).
- If the Web App is served from HTTPS, browsers will complain: “Mixed Active Content”

This is being solved with a New WC3 recommendation (2016):

- Any URL whose host is the loopback address or “Localhost” does not count as mixed content
- The problem will be solved (without any change in SAMP or in Web App) as long as browsers adopt this WC3 recommendation.

Browser	Version	OS	Works out of the box?	Reporter
Chrome	77	Ubuntu	yes	Felix Stoehr
Chromium	78.0	Ubuntu	yes	Felix Stoehr
Chromium	85.0	Ubuntu	yes	Felix Stoehr
Firefox	70.0.1	OSX Mojave	yes	Felix Stoehr
Firefox	70.0	Ubuntu	no	Felix Stoehr
Firefox	59	RHEL6	no	Mark Taylor
Firefox	70.0.1	Ubuntu	no	Mark Taylor
Firefox	81.0	Ubuntu	yes	Mark Taylor
Firefox Nightly	75.0 (64-bit)	GUIX	yes	Hugo Buddelmeijer
Chrome	85.0	MacOS 10.13.6	yes	Thomas Boch
Firefox	81.0	MacOS 10.13.6	yes	Thomas Boch
Safari	13.1.2	MacOS 10.13.6	no	Thomas Boch
Chrome	85.0	Fedora 31	yes	Marco Molinaro
Firefox	80.0	Fedora 31	yes	Marco Molinaro
Chrome	85.0	MacOS 10.11.3	yes	Susana Sánchez Expósito
Firefox	78.2	MacOS 10.11.3	yes	Susana Sánchez Expósito
Safari	9.0.3	MacOS 10.11.3	No	Susana Sánchez Expósito
Firefox	81.0	MacOS 10.14.6	Yes	Susana Sánchez Expósito
Chrome	85.0	MacOS 10.14.6	Yes	Susana Sánchez Expósito
Safari	13.1	MacOS 10.14.6	No	Susana Sánchez Expósito
Firefox	81.0(64 bits)	Ubuntu 20.04.1 LTS	yes	Regis Haigrón
Firefox	80	Windows 10	yes	Regis Haigrón
Firefox	81.0(64 bits)	Ubuntu 18.04.1 LTS	yes	Pierre Le Sidaner
Chrome	86.0.4240.75	Ubuntu 18.04.1 LTS	Yes	Pierre Le Sidaner
Vivaldi	3.3.2022.47	Ubuntu 18.04.1 LTS	Yes	Pierre Le Sidaner
Chrome	84.0.4147.125	MacOS 10.12.5	Yes	Juan Carlos Segovia
Safari	10.1.1	MacOS 10.12.5	No	Juan Carlos Segovia
Firefox	75.0	MacOS 10.12.5	Yes	Juan Carlos Segovia
Chrome	57.0	MacOS 10.12.6	Yes	Alcione Mora
Safari	11.0.2	MacOS 10.12.6	Yes	Alcione Mora
Firefox	69.0	MacOS 10.12.6	Yes	Alcione Mora
Chrome	86.0	MacOS 10.14.6	Yes	Hector Canovas
Safari	12.1.2	MacOS 10.14.6	No	Hector Canovas
Firefox	81.0.1	MacOS 10.14.6	No	Hector Canovas
Edge	86.0	Windows 10.0	Yes	Mark Taylor
Chrome	86.0.4240.80	MacOS 10.13.6	Yes	Tom Donaldson
Firefox	81.0.2	MacOS 10.13.6	Yes	Tom Donaldson
Safari	13.1.2	MacOS 10.13.6	No	Tom Donaldson

<https://wiki.ivoa.net/twiki/bin/view/IVOA/WebSampHttps>

It looks promising !

!!??!!

Conclusions

- SAMP is an opportunity to open ESAP to the IVOA community
- Depending on the use case, SAMP is more than a “nice-to-have” functionality
- The HTTPS problem is being solved (not for all browser)
- Your opinion?