

MASER

Low Frequency Science

Ready tools

**B. Cecconi, A. Loh, L. Lamy, X. Bonnin
and the MASER team**

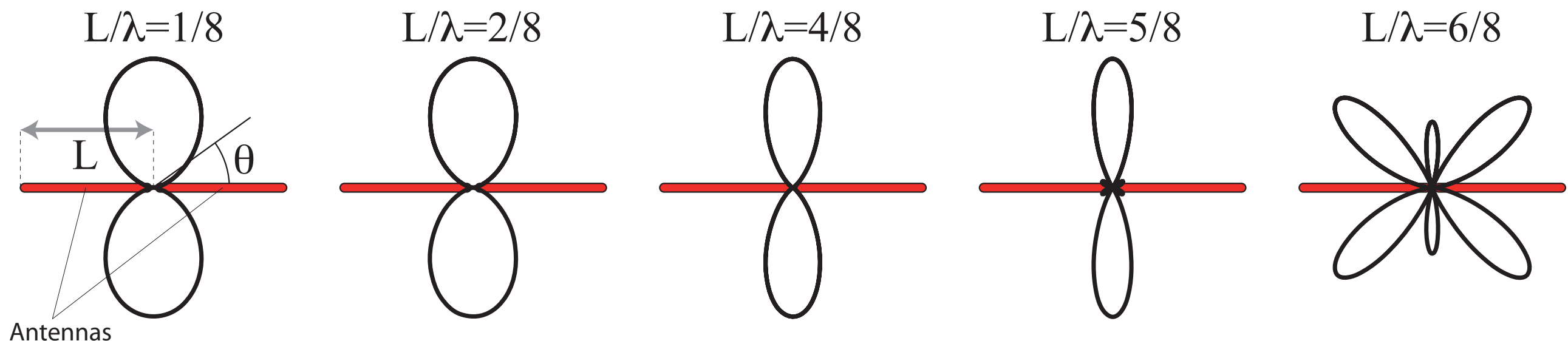
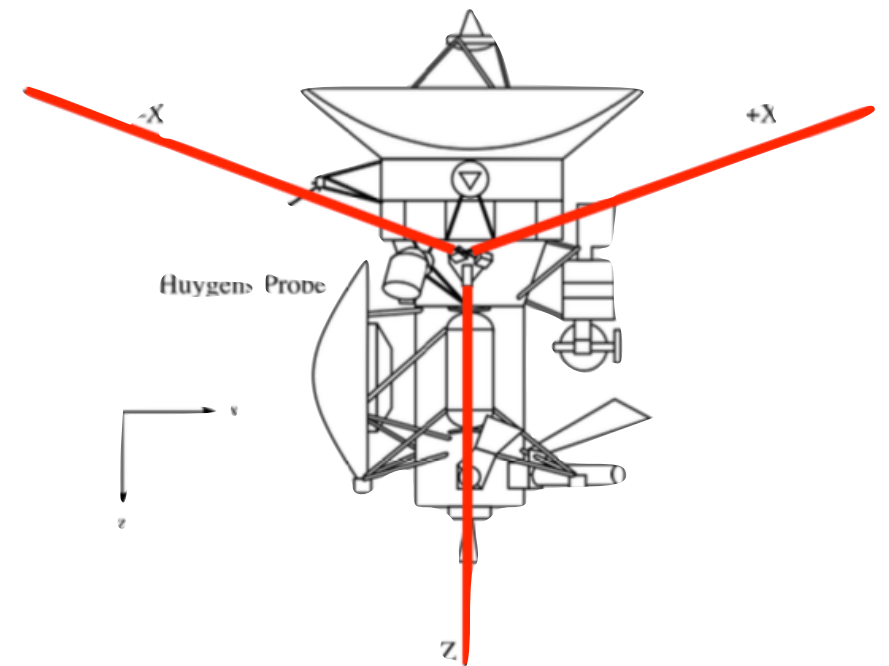
Observatoire de Paris-PSL

The Europlanet-2024 Research Infrastructure project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871149.



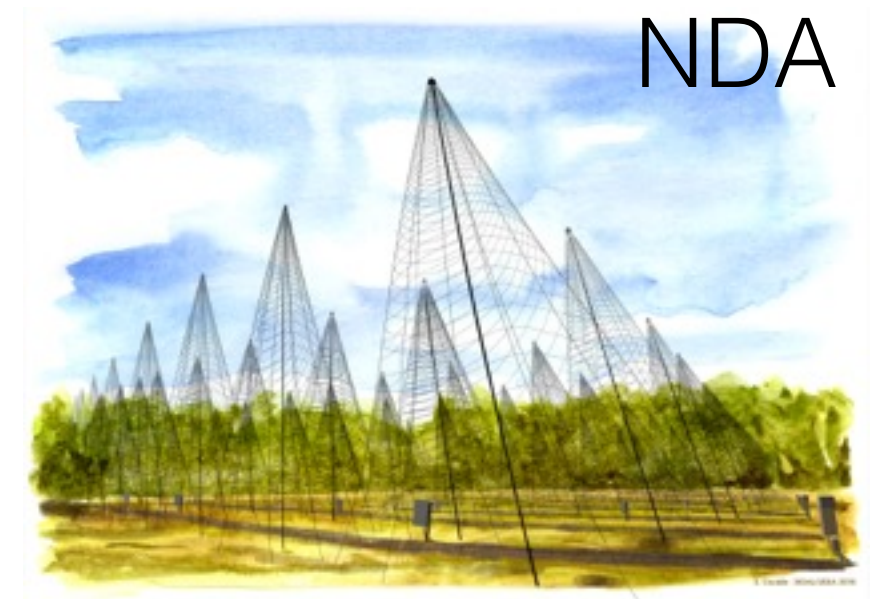
Radio Astronomy: what do we measure

- • **Single antenna** (in space): no directivity,
=> spectro-temporal information.
- **Phased array**: coherent sum, beam forming.
=> spectro-temporal information within beam.
- **Interferometer**: phased correlations.
=> spectro-temporal + spatial frequencies

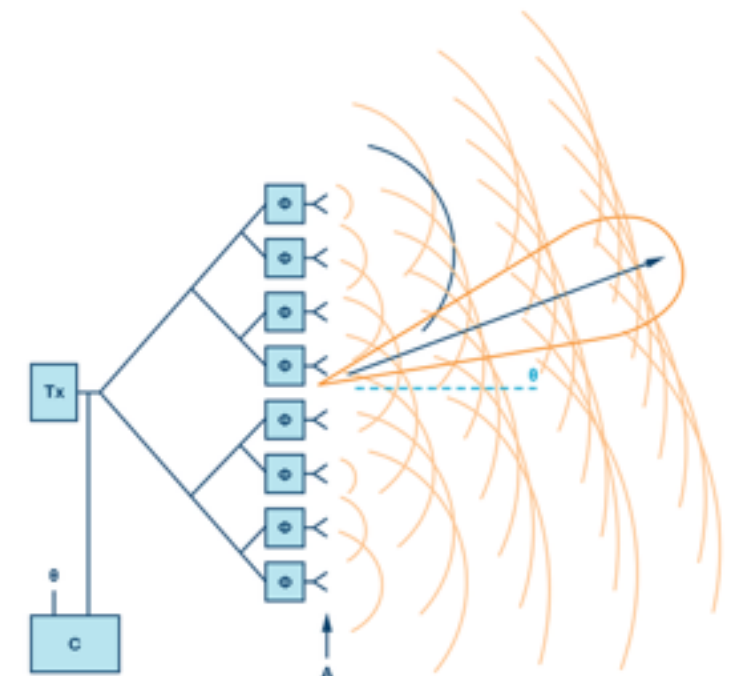
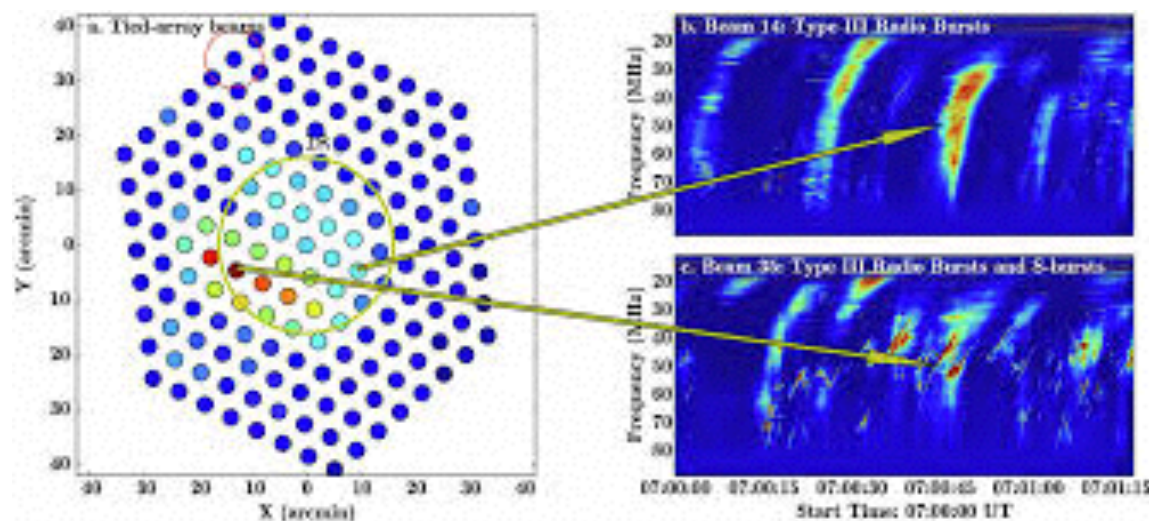


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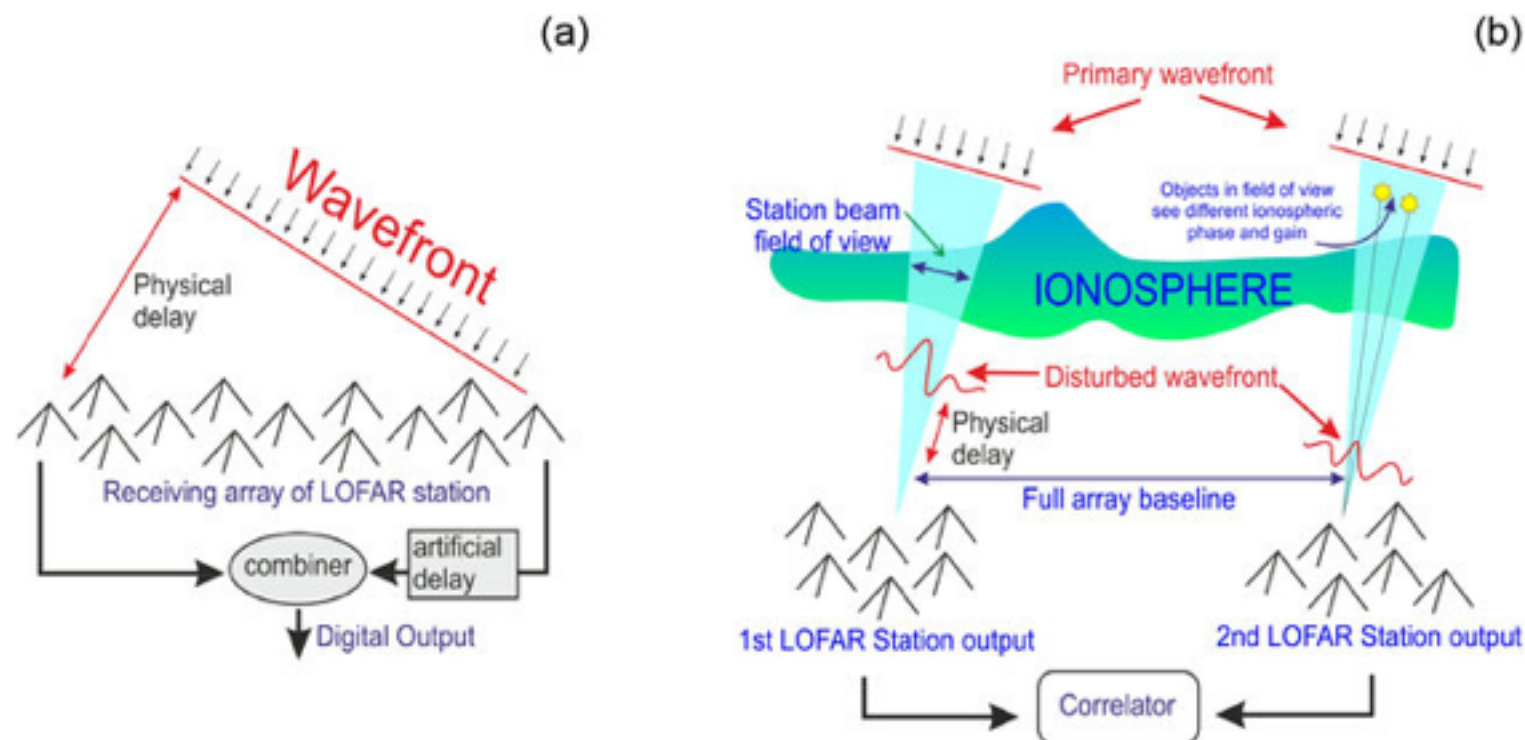
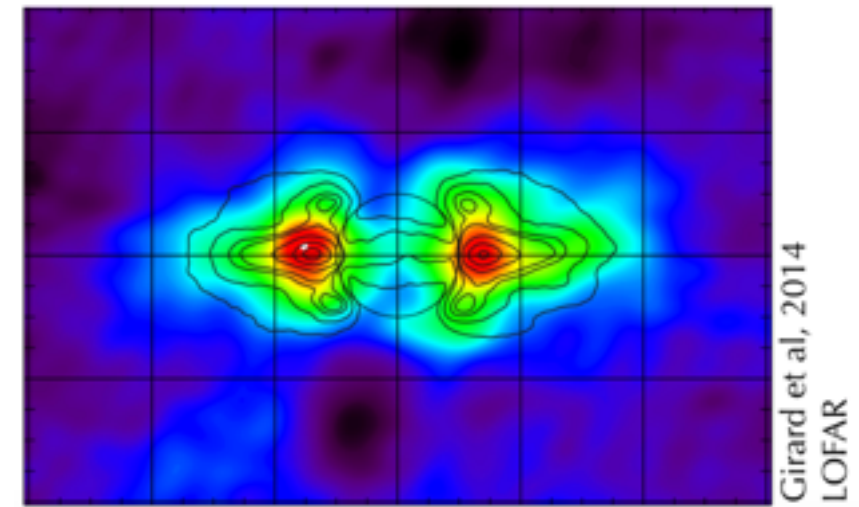


LOFAR



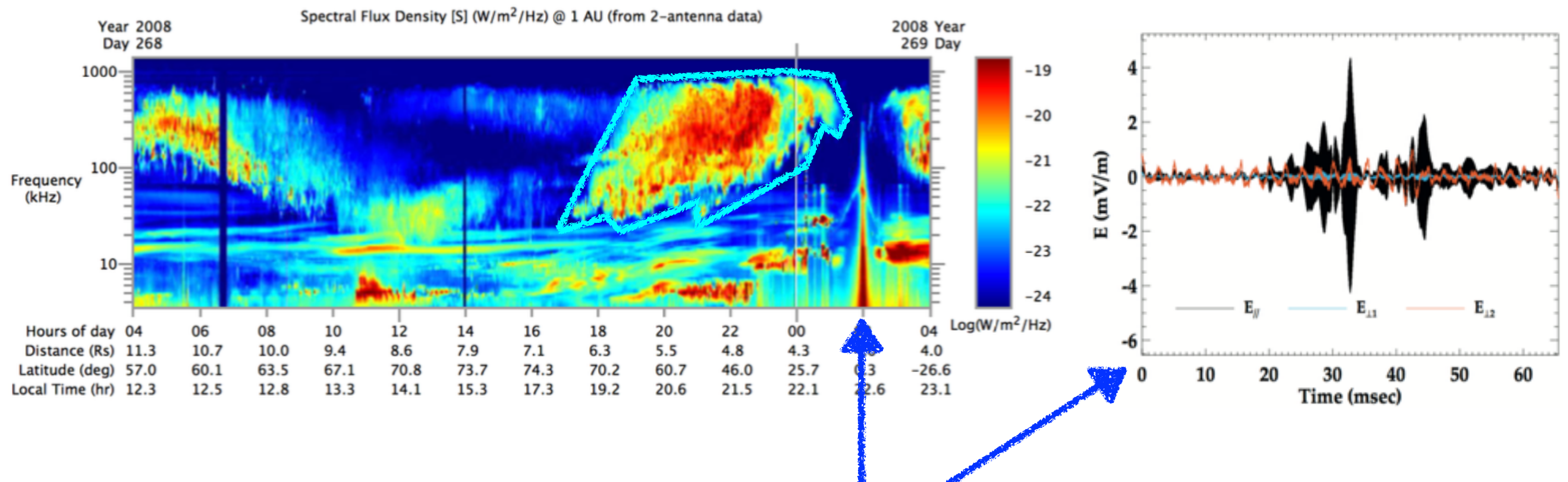
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Data product types

- Mostly **spectrograms (aka dynamic-spectra)**. Measured parameter (flux, polarization...) depending on time and frequency.
- Sometime: “**waveform**” (direct sampling of electric signal temporal fluctuations). Much higher data rate needed.
- also, **events**. timestamp + label + parameters (coverage) + data ? waveform snapshot can be considered as an event.
- and **catalogues** of events/features
- NB: *imaging data not in the scope of MASER*



MASER & EPN-TAP

- MASER (Measuring, Analysing & Simulating Emissions in the Radio range) is offering access to a series of tools and databases related to low frequency radioastronomy (a few kHz to a few 10 MHz).
- MASER web site: <https://maser.lesia.obspm.fr>
- Dedicated TAP servers:
<http://voparis-tap-maser.obspm.fr>
<http://vogate.obs-nancay.fr>
- Gitlab repository for service description:
<https://voparis-gitlab.obspm.fr/vespa/dachs/services/padc/voparis-tap-maser>

TAP services

- space borne observations (Voyager/PRA, Cassini/RPWS, Wind/Waves, STEREO, Juno...),
- ground based observations (NenuFAR, NDA, LOFAR-FR606, ORFEES, NRH, RadioJOVE...)
- catalogues (TFCat)
- simulations (ExPRES)

		voyager_pra		Maintainer
		stereo_waves		Maintainer
		tfcats		Maintainer
		wind_waves		Maintainer
		expres		Maintainer
		cassini_rpws		Maintainer
		NenuFAR		
		NDA		
		FR606		
		VO-ORFEES		VO EPN-TAP for ORFEES
		VO-NRH		VO EPN-TAP for NRH

Not all RD public yet

Not all on VESPA portal

EPN-TAP service configuration

- DaCHS servers (v2.4, soon v2.5)
- Resource configuration using CustomGrammar (external python script parsing data files), CDFGrammar or ODBCGrammar
- Subjects in IVOA/UAT keywords (not updated in Registry yet)
- Datalink implemented on some services to relate with previews, data streaming interfaces, documentation...

Example with Voyager/PRA collection

VESPA
Virtual European Solar and Planetary Access

Form Query
EPN-TAP Services Custom Service

Main Parameters
Target Name
Target Class
Dataproduct Type
Instrument Host Name
Instrument Name
Processing level
Time
Location
Spectral
Illumination

Back To Services Results
Results in service **voyager_pra**

voyager_pra - Voyager PRA Datasets
Voyager PRA (Planetary Radio Astronomy) Datasets catalog. The dataset are originally published by several data centers: NASA/PDS, NASA/NSSDC, NASA/GSFC, Univ. Iowa and CNES/SERAD.
Credits:
Creators: Baptiste Cecconi
Publisher: Paris Astronomical Data Centre

Show 10 entries
Column visibility Show all Hide all
Select All in current page Reset Selection

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	datalink_url
VG2-U-PRA-3-RDR-LOWBAND-6SEC-V1.0:VG2_URN_PRA_6SEC.TAB	dynamic_spectrum	Uranus	1986-01-19T00:00:00.000	1986-01-31T00:00:00.000	http://maser.obspm.fr/...	http://voparis-tap-m...
VG2-S-PRA-3-RDR-LOWBAND-6SEC-V1.0:PRA_V.TAB	dynamic_spectrum	Saturn	1981-09-08T00:00:45.999	1981-09-28T23:59:08.000	http://maser.obspm.fr/...	http://voparis-tap-m...
VG2-S-PRA-3-RDR-LOWBAND-6SEC-V1.0:PRA_IV.TAB	dynamic_spectrum	Saturn	1981-08-14T00:00:00.000	1981-09-07T23:59:58.000	http://maser.obspm.fr/...	http://voparis-tap-m...
VG2-S-PRA-3-RDR-LOWBAND-6SEC-V1.0:PRA_IITAB	dynamic_spectrum	Saturn	1981-07-22T00:00:00.999	1981-08-13T23:59:12.000	http://maser.obspm.fr/...	http://voparis-tap-m...
VG2-S-PRA-3-RDR-LOWBAND-6SEC-V1.0:PRA_IITAB	dynamic_spectrum	Saturn	1981-07-01T00:00:04.000	1981-07-21T23:59:13.000	http://maser.obspm.fr/...	http://voparis-tap-m...
VG2-S-PRA-3-RDR-LOWBAND-6SEC-V1.0:PRA_I.TAB	dynamic_spectrum	Saturn	1981-06-05T00:00:00.000	1981-06-30T23:59:15.999	http://maser.obspm.fr/...	http://voparis-tap-m...
VG2-S-PRA-3-RDR-LOWBAND-6SEC-V1.0:PRA.TAB	dynamic_spectrum	Saturn	1981-06-24T00:00:48.999	1981-08-31T22:05:33.999	http://maser.obspm.fr/...	http://voparis-tap-m...
VG2-N-PRA-3-RDR-LOWBAND-6SEC-V1.0:VG2_NEP_PRA_6SEC	dynamic_spectrum	Neptune	1989-08-11T00:00:00.000	1989-08-31T00:00:00.000	http://maser.obspm.fr/...	http://voparis-tap-m...

Plotting tools
TOPCAT
Aladin
SPLAT
CASSIS
3DView

Example queries
Saturn in March 2012

Help
Help

Table links

Where?	Description	What?
Link	Data Product	#this VG2-U-PRA-3-RDR-LOWBAND-6SEC-V1.0:
Link	Label File	#documentation VG2-U-PRA-3-RDR-LOWBAND-6SEC-V1.0:VG2_URN_PRA_6SEC.TAB
Link	Data Collection repository	#parent VG2-U-PRA-3-RDR-LOWBAND-6SEC-V1.0:V

Index of /data/voyager/pr/PDS/VG2-U-PRA-3

Name	Last modified	Size	Description
Parent Directory	-	-	-
AAREADME.TXT	2013-02-06 10:40	15K	
CATALOG/	2013-02-06 11:12	-	
CHECKSUMS.TXT	2020-04-19 18:15	2.5K	
DATA/	2013-02-06 11:12	-	
DOCUMENT/	2013-02-06 11:12	-	
ERRATA.TXT	2012-02-03 09:51	6.0K	

Example with NDA collection

VESPA

Virtual European Solar and Planetary Access

Form

Query

EPN-TAP Services

Custom Service

Main Parameters

Target Name

Target Class

Dataproduct Type

Instrument Host Name

Instrument Name

Processing level

Time

Location

Spectral

Illumination

Data Reference

Submit

Reset

Afficher un menu

Back To Services Results

Results in service NDA Obs. Database

NDA Obs. Database - Nancay Decameter Array observation database

Dynamic Spectra of the Routine observation of Jupiter with the Nancay Decameter Array. This dataset contains two series of dynamic spectra recorded on each of the Nancay decameter sub-arrays (i.e. on Left Hand and Right Hand Polarization). The receiver is sampling from 10 MHz to 40 MHz with 75 kHz steps on the spectral axis. It records one spectrum every second on each polarization. The list of observation frequencies is provided.

Credits:
Creators: Baptiste Cecconi
Contributors: Andrée Coffre, Emmanuel Théas, PADC
Publisher: Station de Radioastronomie de Nançay (SRN)

Show 50 entries

Column visibility

Show all

Hide all

Select All in current page

Reset Selection

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	datalink
S991231_cdf	dynamic_spectrum	Sun	1999-12-31T07:54:05.290	1999-12-31T14:40:59.390	http://realtime.obs-...	SEND
S991230_cdf	dynamic_spectrum	Sun	1999-12-30T08:01:00.189	1999-12-30T14:43:59.240	http://realtime.obs-...	SEND
S991229_cdf	dynamic_spectrum	Sun	1999-12-29T07:57:00.159	1999-12-29T14:47:59.209	http://realtime.obs-...	SEND
S991228_cdf	dynamic_spectrum	Sun	1999-12-28T07:57:00.170	1999-12-28T14:51:58.749	http://realtime.obs-...	SEND
S991227_cdf	dynamic_spectrum	Sun	1999-12-27T08:59:00.239	1999-12-27T14:55:59.310	http://realtime.obs-...	SEND
S991226_cdf	dynamic_spectrum	Sun	1999-12-26T07:52:05.290	1999-12-26T14:59:59.369	http://realtime.obs-...	SEND
S991225_cdf	dynamic_spectrum	Sun	1999-12-25T07:51:05.240	1999-12-25T15:03:59.280	http://realtime.obs-...	SEND

Plotting tools

TOPCAT

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3DView

Example queries

Saturn in March 2012

Help

Help

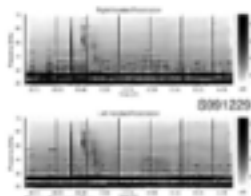
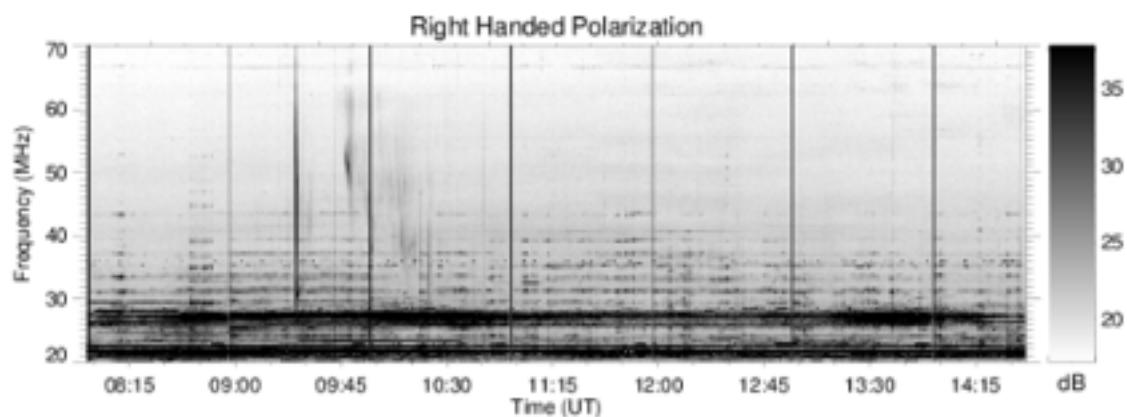
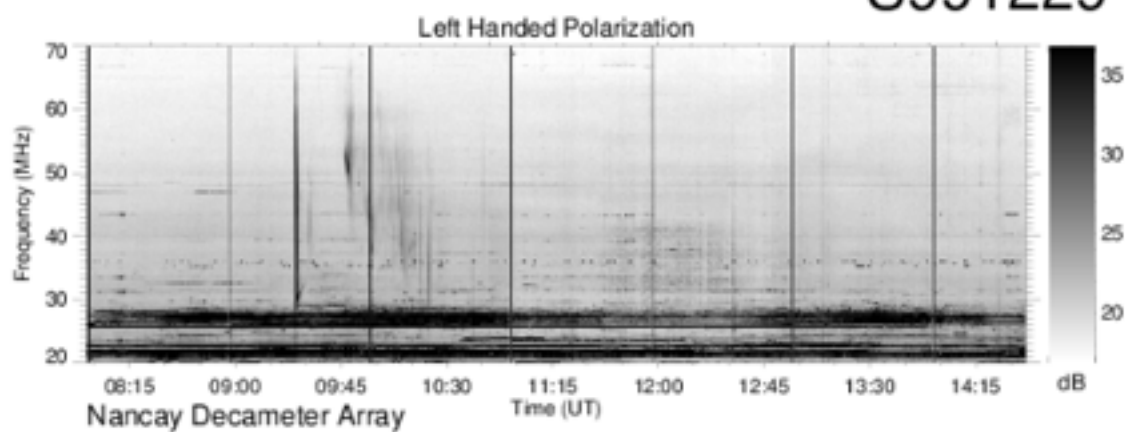


Table links

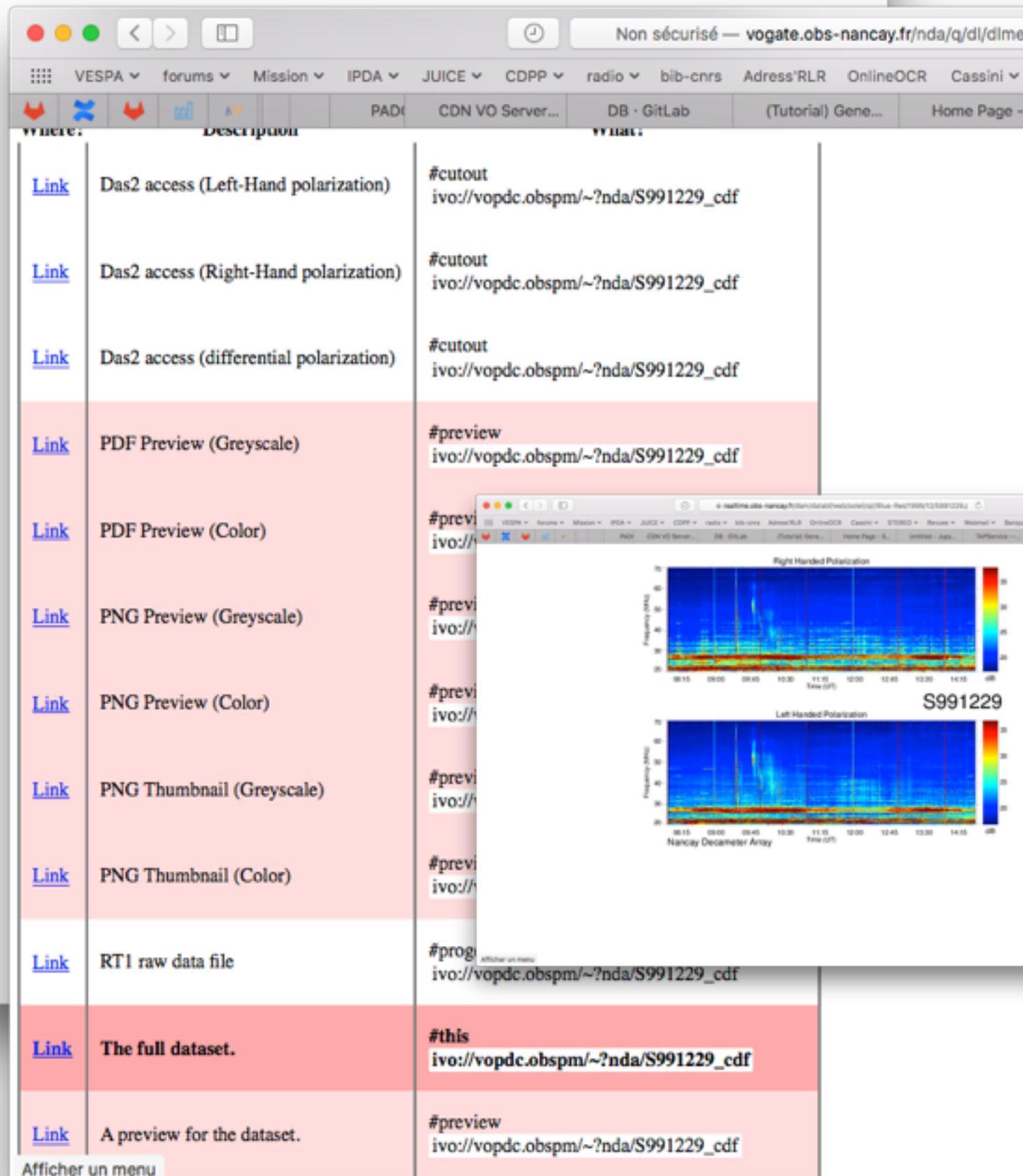


S991229



Where?	Description	What?
Link	Das2 access (Left-Hand polarization)	#cutout ivo://vopdc.obspm/~?nda/S991229_cdf
Link	Das2 access (Right-Hand polarization)	#cutout ivo://vopdc.obspm/~?nda/S991229_cdf
Link	Das2 access (differential polarization)	#cutout ivo://vopdc.obspm/~?nda/S991229_cdf

Afficher un menu



Example with NDA collection (target_name=Jupiter)

VESPA

Virtual European Solar and Planetary Access

Form

Query

EPN-TAP Services

Custom Service

Main Parameters

Target Name

Jupiter

Target Class

Dataproduct Type

Instrument Host Name

Instrument Name

Processing level

Time

Location

Spectral

Illumination

Data Reference

Submit

Reset

Afficher un menu

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Show 10 entries

Column visibility

Show all

Hide all

Select All in current page

Reset Selection

granule_uid	dataproduct_type	target_name	time_min (d)	time_max (d)	access_url	datalink
J991231_cdf	dynamic_spectrum	Jupiter	1999-12-31T14:48:00.219	1999-12-31T22:47:59.280	http://realtime.obs-...	SEND
J991230_cdf	dynamic_spectrum	Jupiter	1999-12-30T14:51:00.199	1999-12-30T22:50:59.259	http://realtime.obs-...	SEND
J991229_cdf	dynamic_spectrum	Jupiter	1999-12-29T14:55:00.090	1999-12-29T22:54:59.140	http://realtime.obs-...	SEND
J991228_cdf	dynamic_spectrum	Jupiter	1999-12-28T14:59:00.169	1999-12-28T22:58:59.240	http://realtime.obs-...	SEND
J991227_cdf	dynamic_spectrum	Jupiter	1999-12-27T15:03:00.170	1999-12-27T23:02:59.259	http://realtime.obs-...	SEND
J991226_cdf	dynamic_spectrum	Jupiter	1999-12-26T15:07:00.150	1999-12-26T19:07:09.199	http://realtime.obs-...	SEND
J991225_cdf	dynamic_spectrum	Jupiter	1999-12-25T15:11:00.180	1999-12-25T23:10:59.229	http://realtime.obs-...	SEND

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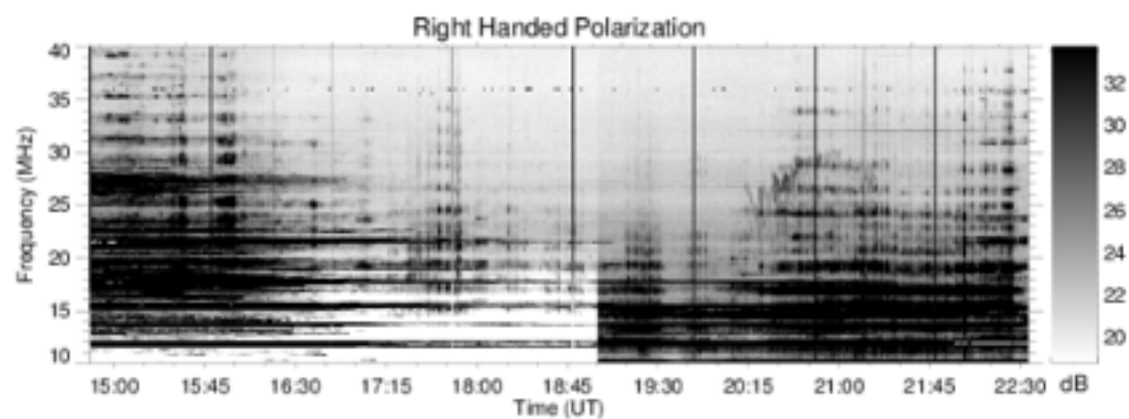
Example queries

Saturn in March 2012

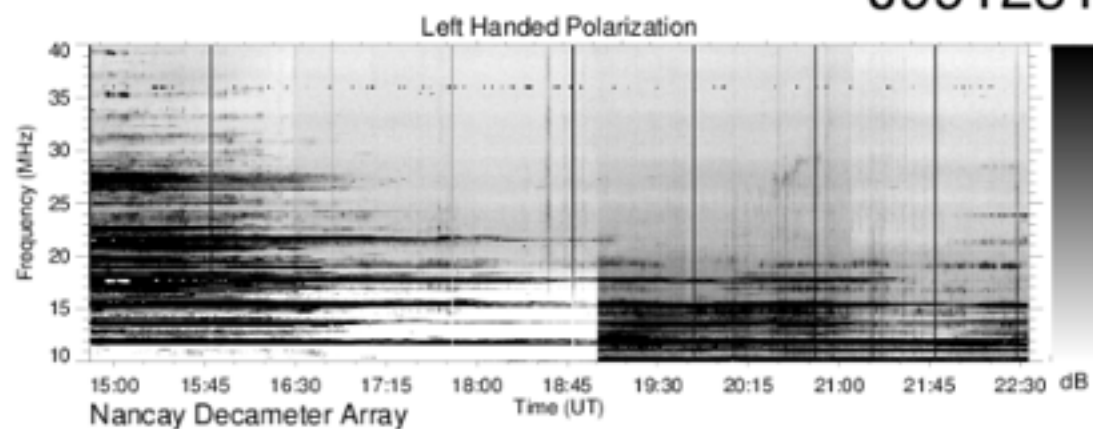
Help

Help

Table links

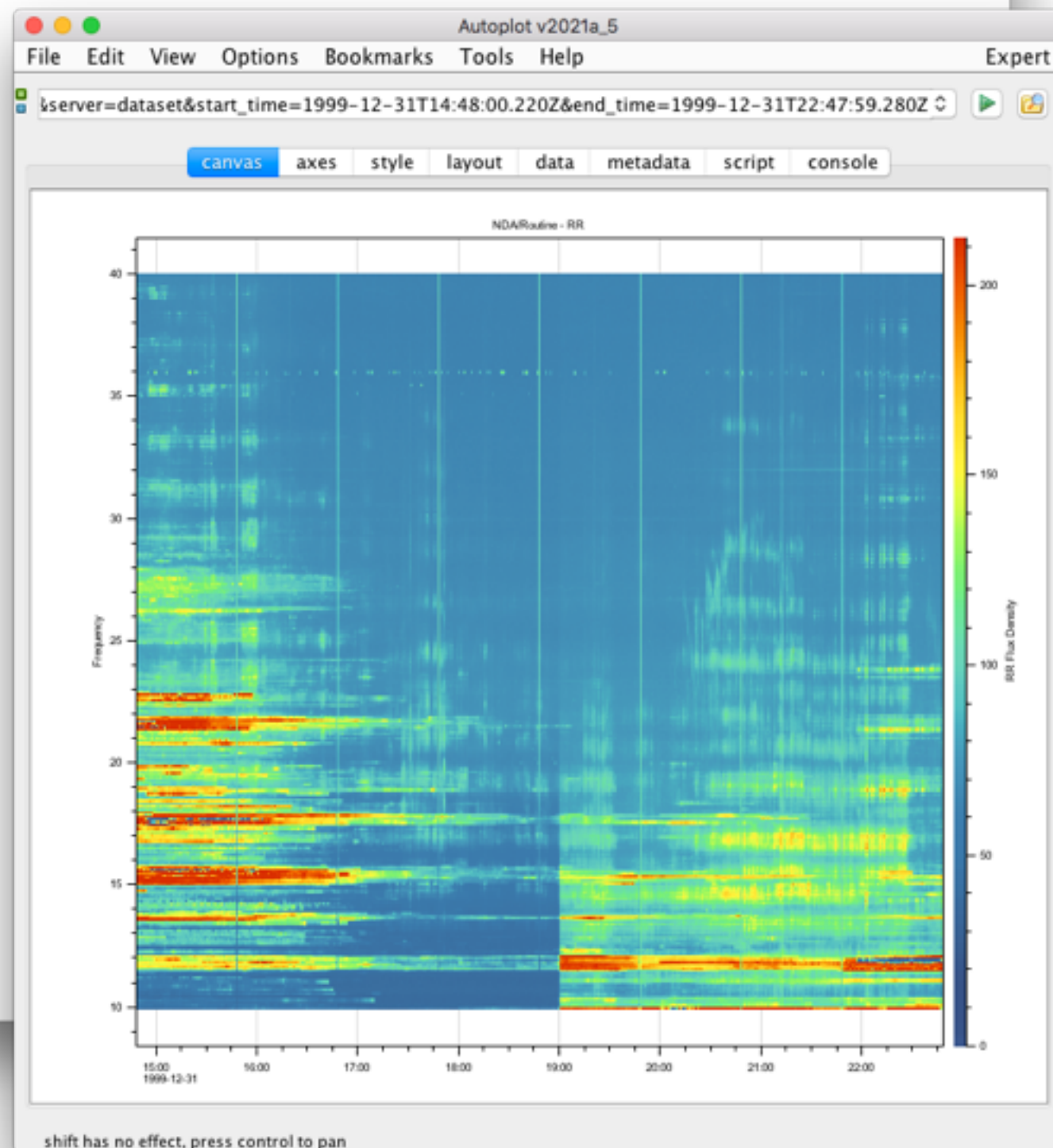


J991231



Where?	Description	What?
Link	Das2 access (Left-Hand polarization)	#cutout ivo://vopdc.obspm/~?nda/J991231_cdf
Link	Das2 access (Right-Hand polarization)	#cutout ivo://vopdc.obspm/~?nda/J991231_cdf
Link	Das2 access (differential polarization)	#cutout ivo://vopdc.obspm/~?nda/J991231_cdf

Afficher un menu

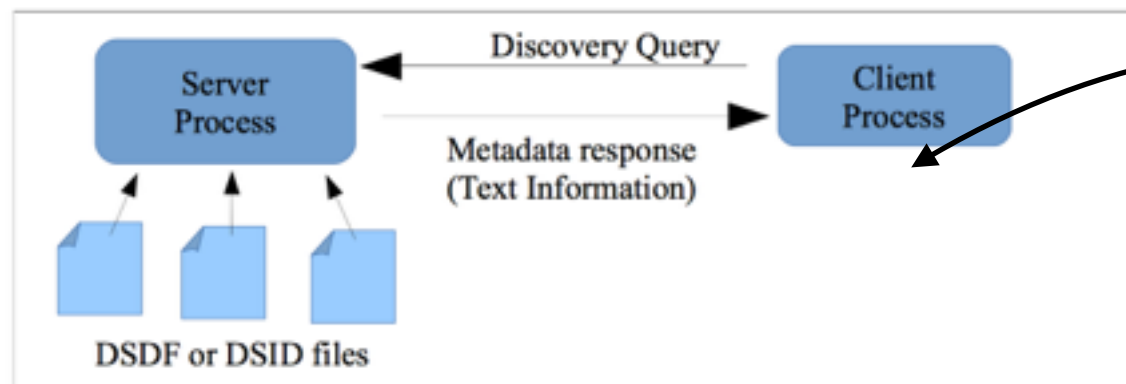


Autoplot

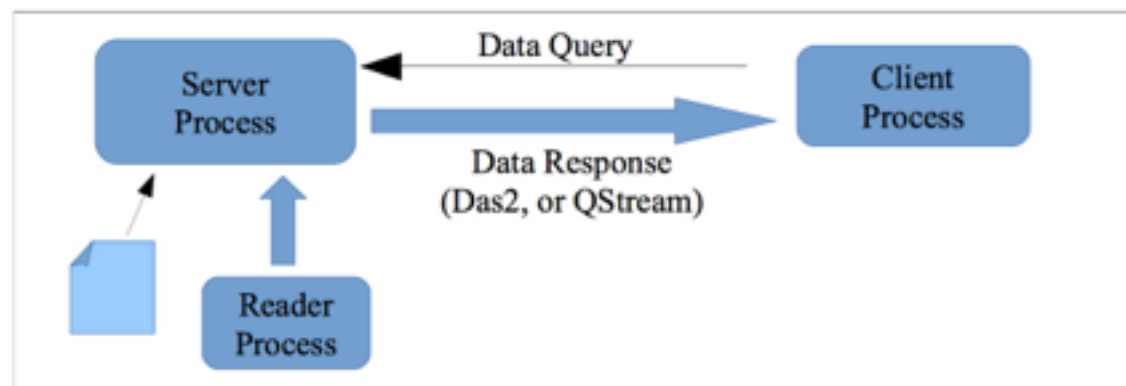
Data on demand

- **Large data rate or long times intervals**
=> need for optimized client/server distribution system.
- Existing solution developed by University of Iowa (USA):
server=**Das2** (<http://das2.org>) and client=**Autoplot** (<http://autoplot.org>)
- **Built for space data** (low data rate), but capable of serving long **resampled** times series.
Tested with success on ground Nançay datasets: adapted also for ground based high data rate collections.
- Very simple configuration:
data collection description files + data reader that produces “das2stream” formatted data.
- Implemented on LESIA, CDPP, and Nançay data collections (using the Maser4py modules):
 - LESIA: <http://voparis-maser-das.obspm.fr/das2/server>
 - Nançay: <https://das2server.obs-nancay.fr/das2/server>

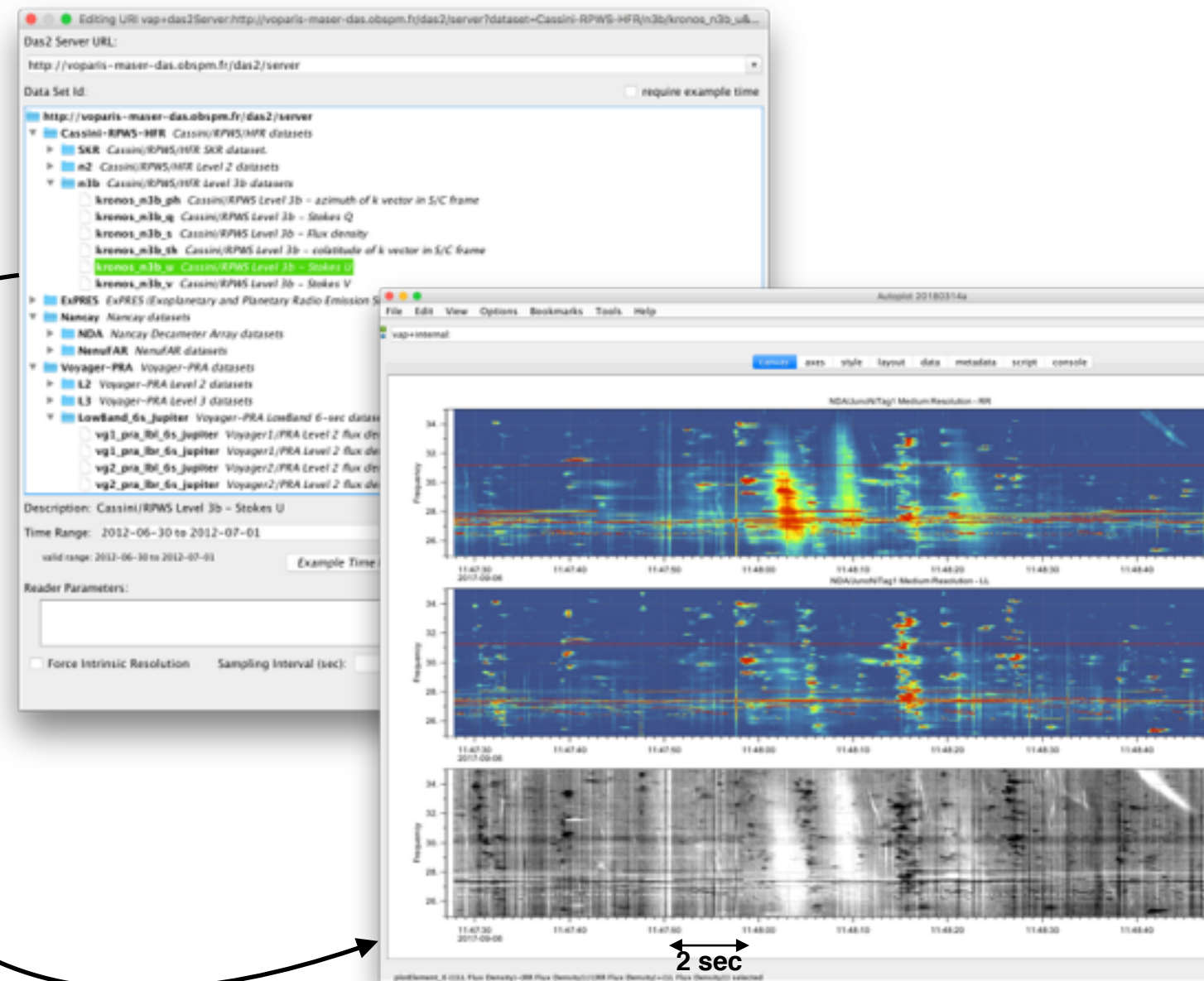
Das2 / Autoplot process



Discovery Query Information Flow



Data Query Information Flow



NDA/JunoN dataset (3TB/day)

- Das2 = **data distribution** system for time series + **on demand resampling** (averaging on the fly).
HTTP REST Query: data collection + time interval + temporal resolution

Time-Frequency Catalogue Model & Format

- **Why?**

In low frequency radio astronomy, *spectro-temporal* (aka *time-frequency*) features are key for science analysis.

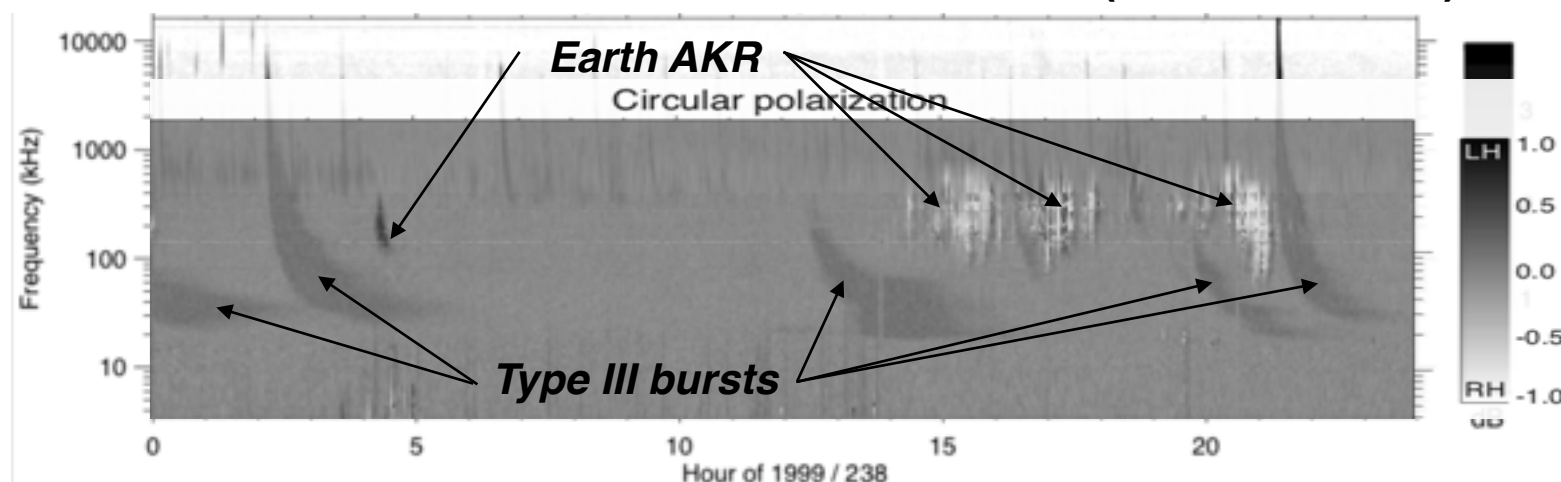
- **Features:**

- planetary emissions (auroral, lightnings...)
- solar emissions

- **Geometries:**

- contour of feature (polygon, points...)
- skeleton line / shape of feature (line, points)

Solar bursts + Earth AKR emissions (Cassini/RPWS)



Jupiter DAM emissions (Nançay/NDA)

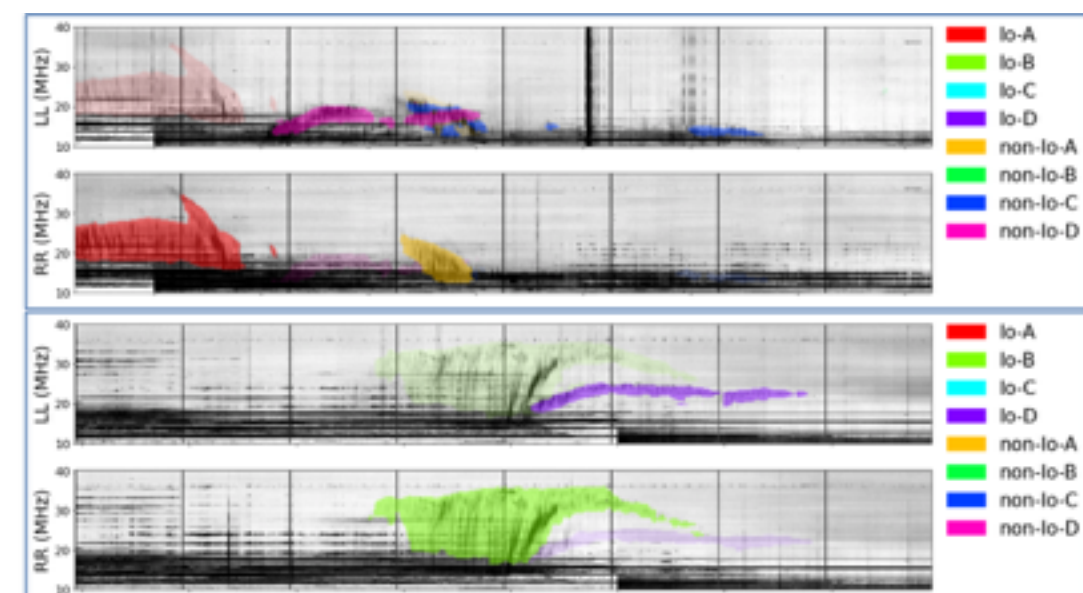


Figure 4. Spectrogrammes radio du NDA annotés, avec (en haut) le catalogue publié (Marques et al. 2017), (au milieu) les événements reconstruits pour la même observation, et (en bas), de nouveaux événements sur une observation récente (hors du catalogue d'entraînement).

TFCat Model

- A **TF-geometry** is a geometry (point, line-string, polygon, multi-points, multi-line-strings, multi-polygon), with coordinates in time and frequency (or wavelength, or wavenumber, or energy).
- The **catalogue contains a list of features**, with a TF-geometry (or a set of geometries), and parameters.
- The **catalogue contains a definition of the features additional properties**, with data type, description, unit, UCD, etc.
- The **catalogue contains a set of global properties**, at catalogue level, with data type, description, unit, UCD, etc.
- The **catalogue contains a description of the CRS** (coordinate reference system) defining the temporal and spectral axes, as well as the frame reference position.

TFCat current implementation

- **Based on GeoJSON**, a catalogue model & format for geo-referenced shapes (on Earth, with lat-long coordinates).
- **Specification:**
<https://gitlab.obspm.fr/maser/catalogues/catalogue-format/-/blob/master/json/spec.md>
- JSON Schema coming soon (and validator in STILTS?)
- Implementation in Python reusing GeoJSON python library
- **With astronomy standards** when applicable:
 - Using IVOA vocabularies (UCD, VOUnits...) as much as possible
 - *STC1*: no support for *complex spectro-temporal geometries** / *STC2*: the same
 - *VOTable*: no support for *complex spectro-temporal geometries**
 - Use of TAP for distributing and searching?
 - Geometry in TAP and ADQL?
 - *Datalink* to link catalogue of feature to catalogue of observation?
 - Export to *Astropy* table: ok, possible for complex geometries (as objects)

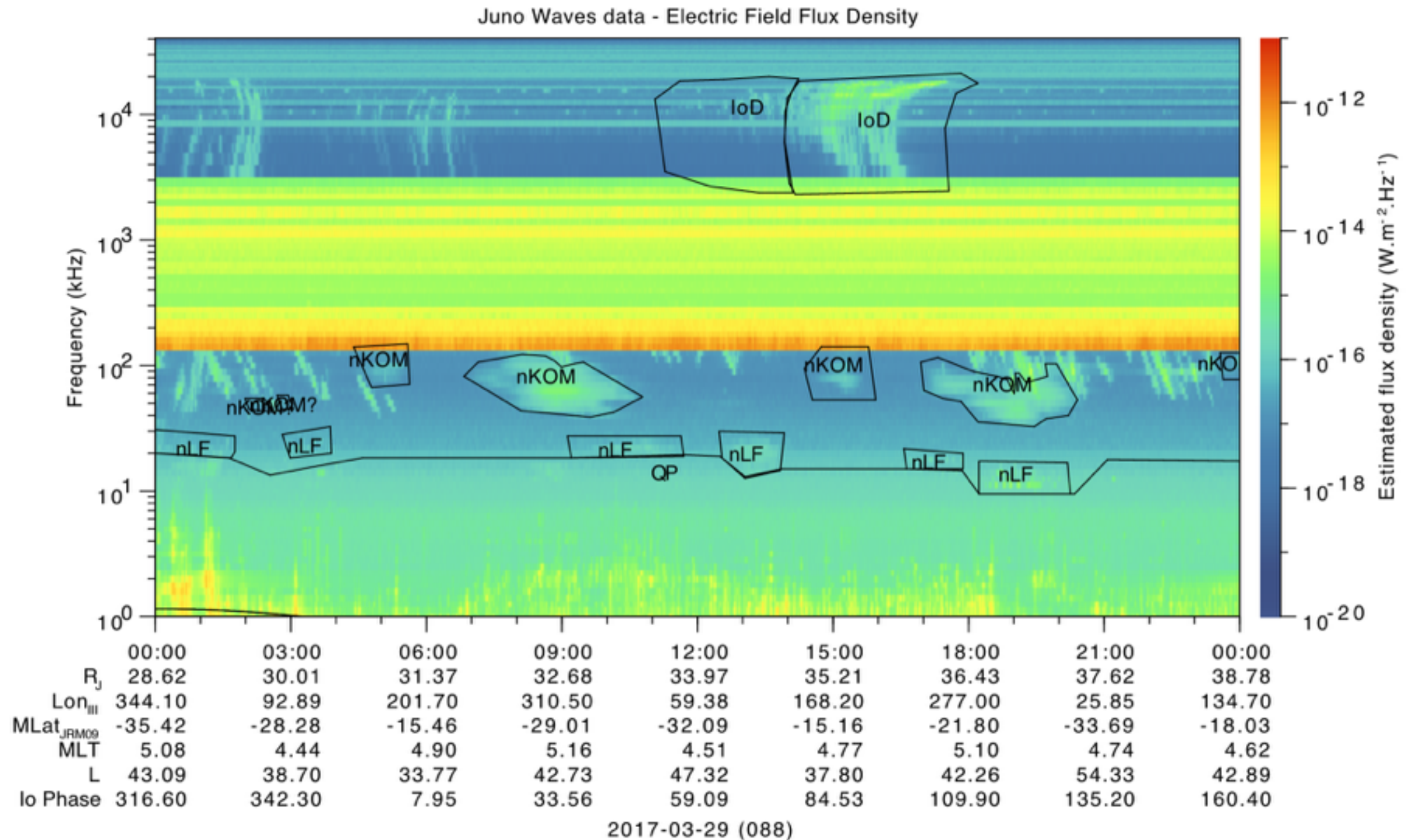
NB: *complex spectro-temporal geometries* = something else than a point or a bounding box

TFCat + TAP exploration

- 1 Feature per row, Geometry as JSON string, Feature mapped properties into columns
- JSON-string allows to keep all information (geometry type, CRS, coordinates) of Feature for future use.

Id	Time_start	Time_end	Freq_min [Hz]	Freq_max [Hz]	Geometry_type	Geometry	Quality	Area [s.Hz]	Nop
						Geometry <pre>{ "type": "Feature", "crs": { "name": "Time-Frequency", "properties": { "time_coords": { "id": "unix", "name": "Timestamp (Unix Time)", "unit": "s", "time_origin": "1970-01-01T00:00:00.000Z", "time_scale": "TT" }, "spectral_coords": { "name": "Frequency", "unit": "Hz", "ref_position": { "id": "Cassini" } } } }, "geometry": { "type": "MultiPoint", "coordinates": [[1158051858.75, 24730.0], [1158051874.75, 24730.0], [1158051890.75, 24730.0], [1158051890.75, 25318.0], [1158051906.75, 25318.0], [1158051922.75, 25318.0], [1158051938.75, 25318.0], [1158051954.75, 25920.0], [1158051970.75, 25920.0], [1158051986.75, 25920.0], [1158051986.75, 26536.0], [1158051986.75, 27167.0], [1158052002.75, 27167.0], [1158052018.75, 27167.0], [1158052034.75, 27167.0], [1158052050.75, 27167.0], [1158052066.75, 27167.0], [1158052082.75, 27167.0], [1158052098.75, 27167.0], [1158052114.75, 27167.0], [1158052130.75, 27167.0], [1158052146.75, 27167.0], [1158052162.75, 27167.0], [1158052178.75, 27167.0], [1158052194.75, 27167.0], [1158052210.75, 27167.0], [1158052226.75, 27167.0], [1158052242.75, 27167.0], [1158052258.75, 27167.0], [1158052274.75, 27167.0], [1158052290.75, 27167.0], [1158052306.75, 27167.0], [1158052322.75, 27167.0], [1158052338.75, 27167.0], [1158052354.75, 27167.0], [1158052370.75, 27167.0], [1158052386.75, 27167.0], [1158052402.75, 27167.0], [1158052418.75, 27167.0], [1158052434.75, 27167.0], [1158052450.75, 27167.0], [1158052466.75, 27167.0], [1158052482.75, 27167.0], [1158052498.75, 27167.0], [1158052514.75, 27167.0], [1158052530.75, 27167.0], [1158052546.75, 27167.0], [1158052562.75, 27167.0], [1158052578.75, 27167.0], [1158052594.75, 27167.0], [1158052610.75, 27167.0], [1158052626.75, 27167.0], [1158052642.75, 27167.0], [1158052658.75, 27167.0], [1158052674.75, 27167.0], [1158052690.75, 27167.0], [1158052706.75, 27167.0], [1158052722.75, 27167.0], [1158052738.75, 27167.0], [1158052754.75, 27167.0], [1158052770.75, 27167.0], [1158052786.75, 27167.0], [1158052802.75, 27167.0], [1158052818.75, 27167.0], [1158052834.75, 27167.0], [1158052850.75, 27167.0], [1158052866.75, 27167.0], [1158052882.75, 27167.0], [1158052898.75, 27167.0], [1158052914.75, 27167.0], [1158052930.75, 27167.0], [1158052946.75, 27167.0], [1158052962.75, 27167.0], [1158052978.75, 27167.0], [1158052994.75, 27167.0], [1158053010.75, 27167.0], [1158053026.75, 27167.0], [1158053042.75, 27167.0], [1158053058.75, 27167.0], [1158053074.75, 27167.0], [1158053090.75, 27167.0], [1158053106.75, 27167.0], [1158053122.75, 27167.0], [1158053138.75, 27167.0], [1158053154.75, 27167.0], [1158053170.75, 27167.0], [1158053186.75, 27167.0], [1158053202.75, 27167.0], [1158053218.75, 27167.0], [1158053234.75, 27167.0], [1158053250.75, 27167.0], [1158053266.75, 27167.0], [1158053282.75, 27167.0], [1158053298.75, 27167.0], [1158053314.75, 27167.0], [1158053330.75, 27167.0], [1158053346.75, 27167.0], [1158053362.75, 27167.0], [1158053378.75, 27167.0], [1158053394.75, 27167.0], [1158053410.75, 27167.0], [1158053426.75, 27167.0], [1158053442.75, 27167.0], [1158053458.75, 27167.0], [1158053474.75, 27167.0], [1158053490.75, 27167.0], [1158053506.75, 27167.0], [1158053522.75, 27167.0], [1158053538.75, 27167.0], [1158053554.75, 27167.0], [1158053570.75, 27167.0], [1158053586.75, 27167.0], [1158053602.75, 27167.0], [1158053618.75, 27167.0], [1158053634.75, 27167.0], [1158053650.75, 27167.0], [1158053666.75, 27167.0], [1158053682.75, 27167.0], [1158053698.75, 27167.0], [1158053714.75, 27167.0], [1158053730.75, 27167.0], [1158053746.75, 27167.0], [1158053762.75, 27167.0], [1158053778.75, 27167.0], [1158053794.75, 27167.0], [1158053810.75, 27167.0], [1158053826.75, 27167.0], [1158053842.75, 27167.0], [1158053858.75, 27167.0], [1158053874.75, 27167.0], [1158053890.75, 27167.0], [1158053906.75, 27167.0], [1158053922.75, 27167.0], [1158053938.75, 27167.0], [1158053954.75, 27167.0], [1158053970.75, 27167.0], [1158053986.75, 27167.0], [1158053998.75, 27167.0], [1158054010.75, 27167.0], [1158054022.75, 27167.0], [1158054034.75, 27167.0], [1158054046.75, 27167.0], [1158054058.75, 27167.0], [1158054070.75, 27167.0], [1158054082.75, 27167.0], [1158054094.</pre>			

TFCat in Autoplot



UWS for run on demand

- ExPRES code (Exoplanetary and Planetary Radio Emission Simulator)
<https://github.com/maserlib/ExPRES>
<https://voparis-uws-maser.obspm.fr/client/jobs/ExPRES> (using OPUS)
- Modelling of the spectro-temporal shape of radio emissions.
- Used in *Cecconi et al., Planet. Space Sci (2021)*
mission planning of JUICE
supplementary material: <https://doi.org/10.25935/8ZFF-NX36>

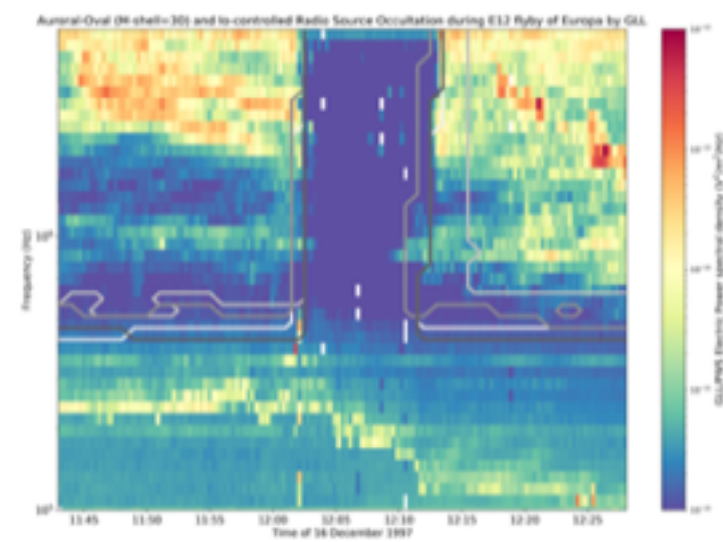
UWS MASER Job List

Job List for: ExPRES-dev

ID	Name	Creation Time	Phase	Job ID	Control
4784a	ExPRES-dev	2021-11-18 17:27:57	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
8821b	ExPRES-dev	2021-11-18 17:28:18	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
7850d	ExPRES-dev	2021-11-18 17:28:40	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
7d88d	ExPRES-dev	2021-11-18 17:28:57	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
4c18ad	ExPRES-dev	2021-11-18 17:29:54	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
1c07f	ExPRES-dev	2021-11-18 17:29:57	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
105a7	ExPRES-dev	2021-11-18 17:29:58	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
1a63a	ExPRES-dev	2021-11-18 17:29:40	ERROR	ExPRES-dev	⌕ ⌕ ⌕
2a43f	ExPRES-dev	2021-08-14 18:10:04	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
179d0	ExPRES-dev	2021-08-14 18:10:28	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
1047a	ExPRES-dev	2021-08-11 12:34:40	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
2a100d	ExPRES-dev	2021-08-18 18:20:47	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
1a188d	ExPRES-dev	2021-08-18 17:52:15	ERROR	ExPRES-dev	⌕ ⌕ ⌕
8008d	ExPRES-dev	2021-08-18 17:48:14	COMPLETED	ExPRES-dev	⌕ ⌕ ⌕
912d47	ExPRES-dev	2021-08-18 17:42:29	ERROR	ExPRES-dev	⌕ ⌕ ⌕

Galileo E12 Flyby

- ▶ [ExPRES data](#) (ExPRES configuration and output)
- ▶ [Cosmographia data](#) (Cosmographia configuration, 'pov' and 'top' movies)



Summary

- MASER: solar system radioastronomy
 - possible extension to transient low frequency radio astronomy (starting of official operation in Jan 2022)
- IVOA integration:
 - EPN-TAP + Datalink 👍
 - search engine for local data management tools
 - data discovery
 - UWS works very well for job on demand
- Community Specific:
 - Das2: data streaming interface for dynamic spectra
 - TFCat for event/feature catalogues