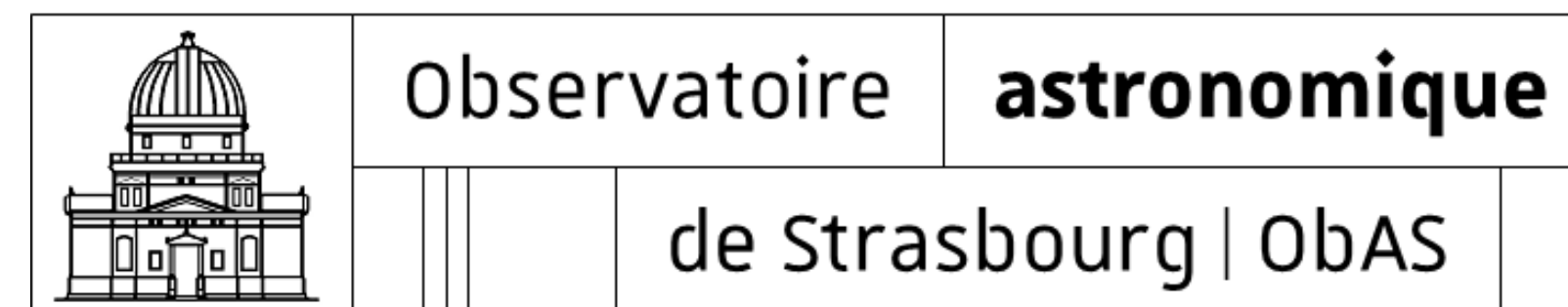


Current Status on ObsCore data model and proposed extensions

VO Working groups involved :
Radio and Time domain IG and Data model WG.

Mireille Louys, F. Bonnarel, and DM WG
CDS and Observatoire de Strasbourg
ICube Laboratory, Strasbourg University



□ ObsCore DM: Context & Goal

- ObsCore Data Model 1.1 specification (2017)
- Common framework for querying data products obtained during an observation process in astronomy
- Designed for data discovery across multiple archives for multi-wavelength search
- Defined from a large set of discovery use-cases
 - <http://saada.unistra.fr/voexamples/show/ObsCore>
- Ex.1: Query Images by Spatial and Spectral Attributes [here](#)
- Ex. 2: Matching images and event lists from different data collections (V1.1) [here](#)
- Ex.3 Search for timeseries [here](#)

IVOA Recommendation

Observation Data Model Core Components and its Implementation in the Table Access Protocol Version 1.1

IVOA Recommendation 09 May 2017

Interest/Working Group:

<http://www.ivoa.net/twiki/bin/view/IVOA/IvoaDataModel>

Author(s):

Mireille Louys, Doug Tody, Patrick Dowler, Daniel Durand, Laurent Michel, Francois Bonnarel, Alberto Micol and the IVOA DataModel working group

Editor(s):

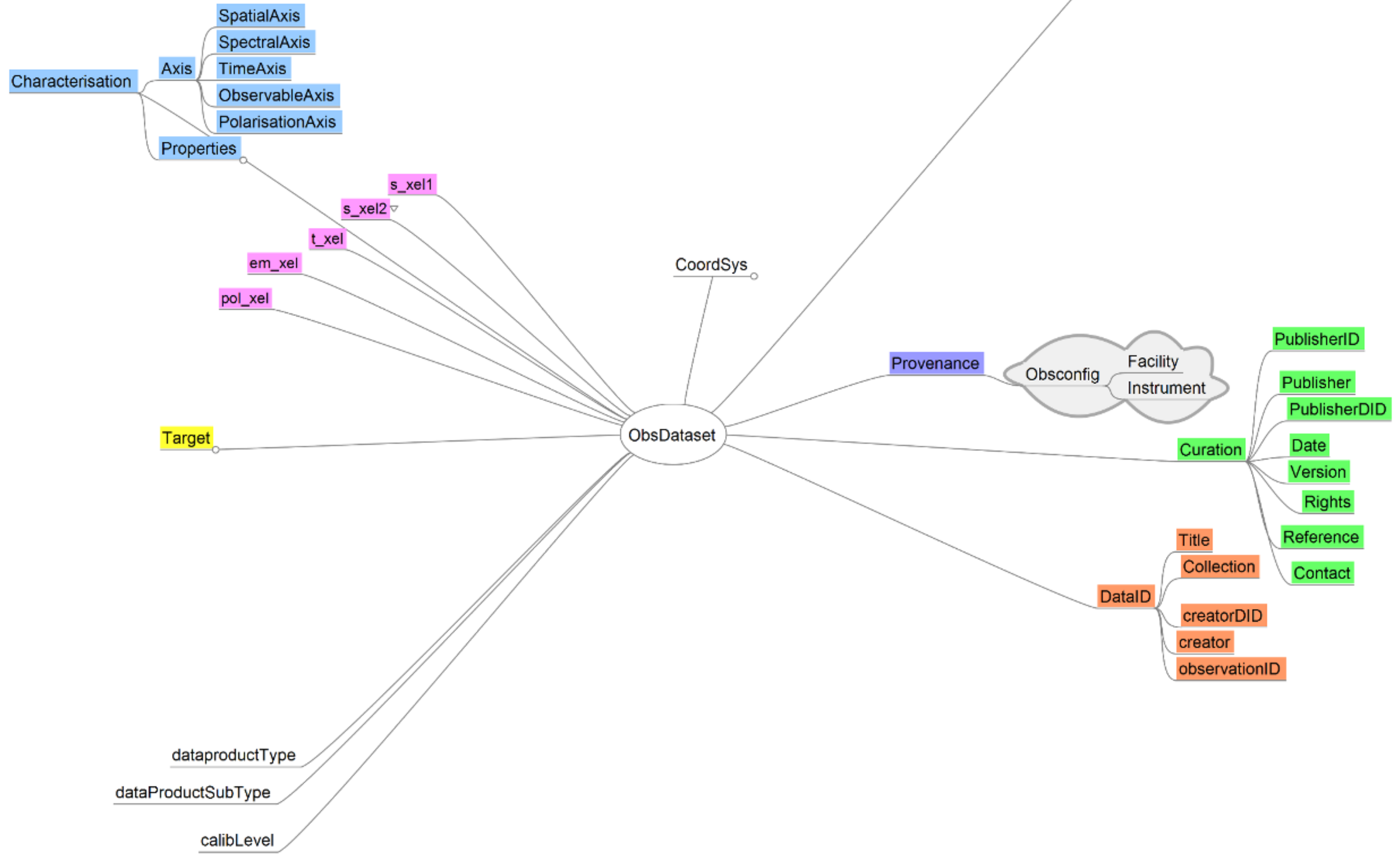
Mireille Louys, Doug Tody, Patrick Dowler, Daniel Durand

DOI:

10.5479/ADS/bib/2017ivoa.spec.0509L

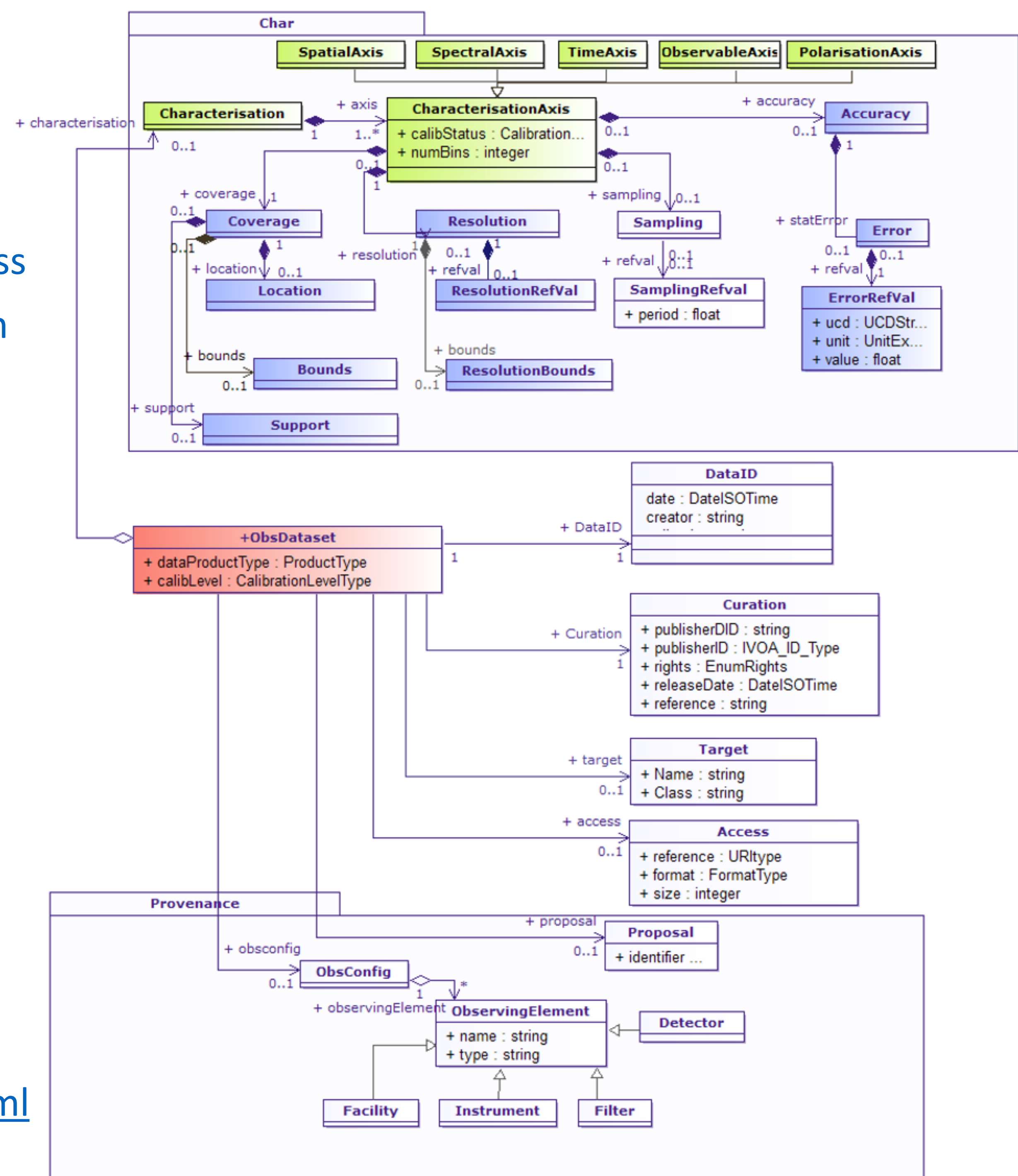
Errata

[3 accepted errata](#) (last change: 2023-11-10)



Data Model

UML class
Diagram



Tap Schema *ivoa.ObSCORE*

Mandatory fields v1.1

<i>Column Name</i>	<i>Datatype</i>	<i>Size</i>	<i>Units</i>	<i>ObsCoreDM Utype</i>	<i>UCD</i>
dataprodect_type	adql:VARCHAR	TBD	NULL	ObsDataset.dataProductType	meta.id
calib_level	adql:INTEGER	NULL	NULL	ObsDataset.calibLevel	meta.code;obs.calib
obs_collection	adql:VARCHAR	TBD	NULL	DataID.collection	meta.id
obs_id	adql:VARCHAR	TBD	NULL	DataID.observationID	meta.id
obs_publisher_did	adql:VARCHAR	TBD	NULL	Curation.publisherDID	meta.ref.url;meta.curation
access_url	adql:CLOB	NULL	NULL	Access.reference	meta.ref.url
access_format	adql:VARCHAR	NULL	NULL	Access.format	meta.code.mime
access_estsize	adql:BIGINT	NULL	kbyte	Access.size	phys.size;meta.file
target_name	adql:VARCHAR	TBD	NULL	Target.name	meta.id;src
s_ra	adql:DOUBLE	NULL	deg	Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C1	pos.eq.ra
s_dec	adql:DOUBLE	NULL	deg	Char.SpatialAxis.Coverage.Location.Coord.Position2D.Value2.C2	pos.eq.dec
s_fov	adql:DOUBLE	NULL	deg	Char.SpatialAxis.Coverage.Bounds.Extent.diameter	phys.angSize;instr.fov
s_region	adql:REGION	NULL		Char.SpatialAxis.Coverage.Support.Area	pos.outline;obs.field
s_resolution	adql:DOUBLE	NULL	arcsec	Char.SpatialAxis.Resolution.Refval.value	pos.angResolution
s_xel1	adql:BIGINT	NULL	NULL	Char.SpatialAxis.numBins1	meta.number
s_xel2	adql:BIGINT	NULL	NULL	Char.SpatialAxis.numBins2	meta.number
t_min	adql:DOUBLE	NULL	d	Char.TimeAxis.Coverage.Bounds.Limits.StartTime	time.start;obs.exposure
t_max	adql:DOUBLE	NULL	d	Char.TimeAxis.Coverage.Bounds.Limits.StopTime	time.end;obs.exposure
t_exptime	adql:DOUBLE	NULL	s	Char.TimeAxis.Coverage.Support.Extent	time.duration;obs.exposure
t_resolution	adql:DOUBLE	NULL	s	Char.TimeAxis.Resolution.Refval.value	time.resolution
t_xel	adql: BIGINT	NULL	NULL	Char.TimeAxis.numBins	meta.number
em_min	adql:DOUBLE	NULL	m	Char.SpectralAxis.Coverage.Bounds.Limits.LoLimit	em.wl;stat.min
em_max	adql:DOUBLE	NULL	m	Char.SpectralAxis.Coverage.Bounds.Limits.HiLimit	em.wl;stat.max
em_res_power	adql:DOUBLE	NULL	NULL	Char.SpectralAxis.Resolution.ResolPower.refVal	spect.resolution
em_xel	adql: BIGINT	NULL	NULL	Char.SpectralAxis.numBins	meta.number
o_ucd	adql:VARCHAR	TBD	NULL	Char.ObservableAxis.ucd	meta.ucd
pol_states	adql:VARCHAR	TBD	NULL	Char.PolarizationAxis.stateList	meta.code;phys.polarization
pol_xel	adql: BIGINT	NULL	NULL	Char.PolarizationAxis.numBins	meta.number
facility_name	adql:VARCHAR	NULL	NULL	Provenance.ObsConfig.Facility.name	meta.id;instr.tel
Instrument_name	adql:VARCHAR	NULL	NULL	Provenance.ObsConfig.Instrument.name	meta.id;instr

ivoa.Obsolete extension

Optional fields

Column Name	Datatype	Size	Units	ObsCoreDM Utype	UCD
dataprodect_subtype	adql:VARCHAR	TBD	NULL	ObsDataset.dataProductSubtype	meta.id
target_class	adql:VARCHAR	TBD	NULL	Target.class	src.class
obs_creation_date	adql:TIMESTAMP	NULL	NULL	DataID.date	time;meta.dataset
obs_creator_name	adql:VARCHAR	TBD	NULL	DataID.creator	meta.id
obs_creator_did	adql:VARCHAR	TBD	NULL	DataID.creatorDID	meta.id
obs_title	adql:VARCHAR	200	NULL	DataID.title	meta.title;obs
publisher_id	adql:VARCHAR	TBD	NULL	Curation.publisherID	meta.ref.url;meta.curation
bib_reference	adql:VARCHAR	TBD	NULL	Curation.reference	meta.bib.bibcode
data_rights	adql:VARCHAR	NULL	NULL	Curation.rights	meta.code
obs_release_date	adql:TIMESTAMP	NULL	NULL	Curation.releaseDate	time.release
s_ucd	adql:VARCHAR	NULL	NULL	Char.SpatialAxis.ucd	meta.ucd
s_unit	adql:VARCHAR	NULL	NULL	Char.SpatialAxis.unit	meta.unit
s_resolution_min	adql:DOUBLE	NULL	arcsec	Char.SpatialAxis.Resolution.Bounds.Limits.LoLimit	pos.angResolution;stat.min
s_resolution_max	adql:DOUBLE	NULL	arcsec	Char.SpatialAxis.Resolution.Bounds.Limits.HiLimit	pos.angResolution;stat.max
s_pixel_scale	adql:DOUBLE	NULL	arcsec	Char.SpatialAxis.Sampling.RefVal.SamplingPeriod	phys.angSize;instr.pixel
s_calib_status	adql:VARCHAR	NULL	NULL	Char.SpatialAxis.calibrationStatus	meta.code.qual
s_stat_error	adql:DOUBLE	NULL	arcsec	Char.SpatialAxis.Accuracy.StatError.Refval.value	stat.error;pos.eq
t_calib_status	adql:VARCHAR	NULL	NULL	Char.TimeAxis.calibrationStatus	meta.code.qual
t_stat_error	adql:DOUBLE	NULL	s	Char.TimeAxis.Accuracy.StatError.Refval.value	stat.error;time
em_ucd	adql:VARCHAR	NULL	NULL	Char.SpectralAxis.ucd	meta.ucd
em_unit	adql:VARCHAR	NULL	NULL	Char.SpectralAxis.unit	meta.unit
em_calib_status	adql:VARCHAR	NULL	NULL	Char.SpectralAxis.calibrationStatus	meta.code.qual
em_res_power_min	adql:DOUBLE	NULL	NULL	Char.SpectralAxis.Resolution.ResolPower.LoLimit	spect.resolution;stat.min
em_res_power_max	adql:DOUBLE	NULL	NULL	Char.SpectralAxis.Resolution.ResolPower.HiLimit	spect.resolution;stat.max
em_resolution	adql:DOUBLE	NULL	m	Char.SpectralAxis.Resolution.Refval.value	spect.resolution;stat.mean
em_stat_error	adql:DOUBLE	NULL	m	Char.SpectralAxis.Accuracy.StatError.Refval.value	stat.error;em
o_unit	adql:VARCHAR	NULL	NULL	Char.ObservableAxis.unit	meta.unit
o_calib_status	adql:VARCHAR	NULL	NULL	Char.ObservableAxis.calibrationStatus	meta.code.qual
o_stat_error	adql:DOUBLE	NULL	o_unit	Char.ObservableAxis.Accuracy.StatError.Refval.value	stat.error;phot.flux
proposal_id	adql:VARCHAR	NULL	NULL	Provenance.Proposal.identifier	meta.id; obs.proposal

□ Limits of ObsCore 1.1

- Many ObsTAP services are running today for very large or small data collections f.i GAVO, CADC, ESO, Heasarc, IPAC, etc .
- But some domains require adjusted metadata for data selection
 - Depending on spectral domains : [radio](#), [high energy](#)
 - For finer description on some physical axes:
 - [time](#), [polarimetry](#) axes are not detailed in ObsCore 1.1



□ ObsCore1.1 regular search for time series

- What do I need in terms of time properties to query for a time series dataset?
- ObsCore 1.1 can provide simple search using the mandatory features

Use case example :

Give me a light curve from an ObsTap service satisfying such constraints :

—> ivoa dataproducttype vocabulary :

<https://www.ivoa.net/rdf/product-type/2024-03-22/product-type.html>

- data type is 'light curve'
- belongs to ZTF survey
- taken around position ra1, dec1
- taken between [date1 date2]
- contains more than 10 time stamps
- Time Interval > 1 week
- *dataproduct_type* == 'light-curve'
- *obs_collection* == 'ZTF'
- *s_region* contains (ra1,dec1)
- *obs_date* in [date1 date2]
- *t_xel* > 10
- *t_max* - *t_min* > 7 (days)

NB: see more Time related use cases in ObsCore standard document (appendix) and on the website <http://saada.unistra.fr/voexamples/show/ObsCore/>



□ Extension for Time series

- Part of a mandate from Time Domain interest group
- Consider more time sampled data product types than *dataproduuct_type == time series*
 - ivoa.net/rdf/product-type defines more types today:
 - light-curve, time-cube, dynamic-spectrum etc.
- Details on time sampling
- Indicate Time reference frame
- Working draft in progress for this specification
<https://github.com/ivoa-std/ObscoreTimeExtension>
- It identifies and explains the elements needed
- Not yet included in a TAP_SCHEMA



International
Virtual
Observatory
Alliance

ObsCore Metadata Extension for Time Properties

Version 1.0

IVOA Working Draft 2024-07-17

Working Group
DM

This version

<https://www.ivoa.net/documents/ObscoreTimeExtension/20240717>

Latest version

<https://www.ivoa.net/documents/ObscoreTimeExtension>

Previous versions

This is the first public release

Author(s)

Mireille Louys, François Bonnarel, Vincenzo Galluzzi, Baptiste Cecconi, Ada Nebot

Editor(s)

Mireille Louys



Time features available in ObsCore 1.1 (current version)

ObsCore metadata	Definition	Utype (Characterisation DM based)	UCD	Units	Mandatory/ optional
t_min	Time start of the sequence (MJD)	Char.TimeAxis.Coverage.Bounds.Limits.LoLim	time.start;obs.sequence	d	man
t_max	Time end of the sequence	Char.TimeAxis.Coverage.Bounds.Limits.HiLim	time.end;obs.sequence	d	man
t_exptime	Exposure time (sum of multiple exposures)	Char.TimeAxis.Support.Extent	time.duration;obs.exposure	s	man
t_resolution	Minimal interpretable time difference	Char.TimeAxis.Resolution.Refval	time.resolution	s	man
t_xel	Number of time stamps in the series	Char.TimeAxis.numBins	meta.number	null	man

□ Time sampling features to add to ObsCore

tObs metadata	Definition	Utype/datamodel path	UCD	Units	Mandatory/ optional
%minimal and maximal sample duration . The estimation of signal to noise signal (SNR) can be derived from this.					
t_exp_min t_sample_extent_min	minimal length of time sample (min integration time)	Char.TimeAxis.Sampling.Extent.lo Lim	time.duration;obs.sequence ;stat.min.	s	opt
t_exp_max t_sample_extent_max	maximal length of time sample (max integration time)	Char.TimeAxis.Sampling.Extent.hi Lim	time.duration;obs.sequence ;stat.max	s	opt
%time space between 2 time samples / cadence					
t_delta_min	minimal length of time interval between 2 observations / cadence (min)	Char.TimeAxis.Sampling.Period.lo Lim	time.interval;obs.sequence; stat.min.	s	opt
t_delta_max	maximal length of time interval between 2 observations / cadence (max)	Char.TimeAxis.Sampling.Period.hi Lim	time.interval;obs.sequence; stat.max	s	opt
t_fold	folding period length		time.period	s	opt
t_fold_phase_reference	Time stamp of folding start		meta.ref;time.phase	s	opt

Time Coordinate System for Data

- The datasets description in Obscore 1.1 does not constrain to use one specific TIME coordinate system for the data.
- In VOTable, the data representation in the time series data rely on a TIMESYS element.
- Is it useful to query on it ?
- At least it is useful to get this in the query response and let a client application prepare time coordinates' conversion if needed

add to time
extension table

ivoa.t_obs	Definition	VODML-ID IN Coords DM and TIMESYS attribute	UCD	Units	Mandatory/ optional	Query setup
% Time Coordinate system						
t_origin	Time(frame origin)	TimeOffset.time0 (TBC) timeorigin	time.epoch	null	opt	
t_scale	Time frame scale	TimeFrame.timeScale timescale	time.scale	null	opt	
t_refPosition (barycenter, heliocenter, ...)	Time reference position	TimeFrame.refPosition refposition	<i><u>meta.id</u>:time</i>	null	opt	
t_refDirection (e.g. for solar observations)	Time reference direction	TimeFrame.refDirection refdirection	<i><u>meta.id</u>:time</i>	null	opt	
%Time representation ISOtime , MJD, JD , ...						
t_format	Time representation	TimeMJD, TimeJD, IsoTime not part of TIMESYS	<i><u>meta.id</u>:time</i>	null	opt	MJD



Table 6: Time extension Table Summary.

(a) Time reference frame for searching and comparing temporally sampled datasets.

t-obs attribute	Definition	VODML-ID in Coords DM	TIMESYS attribute	UCD	Units	Status
t_origin	Time frame origin	TimeOffset.time0	timeorigin	time.epoch		man
t_scale	Time frame scale	TimeFrame.timeScale	timescale	time.scale	?	man
t_refPosition	Time reference position	TimeFrame.refPosition	refposition			man
t_refDirection	Time reference direction	TimeFrame.refDirection	refdirection			man
t_format	Time representation			time;meta.code.class	null	man

(b) Sampling properties along Time axis.

Name	Definition	Utype	UCD	Units	Status
t_variant	sub product attached to a time stamp		meta.code.class		opt
t_exp_min	minimal length of time sample (min integration time)	Char.TimeAxis.Sampling.Extent.LoLim	time.duration; obs.sequence;stat.min	s	man
t_exp_max	maximal length of time sample (max integration time)	Char.TimeAxis.Sampling.Extent.HiLim	time.duration; bs.sequence;stat.max	s	man
t_delta_min	minimal length of time interval cadence (min)	Char.TimeAxis.Sampling.Period.LoLim	time.interval; obs.sequence;stat.min	s	man
t_delta_max	maximal length of time interval cadence (max)	Char.TimeAxis.Sampling.Period.HiLim	time.interval; obs.sequence;stat.max	s	man
t_fold_period	folding period length		time.period	d	man
t_fold_phaseReference	time stamp of folding start in time series		meta.ref; time.phase	d	opt

□ More features to add?

- Pulsar data in radio domain
 - Mapping Pulsar datasets to ObsCore Metadata profile: Experience with PSRFITS keywords
 - cf Baptiste Ceconni's presentation at 2021 Interop meeting
<https://wiki.ivoa.net/internal/IVOA/InterOpNov2021Radio/Radio-PSRFITS-ObsCore.pdf>
 - Pulsar data in ObsCore : cf Vincenzo Galluzzi in Tucson Interop
https://wiki.ivoa.net/internal/IVOA/InterOpNov2023TDIG/Pulsar_and_FRB_Radio_Data_Discovery_and_Access.pdf
 - Time axis representation : 'search mode' or 'folded' ?
add *t_fold_period* to distinguish between both : if zero this means it is not folded
- Polarization metadata : currently ObsCore only describes
 - pol_states*: list the kinds of polarization measures present in the data
 - pol_xel*: number of samples along the polarization axes

More polarization features
for data selection?



□ Extension for radio data products

- Charter from the Radio IG Interest Group
<https://wiki.ivoa.net/twiki/bin/view/IVOA/IvoaRadio>
- Include data product type : ‘visibility’ data
- Spatial coverage and resolution vary with frequency
- Spectral resolution stored as ‘em_resolution’ varies with frequency
- Proposed Endorsed Note in progress for this specification
<https://github.com/ivoa-std/ObsCoreExtensionForRadioData>

See details in Mark Kettenis’s presentation.



*International
Virtual
Observatory
Alliance*

IVOA Obscore Extension for Radio data Version 1.0

Proposed Endorsed Note 2025-02-28

Working Group

Data Model Working Group

This version

<https://www.ivoa.net/documents/ObsCoreExtensionForRadioData/20250228>

Latest version

<https://www.ivoa.net/documents/ObsCoreExtensionForRadioData>

Previous versions

Author(s)

François Bonnarel, Mireille Louys, Baptiste Cecconi, Vincenzo Galluzzi, Yan Grange, Mark Kettenis, Mark Lacy, Alan Loh, Mattia Mancini, Peter Teuben, Alessandra Zanicelli

Editor(s)

François Bonnarel, Mark Kettenis, Mireille Louys



Thanks

Comments ?
Questions ?
Ideas ?

