

Proposal to extend ObsCore DM for time resolved datasets

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

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□ Context & Goal

- More and more data collections of time sampled data are distributed nowadays.
- How can we discover time sampled data sets in the VO frame work ?
- The Time domain group had investigated many uses cases in an internal IVOA Note released in 2018.
- cf IVOA Note draft : <https://wiki.ivoa.net/internal/IVOA/TimeSeries/TSSerializationNote.pdf>
- Revisit former work presented at November interoperability meeting in 2020 and iterated after that.
- What do I need in terms of time properties to query for a time series dataset?
- Which are the time related use-cases already supported by the Obscore Data Model 1.1 [specification](#) (2017) ?
- What is missing to discover and select light curves or other time sampled data sets more precisely?



□ ObsCore regular search for time

- Obscore 1.1 : <https://www.ivoa.net/documents/ObsCore/> contains many general metadata for discovery including time features .

Use case example :

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

- 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

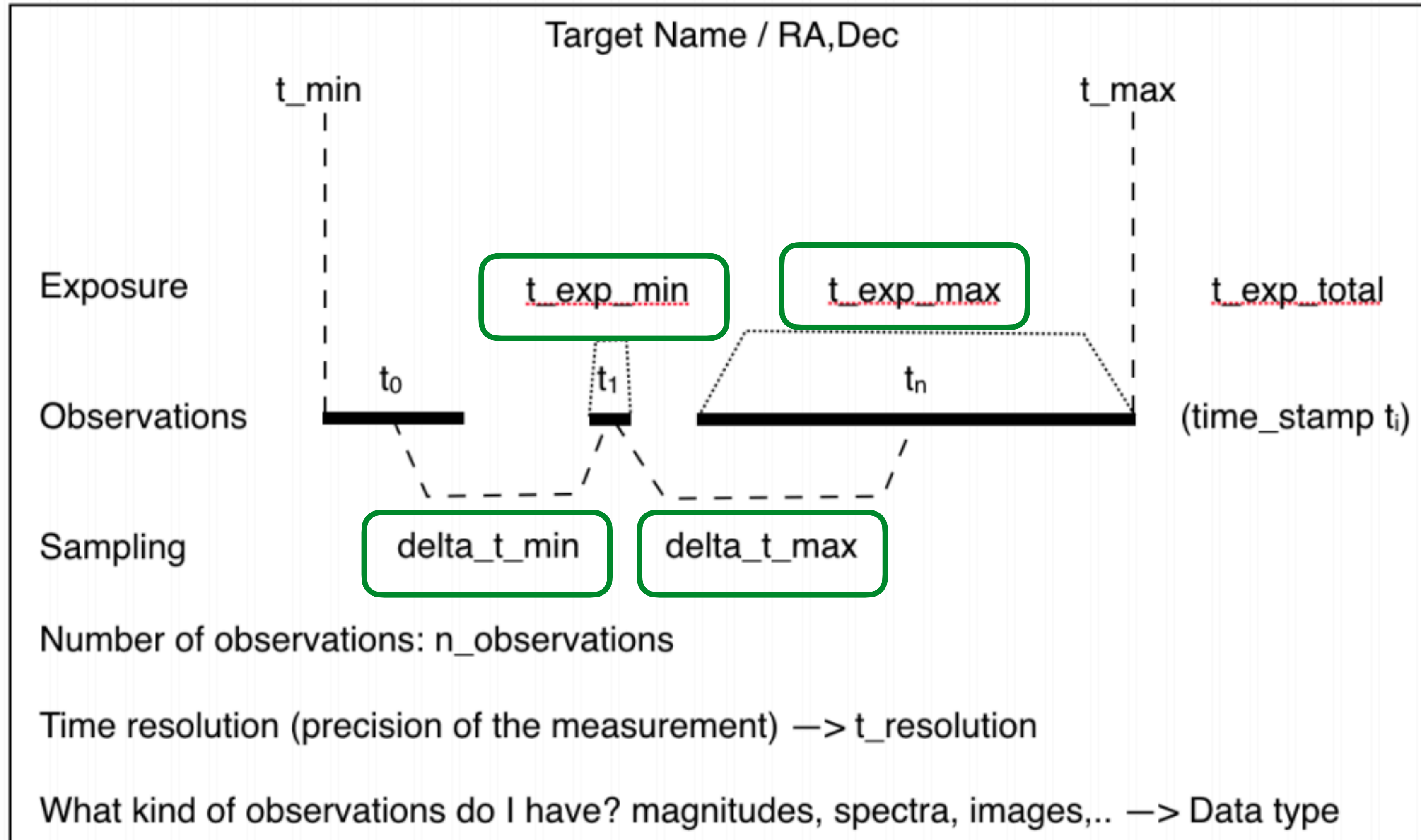
use the ivoa dataproducttype vocabulary :
<https://www.ivoa.net/rdf/product-type/2024-03-22/product-type.html>

Reminder : Time series uses cases for data discovery are in Appendix A : « Uses cases in detail » section A.4 of the Obscore Specification

- see also <http://saada.unistra.fr/voexamples/show/ObsCore/> for more use cases about ObsCore in TAP services. More uses cases to insert soon.



□ Time series specific properties



to be added in
time extension

cf IVOA Note : <https://wiki.ivoa.net/internal/IVOA/TimeSeries/TSSerializationNote.pdf>

Figure 1: Simple representation of Time Series data.



□ Time series data

- ivoa.net/rdf/product-type has evolved to hold several classes of time related data sets.
- former query examples with *dataprodunct_type == time series* can now be restricted to
- *light-curve, time-cube, dynamic-spectrum* etc.
—> better selection of dataset dimensionality
- What data chunk depends on time ?
 - this can be specified by adding a *time_variant* attribute if necessary . (to be discussed)
- Working draft in progress for this specification
<https://github.com/ivoa-std/ObscoreTimeExtension>



ObsCore Metadata Extension for Time Properties

Version 1.0

IVOA Working Draft 2024-05-16

Working Group
DM

This version
<https://www.ivoa.net/documents/ObscoreTimeExtension/20240516>

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

Previous versions
This is the first public release

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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	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	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

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 in the query response and let a client application prepare time coordinates' conversion

add every blue parameters to `ivoa.t_obs` 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>meta.id;time</i>	null	opt	
t_refDirection (e.g. for solar observations)	Time reference direction	TimeFrame.refDirection refdirection	<i>meta.id;time</i>	null	opt	
%Time representation ISOtime , MJD, JD , ...						
t_format	Time representation	TimeMJD, TimeJD, IsoTime not part of TIMESYS	<i>meta.id;time</i>	null	opt	MJD

□ More features to add?

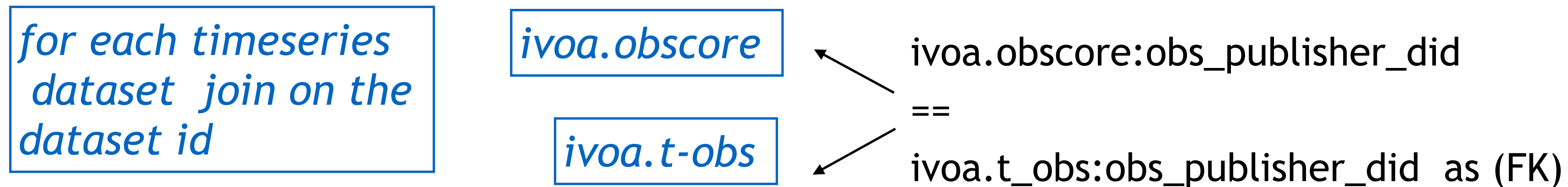
- Pulsar data in radio domain
 - Mapping Pulsar datasets to Obscore Metadata profile: Experience with PSRFITS keywords
 - cf Baptiste Ceconni's presentation at 2021 Interop meeting
<https://wiki.ivoa.net/internal/IVOA/InterOpNov2021Radio/Radio-PSRFITS-ObsCore.pdf>
 - Pulsar data in ObsCore : cf Vincenzo 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?





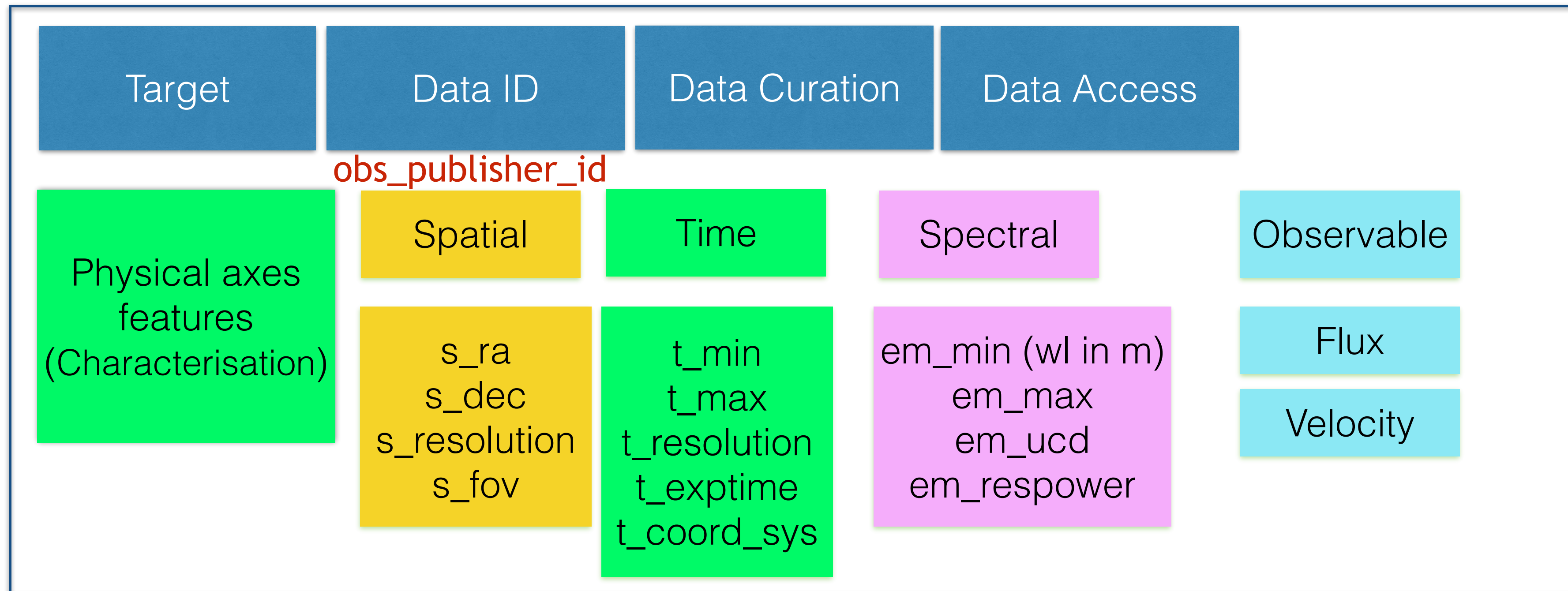
- An ObsTAP service can already provide metadata from *ivoa.obscore* table together with complementary tables. (cf CADC ObsTAP)
- Consider one extra table for added time properties , f. i *ivoa.t-obs*



- A table join allows to search on ObsCore keywords, but also on time specific keywords
- Suggestions:
 1. Define a ‘time series’ ObsTAP capability when *ivoa.t_obs* is served together with *ivoa.obscore*
 - *ivoa.obscore* + *ivoa.t_obs* tables are included in the service TAP_SCHEMA
 2. Include all time properties in only one extended table view merging *ivoa.obscore* and *ivoa.t_obs*

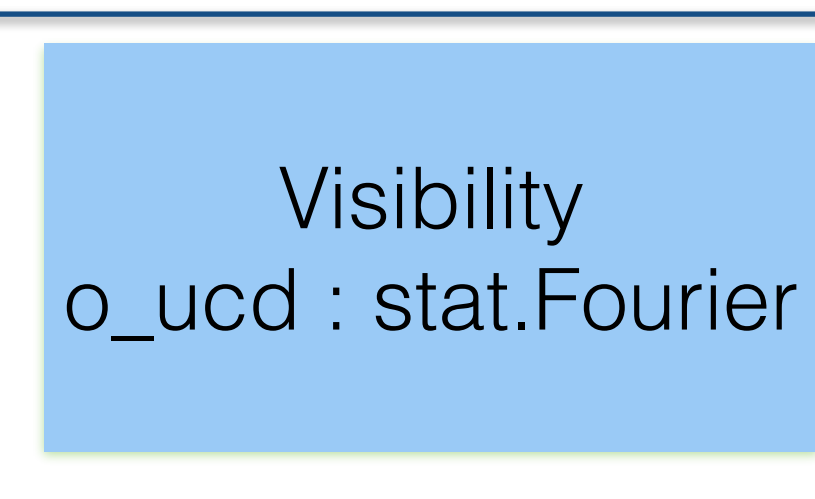
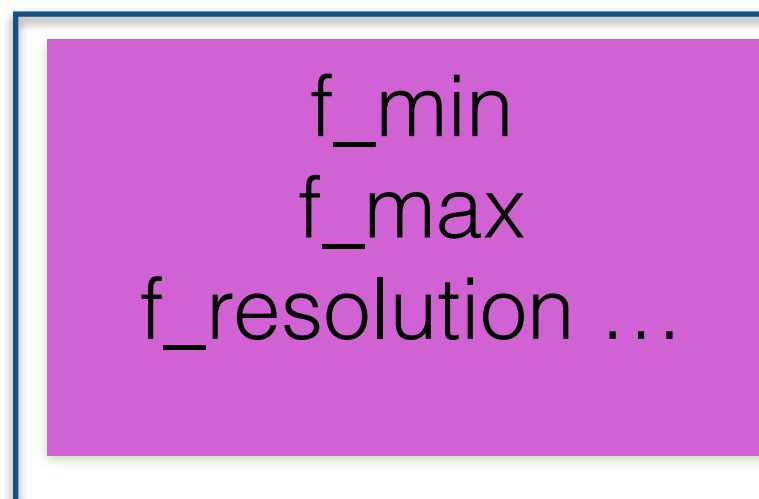
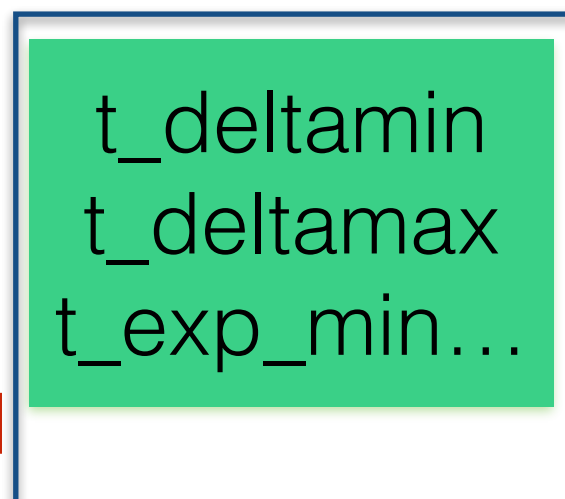
□ Question to solve : Implementing the Data model extension for various flavors : time, radio, high energy

ivoa.obscore



obs_publisher_id

ivoa.t-obs
obs_publisher_id



ivoa.r-obs
obs_publisher_id



□ What to add to Obscore?

- ObsCore is meant for [data discovery](#) in multiple spectral domain
- Metadata extension is needed for various regimes and various types of data products
- optical data :
 - image, cube, spectrum, sed → covered with [ivoa.obscore](#)
 - light-curve → [ivoa.obscore+](#) [ivoa.t_obs](#)
- radio data:
 - image, spectrum, cube, visibility : [ivoa.obscore+](#) [ivoa.r_obs](#)
 - pulsar data : → [ivoa.obscore+](#) [ivoa.r_obs+](#) [ivoa.t_obs](#).
- high energy data:
 - image, spectrum, event-list → [ivoa.obscore](#) + ??? (to be defined)
 - light curve → [ivoa.obscore+](#) [ivoa.t_obs](#)





Thanks for your
attention

Comments ? Questions ?

