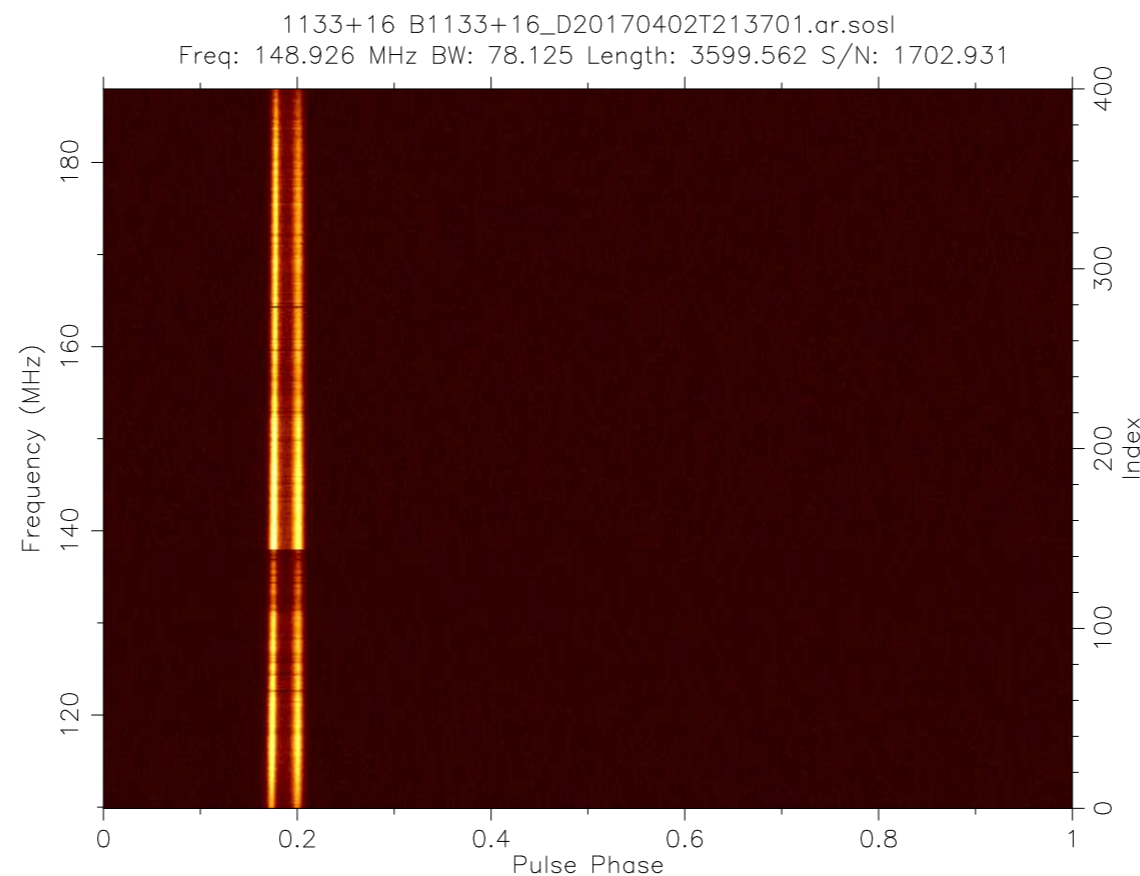


Prototype de diffusion de données Pulsar au Centre de Données de Nançay



Cecconi, B; Le Sidaner, P.; Griebmeier, J.-M., Bondonneau, L. — Mars 2023

Radio Interest Group document

Pulsar and FRB Radio Data Discovery and Access

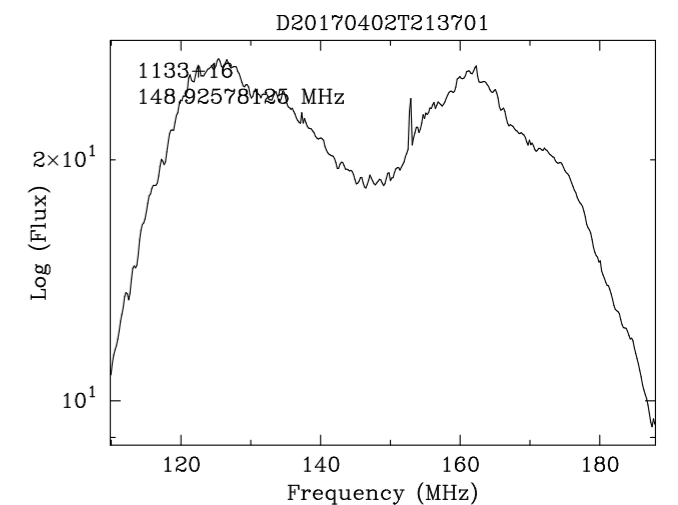
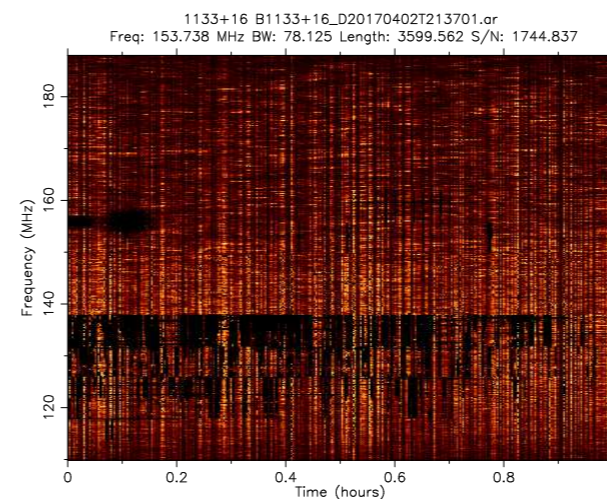
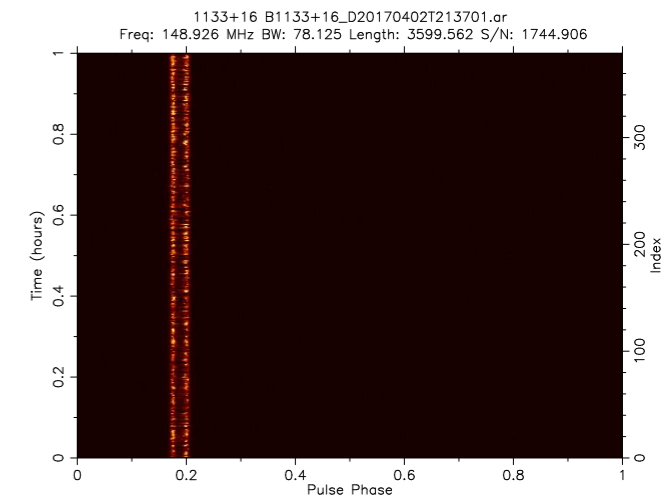
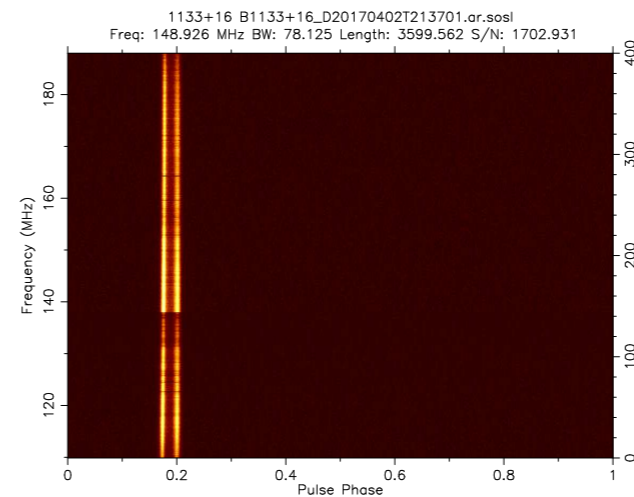
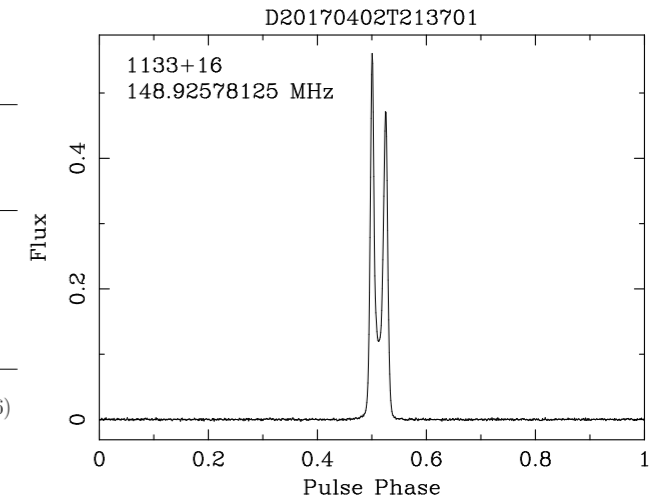
- Document drafted by (2022-09):
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- Review by Baptiste Cecconi, Jean-Mathias Grießmeier
External contact with Joern Kuensemoeller (Uni. Bielefeld, DE)
- Comment to be submitted by 2023-05 IVOA.

Pulsar Dataset

Content

- dedispersed data polarisation or flux measurement
- a set of light curves (usually resulting from data folding at the pulsar rotation period), in a temporal-spectral grid.
e.g.: for each epoch:
a spectral-temporal phase plot
- many metadata (coverage, processing history, configuration...)

observatory	FR606
obs.id	B1133+16_D20170402T213701
PSRNAME	B1133+16
JNAME	J1136+1551
P0	1.18796334845016
DM	4.86110639572144
length	3599.56189695998
nsubint	379
center freq.	148.92578125
BW	78.125
S/N	2669.93
%RFI	13.34
quicklook created	April 13, 2017
by	process-and-calculate.sh (version 1.52.03, 10.12.2016)



Pulsar Dataset

PSRCHIVE & PSRFITS

- Pulsar data are processed using many standard libraries, used by the pulsar community (PRESTO, TEMPO, TEMPO2...)
- Most comprehensive data format is *psrchive* (*.ar), which comes with a CLI: *psredit*, *psrstat*, *psrplot*...
- The PSRFITS format (*.psrfits) is a FITS format with a set of specifications. It is used for data distribution, but content is somewhat loosely defined.
Most exchange of data is done with PSRCHIVE format.
- Data are usually not open and accessible.
- Sharing metadata is a first step.

ObsCore	PSRFITS FILE (.psrfits or .fits)	PSRCHIVE FILE (*.ar through psredit)
t_min	$STT_IMJD + (STT_SMJD + STT_OFFS - TSUBINT[0]/2)/86400$	$int[0]:mjd - 1/2*int[0]:duration/86400$
t_max	$STT_IMJD + (STT_SMJD + STT_OFFS + OFFS_SUB[-1] + TSUBINT[-1]/2)/86400$	$int[nsubint-1]:mjd - 1/2*int[nsubint - 1]:duration/86400$
t_exptime	$t_max - t_min$	length
t_resolution	$f[4].data["TSUBINT"][1]$	$int[1]:duration$
t_xel	$f[1].data["NSUB"][0]$	nsubint
s_ra	$f[4].data['RA_SUB'][0]$	coord
s_dec	$f[4].data['DEC_SUB'][0]$	coord
s_xel1	1	
s_xel2	1	
em_min	c / f_max	c / f_max
em_max	c / f_min	c / f_min
em_xel	$f[1].data["NCHAN"][0]$	nchan
o_ucd	based on npol	
pol_states	based on $f[4].header["POL_TYPE"]$	based on state
pol_xel	$f[4].header["NPOL"]$	npol
facility_name	based on $f[0].header["TELESCOP"]$	based on site
instrument_name	based on $f[0].header["FRONTEND"]$ and $f[0].header["BACKEND"]$	based on "rcvr:name" and "be:name"
t_scale	UTC	
t_refposition	TOPOCENTER	
t_origin	??	
f_resolution	$f[1].data["CHAN_BW"][0]$	bw/nchan
f_min	$f[4].data["DAT_FREQ"][0][0] - f[1].data["CHAN_BW"][0]/2$	$int[0]:freq[0] - bw/nchan/2$
f_max	$f[4].data["DAT_FREQ"][0][-1] + f[1].data["CHAN_BW"][0]/2$	$int[0]:freq[nchan - 1] + bw/nchan/2$

Implementation at CDN

Centre de Données de Nançay

- Using DaCHS server (<http://vogate.obs-nancay.fr>)
 - schema = fr606 (name of french LOFAR station)
 - table: fr606.obscore
- Mapping from a set of Nenufar and LOFAR PSRFITS files.
 - PSRCHIVE files: not yet implemented at CDN
- NenuFAR data: Original observation (OBS_ID) contains several « beams », observing several pulsars in parallel => 1 row per pulsar beam.
- Mapping choices:
 - dataproduct_type => new term: *hyper-dynamic-spectrum*
 - facility_name => LOFAR/FR606, NenuFAR
 - instrument_name => backend name (LuMP, LUPPI)
 - pol_states => « XX/YY/ReXY/ImZY »

Open Issues

and other prospects

- PSRFITS implementation is not homogeneous.
 - NenuFAR PSRFITS (.fits) => one extension (SUBINT)
 - LOFAR PSRFITS (.psrfits) => four extensions (HISTORY, PSRPARAM, T2PREDICT, SUBINT)
 - some parameters are not filled (or not located in the same extension).
- New *dataproduuct_type* term: « hyper-dynamic-spectrum »
(also application to space radar data, like Mars-Express/MARSIS)
- *pol_states*: not fully satisfactory (ReXY and ImXY are not listed in allowed values)
- **Extra remark:** Missing PSRCat name resolver:
 - Should include temporary names
 - Possible to implement from successive versions of PSRCat