

IPTA 2015 Australia

sigproc tutorial

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Install psrsoft online tutorial (by Mike Keith)

<https://www.youtube.com/watch?v=yAoQKeqvbQs>

except (!) change the link to:

```
wget Pulsarastronomy.net/psrsoft/psrsoft.tar.gz
```

Pulsar searching online tutorial (by Mike Keith)

<https://www.youtube.com/watch?v=wAHuO87Ja4E>

filterbank - convert to filterbank format

```
[pulsar@pulsarVmlite test]$ filterbank 20030814_150425_J1910-5958_GC0067_001.afb > 20030814_150425_J1910-5958_GC0067_001.fil  
20030814_150425_J1910-5958_GC0067_001.hdr  
20030814_150425_J1910-5958_GC0067_001.hdr
```

header - view infos of data file

```
[cng@gstar001 06]$ header 2013-02-02-00:31:45.fil
Data file                : 2013-02-02-00:31:45.fil
Header size (bytes)     : 345
Data size (bytes)       : 17284726784
Data type                : filterbank (topocentric)
Telescope                : Parkes
Datataking Machine      : ??????
Source Name              : G004.2+01.3
Source RA (J2000)       : 17:48:24.3
Source DEC (J2000)      : -24:39:01.7
Frequency of channel 1 (MHz) : 1581.804688
Channel bandwidth (MHz) : -0.390625
Number of channels       : 1024
Number of beams         : 13
Beam number             : 6
Time stamp of first sample (MJD) : 56325.022048611114
Gregorian date (YYYY/MM/DD) : 2013/02/02
Sample time (us)        : 64.000000
Number of samples       : 67518464
Observation length (hours) : 1.2
Number of bits per sample : 2
Number of IFs           : 1
[cng@gstar001 06]$ █
```


Dedisperse_all

- dedisperse a range of DM
- build-in determine DM step size
- create one time series (.tim file) per DM step
- set gulp size
- set number of thread

```
[pulsar@pulsarVmlite 2013-02-02-00:31:45_06]$  
[pulsar@pulsarVmlite 2013-02-02-00:31:45_06]$  
[pulsar@pulsarVmlite 2013-02-02-00:31:45_06]$  
[pulsar@pulsarVmlite 2013-02-02-00:31:45_06]$ setenv OMP_NUM_THREADS 8  
[pulsar@pulsarVmlite 2013-02-02-00:31:45_06]$  
[pulsar@pulsarVmlite 2013-02-02-00:31:45_06]$ dedisperse_all -d 0 100 -g 1000000 2013-02-02-00:31:45.fil  
maxdelay = 2051  
1 subbands from 1024 chans  
Dividing output by 16 to scale to 1 byte per sample per subband  
Gulp 0 Loading 1002051 samples, i. e. 256525056 bytes of Raw Data
```

seek - does the FFT

create a .prd file that contains potentially significant periods

```
[htru@raid0 trial2]$ seek 2012-02-26-22:36:21-01.fil.0190.27.tim -fftw
SEEK: is part of SIGPROC version: 4.3
Timer is up and running...
Working with time series data...
Read 33353620 samples...
Reference DM: 190.2740
Sampling time: 64.00000 us
Nearest power of 2: 25
Padding time series with additional zeros...
Data length: 35 min 47 sec
FFT: (fftw-3.1.2)...
Forming amplitude spectrum. (Pmax= 10.000000000000000 s!)
Raw spectral resolution: 0.4656613 mHz)
Nyquist frequency: 7812.500 Hz
Whitening spectrum...
Calculating AGL mean and rms every 128 bins... 5.9604645E-02 Hz
Resulting spectral RMS: 1.013469
Harmonic sums are: 1 2 4 8 16
Doing harmonic summing...
Lyne-Ashworth harmonic summing
Doing harmonic searching...
SNR threshold for fold 1 is 5.000000
SNR threshold for fold 2 is 4.750000
SNR threshold for fold 3 is 4.550000
SNR threshold for fold 4 is 4.370000
SNR threshold for fold 5 is 4.300000
Best suspect: 0.150943387018146 ms
S/N: 35.5
Found peak at: 6625.00040415671 Hz
Number of harmonics: 1
Timer clocked 7 s for this job.
```

best - sift through candidates

group together period harmonics and DM harmonics

```
[htru@raid0 trial2]$ cat 2*prd > All.prd
[htru@raid0 trial2]$
[htru@raid0 trial2]$ best All.prd
File: All.prd
Folds: 1-          5
1-D DM search...
      21 DM group(s).      34000 candidates
DM range: 0.000000      204.7196 pc/cc
Zapping integer+non-integer harmonics...
  P (ms)   S/N   DM   DMID NIDs f   P/Ptop   Ptop/P
0.99999995 45.6  188.0 0007 0312 3   1.0000   1.0000
0.15094339 39.3  201.0 0016 0080 1   0.1509   6.6250
0.13114754 24.7  188.0 0007 0044 1   0.1311   7.6250
0.44824007 21.4  204.7 0021 0065 1   0.4482   2.2309
5.80779276 17.1  191.4 0013 0135 5   5.8078   0.1722
0.17777777 16.6  189.7 0010 0021 1   0.1778   5.6250
1.14285710 15.3  188.5 0008 0047 4   1.1429   0.8750
0.27586206 14.9  185.1 0002 0017 2   0.2759   3.6250
0.13559329 13.7  192.0 0014 0020 1   0.1356   7.3750
1.11108576 12.0  185.1 0002 0029 2   1.1111   0.9000
0.15686275 11.9  202.9 0019 0008 1   0.1569   6.3750
0.21621604 11.8  191.4 0013 0006 1   0.2162   4.6250
0.72727476 11.3  186.8 0005 0006 1   0.7273   1.3750
0.18604652 10.5  202.2 0018 0003 1   0.1860   5.3750
0.13210226 10.1   0.0 0001 0004 1   0.1321   7.5699
0.27244722  9.1  190.2 0011 0001 2   0.2724   2.6570
```


dspsr - create archive file

inputs:

- period (-c) in second
- DM
- number of bins (typically 128)
- length in second for one subint (say aim to have 64 time subint, then this is total obs length /64)
- append subint in one file (-A)
- give an output name

```
[htru@raid0 trial2]$ dspsr -c2.675492573 -D171.6530 -b128 -L20.672020 -A -U1 -t4 -O output 2012-02-26-22:36:21-01.fil
dspsr: Single archive with multiple sub-integrations
dspsr: blocksize=240 samples or 0.996094 MB
itoe_code no alias found for Fake
dsp::Archiver::finish archive 'output.ar' with 104 integrations
```

pdmp - fold archive file

inputs:

- mc : set number of channels
- ms : set number of subint

see also online tutorial: psrchive.sourceforge.net/manuals/pdmp/

```
[htru@raid0 trial2]$ pdmp -mc 16 -ms 16 output.ar
Working on archive J1840-0333B: J1840-0333B_2012-02-26-22:36:21-01.fil-p2.675676-dm195.1.ar2
Searching for optimum DM and Period...
DM: 34 P1: 0 P0: 16
99%

Best S/N = 9.00
BC MJD = 55983.952051
BC Period (ms) = 2675.886031 TC Period (ms) = 2675.676 DM = 195.1000
Best BC Period (ms) = 2675.70259 Correction (ms) = -0.183440917 Error (ms) = 0.05240558387
Best TC Period (ms) = 2675.492573 Correction (ms) = -0.1834265187 Error (ms) = 0.05240558387
Best DM = 171.6530 Correction = -23.45 Error = 28.5
Best BC Frequency (Hz) = 0.3737336143 Error (Hz) = 7.319845016e-06
Pulse width (bins) = 2
```

Hands-on session

Test data on NGC 6752 (J1910-5958) - **hint: DM = 33.7467**

20030814_150425_J1910-5958_GC0067_001.afb

Test data on 47 Tuc - **hint: DM=24.6510**

2014-05-30-20:34:40.fil

2014-05-30-22:35:28.fil

2014-05-31-00:52:48.fil

List of commands

- filterbank xxx.afb > xxx.fil
- dedisperse_all -d 30 35 -g 1000000 xxx.fil
- foreach tim file:
 - seek xxx.tim -fftw
- cat xxx*.prd > All.prd
- best All.prd
- dspsr -c[*period*] -D[*dm*] -b128 -L[*sub-int length in sec*] -A -O output xxx.fil
- pdmp -mc 16 -ms 16 output.ar

psrcat - pulsar catalogue

www.atnf.csiro.au/people/pulsar/psrcat/

ATNF Pulsar Catalogue

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Catalogue version: 1.53

Predefined Variables [Display parameters](#)

<input type="checkbox"/> Name	<input type="checkbox"/> lName	<input type="checkbox"/> Raj	<input type="checkbox"/> DecJ	<input type="checkbox"/> PMRA	<input type="checkbox"/> PMDec
<input type="checkbox"/> PX	<input type="checkbox"/> PosEpoch	<input type="checkbox"/> Elong	<input type="checkbox"/> Elat	<input type="checkbox"/> PMLong	<input type="checkbox"/> PMLat
<input type="checkbox"/> GL	<input type="checkbox"/> GB	<input type="checkbox"/> RaID	<input type="checkbox"/> DecID		
<input type="checkbox"/> P0	<input type="checkbox"/> P1	<input type="checkbox"/> P0	<input type="checkbox"/> P1	<input type="checkbox"/> P2	<input type="checkbox"/> P3
<input type="checkbox"/> PEpoch	<input type="checkbox"/> DM	<input type="checkbox"/> DM1	<input type="checkbox"/> RM	<input type="checkbox"/> W50	<input type="checkbox"/> W10
<input type="checkbox"/> Units	<input type="checkbox"/> Tau_sc	<input type="checkbox"/> S400	<input type="checkbox"/> S1400	<input type="checkbox"/> S2000	
<input type="checkbox"/> Binary	<input type="checkbox"/> TD	<input type="checkbox"/> PB	<input type="checkbox"/> A1	<input type="checkbox"/> DM	<input type="checkbox"/> Ecc
<input type="checkbox"/> Tasc	<input type="checkbox"/> Eps1	<input type="checkbox"/> Eps2	<input type="checkbox"/> MinMass	<input type="checkbox"/> MedMass	<input type="checkbox"/> BinComp
<input type="checkbox"/> Dist	<input type="checkbox"/> Dist_DM	<input type="checkbox"/> DMstnb	<input type="checkbox"/> ZZ	<input type="checkbox"/> XX	<input type="checkbox"/> YY
<input type="checkbox"/> Assoc	<input type="checkbox"/> Survey	<input type="checkbox"/> OSurvey	<input type="checkbox"/> Date	<input type="checkbox"/> Type	<input type="checkbox"/> NGL1
<input type="checkbox"/> R_lum	<input type="checkbox"/> R_lum14	<input type="checkbox"/> Age	<input type="checkbox"/> Bsurf	<input type="checkbox"/> Edot	<input type="checkbox"/> Edotd2
<input type="checkbox"/> PMtot	<input type="checkbox"/> VTrans	<input type="checkbox"/> PL1	<input type="checkbox"/> Age_1	<input type="checkbox"/> Bsurf_1	<input type="checkbox"/> B_LC

User-defined variables


<input type="checkbox"/> cl	<input type="text"/>
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<http://www.atnf.csiro.au/people/pulsar/psrcat/>

psrcat - pulsar catalogue

www.atnf.csiro.au/people/pulsar/psrcat/proc_form.php?version=1.53&Name=Name&RaJ=RaJ&DecJ DecJ Search

ATNF Pulsar Catalogue



Catalogue Version: 1.53

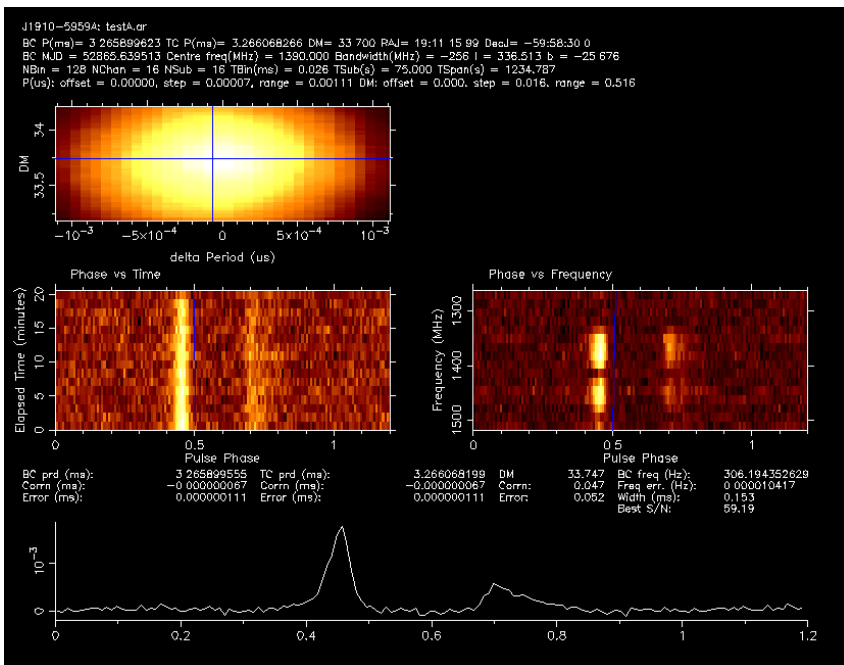
#	NAME	RAJ (hms)	DECJ (dms)	P0 (s)	DM (cm ⁻³ pc)	S1400 (mJy)	PB (days)	ECC	DIST (kpc)	AGE (Yr)	BSURF (G)
1	J0006+1834	00:06:04.8	+18:34:59	0.693748	12.00	*	*	*	0.70	5.24e+06	1.22e+12
2	J0007+7303	00:07:01.7	+73:03:07.4	0.315873	*	*	*	*	1.40	1.39e+04	1.08e+13
3	B0011+47	00:14:17.7	+47:46:33.4	1.240699	30.85	3.00	*	*	1.82	3.48e+07	8.47e+11
4	J0023+0923	00:23:16.8	+09:23:24.1	0.003050	14.30	*	0.1400	*	0.95	*	*
5	B0021-72C	00:23:50.3	-72:04:31.4	0.005757	24.60	0.60	*	*	4.00	*	*
6	B0021-72D	00:24:13.8	-72:04:43.8	0.005358	24.73	*	*	*	4.00	*	*
7	B0021-72E	00:24:11.1	-72:05:20.1	0.003536	24.23	*	2.2568	3.152e-04	4.00	5.69e+08	5.97e+08
8	B0021-72F	00:24:03.8	-72:04:42.8	0.002624	24.38	*	*	*	4.00	6.44e+08	4.16e+08
9	B0021-72G	00:24:07.9	-72:04:39.6	0.004040	24.44	*	*	*	4.00	*	*
10	B0021-72H	00:24:06.7	-72:04:06.7	0.003210	24.36	*	2.3577	7.056e-02	4.00	*	*
11	B0021-72I	00:24:07.9	-72:04:39.6	0.003485	24.42	*	0.2298	6.307e-05	4.00	*	*
12	B0021-72J	00:23:59.4	-72:03:58.7	0.002101	24.58	*	0.1207	*	4.00	*	*
13	B0021-72L	00:24:03.7	-72:04:56.9	0.004346	24.38	*	*	*	4.00	*	*
14	B0021-72M	00:23:54.4	-72:05:30.7	0.003677	24.42	*	*	*	4.00	*	*
15	B0021-72N	00:24:09.1	-72:04:28.8	0.003054	24.56	*	*	*	4.00	*	*
16	J0024-7204O	00:24:04.6	-72:04:53.7	0.002643	24.36	*	0.1360	*	4.00	1.38e+09	2.87e+08
17	J0024-7204P	00:24:05.6	-72:04:52.6	0.003643	24.30	*	0.1472	*	4.00	*	*
18	J0024-7204Q	00:24:16.4	-72:04:25.1	0.004033	24.29	*	1.1891	8.481e-05	4.00	1.88e+09	3.75e+08
19	J0024-7204R	00:24:05.6	-72:04:52.6	0.003480	24.40	*	0.0662	*	4.00	*	*
20	J0024-7204S	00:24:03.9	-72:04:42.3	0.002830	24.35	*	1.2017	3.942e-04	4.00	*	*
21	J0024-7204T	00:24:08.5	-72:04:38.9	0.007588	24.39	*	1.1262	4.025e-04	4.00	4.09e+08	1.51e+09
22	J0024-7204U	00:24:09.8	-72:03:59.6	0.004343	24.34	*	0.4291	1.487e-04	4.00	7.23e+08	6.51e+08

Hands-on session

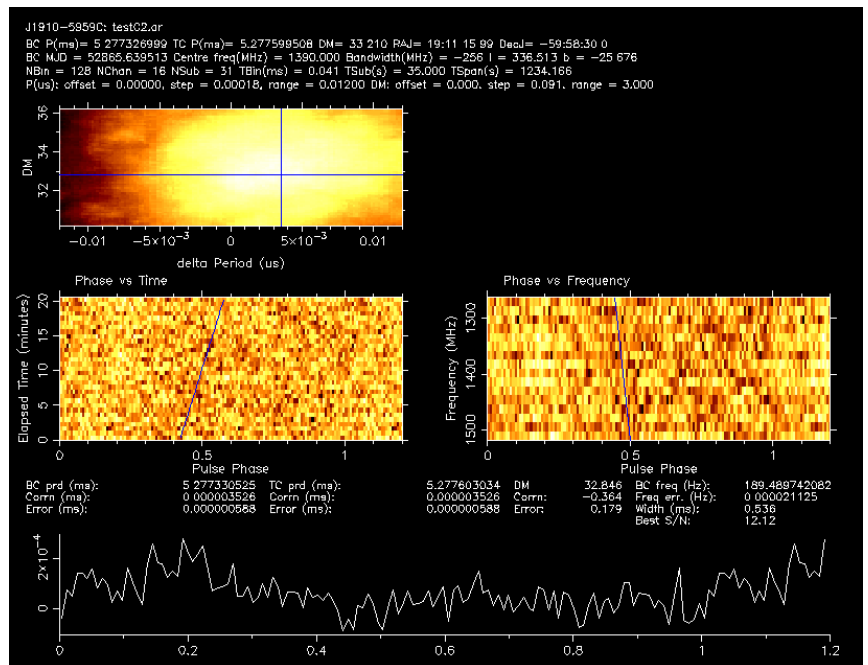
Test data on NGC 6752 (J1910-5958) - **hint: DM = 33.7467**

20030814_150425_J1910-5958_GC0067_001.afb

pulsar A



pulsar C



Hands-on session

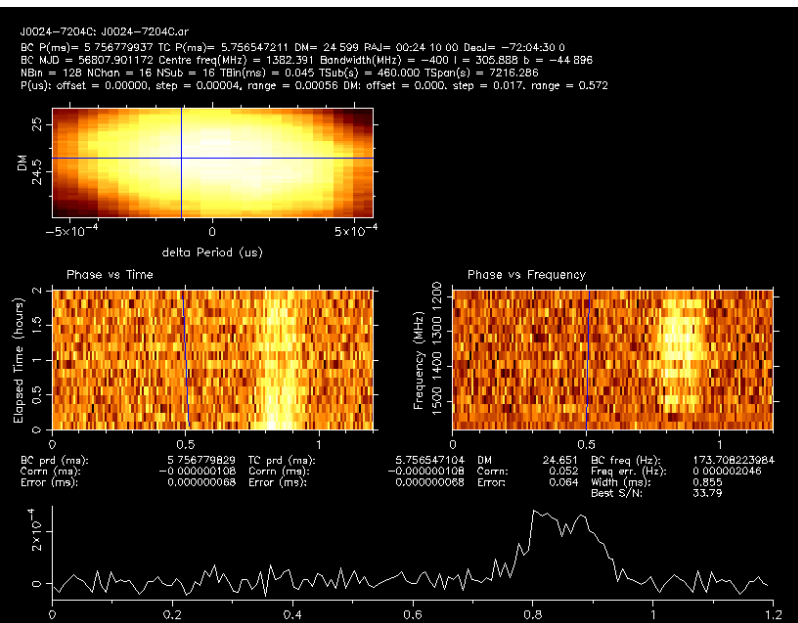
Test data on 47 Tuc - **hint: DM=24.6510**

2014-05-30-20:34:40.fil

2014-05-30-22:35:28.fil

2014-05-31-00:52:48.fil

pulsar C from 2014-05-30-20:34:40



pulsar J from 2014-05-30-20:34:40

