

CyberSKA

Classifying PALFA periodicity candidates

PALFA Candidate Viewer

Use various filters under the different Filter Types to limit the size of your query, and to target candidates that are the most likely to be astrophysical!

The screenshot shows the CYBERSKA platform interface for the PALFA Candidate Viewer. At the top, there's a navigation bar with links for Home, Profile, Settings, myDashboard, myGroups, Tools, Help, and About. A search bar is also present. Below the navigation, the title "CYBERSKA" is displayed with a subtitle "A Cyberinfrastructure platform to meet the needs of data intensive radio astronomy on route to the SKA". The main content area is titled "PALFA Applications" and "PALFA Candidate Viewer". It includes a breadcrumb menu: Home > Periodicity Candidates > Single Pulse Candidates > Logout. Below this are buttons for "Load Candidates", "Advanced Candidate Search", "CSV-Export", and "Saved Queries". A prominent section is the "Filter Load Candidates" panel. It has tabs for "Candidate", "Classification", "Rating", "Header", and "Sorting", with "Candidate" selected. Under "Candidate", there are sections for "Pipeline" (PALFA3 and PALFA4) and "Unclassified by" (Me and Anybody). There are also "Include" and "Exclude" checkboxes for WAPP Type, Test Pointings, and MOCK Type. A "Num Candidates" input field and "Show", "Save", and "Edit" buttons are at the bottom. A "Run Query" button is located at the very bottom.

If you want to only query candidates that have never been classified before, make sure that those buttons are checked!

PALFA Candidate Viewer

Example of a simple query

Here, we only query for candidates that satisfy the following:

- spin period between 2 ms and 5 s
- DM>20
- signal-to-noise ratio > 8
- prefold sigma (indicator of signal strength calculated by prefold) > 10
- data processed after 2018/01/01
- data taken after MJD 57500
- UBC pfd AI score (a machine-learning-based rating) > 0.1

Filter-Load Candidates

Filter Types: Candidate Classification Rating Header Sorting

Pipeline

PALFA3 (FFT) Me
PALFA4 (FFT, FFA) Anybody

Unclassified by

Include

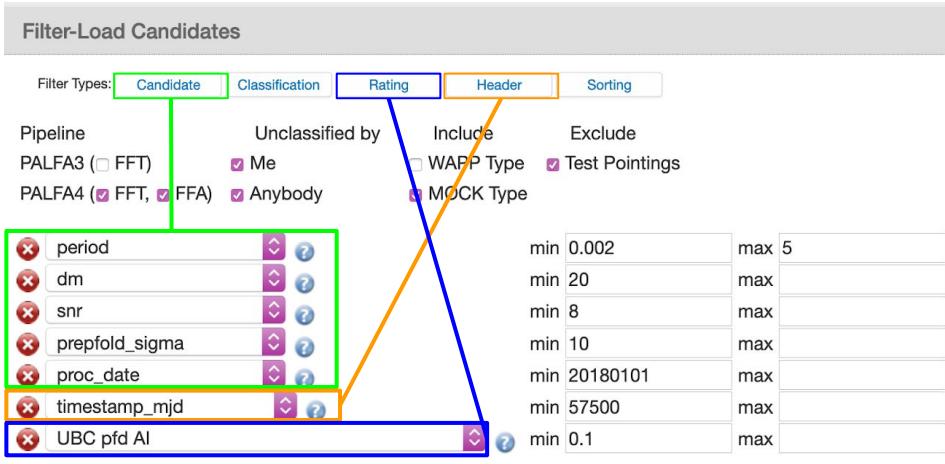
WAPP Type Test Pointings
 MOCK Type

Exclude

	min	0.002	max	5
period	min	20	max	
dm	min	8	max	
snr	min	10	max	
prefold_sigma	min	20180101	max	
proc_date	min	57500	max	
timestamp_mjd	min	0.1	max	
UBC pfd AI	min		max	

Num Candidates

Show Save Edit



The period, dm, snr and prefold_sigma cuts used in this example are one way to eliminate a lot of false positives from your query

 Stop Query

Status

Performing Query...

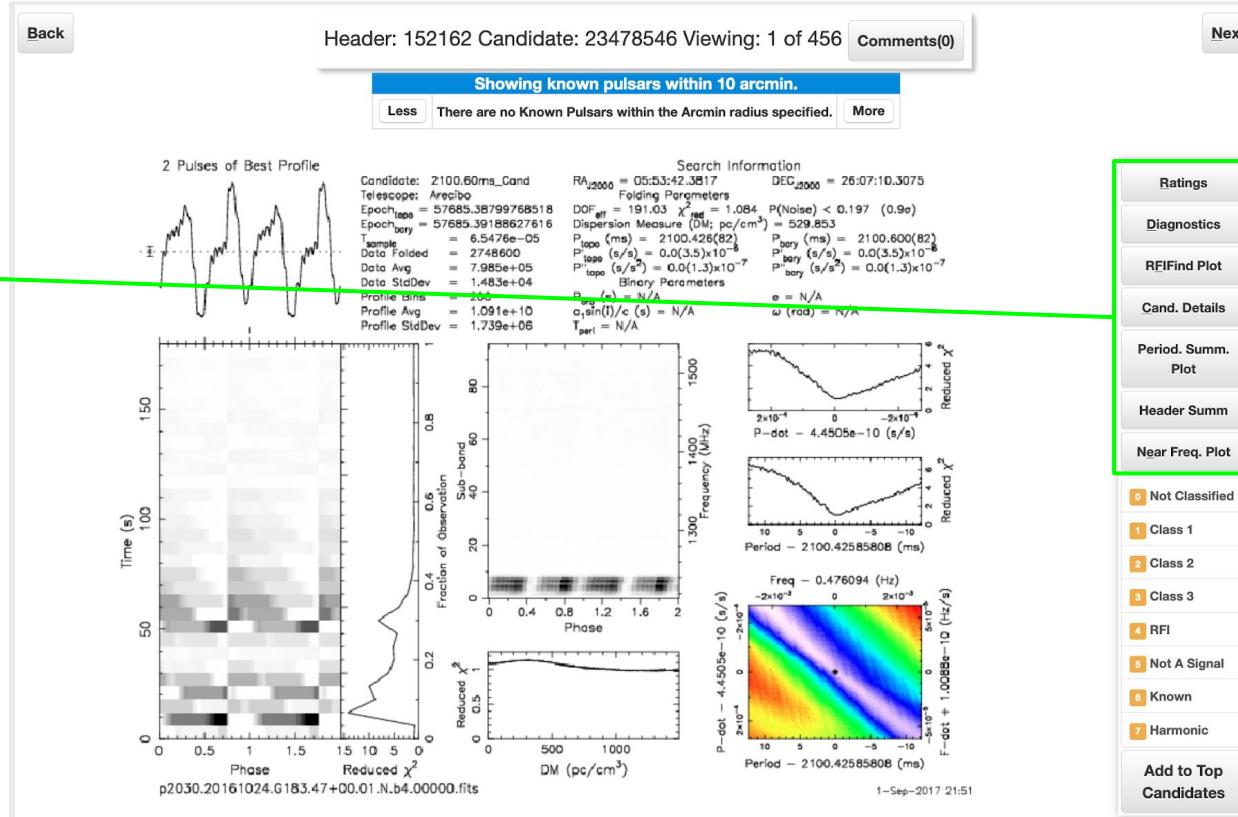


PALFA Candidate Viewer

Click Run Query, and the viewer will display the candidates that matched your query. You can start classifying!

These will give you more information on the candidate currently displayed.

Note: instead of clicking “Back” and “Next”, you can use your keyboard to move on to the next (type N) or come back to the previous candidate (type B). The same applies for the class you want to assign to the candidate.



Selecting the correct candidate Class

Class 1 candidates

Class 1 candidates are certainly pulsars.

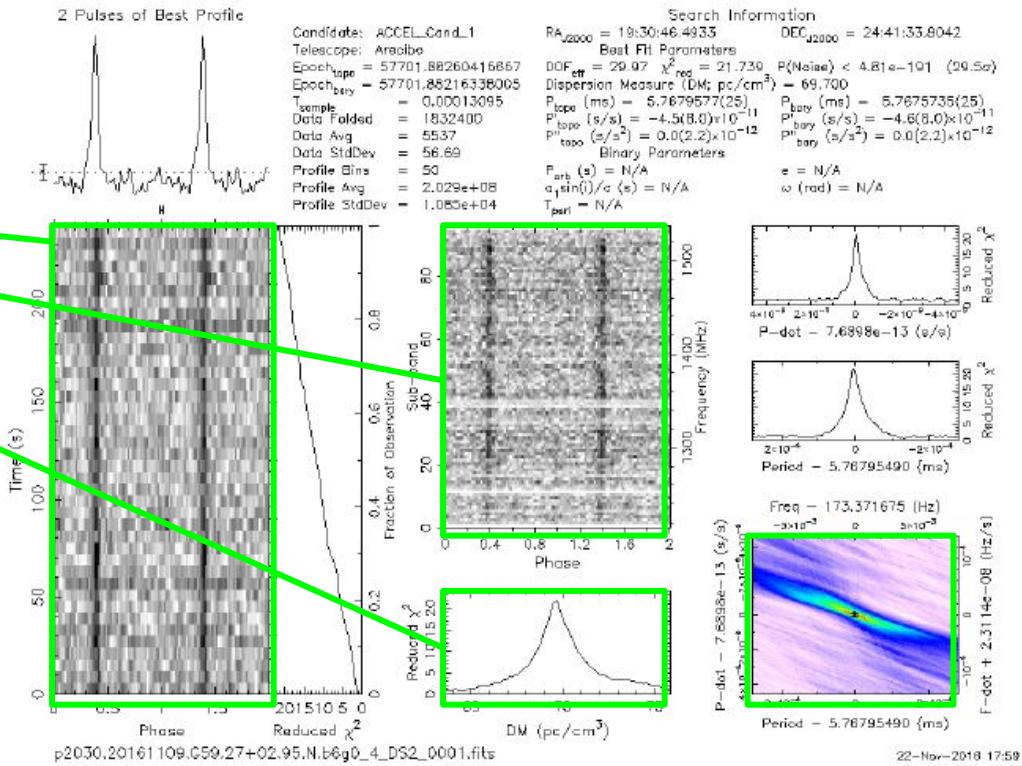
The time vs phase

frequency vs phase and

chi-squared vs DM plots

look very pulsar-like.

Those obvious candidates can be uploaded to TopCands, and members of the collaboration should be informed of this discovery.



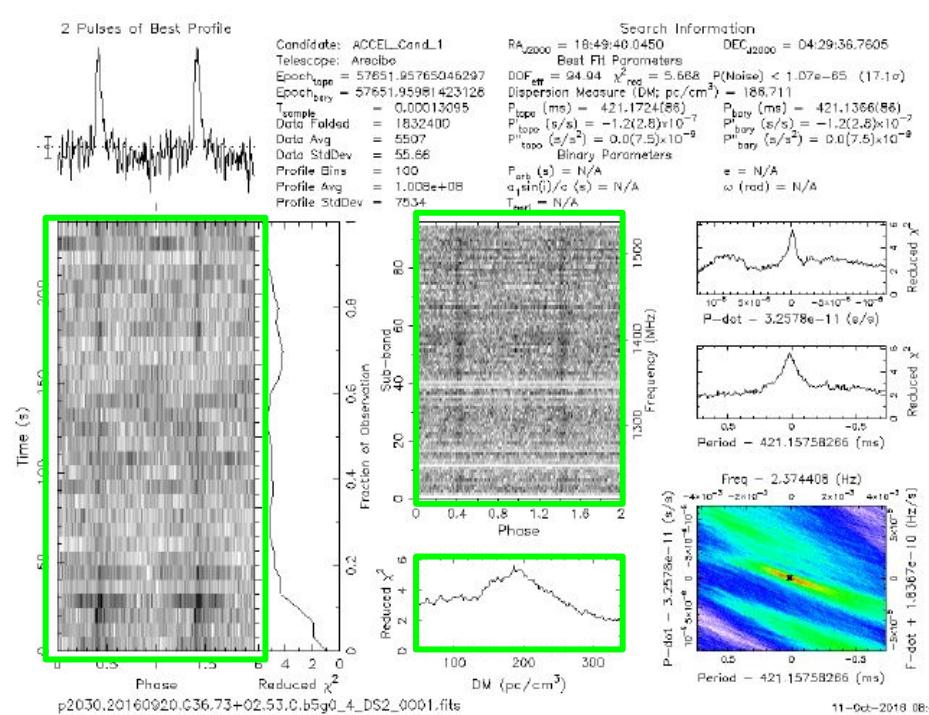
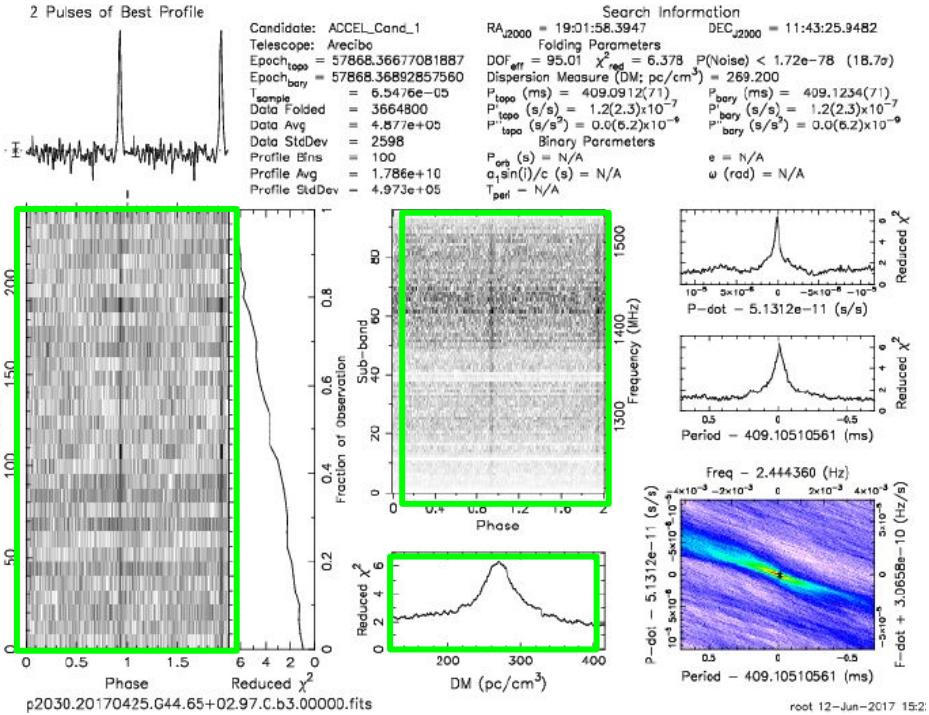
Good

so-so

Bad

Class 1 candidates

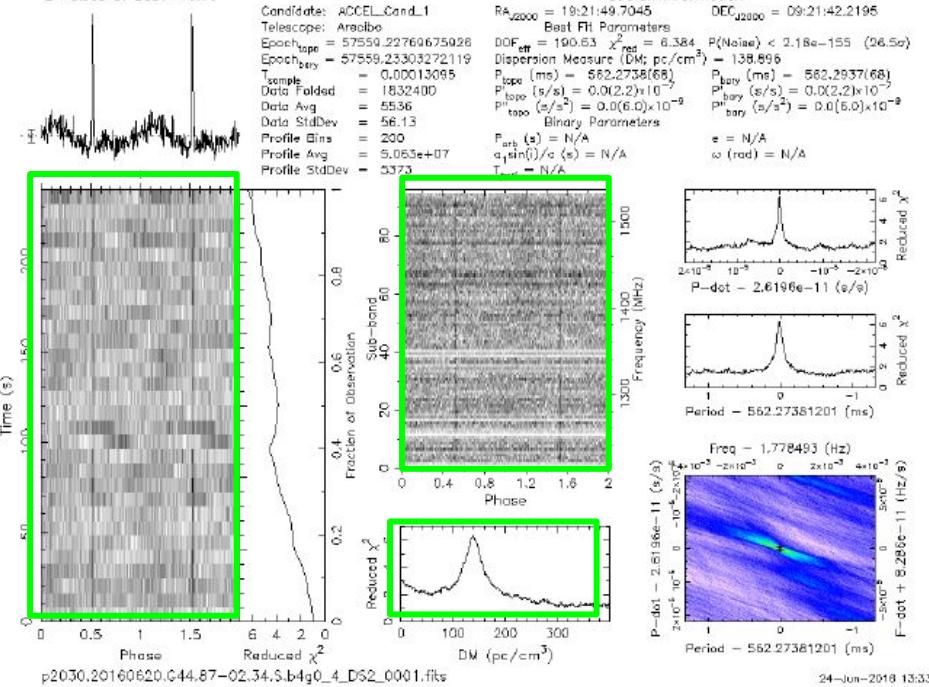
More examples



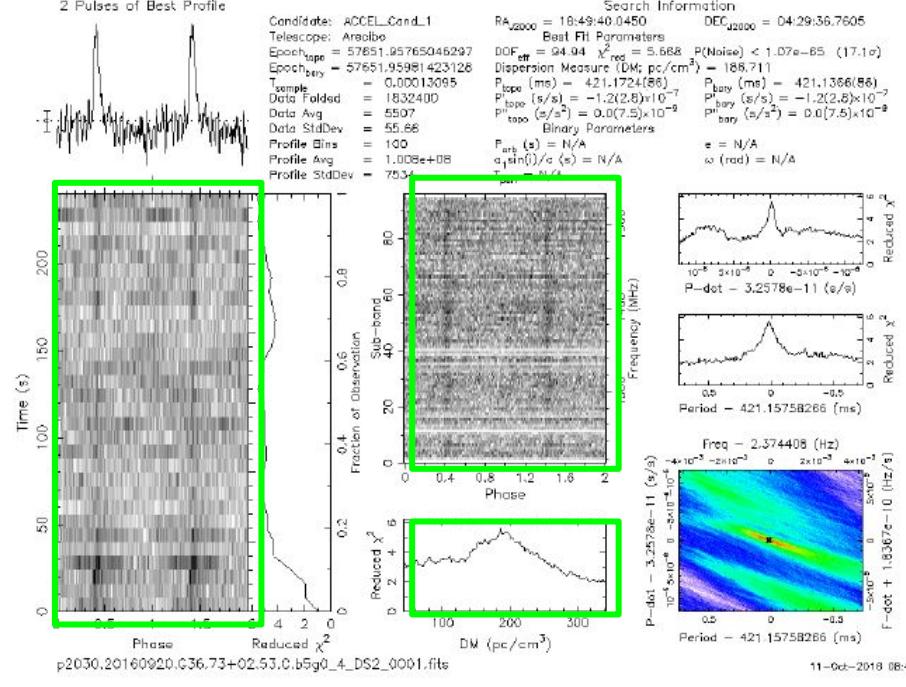
Class 1 candidates

More examples

2 Pulses of Best Profile



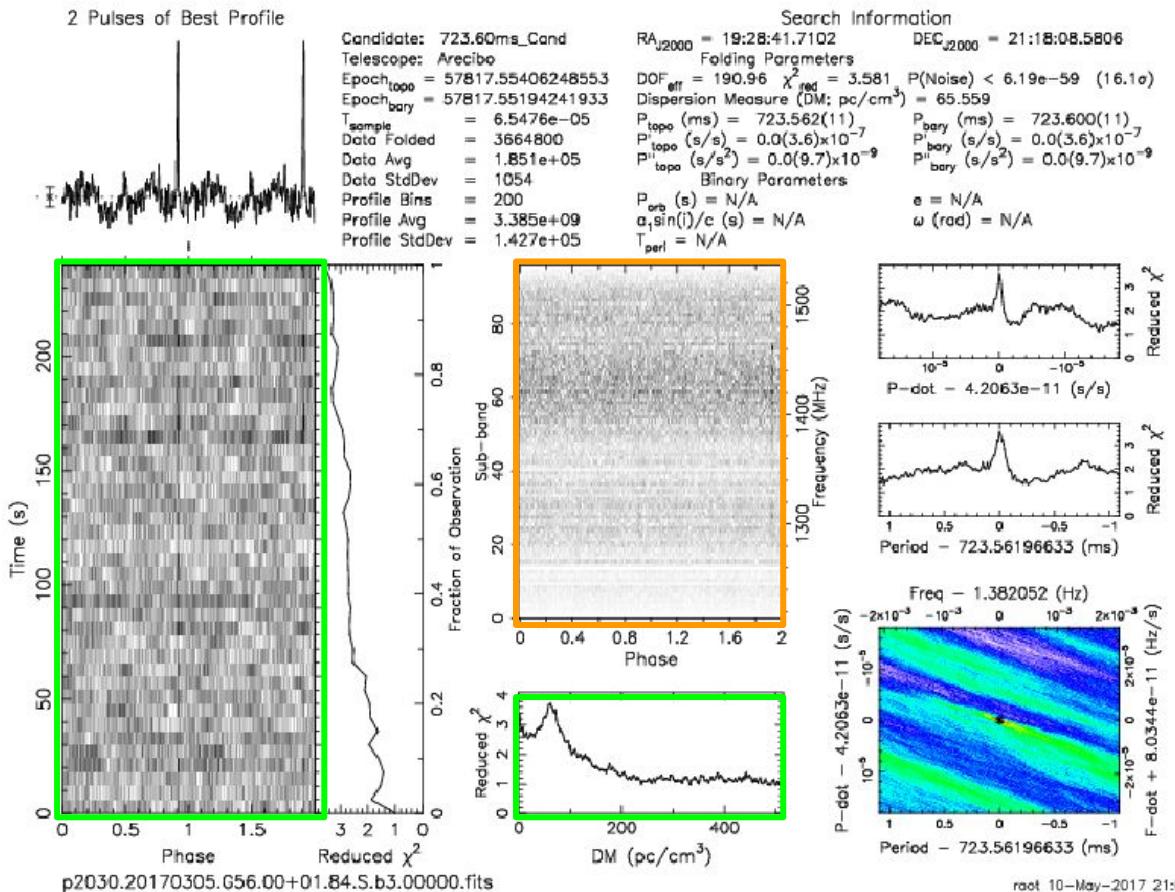
2 Pulses of Best Profile



Class 2 candidates

Those are candidates likely to be pulsars, but it is more ambiguous than Class 1 candidates. In this example, the frequency vs phase plot is not convincing enough to call this candidate an obvious pulsar.

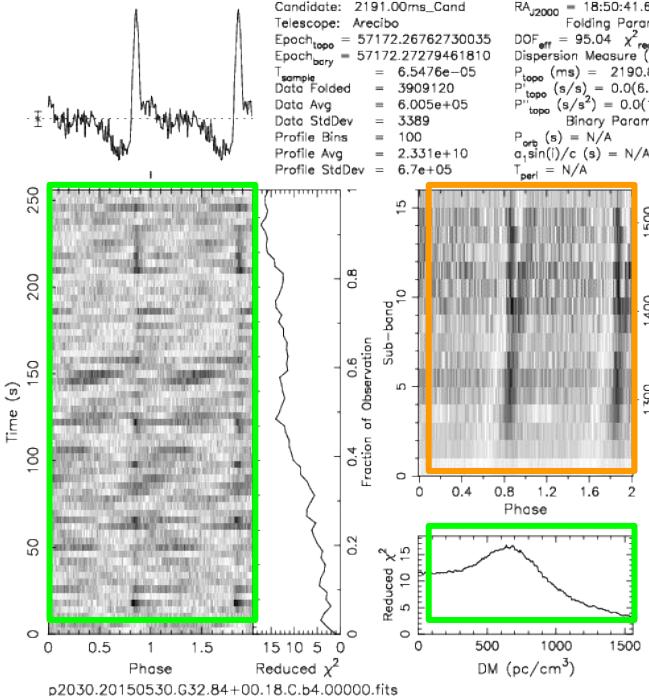
Good class 2 candidates with high prefold sigma could be shared with members of the collaboration.



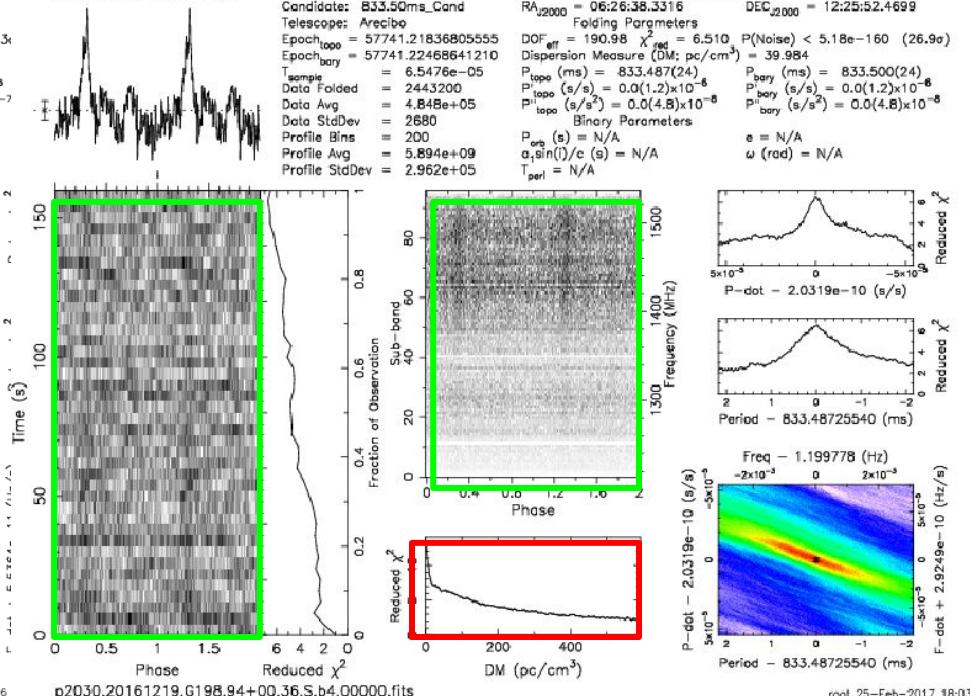
Class 2 candidates

More examples

2 Pulses of Best Profile



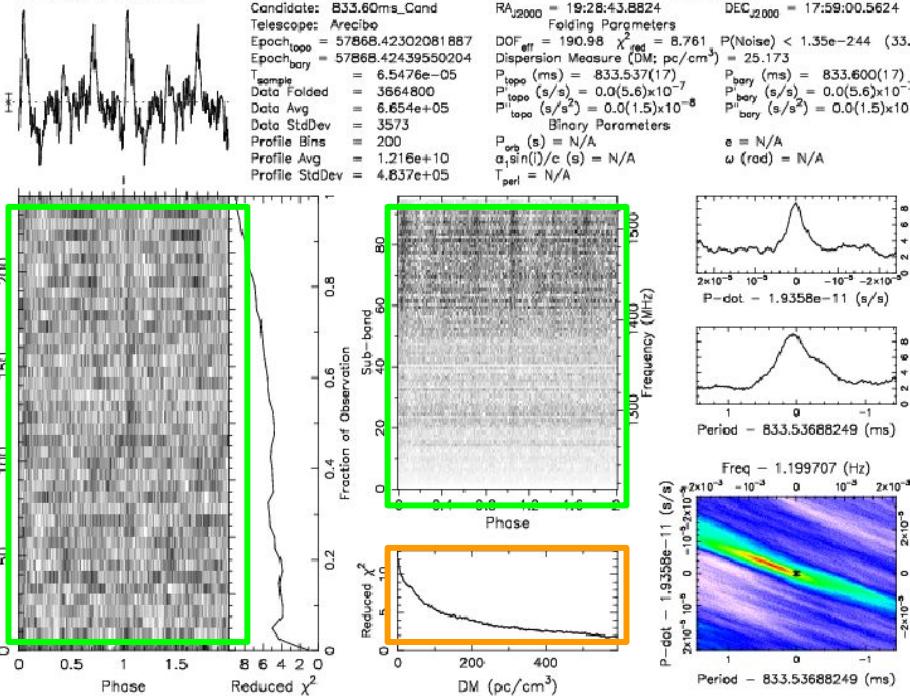
2 Pulses of Best Profile



Class 2 candidates

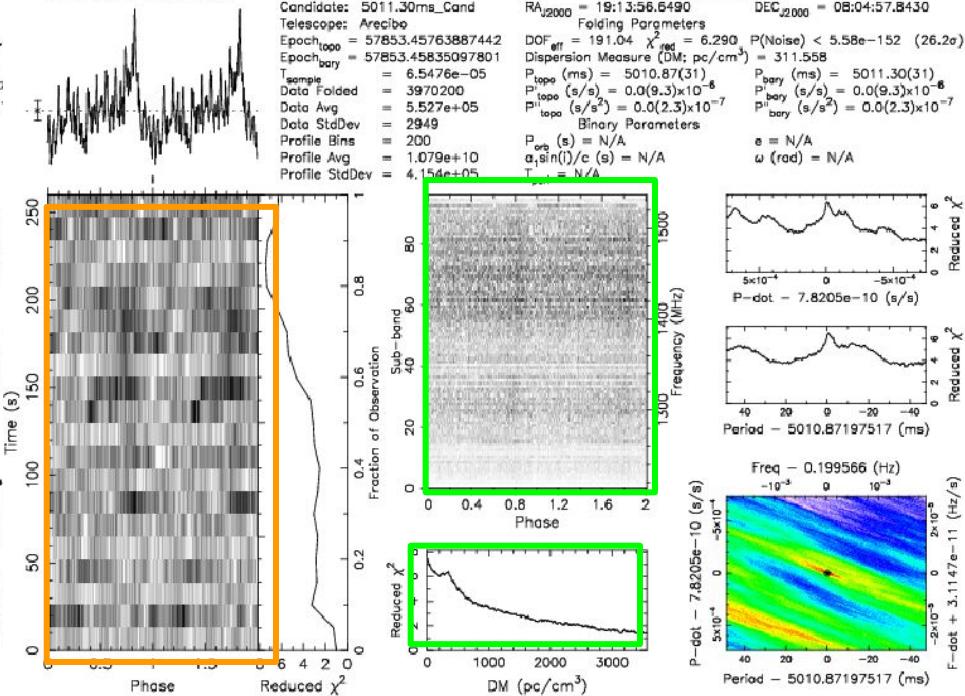
More examples

2 Pulses of Best Profile



p2030.20170425.053.25+00.27.S.b4.00000.fits

2 Pulses of Best Profile



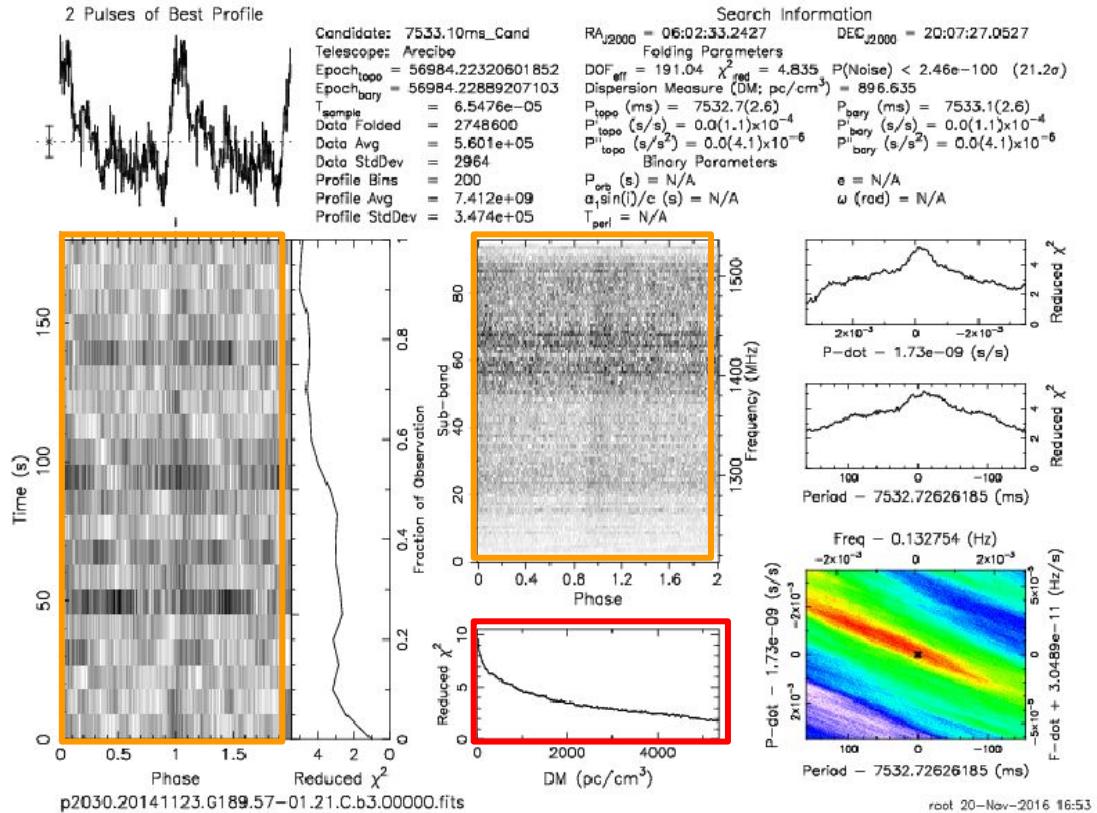
p2030.20170410.042.55-01.35.N.b1.00000.fits

root 12-Jun-2017
ract 21-May-2017 19:17

Class 3 candidates

Those are very marginal candidates: there might be one of the plots that have some pulsar-like characteristics, but overall, the likelihood of it being a pulsar is small. Those are the weakest pulsar candidates and the pulse profile is typically very noisy.

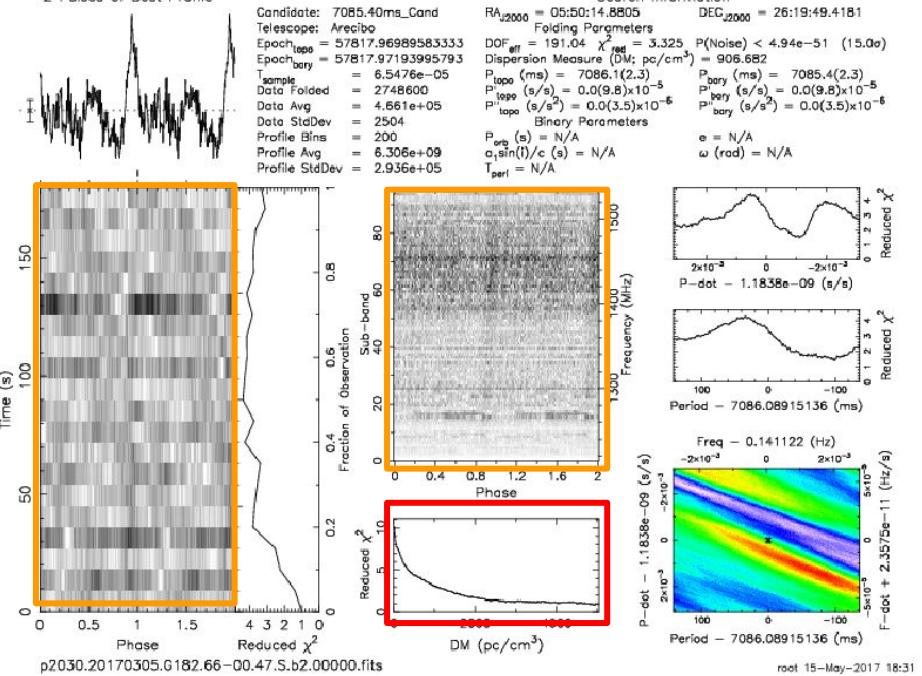
Class 3 cands are numerous and are not worth being shared with the collaboration



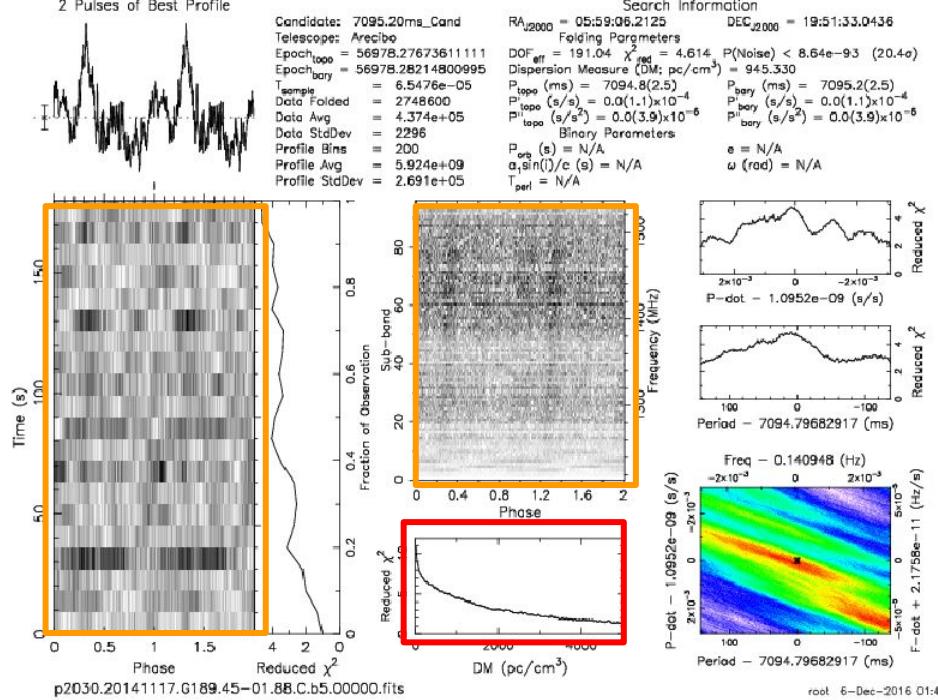
Class 3 candidates

More examples

2 Pulses of Best Profile



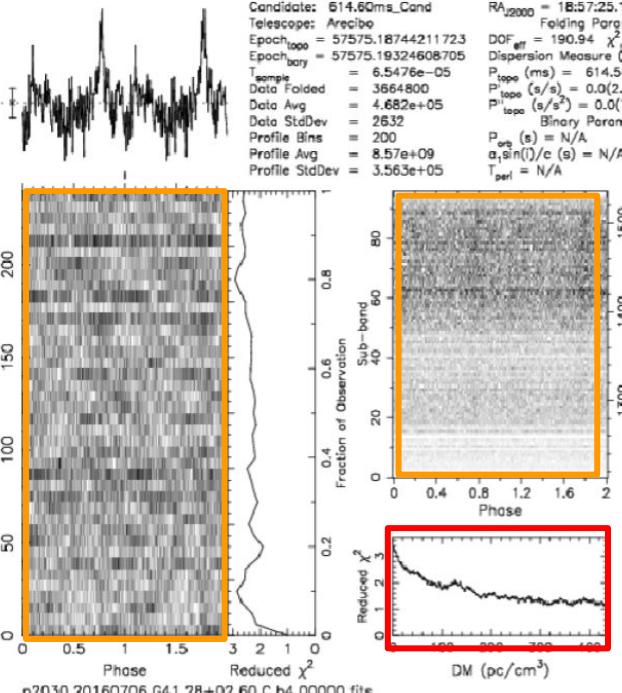
2 Pulses of Best Profile



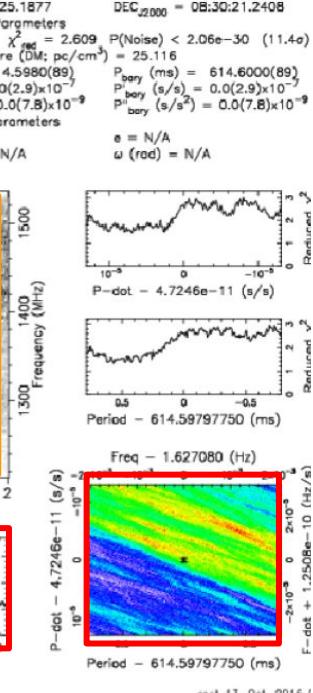
Class 3 candidates

More examples

2 Pulses of Best Profile



Search Information



root 13-Oct-2016 1:

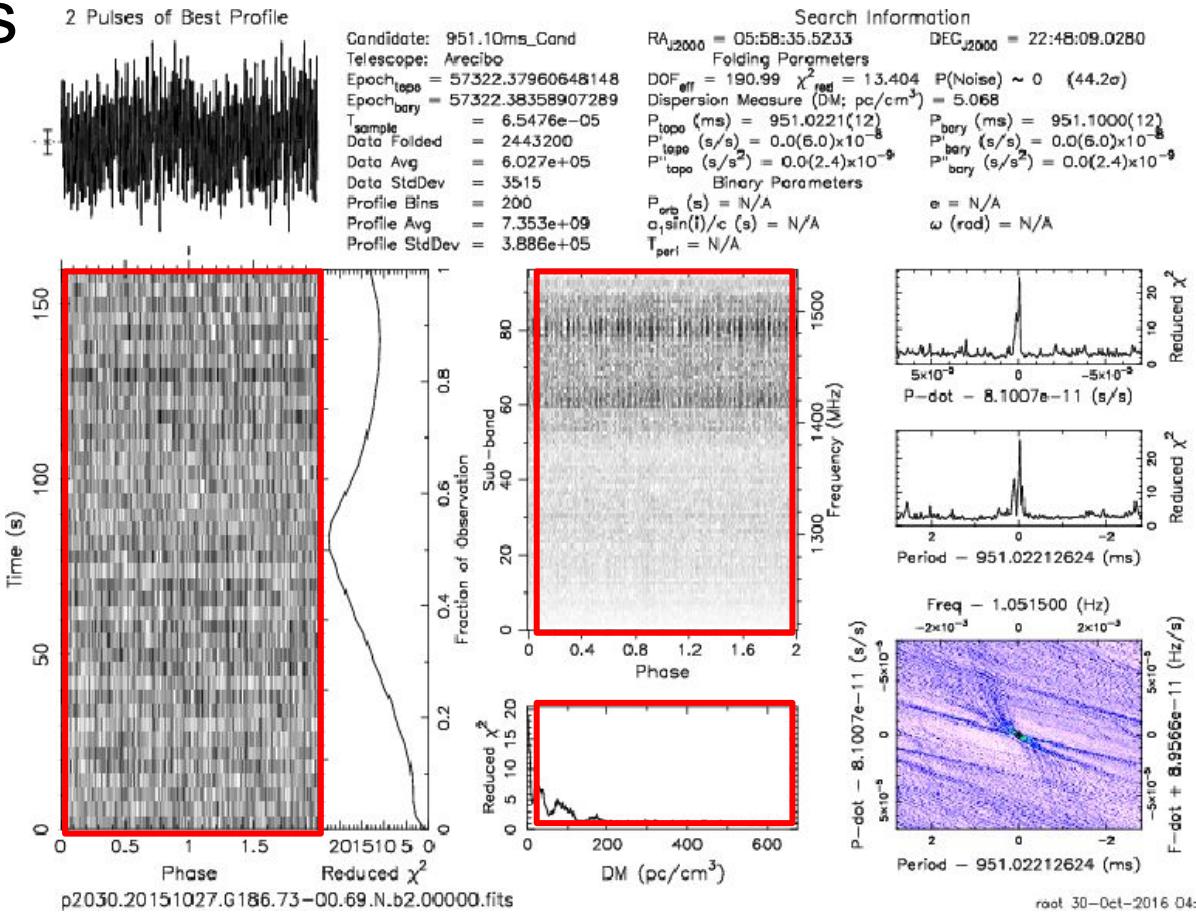
p2030.20160706.G41.28+02.60.C.b4.00000.fits

root 6-Oct-2016 16:00

Class 4 candidates

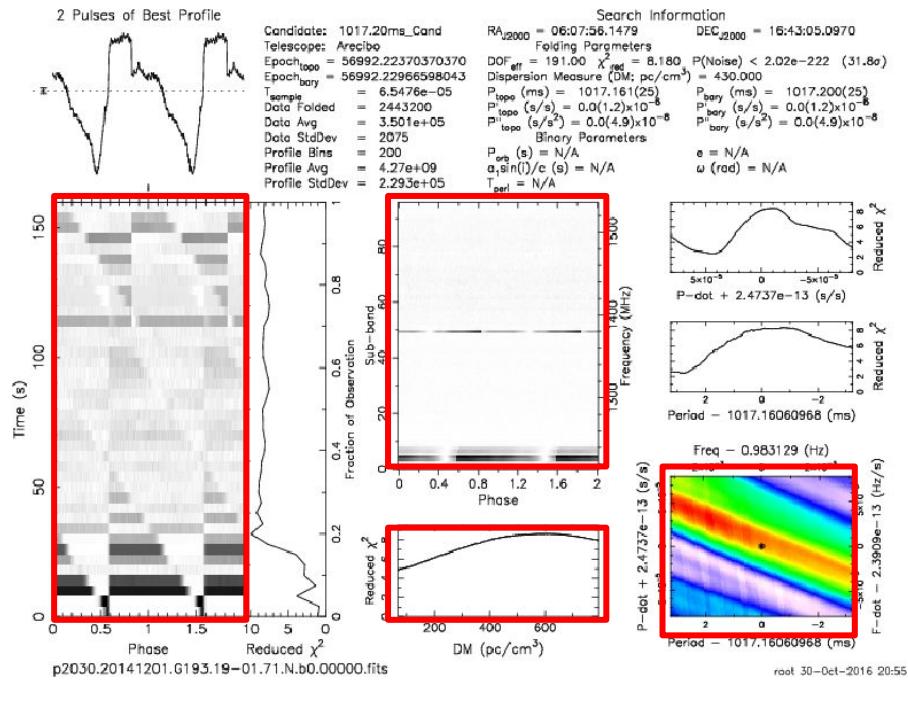
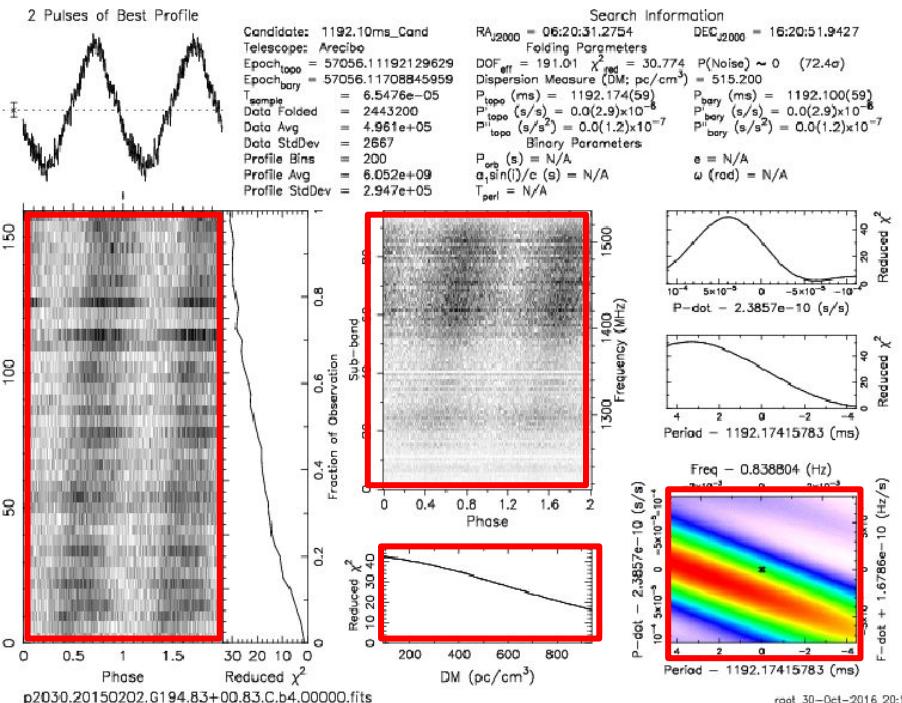
Those are RFI: they are certainly not pulsar signals. None of their plots will look pulsar-like. Narrow-band signals for example are classified as class 4.

Another thing is that RFI can appear at suspicious periodicities: $P=3.0000$ sec, for example.



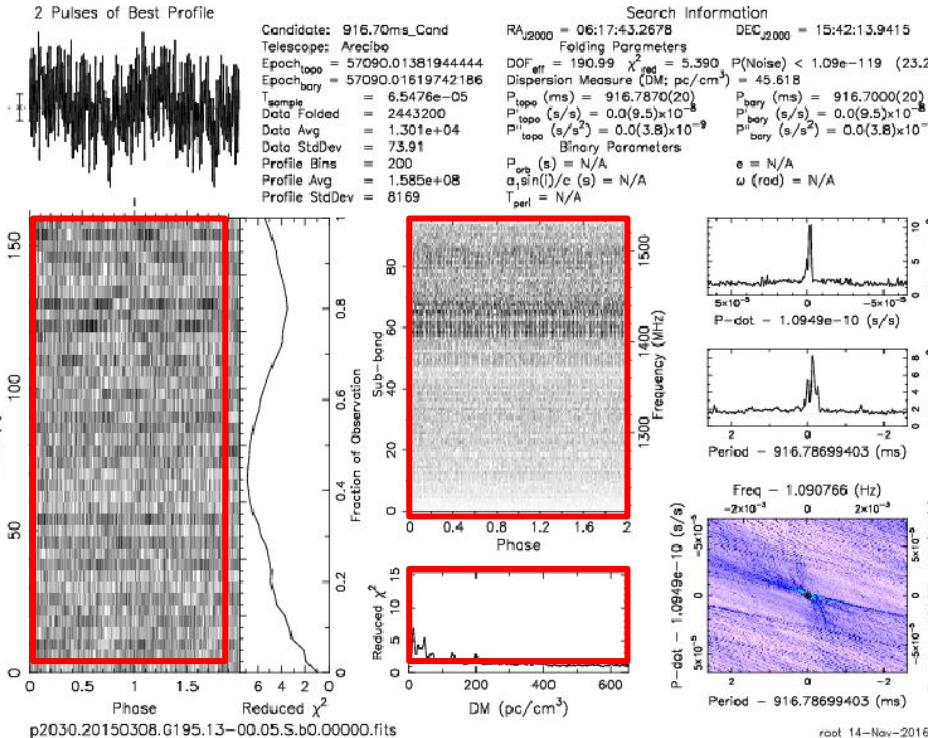
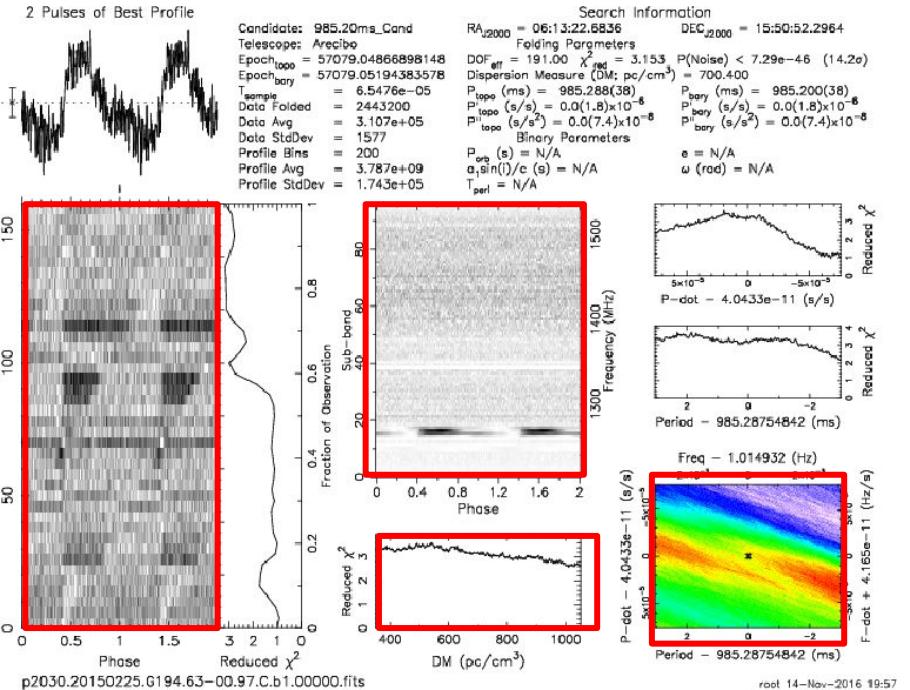
Class 4 candidates

More examples



Class 4 candidates

More examples



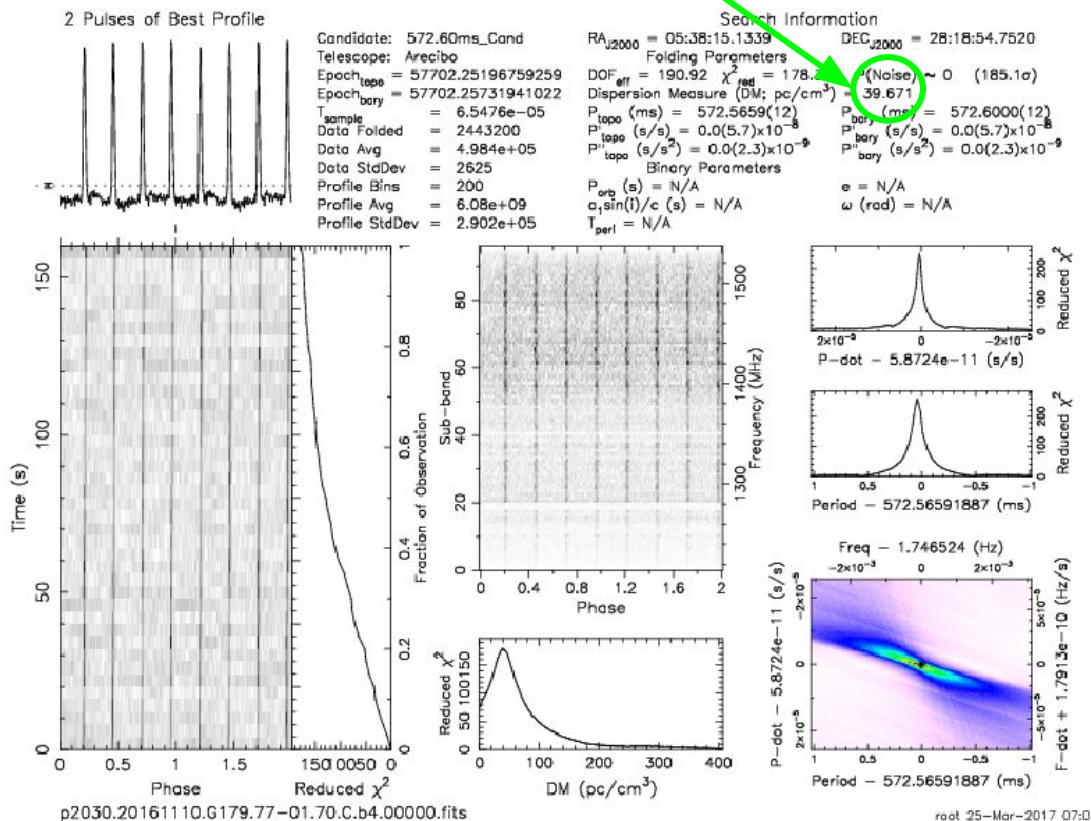
Class 5 candidates

I typically never classify candidates as being a class 5 : instead, I refer to them as class 4 cands.

Class 6 candidates

Those are known pulsars re-detected in the data. You can tell by the table “Showing known pulsars within 10 arcmin. “ above the prefold plot : if there is a nearby pulsar with similar DM value and having a period harmonically related to the candidate pulsar (see the info of the nearby pulsar in that table), it is a re-detection of that pulsar. You then click on the pulsar in the table, and then classify as 6.

Less	Name	Right Asc.	Declination	Period	DM	Catalogue	(Known/Cand.)period	Angular Sep. (')
	J0538+2817	05:38:25.0	+28:17:09.3	0.143158	39.57	ATNF	1/4 + 2.9e-05	2.803

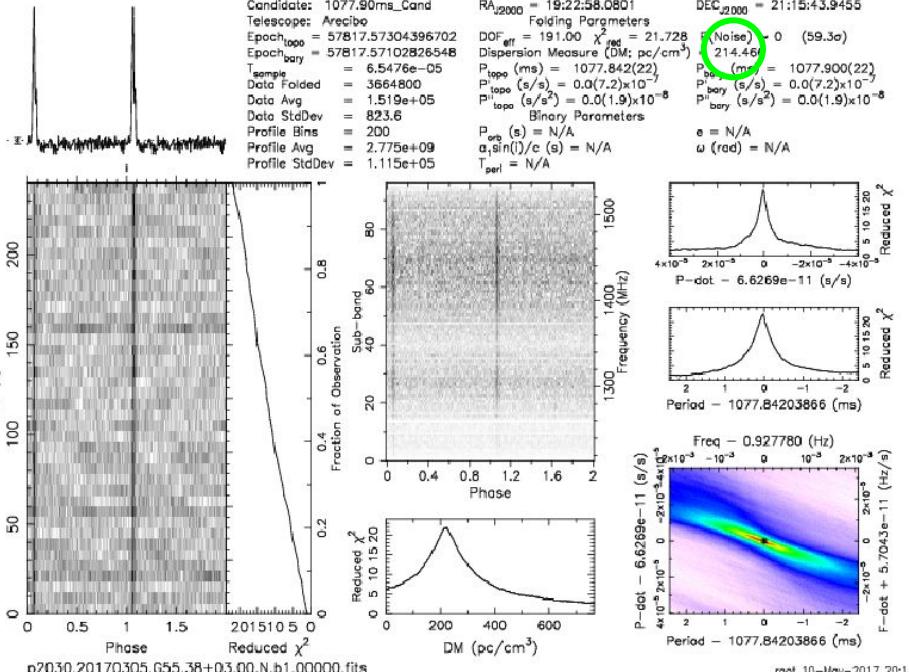


Class 6 candidates

More examples

Less	Name	Right Asc.	Declination	Period	DM	Catalogue	(Known/Cand.)period	Angular Sep. (")
	B1920+21	19:22:53.5	+21:10:41.9	1.077924	217.09	ATNF	1/1 + 6e-05	5.143

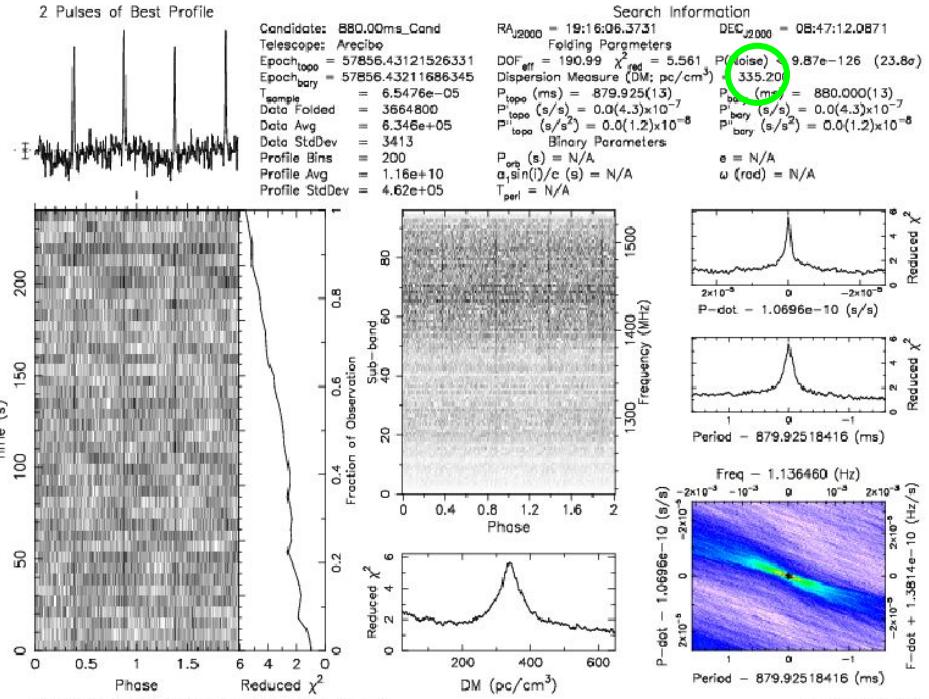
2 Pulses of Best Profile



root 10-May-2017 20:17

Less	Name	Right Asc.	Declination	Period	DM	Catalogue	(Known/Cand.)period	Angular Sep.
	J1916+0844	19:16:19.0	+08:44:07.0	0.439995	339.4	ATNF	1/2 + 1.7e-05	4.402
	J1916+0852	19:16:24.6	+08:52:36	2.182746	230.0	ATNF	2.480604	7.030

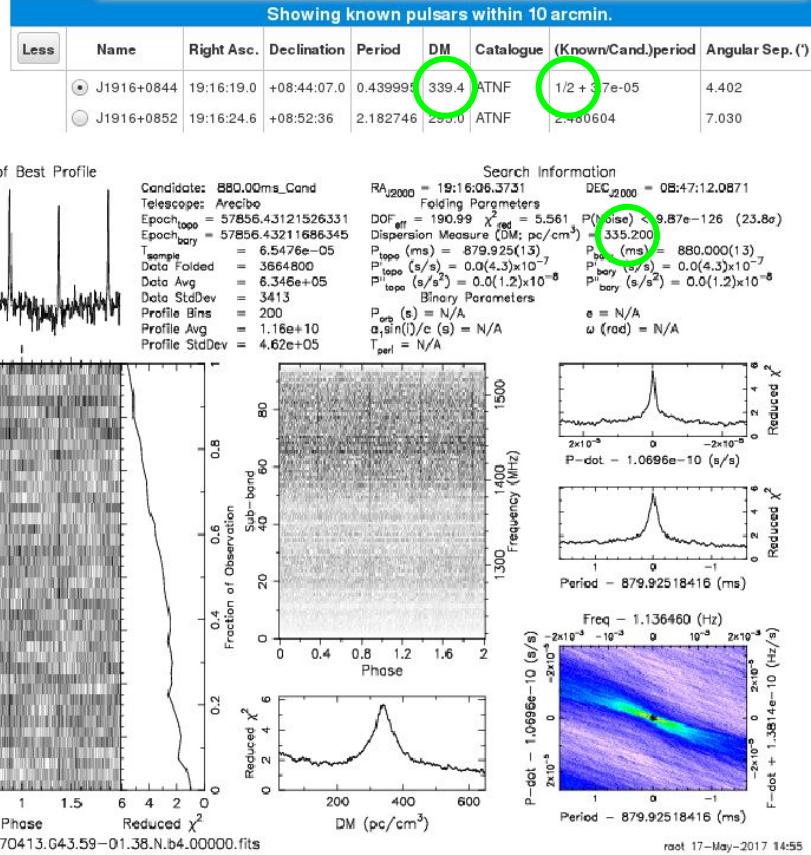
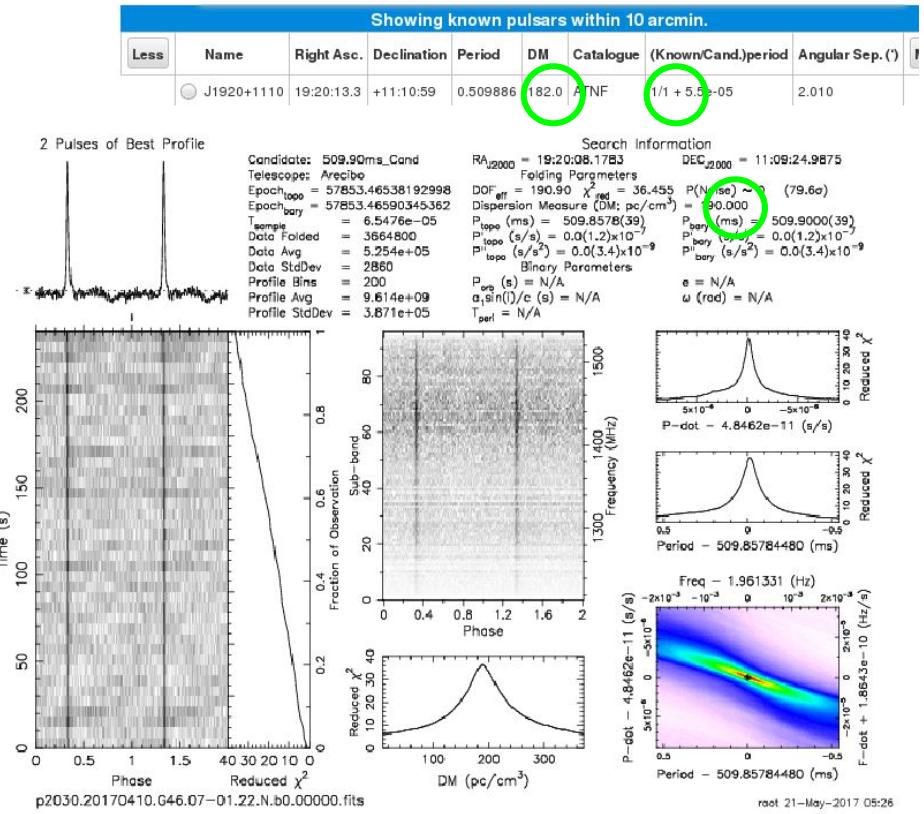
2 Pulses of Best Profile



root 17-May-2017 14:55

Class 6 candidates

More examples



root 21-May-2017 05:26

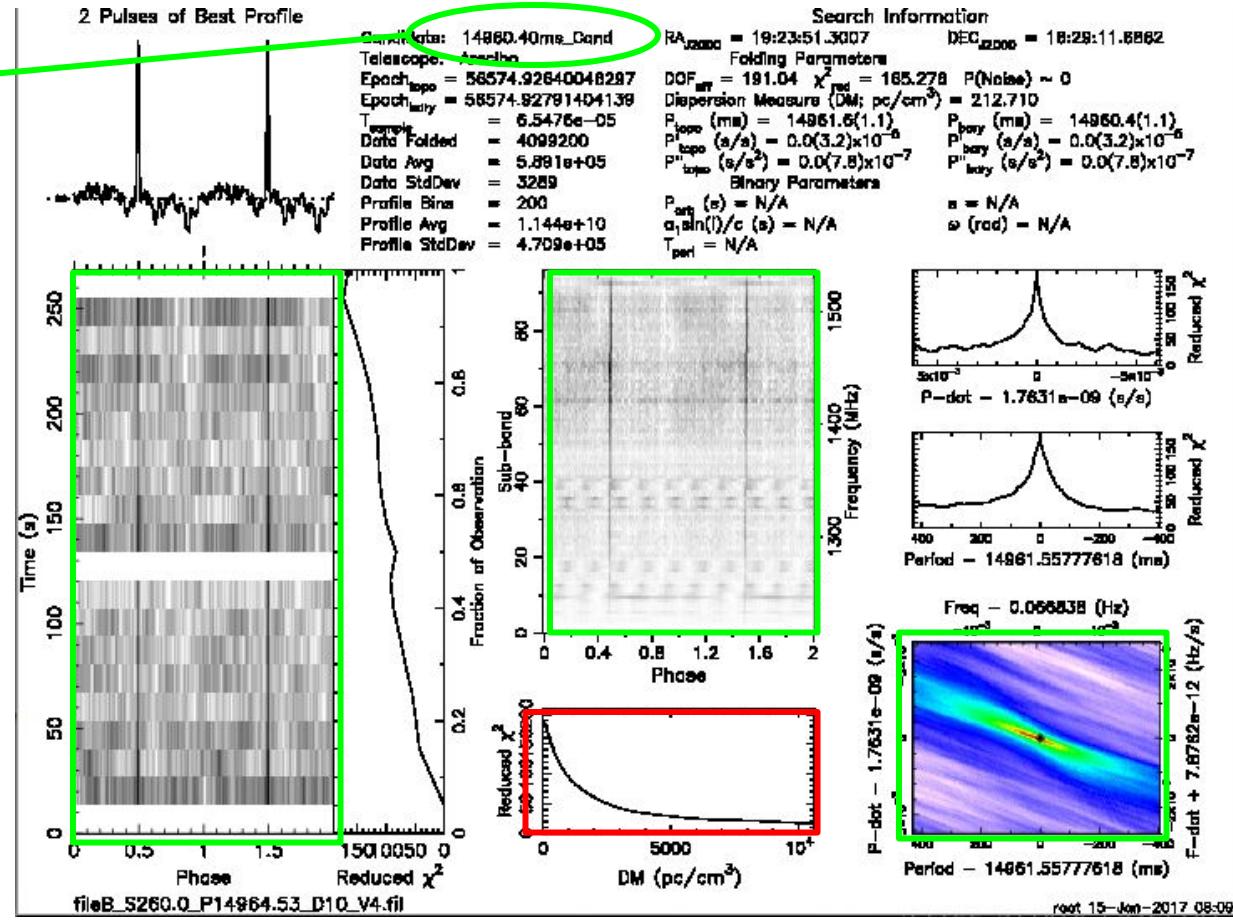
root 17-May-2017 14:55

Examples of prepfold plots of long-period FFA candidates

(synthetic signals injected in the FFA
sensitivity analysis)

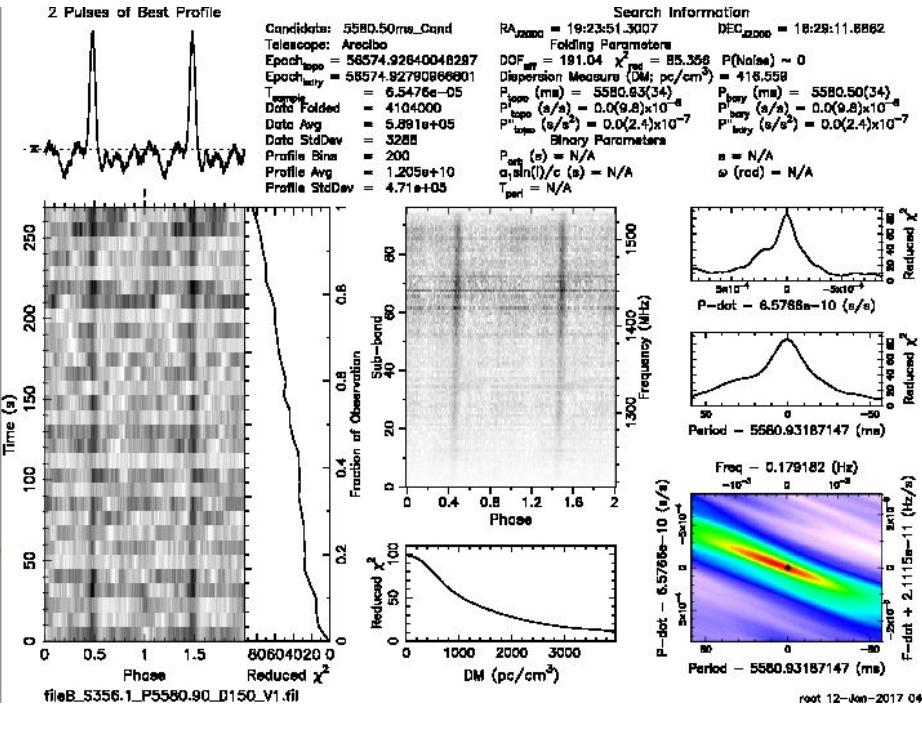
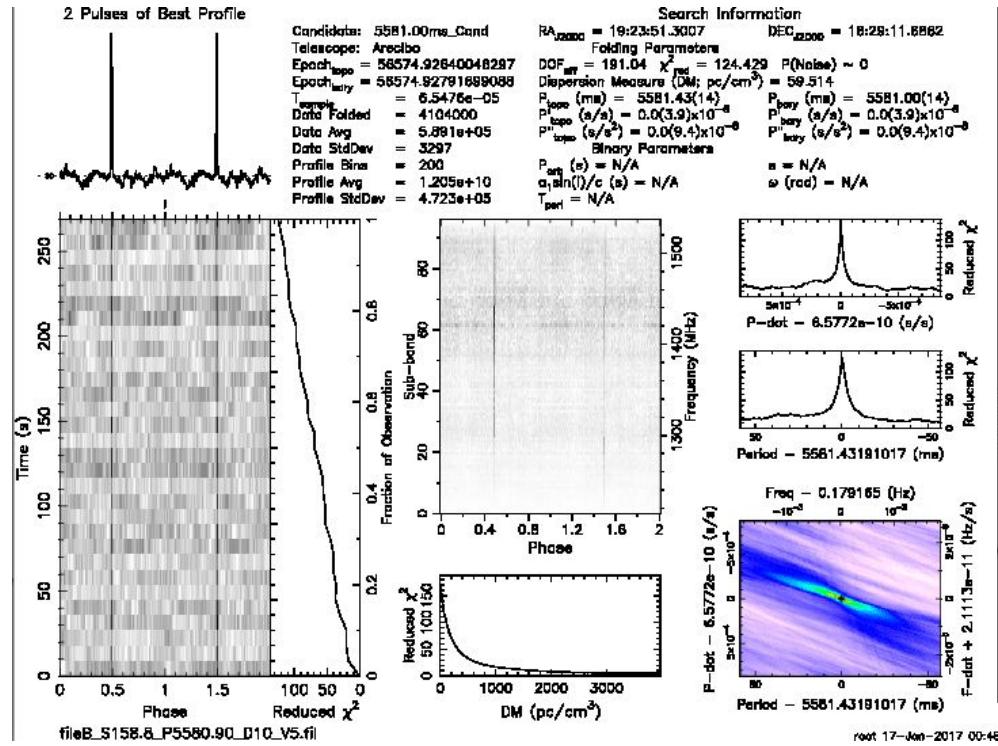
FFA candidates can be recognized via their “Candidate” attribute: there is a period written rather than “ACCEL_cand”.

FFA cands have long-periods, and can have bad chi-squared vs DM plots (peaking at DM~0). This is because of the way the prepfold code folds long-period candidates. Therefore, we must be careful before classifying such cands as Class 4



Only the chi-squared vs DM plots look bad: all the others look very much pulsar-like.

Those should therefore be classified as Class 1



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