

Year 6 Pulsar Timing

Everything is explained in the [memo](#), titled "Radio Pulsar Timing for Fermi: The Second Half-decade" (update 27 Nov '13). This page houses the lists referred to in the memo (see Table, below).

[Final list for Pub Board pages](#)

To [Giovanna Senatore](#): Two things – improve how users add PTC=Pulsar Timing Consortium contributors to the "eligible authors" list of a paper-in-progress ; and update the list of PTC names to the one given here. **D O N E!** *See her comment at the bottom of this page.*

The current situation – Pat Nolan's database, and tools to use it, make it so that any name only appears once, with a hierarchy. "PTC" is at the bottom of that hierarchy, in the sense that only folks that aren't already listed in another category appear there. Examples – Michael Kramer is a team member ; Gregory Desvignes is the postdoc of an affiliate. So neither appears in the "PTC" list. Thus, a LAT author wanting to add PTC people to the list of eligible authors for a paper has to first click PTC, and then go through the lists to click on the other people one-by-one. Only a few of us know who those "other people" are, thus making it arcane for a given author to give PTC contributors the opportunity to receive their due credit for timing contributions.

The requested improvement – could you figure out some way to modify Pat's tools so that the people below get added in just one click? Thank you! David S, Lucas, Dave JT.

Marta Burgay

Ismael Cognard

Gregory Desvignes

Cristobal Espinoza

Lucas Guillemot

Gemma Janssen

Simon Johnston

Matthew Kerr

Michael Kramer

Andrew Lyne

Richard Manchester

Ryan Shannon

Ben Stappers

David Smith

David Thompson

[Year 6 PTC upgrade details](#)

Lucas documents his recent folding of >800 PKS JBO NAN pulsars at <https://confluence.slac.stanford.edu/display/SCIGRPS/PSUE+++July+2013> and in particular, Dave S reads [results_wSearchPulsation.xls](#) into BigFile to make the memo plots and tables for all >2000 known pulsars.

For context, you should read <https://confluence.slac.stanford.edu/display/GLAMCOG/Pulsar+Timing> and <https://confluence.slac.stanford.edu/display/GLAMCOG/Year+2+Pulsar+Timing> .

Below the table you will find discussion of the memo.

Here are our milestones:

- Draft zero to co-authors Lucas, Matthew K, and DJT, 25/10. **done**.
- Version to radio principals Johnston, Manchester, Stappers, Kramer, Cognard the week after. Camilo & Ransom, too. **done**.
- Nançay "every six months" proposal deadline, 5/11. In the past it has evolved little or slowly from proposal to proposal. This year we may make more substantial changes.
- Discuss with Galactic group (**done**, 29/10 EVO meeting) PTC, and PSC in mid-November.
- Parkes proposal deadline is 15/12. We (=LAT. PKS may think otherwise) are proposing a) all MSPs, please ; b) drop Edot > 1E34 pulsars showing no hint of gammas after 5 years ; c) maybe drop pulsars that can be observed by Northern telescopes ; d) add some low Edot pulsars, especially in the Deathline Edot range ; e) add a smattering of e.g. interpulse pulsars ; pulsars spatially co-located with weak Fermi DC sources.

File name	Purpose	Cuts	N pulsars
gt1E34noPulse.txt	Folded 5 years, never a hint of pulsations.	Edot > 1E34, HTS < 20	62 south, 68 north
All_gt1E34unfolded.txt	Track down stragglers, including MSPs	Edot > 1E34 but no .par file	51 boil down to 24 boil down to 19
MSPsNotFolded.txt	Unfolded MSPs	All Edot. P0 < 30 ms	11 (36) south, 3 (57) north (note a)

results_wSearchPulsation.xls	Lucas phase-folding of >800 pulsars	Anything we can get our hands on.	805 includes 2PC, misses some GBT, RXTE
DeathNotFolded.txt	Focus on the deathline region	1E33 < Edot < 1E34, dec < -35, abs(b) > 3, Dist1 < 5	37 south, 12 north
south, north	Focus more on death	Same, but no dist, latitude cuts	172 south, 93 north
ATNF_LATmatches.txt	Spatial coincidences with weak LAT sources	angsep < error ellipse	~30 boil down to ~10
WeakNearOffPlane.txt	Buy some more lottery tickets	(note b)	111 south, 88 north
InterpulsePulsarPTC2014	Not much -- only one or three not phase-folded.	Not MSP, with radio interpulse	27 boils down to <4
PTCpeople.txt	Current list of names		34 PTC + 4 PSC

Notes: a) 11 (3) is the number in ATNF with a pre-launch reference date, and 36 (57) is the number of known MSPs that the LAT team hasn't folded. The difference is due to PSC etc recent discoveries, where either a timing model good enough for gamma folding doesn't exist yet ; or the discoverers prefer to do it independently of the LAT team.

b) Cuts for the WeakNearOffPlane sample:

```

if psr['EDOT'] < 1.E33 :
    if psr['DECJD'] < -35. : (For North, invert)
        if psr['PeakHTS'] == '*' and psr['PSR_Code'] == '*' and psr['TRES'] == '*' and len(psr['PSRJ']) < 11
and psr['P0'] > 0.01:
    "not Lucas folded"          "not gamma detected"          "not other folded"          "not
globular"                      " not MSP"
        if abs(psr['Gb']) > 3. and psr['DIST1'] < 3. :
            "off plane"              "nearby"

```

Discussion and comments

(In preparing the memo, David S made plots like $\sqrt{\text{Edot}}/d^2$ vs latitude, or Htest, and others. But in the end, decided to only put the 3 figures you saw -- the others don't really add much, IMHO. If, in reading, you think you'd like to see such n' so plot, let me know.)

Lucas (24/10)

Would it be useful to push the lower Edot limit down to say 8e32 erg/s, for probing the deathline? Also should the $d < 5$ kpc condition be made more stringent? (in other words, are there pulsars that really stand out in terms of Edot / d^2 or $\sqrt{\text{Edot}} / d^2$ when going to even lower Edot values?)

David: Perhaps study all pulsars nearer than some nearby distance? Once we agree on the idea of fishing around in the deathline zone, we can twiddle the parameters to get the sample size, type that we want.

Matthew (25/10)

Overall, it sounds good to me. My main thoughts are:

(1) On MSPs. It will be a monumental effort, but it will be necessary to track down who is doing what with the recently discovered MSPs, both PSC and HTRU/GBTNCC (i.e. big radio surveys). Many are already being timed (I know of one ongoing project at Parkes for HTRU and one at GBT for PSC specifically for this; Fernando will certainly be doing these new AO MSPs there, etc.)

Many of the PSC Parkes MSPs are dim (since they weren't found in Multibeam) / have low duty cycles and thus are a pain to time. So another question is -- are the ephemerides we have good enough to be carrying on with? There are probably some Multibeam survey MSPs that are not timed and dim, but for which a few TOAs will allow phase connection to archival data, so not all that much time.

I can pretty quickly just look around here for archival data to see what's been/being timed under what project, if that will be useful. But hopefully some of the radio folks can chime in on this.

I do agree that this is an important place to keep pushing!

David: Especially off the plane, we'll quickly see whether there's no gammas to phase even if we did have an ephemeris! Inversely: for MSPs where timing is a hassle and there's no obvious gamma source, calculate a DC upper limit, tabulate, and move on. Stated otherwise: one could imagine a gamma MSP catalog, where the starting point is all known field MSPs. And where some number of the MSPs don't get folded but do get tabulated and plotted.

(2) On the death line / high latitude lottery tickets. I still like this as a science case, and who knows what Pass8 will bring? There is probably some good radio science to be had in monitoring these. In particular, finding more nulling pulsars might be interesting, would be "free", and I'm sure there are tons of pulsars for which this is an open question. Or if we can at all tune the sample to radio pulsars with hints of something interesting based on lit review / favorite pulsars. (Some could be observed in search mode for single pulse studies or mode changes, e.g.)

It's a good question how far these ephemerides will extrapolate back, though, and it's pretty unlikely we'll pick up any dim, new pulsars in < 4 years of integration. Although that having been said, old pulsars are pretty stable. And if we **do** start to see gamma rays from the polar cap, the peaks will be narrow, which will help appreciably...

David: PSR [J1717-5800](#) is a curious use case for backtrapolation.

(3) Since the spatial associations are at low latitude, there's a good chance they aren't blazars, but it would still be good to sanity check the spectra. The ones that hold up should be relentlessly pursued! Already detected as a point source is a big step in the right direction.

David: but for low TS, spectral determination is too shoddy to distinguish PL from PLEC.

Roger (29/10)

(After David's presentation of this page at the Galactic EVO meeting, Roger made some comments, which David paraphrases here.)

- Yes, the plan back in 2008 was to modify the observation strategy once we'd seen which pulsars were popping up as gamma pulsars. So this update is good, and probably overdue.
- Yes, the electrons that produce the radio signal could/should emit gammas, with some difficult-to-predict intensity. So yes, worth fishing around low \dot{E} .
- But: we should do our homework. That is, we have hundreds of gamma-phase-folded pulsars already. Before asking for more, we should better study what we've learned from these. This then would better inform our choice of which more we might want to observe. And *whether* we want to observe more.

David: Totally agree. For example, what do we know about the geometry of the low \dot{E} pulsars we've phase-folded? Do we have an FoM (radio pulse width? other?) to help us guess their orientation? Is our sample of "black dots" random, or biased towards ones that are particularly interesting for the radio people? How do their \dot{E}/d^2 compare to our 2PC sensitivity plots? Yup... "someone" should indeed do all this.

Easier, for lazy people: Fig 2 of the memo shows that we're missing half of the northern pulsars. JBO claims to time them all. So why can't we get their ephemerides and just fold 'em?