



## The PALFA Pipeline and Sensitivity to Single Pulses

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### 1 Extended Abstract

PALFA (Pulsar Arecibo L-band Feed Array) is an on-going survey of the Galactic plane at 1.4 GHz, searching for radio pulsars with the Arecibo 305-m single dish radio telescope. Begun in 2004, PALFA has discovered 172 radio pulsars including 14 Rotating Radio Transients (RRATs) and 1 Fast Radio Burst (FRB). We have upgraded our data analysis pipeline to improve our sensitivity to FRBs, RRATs and long period pulsars (spin period  $P > 0.1$  s). Including a matched-filtering search technique to search for single pulses, we implemented a grouping algorithm to group events that are closely spaced in DM and time. Each group is ranked based on the criteria that astrophysical pulses follow (their signal-to-noise peaks at the optimal DM and falls off on either sides). A final candidate diagnostic plot is produced for each potential astrophysical candidate as identified by the grouping algorithm. Each candidate is then subject to a series of heuristic ratings followed by evaluation with a machine-learning algorithm. The final candidate diagnostic plots are uploaded to an online candidate viewer for by-eye inspection by the members of the PALFA consortium. Using this upgraded pipeline we have so far discovered 5 pulsars and 2 RRATs, 3 of which were detected uniquely by the single pulse analysis of the pipeline and 4 by both single pulse and periodicity analysis. We are currently reprocessing all PALFA archival data using this newly developed single-pulse pipeline.

In order to robustly test the sensitivity of our survey to single pulses, we are injecting synthetic pulses into real PALFA survey data [1]. The pulses are injected with different amplitudes over a range of DMs ( $12 - 8500 \text{ pc cm}^{-3}$ ) and pulse widths ( $1 - 90$  ms), well beyond the parameter space of known single pulses from pulsars, RRATs and FRBs. The data are then processed with our new single pulse pipeline to assess our sensitivity using recovered pulses. We will report the results of our sensitivity analysis here along with the new discoveries made using this pipeline.

### References

- [1] P. Lazarus, A. Brazier, J. W. T. Hessels, C. Karako-Argaman, V. M. Kaspi, R. Lynch, E. Madsen, C. Patel, S. M. Ransom, P. Scholz, J. Swiggum, W. W. Zhu, B. Allen, S. Bogdanov, F. Camillo, F. Cardoso, S. Chatterjee, J. M. Cordes, F. Crawford, J. S. Deneva, R. Ferdman, P. C. C. Freire, F. A. Jenet, B. Knispel, K. J. Lee, J. van Leeuwen, D. R. Lorimer, A. G. Lyne, M. A. McLaughlin, X. Siemens, L. G. Spitler, I. H. Stairs, K. Stovall, A. Venkataraman, "Arecibo Pulsar Survey Using ALFA. IV. Mock Spectrometer Data Analysis, Survey Sensitivity, and the Discovery of 40 Pulsars," *ApJ*, **81**, October 2015, 23 pp., doi: 10.1088/0004-637X/812/1/81.