



Null and Void!



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Introduction

The purpose of this experiment is to determine the capabilities and limitations of the Skynet 20 Meter Radio Telescope located at the Green Bank Radio Astronomy Observatory. Observations of three nulling pulsars, B0809+74, B0823+26, and B1944+17, were taken and analyzed.

Objectives:

- Vary the length of the observation to determine change in data.
- Examine time domain for interesting structures.
- Determine nulling periods.
- Compare and contrast experimental data with published data.

A pulsar is a highly magnetized, rotating neutron star that emits a beam of electromagnetic radiation (light). When a pulsar nulls, continuous signal is not received. Nulling duration can last from missing pulses to hours, days, months, or longer.

Green Bank 20 Meter Telescope



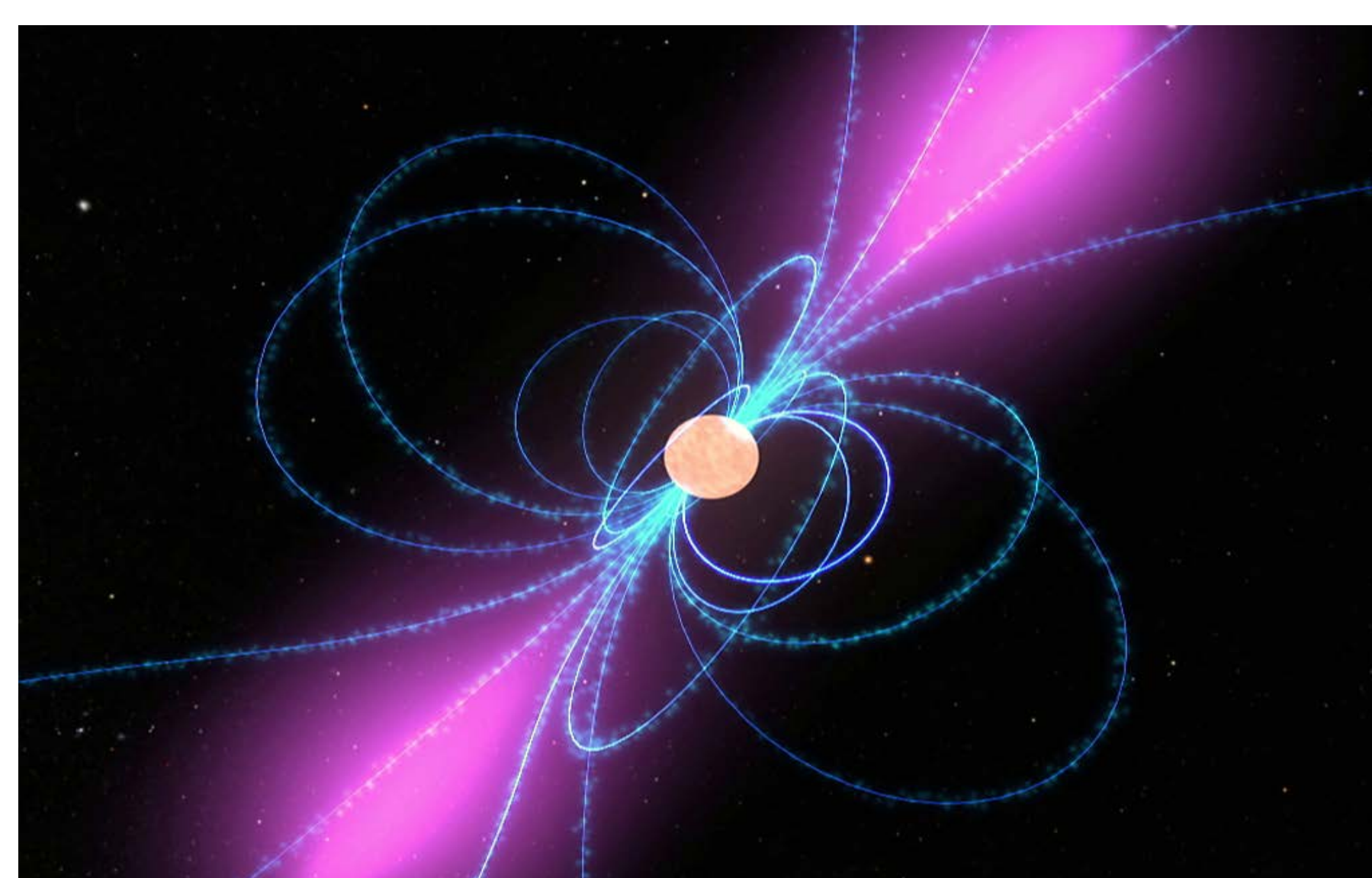
The Skynet 20-meter diameter telescope construction was completed in late 1994. The telescope is operated by the NRAO and funded by the US Naval Observatory (USNO). The 20-meter program was shut down in June 2000, due to budget cutbacks at USNO. In 2010, the National Science Foundation awarded a \$1.8 million grant to the University of North Carolina - Chapel Hill and NRAO Green Bank to expand the Skynet Robotic Telescope Network. The 20m has been restored, automated, and made accessible via the Skynet website.

Telescope specifications:

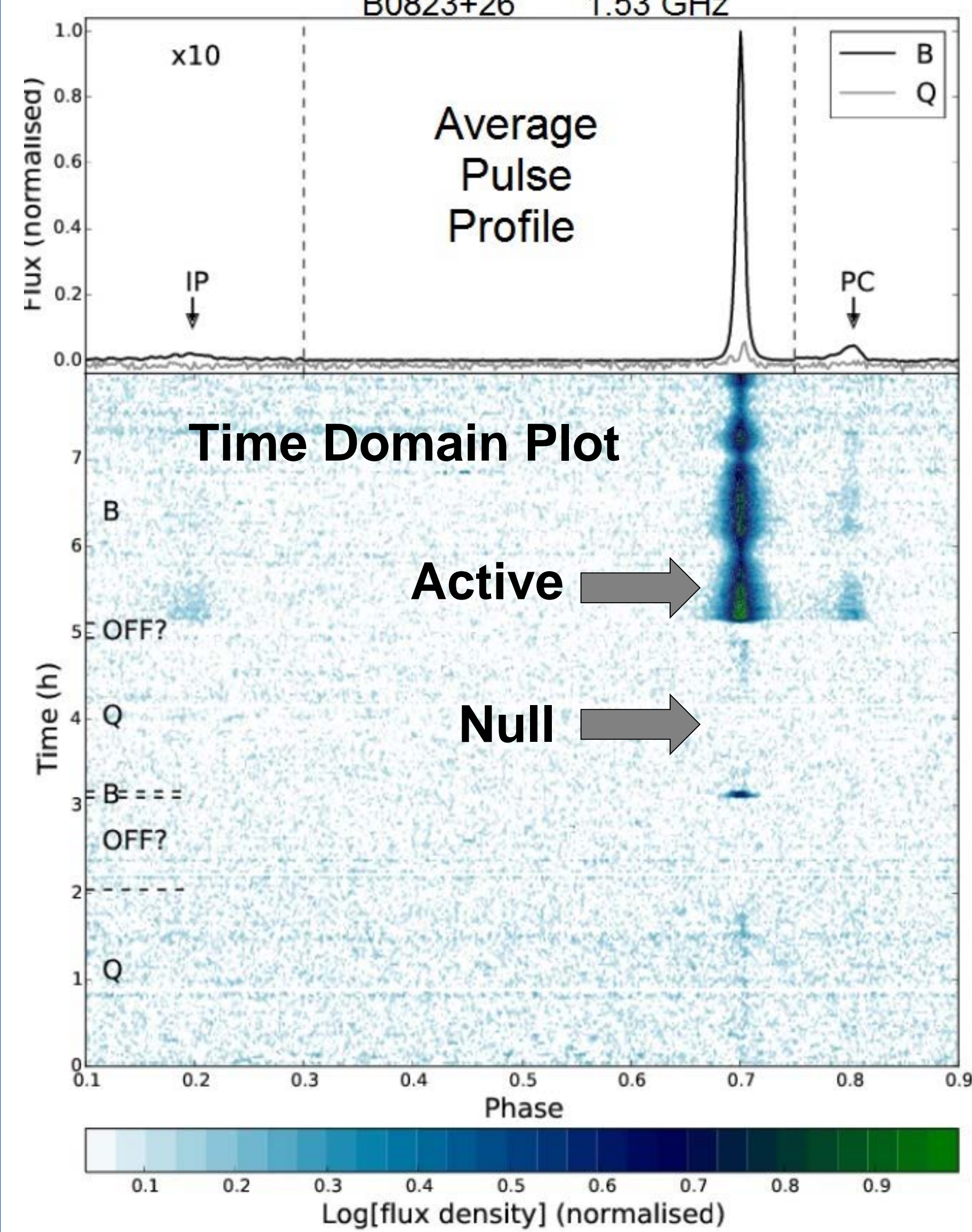
Type: Elevation over azimuth.
 Reflector Diameter: 20 meters
 Frequency bands: 2.2-2.6 GHz; 8.2-9.0 GHz
 Slew Speed: 2 degrees per second

Frequency Bands:	2.4GHz	8.5GHz	1.4GHz
System Temps	46 K	31 K	NA
SEFD*	720 Jy	440 Jy	NA
Aperture efficiency	55-59%	58-61%	NA

*SEFD - the system equivalent flux density (Jy), defined as the flux density of a radio source that doubles the system temperature. Lower values of the SEFD indicate more sensitive performance.



Pulsar	Discovered	Period
B0809+74	1968	1.29 s
B0823+26	1968	0.55 s
B0823+26	1.53 GHz	

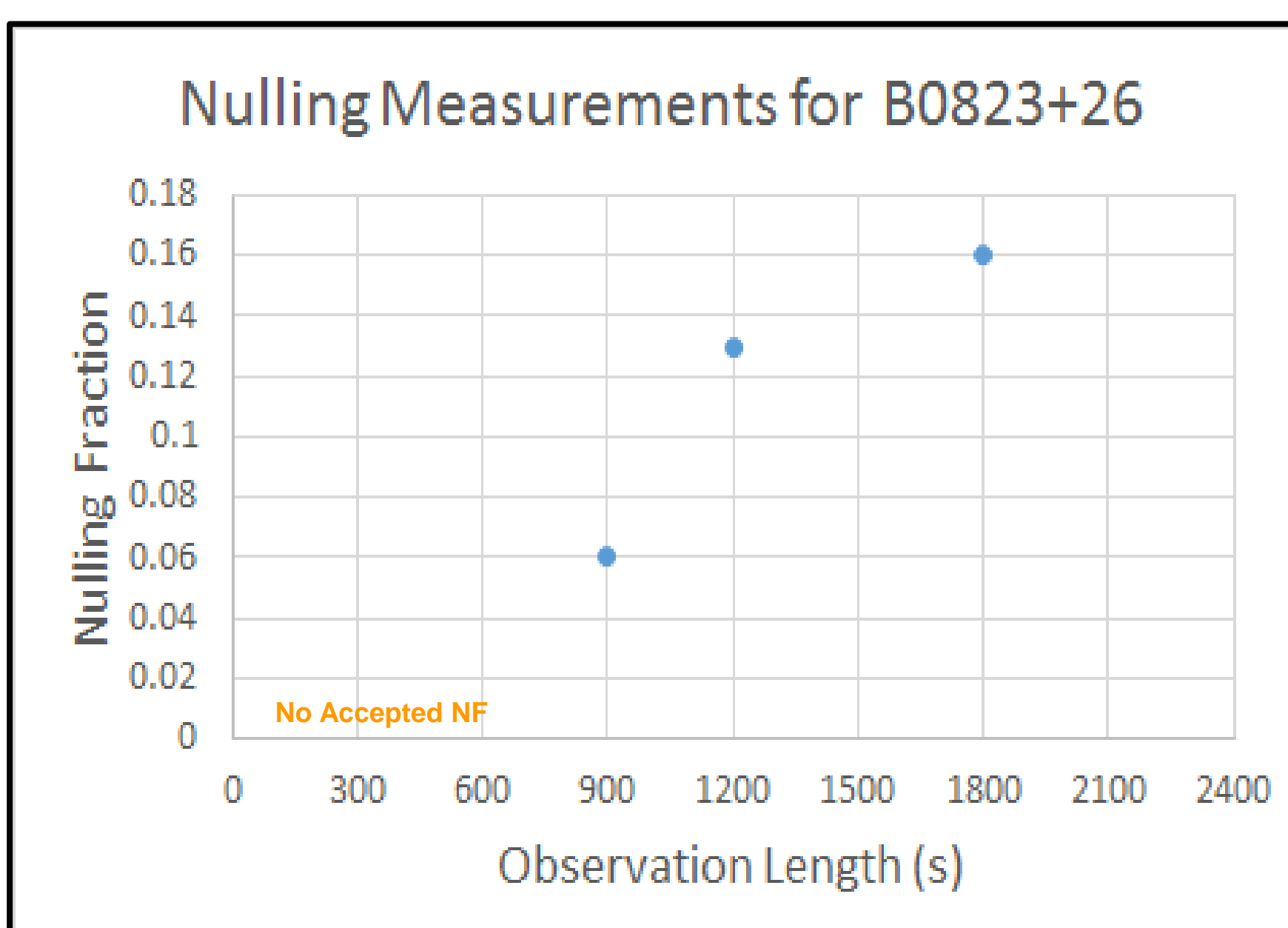


Method

Observational Parameters:

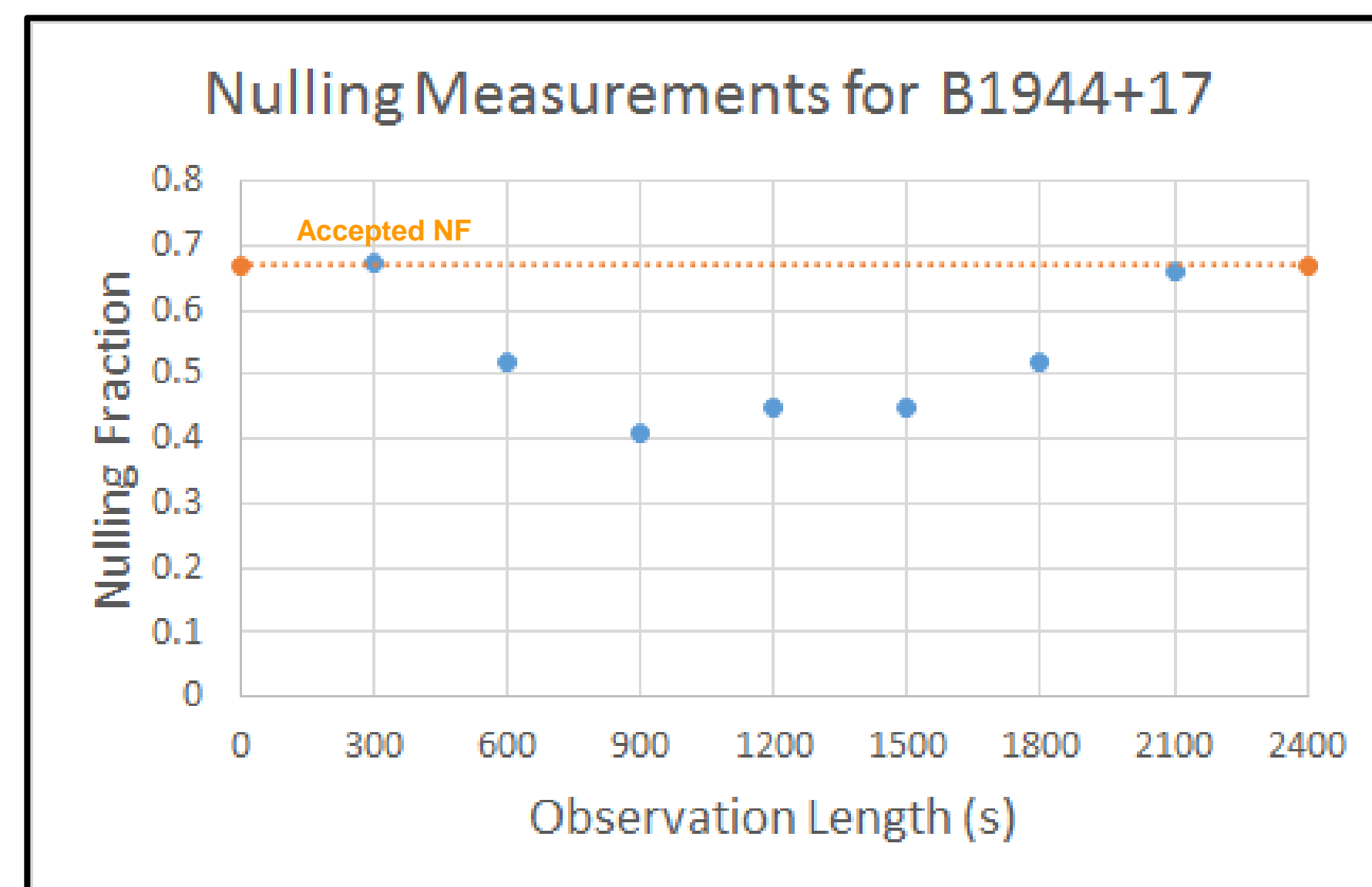
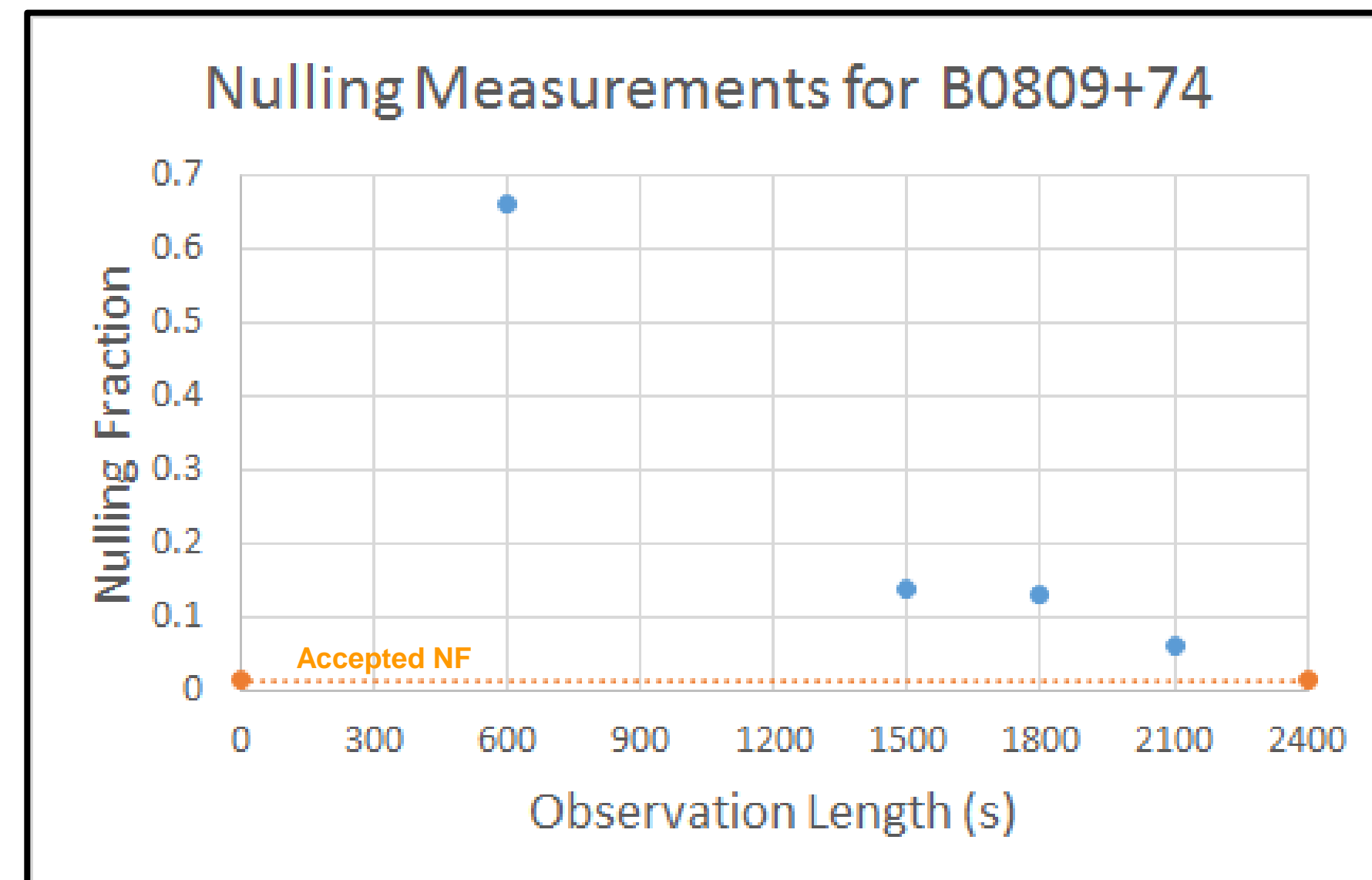
- HI Filter (1.355 - 1.435 MHz)
- Low Spectral Resolution (1024 channels, 78.125 kHz/channel)
- Integration Time = (pulsar period) / 30
- Observation Lengths of 300, 600, 900, 1200, 1500, 1800, and 2100 seconds.

Data Analysis



Consistent with previously published results we find no clear nulling fraction for this pulsar.

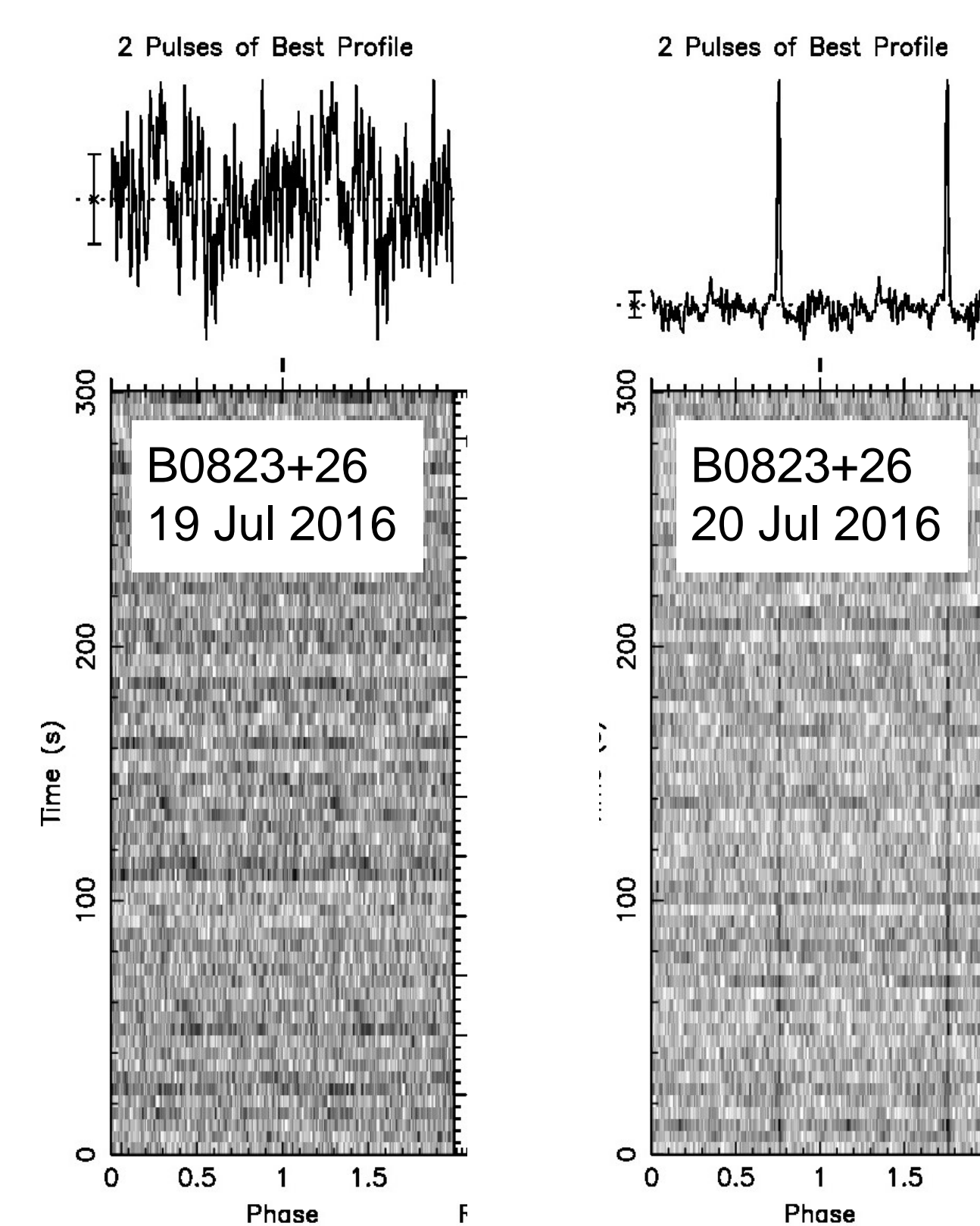
Data Analysis



Consistent with previously published results, the nulling fraction was observed.

Conclusion

- Only 300 seconds of time are needed to obtain good quality (25σ) data on a 10 mJy source



- Since the 3 pulsars have a flux density of 10 mJy, if a pulsar is not detected in our observation, then it is nulling.
- Sporadic RFI signals appeared, but were not significant enough to overwhelm the pulsar's signal.
- When a pulsar is bright, the nulling fraction can be accurately measured with a short observation time.
- When a pulsar is dim, longer observation times are required for quality measurements.

Acknowledgements

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