

A Global Repository for Pulsar Clock Corrections

<https://ipta.github.io/pulsar-clock-corrections/>

Anne Archibald <anne.archibald@newcastle.ac.uk>

Why clock corrections?

- Data is typically referenced to an **observatory clock**
- Observatory clocks drift by **microseconds** relative to GPS
- GPS needs corrections to get to a clean TDB or TCB time where we can expect pulsars to evolve smoothly
- Clock errors are a **common signal** in many pulsars

How do I get clock corrections?

- **Traditionally:** use whatever comes with TEMPO/TEMPO2/PINT; if you need something newer email someone you think might have them and ask
- **Now:** get them from the global repository
 - TEMPO or TEMPO2: `$ python download-clock-corrections.py`
 - PINT: automatically uses recent versions

What is in the repository?

- **Automatic:** GBT clock, GPS to UTC, TAI to TT, `ut1.dat`
 - Conversion between TEMPO and TEMPO2 format
- **Static:** Arecibo clock files, GB140, ...
- **Manual** so far: everything in TEMPO and TEMPO2 source

How to get things into the repository

- Generate up-to-date clock files (preferably automatically)
- Get them into the repository somehow
 - Put them on a web page (easiest),
 - Upload them somewhere (we'll figure that out), or
 - Send them by email (if necessary)
- Repository code will check the updates, keep the old versions in git, generate a status report, and (if appropriate) provide a converted version in the other common format

What about reproducibility?

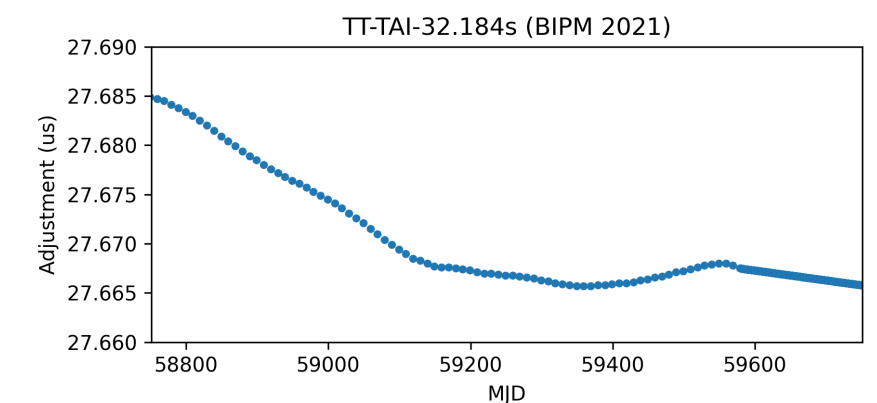
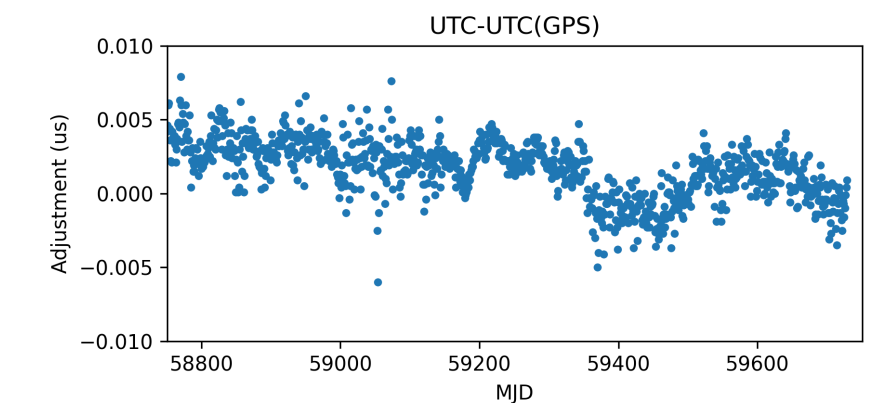
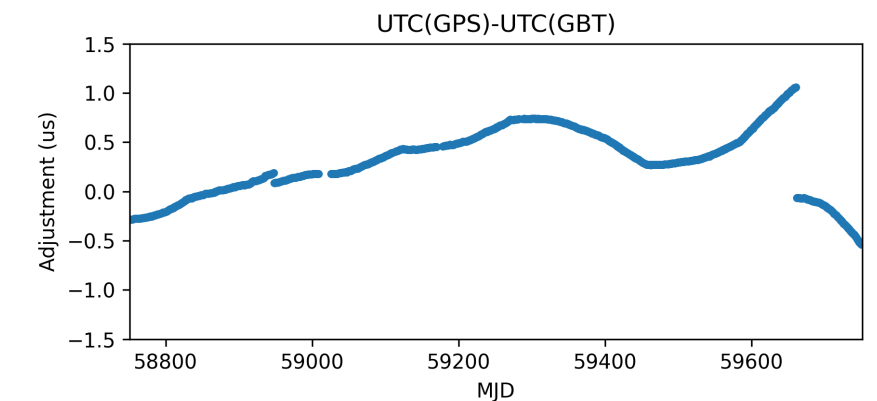
- Repository is in `git`, old versions are available at any time
- Updates are verified to ensure that they do not change old clock correction values
- Conversions preserve metadata and comments
- Erroneous clock files can be marked as needing replacement even if not out of date
- The `update-clock-corrections.py` script makes it easy to download and save the current state of the repository if desired

Excerpt of summary page

The repository makes it easy to check on the status of the clock corrections it holds, with a summary page like that below, and detailed pages with plots of each clock correction file.

Name	File	Corrections start	Corrections end	Last check date	Last check result
GPS to UTC	T2runtime/clock/gps2utc.clk	1993-01-01 MJD 48988.0	2022-05-30 MJD 59729.0	2022-06-20	Unchanged
GBT	tempo/clock/tim_e_gbt.dat	2000-12-31 MJD 51909.5	2022-06-19 MJD 59749.5	2022-06-20	Updated
GBT (TEMPO2 converted from TEMPO)	T2runtime/clock/gbt2gps.clk	2000-12-31 MJD 51909.5	2022-06-19 MJD 59749.5	2022-06-20	Updated
UT1 table	tempo/clock/ut1.dat	1973-01-02 MJD 41684.0	2023-06-17 MJD 60112.0	2022-06-20	Unchanged

Example: Correcting GBT data



After this sequence of corrections, TT can be converted to TDB or TCB to produce a smooth running time scale for pulsar timing.