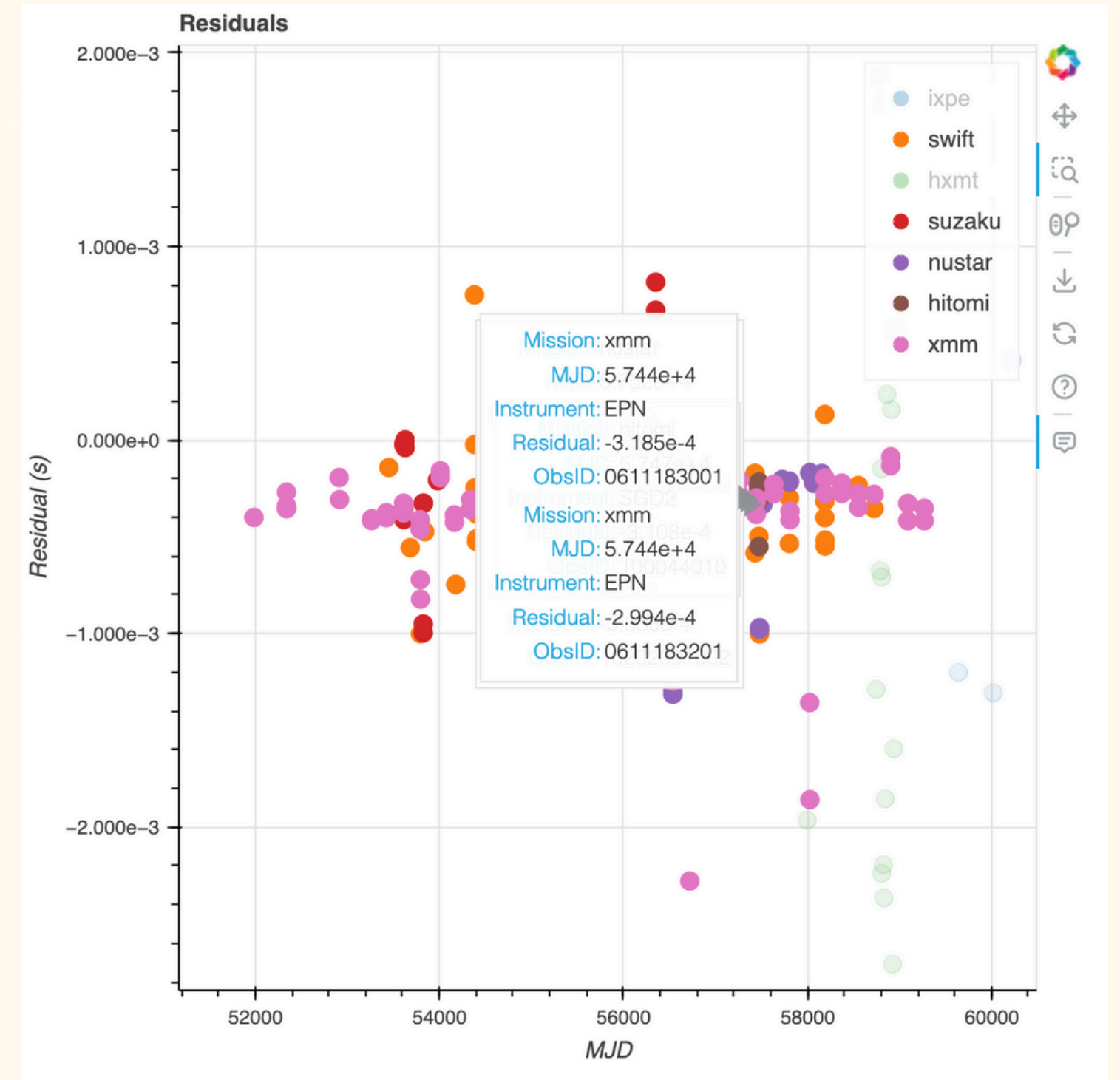# MISSION–AGNOSTIC PULSAR CALIBRATION

Matteo Bachetti

IACHEC meeting, La Granja, 2024

AIMS

Creating an automatic web-based browsable interface that tracks the timing calibration of all missions using the Crab (+ other pulsars) Using a single code, one can avoid the subtle differences that can be introduced by independent processing
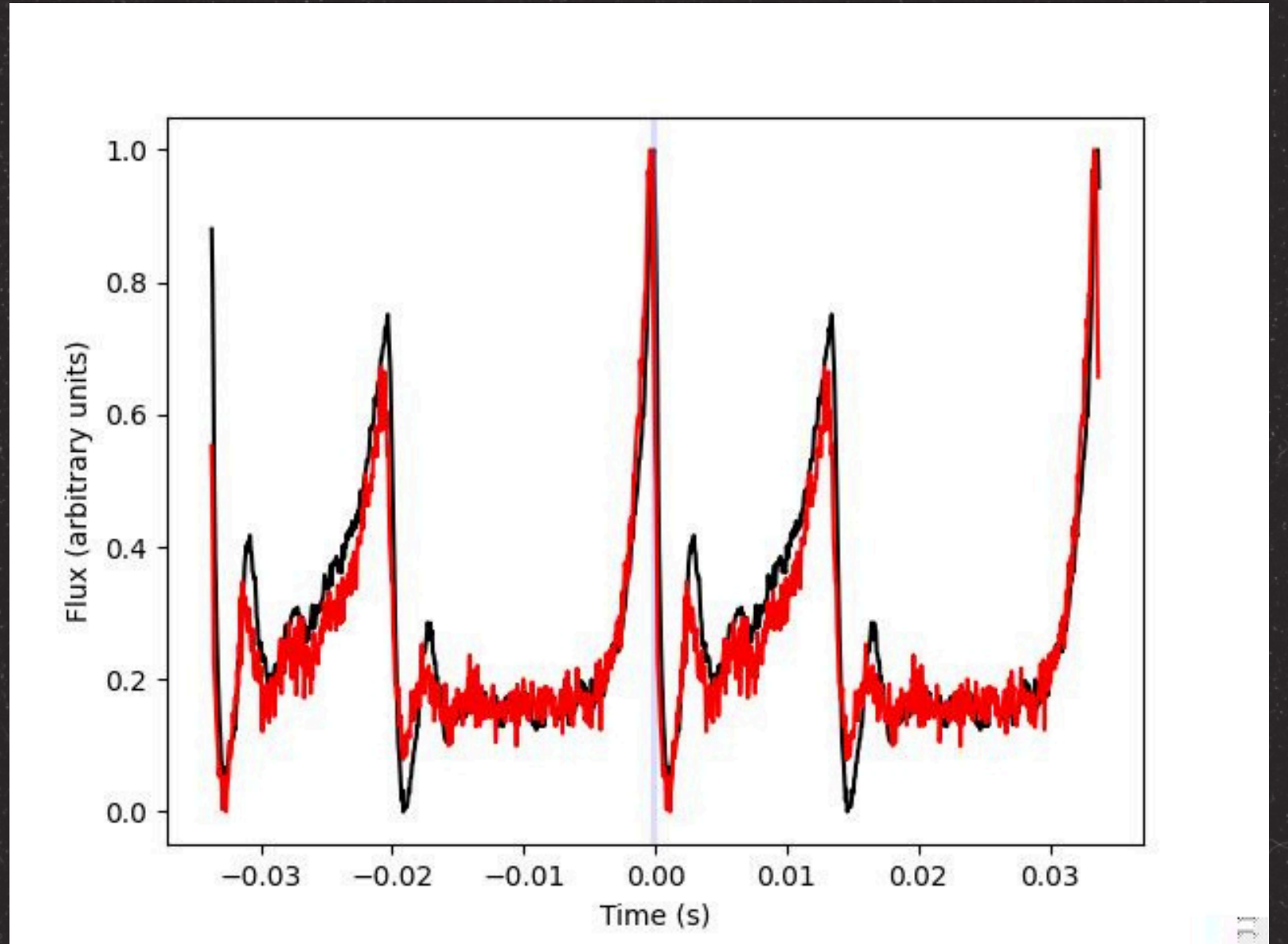

Residuals

TOA CALCULATION

The core of the calculation is the delay between the folded profile and a template
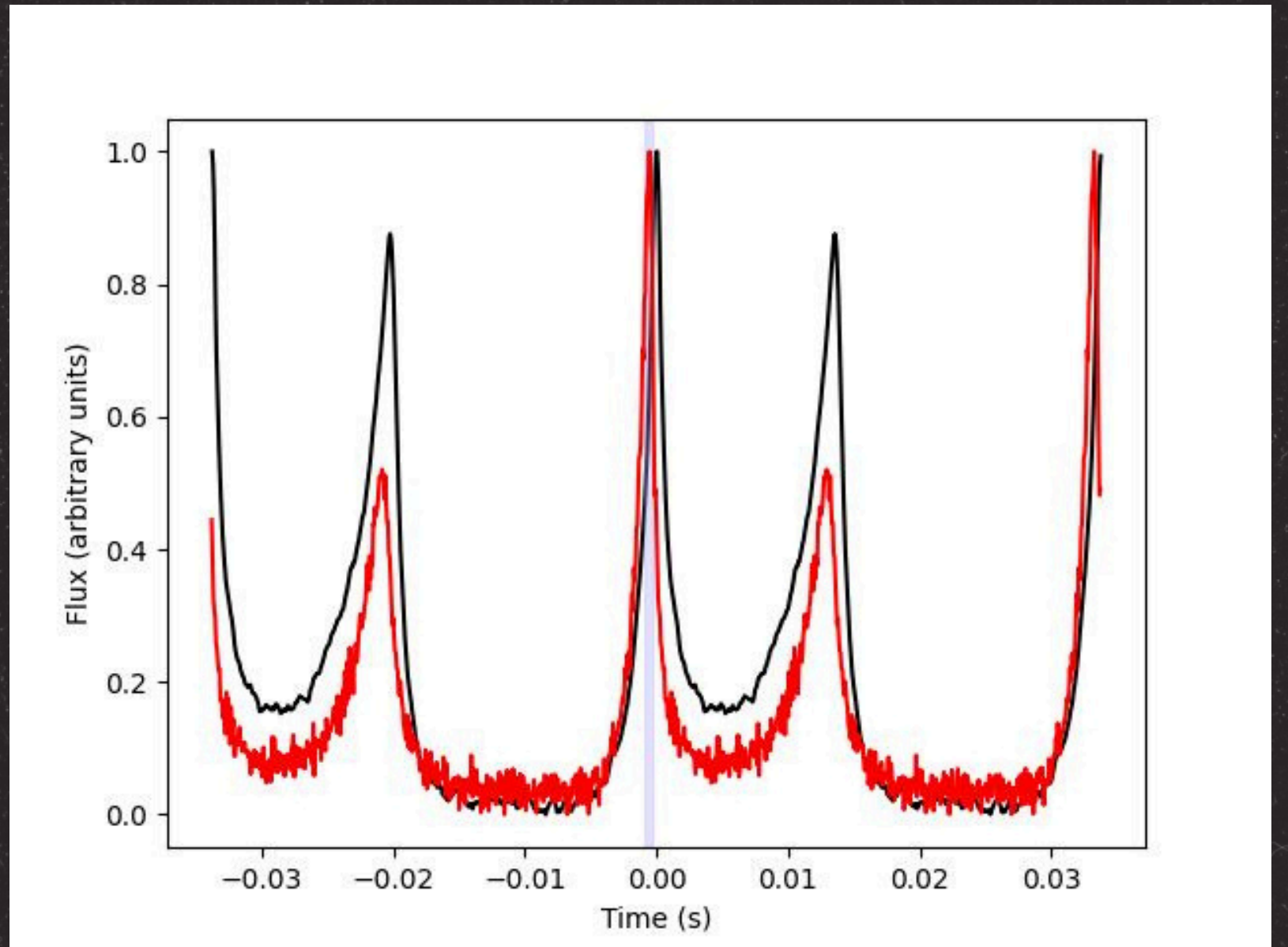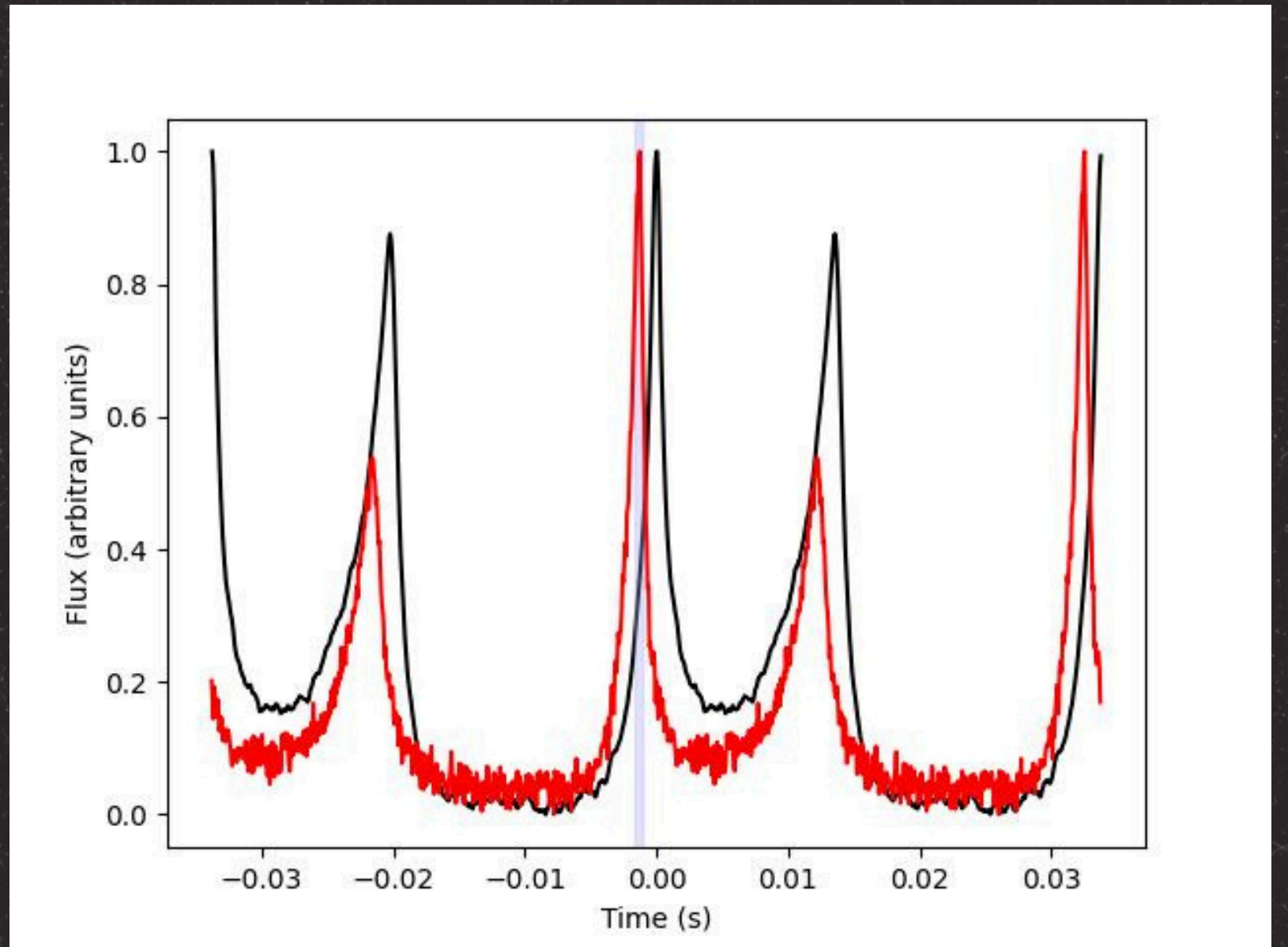
PROFILES CAN CHANGE!

Profile changes, e.g. for **energy-dependence** or **dead time**, need to be taken into account

CONSISTENCY IS KEY

Small errors of **source position**, different **ephemerides**, can create significant errors in delay measurements (~msecs)
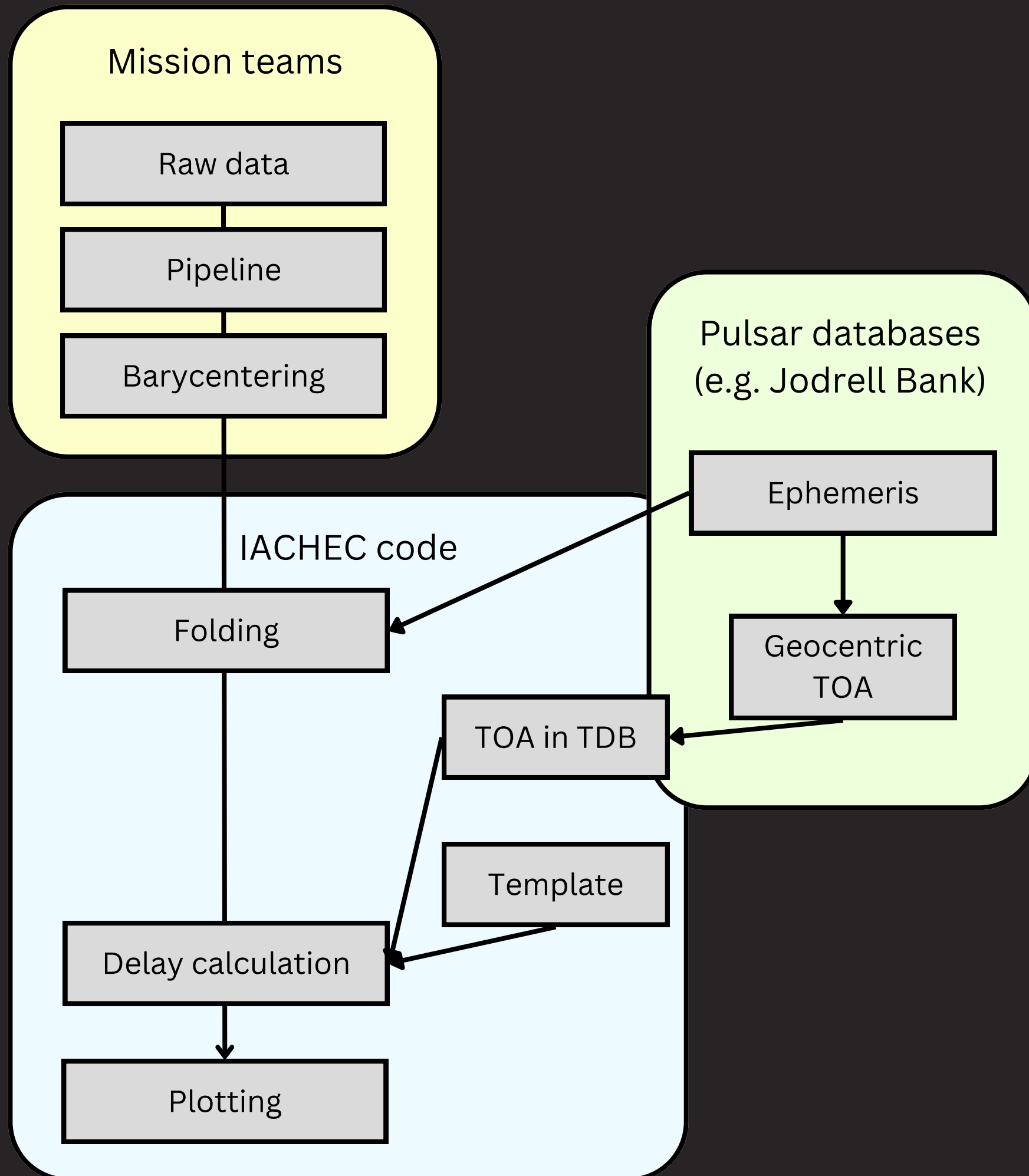
HOW THE CODE WORKS

Mission teams provide **barycentered** data, with the agreed ephemeris and source position. Pulsar databases provide the spin (and orbit when relevant) **parameters** and **TOAs.**

Technologies

- PINT for pulsar ephemeris

- Stingray for data manipulation

- Luigi for pipeline

- Bokeh for plotting

Data format

EV

Barycentered Event lists in FITS formats:

- EVENTS extension with TIME column (and maybe ENERGY)

- GTI extension
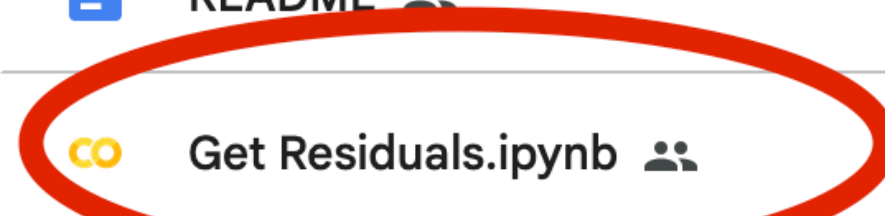
- MJDREF (or MJDREF{I,F}) header keyword

Ephemeris

Preferably JPL DE-430 (or >DE-405)

- RAJ2000 = 05 34 31.972

- DECJ2000 = 22 00 52.07

- ICRS frame

Name		Owner	Last m... ↓	File size	
📁 raw_data		👤 me	May 12, 2022	—	⋮
📁 IXPE		👤 me	Apr 30, 2022	—	⋮
📁 XRT		👤 me	Nov 9, 2021	—	⋮
📁 HXMT		👤 me	Oct 20, 2021	—	⋮
📁 NICER		🅲 cphu0821@g...	May 13, 2021	—	⋮
📁 BAT		👤 me	May 3, 2021	—	⋮
📁 Suzaku		👤 yukikatsu.ter...	Apr 27, 2021	—	⋮
📁 Hitomi		👤 me	Apr 26, 2021	—	⋮
📁 XMM		🆂 srosen@scio...	Apr 20, 2021	—	⋮
📁 NuSTAR		👤 me	Sep 15, 2020	—	⋮
📄 README 👥		👤 me	3:51 PM	2 KB	⋮
🆎 Get Residuals.ipynb 👥		👤 me	3:15 PM	250 KB	⋮

<> Code   ⊙ Issues 3   ⊓ Pull requests   ▶ Actions   ▤ Projects   📖 Wiki   ⊘ Security   Insights   ⚙ Settings

TOAextractor Public

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matteobachetti Fix again source name   77a51f2 · 2 years ago   ⏱ 35 Commits

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📁 docs	First draft	3 years ago
📁 licenses	First draft	3 years ago
📁 toa_extractor	Fix again source name	2 years ago
📄 .gitignore	First draft	3 years ago
📄 .readthedocs.yml	First draft	3 years ago
📄 MANIFEST.in	First draft	3 years ago
📄 README.rst	First draft	3 years ago
📄 pyproject.toml	First draft	3 years ago
📄 setup.cfg	Add test data	3 years ago
📄 setup.py	First draft	3 years ago
📄 tox.ini	fix dependencies	3 years ago

About

A pipeline to extract TOAs from X-ray observations of the Crab pulsar and others. Mostly for cross-calibration purposes

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