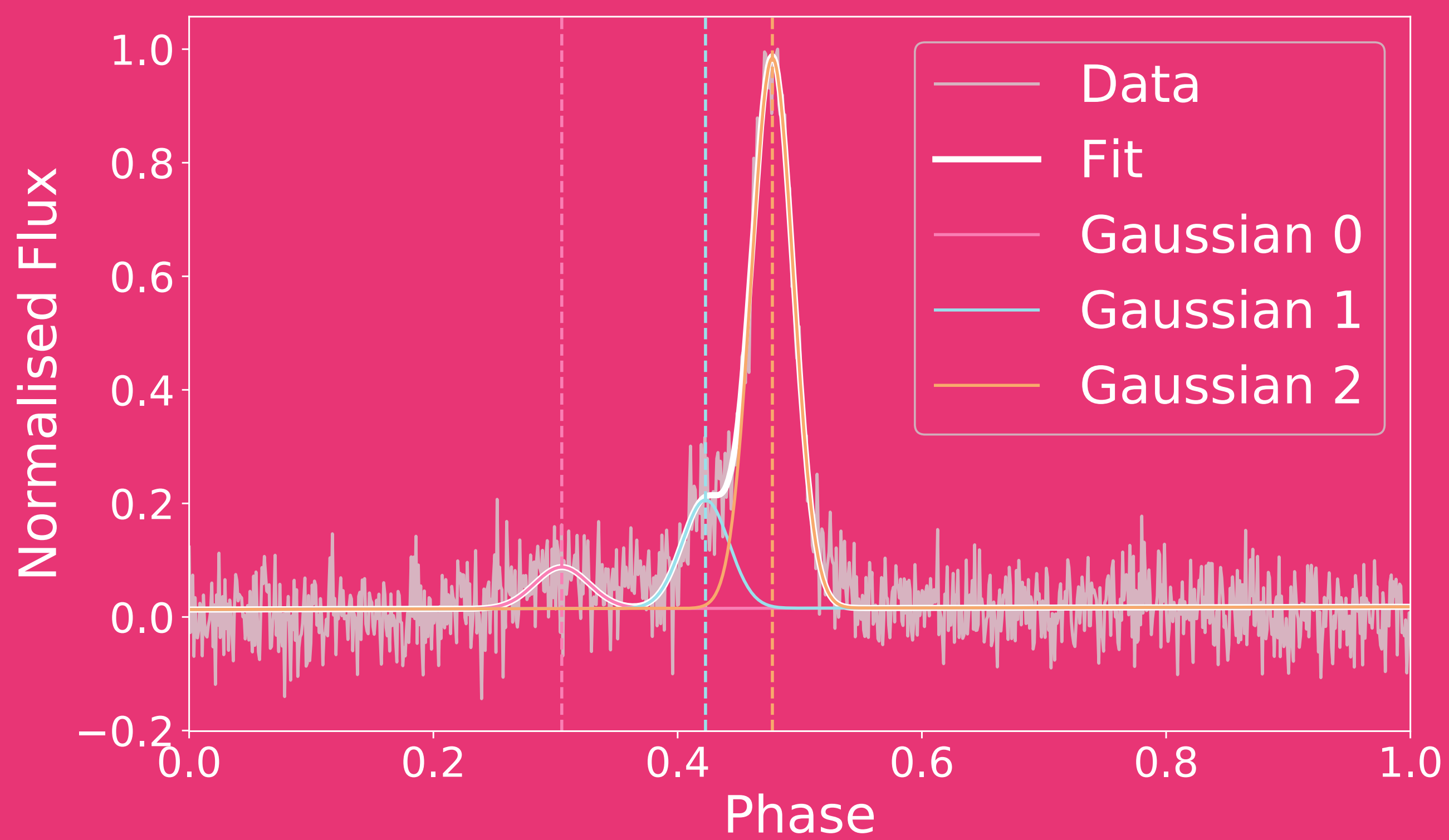
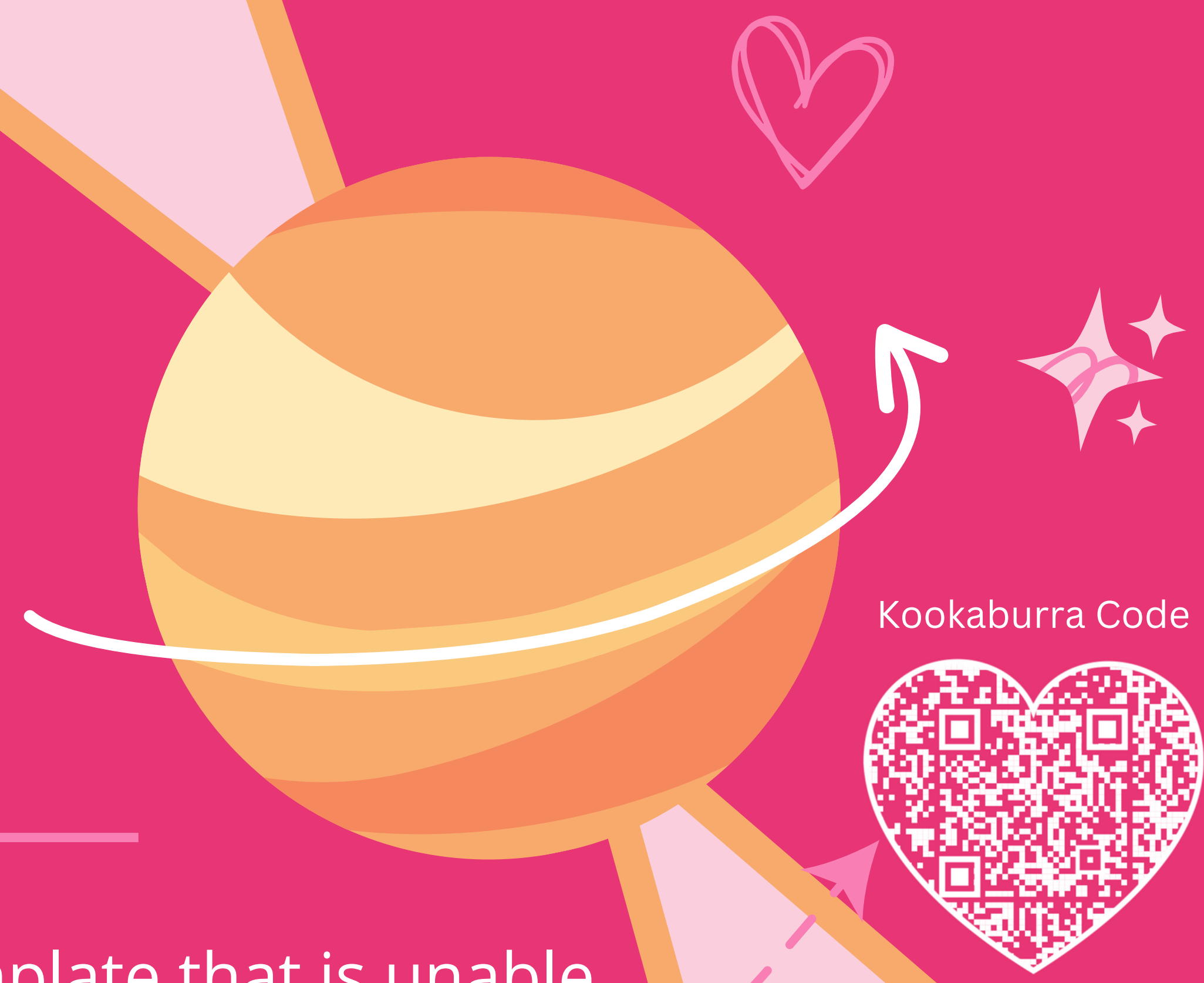




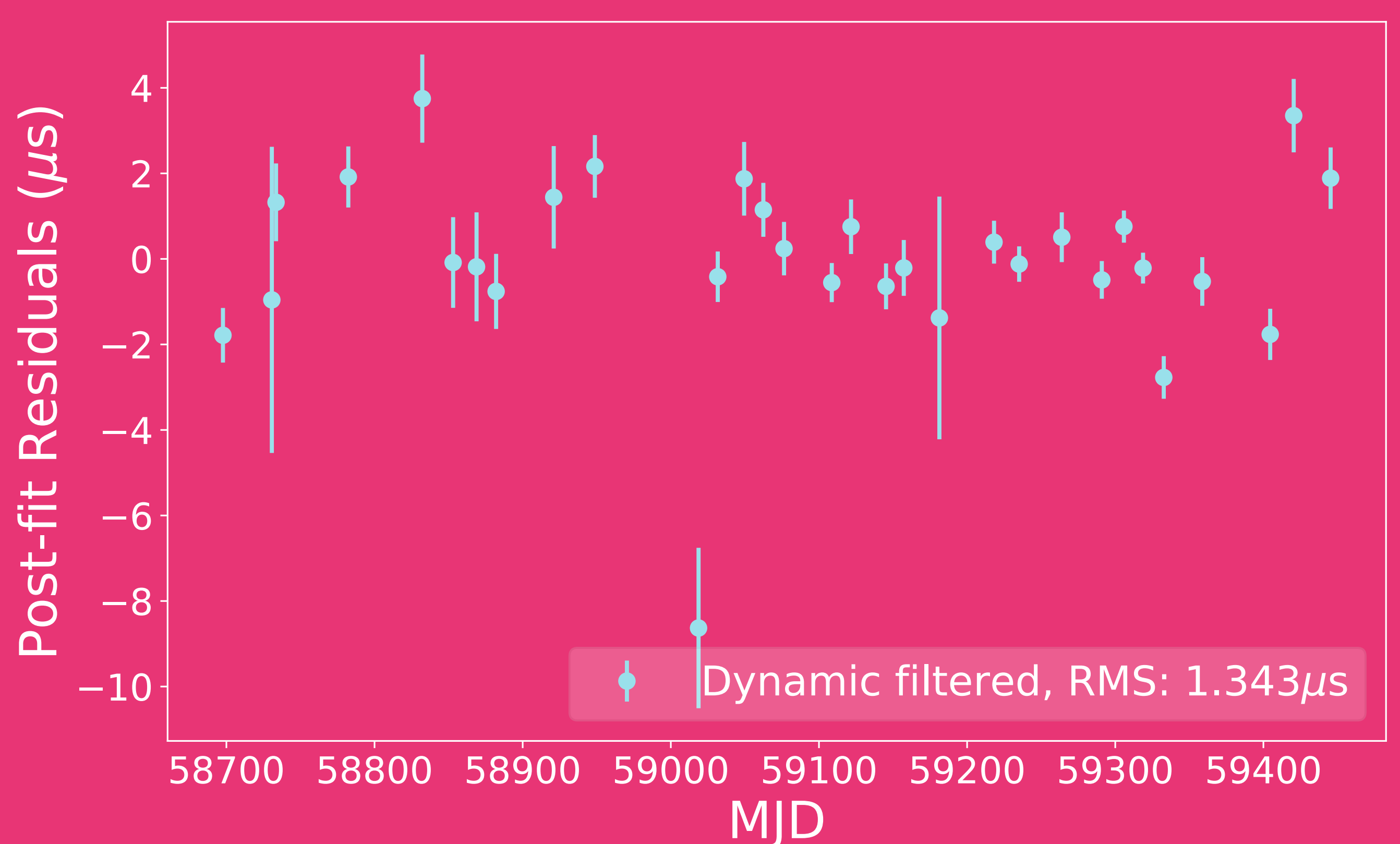
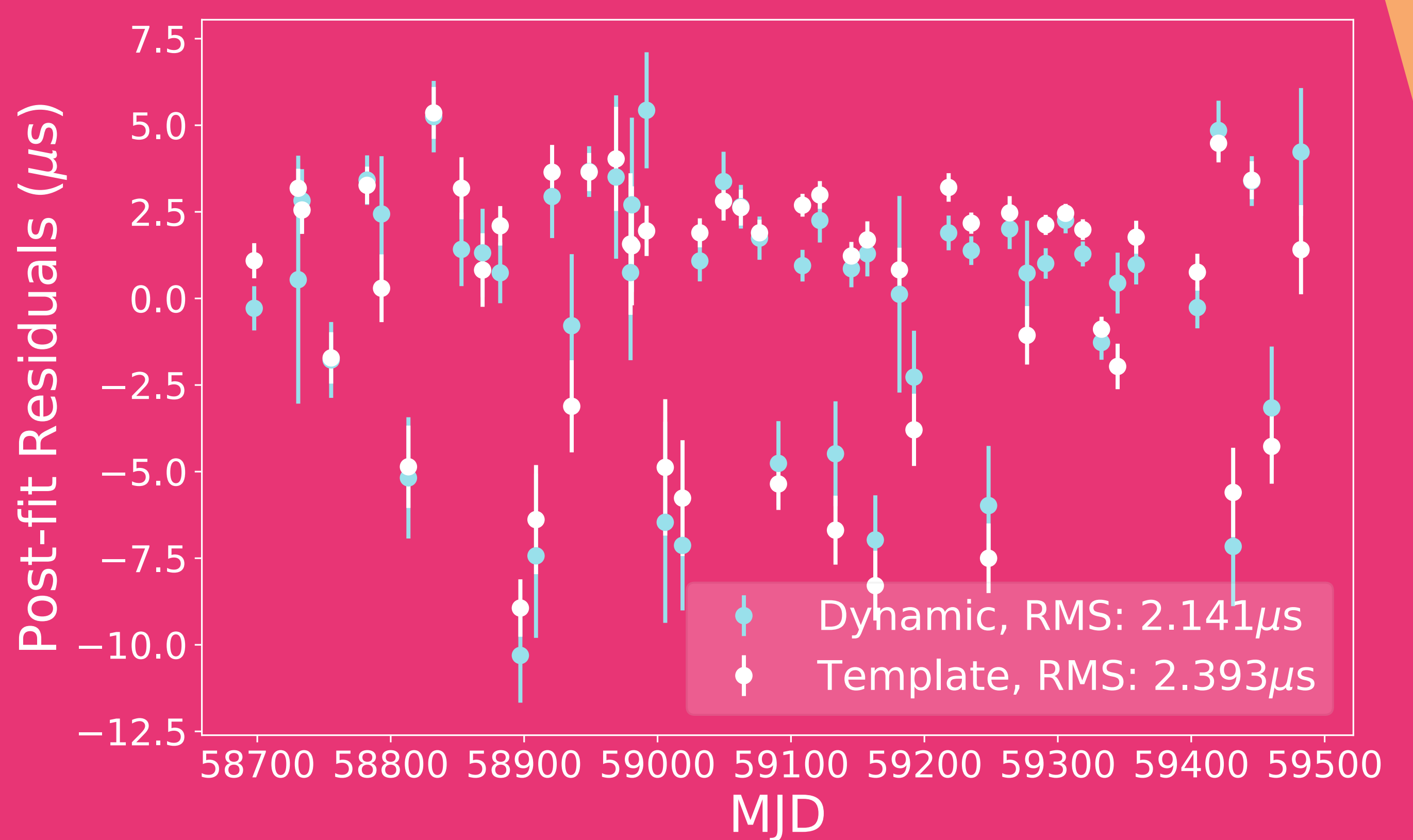
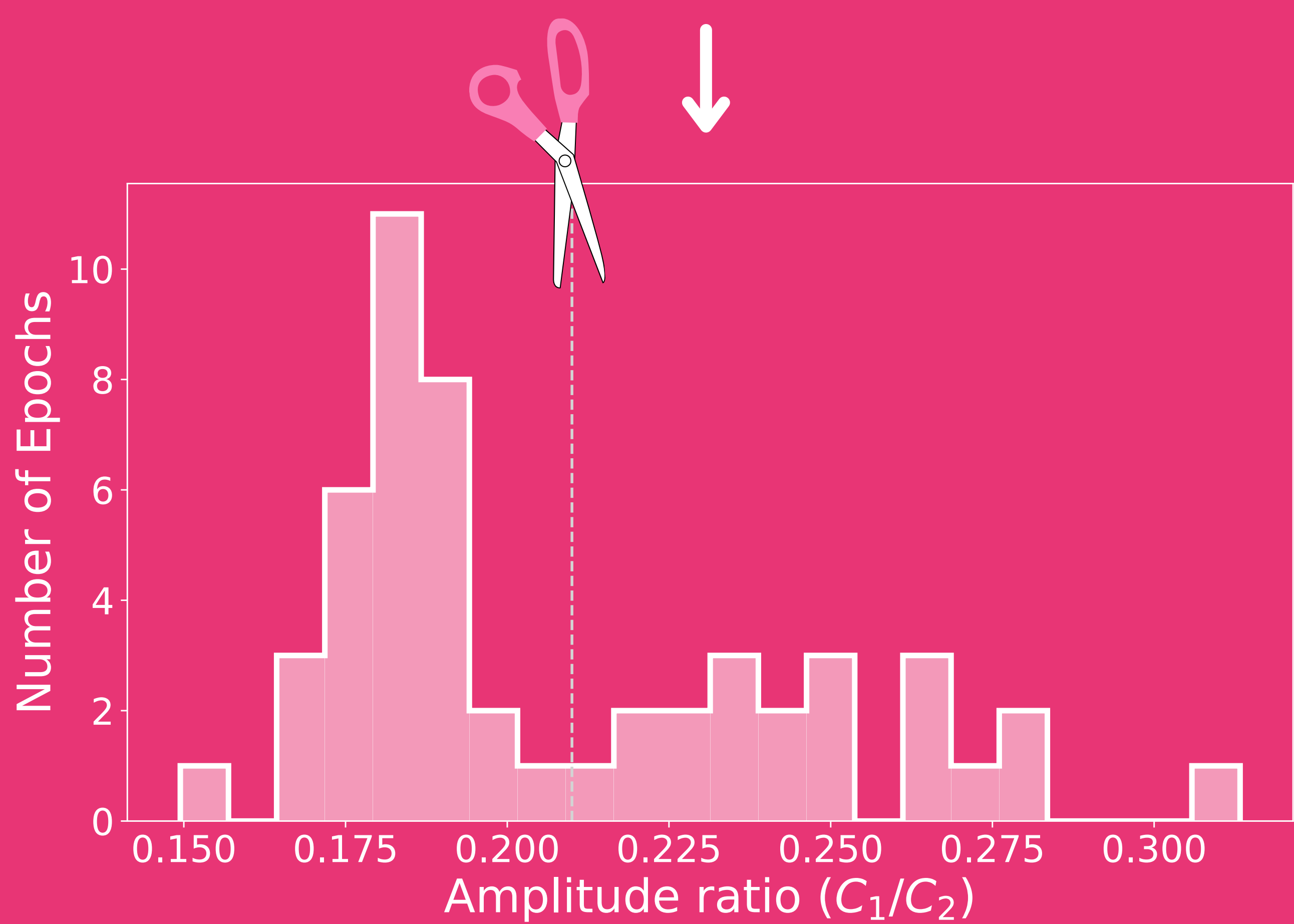
Pulsar timing with dynamic pulse fitting

We introduce a dynamic pulsar timing method that allows for pulse shape variation. Not only does this method improve pulsar timing sensitivity, it also characterises pulse shape.



Traditional timing uses a template that is unable to vary with pulse shape. We fit a sum of basis functions to each observing epoch using nested sampling implemented in our **Kookaburra** code. Each fit is independent. This work uses data from pulsar J1103-5403 taken with the MeerKAT telescope. We fit 3 Gaussians.

We see clustering in the amplitude of the second Gaussian, use this to make a cut and move to single mode timing.



Summary

Our timing method performs similarly to traditional methods when all pulses are included.

We can use the shape characterisation to time a single mode.

This greatly improves the timing sensitivity - by a factor 1.7.

Dynamic fitting characterises the shape of each epoch, quantifying sub-pulse drifting, nulling, mode changing and shape evolution.

This may offer insight into the pulse emission mechanism!

✨ A 32% increase in sensitivity to the nanohertz gravitational wave background*

*from this pulsar

