Timing Analysis of XRT data

A guideline to validate a periodicity detected in the arrival times of events extracted from an XRT observation.

This guideline applies to events recorded both in photon counting and windowed timing mode.

As an example, we analyse the observation 00416485000 performed of SGR1833-0832 in photon counting mode.

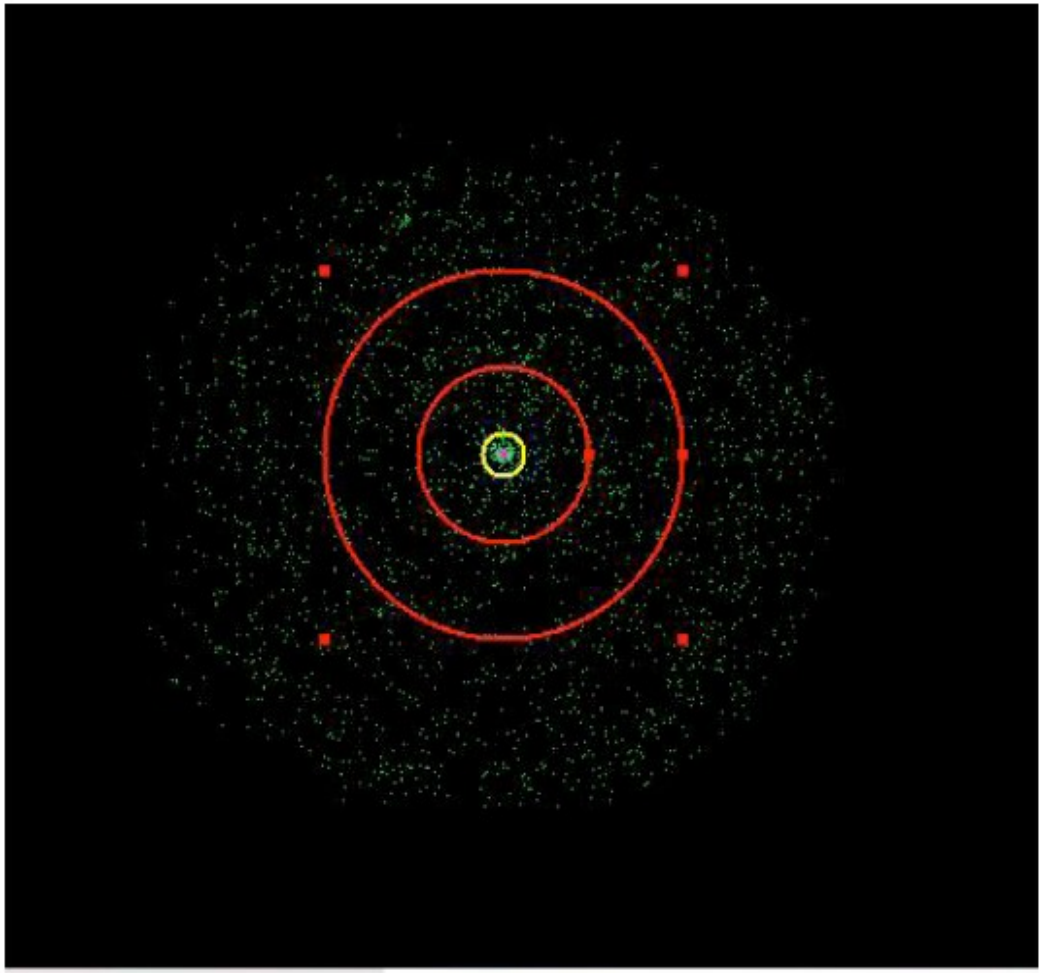
The observation has an exposure of 29171 s and a total number of events of 9725 after standard screening (grades 0-12). Event arrival times were converted to the Solar System Barycentre.

We selected events in 2 regions:

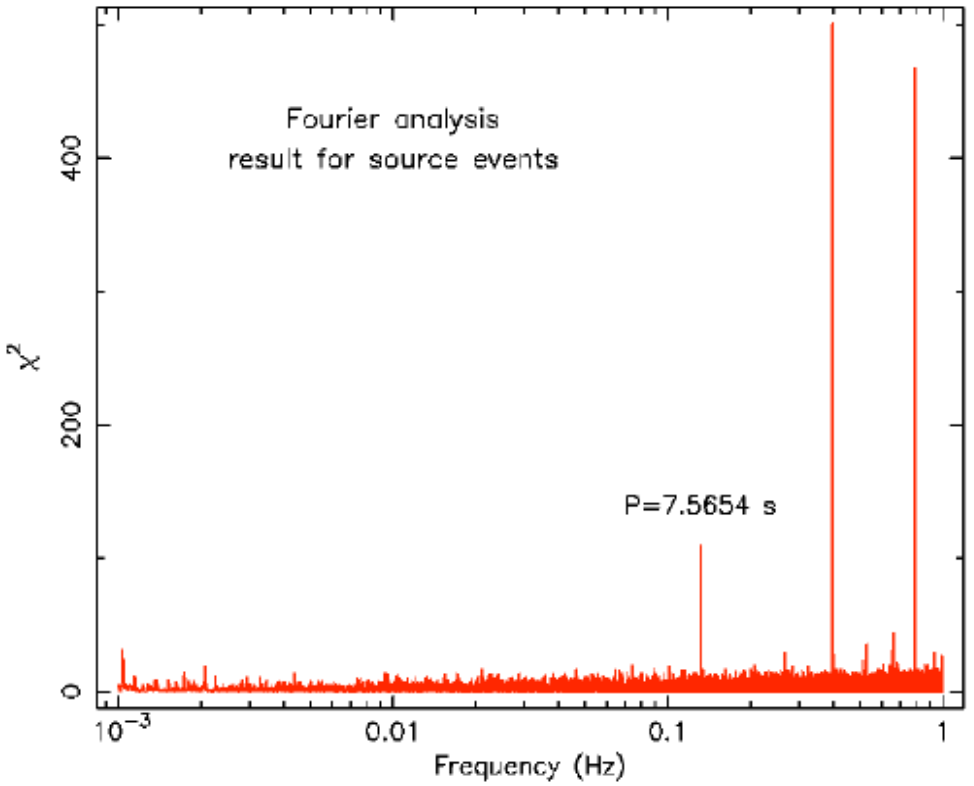
Yellow circle to extract 976 source events

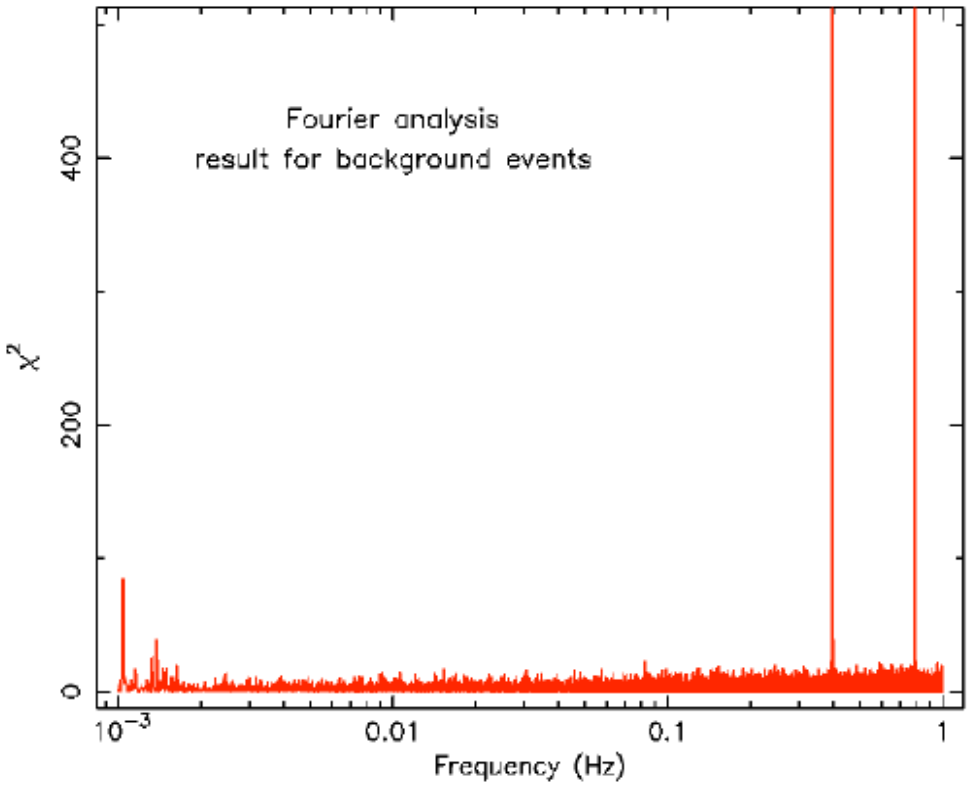
Red annulus to extract 1993 background events

Note that the region for the background should be large enough to extract a number of events comparable to or higher than the source events.



The Fourier analysis performed on the source and background datasets shows a significant feature at 0.132 Hz (7.5654 s) in the power spectrum obtained from the source events. The features at 0.3988 Hz (2.5073 s) and at 2*0.3988 Hz correspond to the PC mode data time resolution and to its first harmonic. In the power spectrum obtained from the background events we do not detect the feature at 0.132 Hz. This validates the detection at 7.5654 s as a genuine periodicity of SGR1833-0832.





The two pictures below show the periodograms obtained by applying a folding technique on the source event dataset (left) and on the background event dataset (right). Both periodograms show a strong feature at about 7.522 s, corresponding to 3*2.5073 s (the PC mode time resolution). Only in the periodogram obtained from the analysis of the source events do we detect a significant feature at 7.5654 s. The absence of this feature in the background validates the genuineness of the source periodicity.