ADAPTIVE FILTER FOR RFI MITIGATION IMPLEMENTED IN ROACH2

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In the last decades, there has been an exponential growth in the use of wireless communication systems, both in the consumer and the industry market. This has had the side effect that many radio telescopes are affected by radio frequency interference. The level of damage by interference ranges from corrupting a small percentage of data, to completely preventing astronomical observations in certain bands. Over the years, radio astronomers and engineers have developed several mitigation techniques to deal with this type of interference, from legislation to ban emissions near telescopes sites, to offline software tools to flag and delete the interference in astronomical data. In this work, a real-time mitigation method is developed, based on the mathematical concept of adaptive filters. In an adaptive filter setup, a second measurement of the interference is taken with a reference antenna, and the filter parameters are tuned in order to properly cancel out both interference copies. The method has the advantage of being able to remove the interference without incurring in any data loss. The filter is implemented in ROACH2 hardware to achieve high speed and bandwidth, and then is tested, both in a laboratory setup, and with a telescope. It is shown that while the filter works very well in controlled laboratory conditions, its performance degrades significantly in the realistic scenario, specifically because the practical limitations become more prevalent in this case. Nevertheless, the filter is still able to clean astronomical data if the interference presents favorable conditions (high power, localized source, and without multipath propagation).