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November 5, 2025**

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To: EDGES group

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Subject:: Tests of the parameters used in RFI filtering of EDGES spectra

The c-code pipeline uses a polyfit and associated qrd functions in acqplot7amoon.c which fits a fourier series to the spectra with the number of terms specified by -pfit argument. This method described in memo 213 uses the residuals from an iterative sliding fourier series fit to the spectrum as follows:

First all channels of the spectrum are given unit weight then as a channel exceeds the rms of weighted channels by “rfi” sigma it is assigned a weight of zero. The iteration stops when no more channels are assigned zero weight. The parameter -nrfi assigns the number of adjacent 6 kHz channels set to one whose weight is also set to zero as described in memo 244.

It is found that performing an iterative sliding gives better results than using the residuals to a fit to the whole spectrum.

In the development of the new EDGES pipeline it has been reported that accuracy of fitting using the qrd matrix inversion method used in the c-code is limited. In this memo some tests using the data analyzed in memo 489 is reprocessed with different number of fourier terms to further test the effects of the error. These tests are in addition to tests of RFI filter parameters made in memo 445.

Using the data listed in the first entry on the table of memo 489 which uses the calibration from 2023 day 316 and other parameters listed in memo 489. The first entry in the table below is result using pfit with 37 terms which has been the choice for almost all the c-code processing.

center MHz	SNR	amp K	width MHz	rms1 mK	rms2 mK	range MHz	pfit	nrfi
79.3	26	0.44	20.9	63.3	22.2	58 - 104	37	2
79.3	26	0.44	20.9	62.7	22.2	“	38	2
79.3	26	0.44	20.9	62.9	22.3	“	36	2
79.7	26	0.42	20.9	62.4	22.3	“	27	2
79.3	25	0.43	20.9	62.4	22.6	“	47	2
79.3	24	0.42	20.9	61.4	23.0	“	20	2
86.7	18	0.33	17.4	71.1	40.1	“	15	2
79.3	21	0.40	20.9	59.2	25.3	“	17	2
79.3	22	0.41	20.9	61.9	24.1	“	37	3
79.7	26	0.46	20.9	66.5	24.2	”	37	1
80.1	26	0.53	20.9	73.4	29.2	“	37	0

Table 1. Results of the changes in the 21-cm absorption using different number of pfit terms

These results show very small changes in the results as long as more than 20 terms are used. The last 3 entries shown in table 1 show the effect of changing the number of frequency channels before and after each channel used to set the number of channels used in the calculation of the rms.

The new bayesian analysis based on python code has found that some of the change with number of terms is the result of the numerical errors in the qrd matrix inversion so that the new analysis will use more accurate arithmetic. Also the python code has the option of using the “Watershed” algorithm which may do a better job of rfi filtering.