C++ Code: (Used KissFFT with Visual Studio)

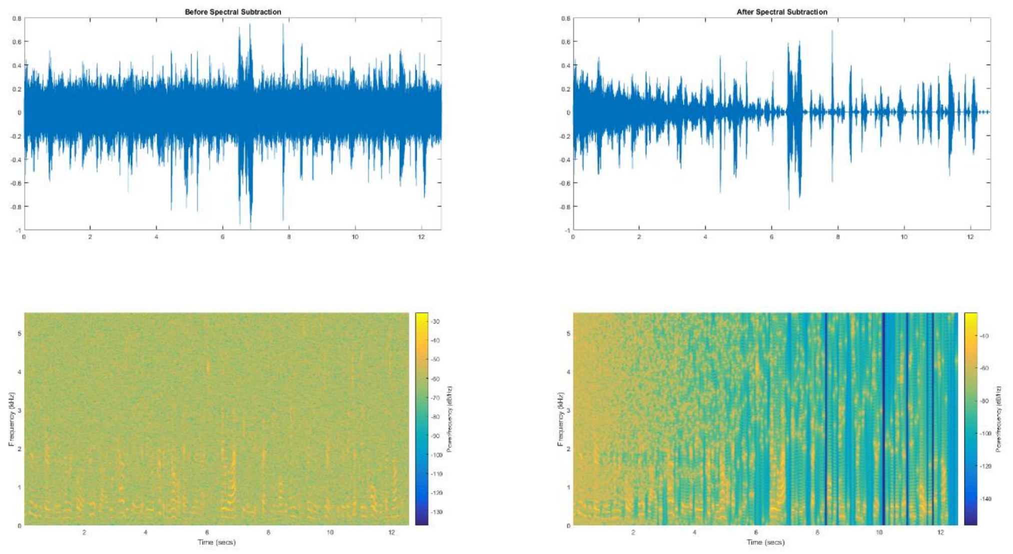
```
#include<iostream>
#include "dspf.hpp"
extern "C" {
#include "kiss_fft.h"
}

kiss_fft_cpx* alloc(const int n) { return (kiss_fft_cpx*)KISS_FFT_MALLOC(n *
sizeof(kiss_fft_cpx)); }
void kiss_fft_copycpx(float* r, kiss_fft_cpx* c, const int n) { for (int i = 0; i < n; ++i) {
c[i].r = r[i]; c[i].i = 0; } }
void clean_noise(DSPFile& fin, DSPFile& fout) {
        const int nfft = 256;
        kiss_fft_cfg  fft = kiss_fft_alloc(nfft, 0, NULL, NULL);
        kiss_fft_cfg ifft = kiss_fft_alloc(nfft, 1, NULL, NULL);
        kiss_fft_cpx *x = alloc(nfft), *X = alloc(nfft),
                                *y = alloc(nfft), *Y = alloc(nfft);

        // Copy the header to the output file
        fout.Header = fin.Header;
        fout.write_h();

        // algorithm variables
        int step = nfft / 2, remainder;
        float lam = 0.999, lam2 = 1.0 - lam;
        float
                temp[nfft] = { 0 },
                Px[nfft] = { 0 },
                out[nfft] = { 0 };

        // processing
        float Xm;
        fin.read_n(temp, nfft); kiss_fft_copycpx(temp, x, nfft);
        for (int n = nfft - 1; n < fin.Header.dim0; n += step) {
                // Compute FFT
                kiss_fft(fft, x, X);
                for (int i = 0; i < nfft; ++i) {
                        float Mag = (X[i].r  * X[i].r) + (X[i].i * X[i].i);
                        Px[i] = lam * Px[i] + (lam2 * Mag);
                        Y[i] = Mag >= 10 * Px[i] ? X[i] : kiss_fft_cpx{0, 0};
                }

                // Compute IFFT * nfft
                kiss_fft(ifft, Y, y);

                for (int i = 0; i < nfft; ++i) {
                        //y[i].r = x[i].r;
                        // overlap with output buffer
                        out[i] += 0.5 * y[i].r / nfft;
                }

                fout.write_d(out, step);

                // Shift buffers
                for (int i = 0; i < step; ++i) {
                        temp[i] = temp[i + step];
                        out[i] = out[i + step];
                        out[i + step] = 0;
                }

                remainder = fin.read_n(temp + step, step); kiss_fft_copycpx(temp, x, nfft);
        }
        fout.write_d(out, step + remainder); // Dr. Gunther's code is wrong...it's missing this

        // Deallocate memory
        free(fft);
        free(ifft);
        kiss_fft_cleanup();
}
```

```
int main() {
        std::string
                in = "output\\harry8noise.bin",
                out = "output\\harry8.bin";

        DSPFile fin(in), fout(out, DSP::Mode::Write);
        clean_noise(fin, fout);
        system("pause");
        return 0;
}
```

Matlab Code:

```
clear all;
[x, fs] = audio2bin('harry8noise.wav');
[y] = bin2audio('harry8.bin');

% helpers for plot axises
t = (0:size(x, 1) - 1)/fs;
tf = (size(y, 1) - 1)/fs;

% Plot the signals
subplot(2, 2, 1);
plot(t, x);
xlim([0 tf]);
title('Before Spectral Subtraction');

subplot(2, 2, 2);
plot(t, y);
xlim([0 tf]);
title('After Spectral Subtraction');

% Plot the spectrograms
subplot(2, 2, 3);
plot_spectrogram(x, 10, fs);

subplot(2, 2, 4);
plot_spectrogram(y, 10, fs);
```

Plots:


Before Spectral Subtraction
After Spectral Subtraction
Frequency (kHz)
Time (secs)
Power/frequency (dB/Hz)