This is a simple tutorial for making average measurements in REW and use these measurements to produce a correction impulse in rePhase.
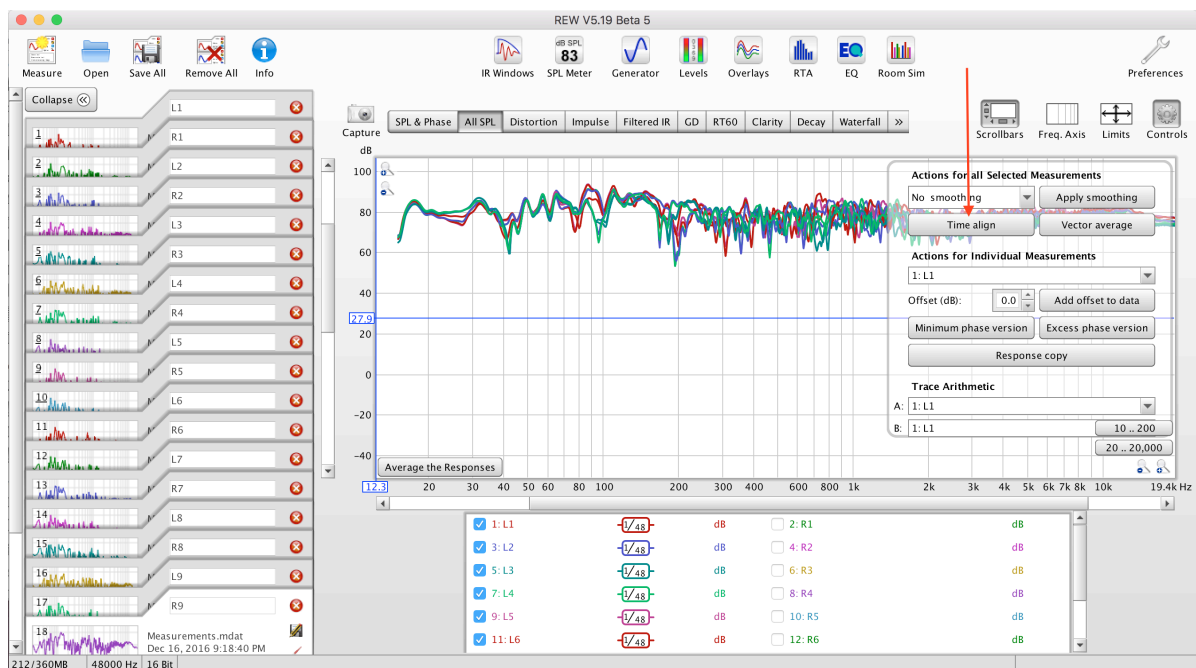
1. Averaged measurements
    The idea behind averaged measurements in REW is to get rid of over-corrections which validity is limited to the exact place where the microphone has been setup in case of a single measurement. There is a wide corpus of technical information pertaining to interference of sound waves and various physical phenomena which affect the perception of the sound within very short distances from one point to the other. In order to make a correction which takes into consideration the main interaction between the loudspeakers and the room, it seems appropriate to make multiple measurements and to average them in order to extract the significant signal from the averages and to avoid the unnecessary noise. This has been remarkably illustrated by Floyd E. Toole, Ph.D. then Vice President Acoustical Engineering Harman International Industries, Inc. in a series of lectures named "The Science of Audio"

    The procedure is simple: you take the same equipment which would be necessary to make a single measurement and you repeat the procedure of measurement at the edges of a parallelepiped, located around the heads of the listeners at the listening position. You number the measures L1..L9 for the left channels in case you make 9 measurements, and R1..R9 for the right channels (8 measurements at the edges and a 9th measurement, at the center of the parallelepiped).

    Once you have made all the measurements, you should have 18 measurements in your REW folder (9 for each channel).

    a) The next step is to make sure that all measurements are time aligned prior to making any kind of algebra on these measurements. John Mulcahy, the author of REW, has made this very easy: you just need to select the corresponding measurements inside the 'All SPL' tag of REW and use the 'Time Align' function in the Control window.


    b) Once you have time aligned the measurements for both channels, you can average them. Prior to doing that, you need to check whether you have selected a default FDW in your preferences of REW. If so, you need to be aware that the algebraic functions will

be conducted with this FDW applied at each step. This is not a problem, but you should be aware of this.
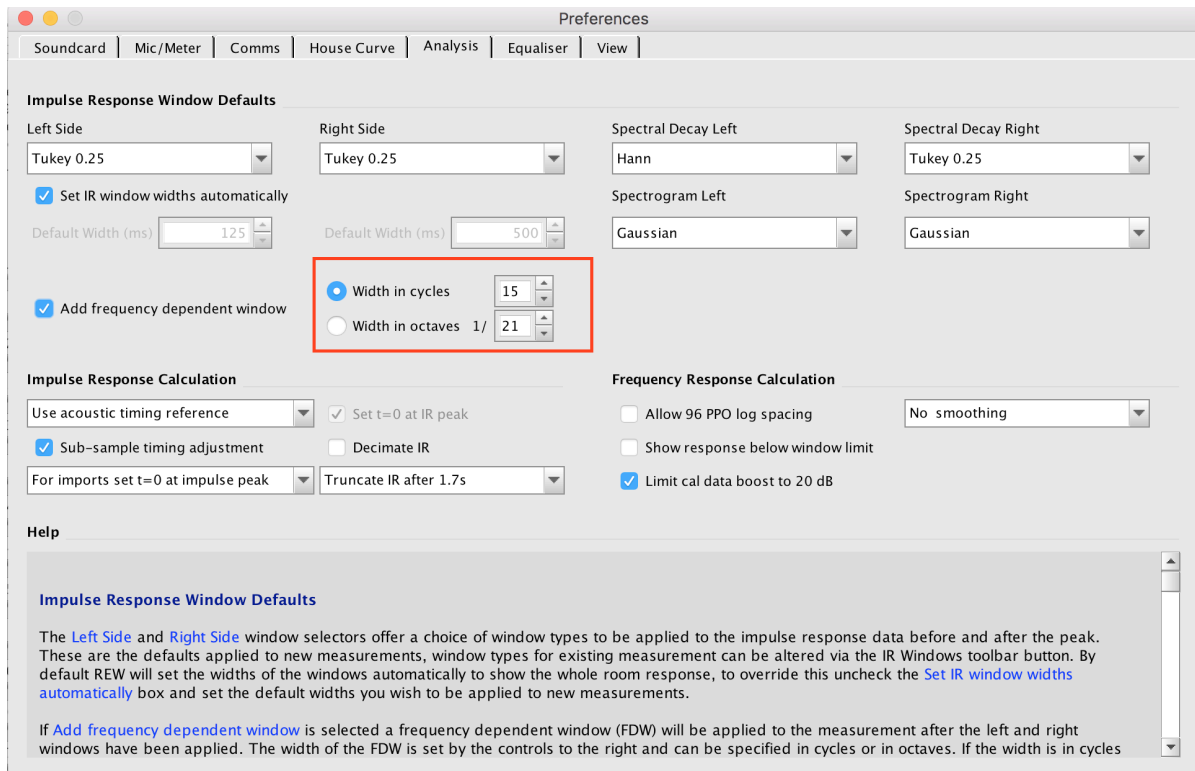
In this example, and to show how powerful the averaging technique is, I will not apply any FDW to the averaged measurements at this step.

Again, John Mulcahy has added a special function to make this step a 'piece of cake': all you need to do is select the measurements you want to average in the 'All SPL' tag of REW and use the 'Vector Average' function inside the Control window.
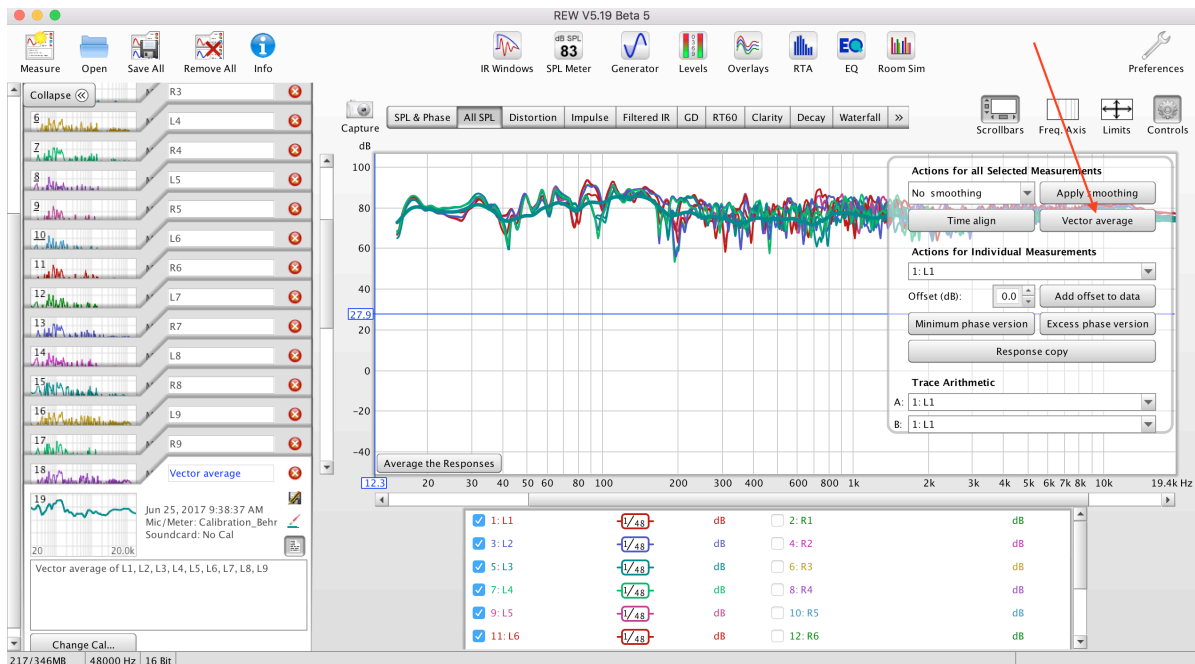

You will execute this averaging process once for each channel.

c) At the end of the process, you should have one averaged measurement for each channel. If you compare these averaged measurements to each and every individual measurement, you will notice that the averaged measurement has got rid of most of the early reflections of the signal against the walls/ceiling/obstacles aso. You can use this averaged signal to calculate an appropriate correction and have a better listening experience when seated than with individual measurements.

To paraphrase Floyd E. Toole, Ph.D. then Vice President Acoustical Engineering Harman International Industries, Inc, "Spatial averaging is adding information to the signal, whereas time averaging (FDW) is removing information from it."

2. Using REW filters generation and calculate the amplitude correction
   The next step is to generate filters in REW in order to automate the amplitude correction.
   Go to EQ tab in REW and follow the procedure as shown in this sample:
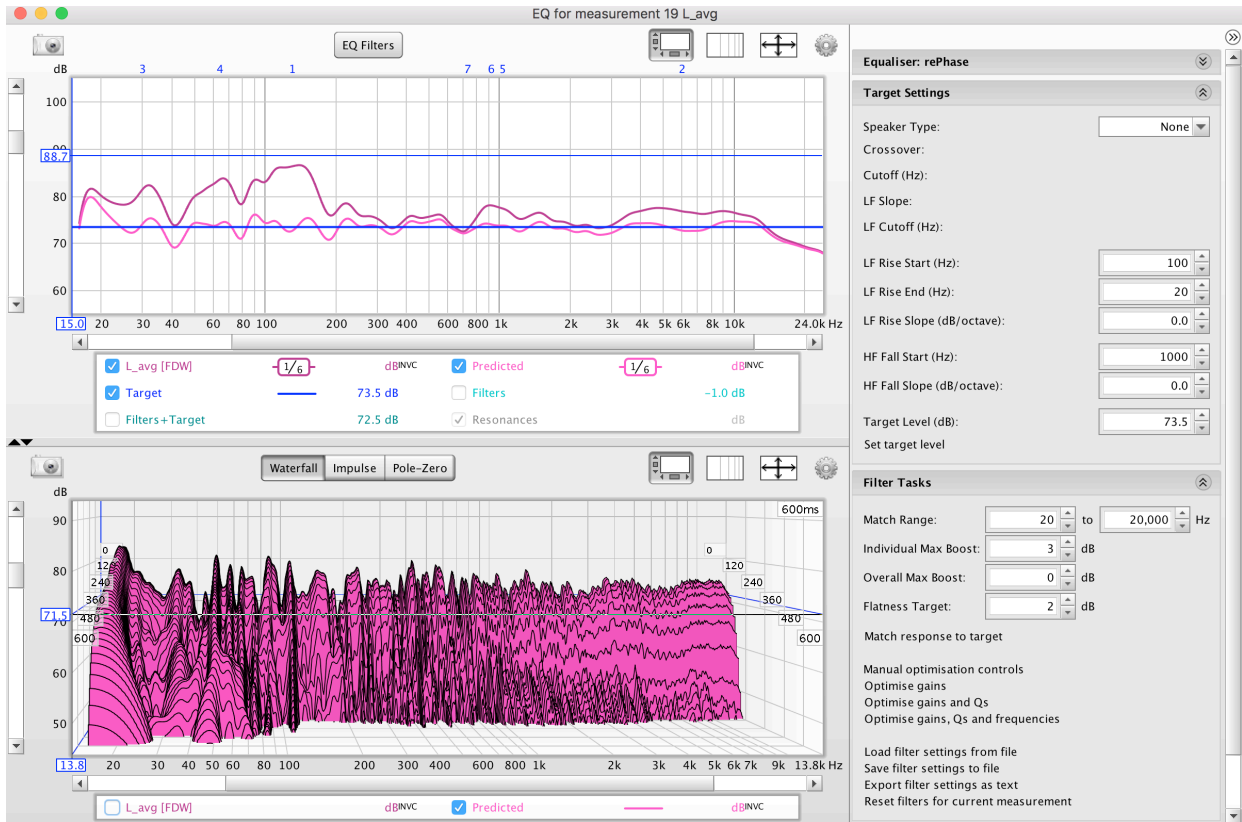
Please note that, at this stage, as the averaged measurement contains all the information from the individual measurements, you can decide to smooth the curve, using FDW or smoothing tools from REW, in order to generate the filters. The smoother the curve you use to calculate the correction, the less filters will be generated by REW… In this example, I have used 1/6th octave smoothing and 15 cycles FDW to generate the correction filters and avoid 'micro-managing' the amplitude and phase corrections.
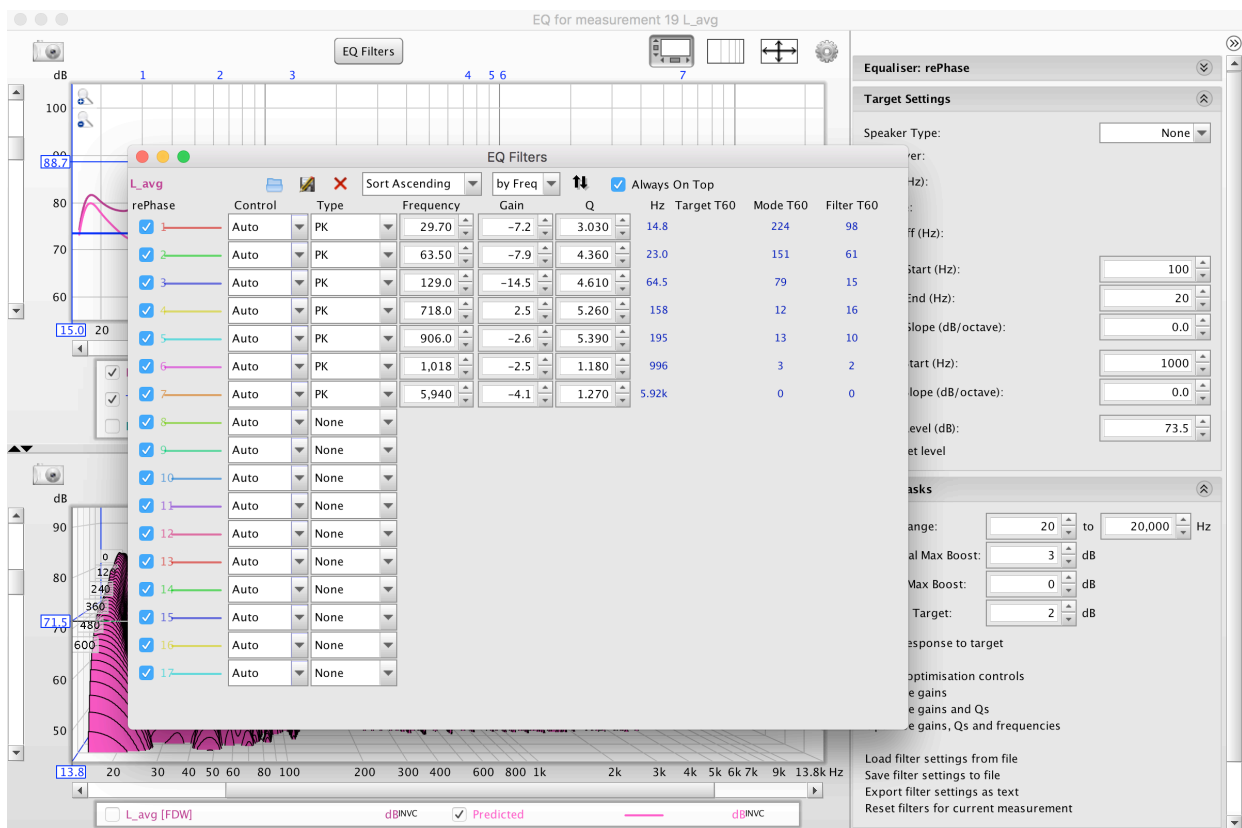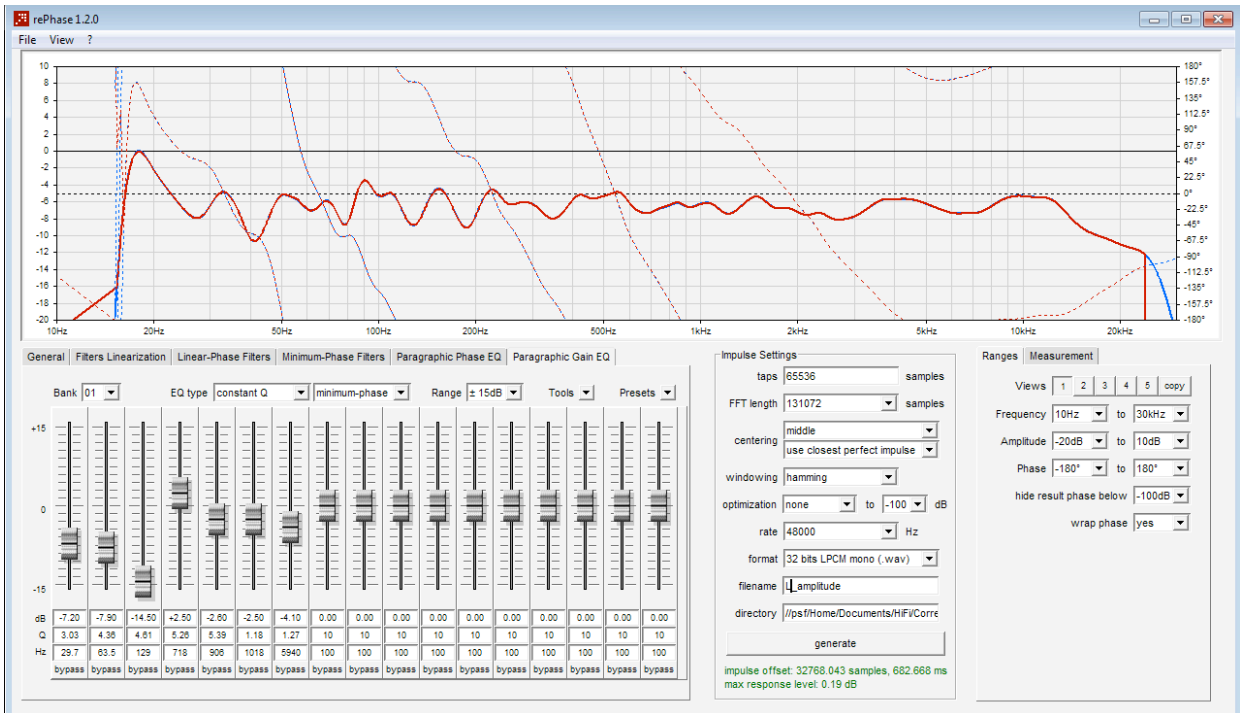
Save the filters to a file with an appropriate name. Export the corresponding averaged measurement as text.
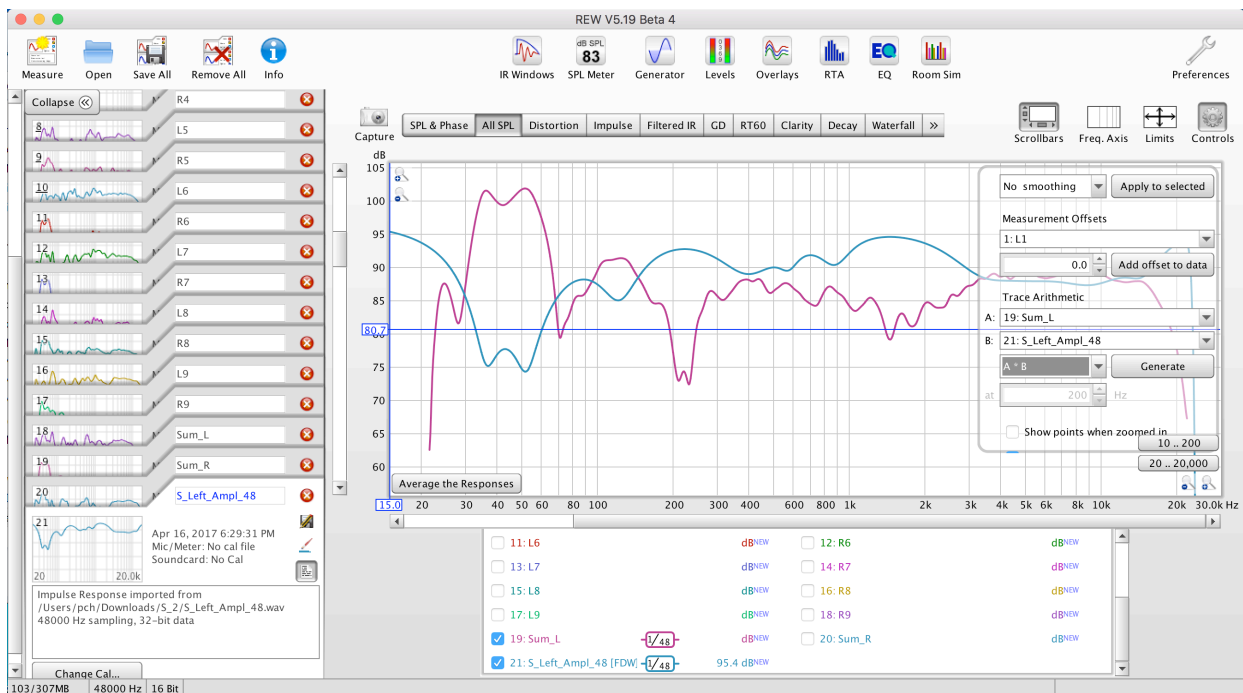
Go to rePhase and import the measurement:
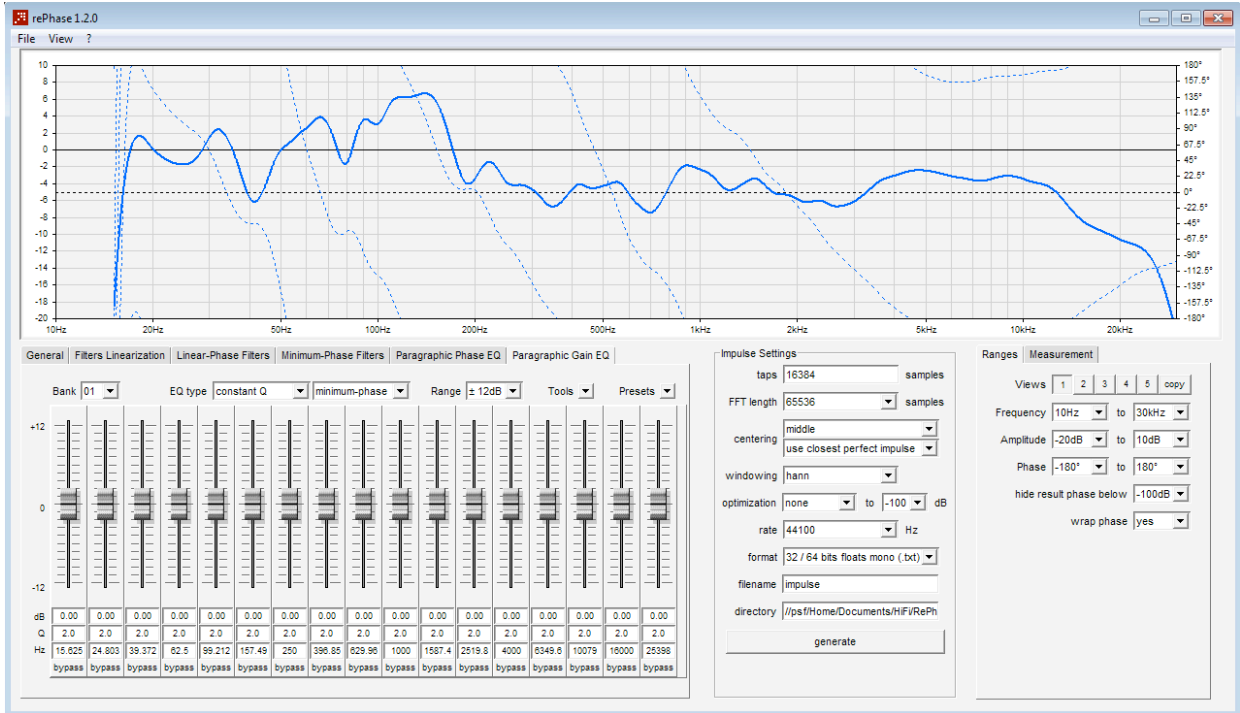
Apply the correction filters:

Generate the corresponding correction impulse and import it inside REW and apply the convolution of this correction to the averaged measurement:

At this stage, you have generated the amplitude correction impulse and applied it to the averaged measurement. The result is an amplitude corrected measurement, which will be used to generate the phase correction.

We will again use a new feature provided by John Mulcahy, the author of REW, to generate a minimum phase correction inside rePhase.

Minimum phase systems have a lot of interesting virtues which are described in the REW documentation.

3. Calculate the excess phase and make the time domain correction

With the amplitude corrected measurement generated above, simply generate the excess phase of this measurement inside REW:
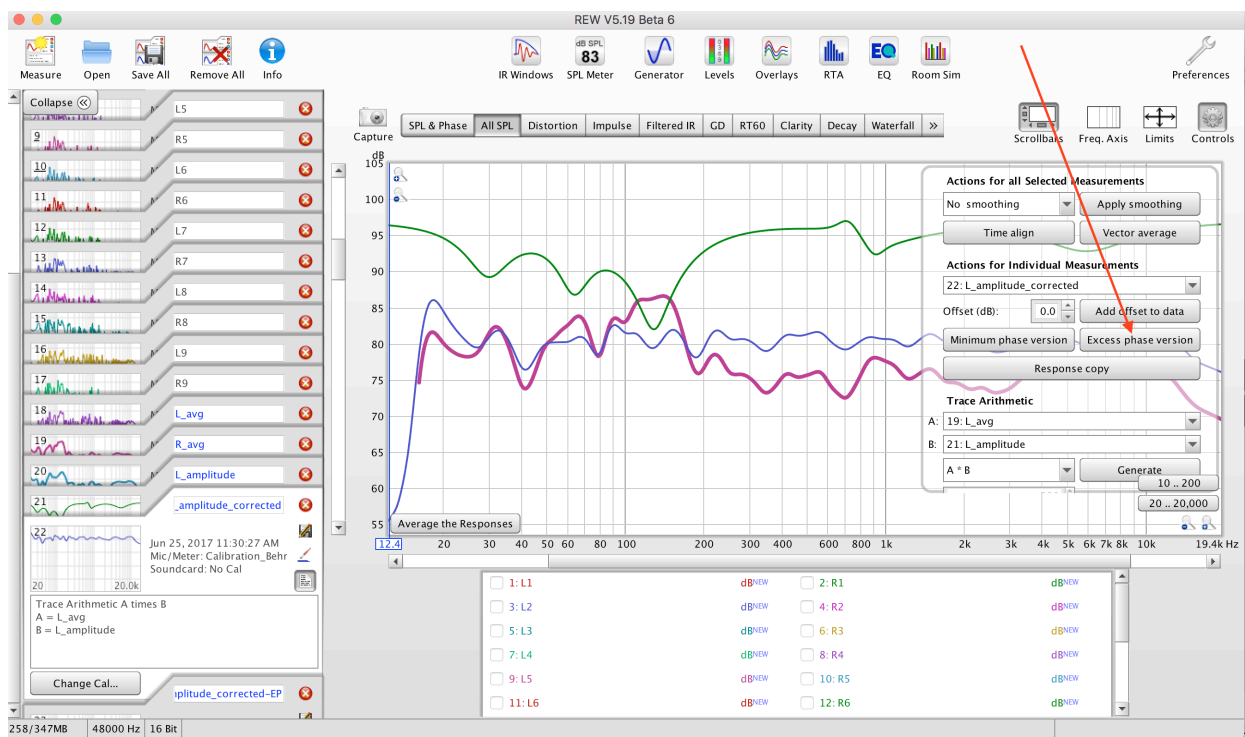
The excess phase, which has been generated, can now be exported as .txt to rePhase, where it will serve to make the time domain correction. The goal is, through Filters linearization and Phase EQ to have a phase curve close to flat at zero.

Please note that, in order to avoid generating pre-ringing, you should avoid correcting the phase bellow 100Hz, which is not useful anyway.

4. Correction finalization

Once you have finalized the phase correction, you can import the initial averaged measurement in rePhase and apply the REW filters. The result could look like this:
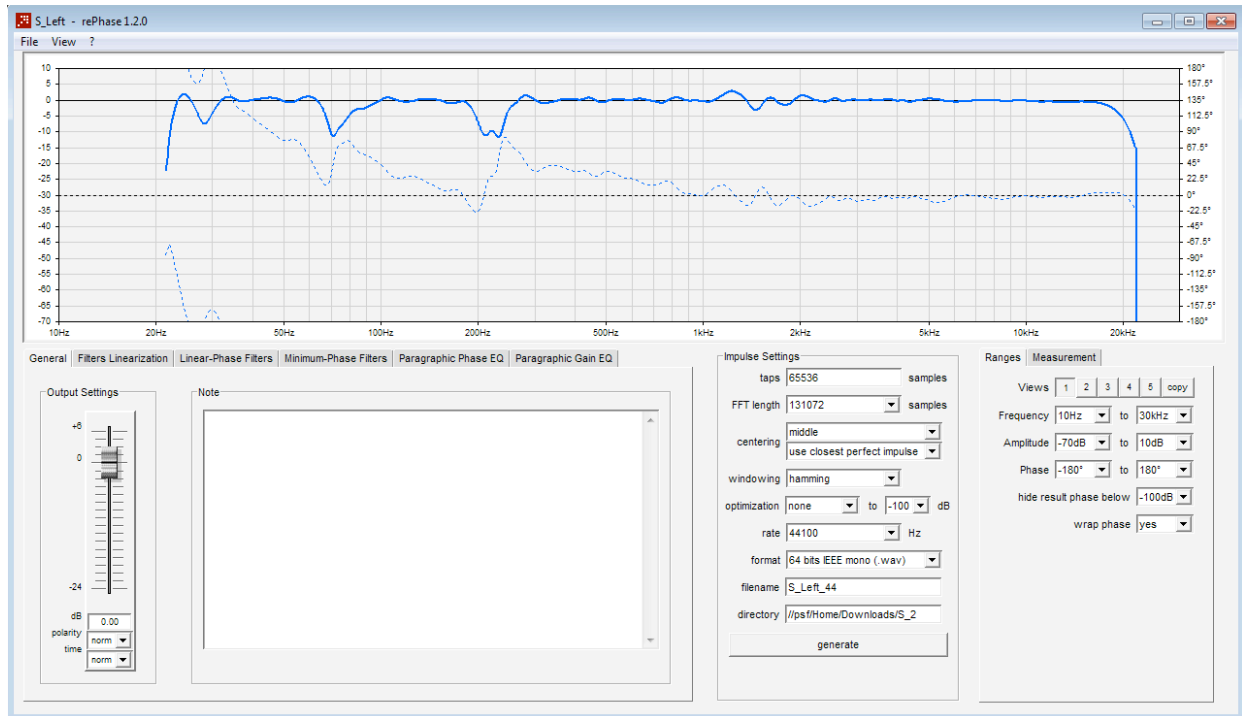
The results of the correction applied should look like this (please note a phase close to the minimum phase on most of the range):
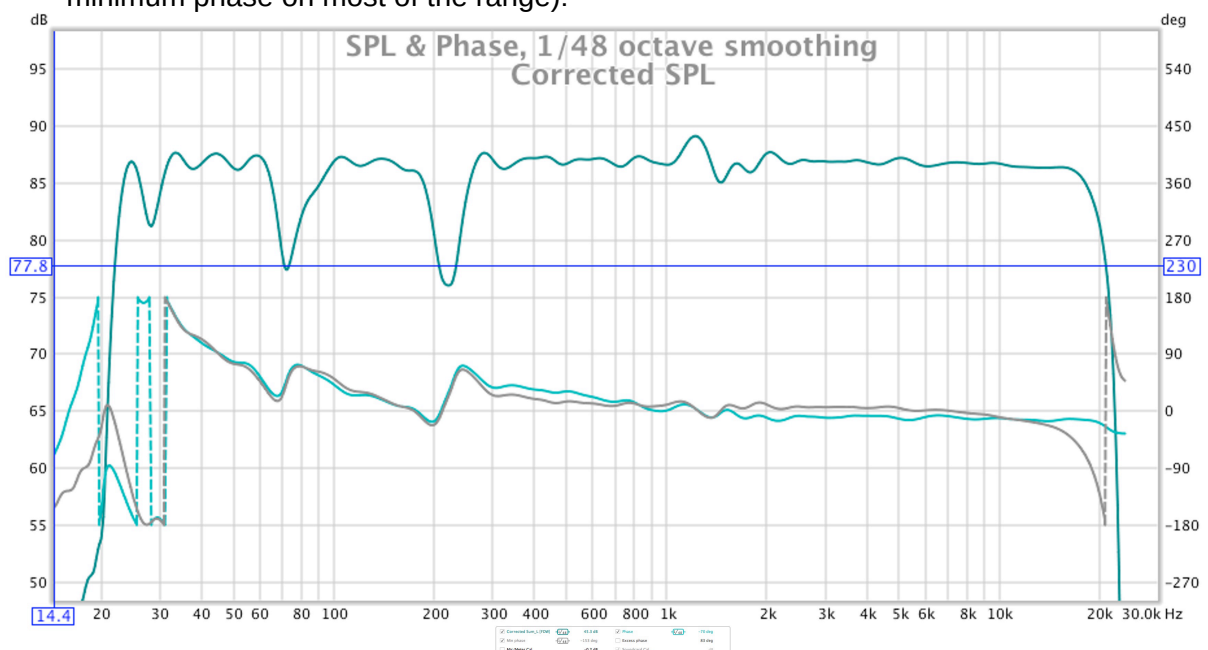
and a clean impulse, with a very good step amortization: