Interactive Tuning Plugin

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2. Introduction

With the addition of the Interactive Tuning plugin, Armonía is capable of communicating with third party measurement software: capturing, importing/exporting transfer function and spectrum traces. Once stored in Armonía, the traces can be manipulated with any equalizer window within the software (Advanced EQ, Speaker EQ, Ways EQ and Group EQ). In addition to this, an extensive set of math operations are available to simulate real life acoustical interactions.

3. Getting Started

The plugin can be found among the other plugins in the Armonía Ribbon bar, accessible with the "view" button. Every section of Armonía can be positioned or resized as preferred, by default the plugin will appear docked on the left side of the screen. Depending on the size of the monitor, it's advisable to drag its right border to show all the info's without a scrollbar. Like any docked window, it can be kept open or auto-shown upon mouse over with the pin icon.

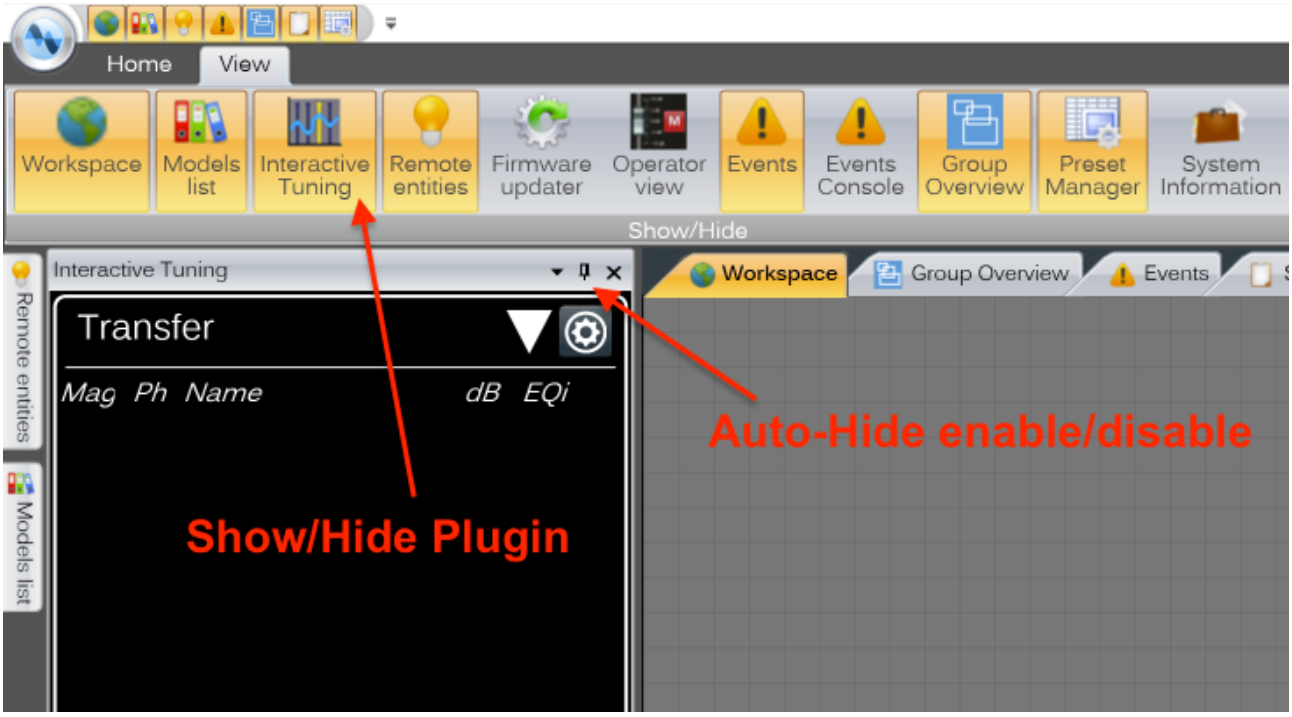

Figure 1 - Enabling the plugin

4. Overview

The plugin consists of three main areas: Curves List, Curves Properties and EQ controls. The title bar of the Curves List can be used to switch between Transfer Function Mode and Spectrum Mode with a simple click.

In the upper right corner, the gearwheel icon is a shortcut to the Interactive Tuning Options, also accessible through the Armonía main menu.

The controls for storing and deleting a trace are visible in the bottom section of the Curves area, alongside the More menu with additional functions.

When an object is selected in the Curves List, the relative Properties will be displayed numerically in the area below, and graphically in the EQ area.

As with Smaart, Magnitude and Phase smoothing options are available in the bottom left corner of the EQ window. Coherence blanking is also available on the right side of the EQ window.

To provide the user even greater control, crop tools have been added to the upper right and left-hand corners of the EQ window. These tools allow the user to hide portions of the Transfer Function trace which may be irrelevant to their measurement and desired area of EQ interaction.

Figure 2 - Plugin areas

5. Options

5.1. Generic

Armonía is able to operate with various measurement formats: Xml, Csv, Txt and Smaart.
Smaart extensions are ".trf" for Transfer Function mode and ".srf" for Spectrum mode; If using Rational Acoustic's software as a measurement engine, it's strongly suggested to select this native format so that the files are easily managed by both applications.

Curves displayed and captured in Armonía are stored by default in the following path:

"C:\Users\Public\Documents\Powersoft\Armonia\Stored Curves"

If Smaart is running on the same machine, we recommend pointing to Rational's default storage path, that by default is:

On Windows "C:\Users\username\Documents\Smaart v8\Traces"
On MacOSX "HD/Users/username/Documents/Smaart v8/Traces"

Having a shared storage location means that if a measurement is captured (or deleted) in either software, it will be displayed in both. This is not mandatory of course, and if the analyser and Armonía are running on separate machines, one can keep the storage separated; curves captured in the Interactive Tuning plugin will then remain in Armonía only unless manually copied later.
An external shared folder path can also be set in both applications, this allows the user to utilize a cloud service to keep the measurements in sync between multiple computers.

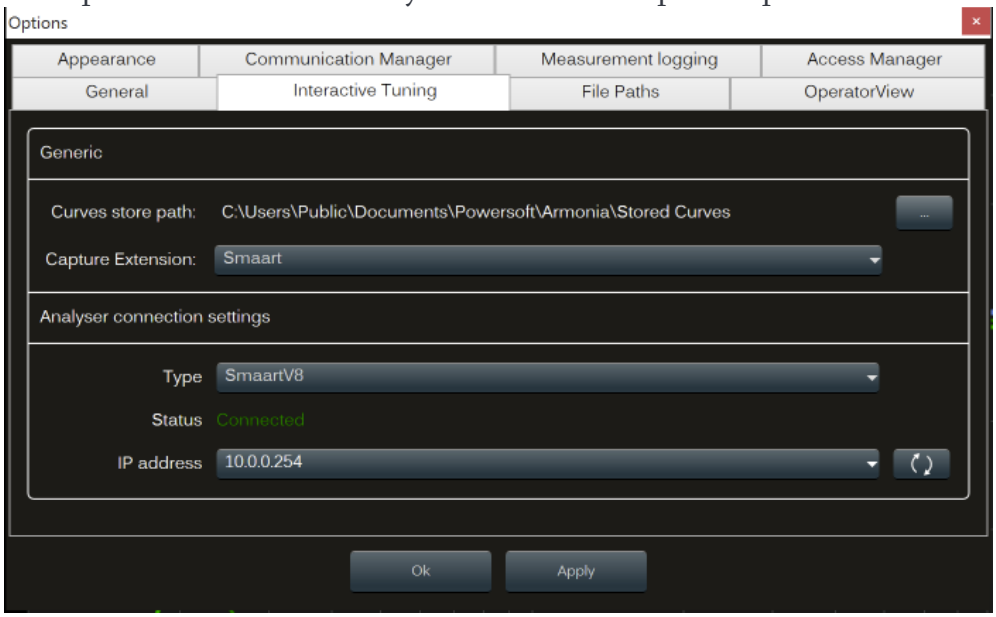

Figure 3 - Armonía options

5.2. Analyser connection settings

The Interactive Tuning plugin is designed to communicate directly with Rational Acoustic's Smaart V8 measurement software. In order to establish a connection, the Analyser Type field has to be set to SmaartV8 and in Rational's software the API status has to be Enabled. Armonía will then be able to discover the analyser address in the IP address combo-box. It's not necessary to run Smaart and Armonía on the same PC, they just need to be on the same local area network.

Once the server IP is displayed and selected, the status will change to "Connected", and the controls will appear in the Curves area.

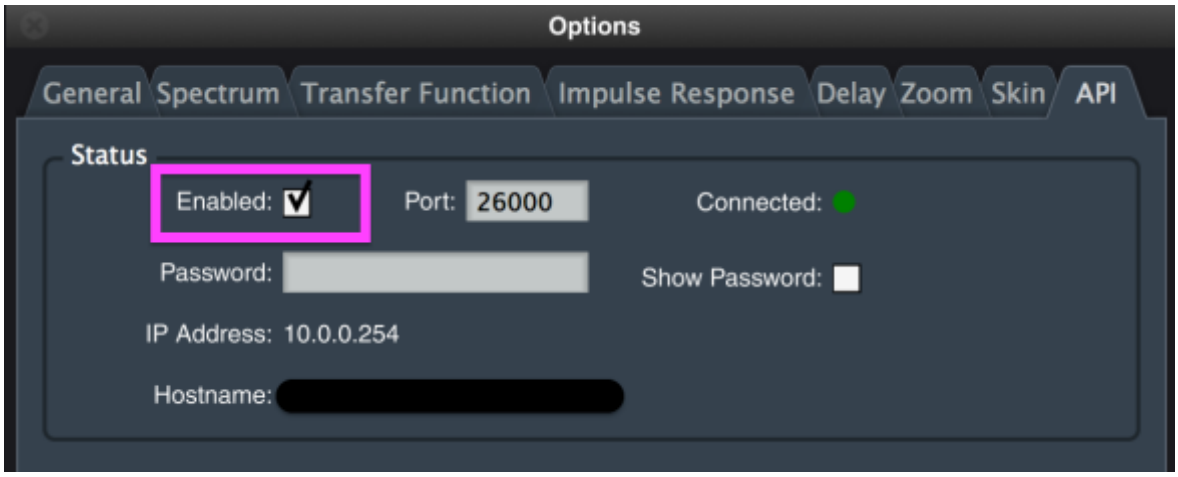

Figure 4 - Smaart options

6. Main window

Once the analyzer is connected via the options menu, Smaart traces will be displayed here depending on the selected mode. When a trace is selected, its options will be displayed in the properties box.

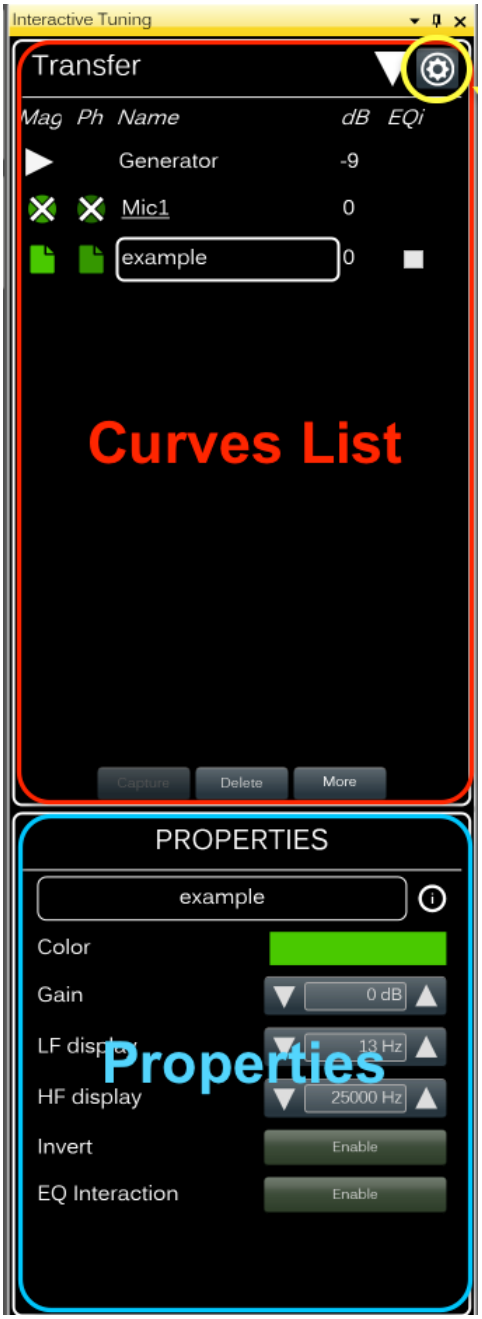

Figure 5 - Main Interactive Tuning Window

6.1. Transfer Function Mode

TF Mode is the default mode selected upon software launch. The following objects can be displayed in the curves list.

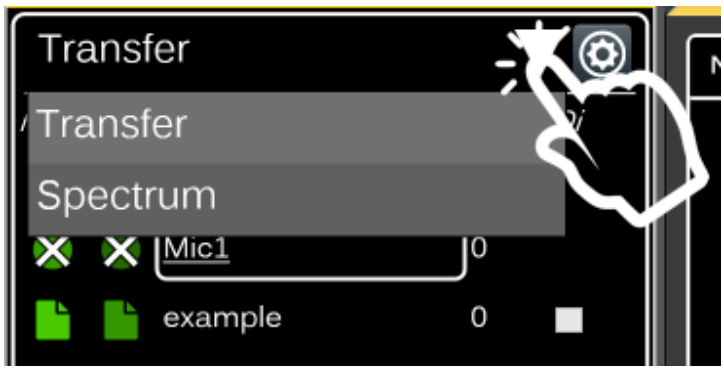

Figure 6 - Mode selection

6.1.1. Generator

This is a remote control of Smaart generator, clicking its icon will enable/disable the test signal. It's possible to adjust the level in 1 dB step within the properties box.

6.1.2. TF Engine

These are equivalent to the Smaart TF measurement engines. Next to the name there are two round icons, used to individually show/hide magnitude and phase response. The last TF Engine selected remains underlined, indicating that it will be the one saved when the capture button is pressed.

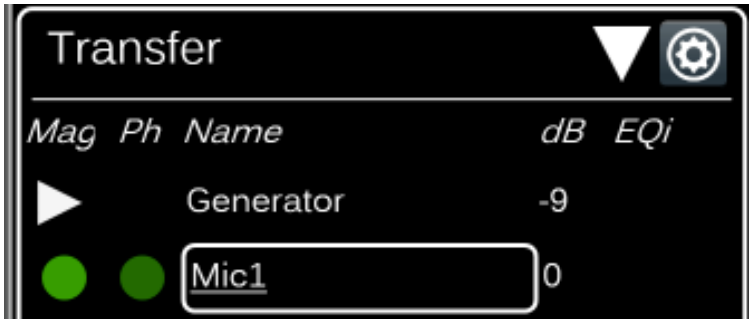

Figure 7 - TF Engine

PROPERTIES

Name	Displays the name of the engine as set in Smaart.
Play status	Remote for the Play/Stop control in Smaart.
Delay	Remote for the delay compensation of Smaart.
Delay Track	Remote for the automatic delay tracking of Smaart.
Gain	A gain offset that will move the magnitude trace up/down in 0.1dB steps; Gain offsets are considered during math operations. It's also shown in "dB" column of the curves list.
LF display	Lowest frequency of the selected curve displayed on the EQ windows; useful to filter out unwanted information out of the bandwidth of interest. It's also shown on the EQ window with a "crop" icon.
HF display	Same of the above but for Highest Frequency
Invert	Toggles the curve mirroring over the 0 dB magnitude axis and 0 deg phase axis; useful to have an idea of the EQ needed to flatten out the current measurement.

6.1.3. Captured TF Curve

Curves are created by pressing the "capture" button in Armonía. Curves which are already present in the Curves storage path will also be displayed here. These may be Curves which were created with Smaart, or in a previous session of Armonia. (the command *more>reload curves* can be used to refresh the list).

The small document icon is used to represent a stored TF measurement, the circular icon represents a live TF measurement active from the Smaart API. Clicking on either icon allows the user to show/hide magnitude and phase traces in the EQ window, as you would in Smaart.

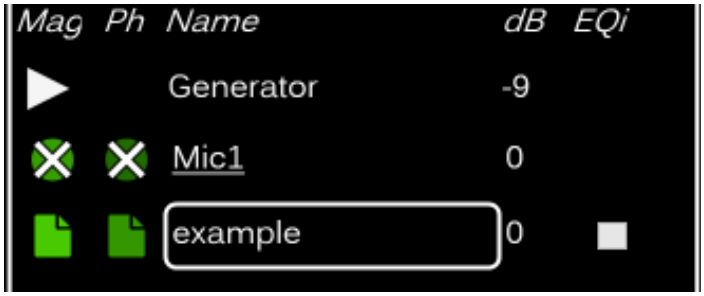

Figure 8 - TF Curve

PROPERTIES

Color	Color swatch to set the selected curve appearance.
Name	The name of the curve can be edited in this field
Gain	See TF Engine
LF display	See TF Engine
HF display	See TF Engine
Invert	See TF Engine
EQ Interaction	This, alongside the Live Sum operation, is a key feature of the Interactive Tuning plugin. When toggled, the selected trace is affected by EQ, Gain, Delay and Polarity settings of the displayed EQ. This function can be enabled also directly from the Curves List, ticking the relative checkbox. A trace can interact with any EQ in the software, but only with one at time; if the trace is interacting with a different EQ from the one currently displayed, the relative checkbox in the curves list will be greyed-out, and upon mouse over a tooltip will show the bonded EQ name. If a trace is representing the combined response of multiple loudspeakers it should interact with an advanced group driving those transducers, and tuned from that group. For instance, the trace of the "Main Left Tops" should interact with their "Main Tops" group, while the Subs with their "Main Subs" group; The Tuning and alignment can then be done within the advanced groups, with the combined response simulated by Armonía (see Math). *NOTE: For the time being (Armonía 2.10.0) phase interaction is only calculated with delay, polarity, IIR and CFIR filters. Raised Cosine filters will not interact with the phase response.*

6.1.4. Math Curve

These curves are created with the "Math" menu (see Math), they are represented and have the same properties as normal captured traces, with the exception of the "Live sum", that has round magnitude and phase icons like TF Engines measurements.

6.2. Spectrum Mode

Spectrum mode can be selected by clicking on the title bar of the Curves List. The List will then swap to spectrum curves only, showing the RTA engines configured in Smaart and the stored spectrum traces.

6.2.1. Generator

This is a remote control of Smaart generator exactly like the one shown in Transfer Function mode (see Generator)

6.2.2. RTA Engine

These are equivalent to the Smaart RTA measurement engine. Next to the name there is one round icon, used to show/hide the magnitude response. The last RTA Engine selected remains underlined, indicating that it will be the one saved when the capture button is pressed.

The curve is displayed on the EQ window, but its values are in dBFS. This can make the curve be drawn outside the EQ window; to solve this, either add gain through the curve properties or adjust the scale of the EQ by clicking on the values at the end of the scales.

Figure 9 - Spectrum mode

PROPERTIES
See TF Engine

6.2.3. Captured RTA Curve

RTA Captured curves behave like the Transfer Function counterparts, with the exception of having data for magnitude only.

PROPERTIES
See Captured TF Curve

6.3. The "More" menu

This Menu is accessible by clicking the relative button in the bottom area of the Curves List, next to Capture and Delete. It's a container for various utility commands described below.

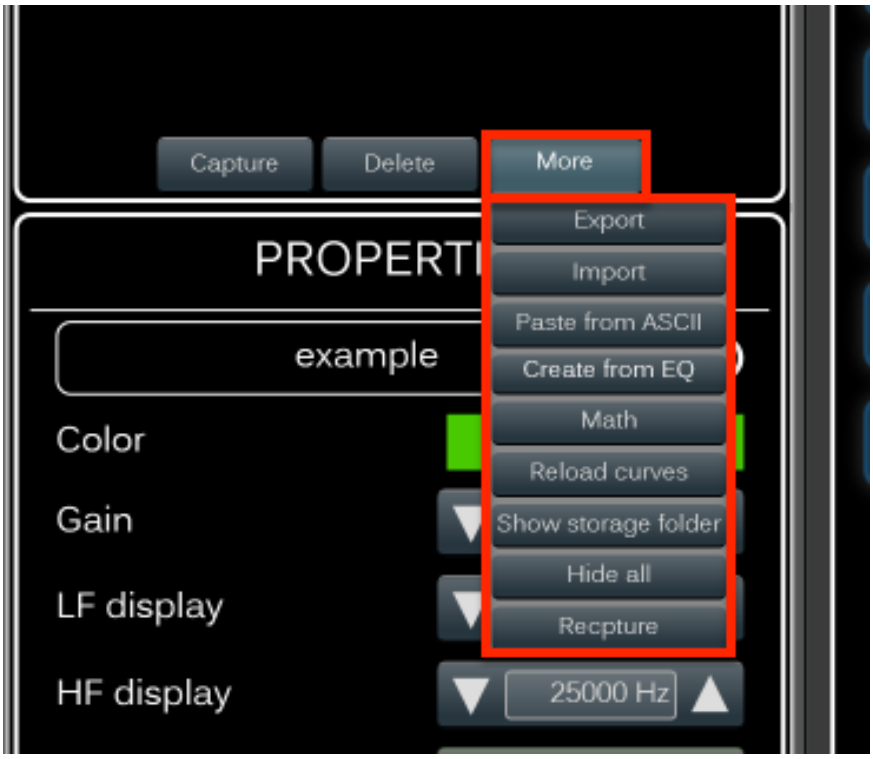

Figure 10 - "More" menu

6.3.1. General commands

Export	Exports the selected curve on the Hard Drive in *.srf/*.trf, *.xml, *.txt, *.csv file formats.
Import	Import in the Curves List one or more curves in the above formats. The File will be also copied in the storage folder.
Paste From ASCII	Creates a new curve in the storage folder with clipboard data. The curve is also imported in the curves list.
Create from EQ	Creates a new curve, this file reflects the onscreen EQ Magnitude and Phase (or mag. only). Very useful to make your own target response to be displayed while tuning the system.
Math	See Math chapter
Reload curves	Refresh the Curves List. It's important to do this if you manually add or remove curves from your storage folder.
Show storage folder	Opens a windows explorer window pointing at the selected Curves store path.
Hide all	Hides all the currently displayed traces.
Recapture	Overwrites the selected curve with a new measurement (the source measurement has the name underlined).

6.3.2. Math

This is an extremely powerful tool at the engineer's disposal. It's now possible to perform a series of mathematical operations to ease the tuning process and save time, simulating the interaction between measurements, creating new merged or averaged ones.

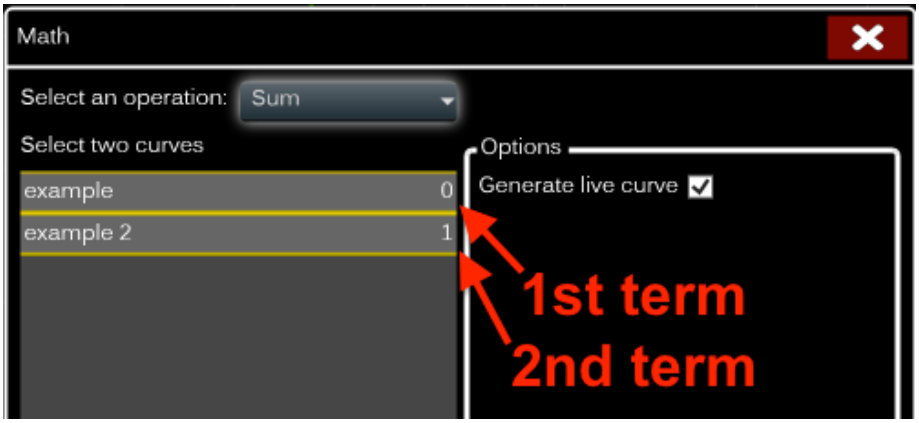

Figure 11 - Math: order of terms

The operations are performed selecting one or two Transfer Function curves (the order of terms is displayed as a progressive number next to the name), and clicking "Execute operation". A new curve will be displayed in the TF curves list, with magnitude and phase hidden by default.
The operations are displayed in the following table.

Sum	Perhaps the most important math function. Sum is used to see the combined response of two independent measurements, for example, a Top and a Sub, without the need of taking an extra measurement with both speakers active. This is valid of course for any measurement (Top + Fill, Tweeter+Woofer, subs in a cardioid configuration etc.) The sum can be performed in static and live mode: in static mode, it will be the result of the two selected measurements and will not be affected by any further changes, in Live mode (tick-box enabled) the newly created track will be displayed with round icons and will self-update if either of the two traces change (they can vary due properties change or EQ interaction).
Subtract	Subtraction can be used to remove from a measurement a contributor, for example to have a rough idea of the Sub response starting with only a full range and a Top only measurement; or to see what acoustical source is needed to compliment another in order to get a particular summed response. For example, subtracting a first-row measurement of a line array top from the reference response would result in the TF of a hypothetic

	front fill speaker that, once summed to the top, would complement it to get the desired acoustic response. To be used with caution and smoothing, to have a rough idea of the needed extra acoustical response to get a certain summed result, avoid overdetailed actions and data out of the bandwidth of interest.
Multiply	Multiplication is very useful to "apply" one measurement to another, for example if you have an unfiltered curve of a speaker, you can see the EQ'd response by a multiplication of the filter's curve by the raw speaker response.
Multiply by number	Multiply is useful to scale the curve by a certain linear amount, useful for creating target curves scaled by a certain amount from the original.
Divide	Division is the inverse of Multiplication. While the latter is used to "apply" a filter to a measurement, the former is useful to calculate what filtering is needed to achieve a certain target response. For example, dividing a target response curve by a starting measurement would result in the filtering needed by your starting measurement to get closer to your target. This function should be used with caution and lots of smoothing, to provide a rough idea of the needed EQ to achieve your target, avoid overdetailed actions and data out of the bandwidth of interest.
Divide by number	Similar to "Multiply by number" but with division.
Average	Average of more measurements, with the coherence weighting option. Useful to have a single measurement trying to characterize the overall response of the PA in the venue. Averaging close or far spaced measurements is also very useful to remove some of the combing caused by reflections, such as floor bounce. Coherence weighting it's important to discard low signal to noise frequencies, such as the ones combing destructively.
Merge	Merging two curves, with a "cross-fade" over a particular frequency and bandwidth of interest. For example, a ground plane measurement (appositely gain adjusted) can be merged to an ear height measurement to create an overall curve with more LF resolution due the absence of floor reflection (this could also be done live without math by cropping the view of two separate microphones). Another example would be combining a close field and a far field measurement to have a "quasi anechoic" response of the speaker.