

ReaMix: Breaking the Barriers with REAPER

Unlock REAPER and add new dimensions to your mixes

By Geoffrey Francis

Author of *Up And Running: A REAPER User Guide*

Demo Version Only

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Preamble

This Mixing Primer is intended to guide you towards getting the best out of mixing your projects in REAPER. It is designed to help you to produce great mixes that will be ready for mastering.

It is not really suitable for the complete novice to REAPER (nor to digital audio) as it assumes a certain basic level of prior knowledge. This includes:

- An understanding of basic audio concepts and terminology.
- A reasonable level of competence at recording and editing with REAPER.
- A reasonable degree of understanding of and competence at navigating within the REAPER environment.

If you do not already have a copy of *Up and Running: A REAPER User Guide*, it is strongly recommended that you get hold of one and read through it before you embark on this primer.

Both a PDF version of the User Guide publication and a Hard Copy are available for download. You should find a link at:

<http://www.lulu.com/content/1295509>

Check it out, then check out the *Dos and Don'ts* list below.

Dos and Don'ts

Do be prepared to read this primer thoroughly.

Do be prepared to go over some of the examples as many times as it takes to understand them. Some of them are quite simple. Some are rather complex. Most fall somewhere in between. You cannot expect to be able to learn and understand all that these examples have to reveal in a few minutes.

Do get ready to all but wear out the Toggle Global FX Bypass feature of REAPER. Use it frequently when you are working through the examples. It will help you identify how the various actions that you take are helping to shape the sound that you are producing.

Do expect to begin seeing results and benefits quite quickly, but also understand that this primer aims to start you off on a journey. It is not the destination.

Do expect to spend a lot of time if you want to get the best results. Some of the finest albums ever have taken over a year in the making. Some of the most memorable of hit singles have taken months. Rome wasn't built in a day and neither will a top quality mix be.

Do follow up what you learn here by pursuing other avenues – such as user forums, web sites, the experience of others.

Do be prepared to use the right tools for the job. If you're serious about recording, you'll need reasonably good mikes, good studio monitors, a PC with enough grunt, a good set of headphones and dual monitors (screens). If your setup lacks any of these, fine, but don't expect to get the same results.

Do be prepared to analyze what you are doing, and to learn by doing. Experiment, investigate and make mistakes. Then learn from those mistakes.

Do be patient and expect to grow and improve steadily and gradually through time.

Don't expect overnight miracles. Any art, skill or craft worthy of its name takes years to master. You won't become the next Phil Spector, Todd Rundgren or George Martin overnight. Neither did they.

Don't be afraid to push the boundaries or to bend or break the rules. There's only really one rule anyway. If it sounds right, it is right.

Disclaimers, Excuses and Grovelling Apologies

Mixing is a multi-disciplinary activity that involves getting on top of a huge number of issues. These issues interact with each other and don't belong in watertight compartments.

For the purposes of learning, however, you will come across a number of places in this book where topics appear to be examined in isolation from the other aspects of mixing. Likewise you will come across other sections where the boundaries between different topics may appear somewhat blurred. That's all part of the learning process. Hopefully, the latter stages of this primer will tie all the loose ends and odds and bits together for you.

Finally, remember that mixing is not an exact science. It's part science to be sure, but there is also a huge subjective element to it. If you don't agree with everything said in this primer, that's fine – in fact, it's better that you don't. The most important thing is that you will learn from putting it to the test.

The Sample Projects

There are three sample projects which are used in the primer, each with a dozen or more variations and versions. The primer includes links to these. All are recordings of acoustic music. There are two reasons for this:

- The need to include examples using only plug-ins that are either supplied with REAPER, or are easily (and legally!) available as freeware. This rules out most popular synthesizers.
- It is the style of music with which I am personally most familiar and of which I have most experience.

This does *not* mean, however, that this is only, or even primarily, a book about how to mix acoustic music. Not even for one minute. The aim is to help you to understand and develop confidence and competence in two main areas:

- The principles of sound and acoustics, and especially how sound behaves, and can be made to behave, in the four dimensions of space that make up mixing. Those principles are exactly the same when applied to any genre of music, be it classical, acoustic, electronic, or any other form. All that will vary is the application of those principles – which is where your specialist knowledge of your music comes in.
- The very special features of REAPER that offer you mixing opportunities that (at time of writing) are just not obtainable with other DAWs, at least none that I have ever encountered. These features, of course, are there for your use regardless of the musical genres within which you are working.

This special demo edition of this Mixing Primer does **not** include these project files

In addition to this, there are a number of especially customised JS Plug-ins that are used in some of the examples. These are also included with the primer, but not with this demo version.

Acknowledgements

This mixing primer could never have been produced without the invaluable assistance of some wonderful people. In particular, I must single out:

Louise Bell, Peter Hicks and **Jeremy Sibson** for their generosity in lending me their musical and vocal skills for the sample recordings used throughout this primer.

Simon “Spike” Mullings for his extraordinary patience and diligence in proof reading, debugging and generating a number of constructive ideas and suggestions that have helped make this a significantly better and more useful book than it would otherwise have been.

What You Get

This free Demo version of ReaMix is intended only to give you a flavour and a feel for the contents of the actual document.

- Check out the Table of Contents for a complete overview.
- Check out the sample pages, These include a small number of the dozens of examples with step by step exercises that are included in the main document.

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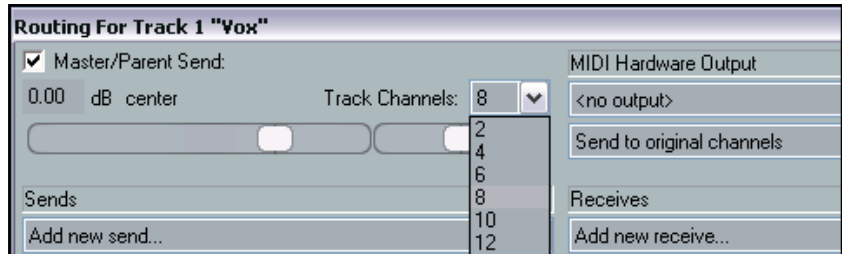
1.5.4 Channel Splitting

How to Create Split Channels

Throughout this primer, we will be making extensive use of REAPER's channel splitting capabilities. If you haven't used channel splitting before, now is the time to get to grips with the basics.

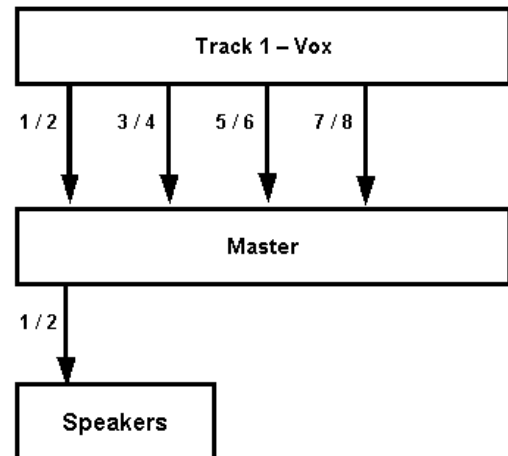
You can define any track as comprising of up to 64 channels, but in most cases it is unlikely that you will need that many. Let's take a more simple example, splitting a track into 8 channels (four stereo pairs).

Channels are created by defining the number that you require by clicking on the track's I/O button to opening its Routing window (see above).



When you split a track into (say) eight channels, you immediately create four identical separate but (initially) identical parallel stereo streams for that track. These will be routed through Channels 1/2, Channels 3/4, Channels 5/6 and Channels 7/8. These four pairs are independently routed to the Master, but by default only the stream on Channels 1/2 are then routed to the Speakers (Hardware Output)

This concept is illustrated by the first of the flow chart diagrams on the right.

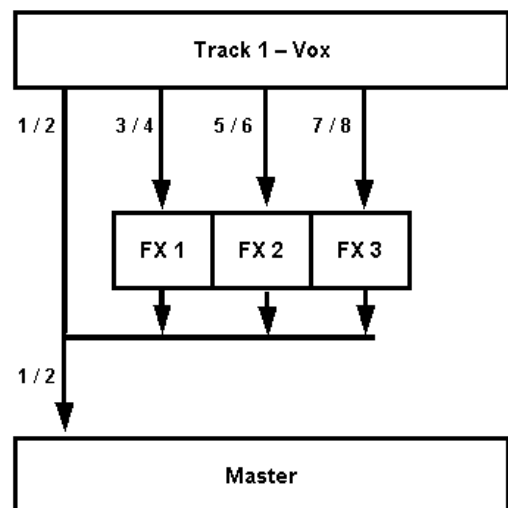


Using Parallel FX

Having created your four parallel streams, you can now route different streams through different FX or FX chains to create just the sound you want.

For example, you could use this technique to add some compression to, say, only the low frequencies on your track, and perhaps some reverb to the mid frequencies, then joining the four channels back together before sending the remixed track to the master.

This concept is illustrated by the second of the flow chart diagrams on the right.



Channel Splitting and Routing

Another benefit of Channel Splitting is that it can be used in conjunction with Routing.

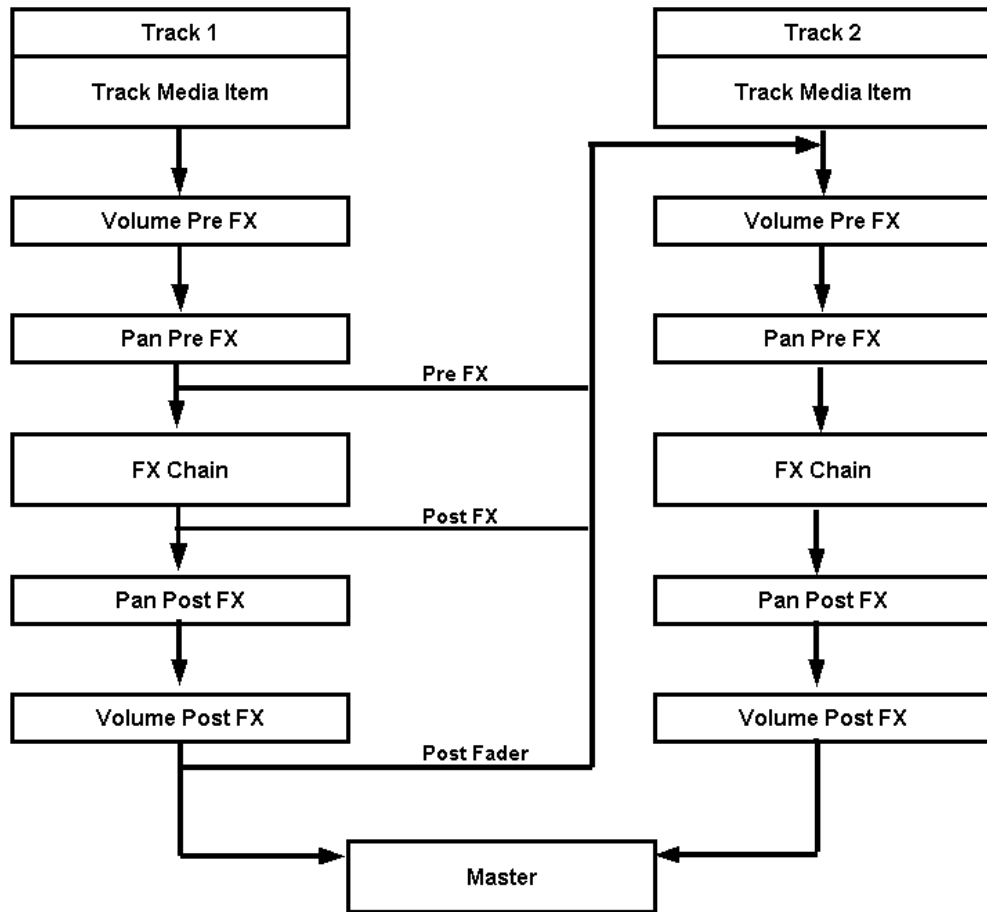
Here is an example.

After you have defined a track as consisting of more than two channels, you can bring in an audio signal from another track on one pair of channels, process it independently and as required, then finally blend it in with the material originally recorded on that track.

You will encounter practical examples of these techniques in action throughout this Mixing Primer.

1.5.5 Routing: Sends and Receives

Sends and receives are very important elements of mixing in REAPER. The diagram below indicates how REAPER manages sends and receives between tracks. In this example, the source track for our send is Track 1, and the destination track is Track 2. To be able to use sends and receives effectively, it is essential that you understand how the various send parameters are controlled.



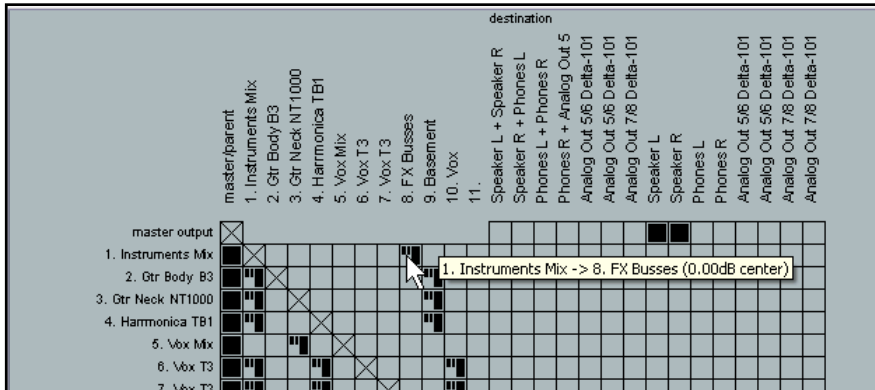
Notice in particular:

- The volume level and panning settings of the signal sent are affected not only by the levels set within the I/O box (or by Send Envelopes) but also by the Volume Pre FX and Pan Pre FX controls for the source track. For example, if the Pan Pre FX setting for Track 1 is set at 40% left and the Pan parameter for the Send itself is set at 40% right, then the net effect is that the signal will be sent dead centre.
- Signals that are sent in this way are received into the destination track before that track's Volume Pre FX or Pan Pre FX settings are applied. For example, if the Volume parameter for the send is set to 0 dB and the Volume Pre FX parameter for the destination track is set tight down to – Infinity, then no volume will be heard from the send.

You can see that one consequence of this is that you will need to be careful when using any of the Pre FX track controls with tracks that use either sends or receives.

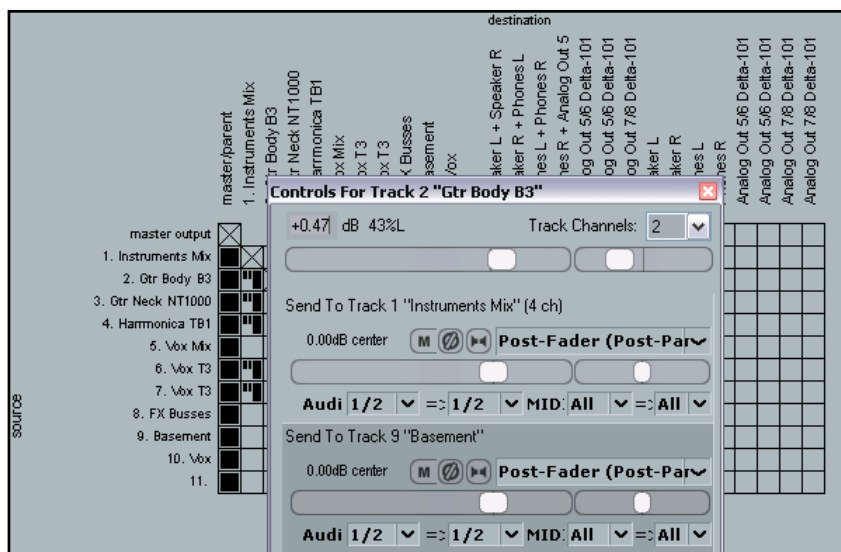
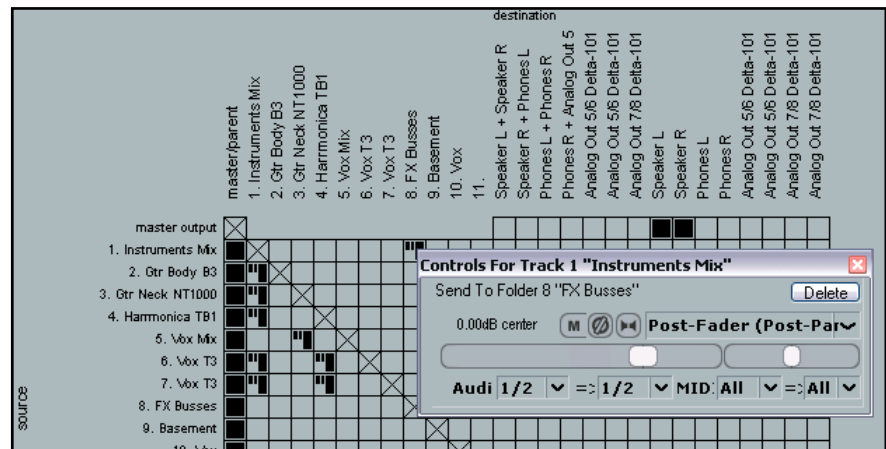
1.5.6 The Routing Matrix

Get to know the Routing Matrix inside out, upside down and back to front. This will save you so much time and give you so much control when using REAPER's very powerful and flexible routing system. In particular, make sure that you are familiar with the following.



Left click over any intersection on the grid to create a send from the item listed in the column of track names (left of matrix) to the item listed in the row of track names (above the matrix).

Right click over any existing send that is displayed within the Routing Matrix to open a window to adjust the controls for that particular send.



Right click over the name of any track along the top or on the left of the matrix to open the Track faders (Volume and Pan), Track Channels Drop Down List and all Sends and Receives for that Track.

In many cases, this will avoid the need to keep jumping back and forth to and from the Track View window.

1.8 Develop a Mixing Strategy

The goal of mixing, put at its simplest, is to make your recording sound as good as possible. Sounds straightforward enough, doesn't it? However, anyone who has ever tried it will tell you that it can be quite a daunting task. One of the most common causes of bad, uninteresting or mediocre mixing is a failure to take a thorough and methodical approach.

There's no one single model that suits everybody, a system to which the entire world must slavishly adhere. However, you are strongly advised to find a system that suits you, and then stick to it. Mixing requires a large amount of discipline, and you are unlikely to obtain the best results by jumping randomly hither and thither without a plan. You can think of mixing as being a four step process. These are:

1.8.1 Corrective Action

Start by identifying and fixing any problems in your recording. The guitar is too muddy. The vocalist's breath sounds are too loud. There's some background hiss on one of the tracks. There's a clunk somewhere. The cleaner your recordings are, the better you will be able to go on to the next step. The time to identify and resolve these issues is at the beginning of the mixing process, not the end.

1.8.2 Spatial Mixing

Work out your desired sound stage. Use the various tools at your disposal (we'll see what these are shortly) to position every instrument pretty much as you want it to be in your final mix.

1.8.3 Artistic Mixing

This is for many the most interesting and enjoyable aspect of mixing, which is why too often you might be tempted to jump over steps 1 and 2 and start right here. Don't! This is where, for example, you set about creating your song's build, highlighting a particular instrument here or there, adding some clever effects at certain passages, and so on.

1.8.4 The Final Touches

The very last stage in the mixing process is mastering. Mastering consists of bringing your mix up to a standard ready for final distribution. Some people choose to do their own mastering, others are happy to work within their limitations and stick with pre-mastering. Pre-mastering consists of taking the necessary action to make your mix ready for mastering by a professional mastering engineer.

In this primer, we will examine the issues involved in pre-mastering, and look at the tools that REAPER makes available for you to do this. However, the topic of mastering is a huge one, worthy of a book in its own right (indeed, many excellent ones have already been written). It is beyond the scope of this primer to go into the science and art of mastering.

I can recognise, however, that this can create something of a dilemma, especially for less experienced users. What do you do if you don't have enough money to pay for a professional mastering engineer, don't have enough experience to master to a professional standard yourself, but need to produce, say, a demo recording.

In an attempt to provide a stop-gap solution, I've included a section at the end on **Pseudo Mastering**. This, I fear will cause more than a few eyebrows to be raised. In this section, you will be shown a few relatively straightforward techniques that should be able to at least improve the overall sound of your final mix. *This pseudo mastering is not intended to serve in any way as a substitute for proper mastering.* Pseudo mastering is only recommended if circumstances really leave you no alternative, and then only as a short term solution.

2 Pre Mix Fix: Corrective Action

2.1 What Is Corrective Action?

Before you go about commencing your “real” mix, listen to each track individually to see if any require corrective action. Corrective action may need to be applied if there are blemishes or other problems in your recorded material, and for some reason these blemishes cannot be corrected by overdubbing or re-recording.

Examples of instances where this may be necessary might include:

- A guitar track that sounds too boomy.
- A piano track that sounds too honky.
- Hi-Hats that sound muddy.
- Small glitches that need removing.
- Vocal issues, such as “popping” or “gasping”.
- Minimising the impact of “bleed” on non discrete recordings.
- Removing unwanted background noise

Corrective mixing should be treated as a separate and distinct task in its own right. Make your recordings as clean and right as they should be before you go on to create your mix.

2.2 Corrective Action Tools

It’s one of the great mysteries of recordings? Wherever did that click or crackle come from? How did it get on to my otherwise pristine track? In any event you will want to remove it.

REAPER offers you at least nine tools for dealing with unwanted sounds on your tracks. Which is most appropriate in any particular circumstance will depend on factors such as the nature and context of the sound. For example, is it present in an otherwise silent passage all by itself, or does it occur at the same time as other recorded material that you wish to keep. In overview, the eight methods are:

- Use EQ.
- Create separate items and mute them.
- Create items and use crossfades.
- Use a mute envelope.
- Use a volume envelope.
- Use a Noise Gate.
- Using ReaFir.
- Use a Multiband Compressor.
- Use Spectro.

We’ll be looking at each of these methods in turn, with examples of the kind of situation in which they might be applicable. In doing so, we will be assuming that you are already familiar with REAPER’s mechanics, such as how to split an item, how to add fades and crossfades, how to create and use envelopes, and so on.

ReaMix: Breaking the Barriers with REAPER

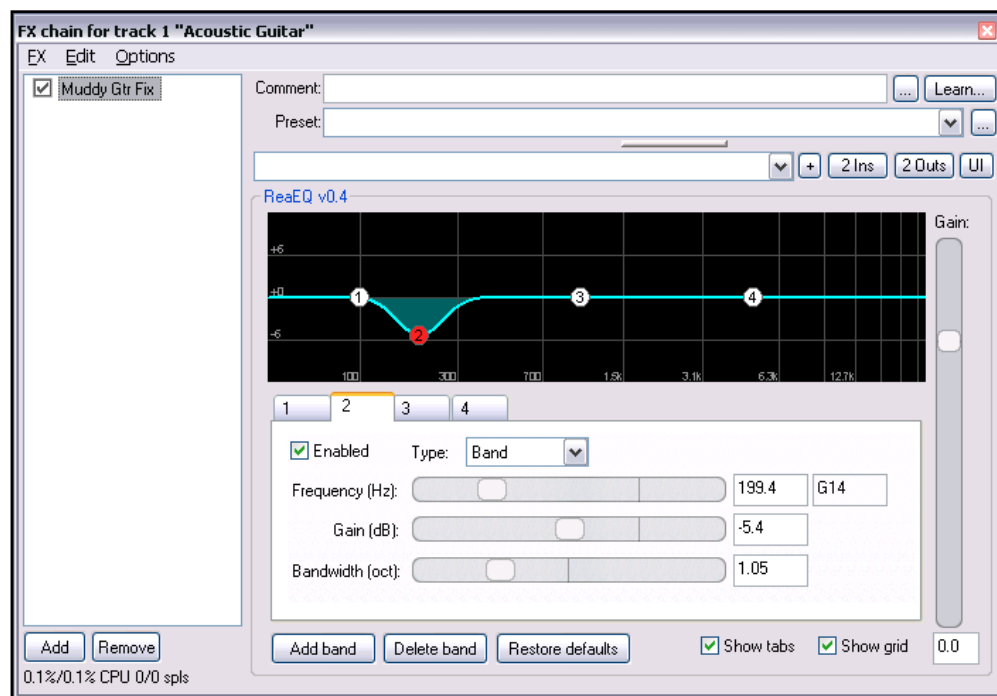
2.3 Corrective EQ

The following table shows some examples where this might occur, together with suggested possible remedies. The remedies are suggested for guidance only, not blind obedience.

Typical Corrective Mixing Issues	
Issue	Comments
Boominess	If an instrument sounds too “boomy”, take off a few decibels around 200 Hz.
Muddiness	If an instrument sounds muddy, try cutting the level around 300 Hz.
Irritation	Especially with percussive instruments, where this occurs try cutting around the 2000 Hz to 4000 Hz range.
Twanginess	This can occur especially with plucked instruments. Cut volume around 1000 Hz to 4000 Hz.
Thinness	Where an instrument sounds too thin, try reducing volume around 5000 Hz to 8000 Hz.
Hiss	If an instrument sounds “hissy”, try rolling off above the 8000 Hz mark.

Notice that in every single one of these examples, the suggested remedy involves *subtractive mixing*. This means that rather than add gain at any point, you should lower the gain fader at or around the critical frequency in order to achieve your objectives.

You can see that corrective mixing as likely as not will involve the application of some EQ. As a rule, you should use a separate renamed instance of your EQ plug-in specifically for this task, as shown on the right. This instance should normally be the very first plug-in in the track's FX chain. You should then consider that particular instance of the plug-in to



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be locked.

If you later wish to make further changes to the EQ any track, add a separate instance lower down the chain and use that. This approach has several advantages.

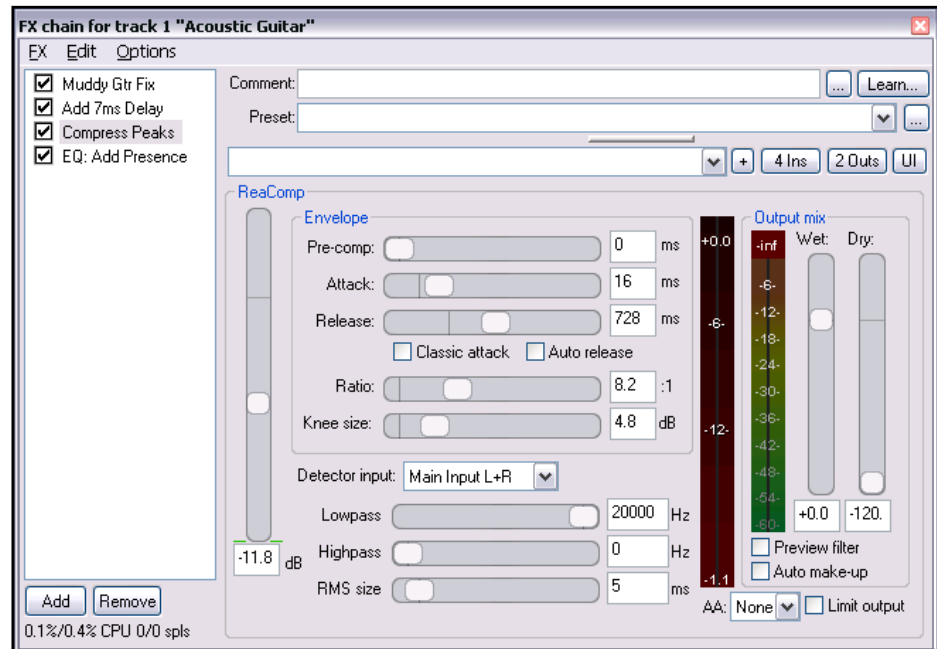
For example:

- It is safe and methodical. You are unlikely to accidentally undo your good work later if it is locked away in a specific plug-in of its own.
- It is more flexible. You may well want to apply further EQ to the track later, but you may also wish to apply other FX, such as perhaps delay or compression. The additional EQ that is required might be best placed further down the FX chain.

Remember that the ability to rename individual plug-in instances is an extremely useful feature of REAPER. Just right click over the name of the FX in the FX Chain (in the FX Window or Mixer View) and choose **Rename FX Instance** from the context menu.

By doing this, you can create an audit trail of your work as you go along.

Take a look at the example shown on the right. How much more useful is it to view a chain such as that shown above right than just a list of plug-in names?

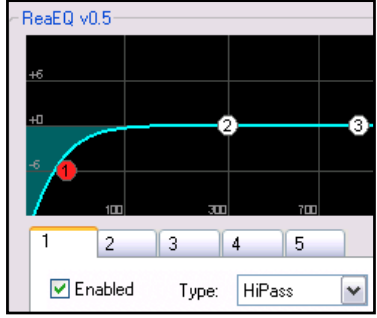
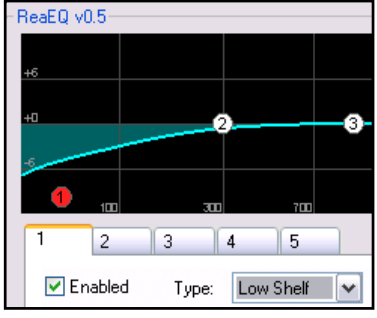
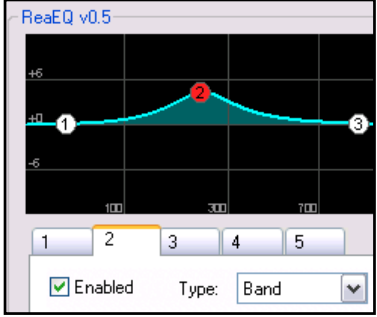
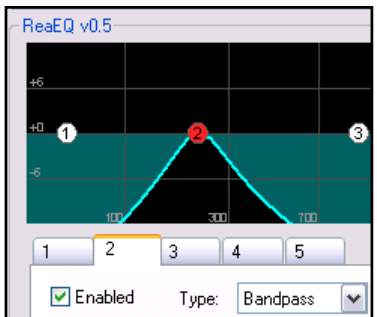


2.4 EQ: Bandwidth and Type

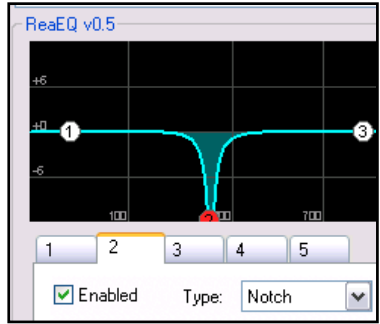
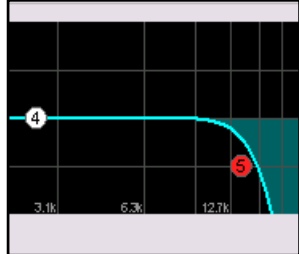
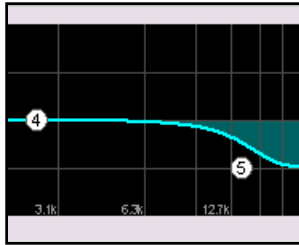

EQ is probably the one type of plug-in that you will use more than any other. Throughout this Mixing Primer, we will primarily be using the plug-in ReaEQ, the parametric EQ plug-in that is supplied with REAPER. Happily, it has only a small number of parameters, at least compared with other types of plug-in. It's worth taking time to make sure that you are comfortable with each of these parameters.

Parameter	Comments
Add Band	By default, the ReaEQ screen displays four bands, but you can add more if you wish.
Delete Band	Deleted the currently selected band.
Enabled	This is a toggle that enables or disables the currently selected band. Useful when you are testing the effect of your settings.
Frequency	Determines the frequency at which the Gain and Bandwidth settings for the currently selected band will be applied.

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Parameter	Comments
Gain	Determines the value of decibels by which the volume at the currently selected frequency will be increased or decreased.
Bandwidth	Determines the number of octaves across which the gain will be applied. The normal range is between 0 and 4.
Band Type	Determines the type of band. The options are explained below.
	<p>High Pass</p> <p>Allows only frequencies above that specified to pass through the filter and be heard.</p> 
	<p>Low Shelf</p> <p>Similar to a High Pass filter but more gradual in its effect.</p> 
	<p>Band</p> <p>Determines the central frequency at which the gain or reduction is applied. The bandwidth setting determines the range that will be affected.</p> <p>The type Band (deprecated) is similar to Band, and reflects the way earlier versions of ReaEQ behaved.</p> 
	<p>Bandpass</p> <p>Allows only that range of frequencies centred on the frequency to pass through the filter and be heard. Can be useful when sweeping a track seeking to identify problem frequencies or key frequencies.</p> 

Demo version only – full version available from <http://www.lulu.com/content/2539885>

Parameter	Comments
	<p>Notch</p> <p>A special kind of Band filter, used for applying a sharp reduction in volume at a highly targeted frequency.</p> 
	<p>Low Pass</p> <p>The opposite of a High Pass Filter. Allows only frequencies below the specified frequency to be heard.</p> 
	<p>High Shelf</p> <p>Similar to Low Pass but creates a more gradual transition.</p> 
Show Phase	 <p>Enables you to check the phase shift implications of your EQ settings. Let your ears be your best judge!</p>
Gain	<p>The gain fader can be used to adjust the overall signal level (increase or decrease) after the effects of your EQ settings have been applied.</p>

2.5 The Grey Area

The boundaries at which corrective EQing ends and spatial EQing starts can get a little blurred, simply because of the very nature of the recording process itself. No matter how careful you are with microphone selection and placement, you are never going to be able to reproduce with 100% fidelity a true representation of that live sound. This is such a common issue that it becomes a bit of a grey area, but it makes sense to address it before we move on to the next section. As a rule it pays to be wary of any suggestions to *always* EQ an instrument in this way or that way. Nevertheless, listen carefully to your instruments and see whether the following suggestions make sense. Notice, by the way, how much of the subtractive EQing in these tables takes place within part that frequency range that we will later be describing as *The War Zone*.

If you wish to experiment with any of the settings on this page, insert a separate instance of your EQ plug-in in your track's FX chain. This should be placed after any Corrective EQ plug-in. You should normally also use this second instance of your EQ for any further EQ that you may wish to apply to the track at a later stage in the mixing process.

The Drum Kit

If your recorded drum kit in its dry state sounds perhaps a little dull or ordinary, you could experiment with some of these:

Instrument	40 to 60 Hz	200 to 400 Hz	1000 to 3000 Hz	5000 to 8000 Hz	10000 to 12000 Hz
Kick	+2 dB	- 8 dB		+ 6dB	
Toms		- 5dB		+ 5dB	
Snare				+ 7dB	
Hi Hat		- 7 dB			+ 3 dB
Overheads		- 5 dB			+ 3 dB

Some Other Common Instruments

See whether these fairly minor tweaks bring your instruments and vocals alive a little:

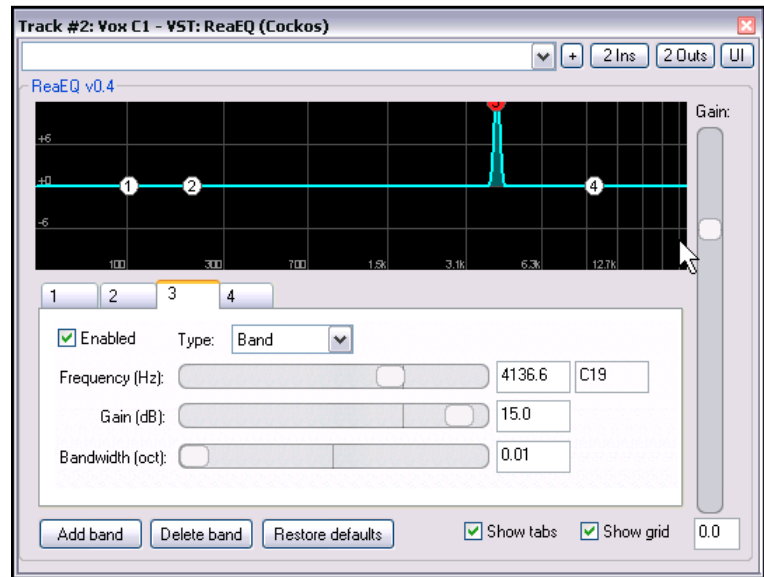
Instrument	40 to 60 Hz	200 to 400 Hz	1000 to 3000 Hz	5000 to 8000 Hz	10000 to 12000 Hz
Bass Guitar	+ 2 dB	- 4 dB			
Acoustic Guitar		- 5 dB		+ 3 dB	+ 2 dB
Electric Guitar			+ 3 dB		
Female Vocals		+ 2 dB		+ 2 dB	
Male Vocals		+ 3 dB			

2.6 Correcting Vocal Problems

2.6.1 Sibilance

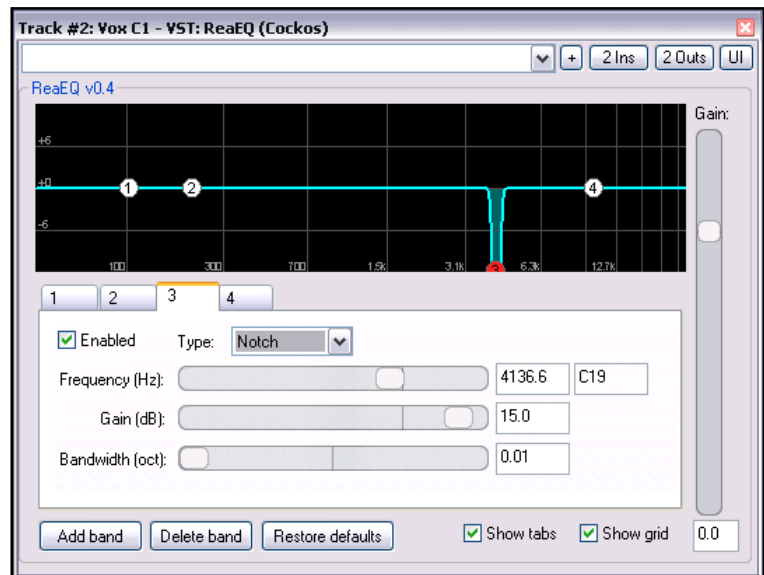
Sibilance is the term used to describe that hissing sound that can sometimes occur when an "ss" sound is recorded. It is most easily tamed with the use of a de-esser. Third party de-esser plug-ins can be purchased, or you can make your own, using an Analyser, EQ and a Multiband Compressor.

Any Spectral Analysis tool (including those mentioned earlier in this primer) can be used to help identify the approximate region where the offending frequency can be found. For male vocals, this is likely to be somewhere in the range 4,500 to 5,000 Hz, for female vocals 6,500 to 7,000 Hz. Once this has been identified, a technique known as *sweeping* can help you to home in on the exact frequency.



This requires you to create a notch filter. In order to do this:

- Choose one of your EQ bands, set it at approximately the required frequency and define the EQ type as band.
- Raise the Gain by about 15 dB for that band.
- Narrow the bandwidth for that band to 0.01 (see picture above).
- Now play the track. As you do so, carefully and slowly drag the frequency slider right or left until you identify the spot at which the sibilance is the worst.
- Now change the filter type to notch, as shown on the right.
- Play your track. You should notice some improvement in the sibilance.



Unfortunately, in solving one problem we have most probably created another. This is because as things stand, our notch filter will be applied all the time, even where there is no sibilance. This could seriously affect the vocal track, for example by adding something of a lisp to otherwise clean sounds.

You might think of using an envelope to enable and disable this filter as required, but this would be a lot of work. A better solution would be to apply what you have learnt to a multiband compressor.

We can therefore now bypass our EQ (or disable the notch filter band) and insert into our FX chain a multiband compressor such as ReaXComp. This allows us to apply compression to selected frequencies only, and only

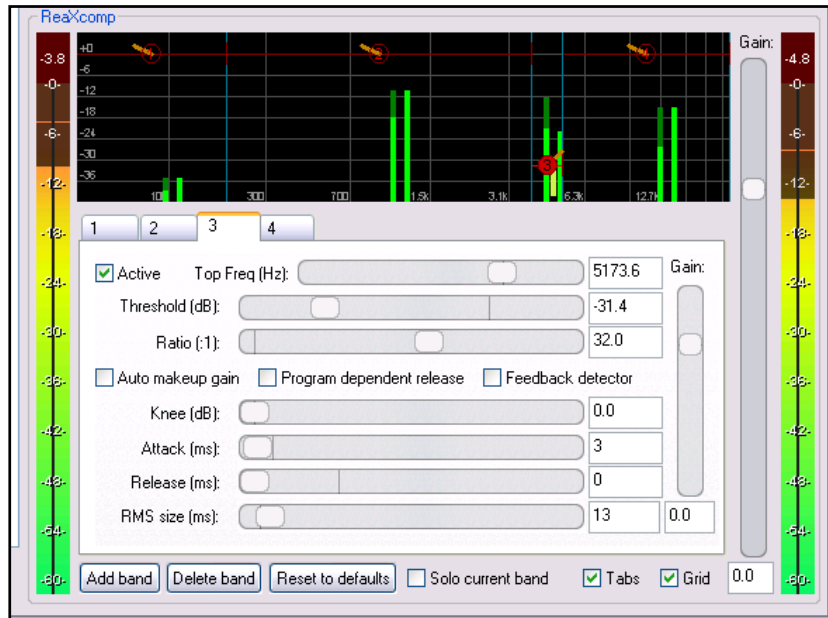
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when the volume at that specific frequency goes above a certain level. This plug-in could have been tailor made for de-essing!

Notice the settings shown on the right. In particular:

- Only Band 3 is made active.
- Automake up gain is disabled.
- The range for this band is set to about 3865 Hz to 5174 Hz. This is quite narrow, but wide enough to capture the sibilance.
- The ratio setting is quite high to ensure that the volume is severely reduced when the compression kicks in.
- The threshold is set by trial and error so as to activate the compressor only when sibilance occurs.
- The other settings (knee, attack, release, etc) are all very low. This ensures that the compressor, when required, will kick in quickly and just as quickly kick out again.



Remember that once you have experimented with your settings and created those that suit your particular needs, you can save them as a preset. You will then have a de-esser that you can apply to other projects as well as the current one.

2.6.2 Plosives

Plosives consist of that popping sound that sometimes occurs with recorded "P" and "B" sounds. When you zoom in closely on a recorded audio item, it is usually quite easy to visually identify a plosive, from its jagged waveform pattern.

Further explanation with step by step examples follow

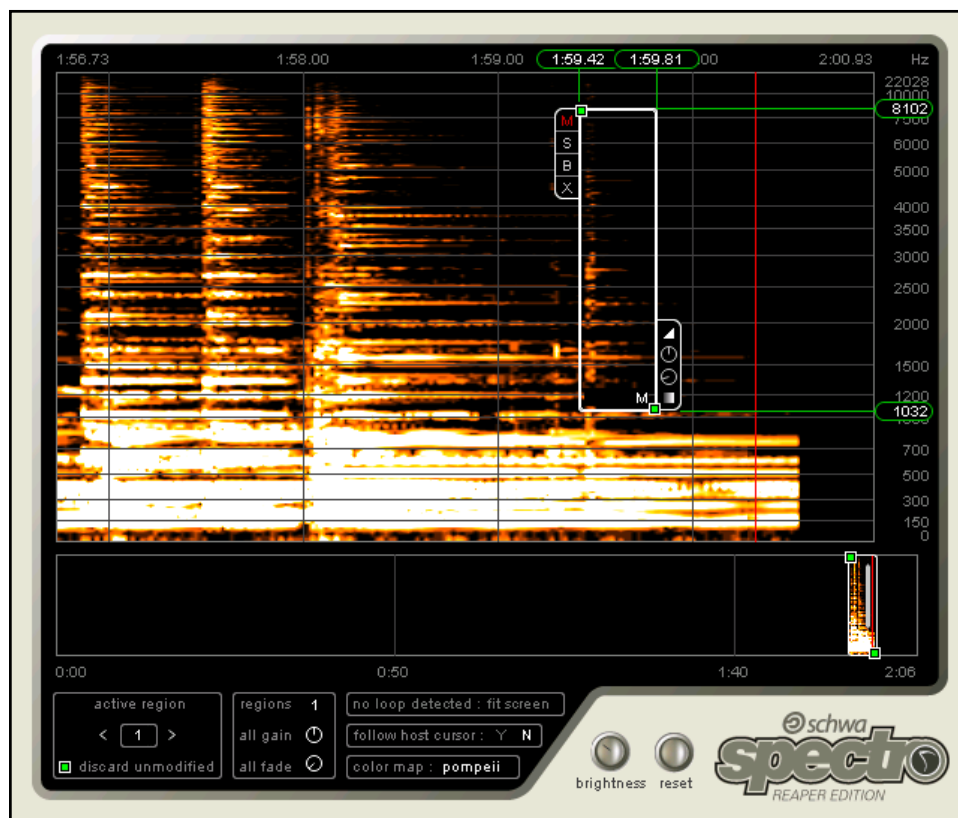
2.6.5 Clunks and Clicks

This category embraces a multitude of sins. It's the sort of thing that can arise, for example, when during an otherwise quite passage (such as the decay of an instrument) a guitarist accidentally taps on his guitar, or a vocalist knocks her music stand.

If you notice this at the time, it's often best to record the part again. Where this isn't possible, you need to do whatever you can to fix it. Sometimes an accelerated fadeout will help, sometimes splitting and trimming can help, but very often the best solution here will be to use **Spectro**.

In the example shown on the right, you can see a sudden spike in the spectral pattern where a musician has accidentally created a clicking sound immediately after the end of the tune. This could be caused, for example, by accidentally catching a finger on the instrument as he removes it from the string.

In this example, Spectro has been used to isolate and mute the offending noise.



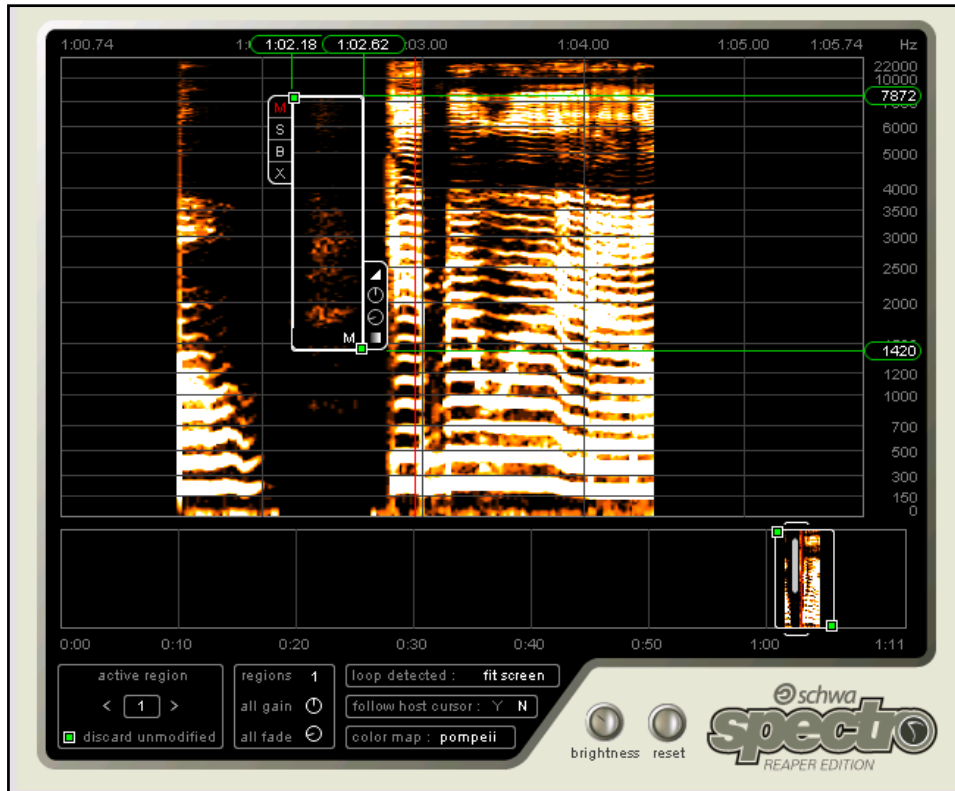
Example

This first example will illustrate the use of **Spectro** to eliminate unwanted background sounds.

1. Open the file **Don't Keep Me Waiting** and immediately save it as **Don't Keep Me Waiting SPECTRO**.
2. Select the **Vox** or **Vocal** track.
3. If there are any FX in the FX chain, set them to Bypass mode.
4. Set the Volume fader to Zero and the Pan fader to Centre.
5. Solo the Vox track.
6. Open the FX Window for this track and insert **Spectro** into the FX Chain. Set the option to **Follow host cursor** to **Y**.
7. Position the play cursor at the time **1:01.500**. You may need to zoom in to get to this exact position.

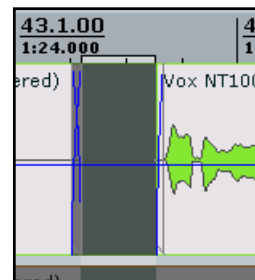
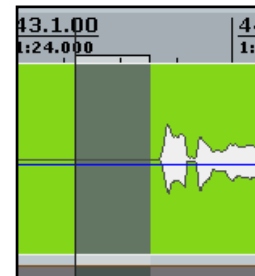
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8. Play the song.
You will hear the singer drawing breath at about 1:02.500. This breath will be visible on the Spectro graph.
9. Use your mouse to "lasso" the breath sound as shown in the illustration on the right. Select the **M** (for Mute) button for that region.
10. Play the song again. The breath can no longer be heard.
11. Save the file.



This second example will use a different approach to a similar problem.

1. Position your play cursor at **1:24.000**. Select and solo the **Vox** track. Play it. You will notice a sound at about 1:25, just before the vocal comes back in.
2. Make sure that Snapping is disabled. Select the media item, then click and drag your mouse to select that part of the track which contains the sound (see right).
3. Right click over the area and choose **Split item at time selection**.
4. Right click over the selected item and choose **Item Settings, Mute**.
5. If you wish, use your mouse to draw a fade in and out from this section, as shown in the illustration below right.
6. Rather than have a track made up of what might become quite a large number of media items, it's worth considering whether after fixing these problems you might wish to double-click on the track in the Track Control Panel then right click over any part of the track itself and choose **Glue Selected Items**. This will bind them together as one.
7. Save the file.



3 Spatial Mixing

3.1 Spatial Mixing Concepts

Have you ever listened to a CD and found that despite it being perhaps a complex arrangement you can hear each and every instrument and voice quite clearly and distinctly, yet with everything also blended in nicely with the overall total production? Have you then listened to another CD with perhaps a similar arrangement and found that it's actually quite difficult to figure out exactly what's going on?

The reasons for this are all about *space*. Mixing requires that every part in the production – *every* part – has to be given its own space. Without this, it doesn't matter how creative you are in working with the dynamics and artistry of your recordings, you simply will not end up with a good mix.

Arguably, many amateur (and alas some professional) mixes are spoilt by a failure to give adequate attention to the issues of space than by anything else. That's why we'll be spending a little time examining some of the theories and concepts involved before going on to work through our first practical case study.

The first mistake that some (indeed, too many) make is to think of space in a mix as consisting of width alone, and that this is simply determined by panning.

Of course panning is important, but panning affects one dimension only – the placing of an instrument on a horizontal scale somewhere between 100% left and 100% right. But width alone is not enough to create a true sense of space in your mix. There are in all not one but four dimensions, all of them important.

The Dimensions of Sound	
Item	Comments
Width (between the speakers)	<p>This is generally represented as being anything between 100% left and 100% right. Most commonly, the left-right placement issues are controlled by Panning.</p> <p>Later in this section, you will see how REAPER's routing capabilities in particular open up interesting exciting possibilities for left-right panning that are not easily possible with other DAWs.</p>
Height (frequency)	<p>The frequency range of instruments and their harmonics spans a range of approx 20 Hz to 16,000 Hz (and above). This determines another spatial dimension of our mix, which we can think of as being height. The role and importance this dimension can play in adding colour to your mix is too often overlooked.</p> <p>This is the aspect of mixing that people are often talking about when they refer to <i>acoustic space</i>.</p>
Depth	<p>As your music plays back through the speakers, some voices and instruments will appear to be closer to you than others. If you like, you can think of this illusion of depth as being conceptually similar to the illusion of depth that will be created by a landscape painter.</p>
Time	<p>Like height, time a dimension to which sufficient attention is often not given. Your mix should not resemble a static snapshot, but should behave dynamically through time.</p>

As you begin to understand that sound operates across these four dimensions, you will grow to appreciate why each of these is important, and why the manner of combination of these different dimensions matters.

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3.2 Designing a Virtual Stage

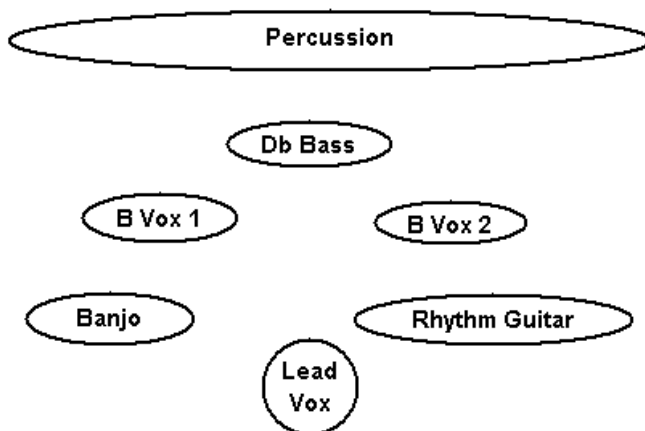
It isn't necessarily true that great minds think alike. Sometimes equally gifted people will approach the same task with completely different systems and methodology. The best approach is that which works for you. Some sound engineers insist that you should always mix only with your ears, and ignore all other sensory input. Others, myself included, would say that if you think that making use of other senses (such as visual senses) can help you then you'd be best advised to use them.

Some people like to sketch out a virtual sound stage before they begin their mixing. It gives them a starting point when it comes to positioning the different instruments in the mix. Others see no point in it but prefer to simply play it by ear. Ultimately you'll have to decide for yourself whether you like this idea, but you should certainly give the idea some consideration.

Try sketching out an overhead view of the stage layout that you are aiming to create with your mix. A couple of examples are shown below:

Consider the two illustrations below.

The first is for a song that features a lead vocalist, two backing vocalists, a rhythm guitar, banjo, acoustic bass and drum kit. We might have it in mind to create a sound stage like that shown below (as viewed from above), where front of stage is at the bottom of the diagram.

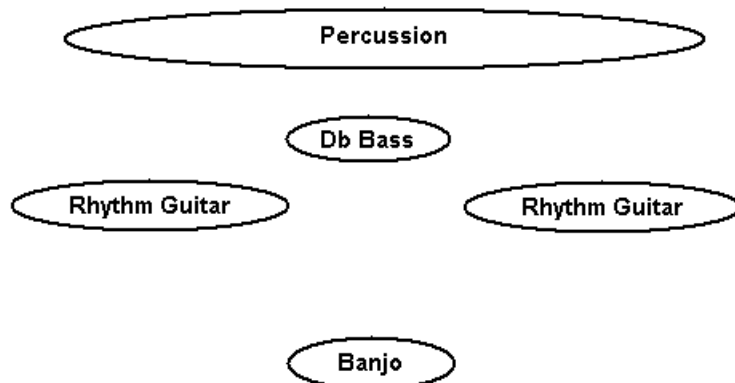


This helps us decide not only how best to pan our instruments, but as you will shortly see, also where we will wish to use other techniques (such as the use of EQ and/or Reverb) to make instruments appear further forward or back in the mix,

Now consider the second picture (below).

Suppose this song includes a break in which we wish to feature the banjo. This leaves us with what might be a rather thin mix. We might decide that whilst bringing the banjo right up front and centre stage, we might also wish to not only push the rhythm guitar further back, but also somehow to spread it out so that it appears to fill most of the space behind the featured instrument.

During this chapter of this book, you will be shown how to create effects like this.

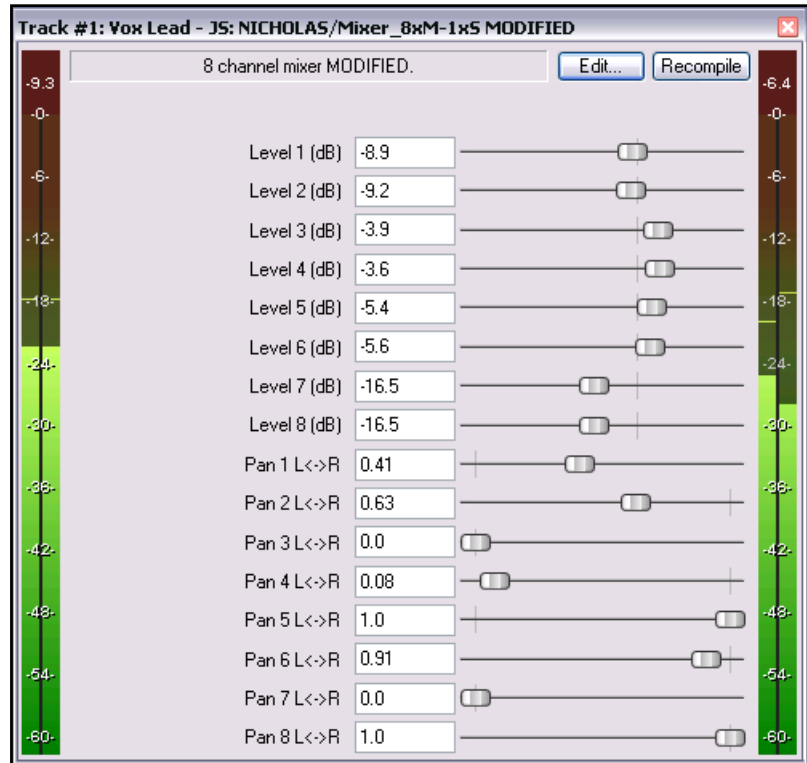


3.5 Channel Splitting Concepts and Techniques

Many of the examples that follow throughout this primer make extensive use of channel splitting and joining. The basic idea is that by splitting a track into several channels and applying different FX to each channel before joining them up again, we can make some pretty impressive sounds.

Shown on the right is one of the mixing plug-ins that we use quite extensively in some of our examples.

The beauty of mixing tools like this one is that you have at your fingertips a very easy method of putting your track together. Each of the channels (in the example shown, there are eight channels) has its completely independent volume and pan controls. As you work through these examples, you will be very pleasantly surprised, if not astounded, the first time that you discover just how much creative control this puts at your fingertips.



It's worth taking some time to understand this clearly before you continue. In some examples, we will be using special Channel Splitter plug-ins to do this. These are relatively straightforward. However, in many cases these channel splitter plug-ins are not capable of giving us the results that we want. This is when we have to use a different complicated method, splitting our tracks into channels in a way that may not be too obvious or intuitive.

Let's look in principle at an example of how this might be done.

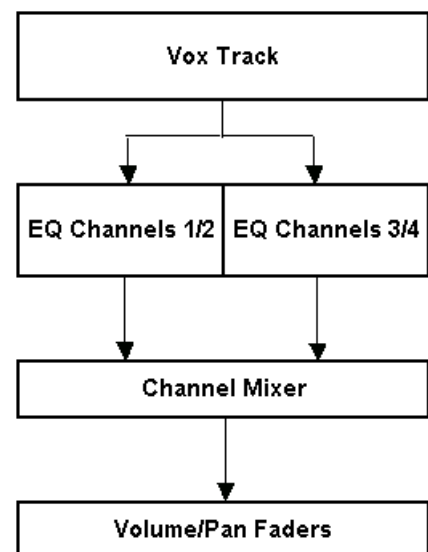
Suppose we were to split a Vocal Track into two pairs of channels. We could then, for example, apply separate EQ to each pair of channels (perhaps making one warmer and the other more present) and then use the Channel Mixer to pan them differently before joining them up to create a more interesting and varied vocal effect.

The diagram on the right illustrates how this might be done. The same original vocal track is passed into two separate instances of ReaEQ, then, as the diagram shows, the output of each EQ instance is fed through a different, separate pair of channels.

How then is this done?

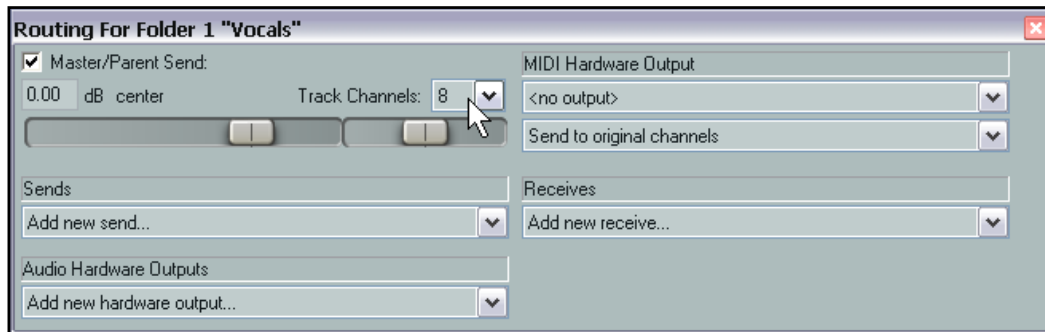
The answer comes in two parts.

The first is that each track's I/O Window lets you determine how many channels a track shall have. The default is two, but this can be changed to any number up to 64. In the hypothetical example that we are considering here, a total of four channels is needed.



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The procedure for setting these up is shown on the right. You simply open the I/O window for the track and specify the number of channels required. In the example shown here, 4 Track Channels have been defined.

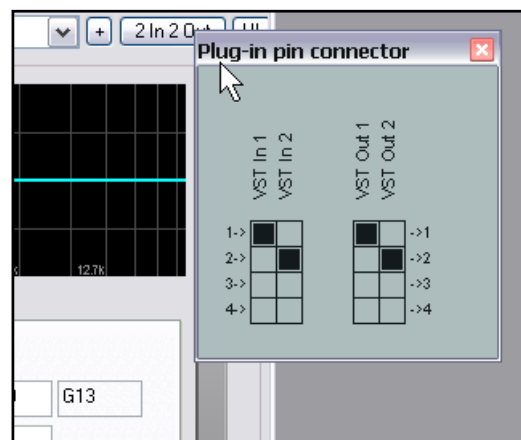


The second part of the answer is found in REAPER's VST Plug-In Interface. This allows you to specify which channels are to be used for the plug-in's inputs and outputs. In most cases, the default settings for both input and output are Channels 1 and 2.

These are illustrated below, using the **ReaEQ** plug-in as an example:

You can click on the **2 In 2 Out** button of the plug-in's **Plug-in pin connector** interface to display the Routing Matrix for that plug-in. Notice that:

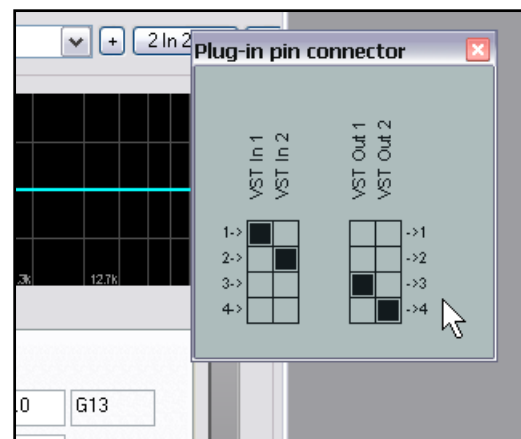
- The number of channels available will be equal to the number of Track Channels that have been defined – in this example, four.
- By default, VST In 1 will be assigned to Channel 1 and VST In 2 will be assigned to Channel 2 (as shown). However, you can change this as you wish.
- By default, VST Out 1 will be also be assigned to Channel 1 and VST Out 2 will be assigned to Channel 2 (as shown). However, you can change this as you wish.



So, to return to the example in question.

The default input and output settings are just right for the first of our **ReaEQ** instances – Channels 1 and 2 in, Channels 1 and 2 out. However, in the second instance we still will need to bring in the signal through Channels 1 and 2, but we want to send it out through Channels 3 and 4 – and *only* Channels 3 and 4.

We therefore require (in this example) a second instance of ReaEQ. For this second instance, you would change the settings on the **Plug-in pin connector** interface as shown here on the right. VST Out 1 has been set to Channel 3 and VST Out 2 has been set to Channel 4.



Especially if you have come to REAPER from another DAW, both this concept and its implementation may seem strange or even bewildering at first. This is because most probably the whole channel splitting concept simply did not exist with your previous DAW software (at least, not for audio). Be prepared to persevere. In time you will get used to it, and you will be surprised at how easy it becomes.

3.6.2 Bookend Panning

Bookend panning is not an easy concept to explain, but its application can be very effective.

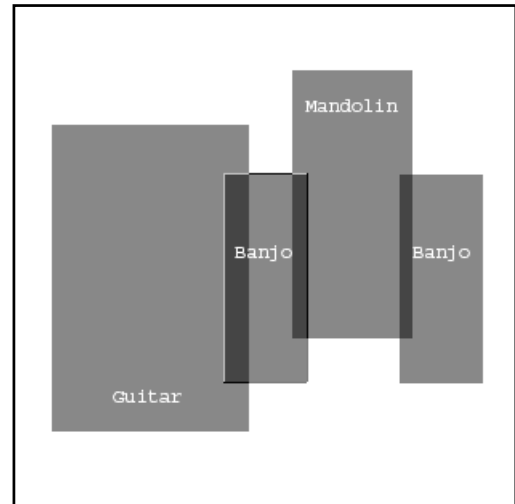
It is especially useful when you want to create a spatial relationship between two instruments, but there arises a problem of one always tending to drown the other one out. This might be the case with our banjo and our mandolin. We may need for various reasons to place these two instruments close together in the panning spectrum. A problem may arise, however, because of these two instruments the mandolin is by far the more present. By this we mean that it resonates at those frequencies up above 1,000 Hz or so, where the banjo just does not go.

Often this issue can be resolved in REAPER by the careful use of bookend panning. Put quite simply, we position our instruments in such a way that the weaker instrument is able to wrap itself around (or bookend) the stronger instrument, thus preventing it from breaking out.

The illustration on the right demonstrates this concept. In this case, we have decided to pan our guitar to the left, our banjo more or less towards the centre, and our mandolin to the right. This might be the case, for example, if the banjo was the main rhythm instrument for this particular tune.

Notice how by the use of bookend panning we have been able to contain the otherwise over-dominant strains of the mandolin.

Now that you understand the theory, let's see just how it is done.

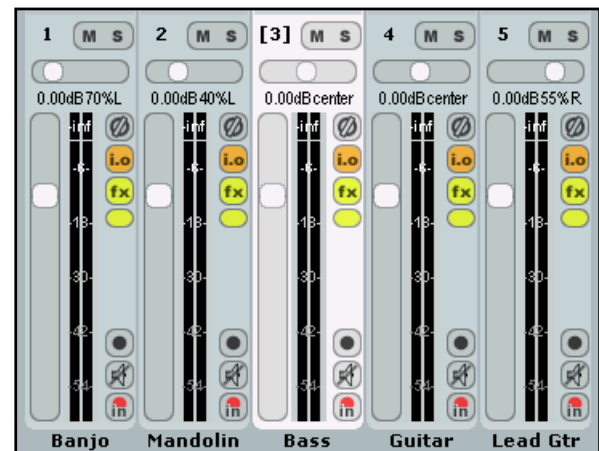


Exercise

In this next example, we will use an instrumental recording which includes a banjo, a mandolin, a bass guitar, a rhythm acoustic guitar and a lead acoustic guitar. We will be “bookending” the acoustic rhythm guitar around the lead guitar.

If you wish, open the **Options, Preferences** dialog box and click on the **Advanced UI/System Tweaks** button. If you then enable the option to **Allow track/routing windows to stay open**, you will be able to keep the routing windows open as you work through this exercise. This might make it easier to understand.

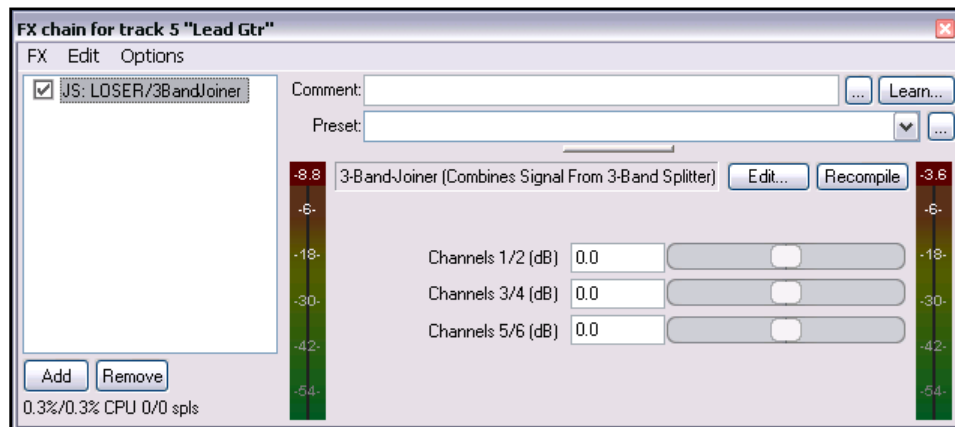
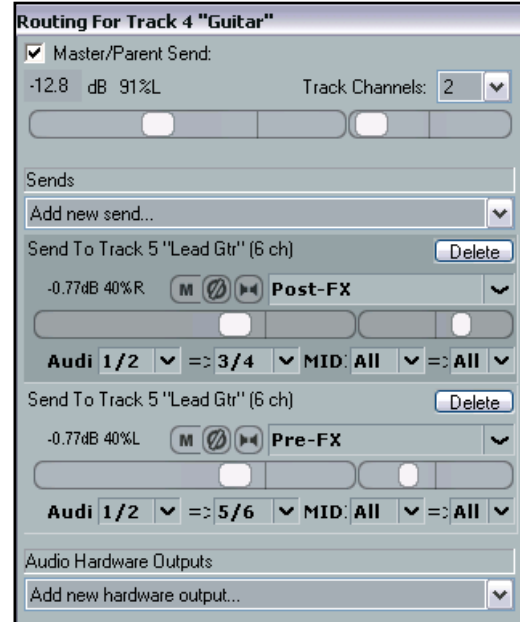
1. Open the file **Pelverata Frost BOOKEND** and immediately save it as **PELVERATA FROST BOOKEND1**
2. Pan the Banjo 70% left, the Mandolin 40% Left and the Lead Gtr 55% Right. You can change these settings later if you wish. Click and drag the tracks to change their order, so that left to right the tracks line up as shown (right).
3. Solo the Guitar Track (now Track 4) and play the tune. Insert an instance of **ReaEQ** into this track. You should find that by taking off about 4 dB at 120 Hz and adding about the same at around 7,000 Hz you should make the sound a little brighter.



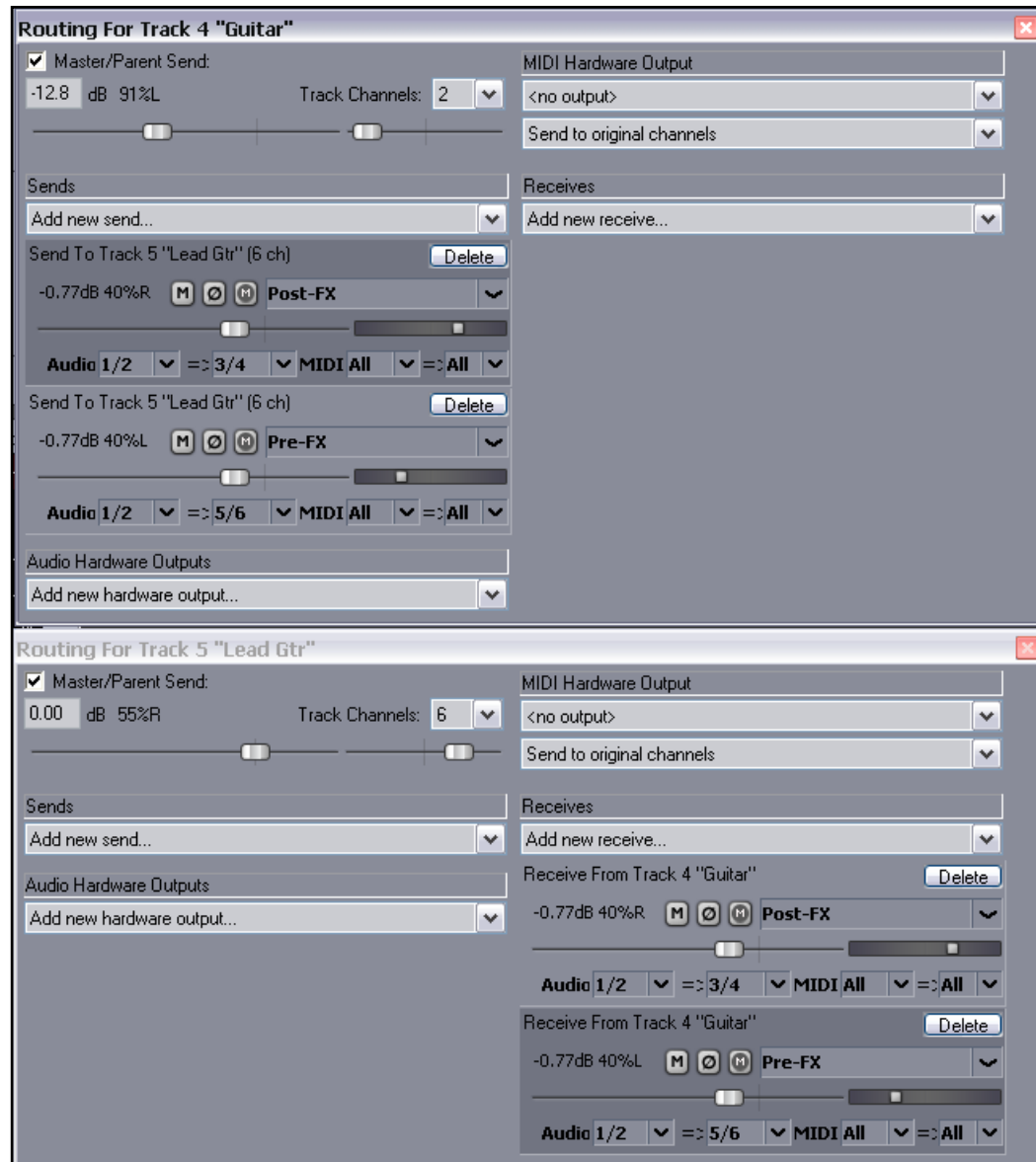
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4. The next few steps can appear strange if you have never done this before. Fade down the volume on this track to about -12 dB and Pan about 95% Left. We are going to hear most of this track's output not directly but as bookends wrapped around the Gtr Lead track.
5. Select **Track 5** (Gtr Lead) and open the I/O (**Routing**) window for that track. Set the number of Channels to 6.
6. Now display **I/O (Routing)** window for the Guitar track (**Track 4**).
7. Add the two sends shown on the right. Notice that:
 - Both outputs go to Track 5.
 - One is sent to Channels 3/4, panned 40% Right, set at about -0.8 dB and is Post FX. This signal will be modified by the EQ inserted into the FX Window of Track 4.
 - The other is sent to Channels 5/6, panned 40% Left, also set at about -0.8 dB and is Pre FX. This signal will not be modified by the EQ inserted into the FX bin for Track 4.
 - These left and right pannings will be relative to the panning of the destination track, Track 5. In other words, they will "bookend" Track 5, one to its left, the other to its right.
8. Now open the FX window for the Gtr Lead, Track 5.
9. Into this FX Window insert an instance of **JS: Loser/3BandJoiner**. The instance shown here has been modified to read Channels 1/2, etc but does exactly the same job as the original plug-in.
10. Solo the track and play. Adjust the levels of the three volume faders to suit.
11. Unsolo the track. Play the song. You should notice that the rhythm guitar sound is full and bright, yet allowing the other instruments to cut through very clearly.
12. If you wish to hear the rhythm guitar track by itself, hold down the **Alt** key while you **Solo** this track.
13. Save this file.



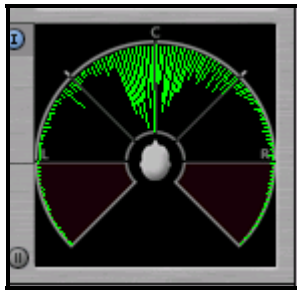
Track Routing Used for Bookend Panning



The illustration above shows the I/O Routing windows for the two tracks used in this bookend panning example. In particular, notice that:

- Every time you create a Send, REAPER will automatically also create a Receive on the destination track. In this example, the Sends on the first track (Track 4) correspond exactly to the Receives on the second track (Track 5). If you wish to make any changes (e.g. to panning), you can do so on either the Send or on the Receive.
- One send is panned to the right, the other to the left. This ensures that the signal received from Track 4 will "bookend" the existing material on Track 5.
- Each send is sent to a different pair of audio track channels. This means that the volume of each receive that is finally used in the track mix can also be controlled using the 3 Band Joiner.

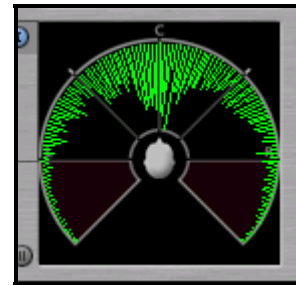
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The two images show the stereo image of this tune without (left) and with (right) bookending.

Notice how the second illustration makes greater use of the available space.

You can test this for yourself using the **JS:LOSER/gfxGoniometer** plug-in, which produces a similar but not identical display to that shown here.



The file **Pelverata Frost BOOKEND1 A** shows a possible suggested solution to this exercise. Please note that this is an example designed to illustrate the concept and implementation of bookending. It is not intended to serve as an example of a complete mix.

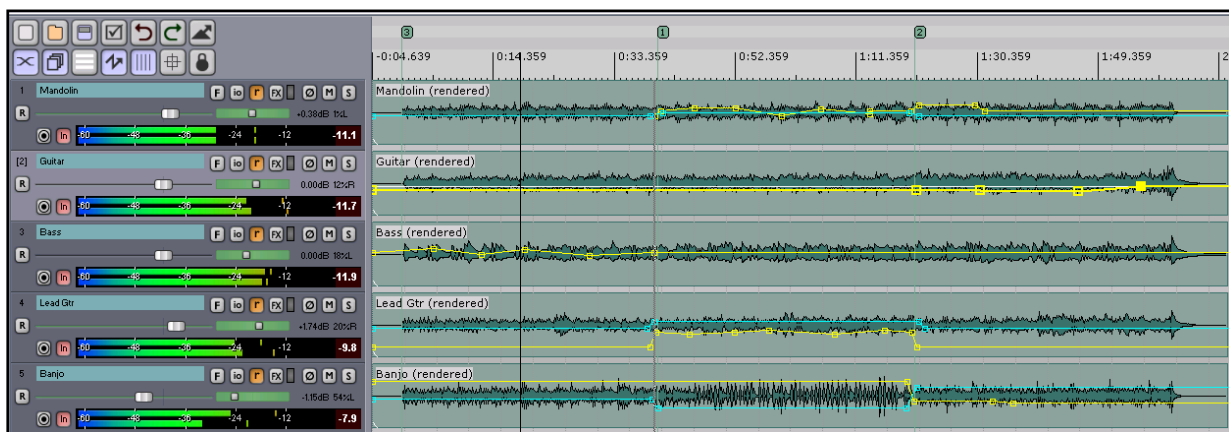
3.6.3 Dynamic Panning

The term dynamic panning simply refers to the practice of varying the panning of your instruments through time. Have you ever seen a live performance where every single member of the band remains motionless throughout the entire gig? No? Then why mix as if they do. Rather than keeping each instrument locked into one place for the entire mix, be prepared to use envelopes to make changes to your panning at different parts of the song. This can occur, for example:

- During a lead break. It's a very common practice to move an instrument into the centre for a lead break, then move it back out again when the break has finished.
- Subtle movements. This is a less commonly used technique. Its effect can be barely noticeable, yet almost at a subliminal or subconscious level the subtle use of changes in panning can help to maintain the listener's interest throughout a mix.

Example

Open the file **Pelverata Frost PAN2 A**



Unfortunately it may not be too obvious from the illustration above, but if you observe this file and listen to it carefully, you will see that:

- The tune is played three times.
- The Mandolin very much carries the tune during the first time round.
- Second time round the Lead Guitar comes into the picture more.
- Third time round the Banjo is featured more prominently.

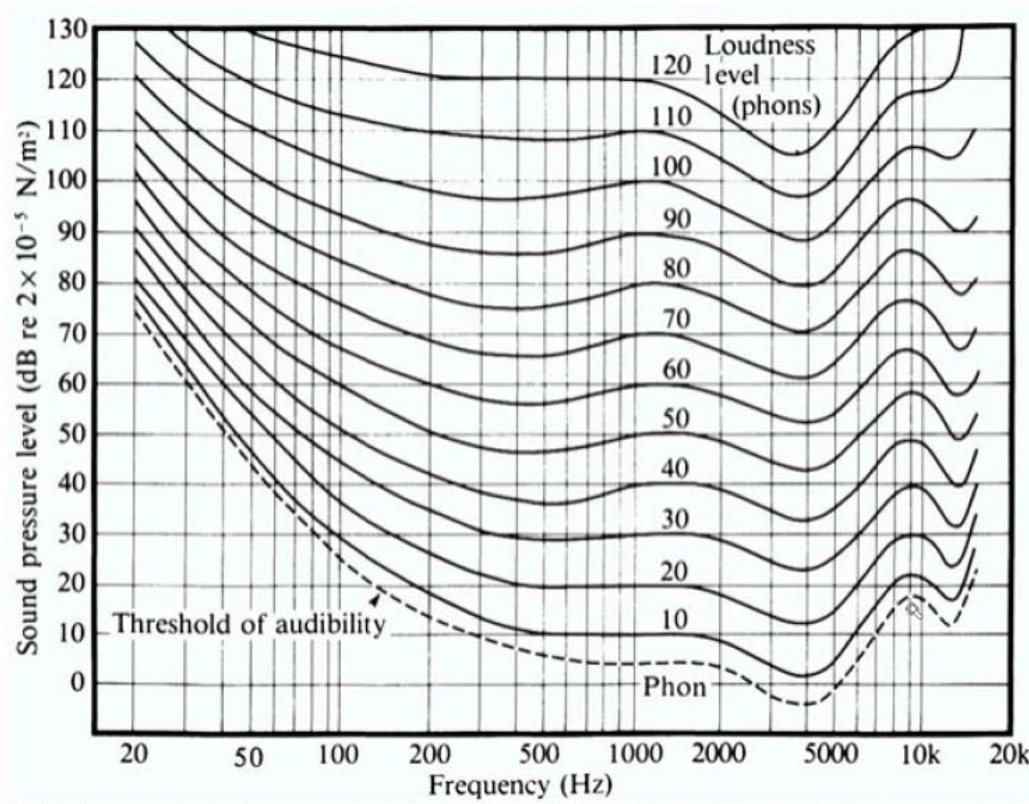
Demo version only – full version available from <http://www.lulu.com/content/2539885>

You'll be surprised at how often your intuition will serve you well when you're experimenting with and exploring EQ options. You've spent most of your life listening to music and other sounds. You know what you enjoy and what you don't. You know how you react emotionally and in other ways to various sounds. It's your life experience.

Don't be afraid to trust that experience and put it to good use in your mixing!

3.7.1 The Fletcher Munson Curve

We've already said that our ears are more sensitive to changes in volume at some frequencies than others. These differences are illustrated in the following diagram, the Fletcher Munson curve.



This diagram quite clearly illustrates the actual levels required at different frequencies for the perceived volume to appear equal. You can see from the dip around the 1000 Hz to 5000 Hz area that these are the frequencies that we hear the loudest. Similarly, our ability to hear sounds drops off quite rapidly at frequencies below about 200 Hz and above about 7000 Hz.

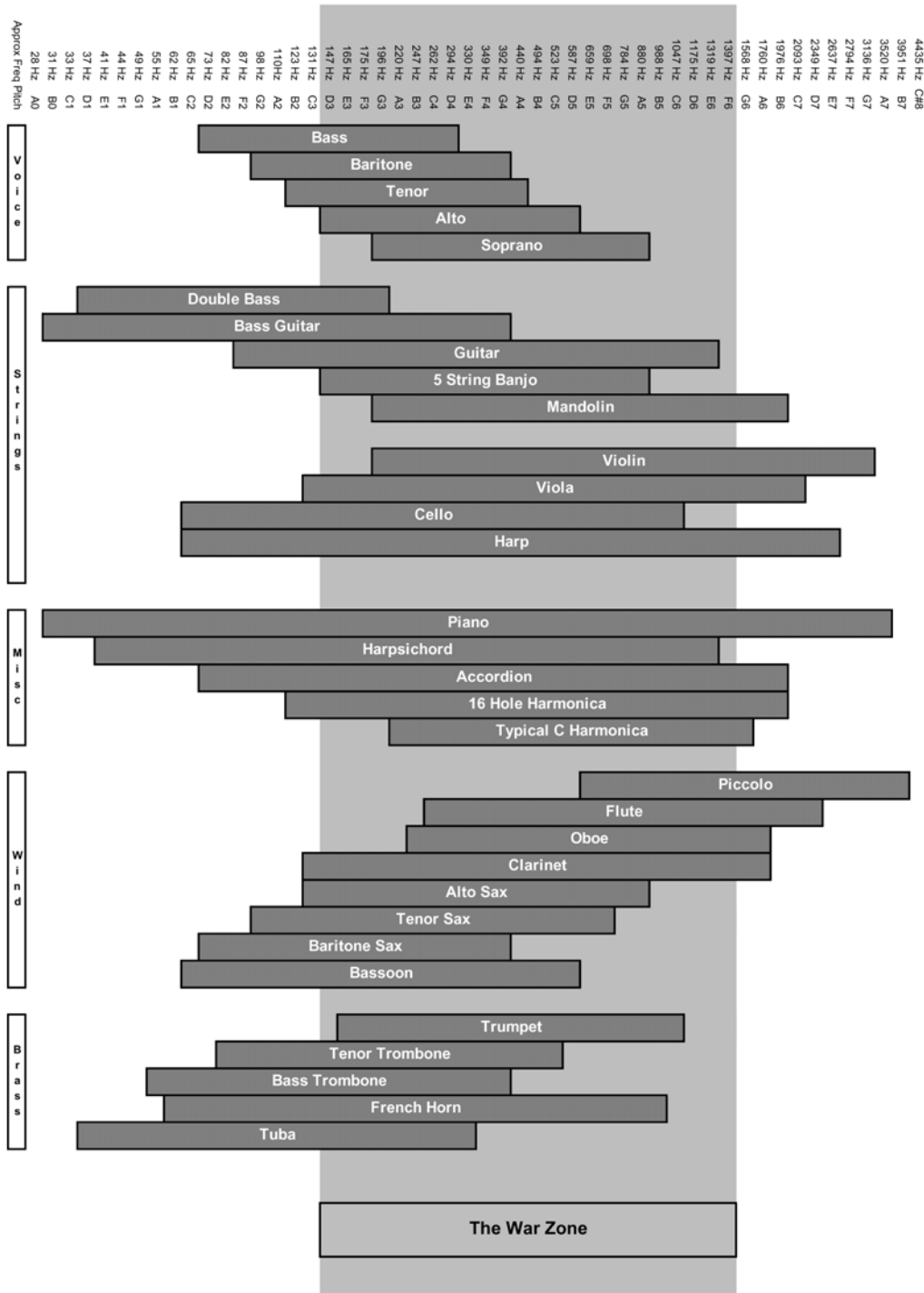
There are several interesting points that we can take from this:

- The relationships between the levels at which different frequencies are perceived are not constant. Notice in particular that as the overall volume is raised, the lower frequencies become more prominent. You can see this, for example, by comparing the shape of, say, the 100 phon curve with the shape of, say, the 40 phon curve.
- Of course you will want to use VU meters when monitoring your sound levels, but where there is a conflict you should generally trust your ears rather than your eyes. Depending on the mix of frequencies which make up one song compared to another, both may appear to be at the same volume, but to the listener one will appear louder than the other. You will ultimately want both to appear to be at approximately the same volume.
- When you are making adjustments to the EQ of a track, you will find that at different frequencies you will need to make greater or smaller adjustments to achieve your desired results. For example, if a track seems boomy, you may need to lower the bottom end by what appears to be quite a substantial amount around the 100 Hz or 180 Hz range to fix the problem. On the other hand, if a track seems to be too present, just the tiniest cut around the 3000 Hz to 5000 Hz area might be enough to fix it.

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3.7.2 The War Zone

The chart below shows the approximately frequency ranges of many popular instruments (excluding drum kits) as well as the human voice. Drums and percussion will be considered a little later.



For guidance only: this chart shows only fundamentals, not harmonics. Notice the lightly shaded area that we have described as *The War Zone*.

Demo version only – full version available from <http://www.lulu.com/content/2539885>

If managing the first dimension of your mix (width) is largely about crowd control, then managing the second (height) is as much as anything about developing a battlefield strategy. Take a careful look at the chart on the previous page. Notice how so many instruments are always competing with each other for the same piece of acoustic space. That, incidentally, is before we even begin to talk about harmonics.

This can happen at any frequency. For example, the viola and the clarinet occupy almost an identical range of acoustic space just about all the way from their lowest notes to their highest. However, the area to which you may need to give this issue the most constant attention is likely to be that area labelled *The War Zone*, between about 140 Hz and 1,500 Hz. Just about every instrument you are ever likely to need to mix will want to lay claim to some space within this zone.

Try an experiment. Put on a CD which contains a full range of instruments and sounds. Well produced classical music is ideal for this.

Now sit down and listen. Listen carefully for the different frequencies, starting with the highs and the lows then, after you have identified them, gradually converging towards the mids. Close your eyes and pay especial attention to where music seems to be coming from.

Do the lower notes seem to be coming up at you from below somewhere, while the higher sounds are drifting down from a plane higher up? Congratulations, you have just discovered the importance of the dimension of height to a good mix.

3.7.3 Understanding Harmonics

We've already seen how different frequencies affect us in different ways. Let's now take that concept several steps further. When you are listening to music, you never just hear one frequency on its own. You hear a complex pattern (or patterns) of many different frequencies in different combinations. If individual frequencies are capable of affecting us in various ways, how much greater is likely to be the effect of different combinations of frequencies?

The sound of any musical instrument is made up of not just a single clean note at a time, but of a whole series of notes that are buried within that sound. These are the harmonics, the elements that shape the sound. As much as anything else, it is the way one musical instrument produces its harmonics that gives the sound its timbre and distinguishes the sound of that particular instrument from any other.

Harmonic	Frequency	Pitch
10 th	4400 Hz	C#
9 th	3960 Hz	B
8 th	3520 Hz	A (3 rd Octave)
7 th	3080 Hz	G ¼ Flat
6 th	2640 Hz	E
5 th	2200 Hz	C#
4 th	1760 Hz	A (2 nd Octave)
3 rd	1230 Hz	E
2 nd	880 Hz	A
Root (Fundamental)	440 Hz	A

The table (left) shows the harmonics for the simple note A when played on an acoustic guitar.

Notice that when you use EQ to raise or lower the volume of any particular frequency, you are actually raising or lowering the volume of a particular harmonic.

This point matters because certain combinations of odd numbered harmonics will tend to produce a more edgy sound, whereas the even harmonics will create a more soothing sound.

There's just one more point to note about harmonics. Notice that every harmonic is arithmetically an exact multiple of the root.

3.7.8 Conflict Resolution

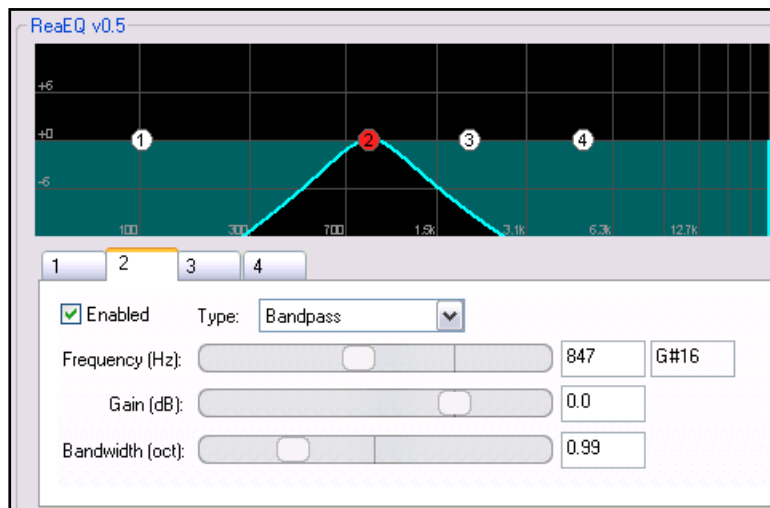
Let's now return to the example **Pelverata Frost** that we panned earlier and see how by applying EQ we can resolve the conflict between the different instruments which are fighting for the same acoustic space. In doing so, we also add an extra dimension to our mix, a dimension that will make the recording immediately appear more vibrant and alive. This is the dimension of height.

We are going to sweep each track one by one to identify which frequencies appear to be the most interesting. Then by boosting those frequencies a little (and sometimes reducing the same frequency on those tracks panned close by) make that instrument more distinctive in our mix.

1. Open the file **Pelverata Frost PAN1** and immediately save it as **Pelverata Frost EQ1**
2. Solo the **Mandolin** track and play it.

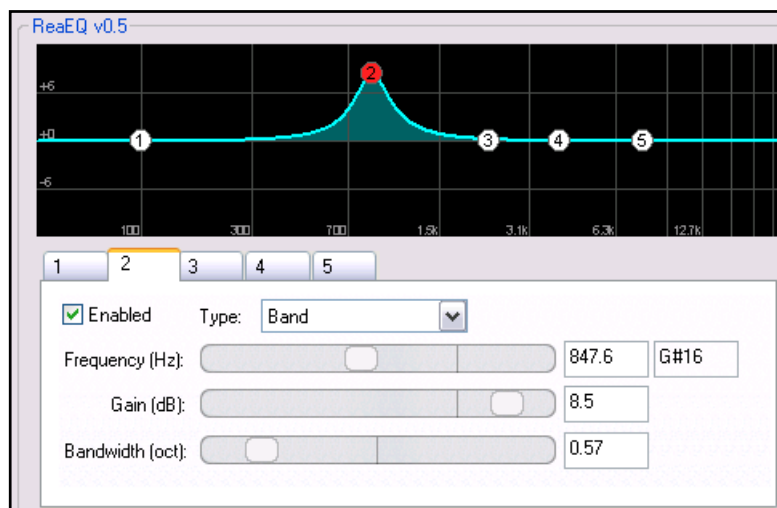
3. Open the FX Window for this track. Make sure that the **ReaEQ** plug-in is enabled.

4. Select Band 2 and change the band type to **Bandpass** with a bandwidth of about 1 octave.



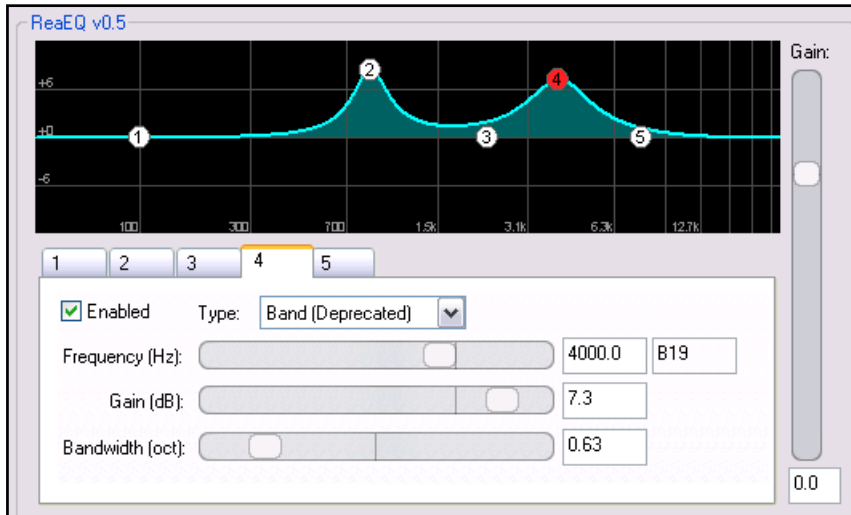
5. As the tune plays, slowly move the frequency slider from left to right. You should find that round about the 850 Hz mark the sound has a pleasing distinct brightness and clarity. This, then, is a key frequency for this instrument. (see right).

6. Change the band type to **Band** and create an EQ curve similar to that shown (below right). If you wish, add a similar gain around 4,000 Hz. You should now repeat this procedure for each of the remaining four instruments, but not at the same frequencies of course. In each case, sweep to find the optimum frequencies. If you are using the same panning as in our example, start with the Lead Guitar. Because this instrument is closest to the Mandolin, as well as adding some gain to its own key frequencies, you might also like to make reduction around the 847 Hz mark.

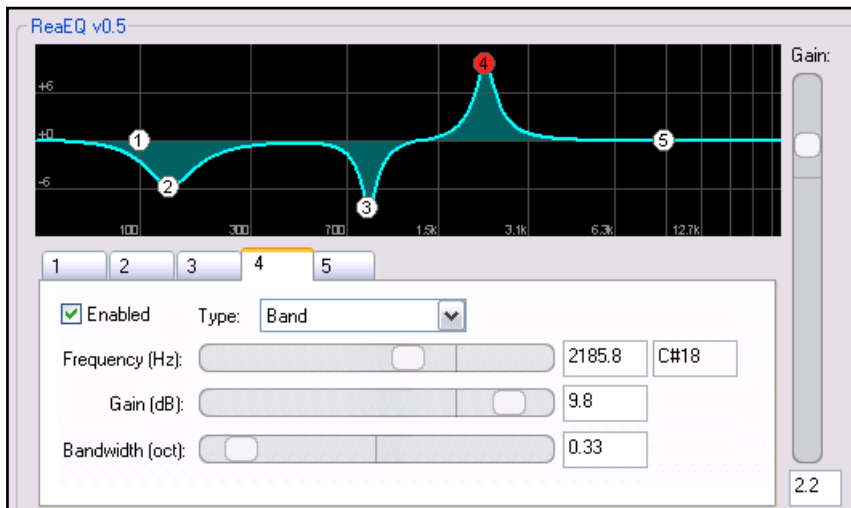


7. As you play the tune, you can switch global FX Bypass on and off to evaluate the effect of your changes. Either hold down the **Control** key and click on any individual track FX Bypass button, or better still, assign a keyboard shortcut to this function. Make it a key that doesn't wear out easily.

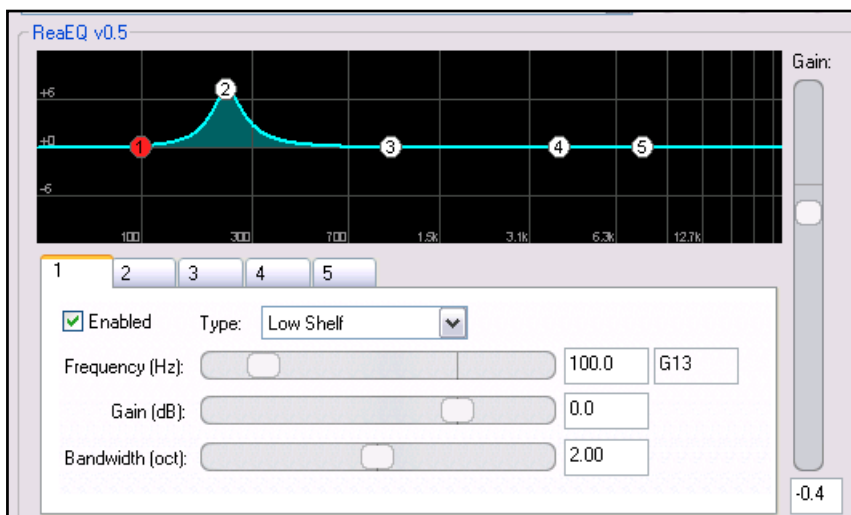
A possible *suggested* solution to this exercise is shown over the page. Don't worry if yours is different. In fact, our suggestions are, if anything, somewhat conservative. What matters is that your mix should sound right!



Track 1
The Mandolin

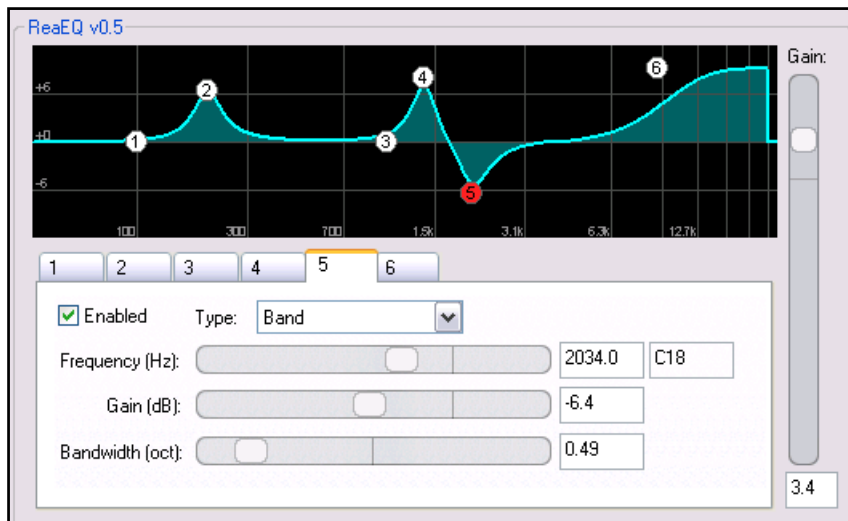


Track 2
Guitar

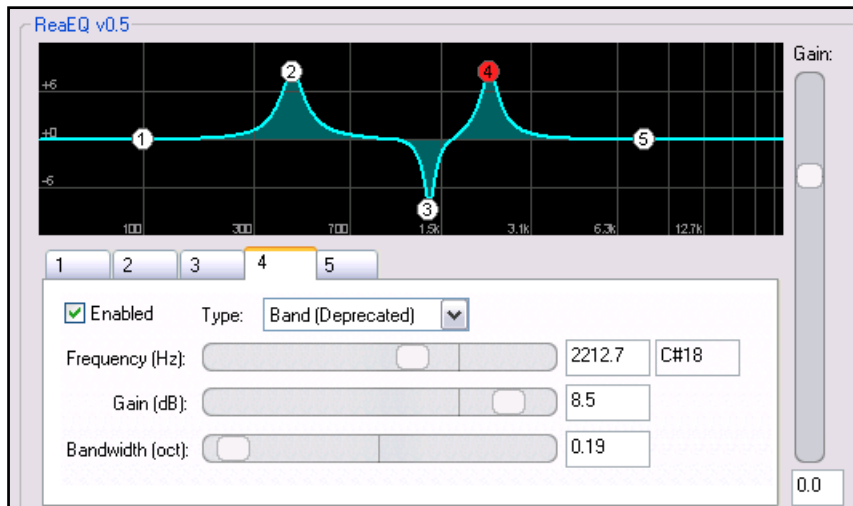


Track 3
Bass

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Track 4
Lead Guitar



Track 5
Banjo

Summary

The above settings have been used in the project file **Pelverata Frost EQ1 A**

Remember that this project is still “work in progress” – it does not represent a final mix.

This primer spends a fair amount of time discussing EQ because it is such a powerful, useful and versatile tool. The purpose of these last few sections has been to help you to understand a theory, and then see how to put that theory into practice.

Whatever you do, don't try to memorise the above settings. It is much more important that you understand the technique and the theory, so that you can apply them to your own mixes in the future.

Familiarise yourself with the technique of listening to a track scanning with bandpass EQ and then flipping to band EQ when you have identified the frequency to be cut or boosted. This is a very useful technique which we will use throughout this primer and which will serve you well in your own experiments with EQ-ing.

3.7.12 Key Frequencies for Some Popular Instruments

The following list indicates the frequencies where you should start looking in order to shape the sound of various popular instruments. Be aware that it is only a guide, and use it as such. Remember that no two instruments are exactly alike. That which works a treat on one acoustic guitar, for example, might not have the same effect on another. Notice that for those instruments where it is especially appropriate, the formants are shown in this chart. The formants are those frequencies at which the instrument is most distinctive. Formants can often be considered as being the frequencies which contribute most to giving the instrument its distinctive sound.

Instrument	Comments
Accordion	Fatness on the left side at 80 Hz to 240 Hz. Brightness (both sides) at 2,500 Hz to 4,000 Hz. Shrill on the right side above 5,000 Hz.
Acoustic Guitar	Fullness and body around 100 to 200 Hz. May be dull around 1,000 to 3,000 Hz. Presence and clarity around 4,000 to 6,000 Hz. Sparkle above 10,000 Hz.
Bass Guitar	Feeling around 40 to 60 Hz. Presence around 1,200 Hz to 2,400 Hz. High harmonics around 5,000 Hz.
Dobro	Fullness around 300 Hz to 500 Hz. Bite around 1,500 Hz to 2,000 Hz. Bright around 2,500 Hz to 5,000 Hz.
Electric Guitar	Fullness around 200 Hz to 300 Hz. Bite around 2,000 Hz to 3,000 Hz. Presence around 5,000 Hz to 7,000 Hz. Sparkle above 8,000 Hz.
Harmonica	Fat around 240 Hz. Highs around 2,500 Hz. Bright harmonics around 5,000 Hz.
Mandolin	Fullness around 200 Hz to 300 Hz. Clarity around 2,500 Hz to 5,000 Hz Sizzle around 10,000 Hz.
Piano	Resonance around 50 Hz. Bass around 80 Hz to 100 Hz. Bite around 3,000 Hz to 5,000 Hz. Presence and Harmonics 5,000 Hz to 15,000 Hz.
Trumpet	Fundamentals around 165 Hz to 1,200 Hz. Formants at 1,000 Hz to 1,500 Hz and 2,000 Hz to 3,000 Hz.
Violin	Fullness at around 240 Hz. Formants at 300 Hz, 1,000 Hz and 1,200 Hz. Scratchy at 7,000 Hz to 10,000 Hz. Overtones above 16,000 Hz.
Woodwinds	Full at 200 Hz to 300 Hz. Crisp around 2,500 Hz. Clarity around 4,000 Hz to 6,000 Hz.

3.8 Depth

The dimension of depth is used to create the illusion in the listener's ears that some instruments are closer or further away in the mix. You might at first think that this dimension at least would be an easy one to fix. After all, the closer a sound is, the louder it sounds, right? So surely, it's basically a question of just turning the volume up or down on different instruments, yes?

Well, no, actually. Before you can begin to understand how to manipulate the dimension of depth, you need to understand two important facts.

1. *Different frequencies decay through space at different rates.* This means that as you move closer to or further from a sound, the relative levels of different frequencies will change. As a rule, higher frequencies decay at a faster rate than lower frequencies. That is why when a distant sound first approaches you, depending on the physical environment, you may find that hear only the bass frequencies at first, or in other circumstances the higher frequencies first, with the total picture filling out as the sound gets closer and closer.
2. *The clarity of sound deteriorates with distance.* Put another way, the more distant a sound, the more it appears muffled. This happens not by any absolute factor, but according to the environment in which the sound is being produced and heard.

From this we can draw a number of inferences, but in particular this:

Making an instrument seem closer to us or further away in a mix is an illusion that can seldom be created satisfactorily by adjusting the volume of that instrument alone.

Let's then take a look at the tools that we do have at our disposal.

3.8.1 Compression

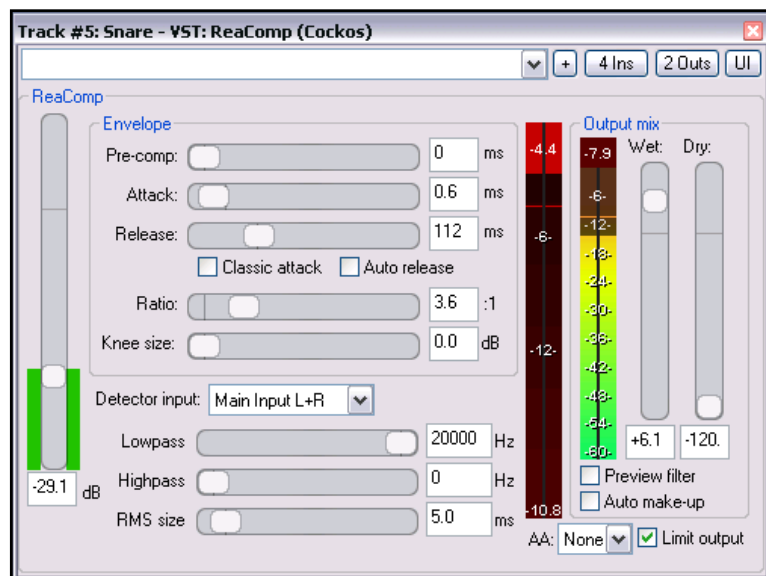
The Compressor is really a multifunctional tool. It can be used to change the perceived distance of an instrument in the mix, making it appear closer forward or further back. Unlike, say EQ or Delay, the effect that compression has on a signal is often quite subtle. This makes it a more difficult tool to understand and to master. REAPER supplies you with two compressors – **ReaComp** (a straightforward compressor) and

ReaXComp (a multiband compressor). We'll return to ReaXComp later in this primer. For the moment, let's focus on the simpler of the two plug-ins, ReaComp. We'll start by getting a handle on its main controls.

The Threshold is the level at which the compressor will kick in. Strangely enough, this isn't actually labelled in the GUI. It's the vertical fader on the left. If, for example, you set the threshold to, say, -10dB, then as long as the volume of the track stays below -10dB, the compressor will do absolutely nothing to the signal (except apply any Gain that you might add to the Output Mix).

The Ratio determines the degree of compression that is applied. For example, a ratio of 4 to 1 means that if the signal coming in to the compressor is 4 dB above the threshold level then the signal going out will be 1 dB above the threshold level. The available range is from 1:1 all the way up to Infinity:1.

More explanation follows with step by step exercises and examples.



3.8.7 Understanding and Using Reverb

REAPER supplies you with at least two Reverb plug-ins – **ReaVerbate** and **ReaVerb**. ReaVerbate is simple but surprisingly powerful. ReaVerb is even more powerful but quite complex in its setup. You'd be well advised to get a good grip on the basic theory and application of reverb before attempting anything too ambitious with ReaVerb. For this reason, in this section we will be using another excellent freeware reverb program, **Kjaerhus Audio Classic Reverb** in the various examples.



Demo version only – full version available from <http://www.lulu.com/content/2539885>

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This plug-in can be downloaded from <http://www.kjaerhusaudio.com/classic-reverb.php>

The challenge of using reverb is to try to recreate digitally and artificially the sound produced in a wide variety of environments, ranging for example from a small nightclub to a church or concert hall to a cavern or a cellar. Before putting reverb into practice, therefore, it's worth spending a little time getting to grips with what are the main parameters that we use in order to fool the listeners' ears into believing that they are experiencing a certain kind of environment.

Different reverb plug-ins vary slightly from each other. Some use different terms to describe what is essentially the same parameter. Some include extra features, for example a number of "colour" controls which essentially apply EQ to the reverb feature. The key parameters, however, are as follows:

Reverb Parameters	
Parameter	Explanation
Pre Delay	<p>Imagine that you are sitting in a room listening to a musician who is playing a violin. As she starts to play, the sound of her music travels out in all directions. If you had been alone in a vast open field, all of the music that you would hear would have travelled directly from the violin to your ears.</p> <p>In an enclosed environment, however, what you will hear will be an incredibly complex pattern of sound. Some will reach your ears directly from the instrument. These will be immediately followed by those sound waves that have bounced off a surface (such as a wall). The very short time that passes between these two events taking place is known as the Pre Delay. Increasing this variable creates the illusion of a larger space.</p>
Early Reflections	<p>Early reflections are those sounds that reach our ears directly and distinctly after bouncing off a surface such as a wall or a ceiling, or a piece of furniture.</p> <p>It is worth understanding that these sound waves do not come to an abrupt halt after bouncing off one surface. They instead travel further to bounce off another surface, then another, and another. Gradually, as they fade through time, these reflections become less distinct and merge into each other.</p>
Room Size Decay Time	<p>Some reverb FX use a combination of two parameters – Room Size and Decay Time – to achieve this next effect, others use just one or the other. The principle is the same.</p> <p>The time it takes for reflections, early and late, to reach the listener's ears and the rate at which these reflections will decay will depend in part upon the size of the room in which the music is being played and in which the listener is seated.</p>
Damping	<p>As our sound waves bounce around all over the place, their timbre or nature will be affected by the kind of material that they encounter.</p> <p>For example, reverberation off a hard surface like a concrete wall will be clearer and more distinct than will reverberation if curtains are hung in front of the same wall. In the latter case, the higher frequencies will decay more quickly, resulting in a warmer sound.</p>
High and Low frequency filters or attenuation	<p>These settings can be used to restrict the reverb to only the range of frequencies that we specify.</p> <p>We have already encountered this concept when we were looking at Delay.</p>

The Good and Bad News About Presets

It's worth taking a moment to discuss the presets that come with many reverb plug-ins.

The first thing you need to understand is that there is no magic or genius about them. A preset is simply a collection of settings that you might logically expect to belong together. For example, if you have a small room size, you would expect to find along with it a short pre-delay time. So the good news about presets is that for the most part they represent fairly safe and sensible combinations of settings. If you feel that you want to recreate the atmosphere of a basement nightclub or a medium sized concert hall, then it is possible that a suitable preset might be able to help you. You do need, however, to be much more wary of presets with names like *Male Vocal* or *Female Vocal*. Would you really, for example, treat voices as varied as Dean Martin, Sid Vicious, Bryn Terfel and Eminem in exactly the same way?

Another issue with presets is that their strength might also at times be regarded as their weakness. What if you are aiming to add a certain edge to an instrument's sound, or create more tension in a vocal? Quite possibly, one of the methods that you may wish to use to create that edge or tension might be to create a reverb effect that models an environment that simply cannot exist in the real world. If you want to be creative, if you want to really make the best use of reverb, you really do need to be prepared to travel outside the comfort zone of presets.

In short, presets may be often safe ... but they are not the be all and end all, and they are often also boring.

Much more follows, including step by step examples ...

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3.10.2 Spacey Vocals

Everything in your mix is equally important, right? Well maybe, but I'd bet that if you had to choose just one aspect of your mixing which was more equal than all others, it would for most styles of music be the vocals. How many times have you heard a mix in which a thin wimpish vocals trickle out at you from dead centre between the speakers, often too loud because raising the volume has been the main or only technique used to lift them above the rest of the mix.

This sort of activity isn't mixing. It's assault on your ears with criminal intent. It's like inviting your friends for dinner, having a gourmet kitchen at your disposal and then serving up to them a plate of white sliced bread and margarine.

Let's see how by thinking smart we can come up with really interesting vocals. Remember two things that we have learnt so far:

1. It's about crowd control.
2. It's about developing a battlefield strategy.

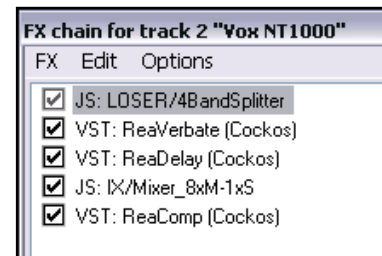
Think about the nature of singing. There are two particular characteristics of the human voice just crying out with the mixing opportunities that they create. Both are blindingly obvious, which might be why they are so often overlooked:

1. The frequency of the vocal will change constantly and continuously throughout the song.
2. The volume of the vocal will change constantly and continuously throughout the song.

It simply doesn't make sense to mix your vocals as if these factors were constants. Yet so many people do. Within your mixing arena you have a huge amount of space available in terms of various permutations of height, depth and width. The very last thing you should be doing is what so many people in fact choose to do – just confining it to a worn out scraggy little path straight down the centre mid-way between your speakers. With this in mind, we can subtly manipulate our vocals so that the voice weaves in and out of much of the space available, creating inside the listener's head a wonderful feeling of presence, fullness and majesty.

The really good news is that REAPER's channel splitting capabilities make this sort of activity so easy to do, and offer you so many options. The example that follows uses female vocals. The same principles, of course, can be applied to male vocals, just with different parameter settings.

The illustration on the right shows the FX chain that we will be using in this example. It is only an *example*, and once you have got to grips with the technique you will be able to create far more interesting instances for yourself.



Some Ideas for Spacey Vocals

There are a number of factors which determine how best you can use the technique described in this section to create spacey vocals. These include the timbre of the voice, the style of singing, the variations in volume, the microphone used and the microphone placement. Keeping this in mind, some of your per channel options include the following.

EQ to emphasise specific qualities of the voice.

Compression with different settings to make different frequency bands more or less present.

Reverb and/or **Delay** to add depth to the voice.

Also be prepared to experiment for the best effect with the frequencies at which you split your bands.

Detailed example with step by step exercises follow ...

Demo version only – full version available from <http://www.lulu.com/content/2539885>

The principle at play here is this. We will first split the vocal tracks into four pairs of channels, in this case by frequency range – low, medium, high, ultra high. Each range will be panned differently, with different subtle FX applied to (in this case) two of the four ranges. The four channel pairs will then be joined up and gently compressed.

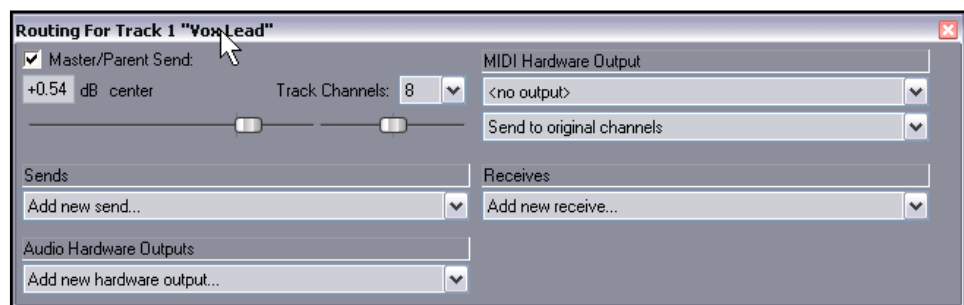
This will not only create a richer, fuller and more interesting vocal. It will also mean that as the song is played, various of these effects will be discernible from time to time (depending on other factors such as the levels of different instruments), ensuring that subtle changes to the vocal will occur as we move through that fourth dimension, time.

OK, let's do it. For this example, you can use the supplied project **RosesBloom.rpp** for learning purposes. Of far greater importance, however, is that you should learn to apply these techniques to your own mixes.

Example

1. Open the file **RosesBloom** and immediately save it as **RosesBloom SPACEY**.

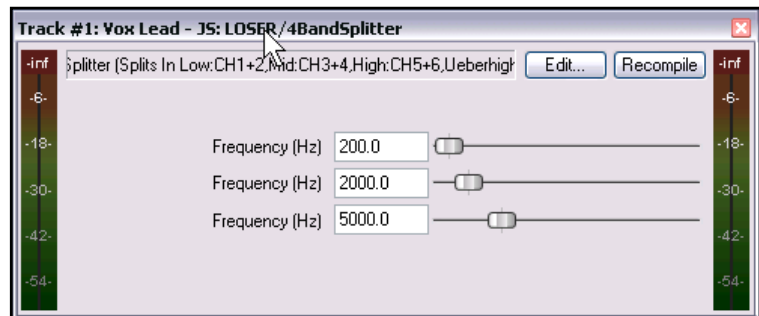
2. Select your vocal track, display its Routing Window and set the number of channels to 8 (as shown). Make sure the track is panned dead centre.



3. Open the FX Window for this track and insert the **JS: LOSER/4BandSplitter**. If you have any corrective mixing plug-ins in this track, place the 4BandSplitter immediately after them. Otherwise, the 4BandSplitter should be the first plug-in in the chain.

There are no hard and fast rules for choosing the frequencies at which you should split the signal. The example shown creates the following four bands:

Ch 1/2: Below 200 Hz
 Ch 3/4: 200 to 2000 Hz
 Ch 5/6: 2000 to 5000 Hz
 Ch 7/8: Above 5000 Hz



4. What we are going to do next is simplicity itself, yet if you have never tried it before it will probably astound you. We are merely going to join our split channels up again and experiment with panning.

Add to your FX Chain the **JS: IX/Mixer_8xM-1xS**. Experiment with the panning as shown below. *Already your vocal track should sound brighter, fuller and warmer.* That's before adding any FX even! All we have done is given our vocal a little freedom to move at will within a band between the limits of the width and height of our mix.

If you wish, experiment also with subtle changes in the levels of volume for the different channels. By doing so you are effectively applying some EQ to your track.

For this particular example, however, after you have finished experimenting, restore the levels for all eight channels to 0.0.

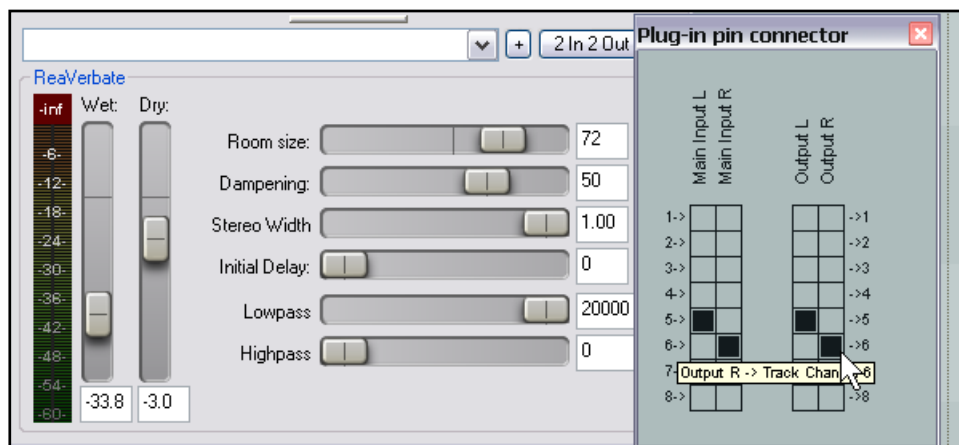
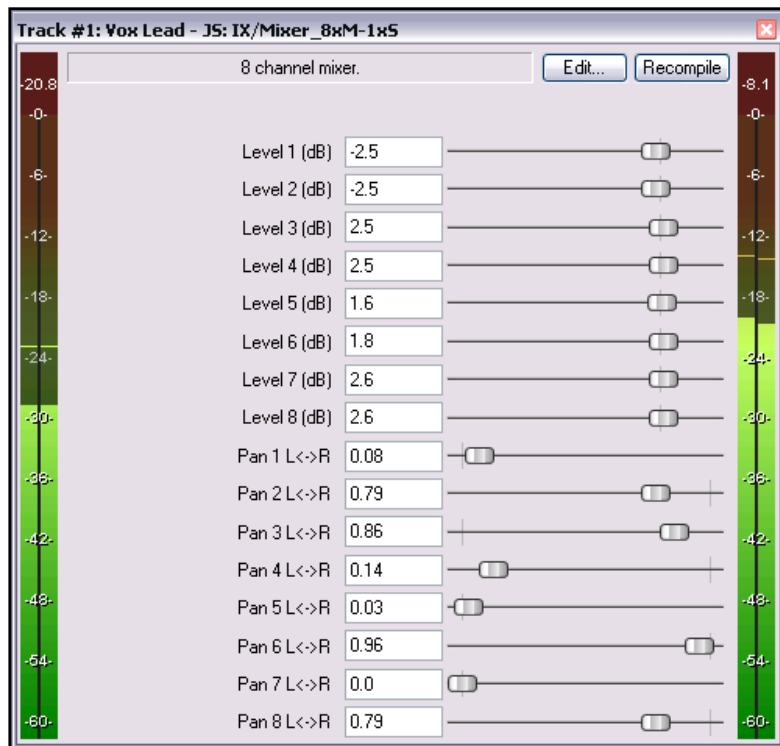
Demo version only – full version available from <http://www.lulu.com/content/2539885>

ReaMix: Breaking the Barriers with REAPER

Of course the best places to leave your pan settings will depend largely upon what else is in your mix. Remember also that you can apply automation envelopes to make dynamic changes to the panning of your different frequency bands as the song progresses.

- Channels 3/4 and 5/6 cover the range of frequencies that our ears hear the best. By applying some subtle effects at these targeted frequencies we should be able to produce something quite interesting.

- Add **ReaVerbate** to your FX Chain and position it immediately after the splitter plug-in. We have chosen this particular reverb plug-in because it is about as simple and unassuming a reverb FX as you will ever find. One point we will be demonstrating here is that *you don't need a \$1,000 reverb plug-in to make good sounds*. What matters most is how you use what you've got!



- In order to apply the reverb to the frequency range 2000 Hz to 5000 Hz only, set Main Input L to channel 5 only (as shown), Main Input R to channel 6 only, Main Output L to channel 5 only and Main Output R to Channel 6 only.
- Experiment with reverb settings to suit. If you're not sure, start with the settings shown.

Room Size is quite large, to create a feeling of depth.

Dampening affects especially the rate at which higher reverb frequencies decay. This can help to make the sound smoother.

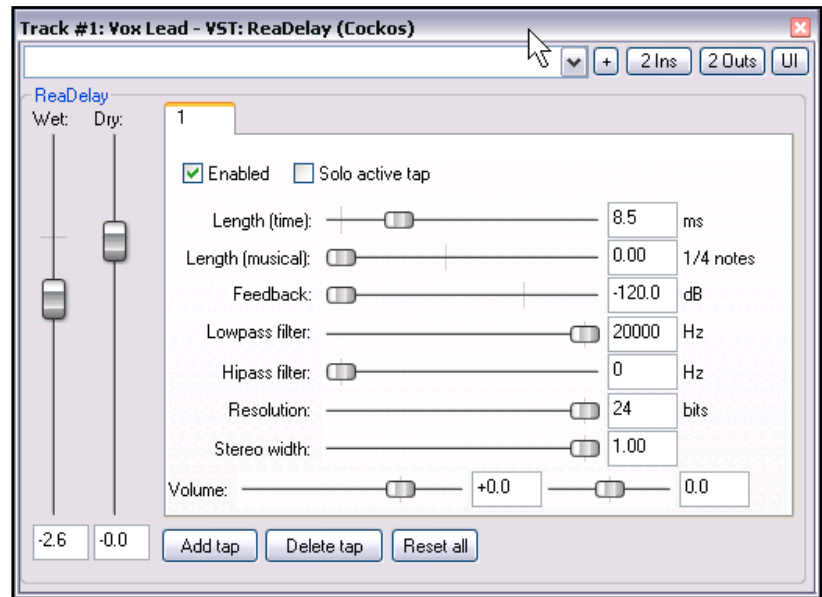
Stereo Width. A high setting maximises the use of width.

Initial Delay. A higher setting here can give the reverb more of an echo effect.

Demo version only – full version available from <http://www.lulu.com/content/2539885>

Wet/Dry Mix. Experiment with these to suit. Insufficient Dry signal will create an exaggerated sense of delay.

9. We are now going to add a touch of Delay to Channels 3 and 4. Put at its simplest, the main difference between Reverb and Delay is that Reverb creates a continuous decaying illusion, whereas Delay creates a discrete separate instance of the original sound.



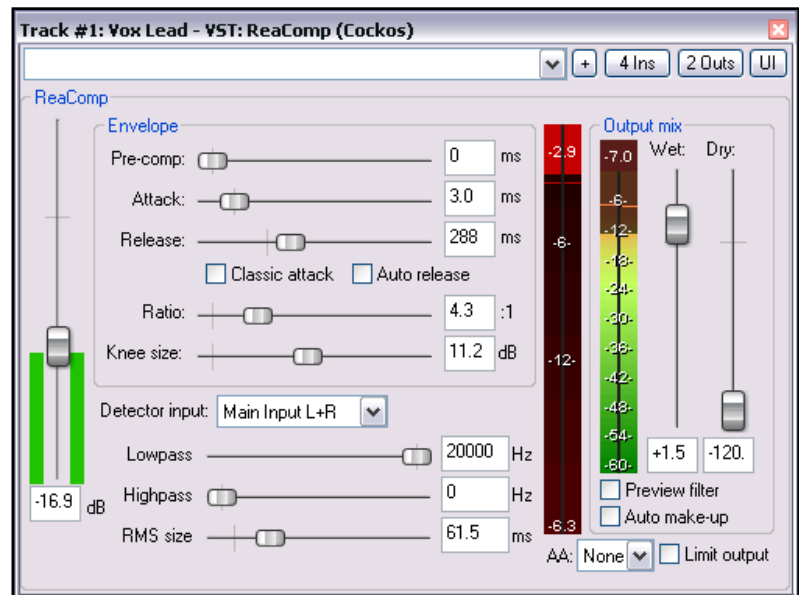
10. Insert **ReaDelay** into your FX Chain, immediately above the **ReaVerbate** plug-in. Set Main Input L to channel 3 only, Main Input R to channel 4 only, Main Output L to channel 3 only and Main Output R to Channel 4 only.

11. Especially with delay, it is advisable to use a fairly conservative setting. Specifying a time of less than about 9 milliseconds will normally ensure that the human ear hears the delay not as a separate discrete sound but rather as a fattening of the original sound. An example of how you can do this is shown.
12. For convenience and future reference, it is a good idea to rename the plug-in instances as shown below.

To do this, simply select the plug-in name in the FX Chain and press **F2** to display the **Rename FX Instance** edit box. Type the new name and press **Enter**.

13. The final plug-in that we will be using in this instance is **ReaComp**. As with the others, the secret is to be gentle!

14. The exact settings required will of course depend on many factors including the volume of the track. Remember that your reasons for using the compressor are to smooth down any peaks, to lift up the quieter passages, and to make the overall vocal seem more present. To this end, you should be aware of the following:



Attack time: too high a setting here will cause the compressor to be slow to kick in when a sudden increase in volume occurs.

Release time: too low a setting will cause the compressor to draw back too quickly, creating a

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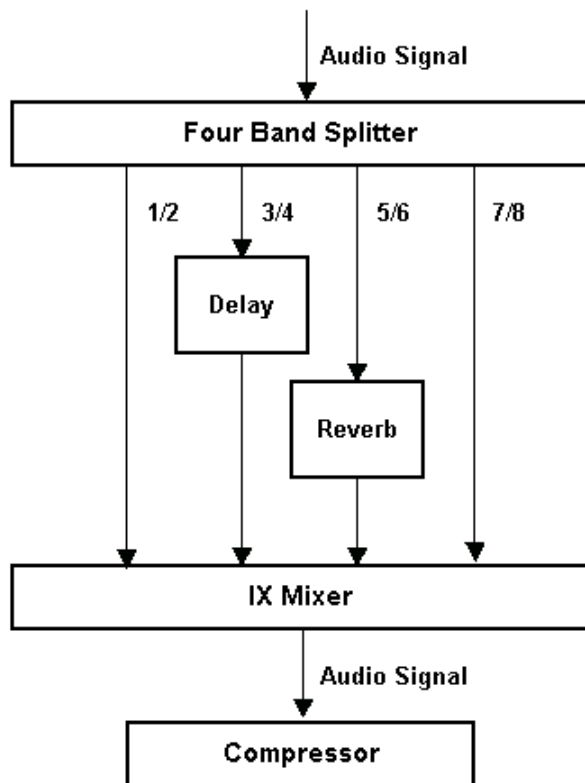
“pumping” effect. Too high a setting causes it to hold on for too long, compressing perhaps also quieter passages,

Ratio: a ratio less than 4:1 is not likely to be very effective, higher than 8:1 here can make the difference too noticeable when the compressor kicks in.

Knee Size: experiment with this setting to ensure that the compressor is engaged smoothly.

Wet Gain Fader: raise this by just enough to ensure that your quieter passages are heard clearly.

15. That's it! The diagram below shows our final FX Chain in this example, and below that is a flow chart indicating what we have just done.



The diagram on the left illustrates the signal flow that we have just created for our spacey vocals.

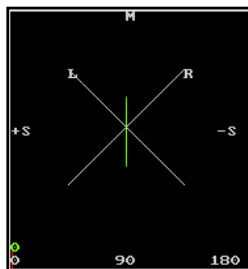
Remember that you can save it as an FX Chain (Right Click, Save FX Chain) which you can then apply to vocals on other tracks if you wish.

The file **RosesBloom SPACEY A** contains a suggested possible outcome for this exercise.

Please remember that this example is only an example, nothing more.

You should be prepared to experiment with those FX which work best on your vocals to achieve the outcomes that suit you best.

Stereo Spread of Vocal Track – Dry compared to Spacey



The illustrations shown here are rather interesting. Using our Goniometer, they show the effective positioning of our vocal track between our ears when dry (left) compared to after inserting the spacey vocals FX chain (right)

It can be interesting to leave this display in view while adjusting the panning of the various channels in the IX Mixer.

