

technique

combining mic
& DI signals

direct dilemma

MATCHING THE PHASE OF MIC & DI SIGNALS

Craig Anderton shows you how to get the best results when combining miked and DI'ed feeds from a bass guitar.

There are two main methods for recording bass guitar: miking an amp, which picks up the amp/speaker combination's character, and recording direct, which avoids the amp by feeding the instrument directly into your mixer or multitrack recorder, via a Direct Injection (DI) box or other interface, for a cleaner sound.

To get the best of both worlds, some engineers seek to use both of these approaches simultaneously. The problem is that the miked signal always ends up being delayed slightly in relation to the DI'ed signal, because of the time sound takes to travel through the air from the speaker cab to the microphone -- approximately one millisecond per foot travelled. This delay causes the two similar signals to be out of phase with each other, so that mixing them together results in comb filtering, a pattern of peaks and troughs in the frequency response which will usually weaken the combined sound.

The good news, though, is that you can compensate for this delay in order to retain a strong sound. Moreover, there are ways to do this both before and after the recording has taken place.

Phase Matching While Tracking

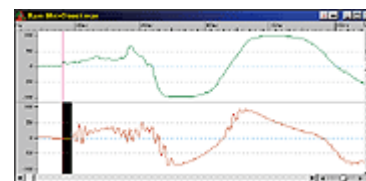
If you want to match the phase of the mic and DI signals while recording, the simplest solution is to artificially delay the DI signal as well, in order to match its phase with that of the already-delayed mic signal. An outboard delay line is one option for doing this, but you won't be able just to use any old unit. For a start, you're likely to need to have a fine delay-time resolution available to you, which rules out most analogue delays as these can't usually resolve delays of less than a millisecond or so. Furthermore, digital delays will typically need at least half a millisecond of processing time, even when set to their minimum delay time, so they'll work only if the mic is placed six inches or more away from the speaker -- sometimes, the amp's mic sits only about an inch away from the speaker cone.

However, a number of digital mixers include a short high-resolution delay line on every channel, which is ideal for time-alignment purposes. For example, both the Panasonic DA7 and the Yamaha O-series mixers allow you to set individual channel delays with single-sample accuracy. Other digital mixers include



built-in insert effects processors which offer a high enough timing resolution.

If you have access to a delay line which cuts the mustard, then the first step towards getting the mic and DI signals lined up is to patch them both into separate mixer channels. Pan the channels to centre, as this makes it easier to detect comb-filtering problems. If you're using an outboard delay line, patch it into the direct path's insert point or between the DI box and the mixer. Alternatively a similar routing could be implemented within a digital mixer using built-in effects processing, though it would be worth placing delay processors into both channels (with the mic channel's delay time set to zero) in order to remove the processing delay of the insert from the equation.



Once you've done this, get the bassist to play continuously on one string, at a consistent level. To simplify the level-setting process, or just to avoid the bassist getting too bored, you could temporarily unplug the instrument and feed in a bass-range synthesizer tone, modulated by an LFO of around 5Hz -- you may need to tape down a key and tweak the amplitude and filter envelopes in order to prevent the sound from decaying over time.

Once you've got audio coming into the two channels, solo each in turn and set them for the same approximate level. Then temporarily flip the DI audio out of phase using that mixer channel's phase invert switch. Now it's time to experiment with the DI channel's delay-time setting. Starting from the minimum delay available, slowly increase the delay using the smallest increments possible. At some point, the overall level of the combined mic and DI signal will start to drop, and you should try to find the delay setting that causes the greatest drop.

If you get no volume drop, then either the delay line can't achieve a short enough delay, or the resolution isn't sufficiently fine. In which case you'd be best advised to record the mic and DI signals onto separate tracks and then to attempt to fix any comb-filtering problems in the mix. There is also a possibility that the lack of volume drop could be due to an out-of-phase wiring problem, but that's a whole separate topic...

Having found the minimum volume point, try for an even lower volume by moving the mic in very small increments closer to or further from the speaker cone -- working in quarters of an inch is a fairly safe bet. If you have no-one to watch the meters for you while you move the mic, then it can be handy to write down meter levels between moves to keep a track of things.

If you've followed these instructions, you ought now to have almost completely compensated for the delay in the miked signal, so it'll be time to

Compensating For The Processing Delay Of Modelling Preamps

Users of physical modelling processors, such as the Bass Pod from Line 6 or Johnson Amplification's J Station guitar processor (which actually has some very good bass amp simulations on it), have an additional factor to take into account. Both the digital conversion and the physical modelling process take finite amounts of time -- a few milliseconds, in fact -- which means that the signal emerging from the outputs could be even later, compared to the DI signal, than the signal from a miked cabinet would have been. Line 6 have cleverly dealt with this issue on the Bass Pod by incorporating a dedicated DI output on the unit itself. This simply offers a buffered clean throughput of the input signal which is delayed to time-align it with the physically modelled signal. The difference between using this output and a traditional DI box split is dramatic, as the Pod's 9mS or so latency places it firmly in comb-filtering territory. Using the time-aligned DI, you can freely balance the clean and amp-simulated signals against one another without producing any notching or tonal coloration -- the two signals simply add.

The J-Station has a lower processing latency, so the audible effect is slightly less pronounced, but it is still there and you certainly wouldn't want to record a bass instrument with that degree of comb-filtering. In the absence of an onboard solution, you will need to use an external

undo the phase change on the DI channel. The two signals should now be well in phase, and ought to be stronger together than they were before. All that remains is to balance the channels appropriately.

delay processor on your DI signal to compensate, as suggested in the main text. I'd recommend starting out in the region of 4mS and fine-tuning from there by ear. *Dave Lockwood*


Fixing It In The Mix

If you don't have a suitable delay to hand while tracking, then you should record the mic and DI signals to separate tracks so that you have the option of aligning them later while mixing. If you're recording to analogue tape, or to a digital multitrack tape machine, then such fixing might have to be done with a delay line in a similar way as when tracking. Some digital tape machines, notably the popular Alesis ADATs, provide facilities for delaying their individual tracks, which can simplify the correction process considerably as no external delay processor is required.

With hard disk recorders and other random-access digital recorders, their waveform displays and non-destructive editing functions can be used instead of delay processing in order to line up the audio. All you have to do is zoom in the waveform display view far enough so that you can clearly see the initial attack of both tracks -- you'll see that the audio recorded from the mic starts slightly later than that recorded from the DI. Simply use your particular program's editing facilities to line up the mic track with the DI track.

Phasing, Shmasing...

Eliminating comb filtering might take a little time to do satisfactorily, but it can greatly improve your bass guitar sounds. So set aside a few minutes to try out some of the techniques described above -- you might well be surprised at how much better your recordings sound in the end.

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