

Cabasse Abyss Integrated Amplifier with DSP Speaker Correction

- [REVIEW](#)

- by [Robert E. Greene](#)

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If our annual awards had a category for “most innovative, future-pointing product,” the Cabasse Abyss would be a leading contender. The Abyss is a truly remarkable item which breaks new ground in using digital signal processing to address some fundamental aspects of speakers and their room interactions in a user-controllable way that is less invasive than usual room-correction processing and much easier to adjust than such room-correction systems are. Moreover, when used with Cabasse speakers, it is programmed to be specifically adapted to the speaker to optimize its performance in ways not accessible to general DSP room-correction systems, especially in dynamic terms.

The results can be startlingly good, though some considerable care is needed in adjusting the unit’s settings for the best results. However, explaining exactly what the Abyss can do will take some extended discussion. The things it does are not simple to explain; indeed, the Cabasse website hardly explains them in detail at all, though the company was very forthcoming about specifics when I asked. So, before going into details, let me just to assure you that a tour of Abyss technology will be well worthwhile.

Also, you should take for granted that the streaming and basic amplification functions of the Abyss work well. (I used Tidal HiFi via Ethernet connection, optical input from CD transport, analog input for external EQ—all easily set up, perfect in operation, with function controls via app installed on an iPad.) But they are not really the subject of this review. Rather, the main subject here is the distinctive things that the Abyss does in terms of DSP processing to fix the behavior of speakers and especially of Cabasse speakers, in this case the Murano Alto. [*The Cabasse Murano Alto was reviewed by Neil Gader in Issue 339.*] It is these DSP functions that move the \$1795 Abyss into a different category from run-of-the-mill streaming integrated amplifiers and make it a product of exceptional interest beyond just being good at streaming and amplification. And these DSP functions are what primarily will be discussed here.



A Musical Interlude

In what follows, I shall need to talk about a large number of issues and compensations for them. So, before we start this lengthy discussion (which might seem a bit tedious but worth it I hope), let me summarize the performance when everything is dialed in just so, to ideal effect, in a specific instance. I am a great admirer of Ofrah Harnoy's cello playing, and I like to listen to her *Favorite Encores* recording for ProArte from years ago. Most of the pieces were recorded in a studio, but two of the 10 pieces were recorded live. The sound of those is different and less convincing in some ways, but they surely show Harnoy's virtuosity in action (her "Dance of the Elves" is quite amazing). The (studio) Gershwin-Heifetz-Harnoy "Lullaby" with the Abyss/Alto Murano combination, properly adjusted, produced a remarkable facsimile of the sound of an actual cello live. Very gratifying, indeed, but it was really the next track, the "Piatti Caprice," which pointed up in audio terms the distinctive results of the Abyss's digital signal processing. In this (live) track, there is some audience noise. One can always hear it, but it tends to come across as somewhat indefinite. With the Abyss/Alto Murano combination, the coughs were far more precisely delineated and located than in previous listenings with other systems. This is, of course, not musically central, but even so it was startling in audio terms. It is not easy to be sure what caused this, but I can assure you it was different from almost all other systems. And presumably this kind of definition has musical significance—in complex musical situations, especially. Audio people are constantly talking about "resolution," without necessarily being very precise about what it means. But here it was in action. I imagine this has something to do with the precision of impulse response after the Abyss processing, which will be discussed in a moment, but in any case, it was something unusual to encounter. And now on to what is going on with the Abyss in general terms.

Problems of Speakers That Need Solving and What Abyss Does About Them

The easiest way to get a picture of what the Abyss does (especially for Cabasse speakers) is to think of it as attacking a number of specific problems that all, or almost all, speakers have. These problems are often simply ignored. But that does not mean they are not there! So here we go:

1) Phase linearity and waveform fidelity. In theory, a speaker is supposed to produce an exact acoustic copy of the input signal arriving at the speaker, or alternatively at the amplifier input, if the amplifier is incorporated in the speaker. But as things are, this essentially never happens with passive loudspeakers and not often with active ones that have integral amplification. It is possible: Passive speakers with first-order crossovers can do this (Quads, Dunlavy's, Thiels, Magnepans, Vandersteens, among others). But first-order crossovers lead to other difficulties, and overall the speaker industry has simply decided to ignore the idea of literal reproduction and shifted to flat frequency response. Flat frequency response is, of course, part of literal replication, but it is not all of it. The phase behavior must be correct, as well. (Correct means "phase linear"—the shift in phase of each frequency must be directly proportional to the frequency, which corresponds to all the components being lined up in time.)

This situation is somewhat odd because everyone who has investigated it knows that phase non-linearity is, in fact, audible. Back in the Nineteenth Century, people believed

it inaudible: This was Ohm's Law (the other one—not the $V=IR$ one). But once it became possible to produce filters which had flat response but nonlinear phase ("all-pass filters"), it became apparent that such things were audible. (A standard reference is researchgate.net/publication/247027642_On_the_Audibility_of_Midrange_Phase_Distortion_in_Audio_Systems.)

It is somewhat disconcerting to watch the same people who purport to be bringing science to audio at the same time claiming that phase linearity is not audible since the demonstrations of audibility come from some of the most respected scientific figures in the field. Since DSP systems can create all-pass filtering with ease, it is also easy to demonstrate the audibility for oneself. (I have listened to systems that phase-linearize speakers without changing frequency response. The effect is not so emphatic as shifts in frequency response, but it is most surely there and indeed is considerably larger in any reasonable sense than a great many of the things audio people worry about.)

One tends to suppose that a certain level of disingenuousness is involved. Since phase linearization is difficult to implement in passive loudspeakers without DSP, it was convenient to claim it did not matter. But now that DSP is becoming common, presumably people will at least admit that it is a real issue; errors in phase linearity are less obvious than frequency-response errors but still a real issue.

Phase linearity in a system with no nonlinear distortion and flat frequency response is mathematically equivalent to preservation of impulses: Impulse in gives impulse out. It is also equivalent to preservation of any full-bandwidth signal. How far most speakers are from doing this can be seen here for instance in published speaker measurements. The Abyss, when used with Cabasse speakers, undertakes to correct this, to make impulse in give an impulse out. Since the specific processing needed is dependent on the speaker—one is correcting the speaker—a device to do this has to be programmed for the particular speaker. In this case, this means the specific processing algorithms in the Abyss are designed for specific models of Cabasse speakers only.

You can see in Figure 1 that it works. The top graph shows the Cabasse Murano Alto's impulse response without correction, and the bottom one with correction through the Abyss. Clearly, while not quite perfect (some time smear is inevitable in any bandwidth-limited system), the great improvement is obvious. Cabasse says that the Abyss when used with Cabasse speakers is heavily oriented toward optimization of impulse response, and this indeed happens. (Audible effects will be discussed later.) These figures are not an "artist's conception;" they are literal photographs of the computer screen showing the impulse response as determined via a short sinewave sweep. The no-processing-first screen is with the Murano Alto driven by a Benchmark AHB2. The second figure shows the response with an impulse input into the Abyss set for the Murano Alto.



2) Bass room interaction. As everyone has experienced, the bass behavior of a speaker is highly dependent on where it is in the listening room. The Abyss corrects the effect of the room boundaries (in particular the wall behind the speakers) by allowing the user to describe to the Abyss where the speakers are. This is not so detailed as a full-room correction system, and it is not based on measurements in the room but on geometry. Still, it is useful.

3) Volume compensation. It is a familiar fact that perceived tonal balance depends on volume level (e.g., the equal-loudness curves of Fletcher-Munson and others later on). The most obvious overall effect on music is primarily loss of perceived bass with decrease in volume, though there is a shift in the top end, as well. In years gone by, preamps had “loudness” buttons for listening at low volume. Some still do. But the Abyss offers a far more comprehensive and detailed correction (called DFE), which operates by continuously monitoring the signal level and doing micro-correction in a far more detailed way than “loudness on” or “loudness off” buttons. It also makes some (smaller) alterations above the bass—indeed, all the way up, it seems. It is also user adjustable, with a control that turns it on or off but also enables the user to adjust the level at which it begins to operate. This is really useful and operates in a way that I consider very effective, however you feel about such processing philosophically. Again, more on audible effects later.

4) Accommodation of dynamics. Almost all speakers will safely and cleanly accept amounts of power over short time intervals that they would not accept without damage for long intervals. This is particularly true of bass signals. This means that ordinarily, in the absence of any processing, one is wasting dynamic capacity of speakers for bass transients. The Abyss, when operated with compatible Cabasse speakers, includes processing which monitors the signal and allows as much power to the speaker as is safe, the amount depending on the context. (This is somewhat

reminiscent of the Devialet SAM system.) This allows the Murano Altos, which are of moderate size, to produce startling bass punch, much beyond what one might expect from a speaker of this size. This is a nonlinear matter, based on ongoing digital monitoring of signal level and context.

5) Listening room acoustics. Rooms differ in their “hardness” acoustically. The appropriate tonal balance for playback thus depends to some extent on the room. The Abyss offers the user a choice of several different balances intended to compensate for the nature of the listening room. This feature turns out to be surprisingly useful, in my experience. (I typically was using one level below neutral [a lower level is for more reflective rooms], though this is a complex issue, as I shall discuss later, because the Abyss with the Murano Altos raises the on-axis response in the higher frequencies to compensate for the drooping power response.

6) Compensation for recording errors. The Abyss offers “tone controls”—bass and treble adjustments—for the usual reasons. Always useful and with DSP without sonic penalty.

7) Frequency response in detail of speakers themselves. This is, of course, a familiar and almost overwhelmingly vital issue. And speaker designers work on it automatically. But DSP can help. Detailed modifications of frequency response using DSP are possible that are inaccessible or at least impractical with analog crossover modifications. There is a practical limit to what can be done in this regard with analog circuits, especially at speaker level where handling filter elements is more difficult and where one must end up with something that amplifiers can still drive effectively. With DSP, there is no real limit to what can be done, or at least the limits are much reduced compared with passive speaker-crossover circuits. It is important to note once again that in DSP, amplitude frequency response can be controlled independently of phase behavior so that Point 1 above and the frequency response issue can be dealt with at the same time. The Abyss allows broad control of frequency response, as already noted. But it also allows detailed frequency response modifications tailored to particular Cabasse speaker models. One picks in a menu which Cabasse model one is using, and the system generates a matching frequency-response correction. This opens the possibility of making speakers of an eligible sort much better behaved than they are when operated as passive loudspeakers with no DSP processing.

The possibility of doing this (and doing phase linearization) is, of course, not a new idea. Already in the late 1990s, the audio group at Essex University in England brought out a device that corrected frequency response and linearized phase, and that could be programmed to any desired speaker. (I still have an Arion/Essex Equaliser programmed for the Spondor SP1/2s, which works very well indeed.) In the Abyss, only Cabasse speakers are addressed, though the Abyss works with any speaker if one selects “Other” for the speaker, which defeats the speaker-oriented DSP, though the features not specific to a particular speaker are still available.

Some of these items work in standard ways. The bass and treble controls are like conventional tone controls, the room-adjustment curve choices for “hardness” are much like the Quad “tilt” controls, and the distance to the backwall control just adjusts bass level to compensate for distance (as far as I could tell). But some of the adjustments operate in quite complicated ways and need detailed, separate consideration, I shall start with the compensation for volume, the “loudness” control as it were.

In Practice: The Volume Compensation

In classical traditional audio, a recording is intended for playback at a particular volume, and it is balanced to sound right at that volume over neutral speakers. But in practice, this theory is flawed by two factors: First, one does not know what the intended volume is exactly. There have been exceptions: The late Gabriel Wiener used to provide a test tone at the beginning of his recordings which was to be used to set the volume at a specified level by measurement. Why this eminently logical procedure has been followed by essentially no one else is unclear. But in almost all instances, one sets volume simply by ear to whatever seems to sound nice. This is, of course, not nearly exact enough. A shift in volume of x dB moves the relative level of bass by $2x$ dB: Turn the level down 3 dB and the bass drops in perceived level not by 3 dB but by 6 dB. (The equal-loudness curves are in effect twice as close together in the bass, though this is only approximate and depends in detail on frequency as well.) So, bass sounds relatively attenuated. This issue is real. And in the early days of “hi-fi,” preamps had a button called the “loudness” control that boosted bass some suitable amount. But, of course, this one-size-fits-all compensation was at best an approximation, since the correct compensation depends on levels and also to some extent on context. Even so, the loudness control was usually regarded as better than nothing. (McIntosh still offers this on some products, as do a few other manufacturers.) But the loudness compensation in the Abyss is from another world, far beyond these simple changes of frequency response. Cabasse has done, I gather, a lot of careful study of how to generate the most appropriate compensation in a dynamic way, changing with the levels and the overall context of the music in a time interval around each instant. It is really hard, as with any such complex dynamic DSP, to know exactly what happens technically or to verify the effects with usual measurements (the latter is pretty much not doable). One must listen. And I must say that, somewhat to my surprise, I found myself liking the results in a great many cases (you can turn this off if you want to—and you can switch it in and out to see what it is doing, and you can also adjust the way it is applied). Discreetly used, it seemed to me to make a great many recordings sound “better” at the moderate values at which I like to play music. The bass was brought up, naturally, but there was also a sense of low-level detail being presented more convincingly in the lower frequencies. This perceptually applied not just to bass itself but to lower frequencies above the bass, as well. Music seemed more vivid in a sense, more full-bodied and not just in a boosted-bass way. Did it sound more like live music? That is a question that it is hard to ascribe precise meaning to, since in a live event there is nothing that corresponds to turning the volume down. (Increasing the distance decreases level, but it has other effects, too. A straight volume cut does not occur in live musical reality.)

There is a genuine issue here: Most people do not want to play recordings quite as loudly as they were played at mastering and surely not at the level of live music at a close-up distance, where microphones typically are. You are almost always turning it down in this sense. The question is what are you going to do about this.

I found that this feature of the Abyss, however unusual it appears, created a satisfying effect in a great many cases. Admittedly, this is a kind of slippery slope, opening the possibility of all kinds of nonlinear processing that could end up altering the music in unfortunate or at least artificial ways. But this processing seemed to me well done and useful. Until the spirit of the late Gabe Wiener leads the whole industry into standardizing playback levels, one needs something like this, I think. And this one works

well. Quite often switching the processing out makes the sound seem anemic and switching it back in brings up the RBC (the red blood count), as it were, of the music. One can get almost addicted to this. I think for many people this feature alone will be enough to justify using the Abyss. (Incidentally this kind of thing involves a good deal of “latency,” time delay of the whole signal to allow the processing, which is very extensive. There is a noticeable delay of output compared to input, as you can hear by changing the input volume and noting how long it takes for the volume of the output to reflect the change).

Speaker Correction in the Murano Alto

The first thing to note is that the speaker correction makes the impulse response more like an impulse. Look again at Figure 1 and 2 where, as already noted, one shows the impulse response of the speaker without processing and the other shows it with the Abyss correction installed. Clearly the impulse signal, which ideally should be reproduced as a spike at one point and nothing else, has come to look more like that with the processing. The timing of the frequency components is more nearly lined up. This is a definite step forward in fidelity in visual terms, and in my experience, it has positive audible effects, too. Transients are more nearly correct and complex textures (voices in a chorus for instance) are more clearly resolved. It is not so important as frequency response, but it matters.

In a linear—no distortion—system, a perfect impulse response implies flat response. But in practice one cannot see very easily how flat the response is from just looking at the impulse if it is not perfect. Getting the frequency response from the impulse response is a mathematical process that the eye does not do easily! So, it is convenient to think of the frequency response separately (and measure it that way, separately, too).

But in the case of the Abyss plus Murano Alto, it is hard to determine how much difference it makes because the correction also changes the frequency response and indeed changes it quite a lot. And here we come to a difficult issue. The Murano Alto requires a fairly large listening distance for the drivers to combine coherently and correctly. The speakers have two 7-inch woofers, identically driven, and a concentric midrange/tweeter unit above, crossover from woofers to mid/tweeter at 800Hz. Up close, the physical separation of the drive units prevents them from combining correctly. Indeed, it is hard to say that the Murano Alto even has a close-up frequency response in any precise sense. One must listen at a distance. Because distance is required for listening, something on the order of ten feet I concluded, one must take the room sound into account more than one would if one could sit close to the speakers.

In this context, Cabasse developed a model of what it believes one will hear in a standard room at the listening distance involved. This involves some combination of the reverberant field and the direct arrival. And—and this is the crucial point—this combination is what is targeted in the correction. In other words, the response is tailored to make the total effect what it should be (smoothly sloping down) according to Cabasse, and the speaker’s response is changed to meet this goal. This involves shifting the speaker’s anechoic response quite a lot.

This runs rather contrary to, say, the viewpoint of the Holm Acoustics room-correction system where in-room response is corrected below 1kHz, but above 1kHz the speaker is made anechoically flat, an approach also used by other room-correction systems (e.g., the Sigtech way back when). Even Floyd Toole, much of whose entire corpus of work was devoted to investigating the influence of off-axis behavior on speakers sound in

rooms, did not advocate changing the upper frequencies away from flat response, but rather altering the pattern of the speakers to match the target. In effect, almost no one has really advocated using changes in the upper frequencies to compensate for the behavior of the reverberant field. And I must say my experience is along the same lines: One makes the direct arrival above say 500Hz non-flat at one's peril. The ear hears these changes, whatever the reverberant field is doing.

Regardless of such theoretical, general considerations, the Abyss correction of the Murano Alto made the speaker sound to me a little rough in response and somewhat aggressive. In measured terms, this was not huge. But in listening it was significant. And in all honesty, I got what was to me a much more satisfactory sound by using an analog EQ device to partially cancel out the response corrections of the Abyss (applied to the Murano Alto). This left the compact impulse response and its advantages essentially intact, but it made the sound much more listenable—and much more like the sound of flat speakers heard close up (i.e., a flat speaker that one could listen to close up).

Cabasse seems committed to its model of what happens in rooms, and I could be wrong or just used to what I am used to. But that was my listening impression.

The whole question of exactly what it means for a speaker in a room to be neutral in response when listened to at a distance is ambiguous. (Toole's answer is really to define some situation as neutral by definition and then say that the recording engineer should record with this in mind.) Reviewers have taken to ignoring this ambiguity and declaring one speaker or another neutral—whether any two of these supposedly neutral speakers sound alike in an actual room. But in any case, I really preferred the speaker with the alteration by the Abyss somewhat modified in the direction of what I estimated was more nearly anechoically flat—to the extent I could tell that for a speaker that cannot be measured at close range (so that I was estimating what the anechoic response would be). What a mouthful! But the short version is that I had to play with analog EQ to get the Abyss /Murano Alto combination to sound right to me. And the relatively small amount of smooth EQ involved left the compact impulse response essentially unchanged.

Incidentally, when one defeated the correction by choosing "Others" in the speaker menu, that meant that one did not have the impulse-response improvement, and in any case, the Murano Alto alone uncorrected did not seem perfect to me, either. This is not a review of the Murano Alto alone, but it struck me uncorrected as not really neutral sounding (and in particular, there seemed to me something odd going on with the midrange driver between 1 and 2kHz). I can see why they wanted to correct it—but the correction went a bit overboard, I thought. And I liked the results better when I partially canceled the correction by external EQ.

I do not want to pick on Cabasse here. These issues arise with any speaker that one wants to listen to at anything beyond extremely close range. Otherwise, one could make any speaker sound like any other by EQ! Most of the time, people just ignore this. And I approve entirely of Cabasse addressing the issue. I just wish that they had done a little more in the way of making the anechoic response above 1kHz flat and less in the way of altering it to fix the combination of direct and reverberant field. But the compactification of impulse response is all to the good.

The Overall Listening Experience At Its Best

With everything adjusted in the best possible way, the Abyss plus Murano Alto system often produced excellent results. Cabasse is, I gather, proud of the soundstaging of its speakers, and the Abyss/Murano Alto combination did indeed produce remarkable

spatial performance. Ralph the Dog on *Stereophile's Test CD 1* has seldom sounded so thoroughly nowhere when out of phase while being well focused in phase. And orchestral music, especially, had instruments well localized and separated and a fine sense of the space around. The concentric driver does seem to deliver the goods in spatial terms. This made for very pleasing listening to large ensembles in large venues. And even if the tonal color was slightly off what I expected, still the overall experience was very convincing in musical terms. The combination also offered huge dynamic scale, surprisingly so in the bass. The Abyss is a small, almost miniature unit by large amplifier standards, but it packs a lot of dynamic punch without ever sounding strained. The basic sound was hugely, almost infinitely, adjustable, but when adjusted optimally, a satisfying orchestral experience was provided, exceptionally so by usual speaker standards. In some way not easy to put one's finger on, one sank into the music. I am always a bit skeptical of such statements, which seem too personal to be transferrable to others. But in this case it was the simple truth. I wanted to keep listening. Still, I could not help wondering if the sound would not be even better with a different EQ—and they were better when I hand-adjusted the speakers by external EQ, although the Abyss got very close.

Summary

I applaud Cabasse's willingness to try to deal with so many of the big issues of speaker performance. And in many respects, what it has done seems to me very successful. The dynamic compensation, the adjustment for speaker position and room acoustics, and the tone controls seem to me to be very well done. And if the automatic correction of the speaker itself did not come out ideally in my room, still, with the right settings of everything, I could get very close to what I regard as ideal. I would be interested to hear what could be accomplished with a speaker slightly less idiosyncratic in radiation pattern than the Murano Altos. Cabasse seems to me to be moving forward on fundamental issues in a way that few others are even attempting. Getting the fundamentals right is something I believe in, and Cabasse is setting out to do this in a way unequaled by anyone else. A standing ovation is called for.

Specs & Pricing

Type: Streaming integrated amplifier with DSP

Power output: 120Wpc into 8 ohms, 215Wpc into 4 ohms

Connectivity: Ethernet, Wi-Fi, Bluetooth, optical SPDIF, analog RCA, USB, TV plug

DSP programs: DEAP (dynamic enhancement of acoustic performance); DFE (dynamic fidelity enhancer)

Price: \$1795

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