

Loudness Penalty Studio

User Manual



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Welcome to Loudness Penalty Studio

Thanks for choosing Loudness Penalty Studio! This manual will get you up and running quickly, and will serve as a reference once you learn the basics.

System Requirements

- macOS 10.11 (El Capitan) or greater (Intel or Apple Silicon)
- Windows 7 or greater (64-bit only)

Installation and Authorization

macOS

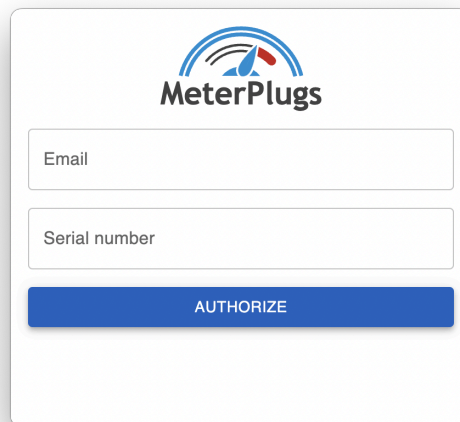
Mount the Loudness Penalty Studio disk image (.dmg) and drag the Loudness Penalty Studio app to the Applications folder to install it.

Windows

Run the Loudness Penalty Studio installer (.msi) to install Loudness Penalty Studio into the default installation directory: *C:\Program Files\Loudness Penalty Studio*.

Online Authorization (Requires Internet Connection)

When you first install and run Loudness Penalty Studio, an authorization dialog will prompt you for your email address and serial number. Enter the email address that you used when you made your purchase. Note that both fields are case-sensitive.

The image shows a software authorization dialog box. At the top center is the 'MeterPlugs' logo, which consists of a stylized blue and red arc above the text 'MeterPlugs'. Below the logo are two text input fields. The first field is labeled 'Email' and the second is labeled 'Serial number'. Both fields are empty. Below these fields is a solid blue button with the word 'AUTHORIZE' in white, uppercase letters. The entire dialog box has a white background and a thin gray border.

Loudness Penalty Studio Authorization Dialog

Introduction

Understanding, balancing and adjusting “loudness” has always been a crucial part of audio production. In recent years this has become even more true with the introduction of the international Loudness Unit (LU / LUFS) method of measuring loudness.

In particular, all the major online streaming services have started regulating playback loudness. This means that loud songs will have their playback volume (or loudness) turned down, to prevent users from being “blasted” by sudden changes, and quieter songs *may* be turned up, depending on the service. The goal is to create a more consistent, enjoyable listening experience for users, especially in “shuffle” mode. This process is known as loudness matching or normalization.

However, all the services achieve this goal in slightly different ways, which makes it challenging to understand and predict how your music will sound on each one. For example, you may be wondering how much your music’s loudness will be affected, and how it will differ depending on the streaming service.

In particular, it is important to understand how your music will sound when shuffled or included in a playlist, and there are subtle but important differences between each service in how they treat Album Mode loudness matching (normalization).

Loudness Penalty Studio has been developed to reveal all this complexity, simply and easily, by giving you an accurate estimate of the change in loudness you can expect when uploading your music to the most popular online streaming services, and a clear, intuitive display showing how this relates to other songs, both individually and in comparison to reference material, for example as part of an album or playlist.

You can also preview the final loudness of your audio, allowing you to compare it to similar reference material, and make optimal decisions for your music, balancing the artistic and technical aspects for maximum impact, both with and without loudness matching.

Getting Started

Using Loudness Penalty Studio is straightforward. Simply drag the audio files you want to assess into the upper Loudness View section at the top of the application window and the analysis will begin immediately.

Once this is complete, Loudness Penalty Studio will provide visual and numerical feedback about how each audio file will be treated when it is played back on the most popular streaming services. The results are displayed graphically in the Loudness View pane, and numerically in the Table View below. These results will be described in detail later. Files can be previewed and compared, both with and without loudness matching (normalization).

The unique Loudness View visualization allows you to see at a glance the overall loudness statistics of all the songs in an album or playlist, and enabling the Loudness Match toggle shows an intuitive visualization of how the playback loudness of each song will be affected by normalization on all the major streaming services. The most important value for assessing this is the Loudness Penalty, reflected in the Loudness View by the Loudness Penalty Arrow graphic and the vertical offset position of each file block.

Uses for Loudness Penalty Studio

Loudness Penalty Studio can be used in a variety of ways to gain invaluable understanding and feedback on the way your audio will be heard when loudness matching (normalization) is being used. Examples include:

- Visualizing the loudness of a group of files (e.g., an album, playlist or selection of podcast episodes or videos)
- Comparing your own material with suitable references and hearing how they sound
- Comparing multiple alternative versions of the same files (e.g., dense vs. dynamic)
- Previewing transitions between audio files - how do they feel?
- Comparing the effects of Track and Album Mode loudness matching

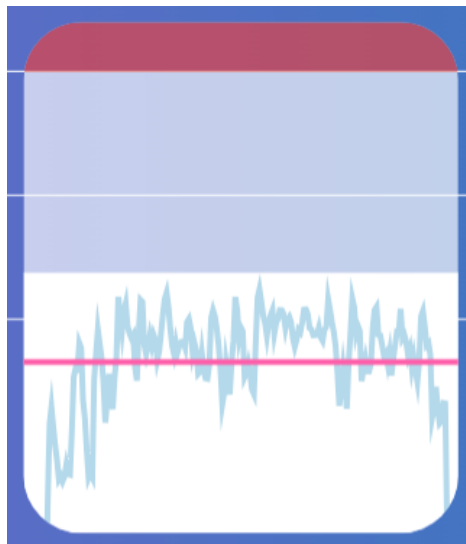
Seamless Version Comparisons

One of the most powerful features of Loudness Penalty Studio is allowing you to compare multiple versions of the same audio content, by importing several different files. This allows you to decide whether you prefer a louder master (with a more negative Loudness Penalty adjustment) or a more dynamic master with lower integrated loudness.

For added insight, simply hold down the Shift key while clicking between files to switch seamlessly at the same playback time, making the comparison even more revealing.

Loudness View

Loudness Penalty Studio's unique Loudness View display gives you immediate, intuitive feedback on the loudness of your audio, and how it will be adjusted by online streaming services. Each file is displayed as a vertical "file block" as seen below:



"File block" in the Loudness View

The file block depicts the following information:

Integrated loudness is represented by the solid pink line in the white section of the block. The higher the line is, the louder the overall file measures.

Loudness Profile The short-term Loudness is represented by the semi-transparent spiky blue line. This gives you an idea of which parts of the file are the loudest, and how the loudness varies throughout the file.

Maximum true peak level is represented by the top of the block. Any red shading indicates true peak clipping (true peaks above 0 dBTP). When Loudness Match is enabled and the peak level is reduced below 0 dBTP, this area is shaded in grey, to indicate that playback clipping may still occur in some scenarios (e.g., mobile or browser players).

Loudness Range (LRA) is represented by the opaque, white section, with the top of the section showing the top 5% loudest moments and the bottom showing the 10% quietest moments. The LRA indicates the amount of dynamic contrast in a file. The larger this section, the more longer-term (macro-dynamic) variety there is between quiet and loud moments in the file.

Peak to Loudness Ratio (PLR) is represented by the area above the solid pink line and indicates how heavily compressed or limited a file is. The smaller this section of the block above the integrated loudness line, the more restricted the micro-dynamics of the file are, and the less contrast there is between peaks and loudness. This often reflects heavier limiting or clipping.

Loudness Matching

By default, the Loudness View shows the original mastered loudness statistics of each measured file. Enabling the Loudness Match toggle changes the way these blocks are displayed by adjusting the loudness of each file using the methods of each streaming service. There are two modes for this:

- **Track Mode** - Adjusts the loudness of files independently
- **Album Mode** - Adjusts the loudness of all files by the same amount, determined by the loudest file

For example, if Spotify is selected in Track Mode, louder songs will be reduced in loudness, and quieter songs will be increased in loudness. The amount of this increase or decrease is represented visually by the Loudness Penalty Arrow. The size of this arrow is defined by the Loudness Penalty value.

Some platforms only allow one type of matching, in which case the Matching Mode will be selected automatically and the other option will be greyed out.

Matching Method

This drop-down method allows you to choose how the loudness of the files should be matched. Options include the Distribution Loudness of the most popular streaming services, as well as the “Lowest LUFS” and “Top of LRA” methods - see below.

Loudness Penalty Values

If your song has a Loudness Penalty value of -2 on YouTube, this means that its loudness will be reduced by 2 dB when it is played there. *(The adjustment is made at playback-time, in the player, and is not “baked in” to the uploaded file.)*

It is normal to see different values for different streaming services. Additionally, the precise results of the loudness matching (normalization) may vary depending on the settings a particular user has chosen in their player. See [Interpreting Loudness Penalty values](#) for details.

You will notice that the louder the original file is, the more negative the Loudness Penalty values become, indicating that the file will be further reduced in level to match the distribution loudness of the selected streaming service.

Preview

Loudness Penalty Studio lets you preview your music at the distribution loudness level of the streaming service that you have selected. This allows you to easily compare your music against suitable reference material, to make sure you’re happy with the way it sounds when heard with loudness matching (normalization) enabled. See [Preview](#) for details.

Loudness Penalty Results

By using Loudness Penalty Studio you can know accurately, in advance, how the loudness of your music will be adjusted when it is played back online, and hear how it sounds in this context. Knowledge is power, and equipped with this information, you will be able to make the best possible technical and creative decisions to make your music sound exactly the way you would like it to, on all the online services.

It is important to stress that there are no “standard” or “target” loudness values, or Loudness Penalty values. Every song is different, even within the same genre or on a single album by a specific artist. Context is crucial, and Loudness Penalty Studio is designed to help you understand this context and optimize your audio accordingly.

Having said that, there are some guidelines that we can suggest, and as part of this guide, we will discuss whether it makes sense to ask what your ideal result is for different types of material, and how to find it. See [The Ideal Loudness Penalty Value](#) for details.

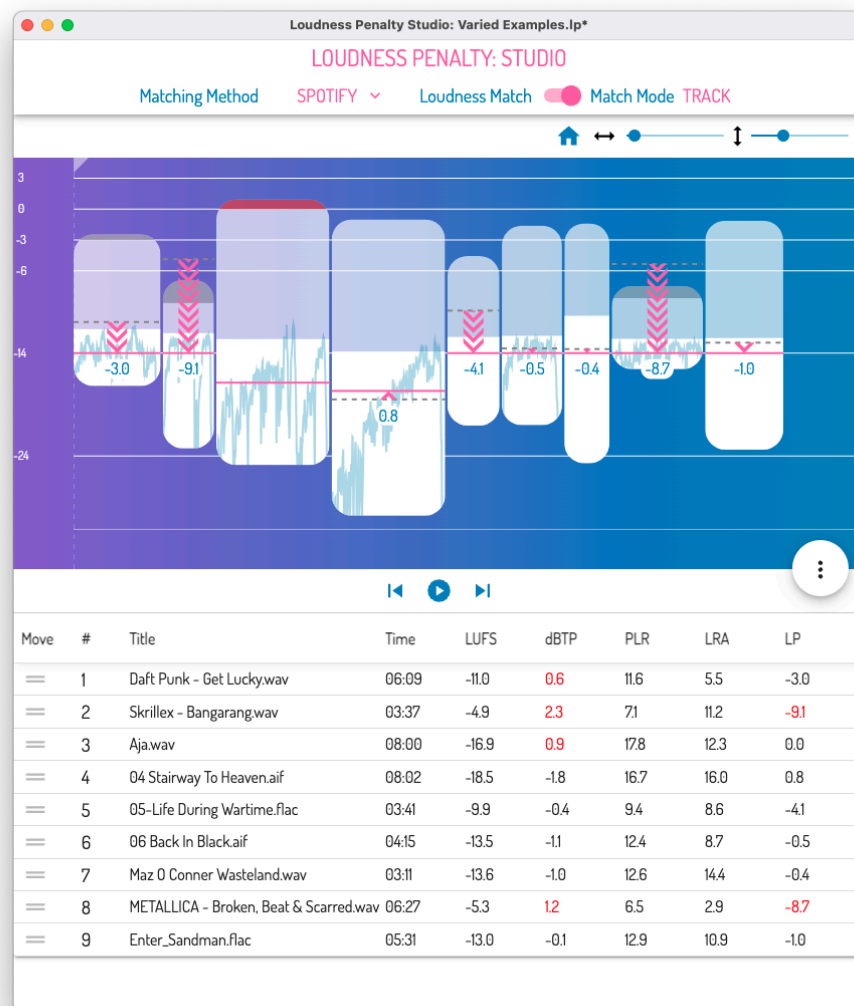
As a rough guide, in our experience LP values of between +2 and -3 are typical for popular content with balanced dynamics. More strongly negative values highlight the potential for mastering at a lower LUFS level and achieving equivalent or better results, without the challenges and compromises associated with achieving very high LUFS levels, and while still achieving excellent playback levels when streaming.

For now though, if you want to get straight to work, knowing that your audio will incur a minimal “penalty” on all the major streaming services, we suggest adjusting its loudness (before the final limiter) so that the whole song has a Loudness Penalty value between 0 and -3 on YouTube or Spotify, with peak levels not exceeding -1 dBTP. This corresponds to an integrated loudness of between -14 and -11 LUFS.

There is much more to be said about this topic though, so please keep reading!

User Interface

This section briefly describes the features of Loudness Penalty Studio. To get the maximum benefit from using it, we also recommend that you read the sections that follow it, especially about interpreting and optimizing the results you get. The display and results include a good amount of detail and nuance, so fully understanding and managing the Loudness Penalty results for your music is crucial for getting the most out of the application.



Loudness Penalty Studio interface

Menu Button



Click the menu button in the lower-right corner of the Loudness View to reveal the following list of actions:



New Project



Open Project



Save Project



Save As



Add File



Save Report

Matching Method

This dropdown menu allows you to select which online streaming service you are interested in, and compare its results with other services. In addition to streaming services, you can also choose to match by “Lowest LUFS” or “Top of LRA.”

All the main streaming services now measure loudness using the same international standard - “Loudness Units Full Scale,” or LUFS. However, they all interpret and adjust these measurements in slightly different ways, which means you may get different results on different services, depending on your audio material and mastering methods. Loudness Penalty Studio allows you to preview and compare these results. The choice of matching method determines the following details:

- The appropriate distribution loudness, meaning the reference level that louder material will be reduced to on streaming services (e.g., -14 LUFS). Some services also increase the level of files that are below the distribution loudness (positive gain).

- Whether positive gain will be applied for material below the distribution loudness or not (i.e. whether quiet material will be made louder).
- Whether Track and/or Album matching modes are available (e.g., YouTube only supports Track Mode, whereas TIDAL always uses Album Mode).
- Whether peak levels (dBTP) will influence the results.

The “Lowest LUFS” and “Top of LRA” matching methods are **not** currently implemented by any mainstream streaming service, however they offer powerful and useful functionality.

The “**Lowest LUFS**” method matches the integrated loudness of all the files to whichever is lowest. When some of the files are quieter than the Distribution Loudness of any of the streaming services, you may see a situation where those files are lower in LUFS even when Loudness Match is enabled.

This is helpful to know since it reflects a situation where some files will not be effectively balanced against others, and allows you to decide if this is desirable for the material. However it also prevents these files from being effectively compared. Selecting “Lowest LUFS” allows any group of files to be matched in loudness, including lower LUFS more dynamic material - for example an un-mastered mix, very dynamic classical music or a movie soundtrack.

In a similar way, “**Top of LRA**” also allows any group of files to be matched in loudness, but instead of matching the integrated LUFS (pink line) of the files, it matches the Top of LRA (top of solid white) values, corresponding to the 5% loudest moments in the file, typically close to the loudest sections of the Loudness Profile graph.

Like “Lowest LUFS” matching, the “Top of LRA” method is not yet implemented in any mainstream service, but in our experience provides a more satisfyingly musical method of matching loudness for a wide range of material. This matching method can be helpful when your goal is to decide which file sounds best to you when as musically balanced in loudness as possible, rather than simply how they will be heard when normalized.

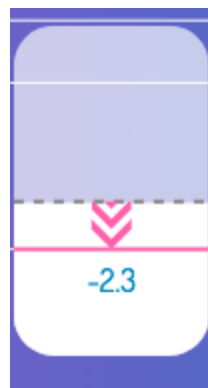
Loudness Match

Enables and disables loudness matching, also known as loudness normalization.

When Loudness Match is disabled, the Loudness View reflects the original LUFS values of the audio files, indicated by the solid pink line. Higher values indicate higher loudness.

When Loudness Match is enabled, the playback levels of the selected audio files are adjusted to match the selected streaming service's distribution loudness as closely as possible, based on the service's algorithm.

The Loudness View pane updates to reflect this. Files that will be reduced in level move down, and files that will be increased move up. This change in loudness – the Loudness Penalty – is represented by the pink Loudness Penalty Arrow, and the exact value of each adjustment is displayed on the file block graphic, as seen in the following image:



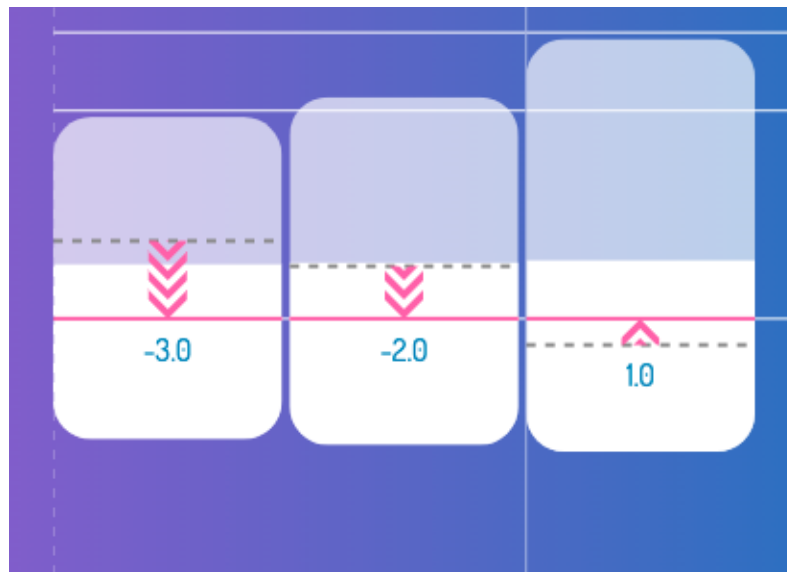
File block with Loudness Match enabled

When Loudness Match is enabled, files will preview with the Loudness Penalty adjustment applied. Loudness matching (normalization) is enabled by default on all the main services, and only disabled by a small fraction of users. As a result, enabling Loudness Match reflects how the majority of the online streaming audience will experience your audio.

Match Mode

Defines whether Track Mode or Album Mode is used for the Loudness Match method (normalization).

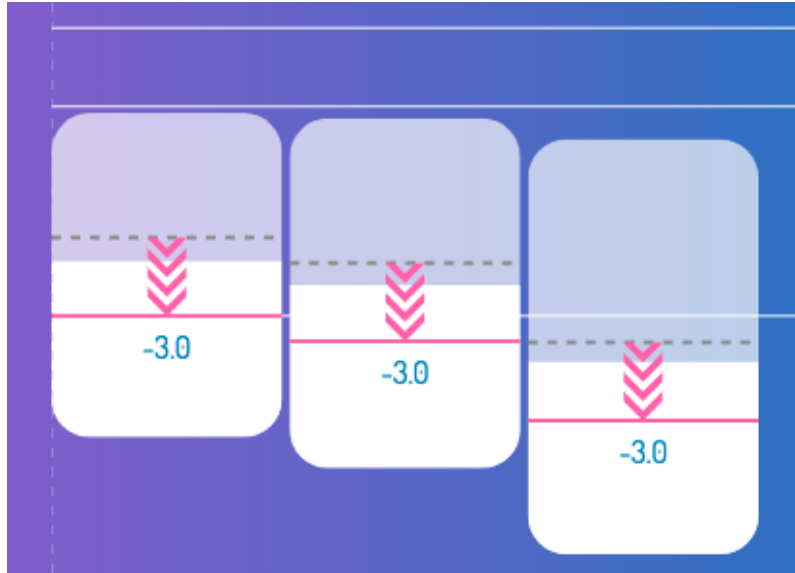
In Track Mode, each song is individually adjusted to the same distribution loudness level, where possible. For example, on Spotify, which has a distribution loudness of -14 LUFS, songs with original integrated loudness measurements of -11, -12 and -15 LUFS will be adjusted by -3, -2 and +1 dB respectively, so that all of them play back at -14 LUFS.



Loudness View in Track Mode

Track Mode is typically used when the user has shuffle playback enabled, or chooses to listen to a playlist, for example.

In Album Mode, all the songs on an album are adjusted by the same Loudness Penalty offset, so that the loudest track is played back at the distribution loudness level, and the loudness differences between songs are retained. If the three example songs above were part of an album, they would *all* be adjusted by -3 dB, resulting in final playback loudness levels of -14, -15 and -18 LUFS.



Loudness View in Album Mode

Album Mode is used when the user chooses to listen to songs from a single album.

Not all services support both matching modes. There is no Album Mode on YouTube, Amazon, Pandora or Deezer, whereas TIDAL uses Album Mode all the time, even when users choose playlists or shuffle. There is evidence that most people prefer this matching method, feeling that it gives more musical results and better preserves the original artistic intent (see [Interpreting results in Loudness Penalty Studio](#) for more information).

The Loudness Penalty Arrow indicators in the Loudness View reveal the different results of these two matching methods - simply switch modes to compare them.

Bear in mind that the application can only calculate the Album Mode value for files that are included in the current project. For an actual album, this will give an accurate result on all platforms. In playlists, more care must be taken since Loudness Penalty Studio will not be aware of the potential impact of Album Mode values for songs that aren't included.

[Loudness View](#)

The Loudness View shows an intuitive visualization of the loudness statistics of your files. The vertical scale shows loudness in LUFS, and the horizontal scale shows time, so longer files are

shown as being wider, allowing specific playback points to be previewed.

The power of the Loudness View visualization is that it reveals a great deal of information in a single display. For example, you can see which songs have the highest and lowest integrated loudness; which have the largest or smallest amount of dynamic variety, both micro-dynamic (area above the integrated loudness line) and macro-dynamic (solid white lower area); which files have the loudest and quietest moments and how the short-term loudness varies; as well as which files have the largest Loudness Penalty values, and how these affect their relative playback loudness.

Each audio file in the Loudness View is represented by a block whose width is proportional to the running time of the file and whose height is determined by the Peak to Loudness Ratio or PLR (upper area above the integrated loudness line) and the Loudness Range or LRA (lower white area). The top of each block represents the maximum true peak value, and the integrated loudness is marked by a solid pink line. The top of the white area reflects the 5% loudest moments of the file, whereas the bottom of this area is defined by the 10% quietest moments.

The top of the block will be shaded in red if it exceeds 0 dBTP, indicating true peak clipping in the source file. When Loudness Match is enabled, this area is shaded in grey, to indicate that playback clipping may still occur in some scenarios (e.g., mobile or browser players)

The short-term LUFS is displayed as a pale blue spiky line, and indicates how the loudness varies throughout the file, allowing the loudest and quietest moments to be easily identified.

Hovering over a block displays the file's name as a tooltip and highlights its corresponding listing in the Table View below.

The file blocks animate when enabling and disabling the Loudness Match feature, and the resulting Loudness Penalty values can be assessed via the Loudness Penalty Arrow graphics and corresponding exact figures. In some cases, increased loudness (positive gain) is restricted by the streaming service because it would otherwise cause clipping (true peaks above zero or -1 dBTP). This can be easily seen since the solid pink integrated loudness line will be below the distribution loudness level, as seen below.



Restricted positive gain due to true peak

Zoom Controls



The Loudness View display can be scaled horizontally and vertically using these controls. Reset the horizontal scale to include all files using the “Home” button.

Preview Controls



The preview controls enable you to audition the selected files both with and without Loudness Match (normalization) enabled. This is an extremely important and powerful feature which will be discussed in more detail in the next section.

Playback can be paused and resumed, and skipped forward or back, using the preview controls. The playback cursor moves to reflect the playback time within each file, which can be changed simply by clicking the mouse to locate specific playback times within a file.

Sync Playback Time

Holding down the Shift key when clicking between files maintains the same playback time offset, enabling you to compare exactly the same playback point in each file. For example, if you are listening to the loudest section of a song at 1:00 and you click on the next file while holding Shift, playback will switch to exactly 1:00 in the new file. This allows you to seamlessly preview exactly the same point in time, which can be highly revealing of subtle musical and sonic differences when different versions of the same file are compared.

Table View

The lower section of Loudness Penalty Studio displays additional information on the selected files in numerical form and allows files to be re-ordered and previewed. Files can also be removed using Table View - simply right-click and select Remove.

The table displays the following columns:

- **Move** - Click and drag to rearrange the playback order as desired
- **Number** - Indicates the numerical playback position of each file
- **Title** - Filename of each file
- **Time** - The duration of each file in minutes and seconds, represented in the Loudness View by the width of the corresponding block
- **LUFS** - The integrated loudness of each file in LUFS, represented in the Loudness View by the solid pink line
- **dBTP** - The maximum true peak level of each file in dBTP, represented by the top edge of the block in the Loudness View
- **PLR** - The Peak to Loudness Ratio or PLR of each file in dB / LU, represented in the Loudness View by the distance between the top of the block and the solid pink integrated loudness line
- **LRA** - The Loudness Range, reflecting the difference between the 5% loudest and 10% quietest moments in the file
- **LP** - The Loudness Penalty in dB / LU of each file, represented in the Loudness View by the Loudness Penalty Arrow

Interpreting Results

Integrated Loudness (LUFS)

The vertical position of each block in the Loudness View is determined by the integrated loudness of the source file, displayed as a solid pink line. For any collection of files, it is entirely normal to see plenty of variation in the integrated loudness values. For example, we shouldn't expect all the songs on an album to have the same integrated loudness. There are two reasons for this:

- Integrated loudness is an overall value. Files that are consistently loud will have a higher integrated loudness than files with more variety (e.g., a combination of louder and quieter moments).
- Varied loudness is often desirable musically. For example, we don't expect an acoustic ballad to be as loud as a heavy rock song. Matching the loudness of these will sound wrong - the ballad will sound too loud. For this reason, we expect to see lower integrated loudness values for quieter songs.

In general, we can say that there's no need to match integrated loudness between audio files. Instead, the goal is usually to balance the loudness for a satisfying aesthetic result.

(Having said that there are also cases where matching *is* desirable - for example where we want consistency, as with the vocal levels between episodes of a podcast, or when complying with broadcast regulations where it is necessary to supply files at a certain specified loudness level.)

In addition, streaming services adjust the integrated loudness for us. Loudness matching (normalization) is enabled by default in the majority of situations, so there is no need to aim for "targets" or match the distribution loudness of individual streaming services.

There are some situations where peak levels above 0 dBTP may cause decoder clipping even when loudness matching is enabled though - see the next section for more details.

True Peak (dBTP)

True peak levels more accurately reflect the final decoded analog waveform than traditional sample peak levels. If your source files are peaking close to 0 dBFS, you may well see dBTP values above zero, which will be shaded red in the Loudness View and highlighted in the table view.

Even in the absence of true peak clipping, some loud files that peak close to zero may decode from streaming formats with sample peaks above zero. Loudness Penalty Studio does not emulate codec clipping so will not warn you of this.

In many cases the loudness matching process will reduce the playback level, meaning that dBTP values above zero won't cause audible issues in the playback chain. However some players, especially on mobile devices, use fixed-point decoding, and in this case, decoder clipping may occur. For this reason, files with source clipping (levels above 0 dBTP) will still show a shaded area in the Loudness View to warn you of this possibility.

To avoid potential issues, we recommend mastering with true peaks no higher than -1 dBTP, and keeping short-term loudness to -10 LUFS or lower.

Loudness Penalty

A Loudness Penalty value is a deceptively simple measurement. In this section, we will start with a high-level overview of what a Loudness Penalty value is, and then dive into some of the nuances. By the end, you should have a clear and detailed understanding of how to interpret Loudness Penalty values, and how they can help you achieve great results when streaming your music online.

At a high level, a Loudness Penalty value tells you how much your music's loudness will be adjusted when played back on a given streaming service. The result is given in dBs, relative to the music's original loudness. In other words, it represents the change in loudness that a streaming service applies. For example, a Loudness Penalty value of -2 for YouTube indicates that the music will be turned down by 2 dB when played back there.

Negative Loudness Penalty Values

If your music has a negative Loudness Penalty value, it will be turned down, but that does not mean that it will be played back quieter than other songs! Rather, it should be played back at the *same* loudness level as other music, with the exception of very quiet music (more on this later). In fact, this is the goal of loudness normalization: to eliminate sudden jumps in loudness between songs.

For example, a song with a Loudness Penalty value of -2 will play back at the same loudness level as a song with a Loudness Penalty value of -4. The latter just needs to be turned down more because it is louder. But the obvious question is then: if it is going to be turned down anyway, why bother turning it *up* in the first place?

This is a great question! Achieving very high LUFS can be difficult, and sometimes has a negative impact on sound quality since it is often necessary to use heavy limiting or clipping. By targeting lower loudness levels, you can reduce the amount of processing needed, which causes less distortion and often allows you to achieve more space, depth and clarity in the sound while maintaining the same final playback loudness.

Finally, note that when your music is turned down by a streaming service, a simple, constant gain adjustment is used. No compression or limiting is applied to achieve the effect.

Positive Loudness Penalty Values

Most modern, mainstream music genres are mastered very loud, resulting in negative Loudness Penalty values, and they get turned down as a result. But some material will result in a positive Loudness Penalty value. In this case (you guessed it) the music *won't* be turned down and may be turned *up* by some services (see [How Streaming Services Increase Playback Loudness](#)).

If your music has a positive Loudness Penalty value, you might decide to master it louder, without having to worry that it will be turned down after uploading. For example, if your music has a Loudness Penalty of +2 on a particular service, you could safely increase the loudness by up to 2 dB without triggering any level reduction.

Remember to consider the context, though. Research shows that 80% of listeners think that an

acoustic ballad shouldn't sound as loud as a full-tilt rock song, even when listening in "shuffle" mode. Just because the Loudness Penalty value tells you it is *safe* to increase the loudness of your music, that doesn't mean you necessarily *should*.

How Streaming Services Increase Playback Loudness

It turns out that raising playback loudness is not quite as straightforward as lowering it, due to the risk of exceeding 0 dBFS and introducing clipping. Because of this, there is more variation in how each service handles loudness increases.

YouTube, TIDAL, Amazon Music and Deezer don't turn quieter songs with a positive Loudness Penalty value up. This means that your music may not sound as loud as other material, so you might want to consider increasing the loudness prior to uploading.

Apple tries to prevent level increases that might cause clipping. This means that in some cases, where the Loudness Penalty is positive, it won't be possible to increase the level enough to achieve equal perceived loudness with other material.

Spotify has several different levels for loudness normalization: Normal, Loud and Quiet. Loudness Penalty values are based on the Normal setting, which is the default. The Loud mode is intended for listening in noisy environments, has a distribution loudness that is 3 dB higher than Normal, and uses a limiter to prevent clipping for positive Loudness Penalty values. The Normal and Quiet modes do not use a limiter but instead restrict gain increases of quiet songs based on the song's true peak level. For example, a -16 LUFS song with a -2 dBTP level would be increased by 1 dB (in Normal mode) to a level of -15 LUFS and a true peak of -1 dBTP.

For all services, the "safest" and most predictable method is to increase the loudness of your music until it no longer has a positive Loudness Penalty value. You can do this using custom dynamics processing and Loudness Penalty Studio's preview feature to ensure that you're entirely happy with the way your audio sounds.

Neutral Loudness Penalty Values

A Loudness Penalty value of 0 indicates that the audio's loudness will not be adjusted. There are several possible reasons for this:

1. The audio already matches the distribution loudness of the service closely
2. The audio is lower than the distribution loudness, and the service in question doesn't increase playback gain (e.g., YouTube and TIDAL)
3. The service in question does increase playback gain, but only if peak levels remain below a certain threshold (e.g., Spotify)

In each case, the first step is to use preview mode to compare your audio with a suitable reference track. If you're happy with the result, no further action is necessary; otherwise, you may want to adjust your processing.

Album vs. Track Normalization

There are two ways of applying loudness normalization: Track normalization and Album normalization. The names of the modes reflect the way normalization levels are applied.

In Track mode, each audio file is normalized individually. The intention is to achieve more consistent results for "shuffle" playback and noisy listening environments, but in practice, we've found it can sometimes sound strange. Songs intended to sound quiet are played at a similar level to songs that are meant to sound loud, which sounds unnatural in some cases. Track normalization also changes the song-to-song balance in albums, which can interfere with the intended artistic result. YouTube and Pandora only ever use track normalization.

In Album mode, all the songs in an album are adjusted by the same amount, based on either an overall measurement or the loudest song. This retains the artistic song-to-song loudness relationships in an album, which in our experience sounds more natural, even in shuffle playback. Both Spotify and Apple use album normalization when appropriate.

Album Mode is important to understand, because TIDAL *a/ways* uses the Album Mode adjustments, even when playing single songs or in shuffle mode. This can introduce added complexity since Loudness Penalty Studio can only calculate the Album Mode value for files that are included in the current project. For an actual album, this will give a completely accurate result on all platforms. In playlists on TIDAL, more care must be taken since the application will not be aware of the potential impact on Album Mode values for songs that aren't included.

The “Ideal” Loudness Penalty Value?

Some people say that the variation in Loudness Penalty values between some services means we should create multiple masters, each optimized for a specific service. This is often impractical though, since most aggregators only accept a single file and submit it to all services.

In fact, in our experience the idea of using a particular service’s distribution loudness as a “target” is misguided. It doesn’t make sense for an acoustic ballad and a heavy rock song to both be mastered at the same loudness, for example. Differences between songs are desirable to get the right musical and emotional impact, which is why album normalization works well.

This means the real challenge is to find a loudness for your audio that achieves a sound you’re comfortable with across all the services. While it is not possible to find a "perfect" value for every service, in our experience it is possible to find a satisfying compromise that works well. The exact strategy you decide to use depends on your goals. In this section, we will look at some examples.

Strategy 1: Maximum Loudness on All Services

To achieve maximum measured loudness on all services, you need to ensure your music matches the highest distribution loudness level of all services that don’t turn quiet material up. At the time of writing, this means -14 LUFS.

(There’s no benefit in terms of measured loudness to going higher than this since the level will simply be reduced. However, you may well choose to exceed it for artistic reasons. At the same time, if your music is substantially lower in level, it won’t sound as loud as you might like.)

Other services will turn the music down further because their distribution loudness levels are lower, but that’s OK as they treat all their content in the same way. You will leave a certain amount of peak headroom unused, but in mainstream genres that’s not necessarily a cause for concern. Whereas if you optimize for a service with a lower distribution loudness, your music may not sound as loud as you would like on the louder services.

As a rule of thumb when aiming for the loudest playback, a small negative Loudness Penalty value on YouTube is OK. Large negative Loudness Penalty values should still be avoided though in our experience, as songs like this can sound “smaller” than those with less negative Loudness Penalty values, and will probably be turned down even further on other services.

Strategy 2: Streaming Quality and Musically Balanced Dynamics

If being as loud as anything else on the service isn't your main priority, we recommend you aim for the loudest song on the album to have a Loudness Penalty value of 0 on TIDAL.

TIDAL currently has the highest streaming quality of all the services supported by Loudness Penalty, and because it uses album normalization at all times (even in shuffle play), you can rely on it to maintain the intended musical balance between songs. By targeting a Loudness Penalty value of 0 for the loudest song on your album, you ensure that the loudest moments of your album balance with everything else on the service, and this will also be reflected on services that don't boost quieter songs (e.g., YouTube).

Strategy 3: Maximum Dynamics and Complete Musical Freedom

Ignore the Loudness Penalty value completely! This may sound silly, but it is a genuine suggestion. You just have to accept that your music's loudness may not be treated exactly as you would prefer on all the services. You can still use Loudness Penalty Studio to preview what the practical effects will be for your music, and make some adjustments if you'd like, but you may find it works out fine to master your music exactly as you choose, with no consideration for streaming loudness.

Conclusion

You may decide that any one of these approaches is best for you, or that none of them fit your needs, in which case you will develop your own strategy.

Whatever you choose, the most important feature is always the preview. The numbers themselves aren't important, the question is how does the music sound as a result of those numbers, in each different situation? There's rarely a perfect answer, and streaming services are constantly refining and updating the way they match loudness, so this will always be a moving target.

Nonetheless, we believe that knowledge is power, and by using Loudness Penalty Studio to assess and preview your audio, you will have all the knowledge and understanding you need to make the best possible decisions. We hope you agree!

Appendix: Comparing the Streaming Services

This table summarizes the most important differences between each of the streaming services, plus some extra details we haven't discussed yet:

	Distribution loudness in LUFS (approx.)	Normalization enabled by default?	Normalization type	Are quiet songs turned up?	Is limiting used?
Apple	-16	Yes	Both	Yes	No
Amazon	-14	Yes	Track	No	No
Deezer	-15	Mandatory	Track	No	No
Spotify	-14	Yes	Both	Yes	Both
TIDAL	-14	Yes	Album	No	No
YouTube	-14	Mandatory	Track	No	No

Spotify

Spotify has three user-selectable normalization levels: Loud, Normal and Quiet. Normal is the default mode and the one that Loudness Penalty values are based on. The Loud normalization level is 3 dB higher than Normal, while the Quiet level is 9 dB lower.

Spotify uses a limiter to prevent clipping when increasing the loudness of songs in Loud mode. It engages at -1 dBFS, with a 5 ms attack time and a 100 ms decay time. In the Normal and Quiet modes, no limiter is used. Instead, Spotify caps the gain increase so that the song's maximum true peak level does not exceed -1 dBTP.

TIDAL

TIDAL always uses album normalization, which gives more satisfying musical results, even in shuffle. The loudness is decided using the loudest song on the album, so the largest, negative Loudness Penalty value will be applied to all the songs on the album.

Deezer

The default playback volume for Deezer is -6 dB, but Loudness Penalty values are based on the volume slider being at maximum (i.e., 0 dB). So, to determine how loud a song will play back at the default playback volume, simply subtract 6 dB from the Loudness Penalty value.