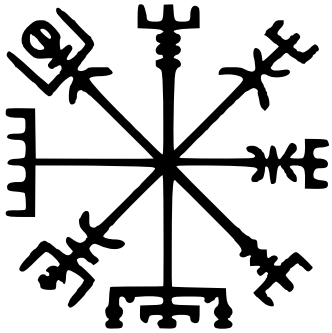
Vulture Sisyphus
— 041 —
2014

YGGDRASILL

FOR PIANO AND ACOUS-MATIC SOUNDS



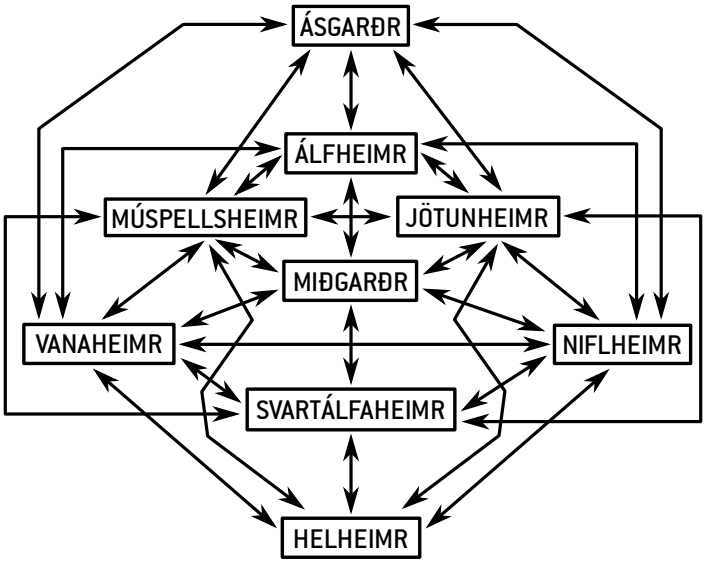
MARCUS ALESSI BITTENCOURT

W.G. COLLINGWOOD 1908

MARCUS ALESSI BITTENCOURT

YGGDRASILL

FOR PIANO AND ACOUSMATIC SOUNDS



Vultur Gryphus

2014

— 041 —

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— Maringá-PR, Brazil : Vultur gryphus (author's editions), 2014.

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MARCUS ALESSI BITTENCOURT

YGGDRASILL

FOR PIANO AND ACOUSMATIC SOUNDS

General Explanations and Performance Instructions

INTRODUCTION

Yggdrasill is a work for solo piano and pre-recorded acousmatic sounds. All the electroacoustic operation is designed to be controlled solely by the pianist during performance, and that is accomplished by means of a computer program implemented by the composer with the free software Pure Data, a visual programming environment for real-time processing of data, audio, and video (*http://www.puredata.info*).

Yggdrasill proposes a microtonal sound universe illustrating the homonymous legendary tree from Norse mythology that provides connections to nine realms or different realities, each populated by one of several mythical beings: *Vanaheimr* (the home of the *Vanir* gods), *Svartálfaheimr* (the home of the Dark Elves), *Jötunheimr* (the home of the Frost Giants), *Múspellsheimr* (a world of fire and lava), *Helheimr* (hell, the land of the dishonorable dead), *Niflheimr* (a world of ice and snow), *Miðgarðr* (the home of the Humans), *Álfheimr* (the home of the Light Elves), and Á*sgarðr* (the home of the *Æsir* gods). Above this sound universe we hear the wanderings of a piano and its 12-tone equal temperament, which interacts in surprising ways with the microtonal elements present in the acousmatic sounds.

THE SCORE FOR THE WORK

To help and guide the pianist in the performance of the work, its score includes a graphical representation of the pre-recorded part of acousmatic sounds, which depicts the basic structure of the definite-pitch notes of the composition, written in proportional notation in relation to a temporal ruler measured in minutes and seconds. In this notation, each definite-pitch note has its beginning represented by a black stemless notehead, and its duration is indicated by means of a horizontal gray rectangular shape which prolongs itself until the respective ending of that note. In the notation, the differences in amplitude of the sounds are indicated by the use of noteheads of different sizes, so that the bigger the notehead is, the louder its respective sound is. The resultant sums of all sound events in each of the two main groups of acousmatic sounds (unpitched sounds versus pitched ones) have their amplitude fluctuations also indicated as graphs of time versus energetic amplitude, which are positioned aligned and parallel to the time ruler and underneath their respective staves, whenever these are present. The definite pitches of the electroacoustic acousmatic sounds – which are microtonal – are indicated in the score approximated to the nearest equal-temperament eighth-tone, considering A4 = 440 Hz. Figure 1 shows the symbols adopted in the score for the microtonal accidentals.

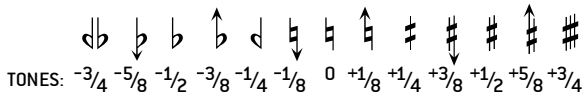


Figure 1.
Table of symbols for the microtonal accidentals adopted, in equal-tempered eighth-tones.

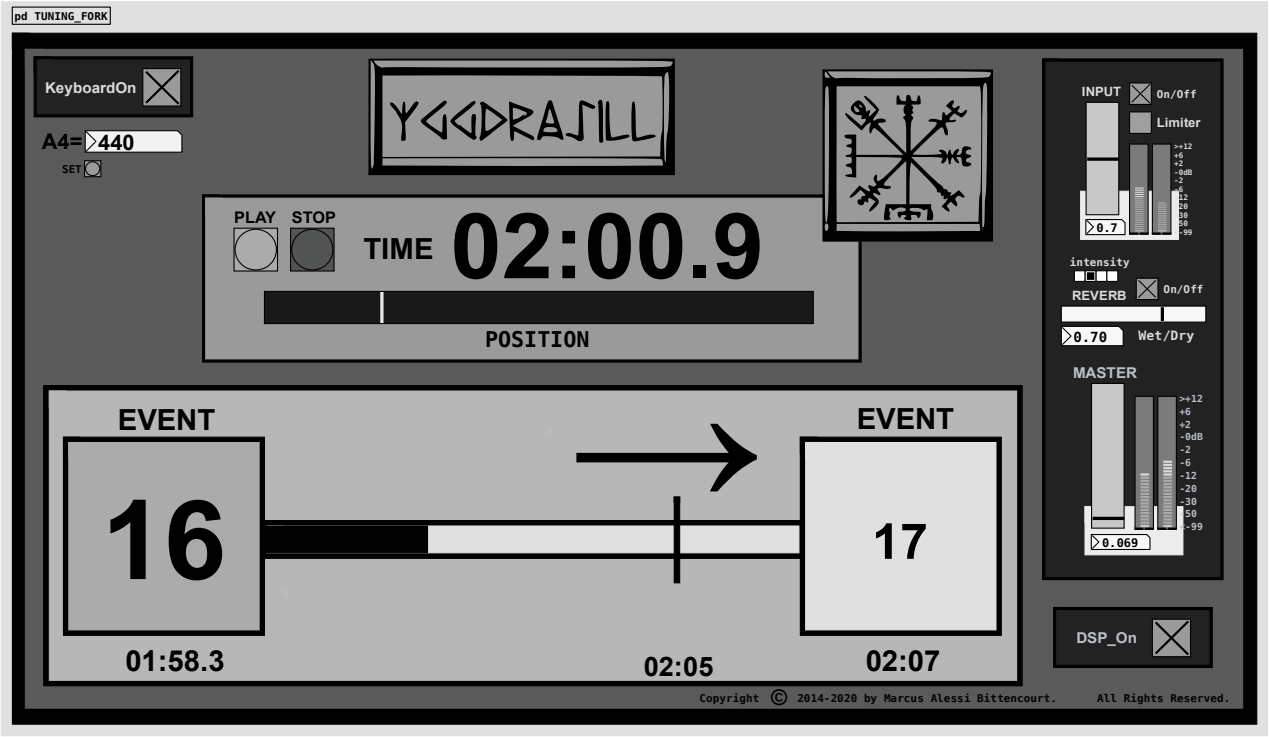


Figure 2.
Main interface for the Yggdrasill Player.

To further depict the acousmatic sounds, the score also makes use of a modified version of the graphic symbols and notation methodology created by Norwegian composer Lasse Thoresen for his 2007 adaptation of Pierre Schaeffer's typomorphology of the sound objects [Thoresen, Lasse, and Hedman, A. "Spectromorphological analysis of sound objects: an adaptation of Pierre Schaeffer's typomorphology." *Organised Sound*, v. 12, issue 02 (August 2007): 129-141]. The non-standard music notation symbols used in the score, including those which were adapted from Thoresen's symbology, are all explained in the table of symbols shown on page VI of this preface.

The piano part is meant to be synchronized to the pre-recorded acousmatic sounds just about as indicated in the score, which is reasonably accurate in its indications of the durations of the musical fragments. The pianist must play each of the 47 piano events starting at the time points indicated in the score, playing always at the given metronome marking, which should guarantee a proper synchronization with the acousmatic part. Nonetheless, as long as the entry points and playing speed are accurately respected, there is no need for an obsessive millimetric synchronization between the pianist and the pre-recorded sounds. As such, the pianist is indeed allowed leeway in the synchronization with the acousmatic part, provided that the performance choices made do remain within the constraints established by the score.

THE PERFORMANCE SOFTWARE

General description

The Yggdrasill Player, which is the piece of software responsible for the playing the pre-recorded acousmatic sounds of the piece, consists of a single PD (Pure Data) patch containing several subpatches of diverse complexity levels. The Pure Data version used to program the Yggdrasill Player was the version pd-0.51.0 *vanilla*, with the addition of the extra libraries *zexy* and *ggee*. The Player's patch contains a main graphical interface that hides from the musician all the complexity of its subpatches, and it presents in a simple way important information to the piano player, while providing also all the controls and buttons necessary for the musician to operate live the work's pre-recorded acousmatic part.

The Yggdrasill Player's interface

The main patch of the Player serves as interface between the musician and the audio processing machine. This interface contains elements that turn on and off the execution of the pre-recorded acousmatic sounds, as well as VU meters and faders that control the dynamic levels of the main audio output and mic input. The interface (seen in figure 2) indicates the temporal position of the pre-recorded acousmatic sounds and, in the context of rehearsals, the time slider also allows the pianist to control the starting time for the playing of the pre-recorded part, thus facilitating the quick access to any point in the work.

Some of the Player's commands can be activated by simply pressing the computer's QWERTY keyboard, always without the need for pressing the "enter" key. To activate this feature, there is a switch placed at the top left of the interface screen. The computer keys used for control and quick access are:

- [Insert] — to start or interrupt Pure Data's general audio processing (DSP on/off);
- [Spacebar] — to start or stop the playing of the pre-recorded acousmatic sounds;
- [UpArrow] and [DownArrow] — to respectively increase or diminish the master volume of the final output audio signal;
- [q] e [a] — to respectively increase or diminish the volume of the input for the piano amplification;
- [LeftArrow] e [RightArrow] — to respectively diminish or increase the wet/dry value for the reverberation of the amplified piano input;

On the Virtual Conductor

The main patch of the Player also provides indications to facilitate the synchronization between the pianist and the pre-recorded part, which is done by means of a graphic animation that serves as an automated virtual conductor. The virtual conductor part of the interface (seen in figure 3) works as a sort of hourglass and contains two squares, which represent the current piano event and the next future one. These squares are connected by a narrow horizontal rectangle which gets filled in dark black color as the current ongoing event unfurls in time. The time the hourglass takes to completely fill the horizontal rectangle is exactly the time difference between the respective starting time points of the two events represented by the squares (which are also marked underneath each square). When the starting time of a piano event occurs, the respective number of that event is shown at its biggest size and its surrounding square changes its color to green. As this event unfurls in time, its number gets progressively smaller in size and the horizontal rectangle which connects the two event squares gets progressively filled in dark black, reaching towards the opposite square, which represents the arrival of the next future event. The vertical barline placed at some point along the course of the horizontal rectangle indicates the time point where the current ongoing event is supposed to finish. When the black column reaches that middle point, the square representing the current event will change its color to red, indicating that the event should have ended by then.

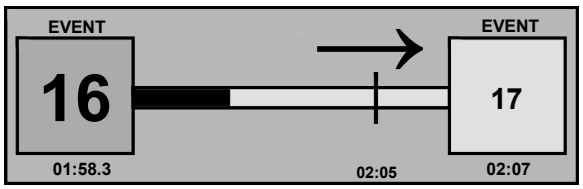


Figure 3.
Graphic interface for the Virtual Conductor.

As the hourglass column fills in black from one side to the other approaching the new future event, the respective number for that future event progressively increases in size and its surrounding square changes its color first from gray to red (which indicates we are still far away from its starting time), then to yellow (when we are close at arriving at its starting time), and finally to green (which indicates the very occurrence of its beginning). After the beginning of a new event, the hourglass starts flowing in the opposite direction towards the opposite square (which now represents the next future event), and all the actions

described earlier repeat in the same manner, continuing until there are no more piano events to happen. A blinking arrow also helps to indicate the direction of the hourglass flow, and this arrow blinks exactly at the metronomical tempo indicated in the score and needed for the correct synchronization between the piano and the pre-recorded part.

ON THE PERFORMANCE OF THE WORK

Gear Positioning and Configuration

The piano can be played either with or without amplification. When desired, the piano can be amplified by the use of either dynamic or condenser microphones, according to the usual stage sound-reinforcement methods, always taking care of protecting the audio system from microphone feedback. When amplified, the piano can be also sent through a reverberating unit, which is included in the Player software, right under the input controls, in the top right corner of the interface. The reverb unit is pre-programmed with four reverb-intensity presets, with controls for wet/dry mixture. There must be always at least two loudspeakers (for achieving a proper stereophonic effect), and they should be mounted on appropriate stands and placed on the stage, around a couple of meters or so behind the piano, turned towards the audience. The distance between the speakers should be as wide as it is possible without ruining the stereophonic effect. The idea here is to have the acousmatic part sounding as if somewhat placed onstage around the piano. If desired, more than two loudspeakers can also be used to double the stereo tracks and spread them more effectively across the stage, surrounding the pianist. The output audio from the computer should be routed to the loudspeakers by means of the usual amplifiers and/or mixing consoles, which will also take care of routing the microphone inputs to the computer. The PD patch of the Yggdrasill Player runs in any modern standard personal computer under Linux, Windows or Mac OS X operating systems, preferably a system with at least a 2GHz dual-core processor and 1Gb of RAM, equipped with a proper sound card, which should be set to work with the smallest audio latency possible, preferably around 10 milliseconds or smaller, if the reverb unit is to be used. The computer must have Pure Data installed in it, in its *vanilla* 0.51.0 version or newer, with the libraries *zexy* and *ggee* installed, which are all freely distributed through the web (at *http://www.puredata.info*). The computer screen must be placed so that it is visible to the pianist, and its QWERTY keyboard must be positioned in the vicinity of the piano's music stand, allowing the pianist easy access to it while playing.

Use and Operation of the PD Patch

The software components for the work Yggdrasill come inside a single folder containing all the software parts necessary for the operation of the PD patch. The folder includes in its first level an executable script which automatically starts PD, loading it with all the needed libraries and flags, and opening the Yggdrasill Player patch. Alternatively, one can open directly in PD the patch *YggdrasillPlayer.pd*, making sure to have the libraries *zexy* and *ggee* loaded and to include the folder *libs* in PD's search path. Once the patch has been started in PD and the internal audio outputs from the computer have been routed to the onstage speakers (and also once the microphone inputs are routed to the computer), one must start the QWERTY keyboard monitoring (by clicking on the "KEYBOARD ON-OFF" toggle switch of the main patch), turn on PD's general digital signal processing (by clicking on the "DSP" toggle switch of the main interface, or by pressing the [Insert] key), and then regulate the master audio output level and the piano amplification input level, according to the particular conditions presented by the performance hall, which the pianist should investigate and experiment with during the rehearsals.

On the Tuning of the Reference Pitch

It is of the utmost importance that the acousmatic sounds and the live acoustic piano are in the same tuning level. The Yggdrasill Player defaults to working with a piano tuned exactly to a reference pitch of A4 = 440 Hz. In case the piano at hand is tuned to a different reference pitch, the patch is equipped with a subpatch device (seen in figure 4) to adjust the tuning level of the acousmatic sounds. To do

this, the pianist should click open the "TUNING_FORK" subpatch located at the upper left corner of the main interface, and then turn on that device and raise its volume. A sine tone will be heard, initially at 440 Hz, and one should compare it to the piano's A4. One should move the device's "PitchBend" fader to the right or left to adjust the pitch of the sine tone up or down, respectively, until it matches in unison the specific A4 of the piano. After that, click on the "SET" button and the playing of all the acousmatic sounds will be readjusted to the specific tuning level of the piano used. After the tuning procedure is done, do turn off the tuning device, lower its volume all the way down, and close its subpatch window. If the tuning level is previously known, one can also type in the value of A4 in Hertz directly in the main patch using the number box marked "A4=" located immediately under the "KeyboardOn" toggle control, at the upper left corner of the interface.

Do notice that this change in tuning is effected by means of changing the playing speed of the pre-recorded part. Because of this, depending on the tuning adjustment made, the time displayed in the clock will flow slightly slower or faster than normal. Also, the metronomical arrows in the virtual conductor interface will blink at a slightly slower or faster rate, to reflect the adjustment in playing speed.

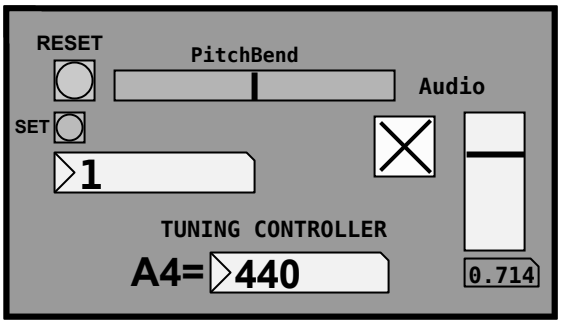


Figure 4.
Interface for the tuning device subpatch.

The Performance of the Work

Once all the needed gear is assembled, well-tuned, calibrated in regards to the main volume level, input level and its reverberation, and the QWERTY keyboard and software DSP are switched on, to perform the work one should simply initiate the pre-recorded sounds by clicking on the [Spacebar] key and follow the instructions provided in the score, guided by the virtual conductor. During the course of a performance, the pianist should only have to adjust volume levels in order to overcome uneven sound responses from the concert hall or if needed during an emergency, in the case of unforeseen mid-performance mishaps. At the end of the work, it is convenient to turn off the audio processing of the Player (using the [Insert] key) prior to the pianist leaving his/her post.

Total length of the work: 09' 30".

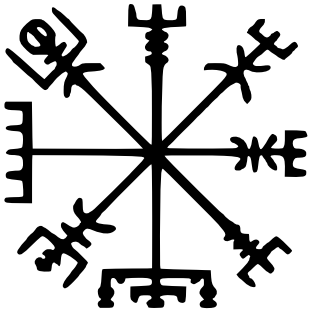


TABLE OF SYMBOLS FOR THE EXTENDED STAFF NOTATION

TYPES OF OCCUPANCY OF FREQUENCY SPECTRAL SPACE
(*critère typologique de masse* [Th: 133] [GOS: 145])

- pitched sound of unvarying mass with multiple harmonic partials (*son tonique* [Th: 133] [GOS: 119])
- unpitched sound of large unvarying mass (*son complexe* [Th: 133] [GOS: 120])

TYPES OF ENERGETIC SUSTAINMENT
(*critère typologique de facture* [Th: 133] [GOS: 122-3])

continuous

TYPES OF EXCENTRIC SOUND OBJECTS
(*objets sonores excentriques* [Th: 133] [GOS: 132])

accumulation (*accumulation* [Th: 133-4][GOS: 137-8]); in this case, one comprised of unpitched sounds of unvarying mass

TYPES OF ONSET
(*attaques* [Th: 138] [GOS: 156-8])

dal niente onset [Th: 138] [GOS: 156-8]

TYPES OF ENDING [Th: 138-9]

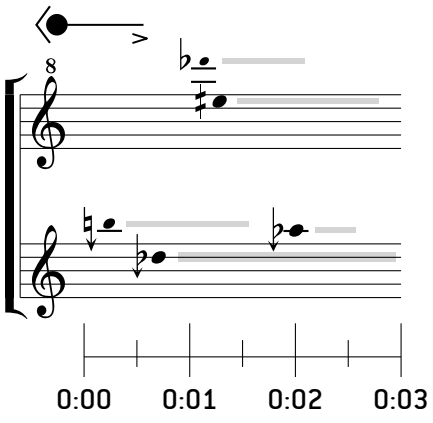
soft ending (ending is rounded off by a *diminuendo*)

MICROTONAL ACCIDENTALS USED

TONES: $^{-3}/_{4}$ $^{-5}/_{8}$ $^{-1}/_{2}$ $^{-3}/_{8}$ $^{-1}/_{4}$ $^{-1}/_{8}$ 0 $^{+1}/_{8}$ $^{+1}/_{4}$ $^{+3}/_{8}$ $^{+1}/_{2}$ $^{+5}/_{8}$ $^{+3}/_{4}$

microtonal pitches are indicated in the score approximated to the nearest equal-temperament eighth-tone

SPECIAL FEATURES OF THE EXTENDED STAFF NOTATION



the typomorphological symbol indicates the type and envelope features of the sound object represented by each notehead instance

the notehead horizontal placement indicates the onset time of its corresponding sound object, according to the time ruler

the gray rectangle indicates the duration and ending time of the sound object

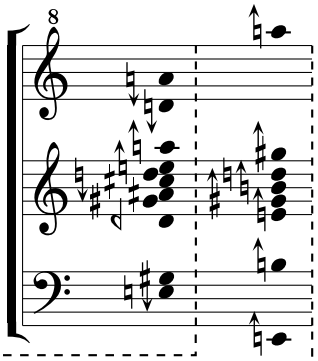
the noteheads of different sizes indicate the relative differences in the amplitude of the sound objects, the bigger, the louder

REFERENCES

[Th:] Thoresen, Lasse, and Hedman, Andreas. "Spectromorphological analysis of sound objects: an adaptation of Pierre Schaeffer's typomorphology." *Organised Sound*, v. 12, issue 02 (August 2007): 129-141.

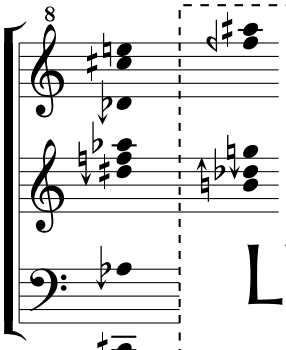
[GOS:] Chion, Michel. *Guide des objets sonores*. Paris: Éditions Buchet-Chastel, 1983.

YGGDRASILL
(the World Tree)
and the NINE REALMS

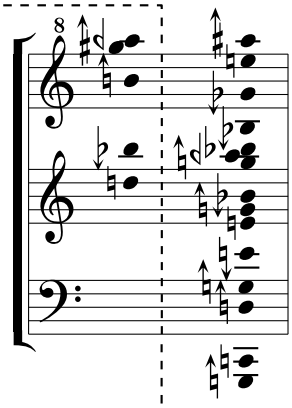


ÁSGARÐR
(home of the Æsir gods)

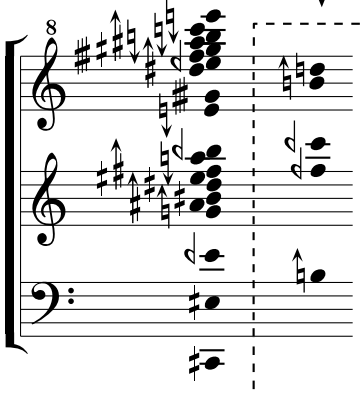
ÁLFHEIMR
(home of the Light Elves)

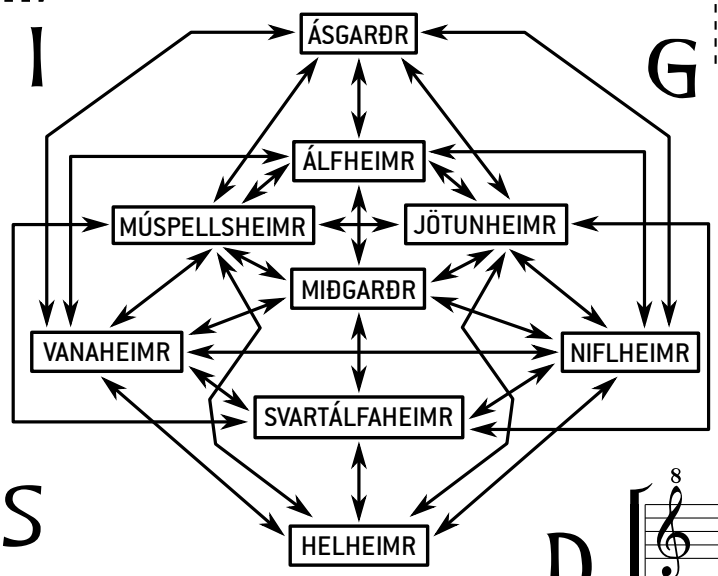


JÖTUNHEIMR
(home of the Frost Giants)

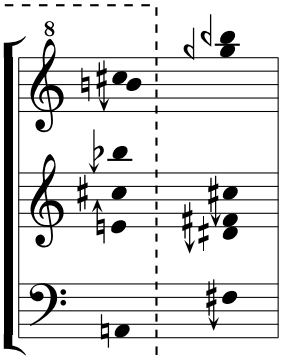


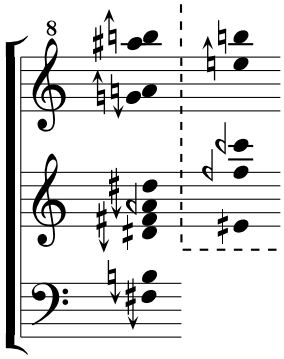
MÚSPELLSHEIMR
(a world of fire and lava)



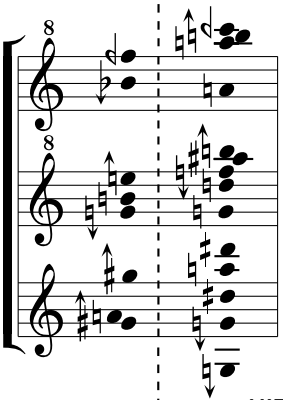


MIÐGARÐR
(home of the Humans)

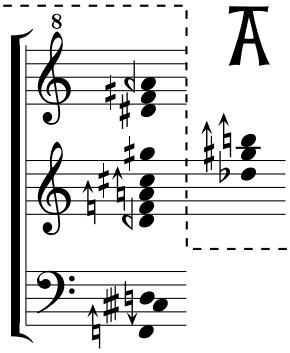




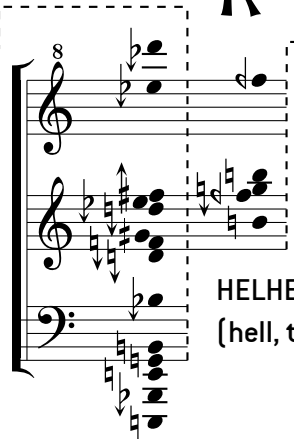
VANAHEIMR
(home of the Vanir gods)



NIFLHEIMR
(a world of ice and snow)



SVARTÁLFAHEIMR
(home of the Dark Elves)



HELHEIMR
(hell, the land of the dishonorable dead)

NOTE: accidentals apply to the measure, just as according to tradition. In spite of this, a great number of courtesy accidentals were placed throughout the score to facilitate reading. Pedal markings are to be executed accordingly. Pedalization of places without pedal markings is *ad libitum*.

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FOR PIANO AND ACOUSMATIC SOUNDS

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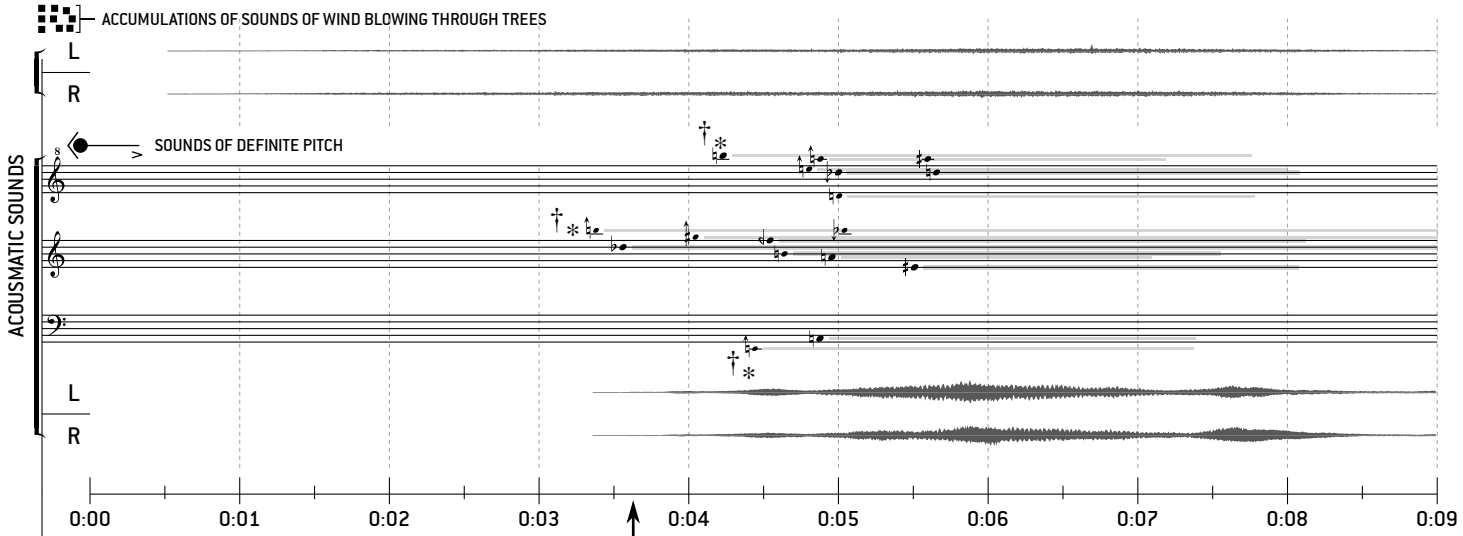
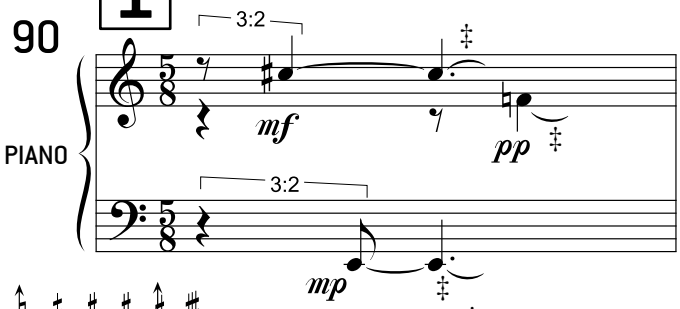


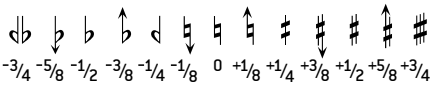
EVENT 1

♪ = 90

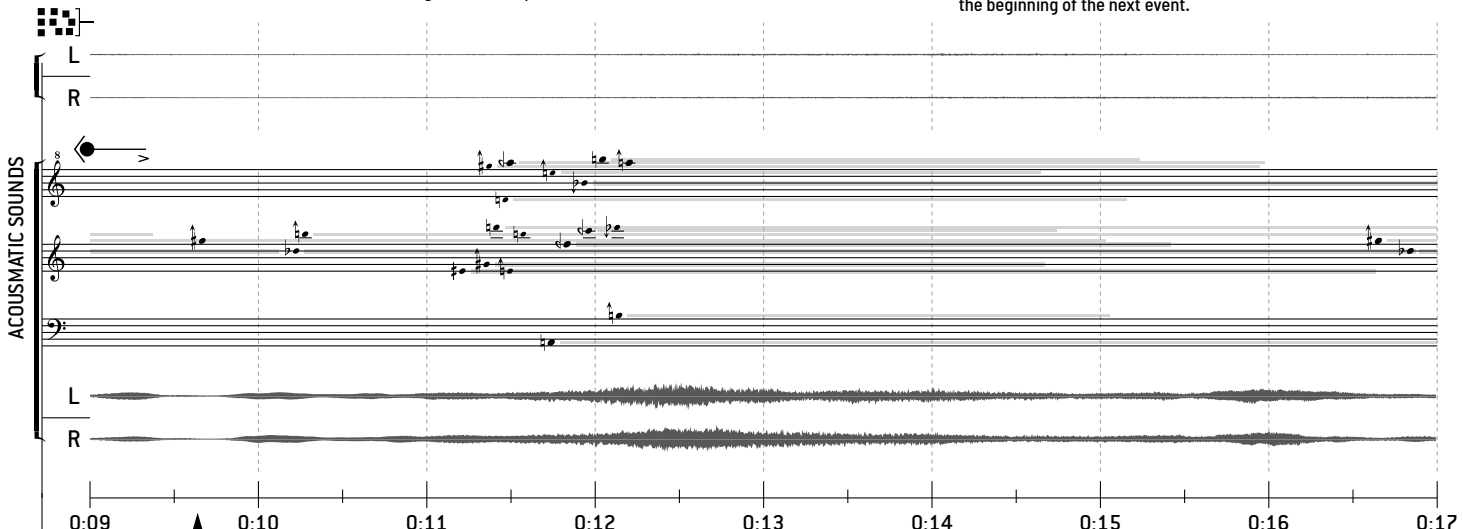


✻ The noteheads indicate the beginning of each pitched sound event, and the horizontal gray bars show their durations, all in proportional time notation in relation to the time ruler. The size of a notehead is proportional to its note's average intensity. The amplitude of the resultant sound mass is indicated by the graphic representation of its sound wave, which is a plot of time versus its energetic intensity. All pitched sounds always fade in *dal niente*.

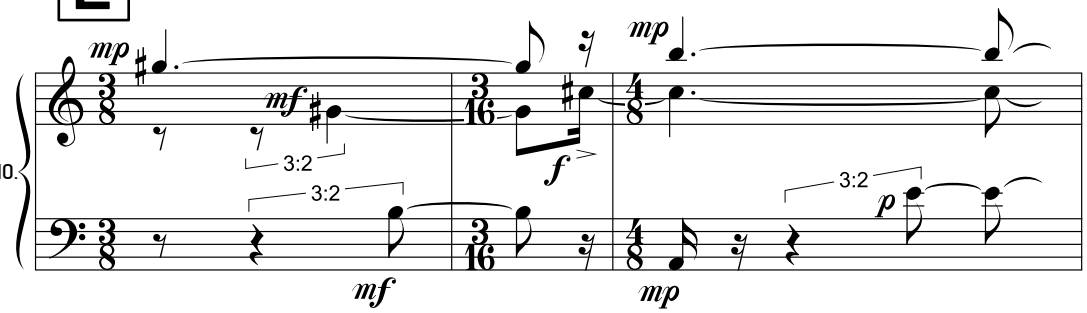
† Microtonal accidentals used:

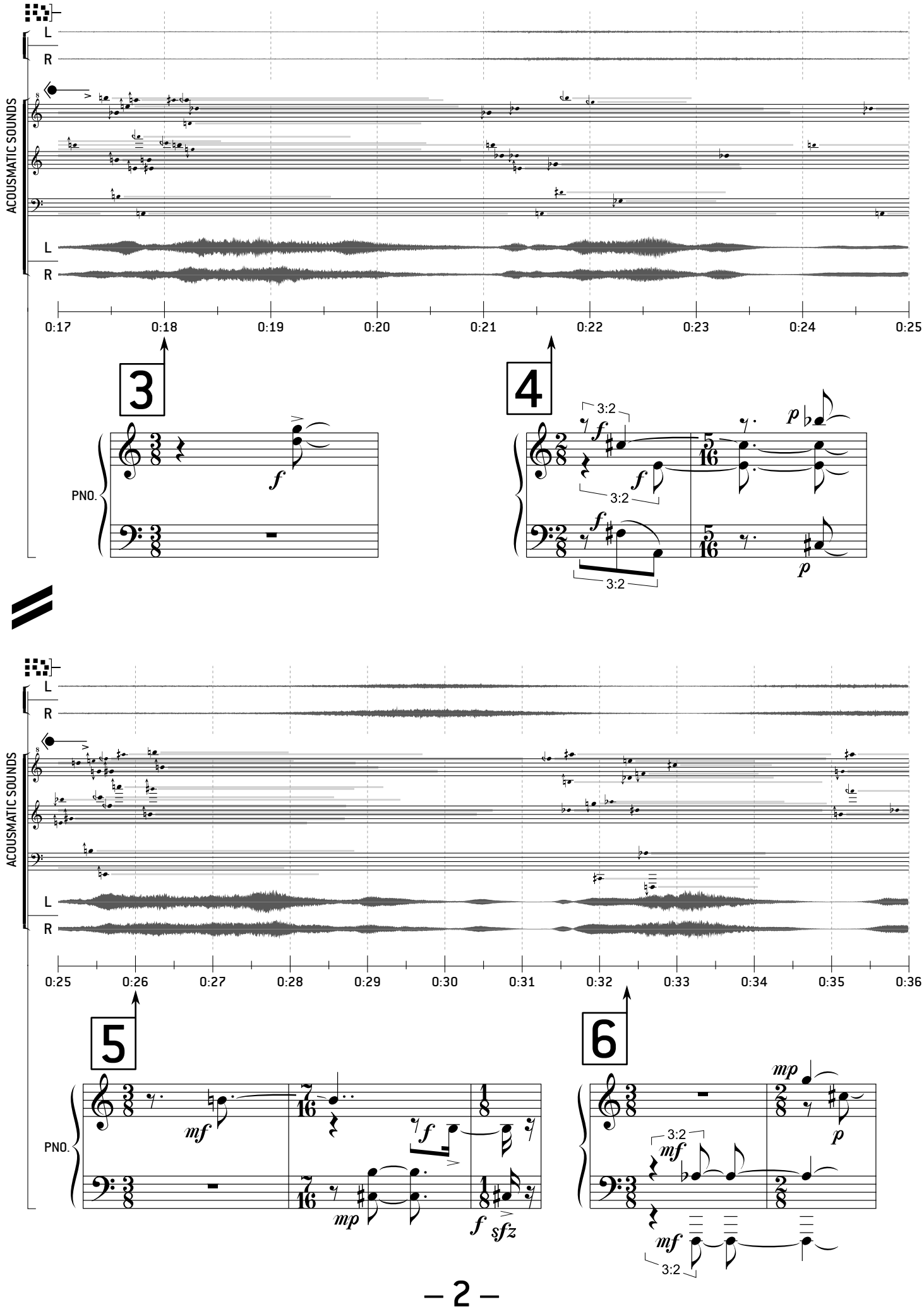


‡ *Lascia vibrare*, either until the next explicit prescription of a silence in the piano part or until the beginning of the next event.



2




ACOUSMATIC SOUNDS
L
R
0:17
0:18
0:19
0:20
0:21
0:22
0:23
0:24
0:25
3
4
PNO.
3:2
0:25
0:26
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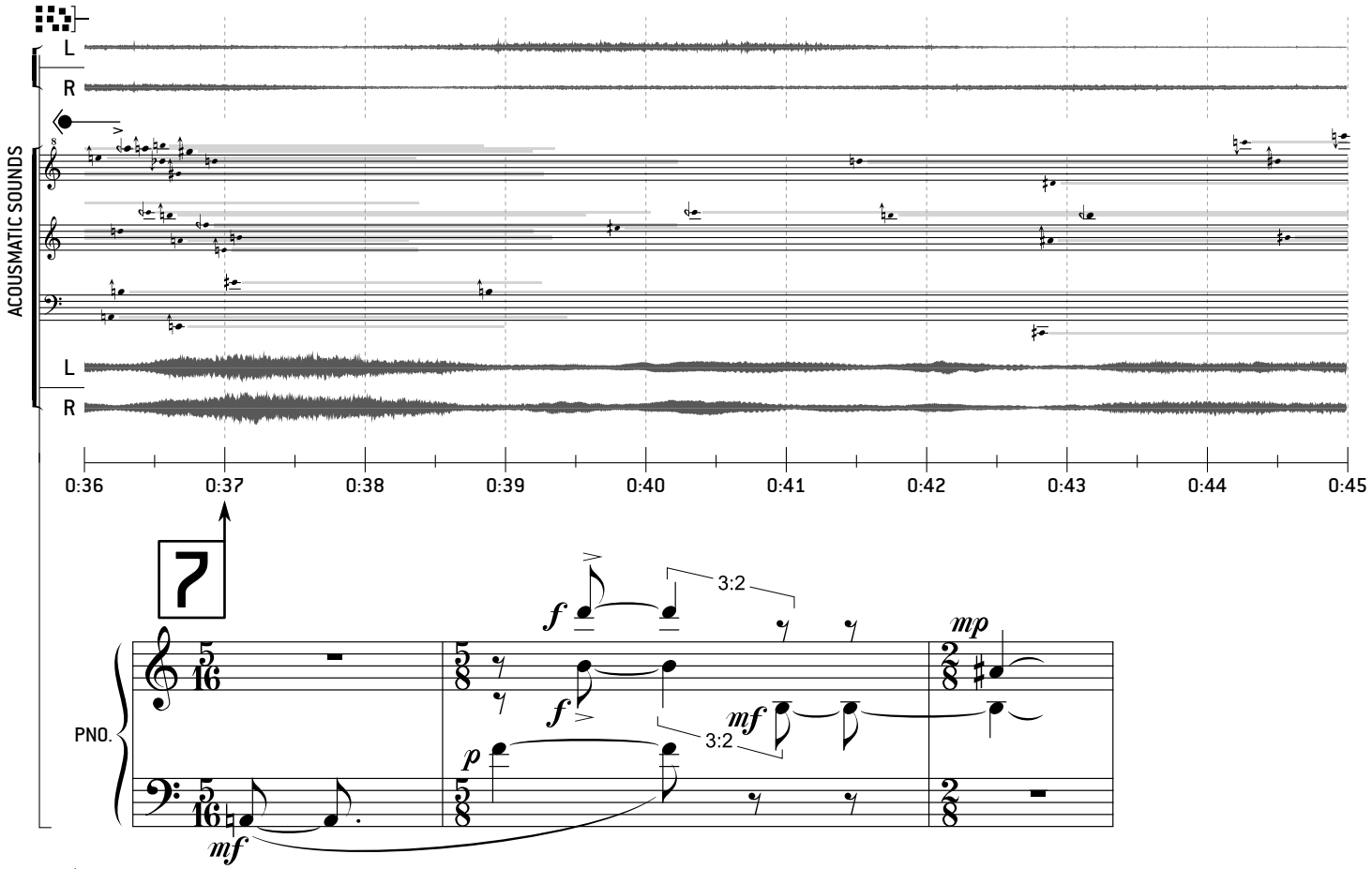
0:35
0:36
5
6


ACOUSMATIC SOUNDS
L
R
0:36
0:37
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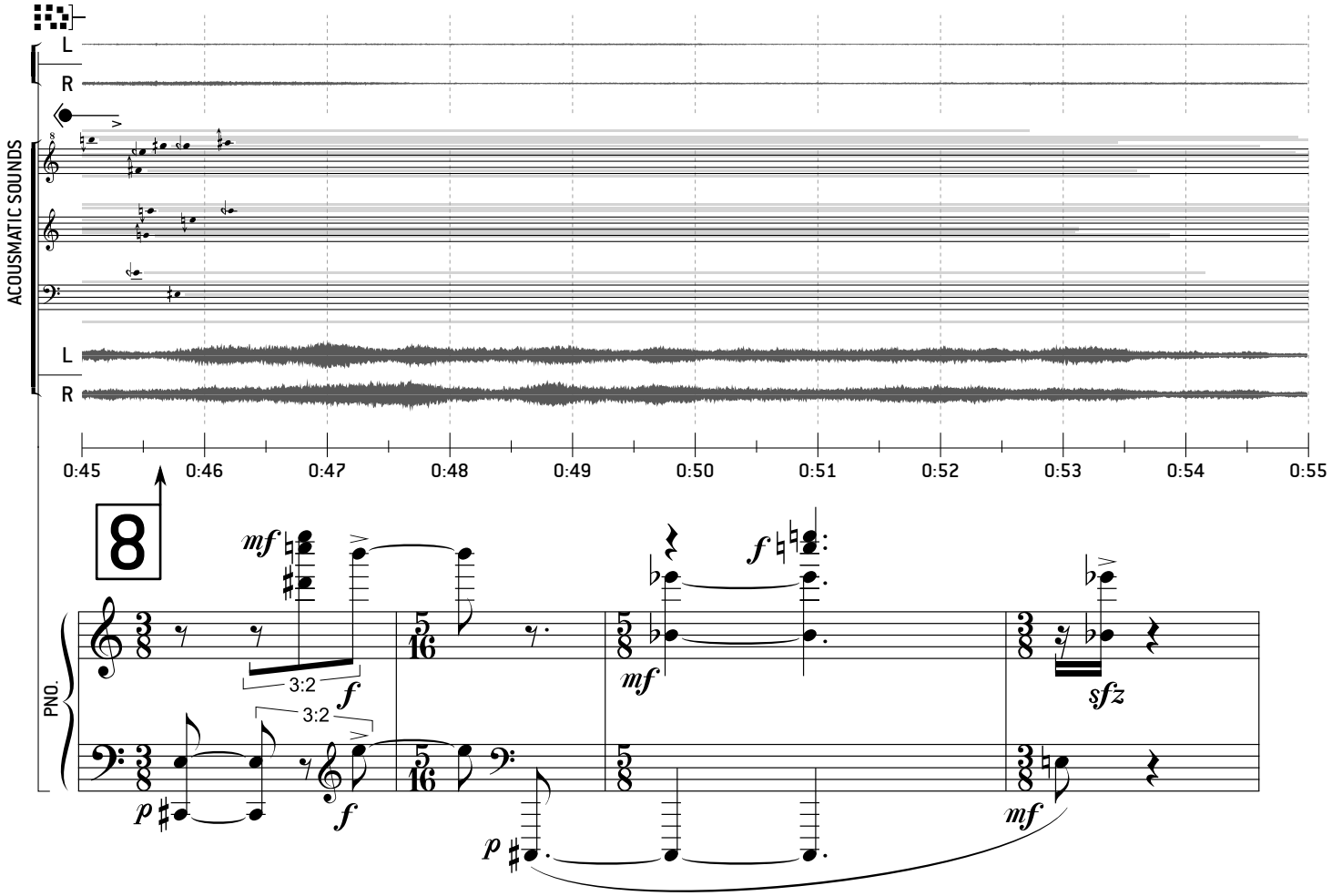
3:2


ACOUSMATIC SOUNDS
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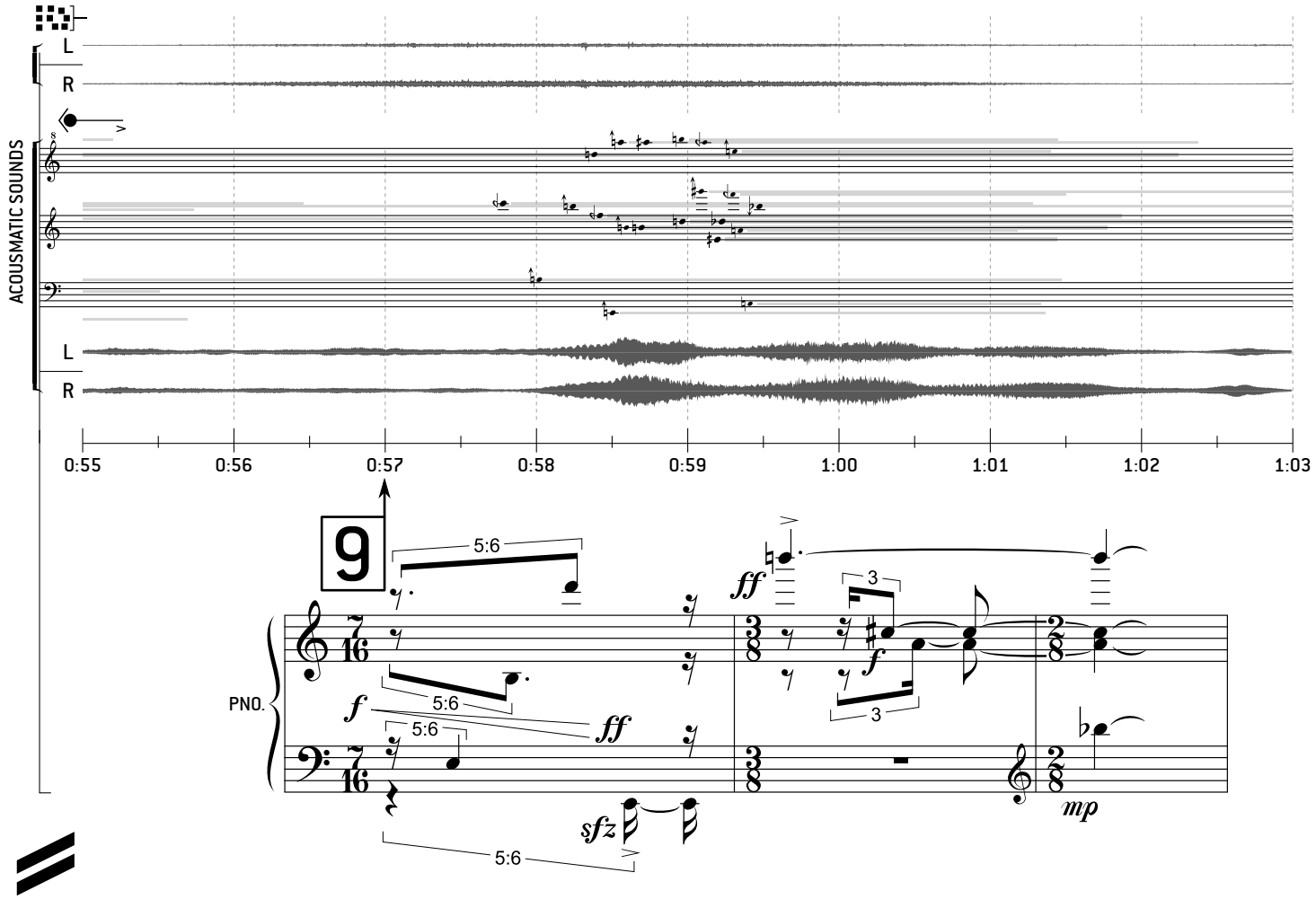
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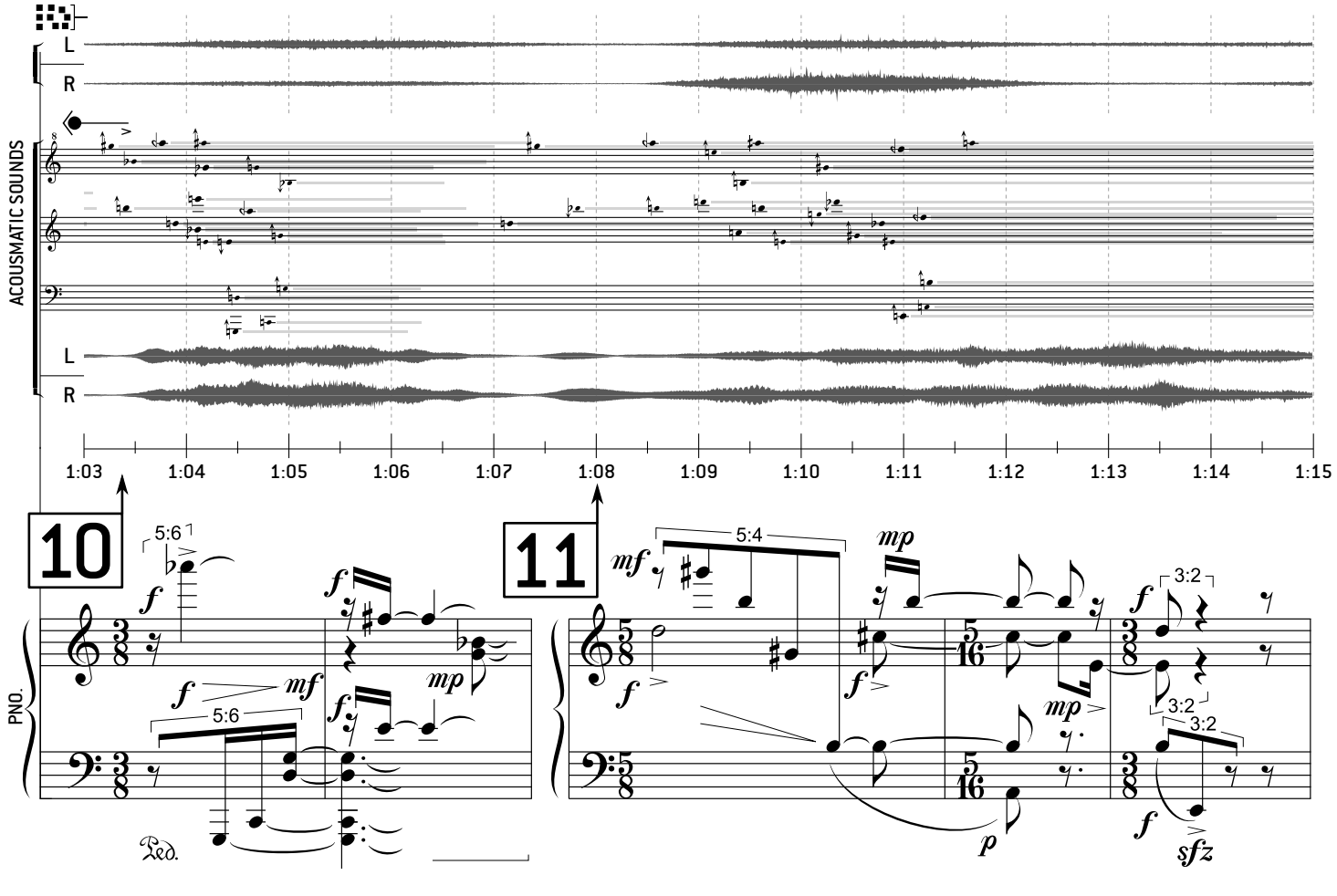
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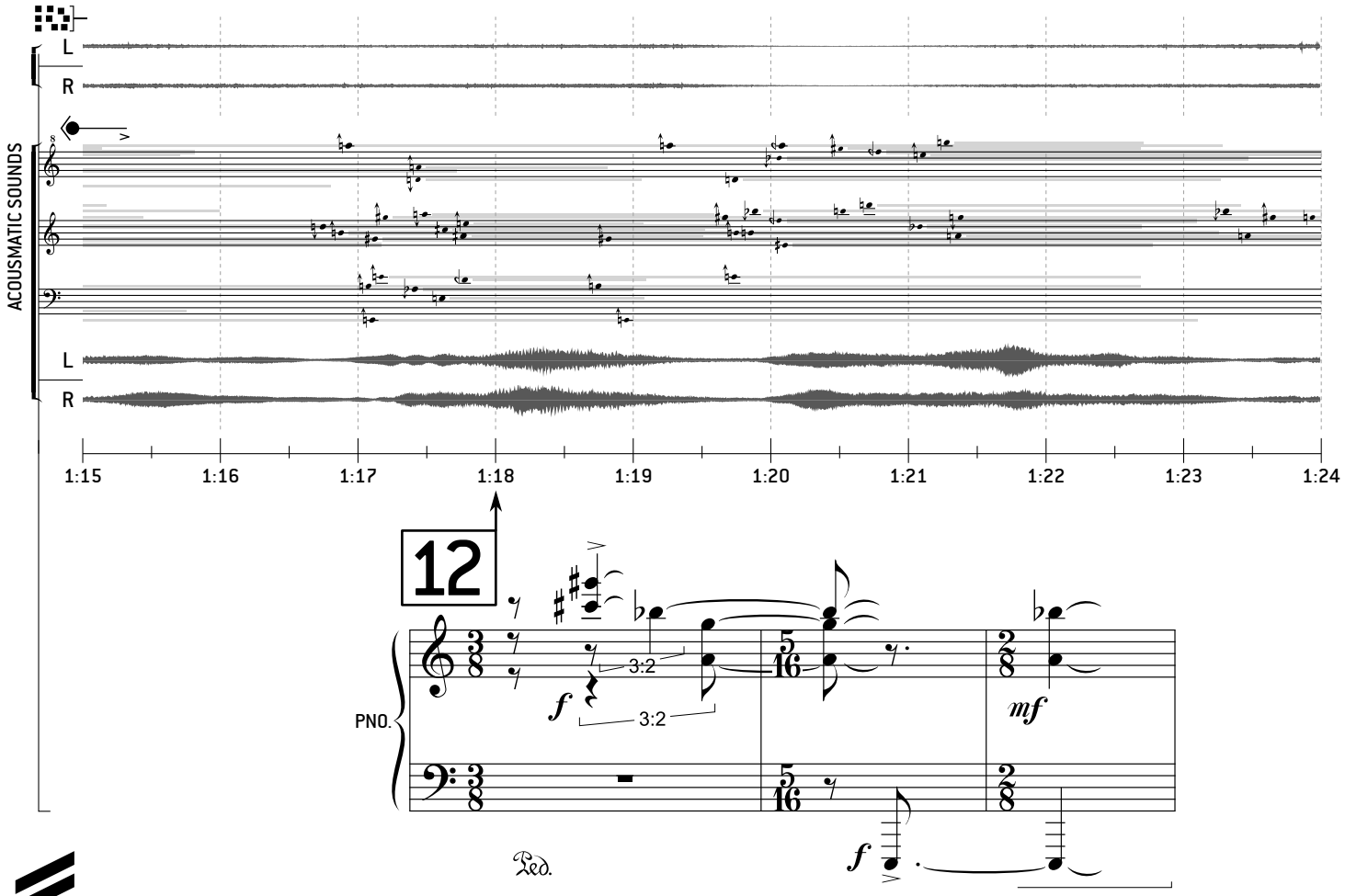
sfz
Ped.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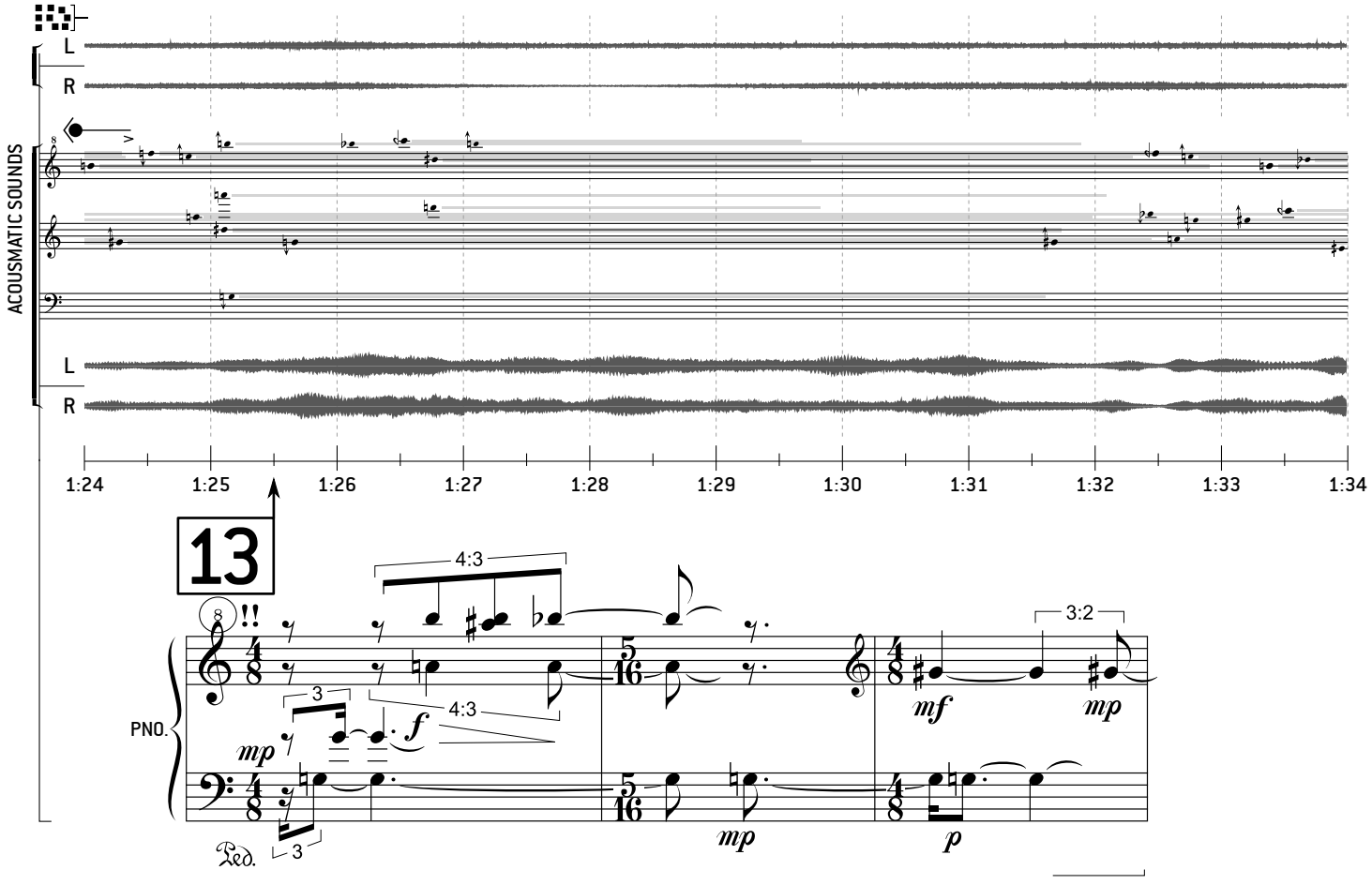
Ped.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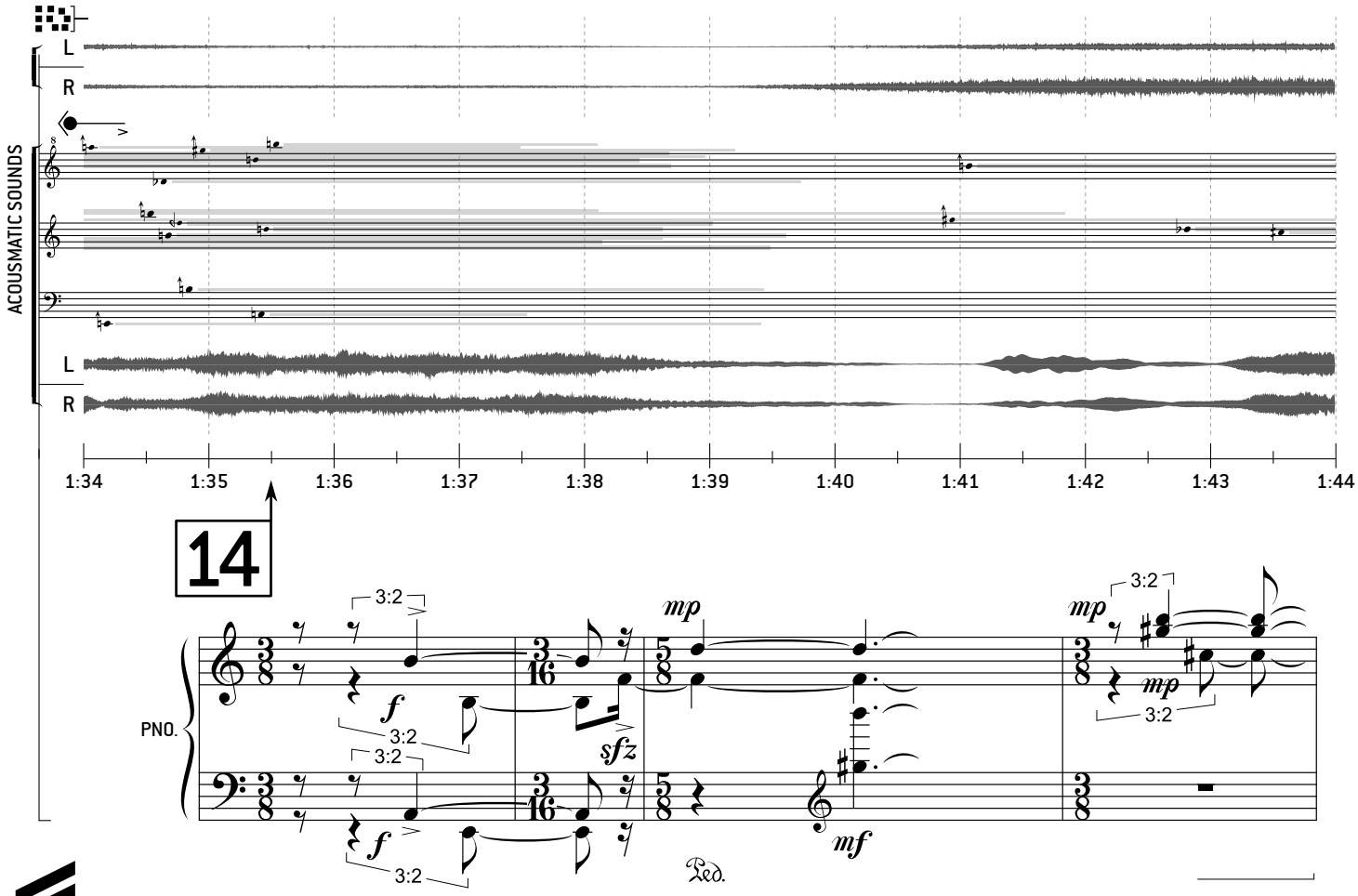
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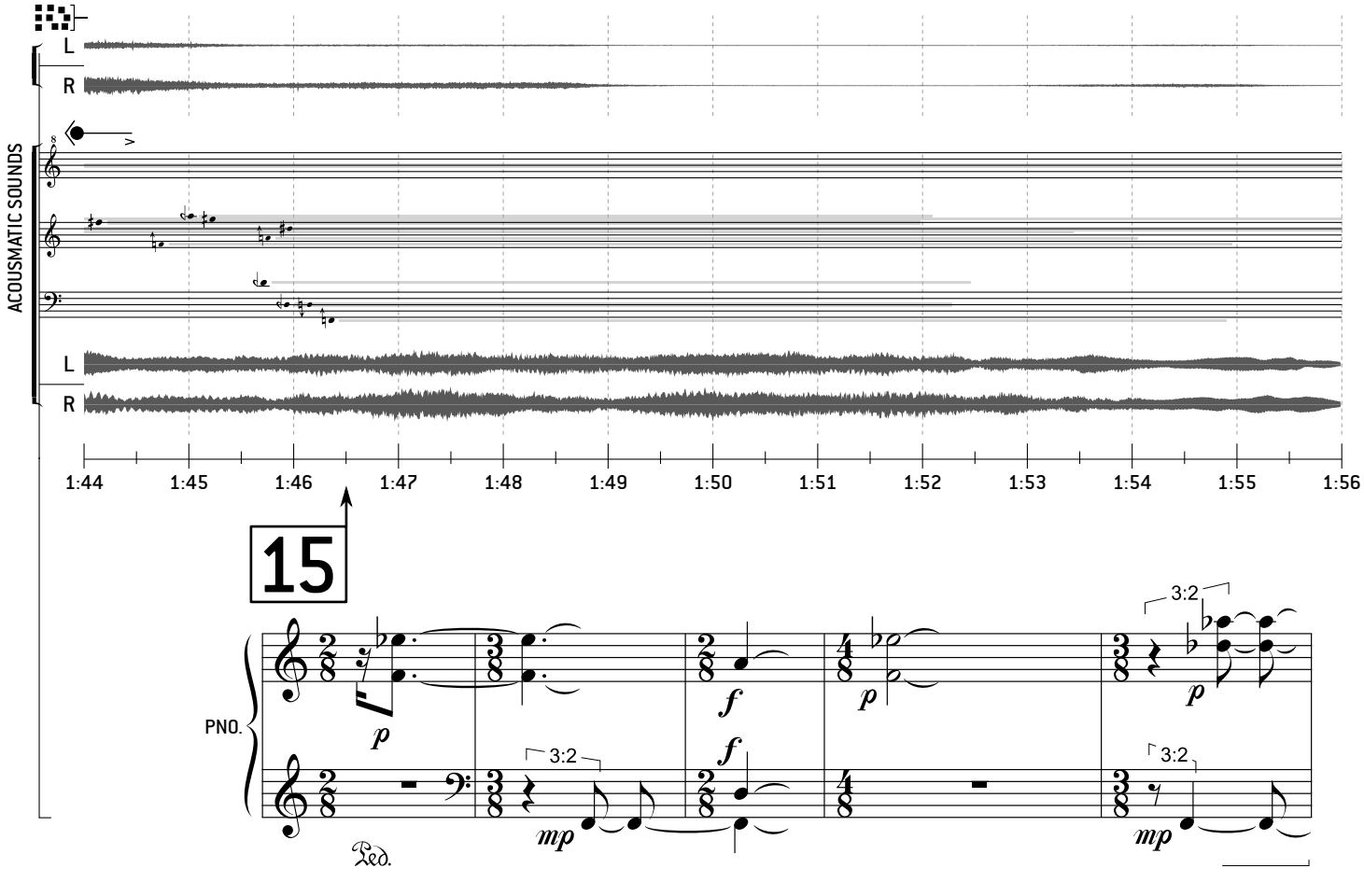
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mp
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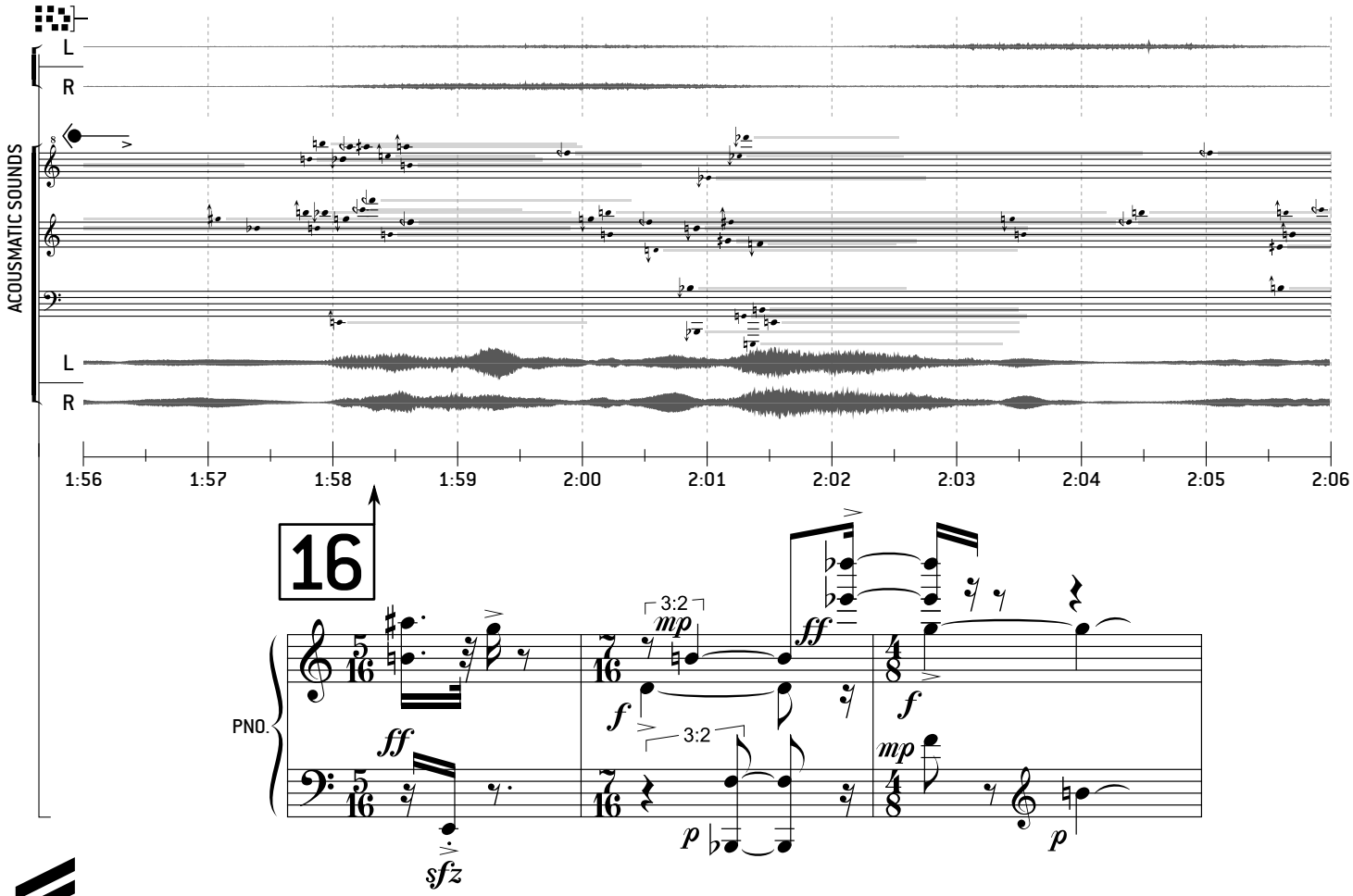
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sfz
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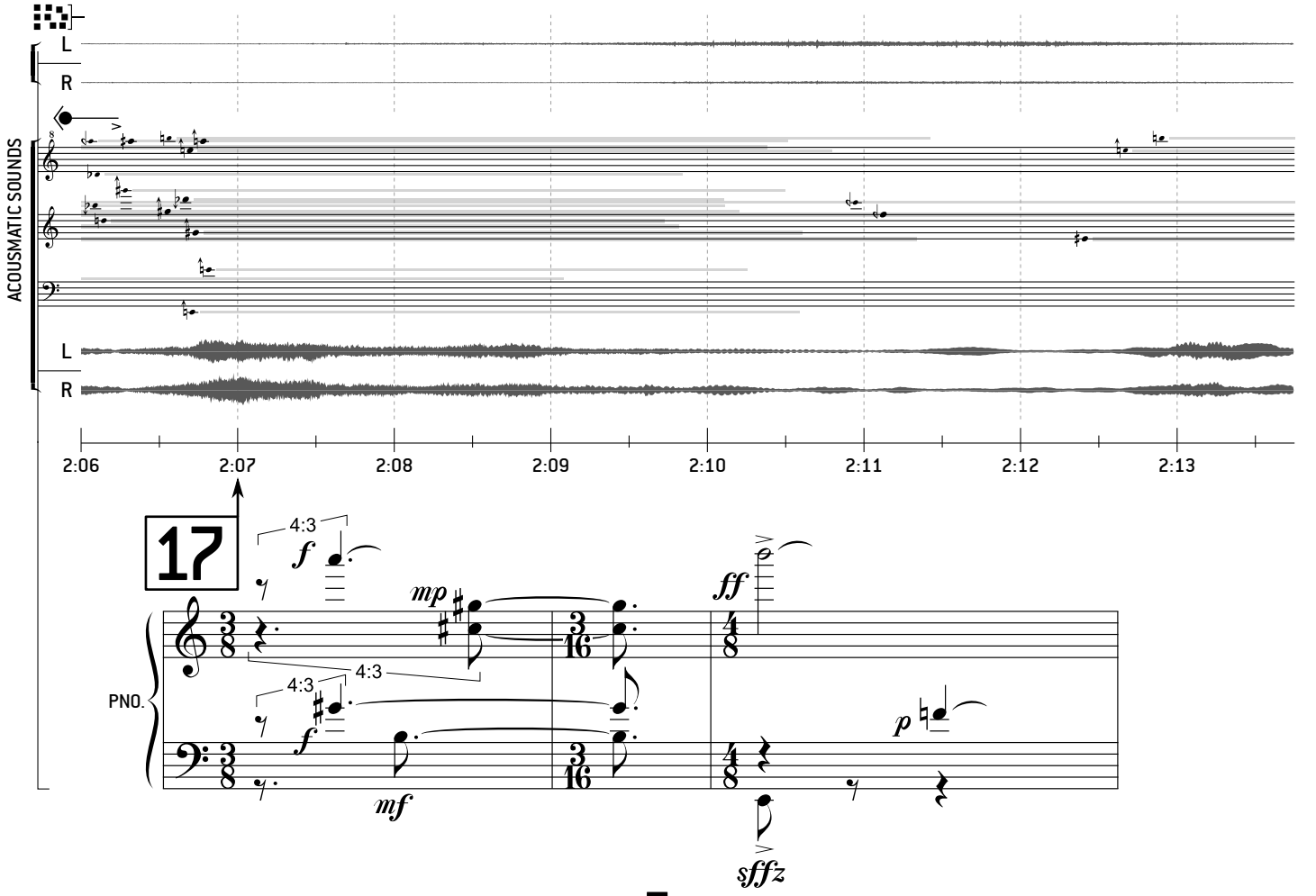
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R
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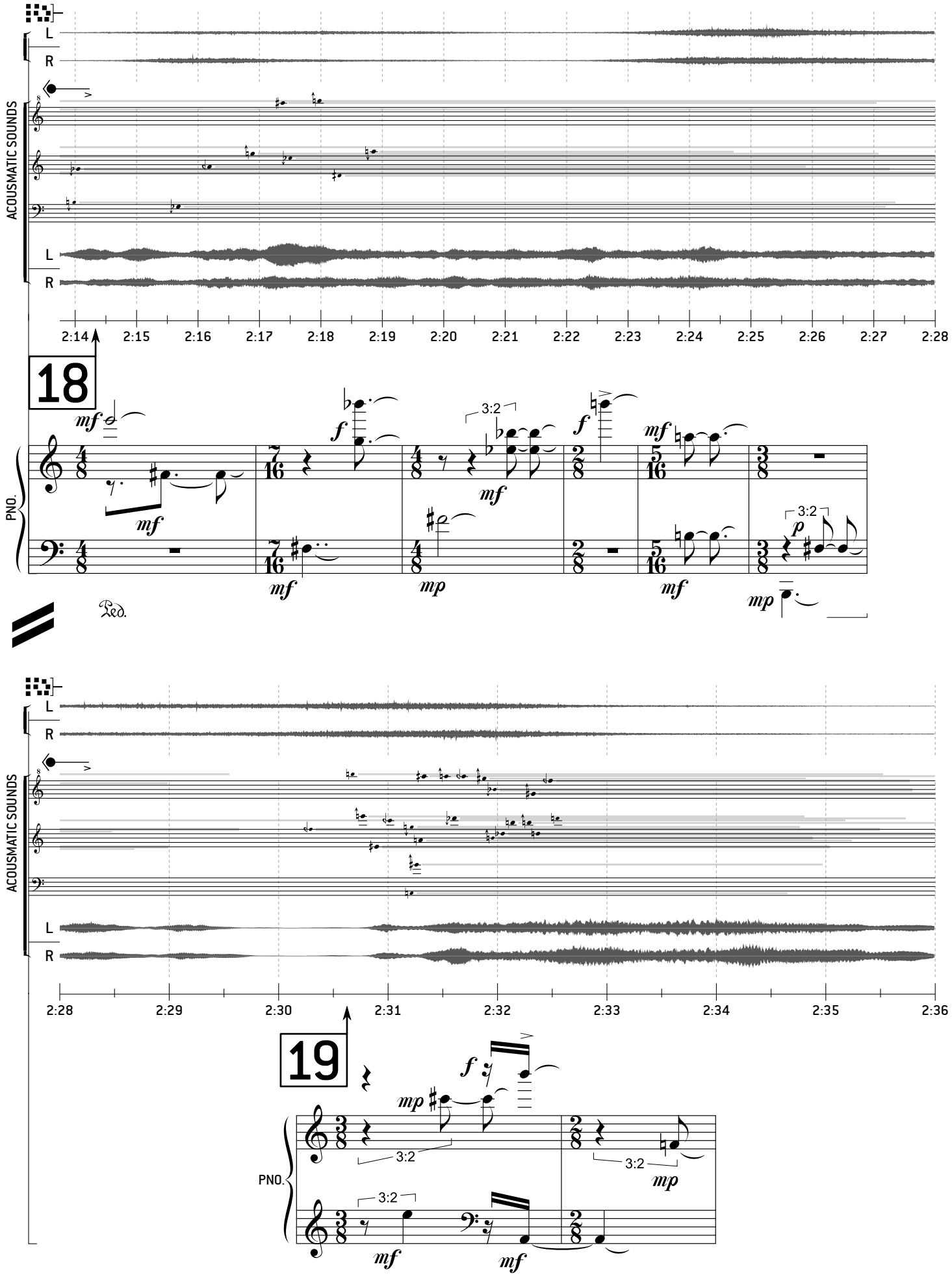
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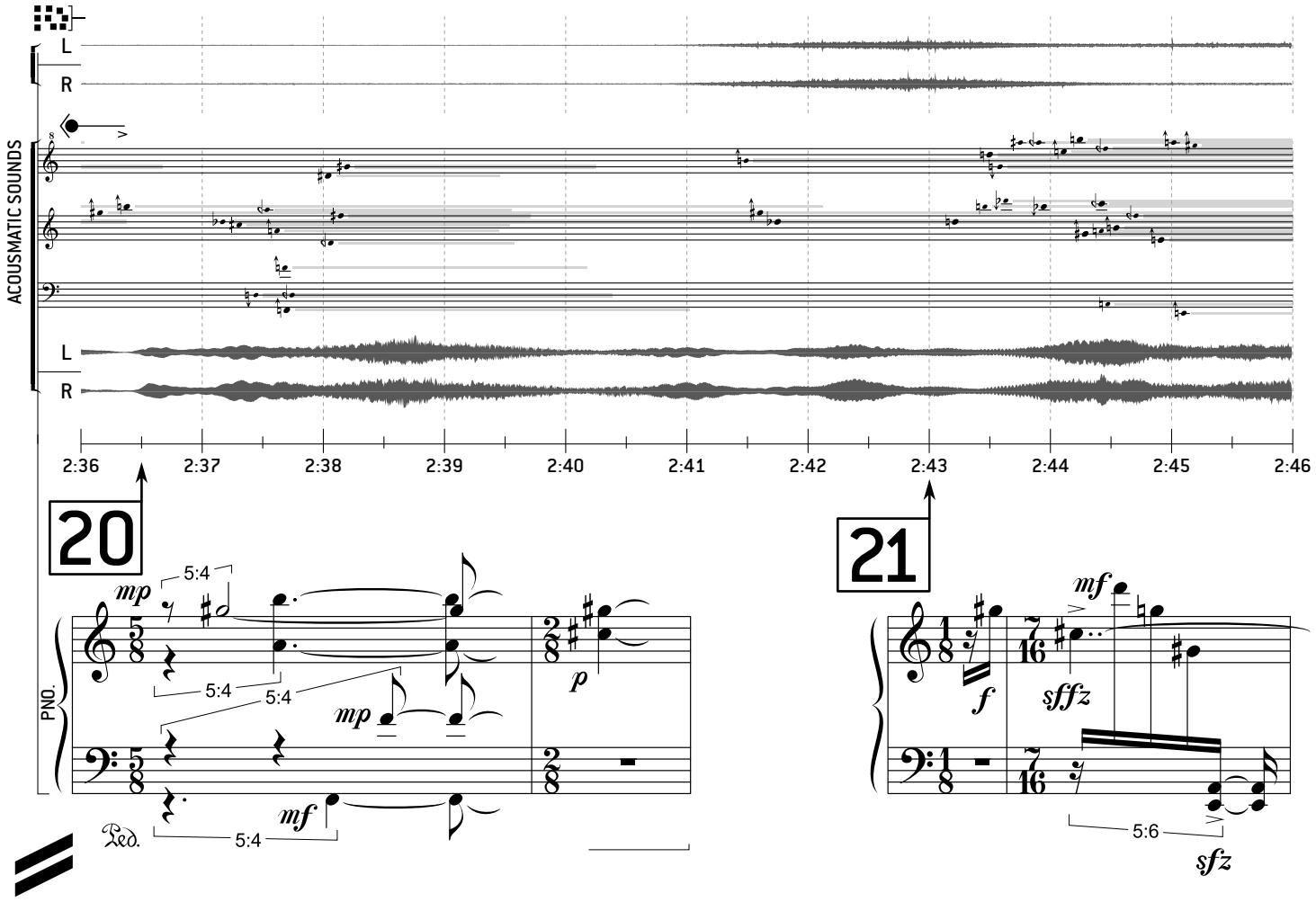
ACOUSMATIC SOUNDS
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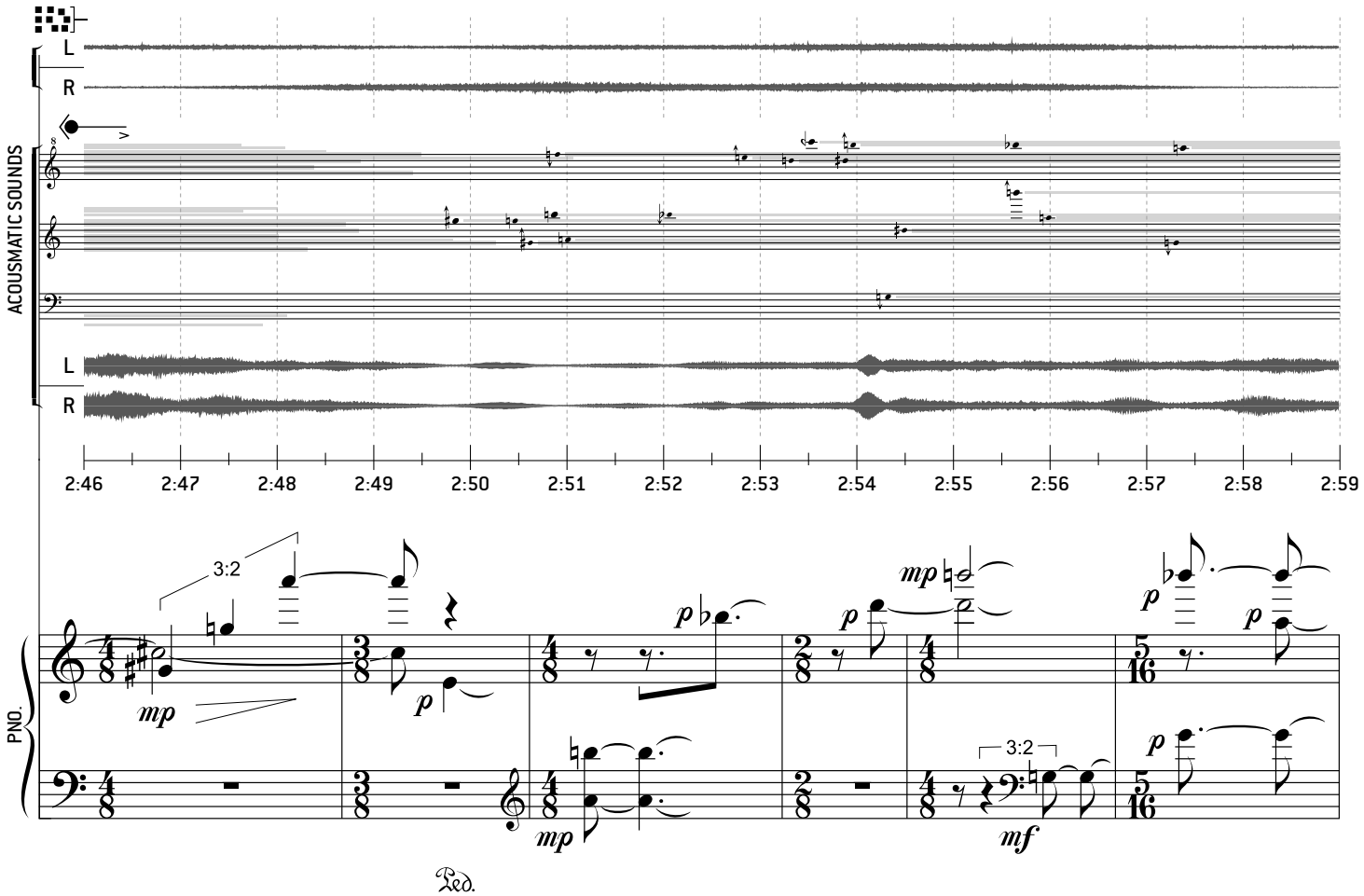
ACOUSMATIC SOUNDS
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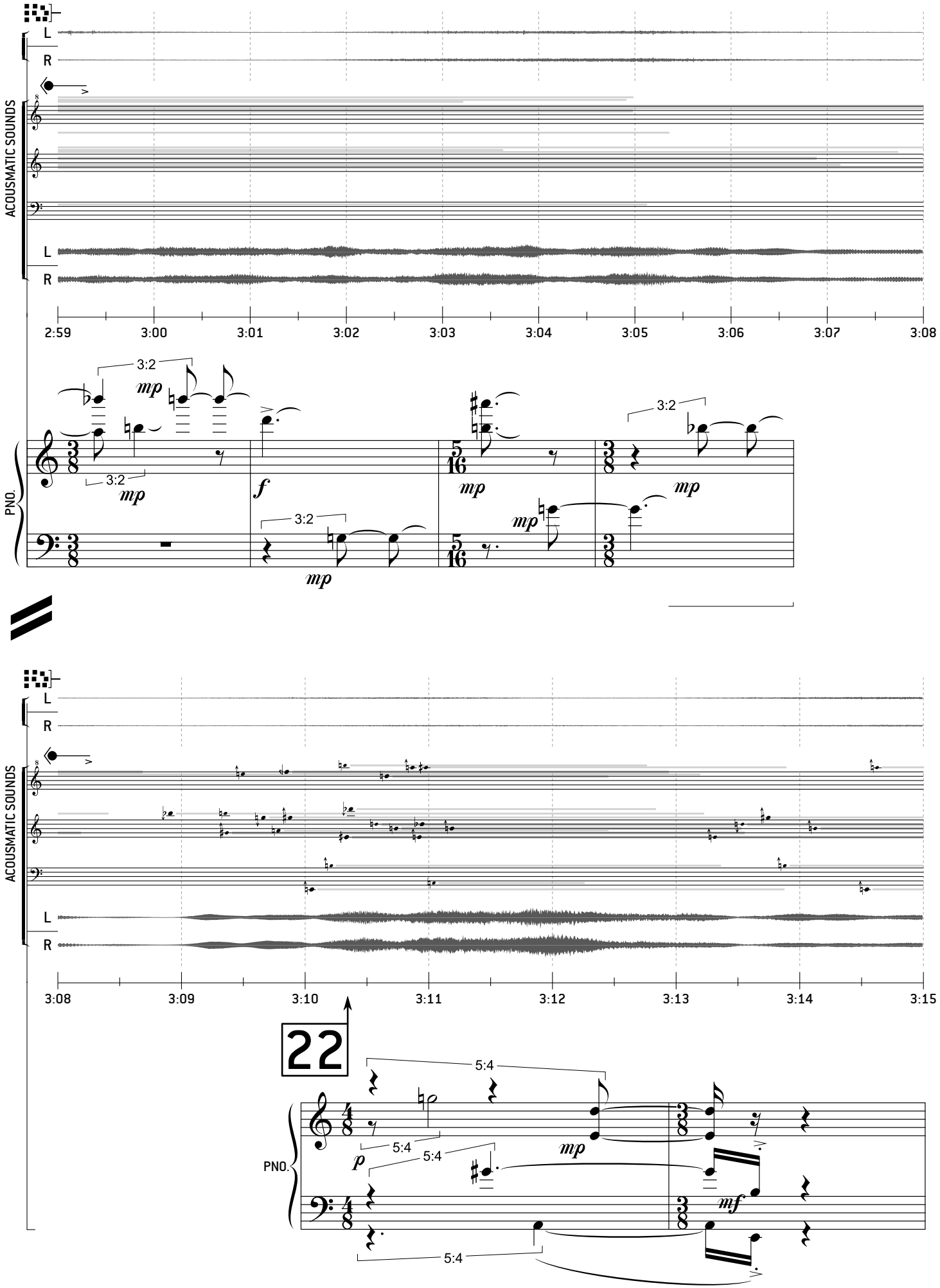
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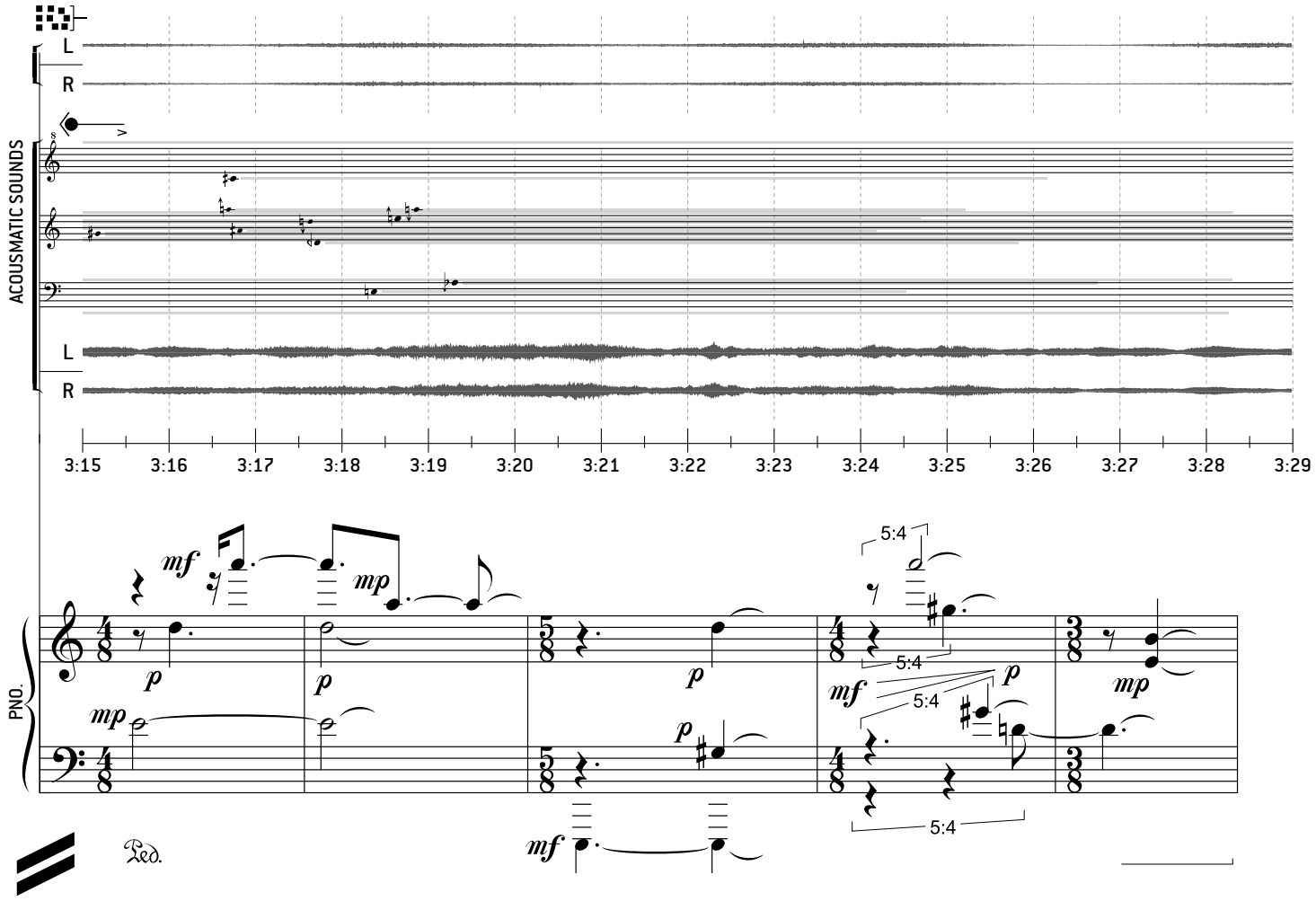
ACOUSMATIC SOUNDS
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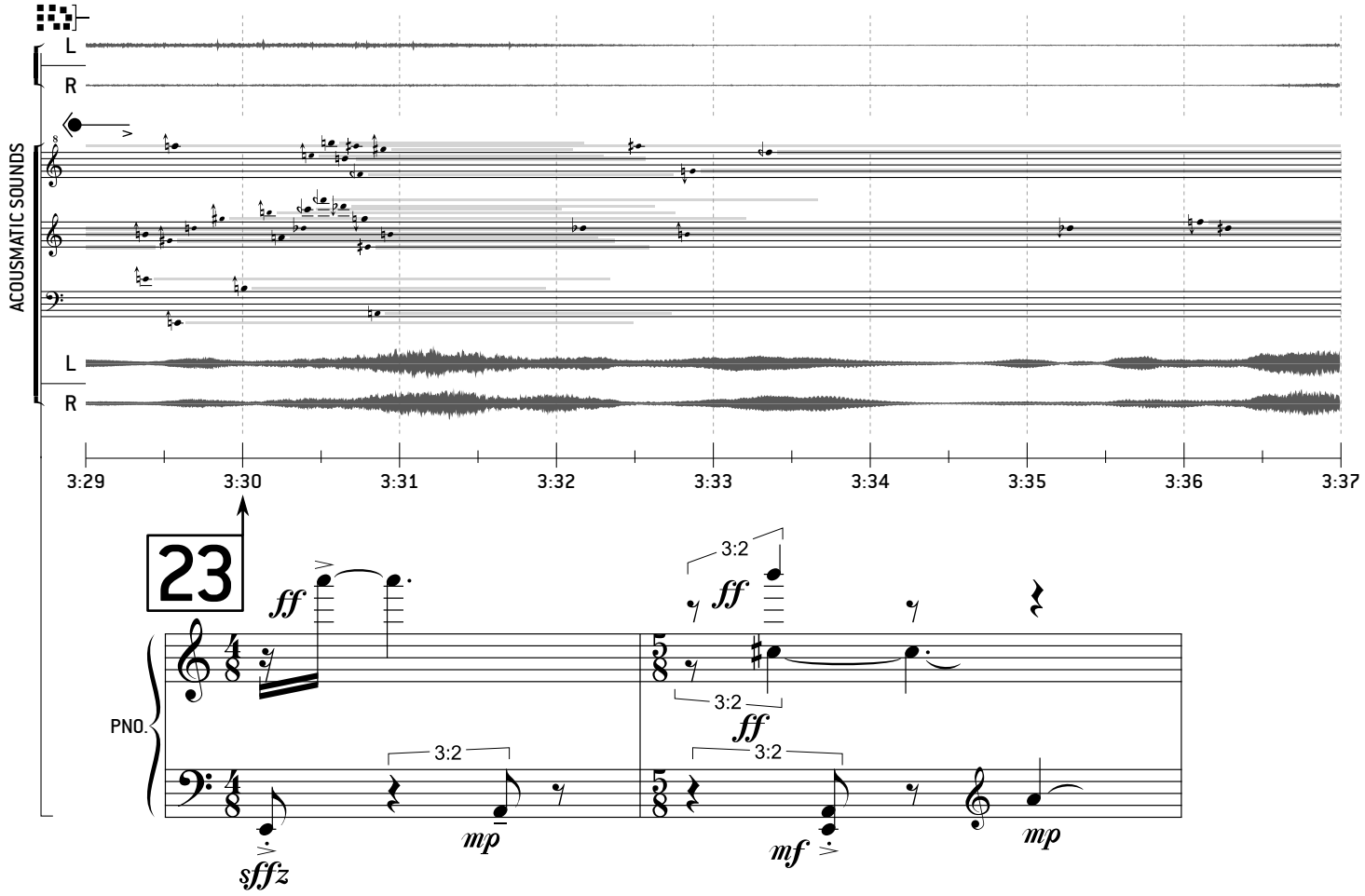
ACOUSMATIC SOUNDS
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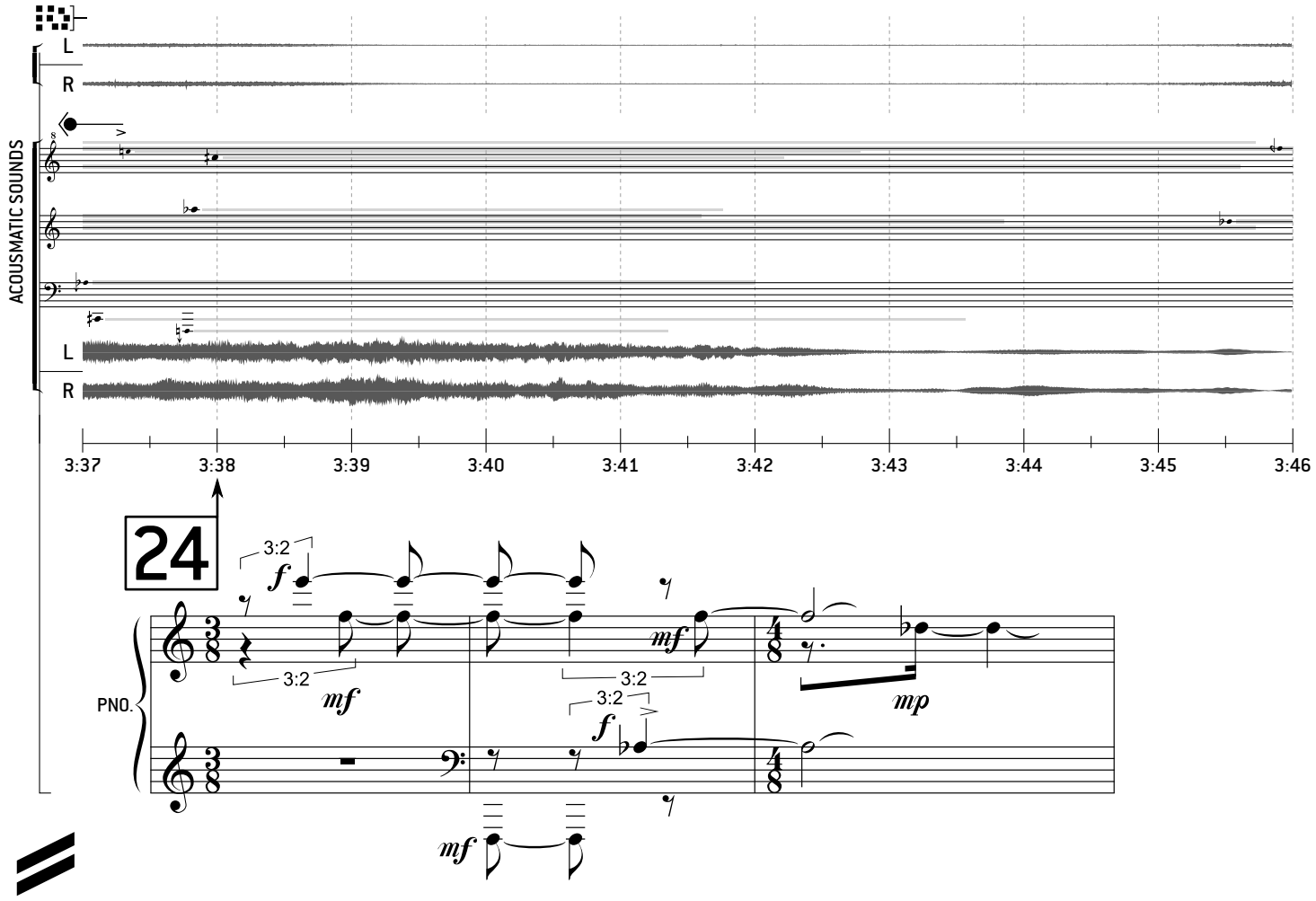
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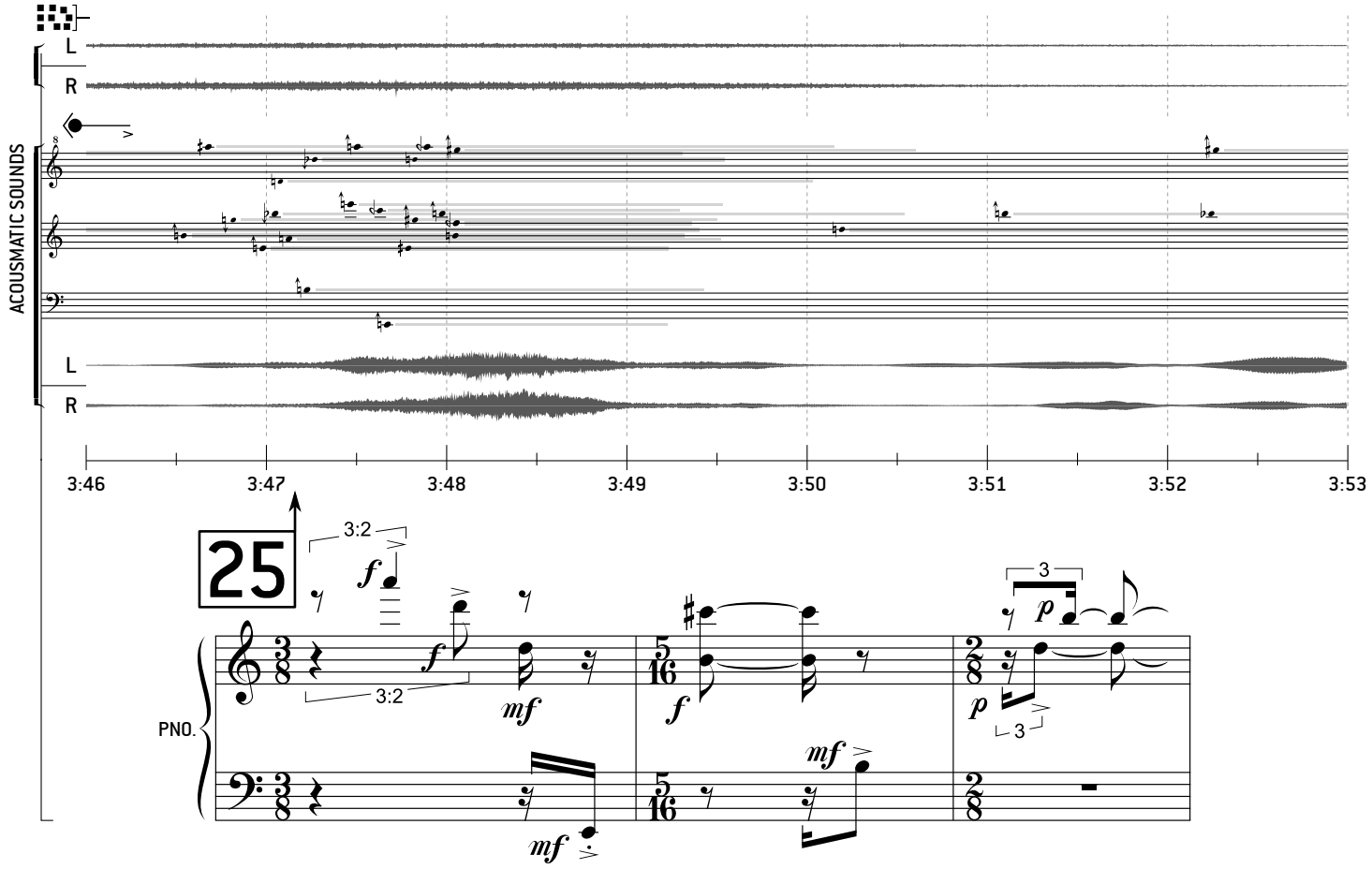
ACOUSMATIC SOUNDS
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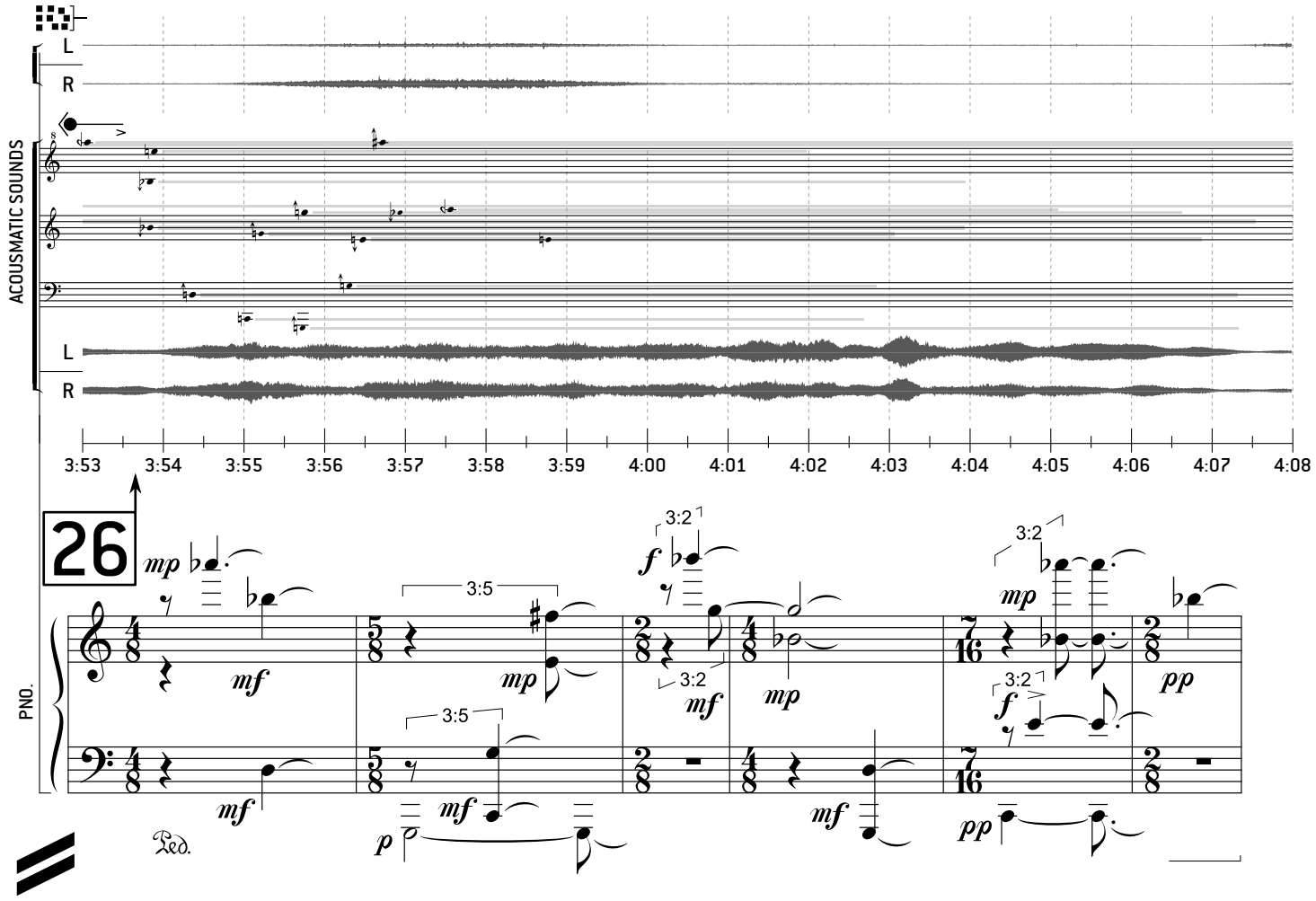
ACOUSMATIC SOUNDS
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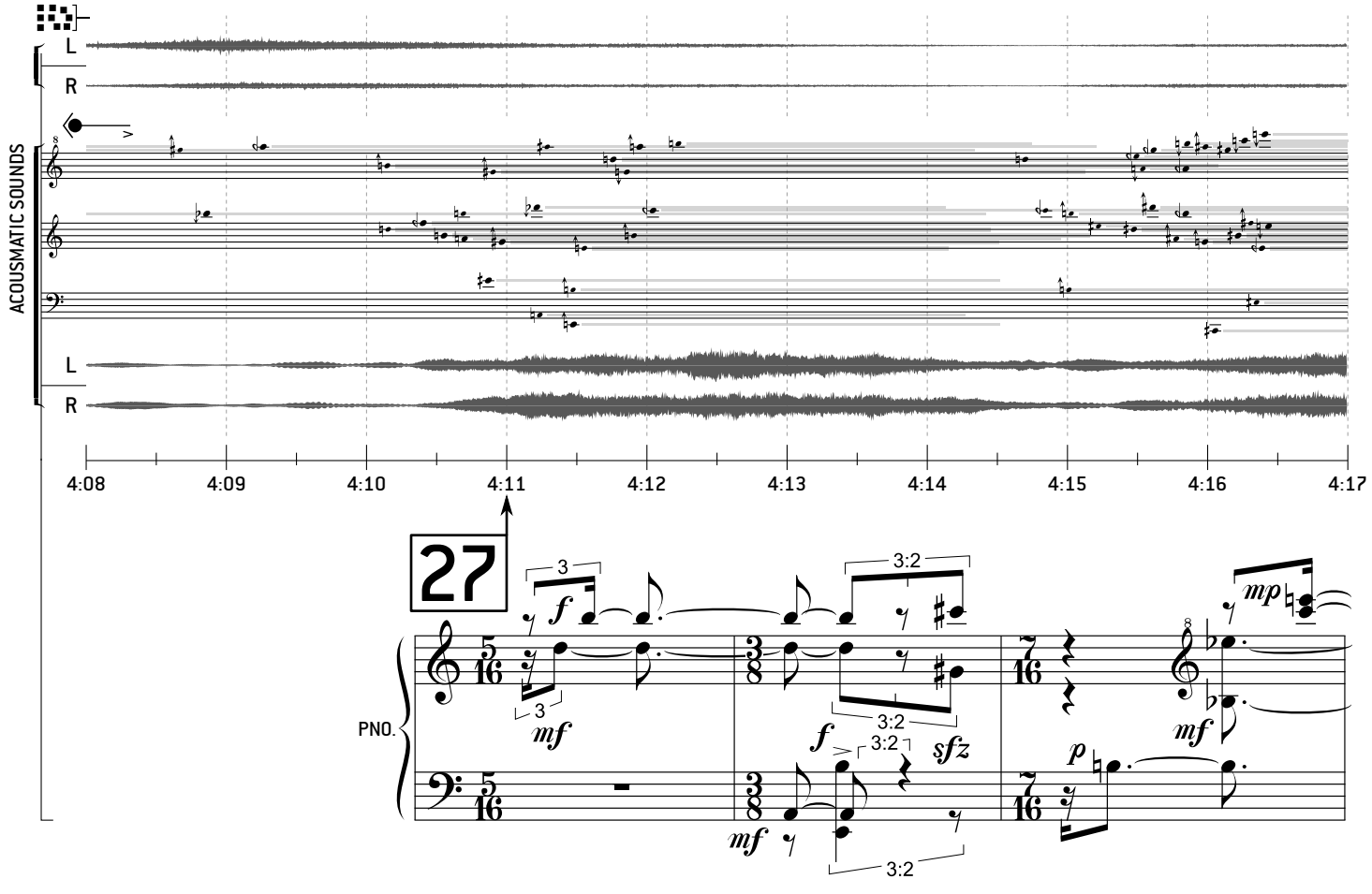
ACOUSMATIC SOUNDS
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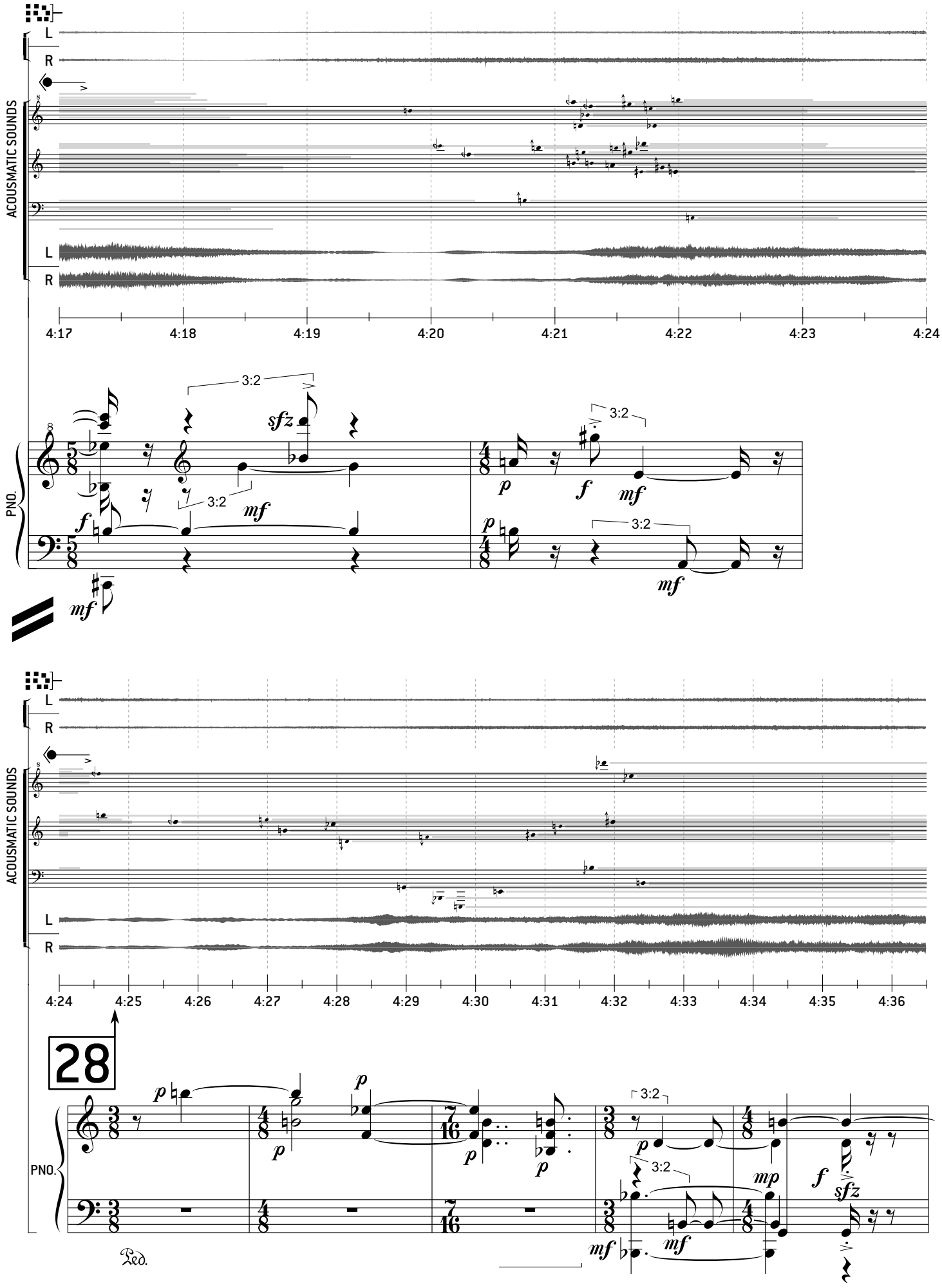
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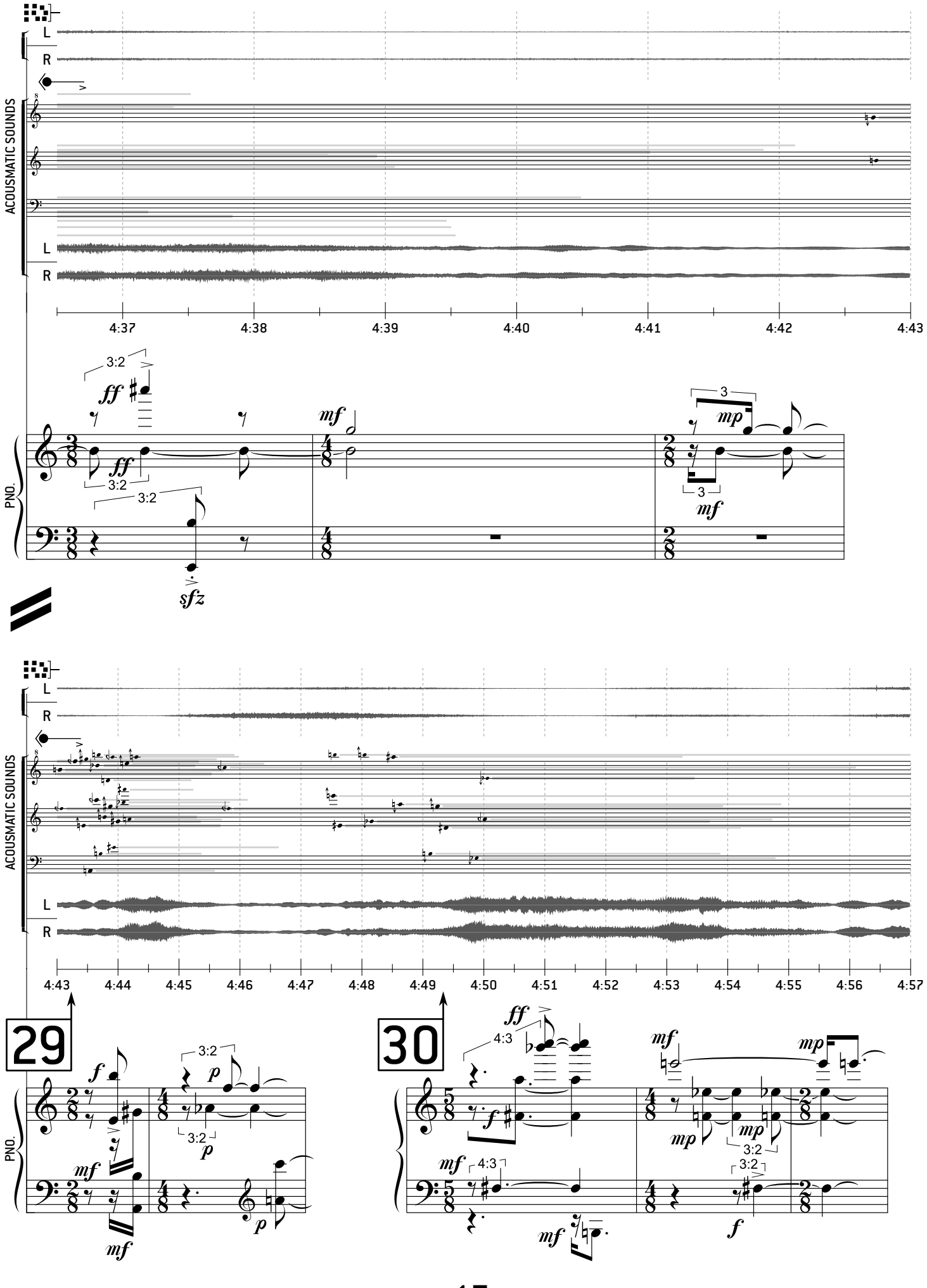
Ped.


ACOUSMATIC SOUNDS
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mf
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mp
sfz
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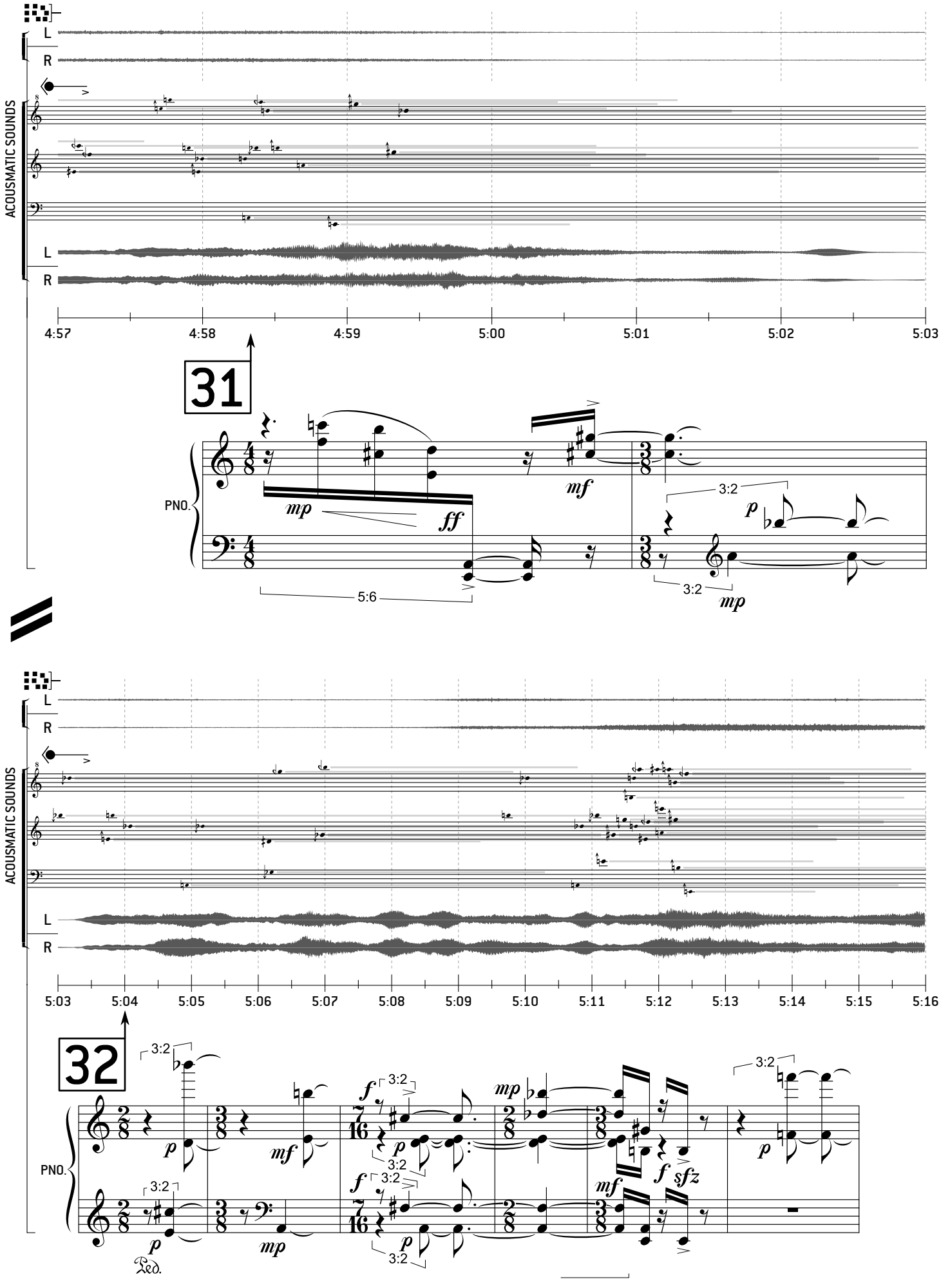
ACOUSMATIC SOUNDS
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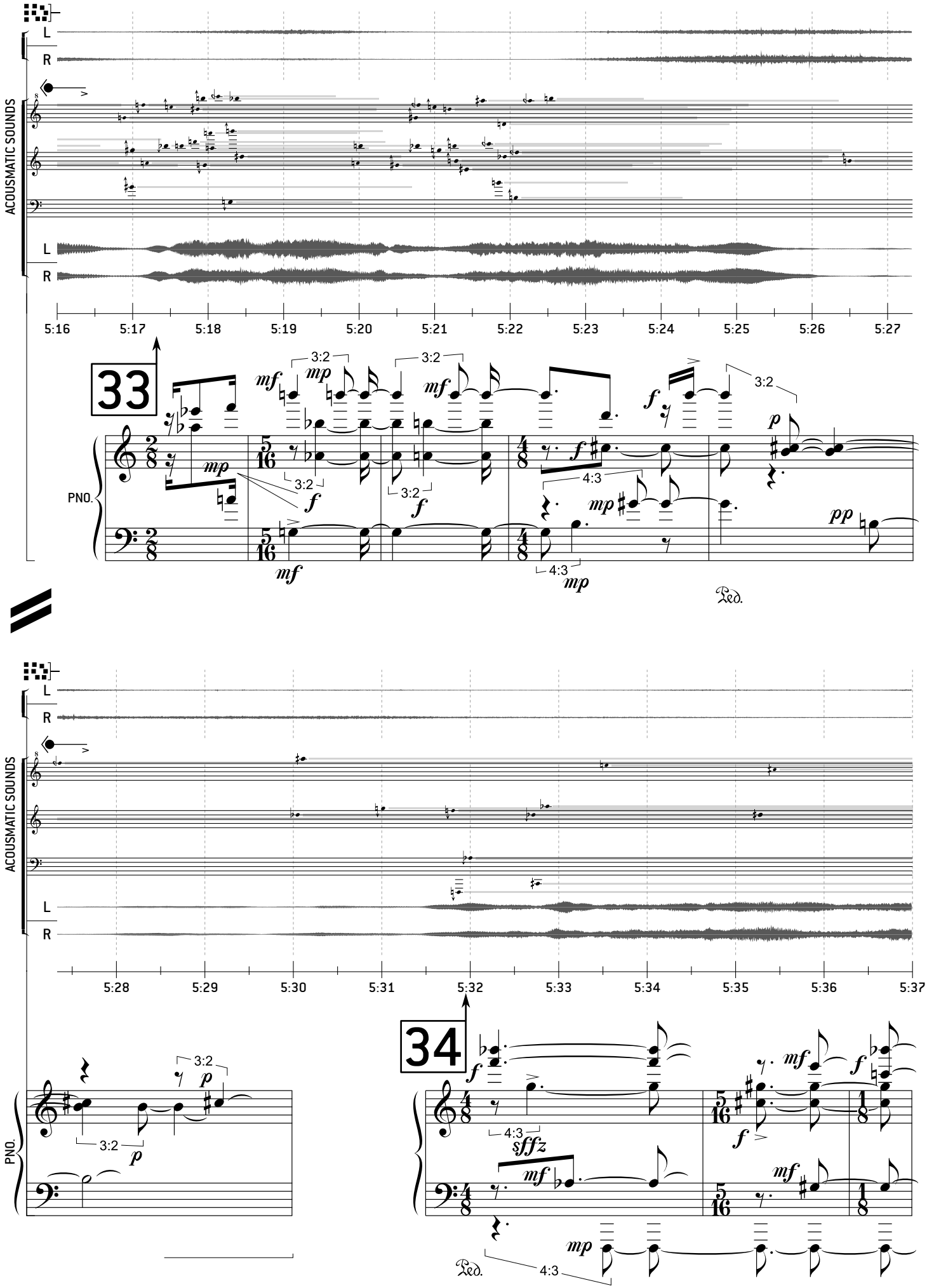
mp
sfz
Ped.


ACOUSMATIC SOUNDS
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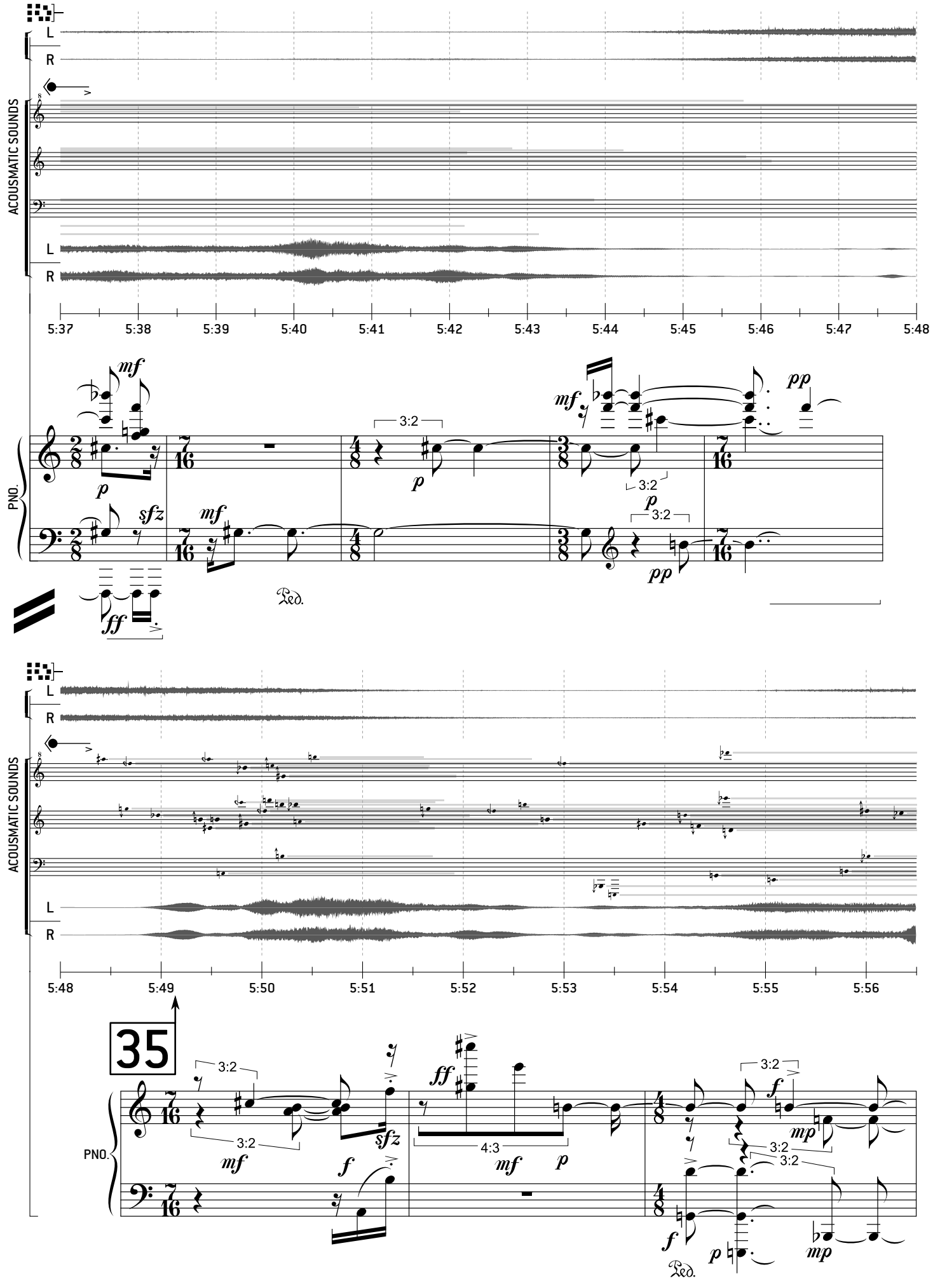
ACOUSMATIC SOUNDS
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p
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mf
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Ped.
ACOUSMATIC SOUNDS
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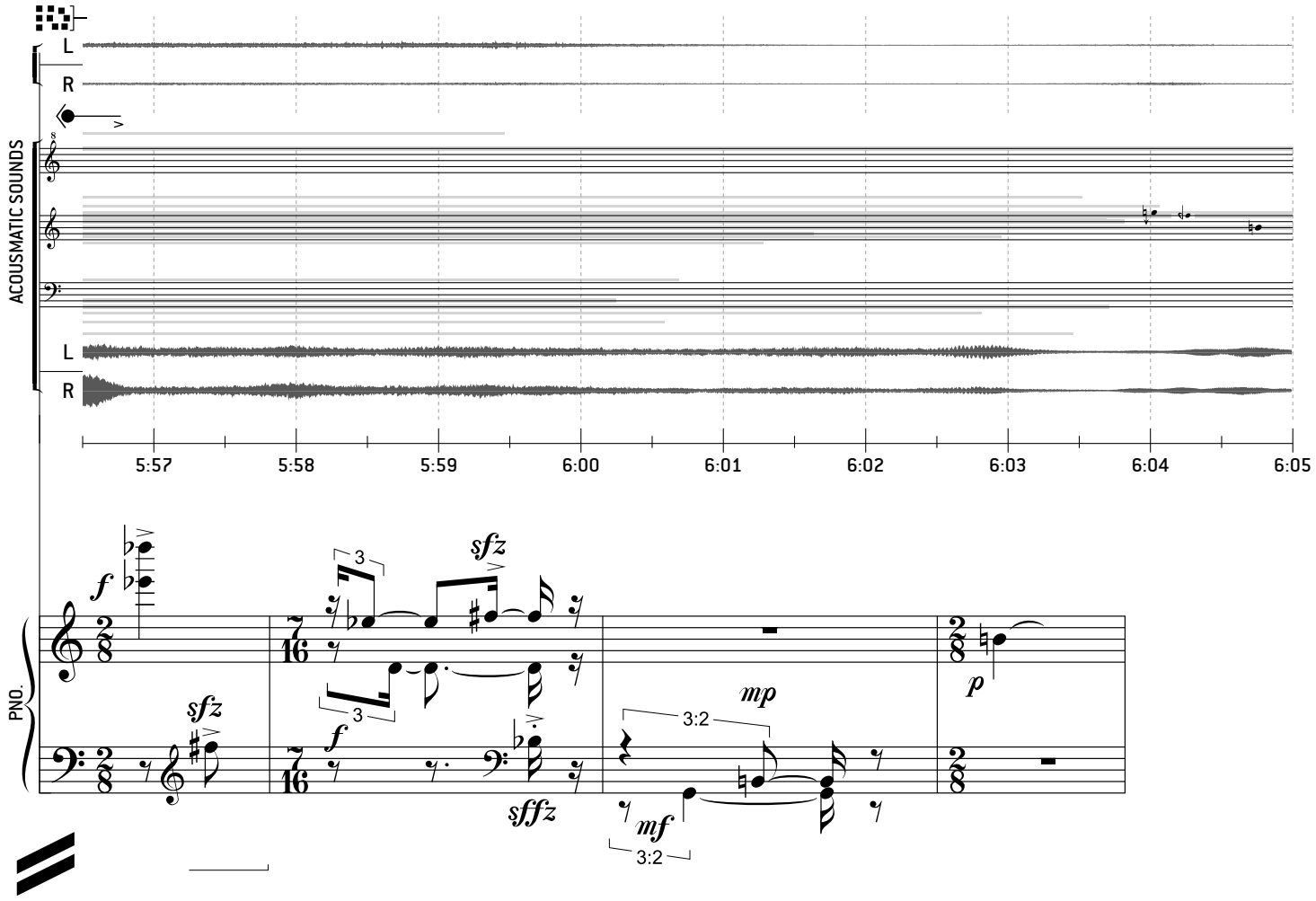
ACOUSMATIC SOUNDS
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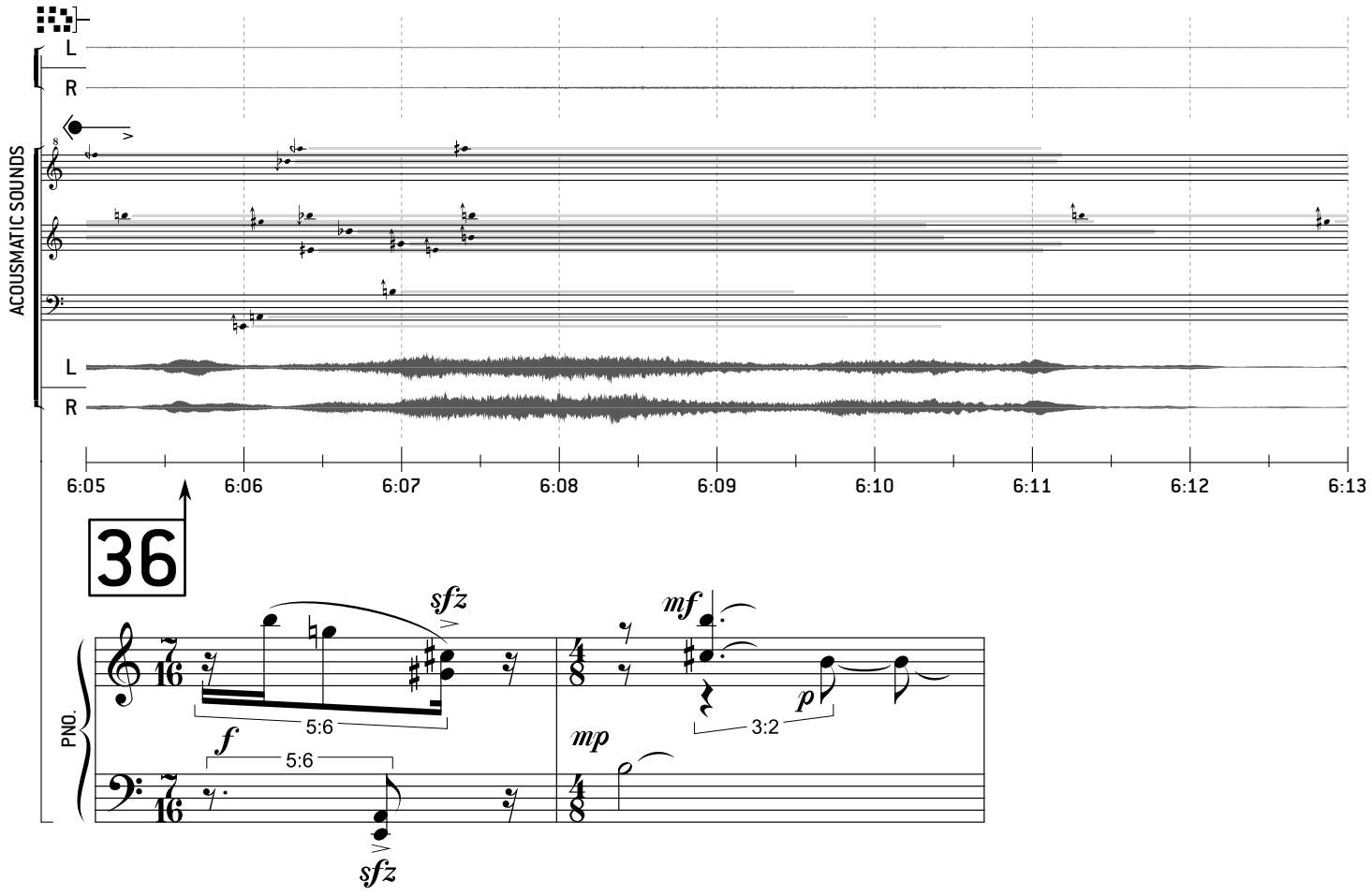
ACOUSMATIC SOUNDS
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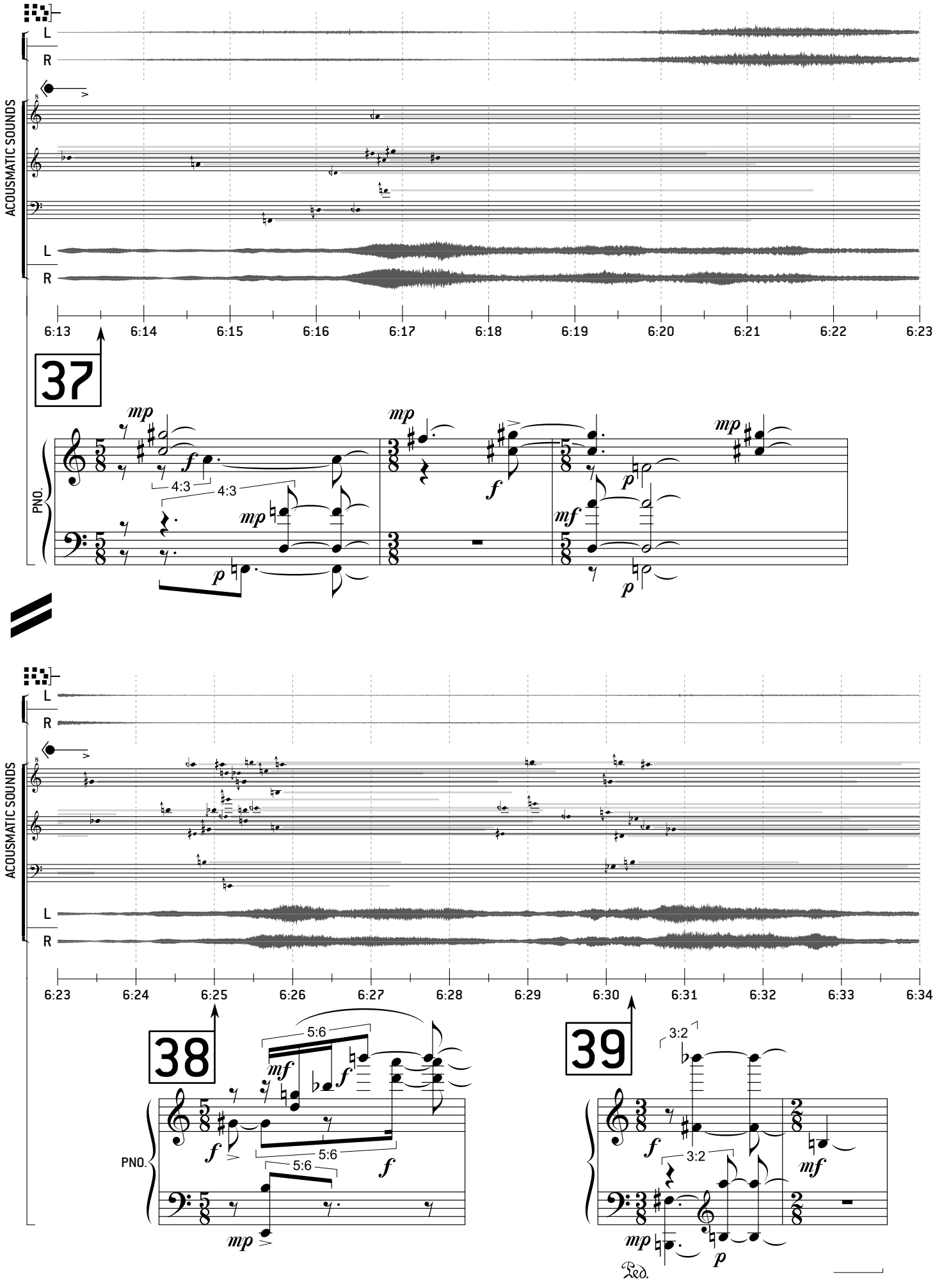
ACOUSMATIC SOUNDS
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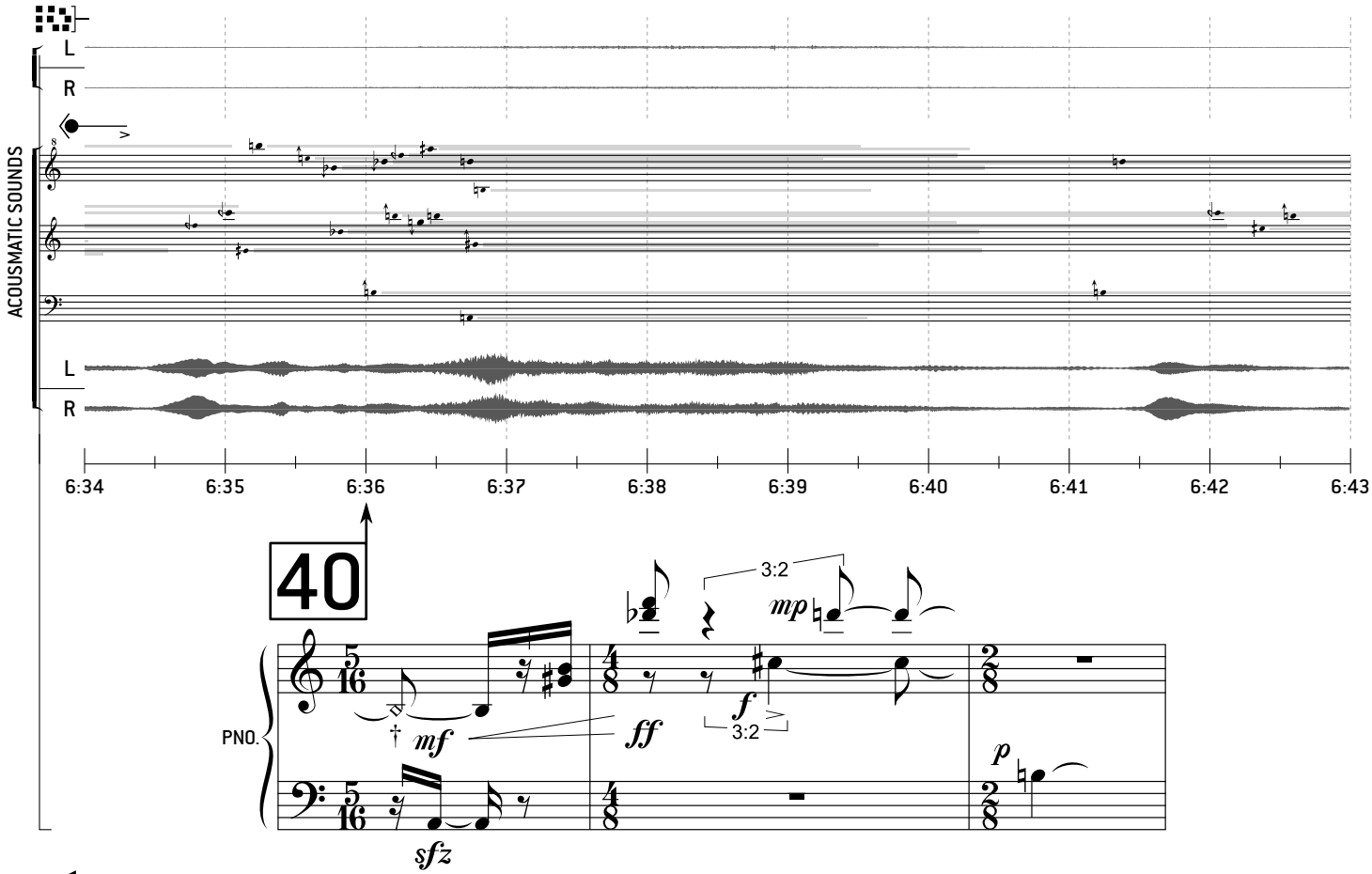
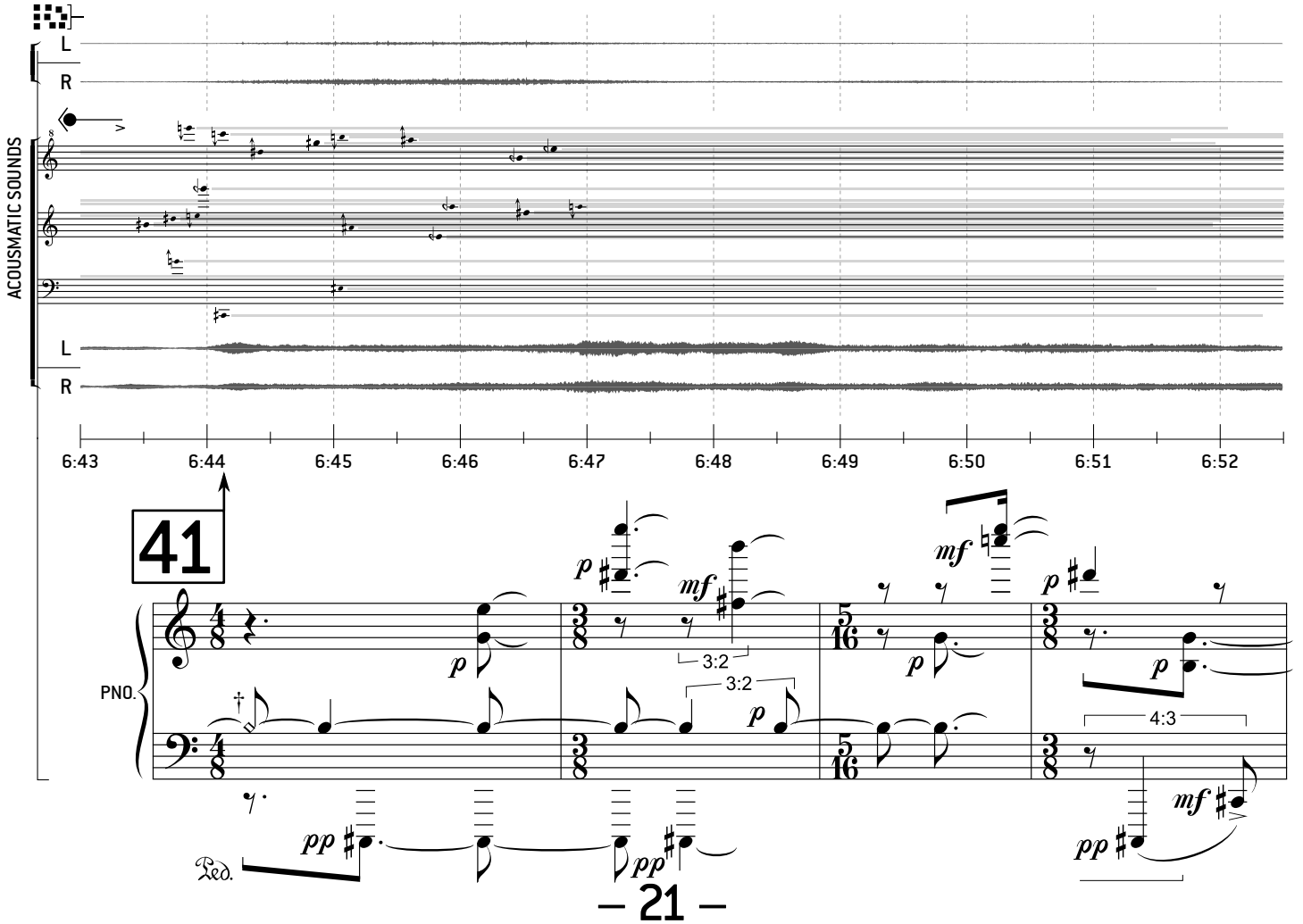
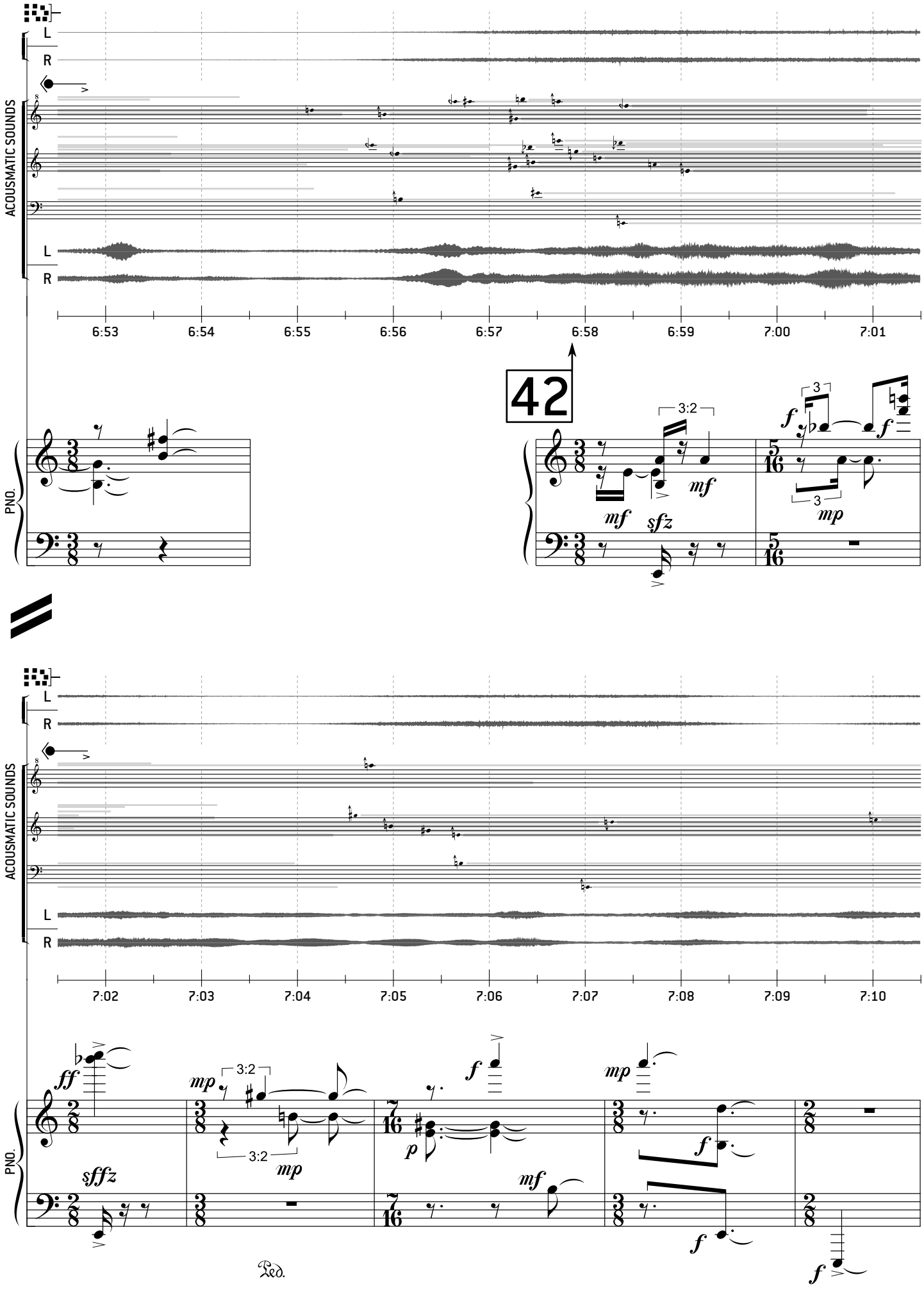


† note tied from the last event

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R
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42
PNO.
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mf
sfz
mp
f
ff
sffz
p
Ped.
7:02
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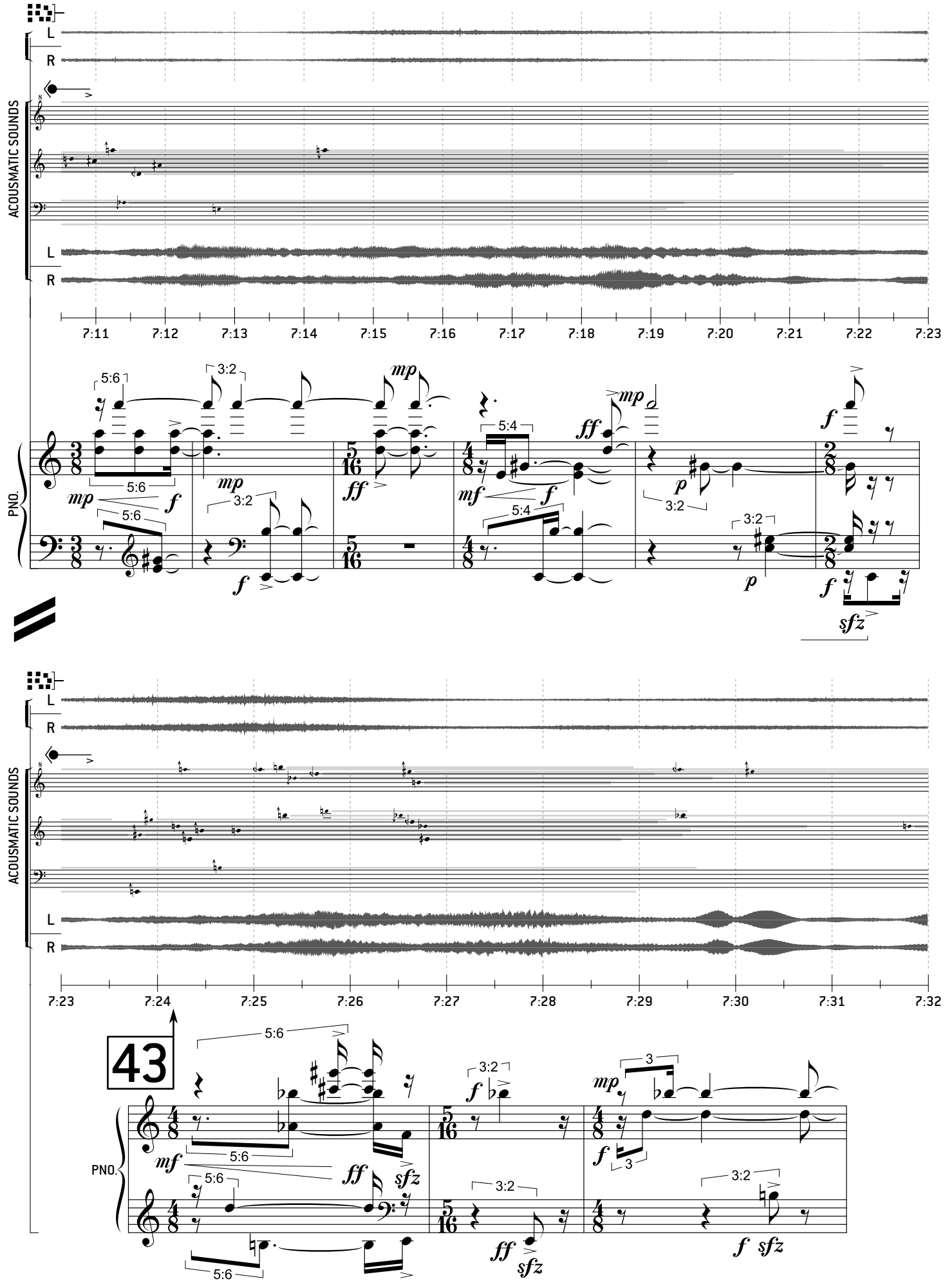
7:10


ACOUSMATIC SOUNDS
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R
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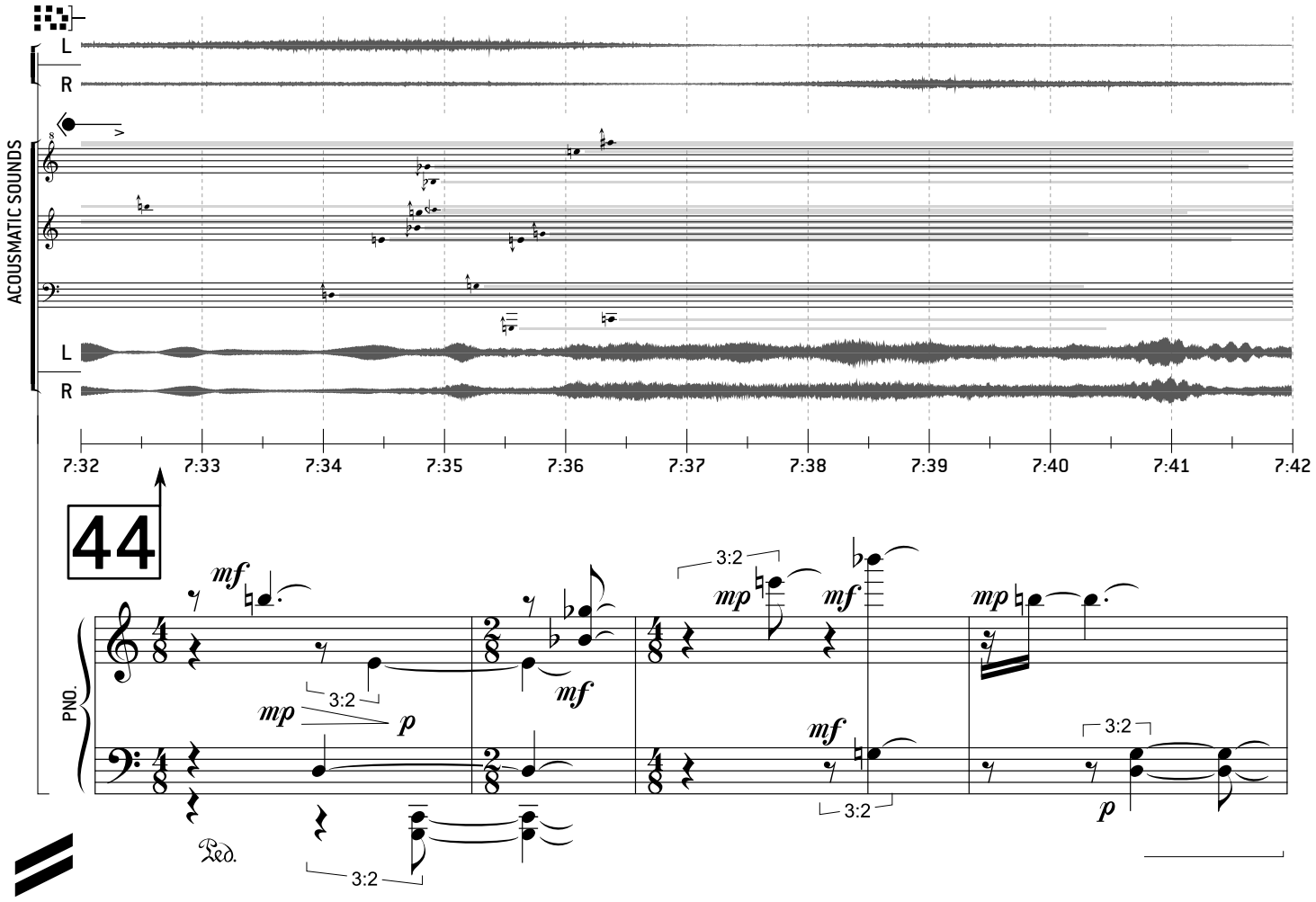
ACOUSMATIC SOUNDS
L
R
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mp
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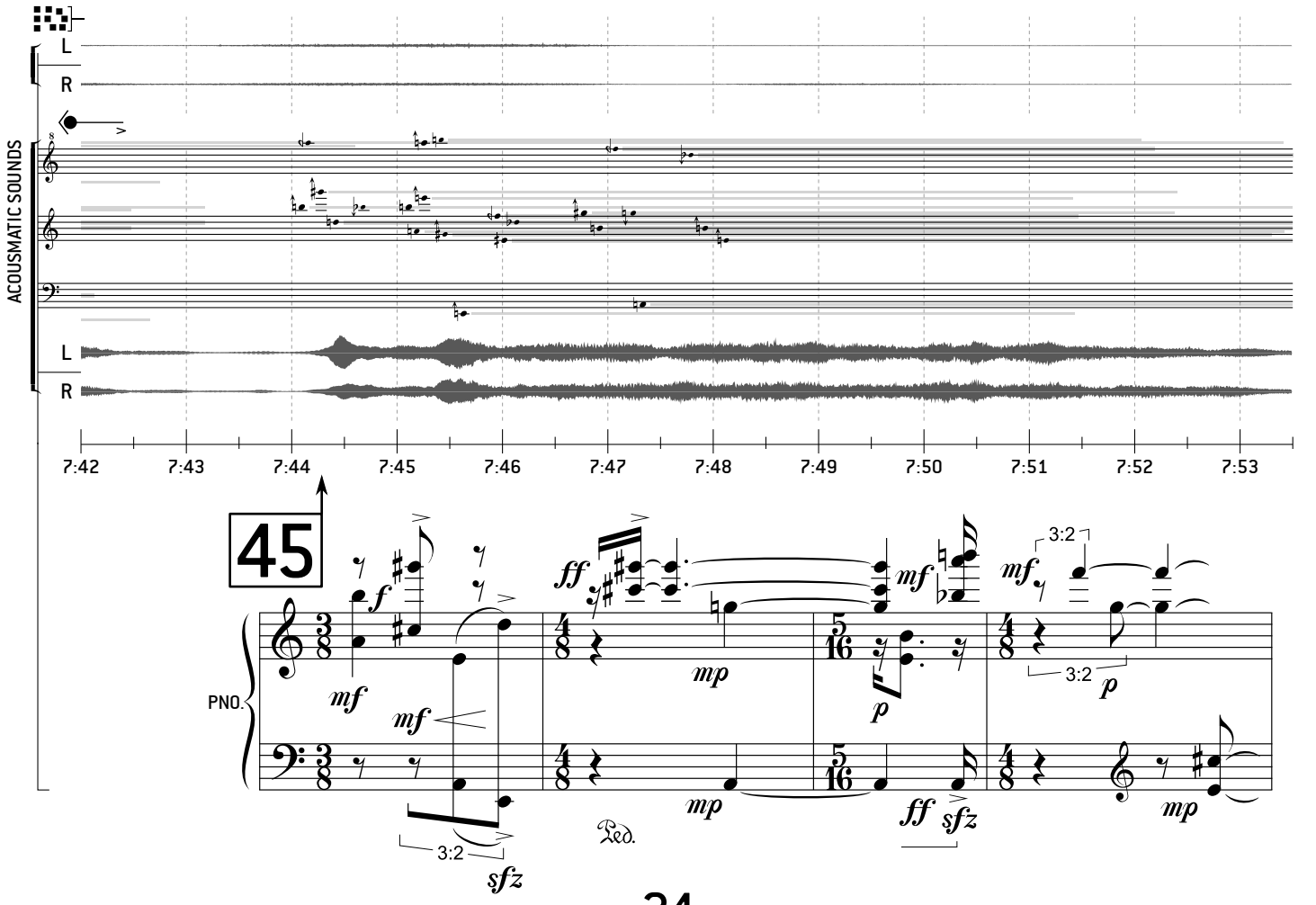
Ped.


ACOUSMATIC SOUNDS
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ff
mf
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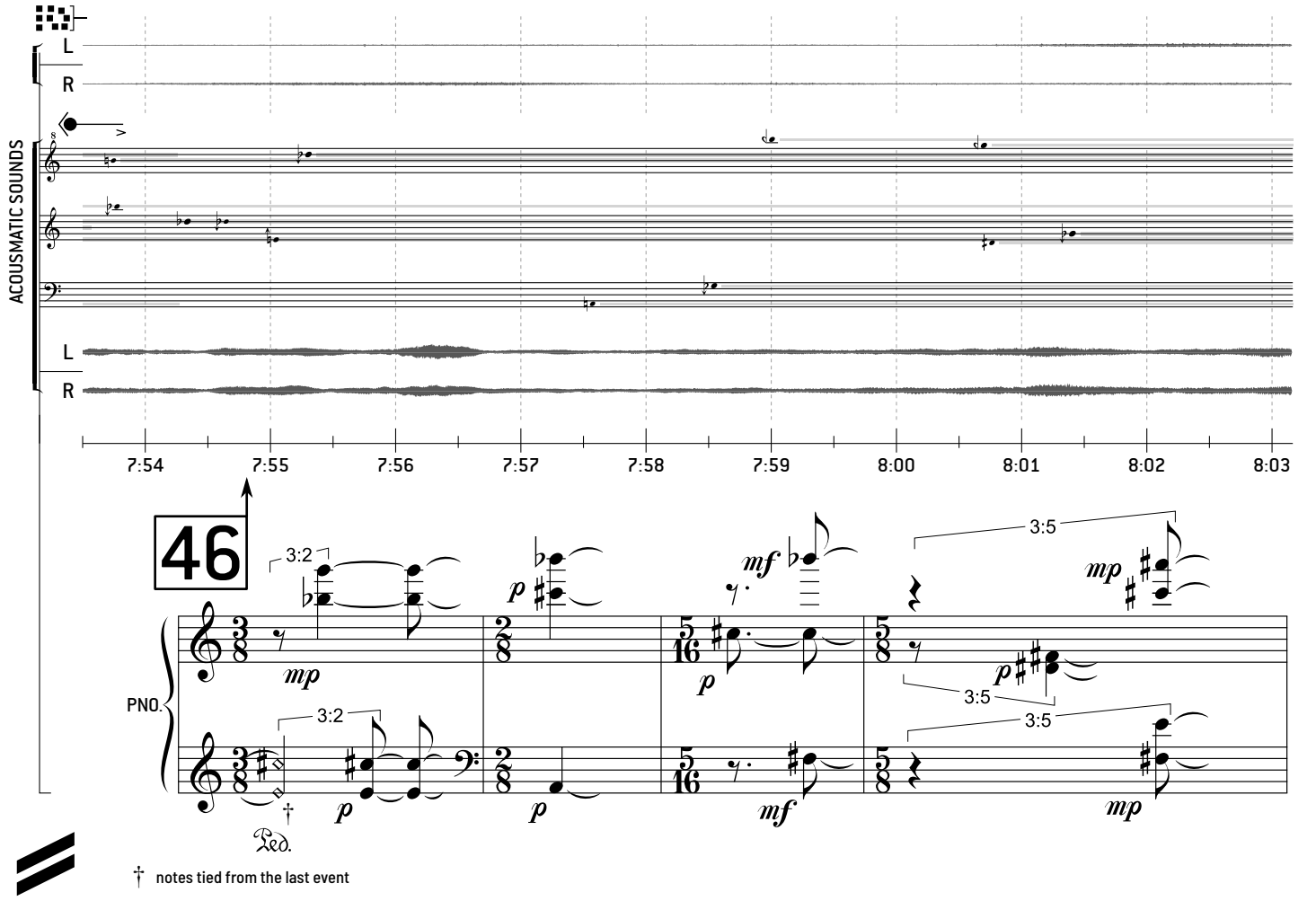
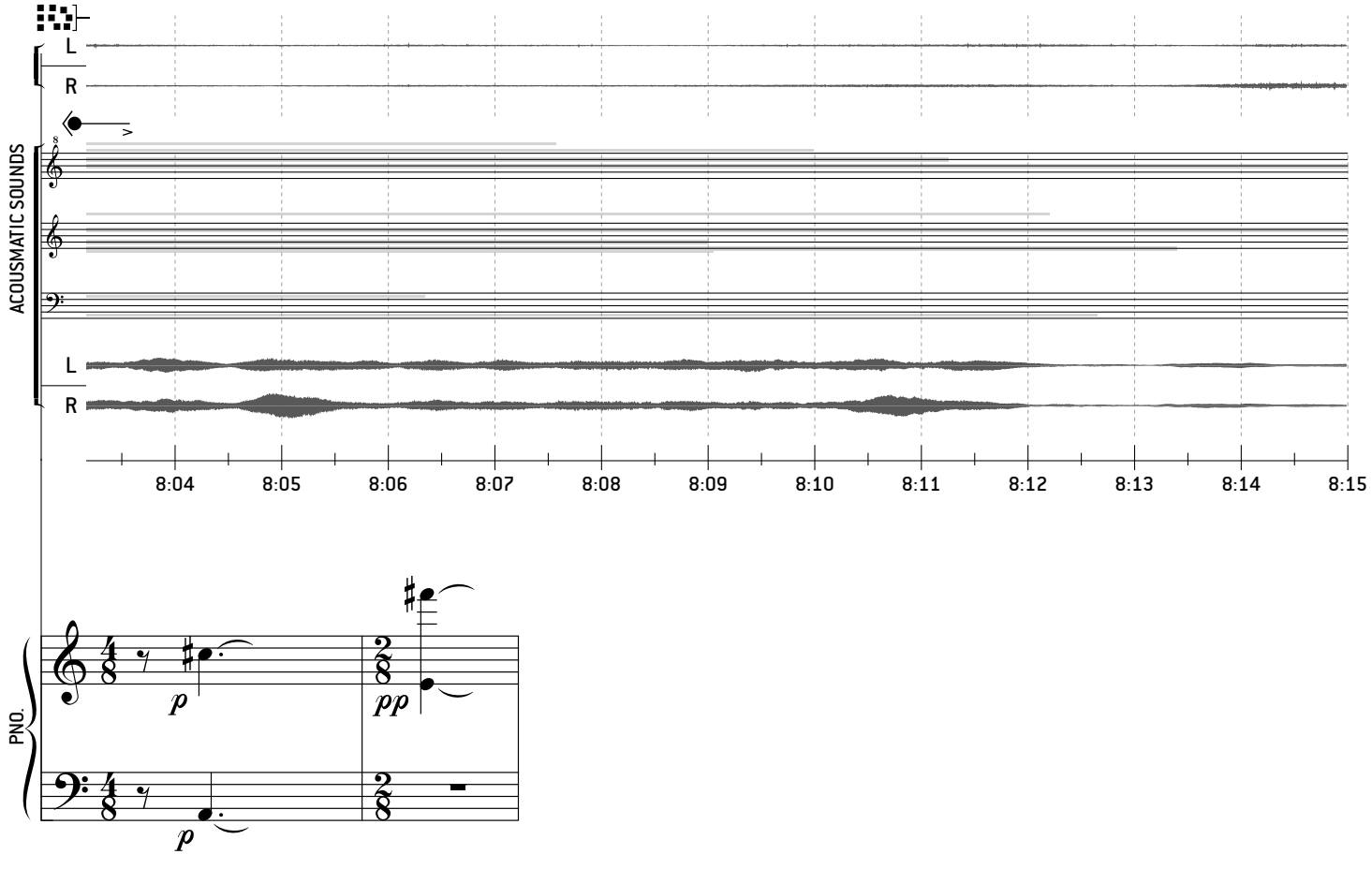
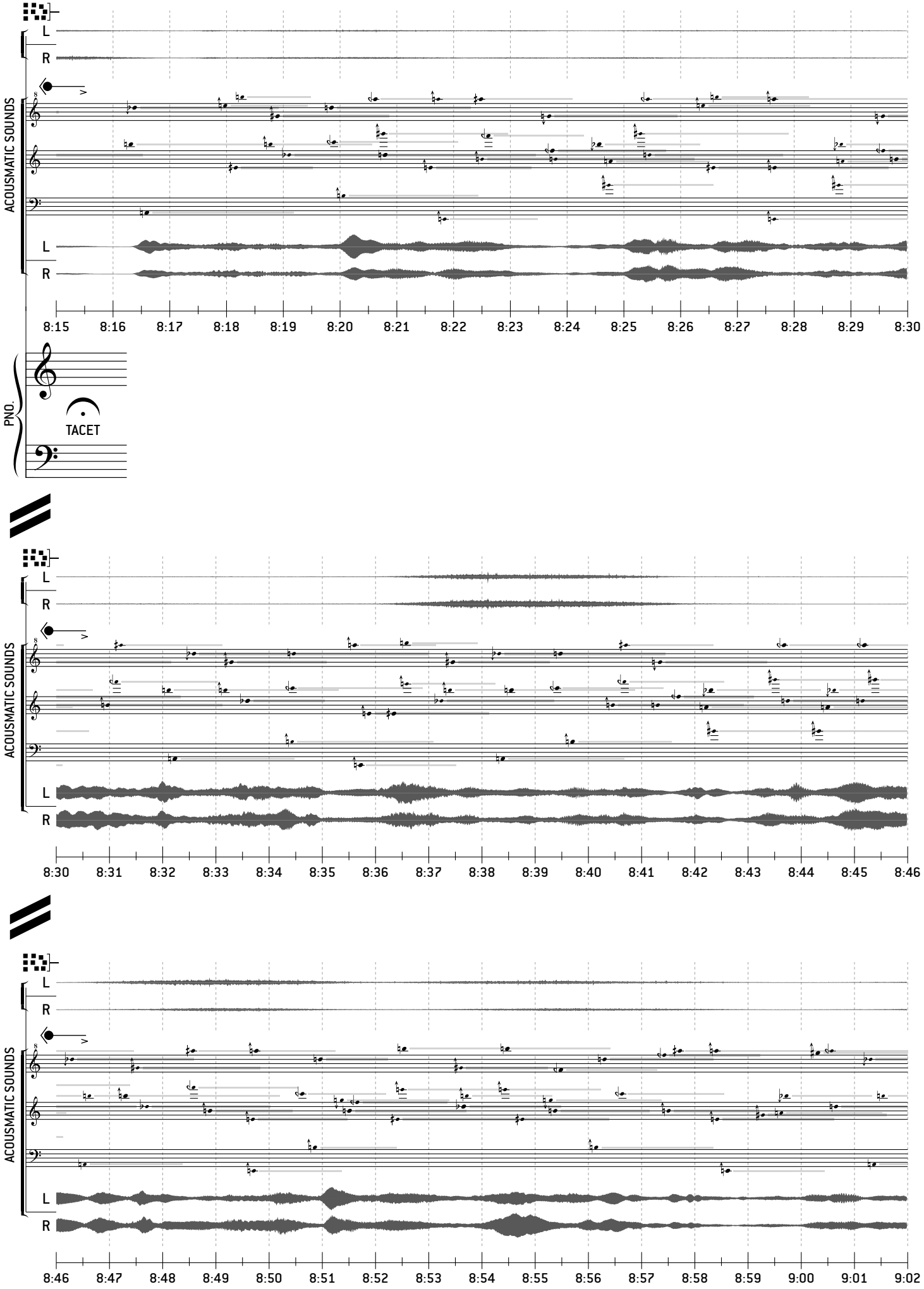
p
sfz
3:2
Ped.



† notes tied from the last event




ACOUSMATIC SOUNDS
L
R
8:15
8:16
8:17
8:18
8:19
8:20
8:21
8:22
8:23
8:24
8:25
8:26
8:27
8:28
8:29
8:30
PNO.
TACET
8:30
8:31
8:32
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8:42
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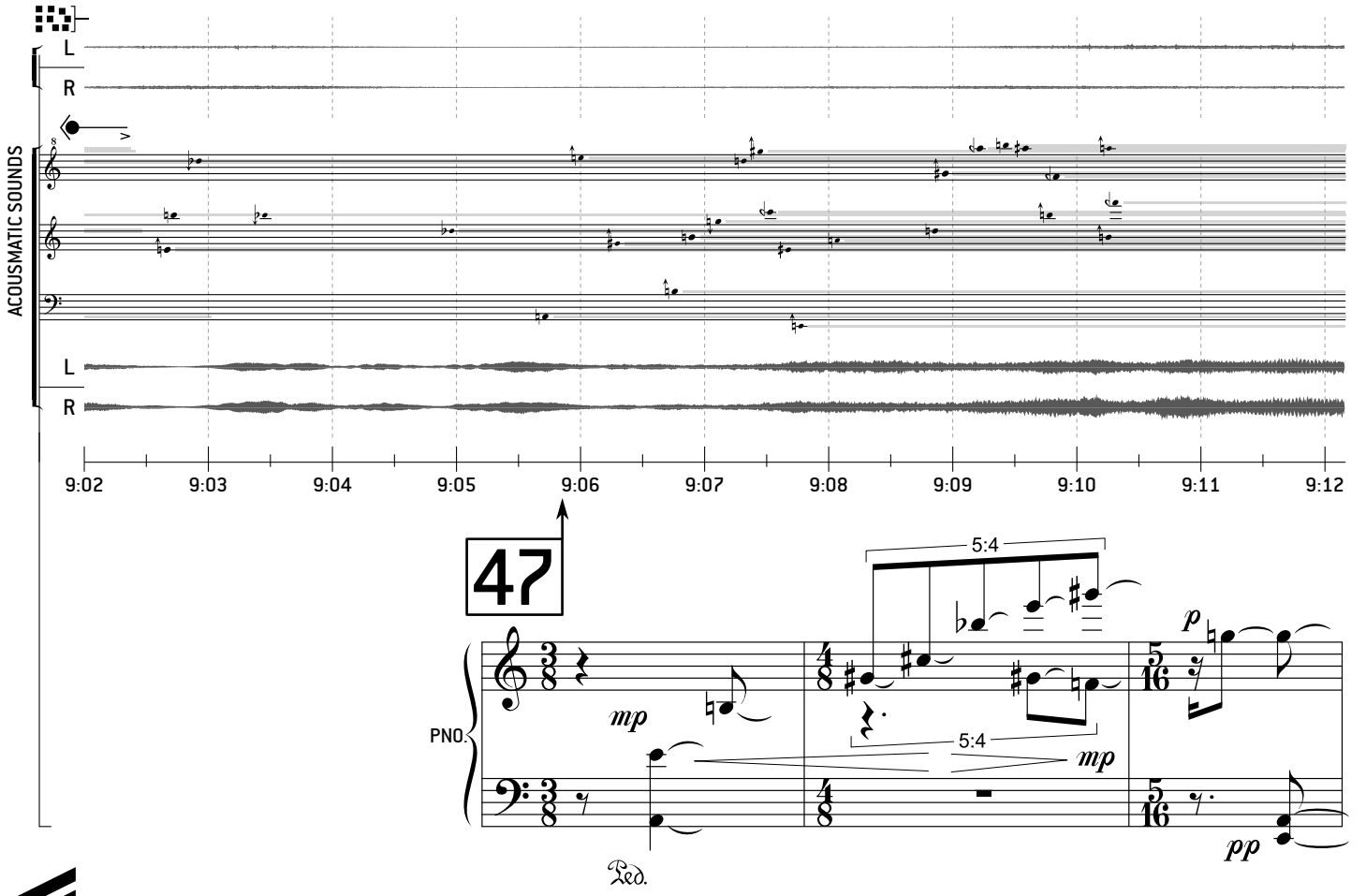
8:59
9:00
9:01
9:02


ACOUSMATIC SOUNDS
L
R
9:02
9:03
9:04
9:05
9:06
9:07
9:08
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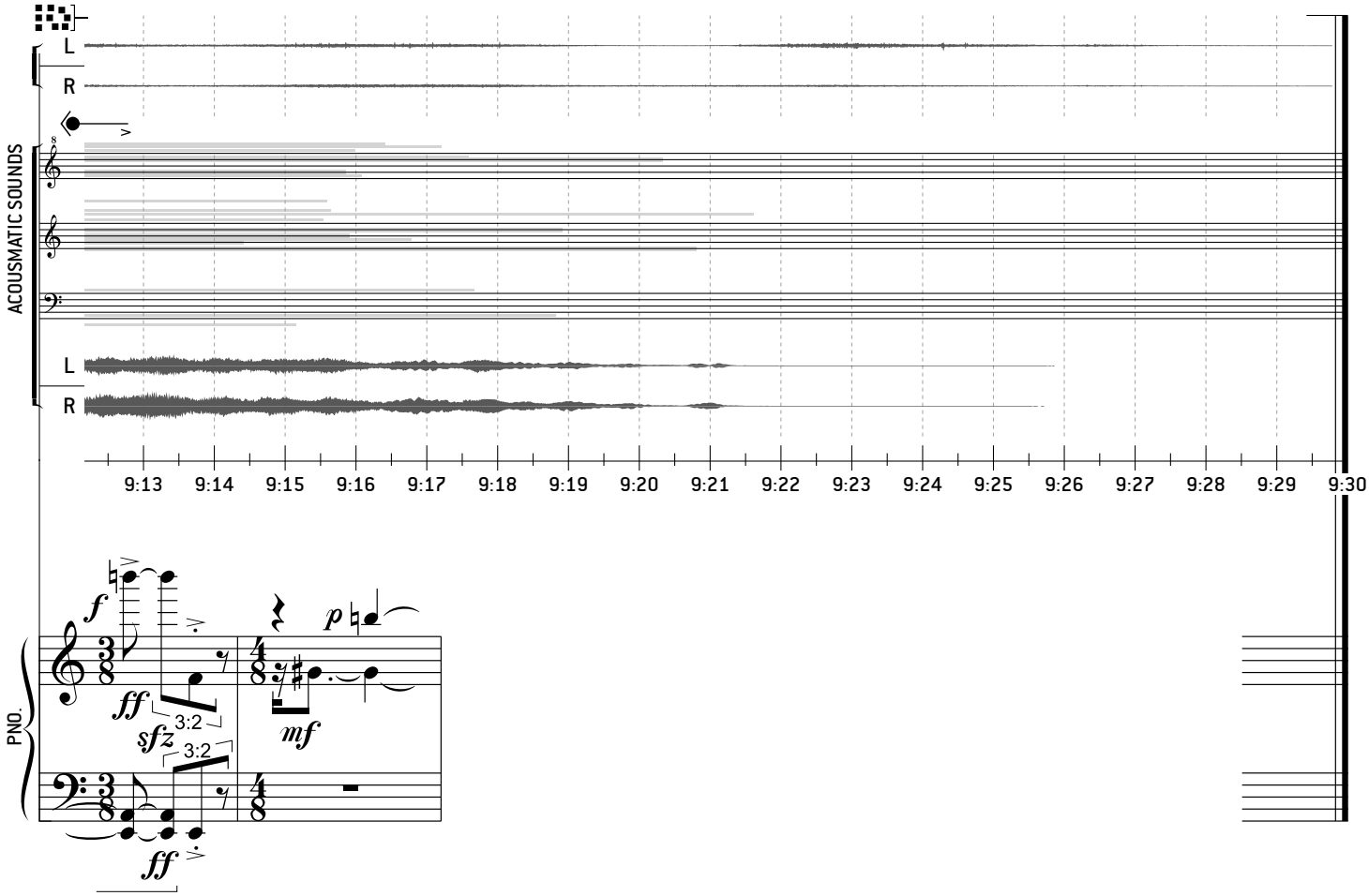
9:10
9:11
9:12
47
PNO.
5:4
5:4
mp
mp
p
pp
Ped.


ACOUSMATIC SOUNDS
L
R
9:13
9:14
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9:23
9:24
9:25
9:26
9:27
9:28
9:29
9:30
PNO.
f
ff
sfz
3:2
3:2
p
mf
ff