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TERRITORIOS

for Percussion Ensemble and Digital Sounds

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of the requirements of the degree of
Masters of Music in Composition

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ABSTRACT

Territorios is a 15-minute composition for eight percussionists and prerecorded sounds on digital tape. The composer chose this particular instrumentation because of his conviction that percussion and electronic/digital instruments are the most powerful sources of fresh and innovative sound matter that have appeared during this century. This choice also allowed him to challenge the development of a new and consistent rhythmic syntax derived from the internal structure of percussion instruments, which in turn made it possible to establish solid ties between the sound itself and the musical syntax that rules its organization.

Since different tempi are often used simultaneously in *Territorios*, the performance of the piece requires a set of computer-generated click-tracks carrying individual pulse lines; hearing these pulses through headphones, the performers are able to play the piece in precise tempo.

RÉSUMÉ

Territorios est un oeuvre de quinze minutes pour huit percussionnistes et pour sons préenregistrés sur ruban numérique. Si le compositeur s'est arrêté à cette instrumentation, c'est qu'il estime que les instruments à percussion et les instruments électroniques et numériques constituent la plus vaste source de matériel sonore novateur qui soit apparue au cours du 20^{e} siècle. Ce choix lui a en outre permis d'élaborer une nouvelle syntaxe rythmique systématique en se basant sur la structure interne des instruments à percussion et, de là, d'établir des rapports fermes entre les sons mêmes et la syntaxe musicale qui en détermine la structure.

Comme l'interprétation de *Territorios* exige souvent de la part des musiciens qu'ils jouent simultanément à des tempi différents, on doit faire appel à des pistes-métronome qui indiquent à chaque musicien, par l'entremise d'écouteurs, le tempo qu'il doit suivre et assurent une très grande précision rythmique d'ensemble.

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INTRODUCTION

The composition of *Territorios* follows a one-year position as composer-in-residence with the McGill Percussion Ensemble, during which the composer became thoroughly acquainted with the fascinating world of percussion instruments and wrote a piece for six percussionists called *Amorçage*. Many of the musical issues that are dealt with in *Territorios* were first experimented with in *Amorçage*, which is to be considered as a preliminary study for the thesis composition, even though it stands as a piece on its own.

This composition was written for eight percussionists and prerecorded digital sounds on tape. Each performer is required to use a relatively large instrumental set-up that includes keyboard percussion as well as a selection of metal, wood and skin indefinite pitch percussion instruments. The tape part consists of digitally processed percussion sounds and synthetic sounds generated by frequency modulation. The tape part was realized at the Electronic Music Studio at McGill University, on NeXT and SGI computers.

The main compositional goal of *Territorios* was the establishment of a consistent relationship between the sounds used and the musical syntax that governs the structure of the piece. The first step towards that goal was the extraction of a spectral analysis of the sound of six percussion instruments, namely the cowbell, the glockenspiel, the gong, the marimba, the tambourine and the tubular bells. The data derived from this operation was used to create the polyrhythmic configurations that were to appear in the piece and to establish a system of proportions which served as the basis for the organization of its temporal structure.

In this paper, the methodological approach will be discussed first, followed by a section by section analysis of the composition.

METHODOLOGY

Polyrhythmic configurations and pitch collections

The sounds of six percussion instruments were used for the spectral analysis part: the glockenspiel (single stroke, B5), the cowbell (single stroke, apparent fundamental around Bb4), the marimba (single stroke, F2), the tambourine (shake), the tubular bells (single stroke, D4) and the low gong (single stroke). These sounds were taken from the MUMS (McGill University Master Samples) and digitally copied into a NeXT computer for the analysis purposes. The spectral analysis was done using the Spectrum application, which was developed at Stanford University.

The spectral analysis of each sound showed the frequency components present, as well as their evolution over time. In order to derive polyrhythmic configurations from that information, the frequency components were scaled down into the realm of rhythm using the following equation:

1"/frequency X scaling factor = duration of rhythmic values.

For example, if a scaling factor of 500 is used in the case of two component partials having frequencies of 1000 and 2000 Hz (ratio of 1:2), these frequencies will become:

1"/1000Hz x 500 = 0.5" =  at ♩ = 60, and

1"/2000Hz x 500 = 0.25" =  at ♩ = 60.

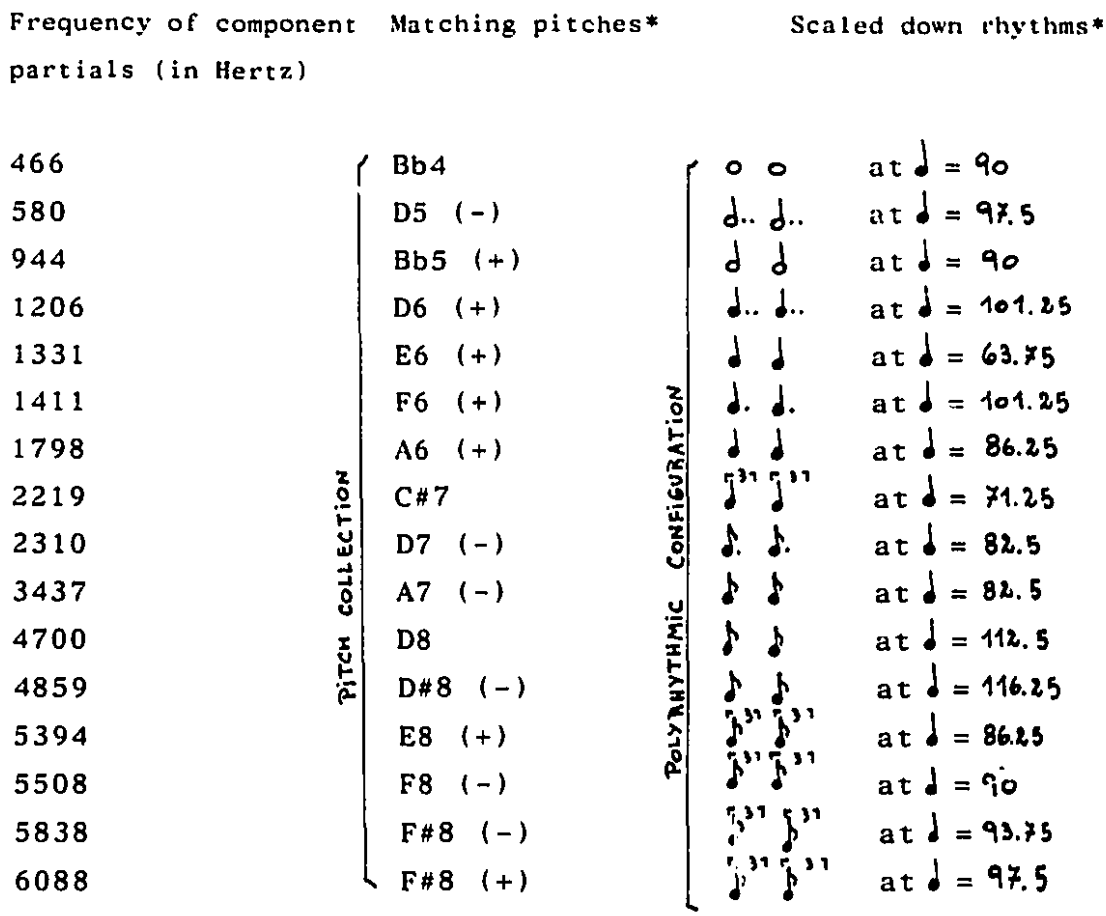
The ratio between the rhythmic values thus obtained is the same as the one that exists between the frequencies from which they were derived.

After experimentation, it was found convenient to use the scaling factor 1242 for this piece.

In this paper, the particular polyrhythmic configurations derived from each analyzed percussion sound will be referred to as A (glockenspiel), B (cowbell), C (marimba), D (tambourine), E (tubular bells) and F (gong). The pitch collections were established by simply matching the frequency of the component partials and the nearest note in the tempered chromatic scale. The resulting pitches were then made available in different octaves. The pitch collections will be referred to as a (glockenspiel), b (cowbell), c (marimba), d (tambourine), e (tubular bells) and f (gong).

Example 1 given in the next page shows the spectral content of the sound of the cowbell and its transformation into a pitch collection and a polyrhythmic configuration. Detailed information about the polyrhythmic configurations and the pitch collections used in this piece are provided in Appendix 2.

Example 1 Transformation of the spectral content of the cowbell into a pitch collection and a polyrhythmic configuration



* The (+) and (-) signs indicate microtonal deviations from the equal temperament tuning system.

** Frequencies scaled down by a factor of approximately 1242.

Temporal proportions

The six sounds mentioned above were also used to generate a system of proportions on which the temporal structure of the composition was based. In order to do so, the sounds were classified according to three criteria, namely duration (the longer the sound, the longer the time span it represents in the system of proportions), register (the lower the sound, the longer the time span it represents), and degree of harmonicity (the less harmonic the sound, the longer the time span it represents). The stability of component partials over time and the ratios between the frequencies of these partials that correspond to integers were considered to be factors of harmonicity.

The sounds were then rated from 1 to 6, as follows:

1. Duration, from short to long:

   Cowbell (1), marimba (2), glockenspiel (3), tambourine (4), tubular bells (5), gong (6).

2. Register, from high to low:

   Tambourine (1), glockenspiel (2), cowbell (3), tubular bells (4), marimba (5), gong (6).

3. Degree of harmonicity, from high to low:

   Glockenspiel (1), marimba (2), tubular bells (3), cowbell (4), gong (5), tambourine (6).

To establish the final system of proportions, an average was calculated for each instrument, as illustrated below for the cowbell.

Cowbell Duration: 1
Register: 3
Degree of harmonicity: 4
1 + 3 + 4 = 8 ÷ 3 = 2.66

General system of proportions

Glockenspiel: 2	Tambourine: 3.66
Cowbell: 2.66	Tubular bells: 4
Marimba: 3	Gong : 5.66

Before discussing the process used to establish the temporal structure of *Territorios*, the use of these proportions will be explained and certain aspects of the overall formal design of the piece will be discussed.

Territorios is articulated in nine sections that display individual features in terms of texture, instrumentation, density and other parameters. All nine sections fall into one of two categories according to the number of polyrhythmic configurations and/or pitch collection on which they are based. There are six sections that use a single configuration/pitch collection; they will be referred to as the "single" sections. The three other sections, all of them based on all six configurations, will be called "multi" sections.

Given a temporal extension of 15 minutes (900 seconds) for the whole piece, the "single" and "multi" sections respectively account for approximately two thirds (600 seconds) and one third (300

seconds) of the piece. The length of each "single" section was calculated in such a way as to be proportional to one particular ratio of the system of proportions. Likewise, the length of the "multi" sections was made to be proportional to three chosen ratios from the system of proportions, namely 5.66, 3.66 and 2.66.

Table 1 indicates the approximate duration of the individual "single" and "multi" sections. The number between square brackets represents the ratio to which that particular duration corresponds in the system of proportions.

Table 1 Duration of individual "single" and "multi" sections

"Single" sections	"Multi" sections
161" [5.66]	141" [5.66]
114" [4]	91.5" [3.66]
104" [3.66]	66.5" [2.66]
85" [3]	
76" [2.66]	300" [6.98]
57" [2]	
600" [21]	

The durations of the smaller formal units into which most sections are subdivided have been established using the same system, except in the case of sections I and II where an alternative arrangement proved to be more interesting from a musical point of view.

All durations in seconds specified for the different sections and smaller formal units of the composition throughout this analysis correspond to the ideal durations generated using the chosen system of proportions. However, for practical and/or musical reasons some of these values have been slightly modified during the composition process.

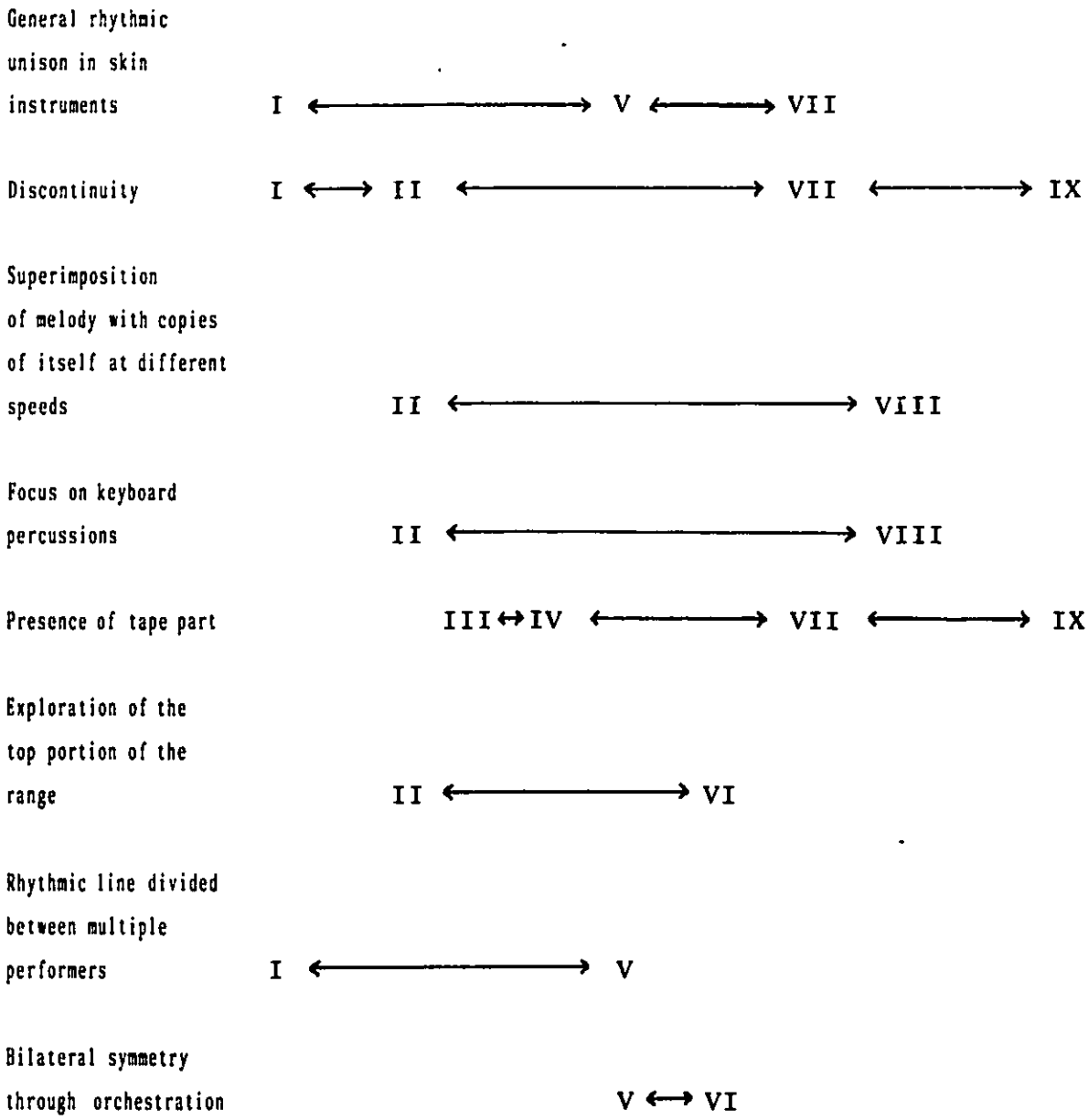
OVERALL FORM

The formal layout of *Territorios* is given below.

"SINGLE"	76"	57"		161"	114"	104"		85"	
SECTIONS	I	II	III	IV	V	VI	VII	VIII	IX
"MULTI"			66.5"				141"		91.5"

Each section is a relatively autonomous event, and the decision as to where each one was to be positioned in the piece was mainly an intuitive one. However, the internal features of the sections were taken into consideration, in an attempt to achieve a somewhat balanced form in terms of continuity and contrast.

Certain processes, textures and colours, as well as the specific use of given parameters, interconnect the different sections in multiple ways, integrating them into a perceptual whole rather than a succession of unrelated sections. Some of the many ways in which the sections are related to each other are shown in the following chart.


General rhythmic unison in skin instruments
I ⟷ V ⟷ VII
Discontinuity
I ⟷ II ⟷ VII ⟷ IX
Superimposition of melody with copies of itself at different speeds
II ⟷ VIII
Focus on keyboard percussions
II ⟷ VIII
Presence of tape part
III ↔ IV ⟷ VII ⟷ IX
Exploration of the top portion of the range
II ⟷ VI
Rhythmic line divided between multiple performers
I ⟷ V
Bilateral symmetry through orchestration
V ⟷ VI

RHYTHMIC COMPLEXITY AND THE USE OF CLICK-TRACKS

Since the level of complexity inherent to the polyrhythmic configurations of *Territorios* is rather high, a notational system that could represent these rhythms in the most efficient way had to be chosen. Traditional notation, with all performers playing at the same metronomic speed, was considered and found to be impractical because it required the percussionists to continuously read very complex and irrational figures. Proportional notation was also discarded because the degree of precision and coordination that is essential for the proper performance of the piece would be difficult to achieve.

Consequently, the use of multiple simultaneous tempi was found to offer the best solution since it made it possible for the performers to execute the rhythmic configurations with precision, while keeping the difficulty level of each line within very reasonable limits. The use of multiple computer-generated click-tracks, each of them carrying an individual pulse line, would guarantee both accuracy and togetherness.

The click-tracks (8, one per performer) may be generated through the use of the sequencing software Performer, on a Macintosh computer. Although this application does not allow different simultaneous metronomic indications, the "scale time" function could be used to scale the speed of each individual track; the results would be the same.

As for the playback of the tracks in a concert situation, two methods may be applied, each one involving a different technology. The first one calls for the use of a Macintosh computer to playback the tracks directly from a Performer sequence file. An application such as Sample Cell or a sampler like the Akai S1000 could be used as the source of sound playback since both devices are capable of

producing up to eight independent audio signals. The second solution requires a multi-track analog tape machine; the sequence must then have been prerecorded on an analog tape. In both cases, the performers will hear their individual pulse through a set of headphones covering one ear only. As for the conductor, he/she will use a copy of the click-track of percussionist number one.

While the use of click-tracks may be the solution to certain problems, it complicates matters in other ways. It is difficult to accurately represent on a score and to rehearse music that involves eight parts moving at different tempi. To solve this problem, different meters were used for different tempi, so that the downbeat of the bar is coincident for all the performers. Using a 4/4 bar at ♩ = 60 (total length, 4 seconds) as a base, the meters/metronomic speed combinations that exactly fit in the same time length were calculated. They are listed in the following table. The time signature chosen was the one that seemed to be the easiest to understand.

Table 2 Meters/metronomic speeds that fit in the same time length

Meter	Metronome marking	Total length in seconds
2/4	♩ = 30	4"
2/4 + 1/16	♩ = 33.25	4"
5/8	♩ = 37.5	4"
5/8 + 1/16	♩ = 41.22	4"
3/4	♩ = 45	4"
3/4 + 1/16	♩ = 48.75	4"
7/8	♩ = 52.5	4"
7/8 + 1/16	♩ = 56.25	4"
4/4	**♩ = 60**	**4"**
4/4 + 1/16	♩ = 63.75	4"
9/8	♩ = 67.5	4"
4/4 + 3/16	♩ = 71.25	4"
5/4	♩ = 75	4"
5/4 + 1/16	♩ = 78.75	4"
5/4 + 1/8	♩ = 82.5	4"
5/4 + 3/16	♩ = 86.25	4"
6/4	♩ = 90	4"
6/4 + 1/16	♩ = 93.75	4"
6/4 + 1/8	♩ = 97.5	4"
6/4 + 3/16	♩ = 101.25	4"
7/4	♩ = 105	4"
7/4 + 1/16	♩ = 108.75	4"
7/4 + 1/8	♩ = 112.5	4"
7/4 + 3/16	♩ = 116.25	4"
4/2	♩ = 120	4"

For each one of these meter/metronomic marking combinations, the durations in seconds of twelve rhythmic figures ranging from a half note to a sixteenth note were calculated 𝅗𝅥 𝅗𝅥. 𝅗𝅥𝅘𝅥𝅘𝅥𝅘 𝅗𝅥. 𝅗𝅥𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 𝅗𝅥𝅘𝅥𝅯𝅘𝅥𝅯 𝅗𝅥𝅘𝅥𝅘 ♩ ♪. 𝅘𝅥𝅘𝅥𝅘𝅥𝅘 ♪ 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯𝅘𝅥𝅯 . The resulting values make up the repertoire of available durations.

When using click-tracks in a relatively long piece, the fact that the constant clicking might interfere with the musician's concentration and adversely affect the overall quality of the performance must be taken into consideration. In an attempt to minimize this problem, sections were built in which all musicians play at the same tempo, so that they may be performed without click-tracks.

The responsibility of the conductor in *Territorios* is to beat the tempo in a normal way during the sections where the click-tracks are not operative (i.e. sections I, IV, VI and IX); in the other sections, he/she will give the downbeat of each bar and deal with some other aspects of the performance.

DETAILED ANALYSIS

SECTION I (bars 1-21)

The development of this "single" section in time occurs through a directional increase of vertical density, starting with a general unison that evolves into a six-voice polyrhythmic texture through the progressive addition of individual rhythms.

The structure of the entire section is based on polyrhythmic configuration "B", of which the six following rhythms are used:

I  at ♩. = 45 M.M.

II  at ♩. = 45 M.M.

III  at ♩. = 75 M.M.

IV at ♩ = 101.25 M.M.

V at ♩. = 45 M.M.

VI  at ♩. = 45 M.M.

Rhythm I runs from the beginning to the end of the section, first as a general unison (bars 1 to 6), then as a split rhythmic line involving various performers. Rhythm V enters at bar 5, rhythm II at bar 7, rhythm IV at bar 10, rhythm VI at bar 12 and rhythm III at bar 13.

The orchestration of the different rhythmic lines shows a special concern for the movement of those rhythms through space. To achieve this type of spatial counterpoint, each rhythmic line was divided and assigned to two or more performers. In order for the individual lines to remain recognizable despite spatial

displacement, a homogeneous instrumentation was used for each one of them. Rhythm I (after bar 6) was scored for skin instruments and assigned to various combinations of performers throughout the section. Rhythm II was given to performers 4 and 5 and scored for temple blocks and log drum. Rhythm III was assigned to performers 2 and 3 and orchestrated for Balinese gongs and brake drums. Performers 6 and 7 play rhythm IV which was orchestrated for cowbells and marimba. Rhythm V was given to performers 1, 4, 5 and 8 and scored for cymbals, and rhythm VI, assigned to performers 1 and 8, was orchestrated for timpani.

The orchestration is such that some performers are involved in the realization of more than one rhythmic line, which results in more challenging and interesting individual parts.

Section I contains 16 small formal units, the duration of each being proportional to a rhythmic element taken from configuration "B". The boundaries between the formal units are defined by silences of variable length that interrupt the rhythmic flow. The arrangement of the formal units corresponds to a macro-rhythm which is a large scale horizontal expression of configuration B.

The following chart shows the temporal layout of the subsections of section I.

Formal unit:	1	2	3	4
Duration:	5.5"	2.2"	2.8"	1.1"
Beginning: Bar	1	2	3	3
Prop. to:	𝅗𝅥 at ♩ = 90	𝅘𝅥𝅯𝅘𝅥𝅯 at ♩ = 71.25	♩ at ♩ = 86.25	𝅘𝅥𝅯 at ♩ = 112.5

Formal unit:	5	6	7	8
Duration:	3.7"	5.5"	11.1"	0.8"
Beginning: Bar	4	5	6	9
Prop. to:	♩ at ♩ = 63.75	♩. at ♩ = 101.25	𝅝 at ♩ = 90	𝅘𝅥𝅯𝅘𝅥𝅯 at ♩ = 90

Formal unit:	9	10	11	12
Duration:	0.8"	4.2"	1.1"	8.6"
Beginning: Bar	9	10	11	12
Prop. to:	𝅘𝅥𝅯𝅘𝅥𝅯 at ♩ = 90	𝅗𝅥. at ♩ = 101.25	𝅘𝅥𝅯 at ♩ = 112.5	𝅗𝅥. at ♩ = 97.5

Formal unit:	13	14	15	16
Duration:	1.5"	0.8"	2.2"	0.8"
Beginning: Bar	15	16	17	18
Prop. to:	𝅘𝅥𝅯 at ♩ = 82.5	𝅘𝅥𝅯𝅘𝅥𝅯 at ♩ = 90	𝅘𝅥𝅯𝅘𝅥𝅯 at ♩ = 71.25	𝅘𝅥𝅯𝅘𝅥𝅯 at ♩ = 90

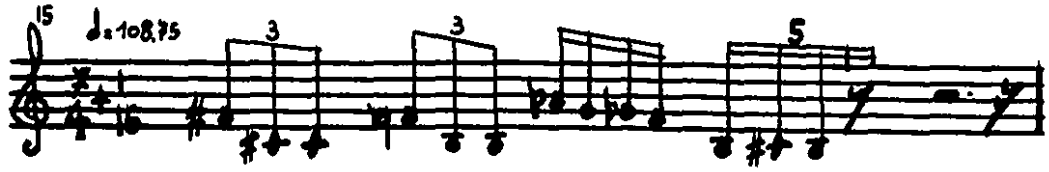
In bars 15 and 17, performers 4 and 6 introduce material that anticipates section II.

SECTION II (bars 22-31)

On the surface, this "single" section alternates between moments of intense activity and sudden moments of stillness during which the preceding events are allowed to resonate.

The melodic material of this section, mostly scored for high-pitched keyboard instruments, is a single short phrase based on pitch collection "a".

Example 2 Short melodic phrase based on pitch collection "a"



In order to avoid excessive predictability due to the repetition of the same musical unit, the phrase was broken up into fragments that appear in a different order within each presentation.

The main technique used to develop this musical unit was the creation of textures of varying densities by superimposing on each phrase one or more copies of itself, at different speeds.

Section II includes 8 smaller formal units, some of which are very brief and involve a simple gesture. The duration of each subsection is proportional to one rhythmic component of configuration A, as shown in the following chart:

Formal unit:	1	2	3
Duration (including the silence that follows):	2"	2"	9"
Beginning: Bar	15	17	19
Proportional to:	𝅘𝅥𝅯 at ♩ = 150	𝅘𝅥𝅯 at ♩ = 150	𝅘𝅥𝅮 at ♩ = 67.5

Formal unit:	4	5	6
Duration (including the silence that follows):	3"	6.5"	26"
Beginning: Bar	21	22	23
Proportional to:	𝅘𝅥𝅯 at ♩ = 108.75	𝅘𝅥𝅮 at ♩ = 93.75	𝅗𝅥 at ♩ = 93.75

Formal unit:	7	8
Duration (including the silence that follows):	3.5"	5"
Beginning: Bar	30	31
Proportional to:	𝅘𝅥𝅯 at ♩ = 90	𝅘𝅥𝅯 at ♩ = 63.75

Although section II starts at bar 22, formal units 1 and 2 occur before this point, as interpolations in section I. This partial interlocking of contiguous sections proved to be a smooth transition from one to the other.

SECTION III (bars 32-47)

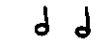
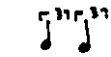
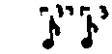
Section III is the first "multi" section of the piece, that is the first one to involve a progression through all six polyrhythmic configurations. Each configuration creates a smaller formal unit within the section.

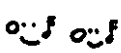
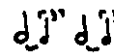
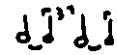
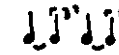
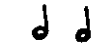
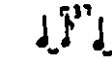
In order to bring out the contrast between the configurations and to further enhance their unique identity, each one was orchestrated in such a way as to evoke the sound quality of the instrument from which it was derived. For example, configuration A, which was generated from the spectral structure of the glockenspiel, was orchestrated around the sonority of that instrument. One rhythmic line was assigned to the glockenspiel and other lines to instruments that have different degrees of affinity with it (namely crotale, vibraphone, tubular bells, Balinese gongs, anvils, triangle and muted cymbals).

The duration of each polyrhythmic configuration was established according to the system of proportions, as follows:

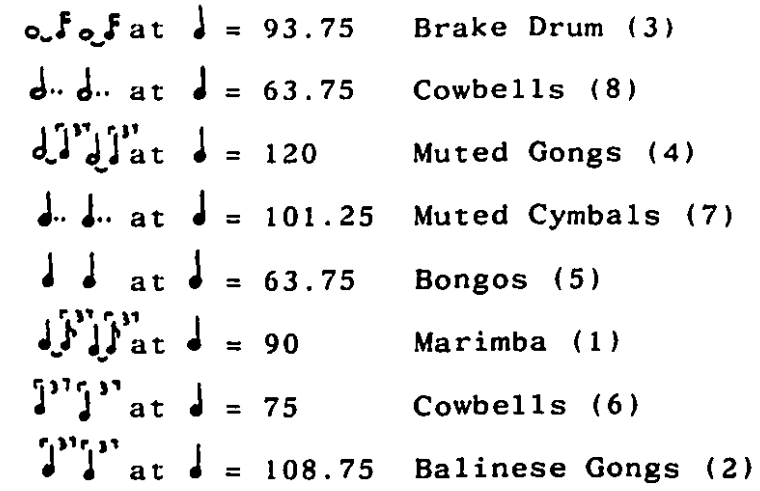
Formal unit	1	2	3	4	5	6
Config.	A	C	B	D	E	F
Duration	6.33"	9.5"	8.4"	11.6"	12.6"	17.9"
Ratio	2	3	2.66	3.66	4	5.66
Bars	32-33	33-35	36-37	38-40	41-44	44-47

The following charts provide information about the rhythms that make up each configuration and indicate which instrument and performer plays each rhythmic line.

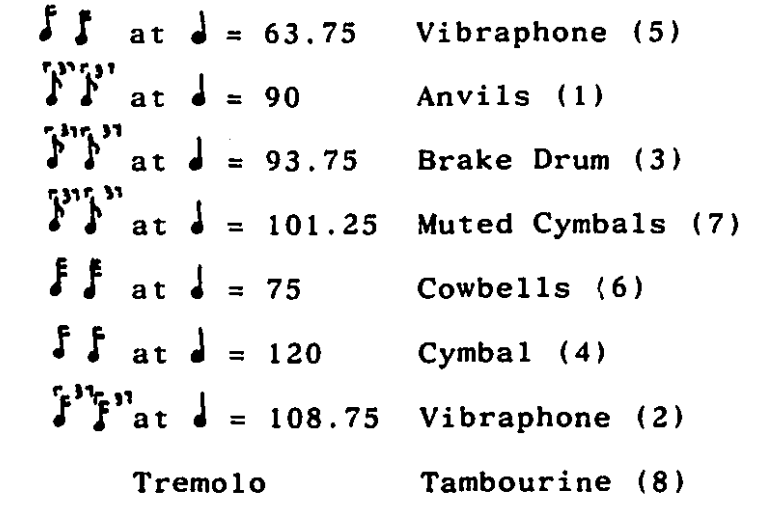
A	Rhythm	
	 at ♩ = 93.75	Tubular Bells (3)
	 at ♩ = 90	Anvils (1)
	 at ♩ = 63.75	Vibraphone (5)
	 at ♩ = 90	Muted Cymbals (8)
	 at ♩ = 120	Glockenspiel (4)
	 at ♩ = 108.75	Balinese Gongs (2)
	 at ♩ = 75	Crotales (6)
	Tremolo	Triangle (8)

C	Rhythm	
	 at ♩ = 93.75	Brake Drums (3)
	 at ♩ = 90	Marimba (7)
	 at ♩ = 120	Temple Block (4)
	 at ♩ = 75	Roto-toms (6)
	 at ♩ = 108.75	Wood Block (2)
	 at ♩ = 90	Congas (1)
	 at ♩ = 63.75	Xylophone (8)
	 at ♩ = 63.75	Log Drum (5)

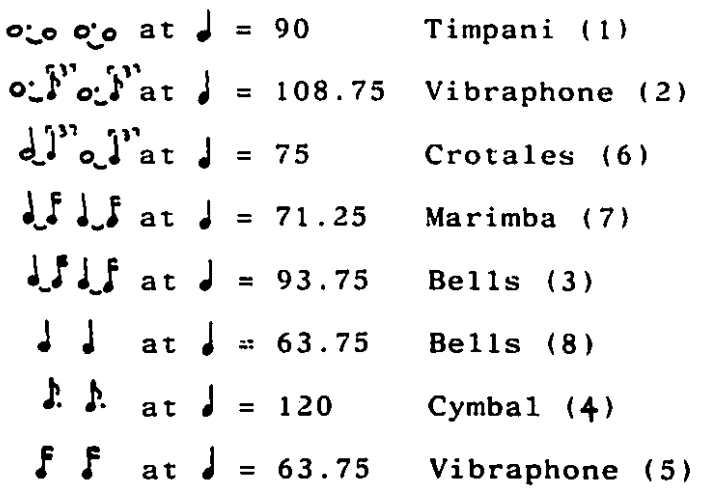
B Rhythm



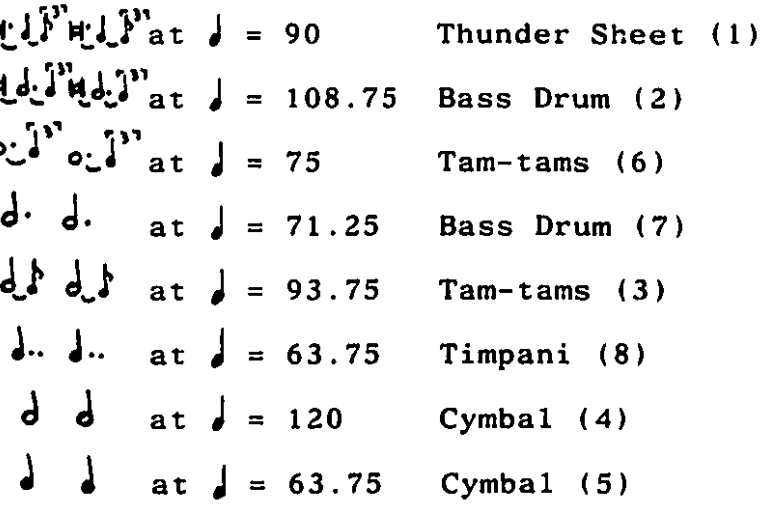
D Rhythm



E Rhythm



F Rhythm



The tape part enters here for the first time, providing a sustained, continuous, texture of accompaniment to the intense polyrhythmic activity of the ensemble. The changes of textural colour are synchronized with the changes of polyrhythmic configurations. Each polyrhythmic configuration is accompanied by digital processings of the sound of the instruments which was used to generate it; this creates a deep structural link between the tape part and the ensemble.

The tape part runs into section IV, thus establishing a link with section III.

SECTION IV (bars 48-88)

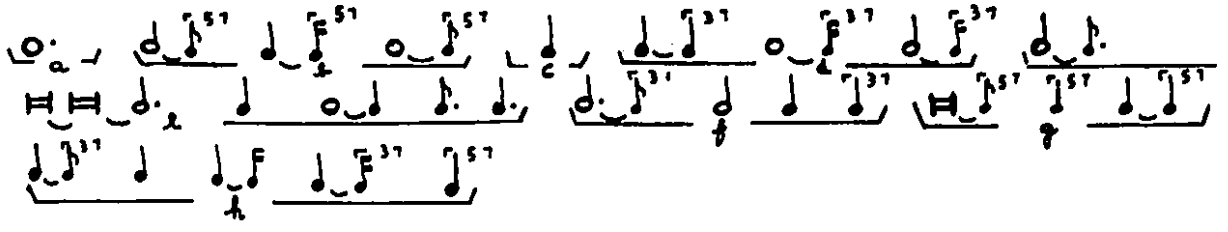
This "single" section, which is based on polyrhythmic configuration "F", is the longest of the whole composition and also the one which explores the lowest portion of the instrumental and tape range.

In this section, the development of the vertical density and the use of register mirrors the evolution through time of the low gong spectrum (from which configuration "F" was derived). When this instrument is sounded, the lower partials are the first and last to be heard; in between, there is a build up of medium and high partials.

This structure was projected into a larger time scale; a few, low range instruments are used first, and then instruments which explore the medium range are added to them. Later on, the process is reversed.

The activity of all the instruments is based on a rhythmic series established using the durations from configuration "F".

Example 3 Rhythmic series based on configuration "F" (values were rounded up so that they could be expressed using a single metronome indication)



To produce a more complex contrapuntal activity, the order of the internal segments (a, b, etc.) was permuted, and retrograde versions of those segments were used. Even though it is based on the superimposition of multiple rhythms, the entire section displays a homogenous overall texture because of the systematic use of tremolos in most instruments and the presence of the tape part.

The relationship between tape and ensemble is here one of integration and blending into a homogeneous texture, in such a way that it becomes perceptually quite difficult to determine whether the sounds are produced by the ensemble or by the tape.

The evolution over time of the tape part parallels that of the ensemble, first exploring the lower frequency regions, then expanding its range to include higher frequencies and returning to the lower frequencies as it fades away.

SECTION V (bars 89-122)

All the rhythms used in this "single" section come from polyrhythmic configuration "E"; the pitch material consists of pitch collection "e".

The section includes six smaller formal units, the length of which was determined using the general system of proportions. The temporal layout may be seen as directional; it starts with the shortest unit and ends with the longest, each unit being longer than the preceding one, as shown in the following chart.

Duration	10.8"	14.4"	16.2"	19.8"	21.7"	30.7
Ratio	2	2.66	3	3.66	4	5.66
Bars	89-93	93-100	100-104	104-109	109-115	115-122

Inside each formal unit, a new process is introduced while most features of the preceding unit are kept. For example, formal unit 1 establishes a rhythmic unison in all skin instruments. Formal unit 2 features the same surface rhythm, but instead of being a unison, it is now unevenly spread among the eight performers, creating a kind of *klangfarben*.

The idea of a rhythmic continuum in all skin instruments remains in formal unit 3, but new speeds are gradually introduced. Each performer plays at a different tempo. As the rhythmic line

circulates among the players, it slows down or speeds up to adjust to the different rhythms generated by the system. The order in which these very precisely measured rhythms circulate is meant to avoid any kind of repetitive pattern.

Formal unit 4 involves a transition from skin instruments to indefinite pitch metal instruments, and it introduces rhythmic pedals, that is, individual lines that keep going, providing temporary accompaniment for other instruments. These new events are significant since they introduce polyphony in a section that has featured only monophony up to this point.

Formal unit 5 gradually modulates from indefinite pitch metal instruments to keyboard instruments. As for formal unit 6, it carries through a process of transition to the next large section which is achieved by gradually discontinuing the consistent relationship between the alternating rhythms and by increasing the speed average. At the same time, the number of pitches is reduced until a convergence on D is reached.

SECTION VI (bars 123-150)

"Single" section VI includes 6 smaller formal units which are all based on the same type of musical idea, namely a general unison which branches out into a cluster. The process through which the idea is transformed differs with each occurrence.

This section is based on rhythmic configuration "D" and pitch collection "d", both being derived from the spectrum of the tambourine. Given the fact that this spectrum approaches coloured noise quality, it was decided to avoid precise connections between component partials, pitch classes and rhythms, and to explore more freely the idea of harmonic and rhythmic clusters as a logical derivation from a spectrum which could be seen as a spectral cluster.

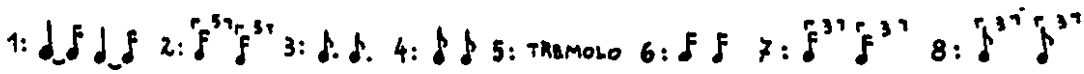
The length of the smaller formal units was determined using the general system of proportions, as shown in the chart that follows:

Duration	28"	18.1"	19.8"	10"	13.1"	14.3"
Ratio	5.66	3.66	4	2	2.66	3
Beginning: Bar	123	130	134	140	143	147

The section displays a transition from keyboard instruments to skin instruments only, with an intermediate stage involving indefinite pitch instruments.

Formal unit 1 (bars 123-129) presents a general unison on "D" which opens up into a chromatic cluster at bar 128 (Bb-B-C-C#-D-Eb-E-F). The new general unison on "G" which starts the second formal unit (bar 130) develops into a cluster (D-E-F#-G-Ab-Bb-C-C#) at bar 133. Formal unit 3 begins at bar 134 with a unison on F# that leads to a cluster made up of notes E-E-F#-G as well as some indefinite pitch components. From bar 142 to the end of the section, silences of variable length have been introduced at the end of each smaller formal unit.

In formal units 4, 5 and 6, the gesture of unison being transformed into clusters is also applied to rhythm. In formal unit 4 (bars 140-142), the rhythmic unison  at ♩ = 105 is replaced by a "rhythmic cluster" that includes the following rhythms :



Formal units 5 (bars 143-146) and 6 (bars 147-150) are built on the same type of material as unit 5, that is, rhythmic unisons branching out into rhythmic clusters. The opening rhythmic unison progressively slows down, from  at ♩ = 105 in formal unit 5 to  at ♩ = 105 in formal unit 6.

SECTION VII (bars 151-184)

This "multi" section features two systematically opposing types of material, namely six smaller formal units which display rhythmic stability consisting of rhythmic octaves (rhythmic ratios 1:2, 1:4, 1:8, etc.) and six units of rhythmic tension, the texture of which is made up of rhythmic glissandos (that is, rhythmic lines which display a gradual and independent process of speeding up or slowing down) performed by skin instruments only. These units respectively start at bars 151, 156, 166, 170, 175 and 179.

Each formal unit of rhythmic stability is based on a different pitch collection and is orchestrated "around" the sonority of the instrument which analysis generated that collection. These units start at bars 154, 159, 168, 172, 178 and 183. The duration of each set of six formal units was established using the general system of proportions.

The tape part enters here for the second time. In this section, its formal structure mirrors that of the ensemble, also featuring systematic opposition between textures made up of glissando material and more stable ones. The articulation of the tape part into smaller formal units and the continuous increase in vertical density are exactly parallel to those of the ensemble.

SECTION VIII (bars 185-220)

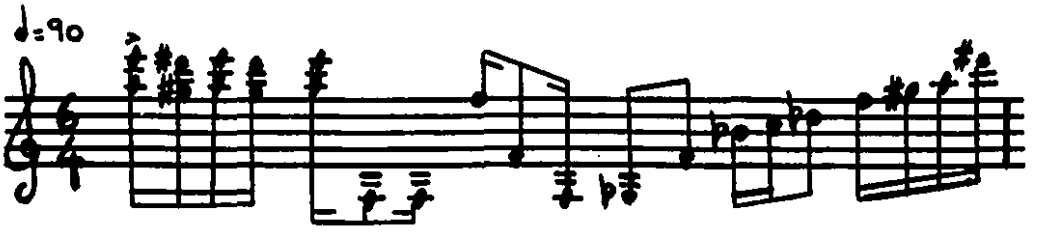
"Single" section VIII is built on a single melodic phrase which is transformed into a polyphonic texture through "micro-phasing", a technique that involves superimposing a musical idea with one or more copies of itself at different speeds, so that as they are repeated they very slowly move out of phase and back into phase (because of the difference in duration).

This section includes four smaller formal units in which the basic melodic idea moves out of phase. In the three first units, it gets back into phase; in the last one, it does not.

The duration of formal units 1, 2, 3 and 4 has respectively been made proportional to 2, 2.66, 3.66 and 2.66; these values represent an incomplete version of the general system of proportions.

Based on pitch collection "c", the one-bar melodic idea is set to a free structured rhythm. It includes three motives that show contrast in contour, range and rhythm. This type of construction makes the micro-phasing process more efficient.

Example 4 Melodic idea based on pitch collection "c"



The vertical density increases progressively throughout the entire section, going from one single melodic line to five lines played at different tempi; at the same time, there is an expansion in range.

Following is an example of micro-phasing as it is applied to the first formal unit:
Starting at bar 185, performers 3 and 7 play twice in unison the one-bar idea at ♩ = 90, after which performer 3 slows down the tempo to ♩ = 86.25 while performer 7 keeps the original tempo. This slight difference in tempi causes a total shift of one sixteenth-note over one measure. Performer 3 then speeds up to ♩ = 93.75 in order to move back into phase with performer 7 who is still playing at ♩ = 90. The motion through which the two performers get back into phase also occurs over a time span of one bar; this completes the first formal unit.

In the last bar of this section, the tape part suddenly fades in. For a short moment, it blends with the sonority of the keyboards, which fade out at this point. A short passage of solo tape leads the piece into the last section, which starts at bar 204.

SECTION IX (bars 209 - 232)

In this "multi" section, tape solos and ensemble alternate. The tape solos feature dense and dynamic multi-layered textures, as well as a dynamic envelope which always consists of a sharp crescendo followed by a sudden cut-off out of which emerges a soft sustained "resonance" of the ensemble. Each resonance is based on a different pitch collection and built around the sonority of the percussion instrument which was used to generate the collection.

The length of each tape solo and each ensemble resonance was established using the system of proportions, and the final layout was structured in such a way as to avoid any kind of symmetrical or sequential pattern, as shown in the chart below:

	Tape solo	Tape solo	Tape solo	Tape solo	Tape solo	Tape solo
Dur.	12.3"	4.3"	8"	6.5"	5.8"	8.7"
Bars	211 -214	215 - 216	218 - 220	221 - 223	225 - 226	229 - 231

	Res.(bell)	Res.(cowb.)	Res.(mar.)	Res.(glock.)	Res.(tamb.)	Res.(gong)	Silence
Dur.	8.7"	5.8"	6.5"	4.3"	8"	12.3"	
Bars	209-211	214-215	216-218	220-221	223-225	226-229	

An unexpected event was kept for the very end of the piece: the last tape crescendo is followed by absolute silence.

CONCLUSION

This composition for eight percussionists and digital sounds on tape proposes the use of the spectral analysis of six percussion instruments as a source from which to derive polyrhythmic configurations and pitch collections as well as a system of proportions used to establish the duration of the different levels of the form. The nine relatively autonomous sections that make up the piece are integrated into a unified whole through multiple interconnections. The way in which complex rhythmic configurations are dealt with explores the use of recent technology to facilitate the performance of music with a high degree of structural complexity.

APPENDIX 1 REALIZATION OF THE TAPE PART

The tape part of *Territorios* was done at the Electronic Music Studio, McGill University, Montreal, using concrete and synthetic sounds.

The concrete sounds were digital recordings of selected sounds of a number of percussion instruments, namely the glockenspiel, the marimba, the cowbell, the gong, the tubular bells and the tambourine, as well as fragments of the composer's percussion piece, *Amorçage*. Numerous techniques were used for the processing of these materials: time compression and expansion, pitch transposition, application of amplitude envelopes, reverberation, flanging, mixing and filtering. The sound manipulations were done on a NeXT computer with the Edsnd soundfile editor, the RT real time mixer and some routines from the Csound software package. A Digitech TSR/24 sound processor was used for reverberation and flanging.

The synthetic sounds were produced by means of a simple FM configuration. Csound software on an SGI computer was used for this purpose.

The final mix was done on a NeXT computer using RT real time mixer.

APPENDIX 2 SPECTRAL ANALYSIS, PITCH COLLECTIONS AND POLYRHYTHMIC CONFIGURATIONS

A GLOCKENSPIEL

Frequency of component partials (in Hertz)	Matching pitches*	Scaled down rhythms**
977	B5 (-)	at ♩ = 93.75
2846	F7 (+)	at ♩ = 120
3908	B7 (-)	at ♩ = 93.75
5353	E8 (+)	at ♩ = 63.75
7477	A#8 (+)	at ♩ = 90
9050	C#9 (+)	at ♩ = 108.75
12555	G9	at ♩ = 75
13341	G#9 (+)	at ♩ = 108.75

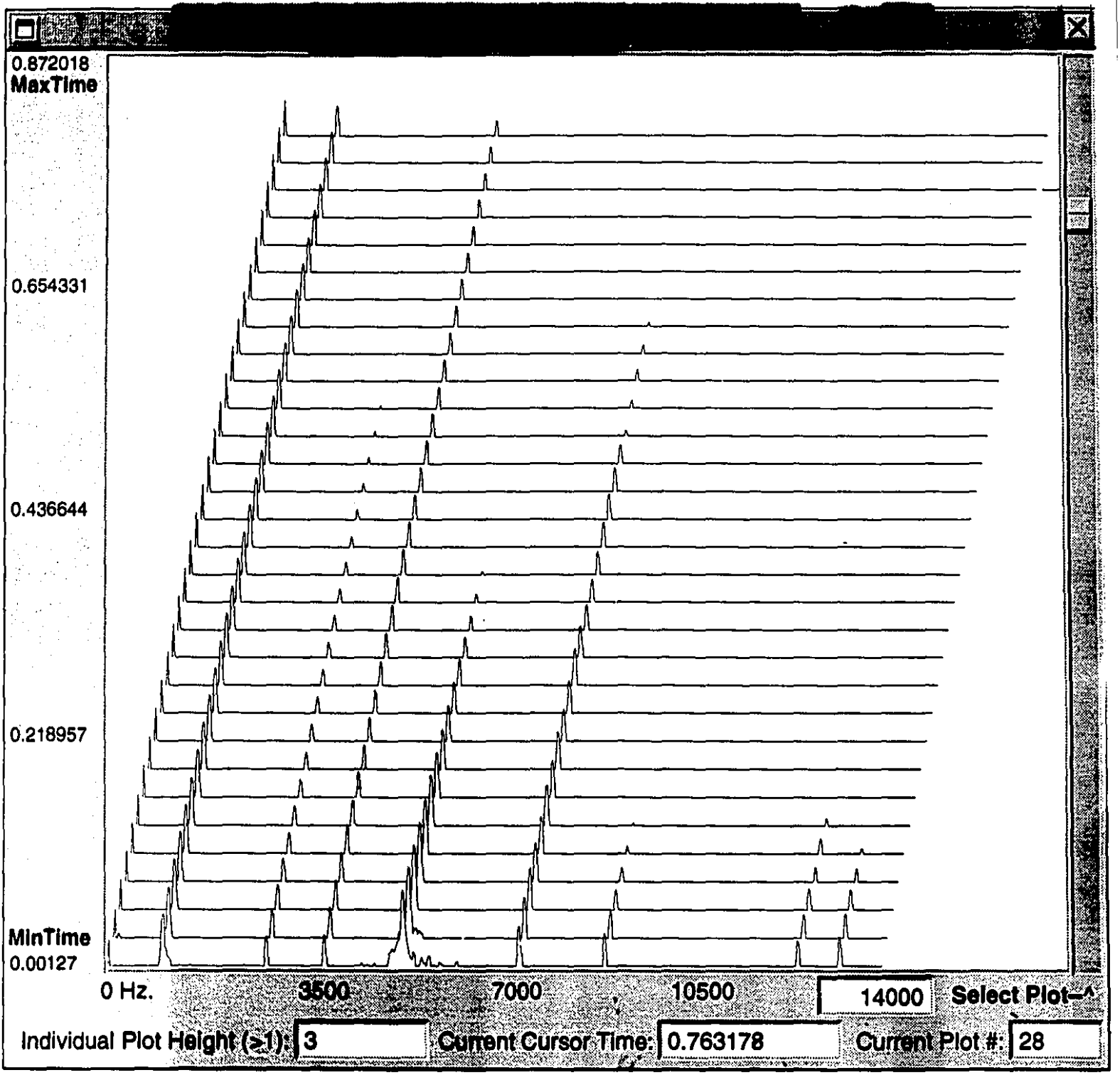
Pitch collection "d"

Polyrhythmic configuration "A"

* The (+) and (-) signs indicate microtonal deviations from the equal temperament tuning system.

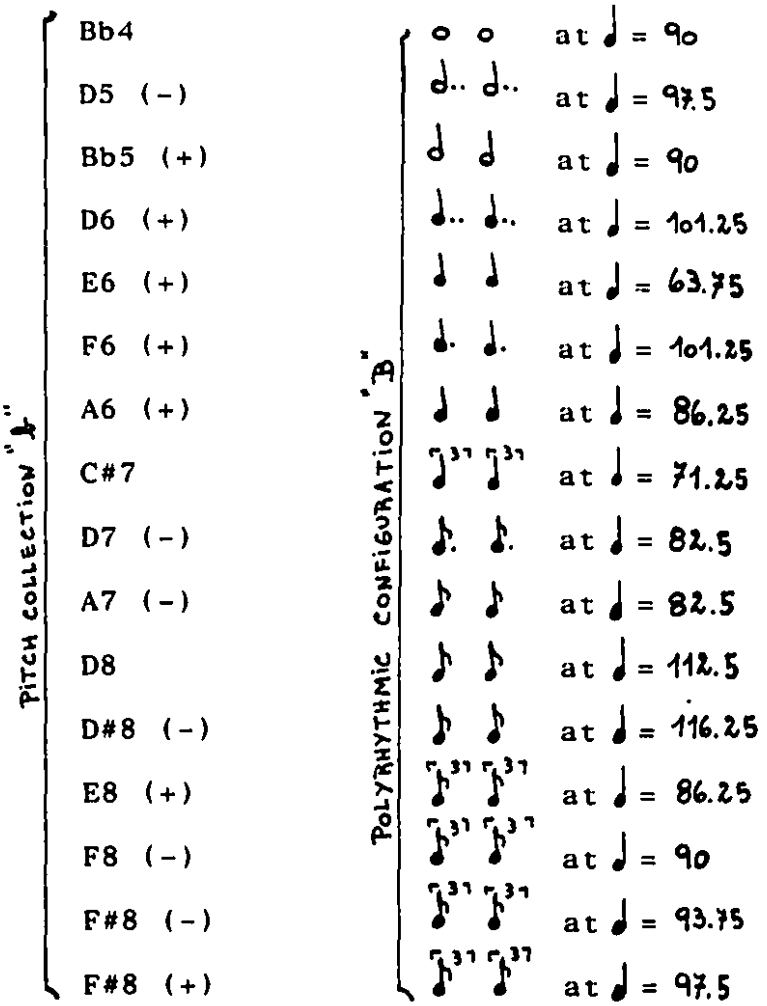
** Frequencies scaled down by a factor of approximately 1242.

Spectral analysis of glockenspiel sound, from 0.00127 " to 0.872018 ", plotted three dimensionally: frequency in Hz, horizontally; time in seconds, vertically, and amplitude, given as departure from the horizontal line, for each sample.



B COWBELL

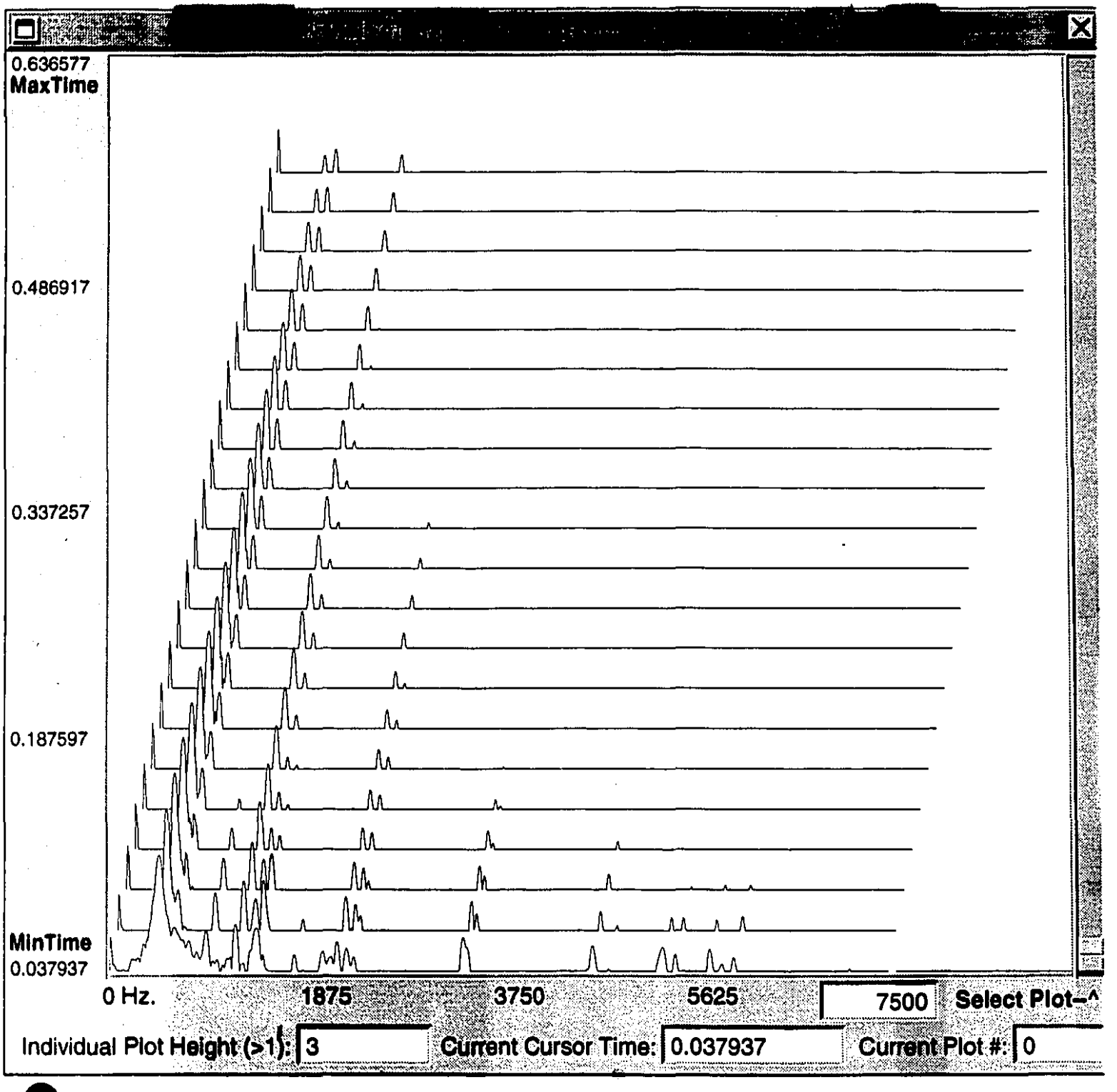
Frequency of component partials (in Hertz)	Matching pitches*	Scaled down rhythms**
466	Bb4	at ♩ = 90
580	D5 (-)	at ♩ = 97.5
944	Bb5 (+)	at ♩ = 90
1206	D6 (+)	at ♩ = 101.25
1331	E6 (+)	at ♩ = 63.75
1411	F6 (+)	at ♩ = 101.25
1798	A6 (+)	at ♩ = 86.25
2219	C#7	at ♩ = 71.25
2310	D7 (-)	at ♩ = 82.5
3437	A7 (-)	at ♩ = 82.5
4700	D8	at ♩ = 112.5
4859	D#8 (-)	at ♩ = 116.25
5394	E8 (+)	at ♩ = 86.25
5508	F8 (-)	at ♩ = 90
5838	F#8 (-)	at ♩ = 93.75
6088	F#8 (+)	at ♩ = 97.5



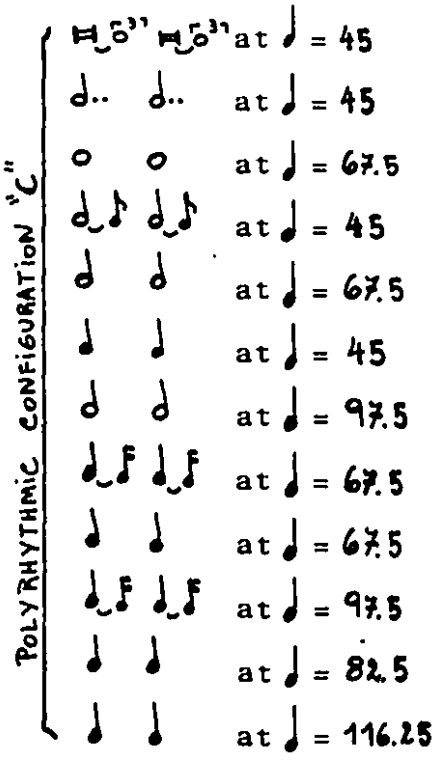
* The (+) and (-) signs indicate microtonal deviations from the equal temperament tuning system.

** Frequencies scaled down by a factor of approximately 1242.

Spectral analysis of cowbell sound.



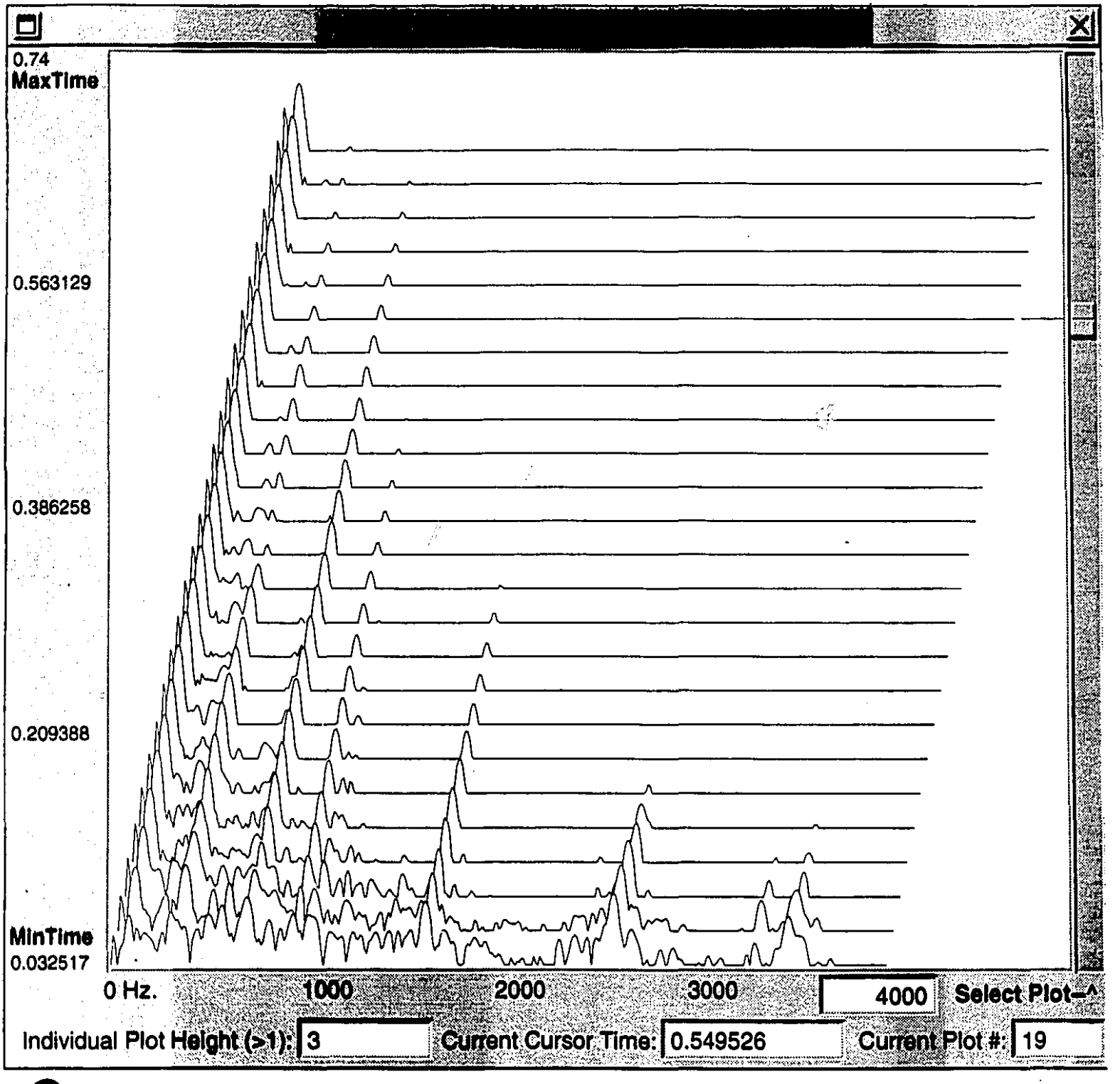
C MARIMBA

Frequency of component partials (in Hertz)	Matching pitches*	Scaled down rhythms**
84	F2 (-)	
267	C4 (+)	
345	F4	
370	F#4	
704	F5	
946	A#5 (+)	
1019	C6 (-)	
1128	C#6 (+)	
1408	F6	
1626	G# (-)	
1723	A6 (-)	
2433	D#7 (-)	

* The (+) and (-) signs indicate microtonal deviations from the equal temperament tuning system.

** Frequencies scaled down by a factor of approximately 1242.

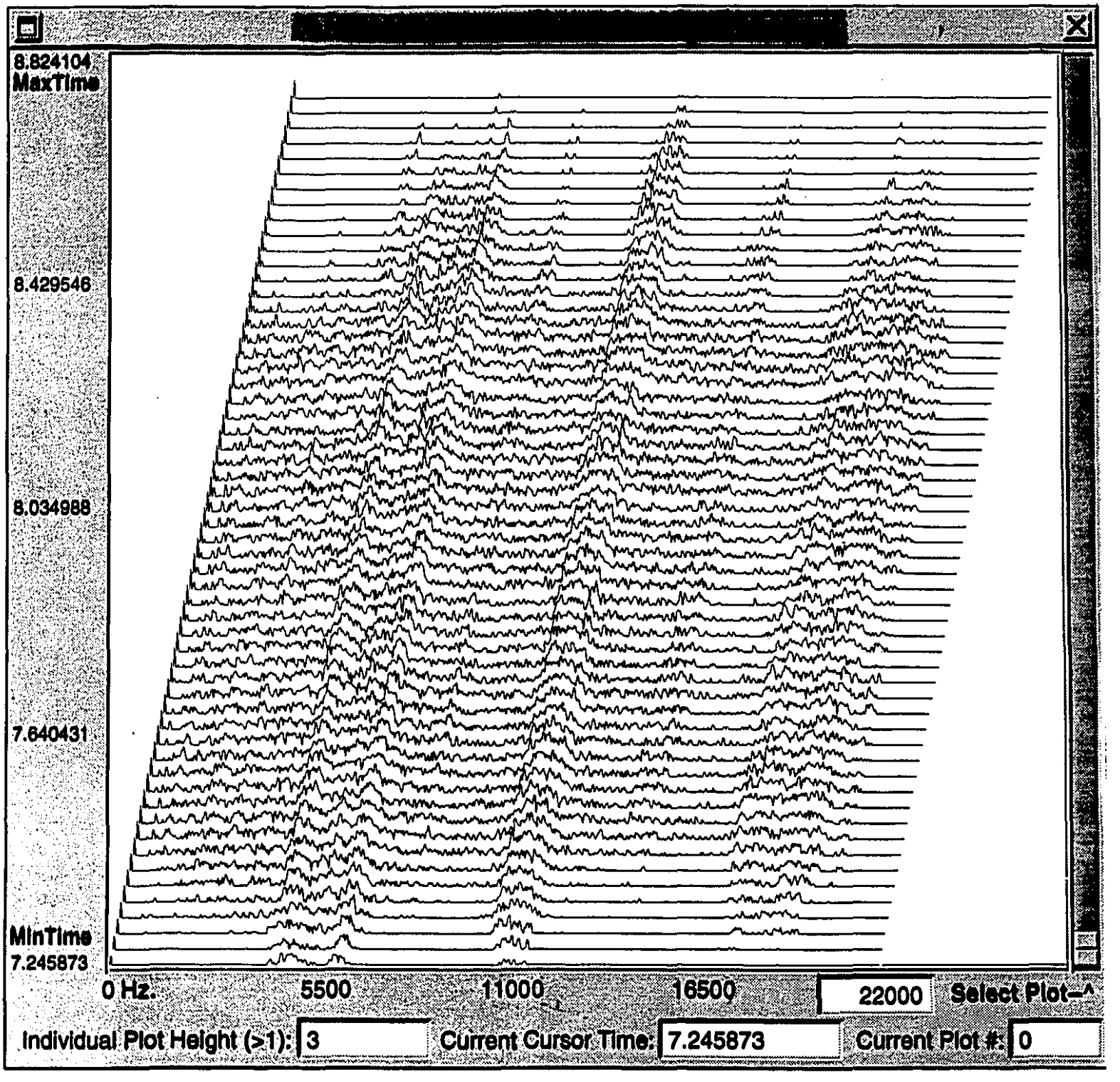
Spectral analysis of marimba sound.



D TAMBOURINE

As shown in the graphic display provided in the next page, the spectrum of the tambourine presents a very large number of inharmonically related component frequencies that are very close to one another. Given this fact, it was decided to avoid precise connections between component partials, pitch classes and rhythms, and to explore more freely the concept of harmonic and rhythmic clusters as a logical derivation from a spectrum which may be seen as a spectral cluster.

Spectral analysis of tambourine sound.



E TUBULAR BELLS

Frequency of component partials (in Hertz)	Matching pitches*	Scaled down rhythms**
183	F3 (-)	at ♩ = 45
350	F4	at ♩ = 67.5
584	D5 (+)	at ♩ = 75
859	A5 (--)	at ♩ = 82.5
1185	D6 (+)	at ♩ = 71.25
1552	G6 (-)	at ♩ = 75
1994	B6 (-)	at ♩ = 63.75
2378	D7 (+)	at ♩ = 86.25
2837	F7 (+)	at ♩ = 101.25
3313	Ab7 (-)	at ♩ = 120
4306	C8 (+)	at ♩ = 105
4832	Eb8 (-)	at ♩ = 116.25
5358	E8 (+)	at ♩ = 63.75

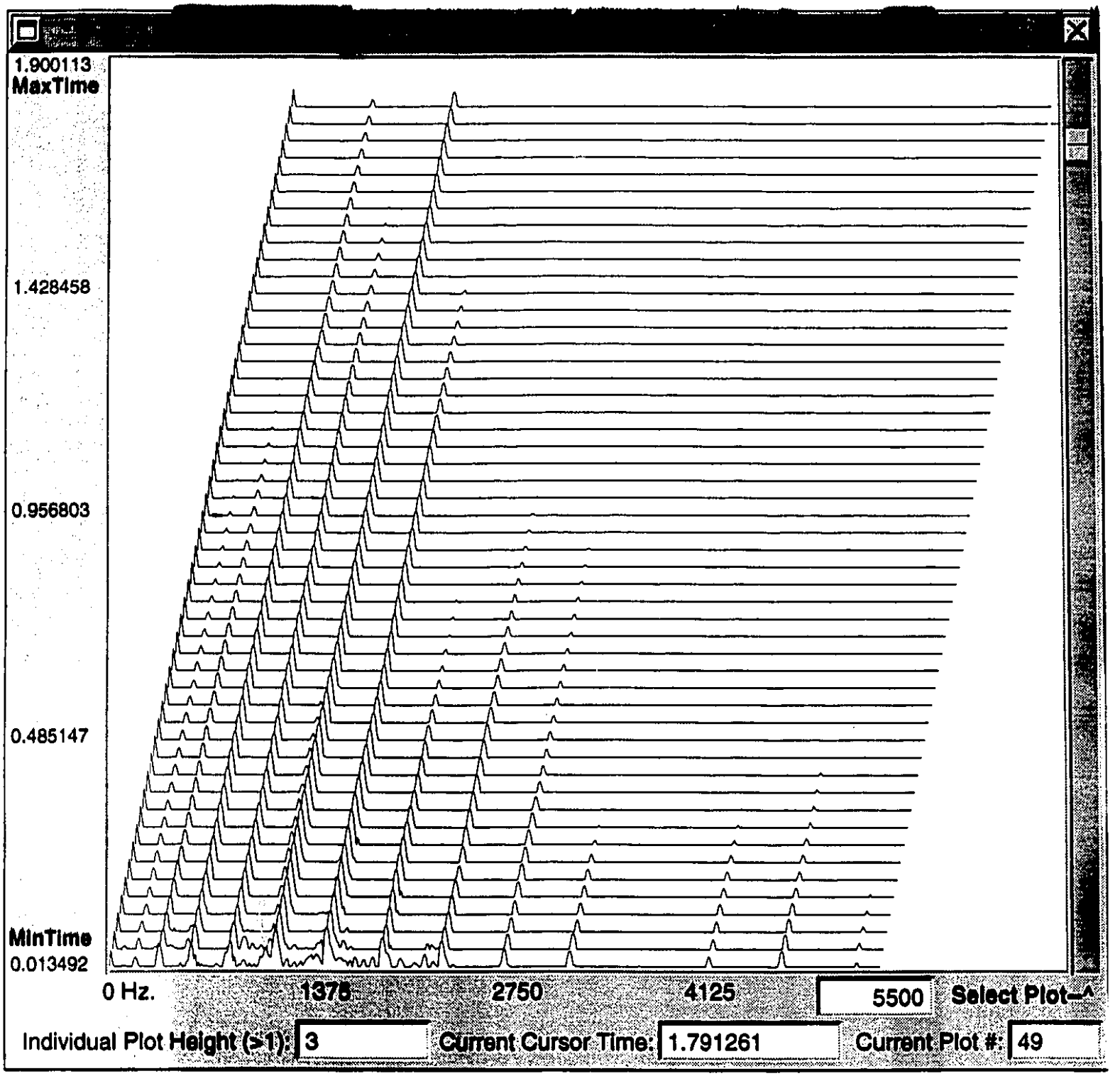
Pitch collection "A"

Polyrhythmic configuration "E"

* The (+) and (-) signs indicate microtonal deviations from the equal temperament tuning system.

** Frequencies scaled down by a factor of approximately 1242.

Spectral analysis of tubular bell sound.



F GONG

Frequency of component partials (in Hertz)	Matching pitches*	Scaled down rhythms**
66	C2	at ♩ = 45
142	C#3 (-)	at ♩ = 45
194	G3	at ♩ = 75
239	A#3 (-)	at ♩ = 60
358	F4 (-)	at ♩ = 60
443	A4	at ♩ = 75
494	B4	at ♩ = 82.5
552	C#5	at ♩ = 105
625	D#5	at ♩ = 60
661	E5	at ♩ = 63.75
722	F#5 (-)	at ♩ = 105
776	G5 (-)	at ♩ = 75
874	A5	at ♩ = 105
1004	B5 (+)	at ♩ = 60
1110	C#6	at ♩ = 93.75
1165	D6	at ♩ = 97.5
1262	D#6 (+)	at ♩ = 101.25
1286	Eb6 (+)	at ♩ = 82.5

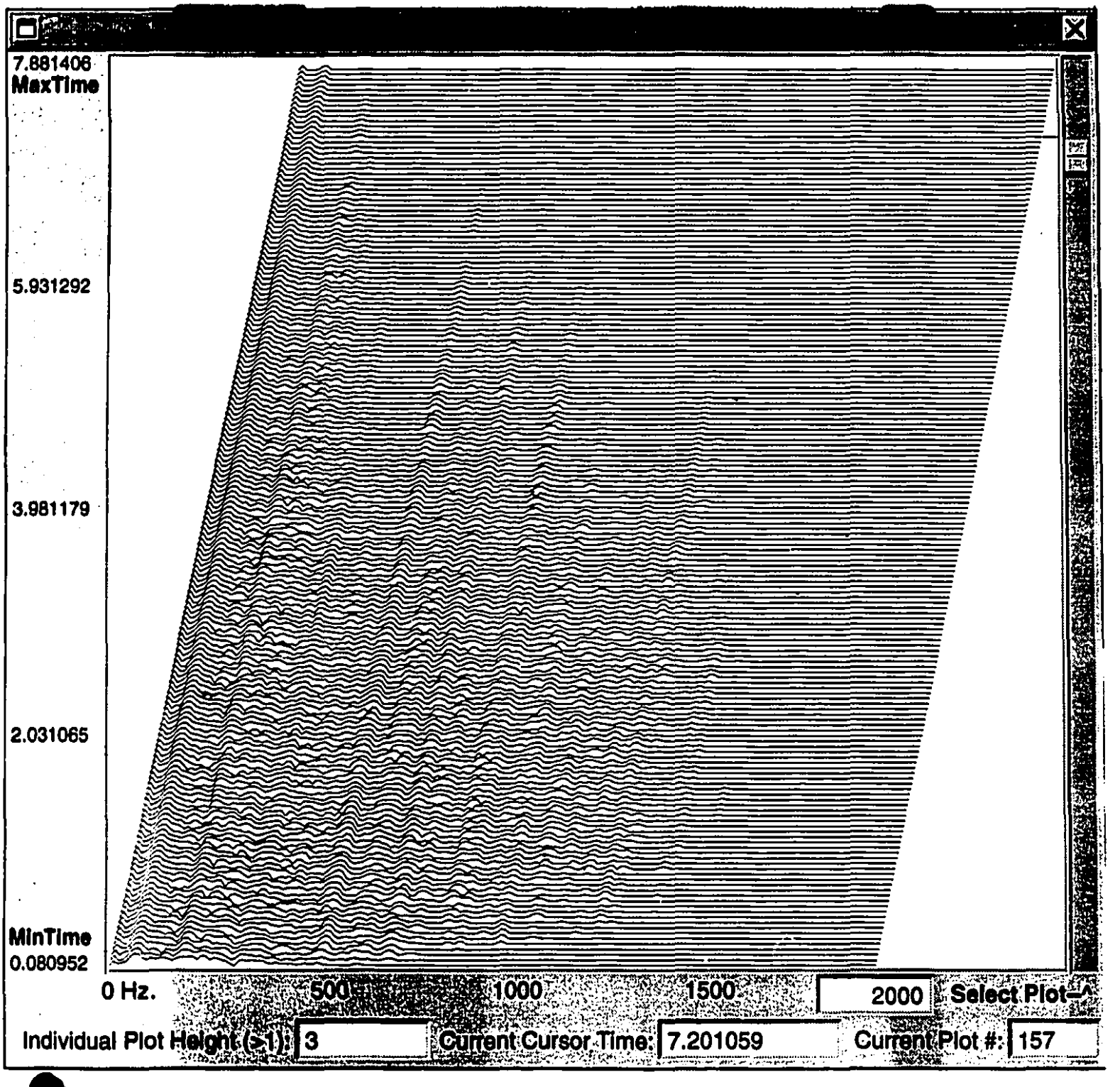
PITCH COLLECTION "F"

POLYRHYTHMIC CONFIGURATION "F"

* The (+) and (-) signs indicate microtonal deviations from the equal temperament tuning system.

** Frequencies scaled down by a factor of approximately 1242.

Spectral analysis of gong sound.



Osvaldo Budón

"Territorios" (1995)

for Percussion Ensemble and Digital Sounds on Tape

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for Percussion Ensemble and Digital Sounds on Tape

Instrumentation

Percussion 1: 2 Timpani, Bass Marimba, Thunder Sheet, Suspended Cymbal, Congas, 3 Anvils, Cymbal on Timpani.
Percussion 2: Vibraphone, Bass Drum, 4 Balinese Gongs, 4 Tom-Toms, 2 Wood-Blocks.

Percussion 3: Marimba, Tubular Bells, 2 Tam-Tams, 4 Roto-Toms, 4 Brake Drums.

Percussion 4: Glockenspiel, Suspended Cymbal, 4 Octobons, 4 Muted Gongs, 4 Temple Blocks.

Percussion 5: Vibraphone, Suspended Cymbal, Thunder Sheet, Bongos, Log Drum, Tambourine.

Percussion 6: Crotales, 2 Tam-Tams, 4 Roto-Toms, 4 Cowbells, Sleigh Bells.

Percussion 7: Marimba, Bass Drum, 4 Tom-Toms, 4 Muted Cymbals, Triangle.

Percussion 8: 2 Timpani, Xylophone, Tubular Bells, Suspended Cymbal, Congas, 4 Cowbells, Tambourine, Triangle, Cymbal on Timpani.

Notes:

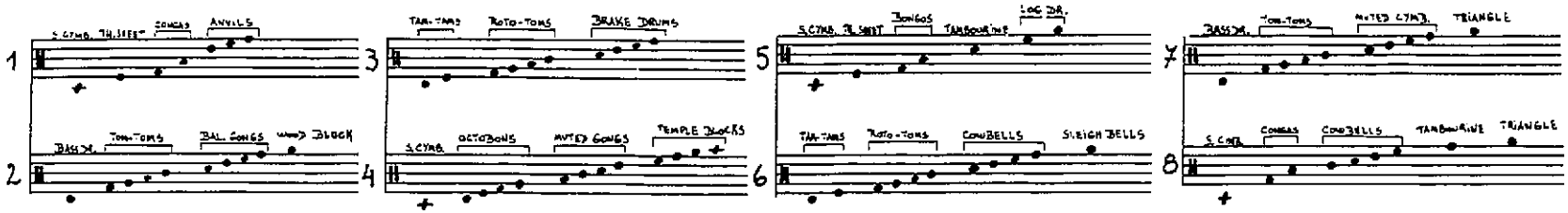
All suspended cymbals should be about the same size. The cowbells used by Percussion 8 should be larger (lower in pitch) than those used by Percussion 6.
Tom-toms used by Percussion 2 should have a different tuning than those used by Percussion 7.
Roto-toms used by Percussion 3 should have a different tuning than those used by Percussion 6.
Range required for the crotales: chromatic from B5 to Bb7 (sounding pitch).
Muted gongs: gongs laid flat on a table covered with cloth to reduce the ringing.
Muted cymbals: cymbals laid flat on a table covered with cloth to reduce the ringing.
Cymbal on timpani: cymbal laid upside down on a timpani.

Notation of percussion instruments

All keyboard instruments sound as written, with the following exceptions :

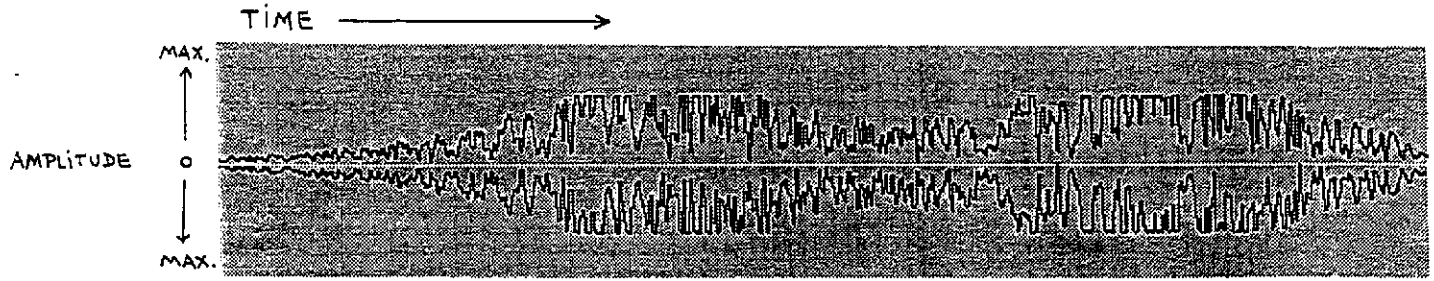
Xylophone and Crotales sound one 8ve. higher than notated.
Glockenspiel sounds two 8ves. higher than notated.

The traditional 5-line staff was chosen to notate all percussion instruments used.
Instruments of indefinite pitch were assigned a fixed position on the staff.
Same instruments, performed by different players, share the same fixed positions. Cowbells and tambourine are the only exception to this rule.



Notation of the tape part

A computer printout of a graphic display of the tape part is included on the score. It shows the combination of the two stereo channels. This notation system shows with great accuracy the activity of the pre-recorded digital sounds in terms of amplitude over time. However, it does not provide information about other parameters such as register.



Signs used

 :Stop the ringing

Fermatas

 : Short

 : Medium

 : Long

Mallets

 : Soft

 : Medium

 : Hard

 : Drum sticks

 : Brushes

About the use of mallets

The performance of "Territorios" requires from the percussionists rapid and frequent changes from one instrument to another.
As a result, there will be times when two or more instruments will have to be played with the same set of mallets. Consequently, the composer has often decided not to indicate which mallets to use leaving this choice to the performers whom he trusts will find the best compromise between musical results and practical aspects of performance.

Tape part

The tape part of this composition was done at the Electronic Music Studio, McGill University, Montréal. It exists in a stereo DAT (Digital Audio Tape) format.
The reproduction system of the tape part in a live performance should include two loudspeakers to be placed on opposite ends of
the stage.

Click-tracks

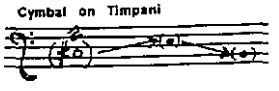
Since different tempi are often used simultaneously in "Territorios", the performance of the piece requires a set of computer-generated click-tracks carrying individual pulse lines; hearing these pulses through headphones, the performers are able to play in precise tempo.
As for the playback of the click-tracks in a concert situation, two methods may be applied, each one involving a different technology.
The first one calls for the use of a MacIntosh computer to playback the tracks directly from a Performer sequence file. An application such as Sample Cell or a sampler like the Akai S1000 could be used as the source of sound playback since both devices are capable of producing up to eight independent audio signals.
The second solution requires a multi-track analog tape. In both cases, the performers will hear their individual pulse through a set of headphones covering one ear only. As for the conductor, he/she will use a copy of the click track of percussionist number one.
Click-tracks start at Entry 1 (bar 9 until 47), Entry 2 (bar 88 until 138) and Entry 3 (bar 151 until 220).

Metronome indications

♩=60 Individual. Applies to the performer for whom it is indicated, only.

♩=60 General. Specified at the top of the score, applies to the whole ensemble.

Special playing techniques



Tremolo on the cymbal while using the timpani pedal to glide pitch up and down . Lines show the direction and black notes the approximate limits of the glissando.

Tape part, click tracks and individual parts are available from the composer.

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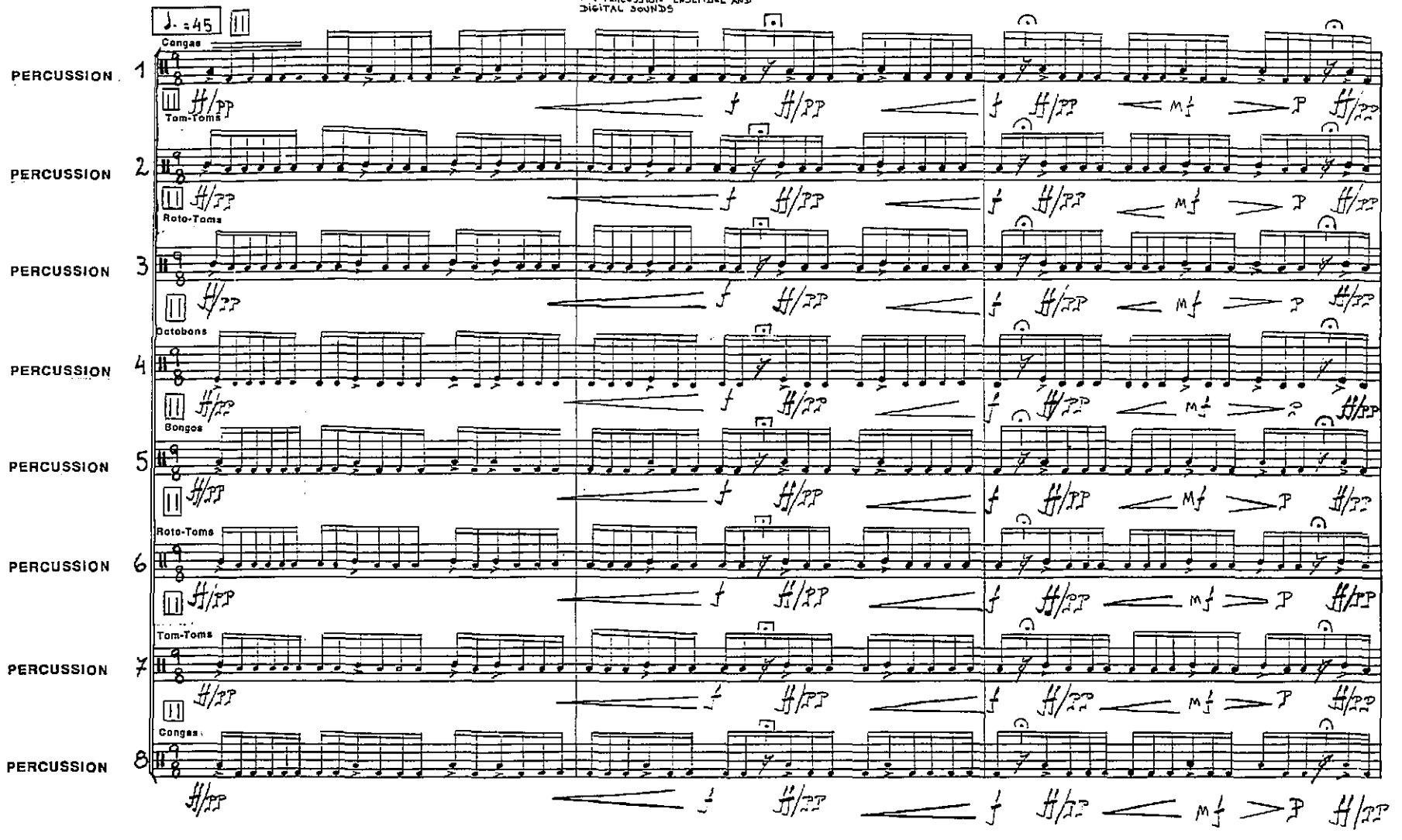
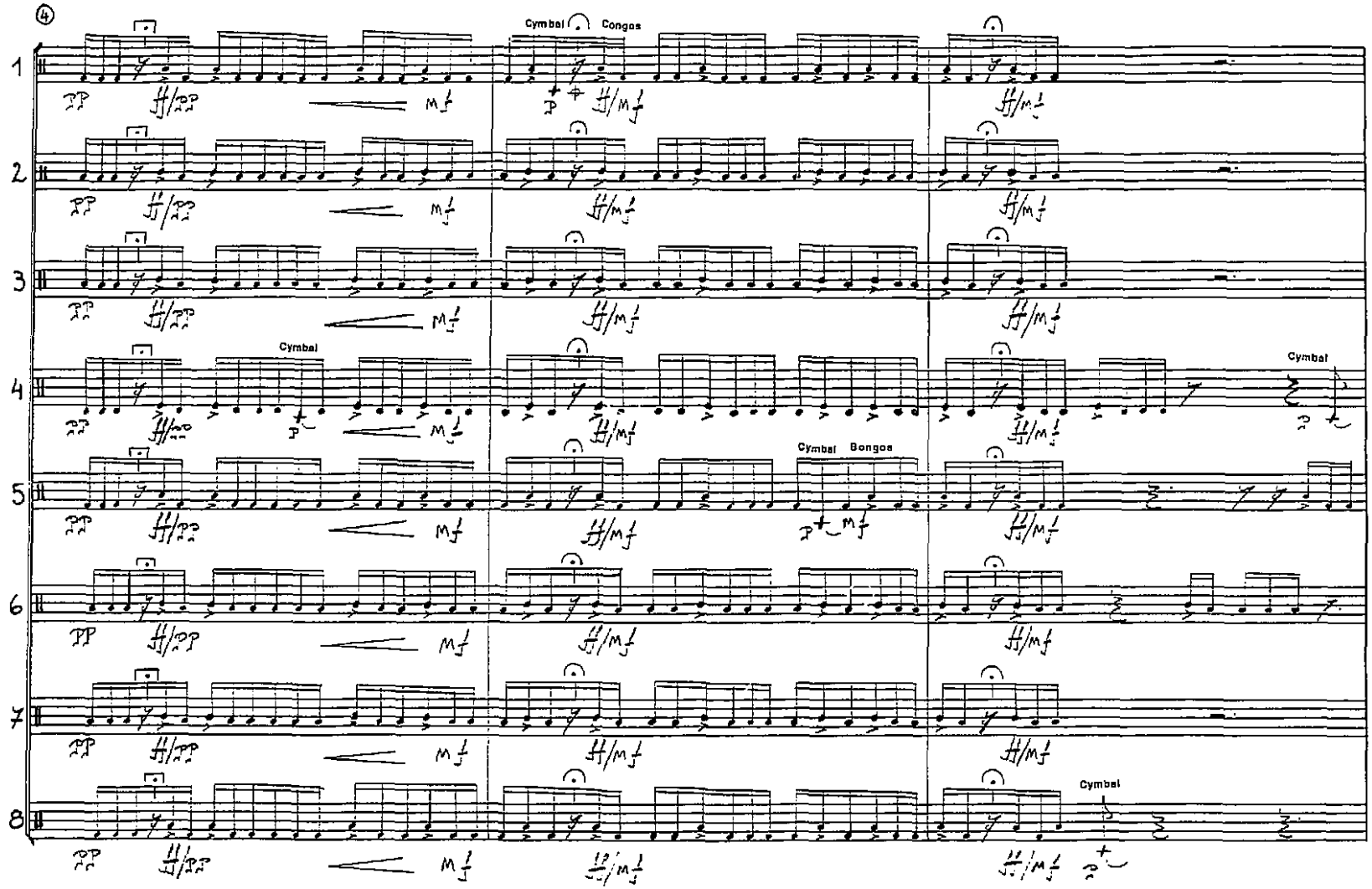
Fax: (514) 398 8061

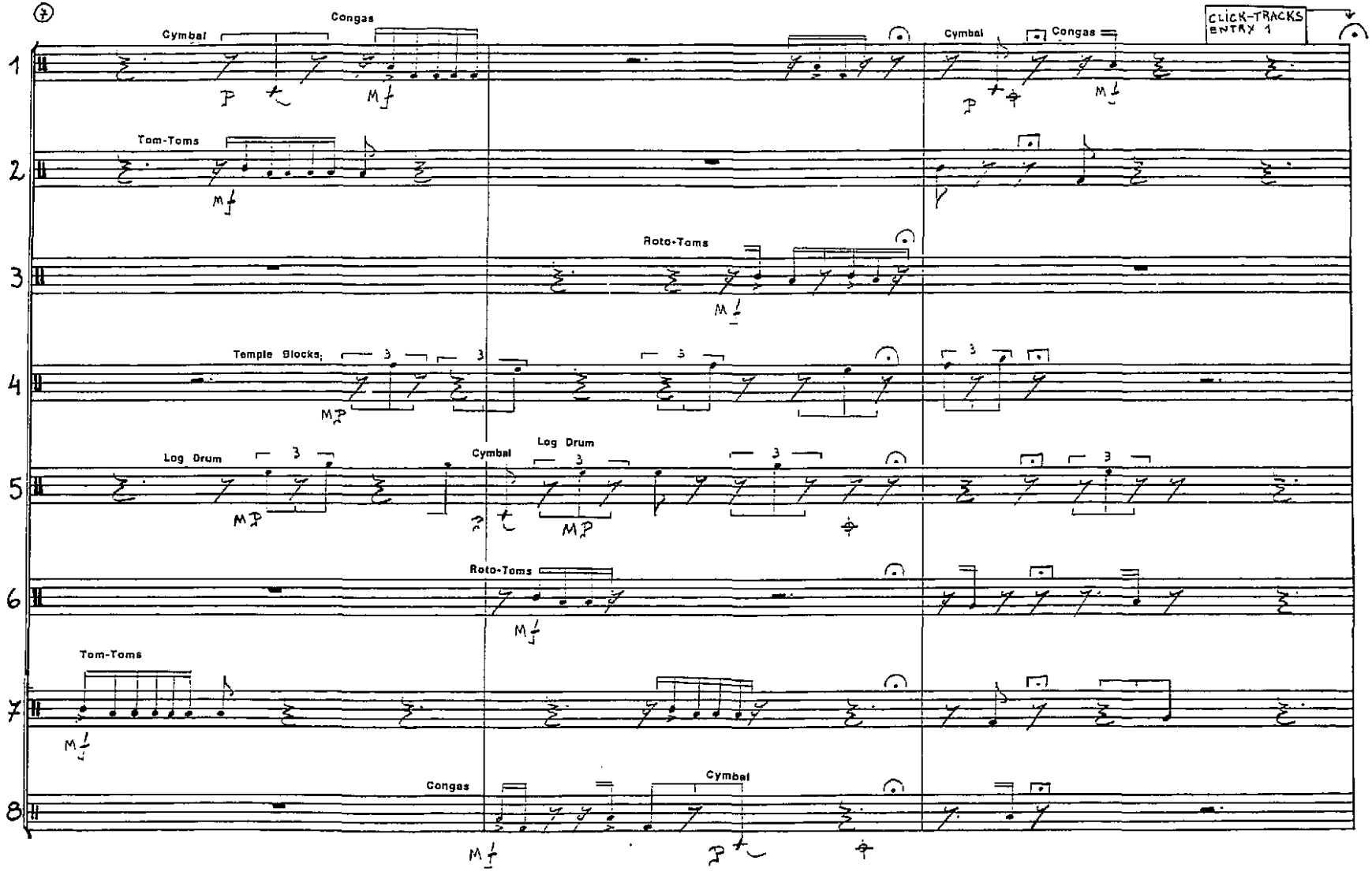
TERRITORIOS (1995)

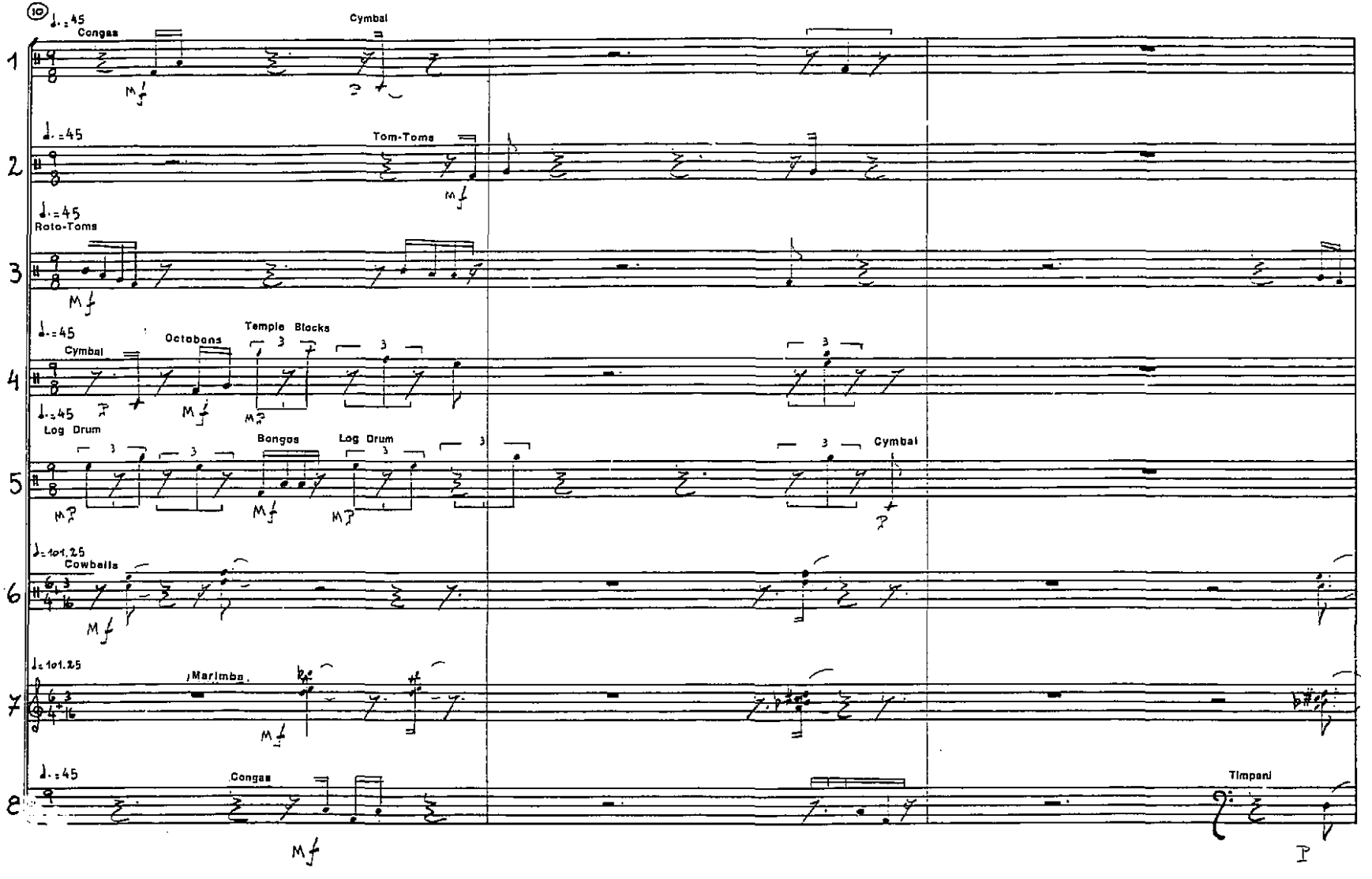
FOR PERCUSSION ENSEMBLE AND DIGITAL SOUNDS

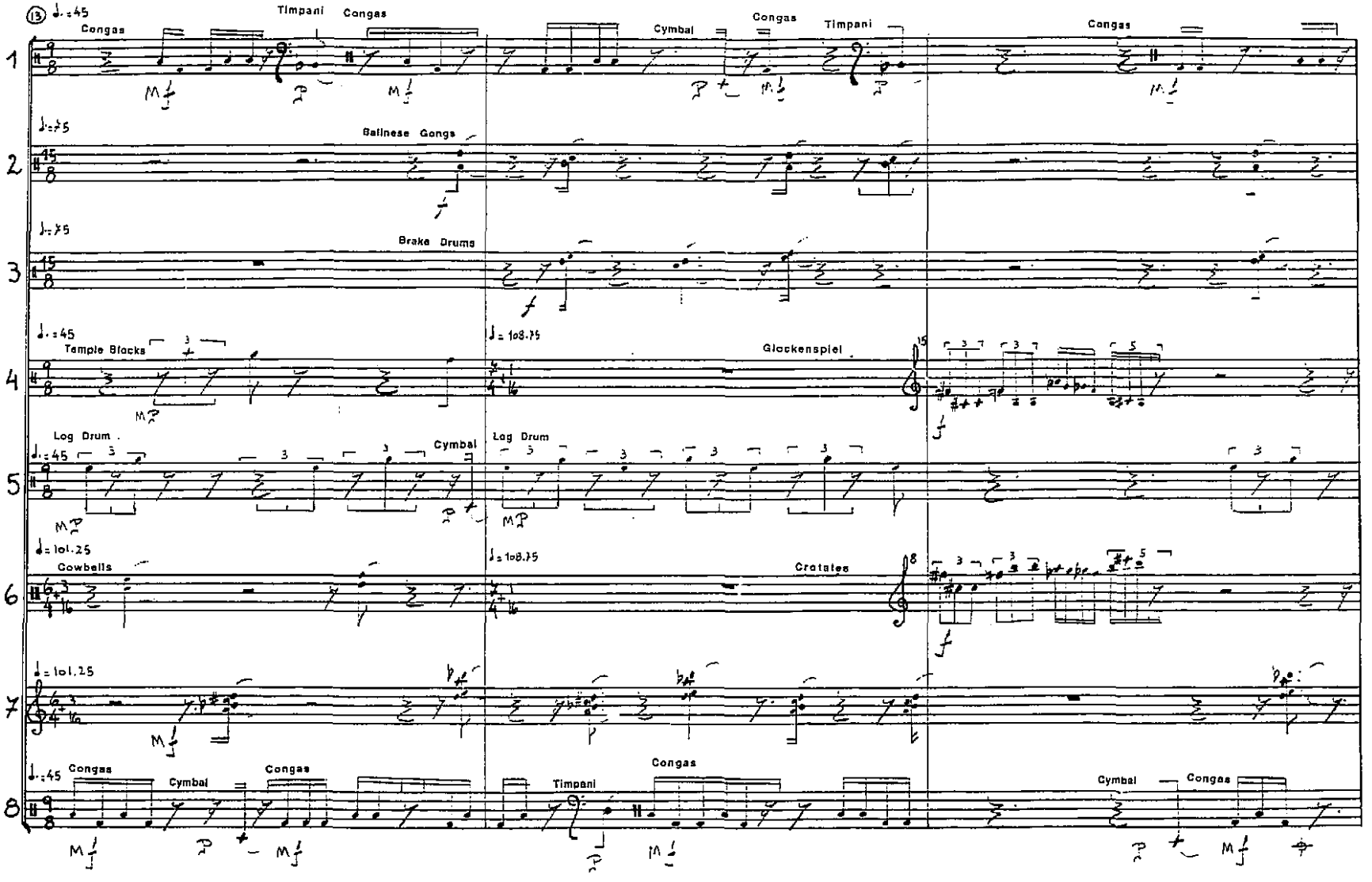
OSVALDO BUDON

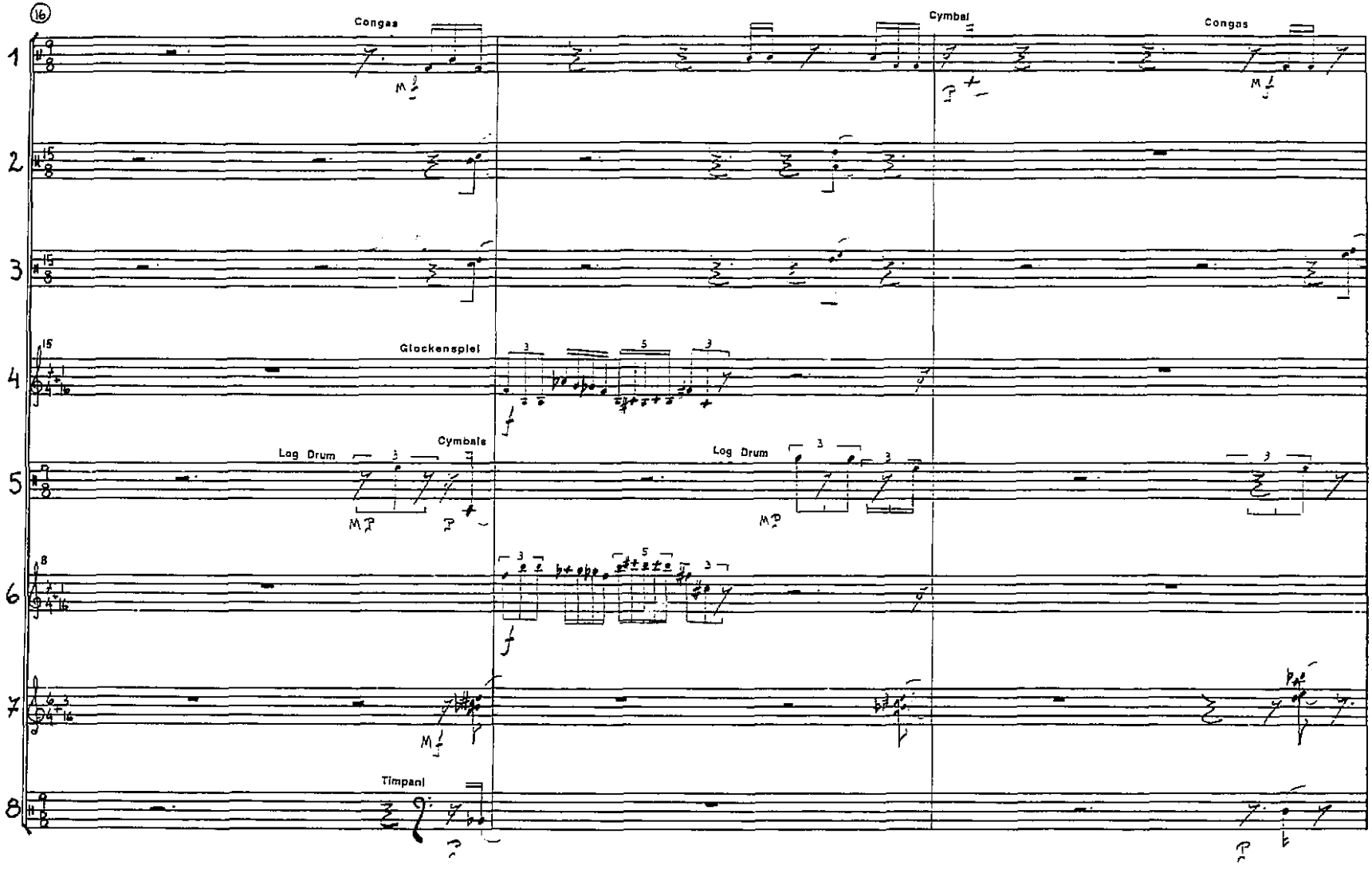


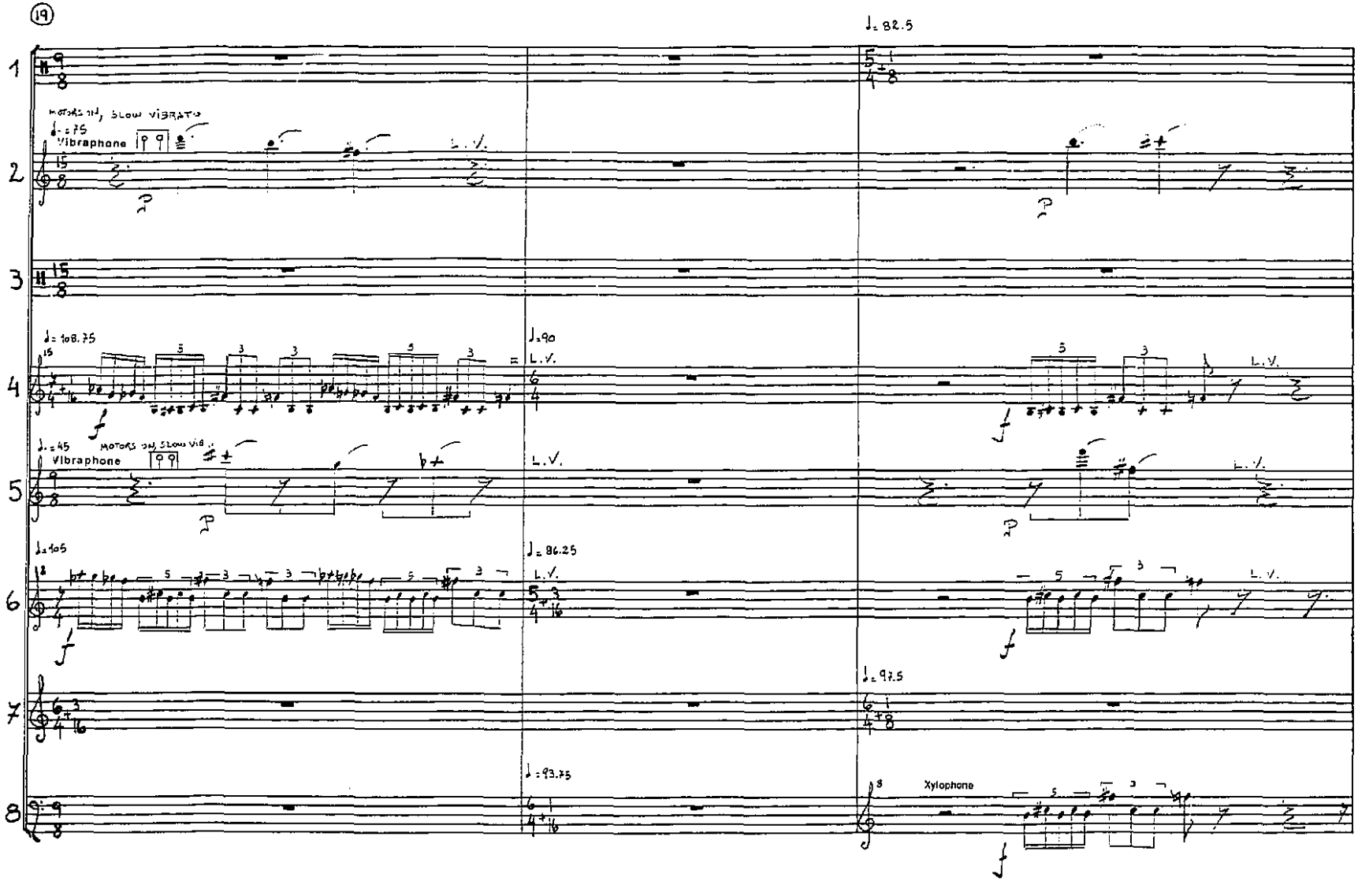

④
Cymbal
Congos
Cymbal
Cymbal
Cymbal
Bongos
Cymbal

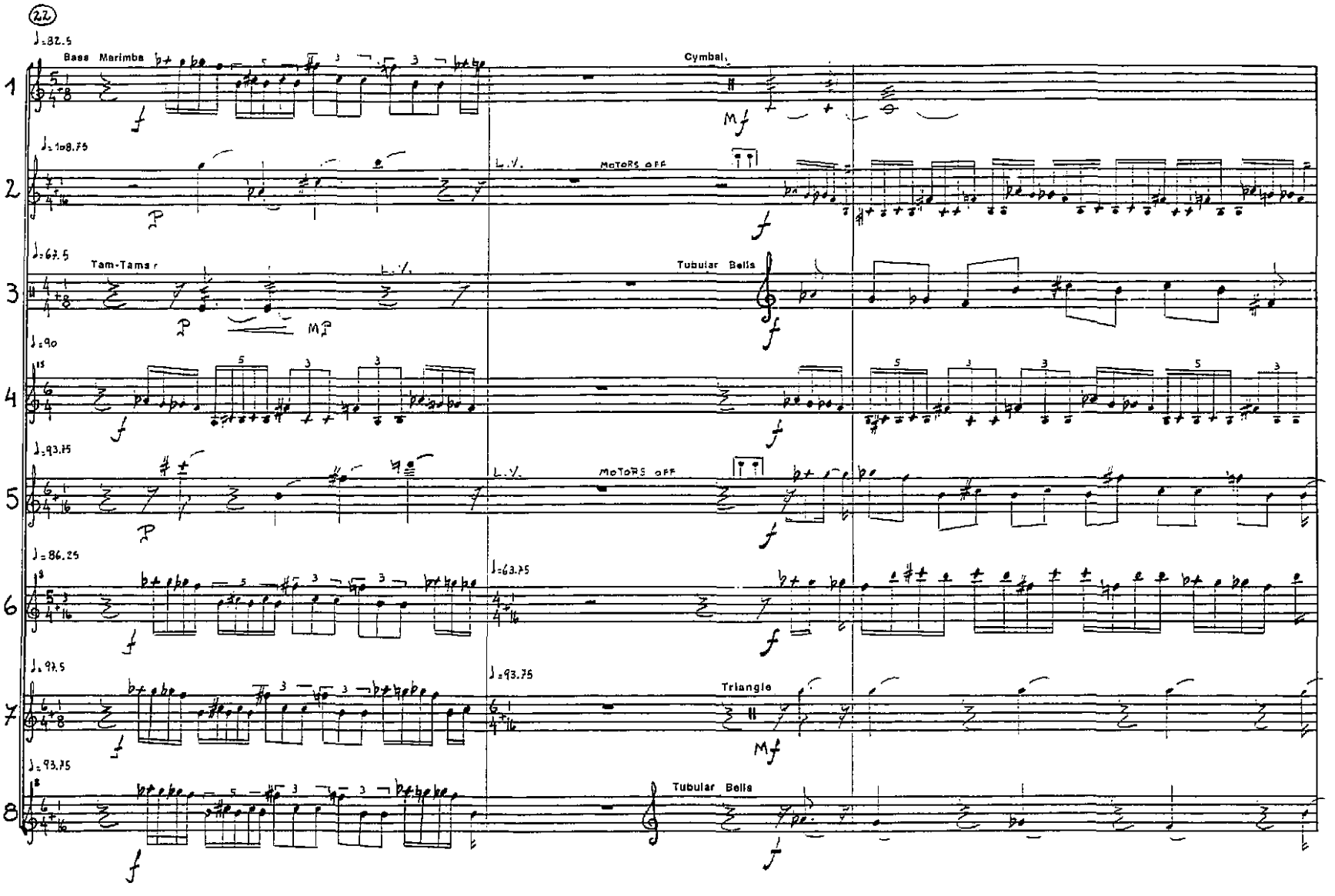

CLICK-TRACKS
ENTRY 1
Cymbal
Congas
Cymbal
Congas
Tom-Toms
Roto-Toms
Temple Blocks
Log Drum
Cymbal
Log Drum
Roto-Toms
Tom-Toms
Congas
Cymbal

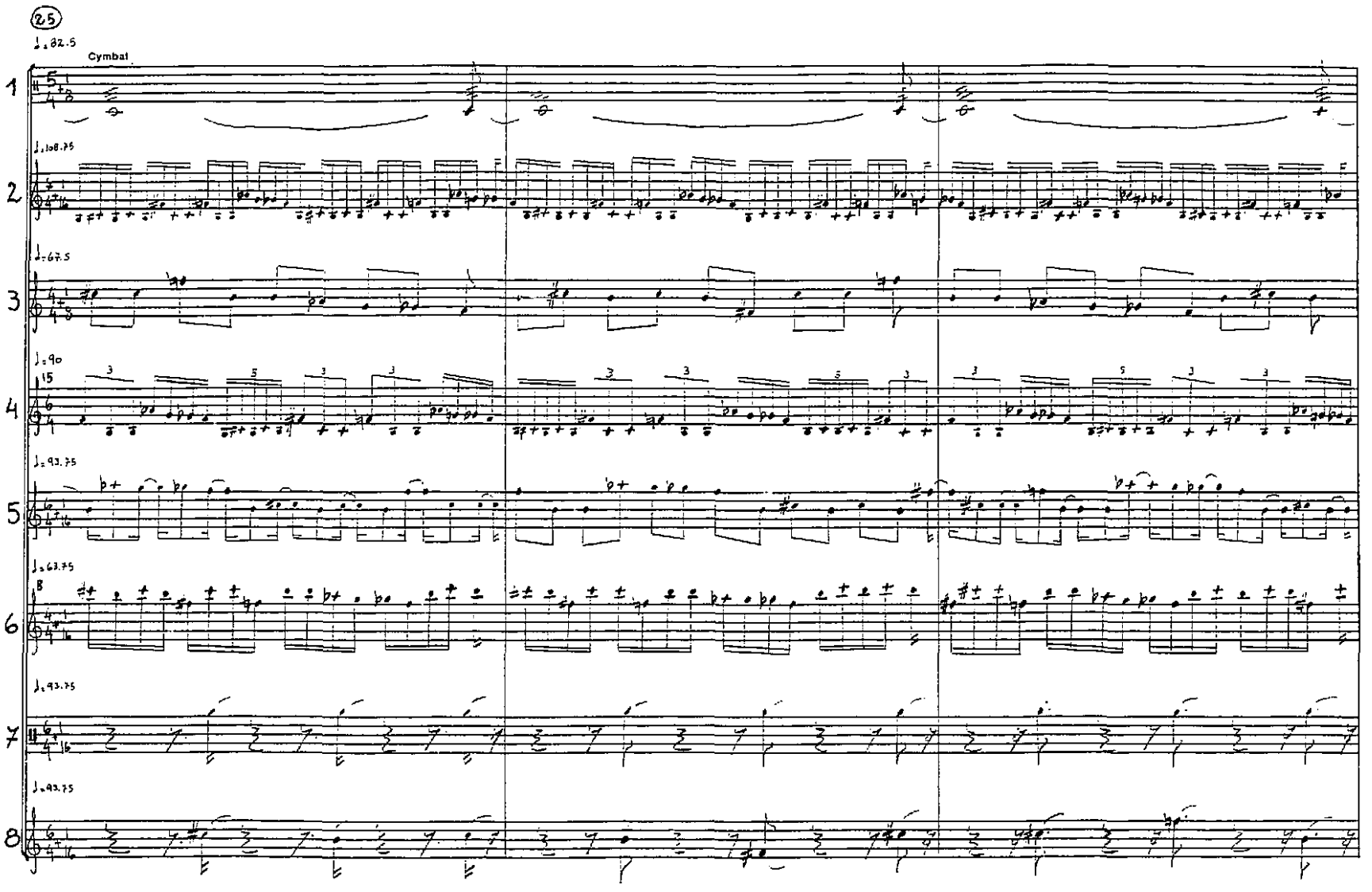

10
♩. = 45
Congas
Cymbal
Tom-Toms
Roto-Toms
Octobans
Temple Blocks
Log Drum
Bongos
Cowbells
Marimba
Timpani
mf
p

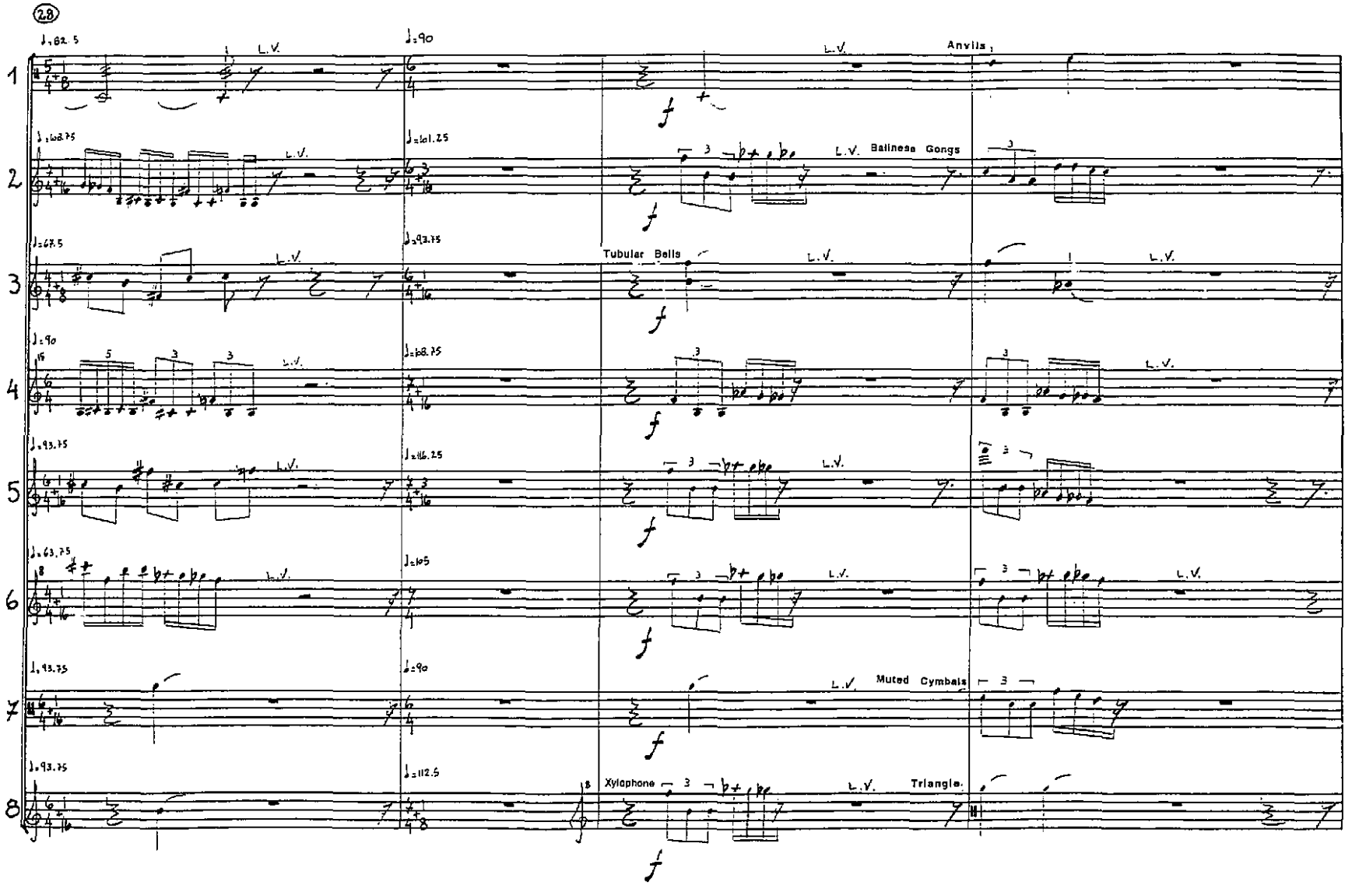

13
Congas
Timpani
Congas
Cymbal
Congas
Timpani
Congas
Balinese Gongs
Brake Drums
Temple Blocks
Glockenspiel
Log Drum
Cymbal
Log Drum
Cowbells
Crotales
Congas
Cymbal
Congas
Congas
Timpani
Cymbal
Congas

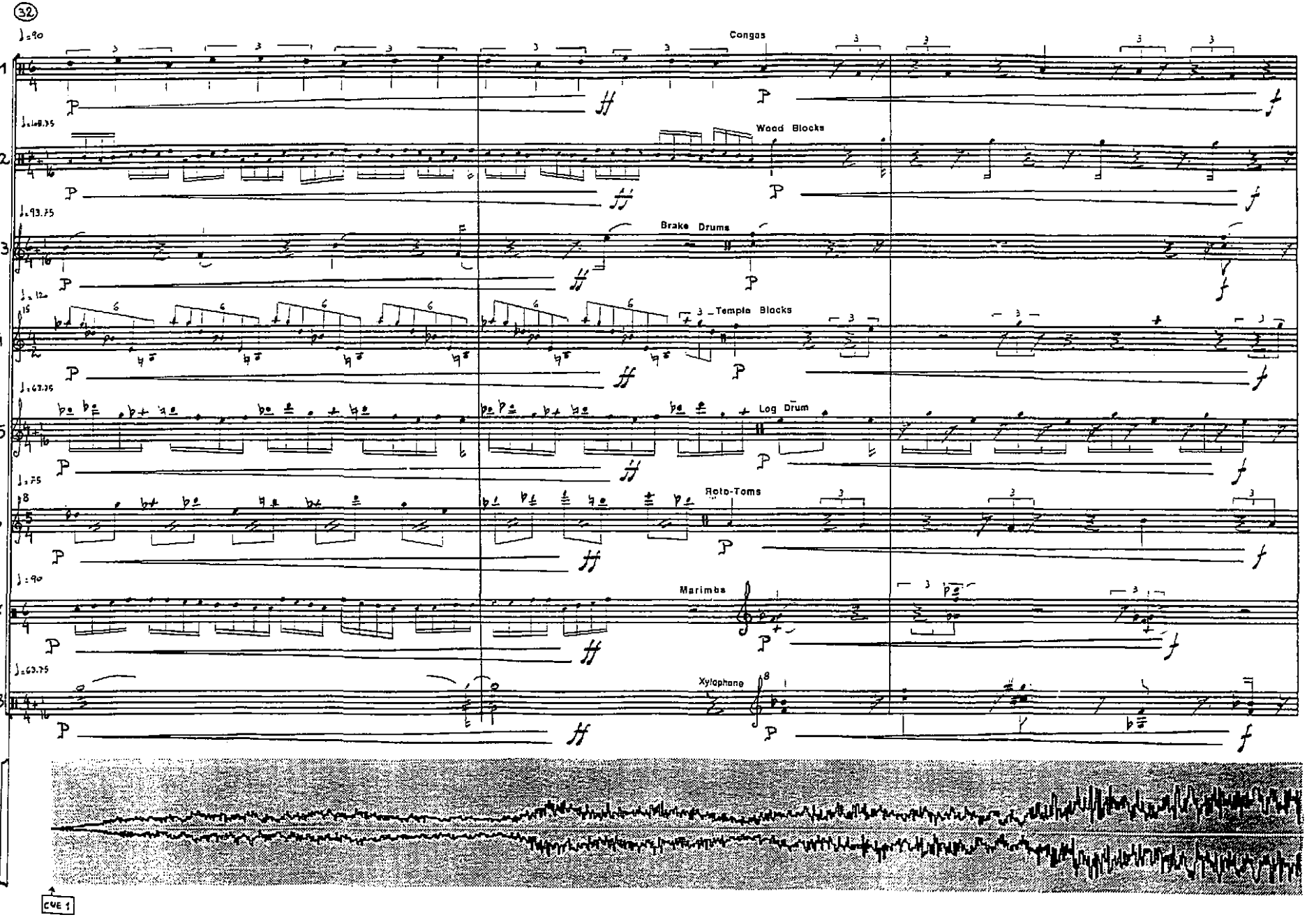

16
Congas
Cymbal
Congas
Glockenspiel
Log Drum
Cymbals
Log Drum
Timpani

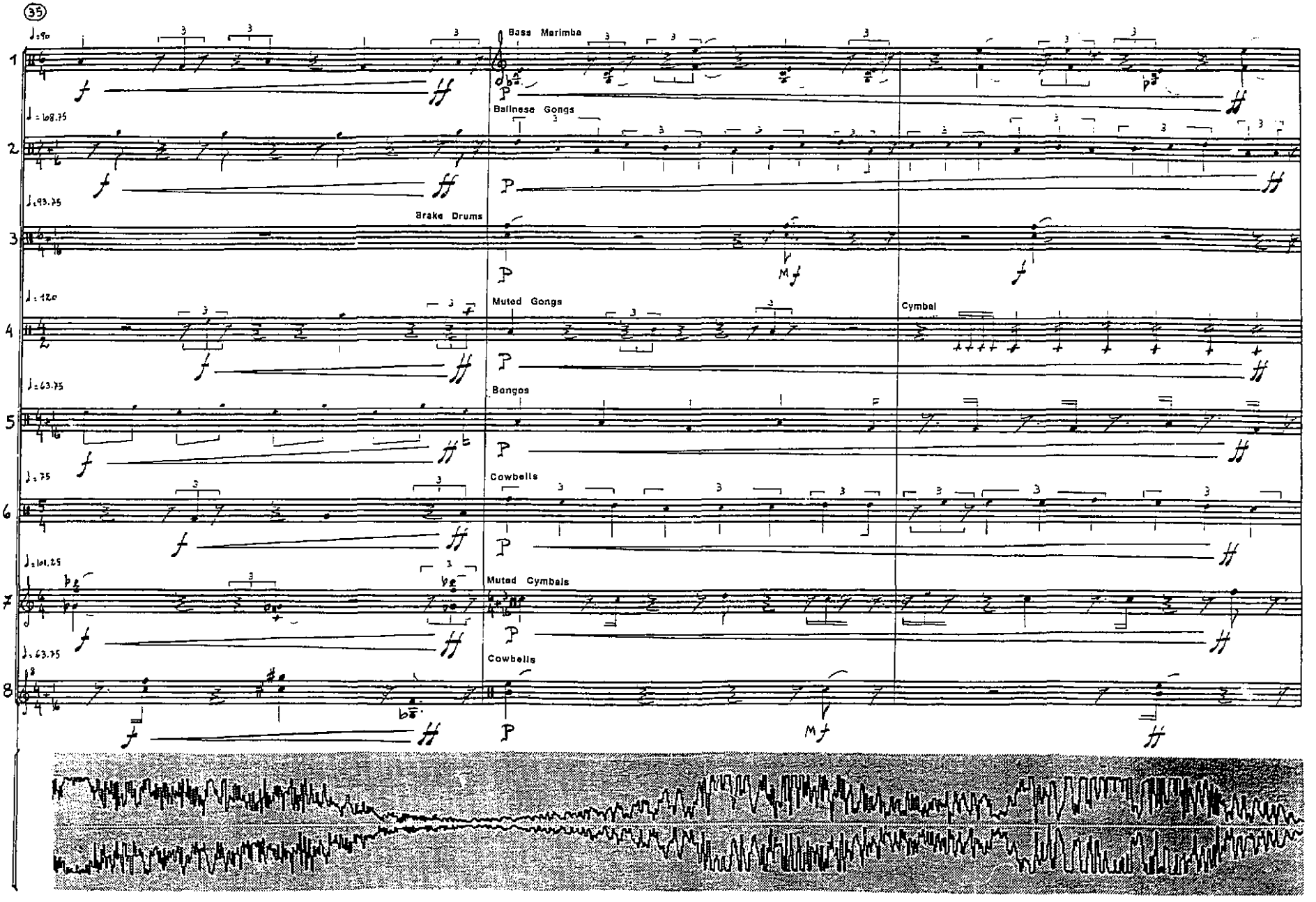

19
♩= 82.5
motors on, slow vibrato
♩= 75
Vibraphone
L.V.
♩= 108.75
♩=90
♩= 45
motors on slow vib.
Vibraphone
♩= 105
♩= 86.25
♩= 97.5
♩= 93.75
Xylophone

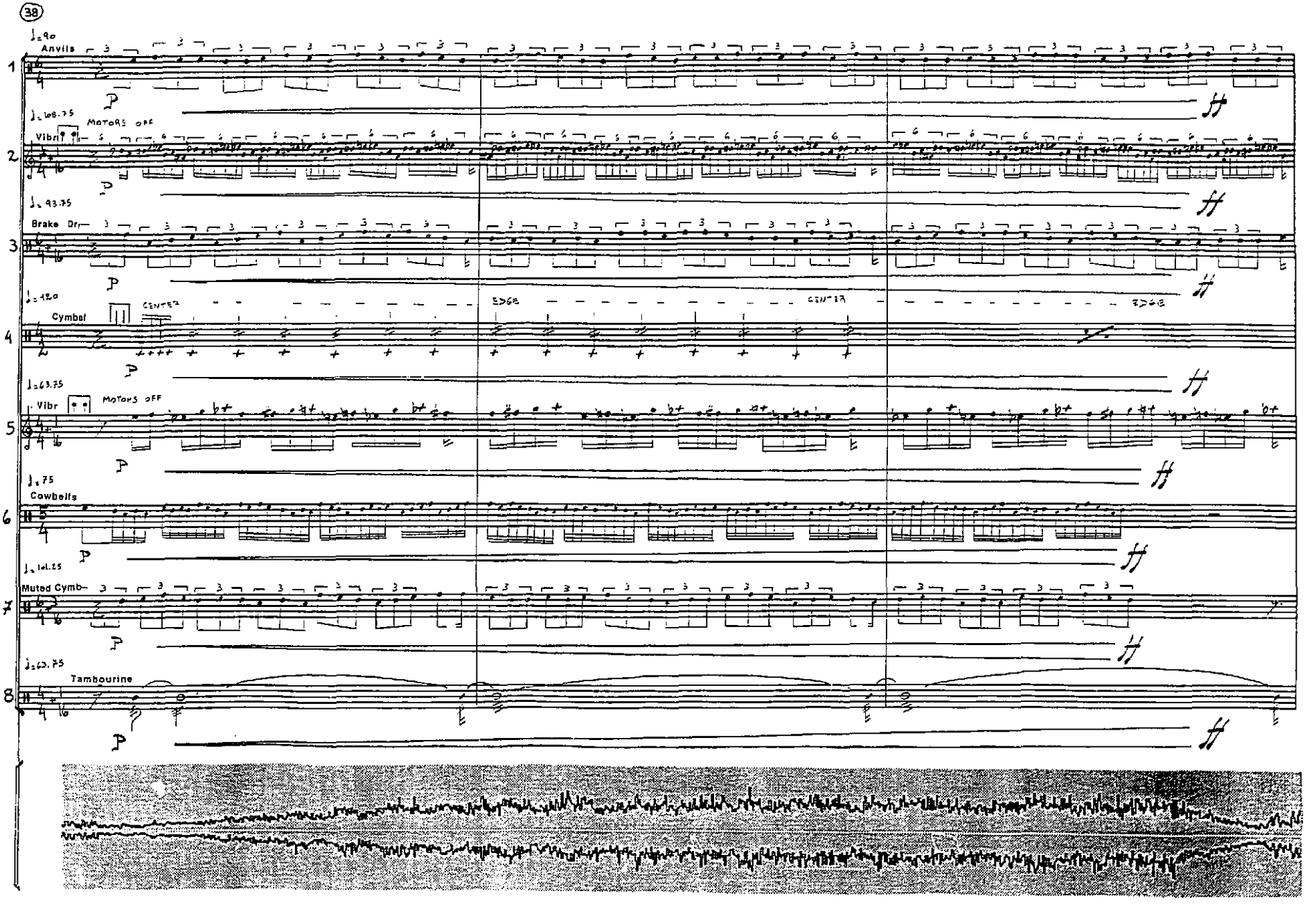

22
Bass Marimba
Cymbal
Tam-Tam
Tubular Bells
L.V.
MOTORS OFF
Triangle
Tubular Bells

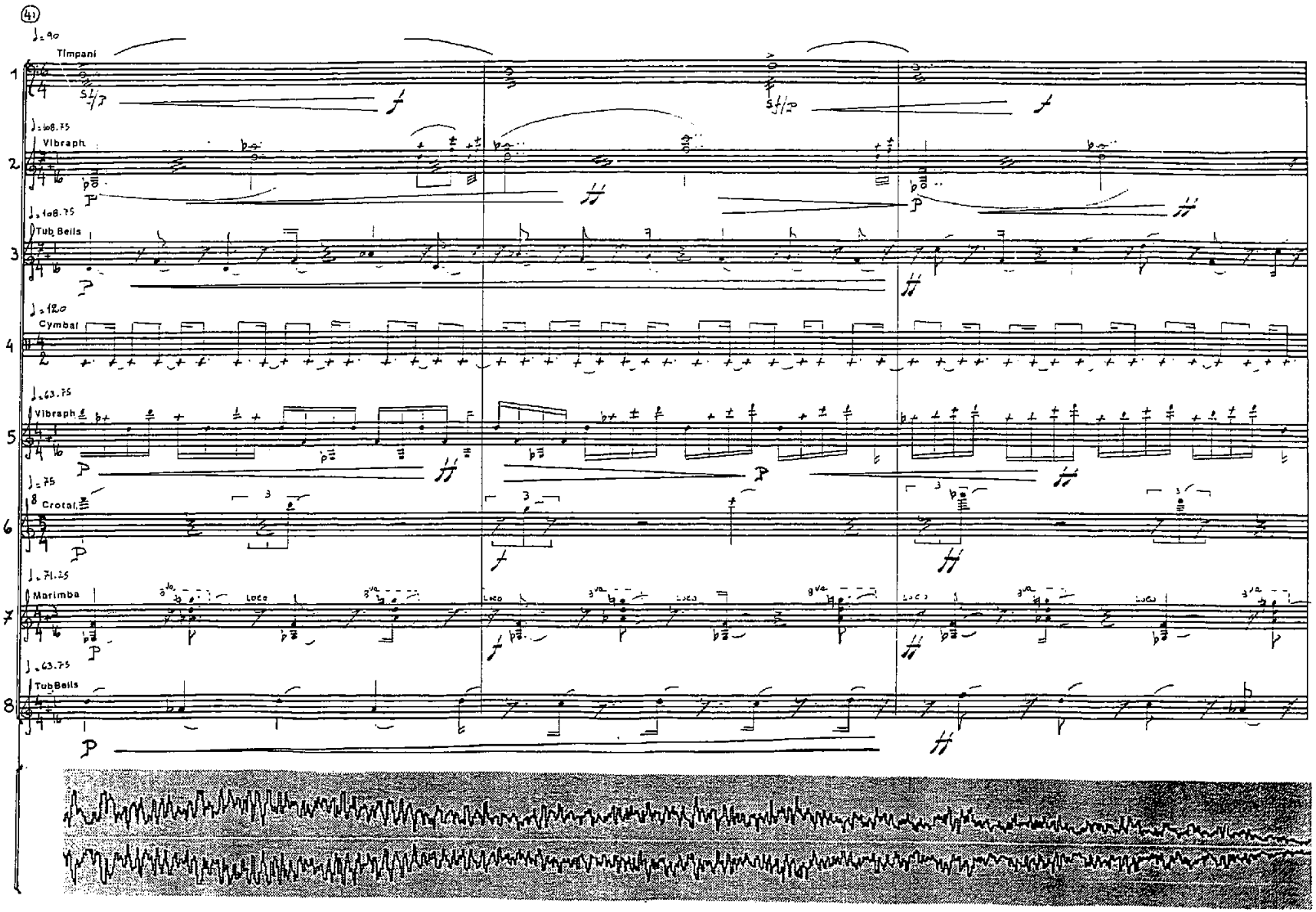

25
♩.82.5
Cymbal
1
♩.168.75
2
♩.67.5
3
♩.90
15
4
♩.93.75
5
♩.63.75
B
6
♩.93.75
7
♩.93.75
8

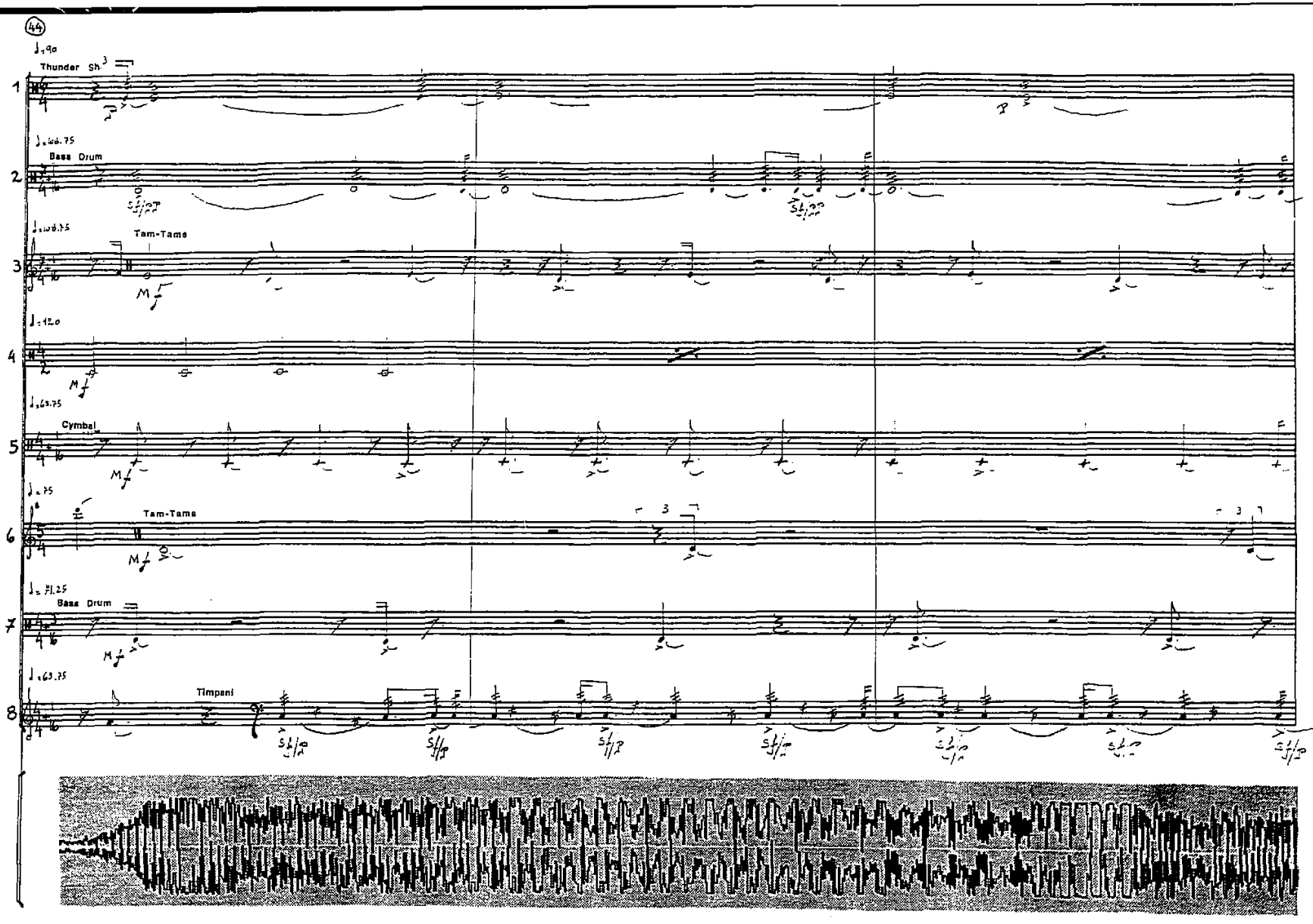

28
1
2
3
4
5
6
7
8
L.V.
Anvils
Balinese Gongs
Tubular Bells
Muted Cymbals
Xylophone
Triangle

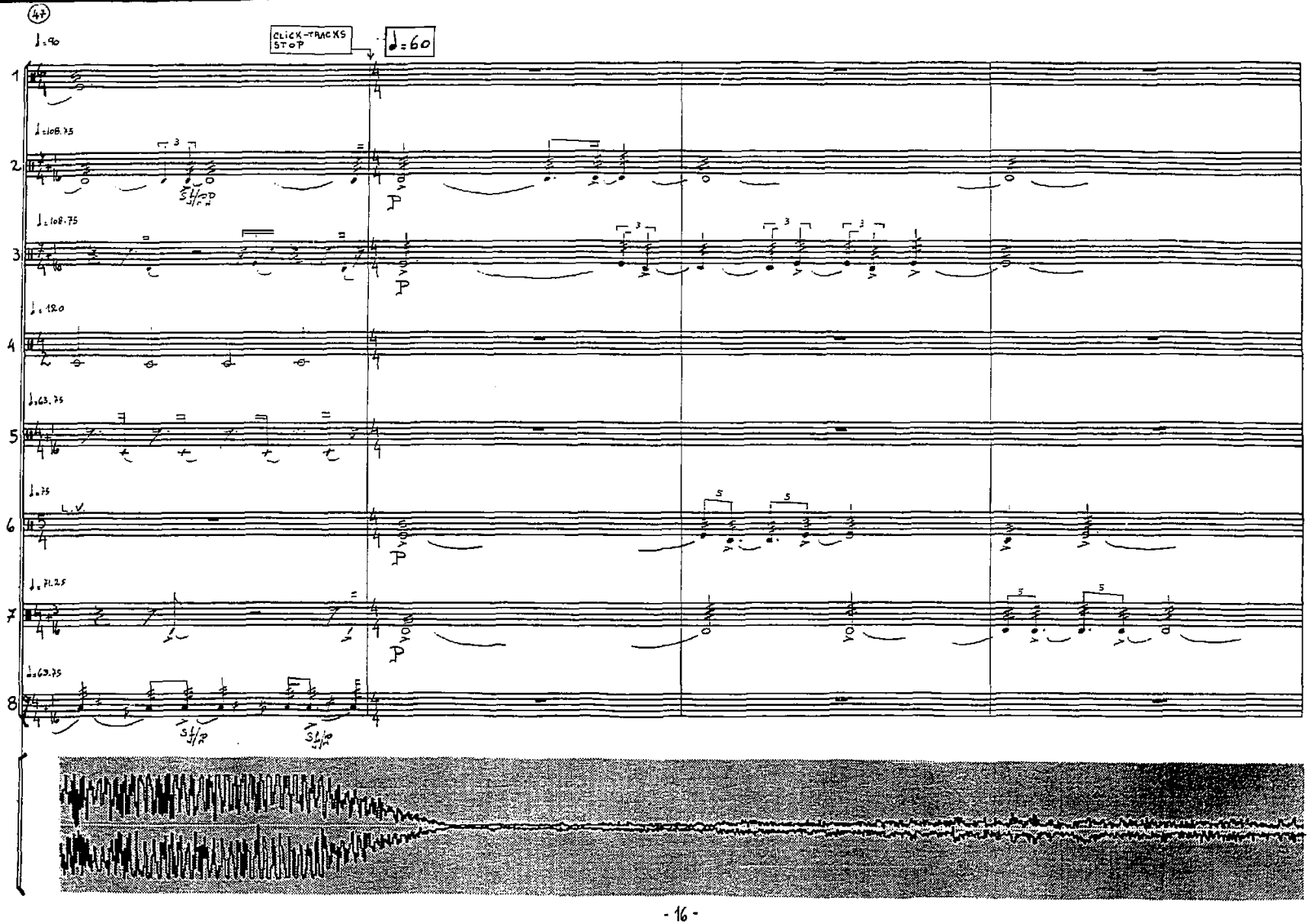

32
Congas
Wood Blocks
Brake Drums
Temple Blocks
Log Drum
Roto-Toms
Marimba
Xylophone
TAPE
CUE 1

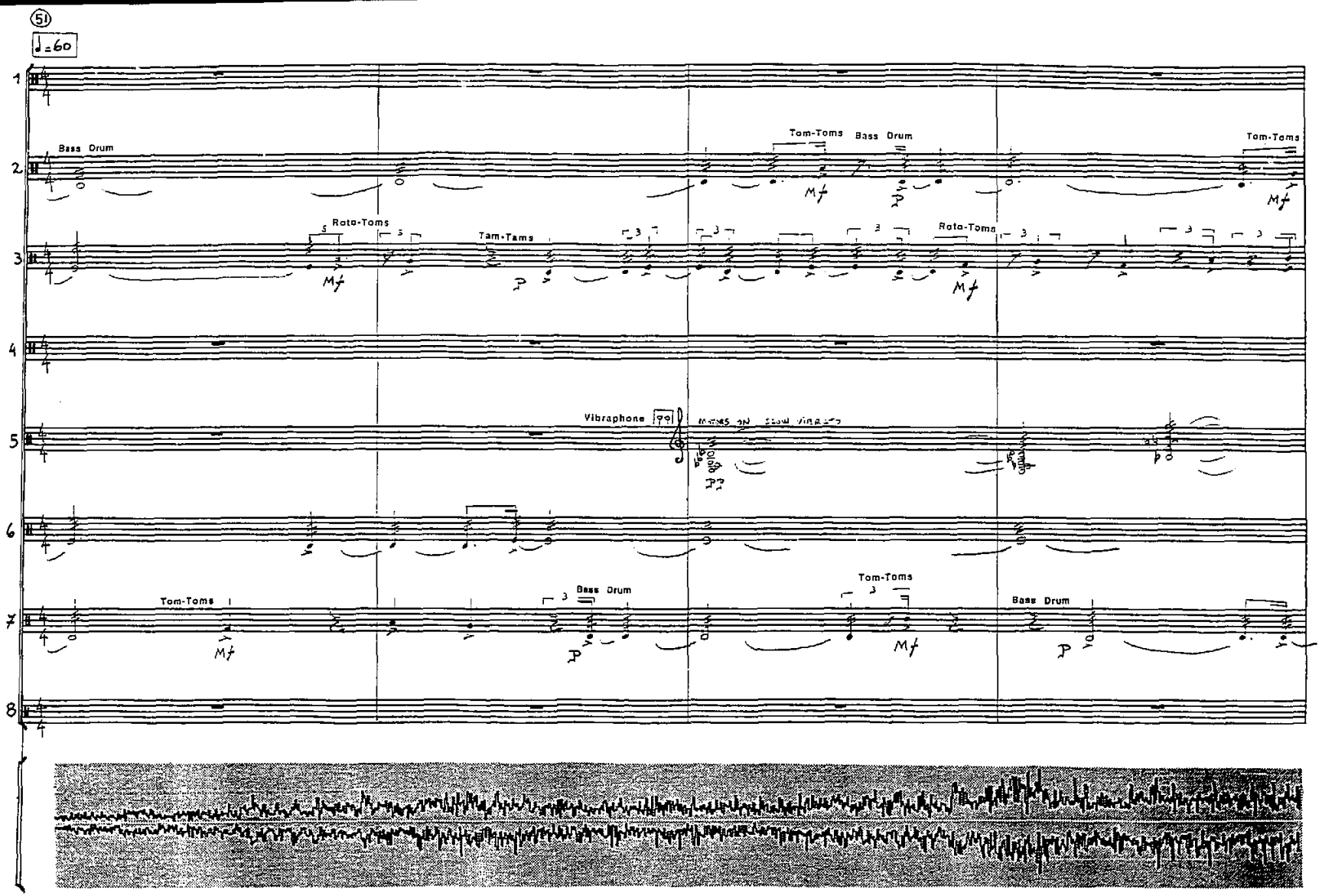

35
Bass Marimba
Balinese Gongs
Brake Drums
Muted Gongs
Cymbal
Bongos
Cowbells
Muted Cymbals
Cowbells

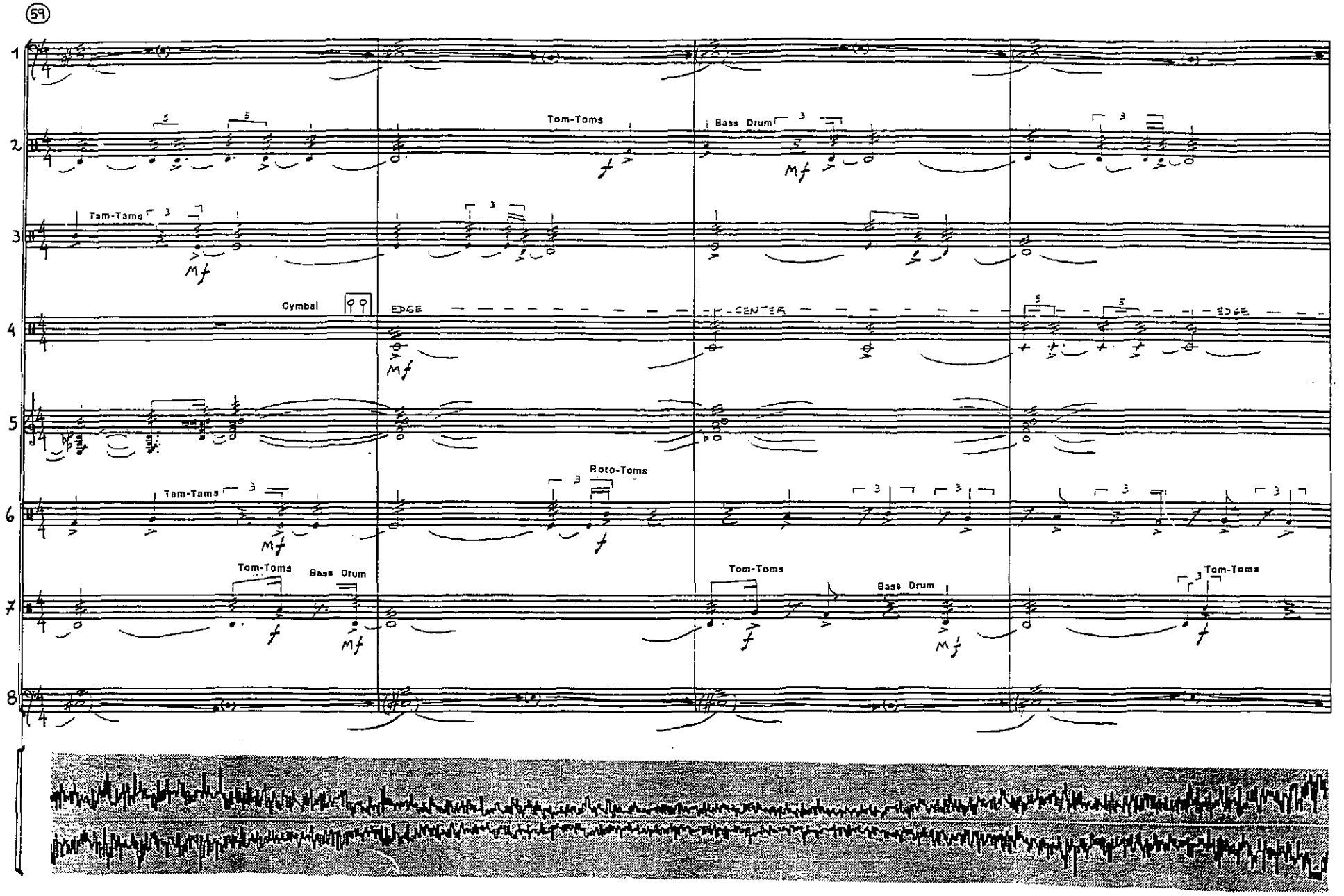

38
Anvils
Vibr
MOTORS OFF
Brake Dr
Cymbal
CENTER
EDGE
Vibr
MOTORS OFF
Cowbells
Muted Cymb
Tambourine

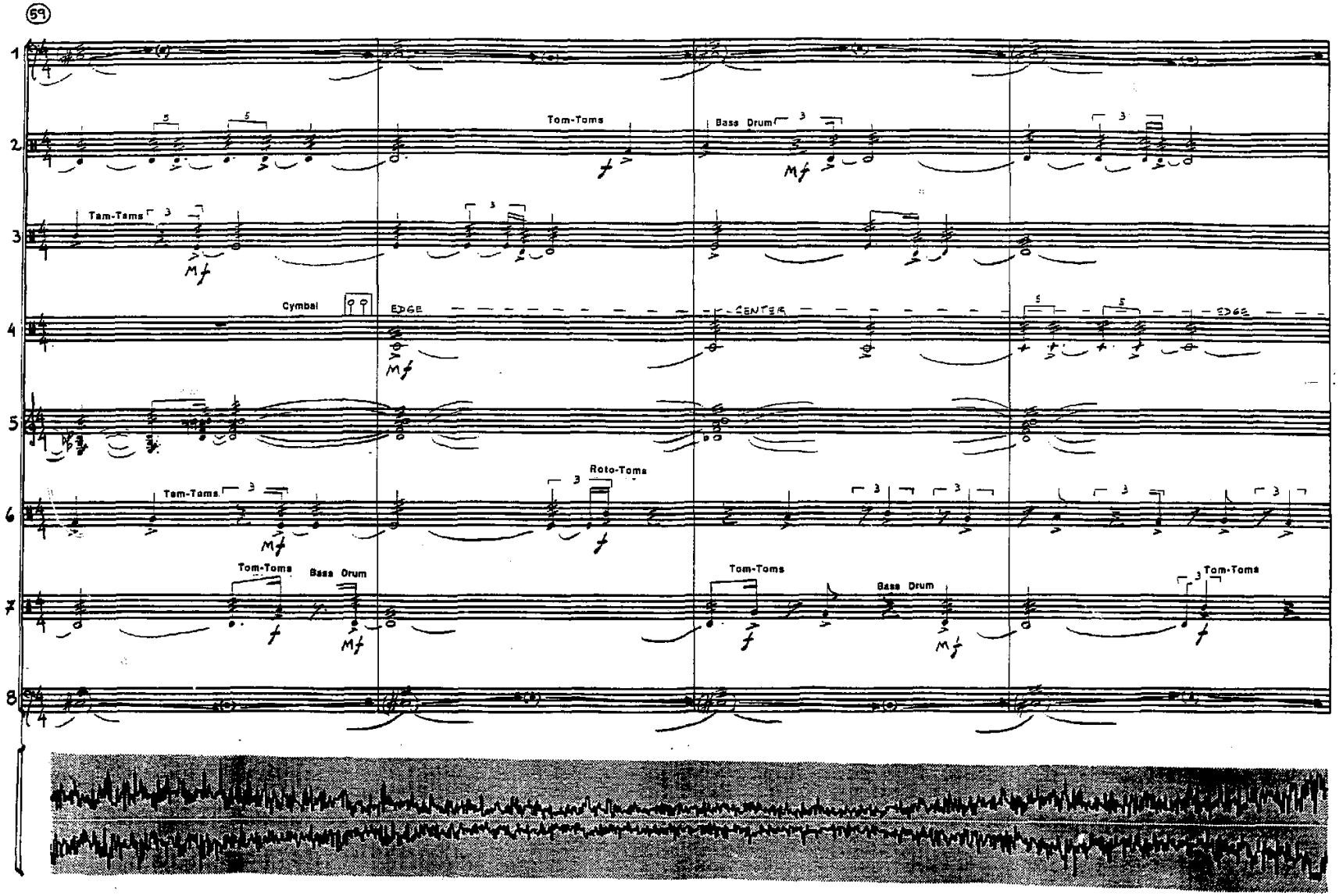

41
Timpani
Vibraph
Tub Bells
Cymbal
Vibraph
Crotal
Marimba
Tub Bells

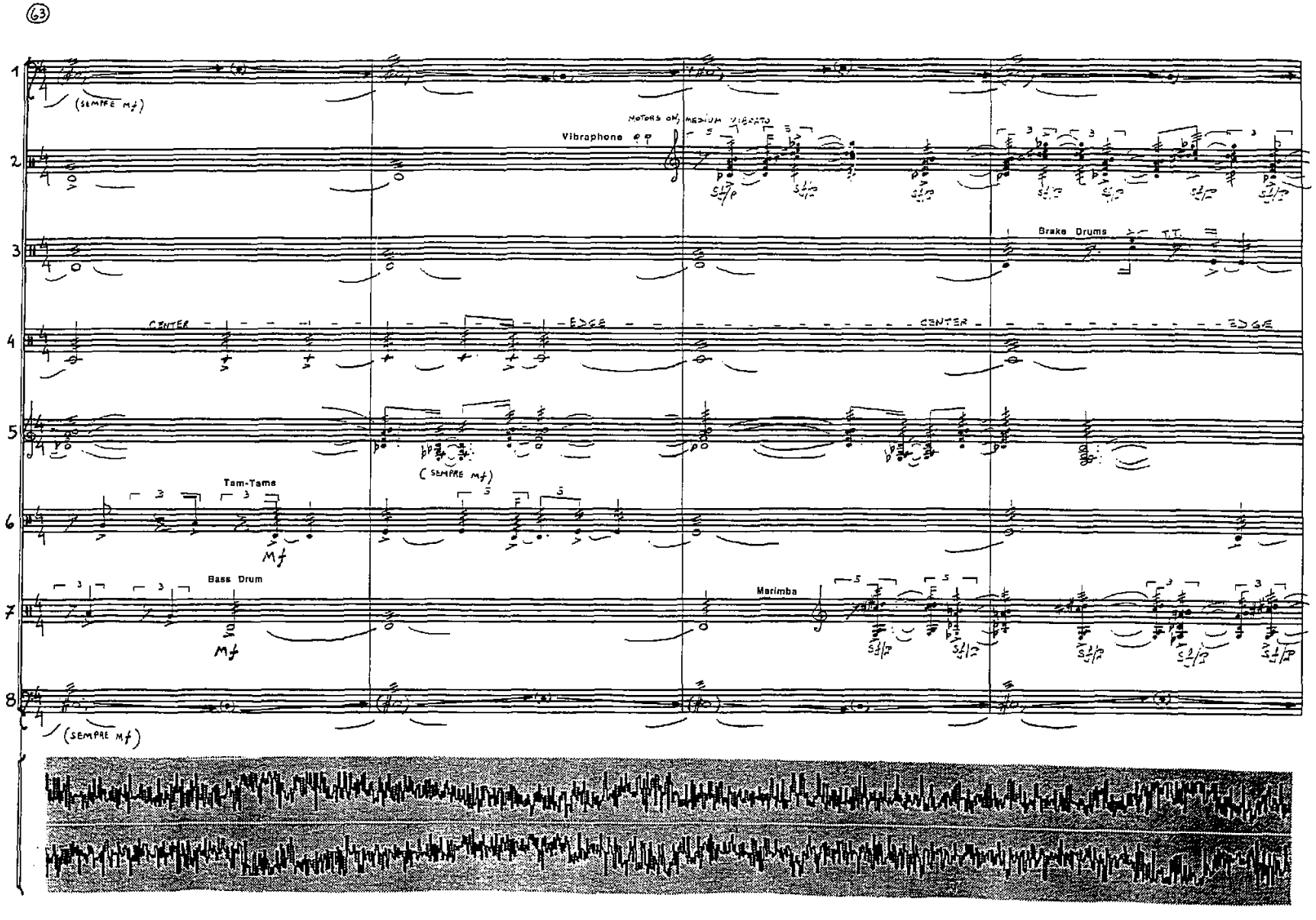

44
Thunder Sh.
Bass Drum
Tam-Tams
Cymbal
Tam-Tams
Bass Drum
Timpani

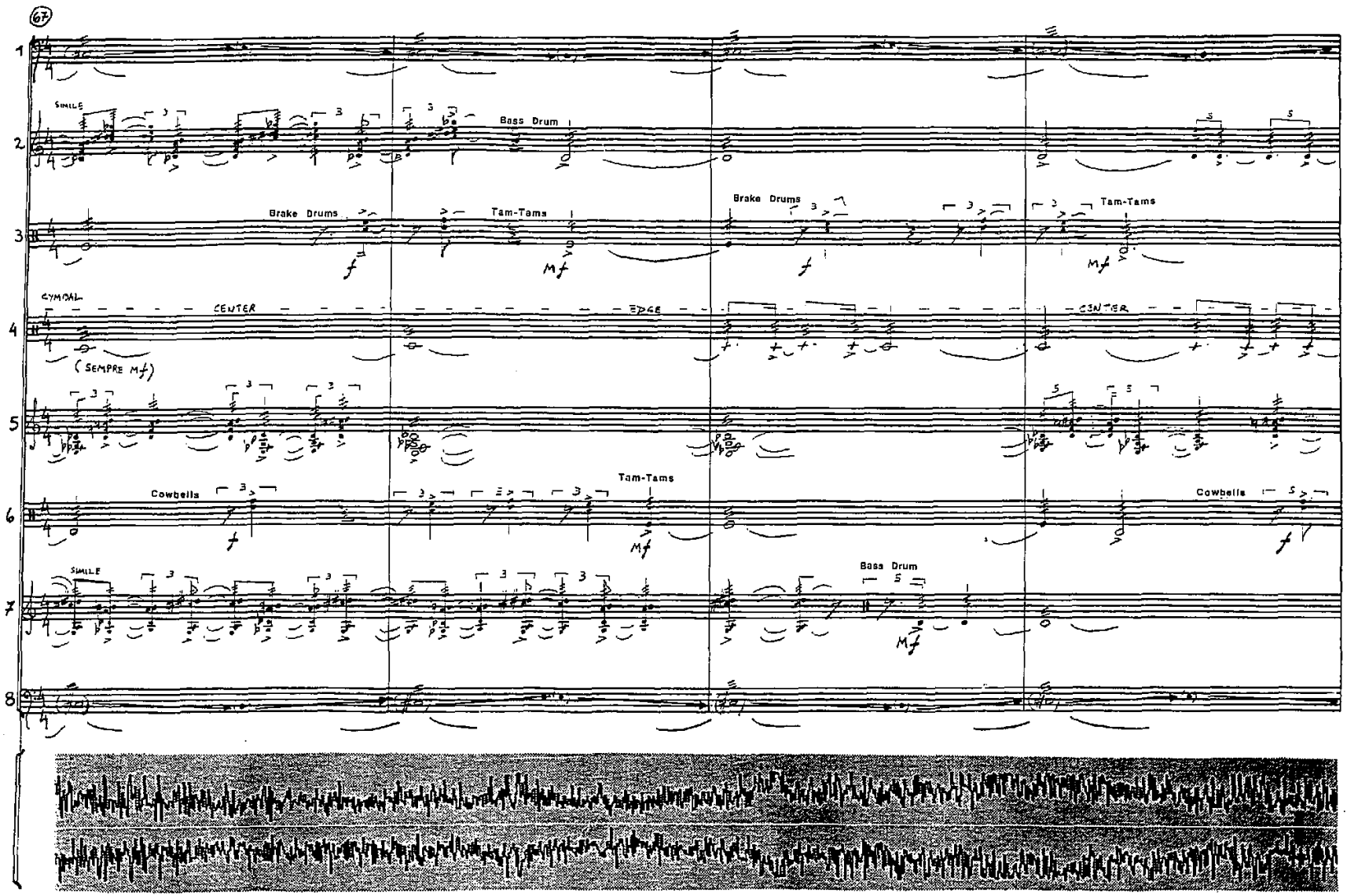

47
CLICK-TRACKS STOP
♩=60
P
S.H.O.D.
L.V.

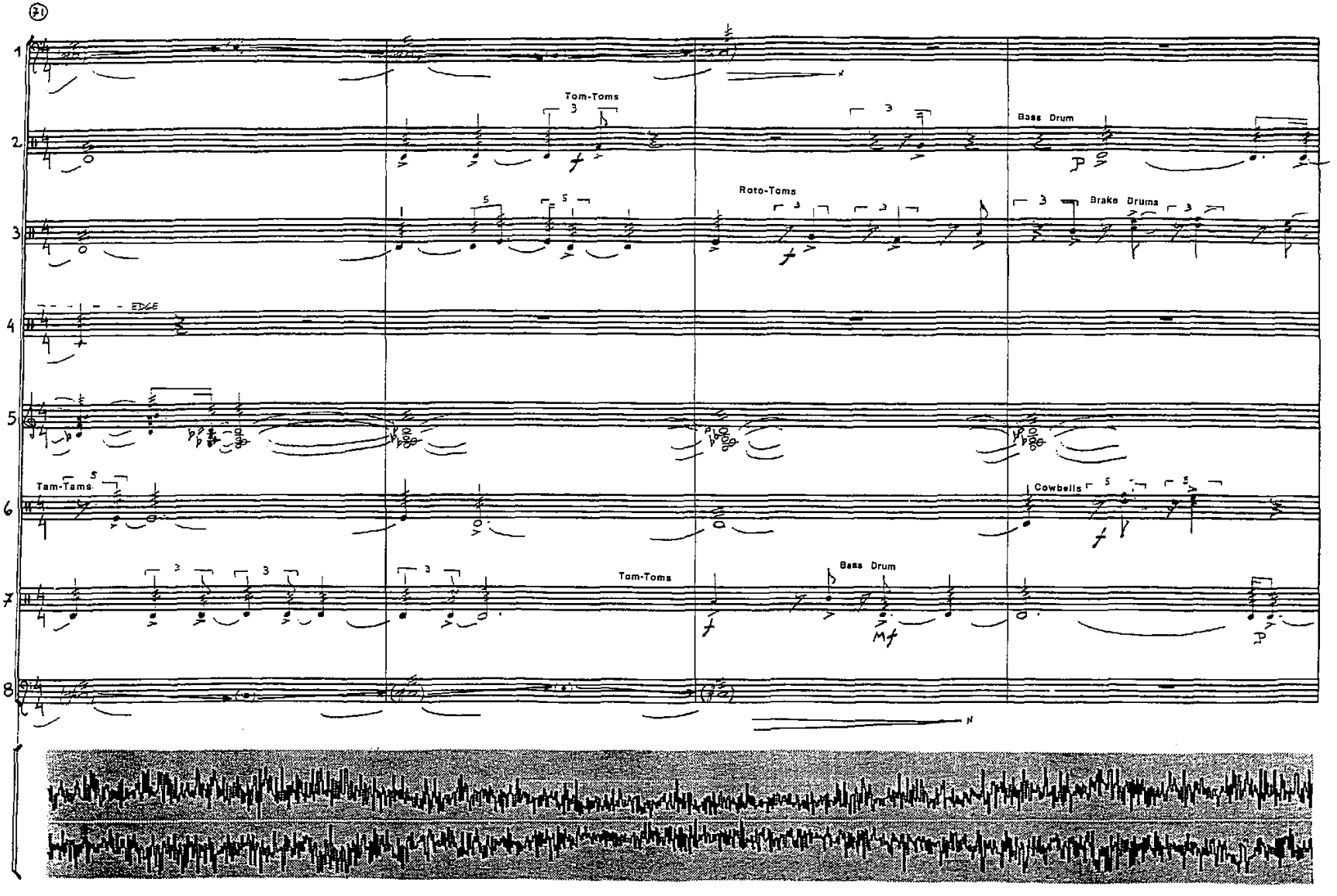

51
♩=60
Bass Drum
Tom-Toms
Bass Drum
Tom-Toms
Rota-Toms
Tam-Tams
Rota-Toms
Vibraphone
Tom-Toms
Bass Drum
Tom-Toms
Bass Drum

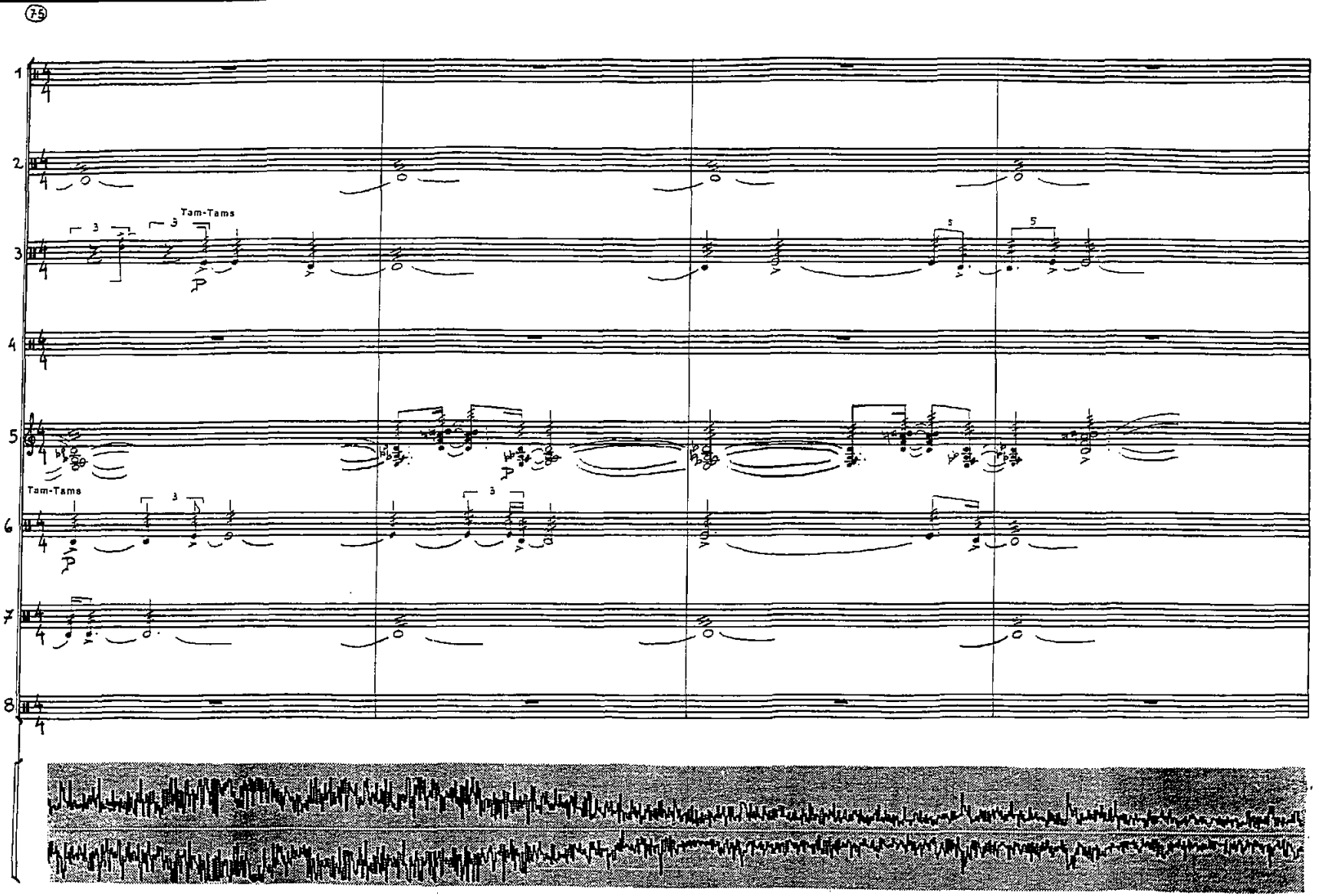

59
1
2
3
4
5
6
7
8
Tom-Toms
Bass Drum
Tam-Tams
Cymbal
EDGE
CENTER
EDGE
Roto-Toms
Tam-Tams
Tom-Toms
Bass Drum
Tom-Toms
Bass Drum
Tom-Toms

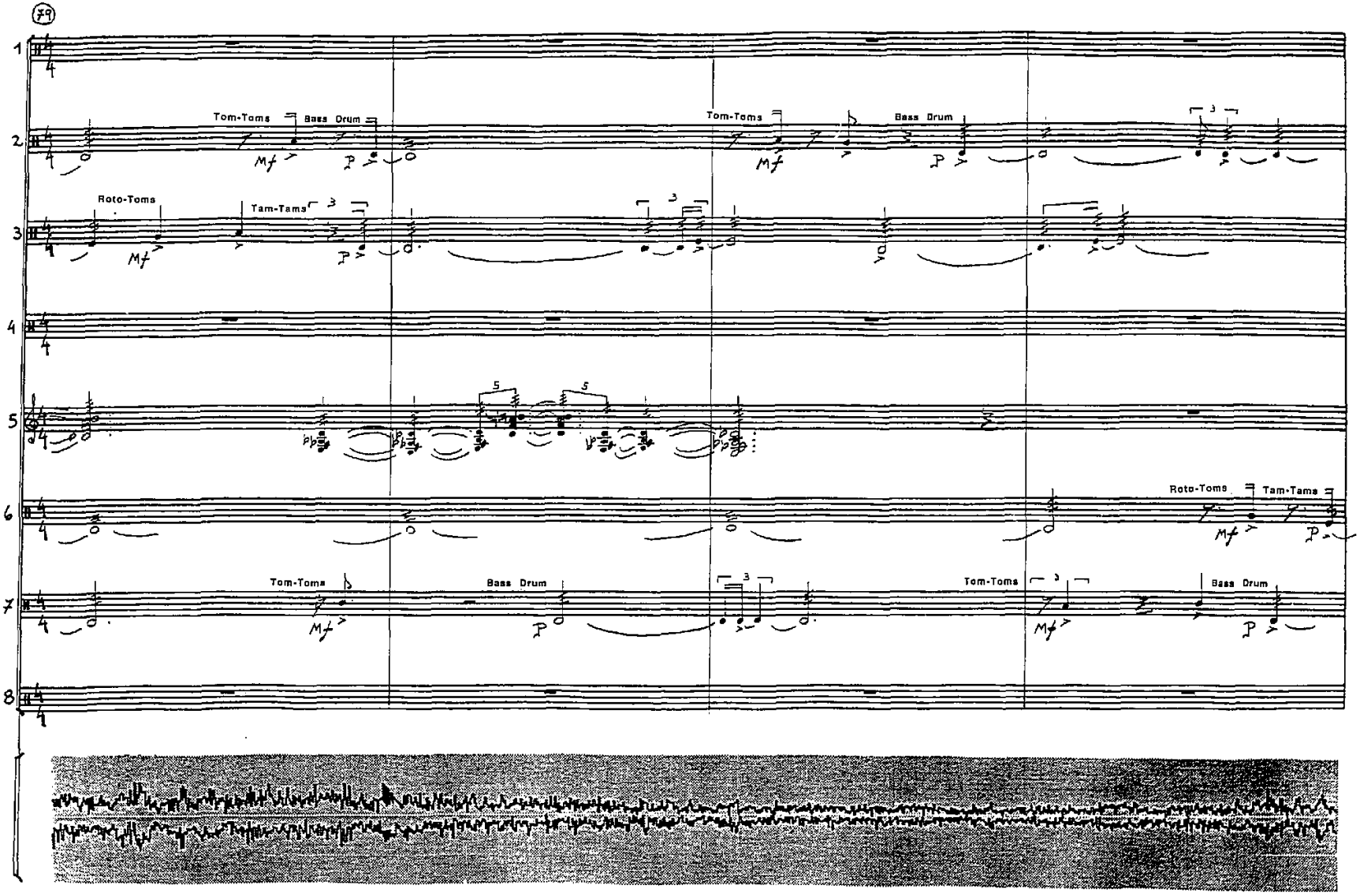

59
1
2
3
4
5
6
7
8
Tom-Toms
Bass Drum
Tam-Tams
Cymbal
EDGE
CENTER
EDGE
Roto-Toms
Tom-Toms
Bass Drum
Tom-Toms
Tom-Toms
Bass Drum

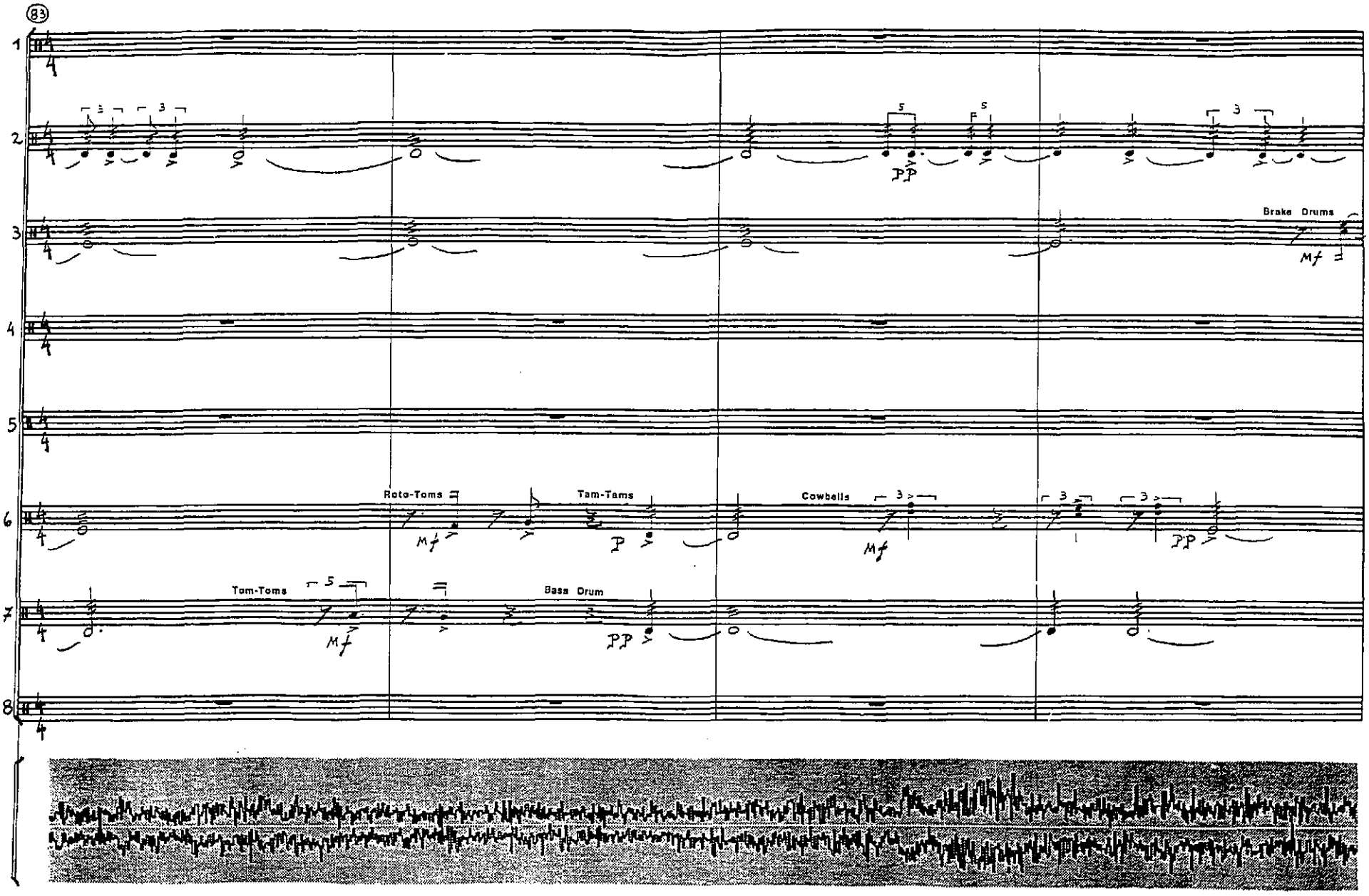

(63)
1
2
3
4
5
6
7
8
(SEMPRE mf)
MOTORS ON, MEDIUM VIBRATO
Vibraphone
Brake Drums
T.T.
CENTER
EDGE
CENTER
EDGE
(SEMPRE mf)
Tam-Tams
mf
Bass Drum
mf
Marimba
(SEMPRE mf)

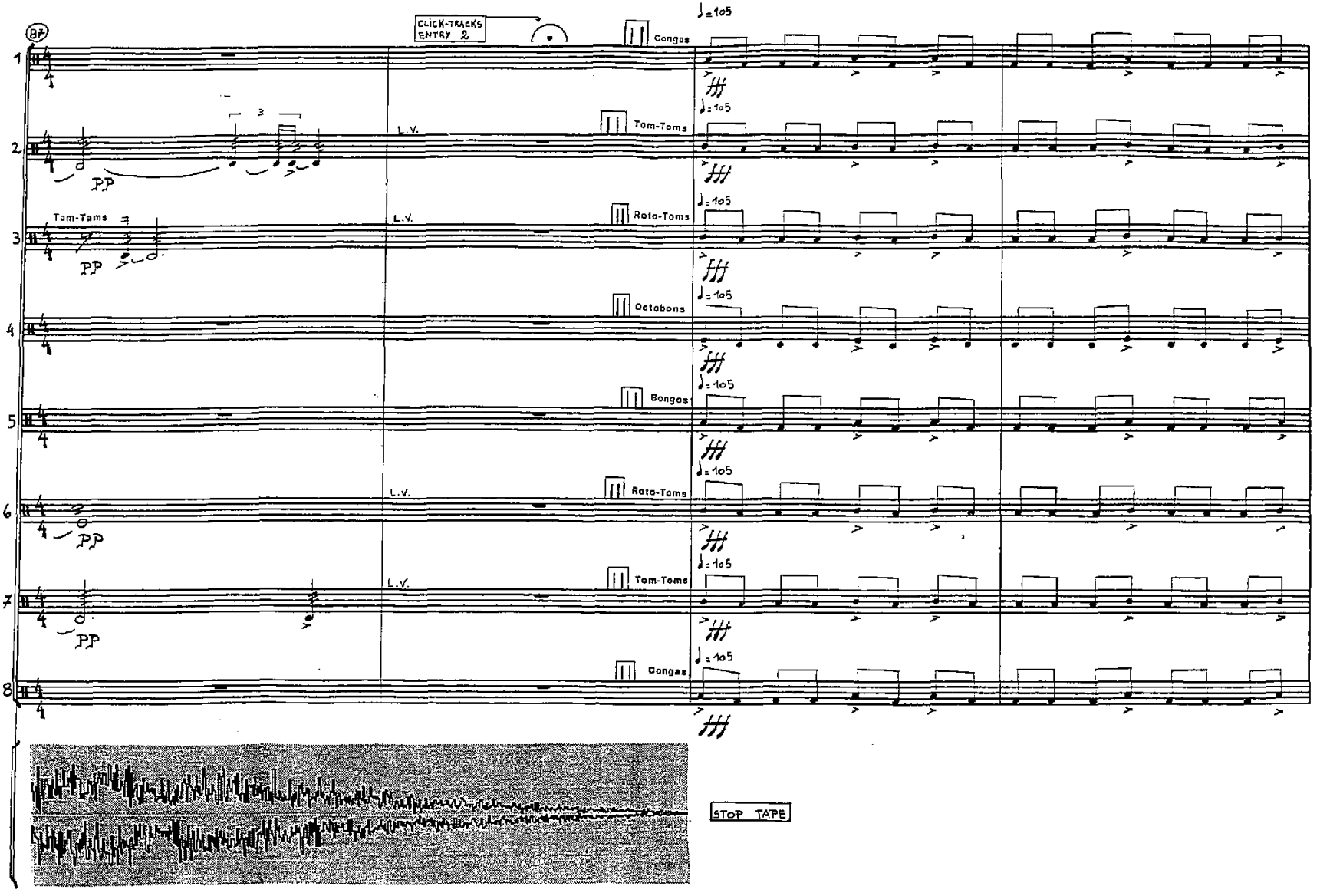

67
1
2
3
4
5
6
7
8
SIMILE
Bass Drum
Brake Drums
Tam-Tams
Brake Drums
Tam-Tams
CYMBAL
CENTER
EDGE
CENTER
(SEMPRE Mf)
Cowbells
Tam-Tams
Cowbells
SIMILE
Bass Drum

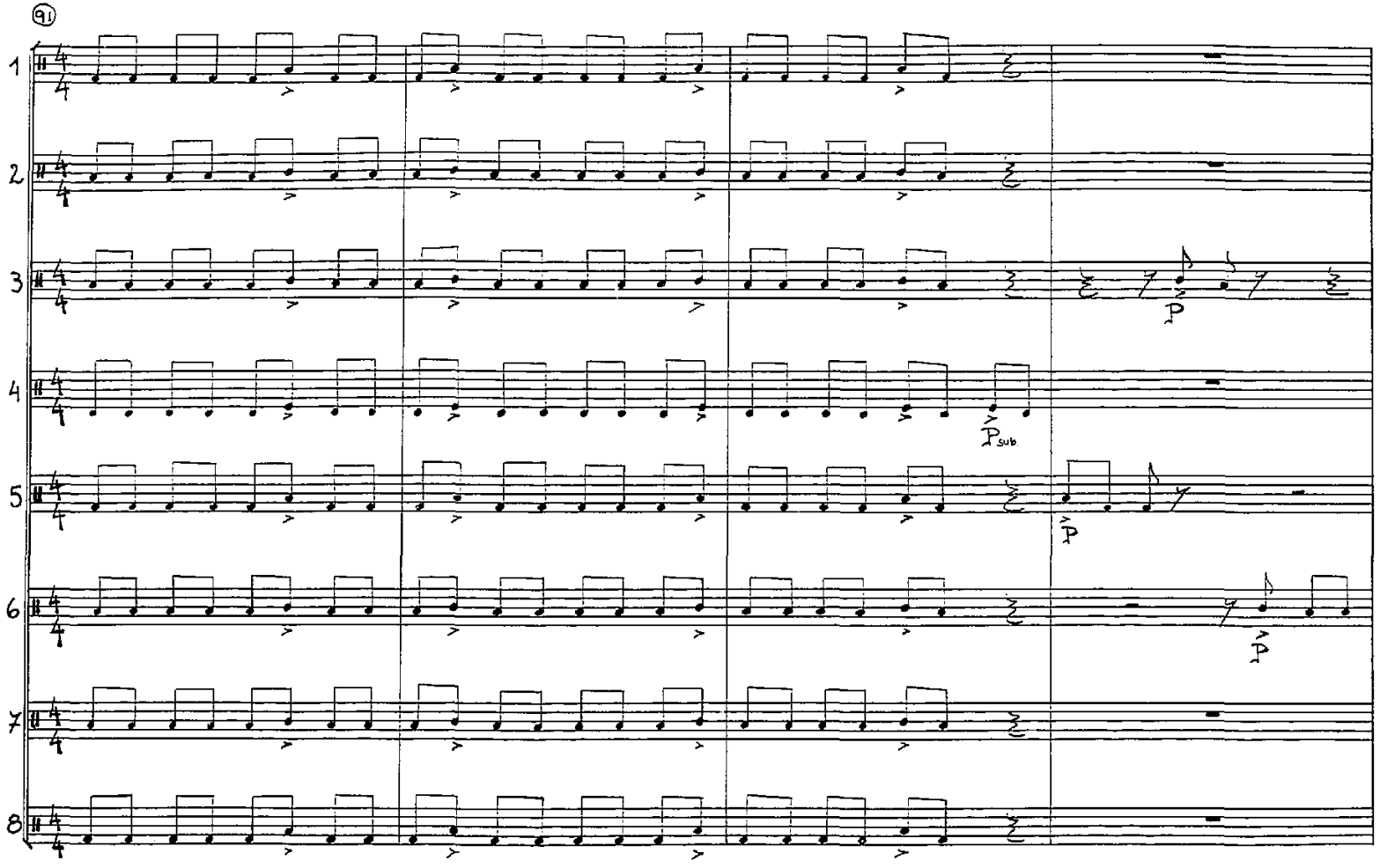

71
Tom-Toms
Bass Drum
Roto-Toms
Brake Drums
EDGE
Tam-Tams
Cowbells
Tom-Toms
Bass Drum

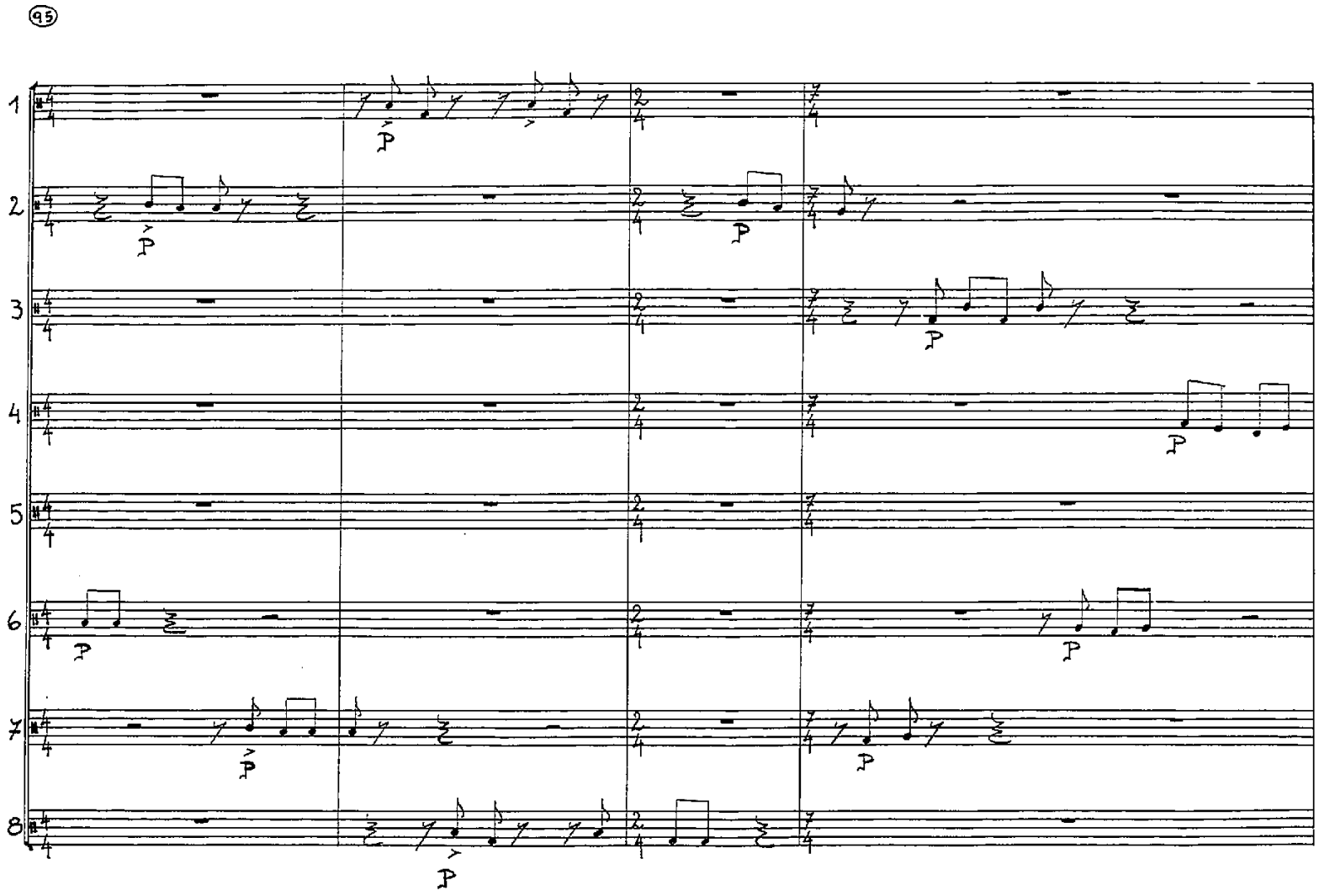

75
1
2
3
Tam-Tams
4
5
Tam-Tams
6
7
8

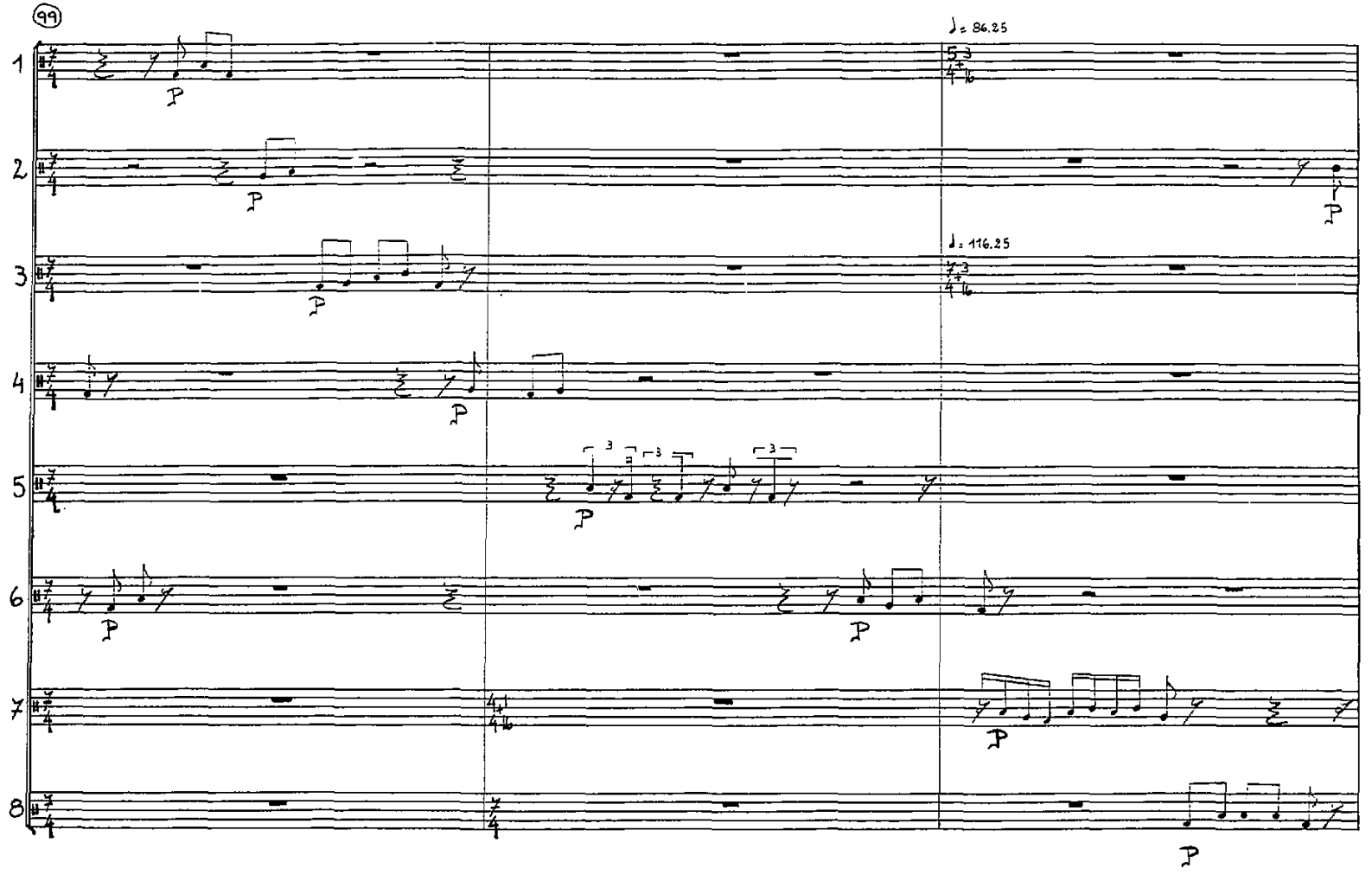

59
1
2
3
4
5
6
7
8
Tom-Toms
Bass Drum
Roto-Toms
Tam-Tams
Mf
P

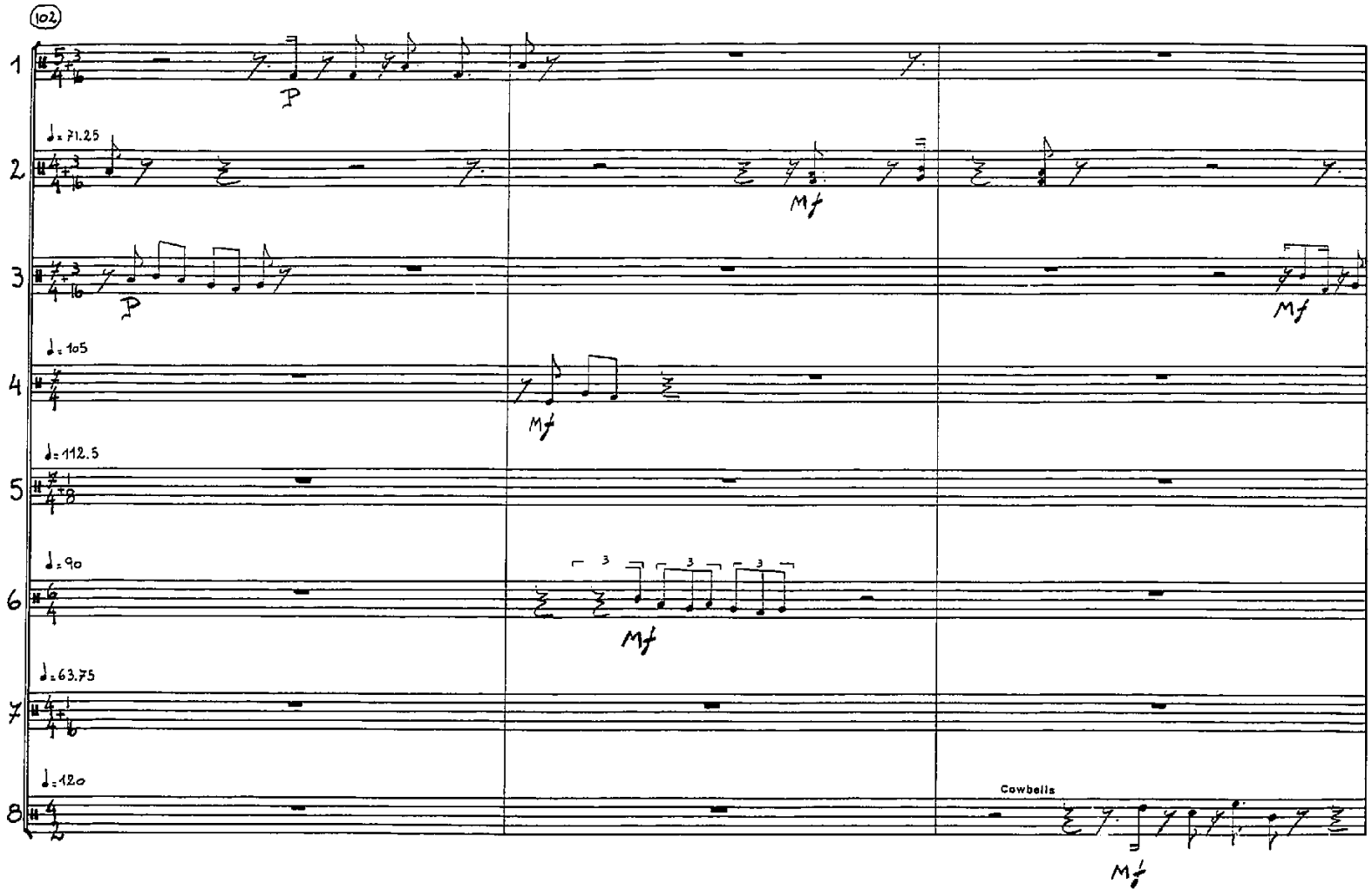

83
Brake Drums
Roto-Toms
Tam-Toms
Cowbells
Tom-Toms
Bass Drum

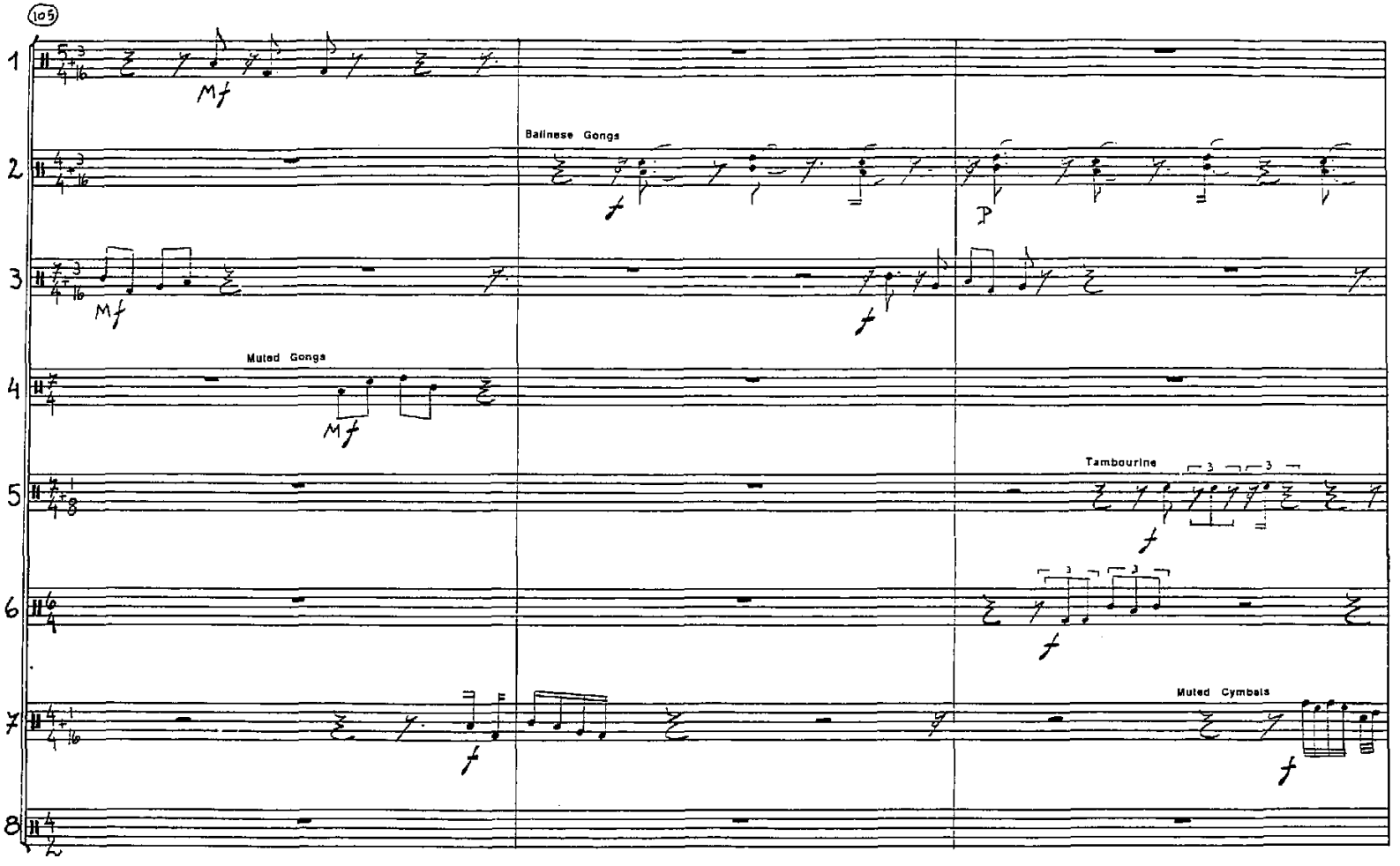

87
CLICK-TRACKS ENTRY 2
Congas
Tom-Toms
Roto-Toms
Octobons
Bongos
Roto-Toms
Tom-Toms
Congas
Tam-Tams
L.V.
PP
STOP TAPE

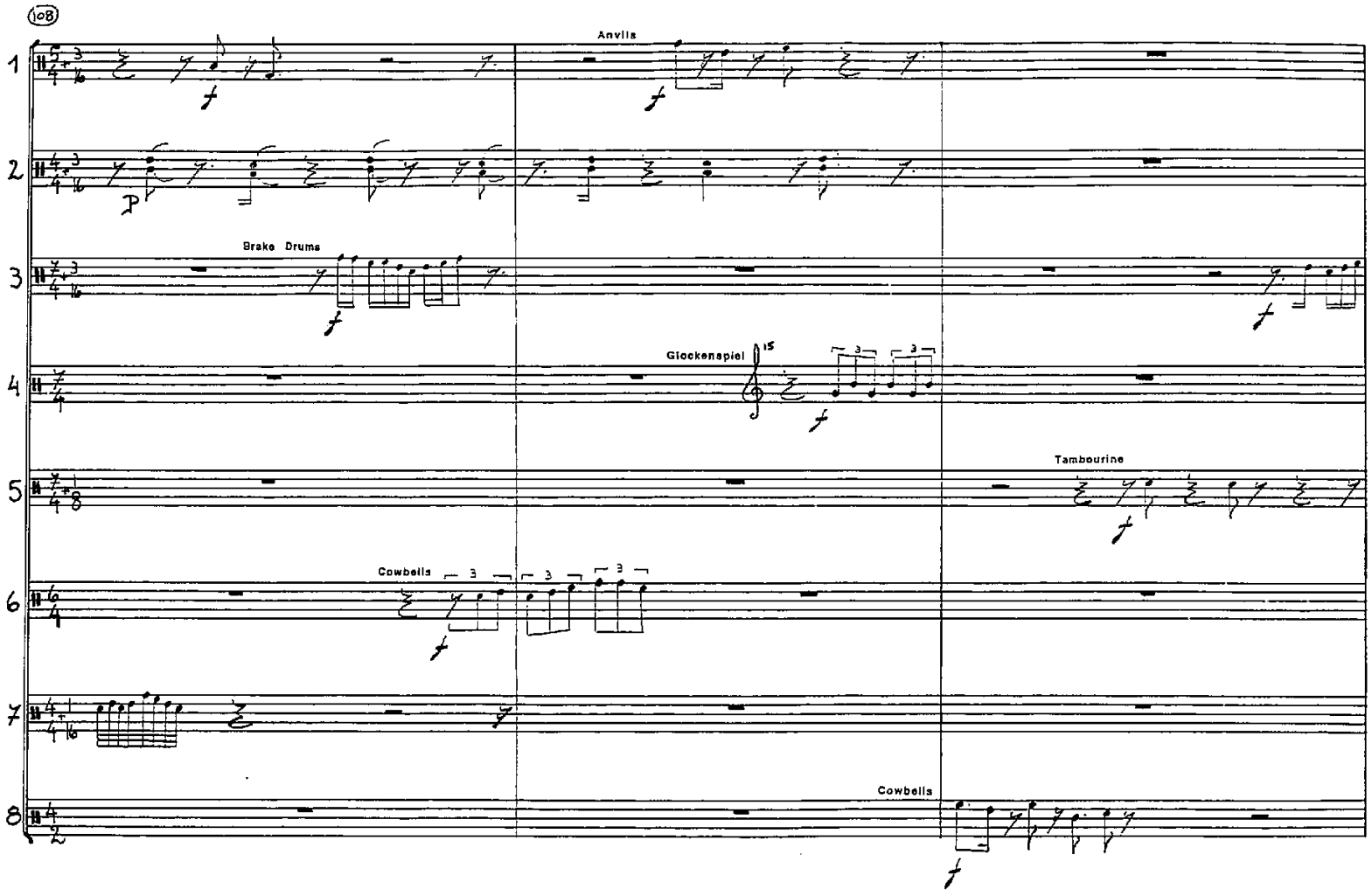

91
1
2
3
4
5
6
7
8
P
P sub
P
P

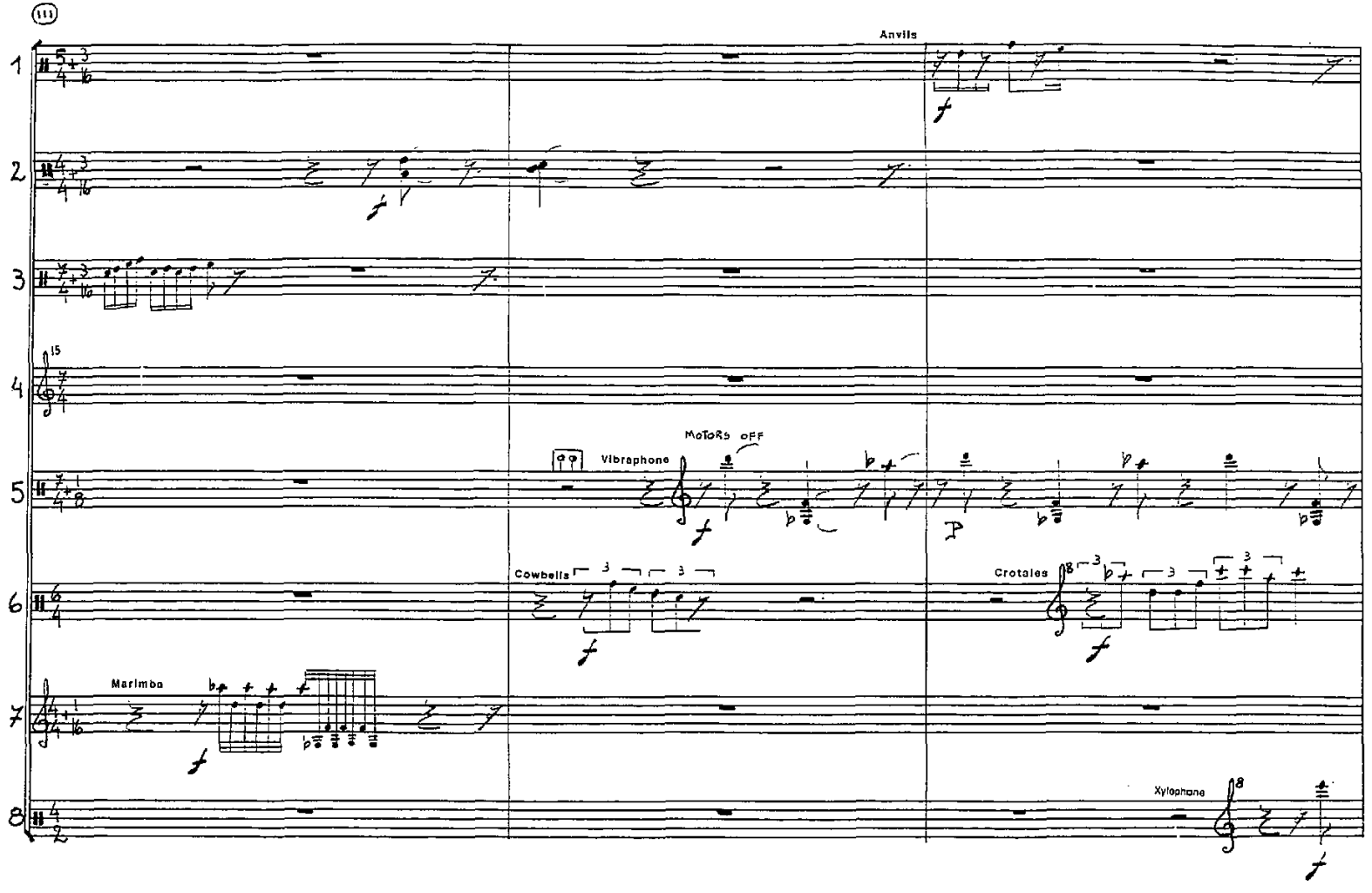

95
1
2
3
4
5
6
7
8
P

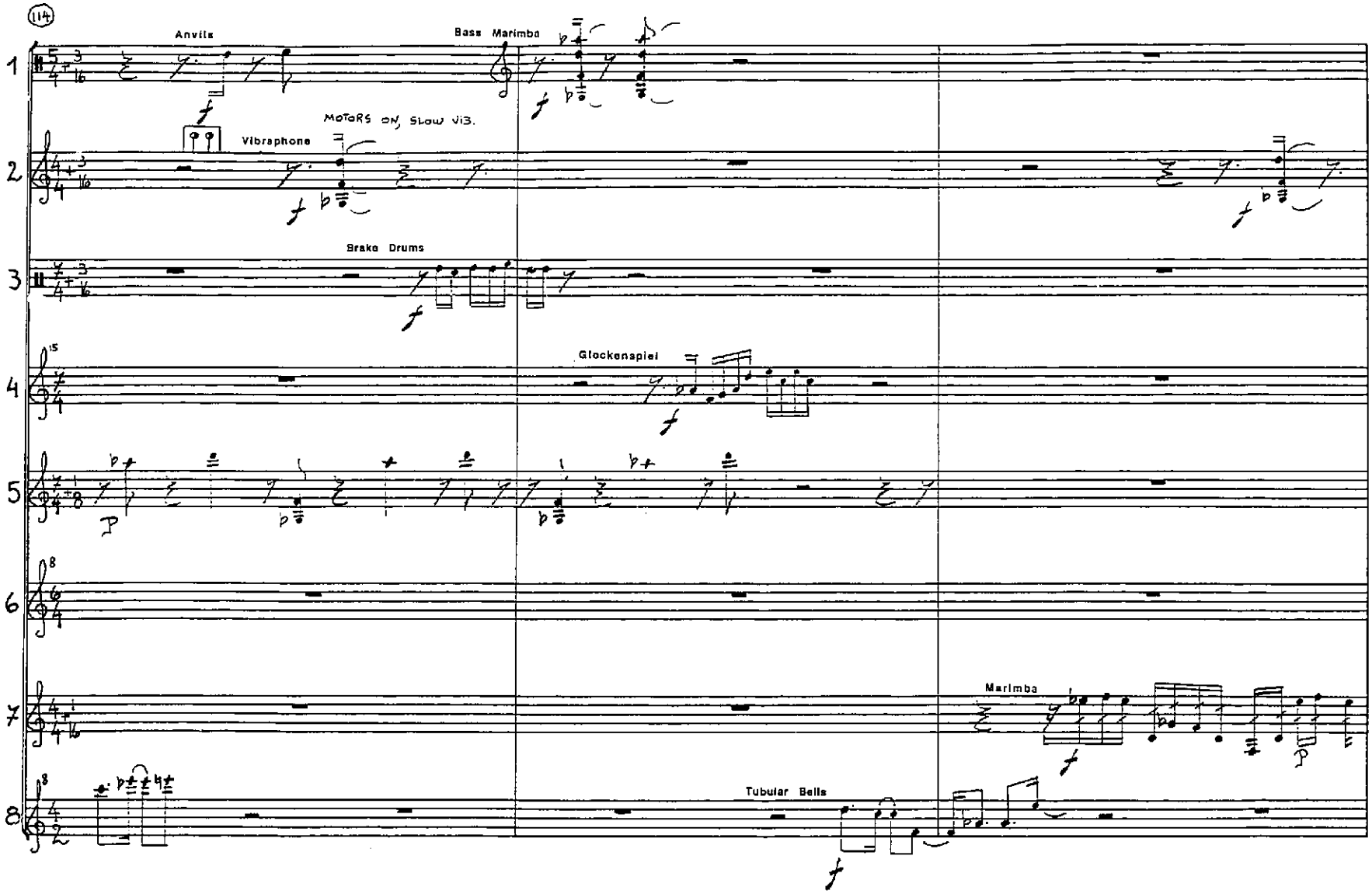

99
♩= 86.25
♩= 116.25
1
2
3
4
5
6
7
8
P

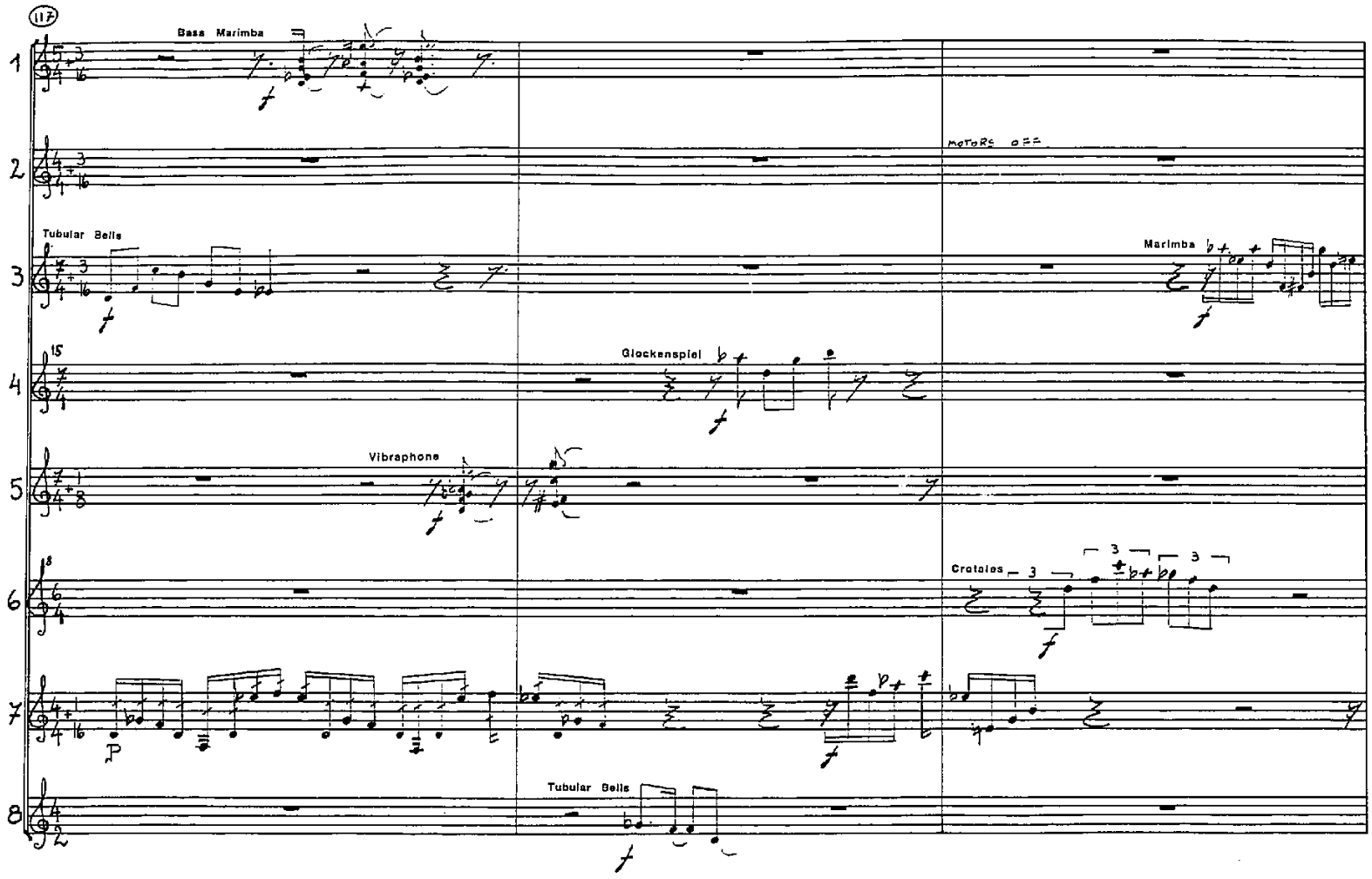

102
1
P
2
♩= 71.25
Mf
3
P
Mf
4
♩= 105
Mf
5
♩= 112.5
6
♩= 90
3
3
3
Mf
7
♩= 63.75
8
♩= 120
Cowbells
Mf

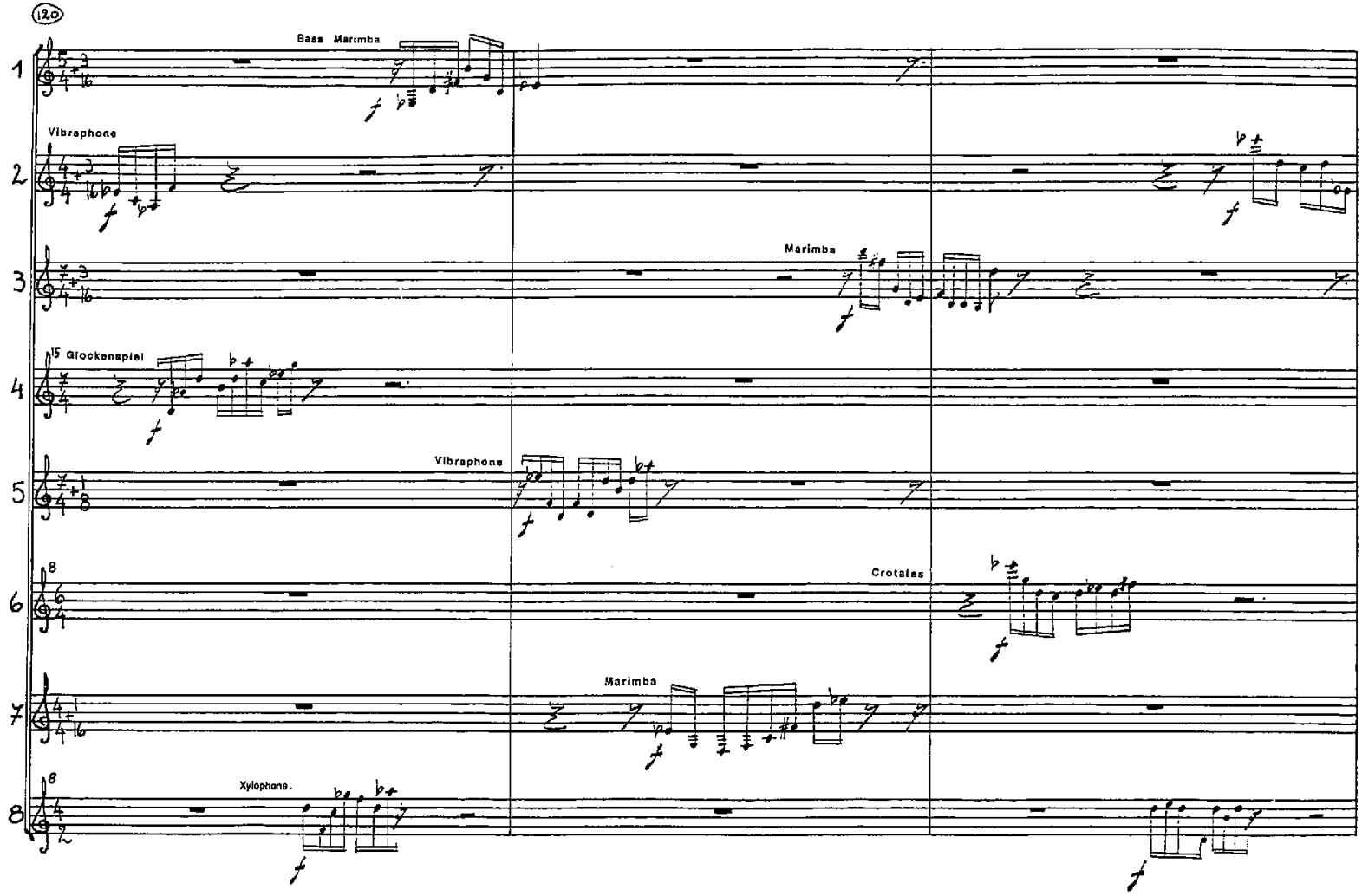

105
1
2
3
4
5
6
7
8
Mf
Balinese Gongs
f
P
Mf
f
Muted Gongs
Mf
Tambourine
3
3
f
3
3
f
Muted Cymbals
f

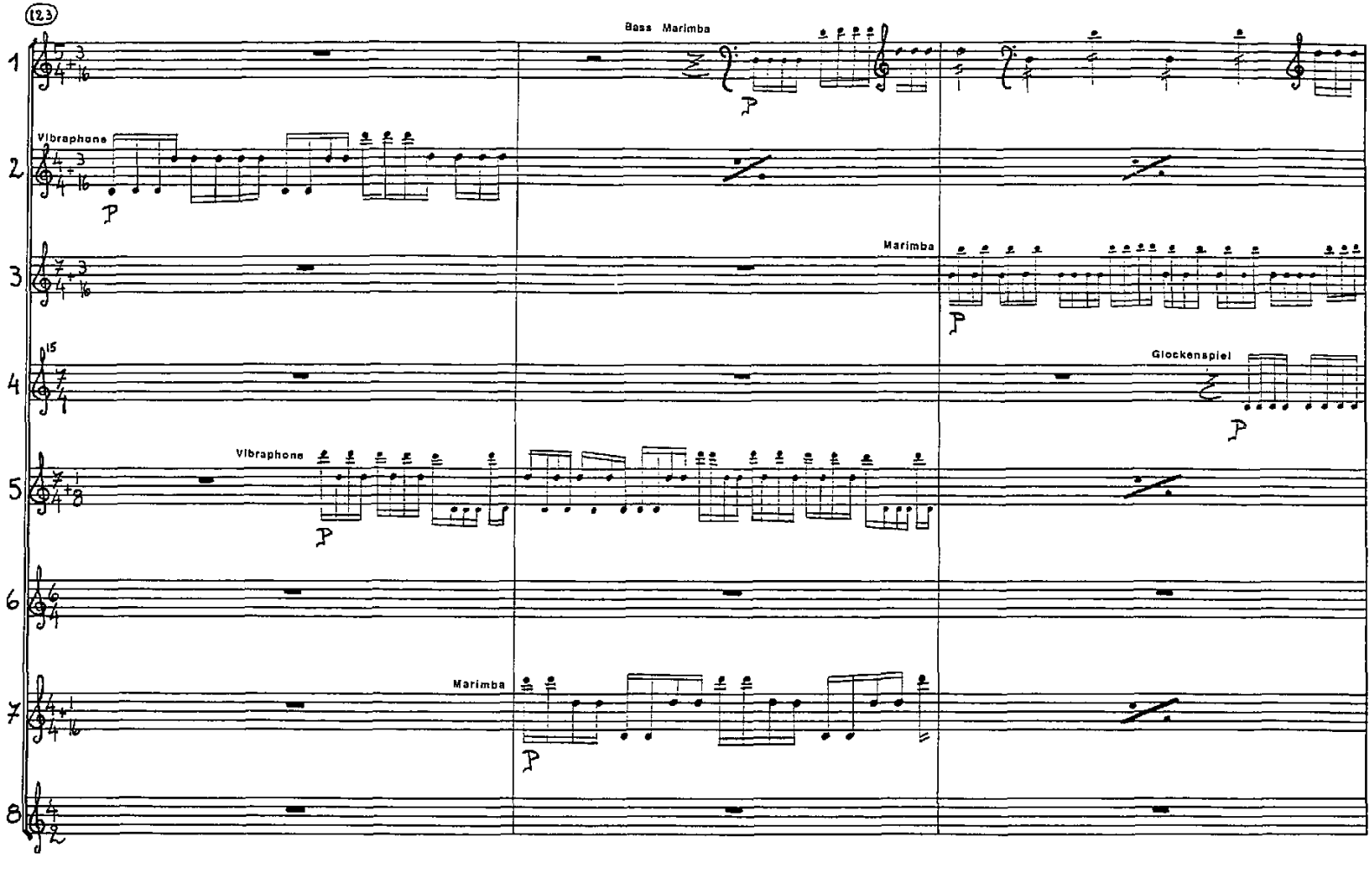

108
Anvils
Brake Drums
Glockenspiel
Tambourine
Cowbells
Cowbells

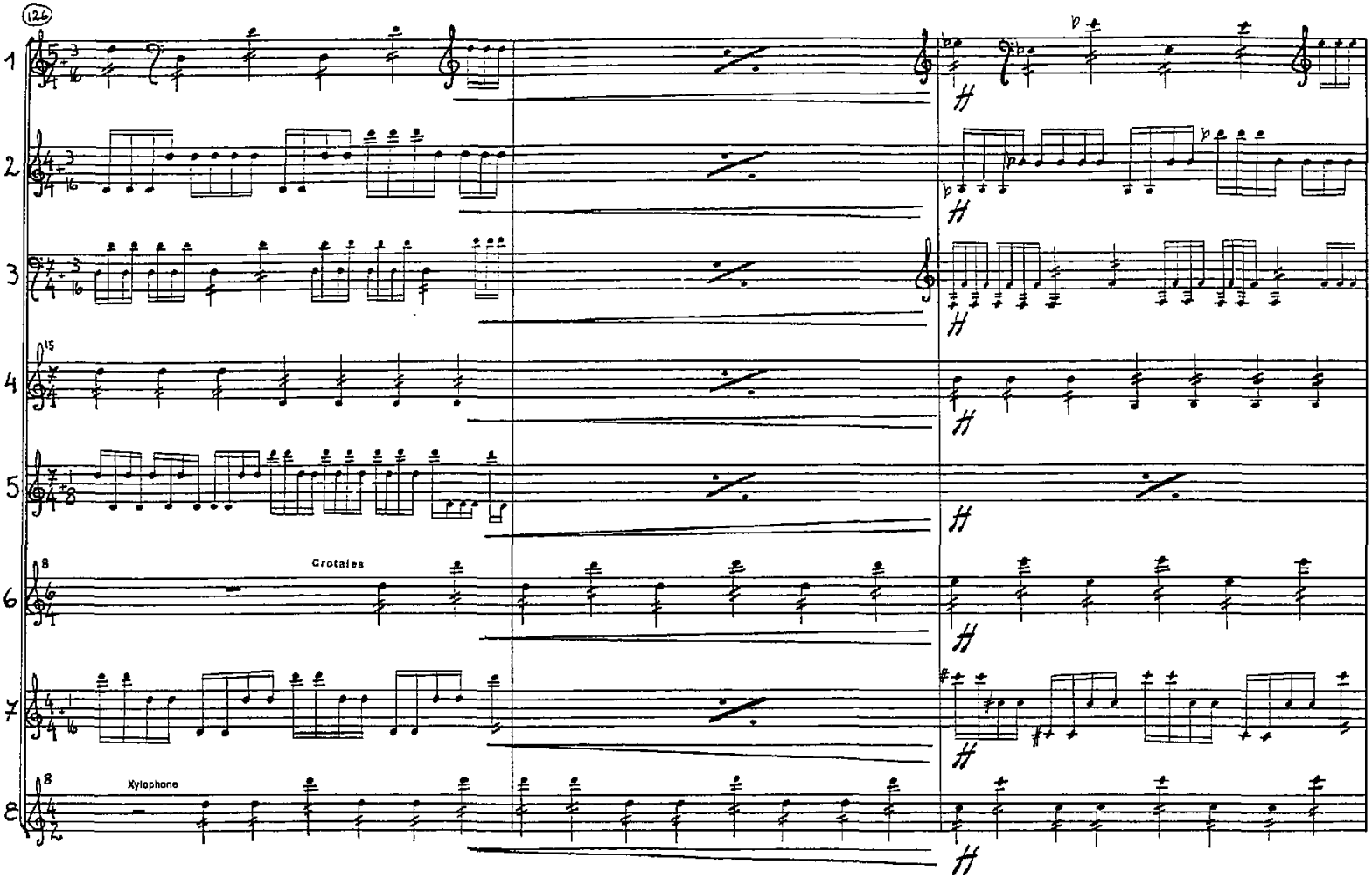

111
Anvils
Motors off
Vibraphone
Cowbells
Crotales
Marimba
Xylophone

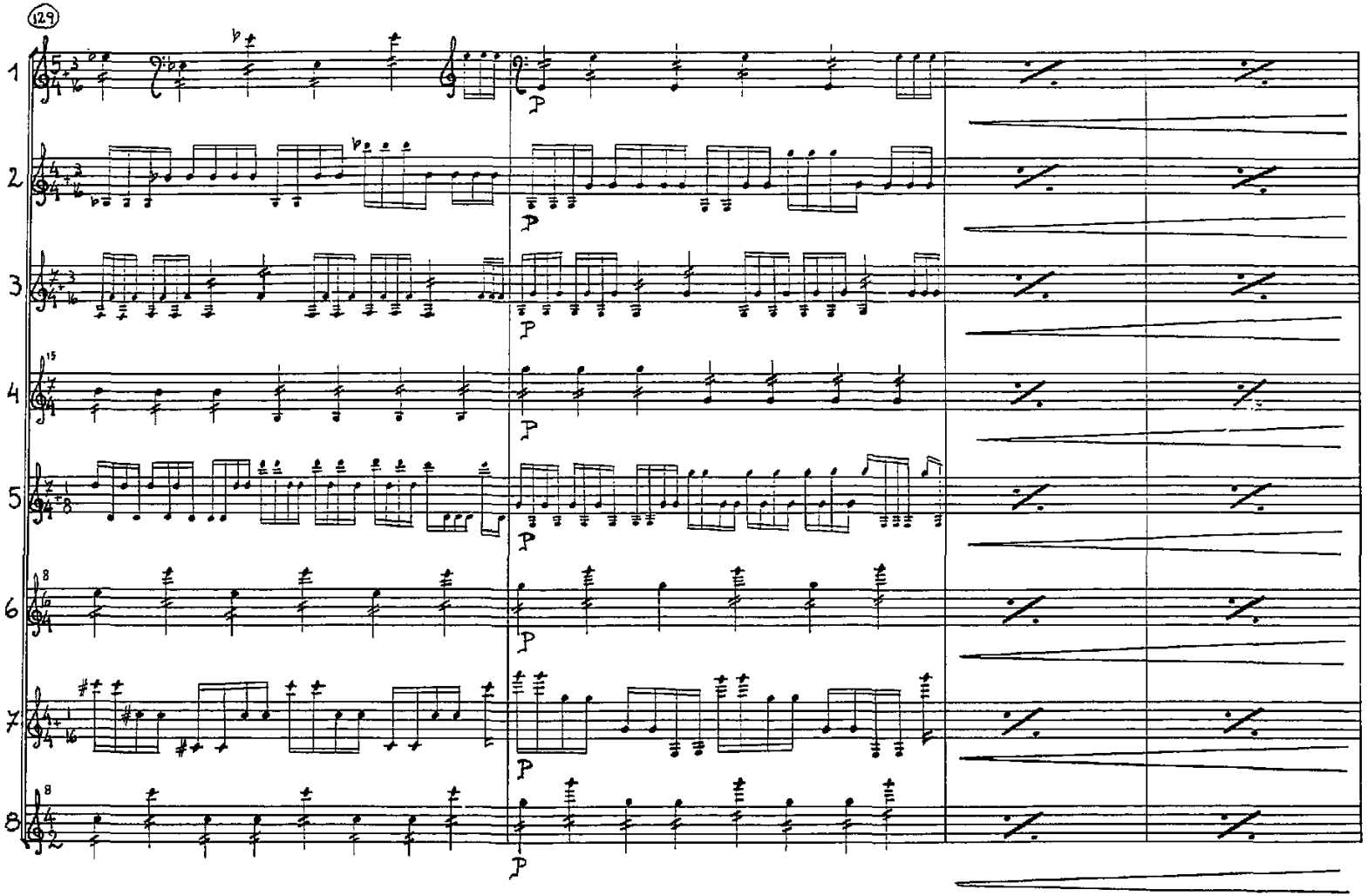

(114)
Anvils
Bass Marimba
MOTORS ON, SLOW VIB.
Vibraphone
Brake Drums
Glockenspiel
Marimba
Tubular Bells

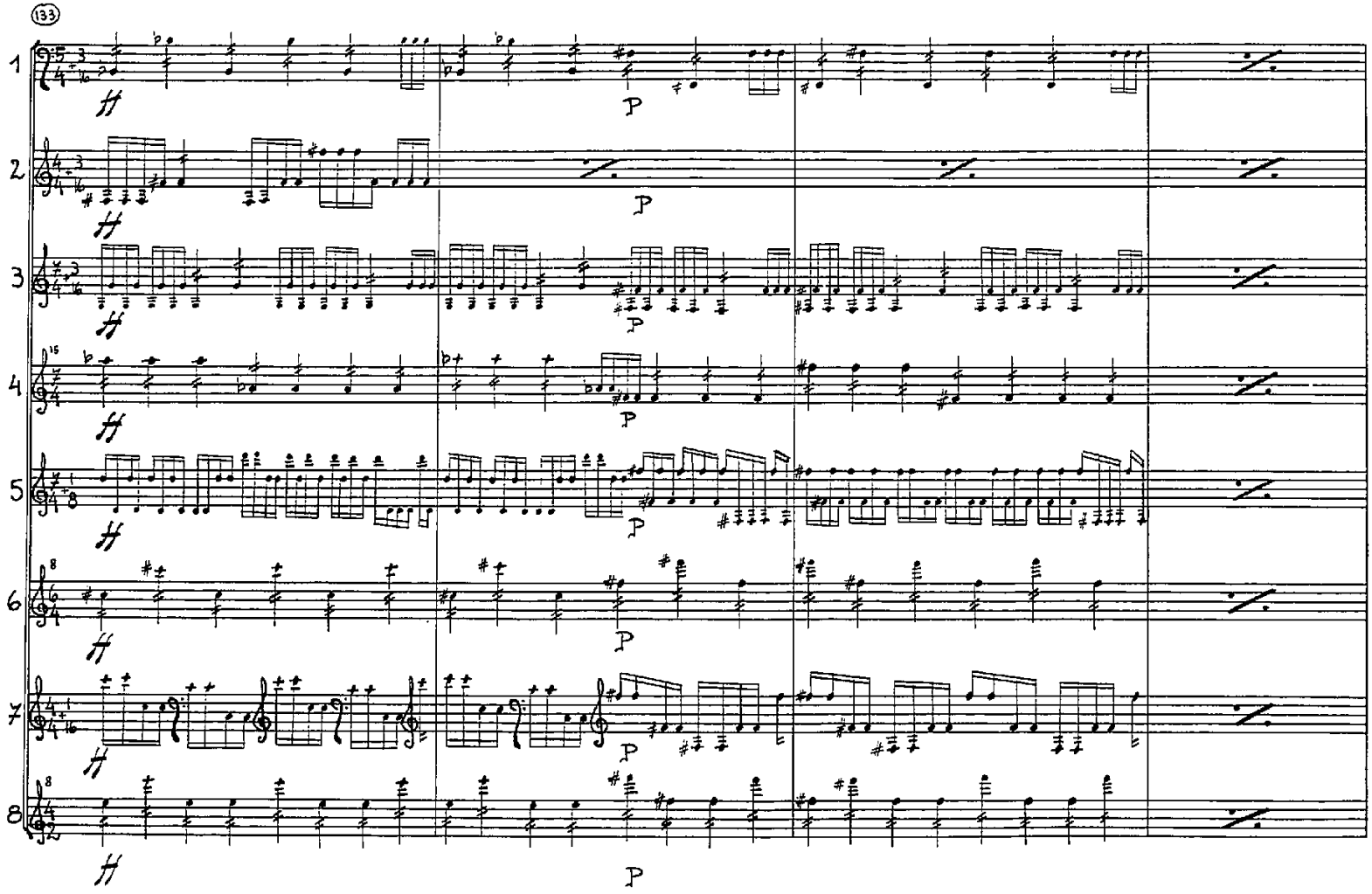

117
Bass Marimba
MOTORS OFF
Tubular Bells
Marimba
15
Glockenspiel
Vibraphone
Crotales
Tubular Bells

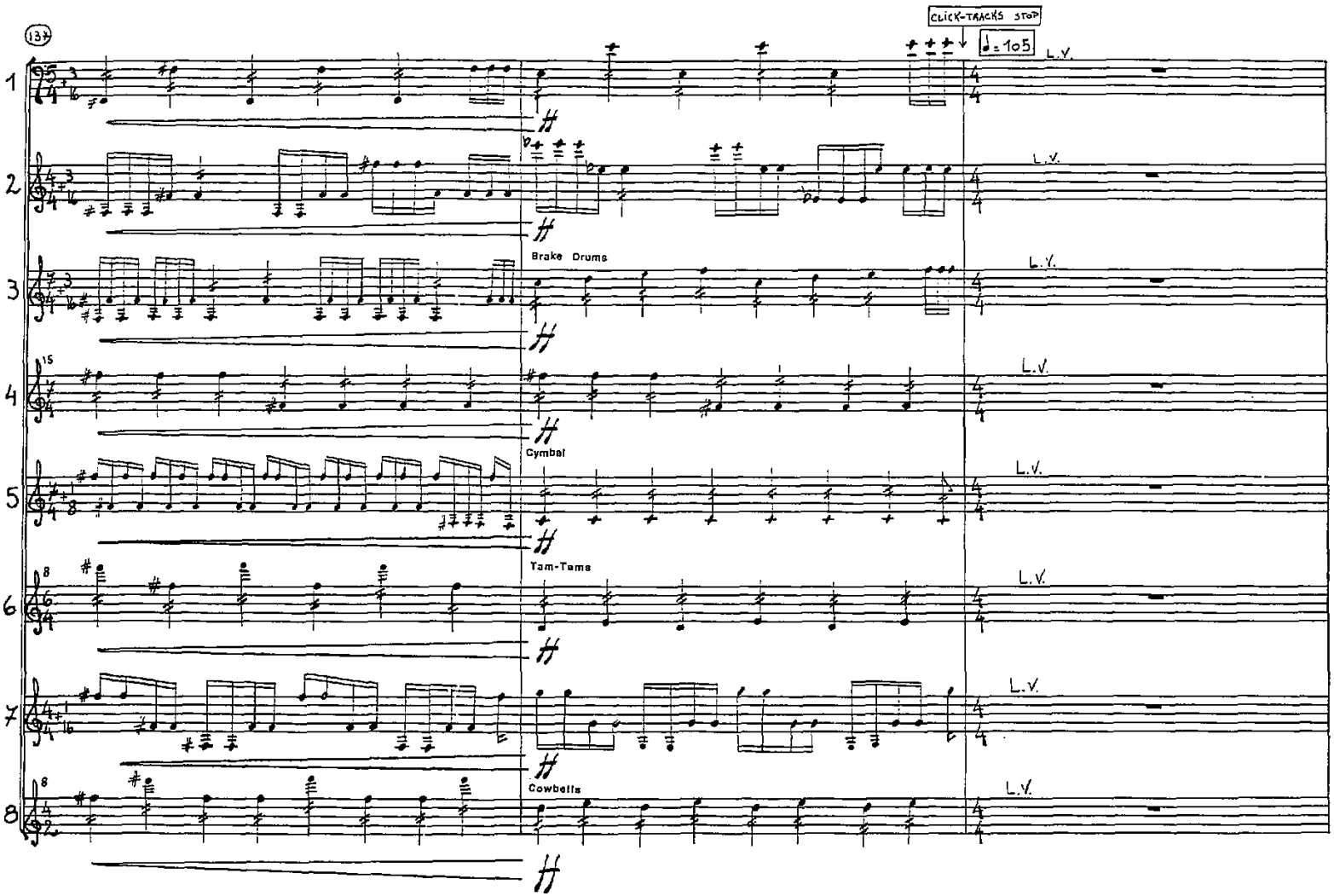

120
1
Bass Marimba
2
Vibraphone
3
Marimba
4
15 Glockenspiel
5
Vibraphone
6
8
Crotales
7
Marimba
8
8
Xylophone

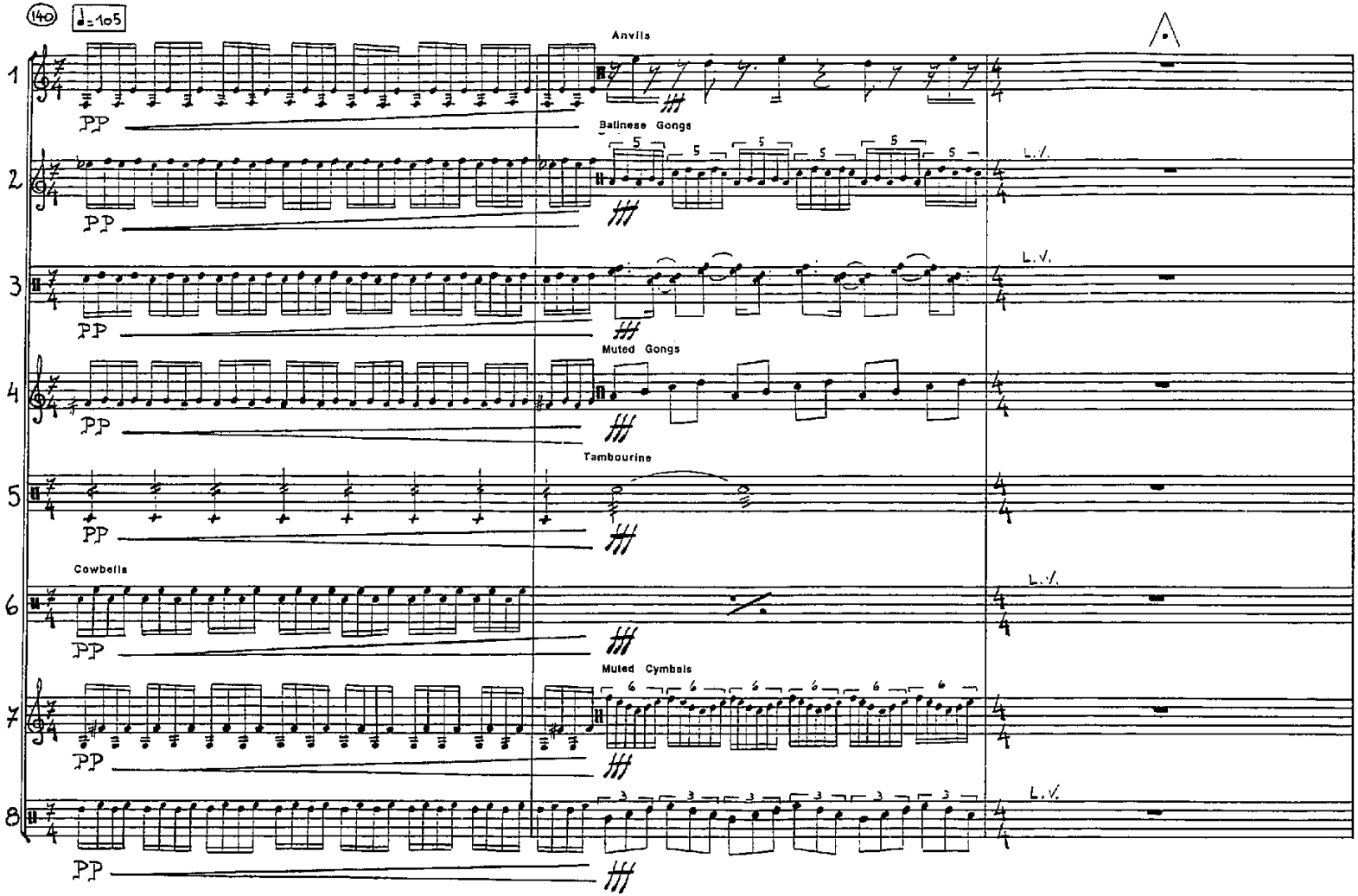

123
Bass Marimba
Vibraphone
Marimba
15
Glockenspiel
Vibraphone
Marimba

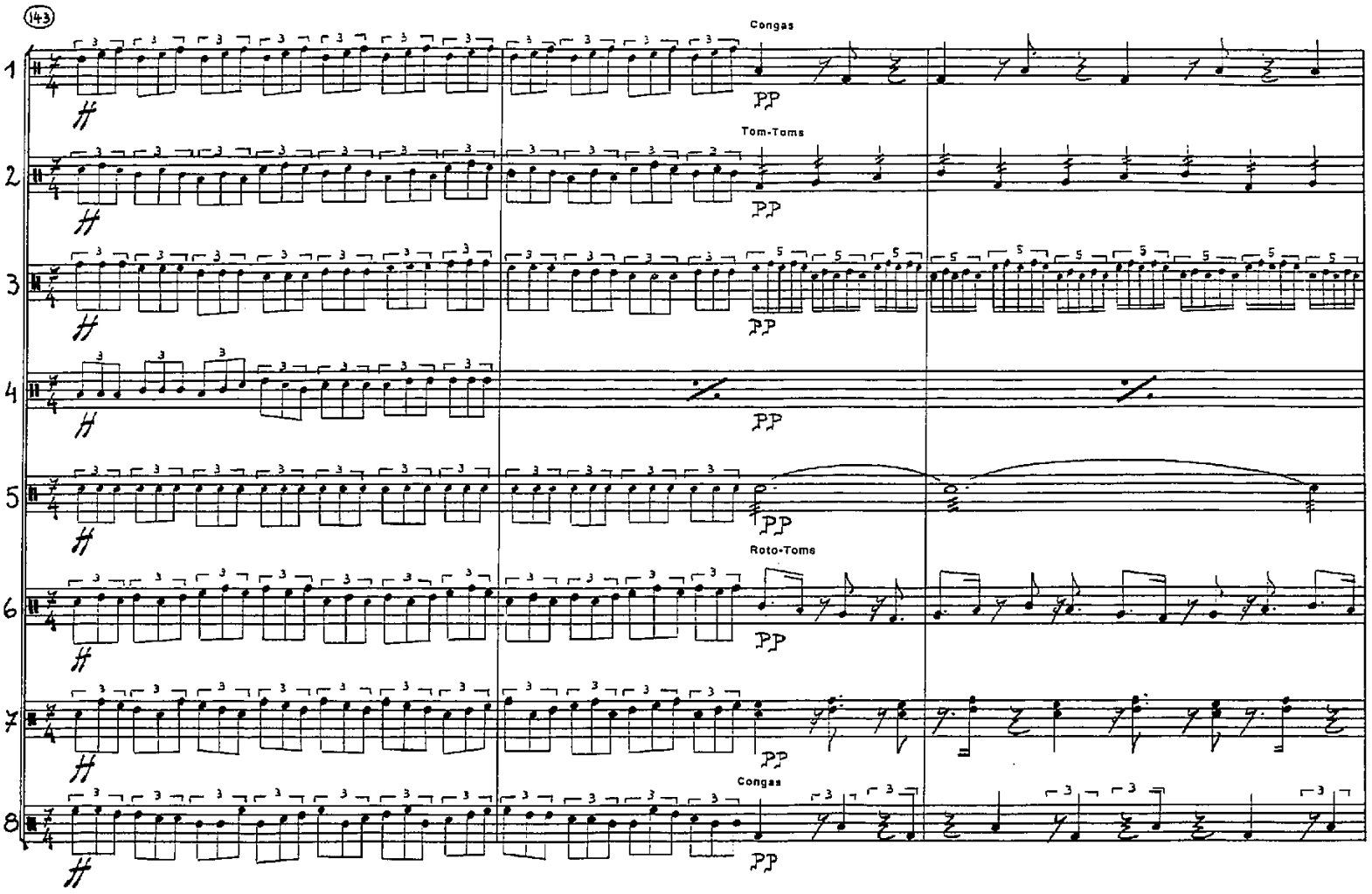

126
1
2
3
4
15
5
8
Crotales
6
7
8
Xylophone
8

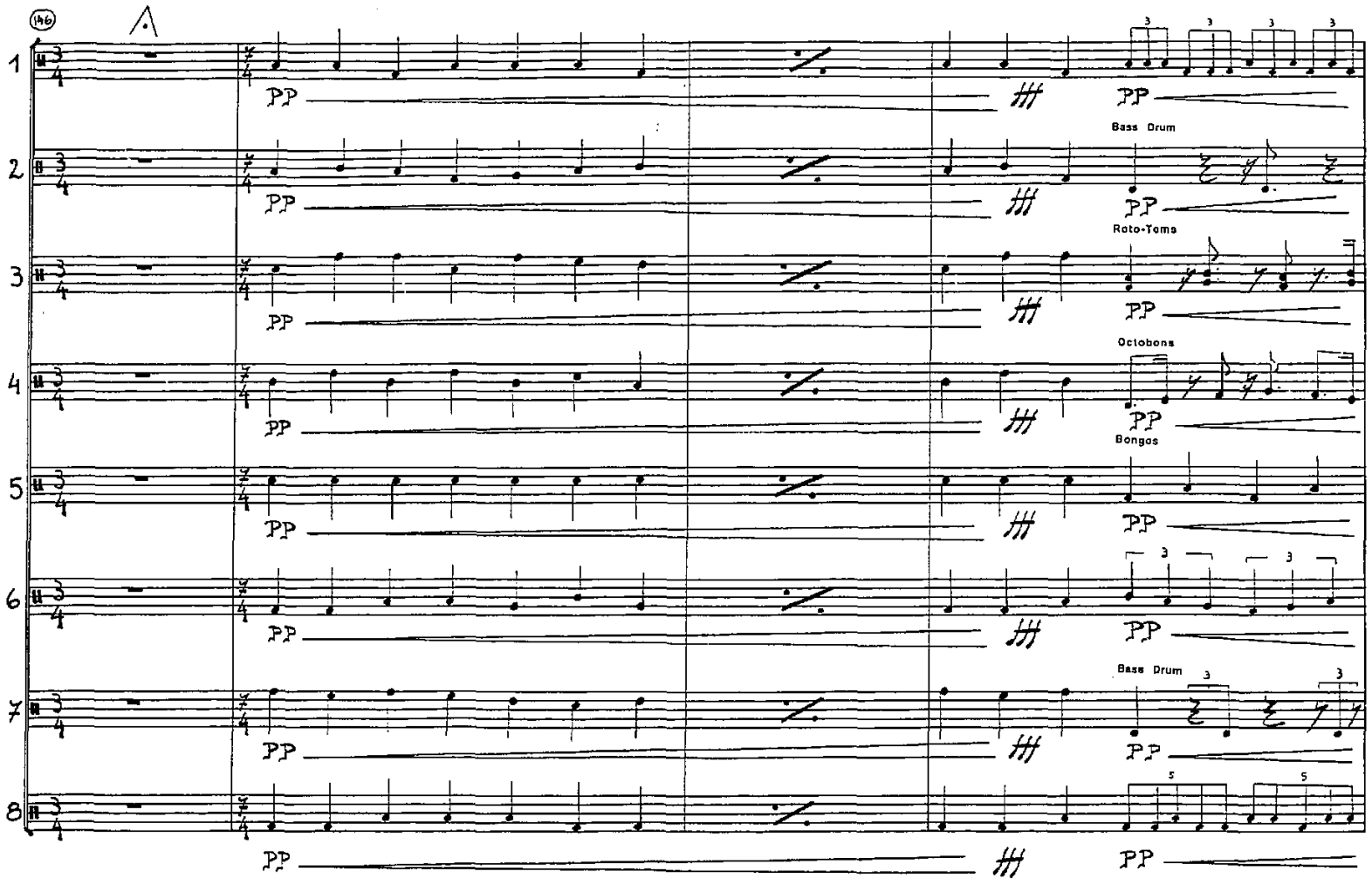

129
1
2
3
4
5
6
7
8
15
8
8
p
p
p
p
p
p
p
p

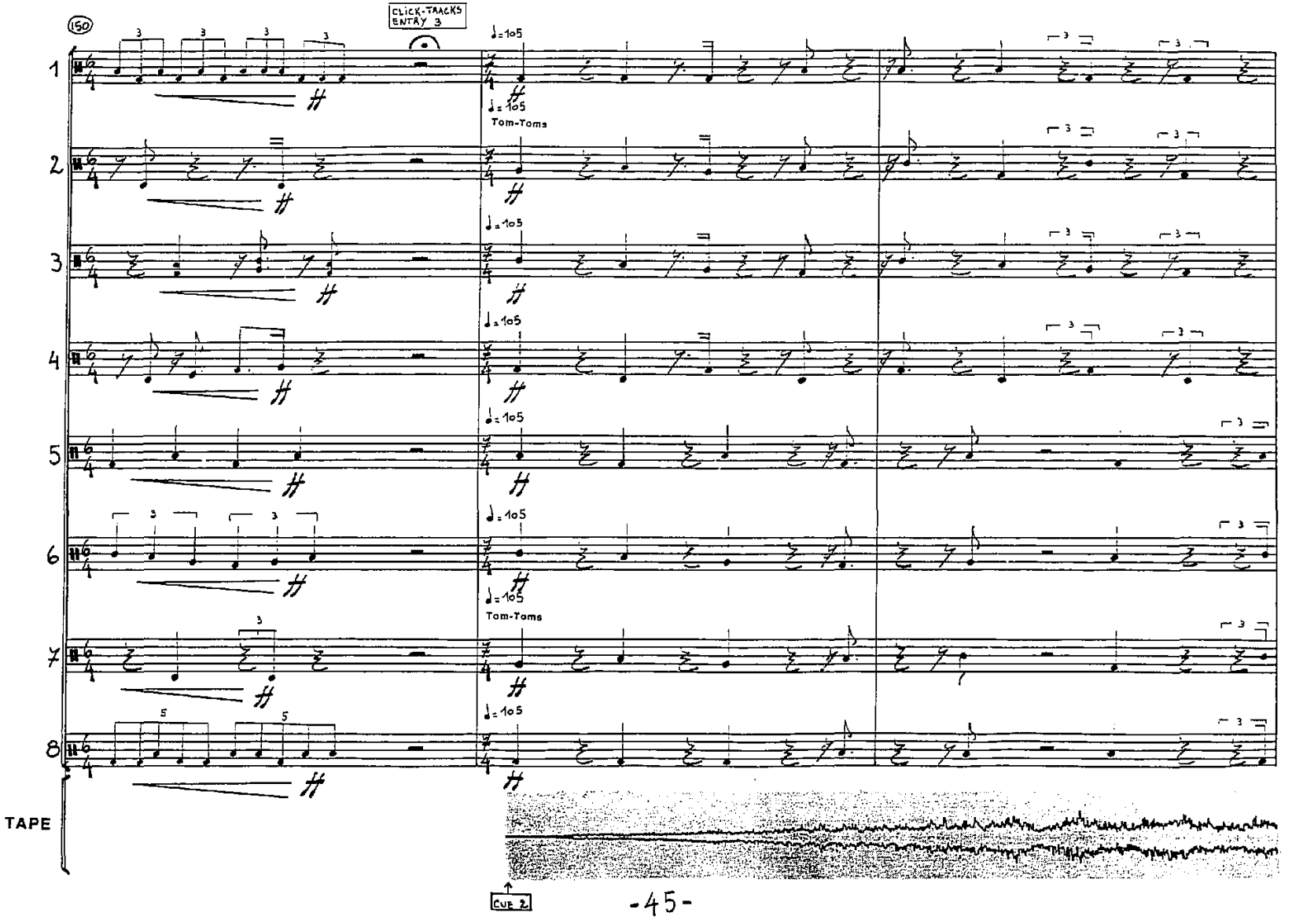

133
1
2
3
4
5
6
7
8
P

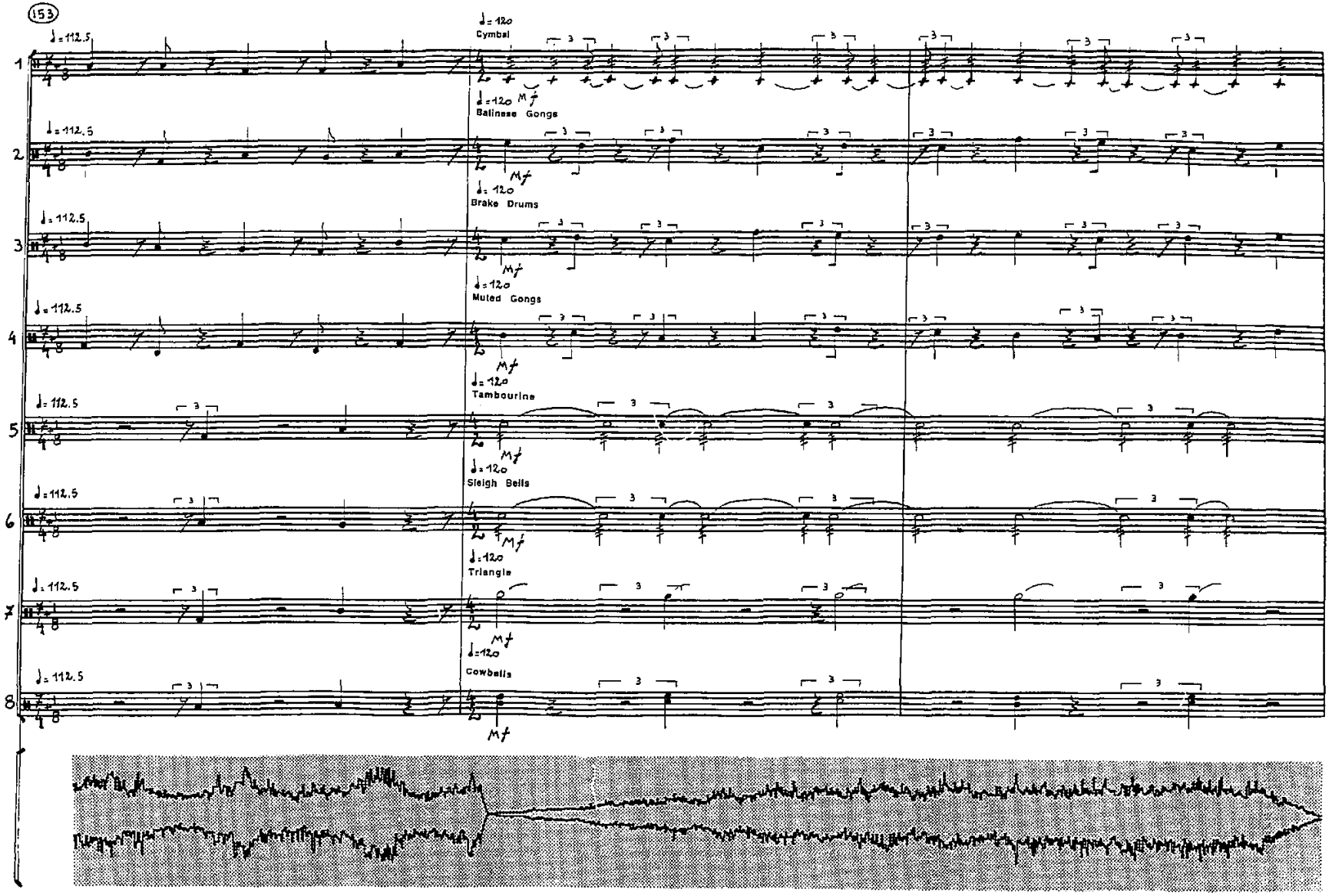

137
CLICK-TRACKS STOP
♩= 105
L.V.
Brake Drums
Cymbal
Tam-Tams
Cowbells

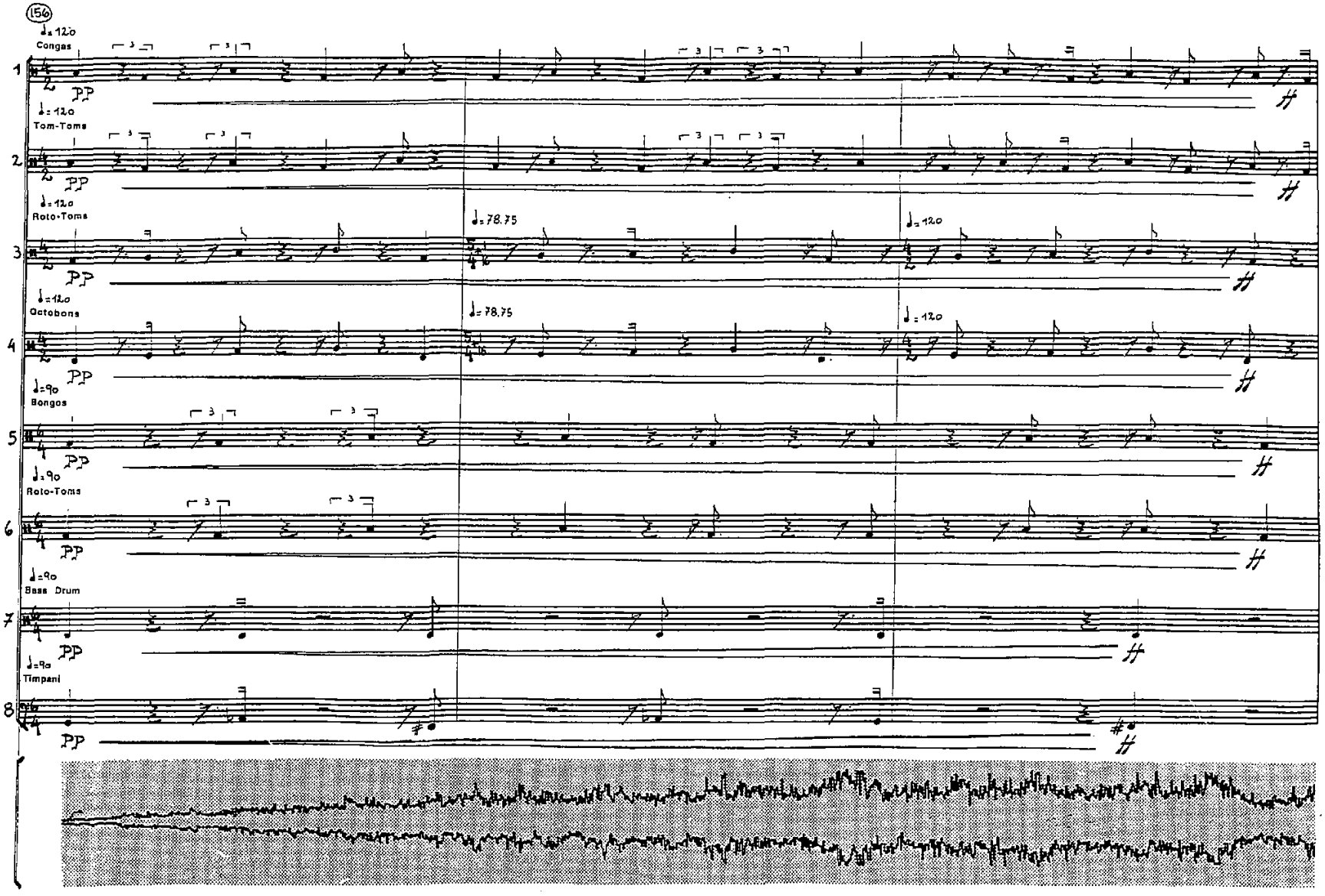

140
♩=105
Anvils
Balinese Gongs
Muted Gongs
Tambourine
Cowbells
Muted Cymbals
PP
L.V.
A

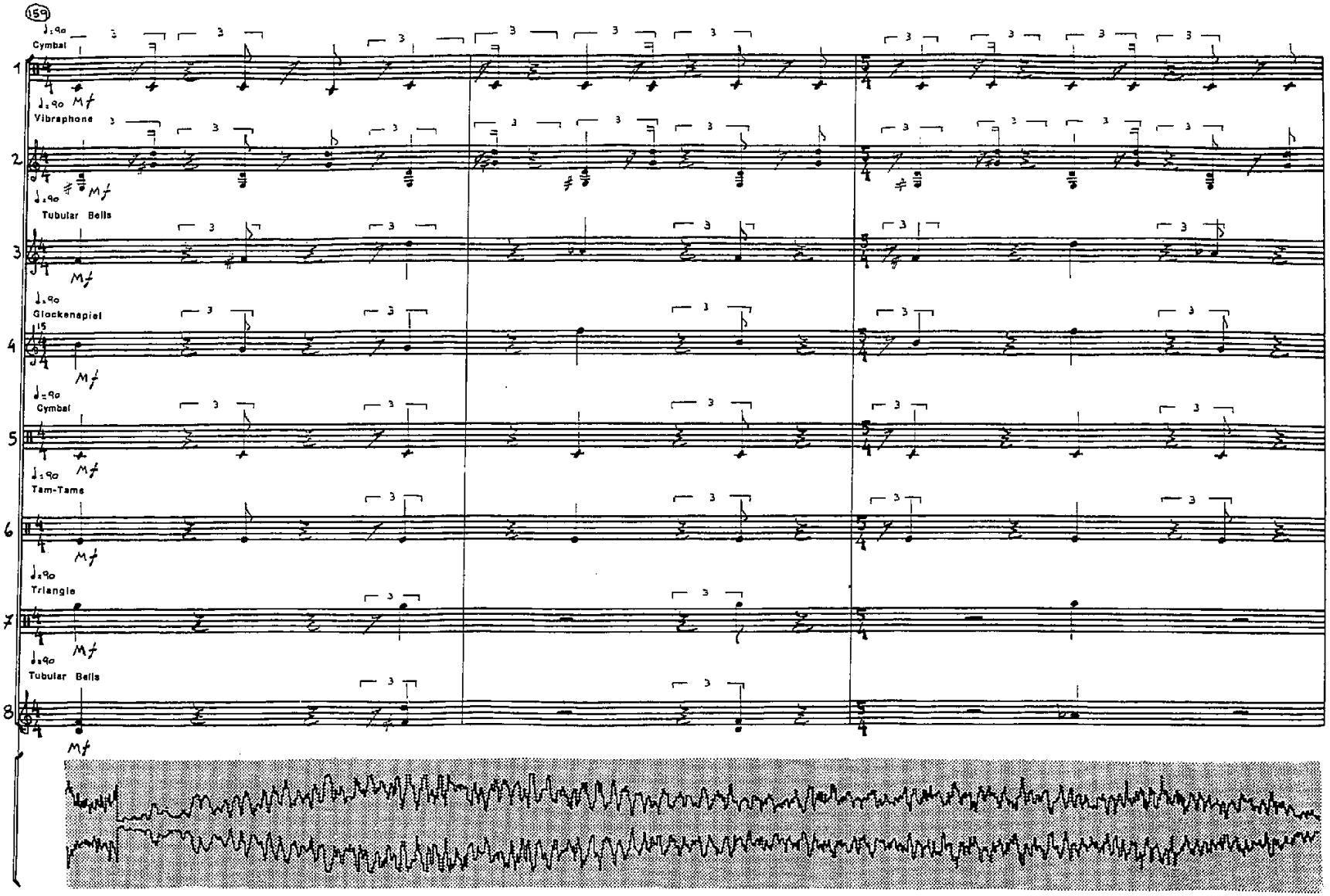

143
Congas
Tom-Toms
Roto-Toms
Congas
pp

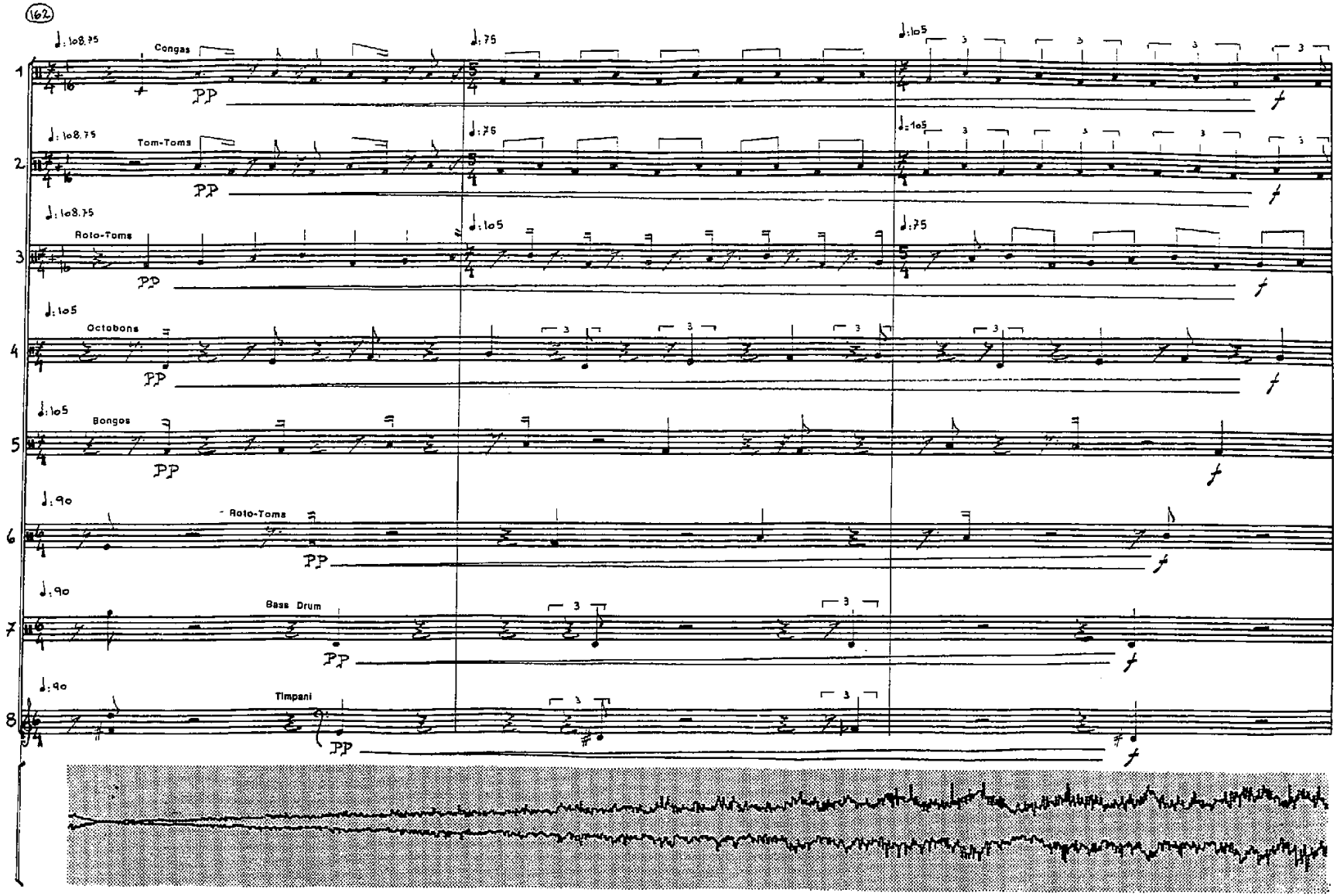

146
A
1
2
3
4
5
6
7
8
PP
Bass Drum
Roto-Toms
Octobons
Bongos
Bass Drum

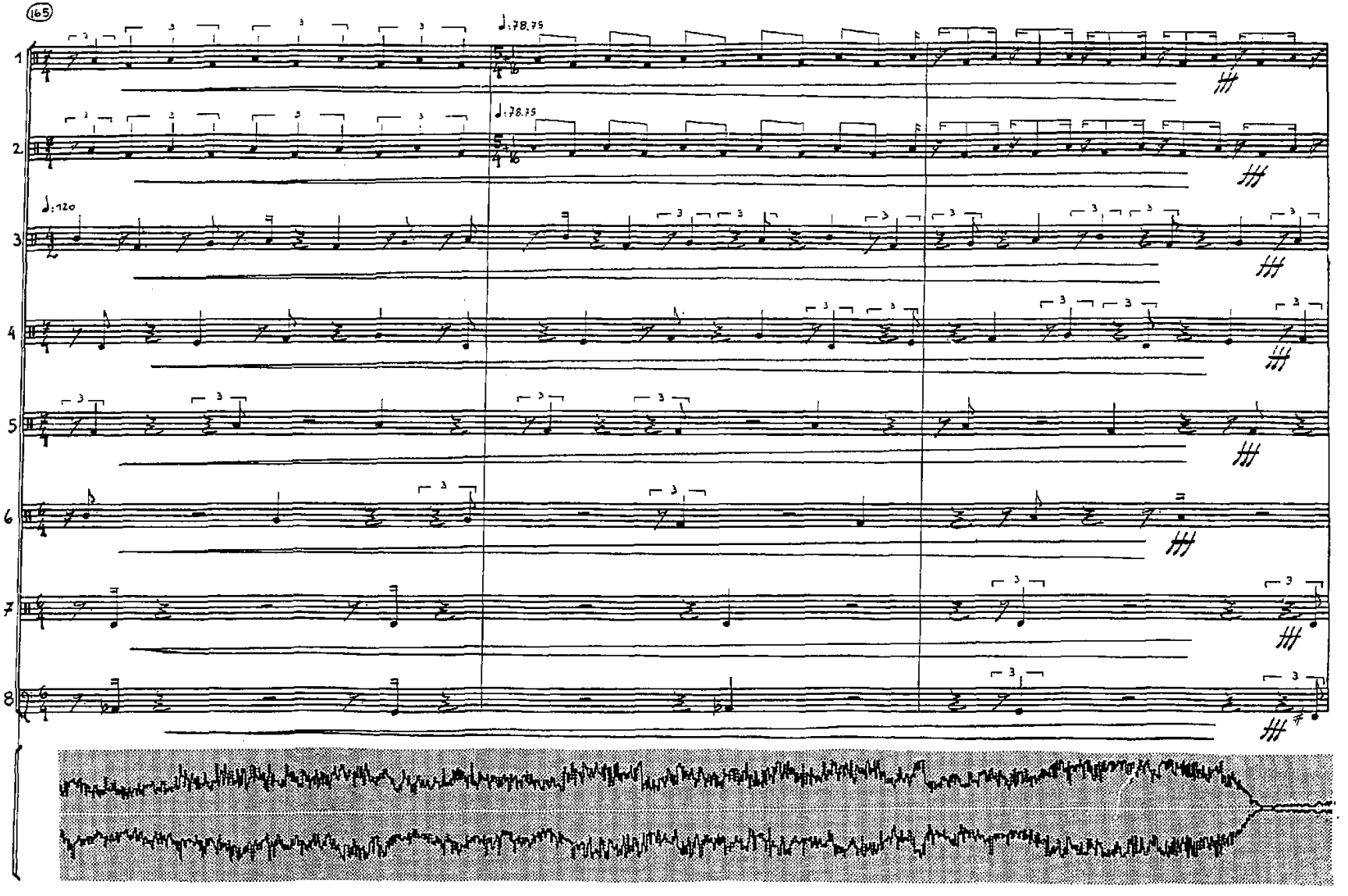

150
CLICK-TRACKS ENTRY 3
♩=105
Tom-Toms
TAPE
CUE 2

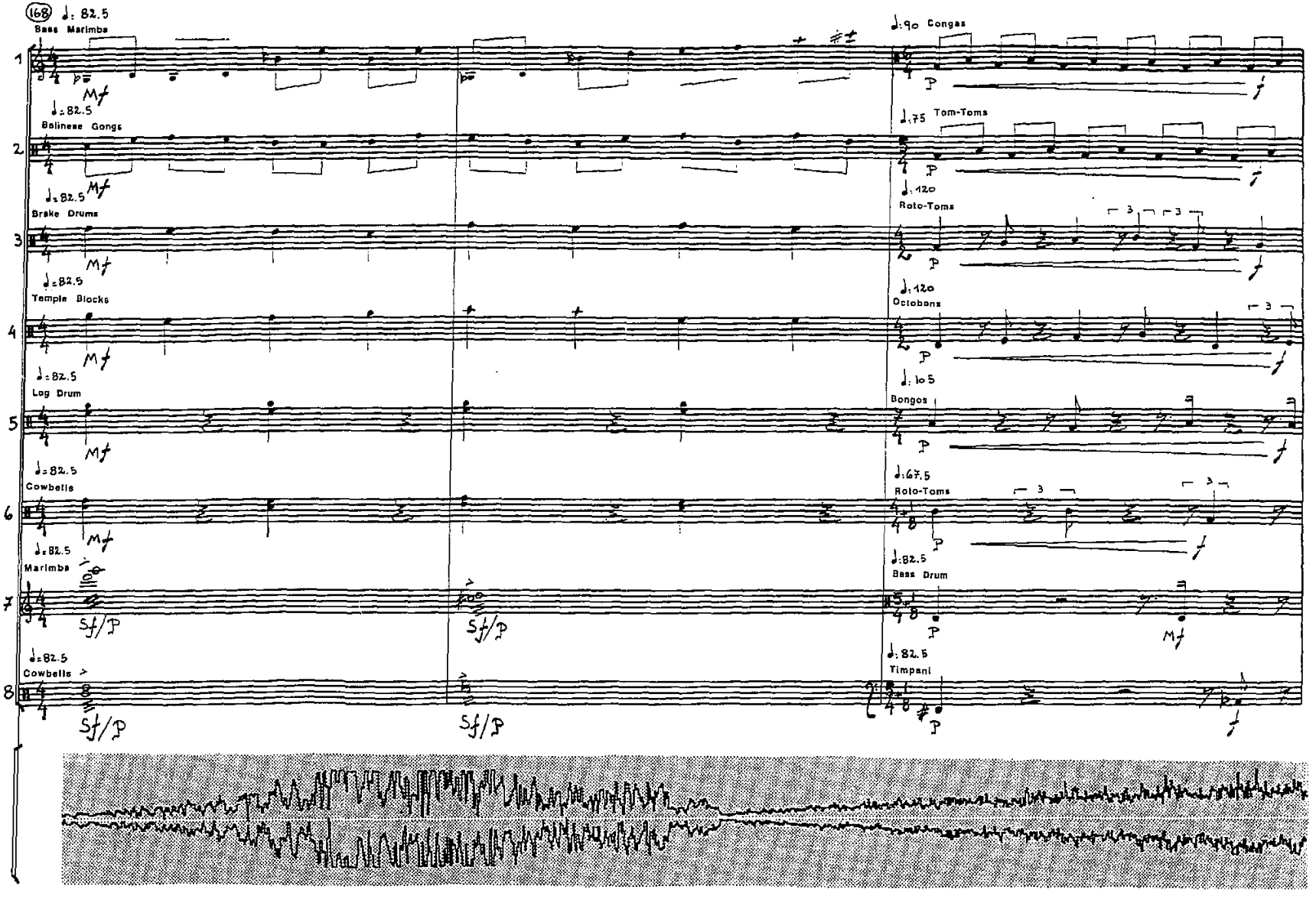

153
♩= 112.5
♩= 120
Cymbal
Balinese Gongs
Brake Drums
Muted Gongs
Tambourine
Sleigh Bells
Triangle
Cowbells
Mf

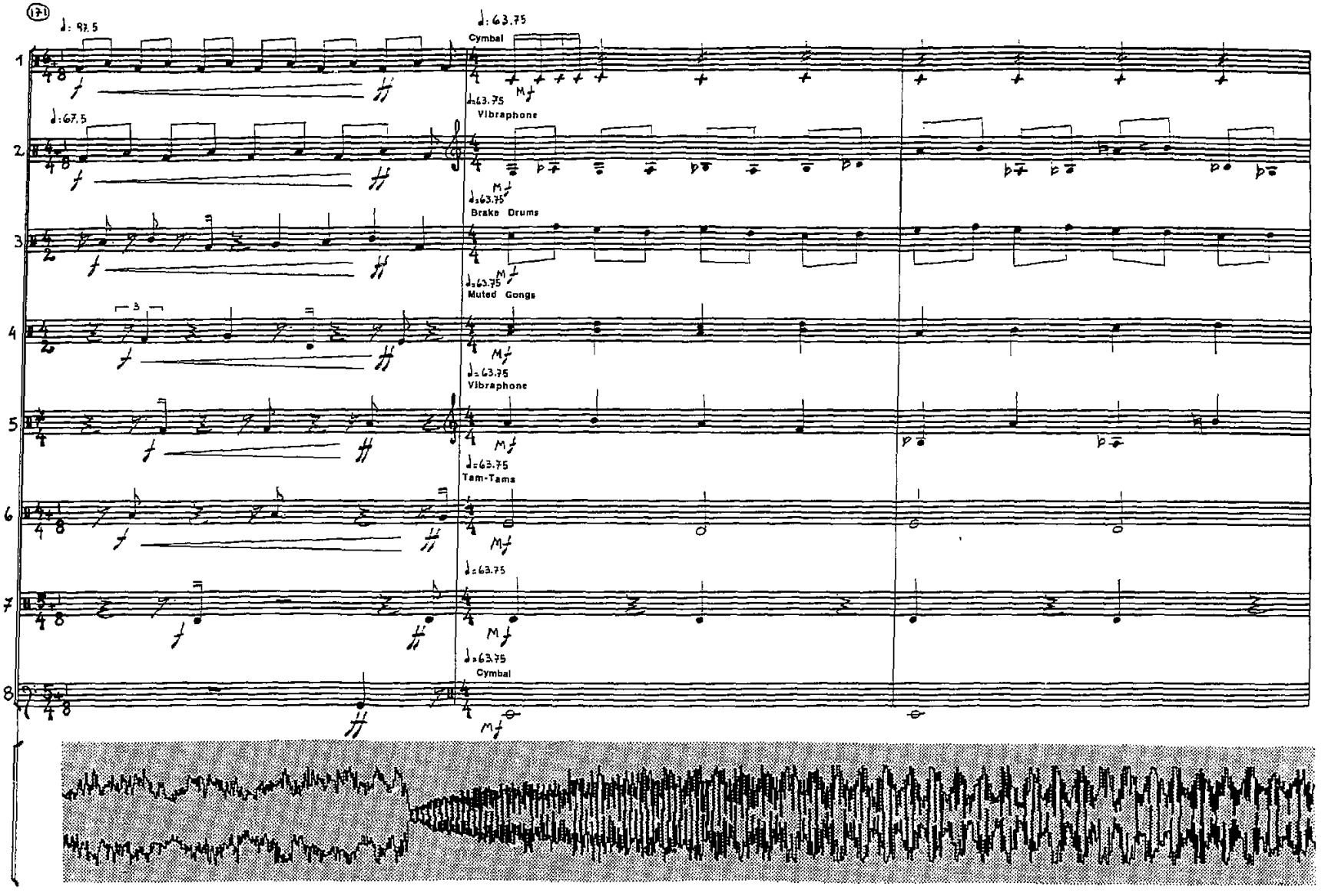

156
Congas
Tom-Toms
Roto-Toms
Octobons
Bongos
Roto-Toms
Bass Drum
Timpani
PP

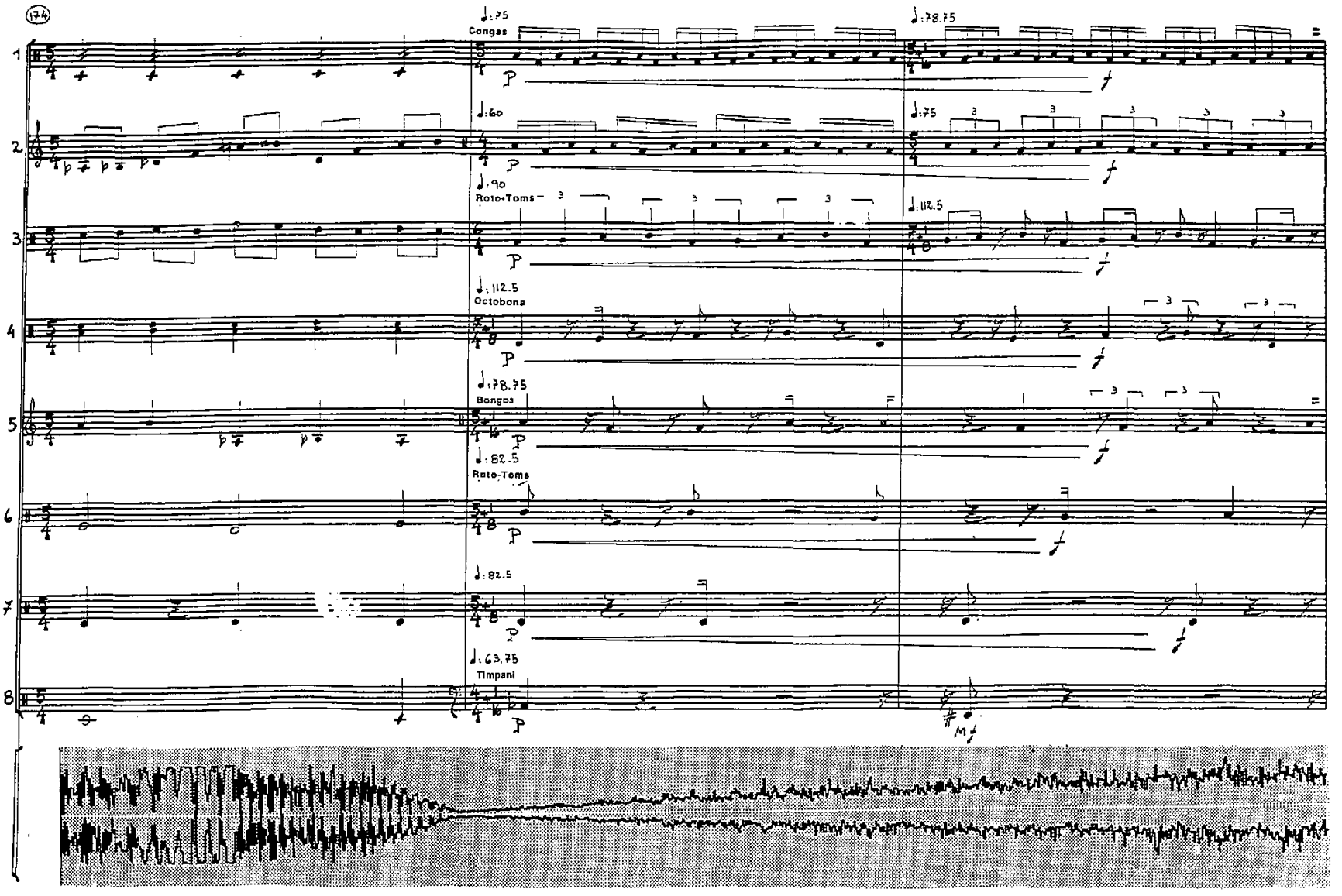

159
Cymbal
Vibraphone
Tubular Bells
Glockenspiel
Cymbal
Tam-Tams
Triangle
Tubular Bells

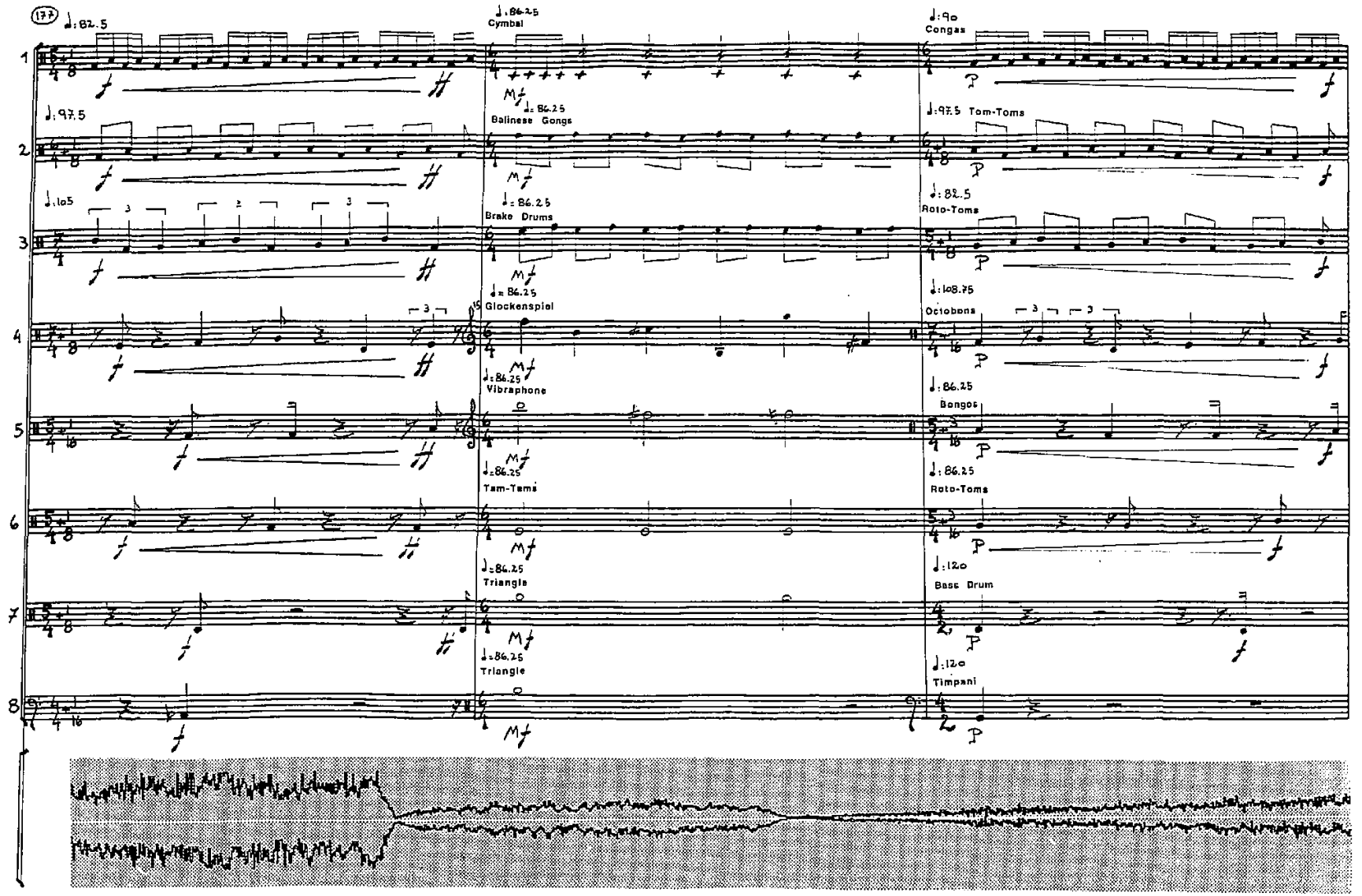

162
Congas
Tom-Toms
Roto-Toms
Octobons
Bongos
Roto-Toms
Bass Drum
Timpani
PP
f

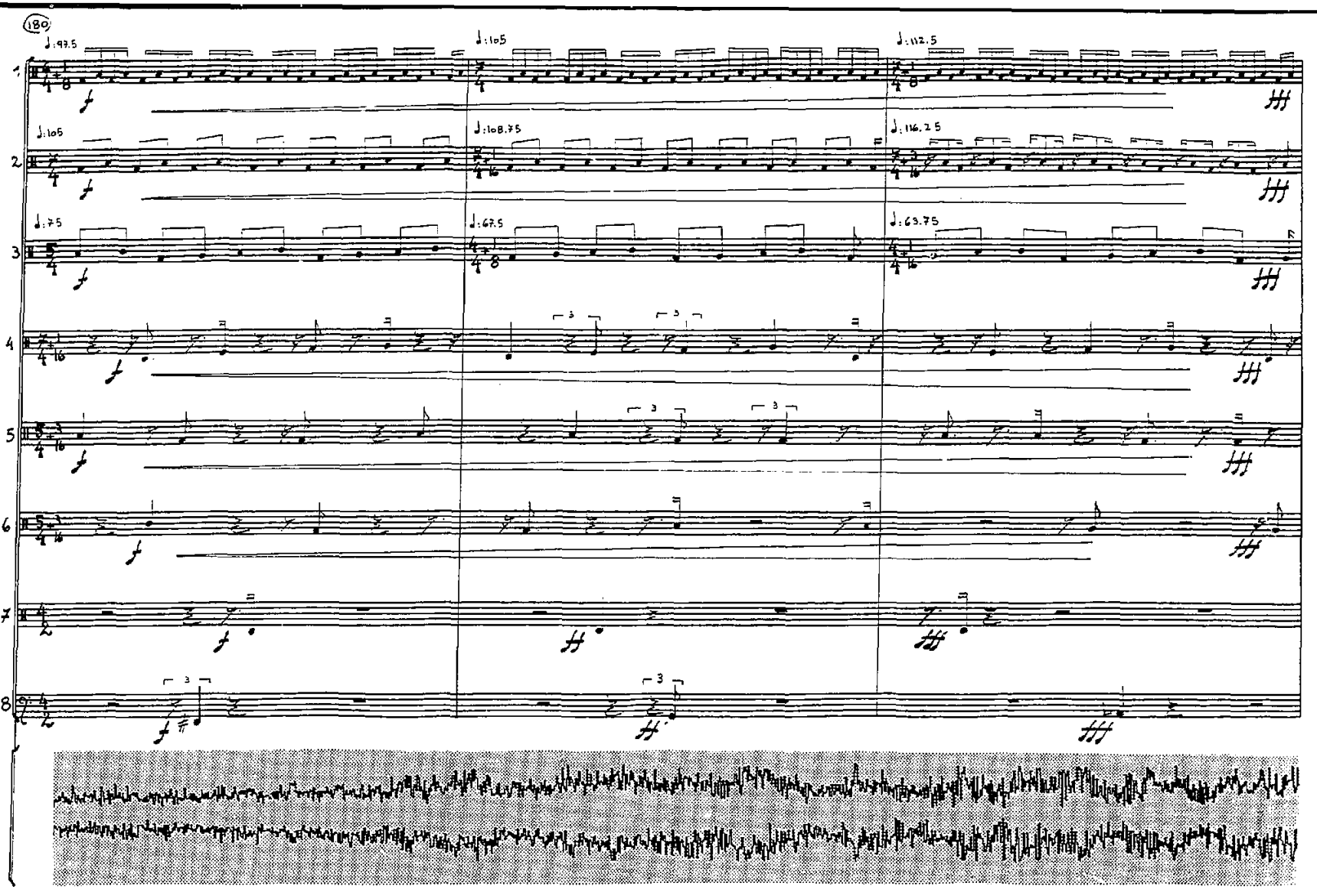

165
♩:78.75
♩:78.75
♩:120
1
2
3
4
5
6
7
8

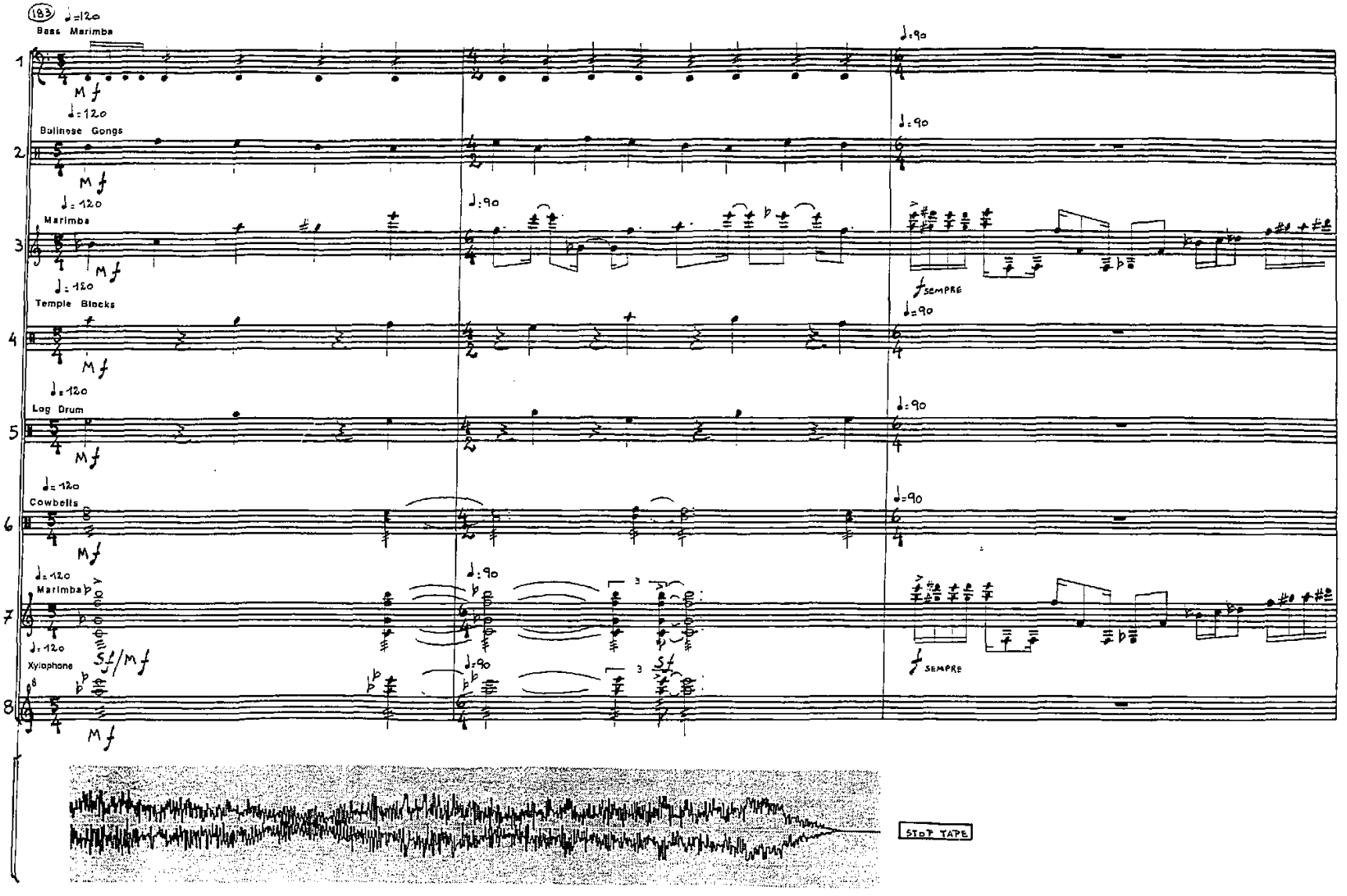

168
Bass Marimba
Balinese Gongs
Brake Drums
Temple Blocks
Log Drum
Cowbells
Marimba
Cowbells
Congas
Tom-Toms
Roto-Toms
Octobans
Bongos
Roto-Toms
Bass Drum
Timpani

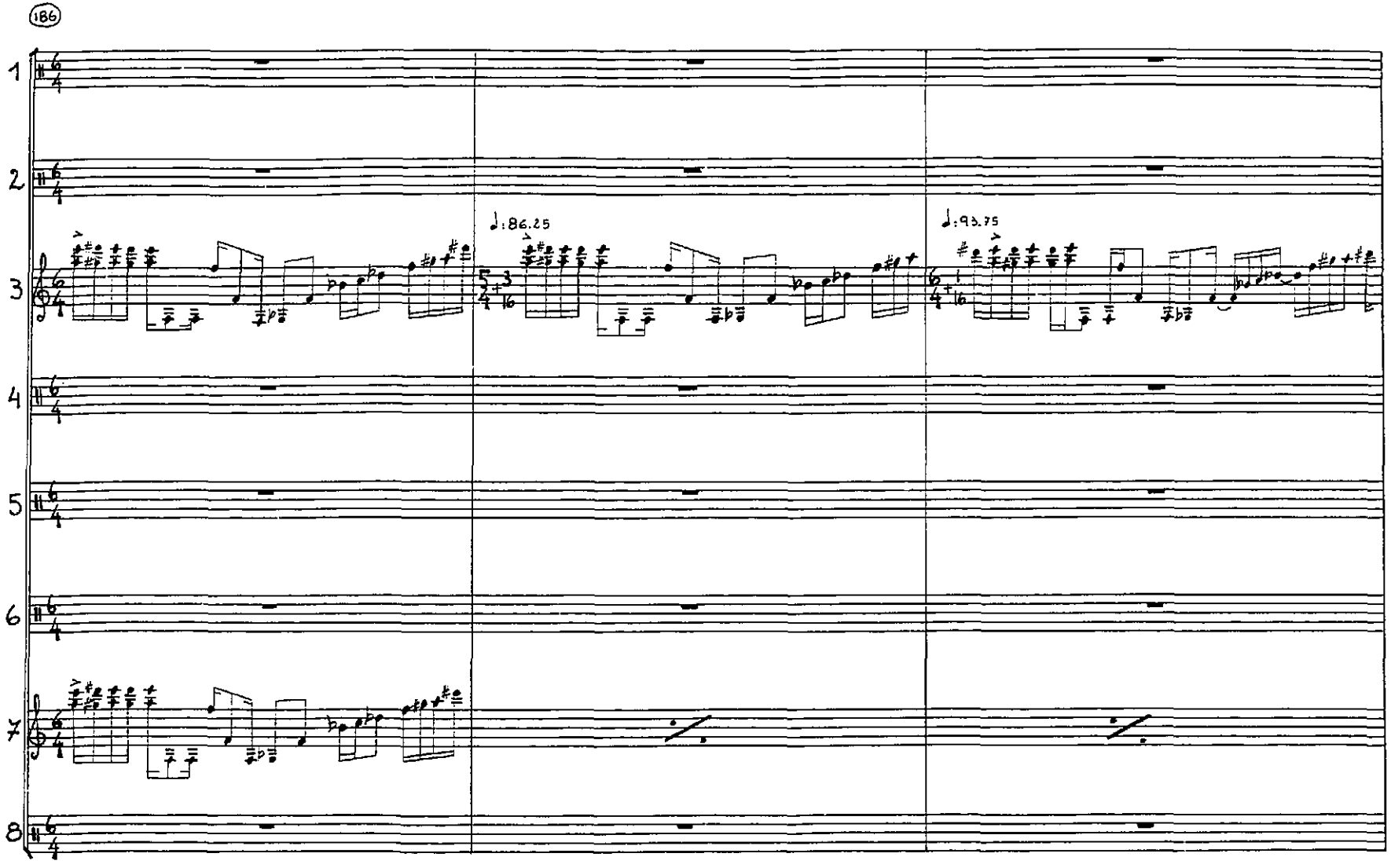

(171)
♩: 92.5
♩: 63.75
Cymbal
♩: 67.5
Vibraphone
Brake Drums
Muted Gongs
Vibraphone
Tam-Tama
Cymbal

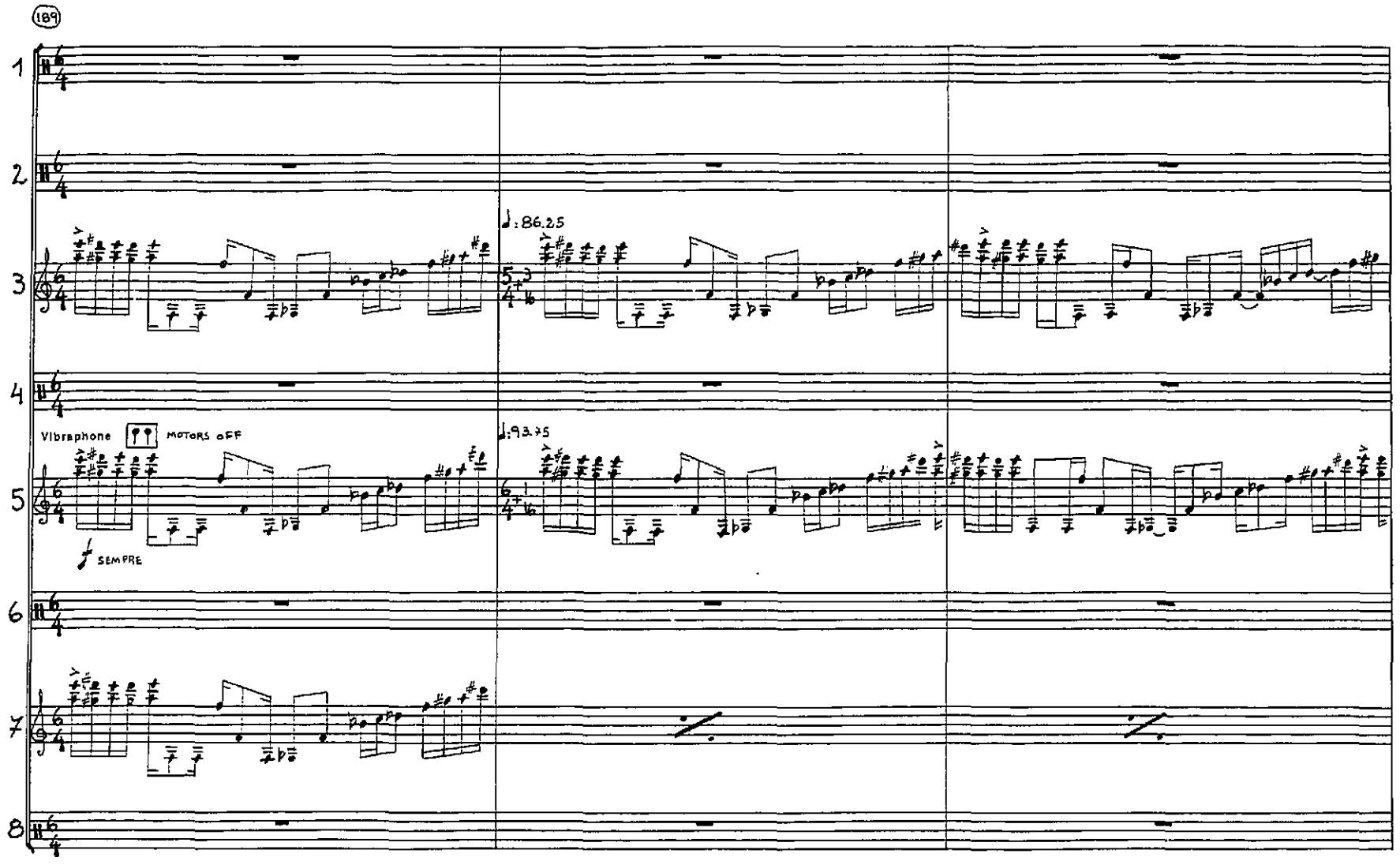

(174)
1
2
3
4
5
6
7
8
♩:75
Congas
♩:78.75
♩:60
♩:75
♩:90
Roto-Toms
♩:112.5
♩:112.5
Octobons
♩:78.75
Bongos
♩:82.5
Roto-Toms
♩:82.5
♩:63.75
Timpani
P
f
mf

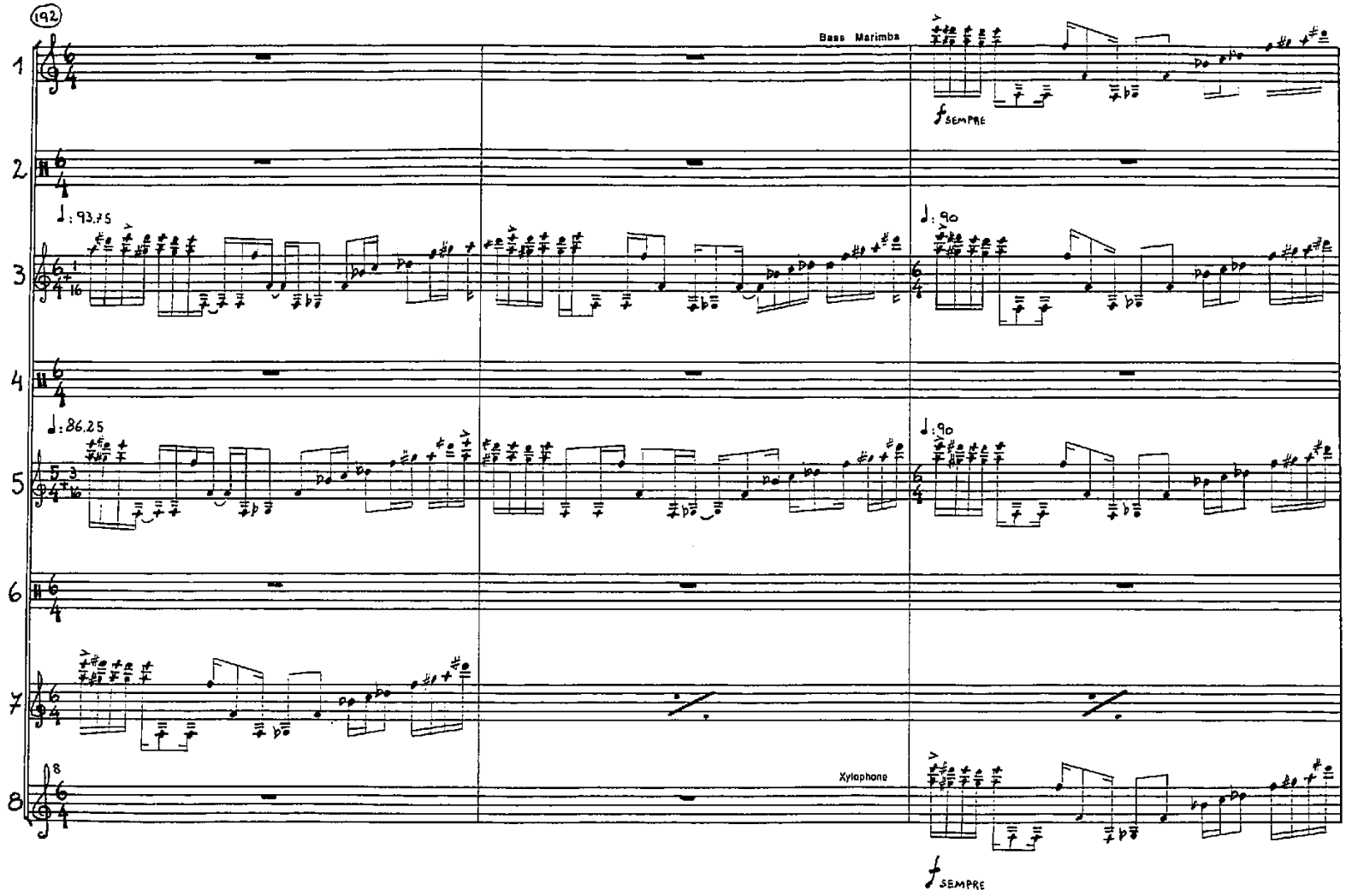

177
♩:82.5
Cymbal
♩:90
Congas
♩:97.5
♩:97.5 Tom-Toms
Balinese Gongs
♩:105
Brake Drums
♩:82.5
Roto-Toms
Glockenspiel
♩:108.75
Octobons
Vibraphone
♩:86.25
Bongos
Tam-Tams
♩:86.25
Roto-Toms
Triangle
♩:120
Bass Drum
Triangle
♩:120
Timpani

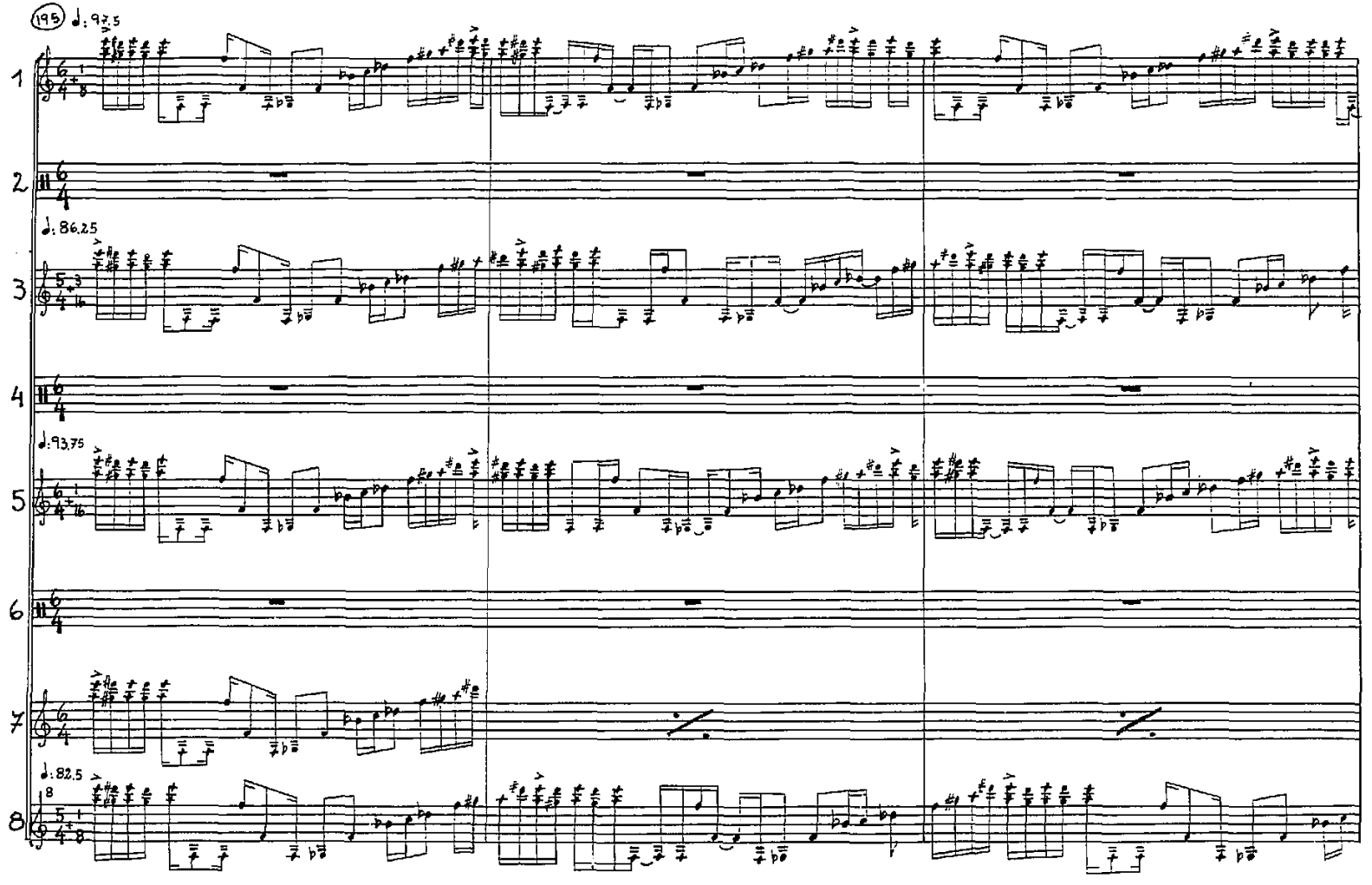

180
♩:97.5
♩:105
♩:112.5
1
♩:105
♩:108.75
♩:116.25
2
♩:75
♩:67.5
♩:63.75
3
4
5
6
7
8

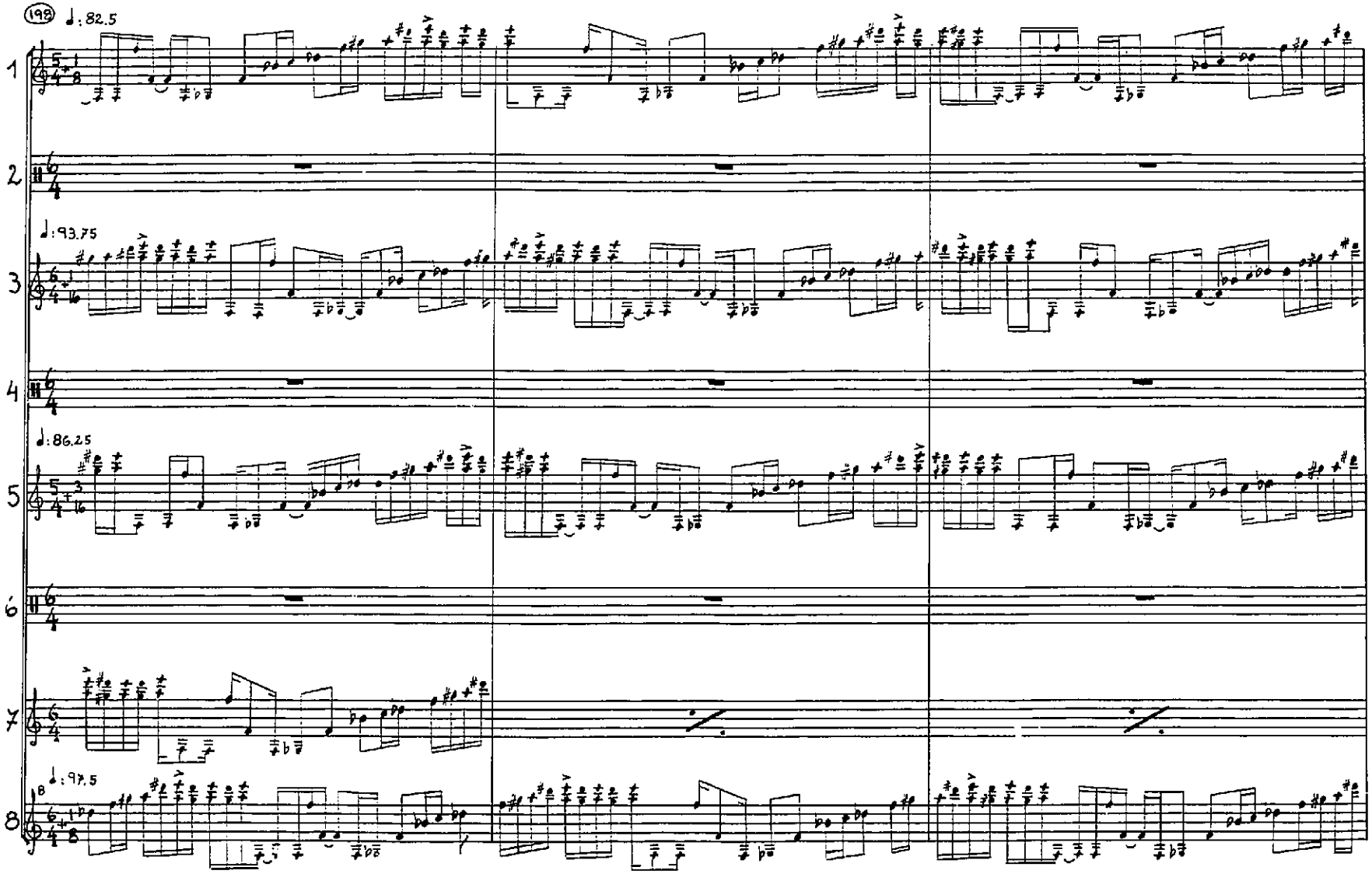

183
Bass Marimba
Balinese Gongs
Marimba
Temple Blocks
Log Drum
Cowbells
Marimba
Xylophone
SEMPRE
SEMPRE
STOP TAPE

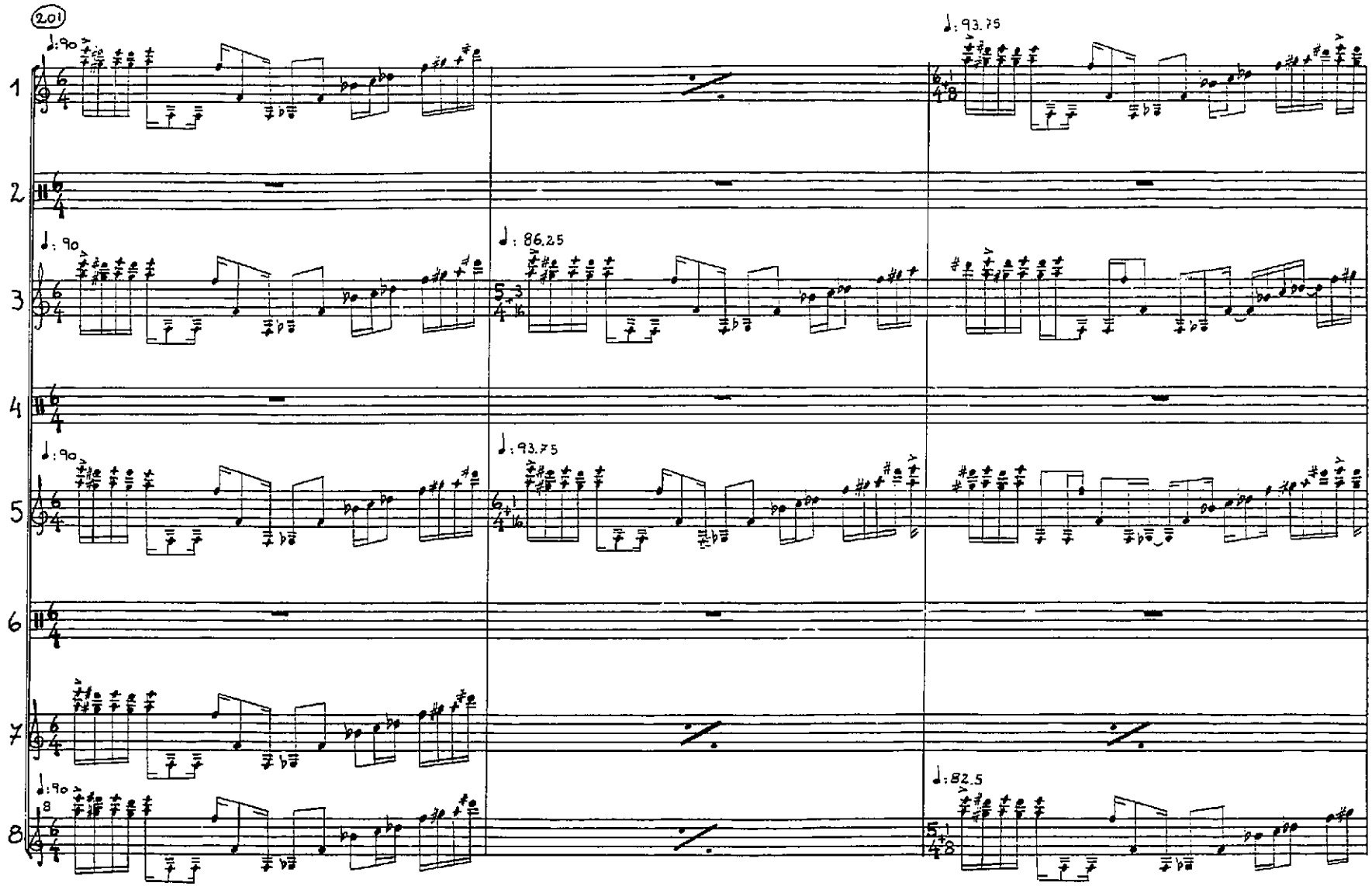

186
1
2
3
4
5
6
7
8
♩:86.25
♩:93.75

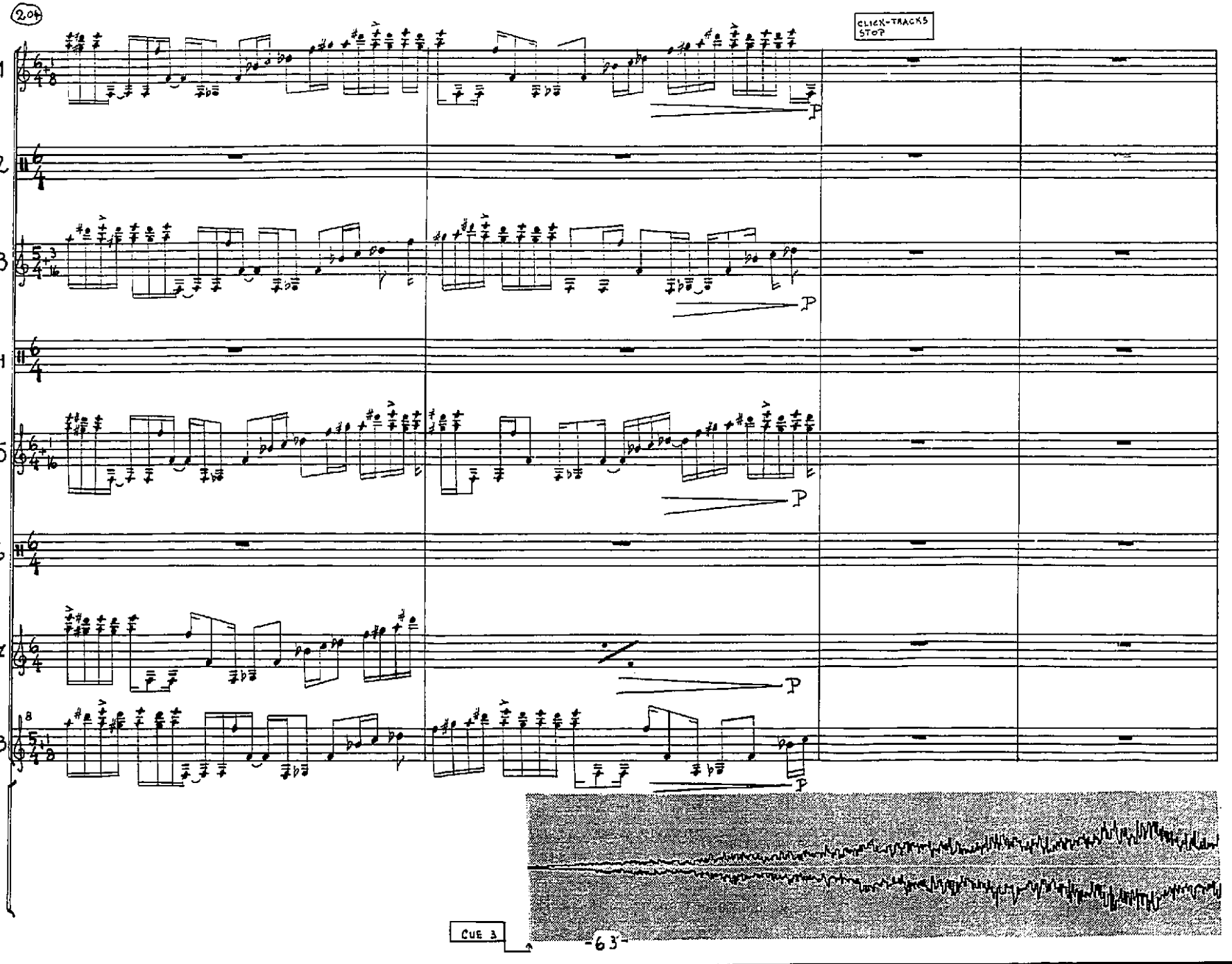

189
1
2
3
♩: 86.25
4
Vibraphone
MOTORS OFF
♩: 93.75
5
SEMPRE
6
7
8

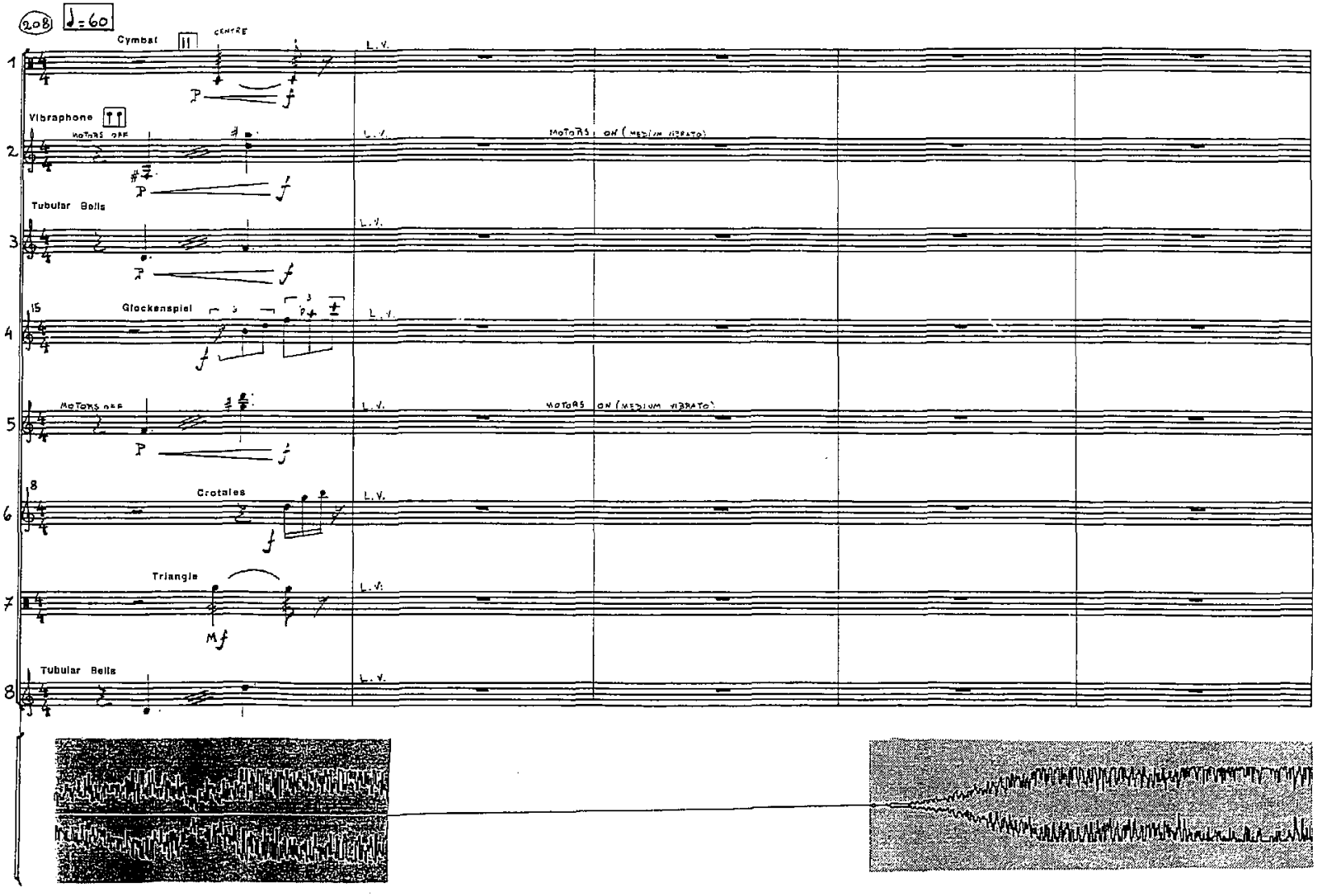

192
Bass Marimba
f SEMPRE
♩: 93.75
♩: 90
♩: 86.25
♩: 90
Xylophone
f SEMPRE

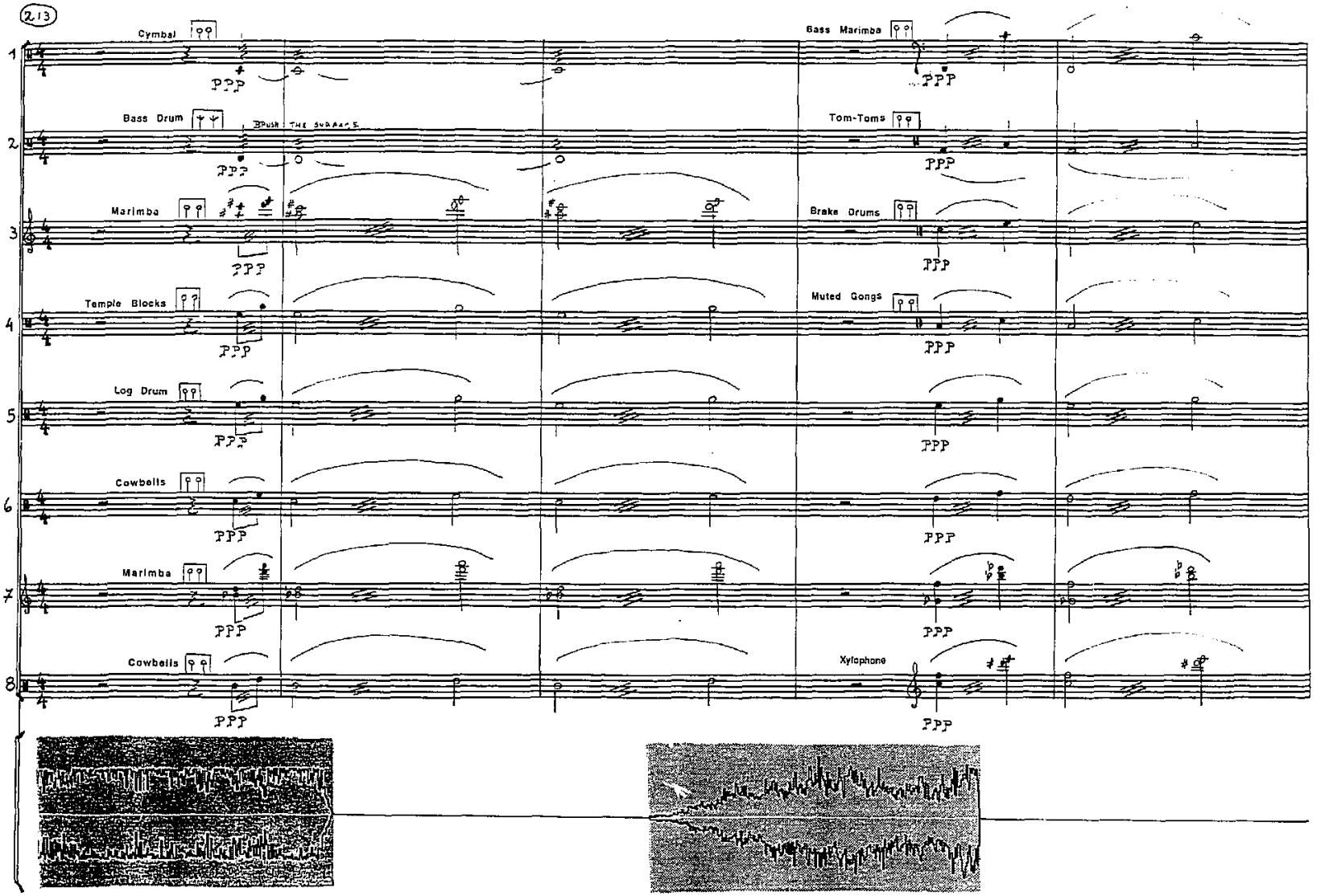

195
♩: 97.5
1
2
♩: 86.25
3
4
♩: 93.75
5
6
7
♩: 82.5
8

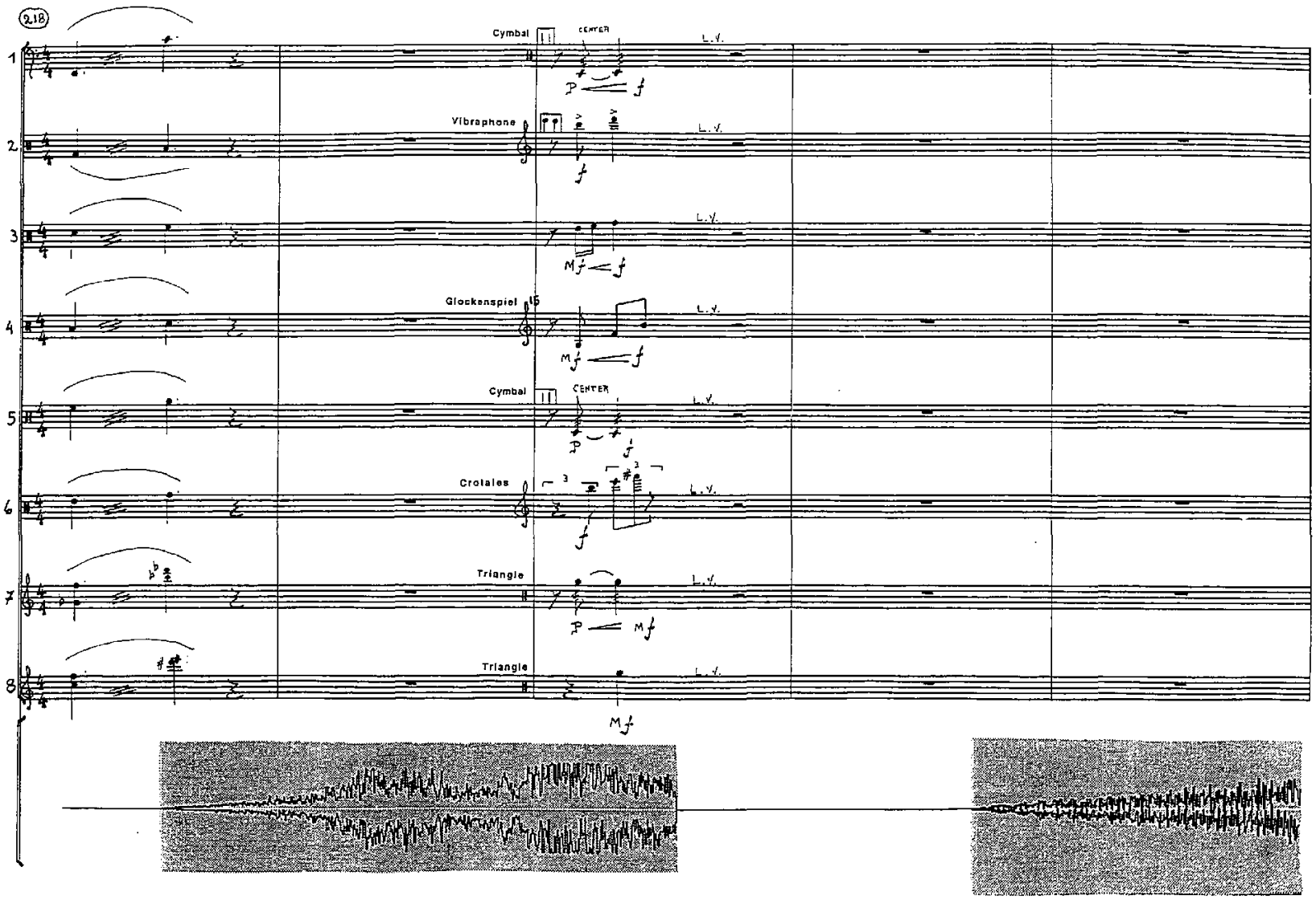

(198)
♩: 82.5
1
2
♩: 93.75
3
4
♩: 86.25
5
6
7
♩: 97.5
8

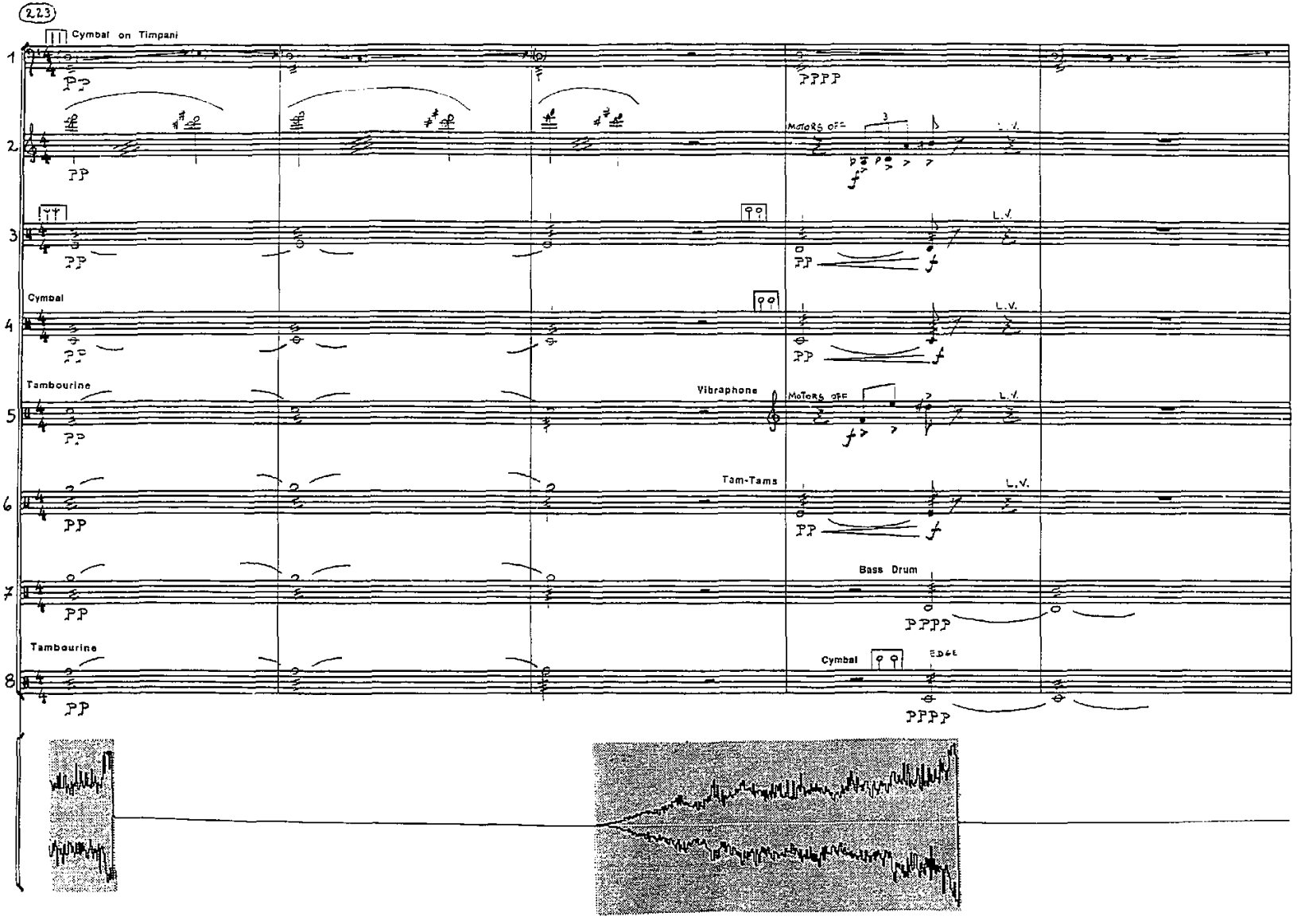

201
♩: 90
♩: 93.75
♩: 86.25
♩: 82.5

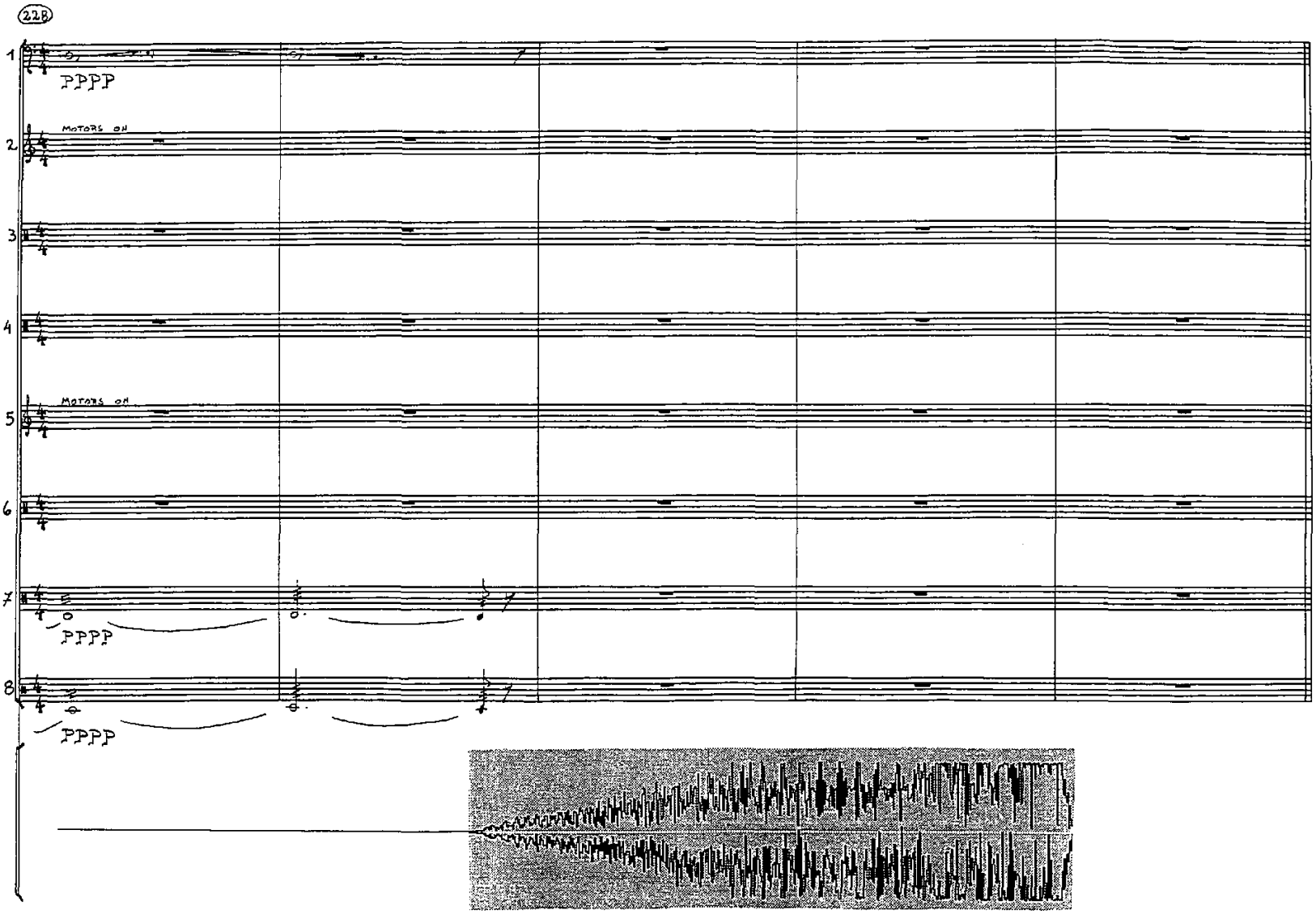

204
CLICK-TRACKS STOP
1
2
3
4
5
6
7
8
P
TAPE
CUE 3
-63-


208
♩=60
Cymbal
CENTRE
L.V.
Vibraphone
MOTORS OFF
MOTORS ON (MEDIUM VIBRATO)
Tubular Bells
Glockenspiel
Crotales
Triangle
1
2
3
4
5
6
7
8
15
8


2.13
Cymbal
Bass Marimba
Bass Drum
Tom-Toms
Marimba
Brake Drums
Temple Blocks
Muted Gongs
Log Drum
Cowbells
Marimba
Cowbells
Xylophone
PPP


2.18
1
2
3
4
5
6
7
8
Cymbal
CENTER
L.V.
P
f
Vibraphone
L.V.
f
L.V.
Mf
f
Glockenspiel
L.V.
Mf
f
Cymbal
CENTER
L.V.
P
f
Crotales
L.V.
f
Triangle
L.V.
P
Mf
Triangle
L.V.
Mf


223
Cymbal on Timpani
Cymbal
Tambourine
Vibraphone
Tam-Tams
Bass Drum
Tambourine
Cymbal
MOTORS OFF
L.V.


22B
1
PPPP
2
Motors on
3
4
5
Motors on
6
7
PPPP
8
PPPP

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